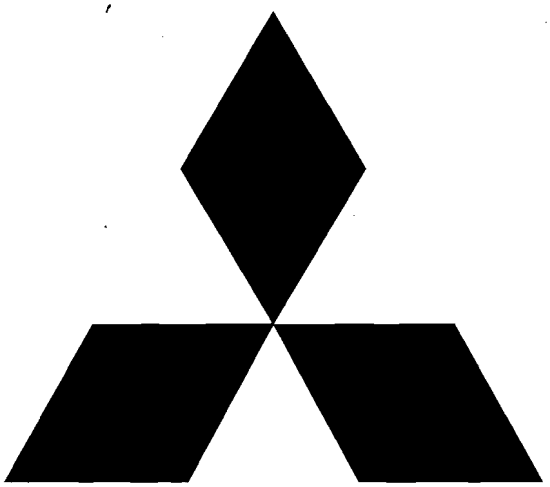
TR-TS MAGNA
KR-KS VERADA



MITSUBISHI
MOTORS

Workshop Manual

QUICK REFERENCE INDEX: To use, bend manual back to expose black markers on pages of the various groups. Then, by means of the index marks on this page, locate the corresponding black marker on the page of the group you desire to find.

MITSUBISHI

MAGNA, VERADA SIGMA, V3000

R and S SERIES

WORKSHOP MANUAL

INCLUDING 1995 MODEL

SEDAN AND WAGON

Part No. AW342051

MITSUBISHI MOTORS

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SERVICE DIVISION
TONSLEY PARK
SOUTH AUSTRALIA

Body Repair Manual AW338329

MITSUBISHI MOTORS AUSTRALIA LTD.
AUST. CO. No. 007 870 395

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AW342051-B REVISED

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12 Lubrication
13 Fuel
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All revised pages carry a revision date, part number and **REVISED** or **ADDED** to signify that the page has been modified. Alterations to the text and/or illustrations are indicated by a single vertical marker adjacent to the revision.

Major revisions or new page layouts carry the revision date, part number and **REVISED** or **ADDED** only, no vertical line.

Fit the new pages to your manual as soon as possible, removing the current pages they replace. Destroy the old pages to avoid confusion at a later date.

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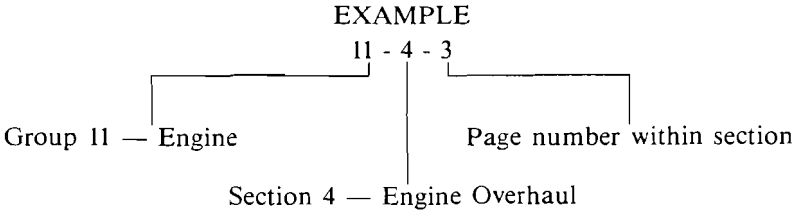
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SECTION 1 — INTRODUCTION

USING THE MANUAL

The pages of this service manual are numbered using a three segment numbering system, these number groups located in the centre of each page, are divided by a dash, and serve the following functions.

- The first figure indicates the service manual **group;**
- The second figure indicates the **section number** within a **group;**
- The last figure is the **page sequence number** within the **section.** Each section commences with page 1.



- Illustrations are numbered in sequence within each section.
- When reference is made to a side of the vehicle, or a handed component, the side is defined as viewed from the driver's seat unless otherwise specified.
- Where possible the component parts described in this manual have been identified by a part number or serial number. Where this is the case, the component part or serial number should be established and then reconciled with the service specifications/descriptions in this manual.

METRIC CONVERSION

In this manual all measurements and capacities are quoted in Metric Units. To carry out conversions from Metric to imperial or vice versa, multiply the unit to be converted by the appropriate factor, or in the case of Temperature, Fuel and Oil consumption apply the required formula. These may be found in the Conversion Values column of the Conversion Chart.

Examples:

Converting millimetres to inches

1.2 mm x 0.03937 (from table) = 0.050"

Converting ^{0}F to ^{0}C

86^{0}F: $^{0}C = \frac{5}{9}(^{0}F - 32)$ (from table)

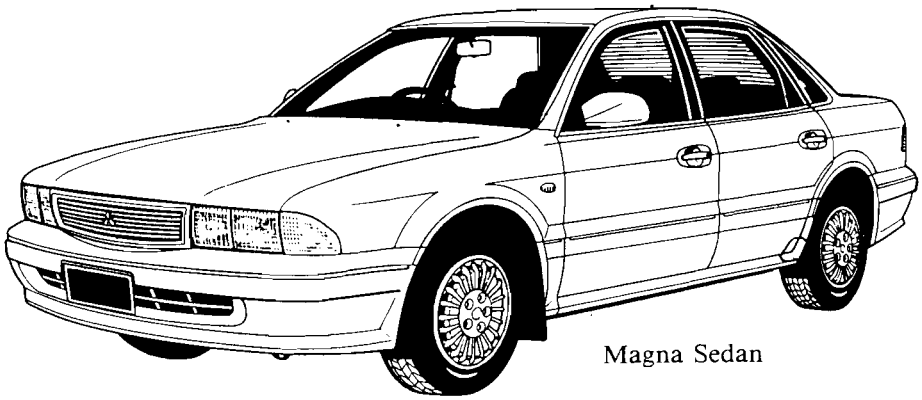
$= \frac{5}{9}(86 - 32)$

$= \frac{5}{9} \times 54$

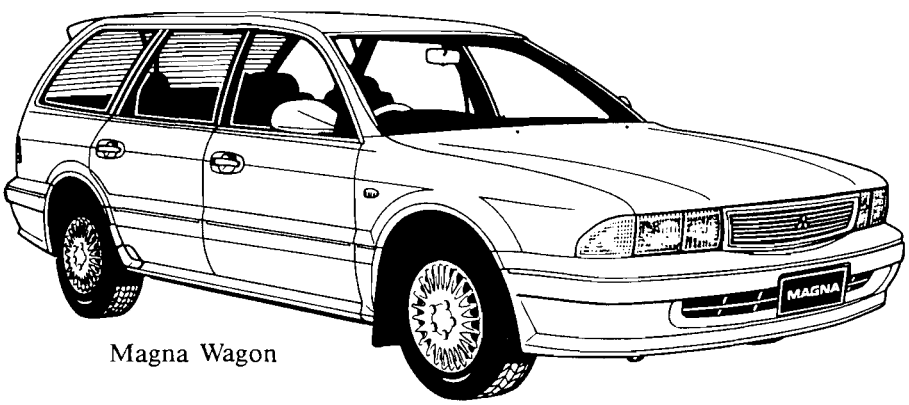
$= 30^{0}C$

CONVERSION CHART — METRIC AND IMPERIAL MEASURES				
Quantity	**Metric units**		**Conversion Values**	
	Name	**Symbol**	**metric to imperial**	**imperial to metric**
LENGTH	millimetre metre kilometre	mm m km	1 mm = 0.03937 inches 1 m = 1.09 yard 1 km = 0.621 miles	1 inch = 25.4 mm 1 yard = 0.914 m 1 mile = 1.61 km
MASS	gram kilogram tonne	g kg t	1 g = 0.0353 ozs. 1 kg = 2.2 lbs. 1 t = 0.984 ton	1 oz. = 28.3 g 1 lb. = 0.454 kg 1 ton = 1.02 t
AREA	square millimetre square centimetre square metre	mm^2 cm^2 m^2	1 mm^2 = 0.00155 $in.^2$ 1 cm^2 = 0.155 $in.^2$ 1 m^2 = 1.20 yd^2	1 $in.^2$ = 645.16 mm^2 1 $in.^2$ = 6.45 cm^2 1 yd^2 = 0.836 m2
VOLUME	cubic centimetre cubic metre	cm^3 m^3	1 cm^3 = 0.0610 $in.^3$ 1 m^3 = 35.3 $ft.^3$	1 $in.^3$ = 16.4 cm^3 1 $ft.^3$ = 0.0283 m^3
VOLUME-FLUIDS	litre	*l*	1 litre = 1.76 pts. 1 litre = 0.2199 gallon	1 pt. = 0.568 litre 1 gallon = 4.546 litre
FORCE	newton	N	1 N = 0.225 lb. force	1 lb. force = 4.45 N
TORQUE	newton metre	Nm	1 Nm = 0.74 lb. ft. 1 Nm = 8.94 lb. ins.	1 lb. ft. = 1.36 Nm 1 lb. in. = 0.113 Nm
PRESSURE	kilopascal	kPa	1 kPa = 0.145 p.s.i.	1 p.s.i. = 6.89 kPa
VACUUM	kilopascal	kPa	1 kPa = 0.295 in. Hg.	1 in. Hg. = 3.386 kPa
VELOCITY	kilometre per hour	km/h	1 km/h = 0.621 m.p.h.	1 m.p.h. = 1.61 km/h
TEMPERATURE	degree Celsius	°C	$^{o}F = \frac{9 \times {}^{o}C}{5} + 32$	$^{o}C = \frac{5}{9}(^{o}F-32)$
POWER	kilowatt	kW	k kW = 1.34 h.p.	1 h.p. = 0.746 kW
FUEL CONSUMPTION	litre per 100 km	*l*/100 km	$\frac{282.481}{l/100\ km}$ = m.p.g.	$\frac{282.481}{m.p.g.}$ = *l*/100 km
OIL CONSUMPTION	litre per 1000 km	*l*/1000 km	$\frac{2824.81}{l/1000\ km}$ = m.p.g.	$\frac{2824.81}{m.p.g.}$ = *l*/1000 km

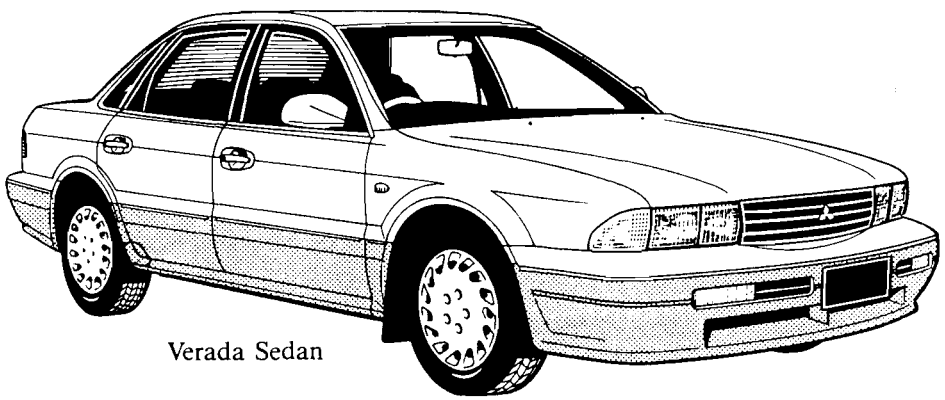
SECTION 2 — VEHICLE SPECIFICATIONS <R Series>



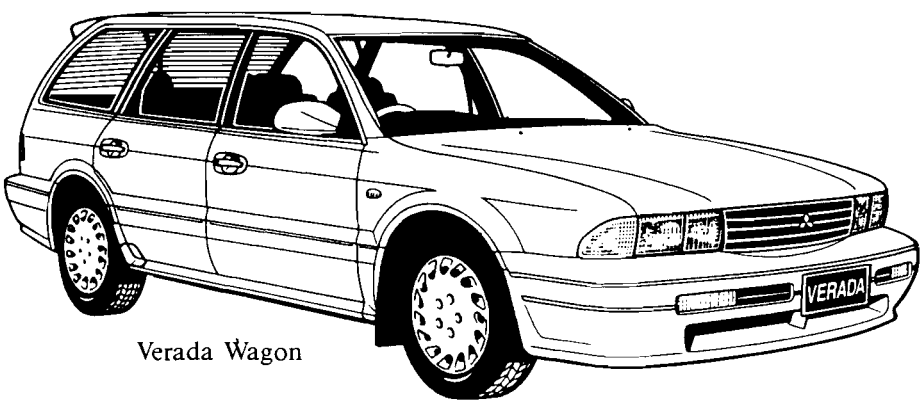
Magna Sedan



Magna Wagon

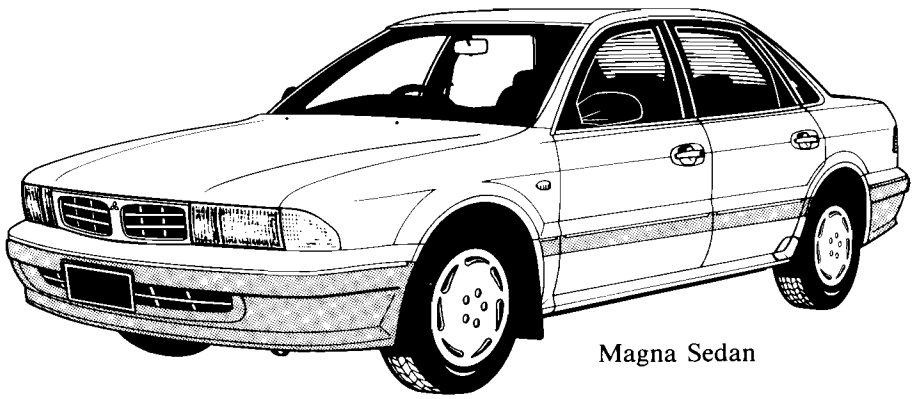


Verada Sedan

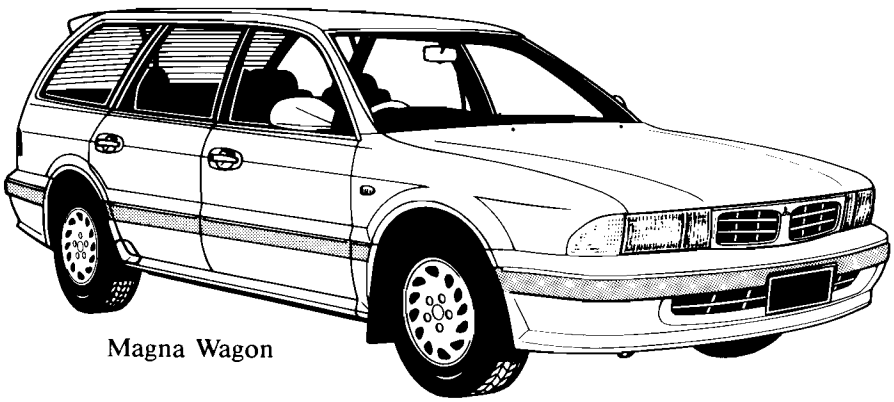


Verada Wagon

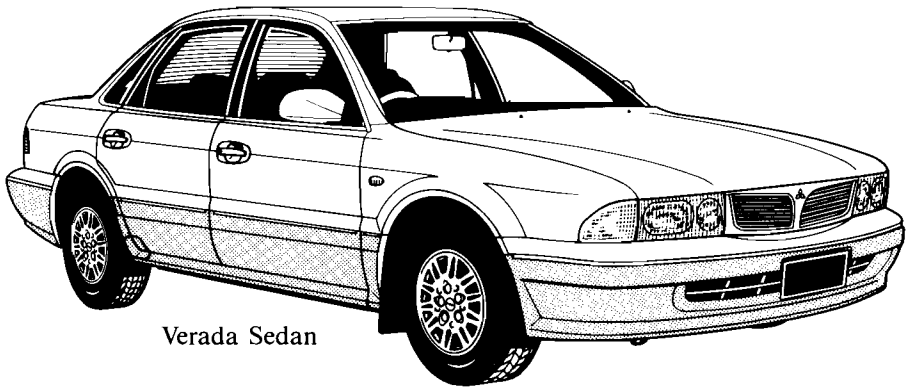
SECTION 2 — VEHICLE SPECIFICATIONS <S Series>



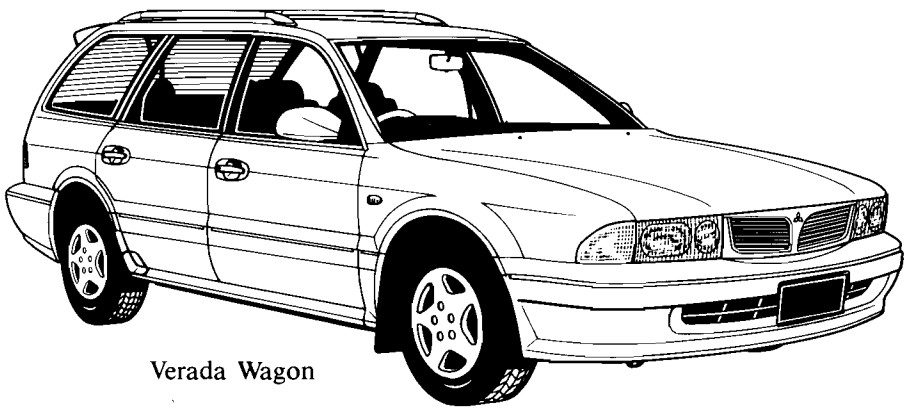
Magna Sedan



Magna Wagon



Verada Sedan



Verada Wagon

MODEL IDENTIFICATION <R Series>

Australia

Model Name	Model Code	Body Type	Engine Type	Transaxle	Price Line
Magna GLX	TR1-H-41	Sedan	2.6L Carby	5 speed manual	GLX
Magna GLX	TR2-H-41	Sedan	2.6L Carby	4 speed automatic	GLX
Magna Executive	TR3-D-41	Sedan	2.6L ECI-Multi	5 speed manual	Executive
Magna Executive	TR4-D-41	Sedan	2.6L ECI-Multi	4 speed automatic	Executive
Magna SE	TR3-P-41	Sedan	2.6L ECI-Multi	5 speed manual	SE
Magna SE	TR4-P-41	Sedan	2.6L ECI-Multi	4 speed automatic	SE
Magna Elite	TR4-X-41	Sedan	2.6L ECI-Multi	4 speed automatic	Elite
Magna Executive	TR5-D-41	Sedan	3.0L ECI-Multi	5 speed manual	Executive
Magna Executive	TR6-D-41	Sedan	3.0L ECI Multi	4 speed automatic	Executive
Verada V6Ei	KR8-P-41	Sedan	3.0L ECI-Multi	4 speed automatic	V6Ei
Verada V6Xi	KR8-X-41	Sedan	3.0L ECI-Multi	4 speed automatic	V6Xi
Magna GLX	TR1-H-45	Wagon	2.6L Carby	5 speed manual	GLX
Magna GLX	TR2-H-45	Wagon	2.6L Carby	4 speed automatic	GLX
Magna Executive	TR3-D-45	Wagon	2.6L ECI-Multi	5 speed manual	Executive
Magna Executive	TR4-D-45	Wagon	2.6L ECI-Multi	4 speed automatic	Executive
Magna SE	TR3-P-45	Wagon	2.6L ECI-Multi	5 speed manual	SE
Magna SE	TR4-P-45	Wagon	2.6L ECI-Multi	4 speed automatic	SE
Magna Executive	TR5-D-45	Wagon	3.0L ECI-Multi	5 speed manual	Executive
Magna Executive	TR6-D-45	Wagon	3.0L ECI-Multi	4 speed automatic	Executive
Verada V6Ei	KR8-P-45	Wagon	3.0L ECI-Multi	4 speed automatic	V6 Ei

New Zealand

Model Name	Model Code	Body Type	Engine Type	Transaxle	Price Line
Magna GLX	TR7-D-41	Sedan	2.6L ECI-Multi	5 speed manual	GLX
Magna GLX	TR8-D-41	Sedan	2.6L ECI-Multi	4 speed automatic	GLX
Magna Super Saloon	TR7-P-41	Sedan	2.6L ECI-Multi	5 speed manual	Super Saloon
Magna Super Saloon	TR8-P-41	Sedan	2.6L ECI-Multi	4 speed automatic	Super Saloon
V3000 Executive	KR5-D-41	Sedan	3.0L ECI-Multi	5 speed manual	Executive
V3000 Executive	KR6-D-41	Sedan	3.0L ECI-Multi	4 speed automatic	Executive
V3000 Super Saloon	KR6-P-41	Sedan	3.0L ECI-Multi	4 speed automatic	Super Saloon
V3000 SEi	KR6-X-41	Sedan	3.0L ECI-Multi	4 speed automatic	SEi
Magna GLX	TR7-H-45	Wagon	2.6L ECI-Multi	5 speed manual	GLX
Magna GLX	TR8-H-45	Wagon	2.6L ECI-Multi	4 speed automatic	GLX
V3000 Executive	KR5-D-45	Wagon	3.0L ECI-Multi	5 speed manual	Executive
V3000 Executive	KR6-D-45	Wagon	3.0L ECI-Multi	4 speed automatic	Executive
V3000 Elite	KR6-P-45	Wagon	3.0L ECI-Multi	4 speed automatic	Elite

Papua New Guinea, Brunei & Fiji

Model Name	Model Code	Body Type	Engine Type	Transaxle	Price Line
Magna Executive	TR7-D-41	Sedan	2.6L ECI-Multi	5 speed manual	Executive
Magna Executive	TR8-D-41	Sedan	2.6L ECI-Multi	4 speed automatic	Executive
Magna SE	TR7-P-41	Sedan	2.6L ECI-Multi	5 speed manual	SE
Magna SE	TR8-P-41	Sedan	2.6L ECI-Multi	4 speed automatic	SE
Magna Elite	TR8-X-41	Sedan	2.6L ECI-Multi	4 speed automatic	Elite
Verada Ei	KR6-P-41	Sedan	3.0L ECI-Multi	4 speed automatic	Ei
Verada Xi	KR6-X-41	Sedan	3.0L ECI-Multi	4 speed automatic	Xi
Magna Executive	TR7-D-45	Wagon	2.6L ECI-Multi	5 speed manual	Executive
Magna Executive	TR8-D-45	Wagon	2.6L ECI Multi	4 speed automatic	Executive
Magna SE	TR7-P-45	Wagon	2.6L ECI-Multi	5 speed manual	SE
Magna SE	TR8-P-45	Wagon	2.6L ECI-Multi	4 speed automatic	SE
Verada Ei	KR6-P-45	Wagon	3.0L ECI-Multi	4 speed automatic	V6 Ei

MODEL IDENTIFICATION <S Series>

Australia

Model Name	Model Code	Body Type	Engine Type	Transaxle	Price Line
Magna GLX	TS1-H-41	Sedan	2.6L Carby	5 speed manual	GLX
Magna GLX	TS2-H-41	Sedan	2.6L Carby	4 speed automatic	GLX
Magna Executive	TS3-D-41	Sedan	2.6L ECI-Multi	5 speed manual	Executive
Magna Executive	TS4-D-41	Sedan	2.6L ECI-Multi	4 speed automatic	Executive
Magna SE	TS3-P-41	Sedan	2.6L ECI-Multi	5 speed manual	SE
Magna SE	TS4-P-41	Sedan	2.6L ECI-Multi	4 speed automatic	SE
Magna SE	TS6-P-41	Sedan	3.0L ECI-Multi	4 speed automatic	SE
Magna Executive	TS5-D-41	Sedan	3.0L ECI-Multi	5 speed manual	Executive
Magna Executive	TS6-D-41	Sedan	3.0L ECI-Multi	4 speed automatic	Executive
Verada V6Ei	KS8-P-41	Sedan	3.0L ECI-Multi	4 speed automatic	V6Ei
Verada V6Xi	KS8-X-41	Sedan	3.0L ECI-Multi	4 speed automatic	V6Xi
Magna GLX	TS1-H-45	Wagon	2.6L Carby	5 speed manual	GLX
Magna GLX	TS2-H-45	Wagon	2.6L Carby	4 speed automatic	GLX
Magna Executive	TS3-D-45	Wagon	2.6L ECI-Multi	5 speed manual	Executive
Magna Executive	TS4-D-45	Wagon	2.6L ECI-Multi	4 speed automatic	Executive
Magna SE	TS3-P-45	Wagon	2.6L ECI-Multi	5 speed manual	SE
Magna SE	TS4-P-45	Wagon	2.6L ECI-Multi	4 speed automatic	SE
Magna SE	TS6-P-45	Wagon	3.0L ECI-Multi	4 speed automatic	SE
Magna Executive	TS5-D-45	Wagon	3.0L ECI-Multi	5 speed manual	Executive
Magna Executive	TS6-D-45	Wagon	3.0L ECI-Multi	4 speed automatic	Executive
Verada V6Ei	KS8-P-45	Wagon	3.0L ECI-Multi	4 speed automatic	V6Ei

New Zealand

Model Name	Model Code	Body Type	Engine Type	Transaxle	Price Line
Magna GLX	TS7-D-41	Sedan	2.6L ECI-Multi	5 speed manual	GLX
Magna GLX	TS8-D-41	Sedan	2.6L ECI-Multi	4 speed automatic	GLX
Magna Super Saloon	TS7-P-41	Sedan	2.6L ECI-Multi	5 speed manual	Super Saloon
Magna Super Saloon	TS8-P-41	Sedan	2.6L ECI-Multi	4 speed automatic	Super Saloon
V3000 Executive	KS5-D-41	Sedan	3.0L ECI-Multi	5 speed manual	Executive
V3000 Executive	KS6-D-41	Sedan	3.0L ECI-Multi	4 speed automatic	Executive
V3000 Super Saloon	KS6-P-41	Sedan	3.0L ECI-Multi	4 speed automatic	Super Saloon
V3000 SEi	KS6-X-41	Sedan	3.0L ECI-Multi	4 speed automatic	SEi
Magna GLX	TS7-H-45	Wagon	2.6L ECI-Multi	5 speed manual	GLX
Magna GLX	TS8-H-45	Wagon	2.6L ECI-Multi	4 speed automatic	GLX
V3000 Executive	KS5-D-45	Wagon	3.0L ECI-Multi	5 speed manual	Executive
V3000 Executive	KS6-D-45	Wagon	3.0L ECI-Multi	4 speed automatic	Executive
V3000 Elite	KS6-P-45	Wagon	3.0L ECI-Multi	4 speed automatic	Elite

Papua New Guinea, Brunei & Fiji

Model Name	Model Code	Body Type	Engine Type	Transaxle	Price Line
Magna Executive	TS7-D-41	Sedan	2.6L ECI-Multi	5 speed manual	Executive
Magna Executive	TS8-D-41	Sedan	2.6L ECI-Multi	4 speed automatic	Executive
Magna SE	TS7-P-41	Sedan	2.6L ECI-Multi	5 speed manual	SE
Magna SE	TS8-P-41	Sedan	2.6L ECI-Multi	4 speed automatic	SE
Magna Elite	TS8-X-41	Sedan	2.6L ECI-Multi	4 speed automatic	Elite
Verada Ei	KS6-P-41	Sedan	3.0L ECI-Multi	4 speed automatic	Ei
Verada Xi	KS6-X-41	Sedan	3.0L ECI-Multi	4 speed automatic	Xi
Magna Executive	TS7-D-45	Wagon	2.6L ECI-Multi	5 speed manual	Executive
Magna Executive	TS8-D-45	Wagon	2.6L ECI Multi	4 speed automatic	Executive
Magna SE	TS7-P-45	Wagon	2.6L ECI-Multi	5 speed manual	SE
Magna SE	TS8-P-45	Wagon	2.6L ECI-Multi	4 speed automatic	SE
Verada Ei	KS6-P-45	Wagon	3.0L ECI-Multi	4 speed automatic	Ei

South East Asia

Model Name	Model Code	Body Type	Engine Type	Transaxle	Price Line
Sigma	KS2-X-41	Sedan	3.0L ECI-Multi	4 speed automatic	Xi
Sigma	KS2-X-45	Wagon	3.0L ECI-Multi	4 speed automatic	Ei

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OPTIONAL EQUIPMENT CODES

Code No.	Equipment Description
A03	Supplementary Restraint System (SRS)
A13	Luxury Pack
A15	Luxury Pack
A26	Luxury Pack
B14	ABS Brakes
C34	Seat Height Adjuster
D66	5 speed Manual Transaxle — F5M31 (4 Cylinder Models)
D67	4 speed Automatic Transaxle — F4A23 (Carburettor Models)
D68	4 speed Automatic Transaxle — F4A33 (ECI-Multi 4 Cylinder Models)
D69	4 speed Automatic Transaxle — F4A33 (V6 ECI-Multi Models)
D78	5 speed Manual Transaxle — F5M33 (V6 ECI-Multi Models)
E02	3.0 litre V6 Engine (ECI-Multi Version)
E24 (Export)	2.6 litre Engine (ECI-Multi Leaded Fuel)
E25 (Export)	3.0 litre V6 Engine (ECI-Multi Leaded Fuel)
E55	2.6 litre Engine (Carburettor Version)
E48	2.6 litre Engine (ECI-Multi Version)
E49	3.0 litre V6 Engine (ECI-Multi Version)
G39	Sunroof
H50	Air Conditioning — M.M.A.L. Fitment
H57	Auto Air Conditioning
J14	Roof Rack
J30	Cruise Control
*K20	Police Vehicle
R17	CD Player
V03	Monotone Paint
V20	Metallic Paint
V21	Pearlescent Paint
V98	Cargo Compartment Blind (Wagon)
W37	Cast Alloy Wheels
W44	Cast Alloy Wheels and Tyres
X27	Export Vehicle Leaded Fuel Magna
X30	Export Vehicle Brunei
X62	Export Vehicle New Zealand
X66	Export Vehicle New Zealand Police
X67	Export Vehicle New Zealand Police
X71	Export Vehicle Fiji
*Y06	Rear Bumper Protector
*Y14	Sun Visor Rear — Exterior
*Y19	Sun Visor (Blade)
Y25	Fuel Cap (locking)
*Y26	Sun Visor (Mesh)
*Y27	Door Weathershield
*Y29	Radiator Insect Screen
*Y31	Fire Extinguisher
*Y34	Mudflaps — rear
*Y44	Cargo Barrier
Y50	Weathershield (LH Door)
*Y51	Air Conditioning — M.M.A.L. Fitment
*Y52	Air Conditioning — Dealer Fitment
*Y54	Air Conditioner — Vendor Fitment
*Y57	Rubber Floor Mats (Front and Rear)
*Y58	Rubber Floor Mats (Front Only)
*Y63	Additional Set of Keys
*Y64	Roof Rack
*Y69	Headlamp Protectors
*Y71	Rear Window Louvre
*Y86	Towbar Package — 1200 kg (Manual)
*Y90	Towbar package — 1200 kg (Automatic)
*Y91	Rear Window Blind — Internal
*Y92	Bonnet Protector
*Y93	Rear Window Venetian (Internal)
*Y94	Side Window Venetian (Internal)
Z45	Cargo Barrier — Wagon
*Z46	Roof Ladder Rack

*Government and Fleet Orders only.

VEHICLE IDENTIFICATION NUMBER (V.I.N.)

This number is stamped on the plenum chamber above the Data Plate and also on the compliance plate. It supplies information for vehicle identification purposes and should be quoted when ordering parts or in any correspondence related to the vehicle.

6MMTR2H41MA000000

Geographic Area
Country within Geo. Area
Manufacturer

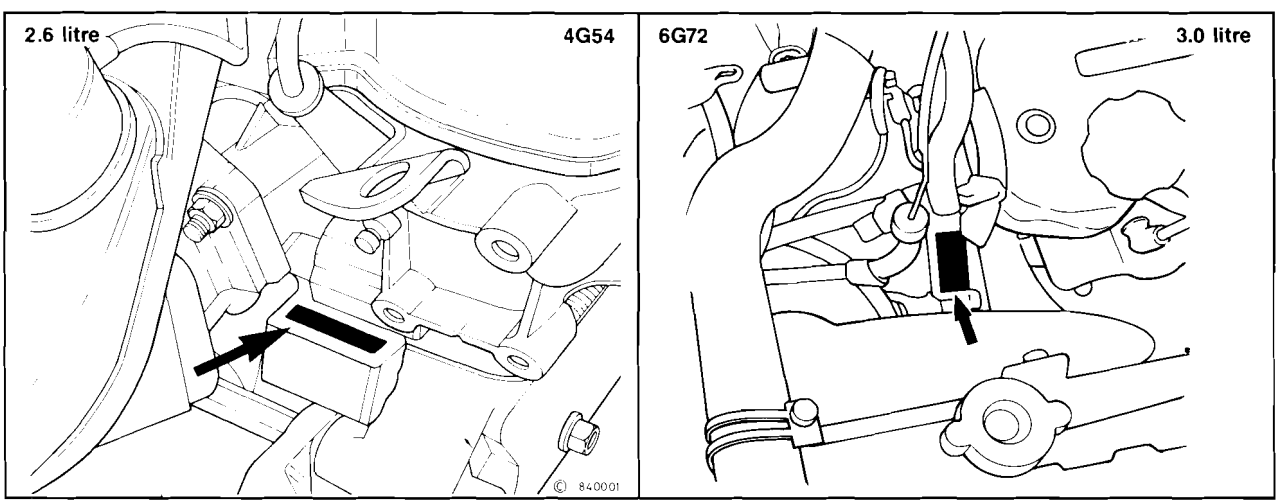
CAR LINE	SERIES		PRICE CLASS	BODY TYPE	MODEL YEAR	ASSEMBLY PLANT	BODY No.
T-Magna	R-Series		H-High	41-Sedan	M-1991	A-Adelaide	
K-Verada	S-Series		P-Premium	45-Wagon	N-1992	T-Tonsley Park	
			X-Luxury		P-1993		
		Australia, New Zealand and Pacific Regions	D-Executive		R-1994		
					S-1995		

Magna ENGINE/TRANS. COMBINATION	Verada/V3000 ENGINE/TRANS. COMBINATION
1-2.6 litre Carb (Man) Unleaded	1 —
2-2.6 litre Carb (Man) Unleaded	2 —
3-2.6 litre ECI-Multi (Man) Unleaded	3 —
4-2.6 litre ECI-Multi (Auto) Unleaded	4 —
5-3.0 litre ECI-Multi (Man) Unleaded	5-3.0 litre ECI-Multi (Man) Leaded export
6-3.0 litre ECI-Multi (Auto) Unleaded	6-3.0 litre ECI-Multi (Auto) Leaded export
7-2.6 litre ECI-Multi (Man) Leaded export	7 —
8-2.6 litre ECI-Multi (Auto) Leaded export	8-3.0 litre ECI-Multi (Auto) Unleaded

ENGINE NUMBER LOCATION

Location

The engine number is stamped on the right hand front, top edge of the cylinder block. Always quote the engine number when ordering engine replacement parts.



Engine number locations

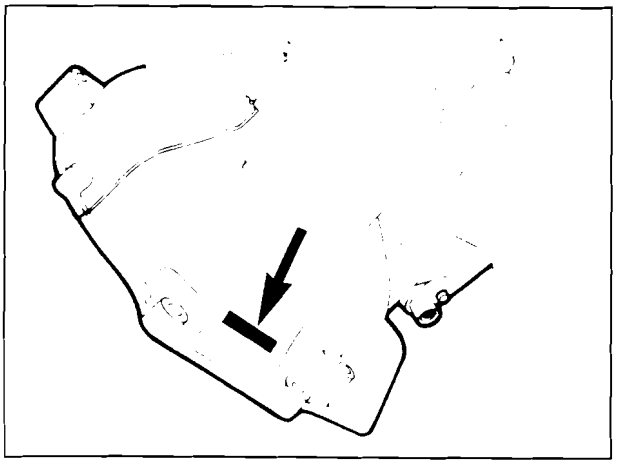
ENGINE NUMBER IDENTIFICATION

W 5 3 2 Z - 00216 *E25

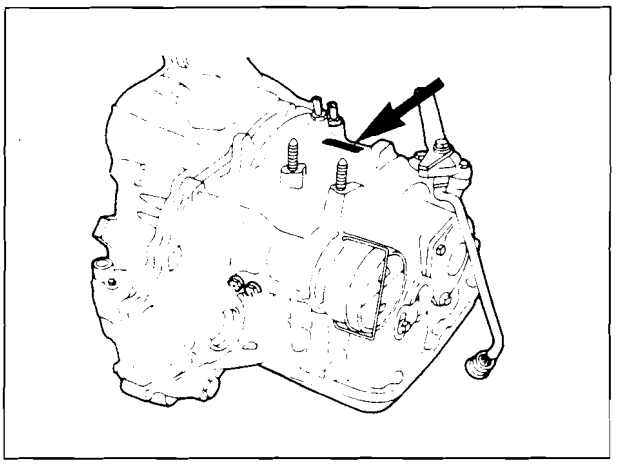
ENGINE SERIES	CAPACITY	TYPE	TRANSAXLE	YEAR BUILT	SERIAL No.
W-4G54	5-2555cm³	3-Balance shaft West East ECI-Multi version	1-Automatic	Z-1990	Commencing from No. 1 each engine and transaxle type
Y-6G72	7-2972cm³	9-Balance shaft West East Carburettor version	2-Manual	A-1991	
		2-V6 6G72 West East ECI-Multi version		B-1992	
				C-1993	
				D-1994	
				E-1995	

*Where special engines (for export models) are built, the engine option code will be stamped in this position.

TRANSAXLE SERIAL NUMBER LOCATION



Manual transaxle serial number



Automatic transaxle serial number (typical)

DATA PLATE

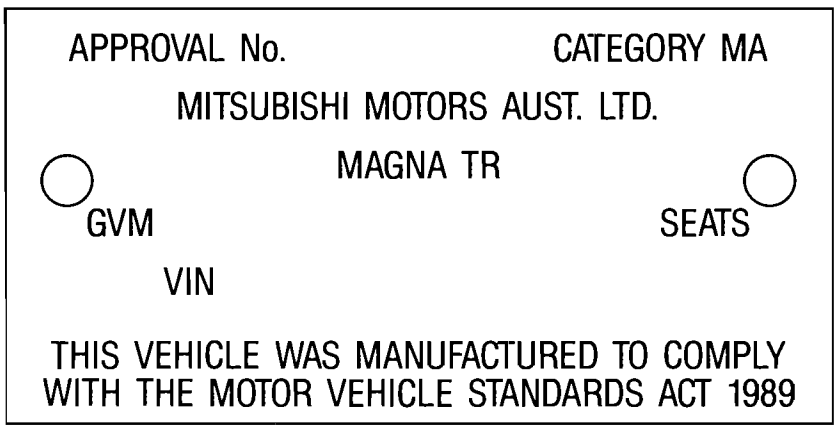
SOA No.:		BUILT:
PAINT TRIM	BODY LWR	*
OPTIONS		
USE GENUINE MITSUBISHI PARTS		
MITSUBISHI MOTORS AUSTRALIA LTD.	ALL CORRESPONDENCE MUST QUOTE V.I.N. SHOWN ON COMPLIANCE PLATE AS WELL AS INFORMATION ABOVE	

The Data Plate is attached to the right hand side of the plenum chamber (adjacent to the compliance plate) in the engine compartment and is stamped with vehicle option codes, trim codes and a daily body sequential build number.
*Body sequential build number
In all correspondence related to a vehicle or when purchasing spare parts, the following information should be quoted:

- The engine number
- The VIN code.
- The trim code.
- The paint code.
- The option code/s.

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COMPLIANCE PLATE



All vehicles are manufactured to conform to specific safety environmental or consumer protective requirements as defined by the Australian Design Rules (ADR).

NOTE: The Compliance Plate is attached to the right hand side of the plenum chamber in the engine compartment and must never be removed from the vehicle.

AUSTRALIAN DESIGN RULES

Australian Design Rules require the manufacturer of components and/or a complete vehicle to conform to specific safety, environmental or consumer protective requirements as defined by that particular rule.

There is legislation that requires, amongst other things, that no modifications be made to a vehicle that would cause that vehicle not to comply with the Design Rules of that vehicle (parts replacement using approved M.M.A.L. components is permissible). Before interchanging or adding optional equipment it is recommended that advice be sought from an Authorised M.M.A.L. Dealer or from a M.M.A.L. Regional Office, because it is possible to inadvertently cause a vehicle not to comply with a Design Rule.

VEHICLE DIMENSIONS

	Magna		Verada		V3000 (NZ)	
	Sedan	**Wagon**	**Sedan**	**Wagon**	**Sedan**	**Wagon**
Wheelbase	2722mm	2722mm	2722mm	2722mm	2722mm	2722mm
Overall length <R series>	4746mm	4790mm	4831mm	4888mm	4746mm	4790mm
Overall length <S series>	4746mm	4790mm	4786mm	4843mm	4746mm	4843mm
Overall width	1775mm	1775mm	1775mm	1775mm	1775mm	1775mm
Overall height	1450mm	1470mm	1449mm	1446mm	1449mm	1446mm
Front track	1535mm	1535mm	1535mm	1535mm	1535mm	1535mm
Rear track	1525mm	1505mm	1525mm	1505mm	1525mm	1505mm
Ground clearance — minimum @ GVM	112mm	122mm	112V6Eimm 147V6Ximm	132mm	139mm	137mm
Turning circle — kerb to kerb — RHS	11.0 m	11.0 m	11.0 m	11.0 m	11.0 m	11.0 m
— LHS	11.4 m	11.4 m	11.4 m	11.4 m	11.4 m	11.4 m

KERB MASS (Estimated)

Australian Models

Sedan Model Code	R Series Mass Kg	S Series Mass Kg	Wagon Model Code	R Series Mass Kg	S Series Mass Kg
TR/TS1-H-41	1335	1360	TR/TS1-H-45	1428	1454
TR/TS2-H-41	1357	1382	TR/TS2-H-45	1442	1468
TR/TS3-D-41	1347	1375	TR/TS3-D-45	1443	1469
TR/TS4-D-41	1384	1406	TR/TS4-D-45	1476	1502
TR/TS3-P-41	1380	1389	TR/TS3-P-45	1482	1496
TR/TS4-P-41	1420	1428	TR/TS4-P-45	1516	1530
TR4-X-41	1427	—	TR/TS5-D-45	1459	1520
TR/TS5-D-41	1370	1430	TR/TS6-D-45	1495	1556
TR/TS6-D-41	1407	1466	KR/KS8-P-45	1563	1595
KR/KS8-P-41	1472	1446			
KR/KS8-X-41	1521	1480			

New Zealand Models

Sedan Model Code	R Series Mass Kg	S Series Mass Kg	Wagon Model Code	R Series Mass Kg	S Series Mass Kg
TR/TS7-D-41	1349	1345	TR/TS7-H-45	1438	1440
TR/TS8-D-41	1386	1376	TR/TS8-H-45	1471	1473
TR/TS8-P-41	1419	1423	KR/KS5-D-45	1488	1456
KR/KS5-D-41	1379	1368	KR/KS6-D-45	1522	1492
KR/KS6-D-41	1416	1404	KR/KS6-P-45	1555	1537
KR/KS6-P-41	1452	1443			
KR/KS6-X-41	1529	1530			

Papua New Guinea, Brunei & Fiji Models

Sedan Model Code	R Series Mass Kg	S Series Mass Kg	Wagon Model Code	R Series Mass Kg	S Series Mass Kg
TR/TS7-D-41	1374	1373	TR/TS7-D-45	1469	1469
TR/TS8-D-41	1411	1404	TR/TS8-D-45	1502	1498
TR/TS8-P-41	1427	1428	TR/TS7-P-45	1490	1561
KR/KS6-P-41	1479	1490	TR/TS8-P-45	1524	1525
KR/KS6-X-41	1521	1535	KR/KS6-P-45	1571	1561

NOTE: Kerb mass as specified is with no load, full fuel tank, oil, water etc. Tolerance is ± 2%.

OPTIONAL EQUIPMENT MASS (Estimated)

	Kg
A03 — Supplemental Restraint System	+ 9.3
A13 — Luxury Pack	+ 7.0
H50 — Air conditioning	+ 23.0
W37 — Cast alloy wheels	− 11.0
B14 — ABS brakes	+ 25.0

NOTE: The mass quoted for factory approved options is not the actual mass of the option, but the difference in mass between the standard vehicle and one fitted with the option.

Some items listed as options on page 00-2-5 may be fitted as standard equipment. When this is the case the mass of that equipment is included in the kerb mass quoted above.

GENERAL SPECIFICATIONS

Front Suspension ..... Independent McPherson strut type with A-arms and stabiliser bar

Brakes

Type— front — 14" ..... 256 mm x 24 mm ventilated disc with BCI single piston, sliding caliper
— front — 15" ..... 276 mm x 24 mm ventilated disc with BCI single piston, sliding caliper
— rear (All) ..... 258 mm x 10.4 mm solid disc with BCI single piston, sliding caliper
Master cylinder ..... BCI tandem master cylinder with integral proportioning valves and "fast fill" system
Vacuum booster ..... BCI 205/180 mm dual diaphragm "Master Vac". Ratio 5:1
Park brake ..... Cable operated on rear wheels, drum in disc

Clutch

Type ..... Hydraulically actuated single dry disc with diaphragm type pressure plate
Clutch disc diameter ..... 225 mm

Engine

Type	OHC 4 cylinder in line, with counter-balance shafts	OHC/OHV/VIV — V6
Model	4G54	6G72 V6
Displacement	2555 cc	2972 cc
Bore	91.10 mm	91.1 mm
Stroke	98.00 mm	76.0 mm
Compression ratio — ECI-Multi	9.2:1	10:1
— Carburettor	8.8:1	

Fuel System

Type — carburettor models ..... Mikuni resin body carburettor with low pressure, in-tank electric fuel pump
fuel injection models ..... Electronically controlled "multi point" injection system with high pressure, in-tank electric fuel pump

Rear Suspension (Sedan) ..... 3 link torsion axle with coil springs
(Wagon) ..... 5 link tubular axle with coil springs and lateral rod

Steering

Type ..... Rack and pinion power assisted with collapsible steering column
Ratio 17:1
Turns lock to lock 3.09

Manual Transaxle

Model — 4 cylinder models ..... F5M31-2-RPKJ 25 tooth splined drive shafts
— V6 models ..... F5M33-2-SNQJ 27 tooth splined drive shafts
— New Zealand V6 models ..... F5M33-2-SNZJ 25 tooth splined drive shafts
Type ..... Cable operated 5 speed, with synchromesh on all gears

Automatic Transaxle

Model — carburettor 4 cylinder models ..... F4A23-2-LPN — 25 tooth splined drive shafts
— fuel injection 4 cylinder models ..... F4A33-1-MPN1 — 25 tooth splined drive shafts
— fuel injection 4 cylinder models ..... F4A33-1-MPP1 — 27 tooth splined drive shafts
— fuel injection 4 cylinder models ..... F4A33-1-MPP2 — 27 tooth splined drive shafts
— fuel injection 4 cylinder models ..... F4A33-1-MPQ1 — 27 tooth splined drive shafts
— fuel injection V6 models ..... F4A33-1-MNN6 — 25 tooth splined drive shafts
— fuel injection V6 models ..... F4A33-1-MNP6 — 27 tooth splined drive shafts
— fuel injection V6 models ..... F4A33-1-MNP9 — 27 tooth splined drive shafts
— fuel injection V6 models ..... F4A33-1-MNQ3 — 27 tooth splined drive shafts

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Gear Ratios

	Manual Transaxle			Automatic Transaxle	
	(4 Cylinder)	(V6 ECI-Multi)	(Carburettor)	(ECI-Multi)	(V6 ECI-Multi)
				*F4A33-1-MNPQ1	*F4A33-1-MNQ3
				F4A33-1-MPP2	*F4A33-1-MNP9
		*F5M33-2-SNQJ		*F4A33-1-MPP1	*F4A33-1-MNP6
	F5M31-2-RPKJ	5M33-2-SNZJ	F4A23-2-LPN	F4A33-1-MPN1	F4A33-1-MNN6
1st	3.166:1	3.090:1	2.551:1	←	←
2nd	1.833:1	1.833:1	1.488:1	←	←
3rd	1.240:1	1.217:1	1.000:1	←	←
4th	0.896:1	0.888:1	0.685:1	←	←
5th	0.666:1	0.741:1	—	—	—
Reverse	3.166:1	3.166:1	2.176:1	←	←
Transfer gear	1.192:1	1.208:1	1.125:1	1.228:1	←
Differential ratio	3.411: 1	3.437:1	3.466:1	3.222:1	←
Final gear ratios	4.068:1	4.153:1	3.900:1	3.958:1	←
Type		2 pinion, helical cut spur gear set			

***NOTE: Transaxle models marked * require 27 tooth splined drive shafts.**

Vehicle standing height

As measured from the wheel centre to wheel arch.

	Front	Rear
Sedan and Wagon (All models)	406 ± 10 mm	382 ± 10 mm
KR Sedan (with ECS)	396 ± 5 mm	367 ± 5 mm

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SECTION 3 — SERVICE INFORMATION

PROTECTING THE VEHICLE

• When performing maintenance or repair operations use suitable covers to prevent damage to paint and interior trim.

• If high pressure or steam cleaning equipment is being used to wash the vehicle, the spray nozzle should be positioned a **MINIMUM** of 300 mm from any plastic components and all opening parts, e.g. doors, deck lid etc.

• Although the paint surface will resist damage, any oil, brake fluid or petrol spills should be cleaned up as soon as possible to prevent discolouration.

SPECIAL TOOLS

Special tools are developed to prevent component damage during assembly/disassembly procedures and to reduce the possibility of operator injury.

It is therefore recommended that special tools are used whenever they are available for a particular operation.

NON RE-USABLE PARTS

If any of the parts listed below are removed, they must be replaced with new parts:

- Oil seals
- Gaskets (except rocker cover)
- O-rings
- D-rings
- Lock washers
- Split pins
- Self-locking nuts

RUBBER/PLASTIC COMPONENTS

Avoid spilling petrol, oil, solvents, brake fluid etc. on plastic and rubber components, as this may lead to deterioration of the component.

METRIC FASTENERS

The vehicles covered in this Service Manual are in most instances, fitted with metric fasteners. The only exceptions are seat belt and child restraint anchorages, in these applications Imperial fasteners, conforming to Australian Design Rules and International Standards, are used.

ELECTRICAL SYSTEM SERVICE PRECAUTIONS

When performing any repair work on the electrical system always disconnect the negative cable from the battery.

CAUTION: Before connecting or disconnecting the negative cable, ensure that the ignition and lighting switches are turned OFF. Failure to do this may result in damage to electronic components incorporated in same equipment.

Wiring Connectors

• When uncoupling a connector, pull on the connector **NOT** the harness.

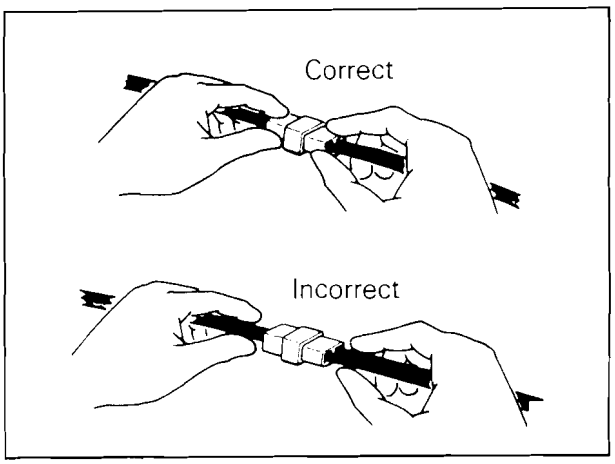


Fig. 1—Disconnecting wiring harness

• To uncouple a connector with a catch, press in the direction of the arrows shown in Fig. 2.

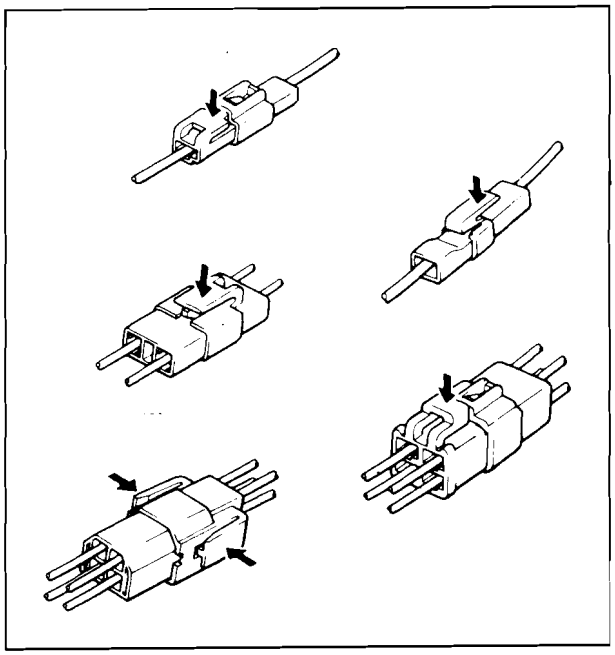


Fig. 2—Uncoupling connectors

• When coupling a connector with a catch insert the connectors until they "snap".

Wiring Harness Routing

• Wiring harnesses, with the exception of those connected to the engine and transaxle, should be routed and clamped so that there is no slack in the harness.

• If a harness mounting identification mark is visible on a harness, the harness should be clamped at that point.

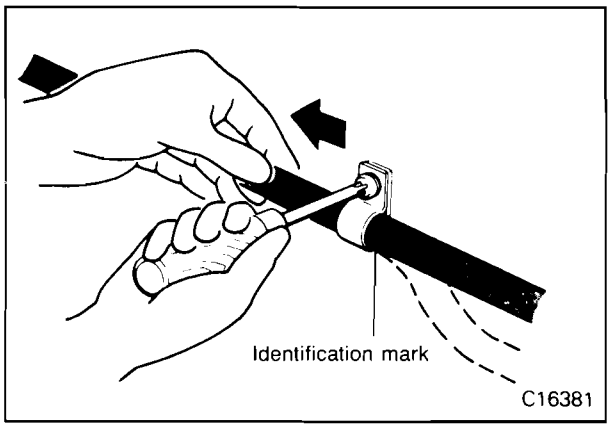


Fig. 3—Harness identification mark

• When routing harnesses to the engine or transaxle allow sufficient slack to prevent harness breakage or uncoupling but not enough to allow the harness to contact surrounding parts.

NOTE: If any section of a harness does contact a component or body panel, ensure that sufficient protection, in the form of insulation tape etc. is provided.

• When installing and tightening components ensure that wiring harnesses are not pinched or damaged.

Continuity and Voltage Testing

When performing continuity or voltage checks it is recommended that harness connectors remain coupled. Following this practice will facilitate identification of faults and reduce the possibility of terminal damage.

To check wiring and connectors insert a suitable test probe into the back of the connector.

NOTE: If the connector is a sealed (or waterproof) type insert the probe through the wire hole in the seal taking care not to damage the wiring insulation.

If it is necessary to uncouple connectors to perform checks, DO NOT force probes into female terminals. This will open the terminal and result in poor contact. Always use the finest probe available.

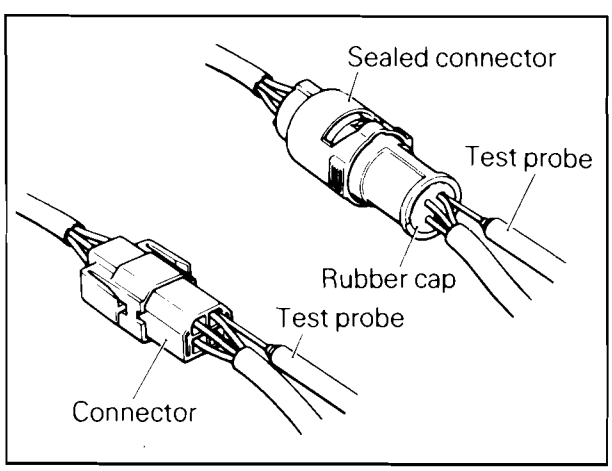


Fig. 4—Inserting test probe

Electrical Component Protection

Sensors, relays, control units etc. are sensitive to shock, impact and, in the case of electronic components, excessive temperatures.

• Handle all electrical components with care and avoid dropping them.

• When body repair or paint operations involving temperatures higher than 80°C are being performed, remove electronic components which may be affected prior to commencing work.

• When performing electrical welding operations, ensure that **BOTH** battery cables are disconnected from the battery to prevent damage to electronic components.

CAUTION: Disconnect the negative cable first, ensuring that all lights and the ignition are switched off.

Fuses and Fusible Links

If a blown fuse is to be replaced, use only a fuse of the specified rating.

If a higher rating fuse is fitted, the system may not be adequately protected and component or harness damage may result.

Accessory Fitment

When fitting accessories, always follow the manufacturers instructions and ensure that the wiring used is adequate for the current draw of the equipment.

INSTALLATION OF RADIO EQUIPMENT

Although the various electronic control systems used have been designed to minimize any possibility of radio wave interference, if the antenna or antenna cable of a radio transceiver is positioned too close to a control unit, unit operation may be affected.

To prevent radio wave interference, the following points should be observed:-

(1) Install the antenna on the roof or rear bumper bar.

(2) Route the antenna cable at least 200 mm away from control units and wiring harnesses. If a cable must cross a harness, it should cross at right angles.

(3) Ensure that the impedance of the antenna and cable are closely matched and that the standing wave ratio is kept low to reduce the number of radio waves emitted from the antenna cable.

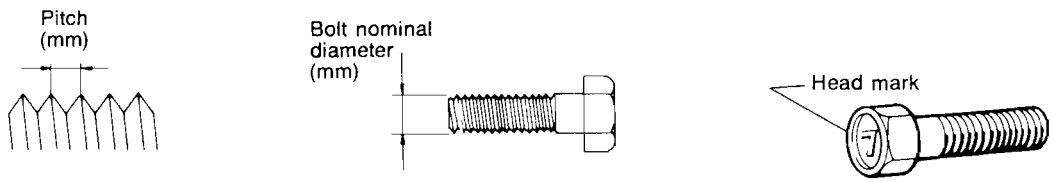
(4) Do not install a high output unit.

(5) After installing the unit; road test the vehicle and ensure that vehicle operation is not affected when the transmitter is used.

STANDARD PARTS TORQUE CHART

Standard bolt and nut tightening torque

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kgm. ft.lbs.)		
		Head mark ④	Head mark ⑦	Head mark ⑧
M5	0.8	2–3 (0.2–0.3, 1.4–2.2)	4–6 (0.4–0.6, 2.9–4.3)	5–7 (0.5–0.7, 3.6–5.1)
M6	1.0	4–6 (0.4–0.6, 2.9–4.3)	7–11 (0.7–1.1, 5.1–8.0)	8–12 (0.8–1.2, 5.8–8.7)
M8	1.25	9–14 (0.9–1.4, 6.5–10)	17–26 (1.7–2.6, 12–19)	20–30 (2.0–3.0, 14–22)
M10	1.25	19–28 (1.9–2.8, 14–20)	35–55 (3.5–5.5, 25–40)	45–60 (4.5–6.0, 33–43)
M12	1.25	34–50 (3.4–5.0, 25–36)	70–95 (7.0–9.5, 51–69)	85–110 (8.5–11, 61–80)
M14	1.5	60–85 (6.0–8.5, 43–61)	120–160 (12–16, 87–116)	130–180 (13–18, 94–130)
M16	1.5	95–130 (9.5–13, 69–94)	180–240 (18–24, 130–174)	200–270 (20–27, 145–195)
M18	1.5	140–190 (14–19, 101–137)	260–350 (26–35, 188–253)	300–400 (30–40, 217–289)
M20	1.5	190–260 (19–26, 137–188)	360–480 (36–48, 260–347)	410–560 (41–56, 297–405)
M22	1.5	260–350 (26–35, 188–253)	480–650 (48–65, 347–470)	560–750 (56–75, 405–542)
M24	1.5	340–460 (34–46, 246–333)	630–860 (63–86, 456–622)	740–1,000 (74–100, 535–723)



Flange bolt andf nut tightening torque

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kgm. ft.lbs.)		
		Head mark ④	Head mark ⑦	Head mark ⑧
M6	1.0	4–6 (0.4–0.6, 2.9–4.3)	8–12 (0.8–1.2, 5.8–8.7)	9–14 (0.9–1.4, 6.5–10)
M8	1.25	10–15 (1.0–1.5, 7.2–11)	19–28 (1.9–2.8, 14–20)	22–23 (2.2–3.3, 16–24)
M10	1.25	21–31 (2.1–3.1, 15–22)	39–60 (3.9–6.0, 28–43)	50–65 (5.0–6.5, 36–47)
M10	1.5	19–29 (1.9–2.9, 14–21)	36–54 (3.6–5.4, 26–39)	45–65 (4.5–6.5, 33–47)
M12	1.25	38–55 (3.8–5.5, 27–40)	80–110 (8.0–11, 58–80)	90–120 (9.0–12, 65–87)
M12	1.75	34–52 (3.4–5.2, 25–38)	70–95 (7.0–9.5, 51–69)	85–110 (8.5–11, 61–80)

Taper thread tightening torque

Thread size	Torque Nm (kgm. ft.lbs.)	
	Female thread material: Light alloy	Female thread material: Steel
NPTF 1/6	5–8 (0.5–0.8, 3.6–5.8)	8–12 (0.8–1.2, 5.8–8.7)
PT 1/8	8–12 (0.8–1.2, 5.8–8.7)	16–20 (1.6–2.0, 12–14)
PT 1/4, NPTF 1/4	20–30 (2.0–3.0, 14–22)	35–45 (3.5, 25–33)
PT 3/8	40–55 (4.0–5.5, 29–40)	60–75 (6.0–7.5, 43–54)

NOTE: NPTF is dry seat pipe thread, while PT is pipe thread.

Each torque value in the table is a standard value for tightening under the following conditions.
(1) Bolts, nuts and washers are all made of steel and plated with zinc.
(2) The threads and bearing surface of bolts and nuts are all in dry condition.

The values in the table are not applicable:
(1) If toothed washers are inserted.
(2) If plastic parts are fastened.
(3) If bolts are tightened to plastic or die-cast inserted nuts.
(4) If self-tapping screws or self-locking nuts are used.

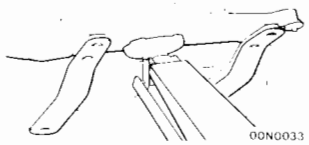
As a standard practice in the following instances, reduce the values shown in the table to the percentages indicated below:

a. If spring washers are used 85%
b. If threads and bearing surfaces are stained with oil 85%

SUPPORT LOCATIONS FOR LIFTING AND JACKING

When using a garage jack

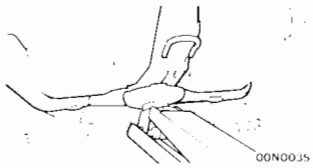


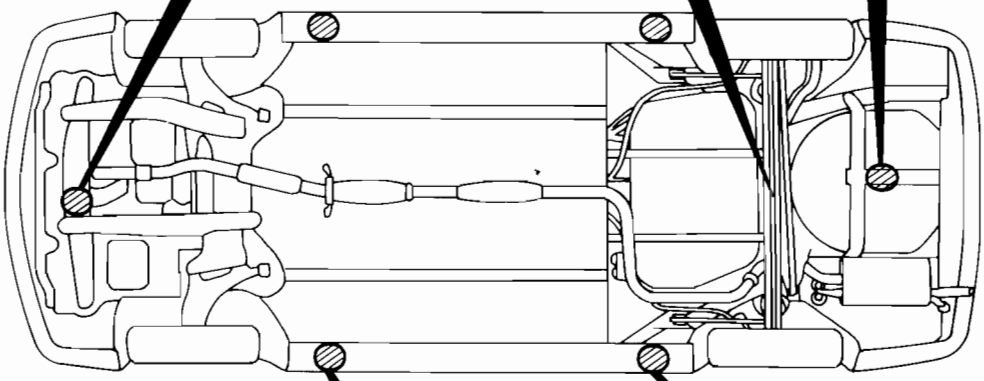


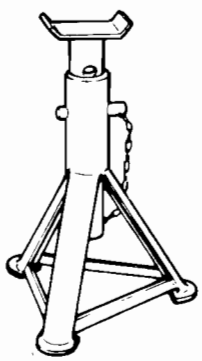
Wagon only

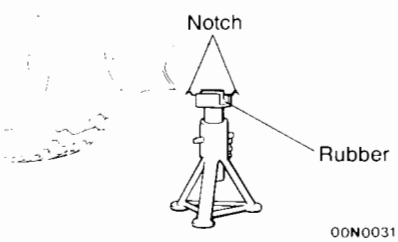


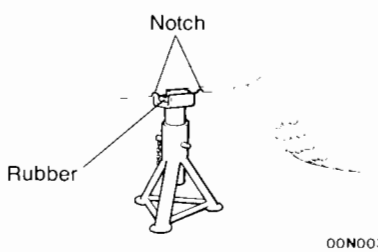
Do not attempt to use the rear suspension components for a jacking point. (Sedan only)



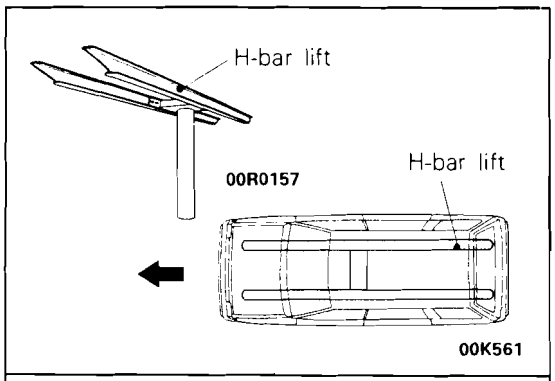


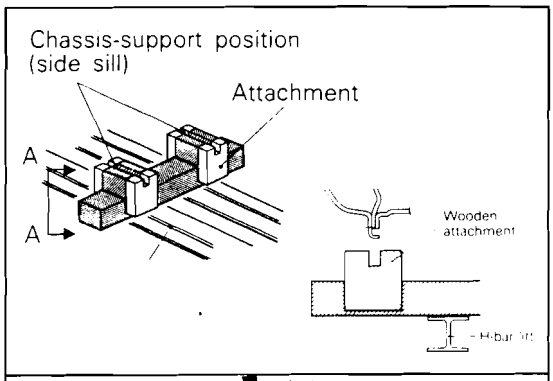


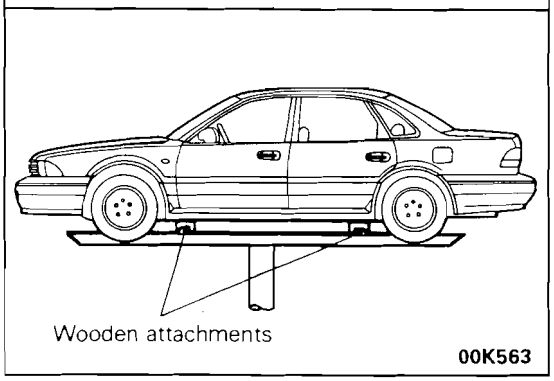


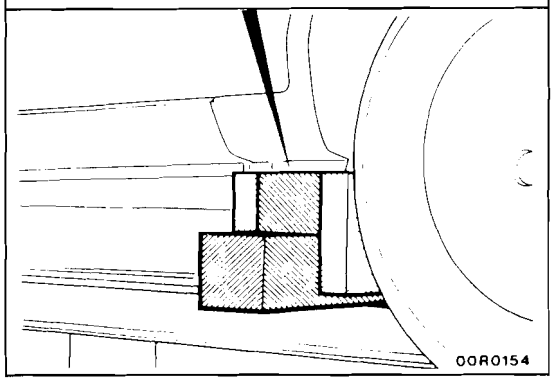


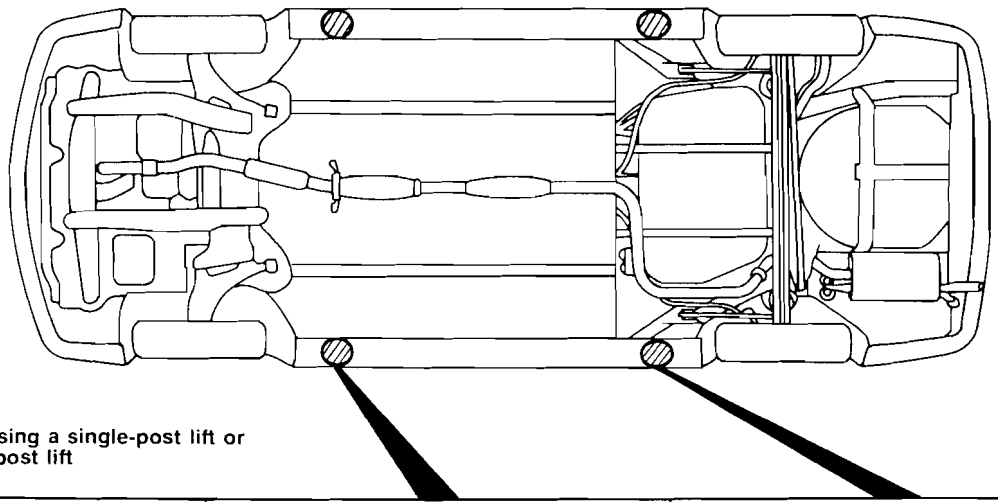
When using a free-wheel-type auto lift



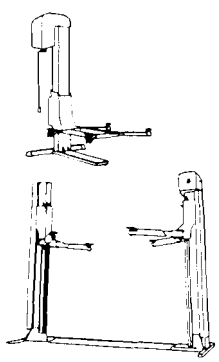


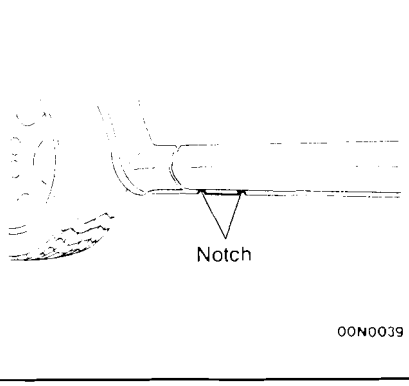


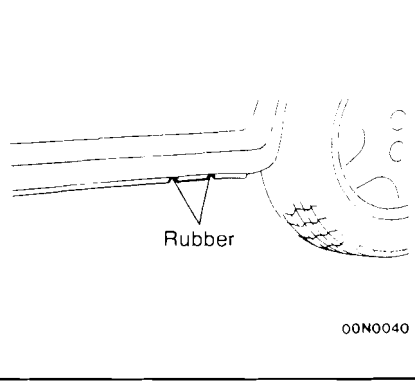




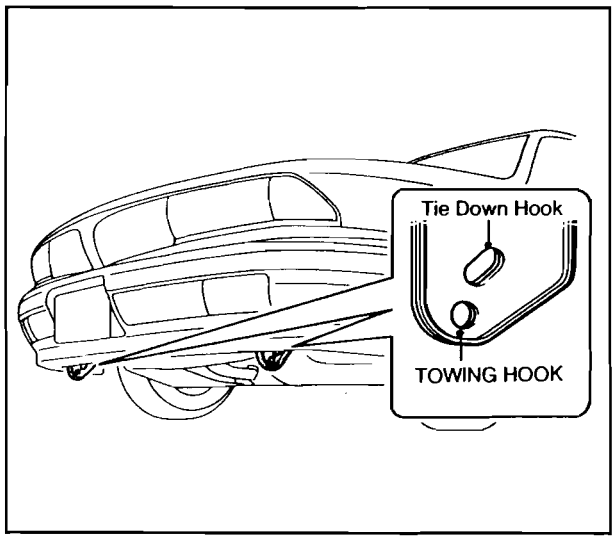
When using a single-post lift or double-post lift



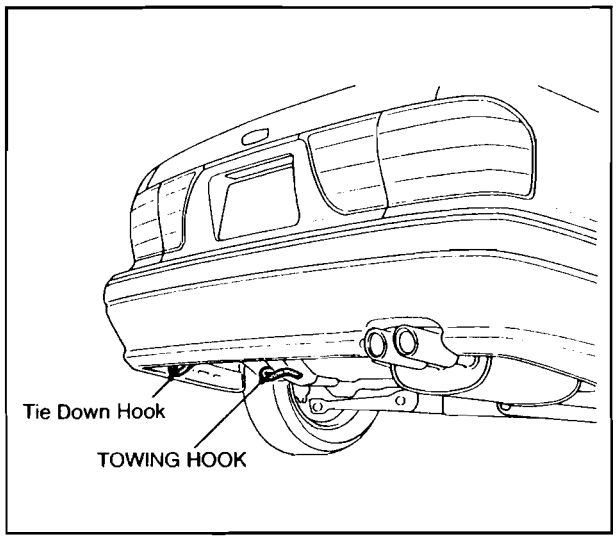




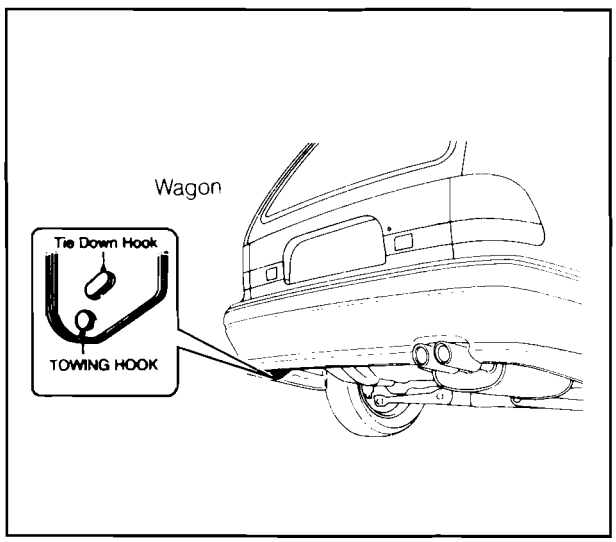
TOWING POINTS



Front



Rear Sedan



Rear Wagon

SECTION 4 — LUBRICANTS

GENERAL INFORMATION

Lubricant recommendations have been determined to maintain maximum performance and provide optimum vehicle protection under various operating conditions. The information contained in this section should, therefore, be used as a guide to ensure that the correct lubricant is selected.

While, in most cases, no particular brand of lubricant is recommended, lubricants manufactured by a reputable oil company should always be used.

It is important that the material used meets the classification requirements stated in this manual.

NOTE: The M.M.A.L. lubricant specifications stated in this manual are the result of considerable development work, and have been established to ensure that materials used meet all the requirements of a specific application.

Lubricants and coolants which meet these specifications are formulated with the optimum quantities of a carefully balanced combination of selected additives, and are suitable for use in vehicles marketed by M.M.A.L. Any arbitrary addition of proprietary materials may disrupt the balance of these additives and destroy the essential properties of the lubricant or coolant, resulting in failure of the mechanical assembly.

Furthermore the addition of proprietary materials is an unnecessary and expensive penalty to vehicle operating costs.

Classification of Lubricants

Engine Oils

Two designations, SAE and API, are used to match engine oils to service requirements. Generally, designations will be found on the oil container.

The SAE grade number indicates engine oil viscosity or fluidity. For example SAE 30 is a single viscosity oil. Most engine oils have multiple viscosity grades such as SAE 10W 30, with a low viscosity when cold. These multigrade oils have a more constant viscosity than single grade oils for the same temperature rise.

The API classification indicates oil performance or quality and ranges from "SA" to "SG" depending on service requirements.

Gear Oils

Gear oil performance level, or quality, is shown by its API classification. The classification range for gear oils is from "GL-1" to "GL-5 (plus)" depending on application.

Automatic Transaxle Fluid

Mitsubishi Magna ELC-4-SP Automatic Transmission Fluid. Use of MMAL specified fluid is mandatory to ensure correct operation of the transmission.

Grease

Semi-solid lubricants specified for chassis and similar applications should meet NLGI Multi-purpose, non-melt type No. 2 specifications except where otherwise stated.

Points NOT Requiring Lubrication

- The bearings listed below are permanently lubricated and require only inspection and/or replacement when a complete component overhaul is performed.

(i) Starter motor bushes
(ii) Clutch release bearing (man. trans.)
(iii) Alternator bearings

- The rubber bushings used at the points listed below are designed to grip the contacting metal parts firmly and act as a flexible medium between metal parts. **The use of any lubricant on these bushes will reduce the friction required for correct operation and result in premature failure of the bushing.**

(i) Rear axle arm bushings
(ii) Front suspension bushings
(iii) Engine drive belts

- The application of any lubricant to the air cleaner element will destroy the effectiveness of the element.

Engine Oil Change Frequency

Regular oil changing is essential for efficient running and long engine life.

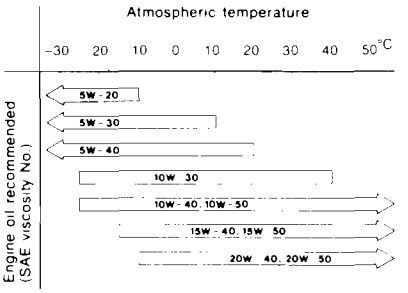
Under normal operating conditions, i.e. good roads in temperate climates, engine oil change intervals should be 10,000 km or six months (whichever occurs first).

Changing the oil every six months regardless of distance travelled, will minimize the harmful effects of any condensation or sludge that may form in the engine when most trips are of short duration at slow speeds, such as city traffic type driving.

If a vehicle is operated under unusual or severe conditions, such as those listed below, the protective life of the oil can be significantly reduced, necessitating oil changes at 5,000 km intervals.

- Frequent towing of trailers, boats, etc.,
- Continuous operation at higher than normal loadings,
- Operating in dusty or sandy terrain,
- Extremely short run operation,

LUBRICANT CHART

COMPONENT		M.M.A.L. SPEC. No.	LUBRICANT
Engine			Conforming to the requirements of the A.P.I. classification "For Service SG, with a phosphorus content not exceeding 0.1% by weight, suitable for use in vehicles equipped with a catalytic converter", having the correct S.A.E. Viscosity grade number for the expected temperature range. 
Power steering		ES-X64022 Type 3	Mitsubishi Power Steering Fluid
Automatic Transaxle		ES-X64022	Mitsubishi Magna **ELC-4-SP** Automatic Transmission Fluid.
Manual transaxle		ESX-64O21 Type 4	Hypoid gear oil: API classification GL-4 SAE Viscosity No. 75W-85W
Radiator		ES-X64216	Rain or demineralized water plus Mitsubishi Longlife coolant in the required concentration.
Brakes Clutch		MS41/46	DOT 4 fluid conforming to AS1960-1983 Grade 3
Front and rear wheel bearings		MS42/5	Multi-purpose, non-melt type No. 2 Grease
Body	Seat slides Door check straps	MS42/2	Lithium base, multi-purpose EP No. 2 Grease
	Engine hood lock Door lock and striker	42/MS 1481-X	Mitsubishi "Easi-Lube" stick lubricant
	Door — hinges — lock cylinders Hood — hinges Front seat — recliner Deck lid — lock — lock cylinder — hinges		Engine oil
Battery terminals		42MS/272	Petroleum jelly
Speedometer cable		42MS 4599	Shell Alvania RVI speedometer cable lubricant

SECTION 5 — LUBRICATION AND MAINTENANCE

SPECIFICATIONS

Engine tune-up

Carburettor models

Idle speed (r.p.m.) — manual	750 ± 50
— automatic	800 ± 50
A/C idle up speed (r.p.m.) — manual	850 ± 50
— auto	900 ± 50
Ignition timing — basic (hose to outer can disconnected and plugged)	5° ± 2° B.T.D.C. @ idle speed
— idle advance (hose connected to outer can)	13° ± 4° B.T.D.C. @ idle speed
Spark plugs — type	Champion N9YC
— gap	0.7 to 0.8 mm

Fuel injection 4 cylinder models

Idle speed (r.p.m.)	800 ± 50
Ignition timing	5° ± ½° B.T.D.C. (electronic spark timing cut)
	13° ± 2° B.T.D.C. (with electronic spark timing)
Spark plugs — type	N9YC
— gap	0.7 to 0.8 mm

Fuel injection V6 models (incl. V3000)

Idle speed (r.p.m.)	700 ± 100
Ignition timing	5° ± 2° B.T.D.C. (electronic spark timing cut)
	15° ± 2° B.T.D.C. (with electronic spark timing)
Spark plugs — type	N9YC4
— gap	1.0 mm pre-gapped
Idle CO% (V3000)	1.5% ± 0.5%

NOTE: The above specifications were correct at time of publication. If these specifications differ from those on the Vehicle Emission Control Decal (located on the underside of the engine hood) use the specifications listed on the decal.

Drive belt tension (4 cylinder models)

Alternator and power steering	— New belt	650 N
	— Used belt	530 N
Air-conditioning	— New belt	440-540 N
	— Used belt	340-440 N

Drive belt tension (6 cylinder models)

Alternator and power steering	— New belt	690-880 N
	— Used belt	490 N
Air-conditioning	— New belt	590-690 N
	— Used belt	390-490 N
Water pump belt deflection (4 cylinder models only)		5-7 mm with 70 N force

NOTE: A new belt becomes classified as a used belt after 5 minutes running time.

SPECIFICATIONS CONT.

Clutch pedal
- Pedal play (at clevis pin) ..... 1 to 3 mm
- Pedal free travel (including pedal play) ..... 6 to 13 mm

Front wheel alignment
- Toe-in — measured at centre of tyre tread ..... 0 ± 3.0 mm
- Toe-out on turns — measured on outer wheel with inner wheel on 20° ..... 22°

Steering wheel freeplay
- At steering wheel circumference ..... 0 to 30 mm

Brake pad wear limit
- Minimum pad material thickness — front and rear ..... 1.0 mm

Park brake adjustment
- Lever stroke ..... 3 to 5 notches @196 N

Brake pedal adjustment
- Pedal freeplay ..... 3 to 8 mm
- Pedal height ..... 176 to 181 mm

SPECIAL TOOLS

MB991502	Multi-Use-Tester (MUT)
MRP-A	ROM Pack
E8M15	LED, Test lamp
	Adjustable power timing light
	CO meter
	Spark plug gapping gauge
	Tachometer

TORQUE SPECIFICATIONS

	Nm
Alternator — pivot bolt	20 to 25
— adjusting bolt clamp	12 to 15
Balance shaft chain adjusting bolt	15 to 20
Balance shaft chain cover	4 to 5
Battery terminal clamp	2.5
Brake caliper guide pin bolt	
— front	30 to 40
— rear	30 to 40
Engine oil drain plug	35 to 45
Exhaust manifold to cylinder head nut	15 to 19
Front strut to knuckle bolt	95 to 105
Rear shock absorber to axle bolt	80 to 100
Road wheels (in sequence)	90 to 110
Spark plug	20 to 28
Steering rack to crossmember bolt	60 to 80
Tie rod end to knuckle nut	24 to 34
Trailing arm (rear axle) to body bolt	80 to 100
Transaxle drain plug	29 to 34
Transaxle filler plug	29 to 34
Transaxle oil pan bolts	10 to 11
Water pump mounting bolts	20 to 25

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FLUID CAPACITIES.

Engine oil pan	— 4G54 without filter	4.1 litres
	— 4G54 with filter	4.6 litres
	— 6G72 without filter	4.0 litres
	— 6G72 with filter	4.3 litres
Manual transaxle		2.0 litres
Automatic transaxle	— F4A23 (incl. T/C)	6.1 litres
	— F4A33 (incl. T/C)	7.5 litres
Cooling system	— 4G54 ECI-Multi models	9.6 litres
	— 4G54 Carby models	8.4 litres
	— 6G72 models	9.5 litres

	Kilometre Intervals																				
	1,500	10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000	110,000	120,000	130,000	140,000	150,000	160,000	170,000	180,000	190,000	200,000
LUBRICATION																					
Check fluid level and condition																					
– engine	x																				
– brake master cylinder	x	x	x	x	x		x	x	x	x		x	x	x	x		x	x	x	x	
– clutch master cylinder	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
– power steering	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
– transaxle manual	x	x	x	x		x	x	x		x	x	x		x	x	x		x	x	x	
– transaxle automatic	x	x	x	x	x		x	x	x	x		x	x	x	x	x		x	x	x	x
Change automatic transaxle fluid						x					x					x					x
Change manual transaxle fluid (normal usage)									x								x				
Change manual transaxle fluid (severe usage)					x				x				x				x				x
Change engine oil every 6 months or		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Change engine oil filter every 6 months or		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
UNDER HOOD OPERATIONS																					
Check engine coolant level and concentration	x	x	x	x		x	x	x		x	x	x		x	x	x		x	x	x	
Drain, flush and refill cooling system using rain or demineralised water and Specified Coolant in the recommended concentration every 24 months or					x				x				x				x				x
Valve clearance adjustment (if applicable)			x		x		x		x		x		x		x		x		x		x
Check battery electrolyte specific gravity	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Check all fluid lines and hoses for routing, tightness and leaks		x			x			x			x			x			x			x	
Check ignition cables, distributor cap and rotor for damage			x				x				x				x				x		
Lubricate distributor (carby models)						x					x					x					x
Check adjustment and condition of external drive belts	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace fuel filter (carby models)						x					x					x					x
Replace fuel filter (MPI models)											x										x
Replace spark plugs (conventional type)					x				x				x				x				x
Replace spark plugs (platinum type)											x										x
Clean and check air cleaner element		x	x	x		x	x	x		x	x	x		x	x	x		x	x	x	
Replace air cleaner element (normal usage)					x				x				x				x				x
Replace air cleaner element (severe usage)			x		x		x		x		x		x		x		x		x		x
Test oxygen sensor (Magna MPI 4 cyl)					x				x				x				x				x
Replace timing belt											x										x
Check ignition timing	x				x				x				x				x				x
Check idle speed and CO concentration * (carby models)	x				x				x				x				x				x
Check air conditioning refrigerant level at receiver drier sight glass	x		x		x		x		x		x		x		x		x		x		x

* Adjustment is not required during regular maintenance. This item is included as a check only, to indicate correct operation of emission control systems including the catalytic converter and the secondary air supply system. If a fault is evident refer to Group 13 — Fuel Systems for diagnosis and adjustment procedures.

	Kilometre Intervals																					
	1,500	10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000	110,000	120,000	130,000	140,000	150,000	160,000	170,000	180,000	190,000	200,000
UNDER VEHICLE OPERATIONS																					
Check exhaust system for alignment, security and leaks	x		x		x		x		x		x		x		x		x		x		x
Check fuel, oil, brake and vapour lines for damage, deterioration and leaks	x		x		x		x		x		x		x		x		x		x		x
Check front and rear suspension components for alignment, damage, wear and security			x		x		x		x		x		x		x		x		x		x
Check condition of ball joint seals and all bushes			x		x		x		x		x		x		x		x		x		x
Check steering components for alignment, wear and security			x		x		x		x		x		x		x		x		x		x
Check driveshaft dust boots for damage and deterioration			x		x		x		x		x		x		x		x		x		x
Check rear wheel bearings for play						x					x					x					x
SUSPENSION, STEERING, TYRES AND BRAKES																					
Check tyres for wear, damage and pressure	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brakes – check and adjust handbrake as necessary	x			x			x			x			x			x			x		
– check pad/lining wear		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
– drain, flush and refill brake hydraulic system using the specified brake fluid (every 24 months) or						x					x					x					x
ROAD TEST																					
Check operation and/or performance of the following:																					
Steering and suspension (including shock absorbers)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brakes and clutch (including handbrake)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Engine and driveability	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Vehicle lighting (including instrument panel, interior and warning lights)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Seat belts	x		x		x		x		x		x		x		x		x		x		x

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

GROUP 11 — ENGINE

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Cylinder Block		2
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Oil Seals, Oil Pan and Oil screen		6
Flywheel and Ring Gear		6
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SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
LOW COMPRESSION (DRY TEST)	Valves sticking or seating poorly.	Overhaul valve system.
	Blown cylinder head gasket (if pressure low in adjacent cylinders or coolant is contaminated with engine oil).	Install new head gasket.
LOW COMPRESSION (WET TEST)	Worn or sticking rings.	Replace or free-up rings.
NOISY VALVES	Worn rocker arms.	Replace arms and check oil supply holes.
	Worn valve guides.	Replace guides and if necessary install new valves.
	Worn or damaged camshaft lobes.	Replace camshaft.
	Excessive valve seat or valve face run-out.	Re-cut valves and seats.
	Malfunctioning hydraulic tappet adjusters.	Replace defective tappet adjusters.
CONNECTING ROD NOISE	Insufficient oil supply.	Check engine oil level.
	Low oil pressure.	Check oil pump output.
	Thin or diluted oil.	Change oil to correct viscosity.
	Excessive bearing clearance.	Measure bearings for correct clearances. Replace if necessary.
	Connecting rod journal out-of-round.	Remove crankshaft and regrind journals.
	Misaligned connecting rods.	Replace the bent connecting rods.
MAIN BEARING NOISE	Insufficient oil supply.	Check engine oil level.
	Low oil pressure.	Check oil pump output.
	Thin or diluted oil.	Change oil to correct viscosity.
	Excessive bearing clearance.	Measure bearings for correct clearances. Replace if necessary.
	Excessive end play.	Check respective end thrust bearing for wear on flanges.
	Crankshaft journals out-of-round or worn.	Remove the crankshaft and regrind journals.
	Loose flywheel.	Tighten to correct torque.
OIL PUMPING AT RINGS	Worn, scuffed or broken rings.	Hone cylinder bores and install new rings.
	Carbon in oil ring slots.	Install new rings.
	Rings fitted too tight in grooves.	Remove the rings. Check the grooves. If groove is not correct width, replace the pistons.

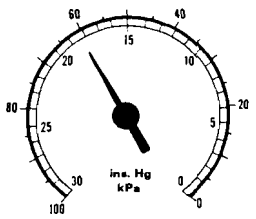
Condition	Possible Cause	Corrective Action
OIL PUMPING AT RINGS (CONT.)	Compression rings installed upside down.	Remove and refit rings correctly.
LOW OIL PRESSURE INDICATED	Low oil level.	Check and top up oil level if required.
	Faulty oil pressure sending unit.	Install a new sending unit.
	Thin or diluted oil.	Change the oil to correct viscosity.
	Oil pump relief valve stuck.	Remove the valve and inspect.
	Oil pump suction tube loose, bent or cracked.	Remove the oil pan and install a new tube if required.
	Clogged oil filter.	Install a new oil filter.
	Excessive bearing clearance.	Check the bearing clearance.
	Excessive oil pump gear clearance.	Remove oil pump and check gears for wear and clearance.

ENGINE DIAGNOSIS WITH VACUUM GAUGE

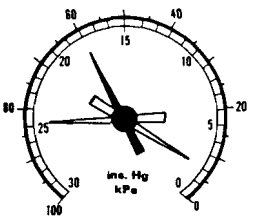
A vacuum gauge can be beneficial as an aid in diagnosing engine problems.

Obtain a reliable, calibrated vacuum guage and "tee" it into the inlet manifold at the brake booster vacuum connection. As for all 4-cylinder engines, a slight fluctuation will be noticed on the gauge when the engine is running. This can be removed by fitting a small petrol tap between the gauge and manifold. With the engine running, close the tap slowly until the fluctuation disappears.

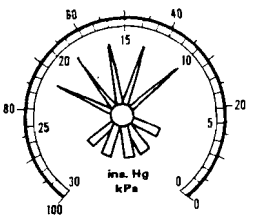
Use the readings as outlined opposite, to carry out your diagnosis.



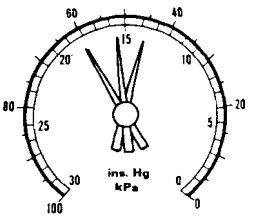
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NORMAL ENGINE



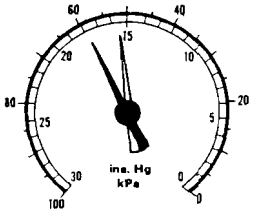
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NORMAL ENGINE



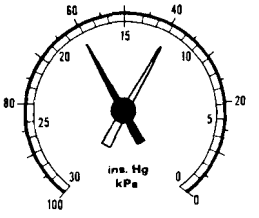
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VALVE SPRINGS WEAK



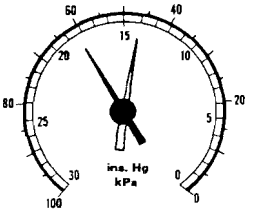
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VALVE GUIDES WORN



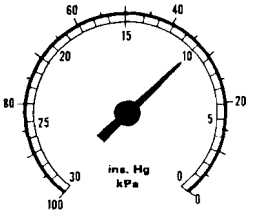
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VALVE LEAKING



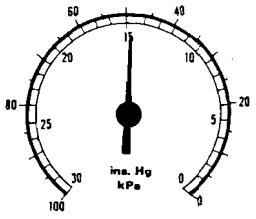
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VALVE BURNT



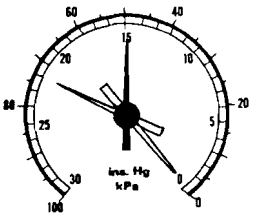
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VALVE STICKING



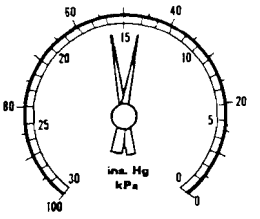
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VALVE TIMING LATE



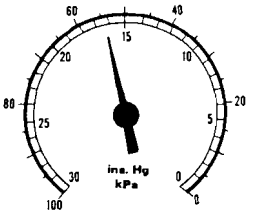
9
WORN RINGS



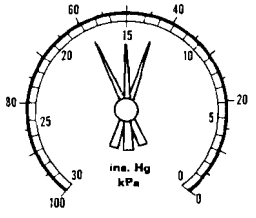
10
WORN RINGS OR INFERIOR LUBRICANT



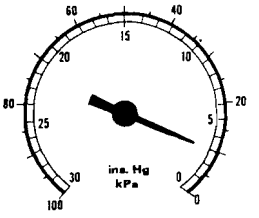
11
IGNITION DEFECTIVE



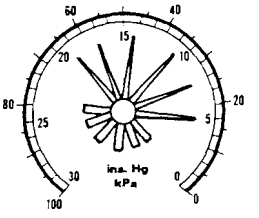
12
IGNITION RETARDED



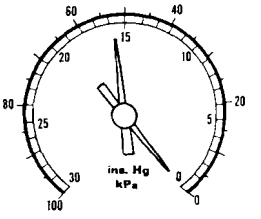
13
CARBURETTOR ADJUSTMENT



14
LEAKING INTAKE SYSTEM



15
LEAKING HEAD GASKET
(between cylinders)



16
BLOCKED EXHAUST SYSTEM

Readings — ins.Hg (kPa)

1. With the engine idling, the hand is steady between 17 and 21 (57 to 71).
2. With a rapid opening and closing of the throttle, the hand will fall to 2 (6.5) and swing back to 24 or 25 (81 to 84), settling on normal idle reading. Rings and valves indicated OK.
3. With fast running engine, the hand reads between 10 and 22 (34 to 74). Increase speed increases hand fluctuations.
4. With engine idling, hand vibrates rapidly between 14 and 19 (47 to 64).
5. When valve should close, hand drops two or three points.
6. At idle, the hand drops consistantly a few points.
7. At idle, the hand sometimes drops around four points.
8. At fast idle, the hand reads steady from 8 to 15 (27 to 50).
9. At idle the hand reads steady but lower than normal. Inferior lubricant may also be indicated.
10. With rapid opening and closing of the throttle, the hand falls to 0 and rises to 23 (78) or less.
11. With a slowly fluctuating hand between 14 and 16 (47 to 54), check ignition system for faults.
12. At fast idle, a steady reading between 14 and 17 (47 to 58) is registered.
13. Check idle mixture if hand moves slowly between 13 and 17 (44 to 57).
14. At idle or fast idle, hand reads between 3 and 5 (10 and 17). Check gaskets.
15. Hand moves consistantly between 5 and 19 (17 and 64).
16. High reading at start reducing to 1 (3) or 0 and increases to 15 to 16 (51 to 54).

SECTION 2 — SPECIFICATIONS AND GENERAL INFORMATION 4G54

SPECIFICATIONS

ENGINE GENERAL

Type	In line OHC with Counter Balance Shafts and Roller Rockers
Number of cylinders	Four
Engine number—carburettor models	W591, W592
—ECI-Multi models	W531, W532
Bore	91.1 mm
Stroke	98.0 mm
Displacement	2555 cm^3
RAC power rating	20.5
Compression ratio (ECI-Multi models)	9.2:1
Compression ratio (carby models)	8.8:1
Compression pressure @ 250 rpm	1250 kPa (approx.) carby models
Compression pressure @ 250 rpm	1300 kPa (approx.) ECI-Multi models
Maximum variation between cylinders	10%
Spark plug type	N9YC
Firing order	1, 3, 4, 2
Direction of rotation	Clockwise observed from front of engine

CYLINDER HEAD

Material	Aluminium alloy
Type	Hemispherical combustion chambers, cross flow design
Maximum allowable distortion	0.2 mm
Cylinder head height (between block and rocker cover gasket surface)	90.0 mm
Maximum allowable re-machining of surface	0.2 mm or less, combined with cylinder block grinding
Inlet valve seat insert hole diameter	
—0.05 mm Oversize	44.050 to 44.075 mm
—0.3 mm Oversize	44.300 to 44.325 mm
—0.6 mm Oversize	44.600 to 44.625 mm
Exhaust valve seat insert hole diameter	
—0.05 mm Oversize	38.050 to 38.075 mm
—0.3 mm Oversize	38.300 to 38.325 mm
—0.6 mm Oversize	38.600 to 38.625 mm
Inlet and exhaust valve seat insert height	
—0.3 mm Oversize	7.90 to 8.10 mm
—0.6 mm Oversize	8.20 to 8.40 mm
Valve guide hole diameter	
—0.05 mm Oversize	13.05 to 13.07 mm
—0.25 mm Oversize	13.25 to 13.27 mm
—0.50 mm Oversize	13.50 to 13.52 mm
Camshaft/camshaft bearing clearance	0.05 to 0.09 mm

VALVES

Material — Inlet	Heat Resisting Steel of JIS STD (SUH3B)
— Exhaust	Heat Resisting Austenitic Steel
Valve length — Inlet	107.96 mm
— Exhaust	105.86 mm
Head diameter — Inlet	46.0 mm
— Exhaust	38.0 mm
Stem diameter	8.0 mm
Stem diameter wear limit — Inlet	0.10 mm
— Exhaust	0.15 mm
Valve face angle	45°
Valve head thickness — Inlet	1.70 mm
— Exhaust	2.50 mm
Valve seat contact width	0.90 to 1.30 mm
Valve stem to guide clearance — Inlet	0.025 to 0.055 mm
— Exhaust	0.050 to 0.085 mm
Installed height between spring seat and retainer	40.40 mm ± 1.0 mm
Valve stem seal installed dimension	14.70 to 15.10 mm
Hydraulic lash adjuster dry clearance	0.5 to 1.3 mm

VALVE GUIDES

Outside diameter	13.06 to 13.07 mm
Inside diameter	8.000 to 8.018 mm
Length — Inlet	47.0 mm
— Exhaust	52.0 mm
Installed dimension	14.70 to 15.30 mm
Cylinder head hole size for oversize guides	
— 0.05 mm	13.05 to 13.07 mm
— 0.25 mm	13.25 to 13.27 mm
— 0.50 mm	13.50 to 13.52 mm

VALVE SPRINGS

Number	8
Free length	47.5 to 46.3 mm
Load/compressed height	28 kg/40.40 mm
Out of Square	4°max.

VALVE TIMING

Inlet opens	25° BTDC
Inlet closes	61° ABDC
Duration	266°
Exhaust opens	66° BBDC
Exhaust closes	20° ATDC
Duration	266°
Overlap	45°

CAMSHAFT

Material	Grey cast iron
Camshaft bearings	5
Bearing clearance	0.05 to 0.09 mm
Journal diameter	34.0 mm
End float	0.10 to 0.20 mm
Camshaft bend	0.02 mm or less
Height of cam lobe — Inlet	42.50 mm
— Exhaust	42.56 mm
Nominal cam lift	10.5 mm
Rocker arm to rocker shaft clearance	0.013 to 0.043 mm

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SPROCKET CAMSHAFT

Material	Cast iron
Number of teeth	38

SPROCKET—CAMSHAFT DRIVE

Material	Grey cast iron
Number of teeth	19

SPROCKET—COUNTER BALANCE SHAFTS

Material	Carbon steel
Number of teeth	17

SPROCKET—COUNTER BALANCE SHAFT DRIVE

Material	Grey cast iron
Number of teeth	34

TIMING CHAIN

Type	Duplex roller
Number of links	102
Pitch	9.525 mm
Chain tensioner spring length	
—Unloaded	65.71 mm
—Loaded at 2.0 kg	36.91 mm

COUNTER BALANCE SHAFTS DRIVE CHAIN

Type	Single row bush type
Number of links	90
Pitch	8.0 mm
Chain adjuster	Hydraulic

COUNTER BALANCE SHAFTS

Front journal diameter	23.0 mm
Rear journal diameter	43.0 mm
Journal to bearing clearance—Front	0.02 to 0.06 mm
—Rear	0.043 to 0.086 mm

CYLINDER BLOCK

Material	Alloy cast iron
Maximum allowable distortion upper face	0.1 mm
Height of block (between cylinder head and oil pan gasket surface)	316.0 mm
Maximum allowable re-machining of surface	0.20 mm or less, with cylinder head machining combined
Cylinder bore diameter	91.1 mm
Maximum bore oversize	1.20 mm
Maximum diameter difference between cylinders	0.02 mm
Maximum bore wear (before reconditioning)	0.2 mm
Maximum ovality and taper (before reconditioning)	0.12 mm
Reconditioning work limits for ovality and taper	0.01 mm
Main bearing tunnel bore diameter	64.0 mm

PISTONS

Material	Aluminium alloy
Type	Closed slipper (elliptically turned)
Piston pin hole	22.0 mm
Mass of pistons	440 ± 4 grams

PISTONS (Continued)

Piston diameter	
Measuring position	2.0 mm up from bottom of skirt
Grade A	91.07 to 91.08 mm
B	91.08 to 91.09 mm
C	91.09 to 91.10 mm
D	91.11 to 91.12 mm
E	91.12 to 91.13 mm
Piston to bore clearance	0.02 to 0.04 mm
Piston oversizes	0.25 mm
	0.50 mm
	0.75 mm
	1.00 mm

PISTON PIN

Type	Press fit in connecting rod
Material	Cold forged chrome molybdenum steel
Diameter	22.0 mm
Length	79.0 mm
Offset in piston	1.0 mm
Clearance in piston	0.005 to 0.009 mm

PISTON RINGS

Number	3
Ring gap—New—Compression	0.249 to 0.399 mm
—Scraper and oil ring	0.249 to 0.449 mm
—Service limit (All)	1.00 mm
Side clearance—New—Compression	0.061 to 0.100 mm
—Scraper	0.020 to 0.061 mm
—Service limit—Compression	0.15 mm
—Scraper	0.12 mm

CONNECTING RODS

Material	Drop forged steel
Length between centres	166.0 mm
Conrod mass	831 grams
Small end bore diameter	21.974 to 21.985 mm
Big end bore diameter	56.00 mm
Conrod bearing clearance	0.015 to 0.056 mm
Conrod bearing undersizes	0.25 mm
	0.50 mm
	0.75 mm
Conrod bend or distortion (within)	0.025 mm
Conrod side clearance on journal	0.10 to 0.25 mm
Bearing material	Aluminium—Tin

CRANKSHAFT

Material	Drop forged steel
Number of main bearings	5
Main bearing journals	
—Standard diameter	60.0 mm
—Maximum allowable ovality	0.01 mm
—Maximum allowable taper	0.01 mm
Main bearing clearance—All except centre journal	0.016 to 0.045 mm
—Centre journal	0.028 to 0.057 mm
Bearing material	Aluminium—Tin
Main bearing undersizes—Rework diameter	
—0.25 mm	59.735 to 59.750 mm
—0.50 mm	59.485 to 59.500 mm
—0.75 mm	59.235 to 59.250 mm

CRANKSHAFT (Continued)

Main bearing journal length—All except No. 3	31.00 to 31.05 mm
—No. 3	30.90 to 31.10 mm
Connecting rod bearing journal	
—Standard diameter	53.00 mm
—Maximum allowable ovality	0.01 mm
—Maximum allowable taper	0.01 mm
Conrod journal length	28.35 to 28.40 mm
Conrod bearing undersizes—Rework diameter	
—0.25 mm	52.735 to 52.750 mm
—0.50 mm	52.484 to 52.500 mm
—0.75 mm	52.235 to 52.250 mm
Crankshaft end float	0.050 to 0.178 mm
End float controlled by	No. 3 bearing
Dynamic balance in relation to centre line	34 g/cm
Flywheel out of round	0.127 mm
Flywheel run out @ 115 mm	0.13 mm max.

OIL PUMP

Pump type	Gear
Drive	Chain drive from crankshaft
Oil pressure—Idle pressure	147 kPa (min.)
—Relief valve	550 ± 50 kPa
Oil pressure relief valve	
Location	Oil pump
Spring free length	47.0 mm
Load	4.3 kg/40.0 mm
Low pressure warning switch operating pressure	29 kPa or less
Oil filter	Full flow sealed 'can'
Crankcase oil capacity—with filter	4.6 litres
—without filter	4.1 litres
Pump body to gear clearance	0.105 to 0.150 mm
Gear end play	0.06 to 0.12 mm
Gear to bearing clearance	0.020 to 0.046 mm
Driven gear rear end bearing clearance	0.044 to 0.066 mm

SPECIAL TOOLS

E192	Compressor—Piston ring
E0102	Compressor—Valve Spring
E9A5	Counter-balance shaft bearing installer
E9A5A	Counter-balance shaft bearing installer sleeve
E9A6	Counter-balance shaft bearing puller
E9M30D	Installer valve stem seal
E9M30	Kit-Remover/Installer valve guide and oil seal installer
E11M12S	Remover/Installer kit—Piston pin
E9M40	Hydraulic tappet adjuster kit
E1150	Hydraulic tappet leakdown tester
E9M58	Chain setting tool
E11M10	"C" tensioner setting tool

TORQUE SPECIFICATIONS 4G54

APPLICATION	Nm
Balance chain	
Guide A attaching bolts	10-12
Guide B special bolt A	30-35
special bolt B	15-22
Tensioner C attaching bolts	10-12
Balance shaft bearing retainer bolts	10-12
Camshaft bearing caps	18-19
Camshaft sprocket	49-58
*Connecting rod cap	44-47
Counter-balance shaft sprocket bolts	59-69
Crankshaft pulley	108-127
Cylinder head attaching bolts—(new gasket)	108-113
Cylinder head to timing chain cover	12
Engine damper insulator bolts	40-50
Engine mount bracket to chain case cover bolts	12-15
Engine mount insulator nut (large)	60-80
Engine mount insulator nut (small)	30-40
Flywheel or drive plate	130-140
Front engine mount bolts to chain case bracket	50-65
Front roll stopper bracket to centre member bolts	40-50
Front roll stopper bracket to engine	55-75
Front roll stopper insulator bolt	50-65
Inlet/exhaust manifold	15-19
Knock sensor	20-25
Main bearing cap	78-83
Mount bracket to automatic transaxle nut	60-80
Mount bracket to manual transaxle nut	30-40
Oil filter	11-12
Oil pan	6-8
Oil pan drain plug	35-45
Oil pick up pipe to block	14-21
Oil pressure switch	15-21
Oil pump cover to body screw	5-6
Oil pump to block	10-12
Oil pump relief valve plug	30-44
Rear roll insulator bolt	30-40
Rear roll stopper bracket to centre member bolts	40-50
Rear roll stopper bracket to engine	108-127
Rocker cover	5-7
Spark plug	20-28
Sump drain plug	40-50
Thermostat housing bolts	17-20
Thrust plate to cylinder block (L.H. counter balance shaft)	10-12
Timing chain guide attaching bolts	14-17
Timing chain cam sprocket retainer	14-17
Transaxle insulator bracket to side frame bolts	40-50
Water pump pulley	27-34

***NOTE: Torque figures quoted are for clean, dry threads in good condition, with the exception of connecting rod nuts which should be oiled with clean gear oil or automatic transmission fluid prior to installation.**

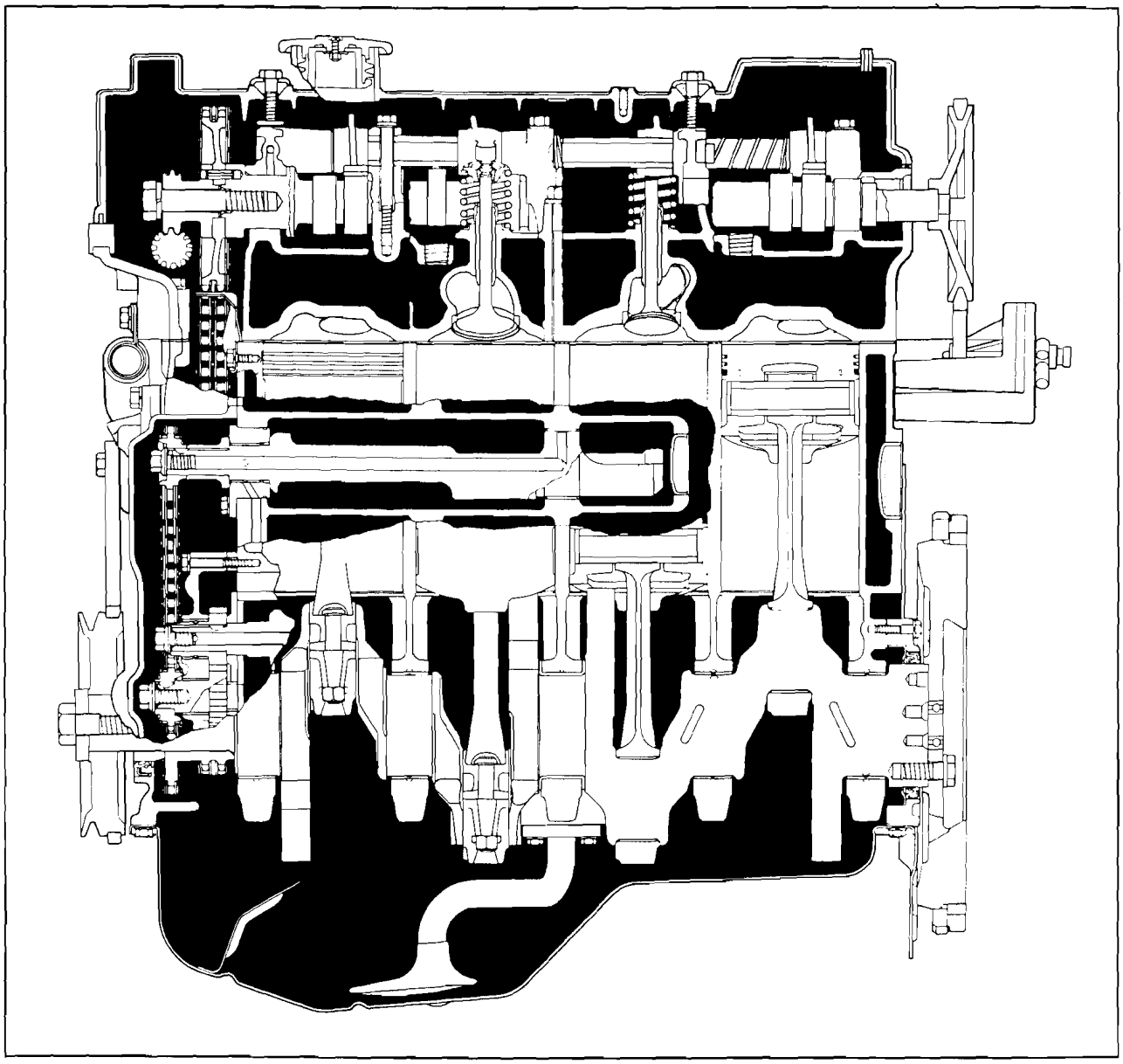


Fig. 1—Mitsubishi 2600 engine longitudinal section

GENERAL INFORMATION

The Mitsubishi 2600 engine is a four cylinder, overhead cam, cross flow design with hemispherical combustion chambers. Two counter balance shafts are incorporated in the cylinder block to reduce engine noise and vibration.

The cylinder head is made of aluminium alloy, being light in weight and ensuring maximum cooling effect. Hemispherical combustion chambers permit the use of large diameter valves helping improve fuel combustion efficiency and minimising differences in combustion chamber volume, thus ensuring smooth engine operation. The cross flow design permits the intake gases to be drawn into the cylinder and exhaust gases to be driven out from the cylinder in one direction, thus improving the effect of combustion chamber scavenging and spark plug cooling.

The camshaft is chain driven by the crankshaft and is supported in the cylinder head by five journals and retained by caps. Valve clearance is maintained automatically by roller rocker arms incorporating hydraulic tappet units. Inlet valves are on the left, exhaust valves are on the right.

The cylinder block is made of alloy cast iron, with good wear resistance characteristics. The crankshaft is supported by five main journals, thrust being taken by the centre bearing.

Two counter balance shafts are incorporated in the cylinder block to cancel vertical and secondary vibrating forces of the engine. The shafts are chain driven from the crankshaft at twice crankshaft speed and in opposite direction to each other. The left hand shaft is mounted in the upper section of the block and rotates in the same direction as the crankshaft. The right hand shaft mounted in the lower section of the block, rotates in the opposite direction to the crankshaft. The right hand shaft rotational direction is reversed by means of a gear drive which in turn is used as the engine oil lubrication pump.

SECTION 3 — IN-VEHICLE SERVICE PROCEDURES

ENGINE MAINTENANCE

Engine maintenance is most important in determining whether or not the vehicle will perform with maximum economy and efficiency.

With this in mind, it is important that engine and other component servicing is carried out at the intervals specified in the Lubrication and Maintenance section, or more often if required.

The service details outlined in this section may be carried out with the engine still in the vehicle.

CAUTION: On fuel injection models, the residual fuel pressure and amount of fuel remaining in the fuel lines, make it essential that care is taken when disconnecting fuel lines. Use suitable containers and/or rags to contain fuel spillage.

COMPRESSION TEST

An engine without reasonably high and uniform compression cannot be effectively tuned. The compression of each cylinder should be tested before any other tuning operations are performed. The engine must be at operating temperature when performing the compression test.

Compression pressure with engine warm, spark plugs removed, wide open throttle at minimum cranking speed of 250 r.p.m. should be within the specified limits.

(1) Remove any foreign matter from around spark plugs by blowing out plug area with compressed air, then loosen all plugs one turn.

(2) Start the engine and accelerate to 1000 r.p.m. to blow out loosened carbon. Stop engine and remove plugs, note cylinder from which each plug was removed for future reference.

NOTE: Clearing out carbon in this manner is important in preventing false compression readings due to particles of carbon becoming lodged under the valves.

(3) Disconnect coil **primary** lead.

(4) Remove air cleaner and block throttle and choke (carburettor models) in wide open position.

(5) Disconnect the control relay (ECI-Multi models) to prevent fuel injection.

(6) Connect remote control starter switch to the starter solenoid.

(7) Insert the compression gauge firmly in spark plug opening, and crank engine through at least four compression strokes to obtain highest possible reading.

(8) Test and record compression of each cylinder. Compression should read within the limits indicated in the specifications.

(9) If one or more cylinders read low or uneven, inject about a tablespoon of engine oil on top of pistons in low reading cylinders. Crank engine several times and re-check compression. If compression comes up but does not reach normal, rings are worn. If compression does not improve, valves are sticking or seating poorly. If two adjacent cylinders show low compression, and injecting oil does not improve condition, the cause may be a head gasket leak between the cylinders.

CYLINDER HEAD

Removal

NOTE: Prior to removing cylinder head allow the engine to cool otherwise cylinder head warpage may occur.

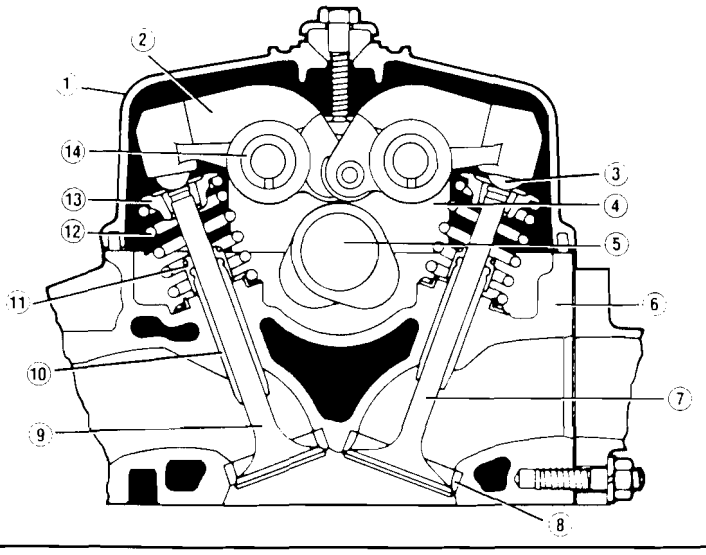
(1) Disconnect the battery negative (ground) terminal.

(2) Drain the water from the radiator and cylinder block by removing the lower hose.

(3) Remove the water pump drive belt and water pump, refer Group 14. If the cylinder head is to be disassembled, remove the water pump pulley.

(4) Disconnect the exhaust pipe from the manifold.

(5) Remove the air cleaner (carburettor models).



1. Rocker cover
2. Roller rocker arm
3. Hydraulic tappet unit
4. Camshaft bearing cap
5. Camshaft
6. Cylinder head
7. Intake valve
8. Valve seat insert
9. Exhaust valve
10. Valve guide
11. Valve stem seal
12. Valve spring
13. Valve spring retainer
14. Rocker arm shaft

Fig. 1—Section view cylinder head

(6) Remove the air cleaner duct from the throttle body (ECI-Multi models).

(7) Disconnect the throttle cable, fuel supply and return lines, vacuum hoses, electrical leads, radiator and heater hoses, etc.

(8) Manually rotate the engine until No. 1 piston is at top dead centre on the compression stroke. Aligning the crankshaft pulley timing mark on the 'T' mark of the timing plate will ensure this position, refer Fig. 2.

(9) Remove the distributor.

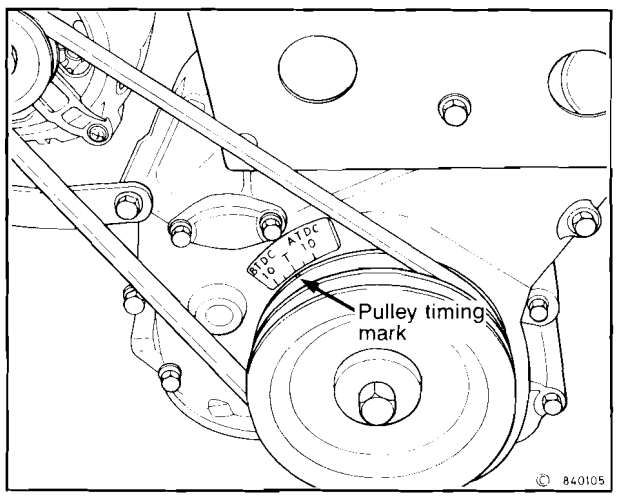


Fig. 2—Top dead centre position for No. 1 piston

(10) If the cylinder head is to be disassembled, the inlet and exhaust manifolds can now be removed for easier handling of the head.

(11) Remove the rocker cover. Check the location of the camshaft dowel pin which should be in the uppermost position.

(12) With a suitable marking pencil, mark the timing chain in line with the camshaft dowel pin.

(13) Remove the camshaft sprocket bolt and distributor drive gear and remove the sprocket from the camshaft and rest on the sprocket holder, refer Fig. 3.

NOTE: Do not remove the sprocket from the timing chain, as this will necessitate timing chain cover removal to realign the timing gears.

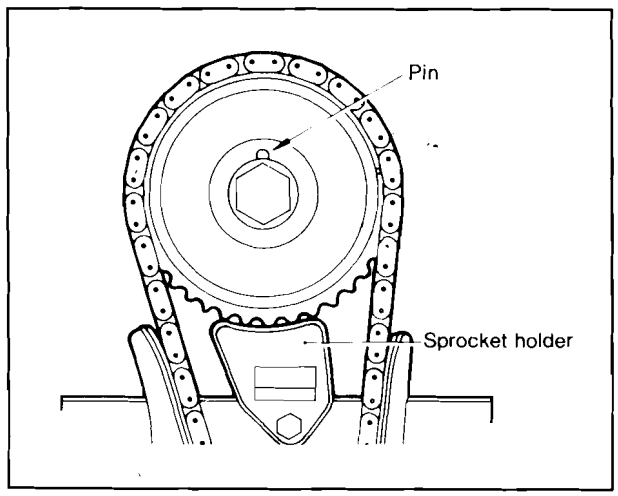


Fig. 3—Timing chain sprocket holder

(14) Loosen the cylinder head bolts in two stages to prevent cylinder head warpage—use order shown in Fig. 4.

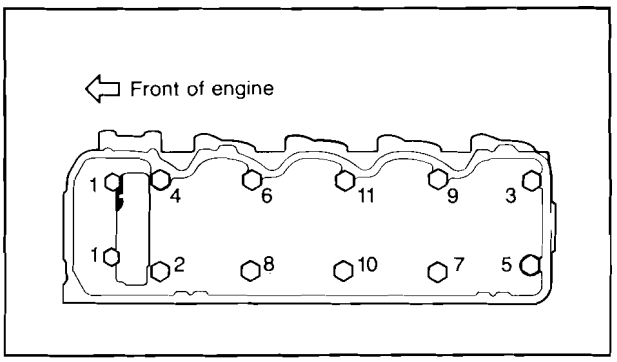


Fig. 4—Cylinder head bolt removing sequence

(15) Remove the cylinder head from the cylinder block by raising it vertically over the timing chain and sprocket.

NOTE: The cylinder head is positioned on the block by two dowel pins. When removing the head, do not twist or slide it or the camshaft sprocket may be dislodged from the chain.

(16) Clean head thoroughly and inspect for damaged surfaces, components, cracks, water leaks, etc.

Installation

(1) Ensure that the joint surface between the top of the chain cover and cylinder block is flat.

(2) Apply sealant to the two joint surfaces as shown in Fig. 5.

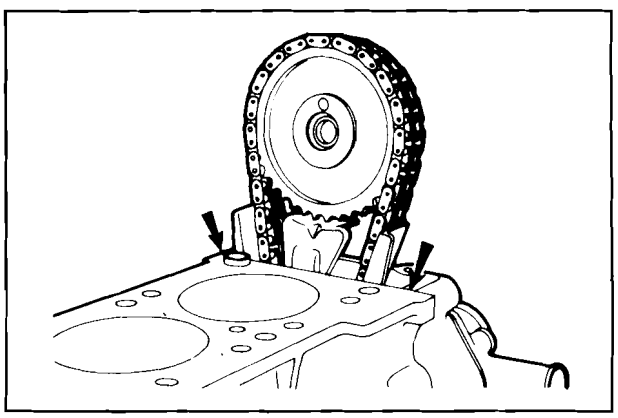


Fig. 5—Sealing points

(3) Fit the cylinder head gasket to the cylinder block locating it correctly on the dowel pins.

(4) Install the cylinder head locating it on the dowel pins. Do not slide the head across the dowel pins as damage to the head surface may occur. Care must also be taken to avoid dislocation of the camshaft sprocket from the timing chain.

(5) Tighten the cylinder head bolts in three stages to the specified torque and in the sequence shown in Fig. 6.

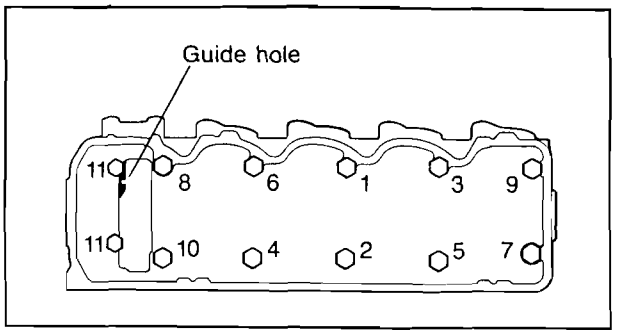


Fig. 6—Cylinder head bolt tightening sequence

NOTE: Using Special Tool E11M10, release oil pump timing chain ratchet to allow timing chain and sprocket to be relocated on to the camshaft. Refer Section 3 this Group.

(6) Install the camshaft sprocket and distributor drive onto the camshaft, rotating the camshaft to align the dowel pin to the sprocket. Ensure that the sprocket mating mark is aligned with the timing chain **plated** link. Temporarily tighten the sprocket bolt.

(7) Turn the crankshaft back 90° and tighten the sprocket bolt to the specified torque.

(8) Install semi-circular (front) rubber packing to the cylinder head and apply sealant as outlined in Fig. 7 and to the rear of the rocker cover.

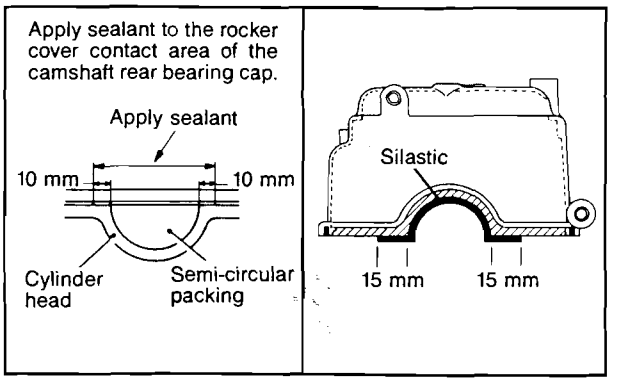


Fig. 7—Sealing of cylinder head and rocker cover packing

(9) Install the rocker shaft cover and tighten the retaining bolts to specification.

NOTE: It has been established that over tightening of the rocker cover bolts can result in distortion of No. 4 camshaft journal with subsequent danger of camshaft seizure.

(10) Install the intake and exhaust manifolds using new gaskets. Apply sealer to the inlet manifold gasket as outlined in Group 15. Tighten all nuts to the specified torque.

(11) Install the water pump pulley, tightening the bolt to the specified torque.

(12) Install the water pump and drive belt, tightening to the specified torque ensuring the drive belt has the correct tension, refer Group 14.

(13) Install the air cleaner or air cleaner duct (ECI-Multi models).

(14) Install the distributor.

(15) Reconnect the throttle cable, fuel supply and return lines, vacuum hoses, electrical leads, radiator and heater hoses etc.

(16) Reconnect exhaust pipe.

(17) Fill the radiator using rain water or demineralised water and Mitsubishi Long Life Coolant in the required concentration, refer Group 14.

(18) Connect battery cable and start engine. If it is suspected that oil has leaked from the hydraulic tappet adjusters, slow race the engine a minute at a time from idle to 3000 r.p.m. to bleed off the air.

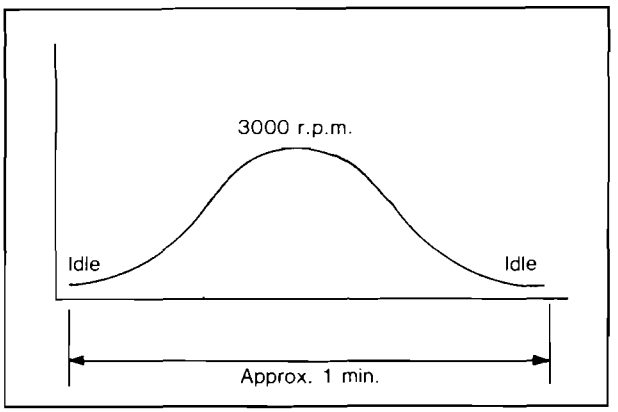


Fig. 8—Bleeding air from hydraulic tappet adjusters

(19) Run the engine until normal operating temperature is reached and check for water and oil leaks.

(20) Set engine idle speed and ignition timing to specifications and check that idle CO concentration is within the specified range.

CYLINDER HEAD DISASSEMBLY

NOTE: If valve grinding or seat refacing is considered necessary, note the following prior to disassembly:—

(a) If the valves or seats are badly worn, it may be necessary to replace the parts rather than recut or regrind them. This decision depends on the amount of dry clearance available at that rocker.

(b) To measure the dry clearance, the valve, rocker and shaft, and camshaft must be in the assembled condition with the cam follower on the base circle of the cam.

(c) Insert a suitable 0.5 mm wire probe through the hole in the rocker arm to unseat the ball in the hydraulic unit relieving the oil behind it. Measure the clearance between the valve stem and hydraulic unit with feeler gauges.

(d) The specified dry clearance is 0.5 to 1.3 mm; therefore, the amount of material removed from the valve and/or seat, must be such that the specified dry clearance is maintained.

The valve stem tip must not be ground to obtain the required clearance.

With head removed from engine, and intake and exhaust manifolds removed, proceed as follows:

(1) Remove spark plugs.

(2) Fit tappet adjuster clips (part of Kit E9M40) to each rocker arm, refer Fig. 9.

NOTE: If the clips are not installed on the rocker arms, on removal of the rocker shaft assemblies the tappet adjusters will fall from the rocker arms.

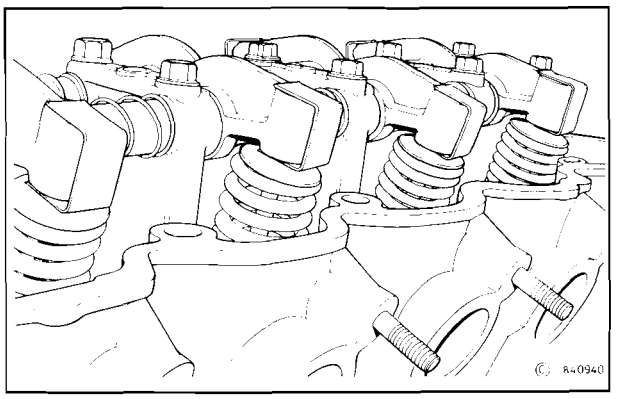


Fig. 9—Rocker arm clip installation

(3) Remove camshaft bearing cap bolts.

(4) Holding the front and rear caps, remove the rocker arm shaft assemblies.

(5) Remove the caps, rocker arms, springs, and wave washers from the shafts keeping them in the order of removal. Care should be taken not to lose the camshaft cap locating dowel pins.

(6) Remove clips from rocker arms, remove tappet adjusters and store in order of removal.

(7) Remove the camshaft.

(8) Remove the water pump pulley oil seal from the end of the camshaft.

(9) Using a valve spring compressor, remove the collets, spring retainers, springs, spring seats and valves, keeping them in order of removal.

(10) Remove valve stem seals, refer Fig. 10.

NOTE: Valve stem seals should not be re-used.

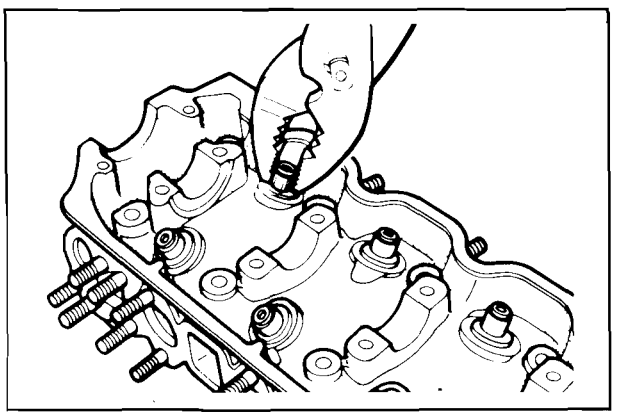


Fig. 10—Removing valve stem seals

Cleaning and Inspection

Check the cylinder head for water leakage and damage before cleaning.

Clean each part carefully removing all pieces of dirt, oil, grease and carbon deposits. Clean oil holes and passages using compressed air ensuring they are not clogged.

Care should be taken not to damage valve seats, cylinder head surface and camshaft journals.

Using a straight edge and feeler gauge, check the cylinder head for distortion as shown in Fig. 11.

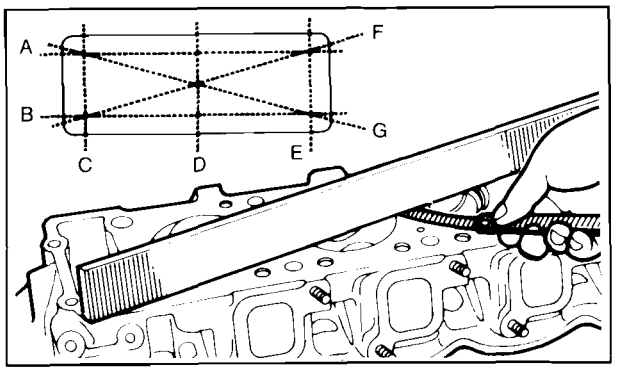


Fig. 11—Checking for cylinder head distortion

If cylinder head distortion exceeds the specified limit it must be resurfaced.

Check the cylinder head manifold mounting surfaces for flatness or damage.

Check condition of camshaft oil seal, replace if necessary.

VALVE GUIDES

Check the valve stem to guide clearance. If the clearance exceeds the specified limit replace the guide with the next oversize guide. Valve guides are shrunk into position, therefore when replacement is necessary the following procedure must be adopted.

(1) Heat the cylinder head (see note) and using Tool No. E9M30, remove the defective guide towards cylinder block surface, refer Fig. 12.

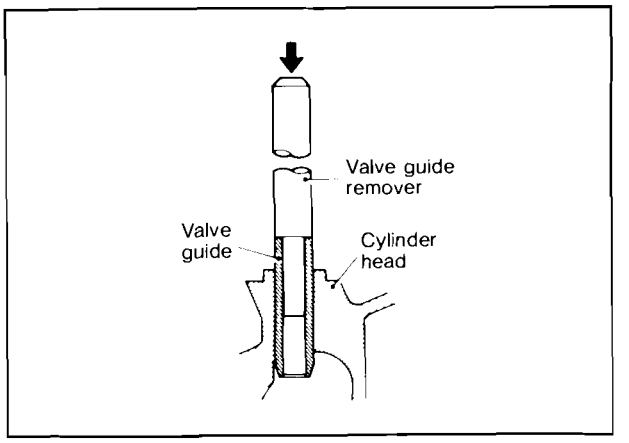


Fig. 12—Removing valve guides

NOTE: This operation should be conducted with the cylinder head temperature raised to a maximum of 250°C. The cylinder head should be kept at this temperature for a minimum amount of time.

CAUTION: Exceeding 250°C could cause permanent damage to cylinder head.

(2) With the cylinder head at normal temperature, ream the head as specified for the oversize guide.

(3) Heat the cylinder head to the correct temperature (see note), and insert the guides quickly. Using Tool No. E9M30, install guides to the specified dimension. Refer Fig. 13.

(4) After guide is installed check the inside diameter and ream to specification if necessary.

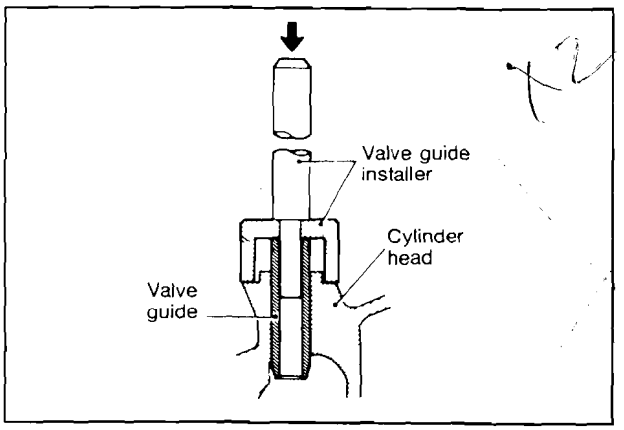


Fig. 13—Installing valve guides

VALVE SEAT INSERT

The valve seat should be checked for overheating and improper contact with the valve face. If faulty it must be re-cut or replaced.

Re-Cutting Valve Seat

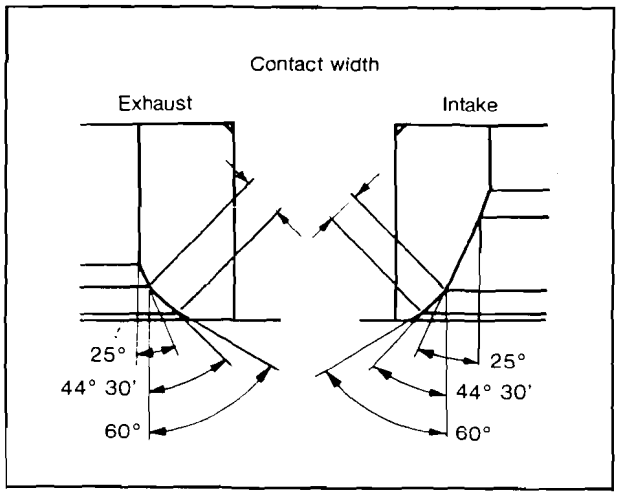


Fig. 14—Valve seat angles

(1) Check valve guide for wear, if faulty replace guide as previously described.

(2) Re-condition the seat using either a seat grinder or seat cutter.

(3) The valve seat contact width should be as specified, at the centre of the valve face and as shown in Fig. 14.

(4) After cutting, lap the valve and valve seat lightly with a fine lapping compound.

Replacing Valve Seat Insert

Check the valve seat insert "sinkage" by measuring the installed height of the valve spring between the spring retainer and seat. If the sinkage exceeds the specified limit, replace the seat insert as follows:

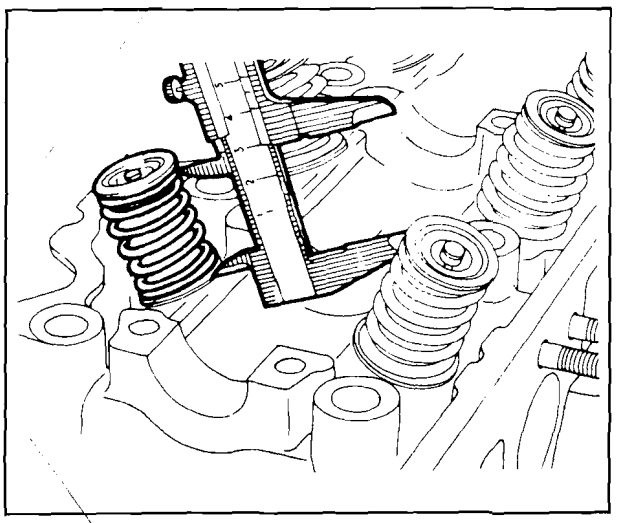


Fig. 15—Checking valve spring installed height

(1) Thin down the valve seat insert by cutting, with a suitable cutter, to within 0.5 to 1.0 mm of the cylinder head, refer to Fig. 16 (A).

(2) Remove the valve seat insert and cut the seat insert bore diameter and height to the dimension shown in the specifications, refer Fig. 16 (B).

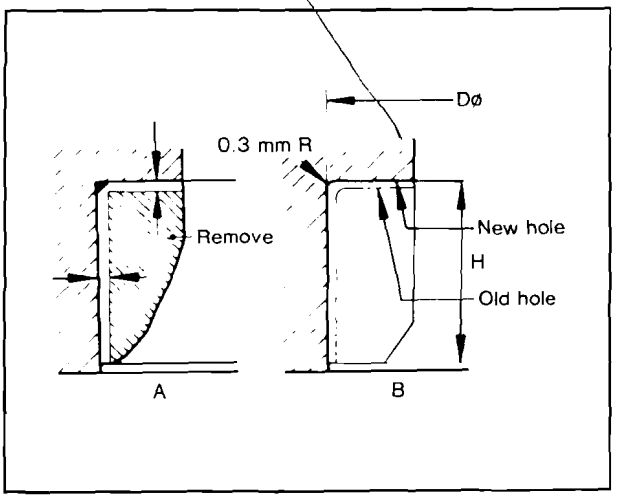


Fig. 16—Replacing valve seat insert

(3) Heat the cylinder head to correct temperature (see note previous page) and press in the new valve seat insert.

(4) Cut the insert to form a new seat as described in Re-cutting Valve Seat.

VALVES

Check each valve for wear, damage and deformation of the head, stem and stem tip.

If the stem tip is pitted or the thickness of the valve head is less than the specified limit, the valve must be replaced.

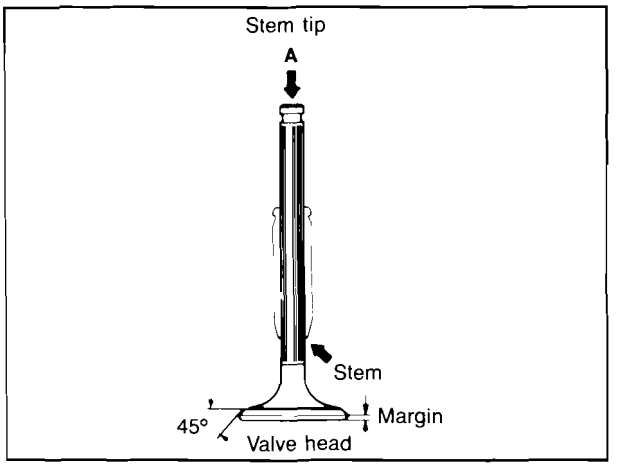


Fig. 17—Valve check points

VALVE SPRINGS

Check the free length and tension of each valve spring. If they are not within specifications replace the spring.

Using a square, check the squareness of each spring. If the spring is excessively out of square, replace the spring.

CAMSHAFT AND CAMSHAFT BEARING CAP

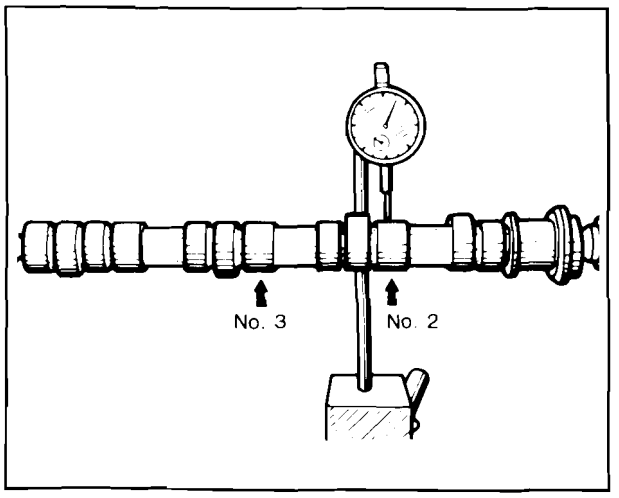


Fig. 18—Checking camshaft for bend

(1) Check the camshaft for bend by supporting it at the ends and mounting a dial indicator at the No. 2 or No. 3 journal. Rotate the camshaft once. Half of the total indicator reading is the amount of camshaft bend, if this exceeds the specified limit the camshaft should be repaired or replaced.

(2) Check the cam lobes and profile for damage. If the lobe or profiles are damaged, or worn excessively (see specifications), replace the camshaft.

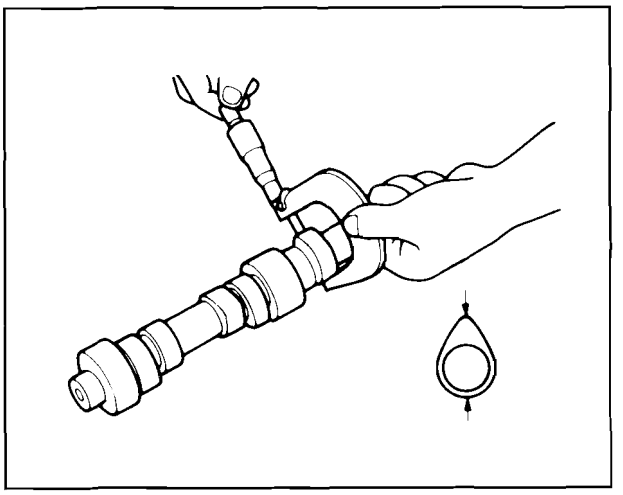


Fig. 19—Checking cam lobe height

(3) Check the camshaft caps for damage on the inner surface. If the caps are excessively damaged the cylinder head must be replaced.

Check the camshaft journal to cap clearance by installing the caps to the cylinder head and measuring the cap inside diameter and the camshaft journal outside diameter as shown in Figs. 20 and 21. If the clearance exceeds the specified limit and the journals are worn, replace the camshaft. If the caps are worn replace the cylinder head.

NOTE: The cap retaining nuts must be tightened to the specified torque prior to measuring internal diameter.

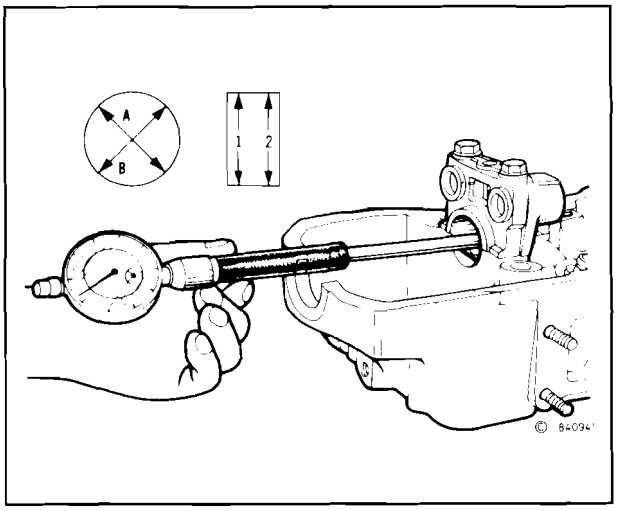


Fig. 20—Measuring camshaft cap diameter

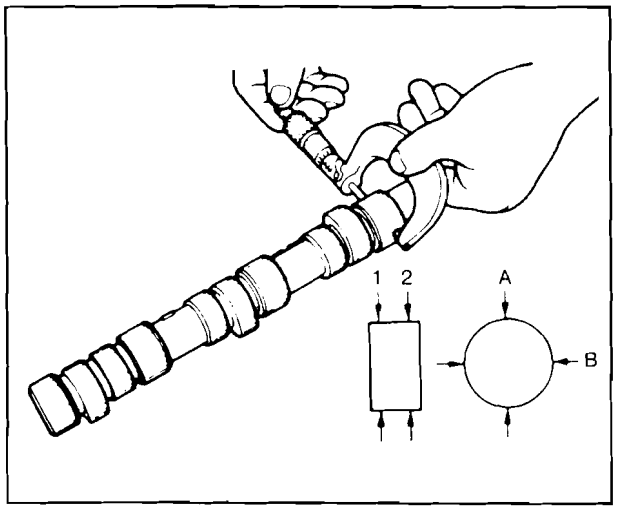


Fig. 21—Measuring camshaft journal diameter

(4) Check the camshaft end float, if it exceeds the specified limit check the camshaft and cylinder head for wear and replace the faulty component, refer fig. 22.

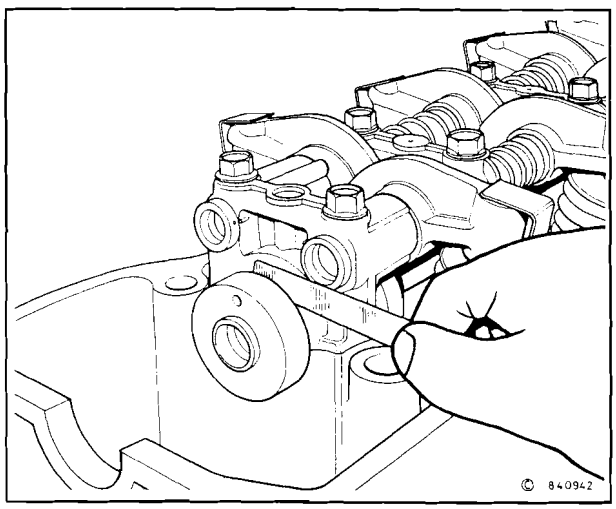


Fig. 22 —Checking camshaft end float

ROCKER ARMS AND ROCKER ARM SHAFTS

(1) Clean the rocker arms and shafts in a suitable solvent ensuring all oil holes and galleries are clear. A length of hard 0.5 mm wire can be used to clear the tappet bleed off hole in the rocker arm.

(2) Check if rocker arm to cam lobe contact face is worn or damaged. If only slight wear is evident, it can be corrected with an oil stone. If severely worn or damaged the arm must be replaced.

(3) Using diesel fuel thoroughly clean the hydraulic tappet units.

NOTE: The hydraulic tappet unit is a precision component, once cleaned ensure the units are protected to prevent the ingress of dirt or foreign material. Do not attempt to dismantle the unit.

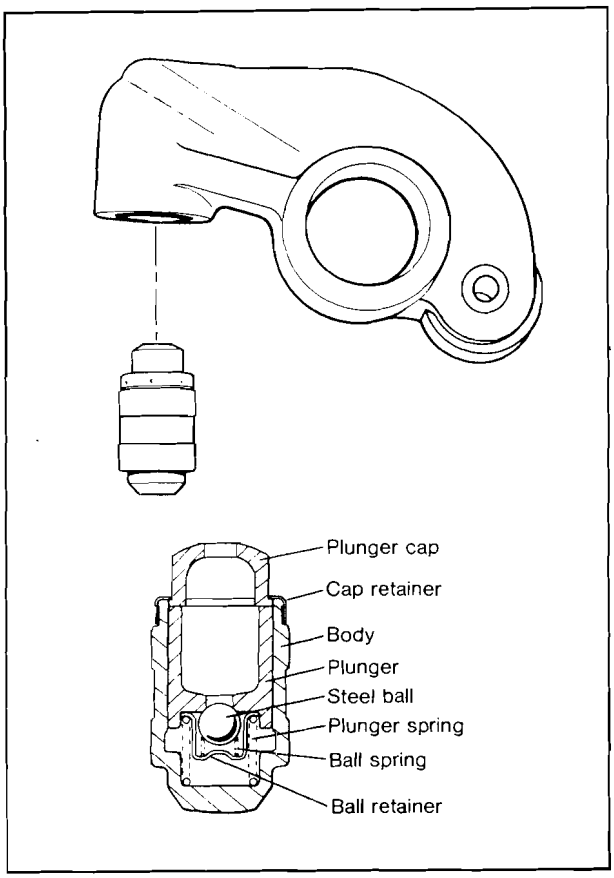


Fig. 23—Rocker arm and hydraulic tappet unit

(4) When cleaned, bleed the hydraulic units using the following procedure:

(a) fit the hydraulic unit into the rocker arm and support on a block, in a bath of clean diesel fuel, refer Fig. 24.

(b) Using a suitable 0.5 mm wire probe, lightly push down the steel ball and move the rocker arm up and down 4 or 5 times, refer Fig. 24.

(c) Allow the ball to seat by removing the probe and push down hard on the rocker arm. If the rocker arm moves slightly, repeat step (b) several times.

(d) If the rocker arm still moves when tested as in step (c), replace the unit.

(5) The hydraulic units can be tested using leak-down tester, Special Tool E1150.

(a) Place a fully bled unit containing diesel fluid into a 13 mm socket and place the assembly into the tester cup.

(b) Adjust the ram so the pointer is on the "Set" mark as it touches the unit.

(c) Lower the weight and after the plunger has fallen slightly (0.2 to 0.5 mm), measure the leak-down rate with the aid of a stop watch.

Leak down rate: **4 to 20 secs/mm** (diesel fuel temperature at 15 to 25°C).

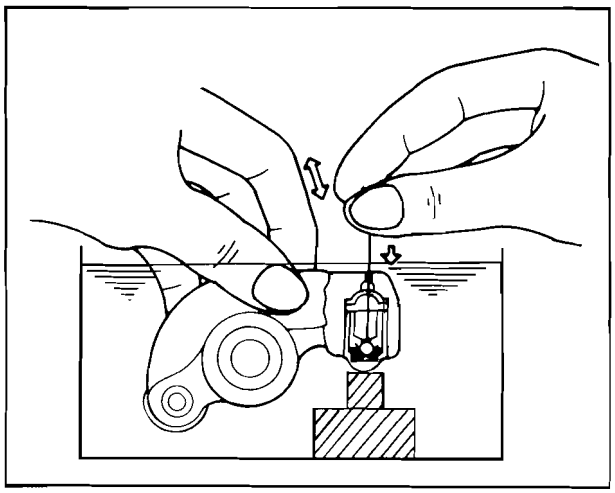


Fig. 24—Bleeding hydraulic tappet unit

(6) The fully bled units should be stored in an upright position ready for re-assembly to ensure the diesel fuel in the units is not spilt.
(7) Check the clearance between the rocker arms and rocker arm shafts, if they exceed the specified limit replace the arms or shafts.
(8) Check the rocker arm shafts for damage and bend, if faulty they must be replaced.

CYLINDER HEAD REASSEMBLY

When assembling cylinder head ensure all parts are thoroughly cleaned and that all moving parts are lubricated with engine oil prior to assembly.

(1) Install the valve spring seats.
(2) Install the valve stem seals over the valve guides using Tool No. E9M30C. The seal is installed to the specified position by the tool. Incorrect fitment will result in damage to the seal and subsequent oil leakage.

NOTE: Old stem seals must not be reused.

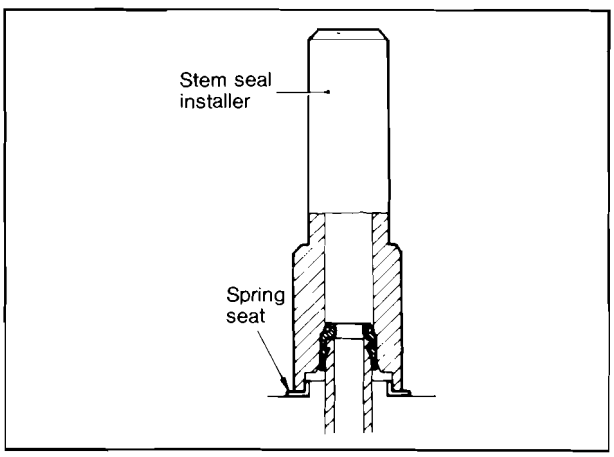


Fig. 25—Installing valve stem seals

(3) Apply engine oil to the valve stem and install the valves into the guides. Do not use excessive force to press the valve stem past the valve stem seal.
(4) Ensure the valve moves smoothly in the guide.
(5) Install valve springs and spring retainers.

NOTE: Install valve springs with the enamel identification marks facing the rocker arms.

(6) Using a valve spring compressor install the valve collets.

NOTE: When compressing the spring, take care that the spring retainer is not forced against the valve stem seal.

(7) Position the camshaft onto the cylinder head and check end float.
(8) Remove the camshaft and install the oil seal on the end of the shaft.
(9) Reposition the camshaft onto the cylinder head.
(10) Install the caps, rocker arms, springs and wave washers onto both rocker arm shafts. The caps must be installed with the indicating arrow to the front of the engine and in the order they were removed. The right hand shaft has 16 lubrication holes, the left hand shaft has 8 lubrication holes.

NOTE: When assembling the rocker arm shafts to the caps align the mating marks on the shafts and cap.

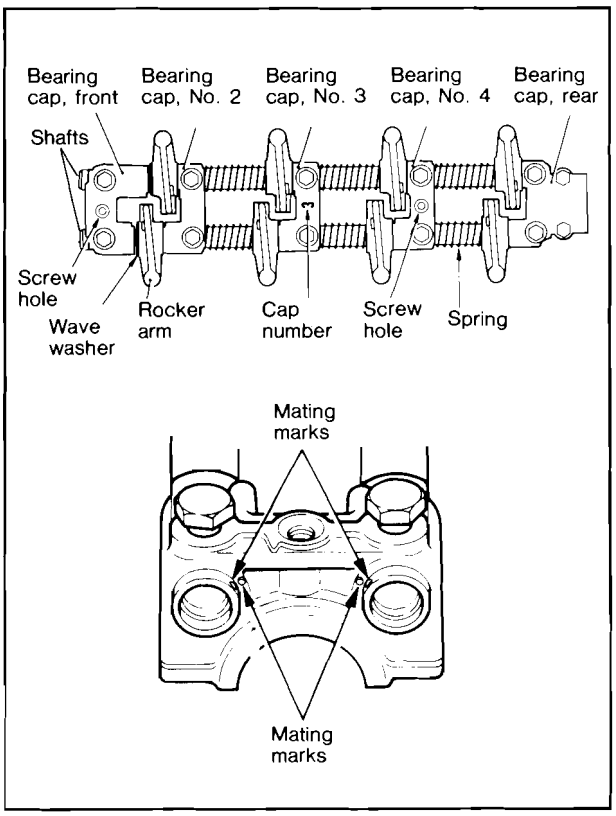


Fig. 26—Assembly of rocker arm shafts

Install the wave washers with the convex side facing the front of the engine.
(11) Position the camshaft with the sprocket locating dowel in the uppermost position, refer Fig. 29.

(12) Install the hydraulic tappet units to the rocker arms **with the hole in the unit to the top of the rocker arm** and in the order they were removed, and fit tappet adjuster retaining clips (part of Kit E9M40) to each rocker arm. Keep the hydraulic units vertical to prevent spillage of the diesel fuel.

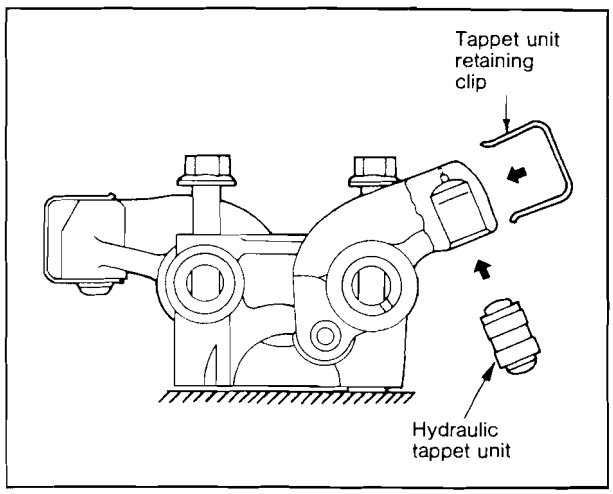


Fig. 27—Installing hydraulic tappet unit

NOTE: Prior to fitting rocker shaft assembly to cylinder head, place silastic bead as shown in Fig. 28 to the cylinder head where the No. 5 camshaft cap is fitted.

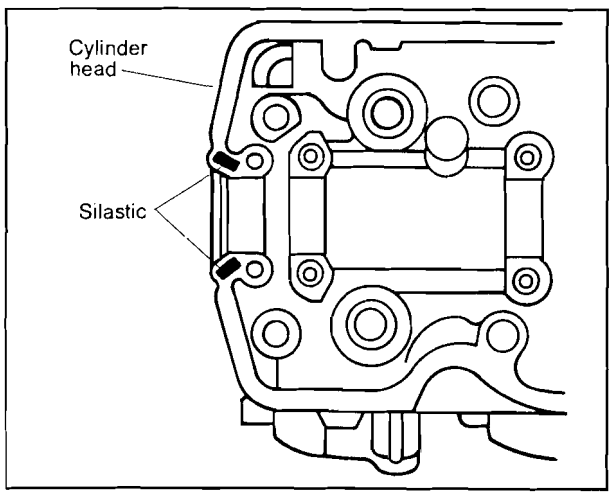


Fig. 28—Sealing bearing cap

(13) Install the cap dowel bushings and position the rocker shaft assembly onto the cylinder head.

NOTE: The oil seal on the rear of the camshaft must be positioned to ensure adequate sealing prior to fitting the rear bearing cap.

(14) Install cap retaining bolts and tighten in two stages, to the specified torque. Tightening order — No. 3, 2, 4, front and rear.
(15) Remove hydraulic tappet retaining clips.
(16) Install spark plugs.

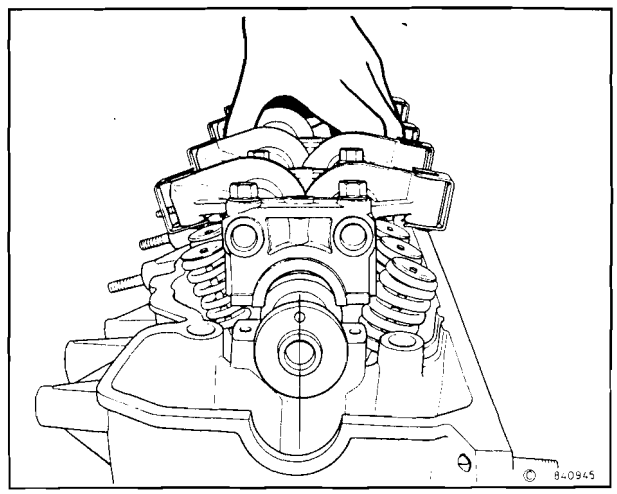


Fig. 29—Installing rocker shaft assemblies

WATER PUMP PULLEY SEAL REPLACEMENT

(1) Loosen water pump drive belt adjusting bolts, refer Group 14.
(2) Remove the drive belt from the water pump.
(3) Remove the camshaft pulley cover and remove the drive belt.
(4) Remove the bolt and remove the water pump drive pulley from the camshaft.
(5) Insert a suitable hook between the camshaft and seal lip and withdraw the seal from the camshaft.
(6) Wrap a cleaning rag around a screwdriver and wipe out the camshaft/seal housing area.
(7) Lubricate the seal (lip and outer edge), seal housing and camshaft with engine oil. Install the seal onto the camshaft.
(8) Position a suitable socket over the camshaft against the seal and tap gently with a hammer until the seal is in place.
(9) Install the drive pulley, cover and belt and adjust the belt as outlined in Group 14.

CAMSHAFT AND COUNTER-BALANCE SHAFT DRIVE CHAINS AND OIL PUMP

Both the camshaft and the counter-balance drive chains are fitted with a hydraulic tensioner supplied by engine oil pressure.

The timing chain tensioner is equipped with a ratchet mechanism which does not allow the tensioner to return unless the ratchet release lever is released. This ratchet mechanism ensures that the chain tension is maintained when oil pressure is low or not available, i.e. engine start up.

Both tensioners are also equipped with a spring which supplements hydraulic pressure, spring force and hydraulic pressure are used to maintain chain tension.

NOTE: WITH THIS CHAIN TENSIONING MECHANISM, REGULAR SERVICE ADJUSTMENT IS NOT REQUIRED ON EITHER CHAIN.

CAUTION: THE COUNTER-BALANCE SHAFT CHAIN STILL FEATURES AN ACCESS POINT FOR GUIDE "B" ON THE TIMING CASE COVER, SHOULD IT BE NECESSARY TO ADJUST AFTER HIGH MILEAGE OR REPAIR SITUATION. THIS POINT IS USED FOR EXTERNAL CHAIN ADJUSTMENT AFTER A REPAIR OR AFTER MILEAGE.

Removal

(1) Disconnect negative battery lead.
(2) Drain the cooling system.
(3) Rotate the engine to T.D.C. with No. 1 piston on compression.
(4) Remove the stone guard (where fitted), drain the engine oil and remove the oil pan bolts. Remove the oil pan and oil pump pick up pipe.
(5) Support the engine under block and remove the front engine mount.
(6) Lower engine and remove crankshaft pulley.
(7) Remove the alternator and air conditioning compressor (if fitted).
(8) Remove rocker cover, distributor and remove the two bolts attaching the cylinder head to the timing chain cover.
(9) Remove the timing chain cover being careful not to damage the head gasket.
(10) Loosen counter-balance shaft sprocket bolts.
(11) Remove the balance shaft chain guides—A, B and tensioner C—Refer Fig. 30.
(12) Remove the bolts retaining the counter-balance shaft sprockets "B".
(13) Remove the crankshaft sprocket "B", counter-balance shaft sprockets "B" and drive chain "B".
(14) Remove the camshaft sprocket retaining bolt and remove the sprocket holder.
(15) Move the timing chain ratchet release lever downwards and depress the chain tensioner and remove the camshafts sprocket and the timing chain, refer Fig. 31.

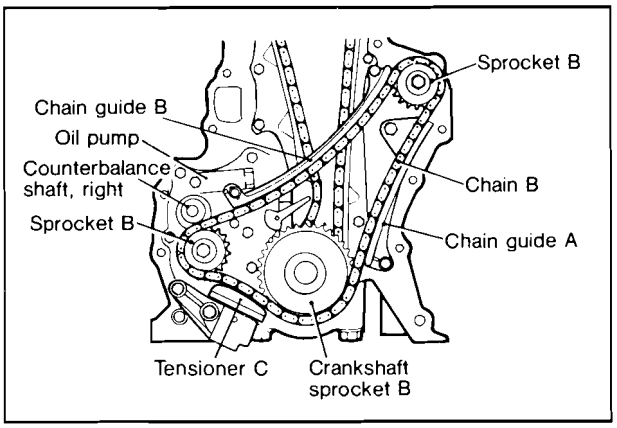


Fig. 30—Counter balance shafts chain drive

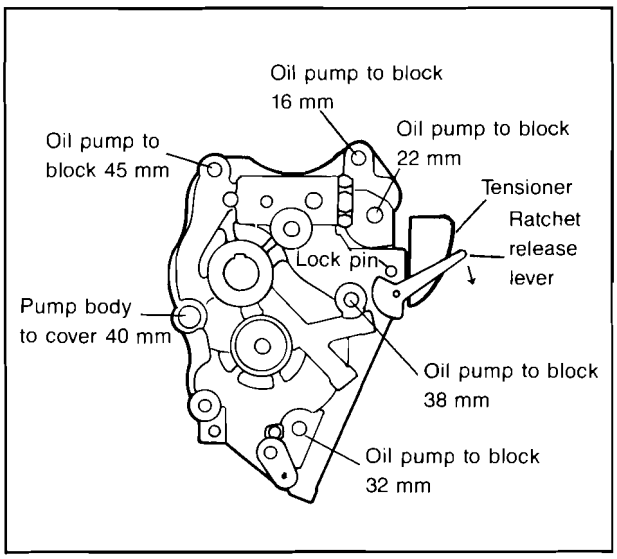


Fig. 31—Timing chain release lever

(16) Remove crankshaft sprocket and chain guides.
(17) Remove the oil pump retaining bolts and remove the oil pump.

Installation

(1) Install the oil pump, timing chain guides and the camshaft sprocket holder.

NOTE: Fill the oil pump with engine oil prior to installation.

(2) Install the camshaft and crankshaft sprockets onto the timing chain with the sprocket mating marks aligned with the plated links on the chain.
(3) With the sprocket and chain mating marks aligned, install the crankshaft sprocket onto the crankshaft.

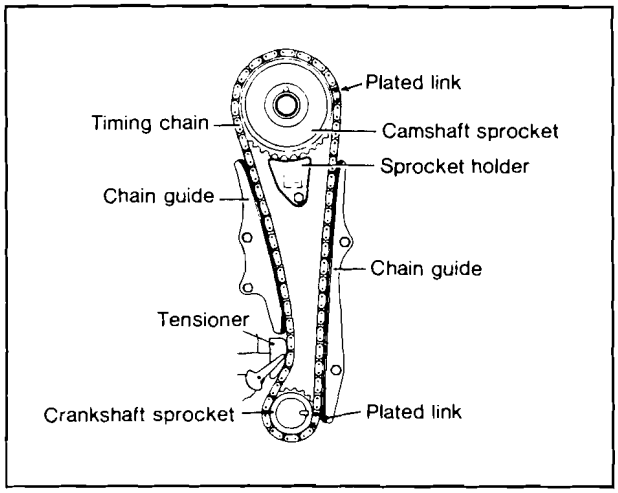


Fig. 32—Timing chain drive

NOTE: Move the timing chain ratchet release lever in direction shown in Fig. 31 to aid installation by allowing the tensioner sleeve to retract into the oil pump body.

(4) Align camshaft dowel pin with the camshaft sprocket and install sprocket onto camshaft. Tighten bolt to the specified torque.

(5) Install the counter-balance shaft crankshaft sprocket "B".

(6) Install the two counter-balance shaft sprockets "B" onto chain "B" aligning the mating marks on the sprockets with the plated links on the chain, refer Fig. 33.

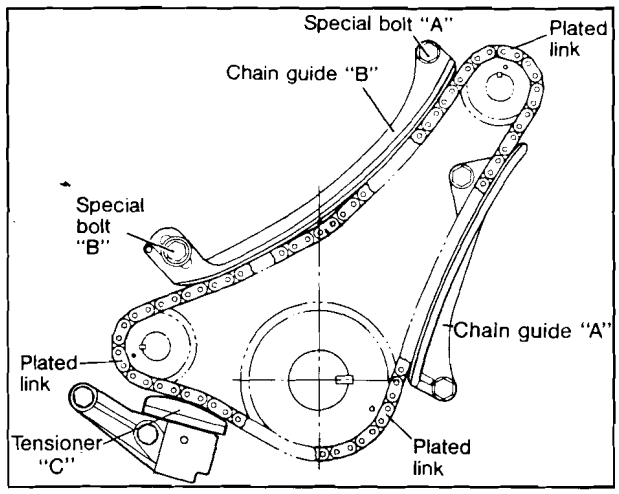


Fig. 33—Counter-balance shaft chain alignment

NOTE: Ensure the right hand sprocket (oil pump) is installed with the chamfer side facing inward and the left hand sprocket with the chamfer facing outward.

(7) While holding the chain and sprockets assembled as above, install the chain onto the crankshaft sprocket with the plated chain link aligned with the mating mark on the crankshaft sprocket.

(8) Install the counter-balance shaft sprockets onto the shaft and oil pump driven gear at the same time.

(9) Temporarily install chain guides "A", "B" and tensioner "C" to prevent the chain from jumping over teeth of sprocket.

(10) Apply Loctite 242 to the bolt threads, install the sprocket retaining bolts and tighten to the specified torque.

NOTE: Ensure the sprocket mating marks align with the plated chain link.

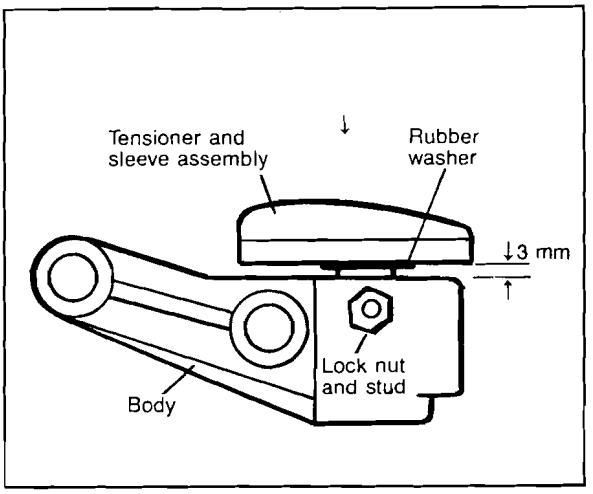


Fig. 34—Tensioner "C" assembly

NOTE: Special bolt "A" of guide "B" (Fig. 33) has Loctite 242 on the bolt thread with a flat washer. On re-assembling an engine, fit the bolt and flat washer with Loctite 242 on the thread and tighten to 30-35 Nm.

(11) Tighten the chain guide "A" mounting bolts.

(12) Tighten the chain tensioner "C" mounting bolts while pushing down on balance chain, see Fig. 35, so as to put the "C" tensioner body in its lowest position.

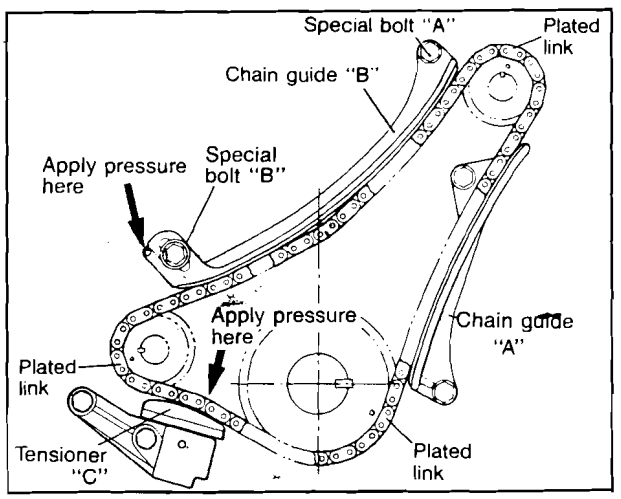


Fig. 35—Chain guide installation

(13) Remove the slackness from the chain by pushing down on "B" guide, refer Fig. 35, and observing the gap at the "C" tensioner, refer Fig. 34, lock the adjusting bolt "B" of guide "B" when a gap of 3 mm is achieved.

NOTE: Ensure there is a 3 mm gap, refer Fig. 34, between the tensioner sleeve assembly and the body of chain guide "C".

(14) Install the timing chain cover.
(15) Install the bolts attaching the cylinder head to the timing cover and torque to specification, install distributor and rocker shaft cover.
(16) Install the crankshaft pulley and tighten the retaining bolt to the specified torque.
(17) Install front engine mounting.
(18) Install the oil pump pick up and engine oil pan, tighten retaining bolts to the specified torque. Install the stone guard (where fitted).
(19) Install the alternator and air conditioning compressor (where fitted), readjust drive belt.
(20) Fill the engine with the correct grade and quantity of first grade engine oil.
(21) Fill the cooling system with rain or demineralized water and Mitsubishi Longlife Coolant in the required concentration, refer Group 14.
(22) Start the engine and set ignition timing to specifications.

Counter-Balance Shaft Chain Resetting Procedure

If the counter-balance shaft chain has to be set up because the chain drive mechanism has been disturbed or the chain guide "B" has been released, proceed as follows:

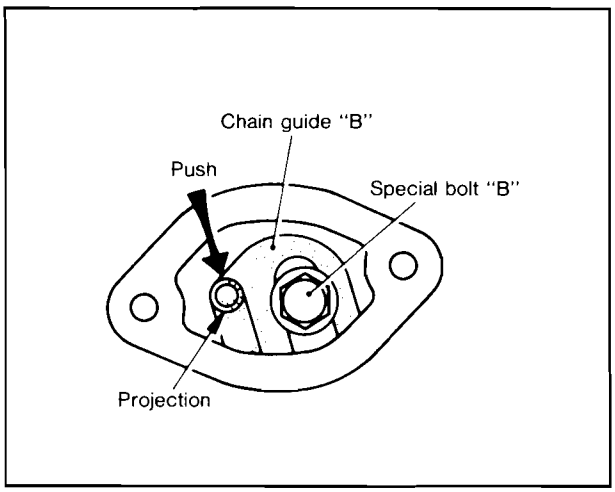


Fig. 36—Adjusting counter balance shaft chain

- Remove the chain guide "B" adjuster access cover on the timing cover.
- Loosen the adjuster bolt and adjust the guide by pushing the guide firmly (approx. 5-6 kg) to take up chain clearance. Special Tool E11M10 will facilitate this procedure. Tighten the adjuster bolt to the specified torque and install the cover plate.

Camshaft Drive Chain Tensioner Setting Procedure

NOTE: The timing chain ratchet release lever must be pushed down to allow the tensioner to be pushed back to the bottom of its travel, i.e. minimum tension position.
This is necessary when installing the timing chain and sprocket on to the camshaft.

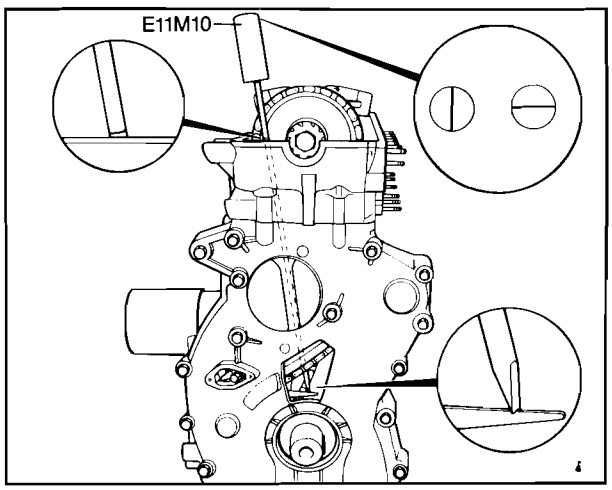


Fig. 37—Positioning chain setting tool

The ratchet release lever can be released by positioning the Special Tool E11M10 down the inside timing cover from the top after the rocker cover has been removed.

A guide channel is cast on the inside of the timing cover to direct the tool onto the camshaft chain ratchet release lever.

(1) Install the tool down the inside of the timing cover, position the blade of Special Tool E11M10 90 degrees to the camshaft, to assist in passing chain guides etc.

NOTE: The blade direction of the tool is identified on the top of the handle.

(2) Insert the tool so that the mark on the shaft is level with the top of the cylinder head.
(3) Rotate the tool 90 degrees, so that the blade of the tool is aligned with the camshaft.
(4) Position the tool all the way down to hold the ratchet lever in the released position. The weight of the tool is sufficient to hold the ratchet disengaged.

CAUTION: DO NOT OVERLOAD THE RATCHET RELEASE LEVER OR DAMAGE TO THE LEVER MAY OCCUR.

NOTE: When the tool is removed and the ratchet lever is released the ratchet is re-applied and tension is applied automatically.

SECTION 4 — ENGINE OVERHAUL

GENERAL INFORMATION

The procedures outlined in this section cover the major overhaul of the engine. The engine may be either in or out of the vehicle depending on the amount of reconditioning required.

CAUTION: On fuel injection models, the residual fuel pressure and amount of fuel remaining in the fuel lines, make it essential that care is taken when disconnecting fuel lines. Use suitable containers and/or rags to contain fuel spillage.

NOTE: Chloro-Fluro-Carbons.
Legislation in various states, prohibits the release of C.F.C.'s to atmosphere. Therefore a C.F.C. recovery unit will be required to contain spent gases if the air conditioning hoses are disconnected.
Check your relevant state government authority in regards to the relevant legislation.

ENGINE

Engine (Automatic Models) or Engine and Transaxle (Manual Models) Removal

(1) Drain engine coolant.
(2) Remove engine hood.
(3) Disconnect battery.
(4) Remove coolant recovery bottle.
(5) Remove air cleaner assembly.
(6) Disconnect wiring from the alternator, starter motor, carburettor, distributor, oil pressure switch and the injection control loom (ECI-Multi models).
(7) Disconnect the earth strap at the intake manifold (carburettor models) or the surge tank (ECI-Multi models).
(8) Disconnect accelerator cable.
(9) Disconnect radiator and heater hoses from engine.
(10) Disconnect all vacuum hoses and label for easy installation.
(11) Disconnect the fuel bowl vapour hose of the intake manifold (carburettor models).
(12) Disconnect the fuel supply and return hoses.
(13) Remove the starter motor.

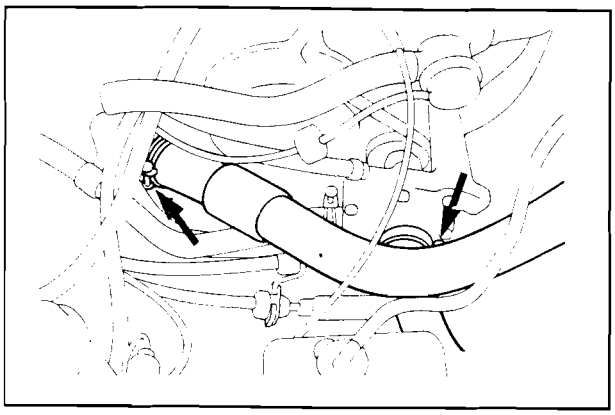


Fig. 1—Disconnecting radiator hoses

For automatic models proceed as follows:

(14) Remove the torque converter lower cover plate.
(15) Remove the torque converter to drive plate attaching bolts and push the torque converter towards the transaxle.
(16) Remove the drive shaft centre bearing to cylinder block bolts and support the drive shaft.
(17) Disconnect the front exhaust pipe from the manifold and remove the exhaust pipe stay strap.
(18) Position a suitable support under the transaxle to support the weight of the transaxle.
(19) Attach a suitable lifting bracket to the engine and, using a hoist, support the weight of the engine.
(20) Remove the transaxle to engine attaching bolts.
(21) Remove the front roll stopper through bolt and damper to engine bracket bolt.
(22) Remove the rear roll stopper through bolt and remove the roll stopper from the cross-member.
(23) Remove the engine mount through bolt and remove the engine mount from the engine mount bracket.
(24) Seperate the engine from the transaxle and lift the engine out of the vehicle.

For manual models proceed as follows:

(14) Disconnect wiring from the reverse light switch.
(15) Disconnect the clutch hydraulic line.
(16) Disconnect gear shift control cables.
(17) Disconnect the engine earth cable at the transaxle.
(18) Disconnect the speedometer from the transaxle.
(19) Drain transaxle oil.
(20) Raise the front of the vehicle and support on jack stands.

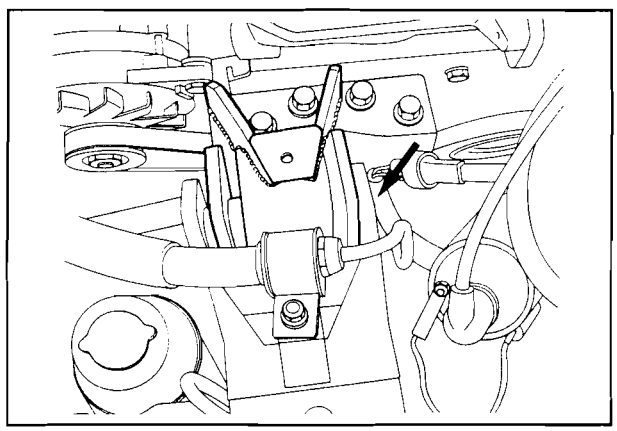


Fig. 2—Front engine mount

(21) Disconnect the drive shafts from the transaxle, refer Group 26, and support to avoid damaging the joints.
(22) Disconnect the exhaust pipe from the manifold and remove the exhaust pipe stay strap.
(23) Attach a suitable lifting bracket to the engine and, using a hoist, support the weight of the engine.
(24) Remove the front and rear roll stopper through bolts.

(25) Remove the rear roll stopper from the cross-member.
(26) Remove the nuts from the engine and transaxle mounting through bolts.
(27) Slightly raise the hoist so that all load is off of the mounting bolts.
(28) Remove the mounting through bolts then, while pushing the transaxle downwards, lift the engine and transaxle assembly from the vehicle.

Installation

Install by reversing the removal procedure, noting the following:
(1) Ensure that no cables, connectors or hoses are caught or damaged on installation.
(2) New retainer rings must be fitted when installing the drive shafts.
(3) All engine mounts must be aligned before being tightened to the specified torque (ensure front and rear roll stopper bolts are positioned in the correct hole in the engine brackets).
(4) Fill and ensure all fluid levels are at the correct level.
(5) Run the engine and check for oil, fuel and exhaust leaks. Rectify where necessary.
(6) Adjust all linkages and settings to specifications.
(7) Ensure vacuum hose connections are correct, refer Group 17 for hose connection graphics.
(8) Set engine idle speed and ignition timing to specifications and check that idle CO concentration is within the specified range.

CYLINDER BLOCK

Disassembly

The following description details the disassembly with the engine removed from the vehicle and transaxle removed from the engine.
(1) Remove the cylinder head assembly as described under Cylinder Head Removal, refer Section 3.
(2) Remove the oil pan and oil screen.

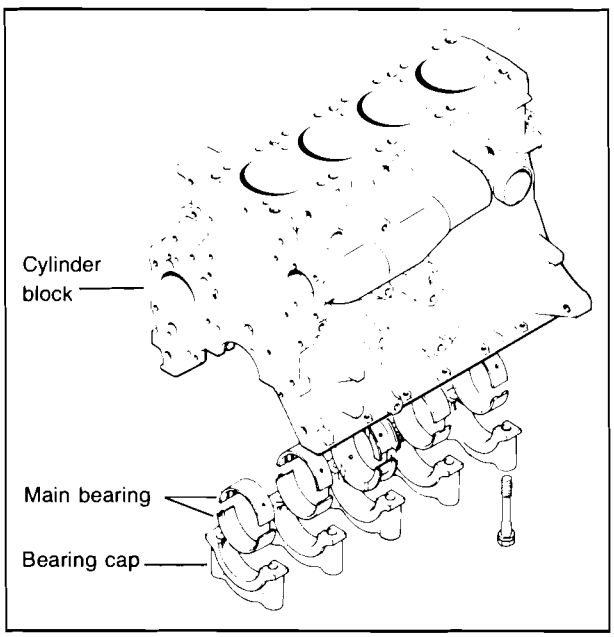


Fig. 3—Cylinder block

(4) Remove the flywheel and clutch assembly or torque convertor drive plate.
(5) Remove the bolt retaining the oil pump driven gear to the counter-balance shaft and then remove the oil pump retaining bolts and remove the pump.
(3) Remove the counter-balance shaft and camshaft drive chains as previously described.

NOTE: If the bolt retaining the oil pump gear to the counter-balance shaft is difficult to remove, remove the oil pump and counter-balance shaft as an assembly and then remove the bolt.

(6) Remove the bolts securing the left hand counter-balance shaft thrust plate.
(7) Remove the thrust plate.
(8) Withdraw the counter-balance shaft.
(9) Remove the crankshaft rear oil seal assembly.
(10) With the cylinder block on its side, remove the connecting rod caps.
(11) With the aid of a soft piece of wood push the piston and rod assembly out through the top of the cylinder block, keeping the piston assemblies and caps in the order removed.

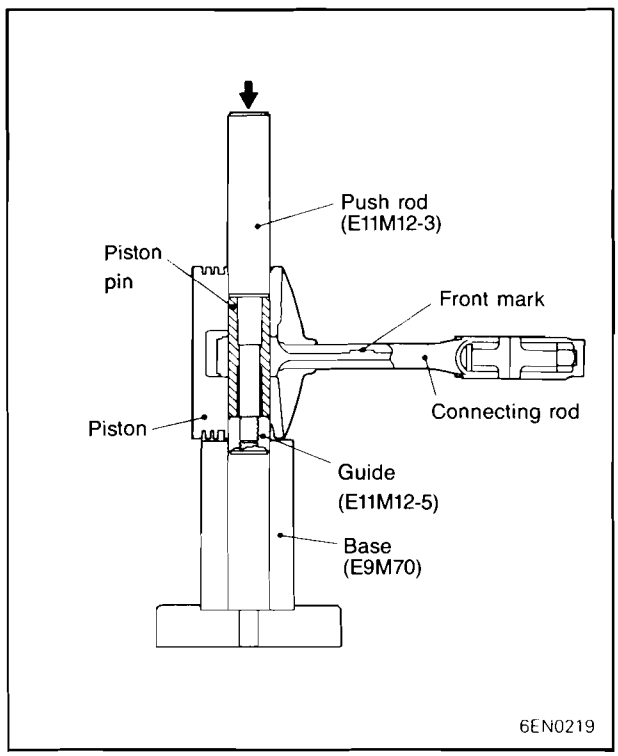


Fig. 4—Removing piston from connecting rod

CAUTION: When removing pistons, ensure the front mark of the piston is facing upwards or DAMAGE to the piston WILL RESULT.

NOTE: Prior to removing the piston and rod assemblies, remove all carbon deposits and/or cylinder ridge from the cylinder bore.

(12) Remove the piston rings from the piston keeping them in order of removal.

(13) Remove the pistons from the rods using special tools required from kit E11M12, refer Fig. 4.

CAUTION: When removing pistons, ensure the front mark of the piston is facing upwards or damage to the piston will result.

(14) Remove the crankshaft bearing caps and lower bearings keeping them in the order removed.

(15) Remove the crankshaft and the upper bearing halves.

NOTE: The main bearings (except the centre one) are interchangeable, however, if they are to be reused they should be installed in the original position.

Cleaning and Inspection

Before cleaning, check the cylinder block for water leakage, cracks or damage.

When cleaning, remove all traces of oil, grease, dirt, carbon, and scale from all components. Clean out all oil passages by blowing with compressed air.

Checking Cylinder Block

(1) Check the cylinder bores for scratches, rust, corrosion, cracks or any defects or damage, if faulty the block must be rebored or replaced.

(2) Check the upper surface of the cylinder block for distortion using a straight edge and feeler gauges. If it is not within specifications the surface must be refaced.

NOTE: If refacing is necessary, an equivalent amount must be removed from the timing chain case to maintain a flat gasket surface.

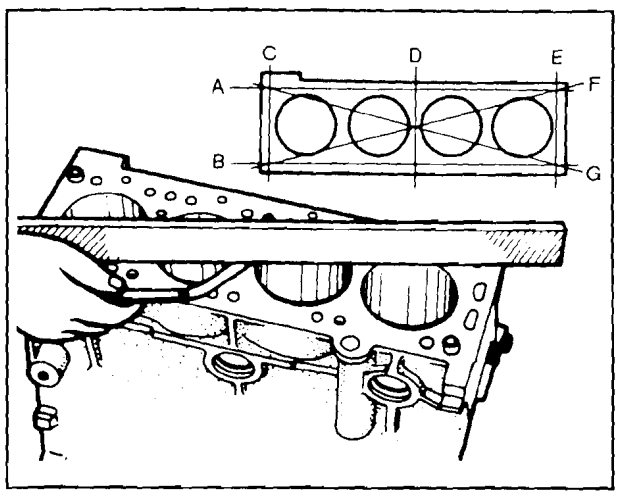


Fig. 5—Checking cylinder block for distortion

(3) Measure the cylinder bore size at three levels. If the wear exceeds the specified limit the cylinders must be re-bored to the next piston size.

NOTE: If only one cylinder requires re-boring, all the cylinders MUST be re-bored.

(4) If the cylinder does not require re-boring, remove the ridge at the top of the cylinder and hone the bores if necessary.

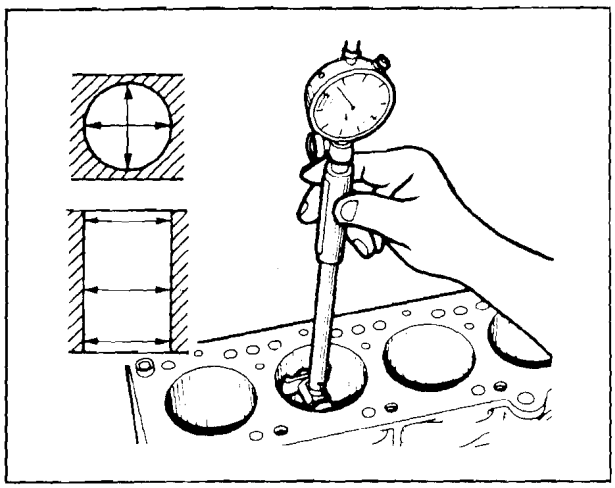


Fig. 6—Measuring cylinder bores

Cylinder Boring

(1) The piston size to be used should be determined by the cylinder which has the largest bore size.

(2) Check the outside diameter of each oversize piston at the skirt and across the thrust faces. The measurement should be taken at a point 2.0 mm from the bottom of the piston.

(3) To determine the cylinder re-boring size proceed as follows:

(a) Measure the diameter of the piston.

(b) Allow piston to bore clearance.

(c) Honing margin = 0.02 mm or less.

(d) Size after boring = (a) + (b) – (c) = (a) + 0 to 0.02 mm.

(4) The cylinder should be re-bored to the size obtained by the calculation.

(5) The final cut should not be greater than 0.05 mm.

NOTE: Do not attempt to cut too much from the bore at one time.

(6) To prevent heat distortion of the bores when re-boring, the cylinders should be bored in the following sequence: 2-4-1-3 or 3-1-4-2.

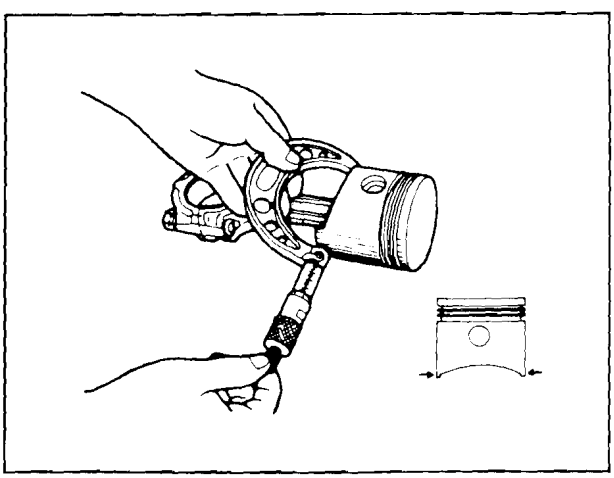


Fig. 7—Measuring piston diameter

(7) The cylinder bore size will vary immediately after re-boring, due to the heat generated by the cutting operation, therefore care should be taken when measuring the bore size.

(8) After cutting, the bore should be honed accurately to the finished size. The bores should be honed until all traces of the cutting operation are removed. The honing angle should be between 30° and 45°.

(9) Check the piston to cylinder wall clearance.

PISTONS, PISTON PINS AND PISTON RINGS

(1) Check the pistons for seizure, nicks, wear, cracks and any other defect. Replace any faulty pistons.

(2) Check the piston pin to pin hole fit. The pin must be a smooth hand press fit into the piston hole. Replace any piston and pin assembly that is defective.

(3) Check the piston rings for breakage, damage and abnormal wear. Replace any defective rings.

NOTE: If a piston is replaced, new rings should also be fitted.

(4) Measure the piston ring side clearance by placing the ring in its respective piston groove and checking the clearance with a feeler gauge. If it exceeds the specified limit, recheck the clearance with a new piston ring. If the clearance is still excessive replace the piston and rings, if it is within specification, replace the rings only.

(5) Measure the piston ring end gap by inserting the ring into the cylinder and positioning it at right angles to the cylinder wall by pressing it down with a piston. Remove the piston and measure the ring gap using a feeler gauge. If the gap exceeds the specified limit, replace the piston rings.

NOTE: If the cylinders are not being re-bored, the ring gap measurement should be made at the lower part of the cylinder, the area having the least wear. When replacing the piston rings, be sure to use rings of the same size.

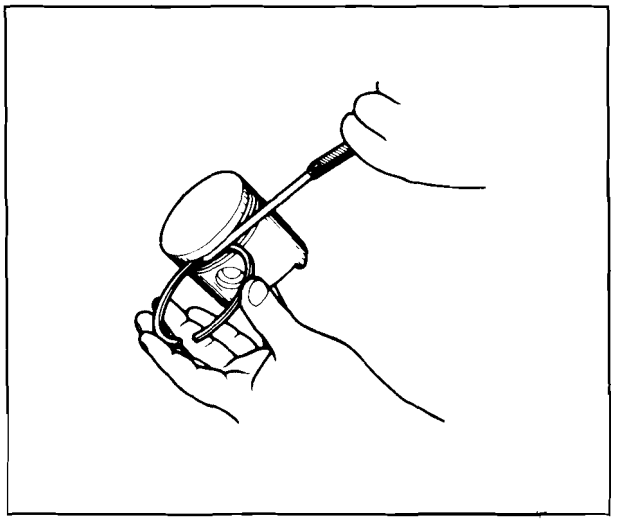


Fig. 8—Measuring piston ring side clearance

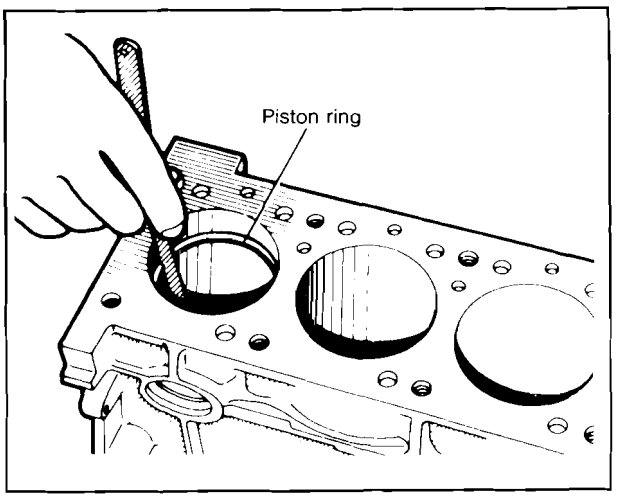


Fig. 9—Measuring piston ring gap

CONNECTING RODS

(1) Check the connecting rod for damage at the thrust faces at either side and for step wear or severely rough surface of the inside diameter of the small end. Replace faulty rods.

NOTE: When using a new connecting rod, the cylinder number should be stamped or marked on the big end.

(2) Measure the connecting rod small end diameter, if not within specifications, replace the rod.

(3) Using a connecting rod aligner, check the rod for bend and twist. If a rod falls just outside the specified limit it can be straightened by using a press. A rod that is severely bent or distorted must be replaced.

(4) Measure the connecting rod side clearance by assembling the rod and bearing onto the crankshaft and tightening the bolts to the specified torque. Measure the clearance between the connecting rod and crankshaft using feeler gauges. If this exceeds the specified limit, replace the rod.

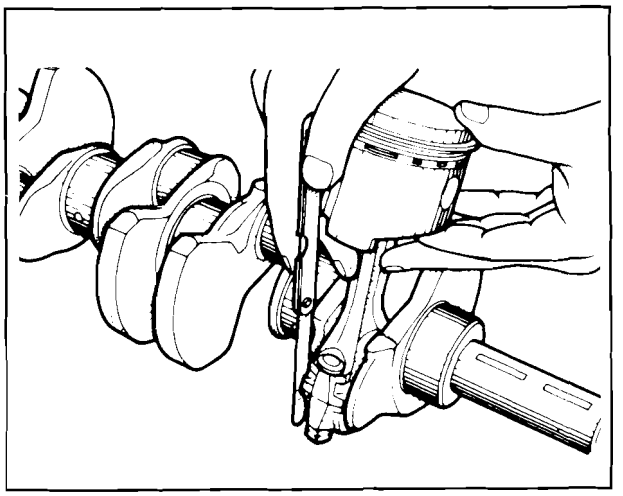


Fig. 10—Measuring connecting rod side clearance

CRANKSHAFT

(1) Check the crankshaft journals for damage, uneven wear and cracks. Check all oil holes for clogging.

(2) Check the crankshaft for bending by supporting it between centres and positioning a dial indicator on the centre journal. Rotate the shaft once noting the total indicator reading. Half of the reading is the amount of bend, if this exceeds the specified limit, repair or replace the crankshaft.

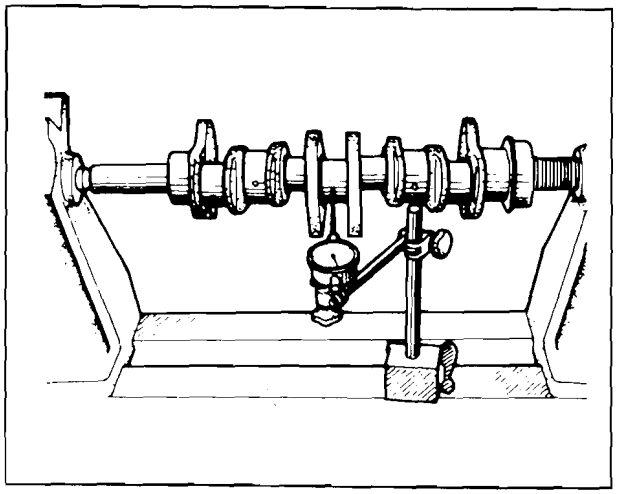


Fig. 11—Measuring crankshaft bend

(3) Measure the crankshaft journal diameters as shown in Fig. 12. If they are excessively out of round, tapered or worn they must be re-ground to the next undersize.

NOTE: Grinding of crankshaft journals must only be done AFTER checking/repairing crankshaft bend.

NOTE: Whenever crankshaft journals are reground, the correct undersize bearings must be fitted.

(4) When grinding the crankshaft, care must be taken to ensure the crankshaft journal fillet radii are 2.5 mm.

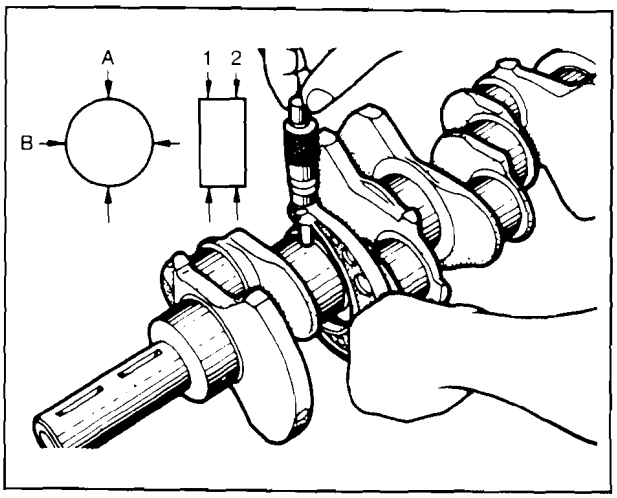


Fig. 12—Measuring crankshaft journal diameter

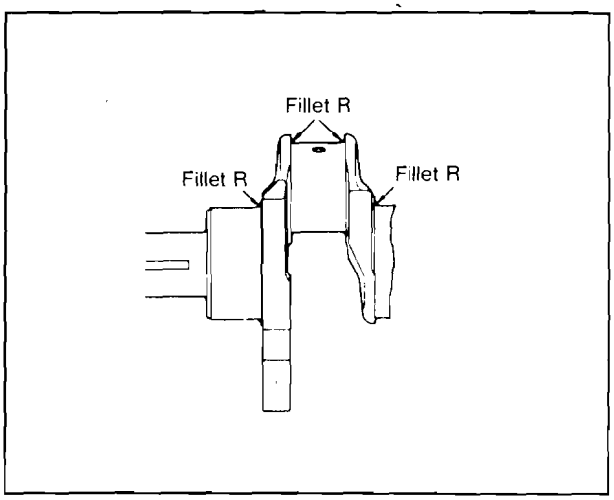


Fig. 13—Crankshaft journal fillet radii

(5) Check the crankshaft end float by assembling the crankshaft, bearings and caps to the cylinder block. Insert a feeler gauge between the centre bearing and crankshaft, if the end float exceeds the specified limit, replace the centre bearing.

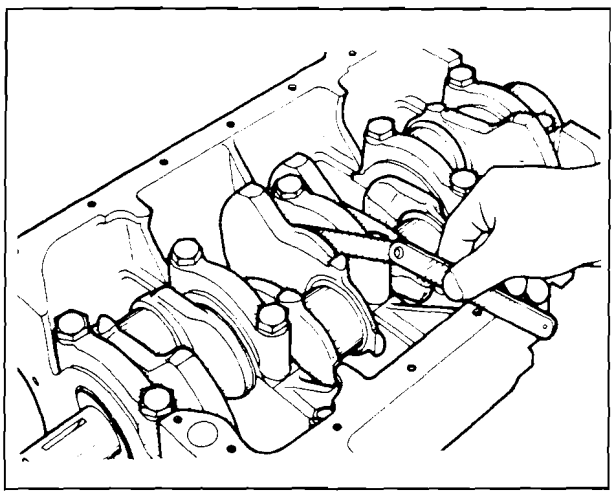


Fig. 14—Measuring crankshaft end float

MAIN AND CONNECTING ROD BEARINGS

(1) Check all bearings for peeling, melting, seizure and improper contact. Replace any faulty bearings.

(2) Checking the journal to bearing clearance can be done using either of two methods:

(a) measure journal and bearing diameters;

(b) using the plastigauge method.

Measuring Diameters

(1) Measure the outside diameter of the main and connecting rod journals, refer Fig. 12.

(2) Assemble the bearings and caps and measure the bearing inside diameter, refer Fig. 15. The clearance is the difference between the respective bearing and journal diameter.

(3) If the clearance is not within specification and the journal diameter is within specification the bearings must be replaced.

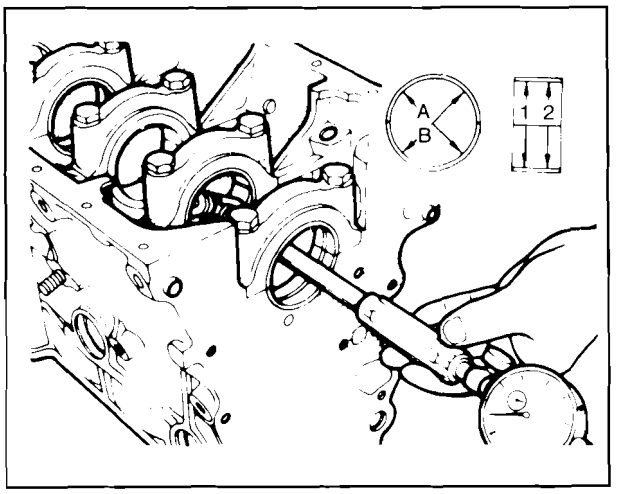


Fig. 15—Measuring bearing diameter

Plastigauge Method

(1) Remove all oil, grease and dirt from the bearings and journals.

(2) Cut a piece of Plastigauge the length of the bearing width and place it across the bearing, away from the oil hole.

(3) Install the crankshaft/connecting rod, bearing and caps and torque them to specifications.

NOTE: Do not rotate the crankshaft or connecting rod during this operation.

(4) Remove the caps and measure the width of the Plastigauge using the scale printed on the Plastigauge packet.

(5) If the clearance is not within specification and the journal diameter is within specification the bearings must be replaced.

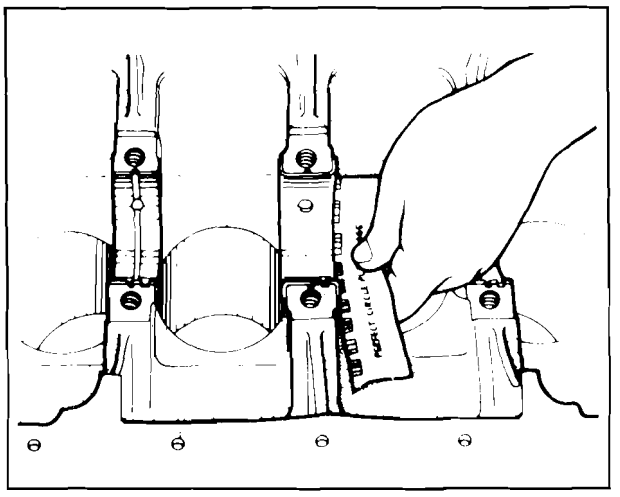


Fig. 16—Checking bearing clearance using Plastigauge

COUNTER-BALANCE SHAFT AND BEARINGS

(1) Check bearings for scratches, seizing and excessive clearance. Replace bearings as necessary.

(2) Check bearing clearance by measuring the outside diameter of the journal and the inside diameter of the bearing.

If clearance exceeds specification and the journal diameter is within specification the bearing must be replaced.

NOTE: The left hand front bearing is serviced as an assembly with the thrust plate. The right hand front bearing is serviced as part of the oil pump cover.

(3) Check oil passages for clogging.

Rear Bearing Replacement

(1) Using Tool No. E9A6 insert the tool through the shaft hole at the front of the cylinder block until its rotatable claw portion passes beyond the bearing.

(2) Pull the tool forward to fit the claws into the bearing.

(3) Hold the shaft of the tool with a spanner and turn the nut of the tool, this will pull out the bearing.

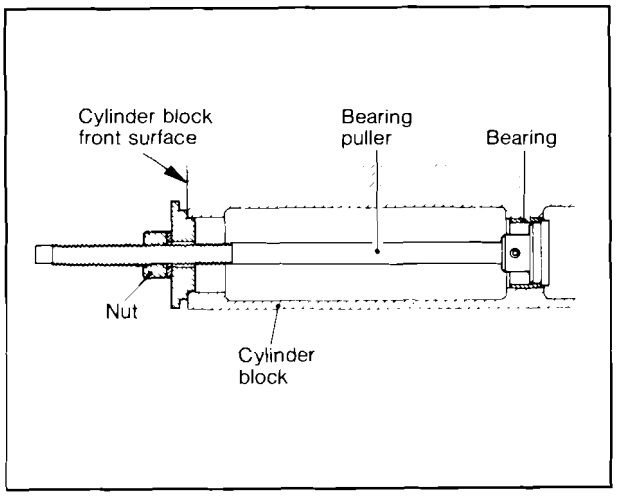


Fig. 17—Removing counter-balance shaft bearing

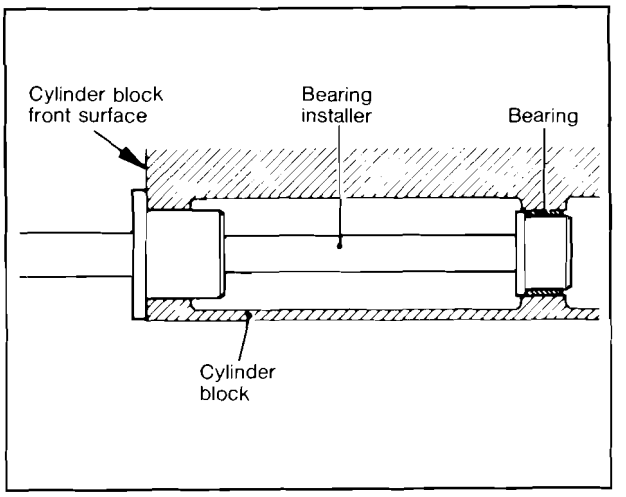


Fig. 18—Installing counter-balance shaft bearing

(4) Using Tool No. E9A5, the bearing can be press fitted to the specified position. Since the tool has no guide, extra care must be taken to align the bearing outside diameter and cylinder hole.

NOTE: Use sleeve tool No. E9A5A in conjunction with tool No. E9A5 when installing the right hand shaft bearing.

SPROCKET, CHAIN, TENSIONER AND GUIDE

(1) Check all sprockets for teeth damage and wear. Check counter-balance shaft sprockets for damaged cushion ring and ring guide. Ensure cushion ring rotates smoothly.

(2) Check the chain for roller play, wear, damage, disconnected links, etc.

(3) Check the chain tensioner rubber shoe for wear and the tensioner spring length specification.

(4) Check the chain guides for wear and damage. If the guides are severely worn or damaged they should be replaced.

FLYWHEEL AND RING GEAR

(1) Check the flywheel surface for wear or damage, if excessively worn or damaged, replace the flywheel.

(2) Check the flywheel surface run-out, if it exceeds the specified limit replace the flywheel.

(3) Check the ring gear for damage, cracking and wear, replace if necessary.

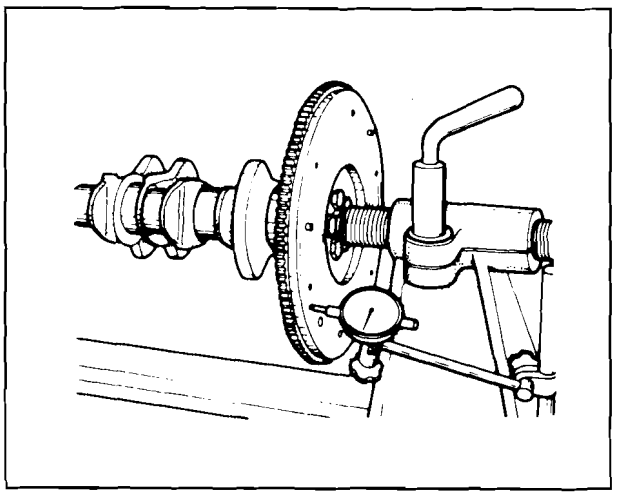


Fig. 19—Checking flywheel surface run-out

RING GEAR REPLACEMENT

(1) Remove the ring gear by cutting through the valley of the ring gear teeth to within 1 mm of the flywheel circumference and then split with a hammer and chisel.

NOTE: Do not attempt to remove the ring gear by heating.

(2) Install the ring gear by heating it on a gas ring to 260 to 280°C and shrinkage-fit it on the flywheel.

OIL SEALS, OIL PAN AND OIL SCREEN

(1) Check the front and rear crankshaft seals for damaged or worn lips. Replace the seal if defective.

(2) Check the oil pan for damage and cracks, repair or replace the oil pan as necessary.

(3) Check the oil screen for failure, damage and cracks. Check the O-ring for defects. Replace any faulty parts.

CYLINDER BLOCK REASSEMBLY

When assembling the cylinder block the following procedures should be observed:

- **Thoroughly clean all components especially oil holes, bearings, housings, bores and cylinder walls.**
- **Apply engine oil to sliding and rotating parts such as cylinder walls, pistons, bearings and gears prior to installation.**
- **Gaskets and oil seals should be replaced with new parts.**
- **Apply sealant to gasket as required.**
- **Torque all bolts to specification and in the specified sequence where necessary.**
- **Check all oil clearances, thrust clearances and backlash where necessary.**

(1) Install main bearings, upper, to the cylinder block. If reusing the main bearings, install them in their original position.

(2) Position crankshaft onto cylinder block and apply oil to journals.

(3) Install the bearing caps and bearings, tightening the cap bolts to specification and in the sequence of: centre, No. 2, No. 4, front and rear.

NOTE: The caps must be installed with the arrow mark facing the front of the engine and in the correct order.

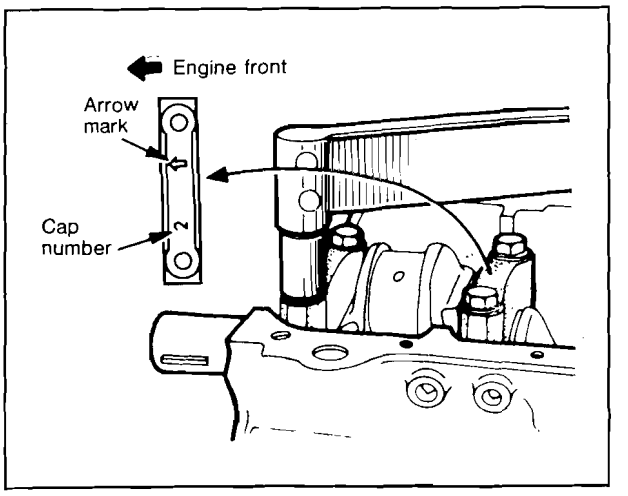


Fig. 20—Installing main bearing caps

(4) Ensure that the crankshaft rotates lightly and smoothly and that the end float is within specifications.

(5) Using Tool No. E9A7 set the piston pin positively between the push rod and guide bar.

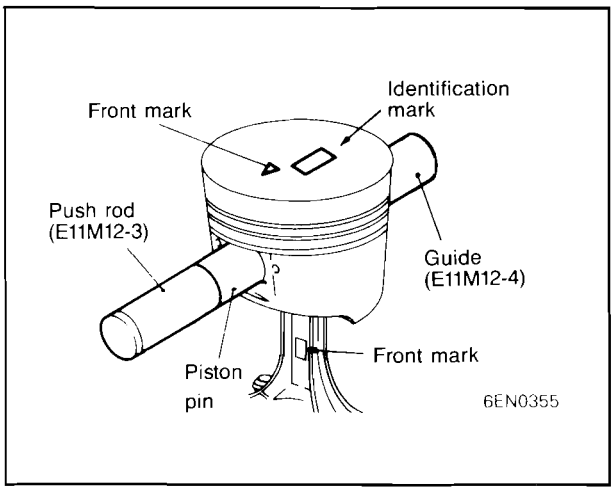


Fig. 21—Fitting piston pin onto tool

(6) Lubricate the outer surface of the piston pin and small end bore of the connecting rod.

(7) With the connecting rod and piston front marks aligned (arrow on piston, numerals on connecting rod), insert the piston pin, guide bar (E11M12-4) and push rod (E11M12-3) into the piston.

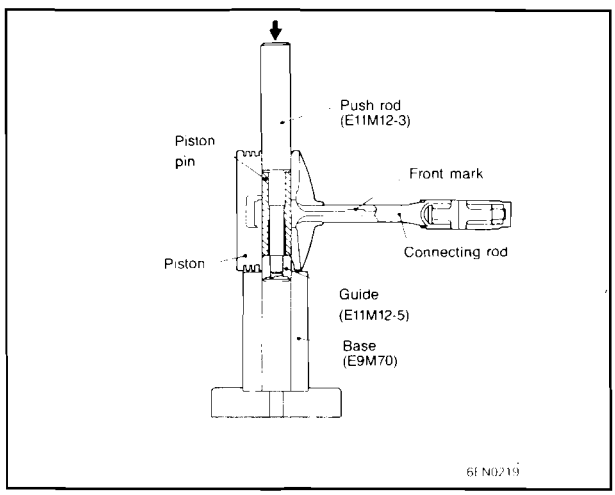


Fig. 22—Piston and connecting rod assembled into tool

(8) Insert guide bar (E11M12-4) in the slot provided in the tool base (E9M70), with the piston top surface positioned on the side indicated by the arrow stamped on the base and the front mark on the piston facing upward, refer Fig. 23.

CAUTION: When installing piston pin ensure the front mark of the piston is facing upwards or damage to the piston will result.

(9) With the aid of a press, install the piston pin until the top end of the guide bar bottoms in the tool base. The force required to install the pin must be between 7360 to 17165 N.

NOTE: If the force required to fit the pin is not as specified, the piston pin must be removed and the pin and connecting rod diameters checked.

(10) With the piston assembled to the connecting rod ensure that the piston moves freely and lightly.

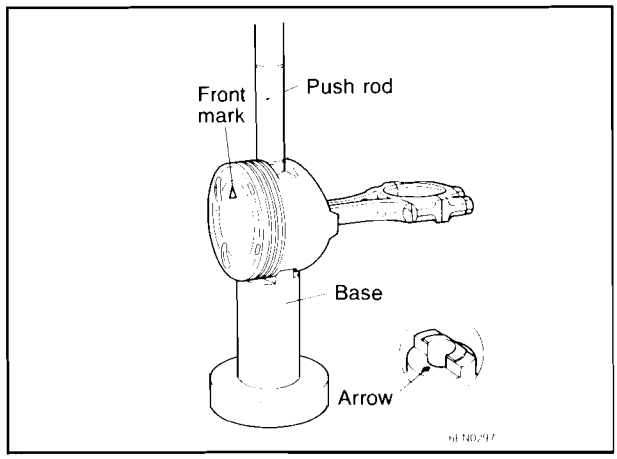


Fig. 23—Installing piston pin

(11) Install the piston rings in the following order:

(a) Install the oil ring expander.

(b) Fit one end of the oil ring top side rail into the groove and "peel" the ring into the groove. (Refer Fig. 24). Fit the lower side rail in a similar manner.

NOTE: Ensure that both upper and lower side rails can be turned freely in the piston.

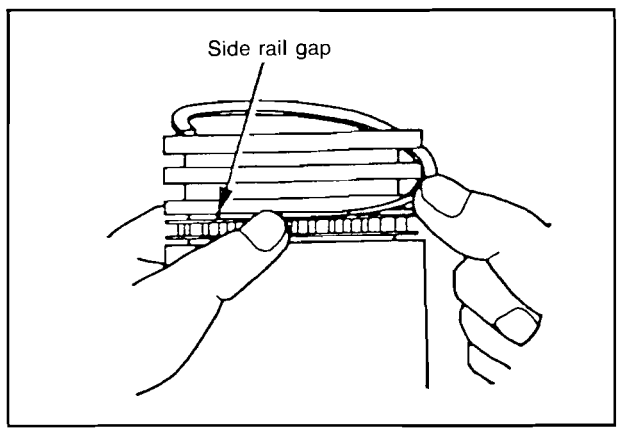


Fig. 24—Fitting oil ring side rail

(c) Install the No. 2 piston ring and then No. 1 piston ring.

NOTE: No. 2 piston ring is identified by a mark on the ring face. The ring must be fitted with the mark facing the top of the piston.

(12) Position the piston rings so that the ring gaps are as far from each other as possible and that they do not align with the piston pin and thrust side of the piston, refer Fig. 26.

(13) Apply a liberal amount of engine oil to the piston and rings.

(14) Compress the rings using a piston ring compressor. Install the piston and connecting rod assembly into the cylinder ensuring the piston front mark is facing the front of the engine and the assemblies are fitted into the correct cylinder.

NOTE: It is advisable to fit plastic covers or masking tape around the connecting rod bolts to protect the cylinder walls and crankshaft journals from damage.

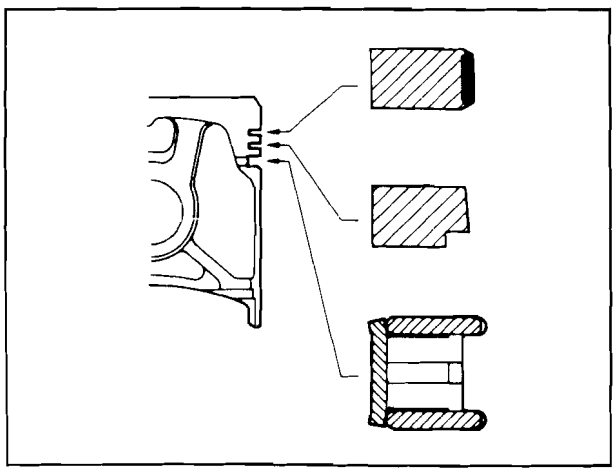


Fig. 25—Order of piston ring installation

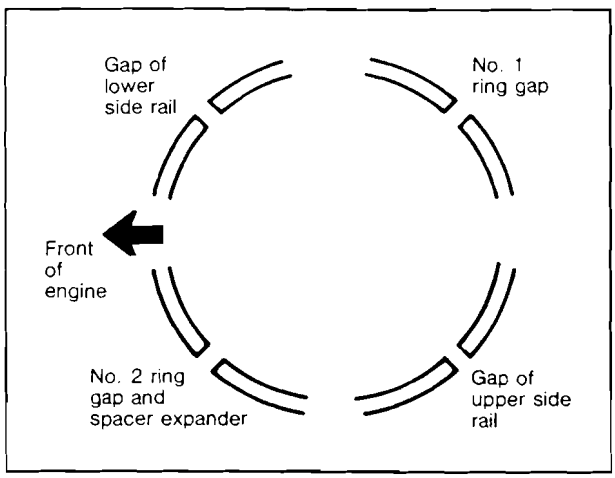


Fig. 26—Piston ring gap position

(15) Install the connecting rod caps in the correct order, with the cylinder number marks on the cap, aligned with the numbers on the connecting rod. Tighten the cap bolts to the specified torque.

(16) Check the connecting rod big-end side clearance.

(17) Install the crankshaft rear oil seal case. If the oil seal has been removed from the case, install a new oil seal to the case, ensuring it is properly seated into the case and that the oil hole in the separator faces the bottom of the case, refer Fig. 28.

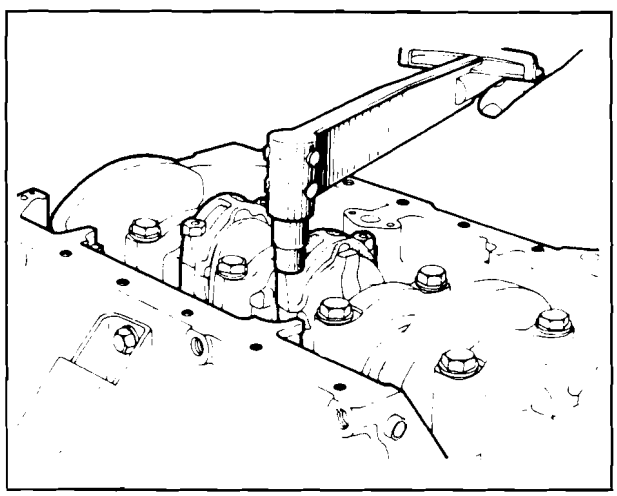


Fig. 27—Tighten connecting rod bearing caps

NOTE: The crankshaft oil seal lip should be lubricated with engine oil prior to installation.

(18) Install the flywheel (or torque convertor drive plate) tightening the bolts to the specified torque.

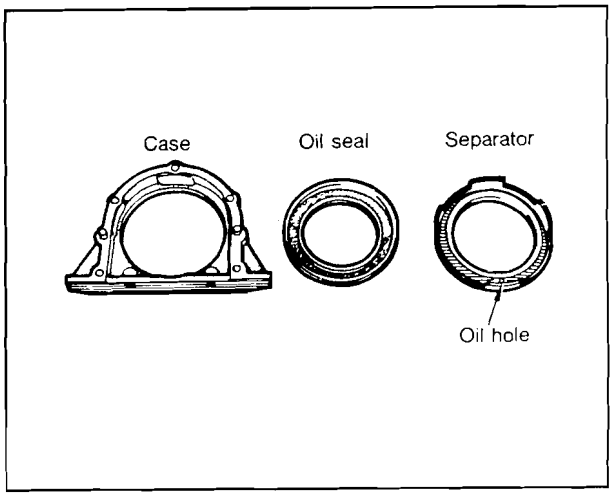


Fig. 28—Rear crankshaft seal assembly

(19) Lubricate the right hand counter-balance shaft bearing journal, and install the shaft into the cylinder block being careful not to damage the rear bearing.

NOTE: The counter-balance shafts are not interchangeable. The left hand shaft is identified by the key way at the forward end of the shaft, the key way on the right hand shaft is further back.

(20) Install the oil pump assembly, making sure that the key way of the oil pump driven gear fits the woodruff key in the counter-balance shaft. Firmly tighten the oil pump mounting bolts.

NOTE: Fill the oil pump with engine oil prior to installation.

(21) Tighten the bolt securing the counter-balance shaft to the oil pump driven gear.

NOTE: If the fit of the counter-balance shaft to the oil pump gear is tight, install the shaft to the gear first and then install the shaft and oil pump onto the cylinder block, as an assembly.

(22) Lubricate the left hand counter-balance shaft bearing journal and install the shaft into the cylinder block being careful not to damage the rear bearing.

(23) Install a new O-ring in the thrust plate taking care not to twist the O-ring.

(24) Lubricate the O-ring prior to installation of the thrust plate.

(25) Install the thrust plate, using two 6 mm diameter threaded bolts, with the heads removed, as guide pins, refer Fig. 30.

NOTE: Failure to use the guide pins will necessitate rotation of the thrust plate to align the bolt holes, which may cause damage or twisting of the thrust plate O-ring.

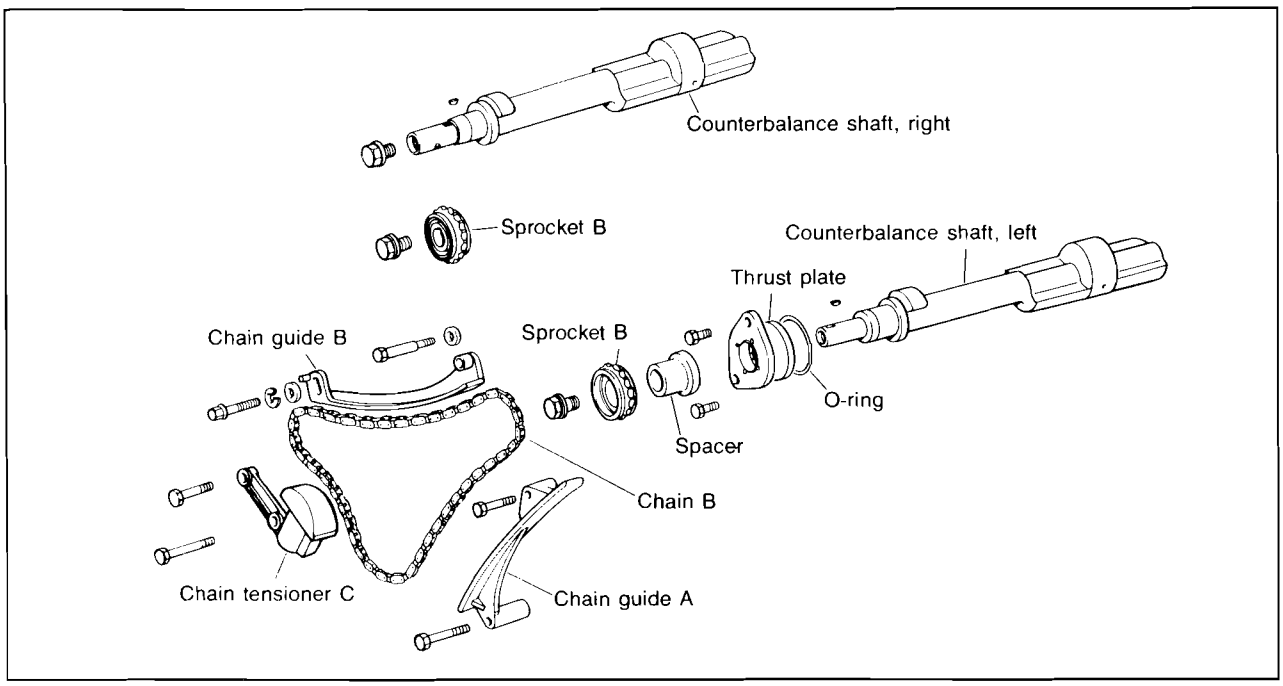


Fig. 29—Counter-balance shaft system

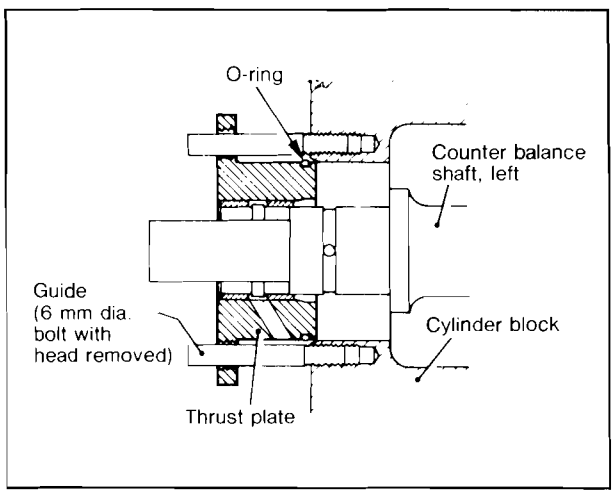


Fig. 30—Installing counter-balance shaft thrust plate

(26) Install the drive chains, sprockets and timing cover as previously described under Camshaft and Counter-Balance Shaft Drive Chains and Oil Pump, refer Section 3.

(27) Install the oil screen.

(28) Install the oil pan with a new gasket, coating both sides of the entire gasket with sealant. The oil pan bolts should be tightened in a criss-cross pattern.

(29) Install the oil pressure switch.

(30) Set the engine upright and install the cylinder head assembly as previously described under Cylinder Head.

(31) Install the engine mounting brackets and install engine into vehicle as previously described.

SECTION 5 — SPECIFICATIONS AND GENERAL INFORMATION 6G72

SPECIFICATIONS

ENGINE GENERAL

Type	V6 OHC/OHV
Number of cylinders	Six
Bore	91.1 mm
Stroke	76.0 mm
Displacement	2972 cc
Max. power -95 RON fuel	123 kW (DIN) @ 5500 rpm
-91 RON fuel	112 kW (DIN) @ 5000 rpm
Compression ratio	10:1
Compression pressure @ 250 rpm	1300 kPa
Pressure difference between cylinders	100 kPa
Spark plug type	N9YC4 Pre-gapped
Firing order	1-2-3-4-5-6
Direction of rotation	Clockwise observed from front of engine

CYLINDER HEAD

Material	Aluminium alloy
Type	Compact hemi-spherical
Maximum allowable distortion	0.2 mm
Grinding limit	0.2 mm

NOTE: If the cylinder block gasket surface has already been ground, then the thickness of the removed stock should be included in the grinding limit.

Inlet valve seat insert hole diameter	
—0.3 mm Oversize	44.300 to 44.325 mm
—0.6 mm Oversize	44.600 to 44.625 mm
Exhaust valve seat insert hole diameter	
—0.3 mm Oversize	38.300 to 38.325 mm
—0.6 mm Oversize	38.600 to 38.625 mm
Inlet and exhaust valve seat insert height	
—0.3 mm Oversize	7.90 to 8.10 mm
—0.6 mm Oversize	8.20 to 8.40 mm
Valve guide hole diameter	
—0.05 mm Oversize	13.050 to 13.068 mm
—0.25 mm Oversize	13.250 to 13.268 mm
—0.50 mm Oversize	13.500 to 13.518 mm
Camshaft/camshaft bearing clearance	0.05 to 0.09 mm

VALVES

Head diameter — Inlet	43 mm
— Exhaust	35 mm
Valve length — Inlet	103.0 mm
— Exhaust	102.7 mm
Stem diameter — Inlet	7.960 to 7.975 mm
— Exhaust	7.930 to 7.950 mm
Stem diameter wear limit — Inlet	0.10 mm
— Exhaust	0.15 mm
Valve face angle	45° to 45.5°
Valve head thickness — Inlet	1.2 mm
— Exhaust	3.5 mm
Valve seat contact width	0.90 to 1.30 mm
Valve stem to guide clearance — Inlet	0.03 to 0.06 mm
— Exhaust	0.05 to 0.09 mm
Installed height between spring seat and retainer	40.4 to 41.4 mm
Hydraulic lash adjuster dry clearance	0.5 to 1.3 mm

SPECIFICATIONS CONT.

VALVE GUIDES

Outside diameter	13.06 to 13.07 mm
Inside diameter	8.000 to 8.02 mm
Length—Inlet	44.0 mm
—Exhaust	48.0 mm
Installed dimension	14.60 ± 0.30 mm
Cylinder head hole size for oversize guides	
— 0.05 mm oversize	13.050 to 13.068 mm
— 0.25 mm oversize	13.250 to 13.268 mm
— 0.50 mm oversize	13.500 to 13.518 mm

VALVE SPRINGS

Number	12
Free length	49.81 mm
Load @ installed height	323 N @ 40.4 mm
Installed height	40.4 mm
Out of Square	4°max.

VALVE TIMING

Inlet opens	16° BTDC
Inlet closes	66° ABDC
Duration	262°
Exhaust opens	56° ABDC
Exhaust closes	26° ATDC
Duration	262°
Overlap	42°

CAMSHAFT

Material	Cast iron
Camshaft bearings	Aluminium alloy
Bearing clearance	0.01 to 0.04 mm
Journal diameter	34.0 mm
Height of cam lobe — Inlet	41.25 mm
— Exhaust	41.25 mm
Nominal cam lift	6.25 mm
Rocker arm to rocker shaft clearance	0.01 to 0.04 mm

CYLINDER BLOCK

Material	Alloy cast iron
Flatness of gasket surface	Less than 0.05 mm
Grinding limit	0.2 mm

NOTE: If the cylinder head gasket surface has already been ground, the thickness of the removed stock should be included in the grinding limit of 0.2 mm

Cylinder bore diameter	91.1 mm
Maximum bore oversize	1.00 mm
Maximum diameter difference between cylinders	0.02 mm
Maximum bore wear (before reconditioning)	0.02 mm
Maximum ovality and taper (before reconditioning)	0.02 mm

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SPECIFICATIONS CONT.

PISTONS

Material	Aluminium alloy
Type	Auto thermic type
Piston pin hole diameter	22.0 mm
Piston diameter	91.05 to 91.07 mm
Piston to bore clearance	0.03 to 0.05 mm
Piston oversizes —	0.25 mm
—	0.50 mm
—	0.75 mm
—	1.00 mm

PISTON PIN

Type	Press fit in connecting rod
Material	Alloy steel
Diameter	22.001 to 22.007 mm
Offset in piston	0.3 mm

PISTON RINGS

Number	3
Ring gap — New — Compression	0.30 to 0.45 mm
— Scraper	0.45 to 0.60 mm
— Oil ring	0.20 to 0.60 mm
Service limit — Compression	0.8 mm
— Scraper	0.8 mm
— Oil ring	1.0 mm
Side clearance — Compression	0.03—0.09 mm
— Scraper	0.02—0.06 mm
— Service limit	0.1 mm

CONNECTING RODS

Material	Forged carbon steel
Length between centres	140.9 to 141.0 mm
Small end bore diameter	22 mm
Big end bore diameter	53 mm
Conrod bearing clearance	0.016 to 0.046 mm
Conrod bearing undersizes —	0.25 mm
—	0.50 mm
—	0.75 mm
Conrod — bend	0.05 mm
— twist	0.1 mm
Conrod side clearance on journal	0.10 to 0.25 mm
— service limit	0.4 mm
Bearing material	Aluminium alloy

CRANKSHAFT

Material	Cast iron
Number of main bearings	4
Main bearing journals diameter	60.0 mm
End float controlled by	No. 3 bearing

SPECIFICATIONS CONT.

CRANKSHAFT (Continued)

End play	0.05 to 0.25 mm
— Limit	0.3 mm
Big end journal diameter	50.0 mm
— maximum allowable ovality	0.03 mm
— maximum allowable taper	0.005 mm
Main bearing clearance	0.02 to 0.048 mm
Big end bearing clearance	0.016 to 0.048 mm
— Service limit (main/big end)	0.1 mm

SPECIAL TOOLS

E192	Compressor—Piston ring
E0102	Compressor—Valve Spring
MB990767	Remover/Installer — Camshaft sprocket
E9M30FA	Installer valve stem seat
MD998115	Remover/Installer — valve guide
E9M40	Hydraulic tappet adjuster kit
E1150	Hydraulic tappet leakdown tester
MD998713	Installer — camshaft oil seal
E9M20A	Remover/Installer — cylinder head bolts
MD998722	Remover/Installer — piston pin
MD998718	Installer — Crankshaft oil seal rear
MD998747	Crankshaft pulley holder
MD998719	Pins — To be used with MB990767
E11M12	Piston pin removing tool

TORQUE SPECIFICATIONS

APPLICATION	Nm
Alternator bracket bolt	20-30
Alternator mounting bolt	12-15
Alternator pivot nut	20-25
Alternator stay bolt	20-30
Alternator stay nut	15-22
Camshaft bearing cap bolt	19-21
Camshaft sprocket bolt	80-100
Connecting rod cap	50-53
Coolant temperature gauge unit	10-12
Coolant temperature sensor	20-40
Crankshaft bolt	150-160
Cylinder head bolt — Cold	100-110
Dipstick mounting bolt	12-15

TORQUE SPECIFICATIONS CONT.

APPLICATION	Nm
Distributor adaptor bolt	12-15
Drive belt tension bolt	35-55
Drive belt tension nut	35-55
Drive plate bolt	72-75
Engine mount front	
— Through bolt nut large	60-80
— small	30-40
Engine mount front to mounting bracket	100-120
Engine mounting bracket front to block	
10 x 45 mm bolts	32-49
10 x 35 mm bolts	32-49
10 x 97 mm bolt	64-74
10 x 68 mm bolt	64-74
12 x 71 mm	103-113
Exhaust manifold nut	15-22
Flywheel mounting bolt	72-75
Heat protector bolt	12-15
Heater pipe bolt	11-13
Intake manifold nut	15-20
Knock sensor	20-25
Main bering cap bolt	75-83
Oil filter — bracket bolt	12-15
Oil pan — bolt	5-7
Oil pan drain plug	35-45
Oil pressure switch	8-12
Oil pump cover bolt	8-12
Oil relief valve plug	40-50
Oil screen bolt	15-22
Rocker cover bolt	8-9
Roll stopper front	
Support bracket to block	
10 x 25 mm bolts	32-49
12 x 30 mm bolt	64-83
Through bolt nut	50-65
Mounting bolt	60-70
Roll stopper rear	
Support bracket to block	
10 x 25 mm bolts	32-49
12 x 30 mm bolts	64-83
Through bolt nut	40-50
Mounting bolt	40-50
Sump drain plug	35-45
Timing belt cover bolt	10-12
Timing belt rear upper cover, left	10-12
Tensioner bolt	22-30
Tensioner bracket bolt — 10 mm	33-50
— 8 mm	20-27
Tensioner bracket stay bolt	20-27
Thermo switch	6-9
Water inlet fitting bolt	10-13
Water outlet fitting bolt	17-20
Water pipe bolt	12-15
Water pump bolt	20-27

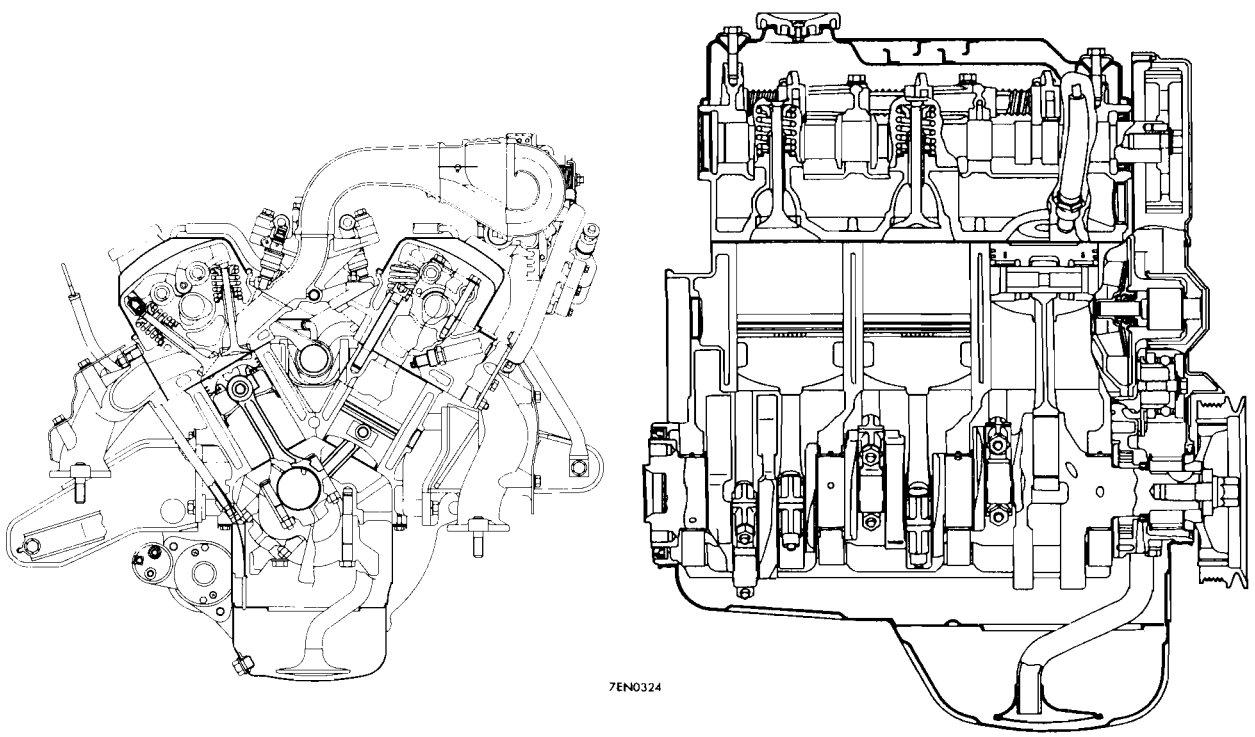


Fig. 1—6G72 engine longitudinal section

GENERAL INFORMATION

The 6G72 engine is a 60° V6, overhead valve, overhead cam crossflow design, with a compact hemispherical combusion chamber, petrol engine.

The cylinder head is made of an aluminium alloy casting, into which the valve guides and valve seat rings of heat resisting steel, have been press-fitted.

The cylinder block is an alloyed casting. The block is a short skirt type. The walls are made as thin as possible to minimise the overall weight of the cylinder block. The exterior walls are shaped and ribbed to provide sufficient strength.

The water jacket is of the full-jacket type, which ensures that each cylinder is cooled properly.

The right and left banks are angled 60° which makes the engine easy to install in the vehicle and enhances serviceability of the auxiliaries.

The inlet and exhaust ports are in a cross-flow arrangement which contributes to better intake/exhaust efficiency.

SECTION 6 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
LOW COMPRESSION (DRY TEST)	Valves sticking or seating poorly.	Overhaul valve system.
	Blown cylinder head gasket (if pressure low in adjacent cylinders or coolant is contaminated with engine oil).	Install new head gasket.
LOW COMPRESSION (WET TEST)	Worn or sticking rings.	Replace or free-up rings.
NOISY VALVES	Worn rocker arms.	Replace arms and check oil supply holes.
	Worn valve guides.	Replace guides and if necessary install new valves.
	Worn or damaged camshaft lobes.	Replace camshaft.
	Excessive valve seat or valve face run-out.	Re-cut valves and seats.
	Malfunctioning hydraulic tappet adjusters.	Replace defective tappet adjusters.
CONNECTING ROD NOISE	Insufficient oil supply.	Check engine oil level.
	Low oil pressure.	Check oil pump output.
	Thin or diluted oil.	Change oil to correct viscosity.
	Excessive bearing clearance.	Measure bearings for correct clearances. Replace if necessary.
	Connecting rod journal out-of-round.	Remove crankshaft and regrind journals.
	Misaligned connecting rods.	Replace the bent connecting rods.
MAIN BEARING NOISE	Insufficient oil supply.	Check engine oil level.
	Low oil pressure.	Check oil pump output.
	Thin or diluted oil.	Change oil to correct viscosity.
	Excessive bearing clearance.	Measure bearings for correct clearances. Replace if necessary.
	Excessive end play.	Check respective end thrust bearing for wear on flanges.
	Crankshaft journals out-of-round or worn.	Remove the crankshaft and regrind journals.
	Loose flywheel.	Tighten to correct torque.
OIL PUMPING AT RINGS	Worn, scuffed or broken rings.	Hone cylinder bores and install new rings.
	Carbon in oil ring slots.	Install new rings.
	Rings fitted too tight in grooves.	Remove the rings. Check the grooves. If groove is not correct width, replace the pistons.

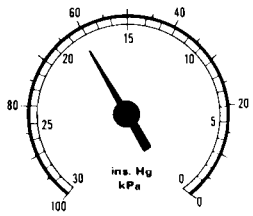
Condition	Possible Cause	Corrective Action
OIL PUMPING AT RINGS (CONT.)	Compression rings installed upside down.	Remove and refit rings correctly.
LOW OIL PRESSURE INDICATED	Low oil level.	Check and top up oil level if required.
	Faulty oil pressure sending unit.	Install a new sending unit.
	Thin or diluted oil.	Change the oil to correct viscosity.
	Oil pump relief valve stuck.	Remove the valve and inspect.
	Oil pump suction tube loose, bent or cracked.	Remove the oil pan and install a new tube if required.
	Clogged oil filter.	Install a new oil filter.
	Excessive bearing clearance.	Check the bearing clearance.
	Excessive oil pump gear clearance.	Remove oil pump and check gears for wear and clearance.

ENGINE DIAGNOSIS WITH VACUUM GAUGE

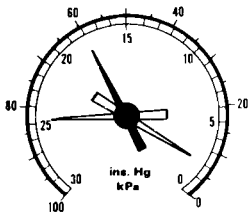
A vacuum gauge can be beneficial as an aid in diagnosing engine problems.

Obtain a reliable, calibrated vacuum guage and "tee" it into the inlet manifold at the brake booster vacuum connection.

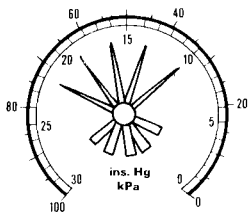
Use the readings as outlined opposite, to carry out your diagnosis.



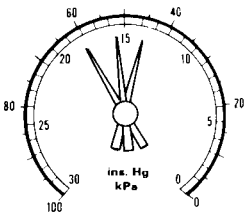
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NORMAL ENGINE



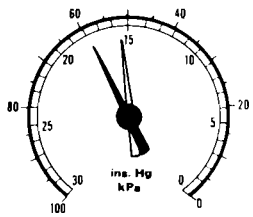
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NORMAL ENGINE



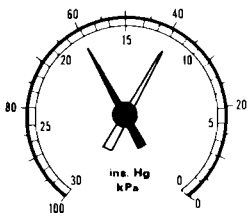
3
VALVE SPRINGS
WEAK



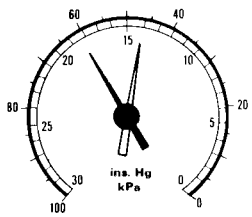
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VALVE GUIDES
WORN



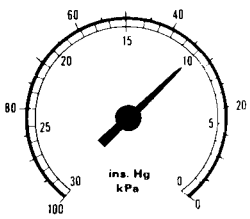
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VALVE LEAKING



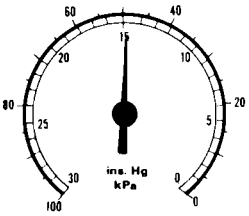
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VALVE BURNT



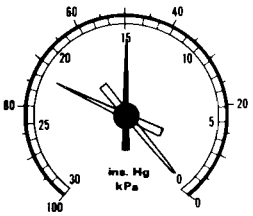
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VALVE STICKING



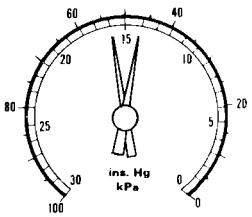
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VALVE TIMING
LATE



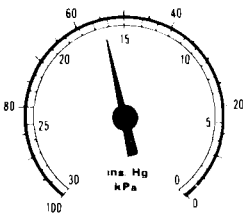
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WORN RINGS



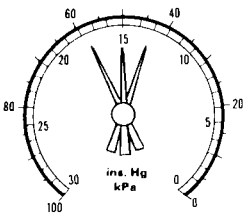
10
WORN RINGS OR
INFERIOR LUBRICANT



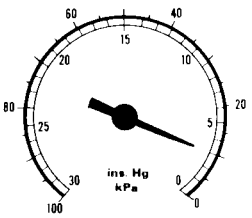
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IGNITION DEFECTIVE



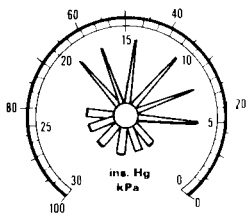
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IGNITION RETARDED



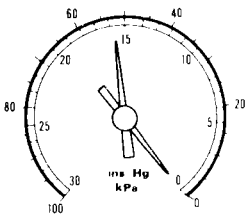
13
CARBURETTOR
ADJUSTMENT



14
LEAKING INTAKE
SYSTEM



15
LEAKING HEAD
GASKET
(between cylinders)



16
BLOCKED EXHAUST
SYSTEM

Readings — ins.Hg (kPa)

1. With the engine idling, the hand is steady between 17 and 21 (57 to 71).
2. With a rapid opening and closing of the throttle, the hand will fall to 2 (6.5) and swing back to 24 or 25 (81 to 84), settling on normal idle reading. Rings and valves indicated OK.
3. With fast running engine, the hand reads between 10 and 22 (34 to 74). Increase speed increases hand fluctuations.
4. With engine idling, hand vibrates rapidly between 14 and 19 (47 to 64).
5. When valve should close, hand drops two or three points.
6. At idle, the hand drops consistantly a few points.
7. At idle, the hand sometimes drops around four points.
8. At fast idle, the hand reads steady from 8 to 15 (27 to 50).
9. At idle the hand reads steady but lower than normal. Inferior lubricant may also be indicated.
10. With rapid opening and closing of the throttle, the hand falls to 0 and rises to 23 (78) or less.
11. With a slowly fluctuating hand between 14 and 16 (47 to 54), check ignition system for faults.
12. At fast idle, a steady reading between 14 and 17 (47 to 58) is registered.
13. Check idle mixture if hand moves slowly between 13 and 17 (44 to 57).
14. At idle or fast idle, hand reads between 3 and 5 (10 and 17). Check gaskets.
15. Hand moves consistantly between 5 and 19 (17 and 64).
16. High reading at start reducing to 1 (3) or 0 and increases to 15 to 16 (51 to 54).

SECTION 7 — IN-VEHICLE SERVICE PROCEDURE

COMPRESSION TEST

An engine without reasonably high and uniform compression cannot be effectively tuned. The compression of each cylinder should be tested before any other tuning operations are performed. The engine must be at operating temperature when performing the compression test.

Compression pressure with engine warm, spark plugs removed, wide open throttle at minimum cranking speed of 250 r.p.m. should be within the specified limits.

(1) Remove any foreign matter from around spark plugs by blowing out plug area with compressed air, then loosen all plugs one turn.

(2) Start the engine and accelerate to 1000 r.p.m. to blow out loosened carbon. Stop engine and remove plugs, note cylinder from which each plug was removed for future reference.

NOTE: Clearing out carbon in this manner is important in preventing false compression readings due to particles of carbon becoming lodged under the valves.

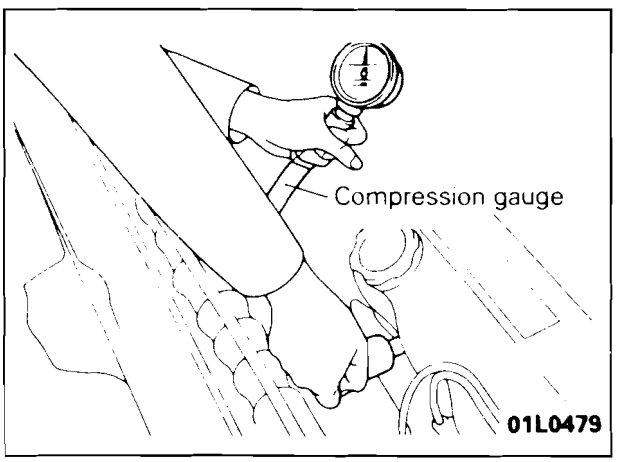


Fig. 1 — Checking compression

(3) Disconnect coil **primary** lead.

(4) Disconnect the ECI-Multi control relay to prevent fuel injection.

(5) Connect remote control starter switch to the starter solenoid.

(6) Insert the compression gauge in spark plug opening, and crank engine through at least four compression strokes to obtain highest possible reading.

(7) Test and record compression of each cylinder. Compression should read within the limits indicated in the specifications.

(8) If one or more cylinders read low or uneven, inject about a tablespoon of engine oil on top of pistons in low reading cylinders. Crank engine several times and re-check compression. If compression comes up but does not reach normal, rings are worn. If compression does not improve, valves are sticking or seating poorly. If two adjacent cylinders show low compression, and injecting oil does not improve condition, the cause may be a head gasket leak between the cylinders.

TIMING BELT ADJUSTMENT

(1) Ensure engine is at No. 1 TDC and remove the access cover, refer Fig. 2.

(2) Using Special Tool No. MD998160 loosen timing bolt 1-2 turns.

(3) Rotate crankshaft **TWO TURNS** in a clockwise direction.

(4) Tighten tension bolt to specified torque.

(5) Replace the access cover.

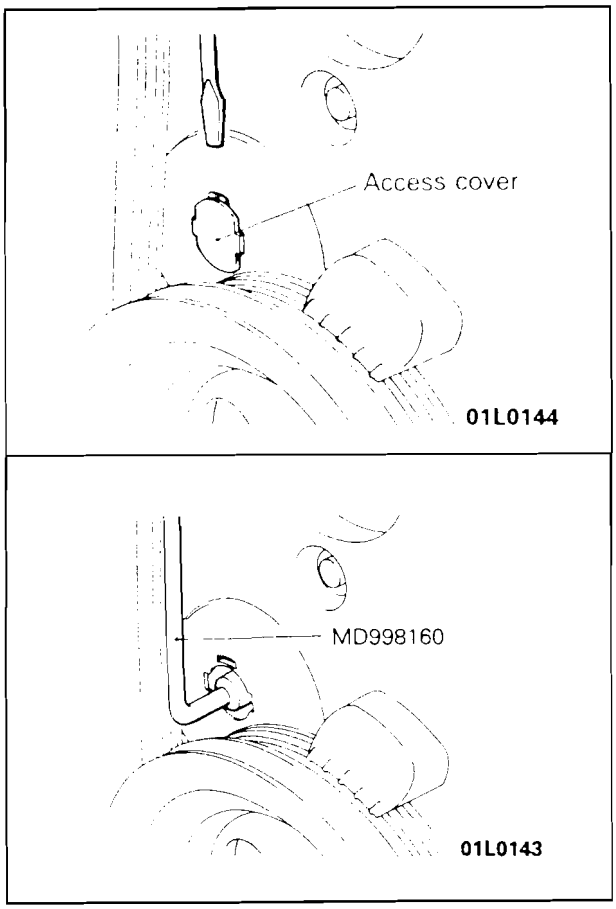


Fig. 2 — Timing belt adjustment

TIMING BELT

Removal

(1) Remove alternator, power steering and air conditioning belts.
(2) Remove power steering pump and air conditioner compressor.
(3) Remove crankshaft pulley, bolt and washer using Special Tool Nos. MB990767 and MD998715, refer Fig. 3.

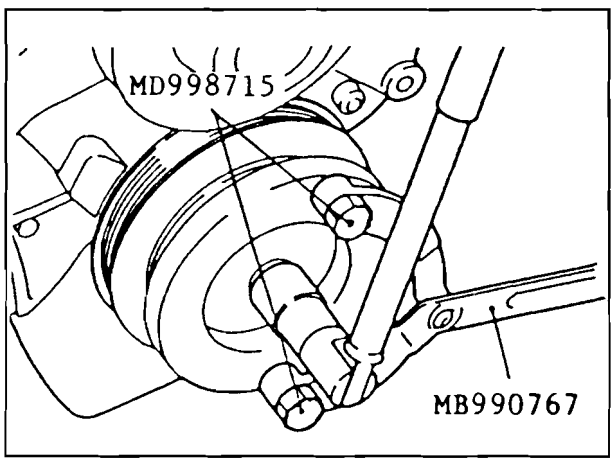


Fig. 3 — Crankshaft pulley removal

(4) Remove right and left upper timing belt covers.
(5) Remove front crankshaft flange.
(6) Remove lower timing belt cover.
(7) Manually rotate engine to No. 1 Top Dead Centre using Special Tool No. MD998716, as shown in Fig. 3. Ensure that all timing marks are aligned, refer Fig. I0.

NOTE: When the timing belt is to be reused, the direction of rotation should be marked on the belt, so that on assembly it is installed in the same direction.

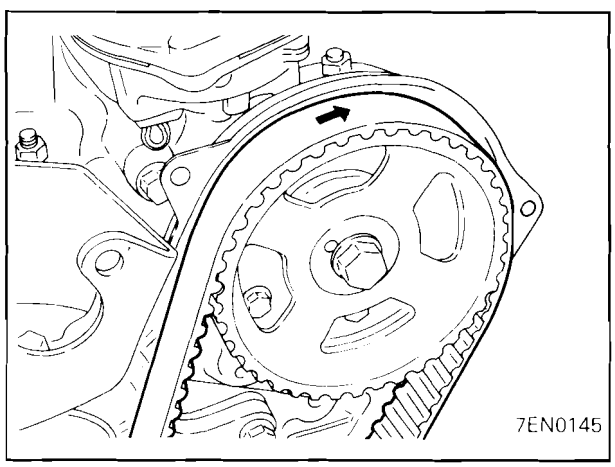


Fig. 4 — Marking direction of timing belt

(8) Remove lockbolt, tensioner and spring and remove the timing belt.

Inspection

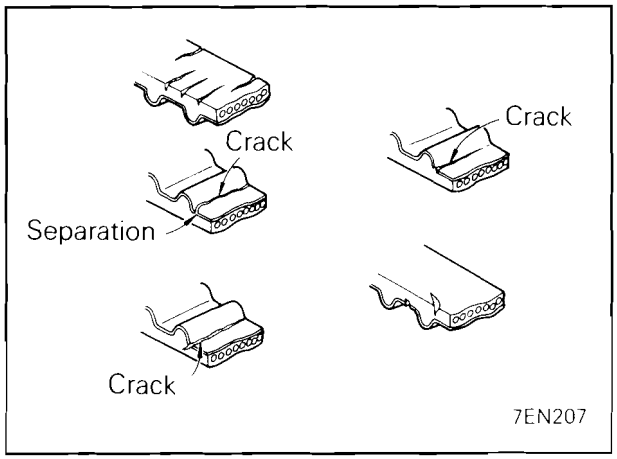


Fig. 5 — Timing belt cracked

Inspect timing belt for cracking, brittleness, damage or worn and broken teeth. Refer Figs. 5 and 6.

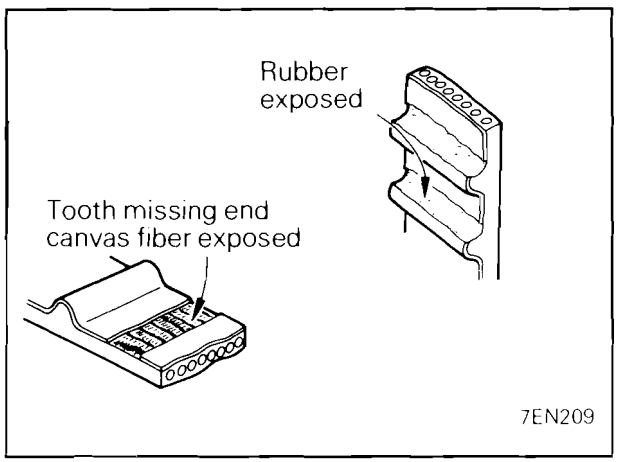


Fig. 6 — Timing belt teeth damage

Inspect timing belt tensioner by rotating the pulley. If it does not rotate smoothly or irregular noise or backlash is observed, replace timing belt tensioner. Refer Fig. 7.

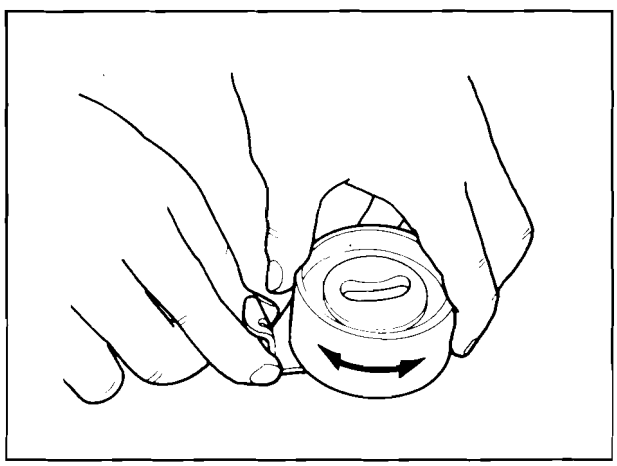


Fig. 7 — Timing belt tensioner

Installation

(1) Install timing belt tensioner and tighten bolt finger tight.

(2) Install tensioner spring to the pin above the water pump case and the tensioner.

NOTE: Ensure the direction of the tensioner spring hook is as shown in Fig. 8.

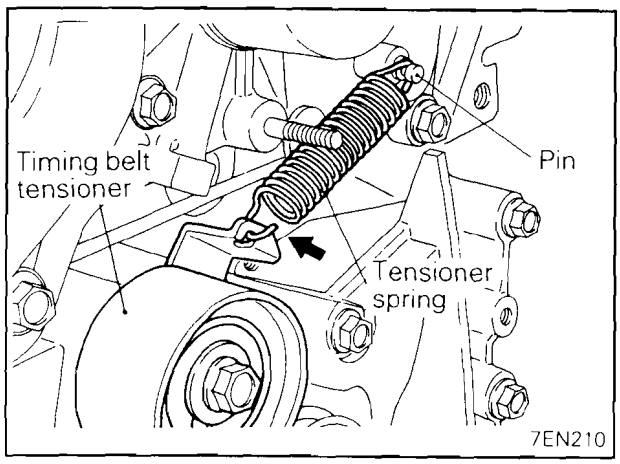


Fig. 8 — Tensioner spring fitment

(3) Force the tensioner in direction of arrow, refer Fig. 9 and tighten the lock bolt.

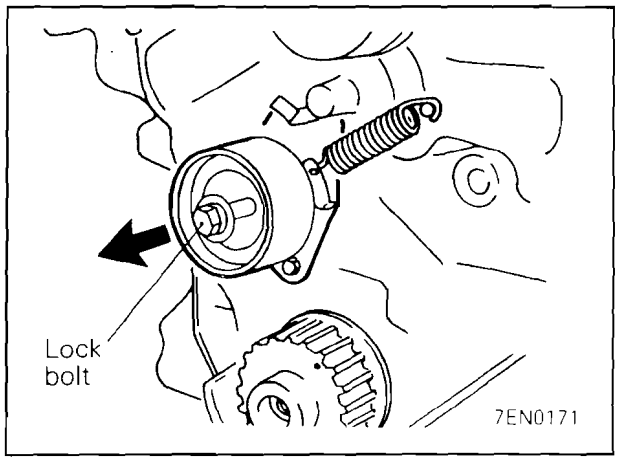


Fig. 9 — Belt tensioner positioning

(4) Align timing marks on camshaft sprockets and crankshaft sprocket, refer Fig. 10.

(5) Install timing belt as follows:—

Route the timing belt onto the crankshaft sprocket and then onto the camshaft sprocket of the left hand bank, maintaining tension in the tension side, refer Fig. 10.

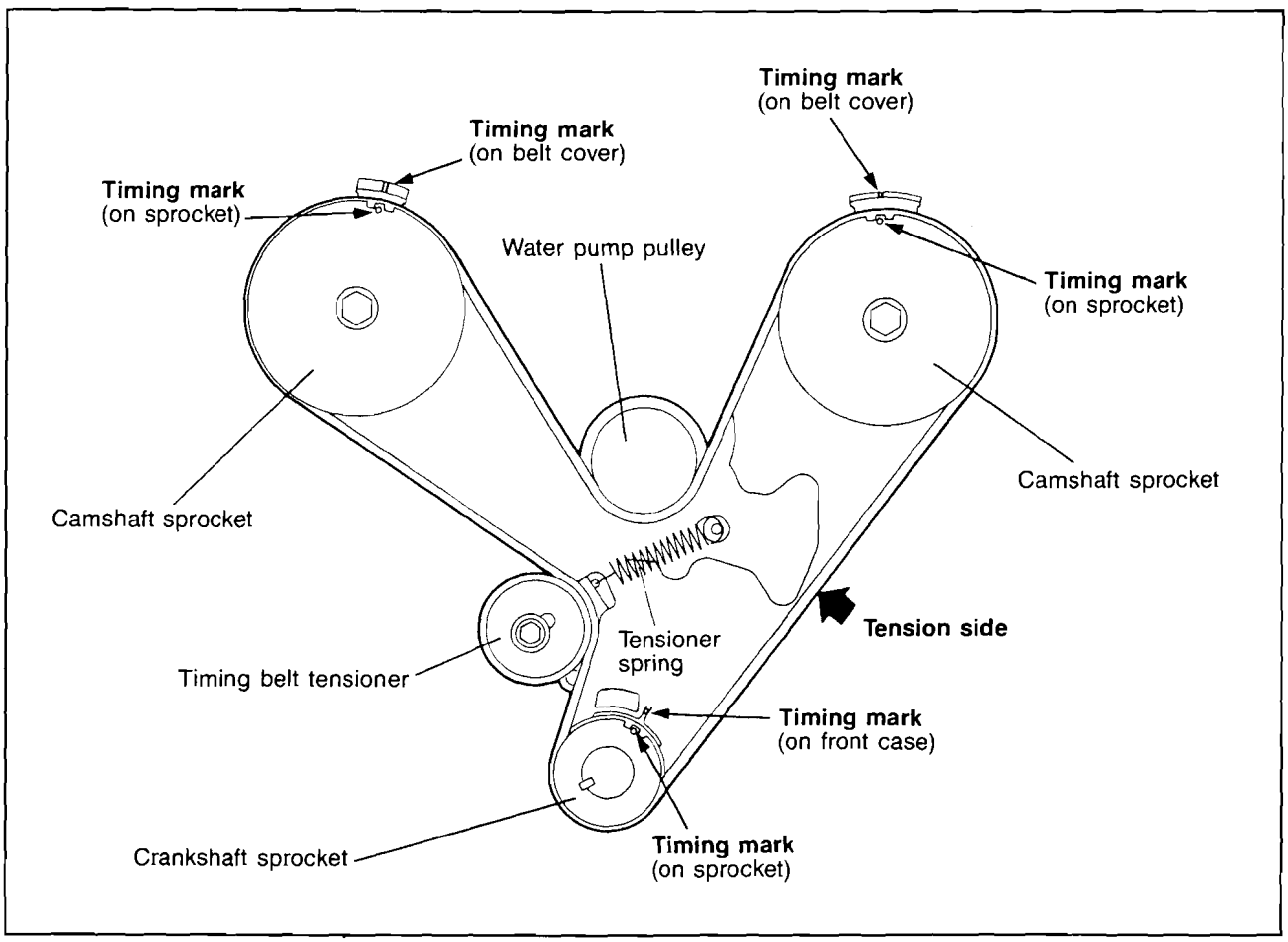


Fig. 10 — Timing mark identification

Continue the belt around the water pump pulley and the camshaft sprocket of the right hand bank and the belt tensioner.

(6) Loosen belt tensioner bolt 1 or 2 turns.

(7) Install flange onto front crankshaft sprocket.

(8) Using tool No. MD998716 smoothly rotate the crankshaft clockwise **two turns**, refer Fig. 11, and tighten tensioner lock bolt to specified torque.

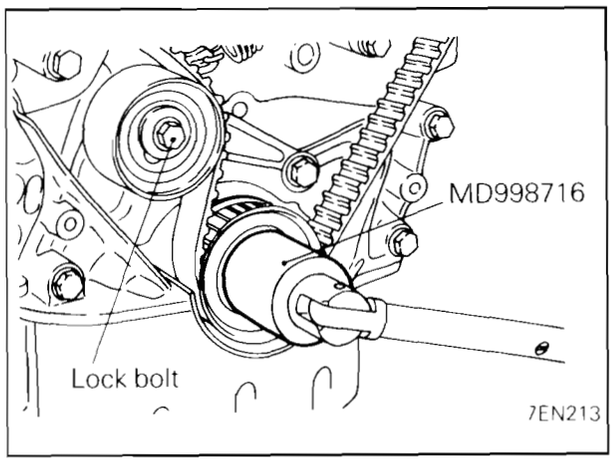


Fig. 11 — Crankshaft tool location

(9) Remove front flange and install timing belt lower cover and refit front flange.

(10) Install timing belt left and right upper covers.

(11) Install crankshaft pulley, washer and using special tool Nos. MB990767 and MD998719, tighten bolt to specified torque.

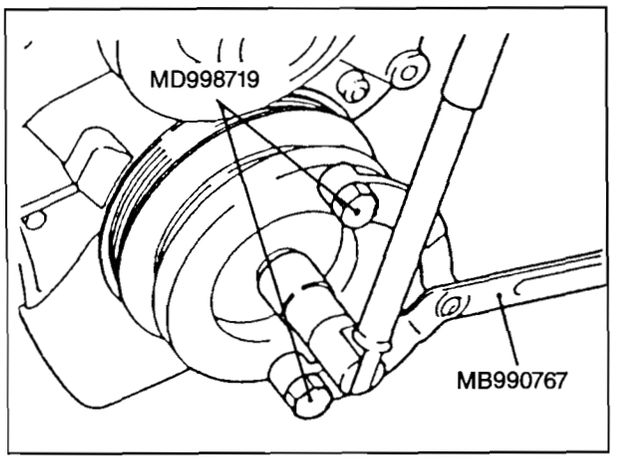


Fig. 12 — Holding crankshaft pulley

(12) Install air conditioning compressor and power steering pump.

(13) Install alternator, power steering and air conditioner belts.

CYLINDER HEAD

Removal

NOTE: Prior to removing cylinder head, allow engine to cool otherwise head warpage may occur.

(11) Disconnect the battery negative (ground) terminal.

(2) Drain the water from the radiator and cylinder block by removing lower hose.

(3) Remove the air cleaner duct from the throttle body.

(4) Disconnect the throttle cable, fuel supply and return lines, vacuum hoses, electrical leads, radiator and heater hoses etc.

(5) Manually rotate the engine to No. 1 top dead centre on the compression stroke, aligning the crankshaft pulley timing mark on the "T" mark of the timing plate.

(6) Remove inlet and exhaust manifolds, refer Group 15.

(7) Remove timing cover and belt.

(8) Remove rocker covers.

(9) Remove cylinder head bolts, using tool No. MD998051, in the sequence shown, refer Fig. 13.

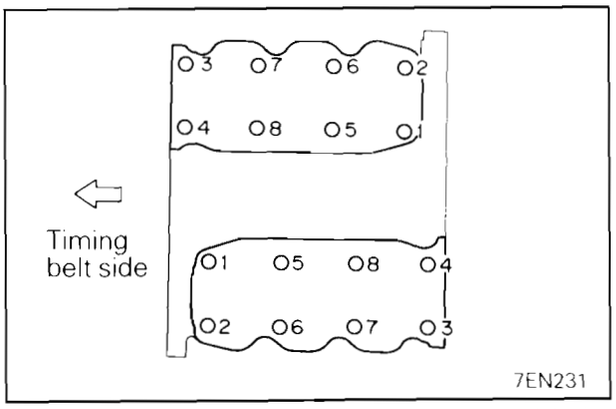


Fig. 13 — Removal sequence of cylinder head bolts

(10) Before cleaning, check the cylinder head for water and gas leaks.

After cleaning, check for damage and cracks.

Installation

(1) Ensure that the joint surface between the cylinder head and block are clean.

(2) Fit the cylinder head gasket to the cylinder block.

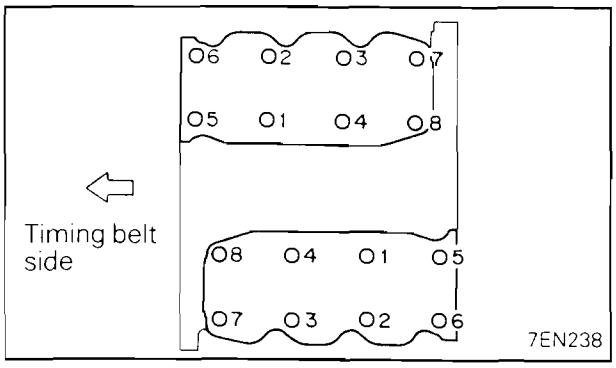


Fig. 14 — Tightening sequence of cylinder head bolts

(3) Tighten cylinder head bolts in three stages to the specified torque and in the sequence shown in Fig. 14.

(4) Install timing belt and covers.

(5) Install the rocker cover and silastic as shown on Fig. 15. Tighten bolts to specified torque.

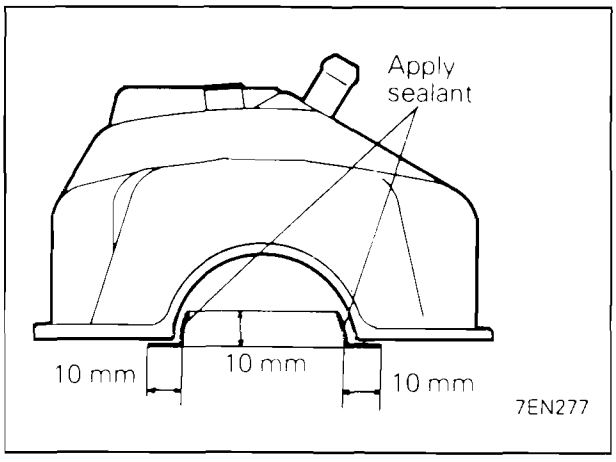


Fig. 15 — Sealing rocker cover to cylinder head

(6) Install exhaust and inlet manifolds with new gaskets, refer Group 15.

(7) Reconnect the throttle cable, fuel supply and return lines, vacuum hoses, electrical leads, radiator and heater hoses.

(8) Install the air cleaner duct to the throttle body.

(9) Fill the radiator with rainwater or demineralised water and Mitsubishi Longlife Coolant in the required concentration, refer Group 14.

(10) Connect the battery and start engine. If it is suspected that oil has leaked from the hydraulic tappet adjusters, slow race the engine a minute at a time from idle to 3000 r.p.m. to bleed off the air.

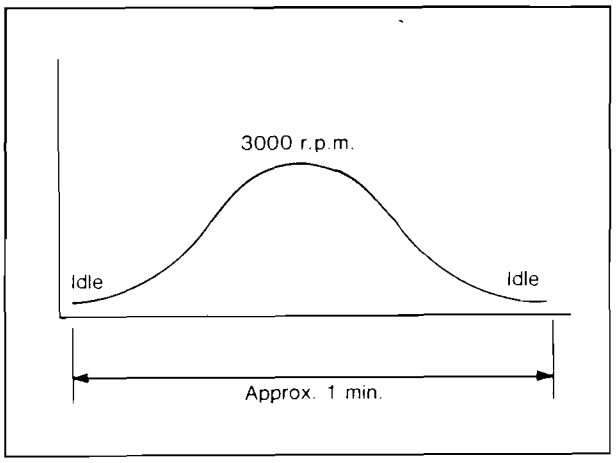


Fig. 16— Bleeding air from hydraulic tappet adjusters

(11) Run the engine until normal operating temperature is reached and check for water and oil leaks.

(12) Set engine idle speed and ignition timing to specifications.

CYLINDER HEAD DISASSEMBLY

NOTE: If valve grinding or seat refacing is considered necessary, note the following prior to disassembly:—

(a) If the valves or seats are badly worn, it may be necessary to replace the parts rather than recut or regrind them. This decision depends on the amount of dry clearance available at that rocker.

(b) To measure the dry clearance, the valve, rocker and shaft, and camshaft must be in the assembled condition with the cam follower on the base circle of the cam.

(c) Insert a suitable 0.5 mm wire probe through the hole in the rocker arm to unseat the ball in the hydraulic unit relieving the oil behind it. Measure the clearance between the valve stem and hydraulic unit with feeler gauges.

(d) The specified dry clearance is 0.5 to 1.3 mm; therefore, the amount of material removed from the valve and/or seat, must be such that the specified dry clearance is maintained.

The valve stem tip must not be ground to obtain the required clearance.

(1) Remove spark plugs.

(2) Fit tappet adjuster clips (part of kit E9M40) to each rocker arm, refer Fig. 17.

(3) Remove camshaft sprockets using tool Nos. MB990767 and MD998715, refer Fig. 18.

(4) Remove camshaft sprocket inner cover, and on left hand bank, remove distributor and distributor adaptor.

(5) Loosen camshaft bearing cap bolts, do not remove bolts from the cap.

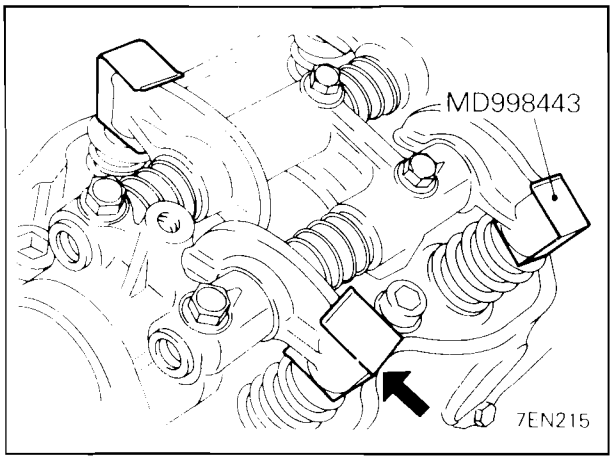


Fig. 17 — Rocker arm clip installation

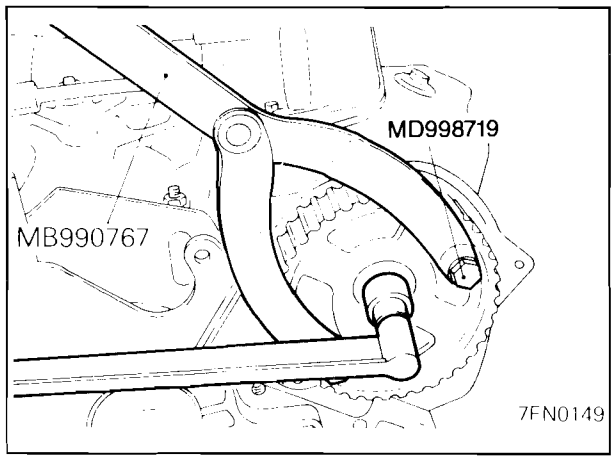


Fig. 18 — Removing camshaft sprocket

(6) Remove rocker arm, shaft and bearing cap as an assembly.

After removal mark the left and right bank for identification.

(7) Remove clips from rocker arms, remove the tappet adjusters and store in order of removal.

(8) Remove the camshafts.

(9) Remove the camshaft front oil seal.

(10) Using a valve spring compressor, remove the collets, spring retainers, springs, spring seats and valves, keeping them in order of removal.

(11) Remove valve stem seals, refer Fig. 19.

NOTE: Valve stem oil seals should not be re-used.

Cleaning and Inspection

Check the cylinder head for water leakage and damage before cleaning.

Clean each part carefully removing all pieces of dirt, oil, grease and carbon deposits. Clean oil holes and passages using compressed air, ensuring they are not clogged.

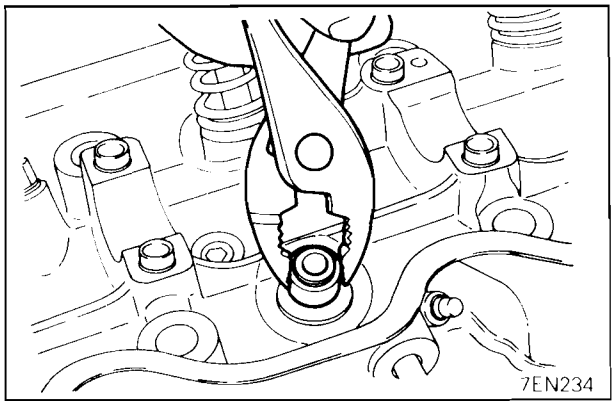


Fig. 19 — Removing valve stem seals

Care should be taken not to damage valve seats, cylinder head surface and camshaft journals.

Using a straight edge and feeler gauge, check the cylinder head for distortion as shown in Fig. 20.

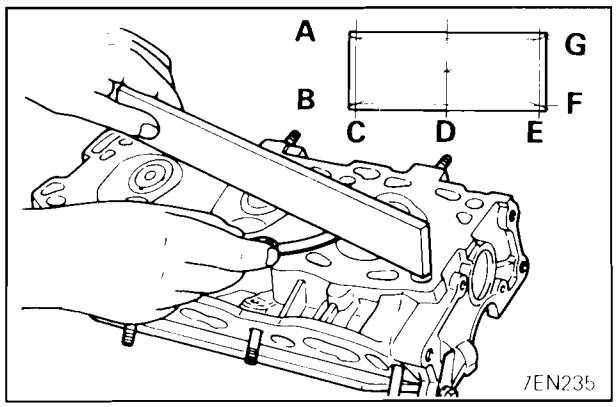


Fig. 20 — Checking for cylinder head distortion

If cylinder head distortion exceeds the specified limit, it must be resurfaced.

Check the cylinder head manifold mounting surfaces for flatness or damage.

Check condition of camshaft oil seal, replace if necessary.

VALVE GUIDES

Check the valve stem to guide clearance. If the clearance exceeds the specified limit, replace the guide with the next oversize guide. Valve guides are shrunk into position, therefore when replacement is necessary the following procedure must be adopted.

(1) Heat the cylinder head (see note) and using Tool No. MD998115, remove the defective guide towards cylinder block surface, refer Fig. 21.

NOTE: This operation should be conducted with the cylinder head temperature raised to a maximum of 250°C. The cylinder head should be kept at this temperature for a minimum amount of time.

CAUTION: Exceeding 250°C, could cause permanent damage to cylinder head.

(2) With the cylinder head at normal temperature, ream the head as specified for the oversize guide.

(3) Heat the cylinder head to the correct temperature (see note), and insert the guides quickly. Using Tool No. MD998115, install guides to the specified dimension, refer Fig. 21.

(4) After guide is installed, check the inside diameter and ream to specification if necessary.

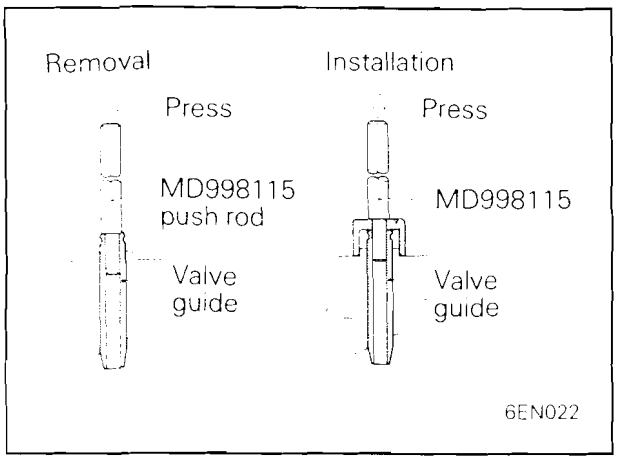


Fig. 21 — Removing and installing valve guides

NOTE: The inlet and exhaust valve guides are of different length, refer Fig. 22.

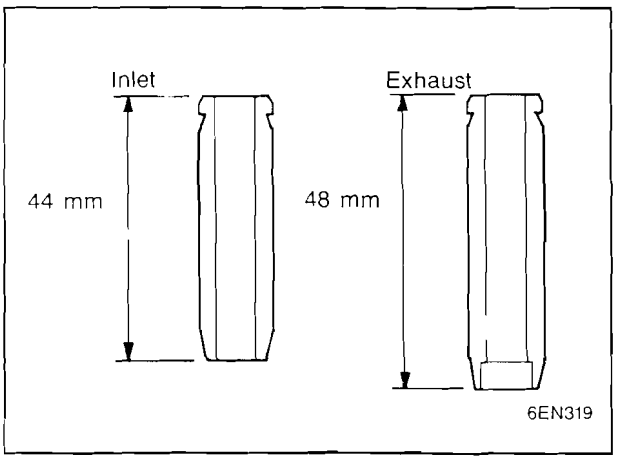


Fig. 22 — Inlet and exhaust valve guides

VALVE SEATS

The valve seat should be checked for over-heating and incorrect contact with the valve face. If faulty, it must be re-cut or replaced.

Re-Cutting Valve Seat

(1) Check valve guide for wear, if not to specification, replace guide as previously described.

(2) Recondition the seat by using either a seat grinder or seat cutter.

(3) The valve seat contact width should be as specified, at the centre of the valve face and as shown in fig. 23.

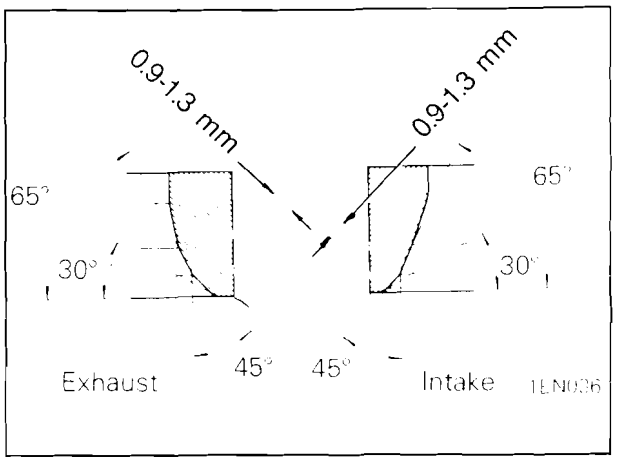


Fig. 23 — Valve seat angles

(4) After cutting, lap the valve and valve seat lightly with a fine lapping compound.

Replace Valve Seat Inserts

Check the valve seat insert "sinkage" by measuring the installed height of the valve spring between the spring retainer and seat. If the sinkage exceeds the specified limit, replace the seat insert as follows:

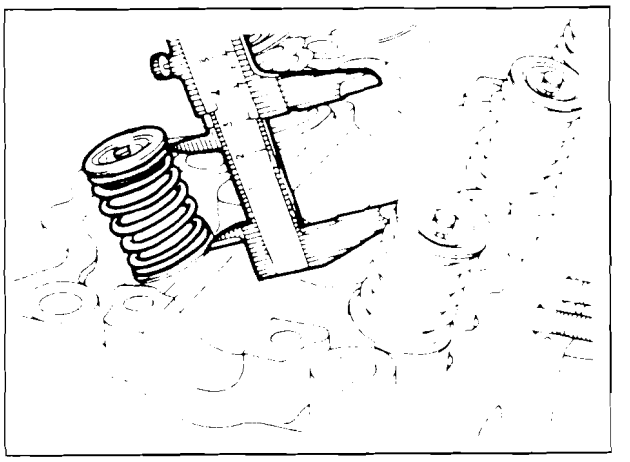


Fig. 24 — Checking valve spring installed height

(1) Thin down the valve seat insert by cutting, with a suitable cutter, to within 0.5 to 1.0 mm of the cylinder head, refer to Fig. 25 (A).

(2) Remove the valve seat insert and cut the seat insert bore diameter and height to the dimension shown in the specifications, refer Fig. 25 (B).

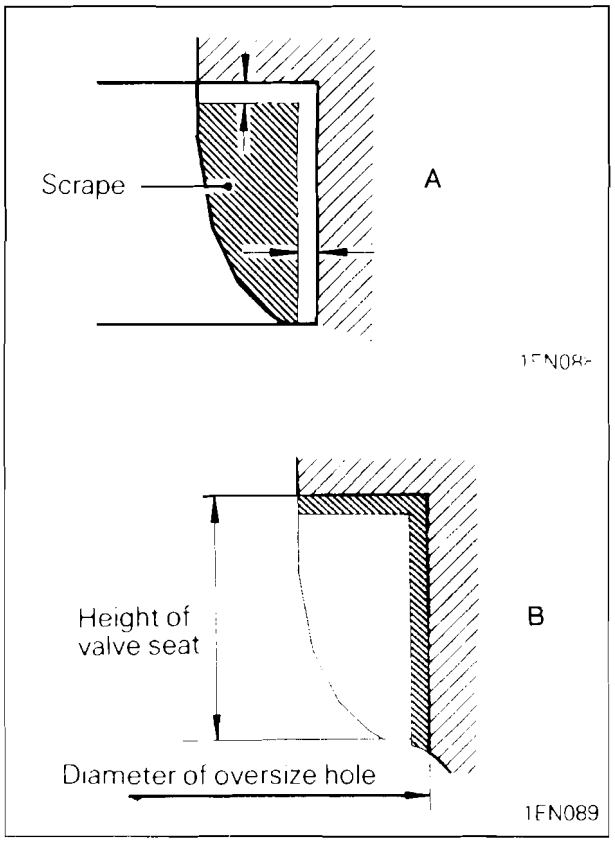


Fig. 25 — Replacing valve seat inserts

VALVES

Check each valve for wear, damage and deformation of the head, stem and stem tip.

If the stem tip is pitted or the thickness of the valve head is less than the specified limit, the valve must be replaced.

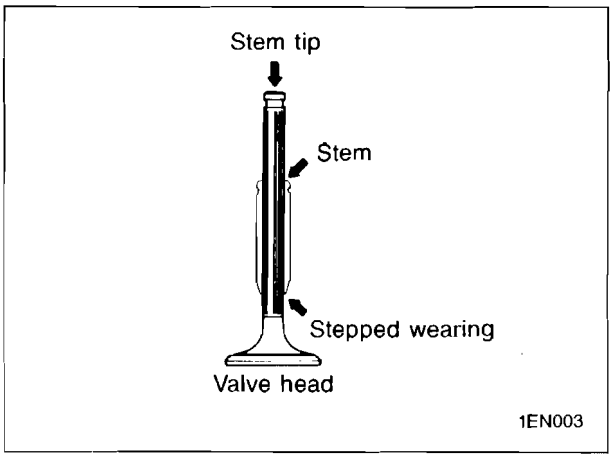


Fig. 26 — Valve check points

VALVE SPRINGS

Check the free length and tension of each valve spring. If they are not within specifications replace the spring.

Using a square, check the squareness of each spring. If the spring is more than 4° out of square, replace the spring, refer Fig. 27.

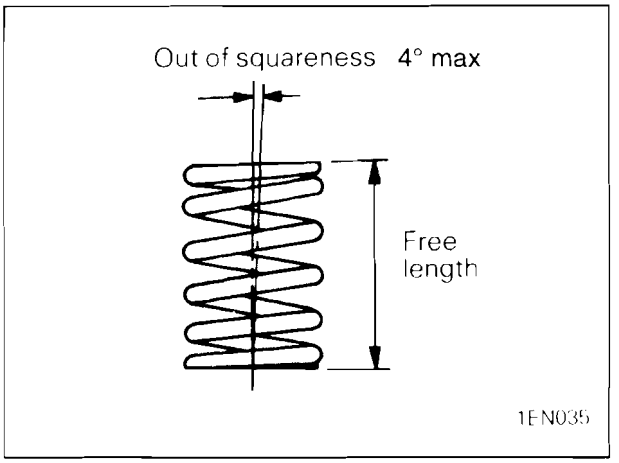


Fig. 27 — Checking valve spring

CAMSHAFT AND CAMSHAFT BEARING CAP

(1) Check camshaft journals for wear or damage, replace if necessary. If journals are damaged, check camshaft bearing for wear or damage. If camshaft bearing is badly worn, replace cylinder head.

(2) Check the cam lobes and profiles for damage. If the lobe or profiles are damaged or worn excessively, (see specifications) replace the camshaft.

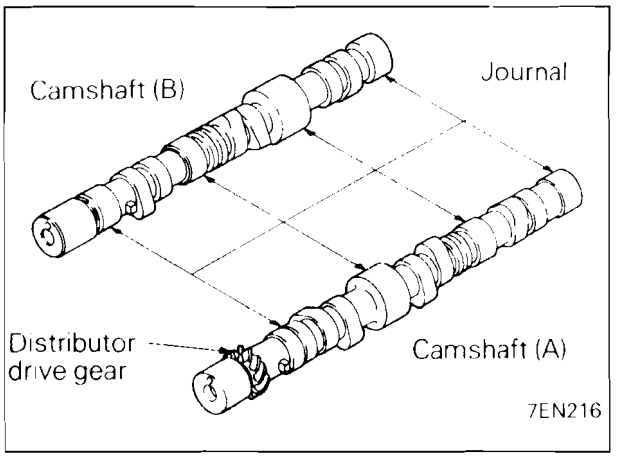


Fig. 28 — Camshaft inspection

ROCKER ARMS AND ROCKER SHAFTS

(1) Remove all bearing cap bolts and separate the rocker arms, springs and bearing caps from the rocker shafts, refer Fig. 29.

(2) Check the roller for smooth rotation and replace the rocker arm if the roller binds or their is excessive play, check the valve contact surface for damage or seizure and replace as necessary.

(3) Using diesel fuel thoroughly clean the hydraulic tappet units.

(4) When cleaned, bleed the hydraulic units using the following procedure:

(a) Fit the hydraulic unit into the rocker arm and support on a block, in a bath of clean diesel fuel, refer Fig. 31.

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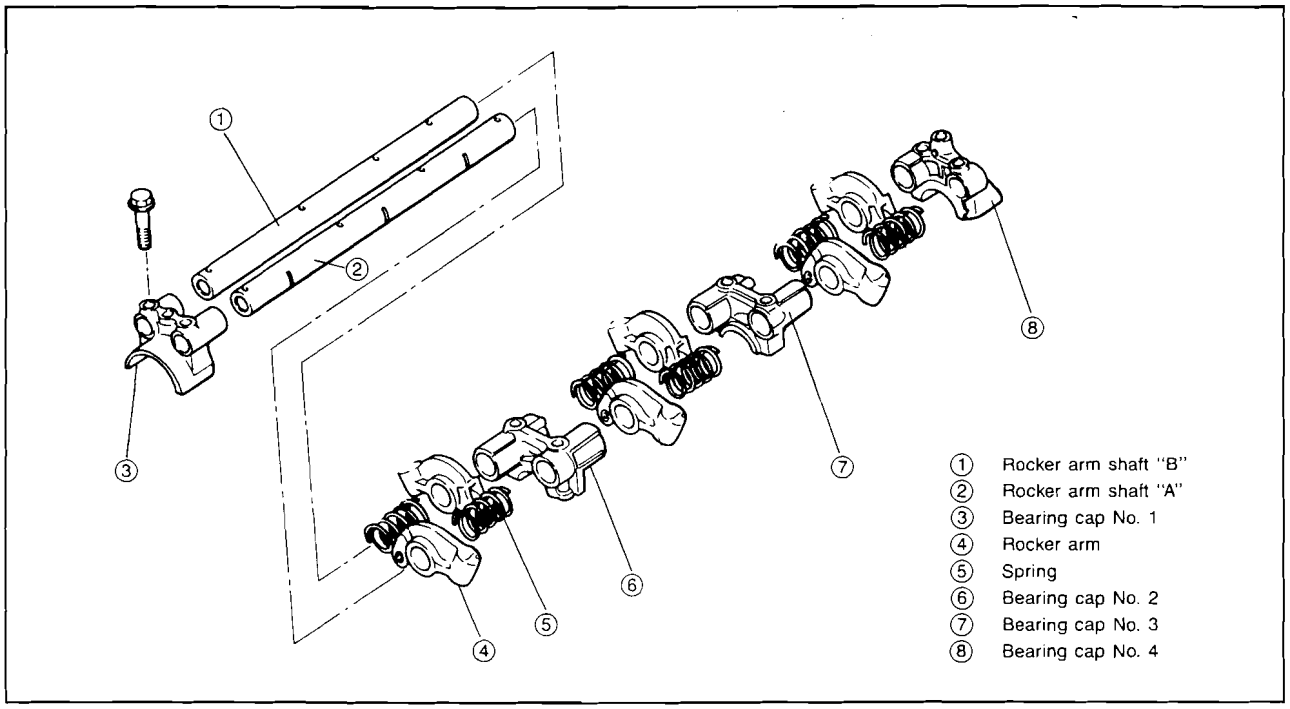


Fig. 29 — Rocker shaft assembly

NOTE: The hydraulic tappet unit is a precision component, once cleaned ensure the units are protected to prevent the ingress of dirt or foreign material. Do not attempt to dismantle the unit.

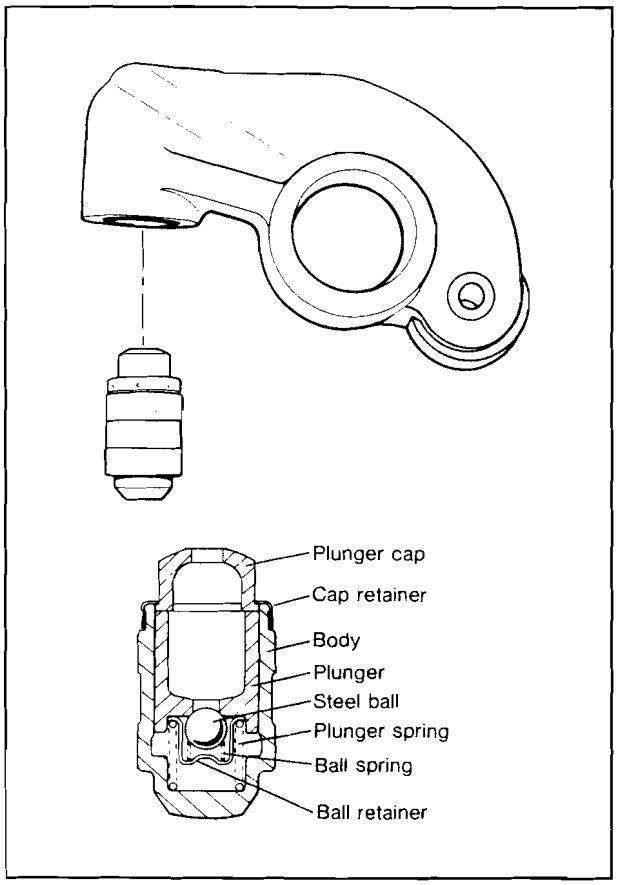


Fig. 30 — Rocker arm and hydraulic tappet unit

(b) Using a suitable 0.5 mm wire probe, lightly push down the steel ball and move the rocker arm up and down 4 or 5 times, refer Fig. 31.

(c) Allow the ball to seat by removing the probe and push down hard on the rocker arm. If the rocker arm moves slightly, repeat step (b) several times.

(d) If the rocker arm still moves when tested as in step (c), replace the unit.

(5) The hydraulic units can be tested using leak-down tester, Special Tool E1150.

(a) Place a fully bled unit containing diesel fluid into a 13 mm socket and place the assembly into the tester cup.

(b) Adjust the ram so the pointer is on the "Set" mark as it touches the unit.

(c) Lower the weight and after the plunger has fallen slightly (0.2 to 0.5 mm), measure the leak-down rate with the aid of a stop watch.

Leak down rate: 4 to 20 secs/mm (diesel fuel temperature at 15 to 25°C).

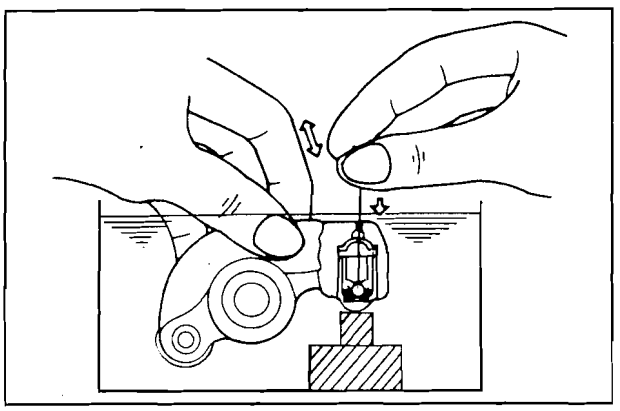


Fig. 31 — Bleeding hydraulic tappet unit

(6) The fully bled units should be stored in an upright position ready for re-assembly to ensure the diesel fuel in the units is not spilt.

(7) Check the clearance between the rocker arms and rocker arm shafts, if they exceed the specified limit replace the arms or shafts.

(8) Check the rocker arm shafts for damage and bend, if faulty they must be replaced.

CYLINDER HEAD REASSEMBLY

When assembling cylinder head ensure all parts are thoroughly cleaned and that all moving parts are lubricated with engine oil prior to assembly.

(1) Install the valve spring seats.

(2) Install the valve stem seals over the valve guides using Tool No. E9M30D. The seal is installed to the specified position by the tool. Incorrect fitment will result in damage to the seal and subsequent oil leakage.

NOTE: Old stem seals must not be reused.

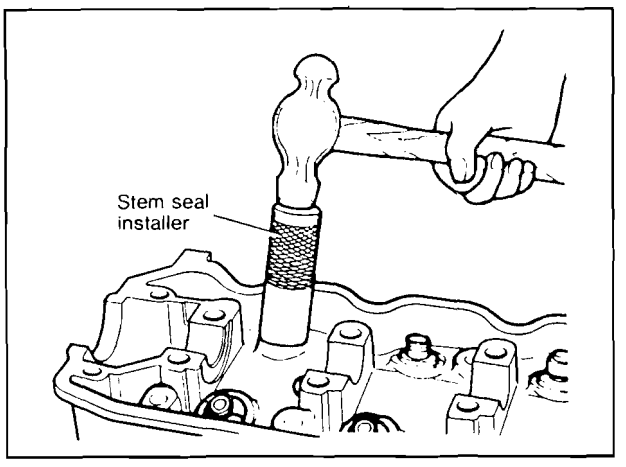


Fig. 32 — Installing valve stem seals (typical)

(3) Apply engine oil to the valve stem and install the valves into the guides. Do not use excessive force to press the valve stem past the valve stem seal.

(4) Ensure the valve moves smoothly in the guide.

(5) Install valve springs and spring retainers.

NOTE: Install valve springs with the enamel identification marks facing the rocker arms.

(6) Using a valve spring compressor install the valve collets.

NOTE: When compressing the spring, take care that the spring retainer is not forced against the valve stem seal.

(7) Lubricate and install the camshaft onto the cylinder head.

(8) Install notched end of rocker arm shafts A and B to No. 1 camshaft bearing cap as shown in Fig. 33. The shaft with the small oil hole is rocker shaft A. Insert the bolts through the hole of the bearing cap and rocker shaft, refer Fig. 33.

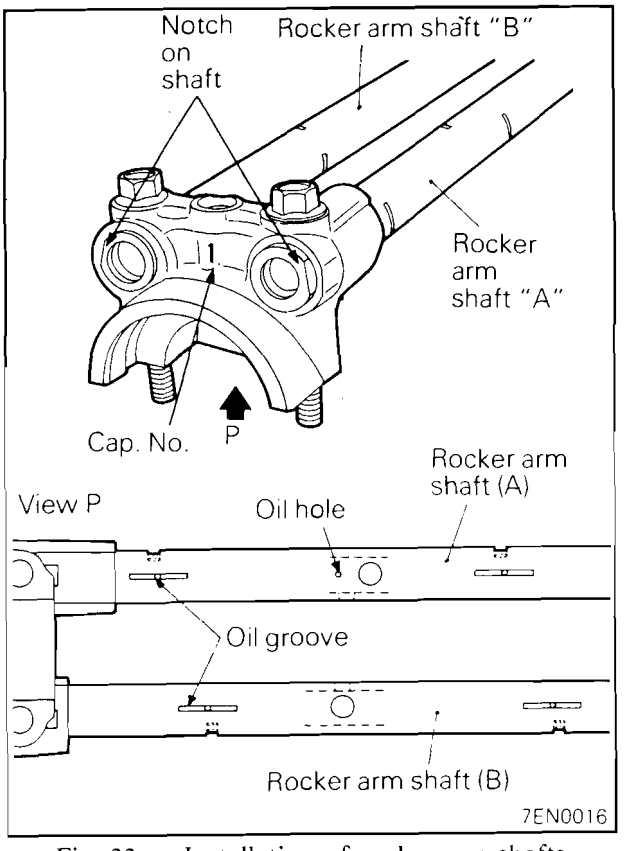


Fig. 33 — Installation of rocker arm shafts

(9) Install the rocker arms, springs, camshaft bearing caps and bolts as shown in Fig. 34.

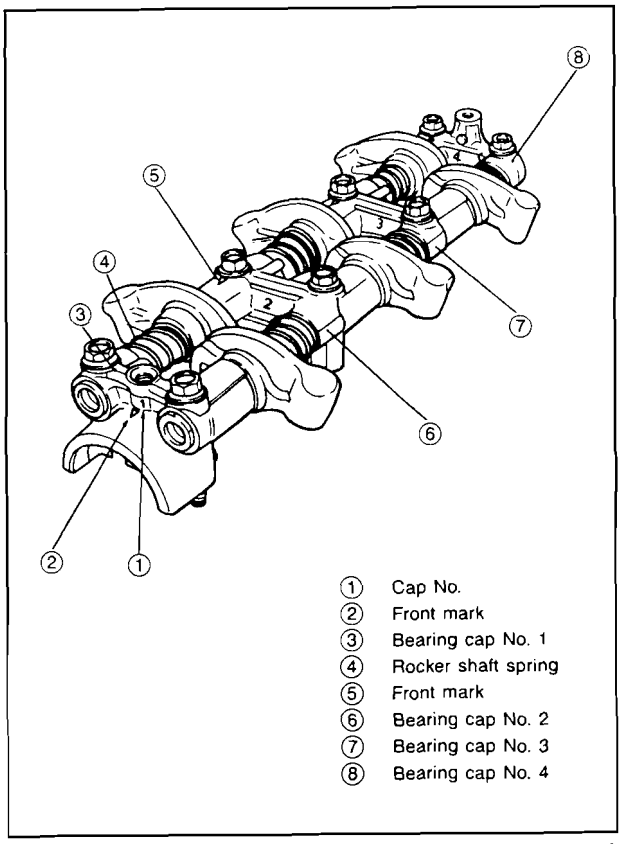


Fig. 34 — Installation of rocker arm, springs and bearing caps

(10) Install the hydraulic tappet units to the rocker arms **with the hole in the unit to the top of the rocker arm** and in the order they were removed, and fit tappet adjuster retaining clips (part of Kit E9M40) to each rocker arm. Keep the hydraulic units vertical to prevent spillage of the diesel fuel.

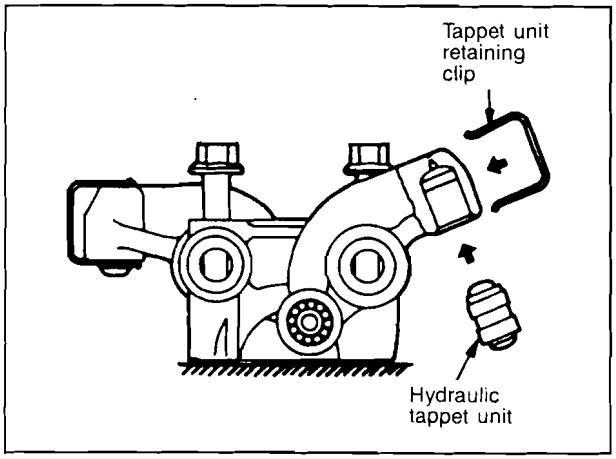


Fig. 35 — Installing hydraulic tappet unit

NOTE: Prior to fitting rocker shaft assembly to cylinder head, place silastic as shown in Fig. 36 between No. 1 and No. 4 bearing cap surface and cylinder head.

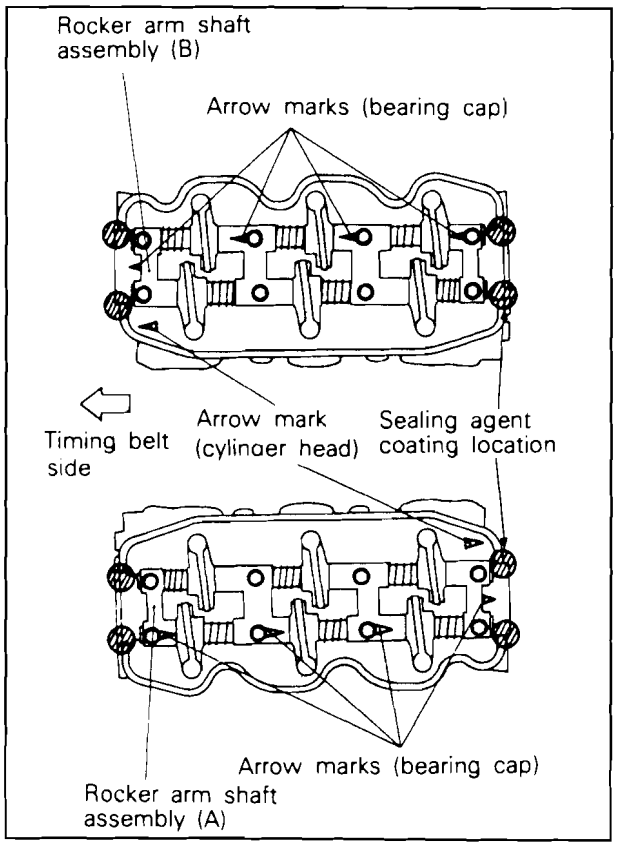


Fig. 36 — Sealing and installation of rocker arm assembly.

(11) Install the rocker arm assembly such that the arrows on the bearing caps are in the same direction as the arrow on the cylinder head.

(12) Tighten cap retaining bolts in two stages to the specified torque, in the sequence; cap No. 2, 3, 1 and 4.

(13) Remove the hydraulic tappet retaining clips.

(14) Install the distributor adaptor with a new 'O' ring, to the left hand bank cylinder head.

(15) Apply a slight amount of oil around the inner circumference of the camshaft oil seal lip and install using Special Tool No. MD998713 refer Fig. 37.

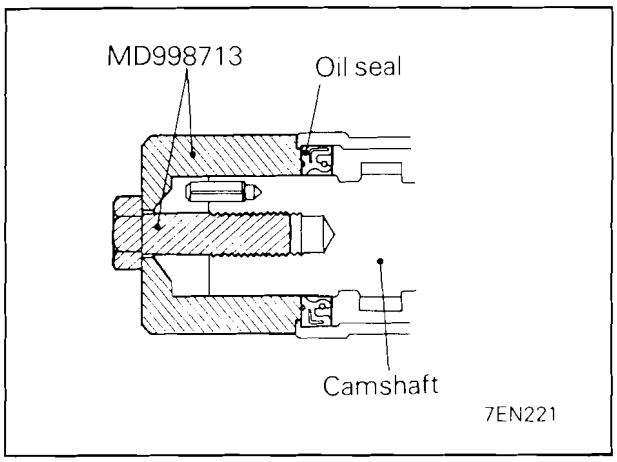


Fig. 37 — Installing camshaft oil seal

(16) Install the circular packing using Special Tool No. MD998714 in conjunction with transmission spacer No. MD724328, refer Fig. 38.

NOTE: If the spacer is not used with the Special Tool, the circular packing will be driven in too far.

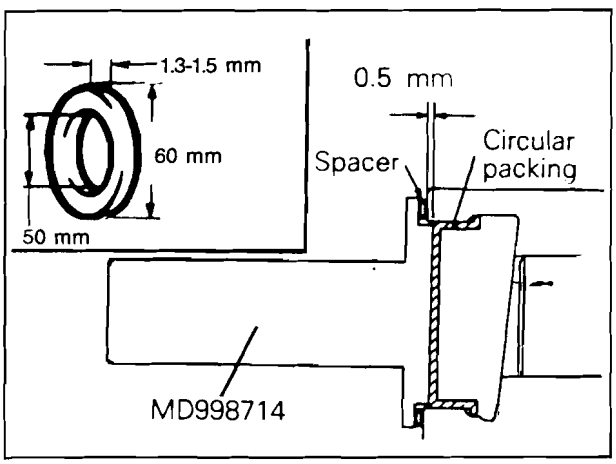


Fig. 38 — Installing circular packer

SECTION 8 — ENGINE OVERHAUL

ENGINE

Engine (Automatic Models) or Engine and Transaxle (Manual Models) Removal

(1) Drain engine coolant.
(2) Remove engine hood.
(3) Disconnect battery.
(4) Remove coolant recovery bottle.
(5) Remove air cleaner assembly.
(6) Disconnect wiring from the alternator, starter motor, distributor, oil pressure switch and the injection control loom.
(7) Disconnect the earth strap at the intake manifold.
(8) Disconnect accelerator cable.
(9) Disconnect radiator and heater hoses from engine.
(10) Disconnect all vacuum hoses and label for easy installation.
(11) Disconnect the fuel supply and return hoses.
(12) Remove ECS compressor assembly (where fitted).
(13) Remove the starter motor.
(14) Remove air conditioner low pressure hose and high pressure hose and electrical connector.

NOTE: Chloro-Fluoro-Carbons.
Legislation in various states, prohibits the release of CFC's to atmosphere. Therefore a CFC recovery unit will be required to contain spent gases if the air conditioning hoses are disconnected.
Check your state government authority in regards to their relevant legislation.

(15) Remove power steering feed hose and return hose.
(16) Remove underbody dust shields.

For automatic models proceed as follows:

(17) Remove the torque converter lower cover plate.
(18) Remove the torque converter to drive plate attaching bolts and push the torque converter towards the transaxle.
(19) Remove the drive shaft centre bearing to cylinder block bolts and support the drive shaft.
(20) Disconnect the exhaust pipes from the manifolds.
(21) Position a suitable support under the transaxle to support the weight of the transaxle.
(22) Attach a suitable lifting bracket to the engine and, using a hoist, support the weight of the engine.
(23) Remove the transaxle to engine attaching bolts.
(24) Remove the rear roll stopper through bolt and damper to engine bracket bolt.
(25) Remove the front roll stopper through bolt and remove the roll stopper from the cross-member.
(26) Remove the engine mount through bolt and remove the engine mount from the engine mount bracket.
(27) Separate the engine from the transaxle and lift the engine out of the vehicle.

NOTE: Ensure that all cables, hoses, harness connectors etc. are disconnected prior to removing engine.

For manual models proceed as follows:

(17) Disconnect wiring from the reverse light switch.
(18) Disconnect the clutch hydraulic line.
(19) Disconnect gear shift control cables.
(20) Disconnect the engine earth cable at the transaxle.
(21) Disconnect the speedometer from the transaxle.
(22) Drain transaxle oil.
(23) Raise the front of the vehicle and support on jack stands.
(24) Disconnect the drive shafts from the transaxle, refer Group 26, and support to avoid damaging the joints.
(25) Disconnect the exhaust pipe from the manifold and remove the exhaust pipe stay strap.
(26) Attach a suitable lifting bracket to the engine and, using a hoist, support the weight of the engine.
(27) Remove the front and rear roll stopper through bolts.
(28) Remove the rear roll stopper from the cross-member.
(29) Remove the nuts from the engine and transaxle mounting through bolts.
(30) Slightly raise the hoist so that all load is off of the mounting bolts.
(31) Remove the mounting through bolts then, while pushing the transaxle downwards, lift the engine and transaxle assembly from the vehicle.

Installation

Install by reversing the removal procedure, noting the following:
(1) Ensure that no cables, connectors or hoses are caught or damaged on installation.
(2) New retainer rings must be fitted when installing the drive shafts.
(3) All engine mounts must be aligned before being tightened to the specified torque (ensure front and rear roll stopper bolts are positioned in the correct hole in the engine brackets).
(4) Fill and ensure all fluid levels are at the correct level.
(5) Run the engine and check for oil, fuel and exhaust leaks. Rectify where necessary.
(6) Adjust all linkages and settings to specifications.
(7) Ensure vacuum hose connections are correct, refer Group 17 for hose connection graphics.
(8) Set engine idle speed and ignition timing to specifications.

CYLINDER BLOCK

Disassembly

The following description details the disassembly with the engine removed from the vehicle and transaxle removed from the engine.

(1) Remove the cylinder head assembly as described under Cylinder Head Removal, refer Section 7.

(2) Remove torque converter drive plate or flywheel and clutch assembly.

(3) Remove the oil pan, oil screen and the rear oil seal case assembly.

(4) With the aid of a soft piece of wood, push the piston and rod assembly out through the top of the cylinder block.

Mark the connecting rods as shown in Fig. 1, keep piston assemblies in order.

NOTE: Prior to removing the piston and rod assemblies, remove all carbon deposits and/or cylinder ridge from the cylinder bore.

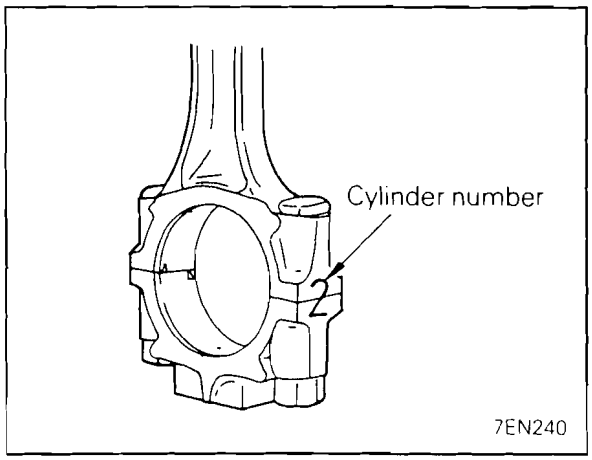


Fig. 1 — Marking connecting rod

(5) Remove piston rings No. 1 and No. 2.

(6) Remove the oil rings.

(7) Remove the pistons from the connecting rods by using Special Tool Nos. E11M12-1 push rod and E9M70 base, refer Fig. 2.

NOTE: Ensure when placing piston on special tool, the frontmark 6G72 is facing up.

(8) Remove the crankshaft bearing cap and lower bearings, keeping them in the order removed.

(9) Remove the crankshaft and the upper bearing halves, refer Fig. 3.

Cleaning and Inspection

Before cleaning, check the cylinder block for water leakage, cracks or damage.

When cleaning, remove all traces of oil, grease, dirt, carbon, and scale from all components. Clean out all oil passages by blowing with compressed air.

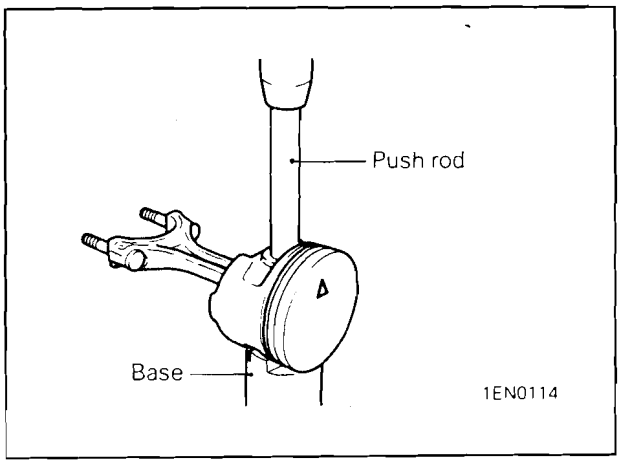


Fig. 2 — Removing piston from connecting rod

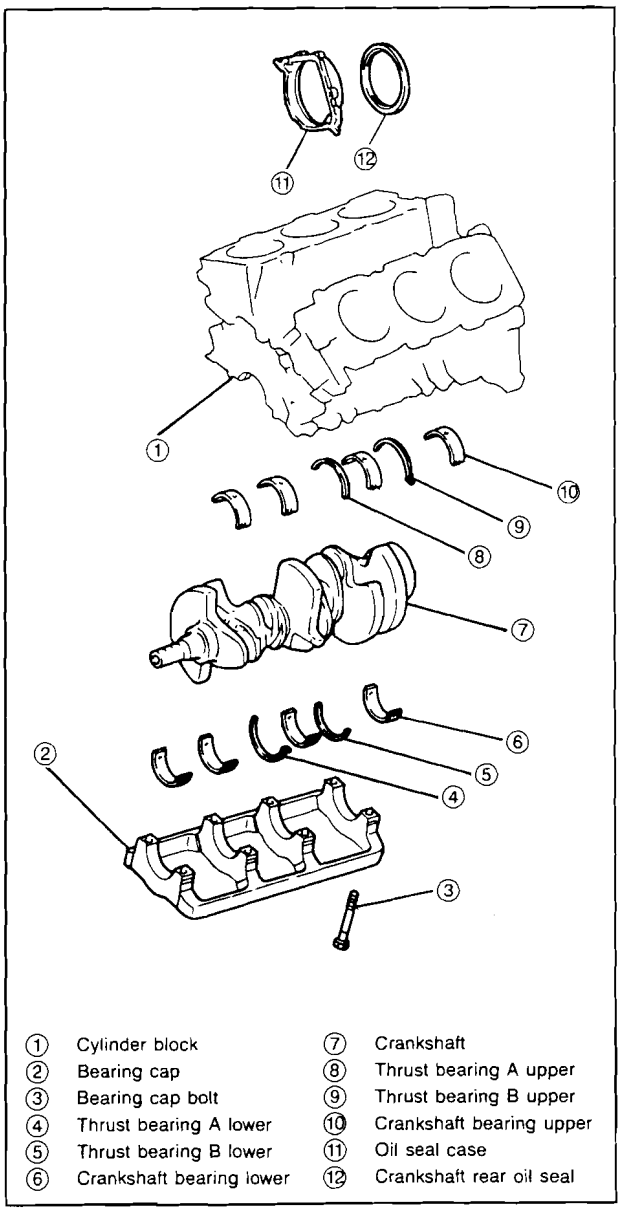


Fig. 3 — Crankshaft removal

Checking Cylinder Block

(1) Check the cylinder bores for scratches, rust, corrosion, cracks or any defects or damage, if faulty the block must be rebored or replaced.

(2) Check the upper surface of the cylinder block for distortion, using a straight edge and feeler gauges. If it is not within specifications the surface must be refaced, refer Fig. 4.

NOTE: The main bearings are interchangeable, however, if they are to be reused they should be installed in the original position.

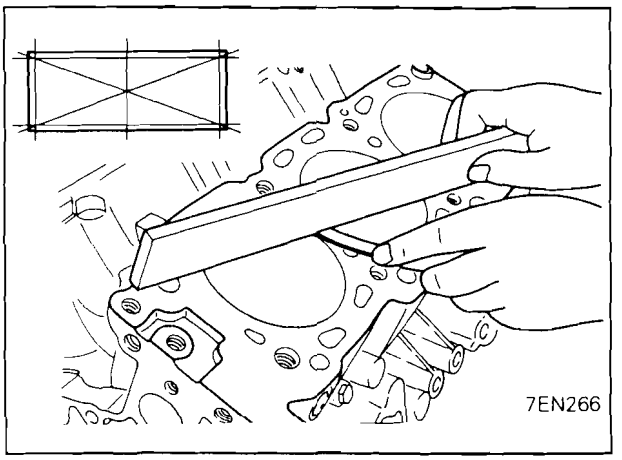


Fig. 4 — Checking cylinder block for distortion

(3) Measure the cylinder bore size at three levels. If the wear exceeds the specified limit the cylinders must be re-bored to the next piston size, refer Fig. 5.

NOTE: If only one cylinder required re-boring, all the cylinders MUST be re-bored.

(4) If the cylinder does not require re-boring, remove the ridge at the top of the cylinder and hone the bores if necessary.

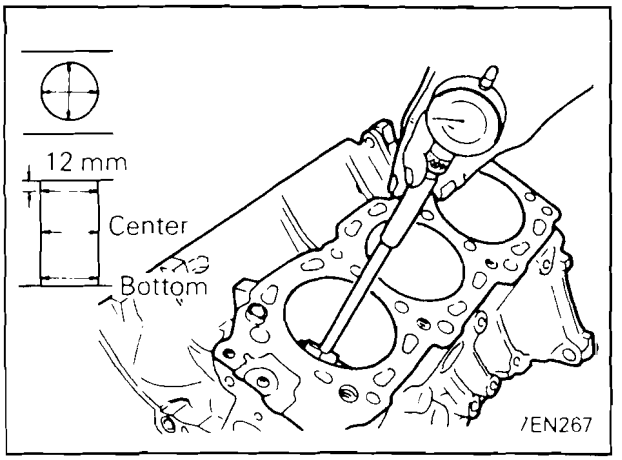


Fig. 5 — Measuring cylinder bores

Cylinder Boring

(1) The piston size to be used should be determined by the cylinder which has the largest bore size.

(2) Check the outside diameter of each oversize piston at the skirt and across the thrust faces. The measurement should be taken at the datum point from the bottom of the piston, refer Fig. 6.

(3) To determine the cylinder re-boring size proceed as follows:

(a) Measure the diameter of the piston.
(b) Allow piston to bore clearance.
(c) Honing margin = 0.02 mm or less.
(d) Size after boring = (a) + (b) – (c)
= (a) + 0 to 0.02 mm.

(4) The cylinder should be re-bored to the size obtained by the calculation.

(5) The final cut should not be greater than 0.05 mm.

NOTE: Do not attempt to cut too much from the bore at one time.

(6) To prevent heat distortion of the bores when re-boring, the cylinders should be bored in their numerical sequence.

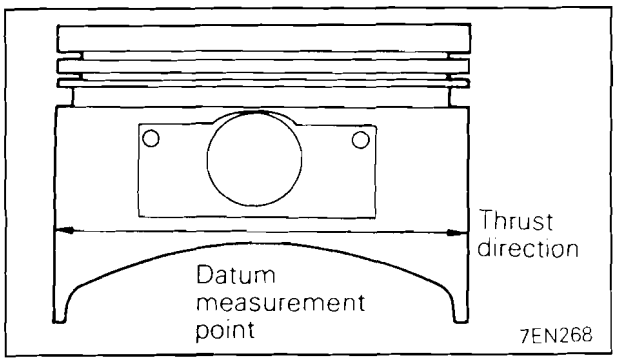


Fig. 6 — Measuring piston diameter

(7) The cylinder bore size will vary immediately after re-boring, due to the heat generated by the cutting operation, therefore care should be taken when measuring the bore size.

(8) After cutting, the bore should be honed accurately to the finished size. The bores should be honed until all traces of the cutting operation are removed. The honing angle should be between 30° and 45°.

(9) Check the piston to cylinder wall clearance.

PISTONS, PISTON PINS AND PISTON RINGS

(1) Check the pistons for seizure, nicks, wear, cracks and any other defect. Replace any faulty pistons.

(2) Check the piston pin to pin hole fit. The pin must be a smooth hand press fit into the piston hole. Replace any piston and pin assembly that is defective.

(3) Check the piston rings for breakage, damage and abnormal wear. Replace any defective rings.

NOTE: If a piston is replaced, new rings should also be fitted.

(4) Measure the piston ring side clearance by placing the ring in its respective piston groove and checking the clearance with a feeler gauge. If it exceeds the specified limit, recheck the clearance with a new piston ring. If the clearance is still excessive replace the piston and rings, if it is within specification, replace the rings only.

(5) Measure the piston ring end gap by inserting the ring into the cylinder and positioning it at right angles to the cylinder wall by pressing it down with a piston. Remove the piston and measure the ring gap using a feeler gauge. If the gap exceeds the specified limit, replace the piston rings.

NOTE: If the cylinders are not being re-bored, the ring gap measurement should be made at the lower part of the cylinder, the area having the least wear. When replacing the piston rings, be sure to use rings of the same size.

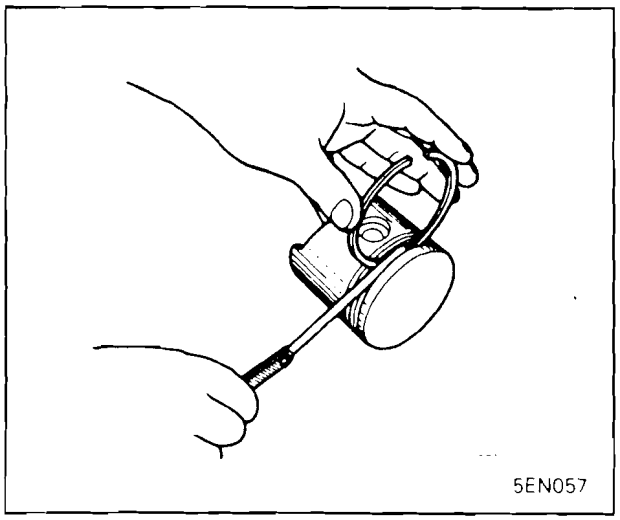


Fig. 7 — Measuring piston ring side clearance

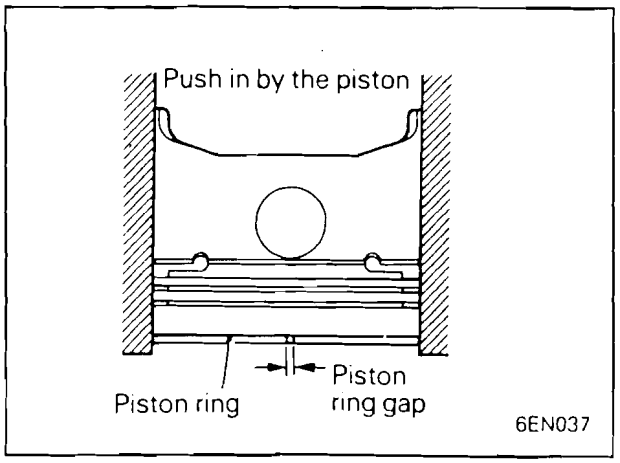


Fig. 8 — Measuring piston ring gap

CONNECTING RODS

(1) Check the connecting rod for damage at the thrust faces at either side and for step wear or severely rough surface of the inside diameter of the small end. Replace faulty rods.

NOTE: When using a new connecting rod, the cylinder number should be stamped or marked on the big end.

(2) Measure the connecting rod small end diameter, if not within specifications, replace the rod.

(3) Using a connecting rod aligner, check the rod for bend and twist. If a rod falls just outside the specified limit it can be straightened by using a press. A rod that is severely bent or distorted must be replaced.

(4) Measure the connecting rod side clearance by assembling the rod and bearing onto the crankshaft and tightening the bolts to the specified torque. Measure the clearance between the connecting rod and crankshaft using feeler gauges. If this exceeds the specified limit, replace the rod.

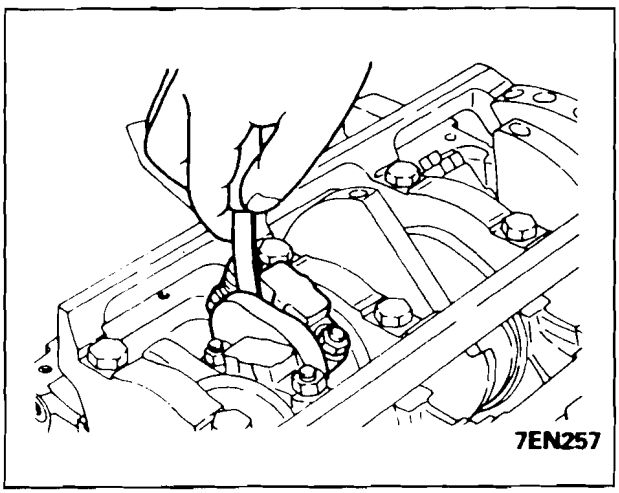


Fig. 9 — Measuring connecting rod side clearance

CRANKSHAFT

(1) Check crankshaft journals for damage, uneven wear and cracks. Check all oil holes for clogging.

(2) Measure the crankshaft journal diameters as shown in Fig. 10. If they are excessively out of round, tapered or worn the crankshaft must be replaced.

NOTE: The crankshaft MUST NOT BE REGROUND.

(3) When checking the crankshaft ensure the crankshaft journal fillet radii are 1.5 mm, refer Fig. 11.

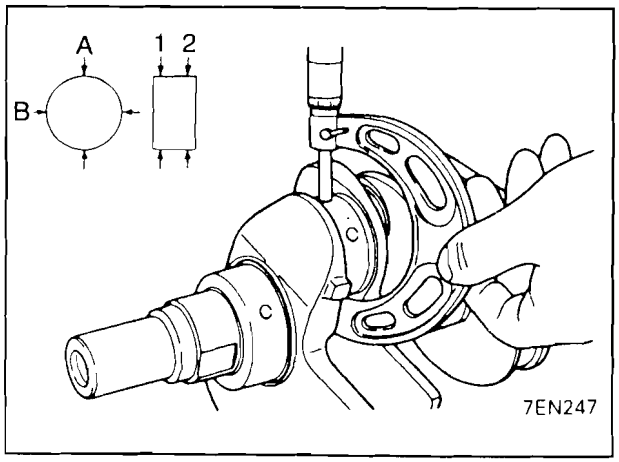


Fig. 10 — Measuring crankshaft journal diameter

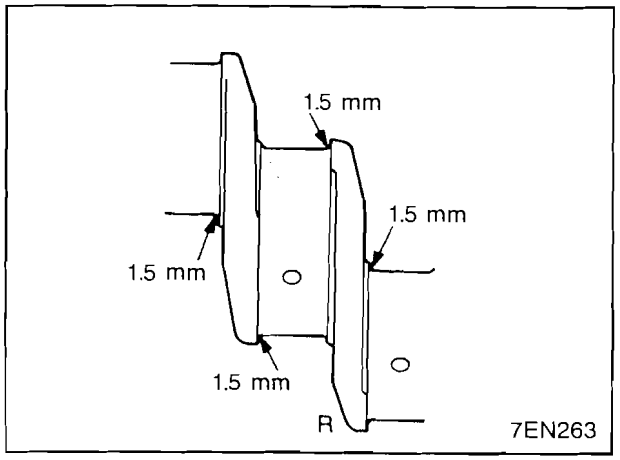


Fig. 11 — Crankshaft journal fillet radii

(4) Check the crankshaft end float by assembling the crankshaft, bearings and caps to the cylinder block. Insert a feeler gauge between the centre bearing and crankshaft, if the end float exceeds the specified limit, replace the thrust bearings, refer Fig. 12.

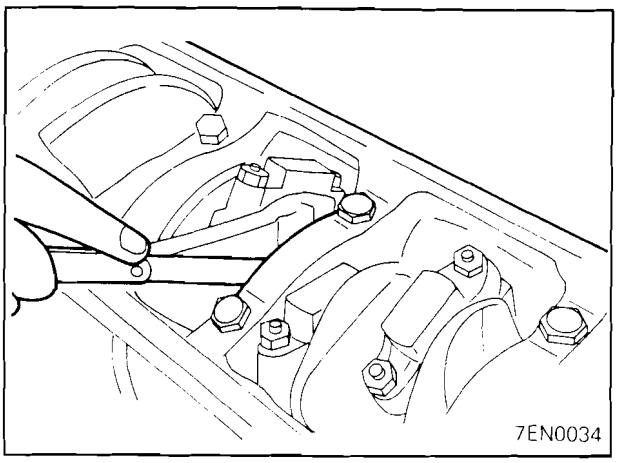


Fig. 12 — Measuring crankshaft end float

MAIN AND CONNECTING ROD BEARINGS

(1) Check all bearings for peeling, melting, seizure and improper contact. Replace any faulty bearings.

(2) Checking the journal to bearing clearance can be done using either of two methods:

(a) measure journal and bearing diameters.

(b) using the plastigauge method.

Measuring Diameters

(1) Measure the outside diameter of the main and connecting rod journals, refer Fig. 10.

(2) Assemble the bearings and caps and measure the bearing inside diameter, refer Fig. 13. The clearance is the difference between the respective bearing and journal diameter.

(3) If the clearance is not within specification and the journal diameter is within specification the bearings must be replaced.

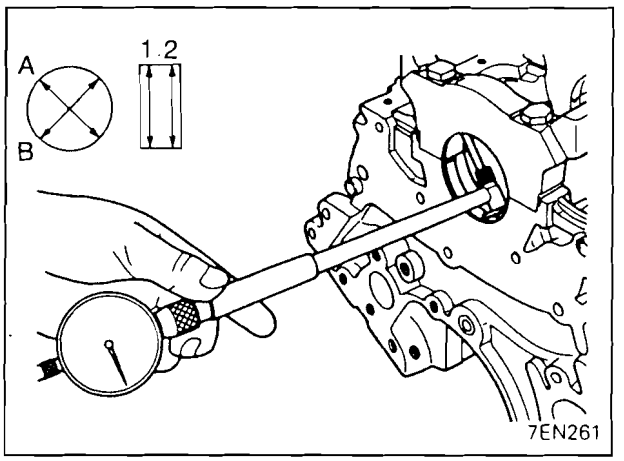


Fig. 13 — Measuring bearing diameter

Plastigauge Method

(1) Remove all oil, grease and dirt from the bearings and journals.

(2) Cut a piece of Plastigauge the length of the bearing width and place it across the bearing, away from the oil hole, refer Fig. 14.

(3) Install the crankshaft/connecting rod, bearing and caps and torque them to specifications.

NOTE: Do not rotate the crankshaft or connecting rod during this operation.

(4) Remove the caps and measure the width of the Plastigauge using the scale printed on the Plastigauge packet.

(5) If the clearance is not within specification and the journal diameter is within specification the bearings must be replaced.

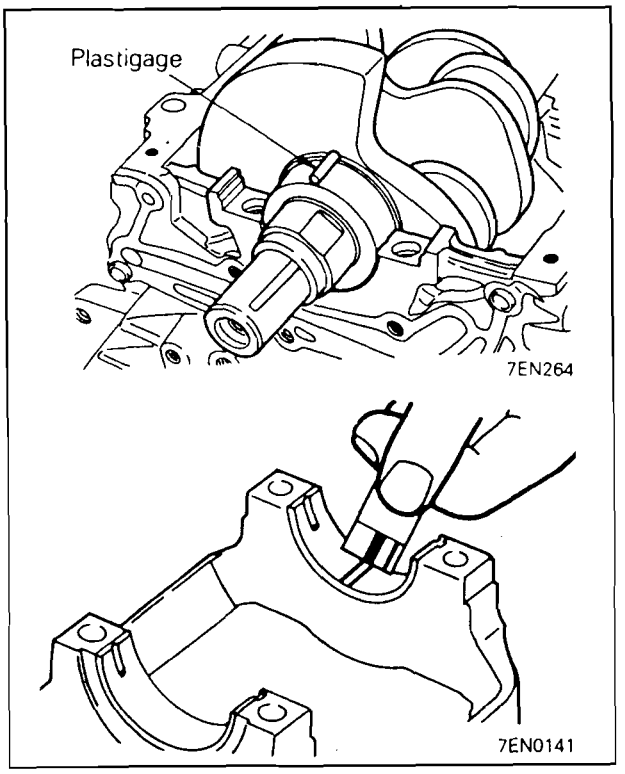


Fig. 14 — Checking bearing clearance using Plastigauge

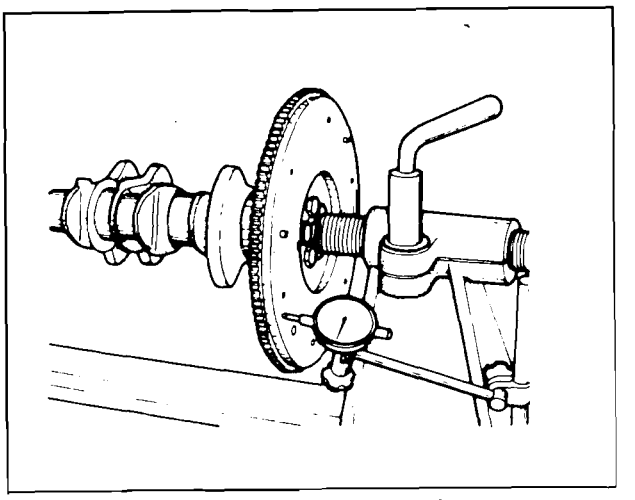


Fig. 15 — Checking flywheel surface run-out

OIL SEALS, OIL PAN AND OIL SCREEN

(1) Check the front and rear crankshaft seals for damaged or worn lips. Replace the seal if defective.

(2) Check the oil pan for damage and cracks, repair or replace the oil pan as necessary.

(3) Check the oil screen for failure, damage and cracks. Replace any faulty parts.

FLYWHEEL AND RING GEAR

(1) Check the flywheel surface for wear or damage, if excessively worn or damaged, replace the flywheel.

(2) Check the flywheel surface run-out, if it exceeds the specified limit replace the flywheel.

(3) Check the ring gear for damage, cracking and wear, replace if necessary.

RING GEAR REPLACEMENT

(1) Remove the ring gear by cutting through the valley of the ring gear teeth to within 1 mm of the flywheel circumference and then split with a hammer and chisel.

NOTE: Do not attempt to remove the ring gear by heating.

(2) Install the ring gear by heating it on a gas ring to 260 to 280°C and shrinkage-fit it on the flywheel.

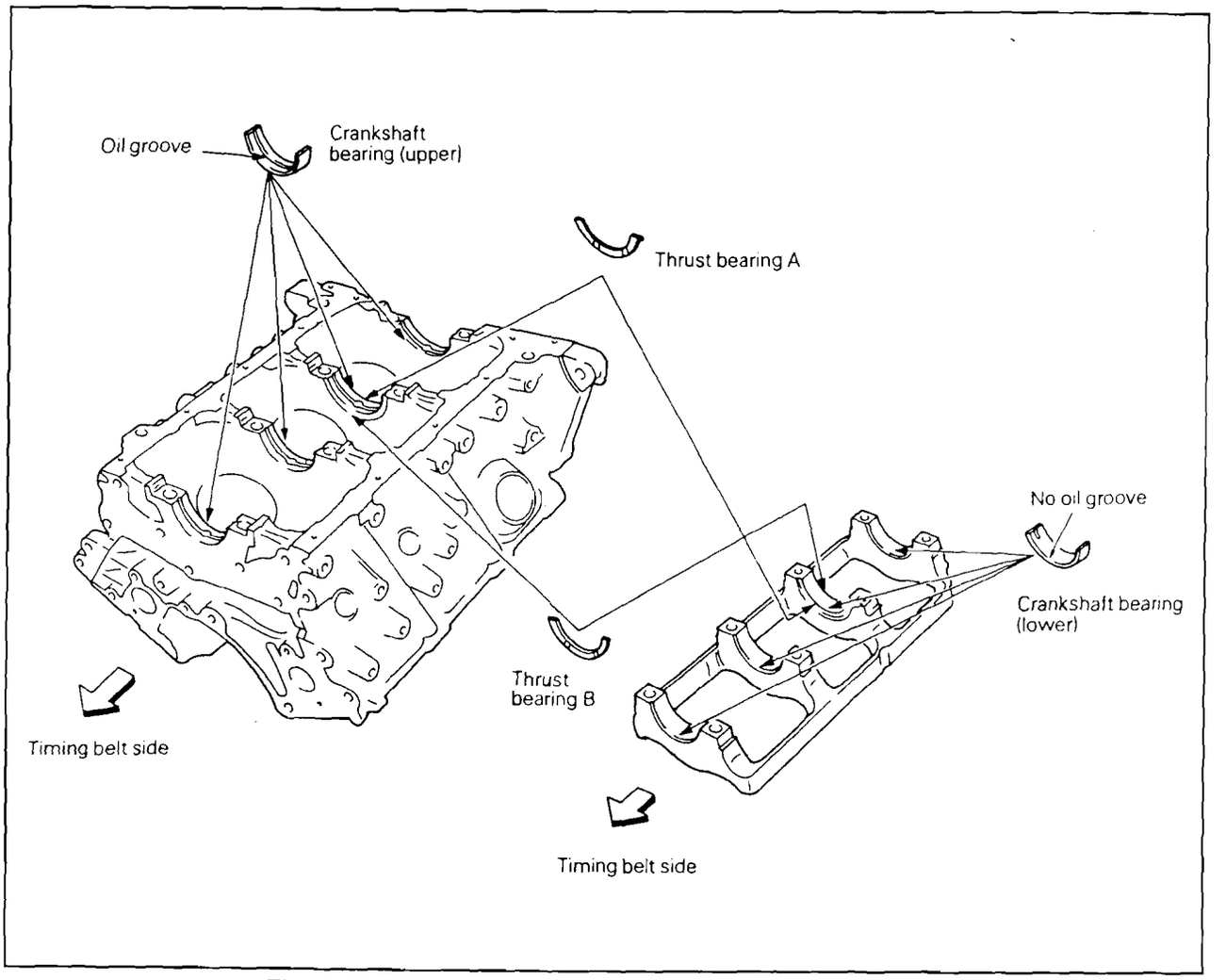


Fig. 16 — Cylinder block, bearing and bearing cap assembly

CYLINDER BLOCK REASSEMBLY

When assembling the cylinder block the following procedures should be observed:

- **Thoroughly clean all components especially oil holes, bearings, housings, bores and cylinder walls.**
- **Apply engine oil to sliding and rotating parts such as cylinder walls, pistons, bearings and gears prior to installation.**
- **Gaskets and oil seals should be replaced with new parts.**
- **Apply sealant to gasket as required.**
- **Torque all bolts to specification and in the specified sequence where necessary.**
- **Check all oil clearances, thrust clearances and backlash where necessary.**

(1) Install main bearings, upper, to the cylinder block. If reusing the main bearings, install them in their original position.

(2) Assemble the thrust bearings A and B onto the cylinder block, refer Fig. 16.

NOTE: Install the thrust bearings with the grooves facing outward.

(3) Position crankshaft onto the cylinder block and apply oil to journals.

(4) Install bearings, lower thrust bearings A and B and bearing cap onto cylinder block. Tighten bolts to specification and in the sequence as shown in Fig. 17.

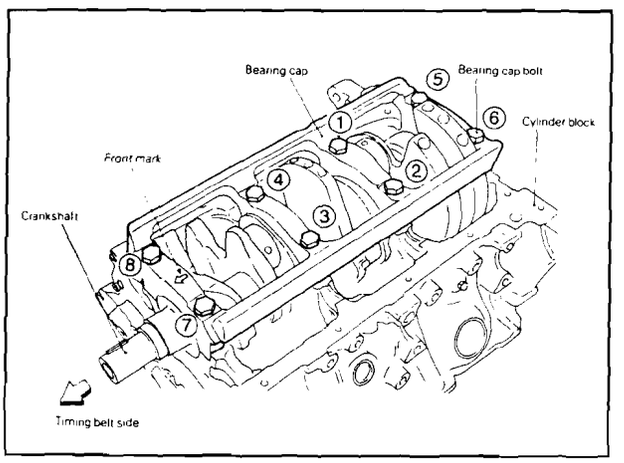


Fig. 17 — Tightening sequence of bearing cap

NOTE: The bearing cap must be installed with the arrow mark facing the front of the engine.

(5) Ensure the crankshaft rotates lightly and smoothly and that the end float is within specifications.

(6) Install the piston pin between the pushrod Special Tool No. E11M12-1 and the guide Special Tool E11M12-5 and apply engine oil to the piston pin.

NOTE: There are ◄ front marks for the pistons. The front mark faces forward.

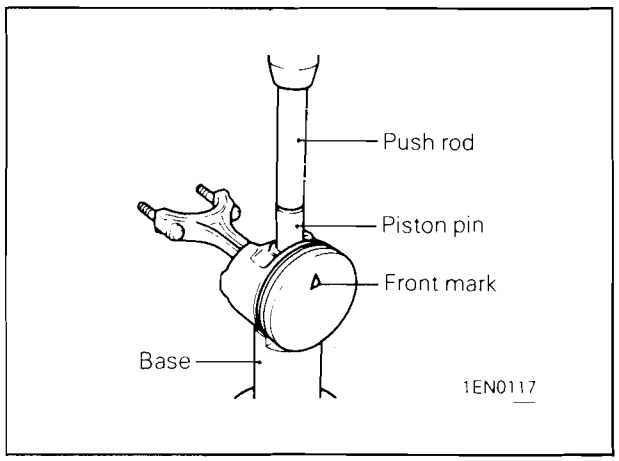


Fig. 18 — Piston pin installation

(8) Insert the guide bar in the slot provided in tool support, with the flat side of the guide bar aligned with the inner wall of the slot. Sit the connecting rod small end, to rest positively on the tool support. Turn the piston pin assembly half a turn.

(9) With the aid of a press, install the piston pin until the top end of the guide bar bottoms in the tool base. The force required to install the pin must be between 7500 to 17500 N.

NOTE: If the force required to fit the pin is not as specified, the piston pin must be removed and the pin and connecting rod diameters checked.

(10) With the piston assembled to the connecting rod ensure that the piston moves freely and lightly.

(11) Install the piston rings in the following order:

(a) Install the oil ring expander.

(b) Fit one end of the oil ring top side rail into the groove and "peel" the ring into the groove. (Refer Fig. 19). Fit the lower side rail in a similar manner.

NOTE: Ensure that both upper and lower side rails can be turned freely in the piston.

(c) Install the No. 2 piston ring and then No. 1 piston ring.

NOTE: No. 2 piston ring is identified by a mark on the ring face. The ring must be fitted with the mark facing the top of the piston.

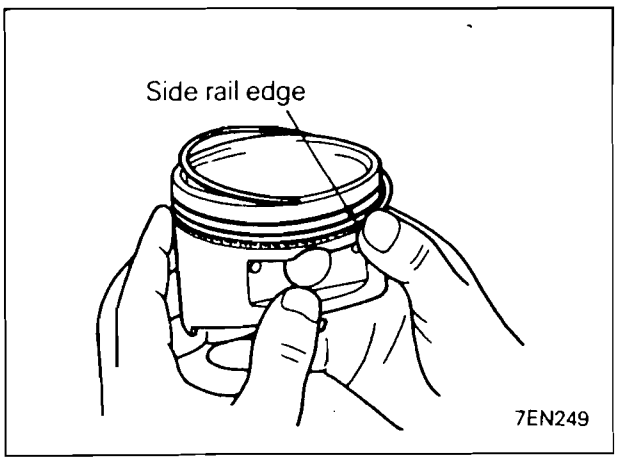


Fig. 19 — Installing oil ring side rail

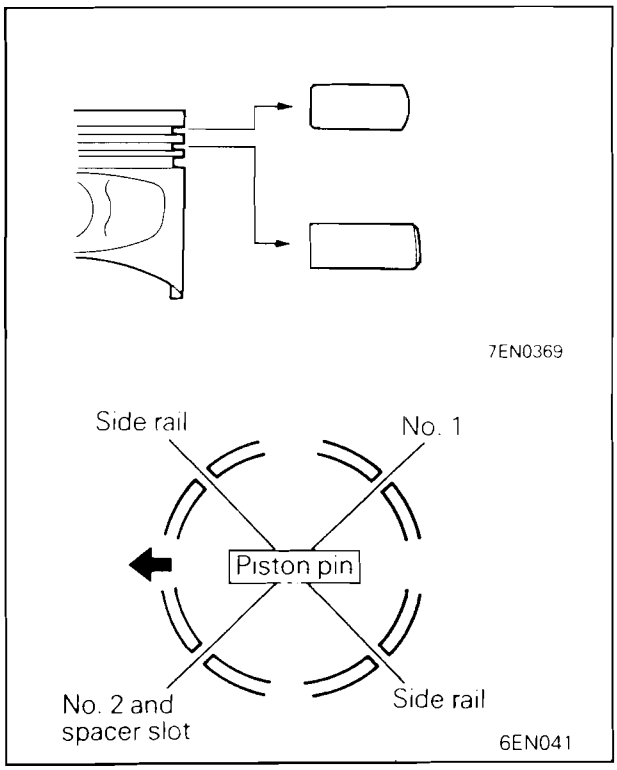


Fig. 20 — Piston ring identification and position

(12) Position the piston rings so that the ring gaps are as far from each other as possible and that they do not align with the piston pin and thrust side of the piston, refer Fig. 20.

(13) Apply a liberal amount of engine oil to the piston and rings.

(14) Compress the rings using a piston ring compressor. Install the piston and connecting rod assembly into the cylinder ensuring the piston front mark is facing the front of the engine and the assemblies are fitted into the correct cylinder.

NOTE: Ensure that the front marks on the pistons are facing towards the front of the engine. Also the connecting rods front marks are facing towards the front of the engine.

(15) Install the connecting rod caps in the correct order, with the cylinder number marks on the cap, aligned with the numbers on the connecting rod. Tighten the cap bolts to the specified torque.

(16) Check the connecting rod big-end side clearance.

(17) Install the crankshaft rear oil seal case. If the oil seal has been removed from the case, install a new oil seal to the case, ensuring it is properly seated into the case using Special Tool No. MD998718, refer Fig. 21.

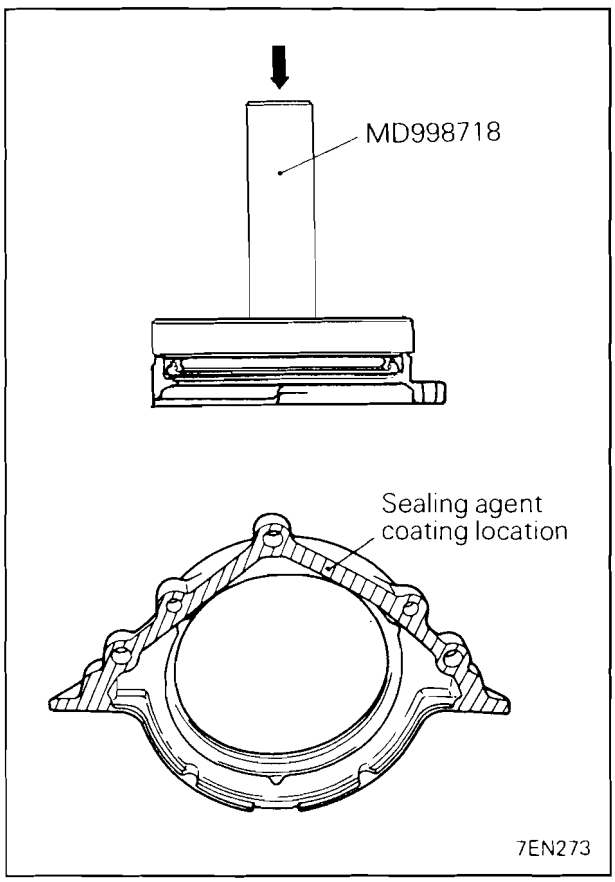


Fig. 21 — Rear oil seal

(18) Apply silastic to area as shown in Fig. 21. Apply a small amount of oil around the circumference of the oil seal lip and install the oil seal assembly onto the cylinder block.

(19) Install oil screen, and tighten attaching bolts to specified torque.

(20) Install oil pan noting the following; ensure that the cylinder block and the oil pan surfaces are clean.

Apply approved liquid silastic all around oil pan flange, refer Fig. 22.

Install the oil pan within 15 minutes of applying the liquid gasket.

Tighten flange bolts in the sequence shown in Fig. 22 to the specified torque.

NOTE: Recommended sealants for oil pan are listed below:
Loctite 857 Superflex Ultra Blue
Permatex 77BR Ultra Blue
Three Band 1207D (available through Mitsubishi Dealers)

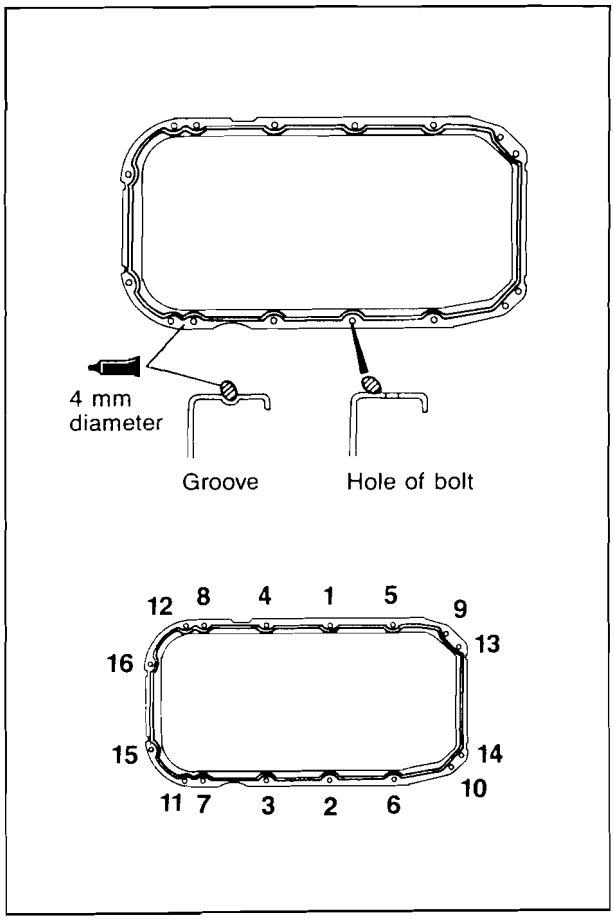


Fig. 22 — Sealing oil pan

(21) Install torque converter drive plate or flywheel and clutch assembly.

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

GROUP 12 — LUBRICATION

SECTION 0 — INDEX

Subject	Section Number	Page Number
INDEX	0	
SERVICE DIAGNOSIS	1	
ENGINE LUBRICATION SYSTEM 4G54 ENGINE	2	
Specifications		1
General Information		2
Oil Pump		2
Oil Filter		5
Oil pressure switch		6
ENGINE LUBRICATION SYSTEM 6G72 ENGINE	3	
Specifications		1
General Information		2
Oil Pump and Oil Pan		2
Oil Filter		5

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
OIL PRESSURE DROP	Low oil level.	Check the engine oil level.
	Faulty oil pressure sender unit.	Install a new sender unit.
	Thin or diluted oil.	Change the oil to correct viscosity.
	Oil pump relief valve stuck.	Remove the valve and inspect.
	Oil pump suction tube loose, bent or cracked.	Remove the oil pan and install a new tube if required.
	Clogged oil filter.	Install a new oil filter.
	Excessive bearing clearance.	Check the bearing clearance.
	Excessive oil pump gear clearance.	Remove oil pump and check gears for wear and clearance.

SECTION 2 — ENGINE LUBRICATION SYSTEM 4G54 ENGINE

SPECIFICATIONS

OIL PUMP

Pump type	Gear
Drive	Chain drive from crankshaft
Oil pressure — Idle pressure	147 kPa (min.)
— Relief valve	550 ± 50 kPa
Oil pressure relief valve	
Location	Oil pump
Spring free length	47.0 mm
Load	4.3 kg/40.0 mm
Low pressure warning switch operating pressure	29 kPa or less
Oil filter	Full flow sealed 'can'
Crankcase oil capacity — with filter	4.6 litres
— without filter	4.1 litres
Pump body to gear clearance	0.105 to 0.150 mm
Gear end play	0.06 to 0.12 mm
Gear to bearing clearance	0.020 to 0.046 mm
Driven gear rear end bearing clearance	0.044 to 0.066 mm

TORQUE SPECIFICATIONS

	Nm
Counter balance shaft sprocket bolt	59 to 69
Crankshaft pulley	108 to 127
Oil filter	11 to 12
Oil pan	6 to 8
Oil pan drain plug	35 to 45
Oil pressure switch	30 to 38
Oil pump cover to body screw	5 to 6
Oil pump to block	10 to 12

SPECIAL TOOLS

E11M10	Holder/tensioner timing chain

GENERAL INFORMATION

The oil pump is a Gear type and is chain driven by the crankshaft via a sprocket on the oil pump drive gear. The oil pump driven gear is attached to the right hand counterbalance shaft thus rotating it in the opposite direction to the crankshaft.

Engine oil is picked up from the oil pan through the oil screen and fed from the oil pump to the full flow oil filter. The filtered oil flows throughout the lubrication system of the engine and returns to the oil pan.

If during operation the oil pump delivery pressure exceeds the maximum specified, the relief valve will open allowing the excess oil to escape out of the pump.

OIL PUMP

Removal and Installation

Refer to Group 11 — Camshaft and Counter Balance Shaft Drive Chains and Oil Pump for removal and installation procedures of the oil pump.

Disassembly

(1) Remove the pump cover plate and remove the gears.

(2) Remove the tensioner from the pump body by holding the ratchet lever in the retracted position (i.e. hold ratchet lever down).

(3) Gently rotate the tensioning sleeve to push out the locking roll pin and remove the sleeve and spring.

(4) Remove the relief valve plug and withdraw the spring and relief valve from the body.

Inspection

Clean all disassembled parts with a suitable cleaning solvent and replace any defective parts after performing the following checks:-

Oil Pump Body and Cover

Check the entire body for cracks and abnormal wear, check the gear contacting portions for ridge wear.

Check the oil holes and orifices in the body for clogging, blow out deposits with compressed air.

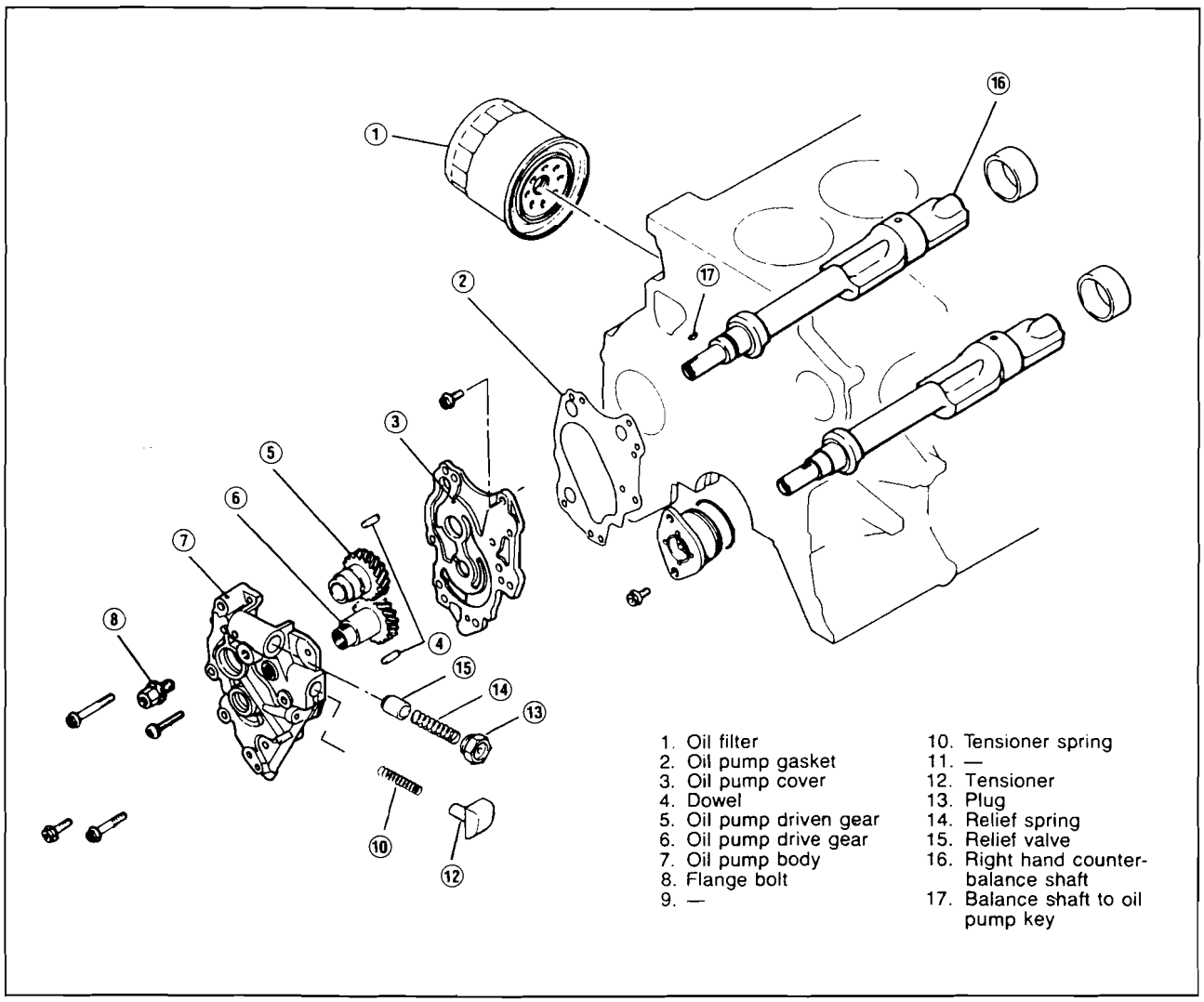


Fig. 1—Lubrication system components

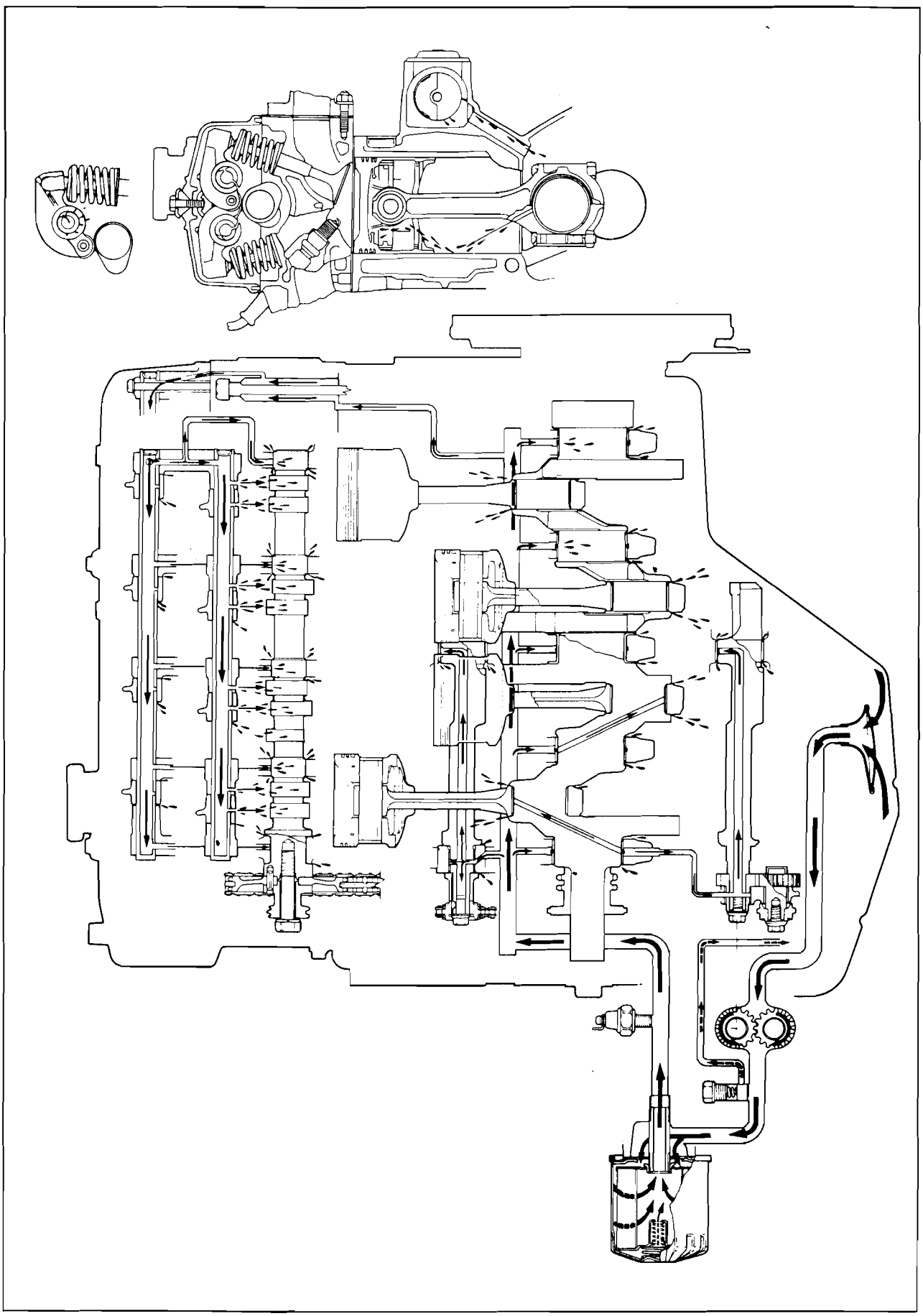


Fig. 2—Schematic layout of engine lubrication system

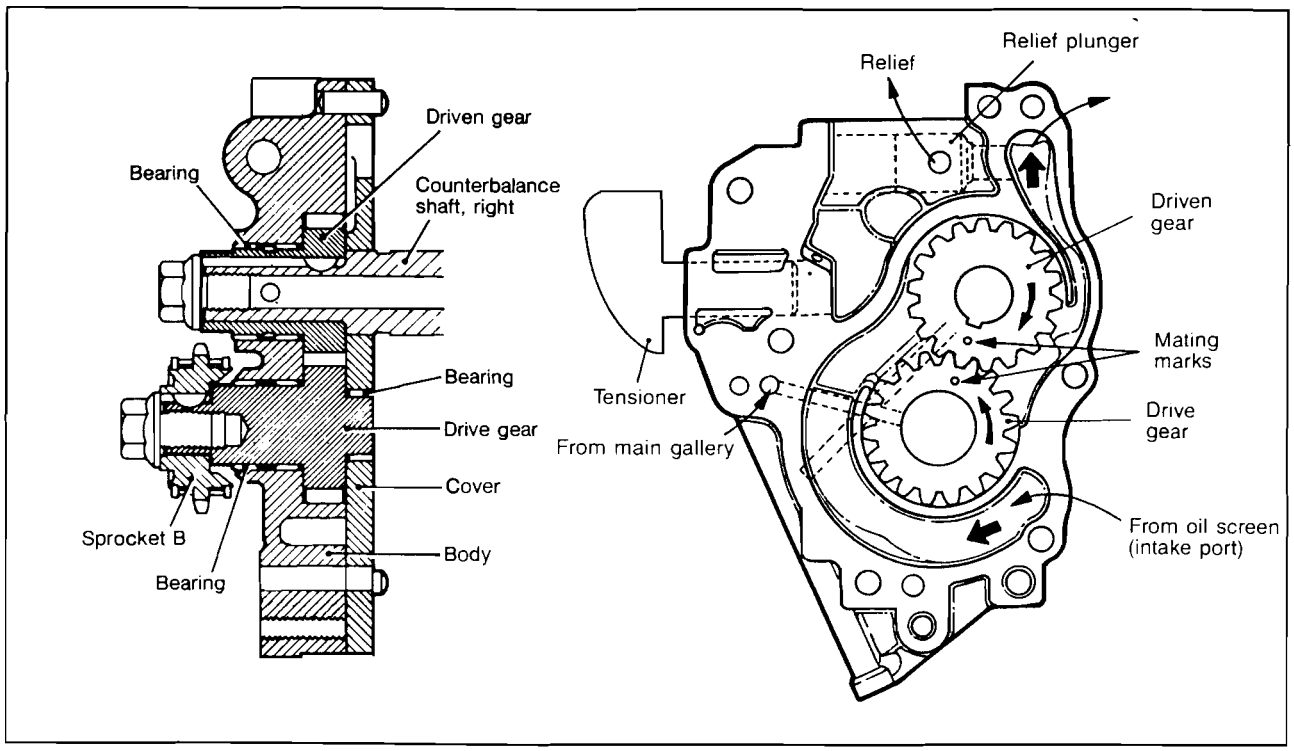


Fig. 3—Oil pump

Check the pump cover gear contacting portions for ridge wear. A badly worn cover should be replaced.

Clearances

Ensure that all clearances shown in Fig. 4 conform to the specified dimensions. Badly worn parts should be replaced. If bearing replacement is necessary due to wear or damage, the oil pump body assembly must be replaced.

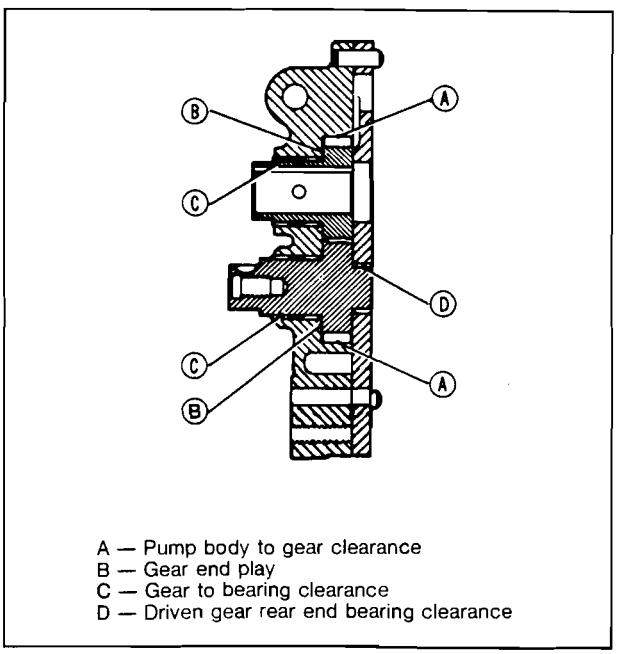


Fig. 4—Oil pump clearances

Relief valve and spring

Insert the valve into the pump body and check for smooth operation in the bore. Check the valve for scoring or wear and the spring for damage.

Tensioner

Insert the tensioner into the body and check for smooth operation in the bore. Check the tensioner plunger for scoring or wear the spring for damage, the rubber washer for deterioration and the rubber damper for breakage or deterioration.

Assembly

(1) Lubricate the relief valve and install the valve (with the solid end of the valve towards the pump body) and spring into the bore. Install the plug and tighten to the specified torque.

(2) Insert the tensioner spring into oil pump body.

(3) Insert tensioner sleeve into the oil pump body and hold tensioner fully in.

(4) Tap a new locking roll pin into position, ensuring that it is inserted far enough to retain the tensioner sleeve, but not too far causing restriction to the tensioner sleeve movement.

(5) Lubricate the gears and bearings and install the gears into the pump housing. Ensure that the gear mating marks stamped on the gear surfaces are aligned (refer Fig. 5) and that the gears rotate smoothly when installed.

NOTE: Failure to align gear mating marks will position the counterbalance shafts out of phase which will result in engine vibrations.

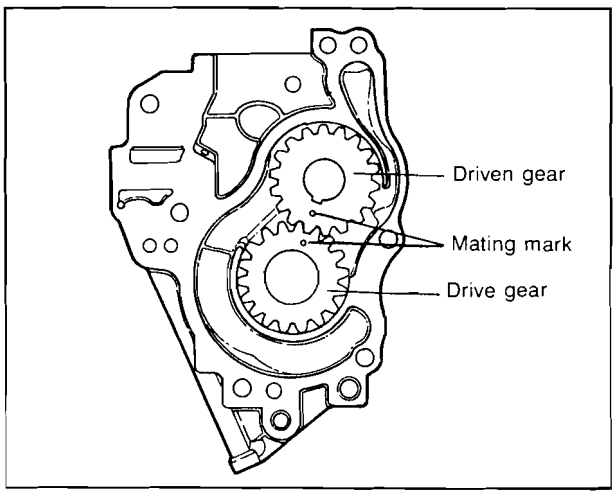


Fig. 5—Gear mating marks

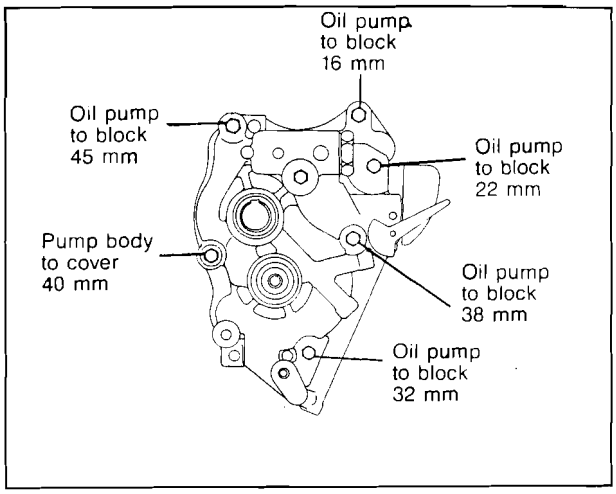


Fig. 7—Oil pump mounting bolts

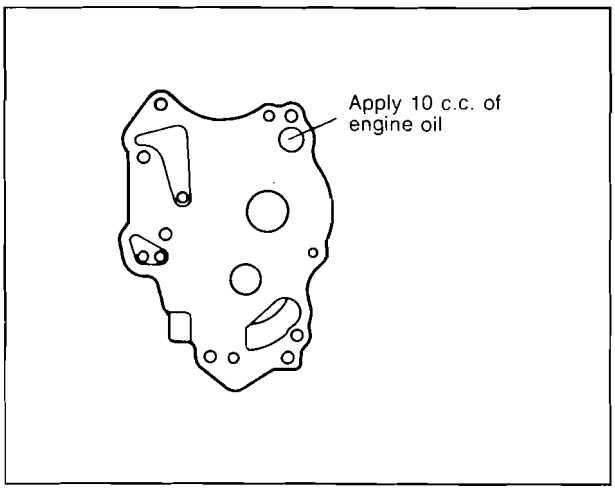


Fig. 6—Engine oil application

(6) Align the pump on the cover dowls and install the body to cover retaining screw. Tighten the screw to the specified torque.

(7) Keep the pump in a vertical position and place approximately 10cc of clean engine oil in the delivery port, refer Fig. 6.

(8) Install the key in the counter balance shaft and rotate the shaft to align the key with the key way in the driven gear, install the pump on the shaft.

NOTE: Ensure the key does not fall out of the key way.

If the pump is difficult to fit to the counterbalance shaft, remove the shaft from the cylinder block and insert the shaft into the oil pump. Install the counter balance shaft and oil pump to the cylinder block as an assembly.

(9) Install the oil pump mounting bolts (refer Fig. 7) and tighten to the specified torque.

(10) Install the counterbalance shaft to driven gear retaining bolt and tighten to the specified torque.

OIL FILTER

The oil filter is a full flow sealed unit. If the filter becomes dirty or clogged and creates a pressure difference of 97 kPa between entering and leaving the filter a valve will open and bypass the filter completely.

Replacement

The oil filter can be removed by hand or if too tight, by using a contracting band type oil filter remover.

Prior to installing the filter, lightly lubricate the "O" ring with engine oil and partially fill the filter with oil. Tighten the filter securely by hand, to the specifications shown on the filter and run the engine to check for the presence of oil leakage.

NOTE: Whenever the oil filter is replaced the engine oil should be changed.

OIL PRESSURE SWITCH

Warning Lamp Type

The oil pressure switch is located at the rear of the right hand side of the engine. If the oil pressure drops below the specified limit the switch will operate and light the instrument cluster warning lamp.

Replacement

The switch can be removed by using a suitable twelve sided deep socket. When installing the switch apply sealant to the threaded portion, tighten switch to specified torque and ensure that the electrical connection is tight and secure.

NOTE: DO NOT OVERTIGHTEN OIL PRESSURE SWITCH, AS DAMAGE TO CYLINDER BLOCK WILL OCCUR.

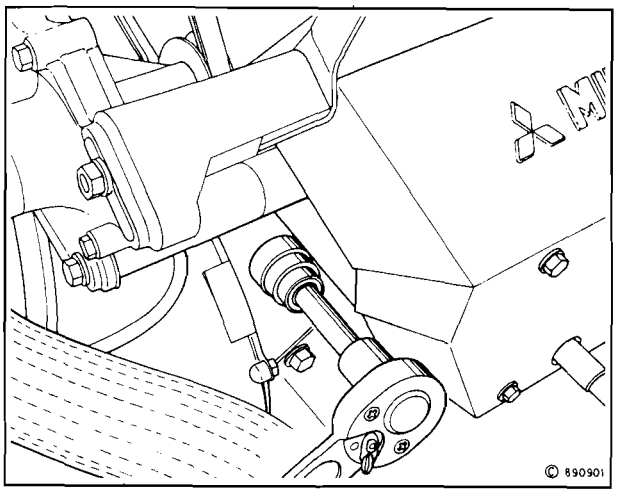


Fig. 8—Replacing oil pressure switch

SECTION 3 — ENGINE LUBRICATION SYSTEM 6G72 ENGINE

SPECIFICATIONS

Oil Pump	
Type	Trochoid
Drive	Crankshaft
Oil pressure — Idle pressure	80 kPa (min.)
— Relief valve	500-600 kPa
Low pressure warning switch operating pressure	50 kPa
Oil filter	Full flow sealed "can"
Body clearance	0.10 to 0.18 mm
Side clearance	0.040 to 0.095 mm
Crankcase oil capacity— with filter	4.3 litres
— without filter	4.0 litres

SPECIAL TOOLS

MD998727	Oil pan remover
MD998054	Oil pressure switch remover/installer
MD998717	Front oil seal installer

TORQUE SPECIFICATIONS

	Nm
Oil pressure switch	8-12
Oil filter bracket bolt	12-15
Oil pan drain plug	35-45
Oil pan bolt	5-7
Oil screen bolt	15-22
Oil relief valve plug	40-50
Oil pump cover bolt	8-12
Oil pump case bolts	12-15

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GENERAL INFORMATION

The lubrication system is a forced lubrication type with a full flow type filter. The oil stored in the oil pan is pumped out by a trochoid oil pump directly driven by the crankshaft and after pressure is regulated by a relief valve, it is fed through an oil filter to the main gallery of the cylinder block, from which it is sent to various parts of the engine.

OIL PUMP and OIL PAN

Disassembly

(1) Remove timing belt, refer Group 11.
(2) Remove crankshaft sprocket and front oil seal.
(3) Remove oil pressure switch terminal and oil pressure switch using tool No. MD998054, refer Fig. 2.

NOTE: Care should be taken not to damage oil pressure switch on removal as there is locktite on the threads.

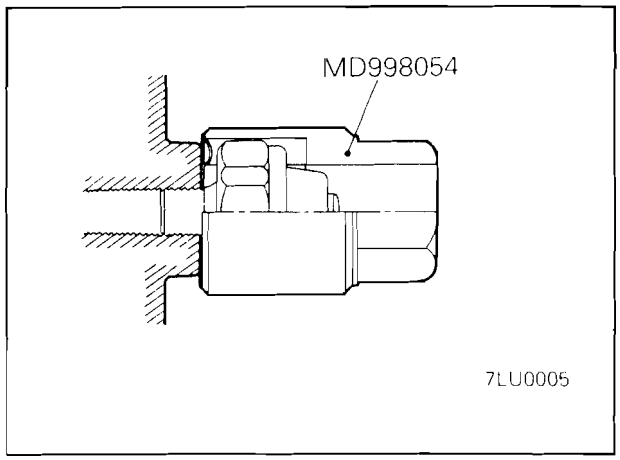


Fig. 2 — Removing oil pressure switch

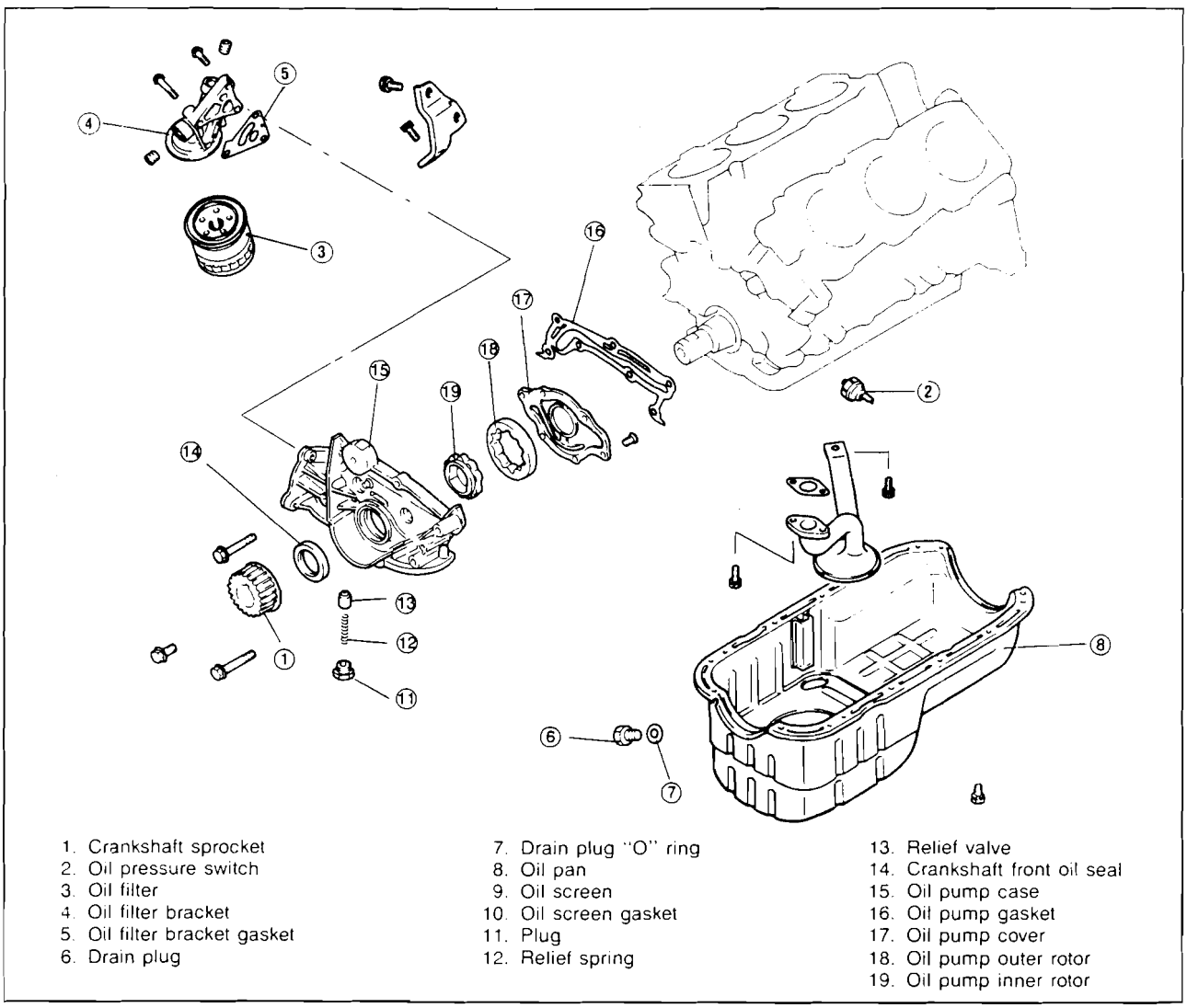


Fig. 1 — Lubrication system

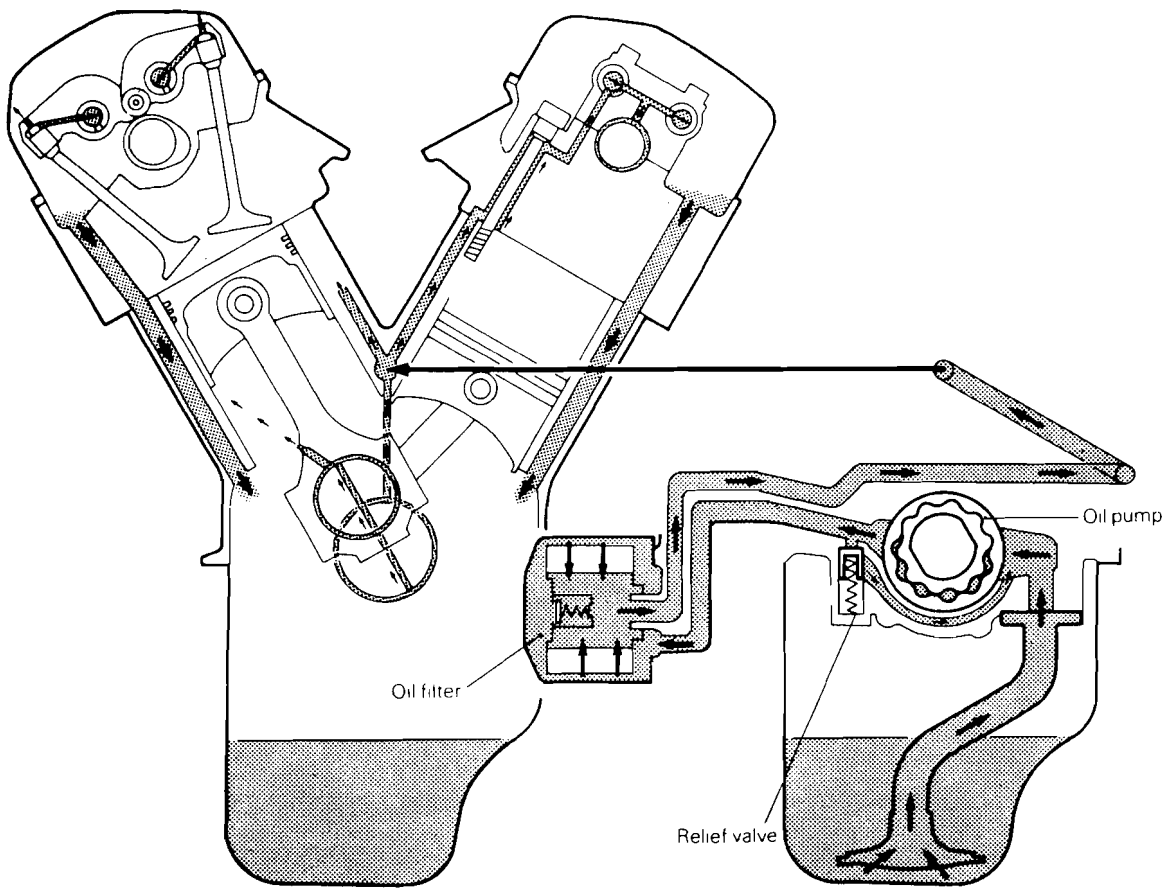


Fig. 3 — Schematic layout of engine lubrication system

(4) Remove oil filter and oil filter bracket.
(5) Remove oil pan, using tool No. MD998727, knock it deep between the oil pan and cylinder block, then hitting side of special tool, work around oil pan, refer Fig. 4.

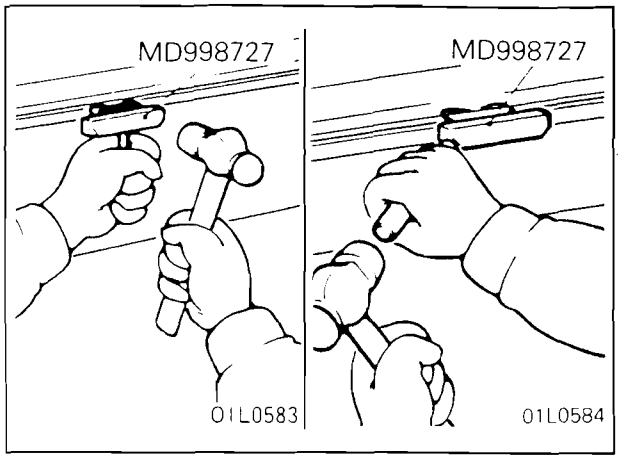


Fig. 4 — Removing oil pan

(6) Remove oil screen.
(7) Remove oil pump case assembly.

NOTE: Oil pump case mounting bolts are of different length.

(8) Remove relief plug and withdraw spring and relief valve from case.
(9) Remove oil pump cover.
(10) Remove inner and outer rotors.

Inspection

Clean all disassembled parts with suitable solvent and replace any defective parts after performing the following checks.

Oil Pump Case

Check the entire case for cracks, damage and abnormal wear.

Check the oil holes and orifices for clogging, blow out deposits with compressed air.

Check the pump cover gear contacting surface for ridge wear. A badly worn cover should be replaced.

Clearances

Assemble inner and outer rotors in oil pump case. Place a straight edge across the case, insert a feeler gauge to check clearance, refer Fig. 5.

Badly worn parts should be replaced.

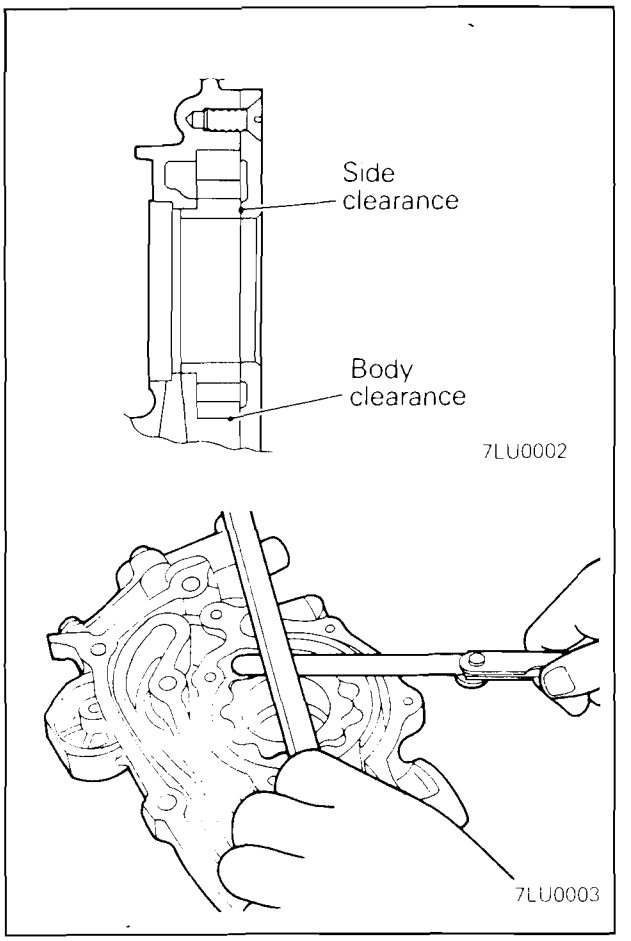


Fig. 5 — Oil pump clearances

Oil Filter Bracket

Check that there are no cracks on the oil filter bracket and that the oil filter installation surface is not damaged.

Relief Valve and Spring

Insert the valve into the pump case and check for smooth operation in the bore. Check the valve for scoring and wear. Check the relief valve spring for damage.

Assembly

(1) Lubricate the inner and outer rotors and install them into the pump case, ensure they rotate smoothly, install oil pump cover.
(2) Lubricate relief valve and install the valve (with the solid end of the valve towards the pump case) and spring into the bore. Install the plug and tighten to specified torque.
(3) Install the oil pump case assembly to the block, refer Fig. 6.

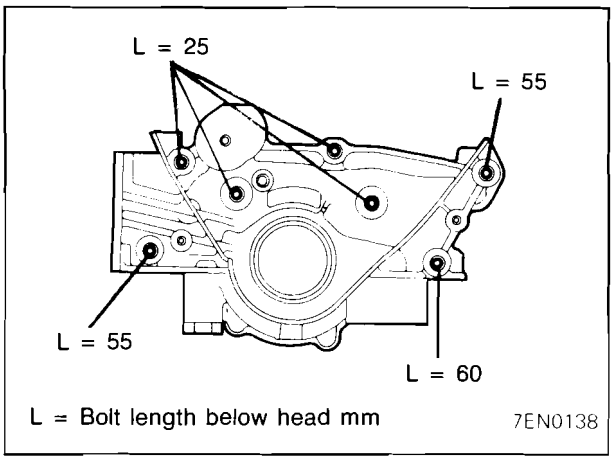


Fig. 6 — Oil pump case mounting bolts

(4) Lubricate inner lip of front oil seal and install using tool No. MD998717, refer Fig. 7.

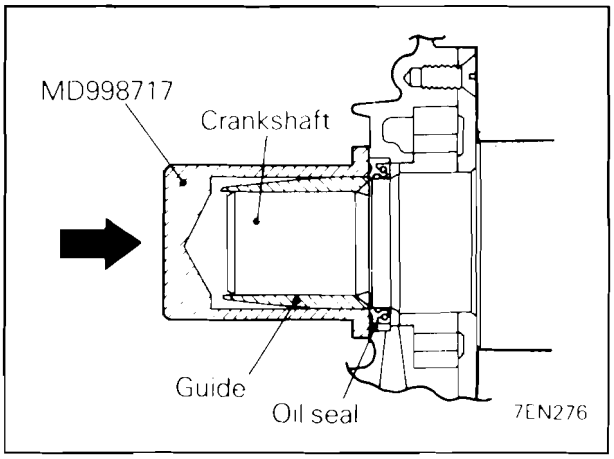


Fig. 7 — Installing front oil seal

(5) Install oil screen.

(6) Install oil pan noting the following; ensure that the cylinder block and the oil pan surfaces are clean.

Apply approved liquid silastic all around oil pan flange, refer Fig. 8.

Install the oil pan within 15 minutes of applying the liquid gasket.

Tighten flange bolts in the sequence shown in Fig. 8 and to the specified torque.

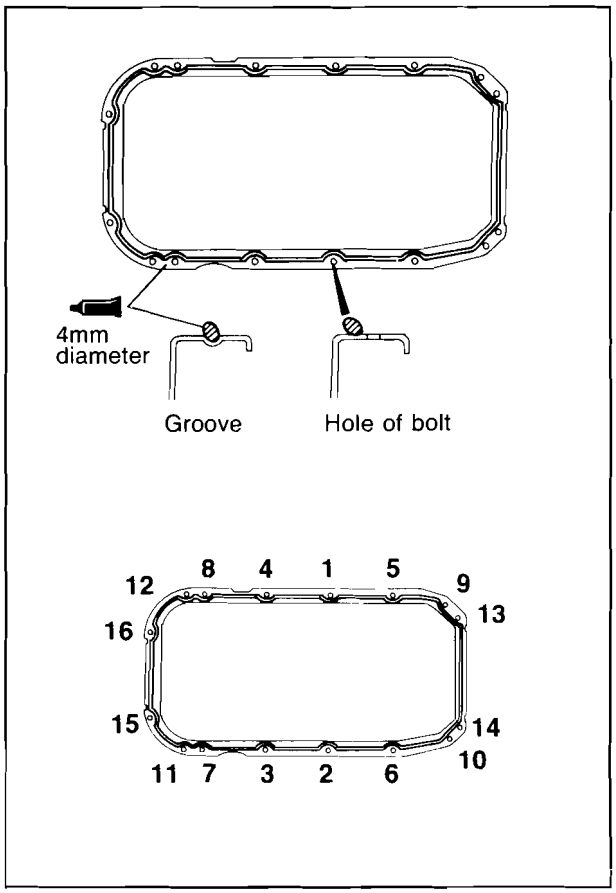


Fig. 8 — Sealant application and tightening sequence

(7) Install oil filter bracket.

(8) Apply approved sealant to oil pressure switch and using special tool, refer Fig. 2, tighten to specified torque.

(9) Install oil filter.

(10) Install crankshaft sprocket.

(11) Install timing belt, refer timing belt installation, Section.

OIL FILTER

The oil filter is a full flow sealed unit. If the filter becomes dirty or clogged and creates a pressure difference of 97 kPa between entering and leaving the filter a valve will open and bypass the filter completely.

Replacement

The oil filter can be removed by hand or if too tight, by using a contracting band type oil filter remover.

Prior to installing the filter, lightly lubricate the "O" ring with engine oil and partially fill the filter with oil. Tighten the filter securely by hand, to the specifications shown on the filter and run the engine to check for the presence of oil leakage.

NOTE: Whenever the oil filter is replaced the engine oil should be changed.

OIL PRESSURE SWITCH

(1) Connect an Ohmmeter between the switch terminal and the body, refer Fig. 9, for continuity. If there is continuity, the switch is satisfactory. If there is no continuity, replace switch.

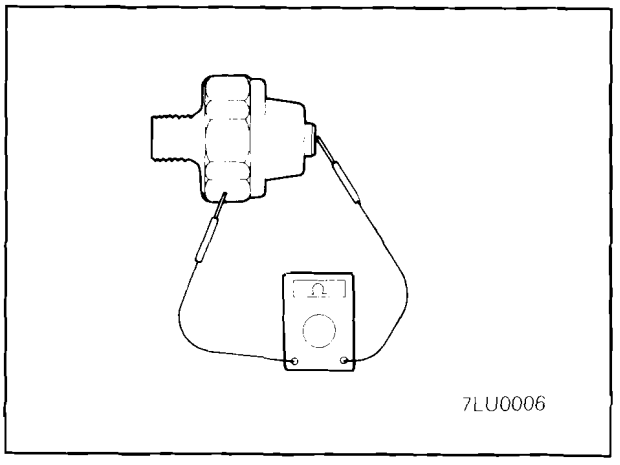


Fig. 9 — Checking switch for continuity

(2) Insert a wire through the oil hole and to the back of the switch with a suitable force, refer Fig. 10, there should not be any continuity, if there is continuity, replace the switch.

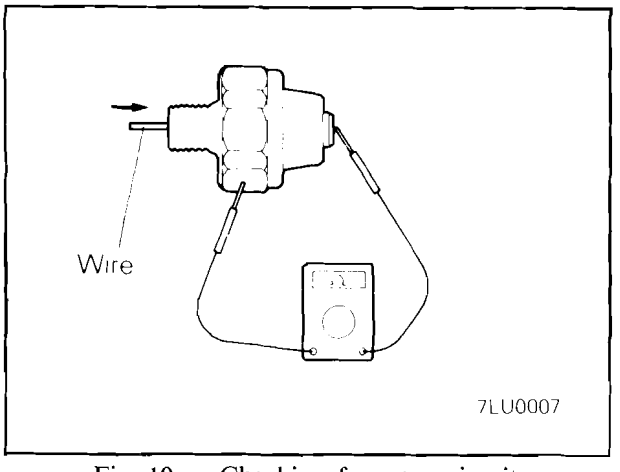


Fig. 10 — Checking for open circuit

GROUP 13 — FUEL SYSTEM

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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

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SECTION 1 — CARBURETTOR FUEL SYSTEM
SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
HARD COLD STARTING	Engine flooded.	Refer to possible causes listed for "Carburettor Floods or Leaks".
	Choke valve not closing correctly.	Refer to possible causes listed for "Choke Sticking".
	Choke valve incorrectly indexed.	Check choke valve adjustment and correct as necessary.
POOR DRIVEABILITY/ STALLING — ENGINE COLD	Choke breaker incorrectly adjusted.	Check adjustment and correct as necessary.
	Choke breaker delay valve faulty.	Check operation, replace as necessary.
	Secondary throttle valve opening.	Refer to possible causes listed for "Malfunction in Secondary Throttle Valve System".
	Choke valve incorrectly indexed.	Check adjustment and correct as necessary.
	Fast idle speed incorrect.	Remove carburettor and set throttle valve to bore gap.
	Choke valve sticking.	Refer to possible causes listed for "Choke Valve Sticking".
	Carburettor flooding.	Refer to possible causes listed for "Carburettor Floods or Leaks".
	Float level low.	Remove carburettor and set float level to specifications.
POOR IDLE QUALITY	Idle speed incorrect.	Adjust to specifications.
	Idle CO concentration incorrect.	Refer to diagnosis procedure, page 13-1A-4.
	Fuel cut off solenoid faulty.	Check solenoid operation and, if necessary, electrical circuit.
	Idle discharge ports or idle air bleeds clogged or restricted.	Remove disassemble and clean carburettor.
	Carburettor flooding	Refer to possible causes listed for "Carburettor Floods or Leaks".
	Hot idle compensator inoperative.	Check system, replace as necessary.
	Throttle shaft worn.	Remove carburettor, check and replace components as necessary.
POOR PERFORMANCE/ DRIVEABILITY — ENGINE HOT		
(a) Poor acceleration	Accelerator pump linkage worn.	Replace linkage.
	Accelerator pump diaphragm hardened or deteriorated.	Replace diaphragm.
	Accelerator pump follow-up spring weak.	Replace spring.
	Float level low.	Remove carburettor and set float level to specifications.

Condition	Possible Cause	Corrective Action
POOR PERFORMANCE/ DRIVEABILITY — ENGINE HOT (CONT.) (b) Engine running rich*	Clogged air cleaner.	Clean or replace as necessary.
	Choke valve not opening fully.	Refer to possible causes listed for "Choke Sticking".
	Carburettor flooding.	Refer to possible causes listed for "Carburettor Floods or Leaks".
	Incorrect main air jet fitted.	Check jet size is as specified.
	Main jet(s) loose.	Tighten jet(s).
(c) Engine running lean*	Main air jet(s) loose.	Tighten jet(s).
	Secondary throttle valve not opening.	Refer to possible causes listed for "Malfunction in Secondary Throttle Valve System".
	Bowl vent valve faulty.	Check operation of bowl vent system.
	Fault in enrichment system.	Check system components for wear, damage or restrictions.
	Main jet clogged.	Remove, disassemble and clean carburettor.
	Float level low.	Remove carburettor and set float level to specifications.
***NOTE: A blackened exhaust pipe does not necessarily indicate an over rich mixture. To ascertain if vehicle is running rich or lean check idle CO concentration.**		
POOR FUEL ECONOMY	Idle CO concentration incorrect.	Refer to diagnosis procedure, page 13-1A-4.
	Carburettor flooding or leaking.	Refer to possible causes listed for "Carburettor Floods or Leaks".
	Fault in enrichment system.	Check system components for wear, damage or restrictions.
	Air bleeds/jets restricted or loose.	Remove carburettor, disassemble and clean as necessary.
CHOKE VALVE STICKING	Choke valve or linkages gummed or fouling.	Check and free up linkages as necessary.
	Poor coolant circulation around wax element.	Check coolant level and hoses for restrictions.
	Choke wax element faulty.	Replace wax element.
MALFUNCTION IN SECONDARY THROTTLE VALVE SYSTEM	Vacuum hose disconnected.	Check hose connection.
	Thermo valve faulty.	Check and replace if necessary.
	Depression chamber diaphragm faulty.	Replace as necessary.
	Carburettor vacuum passage restricted or blocked.	Remove disassemble and clean carburettor.

Condition	Possible Cause	Corrective Action
CARBURETTOR FLOODS OR LEAKS	Float level high.	Remove carburettor and set float level to specifications.
	Needle and seat worn.	Replace needle and seat.
	Float leaking.	Replace float.
	Bowl vent system faulty.	Check operation of bowl vent system.
	Gasket, O-ring or diaphragm faulty.	Replace faulty components as necessary.
	Carburettor body cracked.	Replace carburettor body.

SECTION 1A — CARBURETTOR FUEL SYSTEM

SERVICE ADJUSTMENTS

Idle Speed and CO Concentration

To ensure continued compliance with regulations applying to vehicle exhaust emission levels, it is essential that idle CO concentration is maintained below specified limits.

Although the CO adjustment screw is set and sealed at manufacture and under normal circumstances does not required adjustment, checking CO concentration at the specified intervals provides a check of exhaust emission control systems, including the catalytic converter.

Check Procedure

Accurate checks can only be performed by following the procedures outlined below, using a reliable exhaust gas analyzer and an accurate engine tachometer noting the following.

- The analyzer probe and tubing must be in good condition, since any leaks would result in an erroneous reading.
- If a garage exhaust system is used to conduct exhaust gases away during checks, it will be necessary to use a plenum chamber (or other means) to reduce the vacuum in the system to 12 mm or less on a vacuum gauge.
- If the temperature inside the air cleaner reaches 60°C during checks, the hot idle compensator will be activated resulting in a false reading. To overcome this a suitable fan may be placed adjacent to the air cleaner intake to reduce temperatures in the air cleaner, or the vacuum hose may be disconnected at the manifold and the manifold outlet plugged.

(1) Switch on exhaust gas analyzer and allow it to warm up, then calibrate according to manufacturers instructions.

(2) Connect a tachometer and timing light and start the engine.

(3) Ensure that the engine is at normal operating temperature with the choke valve and HIA snorkel flap valve fully open.

(4) Check that the air cleaner is correctly installed.

(5) Place the transaxle in neutral and switch off all lights, accessories and the air conditioner (where fitted).

(6) Set idle speed to specifications and check ignition timing.

(7) Disconnect and plug secondary air supply hose at the air cleaner.

(8) Insert the exhaust gas analyzer probe into the tailpipe as far as possible.

(9) Check that CO concentration is 0.3 to 4.5%.

(10) Unplug and re-connect secondary air supply hose and check that CO concentration drops below 0.05% within a reasonable time.

Diagnosis and Adjustment Procedure

If CO concentration is not as specified during step 9, proceed as follows:

(1) Ensure that ignition timing is correctly set.

(2) Clean and test spark plugs, replace as necessary.

(3) Check air cleaner element condition and air cleaner intake system for obstructions.

(4) Ensure that the EGR valve is closing fully.

(5) Check that there are no leaks in the intake system.

(6) If the above checks do not indicate a fault, CO concentration may be adjusted as follows.

(a) Remove the carburettor from the vehicle.

(b) Position the throttle body in a vice equipped with soft jaws, with the idle mixture concealment plug facing upwards.

(c) Drill a 2 mm hole in the casting, as shown in Fig. 1, at a 45° angle towards the plug.

(d) Drill the hole out to 3 mm.

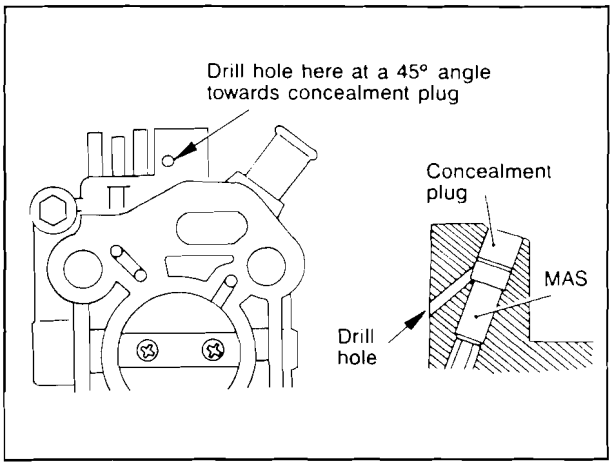


Fig. 1—Removing concealment plug

(e) Insert a blunt punch through the hole and drive out the plug. **DO NOT** discard plug.

(f) Using a new gasket, install the carburettor and fit the air cleaner assembly.

(g) Perform steps 1 to 3 as detailed in "Check Procedure".

(h) Adjust the mixture screw 1/16th turn richer (anti-clockwise), wait 30 seconds then take meter reading.

Repeat this step until meter indicates a definite increase in richness. This procedure is important since some meters (thermal conductivity type) reverse readings and indicate a richer mixture as the carburettor is set lean.

(i) When it has been established that the meter is indicating a rich reading as the mixture screw is turned anti-clockwise, run the engine at 2000 to 3000 rpm for 5 seconds or more then allow engine to idle for 2 minutes.

(j) Adjust mixture screw to give a CO concentration of 2.0 ± 0.5%.

(k) Run engine at 2000 rpm for 5 seconds and check reading, re-adjust CO concentration or idle speed as required.

(l) Install idle mixture screw concealment plug.

(m) Unplug and re-connect secondary air supply hose and check that CO concentration drops to 0.05% or less within a reasonable time.

If CO concentration is not as specified at step 10 of the "Check Procedure" or step (m) of "Adjustment Procedure", proceed as follows:

(1) Check vacuum hose from intake manifold to the secondary air supply reed valve, for leaks or crimping and that manifold vacuum is normal.

(2) Check delay valve, reed valve and thermo valve operation, refer Group 17—Emissions Control.

(3) Check secondary air supply filter for blockage and hose from air cleaner to reed valve for leaks.

(4) If a fault is not evident during steps 1 to 3, a damaged or poisoned catalytic converter is indicated, replace as necessary, refer Group 15.

Accelerator Cable Adjustment

(1) Run the engine until it reaches the specified idle speed (choke fast idle not in operation).

(2) Ensure the accelerator cable and pedal are not binding.

(3) Remove the air cleaner.

(4) Check that the inner cable to the carburettor is not loose and sagging.

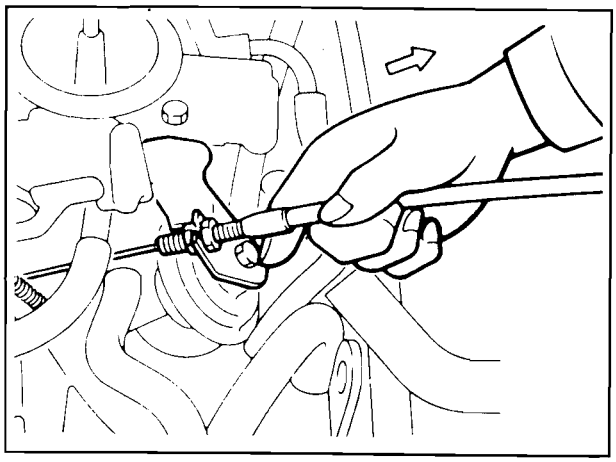


Fig. 2—Accelerator cable mounting

If adjustment is required:-

(5) Loosen the locknut and turn the adjusting nut so that the inner cable is just about to lift the throttle lever.

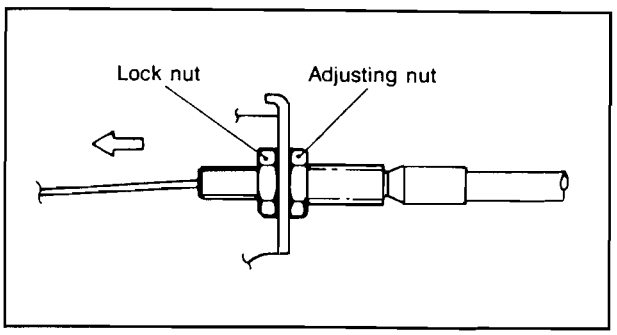


Fig. 3—Cable adjusting nuts

(6) Tighten the locknut after loosening the adjusting nut one turn (manual models) and three turns (auto models).

Accelerator Pedal Switch Adjustment

(1) Run the engine until it reaches its normal operating temperature.

(2) With the pedal fully released, the switch should be in the ON position — check the resistance of the switch. Resistance should read 0 Ohms, set the switch using the adjusting bolt if resistance reads ∞ (infinity).

(3) Press the accelerator by hand and note when the switch changes from ON to OFF (0 Ohms to infinity)—pedal movement should be 4 to 8 mm. Set, using the adjusting bolt, if required.

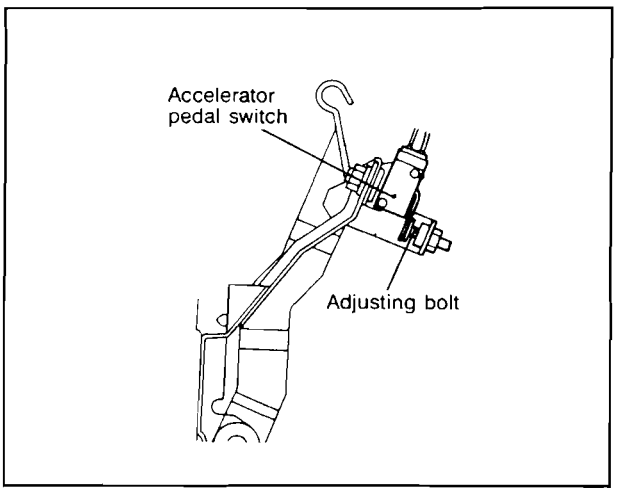


Fig. 4—Accelerator pedal switch adjustment

Accelerator Cable and Pedal

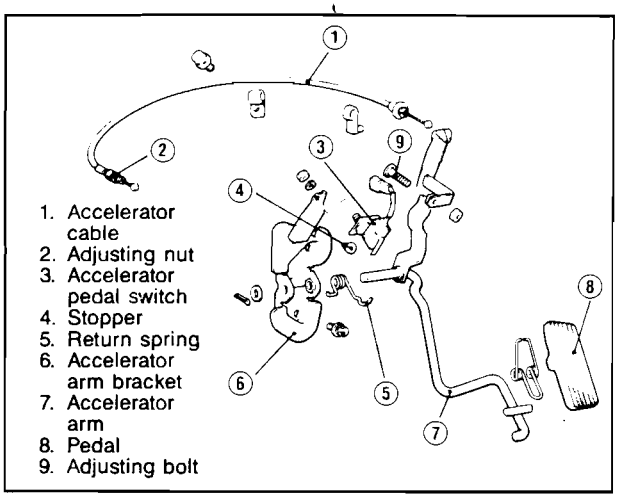


Fig. 5—Accelerator cable and pedal assembly

Removal

(1) Loosen the adjusting nut, remove the cable from the support and disconnect the cable at the throttle lever.

(2) Disconnect the cable from the accelerator arm, refer Fig. 6.

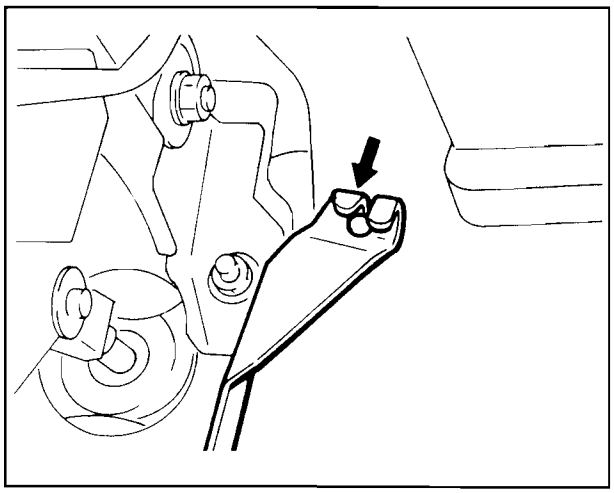


Fig. 6—Cable to pedal arm attachment

(3) Detach the end of the cable casing from the dash panel and remove the cable, refer Fig. 7.

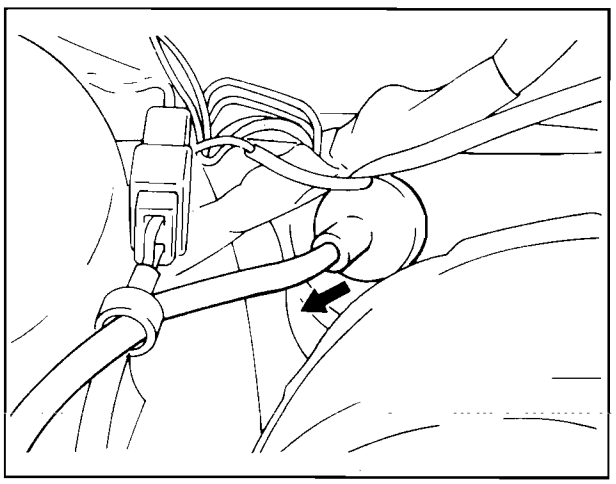


Fig. 7—Removing accelerator cable

(4) Remove the mounting bolts and withdraw the pedal, refer Fig. 8.

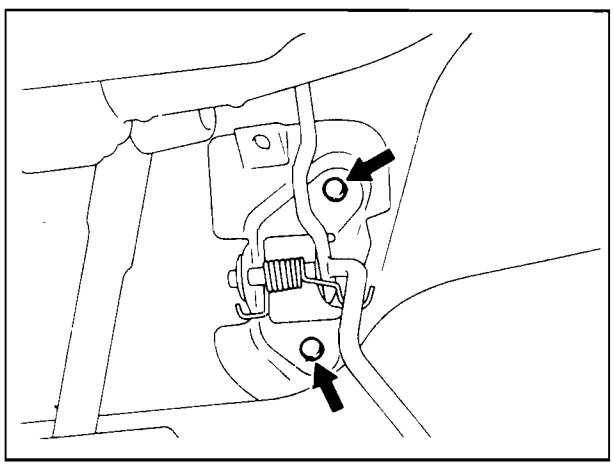


Fig. 8—Accelerator pedal mounting bolts

(5) Remove the return spring from the accelerator arm, the split pin from the pedal shaft and remove the pedal from the bracket.

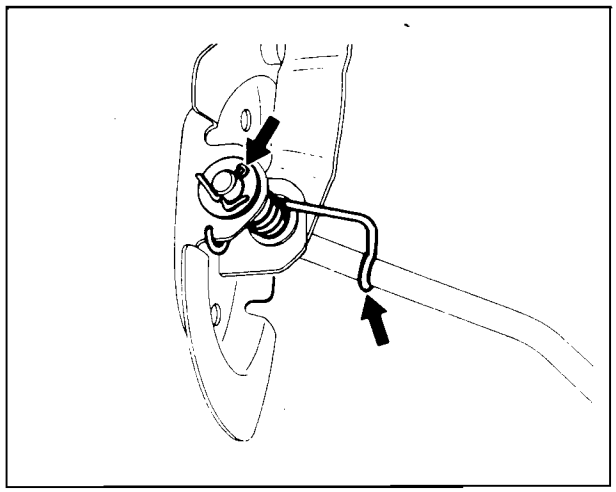


Fig. 9—Pedal return spring

Inspection

(1) Check the cable and outer casing for damage and smooth operation.
(2) Check the accelerator arm for bending.
(3) Check the return spring for deterioration.
(4) Check the cable end fitting.

Installation

Install by reversing removal procedure noting the following:-
(1) Apply multipurpose grease (NLGI No. 3) to all moving parts of the pedal.
(2) Apply dry sealant to the bracket mounting screw holes, install the bracket and tighten the screws to 8-12 Nm.

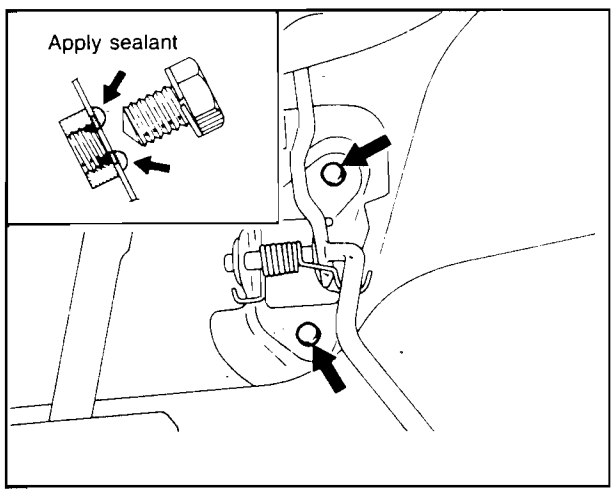


Fig. 10—Installing accelerator arm bracket

(3) Ensure the cable is installed without kinks or sharp bends.
(4) Adjust the cable as previously described.
(5) On automatic models, adjust the pedal switch as previously described.

CARBURETTOR OPERATION

GENERAL INFORMATION

The dual-throat down-draft type carburettor utilizes four basic fuel metering systems. The Idling System provides a mixture for idle and low speed performance; the Main System provides an economical mixture for normal cruising conditions; the Accelerator Pump System provides additional fuel during acceleration; and Enrichment System provides a richer mixture when high power output is desired.

In addition to the four basic systems, there is a fuel inlet system that constantly supplies fuel to the basic metering systems, an automatic choke system which enriches the mixture to aid starting and cold running, a bowl vent system which allows the carburettor float bowl to vent to the canister with the engine off, and a mixture control system which supplies air to below the throttle butterfly during closed throttle deceleration.

Manual transaxle models are fitted with a dashpot to slow down throttle return to idle, and both manual and automatic models are fitted with an auxiliary accelerator pump (AAP) to improve drive ability during warm up.

A fuel cut solenoid shuts off the fuel supply through the idling system when the ignition is switched OFF, reducing the possibility of engine run on.

Idle System (Fig. 11)

This system controls the mixture during idle, off idle and part load operation, ensuring smooth operation from idling to part load.

Fuel passes through the main jet (1) from the float chamber to passage (2) and is metered by the pilot jet (3).

Air drawn through the venturi air passage (4) and pilot air No. 2 jet (5), is metered by the pilot air No. 1 jet (6) and mixed with fuel in the well to produce an air-fuel mixture. The air-fuel mixture is then sprayed from the bypass (7) and pilot outlet (8) to mix with air passing through the throttle valve gap prior to being drawn into the engine.

The mixture screw (9), is used to adjust the air fuel ratio mixture at idle.

The fuel cut solenoid cuts off the air/fuel mixture supplied through the pilot passage, to reduce the possibility of engine run on when the ignition is switched OFF and during closed throttle coasting or deceleration to prevent the induction of excessive quantities of raw fuel.

Main Metering System (Fig. 11)

As the throttle valve is opened, air velocity inside the venturi increases, forming a vacuum in the inner venturi (10). Utilizing this vacuum, the fuel is jetted from the main nozzle (11) into the bore.

The carburettor primary main circuit is used for medium-load operation. When the driver demands more power, the secondary main circuit is brought into operation.

Air Flow System (Fig. 12)

Air drawn through the air cleaner flows from the choke bore (1) into the venturi (2). The amount of air is controlled by the primary throttle valve (3) and secondary throttle valve (7). When the engine is idling, air is drawn through the slight clearance between the primary throttle valve (3) and throttle bore.

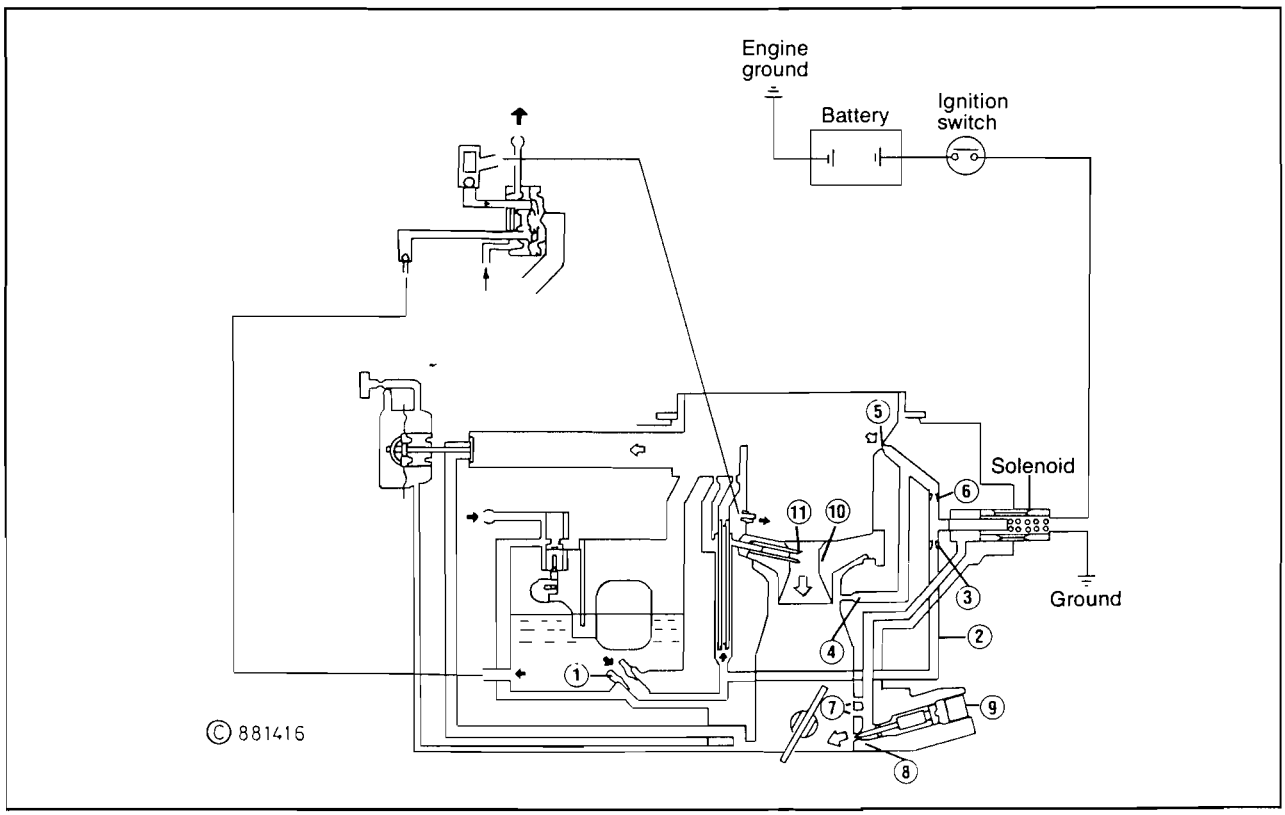


Fig. 11—Idling system and main metering system

During off-idle to intermediate load operation, the air is metered by the primary venturi (2) and controlled by the primary throttle valve (3) before being drawn into the engine.

As the load increases, vacuum produced by air flow past the primary and secondary negative pressure extraction orifices (4), is routed into the depression chamber (5) to operate the diaphragm (6) and open the secondary throttle valve (7).

Vacuum to the depression chamber is connected to a thermo valve, which prevents the secondary throttle valve opening when coolant temperature is below 65°C, by opening the chamber to atmosphere.

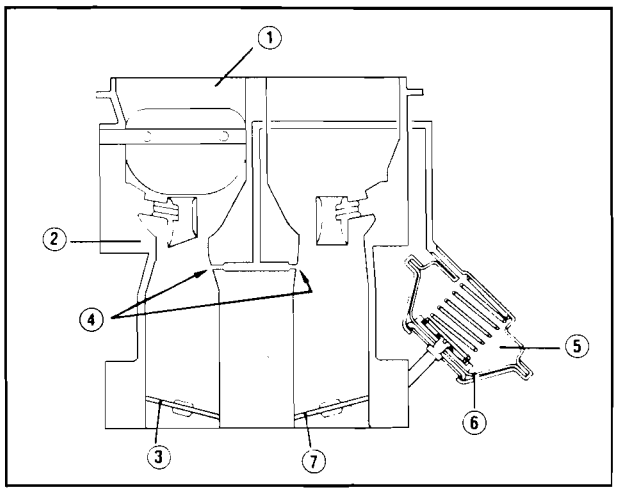


Fig. 12—Air flow system

Enrichment System (Fig. 13)

The carburettor embodies the diaphragm enrichment system. Manifold vacuum is transmitted to the diaphragm chamber through the channel illustrated in the figure. When running at part throttle, the diaphragm is drawn left, closing the enrichment valve. As the throttle is opened widely, the drop in manifold vacuum permits the diaphragm spring to force the diaphragm right, opening the enrichment valve. This allows extra fuel to pass through the enrichment jet into the emulsion well, supplying the fuel required for high load vehicle operation.

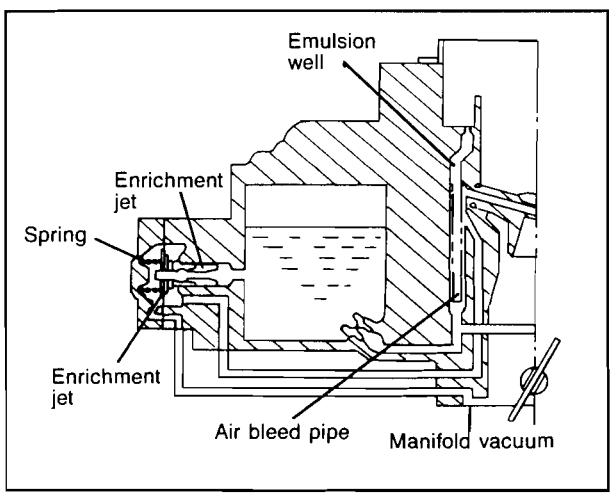


Fig. 13—Enrichment system

Mixture Control System (Fig. 14)

The mixture control valve, mounted on the secondary bore side of the carburettor, responds to intake manifold vacuum generated below the primary throttle valve, to supply additional air to the intake manifold immediately after closed throttle coasting or deceleration. This ensures effective combustion of fuel drawn into the manifold.

Under normal driving conditions, the valve is kept closed by spring (8) force. When the throttle is closed during deceleration or when coasting, vacuum is applied to chamber (1) through orifice (2) and acts on the diaphragm (3) to open the valve (4). At the same time, vacuum is applied to chamber (5) through the orifice (6). When the difference between the vacuum in chamber (5) and vacuum in chamber (1) falls below the pre-set value, spring (8) force overcomes the vacuum in chamber (1) and the valve closes. Atmospheric pressure is applied through orifice (7) to clean orifice (6) and the orifice (6) controls the speed of valve closure.

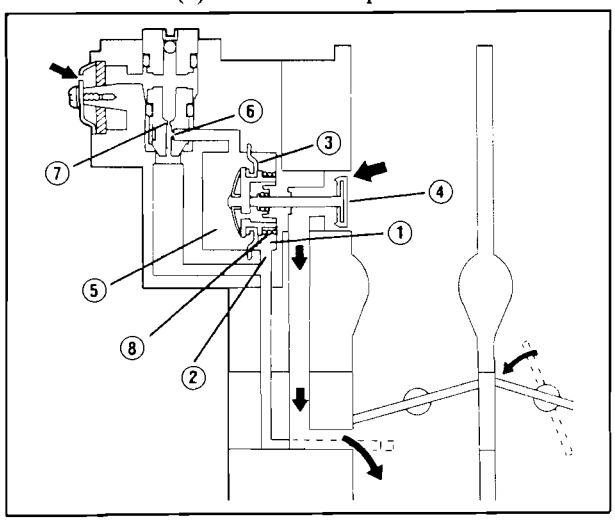


Fig. 14—Mixture control valve

Accelerator Pump System (Fig. 15)

When the engine speed is increased suddenly, the air fuel mixture becomes excessively lean. To overcome this condition, the carburettor is provided with an accelerator pump circuit to provide an additional quantity of fuel to the pump jet.

As the throttle is opened rapidly, the diaphragm (1) is pushed by the pump lever (3), which is linked to the throttle valve (2), to force the fuel through the outlet check valve (4) and spray it toward the top of the primary venturi. When the throttle is closed, the diaphragm (1) is pushed back by the spring (5) to allow fuel flow through the inlet check valve (6) into the pump chamber. Fuel delivery decreases as the engine speed increases.

Lock nut (7) is provided for adjusting the amount of fuel to be injected. This quantity is set at the factory and an adhesive applied to the lock nut.

NOTE: Do not tamper with this adjustment.

Spring (9) is provided to maintain fuel injection for a period after the throttle valve has been opened.

Excess fuel from the vapour separator tank is circulated through the accelerator pump body and back to the fuel tank. The circulation reduces fuel temperature rise in the pump chamber, so that stable pump delivery characteristics can be obtained without the generation of vapour.

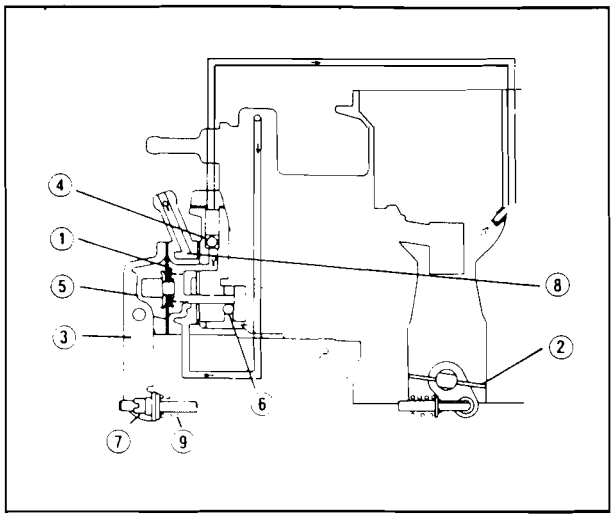


Fig. 15—Accelerator pump system

Fuel Inlet System

The fuel inlet system maintains a constant level of fuel during engine operation. The fuel is drawn from the tank by the fuel pump and flows through the filter and vapour separator tank to the float chamber, via the needle valve.

As fuel enters the float chamber, the float moves upward to the prescribed level, where the needle valve is closed. With the consumption of fuel, the float moves down to open the needle valve to permit fuel to flow into the float chamber, raising the float to the prescribed level. This operation is repeated to maintain a suitable level of fuel within the carburettor during operation.

Automatic Choke System (Fig. 16)

The choke valve is automatically operated by a thermo-wax element which senses the coolant temperature. The sensing element closes the choke valve at low coolant temperature and opens it as the coolant temperature increases.

To prevent an over-rich mixture during cold starts, the choke valve is set initially to the partially open position by the choke breaker, which is actuated by intake manifold vacuum.

A fast idle cam is provided on the choke set lever, and the cam controls the throttle valve opening.

When the vehicle is operated (the throttle valve opened) immediately after cold starting (the choke closed), the choke valve is forced to open by the choke unloader, to allow more air to enter and maintain a suitable air fuel mixture, refer Fig. 17.

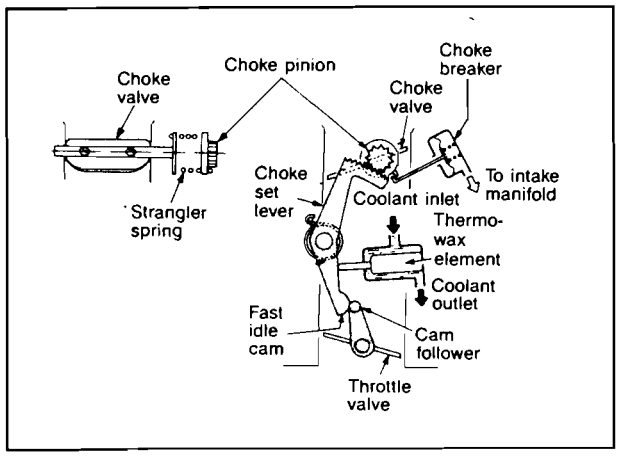


Fig. 16—Automatic choke system

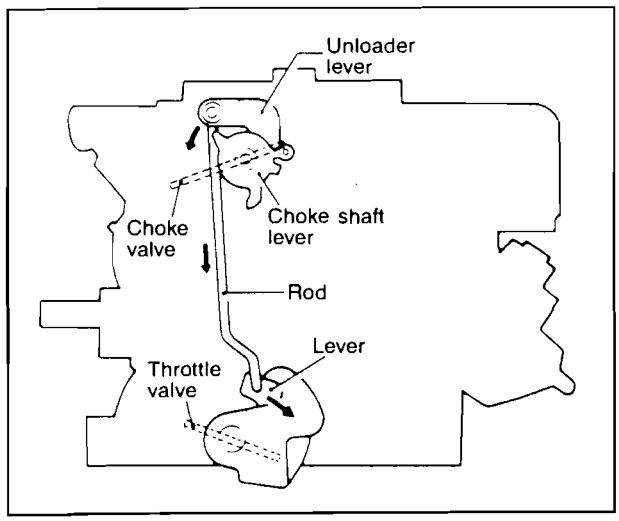


Fig. 17—Choke unloader

Fast Idle Cam

The fast idle cam is integral with the choke lever and has a profile set to provide an optimum fast idle opening through the cam follower, depending on the varying coolant temperature.

Return Spring

The return spring assists the thermo wax element rod to retract as the engine coolant temperature falls and also, ensures that a throttle opening necessary for starting can be automatically obtained against the friction of the throttle return spring and the throttle link system.

Strangler Mechanism (Fig. 18)

The choke valve (1) is mounted on the choke shaft and is held shut by the strangler spring (2). One end of the strangler spring (2) is secured to the choke shaft lever (3), and the other end is secured to the pinion (4). The pinion is in mesh with the rack.

The choke set lever (5) is held in contact with the thermo wax element rod (7) by the return spring (6). When the engine coolant temperature falls, the thermo wax element rod (7) retracts. As the temperature rises, the rod extends. Extension or retraction of the rod rotates the choke set lever (5) which rotates the pinion (4). Rotation of the pinion twists the strangler spring (2), which provides the strongest choke valve closing pressure at the lowest coolant temperature and the weakest pressure at the highest coolant temperature.

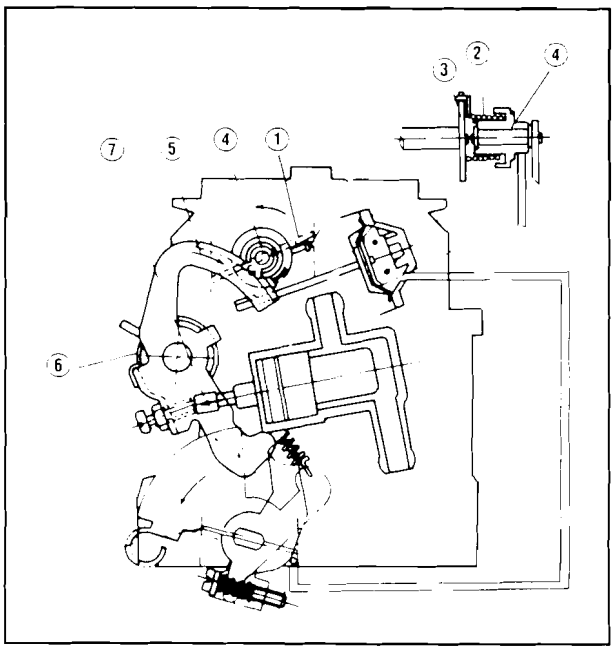


Fig. 18—Strangler mechanism

Choke Breaker Mechanism (Fig. 19)

The choke breaker mechanism prevents an excessively rich mixture after cold starting. When the engine starts, manifold vacuum is applied to the choke breaker diaphragm (3), through an internal passage on manual models or an external passage on automatic models, overcoming spring force to pull the shaft (2) in the direction of the arrow, opening the choke a specified amount.

On automatic models, a valve fitted in the vacuum hose, delays the operation of the choke breaker mechanism by approximately six seconds.

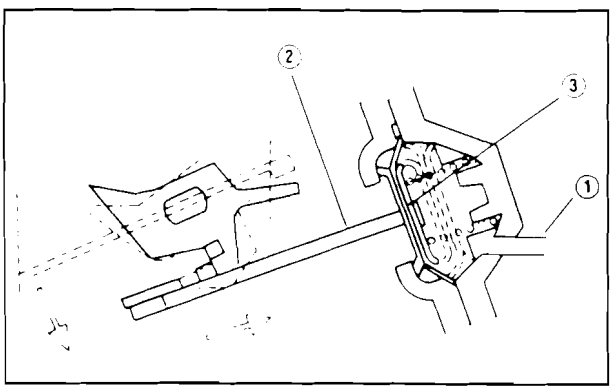


Fig. 19—Choke breaker

Carburettor Dashpot (Manual Models)

The conventional type dashpot is fitted to delay throttle valve closure to the normal idling position, thus reducing the amount of Hydro Carbon emissions.

When the throttle is opened the dashpot rod moves up, moving the diaphragm upward. This action forces the air on the topside of the diaphragm out of the chamber through a one way valve. When the accelerator is released, air is drawn into the top chamber through an orifice slowing the return of the throttle to idle.

Auxiliary Accelerator Pump (AAP)

The Auxiliary Accelerator Pump is provided to improve driveability while the engine is still cold. AAP is controlled by a thermo-valve and intake manifold vacuum and operates in the high load range while the coolant temperature is low (below 65°C).

The thermo-valve is of the bi-metal type and is mounted on the intake manifold. The valve opens when the engine coolant temperature is below 65°C and allows the manifold vacuum to affect AAP chamber (A). The valve closes when the coolant temperature exceeds 65°C to shut off the manifold vacuum and stop the operation of the AAP.

The manifold vacuum operates on AAP chamber (A). When the diaphragm moves to the right, the fuel pushes check valve 1 open, and flows into and fills chamber (B). When the throttle valve opens quickly and the vacuum in chamber (A) lowers, the diaphragm is pushed to the left by spring force. As a result the fuel in chamber (B) pushes open check valve 2 and squirts into the carburettor, enriching the fuel mixture, refer Fig. 20.

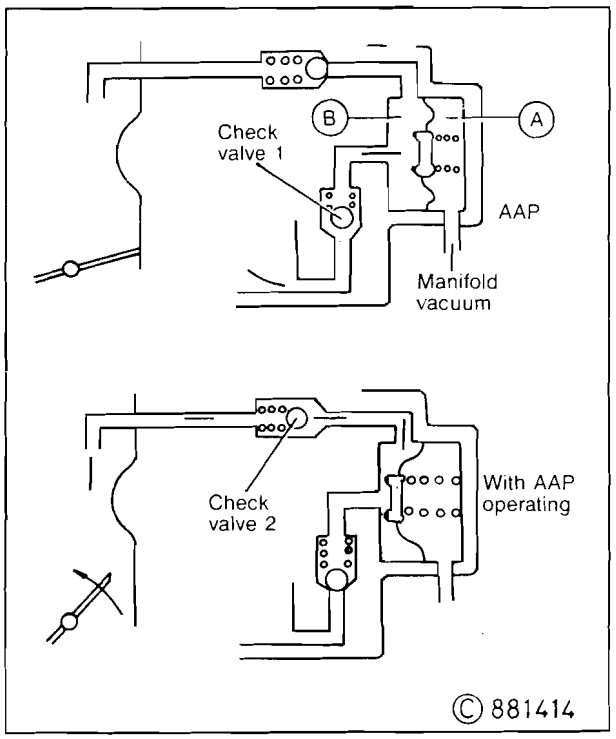


Fig. 20—Auxiliary Accelerator Pump (AAP)

CARBURETTOR OVERHAUL

SPECIFICATIONS

	Manual	Automatic
Model number	32 - 35	32 - 35
Throttle bore — primary	32 mm	◆
— secondary	35 mm	◆
Venturi bore — primary	24 mm	◆
— secondary	30 mm	◆
Main jet — primary	# 113.8	◆
— secondary	# 230	◆
Main air jet — primary	# 75	# 85
— secondary	Ø 0.75 mm	◆
Pilot jet — primary	# 50	◆
— secondary	# 67.5	◆
Enrichment jet	# 70	◆
Dashpot	Conventional	—
Primary throttle valve angle when secondary begins to open	45° ± 2°	◆
Adjustments		
Float level — non adjustable	◆	◆
Idle speed (r.p.m.)	750 ± 50	800 ± 50
Idle CO% (@ idle speed with secondary air cut)	2% ± 0.5%	◆
Air conditioner idle up speed (r.p.m.)	850	900
Nominal setting of choke valve pinion plate	Centre scribe mark on pinion plate at 23°C	
Choke valve to bore gap	1.9 mm @ 23°C	◆
Choke breaker — valve to bore gap	2.0 ± 0.1 mm	◆
Fast idle throttle valve to bore gap (primary bore)	0.71 ± 0.04 mm	0.80 ± 0.04 mm

NOTE: Specifications printed are correct at the time of publication. If these specifications differ from those on the Vehicle Emission Control Information Label, use the specifications on the label.

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1. Water hose
2. Dash pot
3. Bracket
4. O-ring
5. Fuel cut solenoid valve
6. Retainer
7. O-ring
8. Arm and pinion
9. Gasket
10. Servo valve
11. Needle valve seat
12. Needle valve
13. Float
14. Pin
15. Plug
16. O-ring
17. Ball
18. Weight
19. Ball
20. Main jet (primary)
21. Enrichment jet valve assy. **(non removable)**
22. Vacuum hose
23. Depression chamber
24. Throttle lever
25. Fast idle adjusting screw
26. Idle speed adjusting screw (SAS-2)
27. Idle speed adjusting screw (SAS-1)
28. Mixture adjusting screw
29. Screw
30. Throttle position sensor (TPS)
31. Throttle body
32. Spring
33. Abutment plate
34. Free lever
35. Cam follower
36. Pump cover
37. Diaphragm
38. Spring
39. Pump body
40. Gasket
41. Check valve
42. Diaphragm
43. Spring
44. Auxiliary accelerator pump cover (AAP)

(non removable)

45. Main jet (secondary)
46. Steel ball
47. Pilot jet (primary)
48. Pilot jet (secondary)
49. Float chamber cover
50. Cover
51. Diaphragm
52. Spring seat
53. Body
54. Diaphragm
55. Valve
56. Diaphragm
57. Cover
58. Main air jet
59. Mixture control valve

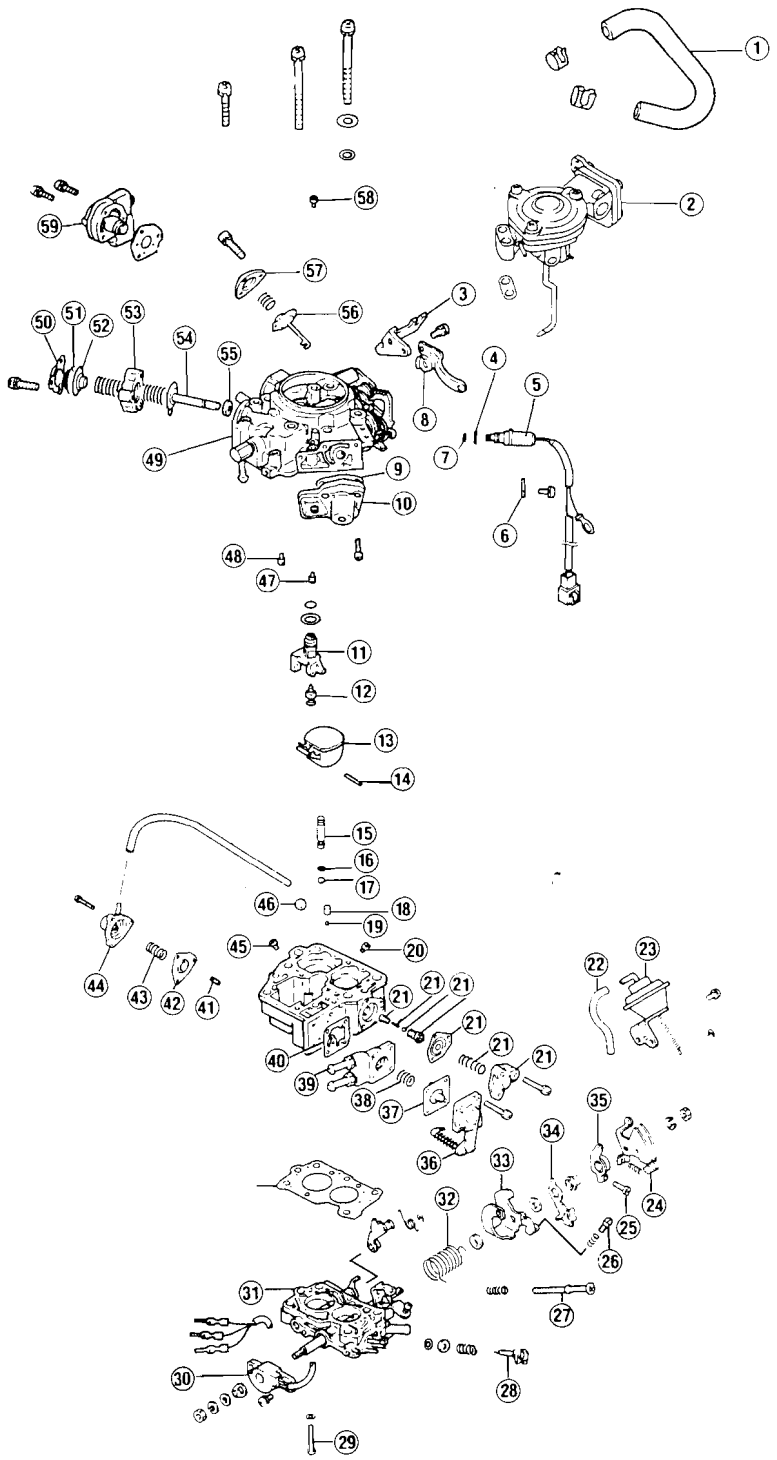


Fig. 21—Carburettor exploded view

Prior to overhauling the carburettor for economy, performance or similar problems, ensure that the fault is not in some other component.

Service Precautions

When overhauling a carburettor, several items of importance should be observed.

(1) The carburettor should be completely disassembled for cleaning.

(2) All parts **(except for diaphragms)** should be cleaned in a suitable solvent and inspected for wear or damage. Since it can be difficult to ascertain whether parts are still serviceable, any questionable parts should be replaced.

(3) Only use air pressure to clean orifices, channels and jets. **NEVER** clean jets etc. with wire, drills or other mechanical means, as orifices may be enlarged.

Cleaning Carburettor Parts

The recommended solvent for gum deposits is methylated spirits. However, there are other commercial solvents which may be used with satisfactory results.

Diaphragms can be damaged by solvents. Avoid placing any diaphragm assembly in ANY liquid. Clean the external surfaces with a clean cloth or a soft wire brush. Shake dirt or other foreign material from the stem (plunger) side of the diaphragm. Depressing the stem to the retracted position, will provide an additional hole for the removal of dirt. Compressed air can be used to remove loose dirt **but should not be connected to the vacuum diaphragm fitting.**

IMPORTANT: If the commercial solvent or cleaner recommends the use of water as a rinse, it should be "HOT". After rinsing, all trace of water must be blown from the passages with air pressure. It is further advisable to rinse all parts in clean kerosene or petrol to be certain no trace of moisture remains.

CARBURETTOR REMOVAL

(1) Drain the engine coolant to a level below the thermostat housing.

(2) Remove the air cleaner.

(3) Disconnect the accelerator cable.

(4) Disconnect the vacuum and fuel hoses and all electrical connectors.

(5) Disconnect the coolant hoses.

(6) Remove the carburettor mounting bolts.

(7) Remove the carburettor assembly.

(8) Remove the carburettor gasket.

NOTE: Using suitable material, blank off the carburettor mounting hole to prevent entry of foreign material into the inlet manifold.

CARBURETTOR DISASSEMBLY

Disassemble the carburettor in a systematic order, paying attention to the following:

- Use spanners and screwdrivers that fit the nuts, screws and jets securely, otherwise the components may be burred or damaged.
- Where parts are disassembled, place them on a clean bench in the order of removal to aid in reassembly.
- Do not remove the inner venturi assemblies.
- Do not disassemble the throttle shaft and throttle valve.
- Do not remove or dismantle the mixture control or bowl vent valves, unless replacement is necessary or the float chamber cover is to be cleaned in solvent.

(1) Disconnect the throttle dashpot lower link from the throttle linkage, remove two dashpot to float chamber attaching screws and remove the dashpot complete (Manual Models).

(2) Remove the fuel cut solenoid.

(3) Remove the choke unloader link retaining clip and disconnect the choke unloader link, refer Fig. 22..

(4) Disconnect the depression chamber to throttle body vacuum hose.

(5) Disconnect the lower end of the depression chamber link and remove the depression chamber, refer Fig. 23. Do not immerse the depression chamber in solvent.

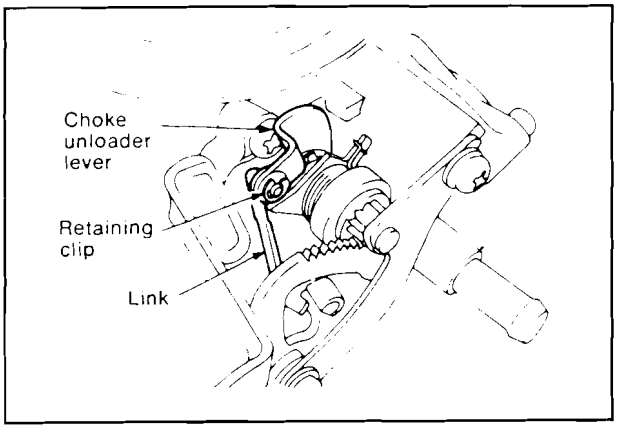


Fig. 22—Removing choke unloader link

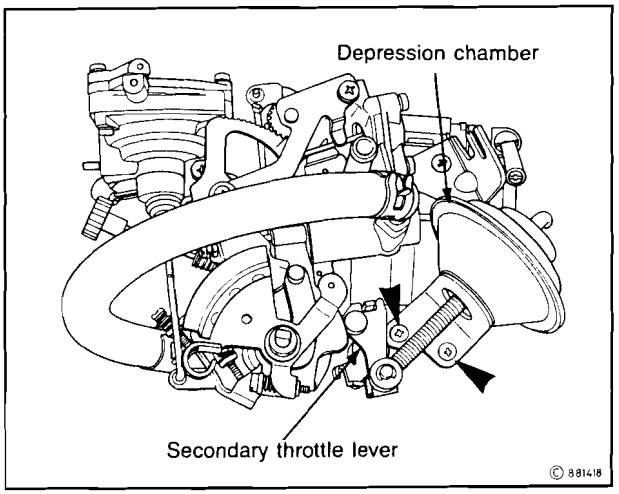


Fig. 23—Removing depression chamber

(6) Disconnect the accelerator lever from the throttle shaft.

(7) Remove the throttle position mounting screws (automatic models) and remove the throttle position sensor.

(8) Remove the five float chamber attaching screws, refer Fig. 24, and the throttle body screw.

CAUTION: The float chamber attaching screws have the threads cut directly into the resin body. Take care when removing screws or damage to the resin body may result.

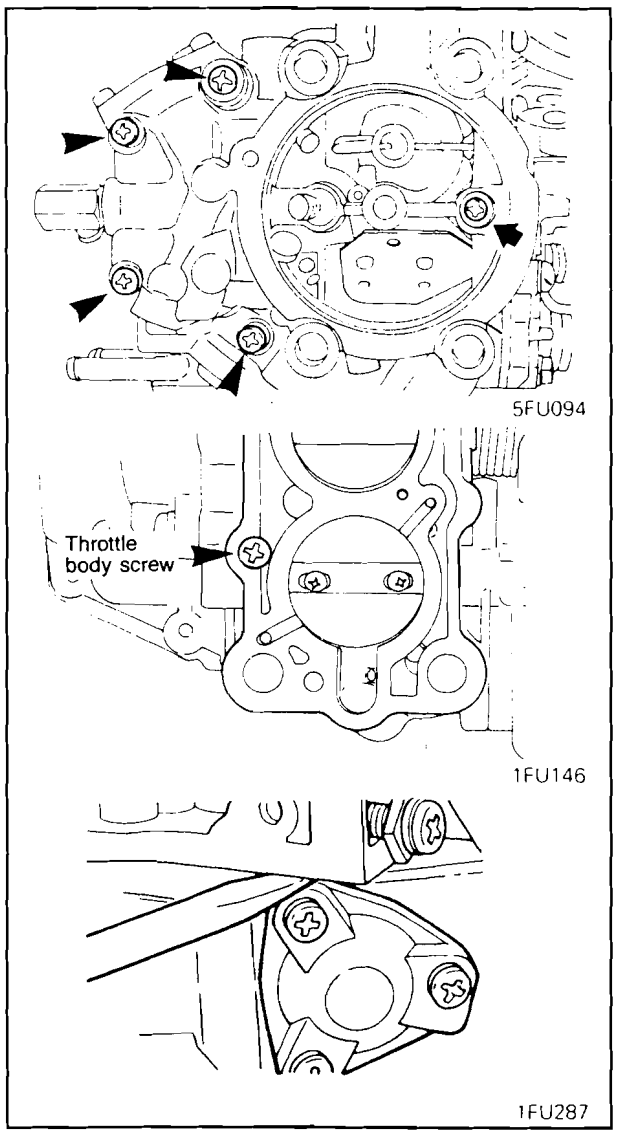


Fig. 24—Float chamber cover removal

(9) Separate the float chamber cover from the main body by lightly prying the float chamber with a screwdriver between the enrichment cover and the float chamber cover, refer Fig. 24.

NOTE: Do not apply excessive force.

Do not turn the carburettor upside down to remove the float chamber cover—the discharge check ball and accelerator pump weight housed in the main body may fall out and become lost.

Remove the float chamber cover gasket.

(10) Remove the float lever pin and the float.

(11) Remove the needle valve assembly, gasket and filter.

(12) Do not remove the automatic choke system because the factory setting will be affected.

(13) Turn the main body upside down and remove the pump discharge check ball and weight.

(14) Remove the main jet baffler, refer Fig. 25.

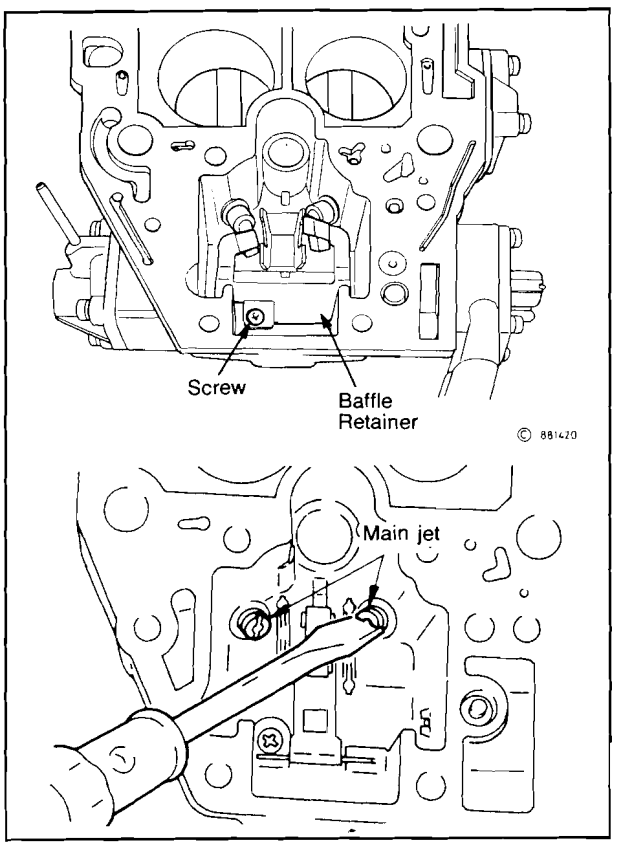


Fig. 25—Primary and secondary main jets

(15) Remove the main jets using a screwdriver with a blade suitable for the jet groove, refer Fig. 25.

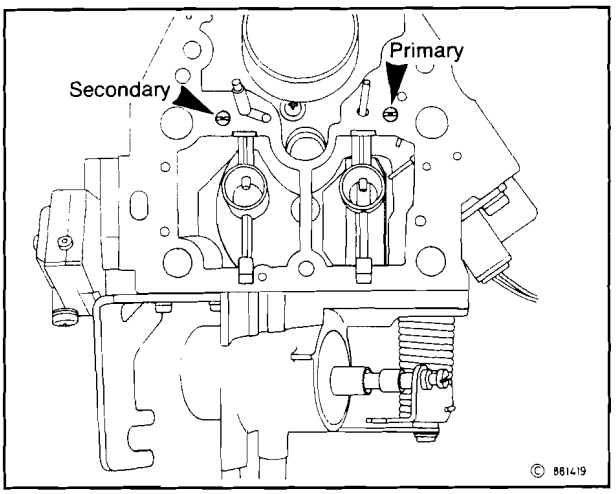


Fig. 26—Primary and secondary pilot jets

(16) Remove the primary and secondary pilot jets, refer Fig. 26.

(17) Remove the primary main air jet, refer Fig. 27.

NOTE: Secondary air jets are not removable.

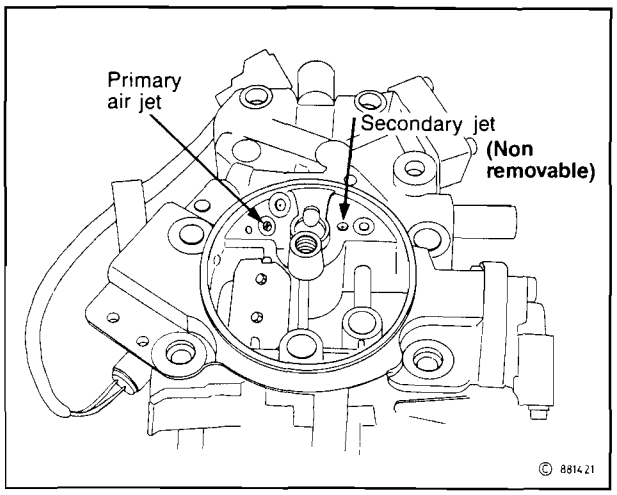


Fig. 27—Primary and secondary main air jets

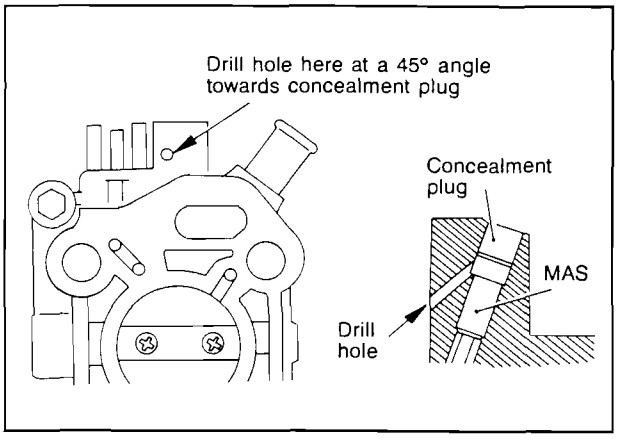


Fig. 28—Removing concealment plug

(18) Remove the idle mixture adjusting screw as follows:

(a) Position the throttle body in a vice equipped with soft jaws, with the idle mixture screw concealment plug facing up.

(b) Drill a 2 mm pilot hole in the casting, as shown in Fig. 29, at a 45° angle towards the plug.

(c) Drill the hole out to 3 mm.

(d) Insert a blunt punch through the hole and drive out the plug. **DO NOT** discard plug.

(e) Remove the idle mixture adjusting screw.

Cleaning and Inspection

(1) Clean the disassembled parts with clean methylated spirits or a suitable solvent.

NOTE: Do not clean O-rings, diaphragms or plastic parts with any cleaning solvent as damage may result.

(2) Clean out fuel passages and jets with compressed air, DO NOT use wire or drills to clean jets as the orifices may be enlarged and thus affect the performance of the carburettor.

(3) If O-rings, gaskets and diaphragms are to be reused, they should be cleaned with a clean cloth or soft brush.

(4) Check the carburettor body and water passages for cracks, scale and clogging.

(5) Check the needle valve and seat contact for damage or wear, replace if defective.

(6) Check the filter for damage and clogging.

(7) Check the jets and air bleeds for damage and clogging.

(8) Check each diaphragm for damage.

(9) Check the mixture screw contact surface for damage.

(10) Check the throttle valve shaft and choke shaft operation, if unsatisfactory clean the shaft and linkage with solvent and lubricate with engine oil.

(11) Check the depression chamber diaphragm by pushing the rod in, sealing off the nipple and releasing the rod. If the rod does not return, the chamber is good. If the rod returns when released, the diaphragm is defective and the assembly must be replaced.

(12) Check the fuel cut solenoid by connecting the black/white wire to the positive (+) terminal of a 12V battery and the other wire to the negative (–) side of the battery. The plunger should move in towards the solenoid when the battery is connected and it should move out as soon as the battery is disconnected. If the solenoid is not satisfactory it must be replaced.

CARBURETTOR ASSEMBLY

Assembly is a reversal of the disassembly procedure noting the following:-

(1) Clean all parts prior to installation. Check to ensure there is no clogging in the air and fuel passages.

(2) Check for smooth operation of the throttle and choke linkage.

(3) Use new O-rings and gaskets. If diaphragms are damaged in any way, replace with a new diaphragm.

(4) When replacing a jet, ensure the new jet is the correct size (a number is stamped on each jet).

CARBURETTOR INSTALLATION

(1) Inspect the mating surfaces of the carburettor and intake manifold. Ensure both surfaces are clean and free of nicks, burrs and other damage.

(2) The carburettor gasket can be installed upside down or backwards. Ensure the holes in the gasket match the holes in the bottom of the carburettor.

(3) Ensure the carburettor attaching bolt holes in the intake manifold are free of water and apply a thin smear of grease to the bolt threads.

(4) Place the carburettor on the intake manifold and install the mounting bolts. Tighten the bolts alternately and in stages to 15-22 Nm.

(5) Connect all fuel and vacuum hoses and electrical connectors.

NOTE: To provide catalyst protection and ensure correct emissions levels, it is essential that vacuum hose connections are correct, refer Fig. 29.

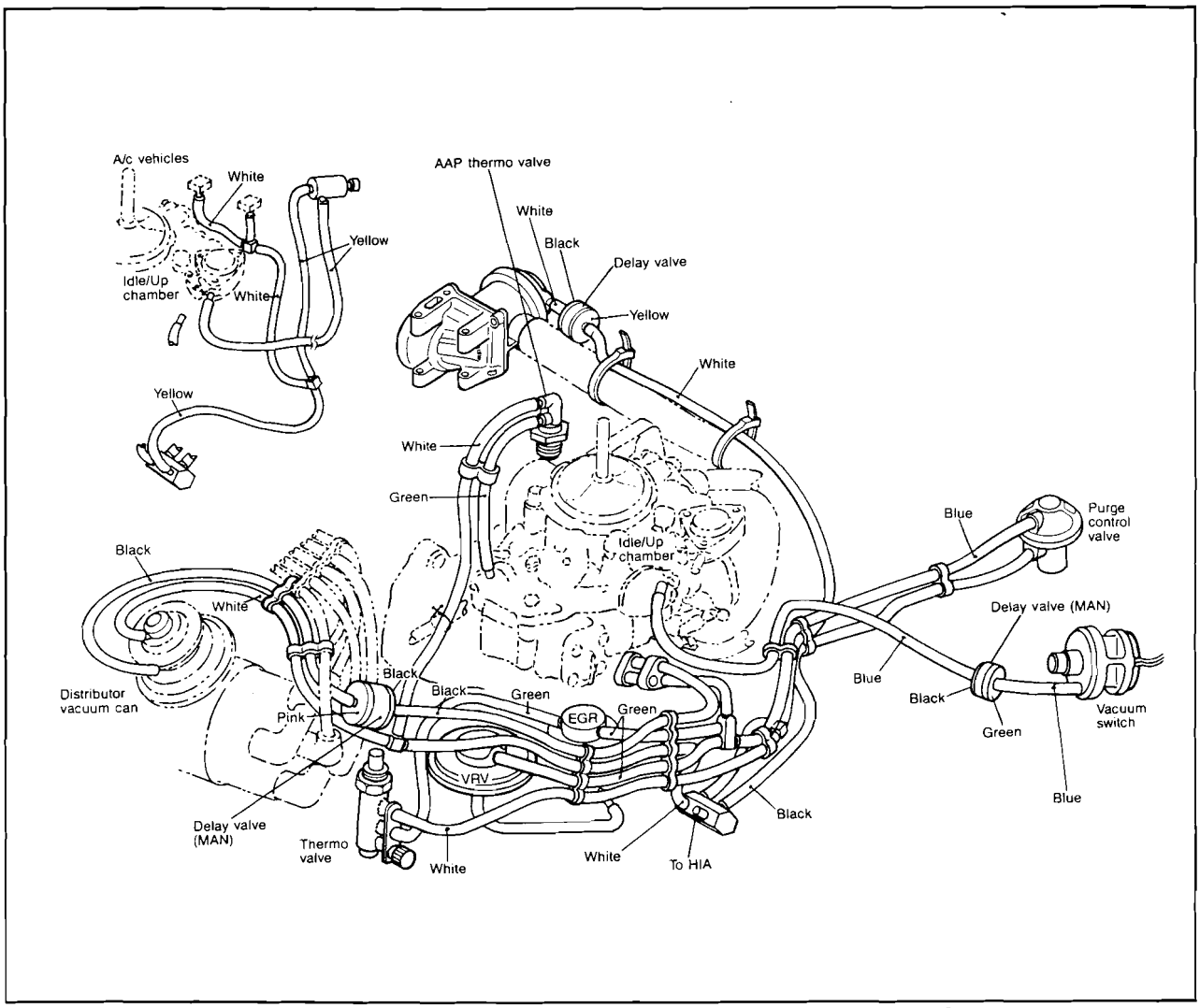


Fig. 29—Vacuum hose connections

(6) Reconnect coolant hoses.
(7) Reconnect the accelerator cable.
(8) Fit the air cleaner.
(9) Top up the cooling system with rain or "demineralized" water and the recommended concentration of Mitsubishi Long Life Coolant, refer Group 14.
(10) Start the engine and run until normal operating temperature is reached.

NOTE: Do not "prime" the engine by pouring fuel down the throttle bore. This practice may result in catalyst damage.

(11) Adjust the throttle position sensor (automatic models), accelerator cable, idle CO concentration, idle speed and dashpot (manual models).
(12) Install the idle mixture screw concealment plug after adjustments have been completed.

CARBURETTOR ADJUSTMENTS

Choke Valve and Fast Idle Adjustment

NOTE: The following method of choke valve adjustment will only be effective if instructions are carefully followed in the listed sequence and with accurate temperature measurements.

(1) Remove the carburettor from the vehicle (this is mandatory).

(2) Leave the carburettor to stabilize in the workshop for a MINIMUM of 1.5 hrs, preferably 2 hrs. Ensure that the carburettor is free from any heating or cooling source during stabilization.

(3) Measure the ambient air temperature with a known good thermometer and record.

(4) Loosen the lock nut at the choke adjustment screw and turn the screw to line up the scribed line on the cam lever with the punch mark on the cam follower, refer Fig. 31.

(5) With the carburettor in this condition, the dot (or stroke) on the choke set lever should be timed with the mark (dye) on the choke pinion, refer Fig. 30.

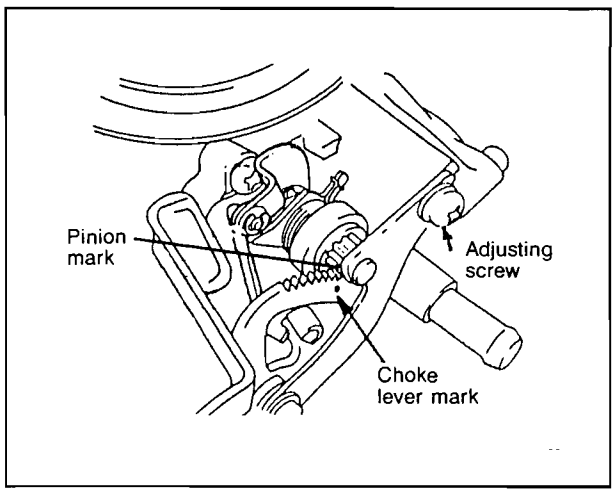


Fig. 30—Choke pinion alignment

(6) If this condition does not exist the choke pinion bracket must be removed, the marks timed and the bracket reinstalled correctly.

(7) Set the fast idle throttle valve to bore gap (see specifications), by turning the fast idle adjustment screw, refer Fig. 31.

(8) Referring to Chart—choke valve adjustment, and the previously recorded ambient air temperature, note the number of turns of the choke adjustment screw needed to correctly set the choke.

(9) Turn the adjusting screw by the amount shown on the chart, noting that this adjustment will result in misalignment between the punch mark and the scribed line for ambient temperature other than 23°C.

(10) Refit the carburettor using a new carburettor to manifold gasket.

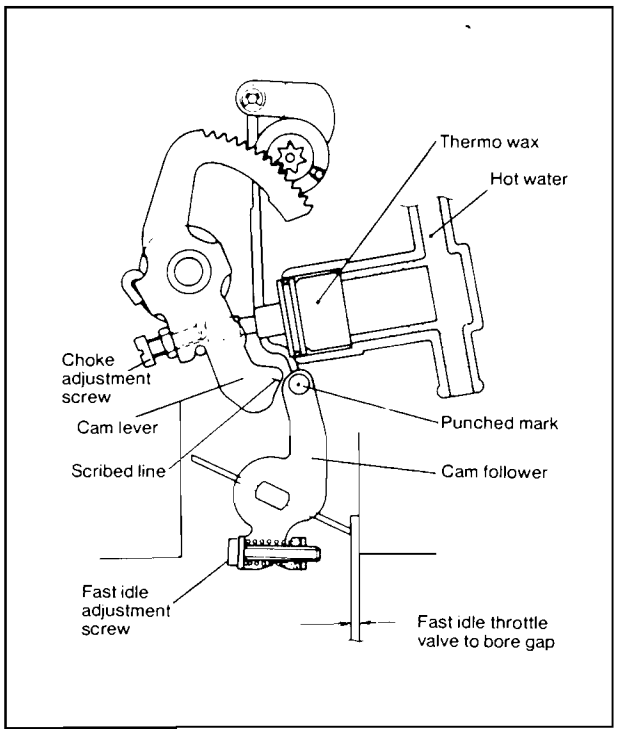


Fig. 31—Fast idle adjustment

(11) If the vehicle still runs rich or lean after the adjustment, a fine adjustment can be performed with the carburettor in place on the vehicle. Loosen the screw at the pinion plate and move the plate down for richer operation or upwards for leaner operation, refer Fig. 32.

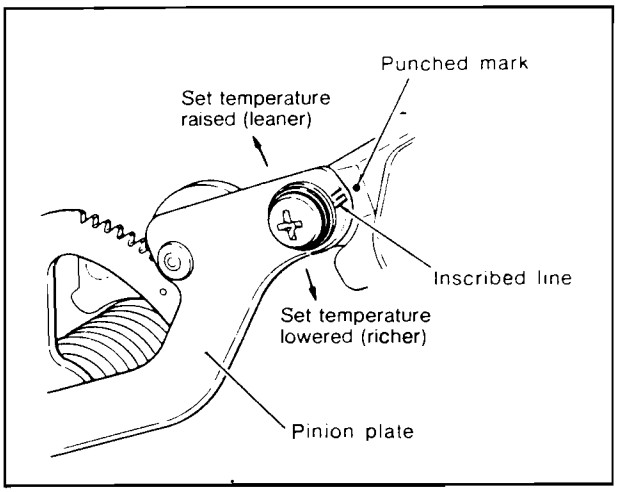


Fig. 32—Choke valve adjustment

Fast Idle Adjustment

(On Vehicle)

The engine fast idle speed is dependent on a number of factors (engine coolant and ambient air temperature etc.). Unless the conditions are ideal, the fast idle speed will vary depending on the above mentioned factors.

The fast idle speed is set at the factory to be approximately 1100 r.p.m., and it is recommended that it is only adjusted as outlined in "Choke Valve and Fast Idle Adjustment".

Ambient Temp °C	Choke Adjustment Screw Turns	Ambient Temp °C	Choke Adjustment Screw Turns	Ambient Temp °C	Choke Adjustment Screw Turns
0	—2.5	15	—0.9	29	+0.7
1	—2.4	16	—0.8	30	+0.8
2	—2.3	17	—0.7	31	+0.9
3	—2.2	18	—0.6	32	+1.0
5	—2.0	19	—0.4	33	+1.1
6	—1.9	20	—0.3	34	+1.2
7	—1.8	21	—0.2	35	+1.3
8	—1.7	22	—0.1	36	+1.5
9	—1.5	23	0	37	+1.6
10	—1.4	24	+0.1	38	+1.7
11	—1.3	25	+0.2	39	+1.8
12	—1.2	26	+0.4	40	+1.9
13	—1.1	27	+0.5	41	+2.0
14	—1.0	28	+0.6	42	+2.1

Note: + = turns clockwise — = turns anti-clockwise

Chart—choke valve adjustment

Choke Breaker Adjustment

Push the choke valve in the direction that it closes and push the vacuum operated choke breaker shaft, to check the specified clearance between the choke valve and choke bore wall. If necessary, adjust the clearance by inserting a screwdriver in the adjusting groove at the end of the shaft.

Unloader Adjustment

Push the choke valve in the direction that it closes and fully open the throttle valve. Check the clearance between the choke valve and choke bore wall. The normal clearance is 1.5 mm. If adjustment is necessary, bend the rod.

Dashpot Adjustment (Manual Models)

With the engine at normal operating temperature and idle speed and idle mixture set to specification, proceed as follows:-

(1) Back off the dashpot link screw so that it is not contacting the dashpot link.

(2) Adjust the screw so that it just contacts the link, i.e. engine speed just starts to increase, then back off the screw half a turn.

(3) Lift the dash pot link so that it contacts the dashpot speed screw and adjust the screw to achieve the specified dashpot speed.

(4) Release the link, the engine should return to idle speed within the specified time.

Engine speed, dashpot bottomed	1500 ± 200 r.p.m.
Engine speed rod released	Idle speed within 3 ± 1.5 secs

Air Conditioner Idle Up Adjustment

Manual Models

Adjust the dashpot as previously described and proceed as follows:-

(1) Switch on the air conditioner, ensuring the compressor is activated.

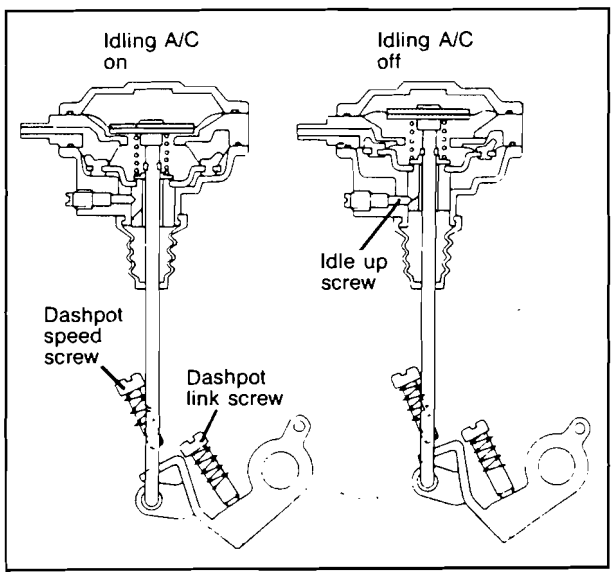


Fig. 33—Dashpot and idle up adjusting screws

(2) Adjust the idle up screw to maintain the specified speed with the compressor on. Anti-clockwise rotation increases speed.

NOTE: Rotation of the idle up screw is difficult when vacuum is applied to the idle up diaphragm. Disconnecting the vacuum supply hose will facilitate idle up screw rotation.

Automatic Models

(1) Ensure that the engine is at normal operating temperature and idle speed is set to specifications.
(2) Switch on the air conditioner and check that compressor clutch is actuated.
(3) Adjust engine speed to maintain the specified speed, using the idle up adjusting screw, refer Fig. 34.

Throttle Position Sensor (T.P.S.) Adjustment (Automatic Models)

For full inspection and test procedures refer to Group 23 — Transaxles.

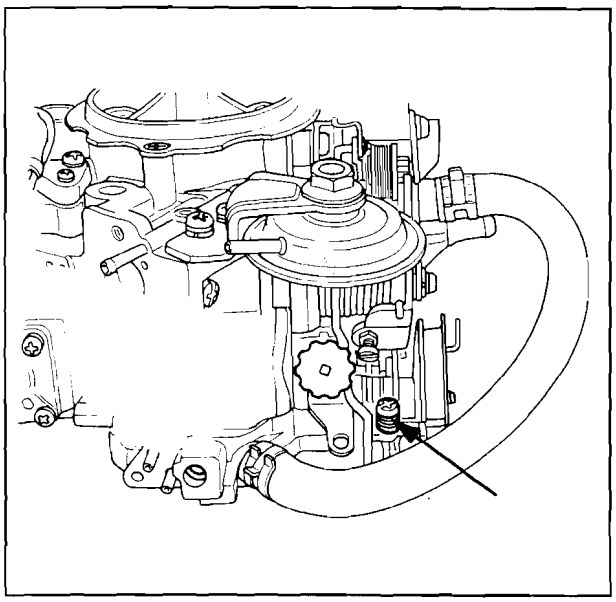


Fig. 34—Idle up adjusting screw—automatic models

Float Level Adjustment

The float on the carburettor, because of its construction, requires no adjustment.
If a float or needle and seat fault is suspected, replace the float and needle and seat as an assembly.

COMPONENT TESTING

Mixture Control Valve (MCV)

(1) Start the engine and run until normal operating temperature is reached.
(2) Remove the air cleaner assembly and plug the secondary air supply hose.
(3) Increase engine speed to 3000 r.p.m. and release throttle. A brief change in intake air noise should be discernable as engine speed decreases.
(4) If a change is not discernable repeat step 3 and using a small mirror positioned adjacent to the valve, visually check if the valve is opening and closing. Replace the valve if faulty.

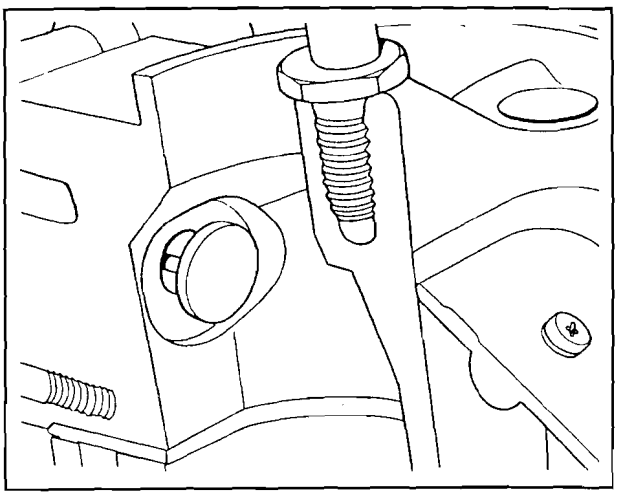


Fig. 35—Testing M.C.V.

Fuel Cut Solenoid

(1) Start the engine and run until normal operating temperature is reached.
(2) Disconnect the wiring from the solenoid, the engine should stop.
(3) If the engine does not stop the solenoid is faulty and should be replaced.

SECTION 2 — FUEL INJECTION — ECI-MULTI SYSTEMS

SPECIFICATIONS

	4 cylinder	V6
Throttle body		
Throttle bore	60 mm	60 mm
Throttle position sensor (TPS)	Variable resistor type	←
Idle speed control (ISC) servo	Stepper motor type (Stepper motor type bypass air control method with fast idle air valve (FIAV) attached.)	←
Idle position switch	Internal contact type	←
Electronic control unit (ECU)		
Maker	Bosch	MMC
Intake manifold	Fixed conventional	Variable intake system
Input sensors		
Airflow sensor (AFS)	Karman vortex type	←
Atmospheric pressure sensor	Semiconductor diffusion type	←
Intake air temperature sensor	Thermistor type	←
Coolant temperature sensor	Thermistor type	←
Oxygen sensor	Zirconia single wire type (Bosch)	Zirconia heated 4 wire type (MMC)
Vehicle speed sensor	Reed switch type	←
Inhibitor switch (auto. models)	Contact switch type	←
No. 1 cylinder reference	'Hall' generator	Photo diode sensor
Crankshaft angle sensor	'Hall' generator	Photo diode sensor
Knock sensor	Piezoelectric element type	←
Output actuators		
Control relay	Coil type	←
Injector type (3.3 bar)	Bosch electromagnetic	MMC electromagnet
Purge control solenoid valve	ON/OFF type solenoid	—
Ignition coil		
Type	Bosch resin mould	←
Distributor		
Type	Hall Effect	Optical
End play	0.3 ± 0.2 mm	←
Rotational torque	0.3 Nm or less	←
Spark plugs		
Type	Champion N9YC	Champion N9YC4 (pre-gapped)
Gap	0.7 to 0.8 mm	1.0 mm
Idle speed	800 ± 50 rpm	700 ± 100 rpm
—A/C idle up	950 rpm	900 rpm
Idle CO% (@ idle speed)	1.5% ± 0.5%	0.6% >
Idle CO% (NZ)	—	1.5% ± 0.5%
Ignition timing — with electronic spark timing cut	5° ± ½° BTDC	5° ± 2° BTDC
— with electronic spark timing	13° ± 2° BTDC	15° ± 2° BTDC

NOTE: The idle speed and ignition timing specifications were correct at time of publication. If these specifications differ from those on the Vehicle Emission Control Decal (located on the underside of the engine hood) use the specifications listed on the decal.

SPECIFICATIONS CONT:

Air flow sensor	2.2 to 3.2 Volts
Atmospheric pressure sensor @ 103 kPa	4 Volts approx.
Air temperature sensor 0°C	6 k Ohms
20°C	2.7 k Ohms
80°C	0.4 k Ohms
Coolant temperature sensor 0°C	5.8 k Ohms
20°C	2.4 k Ohms
40°C	1.1 k Ohms
80°C	0.3 k Ohms
4 cylinder oxygen sensor @ 2500 rpm	OV to 1V and fluctuates 7 to 8 times in 10 seconds
V6 oxygen sensor @ 2500 rpm	0.6 V to 1 Volt
Throttle position sensor — resistance	3.5 to 6.5 k Ohms
— output voltage @ idle	0.4 to 1.0 Volts
Injector resistance	16 ± 3 Ohms @ 20°C
Fuel pressure	330 kPa or higher

SPECIAL TOOLS

Analogue Voltmeter	
E14M35	Fuel pressure gauge
E14M35A-1	Adaptor package
MB991502	Multi-Use-Tester (MUT)
MRP–A	Rom pack
MB991223	Electrical tester
MD998299	MAS Screwdriver
Ohmmeter	
Tachometer	

TORQUE SPECIFICATIONS

	Nm
Accelerator cable to surge tank bolts	4 - 6
Air cleaner to body bolts	8 - 10
Coolant temperature sensor (to computer)	12 - 15
Coolant temperature sender (Temp guage)	8 - 12
Engine coolant temperature sensor	20 - 40
Fuel delivery pipe to manifold	10 - 13
Fuel hose to delivery pipe bolts	5 - 6
Fuel hose to filter	25 - 35
Fuel pressure regulator to delivery pipe bolts	5 - 6
Idle speed control servo	2.5 - 4.5
Knock sensor	20 - 25
Oxygen sensor	40 - 50
Surge tank to intake manifold	15 - 20
Throttle body to surge tank nuts and bolts	10 - 13
Throttle position sensor to throttle body bolts	1.5 - 2.5
Throttle shaft nut	6 (max.)
Throttle cable to surge tank	4 - 6

SERVICE DIAGNOSIS

When checking for and correcting engine problems it is important to always start and finish with a Self Diagnosis output check, refer page 13-2-26 and check the Engine Warning Lamp.

With engine start failure, unstable idling or poor acceleration, check the following basic systems:

(1) Power supply
- Battery
- Fusible link
- Fuse

(2) Body earth

(3) Fuel supply
- Fuel line
- Fuel filter
- Fuel pump and control relay
- Idle speed

(4) Ignition system
- Spark plug
- High tension lead
- Distributor
- Ignition coil
- Power transistor
- Ignition timing

(5) Emission control system
- PCV system
- Vacuum leak

The most likely faults will be wiring related. Next could be basic setting errors and finally component failures. Wiring and component failures will mostly show up in the diagnosis output, setting errors will probably show up only with the use of a timing light and tachometer.

The effect of component failure and wiring problems to each component, will be the same in most cases.

ITEMS INDICATED BY ENGINE WARNING LAMP

1. Engine control unit
*2. Oxygen sensor
3. Air-flow sensor
4. Intake air temperature sensor
5. Throttle position sensor
6. Engine coolant temperature sensor
7. Crank angle sensor
8. Top dead centre sensor
9. Knock sensor
10. Ignition timing adjustment signal
11. Injector

Caution: — The engine warning lamp also comes on when the terminal for ignition timing adjustment is earthed during ignition timing adjustment.

***Note — The O^2 sensor on 4 cylinder models built after February 1992 does not activate the engine warning lamp.**

Condition	Possible Cause	Corrective Action
ENGINE WILL NOT START OR HARD TO START (CRANKS OK)	Malfunction of the fuel pump drive control system.	Check the system; if there is a problem, check its component parts.
	Malfunction of the ignition control system.	Check the system; if there is a problem, check its component parts.
	Power is not being supplied to the ECU.	Check by using the MUT.
	Malfunction of the control relay.	Replace.
	Vacuum hose disconnected or damaged.	Repair or replace.
	Malfunction of the ECI-Multi system.	Check for output of diagnosis code.
	Malfunction of the injector.	• Use the MUT to check the drive signals. • Check individual parts.
	Incorrect fuel pressure.	Check the fuel pressure.
	Malfunction of the ECU.	Replace.
	Damaged or disconnected harness, or short-circuit; improper connection of the connector.	Repair or replace.
ROUGH IDLE OR ENGINE STALLS	Malfunction of the ECI-Multi system.	Check for output of diagnosis code.
	Malfunction of the injector.	• Use the MUT to check the drive signals. • Check individual parts.
	Malfunction of the idle switch.	Check by using the MUT. (Replace after checking of individual parts.)
	Vacuum hose disconnected or damaged.	Repair or replace.
	Malfunction of the ISC servo.	• Use the MUT to check the drive signals. • Check individual parts.
	Incorrect fuel pressure.	Check the fuel pressure.
	Malfunction of the fuel pressure control system.	Check the system; if there is a problem, check its component parts.
	Malfunction of the intake air temperature sensor.	Check by using the MUT. (Replace after checking of individual parts.)
	Malfunction of the inhibitor switch (Auto. only).	Check by using the MUT.
ROUGH IDLE OR ENGINE STALLS	Malfunction of the air conditioner switch.	Check by using the MUT.
	Malfunction of the vehicle speed sensor.	Check by using the MUT.

Condition	Possible Cause	Corrective Action
ROUGH IDLE OR ENGINE STALLS (CONT.)	Damaged or disconnected harness, or short-circuit; improper connection of the connector.	Repair or replace.
	Malfunction of the air-flow sensor.	Check by using the MUT.
	Malfunction of the coolant temperature sensor.	Check by using the MUT. (Replace after checking of individual parts.)
	Malfunction of the atmospheric pressure sensor.	Check by using the MUT.
	Malfunction of the motor position sensor.	Check by using the MUT.
	Intake hose to throttle body cracked or split.	Repair inlet hose.
ENGINE HESITATES OR POOR ACCELERATION	Malfunction of the ECI-Multi system.	Check for output of diagnosis code.
	Malfunction of the injector.	• Use the MUT to check the drive signals. • Check individual parts.
	Incorrect fuel pressure.	Check the fuel pressure.
	Malfunction of the air conditioner power relay control system.	Check the system; if there is a problem, check its component parts.
	Malfunction of the throttle position sensor.	• Check individual parts. • Adjust.
	Malfunction of the intake air temperature sensor.	Check by using the MUT. (Replace after checking of individual parts.)
	Vacuum hose disconnected or damaged.	Repair or replace.
	Damaged or disconnected harness, or short-circuit; improper connection of the connector.	Repair or replace.
	Malfunction of the air-flow sensor.	Check by using the MUT.
	Malfunction of the coolant temperature sensor.	Check by using the MUT. (Replace after checking of individual parts.)
	Malfunction of the atmospheric pressure sensor.	Check by using the MUT.
POOR FUEL ECONOMY	Malfunction of the oxygen sensor.	Check by using the MUT. (Replace after checking of individual parts.)
	Malfunction of the injector	• Use the MUT to check the drive signals. • Check individual parts.
	Malfunction of the ECI-Multi system.	Check for output of diagnosis code.
	Incorrect fuel pressure.	Check the fuel pressure.
	Malfunction of the fuel pressure control system.	Check the system; if there is a problem, check its component parts.

GENERAL INFORMATION

The ECI-Multi fuel injection system functions to control the air/fuel mixture optimum ratio; the engine operating conditions are determined at the electronic control unit (ECU) according to signal input from various sensors, and as a result, the injectors at the intake manifold are controlled according to driving conditions.

The ECU also controls such functions as idle speed and ignition timing.

SYSTEM COMPONENTS

Air Flow Sensor (AFS)

The air flow sensor measures the intake air volume. A Karman vortex detects the air flow rate and sends it to the ECU as the intake air volume signal. The ECU uses this signal to decide the basic fuel injection duration.

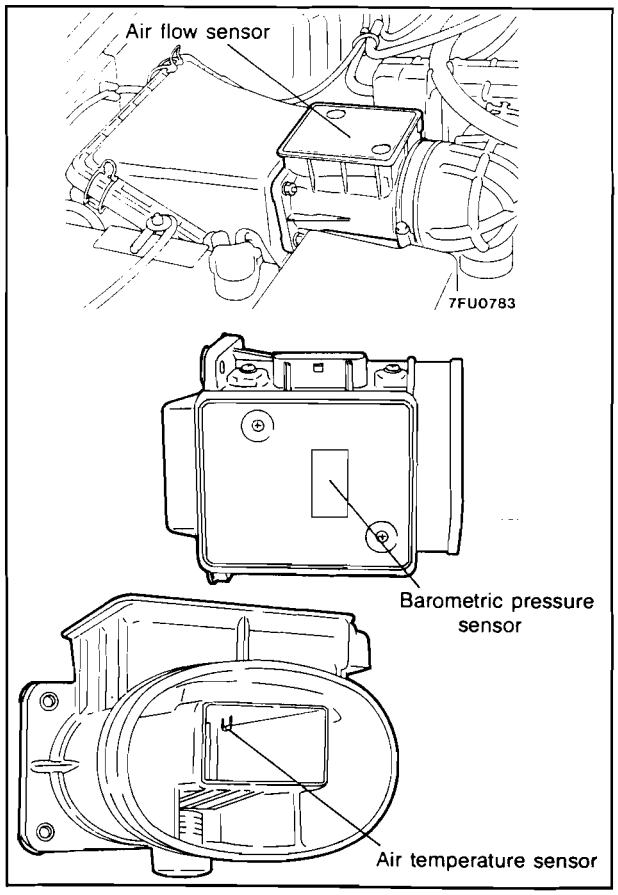


Fig. 1—Air flow sensor

Atmospheric Pressure Sensor

Housed in the AFS, it senses the atmospheric pressure which is converted to a voltage and sent to the ECU.

The ECU uses this signal to compute the altitude at which the vehicle is running and adjusts the air/fuel ratio and ignition timing accordingly.

Intake Air Temperature Sensor

The intake air temperature sensor, also located in the AFS, is a resistor-based sensor for detecting the intake air temperature. The amount of fuel injected is controlled by the ECU according to the temperature signal received.

Throttle Position Sensor (TPS) (With Built-in Idle Position Switch)

The TPS is a rotating type variable resistor that rotates together with the throttle shaft, to sense the throttle valve angle. As the throttle shaft rotates, the output voltage of the TPS changes and the ECU detects the throttle valve opening, based on the change of the voltage.

Based on this output voltage, the ECU computes throttle valve opening change (output voltage change) and judges the engine acceleration state and adjusts fuel injection accordingly.

When closing the throttle valve, the movable contact and the ground terminal first make electrical contact immediately before the throttle lever touches the fixed SAS (throttle stop screw), thus turning on the idle position sensing terminal. This allows the engine control unit to determine whether the accelerator pedal is being operated or not.

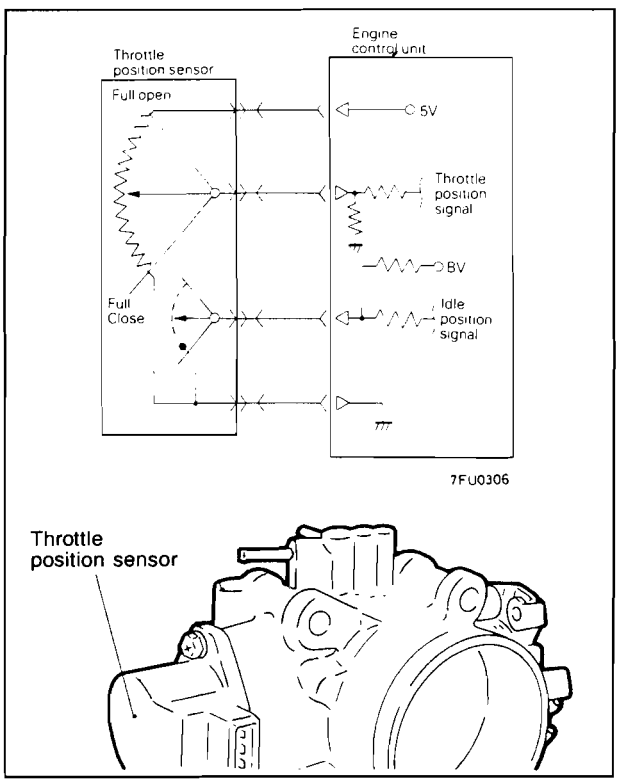


Fig. 2—Throttle position sensor

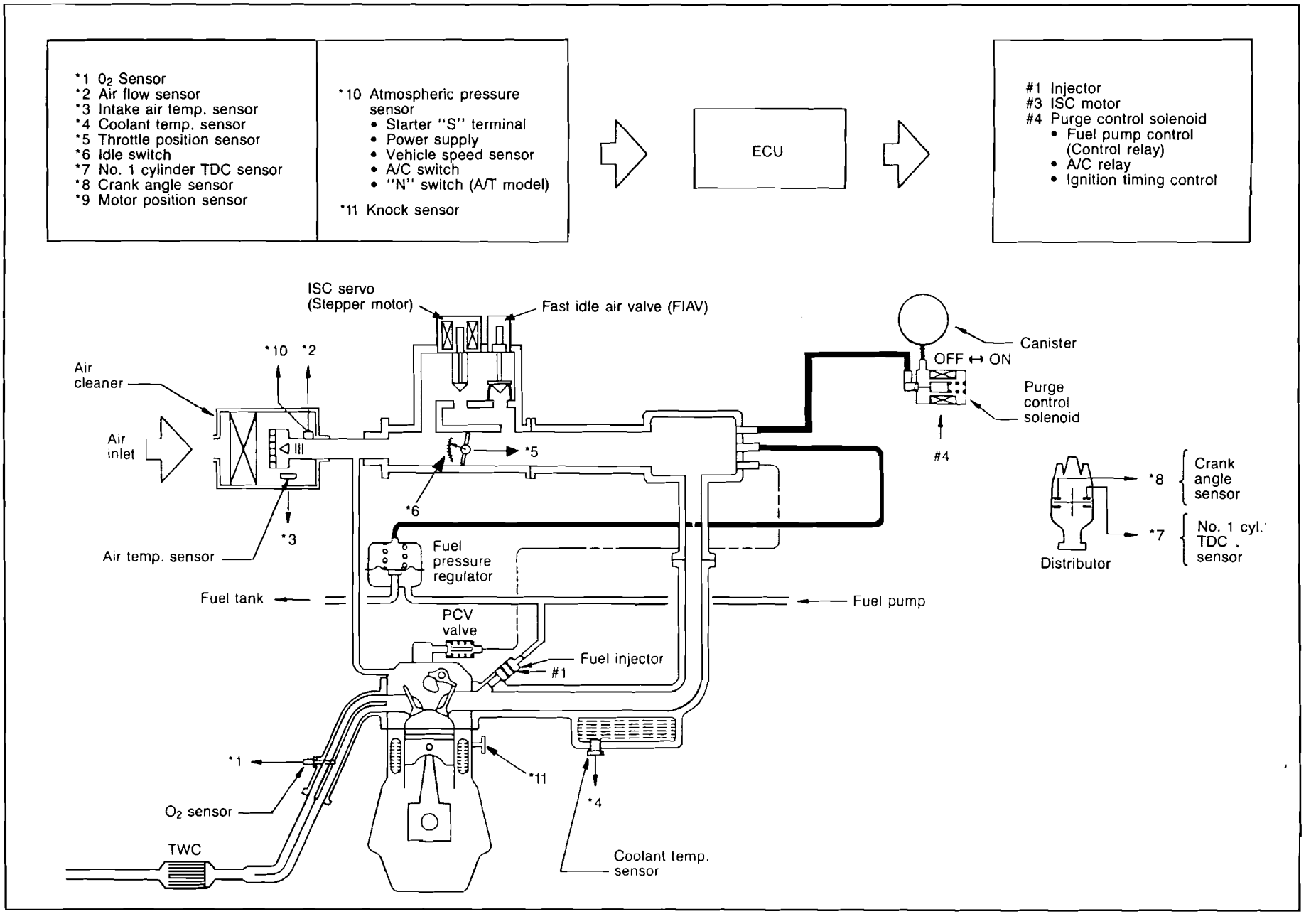


Fig. 3—Schematic ECI—Multi system—4 cyl. models

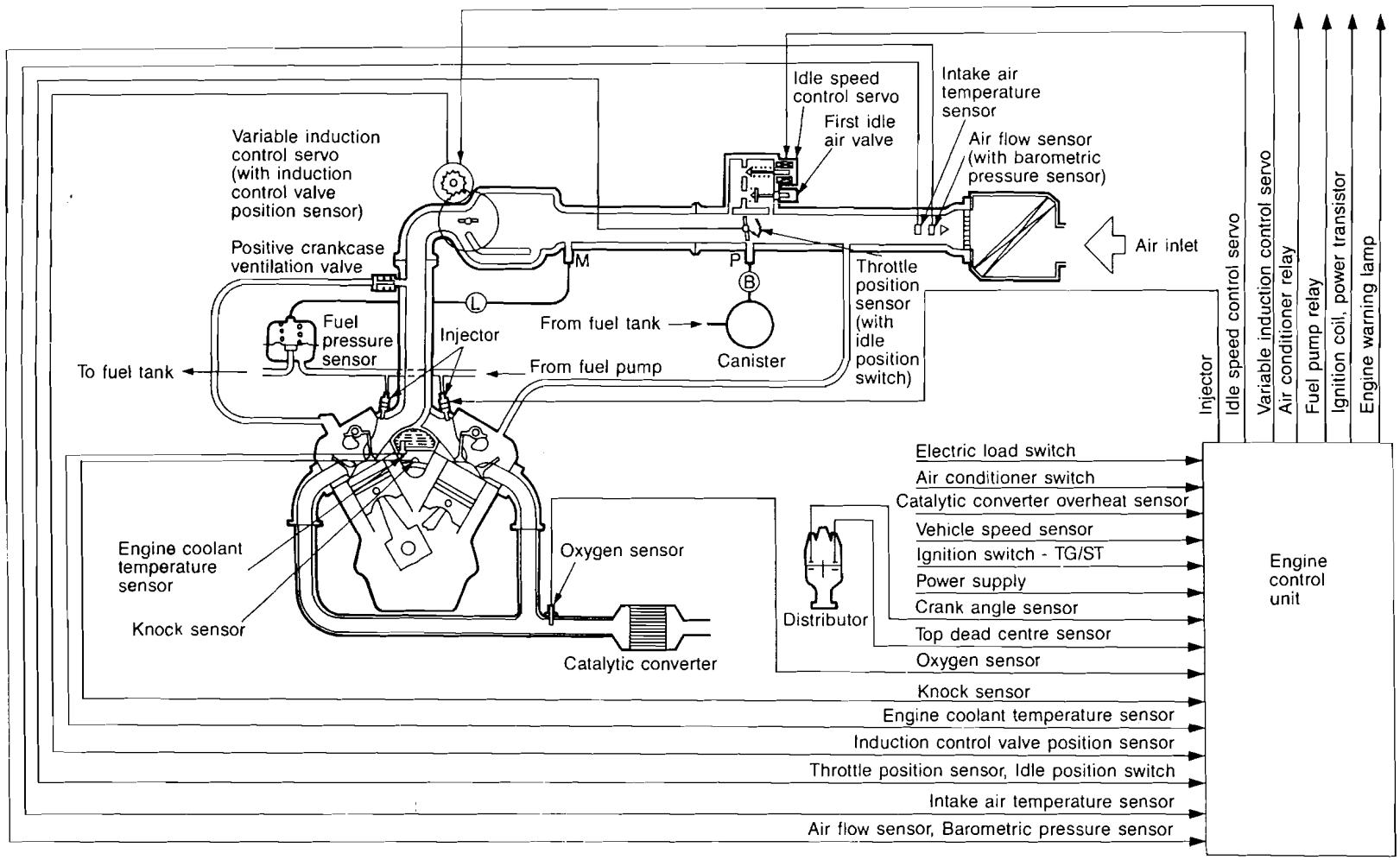


Fig. 4—Schematic ECI—Multi system—V6 models

Idle Speed Control Servo

The idle speed control servo, consisting of a step type motor and pintle and is mounted on the throttle body.

As the motor operates, the pintle extends or retracts to control the by-pass air flow, thus controlling engine speed.

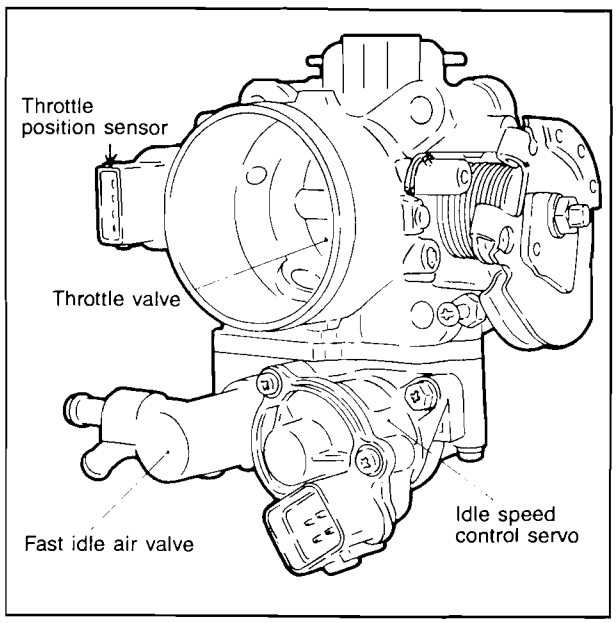


Fig. 5—Idle speed control servo

The step type motor, is a motor that rotates at a fixed angle when an electric pulse is applied. The rotor of the stepper motor rotates 15° whenever a pulse is applied.

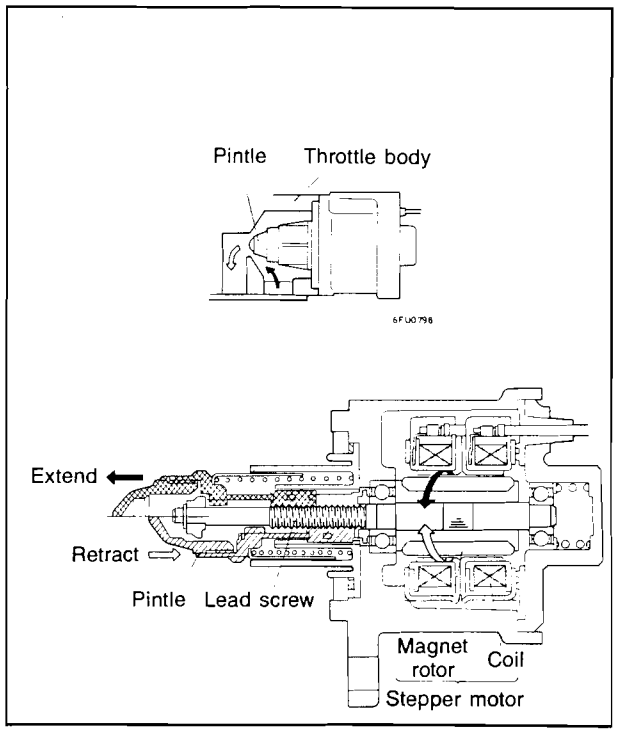


Fig. 6—Idle speed control servo components

The pintle meshes with the lead screw on the magnet rotor shaft. When the rotor rotates in the direction of the outlined arrow, refer Fig. 6.

The lead screw causes the pintle to retract towards the interior of the motor. When the rotor rotates in the diretion of the solid arrow, the pintle extends.

The rotor rotates in either direction by angular step increments, corresponding to the number of pulses coming from the engine control unit, causing the pintle to extend or retract.

As this occurs, the gap it forms between the seat changes, controlling the by-pass air flow.

Stepper Motor

The stepper motor consists of a rotor, which is a series of magnetic laminations and two stators, each of which contains two coils.

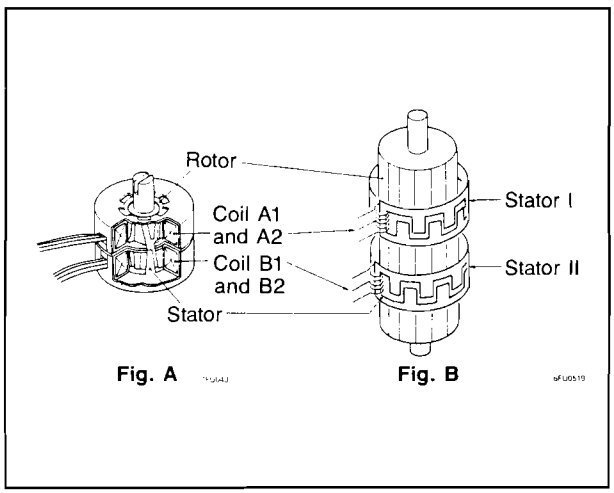


Fig. 7—Stepper motor

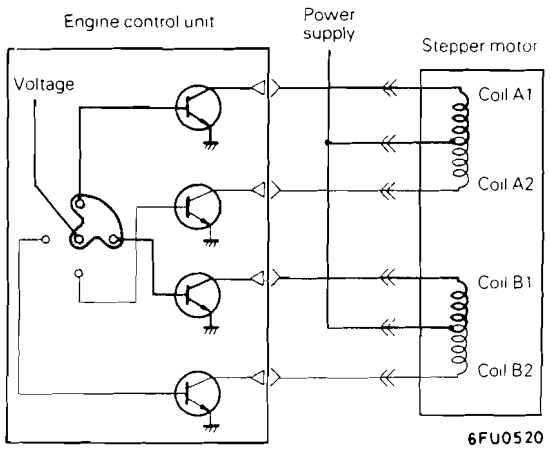
The coils are powered by battery voltage via the control relay, grounding of the coils is controlled by ECI computer.

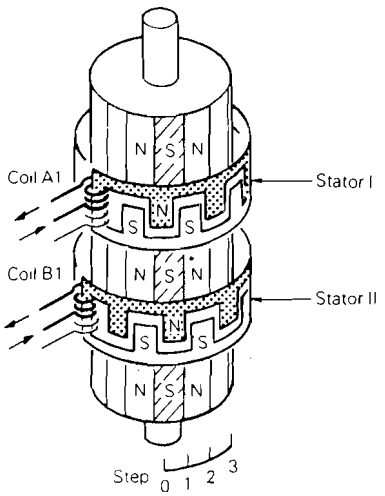
When the coil circuits are energised, a magnetic field is created in the stators. The stators magnetic field then either repels or attracts the magnetic laminations of the rotor. In this manner the rotation of the rotor is controlled in steps, each step is 15° of rotation.

Stepper Motor Operation (Step 1)

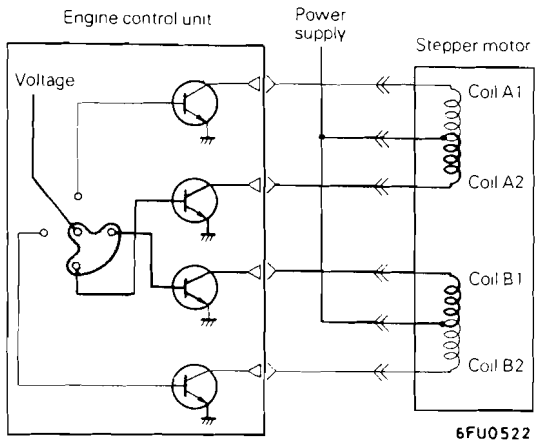
(1) Refer Fig. 8. In this condition when coils A1 and B1 are energised, the upper halves of stators I and II are N. poles, and their lower halves are S. poles. Thus their N. poles and S. poles attract the S. poles and N. poles of the rotor magnets, respectively and the rotor is held stationary.

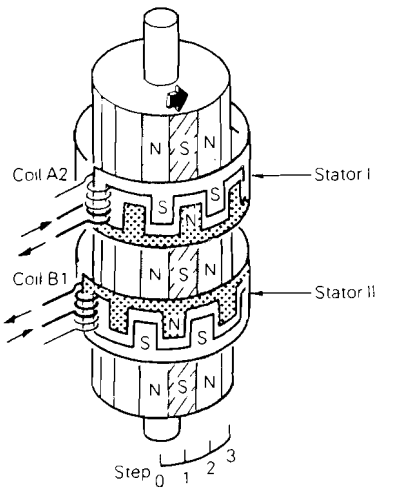
STEP 1.



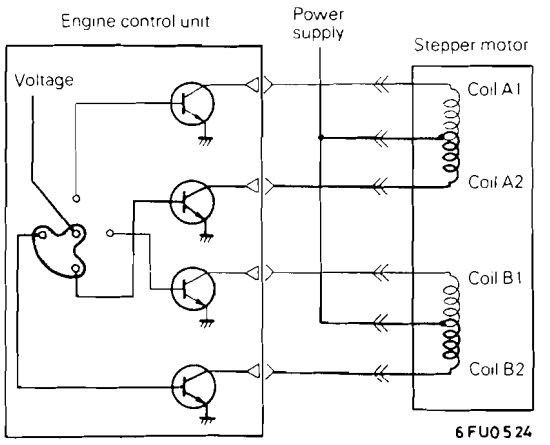


STEP 2.





STEP 3.



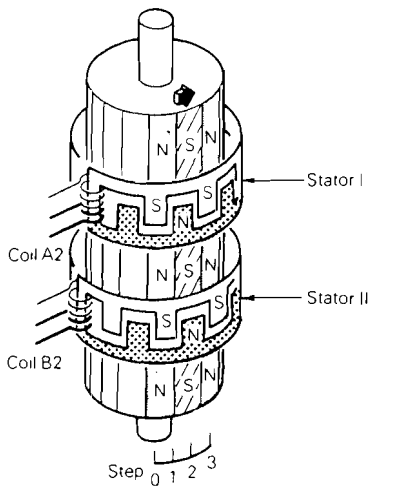


Fig. 8—Stepper motor operation

(2) Refer Fig. 8 - Step 2 when coil A2 is energised instead of coil A1, the lower half of stator 1 becomes an N. pole. This means that the N. pole is moved one step to the right compared to the condition in step 1. As a result the S. pole of the rotor is attached to the N. pole of the stator and the rotor moves one step to the right.

(3) Refer Fig. 8 - Step 3 when coil B2 is energised instead of coil B1, the lower half of stator II becomes an N. pole. This means that the N. pole is moved one step to the right.

Engine Coolant Temperature Sensor

The sensor, installed in the engine coolant passage of the intake manifold, is a resistor-based sensor. The ECU judges engine warm-up state by the sensor output voltage, and provides optimum fuel enrichment when the engine is cold.

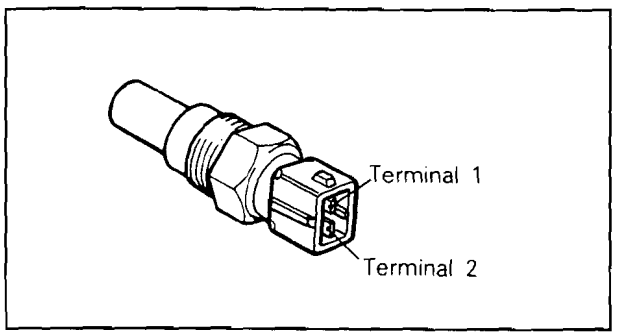


Fig. 9—Engine coolant temperature sensor

Fast Idle Air Valve

The fast idle air valve is a wax pellet actuated valve. The engine coolant circulates around the wax pellet, causing the air valve to be forced out as the coolant temperature increases thus decreasing the bypass air flow rate.

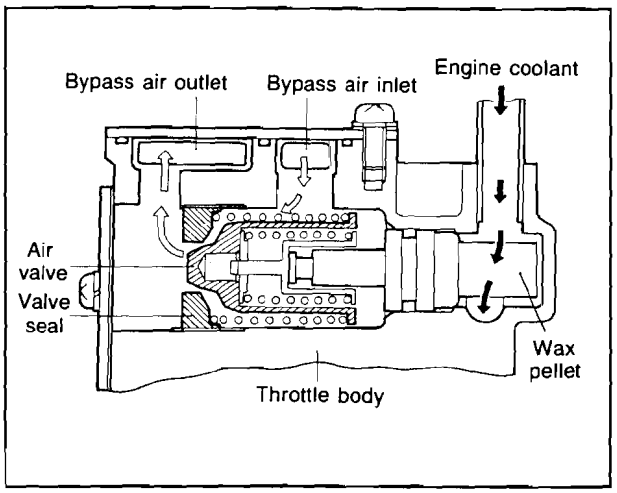


Fig. 10—Fast idle air valve

Fixed SAS (Throttle Stop Screw)

When the accelerator pedal is released causing the throttle valve to be closed, the throttle valve is held at a slightly open position so that it will not damage the bore.

NOTE: This screw has been factory-set and MUST NOT be adjusted.

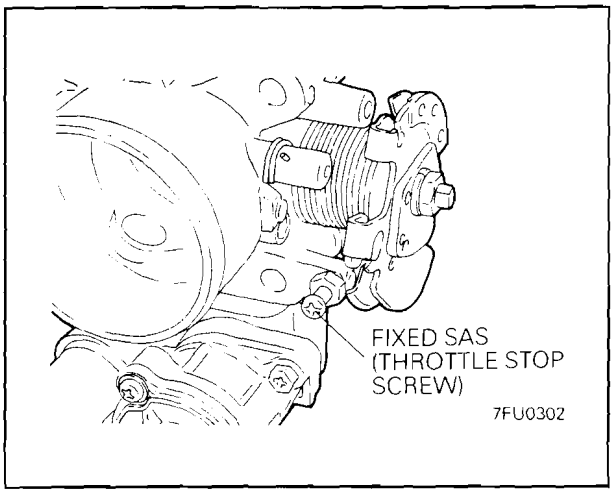


Fig. 11—Throttle stop screw (SAS)

Idle Speed Adjusting Screw

The idle speed adjusting screw is an air by-pass type. Rotating the screw anti-clockwise increasesthe air supply which results in an increased engine speed.

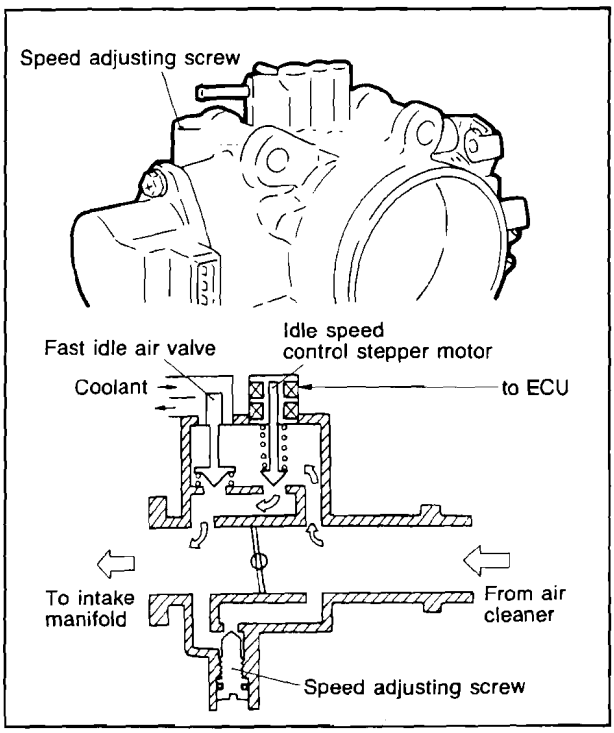


Fig. 12—Idle speed adjusting screw

Crankshaft Angle and No. 1 Cylinder Sensors (4 cylinder models)

These sensors are the Hall generator type. Two Hall generators are located on the base plate in the distributor and a metal trigger disc is located on the distributor shaft.

The disc has four castellations (triggers) on the outside diameter which are spaced 90 degrees apart. These triggers are for engine crank angle detection and engine speed detection.

A single trigger is located inboard of the others and is used for No. 1 cylinder detection.

When the ignition is switched ON, the Hall generator is powered. Because of a magnet located in the Hall generator, a signal voltage called a Hall voltage is generated (the voltage is very small—in the milli volt range). When the trigger passes through the generator, it diverts the magnetic field which causes the Hall voltage to virtually drop to zero.

In this manner, the ECU receives a signal from the outer generator for crank angle position and the inner generator for No. 1 cylinder detection.

The leading edge of each crank angle trigger is the point where fuel injection begins. The trailing edge is the basic ignition timing position. The gap between the leading and trailing edge is equivalent to 70 degrees of crankshaft rotation i.e. basic timing = 5° BTDC, leading edge = 75° BTDC.

NOTE: If basic ignition timing is set incorrectly, the beginning of fuel injection will also be affected.

The crank angle position is used by the ECU to determine:-

- The start of fuel injection
- The sequence of fuel injection
- The ignition spark advance
- Engine speed

The No. 1 cylinder sensor signal is used to reference the crank angle sensor relative to No. 1.

This is required in order to facilitate sequential fuel injection after start up.

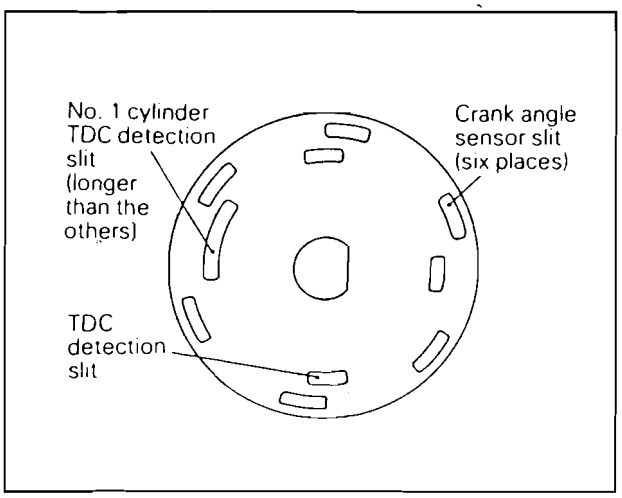


Fig. 13—Crank angle & TDC sensor disc

The disc is secured on the distributor shaft and it rotates as the distributor rotates.

The sensor unit has two LED's and two photo diodes used to detect the crank angle sensor slits and top dead centre sensor slits.

The disc rotates between the LED's and the photo diodes. Each time a slit comes between an LED and photo diode pair, the light emitted by the LED reaches the photo diode by passing through the slit.

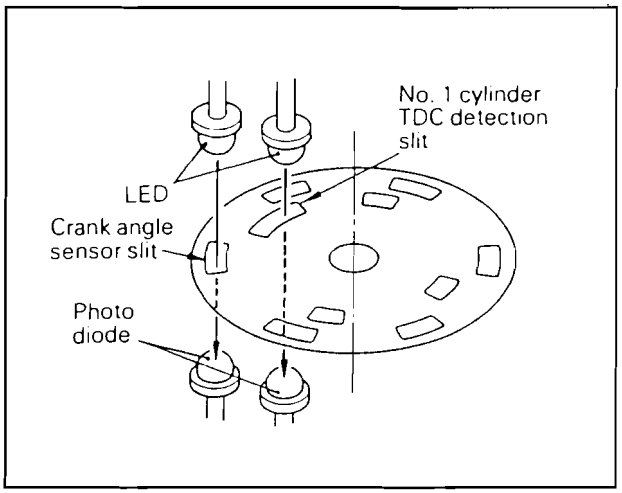


Fig. 14—LED and photo diode

When exposed to light the photo diode conducts current in a direction opposite to an ordinary diode. As a result, current flows in the direction indicated by the arrow and dotted line, refer Fig. 15, and a voltage (5 volts) is applied to the comparator of the sensor unit so that the terminal voltage of the engine control unit becomes 5 volts.

When the disc rotates further and the slit moves beyond the space between the LED/photo diode pair, the light can no longer reach the photo diode, thus the current indicated by the dotted line ceases to flow and the terminal voltage of the engine control unit becomes 0 volts, refer Fig. 15.

Crankshaft Angle and TDC Sensors (V6 models)

The crank angle sensor, built into the distributor consists of a disc and sensor unit. The disc, made of metal, has 6 slits located 60 degrees apart on its periphery and 4 slits located 90 degrees apart inside the peripheral slits.

The inner slits are used by the top dead centre sensor that detects the top dead centre of each cylinder.

NOTE: The slit for detecting TDC of No. 1 cylinder is longer than the three remaining slits.

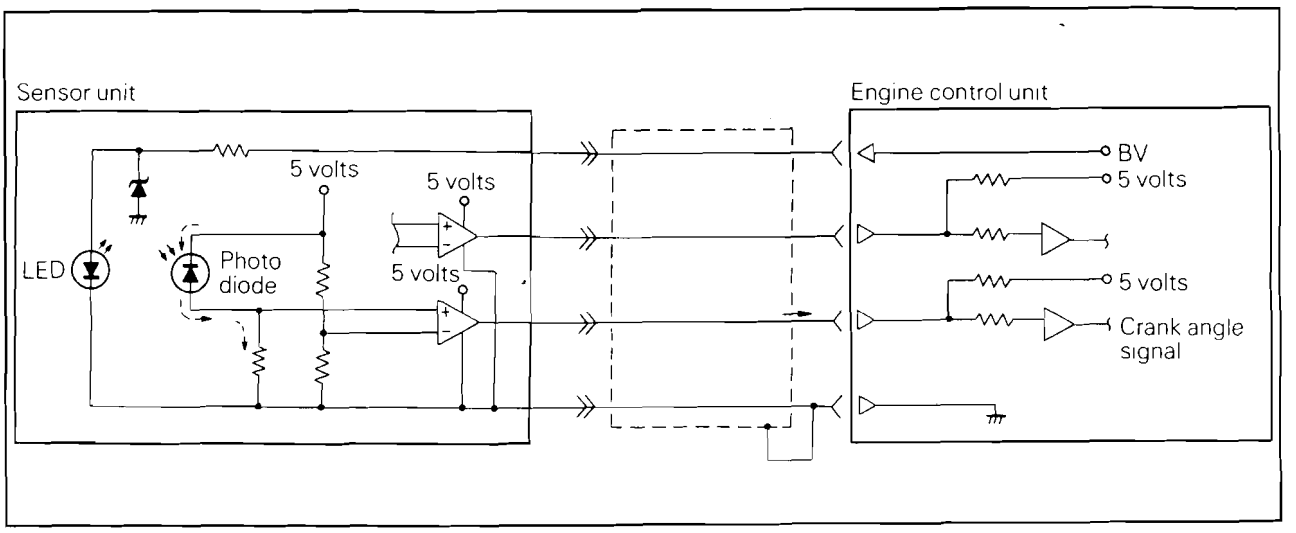


Fig. 15—L.E.D. photo diode sequence

In this way, pulse signals are sent to the engine control unit from the sensor unit.

Oxygen Sensor

The oxygen sensor, installed in the exhaust senses the oxygen concentration in the exhaust gas and feeds back a signal to the ECU. The ECU then judges if the air-fuel ratio is rich or lean as compared to the reference ratio and provides feedback data. The ECU uses this data under certain operating conditions to adjust the air/fuel ratio. This in turn allows the under floor catalytic converter to purify the exhaust gas to an optimum level.

NOTE: 4 cylinder, is single wire type.

NOTE: V6, has a four wire heated type, pre-heated during operation to have wider operating limits, with voltage isolation from stray current.

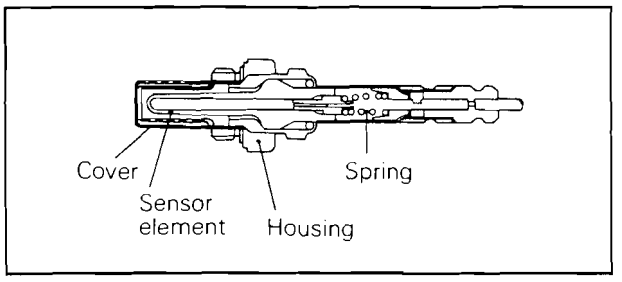


Fig. 16—Oxygen sensor (typical)

Vehicle Speed Sensor

A reed switch is built into the speedometer.

The ECU uses signals from the sensor to calculate road speed.

Inhibitor Switch (Automatic models)

The switch detects whether the select lever is positioned at N or P positions. Based on this signal, the ECU senses the transaxle load and drives the ISC servo to maintain optimum idle speed.

Air Conditioner Switch (where fitted)

With the air conditioner turned ON, a signal is sent to the ECU which drives the ISC servo to maintain the optimum idle speed.

Injectors

The injector, which is an injection nozzle with a solenoid valve, injects fuel based on the injection signal from the ECU. The injectors are installed in the intake port of each cylinder and are clamped by the delivery pipe. When the solenoid coil is energised, the plunger is attracted. The needle valve, integral with the plunger, is pulled to the fully open position and fuel is injected through the open valve.

As the nozzle opening and fuel pressure is fixed, the injection amount is determined by the duration the needle valve is open, i.e. the time the solenoid coil is energised by the ECU.

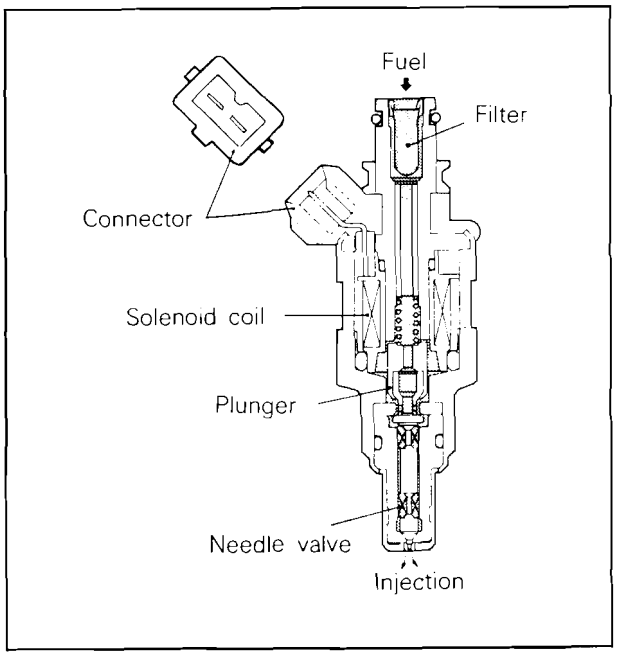


Fig. 17—Fuel injector

Knock Sensor

This sensor detects if detonation (knock) is occurring. An engine with a knock sensor prevents detonation by providing a retard control for the ECU, using signals sent from the sensor as it detects detonation.

A piezoelectric element is used for the sensor that converts the magnitude of engine vibrations into corresponding electrical (voltage) signals.

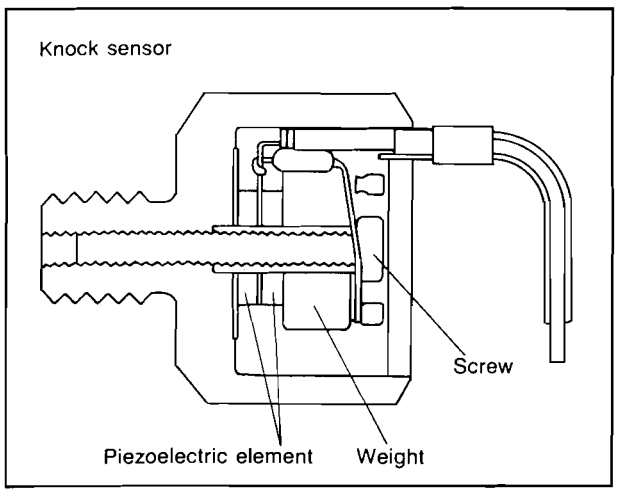


Fig. 18—Knock sensor

Variable Intake Control Servo (VIC)

The VIC servo consists of a DC motor, flat gear, worm gear and worm wheel. When the motor revolves according to the signal from the engine control unit, the intake control valve opens and closes depending on the direction of rotation of the motor.

The ECU controls the DC motor drive IC in the unit and opens and closes the variable intake control valve.

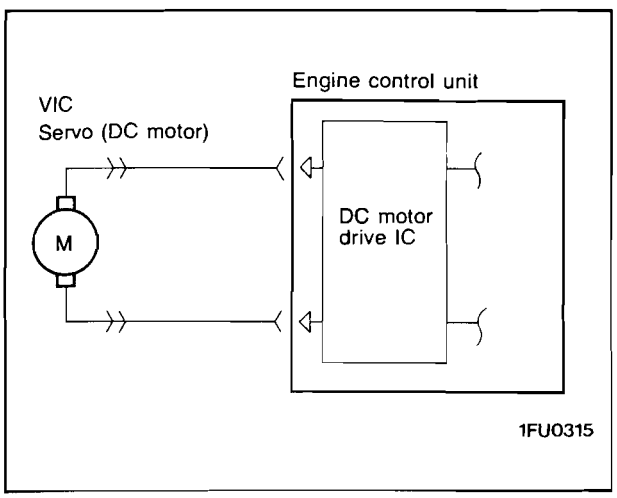


Fig. 19—Variable intake control servo

Intake Control Valve Position Sensor

The intake control valve position sensor, is built into the variable intake control servo and inputs valve position sensor to the engine control unit.

The ECU performs the valve opening and closing control by using this signal. The ECU drives the intake control valve once to a fully closed position (position where it hits the stopper), when the ignition switch is turned ON to perform the initial setting.

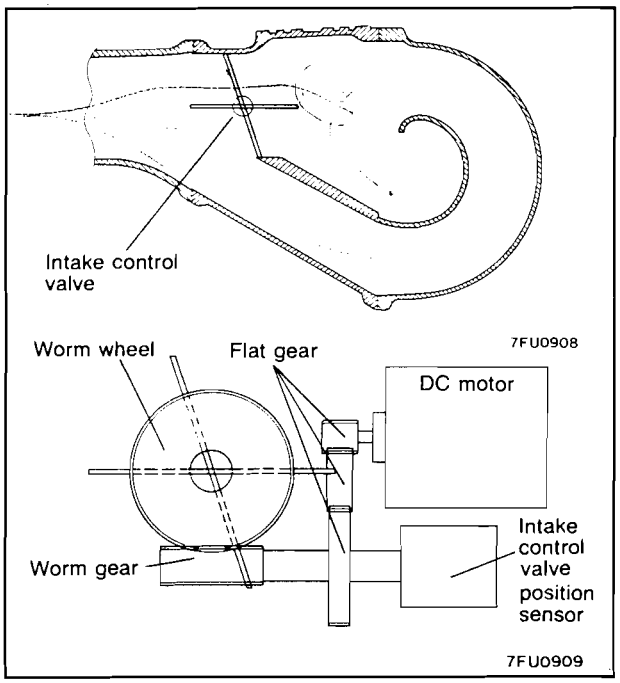


Fig. 20—Intake control valve position sensor

Fuel Pressure Regulator

The regulator always maintains the injector fuel pressure at a level 330 kPa higher than the manifold pressure. By doing so the fuel injection amount is kept constant even when the manifold pressure changes. The spring chamber is connected by vacuum hose to the surge tank so that manifold vacuum acts upon the spring chamber. Therefore, when fuel pressure becomes higher than the spring tension minus manifold vacuum, the diaphragm is forced up. The return fuel flow rate back to the tank then increases maintaining the required delivery pipe fuel pressure.

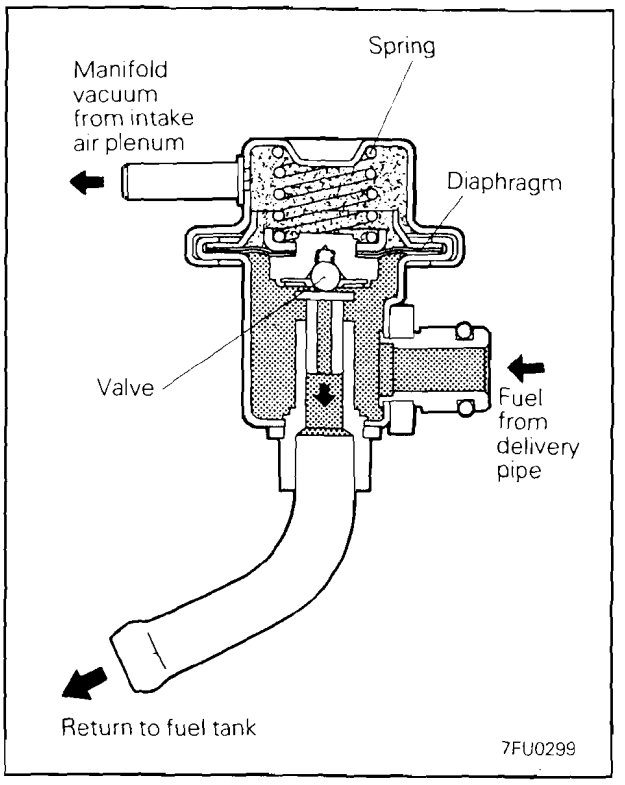


Fig. 21—Fuel pressure regulator (typical)

Power Transistor

The power transistor attached to the coil is controlled by the ECU, its function is to complete the ignition coil's primary circuit to ground, taking the place of conventional points.

When the ECU signals the power transistor, it completes the ignition coil primary circuit to ground, i.e. points closed in a conventional system. When not signalled, the transistor interrupts the ignition coil primary current and high voltage is induced in the coil secondary circuit.

The ECU, via the various sensors, can determine the ignition advance required and controls ignition timing by operating the power transistor.

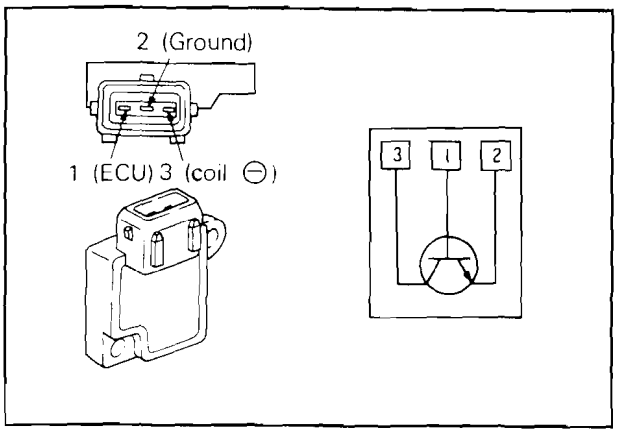


Fig. 22—Power transistor

Ignition Coil

The negative primary terminal of the coil is connected to the ECU through the power transistor. The coil is of the closed magnetic circuit type and is superior to the conventional oil immersed type, by being light and small, resistant to heat and vibration and no restriction with installation.

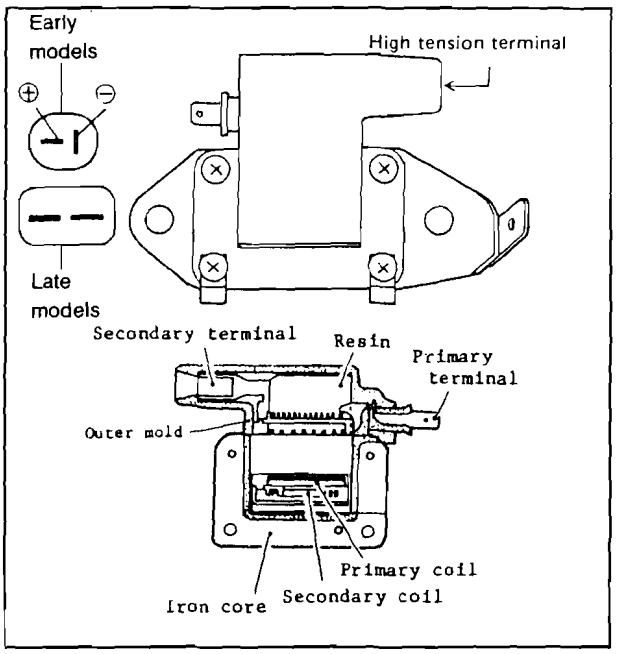


Fig. 23—Mold type ignition coil

Air Conditioner Relay

When the air conditioning is switched on while the engine is at idle, the ECU controls the relay to allow the ISC servo to increase engine speed prior to compressor operation. On automatic transmission models during acceleration (with more than 74° throttle opening), the ECU cuts the relay circuit for 5 seconds to maintain acceleration performance.

Purge Control Solenoid (4 cylinder models only)

The purge control solenoid is connected into the carbon canister vent hose to the surge tank. If the solenoid is OFF, the canister fumes cannot be purged into the engine. If the solenoid is ON, the canister fumes are purged.

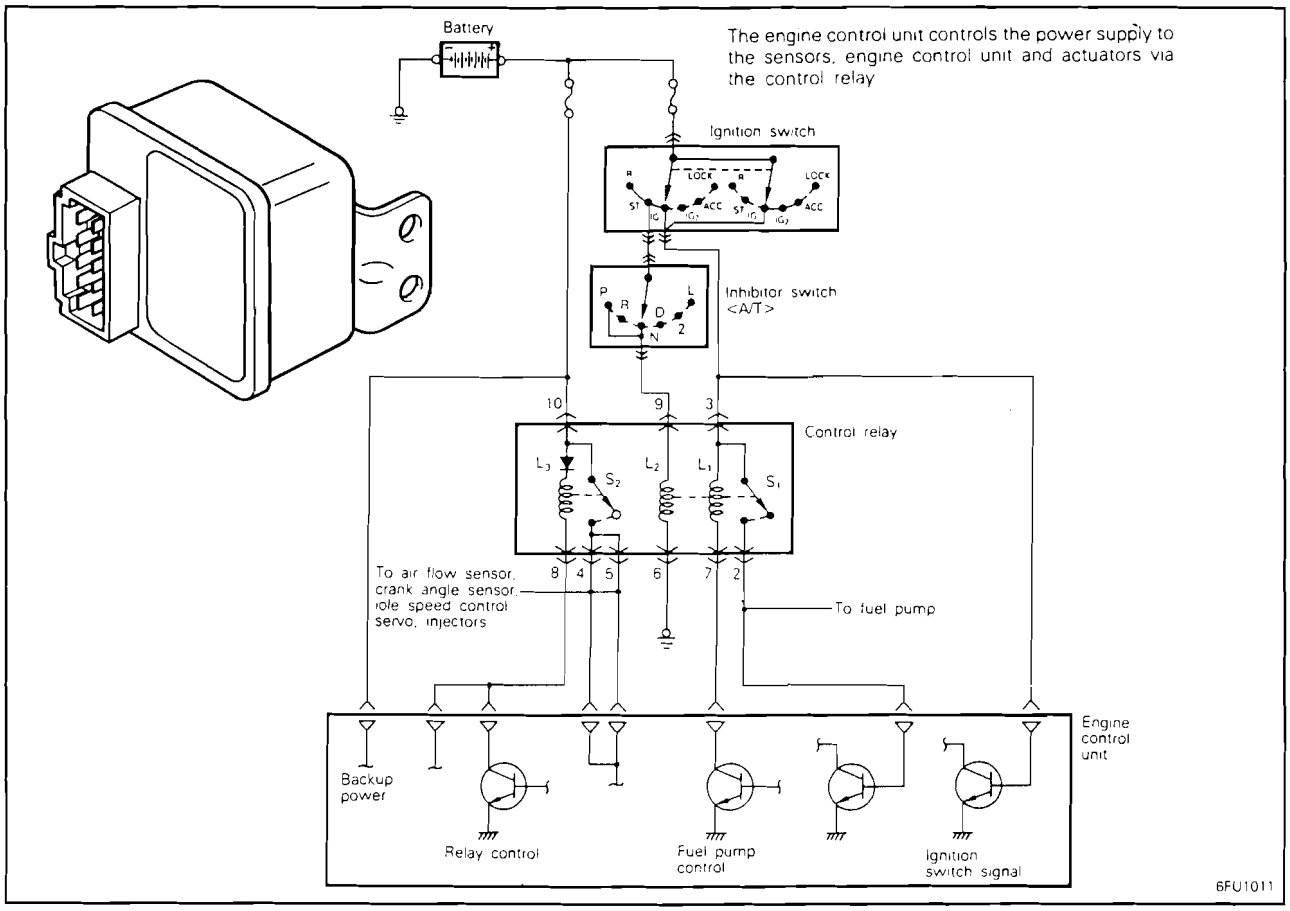


Fig. 24—Control relay

The solenoid is controlled by the ECU and is switched ON when the engine is warm, at idle, with air conditioning ON and also, operating above idle speed.

NOTE: When the engine is operating in oxygen sensor feed back mode, the solenoid switches OFF every 3 minutes for 20 seconds.

Control Relay

The relay is a twin contact, three coil type which performs several power supply functions only one of which is controlled by the ECU.

The relay operates as follows:-

- With the ignition switch in the ON position, the air flow sensor, ECU, stepper motor and injectors are powered.

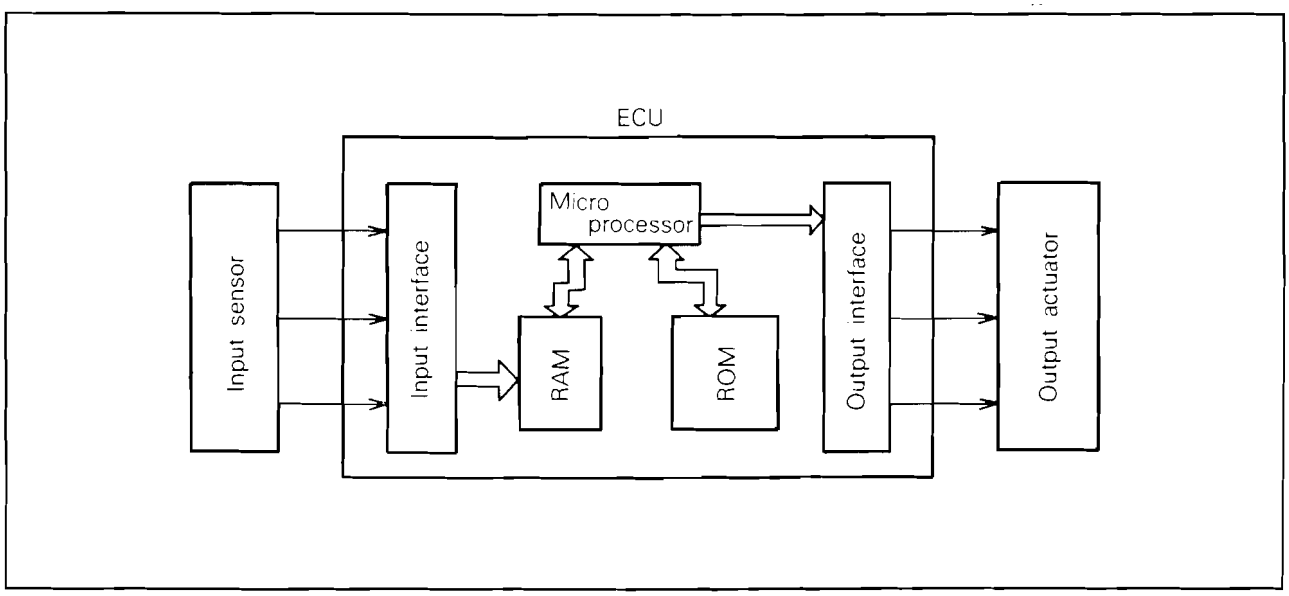


Fig. 25—ECU operation

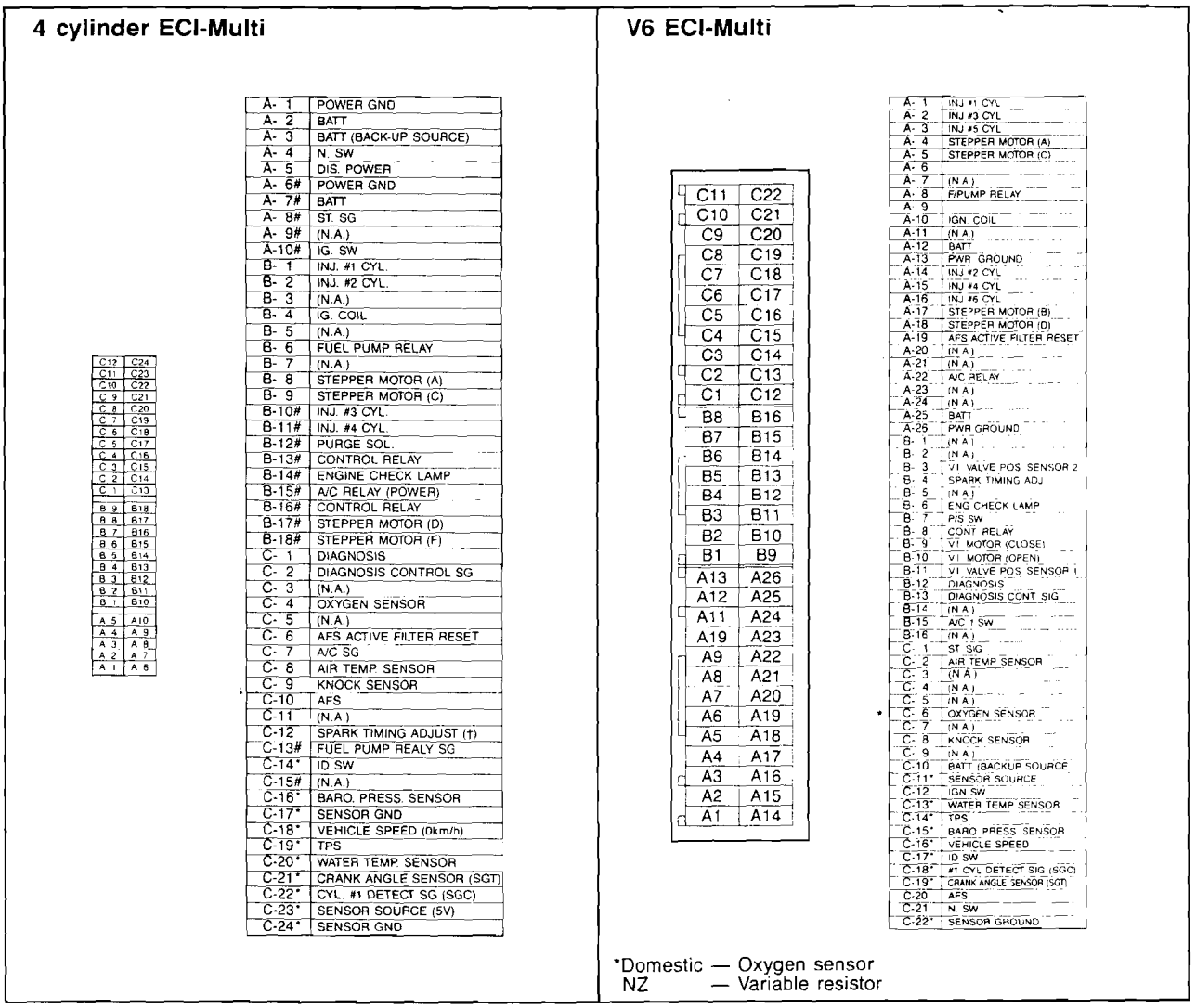


Fig. 26—ECU terminal designation

• With the ignition switch in the START position, the fuel pump is powered and stays powered unless the ignition is switched OFF, or the engine stalls/stops.

Electronic Control Unit (ECU)

Based on information from various sensors the ECU determines (computes) an optimum control for varying operating conditions and accordingly drives the output actuators.

The ECU consists of an 16-bit micro-processor, random access memory (RAM), read only memory (ROM) and input/output (I/O) interface.

SYSTEM OPERATION

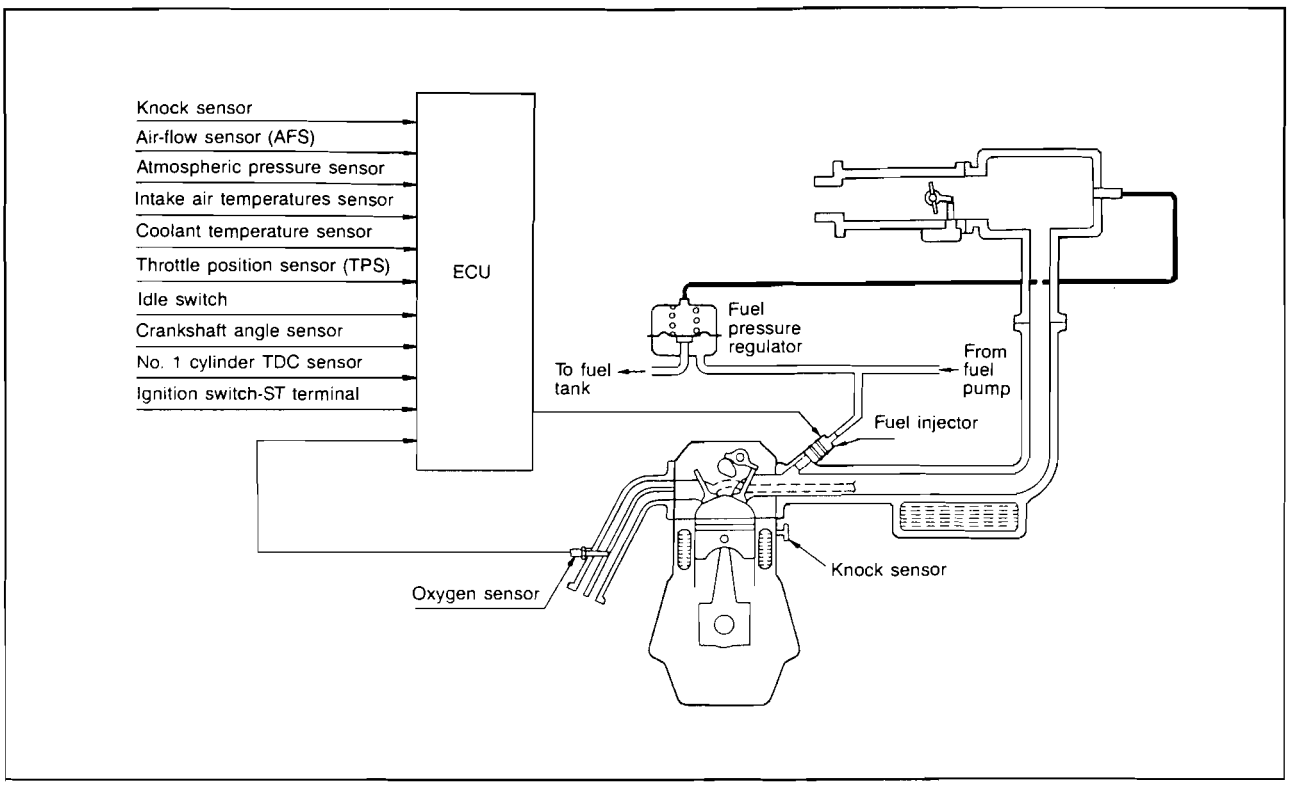


Fig. 27—Fuel injection system (4 cylinder models)

Fuel Injection System

The air/fuel ratio is achieved by controlling the driving time of each injector installed in the manifold.

The electric fuel pump supplies fuel via the two filters to the delivery pipe and injectors. The pressure regulator in conjunction with the fuel pressure solenoid, maintains the system at a required pressure level (330 kPa) above manifold pressure. Excess fuel is returned back to the tank via the return pipe. When the injector is energised, the valve inside the injector opens fully to inject the fuel.

Since the fuel pressure across the injectors is kept at a fixed level, supply of fuel injected into the intake manifold varies with the energised time of the injectors.

The injectors, inject fuel into each manifold port, in the firing order of each cylinder, according to the ECU signals.

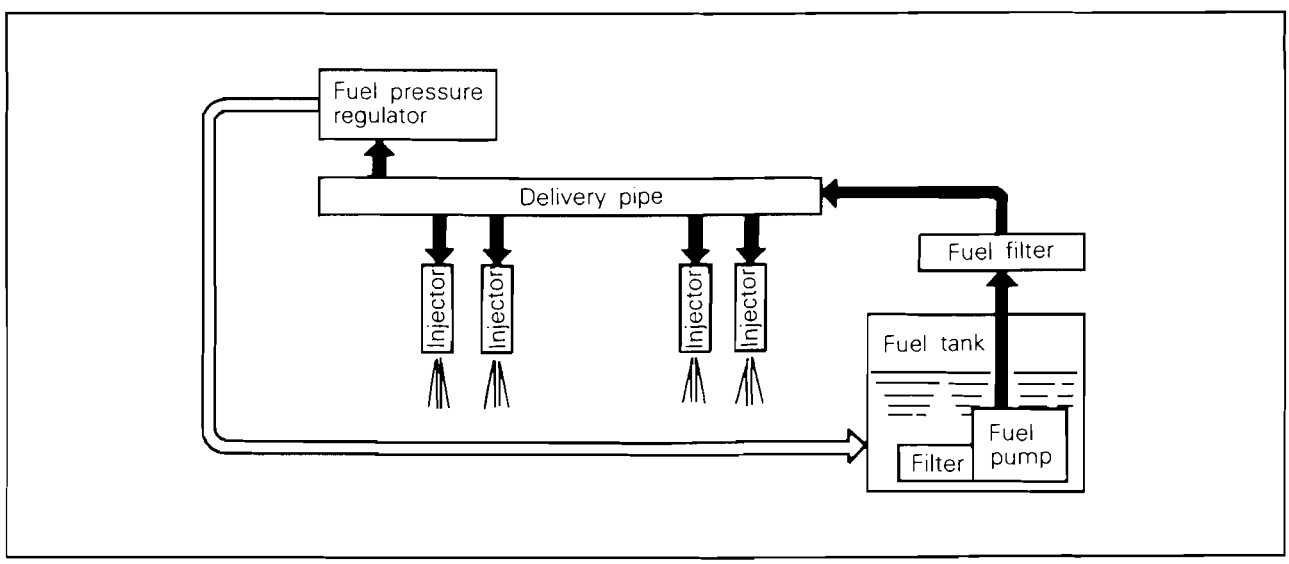


Fig. 28—Fuel system (4 cylinder models)

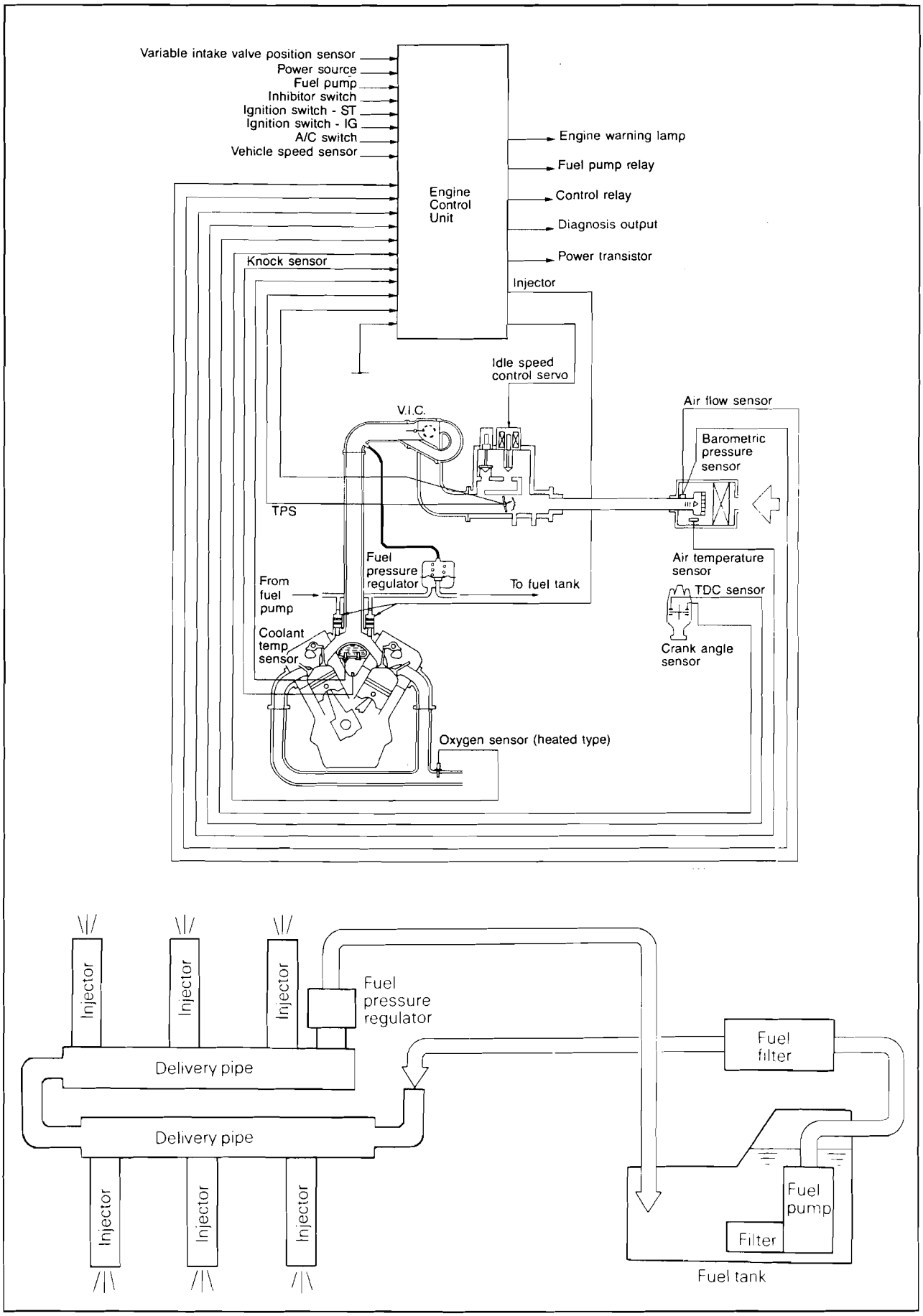


Fig. 29—V6 fuel injection system

Injector Drive Timing

Simultaneous Injection (non-synchronous)

During engine starting (cranking), there are two fuel injections (for each engine revolution) simultaneously for all the cylinders. In addition, when under acceleration, a number of 10 millisecond injections proportionate to the magnitude of acceleration is injected to two cylinders on the intake and exhaust strokes.

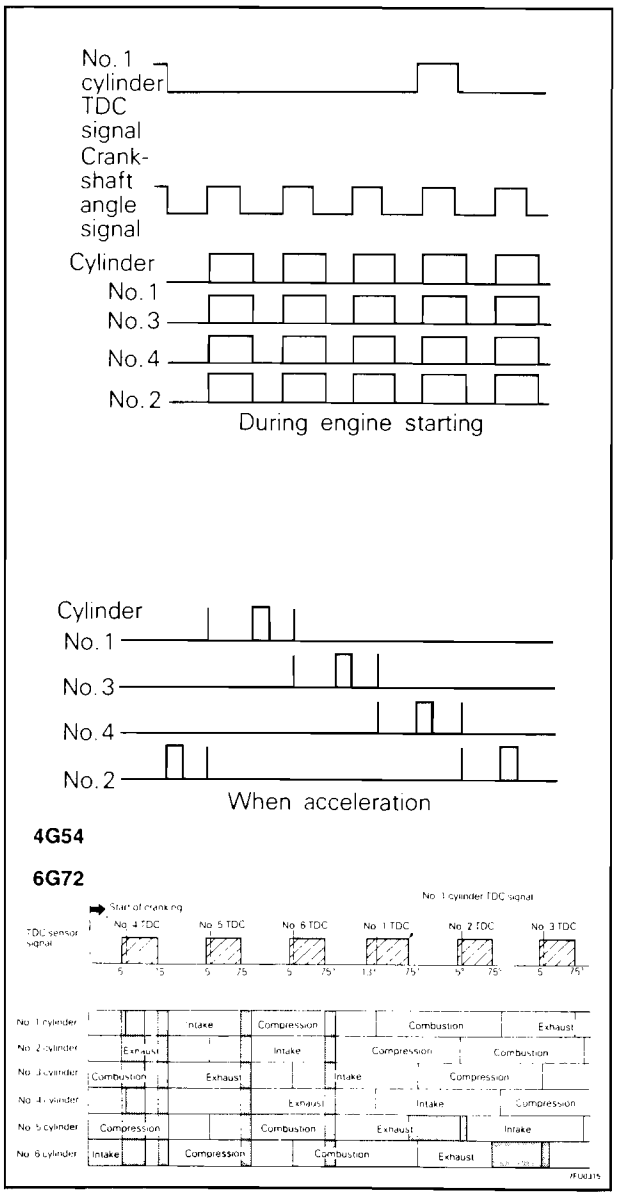


Fig. 30—Simultaneous injection sequence

Sequential Injection (synchronous)

After the engine is started and No. 1 cylinder sensor is signalled, the injectors are activated 75° before TDC of the inlet stroke. Injection is synchronised to the signals of the crank angle sensor.

The No. 1 cylinder sensor signal is used to reference the crank angle sensor signals and all sequential injection.

Injector drive time is determined by the ECU, based on the intake airflow rate and engine speed. This is then modified using various corrections which are stored in the ROM.

Having calculated the basic drive time, the ECU then uses the data from various sensors to adjust the drive time for the following conditions:-

- Oxygen sensor feedback. The ECU makes minor adjustments as indicated by the oxygen sensor. The sensor operates by sensing a rich or lean condition and the air fuel ratio must oscillate for it to function. Its output data is monitored by the ECU which varies the drive time to ensure such an oscillation (an extremely small air fuel variation which is not detectable by the vehicle operator).
- Warm up enrichment. To provide optimum vehicle driveability in all conditions of engine temperature, the drive time is altered according to the coolant temperature.
- After cranking enrichment. For a short time after cranking, the drive time is modified to ensure smooth running.

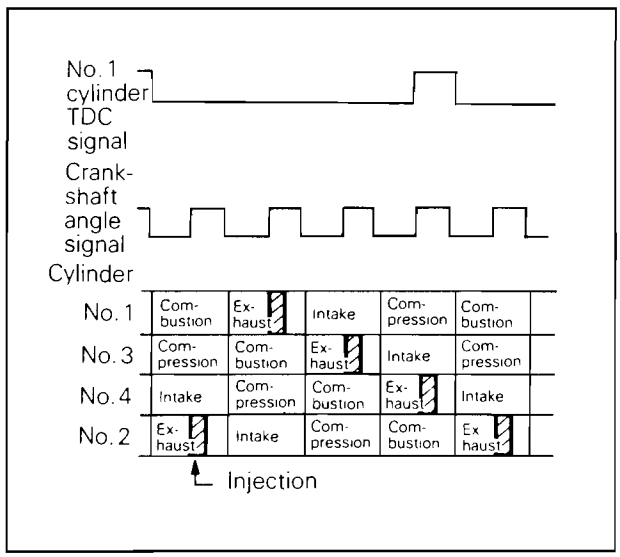


Fig. 31—Sequential injection sequence

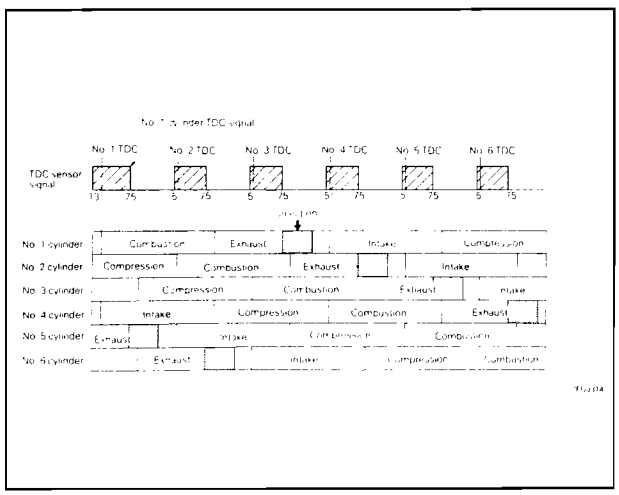


Fig. 32—Injection sequence V6 (sequential)

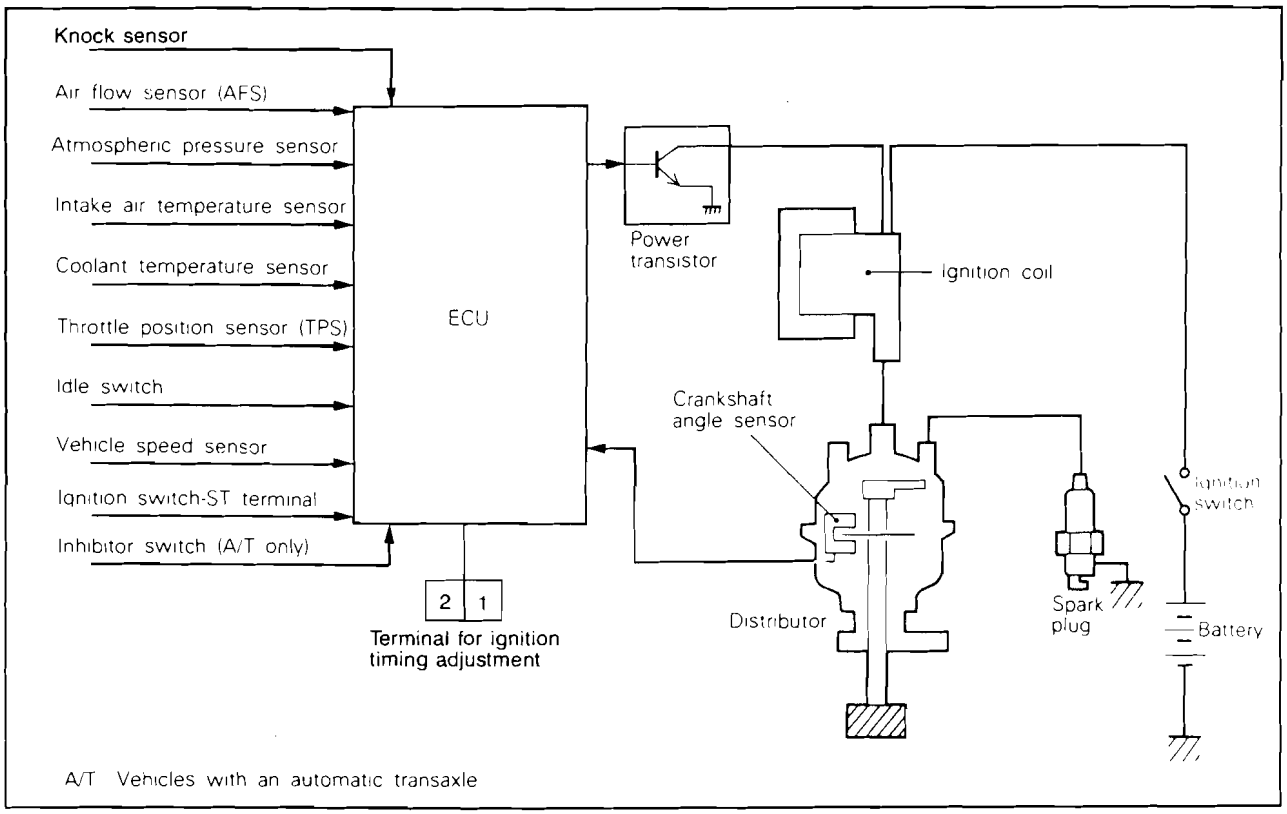


Fig. 33—Ignition timing control 4 cylinder models

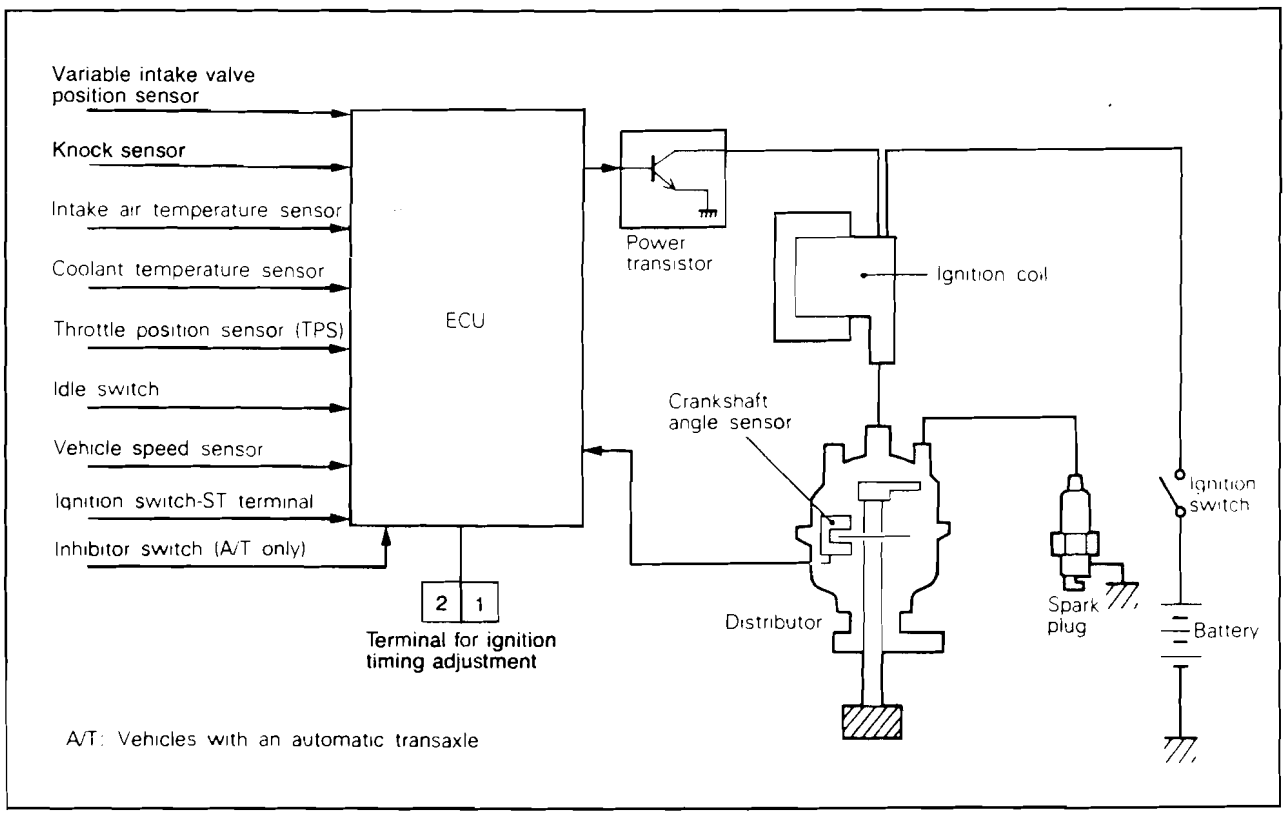


Fig. 34—Ignition timing control V6 models

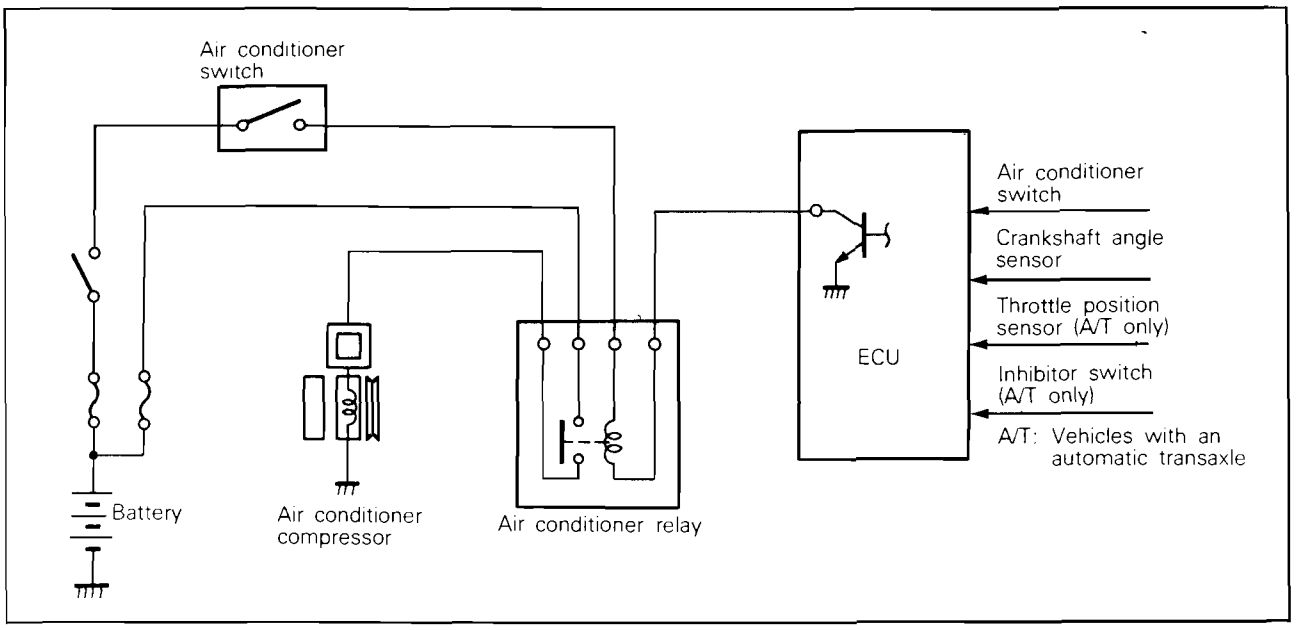


Fig. 35—Air conditioner relay control system

• Intake air compensation. The fuel requirements of the engine vary with intake air temperature and signals to the ECU to allow compensation for the temperature changes.

• Atmospheric pressure compensation. Correction for barometric pressure is made to allow for atmospheric and attitude changes.

• Acceleration/deceleration. Correction is made based on the variation in intake air flow, to engine rpm.

• Dead time compensation. The rise and fall times of the injectors vary with battery voltage and is compensated for, as the voltage rises or falls.

Ignition Timing Control System

The system controls the ignition timing by making the ignition coils primary current intermittent, by ON/OFF control of the power transistor.

During engine cranking, there is synchronisation to the crankshaft angle sensor signals resulting in a fixed time of 5° BTDC.

At other times the ECU determines the required spark advance using data in the ROM, engine speed and inlet air flow data. This data is then further advanced depending on coolant temperature or atmospheric pressure (whichever is the largest value). Also, the influence of battery voltage on the dwell time of the ignition coil is compensated for.

Timing adjustment — when the ignition timing adjustment terminal is grounded, there is synchronisation with the crank angle sensors trailing edge signal, resulting in the fixed ignition timing (5° BTDC). In this condition the basic ignition timing is adjusted.

Air Conditioner Relay Control

When the air conditioner switch is turned ON while the engine is at idle, the ISC servo operates to maintain idle speed. However there is some delay before it actually increases. To maintain the engine free from air conditioner load during that delay period, the ECU keeps the power transistor OFF for a fixed time (about 0.5 seconds) to open the air conditioner power relay circuit. As a result, even if the air conditioner switch is ON, the air compressor is not driven instantly, preventing engine speed drop due to compressor load.

For auto models, during acceleration when the throttle valve opening is large (approx. 74° or more), the air conditioner power relay circuit is cut off for a fixed time (approx. 5 seconds) in order to maintain acceleration performance. If the thottle blade opening drops below 70° before the 5 seconds expires, the air conditioning will be switched on again.

Fuel Pressure Control System

The intake manifold negative pressure (vacuum) acts upon the fuel pressure regulator to maintain a constant fuel pressure across the injectors.

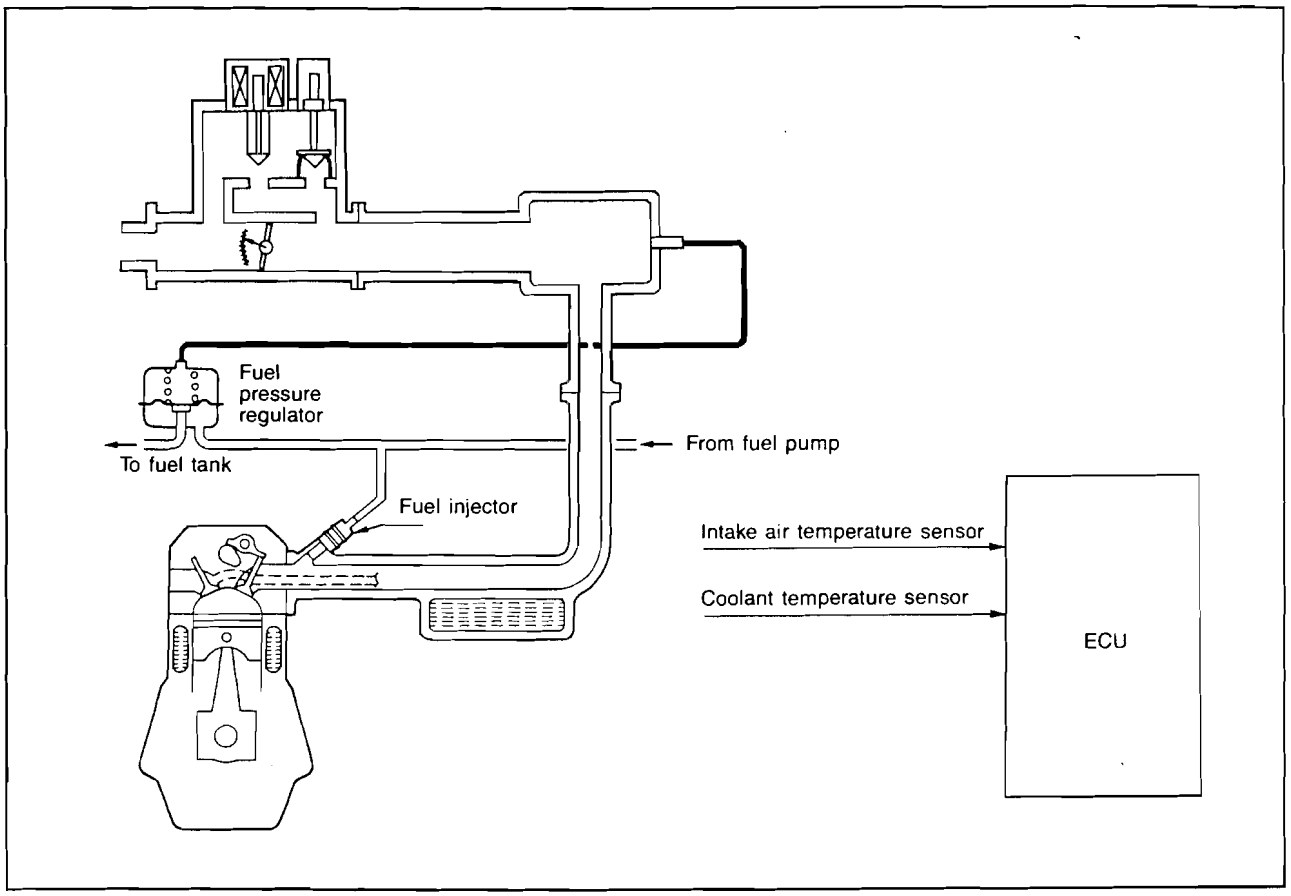


Fig. 36—Fuel perssure control system

Variable Intake Control System Operation

When the engine is operating at low speed, the induction control valve is closed, thus air is entering the engine via the long track. As a result intake efficiency is improved and low speed torque is increased due to the inertia effect.

At high speed the valve is fully open and air enters via the short track. In this condition intake resistance is decreased and air speed increased with a resultant increase in output at high engine speed.

At medium engine speed the valve is partially open, this allows air to enter via both tracks. This reduces intake resistance but still utilizes the inertia effect, thus assuring a higher intake efficiency and larger torque at medium engine speed.

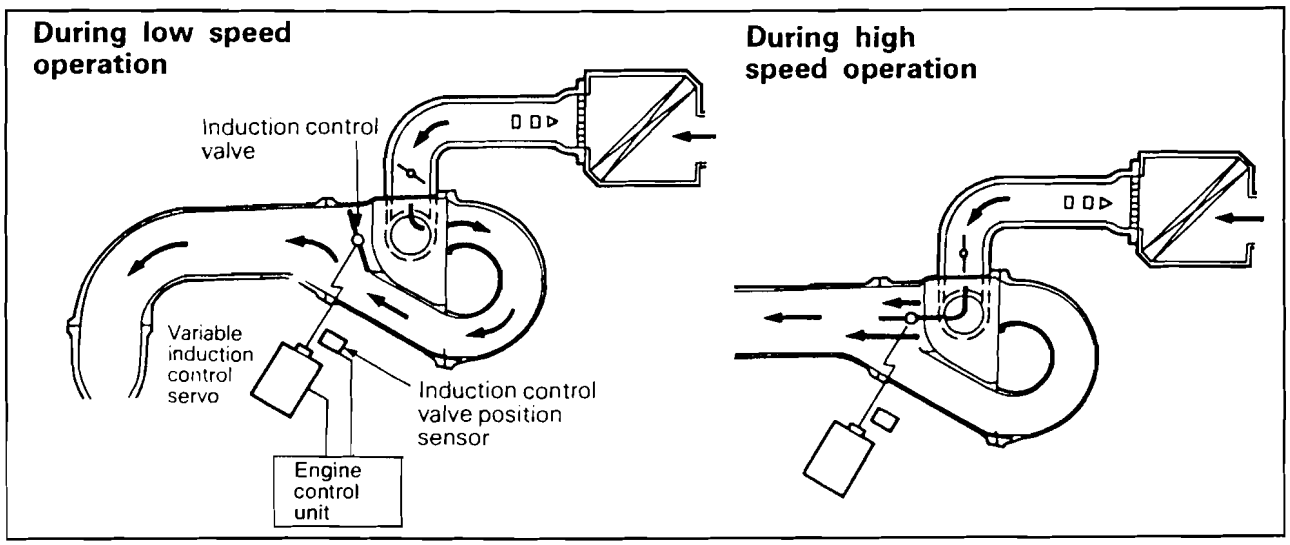


Fig. 36A—Variable intake control system

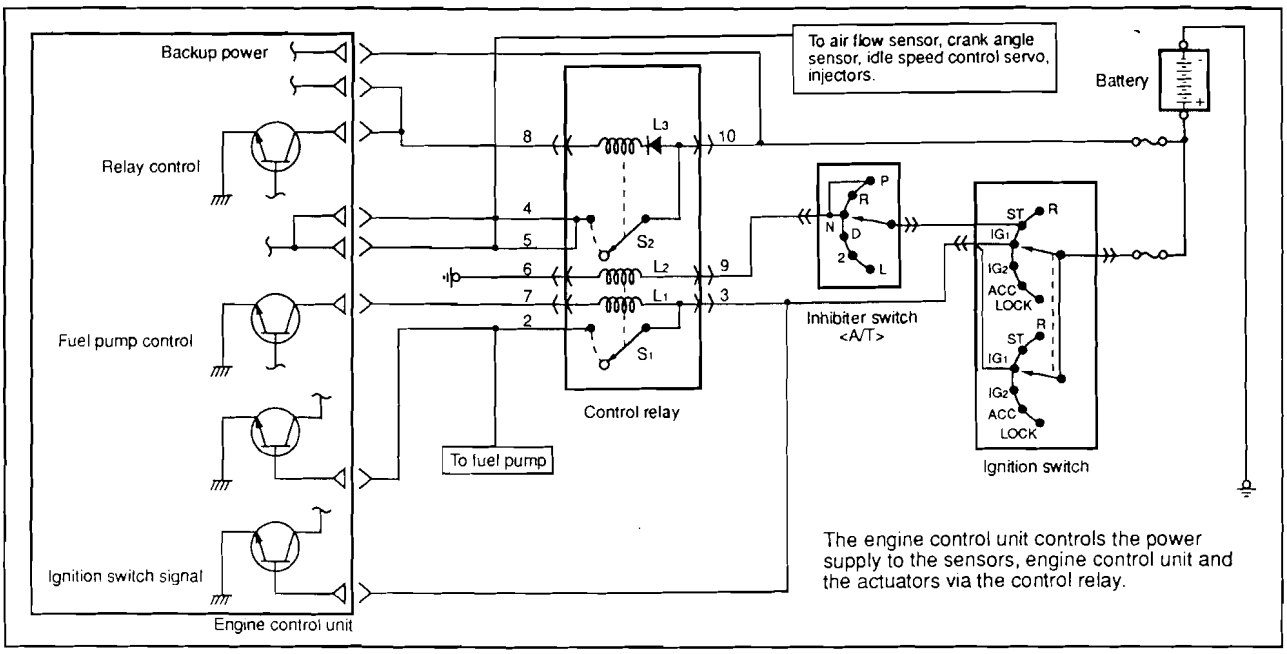


Fig. 37—Power supply and fuel pump control

Power Supply and Fuel Pump Control System

- While cranking (ignition switch at ST), current flows through coil L_2 to close switch S_1, driving the fuel pump.

Current also flows through coil L_3 to close switch S_2, resulting in power supply to the ECU, AFS, power transistor, steppermotor and injectors.

- With the engine running, the ECU turns on the fuel pump drive transistor to complete the earth circuit to coil L_1 and hold switch S_1 closed, keeping the fuel pump running.
- In the event of the engine speed falling below 50 rpm, the ECU turns off the fuel pump drive transistor and opens the coil L_1 circuit. As a result, switch S_2 opens to stop driving the fuel pump.

SELF DIAGNOSIS

The engine control unit, monitors the input/output signals (some signals at all times and the others under specified conditions) of the engine control unit.

When the ECU has noticed that an irregularity has continued for a specified time or longer, from when the irregular signal is initially monitored and passing a certain number, the ECU judges that an irregularity has occured, memorises the malfunction code and outputs the signal to the self diagnosis output terminal.

There are 15 diagnosis items including the NORMAL state and the diagnosis results can be read out with a voltmeter or a Multi-Use-Tester (MUT).

The diagnosis memory is maintained by back-up power from the battery so that it will not be lost even if the ignition switch is turned off.

The malfunction codes will, however, be erased when the battery terminal or the ECU connectors are disconnected.

The diagnosis connector is located near the fuse box on the driver side of the cabin. By connecting the MUT to this connector the item shown in the display code table can be read.

By connecting a voltmeter across terminals 5 and 6 of the diagnosis connector, the output pattern in the display code table will be displayed, refer Fig. 38 and diagnosis display table.

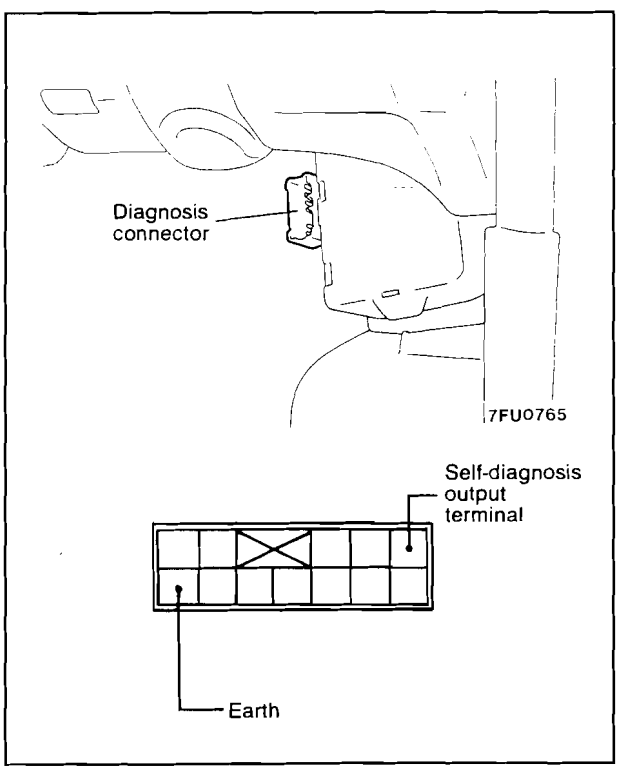


Fig. 38—Diagnosis terminal

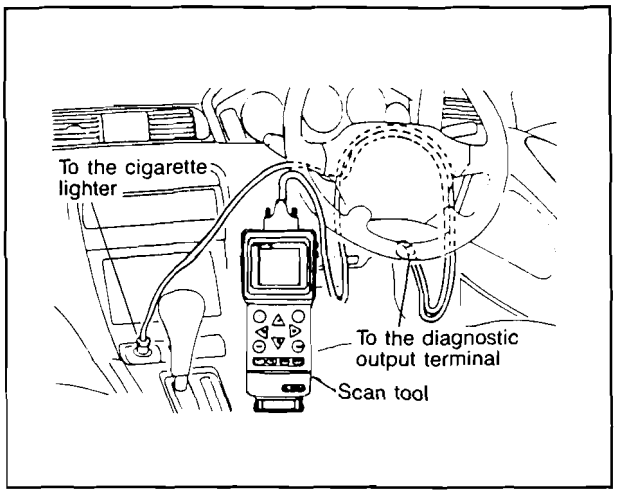


Fig. 39—Multi-Use-Tester

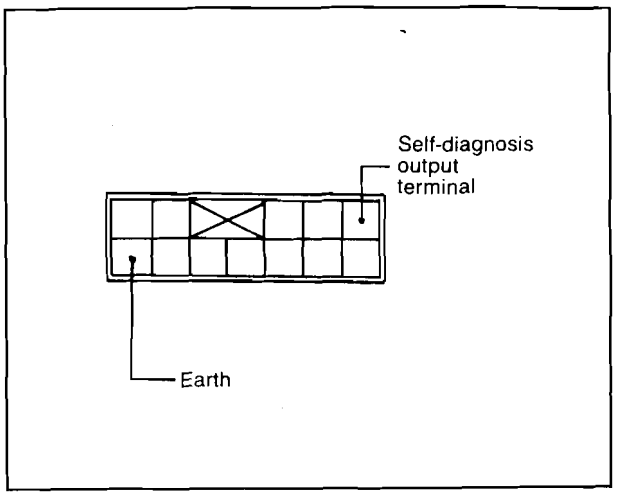


Fig. 40—Diagnosis connector.

Precautions for Operation

(1) When the battery voltage is low, no malfunction code is output. Therefore, check battery voltage before starting the test.

(2) The malfunction code memory is erased if the battery cable is disconnected, or the engine control unit connector is disconnected.

(3) Do not disconnect the battery cable before the diagnosis results are completely read.

Reading of self-diagnosis code

(Using Multi-Use-Tester)

(1) Connect the MUT to the diagnosis connector and power supply, refer Fig. 39.

(2) Turn ignition switch ON. Select model, system and self diagnosis then read and record the self-diagnosis output.

(3) Refer to the following diagnosis chart and repair as necessary.

(4) Erase the malfunction code.

(5) Recheck that a normal code is output.

Using a Voltmeter

(1) Connect an analog voltmeter between the self-diagnosis output terminal of the diagnosis connector and the earth terminal, refer Fig. 40.

(2) Turn the ignition switch ON.

(3) Read the diagnosis output pattern from the voltmeter pointer deflection and record it.

(4) Refer to the diagnosis chart, repair all faults as necessary.

(5) Erase the malfunction code by using the following procedure:—

- Turn the ignition switch OFF.
- Disconnect the negative battery cable from the battery terminal for 10 seconds or more and then reconnect it.
- Turn the ignition switch ON and read the self-diagnosis code to check that a normal output code appears.

Diagnosis by Diagnosis 2 Mode (V6 Models)

(1) Using the Multi-Use-Tester (MUT), change the diagnosis mode of the ECU to DIAGNOSIS 2 MODE.

(2) Perform road test.

(3) In the same manner as "READ OUT OF MALFUNCTION CODE" read the diagnosis code and repair the faulty part.

(4) Disconnect the Multi-Use-Tester.

NOTE: Disconnection of the MUT will erase all self-diagnosis codes and complete the changeover from DIAGNOSIS 2 MODE to DIAGNOSIS 1 MODE.

Diagnosis Erase Procedure Using Multi-Use-Tester (MUT)

The diagnosis erase is available on systems with diagnosis codes. Use the diagnosis erase feature as follows:

(1) Connect the MUT to the self diagnosis connector located near the fuse box on the driver's side.

(2) Turn the ignition switch OFF and then turn it ON.

(3) Select the vehicle model and then select the system.

(4) Select 4 "Special Test".

(5) Select 5 "Diagnosis Erase".

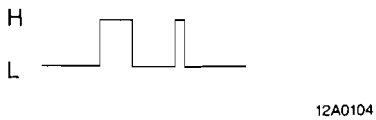
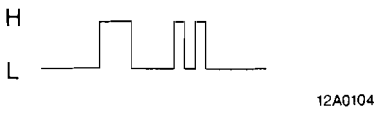
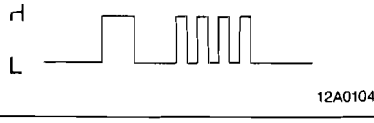
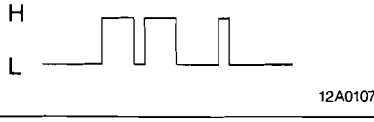
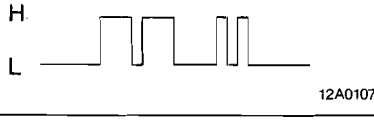
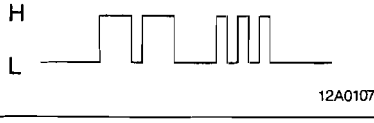
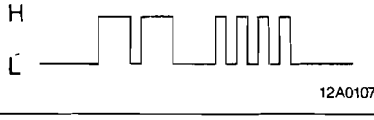
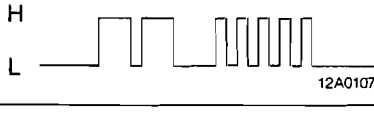
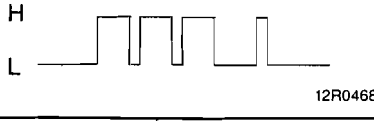
(6) To the prompt, "Erase Diagnosis Code?" and press YES.

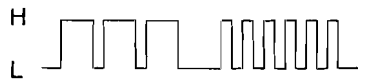
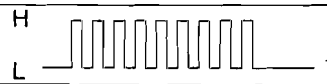
(7) Enter the code nominated on the tester and press YES.

(8) If successful, the diagnosis codes will be erased.

(9) Press clear to return to the menu.

DIAGNOSIS CHART

Output preference order	Diagnosis item	Diagnosis code			Check item (Remedy)
		Output signal pattern	No.	Memory	
1	Engine control unit	 12A0104	—	—	(Replace engine control unit)
2	Oxygen sensor	 12A0104	11	Retained	• Harness and connector • Fuel pressure • Injectors (Replace if defective) • Intake air leaks • Oxygen sensor
3	Air flow sensor	 12A0104	12	Retained	• Harness and connector (If harness and connector are normal, replace air flow sensor assembly.)
4	Intake air tempera-ture sensor	 12A0104	13	Retained	• Harness and connector • Intake air temperature sensor
5	Throttle position sensor	 12A0104	14	Retained	• Harness and connector • Throttle position sensor • Idle position switch
6	Engine coolant temperature sensor	 12A0107	21	Retained	• Harness and connector • Coolant temperature sensor
7	Crank angle sensor	 12A0107	22	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
8	Top dead centre sensor	 12A0107	23	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
9	Vehicle-speed sensor (reed switch)	 12A0107	24	Retained	• Harness and connector • Vehicle-speed sensor (reed switch)
10	Barometric pressure sensor	 12A0107	25	Retained	• Harness and connector (If harness and connector are normal, replace barometric pressure sensor assembly.)
11	Knock sensor	 12R0468	31	Retained	• Harness and connector (If harness and connector are normal, replace knock sensor.)

Output preference order	Diagnosis item	Diagnosis code			Check item (Remedy)
		Output signal pattern	No.	Memory	
12	Ignition timing adjustment signal		36	—	• Harness and connector
13	Injector	 12A0105	41	Retained	• Harness and connector • Injector coil resistance
14	Intake air control valve position sensor		62	Retained	• Harness and connector • Variable intake air control (VIC) servo (If harness and connector as well as variable intake air control (VIC) servo are normal, replace the surge tank assembly.)
15	Normal state	 12A01	—	—	
NOTE: Indication is made in numerical order of code numbers, i.e. (1 to 15 Output preference order)					

SERVICE DATA OUTPUT

The input/output data of the engine control unit is sent to the diagnosis connector as serial signals. These serial signals can be read by connecting the Multi-Use Tester to the diagnosis connector.

Item No.	Service data items	Unit
11	Oxygen sensor output voltage	mV
12	Air flow sensor output frequency	Hz
13	Detected intake air-temperature sensor temperature	°C
14	Throttle position sensor output voltage	mV
16	Battery voltage	V
18	Cranking signal (ignition switch — ST)	ON — OFF
21	Detected coolant temperature sensor temperature	°C
22	Top dead centre sensor output speed	rpm
25	Detected barometric pressure sensor pressure	mmHg
26	Idle position switch signal	ON — OFF
27	Power steering oil pressure switch signal	ON — OFF
28	Air conditioner switch signal	ON — OFF
29	Inhibitor switch signal	P,N — D,2,L,R
41	Injector drive time	mS
44	Ignition advance angle	°BTDC °ATDC
45	Idle speed control servo stepper motor step number	STP
49	Air conditioner relay signal	ON — OFF

ACTUATOR TEST

By using the Multi-Use Tester, various actuators can be forcibly activated.
The use of this function allows inspections to be performed systematically.

Item No.	Actuator test items
01	No. 1 injector: OFF
02	No. 2 injector: OFF
03	No. 3 injector: OFF
04	No. 4 injector: OFF
05	No. 5 injector: OFF (V6 models only)
06	No. 6 injector: OFF (V6 models only)
07	Fuel pump: ON
08	Purge control solenoid valve: ON (4 cylinder models only)

FAULT DIAGNOSIS CHART

Problem symptoms / Check items	Starting		Idling stability			Driving						Stopping
	Will not start (No initial explosion)	Starting problem (Slow engine starting) (Engine stalls after initial explosion)	Idling instability (Rough idling)	Incorrect idling speed	Improper idling continuity	Hesitation, sag	Poor acceleration	Stumble	Shock	Surge	Knocking	Run on (dieseling)
Power supply and ignition switch-IG	① 1											
Engine control unit power ground	② 2											
Fuel pump	③ 3	① 1			① 1	① 1	① 1					
Air flow sensor					⑪ 10	⑩ 10		⑤ 5	⑤ 5		④ 4	
Intake air temperature sensor			⑤			⑥ 6	⑥ 6				② 2	
Barometric pressure sensor			⑦			⑨ 9	⑧ 8				③ 3	
Engine coolant temperature sensor		3	⑥ 5	① 1	⑤ 5	⑧ 8	⑦ 7	④ 4		③ 3		
Throttle position sensor						⑦ 7		③ 3	④ 4			
Idle position switch			③ 3	② 2	④ 4							
Top dead centre sensor	⑤ 5	⑥ 7			⑧ 7				② 2			
Crank angle sensor	⑥ 6	⑦ 8			⑨ 8				③ 3			
Ignition switch-ST and inhibitor switch (A/T)	④ 4	③ 4		⑤								
Vehicle speed sensor					⑥				⑥			
Power steering oil pressure switch				③								
Air conditioner switch and relay				④								
Knock sensor											① 1	
Intake air control valve position sensor (V6)						④ 4	④ 4					
Oxygen sensor			⑧									
Injectors	⑧ 8	② 2	② 2		③ 3	② 2	② 2	① 1		① 1		①
Idle speed control servo		④ 5	① 1	⑥ 3	② 2				⑦ 6			
Ignition coil and power transistor	⑦ 7				⑩ 9		⑨ 9		① 1		⑤ 5	
Variable intake air control servo (DC motor) (V6)						⑤ 5	⑤ 5					
Fuel pressure		⑤ 6	④ 4		⑦ 6	③ 3	③ 3	② 2		② 2		

○ : Warm engine (number inside indicates check order)
□ : Cold engine (number inside indicates check order)

ELECTRONIC CONTROL UNIT (ECU)

Access

(1) Remove the glove box and glove box under cover, refer Group 52.
(2) Remove left hand cowl trim retaining screw.

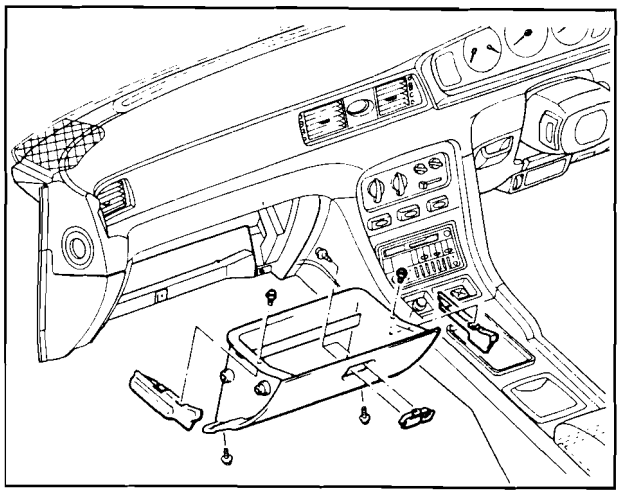


Fig. 41—Glove box removal

(3) Remove the cowl trim.
(4) Unscrew and remove heater blower assembly bracket and earth wires, refer Fig. 42.

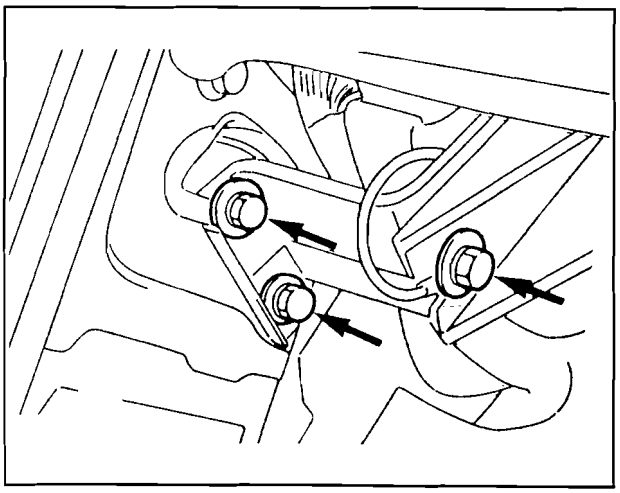


Fig. 42—Heater blower bracket removal

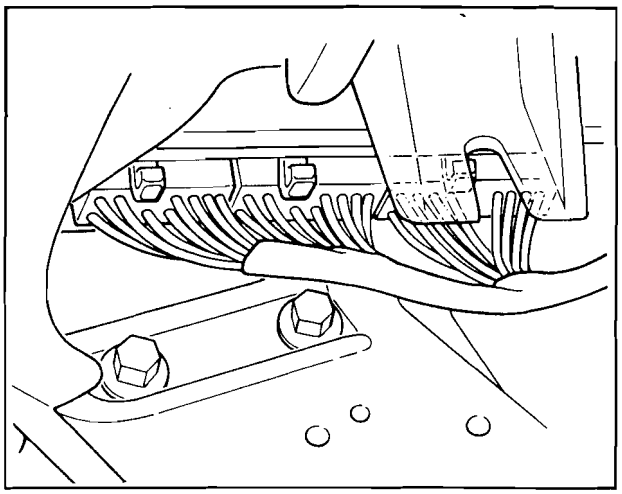


Fig. 43—ECU connectors

ECU Replacement

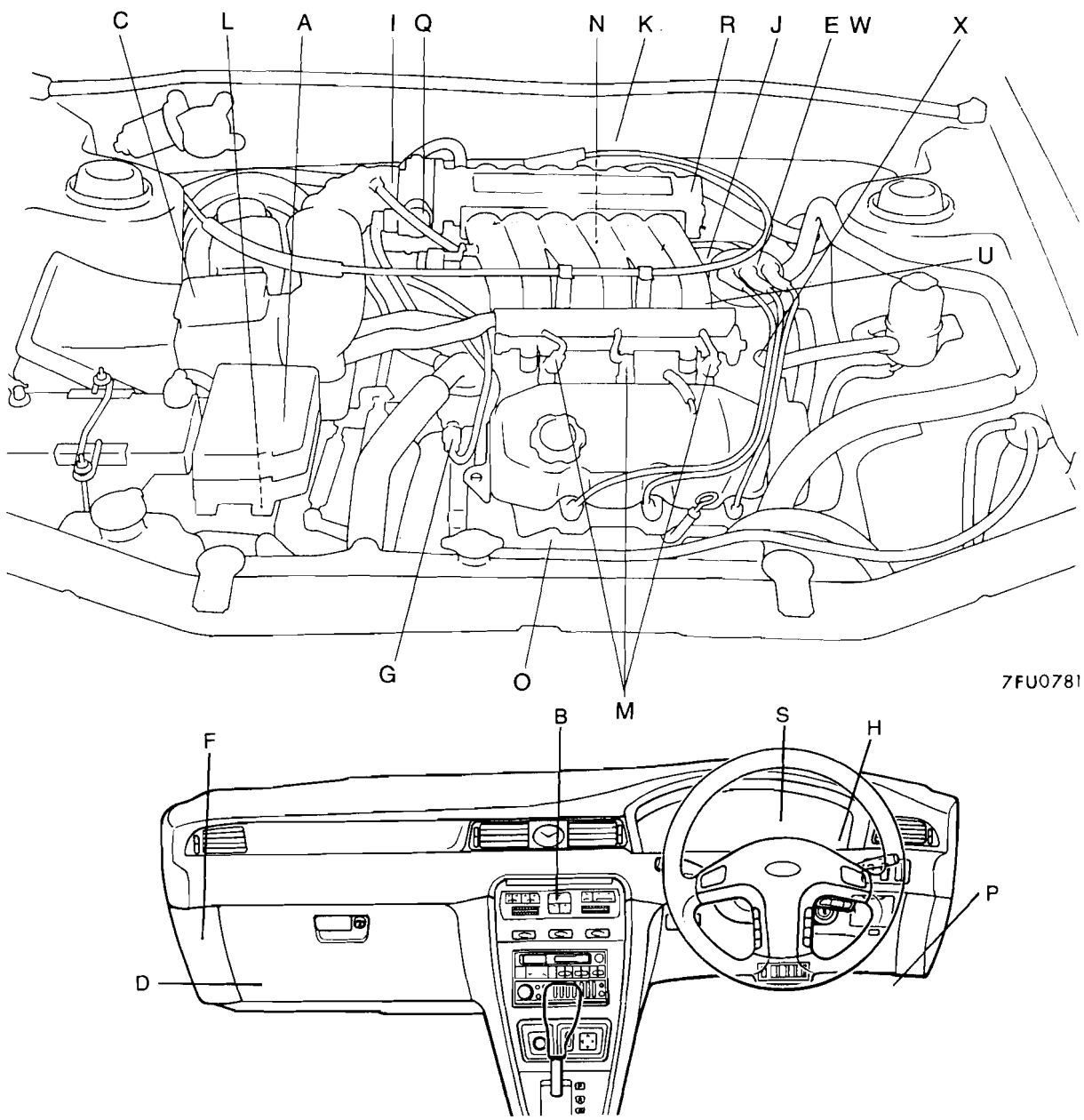
Removal

(1) Complete steps of Access to ECU.
(2) Disconnect control relay and remove left hand section underframe retaining screws. Remove underframe section with control relay attached.
(3) Uncouple ECU connectors.
(4) Remove ECU retaining screws at lower edge.
(5) Slide ECU down and out of retaining bracket.

Installation

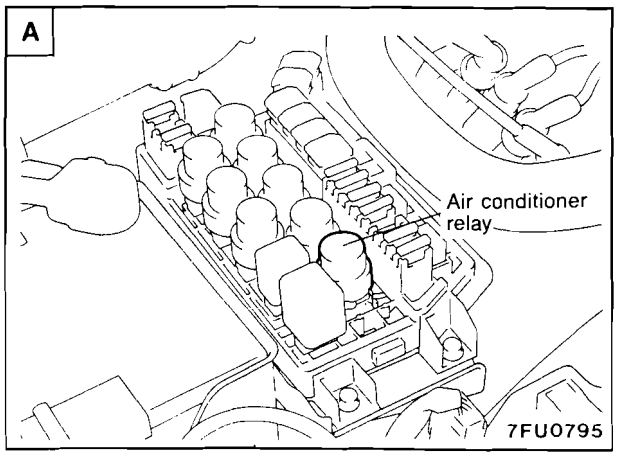
Installation is a reversal of the removal procedure.

COMPONENT LAYOUT

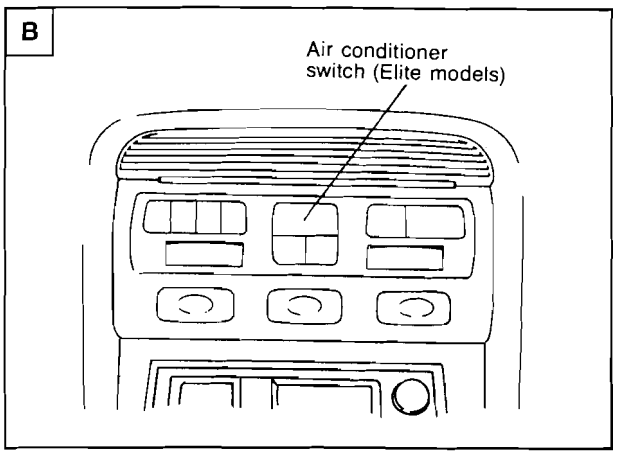


Symbol	Component	Symbol	Component
A	Air conditioner relay	M	Injectors
B	Air conditioner switch (Elite Models)	N	Oxygen sensor (V6)
C	Air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor)	O	Oxygen sensor (4 cylinder)
D	Control relay	P	Self-diagnosis connector
E	Crank angle sensor (V6)	Q	Throttle position sensor (with idle position switch)
F	Engine control unit	R	(DC motor) and intake air control valve position sensor (V6)
G	Engine coolant temperature sensor	S	Vehicle speed sensor (reed switch)
H	Engine warning lamp	T	A/C switch
I	Idle speed control servo	U	Knock sensor (V6)
J	Ignition coil (power transistor)	V	Knock sensor (4 cylinder)
K	Ignition timing adjustment terminal	W	Crank angle sensor (4 cylinder)
L	Inhibitor switch	X	Power steering switch

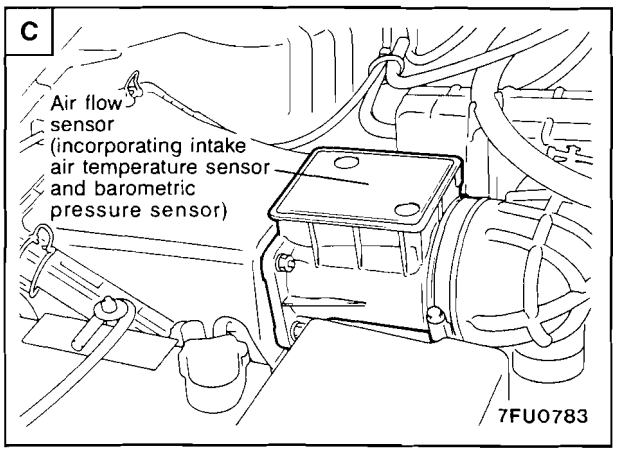
A


Air conditioner relay
7FU0795

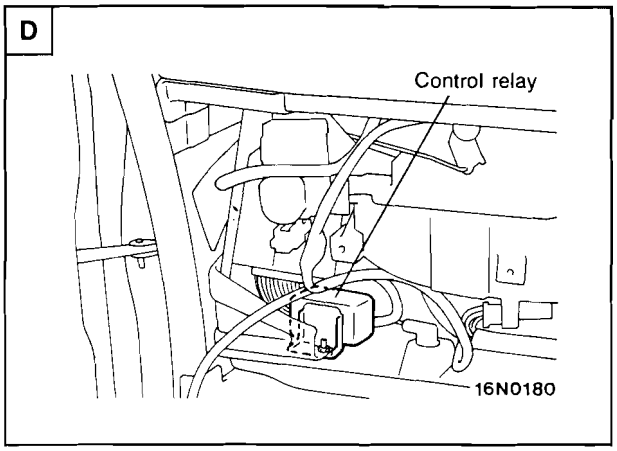
B


Air conditioner switch (Elite models)

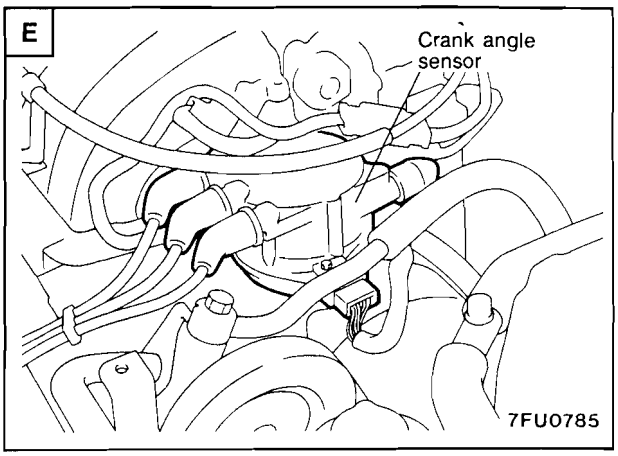
C


Air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor)
7FU0783

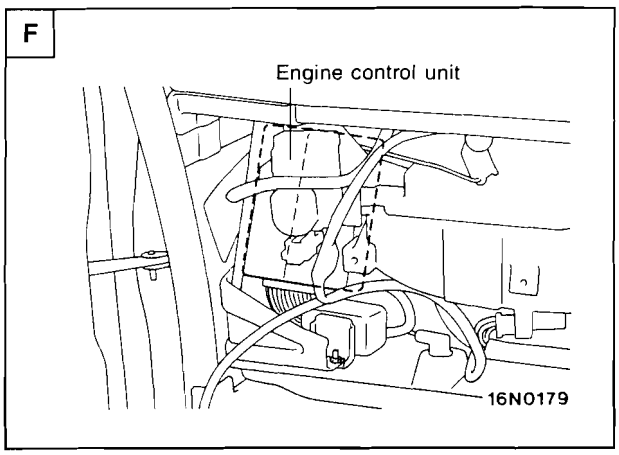
D


Control relay
16N0180

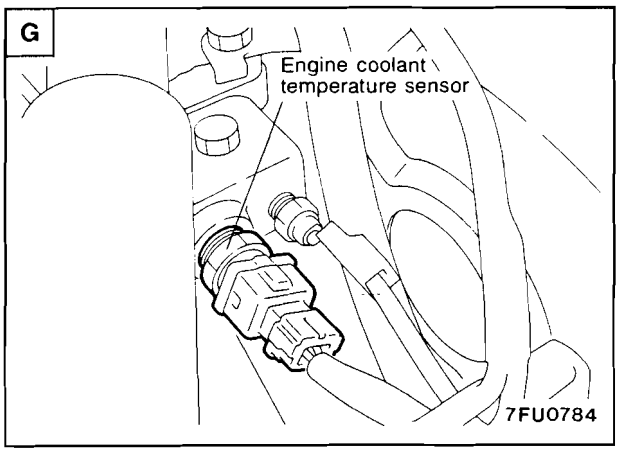
E


Crank angle sensor
7FU0785

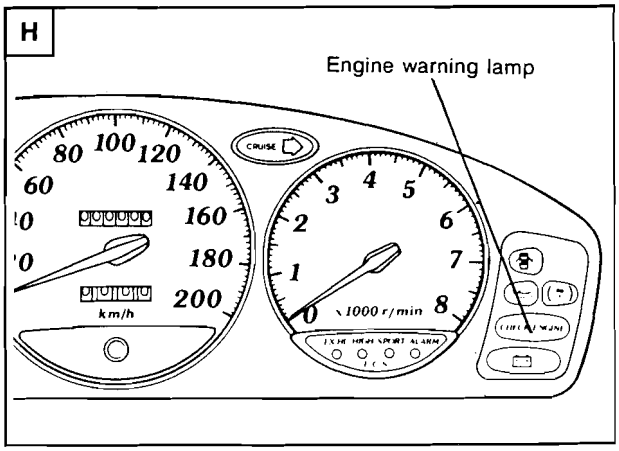
F


Engine control unit
16N0179

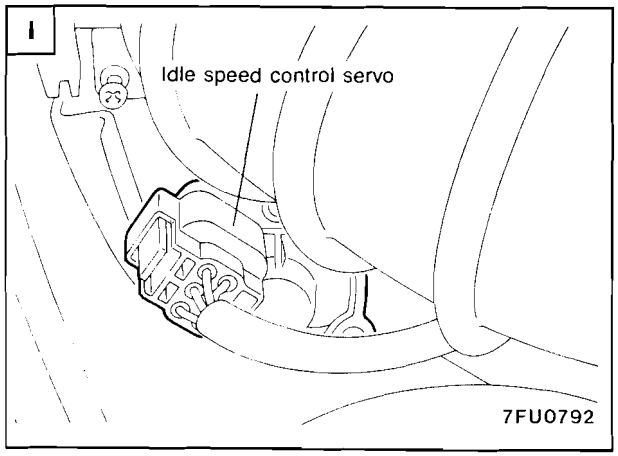
G


Engine coolant temperature sensor
7FU0784

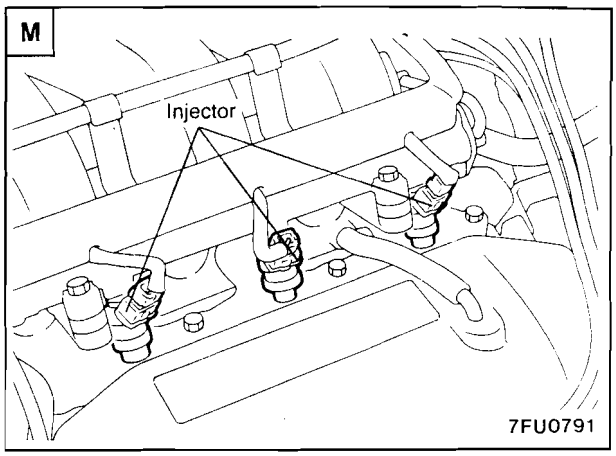
H


Engine warning lamp
CRUISE
km/h
1000 r/min

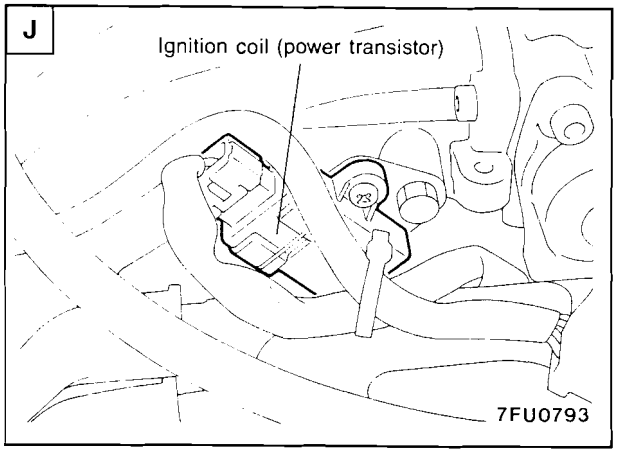
I


Idle speed control servo
7FU0792

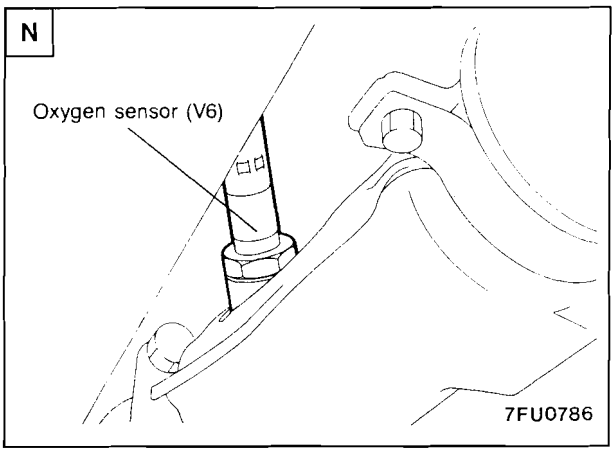
M


Injector
7FU0791

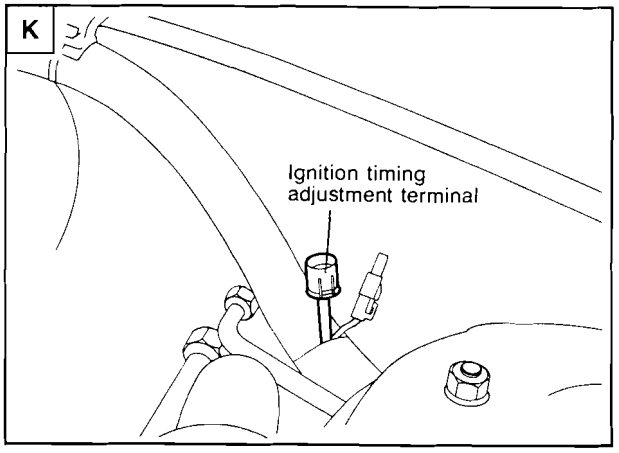
J


Ignition coil (power transistor)
7FU0793

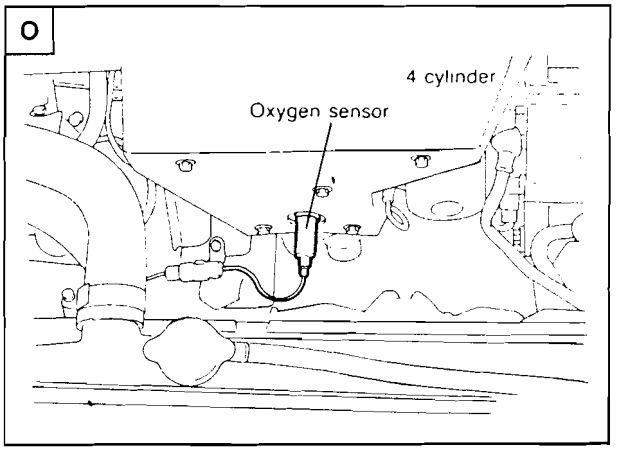
N


Oxygen sensor (V6)
7FU0786

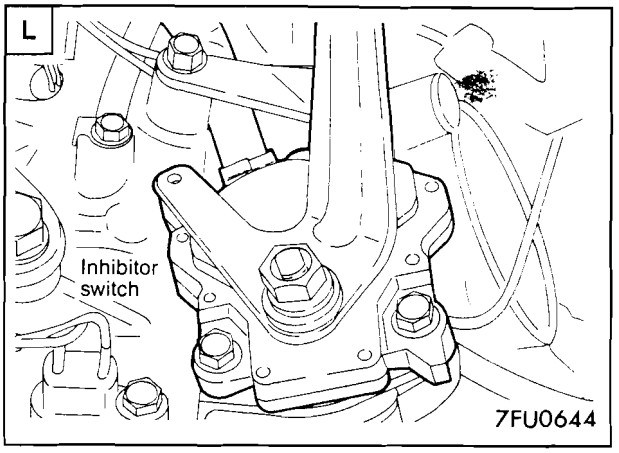
K


Ignition timing
adjustment terminal

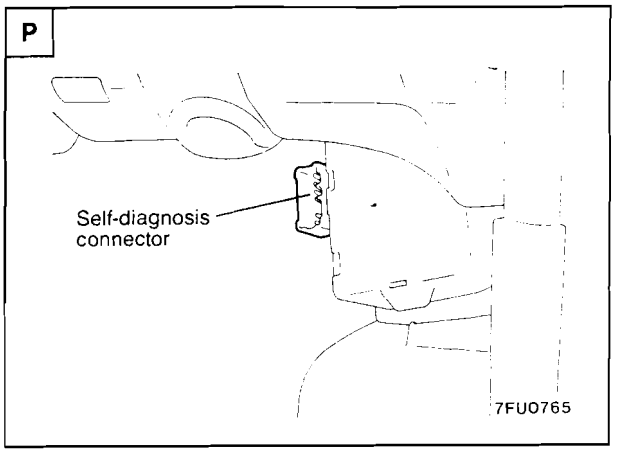
O


4 cylinder
Oxygen sensor

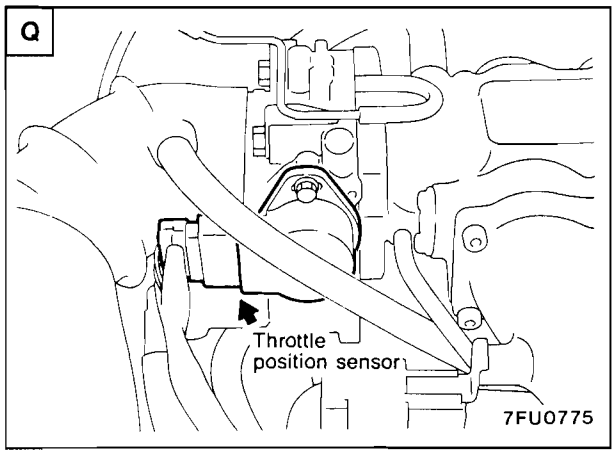
L


Inhibitor
switch
7FU0644

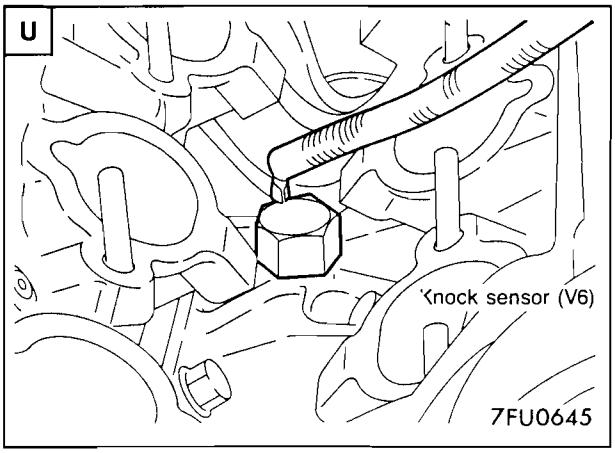
P


Self-diagnosis
connector
7FU0765

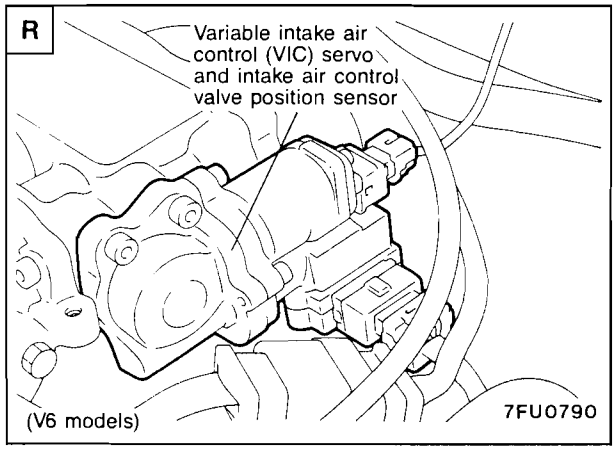
Q


Throttle
position sensor
7FU0775

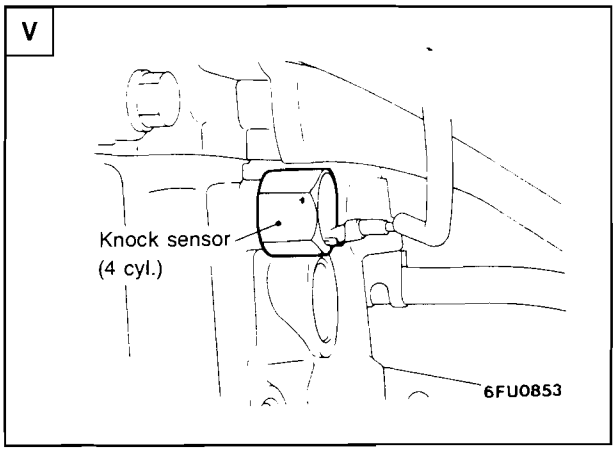
U


Knock sensor (V6)
7FU0645

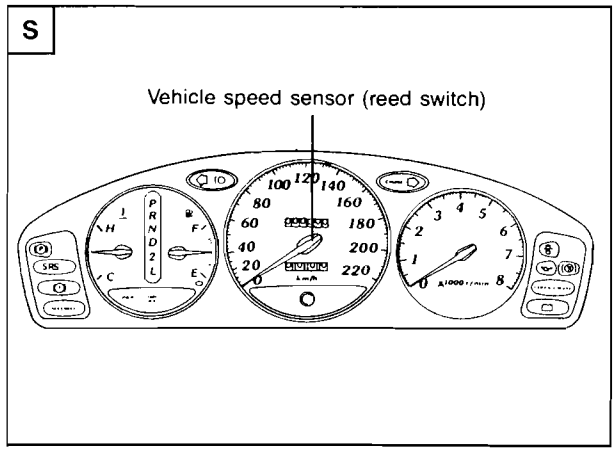
R


Variable intake air
control (VIC) servo
and intake air control
valve position sensor
(V6 models)
7FU0790

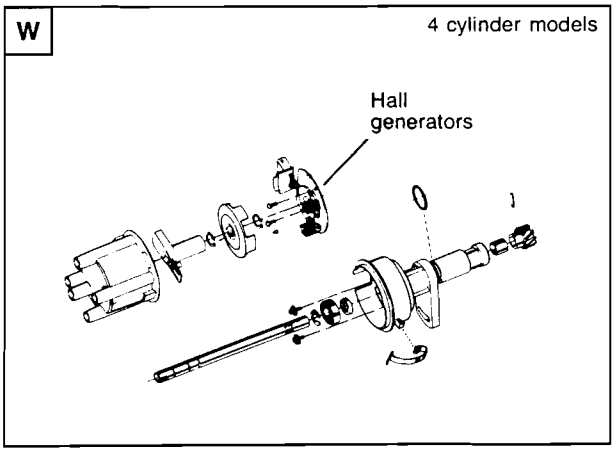
V


Knock sensor
(4 cyl.)
6FU0853

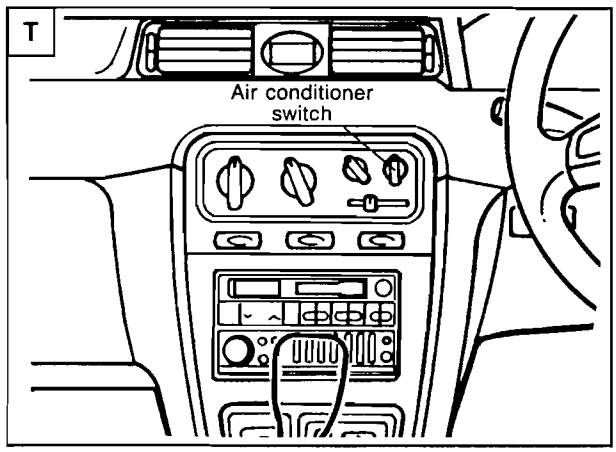
S


Vehicle speed sensor (reed switch)

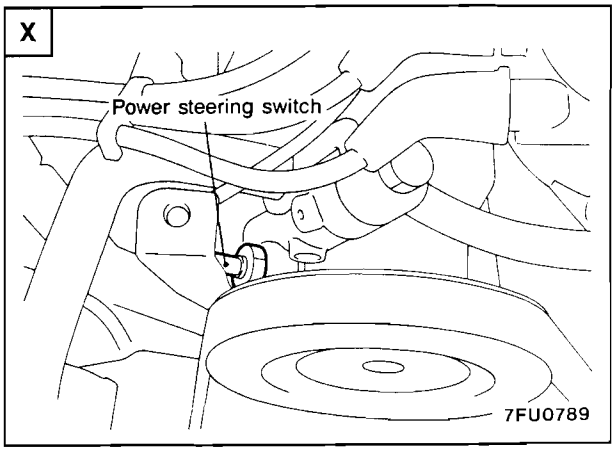
W


4 cylinder models
Hall
generators

T


Air conditioner
switch

X


Power steering switch
7FU0789

SYSTEM REMOVAL AND INSTALLATION

Removal

NOTE: The residual fuel pressure and amount of fuel remaining in the fuel lines, make it essential that care is taken when disconnecting fuel lines. Use suitable containers and/or rags to contain fuel spillage.

(1) Disconnect the battery negative (ground) terminal.
(2) Disconnect the air flow sensor wiring at air cleaner.
(3) Unclip air intake hose clips.
(4) Remove air intake hose.
(5) Unclip air cleaner retaining clips.
(6) Remove air cleaner upper body.
(7) Disconnect throttle cable from throttle body and surge tank.

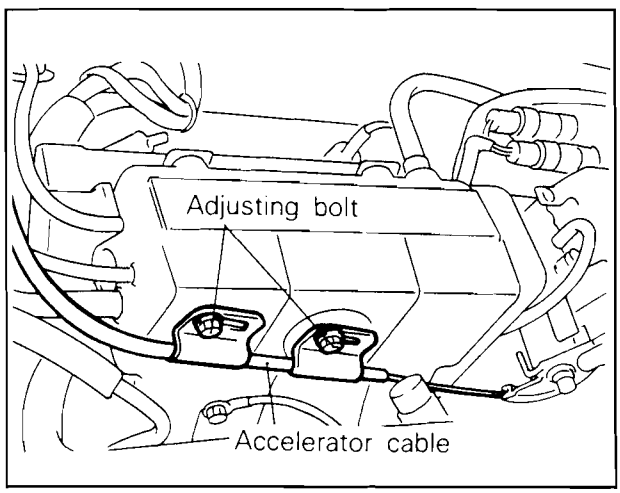


Fig. 44—Accelerator cable attachment

(8) Uncouple all electrical connectors from the throttle body, temperature sender and sensors and injectors. Remove wiring loom from delivery pipe and lay the loom to one side.
(9) Disconnect all fuel supply and return hoses from the delivery pipe.
(10) Remove throttle body to manifold stay. Remove the remaining two bolts and remove the throttle body. On V6 models remove the inlet manifold attaching bolts and remove the manifold.
(11) Remove the delivery pipe to injectors retaining clips, refer Fig. 45.
(12) Remove delivery pipe mounting bolts and remove delivery pipe and injectors.
(13) If necessary, remove surge tank attaching bolts and remove surge tank.

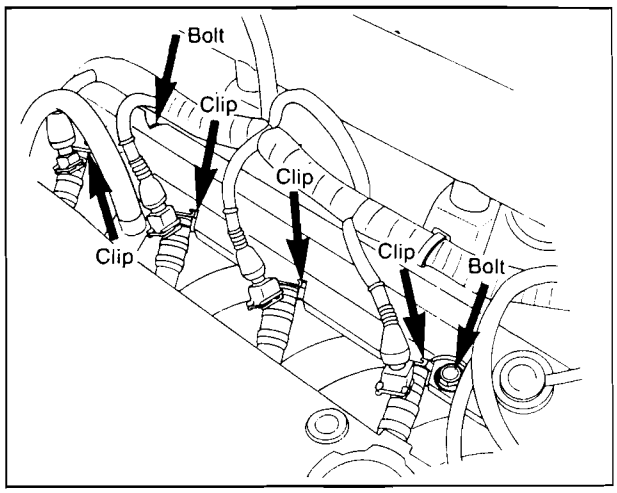


Fig. 45—Injector retaining clips

Inspection

(1) Check all mating surfaces for warpage and distortion.
(2) Check throttle body and surge tank for cracks, damage and porosity.
(3) Check throttle valve for ease of movement in throttle body.
(4) If necessary check electrical components (ISC motor, etc.)—refer Component Inspection this section.

Installation

Installation is a reversal of the removal procedure, noting the following:—
(1) Clean up all mating faces and use new gaskets.

NOTE: Whenever the fuel delivery hose is removed from the filter NEW copper gaskets MUST be used.

(2) Tighten all bolts and nuts to the specified torques.
(3) Adjust accelerator cable.
(4) Ensure injector connections are correctly coupled and in the correct order.
(5) Adjust idle speed control and throttle position sensor — refer this section.
(6) Disconnect the negative battery terminal for 10 seconds to erase ECU memory, (or use the Multi-Use-Tester erase function), reconnect the battery, start engine and carry out diagnosis check.

SERVICE ADJUSTMENTS

NOTE: Prior to and after completion of service adjustments, it is advisable to carry out a system self diagnosis check to ensure of optimum performance.

Ignition Timing

(1) Connect an engine tachometer and start the engine.
(2) Run the engine until normal operating temperature is reached.
(3) Ensure that all lights and accessories are switched off.
(4) Check that idle speed is as specified with the cooling fan OFF. If necessary, adjust using procedure detailed later in this section.
(5) Switch engine OFF and connect the spark advance cut terminal to earth with a suitable jumper lead, refer Fig. 46.

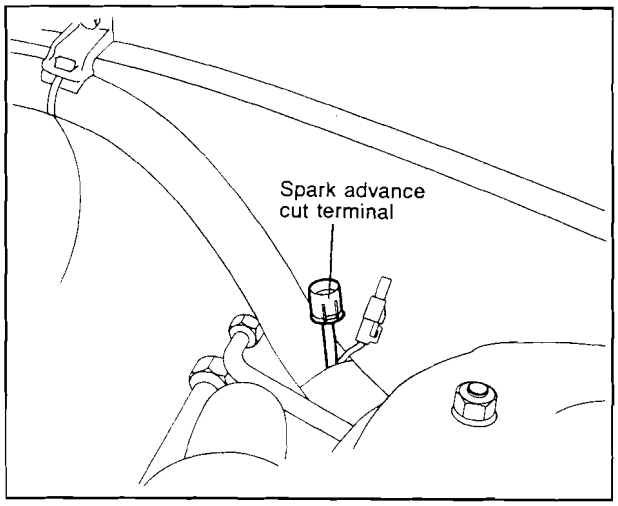


Fig. 46—Electronic spark advance cut terminal

(6) Connect a suitable timing light to No. 1 cylinder and start the engine.

NOTE:
(i) Do not disconnect high tension leads with the engine running as damage to the ignition control unit can occur.
(ii) Do not puncture cables, boots or nipples with test probes. Always use proper adaptors. Puncturing the spark plug cables with a probe will damage the cables. The probe can separate the conductor and cause high resistance. In addition, breaking the rubber insulation may permit secondary current to arc to ground.
(iii) Do not connect timing light primary lead to the alternator output terminal as alternator damage will occur.

(7) Aim the timing light at the timing plate and check that ignition timing is to specifications. If necessary, adjust to specification by loosening the distributor clamp bolt and rotating the distributor.

(8) Disconnect the jumper lead, timing should advance to 13° B.T.D.C. 4 cylinder models and 15° B.T.D.C. V6 models. If timing does not advance, perform a self-diagnosis check.

NOTE: If jumper lead is not disconnected, spark advance cannot occur and performance and fuel economy will be severely affected.

(9) Install the plug in the check connector.

Idle Position Switch and Throttle Position Sensor.

(1) Disconnect the TPS harness connector, refer Fig. 47.

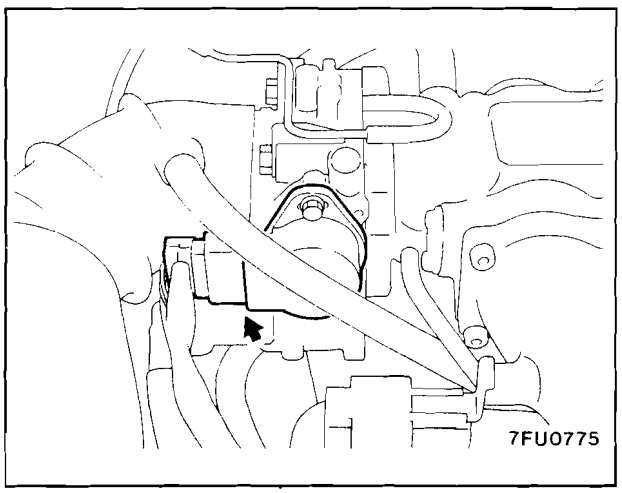


Fig. 47—TPS connector removal

(2) Connect an Ohmmeter between terminals 3 and 4, refer Fig. 48.

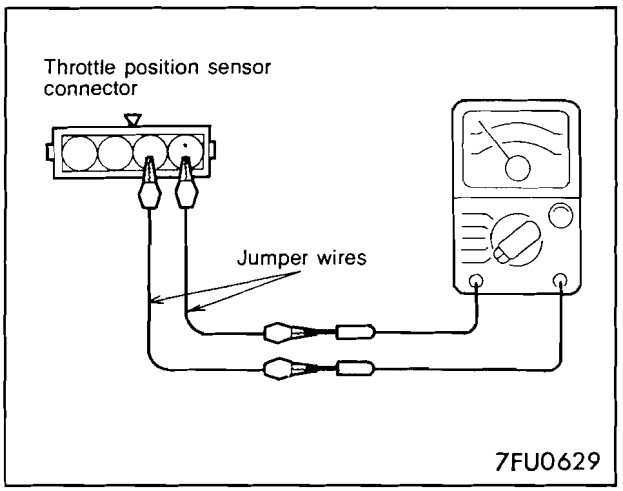


Fig. 48—Ohmmeter connection

(3) Insert 0.55 mm feeler gauge (4 cyl), 0.65 mm feeler gauge (V6) between the fixed SAS screw and the throttle lever, refer Fig. 49.

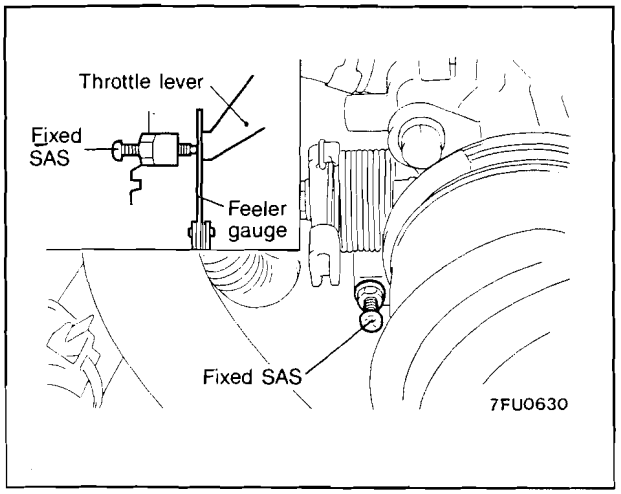


Fig. 49—Feeler gauge location

(4) Loosen the TPS attaching bolts and turn the TPS anti-clockwise, refer Fig. 50.
(5) Check for continuity between terminals 3 and 4.

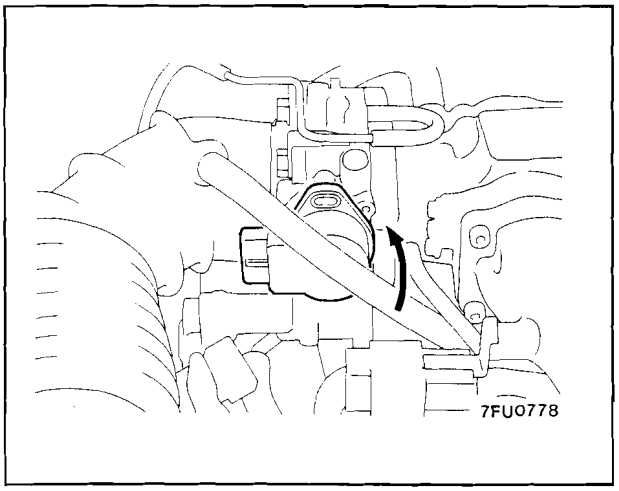


Fig. 50—TPS rotation

(6) Slowly turn the TPS in a clock-wise direction, refer Fig. 51, until the continuity between terminals 3 and 4 changes to an open circuit. At this position tighten the TPS attaching bolts to the specified torque.

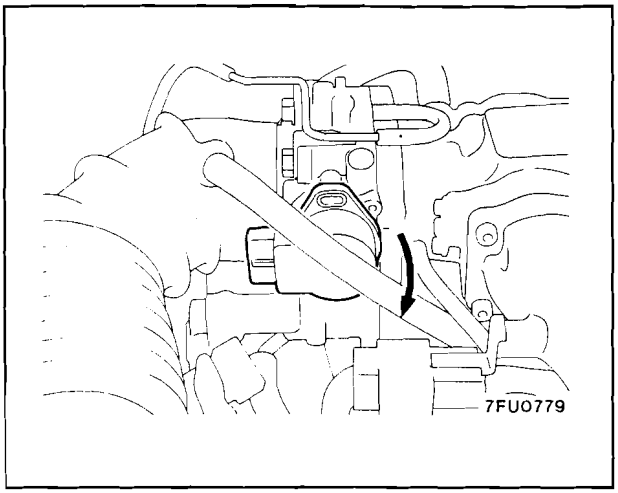


Fig. 51—TPS clockwise rotation

NOTE:
- **If the Multi-Use-Tester is used, reconnect the TPS connector and connect the MUT to the diagnosis connector.**
- **Turn the ignition switch to the ON position, select item No. 14 on the MUT and read TPS output voltage.**

(7) Using Special Tool MB991348, connected between the TPS and the TPS harness connector, refer Fig. 52.

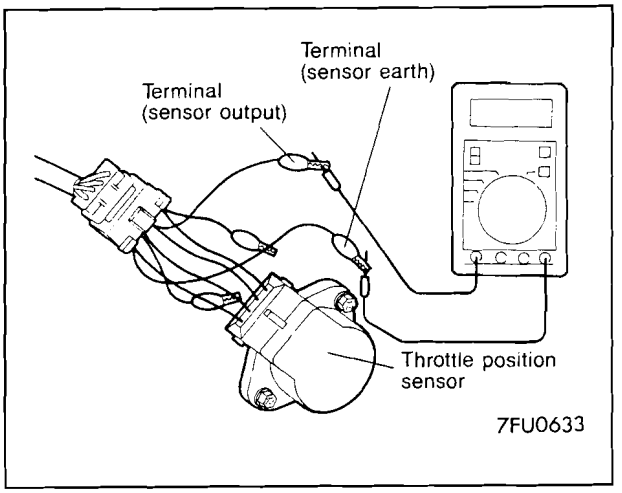


Fig. 52—Terminal location

(8) Connect a voltmeter between terminal 2 (sensor output) and terminal 4 (sensor ground) of the TPS, refer Fig. 52.
(9) Turn the ignition switch to the ON position (do not start the engine).
(10) Check the output voltage of the TPS is 0.4 to 1.0 volts.
(11) If voltage is not to specification check the throttle position sensor and the related harness.
(12) Remove feeler gauge and switch OFF the ignition.

Throttle Stop Screw (Fixed SAS)

CAUTION: The fixed SAS does not require regular adjustment, as it has been precisely set by the manufacturer. If the adjustment has been disturbed, the screw must be adjusted as follows.

(1) Disconnect the accelerator cable.
(2) Loosen the fixed SAS lock nut, refer Fig. 53.
(3) Back off the screw until it is clear of the throttle valve lever.

(4) Turn the screw in until it just contacts the throttle valve lever, then turn the screw in another 1¼ turns.
(5) Hold the fixed SAS screw in this position and tighten the lock nut securely.
(6) Reconnect the accelerator cable and adjust if necessary.

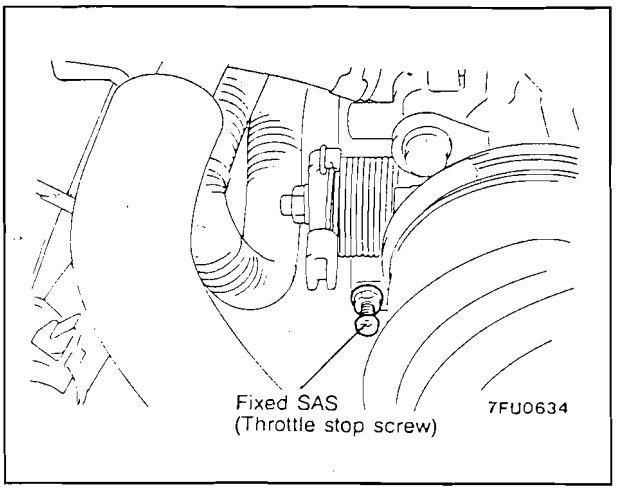


Fig. 53—Fixed SAS (throttle stop screw)

Idle Speed

Idle speed adjustment is controlled automatically by the ISC motor system.
The standard idle speed has been adjusted by the speed adjusting screw (SAS), by the manufacturer and there should normally be no need for readjustment.

NOTE: If adjustment is required proceed as follows:—

(1) Confirm that the spark plugs, injectors, idle speed control servo and compression pressures are all normal.
(2) Ensure that the engine is at normal operating temperature, all vehicle lighting and accessories are turned OFF and the transaxle is in Neutral or Park and the ignition timing is adjusted correctly.
(3) If the MUT is used, connect it to the diagnosis plug.

NOTE: When the MUT is used, the diagnosis control terminals are earthed.

(4) If the MUT is not used, use a suitable test lead to bridge terminals 10 and 12 in the self diagnosis connector, refer Fig. 54.

NOTE: Ensure you are bridging the correct terminals, incorrect terminal connections will result in computer failure.

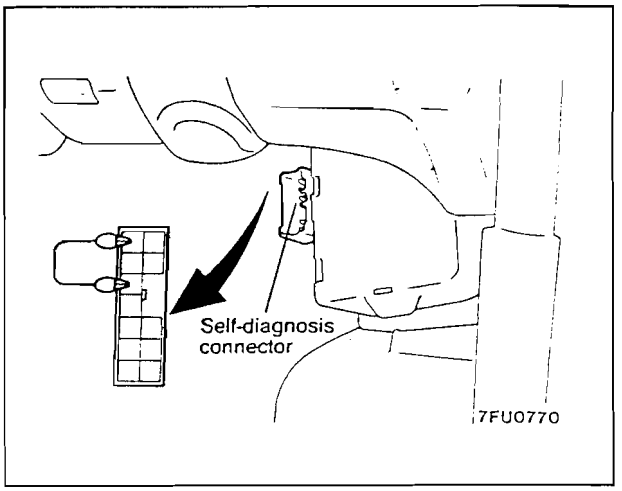


Fig. 54—Self diagnosis connector bridging

(5) Connect a suitable jumper lead to electronic spark advance cut terminal, refer Fig. 55.

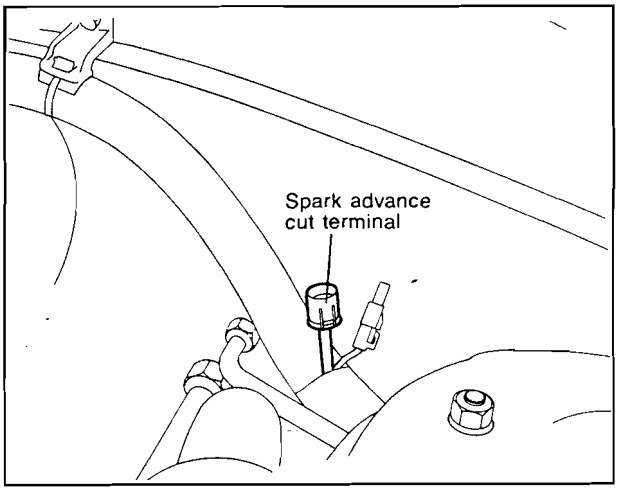


Fig. 55—Electronic spark advance cut terminal

(6) Start the engine and let it idle.
(7) Check the idle speed is to specification.

NOTE: To connect tachometer, pull back boot on the power transistor connector and inert a suitable probe into the white wire terminal.

NOTE: If the MUT is used, select item No. 22 and read the idle speed.

NOTE: The engine speed may be 20 to 100 rpm lower than specified for a new vehicle (driven 500 km or less), but no adjustment is necessary.

(8) If the idle speed is not to specification, remove the speed adjusting screw sealing cap and turn the SAS to achieve the correct idle speed, refer Fig. 56.

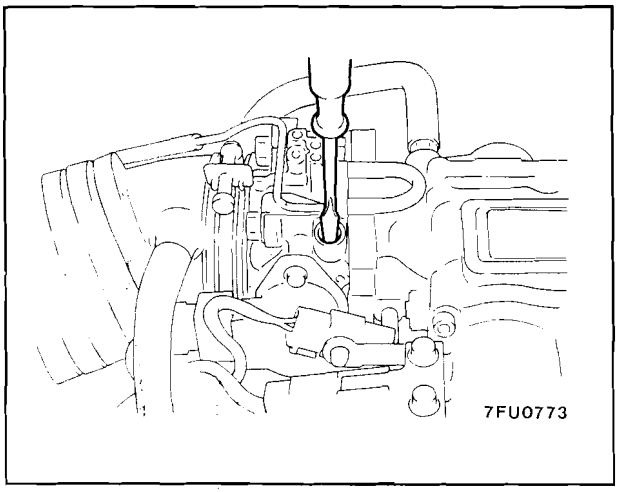


Fig. 56—Speed adjusting screw (SAS)

NOTE: If the idle speed is higher than specified, even when the SAS is fully closed, check the fixed SAS (Throttle stop screw) to see if it has been moved. If so, adjust the throttle stop screw as outlined in this section. If not, it is possible that there is a leakage as a result of deterioration of the fast idle air valve (FIAV), and if so, the throttle body should be replaced.

(9) Switch OFF the ignition, remove the jumper wires from the self diagnosis plug, disconnect the jumper lead from the spark advance cut terminal.

(10) Restart the engine and let it idle for about ten minutes and check the idle speed is to specifications.

Idle Speed and CO% Adjustment — Variable Resistor Setting KR (NZ) Only

(1) Before checking idle speed prepare the vehicle as follows:

Make sure that the engine is at normal operating temperature with coolant temperature 80° to 90°C.

Place transmission in neutral.

Turn all lights and accessories off.

Make sure that the cooling fan is off.

(2) Check ignition timing. Adjust to specification if necessary. Refer page 13-2-1.

(3) Check idle speed. Adjust to specification if necessary. Refer page 13-2-1.

(4) Adjust carbon monoxide concentration to specifications by using the variable resistor adjusting screw. To carry out this adjustment a MAS screwdriver, Part No. MD998299, is available.

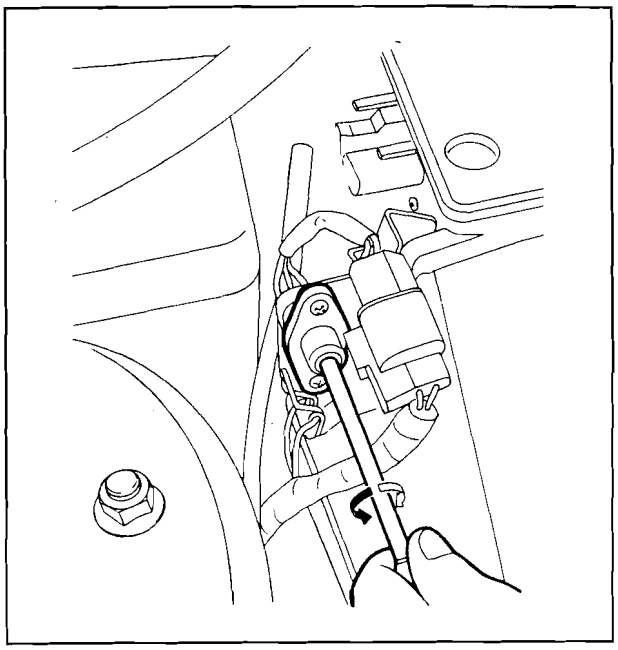


Fig. 56A—Variable resistor

Accelerator Cable Inspection and Adjustment

NOTE: For models with auto-cruise control, refer to Section 5 this Group.

(1) Ensure the engine is at normal operating temperature.

(2) Turn air conditioner and lights OFF.

(3) Check idle speed is to specification.

(4) Stop engine (ignition switch OFF).

(5) Check that there are no sharp bends in the accelerator cable.

(6) Check accelerator cable for correct freeplay, if not to specification adjust by the following procedure:

A. Turn ignition switch to the ON position (without starting the engine) and leave ignition ON for approx. 15 seconds.

B. Loosen the adjusting bolts and then secure the outer cable so that the freeplay of the inner cable is 1-2 mm Manual Trans. (3-5 mm Auto Trans.)

C. Adjust accelerator cable play and confirm throttle lever stopper touches the fixed SAS screw.

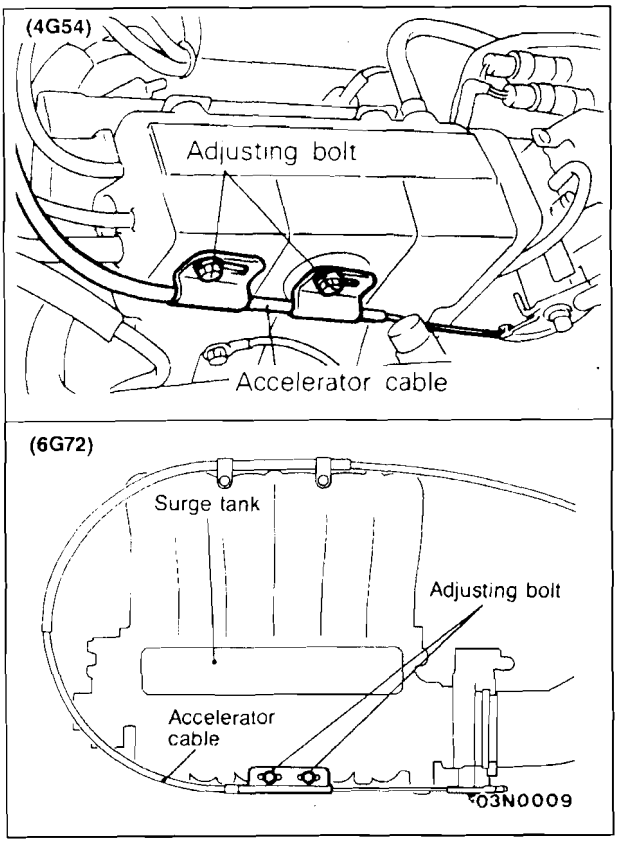


Fig. 56B — Accelerator cable adjustment

COMPONENT TESTING

Fuel Pump Operation Check

(1) Turn ignition switch to OFF.

(2) Apply 12V to the terminal of the checker connector in the engine bay, refer Fig. 57.

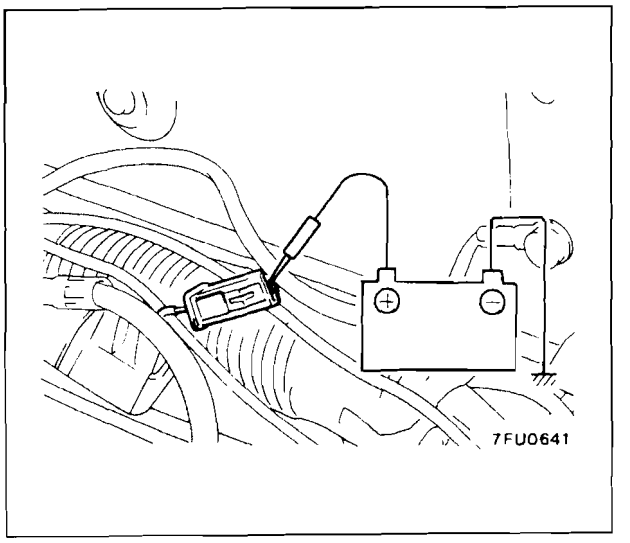


Fig. 57 — Checker connector

NOTE: The fuel pump being the in-tank type may be hard to hear.

(3) Pinch the fuel hose at the delivery pipe or place a hand on the pressure regulator and feel for pulsations.

For further fuel pump testing, refer to Section 3 — Fuel Pump, this Group.

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Air Flow Sensor (AFS)

A faulty AFS will result in a self diagnosis fault or can also be detected with the Multi-Use-Tester. An AFS failure will not stop the engine from operating, it could cause fuel economy or driveability problems.

(1) Start engine and run till normal operating temperature is obtained.

(2) With the AFS connector coupled, connect a voltmeter to terminals 3 and 5 at the back of the connector, refer Fig. 58.

(3) Measure the voltage at terminals 3 and 5.

Engine speed (rpm)	Output voltage (V)
Idling 3,000	2.2 to 3.2

CAUTION: Use thin probes when attaching voltmeter to the back of the connector and be careful not to damage the water proof cover at the back of the connector.

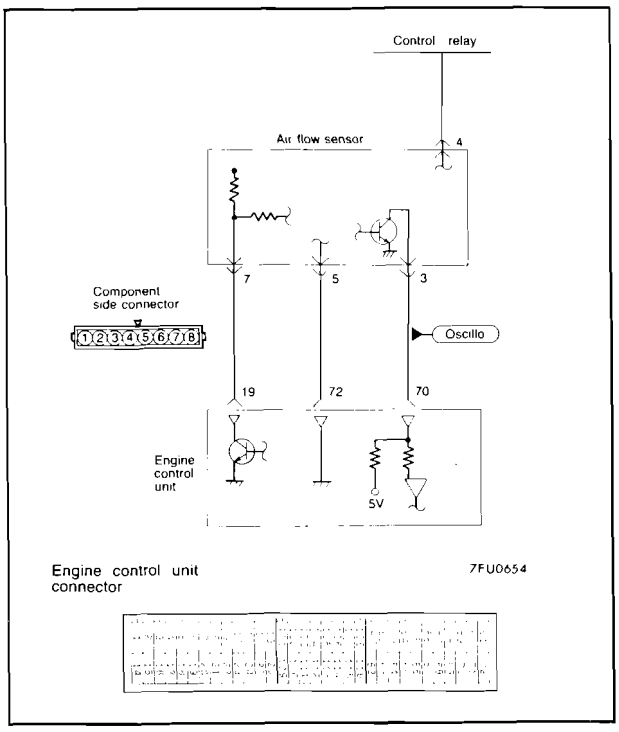


Fig. 58—Air flow sensor schematic

NOTE: For inspection of variable intake control system refer to Group 15.

Intake Air Temperature Sensor

(1) Uncouple the AFS connector at the air cleaner body.

(2) Measure resistance between terminals 5 and 6. Heat the sensor with a hair drier and the resistance should decrease, refer Fig. 59.

Atmospheric Pressure Sensor

If the sensor is faulty a self diagnosis code will result. The voltage output from the sensor can be measured at the AFS connector.

(1) With the AFS connector coupled, connect a voltmeter to terminals 5 and 2 at the back of the connector.

(2) Turn the ignition ON, at atmospheric pressure (103 kPa), reading should be 4 volts (approx.).

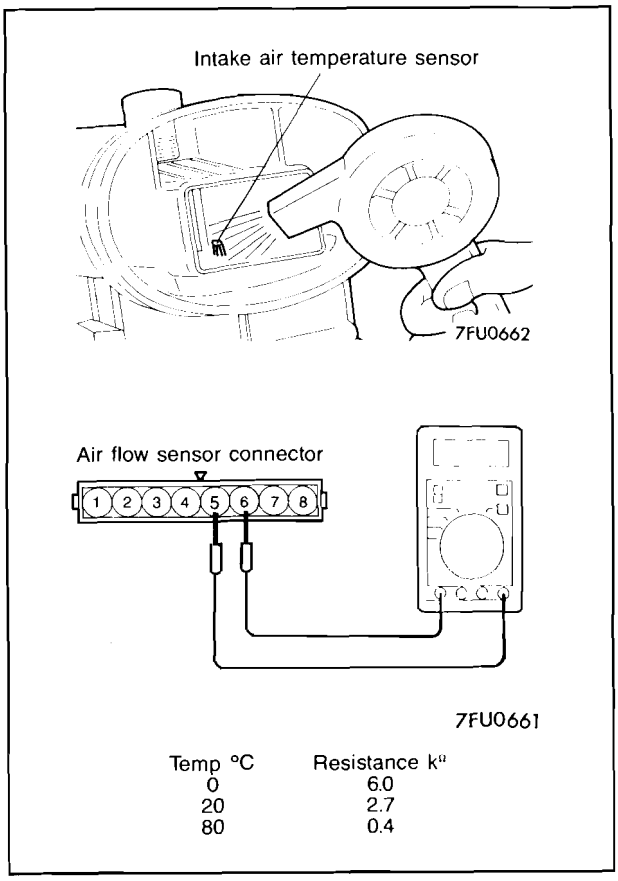


Fig. 59—Intake air temperature sensor inspection

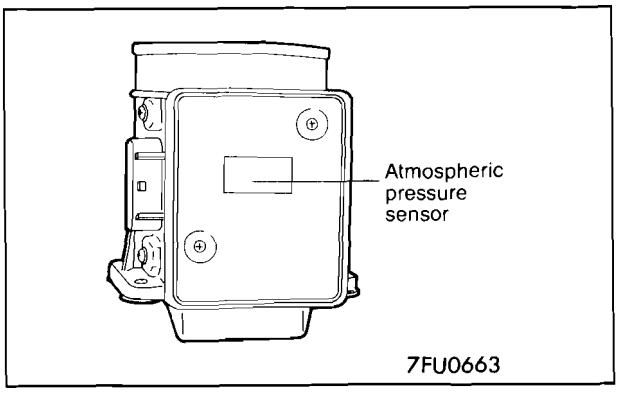


Fig. 60—Atmospheric pressure sensor

Coolant Temperature Sensor

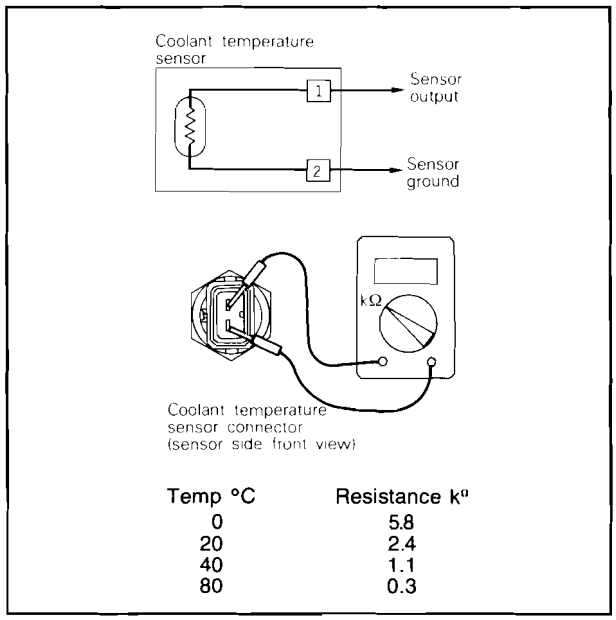
If the sensor is faulty a self diagnosis code will result. The sensor can be checked by immersing in hot water.

(1) Drain the engine coolant to a level below the inlet manifold.

(2) Uncouple the connector and remove the sensor from the underside of the inlet manifold.

(3) With the sensing portion of the unit immersed in water, heat the water and note the change in resistance, refer Fig. 61.

(4) On installation of the sensor use Loctite 242 (Part No. 4253293) on the threads and tighten to 20 to 40 Nm.



Temp °C	Resistance kΩ
0	5.8
20	2.4
40	1.1
80	0.3

Fig. 61—Coolant temperature sensor inspection

Throttle Position Sensor

If the sensor is faulty a self diagnosis code will result. The sensor can be checked using an Ohmmeter.

(1) Uncouple the TPS connector at the throttle body.

(2) Measure the resistance between terminals 1 and 4 at the TPS connector, refer Fig. 62.

Requirement: 3.5-6.5kΩ

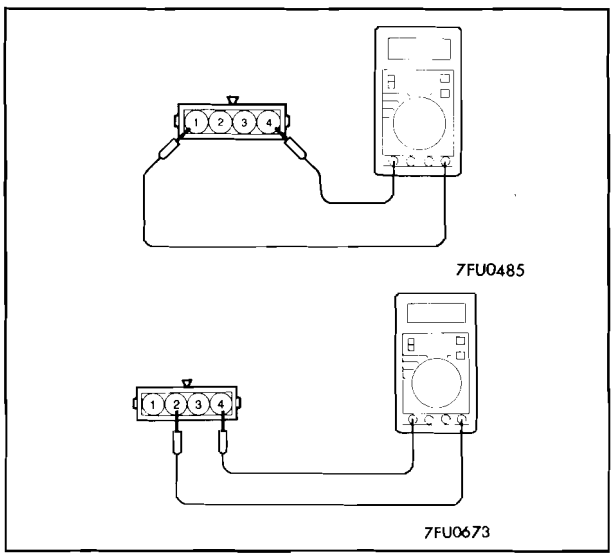


Fig. 62—Throttle position sensor inspection

(3) Measure the resistance between terminal 2 and 4 of the TPS connector.

Operate the throttle valve slowly from the idle position to the full open position.	Resistance changes smoothly in proportion with the throttle valve opening angle.

(4) If the resistance is out of specification or fails to change smoothly, replace the TPS.

Installation torque: 1.5-2.5Nm.

Idle Position Switch

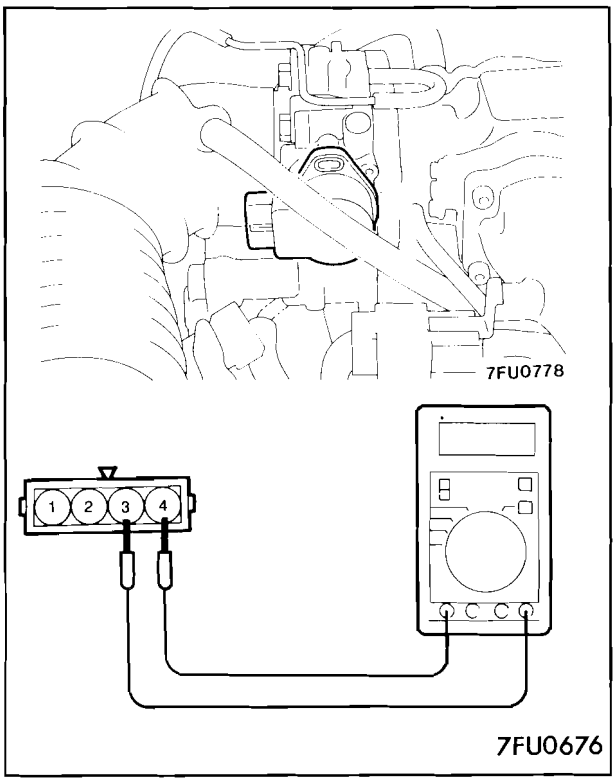


Fig. 63—TPS with inbuilt idle position switch

The idle switch, while checked by the self diagnosis system, can be inspected using the Multi-Use-Tester or by using an ohmmeter:

(1) Uncouple the ISC motor connector at the throttle body.

(2) Check continuity between terminals 3 and 4, refer Fig. 63.

Accelerator pedal	Continuity
Depressed	Open circuit
Released	Ground circuit

(3) If out of specification, replace the TPS sensor assembly.

Fuel Control Relay

Failure of the control relay prevents power supply to the fuel pump, injectors, stepper motor and ECU, resulting in failure to start.

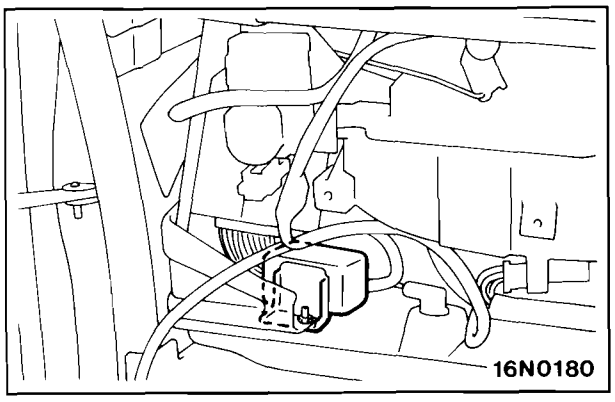
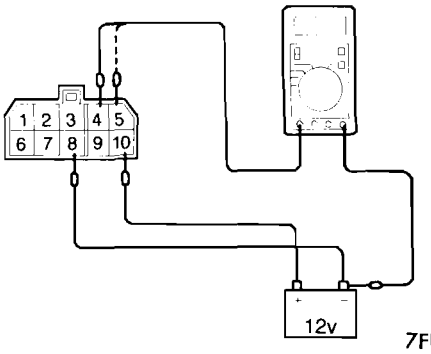


Fig. 64—Fuel control relay location

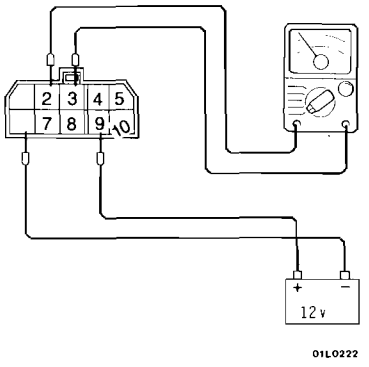
(1) Remove the glove box undercover.
(2) Remove the glove box.
(3) Uncouple the relay connector and remove the relay.

CAUTION: When applying the battery voltage direct, ensure it is to the correct terminals as outlined. Failure to do so may damage the relay.

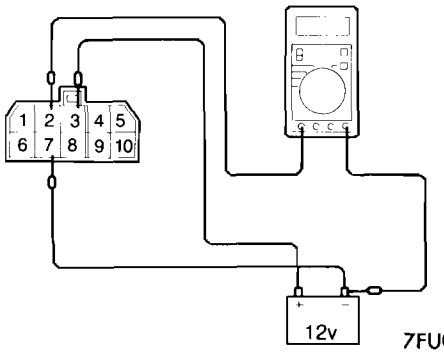
(4) Check continuity between terminals as outlined in Fig. 65 when the coils are energised and not energised.
(5) Replace the relay if faulty.



Jumper wire	Voltage at terminal ④	Voltage at terminal ⑤
Connected	Source voltage	Source voltage
Disconnected	O V	O V



Jumper wire	Continuity across terminals ② and ③
Connected	Conductive
Disconnected	Nonconductive



Jumper wire	Voltage at terminal ②
Connected	Source voltage
Disconnected	O V

Fig. 65—Control relay inspection

Oxygen Sensor Single Wire Type

On early models, if the sensor is faulty, a self diagnosis code will result.

Check the sensor as follows:

(1) Run the engine until normal operating temperature is reached.

(2) Connect a voltmeter to the back of the sensor connector.

(3) Start the engine and increase engine speed to 2,500 rpm. The voltmeter should fluctuate between 0V and 1V approximately 7 or 8 times in 10 seconds.

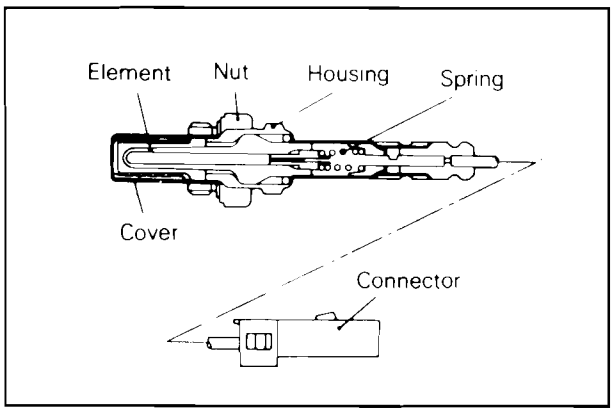


Fig. 66—Oxygen sensor

(4) Replace the oxygen sensor if faulty.

NOTE: Prior to fitting a sensor to the exhaust manifold, coat the threads with a copper based thread release agent (Ampol KOPR KOTE or equivalent).

If the threads are not protected, the sensor will be impossible to remove, if required at a later date.

(5) Tighten the sensor to 50-60Nm.

Oxygen Sensor 4 Wire Type

If the sensor is faulty a self diagnosis code will result. Check the sensor as follows:

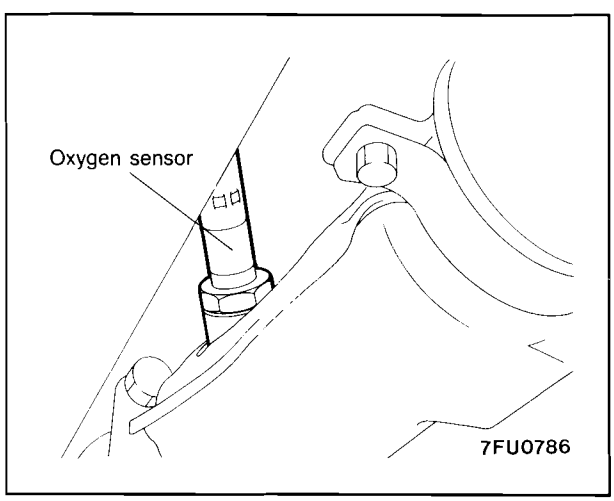


Fig. 67—Oxygen sensor 4 wire type

(1) Disconnect the oxygen sensor connector and connect the Special Tool MB991223, Harness Set connector, to the oxygen sensor side connector, refer Fig. 68.

(2) Check that there is continuity between terminals 3 and 4 of the oxygen sensor connector.

(3) If there is no continuity, replace the oxygen sensor.

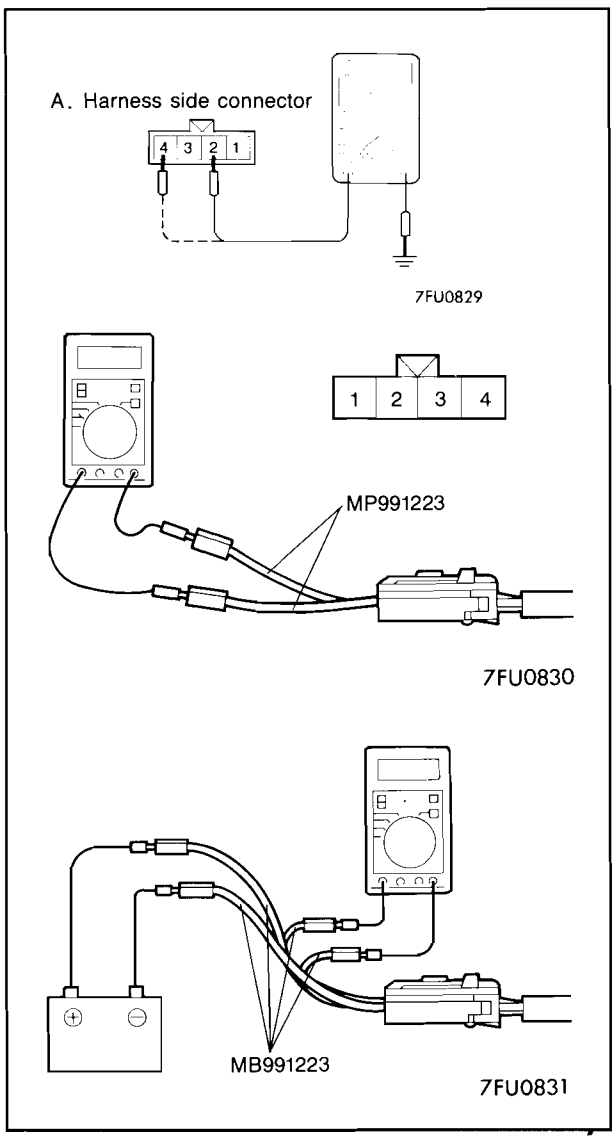


Fig. 68—Oxygen sensor test connections

(4) Warm up the engine until the engine coolant temperature becomes 80°C or higher.

(5) Using jumper wires, connect the terminals 3 and 4 of the oxygen sensor connector to the battery (+) and (−) terminals respectively.

(6) Connect a digital voltmeter across terminals 1 and 2.

(7) Racing the engine repeatedly, measure the output voltage of the oxygen sensor.

Engine	Oxygen sensor output voltage	Remarks
When engine is raced	0.6 — 1.0 V	When the air-fuel mixture becomes richer as a result of repeated racing, the oxygen sensor should output a voltage of 0.6 — 1.0 V

Power Transistor

The power transistor may be checked as follows:

(1) Connect a known good ignition coil to the power transistor as shown, refer Fig. 69.

(2) Connect the leads of an Ohmmeter (containing a 3 volt battery) across terminals 1 and 2 (+ve to 2) of the power transistor.

(3) Connect and disconnect the negative lead of the Ohmmeter to terminal 1 of the power transistor. The ignition coil should emit a spark.

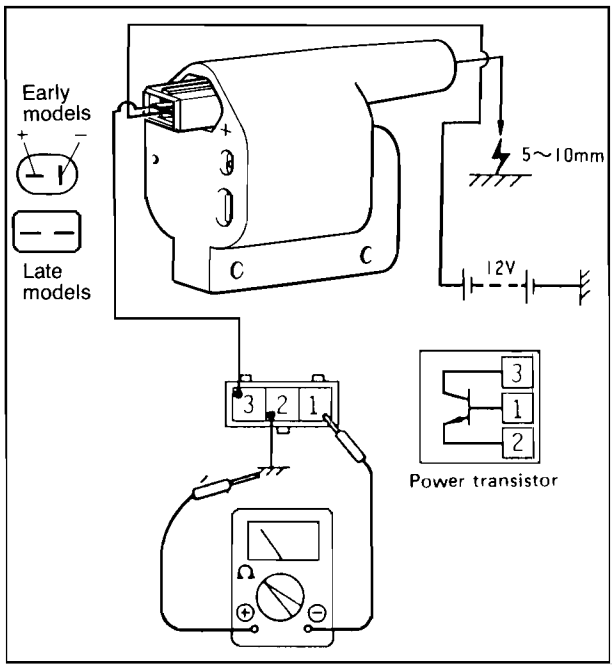


Fig. 69—Checking power transistor

NOTE: Do not use an Ohmmeter which uses a battery of greater capacity than 3 volts. The above test can be performed using a 3 volt battery with the battery positive connected to terminal 1 of the power transistor.

(4) Replace the power transistor if faulty.

Injectors

The injectors can be checked for coil resistance as follows:

(1) Uncouple the injector connector.

(2) Measure the resistance across each injector terminal, refer Fig. 70.

Requirement: 16 ± 3 Ohms @ 20°C.

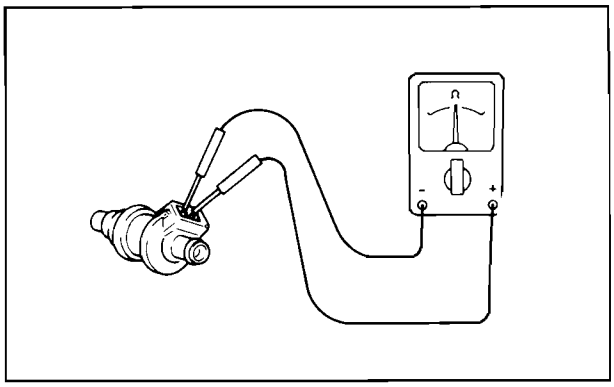


Fig. 70—Injector resistance check

Distributor 4 Cylinder Models

Removal

(1) Uncouple the distributor connector.
(2) Remove high tension leads from spark plugs and coil.

CAUTION: The correct method of detaching this type of lead from the spark plug, is to grasp the rubber insulator at the spark plug end and remove with a combined twisting and pulling motion.

(3) Unfasten the retaining clips and remove the distributor cap.
(4) Rotate the engine crankshaft until the distributor rotor is pointing towards the No. 1 cylinder firing position, ensuring that the crankshaft pulley timing mark is in line with the top dead centre (TDC) mark on the timing plate.

NOTE: No. 1 firing position is when the rotor arm mark is aligned with the raised section on the top of the electrical connector, refer Fig. 71.

(5) Remove distributor clamping nut.
(6) Carefully remove the distributor from the engine, the shaft will rotate a small amount as the distributor gear is disengaged from the camshaft gear.

NOTE: To retain the engine in the correct timing position, DO NOT rotate the crankshaft while the distributor is removed.

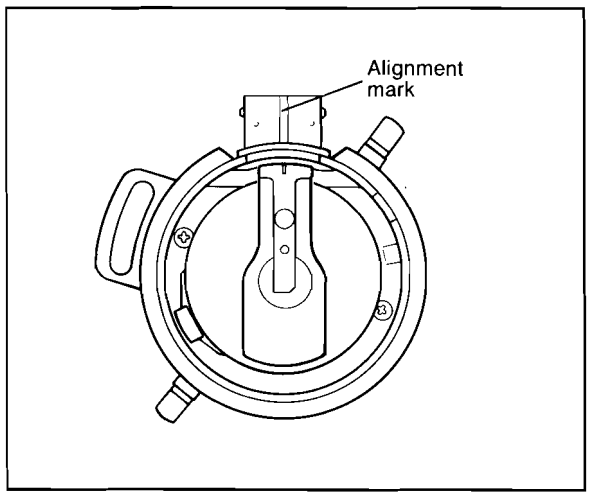


Fig. 71—No. 1 firing position (4 cyl. model)

Disassembly

(1) Remove the distributor rotor.
(2) Remove the trigger disc retaining clip.
(3) Using a suitable puller or levers, carefully remove the trigger disc and retaining pin.

CAUTION: Care should be taken when removing the trigger disc as it can be easily bent during disassembly. It may be necessary to replace the trigger disc if it is bent on removal.

(4) Remove the hall generator retaining clip.
(5) Remove the hall generator retaining screws.
(6) Remove the hall generator assembly.
(7) Remove the main shaft retaining clip and main shaft bearing retaining screws.
(8) Remove the drive gear retaining pin.
(9) Remove the drive gear.
(10) Remove the main shaft.
(11) Remove main shaft bearing.

Inspection

Check all components for wear.
Check cap and rotor for damage.
Check cap for cracks.
Check drive gear for wear or damage.
Replace any defective components.

Assembly

Assemble by reversing the removal procedure.

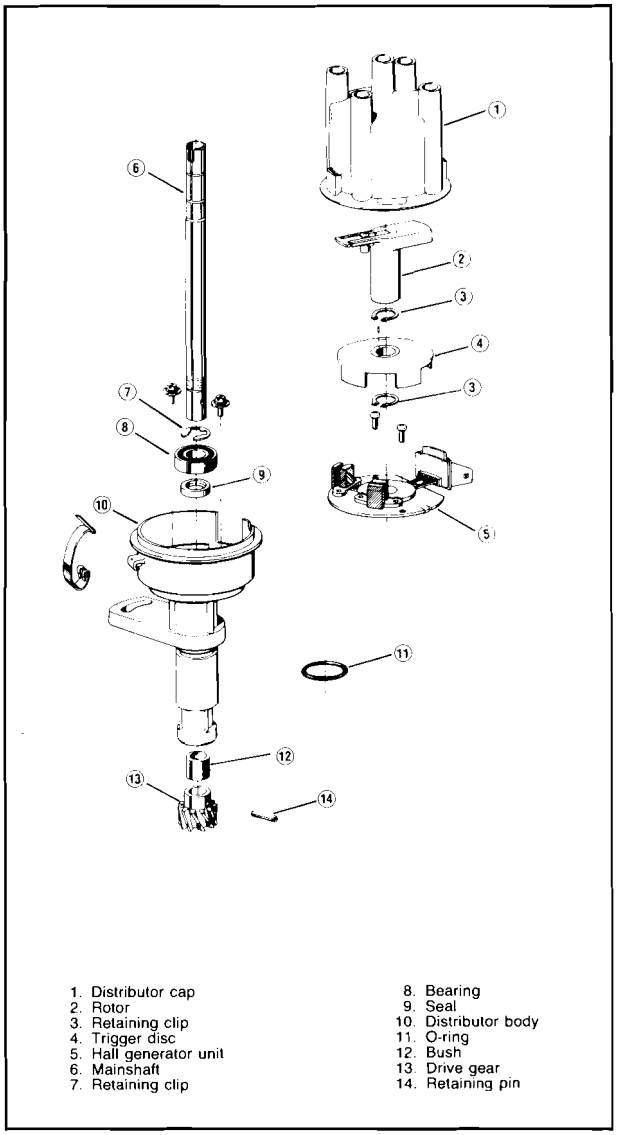


Fig. 72—ECI Multi distributor (4 cyl models)

Installation

(1) Ensure the crankshaft is positioned at TDC with No. 1 piston on compression stroke.

(2) Align the mating mark (line) of the distributor housing with the **protruding** side of the drive gear roll pin, refer Fig. 73.

(3) Insert the distributor into the cylinder head so as the retaining stud enters the retaining flange slot and is positioned in the middle of the slot.

(4) The rotor arm mark should be aligned with or near to the raised section on the connector top, refer Fig. 73.

NOTE: If not aligned, remove the distributor, repeat steps 2 and 3 above, ensuring the mating marks are aligned.

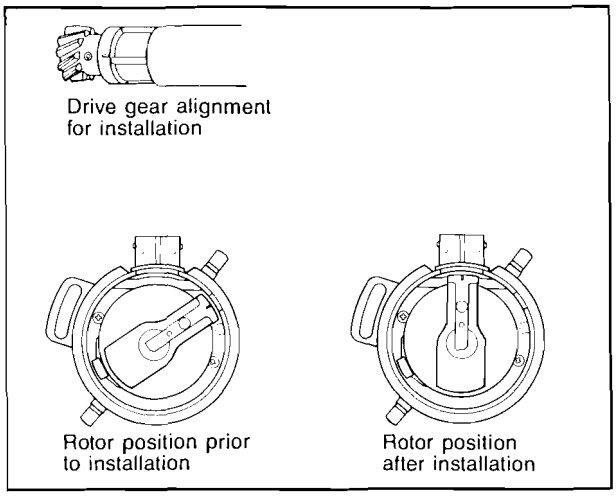


Fig. 73—Distributor installation

(5) Install retaining nut.

(6) Install distributor cap.

(7) Connect high tension leads and distributor connector.

(8) Adjust ignition timing to specification.

Hall Generator Unit Testing

The Hall generator unit can be tested using the self diagnosis system MUT, or by using a voltmeter as follows:—

(1) Carefully remove water proof cover from the back of the distributor loom connector.

(2) Using suitable probes connect a voltmeter to the Green/Black wire and the Black wire at the back of the connector.

(3) Turn ignition on (DO NOT START) battery voltage should be available, (if not check associated wiring).

NOTE: For items 4 to 9 use an analogue voltmeter set on low scale when check output voltage when cranking, because output values are low.

(4) Connect voltmeter to Green/Yellow wire and Black.

(5) Disconnect primary coil connector (refer this section for removal procedure).

(6) Crank engine, voltage should be available.

(7) If not replace hall generator assembly.

(8) Connect voltmeter to Black/White wire and Black wire.

(9) Crank engine, voltage should be available.

(10) If not replace hall generator.

(11) Replace water proof cover to back of the distributor connector.

(12) Refit primary coil connector.

Distributor V6 Models

Removal

(1) Uncouple the distributor connector.

(2) Remove high tension leads from spark plugs and coil.

CAUTION: The correct method of detaching this type of lead from the spark plug, is to grasp the rubber insulator at the spark plug end and remove with a combined twisting and pulling motion.

(3) Rotate the engine crankshaft until the distributor rotor is pointing towards the No. 1 cylinder firing position, ensuring that the crankshaft pulley timing mark is in line with the top dead centre (TDC) mark on the timing plate.

(4) Unfasten the cap retaining screws and remove the distributor cap.

NOTE: No. 1 firing position is when the rotor arm mark is aligned in the eight o'clock position, refer Fig. 74.

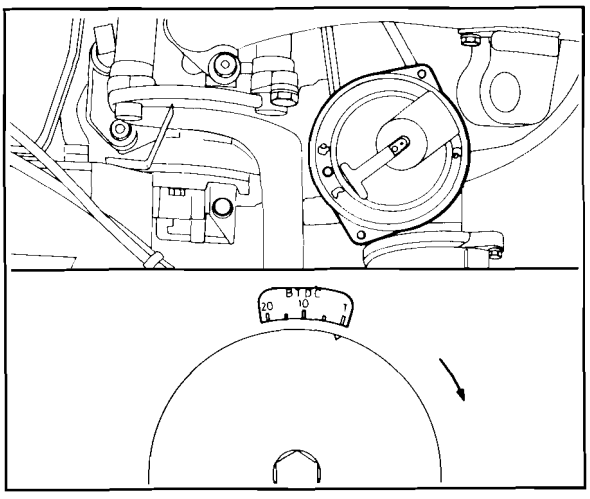


Fig. 74—No. 1 firing position

(5) Remove distributor clamping nut.

(6) Carefully remove the distributor from the engine, the shaft will rotate a small amount as the distributor gear is disengaged from the camshaft gear.

NOTE: To retain the engine in the correct timing position, DO NOT rotate the crankshaft while the distributor is removed.

Disassembly

(1) Remove the rotor holding bolt and remove rotor.

(2) Remove the distributor cover.

(3) Remove the centre screw and remove the spacer (upper).

(4) Remove the washer.

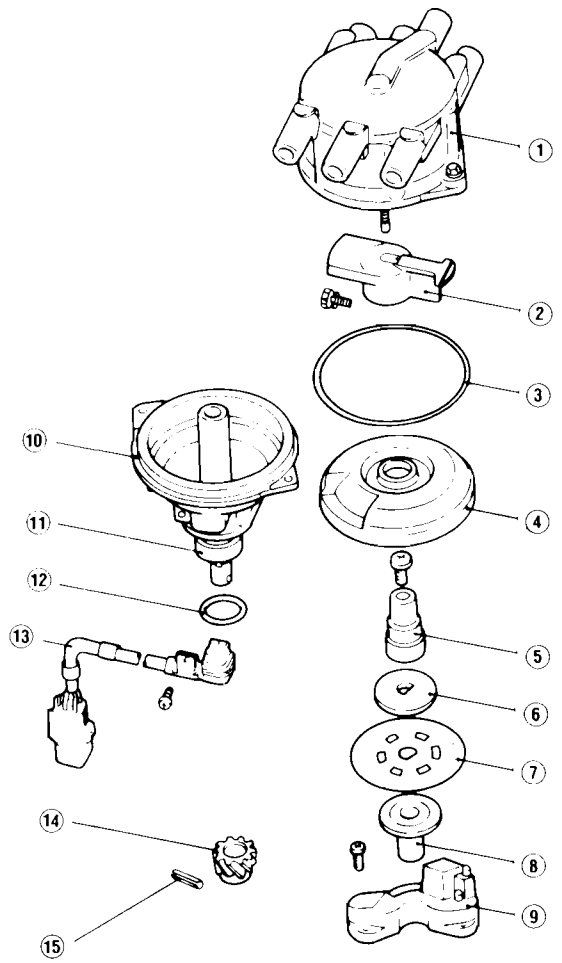


Fig. 75—Distributor assembly

(5) Remove the disc of the drive gear shaft.
(6) Remove the spacer lower.
(7) Remove the sensor unit.
(8) Remove the wiring harness from the distributor housing.
(9) Mark the drive gear and distributor housing for reference, remove the roll pin and slide the drive gear off the shaft.
(10) Remove the shaft from the distributor housing.

Inspection

Check all components for wear.
Check cap and rotor for damage.
Check cap for cracks.
Check drive gear for wear or damage.
Replace any defective components.

Assembly

Install by reversing the disassembly procedure.

Installation

(1) Ensure the crankshaft is positioned at TDC with No. 1 piston on compression stroke.
(2) Align the mating mark (line) of the distributor housing with the **protruding** side of the drive gear roll pin, refer Fig. 76.

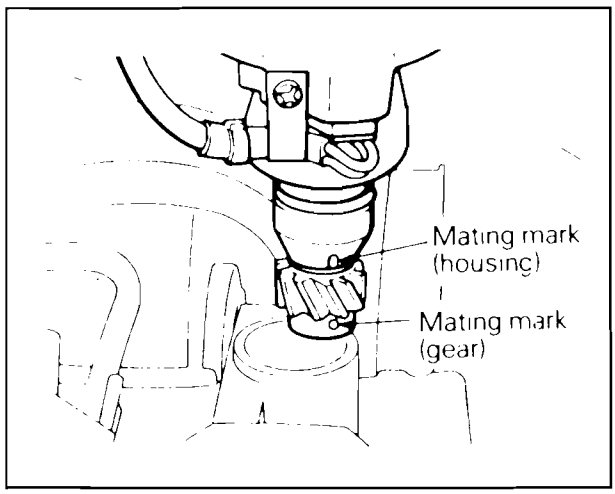


Fig. 76—Distributor installation

(3) Insert the distributor into the cylinder head so as the retaining stud enters the retaining flange slot and is positioned in the middle of the slot.
(4) The rotor arm should be aligned in the eight o'clock position, refer Fig. 74.

NOTE: If not aligned, remove the distributor, repeat steps 2 and 3 above, ensuring the mating marks are aligned.

(5) Install retaining nut.
(6) Install distributor cap.
(7) Connect high tension leads and distributor connector.
(8) Adjust ignition timing to specification.

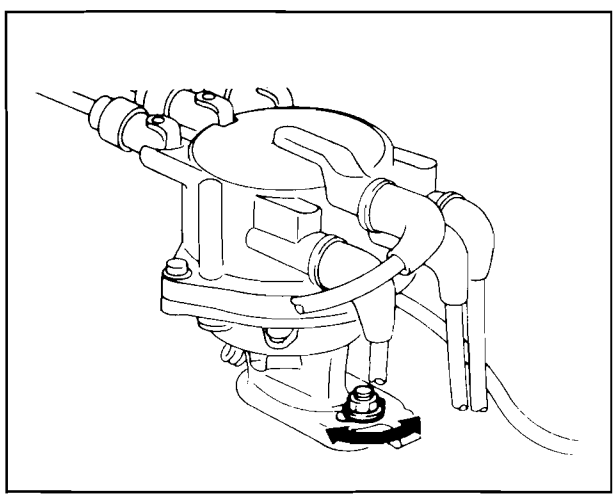


Fig. 77—Adjusting ignition timing

Ignition Coil

(1) Check coil primary resistance by connecting an Ohmmeter between the positive and negative coil terminals.

(2) Check coil secondary resistance by connecting an Ohmmeter between the negative terminal and the high tension tower.

Requirement—Primary 0.72 to 0.88 Ohm
—Secondary 10.29 to 13.92 kOhm

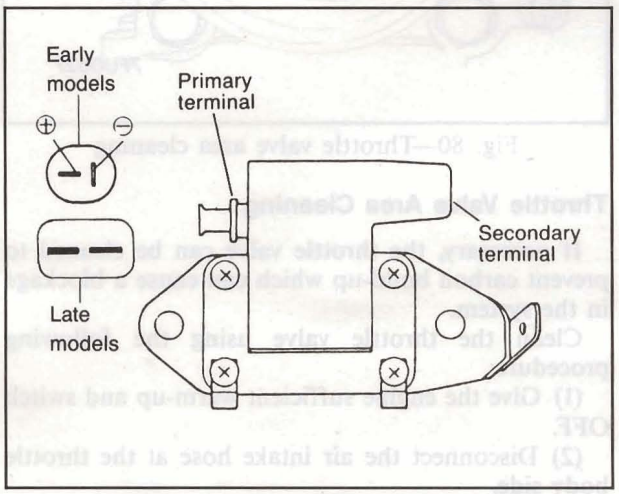


Fig. 78—Ignition coil terminals

NOTE: The connector has a locking tab on the underside which is concealed by a rubber boot. To uncouple, squeeze the rubber boot between the thumb and forefinger (refer Fig. 79), paying particular attention to releasing the locking tab in direction 'A'.

Attempting to uncouple the connector without fully unlatching the lock tab will result in damage to the connector and/or coil.

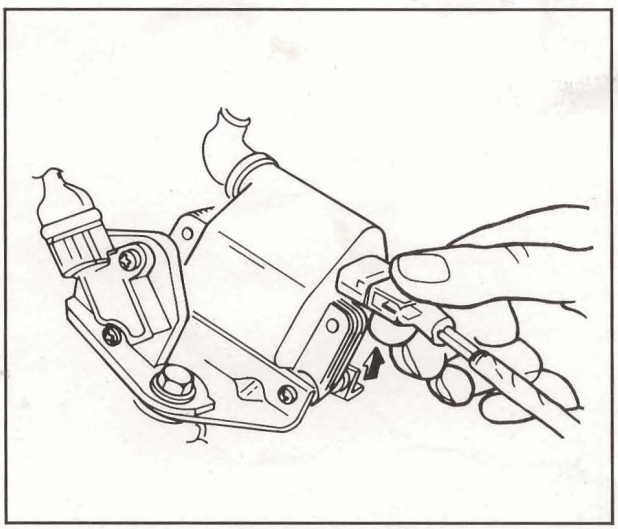


Fig. 79—Uncoupling coil primary connector

Throttle Body

NOTE: The procedure outlined below describes the disassembly of the throttle body when removed from the engine. If the throttle body requires repairing or component replacing, remove only the component/s needed to carry out the repairs.

Disassembly

(1) Unscrew the TPS retaining bolts and remove the throttle position sensor.
(2) Unscrew the idle speed control servo and stepper motor retaining bolts and remove the assembly, refer Fig. 81.

NOTE: Do not remove the throttle valve.

- **Be careful when removing the throttle position sensor and idle speed control servo mounting screws as adhesive has been applied to these screws.**
- **When loosening a Phillips screw which has been firmly tightened, use a Phillips screwdriver that is an exact fit for the screw.**

Inspection

(1) Clean all throttle body parts.

NOTE: Do not use solvent to clean the following parts

- **Throttle position sensor**
- **Idle speed control servo.**

If these parts are immersed in solvent, their insulation will deteriorate. Wipe them with cloth only.

(2) Check if vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

Assembly

Assemble by reversing removal procedure, noting the following:
(1) Make sure the joints of the TPS are aligned correctly on istallation. Reset the TPS to specifications.

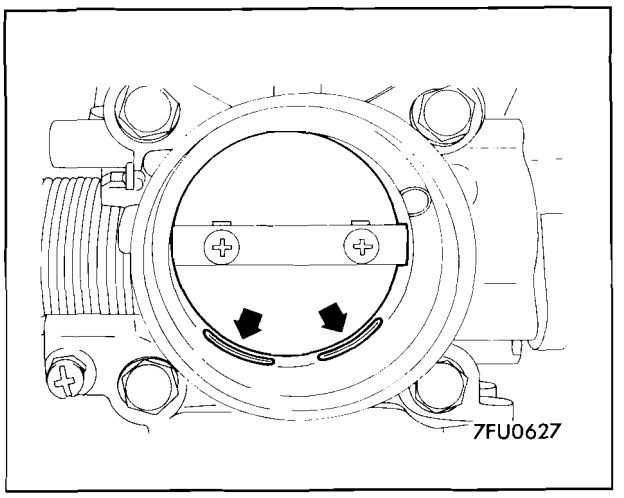


Fig. 80—Throttle valve area cleaning

Throttle Valve Area Cleaning

If necessary, the throttle valve can be cleaned to prevent carbon build-up which can cause a blockage in the system.
Clean the throttle valve using the following procedure:
(1) Give the engine sufficient warm-up and switch OFF.
(2) Disconnect the air intake hose at the throttle body side.

NOTE: Plug the bypass passage entrance of the throttle body, refer Fig. 80.

CAUTION: Make sure that no cleaning liquid enters the bypass passages, or damage may result.

(3) Spray the valve from outside the throttle body with a suitable carburettor cleaner (CRC Clean R. Carb, STP Carb Spray Cleaner or equivalent) and let it soak for five minutes.
(4) Reconnect intake hose and start engine.
(5) Race engine several times and idle for about one minute.
(6) Repeat steps 2 to 5.

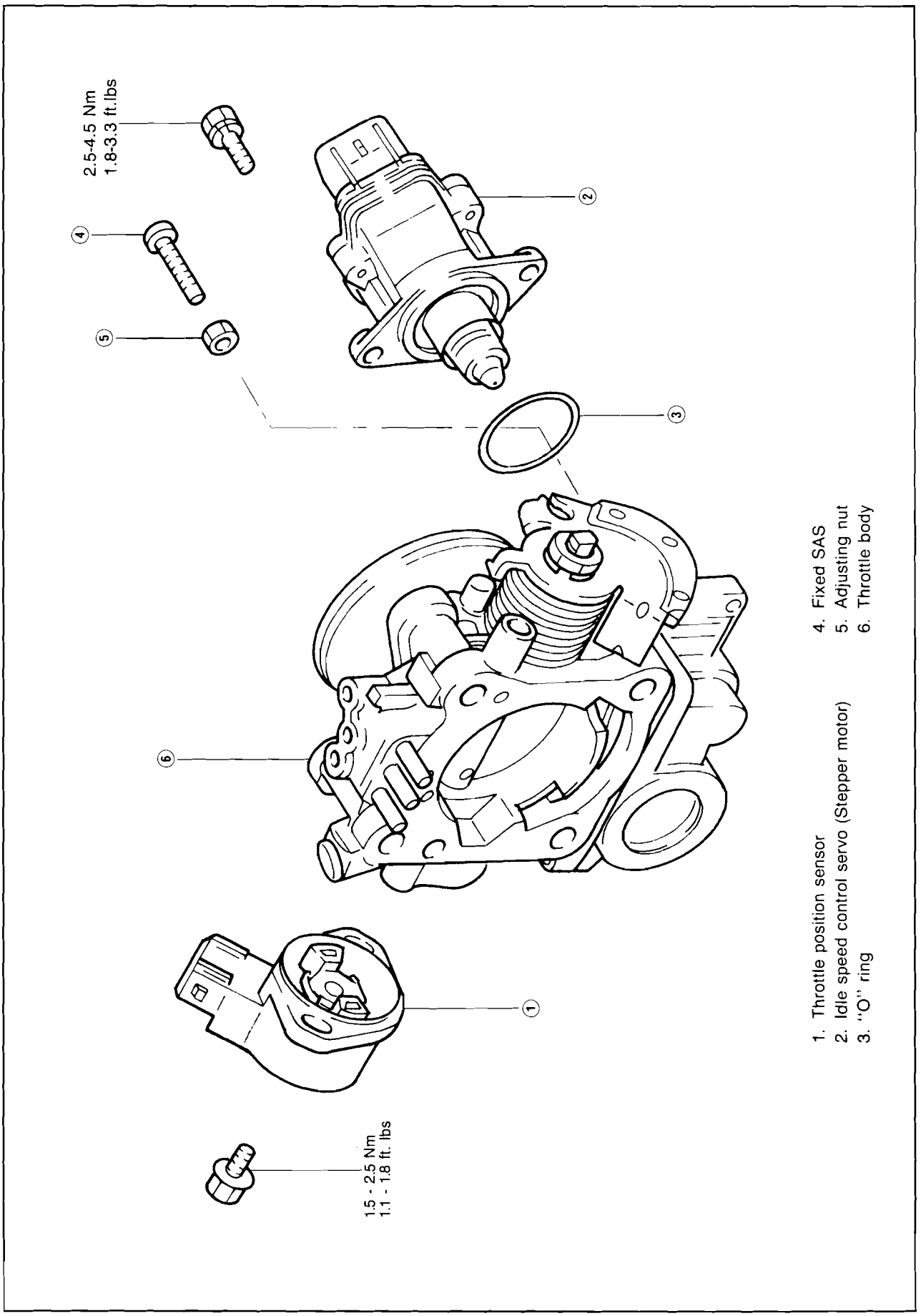


Fig. 81—Throttle body components

VACUUM HOSE LAYOUT

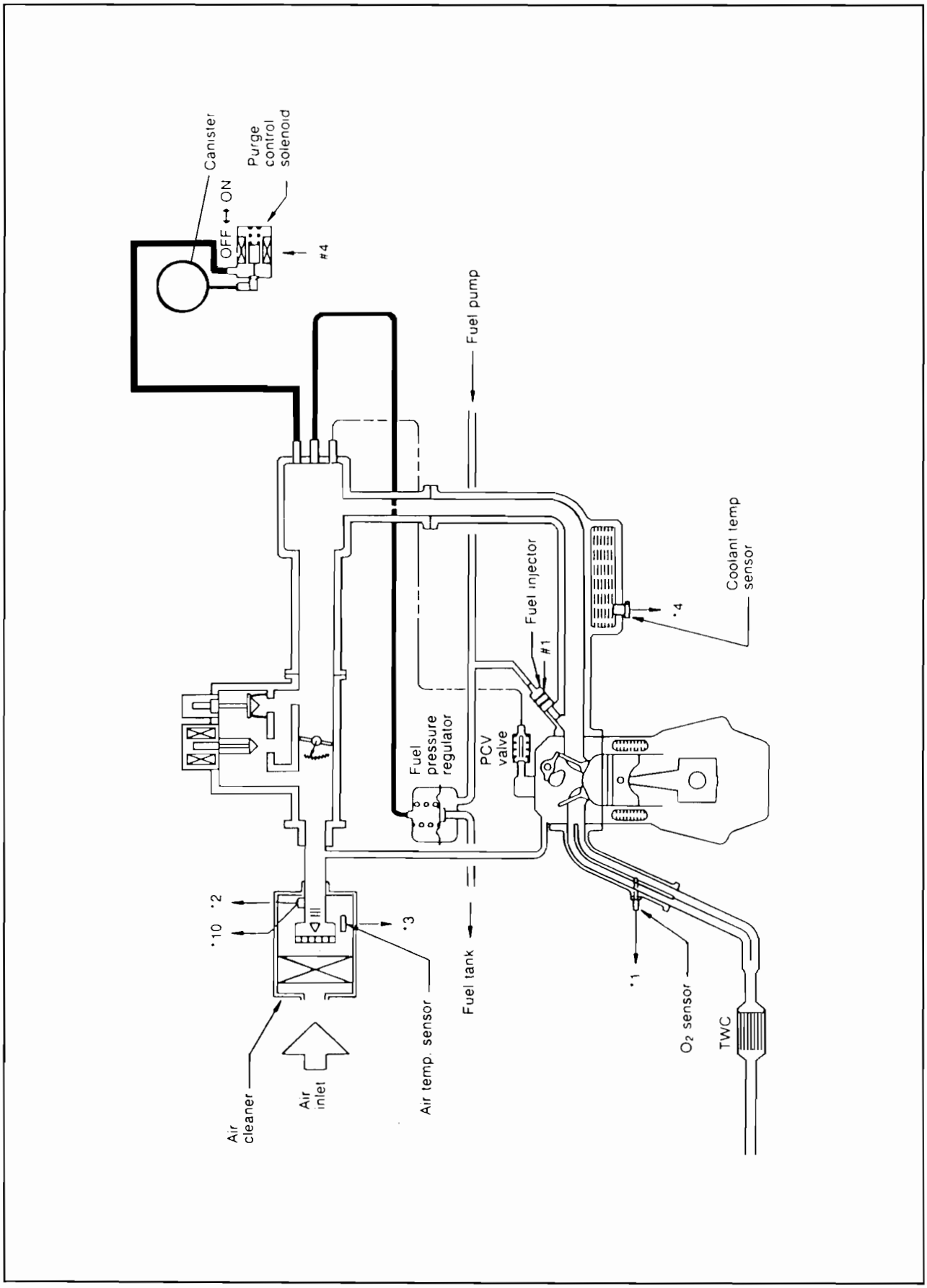


Fig. 82—Vacuum control system 4 cylinder models

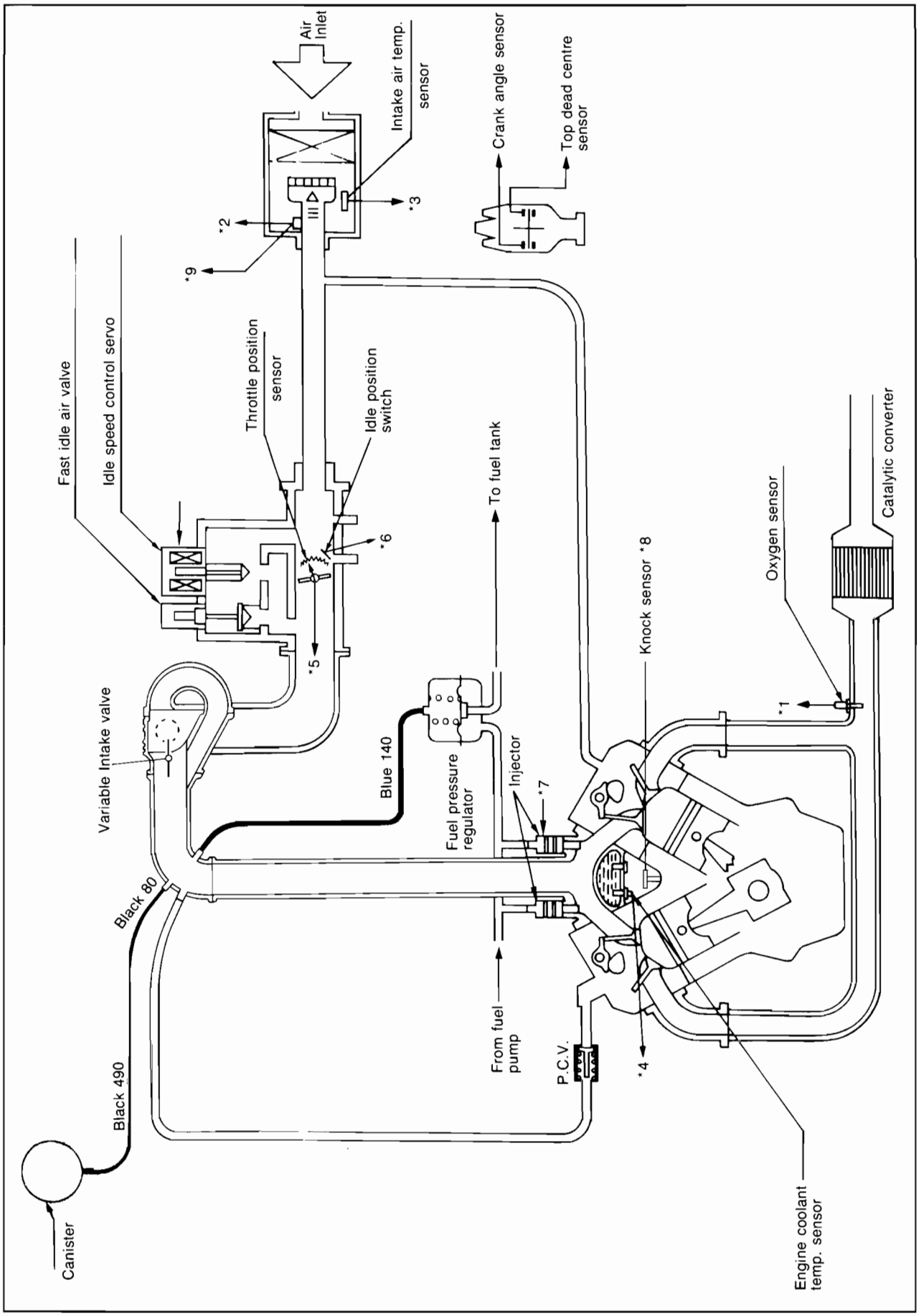


Fig. 83—Vacuum control system V6 models

SECTION 3—ELECTRIC FUEL PUMP

SPECIFICATIONS

Low Pressure Type — Carburettor Models	
Type	Vane pump
Location	In tank
Flow rate — @ 12 ± 0.1V	80 litres/hour @ 20 ± 2 kPa
— @ 13.5 ± 0.1V	140 litres/hour @ 29 ± 2 kPa
Maximum output pressure (unregulated)	68.6 to 98.0 kPa @ 12 ± 0.1V
	117.6 kPa (max) @ 13.5 ± 0.1V
Delivery pressure	19.6 to 24.5 kPa (with return line blocked off)
High Pressure Type — ECI-Multi Models	
Type	Impeller
Location	In tank
Flow rate — @ 12V	80 litres/hour (minimum) @ 300 kPa
— @ 8V	20 litres/hour (minimum) @ 250 kPa
Maximum output pressure (unregulated)	330 kPa
Delivery pressure	265 kPa
Relief valve pressure	650 kPa max @ 12V with no flow
High Pressure Type — ECI-Multi Models (with combined pump/sender unit)	
Type	Impeller
Location	In tank
Flow rate — @ 12V	80 litres/hour (minimum) @ 294 kPa
— @ 8V	20 litres/hour (minimum) @ 250 kPa
Maximum pressure of flow @ 12 volts	637 kPa

SPECIAL TOOLS

E14M35	Fuel pump pressure test kit (ECI-Multi)

TORQUE SPECIFICATIONS

	Nm
Fuel hose to delivery pipe	5-6
Fuel hose to fuel pump	25-33
Fuel pump to tank (upper)	2-3
Fuel pump to tank (lower)	9-14

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SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
FUEL DELIVERY PRESSURE LOW	Kinked or leaking fuel line, hose or connection.	Check routing and condition of lines, hoses and connections.
	In line or pump unit fuel filter blocked.	Replace in line filter, or clean tank and replace pump unit filter.
	Fuel pump relief valve faulty.	Replace fuel pump unit.
	Faulty pressure regulator (valve open) — ECI-Multi.	Check and replace pressure regulator.
	Fuel pump drive control system faulty.	Check drive system, replace components as necessary.
	Fuel pump faulty.	Replace fuel pump unit.
FUEL DELIVERY PRESSURE HIGH	Blocked or kinked fuel return hose or pipe.	Clean or replace hose or pipe.
	Faulty pressure regulator (valve binding) — ECI-Multi.	Replace pressure regulator.
	Fuel pump relief valve faulty (carb. models).	Replace fuel pump unit.
NO FUEL DELIVERY	Kinked fuel line or hose.	Check routing of hoses and lines, repair or replace as necessary.
	In line or pump unit fuel filter blocked.	Replace in line filter, or clean tank and replace pump unit filter.
	Blockage in fuel line.	Clean out fuel lines as necessary.
	Fuel pump relief valve stuck open.	Replace fuel pump unit.
FUEL PRESSURE DROPS SLOWLY AFTER ENGINE STOPPED (ECI-Multi)	Pressure regulator faulty (valve leaking).	Replace pressure regulator.
	Faulty injector (stuck open).	Replace injector.
FUEL PRESSURE DROPS QUICKLY AFTER ENGINE STOPPED (ECI-Multi)	Pressure regulator valve stuck open.	Replace pressure regulator.
	Fuel pump check valve binding.	Replace fuel pump unit.
FUEL PUMP INOPERATIVE Carburettor Models	Fault in wiring harness.	Check wiring, repair as necessary.
	Fuel pump control unit faulty.	Check control unit as outlined this section, replace if necessary.
	Fuel pump faulty.	Test pump as outlined this section, replace if necessary.
ECI-Multi	Fault in wiring harness.	Check wiring, repair as necessary.
	Fuel pump control unit faulty.	Check control unit as outlined in Section 2.
	Fuel pump faulty.	Test pump as outlined this section, replace if necessary.

GENERAL INFORMATION

Fuel Pump

The fuel pump is an in-tank unit, with a low pressure type in carburettor models and high pressure type in ECI-Multi models.

Pump operation for both types is governed by a control relay mounted on the lower left hand side of the glove box opening. On fuel injection models the control relay works in conjunction with the ECI-Multi computer.

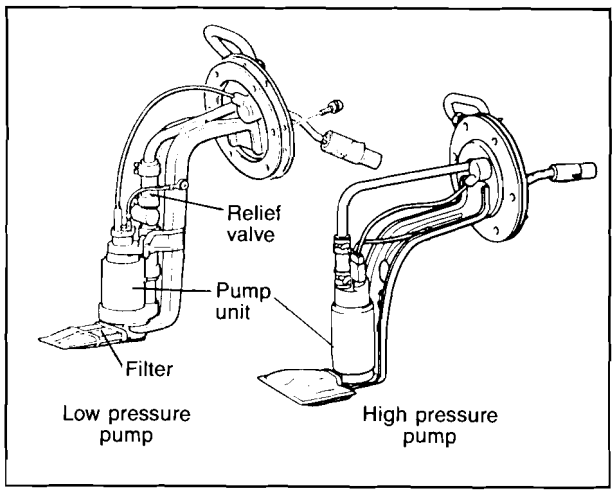


Fig. 1—High and low pressure fuel pump units

Delivery pressure on the low pressure pump is regulated by a relief valve mounted on the pump unit. A pressure regulator in conjunction with the fuel pressure solenoid, controls delivery pressure from the high pressure pump.

Fuel Pump Control Unit

Carburettor Models

The control unit is a transistorised unit which supplies power to the fuel pump under the following conditions only:

- With the ignition switch in the START position i.e. engine cranking.
- With the ignition switch in the ON position with the engine running.

This ensures that should the engine stall, e.g. in the event of an accident, the pump will stop operating.

ECI-Multi

Refer to Section 2 this group, for control unit operation.

Fuel Supply System (refer Fig. 2)

Carburettor Models

A fuel vapour seperator tank (V.S.T.) is mounted on the cylinder head adjacent to the distributor and incorporates three outlets. Fuel from the fuel tank enters the V.S.T. through the middle outlet then flows through the lower outlet to the carburettor. With the engine running, excess fuel is returned to the fuel tank from the upper outlet via the carburettor accelerator pump body. When the engine is stopped, fuel vapours generated in the fuel supply system are returned to the fuel tank in the same way.

NOTE: To ensure adequate fuel supply, it is essential that hoses are connected correctly.

ECI-Multi

The pressure regulator always maintains the injector fuel pressure at a level 330 kPa higher than the manifold pressure. By doing so, the fuel injection amount is kept constant even when the manifold pressure changes.

Ordinarily, the intake manifold vacuum acts upon the pressure regulator to maintain a constant fuel pressure. However, during starting when intake air and engine coolant temperatures are high, the fuel pressure solenoid valve is activated allowing atmospheric pressure to act on the pressure regulator. This slightly raises the fuel pressure, providing reliable hot start and idle characteristics.

FUEL PUMP TESTING

Carburettor Models

Pressure Test

(1) Disconnect the fuel supply hose to the V.S.T. and "Tee" a suitable pressure gauge between the hose and the V.S.T., and block off the return line.

(2) Start the engine and with it running at 1000 r.p.m., check that delivery pressure is within specifications.

(3) If delivery pressure is not within specifications check possible causes listed in "Service Diagnosis".

Electrical Test

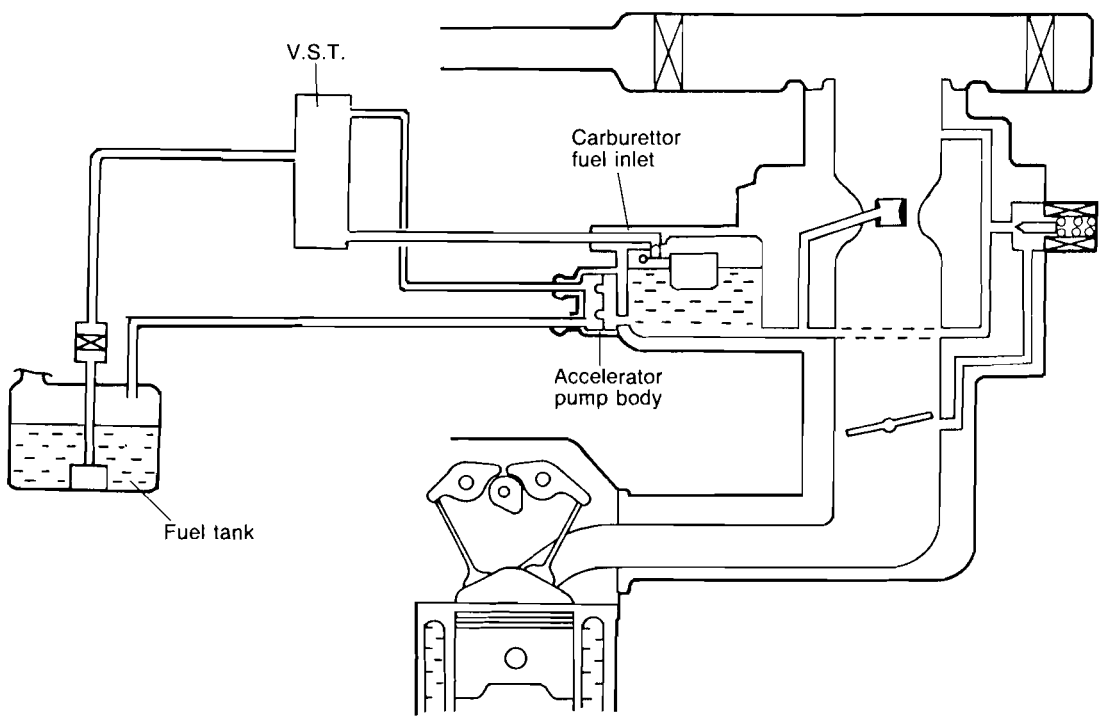
(1) Disconnect the primary ignition wiring at the distributor.

(2) Connect a voltmeter across the battery terminals and with the ignition switch in the START position measure cranking voltage.

(3) Disconnect the wiring harness at the fuel pump and connect a voltmeter across the harness connector terminals (voltmeter positive to black/yellow wire).

(4) Turn ignition switch to START position, i.e. engine cranking, and check voltmeter reading.

Low pressure system (carburettor models)



High pressure system 4G5 engine (ECI-Multi)

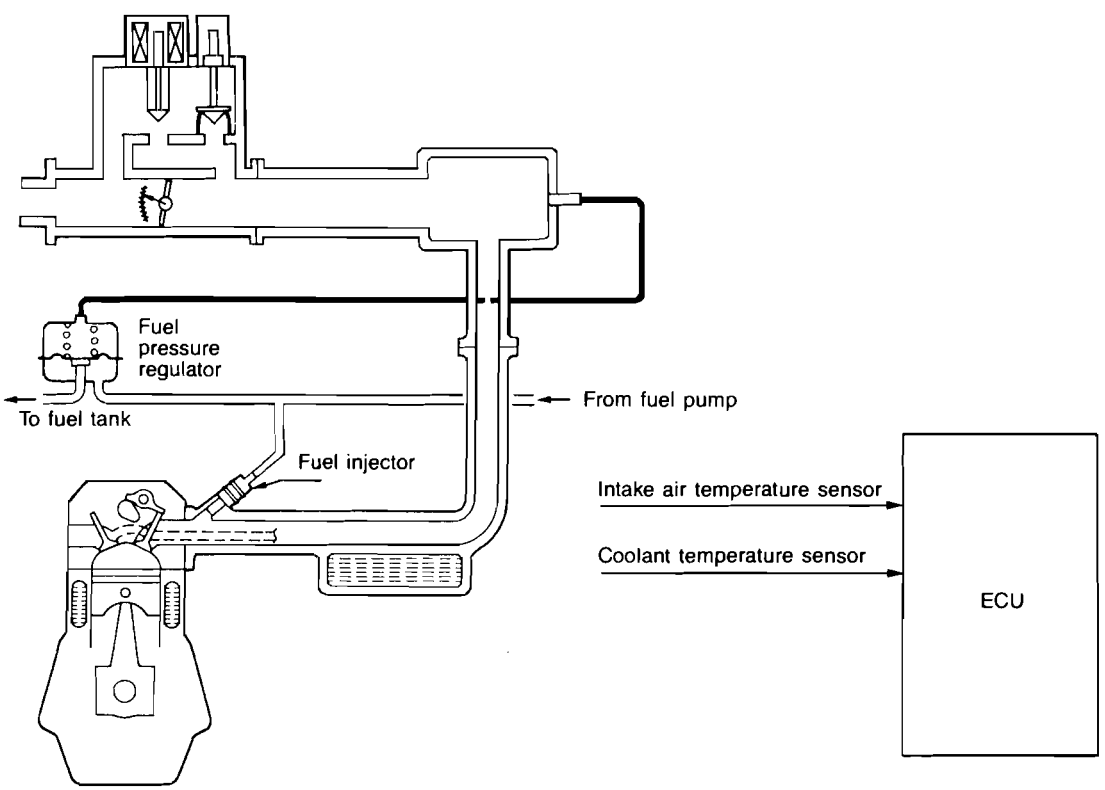


Fig. 2—Fuel delivery system cylinder (4 cylinder)

High pressure system 6G72 engine (ECI-Multi)

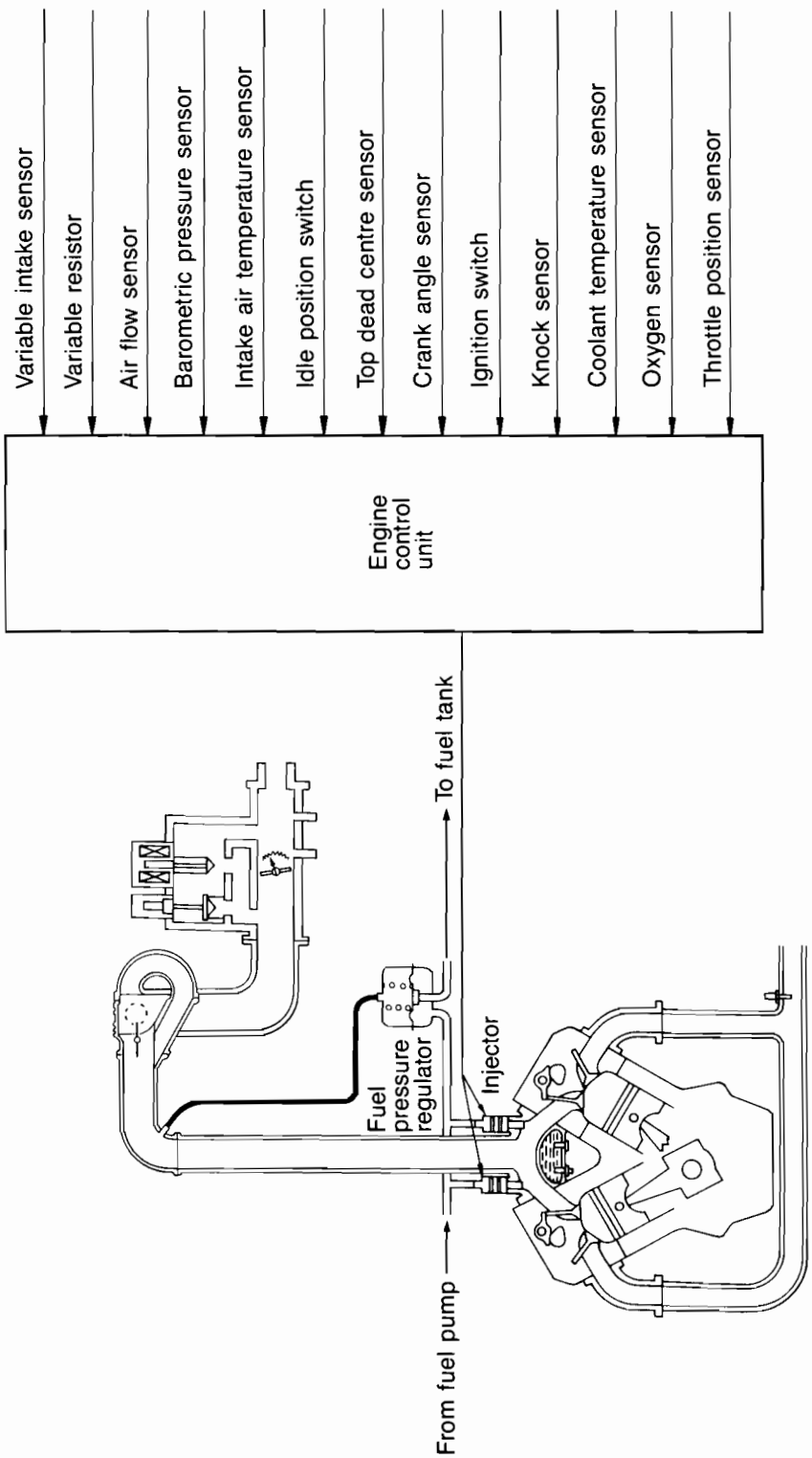


Fig. 3—Fuel delivery system V6 engine

(5) If battery cranking voltage is indicated proceed to step 6, if not proceed to step 8.

(6) Apply battery voltage across the pump, refer Fig. 4 (battery positive to black/yellow wire). Pump operation should be audible.

NOTE: Continue test only as long as is necessary to confirm fuel pump operation.

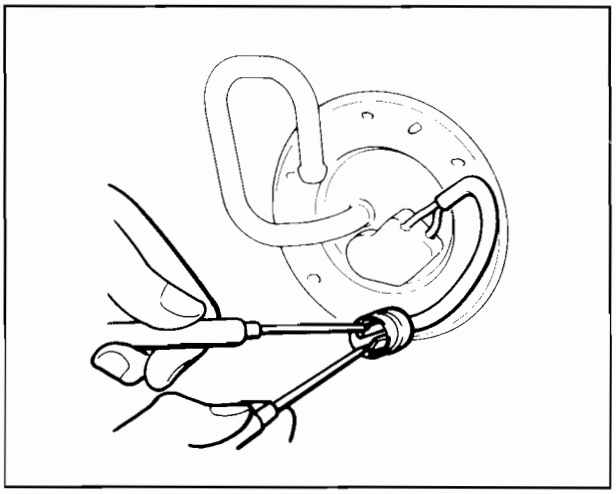


Fig. 4—Testing fuel pump

(7) If pump does not operate, check pump wiring for continuity and connections for tightness. If no fault is evident in the wiring the pump must be replaced as an assembly.

(8) Remove the glove box to gain access to the fuel pump control unit and remove the unit attaching bolt, refer Fig. 5.

(9) With the harness connected to the unit, check voltage at terminal 6, refer Fig. 6, with the ignition switch in the START position. If cranking voltage is indicated, check wiring and connectors between the control unit and the pump, if not proceed to step 10.

(10) Check voltage at terminal 4, with the ignition switch in the START position. If cranking voltage is indicated, proceed to step 11, if not, check wiring and connectors between ignition switch and control unit.

(11) Check voltage at terminal 5 with the ignition switch in the ON position. If 12V is indicated, proceed to step 12, if not, check wiring between the control unit and the ignition switch for continuity.

(12) With the ignition switch in the OFF position, use an ohmmeter to check for continuity between terminal 3 and earth. If continuity does not exist, check wiring for open circuits. If continuity exists replace the relay.

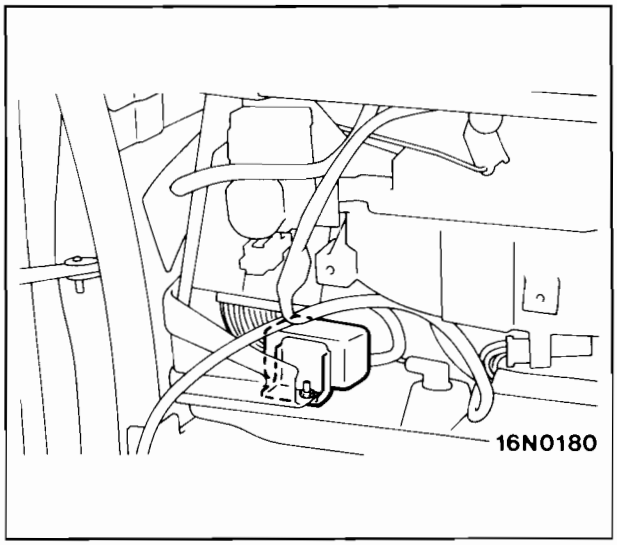


Fig. 5—Fuel pump control unit

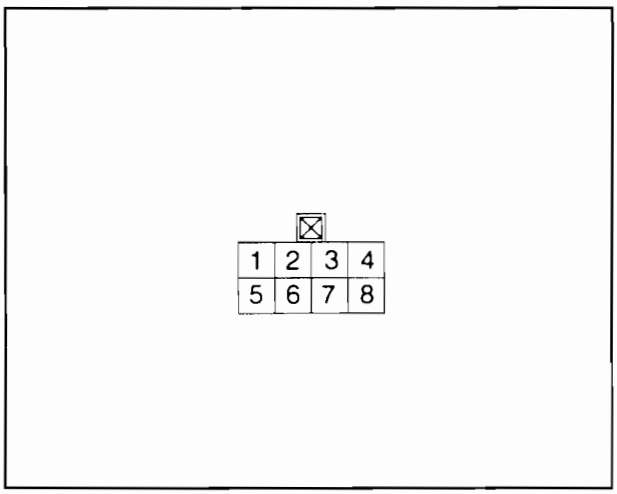


Fig. 6—Relay terminal locations

ECI-Multi

Pressure Test

NOTE: On fuel injection models, the residual fuel pressure, and amount of fuel remaining in the fuel lines, make it, essential that care is taken when disconnecting fuel lines. Use suitable containers and/or rags to contain fuel spillage.

(1) Disconnect the battery negative (–) terminal.
(2) Disconnect the fuel hose at the delivery pipe.

NOTE: Support the square boss on the end of the delivery pipe to prevent distortion of the pipe and attaching brackets.

(3) Using special tool Tester Kit, install the pressure gauge to the delivery pipe, refer Fig. 7.

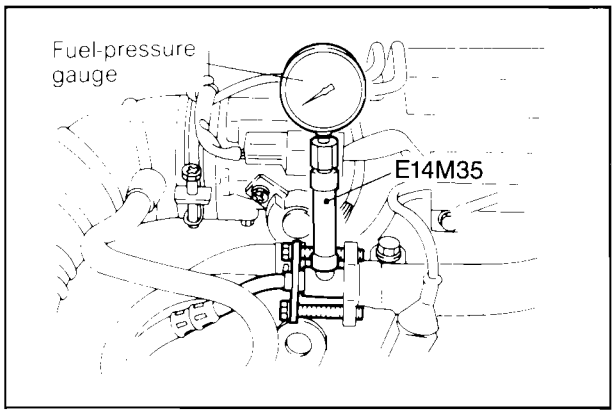


Fig. 7—Pressure gauge attachment

(4) Re-connect the battery negative (–) terminal.

(5) Apply battery voltage to the checker connector terminal (refer Fig. 8) to operate the fuel pump. Check to ensure there is no fuel leakage at the gauge or gauge connection to the delivery pipe.

(6) Disconnect the vacuum hose from the pressure regulator and plug the hose end. Measure the fuel pressure during idling.

Requirement:— 330 kPa.

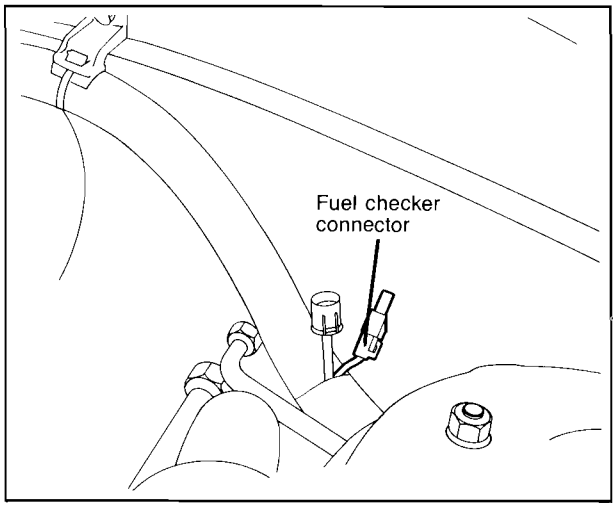


Fig. 8—Checker connector

(7) Re-connect the vacuum hose to the pressure regulator and measure the pressure.

Requirement:— 265 kPa approx. (NOTE: this reading varies with manifold pressure.)

(8) Stop the engine and observe the fuel gauge which should remain steady. If the pressure drops, note the rate of drop and refer to the Service Diagnosis chart for the possible cause and correction.

NOTE: If the fuel return hose is removed from the pressure regulator for any repairs, refit as follows:—

Ensure the hose is pushed onto the nipple up to the regulator body and the clamp is fitted on the hose as close to the regulator body as possible.

(9) Disconnect the pressure gauge from the delivery pipe.

CAUTION: Cover the hose connection to prevent fuel spillage.

(10) Using new gaskets, connect the fuel hose to the delivery pipe. Tighten the bolt to the specified torque while supporting the delivery pipe.

NOTE: Whenever the fuel delivery hose is removed from the filter, NEW copper gaskets MUST be used.

(11) Apply battery voltage to the fuel pump drive terminal of the checker connector and check the fuel system for leaks.

Electrical Test

(1) Check pump operation by applying battery voltage to No. 1 terminal of checker connector.

(2) Pinch the fuel hose at the delivery pipe, or place a hand on the pressure regulator and feel for pulsations.

If the pump does not operate check wiring to pump, if not faulty, proceed to step 8. If the pump operates but the vehicle will not start, check the pump further as follows:

(3) Disconnect the primary ignition wiring at the coil.

(4) Connect a voltmeter across the battery terminals and with the ignition switch in the START position, measure cranking voltage.

(5) Disconnect the wiring harness at the fuel pump and connect a voltmeter across the harness connector terminals (voltmeter positive to black/white wire).

(6) Turn ignition switch to START position, i.e. engine cranking, and check voltmeter reading.

(7) If battery cranking voltage is indicated, proceed to step 8, if not check control relay as outlined in Section 2.

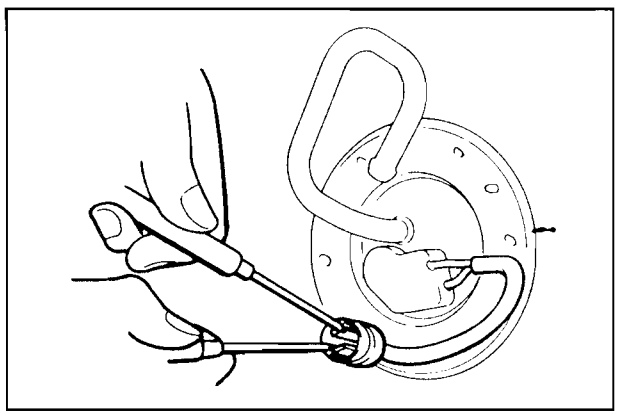


Fig. 9—Testing fuel pump

NOTE: Continue test only as long as is necessary to confirm fuel pump operation.

(8) If pump does not operate, check pump wiring for continuity and connections for tightness. If no fault is evident in the wiring, check the pump motor for continuity. If the pump is faulty, the pump must be replaced as an assembly.

FUEL PUMP REPLACEMENT

Removal

(1) Remove the fuel tank filler cap and drain the fuel tank.
(2) Disconnect the fuel hose and wiring from the pump unit.
(3) Loosen the fuel tank strap rear attaching nuts to the end of the stud threads.
(4) Remove the fuel pump retaining screws, refer Fig. 10.
(5) Remove the fuel pump from the tank.

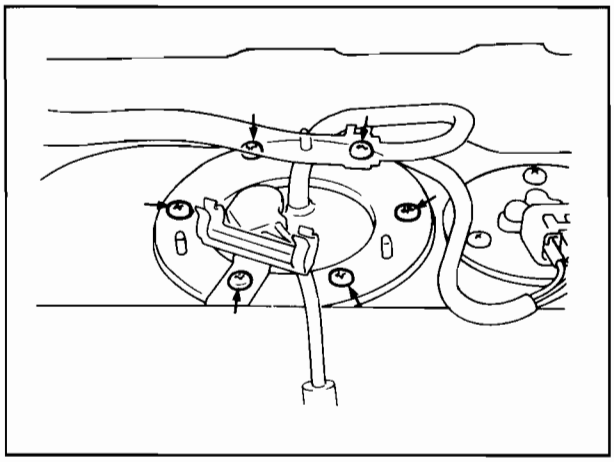


Fig. 10—Fuel pump retaining screws

Installation

Install by reversing removal procedure using a new seal and noting the following:
(1) Replace the "O" ring on lower retaining nut, and tighten nut to specified torque.
(2) Ensure that the upper retaining screws are tightened evenly and to the specified torque.

NOTE: If the lower fuel pump retaining bolt is not tightened to the specified torque a fuel leakage may result.

SECTION 4 — FUEL TANK

GENERAL INFORMATION

The fuel tank is located at the rear of the body under the trunk compartment floor, a seperate filler neck is situated in the left hand rear quarter panel.

The fuel tank is an "Evaporative Control System" type, i.e. not directly vented to atmosphere. Venting is achieved by a hose from the fuel tank to the fuel vapour storage canister.

A two way (or overfill limiting) valve and a vacuum relief filler cap ensure correct operation of the fuel tank evaporative emission control system.

For a full description of the system and component testing procedures, refer Group 17 — Emissions Control Systems.

NOTE: To ensure effective operation of the Evaporative Emissions System it is essential that all lines are connected securely and correctly and are not kinked or leaking.

NOTE: If a car is to be stored for any appreciable-length of time, the fuel should be drained from the entire system in order to prevent gum formation.

FUEL TANK

CAUTION: Since a fuel tank contains a potentially explosive mixture of fuel vapours and air, it is essential that the following precautions are observed when working on the fuel tank.

- **Ensure that the ignition is switched OFF or that the battery is disconnected.**
- **NEVER attempt to weld a fuel tank.**
- **Prior to working on the fuel tank or fuel lines, loosen the fuel cap to release any pressure in the fuel supply system.**

Removal Sedan

(1) Empty the fuel tank.

(2) Disconnect the fuel supply, return and vapour hoses, the filler neck hose and all electrical wiring.

NOTE: When disconnecting all hoses, identify each for ease of reassembly.

(3) Remove the park brake retaining clamps from the fuel tank.

(4) Loosen the tank band installation nut (refer Fig. 2) and lower the fuel tank slightly.

(5) Open the clamps on top of the fuel tank and remove the electrical harness.

(6) Remove the tank band nuts and lower the tank from the vehicle.

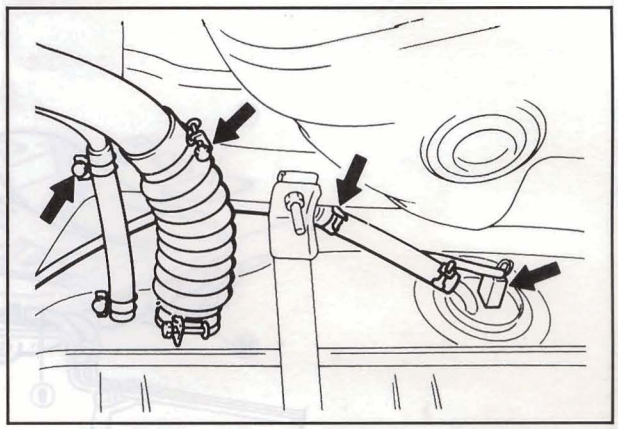


Fig. 1—Removing fuel tank connections

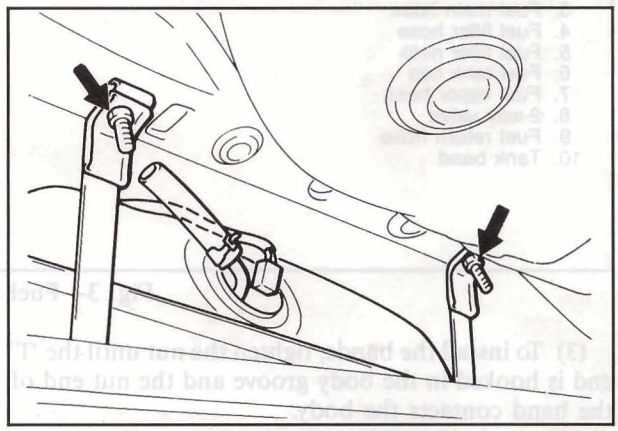


Fig. 2—Tank band installation nut

Inspection

(1) Remove the fuel gauge sender unit, refer this Section and fuel pump, refer Section 3.

(2) Check hoses and pipes for cracking or damage.

(3) Check the tank for deformation, corrosion or cracking.

(4) Check the fuel tank for dust or foreign material.

(5) Check the tank pads for peeling or damage.

(6) Check the operation of the 2-way valve.

NOTE: If the inside of the tank is to be cleaned use only one of the following:—

(1) Kerosene
(2) Trichloroethylene
(3) A neutral emulsion type detergent

Installation

Installation is a reversal of the removal procedure noting the following:—

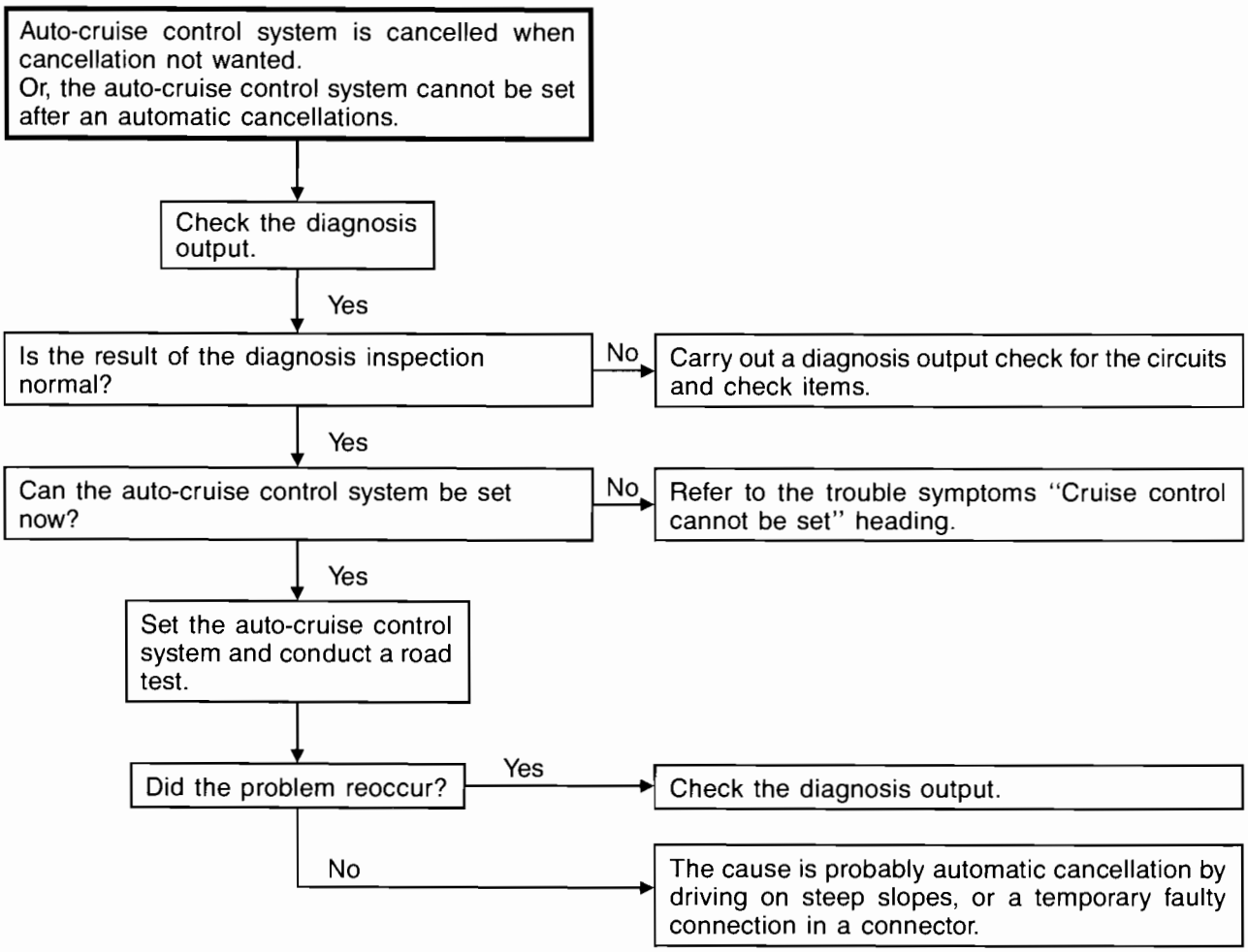
(1) If a pad is to be attached, clean the upper surface of the tank and apply a coating of a dry-type adhesive to the entire surface where it is to be attached.

(2) Use new seals on the fuel gauge sender unit and fuel pump.

SECTION 5 — CRUISE CONTROL

TROUBLESHOOTING FLOW CHART

Before commencing troubleshooting, inspect each of the following and if there is an abnormality, carry out a repair.
(1) Check the installation and connection routes of the cables and vacuum hoses of the auto-cruise vacuum pump assembly, actuator and link assembly are all normal.
(2) Check the link assembly and the movement of all cables are all working smoothly.
(3) Check that there is no excessive play or tension in each cable.



Auto-crusie control system cannot be set.

↓

Conduct input check.

↓

Yes — Are input checks normal?

↓ No

Check	Probable cause	Remedy
Code 21 remains even though SET switch is set to OFF.	SET switch ON malfunction	Replace the control switch.
	SET switch input line short-circuit	Repair the harness.
Code 22 remains even though RESUME switch is set to OFF.	RESUME switch ON malfunction	Replace the control switch.
	RESUME switch input line short-circuit	Repair the harness.
Code 23 is not cancelled even if the stop lamp switch is turned OFF by releasing the brake pedal.	Malfunction of stop lamp switch circuit.	Replace stop lamp switch or repair harness.
Code 25 does not disappear, and code 24 does not appear, even though vehicle speed reaches approximately 40 km/h or higher.	Malfunction of the vehicle speed sensor circuit (damaged or disconnected wiring, or short-circuit).	Check or repair the vehicle speed sensor circuit.
Code 26 is not cancelled even if the clutch switch is turned OFF by releasing the clutch pedal (M/T) or Code 26 is not cancelled if the selector lever is moved to any position but "N" or "P".	Malfunction of clutch switch circuit. (M/T) or malfunction of inhibitor switch circuit.	Replace clutch switch or inhibitor switch or repair harness.
Code 27 remains even when the CANCEL switch is set to OFF.	Malfunction of CANCEL switch circuit.	Replace the control switch or repair the harness.
Code 28 remains even when the accelerator pedal is released.	Malfunction of TPS circuit of accelerator position sensor circuit.	Replace the sensor or repair the harness.
Code 29 remains even when idle switch set to ON.	Malfunction of idle switch circuit.	Replace switch or repair the harness.

Check the auto-cruise vacuum pump circuit.

NOTE: If the results of the auto-cruise vacuum pump circuit and vacuum pump and/or actuator checks reveal no abnormal condition, replace the electronic control unit.

SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
• The set vehicle speed varies greatly upward or downward. • "Hunching" (repeated alternating acceleration and decelaration) occurs after setting is made.	Malfunction of the vehicle speed sensor circuit.	Repair the vehicle speed sensor system, or replace the part.
	Malfunction of the speedometer cable or speedometer drive gear.	
	Auto-cruise vacuum pump circuit poor contact.	Repair the electric vacuum pump system or replace the part.
	Malfunction of the ECLI.	Replace the ECLI.
The auto-cruise control system is not cancelled when the brake pedal is depressed.	Damaged or disconnected wiring of the stop lamp switch input circuit; brake switch (for auto-cruise control) malfunction (short-circuit).	Repair the harness or replace the stop lamp switch.
	Auto-cruise vacuum pump drive circuit short-circuit.	Repair the harness or replace auto-cruise vacuum pump.
	Malfunction of the ECU.	Replace the ECU.
The auto-cruise control system is not cancelled when the clutch pedal is depressed (vehicles with a manual transmission). (It is cancelled, however, when the brake pedal is depressed.)	Damaged or disconnected wiring of clutch switch input circuit.	Repair the harness, or repair or replace the clutch switch.
	Clutch switch improper installation (won't switch ON).	
	Malfunction of the ECU.	Replace the ECU.
The auto-cruise control system is not cancelled when the selector lever is moved to the "N" position. (It is cancelled, however, when the brake pedal is depressed.)	Damaged or disconnected wiring of inhibitor switch input circuit.	Repair the harness or repair or replace the inhibitor switch.
	Improper adjustment of inhibitor switch.	
	Malfunction of the ECU.	Replace the ECU.

Condition	Possible Cause	Corrective Action
Cannot decelarate by using the SET switch.	Temporary damaged or disconnected wiring of SET switch input circuit.	Repair the harness or replace the auto-cruise control switch.
	Auto-cruise vacuum pump circuit poor contact.	Repair the harness or replace the auto-cruise vacuum pump.
	Malfunction of the vacuum pump assembly (including air leaks from negative pressure passage).	
	Malfunction of the ECU.	Replace the ECU.
Cannot accelerate or resume speed by using the RESUME switch.	Damaged or disconnected wiring, or short-circuit, of RESUME switch input circuit.	Repair the harness or replace the auto-cruise control switch.
	Auto-cruise vacuum pump circuit poor contact.	Repair the harness or replace the auto-cruise vacuum pump.
	Malfunction of the vacuum pump assembly (including air leaks from negative pressure passage).	
	Malfunction of the ECU.	Replace the ECU.
Cruise control does not cancel even when the CANCEL switch is set to ON. (However, it is cancelled when the brake pedal is depressed.)	Broken wire in the CANCEL switch circuit inside the control switch.	Repair the harness or replace the auto-cruise control switch.
	Malfunction of the ECU.	Replace the ECU.
Auto-cruise control system can be set while travelling at a vehicle speed of less than 40 km/h, or there is no automatic cancellation at that speed.	Malfunction of the vehicle-speed sensor circuit.	Repair the vehicle-speed sensor system, or replace the part.
	Malfunction of the speedometer cable or the speedometer drive gear.	
	Malfunction of the ECU.	Replace the ECU.
The indicator lamp of the main switch does not illuminate. (But auto-cruise control system is normal.)	Damaged or disconnected bulb of indicator lamp or malfunction of the main switch.	Repair the harness or replace the main switch.
	Harness damaged or disconnected.	

Condition	Possible Cause	Corrective Action
Malfunction of control function by ON/OFF switching of ELC 4 A/T accelerator switch. (Vehicle with Auto. Trans.) (Non-operation of lock up clutch, 2nd gear hold, etc.)	Malfunction of circuit related to accelerator switch OFF function.	Repair the harness or replace the part.
	Malfunction of the ECU.	Replace the ECU.
Overdrive is not cancelled during fixed speed driving. (Vehicles with Auto. Trans.)	Malfunction of circuit related to overdrive cancellation, or malfunction of ECU.	Repair the harness or replace the part.
No shift to overdrive during manual driving. (Vehicles with Auto.Trans.)		

SYSTEM COMPONENTS

The cruise control system consists of an electronic control unit a switch assembly, a vehicle speed sensor, cancel switches and a throttle actuator unit (vacuum pump operated).

Electronic Control Unit (ECU)

The control unit receives input from various sensors, determines the required throttle opening to achieve or maintain the desired (SET) speed, then operates the actuator accordingly.

On vehicles with an automatic transaxle, the accelerator pedal earth circuit is completed through the cruise control ECU.

The control unit opens the circuit when the cruise control system is operating and the accelerator pedal is at rest allowing the lock-up clutch to operate.

Main Switch Assembly

The main switch assembly is mounted in the instrument panel, refer Fig. 1. This switch controls the main power supply to the control unit. It is an ON-OFF type switch and incorporates an indicator lamp.

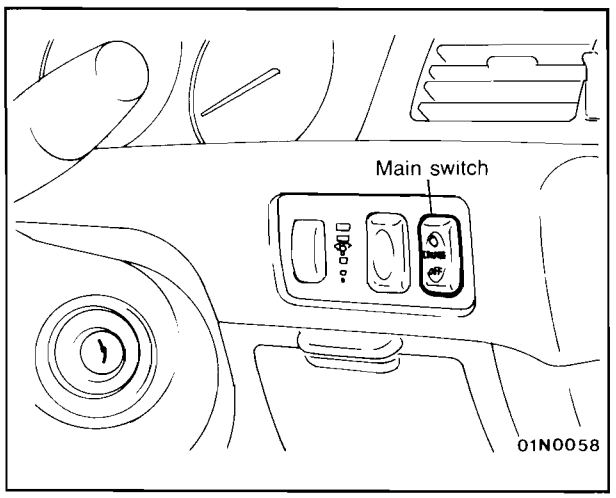


Fig. 1 — Main switch assembly location

Auto-Cruise Control Switch

The auto-cruise control switch assembly is mounted on the steering wheel, refer Fig. 2 and incorporates the SET switch, RESUME switch and the CANCEL switch.

(A) Set switch — this switch has two functions:
- To signal the control unit to activate (SET) the system at a particular speed.
- To decrease the set speed if the system is already activated.

(B) Resume switch — this switch also has two functions:
- To signal the control unit to re-activate the system if the system has been de-activated after being set.
- To increase the set speed if the system is already activated.

(C) Cancel switch — This switch cancels the constant vehicle speed settings.

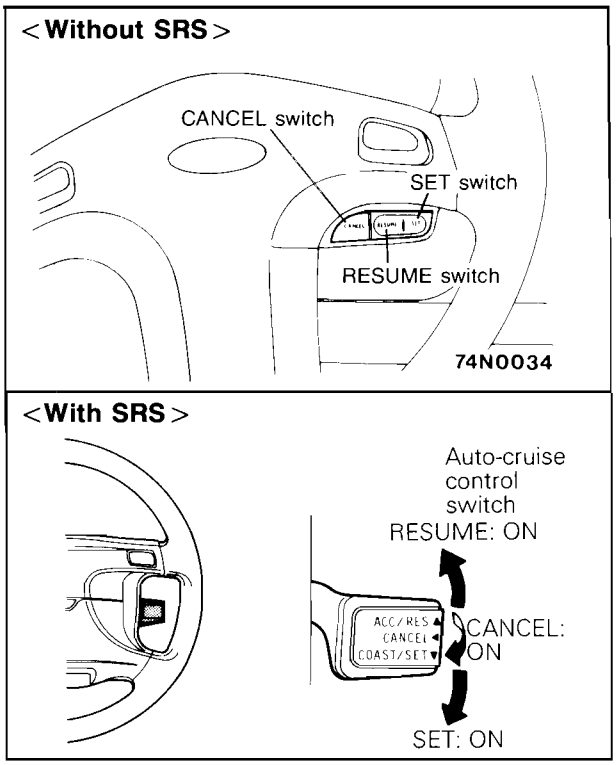


Fig. 2 — Auto-cruise control switch location

Vehicle Speed Sensor

A reed switch is mounted in the speedometer. This switch completes the control unit signal circuit to earth four times per revolution of the speedometer drum. The ECLU uses these signals to calculate vehicle speed.

Cancel Switches

Output from the following switches signals the control unit to cancel or de-activate the system.
- Stop lamp switch — when brakes are applied.
- Clutch switch (man. models) — when clutch pedal is pressed.
- Inhibitor switch (auto. models) — when neutral is selected.

If the system is de-activated as a result of any of the above conditions the set speed can be resumed by pressing the resume switch provided that vehicle speed is above 40 km/h.

Actuator Assembly (Vacuum Pump)

The actuator assembly consists of the diaphragm type negative pressure pump, driven by a DC motor and two solenoid valves (control valve and release valve). The rotary motion of the DC motor, is converted to the reciprocal motion of the diaphragm by the eccentric cam and rod.

When the diaphragm moves in the direction that increases the pump operating chamber volume (downward), refer Fig. 3, the intake valve opens and the discharge valve closes, so that, air in the negative pressure path enters the pump operating chamber.

On the other hand, when the diaphragm moves in the direction that reduces the pump operating chamber volume, (upward), refer Fig. 3, the discharge valve closes and the intake valve opens, discharging air to atmosphere.

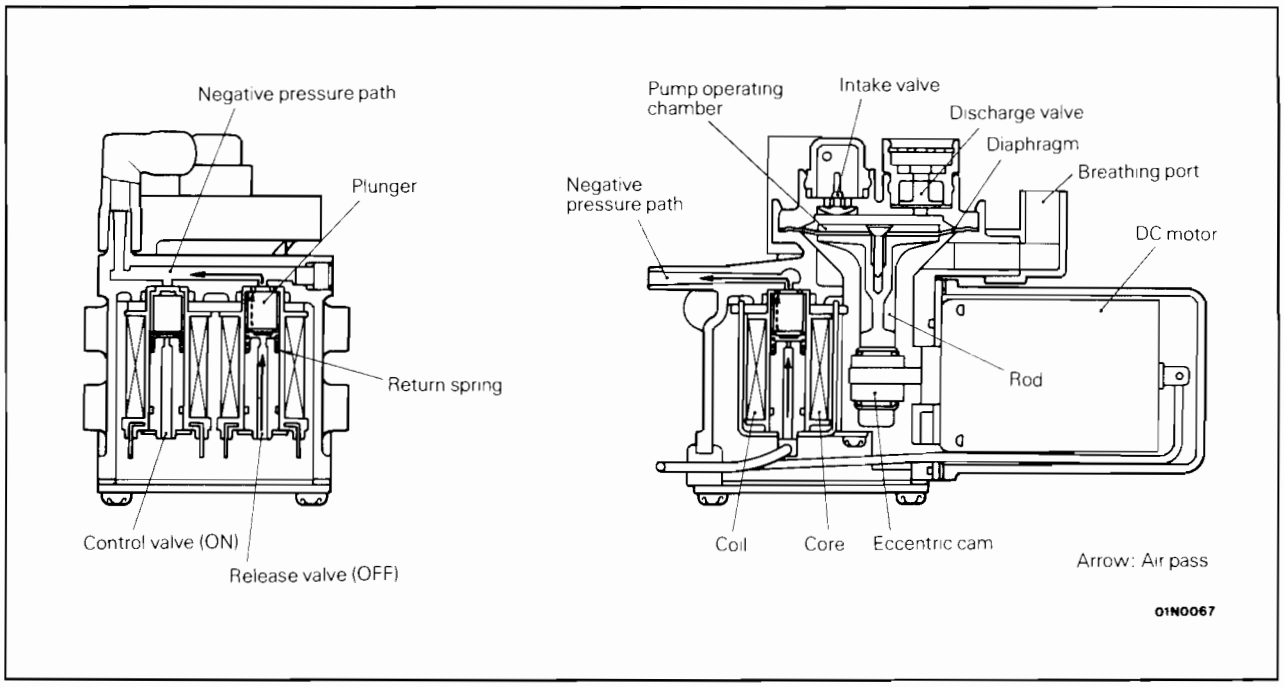


Fig. 3 — Construction of motor driven negative pressure pump

As the air so enters the chamber and the air is discharged to atmosphere in this way, a negative pressure develops.

The solenoid valve plunger is kept fully retracted by the return spring, while the solenoid coil installed in the negative pressure path is not energized, so that the core inside port is open and the negative pressure path is open to atmosphere. When the solenoid coil is energized, the coil attracts the plunger to close the core port, shutting off the negative pressure path from atmosphere.

Actuator (Construction)

The actuator consists of the diaphragm, the case, the cover, the return spring etc. As the negative pressure acting on the negative pressure chamber which is formed by the diaphragm and the case increases, the diaphragm moves in the direction to pull the throttle cable.

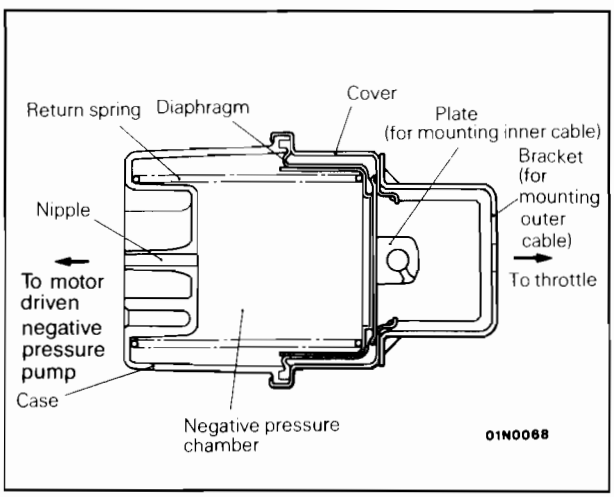


Fig. 4 — Vacuum actuator

When the negative pressure decreases the diaphragm is made to move by the return spring in the direction to loosen the throttle cable. This way the throttle valve is opened or closed as the negative pressure to the negative pressure chamber increases or decreases.

Actuator Assembly Operation

The negative pressure path of the negative pressure pump is connected by a vacuum hose to the negative pressure chamber of the actuator.

The DC motor of the negative pressure pump assembly, the control valve and the release valve are turned ON or OFF by the control signals from the control unit.

There are four stages of actuator operation.

1. Acceleration (Pull Mode)

The DC motor, the control valve and the release valve are all energized. The DC motor drives the negative pressure pump and the control and release valves are closed to shut off the negative pressure path from the atmosphere.

The negative pressure developed by the pump acts in the negative pressure chamber of the actuator, forcing the diaphragm to pull the cruise control cable to open the throttle valve.

2. Hold Mode

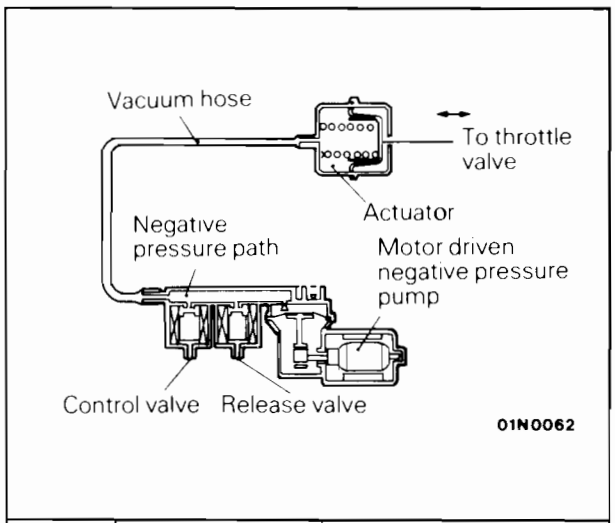
In this condition both the control solenoid valve and the released solenoid valve remain ON maintaining the vacuum (negative pressure) in the actuator, the pump is switched OFF, the diaphragm will not move and the throttle valve is kept stationary.

3. Release Mode (Decelaration)

In this condition the control solenoid valve is OFF allowing for actuator vacuum to vent to atmosphere through a small port. This allows the actuator return spring to push the diaphragm back allowing the throttle valve return spring to reduce throttle valve opening.

4. Cancel Mode

In this condition both the control and release solenoid valves are OFF allowing actuator vacuum (negative pressure) to vent quickly.



Operation	Motor driven negative pressure pump (DC motor)	Solenoid valve ON: Close OFF: Open	
	ON: Energized OFF: De-energized	Control valve	Release valve
PULL	ON	ON	ON
HOLD	OFF	ON	ON
RELEASE	OFF	OFF	ON
CANCEL	OFF	OFF	OFF

Fig. 5 — Actuator operation mode sheet

Throttle Position Sensor (TPS)

The throttle postion sensor which is shared by the engine control system outputs the throttle valve opening as an output voltage to the control unit.

Idle Switch

The idle switch built in the throttle position sensor corrects the TPS voltage variations and scatters with reference to the TPS voltage at which the idle switch is turned ON to OFF.

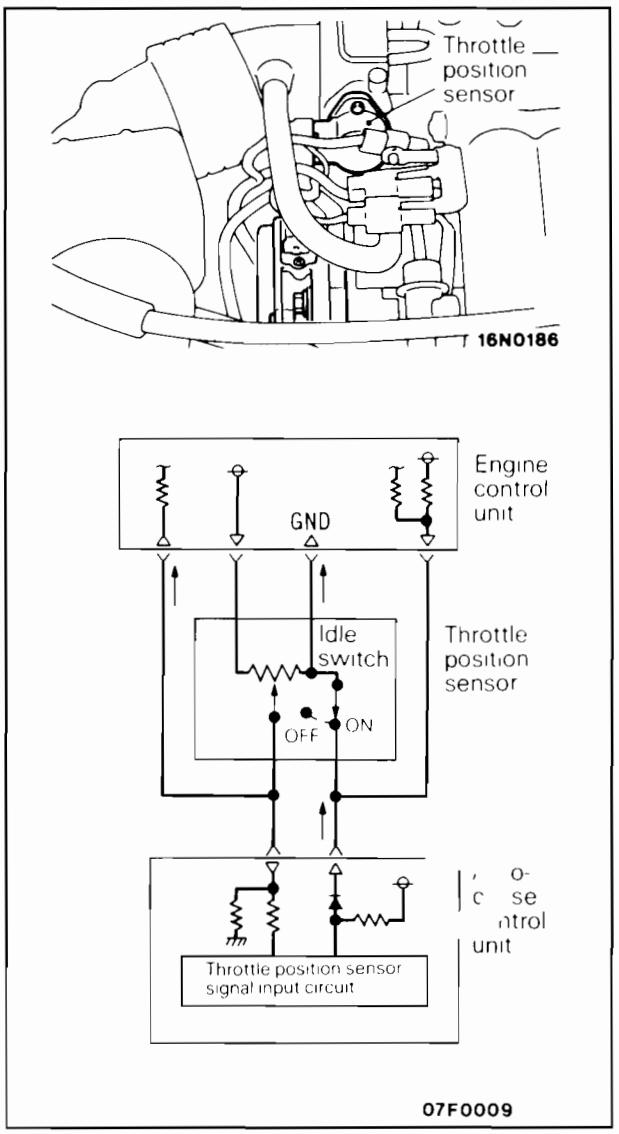


Fig. 6 — TPS and idle switch

SYSTEM OPERATION

When the set button is pressed with the main switch ON the vehicle speed above 40 km/h the system operates as folows:

(1) The ECU calculates vehicle speed from speed sensor input and stores this information as the set speed.

(2) The ECU determined t' ·ial throttle opening required to maintain the s(spe(

(3) The ECU supplies po · · actuator system to attain the required throttle g.

(4) If necessary the ECU will "fine tune" the throttle opening by further actuator movement to compensate for operating conditions.

Should the system be de-activated after a speed has been SET the ECU will use the information stored at step 1 to return the vehicle to the SET speed when required.

NOTE: The set speed will be stored in the ECU memory until power to the ECU is cut, i.e. Main or ignition switch turned OFF.

SYSTEM OPERATION CHECK

This check procedure should be carried out on an open stretch of road with due regard being given to prevailing speed limits and road conditions.

NOTE: Cruise control speed testing cannot be performed on jack stands as the control unit would provide a throttle opening to cater for normal road load conditions and extremely high engine speeds would result.

(1) Start the engine.
(2) Switch the MAIN switch ON and check that the indicator lamp lights.
(3) Drive the vehicle on a flat stretch of road at a speed above 40 km/h in 4th (auto.) or 5th (manual) gear.
(4) Press and release the SET switch and release the accelerator pedal, set speed should be maintained.
(5) Apply the brakes and slow the vehicle.
(6) Release the brake pedal, speed should not increase.
(7) Accelerate vehicle to a speed above 40 km/h but below previous set speed.
(8) Press and release RESUME switch and release accelerator pedal, speed should increase to previous set speed.
(9) Operate clutch pedal (man. models) or move gear lever to neutral (auto. models). Vehicle speed should immediately decrease.
(10 Release clutch pedal or return gear lever to drive.
(11) Before vehicle slows to 40 km/h or drops 20 km/h below set speed press and release RESUME button, vehicle speed should return to previous set speed.
(12) With the vehicle travelling at the set speed press and hold the RESUME switch, vehicle speed should gradually increase.
(13) Release the RESUME switch and press and hold the SET switch, vehicle speed should gradually decrease.

If the system does not perform as specified at any point refer to the service diagnosis procedures detailed in this section.

COMPONENT TESTING

Main Switch Assembly

(1) Remove the instrument panel side switch assembly (which holds the main switch).
(2) Disconnect the wiring loom connector.
(3) Operate the switch and check the continuity between the terminals.

Terminal / Switch Position	1	ILL	2	3	4	5
OFF	○	⌀	○			
NEUTRAL	○	⌀	○		○	○
ON	○	⌀	○	○	○	○

○—○ indicates continuity between terminals

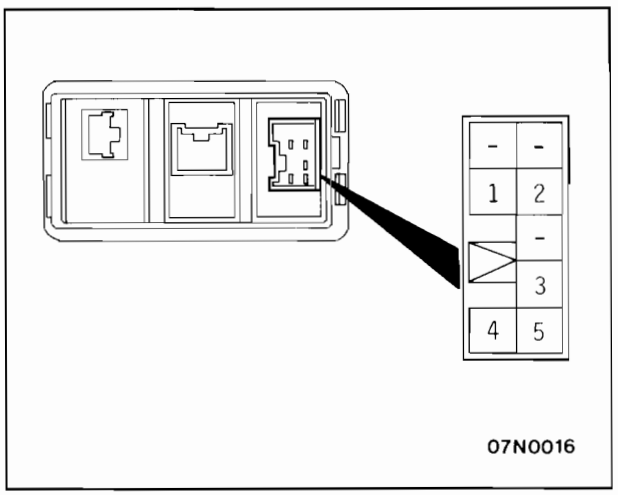


Fig. 7 — Main switch terminal location

(4) If continuity is not as specified, replace the main switch.
(5) Connect a battery across terminals 3 and 5 as shown in Fig. 8 and using a voltmeter check that battery voltage is available between terminal 4 and 5 with the switch in the ON position.

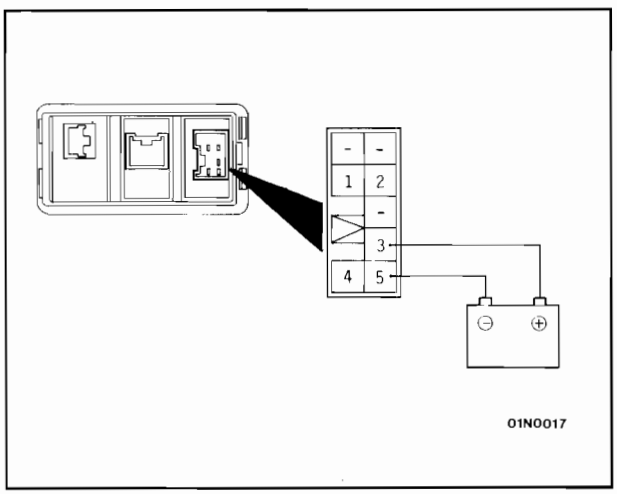


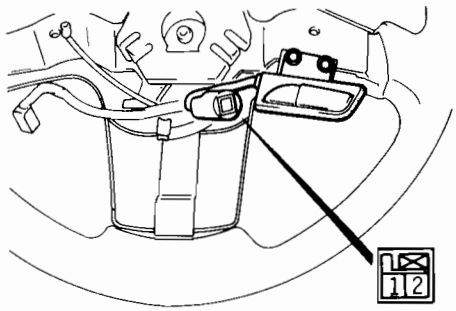
Fig. 8 — Main switch testing

(6) Turn the main switch OFF and voltage should return to zero.
(7) Replace the main switch if it does not perform as specified.

Auto-Cruise Control Switches

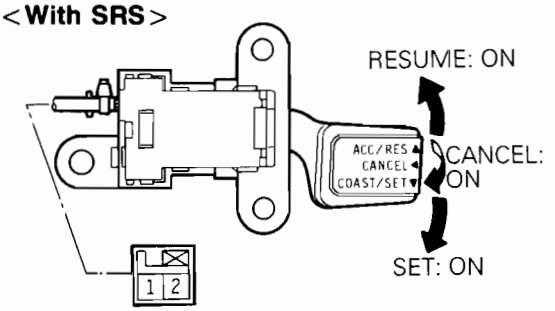
(1) Remove the horn pad.
(2) Disconnect wiring loom connector.
(3) Using a suitable Ohmmeter measure the resistance between the terminals when each of the SET, RESUME and CANCEL positions of the Auto-cruise control switch are pressed, refer Fig. 9.

<Without SRS>



07N0006

<With SRS>



07F0012

SWITCH POSITION	Resistance between terminals
Switch "OFF"	No Continuity
CANCEL switch "ON"	Approx. 0 Ω
RESUME switch "ON"	Approx. 820 Ω
SET switch "ON"	Approx. 2700 Ω

Fig. 9 — Test auto-cruise control switch

Brake Pedal Switch

(1) Disconnect the wiring from the switch.
(2) Using a suitable Ohmmeter check that switch continuity is as shown in Fig. 10.
(3)If continuity is not as specified and switch adjustment is correct, refer Group 35, replace the switch.

Switch / Terminal / Pedal position	Brake switch		Stop light switch	
	1	4	2	3
Pedal released			○	○
Brakes applied	○	○		



B4 connector
M

Fig. 10 — Brake pedal switch continuity

Clutch Pedal Switch (Man. Models)

(1) Disconnect the wiring from the switch and connect a suitable Ohmmeter across switch terminals.
(2) Check that there is no continuity with the pedal released and contunity with the pedal depressed.
(3) If continuity is not as specified, replace the switch.

Transaxle Inhibitor Switch (Auto. Models)

(1) Disconnect the wiring from the inhibitor switch.
(2) Check for continuity between inhibitor switch connector terminals 10 and 11, refer Fig. 11, with the gear lever in the "P" and "N" position.
(3) If continuity is not as specified and the switch is correctly adjusted, refer Group 23, replace the switch.

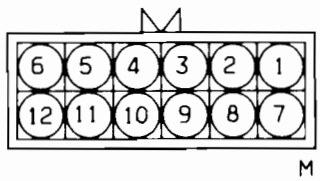


Fig. 11 — Inhibitor switch continuity test

Reed Switch Testing

(1) Remove the instrument cluster, refer Group 52.

CAUTION: THE INSTRUMENT CLUSTER MUST NOT BE ALLOWED TO FACE DOWN AT ANY TIME. THE TACHO MECHANISM USED HAS A SILICONE DAMPENING DEVICE WHICH WILL LEAK.

(2) Connect an Ohmmeter across terminals 1 and 2, refer Fig. 12.

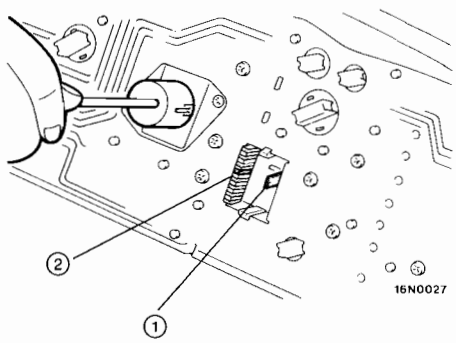


Fig. 12 — Reed switch testing

(3) Rotate the speedometer drive.
(4) The Ohmmeter should fluctuate between an open and closed circuit four times per revolution, i.e. 4 pulses/rev.

Auto-Cruise Vacuum Pump Master Control Solenoid Valve and Release Soleoid Valve

(1) Remove the auto-cruise vacuum pump wiring loom connector.

(2) Using a suitable Ohmmeter, measure the resistance between terminals 1 and 2 and between 1 and 3, refer Fig. 13, resistance should be 50-60 Ω.

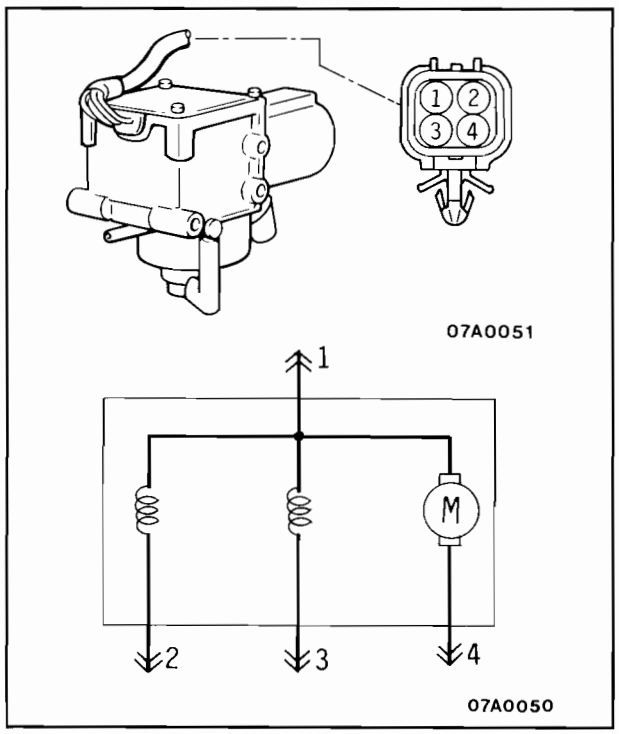


Fig. 13 — Pump testing

(3) Check that solenoid valve operation is audible when battery voltage is applied between terminals 1 and 2 and between 1 and 3.

(4) Check that the vacuum pump motor operator when battery voltage is applied to terminals 1 and 4.

(5) Replace the vacuum pump assembly if it does not perform as specified.

Actuator

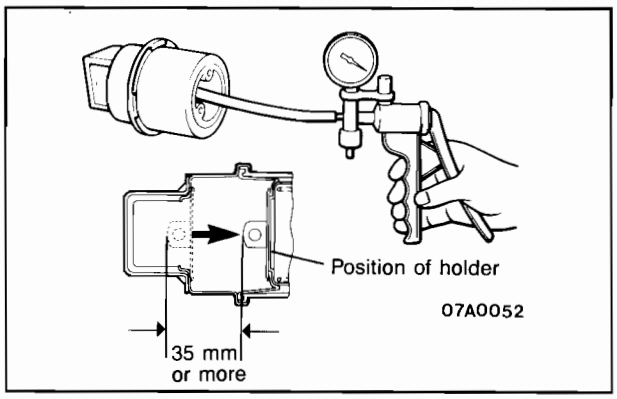


Fig. 14 — Actuator Testing

(1) Disconnect the throttle cable from the actuator.

(2) Remove the actuator mounting bolts and remove the actuator.

(3) Apply negative pressure to the actuator with a vacuum pump and check that the holder moves more than 35 mm, in addition check that there is no change in the position of the holder when negative pressure is maintained in that condition.

Electronic Control Unit

The ECU is a transistorized unit incorporating a micro-computer. It cannot be tested and if, as a result of logical diagnosis, the control unit is identified as the faulty component, it should be replaced with a known good unit to verify the diagnosis.

The ECU is mounted in the centre console behind the audio system, refer Fig. 15.

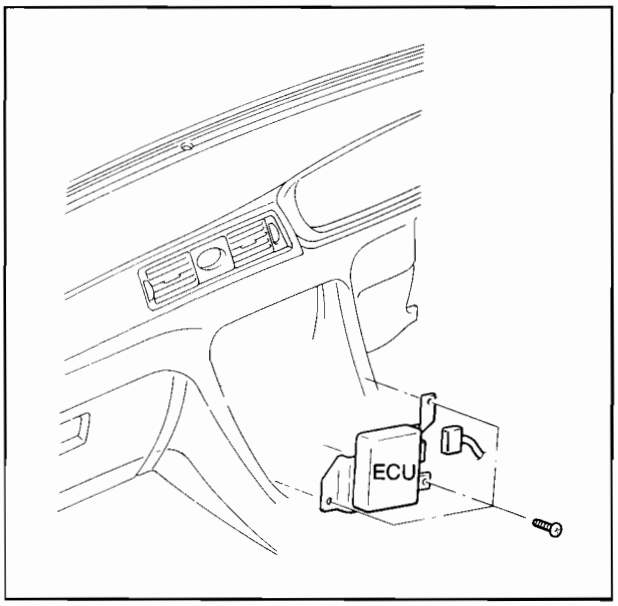


Fig. 15 — ECU location

Auto-Cruise Control Cable Inspection and Adjustment

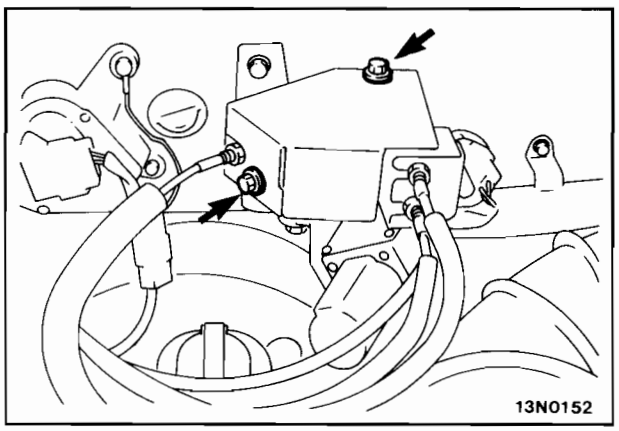


Fig. 16 — Cable cover

(1) Remove the cable link actuator cover, refer Fig. 16.

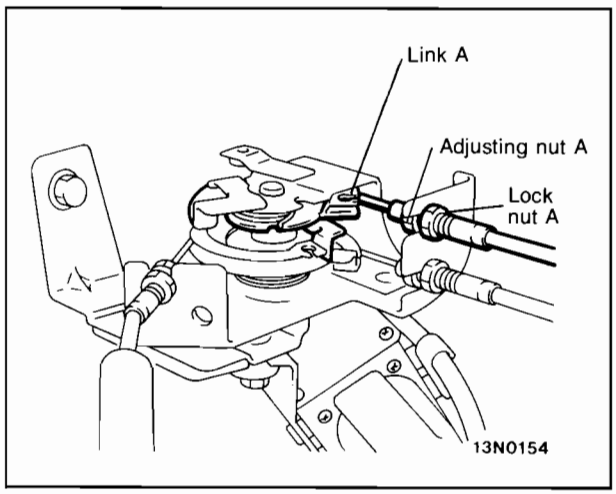


Fig. 17 — Link 'A' lock and adjusting nut

(2) Loosen the adjusting nuts and lock nuts of the throttle lever and intermediate links A, B and C, so that the intermediate links A, B and C and the throttle lever can move freely.

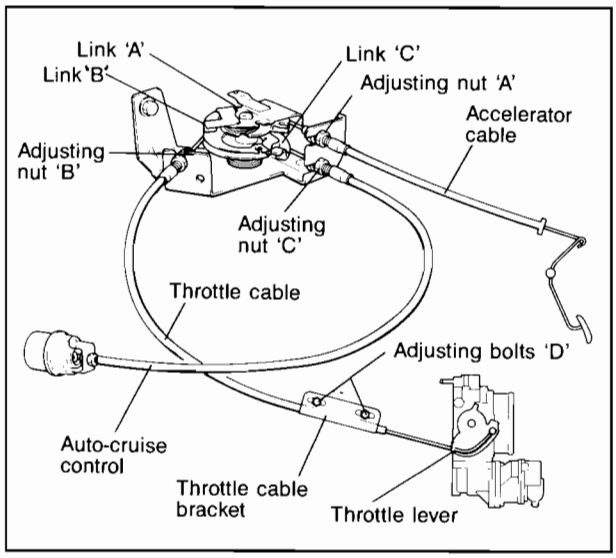


Fig. 18 — Cable components

(3) Position the throttle cable bracket in the centre of its travel and tighten the adjusting bolts 'D'.

(4) With link 'A; positioned against the stopper, rotate adjusting nut 'A' to remove cable freeplay.

(5) Then unscrew the adjusting nut 'A' to achieve 2-3 mm freeplay Auto Trans or 0-1 mm freeplay Manual Trans, then tighten lock nut.

(6) With link 'B' against the stopper of link 'C' rotate the adjusting nut 'B' to remove cable freeplay.

(7) Then uncrew the adjusting nut 'B' approximately 1 turn to achieve 1-2 mm freeplay then tighten lock nut.

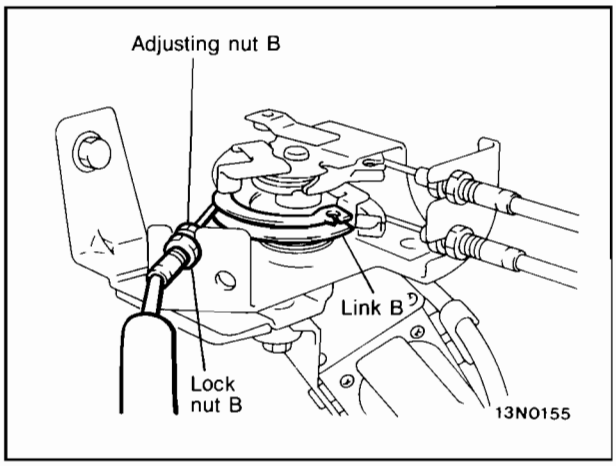


Fig. 19 — Link 'B' adjustment

(8) With link 'C' against its stopper, rotate adjustment nut 'C' to remove cable freeplay.

(9) Then unscrew the adjusting nut 'C' approximately 1 turn to achieve 1-2 mm freeplay.

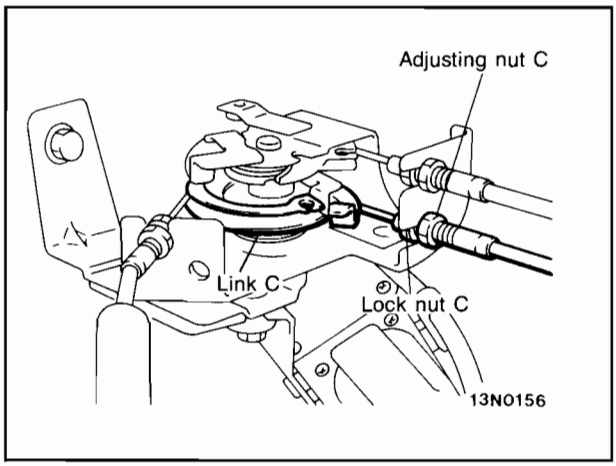


Fig. 20 — Link 'C' adjustment

(10) Then tighten the lock nut.

(11) After completing the adjustment procedure, confirm that the throttle valve opens and closes fully and is touching the fixed SAS screw by operating the accelerator pedal.

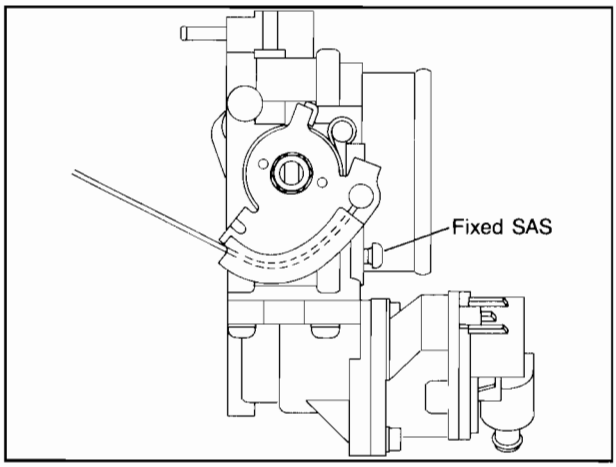


Fig. 21 — Throttle lever stopper position

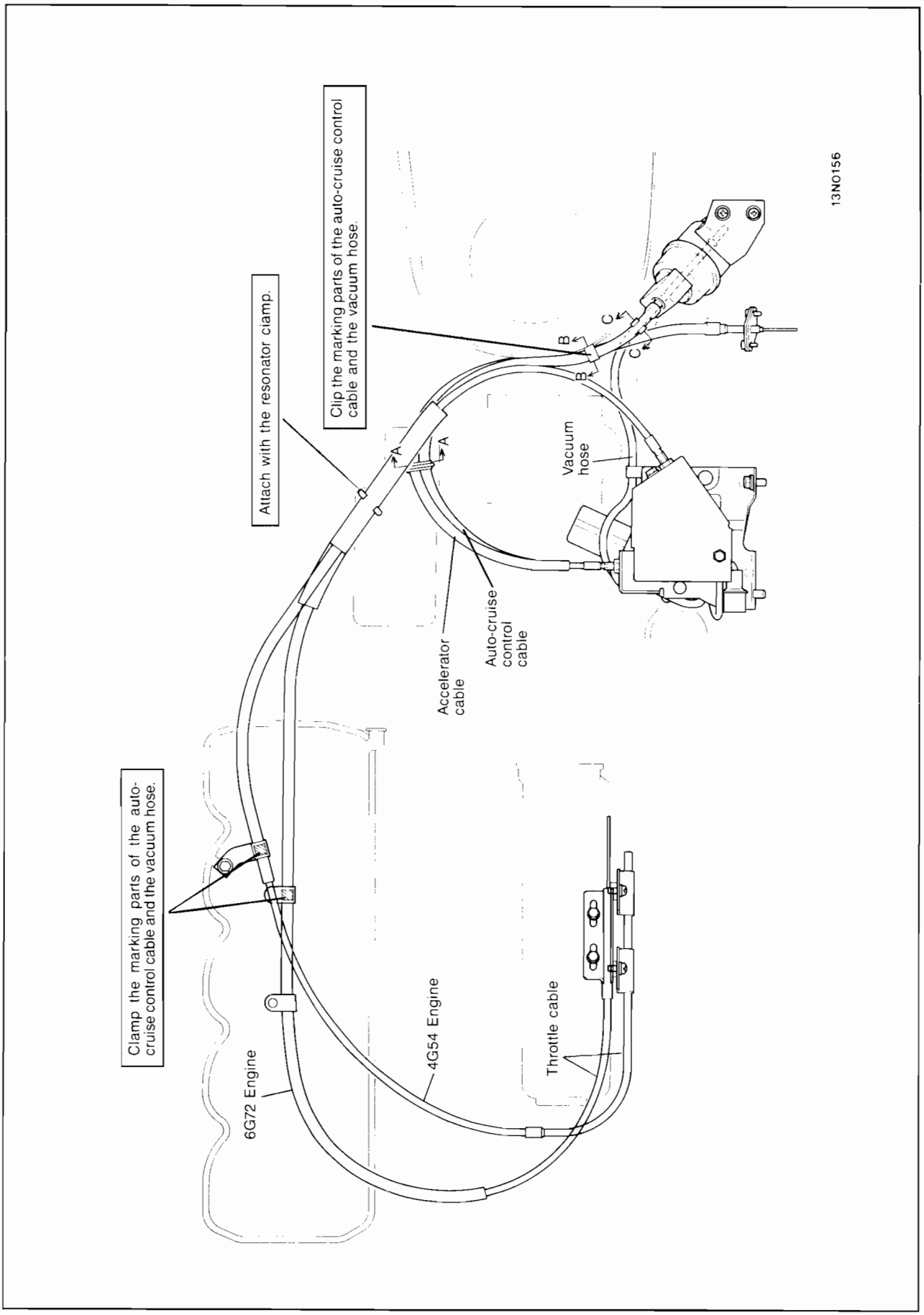


Fig. 22 — Cable installation

Accelerator Pedal Switch (where fitted)

Faulty switch operation may result in:

- Excessive idle vibration
- Excessive vehicle "creep" in drive at idle
- Poor "take off"

(1) With the pedal fully released check for continuity between terminals 1 and 2, refer Fig. 23, if an open circuit is indicated, check switch adjustment.

(2) Check stroke 'A', refer Fig. 23. Stroke should be 2-6 mm.

(3) Check resistance with the pedal depressed, an open circuit should be indicated.

If the above conditions do not exist, replace the switch.

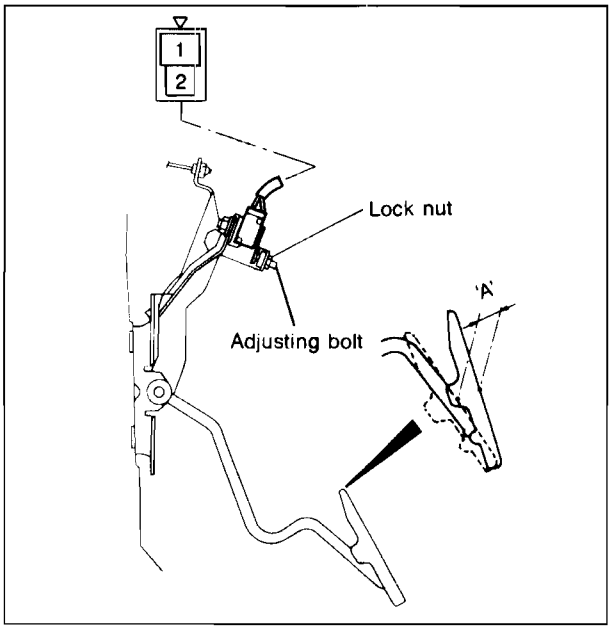


Fig. 23 — Accelerator pedal switch adjustment

Cruise Control Input Signal Check

The Input signal check is performed as follows:—

(1) Connect a voltmeter or the M.U.T. to the diagnosis connector located near the fuse box on the driver's side of the cabin. Refer Fig. 24.

(2) Turn the ignition switch ON.

(3) Whilst holding the SET switch ON, turn ON the main switch and then within 1 second of activating the main switch release the SET switch and activate the RESUME switch.

(4) Select self diagnosis for cruise control on the MUT and perform the input operation as nominated on the Input Check Function chart Fig. 26.

(5) The code will display only while the input operation is being performed, i.e. you stop the operation (e.g. SET switch OFF) the code completes and then stops.

(6) If the code does not stop when the operation is stopped, it indicates a fault in that system, also if no code is displayed there also could be a fault in the system.

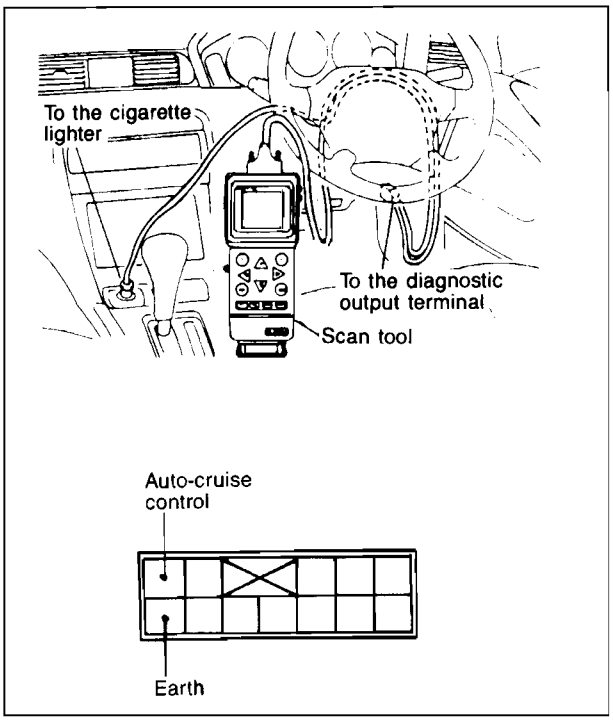


Fig. 24 — Diagnosis connector location

Self Diagnosis Check

(1) Connect a voltmeter or the M.U.T. to the diagnosis connector located near the fuse box on the driver's side of the cabin, refer Fig. 27 for code or display explanation.

NOTE: Self diagnosis codes that are stored in the memory will be displayed when the MAIN switch and the ignition switch are ON after the cruise control cancellation occurs.

NOTE: The self diagnosis code will only be displayed if the vehicle speed is below 20 km/h or the vehicle is stationary.

(2) When the cruise control MAIN switch is initially turned ON and the vehicle speed is above approximately 20 km/h a "code normal" is displayed, refer Fig. 25. If the M.U.T. is used, the words "NO TROUBLE CODE" will be displayed.

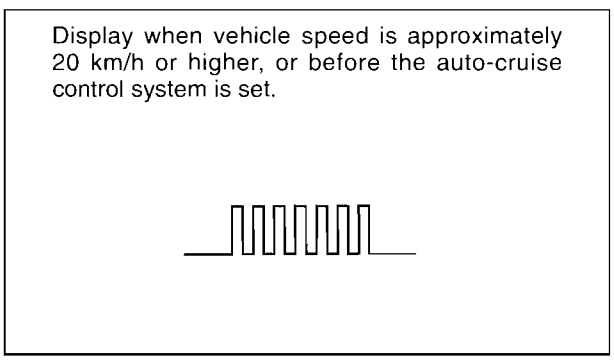


Fig. 25 — Normal code above 20 km/h

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Diagnosis Erase Procedure Using Multi-Use-Tester (MUT)

Diagnosis erase function is available on this system. You can either disconnect the battery for 10 seconds or use the diagnosis erase feature as follows:

(1) Connect the M.U.T. to the diagnosis connector located near the fuse box on the driver's side of the cabin. Refer Fig. 24.

(2) Turn the ignition switch ON.

(3) Whilst holding the SET switch ON, turn ON the main switch and then within 1 second of activating the main switch release the SET switch and activate the RESUME switch.

(4) Press Set and Brake switches simultaneously for 5 seconds.

(5) Turn main switch OFF then ON.

(6) Select self diagnosis for cruise control on the MUT and verify no trouble codes are present.

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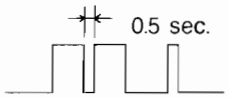
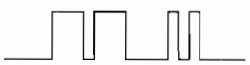
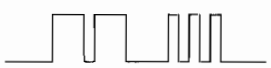
Output codes		Input operation	Check results
No.	Display patterns		
21		SET switch ON	SET switch circuit normal
22		RESUME switch ON	RESUME switch circuit normal
23		Stop lamp switch ON (brake pedal depressed)	Stop lamp switch normal
24		Driving at approx. 40 km/h or higher	When both No. 24 and No. 25 can be confirmed, vehicle speed sensor circuit normal
25		Driving at less than approx. 40 km/h, or stopped	
26		1. Clutch switch ON (clutch pedal depressed) 2. Inhibitor switch ON (selector lever in 'N' or 'P' range)	Inhibitor switch or clutch switch normal
27		CANCEL switch ON	CANCEL switch circuit normal
28		Throttle position sensor (when the accelerator pedal is pressed more than halfway	Throttle position sensor circuit
29		Idle switch OFF (accelerator pedal depressed)	Idle switch circuit normal

Fig. 26 — Input signal check chart

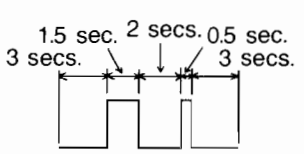
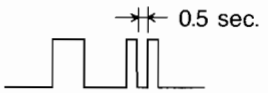
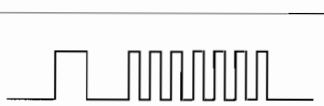
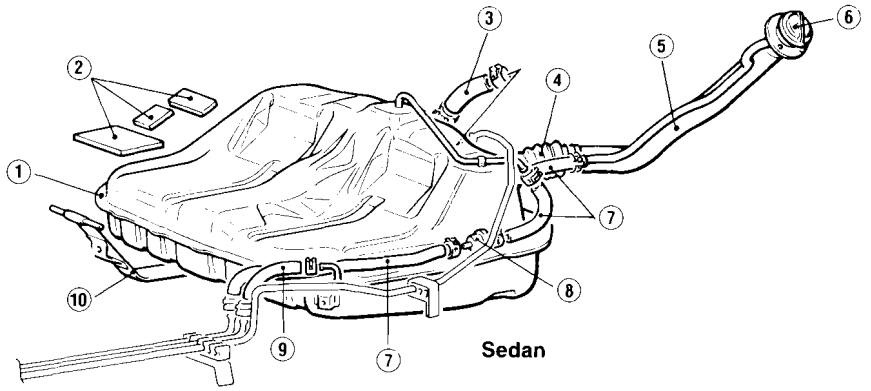
Output codes		Probable cause
No.	Display patterns	
11		Abnormal condition of auto-cruise vacuum pump drive system
*12		Abnormal condition of vehicle speed signal system
*15		Control switch malfunction (when SET and RESUME switches switched ON simultaneously for some period)
*16		Abnormal condition of ECU
17		Abnormal condition of throttle position sensor or accelarator position sensor. Abnormal condition of idle switch

Fig. 27 — Self diagnosis chart



1. Fuel tank
2. Pad
3. Fuel main hose
4. Fuel filler hose
5. Fuel filler neck
6. Fuel tank cap
7. Fuel vapor hose
8. 2-way valve
9. Fuel return hose
10. Tank band

Fig. 3—Fuel tank components

(3) To install the bands, tighten the nut until the 'T' end is hooked in the body groove and the nut end of the band contacts the body.

NOTE: The tank band nuts are the self locking type. If removed replace with new nuts.

(4) Connect all hoses to the correct pipes.

FUEL GAUGE SENDER UNIT

Removal

(1) Drain the fuel to a level below the sender unit.
(2) Disconnect the wiring from sender unit.
(3) Remove the three retaining screws, refer Fig. 4, and remove the sender unit.

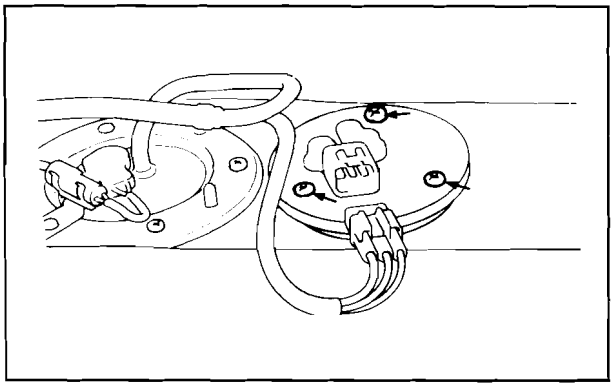


Fig. 4—Fuel gauge sender unit removal

Inspection

Refer to Group 54 — for inspection and test procedures.

Installation

Install by reversing removal procedure, noting the following:
(1) Use a new seal and ensure it is positioned correctly.
(2) Position the sender unit so that the notch in the unit is positioned on the tab at the tank opening.
(3) Ensure that the retaining screws are tightened evenly and securely.

ELECTRIC FUEL PUMP

For removal, installation and test procedures refer to Section 3.

GROUP 14 — COOLING SYSTEM

SECTION 0 — INDEX

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Water Pump and Drive Belt (4 cylinder models)		5
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Fan Motor Relay		7
Thermosensor		7
Automatic Transaxle Fluid Oil Cooler		8

SECTION 1 — COOLING SYSTEM SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
POOR COOLANT CIRCULATION	Low coolant level.	Top up cooling system.
	Faulty thermostat.	Replace thermostat.
	Collapsed radiator hose (a hose may only collapse at high engine speed).	Replace hose.
	Water pump drive belt loose glazed or oil soaked.	Adjust drive belt or replace as necessary.
	Water pump impeller broken or loose on shaft.	Replace water pump.
	Radiator or engine water passages restricted.	Drain and flush cooling system.
	Coolant frozen.	Allow coolant to thaw and adjust coolant concentration to the level recommended for the expected temperature range.
	Coolant concentration too high.	Reduce coolant concentration to within the recommended limits.
WATER PUMP NOISY	Drive belt loose.	Adjust to the specified tension.
	Drive belt glazed.	Replace drive belt.
	Water pump or drive pulley loose.	Tighten components as necessary.
	Bearing worn, dry or damaged.	Replace water pump.
RADIATOR FAN RUNS CONTINUOUSLY — Ignition switch "OFF"	Faulty fan relay.	Test relay, replace if faulty.
—Ignition switch "ON"	Thermosensor faulty.	Test thermosensor, replace if faulty.
	Short circuit in wiring harness.	Disconnect thermosensor with ignition ON, if fan continues to run check the wiring harness between the thermosensor and the relay.
RADIATOR FAN INOPERATIVE	Faulty fan relay.	Test relay, replace if faulty.
	Thermosensor faulty.	Test thermosensor, replace if faulty.
	Fan motor faulty.	Test fan motor, replace if faulty.
	Fusible link burnt out.	Locate cause and replace link.
	Open circuit in wiring harness.	Check all wiring and connections for continuity, repair as necessary.

SECTION 2 — COOLING SYSTEM

SPECIFICATIONS

Cooling system capacity — 4G54 ECI — MULTI models ..... 9.6 litres
— 4G54 Carby models ..... 8.4 litres
— 6G72 models ..... 9.5 litres

Radiator
- Type ..... Vertical flow fin and tube
- Core size — ECI-Multi models (4 cyl. and V6) ..... 728 mm x 400 mm x 32 mm
  — Carburettor models ..... 728 mm x 400 mm x 16 mm
- Fin spacing — ECI-Multi models ..... 3.0 F/2.0 mm
  — Carburettor models ..... 2.5 F/2.0 mm
- Heat rejection capacity — ECI-Multi models ..... 50,500 KCal/hr
  — Carburettor models ..... 38,800 KCal/hr
- Radiator cap — type ..... Pressure vent
  — release valve opening pressure
  — N.D. — small cap ..... 74 to 103 kPa

Automatic transmission oil cooler — incorporating a double tube type, located in the bottom of the radiator as well as a fin tube type mounted forward of the radiator.

Fan
- Number of blades 4
- Diameter ..... 340 mm
- Drive unit ..... Electric

	4 cylinder	V6
Motor		
Type	D.C. Ferrite	←
Rated voltage	12V	←
Rated current	6.7 ± 1A	12.2 ± 1.5A
Rated speed	2150 ± 250 r.p.m.	2050 ± 300 r.p.m.
Rated load torque	0.254 Nm	0.553 Nm
Non load current	2A maximum	←
Rotation direction	Clockwise from shaft end	←

NOTE: All performance figures measured at 20° ± 3°C

Thermosensor operating temperature (°C)
- Off to on ..... 85 ± 3
- On to off ..... 81 ± 3

Water pump
- Type (4 cylinder and V6) ..... Centrifugal impeller
- Drive belt deflection at top run (4 cylinder) .. 4 to 7 mm

	4 cylinder	V6
Thermostat		
Type	Wax pellet	←
Opening temperature	82°C	88°C
Full opening temperature	95°C	100°C

TORQUE SPECIFICATIONS

	Nm
Temperature sender unit to intake manifold	8 to 12
Thermosensor to radiator	9 to 19
Thermostat housing bolt	9 to 12
Water pump attaching bolts	20 to 25
Water pump drive pulley to camshaft bolt	25 to 30
Water pump drive pulley cover bolt	12 to 15

GENERAL INFORMATION

The cooling system consists of a vertical flow fin and tube type radiator with a pressure sealing cap, a coolant recovery bottle, a belt driven water pump, a thermostat and an electric cooling fan.

The system is filled with demineralized water and a formulated glycol in a minimum concentration of 30%.

This coolant provides corrosion protection, improves coolant flow by reducing turbulence in the system, increases the boiling point and reduces the freezing point of the coolant.

Coolant is circulated by the pump through the cylinder block, the head and then through the top hose to the top tank of the radiator. It then passes down through the radiator and is cooled by air flow through the radiator fins.

Coolant is drawn from the cylinder head to the intake manifold, the automatic choke and the heater unit.

The radiator cap is a pressure sealing type. It incorporates two valves; a pressure release valve and a vacuum release valve, and has two functions:

(1) To increase pressure in the cooling system and thus raise the boiling point of the coolant.

(2) In conjunction with the coolant recovery bottle, to maintain the coolant in the radiator at the maximum level.

The coolant recovery bottle is connected to the radiator filler neck by a plastic tube. The system operates in the following manner:

(1) As the coolant is heated it expands and the pressure in the system increases. When the pressure reaches a predetermined point the pressure release valve in the radiator cap opens and coolant is forced out of the radiator and into the recovery bottle.

(2) As the engine cools the coolant contracts thus creating a vacuum in the radiator. The vacuum release valve in the radiator cap opens and coolant is drawn back into the radiator.

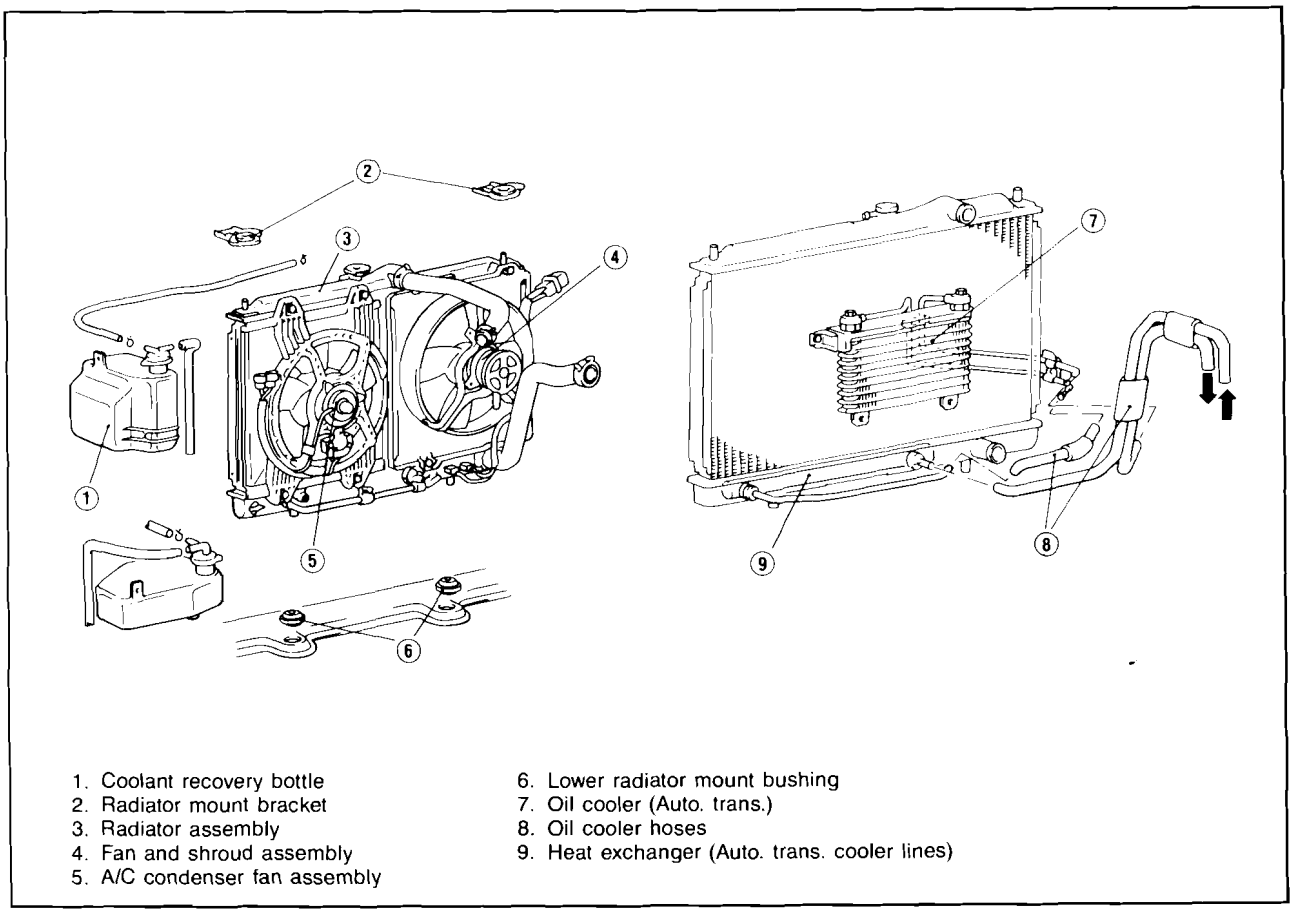
NOTE: The coolant recovery system will not operate if the cooling system contains air leaks.

The 4 cylinder engine water pump is an outboard centrifugal type pump. It is mounted at the rear of the motor and is belt driven by a pulley mounted to the camshaft.

The V6 engine water pump is an outboard centrifugal type pump mounted at the front of the motor and is driven by the engine timing belt.

The thermostat is a wax pellet type and is incorporated in the system to ensure quick engine warm up and to keep the engine at the optimum operating temperature.

The fan is mounted on the radiator and is driven by a D.C. ferrite type electric motor. Power for the motor is supplied through a thermosensor located in the radiator bottom tank. The thermosensor switches current to the fan motor when the coolant reaches the specified temperature.



1. Coolant recovery bottle
2. Radiator mount bracket
3. Radiator assembly
4. Fan and shroud assembly
5. A/C condenser fan assembly
6. Lower radiator mount bushing
7. Oil cooler (Auto. trans.)
8. Oil cooler hoses
9. Heat exchanger (Auto. trans. cooler lines)

Fig. 1—Cooling system components

Coolant temperature (°C) and specific gravity							Percentage coolant concentration	Minimum operating temperature (°C)
0°	10°	20°	30°	40°	50°	60°		
1.058	1.056	1.053	1.048	1.043	1.038	1.032	30%	-16°
1.067	1.064	1.061	1.056	1.050	1.045	1.039	35%	-20°
1.076	1.073	1.069	1.064	1.058	1.053	1.046	40%	-24°
1.085	1.081	1.076	1.071	1.065	1.060	1.053	45%	-30°
1.093	1.088	1.083	1.078	1.072	1.066	1.059	50%	-37°

Fig. 2—Coolant concentration chart

COOLANT CONCENTRATION

As detailed in "General Information", the cooling system is filled with a formulated glycol coolant which provides many benefits. To ensure that these benefits are fully realized the following points must be noted:

- Coolant concentration must be maintained between 30% and 50%, a concentration of less than 30% will result in loss of corrosion protection properties, while a concentration of more than 50% will result in reduced coolant flow hence reduced cooling efficiency.
- Never mix other coolant additives with the recommended coolant.
- Always use coolant in the required concentration when topping up the cooling system.
- Drain, flush and refill the cooling system at the recommended intervals.

NOTE: On ECI-Multi models when filling or topping up the cooling system it is important to depress the radiator hose by hand to expel air from the system and to replace the radiator cap before releasing the radiator hose.
Exercise care when depressing the hose on a hot engine to avoid being burnt.

Measuring Coolant Concentration

(1) Release the pressure in the cooling system and remove the radiator cap.
(2) Using a suitable thermometer, measure coolant temperature.
(3) Measure coolant specific gravity using a suitable hydrometer.
(4) Check that the specific gravity is correct for the required concentration by referring to Fig. 2.
(5) If necessary adjust specific gravity by adding Mitsubishi Long Life Coolant (to increase specific gravity) or rain or demineralized water (to reduce specific gravity).
(6) Run the engine to allow coolant to circulate then re-check specific gravity.
Alternatively, use a commercial type coolant concentration gauge to measure concentration.

PRESSURE TESTING RADIATOR CAP

(1) Remove the radiator cap.

CAUTION: To avoid scalding with steam or hot water, use the following procedure when removing a radiator cap.
(i) Cover the cap with several layers of cloth and loosen the cap to the first notch to release pressure.
(ii) When the pressure has been released, depress the cap and turn to remove.

(2) Attach a suitable adaptor to the pressure tester.
(3) Dip the radiator cap in water and fit onto tester adaptor.
(4) Apply the specified pressure to cap. If cap fails to hold pressure, replace cap.

NOTE: On some pressure testers, the pressure relief orifice may be covered by the cap seal. To overcome this, an additional 1.5 mm hole may be drilled 10 mm below the existing hole.

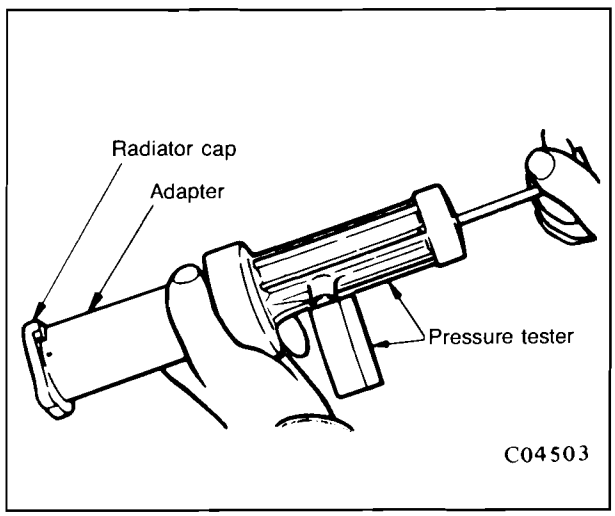


Fig. 3—Testing the radiator cap

PRESSURE TESTING COOLING SYSTEM

(1) Remove the radiator cap refer Caution detailed in "Pressure Testing Radiator Cap".
(2) Fill the radiator to within 10 mm of the filler neck.
(3) Wipe the filler neck sealing surface clean.

(4) Using a suitable adaptor, attach pressure tester to the filler neck and apply a pressure of 74 to 103 kPa to the cooling system.

(5) If pressure gauge holds steady, the system is satisfactory. If pressure drops, continue as follows.

(6) Check all points for external leaks, if none are evident after the dial gauge shows drop in pressure, continue test.

(7) Remove tester, fit radiator cap and run engine until normal operating temperature is reached, re-attach tool, apply recommended pressure and increase engine speed to half throttle.

NOTE: Leaving the tester in place during step 7 may result in damage to cooling system components due to excessive pressure build up.

(8) If needle on dial fluctuates, it indicates a combustion leak, generally the head gasket.

(9) If needle on dial did not fluctuate in step (7), sharply accelerate the engine several times. If an abnormal amount of water emits from the tail pipe it indicates a head gasket leak, cracked block or head.

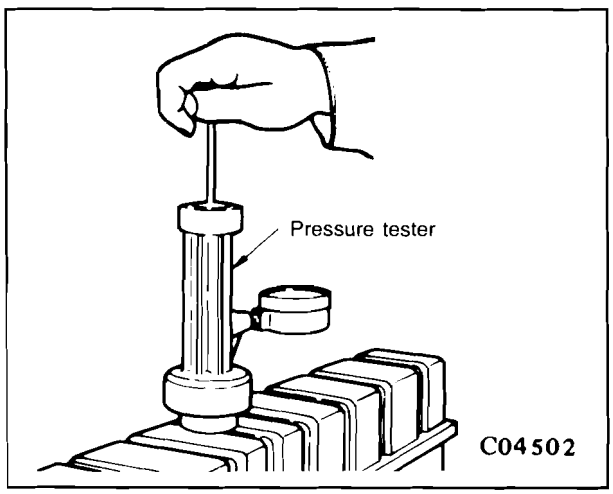


Fig. 4—Pressure testing cooling system

TESTING COOLANT RECOVERY SYSTEM

(1) Check radiator and recovery bottle levels and fit the radiator cap.

(2) Loosen the bottom hose clamp at the radiator and slide the hose rearward until a leak occurs.

(3) Check that coolant is drawn from the recovery bottle into the radiator.

(4) If coolant is not drawn from the recovery bottle check for leaks at the radiator filler neck and overflow outlet, the radiator cap and the recovery bottle hose.

NOTE: This test should only be carried out with the engine cold.

COOLING SYSTEM FLUSHING

(1) Drain the radiator and remove both radiator hoses.

(2) Remove the thermostat and re-install the housing.

(3) Connect a suitable flushing gun to the thermostat housing.

(4) Fit a drain hose to the water pump inlet.

(5) Connect the flushing gun to water and compressed air supplies.

(6) Fully open the heater valve.

(7) Restrict the drain hose, fill the block with water and leave the water valve open.

(8) Open and close the air valve to agitate and force away any foreign material, continue the operation until the water runs clear.

(9) For final block flushing, fill the block with water and remove the drain plug. Use air pressure until the water from the block drain runs clear.

(10) Fit the drain plug and the thermostat using a new thermostat housing gasket.

(11) To pressure flush the radiator, disconnect the two hoses from the engine and attach them to the radiator. Attach the flushing gun hose to the lower radiator tank and drain hose to the top tank.

(12) Fill the radiator with water, leave the water valve open, then open and close the air valve until the water runs clear.

(13) For final radiator flushing, attach flushing gun to top hose and repeat flushing operation.

(14) Disconnect the flushing gun and fit the radiator hoses.

(15) Fill the cooling system using rain or demineralized water and Mitsubishi Long Life Coolant in the required concentration.

(16) Run the engine for five minutes after normal operating temperature is reached to ensure no air is trapped in the system.

(17) Check coolant level and top up if necessary.

RADIATOR

NOTE: The radiator and mountings are designed to perform as a tuned vibration damper to reduce engine vibrations at idle speed. If a radiator core is to be replaced it is essential that the replacement core is manufactured to the same specifications and weight as the original core.

Removal

(1) Remove the radiator cap.

(2) Drain the radiator by removing the bottom hose.

(3) Remove the top hose, coolant recovery hose and the transaxle oil cooler hoses (where applicable).

NOTE: Plug the ends of the oil cooler hoses and radiator connections to prevent the ingress of dirt and moisture.

(4) Disconnect the electrical wiring.
(5) Remove the retaining nuts at the top of the radiator and remove the radiator, complete with the fan and motor assembly from the vehicle.

NOTE: Use care to avoid damaging the radiator cooling fins and tubes, and on M.P.I. models, the oxygen sensor during removal.

(6) Remove the fan and motor assembly from the radiator.

Installation

(1) Install the fan and motor onto the radiator.
(2) Position the radiator in the vehicle ensuring that the lugs on the radiator are correctly located in the bushes on the body.
(3) Connect the radiator hoses and oil cooler hoses and tighten clamps.
(4) Connect the coolant recovery hose to the radiator.
(5) Fill the cooling system with rain or demineralized water and Mitsubishi Long Life Coolant in the required concentration.
(6) Run the engine until normal operating temperature is reached, remove the radiator cap and check coolant level.

CAUTION: To avoid scalding with hot water or steam use the following procedure when removing the cap:
(i) Cover the cap with several layers of cloth and loosen the cap to the first notch to release pressure.
(ii) When pressure has been released depress the cap and turn to remove.

(7) Using a suitable tester, pressurize the cooling system and check for leaks.
(8) If transaxle oil cooler hoses have been disconnected, check transaxle fluid level and top up as required.

THERMOSTAT

Removal

(1) Drain the cooling system to a level below the thermostat housing.
(2) Remove the top radiator hose from the thermostat housing.
(3) Remove the thermostat housing bolts, thermostat housing and the thermostat.

Testing and Installation

(1) Immerse the thermostat in a container of water and raise the temperature while stirring to ensure even heat distribution.
(2) Measure water temperature with a suitable thermometer and check that thermostat opening temperature is within specifications.
(3) If test is not satisfactory the thermostat should be replaced.

NOTE: The thermostat and the thermometer should be supported so that they do not contact the container.

(4) Install the thermostat by reversing removal procedure, using a new gasket.

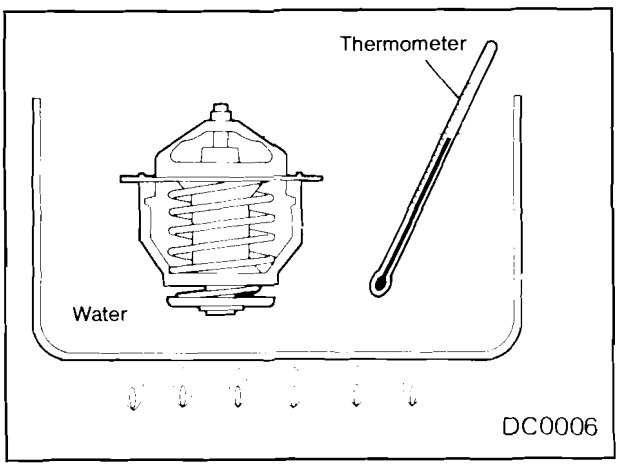


Fig. 5—Testing thermostat

WATER PUMP AND DRIVE BELT (4 cylinder models)

Drive Belt Adjustment

(1) Loosen the bolts shown in Fig. 6.
(2) Using a suitable lever, tension the drive belt, being careful to avoid damage to components.
(3) Tighten all adjusting bolts.
(4) Apply light finger pressure at the centre of the belt run and check that belt deflection is 4 to 7 mm.

NOTE: After adjusting belt ensure that the top radiator hose is not kinked or twisted. If necessary loosen the hose clamp and reposition the hose.

NOTE: When installing a new belt it should be readjusted after five minutes running.

Drive Belt Replacement

(1) Loosen the water pump mounting bolts, refer Fig. 6.
(2) Remove the drive belt from the water pump.
(3) Remove the camshaft pulley cover and remove the drive belt.
(4) Fit a new drive belt by reversing steps (2) and (3).
(5) Adjust the belt as previously described.

Water Pump Replacement (4 cylinder models)

The water pump is non-serviceable and if faulty, must be replaced as a unit.

Removal

(1) Remove the radiator cap.
(2) Disconnect the bottom hose at the radiator and drain the cooling system.
(3) Remove the drive belt from the water pump as previously described.
(4) Disconnect all hoses from the water pump.
(5) Remove the water pump mounting bolts, refer Fig. 6, and remove the water pump.
(6) Remove and discard the water pump to cylinder block "O" ring.

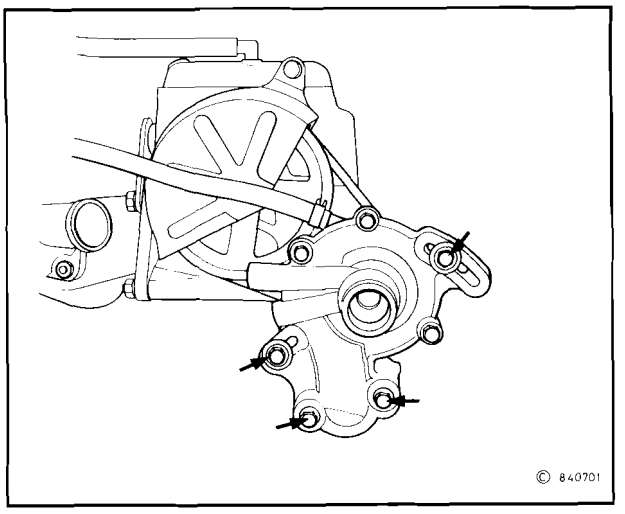


Fig. 6—Water pump mounting bolts (4 cylinder models)

Installation

Install by reversing the removal procedure, noting the following:

(1) Use a new "O" ring between the water pump and the block.

(2) Ensure that the water pump is squarely located on the block and bolts are tightened to the specified torque.

(3) Adjust the drive belt as previously described.

(4) Top up the cooling system with rain or demineralized water and Mitsubishi Long Life Coolant in the required concentration.

WATER PUMP DRIVE PULLEY SEAL (4 cylinder models)

Refer to Group 11 — Section 3, for replacment procedure.

WATER PUMP (V6 models)

Water Pump Replacement

The water pump is non-serviceable and if faulty, must be replaced as a unit.

Removal

(1) Disconnect battery.

(2) Remove the radiator cap.

(3) Disconnect the bottom radiator hose at the radiator and drain the cooling system.

(4) Remove engine timing belt, refer to Group 11 — Section 7 for removal procedure.

(5) Remove water pump mounting bolts, refer Fig. 7.

(6) Twist and pull water pump to disconnect pump from inlet water pipe and "O" ring.

(7) Remove air intake hose, disconnect heater hose, water hoses and bottom radiator hose from inlet water pipe.

(8) Remove inlet water pipe retaining bracket bolts and remove inlet water pipe.

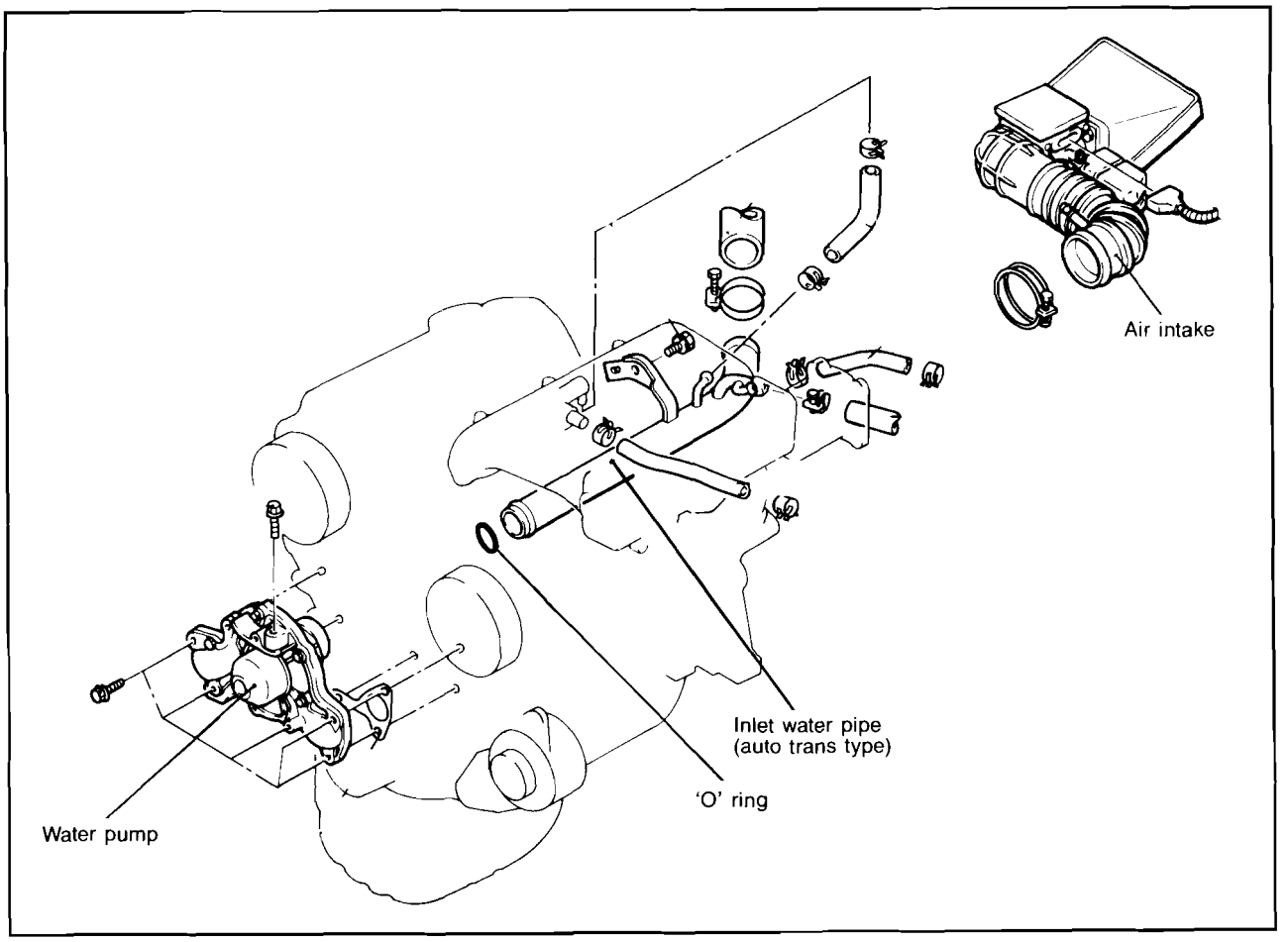


Fig.7—V6 water pump

Installation

Install by reversing removal procedure, noting the following:

(1) Install a new water pump to inlet water pipe "O" ring and water pump to block gasket.

(2) Use only water to lubricate inlet water pipe "O" ring when installing to water pump.

(3) Ensure water pump is squarely located on the block, inlet water pipe is based and bolts are tightened to the specified torque.

(4) Refer Group 11 — Section for engine timing belt installation procedure.

(5) Refill the cooling system with rain or demineralized water and Mitsubishi Long Life Coolant in the required concentration.

(6) Connect battery and reset clock, insert radio security code as required.

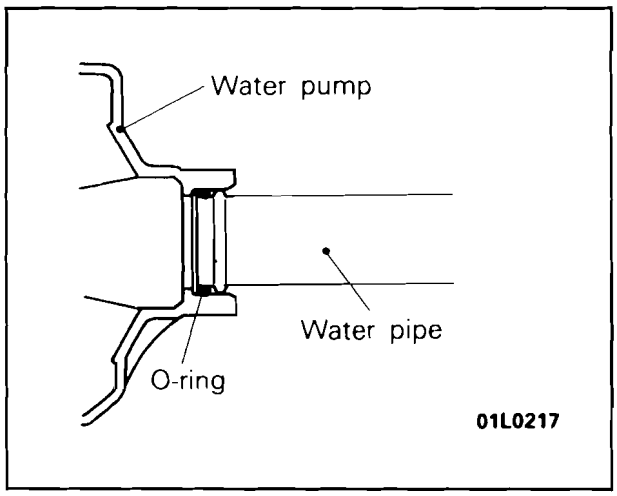


Fig. 8—Inlet water pipe "O" ring

RADIATOR FAN MOTOR

Removal

(1) Disconnect wiring from the fan motor and the thermosensor.

(2) Remove the shroud to radiator attaching bolts.

(3) Remove the fan from the fan motor.

(4) Remove the fan motor from the shroud.

Installation

Install by reversing the removal procedure.

Testing

Apply battery voltage between terminals 1 and 3, refer Fig. 9 (positive to terminal 1, negative to terminal 3), and check that the motor rotates freely and smoothly.

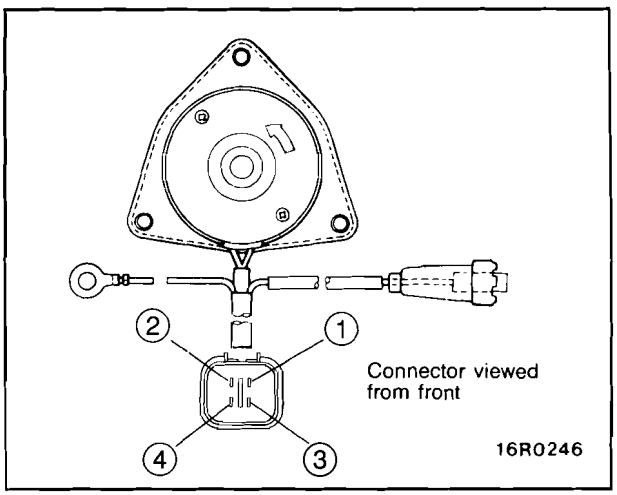


Fig. 9—Fan motor terminals

FAN MOTOR RELAY

Testing

(1) Remove the relay from the vehicle, refer Group 54 for relay location.

(2) Using an ohmmeter check that there is continuity between terminals 1 and 3 and no continuity between terminals 2 and 4.

(3) Apply battery voltage between terminals 1 and 3 and check for continuity between terminals 2 and 4.

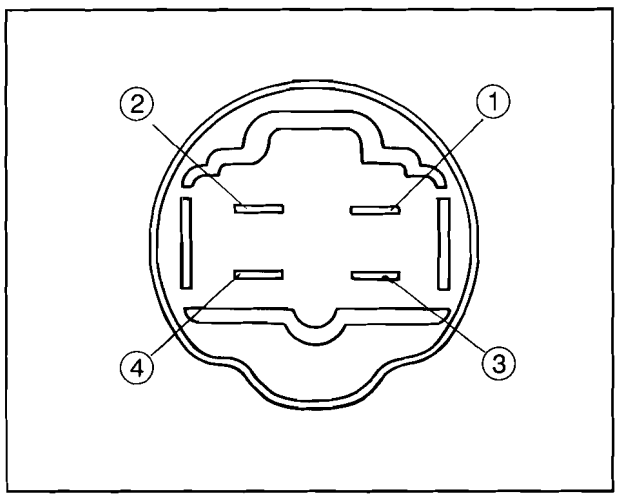


Fig. 10—Fan relay terminals

THERMOSENSOR (fan)

Testing

(1) Drain the cooling system and remove the thermosensor located on the left hand side of the bottom hose outlet of the bottom radiator tank.

(2) Immerse the thermosensor in a container of water as shown in Fig. 11 and raise the temperature of the water while stirring to ensure even heat distribution.

(3) Connect an ohmmeter across the thermosensor and using a suitable thermometer to measure water temperature, check that the thermosensor operates within the specified range.

NOTE: The thermosensor and thermometer should be supported to ensure that they do not contact the container.

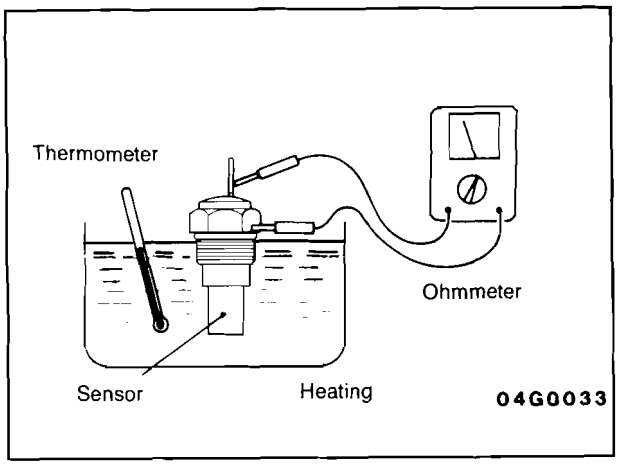


Fig. 11—Testing thermosensor

AUTOMATIC TRANSAXLE FLUID OIL COOLER

Removal

(1) Remove the radiator grille, refer Group 51 — Exterior.

(2) Disconnect hoses from the cooler and plug ends to prevent the ingress of dirt.

(3) Remove the oil cooler mounting bolts and remove the cooler from the vehicle.

Installation

Install by reversing removal procedure, noting the following:

(1) Ensure that all hose connections are secure and that no leaks exist.

(2) Ensure that hoses are routed to avoid fouling and that foam protectors are correctly positioned.

(3) Top up the transaxle after cooler installation.

GROUP 15 — EXHAUST SYSTEM AND INTAKE MANIFOLD

SECTION 0 — INDEX

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SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
EXCESSIVE EXHAUST RESONANCE OR VIBRATION	Exhaust system misaligned.	Re-align exhaust system.
	Exhaust rubber hangers loose, damaged or misaligned.	Replace damaged rubber hangers and align exhaust system.
	Exhaust hanger loose.	Tighten exhaust hangers.
	Loose or incorrectly aligned engine mounts.	Centralize and tighten engine mounts.
	Internal muffler baffles loose.	Replace muffler.
LEAKING EXHAUST GASES	Corroded/damaged muffler or pipe.	Replace faulty component.
	Loose joint or flange.	Tighten to specifications.
	Gasket burnt or damaged.	Replace gasket.
	Manifold mating surface warped.	Machine or replace manifold.
	Manifold cracked.	Replace manifold.

SECTION 2 — EXHAUST SYSTEM

SPECIFICATIONS

Maximum allowable distortion of manifold mating surface ..... 0.15 mm

TORQUE SPECIFICATIONS

	Nm
Exhaust pipe flange to manifold nuts (4 cylinder)	30 to 40
Exhaust pipe flange to manifold nuts (6 cylinder)	40 to 60
Exhaust pipe front clamp bolt (4 cylinder only)	30 to 40
Exhaust pipe hanger bracket to body bolt	10 to 15
Centre to rear muffler flange bolt	30 to 40
Rubber hanger to exhaust pipe and body bolt	10 to 15
Exhaust manifold to cylinder head attaching nuts	15 to 19
Exhaust manifold to cylinder head attaching nuts (V6)	15 to 21
Manifold to catalyst chamber attaching bolts (carburettor models)	30 to 35
Heat shield to manifold bolts	8 to 10
Heat shield to manifold bolts V6	12 to 15
Hot air intake cowl to manifold bolts	8 to 10
Oxygen sensor	50 to 60
Catalytic convertor to exhaust flange nuts	20 to 30

GENERAL INFORMATION

The exhaust manifold is manufactured from cast iron. On carburettor models, the Secondary Air Supply System is connected to the manifold and a heat stove over the manifold supplies heated air for the Heated Inlet Air System when required.

The outlet ports blend into a dual connection to the exhaust pipe, which houses an underfloor catalytic converter. On fuel injection models, the exhaust gas sensor end of the oxygen sensor system is connected to the manifold just prior to the exhaust pipe flange.

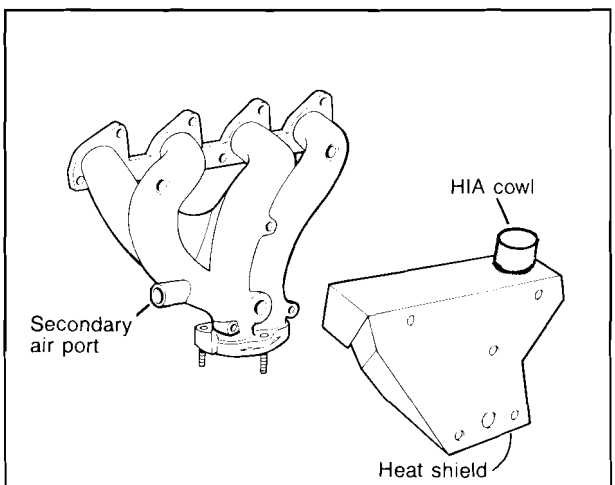


Fig. 1—Exhaust manifold—carburettor models

EXHAUST MANIFOLD

Removal

Carburettor Models

(1) Remove the air cleaner assembly, heated inlet air supply hose and secondary air supply pipe.

(2) Remove the heat shield and heated intake air cowl from the manifold.

(3) Remove the exhaust pipe to manifold attaching nuts.

(4) Remove the exhaust pipe clamp bolt and lower the pipe sufficiently to clear the exhaust manifold.

NOTE: Suitably support the exhaust pipe to avoid damage to the exhaust hangers.

(5) Remove the secondary air support bracket bolts.

(6) Remove the exhaust manifold retaining nuts and remove the manifold.

Fuel Injection Models

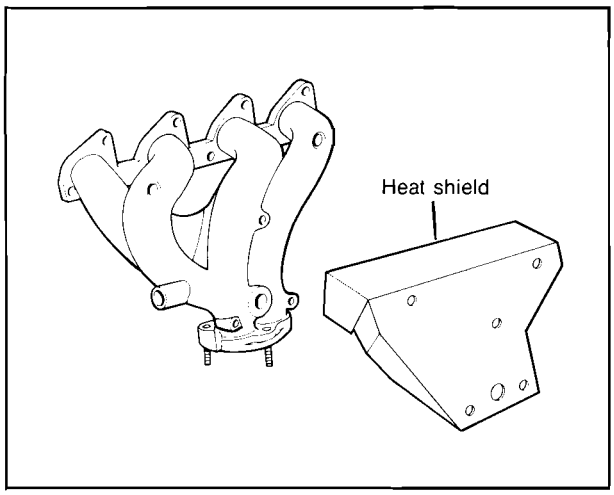


Fig. 2—Exhaust manifold—fuel injection models

(1) Uncouple oxygen sensor at connector clipped to radiator.
(2) Remove the heat shield bolts and carefully remove the heat shield over the sensor and wiring.
(3) Remove the oxygen sensor from the manifold.
(4) Remove the exhaust flange bolts and lower the pipe sufficiently to clear the exhaust manifold.

NOTE: Suitably support the exhaust pipe to avoid damage to the exhaust hangers.

(5) Remove the bolt from the water pump through to the support bracket.
(6) Remove the manifold retaining nuts and remove the manifold and gasket.

V6 Model. Refer Fig. 4

Front Manifold

(1) Remove the heat shield attaching bolts and remove the heat shield.
(2) Remove the exhaust flange retaining bolts and lower the exhaust pipe sufficiently to clear the manifold.
(3) Remove the oil dipstick guide.
(4) Remove the manifold retaining nuts and remove the manifold and gasket.

Rear Manifold

(5) Remove the rear roll stopper stay.
(6) Remove the surge tank stay left hand.
(7) Remove the surge tank stay bracket.
(8) Remove the exhaust flange retaining bolts and lower the exhaust pipe sufficiently to clear the exhaust manifold.
(9) Remove the heat shield attaching bolts and remove the heat shield.
(10) Remove the exhaust manifold retaining nuts and remove the manifold and gasket.

Inspection

Check the manifold for cracks, damage and distortion and repair or replace as necessary.

Installation

Install the manifold by reversing the removal procedure noting the following:
(1) Use new gaskets.
(2) Tighten all attaching nuts and bolts to specifications.
(3) On Fuel Injection models ensure the oxygen sensor is reconnected.
(4) On V6 Models. refer Fig. 4
Install gaskets, with Numbers 1, 3 and 5 embossed on the top side, to the front bank and gasket with Numbers 2, 4 and 6 to the rear bank.
(5) On V6 models when refitting oil dipstick tube, apply oil to the O-ring. Refer Fig. 3.
(6) On V6 models replace rear roll stopper stay lock nut.

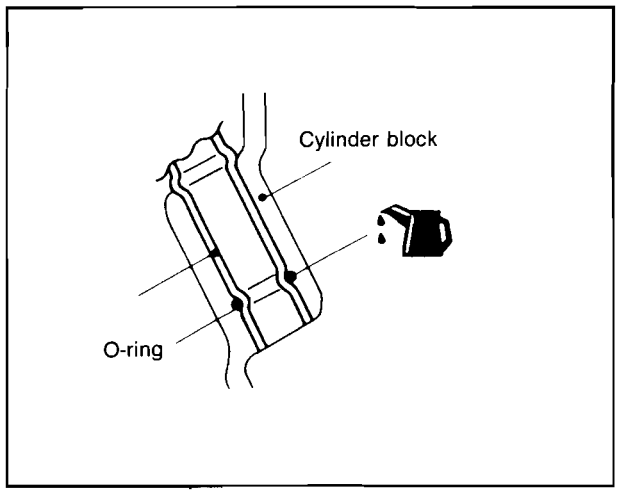


Fig. 3—Oil dipstick tube V6

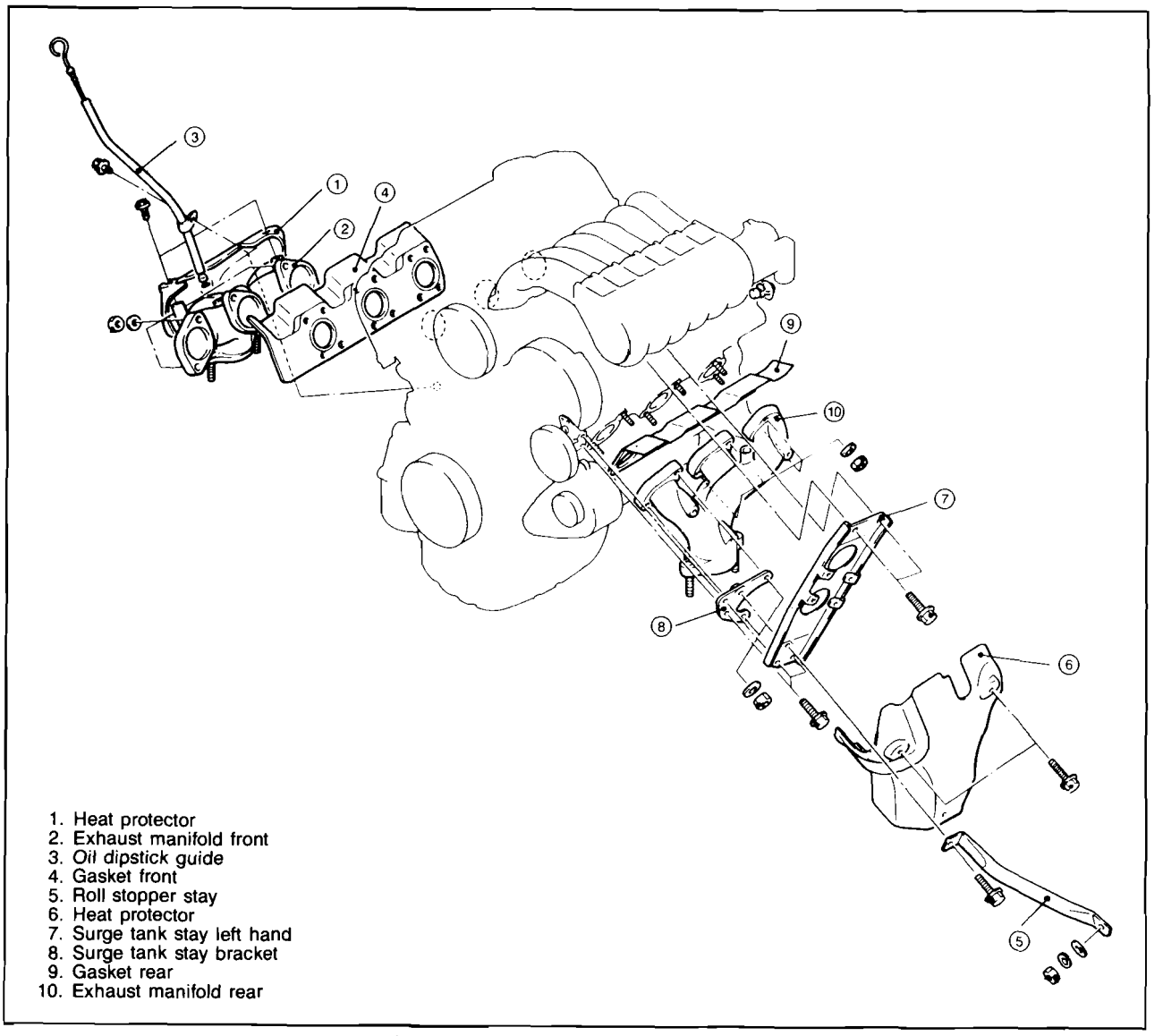


Fig. 4—Exhaust manifolds V6 model

CATALYTIC CONVERTER REPLACEMENT

NOTE: The catalytic converter should not require replacement under normal circumstances. The converter should only be changed if visual inspection shows it is burnt out (melted), or CO levels are not below the limits specified, when performing CO concentration checks as outlined in Group 13.

If replacement is necessary, the converter and case must be changed as an assembly.

Removal

(1) Remove exhaust pipe to manifold flange nuts.

(2) Remove converter case to front and rear exhaust pipe nuts, refer Fig. 5.

NOTE: Spraying attaching nuts with CRC-556 or similar, prior to loosening, will allow easier nut removal.

(3) Support front exhaust pipe and remove hanger. Lower and remove the pipe from the converter housing.

(4) Remove converter housing assembly from the rear exhaust pipe.

Installation

Installation is a reversal of the removal procedure noting the following:-

(a) Use new gaskets.

(b) Fit new converter with the "FLOW" indicating arrow to the rear of the vehicle.

(c) Tighten all nuts to the specified torque.

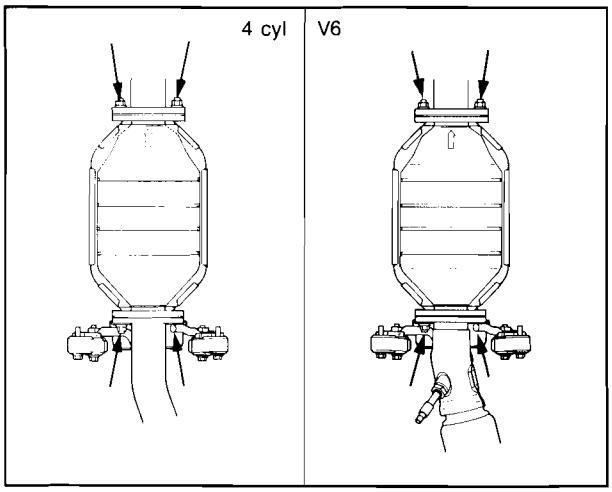


Fig. 5 — Converter attaching nuts

EXHAUST PIPE, TAILPIPE AND MUFFLER

Removal

(1) Remove centre pipe flange to muffler pipe flange attaching bolts.

(2) Support rear muffler, remove rubber hanger attaching bolts and remove muffler assembly.

(3) Remove centre pipe flange to catalytic converter attaching nuts.

(4) Support centre pipe remove rubber hanger attaching bolts and remove the centre pipe.

(5) Remove catalytic converter attaching nuts and remove converter.

(6) 4 cylinder models, remove front pipe to manifold attaching nuts.

(7) Support front pipe, remove front pipe clamp bolt, remove rubber hanger attaching bolts and remove front pipe.

(8) 6 cylinder models, support front pipe, remove front pipe to manifold attaching nuts, remove rubber hanger attaching bolts and remove front pipe.

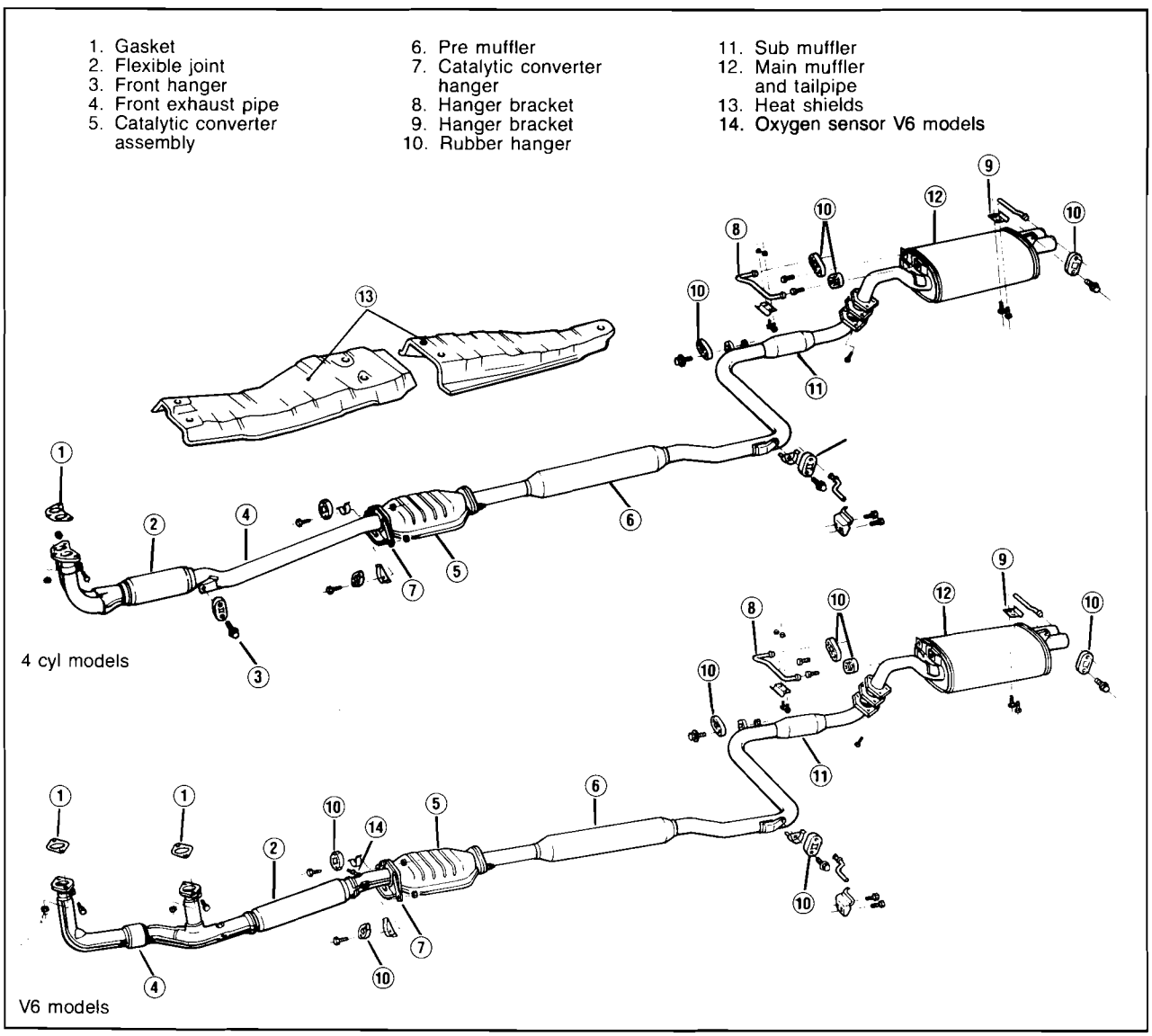


Fig. 6 — Exhaust system components

Inspection

Perform the following inspection and repair or replace any faulty components.

(1) Check the mufflers and pipes for corrosion, damage, restrictions or burning.

(2) Check rubber hangers for damage, deterioration and stretching.

Installation

Install the exhaust system by reversing the removal procedure noting the following:

(1) Use new gaskets.

(2) Ensure that components are correctly aligned and do not foul any body or mechanical components.

(3) Ensure that all exhaust supports are centrally located and square at hanger points.

NOTE: It is essential that the load is distributed evenly onto each rubber hanger.

(4) Tighten attaching nuts and bolts to specifications.

SECTION 3 — INTAKE MANIFOLD

SPECIFICATIONS

Maximum allowable distortion of manifold mating surface ..... 0.15 mm

TORQUE SPECIFICATIONS

	Nm
Intake manifold to cylinder head nuts	15 to 19
Intake manifold to cylinder head nuts (V6)	15 to 20
EGR valve attaching bolts	7 to 11
Temperature sender unit to intake manifold	30 to 39
Thermostat housing attaching bolts	17 to 20
Carburettor to intake manifold bolts	15 to 20
Surge tank to intake manifold nuts and bolts (fuel injection)	15 to 20
Throttle body to surge tank nuts and bolts (fuel injection)	10 to 13
Accelerator cable attaching bracket bolts	8 to 10
Fuel delivery pipe to manifold bolts (fuel injection)	10 to 13
Intake manifold to cylinder block, stay bolts (4 cyl.) (fuel injection)—upper	45 to 55
—lower	50 to 55
Surge tank stay V6	15 to 20
Fuel hose to delivery pipe bolt (fuel injection)	4 to 6
Temperature sensor to intake manifold (fuel injection)	11 to 15

GENERAL INFORMATION

The intake manifold, cast from aluminium alloy, has on carburettor models an integral heat exchanger in the base. Engine coolant is directed through the heat exchanger, heating the manifold, which assists in maintaining the fuel in an atomised state giving high combustion efficiency.

The Exhaust Gas Recirculation (EGR) valve on carburettor models, is mounted to the intake manifold, with passages cast in the manifold to direct the recirculated exhaust gases to and from the EGR valve.

On fuel injection models the injectors are mounted in the manifold. A surge tank to prevent/reduce pressure fluctuations in the intake track is mounted on a flange at the outer edge of the manifold.

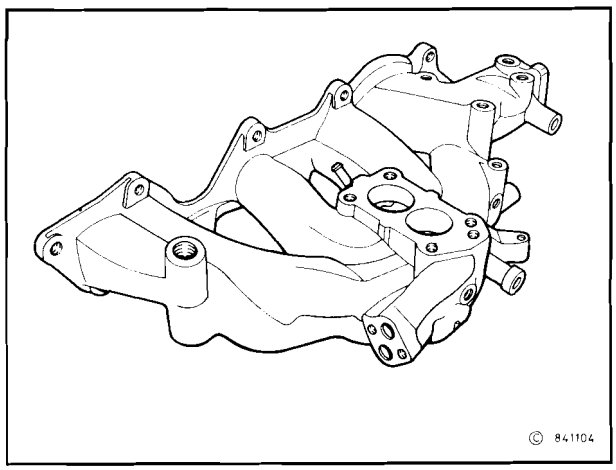


Fig. 1—Intake manifold—carburettor models

INTAKE MANIFOLD

Carburettor Models

Removal

(1) Drain the cooling system to a level below the thermostat housing.

(2) Remove the air cleaner assembly.

(3) Disconnect all coolant hoses from the intake manifold.

(4) Disconnect all vacuum hoses from the intake manifold and carburettor.

(5) Disconnect all electrical wiring from the intake manifold and carburettor.

(6) Disconnect the fuel lines from the carburettor noting the location of each hose.

(7) Disconnect the accelerator cable from the carburettor.

(8) Remove the manifold retaining nuts and remove the manifold.

(9) If the manifold is to be replaced, remove the carburettor, thermostat housing and thermostat, temperature sender unit and thermo valve, EGR valve, all vacuum hoses and coolant connections.

Inspection

Perform the following inspection and repair or replace the manifold as necessary.

(1) Check the manifold for cracks, damage and porosity.

(2) Check the mating surface for warpage and distortion.

(3) Check the EGR passages for blockage.

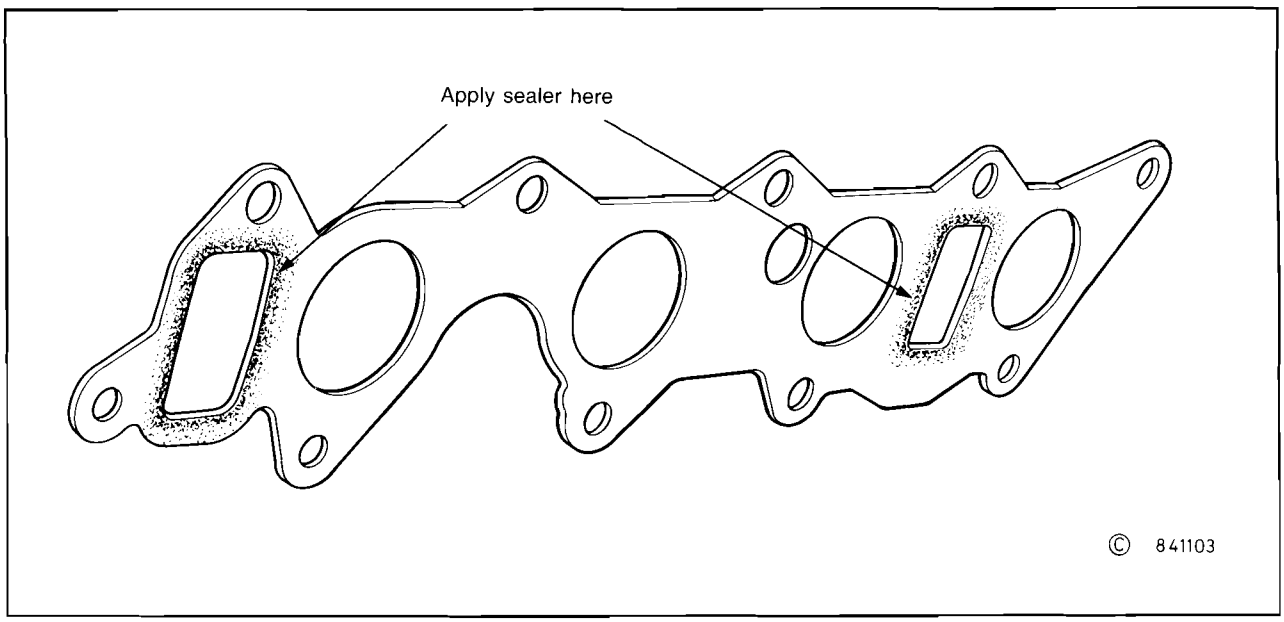


Fig. 2—Intake manifold gasket (carburettor models)

Installation

Install by reversing the removal procedure noting the following.

(1) Clean the mating surfaces of the cylinder head and intake manifold, ensuring that no foreign material enters the cylinder head or intake manifold ports.

(2) Ensure that the carburettor attaching bolt holes are free of water and foreign material.

NOTE: A thin smear of grease applied to the bolt threads will eliminate the possibility of corrosion on the bolts.

Fuel Injection (4 Cylinder Models)

Removal

(1) Disconnect the battery negative (ground) terminal.

(2) Drain the cooling system to a level below the thermostat housing by removing the lower radiator hose.

(3) Remove the air cleaner duct from the throttle body.

(4) Disconnect, top radiator hose from thermostat housing and other coolant hoses.

(5) Disconnect the throttle cable from the throttle body.

(6) Disconnect all electrical connectors from the throttle body, temperature sender and sensor and injectors. Remove the wiring loom clip from the delivery pipe and lay the loom to one side.

(7) Disconnect all vacuum hoses and label for reassembly.

(8) Disconnect fuel supply and return hoses from the delivery pipe.

NOTE: On fuel injection models, the residual fuel pressure and amount of fuel remaining in the fuel lines, make it essential that care is taken when disconnecting fuel lines. Use suitable containers and/or rags to contain fuel spillage.

(9) Remove manifold to engine stay bolts and remove the stay.

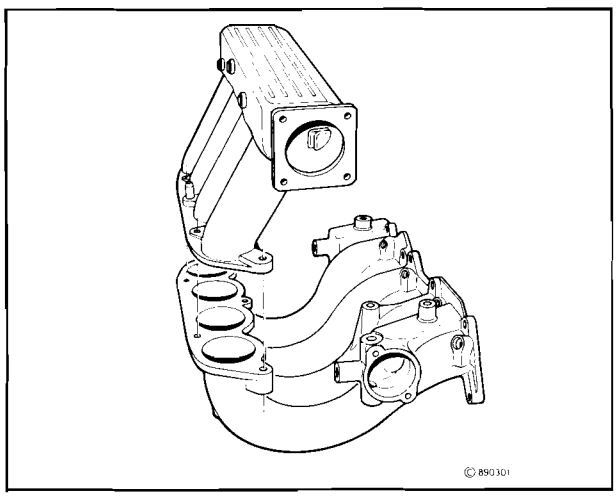


Fig. 3—Intake manifold and surge tank — (4 cyl) fuel injection models

(10) Remove manifold to cylinder head nuts and remove the manifold assembly.

(11) If the manifold is to be replaced remove the throttle body, fuel delivery pipe, injectors, surge tank, thermostat housing and thermostat, temperature sender, temperature sensor and centre cover plate.

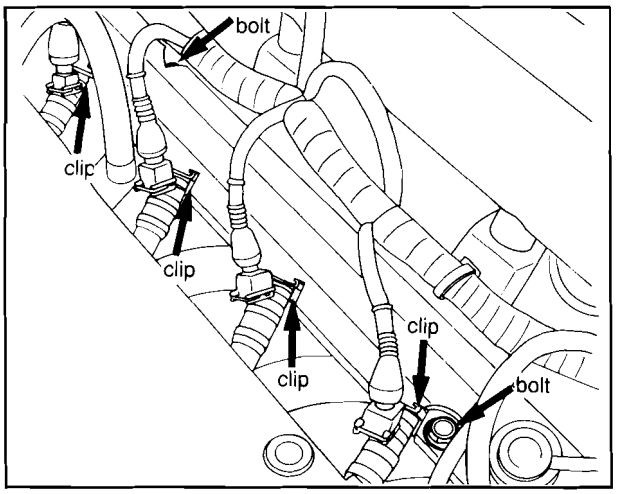


Fig. 4—Injector removal

Inspection

Perform the following inspection and repair or replace the manifold as necessary.

(1) Check the manifold for cracks, damage and porosity.

(2) Check all mating surfaces for warpage and distortion.

(3) Check all coolant passages for blockage and corrosion.

Installation

Install by reversing removal procedure noting the following:

(1) Clean the mating surfaces of the cylinder head, manifold and surge tank ensuring that no foreign material enters any of the ports.

(2) Use new gaskets and tighten all bolts and nuts to the specified torque.

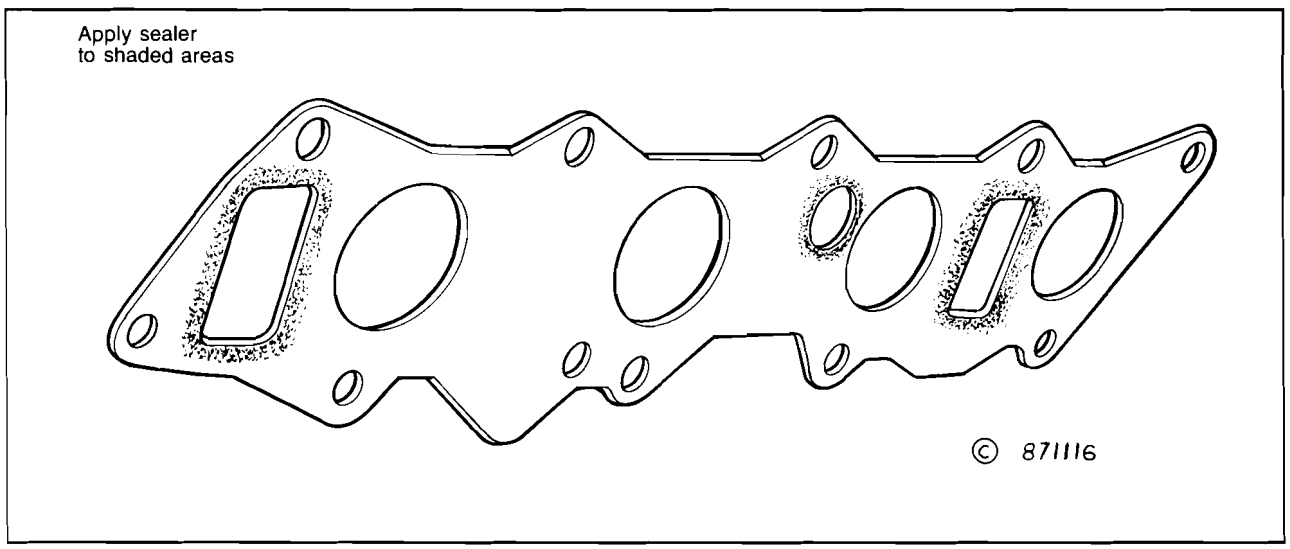


Fig. 5—Intake manifold gasket (4 cylinder fuel injection models)

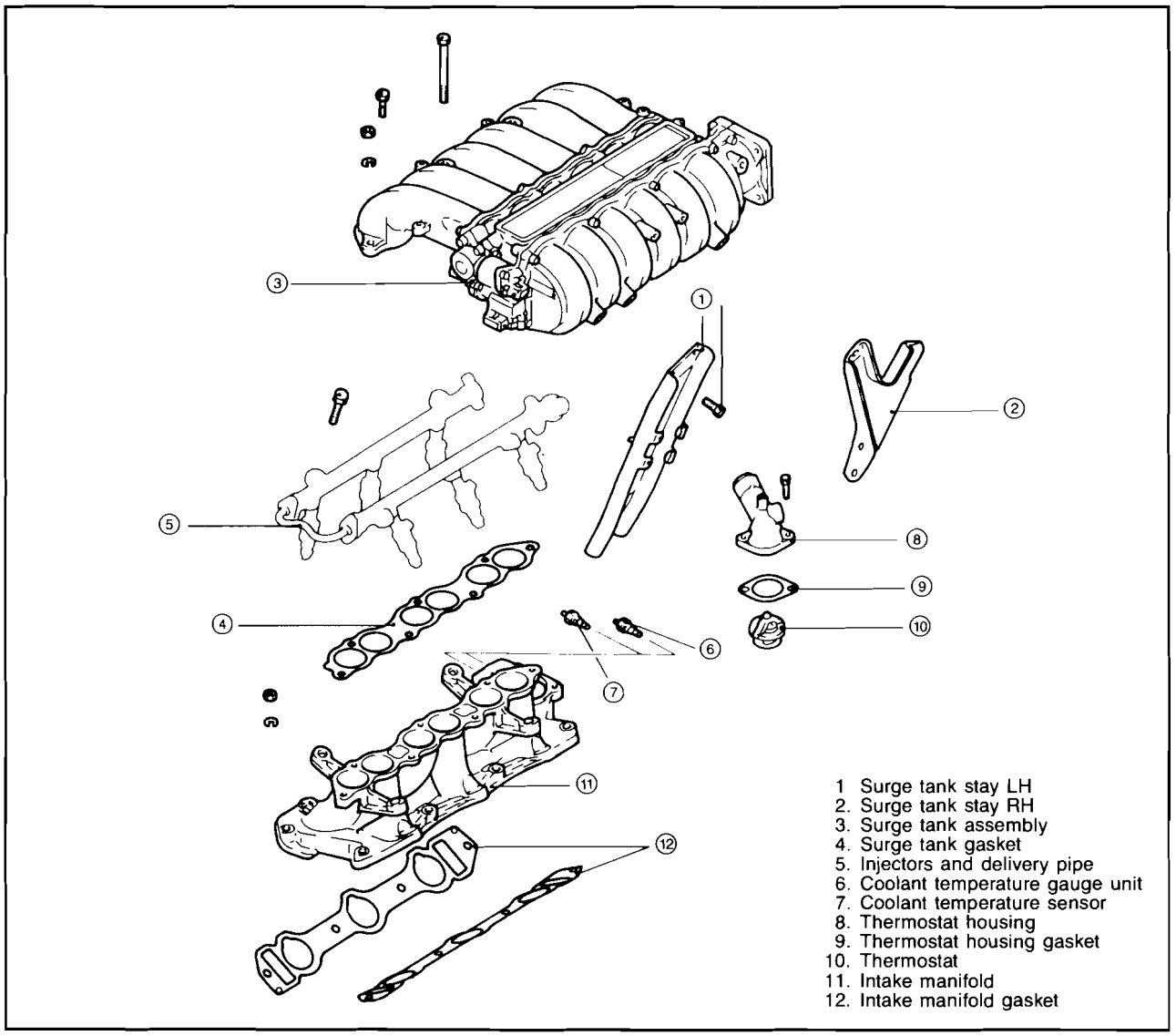


Fig. 6 — V6 intake manifold

V6 Model

Removal

Refer Fig. 6

(1) Disconnect the battery negative (ground) terminal.

(2) Remove the throttle cable from the throttle body and surge tank.

(3) Remove the air cleaner duct from the throttle body.

(4) Disconnect all vacuum hoses from the throttle body and surge tank

(5) Disconnect all electrical connections from the distributor, ignition coil, variable intake control, throttle body, temp sender and sensor and injectors.

(6) Drain the radiator to a level below the thermostat housing.

(7) Remove the top radiator hose and coolant hoses from the throttle body and intake manifold.

(8) Remove the left hand and right hand surge tank stay bolts and stays.

(9) Remove the surge tank attaching bolts and remove the surge tank.

(10) Remove the surge tank gasket.

(11) Disconnect fuel supply and return hoses from the delivery pipe.

NOTE: On fuel injection models, the residual fuel pressure and amount of fuel remaining in the fuel lines, make it essential that care is taken when disconnecting fuel lines. Use suitable containers and/or rags to contain fuel spillage.

(12) Remove the intake manifold attaching nuts and remove the manifold.

(13) Remove the intake manifold gasket.

(14) If the manifold is to be replaced remove the throttle body, temperature sender and sensor, fuel delivery pipe and injectors.

Inspection

Perform the following inspection and repair or replace the manifold as necessary.

(1) Check the manifold for cracks, damage and porosity.

(2) Check all mating surfaces for warpage and distortion.

(3) Check all coolant passages for blockage and corrosion.

Installation

Install by reversing removal procedure noting the following:

(1) Clean the mating surfaces of the cylinder head, manifold and surge tank ensuring that no foreign material enters any of the ports.

(2) Use new gaskets and tighten all bolts and nuts to the specified torque.

(3) Apply oil to the inlet manifold mounting studs.

(4) Use a suitable thread sealant on the temperature sender and sensor.

VARIABLE INDUCTION CONTROL SYSTEM INSPECTION

System Inspection On Vehicle

(1) Warm up the engine.

(2) Connect the tachometer. Refer to Group 13.

(3) Make sure that when the engine speed is increased from the idle speed to 5,000 rpm, the induction control valve shaft turns. Refer Fig. 7.

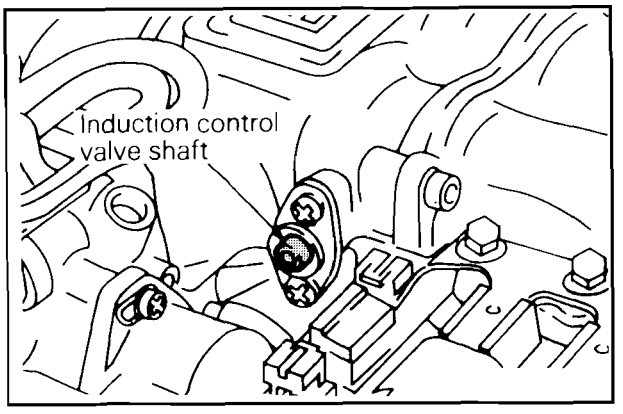


Fig. 7 — Induction control valve shaft

VARIABLE INDUCTION CONTROL SERVO INSPECTION

(1) Disconnect the variable induction control servo connectors.

(2) Check the variable induction control servo coil for continuity. Refer Fig. 8

Standard Value

Measured terminal	Continuity
Between terminals 1 and 2	Present 5-35 Ohms @ 20°C

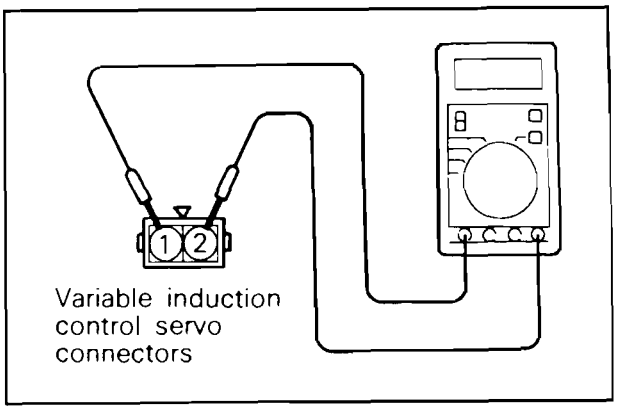


Fig. 8 — Variable intake control connector

(3) Make sure that when DC 6V 4 dry Cells is applied to terminals ① and ② of the variable induction control servo connector, the induction control valve shaft turns smoothly. Refer Figs. 9 and 10.

CAUTION: Be sure to apply a voltage of not higher than DC 6V to the variable induction control servo connector terminals since application of high voltage may lock the variable intake control.

(4) If deviation from the standard value occurs or the variable induction control valve shaft does not turn smoothly, replace the surge tank assembly.

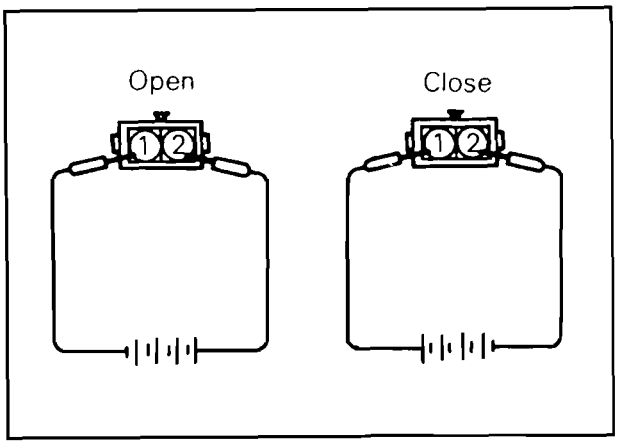


Fig. 9 — Variable intake control connector

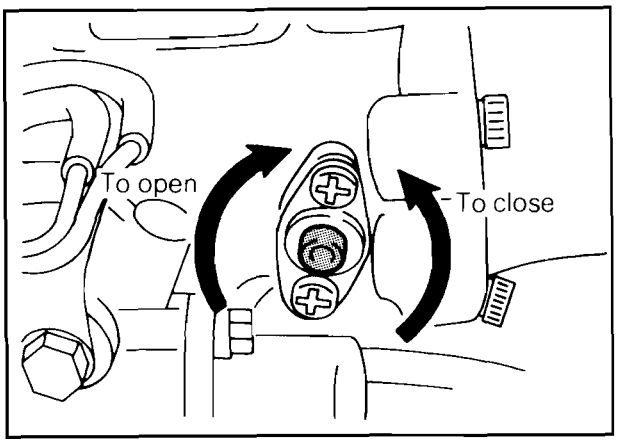


Fig. 10 — Variable intake control shaft

SECTION 4 — AIR CLEANER

SPECIFICATIONS

Carburettor Models

Type	Dry type
Element	Unwoven cloth
Heated intake air	Vacuum motor, controlled by bi-metal thermosensor
Hot idle compensator	Bi-metal thermosensor

Fuel Injection Models (4 Cylinder and V6)

Type	Cyclone — Dry Type
Element	Unwoven cloth
Airflow sensor	Electronic

TORQUE SPECIFICATIONS

	Nm
Air cleaner to rocker cover	12 to 15
Air cleaner to body bolt (fuel injection)	8 to 10
Air flow sensor to air cleaner assembly	8 to 10
Air intake hose clamp	3 to 5

GENERAL INFORMATION

The air cleaner filters dust, dirt and other contaminants from the air used by the engine for combustion. A vacuum motor and thermo sensor on carburettor models for the heated inlet air system and thermosensor for the hot idle compensator are located in the air cleaner body.

On fuel injection models, the air cleaner houses an airflow sensor assembly, used by the fuel injection computer to calculate the basic fuel requirements of the engine.

AIR CLEANER

Carburettor Models

Removal

(1) Remove high tension cables 2, 3 and 4 from spark plugs and remove from retainer on air cleaner snorkel.

(2) Remove retaining clip and remove inlet tube from snorkel.

(3) Remove secondary air hose from filter box.

(4) Remove crankcase breather hose from air cleaner pipe.

(5) Remove vacuum hose from tee—back lower edge of air cleaner body.

(6) Remove centre wing nut from air cleaner top cover.

(7) Remove air cleaner body to rocker cover nuts and lift off air cleaner assembly.

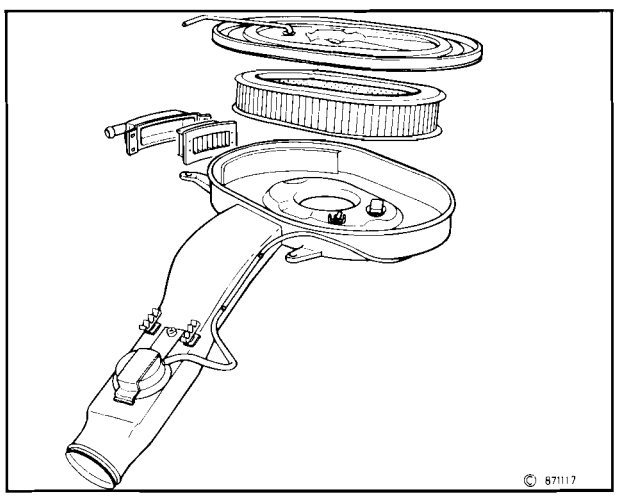


Fig. 1—Air cleaner components (carburettor models)

Inspection

(1) Check the air cleaner body for cracks and splits.

(2) Check condition of air cleaner element and secondary air filter. Clean or replace if necessary.

NOTE: The above elements should be cleaned or replaced as often as conditions warrant, but not exceeding the scheduled service intervals.

(3) Check condition of the rubber seals (top cover to base, base to carburettor). Replace if necessary.

(4) Refer to Group 17—Emission Control Systems for test procedures for the Heated Intake Air and Hot Idle Compensator systems.

Installation

Install by reversing removal procedure.

Fuel Injection Models (4 Cylinder and V6)

Removal

(1) Disconnect the air flow sensor wiring.
(2) Remove the air intake duct from the throttle body.
(3) Remove the breather hose.
(4) Loosen the air cleaner attaching clips.
(5) Remove the air cleaner upper body and air flow sensor as an assembly.
(6) Remove the air cleaner element.

Inspection

(1) Check the duct, air cleaner body and intake hose for cracks and splits.
(2) Check condition of element. Clean or replace if necessary.

NOTE: The air cleaner element should be cleaned or replaced as often as conditions warrant, but not exceeding the scheduled service intervals.

Installation

Install by reversing removal procedure.

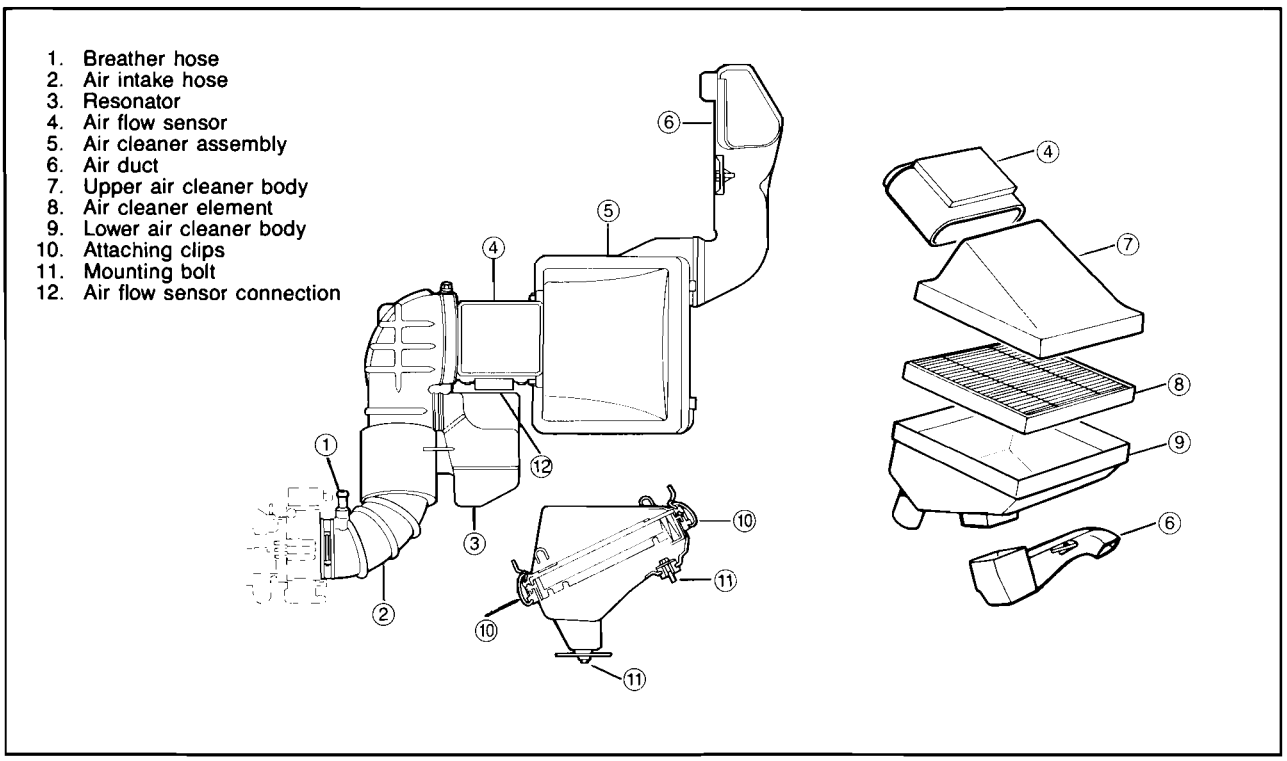


Fig. 2—Air cleaner components (fuel injection models)

GROUP 16 — ENGINE ELECTRICAL

SECTION 0 — INDEX

CAUTION: To avoid damage to the electronic components used in many systems, ensure that the precautions outlined in Section 1 are observed.

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SECTION 1 — GENERAL INFORMATION

ELECTRONIC COMPONENT PROTECTION

Many of the electrical systems on the vehicle incorporate electronic components, i.e. micro-processors, semi-conductors, transistors, etc.

Many of these components operate on low voltages and current draws. To prevent voltage peaks and/or excessive current draw which may damage the component the following precautions should be observed:

(a) Ensure that the ignition and vehicle lighting switches are turned OFF before disconnecting wiring from a component or the battery.

(b) When disconnecting the battery, always disconnect the negative cable first.

(c) Do not disconnect the battery with the engine running.

(d) Ensure correct polarity is maintained when "jump" starting.

(e) Always disconnect the battery before performing electrical welding.

(f) The use of a conventional 12V test lamp should be restricted to checking fuses etc. The recommended test lamp for all other circuits is special tool E8M15-L.E.D. test lamp.

(g) When performing continuity, voltage or current draw testing, ensure that all the usual precautions are taken, i.e. connect voltmeters in parallel, ammeters in series and ensure that the circuit is "dead" when using an ohmmeter.

In addition to the above precautions it should be noted that sensors, relays, control units, etc. are sensitive to shocks, impact and high temperatures.

To prevent physical damage, handle all electrical components with care and avoid dropping or striking them.

CIRCUIT CHECKING

Harness checking should be performed in the following order:

(1) Check for continuity between terminals or voltage at terminal.

(2) Check terminal security in connector and terminal to terminal contact.

CAUTION: In instances where electrical system testing requires the battery to remain connected, it is essential for safety reasons to unplug the starter motor solenoid lead, from the starter motor solenoid. This procedure will inhibit accidental engagement of the starter motor, thus preventing possible injury.

SECTION 2 — STARTER MOTOR SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
STARTER FAILS TO OPERATE	Weak battery or dead cell in battery.	Test specific gravity. Recharge or replace battery as required.
	Ignition switch faulty.	Test and replace switch if necessary.
	Loose or corroded battery cable terminals.	Clean terminals and clamps, replace if necessary. Apply a light film of petroleum jelly to terminals after tightening.
	Open circuit, wire between the ignition/starter switch and ignition terminal on starter relay.	Inspect and test all the wiring.
	Starter relay defective.	Test relay and replace if necessary.
	Faulty starter.	Test and repair as necessary.
	Armature shaft sheared.	Test and repair.
	Open solenoid pull-in wire.	Test and replace solenoid if necessary.
STARTER FAILS AND LIGHTS DIM	Weak battery or dead cell in battery.	Test specific gravity. Recharge or replace battery as required.
	Loose or corroded battery cable terminals.	Clean terminals and clamps, replace if necessary. Apply a light film of petroleum jelly to terminals after tightening.
	Internal ground in windings.	Test and repair starter.
	Grounded starter fields.	Test and repair starter.
	Armature rubbing on pole shoes.	Test and repair starter.
STARTER TURNS, BUT ENGINE DOES NOT ENGAGE	Starter clutch slipping.	Replace the clutch unit.
	Broken clutch housing.	Test and repair starter.
	Pinion shaft rusted, dirty or dry, due to lack of lubrication.	Clean, test and lubricate.
	Engine basic timing wrong.	Check engine basic timing and condition of distributor rotor and cap.
	Broken teeth on engine ring gear.	Replace ring gear. Inspect teeth on starter clutch pinion.
STARTER RELAY DOES NOT CLOSE	Battery discharged.	Recharge or replace battery.
	Faulty wiring.	Test for open circuit wire between ignition-starter switch and ignition terminal and starter relay.
	Starter relay faulty.	Test and replace if necessary.
RELAY OPERATES BUT SOLENOID DOES NOT	Faulty wiring.	Test for open circuit wire between starter relay solenoid terminal and solenoid terminal post.
	Faulty solenoid switch or connections.	Test for loose terminal connections between solenoid and starter field.
	Solenoid switch contacts corroded.	Test and replace solenoid if necessary.
	Broken lead or a loose soldered connection inside solenoid switch (brush holder plate).	Test and replace solenoid if necessary.

SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
SOLENOID PLUNGER VIBRATES BACK AND FORTH WHEN SWITCH IS ENGAGED	Battery low.	Test for specific gravity of battery. Replace or recharge battery.
	Faulty wiring.	Test for loose connections at relay, ignition-starter switch and solenoid.
	Lead or connections broken inside solenoid switch cover (brush holder plate) or open hold-in winding.	Test and replace solenoid if necessary.
	Check for corrosion on solenoid contacts.	Test and clean the contacts.
STARTER OPERATES BUT WILL NOT DISENGAGE WHEN THE IGNITION-STARTER SWITCH IS RELEASED	Broken solenoid plunger spring or spring out of position.	Test and repair.
	Faulty ignition-starter switch.	Test and replace the switch if necessary.
	Solenoid contact switch plunger stuck in solenoid.	Remove contact switch plunger, wipe clean of all dirt, apply a film of SAE 10 oil on plunger, wipe off excess.
	Insufficient clearance between winding leads to solenoid terminal and main contactor in solenoid.	Test and repair.
	Faulty relay.	Test and replace relay if necessary.

ELECTRICAL TESTING

The electrical test values depend upon the condition of the battery (capacity and charge). The testing period also plays an important part (heating of the starter, and battery discharge). The unavoidably long cables on the test bench at times also influence starter performance. The test period should therefore be as short as possible. The batteries must be in good condition and well charged or the electrical values of a faulty starter will differ considerably from the specified test data.

Solenoid Pull-in Coil Test.

Connect the starter as shown in Fig. 1, note that "M" terminal is disconnected. If the pinion comes out smoothly, the pull-in coil is operating correctly.

NOTE: Do not apply current for more than 10 seconds.

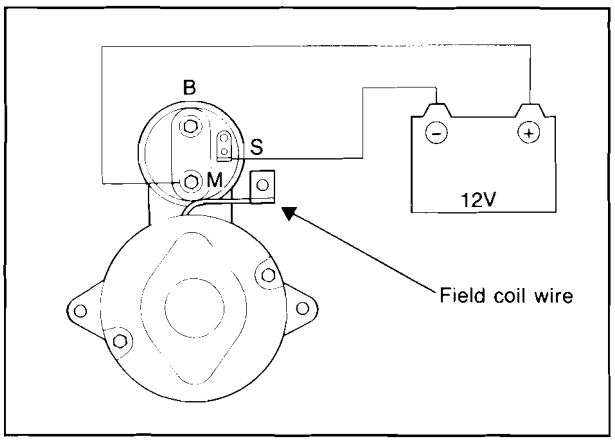


Fig. 1—Pull-in coil test connection (typical)

Solenoid Holding Coil Test

Connect the starter as shown in Fig. 2. Pull out the pinion by hand, as far as the pinion stopper and then release it. If the pinion does not return the holding coil is operating correctly.

NOTE: Do not apply current for more than 10 seconds.

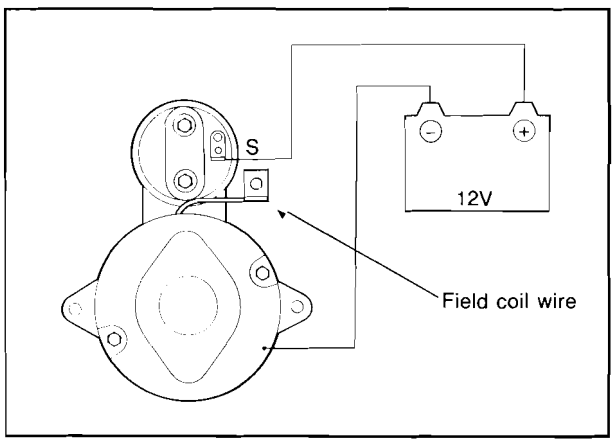


Fig. 2—Holding coil test connection (typical)

Free Running Test

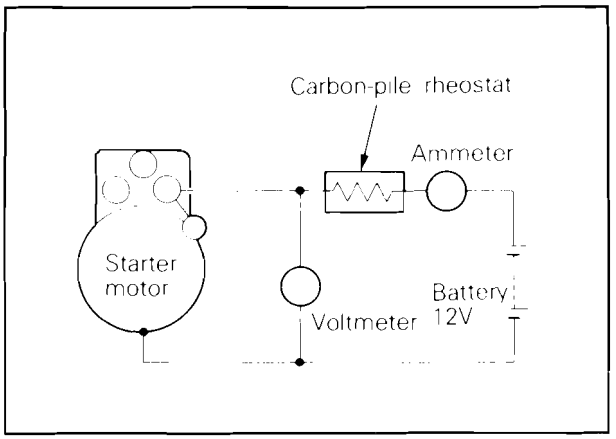


Fig. 3—Free running test connection (typical)

Place starter motor in a vice equipped with soft jaws and connect a fully charged 12V battery to the starter motor as follows:

(1) Connect a test ammeter (100— ampere scale) and carbone pile rheostat in series with battery positive terminal and starter solenoid "M" terminal.

(2) Connect a voltmeter (15+V scale) across starter motor.

(3) Rotate carbon pile to the full resistance position.

(4) Connect earth wire between starter motor body and battery negative terminal.

(5) Adjust rheostat until battery voltage shows 11 volts on voltmeter.

(6) Ensure that the amperage is within specification and that starter motor turns smoothly and freely.

MECHANICAL ADJUSTMENT

Pinion Gap

With starter motor removed disconnect the lead to the "M" terminal and connect a 12V battery between the "S" terminal and the starter motor body. This will move the pinion to the engaged position. With the pinion in this position check the gap between the pinion and the stopper ring. If the gap is not as specified, adjust by adding or removing shims between solenoid body and drive end bracket.

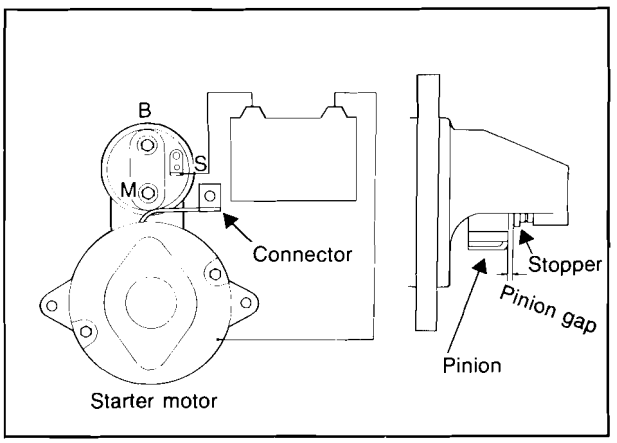


Fig. 4—Checking pinion gap (typical)

SECTION 2A — STARTER MOTOR 4G54

SPECIFICATIONS

Type	Bosch reduction drive
Part No. — M.M.A.L.	AW327819
— Bosch	9 000 061 001
Nominal voltage	12V
Output	1.2 kW
Direction of rotation	Clockwise from pinion side
Number of brushes	4
Reduction gear type	Planetary gear set
Test Specifications	
Maximum permissible test current	1350 amp
No load test — terminal voltage	11.5V
— current	120 amp or less
— minimum speed	4000 rpm
Stall test — terminal voltage	4V ± 0.1
— current	800 amp or less
— torque	20 Nm or less
Solenoid pull-in voltage @ 20°C	less than or equal to 6.0V
Solenoid pull-in current	less than or equal to 30A
Commutator	
Outside diameter	32 mm
— service limit	31 mm
Depth of undercut	
— service limit	0.2 mm
Armature end play	0.05 to 0.4 mm

SPECIAL TOOLS

KDAL 5028	Mounting sleeve
KDAL 5047	Gear set support base
KDAL 5048	Brush plate assembly tool
KDAL 5487	Pinion stop ring calking tool

TORQUE SPECIFICATIONS

	Nm
Starter motor to transaxle bolts	19 to 28
Solenoid attaching screws	7.5 to 11
Starter motor through bolts	4.5 to 6
Positive cable attaching nut	6 to 8

GENERAL INFORMATION

The Bosch reduction drive starter motor is a lightweight, compact four brush unit, with permanent magnet exitation, planetary gear set reduction drive and solenoid actuated, positive pre-engaged, pinion drive.

The planetary gearing consists of three needle bearing mounted gears, mounted in an annulus gear, which are driven by gear teeth on the armature shaft.

Operation

When the ignition switch is turned to the START position, the solenoid pull-in and hold-in windings are energized and the solenoid plunger is drawn in. The plunger moves the engaging lever and fork which in turn moves the drive assembly towards the ring gear. The drive assembly rotates on the coarse thread of the drive shaft to facilitate engagement.

Before the pinion is completely in mesh, the contacts in the solenoid switch are closed by the action of the solenoid plunger and the starter rotates and cranks the engine.

Should a pinion tooth come up against a ring gear tooth, the engaging lever compresses the spring on the drive assembly until the solenoid switch contacts close. The pinion is then turned and engages with the ring gear under spring force.

When the starter rotates, the pull-in winding is de-energised by the isolation of its ground connection, providing more starter current for cranking. As the starting speed of the engine exceeds that of the starter, the over-running clutch allows the pinion to rotate freely and engine acceleration does not affect the starter.

The drive being under no load, is pulled back by the spring, however the pinion remains partly engaged until the switch is released, the plunger return spring then returns the pinion to its rest position and opens the switch contacts.

① Solenoid
② Solenoid barrel
③ Rubber seal
④ Fork
⑤ Bush
⑥ Cover
⑦ Drive shaft and gear set
⑧ Circlip
⑨ Overrunning clutch and drive pinion assembly
⑩ Stopper ring
⑪ Snap ring
⑫ Front housing
⑬ End cover
⑭ Rear housing
⑮ Brush holder
⑯ Brush assembly
⑰ Armature assembly
⑱ Yoke assembly

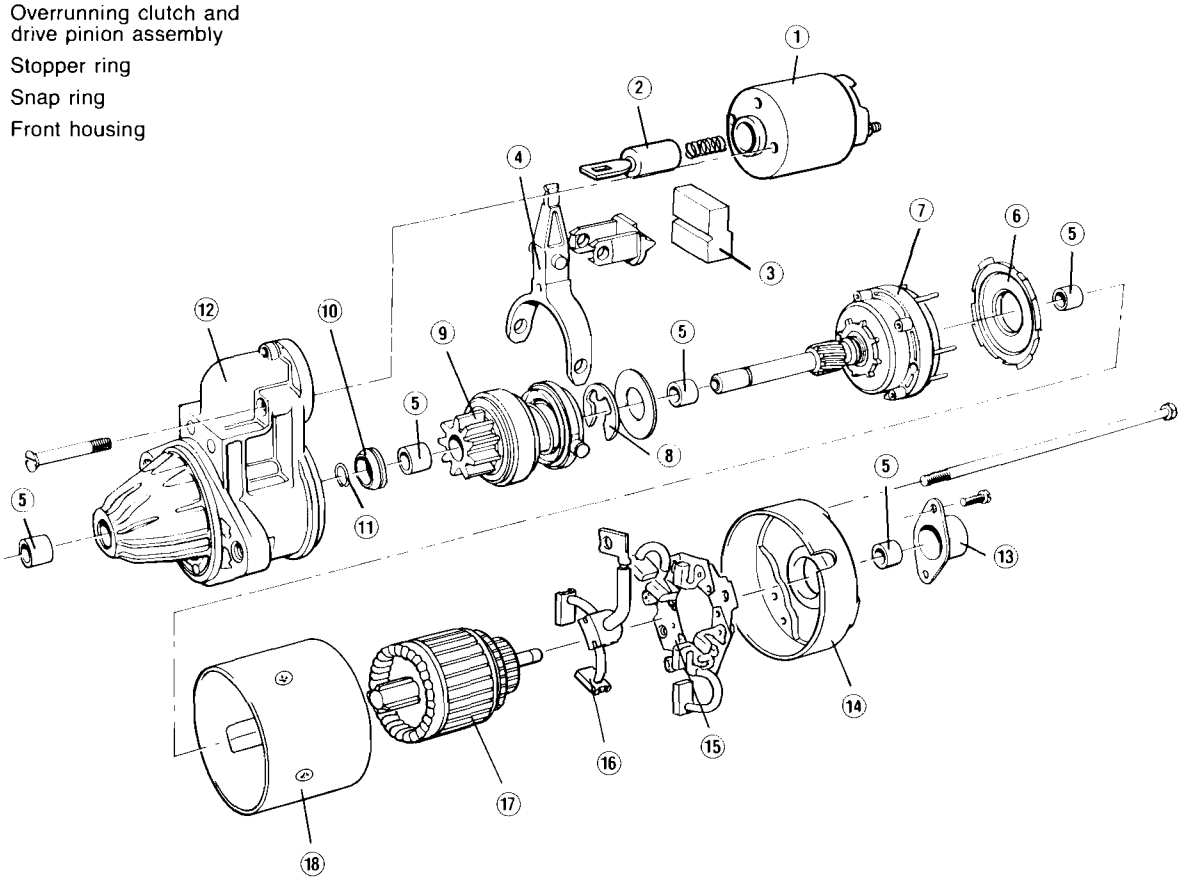


Fig. 1—Starter motor components

STARTER SERVICING

Removal

(1) Disconnect the negative (ground) cable from the battery.
(2) Disconnect wiring from the starter motor.
(3) Remove the two starter motor attaching bolts and remove from the vehicle.

Installation

Install by reversing removal procedure, ensuring that the starter motor to engine mounting surface is clean and attaching bolts are tightened to the specified torque.

Disassembly

(1) Disconnect wiring from the solenoid "M" terminal, refer Fig. 2.
(2) Remove the solenoid mounting screws and remove the solenoid and spring as an assembly leaving the solenoid barrel connected to the fork lever.

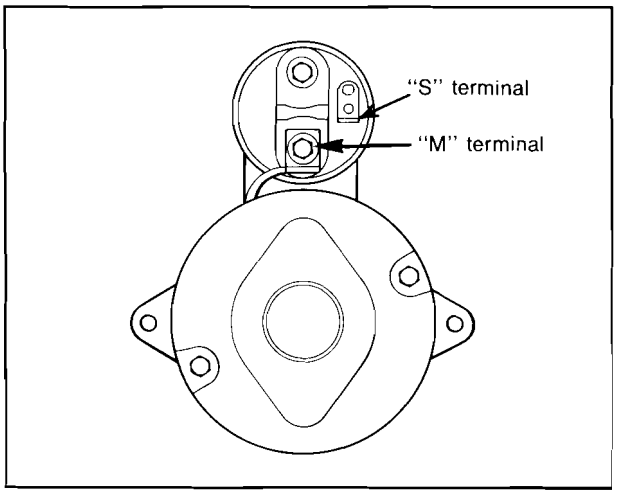


Fig. 2—Solenoid assembly.

(3) Remove Solenoid barrel off the fork lever.
(4) Remove the end cover attaching screws, then remove the starter motor through bolts.
(5) Remove the end cover and rear housing.
(6) Remove the brushes and the brush holder from the armature.
(7) Remove the armature and yoke as an assembly.
(8) Separate armature and yoke assembly.
(9) Remove the rubber seal.
(10) Remove the gear set, drive pinion, overrunning clutch assembly and clutch fork from the front housing.
(11) Using a suitable socket, tap the stopper ring off the snap ring in the direction of the overrunning clutch, refer Fig. 3.
(12) Remove the snap ring, slide the overrunning clutch and drive pinion off the drive shaft.

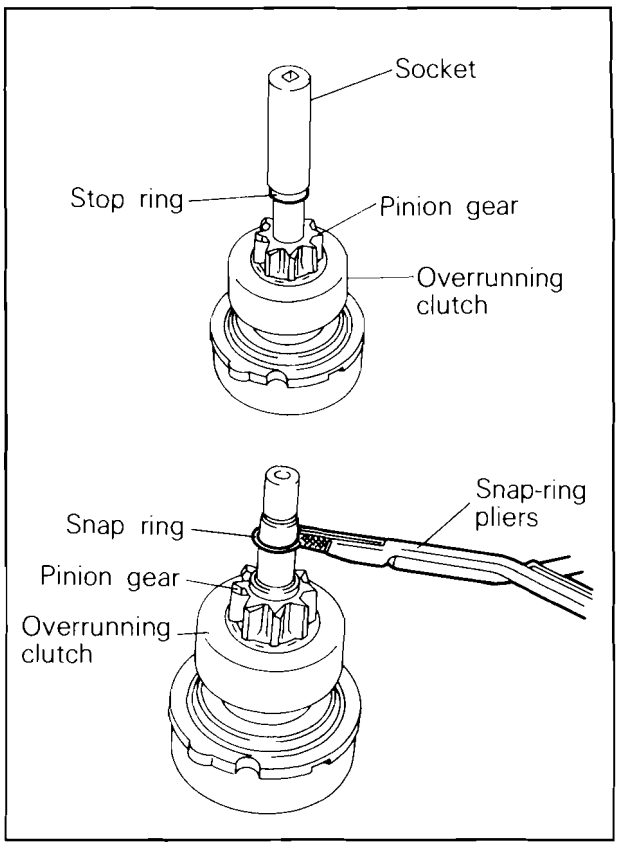


Fig. 3—Removing snap ring.

INSPECTION AND COMPONENT TESTING

DO NOT immerse parts in cleaning solvent as damage may occur to the yoke, brush assembly, and/or armature assembly insulation.

DO NOT immerse overrunning clutch in cleaning solvent as it is pre-packed with grease and the solvent will dissolve it.

Parts may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

Commutator

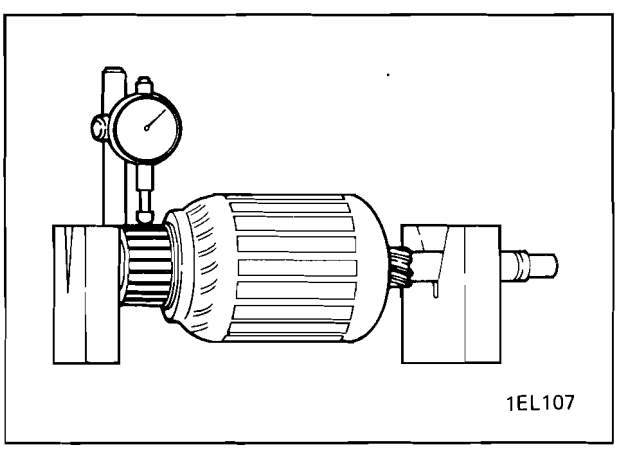


Fig. 4—Checking armature runout (typical)

(1) Place armature on "V" blocks and check runout, refer Fig. 4.

(2) Measure the outer diameter of commutator, refer Fig. 5.

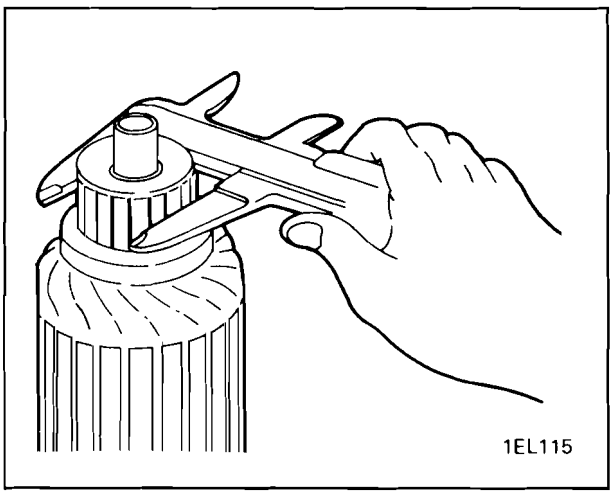


Fig. 5—Measuring commutator

(3) Check the measurement of the undercut depth between segments.

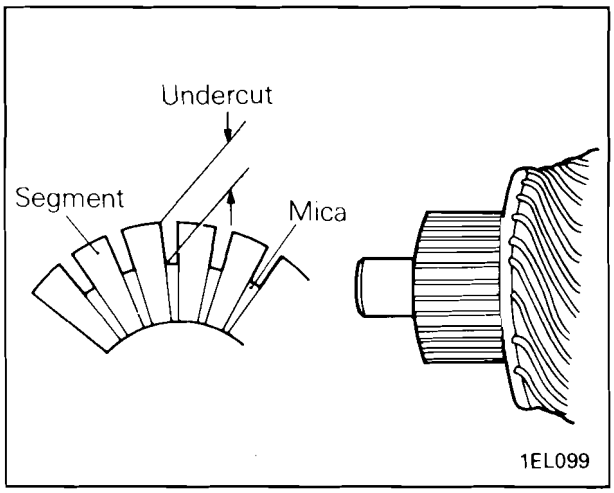


Fig. 6—Checking undercut depth

If any of the above checks are not to specification replace the commutator.

Brush Holder

Check for no-continuity between the brush holder plate and brush holder. If there is continuity, replace the brush holder assembly.

BUSHES

(1) Inspect all bushes for damage or excessive wear.

(2) Replace bushes by pressing old bushes out and new bushes in with a suitable sized mandrel.

NOTE: New sintered bushes must be soaked in Bosch Oil (5 962 260 605) or Shell Tellus Oil before installation.

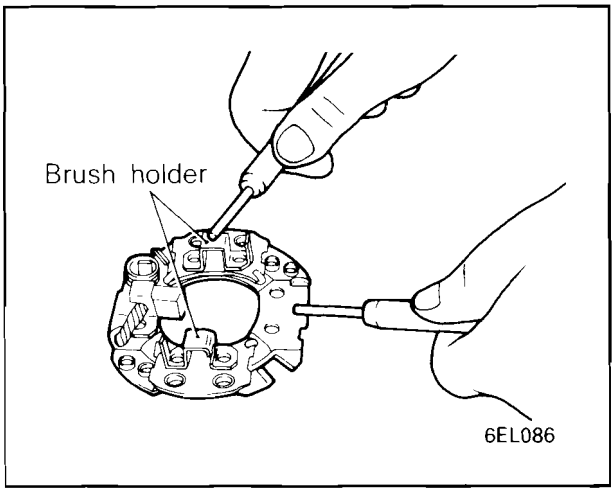


Fig. 7—Brush holder

Overrunning Clutch

(1) While holding the clutch housing, rotate the pinion. The pinion should rotate freely in one direction, if it does not, replace the overrunning clutch assembly, refer Fig. 8.

(2) Inspect the pinion for wear or burrs. Replace the assembly if there is excessive wear or burrs. If pinion is damaged inspect the ring gear on the engine.

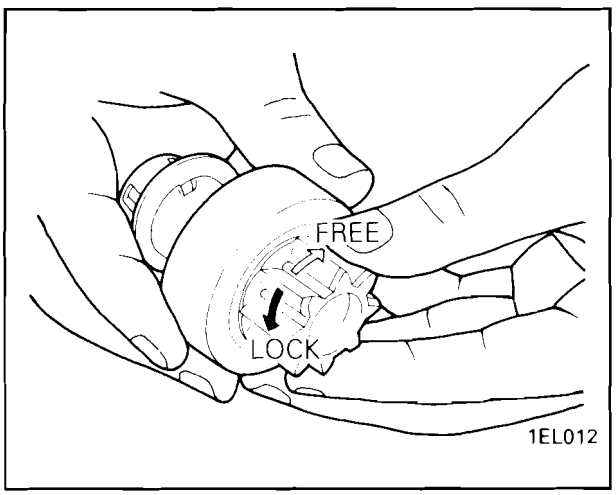


Fig. 8—Overrunning clutch assembly

Brush Replacement

(1) Brushes that are worn beyond limit line, or oil soaked, should be replaced.

(2) When replacing field coil brushes, remove the old pigtail from the brush, by crushing the worn brush, taking care not to damage the pigtail.

(3) Clean up end of pigtail to ensure good contact when soldered.

(4) Insert pigtail into hole provided in new brush and solder pigtail end, refer Fig. 9.

NOTE: Ensure pigtail end does not protrude from outer side of brush.

(5) When replacing ground brush, slide the brush from the brush holder by prying retainer spring back.

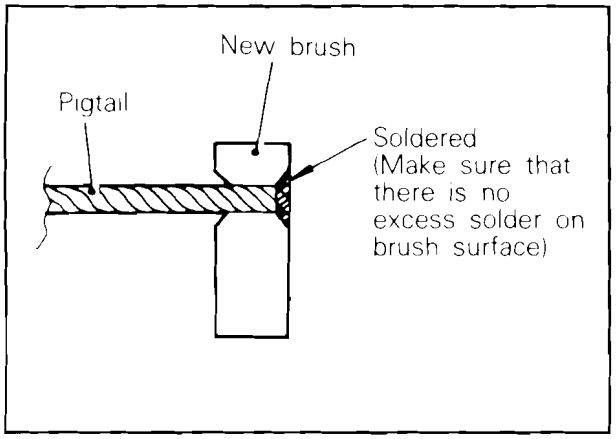


Fig. 9—Brush replacement

Testing Armature

(1) Test armature for Short-Circuit by placing it in a growler.

Hold a thin steel blade parallel and just above the armature. Whilst slowly rotating, a shorted armature will cause the blade to vibrate and be attracted by the core.

Replace a shorted armature.

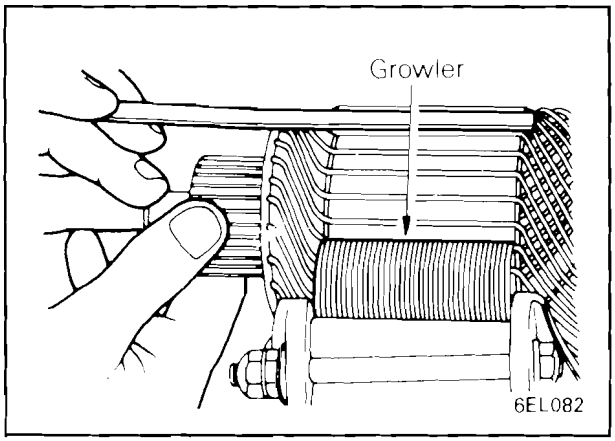


Fig. 10—Testing armature in a growler

(2) Test armature for grounding by checking the armature coil cores and the commutator segments. There should be no continuity.

(3) Check for continuity between the segments of the commutator.

Installation

(1) Assemble the overrunning clutch, drive pinion and stopper ring (with the flat side of stopper ring towards the overrunning clutch, refer Fig. 13) onto the drive shaft.

(2) Install the snap ring, and with a suitable tool, pull the stop ring over the snap ring, refer Fig. 13.

(3) Install the fork onto the overrunning clutch.

(4) Install the clutch assembly into the front housing.

(5) Install the rubber seal.

(6) Install the armature inside the yoke assembly.

(7) Invert the front housing assembly so that the front housing is lower most.

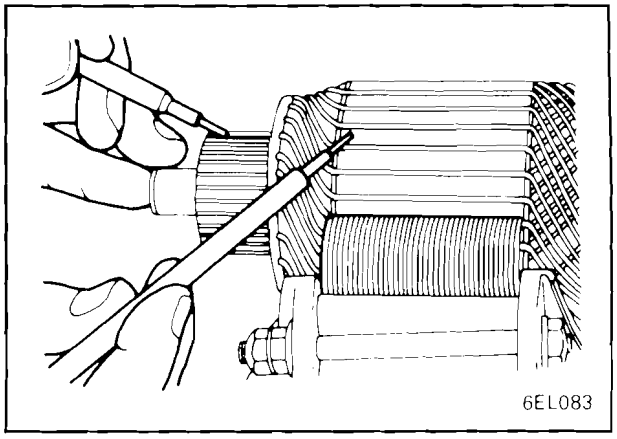


Fig. 11—Checking armature for grounding

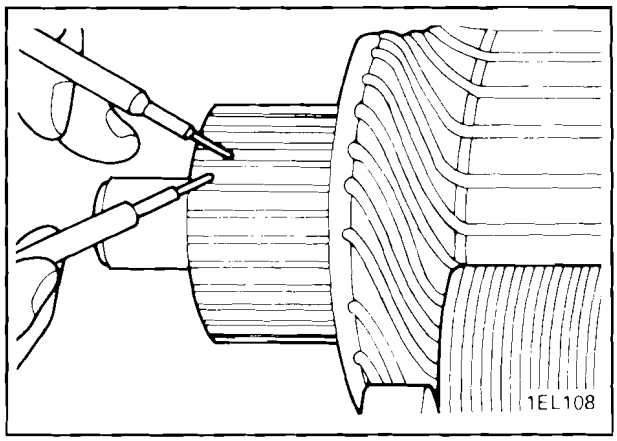


Fig. 12—Checking commutator segments

(8) Install the yoke and armature assembly.

(9) Install brush assembly into brush holder and install onto armature.

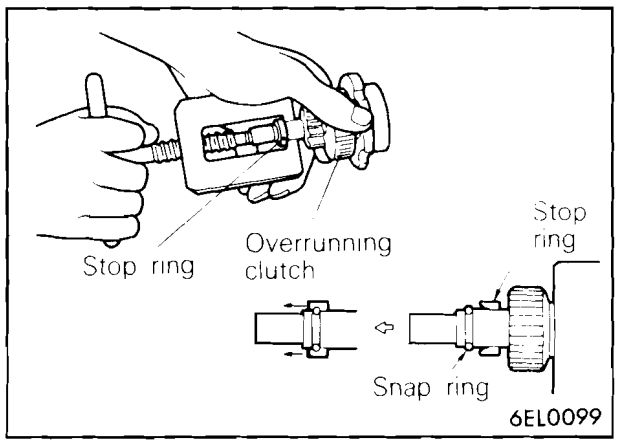


Fig. 13—Snap ring and stop ring installation

(10) Install rear housing ensuring the rubber grommet of solenoid "M" terminal wire is inserted correctly into the cut out of the rear housing.

(11) Install through-bolts loosely, install end cover screws into brush holder.

(12) Tighten all screws.

After assembly, carry out electrical tests to ensure that starter motor performs to specifications.

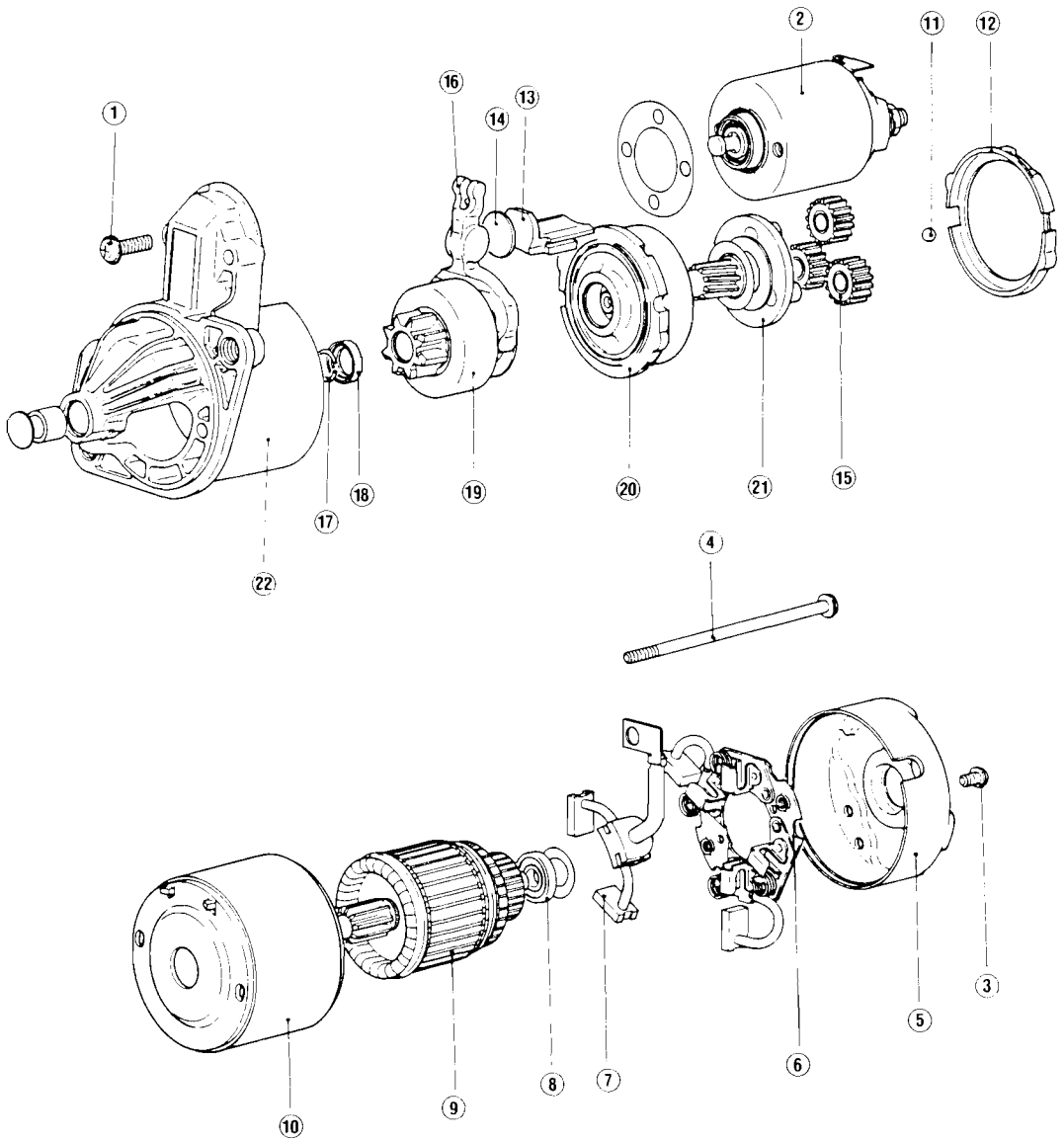
SECTION 2B — MITSUBISHI REDUCTION DRIVE STARTER 6G72

SPECIFICATIONS

Type	Mitsubishi reduction drive
Part No. — Manual transmission	MD162842/MD172863
— Automatic transmission	MD162843/MD172864
Output	1.2 kW 12V
Direction of rotation	Clockwise from pinion side
No load test — terminal voltage	11V
— current	90 amp or less
— speed	3000 rpm or more
Commutator — outside diameter	29.4 mm
— service limit	28.8 mm
— depth of undercut	0.5 mm - 0.8 mm
— run-out	0.1 mm
Brush length — new	17 mm
— service limit	11.5 mm
Brush spring load	14.7 N
Pinion shaft end play	0.5 mm
Pinion gap	0.5 mm to 2.0mm

TORQUE SPECIFICATIONS

Starter mounting bolt	27-34 Nm



1. Screw
2. Magnatic switch
3. Screw
4. Through-bolt
5. Rear housing
6. Brush holder
7. Brush
8. Rear bearing
9. Armature
10. Yoke assembly
11. Ball
12. Packing A
13. Packing B
14. Plate
15. Planetary gear
16. Lever
17. Snap ring
18. Stop ring
19. Overrunning clutch
20. Internal gear
21. Planetary gear holder
22. Front housing

Fig. 1—Exploded view Mitsubishi Reduction Drive Starter Motor

GENERAL INFORMATION

The Mitsubishi 12V 1.2 kW Reduction Gear Starter Motor is a compound wound, four pole, four brush type with solenoid actuated positive pre-engaged pinion operation. The main battery supply is not connected until the pinion is in full engagement. The drive is taken from the armature through reduction gears to the pinion shaft which carries the drive assembly.

Operation

When the starting switch is activated, current flows to the solenoid switch which energises the pull-in and hold-in windings. The soft iron plunger is drawn in, moving the engaging lever, which in turn moves the drive assembly towards the ring gear. The coarse thread on the drive shaft causes the pinion to rotate and assist in engagement. When the pinion is fully meshed, the contacts in the solenoid switch are closed by the action of the soft iron plunger and the starter rotates and cranks the engine. When the starter rotates, the pull winding is de-energised by the isolation of its ground connection. When the engine speed exceeds that of the starter, the pinion rotates freely and engine acceleration does not affect the starter.

The drive being under no load is pulled back by spring force, however, the pinion remains partly engaged as the starting switch is operating.

Once the starter switch is released, the plunger return spring moves the pinion to its rest position and the switch contacts open.

SERVICING THE STARTER

Removal

(1) Disconnect the negative (ground) battery cable from the battery.

(2) Disconnect the electrical leads to the starter.

(3) Remove the starter mounting bolts and remove starter from engine.

Installation

Install by reversing removal procedure ensuring that the starter to engine mounting surface is clean and that the bolts are torqued to specification.

Disassembly

(1) Disconnect the wiring from the solenoid "M" terminal.

(2) Remove the solenoid mounting screws and remove the solenoid.

(3) Remove the rear housing by firstly removing the inner screws and the outer through bolts.

(4) Remove the brush holder and brushes.

(5) Remove the armature and yoke as an assembly.

NOTE: When removing the armature do not lose the ball bearing.

(6) Remove packing A and B and remove the packing plate.

(7) Remove the planatery gears.

(8) Remove the overrunning clutch and lever assembly.

(9) Using a suitable socket, tap the stopper ring toward the overruning clutch, refer Fig. 2

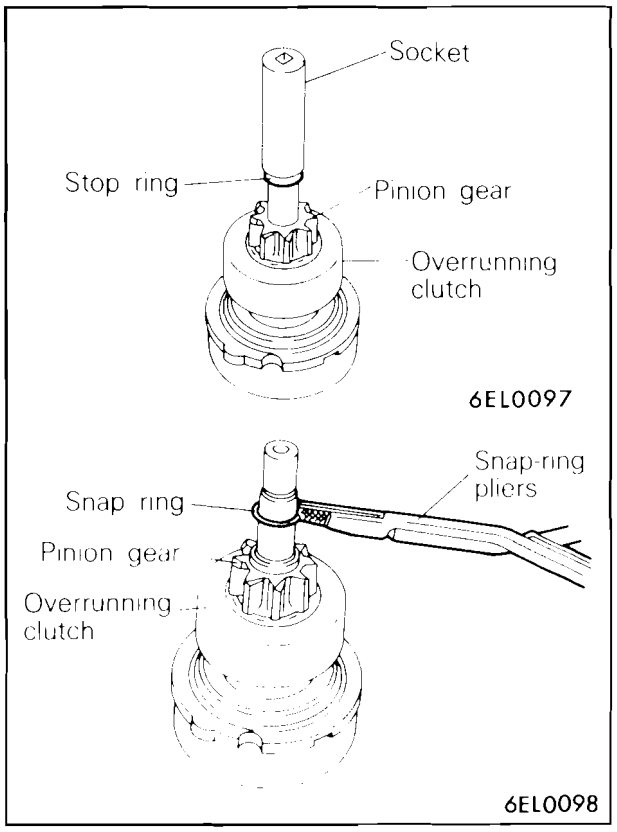


Fig. 2 — Removing snap ring

(10) Remove the snap ring and slide the overrunning clutch and internal gear off the shaft, refer Fig. 2.

Cleaning

Do not immerse parts in cleaning solvent as damage may occur to the yoke, brush assembly and/or armature assembly insulation. Wipe parts with a clean cloth.

Do not immerse overruning clutch in cleaning solvent as it is pre-packed with grease and the solvent will dissolve it.

Parts may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

INSPECTION AND COMPONENT TESTING

Commutator

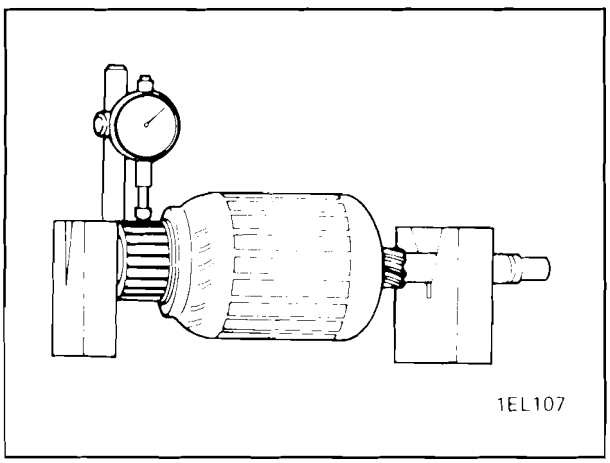


Fig. 3 — Checking armature runout (typical)

(1) Place armature on "V" blocks and check runout, refer Fig. 3.
(2) Measure the outer diameter of the commutator, refer Fig. 4.

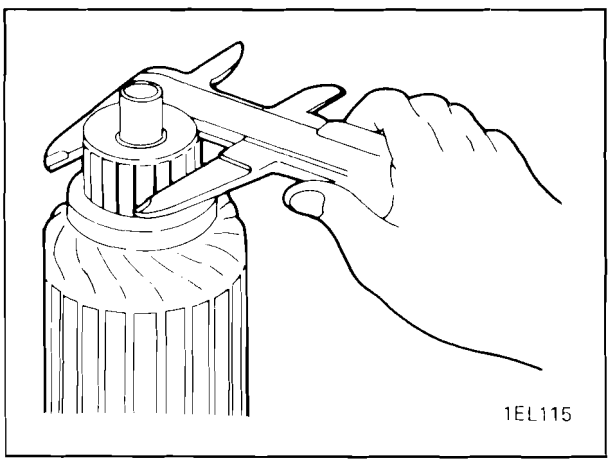


Fig. 4 — Measuring commutator

(3) Check the measurement of the undercut depth between segments.
If any of the above checks are not to specification replace the commutator.

Brush holder

Check for no-continuity between the brush holder plate and brush holder. If there is continuity, replace the brush holder assembly.

Front Bush and Rear Bearing

Check front housing bush for wear or burrs and check rear bearing for excessive free play or rough rotation, replace parts as necessary.

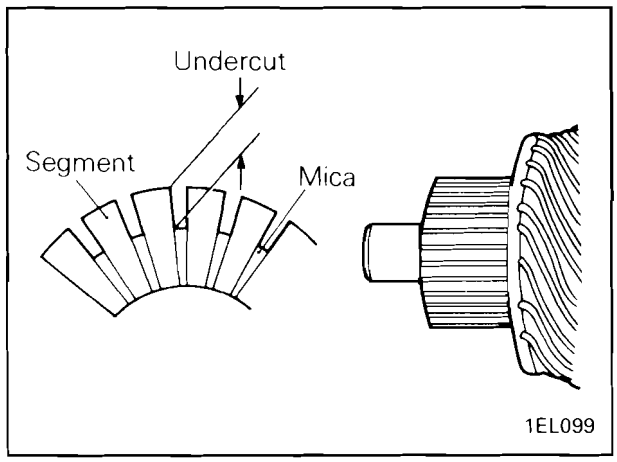


Fig. 5 — Checking undercut depth

Overruning Clutch

(1) While holding the clutch housing, rotate the pinion. The pinion should rotate freely in one direction, if it does not, replace the overunning clutch assembly, refer Fig. 7.
(2) Inspect the pinion for wear or burrs. Replace the assembly if there is excessive wear or burrs. If pinion is damaged, inspect the ring gear on the engine.

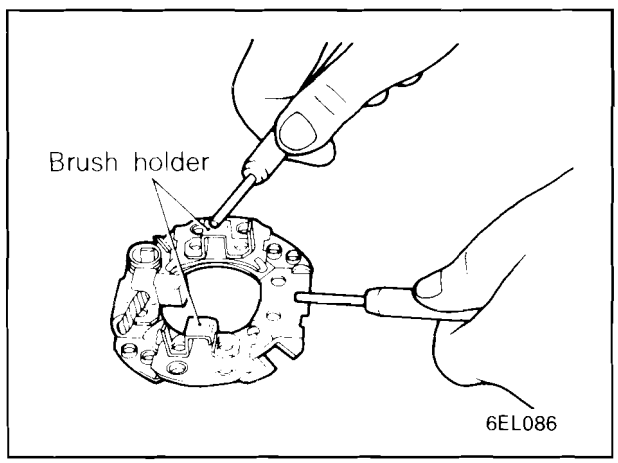


Fig. 6 — Brush holder

Brushes and Springs Replacement

(1) Brushes that are worn beyond limit line, or oil soaked should be replaced.
(2) When replacing field coil brushes, crush the worn brush to remove the pigtail, taking care not to damage the pigtail.
(3) Clean up end of pigtail to ensure good contact when soldered.
(4) Insert pigtail into hole provided in new brush and solder pigtail end, refer Fig. 9.

NOTE: Ensure pigtail end does not protrude from outer side of brush holder by prying retainer spring back.

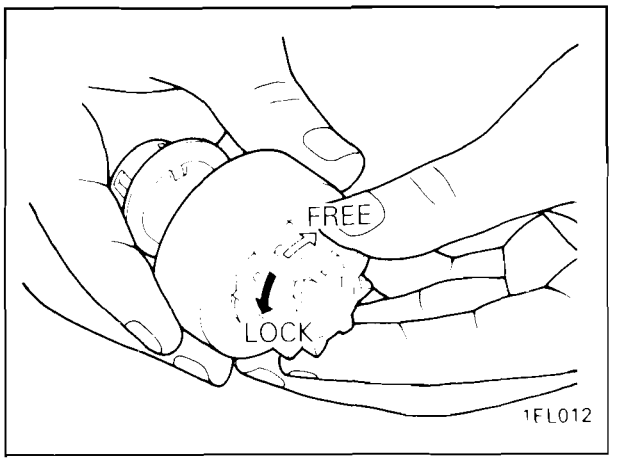


Fig. 7 — Overrunning clutch assembly

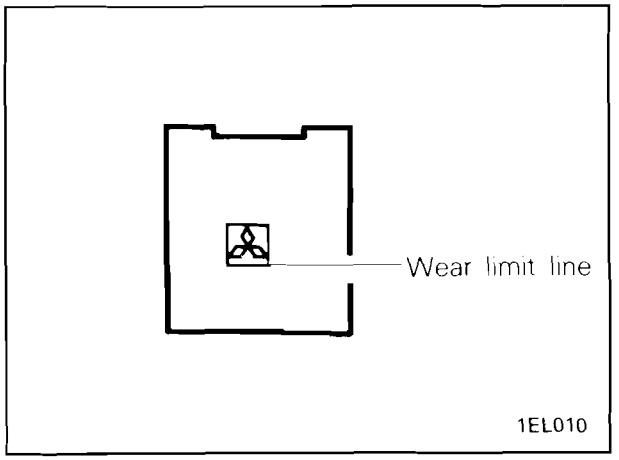


Fig. 8 — Brush wear limit

(5) When replacing ground brush, slide the brush from the brush holder by prying retainer spring back.

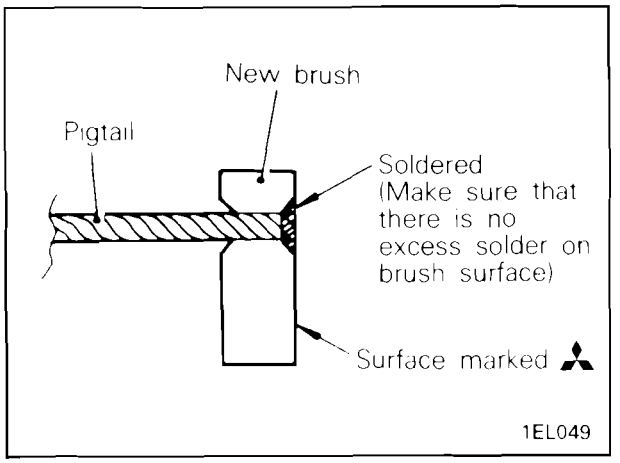


Fig. 9 — Brush replacement

Testing armature

(1) Test armature for short-circuit by placing it in a growler.

Hold a thin steel blade parallel and just above the armature, whilst slowly rotating, a shorted armature will cause the blade to vibrate and be attracted by the core.

Replace a shorted armature.

(2) Test armature for grounding by checking the armature coil cores and the commutator segments. There should be no continuity.

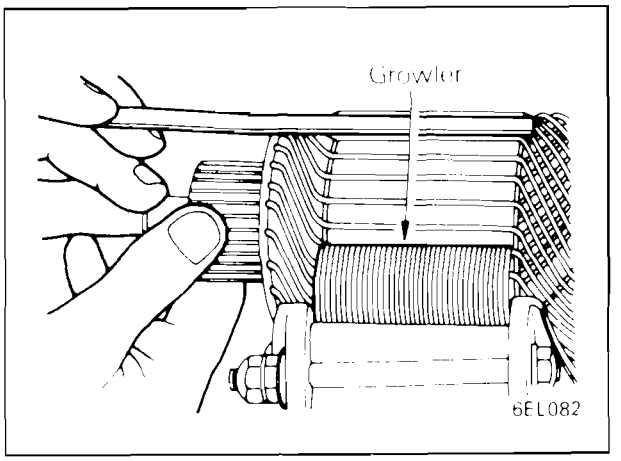


Fig. 10 — Testing armature in a growler

(3) Check for continuity between the segments of the commutator.

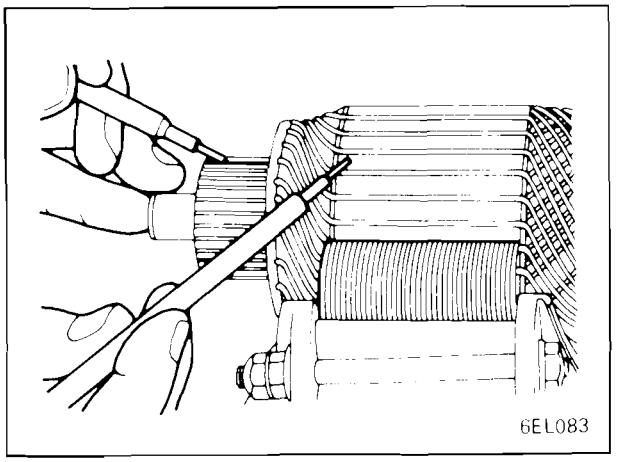


Fig. 11 — Checking armature for grounding

Installation

(1) Assemble the internal gear, overruning clutch and stoper ring (with the flat side of stopper ring towards the overrunning clutch, refer Fig. 13) onto the planetary gear holder.

(2) Install the snap ring and with a suitable tool, pull the stop ring over the snap ring, refer Fig. 13.

(3) Install the clutch lever on to the overrunning clutch.

(4) Install the clutch assembly into the front housing.

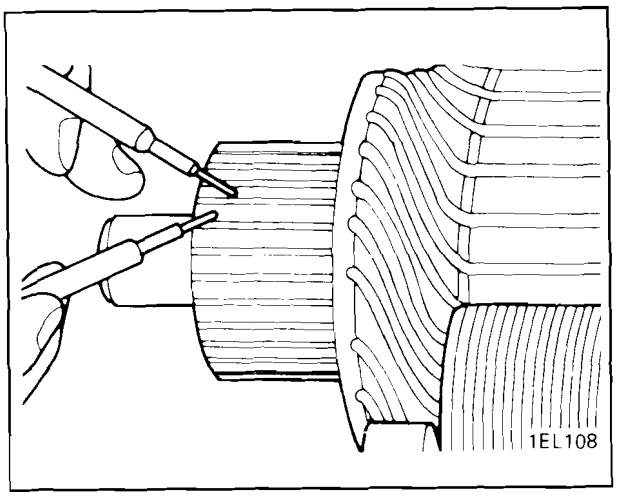


Fig. 12 — Checking for continuity between commutator segments

(5) Install pinion gears, packing plate and packing B and A.

(6) Install the armature inside the yoke assembly.

(7) Invert the front housing assembly so that the front housing is lower most.

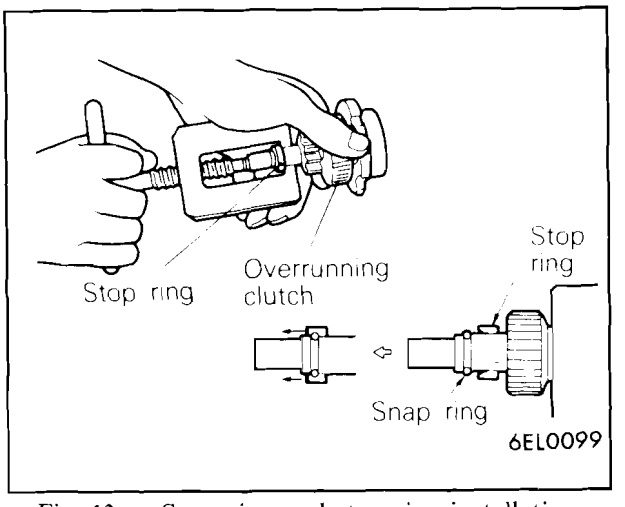


Fig. 13 — Snap ring and stop ring installation

(8) Install the ball bearing, yoke and armature assembly.

(9) Install brush asembly into brush holder and install onto armature.

(10) Install rear housing ensuring rubber grommet of field coil wire is inserted correctly.

(11) Install through-bolts loosely, install brush holding screws.

(12) Tighten all screws.

After assembly, carry out electrical tests to ensure that starter motor performs to specifications.

SECTION 3 — ALTERNATOR SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
ALTERNATOR NOT CHARGING	Drive belt slipping.	Adjust drive belt or replace if glazed.
	Open circuit or high resistance in charging or field circuits.	Check all wiring and connectors.
	Voltage regulator not correctly grounded.	Ensure regulator to alternator body contact is clean and retaining screws are tight.
	Worn brushes and/or slip rings.	Replace brushes and/or slip rings.
	Sticking brushes.	Clean slip rings and brush holders.
	Faulty voltage regulator.	Replace voltage regulator.
	Open circuit in stator windings.	Replace stator.
	Open recitifier.	Replace faulty rectifier.
	Warning light faulty.	Replace warning light globe.
LOW UNSTEADY CHARGING RATE	High resistance in body to engine ground lead.	Tighten ground lead connections. Install new ground lead if necessary.
	Alternator drive belt loose.	Adjust alternator drive belt.
	High resistance at battery terminals.	Clean and tighten battery terminals.
	High resistance in charging circuit.	Test charging circuit resistance. Correct as required.
	Open stator winding.	Remove and disassemble alternator. Test stator windings. Install new stator if necessary.
EXCESSIVE CHARGING RATE TO A FULLY CHARGED BATTERY	Faulty ignition switch.	Install new ignition switch.
	High resistance at battery teminals.	Clean and tighten battery terminals.
	Faulty voltage regulator.	Replace voltage regulator.
NOISY ALTERNATOR	Alternator mounting loose.	Properly install and tighten alternator mounting.
	Worn or frayed drive belt.	Install a new drive belt and adjust to specifications.
	Worn bearings.	Remove and disassemble alternator. Install new bearings as required.
	Interference between rotor fan and stator leads.	Remove and disassemble alternator. Correct interference as required.
	Rotor or rotor fan damaged.	Remove and disassemble alternator. Install new rotor.

ALTERNATOR WARNING LAMP SERVICE DIAGNOSIS

Condition	Ignition ON (Engine stopped)	Engine Running	Fault Indicated
Battery to alternator cable broken when driving.	Warning light ON.	Warning Light ON.	YES.
Battery sense wire broken.	Warning light ON.	Warning light ON.	YES.
Battery overcharged.	Warning light ON.	Warning light ON.	YES.
Battery is not charged.	Warning light ON.	Warning light ON.	YES.
-ve power diode short circuit.	Warning light ON.	Warning light ON.	YES.
Phase voltage sensing cable broken.	Warning light ON.	Warning light ON.	YES.
Power darlington is not switching.	Warning light ON.	Warning light ON.	YES.

SECTION 3A — BOSCH ALTERNATOR WITH BUILT IN ELECTRONIC VOLTAGE REGULATOR

SPECIFICATIONS

Manufacturer	Bosch
Bosch part no. — 4 cyl	9 120 060 028 85 amp
M.M.A.L. part no. — 4 cyl	AW331052 85 amp
Bosch part no. — 6 cyl	9 120 060 029 85 amp
M.M.A.L. part no. — 6 cyl	AW321821 85 amp
Nominal voltage	12V
Polarity to earth	Negative (—)
Number of brushes	2
Brush wear — minimum length	3.8 mm
Minimum diameter of slip rings	26.7 mm
Slip rings to be true within	0.45 mm
Claw poles to be true within	0.50 mm
Resistance — rotor	2.60 ± 0.13 ohms
Regulator output voltage	14.25 V - 14.55 V
Output test	
1050 alternator r.p.m.	10 amp
1500 alternator r.p.m.	30 amp
6000 alternator r.p.m.	85 amp
Alternator pulley to engine pulley ratio —	
4 cyl.	2.76:1
6 cyl.	2.72:1

NOTE: To obtain engine r.p.m. where alternator r.p.m. is quoted divide the alternator r.p.m. by the alternator pulley to engine pulley ratio.

SPECIAL TOOLS

Battery load resistor	Bosch tester EFAW107
Mounting adaptor	EFLJ54

TORQUE SPECIFICATIONS

	Nm
Pulley retaining nut	54 to 68
Alternator through bolts	3.8 to 5.5
B+ terminal to alternator nut	7.5 to 8.5
B+ terminal to rectifier nut	8.0 to 11.0
Regulator retaining screws	1.6 to 2.3
Rectifier fixing screws	1.0 to 2.5
Bearing retaining plate screws	2.1 to 3.0
Capacitor retaining screw	2.9 to 4.1

GENERAL INFORMATION

The Bosch alternator is designed for negative ground operation and has an external cooling fan retained by the drive pulley. A twelve pole rotor is used and the alternator output is rectified by heavy duty silicone diodes mounted in heat sinks for maximum cooling.

Six diodes are arranged in a three phase bridge connection whereby three diodes have cathodes connected to the output terminal (normal polarity) and three diodes have anodes at the housing (reverse polarity). The regulator senses the battery voltage via the battery sense wire and controls alternator output voltage by switching the alternator excitation field current ON and OFF. As long as the battery voltage remains below the regulated voltage, power is supplied to the battery.

Operation — Alternator (refer Fig. 1)

With the ignition switch turned ON and the engine running, the flow of current through the rotor field coil winding energises the rotating electro-magnet. The rotation of the rotor will cause the stator windings to cut the magnetic lines of force of the rotor. This induces an AC current voltage in the stator windings. The rectifiers convert the (AC) alternating current to (DC) direct current at the output terminal, to carry the electrical load and charge the battery.

The rectifiers prevent the battery from discharging through the alternator.

As the rotor speed increases, the induced voltage in the stator windings increases causing more current flow to satisfy the load requirements. However, there is another factor, commonly known as "inductive reactance" which has an important bearing on current control.

"Inductive reactance" is a counter voltage (voltage of opposite polarity) which is also induced in the stator windings. The voltage tends to oppose the "induced" voltage in the stator windings.

As the rotor speed increases, the counter voltage also increases. By designing the correct size and shape of rotor and stator, the selection of the correct size and number of windings, the correct air gap between the rotor poles and stator and other design features, the alternator permits "inductive reactance" to limit output current, therefore no current regulator is needed.

Operation — Voltage Regulator

When the engine is running, the three phase current generated in the stator winding of the alternator is rectified by six power diodes. This current charges up the battery and supplies to the load. The regulator senses the battery voltage via the battery sense wire and controls this voltage by switching the alternator excitation field current ON and OFF. So long as battery voltage remains below regulated voltage power Darlington (transistor) T15 is switched ON. Should the battery voltage exceed the specified limit, power Darlington T15 is switched OFF, causing output voltage to drop. Diode D38 protects T15 and regulator circuitry from voltage transients when the field is switched OFF by T15. These regulator cycles are repeated so quickly that the output voltage is maintained constant, at a desired regulated level.

CHARGING SYSTEM TESTING — ON VEHICLE

Diagnosis of the charging system is based on a series of tests that can be made on the vehicle. Before proceeding with the test, check that the charge indicator lamp is functional. A break in this circuit results in loss of pre-excitation.

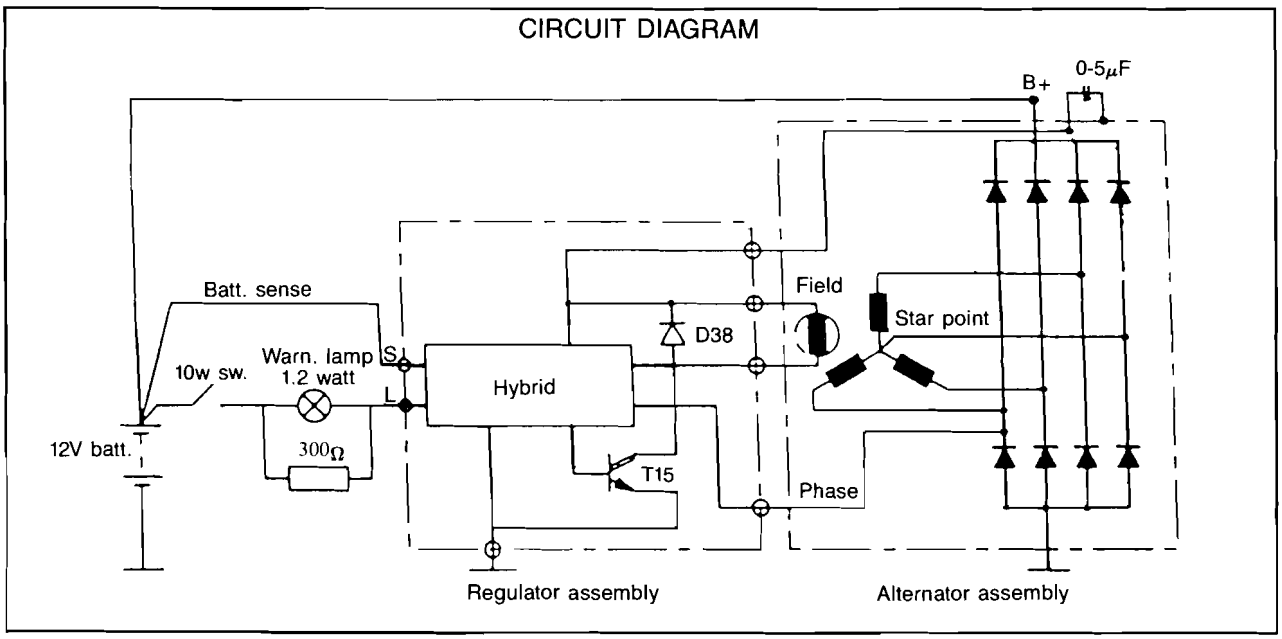


Fig. 1 — Charging system

The following precautions must be observed during testing:

(1) Test the battery. If it is not fully charged, install a fully charged battery for test purposes.

(2) Disconnect the battery negative cable before connecting test equipment.

(3) Test connections should NOT be in the form of alligator clips, etc., quick connectors should be used. This prevents them falling off during the test and causing diode failure.

(4) Do not operate the alternator with the battery disconnected.

(5) Do not disconnect battery during testing, as diode damage will result.

(6) Operate the engine to attain normal operating temperature.

CHARGING SYSTEM TEST

Regulating Voltage

(1) Disconnect the battery ground cable to avoid accidental shorting.

(2) Disconnect the lead from the alternator main output terminal " B+."

(3) Connect a DC ammeter in series with the alternator " B+" terminal and the lead previously disconnected from the " B+" terminal.

(4) Connect the positive lead of a voltmeter to the alternator " B+" terminal and ground the negative lead to the alternator housing (D-).

(5) Connect the battery ground cable.

(6) Connect a tachometer, start the engine and adjust engine speed to give **6000 alternator r.p.m.,** refer specifications.

(7) Switch on lights and/or accessories to obtain a 10 amp charging rate on the test ammeter.

(8) Readjust alternator speed if necessary.

(9) Read the regulator output voltage within one minute of starting the test, the voltage should be as specified. If the voltage is not within specification replace the voltage regulator.

NOTE: The electronic regulator is temperature compensated and a decrease in regulated voltage of 0.03 V will occur for every 10°C temperature rise.

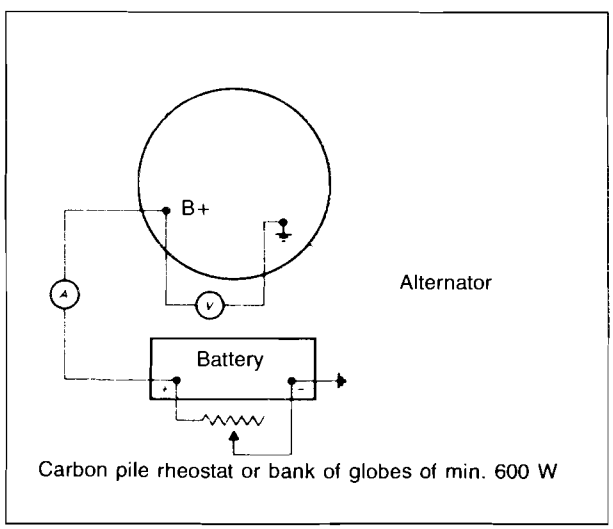


Fig. 2 — Charging system test connections

REGULATING RANGE

(1) Using test equipment previously described maintain engine speed to give **6000 alternator r.p.m.,** refer specifications.

(2) Adjust load until a charging rate of 85% of rated output is obtained.

(3) Re-adjust alternator speed if necessary.

(4) The voltage reading at terminal "B+" and ground must not vary more than specified from the regulating voltage.

(5) If the voltage difference is not within specification replace the voltage regulator.

ALTERNATOR

Removal (4 cyl models)

(1) Disconnect the positive battery terminal.

(2) Disconnect all wiring from the alternator.

(3) Remove adjusting strap bolt at alternator end of strap.

(4) Remove pivot bolt attaching alternator to the engine block and remove alternator.

Installation (4 cyl models)

Install by reversing the removal procedure noting the following:

(1) Ensure that the belt ribs are correctly located in the pulley grooves.

(2) Measure belt deflection at the centre of the top belt run by applying a force of 10 kg. Adjust the belt to give a deflection of 9.0 to 10.0 mm.

Removal (V6 models)

(1) Remove air cleaner top with intake hose.

(2) Raise vehicle and remove L/H splash shield.

(3) Remove oil pressure switch wire.

(4) Remove alternator drive belt and alternator wiring.

(5) Remove alternator top mounting bolt

(6) Remove rear engine stabiliser bar.

(7) Remove E.C.S. pump (where fitted), heater hose to engine clamp, disconnect lower end of speedo cable.

(8) Remove heat shield from exhaust.

(9) Remove lower alternator mounting bolt and remove alternator.

Installation (V6 models)

(1) Install alternator in position and fit lower mounting bolt.

(2) Install top alternator mounting bolt and alternator wiring.

(3) Install alternator drive belt and ensure that the belt ribs are correctly located in the pulley grooves adjust belt tension. Adjust the belt to give a deflection of 9.0 to 10.0 mm while applying a force of 10 kg.

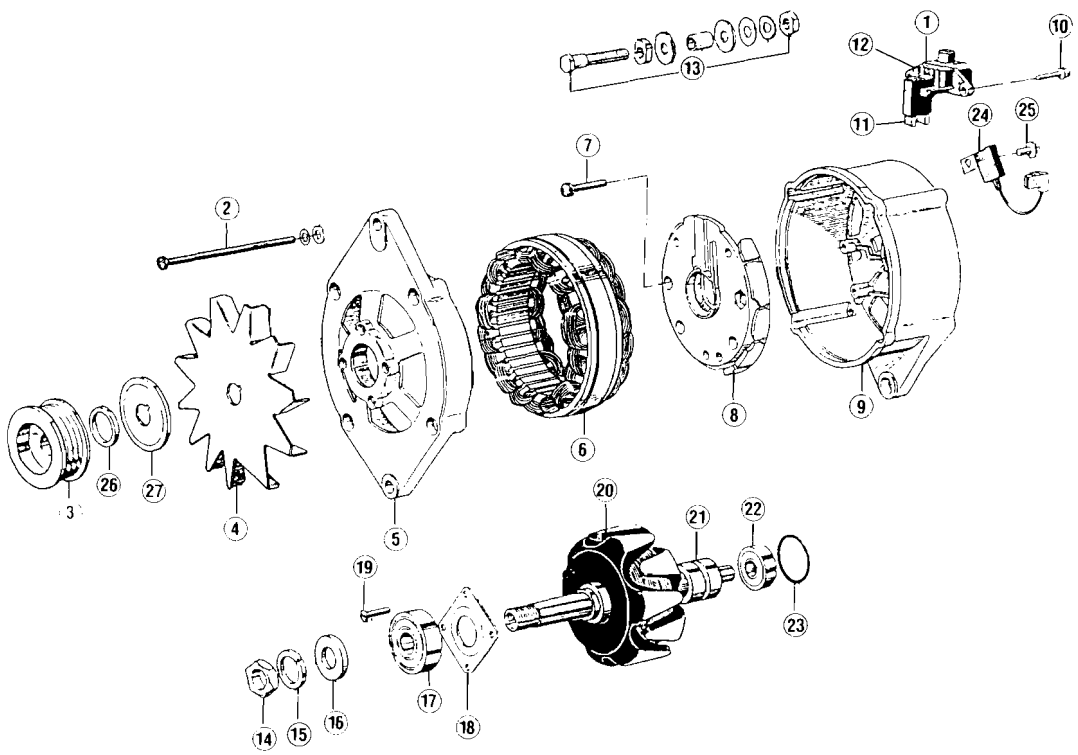
(4) Install L/H splash shield and exhaust heat shield.

(5) Install rear engine stabiliser bar.

(6) Install speedo cable, heater hose to engine clamp and E.C.S. pump (where fitted).

(7) Install Air Cleaner top and hose.

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1. Voltage regulator
2. Through bolt
3. Pulley
4. Fan
5. Drive end plate
6. Stator
7. Screw
8. Rectifier assembly
9. Slip ring and housing
10. Screw
11. Brush plate & voltage regulator
12. Brush set
13. Output terminal assembly
14. Retaining nut
15. Spring washer
16. Spacer
17. Drive end bearing
18. Bearing retainer
19. Screw
20. Rotor
21. Slip ring assembly
22. Slip ring end housing bearing
23. Wave washer
24. Suppressor
25. Screw
26. Spacer
27. Plate Washer

Fig. 3 — Alternator components (4 cylinder shown)

Disassembly

(1) Mark relative positions of the stator and the end plates.

(2) Remove brush holder/regulator screws and lift out assembly, refer Fig. 4.

(3) Remove the four through bolts.

(4) Withdraw drive end plate and rotor complete being careful not to lose wave washer from behind the bearing.

(5) Remove three rectifier retaining screws and nut and insulation components from "B+" terminal.

(6) Withdraw stator and rectifier assembly from end plate.

(7) The stator connections can be unsoldered from the rectifier assembly for test purposes.

NOTE: 85 Amp alternator has 4 stator connections.

CAUTION: To avoid the possibility of diode failure from excessive heat, a pair of pliers should be used to hold the diode side of this connection during soldering operations to dissipate any excess heat.

(8) Grip rotor in a vice equipped with soft jaws and unscrew the pulley retaining nut. The rotor may then be pressed out of the drive end bearing.

(9) Remove the four screws from the drive end bearing retainer and remove the bearing. The rear bearing can be pulled off the rotor shaft using a suitable puller.

(10) Clean all metal parts, except stator and rotor, with cleaning solvent and blow dry with compressed air. Ensure that the rectifier assembly is particularly clean to enable correct transfer of heat.

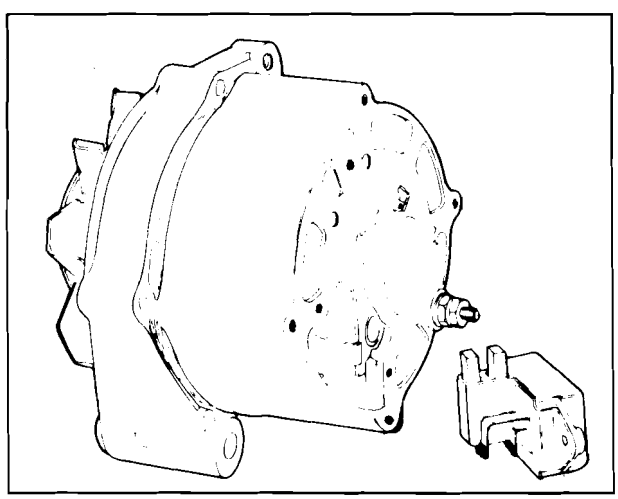


Fig. 4 — Regulator removal

COMPONENT TESTING

Voltage Regulator

To test the voltage regulator place it in an alternator either on a test bench or in a vehicle.

Using test circuit as shown in Fig. 2 check the voltage regulator as follows:

NOTE: Do not reverse S and L connections as this will destroy the warning lamp circuit of the regulator.

A. Regulating Voltage

(1) Start engine and run to obtain alternator speed of 6000 r.p.m.

(2) Adjust the load to obtain a charging rate of 10 amps.

(3) Re-adjust alternator speed if necessary.

(4) The regulating voltage should now be between 14.25 and 14.55 volts.

B. Regulating Range

(1) Maintain alternator speed at 6000 r.p.m. and adjust load until a charging rate of 85% of rated output is obtained.

(2) Re-adjust alternator speed if necessary.

(3) The voltage reading at terminal "B+" and ground must not vary more than 0.3 volts.

NOTE: If readings at step A(4) or B(3) are not as specified, proceed as follows:

(a) Remove the regulator and inspect the regulator to rectifier contacts.

(b) If there is any indication of poor contact, raise the rectifier contacts to improve contact and install regulator.

(c) Repeat voltage regulator test.

(4) If the variance between the readings is greater than specified the regulator is faulty.

NOTE: The specified test values apply at 20 °C. For every rise of 10°C in temperature a voltage variation of 0.03 volts will occur.

Diodes

(1) Test diodes with a series test lamp of up to 24 volts DC. Apply the test probes between the connecting points (B, C, D and E, F, G), refer Fig. 5 and the heat sink. The positive probe of the test light should connect to the anode and the negative probe to the cathode.

NOTE: The housing will form the cathode on positive heat sink and will form the anode on the negative heat sink, refer Fig. 5.

The test light should light up when connected in this manner, but not light when connected in the reverse direction. If diodes sets G-B, F-C, or E-D are short circuited, all six diodes will show a short circuit when tested with the test lamp. A short circuit is indicated with the test lamp lights when connected in both directions.

NOTE: 85 Amp alternator has 8 diodes.

An open circuit is indicated if the test lamp does not light in either direction. If a diode failure is evident, the complete diode plate must be replaced.

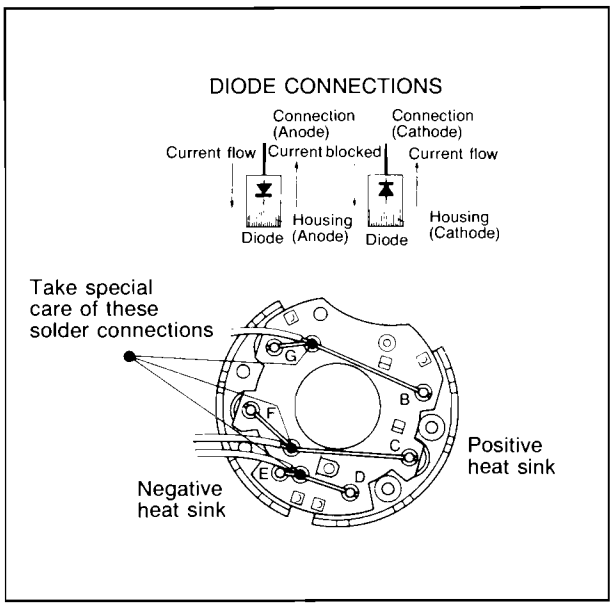


Fig. 5 — Diode plate assembly

Stator

(1) Test the stator windings with a low voltage test lamp (up to 40 volts) for grounding by connecting the test lamp between any stator lead and the frame. The windings are grounded if the lamp lights. This test can also be conducted using an ohmmeter, refer Fig. 6, a low reading indicates grounded windings.

(2) Measure the resistance between any two leads of the stator windings, refer Fig. 7. If the readings are not as specified there is an open circuit in the stator windings. Test the remaining stator winding lead in a similar manner. This test can also be conducted using a low voltage test lamp, the lamp will not light if there is an open circuit.

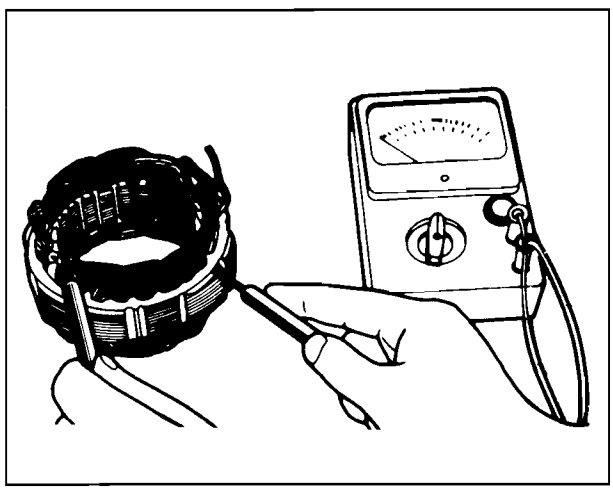


Fig. 6 — Checking stator windings for grounding

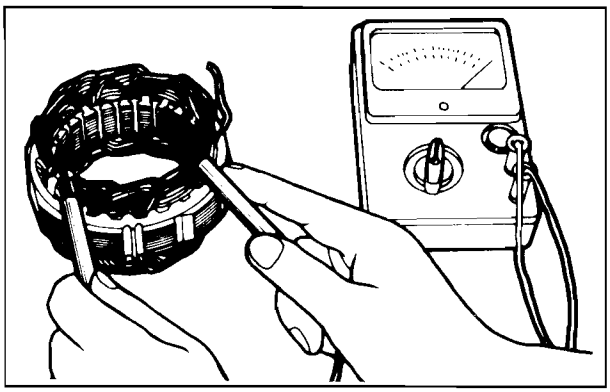


Fig. 7 — Checking stator windings for open circuit

Rotor

(1) Test the rotor windings for a short circuit to ground using a low voltage test lamp or an ohmmeter as shown in Fig. 8. Connect one test lamp or ohmmeter lead to the slip ring and the other lead to a pole piece. If the lamp lights or the ohmmeter reading is low, the field windings are grounded.

(2) Connect one lead of an ohmmeter to each slip ring to test for an open circuit. The ohmmeter reading will be high if there is an open circuit, refer Fig. 9.

(3) Check the resistance of the field windings while the ohmmeter is connected for test 2. If the reading is not as specified, the windings are shorted.

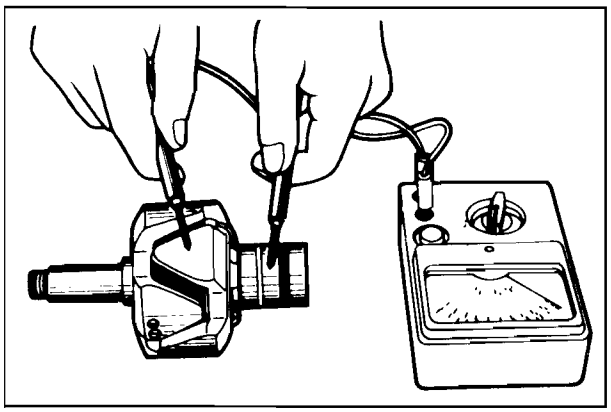


Fig. 8 — Checking rotor for grounding

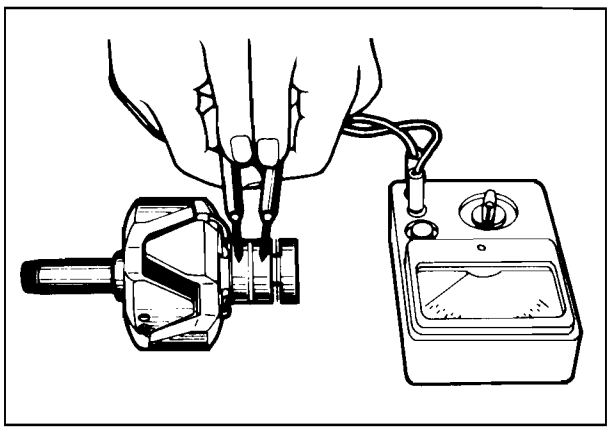


Fig. 9. — Checking rotor for open circuits

Inspection

(1) Check the slip rings and brushes for wear and damage, refer specifications.

(2) Check brush springs for burning and damage.

(3) Check that bearings rotate smoothly and freely.

Assembly

(1) Replace worn bearings with approved replacement bearings only.

(2) Assemble the alternator (by reversal of the disassembly procedure), ensuring that the through bolts are tightened evenly and that the air gap between the rotor and the stator is equal at all points, if not loosen the through bolts again and reposition the end plates to the stator until the gap is equal, then retighten the bolts. Tighten the pulley nut to specifications.

(3) Position the alternator in Bosch adaptor EFLJ54 and set the unit in an approved test bench.

NOTE: The fan must be fitted while the alternator is under test. Do not use temporary connections and ensure that a 12 volt battery is connected in parallel with the alternator to act as a buffer to eliminate voltage peaks which will ruin the diodes.

(4) Connect the test bench voltmeter between "B+" and the alternator housing and connect the ammeter between the "B+" terminal and "B+" lead. Connect a battery load resistor (Bosch tester **EFAW107**) in parallel with the battery.

(5) Start the test bench and increase the speed maintaining a reading between 14.25 - 14.55 volts by adjusting the load resistor.

(6) After the alternator has been running for approximately 5 minutes, test the output figures according to specifications.

SECTION 3B — MITSUBISHI ALTERNATOR WITH BUILT IN ELECTRONIC REGULATOR

SPECIFICATIONS

Manufacturer	Mitsubishi Electric
Part No. (early 6 cyl manual models)	MD112322
Nominal voltage	12V
Nominal output	75A
Part No.	MD112323
Nominal voltage	12V
Nominal output	90A
Polarity to earth	Negative (-)
Number of brushes	2
Resistance — rotor	3 to 4 ohms
Regulator output voltage	14.4 ± .3V
Alternator pulley to engine pulley ratio	2.50:1

NOTE: To calculate engine r.p.m. when alternator r.p.m. is quoted divide alternator r.p.m. by alternator pulley to engine pulley ratio.

TORQUE SPECIFICATIONS

	Nm
Pulley nut	34 to 43
Through bolts	4.0 to 5.4
Adjusting strap to alternator bolt	12 to 15
Alternator pivot bolt	20 to 24

GENERAL INFORMATION

The Mitsubishi alternator is a compact, lightweight unit designed far negative ground operation. It features an internally mounted cooling fan integral with the rotor. Voltage regulation is by means of an electronic regulator incorporated in the brush holder.

A twelve pole rotor is used and alternator output is rectified from AC to DC by heavy duty silicon diodes mounted in heat sinks.

Three auxiliary or exciter diodes are located in the rectifier assembly. These diodes allow a portion of stator alternating current (after rectification to DC) to be routed to the rotor for excitation of the rotor windings.

The charge warning lamp provides pre-excitation and prevents the exciter diodes from load sharing. In the event of lamp globe failure a "back-up" system is provided from the ignition switch via the fuse box and a resistor located in the alternator.

CHARGING SYSTEM TESTING-ON VEHICLE

A series of tests can be performed prior to alternator removal to assist in fault diagnosis.

Before proceeding with the test, check that the charge warning lamp and the alternator fuse are functional.

The following precautions must be observed during testing:

(1) Disconnect the battery negative cable before connecting test equipment.

(2) Test connections should NOT be in the form of alligator clips, etc., quick connectors should be used. This prevents them falling off during the test and causing diode failure.

(3) Do not operate the alternator with the battery disconnected.

(4) Do not disconnect battery during testing, as diode damage will result.

(5) Operate the engine to attain normal operating temperature.

Output Current Test (refer Fig. 1)

(1) Disconnect battery negative lead.

(2) Disconnect the wiring from the output terminal "B" of the alternator.

(3) Connect an ammeter between terminal "B" and the previously removed wiring.

(4) Connect a voltmeter between terminal "B" and earth.

(5) Connect a tachometer to the engine.

(6) Connect the battery earth lead, voltmeter should indicate battery voltage.

(7) Start the engine and switch on all electrical loads increase engine speed to 1200 r.p.m. and check output current.

Output current should be greater than 70% of nominal output.

NOTE: If battery is fully charged it will be necessary to connect a suitable load across the battery terminals. Switch off the engine prior to connecting the load.

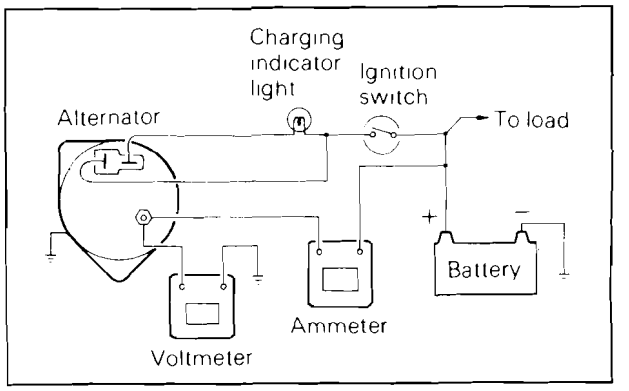


Fig. 1 — Output current test connections

Output Voltage Test (refer Fig. 2)

(1) Disconnect the battery negative lead.

(2) Connect a voltmeter between the "L" terminal on the alternator and the negative battery terminal.

(3) Connect a tachometer to the engine.

(4) Connect battery negative lead, Voltmeter reading should be lower than battery voltage.

(5) Start engine, increase speed to 2300 r.p.m. and maintain speed for a short period.

(6) Check voltmeter reading. Voltage should be 14.4V ± 0.3V at 20°C.

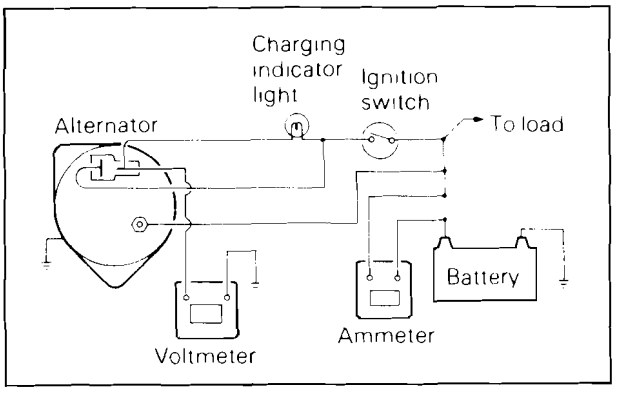


Fig. 2 — Output voltage test connections

ALTERNATOR

Removal (V6 models)

(1) Remove air cleaner top with intake hose.

(2) Raise vehicle and remove L/H splash shield.

(3) Remove oil pressure switch wire.

(4) Remove alternator drive belt and alternator wiring.

(5) Remove alternator top mounting bolt

(6) Remove rear engine stabiliser bar.

(7) Remove E.C.S. pump (where fitted), heater hose to engine clamp, disconnect lower end of speedo cable.

(8) Remove heat shield from exhaust.

(9) Remove lower alternator mounting bolt and remove alternator.

Installation

Install by reversing the removal procedure noting the following:

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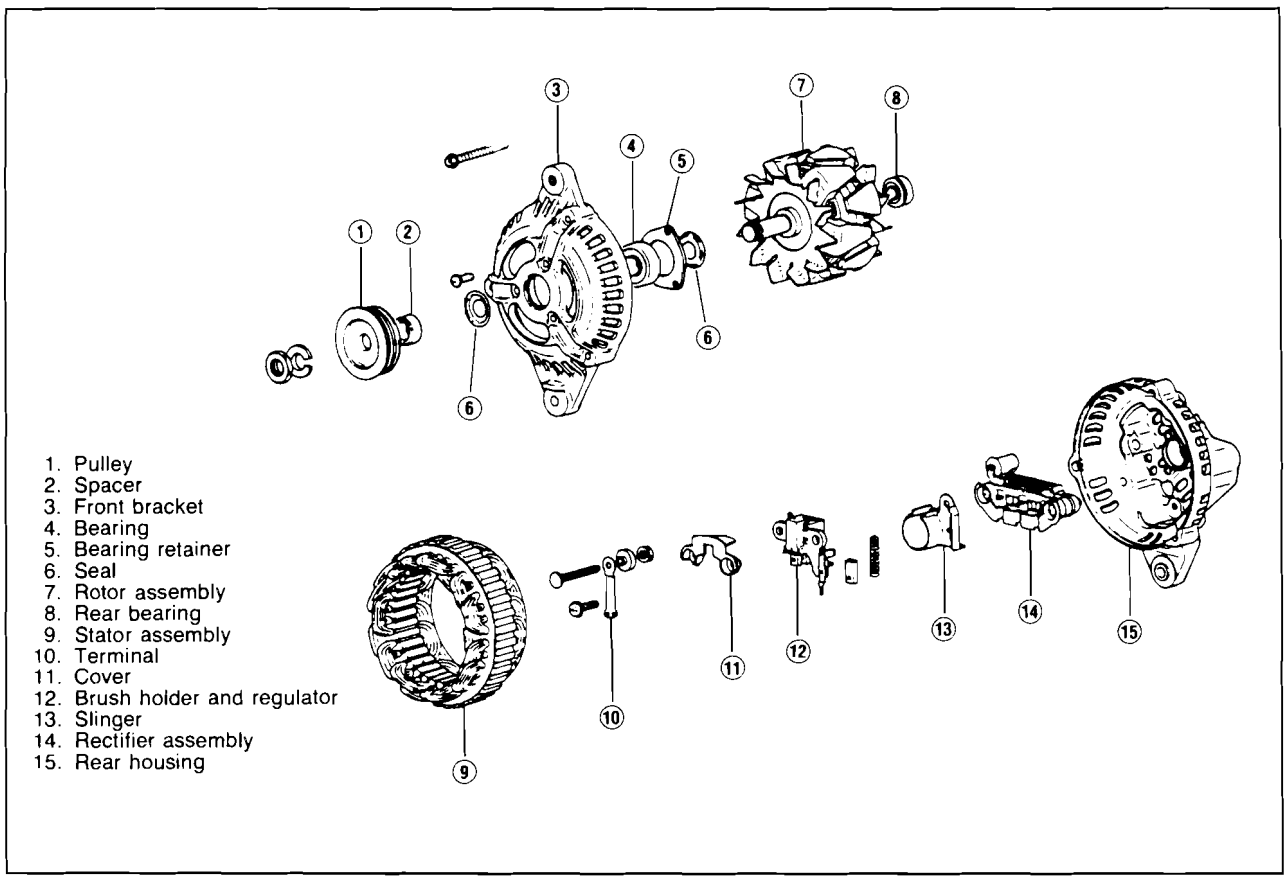


Fig. 3—Alternator components

(1) Ensure that the belt ribs are correctly located in the pulley grooves.

(2) Measure belt deflection at the centre of the top belt run by applying a force of 10 kg.

Belt deflection should be 9.0 to 10.0 mm.

Disassembly

(1) Mark the relative position of the stator and the end plates.

(2) Remove the three alternator through bolts.

(3) Insert two screwdrivers between the front housing and the stator and pry the rear housing and stator off, refer Fig. 4.

NOTE: Do not insert the screwdrivers too far as the stator may be damaged.

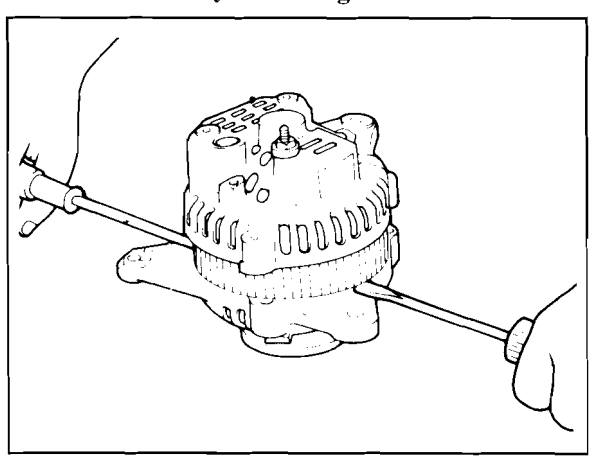


Fig. 4—Removing rear housing and stator

CAUTION: Do not exert excessive force to pry rear housing and stator off. If disassembly is difficult follow step 4.

(4) If necessary apply a 200W soldering iron to the bearing section of the rear housing until it is possible to pry the housing off easily, refer Fig. 5.

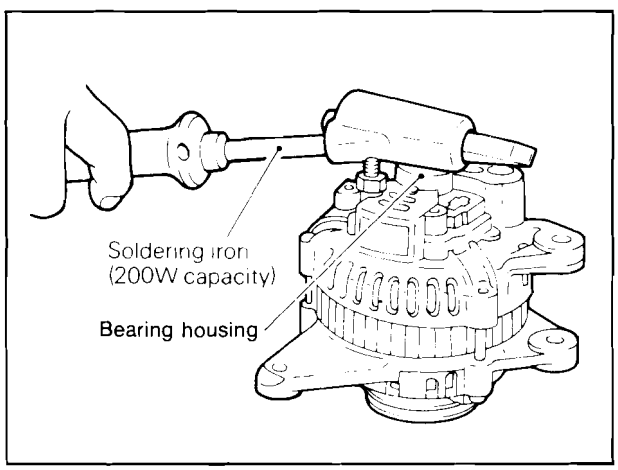


Fig. 5—Heating rear housing

(5) Remove the "B" terminal nut and washer.

(6) Remove the brush holder and rectifier retaining screws.

(7) Remove the stator assembly from the rear housing.

(8) To remove the rectifier and the brush holder from the stator unsolder the stator wires from the rectifier, refer Fig. 6.

(9) To remove the brush holder from the rectifier unsolder the plates at the rectifier, refer Fig. 6.

NOTE: Soldering operations must be completed as quickly as possible to avoid damaging the diodes.

Do not exert undue force on the diode leads.

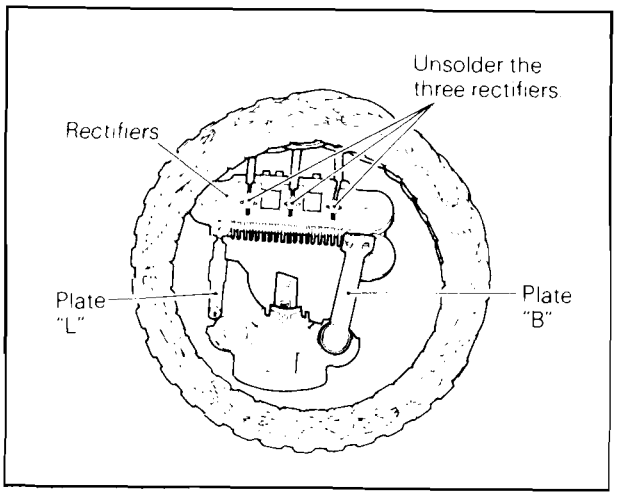


Fig. 6—Brush holder and rectifier attaching points

(10) Position the rotor in a vice fitted with soft jaws and remove the pulley retaining nut and spring washer, the pulley and spacer and the front housing from the rotor.

(11) Remove the front bearing from the front housing by removing the three bearing retainer screws. The rear bearing can be removed from the rotor shaft using a suitable puller.

COMPONENT TESTING

Rotor

(1) Using an ohmmeter as shown in Fig. 7 check that the resistance of the rotor windings is 3 to 4 ohms.

If resistance is low a short circuit is indicated. If there is no continuity an open circuit is indicated. In either case the rotor should be replaced.

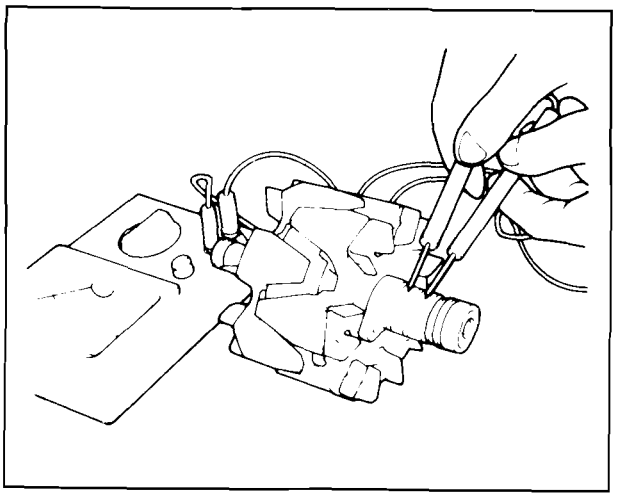


Fig. 7—Rotor winding continuity check

(2) Using an ohmmeter as shown in Fig. 8, check the rotor winding for grounding. If continuity exists the rotor windings are grounded and the rotor must be replaced.

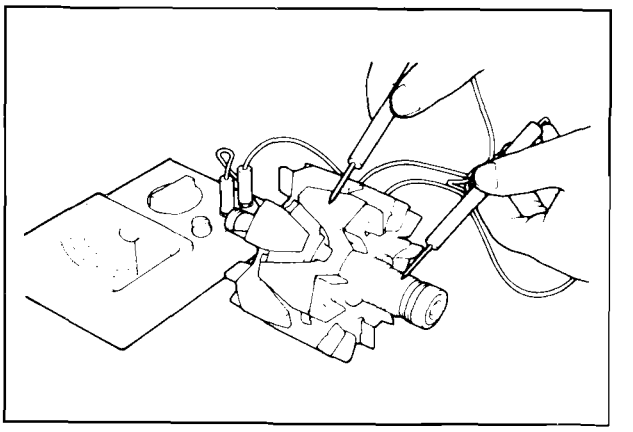


Fig. 8—Check rotor windings for grounding

Stator

(1) Check the stator windings for grounding using an ohmmeter as shown in Fig. 9, if the ohmmeter indicates continuity the stator must be replaced.

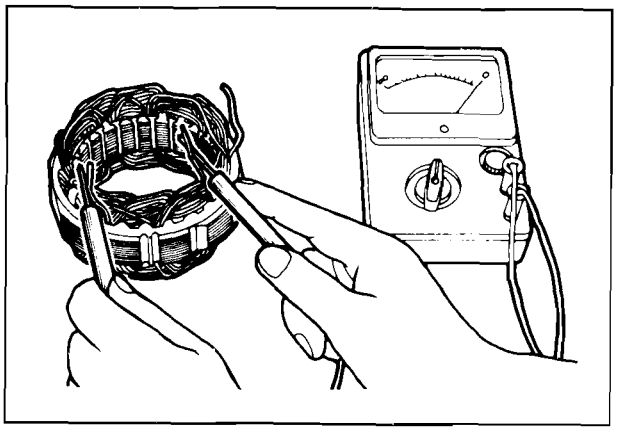


Fig. 9—Checking stator for grounding

(2) Check the stator windings for continuity using an ohmmeter as shown in Fig. 10, if there is no continuity between the windings, the stator must be replaced.

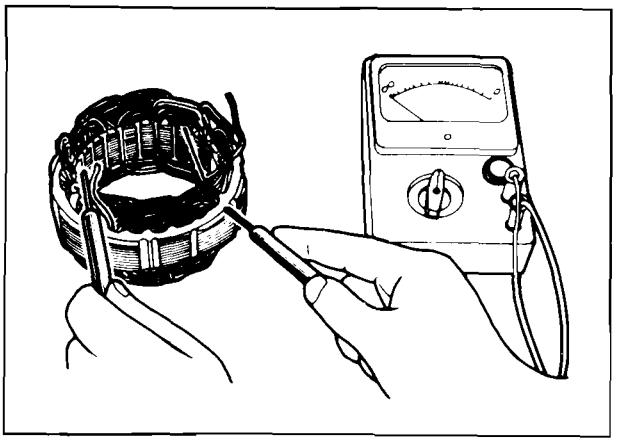


Fig. 10—Check stator windings for continuity

Diodes (refer Fig. 11)

NOTE: If any diode is found to be faulty the rectifier assembly must be replaced.

(1) (+) Heatsink assembly test: check for continuity between the (+) heatsink and the stator winding connection terminal with an ohmmeter. Continuity in both directions indicates a faulty diode.

(2) (–) Heatsink assembly test: check for continuity between the (–) heatsink and the stator winding connection terminal. Continuity in both directions indicates a faulty diode.

(3) Auxiliary diode test: check the three diodes by connecting an ohmmeter across the diodes. Continuity in both directions indicates a faulty diode.

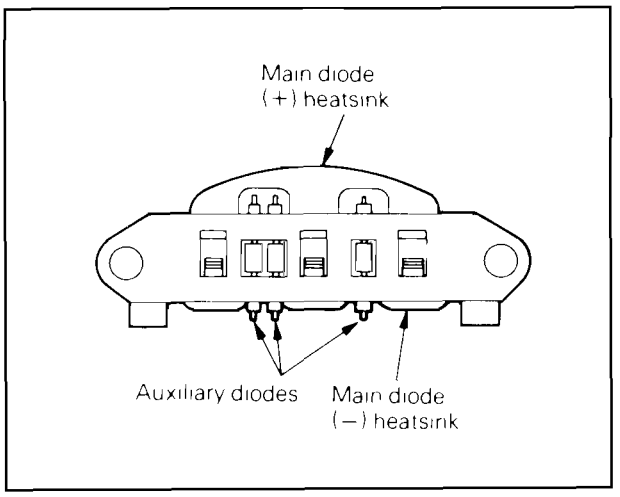


Fig. 11 – Rectifier assembly

Inspection

(1) Check the slip rings and brushes for wear and damage, refer Fig. 12.

(2) Check brush springs for burning and damage.

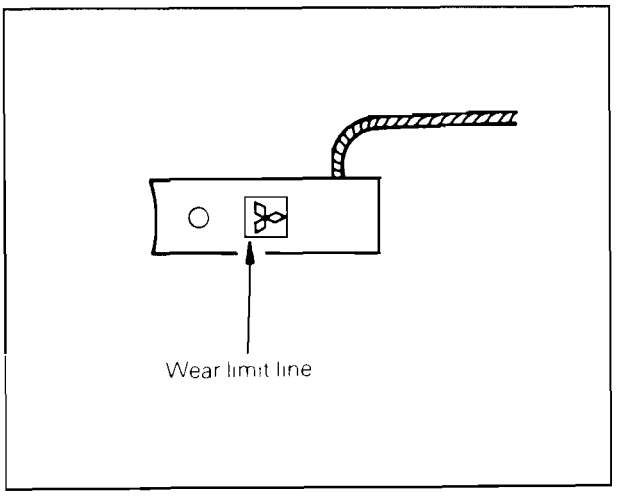


Fig. 12 – Brush wear limit

Brush Replacement

(1) With the brush holder removed unsolder the pigtail, refer Fig. 13, and remove the brush and spring.

(2) Install a new brush and solder the pigtail so that the brush enters the holder approximately 5 mm, refer Fig. 14.

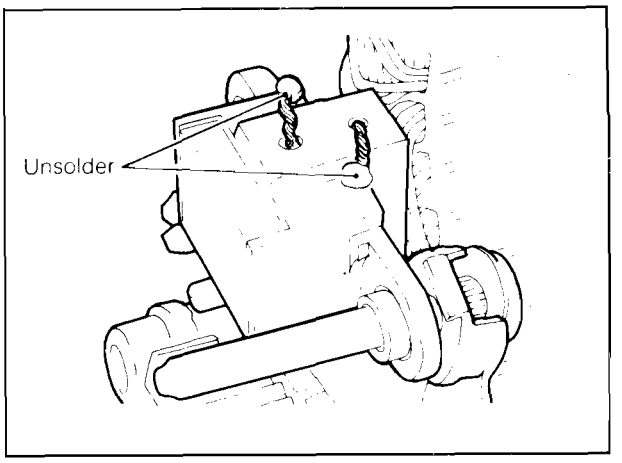


Fig. 13 – Brush removal

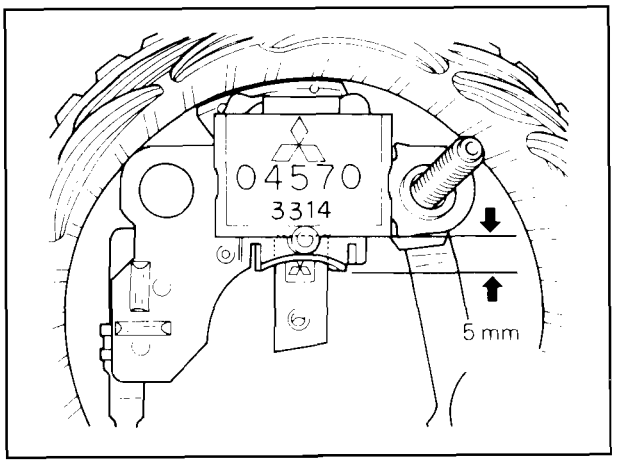


Fig. 14 – Brush installation

Assembly

Assemble by reversing disassembly procedure noting the following:

(1) Prior to assembling housing halves press the brushes into the brush holders and insert a suitable size wire through the access hole in the rear housing to hold the brushes in that position, refer Fig. 15.

(2) Remove the wire after assembly and check that the rotor rotates smoothly.

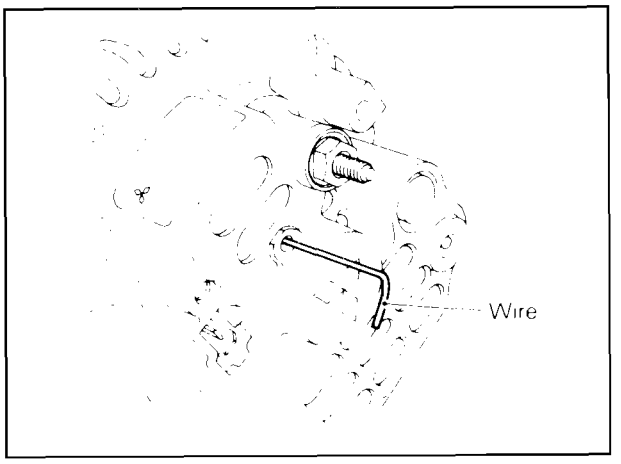


Fig. 15 – Holding brushes

(3) Tighten the through bolts evenly.

(4) Tighten the pulley nut to the specified torque.

SECTION 3C — BOSCH ALTERNATOR WITH BUILT IN ELECTRONIC VOLTAGE REGULATOR AND INTERNAL COOLING FANS

SPECIFICATIONS

Manufacturer	Bosch
M.M.A.L. Part No.	AW335900 90 amp
Nominal voltage	12V
Polarity to earth	Negative (-)
Number of brushes	2
Brush wear — minimum length	3.8 mm
Minimum diameter of slip rings	26.7 mm
Slip rings to be true within	0.45 mm
Claw poles to be true within	0.05 mm
Resistance — stator	more than 1 Meg Ohm
Resistance— rotor	2.60 ± 0.13 Ohms
Regulator output voltage	14.25 V - 14.55 V
Output test	
1500 alternator r.p.m.	32 amp
1800 alternator r.p.m.	50 amp
6000 alternator r.p.m.	90 amp
Alternator pulley to engine pulley ratio.	2.5

NOTE: To obtain engine r.p.m. where alternator r.p.m. is quoted divide the alternator r.p.m. by the alternator pulley to engine pulley ratio.

SPECIAL TOOLS

Battery load resistor.	Bosch tester EFAW107
Mounting adaptor	EFLJ54
Drive end bearing puller	Bosch 9 981 066 601
Drive end bearing assembly tool	Bosch 9 981 066 600

TORQUE SPECIFICATIONS

	Nm
Pulley retaining nut	54 to 68
Alternator through bolts	3.8 to 5.5
B+ terminal to alternator nut	7.5 to 8.5
B+ terminal to rectifier nut	8.0 to 11.0
Regulator retaining screws	1.6 to 2.3
Rectifier fixing screws.	1.0 to 2.5
Bearing retaining plate screws.	2.1 to 3.0
Capacitor retaining screw	2.7 to 3.8

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ALTERNATOR SERVICE DIAGNOSIS CHART

Fault	Detail	Sensing Mode	Effect on output	Ignition ON. Engine not running.	Engine running	Fault Indicated
Stator short circuited.	The stator winding is partially shorted between adjacent wires (in the same phase or different phases), resulting in a lower resistance in the winding and hence stator current increases.	N.A.	Alternator becomes noisy and output voltage drops.	Warning lamp ON.	Warning lamp ON.	YES[1].
Stator to the recifier diode open circuited.		N.A.	Alternator becomes noisy and output voltage drops.	Warning lamp ON.	Warning lamp OFF.	NO.
Positive diode short circuited to B+.	Alternator positive power diode short circuit (the defective diode is one whose phase is being sensed by the regulator).	The phase input will be pulled high and the warning lamp will be off at all times.	Alternator becomes noisy and output voltage drops.	Warning lamp OFF.	Warning lamp OFF.	YES.
Positive diode short circuited to B+.	Alternator positive power diode short circuit (the defective diode is one whose phase in not being sensed by the regulator).	The phase input will be pulled high through the stator winding and the warning lamp will be off at all times.	Alternator becomes noisy and output voltage drops.	Warning lamp OFF.	Warning lamp OFF.	YES.
Positive diode open circuited.	Positive power diode open circuit (the defective diode is one whose phase is being sensed by the regulator).	N.A.	Slight drop in output voltage. Average phase voltage detected rises.	Warning lamp ON.	Warning lamp OFF.	NO.
Positive diode open circuited.	Positive power diode open circuit (the defective diode is one whose phase is not being sensed by the regulator).	N.A.	Slight drop in output voltage.	Warning lamp ON.	Warning lamp OFF.	NO.
Negative diode short circuited to ground.	Negative power diode short circuit (the defective diode is one whose phase is being sensed by the regulator).	The phase input will be dragged low and the warning lamp will be ON at all times.	Alternator becomes noisy and output voltage drops.	Warning lamp ON.	Warning lamp ON.	YES.
Negative diode short circuited to ground.	Negative power diode short circuit (the defective diode is one whose phase is not being sensed by the regulator).	The phase input will be dragged low through the stator winding and the warning lamp will be ON at all times.	Alternator becomes noisy and output voltage drops.	Warning lamp ON.	Warning lamp ON.	YES.
Negative diode open circuited.	Negative power diode open circuit (the defective diode is one whose phase is being sensed by the regulator).	N.A.	Slight drop in output voltage.	Warning lamp ON.	Warning lamp OFF[2].	NO.
Negative diode open circuited.	Negative power diode open circuit (the defective diode is one whose phase is not being sensed by the regulator).	N.A.	Slight drop in output voltage.	Warning lamp ON.	Warning lamp OFF.	NO.

1 Not all faults will give an indication, it depends on the severity of the short.
2 The warning lamp is mainly off, noise in the floating phase input to the regulator may occasionally cause the lamp to flicker.

ALTERNATOR SERVICE DIAGNOSIS CHART, continued

Fault	Detail	Sensing Mode	Effect on output	Ignition ON. Engine not running.	Engine running	Fault Indicated
Field short circuited.	The field winding in the rotor is partially shorted, resulting in a lower resistance in the winding and hence field current increases.	When the battery voltage keeps rising, the warning lamp will be turned ON when it exceeds reference voltage.	Output voltage rises. Overcharging.	Warning lamp ON.	Warning lamp ON.	YES.
Field short circuited.	The field winding in the rotor is completely shorted across the DF & B+, resulting in no excitation to the alternator.	The warning lamp will be turned ON due to lack of phase voltage.	No output.	Warning lamp ON.	Warning lamp ON.	YES.
Field open circuited.	The field winding is open and there is no field current.	The warning lamp will be turned ON due to lack of phase voltage.	No output.	Warning lamp ON.	Warning lamp ON.	YES.
Brush No Contact.	B+ brush broken.	The warning lamp will be turned ON due to lack of phase voltage.	No output.	Warning lamp ON.	Warning lamp ON.	YES.
Brush No Contact.	DF brush broken.	The warning lamp will be turned ON due to lack of phase voltage.	No output.	Warning lamp ON.	Warning lamp ON.	YES.

REGULATOR SERVICE DIAGNOSIS CHART

Fault	Detail	Sensing Mode	Effect on output	Ignition ON. Engine not running.	Engine running	Fault Indicated
Field Driver short circuited.	Power Darlington is not switching (short circuit).	For alternator output current below rated maximum, output voltage will exceed regulation threshold and warning lamp will be ON.	Output voltage rises. Overcharging.	Warning lamp ON.	Warning lamp ON.	YES.
Field Driver open circuited.		The warning lamp will be turned ON due to lack of phase voltage.	No output.	Warning lamp ON.	Warning lamp ON.	YES.
No Phase Input to regulator.	Phase voltage sensing connection broken.	The warning lamp will be turned ON due to lack of phase voltage. (The pull down resistor inside the hybrid will pull the phase input low.)	Regulator is always in standby mode (i.e. field driver at 50% duty cycle) when battery voltage is less than reference voltage. Field driver will be off when battery voltage is greater than reference voltage. Output voltage which is always lower than the reference voltage rises with increasing speed.	Warning lamp ON.	Warning lamp ON.	YES.
No B+ input to regulator		If warning lamp is still connected, the self biased characteristic of the lamp driver will turn the lamp on.	No output.	Warning lamp ON.	Warning lamp ON.	YES.

VEHICLE WIRING SERVICE DIAGNOSIS CHART

Fault	Detail	Sensing Mode	Effect on output	Ignition ON. Engine not running.	Engine running	Fault Indicated
Battery to alternator charge cable open circuit.	Battery to alternator cable broken when driving.	The Voltage difference between the regulator B+ and Sense input will cause the lamp to turn on. Intensity depends on loading at the point of failure.	Regulate according to B+ voltage rather than battery sense input.	Warning lamp ON.	Warning lamp ON.	YES.
Battery to alternator charge cable open circuit.	Battery to alternator cable broken before engine is running.	The warning lamp will be turned ON due to lack of phase voltage.	Alternator connot be started due to the lack of field current. No output.	Warning lamp ON.	Warning lamp ON.	YES.
Sense line open circuit.	Battery sensor wire broken.	The Voltage difference between the regulator B+ and Sense input will cause the lamp to turn on.	Field driver is not switching. No output from alternator.	Warning lamp ON.	Warning lamp ON.	YES.
B+ Line and Sense wire open circuit.		If warning lamp is still connected, the self biased characteristic for the lamp driver will turn the lamp on.	Field driver is not switching. No output from alternator.	Warning lamp ON.	Warning lamp ON.	YES.
Lamp and Sense wire reversed.	This is only allowed for momentary pin reversal. Prolonged pin reversal may cause internal damage to the regulator.	Current limiting feature will limit the short circuit current to the lamp driver during the fault.	The output is as per normal regulator before damage occurred.	Warning lamp OFF.	Warning lamp OFF.	YES.
Warning lamp open circuited.		Warning lamp cannot be lit up even when the key is in ignition and engine is not running.	Regulation starts when phase voltage exceeds the self-excitation threshold at high speed ~6000 Alternator RPM.	Warning lamp OFF.	Warning lamp OFF.	YES.

GENERAL INFORMATION

The Bosch alternator is designed for negative ground operation and has two internal cooling fans. A twelve pole rotor is used and the alternator output is rectified by heavy duty silicone diodes mounted in heat sinks for maximum cooling.

Six diodes are arranged in a three phase bridge connection whereby three diodes have cathodes connected to the output terminal (normal polarity) and three diodes have anodes at the housing (reverse polarity). The regulator senses the battery voltage via the battery sense wire and controls alternator output voltage by switching the alternator excitation field current ON and OFF. As long as the battery voltage remains below the regulated voltage, power is supplied to the battery.

The EP regulator has the ability to detect many faults in the charging system not previously possible with earlier types. Detection of open circuit rotor winding is now possible. Backup regulation is provided should a malfunction occur, this supplies useable output until service can be obtained. Battery sensing ensures that the correct voltage is available at the battery at all times thus compensating for resistance in the charge cable.

Operation — Alternator (refer Fig. 1)

With the ignition switch turned ON and the engine running, the flow of current through the rotor field coil winding energises the rotating electro-magnet. The rotation of the rotor will cause the stator windings to cut the magnetic lines of force of the rotor. This induces an AC current voltage in the stator windings. The rectifiers convert the (AC) alternating current to (DC) direct current at the output terminal, to carry the electrical load and charge the battery.

The rectifiers prevent the battery from discharging through the alternator.

As the rotor speed increases, the induced voltage in the stator windings increases causing more current flow to satisfy the load requirements. However, there is another factor, commonly known as "inductive reactance" which has an important bearing on current control.

"Inductive reactance" is a counter voltage (voltage of opposite polarity) which is also induced in the stator windings. The voltage tends to oppose the "induced" voltage in the stator windings.

As the rotor speed increases, the counter voltage also increases. By designing the correct size and shape of rotor and stator, the selection of the correct size and number of windings, the correct air gap between the rotor poles and stator and other design features, the alternator permits "inductive reactance" to limit output current, therefore no current regulator is needed.

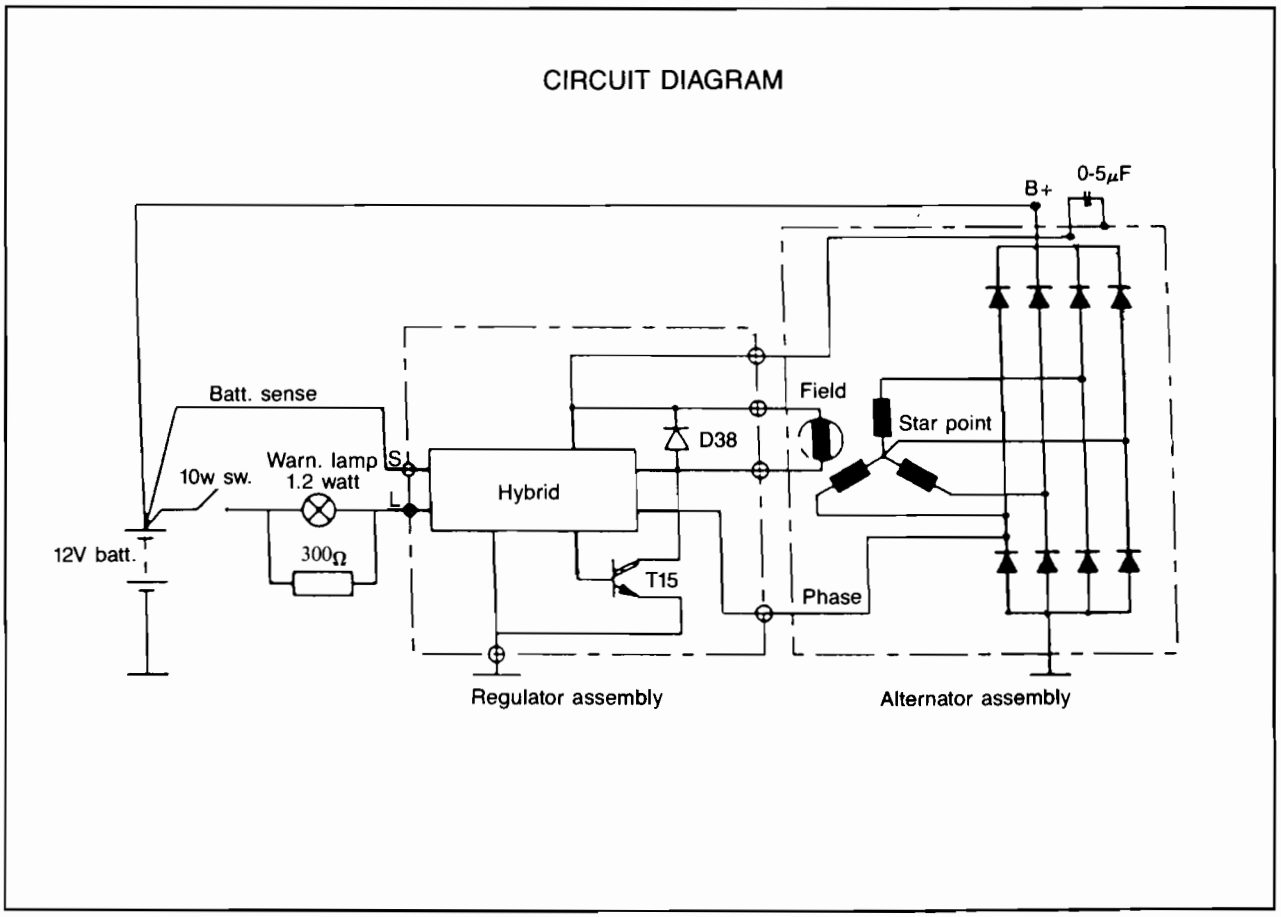


Fig. 1 — Charging system

Operation — Voltage Regulator

With the Ignition switch turned "ON", current is supplied via the warning lamp to the "L" terminal of the regulator. Base current is fed to T15 which turns on, current then flows from B+ through the rotor winding via the regulator brushes and the collector emitter junction of T15 to earth completing the circuit. The current in the rotor causes a magnetic field between adjacent poles to be created, this field is rotated and cuts the windings of the stator at right angles inducing a voltage into them. As the speed is increased this induced voltage increases and results in current being rectified in the 3 phase diode bridge and supplied as DC to the B+ output and hence to the battery. When the voltage at the B+ terminal of the battery reaches around 14.2 volts, this voltage is monitored by the "S" lead and turns the regulator Hybrid base current to T15 OFF removing rotor current, resulting in a decrease in output voltage to below the regulating voltage, T15 base current turns ON and the whole cycle is repeated very rapidly. D38 protects T15 and the regulator against the back voltage developed across the rotor winding when T15 turns OFF. The new generation EP regulators incorporate current limiting in the warning lamp circuit.

Backup Regulation

The EP regulator will limit the output voltage to a safe level should either the main B+ cable or the battery sense wire become de-coupled, the output voltage will be slightly above the normal setting (1-3 volts).

Start up phase

When the Ignition switch is turned on and the engine is not running, the current to the rotor is reduced by switching it on and off at a 50% duty cycle, the frequency is approximately 4 kHz and may be audible at times, this is quite normal, once the engine is started normal regulation commences.

Warning lamp failure

Should the warning lamp fail, the alternator will self excite by deriving a small current from the phase connection allowing the voltage to build up to regulating level.

NOTE: No field current will flow when the engine is cranking.

Diagnostics

The EP regulator incorporates diagnostics which will illuminate the warning lamp as a result of fault conditions in the alternator and external circuitry. These conditions include:

(1) An open circuit in the regulator battery sensing wire (S Terminal).

(2) An open circuit or excessive voltage drop in the B+ cable.

(3) An open circuit in the alternator phase connection.

(4) Overcharging of the battery.

(5) Regulator output stage short circuit.

(6) Open circuit rotor.

The regulator compares the voltage at B+ with the voltage at the "S" terminal connected to battery positive. If the voltage differential exceeds a predetermined threshold, the regulator will operate in backup mode to limit the output voltage to a safe level. The warning lamp will remain illuminated as long as these conditions prevail.

Sources of high resistance which will trigger the warning lamp are:

(a) Poor contact in wiring harness connectors.

(b) Poor contact between rectifier and regulator.

(c) High resistance in fusible link assembly.

CAUTION: When bench testing the alternator it is important that the warning lamp wattage of 2 watts is not exceeded. Reversal of the "S" and "L" cables on the regulator will damage the regulator.

CHARGING SYSTEM TESTING — ON VEHICLE

Diagnosis of the charging system is based on a series of tests that can be made on the vehicle. Before proceeding with the test, check that the charge indicator lamp is functional. A break in this circuit results in loss of pre-excitation.

The following precautions must be observed during testing:

(1) Test the battery. If it is not fully charged, install a fully charged battery for test purposes.

(2) Disconnect the battery negative cable before connecting test equipment.

(3) Test connections should NOT be in the form of alligator clips, etc., quick connectors should be used. This prevents them falling off during the test and causing diode failure.

(4) Do not operate the alternator with the battery disconnected.

(5) Do not disconnect battery during testing, as diode damage will result.

(6) Operate the engine to attain normal operating temperature.

CHANGING SYSTEM TEST

Regulating Voltage

(1) Disconnect the battery ground cable to avoid accidental shorting.

(2) Disconnect the lead from the alternator main output terminal "B+."

(3) Connect a DC ammeter in series with the alternator "B+" terminal and the lead previously disconnected from the "B+" terminal or use a clamp type ammeter.

(4) Connect the positive lead of a voltmeter to the alternator "B+" terminal and ground the negative lead to the alternator housing (D−).

(5) Connect the battery ground cable.

(6) Connect the tachometer, start the engine and adjust engine speed to give **6000 alternator r.p.m.,** refer specifications.

(7) Switch on lights and/or accessories to obtain a 5 to 10 amp charging rate on the test ammeter.

(8) Re-adjust alternator speed if necessary.

(9) Read the regulator output voltage within one minute of starting the test, the voltage should be 14.0 to 14.2 V. If the voltage is not within specification replace the voltage regulator.

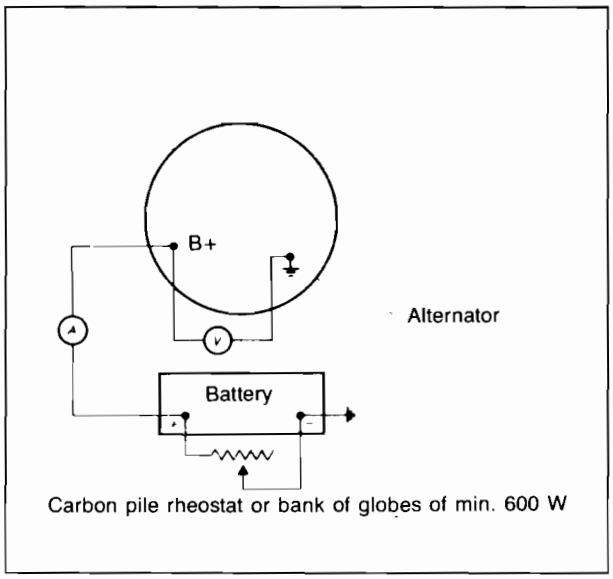


Fig. 2 — Charging system test connections

NOTE: The electronic regulator is temperature compensated and a decrease in regulated voltage of 0.03 V will occur for every 10°C temperature rise.

Regulating Range

(1) Using test equipment previously described maintain engine speed to give 6000 alternator r.p.m., refer specifications.

(2) Adjust load until a charging rate of 85-90% of the rated output is obtained.

(3) Re-adjust alternator speed if necessary.

(4) The voltage reading at terminal "B+" and ground must not decrease by more than 0.5 V from the reading obtained in the previous test.

(5) If the voltage difference is not within specification replace the voltage regulator.

Alternator Output Test at Full Load

Increase engine speed until the alternator is running at 6000 r.p.m., switch on electrical loads until the alternator voltage drops to 13.5 volts. Full output should be obtained under these conditions. It may be necessary to adjust engine speed to maintain alternator speed. If sufficient electrical loads are not available a carbon pile resistance can be connected across the battery and adjusted until maximum output is obtained.

CAUTION: Keep the time for this test to a minimum to avoid undue heating and high engine speeds.

ALTERNATOR

Removal (4 cyl models)

(1) Disconnect the positive battery terminal.

(2) Disconnect all wiring from the alternator.

(3) Remove adjusting strap bolt at alternator end of strap.

(4) Remove pivot bolt attaching alternator to the engine block and remove alternator.

Installation (4 cyl models)

Install by reversing the removal procedure noting the following:

(1) Ensure that the belt ribs are correctly located in the pulley grooves.

(2) Measure belt deflection at the centre of the top belt run by applying a force of 10 kg. Adjust the belt to give a deflection of 9.0 to 10.0 mm.

Removal (V6 models)

(1) Remove air cleaner top with intake hose.

(2) Raise vehicle and remove L/H splash shield.

(3) Remove oil pressure switch wire.

(4) Remove alternator drive belt and alternator wiring.

(5) Remove alternator top mounting bolt

(6) Remove rear engine stabiliser bar.

(7) Remove E.C.S. pump (where fitted), heater hose to engine clamp, disconnect lower end of speedo cable.

(8) Remove heat shield from exhaust.

(9) Remove lower alternator mounting bolt and remove alternator.

Installation (V6 models)

(1) Install alternator in position and fit lower mounting bolt.

(2) Install top alternator mounting bolt and alternator wiring.

(3) Install alternator drive belt and ensure that the belt ribs are correctly located in the pulley grooves adjust belt tension. Adjust the belt to give a deflection of 9.0 to 10.0 mm while applying a force of 10 kg.

(4) Install L/H splash shield and exhaust heat shield.

(5) Install rear engine stabiliser bar.

(6) Install speedo cable, heater hose to engine clamp and E.C.S. pump.

(7) Install Air Cleaner top and hose.

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1. Retaining nut
2. Spring washer
3. Screw
4. Pulley
5. Drive end plate
6. Bearing retainer
7. Drive end bearing
8. Through bolt
9. Rotor
10. Slipring assembly
11. Slipring end housing bearing
12. Stator
13. Bearing cap
14. Screws
15. Rectifier assembly
16. Slipring end housing
17. Brush plate and voltage regulator
18. Voltage regulator
19. Brush set
20. Bush
21. Suppressor
22. Nut
23. Cooling fans
24. Screws

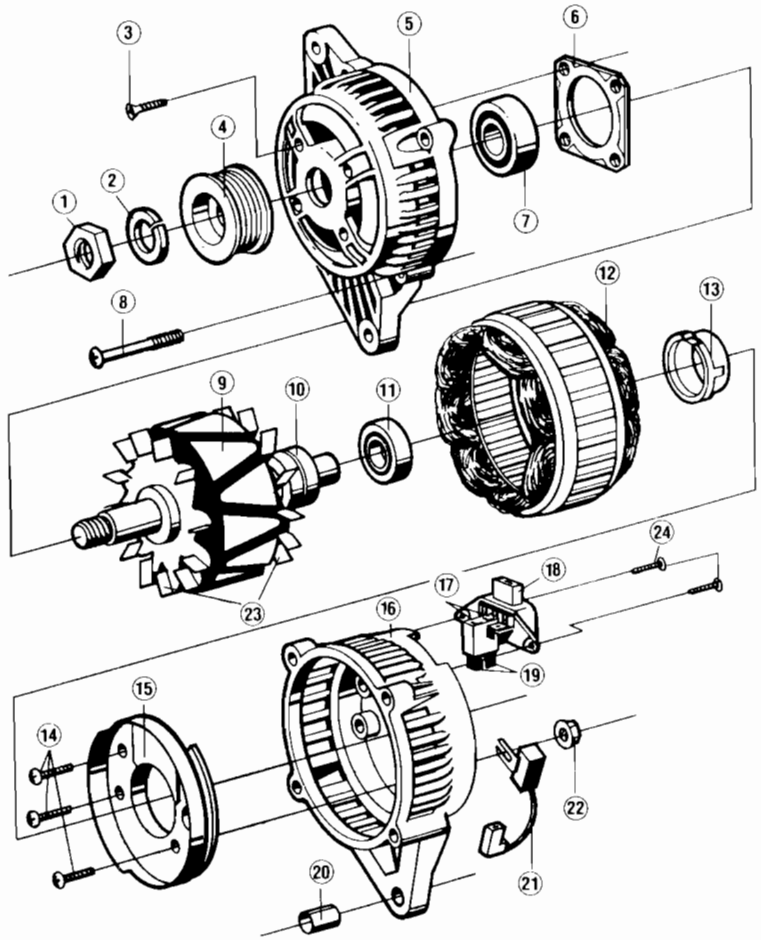


Fig. 3 — Alternator components

Dissasembly

(1) Mark the relative positions of the end housings in relation to the stator assembly to aid reassembly. Use a permanent marking pen do not use centre punches as this can cause misalignment of the housings.

(2) Remove the EP regulator from the slipring end housing by removing the two screws. Tilt the regulator slightly from the plug connection until the regulator clears the housing, then lift clear, refer Fig. 4.

(3) Remove the four through bolts.

(4) Carefully remove the stator assembly along with the slipring end housing, taking care not to put strain on the stator wires.

(5) Disconnect the stator from the rectifier assembly, grasp the stator wires close to the wire loop with a pair of long nosed pliers, heat the joint with a soldering iron, when the joint becomes plastic apply a slight twisting motion to the wires, then pull upwards to release the wires. Remove the stator.

This procedure opens the wire loop to release the stator connections easily.

(6) Remove the rectifier retaining screws and the B+ terminal nut and washers.

NOTE: The B+ bolt and the positive heatsink retaining screw are fitted with mica insulating washers. These must be discarded and replaced with new washers and heatsink compound.

(7) To remove the pulley, mount an 8 mm Allen key in the vice with the short end upwards, place a ring spanner on the pulley nut, position the internal hexagon of the rotor shaft onto the Allen key, loosen the nut and remove the pulley.

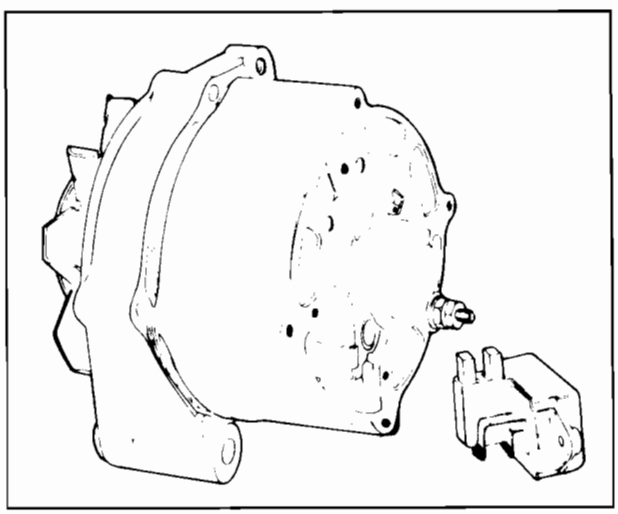


Fig. 4 — Regulator removal

NOTE: The pulley has an integral boss which locks up against the bearing, therefore no thrust collar is provided.

(8) Remove the four retaining screws from the drive end housing, withdraw the rotor complete with the bearing.

NOTE: The rotor must not be pressed from the drive end housing using a press as the bearing retaining plate and drive end housing will be damaged or distorted.

(9) Remove the drive end bearing from the rotor shaft using a suitable puller, take care not to distort the fan assembly during this process.

(10) Remove the slipring end bearing using a suitable puller.

(11) Thoroughly clean all components except the rotor and stator with a suitable solvent. Ensure that all traces of oil and dirt are removed. If an abrasive cleaner is used to remove scale and paint from the housings take care not to abrade the bearing and mounting spigot surfaces. The rotor and stator must be cleaned with compressed air only, the use of solvents could cause damage to the insulating materials.

COMPONENT TESTING

Voltage Regulator

To test the voltage regulator place it in an alternator either on a test bench or in a vehicle.

Using test circuit as shown in Fig. 2 check the voltage regulator as follows:

NOTE: Do not reverse S and L connections as this will destroy the warning lamp circuit of the regulator.

A. Regulating Voltage

(1) Start engine and run to obtain alternator speed of 6000 r.p.m.

(2) Adjust the load to obtain a charging rate of 10 amps.

(3) Re-adjust alternator speed if necessary.

(4) The regulating voltage should now be between 14.25 and 14.55 volts.

B. Regulating Range

(1) Maintain alternator speed at 6000 r.p.m. and adjust load until a charging rate of 85 to 90% of the rated output is obtained.

(2) Re-adjust alternator speed if necessary.

(3) The voltage reading at terminal "B+" and ground must not vary more than 0.3 volts.

NOTE: If readings at step A(4) or B(3) are not as specified, proceed as follows:

(a) Remove the regulator and inspect the regulator to rectifier contacts.

(b) If there is any indication of poor contact, raise the rectifier contacts to improve contact and install regulator.

(c) Repeat voltage regulator test.

(4) If the variance between the readings is greater than specified the regulator is faulty.

NOTE: The specified test values apply at 20°C. For every rise of 10°C in temperature a voltage variation of 0.03 volts will occur.

Power Diodes

(1) Apply the negative test probe of the diode tester or a multimeter with a diode test feature to the positive heatsink and the positive probe alternatively to A, B, C, (refer Fig. 5) a low resistance reading, or the forward voltage drop across the diode should be obtained. Reverse the test probes, a high resistance reading or a higher reverse voltage should be obtained.

(2) Connect the positive test probe to the negative heatsink and the negative probe alternatively to D, E, F, (refer Fig. 5) a low resistance or forward voltage drop across the diode should be obtained. Reverse the test probes, a high resistance reading or higher reverse voltage reading should be obtained.

For 8 diode rectifier plates tests for G and H should be included. When the reverse voltage test is done the applied voltage should be less than 14 volts DC or 12 volts RMS for AC testers.

NOTE: If a diode failure is evident the complete diode plate must be replaced. Zener voltage test of power diodes.

The power diode test should be undertaken first before the diode zener voltage is tested. Diodes are grouped together according to their zener voltage, as shown in the table below. All diodes within a rectifier must have the same zener voltage.

Connect the test probes as for the reverse test listed above i.e. reverse biased apply the test voltage from the zener diode tester (current limited to 5ma) and read to zener breakdown voltage this should be a steady reading and not increase with increased voltage from the tester.

NOTE: 90 Amp alternator has 8 diodes.

Zener voltage	Positive diode	Negative diode	Forward current rating
17.8v-19.2v	031	032	35A
18.8v-20.2v	033	034	35A
19.8v-21.2v	035	036	35A
20.8v-22.2v	037	038	35A
21.8v-23.2v	039	040	35A
22.8v-24.2v	041	042	35A

NOTE: Diode number is stamped on the rear of the diode.

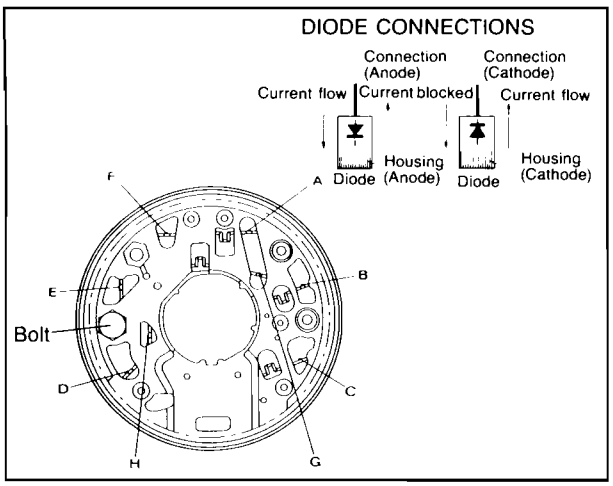


Fig. 5 — Diode plate assembly

Stator

(1) Test the stator windings with a low voltage test lamp (up to 40 volts) for grounding by connecting the test lamp between any stator lead and the frame. The windings are grounded if the lamp lights. This test can also be conducted using an ohmmeter, refer Fig. 6, a low reading indicates grounded windings, the insulation resistance must be greater than 1 Mega Ohm.

(2) Measure the resistance between any two leads of the stator windings, refer Fig. 7. If the readings are not as specified there is an open circuit in the stator windings. Test the remaining stator winding lead in a similar manner. This test can also be conducted using a low voltage test lamp, the lamp will not light if there is an open circuit.

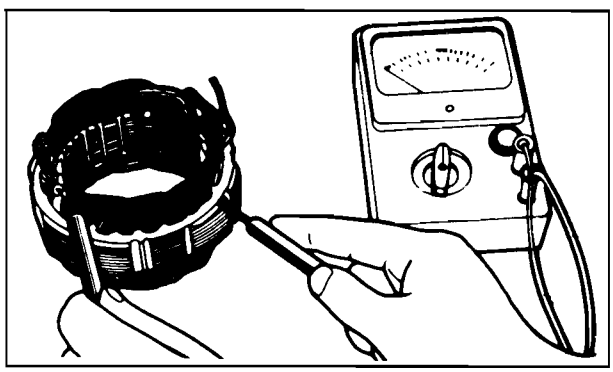


Fig. 6 — Checking stator windings for grounding

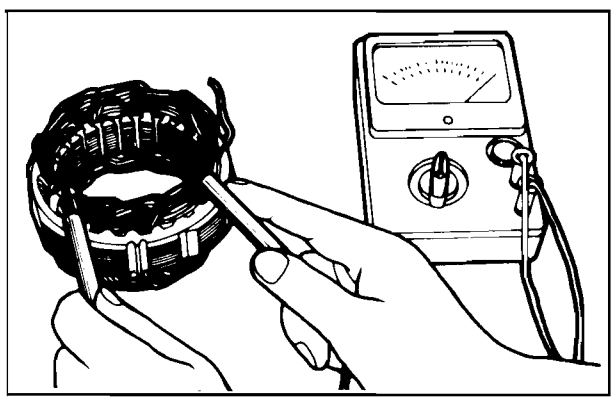


Fig. 7 — Checking stator windings for open circuit

Rotor

(1) Test the rotor windings for a short circuit to ground using a low voltage test lamp or an ohmmeter as shown in Fig. 8 Connect one test lamp or ohmmeter lead to the slipring and the other lead to a pole piece. If the lamp lights or the ohmmeter reading is low, the field windings are grounded.

(2) Connect one lead of an ohmmeter to each slipring to test for an open circuit. The ohmmeter reading will be high if there is an open circuit, refer Fig. 9.

(3) Check the resistance of the field windings while the ohmmeter is connected for test 2. If the reading is not as specified, the windings are shorted.

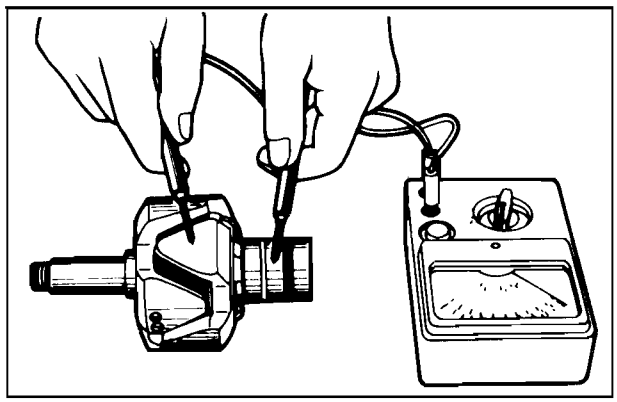


Fig. 8 — Checking rotor for grounding

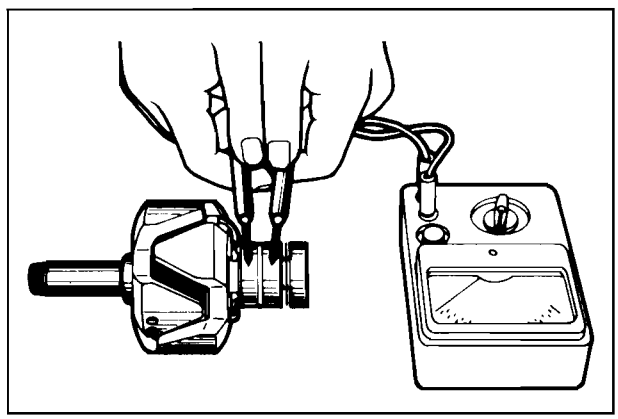


Fig. 9 — Checking rotor for open circuits

Inspection

Check the sliprings and brushes for wear and damage, refer specifications.

(2) Check brush springs for burning and damage.

(3) Check that bearings rotate smoothly and freely.

Assembly

(1) Replace worn bearings with approved replacement bearings only.

(2) Assemble the alternator (by reversal of the disassembly procedure), ensuring that the through bolts are tightened evenly and that the air gap between the rotor and the stator is equal at all points, if not loosen the through bolts again and reposition the end plates to the stator until the gap is equal, then retighten the bolts. Tighten the pulley nut to specifications.

(3) Position the alternator in Bosch adaptor EFLJ54 and set the unit in an approved test bench.

NOTE: While the alternator is under test do not use temporary connections. Ensure that a 12 volt battery is connected in parallel with the alternator to act as a buffer to eliminate voltage peaks which will ruin the diodes.

(4) Connect the test bench voltmeter between "B+" and the alternator housing and connect the ammeter between the "B+" terminal and "B+" lead. Connect a battery load resistor (Bosch tester **EFAW107**) in parallel with the battery.

(5) Start the test bench and increase the speed maintaining a reading between 14.25-14.55 volts by adjusting the load resistor.

(6) After the alternator has been running for approximately 5 minutes, test the output figures according to specifications.

SECTION 4 — IGNITION SYSTEM–CARBURETTOR MODELS

SPECIFICATIONS

Ignition system	
Type	High energy electronic
Current draw-measured at ignition switch to coil wire (at coil)	
Engine starting	2.07 to 2.53A
Engine running	2.25 to 2.70A
Distributor	
Manufacturer	Bosch
Part Number—M.M.A.L.	AW312664
—Bosch	9 230 064 537
Mainshaft endfloat	0.1 mm (max.)
Mainshaft rotation torque	0.3 Nm (max.)
Timing—vacuum hoses disconnected and plugged	
—basic	5° ± 2° B.T.D.C. @ specified idle speed
—idle advance	13° ± 4° B.T.D.C. @ specified idle speed
Centrifugal advance—distributor degrees	
@ distributor r.p.m.	-1° to 1° @ 800
	3.5° to 5.5° @ 1400
	8.5° to 10.5° @ 3000
	8° to 10.5° @ 3500
Vacuum advance—distributor degrees	
@ mm of mercury (Hg)	
—main advance (inner can)	0° to 1.5° @ 90
	2.5° to 4.5° @ 150
	6.5° to 8.5° @ 250
	13° to 15° @ 410
—idle advance (outer can)	0° to 2° @ 220
	2° to 5° @ 340
	2.5° to 5° @ 365
Pick up coil resistance	800 ± 80 ohms
Reluctor to pole piece gap	0.15 mm (min.) must be equal at each pole piece
Spark plugs	
Make	Champion
Type	N9YC
Size	14 mm
Gap	0.7 to 0.8 mm
Coil	
Make	Bosch
Primary resistance	0.8 Ohms ± 10%
Secondary resistance	12.1 kOhms ± 20%
High tension cables	
Resistance—cables shorter than 635 mm	less than 30 kOhms
—cables longer than 635 mm	less than 50 kOhms

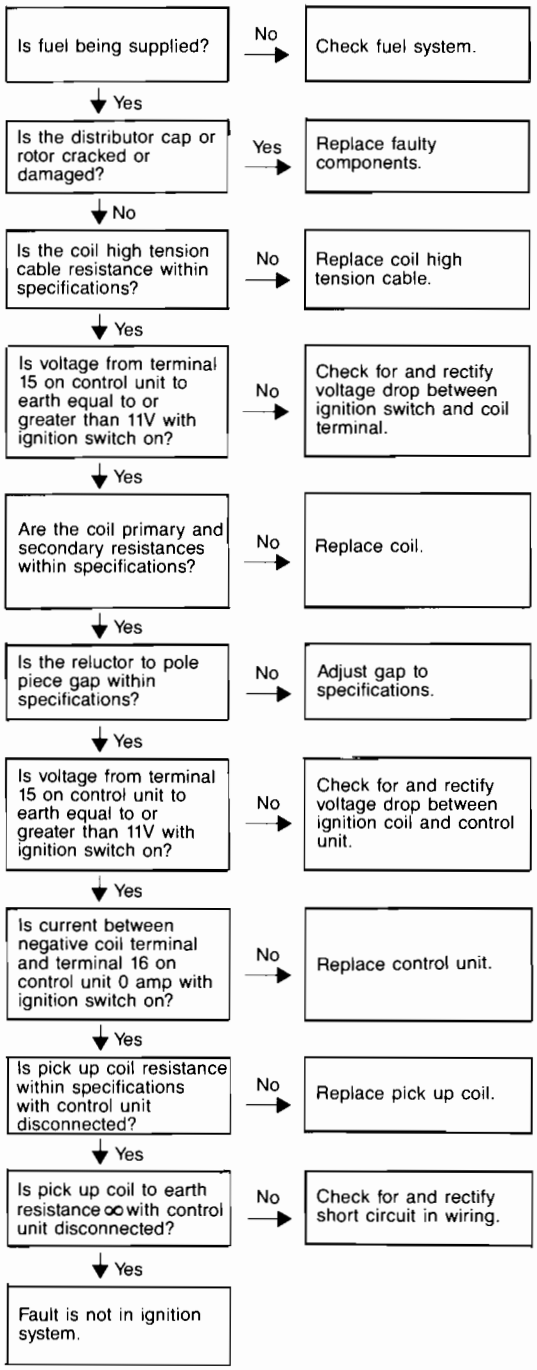
NOTE: The idle speed and ignition timing specifications were correct at time of publication. If these specifications differ from those on the Vehicle Emission Control decal (located on the underside of the engine hood) use the specifications listed on the decal.

SERVICE DIAGNOSIS

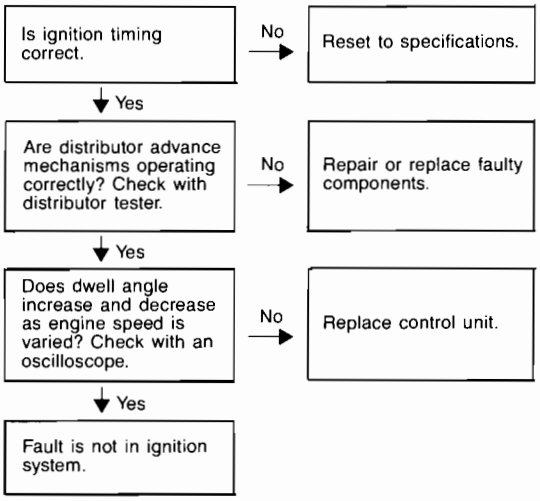
TEST PROCEDURES

(1) The battery must be fully charged before ignition system testing.
(2) Manufacture test leads and only use test equipment as outlined in "IGNITION SYSTEM TESTING".
(3) **DO NOT OPEN CIRCUIT** any high tension cable with ignition switched on or with engine running as the control unit can be damaged.
(4) When testing, leave the ignition switched off until voltage or current check is necessary and switch off immediately check is complete.
(5) AVOID CONTACT WITH PRIMARY AND SECONDARY WIRING WITH IGNITION SYSTEM ENERGIZED. THE HIGH VOLTAGES PRESENT MAY BE HAZARDOUS.

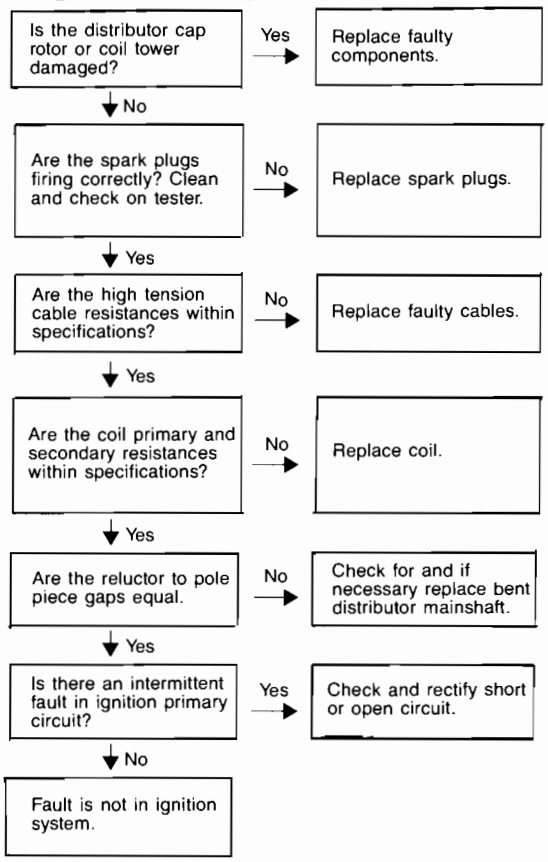
ENGINE WILL NOT START



ENGINE LACKS POWER



ENGINE MISFIRES



GENERAL INFORMATION

The ignition system is a "High Energy" system which features a miniaturized control unit mounted on the distributor.

The distributor incorporates an inductive type pulse generator which signals the control unit to switch the primary current at the ignition coil. The dwell angle is regulated by the control unit and cannot be adjusted. The control unit also incorporates a current control circuit which automatically maintains the optimum current level for all operating conditions.

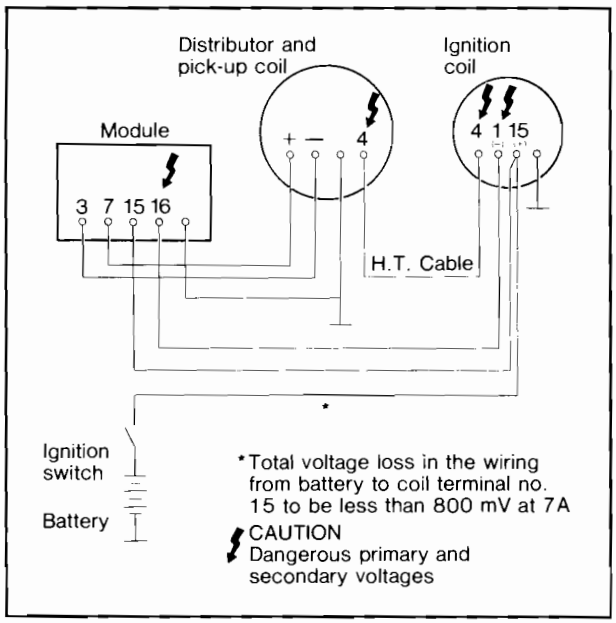


Fig. 1—Schematic diagram of "High Energy" ignition system

SAFETY PROCEDURES

(1) The "High Energy" ignition system produces extremely high voltages. These voltages occur not only in the components but also in the wiring between the components. **SPECIAL CARE** should be taken when working on the entire ignition system.

(2) DO NOT open circuit the high tension leads as damage can occur to the control unit.

(3) When connecting a battery charger, BE SURE the ignition is switched OFF and the battery leads are disconnected.

(4) While carrying out test procedures leave ignition switched OFF until required and switch OFF immediately the test is finished.

IGNITION SYSTEM TESTING

Test Equipment

When conducting electrical checks on the vehicle always use commercial type equipment (timing lights, oscilloscopes, tachometers, battery chargers, etc.). **Older equipment can produce transient voltages which will cause damage to the control unit.** Check with the manufacturer to determine if your test equipment is suitable for use with semi-conductor devices.

To connect test instruments to the primary terminals of the coil, manufacture two connectors as shown in Fig. 2. This will allow the system to be operated normally with safe equipment connections.

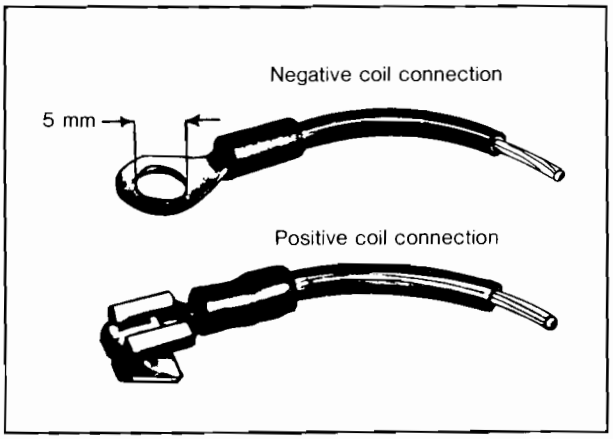


Fig. 2—Ignition coil test leads

Test Procedures

Refer to Service Diagnosis, this section.

DISTRIBUTOR

Removal

(1) Disconnect vacuum hose at the distributor.

(2) Disconnect primary wiring at the distributor.

(3) Remove cables from spark plugs and coil by simultaneously twisting and pulling on the insulator, refer Fig. 3, **Do Not** pull on the cable.

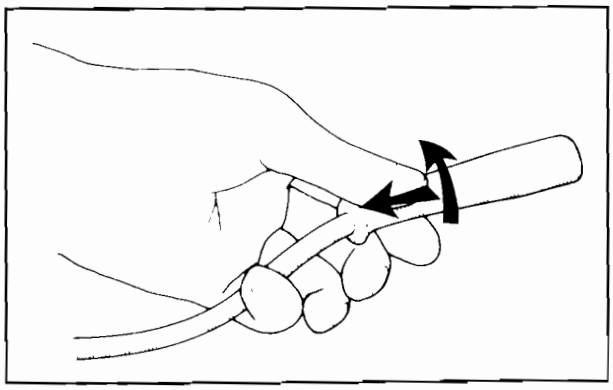


Fig. 3—Removing spark plug cable

(4) Unfasten distributor cap retaining clips and lift off the distributor cap.

(5) Rotate the engine crankshaft until the distributor is pointing toward the No. 1 cylinder firing position, **ensuring that the mark on the crankshaft pulley is in line with the top dead centre mark on the timing plate.**

NOTE: The distributor does not have a No. 1 timing mark on the body. No. 1 firing position is located when the rotor is aligned just right of centre of the insulator block and the reluctor and pole-pieces are aligned, refer Fig. 4.

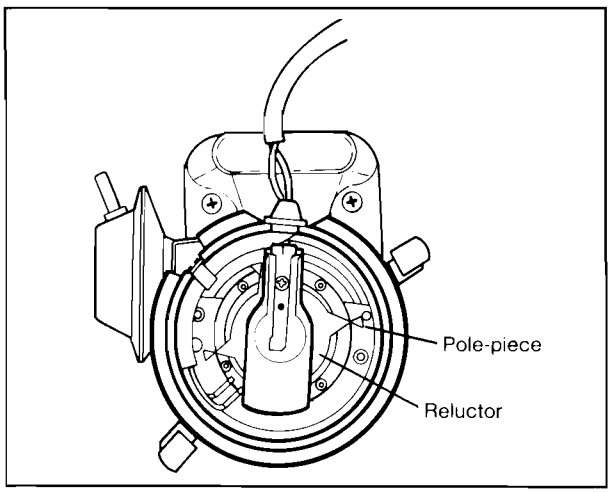


Fig. 4—Distributor T.D.C. No. 1 position

(6) Remove distributor hold down nut.

(7) Carefully lift the distributor from the engine; the shaft will rotate a small amount as the distributor gear is disengaged from the camshaft gear.

NOTE: To retain the engine in the correct timing position, do not rotate crankshaft while distributor is removed.

Installation

(1) Ensure the crankshaft is positioned at T.D.C. with No. 1 piston on compression stroke.

(2) Align the mating mark (line) of the distributor housing with the **protruding** side of the roll pin of the drive gear.

(3) Insert the distributor into the cylinder head with the control unit cover uppermost, refer Fig. 5, and install retaining nut.

NOTE: The rotor should now be aligned just right of centre of the insulator block, refer Fig. 5. If not aligned, remove the distributor, repeat steps 2 and 3 above ensuring the mating marks are aligned.

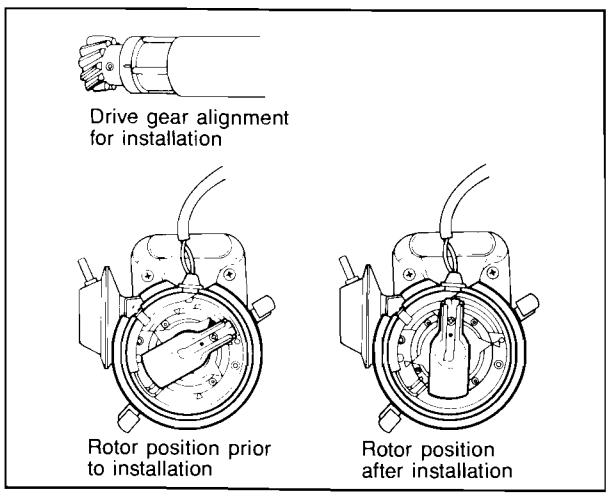


Fig. 5—Distributor installation

(4) Install distributor cap.

(5) Connect high tension leads and distributor primary lead.

(6) Adjust ignition timing to specification.

(7) Connect vacuum hose to the distributor.

NOTE: The outer can is connected to intake manifold vacuum.

Shaft and Bushing Wear Test

(1) Remove the distributor rotor.

(2) Clamp the distributor in a vice equipped with soft jaws and apply only enough pressure to restrict any movement of the distributor, during the test.

(3) Attach a dial indicator to the distributor housing so indicator plunger arm rests against upper mainshaft (not against the reluctor).

(4) Place one end of a wire loop around the upper mainshaft just above the reluctor.

(5) Hook a spring scale in the other end of the wire loop.

NOTE: The wire loop must be down against the top of the reluctor to ensure a straight pull; also be sure that the wire loop does not interfere with the indicator holding bracket.

(6) Apply a 4.5 N pull toward the dial indicator and a 4.5 N pull away from the indicator and read the total movement of the plunger on the indicator dial. If the total indicator plunger movement exceeds 0.15 mm replace the distributor housing or shaft assembly.

Disassembly

(1) Unfasten spring clips holding distributor cap and remove cap from housing.

(2) Remove the distributor rotor.

(3) Loosen the control unit cover screws and remove the cover, refer Fig. 6.

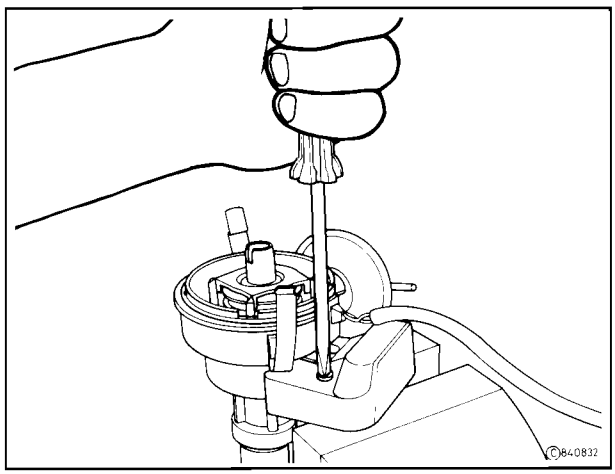


Fig. 6—Removing control unit cover

(4) Remove the two wires on the control unit which connects to the pulse generator, refer Fig. 7.

(5) Carefully prise out the insulator block from the distributor body and remove the control unit and wiring.

(6) Remove the circlip, located on top of the reluctor with suitable circlip pliers, refer Fig. 8

(7) Remove the reluctor with a suitable puller, refer Fig. 9. A bearing puller can be used provided the arms are ground to a suitable shape.

CAUTION: Care must be taken not to burr or mark the reluctor teeth and they must not be filed or otherwise metal finished. Any variation to the reluctor teeth shape will result in an erratic voltage signal to the control unit.

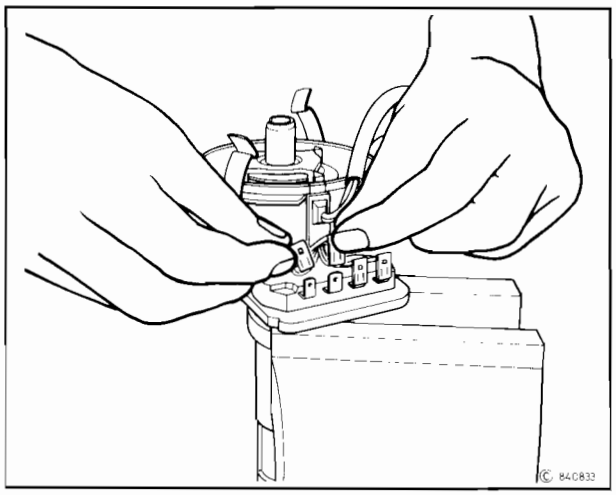


Fig. 7—Removing pulse generator wires

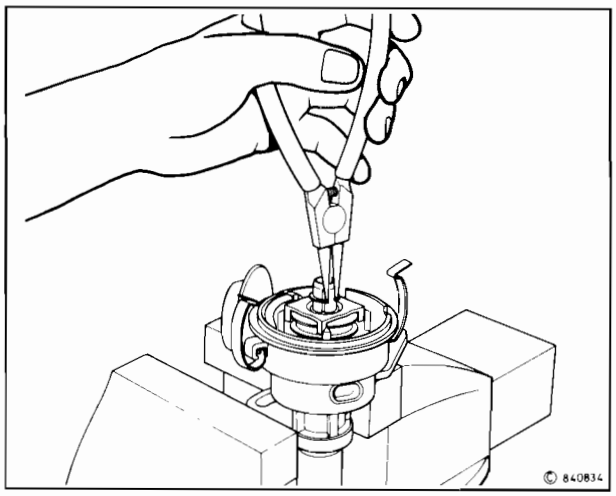


Fig. 8—Removing upper circlip

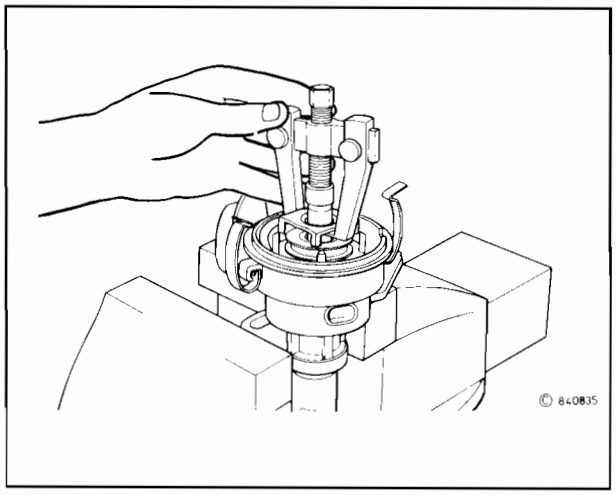


Fig. 9—Removing reluctor

(8) Remove the circlip located on top of the pulse generator with suitable circlip pliers, refer Fig. 10.

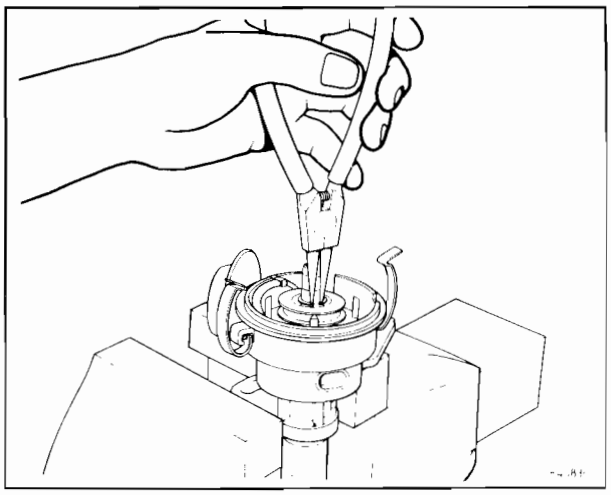


Fig. 10—Removing lower circlip

(9) Remove the vacuum unit holding screws. Pull the unit away from the distributor body and tilt upwards to disengage the vacuum unit pull rod from the pulse generator pin.

(10) Remove the allen head screws from the base plate with a 3 mm allen key, refer Fig. 11. Note in which holes the screws are located, to aid in reassembly.

(11) Prise out the wire clip from the distributor body and lift out pulse generator and base plate assembly.

(12) Mark the relative position of the drive gear and shaft, press out roll pin, remove the gear and spacers.

(13) To separate the mainshaft (if required), remove the automatic advance springs and insert two screwdrivers between the upper mainshaft and driving plate. Lever the upper mainshaft and the circlip within the bore will be disengaged, releasing the shaft.

(14) If leakage past the oil seal is evident, remove and discard the seal.

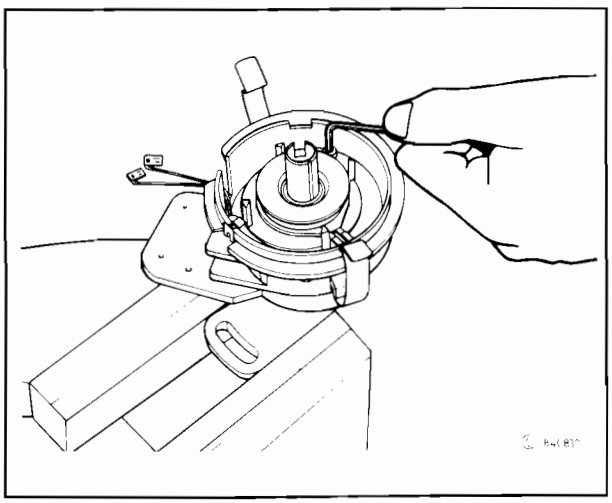
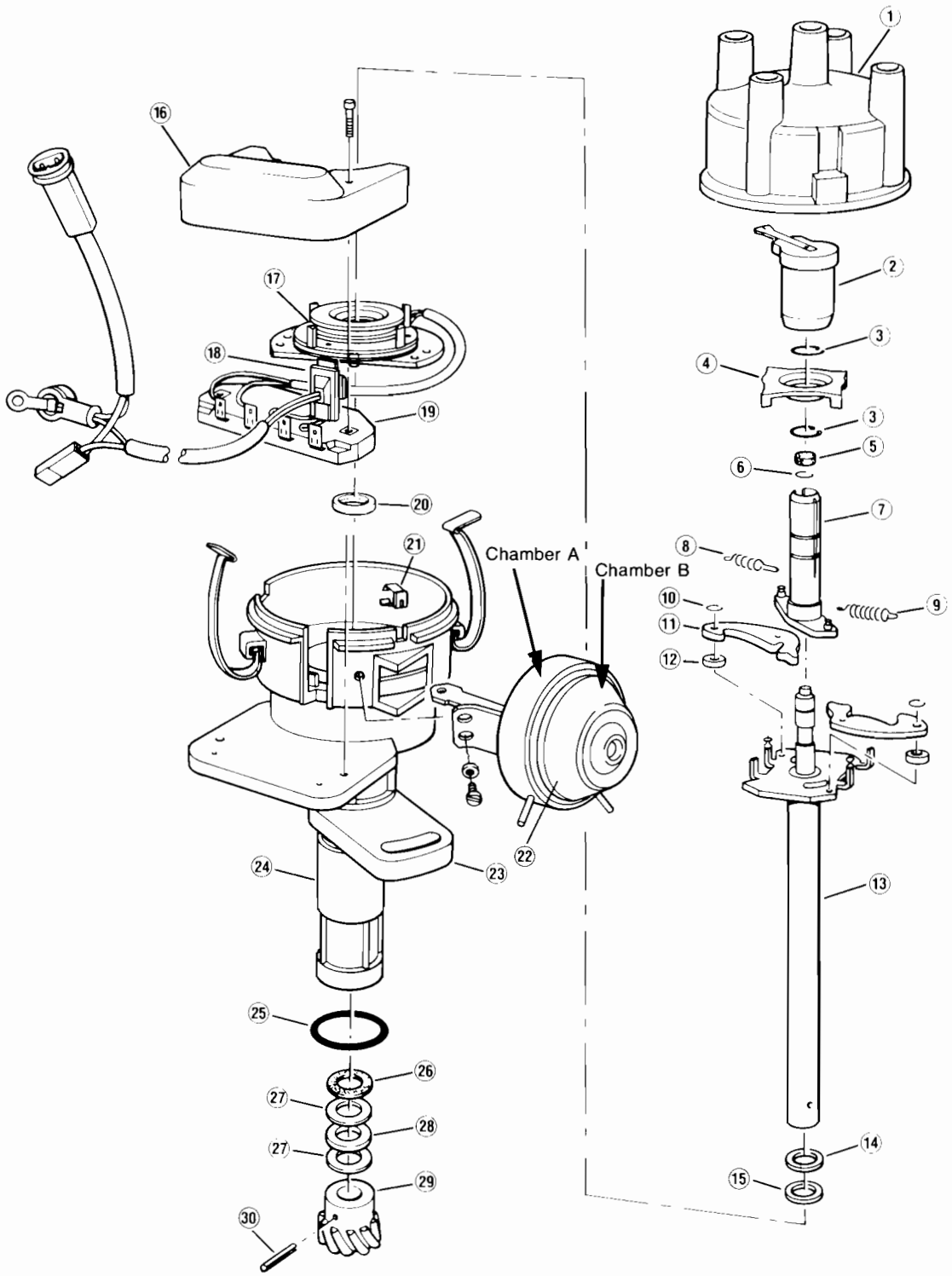


Fig. 11—Removing base plate screws

Inspection

Perform the following inspection and replace any faulty components.



1. Distributor cap
2. Rotor
3. Circlip-large
4. Reluctor
5. Felt pad
6. Circlip-small
7. Upper mainshaft
8. Advance spring No. 1
9. Advance spring No. 2
10. Circlip-small
11. Advance weight
12. Spacer
13. Lower mainshaft
14. Steel thrust washer
15. Fibre washer
16. Control unit cover
17. Pulse generator and pick up coil assembly
18. Insulator block and loom
19. Control unit
20. Oil seal
21. Wiring clip
22. Vacuum advance unit
23. Mounting flange
24. Main body
25. O-ring
26. Fibre washer
27. Thin steel washer
28. Thick steel washer
29. Drive gear
30. Roll pin

Fig. 12—Distributor components

(1) Check bearing surfaces for wear. If necessary replace with bushes which have been soaked in light oil for at least one hour. Use a suitable mandrel to press out and install the bushes.
(2) Check advance springs for distortion.
(3) Check vacuum advance unit for leaks.
(4) Check pick up coil resistance using a suitable ohmmeter.
(5) Inspect pick up coil wiring.
(6) Check distributor cap and rotor for cracks, damage and signs of arcing.

Assembly

Assemble the distributor by reversing disassembly procedure, noting the following:
(1) If replacement bushes are fitted, they should be immersed in light oil (SAE10) for 1 hour prior to assembly.
(2) If required, install a new seal in the distributor body with the lips facing toward the drive gear.
(3) Prior to fitment of the shaft assembly, lubricate the shaft and shaft recess with SAE30 engine oil, oil seal lips with molybdenum type grease.
(4) Lubricate the bore of the upper mainshaft, weight pivots and contact surfaces, upper mainshaft and vacuum link pivot with molybdenum type grease, and install the mainshaft.

NOTE: If a new mainshaft is fitted it is recommended that a new drive gear kit is fitted at the same time.

(5) Fit the drive gear to the shaft maintaining the same relationship as when dis-assembled.
If a new gear is fitted, install the rotor and rotate to the No. 1 timing position (see Distributor Removal, this section). Using the guide holes already in the gear, **fit the gear so that the hole in line with the top of the tooth is toward the mounting flange. Ensure that the specified end float is maintained.**

NOTE: If the gear is installed 180° out of alignment, basic timing will not be achieved.

(6) Fit the roll pin with the protrusion on the side that aligns with the tooth at the top of the gear.

NOTE: Ensure that the roll pin is installed with the opening in the side of the pin at 90° to the axis of the mainshaft.

(7) Before tightening the two allen head screws securing the pulse generator to the distributor body, ensure the pulse generator is centred by inserting two brass feeler gauges of no less than 0.15 mm thickness on opposite points between the reluctor teeth and magnetic pole pieces.
(8) When replacing the control unit ensure that the mounting plate and back of the control unit are clean. Spread silicon grease (supplied in spare parts kit) evenly over the back of the control unit, refer Fig. 13. This ensures good heat transfer to the distributor housing.
(9) Connect wiring to the control unit ensuring that the coil connections to terminals 15(B/W) and 16(B) are correct. The pulse generator connections, terminals 3 and 7, are different sizes to prevent incorrect connection, refer Fig. 14.

NOTE: Reversing coil connections will result in damage to the control unit.

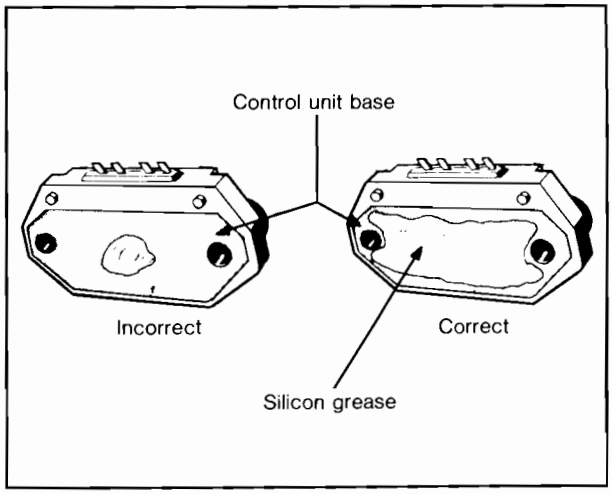


Fig. 13—Application of silicon heat sink compound

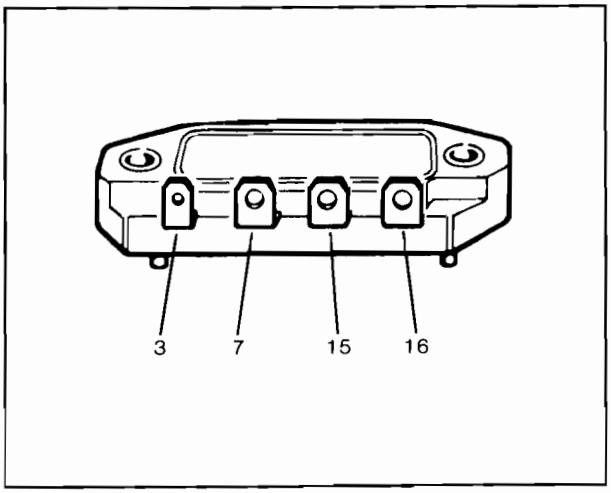


Fig. 14—Control unit terminals

(10) Install the control unit cover and screws, before tightening the cover screws, check that the unit locating pins are correctly engaged and the connecting wires are not clamped under the cover. Tighten cover screws to 0.8 Nm. The earth connection to the control unit and coil rely on the correct tightening of the cover screws.
(11) Apply vacuum to vacuum unit and rotate drive shaft. The reluctor teeth should not make contact with the pole pieces. If contact occurs the pulse generator is not correctly centred. If contact occurs on one side of the reluctor only, the distributor shaft is bent and requires replacement.
(12) When the distributor is assembled, check for the correct rotation torque and end float, refer Specifications.

CHECKING DISTRIBUTOR ADVANCE CURVES

Centrifugal Advance Curve

Carefully mount distributor assembly (less cap and rotor) in a reliable stroboscope-type distributor tester so that the gear is not damaged. It is important that the appropriate adapter for checking electronic type

distributors is connected to the distributor stand and that the instructions for its usage are followed. After this is done proceed with test as follows:

(1) Adjust the tester speed control to operate distributor at a slow speed (below point at which centrifugal advance starts to operate), and align the "O" of the tester degree ring with any of the arrow flashes.

(2) Adjust the tester speed control to operate distributor at speeds called for in Specifications, and observe arrow flashes opposite tester degree ring to determine degrees of advance.

(3) If the centrifugal advance curve does not meet Specifications, adjust spring tension by bending the spring mounting tabs in the required direction.

Bending the spring tab towards the distributor cam decreases the tension, whilst bending away increases the spring tension. The lighter spring controls the initial advance and the combination of both springs controls the advance at the higher speeds.

Vacuum Advance Curve

With the distributor mounted in a distributor tester and with the vacuum unit attached to the distributor, proceed as follows:

(1) Place thumb over end of vacuum pump hose and adjust the regulator control knob to give a reading of 450 mm of vacuum with hose closed off to ensure tester hose does not leak.

(2) Attach the tester vacuum pump hose to each vacuum chamber in turn and adjust the pump to give a reading of 450 mm of vacuum. Any loss of vacuum indicates that the vacuum diaphragm is leaking and that the unit must be replaced.

(3) While performing the leak test check that the pulse generator and pick up coil base plate operates smoothly in both directions and responds instantly when vacuum is applied. If any binding occurs the distributor should be disassembled, cleaned and checked.

(4) Connect the tester vacuum hose to chamber A (inner can), refer Fig. 12, and leave chamber B open to atmosphere.

(5) Set tester speed to 1200 rpm and align "0" mark on the tester degree ring with any of the arrow flashes.

(6) Adjust vacuum pump to supply the vacuum necessary to check main advance operation, refer Specifications.

(7) Connect the tester hose to chamber B (outer can) and leave chamber A open to atmosphere.

(8) Adjust vacuum pump to supply vacuum necessary to check idle advance operation.

(9) If advance figures are not within specifications, the vacuum unit must be replaced.

IGNITION TIMING

(1) With the ignition switched OFF connect a suitable timing light to No. 1 cylinder and an engine tachometer.

NOTE:

(i) Do not disconnect high tension leads with the engine running as damaged to the ignition control unit can occur.

(ii) Do not puncture cables, boots or nipples with test probes. Always use proper adaptors. Puncturing the spark plug cables with a probe will damage the cables. The probe can separate the conductor and cause high resistance. In addition breaking the rubber insulation may permit secondary current to arc to ground.

(iii) Do not connect timing light primary lead to the alternator output terminal as alternator damage will occur.

(2) Start the engine and run until normal operating temperature is reached.

(3) Ensure that all lights and accessories are off and the transaxle is in neutral.

(4) Disconnect and plug the vacuum hose to outer can of the vacuum unit.

NOTE: To check basic timing it is essential that step 4 is performed.

(5) Adjust engine idle speed to specifications.

(6) Aim the timing light at the timing plate, refer Fig. 15. If the light flash occurs when timing mark on crank shaft pulley is located ahead of specified degree mark, refer Specifications, in the direction of engine rotation, timing is advanced. If flash occurs when the pulley timing mark is past the specified degree mark in the direction of engine rotation, timing is retarded.

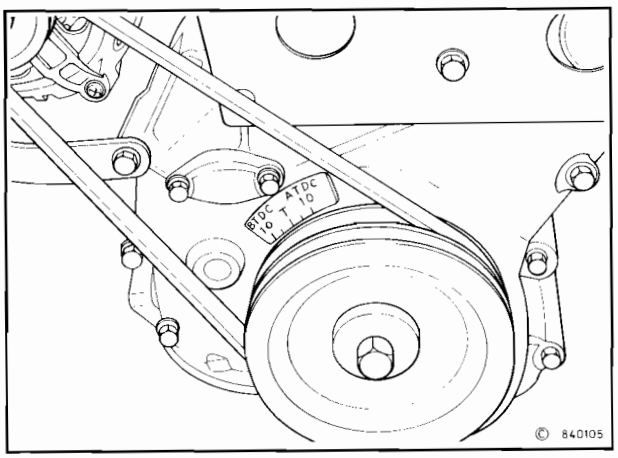


Fig. 15—Timing plate location

(7) If adjustment is necessary loosen the distributor mounting nut and rotate the distributor to obtain the correct basic timing, refer Fig. 16.

(8) Tighten the mounting nut and check that the timing has not altered.

(9) Reconnect the vacuum hose.

(10) Adjust idle speed to specifications.

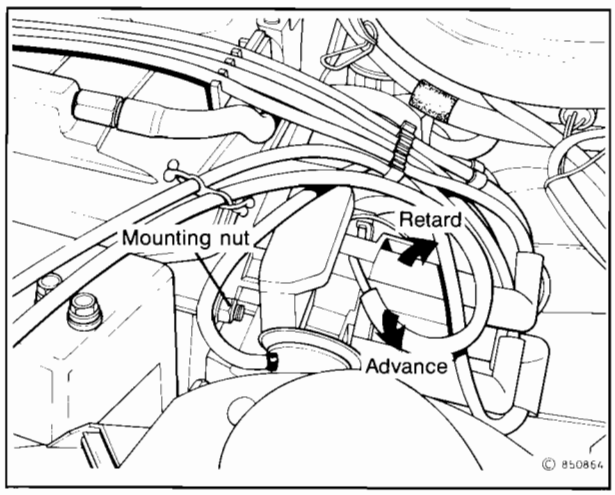


Fig. 16—Adjusting ignition timing

(11) Check that idle advance is as specified. If it is not as specified remove the distributor test, and replace faulty components.

NOTE: Do not attempt to set ignition timing by following step 11, this is a CHECK ONLY. Any deviation from the procedure outlined above may result in incorrect basic timing and subsequent catalyst overheating.

IGNITION COIL

The ignition coil is specially designed to ensure compatibility with the miniaturized control unit and to handle the high currents required in the "High Energy" system.

Coil Testing

NOTE: If coil replacement is necessary a coil which conforms exactly to manufacturers specifications must be used.

(1) Inspect the coil for arcing. Replace the coil if the coil tower is burnt or there is evidence of carbon tracking or arcing at the tower or the cable nipple. In these circumstances the coil high tension lead should also be replaced since arcing will carbonize the nipple which could result in further coil failures.

(2) Check coil primary resistance by connecting an Ohmmeter between the positive and negative coil terminals, refer to Specifications for correct reading.

(3) Check coil secondary resistance by connecting an Ohmmeter between the negative terminal and the high tension tower refer to Specifications for correct reading.

HIGH TENSION CABLES

Inspection

(1) Check the high tension cable connections for good contact at the coil, distributor cap towers and at the spark plugs. Terminals should be fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil cap towers and spark plug cover should fit tight around spark plug insulators. Cable connections that are loose will corrode and increase the resistance and permit water to enter the towers causing ignition problems. **To maintain proper sealing between the towers and nipples, cable and nipple assemblies should not be removed from the distributor towers unless nipples are damaged or cable testing indicates high resistance or broken insulation.**

(2) Clean high tension cables using a cloth moistened with a suitable non-flammable solvent.

(3) Check cables for brittle or cracked insulation.

Testing

Use an Ohmmeter to check cables for open circuits, loose terminals or high resistance as follows:

(1) Remove cable from spark plugs by simultaneously twisting and pulling on the insulator, refer Fig. 17.

(2) Remove the cable from the coil tower by twisting and pulling on the nipple.

(3) Lift distributor cap from distributor with cables intact. **Do not remove cables from cap.**

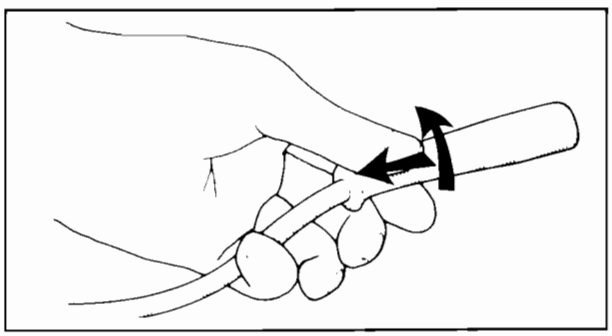


Fig. 17—Removing spark plug cable

(4) Connect the Ohmmeter between the cable terminal and the corresponding electrode inside the cap, making sure Ohmmeter probes are in good contact. If resistance is more than 30,000 Ohms, remove cable at cap tower and check the cable resistance. If resistance is more than 30,000 Ohms on cables under 635 mm long or 50,000 Ohms on cables over 635 mm long, replace cable assembly. Test all spark plug cables in same manner.

Replacement

When installing new cable assemblies, install new high tension cable and nipple assembly over cap or coil tower, entering the terminal into the tower, push lightly, then pinch the large diameter of nipple to release trapped air between the nipple and tower. **Continue pushing on the cable and nipple until cables are properly seated in the cap towers. Use the same procedure to install cable in coil tower. Wipe the spark plug insulator clean before reinstalling cable and cover.**

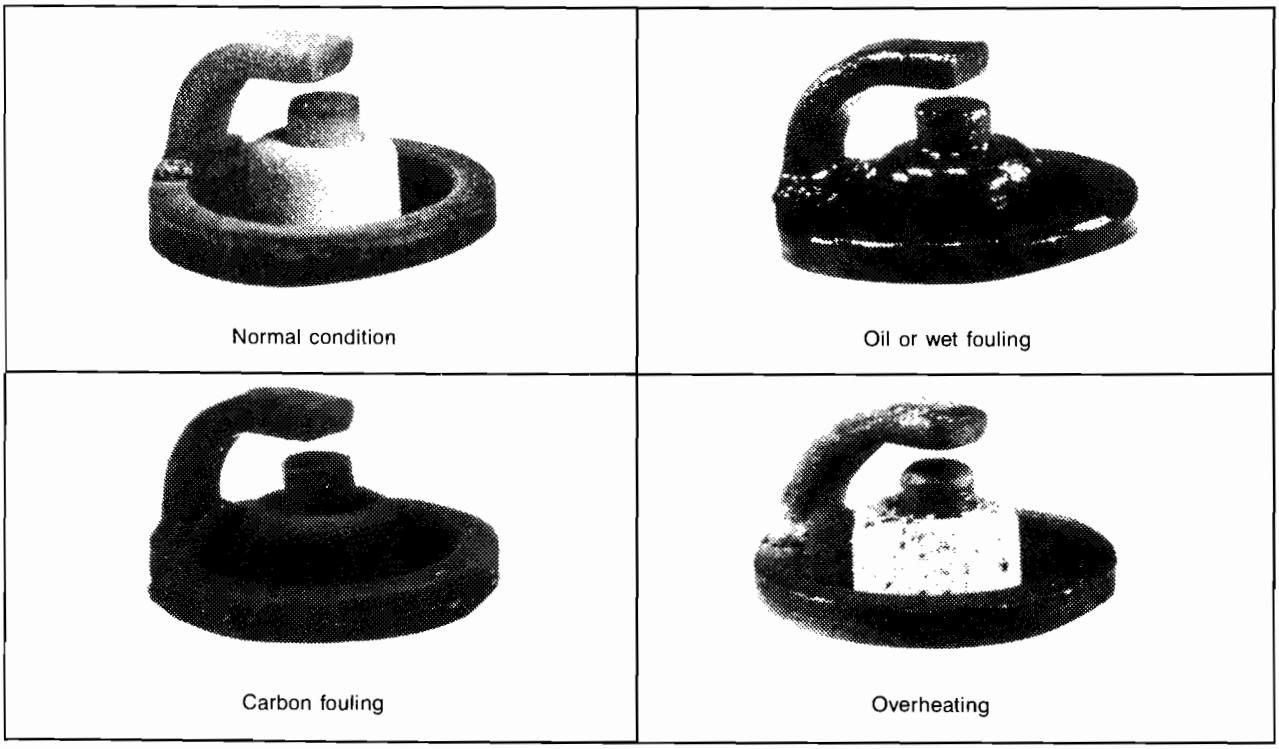


Fig. 18—Spark plug condition

SPARK PLUGS

Spark plugs appearance, refer Fig. 18, or condition can reflect a wide variety of engine conditions as follows:

Normal Condition

Under normal conditions deposits will be light tan or grey in colour and electrode erosion will be slight. The gap should not increase more than 0.03 mm every 1600 km.

A plug in this condition may be cleaned, gapped and reinstalled.

Carbon Fouling

This dry, black deposit is fuel carbon and is the result of an over rich air-fuel mixture. This condition can be caused by a sticking or incorrectly adjusted choke, clogged air cleaner element, incorrect idle mixture, retarded ignition timing, low ignition voltage or continuous low speed operation.

Oil or wet fouling

This condition usually indicates that the piston rings are worn and in need of replacement. The use of a hotter plug may temporarily relieve oil fouling but this practice may lead to engine damage.

NOTE: Oil fouling may occur when "running in" a new or overhauled engine before normal oil control is achieved. In this case the plugs may be cleaned, gapped and reinstalled.

Overheating

A plug that has overheated is evidenced by a blistered white insulator and an excessively eroded electrode. Possible causes of spark plug overheating include over advanced ignition timing, cooling system blockages, detonation (due to incorrect fuel), incorrectly tightened spark plug and incorrect heat range plug fitted.

Lead Fouling (not shown)

Lead fouling appears as a yellowish-brown deposit on the insulator. The deposit is a result of using leaded petrol. Frequent cleaning of the plug or using a hotter plug may result in an improvement if lead fouling is a persistent problem.

Cleaning and Regapping

(1) Clean spark plugs in a abrasive type cleaner, taking careful note of manufacturers instructions.

(2) Remove carbon and other deposits from the threads with a stiff wire brush.

(3) Dress the centre electrode, with a small file to a flat surface.

(4) Adjust the spark plug gap to specifications by using a pin or wire, type feeler gauge and bending the side (ground) electrode.

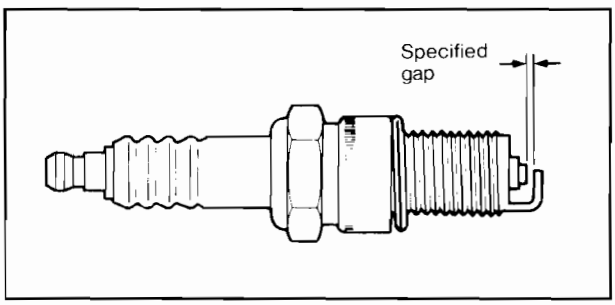


Fig. 19—Spark plug gap

(5) Install spark plug and tighten to 20-28 Nm.

POWER TRANSISTOR

The power transistor may be checked as follows:

(1) Connect a known good ignition coil to the power transistor as shown, refer Fig. 20.

(2) Connect the leads to an analogue Ohmmeter (containing a 3 volt battery) across terminals 1 and 2 (+ve to 2) of the power transistor.

(3) Connect and disconnect the negative lead of the Ohmmeter to terminal 1 of the power transistor. The ignition coil should emit a spark.

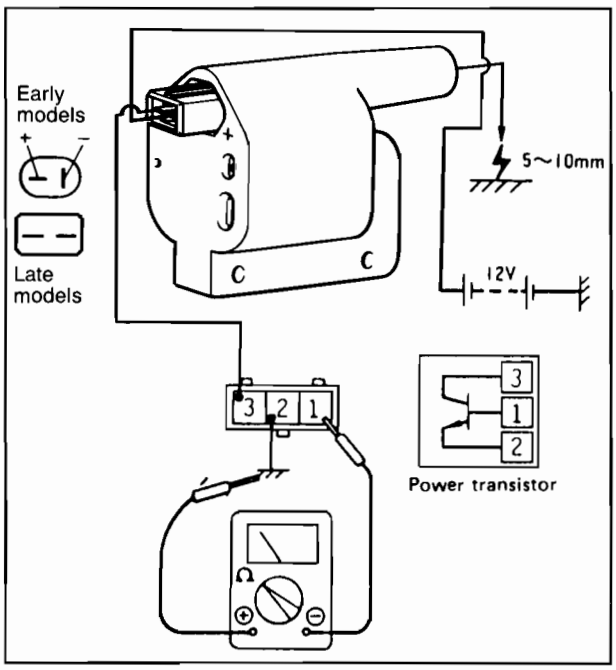


Fig. 20 — Checking power transistor

NOTE: Do not use a Ohmmeter which uses a battery of greater capacity than 3 volts. The above test can be performed using a 3 volt battery with the battery positive connected to terminal 1 of the power transistor.

(4) Replace the power transistor if faulty.

SECTION 5 — IGNITION SYSTEM — ECI-MULTI 4G54

SPECIFICATIONS

Distributor	
Type	Bosch electronic spark timing
End play	0.3 ± 0.2 mm
Rotational torque	0.3 Nm or less
Ignition Coil	
Type	Bosch resin mould
Primary resistance	0.8 Ohms ± 10%
Secondary resistance	12.1 kOhms ± 20%
Spark Plugs	
Make	Champion
Type	N9YC
Size	14 mm
Gap	0.7 to 0.8 mm
Torque	20 to 28 Nm
Ignition timing	5° ± 1/2° BTDC (electronic spark timing cut))
	13° ± 2° BTDC (with electronic spark timing)
Idle speed — @5°	800 ± 50 rpm
— @15°	800 rpm
A/C idle up	950 rpm
High tension cables	
Resistance — Cables shorter than 635 mm	Less than 30 kOhms
— Cables longer than 635 mm	Less than 50 kOhms

NOTE: The idle speed and ignition timing specifications were correct at time of publication. If these specifications differ from those on the Vehicle Emission Control Decal (located on the underside of the engine hood) use the specifications listed on the decal.

SPECIAL TOOLS

Multi-use-tester (M.U.T.)	MB991502
ROM Pack	MRP — A
Ohmmeter (analogue)	
Ohmmeter (digital)	
Tachometer	
Timing Light	

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SERVICE DIAGNOSIS — ECI-MULTI 4G54

Condition	Possible Cause	Corrective Action
ENGINE WILL NOT START OR HARD TO START (CRANKS OK)	Malfunction of the ignition control system.	Check the system; if there is a problem check its component parts.
	Incorrect ignition timing.	Adjust ignition timing to specifications.
	Distributor cap and rotor cracked or damaged.	Replace faulty components.
	Coil high tension cable resistance not to specification.	Replace faulty high tension cables.
	Coil primary and secondary resistance are not to specification.	Replace coil.
	Spark plugs faulty.	Replace spark plugs.
	Power transistor faulty	Replace power transistor.
ROUGH IDLE OR ENGINE STALLS	Incorrect ignition timing.	Adjust ignition timing to specifications.
	Incorrect high tension cable location or resistance.	Check high tension cable routing and check resistance is within specification.
	Spark plugs faulty.	Replace spark plugs.
ENGINE HESITATES OR POOR ACCELERATION	Incorrect ignition timing.	Adjust ignition timing to specification.
	Earth leakage in high tension cables.	Check cable wiring, repair or replace cables.

IGNITION TIMING INSPECTION AND ADJUSTMENT

Prior to checking ignition timing ensure:
— engine is at operating temperature
— lamps and all accessories are OFF
— transmission is in Neutral or Park
— steering wheel is in the straight ahead position
— the handbrake is fully applied.

(1) Attach an engine tachometer and check the engine idle speed is approximately 800 ± 50 r.p.m.

(2) Switch engine off and connect the spark advance cut terminal to earth with a suitable jumper lead, refer Fig. 1.

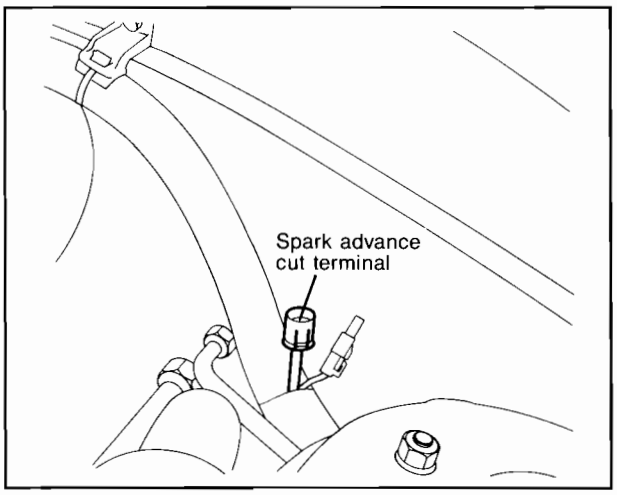


Fig. 1—Spark advance cut terminal

(3) Connect a suitable timing light to No. 1 cylinder and start the engine.

NOTE:

(A) Do not disconnect high tension leads with the engine running as damage to the ignition control unit can occur.

(B) Do not puncture cables, boots or nipples with test probes. Always use proper adaptors. Puncturing the spark plug cables with a probe will damage the cables. The probe can separate the conductor and cause high resistance. In addition breaking the rubber insulation may permit secondary current to arc to ground.

(C) Do not connect timing light primary lead to the alternator output terminal as alternator damage will occur.

(4) Aim the timing light at the timing plate, refer Fig. 2, and check that ignition timing is 5° ± ½° BTDC.

(5) If timing is incorrect loosen the distributor mounting nut and rotate distributor body so that ignition timing is to specification.

(6) Disconnect the earthed jumper lead from spark advance cut terminal, the ignition timing should increase to 15° BTDC.

(7) Re-install blanking plug in spark advance cut terminal.

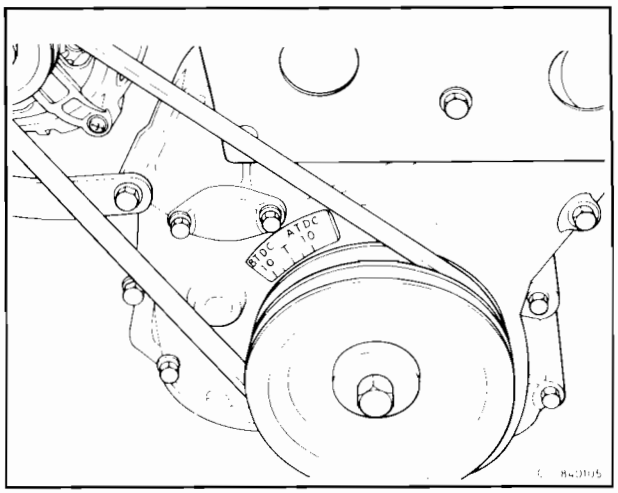


Fig. 2—Timing plate location

DISTRIBUTOR

Removal

(1) Uncouple the distributor connector.

(2) Remove high tension leads from spark plugs and coil.

CAUTION: The correct method of detaching this type of lead from the spark plug, is to grasp the rubber insulator at the spark plug end and remove with a combined twisting and pulling motion, refer Fig. 10.

(3) Unfasten the retaining clips and remove the distributor cap.

(4) Rotate the engine crankshaft until the distributor rotor is pointing towards the No. 1 cylinder firing position, ensuring that the crankshaft pulley timing mark is in line with the top dead centre (TDC) mark on the timing plate.

NOTE: No. 1 firing position is when the rotor arm mark is aligned with the raised section on the top of the electrical connector, refer Fig. 3.

(5) Remove distributor clamping nut.

(6) Carefully remove the distributor from the engine; the shaft will rotate a small amount as the distributor gear is disengaged from the camshaft gear.

NOTE: To retain the engine in the correct timing position, DO NOT rotate the crankshaft while the distributor is removed.

Disassembly

(1) Remove the distributor rotor.

(2) Remove the trigger disc retaining clip.

(3) Using a suitable puller or levers, carefully remove the trigger disc and retaining pin.

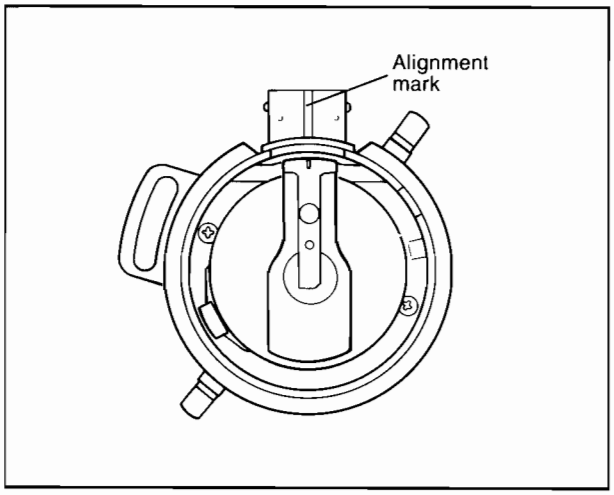


Fig. 3—No. 1 firing position

CAUTION: Care should be taken when removing the trigger disc as it can be easily bent during disassembly. It may be necessary to replace the trigger disc if it is bent on removal.

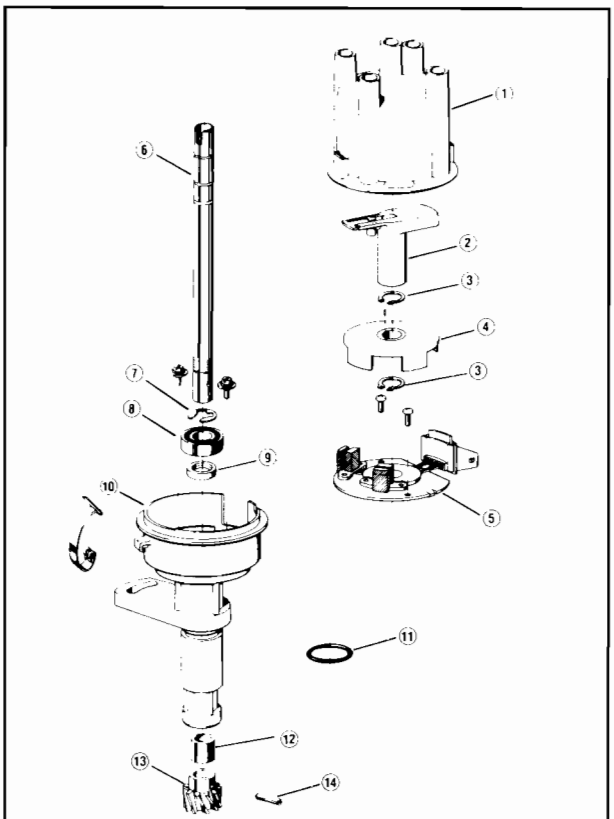


Fig. 4—ECI-Multi distributor

(4) Remove the hall generator retaining clip.
(5) Remove the hall generator retaining screws.
(6) Remove the hall generator assembly.
(7) Remove the main shaft retaining clip and main shaft bearing retaining screws.
(8) Remove the drive gear retaining pin.
(9) Remove the drive gear.
(10) Remove the main shaft.
(11) Remove main shaft bearing.

Inspection

Check cap for cracks.
Check cap and rotor for wear or damage.
Inspect drive gear for wear or damage.
Replace any defective components.

Assembly

Install by reversing disassembly procedure

Installation

(1) Ensure the crankshaft is positioned at TDC with No. 1 piston on compression stroke.
(2) Align the mating mark (line) of the distributor housing with the **protruding** side of the drive gear roll pin, refer Fig. 5.
(3) Insert the distributor into the cylinder head so as the retaining stud enters the retaining flange slot and is positioned near the lower end of the slot.
(4) The rotor arm mark should be aligned with or near to the raised section on the connector top, refer Fig. 5.

NOTE: If not aligned, remove the distributor, repeat steps 2 and 3 above, ensuring the mating marks are aligned.

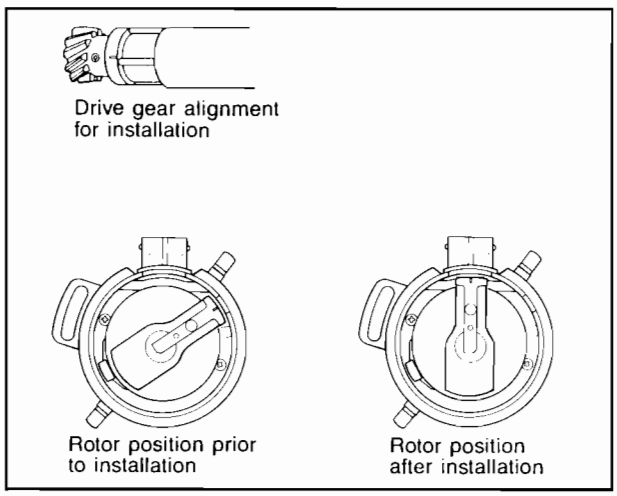


Fig. 5—Distribution installation

(5) Install retaining nut.
(6) Install distributor cap.
(7) Connect high tension leads and distributor connector.
(8) Adjust ignition timing to specification, as outlined this section.

Ignition Coil

(1) Check coil primary resistance by connecting an Ohmmeter between the positive and negative coil terminals.

(2) Check coil secondary resistance by connecting an Ohmmeter between the negative terminal and the high tension tower.

Requirement—Primary 0.8 Ohm ± 10%
—Secondary 12.1 kOhm ± 15%

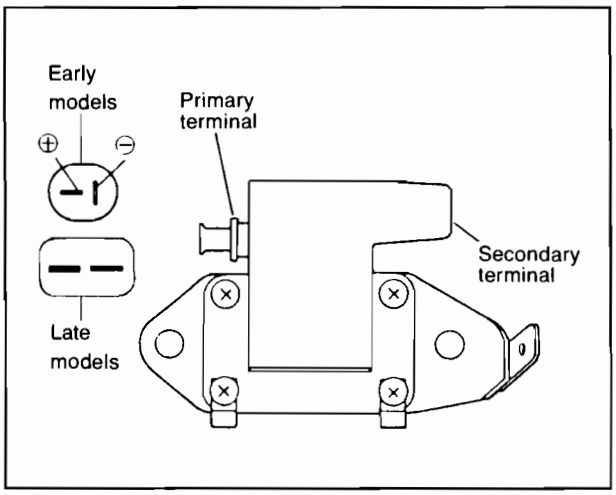


Fig. 6—Ignition coil terminals

NOTE: The primary connector at the coil has a locking tab on the underside which is concealed by the rubber boot. To uncouple, squeeze the rubber boot between the thumb and forefinger (refer Fig. 7), paying particular attention to releasing the locking tab in direction shown.

Attempting to uncouple the connector without fully unlatching the lock tab will result in damage to the connector and/or coil.

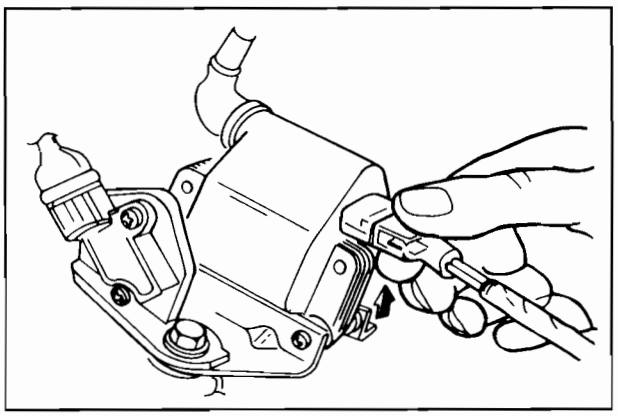


Fig. 7—Uncoupling coil primary connector

SPARK PLUGS

Spark plugs appearance, refer Fig. 8, or condition can reflect a wide variety of engine conditions as follows:

Normal Condition

Under normal conditions deposits will be light tan or grey in colour and electrode erosion will be slight. The gap should not increase more than 0.03 mm every 1600 km

A plug in this condition may be cleaned, gapped and reinstalled.

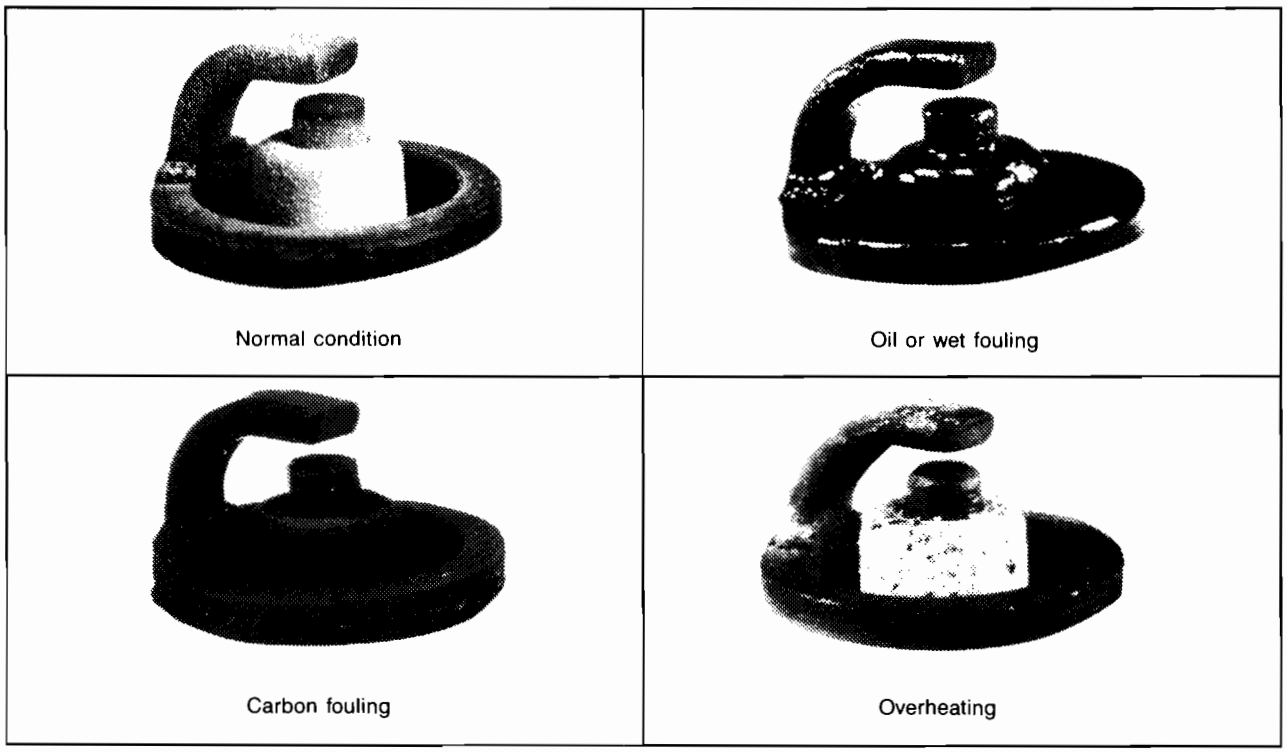


Fig. 8—Spark plug condition

Carbon Fouling

This dry, black deposit is fuel carbon and is the result of an over rich air-fuel mixture. This condition can be caused by a sticking or incorrectly adjusted choke, clogged air cleaner element, incorrect idle mixture, retarded ignition timing, low ignition voltage or continuous low speed operation.

Oil or wet fouling

This condition usually indicates that the piston rings are worn and in need of replacement. The use of a hotter plug may temporarily relieve oil fouling but this practice may lead to engine damage.

NOTE: Oil fouling may occur when "running in" a new or overhauled engine before normal oil control is achieved. In this case the plugs may be cleaned, gapped and reinstalled.

Overheating

A plug that has overheated is evidenced by a blistered white insulator and an excessively eroded electrode. Possible causes of spark plug overheating include over advanced ignition timing, cooling system blockages, detonation (due to incorrect fuel), incorrectly tightened spark plug and incorrect heat range plug fitted.

Lead Fouling (not shown)

Lead fouling appears as a yellowish-brown deposit on the insulator. The deposit is a result of using leaded petrol. Frequent cleaning of the plug or using a hotter plug may result in an improvement if lead fouling is a persistent problem.

Cleaning and Regapping

(1) Clean spark plugs in a abrasive type cleaner, taking careful note of manufacturers instructions.
(2) Remove carbon and other deposits from the threads with a stiff wire brush.
(3) Dress the centre electrode, with a small file to a flat surface.
(4) Adjust the spark plug gap to specifications by using a pin or wire, type feeler gauge and bending the side (ground) electrode.

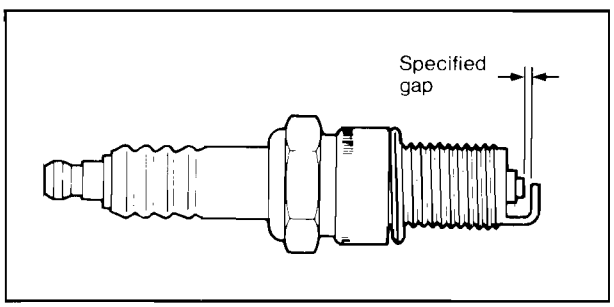


Fig. 9—Spark plug gap

(5) Install spark plug and tighten to 20-28 Nm.

HIGH TENSION CABLES

Inspection

(1) Check the high tension cable connections for good contact at the coil, distributor cap towers and at the spark plugs. Terminals should be fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil cap towers and spark plug cover should fit tight around spark plug insulators. Cable connections that are loose will corrode and increase the resistance and permit water to enter the towers causing ignition problems. **To maintain proper sealing between the towers and nipples, cable and nipple assemblies should not be removed from the distributor towers unless nipples are damaged or cable testing indicates high resistance or broken insulation.**
(2) Clean high tension cables using a cloth moistened with a suitable non-flammable solvent.
(3) Check cables for brittle or cracked insulation.

Testing

Use an Ohmmeter to check cables for open circuits, loose terminals or high resistance as follows:
(1) Remove cable from spark plugs by simultaneously twisting and pulling on the insulator, refer Fig. 10.
(2) Remove the cable from the coil tower by twisting and pulling on the nipple.
(3) Lift distributor cap from distributor with cables intact. **Do not remove cables from cap.**

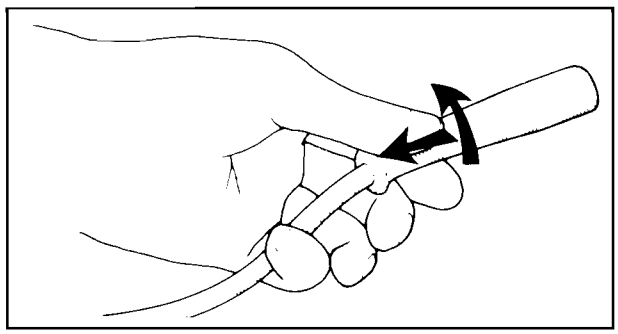


Fig. 10—Removing spark plug cable

(4) Connect the Ohmmeter between the cable terminal and the corresponding electrode inside the cap, making sure Ohmmeter probes are in good contact. If resistance is more than 30,000 Ohms, remove cable at cap tower and check the cable resistance. If resistance is more than 30,000 Ohms on cables under 635 mm long or 50,000 Ohms on cables over 635 mm long, replace cable assembly. Test all spark plug cables in same manner.

Replacement

When installing new cable assemblies, install new high tension cable and nipple assembly over cap or coil tower, entering the terminal into the tower, push lightly, then pinch the large diameter of nipple to release trapped air between the nipple and tower. **Continue pushing on the cable and nipple until cables are properly seated in the cap towers. Use the same procedure to install cable in coil tower. Wipe the spark plug insulator clean before reinstalling cable and cover.**

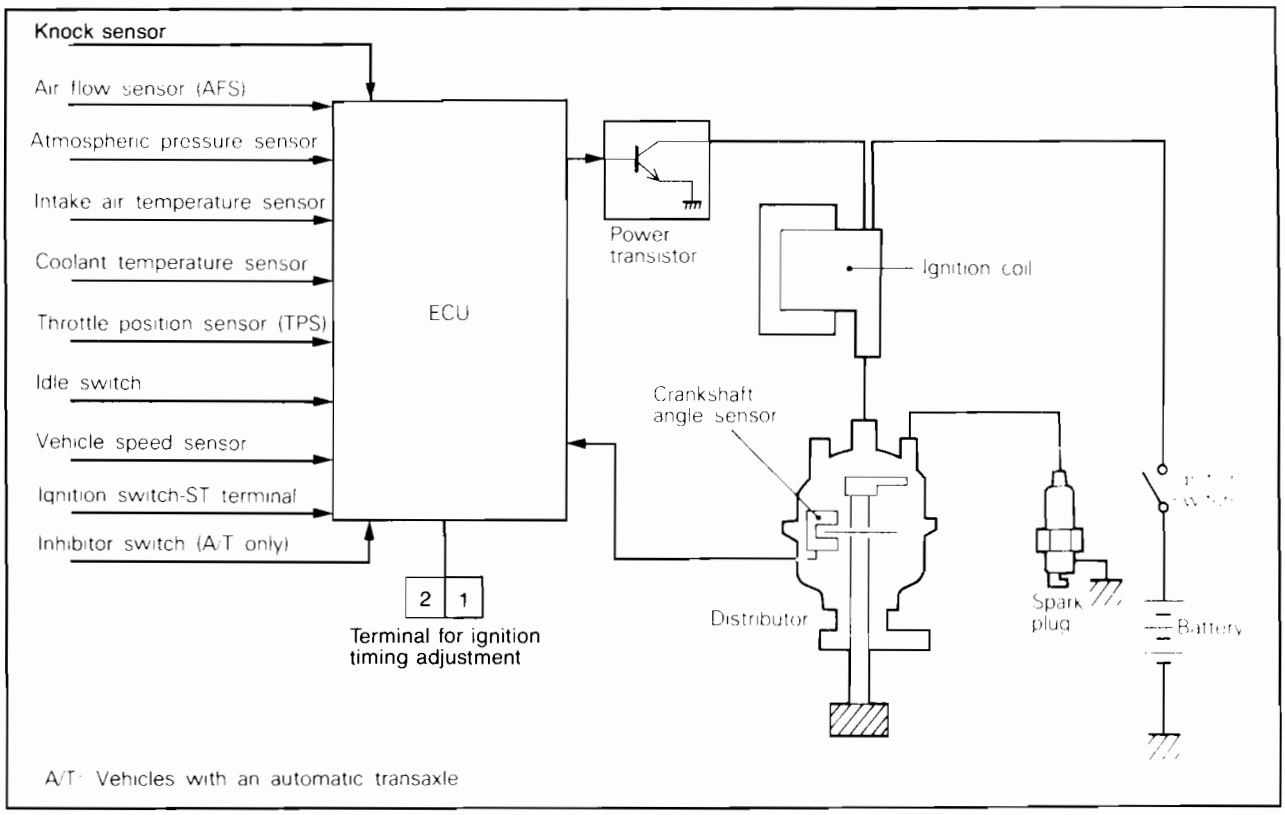


Fig. 11—Ignition timing control

IGNITION TIMING CONTROL SYSTEM

The system controls the ignition timing by making the ignition coils primary current intermittent, by ON/OFF control of the power transistor.

During engine cranking, there is synchronisation to the crankshaft angle sensor signals, resulting in a fixed time of 5° BTDC.

At other times the ECU determines the required spark advance using data in the ROM, engine speed and inlet air flow data. This data is then further advanced depending on coolant temperature or atmospheric pressure (whichever is the largest value). Also, the influence of battery voltage on the dwell time of the ignition coil is compensated for.

Timing adjustment — when the ignition timing adjustment terminal is grounded, there is synchronisation with the crankshaft angle sensors trailing edge signal, resulting in the fixed ignition timing (5° BTDC). In this condition the basic ignition timing is adjusted.

POWER TRANSISTOR

The power transistor may be checked as follows:

(1) Connect a known good ignition coil to the power transistor as shown, refer Fig. 12, for MPI coil terminal locations, refer Fig. 6 this Section.

(2) Connect the leads of an analogue Ohmmeter (containing a 3 volt battery) across terminals 1 and 2 (+ve to 2) of the power transistor.

(3) Connect and disconnect the negative lead of the Ohmmeter to terminal 1 of the power transistor. The ignition coil should emit a spark.

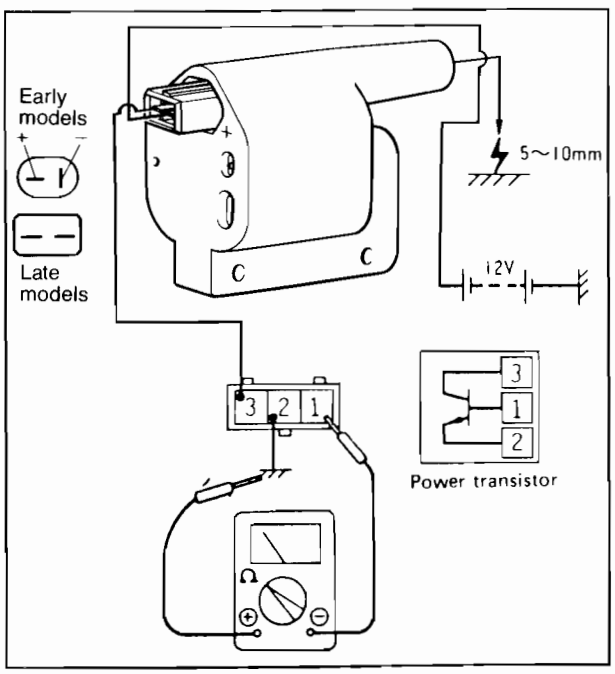


Fig. 12 — Checking power transistor

NOTE: Do not use an Ohmmeter which uses a battery of greater capacity than 3 volts. The above test can be performed using a 3 volt battery with the battery positive connected to terminal 1 of the power transistor.

(4) Replace the power transistor if faulty.

SECTION 6 — IGNITION SYSTEM — ECI-MULTI 6G72

SPECIFICATIONS

Distributor	
Type	MMC (Optical) electronic spark timing
End play	0.3 ± 0.2 mm
Rotational torque	0.3 Nm or less
Ignition Coil	
Type	Bosch resin mould
Primary resistance	0.8 Ohms ± 10%
Secondary resistance	12.1 kOhms ± 20%
Spark Plugs	
Make	Champion
Type	N9YC4
Size	14 mm
Gap	1.0 mm pre gapped
Torque	20 to 28 Nm
Ignition timing	5° ± 2° BTDC (electronic spark timing cut)) 15° ± 2° BTDC (with electronic spark timing)
Idle speed — @ 5°	700 ± 100 rpm
— @15°	700 rpm
A/C idle up	900 rpm
High tension cables	
Resistance — Cables shorter than 635 mm	Less than 30 kOhms
— Cables longer than 635 mm	Less than 50 kOhms

NOTE: The idle speed and ignition timing specifications were correct at time of publication. If these specifications differ from those on the Vehicle Emission Control Decal (located on the underside of the engine hood) use the specifications listed on the decal.

SPECIAL TOOLS

Multi-use-tester (M.U.T.)	MB991502
ROM Pack	MRP — A
Ohmmeter (analogue)	
Ohmmeter (digital)	
Tachometer	
Timing Light	

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SECTION 6 — SERVICE DIAGNOSIS 6G72

Condition	Possible Cause	Corrective Action
ENGINE WILL NOT START OR HARD TO START (CRANKS OK)	Malfunction of the ignition control system.	Check the system; if there is a problem check its component parts.
	Incorrect ignition timing.	Adjust ignition timing to specifications.
	Distributor cap and rotor cracked or damaged.	Replace faulty components.
	Coil high tension cable resistance not to specification.	Replace faulty high tension cables.
	Coil primary and secondary resistance are not to specification.	Replace coil.
	Spark plugs faulty.	Replace spark plugs.
	Power transistor faulty	Replace power transistor.
ROUGH IDLE OR ENGINE STALLS	Incorrect ignition timing.	Adjust ignition timing to specifications.
	Incorrect high tension cable location or resistance.	Check high tension cable routing and check resistance is within specification.
	Spark plugs faulty.	Replace spark plugs.
ENGINE HESITATES OR POOR ACCELERATION	Incorrect ignition timing.	Adjust ignition timing to specification.
	Earth leakage in high tension cables.	Check cable wiring, repair or replace cables.

IGNITION TIMING INSPECTION AND ADJUSTMENT

Prior to checking ignition timing ensure:
— engine is at operating temperature
— lamps and all accessories are OFF
— transmission is in Neutral or Park
— steering wheel is in the straight ahead position
— the handbrake is fully applied.

(1) Attach an engine tachometer and check the engine idle speed is approximately 700 ± 100 r.p.m.

(2) Switch engine off and connect the spark advance cut terminal to earth with a suitable jumper lead, refer Fig. 1.

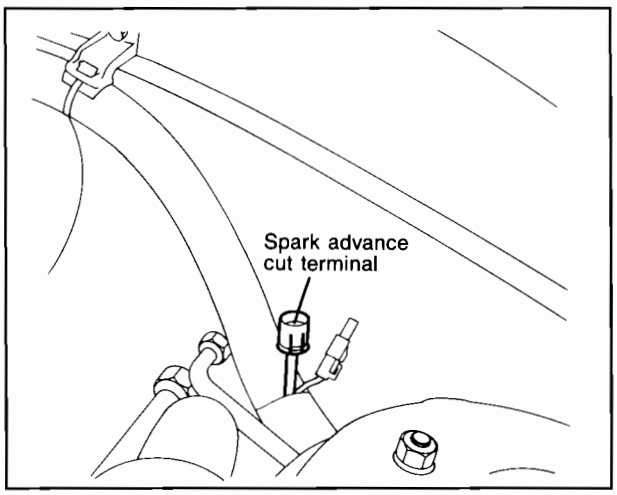


Fig. 1—Spark advance cut terminal

(3) Connect a suitable timing light to No. 1 cylinder and start the engine.

NOTE:

(A) Do not disconnect high tension leads with the engine running as damage to the ignition control unit can occur.

(B) Do not puncture cables, boots or nipples with test probes. Always use proper adaptors. Puncturing the spark plug cables with a probe will damage the cables. The probe can separate the conductor and cause high resistance. In addition breaking the rubber insulation may permit secondary current to arc to ground.

(C) Do not connect timing light primary lead to the alternator output terminal as alternator damage will occur.

(4) Aim the timing light at the timing plate, refer Fig. 2, and check that ignition timing is 5° ± 2° BTDC.

(5) If timing is incorrect loosen the distributor mounting nut and rotate distributor body so that ignition timing is to specification, refer Fig. 3.

(6) Disconnect the earthed jumper lead from spark advance cut terminal, the ignition timing should increase to 15° BTDC.

(7) Re-install blanking plug in spark advance cut terminal.

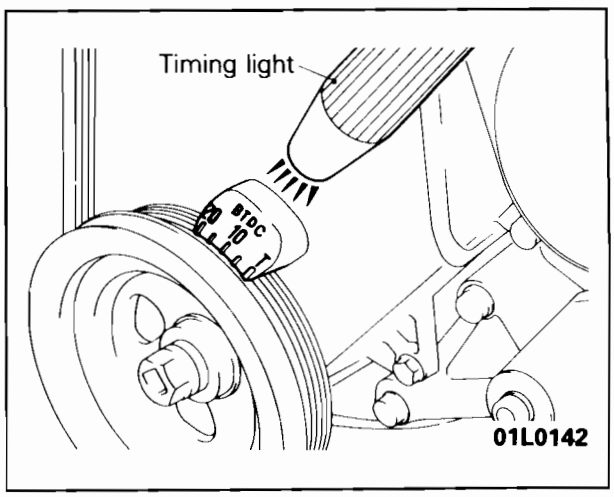


Fig. 2—Timing plate location

DISTRIBUTOR

Removal

(1) Uncouple the distributor connector.

(2) Remove high tension leads from spark plugs and coil.

CAUTION: The correct method of detaching this type of lead from the spark plug, is to grasp the rubber insulator at the spark plug end and remove with a combined twisting and pulling motion, refer Fig. 12.

(3) Unfasten the retaining screws and remove the distributor cap.

(4) Rotate the engine crankshaft until the distributor rotor is pointing towards the No. 1 cylinder firing position, ensuring that the crankshaft pulley timing mark is in line with the top dead centre (TDC) mark on the timing plate.

NOTE: No. 1 firing position is when the rotor arm mark is aligned in the eight o'clock position, refer Fig. 4.

(5) Remove distributor clamping nut.

(6) Carefully remove the distributor from the engine; the shaft will rotate a small amount as the distributor gear is disengaged from the camshaft gear.

NOTE: To retain the engine in the correct timing position, DO NOT rotate the crankshaft while the distributor is removed.

Disassembly

(1) Remove the rotor holding bolt and remove rotor.

(2) Remove the distributor cover.

(3) Remove the centre screw and remove the spacer (upper).

(4) Remove the washer.

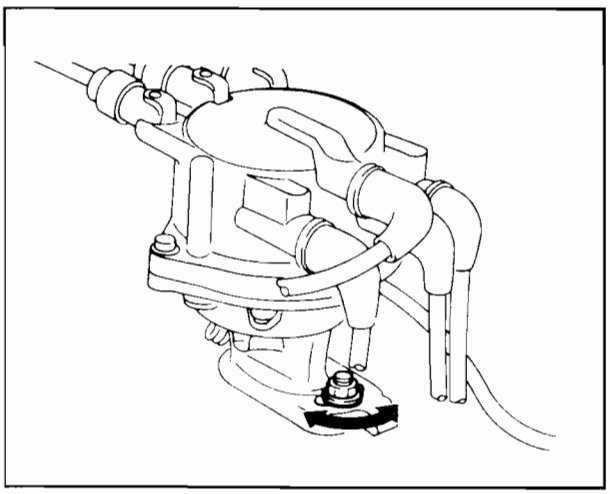


Fig. 3—Adjusting ignition timing

(5) Remove the disc of the drive gear shaft.
(6) Remove the spacer lower.
(7) Remove the sensor unit.
(8) Remove the wiring harness from the distributor housing.
(9) Mark the drive gear and distributor housing for reference, remove the roll pin and slide the drive gear off the shaft.
(10) Remove the shaft from the distributor housing.

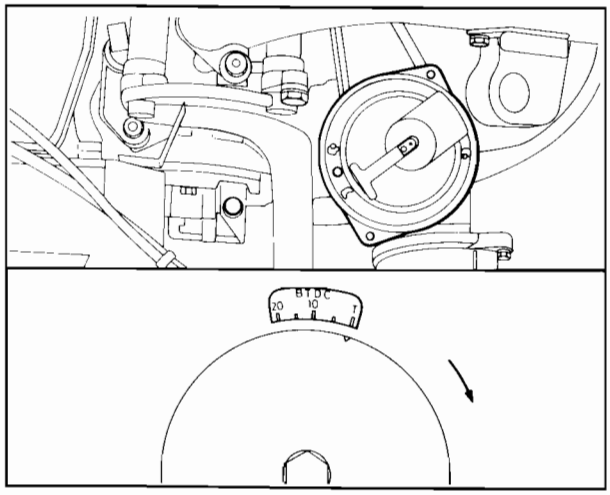


Fig. 4—No. 1 firing position

Inspection

Check all components for wear.
Check cap and rotor for damage.
Check cap for cracks.
Check drive gear for wear or damage.
Replace any defective components.

Assembly

Install by reversing the disassembly procedure.

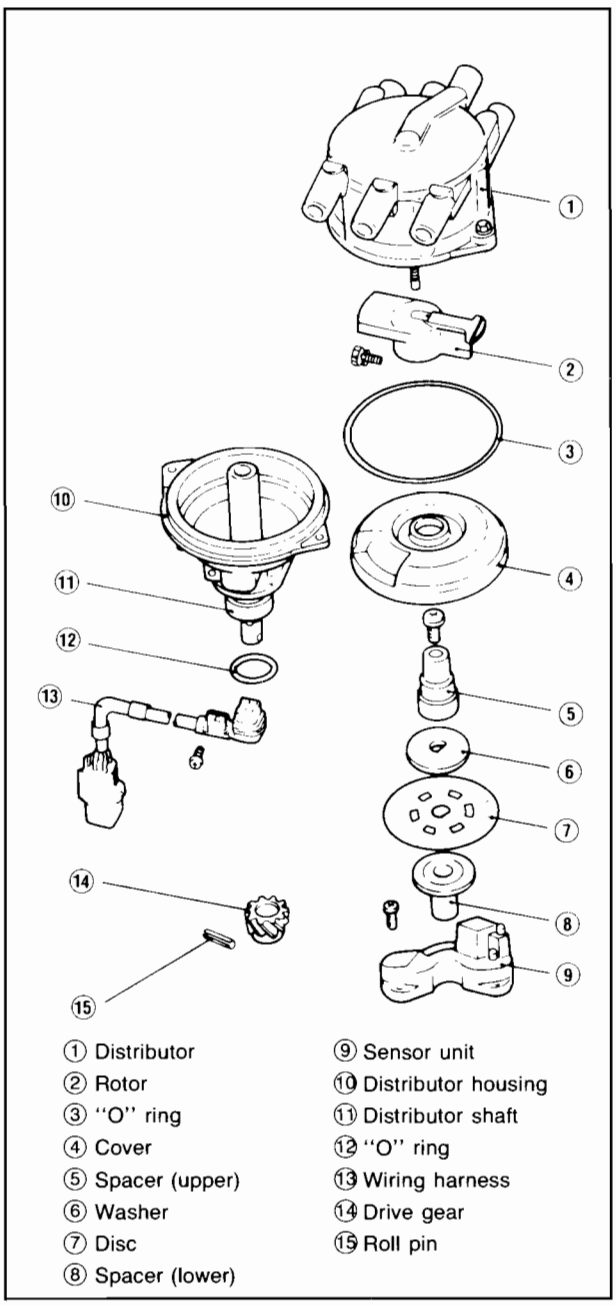


Fig. 5—Distributor assembly

Installation

(1) Ensure the crankshaft is positioned at TDC with No. 1 piston on compression stroke.
(2) Align the mating mark (line) of the distributor housing with the **protruding** side of the drive gear roll pin, refer Fig. 6.
(3) Insert the distributor into the cylinder head so as the retaining stud enters the retaining flange slot and is positioned near the lower end of the slot.
(4) The rotor arm mark should be aligned with or near to the raised section on the connector top.

NOTE: If not aligned, remove the distributor, repeat steps 2 and 3 above, ensuring the mating marks are aligned.

(5) Install retaining nut.
(6) Install distributor cap.
(7) Connect high tension leads and distributor connector.
(8) Adjust ignition timing to specification, as outlined this section.

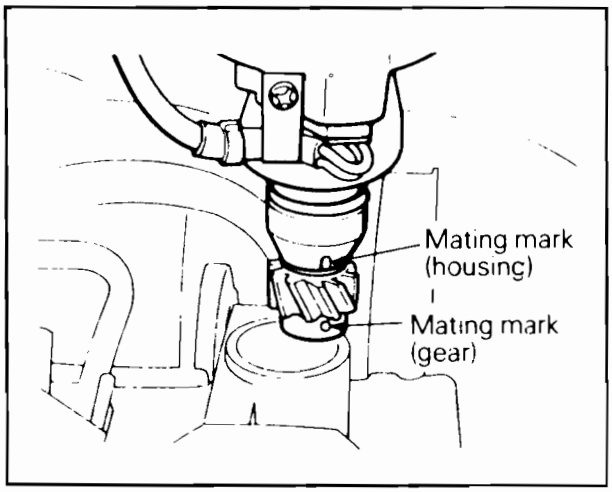


Fig. 6—Distributor installation

IGNITION COIL

(1) Check coil primary resistance by connecting an Ohmmeter between the positive and negative coil terminals.
(2) Check coil secondary resistance by connecting an Ohmmeter between the negative terminal and the high tension tower.
Requirement—Primary 0.8 Ohm ± 10%
—Secondary 12.1 kOhm ± 20%

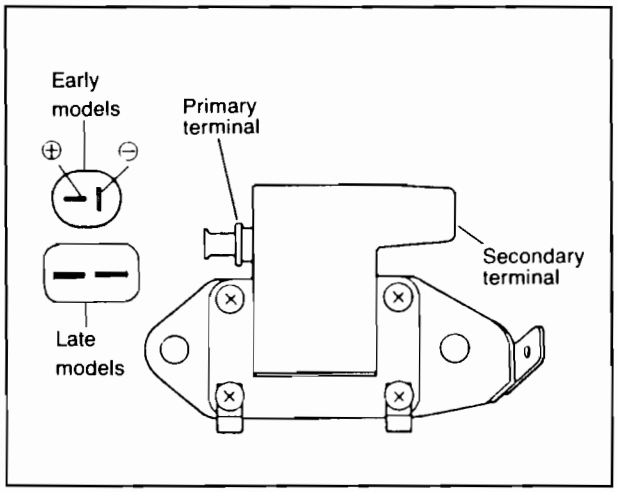


Fig. 7—Ignition coil terminals

NOTE: The primary connector at the coil has a locking tab on the underside which is concealed by the rubber boot. To uncouple, squeeze the rubber boot between the thumb and forefinger (refer Fig. 8), paying particular attention to releasing the locking tab in direction shown.

Attempting to uncouple the connector without fully unlatching the lock tab will result in damage to the connector and/or coil.

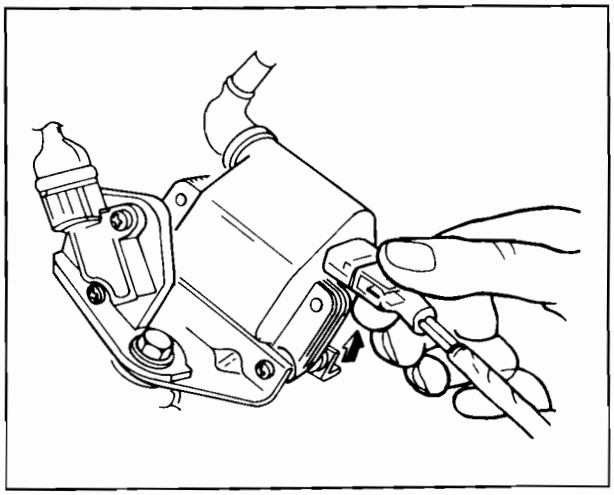


Fig. 8—Uncoupling coil primary connector (typical)

SPARK PLUGS

Spark plugs appearance, refer Fig. 9, or condition can reflect a wide variety of engine conditions as follows:

Normal Condition

Under normal conditions deposits will be light tan or grey in colour and electrode erosion will be slight. The gap should not increase more than 0.03 mm every 1600 km
A plug in this condition may be cleaned, gapped and reinstalled.

Carbon Fouling

This dry, black deposit is fuel carbon and is the result of an over rich air-fuel mixture. This condition can be caused by a sticking or incorrectly adjusted choke, clogged air cleaner element, incorrect idle mixture, retarded ignition timing, low ignition voltage or continuous low speed operation.

Oil or wet fouling

This condition usually indicates that the piston rings are worn and in need of replacement. The use of a hotter plug may temporarily relieve oil fouling but this practice may lead to engine damage.

NOTE: Oil fouling may occur when "running in" a new or overhauled engine before normal oil control is achieved. In this case the plugs may be cleaned, gapped and reinstalled.

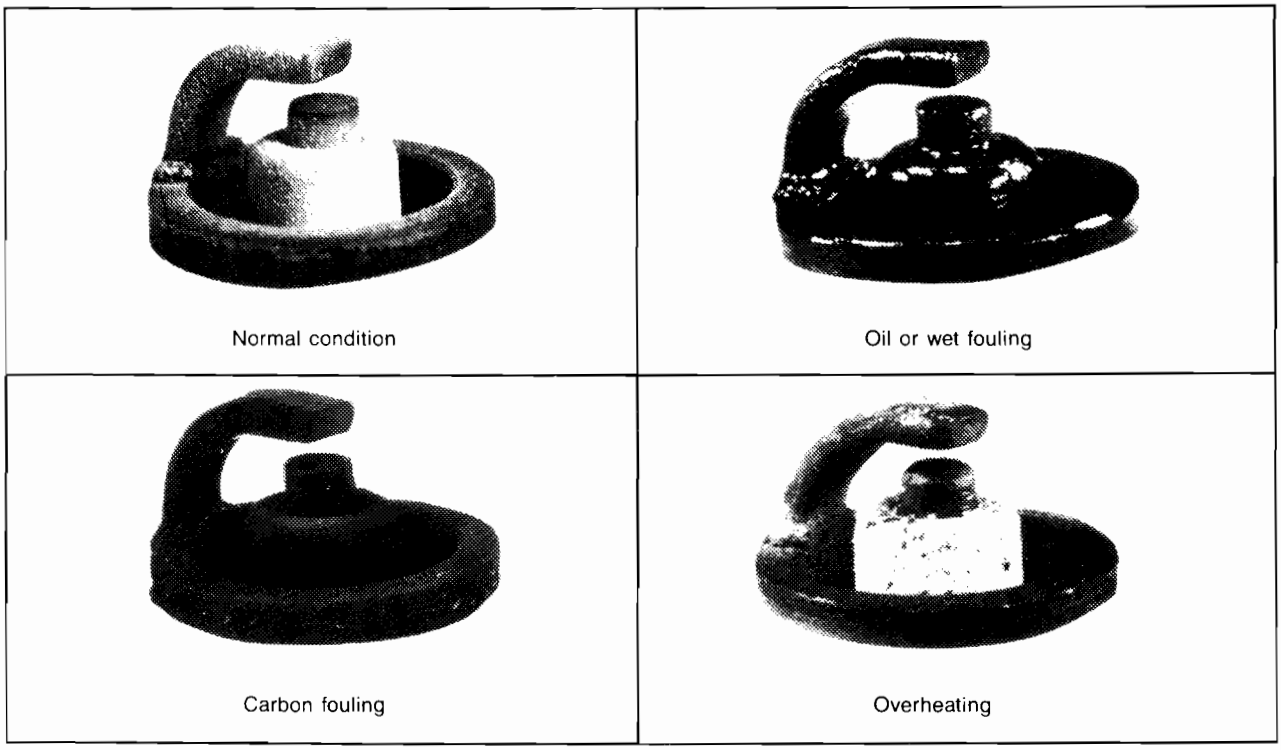


Fig. 9—Spark plug condition

Overheating

A plug that has overheated is evidenced by a blistered white insulator and an excessively eroded electrode. Possible causes of spark plug overheating include over advanced ignition timing, cooling system blockages, detonation (due to incorrect fuel), incorrectly tightened spark plug and incorrect heat range plug fitted.

Lead Fouling (not shown)

Lead fouling appears as a yellowish-brown deposit on the insulator. The deposit is a result of using leaded petrol. Frequent cleaning of the plug or using a hotter plug may result in an improvement if lead fouling is a persistent problem.

Cleaning and Regapping

(1) Clean spark plugs in a abrasive type cleaner, taking careful note of manufacturers instructions.
(2) Remove carbon and other deposits from the threads with a stiff wire brush.
(3) Dress the centre electrode, with a small file to a flat surface.
(4) Adjust the spark plug gap to specifications by using a pin or wire, type feeler gauge and bending the side (ground) electrode.
(5) Install spark plug and tighten to 20-28 Nm.

HIGH TENSION CABLES

Inspection

(1) Check the high tension cable connections for good contact at the coil, distributor cap towers and at the spark plugs. Terminals should be fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil cap towers and spark plug cover should fit tight around spark plug insulators. Cable connections that are loose will corrode and increase the resistance and permit water to enter the towers causing ignition problems. **To maintain proper sealing between the towers and nipples, cable and nipple assemblies should not be removed from the distributor towers unless nipples are damaged or cable testing indicates high resistance or broken insulation.**
(2) Clean high tension cables using a cloth moistened with a suitable non-flammable solvent.
(3) Check cables for brittle or cracked insulation.

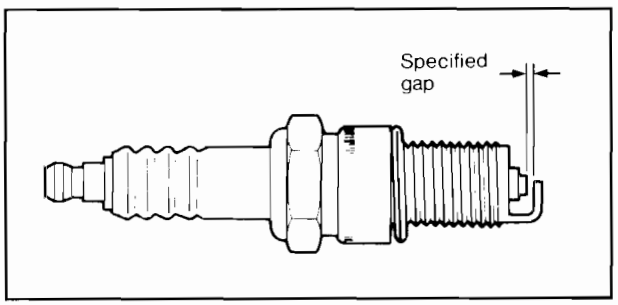


Fig. 10—Spark plug gap

Testing

Use an Ohmmeter to check cables for open circuits, loose terminals or high resistance as follows:
(1) Remove cable from spark plugs by simultaneously twisting and pulling on the insulator, refer Fig. 12.

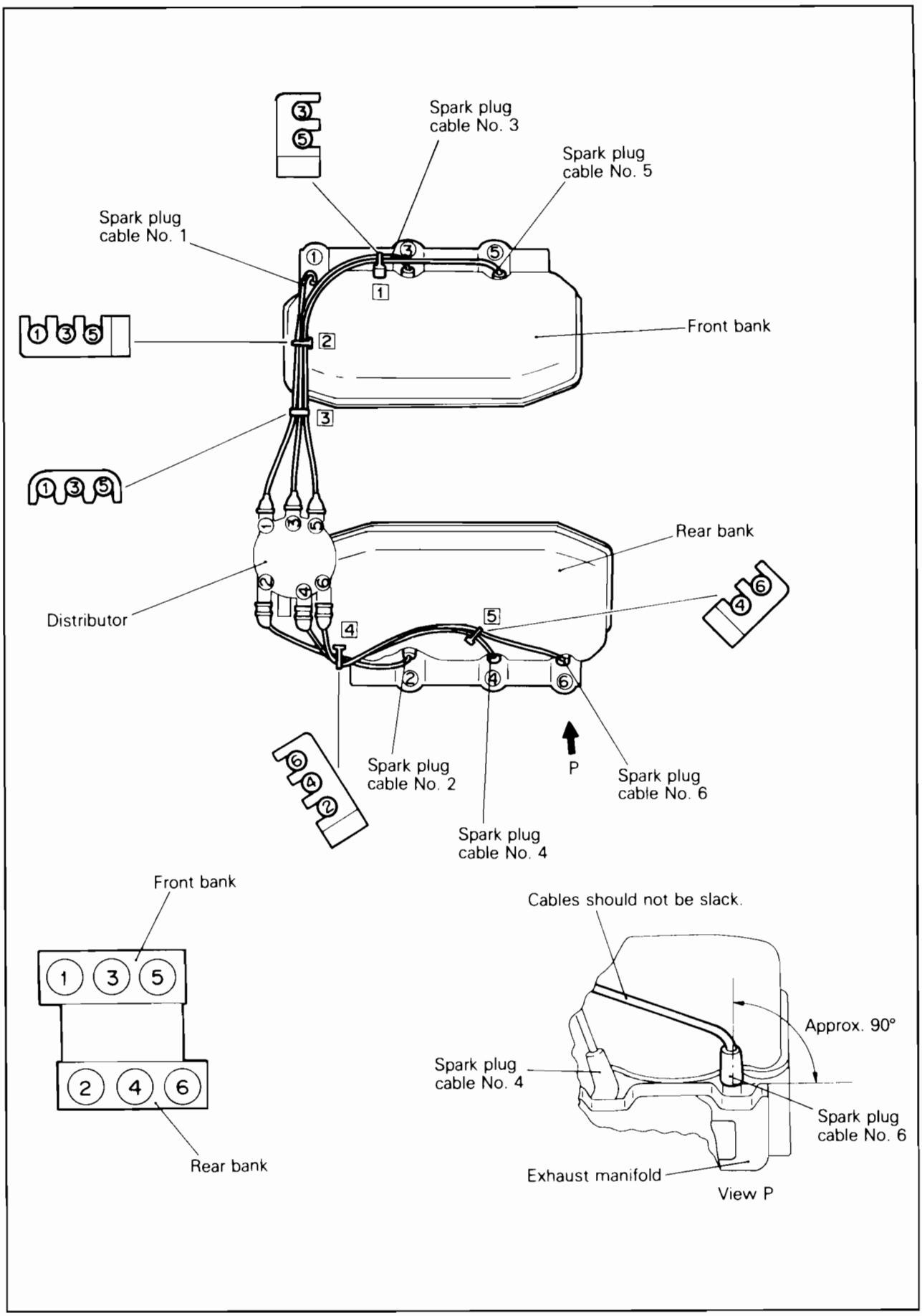


Fig. 11—High tension lead layout

(2) Remove the cable from the coil tower by twisting and pulling on the nipple.

(3) Lift distributor cap from distributor with cables intact. **Do not remove cables from cap.**

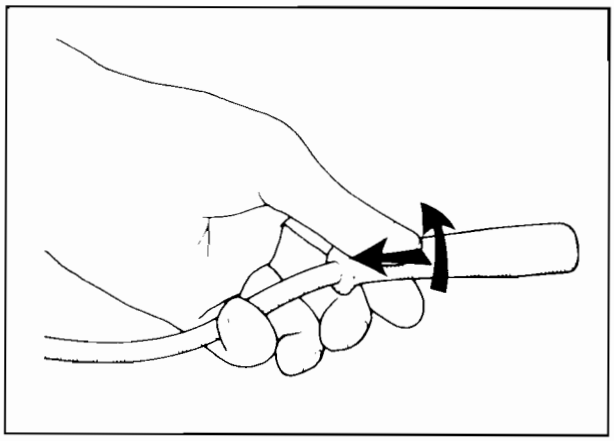


Fig. 12—Removing spark plug cable

(4) Connect the Ohmmeter between the cable terminal and the corresponding electrode inside the cap, making sure Ohmmeter probes are in good contact. If resistance is more than 30,000 Ohms, remove cable at cap tower and check the cable resistance. If resistance is more than 30,000 Ohms on cables under 635 mm long or 50,000 Ohms on cables over 635 mm long, replace cable assembly. Test all spark plug cables in same manner.

Replacement

When installing new cable assemblies, install new high tension cable and nipple assembly over cap or coil tower, entering the terminal into the tower, push lightly, then pinch the large diameter of nipple to release trapped air between the nipple and tower. **Continue pushing on the cable and nipple until cables are properly seated in the cap towers. Use the same procedure to install cable in coil tower. Wipe the spark plug insulator clean before reinstalling cable and cover.**

IGNITION TIMING CONTROL SYSTEM

The system controls the ignition timing by making the ignition coils primary current intermittent, by ON/OFF control of the power transistor.

During engine cranking, there is synchronisation to the crankshaft angle sensor signals resulting in a fixed time of 5° BTDC.

At other times the ECU determines the required spark advance using data in the ROM, engine speed and inlet air flow data. This data is then further advanced depending on coolant temperature or atmospheric pressure (whichever is the largest value). Also, the influence of battery voltage on the dwell time of the ignition coil is compensated for.

Timing adjustment — when the ignition timing adjustment terminal is grounded, there is synchronisation with the crankshaft angle sensors trailing edge signal, resulting in the fixed ignition timing (5° BTDC). In this condition the basic ignition timing is adjusted.

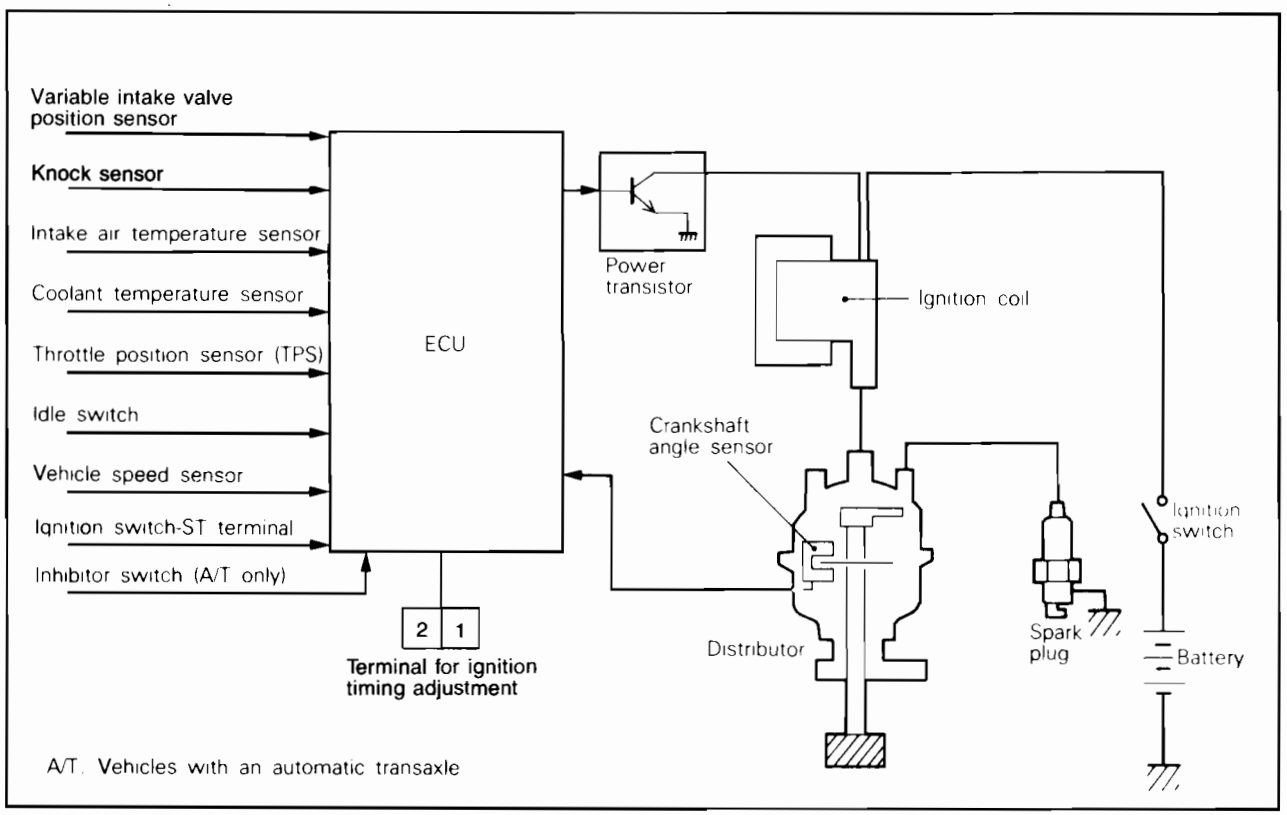


Fig. 13—Ignition timing control

POWER TRANSISTOR

The power transistor may be checked as follows:

(1) Connect a known good ignition coil to the power transistor as shown, refer Fig. 14, for MPI coil terminal locations, refer Fig. 7 this Section.

(2) Connect the leads of an analogue Ohmmeter (containing a 3 volt battery) across terminals 1 and 2 (+ve to 2) of the power transistor.

(3) Connect and disconnect the negative lead of the Ohmmeter to terminal 1 of the power transistor. The ignition coil should emit a spark.

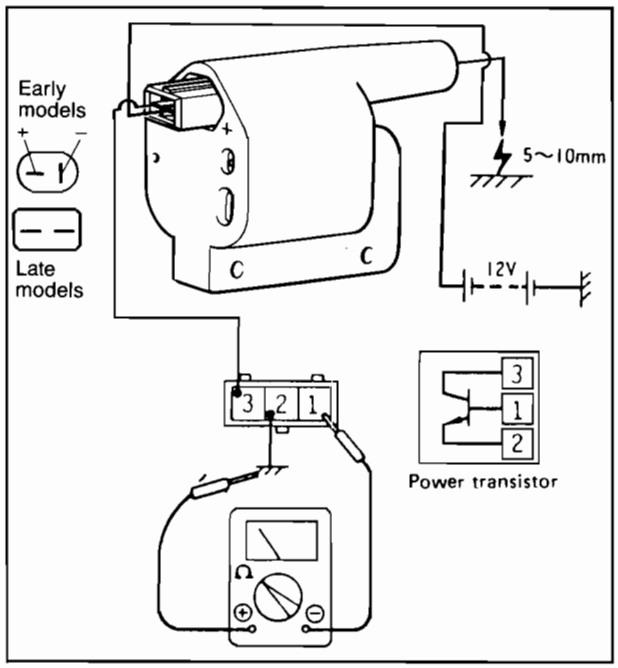


Fig. 14 — Checking power transistor

NOTE: Do not use an Ohmmeter which uses a battery of greater capacity than 3 volts. The above test can be performed using a 3 volt battery with the battery positive connected to terminal 1 of the power transistor.

(4) Replace the power transistor if faulty.

GROUP 17 — EMISSIONS CONTROL SYSTEMS
SECTION 0 — INDEX

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SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
SECONDARY AIR SUPPLY SYSTEM NOT FUNCTIONING	Thermo valve faulty.	Remove and test thermo valve, replace if faulty.
	Vacuum delay valve faulty.	Test delay valve, replace if faulty.
	Insufficient vacuum available at air cut valve.	Check vacuum hoses for crimping, kinking or leaks.
	Air cut valve faulty.	Test air cut valve, if necessary replace reed valve assembly.
	Reed valve faulty.	Test reed valve, replace if faulty.
	Insufficient air supply to reed valve.	Check secondary air supply filter for clogging. Check air supply hose for leaks, crimping and kinking.
CATALYTIC CONVERTER BURNT	Incorrect ignition timing.	Check ignition timing and adjust if necessary, refer Group 16.
	Ignition timing advance mechanisms faulty.	Remove and test distributor, refer Group 16.
	Vehicle operated while misfiring.	Locate and correct cause of misfiring.
	Vacuum control hoses connected incorrectly.	Check connections, refer Figs. 28 to 31.
	Protection system malfunction.	Check system operation using procedures outlined in this section and replace faulty components.
	Incorrect air conditioning (where fitted) idle up system fitted, or system connected incorrectly.	Idle up system must be earthed through engine speed sensor relay, refer Wiring Diagrams.
PRESSURE BUILDS UP IN FUEL TANK	Fuel tank vent line crimped or blocked.	Check all vent lines and hoses for crimping and damage.
	Two-way valve inoperative.	Check valve operation, replace if faulty.
	Canister clogged or saturated.	Replace canister.
	Purge control valve malfunction.	Check hose connections to valve. Test valve, replace if faulty.
VACUUM GENERATED IN FUEL TANK	Two-way valve faulty.	Test valve and replace if necessary.
	Crimped or blocked vent line.	Check all vent lines and hoses for crimping or damage.
	Fuel filler cap faulty.	Replace filler cap.

SECTION 2 — EMISSIONS CONTROL SYSTEMS

GENERAL INFORMATION

In order to improve air quality and to protect the environment by reducing atmospheric pollution, Australian Design Rules require that the components of vehicle exhaust and evaporative emissions listed below are controlled to a specified level and that vehicles manufactured on or after January 1st, 1986 must use unleaded petrol exclusively.

- Carbon Monoxide (CO): a gaseous compound contained in exhaust gases when there is insufficient air in the air/fuel mixture to fully burn the fuel, or insufficient time for the combustion to be completed.
- Hydrocarbons (HC): unburned or partially burned fuel contained in exhaust gases or crankcase "blow by" gases as a result of incomplete combustion or fuel vapours resulting from evaporation in the fuel system.
- Oxides of Nitrogen (NOx): compounds of nitrogen (one molecule) and oxygen (any number of molecules) contained in exhaust gases and produced as a result of the high temperatures occurring during combustion.

Methods of Controlling Emissions

Exhaust Emissions

- By ensuring optimum combustion efficiency through basic engine, carburettor and distributor design (HC and CO).
- By using a catalytic converter to promote the afterburning, with additional air supplied through the secondary air system, and subsequent oxidation of CO and HC in exhaust gases to form CO_2 (carbon dioxide), water and heat.
- By reducing combustion temperatures under certain operating conditions by recirculating a metered quantity of exhaust gas to dilute the air/fuel mixture (NOx).

NOTE: For adjustment of V3000 CO refer to Group 13.

Crankcase Emissions

- By directing crankcase blow by gases through the P.C.V. (positive crankcase ventilation) system back into the combustion chamber through the intake system.

Evaporative Emissions

- By directing fuel vapour from the fuel tank and the carburettor float bowl back into the combustion chamber through the intake system.

NOTE: To ensure continued compliance with Australian Design Rules and State regulations relating to vehicle emissions, it is essential that systems are serviced in accordance with the Lubrication and Maintenance schedule shown in Group 00 using the procedures outlined in this manual.

SYSTEM DESCRIPTION, MAINTENANCE AND TESTING

CARBURETTOR

The carburettor is a progressive dual-throat down-draft type with a thermo wax element automatic choke.

In addition to the basic carburettor systems, i.e. idle, main, enrichment, accelerator pump and choke, the following systems are used:

- A fuel cut off solenoid, mounted on the carburettor, which cuts the fuel supply to the idle circuit when the ignition is switched OFF, to prevent engine run on and, during closed throttle coasting or deceleration to reduce HC emissions and prevent catalyst overheating.
- A mixture control valve (M.C.V.), which supplies additional air to the intake manifold during closed throttle deceleration, to reduce HC emissions and prevent catalyst overheating. For a description of M.C.V. operation and testing refer to "Catalyst Protection Systems".

For a full description of carburettor and ECI-Multi systems adjustment and testing procedures, refer Group 13 — Fuel Systems.

HEATED INTAKE AIR (H.I.A.) SYSTEM

General Information

The H.I.A. System supplies heated air (drawn over the exhaust manifold) to the carburettor to reduce choke requirement after cold starts.

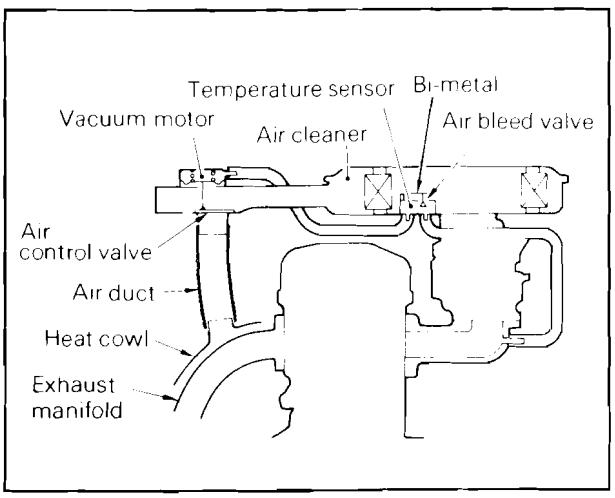


Fig. 1—Heated intake air system

Carburettor intake air temperature is controlled by a thermo sensor valve, mounted on the air cleaner base, which regulates the intake manifold vacuum applied to the vacuum motor by means of an air bleed.

When the temperature at the thermo sensor is below 30°C the air bleed is closed and manifold vacuum is applied to the vacuum motor diaphragm which opens the control valve to supply heated intake air.

As the temperature at the thermo sensor increases the air bleed opens and vacuum applied to the diaphragm decreases which allows the spring in the vacuum motor to close the control valve to supply a mix of heated and ambient air.

At 45°C the air bleed is fully open and intake air is supplied directly through the fresh air duct.

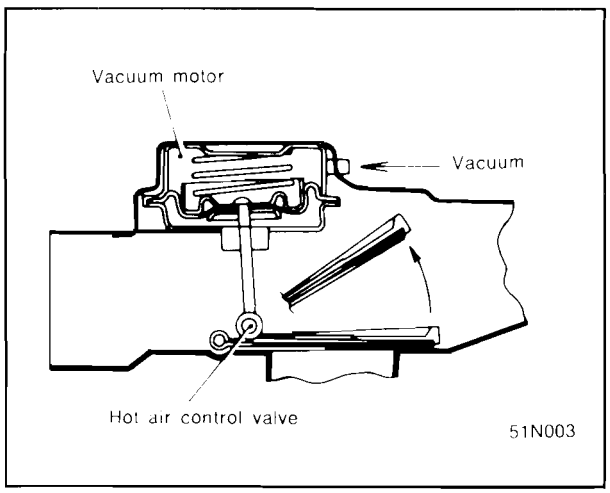


Fig. 2—H.I.A. vacuum motor and control valve

Testing

NOTE: Where possible, it is recommended that testing is performed on a cold engine.

(1) Remove the air cleaner and allow the thermo sensor valve to cool below the specified temperature, refer General Information.

(2) Refit the air cleaner, leaving the air intake tube disconnected and with the vacuum hose to the vacuum motor disconnected, start the engine and check that manifold vacuum is available at the hose. If vacuum is not available the thermo sensor valve is faulty.

(3) Connect the hose and check that the control valve lifts fully. If the control valve does not lift, the vacuum motor is faulty.

(4) Run the engine until air cleaner temperature reaches the specified full open temperature, refer General Information.

(5) Disconnect the vacuum hose from the vacuum motor and check that no vacuum is available. If vacuum is available, the thermo sensor valve is faulty.

(6) Check that the control valve is fully down. If valve is not fully down, the vacuum motor is faulty.

(7) If either the thermo sensor valve or vacuum motor is faulty it must be replaced.

HOT IDLE COMPENSATOR SYSTEM

General Information

The hot idle compensator is designed to stabilize engine idle at high ambient temperatures. A thermo sensor valve, mounted in the air cleaner base, incorporates an air bleed which is opened when the temperature inside the air cleaner reaches 60°C supplying additional air to the intake manifold.

NOTE: If the hot idle compensator system is activated during CO concentration checks, a false reading will be obtained. To overcome this, a suitable fan may be placed adjacent to the air cleaner intake to reduce temperatures in the air cleaner, or the vacuum hose may be disconnected at the manifold, and the manifold outlet plugged.

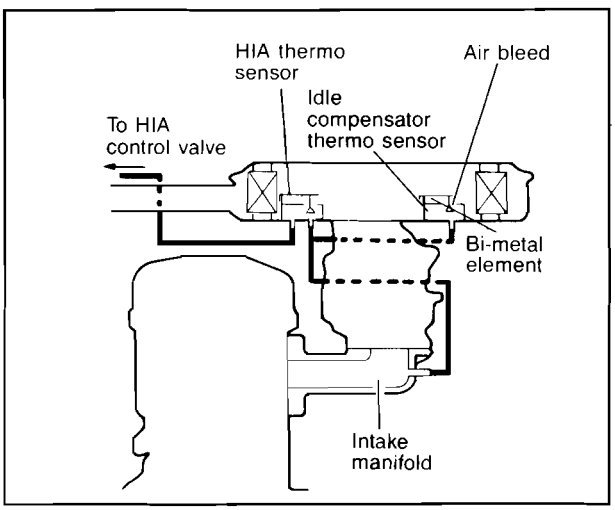


Fig. 3—Hot idle compensator system

Testing

(1) Disconnect the vacuum hose to the idle compensator at the intake manifold end and install a vacuum pump to the hose.

(2) Ensure the temperature inside the air cleaner is below 50°C and operate the pump. Vacuum should be generated.

(3) Heat the interior of the air cleaner with a hot air gun or alternatively, reconnect the vacuum hose and run the engine, until the air cleaner interior temperature exceeds 60°C.

(4) Reconnect vacuum pump (if removed) and operate. No vacuum should be generated.

(5) If the above conditions do not apply, the thermo sensor is faulty and must be replaced.

(6) Disconnect the vacuum pump and reconnect the hose to the intake manifold.

DISTRIBUTOR AND IGNITION SYSTEM

General Information

The ignition system is a "high energy" type with the control unit integrated in the distributor. Ignition coil switching is performed by an inductive type pulse generator, eliminating dwell and ignition timing variations.

Distributor vacuum (dual can) and centrifugal advance characteristics are set for optimum performance, emission control, and catalyst protection.

For additional information, and service and test procedures refer to Group 16 — Section 4, carburettor models and Group 13 ECI-Multi models.

ORIFICE SPARK ADVANCE CONTROL (O.S.A.C.) VALVE

On some models an O.S.A.C. valve is fitted in the vacuum hose between the carburettor and the distributor, delaying the application of vacuum to the vacuum advance unit when moving from idle to part throttle, to improve driveability.

To ensure correct operation, the valve must be installed with the black side of the valve towards the vacuum supply.

Testing

With the engine at normal operating temperature proceed as follows:

(1) "Tee" a vacuum gauge into the vacuum hose between the O.S.A.C. valve and the distributor.

(2) Start the engine.

(3) Increase engine speed to 2000 r.p.m. Vacuum should increase gradually. If vacuum increase is immediate or vacuum does not increase, the valve is faulty and must be replaced.

CATALYTIC CONVERTER

General Information

The catalytic converter is a ceramic monolith type located under floor in the exhaust. A ceramic monolith is an extrusion of fine cellular structure which forms a substrate for a fine "wash coat" of precious metals. The "wash coat" acts as the catalyst to promote the afterburning, with additional air supplied through the secondary air system, and subsequent oxidation of CO and HC contained in exhaust gases to form CO_2 (carbon dioxide), water and heat.

The catalytic converter does not require any maintenance under normal circumstances, however it should be noted that it will be rendered ineffective if poisoning occurs as a result of misfuelling, i.e. using leaded petrol, or if damage occurs as a result of exessive exhaust gas temperatures caused by engine misfiring, incorrect ignition timing or the intake of large quantities of raw fuel into the exhaust manifold due to a failure in a catalyst protection system.

Since catalyst failure will result in exhaust emission levels higher than legal limits it is essential that the following precautions are observed when carrying out maintenance or repair operations.

- Do not "prime" the carburettor by pouring fuel down the throttle bore to facilitate engine starting after carburettor bowl has been emptied.
- Avoid driving the vehicle if misfiring is evident.
- Do not allow the engine to idle for prolonged periods if idle is very rough or misfiring is evident.
- Do not disconnect high tension cables with the engine running.
- Do not switch ignition OFF or otherwise interrupt the ignition power supply with the transaxle in gear and the vehicle in motion.
- Do not disconnect, modify or otherwise tamper with catalyst protection systems.
- Do not attempt to push or tow start a disabled vehicle.

If for any reason, the catalyst requires replacement refer to Group 15 for correct procedure.

CATALYST PROTECTION SYSTEMS

Catalyst protection systems are used to prevent the induction of large quantities of raw fuel into the exhaust manifold during closed throttle coasting or deceleration.

Two main systems are used; a mixture control valve and a fuel cut system.

Mixture Control Valve (M.C.V.)

The M.C.V. mounted on the secondary bore side of the carburettor, responds to vacuum generated below the throttle valve during closed throttle deccleration to supply additional air to the intake manifold, ensuring effective combustion of fuel drawn into the intake manifold.

Operation (refer Fig. 5)

During normal operation the valve is closed by spring force. When the throttle valve is closed during deceleration vacuum is applied to the diaphragm through chamber A, moving the diaphragm against spring force to open the valve. At the same time vacuum is applied to chamber B through an orifice. When vacuum in chamber B reaches a pre-set value, spring force will overcome vacuum in chamber A and the valve will close. Atmospheric pressure is applied through orifice C to control the speed of valve closure.

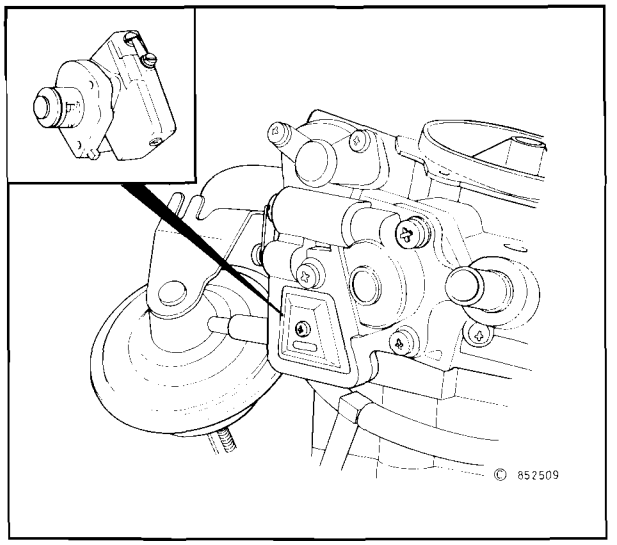


Fig. 4—Mixture control valve

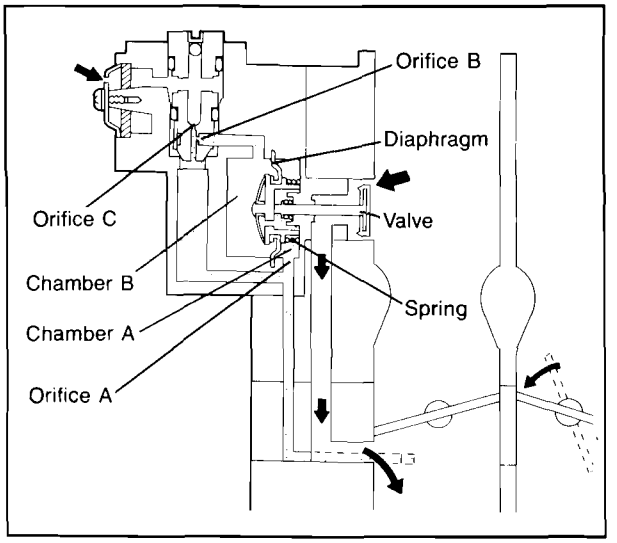


Fig. 5—M.C.V. operation

Testing

(1) Start and run the engine until it reaches normal operating temperature.

(2) Remove the retaining nuts and shift the air cleaner to one side.

(3) Increase the engine speed to 3000 r.p.m. Release the throttle quickly and listen for a short change to the intake air note as the engine speed decreases.

(4) If the change in intake note is not discernable repeat step (3) and using a small mirror check if the valve is opening and closing.

(5) If the valve does not open, it is faulty and must be replaced.

NOTE: DO NOT attempt to repair or adjust the M.C.V.

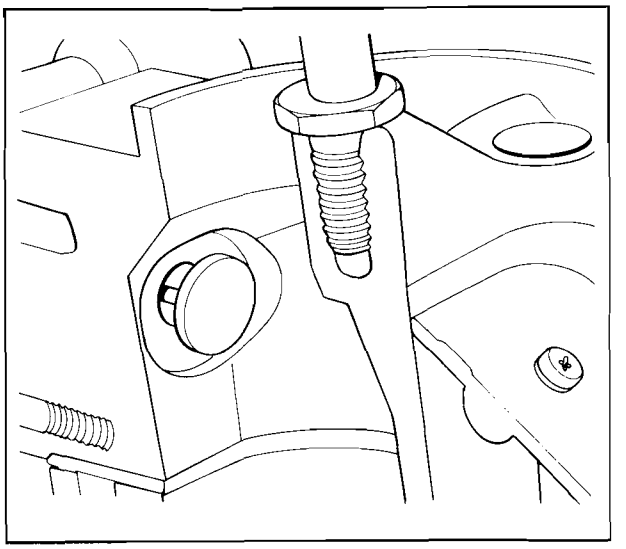


Fig. 6—Testing M.C.V.

Fuel Cut System

The fuel cut system cuts the fuel supply through the idle circuit during closed throttle coasting at engine speeds above 1600 r.p.m., and with ignition OFF.

The sytem consists of an engine speed sensor (E.S.S.) relay, mounted inside the vehicle behind the left hand cowl side trim, a vacuum switch mounted on the outer plenum chamber just above the heater hoses, a delay valve (manual models only) and a fuel off solenoid valve mounted on the primary bore side of the carburettor.

Operation

(1) With the throttle open at engine speeds below 1600 r.p.m. the E.S.S. relay is closed but the vacuum switch is open, so that the fuel cut solenoid is earthed through the E.S.S. relay leaving the solenoid valve and idle circuits open.

(2) With the throttle open at engine speeds above 1600 r.p.m. the E.S.S. relay is open, however the fuel cut solenoid is earthed through the vacuum switch, which is closed as there is no vacuum to open the switch, therefore the solenoid valve and idle circuits remain open.

(3) With the throttle closed at engine speeds above 1600 r.p.m., the E.S.S. relay and the vacuum switch are open so that the fuel cut solenoid is not earthed, therefore the solenoid valve and idle circuits are closed.

(4) When the ignition is switched OFF, power to the solenoid is cut and the solenoid valve closes.

NOTE: When installing air conditioning, the idle up actuator must be earthed through the E.S.S. relay to provide catalytic converter protection.

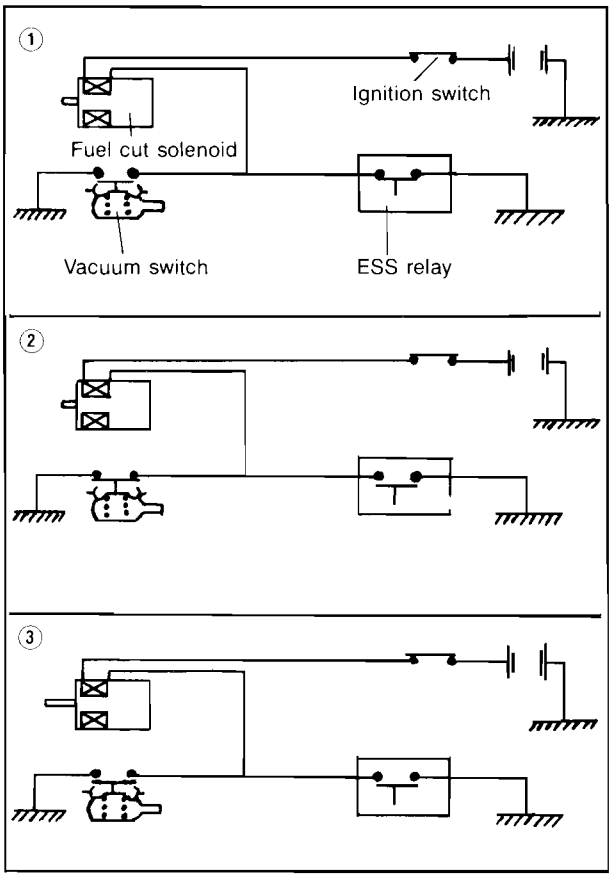


Fig. 7—Schematic of fuel cut circuit

Testing

E.S.S. Relay

(1) Connect a voltmeter across fuel cut solenoid connector terminals, voltmeter positive to black/white wire.
(2) Disconnect wiring from vacuum switch.
(3) Start the engine and run at idle speed.
(4) Voltmeter should indicate 12V.
(5) Increase engine speed to 2000 r.p.m. Voltmeter should indicate 0V.
(6) If the above conditions do not apply, the relay is faulty and should be replaced.

Vacuum Switch

(1) Disconnect the vacuum switch wiring and connect a suitable ohmmeter across the switch terminals.
(2) Disconnect the vacuum hose from the switch and connect a suitable vacuum pump to the switch.
(3) With no vacuum applied to the switch, ohmmeter should read 0 Ω .
(4) With vacuum applied to the switch, ohmmeter should read ∞ .
(5) If the above conditions do not apply, the vacuum switch is faulty and should be replaced.

Delay Valve

(1) Remove the delay valve from the vacuum hose.
(2) Connect a vacuum pump to green side of the valve.
(3) Vacuum should not be generated when the pump is operated.
(4) Connect vacuum pump to black side of valve and cover green side with finger.
(5) Apply vacuum to valve, then remove finger.
(6) Vacuum should drop gradually.
(7) If vacuum drop is instantaneous or does not drop the valve is faulty and must be replaced.
(8) Install the valve with the black side towards the vacuum source.

SECONDARY AIR SUPPLY SYSTEM

General Information

The secondary air supply system utilizes the small pulses of negative pressure generated in the exhaust manifold to draw additional air, required by the catalyst to promote after burning of exhaust gases, into the exhaust manifold.

The system consists of a filter, mounted on the air cleaner, a reed valve assembly incorporating an air cut valve, a vacuum delay valve, a tuned length air pipe and a thermo valve.

The reed valve opens to supply air to the exhaust manifold in response to negative pressure in the manifold and closes when exhaust pressure is high.

The air cut off valve responds to intake manifold vacuum to shut off the air supply through the reed valve when intake manifold vacuum is below 13.4 kPa. A delay valve is fitted in the vacuum hose to delay closure of the valve under these conditions.

The thermo valve is incorporated in the system to prevent secondary air supply system operation at coolant temperature below 18°C, by opening the vacuum line to the air cut off valve to atmospheric pressure.

Testing

Reed Valve

(1) Disconnect the air hose, air pipe and vacuum hose from the reed valve and remove the reed valve assembly from the vehicle.
(2) Check that air cannot be blown through either port, refer Fig. 9.
(3) Connect a vacuum pump to nipple "A" and apply a vacuum of more than 13.4 kPa.
(4) Check that air can be blown through port "B" but not through port "C".
(5) If the above conditions do not apply, the valve is faulty and should be replaced.

Delay Valve

(1) Connect a vacuum pump to nipple "A", refer Fig. 10, of the delay valve. Vacuum should not be generated when pump is operated.

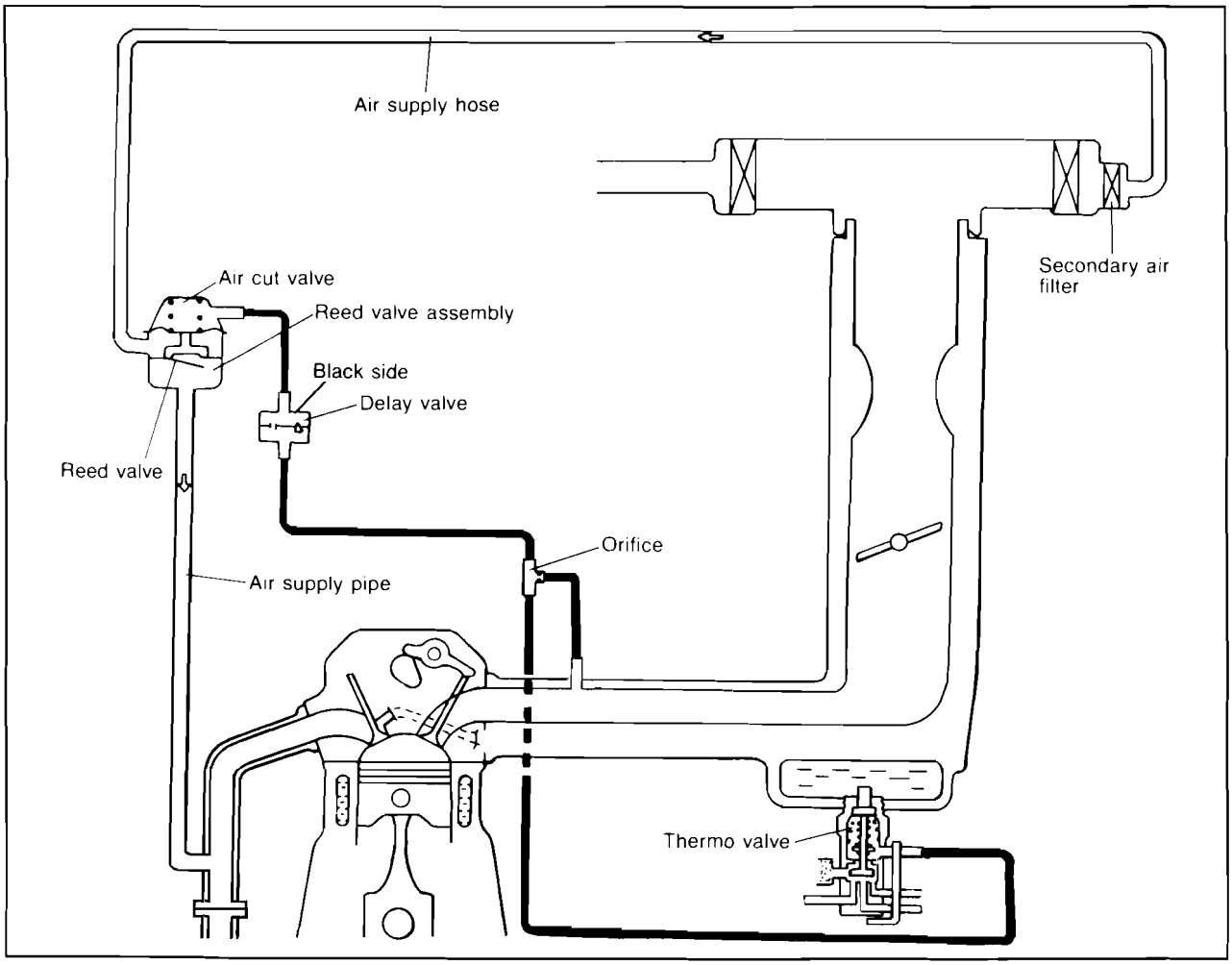


Fig. 8—Secondary air supply system

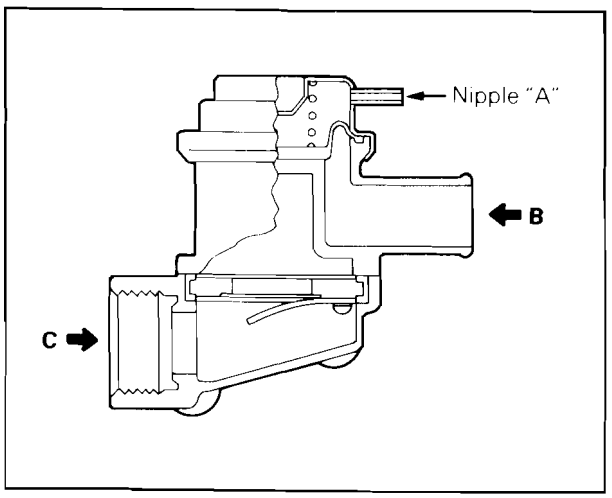


Fig. 9—Testing reed valve

(2) Connect vacuum pump to nipple"B" of delay valve and cover nipple "A" with finger.

(3) Apply a vacuum of 50 to 65 kPa to the valve.

(4) Uncover nipple "A". Vacuum should fall gradually.

(5) If vacuum drop is instanteous or vacuum does not drop, the valve is faulty and should be replaced.

(6) When installing the valve ensure it is fitted the correct way, refer Fig. 10.

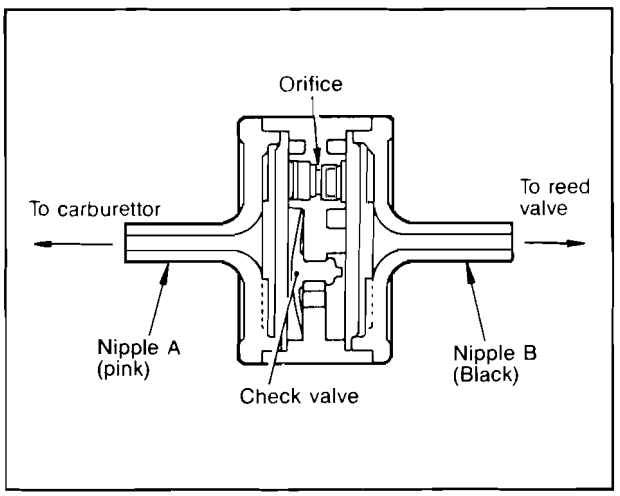


Fig. 10—Delay valve

Thermo Valve

For description and testing refer to "Thermo Valve" — this Section.

EXHAUST GAS RECIRCULATION (E.G.R.) SYSTEM (CARBURETTOR MODELS ONLY)

General Information

The E.G.R. system recirculates a metered quantity of exhaust gases from No. 2 exhaust port to the intake manifold through passages cast in the cylinder head and intake manifold. The gases dilute the air/fuel mixture, resulting in lower combustion temperatures and a reduction in exhaust gas NOx concentration.

The system consists of the E.G.R. valve, vacuum regulator valve, and a thermo valve.

E.G.R. Valve

Construction of the E.G.R. valve is shown in Fig. 11. Ported vacuum from above the throttle valve, regulated by the vacuum control valve or vacuum regulator valve, is applied to the diaphragm through the upper chamber to open the E.G.R. valve allowing gas to circulate.

NOTE: E.G.R. valve calibration varies between manual and automatic transmission models.

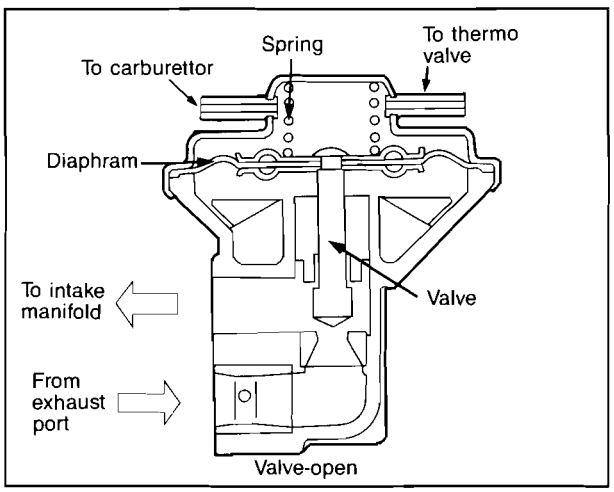


Fig. 11—E.G.R. valve construction (typical)

Vacuum Regulator Valve (V.R.V.)

The V.R.V. is mounted on a bracket located on the E.G.R. valve attaching bolts and regulates E.G.R. valve operation in response to exhaust pressure.

When engine load is low, exhaust pressure is low and vacuum applied to the E.G.R. valve diaphragm is reduced by opening an air bleed in the V.R.V. to atmospheric pressure. As engine load increases, exhaust pressure increases, the air bleed closes and vacuum applied to the diaphragm increases.

E.G.R. Valve Testing

(1) Disconnect the E.G.R. valve vacuum supply hose at the carburettor and connect a vacuum pump.

(2) Disconnect and plug the vacuum hose from the upper valve body to the vacuum control valve or vacuum regulator valve.

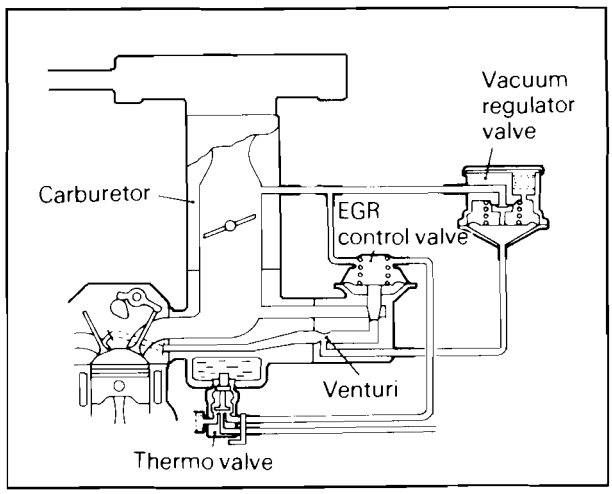


Fig. 12—E.G.R. system with V.R.V.

(3) Start the engine and run until normal operating temperature is reached.

(4) Apply a vacuum of more than 9 kPa to the valve. Idle quality should deteriorate.

(5) If idle quality is not affected or vacuum cannot be generated disconnect and plug the vacuum hose from the E.G.R. valve to the thermo valve.

(6) Re-apply vacuum to the valve. If idle quality is not affected the E.G.R. valve is faulty and must be replaced. If idle quality deteriorates the E.G.R. valve is serviceable but a faulty thermo valve is indicated.

E.G.R. Valve Replacement

(1) Identify, then remove vacuum hoses from the E.G.R. valve.

(2) Remove the two valve to manifold attaching bolts and remove the valve.

(3) Install by reversing removal procedure, using a new gasket.

(4) Tighten bolts to 10 Nm.

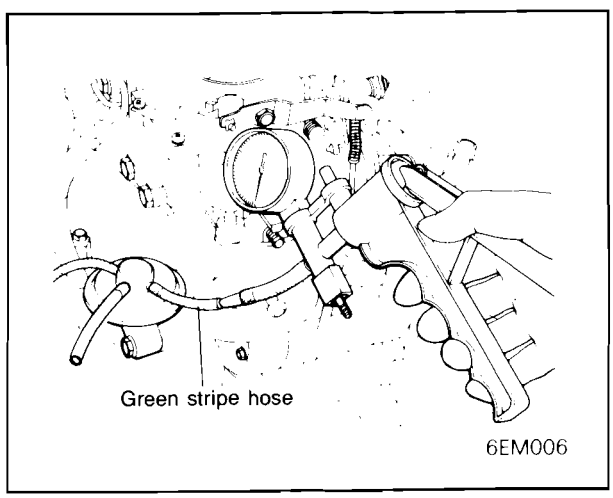


Fig. 13—Testing E.G.R. valve

Vacuum Regulator Valve Testing

(1) Identify and disconnect hoses from the V.R.V.
(2) Remove V.R.V. from vehicle.
(3) Remove valve cap and clean filter prior to testing.
(4) Connect a vacuum pump to nipple "A".
(5) No vacuum should be generated when the pump is operated.
(6) Connect a low pressure air pump or blow into nipple "B" and apply a pressure of 4 kPa.
(7) Vacuum should be generated when vacuum pump is operated.
(8) If the above conditions do not apply the V.R.V. is faulty and must be replaced.

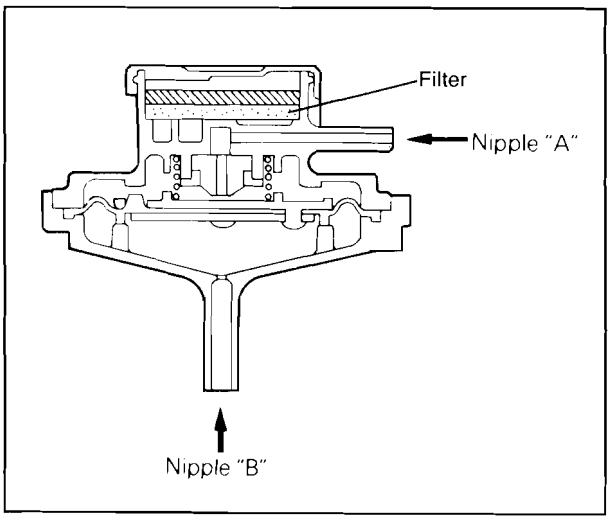


Fig. 14—Vacuum Regulator Valve

THERMO VALVE (CARBURETTOR MODEL ONLY)

General Information

A wax element, three port dual range, type thermo valve is mounted in the intake manifold coolant passage.

The valve vents the vacuum signal to the following systems to atmosphere when engine coolant temperature is below that specified.

- E.G.R. system: (65°C).
- Purge control system: (65°C)
- Secondary air supply system: (18°C)

Thermo Valve Testing

To accurately test valve it should be removed from the vehicle.

(1) Release pressure in the cooling system and re-install the cap to the first notch to prevent excessive coolant loss.
(2) Disconnect the vacuum hoses from the thermo valve.
(3) Remove the thermo valve from the intake manifold taking care to avoid damaging the resin section of the valve.
(4) Cool thermo valve to a temperature of less than 15°C.
(5) Connect a vacuum pump to the secondary air supply port, refer Fig. 15, and plug the other ports. No vacuum should be generated when the pump is operated.
(6) Immerse the heat sensing bulb of the thermo valve in a container of water heated to 20°C for a period of one minute.
(7) Operate the vacuum pump. Vacuum should be generated.
(8) Disconnect pump and plug outlet.
(9) Connect pump to one of the other ports and plug other ports.
(10) Heat water to 45°C to 50°C.
(11) Operate pump, vacuum should not be generated. Repeat test on other two ports.
(12) Heat water to 65°C, and check that vacuum is generated when pump is operated on each port with the other ports plugged.
(13) If vacuum is not generated the valve is faulty and must be replaced.
(14) Install the thermo valve in the intake manifold and top up the cooling system using rain or demineralized water and Mitsubishi Longlife Coolant in the required concentration, refer Group 14.

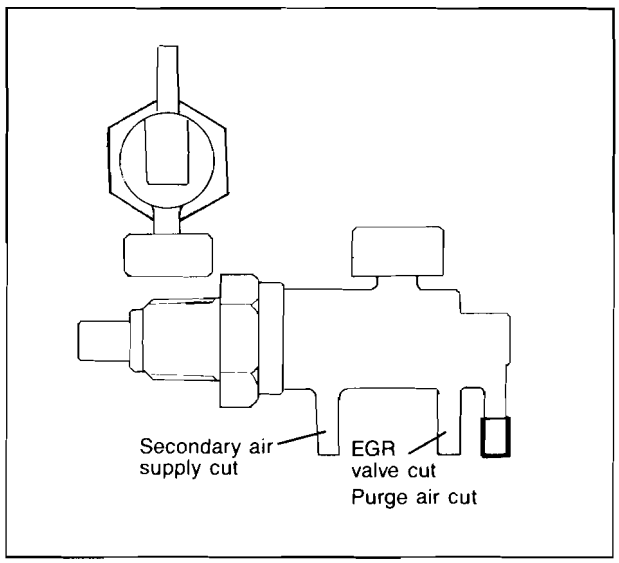


Fig. 15—Thermo valve connections

EVAPORATIVE EMISSIONS CONTROL SYSTEM

General Information

The evaporative emission control system prevents the release of fuel system vapours into the atmosphere by storing vapours in an activated carbon filled fuel vapour storage canister, when the engine is not running, and releasing vapours from the canister to the intake manifold, through a purge control valve, when the engine is running.

Purge Control Valve Carburettor Models

This valve controls the release to the intake manifold of vapours held in the fuel vapour storage canister, in response to carburettor vacuum.

When vacuum is above 6.9 kPa, the valve opens allowing the stored vapours to be drawn into the intake manifold.

The vacuum signal hose to the purge control valve is connected to a thermo valve via the EGR valve which vents the vacuum signal to atmosphere when coolant temperature is below 65°C, preventing canister purging when the engine is operating on choke.

For description of thermo valve and testing procedures, refer to "Thermo Valve", this section.

Purge Control Valve Testing

(1) Disconnect vacuum hoses from the valve, noting their position.
(2) Remove the valve from the canister.
(3) Blow through port "A", refer Fig. 16, of valve. Air should not flow through valve.
(4) Connect a vacuum pump to nipple "A" and apply a vacuum of more than 7 kPa.
(5) Blow through port "A", air should flow through nipple "B".
(6) If the valve does not perform as specified it should be replaced.
(7) Install the valve, ensuring that hose connections are correct.

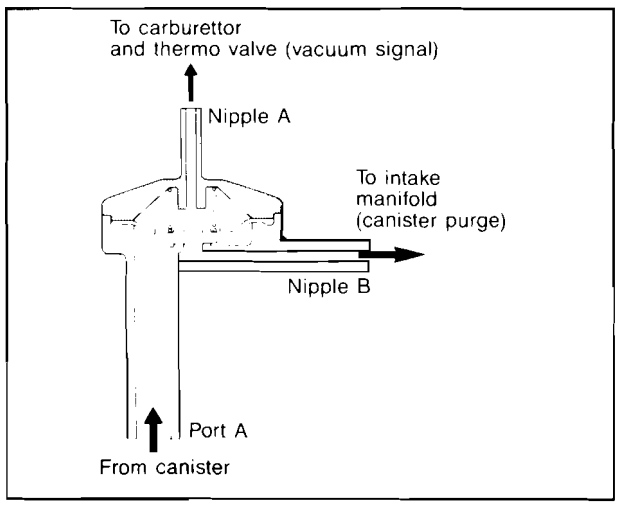


Fig. 16—Purge control valve construction

Purge Control Valve Testing (ECI-Multi 4 cyl models)

(1) Disconnect the vacuum hoses from the solenoid valve, refer Fig. 17, and connect a vacuum pump to the lower nipple.

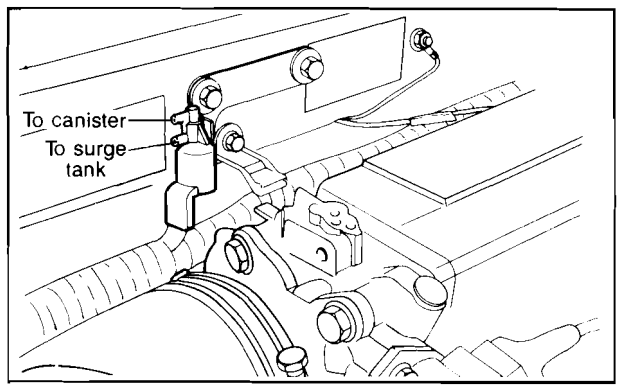


Fig. 17—Checking purge control valve

(2) Disconnect the wiring harness connector.
(3) Apply vacuum and check for air-tightness, when voltage is applied directly to the purge-control solenoid valve and when the voltage is discontinued, refer Fig. 18.

Battery Voltage	Normal condition
When applied	Negative pressure leaks
When discontinued	Negative pressure is maintained

(4) Measure the resistance between the terminals of the solenoid valve, refer Fig. 19.

RESISTANCE: 38-44 ohms @ 20°C

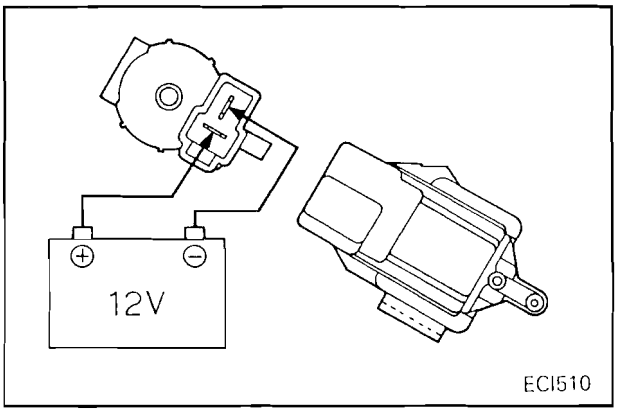


Fig. 18—Battery connection for purge control valve testing

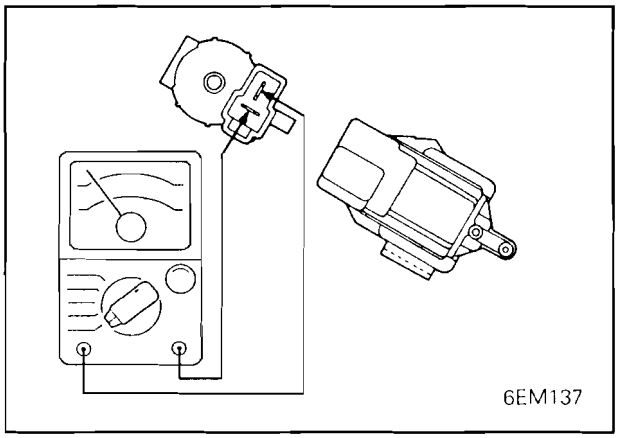


Fig. 19—Purge control valve resistance testing

Fuel Tank Vapour Control

The fuel tank is fitted with a vacuum relief filler cap so that, with the cap fitted, the only means of tank venting is through a vent line to the vapour storage canister.

The tank and filler neck are designed so that, even after the tank is filled, there is a pocket of air above the fuel. A fuel vapour line is situated above this air pocket and is connected to the canister.

A two-way valve, incorporating pressure and vacuum relief valves, is fitted in the vent line. The pressure relief valve opens when pressure in the tank rises above normal. The vacuum relief valve opens when vacuum is generated in the tank. In situations where vacuum in the tank exceeds valve capacity the relief valve in the filler cap opens.

The fuel tank has a smaller diameter filler neck incorporating a spring loaded flap valve which will accept only the small diameter ULP nozzle. A threaded 'screw' type cap is fitted. The cap should be tightened, until a click is heard to ensure of an effective seal.

Two-way Valve Testing

The valve is located in the vent line on the left hand side of the fuel tank.

Accurate testing of the valve requires special measuring equipment however a simple test can be performed as follows:

(1) Remove the valve from the vehicle.

(2) Lightly blow into the valve from each end.

(3) After slight resistance air should flow through the valve in both directions.

(4) Install the valve ensuring it is fitted in the correct direction, refer Fig. 20.

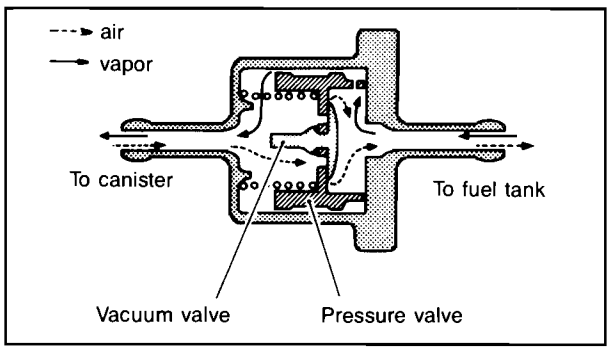


Fig. 20—Two-way valve construction

Fuel Vapour Storage Canister Testing

(1) Disconnect hoses at canister and remove canister from vehicle.

(2) Inspect filter at the underside of the canister for damage or foreign material (mud, etc.) and replace if evidence of either exists.

(3) Shake canister lightly to ensure that the carbon is still retained and restrained inside.

(4) Block the purge port and the carburettor port and lightly blow into the tank port, air should flow easily, through filter.

(5) Block the tank port and the carburettor port and blow into the purge port, air should flow easily.

(6) If the canister does not perform as specified replace the canister.

(7) Re-install the canister and reconnect the hoses to their correct ports.

Carburettor Float Bowl Vapour Control

The bowl vent system that controls the carburettor float bowl vapours consists of bowl vent valve, diaphragms A & B, springs A & B and a check valve, refer Fig. 21.

When the engine is stopped, manifold negative pressure is not generated so that both chambers A and B are at atmospheric pressure. Therefore, spring B forces the bowl vent valve to the right, as a result, the carburettor bowl vapour is stored in the canister.

When the engine is started, the negative pressure generated in the manifold acts on chamber A and it also acts through the check valve to chamber B. When the negative pressure acts on chamber A it overcomes the force of spring A and acts upon diaphragm A to close the orifice.

When the negative pressure acting on chamber B overcomes the force of spring B, diaphragm B moves the bowl vent valve to the left to open the carburettor bowl to the air vent. The pressure in chamber B is maintained by the check valve and the orifice closed by diaphragm A, the bowl vent valve does not move even if the manifold negative pressure drops during operation.

When the engine stops, the pressure in chamber A is equalized with atmospheric pressure to open the orifice through which the negative presure in chamber B leaks out. As a result the bowl vent valve moves to the right.

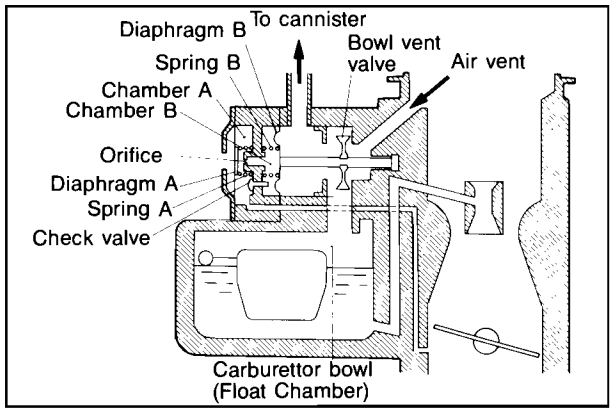


Fig. 21—Bowl vent system

Bowl Vent Valve Testing

(1) Remove the air cleaner.

(2) Disconnect the bowl vapour hose from the bowl vent valve (BVV) nipple and connect a hand vacuum pump to the nipple.

(3) Apply a vacuum of 13 kPa to the BVV and inspect.

Engine status	Normal condition
STOP	Vacuum leaks
Idling	Vacuum is applied

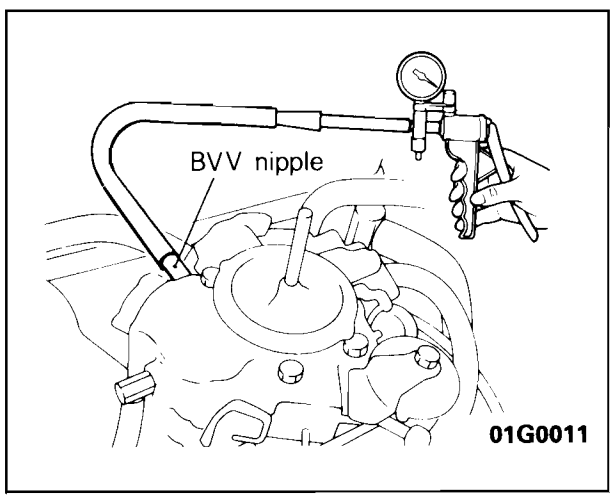


Fig. 22—Bowl vent testing

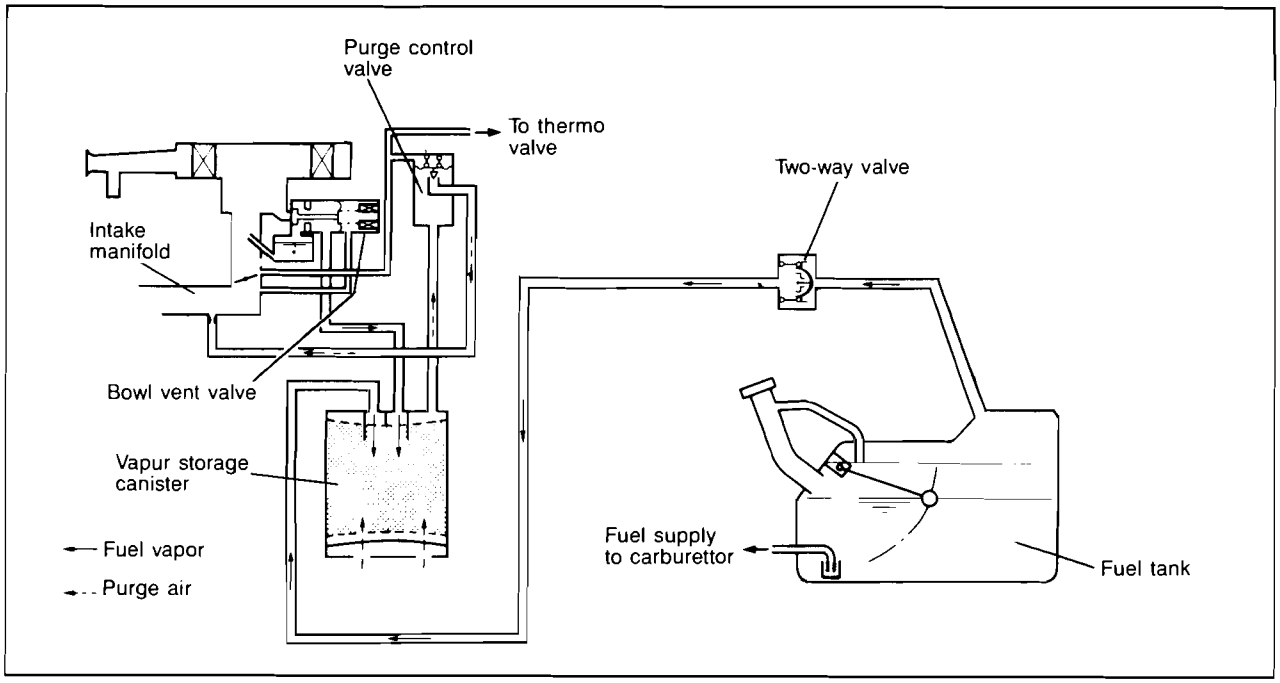


Fig. 23—Evaporative emission control system (typical)

CRANKCASE EMISSIONS CONTROL SYSTEM

General Information

The crankcase ventilation system prevents the release of crankcase "blow by" gases into the atmosphere. A closed system incorporating a PCV (positive crankcase ventilation) valve is used.

Operation

Fresh air, from the air cleaner, is drawn into the crankcase through the rocker cover and mixes with crankcase "blow by" gases.

At part throttle openings the mixture is drawn into the intake manifold through a metering orifice in the PCV valve, in response to manifold vacuum.

At wide open throttle less manifold vacuum is available and "blow by" gases exceed PCV valve capacity. In this situation some gases are drawn into the intake manifold and excess gases "back up" the breather hose to be drawn into the carburettor.

Testing PCV Valve

(1) Disconnect the vacuum hose from the PCV valve and remove the PCV valve from the rocker cover.

(2) Connect the vacuum hose to the PCV valve and start the engine.

(3) A hissing noise should be heard from the valve and a strong vacuum felt when a finger is placed over the valve inlet, refer Fig. 25.

(4) Turn engine off and disconnect vacuum hose from valve.

(5) Blow through the valve from the threaded end. Air should flow freely, refer Fig. 26.

(6) If the above conditions do not apply, the valve is clogged and should be cleaned in a suitable solvent, e.g. X55.

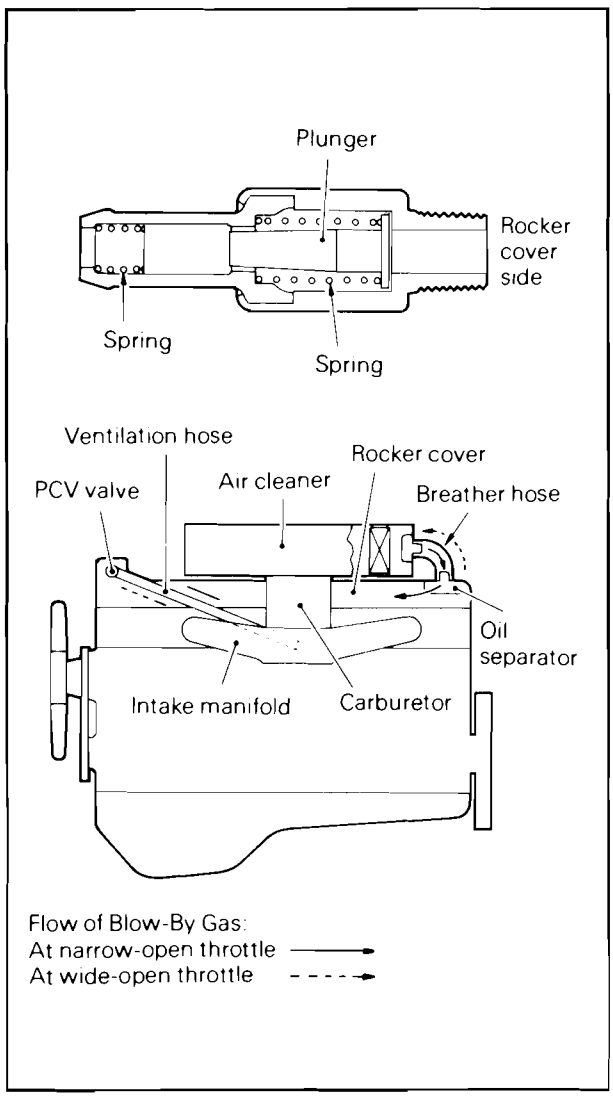


Fig. 24—Crankcase ventilation system

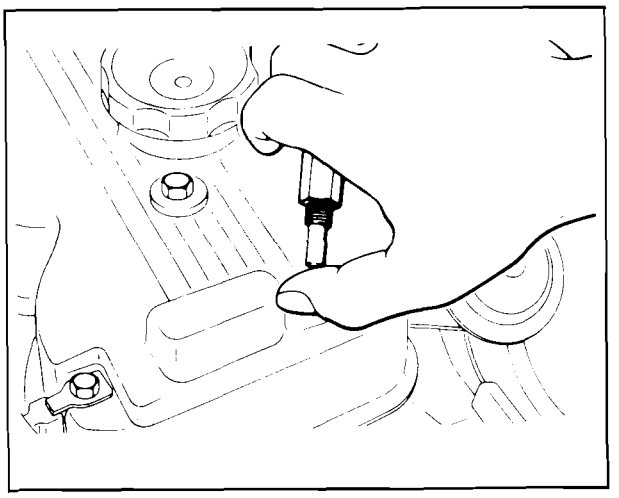


Fig. 25—Checking PCV valve operation

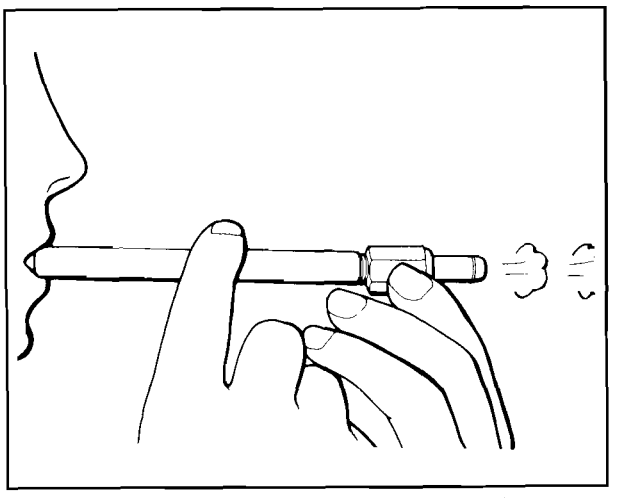


Fig. 26—Checking PCV valve operation

VACUUM CONTROL HOSE INFORMATION AND CONNECTIONS

General Information

Effective operation of emission control systems depends on correct connection of vacuum hoses, delay valves and three way connectors incorporating an orifice.

NOTE: Incorrect hose connections may cause the following problems:-

- **Catalytic converter damage**
- **Poor fuel economy**
- **Poor driveability**
- **Non-compliance with ADR 37/00.**

Vacuum Hoses

Vacuum hoses must be connected as shown in the schematic layout illustrations, Figs. 28 to 30.

To further assist in correct hose connection Fig. 27 shows carburettor vacuum outlets and Figs. 28 and 29 are a graphic of hose connections showing colour coding and hose routing, Fig. 30 is a graphic of hose connections, for ECI-Multi vehicles.

Connectors

Some connectors incorporate an orifice as shown in the schematic layouts. It is essential that connectors are fitted correctly.

NOTE: On three-way connectors with an orifice, the orifice is located in the centre leg of the connector.

Delay Valves

All delay valves with the exception of the secondary air supply delay valve must be installed with the black side towards the vacuum source. The secondary air supply delay valve is fitted with the black side facing the reed valve assembly.

Canister Purge Port

The canister purge port at the intake manifold is the largest diameter port of the multiple connector.

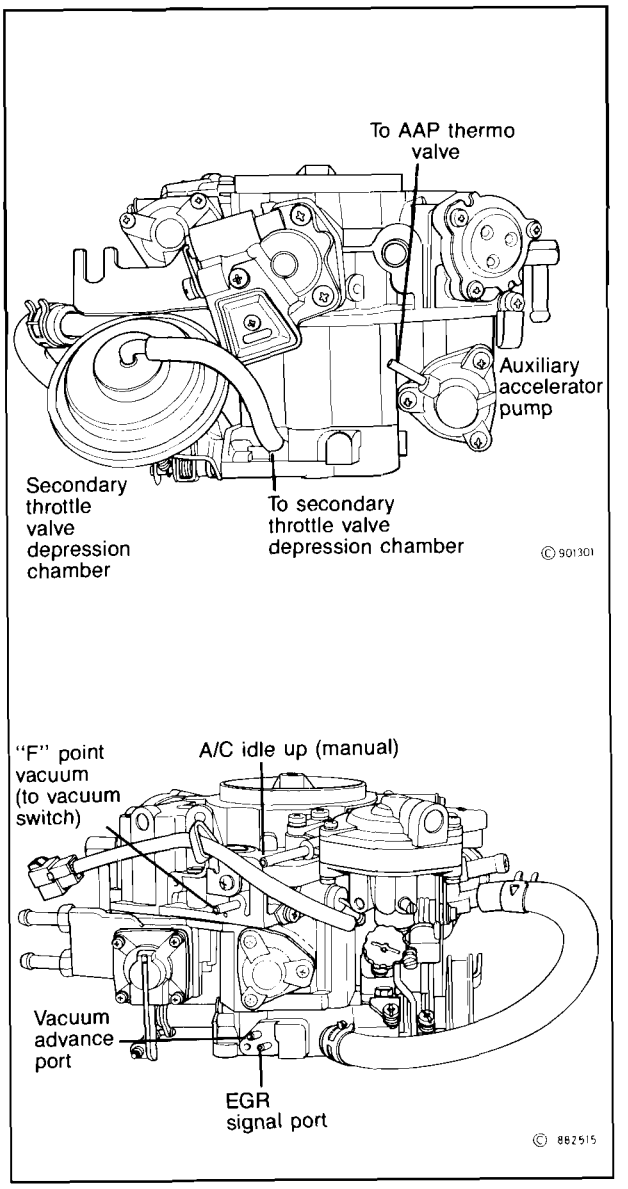


Fig. 27—Carburettor vacuum outlets

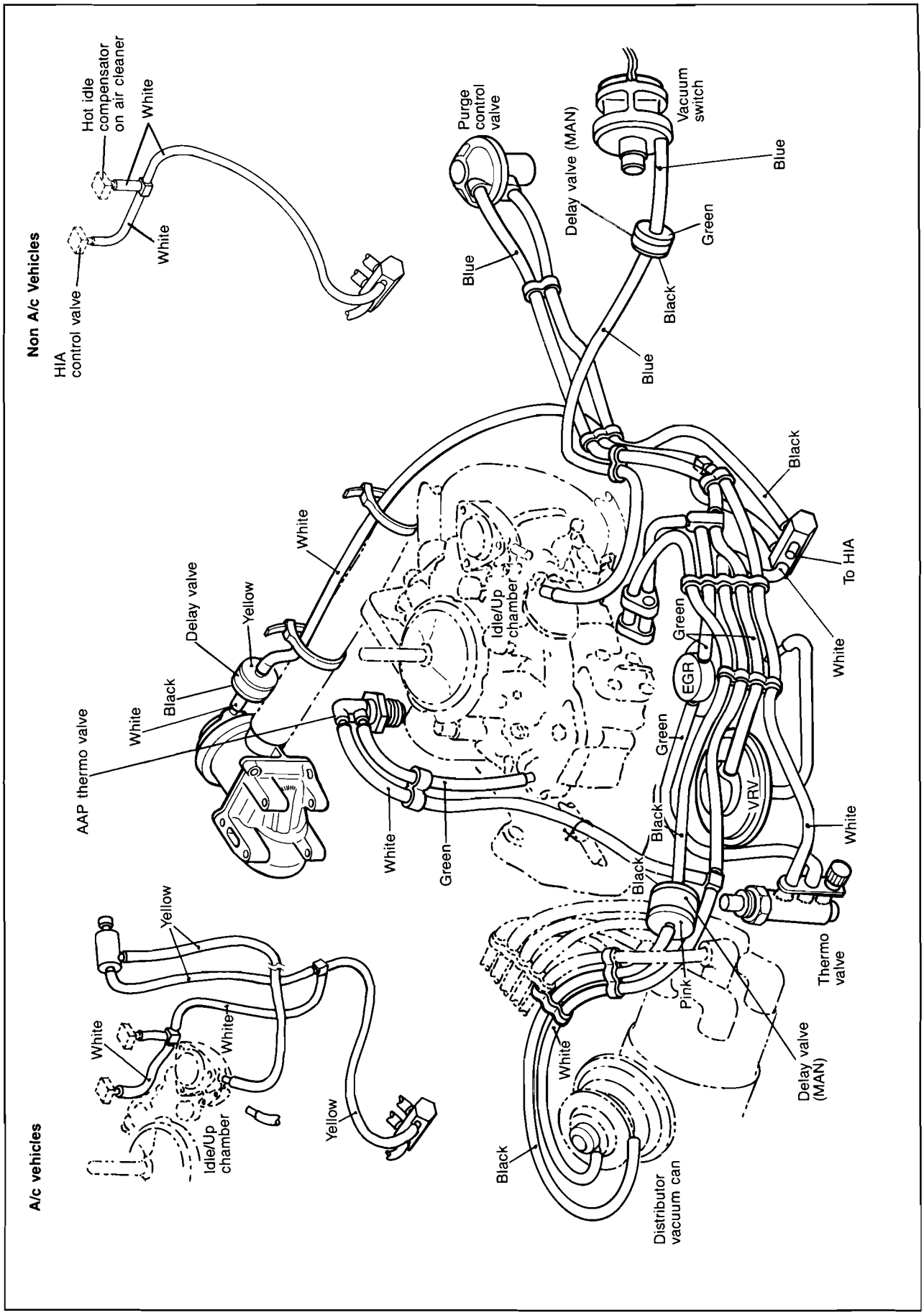


Fig. 28—Vacuum hose routing carburettor models

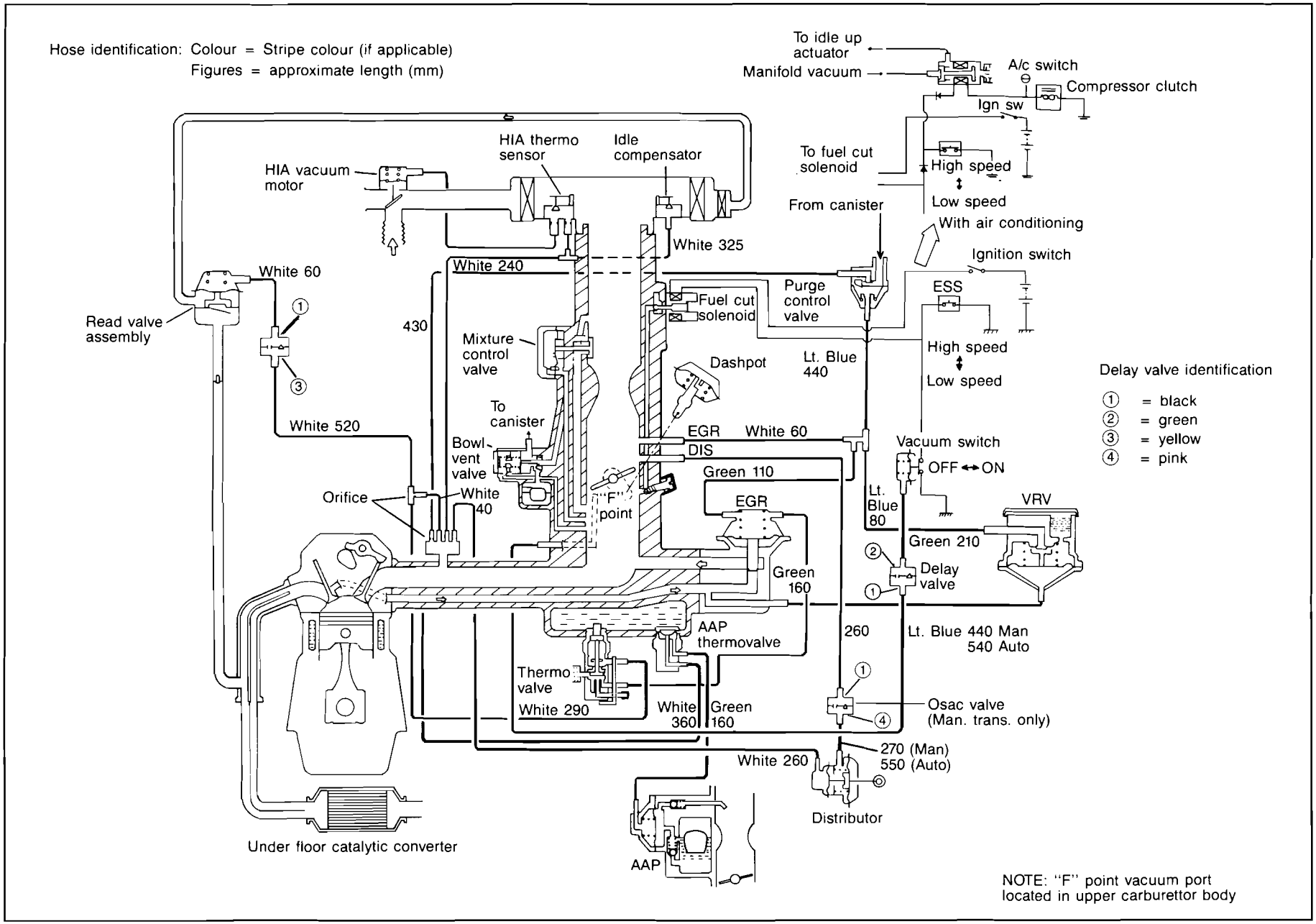


Fig. 29—Schematic of vacuum control system, carburettor models

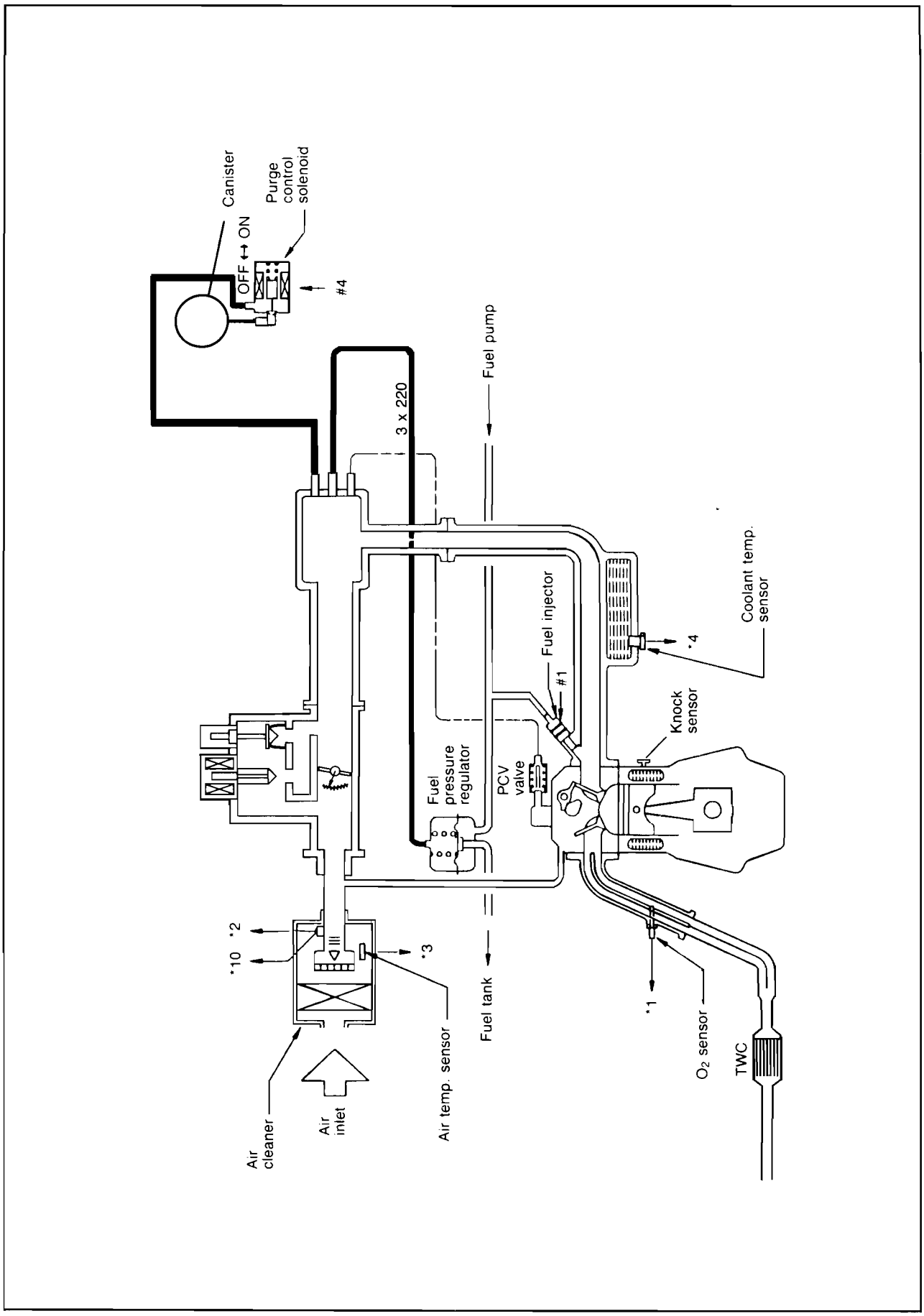


Fig. 30—Vacuum control system ECI-Multi 4 cyl. models

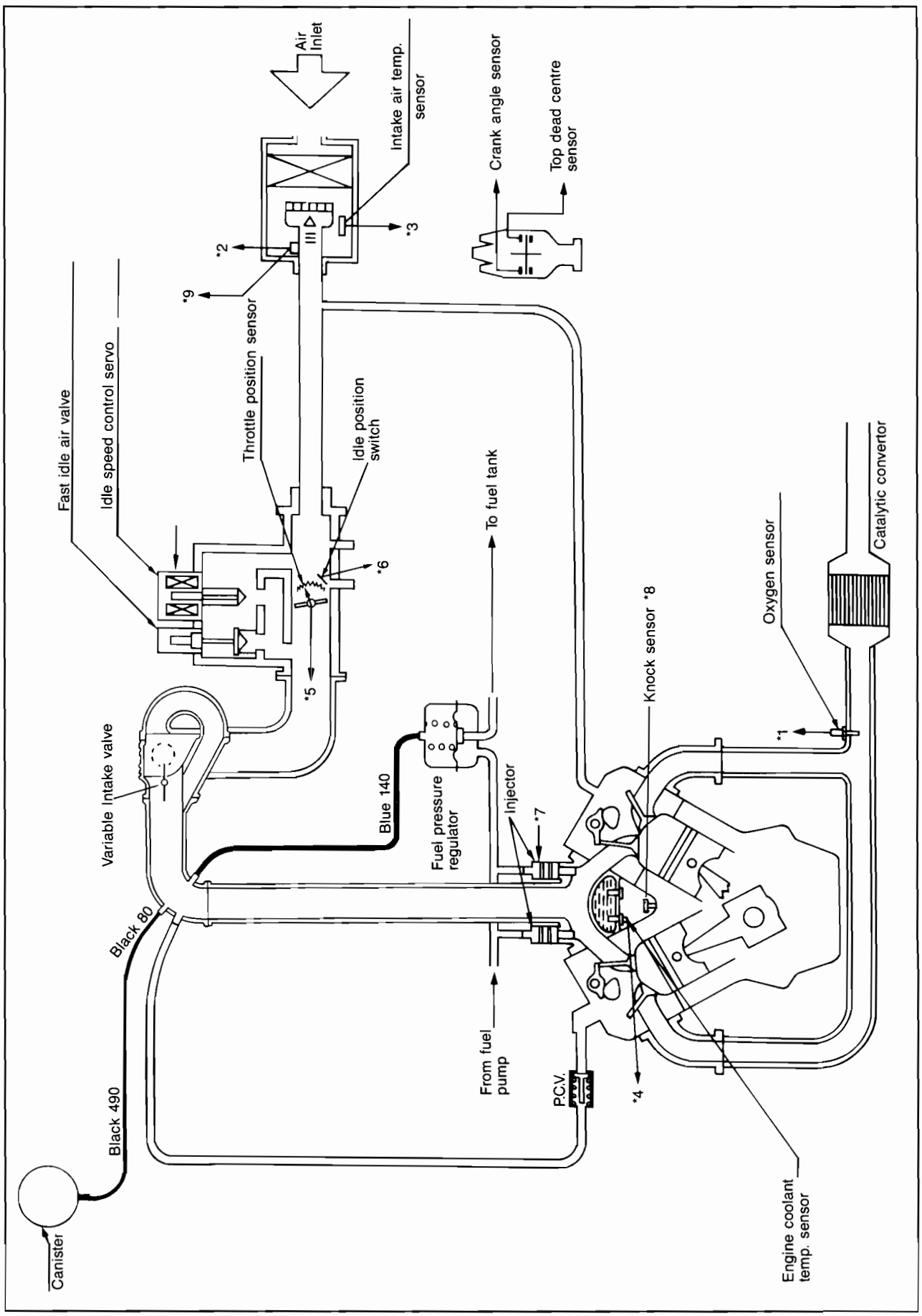


Fig. 31—Vacuum control system ECI-Multi V6 models

SECTION 3 — EMISSION CONTROL SYSTEMS V6 MODELS

GENERAL INFORMATION

In order to improve air quality and to protect the environment by reducing atmospheric pollution, Australian Design Rules require that the components of vehicle exhaust and evaporative emissions listed below are controlled to a specified level and that vehicles manufactured on or after January 1st, 1986 must use unleaded petrol exclusively.

- **Carbon Monoxide (CO):** a gaseous compound contained in exhaust gases when there is insufficient air in the air/fuel mixture to fully burn the fuel, or insufficient time for the combustion to be completed.

- **Hydrocarbons (HC):** unburned or partially burned fuel contained in exhaust gases or crankcase "blow by" gases as a result of incomplete combustion or fuel vapours resulting from evaporation in the fuel system.

- **Oxides of Nitrogen (NOx):** compounds of nitrogen (one molecule) and oxygen (any number of molecules) contained in exhaust gases and produced as a result of the high temperatures occurring during combustion.

Methods of Controlling Emissions

Exhaust Emissions

- By ensuring optimum combustion efficiency through basic engine, fuel system and ignition design (HC and CO).

- By using a catalytic converter to promote the afterburning and subsequent oxidation of CO and HC in exhaust gases to form CO_2 (carbon dioxide), water and heat.

- By reducing combustion temperatures under certain operating conditions by recirculating a metered quantity of exhaust gas to dilute the air/fuel mixture (NOx).

NOTE: For adjustment of CO refer to Group 13.

Crankcase Emissions

- By directing crankcase blow by gases through the P.C.V. (positive crankcase ventilation) system back into the combustion chamber through the intake system.

Evaporative Emissions

- By directing fuel vapour from the fuel tank back into the combustion chamber through the intake system.

NOTE: To ensure continued compliance with Australian Design Rules and State regulations relating to vehicle emissions, it is essential that systems are serviced in accordance with the Lubrication and Maintenance schedule shown in Group 00 using the procedures outlined in this manual.

CATALYTIC CONVERTER

General Information

The catalytic converter is a ceramic monolith type located under floor in the exhaust. A ceramic monolith is an extrusion of fine cellular structure which forms a substrate for a fine "wash coat" of precious metals.

The "wash coat" acts as the catalyst to promote the afterburning and subsequent oxidation of CO and HC contained in exhaust gases to form CO_2 (carbon dioxide), water and heat.

The catalytic converter does not require any maintenance under normal circumstances, however it should be noted that it will be rendered ineffective if poisoning occurs as a result of misfuelling, i.e. using leaded petrol, or if damage occurs as a result of excessive exhaust gas temperatures caused by engine misfiring, incorrect ignition timing or the intake of large quantities of raw fuel into the exhaust manifold.

Since catalyst failure will result in exhaust emission levels higher than legal limits it is essential that the following precautions are observed when carrying out maintenance or repair operations.

- Do not "prime" the system by pouring fuel down the throttle body to facilitate engine starting after fuel system has been emptied.

- Avoid driving the vehicle if misfiring is evident.

- Do not allow the engine to idle for prolonged periods if idle is very rough or misfiring is evident.

- Do not disconnect high tension cables with the engine running.

- Do not switch ignition OFF or otherwise interrupt the ignition power supply with the transaxle in gear and the vehicle in motion.

- Do not disconnect, modify or otherwise tamper with catalyst protection systems.

- Do not attempt to push or tow start a disabled vehicle.

If for any reason, the catalyst requires replacement refer to Group 15 for correct procedure.

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EXHAUST GAS RECIRCULATION

General Information

The E.G.R. system recirculates a metered quantity of exhaust gases from exhaust port to the intake manifold. The gases dilute the air/fuel mixture, resulting in lower combustion temperatures and a reduction in exhaust gas NOx concentration.

E.G.R. Valve

Construction of the E.G.R. valve is shown in Fig. 1. Vacuum from the throttle body, regulated by the EGR control solenoid valve via the ECU, is applied to the diaphragm through the upper chamber to open the E.G.R. valve allowing gas to circulate.

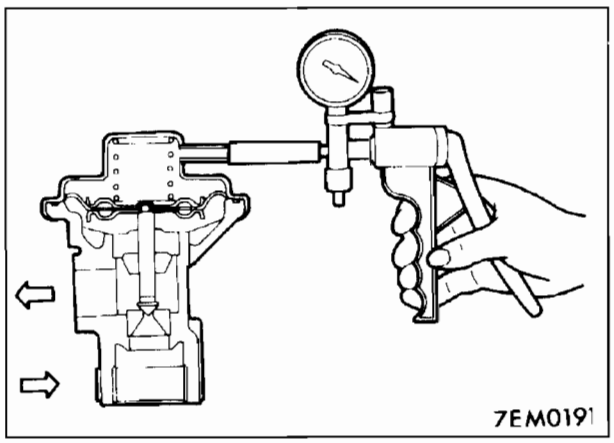


Fig. 1 — E.G.R. valve construction

NOTE: E.G.R. valve calibration varies between manual and automatic transmission models.

E.G.R. Valve Replacement

(1) Identify, then remove vacuum hoses from the E.G.R. valve.

(2) Remove the two valve to manifold attaching bolts and remove the valve.

(3) Install by reversing removal procedure, using a new gasket.

(4) Tighten bolts to 10 Nm.

EGR Control Solenoid Valve Testing

(1) Disconnect the vacuum hoses from the EGR solenoid valve and connect a vacuum pump to the nipple.

(2) Disconnect the wiring harness connector.

(3) Apply vacuum and check for air-tightness, when voltage is applied directly to the EGR control solenoid valve and when the voltage is discontinued, refer Fig. 2.

(4) Measure the resistance between the terminals of the solenoid valve, refer Fig. 3.

RESISTANCE: 36-44 Ohms @ 20°C

Battery Voltage	Normal condition
When applied	Negative pressure is maintained
When discontinued	Negative pressure leaks

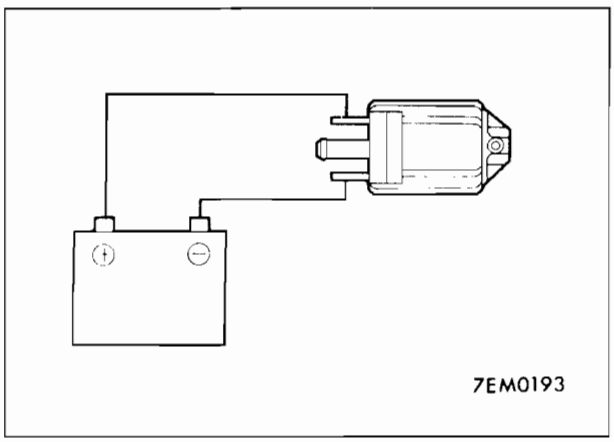


Fig. 2 — Battery connection for EGR control solenoid valve testing

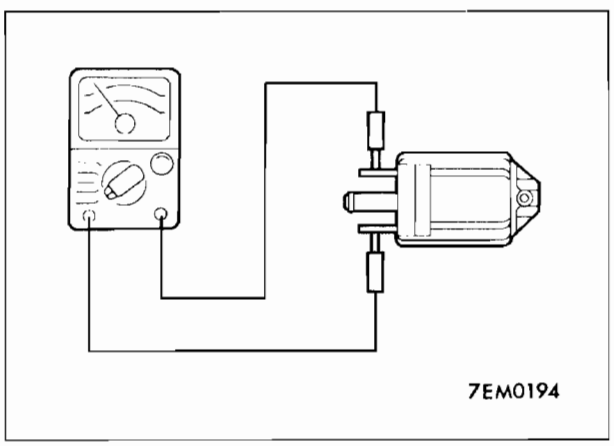


Fig. 3 — EGR control solenoid valve resistance testing

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EVAPORATIVE EMISSIONS CONTROL SYSTEM

General Information

The evaporative emission control system prevents the release of fuel system vapours into the atmosphere by storing vapours in an activated carbon filled fuel vapour storage canister, when the engine is not running, and releasing vapours from the canister to the intake manifold, through a purge control valve, when the engine is running.

Purge Control Solenoid Valve Testing

(1) Disconnect the vacuum hoses from the solenoid valve and connect a vacuum pump to the lower nipple.

(2) Disconnect the wiring harness connector.

(3) Apply vacuum and check for air-tightness, when voltage is applied directly to the purge-control solenoid valve and when the voltage is discontinued, refer Fig. 4.

(4) Measure the resistance between the terminals of the solenoid valve, refer Fig. 5.

RESISTANCE: 36-44 Ohms @ 20°C

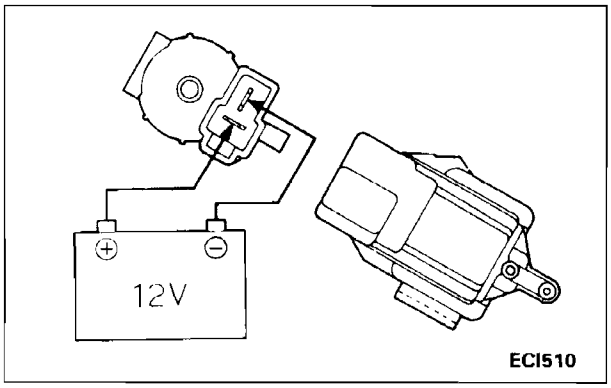


Fig. 4 — Battery connection for purge control valve testing

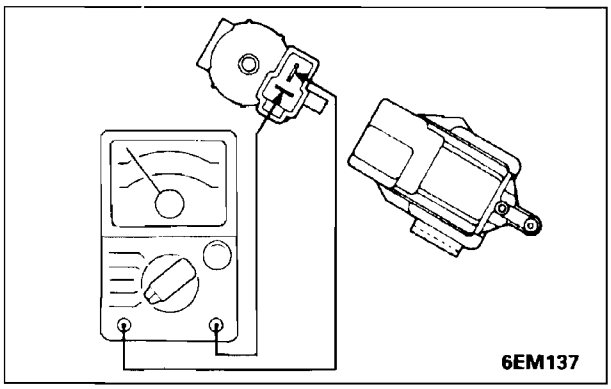


Fig. 5 — Purge control valve resistance testing

Battery Voltage	Normal condition
When applied	Negative pressure leaks
When discontinued	Negative pressure is maintained

Fuel Tank Vapour Control

The fuel tank is fitted with a vacuum relief filler cap so that, with the cap fitted, the only means of tank venting is through a vent line to the vapour storage canister.

The tank and filler neck are designed so that, even after the tank is filled, there is a pocket of air above the fuel. A fuel vapour line is situated above this air pocket and is connected to the canister.

A two-way valve, incorporating pressure and vacuum relief valves, is fitted in the vent line. The pressure relief valve opens when pressure in the tank rises above normal. The vacuum relief valve opens when vacuum is generated in the tank. In situations where vacuum in the tank exceeds valve capacity the relief valve in the filler cap opens.

The fuel tank has a smaller diameter filler neck incorporating a spring loaded flap valve which will accept only the small diameter ULP nozzle. A threaded 'screw' type cap is fitted. The cap should be tightened until a click is heard to ensure of an effective seal.

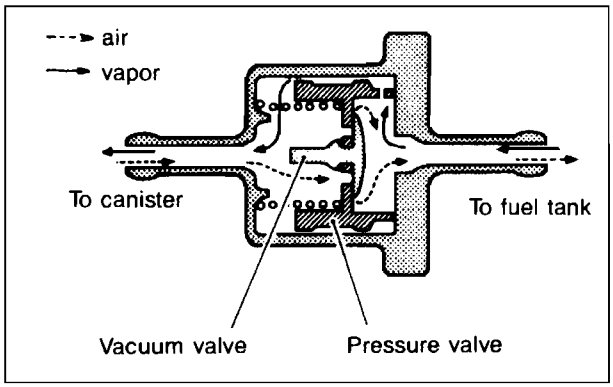


Fig. 6 — Two-way valve construction

Two-way Valve Testing

The valve is located in the vent line on the left hand side of the fuel tank.

Accurate testing of the valve requires special measuring equipment however a simple test can be performed as follows:

(1) Remove the valve from the vehicle.

(2) Lightly blow into the valve from each end.

(3) After slight resistance air should flow through the valve in both directions.

(4) Install the valve ensuring it is fitted in the correct direction, refer Fig. 6.

Fuel Vapour Storage Canister Testing

(1) Disconnect hoses at canister and remove canister from vehicle.

(2) Inspect filter at the underside of the canister for damage or foreign material (mud, etc.) and replace if evidence of either exists.

(3) Shake canister lightly to ensure that the carbon is still retained and restrained inside.

(4) Block the purge port and the carburettor port and lightly blow into the tank port, air should flow easily, through filter.

(5) Block the tank port and the carburettor port and blow into the purge port, air should flow easily.

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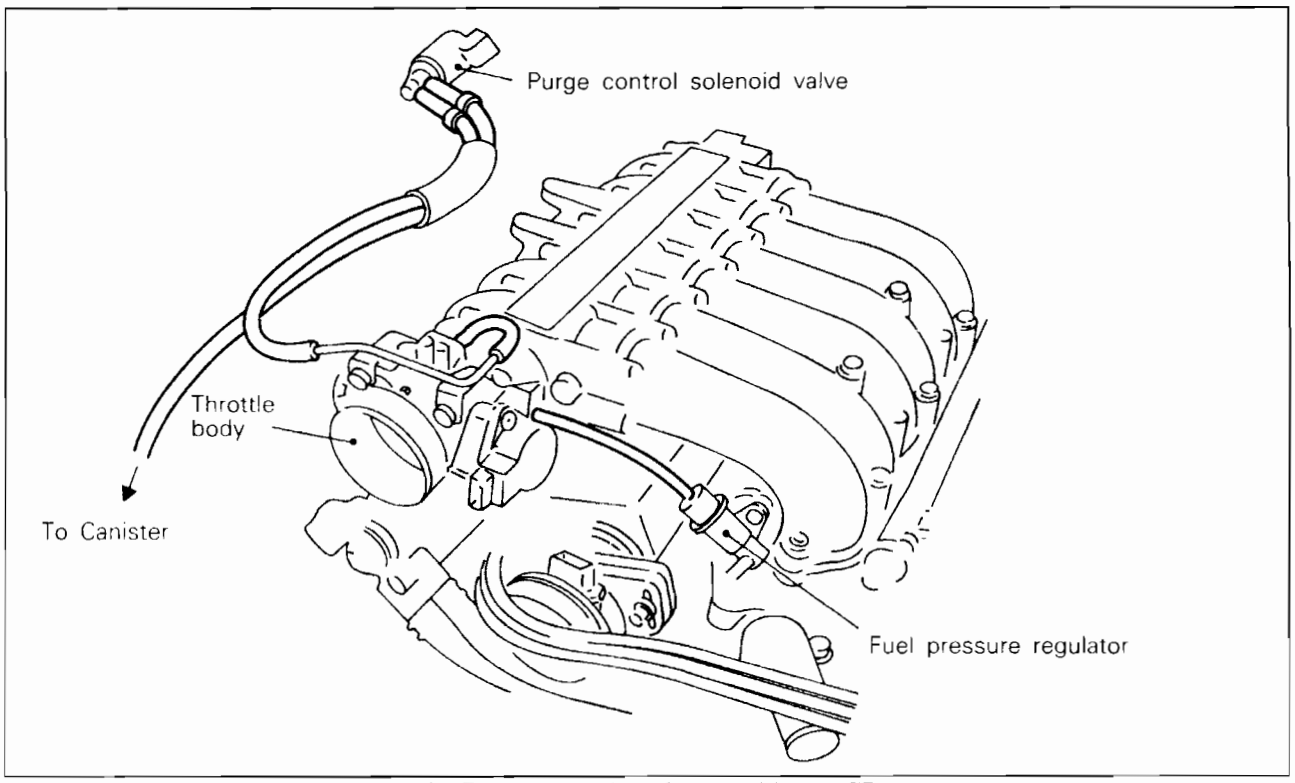


Fig. 7 — Vacuum hose layout without EGR

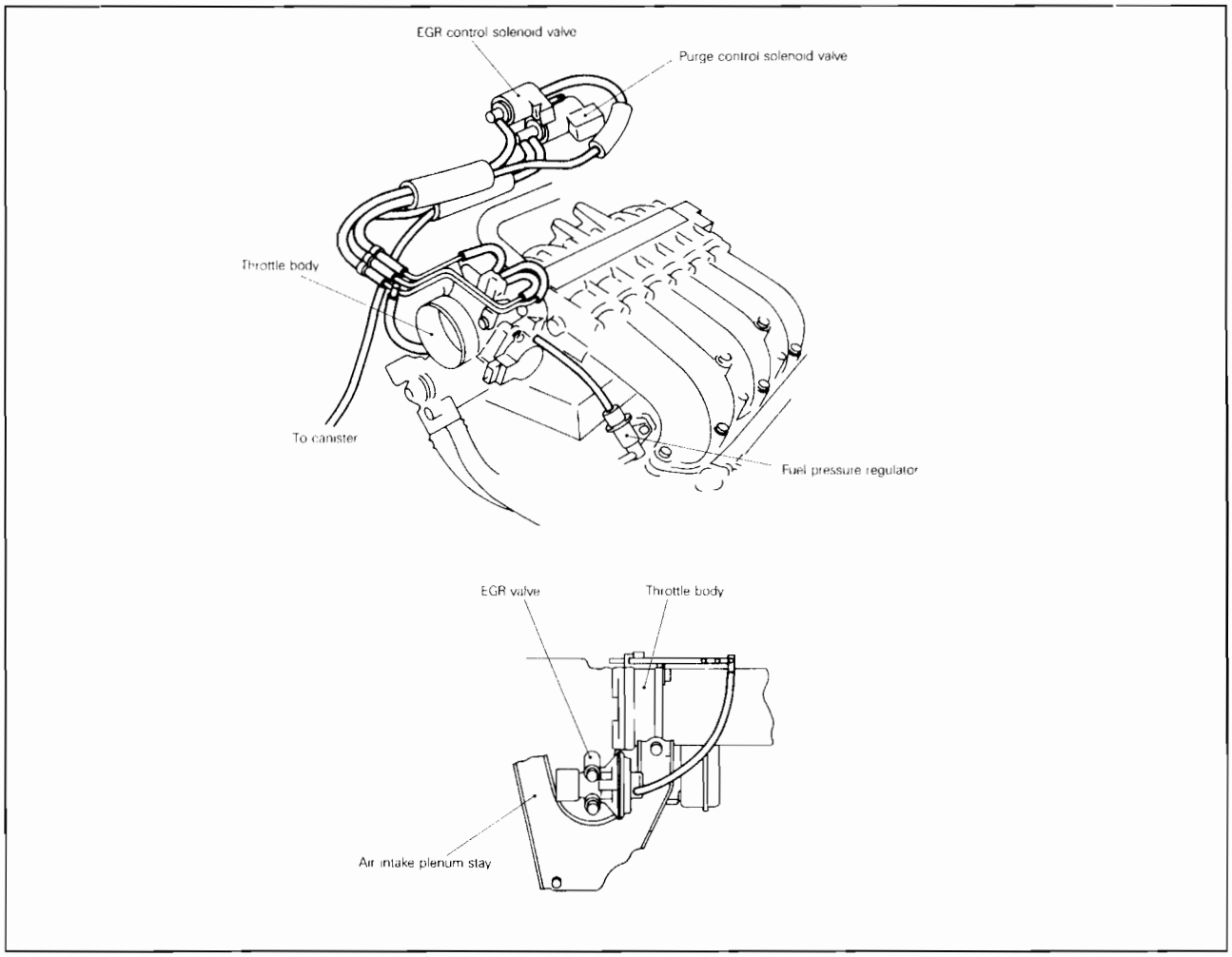
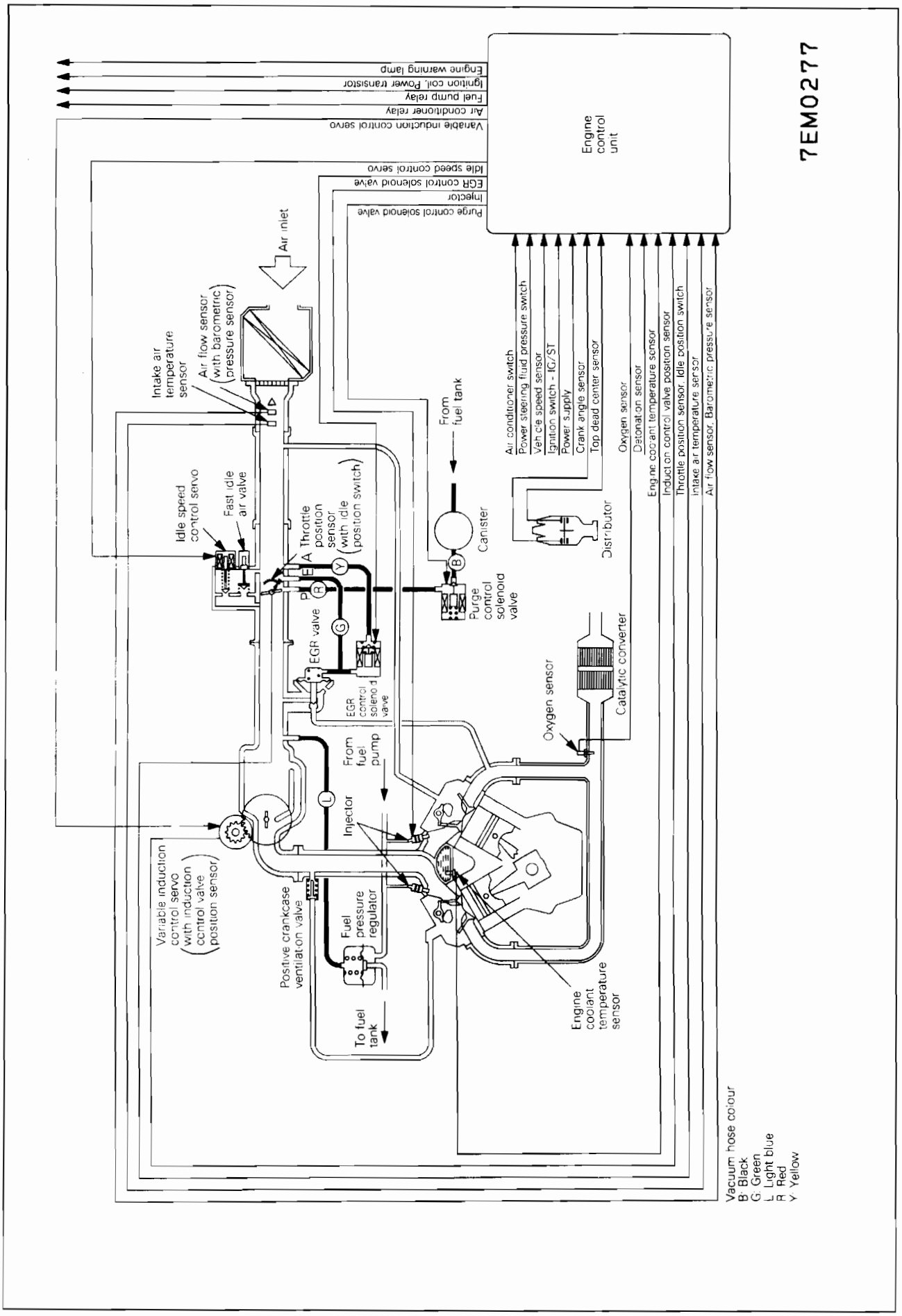


Fig. 8 — Vacuum hose layout with EGR



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(6) If the canister does not perform as specified replace the canister.

(7) Re-install the canister and reconnect the hoses to their correct ports.

CRANKCASE EMISSIONS CONTROL SYSTEM

General Information

The crankcase ventilation system prevents the release of crankcase "blow by" gases into the atmosphere. A closed system incorporating a PCV (positive crankcase ventilation) valve is used.

Operation

Fresh air, from the air cleaner, is drawn into the crankcase through the rocker cover and mixes with crankcase "blow by" gases.

At part throttle openings the mixture is drawn into the intake manifold through a metering orifice in the PCV valve, in response to manifold vacuum.

At wide open throttle less manifold vacuum is available and "blow by" gases exceed PCV valve capacity. In this situation some gases are drawn into the intake manifold and excess gases "back up" the breather hose to be drawn into the carburettor.

Testing PCV Valve

(1) Disconnect the vacuum hose from the PCV valve and remove the PCV valve from the rocker cover.

(2) Connect the vacuum hose to the PCV valve and start the engine.

(3) A hissing noise should be heard from the valve and a strong vacuum felt when a finger is placed over the valve inlet, refer Fig. 9.

(4) Turn engine off and disconnect vacuum hose from valve.

(5) Blow through the valve from the threaded end. Air should flow freely, refer Fig. 10.

(6) If the above conditions do not apply, the valve is clogged and should be cleaned in a suitable solvent, e.g. X55.

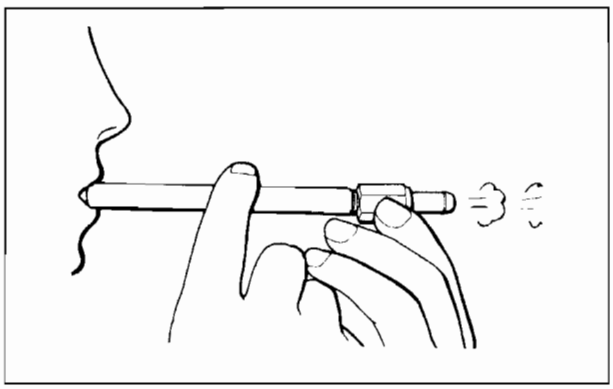


Fig. 10 — Checking PCV valve operation

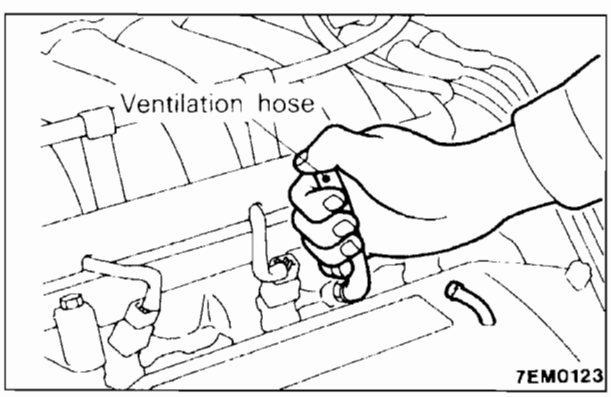


Fig. 9 — Checking PCV valve operation

GROUP 21 — CLUTCH

SECTION 0 — INDEX

Subject	Section Number	Page Number
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General Information		2
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Release Bearing and Lever		2
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Release Cylinder		5
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Pedal Height Adjustment		7

SECTION 1 — CLUTCH SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
CLUTCH SHUDDER	Worn or damaged clutch disc facings.	Replace clutch disc.
	Pressure plate worn.	Replace pressure plate.
	Grease or oil on clutch disc facings.	Locate and correct cause of leakage and replace clutch disc.
CLUTCH SLIPPING	Insufficient pedal free travel.	Check pedal height adjustment.
	Burned, worn or oil soaked clutch disc facings.	Replace clutch disc.
	Weak or broken pressure plate springs.	Replace pressure plate.
CLUTCH NOT DISENGAGING FULLY	Excessive pedal free travel.	Check pedal height adjustment.
	Air in hydraulic system.	Bleed hydraulic system.
	Worn pressure plate springs.	Replace pressure plate.
	Clutch disc splines sticking.	Clean splines and check for damage.
CLUTCH OPERATION NOISY	Release bearing noisy.	Replace release bearing.
	Pressure plate levers worn.	Replace pressure plate.
	Clutch disc facings worn.	Replace clutch disc.
	Release cylinder pushrod socket or release lever fulcrum dry.	Lubricate.

SECTION 2 — CLUTCH

SPECIFICATIONS

	4G54	6G72
Clutch disc		
Type	Single dry plate	←
Facing material	Moulded woven asbestos	Non asbestos
Facing diameter — outside	225 mm	←
— inside	155 mm	150 mm
Free thickness	8.3 ± 0.3 mm	9.0 ± 0.3 mm
Compressed thickness (nominal)	8.1 to 7.6 mm @ 5.68 kN	8.4 ± 0.3 mm @ 6.3 kN
Pressure plate		
Type	Diaphragm spring	←
Clamping load — new	5.2 ± 0.40 kN	6.3 ± 0.44 kN
— used	4.9 kN (min.)	5.85 kN (min.)
Finger height from flywheel disc contact face (clutch disc @ nominal thickness)	30.6 ± 1 mm	31.9 ± 0.7 mm
Release bearing		
Type	Pre-lubricated, sealed ball bearing	←
Master cylinder		
Bore	15.87 mm	←
Stroke	31.4 mm (minimum)	←
Piston to bore clearance service limit	0.15 mm	←
Release cylinder		
Bore	20.5 mm	←
Piston to bore clearance service limit	0.15 mm	←
Clutch pedal		
Pedal play (at clevis pin)	1 to 3 mm	←
Pedal free travel (including pedal play)	6 to 13 mm	←
Pedal height (measured at floor pan)		
— clutch engaged	176 to 181 mm	←
— clutch disengaged	35 mm (minimum)	←
Recommended hydraulic fluid	DOT 4 Brake fluid conforming to AS1960-1983 Grade 3.	←

SPECIAL TOOLS

E6M15	Clutch disc aligning tool

TORQUE SPECIFICATIONS

	Nm
Clutch pedal shaft nut	25 to 35
Pressure plate to flywheel bolt	15 to 21
Starter motor mounting bolt	22 to 32
Transaxle to engine bolt	43 to 55
Transaxle insulator through bolt	60 to 80
Transaxle insulator bracket to body bolt	40 to 50

GENERAL INFORMATION

The clutch used is a hydraulically actuated single dry disc type.

The hydraulic system consists of a master cylinder connected to the clutch pedal, clutch damper assembly (V6 models only) which retards engagement of the clutch if the clutch pedal is released suddenly and a release cylinder mounted on the transaxle which acts on the release bearing lever. There is provision for pedal free play adjustment, it is important to maintain the correct pedal height adjustment.

The clutch disc incorporates rubber torsion dampers and torsion springs to provide torsional cushioning and damping.

The pressure plate is a diaphragm spring type. The diaphragm lever height is not adjustable and the unit is serviced only as an assembly.

The release bearing is a fully enclosed pre lubricated type and is actuated by the release lever which pivots on a fulcrum located inside the clutch housing of the transaxle.

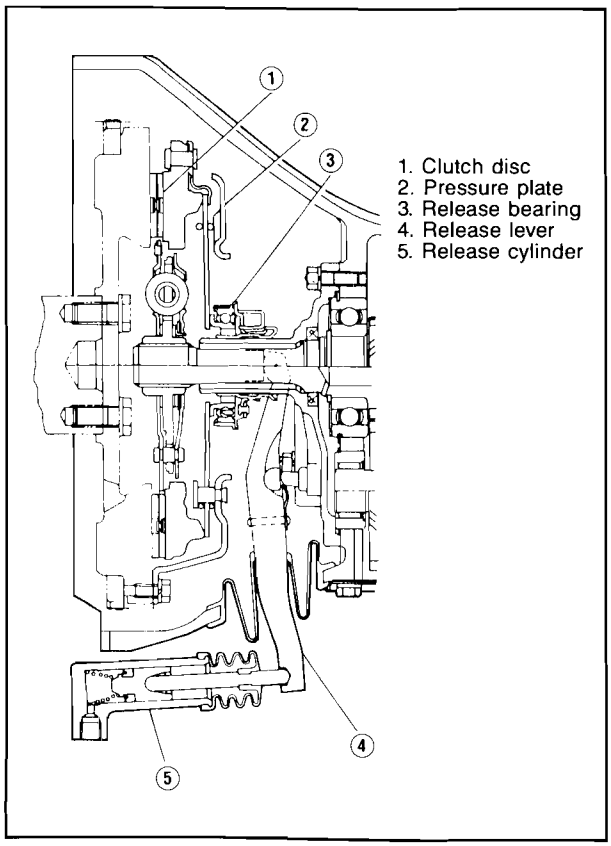


Fig. 1—Clutch components

CLUTCH DISC AND PRESSURE PLATE

Removal

(1) Remove the transaxle as outlined in Group 22 — Transaxle.

(2) Mark the position of the pressure plate relative to the flywheel to ensure that the pressure plate can be correctly located on reassembly.

(3) Insert a suitable aligning tool through the clutch disc and into the flywheel to support the disc, refer fig. 2.

(4) Gradually loosen the pressure plate retaining bolts in a diagonal sequence.

(5) Remove the bolts, the pressure plate and the clutch disc.

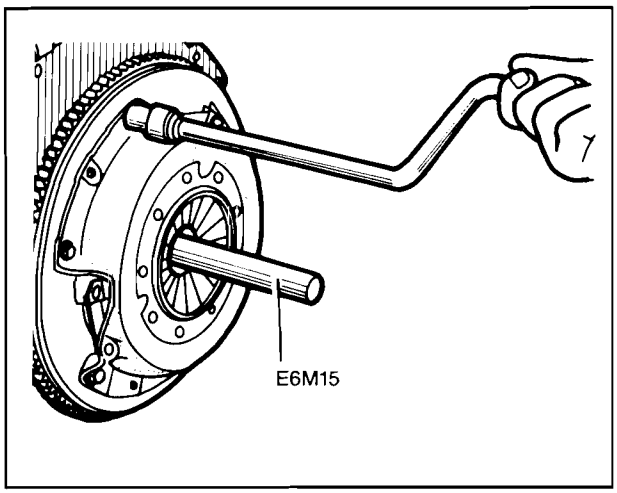


Fig. 2— Removing pressure plate and clutch disc

Installation

Install by reversing the removal procedure noting the following:

(1) Thoroughly clean the surface of the flywheel and pressure plate (with a clean dry cloth).

(2) Use a suitable aligning tool to position the clutch disc on the flywheel.

(3) Tighten the clutch cover retaining bolts a few threads at a time in a diagonal sequence and ensure that the bolts are tightened to specifications.

(4) With the clutch cover tightened the aligning tool should slide freely out of the flywheel. If this is not the case the cover bolts should be loosened and the clutch disc re-aligned.

(5) Install transaxle assembly.

(6) Bleed the clutch using the procedure outlined in this section.

(7) Check that the clutch pedal freeplay is within specifications. If it is not within specifications adjust the pedal height using the procedure outlined in this section.

RELEASE BEARING AND LEVER

Removal

(1) Remove the transaxle as outlined in Group 22 — Transaxle.

(2) Remove the release bearing from the transaxle by removing the clip and sliding the bearing off.

(3) Remove the release lever boot.

(4) Remove the release lever by sliding in the direction shown in fig. 3.

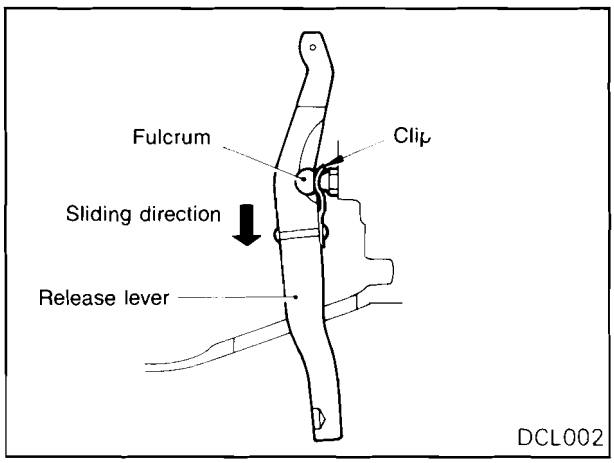


Fig. 3—Release lever removal

Inspection

Rotate the bearing by hand and check that it rotates smoothly and quietly.

NOTE: The bearing is sealed and is serviced as an assembly. Do not wash the bearing in solvent or attempt to disassemble it.

Installation

Install by reversing the removal procedure noting the following.

(1) Before installing the release bearing, grease the internal area of the bearing carrier and apply a coat of grease to release lever fulcrum, the release lever to bearing carrier contact area, and the release lever pushrod socket, refer Fig. 4. Multipurpose grease E.P. Grade 2 is recommended.

(2) Bleed the clutch using the procedure outlined in this section.

(3) Check that the clutch pedal free travel is within specifications. If it is not within specifications adjust the pedal height using the procedure outlined in this section.

MASTER CYLINDER

Removal

(1) Remove the push rod to brake pedal clevis pin.

(2) Disconnect the hydraulic tube from the master cylinder.

(3) Remove the master cylinder attaching bolts and remove the master cylinder.

NOTE: On vehicles equipped with cruise control and fuel injection, access to master cylinder is limited. To avoid damage to components it may be necessary to remove the air cleaner to throttle body duct.

Installation

Install by reversing the removal procedure noting the following:

(1) Top up the reservoir and bleed the system using the procedure outlined in this section.

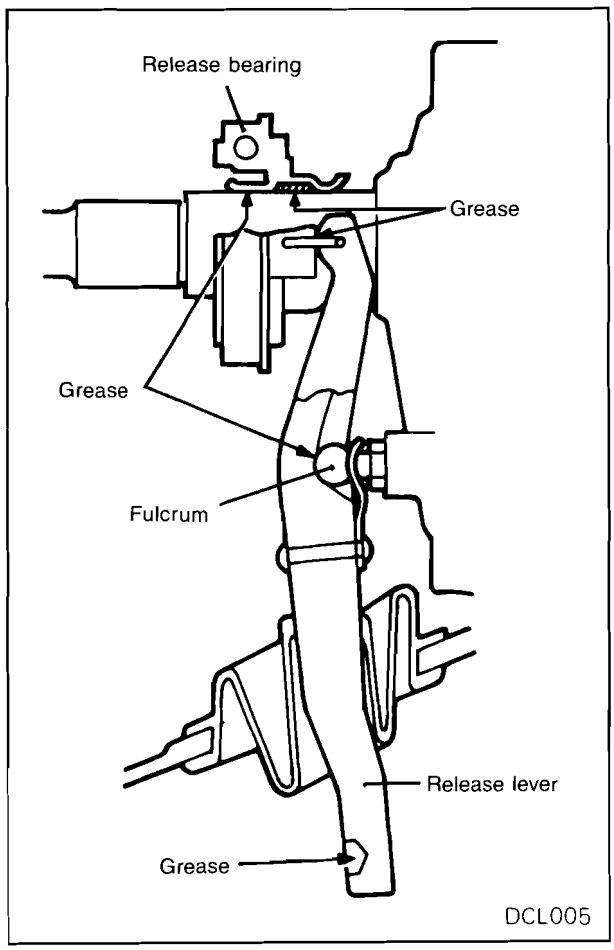


Fig. 4—Grease application points

NOTE: Always use the specified fluid from a sealed container.

(2) Check that the pedal free travel is within specifications. If it is not within specifications adjust the pedal height using the procedure outlined in this section.

NOTE: If a new master cylinder is fitted the pedal height must be checked.

Disassembly

(1) Remove the reservoir cap and drain the hydraulic fluid.

(2) Remove the rubber boot from the cylinder.

(3) Using long nosed pliers remove the pushrod retaining circlip and remove the pushrod and washer.

(4) Remove the piston and valve assembly by lightly tapping the body mounting flange on a wooden block.

(5) Remove the piston from the valve by lifting the tab on the spring thimble with a screwdriver, refer Fig. 6.

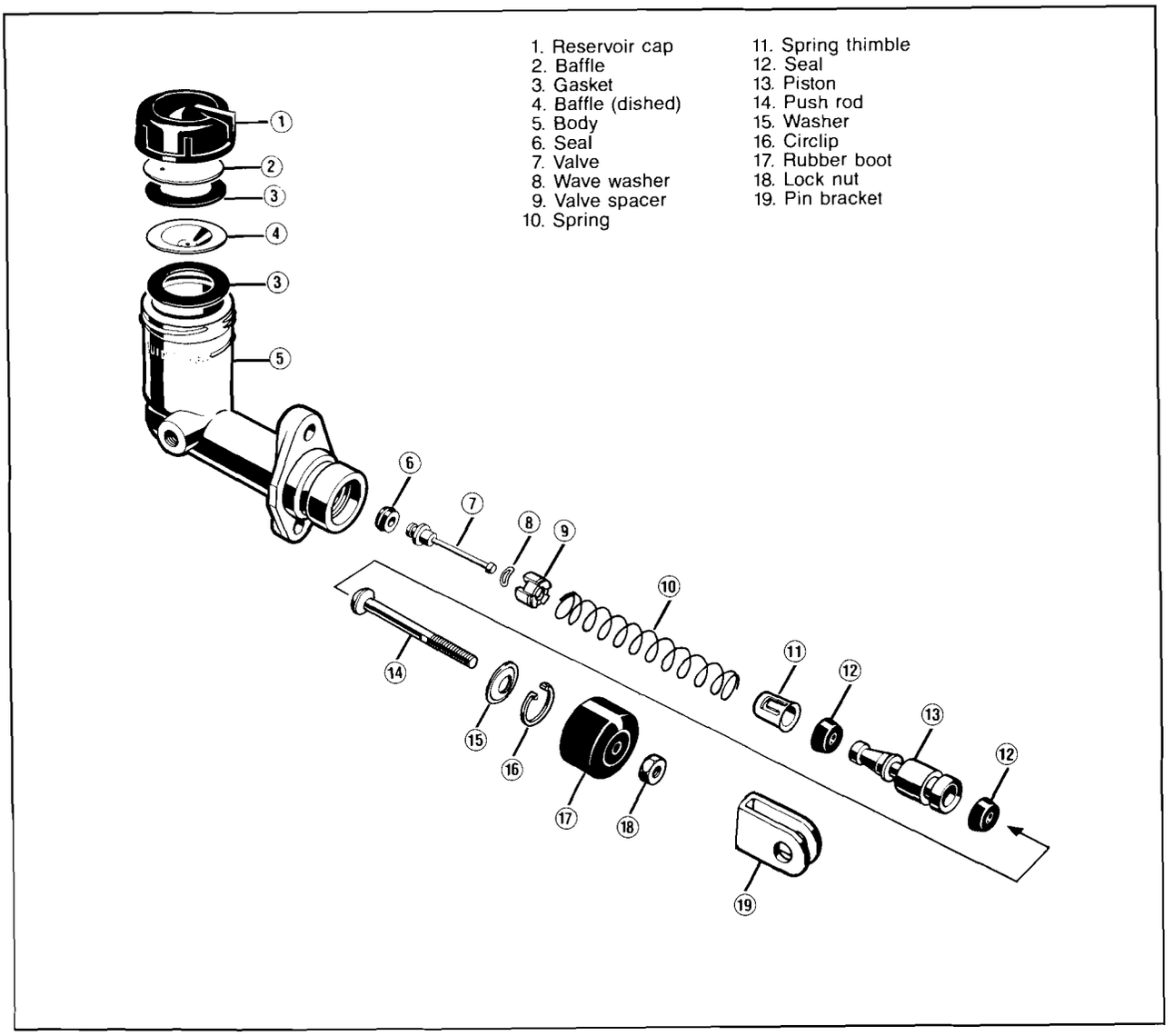


Fig. 5—Master cylinder components

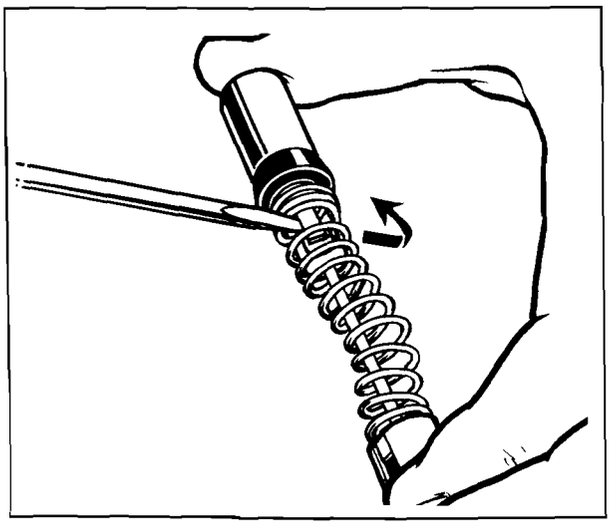


Fig. 6—Piston removal

(6) Disassemble the valve assembly by compressing the spring, sliding the valve stem to one side and removing the thimble from the valve.

(7) Using a blunt tool carefully remove the valve and piston seals.

NOTE: Take care to avoid damaging the piston when removing the seals.

Inspection

Perform the following inspection and replace any faulty components.

(1) Clean all components in methylated spirits and dry using compressed air or lint free cloth.

(2) Check the piston for scoring, pitting or corrosion.

(3) Check the cylinder bore for scoring, pitting or corrosion.

NOTE: The cylinder bore must not be honed. If the bore is damaged in any way the master cylinder should be replaced as an assembly.

Assembly

NOTE: All components supplied in the repair kit should be used.

(1) Apply a coat of the specified hydraulic fluid to the piston and valve seals.
(2) Fit the piston seals with the lip of the seal away from the push rod end of the piston.
(3) Fit the valve seal with the lip of the seal facing away from the spring.
(4) Fit the wave washer, valve spacer and the return spring onto the valve stem.

NOTE: Ensure that the wave washer and the valve spacer are fitted as shown in Fig. 7.

(5) Locate the spring thimble into the spring.
(6) Compress the spring, locate the valve stem in the hole in the thimble and then slide the valve stem sideways to locate it in the retaining slot.

NOTE: Carefully hold the sub-assembly to prevent components separating under spring tension.

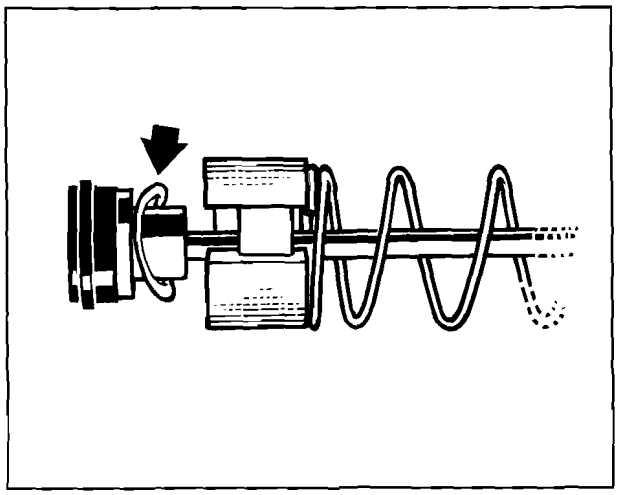


Fig. 7—Wave washer fitment

(7) Install the piston into the spring thimble and secure by locating the tab on the spring thimble under the front shoulder of the piston.
(8) Coat the inside of the cylinder bore and the piston and valve assembly with the specified hydraulic fluid.
(9) Insert the piston and valve assembly into the cylinder bore ensuring that the seals are not damaged on installation.
(10) Install the pushrod and washer into the master cylinder and fit the circlip ensuring that the circlip is correctly located in its groove.

RELEASE CYLINDER

Removal

(1) Disconnect the hydraulic line at the release cylinder, refer Fig. 8, and plug the tube to prevent the ingress of dirt.
(2) Remove the cylinder attaching bolts, refer Fig. 8, and remove the release cylinder.

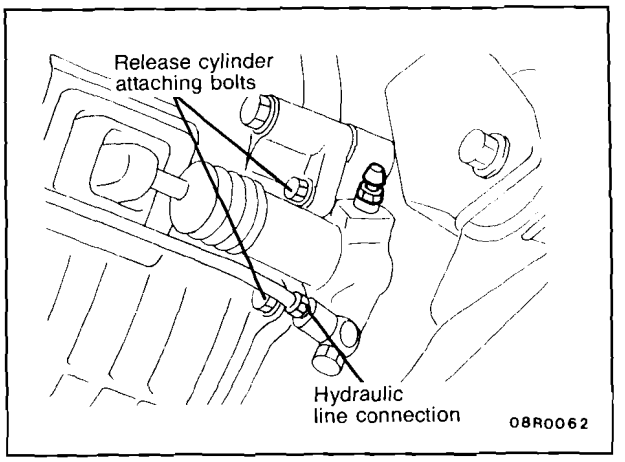


Fig. 8—Release cylinder attaching bolts

Installation

Install by reversing the removal procedure noting the following:
(1) Apply a coat of grease to the release cylinder pushrod socket.
(2) Ensure that the hydraulic line and union bolt are tightened.
(3) Top up the master cylinder and bleed the hydraulic system using the procedure described in this section.

NOTE: Always use the specified fluid from a sealed container.

Disassembly (refer Fig. 9)

(1) Remove the bleed valve and drain fluid from the cylinder.
(2) Remove the union bolt, union, gaskets, valve plate and valve plate spring.
(3) Remove the rubber boot and push rod together.
(4) Remove the piston and spring assembly by tapping the cylinder on a block of wood.
(5) Remove the spring from the piston assembly.

Inspection

Perform the following inspection and replace any faulty components.
(1) Clean all components in methylated spirits and dry using compressed air or clean, lint-free cloth.
(2) Check the cylinder bore and piston for scoring, pitting or corrosion.

NOTE: The cylinder bore MUST NOT be honed, if the bore is damaged in any way, the release cylinder must be replaced as an assembly.

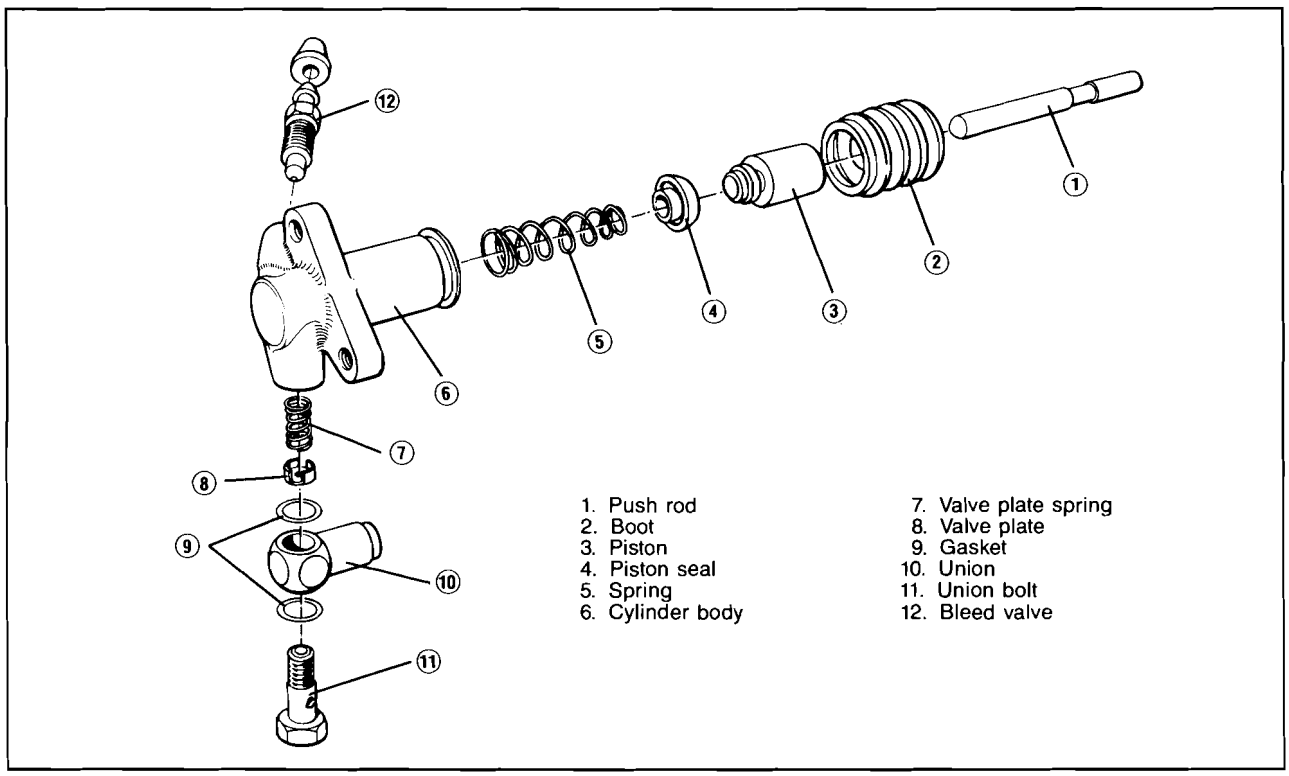


Fig. 9—Release cylinder components

Assembly

(1) Ensure that the piston seal is fitted with the seal lip facing away from the piston.
(2) Fit the spring to the piston.
(3) Apply a coat of the specified hydraulic fluid to the piston, seal and cylinder bore.
(4) Insert the piston in the cylinder bore.
(5) Fit the pushrod and rubber boot, ensuring that the lip on the boot is correctly located in the groove on the cylinder.
(6) Install the valve plate spring, valve plate, union and union bolt, **ensuring that new gaskets are used.** Leave union bolt finger tight to facilitate fluid line installation.
(7) Install the bleed valve.

BLEEDING HYDRAULIC SYSTEM

NOTE: Always use specified fluid that is clean and uncontaminated and has been stored in a sealed container.

(1) Top up the fluid reservoir.

NOTE: Clean the reservoir cap before removal and ensure that no dirt enters the reservoir.

(2) Clean the bleed valve on the release cylinder, refer Fig. 10.
(3) Attach a length of transparent tubing to the bleed valve and insert the other end into a clean jar partially filled with hydraulic fluid.
(4) With an assistant to operate the clutch, open the bleed valve approximately half a turn, and depress the pedal. Just before the pedal reaches the end of its travel, close the bleed valve and allow the pedal to return to the rest position.

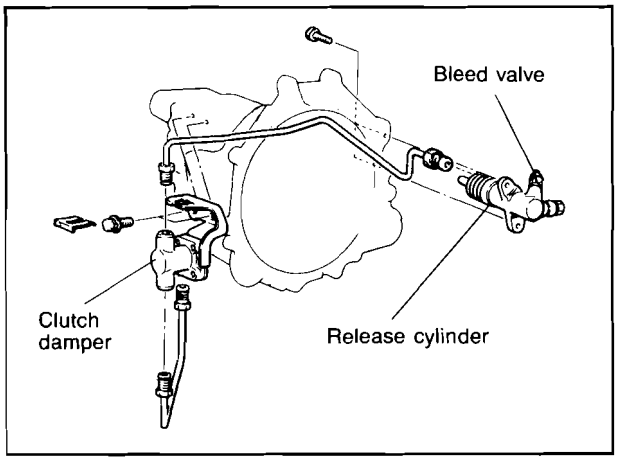


Fig. 10—Release cylinder — V6 models

(5) Repeat step (4) until the fluid in the hose is free of air bubbles.

NOTE: Ensure that the reservoir fluid is replenished throughout the bleeding procedure.

(6) Fill the master cylinder reservoir to correct level

CLUTCH PEDAL

Removal

(1) Remove the lap heater duct and the instrument under cover, refer Group 52 — Interior.
(2) Remove the push rod clevis pin.
(3) Disconnect the pedal return spring from the pedal.
(4) Remove the pedal shaft retaining nut, refer Fig. 12, and remove the shaft and the pedal.

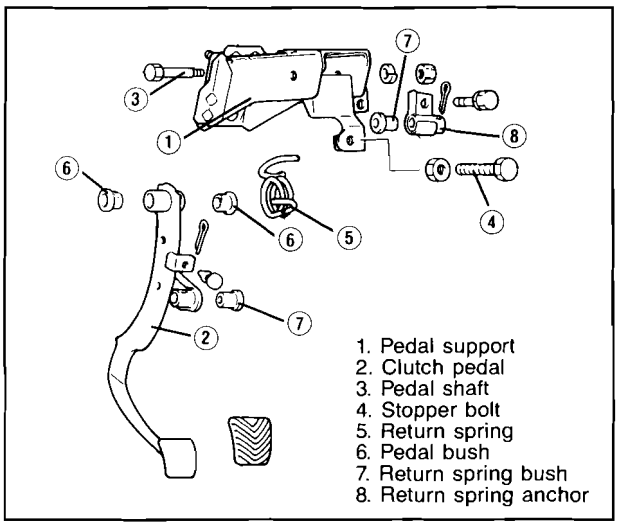


Fig. 11—Clutch pedal components

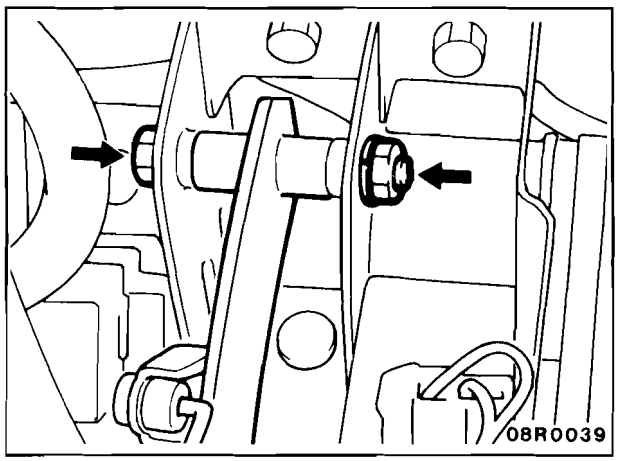


Fig. 12—Pedal shaft retaining nut

Inspection

Perform the following inspection and replace any faulty components.

(1) Check the pedal shaft for bend or wear.
(2) Check the bushes for wear or damage.
(3) Check the pedal return spring for loss of tension.

Installation

Install by reversing the removal procedure, noting the following:

(1) Prior to installation apply multi-purpose grease (NLGI No. 3) to the pedal shaft and bushes, refer Fig. 13.
(2) Tighten the pedal shaft retaining nut to specifications.
(3) Adjust the clutch pedal height and pedal free travel to specifications.

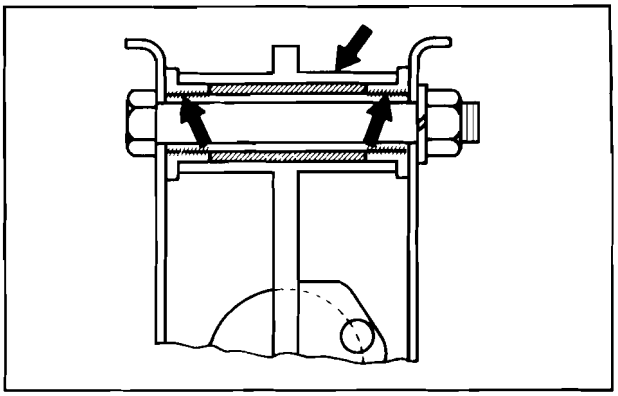


Fig. 13—Clutch pedal shaft lubrication

PEDAL HEIGHT ADJUSTMENT

(1) Remove the push rod clevis pin.
(2) Loosen the pedal stopper bolt lock nut, refer Fig. 14, rotate the bolt to obtain the correct pedal height, refer Fig. 15, and tighten the lock nut.

On vehicles with cruise control, disconnect the clutch pedal switch wiring, loosen switch lock nut and rotate switch to obtain correct pedal height, tighten lock nut and re-connect switch wiring.

NOTE: Pedal height should be measured from the floor pan with the carpet and underfelt lifted.

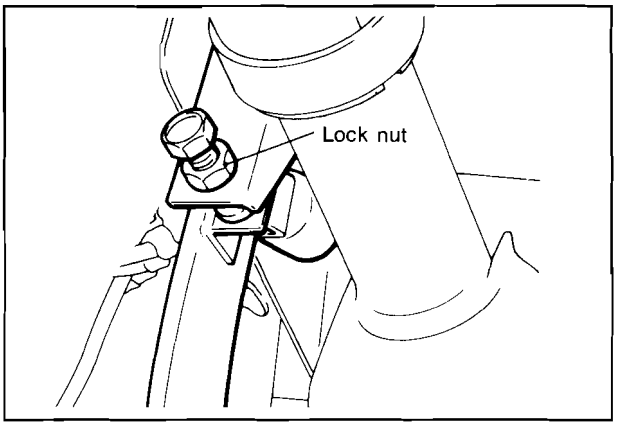


Fig. 14—Stopper bolt lock nut

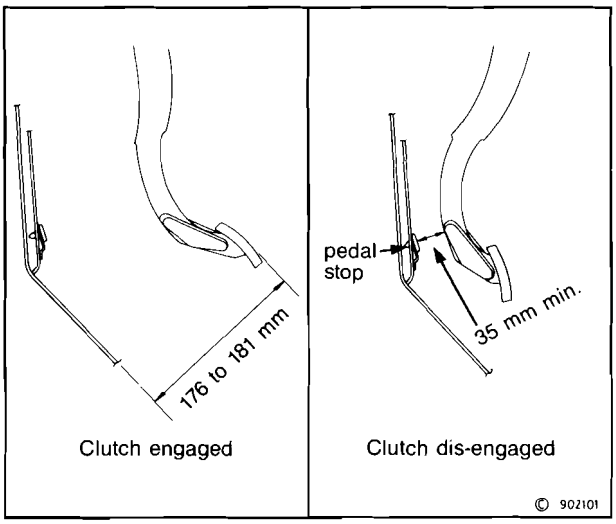


Fig. 15—Clutch pedal height

(3) Loosen the push rod lock nut, refer Fig. 16, and rotate the push rod to align the push rod and clutch pedal clevis pin holes to allow the clevis pin to slide freely into the hole and tighten the push rod lock nut.

(4) Fit the clevis pin and secure with the split pin.

(5) Depress and release the clutch pedal several times and then with the clutch disengaged, measure the pedal height, refer Fig. 15.

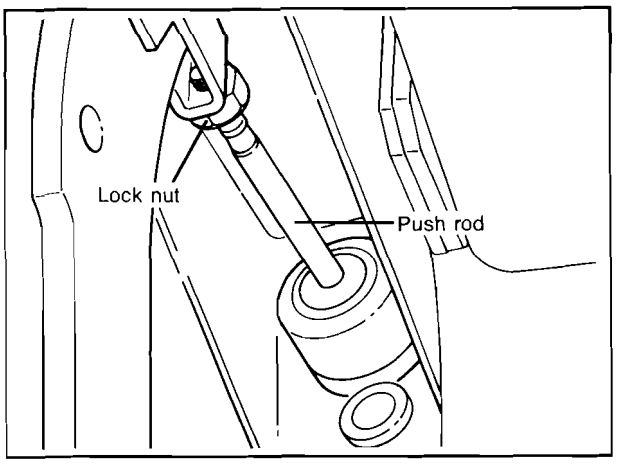


Fig. 16—Push rod and lock nut

(6) Check that the clutch pedal free travel is within specifications.

(7) If disengaged pedal height or clutch free travel are not within specifications, the hydraulic system should be bled and the pedal height and free travel checked again.

(8) If pedal height or free travel are not within specifications after bleeding the system, the pressure plate and clutch disc should be removed and inspected.

(9) On vehicles fitted with cruise control, check that the clutch pedal switch is correctly adjusted, refer Group 13, section 5.

GROUP 22 — MANUAL TRANSMISSION

SECTION 0 — INDEX

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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

SECTION 1 — F5M31, F5M33 FIVE SPEED TRANSAXLES

SERVICE DIAGNOSIS — MANUAL TRANSAXLE

Condition	Possible Cause	Corrective Action
VIBRATION, NOISE	Loose or damaged, transmission and engine mounts.	Replace, tighten or replace mounts.
	Inadequate shaft end play/pre-load.	Correct end play/pre-load to specification.
	Worn or damaged gears.	Replace gears.
	Wrong grade of transmission oil.	Replace with specified oil.
	Low oil level.	Top up to correct level.
	Inadequate engine idle speed.	Adjust idle to specification.
OIL LEAKAGE	Broken or damaged oil seal or O-ring.	Replace oil seal or O-ring.
	Wrong or inadequate use of sealant.	Reseal with specified sealant.
HARD SHIFT	Faulty control cables.	Adjust or replace cables.
	Poor contact or wear of synchronizer ring and gear cone.	Correct or replace.
	Weakened synchronizer spring.	Replace sychronizer spring.
	Use of inadequate grade of oil.	Replace with specified oil.
JUMPS OUT OF GEAR	Worn gear shift fork or broken poppet spring.	Replace shift fork or poppet spring.
	Sychronizer hub to sleeve spline clearance to large.	Replace synchronizer hub and sleeve.

SPECIFICATIONS

Type	Manual transaxle	←
Model	F5M31-2-RPKJ 5 speed (4 cyl.)	*F5M33-2-SNZJ 5 speed F5M33-2-SNQJ 5 speed (6 cyl.)

Note: Transaxle marked thus * require 27 tooth splined drive shaft.

Gear Ratios		
1st	3.166:1	3.090:1
2nd	1.833:1	1.833:1
3rd	1.240:1	1.217:1
4th	0.896:1	0.888:1
5th	0.666:1	0.741:1
Reverse	3.166:1	3.166:1
Transfer gear	1.192:1	1.208:1
Differential ratio	3.411:1	3.437:1
Final gear ration	4.067:1	4.153:1
Recommended Lubrication	Hypoid gear oil, SAE 75W-85W API GL-4.	←
— Quantity	2.0 litres.	←
Speedometer		
Number of teeth		
— drive gear	36	36
— driven gear	29	28
Input shaft bearing end play	0.01 - 0.12 mm	0.000 - 0.05 mm
Intermediate gear front bearing end play	0.01 - 0.11 mm	←
Intermediate shaft pre-load	0.05 - 0.10 mm	←
Output shaft pre-load	0.05 - 0.10 mm	←
Differential case bearing pre-load	0.05 - 0.10 mm	←
Differential pinion backlash	0.025 - 0.150 mm	←

Input shaft front bearing end play snap ring chart (F5M31):—

Thickness (mm)	Identification Symbol	M.M.A.L. Part Number
2.24	None	MD706537
2.31	Blue	MD706538
2.38	Brown	MD706539

Input shaft rear bearing endplay snap ring chart (F5M31):—

Thickness (mm)	Identification Symbol	M.M.A.L. Part Number
1.40	Blue	MD723276
1.45	Purple	MD730889
1.50	Red	MD723277
1.55	White	MD730890
1.60	Yellow	MD723278
1.65	Brown	MD730891
1.70	Green	MD723279
1.75	Orange	MD730892

SPECIFICATIONS CONT.

Input shaft end play spacer selection chart (F5M33):—

Thickness (mm)	Identification Symbol	M.M.A.L. Part Number
0.80	80	MD727661
0.83	83	MD720937
0.86	86	MD720938
0.89	89	MD720939
0.92	92	MD720940
0.95	95	MD720941
0.98	98	MD720942
1.01	01	MD720943
1.04	04	MD720944
1.07	07	MD720945
1.10	J	MD710454
1.13	D	MD700270
1.16	K	MD710455
1.19	L	MD710456
1.22	G	MD700271
1.25	M	MD710457
1.28	N	MD710458
1.31	E	MD706574
1.34	O	MD710459
1.37	P	MD710460
1.40	None	MD706573
1.43	Q	MD710461
1.46	R	MD710462

Intermediate gear front bearing end play snap ring chart (F5M31):—

Thickness (mm)	Identification Symbol	M.M.A.L. Part Number
1.40	Blue	MD723276
1.50	Red	MD723277
1.60	Yellow	MD723278
1.70	Green	MD723279

Intermediate gear front bearing end play snap ring chart (F5M33):—

Thickness (mm)	Idenification Symbol	M.M.A.L. Part Number
1.40	None	MD703779
1.50	Brown	MD703780
1.60	Blue	MD703781

SPECIFICATIONS CONT.

Intermediate shaft pre-load spacer chart (F5M31 and F5M33):—

Thickness (mm)	Identification Symbol	M.M.A.L. Part Number
0.62	62	MD736754
0.65	65	MD736755
0.68	68	MD735659
0.71	71	MD735660
0.74	74	MD735661
0.77	77	MD735662
0.80	80	MD724142
0.83	83	MD724143
0.86	86	MD724144
0.89	89	MD724145
0.92	92	MD724146
0.95	95	MD724147
0.98	98	MD724148
1.01	01	MD724149
1.04	04	MD724150
1.07	07	MD724151
1.10	10	MD724152
1.13	13	MD724153
1.16	16	MD724154
1.19	19	MD724155
1.22	22	MD724156
1.25	25	MD724157
1.28	28	MD724158
1.31	31	MD724159
1.34	34	MD724160
1.37	37	MD724161

Output shaft pre-load spacer selection chart (F5M31 and F5M33):—

Thickness (mm)	Identification Symbol	M.M.A.L. Part Number
0.83	83	MD720937
0.86	86	MD720938
0.89	89	MD720939
0.92	92	MD720940
0.95	95	MD720941
0.98	98	MD720942
1.01	01	MD720943
1.04	04	MD720944
1.07	07	MD720945
1.10	J	MD710454
1.13	D	MD700270
1.16	K	MD710455
1.19	L	MD710456
1.22	G	MD700271
1.25	M	MD710457
1.28	N	MD710458
1.31	E	MD706574
1.34	O	MD710459

SPECIFICATIONS CONT.

Differential pinion spacer set part number MB185340

Differential case pre-load spacer selection chart (F5M31 and F5M33):—

Thickness (mm)	Identification Symbol	M.M.A.L. Part Number
0.80	80	MD727661
0.83	83	MD720937
0.86	86	MD720938
0.89	89	MD720939
0.92	92	MD720940
0.95	95	MD720941
0.98	98	MD720942
1.01	01	MD720943
1.04	04	MD720944
1.07	07	MD720945
1.10	J	MD710454
1.13	D	MD700270
1.16	K	MD710455
1.19	L	MD710456
1.22	G	MD700271
1.25	M	MD710457
1.43	Q	MD710461
1.46	R	MD710462
1.49	C	MD706572
1.52	S	MD710463
1.55	T	MD710464
1.58	B	MD706571
1.61	U	MD710465
1.64	V	MD710466
1.67	A	MD706570
1.70	W	MD710467
1.73	X	MD710468
1.76	F	MD706575
1.79	Y	MD710469
1.82	Z	MD710470
1.85	H	MD700272
1.88	AA	MD710471

TORQUE SPECIFICATIONS

	Nm
Rear cover	15 - 22
Backup light switch	30 - 35
Transmission switch	30 - 35
Detent plug	30 - 42
Speedometer sleeve bolt	3 - 5
Input shaft lock nut	140 - 160
Intermediate gear lock nut	140 - 160
Reverse Idler gear shaft bolt	43 - 55
Transmission case tightening bolt	35 - 42
Stopper bracket bolt	15 - 22
Restrict ball assembly	30 - 35
Bearing retainer bolt	15 - 22
Differential drive gear bolt	130 - 140
Interlock plate bolt	20 - 27
Oil drain plug	30 - 35
Oil filler plug	30 - 35
Bell housing cover mounting bolt	7 - 11
Reverse shift lever assembly bolt	15 - 22
Select lever mounting bolt	15 - 22
Shift cable bracket mounting bolt	15 - 22
Transaxle mount bracket bolt	65 - 75
Output gear mounting bolt	70 - 80
Transmission mounting bolt — 10 mm bolt	43 - 55
— 8 mm bolt	25 - 30
— 6 mm bolt	8 - 15
Starter motor mounting bolt	27 - 34

SPECIAL TOOLS

E1673MT	Puller — taper bearing (main tool)
E1673 B20	Jaws — intermediate shaft bearing removal
E1673 A20	Jaws — output shaft bearing removal
E1673 B15	Jaws — differential bearing removal
E21M14	Installer — drive shaft oil seal
E21M18	Installer — drive shaft oil seal
E21M26	Holder input shaft
E7403 (use with E7511A)	Installer — differential bearing installer

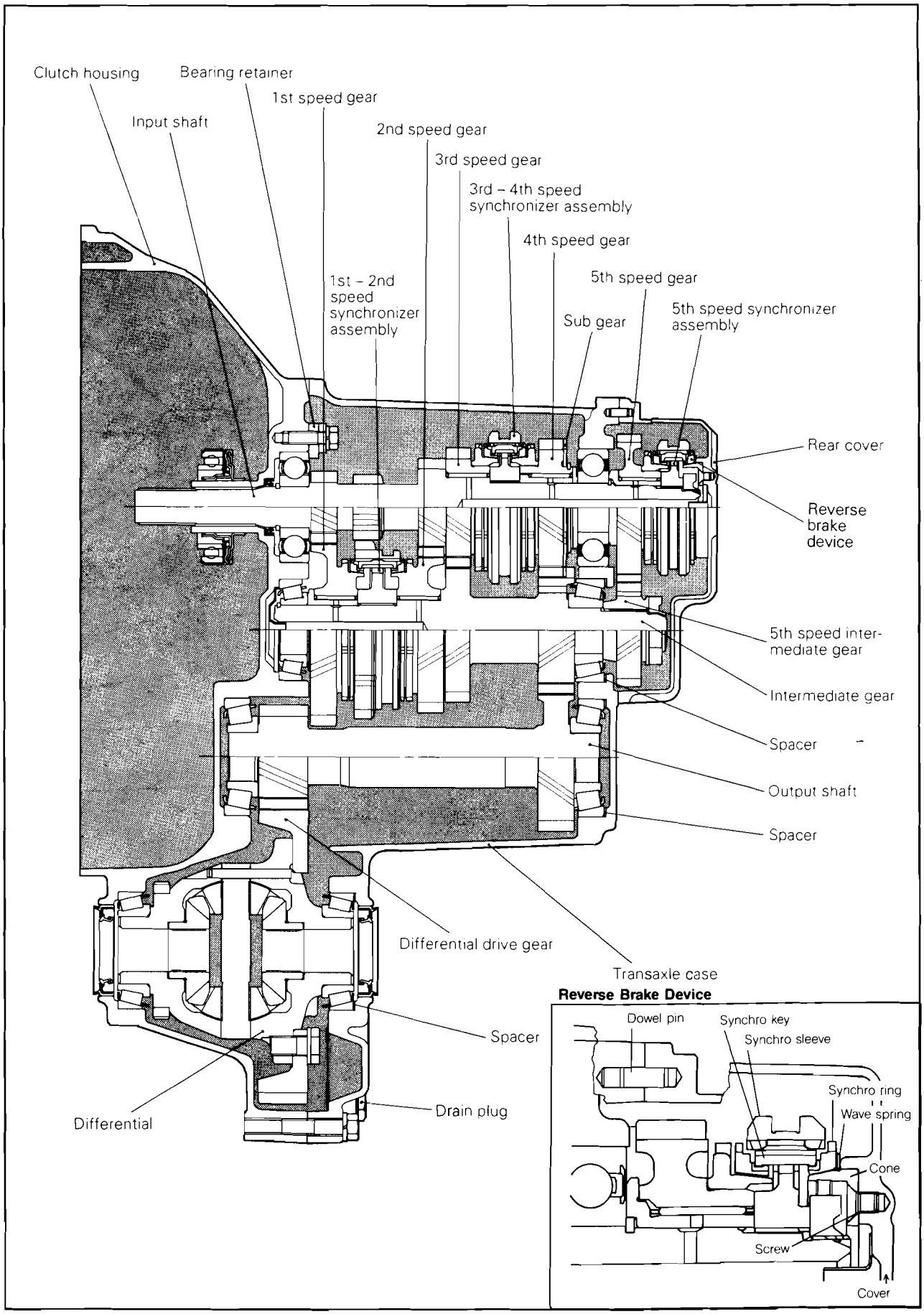


Fig. 1—Transaxle sectional view (F5M31)

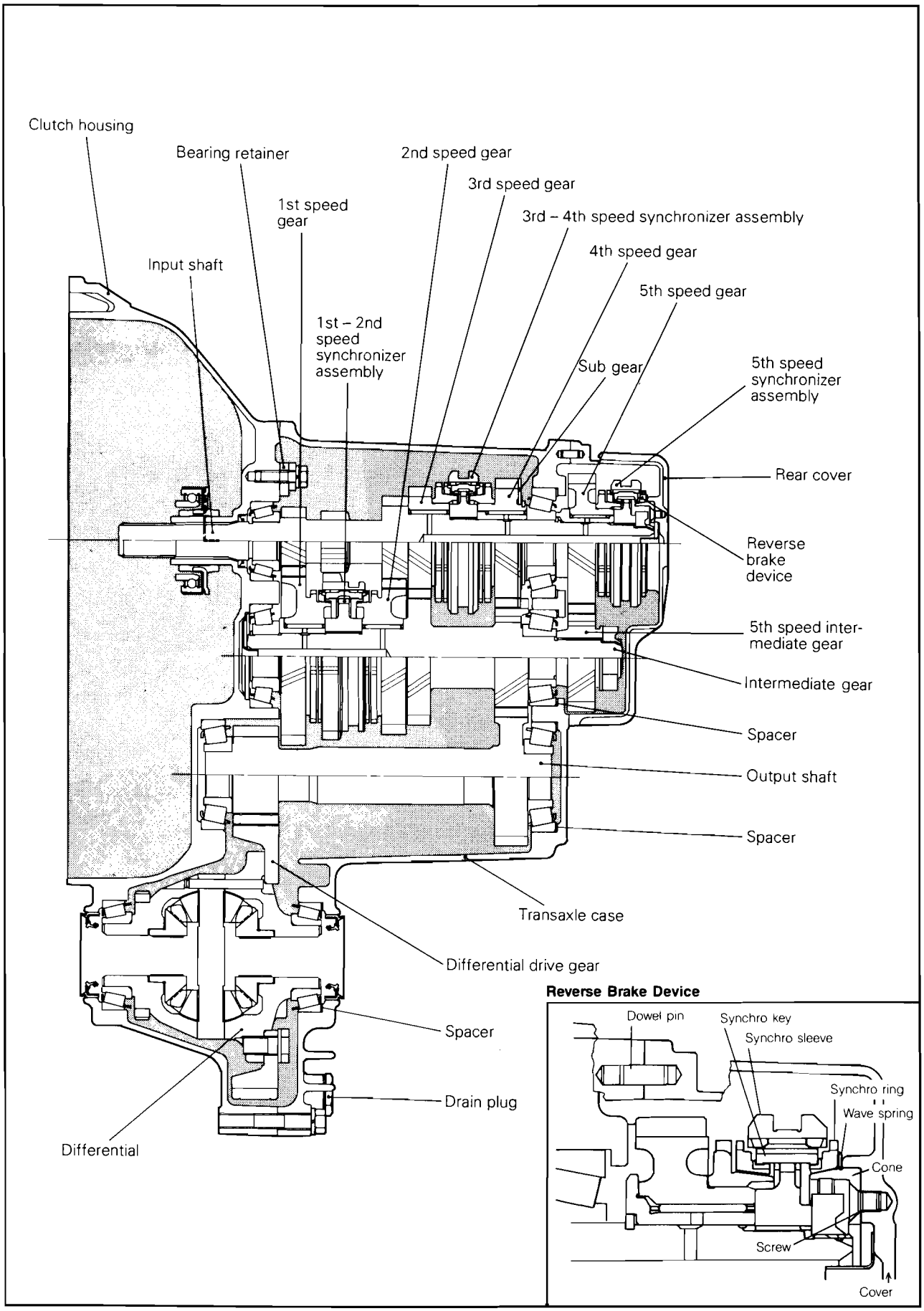


Fig. 2—Transaxle sectional view (F5M33)

GENERAL INFORMATION

The F5M31 and F5M33 transaxles are five speed manual transmissions which have the gear reduction, ratio selection and differential functions combined into one unit and housed in an aluminium die cast housing and case.

The transmissions have a large diameter, large capacity synchronizer which combined with improved shift control mechanism, reduces shift operation force and gives comfortable shift feeling.

The shift control mechanism includes an interlock device and a reverse shift error prevention device which ensures correct operation.

The input shaft incorporates 3rd, 4th and 5th speed gears and synchronizer assembly. The intermediate gear shaft incorporates 1st and 2nd speed gears and synchronizer assembly and the 5th speed intermediate gear.

The output shaft transfers the drive from the transmission to the differential. All forward gears and output shaft gears are helical cut and in constant mesh to give smooth and quiet operation.

The first, second, third, fourth and fifth speed gears when not engaged by the synchronizer sleeves are free to rotate on their respective shafts.

The synchronizer assemblies comprise of three synchronizer keys which fit into slots in the hub. The keys engage in the three recesses in the rear of the synchronizer rings which fit over the tapered cone of speed gears. The synchronizer rings have clutch teeth similar to those on the gears. When a forward gear is to be engaged, the synchronizer sleeve carrying with it the synchronizer keys move over the hub, bringing the keys into contact with the back face of the recess in the synchronizer ring. As synchronization takes place, the synchronizer ring teeth index so that the sleeve can slide over the keys and engage the gear clutch teeth.

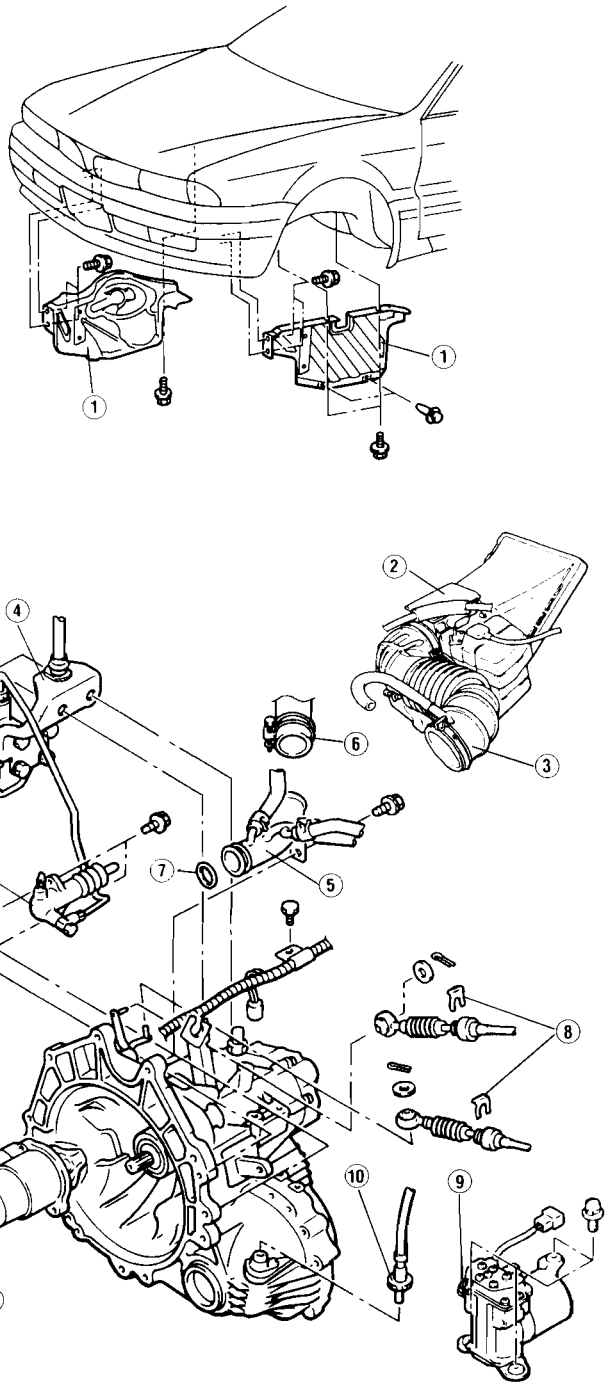
The F5M33 transaxle features a twin cone type 2nd gear synchronizer assembly. The operation of this synchronizer is similar to a single cone type but due to the greater contact area of the synchronizer cones, the unit is more efficient in operation.

To engage reverse gear the reverse idler gear is moved by the reverse shift lever into mesh with the input shaft gear and combined with 1st - 2nd speed synchronizer sleeve/reverse gear on the intermediate drive shaft, with drive being transfered from the intermediate gear to output shaft.

The gear shift interlock mechanism consists of an interlock plunger on the 4th - 3rd shift rail, reverse shift lug, 5th - Reverse, 4th - 3rd shift rails and an interlock plate on the control shaft which prevents the engagement of two gears simultaneously.

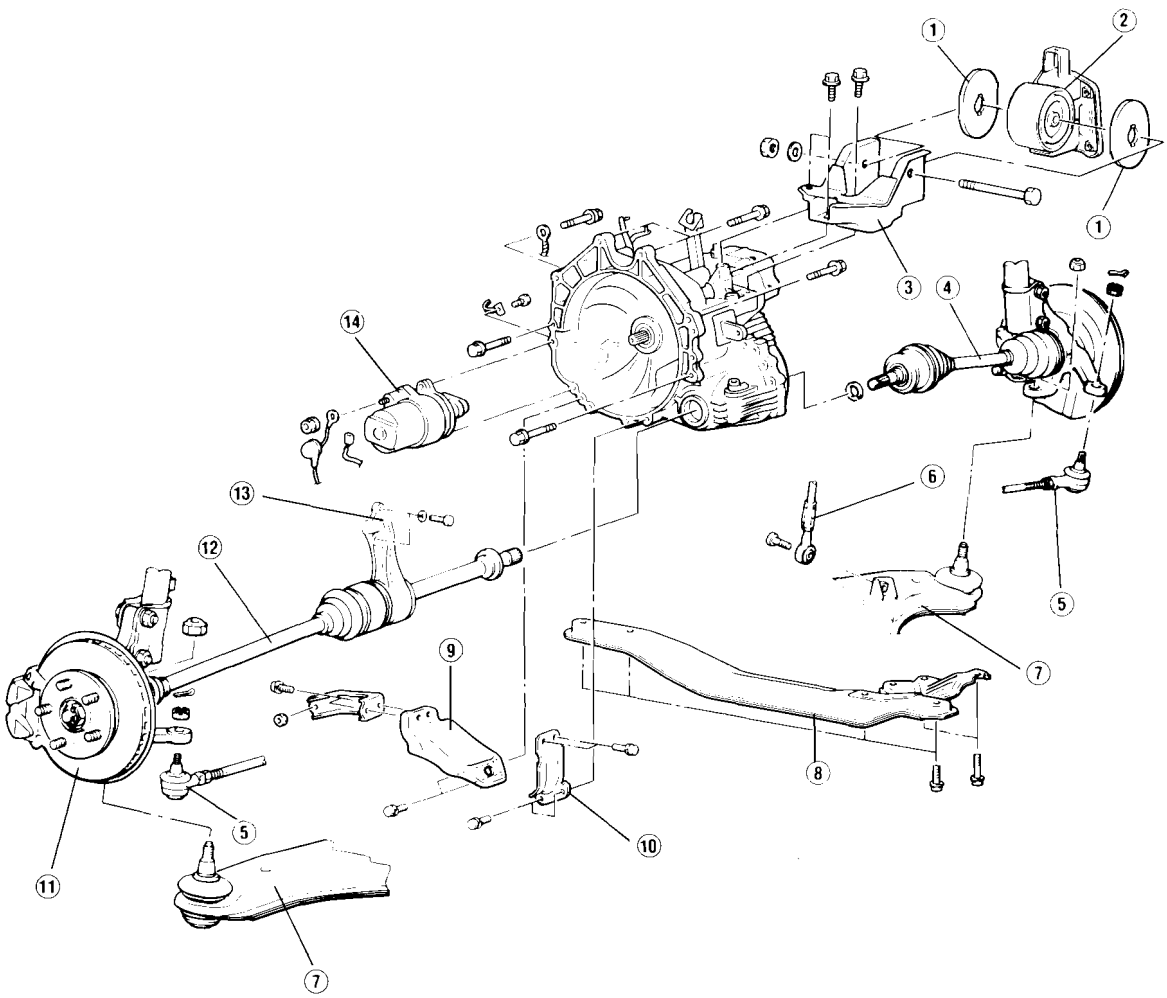
Detent balls and spring are located on each shift rail, providing a load which must be overcome by a force applied to the gear shift lever before a gear change can be made.

TRANSAXLE REPLACEMENT



1. Side under cover
2. Air cleaner cover
3. Air intake hose
4. Clutch damper bracket
5. Water inlet pipe (V6)
6. Bottom radiator hose (V6)
7. "O" ring (V6)
8. Cable retainer clip
9. E.C.S. compressor (where fitted)
10. Speedometer cable
11. Starter motor
12. Clutch release cylinder

Fig. 3—Transaxle removal components — under hood



1. Transaxle mounting stopper
2. Transaxle mounting
3. Transaxle mounting bracket
4. Right hand drive shaft
5. Tie rod end (where fitted)
6. Front height sensor rod
7. Lower control arm
8. Right member
9. Transmission stay (front bank — V6)
10. Transmission stay (rear bank — V6)
11. Hub and disc assembly
12. Left hand drive shaft
13. Centre bearing bracket
14. Starter motor

Fig. 4—Transaxle removal components — under vehicle

TRANSAXLE REPLACEMENT PROCEDURE

Removal

(1) Disconnect Neg. (-) battery cable.
(2) On ECI-Multi vehicles remove air flow sensor.
(3) On vehicles fitted with E.C.S. it may be necessary to remove the air pump assy — refer Group 33.
(4) Disconnect clutch pipe from the flexible hose and unclip the hose and block the end of the pipe to prevent ingress of dirt.
(5) Disconnect the gearshift control cables and unclip the cables from the transaxle, refer Fig. 5.

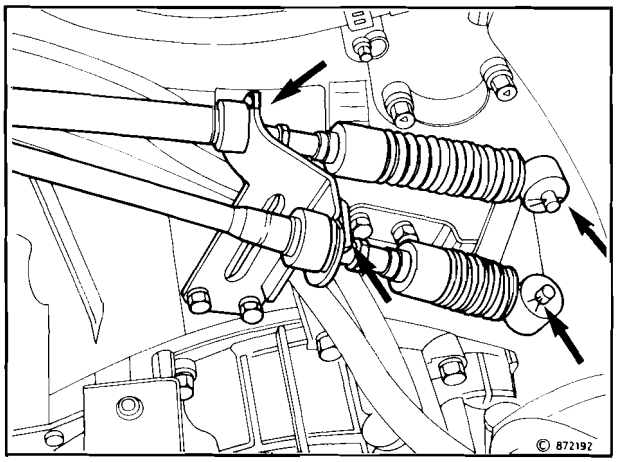


Fig. 5—Disconnecting gear shift control cables

(6) Disconnect the speedo cable and reverse light wiring.
(7) Remove the upper clutch housing bolts, refer Fig. 6.

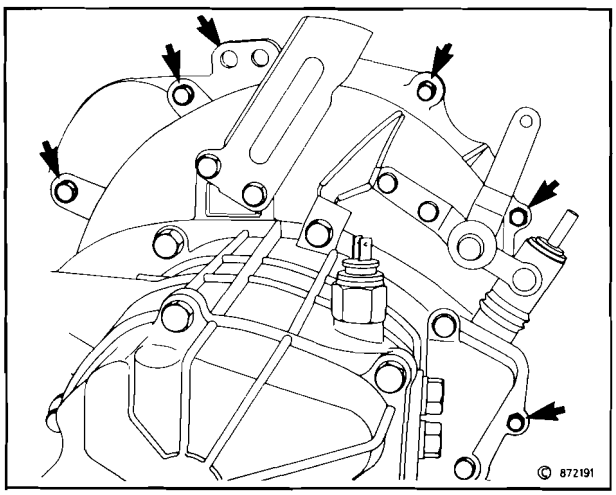


Fig. 6—Upper clutch housing bolts

(8) On V6 engine models, remove lower radiator hose from engine inlet water pipe and remove rear section of pipe.
(9) Disconnect the starter motor wiring and remove the starter motor from the vehicle.
(10) Drain the oil from the transaxle, refer Fig. 7.

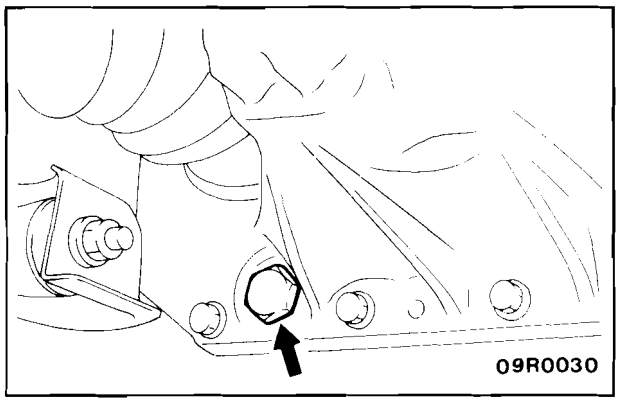


Fig. 7—Transaxle drain plug location

(11) Raise the front of the vehicle and support on stands in the location outlined in Group 00—General Information.
(12) Remove the front wheels.
(13) Remove the right crossmember.
(14) Remove the right hand engine under cover.
(15) Using a suitable puller, disconnect the lower arm and tie rod and ball joints from both knuckles.
(16) Remove the left hand drive shaft centre bearing bolts.
(17) Withdraw L.H. and R.H. drive shafts from the transaxle, refer Fig. 8 and support to avoid damaging the joints.

NOTE: A prybar is recommended for drive shaft removal. Do not insert prybar to a depth of more than 7 mm or damage to the oil seal may occur.

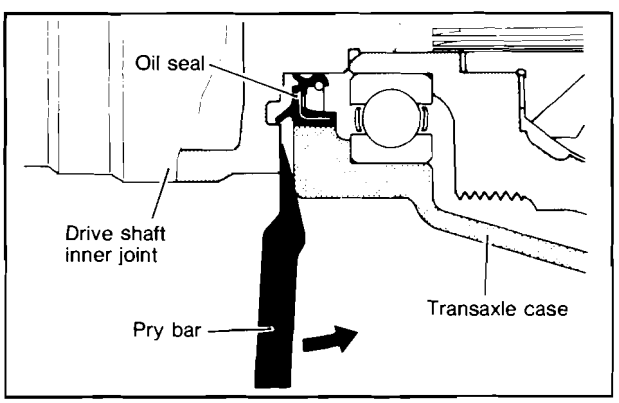


Fig. 8—Drive shaft removal

(18) On E.C.S. equipped vehicles, remove the front height sensor rod.
(19) Suitably support the engine at the transaxle end of the sump.

NOTE: To avoid damage to the sump support a large area of the sump.

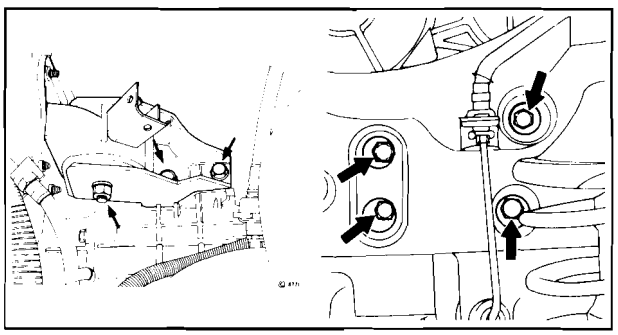


Fig. 9—Transaxle mount attaching bolts

(20) Remove the transaxle mounting insulator through bolt and the mounting bracket to transaxle case attaching bolts, refer Fig. 9 and remove bracket.
(21) Remove the clutch cover lower clutch-housing bolts, refer Fig. 10.
(22) Carefully remove the support from the engine and lower the engine.
(23) Remove the transaxle.

Installation

Install the transaxle by reversing the removal procedure, noting the following:
(1) Do not allow the transaxle to "hang" on the clutch assembly during installation.

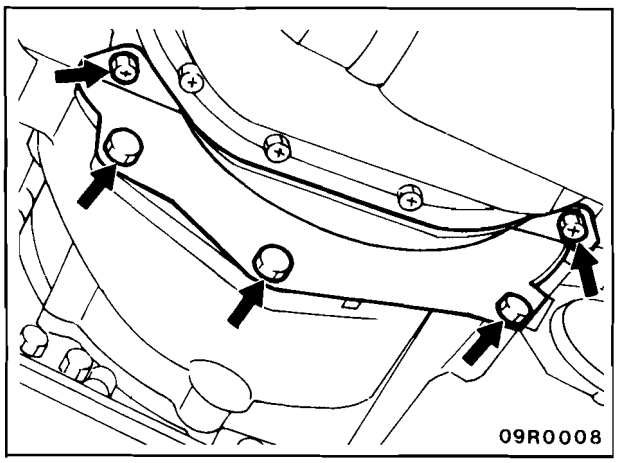


Fig. 10—Lower clutch housing bolts

(2) Tighten all bolts to the specified torque.
(3) Always use new driveshaft retaining clips.
(4) Bleed the clutch system using the procedure outlined in Group 21 — Clutch.
(5) On V6 models, install a new 'O' ring when refitting the inlet water pipe. Only lubricate with water. **Do not use oil or grease on the 'O' ring.**
(6) Fill the transaxle with the correct grade and quantity of lubricant, refer specifications.
(7) Check the gearshift operation, if adjustment is necessary refer to Section 2 "Shift Control".

TRANSAXLE OVERHAUL

TRANSAXLE DISASSEMBLY

(1) Remove rear cover bolts and remove rear cover.

NOTE: Avoid damaging oil guide projection from transaxle case.

(2) Remove reverse light switch.
(3) Remove the three detent plugs, springs and balls.
(4) Remove the fifth gear shift fork roll pin, refer Fig. 11.

NOTE: ONLY DRIFT THE ROLL PIN ENOUGH TO CLEAR THE SHIFT RAIL, ANY FURTHER AND DAMAGE TO FIFTH GEAR MAY RESULT.

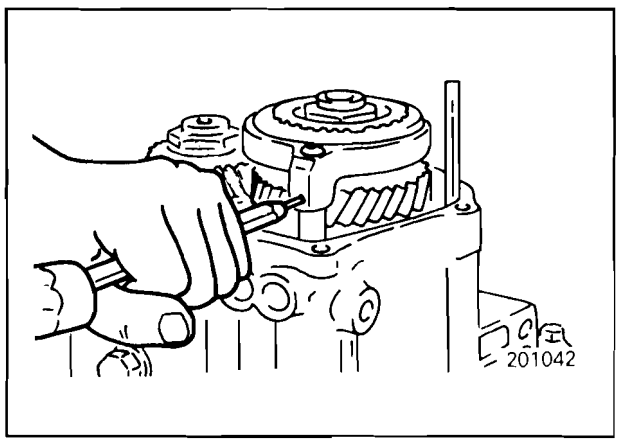


Fig. 11—Removing roll pin

(5) Unstake lock nuts on input shaft and intermediate gears, refer Fig. 12.

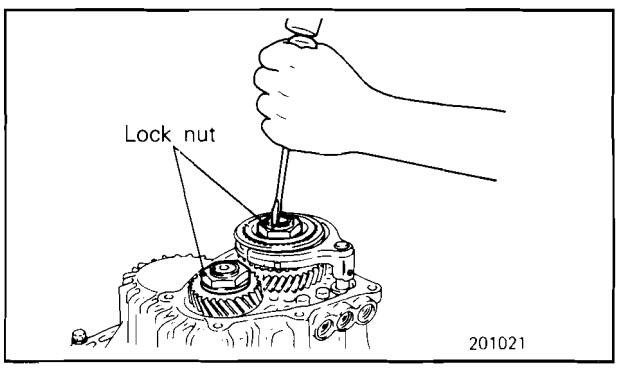


Fig. 12—Unstaking lock nuts

(6) Shift transmission into any gear.
(7) Install special tool E21M26 onto input shaft and using suitable handle attached to transaxle clutch housing, refer Fig. 13, remove lock nuts.

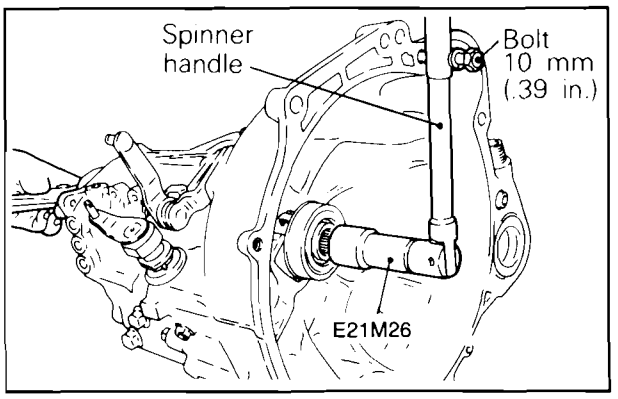


Fig. 13—Lock nut removal

NOTE: LOCK NUTS SHOULD NOT BE REUSED.

(8) Remove 5th speed synchronizer assembly and 5th speed shift fork synchronizer ring, 5th speed gear and needle bearing with the aid of a suitable puller, refer Fig. 14.

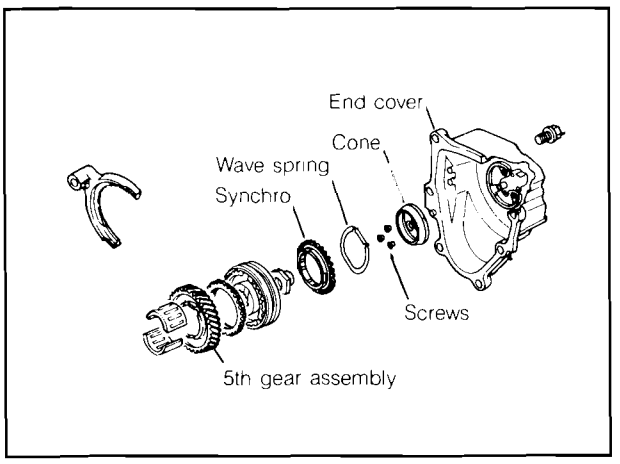


Fig. 14—5th Gear assembly

(9) With the aid of a suitable puller, remove 5th speed intermediate gear.
(10) Remove the idler gear shaft bolt, refer Fig. 15.
(11) Position transaxle on the bench with the clutch housing face down and remove the bolts from the periphery of the case.
(12) Remove reverse gear restrict ball assembly.
(13) Using a suitable hammer, lightly tap the transaxle case at the location provided to separate the case from the clutch housing.

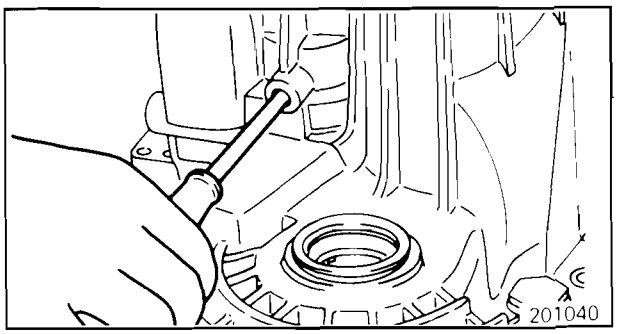


Fig. 15—Idler gear shaft bolt

NOTE: Do not pry the case apart with a lever, as this could result in damage to the mating surfaces and subsequent sealing problems.

(14) Remove the trans oil guide, refer Fig. 16.

CAUTION: Oil guide is made of plastic, without careful handling damage may result.

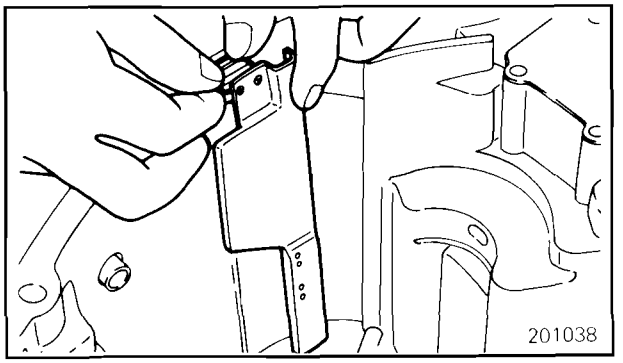


Fig. 16—Oil guide removal

(15) Remove stopper bracket.
(16) Remove the reverse shift lever assembly and the reverse shift lever shoe.
(17) Remove the idler gear shaft and the reverse idler gear.
(18) Remove the shift rail roll pins using a suitable punch, refer Fig. 17.

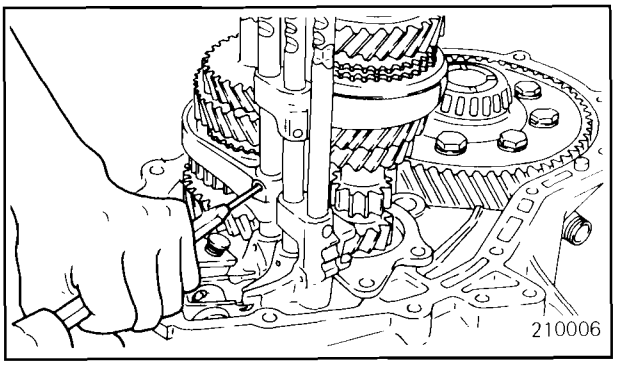


Fig. 17—Roll pin removal

(19) Shift the 1st - 2nd speed fork to 2nd speed.
(20) Shift the 3rd - 4th speed fork to 4th speed, refer Fig. 18.

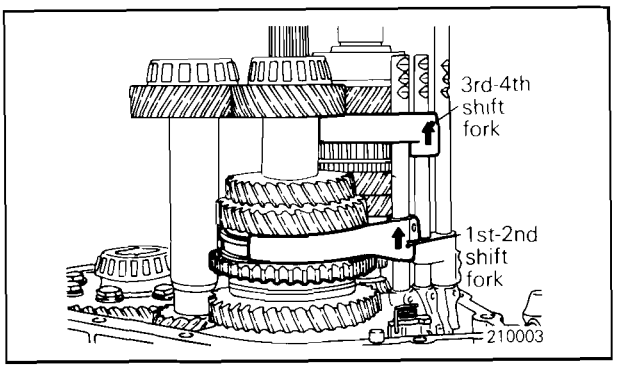


Fig. 18—Shift fork positioning

(21) Rotate shift lugs as shown in Fig. 19.

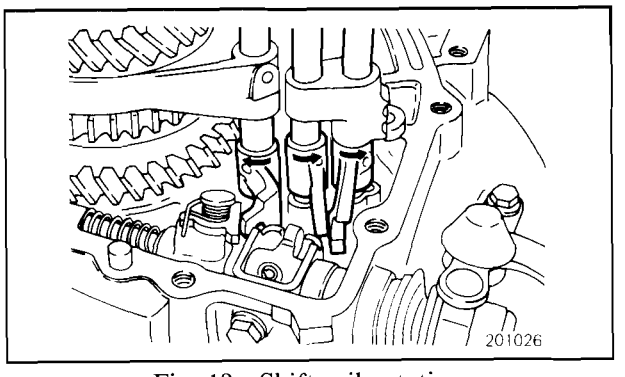


Fig. 19—Shift rail rotation

(22) Remove the shift rail assembly.
(23) Remove input shaft bearing retainer bolts, refer Fig. 20.

NOTE: The counter sunk hexagon head bolt may be difficult to remove, if so tapping its head with a suitable drift may assist removal.

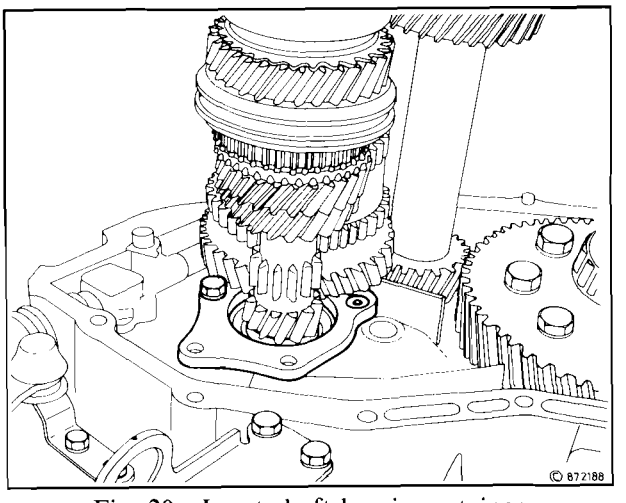


Fig. 20—Input shaft bearing retainer

(24) Lift up the input shaft assembly and remove the intermediate gear assembly.
(25) Remove the input shaft assembly, refer Fig. 21.
(26) Remove output shaft.

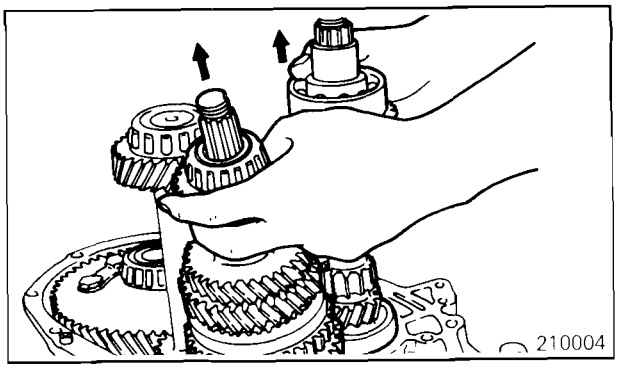


Fig. 21—Intermediate and input shaft removal

(27) Remove differential gear assembly.
(28) Remove all the bearing cups, spacers and oil guides from the clutch housing noting the respective locations.

Inspection

Perform the following inspection and replace or repair any faulty components.
(1) Clean all parts in a suitable solvent and blow dry with compressed air.

CAUTION: Synchronizer ring with paper lining MUST ONLY be washed in manual transmission oil.

NOTE: Do not spin bearings with compressed air. The bearings should be immersed in clean solvent and rotated by hand until clean. A bearing that is spun by air is likely to score due to absence of lubrication.
Lubricate the clean bearings with light oil and turn by hand to test for roughness, looseness or wear. Test the fit of the bearings on their respective shaft and in the bores.

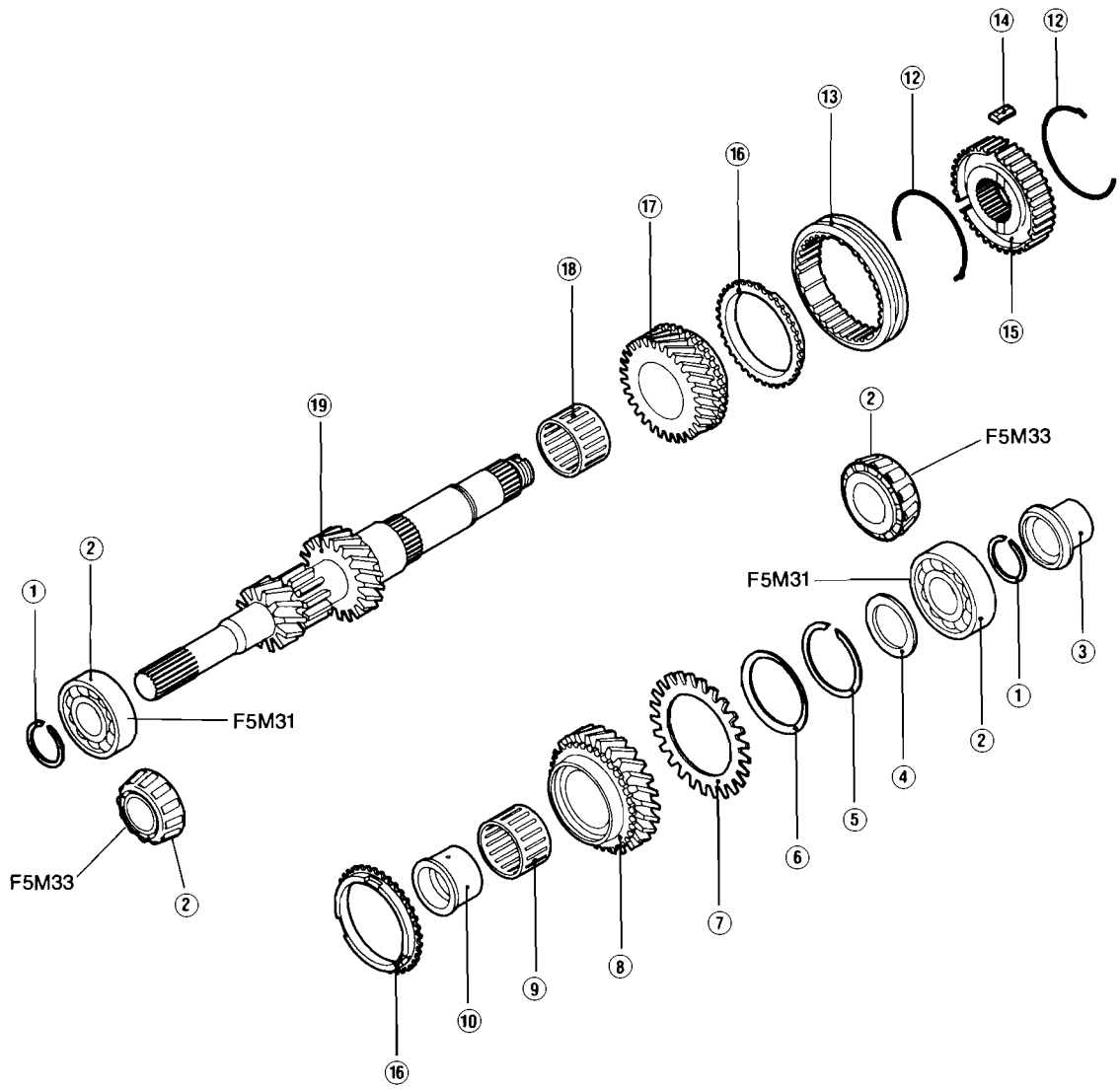
(2) Check the transaxle case and clutch housing for cracks, wear and damage.
(3) Inspect all gears for worn or damaged teeth.
(4) Inspect all bearings and cups for wear and damage.
(5) Inspect synchronizer hubs, sleeves and rings for rough or damaged surfaces and for worn or damaged teeth.

NOTE: Prior to disassembling synchronizer assemblies mark both the hub and sleeve on one side to allow assembly in the correct position. If either the hub or sleeve require replacement due to damage or wear, the hub and sleeve must be replaced as an assembly.

(6) Inspect the input shaft clutch plate splines for damage and wear, check sliding condition with clutch plate.
(7) Inspect selector shift rails, forks and reverse shift lever for wear and damage.

SUB-ASSEMBLY OVERHAUL

INPUT SHAFT



1. Snap ring (F5M31)
2. Bearing
3. Bearing sleeve
4. Spacer (F5M31)
5. Sub gear snap ring
6. Cone spring
7. Sub gear
8. 4th speed gear
9. Needle bearing
10. Bearing sleeve
11. Synchronizer ring
12. Synchronizer spring
13. 3rd - 4th speed synchronizer sleeve
14. Synchronizer key
15. 3rd - 4th synchronizer hub
16. Synchronizer ring
17. 3rd speed gear
18. Needle bearing
19. Input shaft

Fig. 22—Input shaft components

Disassembly

(1) Remove input shaft front bearing snap ring.
(2) Using suitable press plates remove input shaft front bearing, refer Fig. 23.

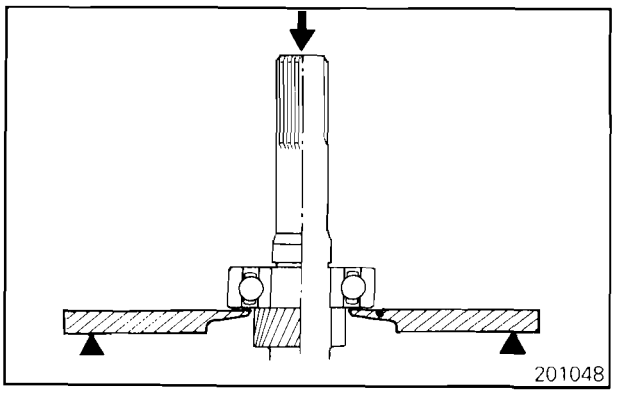


Fig. 23—Removing input shaft bearing

(3) Remove rear input shaft bearing sleeve using suitable press plates, refer Fig. 24, remove circlip, then rear bearing.

NOTE: When disassembling the input shaft, the bearing sleeve must be removed, then the snap ring BEFORE the rear input shaft bearing can be removed.
FAILURE TO REMOVE THE SLEEVE AND SNAP RING WILL RESULT IN DAMAGE TO THE INPUT SHAFT.

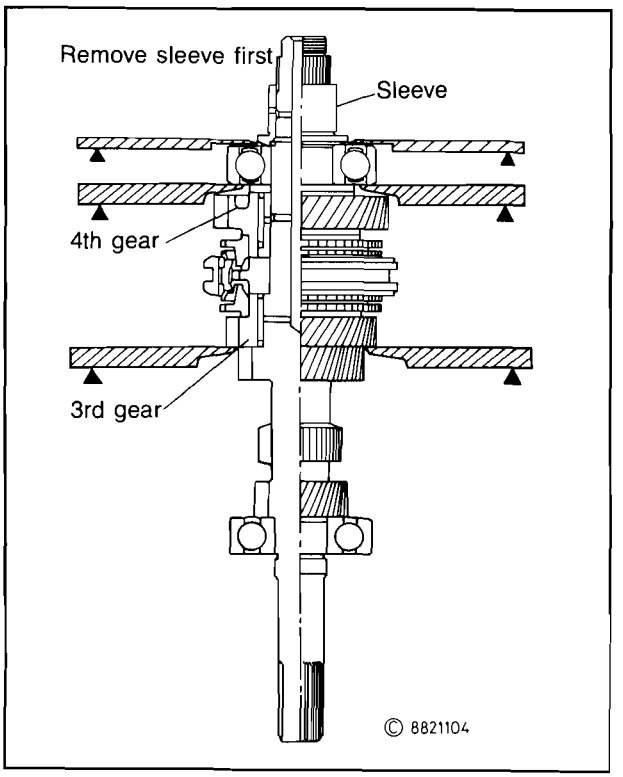


Fig. 24—Input shaft rear bearing removal

(4) Remove the bearing sleeve, 3rd - 4th speed synchronizer assembly and 3rd speed gear together using suitable press plates, refer Fig. 25.
(5) Check the outer surface of the input shaft where the needle bearing is mounted for damage, abnormal wear, seizure (portion A), refer Fig. 26, and check the splines for damage and wear.

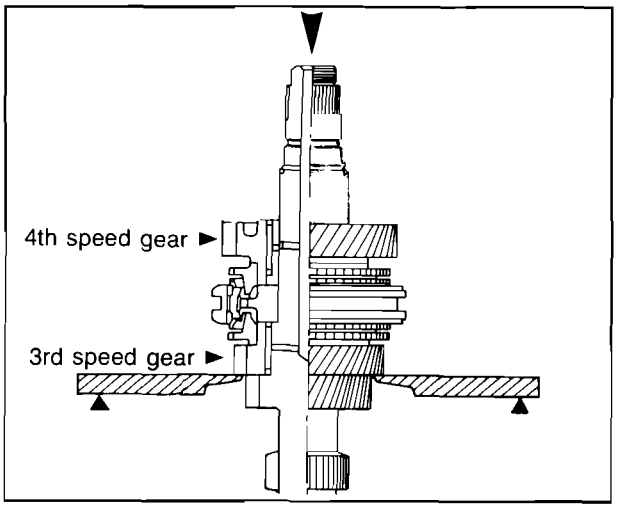


Fig. 25—3rd gear removal

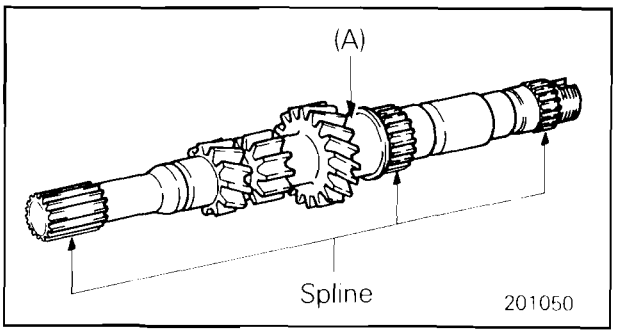


Fig. 26—Needle bearing position A

(6) Combine the needle bearing with the shaft or bearing sleeve and gear, and check that it rotates smoothly without abnormal noise or play.
(7) Check the needle bearing cage for deformation, refer Fig. 27.

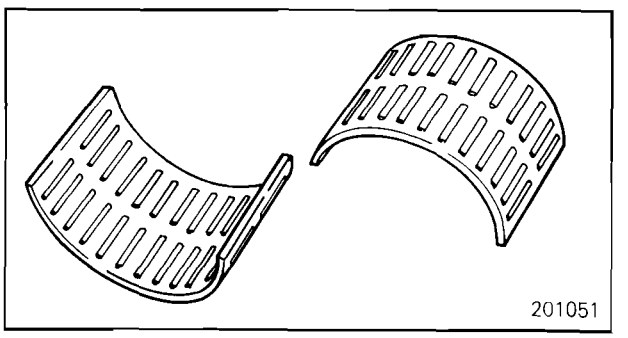


Fig. 27—Needle roller bearing

Inspection

(1) Inspect the synchronizer ring gear teeth for damage and breakage, check the internal surface for damage and wear, refer Fig. 28.

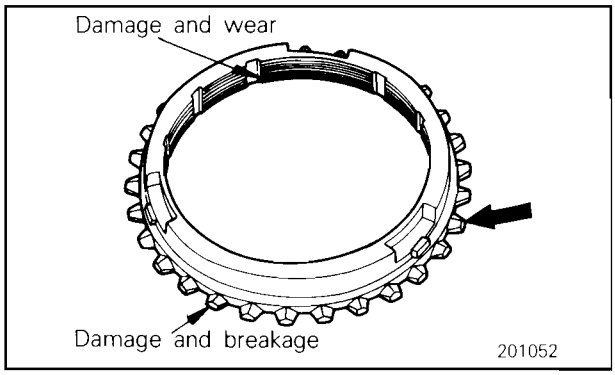


Fig. 28—Synchronizer ring

(2) Check the synchronizer ring, to speed gear clearance, by forcing the synchronizer ring towards the clutch gear and check clearance, refer Fig. 29, replace the synchronizer ring, if the clearance is out of specification, limit 0.5 mm.

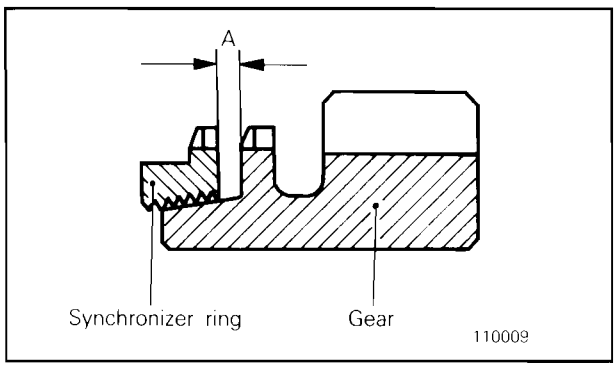


Fig. 29—Synchronizer ring clearance

(3) Check the synchronizer sleeve and hub by combining the sleeve and hub, and check that they slide smoothly, refer Fig. 30.

(4) Check that the sleeve is free from damage at its inside, front and end surfaces.

(5) Check for wear of hub end surfaces (in contact with each speed gear).

NOTE: When replacing synchronizer hub and sleeve replace as a set.

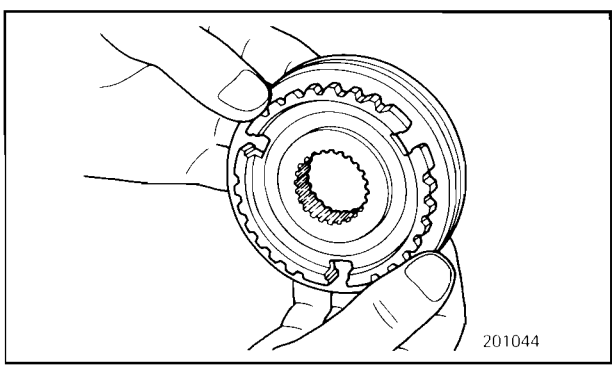


Fig. 30—Synchronizer hub and sleeve

(6) Check the synchronizer key for wear of the centre protrusion, refer Fig. 31 and the spring for deterioration, deformation and breakage.

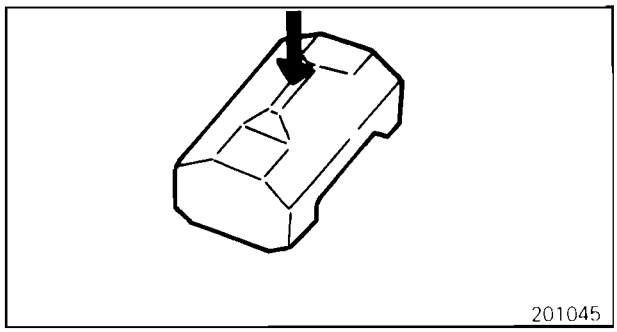


Fig. 31—Synchronizer key

(7) Check the bevel gear and clutch gear teeth of the speed gears for damage and wear, check the synchronizer cone for rough surface, damage and wear, and check the gear bore and front ends for damage and wear, refer Fig. 32.

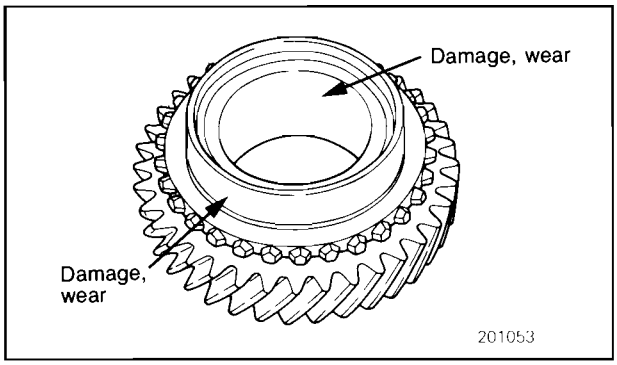


Fig. 32—Speed gear

Assembly Input Shaft

(1) Install 3rd gear needle bearing and 3rd speed gear.

(2) Install synchronizer ring.

(3) Assemble 3rd - 4th speed synchronizer hub and sleeve, refer Fig. 33 and Fig. 34.

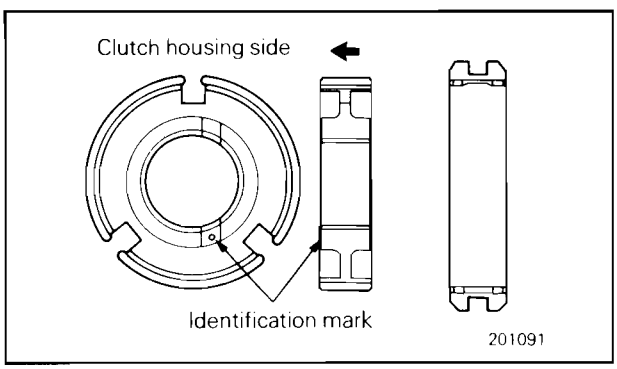


Fig. 33—Synchronizer hub and sleeve

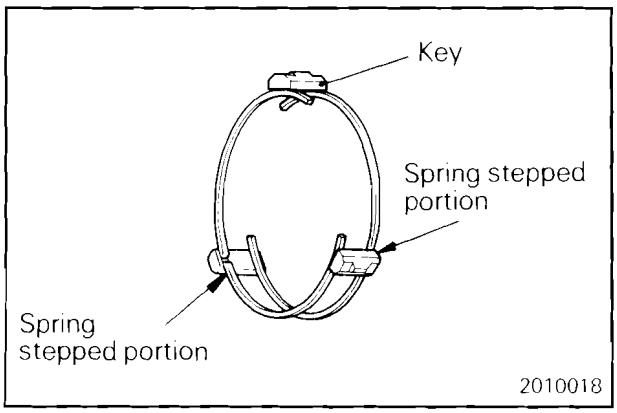


Fig. 34—Synchronizer spring position

NOTE: When installing synchronizer springs, ensure that the ends of the springs are not opposite each other, refer Fig. 34.

(4) Install the 3rd - 4th speed synchronizer assembly over the input shaft using a suitable installer, refer Fig. 35.

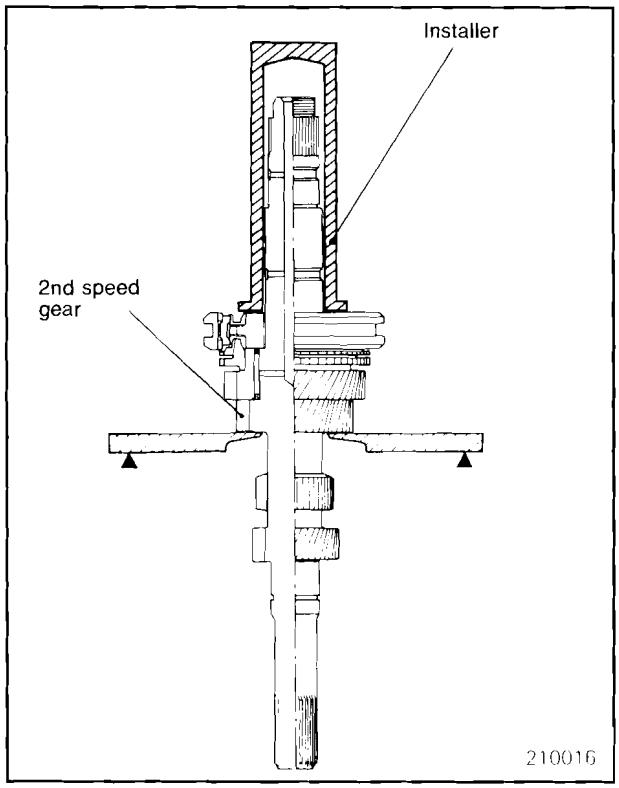


Fig. 35—3rd - 4th synchronizer installation

NOTE: • When installing the synchronizer assembly make sure that the three synchronizer keys are seated correctly in their respective grooves of the synchronizer ring.

• After installation of the synchronizer assembly, check that the 3rd speed gear rotates smoothly.

(5) Using a suitable installer, install the 4th speed gear bearing sleeve over the input shaft, refer Fig. 36.

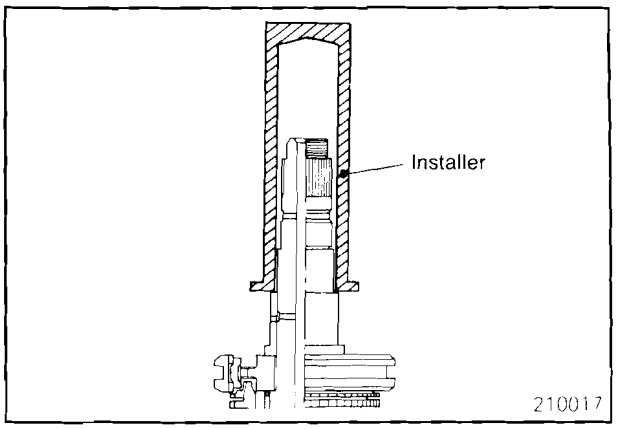


Fig. 36—4th speed bearing sleeve

(6) Assemble 4th speed gear with sub gear and snap ring, refer Fig. 37.

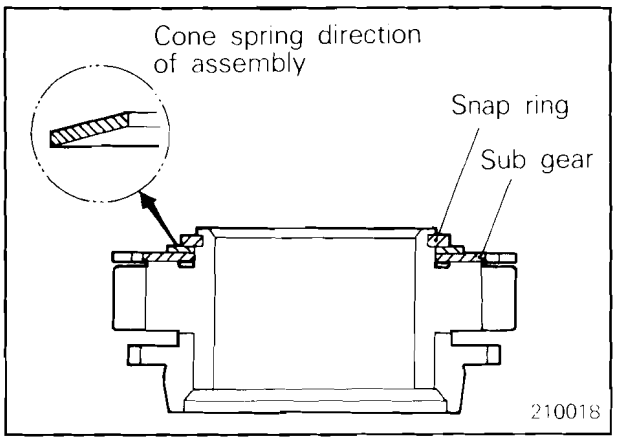


Fig. 37—4th speed gear assembly

(7) Install 4th speed gear onto input shaft.

(8) Install the spacer onto the input shaft, refer Fig. 38 for direction, (F5M31 only).

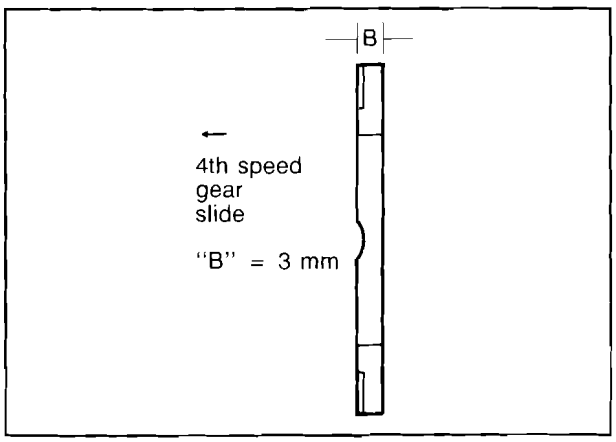


Fig. 38—Spacer installation

(9) Using a suitable installer, install the input shaft rear bearing.

NOTE: The snap ring must be fitted before the bearing sleeve is installed. Select the thickest snap ring that fits in the snap ring groove, to achieve the specified end play.

CAUTION: Do not reuse old snap ring.

CAUTION: When installing snap ring onto input shaft take care not to over stretch NEW snap ring.

NOTE: When the 5th speed sleeve has been installed onto the input shaft, make sure the snap ring does not prevent the sleeve from seating against the bearing.

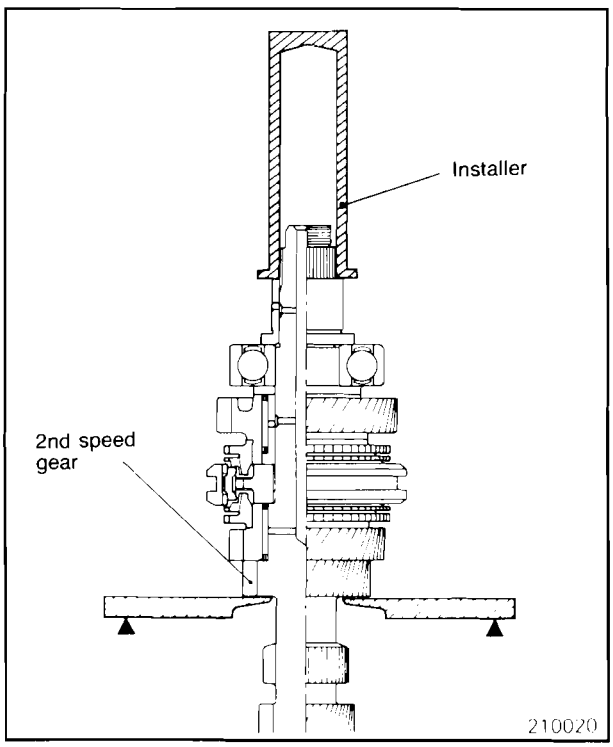


Fig. 39—Rear input shaft bearing sleeve installation

(10) Install the front input shaft bearing over the input shaft using a suitable installer, refer Fig. 40.

NOTE: When installing bearing, push the inner race only.

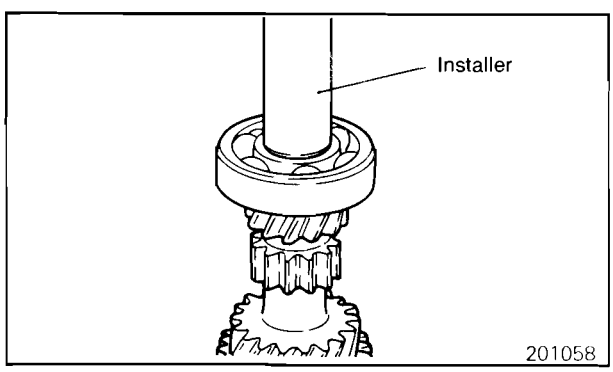


Fig. 40—Input shaft bearing installation

(11) Install input shaft bearing snap ring, refer Fig. 41, (F5M31 only).

NOTE: Snap rings are available in different thicknesses. Select the thickest one that fits in the snap ring groove. Do not cause damage to the input shaft oil seal contacting surface.

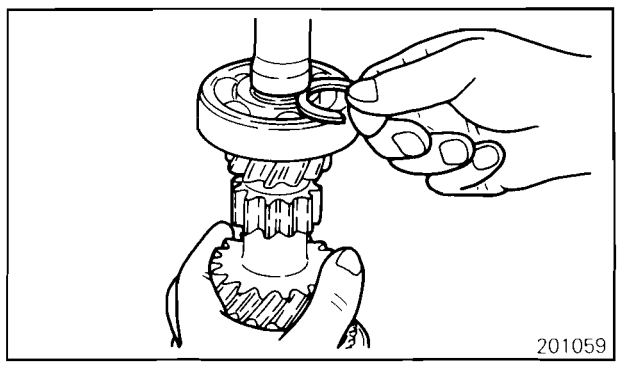


Fig. 41—Input shaft snap ring installation (F5M31)

INTERMEDIATE GEAR ASSEMBLY

Disassembly

(1) Remove intermediate gear front bearing snap ring.

(2) Using suitable press plates remove the front taper bearing, 1st speed gear and bearing sleeve, refer Fig. 42.

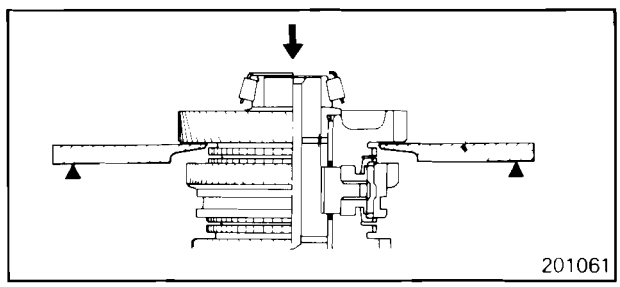


Fig. 42—1st gear bearing removal

(3) Remove the synchronizer ring.

(4) Using suitable press plates, remove the 1st - 2nd speed synchronizer hub and sleeve, refer Fig. 43.

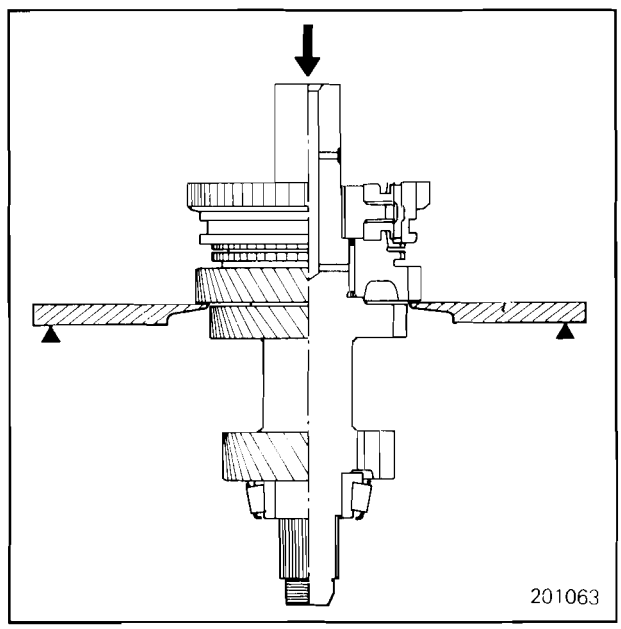


Fig. 43—1st - 2nd synchronizer removal

(5) Remove 2nd speed gear and needle bearing.

(6) Using special tool E1673 B20 remove the rear intermediate bearing, refer Fig. 44.

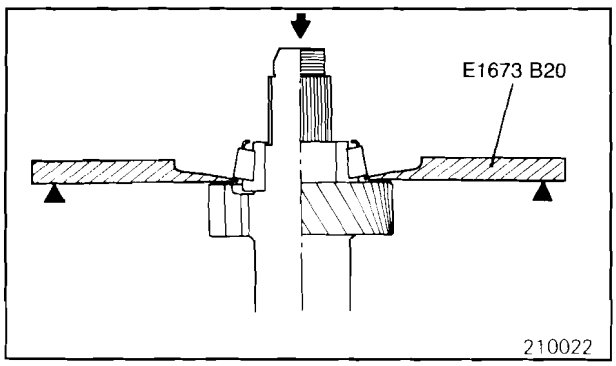


Fig. 44—Intermediate shaft rear bearing removal

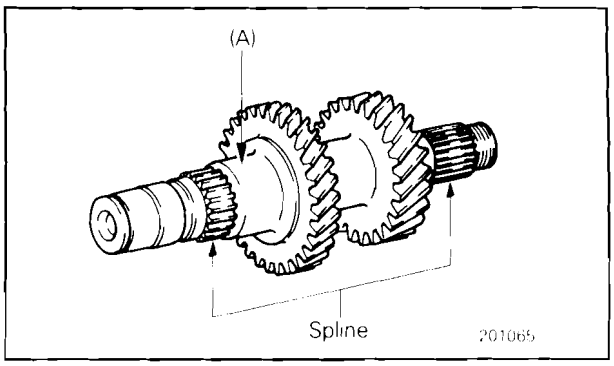


Fig. 46—Intermediate gear

Inspection

(1) Check the intermediate gear outer surfaces where the needle bearing is mounted for damage, abnormal wear and seizure (portion A), refer Fig. 46 and check the splines for damage and wear.

(2) Check synchronizer ring for teeth damage and breakage and check the internal surface for damage.

(3) Check synchronizer ring to speed gears for specified clearance, 0.5 mm is the minimum, refer Fig. 29.

(4) Check synchronizer sleeve and hub that they slide smoothly and the sleeve is free from damage at its inside front and rear ends, and check the hub and surfaces (in contact with each speed gear).

NOTE: Replace the synchronizer hub and sleeve as a set, if required.

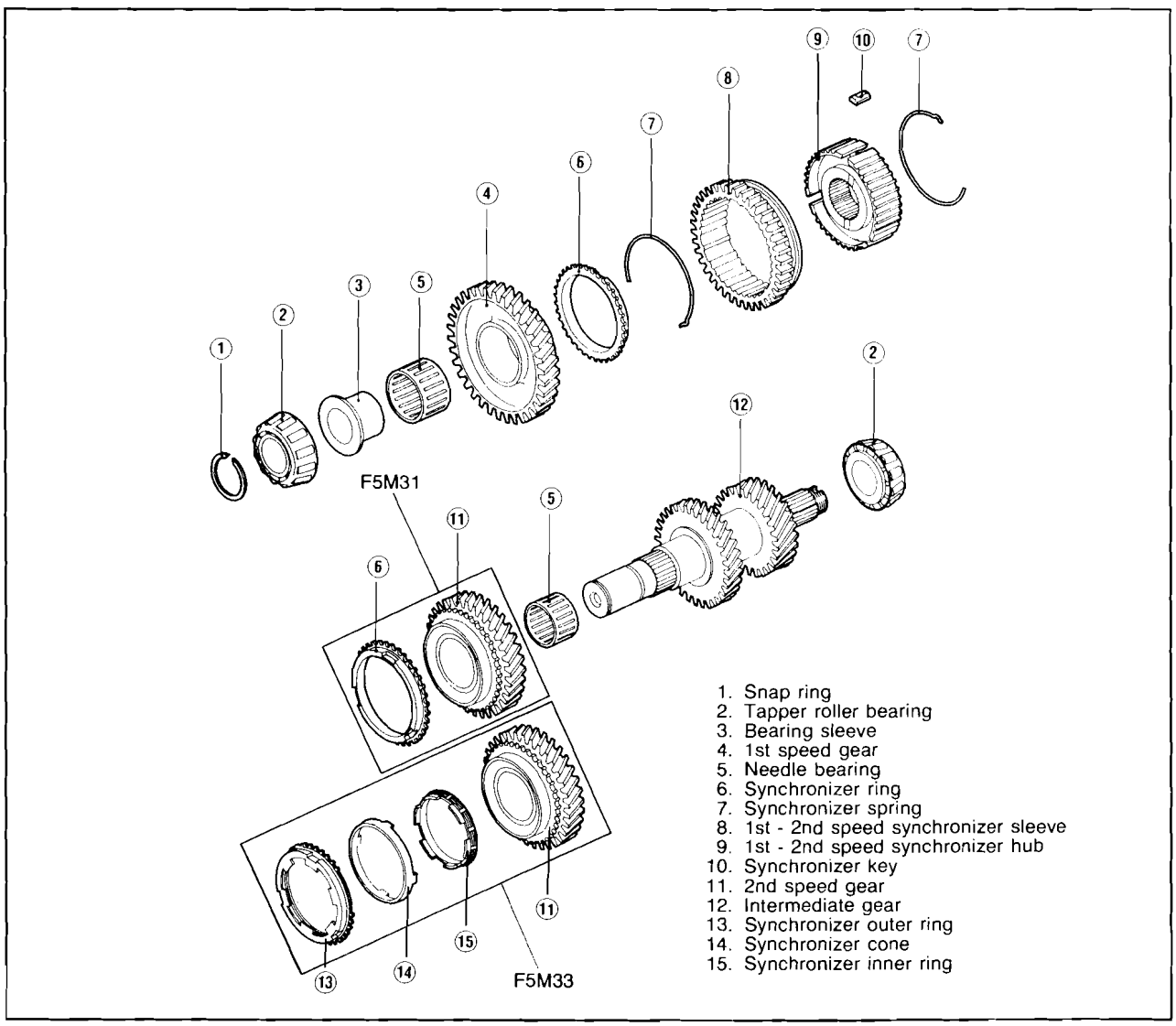


Fig. 45—Intermediate shaft components

(5) Check each speed gears clutch teeth for damage, and wear and the synchronizer cone for rough surface, damage and wear, check the gear bore and front and rear ends for damage and wear.

(6) Check the synchronizer key centre protrusion for wear, and springs for weakness, deformation and breakage.

Assembly

(1) Install the intermediate gear rear bearing using a suitable installer, refer Fig. 47.

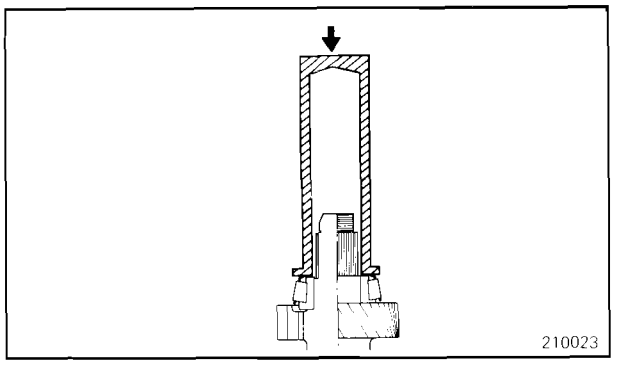


Fig. 47—Rear bearing installation

(2) Install 2nd speed gear and needle bearing to intermediate gear.

(3) Install 2nd speed gear synchronizer ring to the second speed gear, refer Fig. 48.

NOTE: Paper lined synchronizer rings were used in early model F5M31 transmissions.

NOTE: 2nd speed twin cone synchronizer assembly used on F5M33 transmissions.

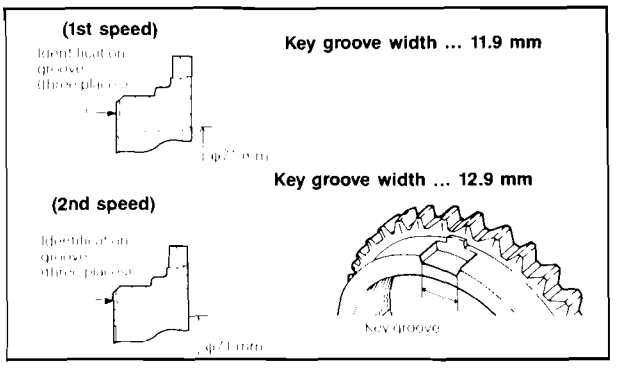


Fig. 48—1st and 2nd speed Synchro ring identification

(4) Assemble synchronizer hub and sleeve, refer Figs. 49, 50 and 51.

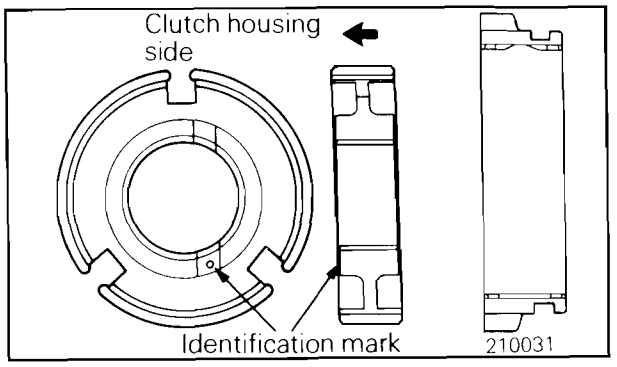


Fig. 49—1st - 2nd synchro hub and sleeve

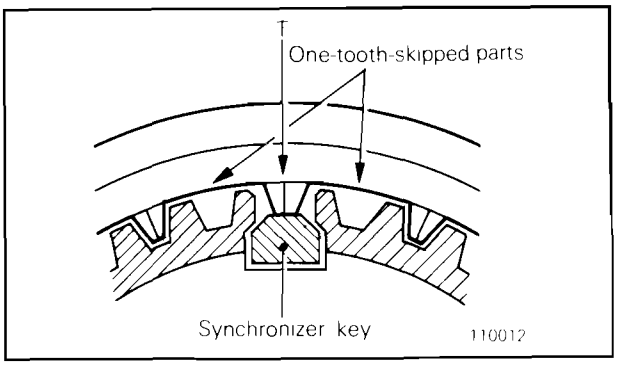


Fig. 50—Synchronizer key position

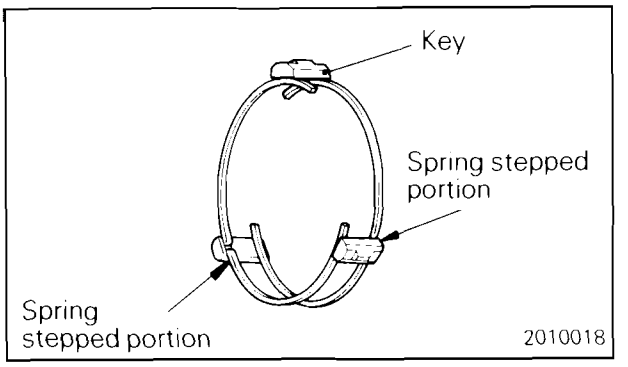


Fig. 51—Synchronizer spring position

NOTE: When installing the synchronizer springs, ensure that the ends of the springs are not opposite each other, refer Fig. 51.

(5) Install the 1st - 2nd speed synchronizer hub and sleeve over the intermediate gear using a suitable installer, refer Fig. 52.

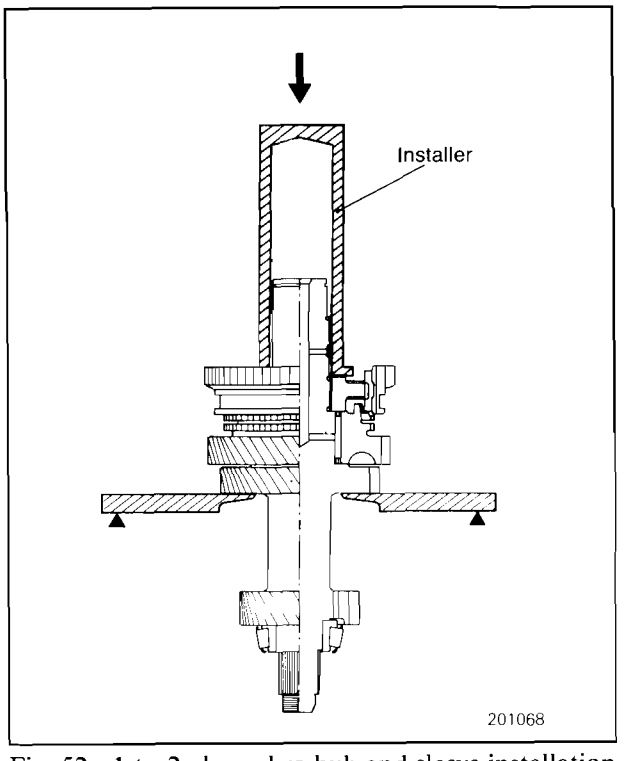


Fig. 52—1st - 2nd synchro hub and sleeve installation

(6) After installing 1st - 2nd speed synchronizer hub and sleeve to the intermediate gear check that the 2nd speed gear rotates smoothly.

(7) Install 1st gear synchronizer ring. Refer Fig. 48.

(8) Install 1st gear needle bearing and using a suitable installing tool press onto the intermediate gear the 1st speed gear bearing sleeve, refer Fig. 53.

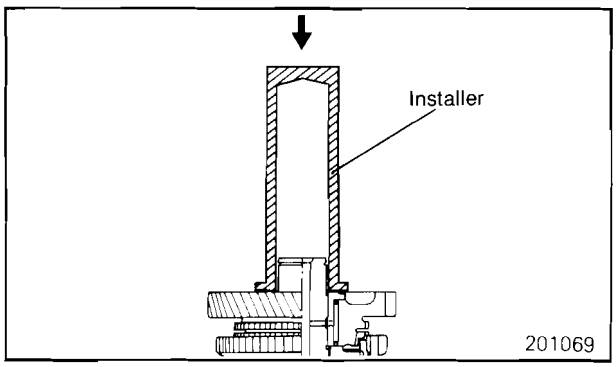


Fig. 53—Installing 1st gear bearing sleeve

(9) Using a suitable installing tool, refit front intermediate gear taper bearing, refer Fig. 54.

NOTE: When installing the bearing, only push on the inner race.

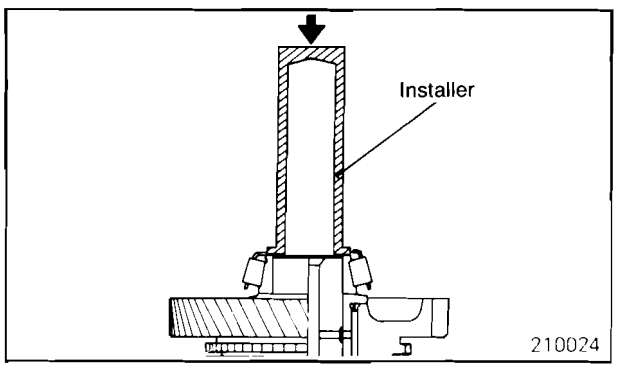


Fig. 54—Bearing installation intermediate gear

(10) Install new intermediate gear snap ring, select the thickest snap ring that will fit into the groove to achieve a maximum end play of 0.01-0.11mm. Refer to the specification chart for snap ring selection chart.

OUTPUT SHAFT

Disassembly

(1) Using special tool E1673 A20, remove bearings from output shaft, refer Fig. 55.

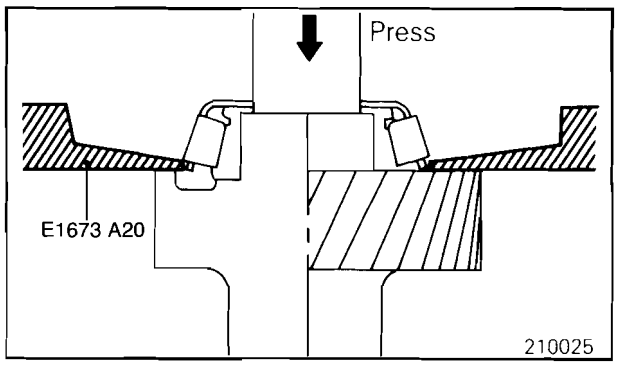


Fig. 55—Bearing removal output shaft

Inspection

Clean and check output shaft teeth for wear and damage.

Assembly

(1) Using a suitable installer, fit bearings onto output shaft, refer Fig. 56.

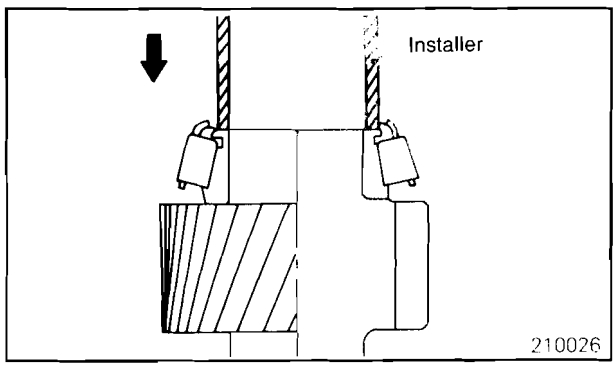


Fig. 56—Output shaft bearing installation

NOTE: When installing the bearing, push the inner race only.

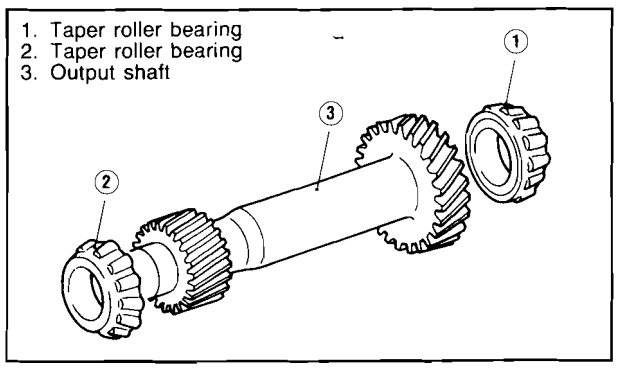


Fig. 57—Output shaft components

DIFFERENTIAL

Disassembly

(1) Using special tools E1673 MT, E1673 G16 and E1673 B15 remove both differential bearings, refer Fig. 58.

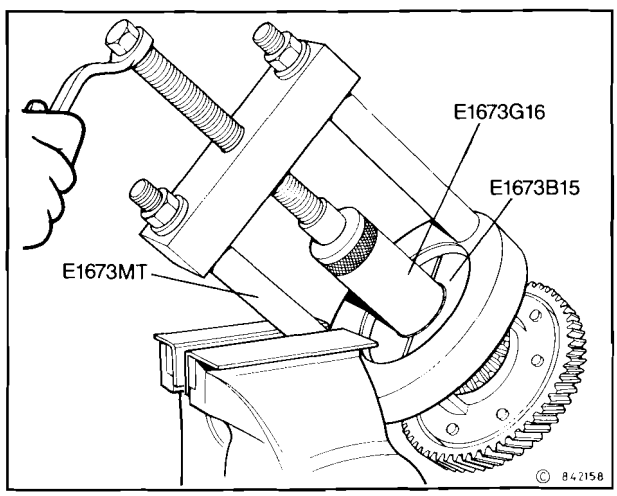


Fig. 58—Removing bearings

(2) Remove the drive gear attaching bolts and remove the drive gear.

(3) With the aid of a suitable punch, drive out the pinion shaft lock pin, refer Fig. 59.

NOTE: The pin must not be reused.

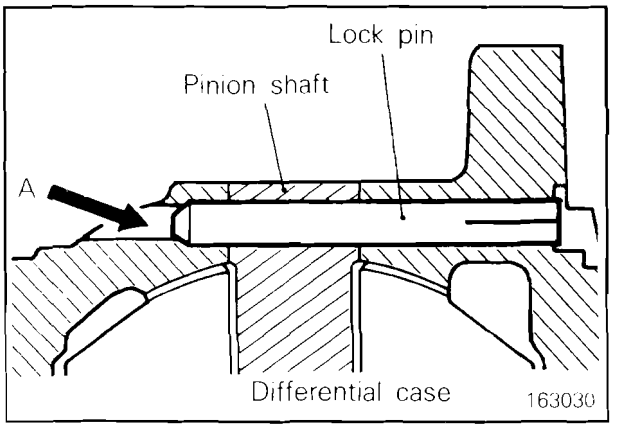


Fig. 59—Pinion shaft lock pin

NOTE: It may be necessary to remove a small amount of metal from the case with a file or grinder to expose access hole A.

(4) Remove the pinion shaft gears and spacers, noting the location of the spacers.

Assembly

(1) Install the side gears and spacers into the case.

NOTE: If installing the original spacers and gears, install in the locations noted on dissasembly. If new side gears are to be installed, fit medium thickness spacers, refer to specifications.

(2) Install the pinion gears, washers and pinion shaft.

(3) Measure the backlash between the side gear and the pinion gear using a dial indicator, refer Fig. 61.

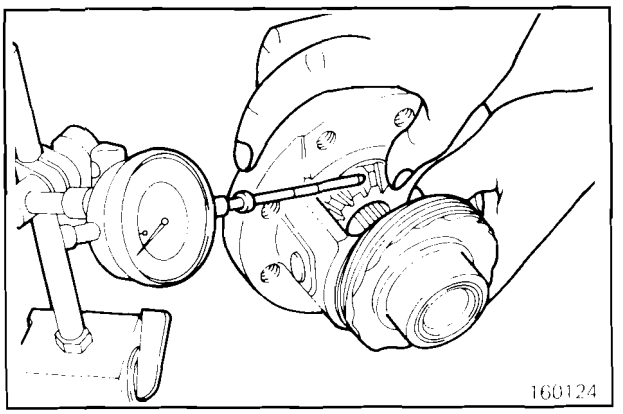


Fig. 61—Measuring backlash

(4) Select suitable side gear spacers to provide the specified side gear to pinion backlash, refer to specifications.

NOTE: The backlash of both right and left hand side gears must be equal.

(5) Install a new pinion shaft lock pin. Drive the lock pin into the differential case until lock pin head is SUNK from the flange surface of the differential case, refer Fig. 62.

(6) Install the drive gear onto the differential case.

Apply loctite thread bolt 271 to the threads of the drive gear attaching bolts, install the bolts and tighten to the specified torque, in two stages in the sequence shown in Fig. 63. Remove any excess loctite sealer from the bolts.

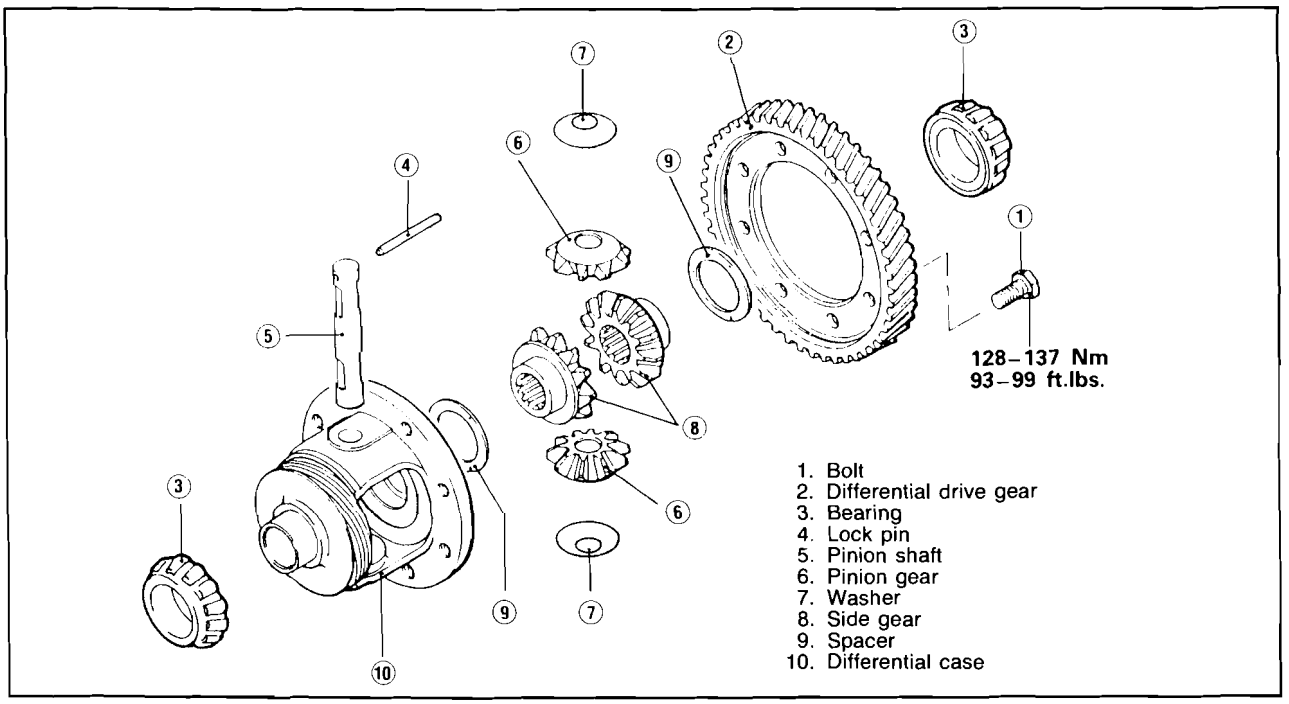


Fig. 60—Differential components

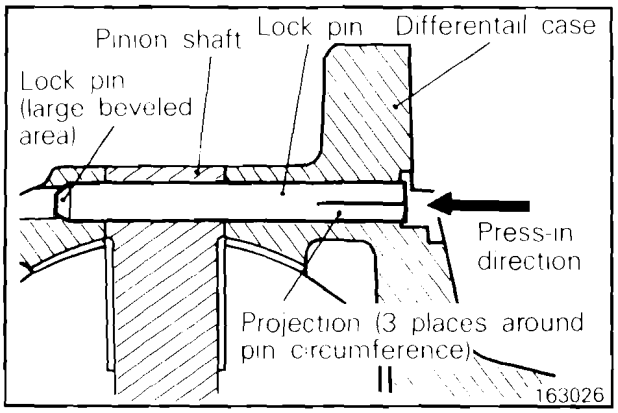


Fig. 62—Lock pin installation

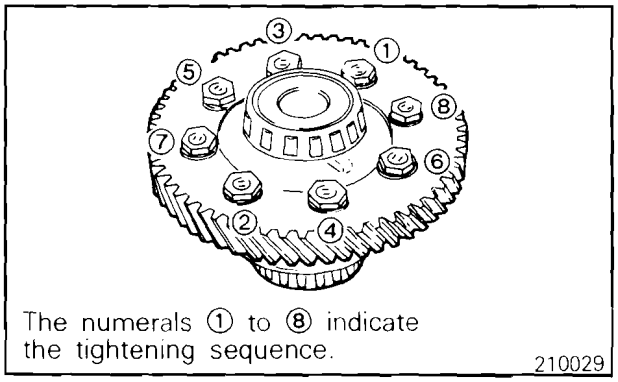


Fig. 63—Drive gear bolt tightening sequence

(7) Using special tools E7403 or a suitable alternative, press the bearings onto the differential case, refer Fig. 65.

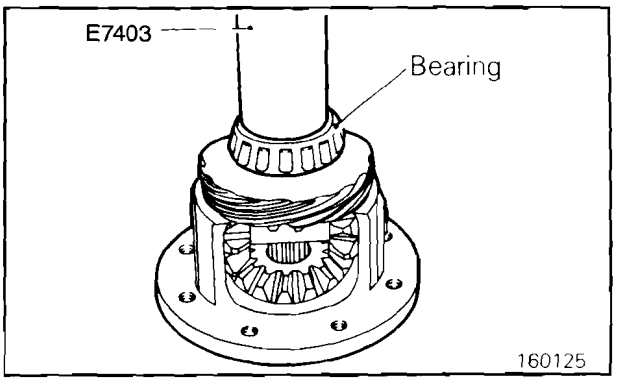


Fig. 65—Bearing installation

SHIFT FORK

Disassembly

(1) Remove 3rd - 4th speed shift fork.
(2) Remove 1st - 2nd speed shift rail.
(3) Remove 3rd - 4th speed shift fork.
(4) Remove 5th - reverse speed shift rail.
(5) Remove the interlock plunger.
(6) Remove the 3rd - 4th speed shift rail.
(7) Remove the reverse shift lug.

Assembly

Reverse the disassembly procedure to reassemble.

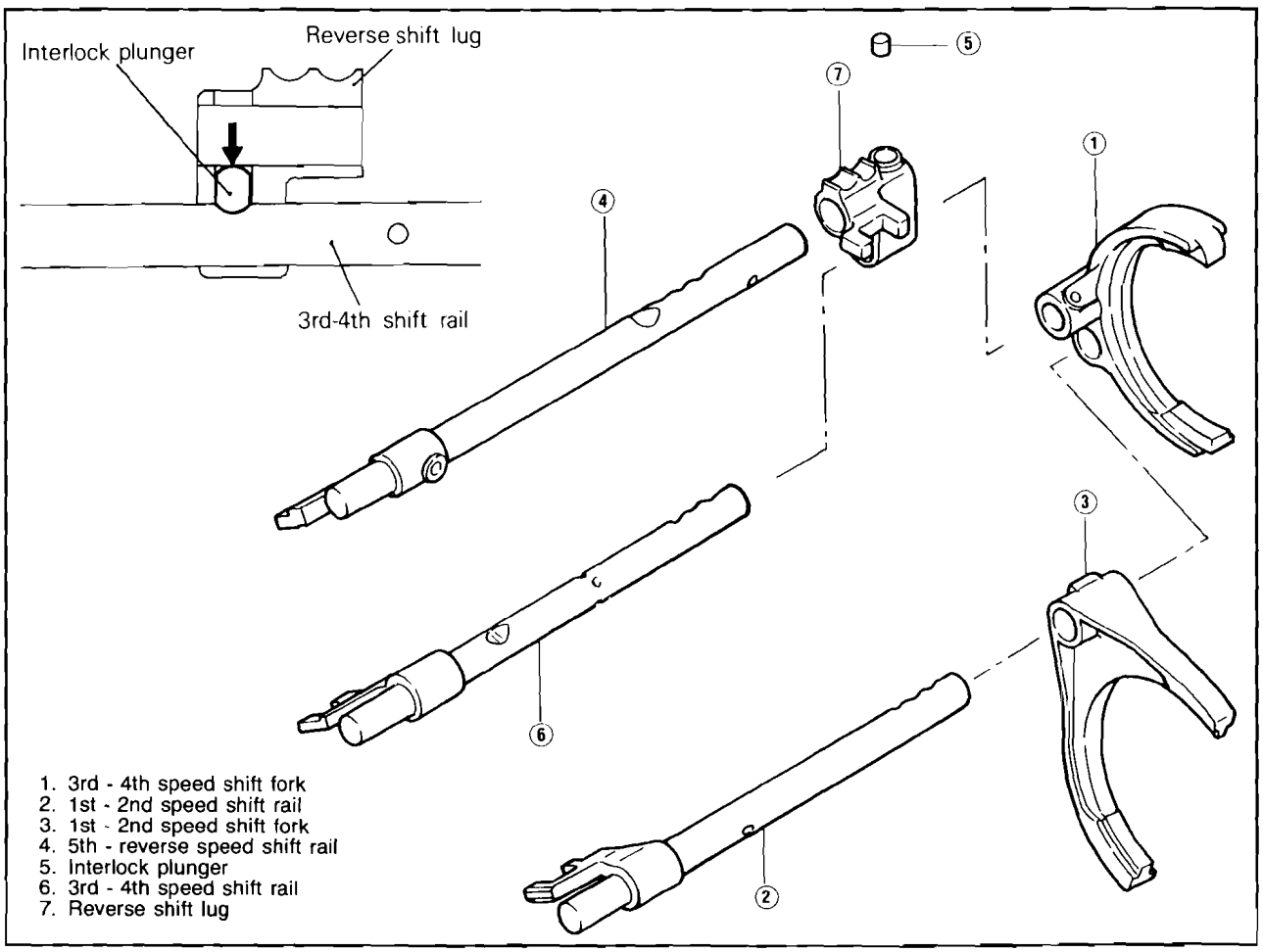


Fig. 64—Shift fork components

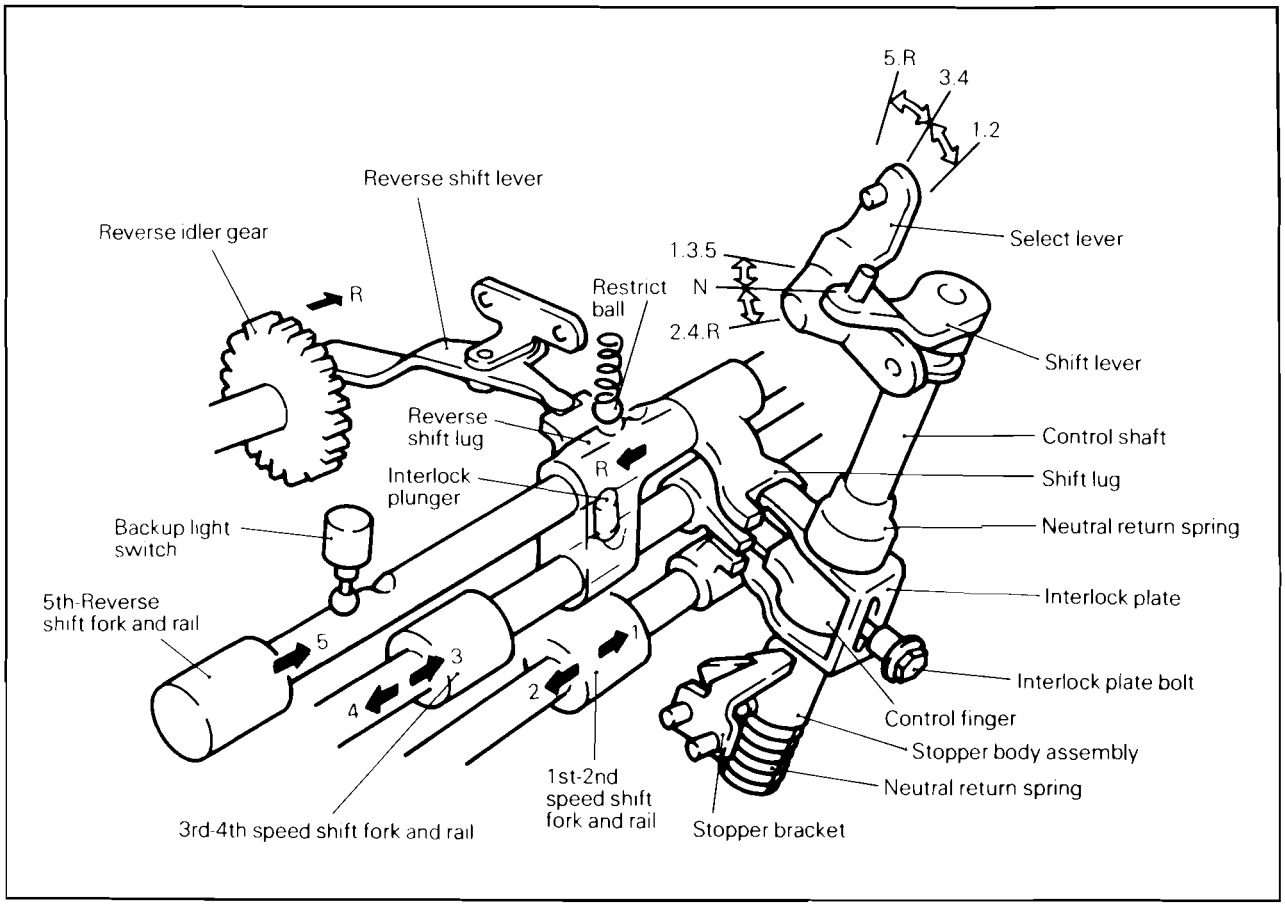


Fig. 66—Shift control mechanism

CLUTCH HOUSING

Disassembly

(1) Remove select lever assembly.
(2) Remove select lever shoe.
(3) Remove interlock plate bolt.
(4) Remove control finger lock pin, refer Fig. 67.

NOTE: When removing the lock pin from the control finger, turn the control lever to such a position that the lock pin will not contact the clutch housing.

(5) Remove the stopper body roll pin, refer Fig. 69.

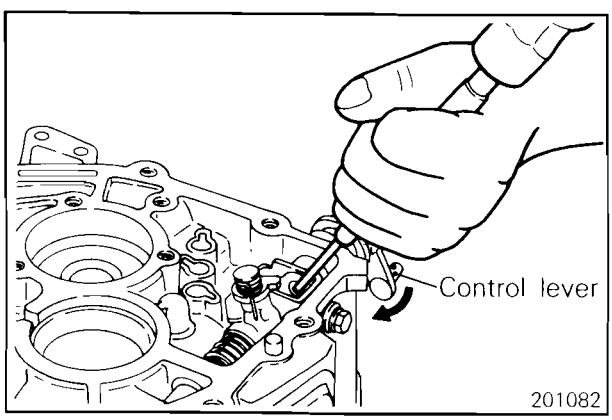


Fig. 67—Control finger lock pin removal

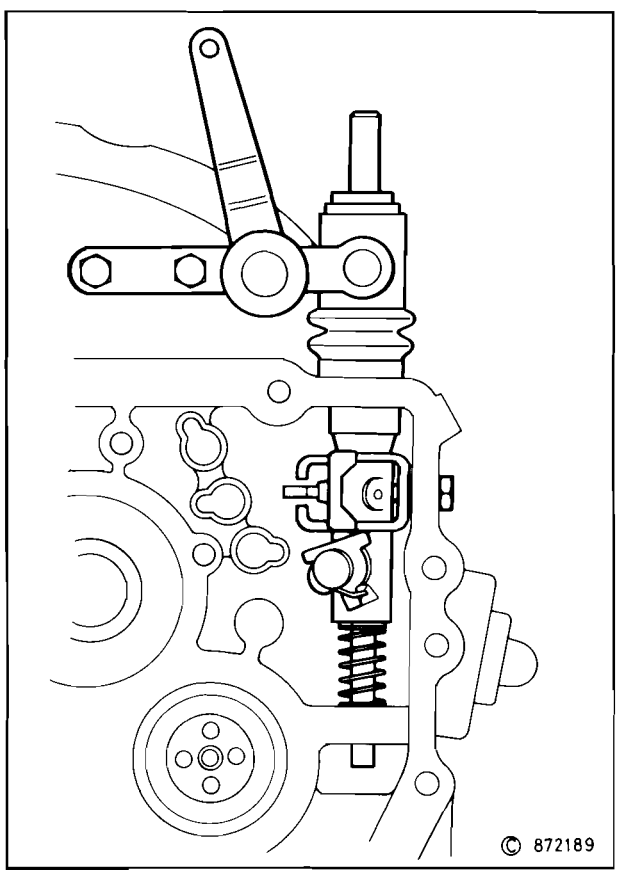


Fig. 68—Shift control lever

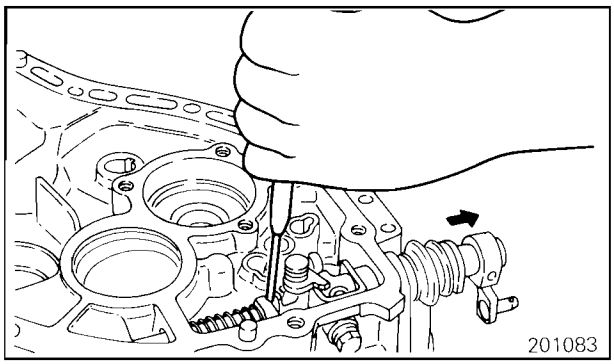


Fig. 69—Stopper body roll pin removal

NOTE: When removing the roll pin from the stopper body, pull the control shaft in direction shown in Fig. 69, so that the roll pin will not contact the clutch housing.

(6) Withdraw the control shaft from the clutch housing, noting position of neutral return spring, stopper body, control finger, interlock plate and neutral return spring assembly, refer Fig. 70.

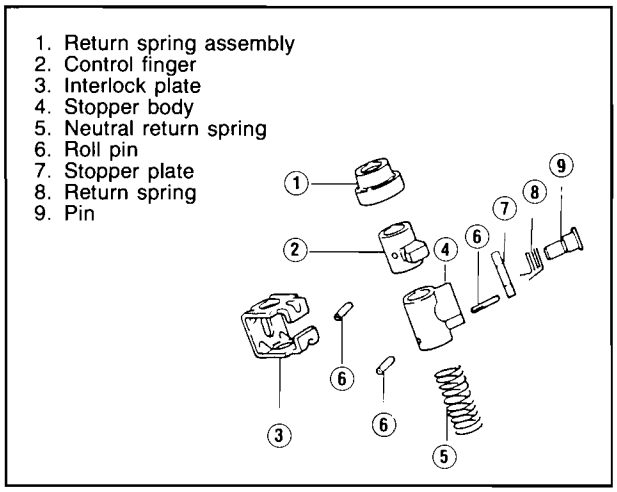


Fig. 70—Control shaft components

(7) Using a suitable drift remove needle bearings.

Assembly

(1) Install needle bearings flush with the surface A of the clutch housing, refer Fig. 71.

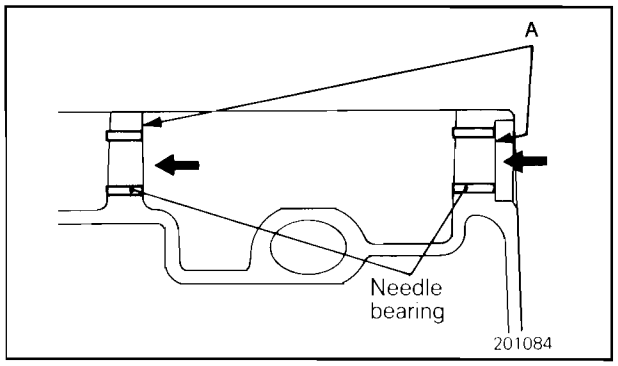


Fig. 71—Bearing installation

(2) Install oil seal using a suitable socket wrench or installer, refer Fig. 72.

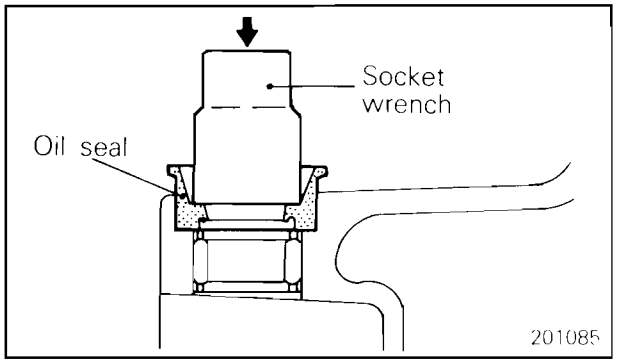


Fig. 72—Control shaft oil seal

(3) Install control shaft boot to control rod.

(4) Install control rod into clutch housing, replacing neutral return spring assembly, control finger, interlock plate, stopper body and neutral return spring, refer Fig. 70.

(5) Install new roll pin and lock pin to control finger and stopper body with roll pin slit at right angle to control shaft centre, refer Fig. 73.

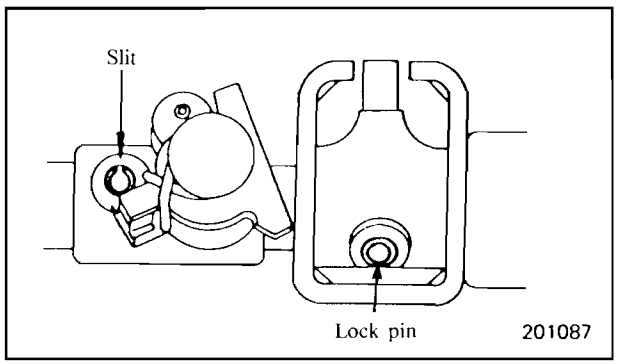


Fig. 73—Roll pin installation

SPEEDOMETER GEAR

Removal

(1) Disconnect the speedometer cable from the speedometer gear assembly.

(2) Remove the retaining bolt and remove the gear assembly.

Installation

Install by reversing removal procedure ensuring that the bolt is tightened to specifications.

Disassembly

(1) Using a suitable pin punch remove the roll pin and dismantle the assembly.

(2) Clean and inspect components.

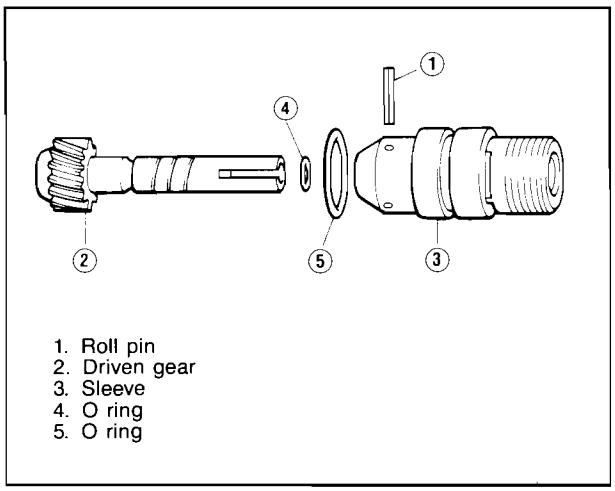


Fig. 74—Speedometer gear assembly

Assembly

NOTE: New "O" rings and a new roll pin must be used.

(1) Install the "O" ring in the groove on the inside diameter of the gear sleeve.
(2) Apply a coat of gear oil to the gear shaft and insert the gear in the gear sleeve.
(3) Align the roll pin hole in the sleeve with the groove in the shaft and drive in a new roll pin.

NOTE: The slit in the roll pin should not contact the gear shaft.

(4) Apply a coat of gear oil to the outside of the sleeve and slide the "O" ring onto the sleeve.

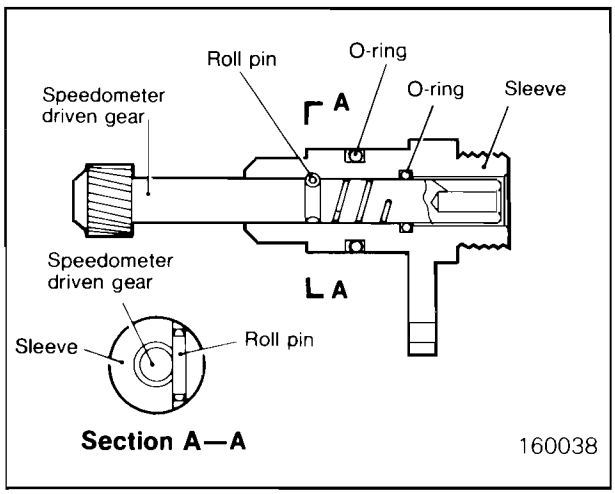


Fig. 75—Cross section of speedometer gear assembly

TRANSAXLE ASSEMBLY

(1) Install bearing cups and oil guides into clutch housing.
(2) Install input shaft oil seal using suitable installer, refer Fig. 76.

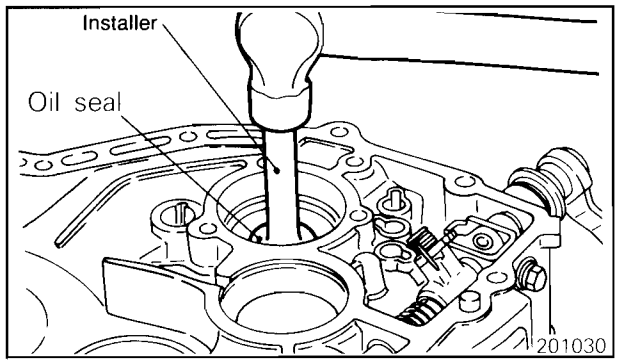


Fig. 76—Input shaft oil seal installation

(3) Install differential into clutch housing.
(4) Install output shaft into clutch housing.
(5) Install intermediate gear together with input shaft, refer Fig. 77.

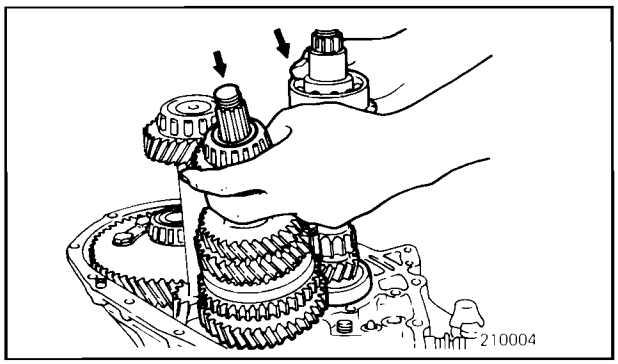


Fig. 77—Intermediate gear installation

(6) Refit input shaft bearing retainer, refer Fig. 78, apply loctite 271 or equivalent to bearing retainer bolt threads (approximatly 5 mm) and tighten bolts to specified torque.

NOTE: Wipe excess sealant from bolts.

NOTE: ONLY 2 BOLTS REQUIRED at this stage, refer Fig. 78.

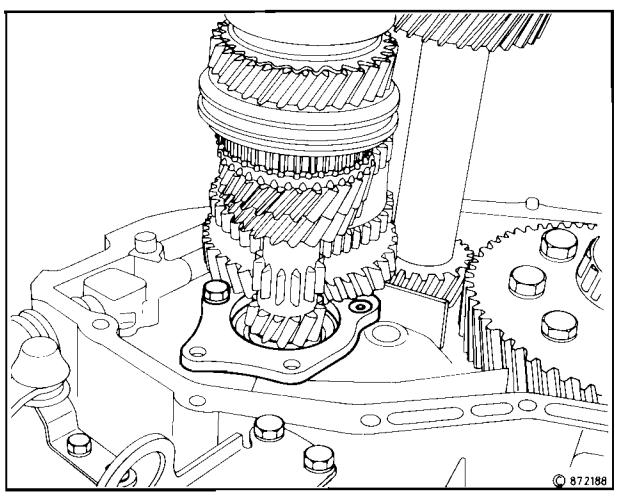


Fig. 78—Input shaft bearing retainer

(7) Set the 1st - 2nd speed shift sleeve in 2nd.

(8) Set the 3rd - 4th speed shift sleeve, refer Fig. 79.
(9) Install the shift forks to respective sleeves.

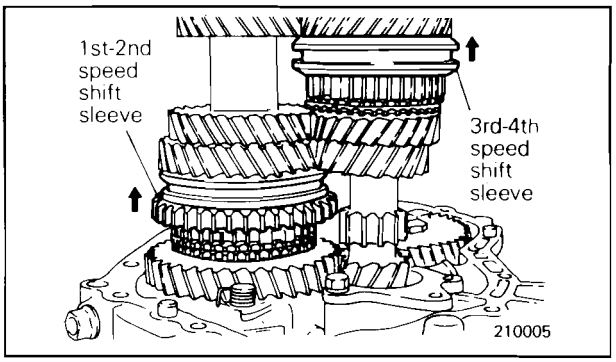


Fig. 79—1st - 2nd, 3rd - 4th set positions

(10) Install the shift rail into the shift fork hole while turning, so as to prevent the shift lug from interfering with the stopper plate, refer Fig. 80.

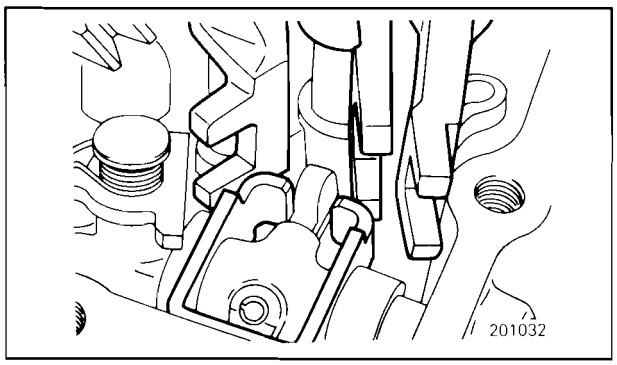


Fig. 80—Shift rail installation

(11) Turn the shift rails to engage shift lug.
(12) Reposition the 1st - 2nd and the 3rd - 4th speed sleeve to the neutral position.
(13) Using a suitable drift, drive the roll pins into the 1st - 2nd and 3rd - 4th shift forks, refer Fig. 81.

NOTE: Ensure that the split in the roll pin is aligned with the shift rail centre line.

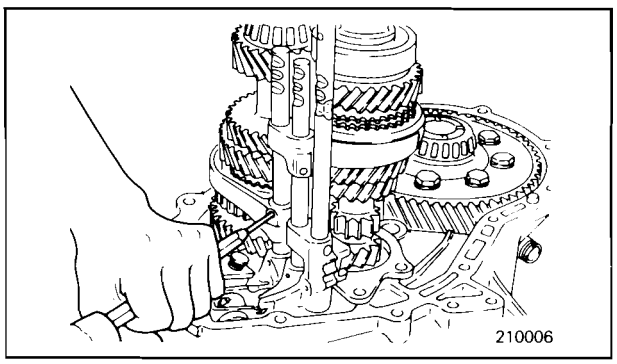


Fig. 81—Roll pin installation

CAUTION: Support the shift rails when installing the roll pin to prevent bending the shift rails.

(14) Install the reverse idler gear shift lever.
(15) Apply loctite 271 or equivalent to bearing retainer bolt threads, approximately 5 mm, and tighten bolts to specified torque. Wipe excess sealant from bolts.
(16) Install the reverse idler gear and shaft and shift lever shoe to make sure the idler gear shaft is positioned in the direction illustrated, refer Fig. 82.

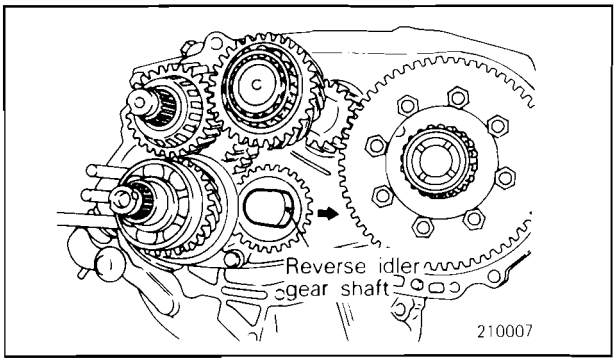


Fig. 82—Reverse idler shaft position

(17) Check the input shaft(F5M33), intermediate shaft output shaft and differential bearing end play/pre-load using the following method.
(a) Bend two 20 mm pieces in length and 1.6 mm in diameter of solder and place on the bottom of the outer circumference of the bearing cup recess of the input shaft (F5M33), differential case, intermediate shaft and the output shaft, refer Fig. 83.

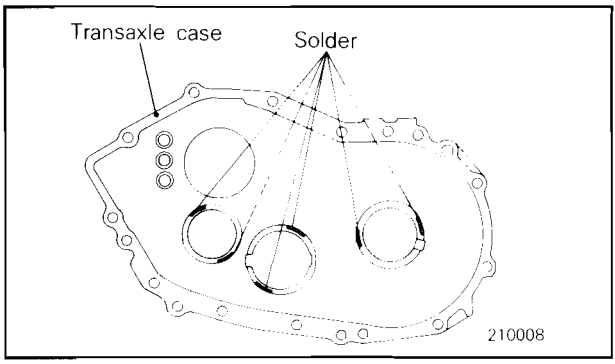


Fig. 83—Positioning solder pieces (F5M31) shown

(b) Install the bearing cups and push fit to hold the solder in place.

NOTE: Ensure that the solder is not crushed when initially installing the cups.

(c) Install the transaxle case without sealant and progressively tighten all bolts to the specified torque.
(d) Progressively loosen and remove bolts and remove the transaxle case.
(e) Remove all bearing cups, using a sliding hammer if necessary and remove the solder pieces taking careful note of their location.
(f) Measure the thickness of the crushed solder strips with a micrometer, refer Fig. 84.

NOTE: If the solder is not crushed, use solder of a larger diameter and repeat steps (a) to (f).

(8) Set the 3rd - 4th speed shift sleeve, refer Fig. 79.
(9) Install the shift forks to respective sleeves.

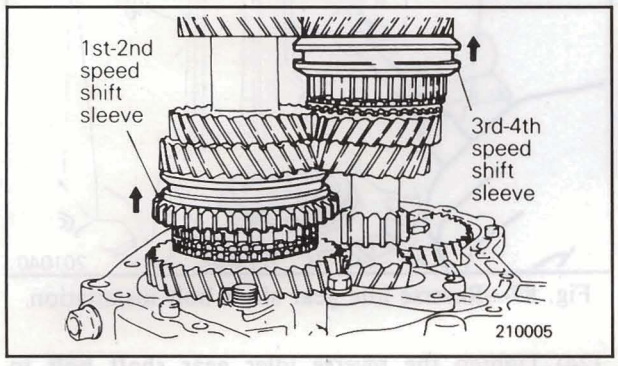


Fig. 79—1st - 2nd, 3rd - 4th set positions

(10) Install the shift rail into the shift fork hole while turning, so as to prevent the shift lug from interfering with the stopper plate, refer Fig. 80.

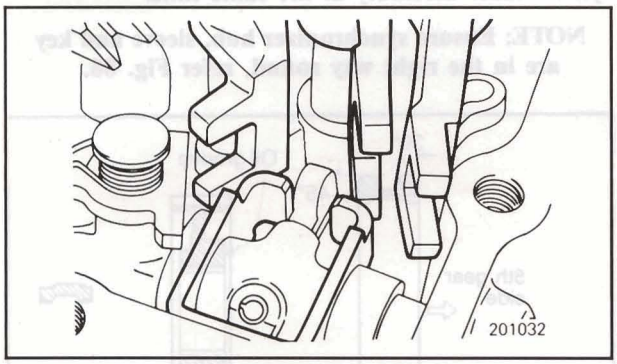


Fig. 80—Shift rail installation

(11) Turn the shift rails to engage shift lug.
(12) Reposition the 1st - 2nd and the 3rd - 4th speed sleeve to the neutral position.
(13) Using a suitable drift, drive the roll pins into the 1st - 2nd and 3rd - 4th shift forks, refer Fig. 81.

NOTE: Ensure that the split in the roll pin is aligned with the shift rail centre line.

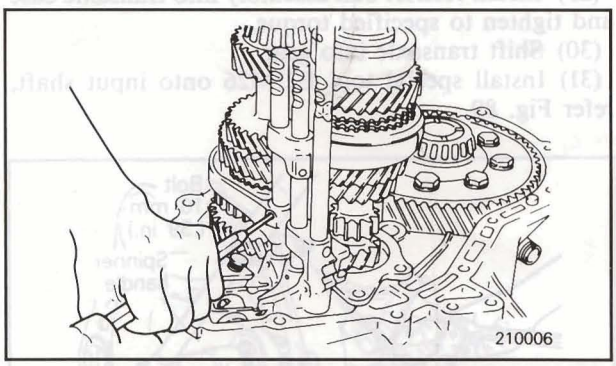


Fig. 81—Roll pin installation

CAUTION: Support the shift rails when installing the roll pin to prevent bending the shift rails.

(14) Install the reverse idler gear shift lever.
(15) Apply loctite 271 or equivalent to bearing retainer bolt threads, approximately 5 mm, and tighten bolts to specified torque. Wipe excess sealant from bolts.
(16) Install the reverse idler gear and shaft and shift lever shoe to make sure the idler gear shaft is positioned in the direction illustrated, refer Fig. 82.

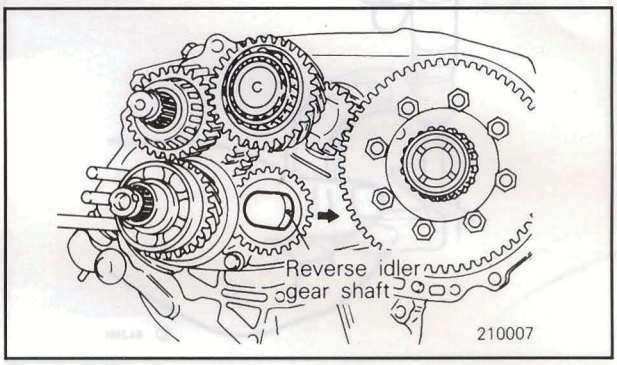


Fig. 82—Reverse idler shaft position

(17) Check the input shaft(F5M33), intermediate shaft output shaft and differential bearing end play/pre-load using the following method.
(a) Bend two 20 mm pieces in length and 1.6 mm in diameter of solder and place on the bottom of the outer circumference of the bearing cup recess of the input shaft (F5M33), differential case, intermediate shaft and the output shaft, refer Fig. 83.

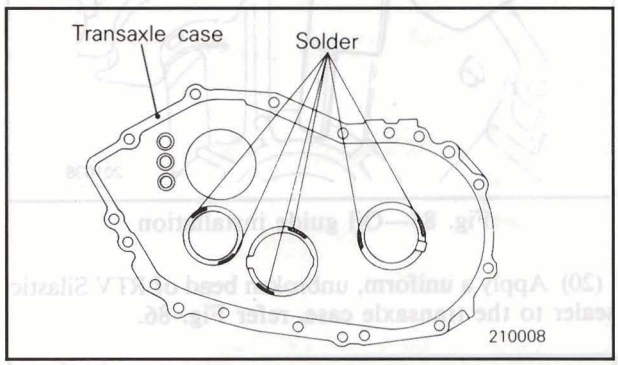


Fig. 83—Positioning solder pieces (F5M31) shown

(b) Install the bearing cups and push fit to hold the solder in place.

NOTE: Ensure that the solder is not crushed when initially installing the cups.

(c) Install the transaxle case without sealant and progressively tighten all bolts to the specified torque.
(d) Progressively loosen and remove bolts and remove the transaxle case.
(e) Remove all bearing cups, using a sliding hammer if necessary and remove the solder pieces taking careful note of their location.
(f) Measure the thickness of the crushed solder strips with a micrometer, refer Fig. 84.

NOTE: If the solder is not crushed, use solder of a larger diameter and repeat steps (a) to (f).

(g) Select the correct spacer to ensure the specified end play or pre-load, using the measured solder thickness as a guide.

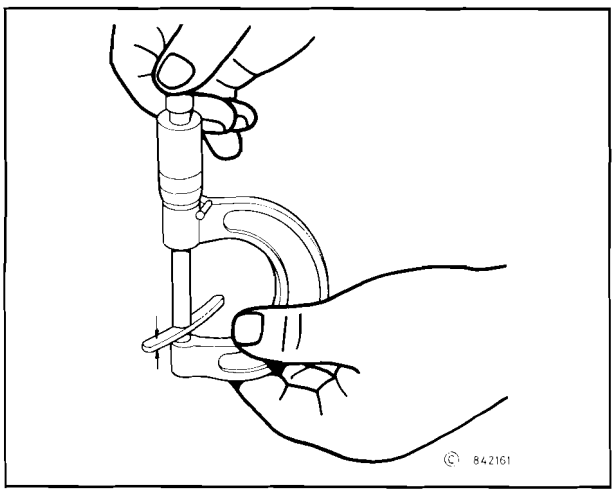


Fig. 84—Measuring solder strips

(18) Install the spacers and bearing cups into the transaxle case.
(19) Install the transaxle case oil guide, refer Fig. 85.

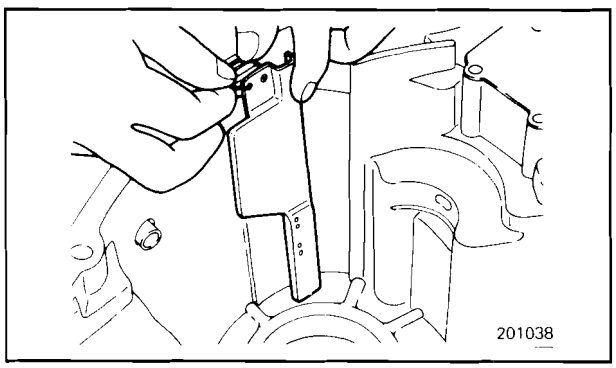


Fig. 85—Oil guide installation

(20) Apply a uniform, unbroken bead of RTV Silastic sealer to the transaxle case, refer Fig. 86.

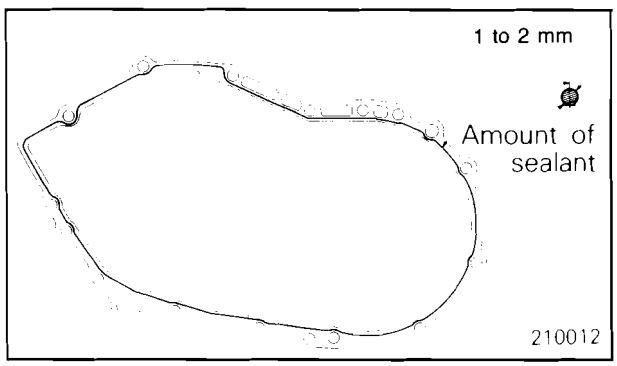


Fig. 86—Sealant application

(22) Install the transaxle case onto the clutch housing and tighten all bolts to specifications.
(23) Centre the reverse idler gear shaft with a Phillips screwdriver (shaft diameter 8 mm) or the like, refer Fig. 87.

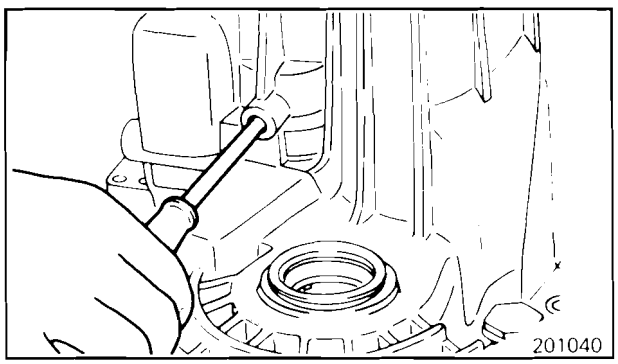


Fig. 87—Reverse idle gear shaft bolt installation

(24) Tighten the reverse idler gear shaft bolt to specified torque.
(25) Install detent balls and springs. Apply sealant to the detent plugs. Install plugs and tighten bolts to specified torque.
(26) Install the 5th speed shift fork and 5th speed synchronizer assembly at the same time.

NOTE: Ensure synchronizer hub, sleeve and key are in the right way round, refer Fig. 88.

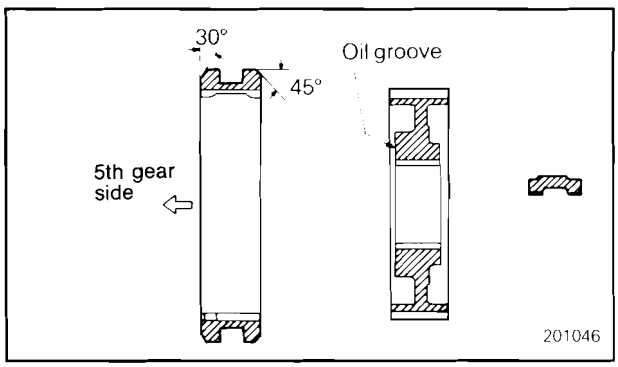


Fig. 88—5th speed synchronizer hub and sleeve

(27) Install 5th speed synchronizer hub and sleeve lock nut (at this stage only finger tight).
(28) Install 5th speed intermediate gear and lock nut (only finger tight).
(29) Install restrict ball assembly into transaxle case and tighten to specified torque.
(30) Shift transaxle into gear.
(31) Install special tool E21M26 onto input shaft, refer Fig. 89.

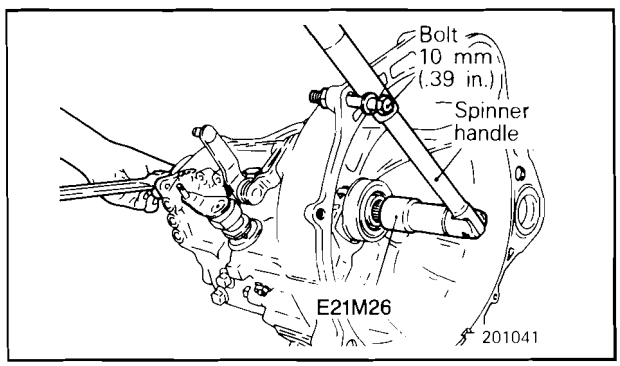


Fig. 89—Input shaft holding tool

(32) Tighten 5th speed synchronizer hub and sleeve lock nut and 5th speed intermediate gear lock nut to specified torque.
(33) Restake lock nuts.
(34) Using a suitable punch, install a new roll pin to the 5th speed shift fork, refer Fig. 90.

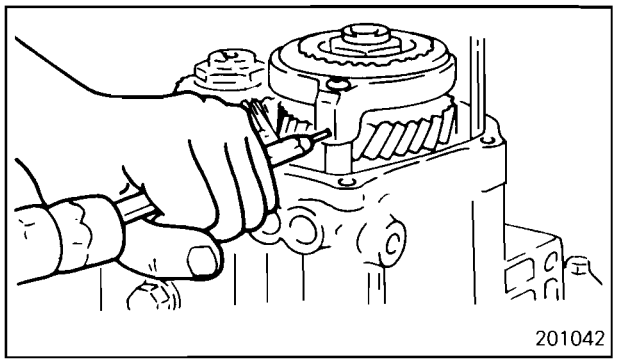


Fig. 90—Roll pin installation

NOTE: When installing roll pin, position roll pin slit with the centre line of the shift rail.

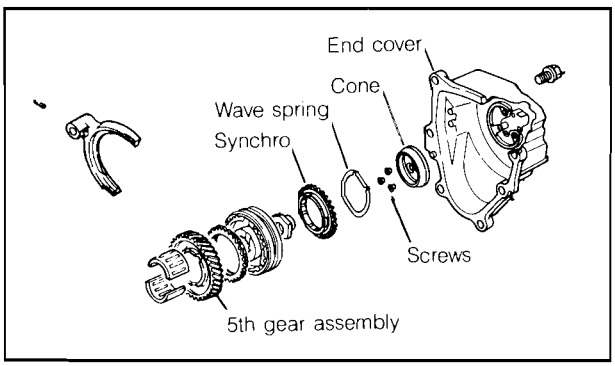


Fig. 91—Rear cover components

(35) Install the reverse synchronizer ring to the 5th speed synchronizer hub and sleeve.
(36) Install the reverse brake cone to the rear cover.
(37) Install the 3 countersunk attaching screws (coat whole thread of screw with loctite #648) and tighten to 2 to 3 Nm.
(38) Install the wave spring, be sure to align the two tangs of the wave spring into the gap on the rear cover.

(39) Apply a uniform, unbroken bead of RTV Silastic sealer to the transaxle case, refer Fig. 92.

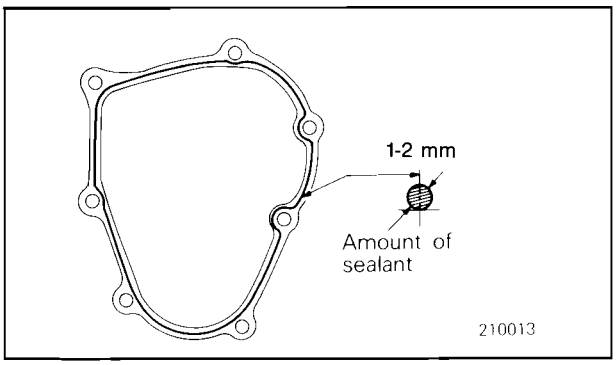


Fig. 92—Sealant application

(40) Install the rear cover to the transaxle case and tighten all bolts to the specified torque.
(41) Using special tool E21M14, install new drive shaft oil seals, refer Fig. 93.

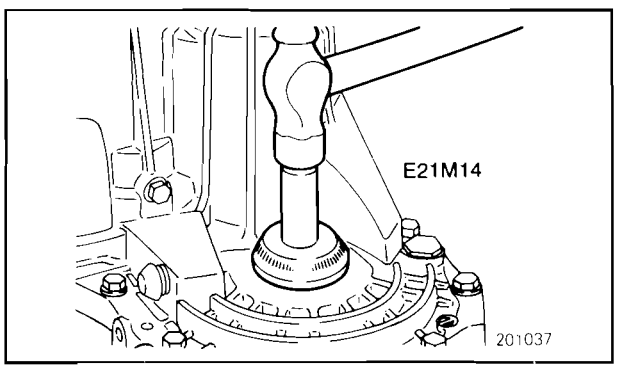


Fig. 93—Installing driveshaft oil seal

SECTION 2 — SERVICE DIAGNOSIS — GEAR SHIFT CONTROL

Condition	Possible Cause	Corrective Action
DIFFICULT GEAR SELECTION	Bent shift lever.	Replace faulty components.
	Control cables incorrectly adjusted.	Adjust control cables.
	Shift lever return spring worn.	Replace the spring.
SLIPS OUT OF GEAR OR EXCESSIVE LEVER FREE PLAY	Control cables incorrectly adjusted.	Adjust control cables.
	Worn gear shift assembly bushes.	Replace bushes as necessary.
	Shift lever bent.	Replace faulty components.
GEAR LEVER OPERATION STIFF	Lack of lubrication in gear shift assembly.	Lubricate as necessary.
	Lack of lubrication in control cable.	Replace cable.
NOISY GEAR SHIFT	Gear shift assembly bushes worn.	Replace bushes as necessary.
TRANSMISSION GEAR NOISE TRANSMITTED THROUGH GEAR LEVER	Gearshift control cables out of adjustment.	Adjust cables.

GENERAL INFORMATION

Gear selection on the F5M31 and F5M33 transaxles is by means of two cables controlled by a remote gear lever. The use of cables ensures a smooth gear change and also reduces the level of engine noise and vibration transmitted to the vehicle cabin.

One cable operates the select lever to engage the required shift rail while the other cable operates the shift lever to move the shift rail and engage the required gear.

The cables can be adjusted by means of turnbuckles located at the gear lever end of the cable.

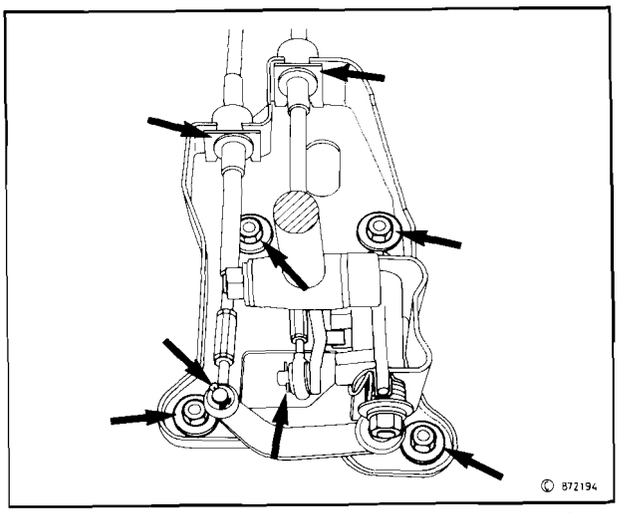


Fig. 2—Gear shift retaining bolts and clip positions

GEAR SHIFT ASSEMBLY

Removal

(1) Remove the gear shift knob.

(2) Remove the floor console, refer Group 52 — Interior.

(3) Disconnect the control cables from the gear shift assembly, refer Fig. 2.

(4) Remove the gear shift assembly retaining bolts, refer Fig. 2, and remove the gear shift assembly.

Installation

Install by reversing the removal procedure, noting the following:

(1) Ensure that the control cables do not twist.

(2) Install the control cables at the shift levers, refer Fig. 3.

(3) Ensure that the split pins are correctly secured and do not interfere with the gearshift operation.

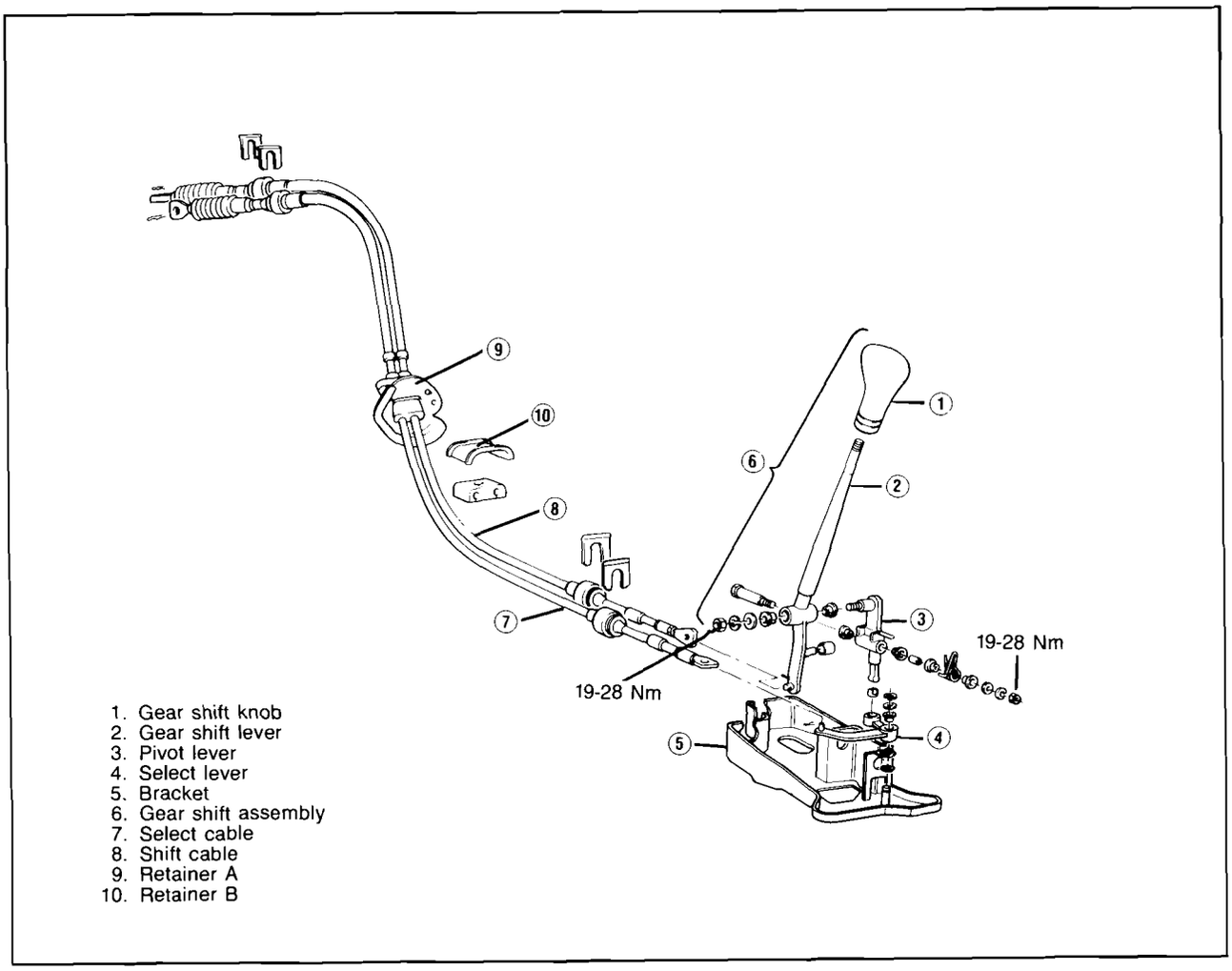


Fig. 1—Gear shift components

(4) Check that all gears engage correctly. If necessary adjust the cables at the turnbuckles.

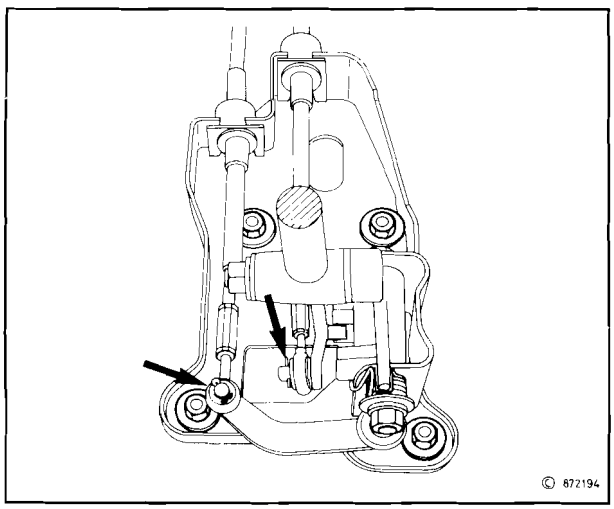


Fig. 3—Control cable location

Adjustment (Select cable)

(1) Place the transmission shift lever in neutral position, refer Fig. 4.

NOTE: Placing the transmission shift lever in the neutral position will also put the transmission select lever in the neutral position.

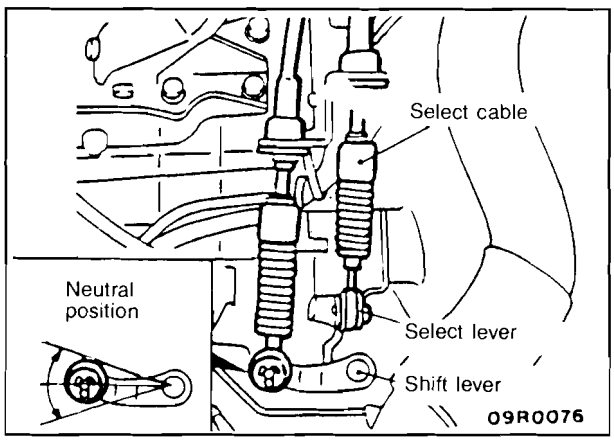


Fig. 4—Shift lever position

(2) Place the gear lever select lever in the neutral position, refer Fig. 5.

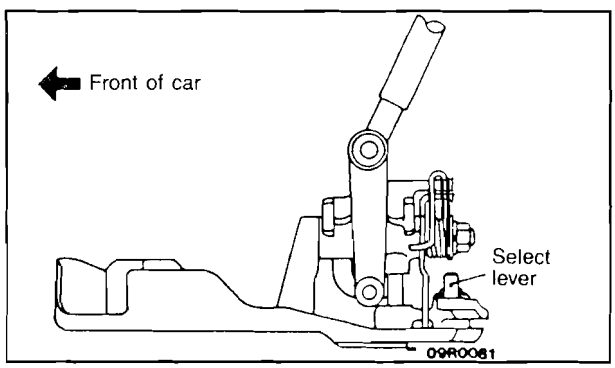


Fig. 5—Gear lever position

(3) Turn the turnbuckle until the select lever cable end comes to the proper position in relation to the select lever, refer Fig. 6.

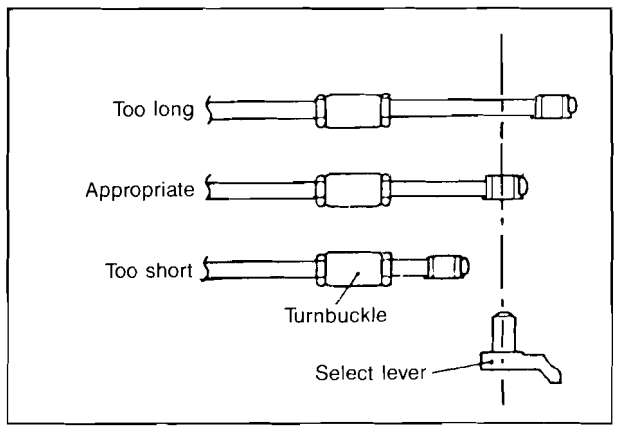


Fig. 6—Adjuster position

(4) Connect the select cable to the gear lever select lever.

Adjustment (Shift Cable)

(1) With the transmission select lever in the neutral position move the transmission shift lever to 4th gear.

NOTE: If the shift lever does not move freely, depress the clutch pedal when the lever is moved.

(2) Move the gear lever towards the 4th speed position until it touches the stopper, refer Fig. 7.

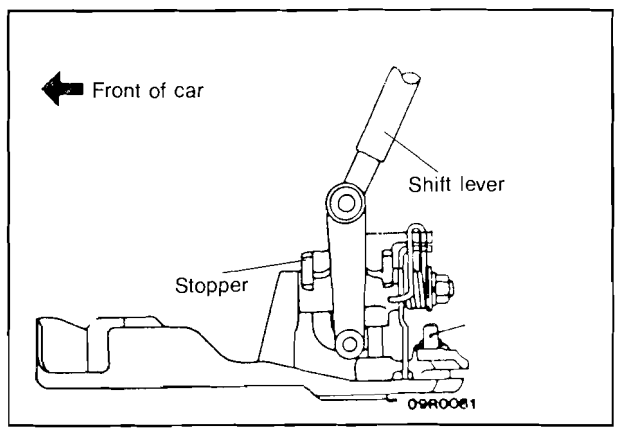


Fig. 7—Gear lever position

(3) Turn the turnbuckle until the shift cable can be connected to the shift lever, refer Fig. 8.

(4) Connect the shift cable to the shift lever.

(5) Use the turnbuckle to adjust shift cable length so that when the shift lever is shifted to the 3rd and 4th speed positions, the shift lever to stopper clearance (A) and (B) is equal ± 0.5 mm, refer Fig. 9.

(6) Move the shift lever to each position to make sure that it shifts freely.

(7) Tighten turnbuckle lock nuts.

NOTE: ENSURE CABLE ENDS ARE NOT TWISTED WHEN TURNBUCKLE LOCK NUTS ARE TIGHTENED.

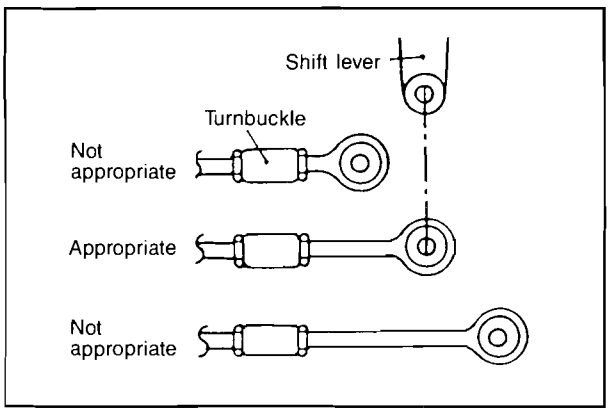


Fig. 8—Shift lever cable adjuster

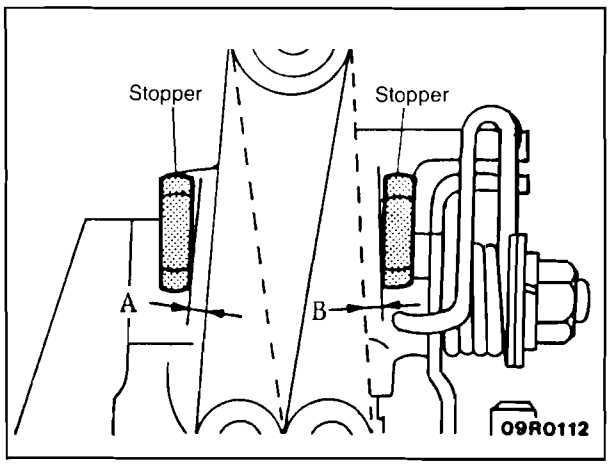


Fig. 9—Shift lever clearance

Disassembly

(1) Remove the shift lever retaining nut and remove the shift lever.
(2) Remove the pivot lever retaining nut.
(3) Remove the return spring.
(4) Remove the pivot lever bolt.
(5) Remove the pivot lever.
(6) Remove the select lever pivot circlip.
(7) Remove the select lever, refer Fig. 11.

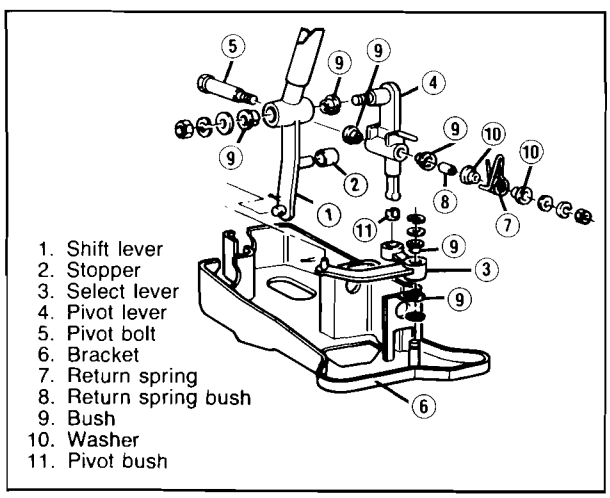


Fig. 10—Gear lever components

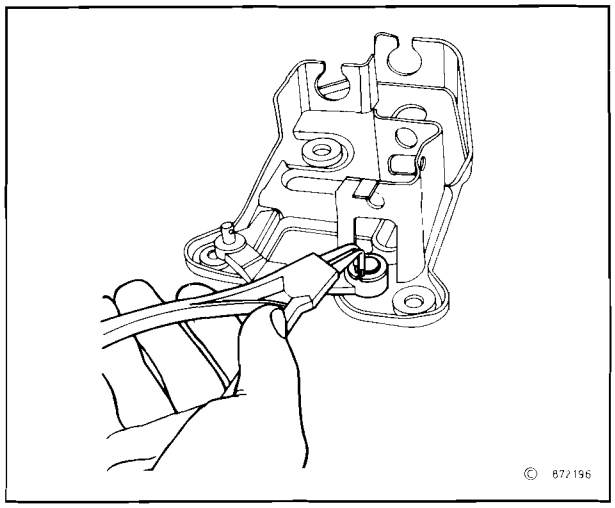


Fig. 11—Select lever removal

Assembly

Assemble by reversing disassembly procedure after apply multi-purpose grease (NLGI No. 3) to the points shown in Fig. 12.

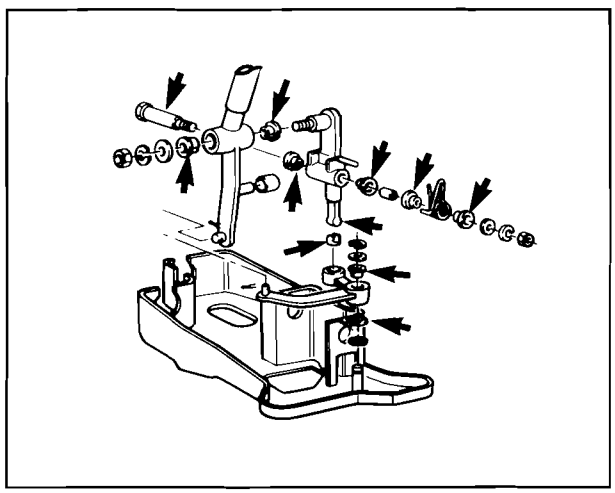


Fig. 12—Gear lever lubrication points

SHIFT CONTROL CABLES

(1) Remove the gear shift knob.
(2) Remove the floor console, refer Group 52—Interior.
(3) Disconnect the cables from the gear shift assembly.
(4) Remove the right hand cowl side trim and scuff plate and lift the carpet sufficiently to gain access to the cable clamp bolts shown in Fig. 13, and remove the clamp bolts.
(5) Disconnect the cables at the transaxle, refer Fig. 14.

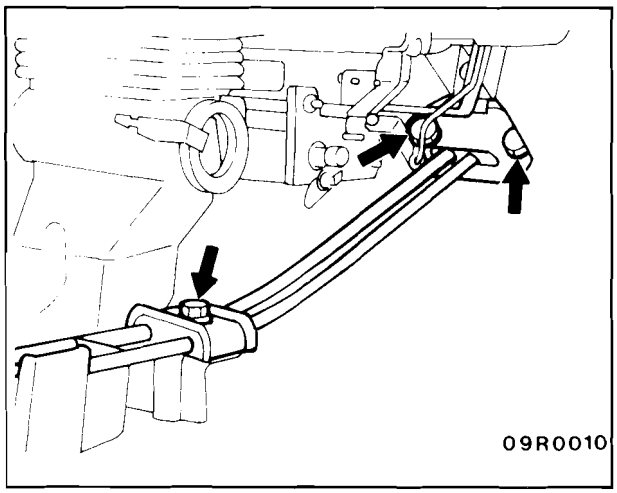


Fig. 13—Control cable clamp bolts

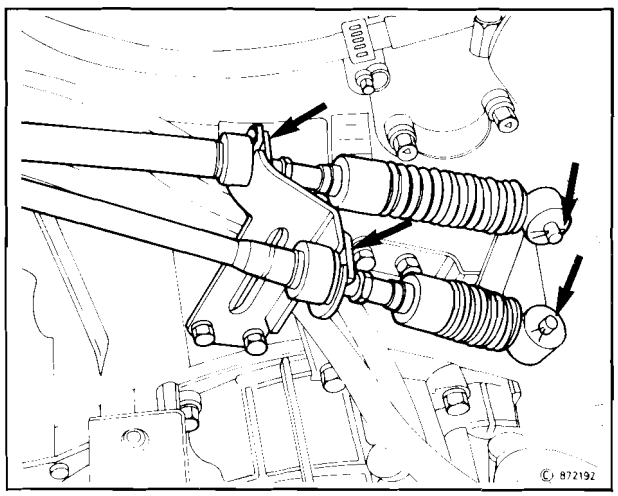


Fig. 14—Disconnecting cables at transaxle

(6) Remove the cables by pulling them into the interior of the vehicle.

Installation

Install by reversing the removal procedure, noting the following:
(1) Connect and clamp cables in the order shown in Fig. 15.

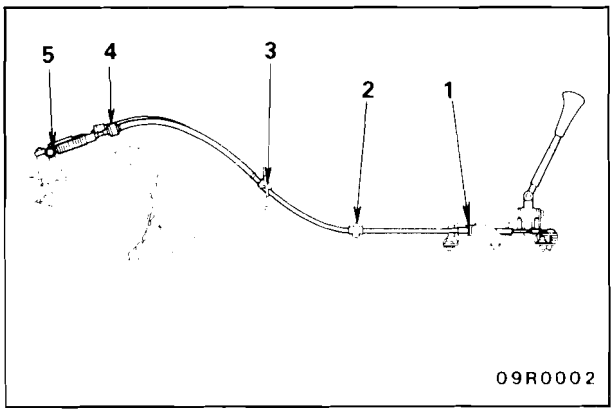


Fig. 15—Control cable installation

(2) Install control cables at the shift levers, refer Fig. 16.
(3) Ensure cables do not become twisted on installation.
(4) Ensure that the split pins are secure and do not interfere with gearshift operation.
(5) Check that all gears engage correctly. If necessary adjust the cables at the turnbuckles.

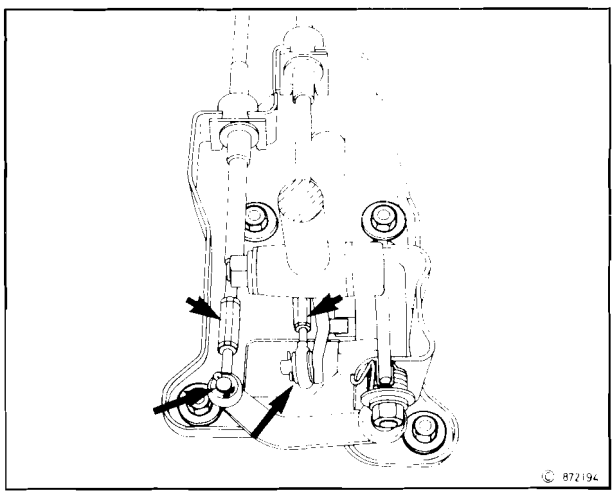


Fig. 16—Control cable location

GROUP 23 — AUTOMATIC TRANSMISSION

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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

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SECTION 1 — AUTOMATIC TRANSAXLE

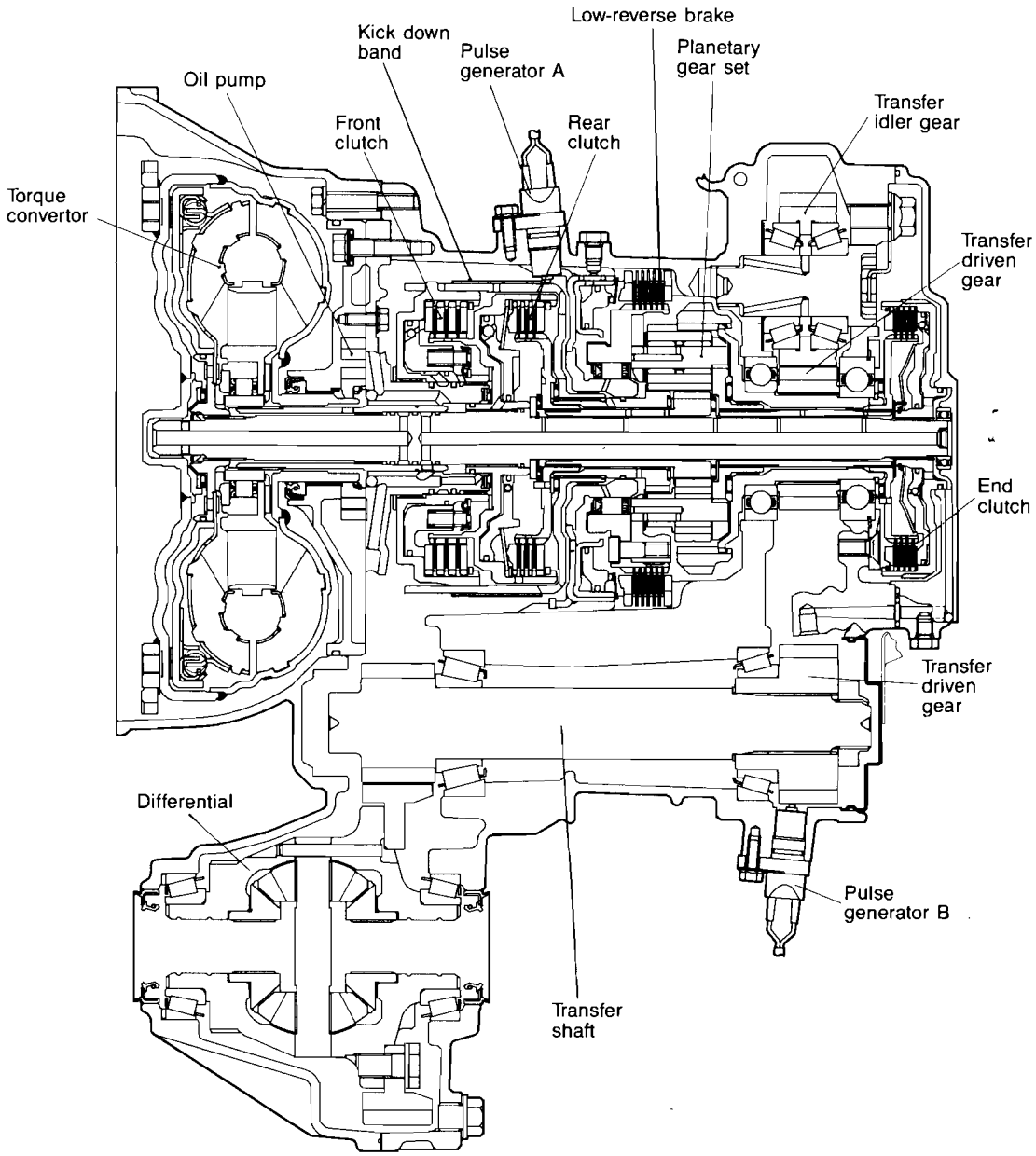


Fig. 1—Transaxle cross-sectional view—model F4A23

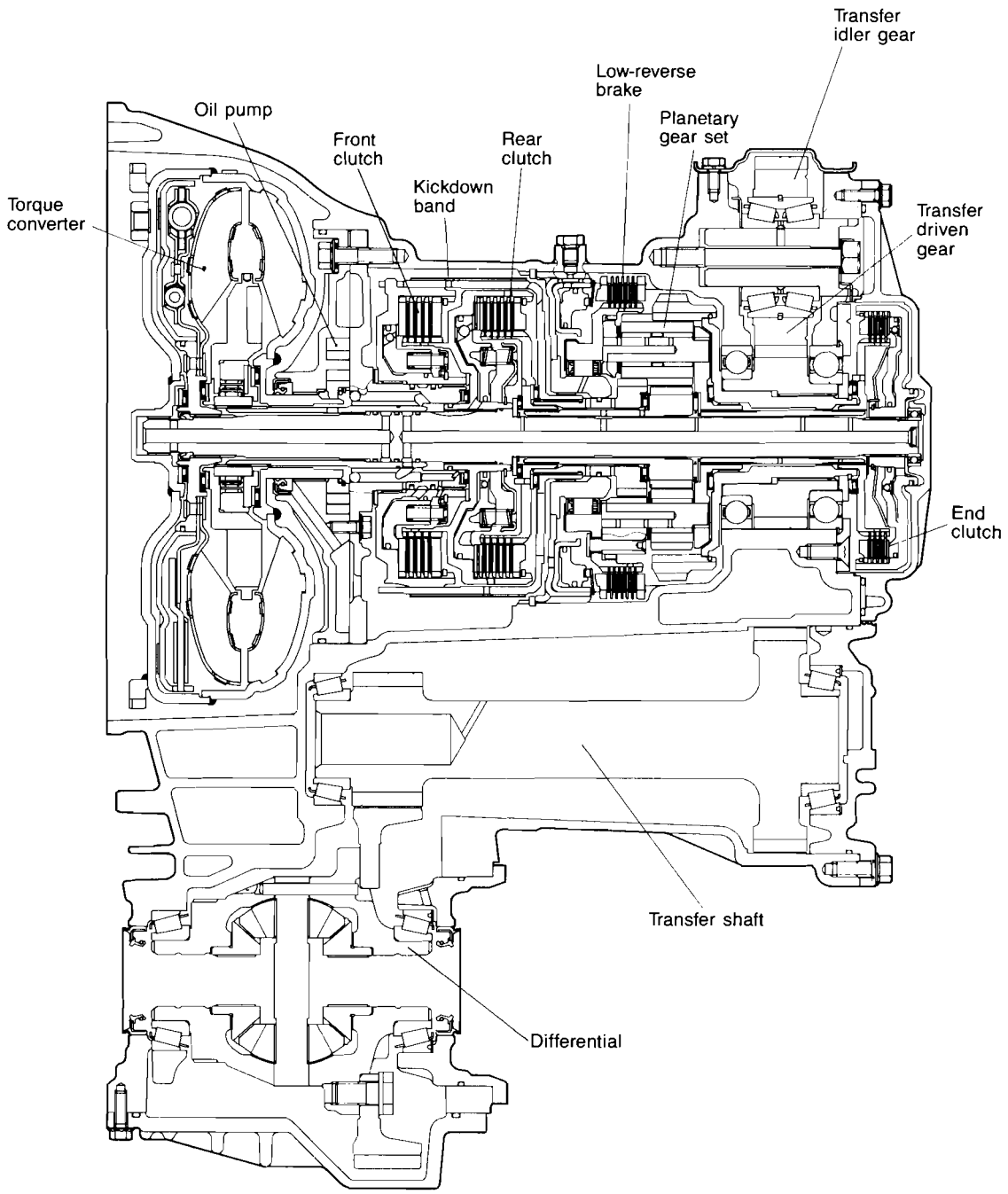


Fig. 2—Transaxle cross-sectional view—model F4A33

GENERAL INFORMATION

The F4A series transaxles are four speed overdrive automatics which feature electronic shift control and a lock up clutch type torque converter and a two-mode shift pattern (i.e. Power & Economy).

The transaxle control unit (TCU), controls gearshift points, hydraulic pressure during gearshifting and damper clutch operation.

In addition the control unit features a self-diagnosis function, which enables quick and accurate fault diagnosis to be carried out, and a "fail safe" mode, which in the event of a failure in ancillary electronic components allows the vehicle to be driven until a repair can be carried out.

NOTE: It is recommended that prior to performing repair work or fault diagnosis that mechanics familiarize themselves with the operation of the transaxle, the various electronic components and sensors and their functions and the recommended diagnosis and repair procedures.

TORQUE CONVERTER

Torque Converter Components (refer Fig. 3)

- Impeller: driven by the engine drive plate via the torque converter housing.
- Turbine: splined to and drives the transaxle input shaft.
- Stator: mounted in the transaxle housing on a one way clutch.
- Lock up clutch: located between the turbine and the converter housing. It is attached to the turbine by a lock ring pawl.

Operation

There are two basic modes of operation depending on operating conditions.

Lock up Clutch Released

With the vehicle stationary the turbine is stationary and the impeller is turning at engine speed. As engine speed increases oil is thrown out by centrifugal force and directed onto the turbine vanes by the impeller vanes. The turbine rotates, drives the transaxle and directs oil flow onto the stator vanes. The force of the oil causes the one way clutch to lock and prevent the stator from rotating in the opposite direction to engine rotation. This results in oil flow being redirected onto the impeller vanes which assists the impeller and provides torque multiplication.

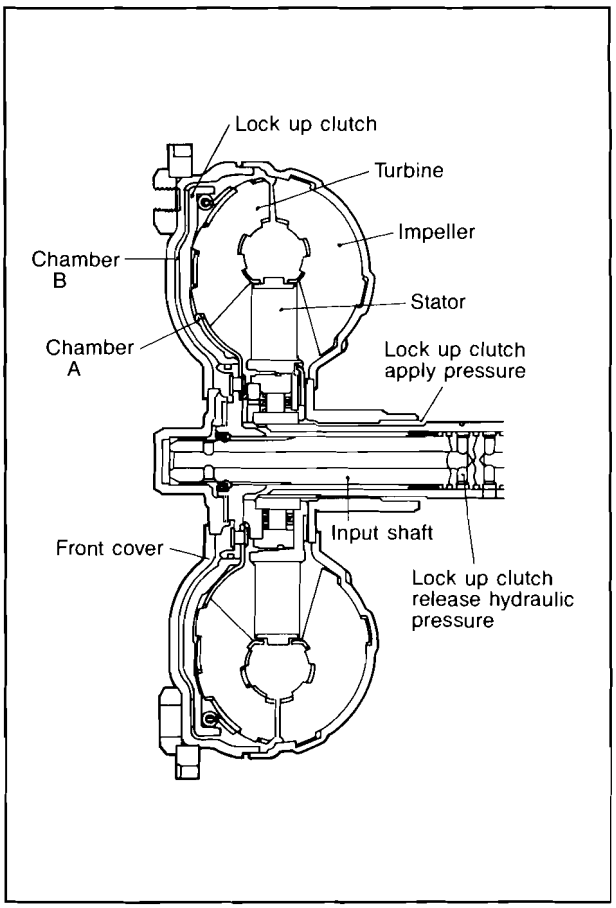


Fig. 3—Torque converter

As impeller and turbine speeds equalize, oil flow is reduced, the one way clutch is released and the impeller, the turbine and the stator, rotate as a unit to form a fluid coupling.

Lock Up Clutch Applied

When the lock up clutch is applied, the turbine is connected to the converter housing by a clutch plate, providing drive directly through the turbine with a minimal amount of slippage which is regulated by the control unit.

The lock up clutch will not operate if any of the following conditions apply:

(1) A.T.F. temperature below 50°C.
(2) In first and reverse gears.
(3) Turbine speed below 1800 r.p.m.
(4) Throttle opening greater than 60% with turbine speed below 4500 r.p.m. (ECI-Multi).
(5) Throttle opening greater than 70% with turbine speed below 2300 r.p.m. (carby).
(6) On deceleration with the throttle closed.
(7) On downshift.

LOCK UP CLUTCH OPERATION

Lock up clutch application is controlled by the transaxle control unit, by means of a solenoid valve located on the valve body, in conjunction with two hydraulic spool valves.

Lock Up Clutch Applied (refer Fig. 4)

With the solenoid switched on, oil pressure from the reducing valve is released through the solenoid valve and pressure on the left of the Lock up Clutch Control Valve (LUCCSU) drops. The LUCCSU moves to the left and line pressure is regulated and directed to chamber A in the torque converter to apply the damper clutch, while chamber B is vented to exhaust, refer Fig. 2.

Lock Up Clutch Released (refer Fig. 5)

With the solenoid switched off, oil pressure from the reducing valve can no longer vent through the solenoid valve and pressure on the left of the LUCCV increases and moves the LUCCV to the right. Line pressure is then directed to chamber B in the torque converter to release the damper clutch and chamber A is vented to exhaust.

The reducing valve stabilizes the pressure on the left of the LUCCV at a pre-determined value.

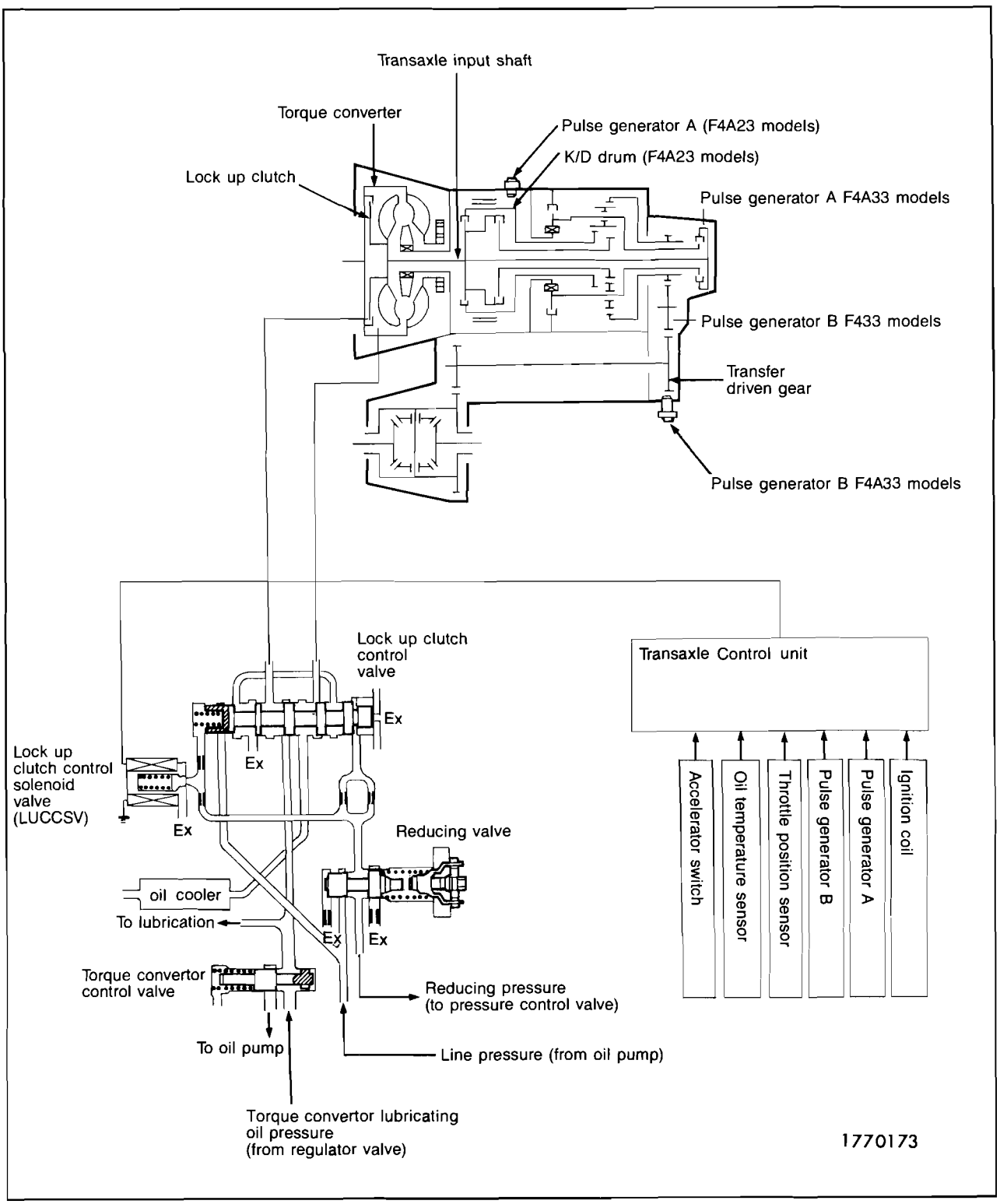


Fig. 4—Lock up clutch control system

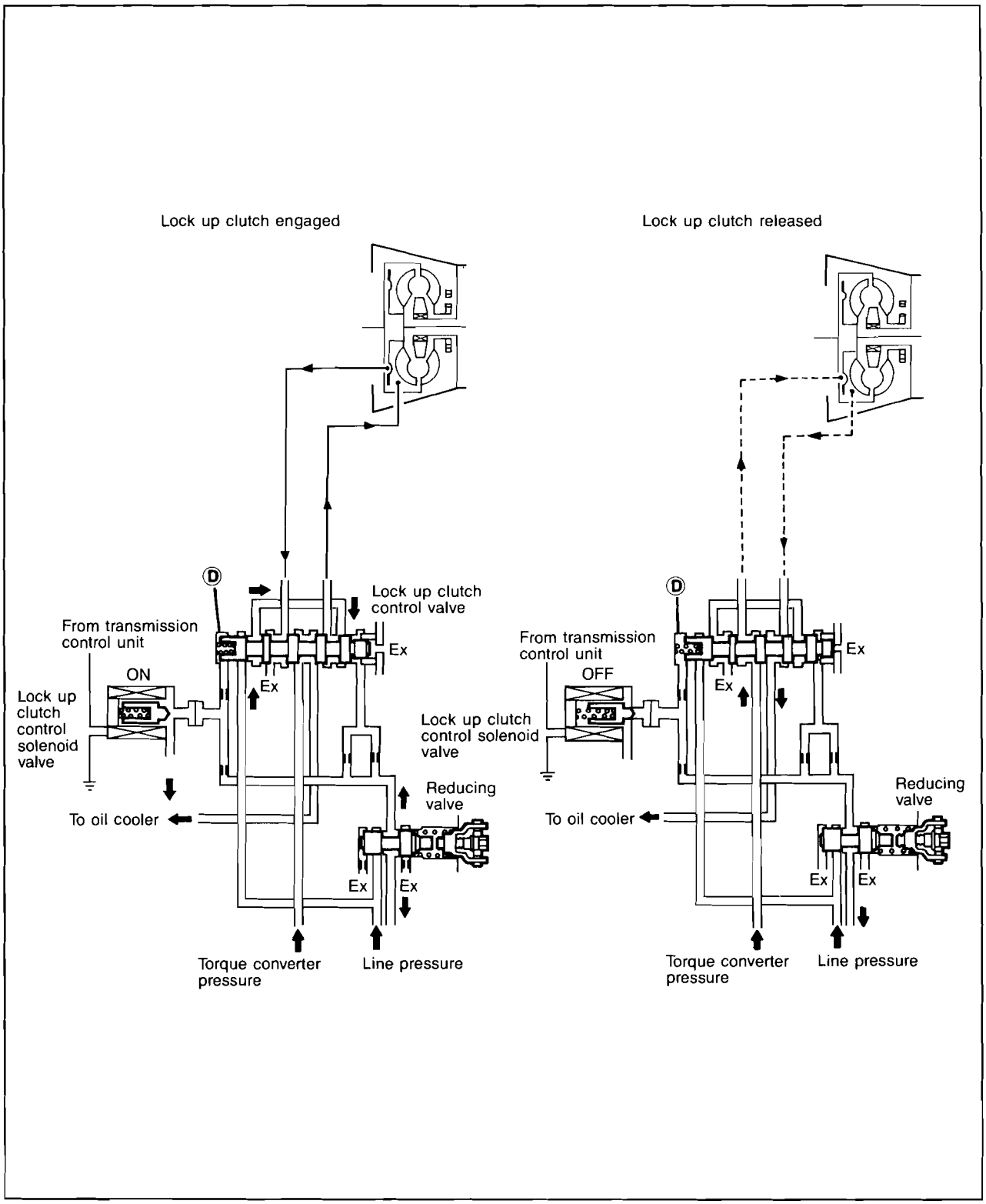


Fig. 5—Lock up clutch control circuits

TRANSAXLE GEAR TRAIN

Gear train components and functions are as follows:

- Three multi plate clutches — used as driving members.
- One band — used as a holding member.
- One multi plate clutch — used as a holding member.
- A one way clutch — used as a holding member.
- A Ravigneaux type planetary gear set.

Front Clutch (refer Fig. 7)

The front clutch is engaged in third and reverse gear and connects the transaxle input shaft to the reverse sun gear.

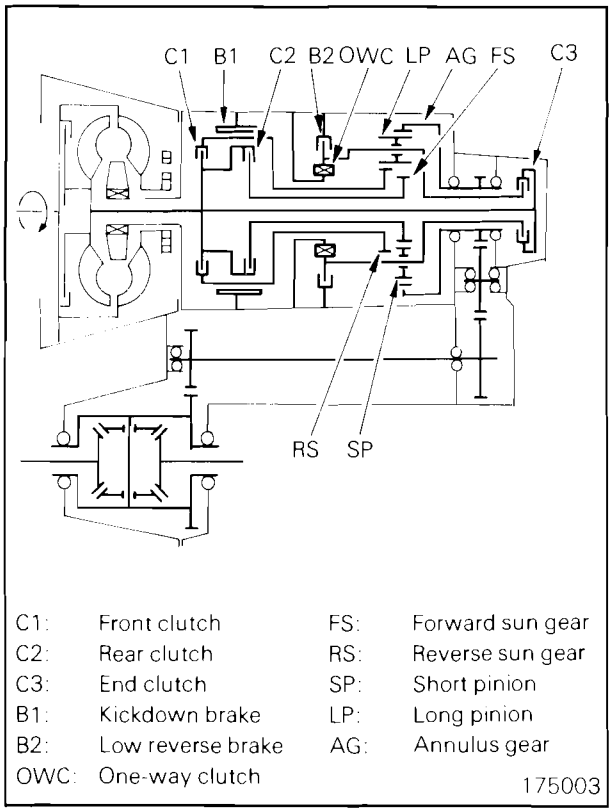


Fig. 6—Gear train components

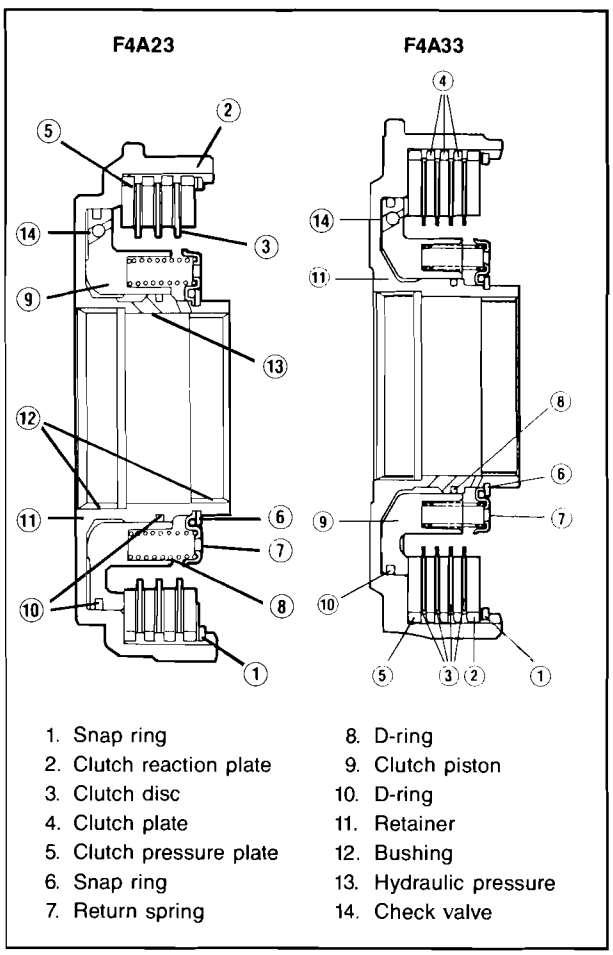


Fig. 7—Front clutch

Rear Clutch (refer Fig. 8)

The rear clutch is engaged in first, second and third gears and connects the input shaft to the forward sun gear.

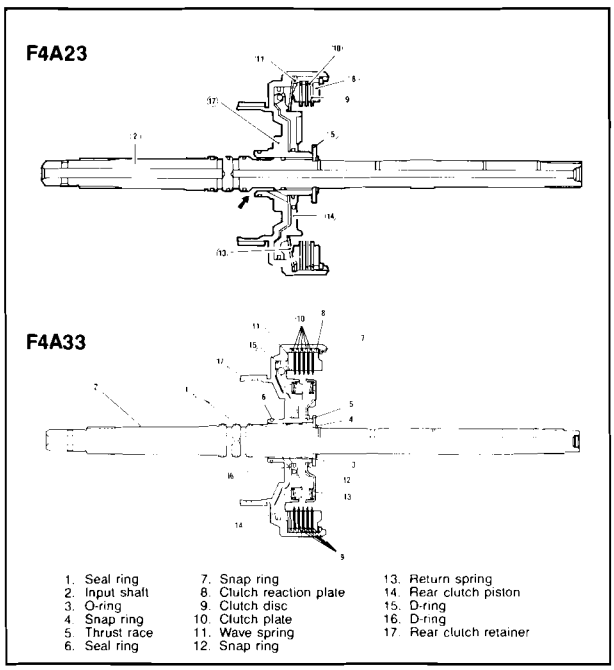


Fig. 8—Rear clutch

End Clutch (refer Fig. 9)

The end clutch is engaged in third and fourth gears and connects the input shaft to the planet pinion carrier.

It is not required for drive in third gear, but is engaged in readiness for the shift to fourth gear.

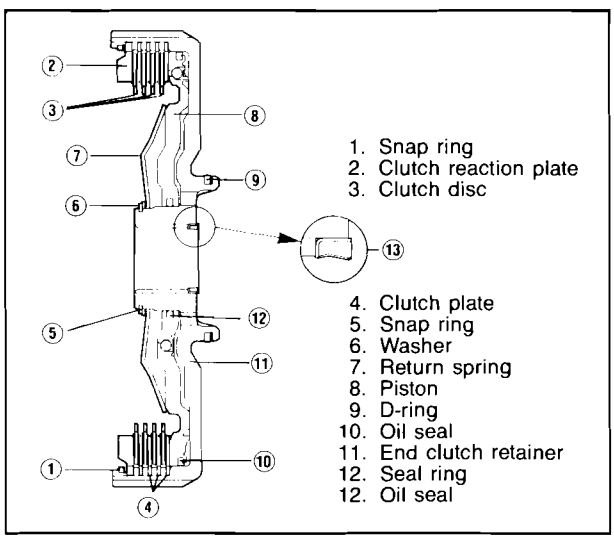


Fig. 9—End clutch

Kickdown Band/Brake (refer Fig. 10)

The kickdown band is applied in second and fourth gears. When applied it holds the kickdown drum which is attached to the reverse sun gear thus stopping it from rotating.

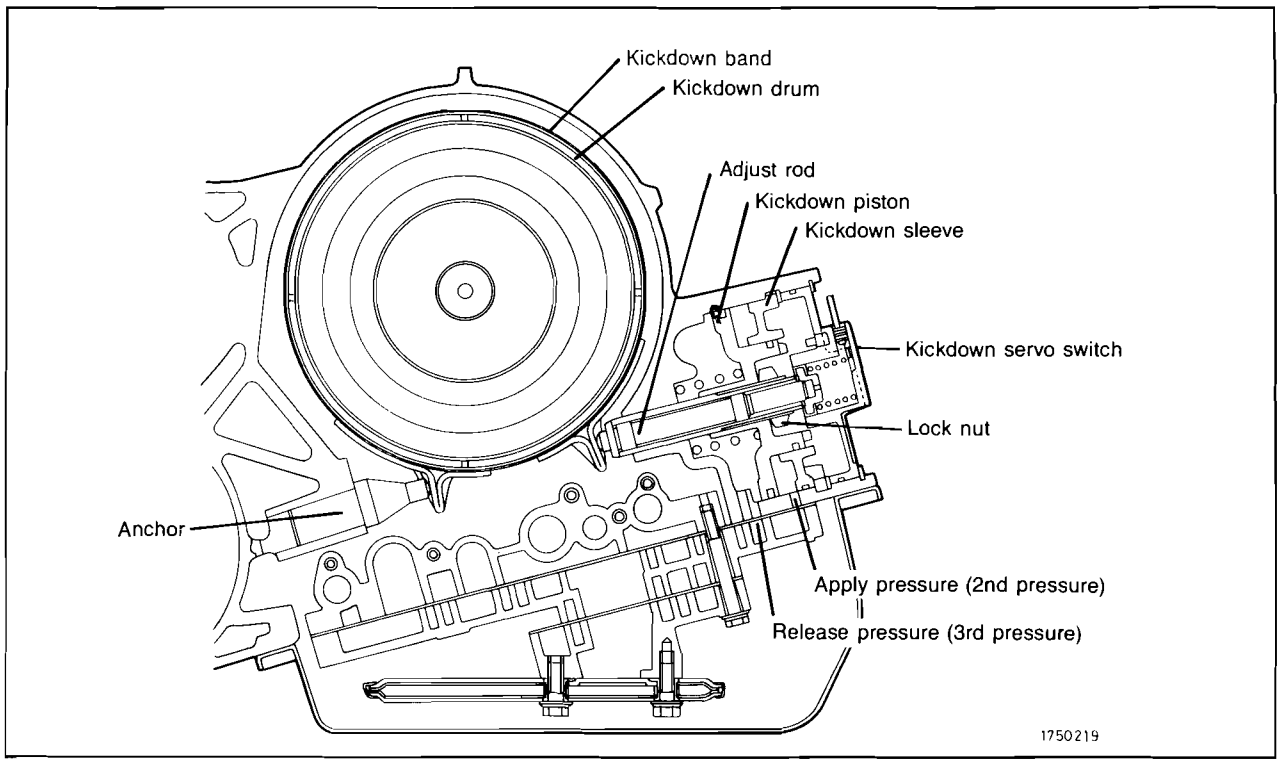


Fig. 10—Kickdown band

Low-Reverse Brake (refer Fig. 11)

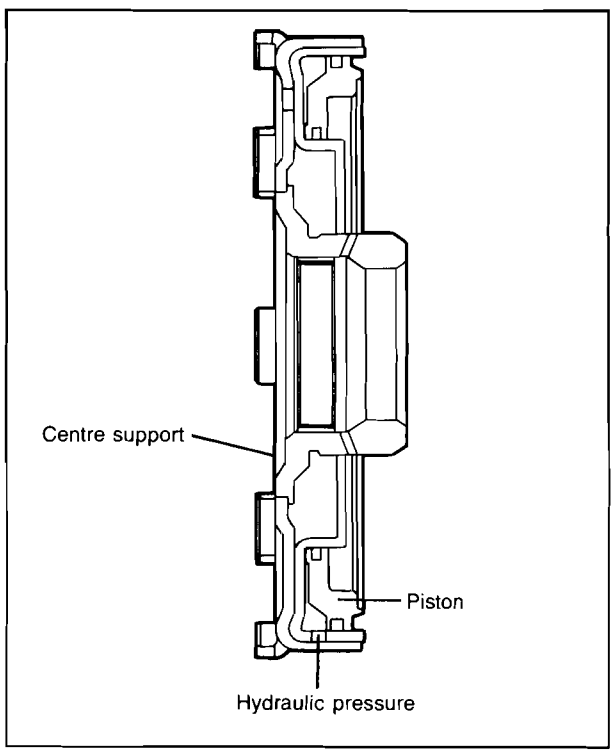


Fig. 11—Low-reverse brake

The low-reverse brake is a multi plate clutch type. It is attached to the transaxle case and connected to the planet pinion carrier of the gear set. When applied in manual low and reverse gear it prevents the planet pinion carrier rotating.

One-Way Clutch (refer Fig. 12)

The one way clutch is a sprag type connecting the planet pinion carrier to the transaxle case via the centre support. The outer race can only rotate clockwise, thus the planet pinion carrier can only rotate clockwise. The one-way clutch is used as a holding member when the transaxle is in first gear drive range, but not in manual low.

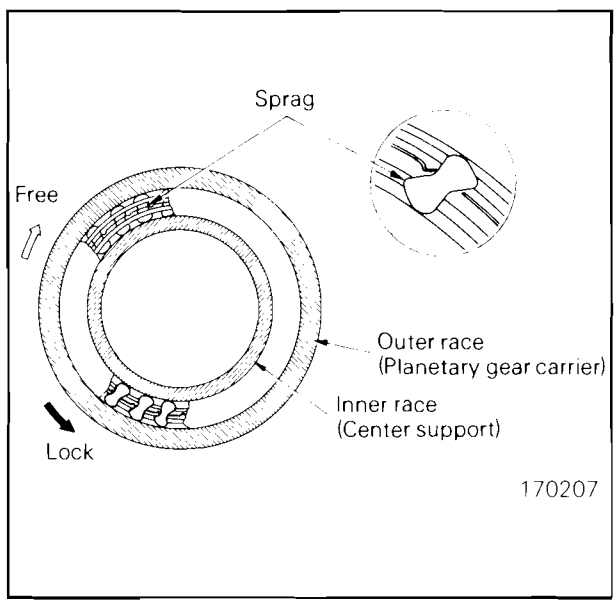


Fig. 12—One-way clutch

Planetary Gear Set (refer Fig. 13)

The planetary gear set is a Ravigneaux type consisting of:

- Forward sun gear (small)
- Reverse sun gear (large)
- Short pinions
- Long pinions
- Annulus gear (incorporating parking sprag)
- Planet pinion carrier

The reverse sun gear is connected to the front clutch via the kickdown drum, thus it can be driven by the clutch or held by the kickdown band.

The forward sun gear is connected to the rear clutch, thus it can only be driven by the clutch.

The planet pinion carrier houses both the long and short pinions, it is connected to the one-way clutch, the low-reverse brake and the end clutch. It can be held by either the one-way clutch or low-reverse brake or driven by the end clutch.

The annulus gear is the output member of the gear set and is driven by the long pinions. The parking sprag is incorporated on its outer circumference.

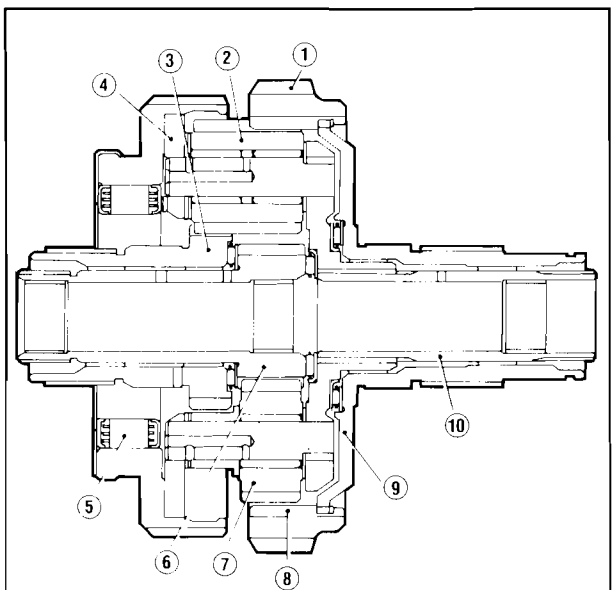


Fig. 13—Planetary gear set

Parking Mechanism (refer Fig. 14)

The parking mechanism consists of a pawl which pivots in the transaxle case and engages in the sprag incorporated on the outer circumference of the annulus gear.

As the gear lever is moved to the park position, the parking sprag rod is moved by the detent plate. The cam on the rod moves between the support and the parking pawl and pushes the pawl into the sprag on the annulus gear, locking the annulus to the transaxle case.

If the annulus is in a position where the pawl is located on the top of a sprag tooth, the cam spring will compress, thus allowing the gear lever to be moved to the park position. When the vehicle moves, the sprag will rotate and the spring will push the cam and the pawl to engage.

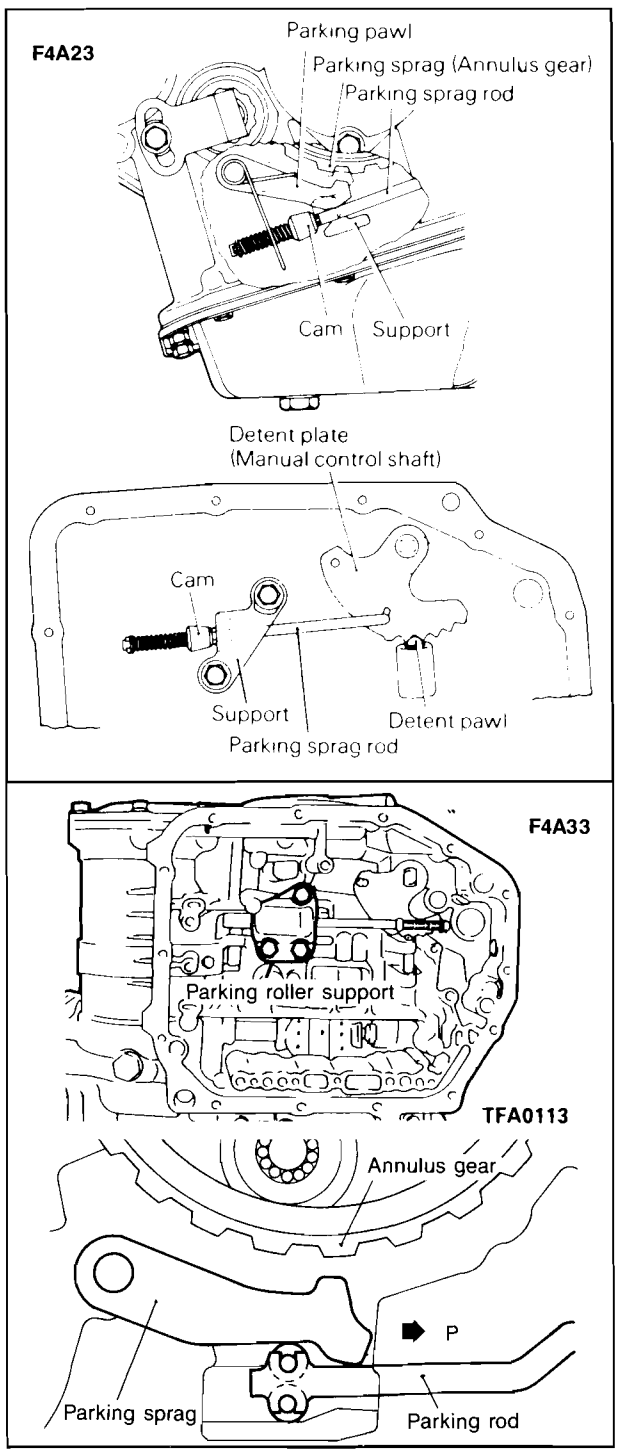


Fig. 14—Parking mechanism

TRANSAXLE POWER FLOW

Element in Use at Each Position of Selector Lever											
						Clutches				Brakes	
Selector lever position	O/D switch	Gear position	Gear ratio	Engine start	Parking mechanism	Front C1	Rear C2	End C3	OWC	K/down B1	Low rev. B2
P	—	Neutral	—	O	O						
R	—	Reverse	2.176			O					O
N	—	Neutral	—	O							
D	On	First	2.551				O		O		
		Second	1.488				O			O	
		Third	1.000			O	O	O			
		OD	0.685					O		O	
D	OFF	First	2.551				O		O		
		Second	1.488				O			O	
		Third	1.000			O	O	O			
2	—	First	2.551				O		O		
		Second	1.488				O			O	
L	—	First	2.551				O				O

Fig. 15—Transaxle power flow chart

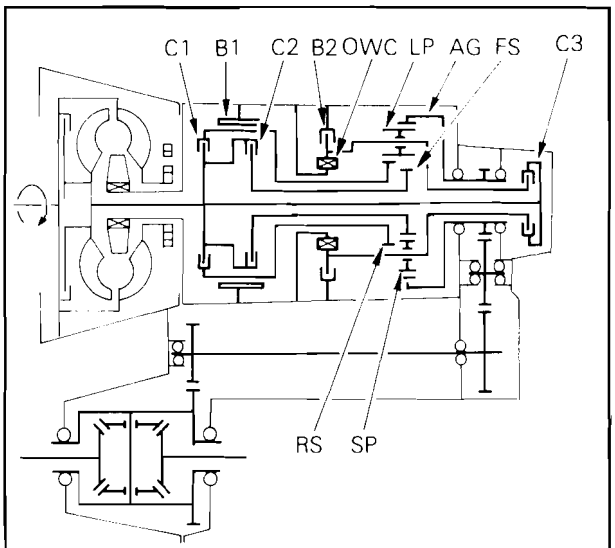


Fig. 16—Gear train components

First Gear (D selected)

The rear clutch is applied and driving force is transmitted to the forward sun gear which rotates clockwise. The short pinions rotate anti-clockwise and drive the long pinions clockwise. The long pinions react on the annulus gear to try and rotate it anti-clockwise, however the one-way clutch locks and prevents this causing the long pinions to drive the annulus clockwise providing a ratio of 2.551:1. Engine braking is not available.

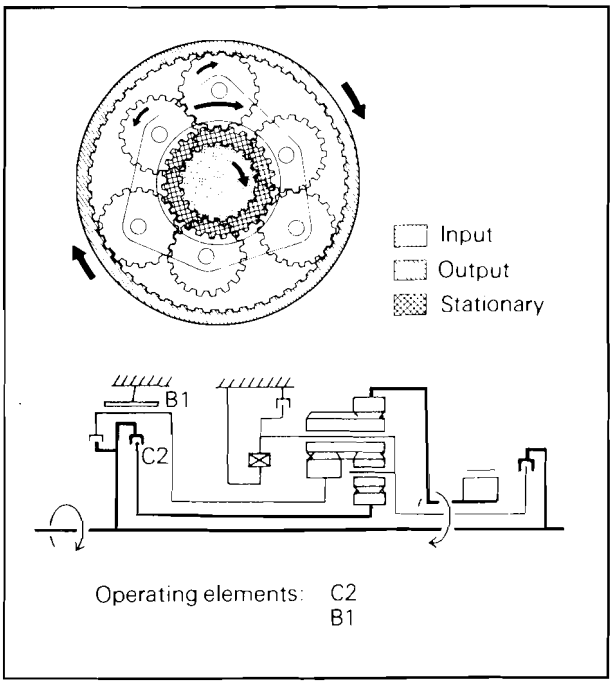


Fig. 17—First gear

First Gear (Manual low)

Gear train operation is identical to first gear (D selected) except that the low-reverse brake is applied and holds the planet pinion carrier stationary which permits engine braking.

Second Gear

The rear clutch is still applied, connecting the converter to the forward sun gear, the kickdown band is applied holding the kickdown drum stationary, thus holding the reverse sun gear stationary.

Power enters through the forward sun gear causing the long pinions to rotate clockwise, thus rotating the planet pinion carrier in the same direction at a reduced speed, providing a ratio of 1.488:1.

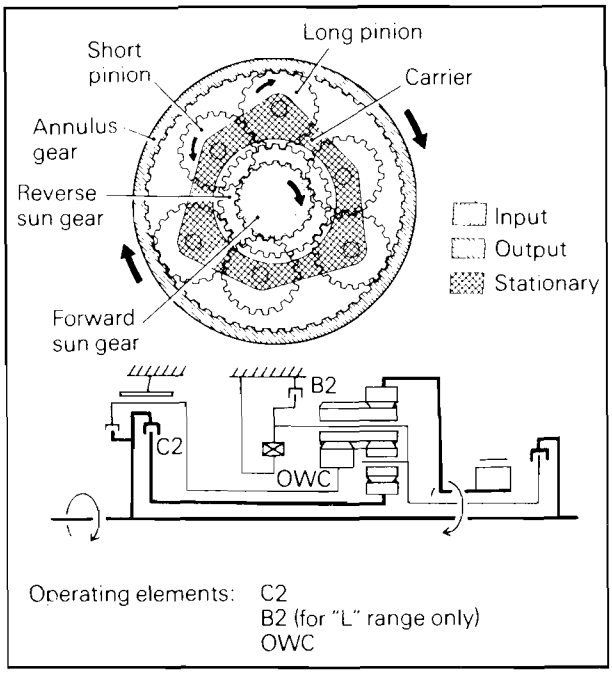


Fig. 18—Second gear

Third Gear

The rear clutch is still applied connecting the converter to the forward sun gear, the front clutch is applied connecting the converter to the reverse sun gear.

Power enters through the forward and reverse sun gears, the gear set is locked together and rotates as one unit providing a ratio of 1:1.

The end clutch is applied in readiness for the shift to fourth gear.

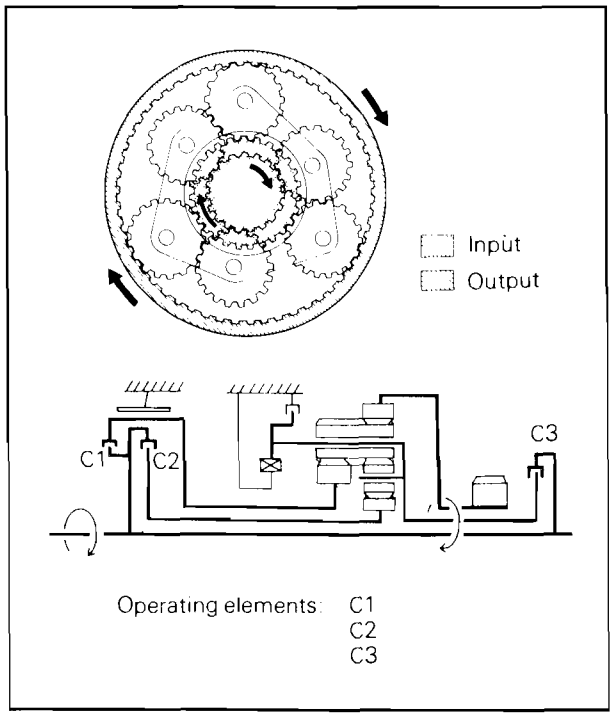


Fig. 19—Third gear

Fourth Gear

The end clutch is applied and the kickdown band is applied holding the reverse sun gear.

The clutch drives the planet pinion carrier clockwise, causing the long pinions to "walk" clockwise around the stationary reverse sun gear. The long pinions, therefore drive the annulus gear clockwise providing a ratio of 0.685:1.

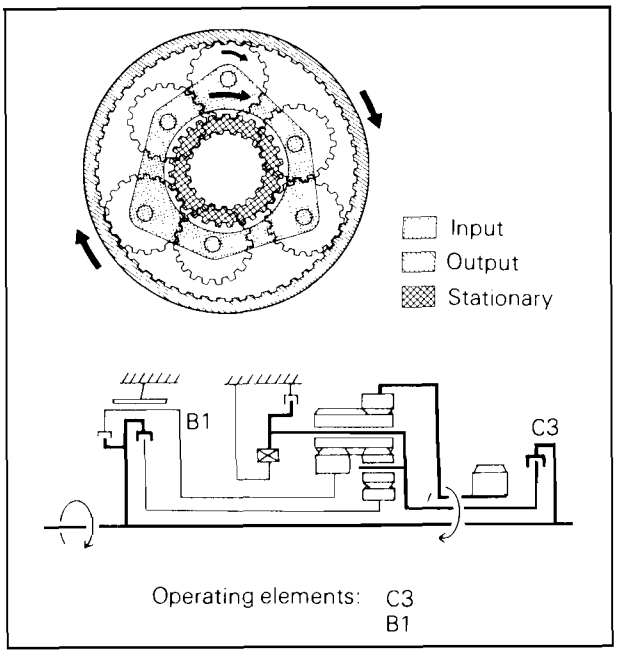


Fig. 20—Fourth gear

Reverse Gear

The front clutch is applied, connecting the converter to the reverse sun gear. The low-reverse brake clutch is applied holding the planet pinion carrier stationary. Power enters through the reverse sun gear. The long pinions cause the annulus gear to rotate in the opposite direction to the sun gear. The forward sun gear and short pinions idle. The gear train provides a reduction in the reverse direction, providing a ratio of 2.176:1.

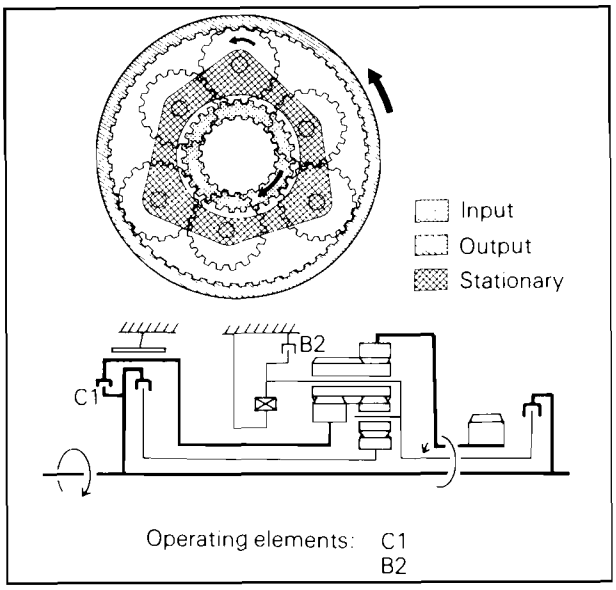


Fig. 21—Reverse gear

GEAR LEVER POSITION CHARACTERISTICS

Position selected	
P — Park	• Transaxle locked, vehicle held. Engine can be started.
R — Reverse	• Vehicle moves in reverse direction only.
N — Neutral	• Drive not transmitted. Engine can be started.
D — Drive	• Vehicle moves forward. Shifts are performed automatically between forward four gears (if overdrive is engaged). • Shift speed is determined by control unit. • Lock Up clutch can be actuated. • Engine braking is not available.
2 — Second	• Vehicle moves forward. Shifts are performed automatically between 1 - 2 and 2 - 1. • If 2 is selected from D, a downshift will only occur when vehicle is travelling below a pre-determined speed. • Lock Up clutch can be actuated. • Engine braking is not available.
L — Manual low	• Vehicle moves forward. • If L is selected from 2 or D, a downshift will only occur when vehicle is travelling below a pre-determined speed. • Engine braking is available.

NOTE: Regardless of selected forward gear position, 2nd gear will be engaged with the vehicle stationary at idle.

TRANSAXLE ELECTRONIC CONTROL

CONTROL UNIT

The control unit is located inside the vehicle on the centre tunnel behind the front floor console.

The unit receives signals from various sensors which monitor engine, transaxle and vehicle operating conditions and in response to these signals, operates solenoid valves located on the transaxle valve body to control gear shift points and hydraulic pressure during gear shifting, and lock up clutch operation.

The control unit is also provided with a "Fail-safe" system and a self-diagnosis system to assist in fault finding should a malfunction occur.

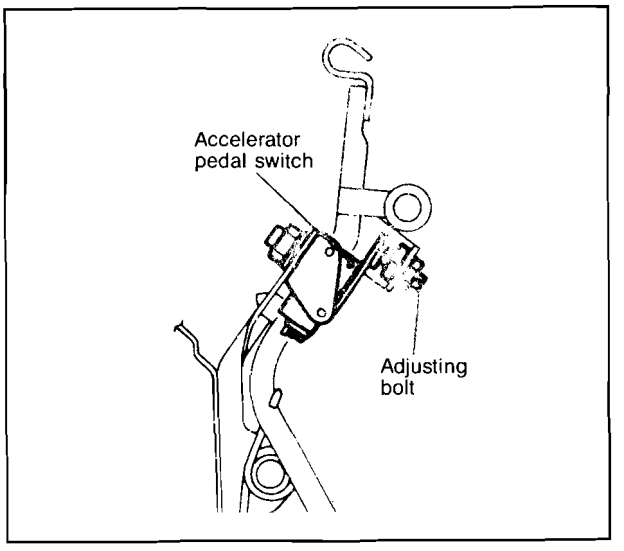


Fig. 22—Accelerator pedal switch

Throttle Position Sensor (T.P.S.)

The throttle position sensor is mounted on the carburettor or throttle body (ECI-Multi). It is a variable resistor and is operated by the throttle valve shaft.

It supplies the control unit with throttle opening input.

For service and adjustment, refer Group 23, section 3.

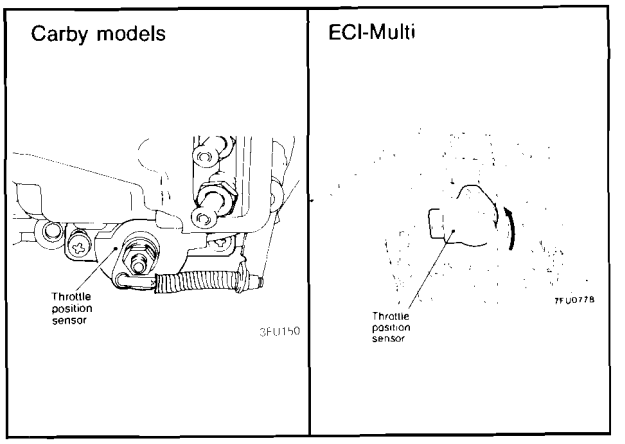


Fig. 23—Throttle position sensor

Accelerator Switch

The accelerator switch is an on/off switch mounted on the accelerator pedal bracket.

Its purpose is to signal the control unit what position the pedal is in, i.e. released or depressed.

The information signals the control unit to engage second gear with the vehicle stationary at idle, thus reducing idle vibrations and vehicle creep.

Oil Temperature Sensor

The oil temperature sensor installed in the valve body, senses the temperature of the automatic transmission fluid (ATF).

The sensor is a thermistor and translates variations in temperature to variations in resistance and provides that information to the control unit.

This information is used in determining the lock up clutch operating range, selecting the shift pattern under low oil-temperature condition, and in temperature correction for gear shifting hydraulic control.

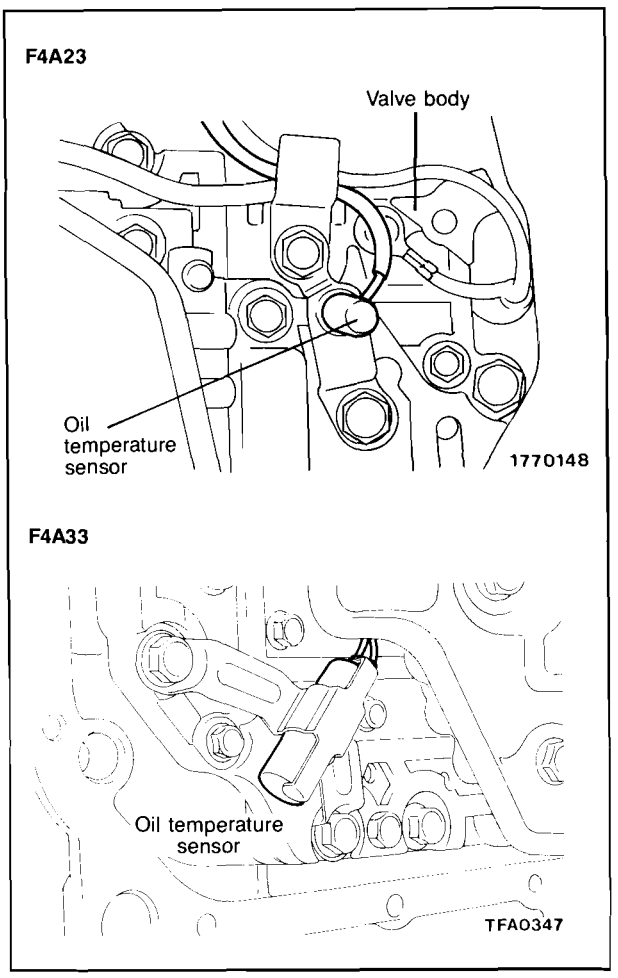


Fig. 24—Oil temperature sensor

NOTE: If transmission oil temperature is high the selection of fourth gear (OD) is inhibited.

Inhibitor Switch

The inhibitor switch is mounted on the transaxle. It performs the normal functions of an inhibitor switch, i.e. allows engine start in park and neutral only, but also provides the control unit with information of the gear position selected.

Ignition Coil

The ignition coil operates in the conventional manner and also provides the control unit with engine speed information from the primary negative side.

Vehicle Speed Sensor

A reed switch type located in the speedometer.

The vehicle speed sensor provides the control unit with a pulse signal proportional to vehicle speed. The signal is used to activate the "fail safe" mode.

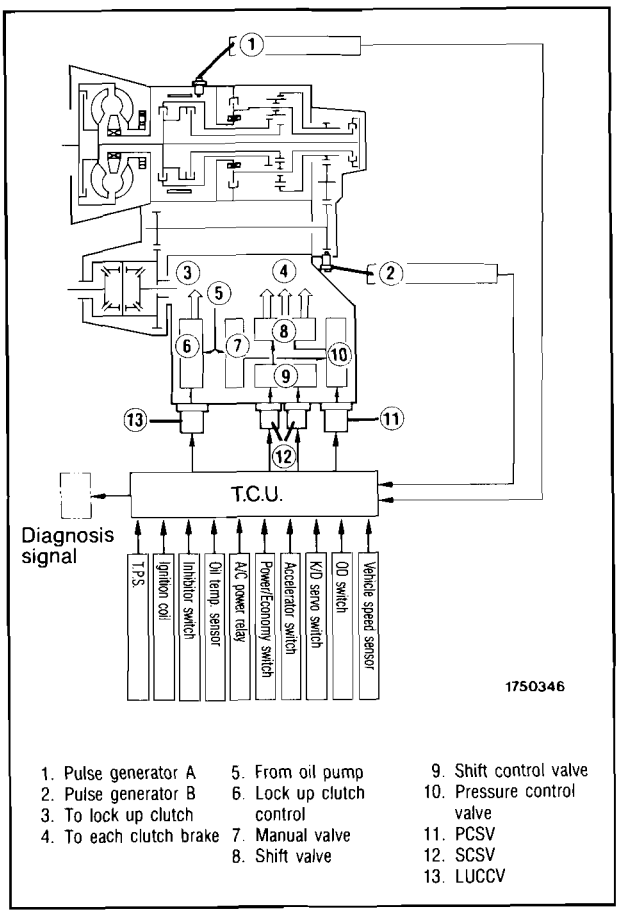


Fig. 25—Electronic control system

Air Conditioner Power Relay

The air conditioner power relay ON/OFF signal is used to determine whether the engine is being loaded by the air conditioner, thereby correcting variations in hydraulic pressure according to a change of engine output by air conditioner load.

Power/Economy Select Switch

The power/economy select switch which is mounted in the console allows the driver to choose between the two shift patterns. The power pattern is just right for sporty cruising and driving in mountains, while the economy pattern is intended for quiet, economical driving.

NOTE: Until ATF reaches 20°C, Economy shift pattern is automatically selected by the ECU.

Kickdown Servo Switch

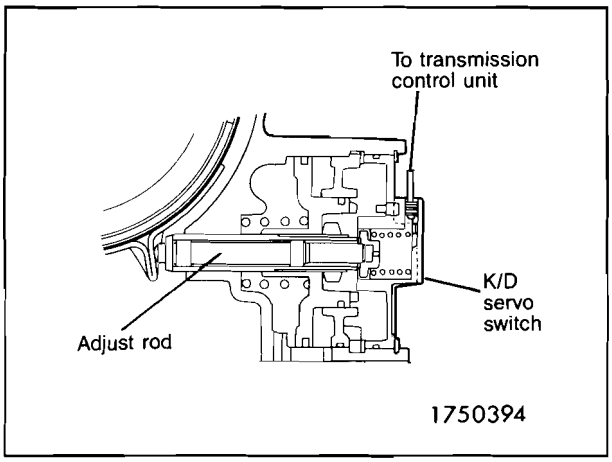


Fig. 26—Kickdown servo switch

The kickdown servo switch, forming part of the kickdown servo cover, is installed to the side face of transaxle case.

The switch is turned ON and OFF as the kickdown servo is activated and deactivated. When the kickdown brake is being applied, the switch is OFF (there is no continuity between the kickdown servo switch terminal and transaxle case) and when the kickdown brake is released the switch is turned ON (there is continuity between kickdown servo switch terminal and the transaxle case).

Pulse Generators

Two pulse generators are mounted on the transaxle.

On F4A23 series transaxles one measures the speed of the kickdown drum and the other measures the speed of the transfer shaft.

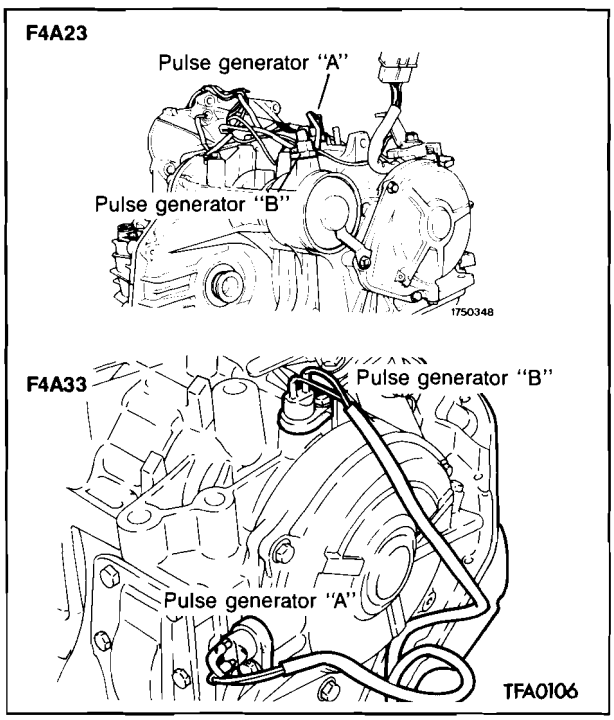


Fig. 27—Pulse generator

On F4A33 series transaxles, one measures the speed of the input shaft via projections on the outer diameter of the clutch retainer and the other measures the speed of the transfer shaft drive gear teeth.

The signal to the control unit is used to determine shift speeds.

SOLENOID VALVES

Four solenoid valves are mounted on the transaxle valve body. Solenoid operation is controlled by the transaxle control unit. They are on/off valves which allow hydraulic oil to flow to exhaust when open or stop oil flow when closed. The four valves are:

- Lock up clutch control solenoid (LUCCSU)
- Pressure control solenoid (PCSV)
- Shift control solenoids A and B (SCSV "A" and SCSV "B")

For valve operation and function refer to "Hydraulic System Components".

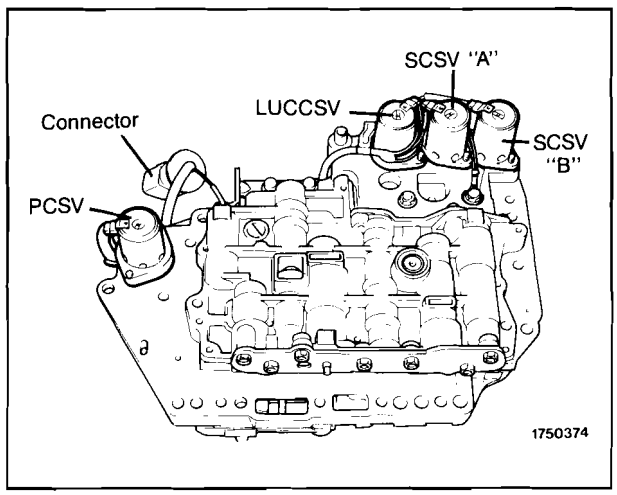


Fig. 28—Solenoid valve location

HYDRAULIC SYSTEM COMPONENTS

Oil Pump

The oil pump is located in the front of the housing, it is a crescent type rotary pump driven by a hub in the centre of the torque converter housing.

Pressure Regulator Valve

This valve regulates the oil pressure generated by the oil pump into line pressure. In forward ranges, oil pressure is directed to the right hand end of the valve and acts against the spring to regulate line pressure. In reverse range, oil pressure is directed to the smaller area (second from right) to act against the spring thus a higher line pressure is created in reverse.

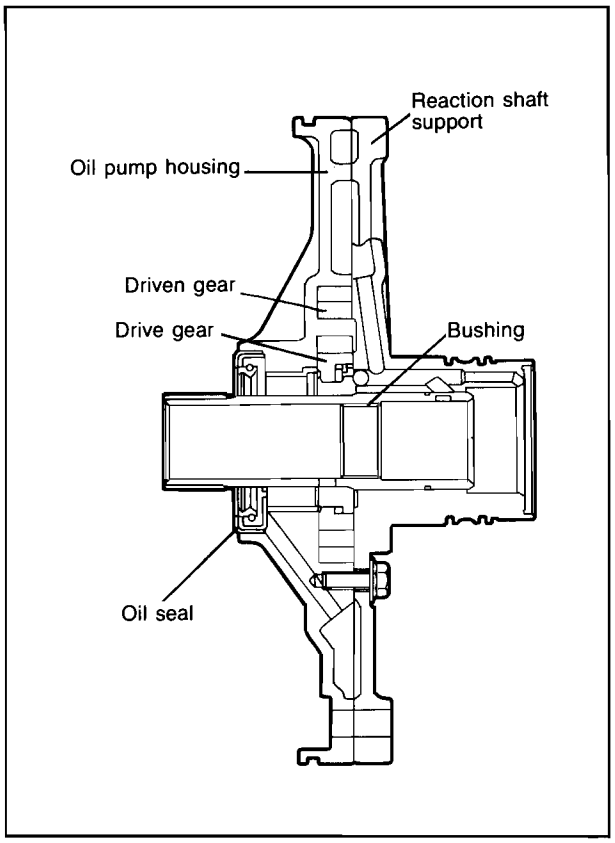


Fig. 29—Oil pump

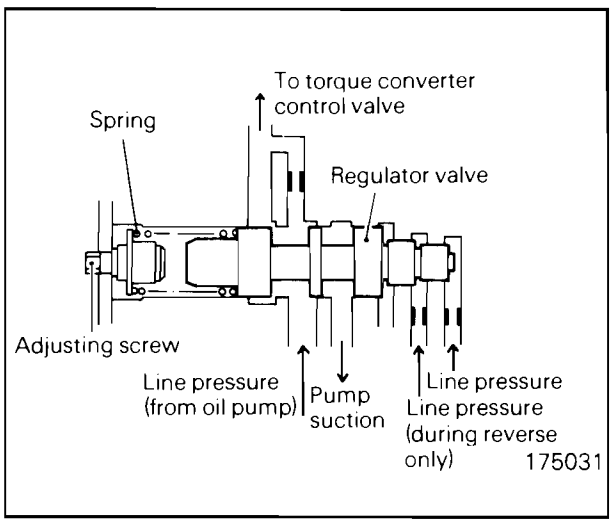


Fig. 30—Pressure regulator valve

Torque Converter Control Valve

This valve regulates line pressure to a lower pressure which is supplied to the torque converter. Line pressure is directed to the bottom of the valve via a hole in the bottom valve land. Pressure acts on this area to push the valve up against the spring.

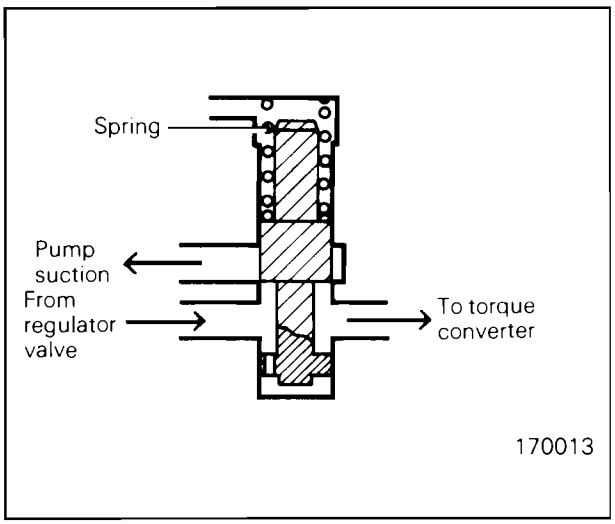


Fig. 31—Torque converter control valve

Reducing Valve

This is a regulating valve. Line pressure supplied to it is regulated to reducing pressure and directed to the lock up clutch control valve and pressure control valve.

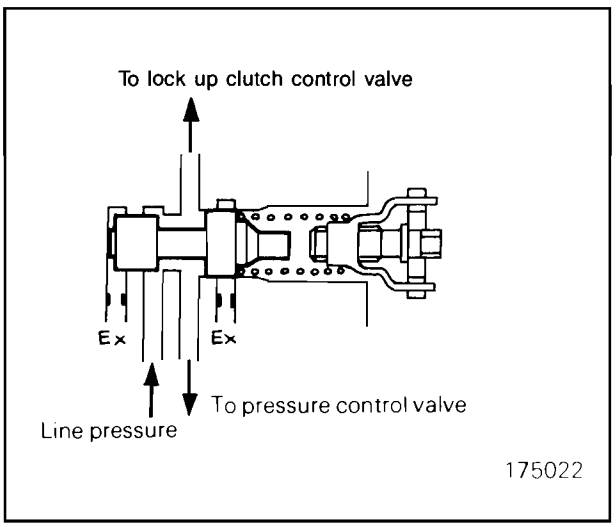


Fig. 32—Reducing valve

Lock Up Clutch Control Valve

This valve controls oil flow to the torque converter to release or apply the lock up clutch.

- Lock up clutch released: The lock up clutch control solenoid valve (LUCCSV) is closed. Reducing pressure assisting the spring positions the valve to the right. Oil pressure from the torque converter valve is directed to the lock up clutch release passage.
- Lock up clutch applied: The LUCCSV is activated (pulsing). Reducing pressure on the spring end of the valve drops and the reducing pressure on the right pushes the valve to the left, opening the line pressure port. The line pressure is regulated by the lock up clutch control valve and directed to engage the lock up clutch. In this condition oil pressure from the torque converter valve is re-directed to the transaxle oil cooler.

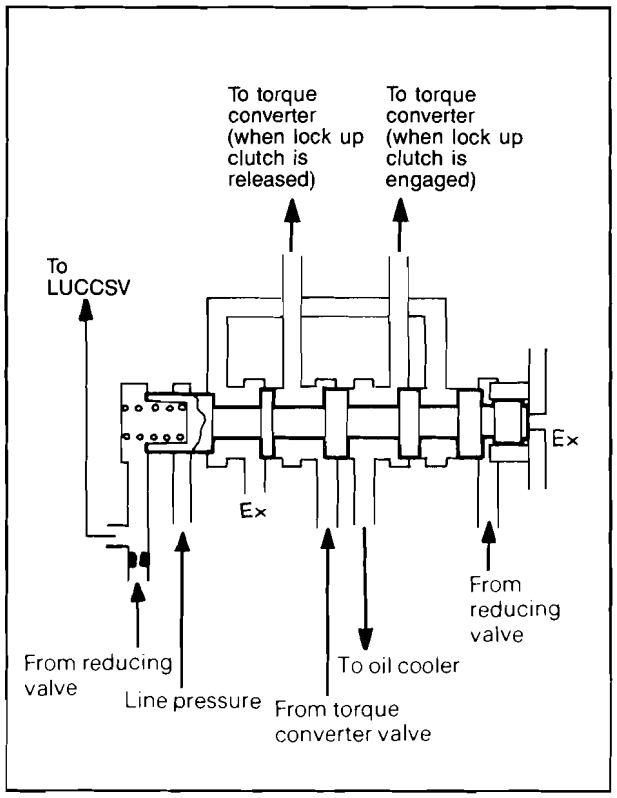


Fig. 33—Lock up clutch control valve

Manual Valve

This valve is positioned by the gear lever, it directs line pressure in the transaxle to the reverse and forward circuits.

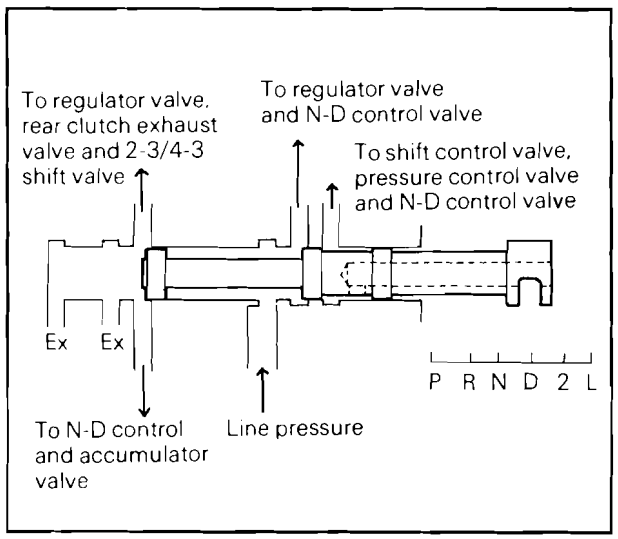


Fig. 34—Manual valve

Neutral-Reverse Control Valve

This valve prevents harsh engagement of reverse when the gear lever is moved from Park or Neutral. Line pressure directed through the valve to the low/reverse brake (via 1-2 shift valve), is regulated by control pressure acting against spring force.

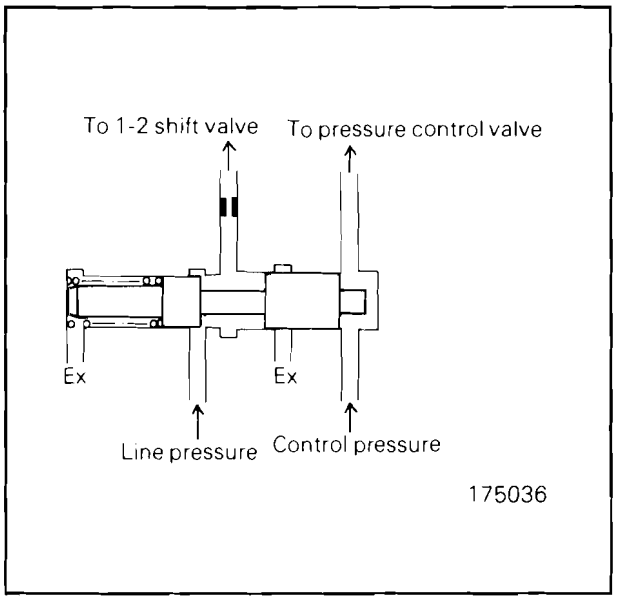


Fig. 35—Neutral-reverse control valve

Pressure Control Valve

This valve controls the line pressure supplied to the 1-2 shift valve. It has three operating conditions:

- When reducing pressure and control pressure are equal, the valve moves to the right allowing line pressure to flow unrestricted.
- When low control pressure is supplied, the valve moves to the left and stops line pressure flow to the 1-2 shift valve.
- When medium control pressure is supplied, the valve moves to the right and allows line pressure to flow to the 1-2 shift valve. The line pressure will act on the differential area, resulting in regulation of line pressure to the 1-2 shift valve.

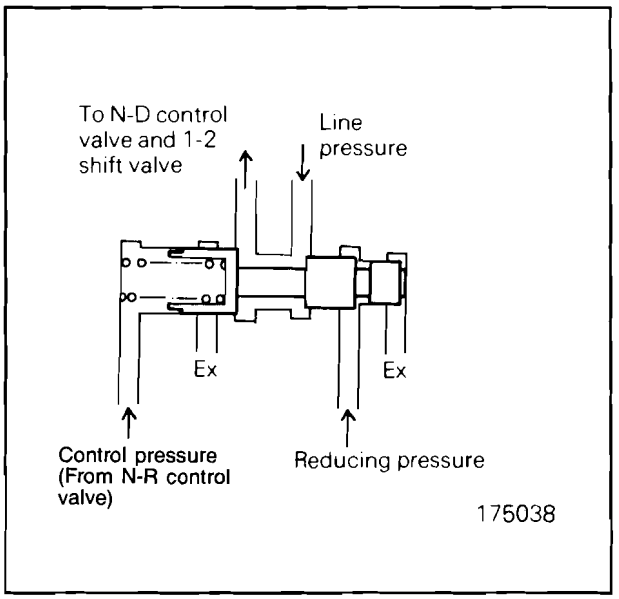


Fig. 36—Pressure control valve

Pressure Control Solenoid Valve

The solenoid is operated by the control unit, it regulates the reducing valve pressure supplied to it into one of three conditions:

- Valve off — high pressure.
- Valve on — low pressure.
- Valve pulsing — medium pressure.

The solenoid pulses in manual first and second hold. It is on in drive first and off in all other gears.

The pressure it controls is directed to the neutral-reverse control accumulator valve and pressure control valve.

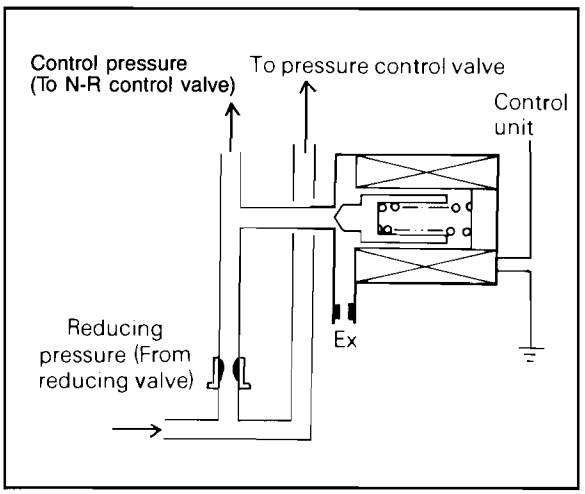


Fig. 37—Pressure control solenoid valve

Neutral-Drive Control Valve

This valve prevents harsh application of the rear clutch when the gear lever is moved from neutral to drive. When in neutral the valve is positioned to the left by line pressure, entering the valve from the top. When drive is selected line pressure enters from the bottom left passage and is directed to the rear clutch exhuast valve via a restrictor, thus smooth clutch application is achieved. When the clutch is fully applied the line pressure on the left of the valve will build up and push the valve to the right.

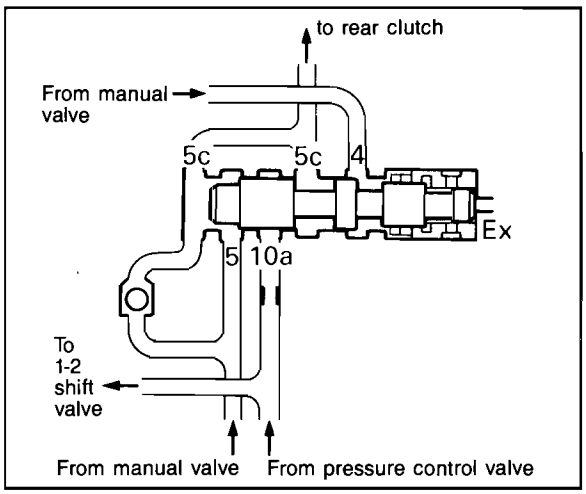


Fig. 38—Neutral-drive control valve

Shift Control and Solenoid Valves

The shift control valve can be moved to one of four positions:

- 1st gear position.
- 2nd gear position.
- 3rd gear position.
- 4th gear position.

This is achieved by the two shift control solenoid valves which are opereated by the control unit. Line pressure supplied to the shift control valve is thus directed by the valve to achieve forward ratio up and down shifts.

Shift Control Valve Operation

First Gear

Both solenoid valves are open therefore line pressure supplied to the solenoid via restrictors 1 and 2, is exhausted. The line pressure flowing through the restrictors is high on the supply side and low on the exhaust side, therefore pressure is not supplied to the plugs on each end of the shift control valve. The line pressure entering the shift control valve will react on the larger spool (left) and push the valve left until the plug bottoms. In this section the shift control valve directs line pressure to the restrictors only.

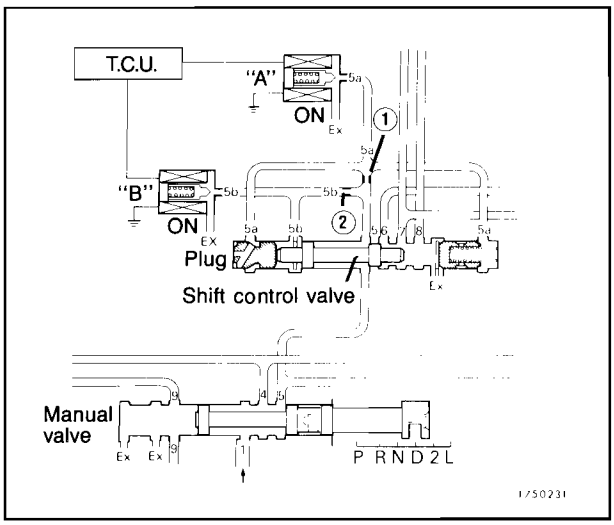


Fig. 39—First gear

	Shift control solenoid valve	
	A	B
1st gear	ON	ON
2nd gear	OFF	ON
3rd gear	OFF	OFF
4th gear	ON	OFF

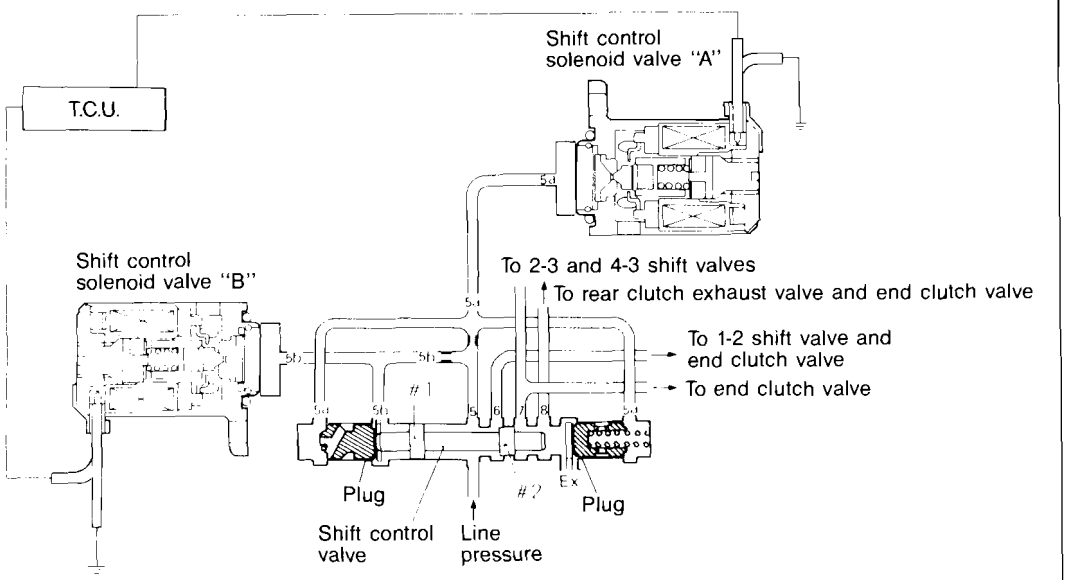


Fig. 40—Shift control and solenoid valves

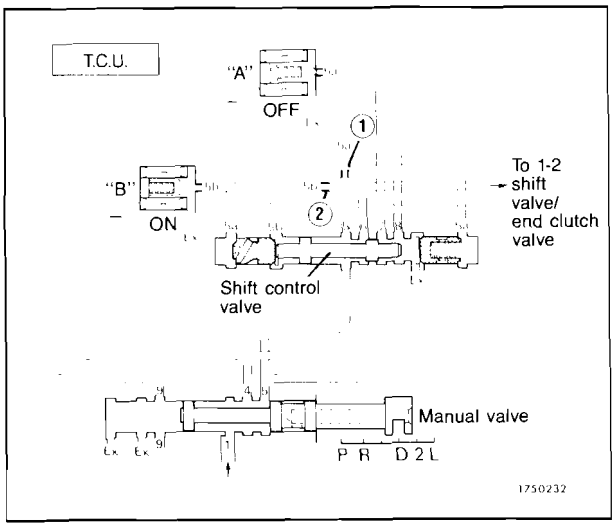


Fig. 41—Second gear

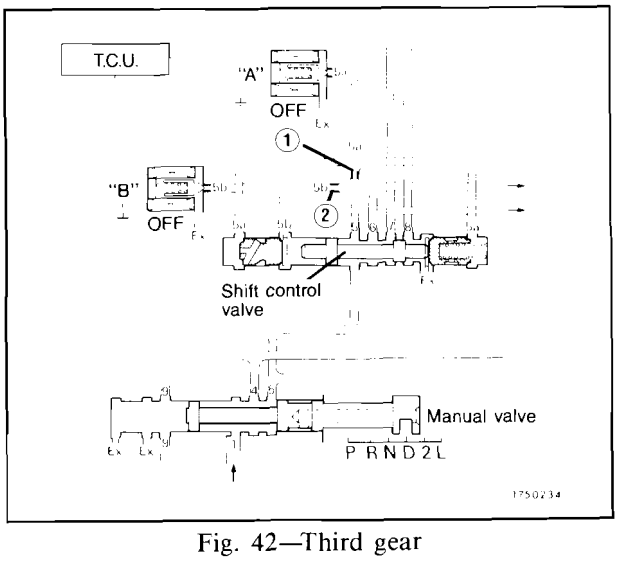


Fig. 42—Third gear

Second Gear

Solenoid valve A closes therefore line pressure does not exhaust. Since line pressure does not flow through restrictor 1, the pressure equalizes on both sides of the restrictor and is directed to the plugs on both ends of the shift control valve. The plugs are pushed in against the stopper plates, in this way the shift control valve is moved to the right by the plug on the left and line pressure entering the shift control valve is now also directed to the 1-2 shift valve and end clutch valve.

Third Gear

Both solenoid valves are closed, therefore line pressure does not exhaust. Line pressure equalizes across restrictor 2 so that the pressure directed between the left shift plug and the shift control valve, pushes the valve to the right until it contacts the right shift plug. Line pressure entering the shift control valve is now also directed to the 2-3/4-3 shift valve and the end clutch valve.

Fourth Gear

Solenoid valve A opens allowing line pressure to exhaust which results in line pressure flow and associated pressure drop across restrictor 1. Since the pressure behind the shift plugs has diminished, the line pressure on the left of the shift control valve pushes the valve to the right until the shift plug bottoms. Line pressure entering the shift control valve is now also directed to the rear clutch exhaust valve and the end clutch valve.

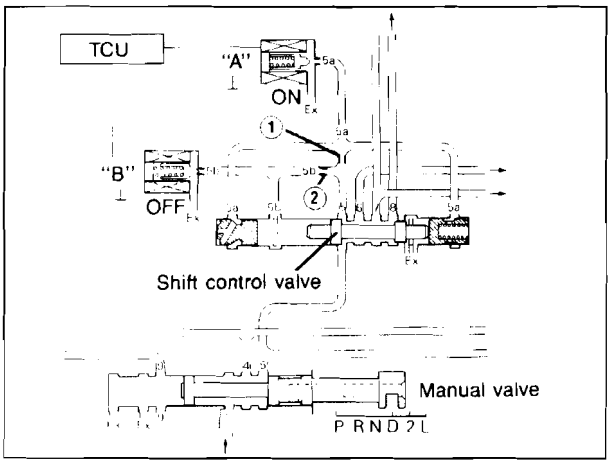


Fig. 43 — Fourth gear

1-2 Shift Valve

This valve directs line pressure to apply the kickdown servo or low-reverse brake depending on the gear to be selected:

- Second gear: Line pressure from the shift control valve enters the valve from the left and pushes it against the spring. This allows line pressure from the pressure control valve to flow to the kickdown servo in second, third and fourth gears.
- Manual first: Spring force holds the valve to the left, allowing line pressure from the pressure control valve to flow through to the low-reverse brake.
- Reverse: Reverse line pressure directed by the manual valve enters the valve between the two spools on the left. The valve is pushed against the spring and line pressure is directed to the low-reverse brake.

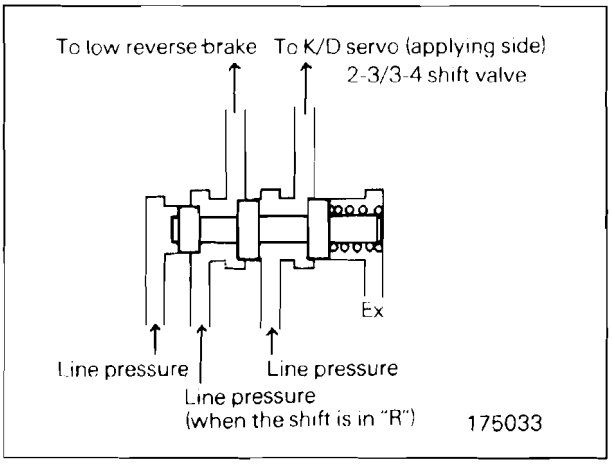


Fig. 44 — 1-2 Shift valve

2-3/4-3 Shift Valve

This valve directs line pressure to the front clutch and to release the kickdown servo depending on the gear to be selected:

- Third gear: Line pressure from the shift control valve acts on the left, positioning the valve to the right. Line pressure from the 1-2 shift valve is directed to the front clutch.
- Fourth gear: Line pressure from the shift control valve acts on the right, assisting spring force, pushing the valve back to the left. Front clutch apply oil is, therefore, exhausted.
- Reverse: Spring force positions the valve to the left therefore line pressure from the manual valve is directed through this valve to apply the front clutch.

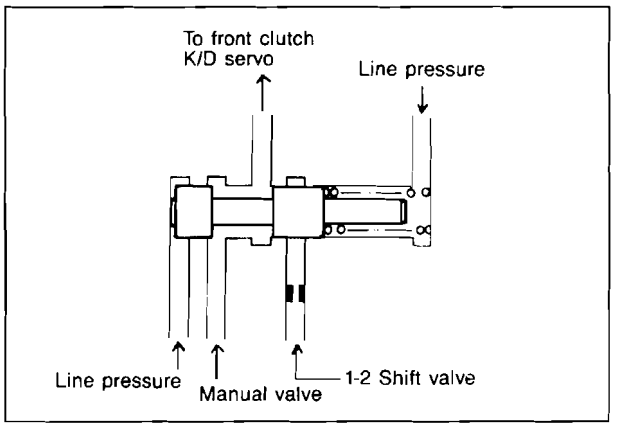


Fig. 45 — 2-3/4-3 shift valve

End Clutch Valve

This valve controls the flow of line pressure to apply the end clutch on a 2-3 shift.

In second gear, line pressure enters the valve from the left pushing it to the right against the spring. In third gear, line pressure from the 2-3/4-3 shift valve assists the spring and pushes the valve to the left. Line pressure from the shift control valve will flow to the end clutch and to the right end of this valve. In fourth gear, line pressure from the 2-3-/4-3 shift valve is no longer available, however end clutch line pressure still acts on the right of this valve. Therefore the valve remains held to the left and line pressure from the shift control valve maintains end clutch application.

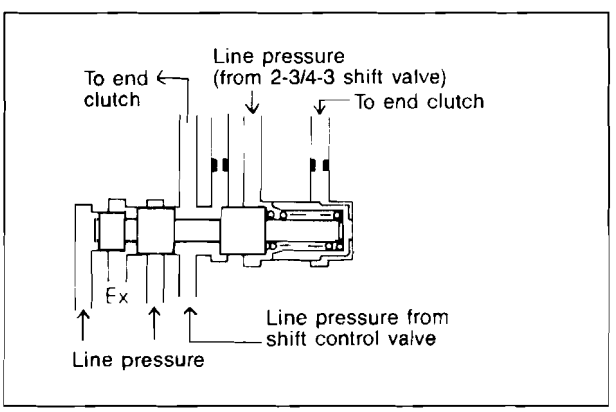


Fig. 46 — End clutch valve

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Rear Clutch Exhaust Valve

This valve exhausts the rear clutch apply oil on a 3-4 shift.

In first, second and third gear, spring force holds the valve to the left, allowing line pressure from the N-D control valve to flow through the valve and apply the rear clutch. In fourth gear line pressure from the shift control valve is directed to the left end of this valve and pushes it to the right. In this position the line pressure supply to the rear clutch is blocked and oil pressure in the rear clutch is vented via the centre exhaust port on this valve, thus releasing the clutch.

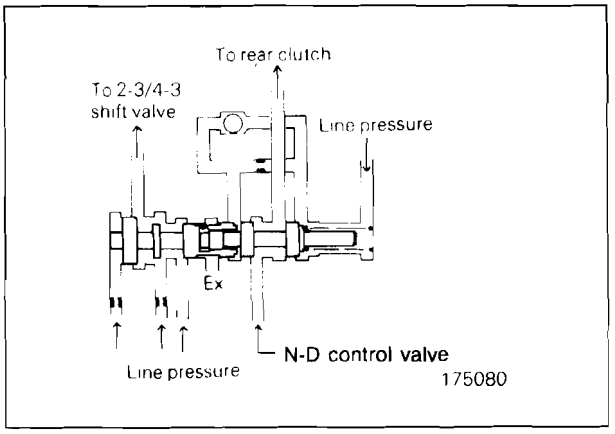


Fig. 47 — Rear clutch exhaust valve

Shift Pattern Control

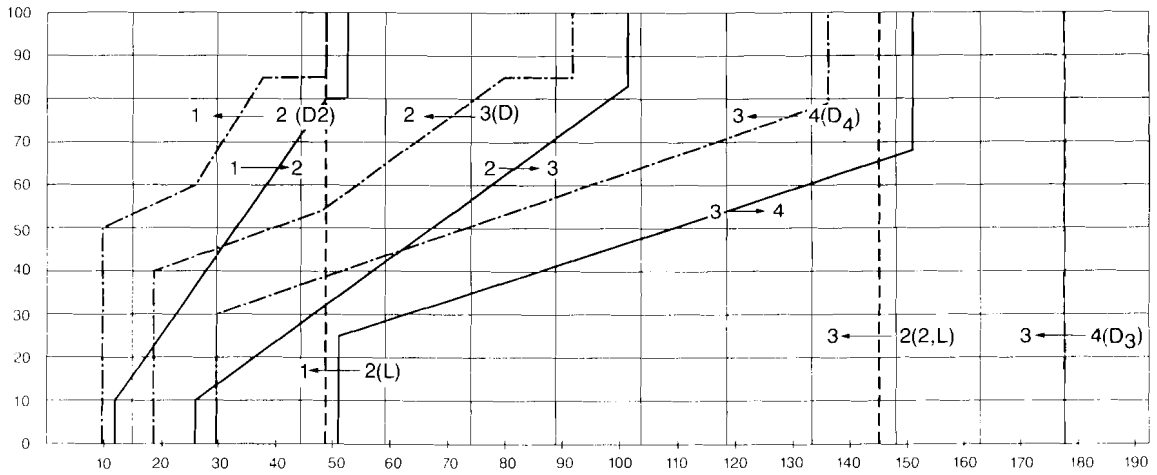
The new transaxle control unit (TCU) has two shift patterns stored in its memory, allowing the driver to select a desired driving pattern by just operating the Power/Economy select switch provided inside the vehicle on the console.

In the Power pattern, the shift points are set more on the high-speed side, for greater performance.

In the Economy pattern the shift points are set on the low speed end contributing to quiet economical driving.

NOTE: The Economy pattern is selected by the TCU if the transmission fluid temperature is below 20°C

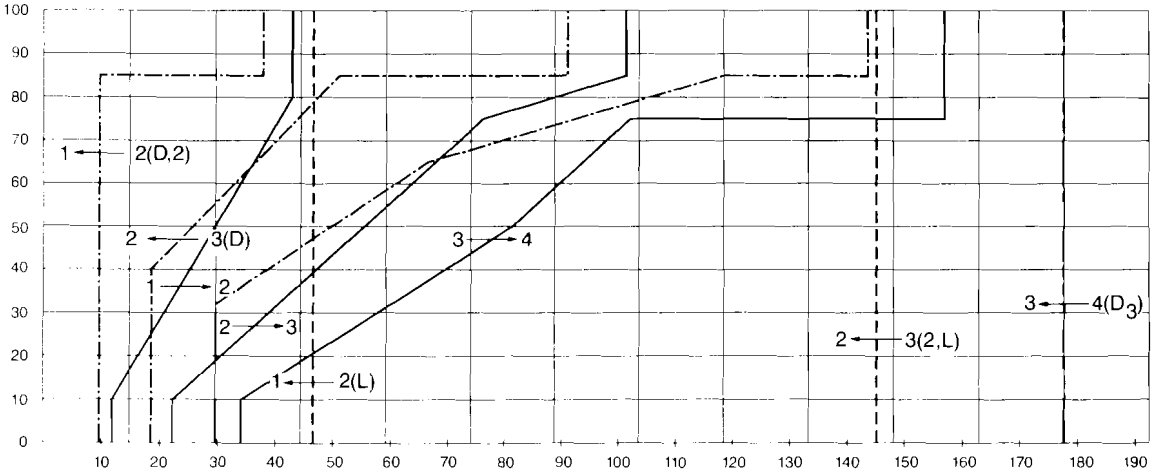
POWER PATTERN



Vehicle speed (km/h)

% Throttle opening

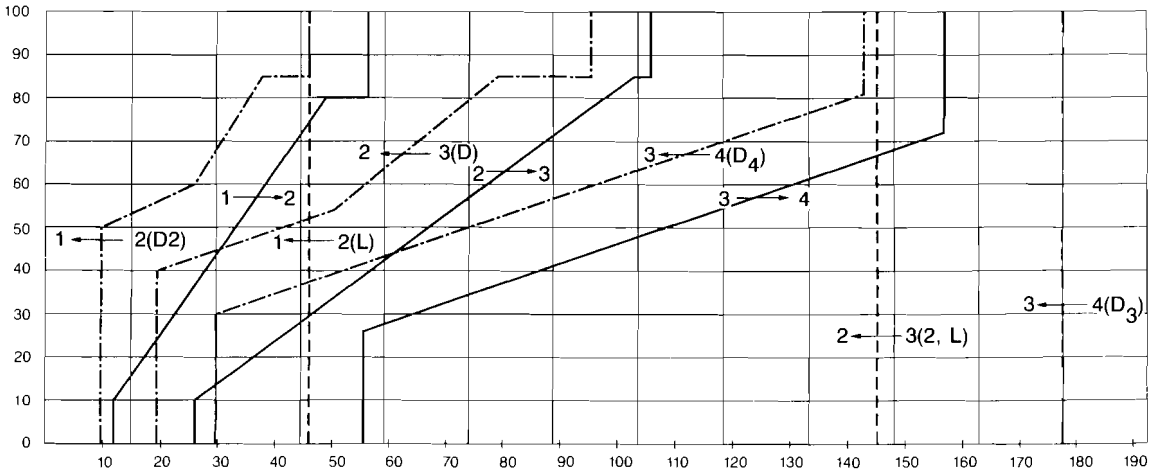
ECONOMY PATTERN



Vehicle speed (km/h)

Fig. 48—Shift points ECI-MULTI 4 cylinder-models

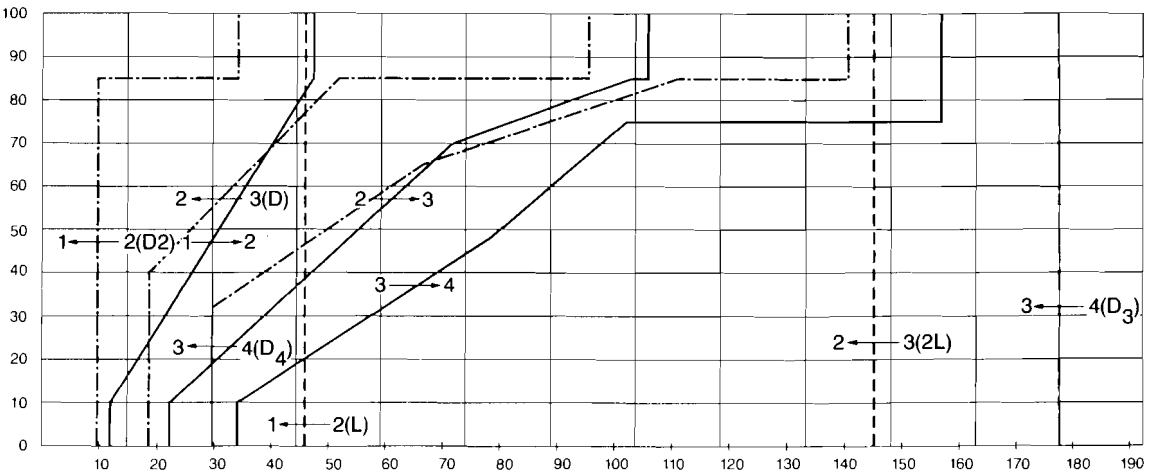
POWER PATTERN



Vehicle speed (km/h)

% Throttle opening

ECONOMY PATTERN



Vehicle speed (km/h)

Fig. 49—Shift points ECI-MULTI V6 models

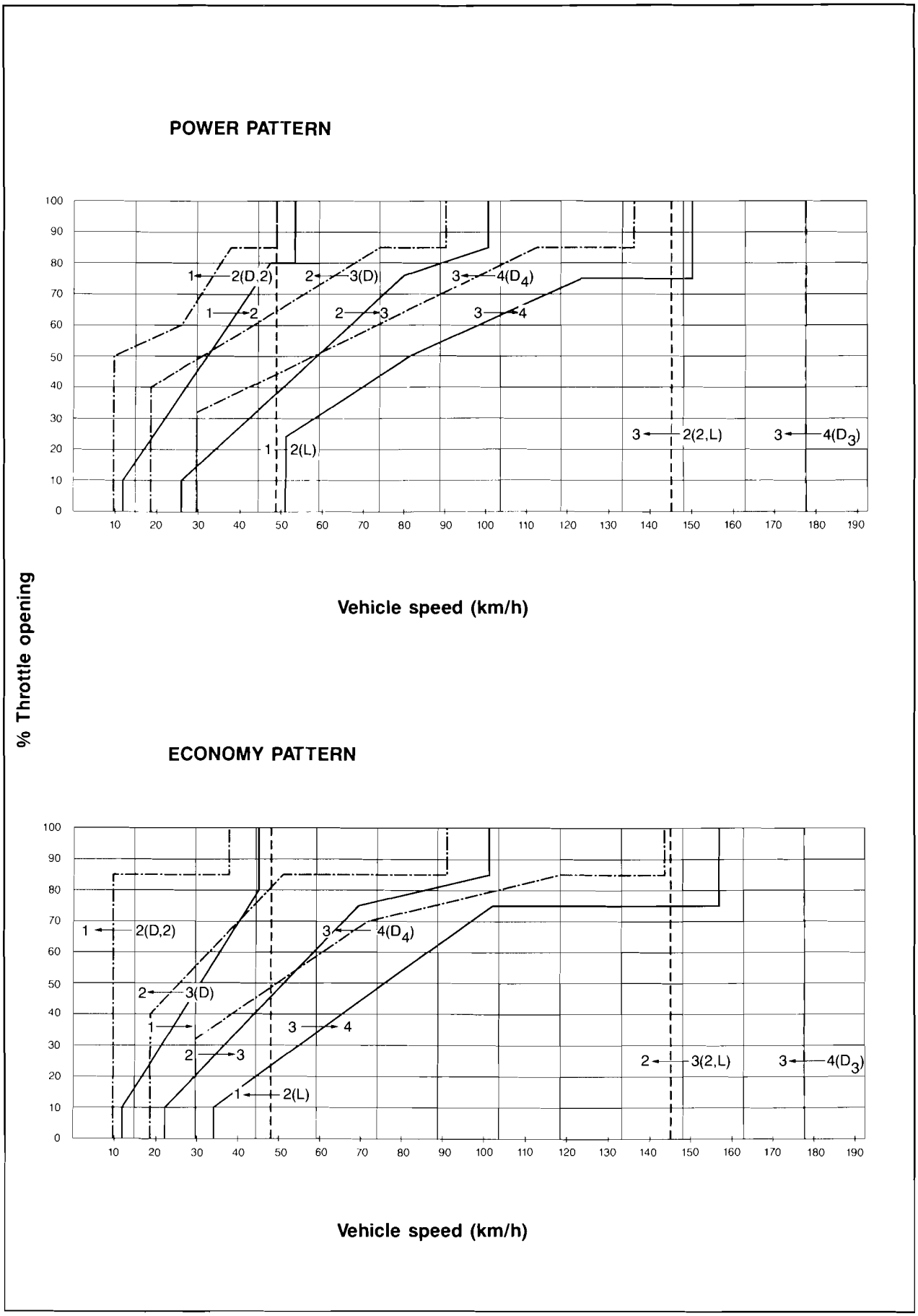


Fig. 50—Shift points carburettor models

HYDRAULIC FLOW CHARTS

SELECTOR LEVER IN "P"

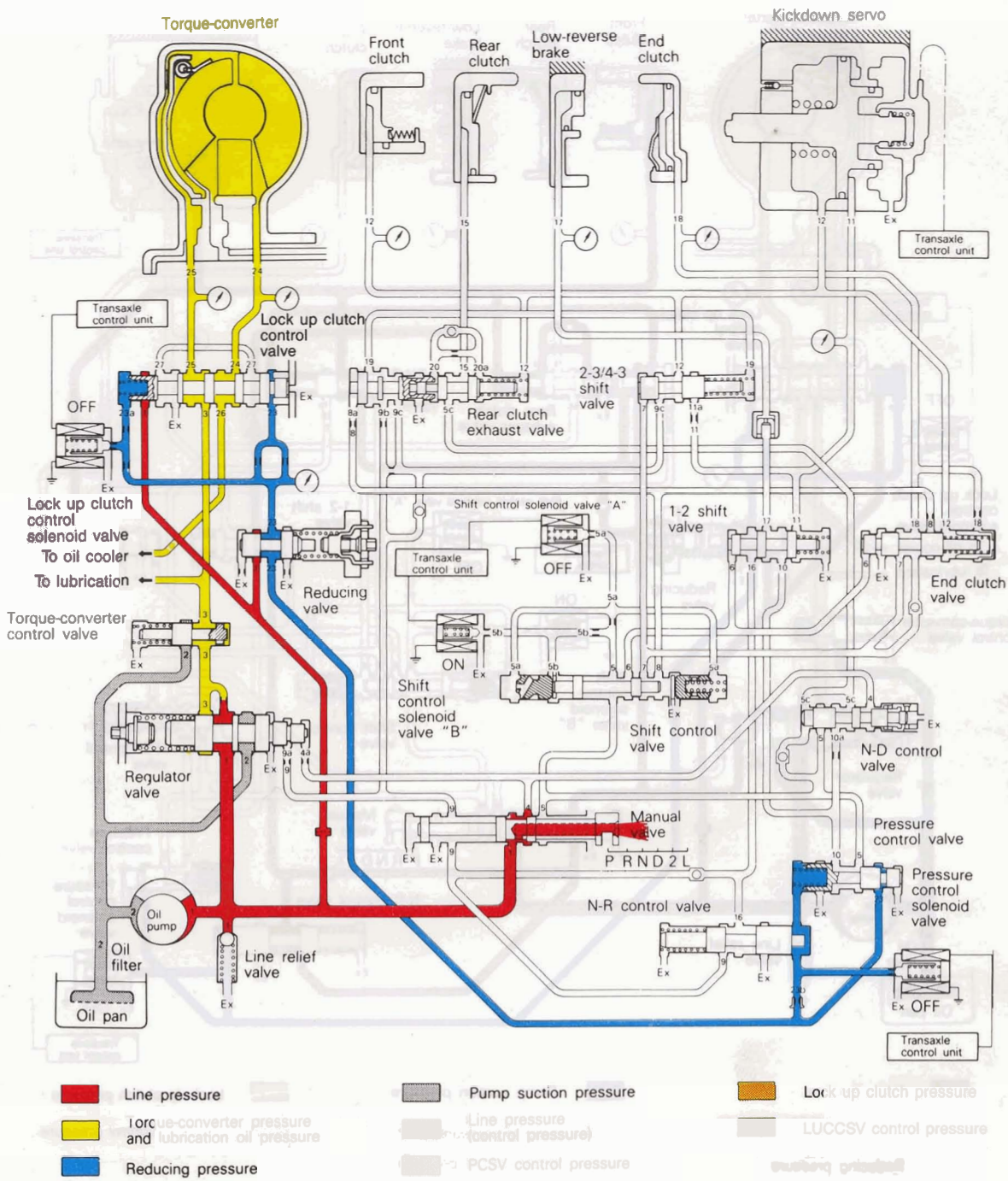


Fig. 51—Hydraulic action — park

SELECTOR LEVER IN "R"

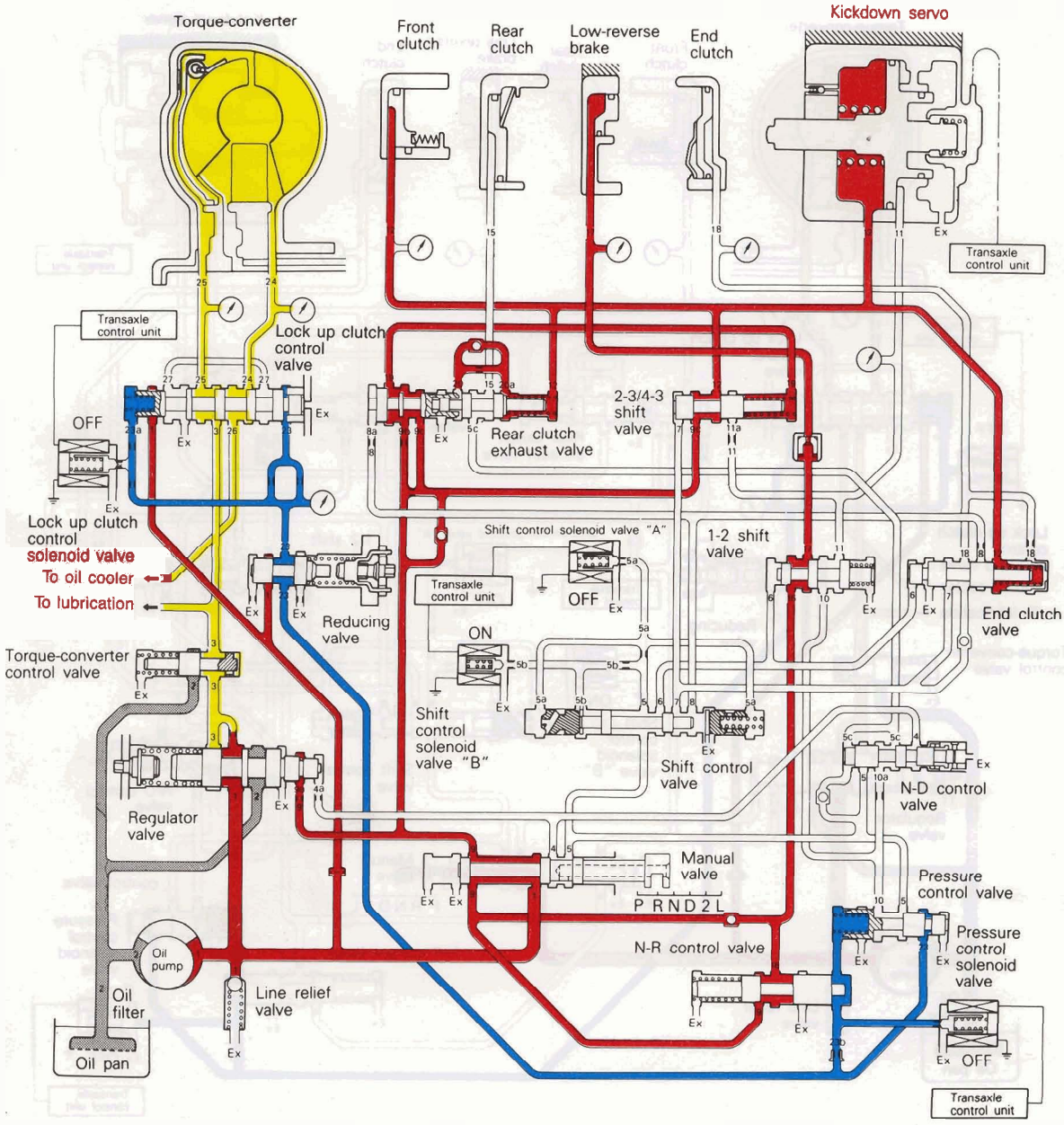


Fig. 52—Hydraulic action — reverse

SELECTOR LEVER IN "N"

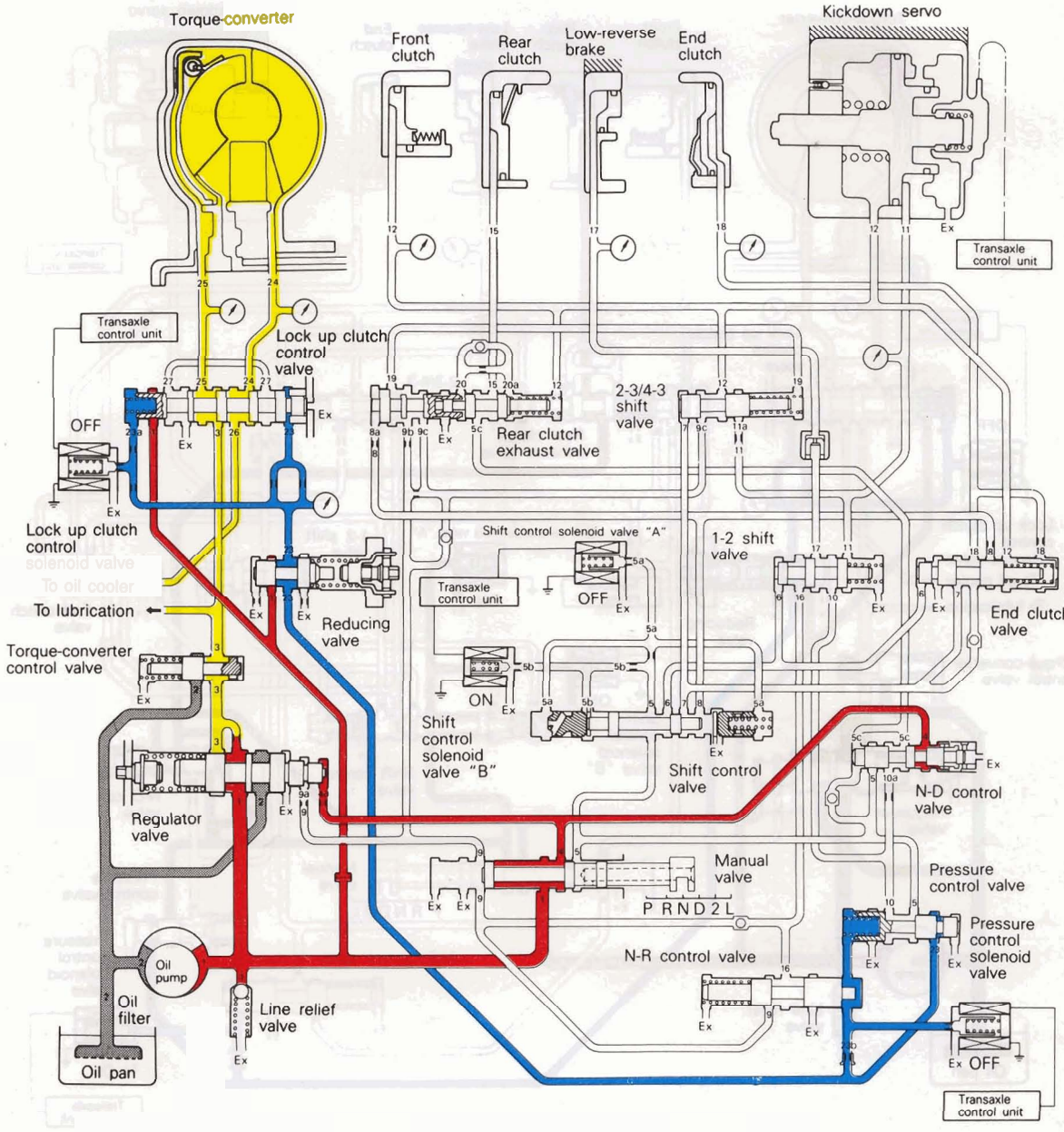


Fig. 53—Hydraulic action — neutral

SELECTOR LEVER IN "D" (1st Gear)

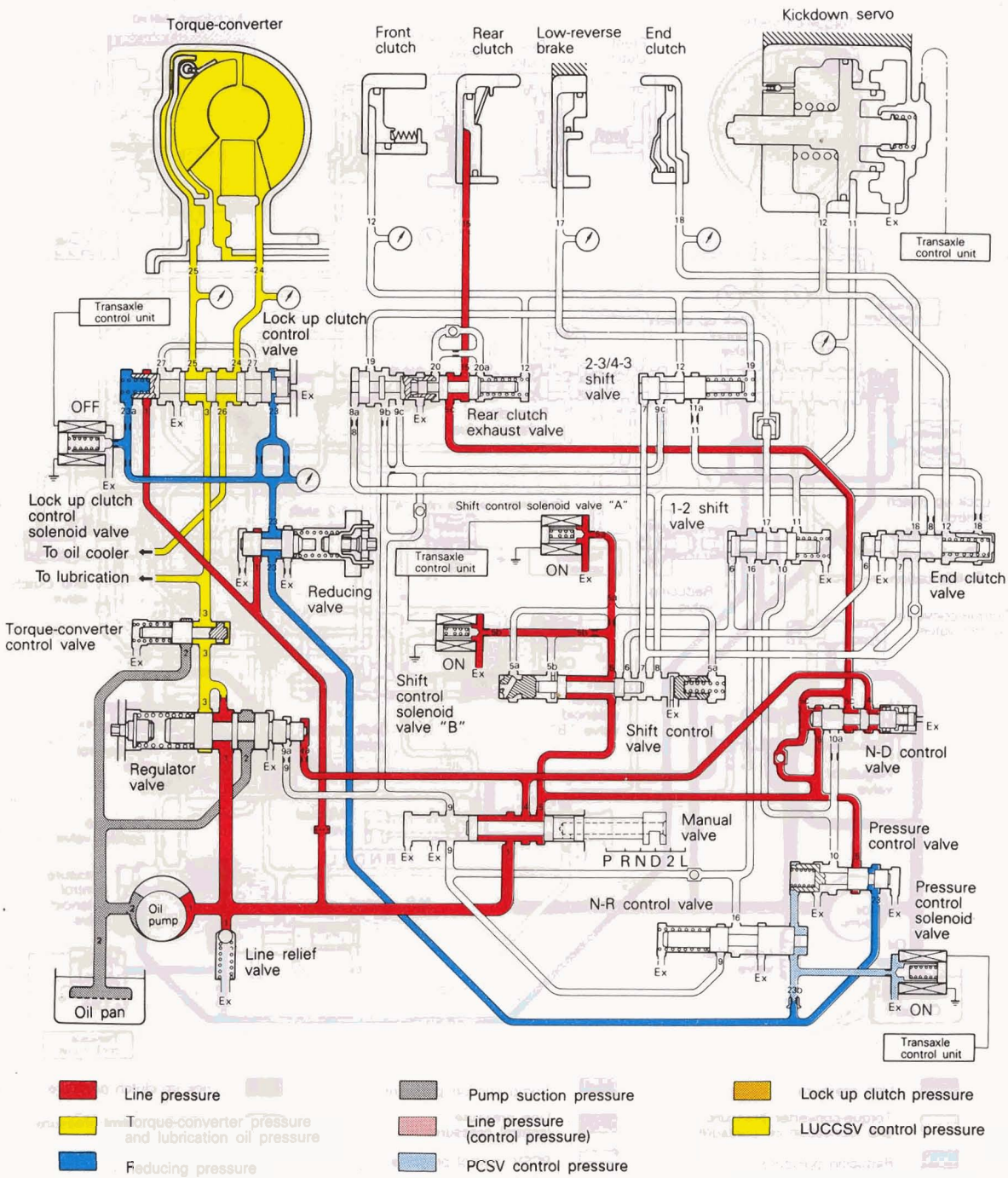


Fig. 54—Hydraulic action — drive — first

SELECTOR LEVER IN "D" (2nd Gear)

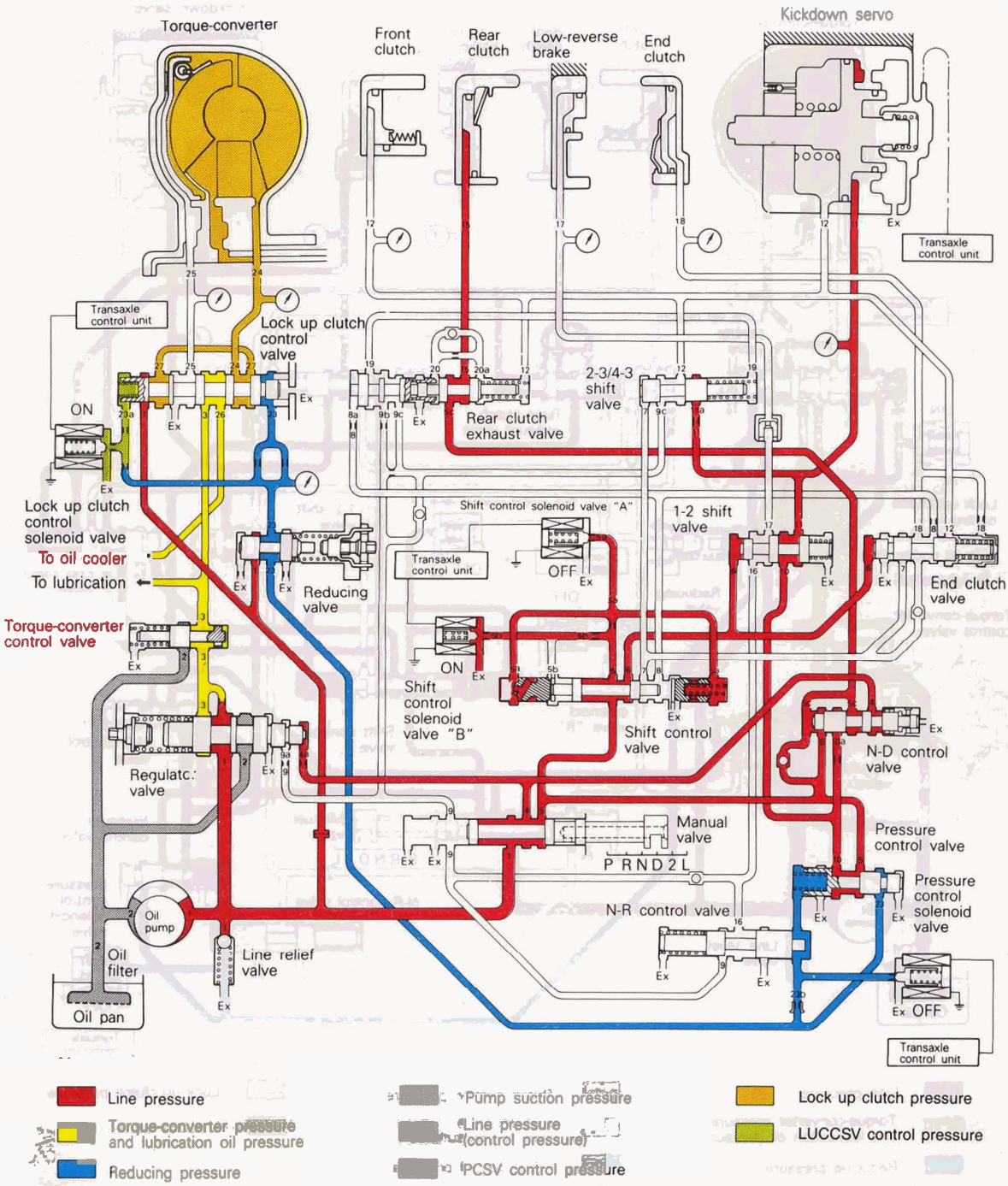


Fig. 55—Hydraulic action — drive — second

SELECTOR LEVER IN "D" (3rd Gear)

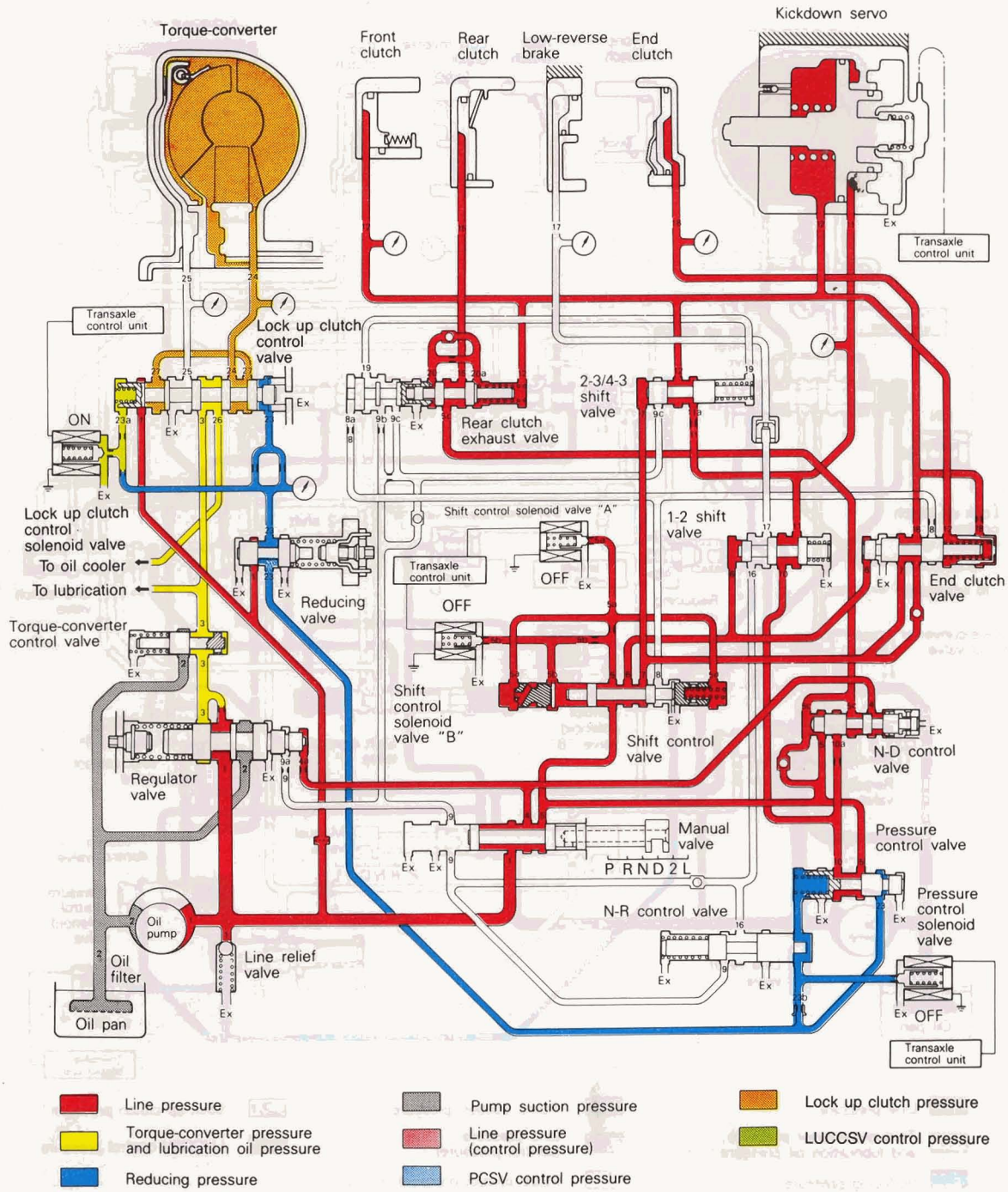


Fig. 56—Hydraulic action — drive — third

SELECTOR LEVER IN "D" (4th Gear)

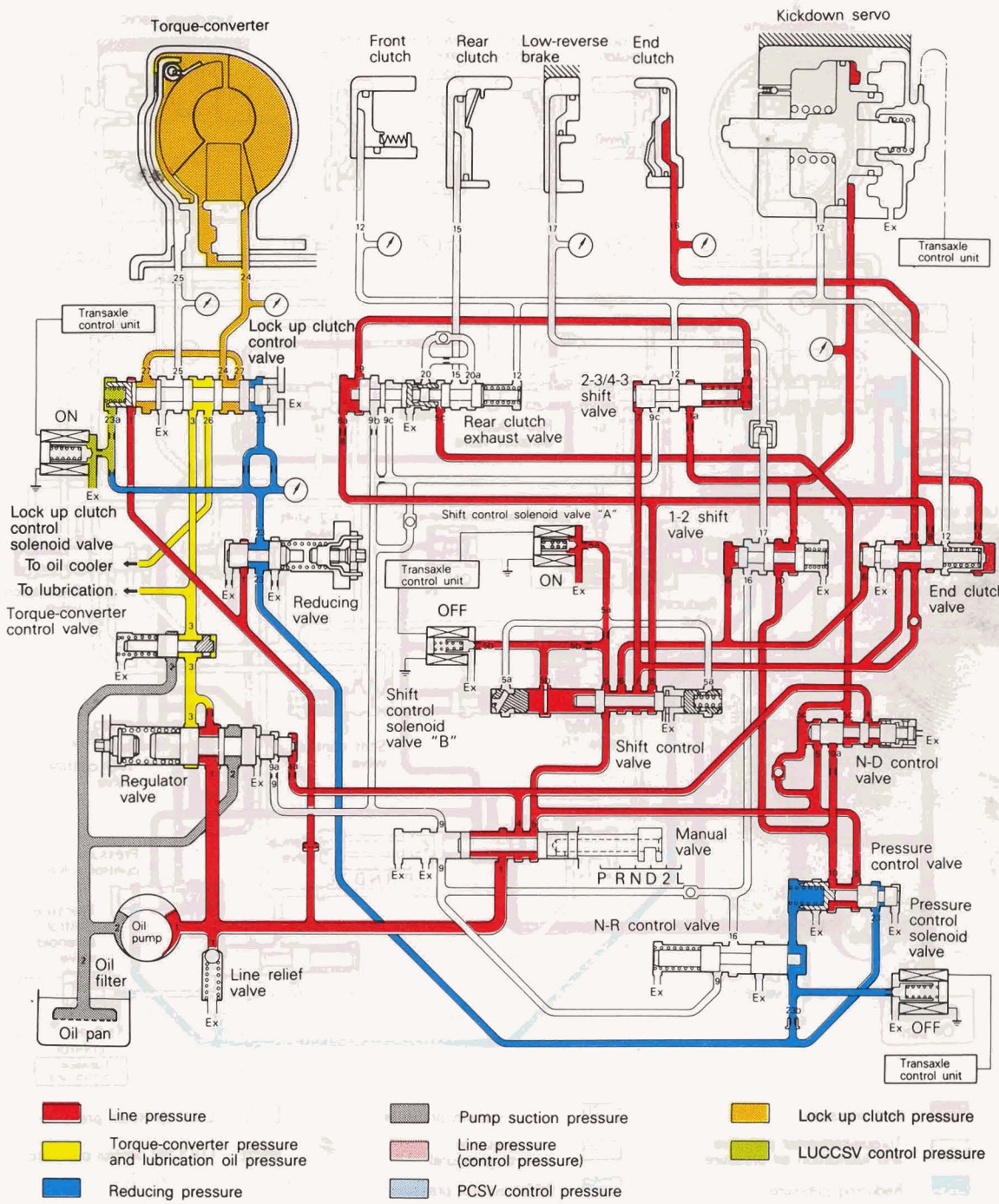


Fig. 57—Hydraulic action — drive — fourth

SELECTOR LEVER IN "L"

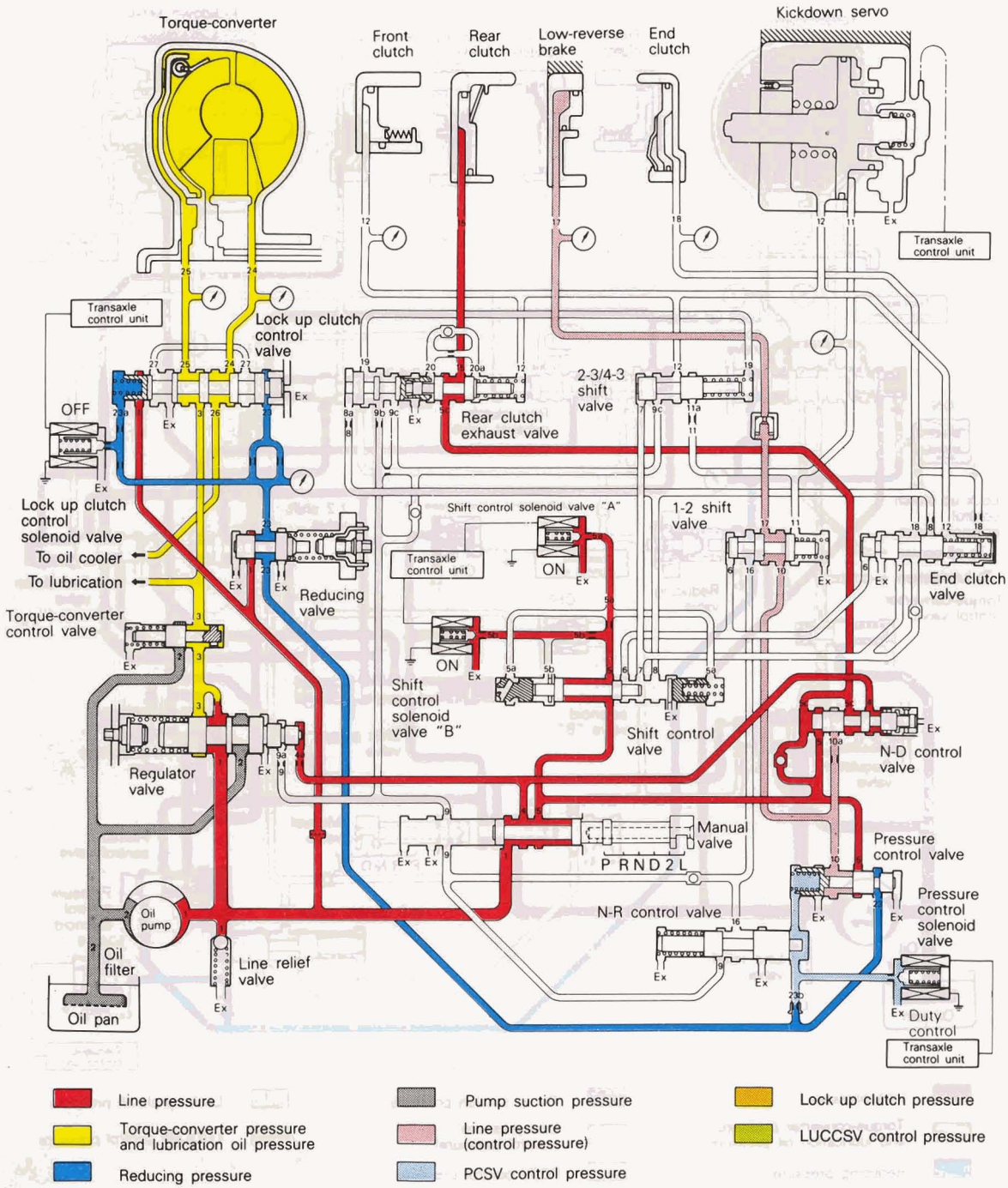


Fig. 58—Hydraulic action — lock up first

SELECTOR LEVER IN "D"

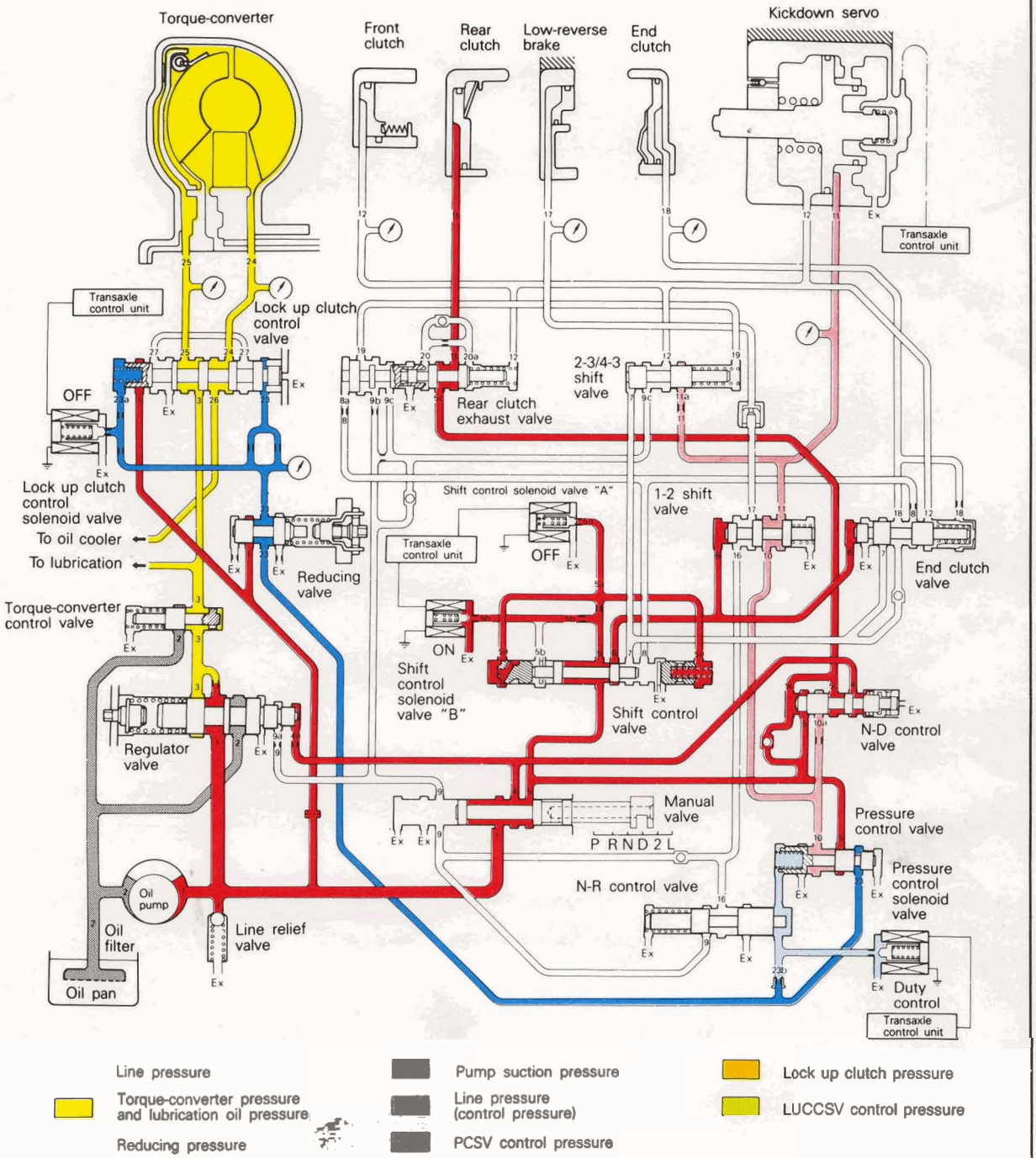


Fig. 59—Hydraulic action — drive — stationary

SECTION 2 — SERVICE DIAGNOSIS AND TESTING

SERVICE DIAGNOSIS PROCEDURE

Automatic transaxle problems/failures usually occur as a result of:

(a) Inadequate maintenance, e.g. incorrect fluid level.

(b) Incorrect adjustments.

(c) Faults in wiring and/or electrical components.

(d) Hydraulic system faults.

(e) Mechanical/drive line faults.

When diagnosing faults on the F4A transaxles it is essential that the procedures outlined in this section are carefully followed in the correct sequence, that no step is omitted and that all possible causes are investigated prior to moving on to the next step.

NOTE: The "Self-Diagnosis" system outlined in this section is only provided to assist in fault diagnosis. IT CANNOT INDICATE ALL TRANSAXLE FAULTS AND DOES NOT ELIMINATE THE NEED TO FOLLOW STANDARD DIAGNOSIS PROCEDURES.

STEP 1 — Obtain all possible information on the fault
- when
- where
- how often
- what kind
- where possible conduct simulation test with owner

STEP 2 — Check the self-diagnosis output
- Read the code using Multi-Use-Tester or voltmeter
- The control unit has a battery backup so the code numbers are retained even when the ignition switch is turned OFF.

STEP 3 — Isolate the trouble spot by following the trouble shooting chart
- Compare results from Step 1 and Step 2 with the systems shown in the fault diagnosis charts this section

STEP 4 — Check basic items
- ATF level and condition
- Manual linkage adjustment
- Throttle position sensor
- K/D band adjustment
- ALL connectors for proper connection

STEP 5 — If an electrical fault is indicated
- Check sensors and actuators
- Check wiring harness and connectors

STEP 6 — If a hydraulic fault is indicated
- Perform "Hydraulic pressure test" using procedure outline this section
- If the specified hydraulic pressure is not reached, use Hydraulic pressure test diagnosis chart for possible cause/corrective action
- If hydraulic pressure is normal conduct stall test

SPECIFICATIONS

Pulse Generators [@20°C (68°F)]	245 ± 30 Ohms
Pressure Control Solenoid Valve [@20°C (68°F)]	3 Ohms approx.
Lock Up Clutch Control Valve [@20°C (68°F)]	3 Ohms approx.
Shift Control Solenoid Valve ("A" and "B") [@20°C (68°F)]	23 Ohms approx.
Torque Convertor clutch solenoid valve coil [@20°C (68°F)]	3 Ohms
— With ECU's MD758360 and MD757075	13 Ohms
Oil Temperature Sensor (Refer 23-2-18)	Resistance varies with temperature
Throttle Position Sensor Resistance	3.5 to 6.5 kOhms

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FAULT DIAGNOSIS CHART

		Condition / Possible cause	Driving impossible or abnormal (before start - off)												
			Starter motor won't function	Forward/backward movement impossible	Forward movement impossible	Backward movement impossible	Engine stalls when N — D or R	Clutch slips at D (stall rpm too high)	Clutch slips at R (stall rpm to high)	Stall rpm too low	Vehicle moves at P or N	Engine starts, or vehicle moves between N-R or N-D	Parking doesn't hold	Abnormal vibration-shock when shift to D-2-L-R
Engine	1	Abnormal idling rpm					⊗							⊗
	2	Performance malfunction					X			X				
Transmission (power train)	3	Improper adjustment of manual linkage	X	⊗	⊗	⊗		⊗	⊗		⊗	⊗	⊗	⊗
	4	Malfunction of torque converter		X	X	X				X				
	5	Operation malfunction of oil pump		X	X	X		X	X					
	6	Malfunction of one-way clutch			X		X							
	7	Damaged or worn gear or other rotating part, or improper adjustment of the preload												
	8	Malfunction of parking mechanism									X		X	
	9	Cracked drive plate, or loose bolt		X										
	10	Worn inside diameter of front clutch retainer				X		X						
Oil-pressure system (including friction elements)	11	Low fluid level		⊗	⊗	⊗		X	X					
	12	Line pressure too low (seal damaged, leakage, looseness, etc.)		⊗	⊗	⊗		X	X					
	13	Malfunction of valve body (sticking valve, working cavity, adjustment.etc.)		⊗	⊗	⊗	X	X	X		X	X		X
	14	Malfunction of front clutch or piston				X			X					X
	15	Malfunction of rear clutch or piston			⊗			X						X
	16	Malfunction of kickdown band or piston												
	17	Improper adjustment of kickdown servo												
	18	Malfunction of low-reverse brake or piston		X		X		X						X
	19	O-ring of low-reverse brake circuit between valve body and case not installed				X		X						
	20	Malfunction of end clutch or piston (check ball hole, other)												
Electronic control system	21	Malfunction of inhibitors switch, damaged or disconnected wiring, or improper adjustment		X							X	X		X
	22	Malfunction of TPS, or improper adjustment												X
	23	Pulse generator (A) damaged or disconnected wiring, or short-circuit												
	24	Pulse generator (B) damaged or disconnected wiring, or short-circuit				X								
	25	Malfunction of kickdown servo switch												
	26	SCSV-A or B damaged or disconnected wiring, or short-circuit or sticking (valve open)												
	27	Malfunction of ignition signal system												
	28	Incorrectly grounded ground strap, TCU, Earth No.10												
	29	PCSV damaged or disconnected wiring, or short-circuit												
	30	PCSV damaged or disconnected wiring (valve open)		⊗	⊗	⊗		X	X					
	31	LUCCSV damaged or disconnecting wiring (valve closed)												
	32	LUCCSV short-circuit or sticking (valve open)					⊗							
	33	Malfunction of overdrive control switch												
	34	Malfunction of accelerator switch, or improper adjustment												X
	35	Malfunction of oil-temperature sensor												
	36	Malfunction of lead switch												
	37	Poor contact of ignition switch												
	38	Malfunction of transmission control unit												X

NOTE: ⊗ indicates items of high priority during inspection.
Abbreviations: TPS = Throttle position sensor. SCSV = Shift control solenoid valve.

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FAULT DIAGNOSIS CHART CONT.

	Transmission malfunction of shift-shock (after start-off)														Abnormal noise, other					
	Won't shift from 2nd to 3rd	Won't shift to 4th	Overdrive control switch doesn't function	Doesn't shift according to shift pattern (shifting is possible)	Improper start-off (starts off from 2nd etc)	Excessive creeping or idling vibration	Excessive vibration-shock when shift 1-2 or 3-4	Excessive vibration-shock when shift 2-3 or 4-3	Excessive vibration-shock during upshift	Excessive vibration-shock during D-2 downshift	Sudden engine rpm increase during upshift	Sudden engine rpm increase during 3-2 shift excessive vibration	Excessive vibration-shock only when cold	Excessive vibration-shock (other than already described)	Lock up clutch won t function	Abnormal vibration in high-load region in low gear (approx. 1Hz)	Abnormal noise from convertor housing together with engine rpm	Mechanical noise (clatter noise) from convertor housing	Abnormal noise inside transmission case	3rd gear is held
1						X														
2					X		X	X	X	X			X	X		X	X			
3		X			X															X
4					X											X	X			
5												X						X		
6																				
7																			X	
8																				
9																		X		
10	X	X									X	X								X
11												X								X
12											⊗	⊗		X						X
13	X			X	X		X	X	X	X	X	X	X	X	X	X				X
14	X							X	X		X									X
15																				X
16							X				X	X								X
17							X				X	X		X						
18										X										X
19																				X
20		⊗					X			X										X
21		X			X		X	X	X											X
22				⊗			X	X	⊗	X	⊗	X		X	X	X				
23							X	X	X	X	X	X		X	X	X				X
24				X											X	X				X
25							X					X								X
26																				X
27							X	X	X	X	X	X		X	X					
28							X	X	X											X
29																				X
30	X	X									X	X								X
31															X					
32																X				X
33		X	X																	
34					X	X									X					
35														X	X	X				
36																				X
37				X																X
38	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X

PSCV = Pressure control solenoid valve. LUCCSV = Lock up clutch control solenoid valve.

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TEST PROCEDURE

The Transaxle Electronic Control unit has up to six "Fail-safe" codes and up to 26 self diagnosis codes.

These codes can be read by connecting a voltmeter (analog type) or the multi-use-tester to the diagnosis connector of the vehicle.

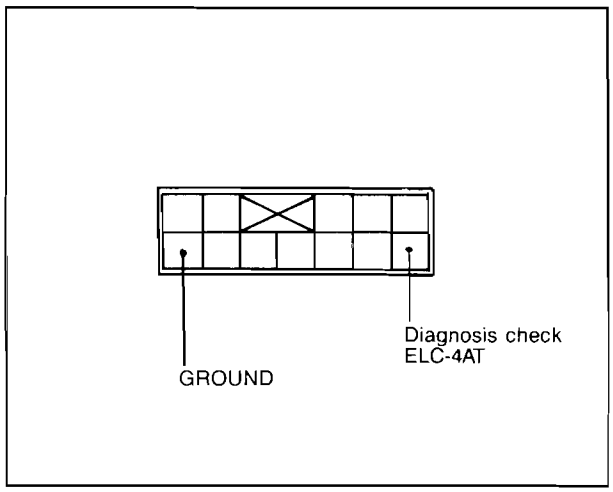


Fig. 1—Self diagnosis terminals

Voltmeter Test

(1) Connect a voltmeter across the terminals shown in Fig. 1.

(2) Turn the ignition switch ON.

(3) If the diagnosis item has been stored in the memory, the code is shown with the following output pattern, refer Fail-safe and self diagnosis charts this section.

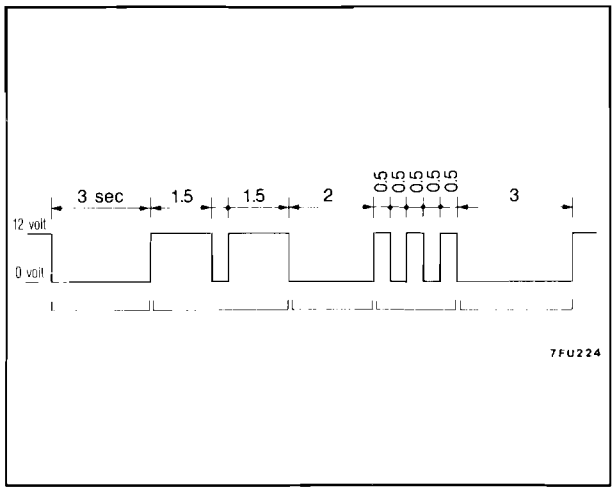


Fig. 2—Fault diagnosis code (example)

ROAD TEST PROCEDURE CHART

Order	Operation	Check item
1	Turn the ignition key to "ON".	Voltmeter indicator fluctuates at 0.5 sec. intervals if no fault found.
2	Start the engine.	The voltmeter indicator fluctuation continues as normal pattern if no fault found.
3	With the engine speed at 1,500 r.p.m. move the selector lever from "P" to "R".	There should not be any abnormal feeling of shifting impact.
4.	With the engine idling, shift from "R" to "N".	Same as above.
5.	With the engine speed at 1,500 r.p.m. shift from "N" to "D".	Same as above.
6.	Engine idling (with the selector lever still in "D" and the Power (PWR)/Economy (ECO) select switch set to the "Economy (ECO)" position).	"Creeping" should be small. (4.5 m or less in 5 seconds.)
7	Accelerate to 70 km/h with the accelerator fully open.	Shift from "1" to "2". Specified vehicle speed 38-48 km/h.
		There should be no abnormal feeling of shifting impact.
8	Drive the prescribed course at 70 km/h. (Continue for 20 seconds or more.)	Shift from "2" to "3" and then from "3" to "4" (overdrive). There should be no abnormal feeling of shifting impact. After stopping, use the voltmeter to check whether there is an abnormal condition.
9	Switch the overdrive switch to OFF at the same time the accelerator is fully closed (when the accelerator pedal is released).	Shift from 4th to 3rd to increase the engine speed.
10	Shift from "D" to "2" after checking item 9.	Shift from 3rd to 2nd to increase the engine speed.
11	Shift from "2" to "L" after checking item 10.	Shift from 2nd to 1st. Specified vehicle speed 39-49 km/h.
12	Stop the vehicle (let engine idle).	Check to be sure that there is no malfunction display pattern shown by the voltmeter.
13	Turn the ignition key to OFF.	Stop the engine.

FAIL-SAFE SYSTEM

The transmission control unit has a fail-safe function that provides control to achieve maximum vehicle safety in the event of an electronic circuit failure or malfunction, or error caused by the driver. The controls and construction are as described below.

(1) The circuit that supplies hydraulic pressure to the friction elements that don't couple simultaneously is composed of a switching valve device that cannot supply hydraulic pressure simultaneously so that there is no internal locking of the gear train.

(2) Even if there is an attempted shift to R (reverse) while the vehicle is moving forward at a speed of 7 km/h or higher, the hydraulic pressure to the low-reverse brake is electrically interrupted so that the shift cannot be made. As a result, there is, unlike previously, no damage to the transmission and no engine stall.

(3) In case the transmission control unit detects any of the following states, it considers that particular state a "failure" and provides control (Locked in 3rd gear or 2nd gear; reverse is available) depending on the item considered a failure.

NOTE: up to three fail-safe code items are stored in the transmission control unit memory and they can be read in the same way as the self-diagnosis.

FAIL-SAFE DIAGNOSIS CHART

Fail-safe output code		Description	Fail-safe measure	Note (relation to self-diagnosis)
Code No.	Display pattern			
*81		Open-circuited pulse generator A	Locked in 3rd (D) or 2nd (2, L)	When code No. 31 is generated 4th time.
82		Open-circuited pulse generator B	Locked in 3rd (D) or 2nd (2, L)	When code No. 32 is generated 4th time.
83		Open-circuited or shorted shift control solenoid valve A	Locked in 3rd	When code No. 41 or 42 is generated 4th time.
84		Open-circuited or shorted shift control solenoid valve B	Locked in 3rd	When code No. 43 or 44 is generated 4th time.
85		Open-circuited or shorted pressure control solenoid valve	Locked in 3rd (D) or 2nd (2, L)	When code No. 45 or 46 is generated 4th time.
86		Gear shifting does not match the engine speed	Locked in 3rd (D) or 2nd (2, L)	When either code No. 51, 52, 53 or 54 is generated 4th time.
—	No level change of output	Transmission control unit failure	Locked in 3rd	—

NOTE: Codes marked * are only used on F4A33 transmissions all other codes apply to both F4A23 and F4A33 transmissions.

SELF DIAGNOSIS SYSTEM

There are up to 26 diagnosis items, a maximum of 10 items can be stored in memory, in the order that they occur. The memory is supported by a power supply directly connected to the battery, so that it is retained even after the ignition switch is turned to the OFF position.

To clear the memory once an inspection has been completed, disconnect the negative (—) battery terminal for 10 seconds or longer.

Code No.	Output pattern (for voltmeter)	Description	Remedy
		Normal.	
11		Excessively high throttle postion sensor output.	• Check the throttle-position sensor connector. • Check the throttle position sensor itself. • Adjust the throttle position sensor. • Check the accelerator switch (No. 24: output or not).
12		Excessively low throttle position sensor output.	
13		Throttle position sensor malfunction.	
*14		Improperly adjusted throttle position sensor system.	
15		Open-circuit in the low-temperature side of the oil temperature sensor system.	• Oil temperature sensor connector inspection. • Oil temperature sensor inspection.
*16		Short-circuit in the high-temperature side of the oil temperature sensor circuit.	
*17		Open-circuit in the high-temperature side of the oil temperature sensor circuit or short in the low-temperature side circuit.	
21		Open-circuit kickdown servo switch circuit.	• Check the kickdown servo switch connector. • Check the kickdown servo switch.
22		Shorted-circuit kickdown servo switch circuit.	
23		Open-circuit pulse pickup cable circuit.	• Check the ignition pulse signal line.
24		Open-circuited or improperly adjusted accelerator switch.	• Check the accelerator switch connector. • Check the accelerator switch itself. • Adjust the accelerator switch.

NOTE: Codes marked * only apply to F4A33 transmissions all other codes apply to both F4A23 and F4A33 model transmissions.

Self Diagnosis System cont.

Code No.	Output pattern (for voltmeter)	Description	Remedy
*31		Open circuit pulse generator A.	• Check pulse generator A or B. • Check the vehicle speed reed switch (for chattering).
32		Open circuit pulse generator B.	
41		Damaged or disconnected wiring of the shift control solenoid valve A system.	• Check the solenoid valve connector. • Check shift control solenoid valve A itself. • Check the shift control solenoid valve A drive circuit harness.
42		Short circuit of the shift control solenoid valve A system.	
43		Damaged or disconnected wiring of the shift control solenoid valve B system.	• Check the solenoid valve connector. • Check shift control solenoid valve B itself. • Check the shift control solenoid valve B drive circuit harness.
44		Short circuit of the shift control solenoid valve B system.	
45		Damaged or disconnected wiring of the pressure control solenoid valve system.	• Check the solenoid valve connector. • Check the pressure control solenoid valve itself. • Check the pressure control solenoid valve drive circuit harness.
46		Short circuit of the pressure control solenoid valve system.	
47		Damaged or disconnected wiring of the lock up clutch control solenoid valve system.	• Check the solenoid valve connector. • Check the lock up clutch control solenoid valve itself. • Check the lock up clutch control solenoid valve drive circuit harness.
48		Short circuit of the lock up clutch control solenoid valve system.	
49		Malfunction of the lock up clutch system.	• Check the lock up clutch control solenoid valve drive circuit harness. • Check the lock up clutch hydraulic pressure system. • Check the lock up clutch control solenoid valve itself. • Replace the control unit.
51		First gear non-synchronous.	• Check the pulse generator output circuit harness. • Check the pulse generator connector. • Check pulse generator A and pulse generator B themselves. • Rear clutch slippage.

NOTE: Codes marked * only apply to F4A33 transmissions all other codes apply to both F4A23 and F4A33 model transmissions.

Self diagnosis system cont.

Code No.	Output pattern (for voltmeter)	Description	Remedy
52		Second gear non-synchronous.	• Check the pulse generator A output circuit harness. • Check the pulse generator A connector. • Check the pulse generator A itself. • Kickdown brake slippage.
53		Third gear non-synchronous	• Check the pulse generator A output circuit harness. • Check the pulse generator connector. • Check the pulse generator A and pulse generator B themselves. • Front clutch slippage. • Rear clutch slippage.
54		Fourth gear non-synchronous	• Check the pulse generator A output circuit harness. • Check the pulse generator A connector. • Check the pulse generator A itself. • End clutch slippage.
61		Short circuited torque reduction request signal line or open-circuit torque reduction execution signal	• Check torque reduction request signal line. • Check torque reduction execution signal line.
62		Open-circuited torque reduction request signal line	• Check torque reduction execution signal line.
63		Short-circuited torque reduction execution signal line	• Check torque reduction execution signal line.

SELF DIAGNOSIS AND FAIL-SAFE CODE CHART

Code No. / Possible Cause	Self diagnosis and fail-safe codes																								
												81	82	83		84		85					86		
	11	12	13	14	15	16	17	21	22	23	24	31	32	41	42	43	44	45	46	47	48	49	51	52	53	54
ATF level																							●	●	●	●
ATF condition																							●	●	●	●
Oil pump																							●	●	●	●
Torque converter																										
Lock up clutch																						●				
Front clutch																									●	
Rear clutch																							●		●	
End clutch																										
One-way clutch																										
L/R brake																										
K/D brake																							●	●	●	●
Planetary-gear set																										
Idler gear																										
Output shaft																							●		●	
Differential																										
Valve body																						●	●	●	●	●
Transmission case																										
Housing gasket																										
Oil pan gasket																										
Rear cover O-ring																										
Plug seals																										
Manual linkage																										
Connector connection	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
P.G — A																							●	●	●	●
P.G. — B																							●		●	
Inhibitor switch																										
O/D switch																										
Accelerator switch	●	●	●	●							●															
Ignition pulse signal										●																
T.P.S.	●	●	●	●																						
K/D servo switch								●	●																	
Oil temperature sensor					●	●	●																			
Vehicle speed reed switch																										
A/C relay signal																										
P/E select switch																										
LUCCSV																				●	●	●				
PCSV																		●	●							
SCSV — A														●	●											
SCSV — B																●	●									
TCU												●	●									●	●			

DIAGNOSIS PROCEDURE USING MULTI-USE-TESTER (M.U.T.)

(1) Connect the MUT to the Self diagnosis connector located near the fuse box on the driver's side.

(2) Connect the MUT to power supply.

(3) With the ignition ON or the engine running select the model using the NO key or the Up arrow or by model number i.e.

MAGNA 2.6 CARB	TP/TR MDL
MAGNA 2.6 MPI	TR MDL
VERADA 3.0 V6	KR MDL

(4) Then the YES key.

(5) Then select the system i.e. ELC–4AT using the YES key.

(6) Then select the desired function i.e.

* 1. Self diagnosis.
* 2. Service data.
* 3. Actuator Test.
* 4. Special Test.
* 5. Erase Code.

The features of these functions are:

*1 Self diagnosis. If no self diagnosis fault is recorded in the memory, the MUT tester will display "NO TROUBLE CODE" on the screen. If a self diagnosis fault is recorded, the tester will identify the faulty system, by fault code number and name. Repair the fault displayed.

NOTE: Multiple faults can be displayed.

CAUTION: If no self diagnosis fault is displayed it does not necessarily mean that there is "NO FAULT" to be found. It is advisable to perform a service data test.

(7) Press CLEAR key to go back to the Function menu.

(8) *2 Select Service Data.

a. Select desired component to be tested by using the Up/Down arrowed keys.
b. Refer to service data charts for available outputs.
c. If a service data item tested is faulty, fix or repair as necessary.
d. Press CLEAR key to return to function menu.

(9) *3 Select Actuator Test and test as per chart. If fault is found repair as necessary.

(10) Press CLEAR to return to function menu.

(11) *4 Select Special Test.

The only test you may use for automatic transaxle is DRIVE RECORDER as follows:

a. Choose the sensor you wish to record.

NOTE: Maximum of 4 sensors at a time can be recorded.

b. Select trigger method.
c. Drive vehicle.
d. Set trigger.
e. Review recorded data to identify fault.

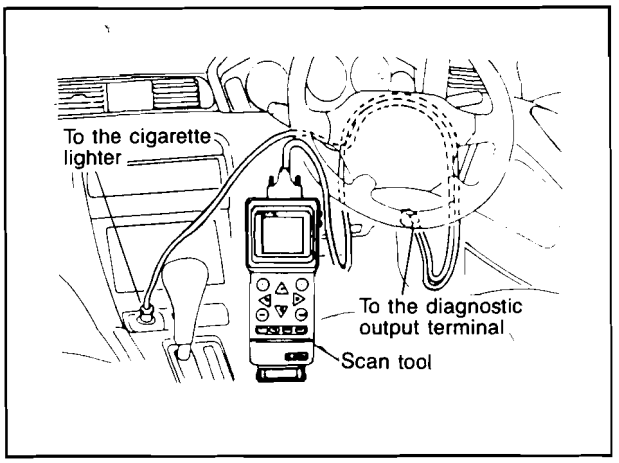


Fig. 3—MULTI-USE-TESTER

* 5. Erase Code

DIAGNOSIS ERASE PROCEDURE USING MULTI-USE-TESTER (MUT)

The diagnosis erase is available on systems with diagnosis codes. Use the diagnosis erase feature as follows:—

(1) Connect the MUT to the self diagnosis connector located near the fuse bay on the driver's side.
(2) Turn the ignition switch OFF and then turn it ON.
(3) Select the vehicle model and then select the system.
(4) Select 4 "Special Test".
(5) Select 5 "Diagnosis Erase".
(6) To the prompt "Erase Diagnosis Code?" and press YES.
(7) Enter the code nominated on the tester and press YES.
(8) If successful, the diagnosis codes will be erased.
(9) Press clear to return to the menu.

Service Data

This function outputs the control unit input/output data to the diagnosis connector as a serial signal. This signal can be read by connecting the multi-use-tester, to the self-diagnosis connector.

Item No.	Service data item	Unit
11	Throttle position sensor output	mV
15	Oil temperature sensor output	°C
21	Kickdown servo switch output	ON–OFF
23	Engine speed (Ignition coil)	RPM
24	Accelerator switch output	ON–OFF
25	Idle switch	ON–OFF
26	Air conditioner relay signal	ON–OFF
27	Shift gear	4th-3rd-2nd-1st-C*
31	Kickdown drum speed (P.G. — A)	RPM
32	Transfer shaft speed (P.G. — B)	RPM
35	Overdrive switch output	OD–OD OFF
36	POWER/ECONOMY select switch output	POWER–ECONOMY
37	Shift lever position	P–R–N–D–2–L
38	Vehicle speed reed switch output	Km/h
45	Pressure control duty ratio	%
47	Lock up clutch slippage amount (LUCCSV)	RPM
49	Lock up clutch duty ratio (LUCCSV)	%
*C — Stands for Drive Stationary.		

SERVICE DATA OUTPUT CHART

Check items	Check procedures		Probable cause (or remedy) if a malfunction is found
	Check conditions	Normal value	
Throttle position sensor (TPS) • Data reading • Item No. 11	Accelerator fully released	0.3 – 1.0 V	• TPS is incorrectly adjusted if voltage is high during fully closed or fully open • TPS or circuit harness malfunction if there is no change • TPS or accelerator wire malfunction if the change is not smooth
	Accelerator slowly depressed	Changes occur according to degree of opening	
	Accelerator fully depressed	4.5 – 5.5 V	
Oil temperature sensor • Data reading • Item No. 15	Engine cold (before starting)	Corresponding to outside air temperature	• Oil temperature sensor or circuit harness malfunction
	Engine warming up (during driving)	Gradual increase	
	After engine warmed up	80 – 110°C	
Kickdown servo switch • Data reading • Item No. 21	L range; idling	ON	• Kickdown servo improperly adjusted • Kickdown servo switch or circuit harness malfunction • Kickdown servo malfunction
	D range; 1st or 3rd gear	ON	
	D range; 2nd or 4th gear	OFF	
Ignition signal line • Data reading • Item No. 23	N range; idling	600 – 800 r/min	• Ignition system malfunction • Ignition signal pick-up circuit harness malfunction
	N range; 2,500 r/min. (tachometer reading)	2,400 – 2,600 r/min.	
Accelerator switch • Data reading • Item No. 24	Accelerator fully closed	ON	• Accelerator switch incorrectly adjusted • Accelerator switch or circuit harness malfunction
	Accelerator slightly depressed	OFF	
Idle switch • Data reading • Item No. 25	Accelerator fully closed	ON	• TPS is incorrectly adjusted • TPS or circuit harness malfunction
	Accelerator slightly depressed	OFF	
Air conditioner relay signals • Data reading • Item No. 26	D range; air conditioner switch ON	ON	• Air conditioner power relay ON signal-detection circuit harness malfunction
	D range; air conditioner switch OFF	OFF	
Transmission gear position • Data reading • Item No. 27	D range; idling	C	• TCU malfunction • Accelerator switch system malfunction • Inhibitor switch system malfunction • TPS system malfunction
	L range; idling	1ST	
	2 range; 2nd gear	2ND	
	D range; overdrive-OFF; 3rd gear	3RD	
	D range; overdrive; 4th gear	4TH	
Pulse generator A • Data reading • Item No. 31	D range; stopped	0 r/min.	• Pulse generator A opr circuit harness malfunction • Pulse generator A shielded line malfunction • Kickdown brake slippage
	D range; driving at 50 km/h in 3rd gear	1,600 – 2,000 r/min.	
	D range; driving at 50 km/h in 4th gear	1,100 – 1,400 r/min.	
Pulse generator B • Data reading • Item No. 32	D range; stopped	0 r/min.	• Pulse generator B or circuit harness malfunction • Pulse generator B shielded line malfunction
	D range; driving at 50 km/h in 3rd gear	1,600 – 2,000 r/min.	
	D range; driving at 50 km/h in 4th gear	1,600 – 2,000 r/min.	

SERVICE DATA OUTPUT CHART — continued

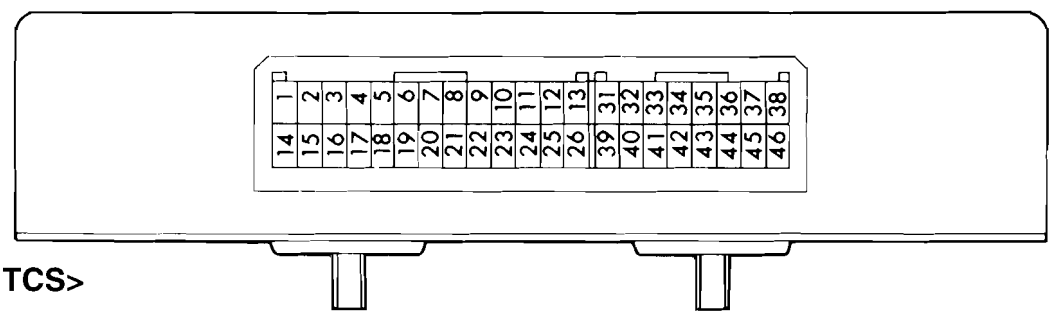
Check items	Check procedures		Probable cause (or remedy) if a malfunction is found
	Check conditions	Normal value	
Over drive switch • Data reading • Item No. 35	Overdrive switch: ON	OD	• Overdrive switch or circuit harness malfunction
	Overdrive switch: OFF	OD-OFF	
Power/Economy select switch • Data reading • Item No. 36	Selection of the Power pattern (including during E pattern control when oil temperature is low)	Power	• Power/Economy select switch or circuit harness malfunction
	Selection of the Economy pattern	Economy	
Inhibitor switch • Data reading • Item No. 37	Shift to P range	P	• Inhibitor switch improperly adjusted • Inhibitor switch or circuit harness malfunction • Manual control cable malfunction
	Shift to R range	R	
	Shift to N range	N	
	Shift to D range	D	
	Shift to 2 range	2	
	Shift to L range	L	
Vehicle speed reed switch • Data reading • Item No. 38	Vehicle stopped	0 km/h	• Vehicle speed reed switch malfunction if high-speed signals emitted while vehicle is stopped • Otherwise, vehicle speed reed switch or circuit harness malfunction
	Driving at 30 km/h	30 km/h	
	Driving at 50 km/h	50 km/h	
PCSV duty • Data reading • Item No. 45	D range; idling	50 – 70%	• Duty should become 100% when, while idling in D range, accelerator is pressed even slightly • TCU malfunction • TPS malfunction • Accelerator switch system malfunction
	D range; 1st gear	100%	
	D range; during shift	Changes occur according to conditions	
Amount of lock up clutch slip • Data reading • Item No. 47	D range, 3rd gear 1500 r/min (reading on tachometer)	100 – 300 r/min	• Lock up clutch is defective • Ignition signal line or pulse generator system is defective • Transmission hydraulic pressure is inadequate • LUCCSV is defective
	D range, 3rd gear 3500 r/min. (reading on tachometer)	0 r/min.	
LUCCSV duty • Data reading • Item No. 49	D range, 3rd gear 1500 r/min (reading on tachometer)	0%	• Transmission control unit is defective • TPS system is defective • Pulse generator B system is defective
	D range, 3rd gear 3500 r/min (reading on tachometer)	Change according to negative load	

Actuator Test

This function activates the actuator on a compulsory basis by sending the signal from the Multi-Use Tester to the control unit.

ACTUATOR TEST PROCEDURE CHART

Item	Content
Applicable actuator (Item No.)	Pressure control solenoid valve (01).
Transmitted command	To energize solenoid for 5 seconds at 50% duty.
Conditions for energization	When following conditions are all met. 1. Vehicle speed 0 km/h 2. Shift lever at "D" position 3. Accelerator switch ON 4. Throttle opening 10% or less
Conditions for cancelling energization	When one or more energization conditions are not met or when 5 seconds have elapsed after the command has been sent.
Application	With the transmission in place in the vehicle and the engine at idle, the hydraulic pressure characteristics at 50% duty of pressure control solenoid valve can be checked (for use in an oil pressure test).



<With TCS>

14. Pressure control solenoid valve
15. Shift control solenoid valve B
16. Wide open throttle switch <L H drive vehicles only>
17. Communication line to engine
18. Communication line to engine
19. —
20. Idle position switch
21. Throttle position sensor
22. —
23. Oil temperature sensor
24. Sensor earth
25. Power source
26. Earth

1. Lock-up clutch control solenoid valve
2. Shift control solenoid valve A
3. —
4. Communication line to engine
5. —
6. —
7. Kickdown servo switch
8. Air conditioner relay signal
9. Diagnosis output terminal
10. Pulse generator B output
11. Diagnosis control terminal
12. Power source
13. Earth

39. Power source (Backup)
40. Vehicle speed reed switch
41. Pulse generator (B)
42. Pulse generator (B)
43. Pulse generator (A)
44. Pulse generator (A)
45. Earth
46. Ignition pulse

31. Inhibitor switch (P)
32. Inhibitor switch (R)
33. Inhibitor switch (N)
34. Inhibitor switch (D)
35. Inhibitor switch (2)
36. Inhibitor switch (L)
37. Overdrive switch
38. Power mode signal

Control unit terminal locations with TCS

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FLUID LEVEL

Incorrect fluid level can cause a variety of conditions/problems. If fluid level is low it allows the pump to take in air with the fluid, if fluid level is high the gears churn up the oil, producing foam which allows the pump to take in air. As in any hydraulic system air bubbles can be compressed making the fluid "spongy". This results in low pressures which build up only slowly, transaxle overheating and fluid varnishing. Fluid foaming can also result in fluid leakage from the dipstick area which may be mistaken for a leak.

To check the fluid level, proceed as follows:

(1) Apply the park brake and with the engine idling at the specified speed and the transaxle at normal operating temperature engage each gear briefly ending with the selector at "N" Neutral.

NOTE: The transaxle must be at normal operating temperature (approximately 70° to 80°C) to obtain an accurate dipstick reading.

(2) Wipe all dirt from around the dipstick area.

(3) Withdraw the dipstick and wipe with a clean cloth. Install the dipstick, withdraw it and check the fluid level. Fluid level is correct if it is between the "HOT" range on the dipstick.

FLUID CONDITION

When checking the fluid level it is important to check fluid condition.

If the fluid smells burned or is contaminated with particles of metal or friction material, a complete transaxle overhaul is indicated.

If the fluid appears milky, it may be contaminated with water. This condition is not common, but it is possible. Since engine coolant attacks "O" rings, seals, clutches and bands, a complete overhaul is necessary.

If this condition is found, ensure that the reason for coolant leakage into the transmission fluid is rectified. Check for a leak in the transaxle oil cooler in the lower tank of the radiator by disconnecting the fluid lines and applying air pressure to the cooler—no more than 354 kPa. If a leak exists, air will bubble up through the coolant in the radiator.

Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

Electrical Test Procedure

NOTE: When performing any electrical testing on the transaxle electrical system DO NOT use a conventional 12V test lamp, as the transaxle control unit may be damaged. The only test lamp recommended is special tool E8M15-L.E.D. test lamp.

<Without TCS>

106. Pressure control solenoid valve
107. Shift control solenoid valve B
108. —
109. Power supply
110. Ground

10. Power supply (Backup)
11. Kickdown servo switch
12. Idle switch
13. —
14. Low oil temperature sensor
15. High oil temperature sensor
16. TPS-Output
17. Sensor ground
18. Vehicle speed sensor (reed switch)

58. Pulse generator (B)
59. Pulse generator (B)
60. Pulse generator (A)
61. Pulse generator (A)
62. Ground
63. Ignition pulse
64. Power mode signal

106	101
107	102
108	103
109	104
110	105
10	1
11	2
12	3
13	4
14	5
15	6
16	7
17	8
18	9
58	51
59	52
60	53
61	54
62	55
63	56
64	57

101. Lock up clutch control solenoid valve
102. Shift control solenoid valve A
103. —
104. Power supply
105. Ground

1. Ground
2. —
3. Accelerator switch
4. —
5. Signal of diagnosis output
6. Air condition ON-OFF switch
7. —
8. Diagnosis output selection
9. —

51. Inhibitor switch (P)
52. Inhibitor switch (R)
53. Inhibitor switch (N)
54. Inhibitor switch (D)
55. Inhibitor switch (2)
56. Inhibitor switch (L)
57. Overdrive switch

Fig. 4 — Control unit terminal locations without TCS

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ELECTRICAL COMPONENT TESTING

Wiring/Wiring Connectors

Many faults result from open or short circuits in wiring and connectors. The importance of good clean, tight connections cannot be over emphasised.

NOTE: It is essential when any component is suspect that the associated wiring is included in tests/checks.

An accurate (preferably digital) ohmmeter and voltmeter will facilitate harness checking.

WARNING: When performing electrical tests DO NOT use a conventional 12V test lamp. The only test lamp recommended is LED test lamp, Special Tool No. E8M15.

Control Unit

A faulty control unit can cause:-
- Incorrect shift timing
- No shifting
- Poor shift quality
- No lock up clutch operation

A faulty control unit will usually cause the "fail safe" system to operate i.e. transaxle will be locked in one gear.

Performing the Self-Diagnosis Procedure is the recommended method for locating the fault.

NOTE: If a control unit is replaced, it is advisable to check the solenoid valve circuits for short circuits. Failure to do this may result in damage to the new unit.

Lock Up Clutch

A non-operating lock up clutch will cause:-
- Increased fuel consumption
- Change in engine speed : road speed ratio

Performing the "Self-Diagnosis" procedure is the recommended method for checking for a non-operating lock up clutch.

If the lock up clutch is applied constantly the engine will stall when drive or reverse is selected.

Faults in the lock up clutch system may be caused by:-
- Faulty pulse generators or wiring
- Faulty temperature sensor or wiring
- Faulty LUCCSV or wiring
- Torque converter control valve stuck
- Torque converter seized

Pulse Generators A and B (refer Fig. 5)

A faulty pulse generator may cause:-
- Incorrect shift timing
- No shifting
- No lock up clutch operation

(1) Disconnect pulse generator connector from the transaxle.

(2) Measure resistance across transaxle harness connector terminals as follows:

(a) 1 and 2 ..... 245 ± 30 ohms
(b) 3 and 4 ..... 245 ± 30 ohms

(3) If resistance is not as specified, replace the faulty pulse generator.

NOTE: When installing pulse generators ensure they are fully based in the transaxle prior to tightening retaining bolt. Any attempt to "pull" the pulse generator in using the bolt may result in breakage.

Valve Body Solenoid Valves (refer Fig. 5)

The four solenoid valves control hydraulic pressures and circuit pressure application in response to signals from the control unit.

Each solenoid can be checked for:-
(a) Resistance
(b) Activation

Replace any solenoid that does not perform as specified.

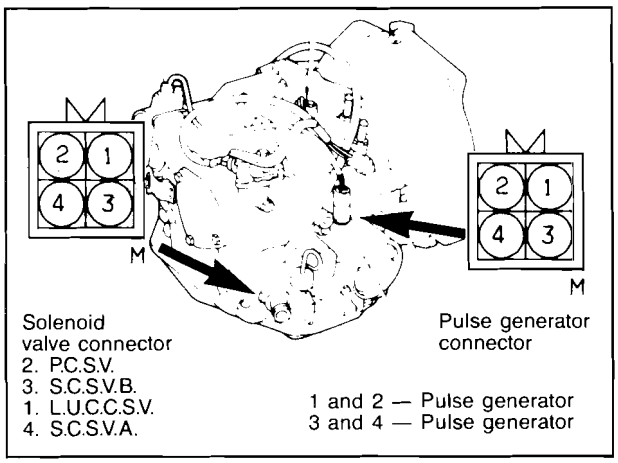


Fig. 5—Connector terminals

NOTE: Resistances quoted are measured at 20°C, resistance will vary with temperature.

Lock Up Clutch Control Solenoid Valve (LUCCSV)

A faulty LUCCSV may result in:-
- Non-application of lock up clutch
- Constant application of lock up clutch

(1) Disconnect solenoid valve connector of transaxle.

(2) Measure resistance between terminal 1 (transaxle connector) and earth, resistance should be approximately 3 ohms.

(3) Apply 12 volts between terminal 1 (positive) and transaxle case (negative), solenoid operation should be audible.

Pressure Control Solenoid Valve (P.C.S.V.)

A faulty P.C.S.V. may result in:-
- Incorrect/no hydraulic pressures
- Incorrect shift timing

(1) Disconnect solenoid valve connector at transaxle.

(2) Measure resistance between terminal 2 (transaxle connector) and earth, resistance should be approximately 3 ohms.

(3) Apply 12 volts between terminal 2 (positive) and transaxle case (earth), solenoid operation should be audible.

Shift Control Solenoid Valve (S.C.S.V.) A and B (Refer Fig. 5)

A faulty S.C.S.V. may result in:-
- Incorrect shift timing
- No selection of a particular gear

(1) Disconnect solenoid valve connector at transaxle.
(2) Measure resistance between terminal 4 (S.C.S.V. A) and earth, resistance should be approximately 23 Ohms.
(3) Measure resistance between terminal 3 (S.C.S.V. B) and earth, resistance should be approximately 23 ohms.
(4) Apply 12 volts between terminal 4 (positive) and transaxle case (earth), solenoid operation should be audible.
(5) Repeat step 4 on terminal 3.

Accelerator Pedal Switch (where fitted)

Faulty switch operation may result in:-
- Excessive idle vibration
- Excessive vehicle "creep" in drive at idle
- Poor "take off"

(1) With the pedal fully released check for continuity between terminals 1 and 2, refer Fig. 6, if an open circuit is indicated, check switch adjustment, refer Section 3, then repeat check.
(2) Check resistance with the pedal depressed, an open circuit should be indicated.
If the above conditions do not exist, replace the switch.

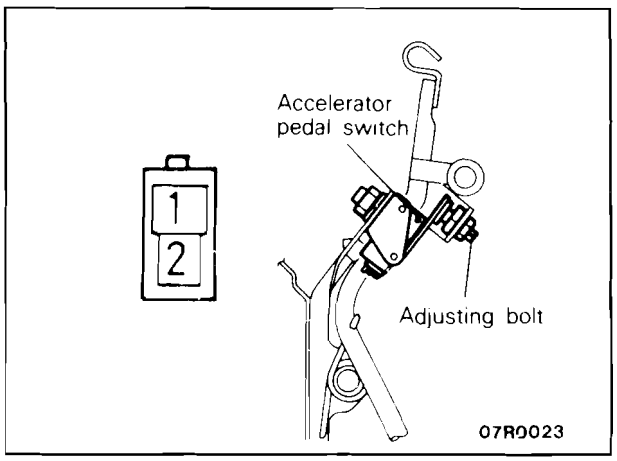


Fig. 6—Accelerator pedal switch

Kickdown Servo Switch

A faulty switch can result in:-
- Excessive shift shock
- "Flaring" between shifts
- No shift to 2nd gear

(1) With the ignition switched OFF check continuity between the switch terminal and earth, continuity should exist, if not replace the switch.
(2) With the engine idling in D (with handbrake applied), check continuity between the switch terminal and earth, if continuity exists replace the switch.

Inhibitor Switch

Faulty switch operation may result in:-
- No start in "P" or "N"
- No reverse light operation
- Incorrect gear shifts
- Incorrect shift pattern

(1) Disconnect the wiring harness from the inhibitor switch.
(2) Using an Ohmmeter check for continuity between switch terminals as shown in Fig. 8 with the gear leaver in each position indicated.
(3) If continuity does not exist replace the switch assembly.

Vehicle Speed Senor

A faulty speed sensor may fail to activate the "fail safe" system or may activate the system when no fault is present.

Reed Switch Type

(1) Remove the speedometer, refer Group 52.
(2) Connect an Ohmmeter across the terminals shown in Fig. 7.
(3) The Ohmmeter should alternate between an open and closed circuit four times per revolution.

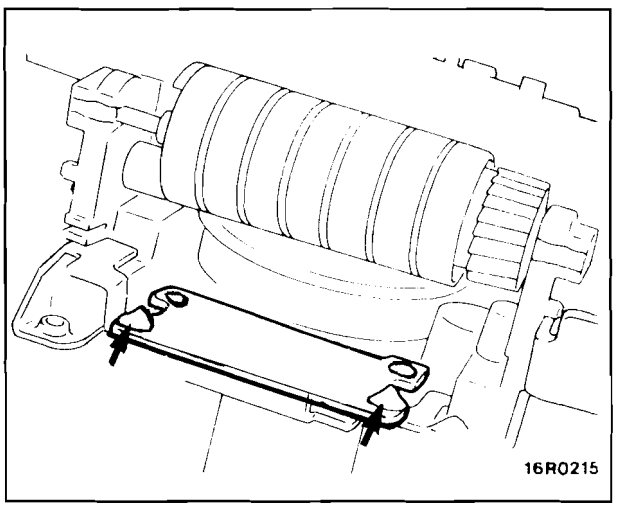
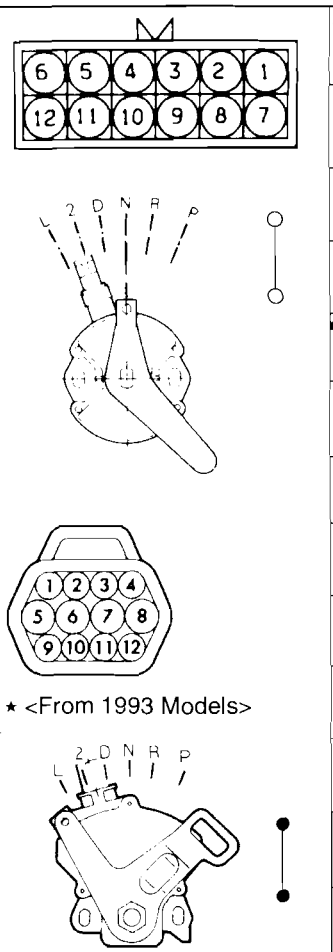


Fig. 7—Reed switch testing



Terminal No.	P	R	N	D	2	L	Connected circuit
1				○			Control unit
2		●				○	Control unit
3	● ○	● ○	● ○	● ○	● ○	● ○	Fuse No. 7
4	● ○						Control unit
5		●	○				Control unit
6		●			○		Control unit
7	●		●				Ign. Switch "ST" Terminal
8	●	○	●				Reverse lamps
9		○				●	Fuse No. 18
10	○		○	●			Starter motor "S" Terminal
11	○		○		●		Ign. switch "ST" Terminal
12		○	●				Control unit

Fig. 8 — Inhibitor switch continuity chart

Oil Temperature Sensor

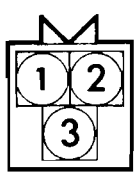
A faulty temperature sensor can result in:—
- No lock up clutch operation.
- Poor shift quality.
- Power range cannot be selected.

(1) With the ignition switch OFF, check continuity between sensor terminals 1 and 2 or 2 and 3, continuity should exist, if open circuit, replace sensor.

(2) Vary the thermo-sensitive part of the sensor from low temperature to high temperature and check the resistance between the terminals 1 and 2 or 2 and 3, the resistance should change continuously and smoothly, if not replace switch.



1. = (+) side
2. = (-) side



1. = Low temperature side
2. = Ground
3. = High temperature side

Single Temp TR/KR

Oil Temperature sensor

Temp °C	Resistance kΩ
20	Approx 2.5 to 2.7
60	Approx 0.63 to 0.69
100	Approx 0.21 to 0.23

Single Temp TS/KS

Oil Temperature sensor

Temp °C	Resistance kΩ
0	Approx 16.7 to 20.5
100	Approx 0.57 to 0.69

Dual Temp

Oil temperature sensor for cold temperature side.

Temp °C	Resistance kΩ
20	Approx 2.5 to 2.7
60	Approx 0.63 to 0.69
100	Approx 0.21 to 0.23

Oil temperature sensor for hot temperature side.

Temp °C	Resistance kΩ
20	Approx 58.5 to 65
60	Approx 11.5 to 12.7
100	Approx 3.0 to 3.6

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HYDRAULIC PRESSURE TESTING

Hydraulic pressure testing may be performed on the road or in the workshop. If testing is performed in the workshop raise the front of the vehicle and support the lower control arms on safety stands to avoid operating the drive shaft joints at excessive angles.

(1) Ensure the transaxle fluid is at normal operating temperature.

(2) Using special tool E21M71A connect a pressure gauge to the required circuit.

NOTE: Forward gears require a 1000 kPa gauge. Reverse gear requires a 3000 kPa gauge.

(3) Refer to Fig. 9 for pressure test points and Figs. 10 and 11 for correct pressure.

(4) If pressures are not to specifications refer to trouble shooting guides on the following pages.

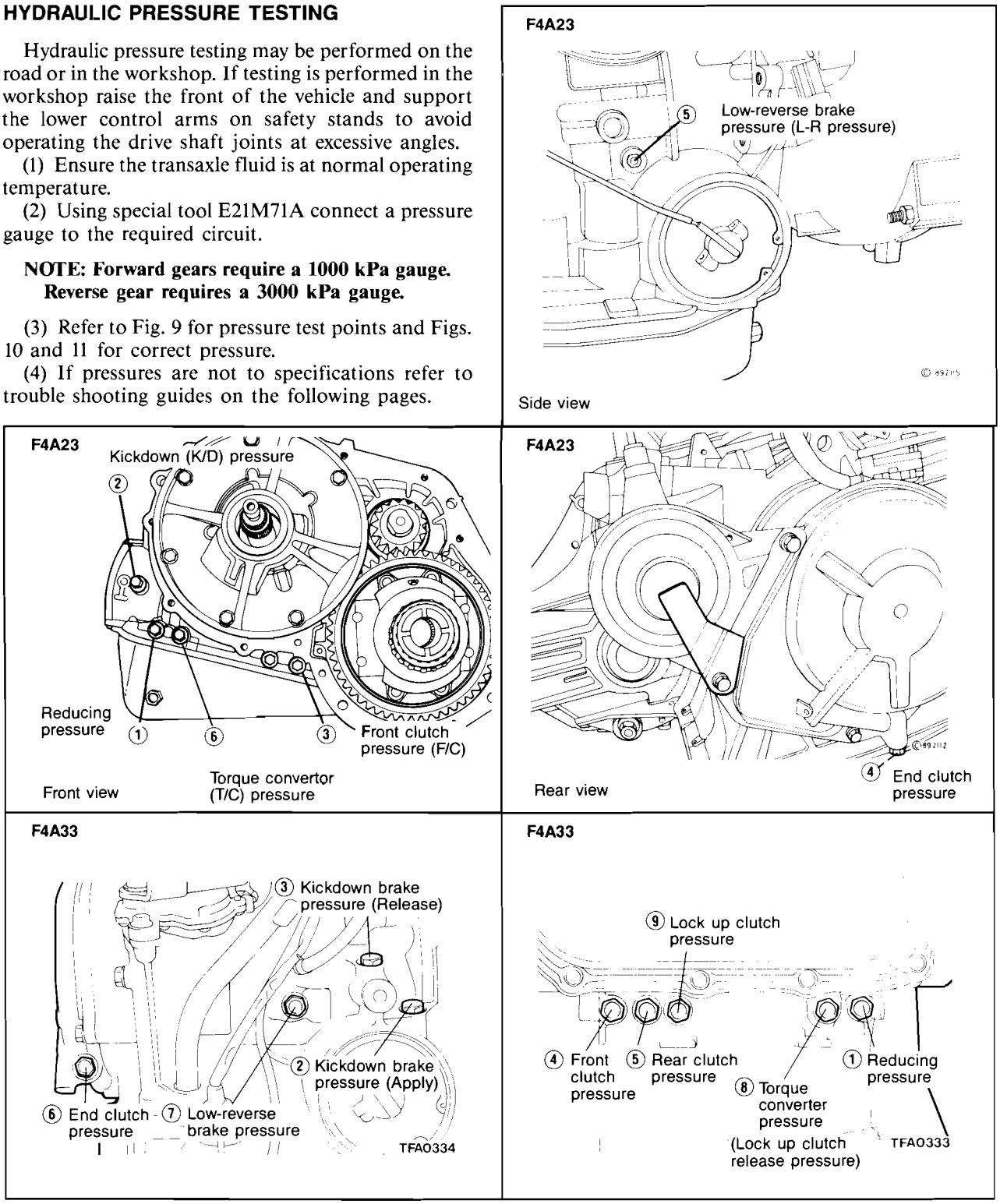


Fig. 9—Hydraulic test points

F4A23 HYDRAULIC PRESSURE TEST DIAGNOSIS		
Condition	**Possible Cause**	**Corrective Action**
ALL LINE PRESSURES HIGH OR LOW (LINE PRESSURE IS PRESSURES 2, 3, 4 AND 5)	Clogged oil filter.	Visually check oil filter, replace if necessary.
	Incorrect pressure adjustment at regulator valve.	Adjust line pressure at regulator valve.
	Regulator valve sticking.	Clean and check valve body, replace if necessary.
	Valve body bolts loose.	Tighten all valve body assembly and attaching bolts.
	Low oil pump discharge pressure.	Check oil pump clearances, replace pump assembly if necessary.
INADEQUATE REDUCING PRESSURE	Line pressure low.	Check pressure at testing point 2 and adjust if necessary.
	Clogged reducing pressure circuit filter.	Disassemble valve body and check filter. Replace filter if clogged.
	Incorrect reducing valve adjustment.	Adjust reducing pressure at the reducing valve.
	Reducing valve sticking.	Clean and check valve body, replace if necessary.
	Valve body bolts loose.	Tighten all valve body assembly and attaching bolts.
KICKDOWN BRAKE PRESSURE LOW	Kickdown servo seal ring leaking.	Disassemble kickdown servo and replace damaged rings.
	Valve body bolts loose.	Tighten all valve body assembly and attaching bolts.
	Valve body malfunction.	Clean and check valve body, replace if necessary.
FRONT CLUTCH PRESSURE LOW	Kickdown servo seal ring leaking.	Disassemble kickdown servo and replace damaged rings.
	Valve body bolts loose.	Tighten all valve body assembly and attaching bolts.
	Valve body malfunction.	Clean and check valve body, replace if necessary.
	Front clutch piston seal rings leaking.	Disassemble front clutch, replace damaged seal rings.
	Front clutch piston or retainer worn.	Replace worn components.
END CLUTCH PRESSURE LOW	End clutch seal rings leaking.	Disassemble end clutch, replace damaged seal rings.
	Valve body bolts loose.	Tighten all valve body assembly and attaching bolts.
	Valve body malfunction.	Clean and check valve body replace if necessary.

F4A23 HYDRAULIC PRESSURE TEST DIAGNOSIS CONT.

Condition	Possible Cause	Corrective Action
LOW-REVERSE BRAKE PRESSURE LOW	"O" ring between centre support and transaxle case damage.	Replace "O" ring.
	Valve body bolts loose.	Tighten all valve body assembly and attaching bolts.
	Low-reverse brake seal rings damaged or leaking.	Disassemble low-reverse brake and replace damaged seal rings.
	Valve body malfunction.	Clean and check valve body replace if necessary.
	Valve body "O" ring damaged or leaking.	Replace "O"ring.
TORQUE CONVERTER PRESSURE LOW	Lock up clutch control solenoid valve (LUCCSV) or lock up clutch control valve sticking.	Check operation of solenoid valve and control valve.
	Clogged or leaking oil cooler or hoses.	Repair or replace cooler and/or hoses.
	Damaged input shaft seal rings.	Replace damaged seal rings.
	Faulty torque converter.	Replace torque converter.

F4A23

No.	Conditions			Standard oil pressure kPa					
	Select lever position	Engine speed rpm	Shift position	① Reducing pressure	② Kickdown brake pressure	③ Front clutch pressure	④ End clutch pressure	⑤ Low-reverse brake pressure	⑥ Torque-convertor pressure
1	N	Idling	Neutral	360–490	—	—	—	—	☆
2	D	Idling	2nd gear	360–490	100–210 (250–310)*	—	—	—	☆
3	D (SW-ON)	Approx. 2,500	4th gear	360–490	830–900	—	830–900	—	350–450
4	D (SW-OFF)	Approx. 2,500	3rd gear	360–490	830–900	830–900	830–900	—	350–450
5	2	Approx. 2,500	2nd gear	360–490	830–900	—	—	—	350–450
6	L	Approx. 1,000	1st gear	360–490	—	—	—	300–420	☆
7	R	Approx. 2,500	Reverse	360–490	—	1640–2240	—	1640–2240	350–450
		Approx. 1,000				1,500		1,500 or more	

NOTE
– must be 10 kPa . . . or less.
SW-ON: Switch ON the overdrive control switch
SW-OFF: Switch OFF the overdrive control switch

☆: Hydraulic pressure is generated, but not the standard value
* This pressure is generated when PCSV is driven at 50% duty using MUT.

Fig. 10—Hydraulic test pressures F4A23

F4A33 HYDRAULIC PRESSURE TEST DIAGNOSIS

Condition	Probable Cause	Corrective Action
1. Line pressures are all low (or high). NOTE * "Line pressures" refers to oil pressure ②, ③, ④, ⑤, ⑥, and ⑦, in the "Standard oil pressure table" on page 23-2-26.	Clogging of oil filter.	Visually inspect the oil filter; replace the oil filter if it is clogged.
	Improper adjustment of oil pressure (line pressure of regulator valve).	Measure line pressure ② (kickdown brake pressure); if the pressure is not the standard value, readjust the line pressure, or, if necessary, replace the valve body assembly.
	Functional malfunction of valve body assembly	Replace the valve body assembly.
	Looseness of valve body tightening part.	Tighten the valve body tightening bolt and installation bolt.
	Improper oil pump discharge pressure.	Check the side clearance of the oil pump gear; replace the oil pump assembly if necessary.
2. Improper reducing pressure	Clogging of the filter (L-shaped type) of the reducing-pressure circuit.	Disassemble the valve body assembly and check the filter; replace the filter if it is clogged.
	Improper adjustment of oil pressure	Measure the ① reducing pressure; if it is not the standard value, readjust, or replace the valve body assembly.
	Functional malfunction of the valve body assembly.	Replace the valve body assembly.
3. Improper kickdown brake pressure (Apply)	Malfunction of the seal ring Ⓐ, D-ring Ⓑ or seal ring Ⓒ of the sleeve of the kickdown servo piston.	Disassemble the kickdown servo and check whether the seal ring or D-ring is damaged. If it is cut or has scratches, replace the seal ring or D-ring.
	Functional malfunction of the valve body assembly.	Replace the valve body assembly.
4. Improper kickdown brake pressure (Release)	Malfunction of the seal ring Ⓐ, D-ring Ⓑ or seal ring Ⓒ of the sleeve of the kickdown servo piston.	Disassemble the kickdown servo and check whether the seal ring or D-ring is damaged. If it is cut or has scratches, replace the seal ring or D-ring.
	Functional malfunction of the valve body assembly.	Replace the valve body assembly.
5. Improper front clutch pressure	Malfunction of the seal ring Ⓐ, D-ring Ⓑ or seal ring Ⓒ of the sleeve of the kickdown servo piston.	Disassemble the kickdown servo and check whether the seal ring or D-ring is damaged. If it is cut or has scratches, replace the seal ring or D-ring.
	Functional malfunction of the valve body assembly.	Replace the valve body assembly.
	Wear of the front clutch piston or retainer, or malfunction of the D-ring Ⓓ or seal ring Ⓔ.	Disassemble the transmission itself and check whether or not there is wear of the front clutch piston and retainer inner circumference, or damage of the D-ring and/or seal ring. If there is any wear or damage, replace the piston, retainer, D-ring and/or seal ring.

F4A33 HYDRAULIC PRESSURE TEST DIAGNOSIS CONT.

Condition	Probable Cause	Corrective Action
6. Improper rear clutch pressure.	Malfunction of D-ring Ⓕ of rear clutch piston, retainer seal ring Ⓖ and seal rings Ⓗ and Ⓘ of input shaft.	Disassemble the rear clutch, check input shaft seal ring, retainer seal ring, piston D ring, etc. and replace broken or damaged parts.
	Functional malfunction of the valve body assembly.	Replace the valve body assembly.
7. Improper end clutch pressure	Malfunction of seal ring Ⓙ or the D-ring Ⓚ and/or oil seal Ⓛ of end clutch.	Disassemble the end clutch and check the oil seal or D-ring of the piston, seal ring of the retainer, etc.; replace if there are cuts, scars, scratches or damage.
	Functional malfunction of the valve body assembly.	Replace the valve body assembly.
8. Improper low-reverse brake pressure	O-ring between valve body and transmission damaged or missing.	Remove the valve body assembly and check to be sure that the O-ring at the upper surface of the upper valve body is not missing or damaged; install or replace the O-ring if necessary.
	Functional malfunction of the valve body assembly.	Replace the valve body assembly.
	Malfunction of the D-ring Ⓜ of the low-reverse brake piston or the Ⓝ of the retainer.	Disassemble the transmission itself and check the D-ring and O-ring for damage; replace if there are cuts, scars, scratches or damage.
9. Improper torque converter pressure	Clogging or leaking of the oil cooler and/or piping.	Repair or replace, as necessary, the cooler and/or piping.
	Malfunction of the torque converter.	Replace the torque converter.

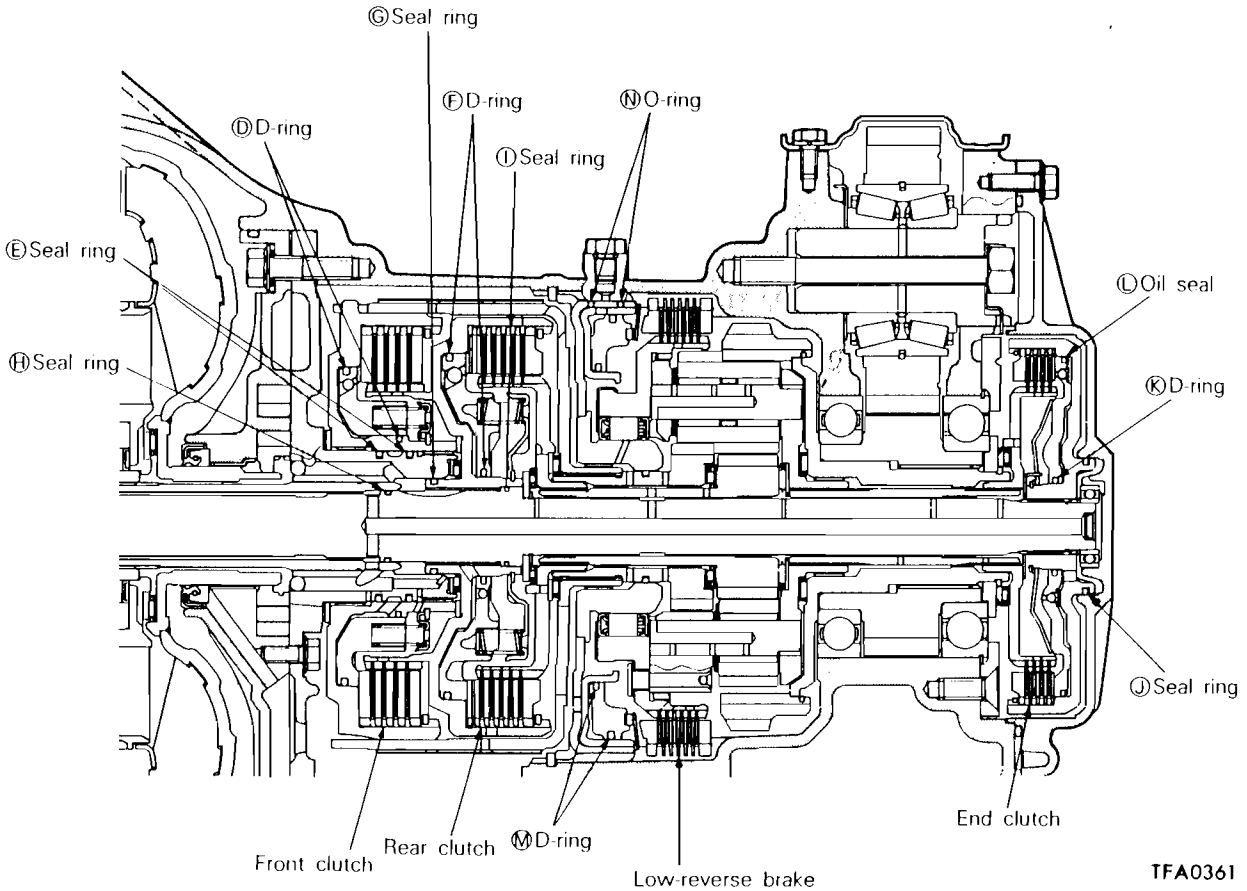
F4A33

No.	Conditions			Standard oil pressure kPa							
	Select lever position	Engine speed rpm	Shift position	① Reducing pressure	② Kickdown brake pressure (Apply)	③ Kickdown brake pressure (Release)	④ Front clutch pressure	⑤ Rear clutch clutch pressure	⑥ End Clutch clutch pressure	⑦ Low-reverse reverse brake pressure	⑧ Torque-converter pressure
1	N	Idling	Neutral	360–480	—	—	—	—	—	—	☆
2	D	Idling	2nd gear	360–480	100–210 (250–310)*	—	—	730–830	—	—	☆
3	D (SW-ON)	Approx. 2,500	4th gear	360–480	830–900	—	—	—	830–900	—	450–650
4	D (SW-OFF)	Approx. 2,500	3rd gear	360–480	830–900	830–900	830–900	830–900	830–900	—	450–650
5	2	Approx. 2,500	2nd gear	360–480	830–900	—	—	830–900	—	—	450–650
6	L	Approx. 1,000	1st gear	360–480	—	—	—	830–900	—	300–450	☆
7	R	Approx. 2,500	Reverse	360–480	—	1640–2240	1640–2240 233–319	—	—	1640–2240	450–650
		Approx. 1,000				1500 or more	1500 or more			1500 or more	

NOTE
– must be 10 kPa . . . or less.
SW-ON: Switch ON the overdrive control switch
SW-OFF: Switch OFF the overdrive control switch

☆: Hydraulic pressure is generated, but not the standard value
* This pressure is generated when PCSV is driven at 50% duty using MUT.

Fig. 12—Hydraulic test pressures F4A33



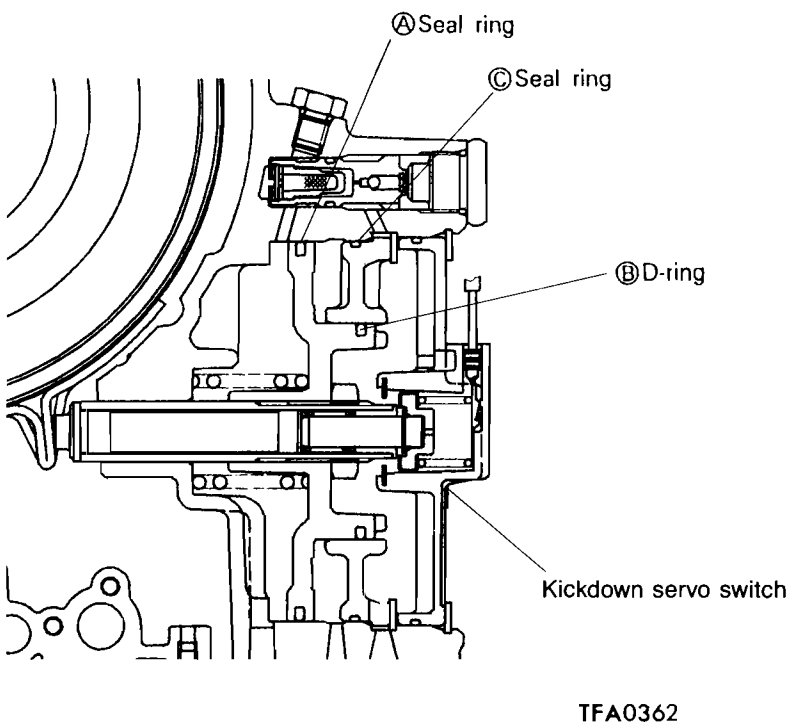


Fig. 11—Component location F4A33

TORQUE CONVERTER STALL TEST

The stall test involves determining the maximum engine speed obtained at full throttle in "D" or "R" with the vehicle held.

The test checks torque converter stator overrunning clutch operation and the holding ability of clutches and brakes.

WARNING: While performing this test allow no-one to stand in front of or behind the vehicle.

(1) Ensure transaxle and engine are at operating temperature.
(2) Check transaxle fluid level.
(3) Chock the rear wheels.
(4) Attach engine tachometer and support so that it is visible from the drivers seat.
(5) Apply parking and service brakes fully.
(6) Start engine and select "D".
(7) Fully depress accelerator pedal and read maximum engine r.p.m.

CAUTION: Do not hold throttle open longer than is necessary to obtain maximum engine r.p.m. and NEVER LONGER THAN EIGHT SECONDS AT A TIME.

Always allow the transaxle to cool down between tests by running the engine at 1000 r.p.m. in neutral.

(8) Stall speed should be 1800 to 2800 r.p.m.
(9) Select "R" and repeat step 7.

Diagnosis

(1) If stall speed is higher than specified in "D" the rear clutch is slipping.
(2) If stall speed is higher than specified in "R" the front clutch or low-reverse band is slipping.
(3) If stall speed is lower than specified and is the same in "D" or "R" insufficient engine output is indicated, or the torque convertor overrunning clutch is slipping.

SECTION 3 — MAINTENANCE AND ADJUSTMENT

LUBRICATION

Fluid Level

The dipstick is located in the right front section of the engine compartment. To check the level, use the following procedure:

Apply the parking brake and with the engine idling and transaxle at normal operating temperature, engage each gear briefly, ending with the selector in "N" neutral.

NOTE: The transaxle must be at normal operating temperature to obtain an accurate dipstick reading.

Withdraw the dipstick and wipe clean with a lint free cloth. Install the dipstick into the transaxle case, withdraw and check the level. The level must be within the "hot" range on the dipstick, refer Fig. 1.

CAUTION: Avoid entry of dirt into the transaxle by ensuring that the dipstick is properly seated. Maintaining the transaxle to the correct level with the recommended fluid is essential for correct operation of the unit.

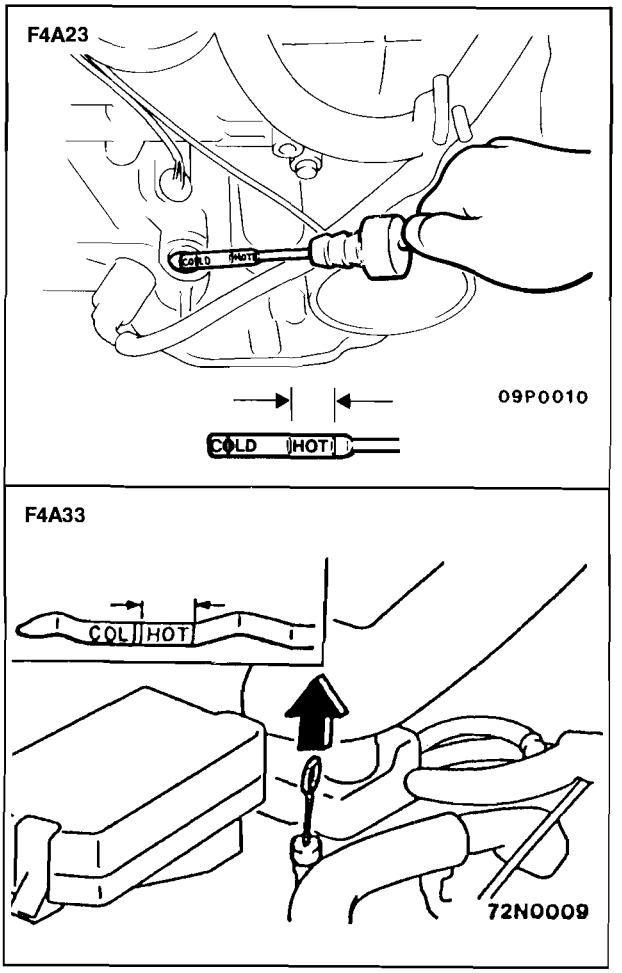


Fig. 1—Automatic transaxle fluid level

Fluid Changing Procedure

(1) Raise the vehicle and place a large drain tray under the differential and oil pan drain plugs.

(2) Remove the drain plugs and allow the fluid to drain, refer Fig. 2.

(3) Remove the oil pan retaining bolts and remove the oil pan.

(4) Check the oil filter for clogging or damage and replace if necessary.

(5) Install the drain plugs and tighten to specified torque.

(6) Clean the transaxle case gasket surface and oil pan and the five magnets in pan.

(7) Install the five magnets free from dust to the five recesses provided in the oil pan.

(8) Install the oil pan with a new gasket, tighten bolts to the specified torque.

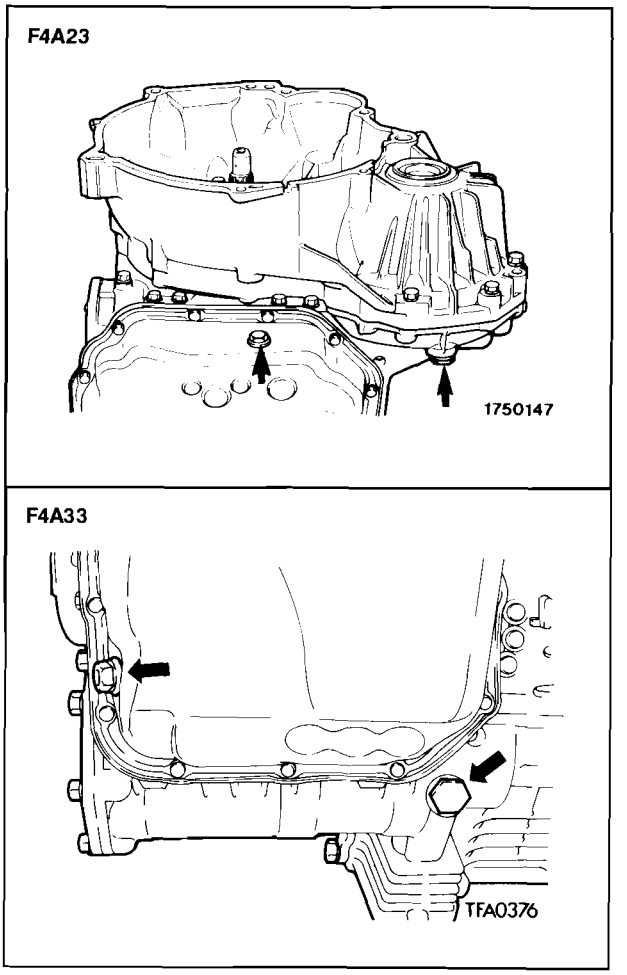


Fig. 2—Transaxle drain plugs

(9) Initially pour 4 litres of the specified A.T.F. into the transaxle through the dipstick hole.

(10) Start the engine and allow to idle for at least two minutes. With the park brake on, move the selector lever momentarily to each position ending in "N" neutral position.

(11) Add sufficient A.T.F. to bring the fluid level to the lower mark on the dipstick. Re-check fluid level after the transaxle has reached operating temperature. The fluid level should be between the upper and lower marks of the "HOT" range on the dipstick. Insert the dipstick fully to prevent dirt entry into transaxle.

ADJUSTMENTS

KICKDOWN BAND ADJUSTMENT

(1) Thoroughly clean the kickdown servo cover and surrounding area.
(2) Disconnect the kickdown servo switch harness connector.
(3) Remove the snap ring, refer Fig. 3.

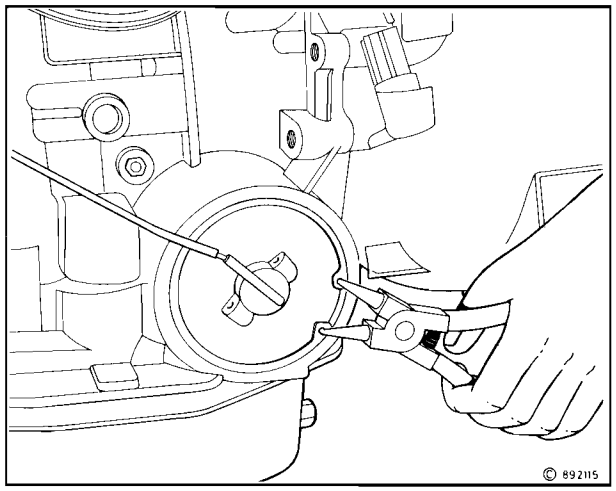


Fig. 3—Removing kickdown servo cover snap ring

(4) Using suitable pliers, remove the cover from the transaxle, refer Fig. 4.

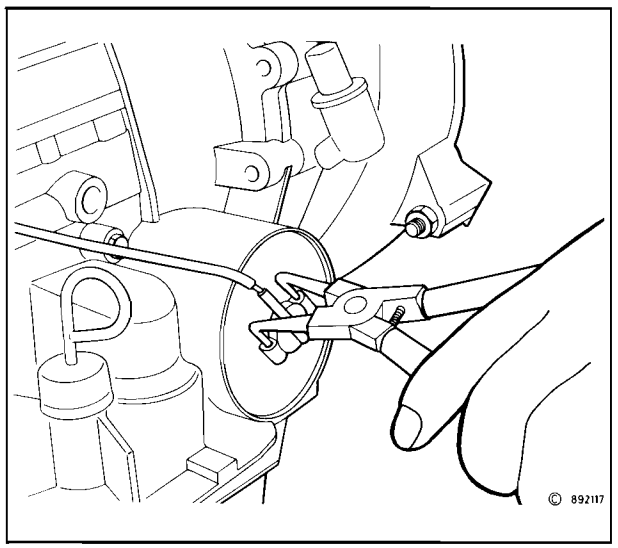


Fig. 4—Removing kickdown servo cover

(5) Using special tool E21M74B (F4A23 models) or E23M13-1 (F4A33 models) hold the piston to prevent it rotating and loosen the lock nut, refer Fig. 5.
(6) Loosen the lock nut to the "V" channel in the adjuster rod.
(7) Tighten the adjuster rod to 10 Nm using Special Tool E21M74-1 on F4A23 and F4A33 models and a suitable torque wrench and then back it off. Repeat this operation twice.

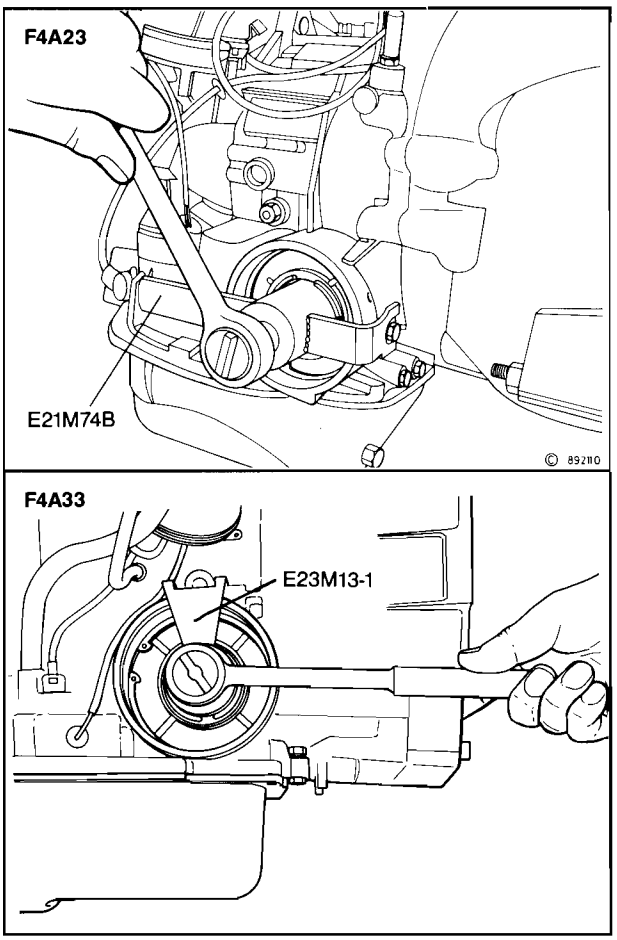


Fig. 5—Loosening the lock nut

(8) Tighten the adjusting rod to 5 Nm then back off 2 to 2¼ turns, refer Fig. 6.
(9) Tighten the lock nut to 25 to 33 Nm, while using Special Tool E21M74B on F4A23 models and E23M13-1 on F4A33 models and make sure the adjusting rod does not rotate.
(10) Install a new "D" ring in the servo cover groove.
(11) Install the cover and snap ring.

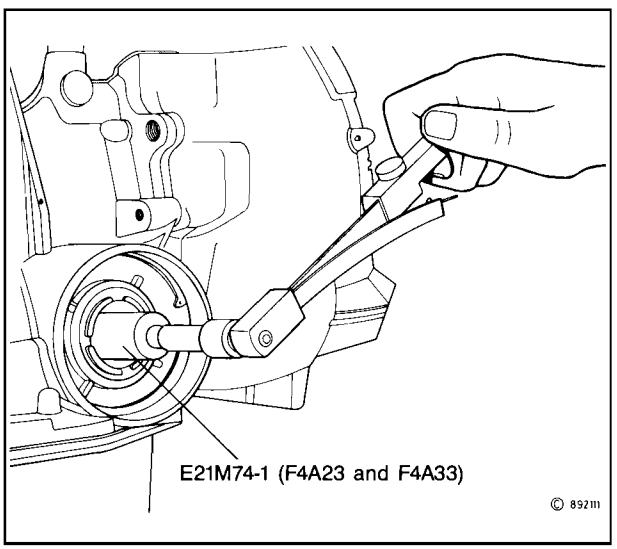


Fig. 6—Tightening adjuster rod

HYDRAULIC PRESSURE ADJUSTMENTS

Refer to Section 2 for Hydraulic test procedure and specifications.

Line Pressure

(1) Remove the oil pan drain plug and allow the fluid to drain.
(2) Remove the oil pan retaining bolts and remove the oil pan.
(3) Remove the oil filter.
(4) Remove the oil temperature sensor bolts and remove the sensor.
(5) Disconnect the solenoid valve wiring harness connector.
(6) Press the tabs of the solenoid valve harness grommet connector and push the connector into the transaxle case.

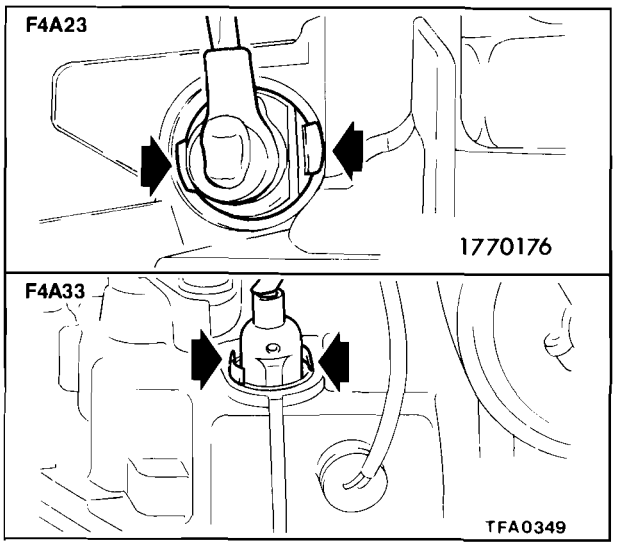


Fig. 7—Removing solenoid valve connector

(7) Remove the valve body mounting bolts, refer Fig. 8 and remove the valve body, taking care not to drop the manual valve.

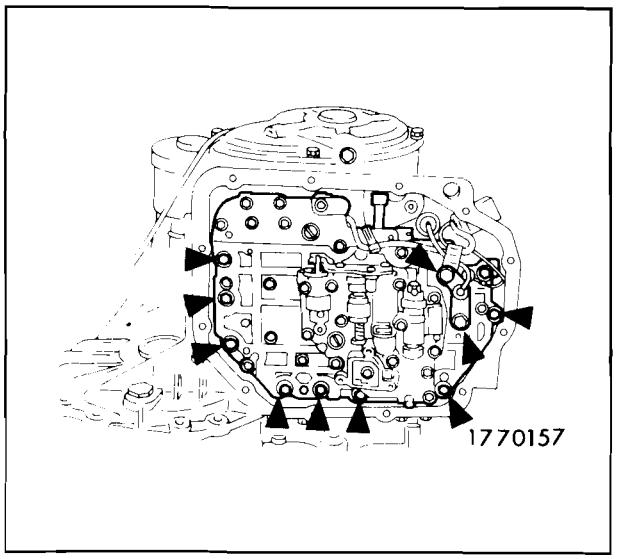


Fig. 8—Valve body mounting bolts

(8) Adjust the line pressure by turning the adjusting screw at the regulator valve, refer Fig. 9. Turn the screw clockwise to decrease line pressure or anti-clockwise to increase line pressure.

NOTE: Line pressure will change 38 kPa for each turn of the screw, both transmissions.

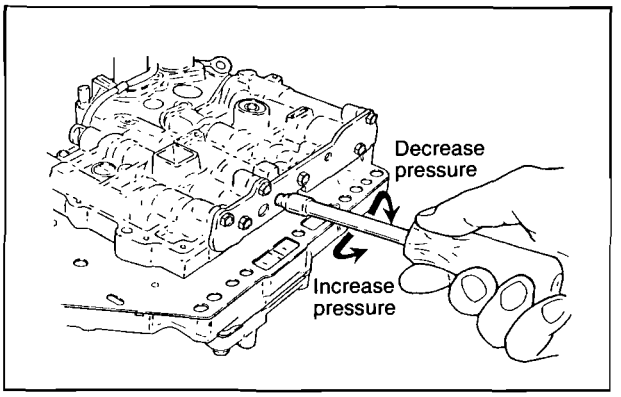


Fig. 9—Line pressure adjustment

(9) Install a new "O" ring to the location shown in Fig. 10.

(10) Fit a new "O" ring to the solenoid valve connector.

(11) Install the valve body ensuring that the manual control shaft detent plate pin is correctly located in the manual control valve recess, and insert the solenoid valve connector in the case, positioning it as shown in Fig. 11, ensuring that wiring is not trapped.
(12) Install the oil temperature sensor in the position shown in Fig. 12, install the valve body mounting bolts as shown in Fig. 13, tighten to the specified torque.

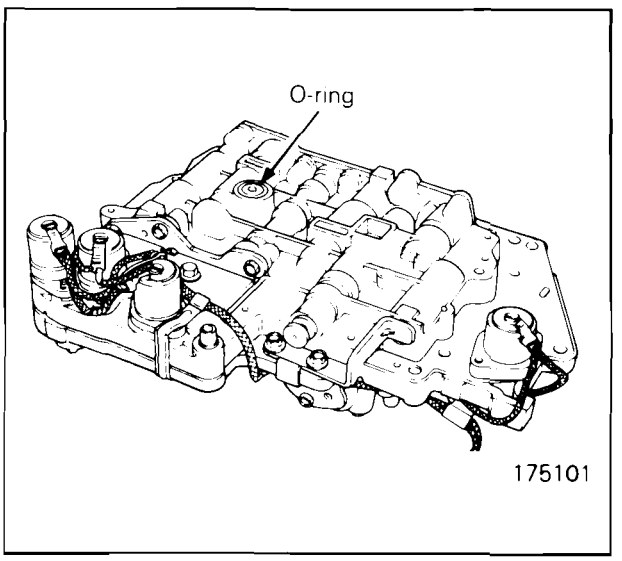


Fig. 10—"O" ring location

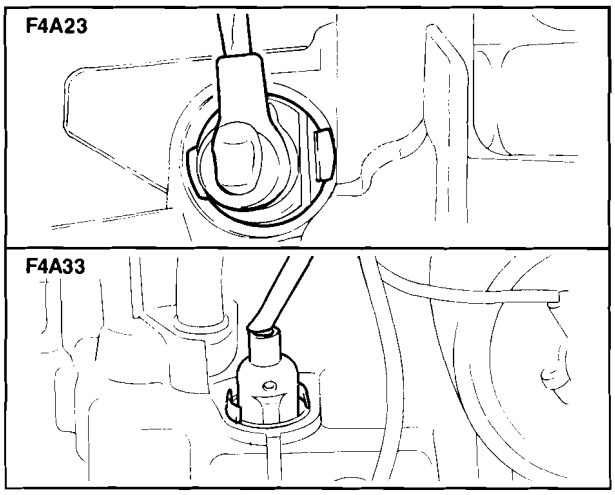


Fig. 11—Solenoid valve connector position

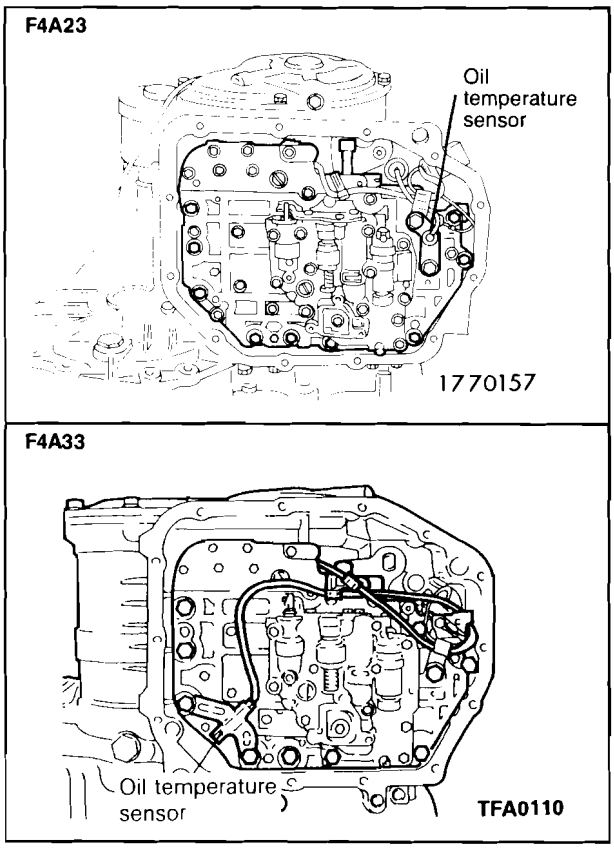


Fig. 12—Oil temperature sensor location

(13) Install the oil filter.
(14) Fit a new oil pan gasket and install the oil pan tightening the bolts to the specified torque.
(15) Install the differential drain plug.
(16) Fill the transaxle using specified A.T.F.
(17) Check line pressure using a suitable gauge and adaptor, refer to Section 2 for test procedure and specifications.

Valve body

• The length of the valve body installing bolts are as follows.

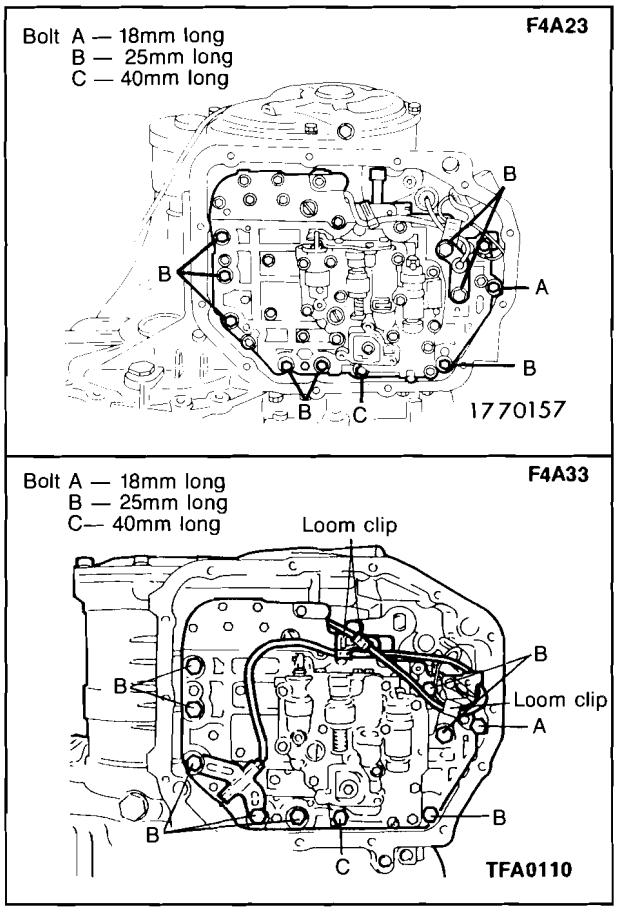


Fig. 13—Valve body bolt lengths

Reducing Pressure

(1) Perform steps 1 to 3 as outlined in "Line Pressure Adjustment".
(2) Adjust reducing pressure by turning screw shown in Fig. 14. Turn clockwise to decrease and anti-clockwise to increase pressure.

NOTE: Reducing pressure will change 45 kPa for each turn of the screw, both transmissions.

(3) Perform steps 14 to 17 as outlined in "Line Pressure Adjustment".

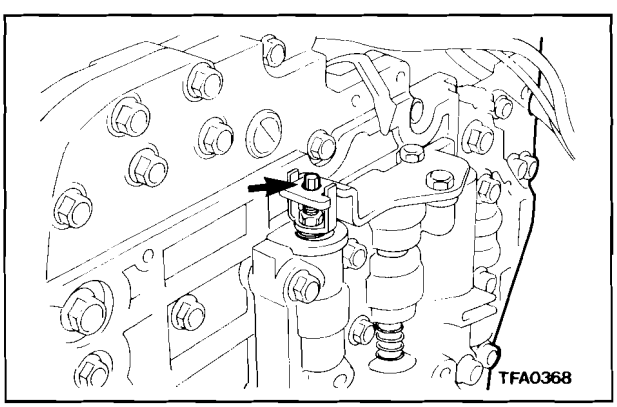


Fig. 14—Reducing pressure adjusting screw

Reducing Pressure Adjustment Using MUT

1. Using a Multi-Use-Tester, adjust the reducing pressure adjustment screw so that the kickdown brake pressure is 275±25 kPa when the pressure control solenoid is at 50% duty.

Standard Value: 275 ± 25 kPa

NOTE: Oil pressure change for each turn of the adjusting screw = 22 kPa when pressure control solenoid is activated by the MUT.

2. Check after completing this adjustment that the reducing pressure is 370 to 390 kPa.

CAUTION: The adjustment should be made at an oil temperature of 70-80°C.

If the adjustment is made at an oil temperature that is to high the line pressure will decrease during idling, give an incorrect pressure.

INHIBITOR SWITCH ADJUSTMENT

(1) Disconnect the shift control cable from the manual control lever at the transaxle.
(2) Rotate the manual control lever clockwise to the Park position.
(3) Rotate the control lever anti-clockwise two detents to select the Neutral position, refer Fig. 15.
(4) Insert a 5 mm diameter rod or drill into hole "B" of the control lever to engage in the recess of the inhibitor switch, refer Fig. 15.
(5) If the rod or drill fails to engage in the inhibitor switch recess, loosen the switch mounting bolts and rotate the switch until the rod or drill can be engaged.
(6) Tighten mounting bolts to the specified torque and remove the rod or drill.

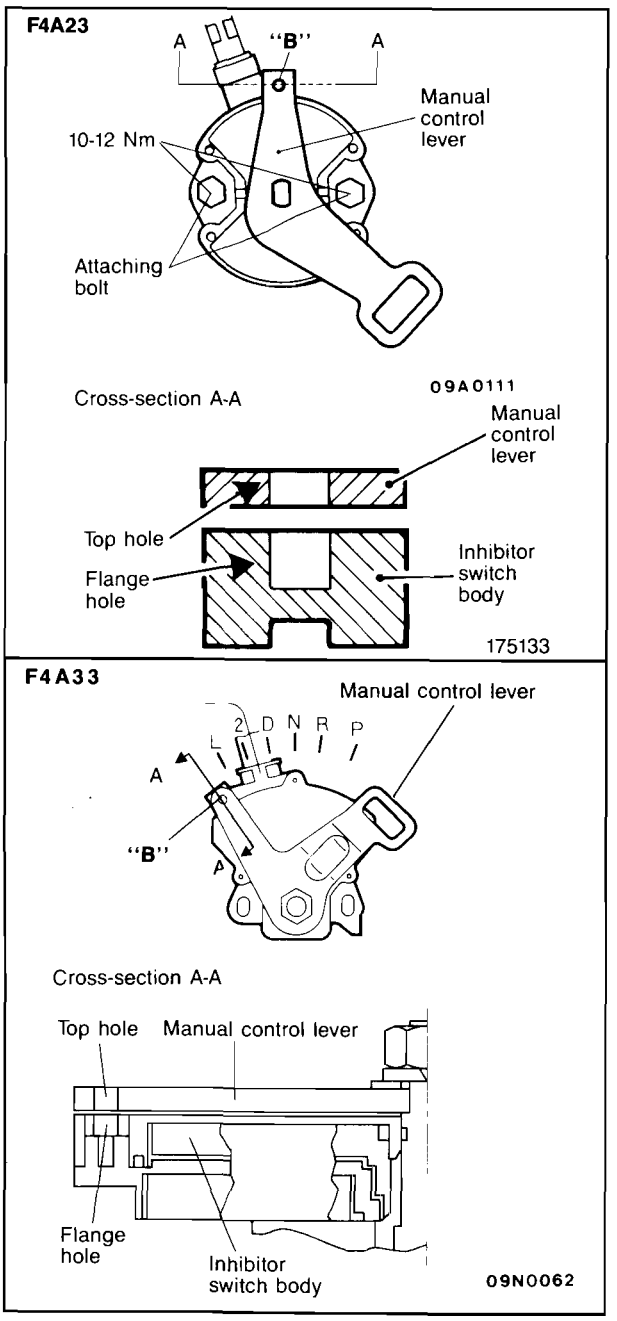


Fig. 15—Inhibitor switch adjustment

(7) Select "N" at the selector lever and loosen the control cable to manual control lever coupling adjusting nut to set the cable and lever free.
(8) Gently pull the transmission control cable in the direction of the arrow in Fig. 16 and tighten the adjusting nut to the specified torque.

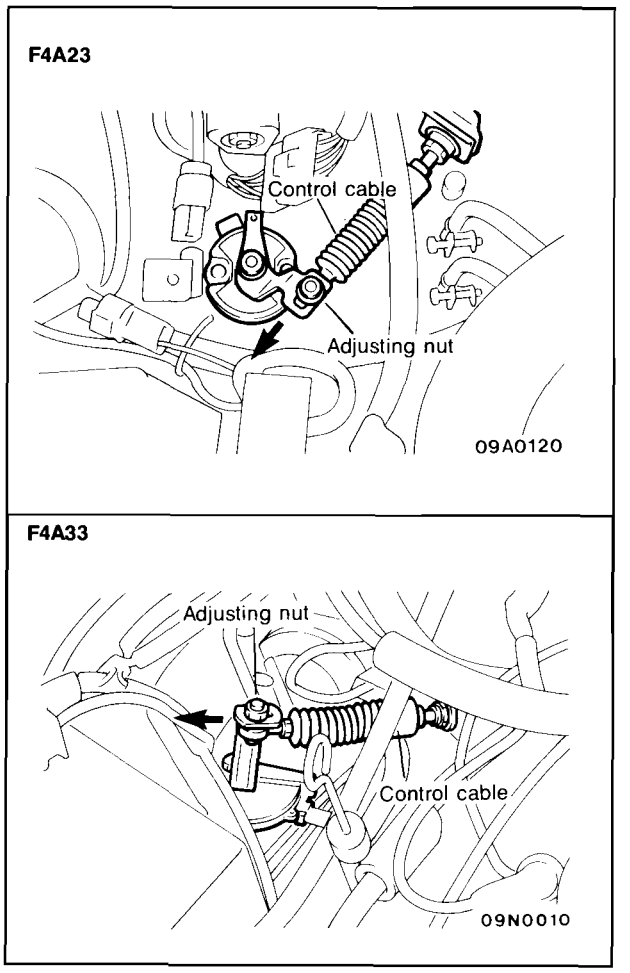


Fig. 16— Control cable adjusting nut

(9) Move the Selector lever through all positions and note that the indicator aligns with the gear ratio selected.
(10) Ensure the vehicle starter operates only in the "N" and "P" positions and the reverse lights operate in the "R" position.

THROTTLE POSITION SENSOR (T.P.S.) ADJUSTMENT WITH CARBURETTOR

Check Procedure

NOTE: To obtain accurate readings it is recommended that digital type instruments are used.

(1) Ensure that the engine is at normal operating temperature and idle speed is adjusted to specifications.
(2) With the wiring connected to the T.P.S., switch ignition ON.
(3) Using suitable probes, connect a voltmeter between terminals 1 and 2 (positive to terminal 1), refer Fig. 17, for terminal numbers.

NOTE: Use care to avoid damage to the wiring when inserting probes.

(4) Voltage should be 4.5 to 5.0 V, if voltage is not to specifications proceed as follows:
(a) Switch ignition OFF and disconnect wiring at T.P.S.
(b) Connect an ohmmeter between terminals 1 and 2 of the T.P.S. connector. Resistance should be 3.5 to 6.5 kOhms.
(c) If resistance is not as specified replace the T.P.S.
(d) If resistance is as specified check the wiring between the T.P.S. harness connector and the transaxle control unit for open or short circuits. If a fault is evident, locate and correct the fault.
(5) If voltage is as specified at step 3, check voltage between terminals 2 (negative) and 3 (positive), voltage should be 12 ± 1% of the voltage measured at step 3. If voltage is not as specified, correct using the adjusting screw, refer Fig. 17.

NOTE: To calculate percentage proceed as follows:

$$\frac{\text{Voltage between 2 and 3}}{\text{Voltage between 1 and 2}} \times 100$$

Sample calculation:

$$\frac{0.625}{4.96} \times 100 = 12.6\%$$

NOTE: If the throttle position sensor has been loosened or removed for any reason, it may be necessary to loosen and re-position the sensor to achieve the required value.

(6) With the voltmeter still connected between terminals 2 and 3, move the throttle slowly from the idle position to full open throttle. The resistance should increase slowly to between 90 and 102% of voltage measured at step 3.
(7) If any of the above conditions do not apply or correct adjustment can not be achieved the throttle position sensor should be replaced.

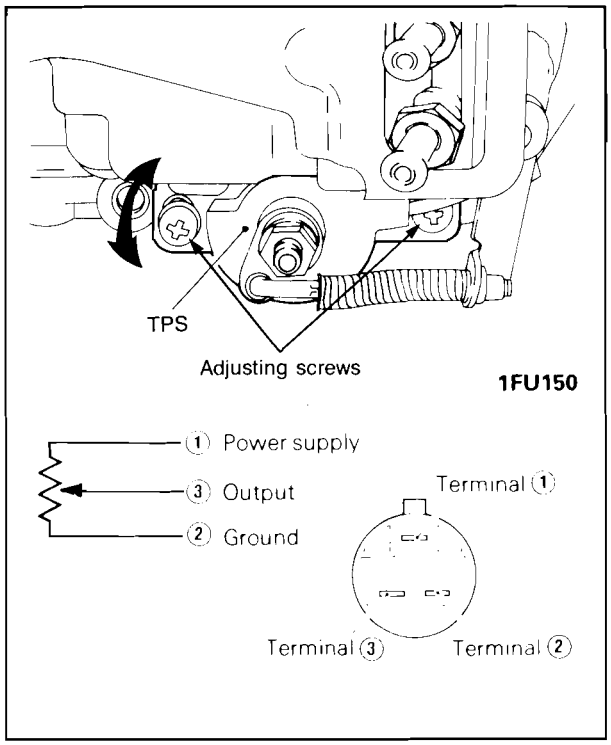


Fig. 17—Throttle position sensor

T.P.S. ADJUSTMENT ECI-MULTI

Refer Group 13—Section 2.

ACCELERATOR PEDAL SWITCH ADJUSTMENT (Where fitted)

(1) Start engine and run until normal operating temperature is reached.
(2) Switch ignition OFF.
(3) Depress the accelerator pedal gradually to the point where the switch is turned from ON to OFF (a definite click should be audible, however if necessary an ohmmeter can be connected across switch terminals).
(4) Measure stroke B, refer Fig. 18. Stroke should be 4 to 8 mm.
(5) If necessary adjust stroke by loosening the lock nut and turning the adjusting bolt.

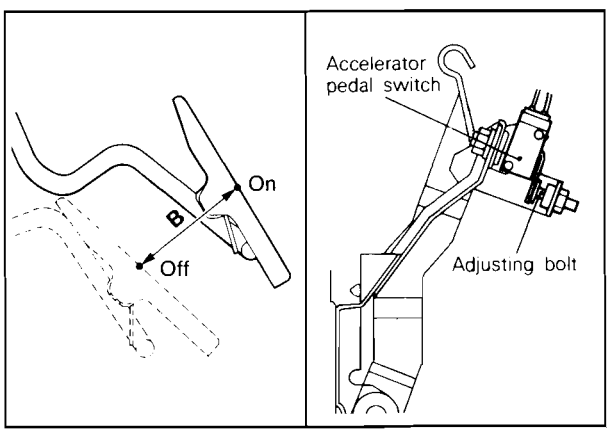


Fig. 18—Accelerator pedal switch adjustment

SECTION 4 — TRANSAXLE OVERHAUL F4A23

SPECIFICATIONS

Type	Electronically controlled 4 speed (including overdrive) automatic with torque converter and lock up clutch
Model	F4A23-K2-LPN 25 tooth spline drive shaft
Engine	4G54 Carburettor
Torque converter	
—stall torque ratio	1.90:1
—stall speed (rpm)	1800 to 2800
Lubrication	
—pump type	Involute gear
—fluid type	Mitsubishi Magna ELC-4-SP
—fluid capacity	6.1 litres
Gear ratios	
First	2.551:1
Second	1.488:1
Third	1.000:1
Fourth	0.685:1
Reverse	2.176:1
Transfer gear ratio	1.125:1
Differential ratio	3.466:1
Final drive ratio	3.900:1
Speedometer	
—drive gear teeth	36
—driven gear teeth	29
Kickdown band adjustment	Tighten to 10 Nm and back off. Repeat twice. Tighten to 5 Nm and back off as follows — 2 to 2¼ turns
Front clutch (No. of discs)	3
Rear clutch (No. of discs)	3
End clutch (No. of discs)	4
Low-reverse brake (No. of discs)	6
Input shaft end play	0.3-1.0 mm
Transfer shaft end play	0-0.025 mm
Oil pump gear side clearance	0.03-0.05 mm
Front clutch end play	0.7-0.9 mm
Rear clutch end play	0.4-0.6 mm
Low reverse brake end play	1.0-1.3 mm
Differential case pre-load	0.08-0.13 mm
Differential side gear and pinion backlash	0.025-0.150 mm
Transfer idler gear pre-load	1.5 Nm
End clutch end play	0.6-0.85 mm

SPECIFICATIONS CONT.

Pressure plate selection chart for adjustment of Low Reverse Brake end play:

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
5.6	—	MD731720	6.4	4	MD727804
5.7	Z	MD731721	6.5	5	MD731003
5.8	8	MD727801	6.6	6	MD727805
5.9	9	MD731000	6.7	7	MD731004
6.0	0	MD727802	6.8	X	MD731005
6.1	1	MD731001	6.9	A	MD734766
6.2	2	MD727803	7.0	B	MD734767
6.3	3	MD731002			

Transfer shaft END PLAY spacer selection chart:

Thickness (mm)	M.M.A.L. Part Number	Thickness (mm)	M.M.A.L. Part Number	Thickness (mm)	M.M.A.L. Part Number
1.20	MD723160	1.41	MD723167	1.62	MD723174
1.23	MD723161	1.44	MD723168	1.65	MD723175
1.26	MD723162	1.47	MD723169	1.68	MD723176
1.29	MD723163	1.50	MD723170	1.71	MD723177
1.32	MD723164	1.53	MD723171	1.74	MD723178
1.35	MD723165	1.56	MD723172	1.77	MD723179
1.38	MD723166	1.59	MD723173	1.80	MD723180

Clutch pack clearance snap ring selection chart:-

—front and rear clutches .....

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
1.6	None	MD955630	2.4	Blue	MD955634
1.8	Blue	MD955631	2.6	Brown	MD955635
2.0	Brown	MD955632	2.8	None	MD955636
2.2	None	MD955633	3.0	Blue	MD955637

—end clutch .....

1.05	White	MD715800	1.55	None	MD715802
1.30	Yellow	MD715801	1.80	Green	MD715803
2.05	Pink	MD720849			

Input shaft end play spacer selection chart:

Thrust race #3 (metal) Thickness mm	Thrust race #1 (fibre) Thickness mm	Part Number of Thrust Washer Set
1.4	1.0	MD997854
1.4	1.2	MD997847
1.8	1.4	MD997848
1.8	1.6	MD997849
2.2	1.8	MD997850
2.2	2.0	MD997851
2.6	2.2	MD997852
2.6	2.4	MD997853

SPECIFICATIONS CONT.

Differential case preload spacer selection chart:

Thickness (mm)	M.M.A.L. Part Number	Thickness (mm)	M.M.A.L. Part Number	Thickness (mm)	M.M.A.L. Part Number
1.10	MD710454	1.55	MD710464	2.00	MD715958
1.13	MD700270	1.58	MD706571	2.03	MD715959
1.16	MD710455	1.61	MD710465	2.06	MD715960
1.19	MD710456	1.64	MD710466	2.09	MD715961
1.22	MD700271	1.67	MD706570	2.12	MD715962
1.25	MD710457	1.70	MD710467	2.15	MD715963
1.28	MD710458	1.73	MD710468	2.18	MD715964
1.31	MD706574	1.76	MD706575	2.21	MD715965
1.34	MD710459	1.79	MD710469	2.24	MD715966
1.37	MD710460	1.82	MD710470	2.27	MD715967
1.40	MD706573	1.85	MD700272	2.30	MD715968
1.43	MD710461	1.88	MD710471	2.33	MD715969
1.46	MD710462	1.91	MD715955	2.36	MD715970
1.49	MD706572	1.94	MD715956	2.39	MD715971
1.52	MD710463	1.97	MD715957	2.49	MD722734
				2.45	MD722735
				2.48	MD722736

Differential pinion and side backlash spacer slection chart:

0.75-0.82 mm	MD722986	1.01-1.08 mm	MD722983
0.83-0.92 mm	MD722985	1.09-1.16 mm	MD722982
0.93-1.00 mm	MD722984		

Valve body spring identification	Wide diameter (mm)	Outside diameter (mm)	Length (mm)
Pressure control spring	0.45	7.6	21.3
Torque converter control spring	1.30	9.0	22.6
Regulator spring	1.40	15.0	52.0
Rear clutch exhaust spring	0.70	6.8	27.4
2-3 shift spring	0.80	7.0	27.5
1-2 shift spring	0.60	7.6	26.6
Relief spring	1.00	7.0	17.3
Reducing spring	1.2	8.9	29.5
N-R control spring	0.70	9.2	32.1
End clutch spring	0.60	6.6	24.4
Shift control spring	0.50	5.7	26.8
Damper clutch spring	0.70	6.2	14.2

TORQUE SPECIFICATIONS

	Nm
Transaxle mounting bracket to transaxle	60 to 80
Transaxle mounting bracket to body	40 to 50
Selector lever mounting nut	14 to 20
Starter motor mounting bolt	27 to 34
Drive shaft nut	200 to 260
Transaxle stay to engine	65 to 85
Transaxle stay to transaxle	30 to 42
Bell housing cover to engine	8 to 10
Transaxle mounting bolt (10T)	30 to 40
Transaxle mounting bolt (7T)	43 to 34
Torque converter to drive plate	73 to 77
Drive plate-to-converter tightening bolt	46 to 53
Drain plug	30 to 35
Pressure check plug	8 to 10
Pulse generator mounting bolt	10 to 12
Bearing retainer screw	17 to 22
Lock plate bolt	48 to 60
Oil cooler connector	15 to 22
Converter housing bolt	19 to 23
Oil pan bolt	10 to 12
Kickdown servo piston plate screw	6 to 8
One-way clutch outer race bolt	25 to 35
Differential drive gear bolt	130 to 140
Manual control lever nut	17 to 21
Manual control shaft set screw	8 to 10
Inhibitor switch	10 to 12
Sprag rod support bolt	20 to 27
Pump housing-to-reaction shaft support bolt	20 to 27
Oil pump assembly mounting bolt	15 to 22
Valve body bolt	4 to 6
Valve body assembly mounting bolt	10 to 12
Oil filter bolt	5 to 7
Speedometer sleeve locking plate bolt	3 to 5

SPECIAL TOOLS

E21M16	Bearing puller
E21M16D	Jaws — annulus inner gear removal
E21M83	Front clutch spring compressor
E1673MT	Bearing puller
E1673G16	Step plug — annulus and differential bearing removal
E7511A	Installer — annulus bearing and gear
E7403	Installer — differential bearing and transfer shaft output bearing
E7513B	Installer — transfer shaft input bearing
E21M36	Adaptor — idler gear shaft installation
E21M40	Installer — end clutch circlip
E9055	Installer — pump seal
E21M14A	Installer — drive shaft oil seal
E21M71A	Adaptor — oil pressure gauge
E21M43	Compressor — front clutch
E1344A	Oil pressure gauges (without adaptors)
E21M74B	Kickdown band adjustment
E21M39	Adaptor — idler gear pre-load adjustment
E21M41-1	Expander — end clutch circlip — use with E21M40
E1673 R15	Jaws — Transfer shaft bearing removal
E1673 B15	Jaws — Differential bearing removal
E1673 D15	Jaws — Transfer shaft (output end) bearing removal
E7403 (use with E7511A)	Adaptor — Bearing installer differential
E8M16	Electrical tester (3 wire)
E21M41	Remover/installer centre support
E21M44	Dial indicator extension
MB991502	Multi-use-tester
MRP-A	ROM pack

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TRANSAXLE REMOVAL

(1) Disconnect the negative (–) battery cable.
(2) Remove the air cleaner assembly.
(4) Disconnect all electrical wiring from the transaxle.
(4) Disconnect the select control cable, refer Fig. 1.

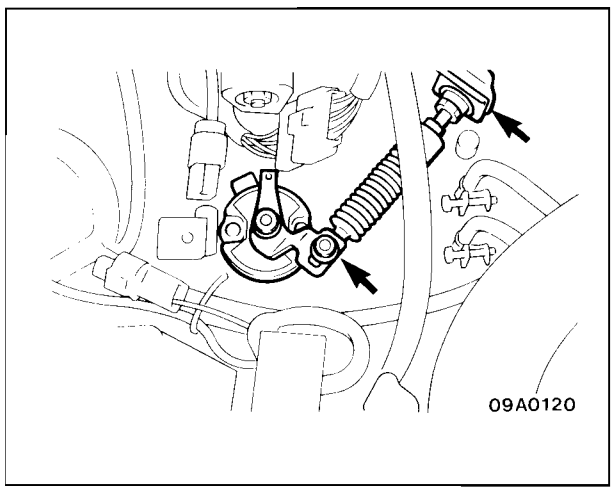


Fig. 1—Control cable removal

(5) Disconnect the speedometer cable or pulse generator wiring.
(6) Disconnect transaxle oil cooler hoses from the transaxle.

NOTE: Plug the hoses and connections to prevent the ingress of dirt and moisture.

(7) Remove the engine undercover.
(8) Remove the differential and oil pan drain plugs and drain the transaxle fluid.

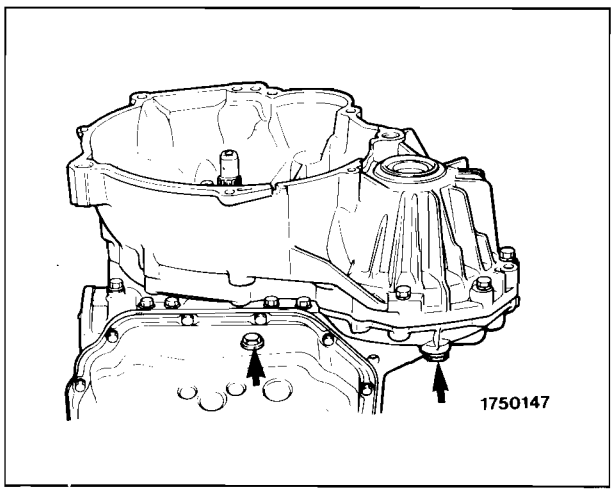


Fig. 2—Transaxle drain plug

(9) Remove the transaxle to engine attaching bolts, refer Fig. 3.

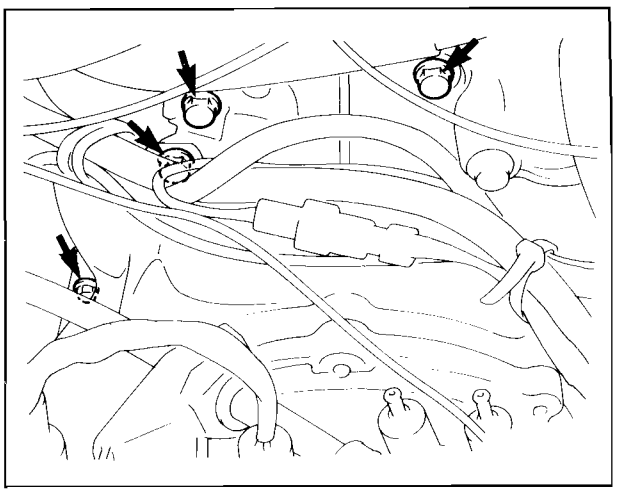


Fig. 3—Transaxle attaching bolts

(10) Disconnect the wiring and remove the starter motor.
(11) Raise the front of the vehicle and support on stands in the locations outlined in Group 00 General Information.
(12) Remove the front wheels.
(13) Using a suitable puller disconnect the lower arm and tie rod end ball joints from both knuckles.
(14) Withdraw the driveshafts from the transaxle and transfer shaft, refer Fig. 4, and support to avoid damaging the joints.
(15) Remove the transfer shaft centre support to engine attaching bolts and withdraw the transfer shaft from the transaxle.

NOTE: A pry bar is recommended for drive shaft removal. Do not insert prybar to a depth of more than 7 mm or damage to the oil seal may occur.

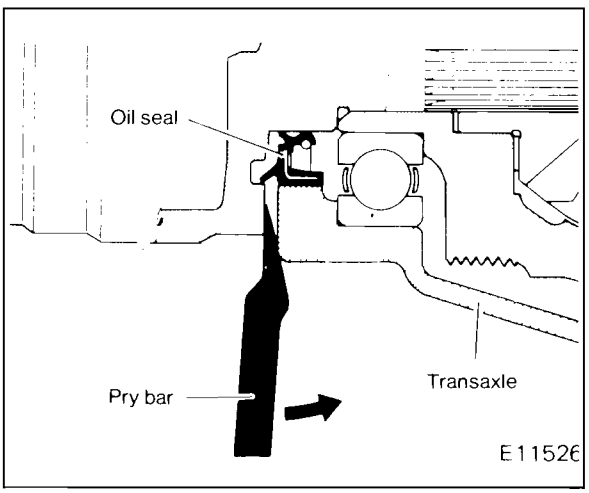


Fig. 4—Drive shaft removal

(16) Remove the crossmember (Right member). Refer Group 33.
(17) Remove the torque converter lower cover plate

(18) Remove the torque converter to drive plate attaching bolts, refer Fig. 5, and push the torque converter towards the transaxle.

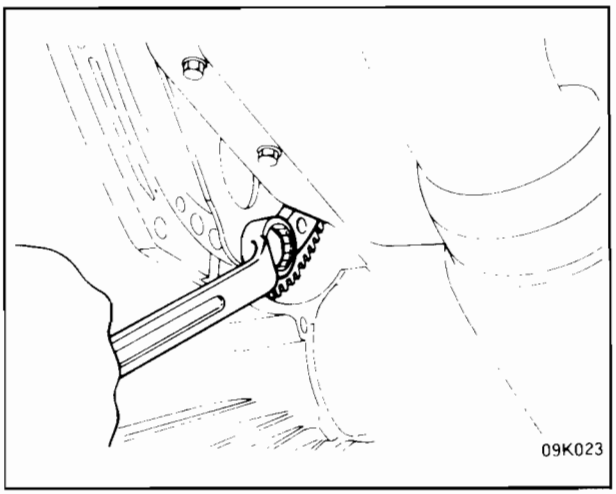


Fig. 5—Removing torque converter attaching bolts

(19) Support the transaxle on a suitable jack or hoist ensuring that excessive pressure is not exerted on the transaxle oil pan.
(20) Remove the transaxle mounting through bolt, refer Fig. 6.
(21) Pry the caps out of the right hand fender inner panel, remove the bracket to body attaching bolts, refer fig. 6, and remove the bracket.

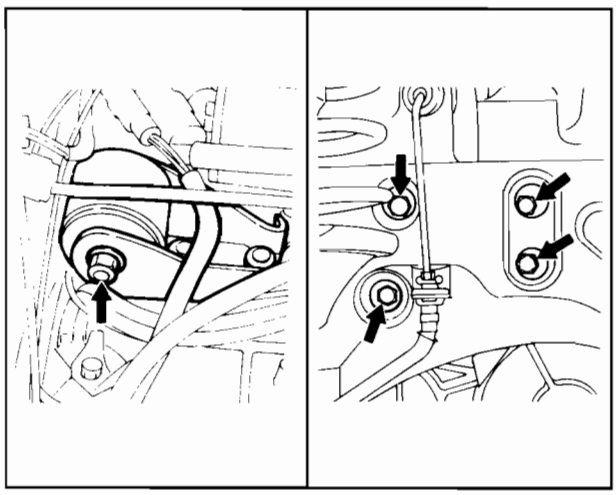


Fig. 6—Transaxle attaching bolts

(22) Remove the mounting bracket from the transaxle.
(23) Remove the remaining transaxle to engine attaching bolts.
(24) Move the transaxle away from the engine and lower the jack to remove the transaxle.

TRANSAXLE INSTALLATION

Install by reversing the removal procedure, noting the following:

(1) Install the torque converter in the transaxle.

NOTE: Do not attempt to fit the torque converter to the drive plate and install the transaxle to it, as seals will be damaged.

(2) Tighten all bolts to the specified torque.
(3) Adjust the select control cable as outlined in Section 5.
(4) Fill the transaxle with the specified fluid, start the engine and move the gear shift lever through all positions finishing in the N position, check that the fluid level is as shown in Fig. 7.

NOTE: The temperature should be within 70-80°C to obtain a correct reading.

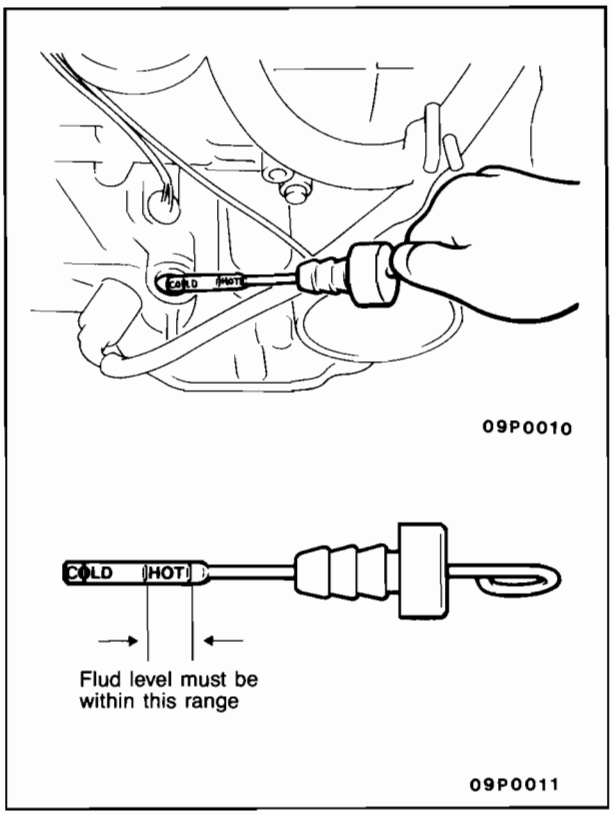


Fig. 7—Correct fluid level

(5) Road test the vehicle to check transaxle operation.

TORQUE CONVERTER FLUSHING

When a transaxle failure has contaminated the fluid, the torque converter should be flushed to insure that metal particles or sludged oil are not later transferred back into the reconditioned transaxle. Also flush and blow out the oil cooler and its lines.

Machine Flushing

Machine cleaning is recommended; using the type which rotates the converter while pumping cleaning fluid through it. The machine automatically adds timed blasts of compressed air to the cleaning fluid as it enters the converter, providing thorough cleaning.

ALUMINIUM THREAD REPAIR

Damaged or worn thread in the aluminium transaxle case and valve body can be repaired by the use of Heli-Coils. Essentially, this repair consists of drilling out the worn or damaged threads, tapping the hole with a special Heli-Coil tap and installing a Heli-Coil insert in the tapped hole. This brings the hole back to its original thread size. Heli-Coil tools and inserts are readily available from most automotive parts dealers.

NOTE: Some thread drag may occur in screwing a bolt into the installed Heli-Coil insert; therefore, a torque reading should be taken of the thread drag with a torque wrench and added to the specified bolt torque, so that all bolts securing a particular part will be tightened to the same torque.

TRANSAXLE DISASSEMBLY

Prior to removing any transaxle sub-assemblies, plug all openings and thoroughly clean exterior of the unit, preferably by steam. Cleanliness throughout the entire disassembly and assembly procedure cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.**

All mating surfaces in the transaxle are accurately machined; therefore, careful handling of parts must be exercised to avoid nicks or burrs.

INPUT SHAFT END PLAY

Measuring drive train end play before disassembly will usually indicate when a thrust washer change is required (except when major parts are replaced).

(1) Attach a dial indicator to the transaxle converter housing with the plunger seated against the end of the input shaft, refer Fig. 8.

(2) Move the input shaft in and out to obtain an end play reading.

(3) Record the end play for reference when reassembling the transaxle. Refer to specifications for the correct end play.

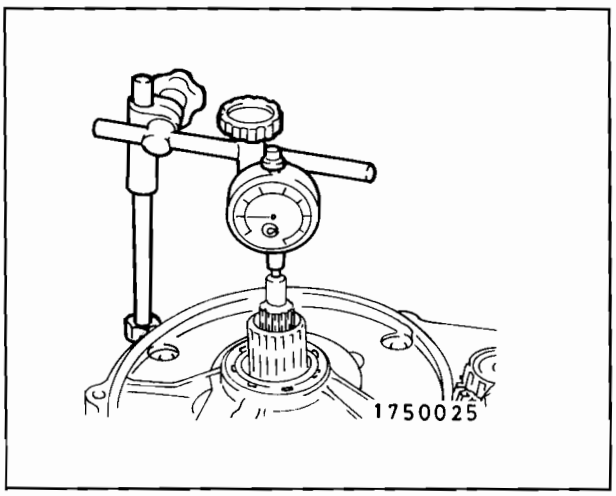


Fig. 8—Checking input shaft end play

SUB-ASSEMBLY REMOVAL

(1) Remove pulse generators A and B, refer Fig. 9.

(2) Remove the manual control lever and inhibitor switch, refer Fig. 10.

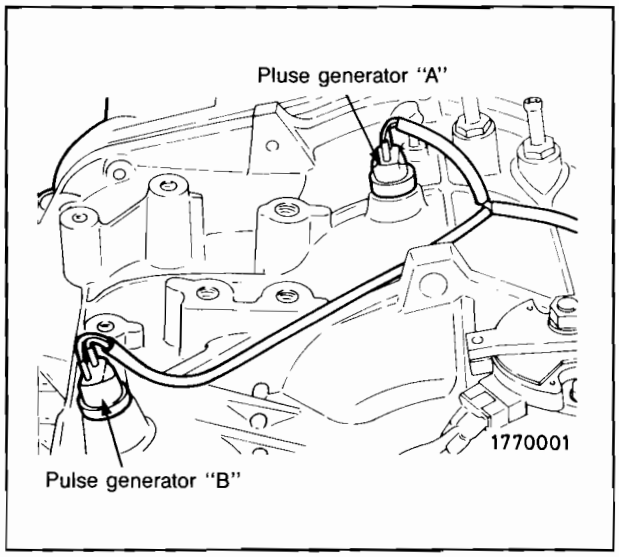


Fig. 9—Pulse generator location

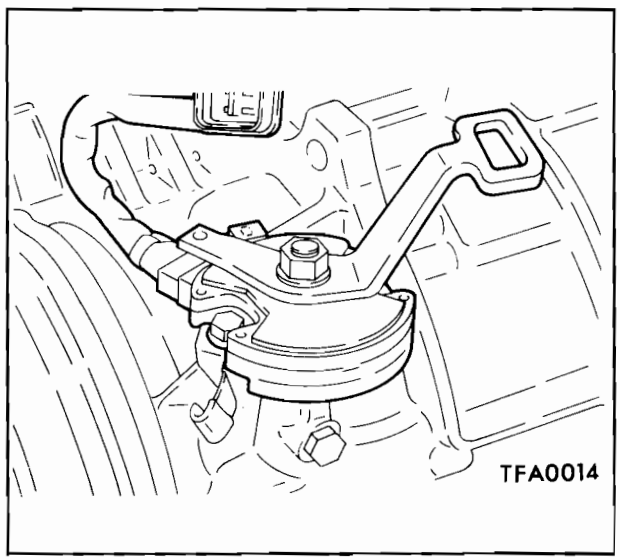


Fig. 10—Inhibitor switch removal

NOTE: Thread the nut onto the control shaft to prevent thread damage during repair work.

(3) Position the transaxle with the oil pan up and remove the oil pan and gasket.

(4) Remove the oil filter.

(5) Remove the oil-temperature sensor installation bolts and remove the sensor from the installation bracket and push the gromet from the transaxle case and remove the sensor.

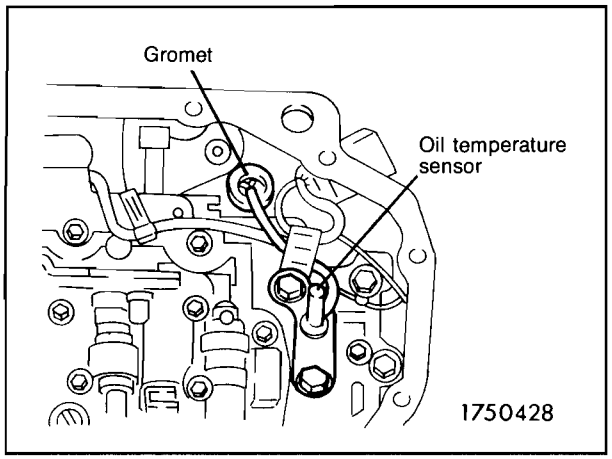


Fig. 11—Oil temperature sensor

(6) Remove the valve body attaching bolts, refer Fig. 12, and remove the valve body.

NOTE: Do not allow the manual valve to slide out when removing valve body.

(7) Remove the transfer shaft cover retainer, refer Fig. 13.

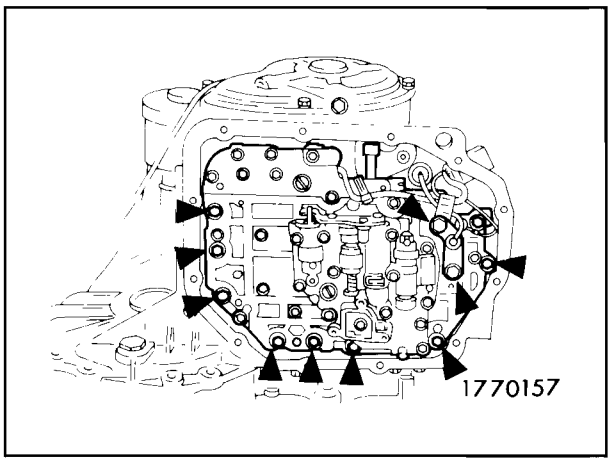


Fig. 12—Valve body attaching bolts

(8) Remove the end clutch cover bolts and remove cover, refer Fig. 14.

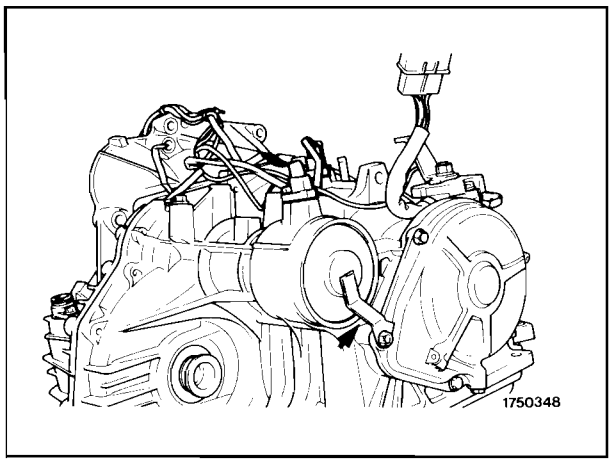


Fig. 13—Transfer shaft cover retainer

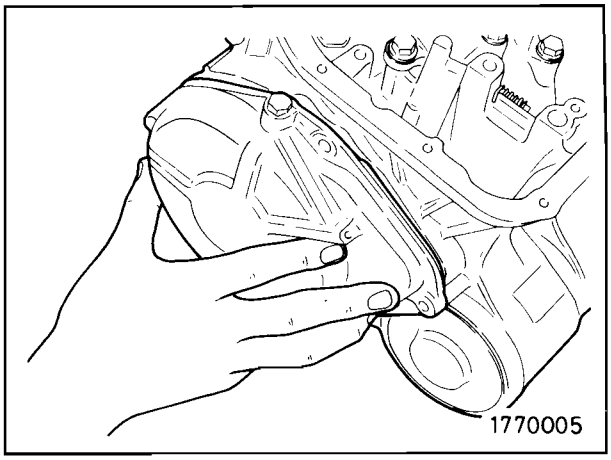


Fig. 14—End clutch cover

(9) Remove the end clutch, refer Fig. 15.

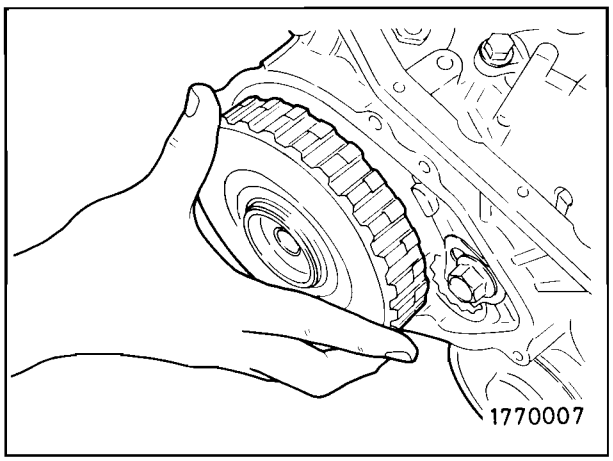


Fig. 15—Removing end clutch

(10) Remove the end clutch thrust washer, refer Fig. 16 and clutch hub, refer Fig. 17 and remove the thrust bearing.

NOTE: The bearing may stick to the end clutch hub.

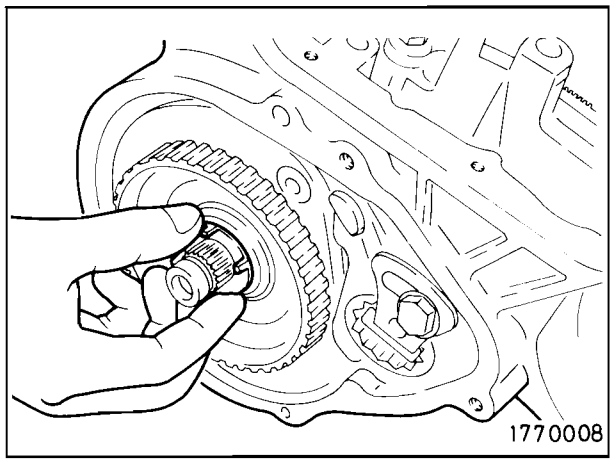


Fig. 16—Remove end clutch thrust washer

(11) Remove the end clutch hub, refer Fig. 17.

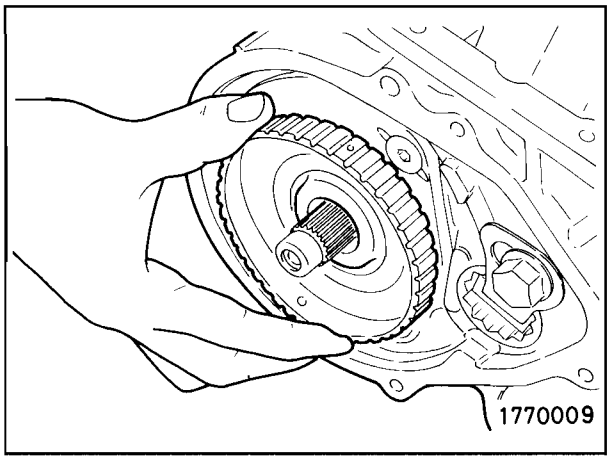


Fig. 17—Removing end clutch hub

(12) Remove end clutch shaft, refer Fig. 18.

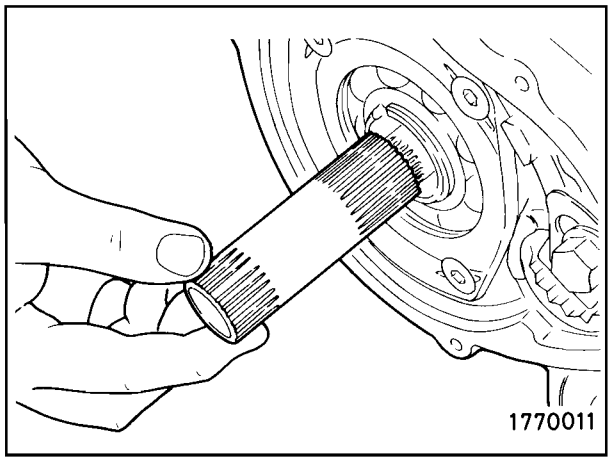


Fig. 18—Removing end clutch shaft

(13) Position and support the transaxle with the engine mounting face up.

NOTE: Avoid damaging the input shaft projecting from the rear of the housing.

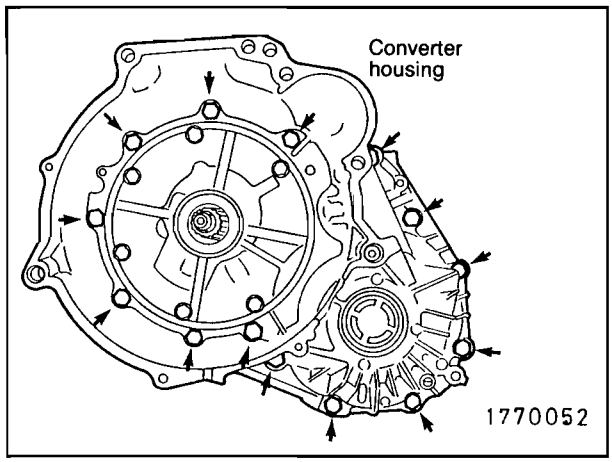


Fig. 19—Torque converter housing bolts

(14) Remove torque converter housing attaching bolts, refer Fig. 19, and remove the housing.

(15) Remove the oil pump mounting bolts and remove the oil pump by carefully levering with two screw-drivers.

NOTE: Do not damage the gasket surface while removing the pump.

(16) Remove the differential assembly.

(17) Remove the fibre thrust washer, refer Fig. 20.

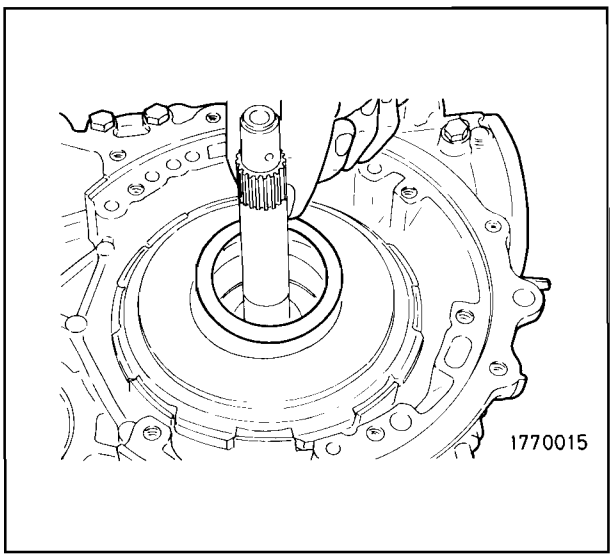


Fig. 20—Removing thrust washer

(18) Pull the input shaft upwards, and remove the front and rear clutch together, refer Fig. 21.

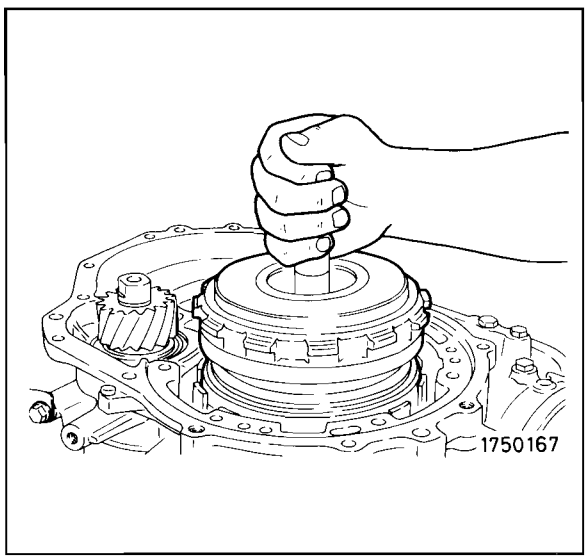


Fig. 21—Removing front and rear clutch

(19) Remove the thrust bearing, refer Fig. 22, and the clutch hub, refer Fig. 23.

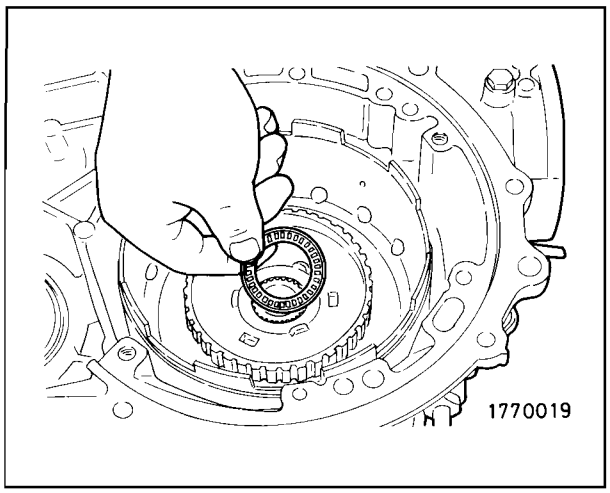


Fig. 22—Removing thrust bearing

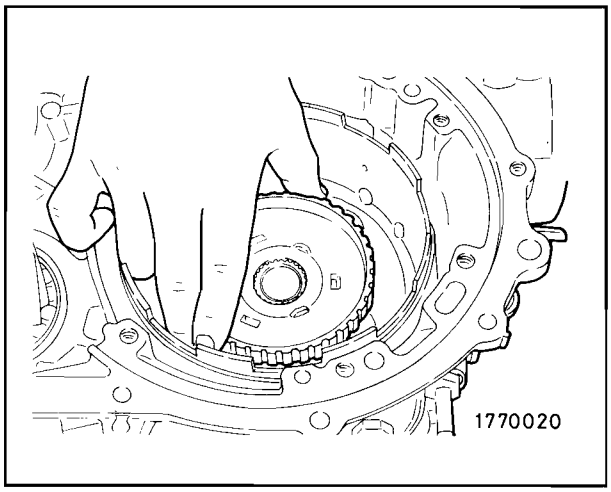


Fig. 23—Removing clutch hub

(20) Remove the thrust race and thrust bearing, refer Fig. 24, the kickdown drum, refer Fig. 25, and the kickdown band, refer Fig. 26.

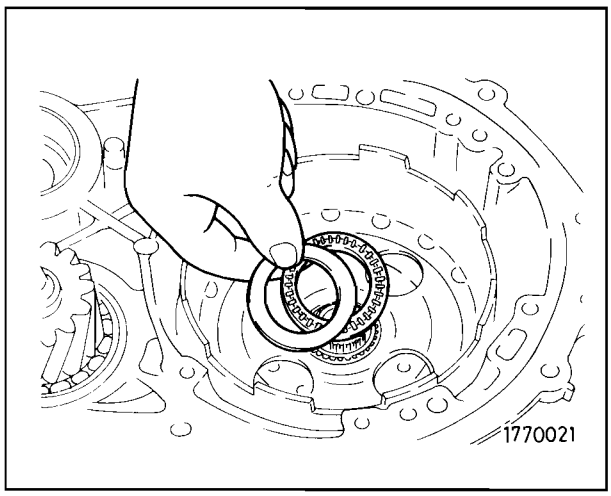


Fig. 24—Removing thrust race and bearing

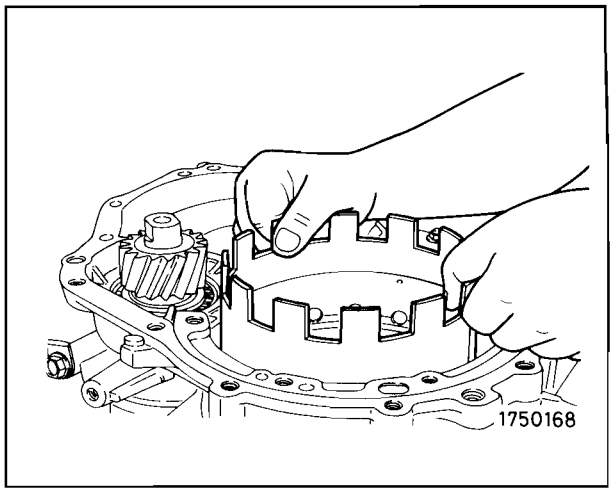


Fig. 25—Removing kickdown drum

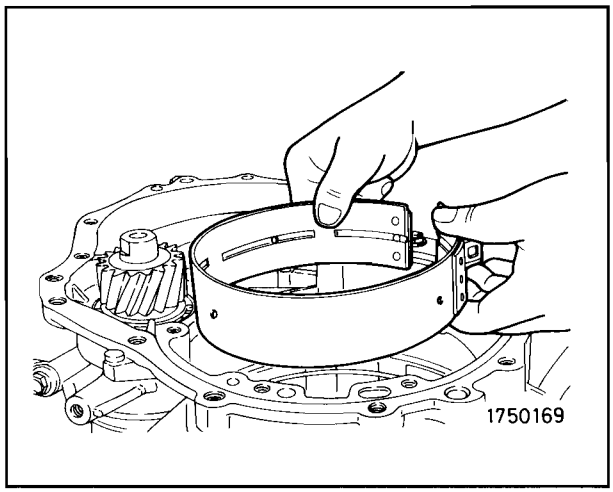


Fig. 26—Removing kickdown band

(21) Remove the kickdown servo cover snap ring and kickdown switch, refer Fig. 27.

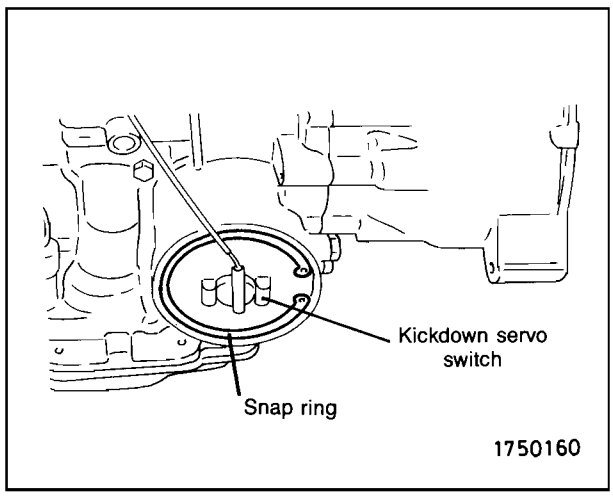


Fig. 27—Removing kickdown servo cover snap ring

(22) Using a valve spring compressor with a suitable adaptor, compress the kickdown servo and remove the snap ring, refer Fig. 28.

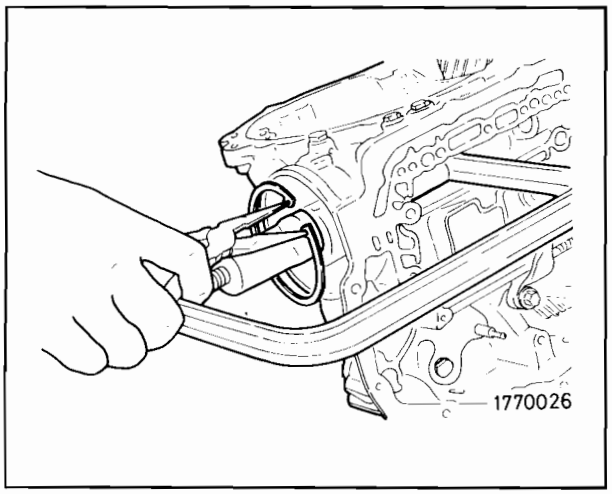


Fig. 28—Removing kickdown servo snap ring

(23) Release the spring compressor and remove the servo piston, sleeve and spring, refer Fig. 29.

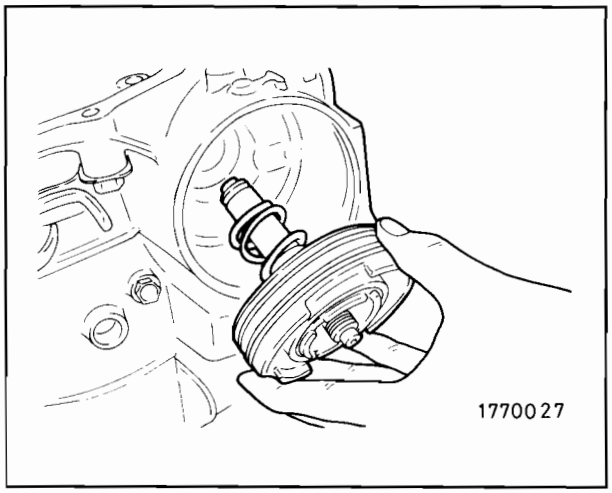


Fig. 29—Removing kickdown servo

(24) Remove the anchor rod, refer Fig. 30.

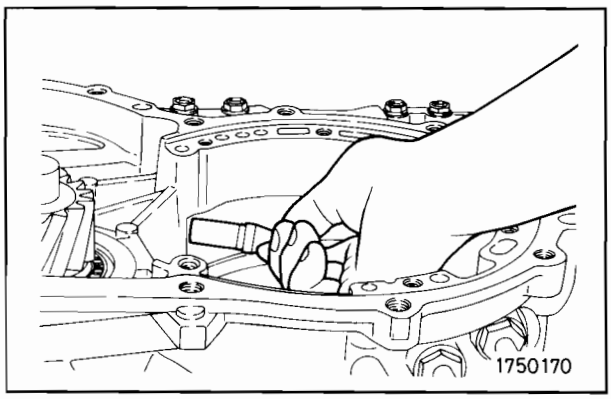


Fig. 30—Removing anchor rod

(25) Remove the centre support snap ring, refer Fig. 31.

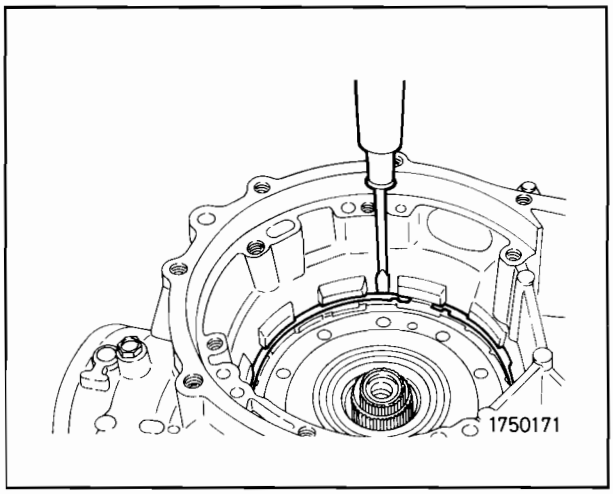


Fig. 31—Removing centre support snap ring

(26) Using special tool E21M41 attached to the centre support, remove the centre support by pulling straight upwards, refer Fig. 32.

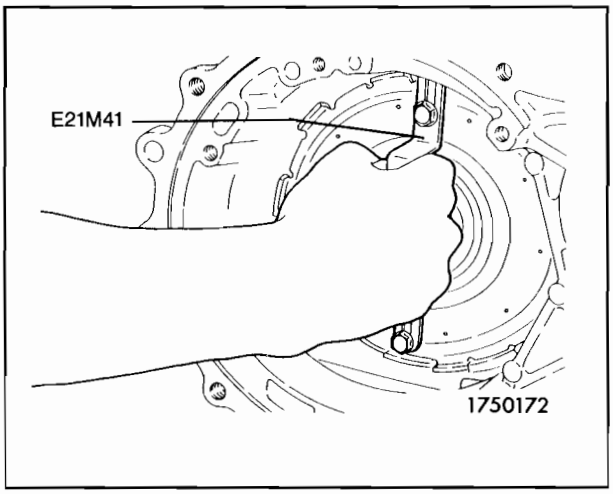


Fig. 32—Removing centre support

(27) Remove the reverse sun gear and forward sun gear together, refer Fig. 33.

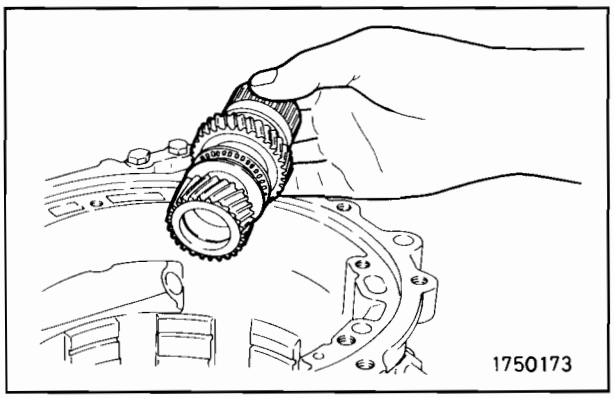


Fig. 33—Removing reverse and forward sun gear

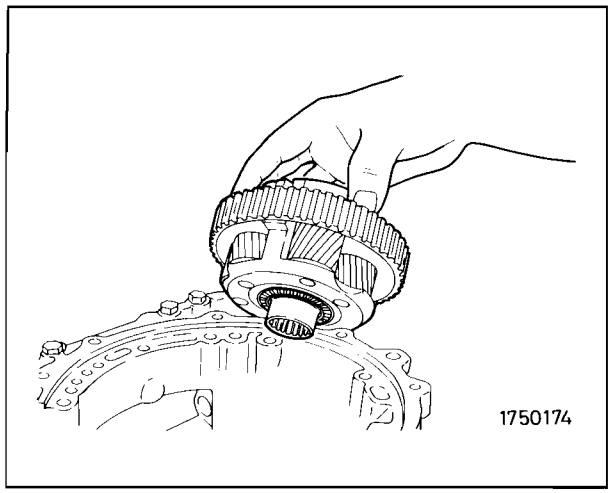


Fig. 34—Removing planet pinion carrier

(28) Remove the plant pinion carrier, refer Fig. 34.
(29) Remove the low reverse wave spring, return spring, reaction plate, brake disc and brake plate, refer Fig. 35.

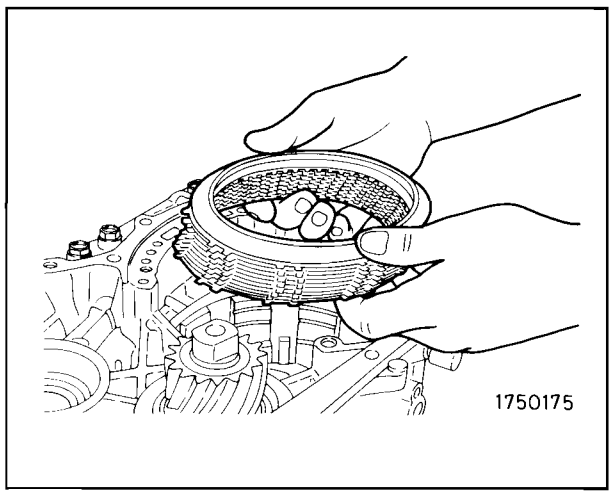


Fig. 35—Removing low reverse brake

(30) Using an impact driver, loosen the bearing retainer bolts, refer Fig. 36.

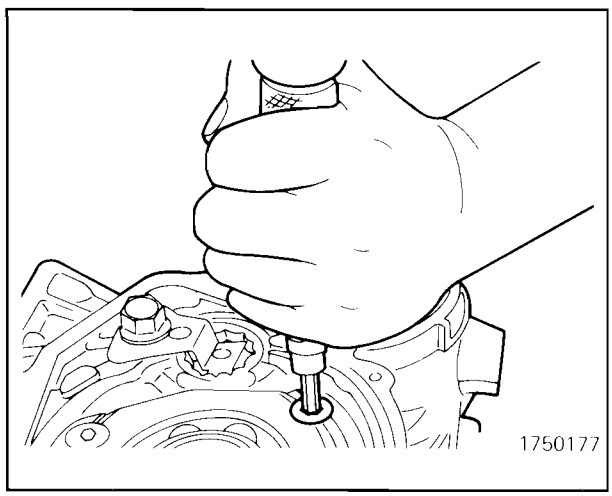


Fig. 36—Bearing retainer removal

NOTE: THE FLAT-HEAD BOLT WITH HEXAGONAL HOLE MAY BE DIFFICULT TO REMOVE BECAUSE OF APPLIED THREAD LOCK SEALANT, IF SO, REMOVE IT AFTER FIRST TAPPING ITS HEAD WITH A HAMMER AND BRASS DRIFT.

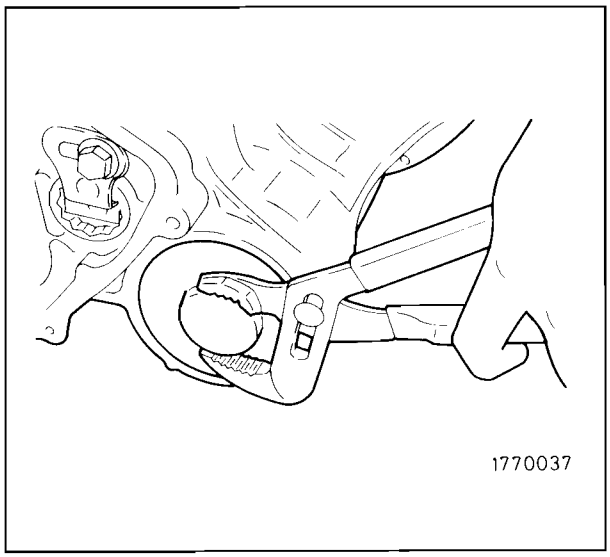


Fig. 37—Transfer cover removal

(31) Remove the transfer shaft cover, refer Fig. 37.
(32) Using a suitable punch, unstake the transfer shaft lock nut, refer Fig. 38.

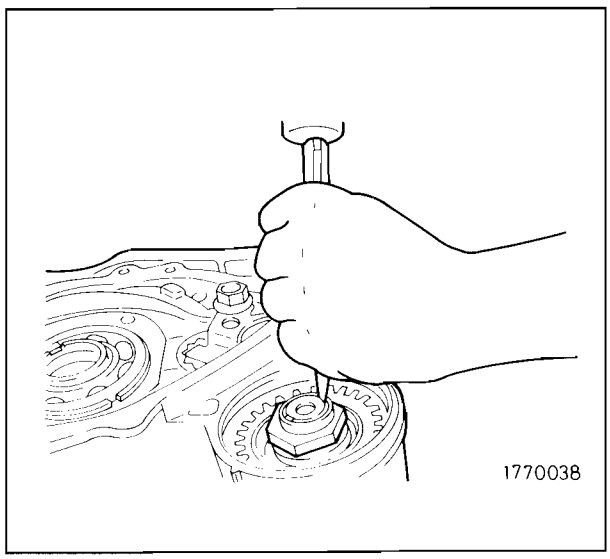


Fig. 38—Unstaking lock nut

(33) Clamp the end of the transfer shaft in a vice with the lock nut side up, refer Fig. 39.
(34) Remove the transfer shaft lock nut, refer Fig. 40.

NOTE: THE TRANSFER SHAFT LOCK NUT IS LEFT-HAND THREADED.

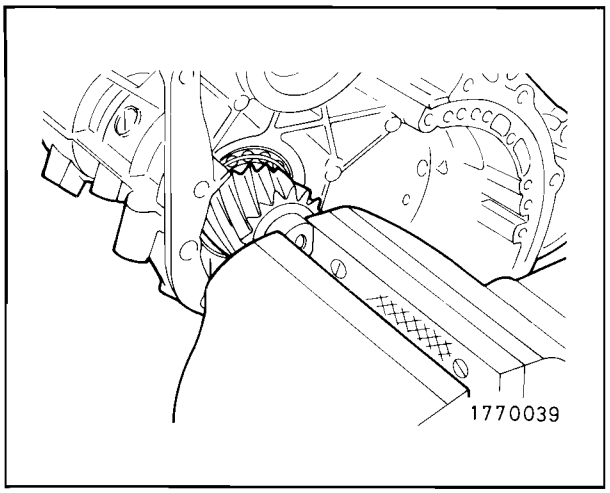


Fig. 39—Clamping the transfer shaft

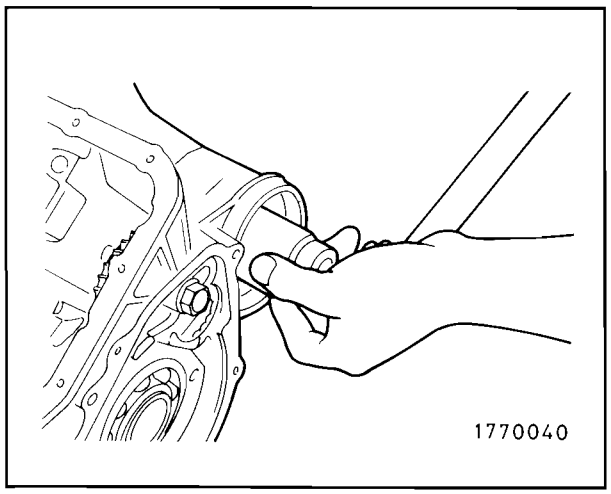


Fig. 40—Lock nut removal

(35) With the aid of a press and a suitable drift, remove the transfer shaft.
(36) Using a suitable punch, remove the transfer shaft bearing outer races, refer Fig. 41.

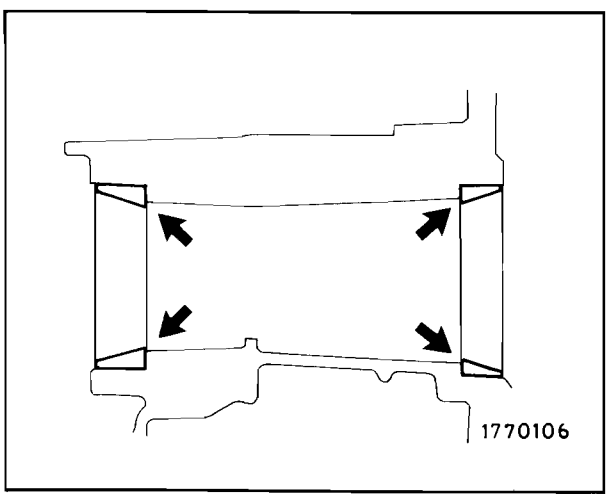


Fig. 41—Bearing race removal

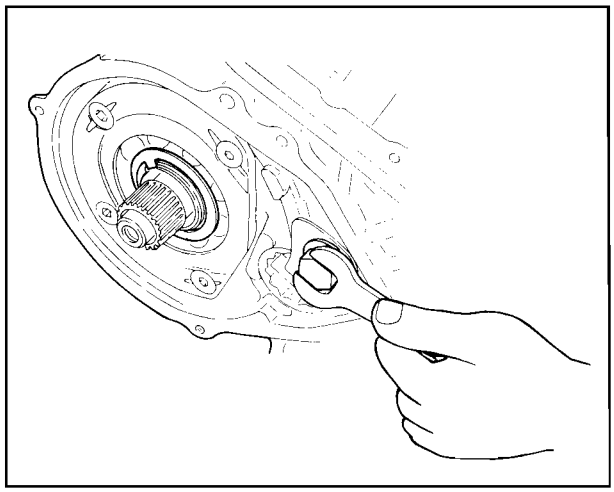


Fig. 42—Removing idler shaft lock plate

(37) Remove idler shaft lock plate, refer Fig. 42.
(38) Use special tool E21M36 to loosen the idler shaft, refer Fig. 43.

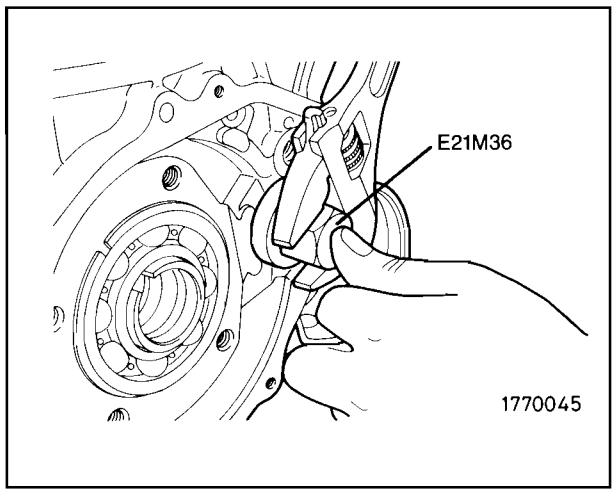


Fig. 43—Loosening idler shaft

(39) Remove idler shaft and remove the idler gear, and bearings, refer Fig. 44.

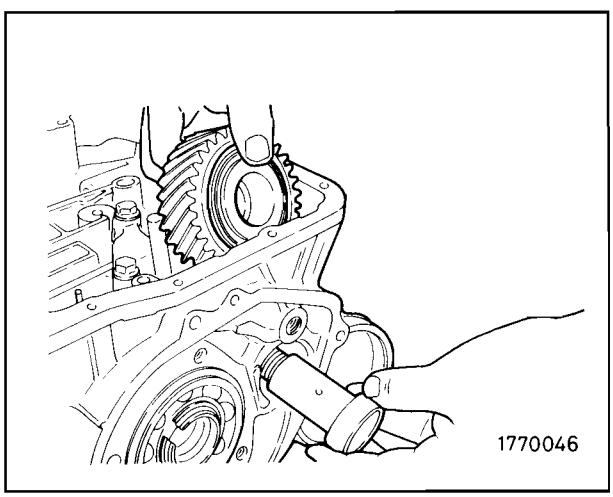


Fig. 44—Idler shaft removal

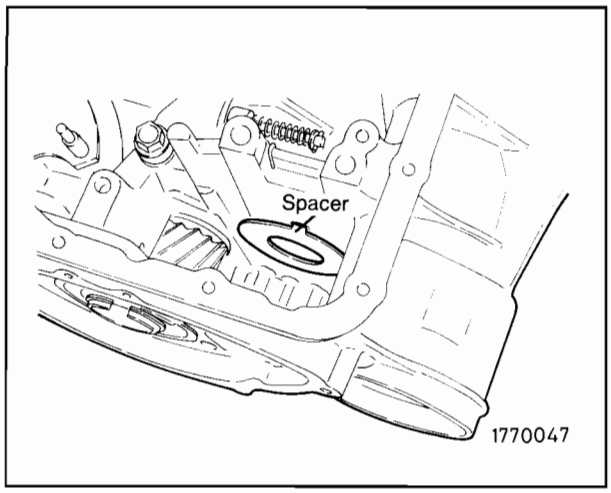


Fig. 45—Removing idler gear spacer

(40) Remove the idler gear spacer, refer Fig. 45.
(41) Remove the rear bearing snap ring, refer Fig. 46.

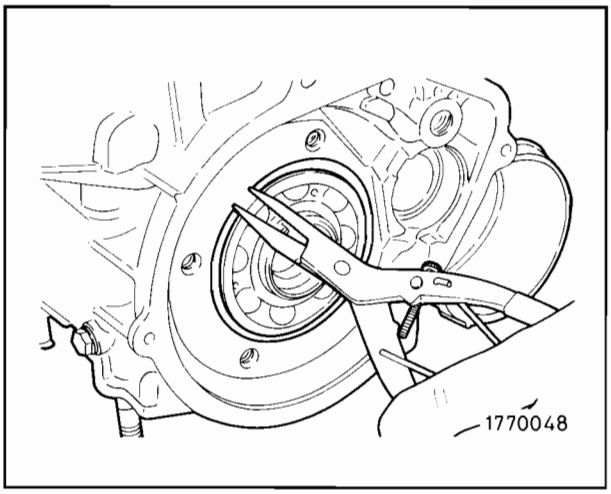


Fig. 46—Removing bearing snap ring

(42) Remove the annulus gear, output flange, transfer drive gear and bearing as an assembly, refer Fig. 47.

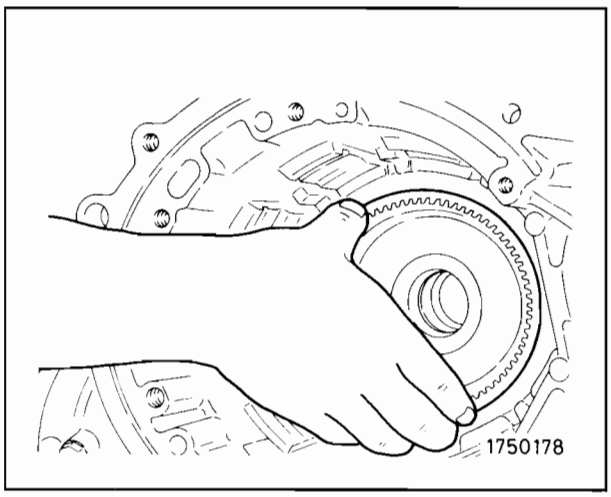


Fig. 47—Removing annulus gear assembly

(43) Remove the two bolts and parking sprag rod, refer Fig. 48.

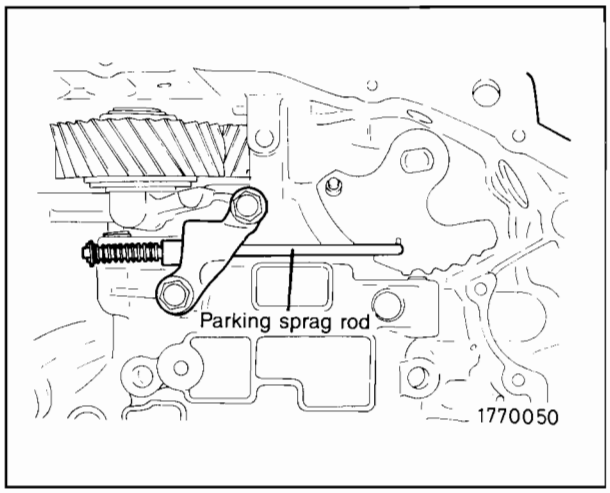


Fig. 48—Removing sprag rod

(44) Remove the set screw and the manual control shaft assembly.
(45) Remove the steel ball, seat and the spring together at this time.

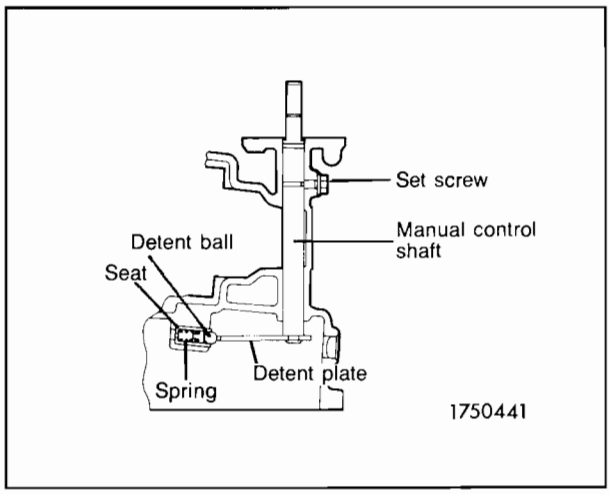


Fig. 49—Manual control shaft removal.

SUB ASSEMBLY OVERHAUL

OIL PUMP

Disassembly

(1) Remove the "O" ring from the oil pump housing.
(2) Remove the bolts from the pump assembly and separate the unit.
(3) Measure gear clearances, refer Specifications, if clearances are not within specifications replace the oil pump assembly.

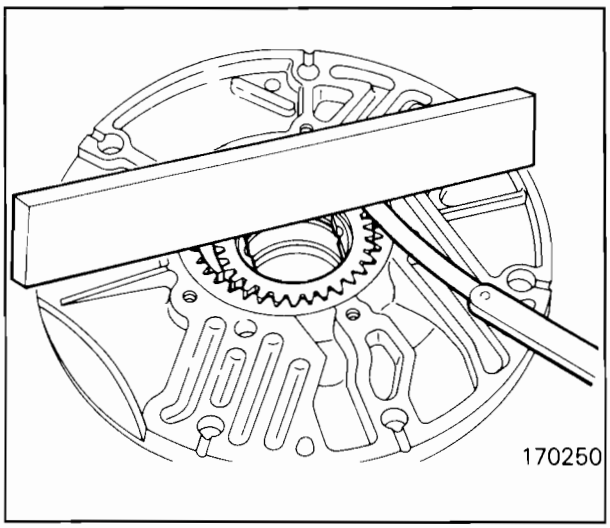


Fig. 50—Checking clearances

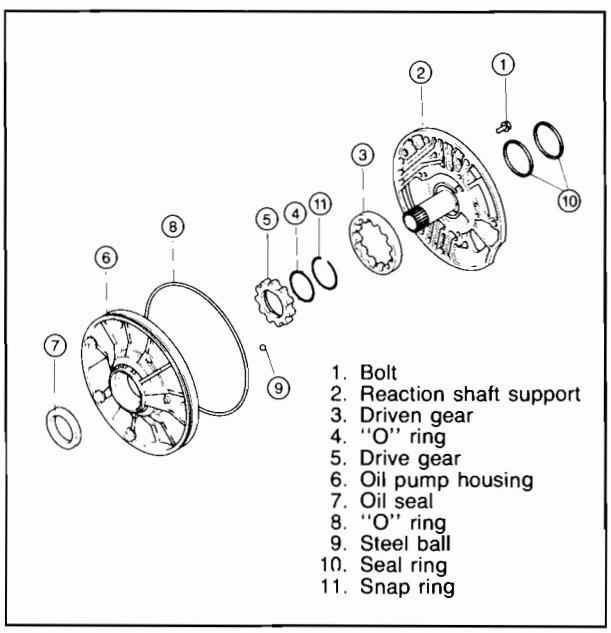


Fig. 51—Oil pump components

If clearances are within specifications, mark the relative position of the gears to ensure correct installation.
(4) Remove the steel ball the drive gear and the driven gear, refer Fig. 52.

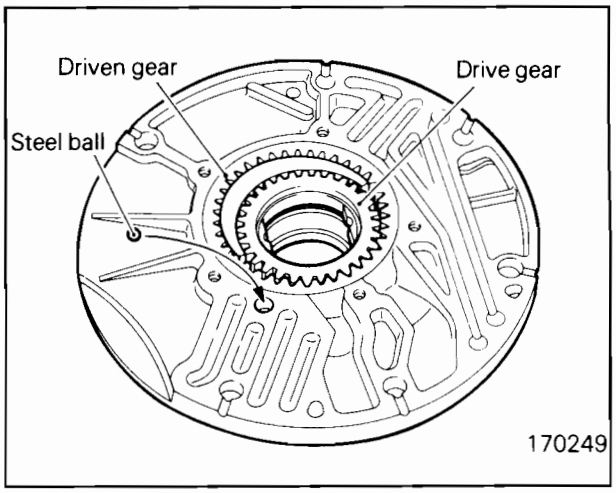


Fig. 52—Oil pump internal components

(5) Remove the seal rings from the reaction shaft support, refer Fig. 53.
(6) Remove and discard the pump housing oil seal, refer Fig. 54.
(7) Remove the O-ring and snap ring from the drive gear.
(8) Clean all components in suitable solvent and check for damage.

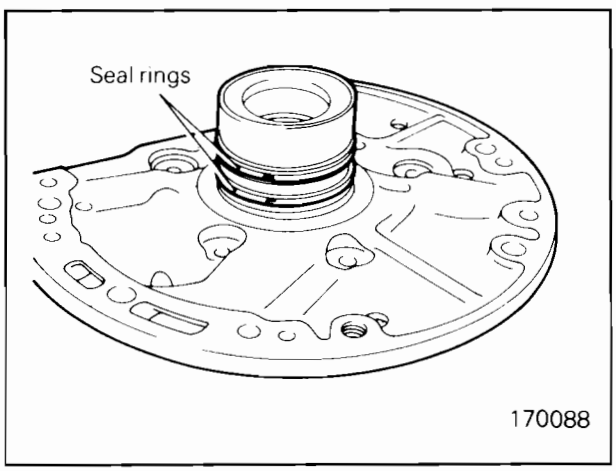


Fig. 53—Reaction shaft support seal rings

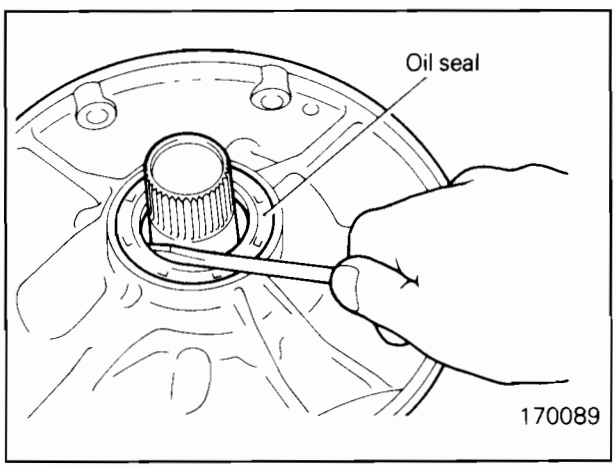


Fig. 54—Removing oil seal

Assembly

(1) Apply a coat of A.T.F. to the oil seal lip and using special tool E9055, install a new oil seal in the pump housing, refer Fig. 55.

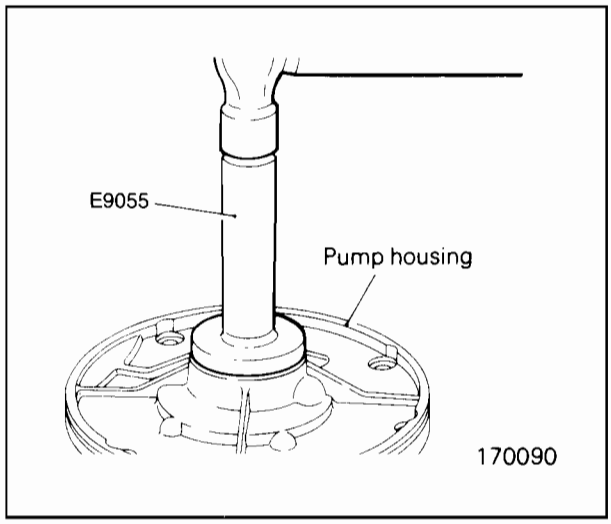


Fig. 55—Installing oil seal

(2) Immerse the drive gear and the driven gear in A.T.F. and install in the pump housing, ensuring that the mating marks are correctly aligned.

(3) Install the snap ring and a new "O" ring in the drive gear.

(4) Install the steel ball, refer Fig. 56.

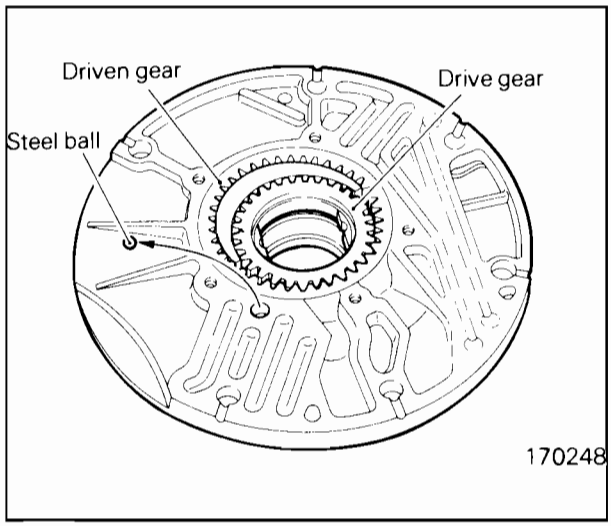


Fig. 56—Steel ball location

(5) Coat new seal rings with A.T.F. and fit onto the reaction shaft support.

(6) Fit the reaction shaft support onto the pump housing and install and finger tighten attaching bolts.

(7) With the torque housing positioned engine side down on the bench, position and support the oil pump assembly in the housing to align the two oil pump components, refer Fig. 57.

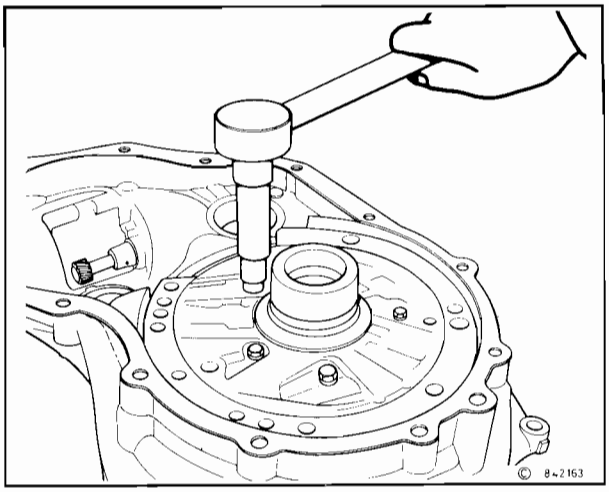


Fig. 57—Oil pump assembly

(8) Tighten the pump housing to reaction shaft attaching bolts.

(9) Remove the oil pump assembly and support in a vice fitted with soft jaws.

(10) Torque the attaching bolts to specifications.

(11) Rotate the oil pump and check that the pump gears rotate freely.

(12) Install a new "O" ring in the groove on the circumferance of the pump housing and coat with A.T.F.

FRONT CLUTCH

Disassembly

(1) Remove the outer snap ring and remove the clutch discs and plates.

(2) Using special tool E21M43 compress the return spring and remove the snap ring, refer Fig. 59.

(3) Slowly release the spring until the spring retainer is free of the hub.

(4) Remove the tool, the spring retainer and the spring.

(5) Invert the clutch retainer assembly and tap it on a block of wood to remove the piston. Remove and discard seal rings from the piston and the clutch retainer hub.

Inspection

Inspect facing material on all driving discs. Replace discs that are charred glazed or heavily pitted. Discs should be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in grooves. Inspect contacting surface on the clutch retainers for scores, **the contact surface should be protected from damage during disassembly and handling.** Inspect piston seal ring surfaces in clutch retainer for nicks or

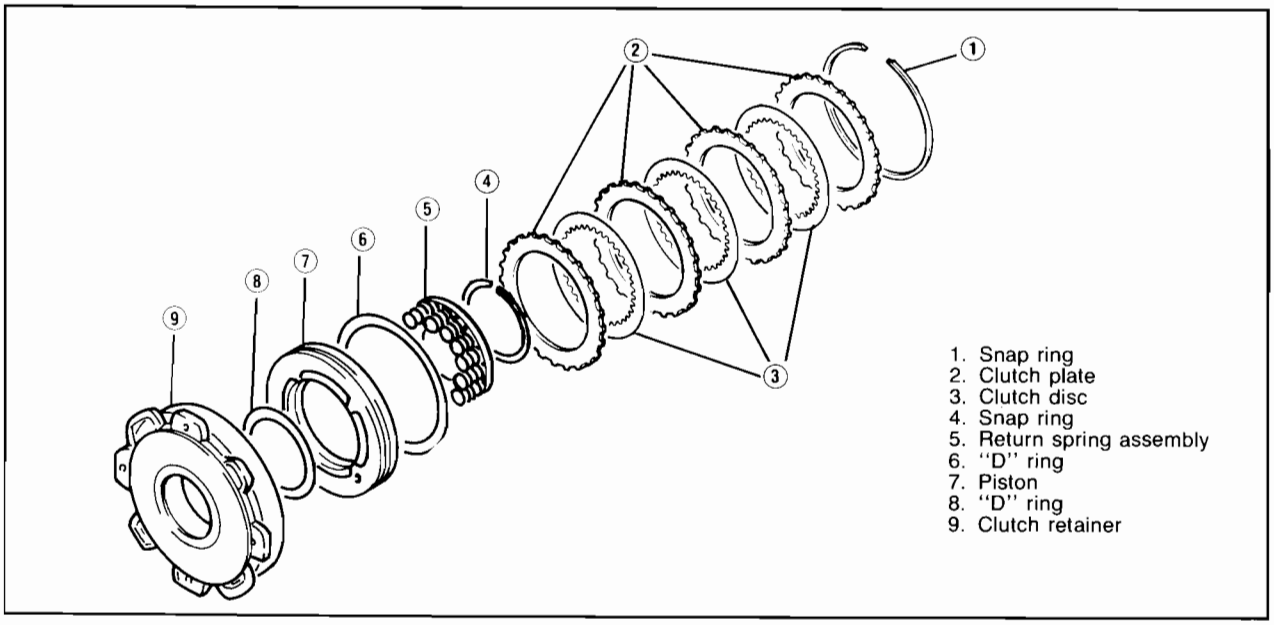


Fig. 58—Front clutch components

deep scratches, light scratches will not interfere with sealing of neoprene rings. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.

Inspect bore of piston for score marks, if light, remove with crocus cloth. Inspect seal ring grooves for nicks and burrs. Inspect neoprene rings for deterioration, wear and hardness. Inspect piston spring, retainer and circlip for distortion.

Thoroughly clean all components prior to assembly and installation.

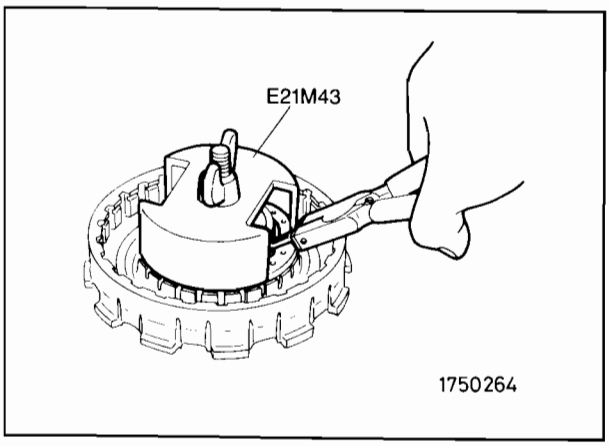


Fig. 59—Snap ring removal

Assembly

(1) Install a new "D" section sealing ring to groove in outside surface of piston, with the round section facing out, refer Fig. 60. Install a new "D" section sealing ring to front clutch retainer.

(2) Coat outside surface of "D" rings with A.T.F. and push the piston into the front clutch retainer by hand.

(3) Install return spring and spring retainer. Compress return spring with special tool E21M43 and install snap ring.

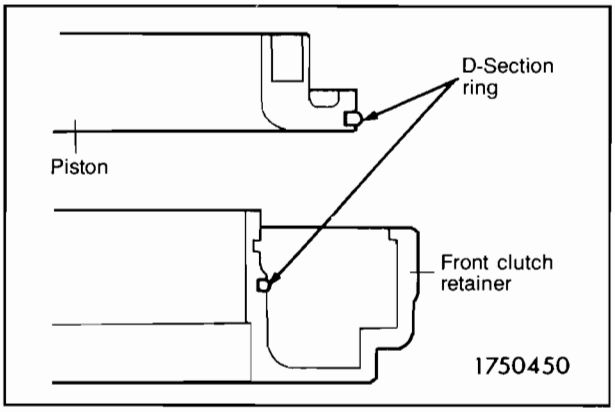


Fig. 60—"D" ring installation

(4) Coat the four clutch plates and the three clutch discs with A.T.F. and install in the retainer as shown in Fig. 61.

NOTE: When the clutch reaction plates are installed, make sure that all their missing teeth are in alignment.

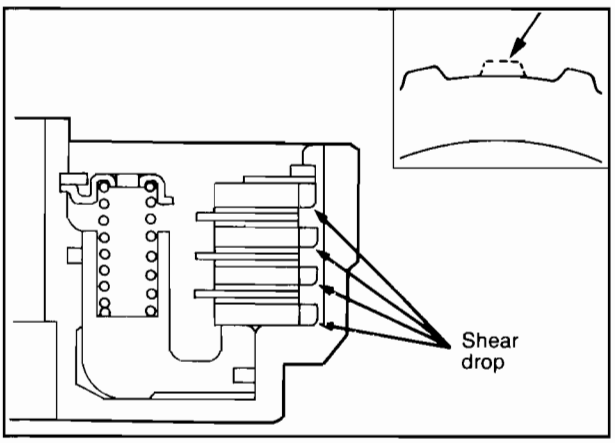


Fig. 61—Clutch disc and plate installation

NOTE: When new clutch discs are used immerse in A.T.F. for at least two hours prior to installation.

(5) Install snap ring and check clearance between snap ring and clutch plate. To check clearance, hold circumference of clutch plate down with a force of 5 kg. Measure clearance with a feeler gauge, refer Fig. 62.

(6) If the clearance fails to meet specifications, select a suitable snap ring, refer to specifications, to give the required clearance.

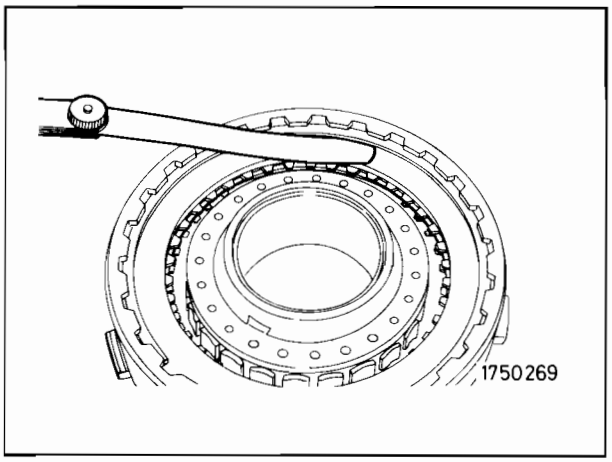


Fig. 62—Checking clutch plate clearance

REAR CLUTCH

Disassembly

(1) Remove the snap ring from the clutch retainer.

(2) Remove the clutch plates, clutch discs and the pressure plate from the retainer.

(3) Remove the snap ring and the thrust race, refer Fig. 64.

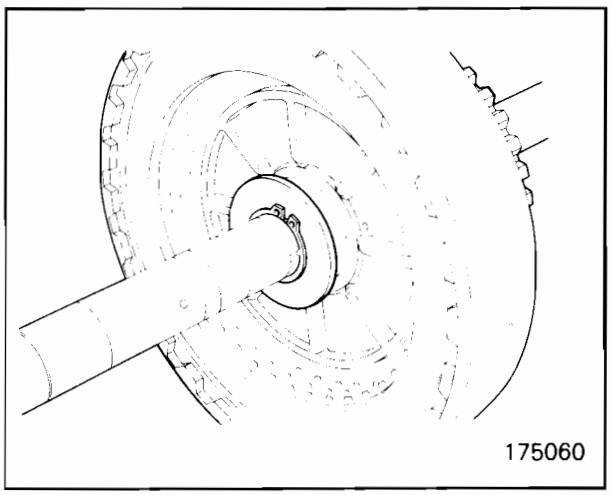


Fig. 64—Snap ring and thrust race

(4) Using a screwdriver, refer Fig. 65, remove the wave spring.

(5) Remove the return spring and piston.

Inspection

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should be replaced if they show evidence of material flaking off or if facing material can be scraped off

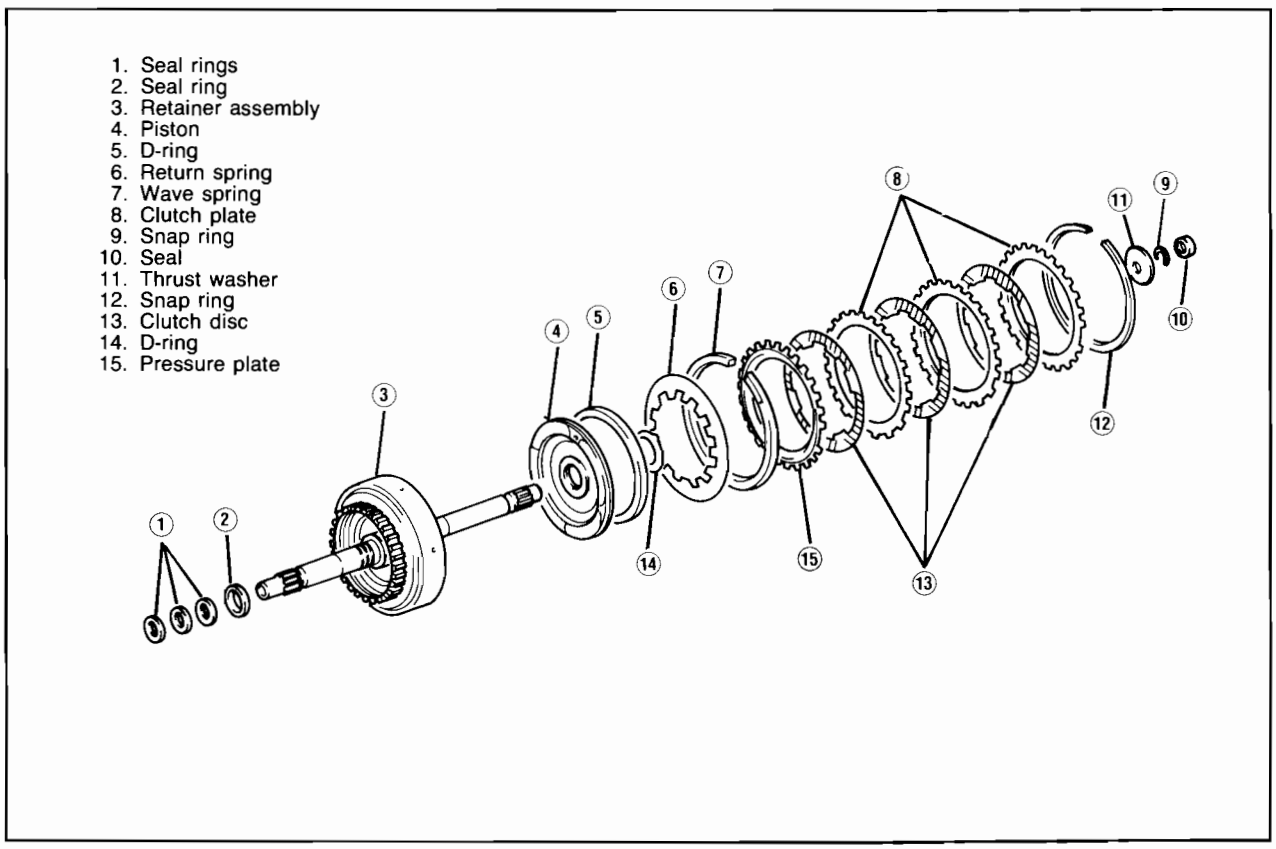


Fig. 63—Rear clutch components

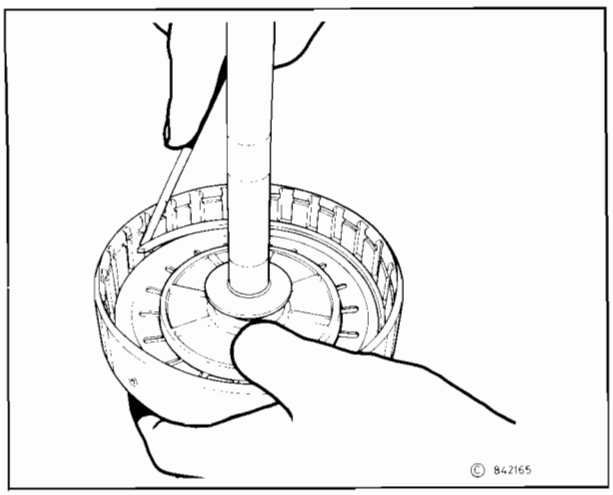


Fig. 65—Removing wave washer

easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in grooves. Inspect band contacting surface on clutch retainers for scores, **the contact surface should be protected from damage during disassembly and handling.** Inspect piston seal ring surfaces in clutch retainer for nicks or deep scratches, light scratches will not interefere with sealing of neoprene rings. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.

Inspect bore of piston for score marks, if light, remove with crocus cloth. Inspect seal ring grooves for nicks and burrs. Inspect neoprene seal rings for deterioration, wear and hardness. Inspect piston spring, retainer, and circlip for distortion.

Thoroughly clean all components prior to assembly and installation.

Assembly

(1) Install new "D" section sealing rings to inside and outside grooves of piston, with the round section facing out, refer Fig. 66.

(2) Coat outside surfaces of "D" rings with A.T.F. and push the piston into the housing by hand.

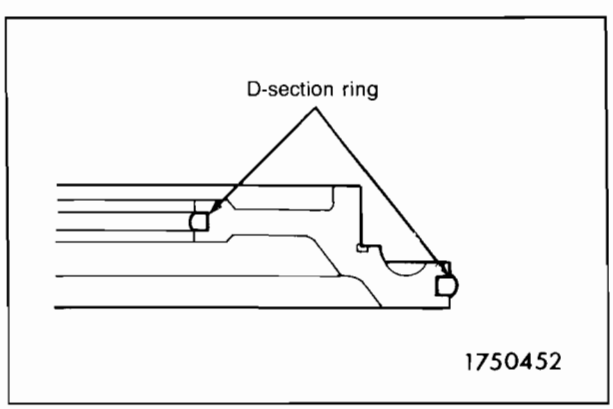


Fig. 66—"D" section ring fitment

(3) Install the return spring and the wave spring ensuring that the wave spring is correctly seated in the housing groove.

(4) Coat the three clutch discs, two plates, pressure plate and reaction plate with A.T.F. and install in the retainer as shown in Fig. 67.

NOTE: When the clutch pressure plate and clutch plate are installed, all their missing teeth are in alignment.

NOTE: When new clutch discs are used immerse in A.T.F. for at least two hours prior to installation.

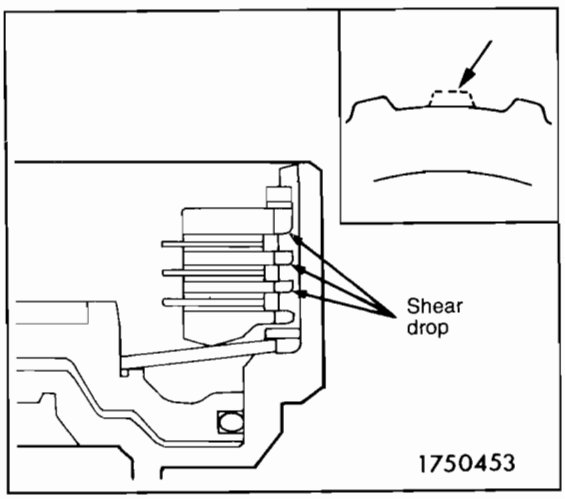


Fig. 67—Clutch disc and plate installation

(5) Install snap ring and check clearance between snap ring and clutch plate. To check clearance hold circumference of clutch plate down with a force of 5 kg. Measure clearance with a feeler gauge, refer Fig. 68.

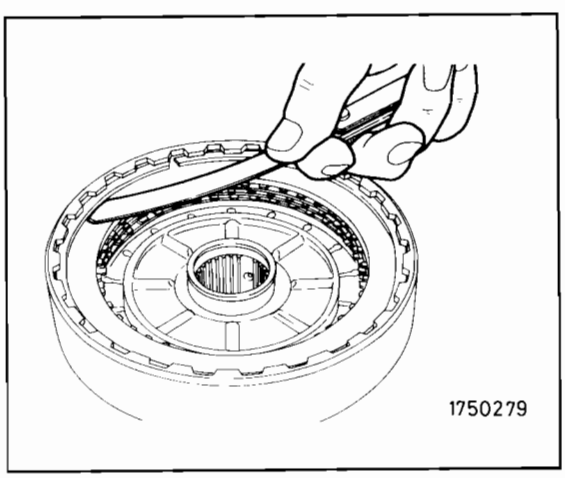


Fig. 68—Checking clutch plate clearance

(6) If the clearance fails to meet specifications, select a suitable snap ring, refer to specifications, to give the required clearance.

(7) Install the D-ring, thrust race and snap ring. Install new seal rings in the input shaft grooves.

(8) Install the rear clutch onto the input shaft so that the mating mark on the rear clutch retainer is aligned with the groove in the input shaft, refer Fig. 69.

piston seal ring surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of neoprene rings. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.

Inspect bore of piston for score marks, if light, remove with crocus cloth. Inspect seal ring grooves for nicks and burrs. Inspect neoprene seal rings for deterioration, wear and hardness. Inspect piston spring, retainer and circlip for distortion.

Thoroughly clean all components prior to assembly and installation.

Assembly

(1) Install new "D" section ring to the inner groove of the piston, and a new lip seal to the outer groove of the piston.

(2) Coat the outer surface of the seal rings with A.T.F. and push the piston into the retainer by hand.

(3) Install the return spring and washer.

(4) Fit a new snap ring onto the guide of special tool E21M41 and locate the guide in the retainer, refer Fig. 72.

(5) Support the retainer in a press, supported under the shaded area, refer Fig. 72.

NOTE: Do not support under the arrowed section.

(6) Position the installer on the guide and press the snap ring onto the retainer.

NOTE: Stop pressing immediately the snap ring is located in the retainer groove.

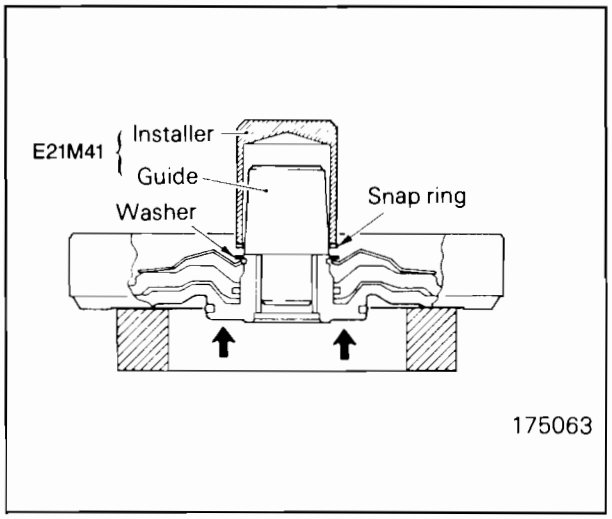


Fig. 72—Installing snap ring

(7) Coat the clutch discs, clutch plates and the reaction plate with A.T.F. and install in the retainer as shown in Fig. 73.

NOTE: When new clutch discs are used immerse in A.T.F. for at least two hours prior to installation.

(8) Install snap ring and check clearance between snap ring and clutch plate. To check clearance hold circumference of clutch plate down with a force of 5 kg. Measure clearance with a feeler gauge, refer Fig. 74.

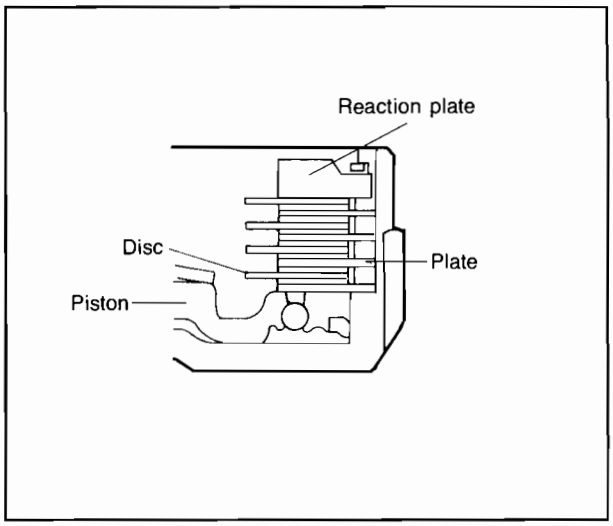


Fig. 73—Clutch disc and plate installation

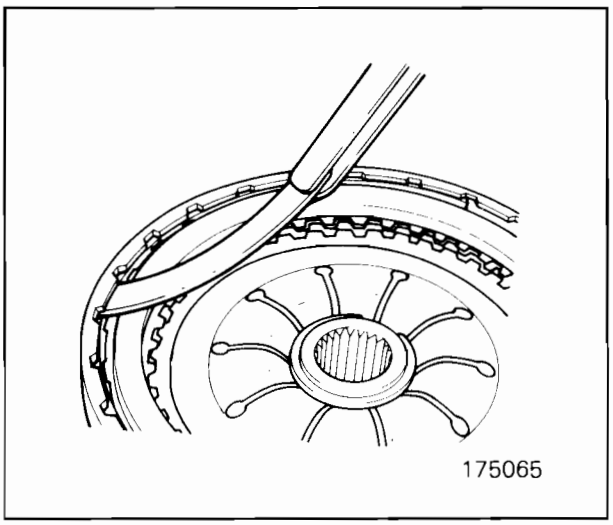


Fig. 74—Checking clutch plate clearance

(9) If the clearance fails to meet specifications, select a suitable snap ring, refer Specifications, to give the required clearance.

KICKDOWN SERVO

Disassembly

(1) Remove the lock nut and withdraw the adjusting screw.
(2) Remove the piston from the sleeve.
(3) Remove and discard the "O" and "D" rings.

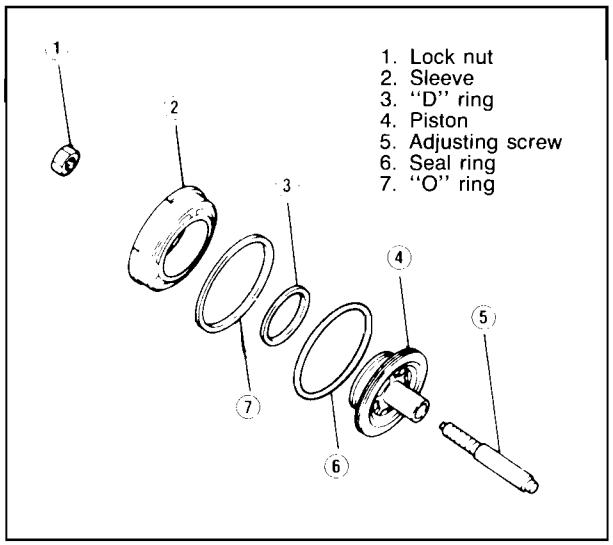


Fig. 75—Kickdown servo components

Inspection

Throughly clean all components and inspect the sliding surfaces of the piston and sleeve for scoring or wear. Replace faulty components.

Assembly

(1) Install new "D" ring and seal ring to piston.
(2) Install new "O" rings to sleeve.
(3) Coat "D" ring and seal ring with A.T.F. and insert into sleeve, refer Fig. 76.
(4) Install piston rod and adjusting screw.

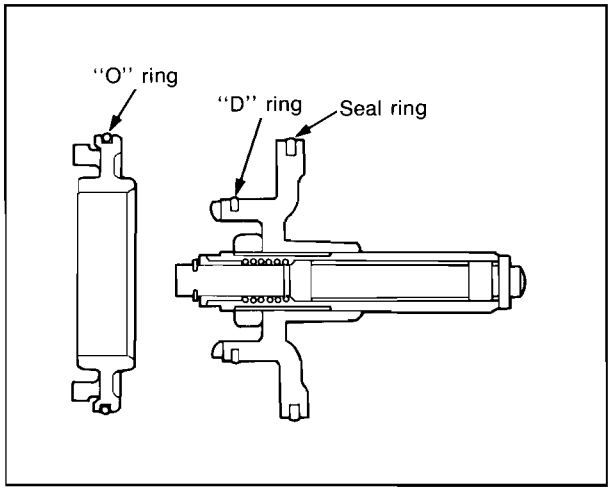


Fig. 76—"D" and "O" ring installation

NOTE: Adjust kickdown servo assembly after installation, refer Section 3B — "Maintenance and Adjustment".

PLANET PINION CARRIER

Disassembly

(1) Remove the three bolts, refer Fig. 77.

(2) Lift off the over-running clutch outer race, refer Fig. 78. Remove the over-running clutch end plate.

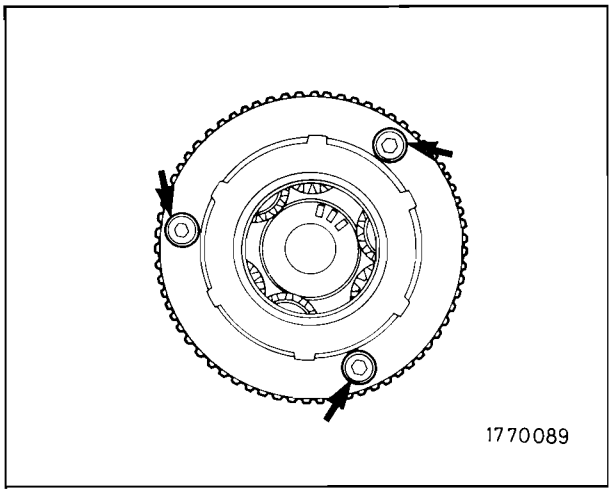


Fig. 77—Removing clutch race bolts

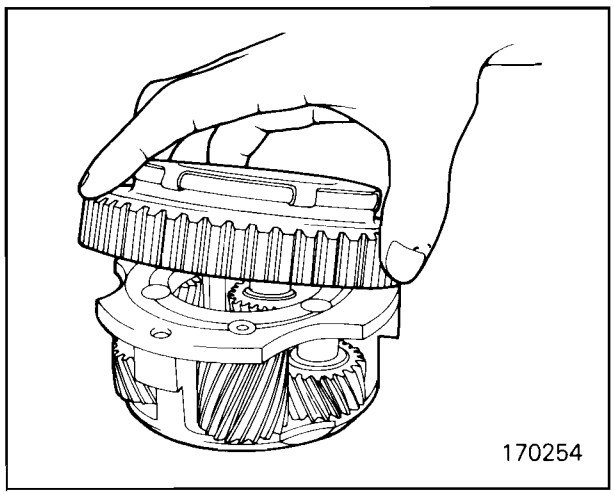


Fig. 78—Removing one way clutch outer race

(3) Remove one of the short pinion shafts and spacer bushing, refer Fig. 80. Remove the pinion and ensure the twenty rollers inside the pinion are removed and put aside for reassembly.

(4) Slide the thrust bearing from under the remaining pinions and lift out through the front of the carrier, refer Fig. 81.

(5) Push the over-running clutch from the outer race using the fingers, refer Fig. 82.

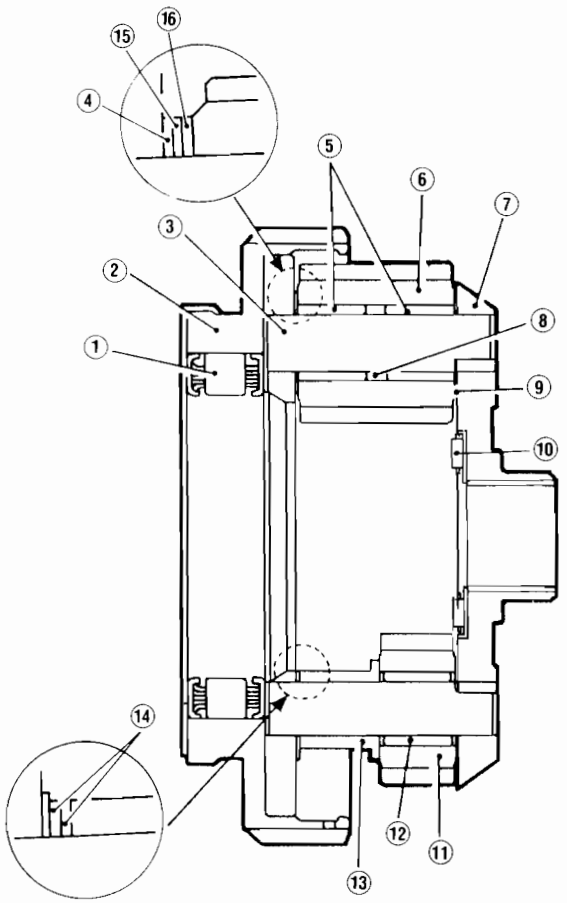


Fig. 79—Planet carrier assembly

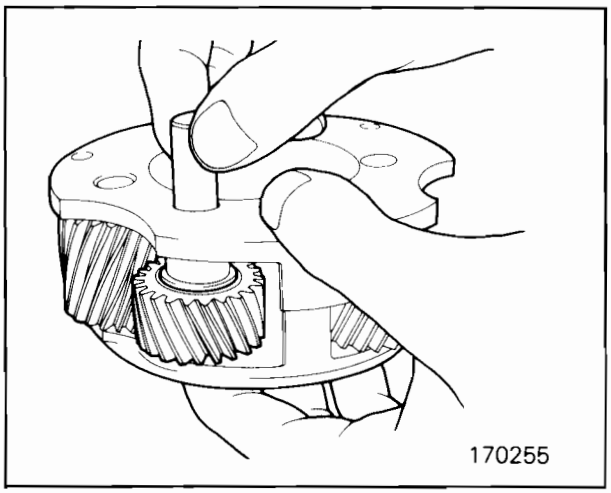


Fig. 80—Removing short pinion

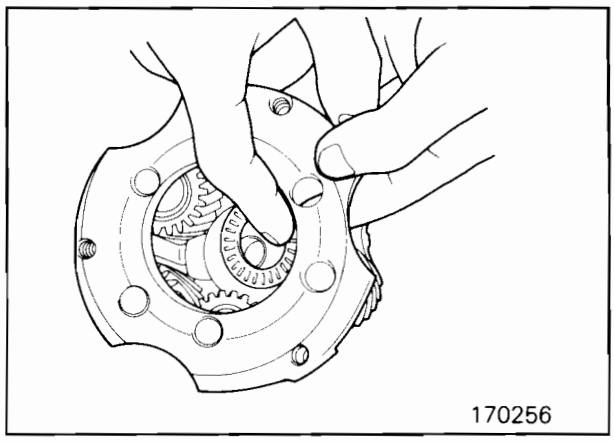


Fig. 81—Removing thrust washer

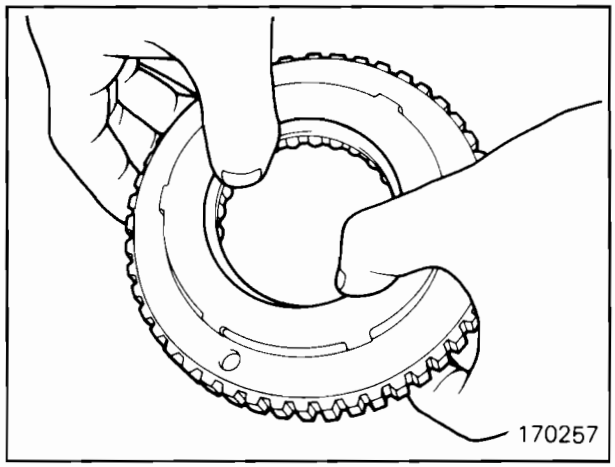


Fig. 82—Removing one way clutch from outer race

Inspection

Thoroughly clean all components prior to inspection.

(1) Inspect over-running clutch rollers for smooth round surfaces, they must be free of flat spots, chipped edges, nicks or burrs. Inspect roller contacting surfaces in the cam and race for brinelling. Check roller springs for distortion, wear or damage.

(2) Inspect thrust bearing and thrust surfaces for wear and damage, replace if necessary.

(3) Inspect planetary gear teeth for chips or wear.

(4) Inspect planet pinion carrier roller bearing for wear and score marks.

Assembly

(1) Install the thrust bearing in the carrier, refer Fig. 83, ensuring that it sits correctly on the spot faced section of the carrier.

(2) Install the seventeen rollers to the pinion using petroleum jelly to hold them in place, refer Fig. 84.

(3) Align the holes in the front and rear pinion thrust washers with the holes in the carrier, refer Fig. 85.

(4) Insert the pinion and spacer bushing. Install the shaft ensuring the notch in the shaft fits correctly into the rear plate, refer Fig. 86

(5) Install the one way clutch inner end plate in the outer race, refer Fig. 87.

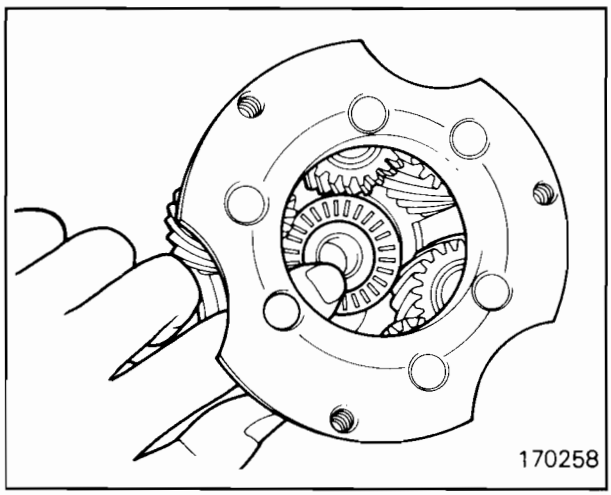


Fig. 83—Installing thrust bearing

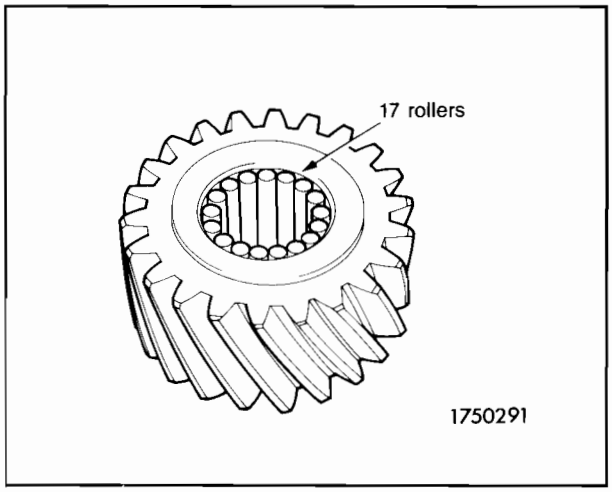


Fig. 84—Installing rollers in pinion

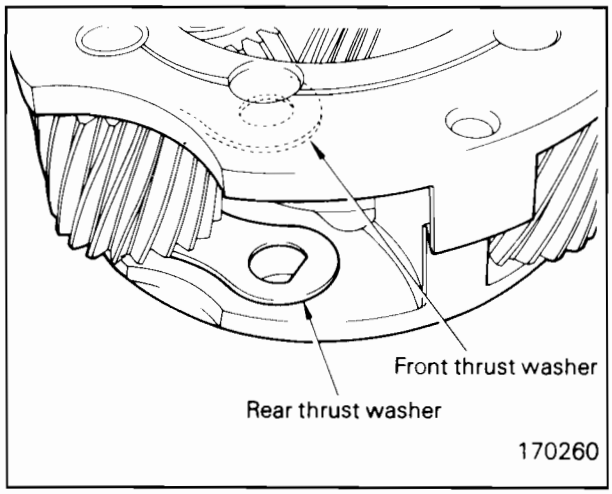


Fig. 85—Aligning pinion thrust washers

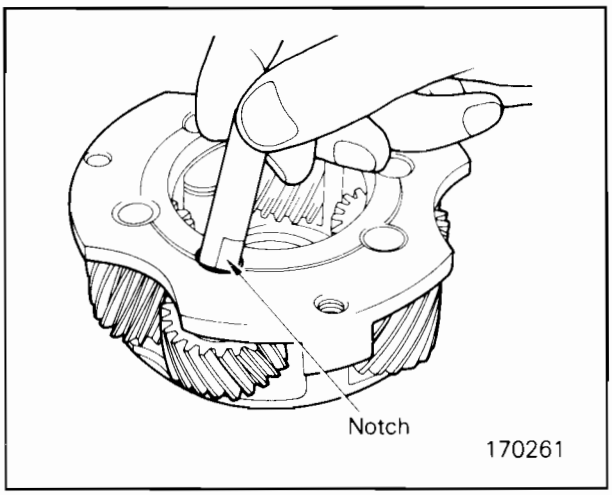


Fig. 86—Installing pinion and shaft

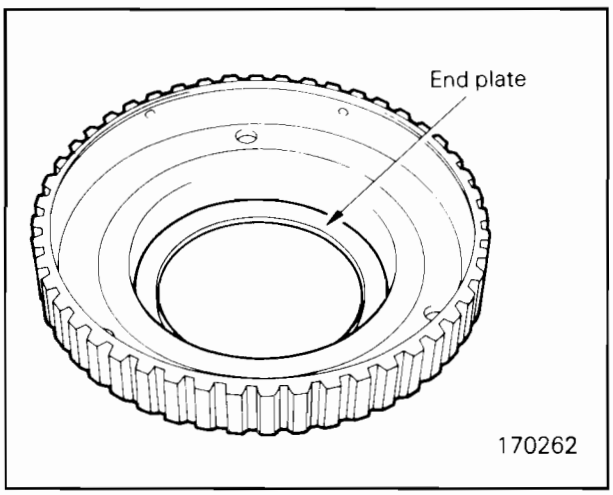


Fig. 87—End plate installation

(6) Push the one way clutch into the outer race by hand, ensuring the arrow on the outside of the cage is pointed upward, refer Fig. 88.

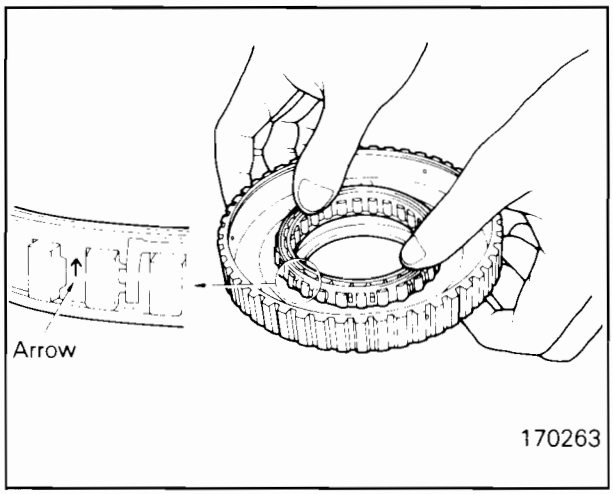


Fig. 88—Installing one way clutch

(7) Smear the one way clutch outer end plate with petroleum jelly and fix it to the one way clutch, refer Fig. 89.

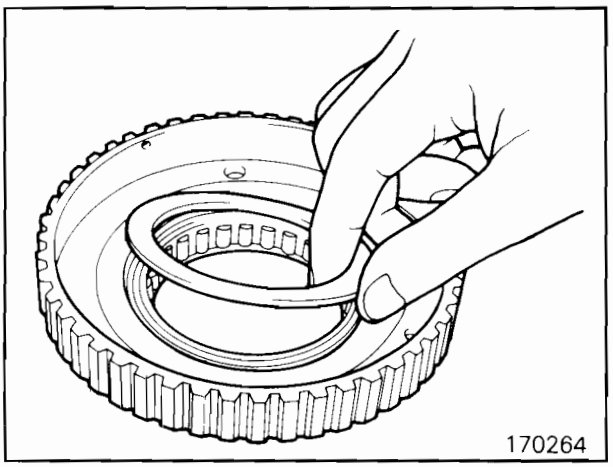


Fig. 89—Outer end plate installation

(8) Position the one way clutch assembly on the carrier and align the bolt holes.

(9) Install the three bolts and tighten to the specified torque, refer Fig. 90.

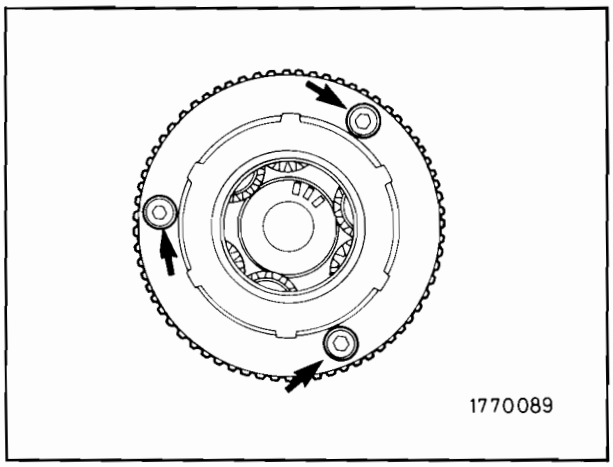
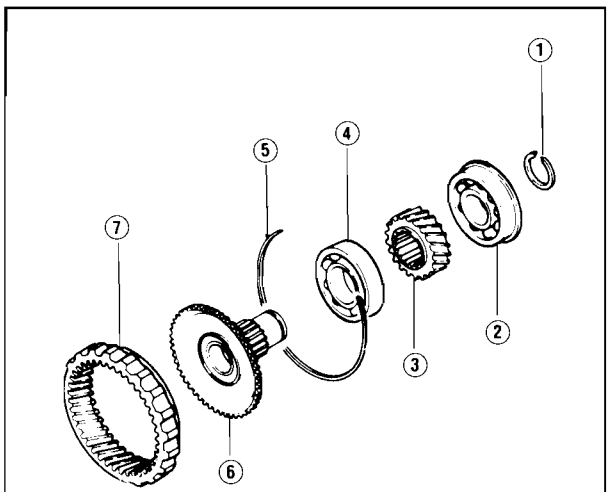


Fig. 90—Clutch race bolt installation

ANNULUS AND TRANSFER DRIVE GEAR



1. Snap ring
2. Bearing
3. Transfer drive gear
4. Bearing
5. Snap ring
6. Output flange
7. Annulus gear

Fig. 91—Annulus gear and drive gear components

Disassembly

(1) Remove the snap ring adjacent to the bearing at the rear end of the output flange.

(2) Using special tool E21M16 with jaws E21M16D and step plug E1673G16 remove the bearings and gear from the output flange, refer Fig. 92.

(3) Remove the snap ring and remove the annulus gear from the output flange, refer Fig 93.

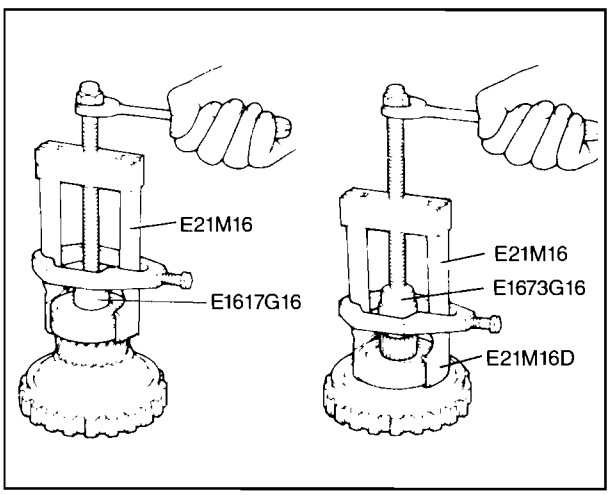


Fig. 92—Bearing removal

Inspection

Thoroughly clean all components prior to inspection.

(1) Check the bearings for smooth rotation.

(2) Check gear teeth for chips and wear.

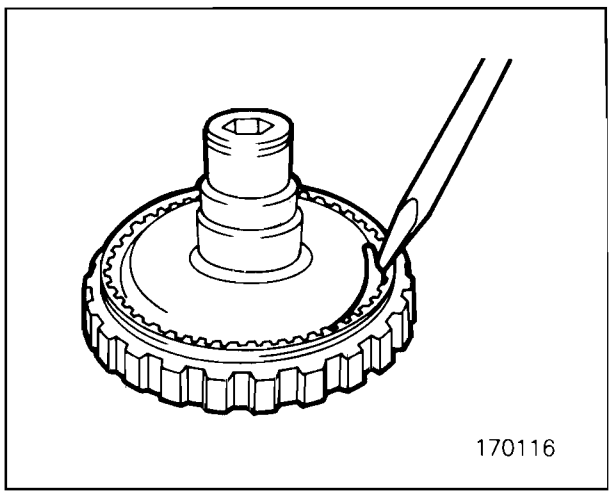


Fig. 93—Removing annulus gear snap ring

Assembly

(1) Install the annulus drive gear onto the output flange and fit the snap ring.

(2) Install the bearings and the gear using special tool E7511A, refer Fig. 94 and 95, ensuring that the gear is fitted in the direction shown in Fig. 95.

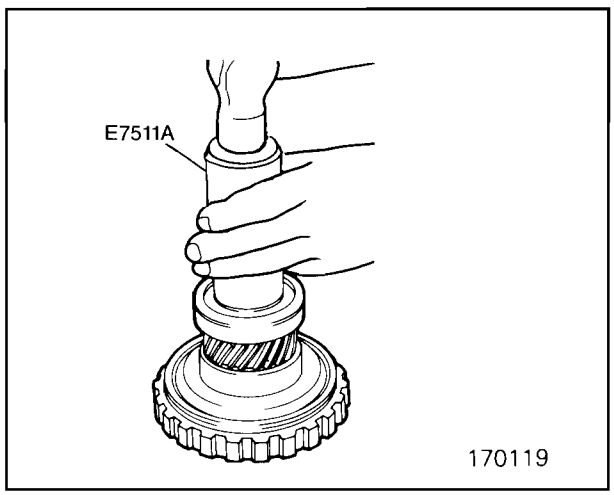


Fig. 94—Bearing installation

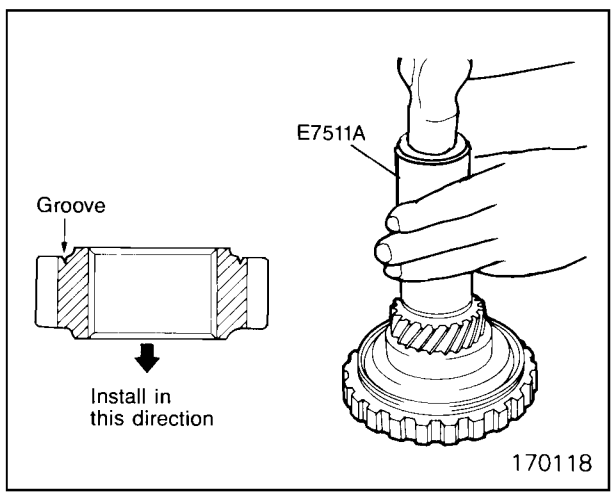


Fig. 95—Installing transfer drive gear

(3) Select the thickest spacer that will fit in the groove, refer specifications for spacer selection chart, and install in the output flange groove, refer Fig. 96.

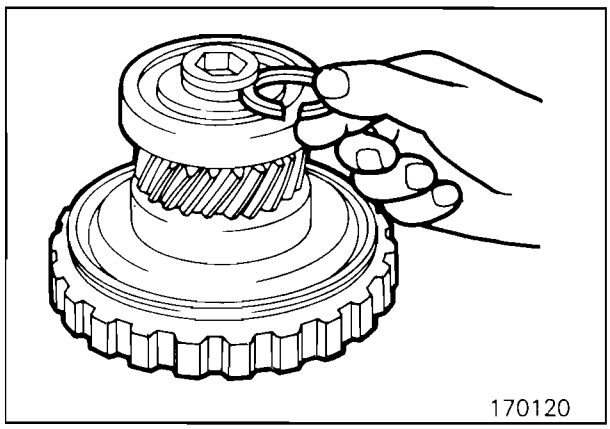


Fig. 96—Selecting snap ring

TRANSFER SHAFT

Output Bearing Removal

(1) Using special tool E1673MT with jaws E1673D15 remove output bearing, refer Fig. 97

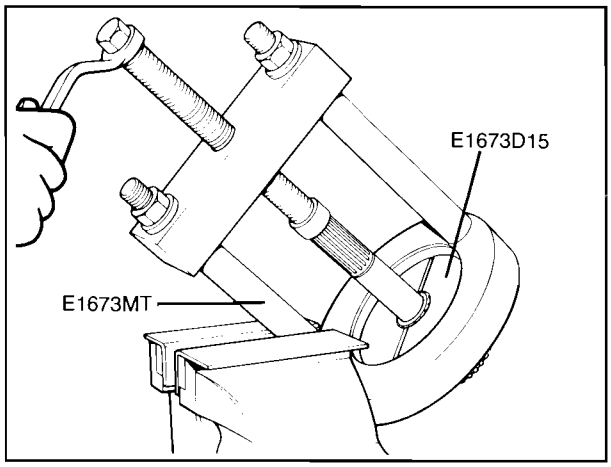


Fig. 97—Transfer shaft bearing removal

Output Bearing Installation

(1) Using a suitable installer press the bearing on the transfer shaft, refer Fig. 98.

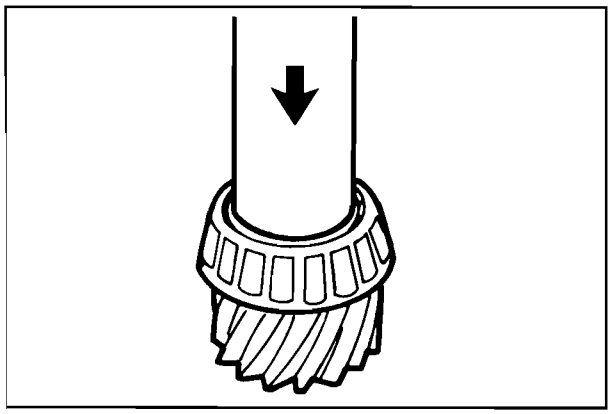


Fig. 98—Transfer shaft bearing installation

TRANSFER DRIVEN GEAR

Bearing Removal

(1) Using special tool E167MT with jaws E1673R15 remove the bearing, refer Fig. 99.

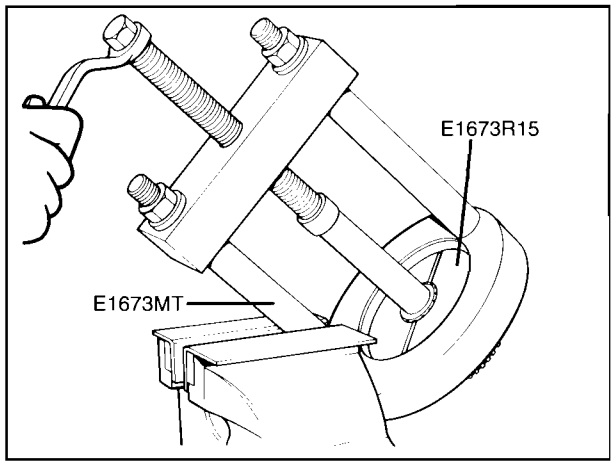


Fig. 99—Transfer driven gear bearing removal

Bearing Installation

(1) Using a suitable installer press the bearing onto the driven gear, refer Fig. 100.

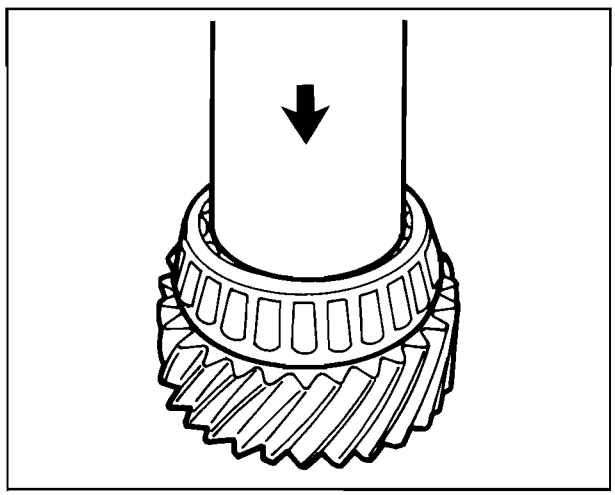


Fig. 100—Driven gear bearing installation

TRANSFER SHAFT END FLOAT ADJUSTMENT

(1) Assemble the transfer shaft with a 1.80 mm thickness spacer.

(2) Measure the transfer shaft end play using a dial indicator, refer Fig. 101.

(3) Based on the measurement, select the spacer that will provide the specified end play. (0.0 to 0.025 mm end play).

(4) Disassemble the transfer shaft and re-assemble with the selected spacer and check that end float is correct.

NOTE: DO NOT REUSE OLD LOCK NUT IN FINAL ASSEMBLY.

(5) Tighten NEW LOCK NUT to specified torque and stake the lock nut at the notch of the transfer shaft.

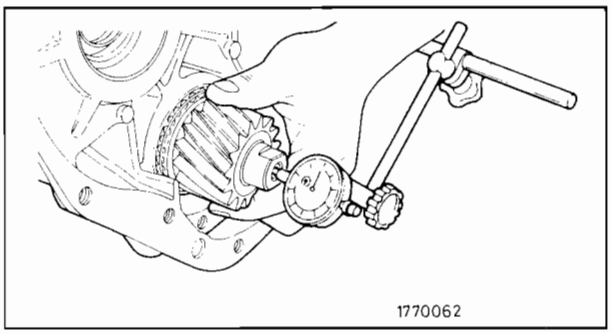


Fig. 101—Measure transfer shaft end play

DIFFERENTIAL

Disassembly

(1) Using special tools E1673MT, E1673D15 and E1673G16 remove both differential bearings, refer Fig. 102

(2) Remove the drive gear attaching bolts and remove the drive gear.

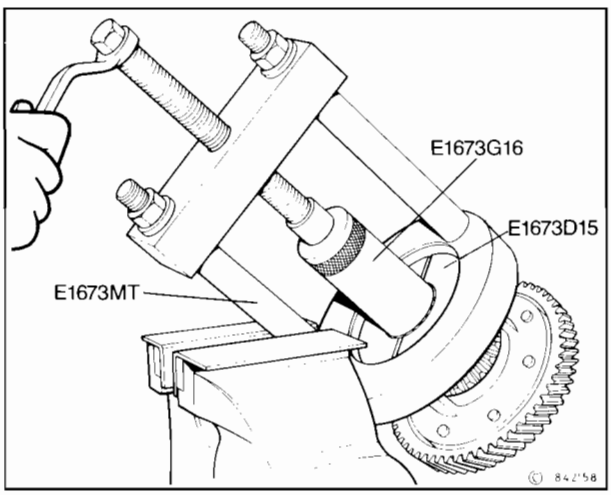


Fig. 102—Removing differential bearings

(3) Using a suitable punch drive out the pinion shaft lock pin, refer Fig. 103, it may be necessary to remove a small amount of metal to expose access hole A.

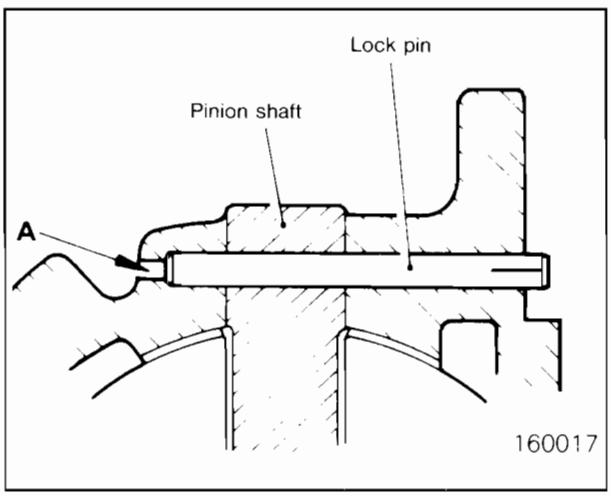


Fig. 103—Pinion shaft lock pin

NOTE: The lock pin must not be re-used.

(4) Remove the pinion shaft gears and spacers noting the location of the spacers.

Inspection

Perform the following inspection and replace any faulty components.

(1) Inspect all gears for wear, chips and other damage.

(2) Inspect thrust washers for scoring and wear.

(3) Check that all bearings rotate freely.

Assembly

(1) Install the side gears and spacers into the case.

NOTE: If installing original spacers and gears, install in positions noted in disassembly. If new side gears are being installed, fit medium thickness spacers, refer to specifications.

(2) Install pinion gears, washers and pinion shaft.

(3) Measure the backlash between the side gear and pinion gear with a dial indicator, refer Fig. 104. Select suitable side gear spacers to achieve the specified side gear to pinion backlash, refer to specifications.

NOTE: The backlash of both left and right side gears must be equal.

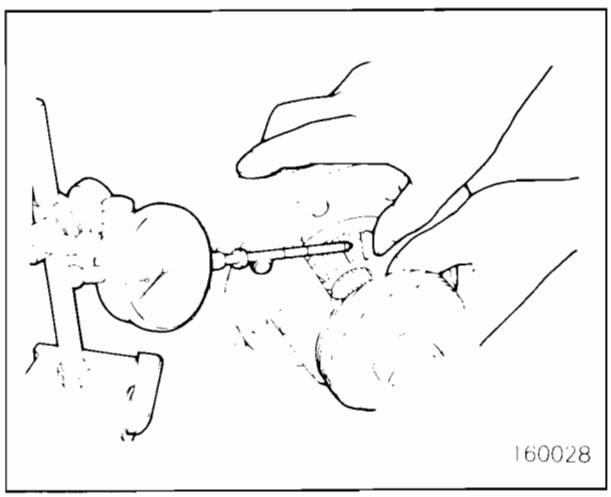


Fig. 104—Measuring backlash

(4) Install a new pinion shaft lock pin, drive the lock pin into the differential case until the head of the lock pin protrusion is less that 3 mm from the surface of the case, refer Fig. 106.

NOTE: A new lock pin must be installed.

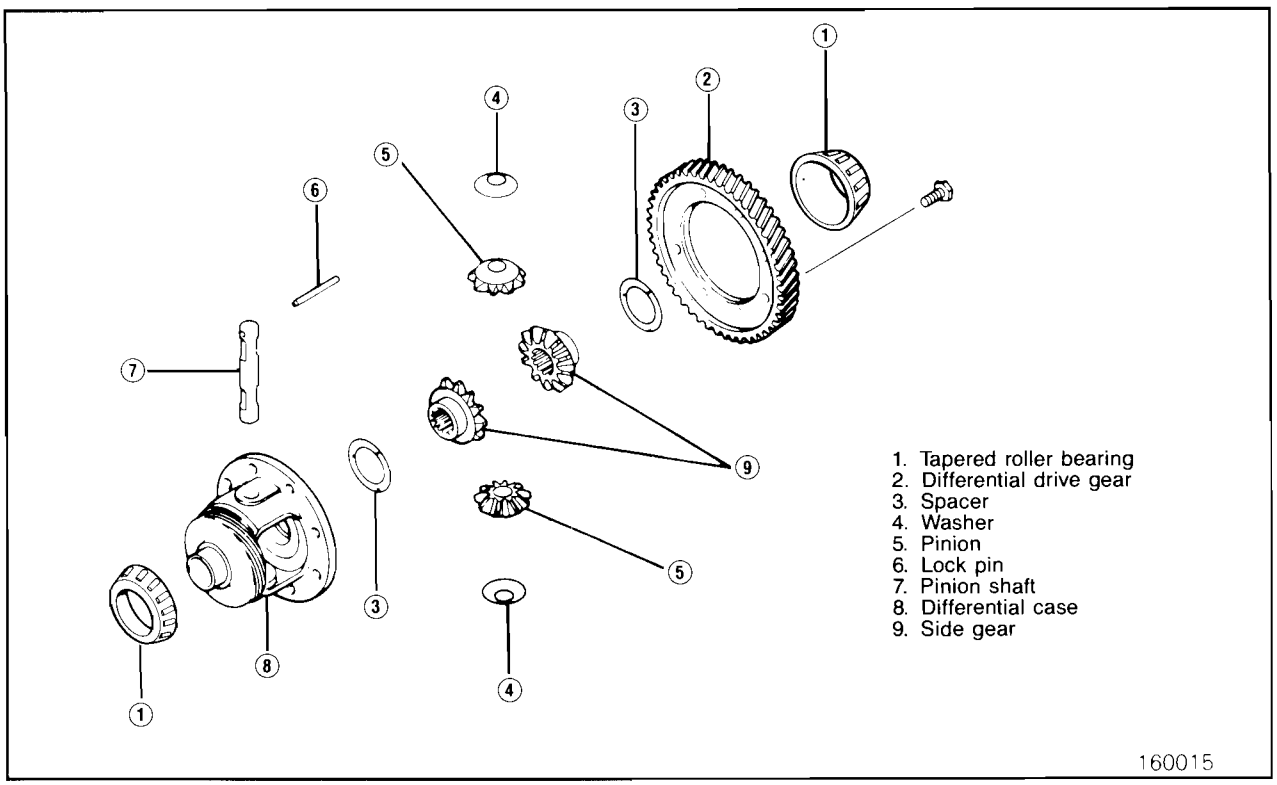


Fig. 105—Differential components

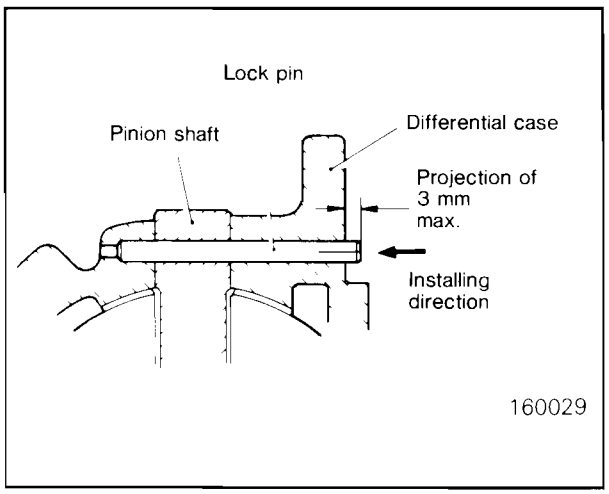


Fig. 106—Pinion shaft lock pin installation

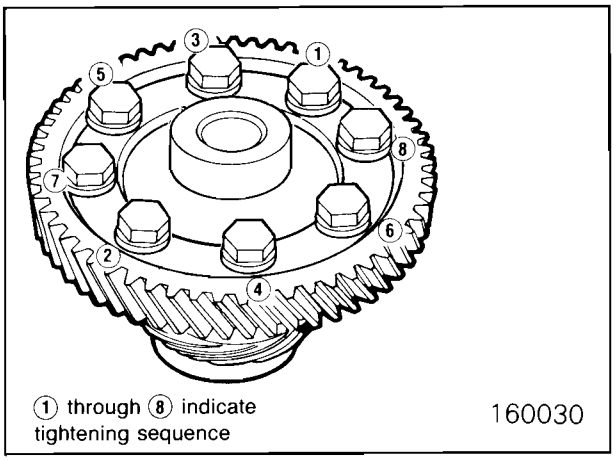


Fig. 107—Drive gear bolt tightening sequence

(5) Install the differential drive gear onto the case. Apply Loctite Threadlock 271 to the threads of the drive gear attaching bolts, install and tighten bolts to the specified torque in two stages and in the sequence shown in Fig. 107. Remove excess loctite sealer from the bolts.

(6) Using special tools E7511A and E7403 or a suitable alternative, press the bearings onto the differential case, refer Fig. 108.

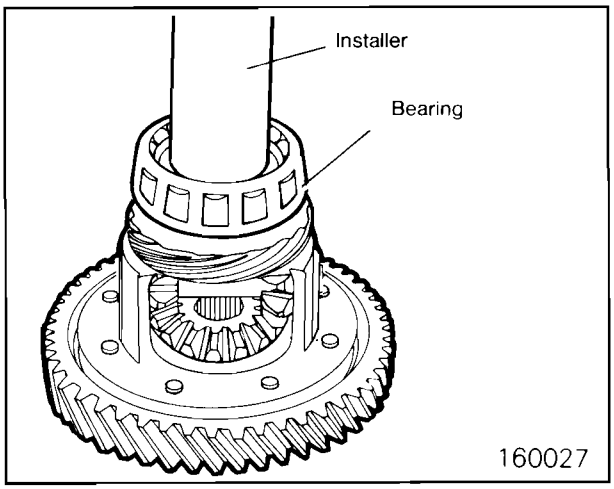


Fig. 108—Installing bearings

VALVE BODY

Disassembly

NOTE: Do not clamp any portion of the valve body or the transfer plate in a vice. Any distortion of the aluminium valve body or transfer plate will result in sticking valves, excessive leakage or both. When removing or installing valves or plugs, slide them in or out carefully. Do not use force. All springs and valves should be identified by a tag or placed in order of removal on a convoluted tray ready for cleaning and re-assembly.

(1) Remove the solenoid valve screws, refer Fig. 109, and remove the solenoid valves.

(2) Remove the manual valve from the valve body, refer Fig. 110.

(3) Remove the valve stopper and harness clamp, refer Fig. 111.

(4) Remove the N-D valve and sleeve from the upper valve body, refer Fig. 112.

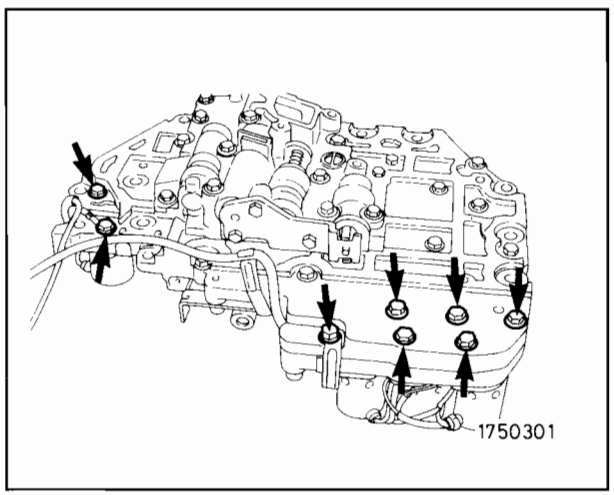


Fig. 109—Solenoid valve screws

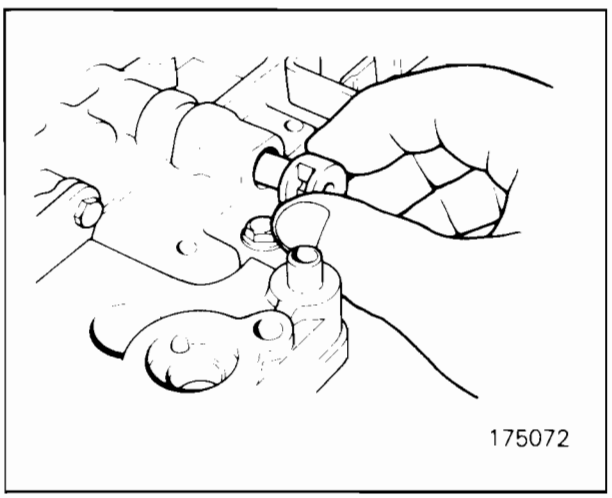


Fig. 110—Removing manual valve

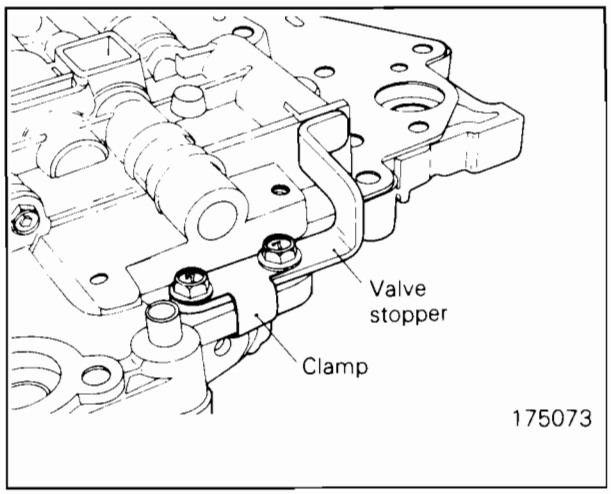


Fig. 111—Valve stopper

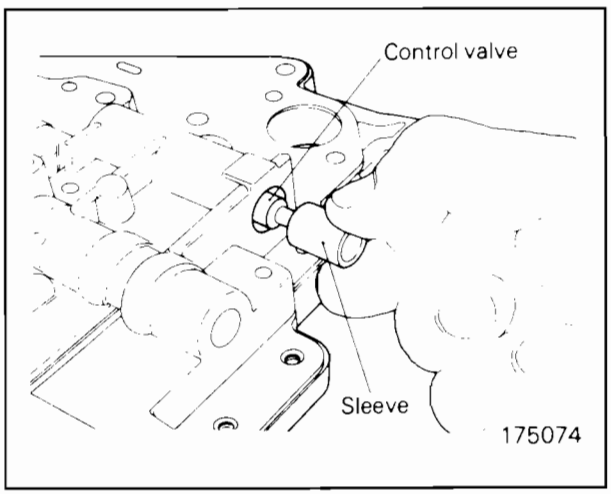


Fig. 112—Removing N-D control valve

(5) Remove the lower valve body attaching bolts, refer Fig. 113, and remove the lower valve body and separating plate.

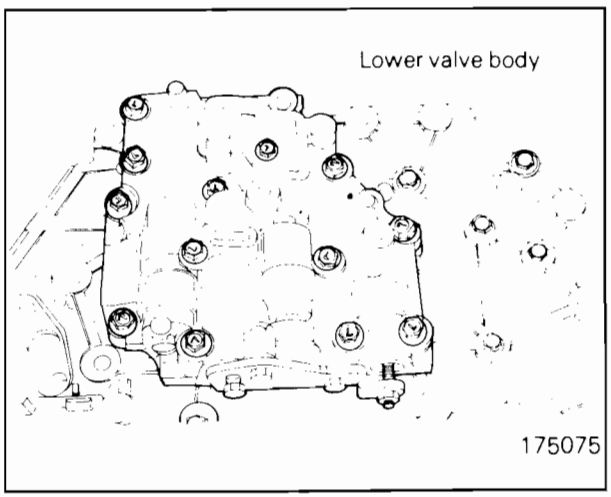
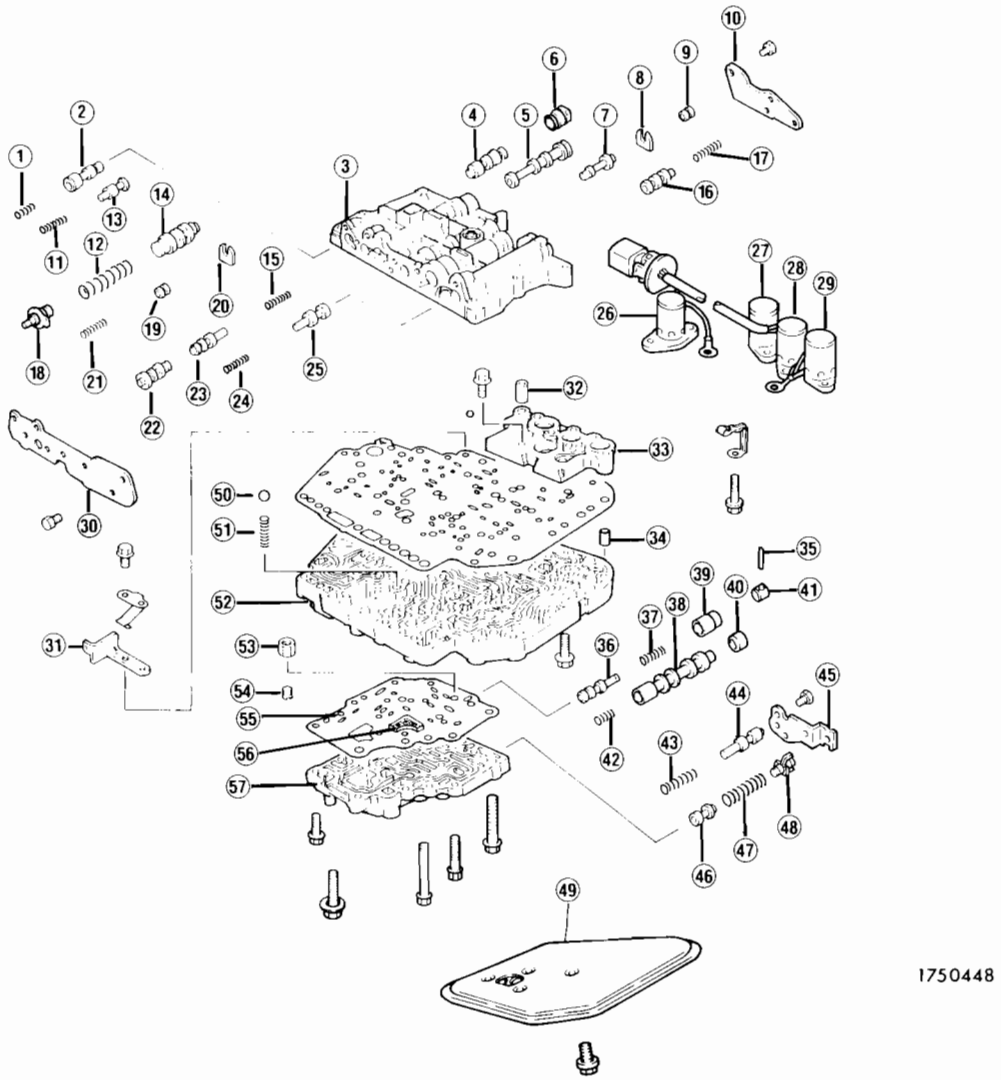


Fig. 113—Lower valve body attaching bolts



1. Pressure control spring
2. Pressure control valve
3. Upper valve body
4. N-D control valve
5. Manual valve
6. N-D control sleeve
7. Shift control valve
8. Stopper plate
9. Shift control plug B
10. Rear end cover
11. Torque convertor control spring
12. Regulator spring
13. Torque convertor control valve
14. Regulator valve
15. Rear clutch exhaust spring
16. 1-2 shift valve
17. 1-2 shift spring
18. Adjusting screw
19. Shift control plug
20. Stopper plate
21. Shift control spring
22. Rear clutch exhaust valve A
23. Rear clutch exhaust valve B
24. 2-3/4-3 shift spring
25. 2-3/4-3 shift valve
26. PCSV
27. LUCCSV
28. SCSV "A"
29. SCSV "B"
30. Front end cover
31. Valve stopper
32. Pipe
33. Block
34. Dowel bushing
35. Pin
36. End clutch valve
37. End clutch spring
38. Lock up clutch control valve
39. End clutch plug
40. Lock up clutch control sleeve
41. Stopper
42. Lock up clutch control spring
43. N-R control spring
44. N-R control valve
45. End cover
46. Reducing valve
47. Reducing spring
48. Adjusting screw
49. Filter
50. Steel ball
51. Relief spring
52. Intermediate plate
53. Nut
54. Restrictor
55. Lower separating plate
56. Filter
57. Lower valve body

Fig. 114—Valve body components

(6) Remove the two steel balls, spring and oil filter from the intermediate plate, refer Fig. 115.

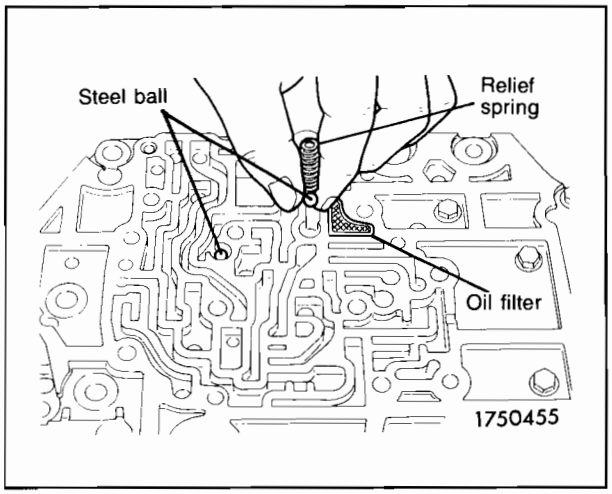


Fig. 115—Ball and filter removal

(7) Remove the intermediate plate attaching bolts, refer Fig. 116, and remove the plate.

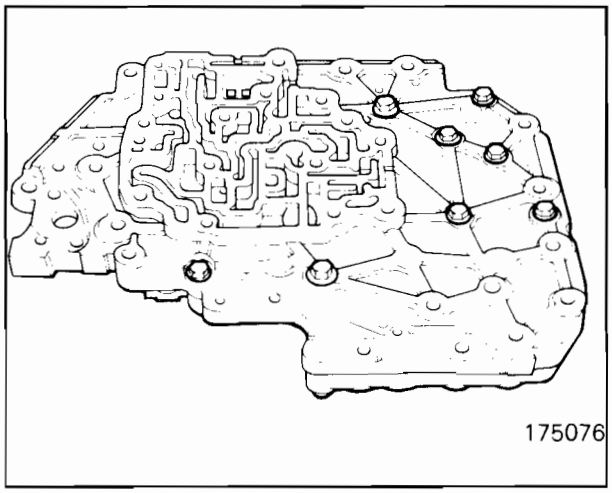


Fig. 116—Intermediate plate attaching bolts

(8) Remove the steel balls and the teflon ball and the two stopper plates, refer Fig. 117.

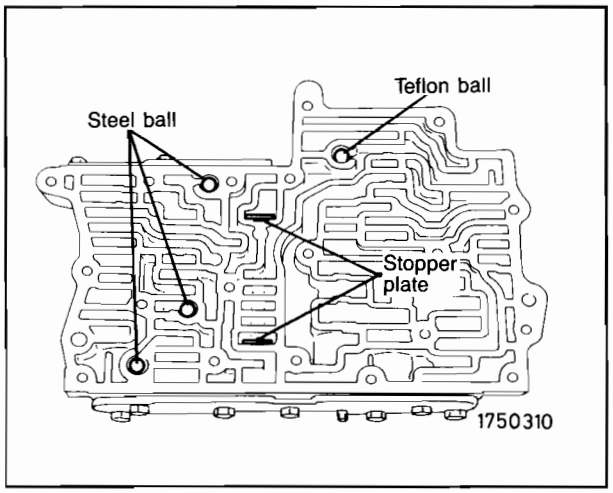


Fig. 117—Ball and stopper plate removal

(9) Remove the block and upper separating plate, refer Fig. 118.

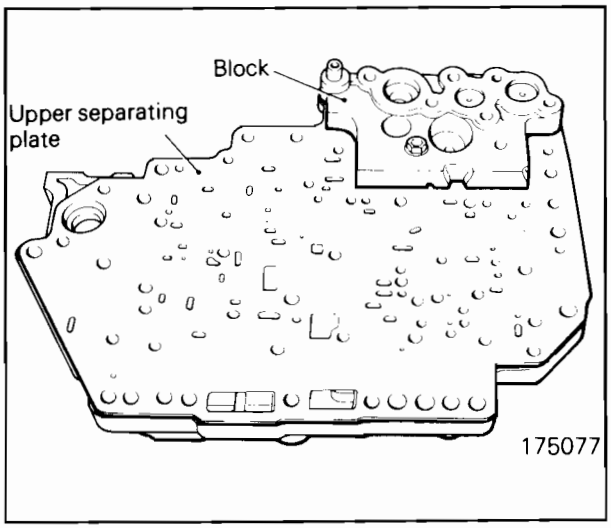


Fig. 118—Removing separating plate

(10) Remove the end cover then the 1-2 shift valve spring, shift control valve and plug from the upper valve body, refer Fig. 119.

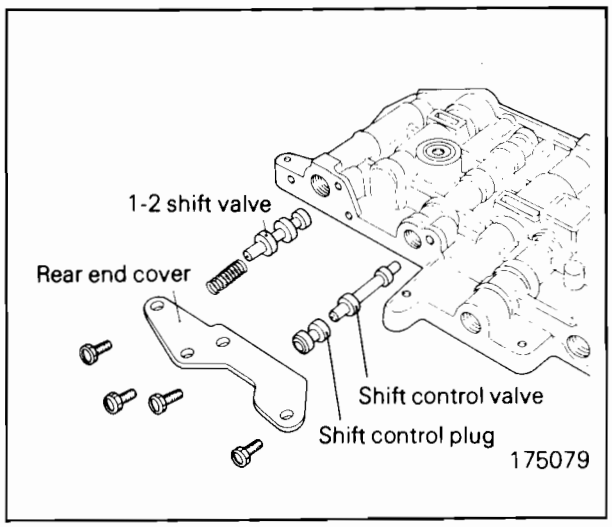
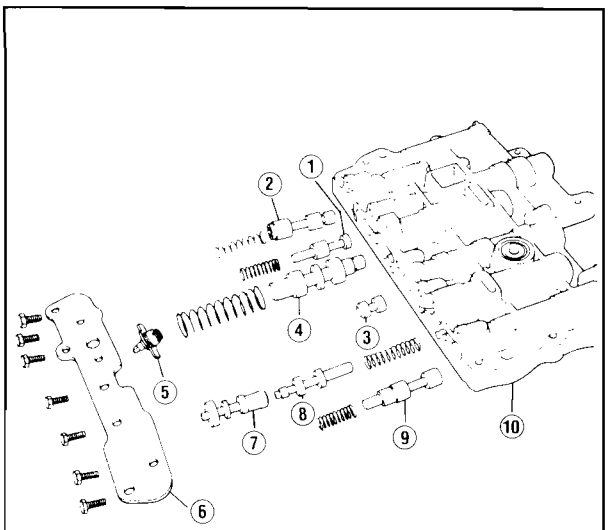


Fig. 119—Removing valves and spring

(11) Remove the end cover and then valves and springs, refer Fig. 120, from the upper valve body.

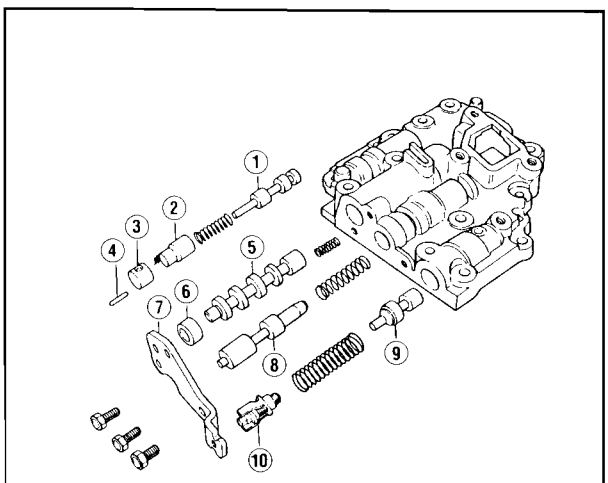
(12) Remove the pin, refer Fig. 121, and remove the stopper, plug, spring, and end clutch valve from the lower valve body.

(13) Remove the end cover and then the damper clutch valve sleeve, valve, N-R control valve, reducing valve and springs from the lower valve body, refer Fig. 121.



1. Torque converter control valve
2. Pressure control valve
3. Shift control plug and spring
4. Regulator valve
5. Adjusting screw
6. Front end cover
7. Rear clutch exhaust valve A
8. Rear clutch exhaust valve B
9. 2-3 shift valve
10. Upper valve body

Fig. 120—Upper valve body components



1. End clutch valve
2. End clutch valve plug
3. Stopper
4. Pin
5. Lock up clutch control valve
6. Lock up clutch valve sleeve
7. End cover
8. N-R control valve
9. Reducing valve
10. Adjusting screw

Fig. 121—Lower valve body components

Cleaning and Inspection

Allow all parts to soak for a few minutes in a suitable clean solvent. Wash thoroughly and dry with compressed air.

Inspect all mating surfaces for nicks, burrs and scratches. Using a straight edge inspect mating surfaces for warpage or distortion. Make sure all metering holes in the transfer plate and valve body are open. Using a pen light, inspect bores in valve body for scores, scratches, pits and irregularities.

Inspect all valve springs for distortion and collapsed coils. Inspect all valves and plugs for burrs, nicks and scores. Small nicks and scores may be removed with crocus cloth, providing extreme care is taken not to round off sharp edges. The sharpness of these edges is vitally important because it prevents foreign matter from lodging between valve and valve body, thus reducing possibility of sticking. Inspect all valves and plugs for freedom of operation in valve body bores.

When bores, valves and plugs are clean and dry, the valves and plugs should fall freely in the bores. **The valve body bores do not change dimensionally with use. Therefore, a valve body that was functioning properly when vehicle was new, will operate correctly if it is properly and thoroughly cleaned. There is no need to replace the valve body unless it is damaged in handling.**

Assembly

NOTE: Prior to assembly ensure all valves and plugs are well lubricated with clean A.T.F. Refer to specifications for valve spring identification chart.

(1) Install valves and springs in the order shown in Fig. 123, to the upper valve body. The line pressure adjusting screw should have its dimension "A", refer Fig. 122, preset at specified value. Specified value: 4 mm.

NOTE: Perform actual line pressure adjustment on the vehicle, measuring the actual pressure and adjust as necessary, refer section 3B for the procedure.

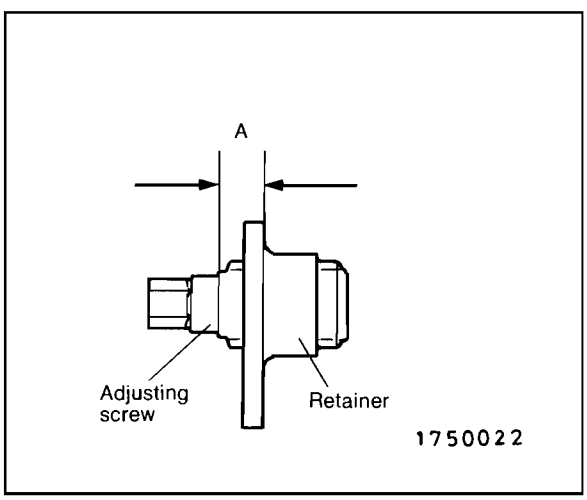
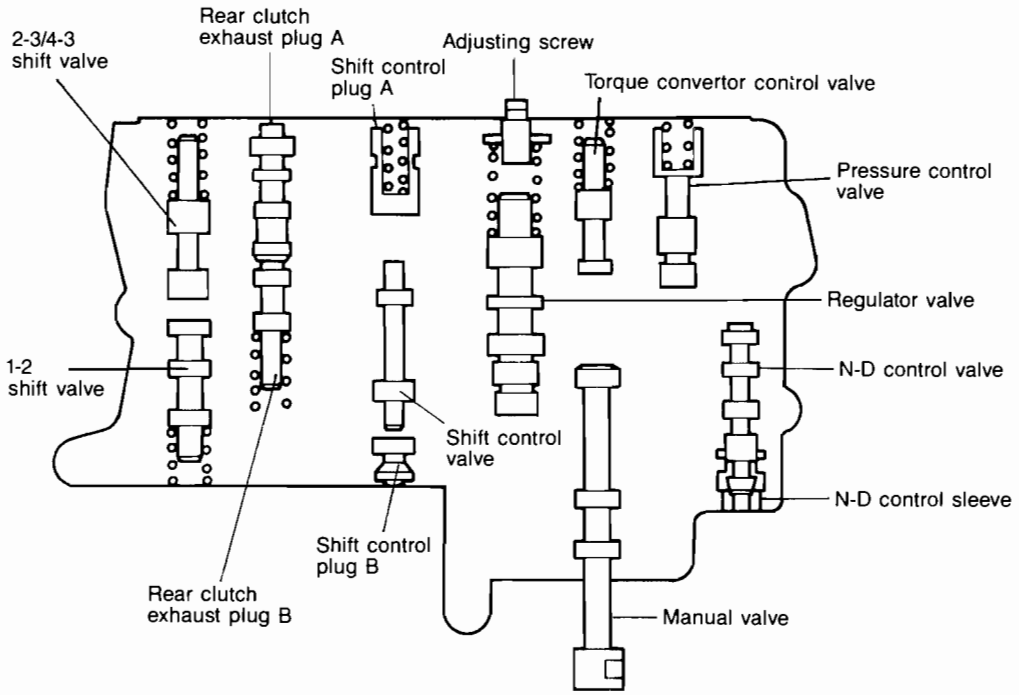


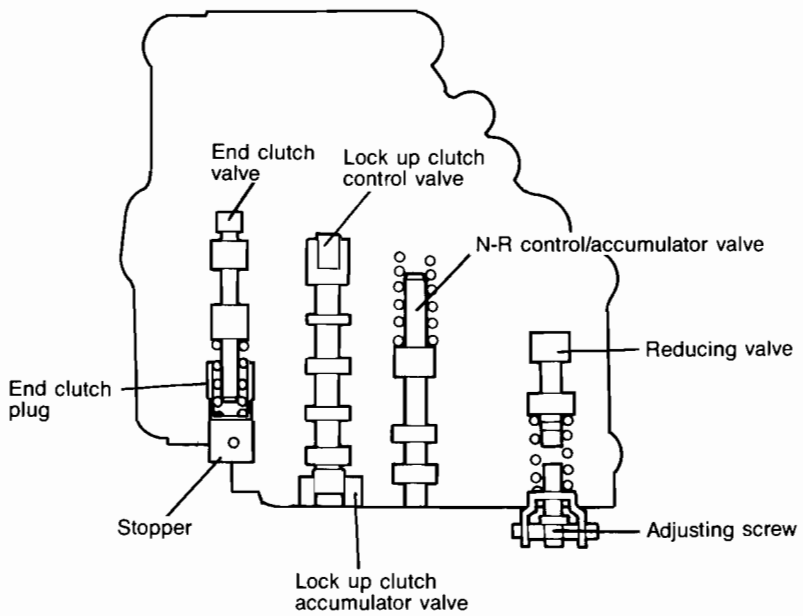
Fig. 122—Preseting adjusting screw

Upper valve body



TFA0420

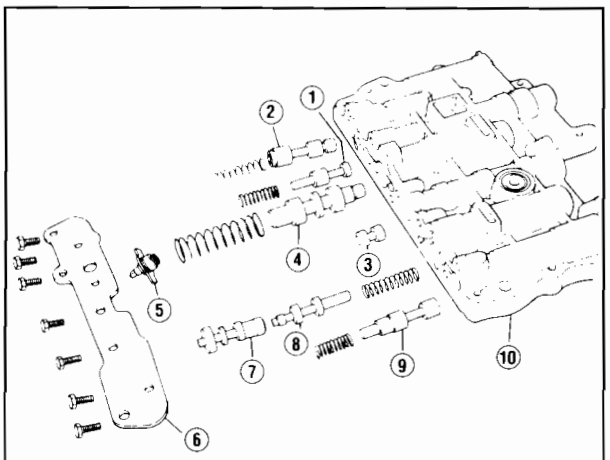
Lower valve body



1750336

Fig. 123—Upper and lower valve body valve location

(2) Install the end cover and tighten bolts to the specified torque.



1. Torque converter control valve
2. Pressure control valve
3. Shift control plug and spring
4. Regulator valve
5. Adjusting screw
6. Front end cover
7. Rear clutch exhaust valve A
8. Rear clutch exhaust valve B
9. 2-3 shift valve
10. Upper valve body

Fig. 124—Upper valve body components

(3) Install the 1-2 shift valve, spring, shift control valve and plug in the upper valve body, refer Fig. 125.

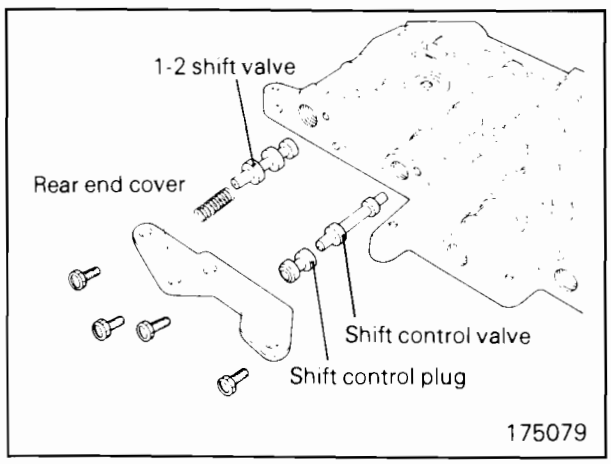


Fig. 125—Valve and spring installation

(4) Install end cover and tighten bolts to the specified torque.

(5) Install the three steel balls and one teflon ball and two stopper plates, refer Fig. 126, in the upper valve body, ensuring that the plates are correctly positioned on the shift control valve.

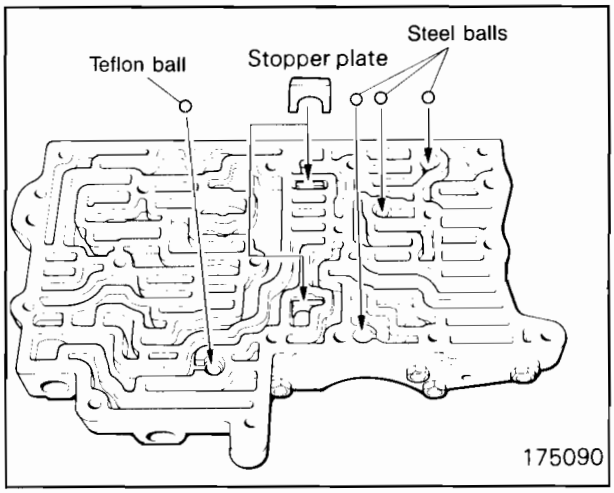


Fig. 126—Ball and stopper plate location

(6) Install the upper seperating plate and block to the intermediate plate, leaving the bolts finger tight, refer Fig. 127.

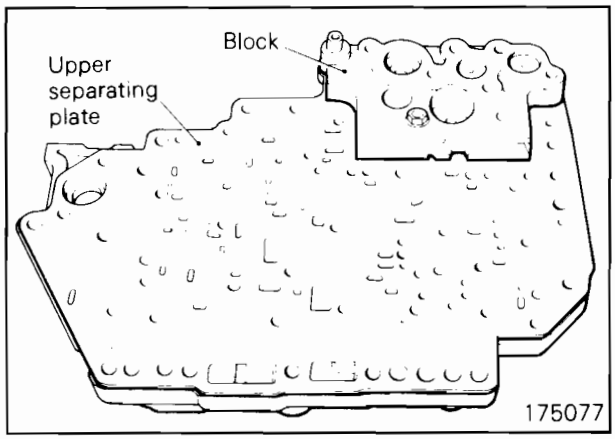


Fig. 127—Installing upper seperating plate

(7) Install the intermediate plate and upper seperating plate assembly, refer Fig. 128, leaving all bolts finger tight.

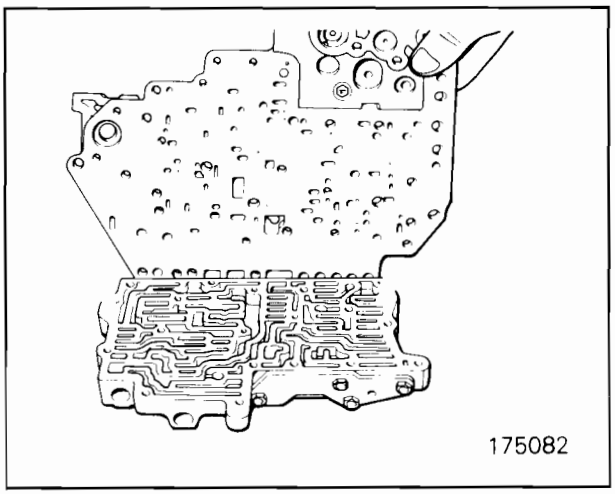


Fig. 128—Installing intermediate plate

(8) Install the end clutch valve, plug, stopper and pin in the lower valve body, refer Fig. 129.

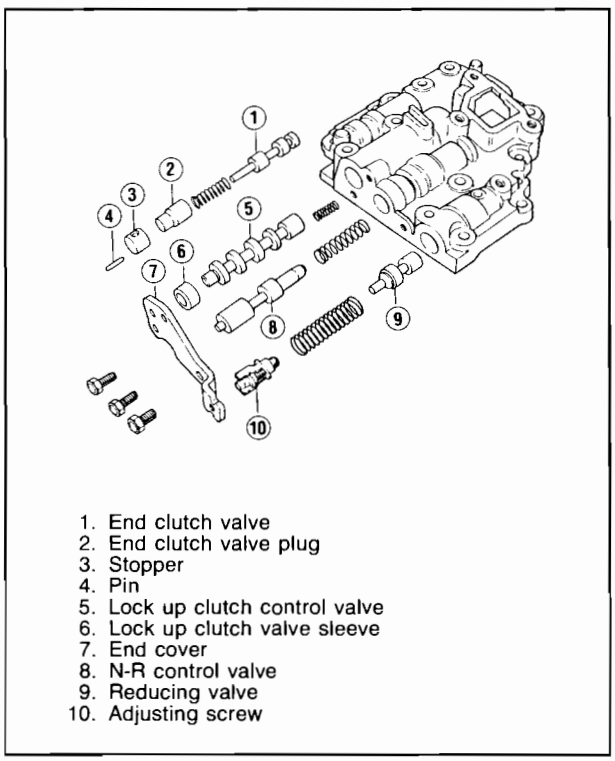


Fig. 129—Lower valve body components

(9) Install the reducing valve and spring, the N-R valve and spring, the lock up clutch control spring, valve and sleeve to the lower valve body, refer Fig. 129.

NOTE: The reducing pressure adjusting screw should have its dimension A (refer Fig. 130) preset at specified value: 10 mm. Check actual reducing pressure on vehicle and adjust as necessary, refer "maintenance and adjustment", section 3.

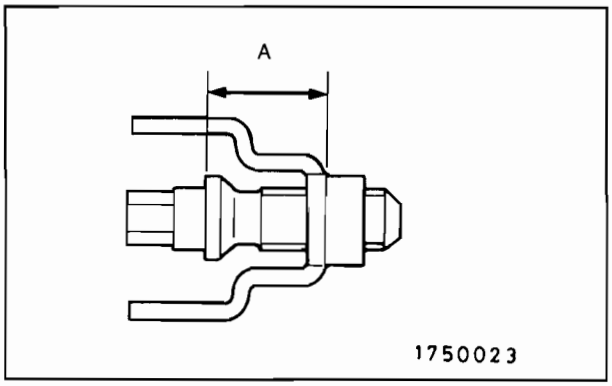


Fig. 130—Reducing valve adjusting screw adjustment

(10) Install end cover and tighten to the specified torque.

(11) Install the steel balls and spring in the intermediate plate, refer Fig. 131.

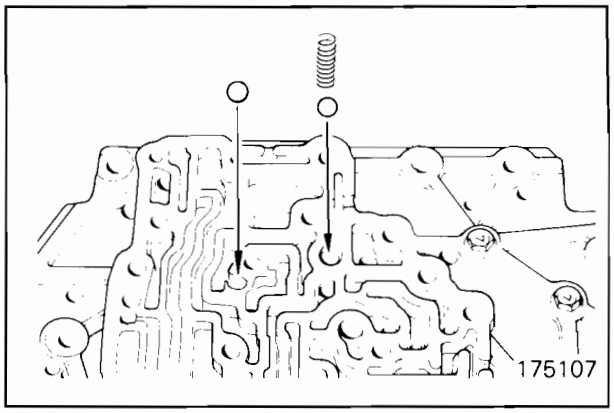


Fig. 131—Steel ball and spring location

(12) Position the lower separating plate and lower valve body on the valve body assembly, refer Fig. 132. Install retaining bolts, leaving bolts finger tight.

(13) Tighten all valve body assembly bolts to specifications.

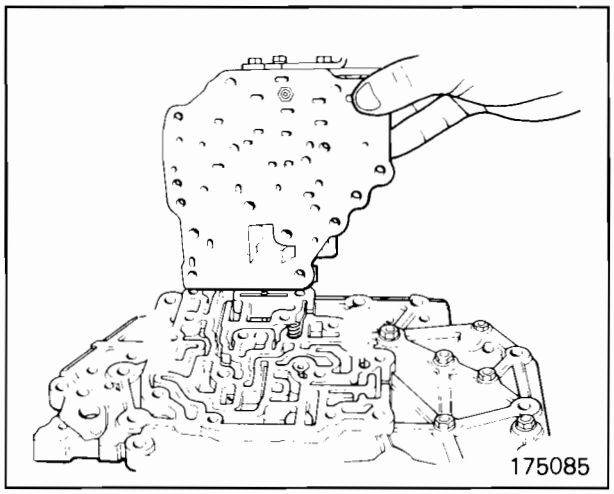


Fig. 132—Installing lower valve body

(14) Install the N-D control valve and sleeve in the upper valve body, refer Fig. 133.

(15) Install the valve stopper and harness clamp, refer Fig. 134.

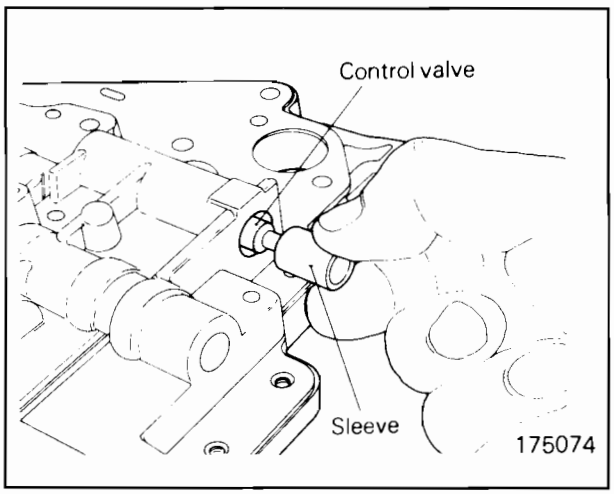


Fig. 133—Installing N-D control valve

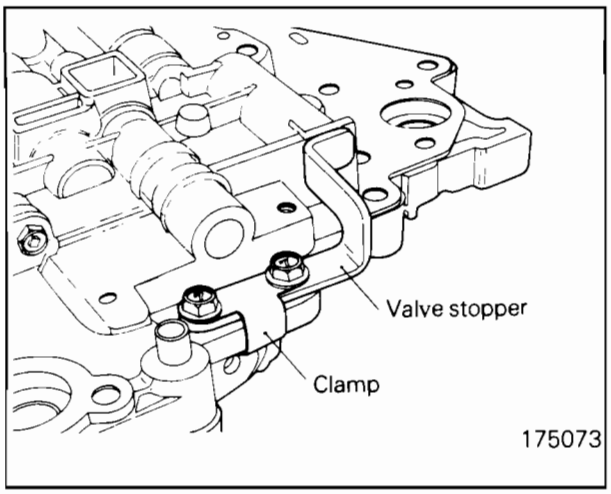


Fig. 134—Installing valve stopper

(16) Install the manual valve, refer Fig. 135.
(17) Clean the solenoid valve oil screens and replace the "O" rings, refer Fig. 136.

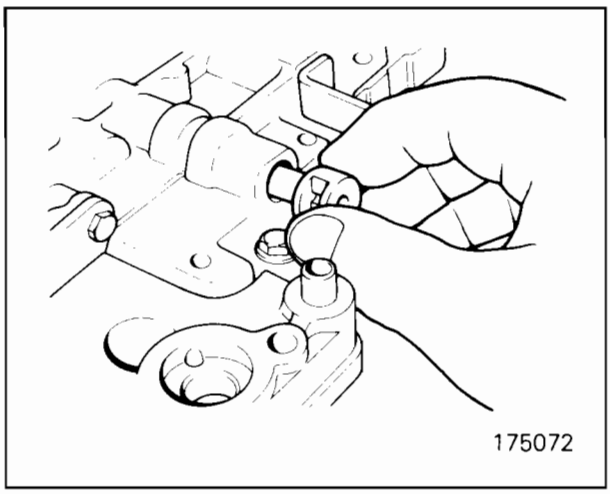


Fig. 135—Installing manual valve

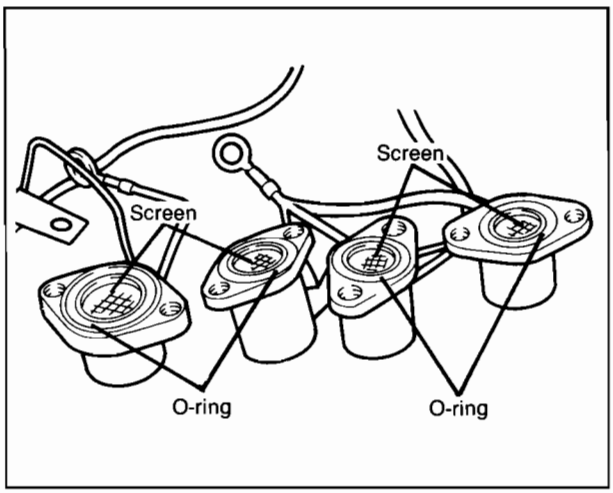


Fig. 136—Solenoid valves

(18) Apply a coat of A.T.F. to the "O" rings and install the solenoid valves in the valve body, refer Fig. 137.

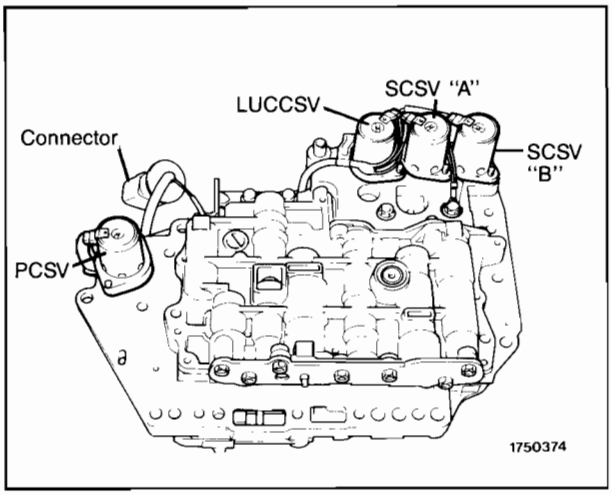


Fig. 137—Solenoid valve locations

TRANSAXLE ASSEMBLY

Always observe the following points when assembling the transaxle.

(a) Always use new gaskets, "O" rings and seals.

(b) Use only petroleum jelly for fixing spacers, thrust races, etc.

(c) Apply A.T.F. to friction elements, sliding and rotating components prior to assembly.

(d) Keep all components clean and free of cloth lint.

(e) The oil in the oil cooler should be replaced.

NOTE: Before assembly of the transaxle, measure the end play of the low-reverse brake, and select a pressure plate that will achieve the correct clearance, using the following procedure.

(A) Install the brake reaction plate, brake plate and brake disc to the transaxle case, refer Fig. 138.

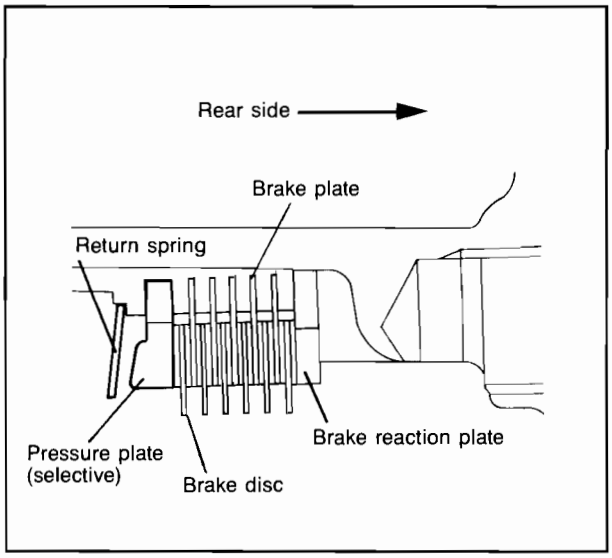


Fig. 138—Installing brake reaction plate

NOTE: When new brake discs are used, immerse in A.T.F. for at least two hours prior to installation.

(B) Install the pressure plate and then the return spring, ensuring that the return spring is fitted as shown in Fig. 138.

(C) Apply a coating of petroleum jelly to the wave spring of the centre support and attach it to the centre support, refer Fig. 139.

(D) Using special tool E21M41 attached to centre support, install centre support, refer Fig. 140.

(E) Install the centre support snap ring, refer Fig. 141.

(F) Using a suitable adaptor, attach a dial indicator with extension E21M44 to the rear of the transaxle case, refer Fig. 142.

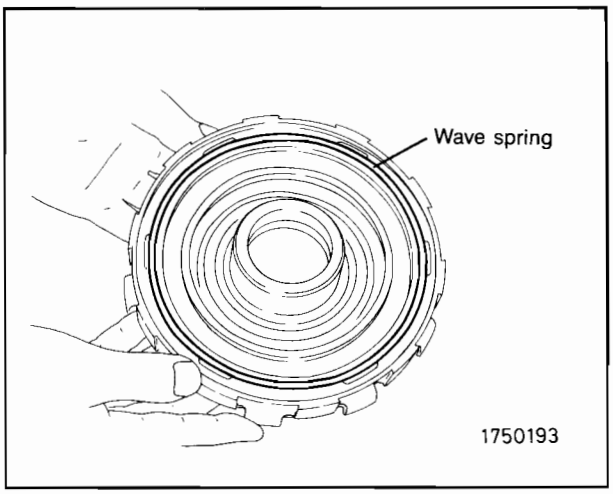


Fig. 139—Wave spring position

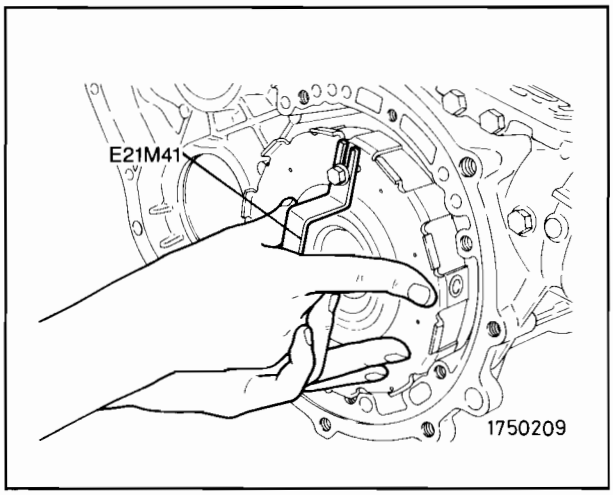


Fig. 140—Installing centre support

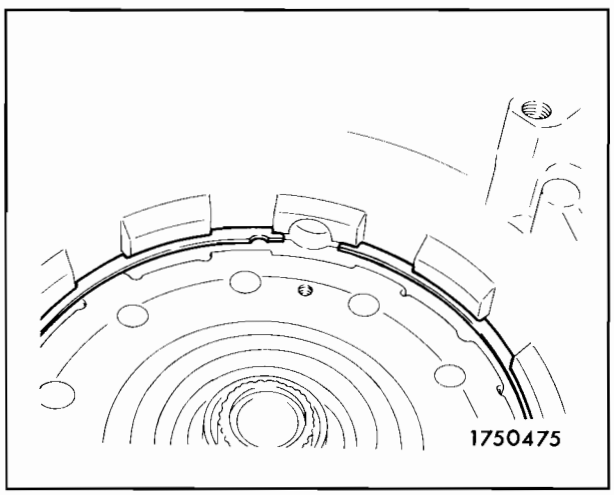


Fig. 141—Snap ring installation

NOTE: Install the dial indicator so that it contacts the brake reaction plate at a right angle from the transfer idler shaft hole.

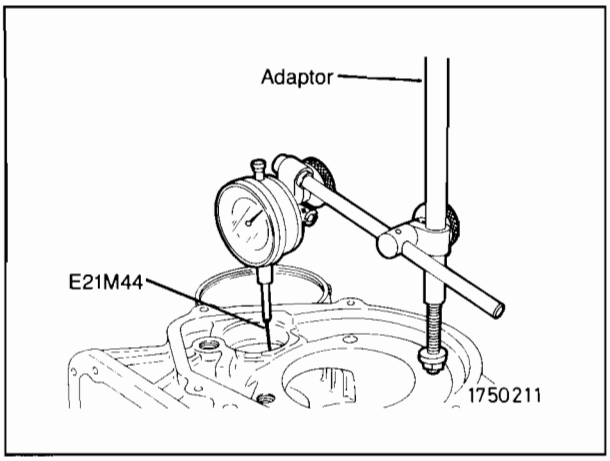


Fig. 142—Dial indicator installation

(G) Position the dial indicator so as the dial indication extension E21M44 touches the low reverse brake reaction plate, refer Fig. 143.

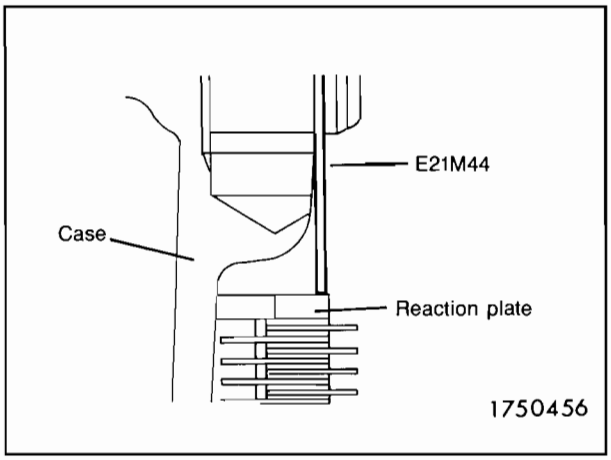


Fig. 143—Extension position

(H) Using a manual air pump, in the position shown in Fig. 144, check the dial indicator reading and select a pressure plate that will ensure the specified end play, i.e. 1.0 mm to 1.3 mm.

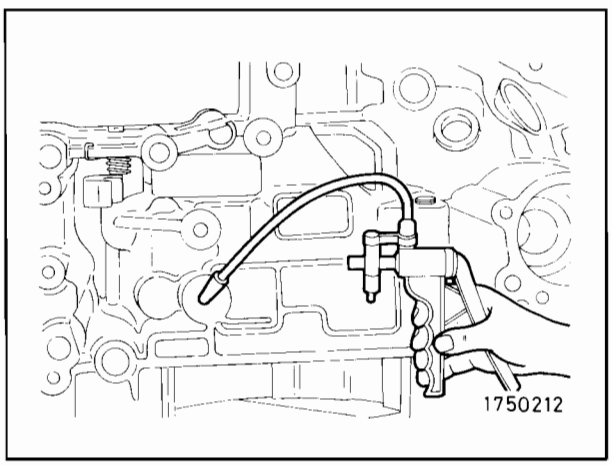


Fig. 144—Air pump connection

(1) Using a suitable installer install both transfer shaft bearing races.

(2) Position the transaxle on the bench with the oil pan mounting surface facing up.

(3) Install the annulus gear and output flange assembly into the case, refer Fig. 145.

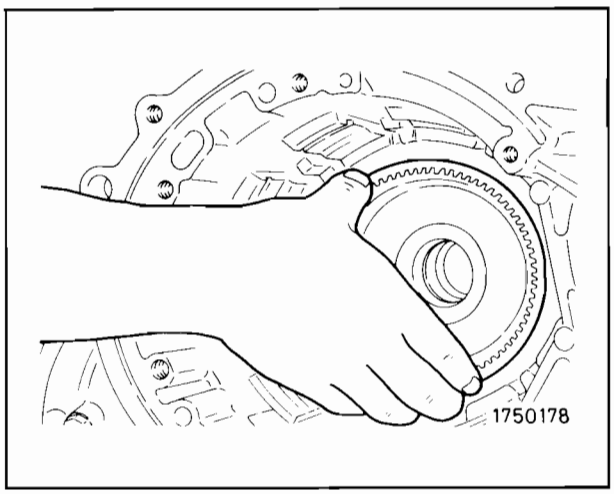


Fig. 145—Installing annulus gear and output shaft

(4) Install the snap ring in the groove on the output flange rear bearing, refer Fig. 146.

(5) Install the two taper roller bearings in the transfer idler gear, refer Fig. 147.

(6) Using petroleum jelly affix the spacer to the transaxle case, refer Fig. 148.

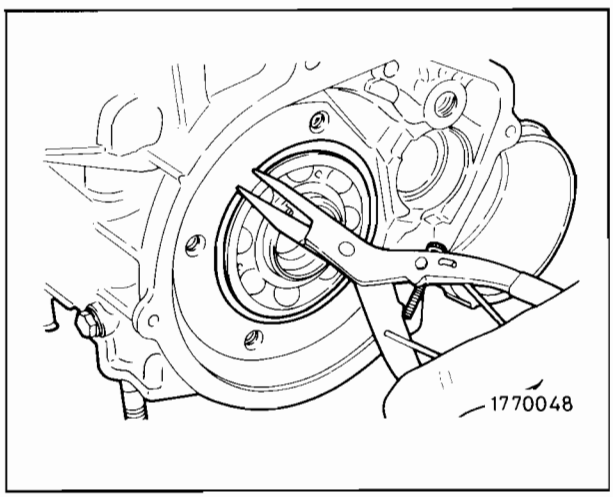


Fig. 146—Snap ring installation

(7) Install the transfer idler gear in the transaxle case in the direction shown in Fig. 147, ensuring that the lug on the spacer is correctly located in the transaxle case.

(8) Insert the idler shaft from the outside of the case, refer Fig. 149, then screw in the tighten using special tool E2IM36, refer Fig. 150.

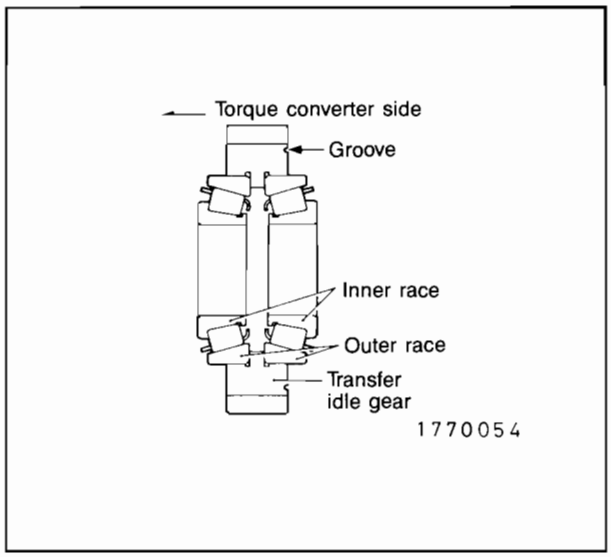


Fig. 147—Transfer idler gear installation direction

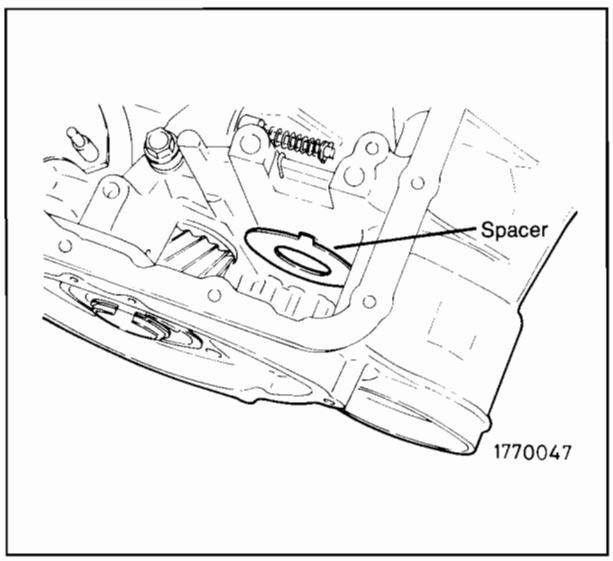


Fig. 148—Spacer location

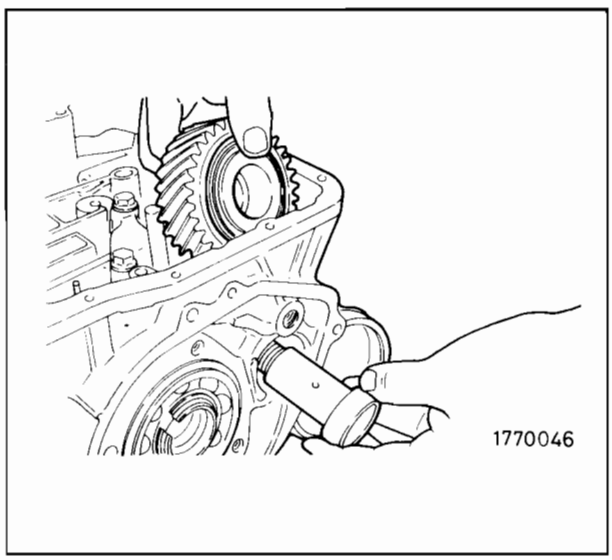


Fig. 149—Installing idler gear shaft

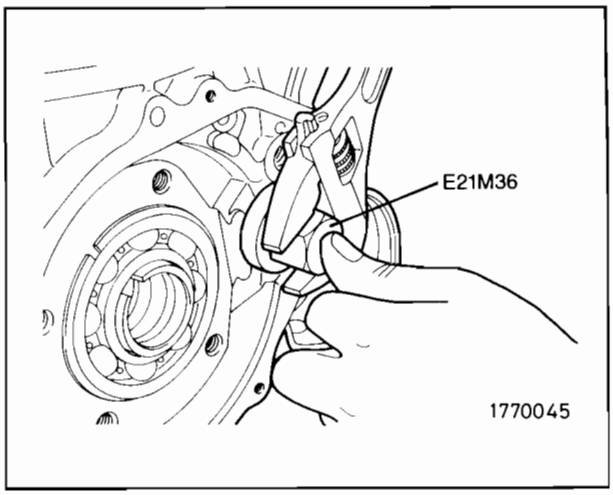


Fig. 150—Tightening idler shaft

(9) Insert special tool E21M39 in the output flange, refer Fig. 151, and using suitable torque wrench measure idler gear preload.

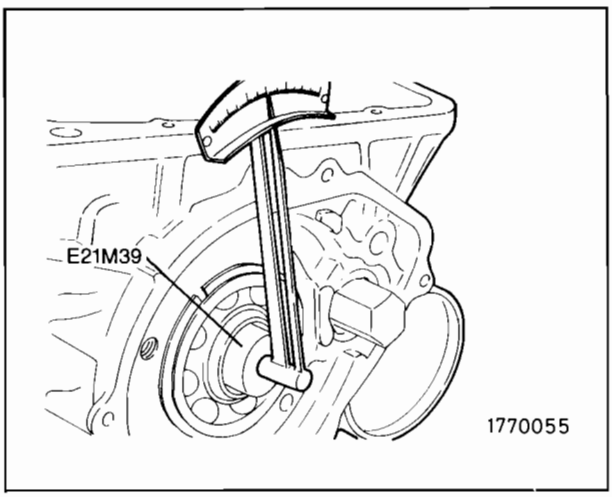


Fig. 151—Adjusting idler gear preload

(10) Adjust preload to 1.5 Nm by tightening or loosening idler shaft.

(11) After preload adjustment is completed, install the idler shaft lock plate and lock plate bolt, refer Fig. 152. Tighten the lock plate bolt to the specified torque.

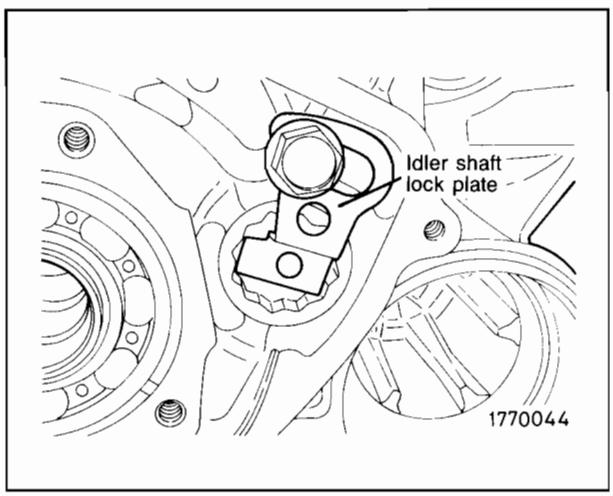


Fig. 152—Idler shaft lock plate installation

(12) Install the transfer shaft with taper bearing into the transaxle case, refer Fig. 153.
(13) Hold the transfer shaft and position the transaxle on the bench.

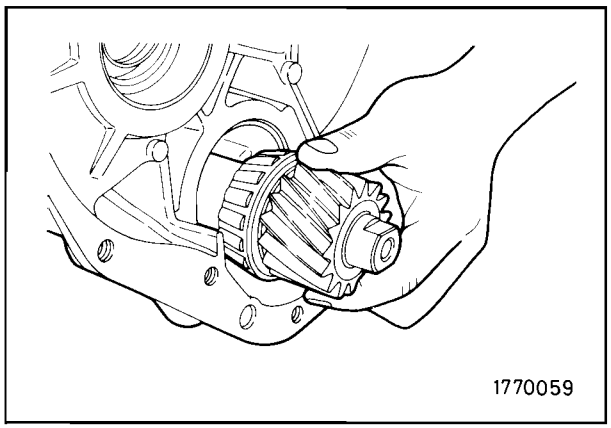


Fig. 153—Transfer shaft installation

(14) Install the spacer onto transfer shaft.
(15) Using suitable installer, install the transfer driven gear with taper bearing on the transfer shaft, refer Fig. 154.

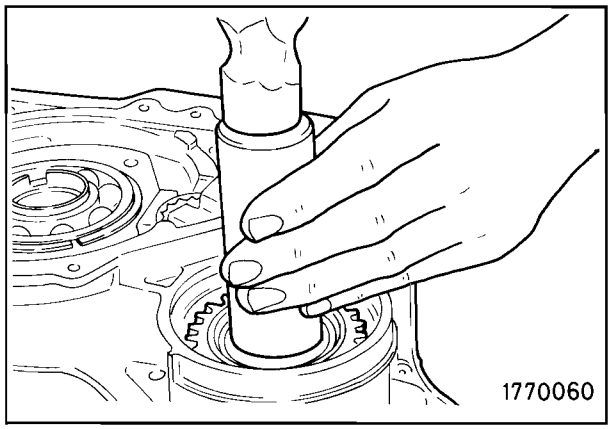


Fig. 154—Transfer driven gear installation

(16) Clamp the end of transfer shaft in a vice with lock nut side up. Install the new lock nut onto transfer shaft and tighten to specified torque, refer Fig. 155.

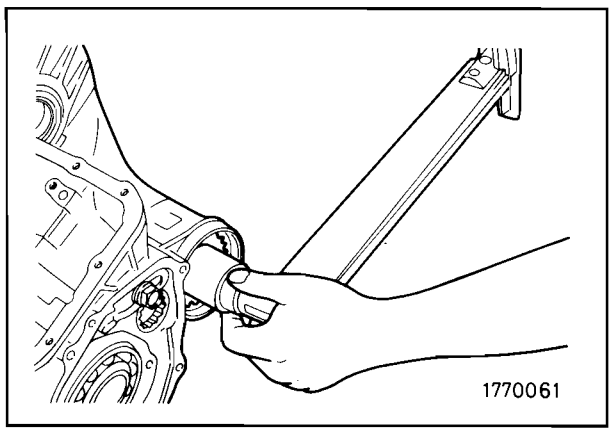


Fig. 155—Tightening transfer shaft lock nut

NOTE: LOCK NUT HAS LEFT HAND THREAD.
• ALWAYS USE A NEW LOCK NUT.

(17) Check the transfer shaft end play, refer Fig. 156. If specified end play is not obtained select spacer of proper size, remove transfer shaft and repeat steps 12 to 17.

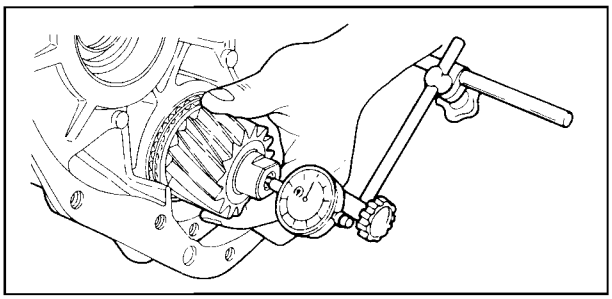


Fig. 156—Transfer shaft end play adjustment

(18) Stake the lock nut only at notch of transfer shaft, refer Fig. 157.

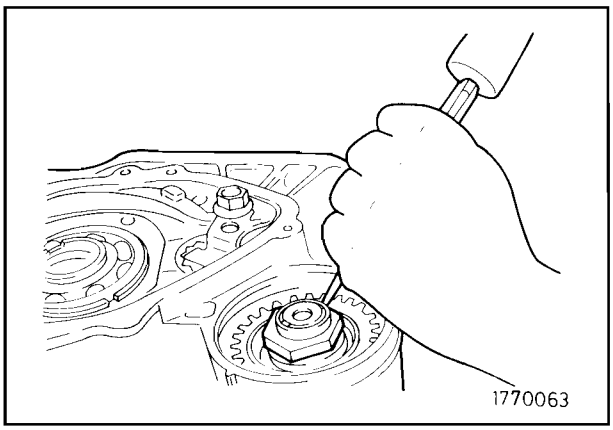


Fig. 157—Staking lock nut

(19) Install bearing retainer and tighten screws to specified torque, refer Fig. 158.

NOTE: Apply loctite Thredlock 271 or 3M stud locking No. 4176 to the screw threads, and wipe of excess from screws.

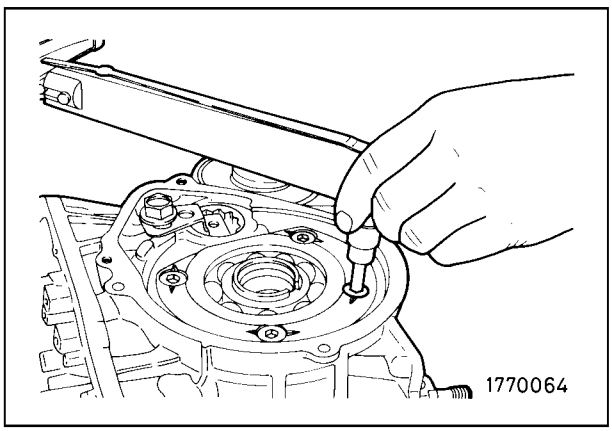


Fig. 158—Installing bearing retainer

(20) Using a suitable punch restake bearing retainer screws, refer Fig. 159.

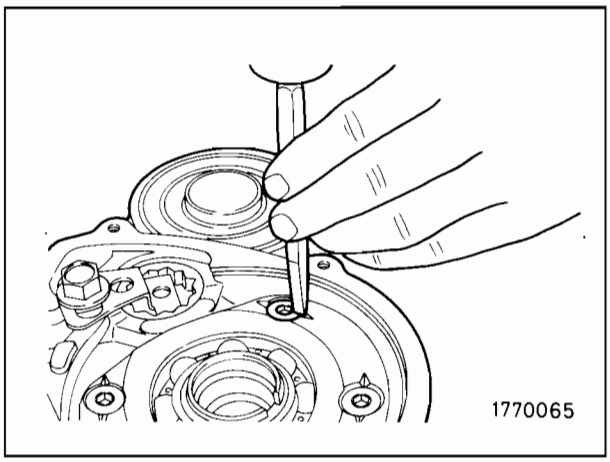


Fig. 159—Staking bearing retainer screws

(21) Position the transaxle with the oil pan mounting surface face up.

(22) Apply petroleum jelly to thrust bearing #12 and attach it to the planet pinion carrier, refer Fig. 160.

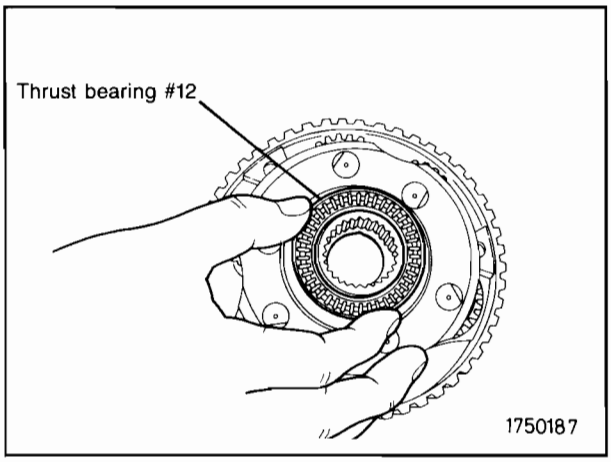


Fig. 160—Install thrust bearing

(23) Install planet pinion carrier into the transaxle case, refer Fig. 161.

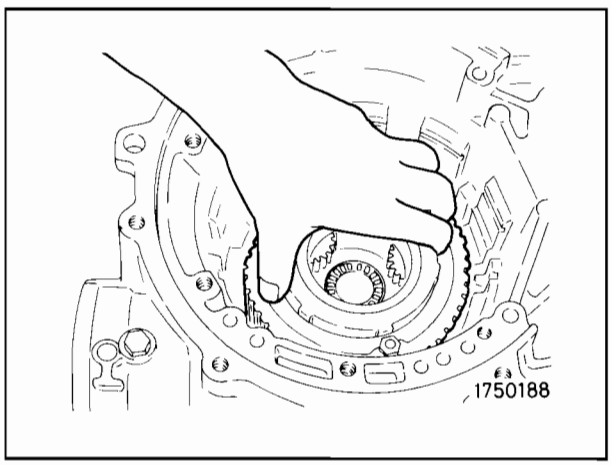


Fig. 161—Installing planet pinion carrier

(24) Assemble the reverse sun gear and the forward sun gear in the following order:

(a) Attach the seal ring and snap ring to the reverse sun gear. When attaching squeeze the seal ring as shown in Fig. 162 to maintain concentricity.

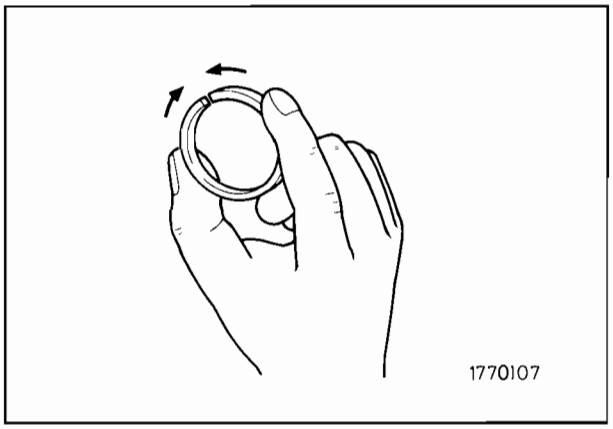


Fig. 162—Seal ring

(b) Attach the thrust race #10 to the forward sun gear.

(c) Attach the thrust bearing #9 to the forward sun gear, refer Fig. 163.

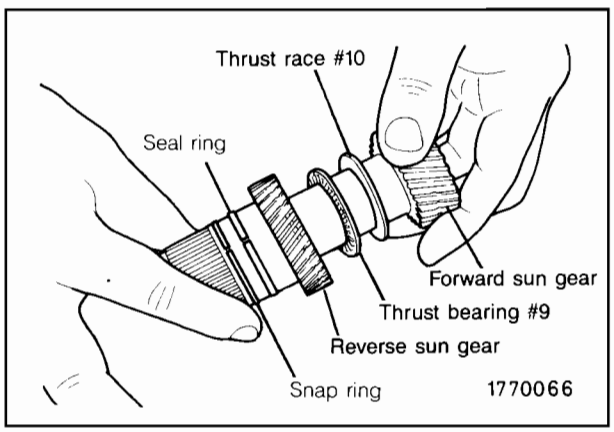


Fig. 163—Reverse/forward sun gear assembly

(25) Install the sun gears inside the planet pinion carrier, refer Fig. 164.

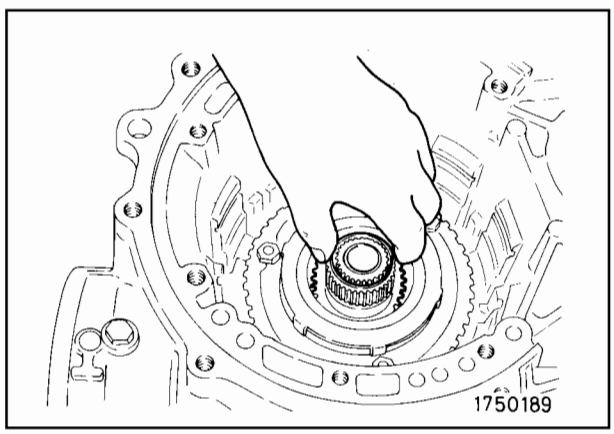
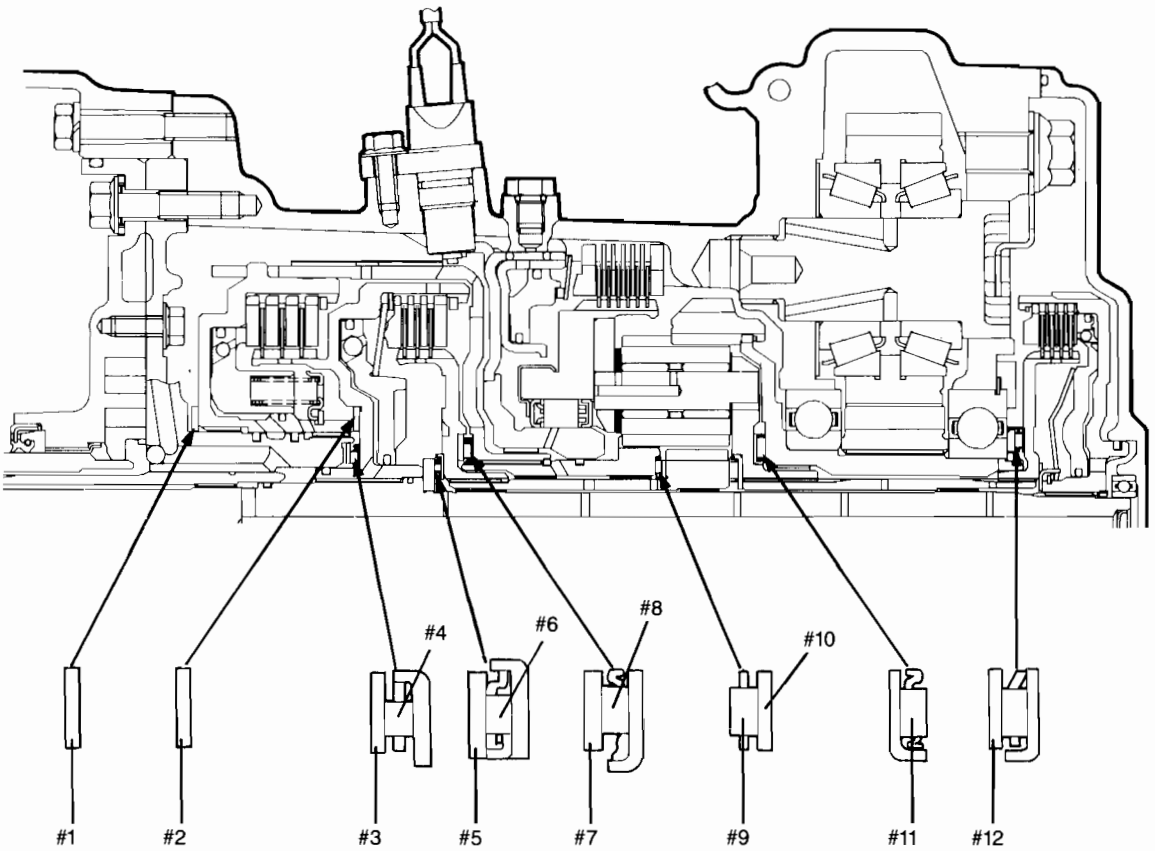


Fig. 164—Installing reverse/forward sun gear



D = Outside diameter, d = Inside diameter, t = Thickness

D	d	t	Part No.	Symbol	D	d	t	Part No.	Symbol
70	55.7	1.4	*1	#1	48.9	37	1.4	MD997848 (incl. *2)	#3
70	55.7	1.8	*2		48.9	37	1.6	MD997849 (incl. *2)	
70	55.7	2.2	*3		48.9	37	1.8	MD997850 (incl. *3)	
70	55.7	2.6	*4		48.9	37	2.0	MD997851 (incl. *3)	
70	55.7	1.8	MD707290	#2	48.9	37	2.2	MD997852 (incl. *4)	
48.1	34.4	—	MD707271	#4	48.9	37	2.4	MD997852 (incl. *4)	
42.6	28	—	MD720753	#6	40	21	3.2	MD720751	#5
54	36.4	—	MD719846	#11	54	38.7	1.6	MD704936	#7
52	36.4	—	MD720010	#8	41	28	1.2	MD728764	#10
48.9	37	1.0	MD997854 (incl. *1)	#3	41	28	—	MD728763	#9
48.9	37	1.2	MD997847 (incl. *1)		58	44	—	MD724206	#12

Fig. 165—Thrust bearing and thrust race location and identification chart

(26) Install the low reverse brake reaction plate and brake discs, refer Fig. 166.

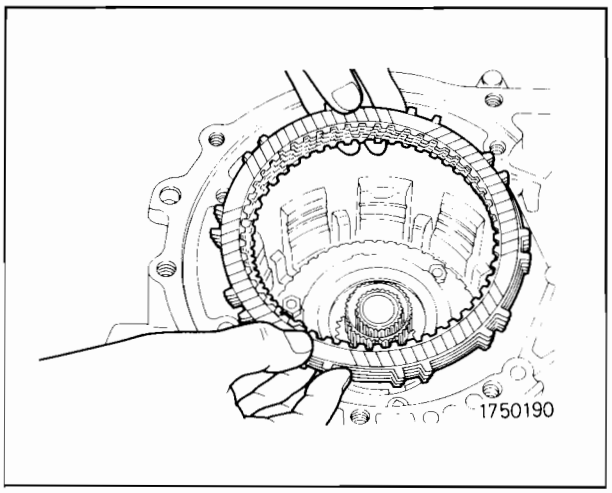


Fig. 166—Low reverse brake plate and disc installation

(27) Install the selected brake pressure plate.
(28) Install the return spring, refer Fig. 167 for correct direction.

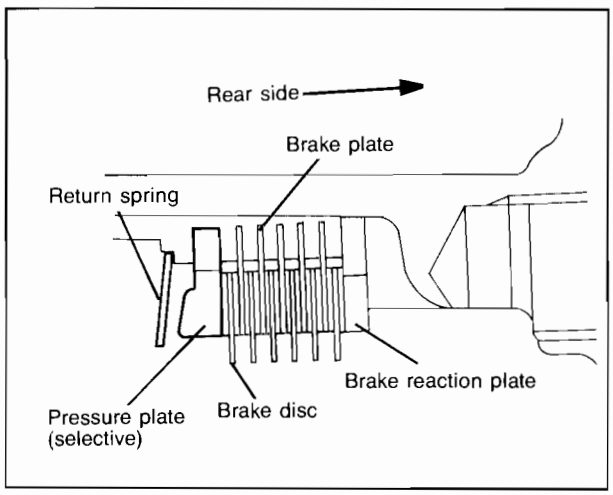


Fig. 167—Return spring installation

(29) Apply petroleum jelly to the wave spring and attach it to the centre support, refer Fig. 168.
(30) Install two new O-rings to the centre support, refer Fig. 169.
(31) Coat centre support O-ring with ATF and using special tool E21M41 attached to centre support, install the centre support into the transaxle case using a suitable drift.

NOTE: Be sure that the centre support wave spring does not fall out of position.

CAUTION: If the wave spring is dislodged, the centre support snap ring will be difficult to base.

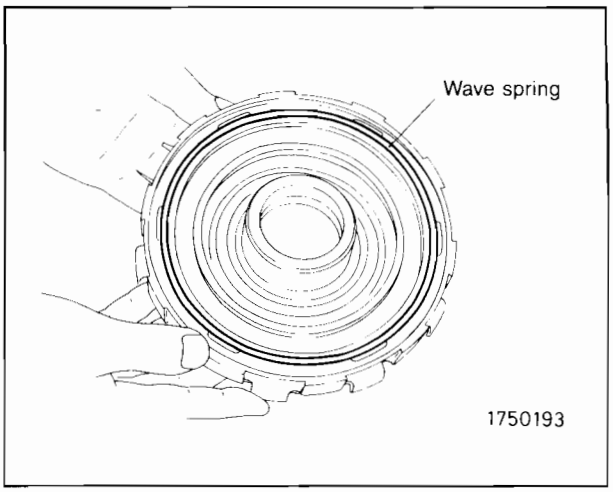


Fig. 168—Wave spring installation

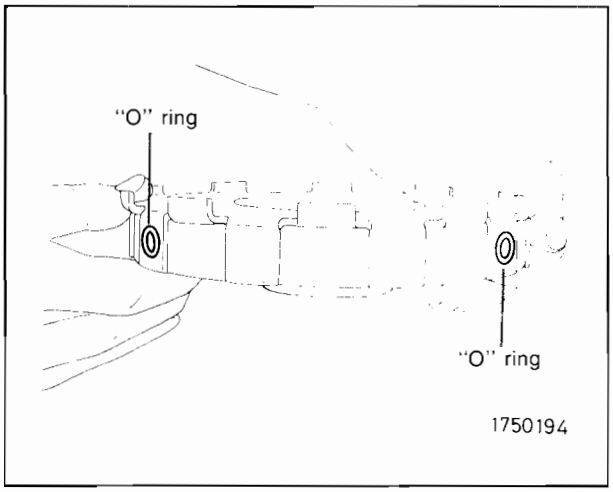


Fig. 169—O-ring installation

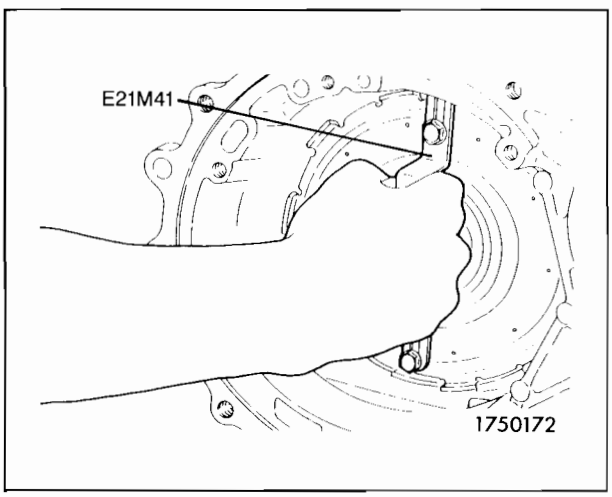


Fig. 170—Installing centre support

(32) Install the centre support snap ring, refer Fig. 171.

NOTE: The mating hole of the snap ring must be aligned with the installation hole of pulse generator "A".

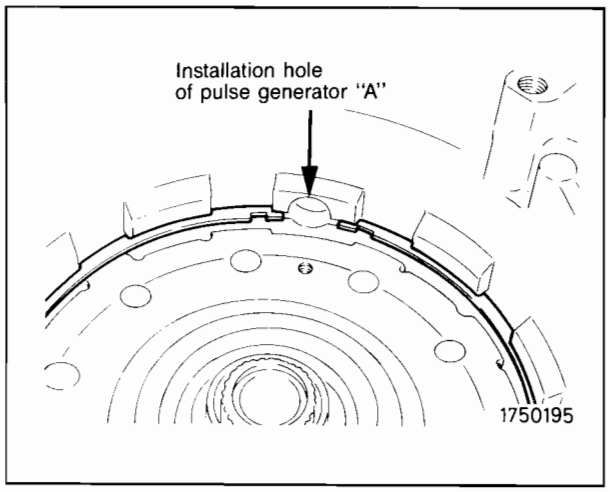


Fig. 171—Snap ring installation

(33) Install the kickdown band anchor rod, refer Fig. 172.

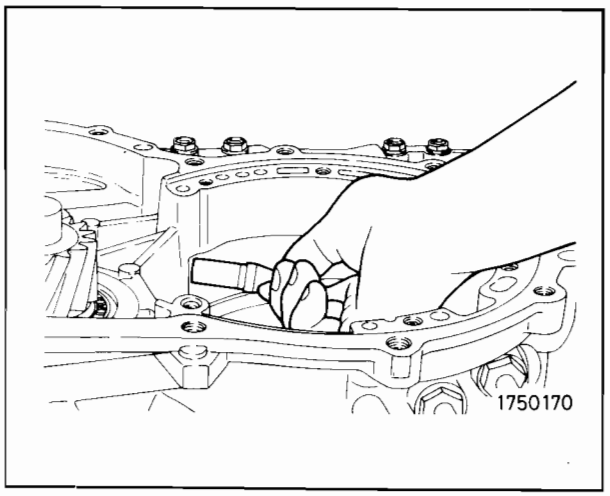


Fig. 172—Anchor rod installation

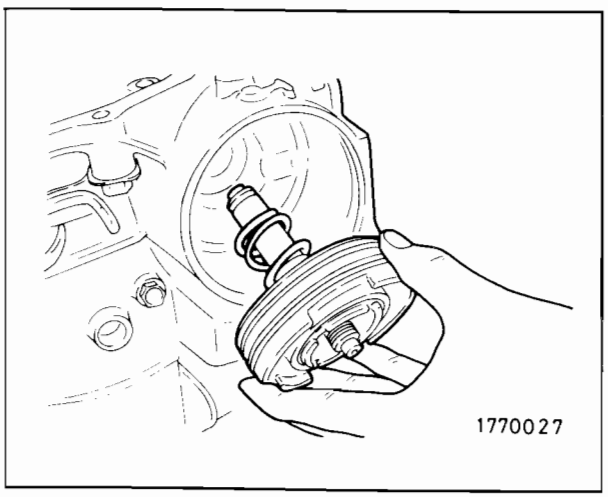


Fig. 173—Installing kickdown servo piston

(34) Install new "D" rings to the kickdown servo piston, and install a new O-ring in the groove around the sleeve, coat O-ring and "D" rings with ATF then assemble the kickdown servo spring, piston and sleeve into the transaxle case, refer Fig. 173.

(35) Using a valve spring compressor and a suitable adaptor, refer Fig. 174, compress the kickdown servo piston and sleeve, install the snap ring, refer Fig. 174, then release the spring compressor.

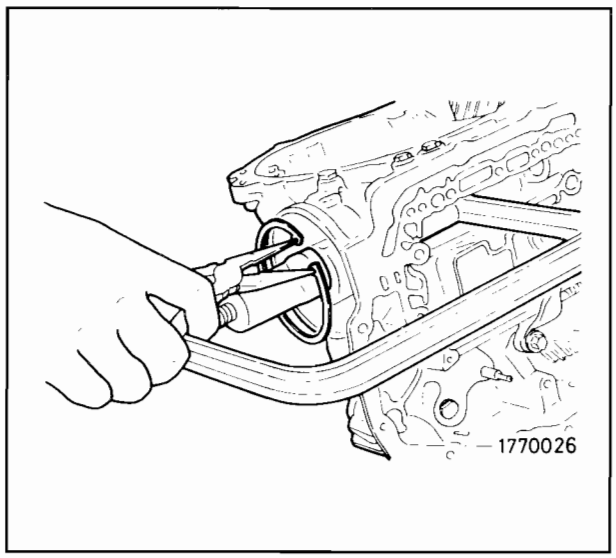


Fig. 174—Installing kickdown servo snap ring

(36) Install kickdown band, refer Fig. 175 attaching the ends of the band to the anchor and the servo piston adjusting rod.

NOTE: The kickdown band is only installed in one direction. The arrow mark indicates forward position.

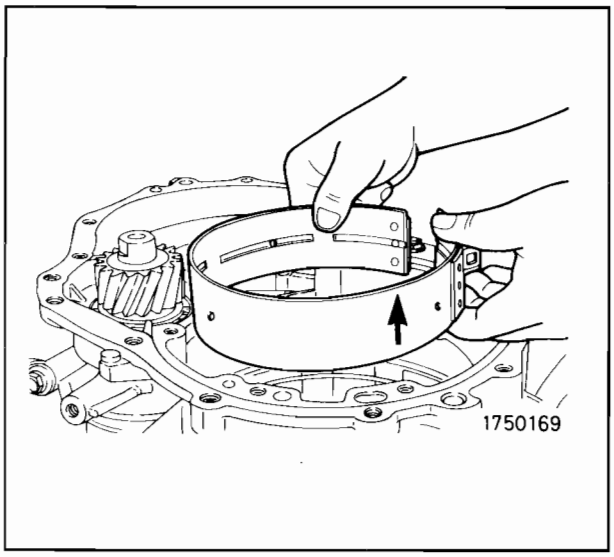


Fig. 175—Installing kickdown band

(37) Install the kickdown drum, refer Fig. 176, meshing the splines with the reverse sun gear. Locate the kickdown band on the kickdown drum and tighten the servo adjusting rod, to hold the band in position.

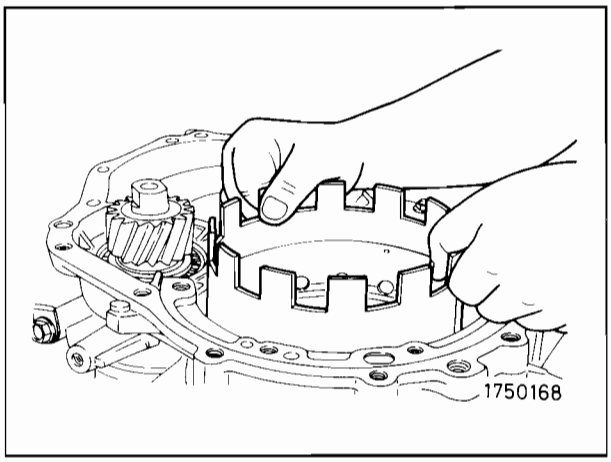


Fig. 176—Installing kickdown drum

(38) Apply petroleum jelly to thrust bearing #8 and position on the kickdown drum, refer Fig. 177.

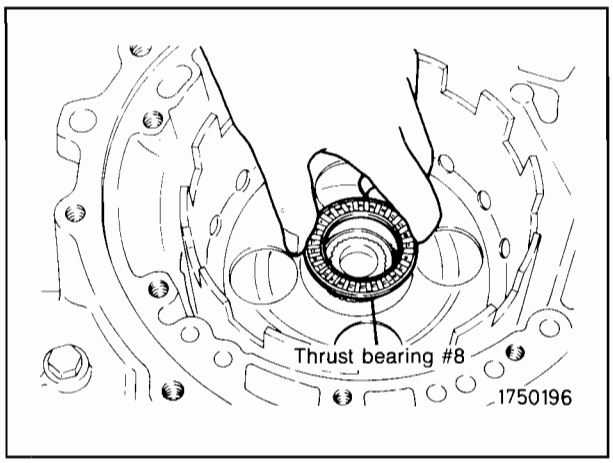


Fig. 177—Installing thrust bearing

(39) Apply petroleum jelly to thrust race #7 and attach to the rear clutch hub, refer Fig. 178.

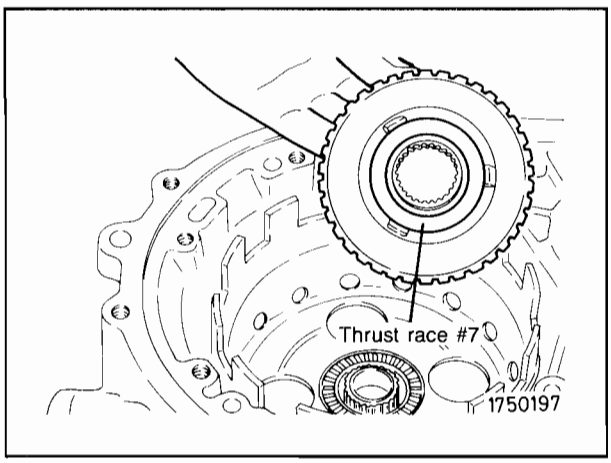


Fig. 178—Thrust race installation

(40) Install the clutch hub on the forward sun gear, refer Fig. 179.

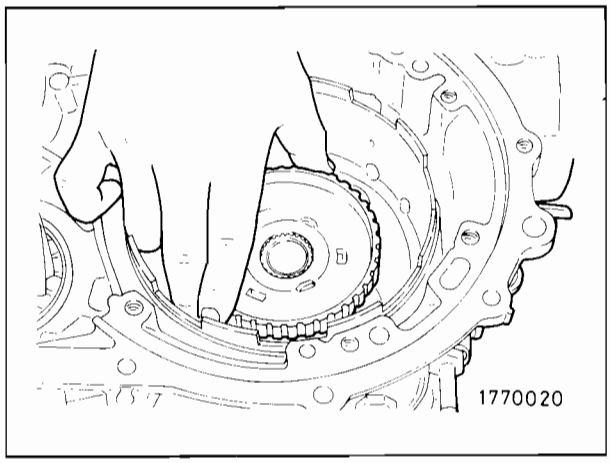


Fig. 179—Install rear clutch hub

(41) Apply petroleum jelly to thrust bearing #6 and attach it to the clutch hub, refer Fig. 180.

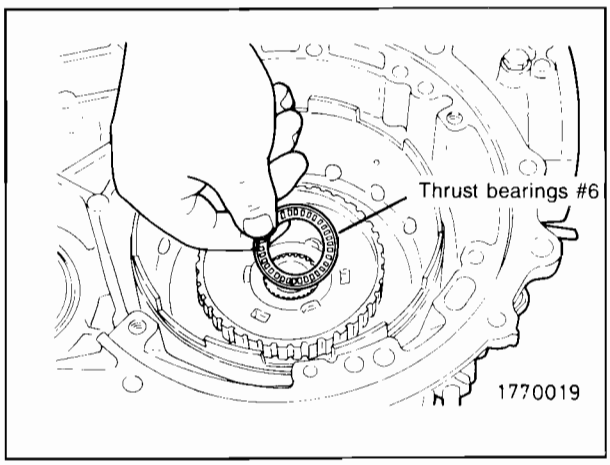


Fig. 180—Installing thrust bearing #6

(42) Apply petroleum jelly to thrust washer #2, thrust bearing #4, and attach them to the rear clutch assembly, refer Fig. 181.

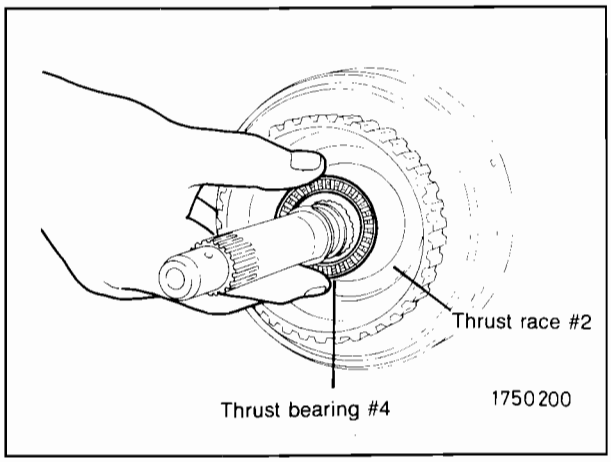


Fig. 181—Installing rear clutch thrust race and bearing

(43) Assemble the front clutch to the rear clutch, refer Fig. 182.

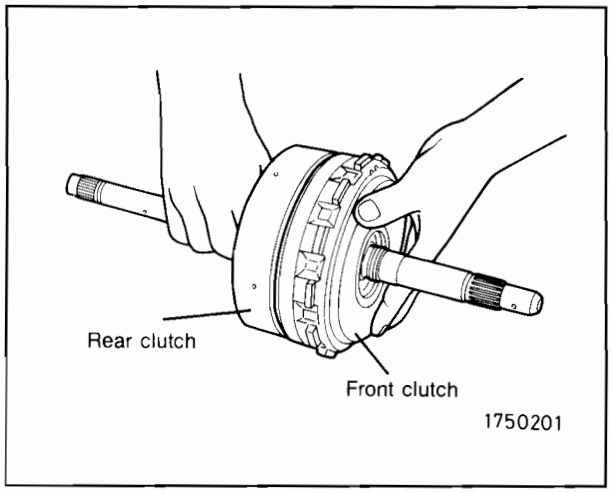


Fig. 182—Assembling front and rear clutch

(44) Install the clutch assembly in the transaxle, refer Fig. 183.

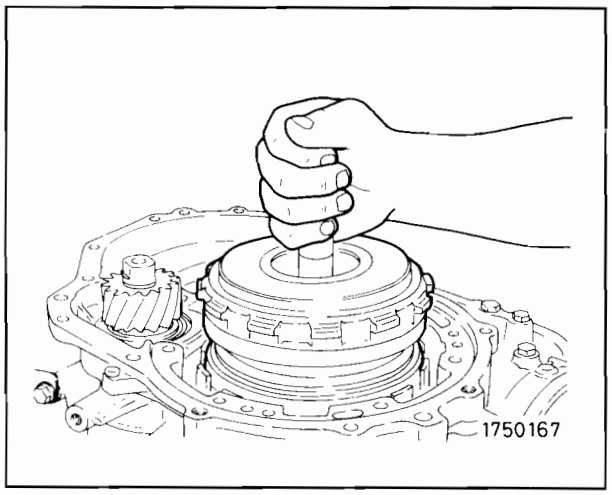


Fig. 183—Installing front and rear clutch

(45) Install the differential assembly, refer Fig. 184.

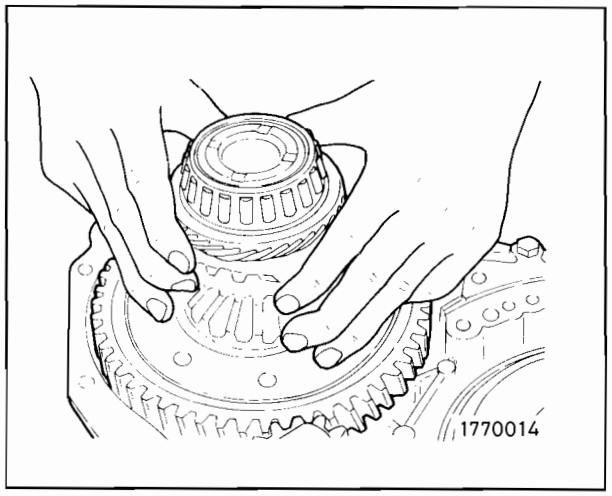


Fig. 184—Installing differential assembly

(46) Attach thrust washer #1 to the front clutch, refer Fig. 185, using petroleum jelly.

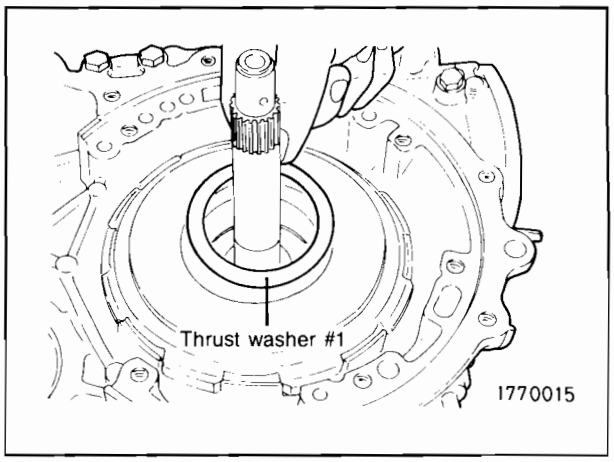


Fig. 185—Installing #1 thrust washer

(47) Attach thrust race #3 to the oil pump using petroleum jelly, refer Fig. 186.

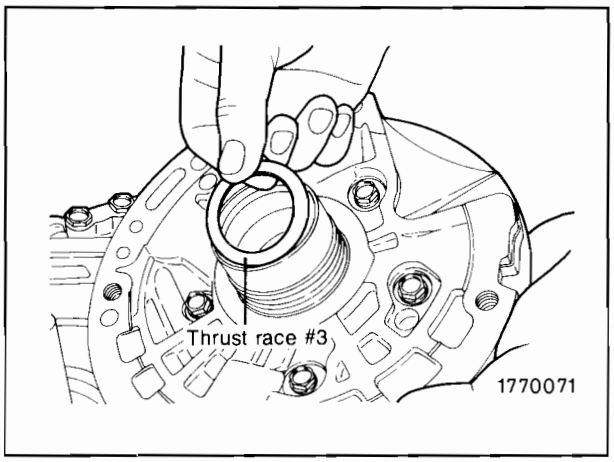


Fig. 186—Installing thrust race #3

(48) Fit a new oil pump gasket and install the oil pump ensuring that the bolt holes are correctly aligned, refer Fig. 187.

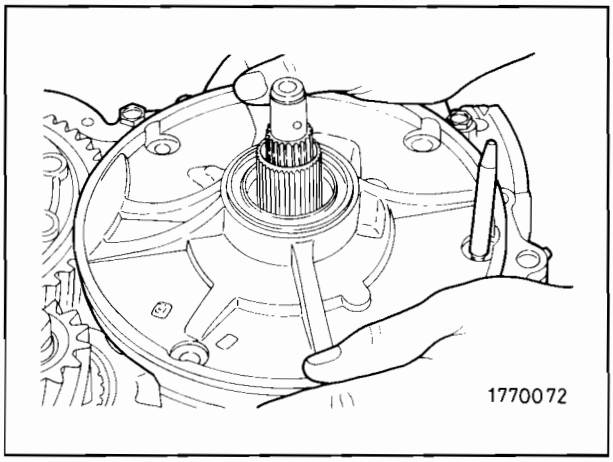


Fig. 187—Installing oil pump

(49) Install oil pump bolts and tighten evenly to the specified torque.
(50) Suitably mount a dial indicator and measure input shaft end play, refer Fig. 188.

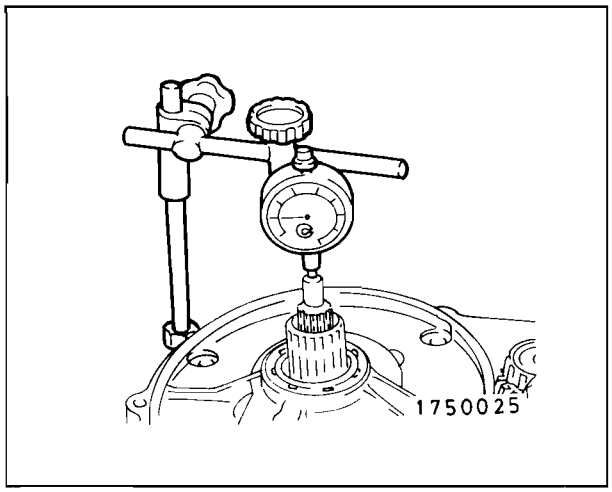


Fig. 188—Measuring input shaft end play

(51) If end play is not within specifications, adjust by replacing thrust race #3 with one of suitable thickness.

NOTE: If thrust race #3 is replaced, thrust washer #1 must be replaced with the washer supplied in the set.

Thrust washer #3 fibre	Thrust washer #1 metal	Part number of thrust washer set
Thickness mm	Thickness mm	
1.4	1.0	MD997854
1.4	1.2	MD997847
1.8	1.4	MD997848
1.8	1.6	MD997849
2.2	1.8	MD997850
2.2	2.0	MD997851
2.6	2.2	MD997852
2.6	2.4	MD997853

Thrust washer selection chart

NOTE: When a metal thrust washer is selected, a fibre washer is included — both must be used.

(52) Check and adjust differential to transaxle case preload as follows:
(a) Remove the differential bearing cup and spacer from the torque converter housing.
(b) Bend two 10 mm lengths of 3 mm diameter resin cored solder to suit and position on the bottom outer circumference of the differential bearing cup recess in the torque converter housing, refer Fig. 189.

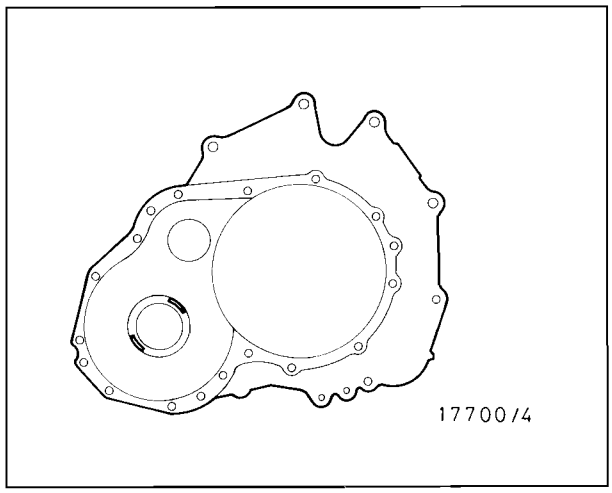


Fig. 189—Solder location

NOTE: The solder pieces should be positioned diametrically opposite each other.

(c) Install the bearing cup and push fit to hold the solder in place.

NOTE: Ensure solder is not crushed when installing the cups.

(d) Install the converter housing (without the gasket) and tighten all bolts to the specified torque.
(e) Progressively loosen and remove bolts and remove the converter housing.
(f) Remove the bearing cup, using a sliding hammer if necessary and remove the solder strips.
(g) Measure the thickness of the solder strip with a micrometer, refer Fig. 190.

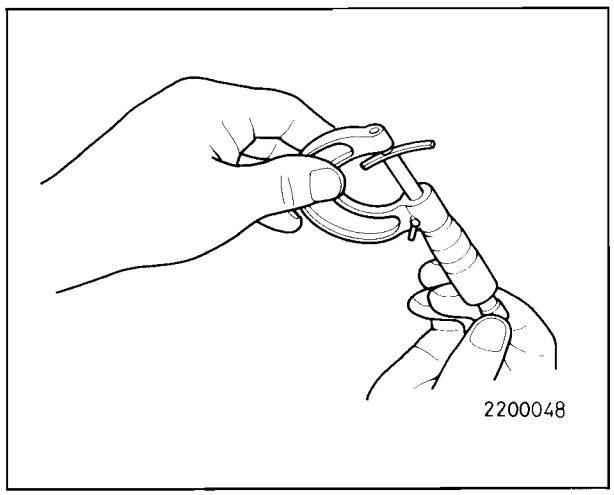


Fig. 190—Measuring solder strips

Then add the thickness (0.38 mm) of the rubber-coated metal gasket to the thickness of the crushed solder, and select and install a spacer so that the preload of the differential to transaxle case is as specified, refer to specifications.

NOTE: The rubber-coated metal gasket must not be reused.

(53) Install the selected spacer and the bearing cup in the converter housing.

(54) Apply a coat of silicone grease to the hatched area of the transaxle case, refer Fig. 191.

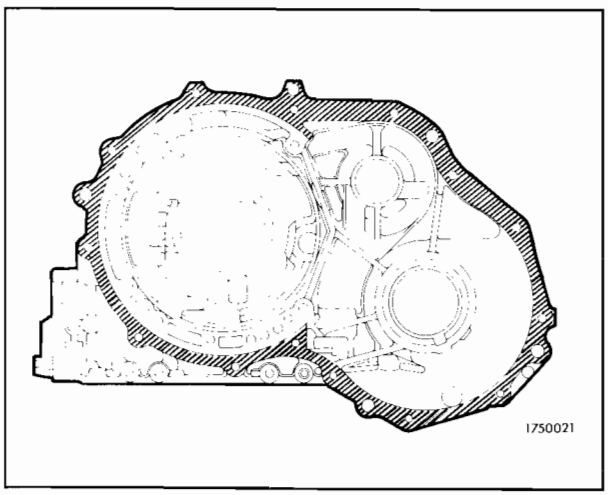


Fig. 191—Transaxle housing grease application

(55) Install a new rubber-coated metal gasket on the transaxle case.

(56) Install the converter housing and progressively tighten all bolts to the specified torque.

(57) Install the end clutch shaft with its longest spline towards the front, refer Fig. 192.

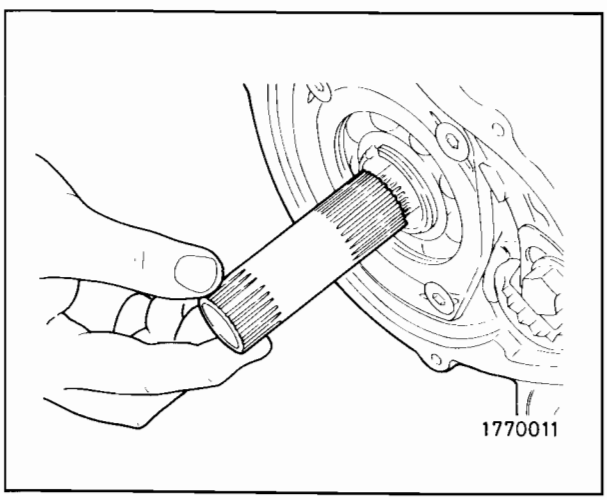


Fig. 192—Installing the end clutch shaft

(58) Install the thrust washer to return spring at the end clutch side, refer Fig. 193.

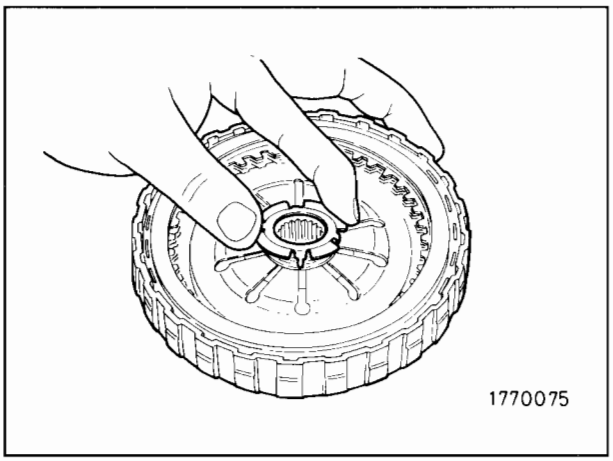


Fig. 193—Installing thrust washer

(59) Install the end clutch hub to the end clutch, refer Fig. 194.

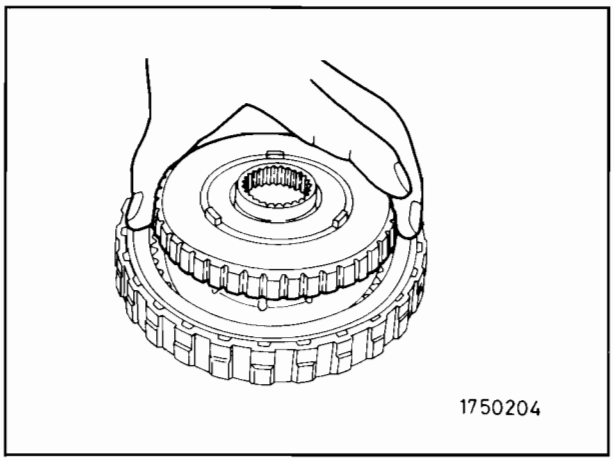


Fig. 194—Installing end clutch hub

(60) Apply petroleum jelly to thrust bearing #12 and attach bearing to the end clutch hub, refer Fig. 195.

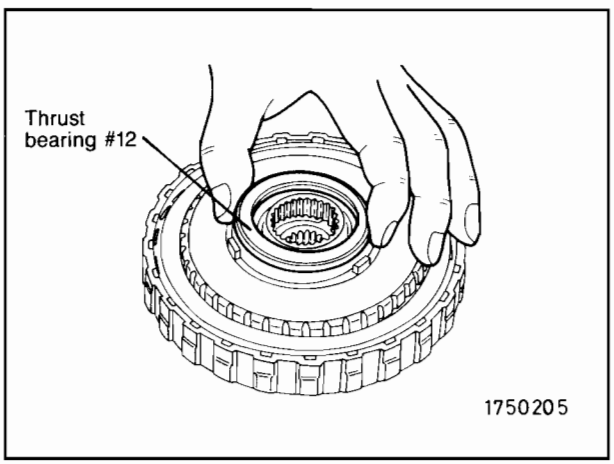


Fig. 195—Installing #12 thrust bearing

(61) Install the end clutch assembly, refer Fig. 196.

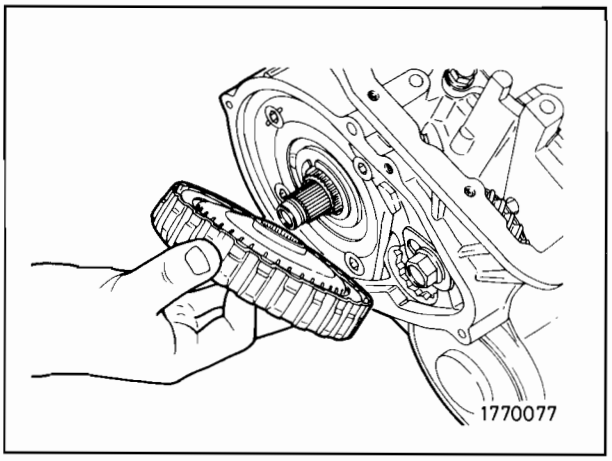


Fig. 196—Installing end clutch

(62) Install a new seal to the end clutch cover, refer Fig. 197, and coat the end clutch cover bearing with ATF.

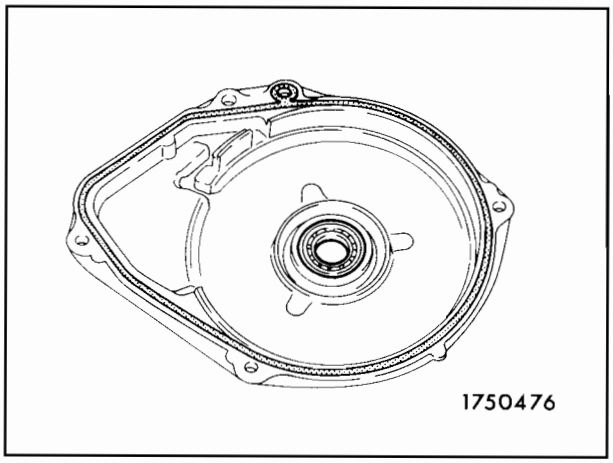


Fig. 197—End clutch cover seal location

(63) Install the end clutch cover and the transfer shaft cover and transfer shaft cover retainer, refer Fig. 198.

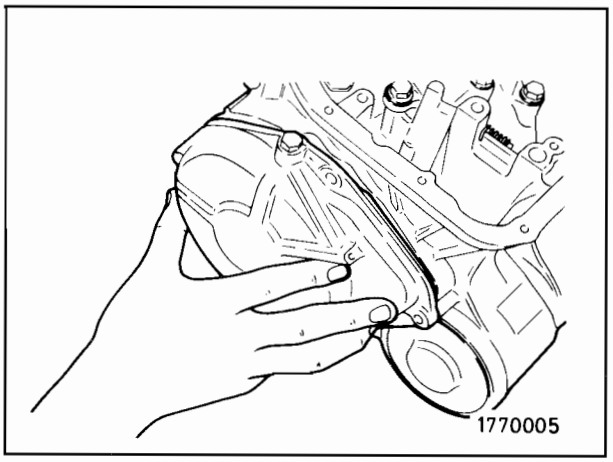


Fig. 198—End clutch cover installation

(64) Install a new "O" ring on the valve body, refer Fig. 199.

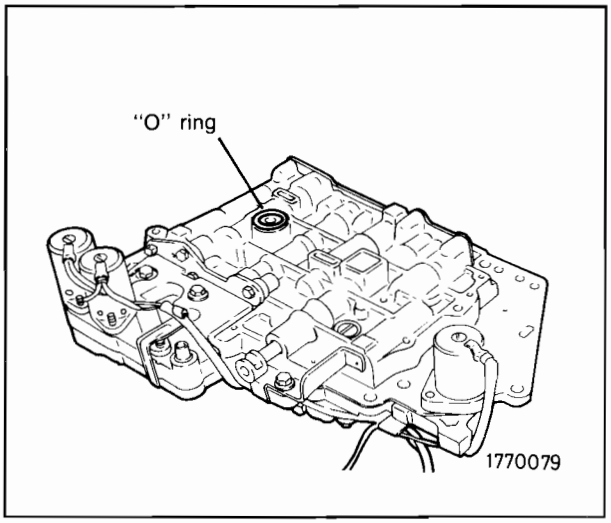


Fig. 199—Valve body "O" ring location

(65) Install a new "O" ring on the solenoid valve connector.

(66) Position the valve body in the transaxle, ensuring that the manual control shaft detent plate pin is correctly located in the manual control valve recess.

(67) Insert the solenoid valve connector into the transaxle case.

(68) Install the oil-temperature sensor from the transaxle case hole and install all valve body bolts, refer Fig. 200 for location and tighten to specified torque.

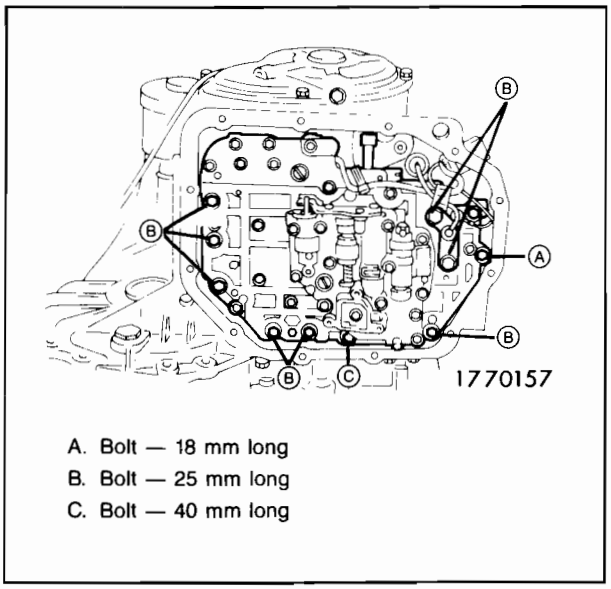


Fig. 200—Valve body mounting bolt location

(69) Install the oil filter, refer Fig. 201, and tighten the attaching bolts to the specified torque.

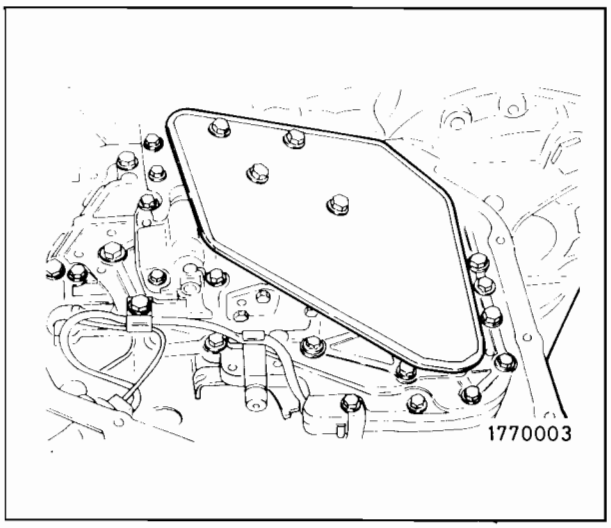


Fig. 201—Oil filter installation

(70) Install the five magnets in the depressions provided in the oil pan, refer Fig. 202.

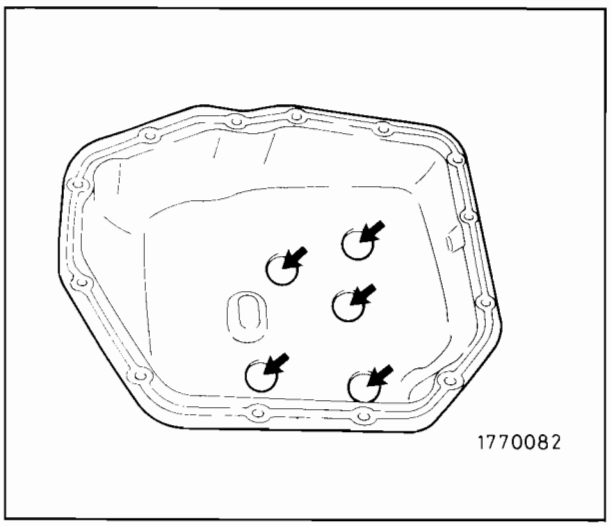


Fig. 202—Oil pan magnet position

(71) Using a new gasket fit the oil pan and tighten bolts to the specified torque.

(72) Using special tool E21M14A install new drive shaft oil seals, refer Fig. 203.

(73) Install the inhibitor switch and adjust using the procedure outlined in Section 3 — Maintenance and Adjustment.

(74) Fit pulse generators A and B.

NOTE: Do not attempt to "pull" the pulse generators into the case using the retaining bolts as they may break. Ensure the pulse generators are fully based int he case before installing bolts.

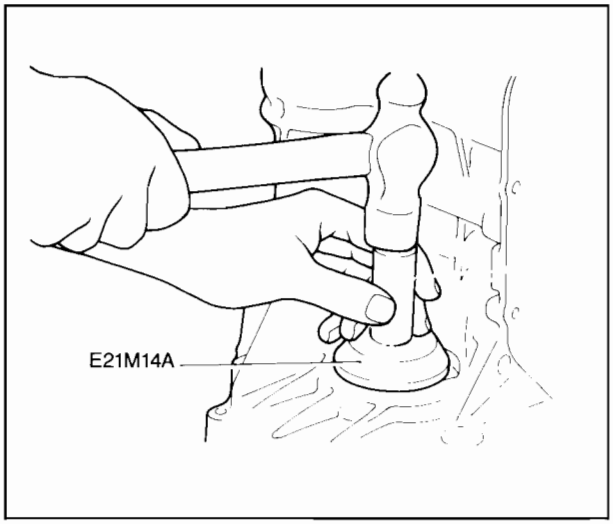


Fig. 203—Installing drive shaft oil seal

(75) Adjust the kickdown band using the procedure outlined in Section 3 — Maintenance and Adjustment.

(76) Apply A.T.F. to the torque converter tangs and carefully slide the converter assembly over the converter support and input shaft, ensuring that the pump seal is not damaged on installation.

(77) Check torque converter installed height. Distance between ring gear and converter housing mounting surfaces should be approximately 12 mm, refer Fig. 204.

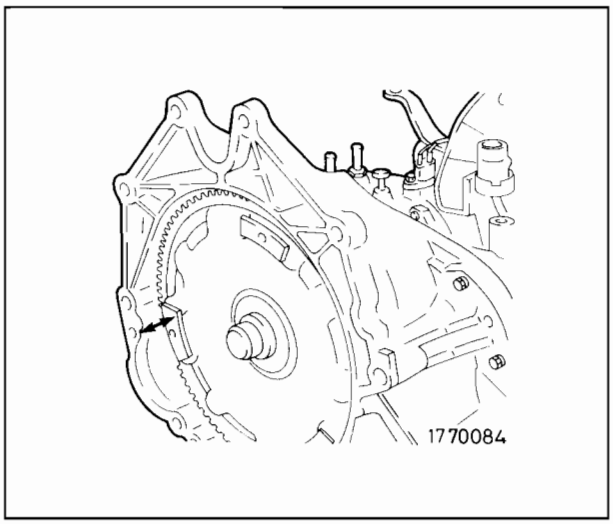


Fig. 204—Torque converter installed height

SPEEDOMETER GEAR ASSEMBLY

Removal

Cable Type

(1) Disconnect the speedometer cable from the speedometer gear assembly.
(2) Remove the retaining bolt and remove the gear assembly.

Installation

Install by reversing removal procedure, ensuring that the retaining bolt is tightened to specifications.

Disassembly

(1) using a suitable pin punch remove the roll pin and dismantle the assembly.
(2) Clean and inspect components for wear. Replace any worn components.

Assembly

NOTE: New "O" rings and a new roll pin must be use.

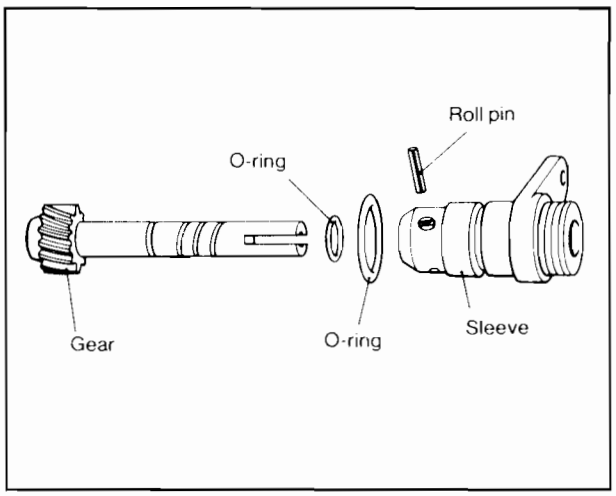


Fig. 205—Speedometer gear components

(1) Install the "O" ring in the groove on the inside diameter of the gear sleeve.
(2) Apply a coat of A.T.F. to the gear shaft and insert the shaft in the gear sleeve.
(3) Align the roll pin hole in the sleeve with the groove in the shaft and drive in the roll pin.

NOTE: The slit in the roll pin should not contact the gear shaft.

(4) Apply a coat of A.T.F. to the sleeve and slide the "O" ring onto the sleeve.

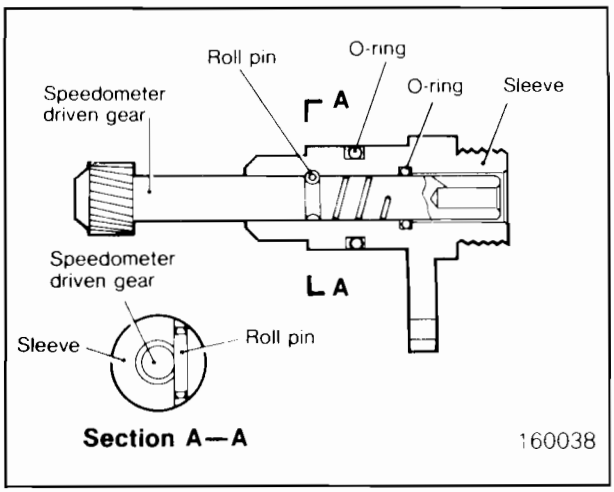


Fig. 206—Cross section of speedometer gear assembly

SECTION 4A — TRANSAXLE OVERHAUL F4A33

SPECIFICATIONS

Type	Electronically controlled 4 speed (including overdrive) automatic with torque converter and lock up clutch
Model (4G54 ECI-Multi engine)	F4A33-1-MPN1 25 Tooth splined driveshafts
(4G54 ECI-Multi engine)	F4A33-1-MPP1 27 Tooth splined driveshafts
(4G54 ECI-Multi engine)	F4A33-1-MPP2 27 Tooth splined driveshafts
*(4G54 ECI-Multi engine)	F4A33-1-MPQ1 27 Tooth splined driveshafts

***NOTE: With transaxle F4A33-1-MPQ1 fit ONLY ECU Part No. MD758360.**

***CAUTION: Failure to fit the correct ECU with correct transaxle will result in transaxle failure.**

(6G72 ECI-Multi engine)	F4A33-1-MNN6 25 Tooth splined driveshafts
(6G72 ECI-Multi engine)	F4A33-1-MNP6 27 Tooth splined driveshafts
(6G72 ECI-Multi engine)	F4A33-1-MNP9 27 Tooth splined driveshafts
#(6G72 ECI-Multi engine)	F4A33-1-MNQ3 27 Tooth splined driveshafts

#NOTE: With transaxle F4A33-1-MNQ3 fit ONLY ECU Part No. MD757075.

#CAUTION: Failure to fit the correct ECU with correct transaxle will result in transaxle failure.

Torque convertor	
— stall torque ratio	2.00:1
— stall speed (rpm)	1800 to 2800
Lubrication	
— pump type	Involute gear
— fluid type	Mitsubishi Magna ELC-4-SP
— fluid capacity	7.5 litres
Gear ratios	
First	2.551:1
Second	1.488:1
Third	1.000:1
Fourth	2.176:1
Transfer gear ratio	1.228:1
Differential ratio	3.222:1
Final drive ratio	3.958:1
Speedometer	
— drive gear teeth	36 (4 cylinder) — 36 (V6)
— driven gear teeth	29 (4 cylinder) — 28 (V6)
Kickdown band adjustment	Tighten to 10 Nm and back off. Repeat twice. Tighten to 5 Nm and back off as follows — 2 to 2½ turns
Front clutch (No. of discs)	4
Rear clutch (No. of discs)	5
End clutch (No. of discs)	4
Low-reverse brake (No. of discs)	6
Input shaft end play	0.3-1.0 mm
Oil pump gear side clearance	0.03-0.05 mm
Front clutch end play	0.80-1.0 mm
Rear clutch end play	1.0-1.2 mm
Low reverse brake end play	1.0-1.3 mm
Output flange bearing end play	0-0.09 mm
End clutch end play	0.6-0.85 mm
Differential case pre-load	0.075-0.135 mm
Differential side gear and pinion backlash	0.025-0.150 mm
Transfer driven gear pre-load (Centre differential case pre-load)	0.075-0.135 mm

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SPECIFICATIONS

Pressure plate selection chart for adjustment of Low Reverse Brake end play:

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
5.9	A	MD731736	6.5	5	MD731741
6.0	0	MD731737	6.6	6	MD731742
6.1	I	MD731738	6.7	7	MD731743
6.2	2	MD731739	6.8	8	MD731744
6.3	3	MD731740	6.9	9	MD731745
6.4	4	MD731588			

Transfer drive gear preload (centre differential care) spacer selection chart:

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
0.62	62	MD737444	0.98	98	MD728810
0.65	65	MD737445	1.01	01	MD728811
0.68	68	MD737446	1.04	04	MD728812
0.71	71	MD737447	1.07	07	MD728813
0.74	74	MD728802	1.10	10	MD728814
0.77	77	MD728803	1.13	13	MD728815
0.80	80	MD728804	1.16	16	MD728816
0.83	83	MD728805	1.19	19	MD728817
0.86	86	MD728806	1.22	22	MD728818
0.89	89	MD728807	1.25	25	MD728819
0.92	92	MD728808	1.28	28	MD728820
0.95	95	MD728809	1.31	31	MD728821

Differential case preload spacer selection chart:

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
0.71	71	MD754475	0.98	98	MD720942
0.74	74	MD727660	1.04	04	MD720944
0.77	77	MD754476	1.07	07	MD720945
0.80	71	MD727661	1.13	D	MD700270
0.83	83	MD720937	1.16	K	MD710455
0.86	86	MD720938	1.22	G	MD700271
0.89	89	MD720939	1.25	M	MD710457
0.92	92	MD720940	1.31	E	MD706574
0.95	95	MD720941	1.34	O	MD710459
			1.37	P	MD710460

Output flange bearing end play snap ring selection chart:

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
1.76	Brown	MD733314	2.00	None	MD721016
1.82	None	MD722538	2.06	Blue	MD721017
1.88	Blue	MD721014	2.12	Brown	MD722539
1.94	Brown	MD721015	2.18	None	MD733315

Front and rear clutch end play snap ring selection chart:

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
1.3*	None	MD731747	1.9	None	MD731753
1.4*	Blue	MD731748	2.0	Blue	MD731754

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SPECIFICATIONS CONT.

Front and rear clutch end play snap ring selection chart cont:

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
1.5	Brown	MD731749	2.1	Brown	MD731755
1.6	None	MD731750	2.2	None	MD731756
1.7	Blue	MD731751	2.3	Blue	MD731757
1.8	Brown	MD731752	2.4	Brown	MD731758

* Rear clutch only

End clutch snap ring clearance selection chart:

Thickness (mm)	Identification Mark	M.M.A.L. Part Number	Thickness (mm)	Identification Mark	M.M.A.L. Part Number
1.05	White	MD715800	1.80	Green	MD715803
1.30	Yellow	MD715801	2.05	Pink	MD715804
1.55	None	MD715802			

Differential pinion and side backlash spacer selection chart:

0.75-0.82 mm	MD722986	1.01-1.08 mm	MD722983
0.83-0.92 mm	MD722985	1.09-1.16 mm	MD722982
0.93-1.00 mm	MD722984		

Valve body spring identification	Wide diameter (mm)	Outside diameter (mm)	Length (mm)
Pressure control spring	0.45	7.6	21.3
Torque converter control spring	1.30	9.0	22.6
Regulator spring	1.40	15.0	52.0
Rear clutch exhaust spring	0.70	6.8	27.4
2-3 shift spring	0.80	7.0	27.5
1-2 shift spring	0.60	7.6	26.6
Relief spring	1.00	7.0	17.3
Reducing spring	1.30	8.9	29.5
N-R control spring	0.70	9.2	32.1
End clutch spring	0.60	6.6	24.4
Shirt control spring	0.50	5.7	26.8
Lockup clutch spring	0.70	6.2	14.2

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TORQUE SPECIFICATIONS

	Nm
Air exhaust plug	30-35
Differential cover bolt	10-12
Differential drive gear bolt	130-140
Differential front bearing cap bolt	60-80
Differential rear bearing retainer bolt	30-40
End clutch cover bolt	10-12
Idler gear cover bolt	10-12
Idler shaft lock bolt	31-44
Inhibitor switch bolt	10-12
Kickdown servo lock nut	25-32
Manual control lever nut	17-21
Manual control shaft set screw	8-10
Oil drain bolt	30-35
Oil filter bolt	5-7
Oil level gauge guide bolt	20-27
Oil pan bolt	10-12
Oil pressure check plug	4-6
Oil pump assembly mounting bolt	19-23
Oil pump bolt	10-12
Output bearing retainer bolt	20-27
Output flange bearing retainer bolt	17-22
Parking rod support bolt	20-27
Pulse generator bolt	10-12
Roll stopper bracket bolt	43-55
Shift control cable bracket bolt	20-27
Speedometer gear locking plate bolt	4-6
Transmission mount bracket bolt	60-80
Valve body assembly mounting bolt	10-12
Valve body bolt	4-6

SPECIAL TOOLS

E21M16	Bearing puller
E6673	Jaws—annulus gear removal
E21M83	Front/rear clutch spring compressor
E1673MT	Bearing puller
E167316G	Step plug—differential bearing removal
E7511A	Installer—annulus bearing and gear/transfer shaft input bearing
E7403	Installer—transfer shaft output bearing
E21M36	Adaptor—idler gear shaft installation
E23M14	Installer—end clutch circlip
E9055	Installer—pump seal
E21M14A	Installer—drive shaft oil seal
E21M71A	Adaptor—oil pressure gauge
E21M43	Compressor—front clutch
E1344A	Oil pressure gauges (without adaptors)
E23M13	Kickdown band adjustment
E1673 R15A	Jaws—Transfer shaft bearing removal (input end)
E1673 B15	Jaws—Differential bearing removal
E1673 A15	Jaws—Transfer shaft (output end) bearing removal
E7511A	Adaptor—Bearing installer differential
E21M41	Remover/installer centre support
MB991502	Multi-use-tester
MRP–A	ROM pack
TX40	Remove/installer rear bearing retainer screws
E167316B	Adaptor bearing remover
E21C35H	Band, front pump assembly
E23M11	Front pump removal
E23M12	Front pump guide pin

TRANSAXLE REMOVAL

(1) Disconnect the negative (–) battery cable.
(2) Remove the air flow sensor assembly.
(3) Disconnect all electrical wiring from the transaxle.
(4) Disconnect the select control cable, refer Fig. 1.

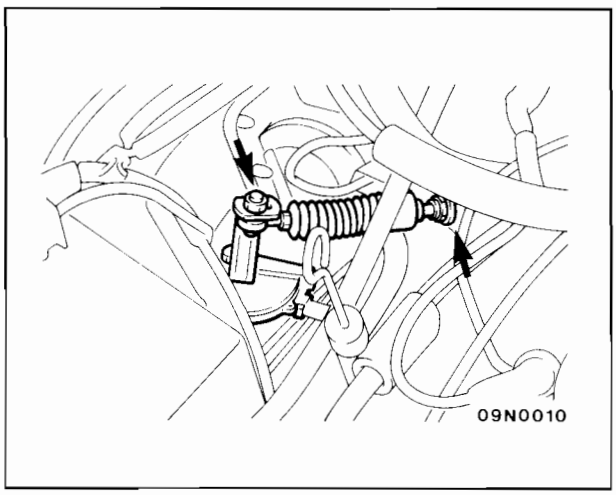


Fig. 1—Control cable removal

(5) Disconnect the speedometer cable.
(6) Disconnect transaxle oil cooler hoses from the transaxle.

NOTE: Plug the hoses and connections to prevent the ingress of dirt and moisture.

(7) Remove the engine undercover.
(8) Remove the differential and oil pan drain plugs and drain the transaxle fluid.

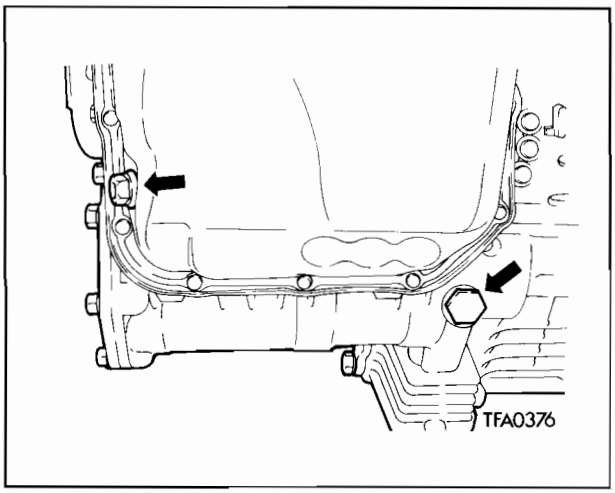


Fig. 2—Transaxle drain plug

(9) Remove the transaxle to engine attaching bolts, refer Fig. 3.

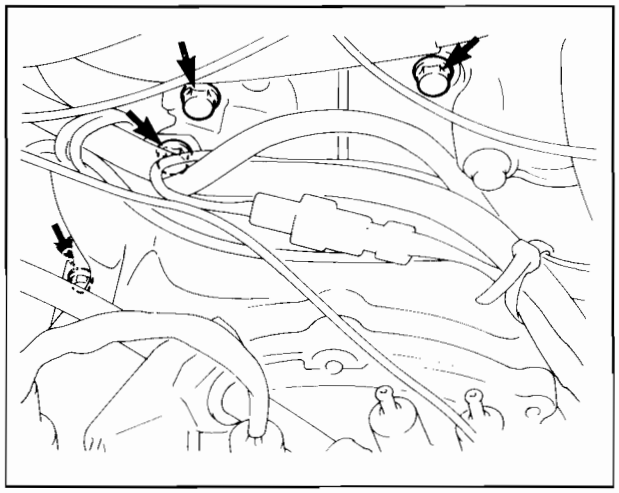


Fig. 3—Transaxle attaching bolts

(10) Vehicles fitted with ECS. If necessary remove the air pump assembly. Refer Group 33.
(11) Disconnect the wiring and remove the starter motor.
(12) Raise the front of the vehicle and support on stands in the locations outlined in Group 00 — General Information.
(13) Remove the front wheels.
(14) Using a suitable puller disconnect the lower arm and tie rod end ball joints from both knuckles.
(15) Withdraw the driveshafts from the transaxle and transfer shaft, refer Fig. 4, and support to avoid damaging the joints.
(16) Remove the transfer shaft centre support to engine attaching bolts and withdraw the transfer shaft from the transaxle.

NOTE: A pry bar is recommended for drive shaft removal. Do not insert prybar to a depth of more than 7 mm or damage to the oil seal may occur.

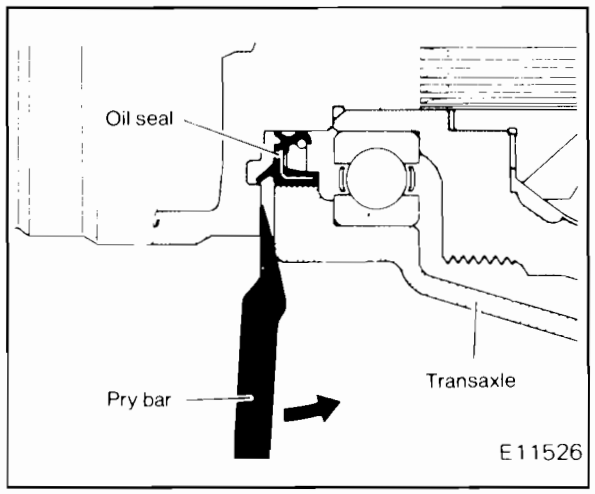


Fig. 4—Drive shaft removal

(17) Remove the crossmember (right member). Refer Group 33.
(18) Remove the torque converter lower cover plate

(19) Remove the torque converter to drive plate attaching bolts, refer Fig. 5, and push the torque converter towards the transaxle.

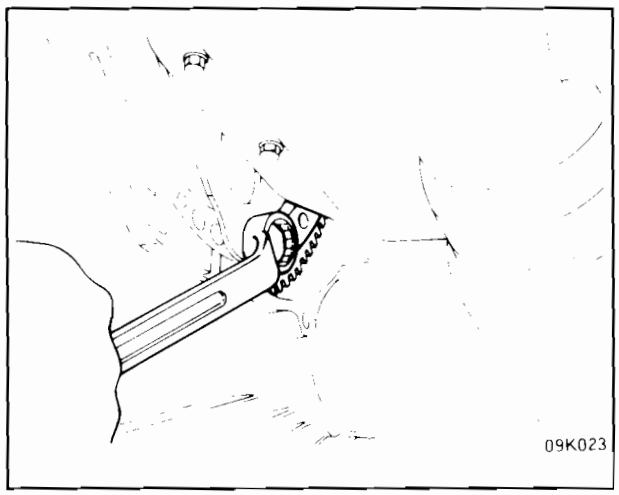


Fig. 5—Removing torque converter attaching bolts

(20) Support the transaxle on a suitable jack or hoist ensuring that excessive pressure is not exerted on the transaxle oil pan.
(21) Remove the transaxle mounting through bolt, refer Fig. 6.
(22) Pry the caps out of the right hand fender inner panel, remove the bracket to body attaching bolts, refer fig. 6, and remove the bracket.

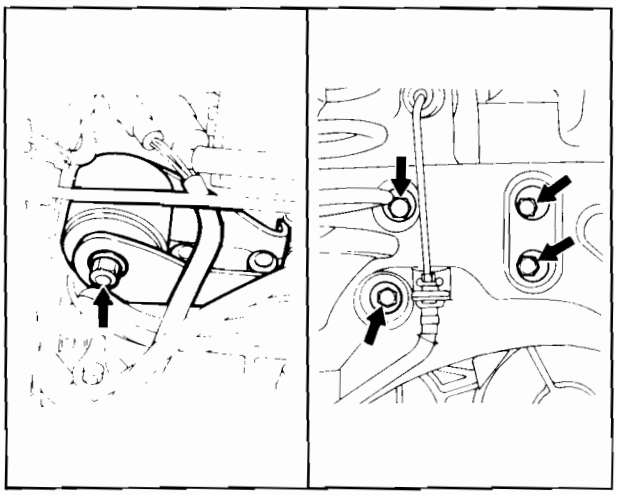


Fig. 6—Transaxle attaching bolts

(23) Remove the mounting bracket from the transaxle.
(24) Remove the remaining transaxle to engine attaching bolts.
(25) Move the transaxle away from the engine and lower the jack to remove the transaxle.

TRANSAXLE INSTALLATION

Install by reversing the removal procedure, noting the following:

(1) Install the torque converter in the transaxle.

NOTE: Do not attempt to fit the torque converter to the drive plate and install the transaxle to it, as seals will be damaged.

(2) Tighten all bolts to the specified torque.
(3) Adjust the select control cable as outlined in Section 5.
(4) Fill the transaxle with the specified fluid, start the engine and move the gear shift lever through all positions finishing in the N position, check that the fluid level is as shown in Fig. 7.

NOTE: The temperature should be within 70-80°C to obtain a correct reading.

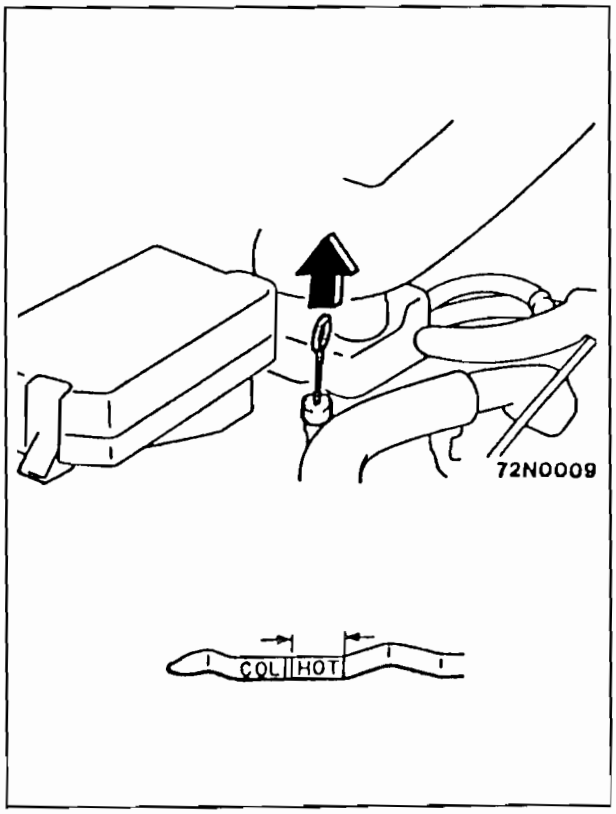


Fig. 7—Correct fluid level

(5) Road test the vehicle to check transaxle operation.

TORQUE CONVERTER FLUSHING

When a transaxle failure has contaminated the fluid, the torque converter should be flushed to insure that metal particles or sludged oil are not later transferred back into the reconditioned transaxle. Also flush and blow out the oil cooler and its lines.

Machine Flushing

Machine cleaning is recommended; using the type which rotates the converter while pumping cleaning fluid through it. The machine automatically adds timed blasts of compressed air to the cleaning fluid as it enters the converter, providing thorough cleaning.

ALUMINIUM THREAD REPAIR

Damaged or worn thread in the aluminium transaxle case and valve body can be repaired by the use of Heli-Coils. Essentially, this repair consists of drilling out the worn or damaged threads, tapping the hole with a special Heli-Coil tap and installing a Heli-Coil insert in the tapped hole. This brings the hole back to its original thread size. Heli-Coil tools and inserts are readily available from most automotive parts dealers.

NOTE: Some thread drag may occur in screwing a bolt into the installed Heli-Coil insert; therefore, a torque reading should be taken of the thread drag with a torque wrench and added to the specified bolt torque, so that all bolts securing a particular part will be tightened to the same torque.

TRANSAXLE DISASSEMBLY

Prior to removing any transaxle sub-assemblies, plug all openings and thoroughly clean exterior of the unit, preferably by steam. Cleanliness throughout the entire disassembly and assembly procedure cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.**

All mating surfaces in the transaxle are accurately machined; therefore, careful handling of parts must be exercised to avoid nicks or burrs.

INPUT SHAFT END PLAY

Measuring drive train end play before disassembly will usually indicate when a thrust washer change is required (except when major parts are replaced).

(1) Attach a dial indicator to the transaxle converter housing with the plunger seated against the end of the input shaft, refer Fig. 8.

(2) Move the input shaft in and out to obtain an end play reading.

(3) Record the end play for reference when reassembling the transaxle. Refer to specifications for the correct end play.

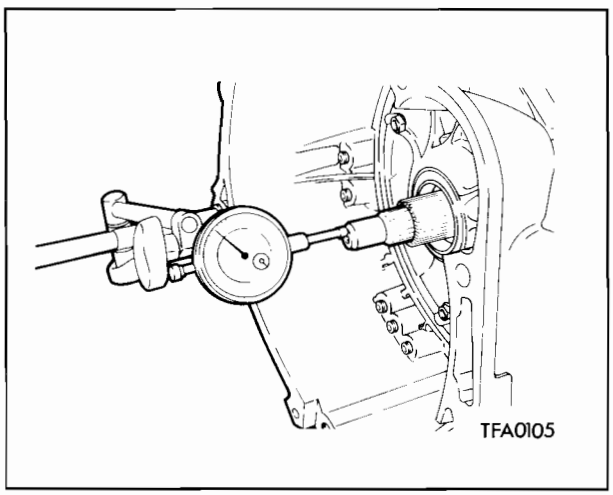


Fig. 8—Checking input shaft end play

SUB-ASSEMBLY REMOVAL

(1) Remove pulse generators A and B, refer Fig. 9.

(2) Remove the manual control lever and inhibitor switch, refer Fig. 10 and remove dip stick tube and speedo drive assembly.

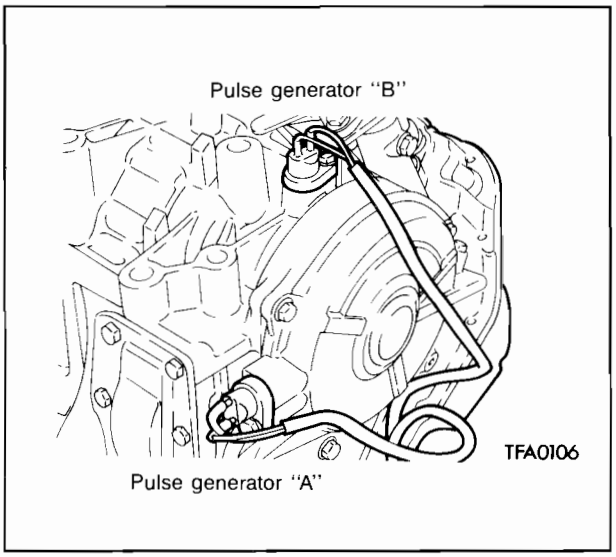


Fig. 9—Pulse generator location

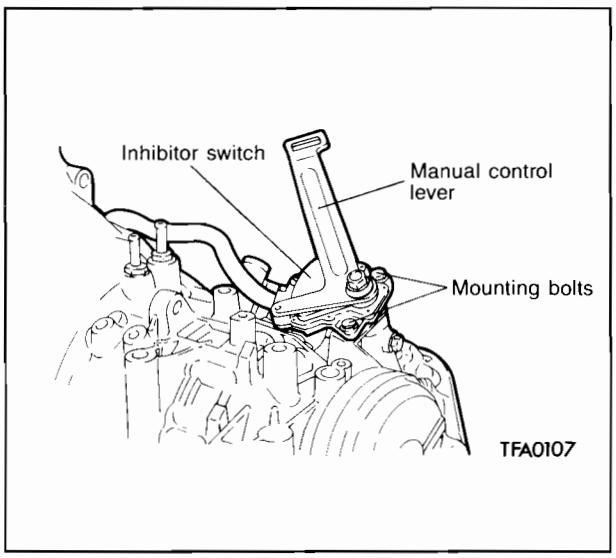


Fig. 10—Inhibitor switch removal

(3) Position the transaxle with the oil pan up and remove the oil pan and gasket.

(4) Remove the oil filter, refer Fig. 11.

(5) Loosen the valve body mounting bolts, refer Fig. 12.

(6) Remove the oil temperature sensor holder and sensor harness from the clamps, refer Fig. 13.

NOTE: Position the manual control shaft so the solenoid valve harness gromet can be removed from the transaxle case.

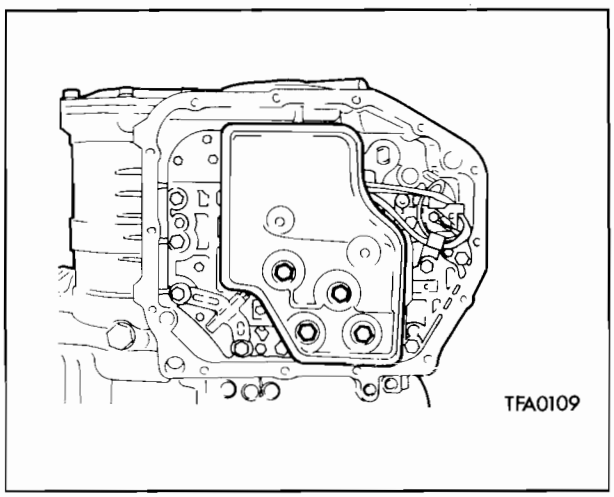


Fig. 11—Oil filter removal

(7) Press the fingers of the solenoid valve harness grommet, push the grommet into the case and remove the valve body assembly.

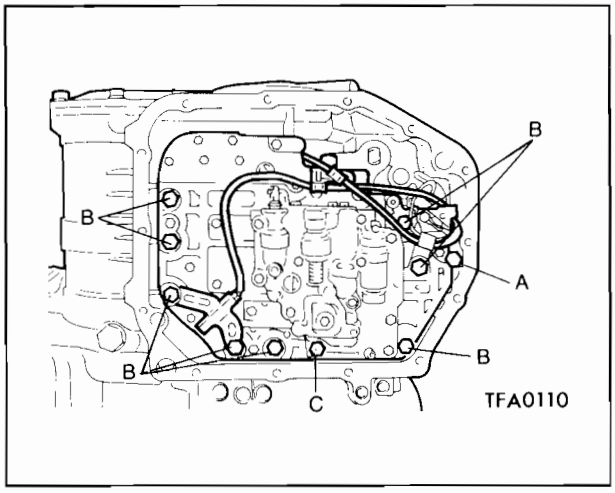


Fig. 12—Valve body mounting bolts

(8) Remove the oil temperature sensor.
(9) Remove the parking roller support bolts and remove the support, refer Fig. 15.

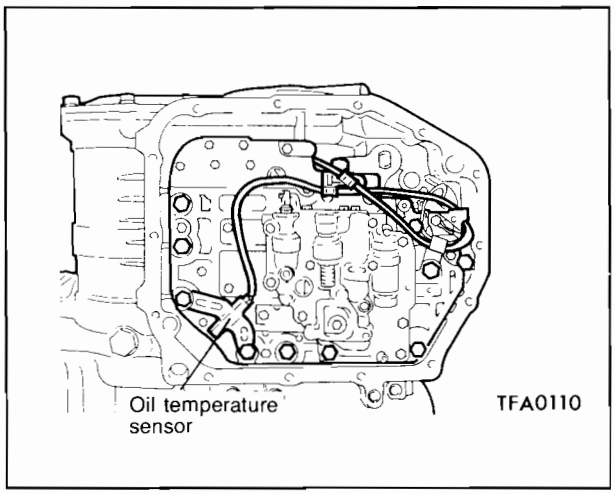


Fig. 13—Oil temperature sensor

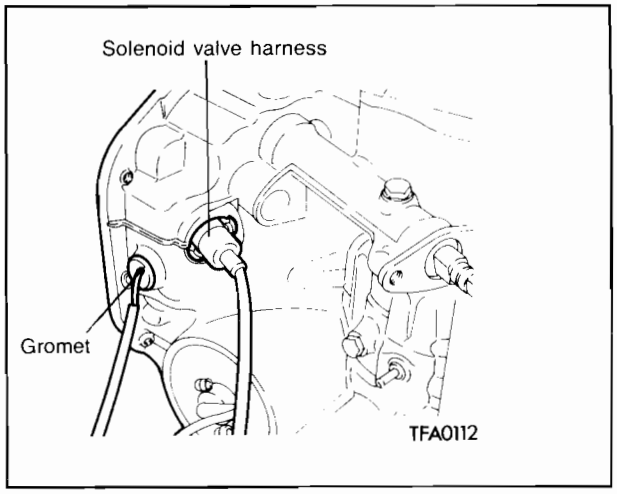


Fig. 14—Solenoid valve harness removal

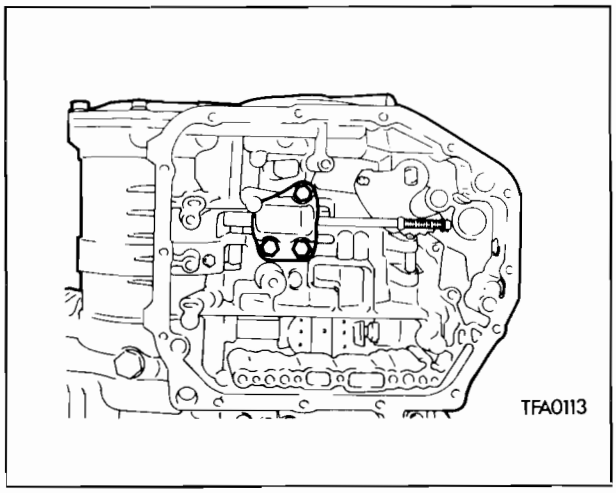


Fig. 15—Parking roller support removal

(10) Remove the manual control shaft set screw, refer Fig. 11, and remove the manual control shaft assembly.

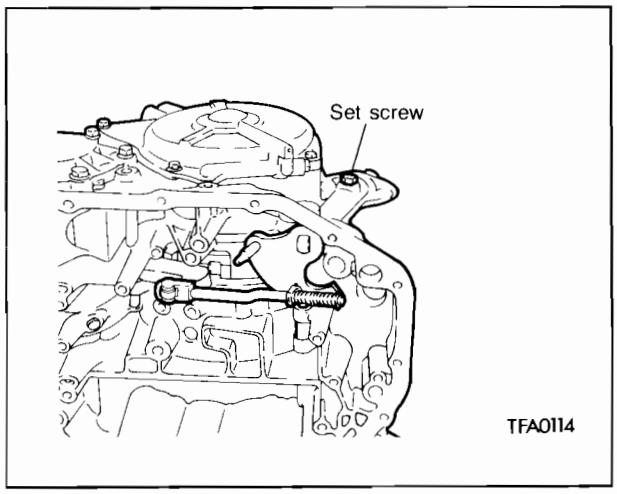


Fig. 16—Control shaft removal

(11) Remove the detent assembly.
(12) Remove the differential cover attaching bolts and remove the cover, refer Fig. 17.

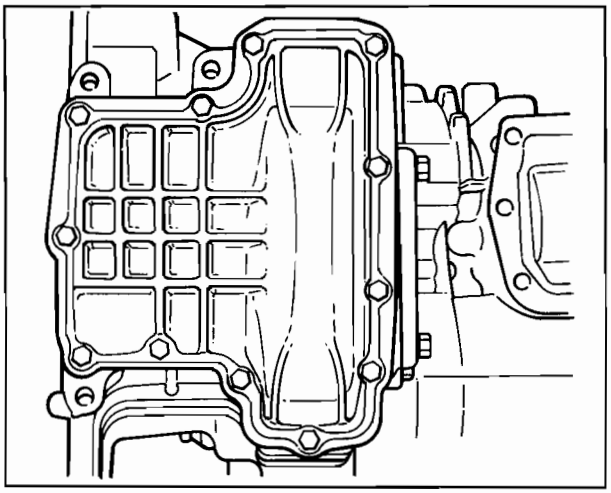


Fig. 17—Differential cover removal

(13) Remove the differential front bearing cap attaching bolts and remove the cap, refer Fig. 18.

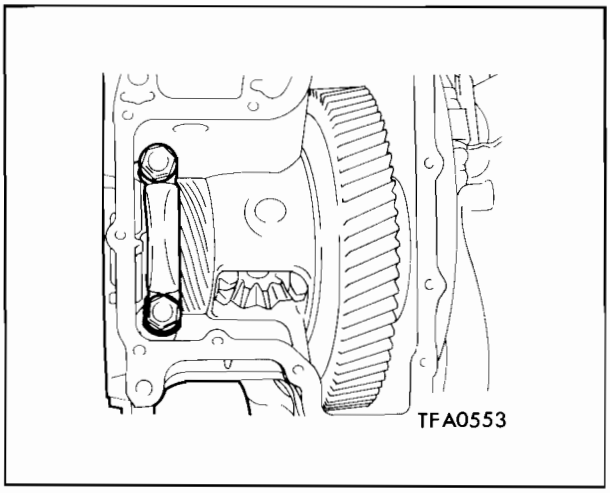


Fig. 18—Bearing cap removal

(14) Remove the differential bearing retainer, spacer and outer race assembly, refer Fig. 19.

(15) Remove the differential assembly, refer Fig. 20.

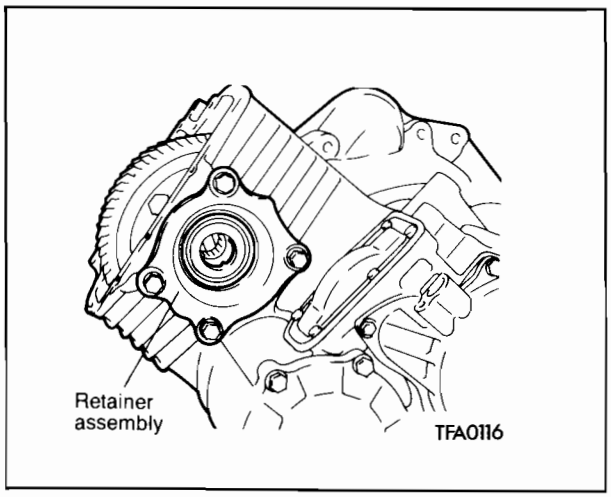


Fig. 19—Bearing retainer removal

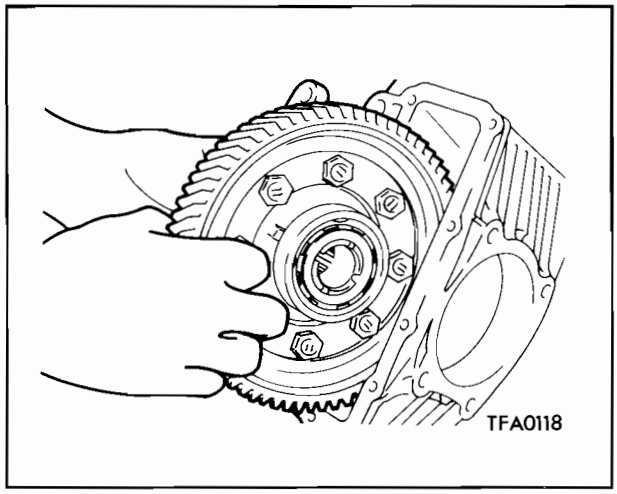


Fig. 20—Differential removal

(16) Remove the end clutch cover installation bolts, refer Fig. 21, and remove the cover.

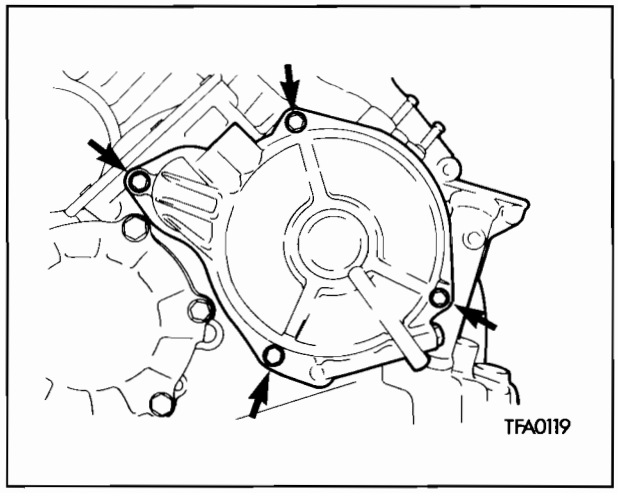


Fig. 21—End clutch cover bolts

(17) Remove the end clutch assembly, refer Fig. 22.

(18) Remove the end clutch thrust washer, refer Fig. 23.

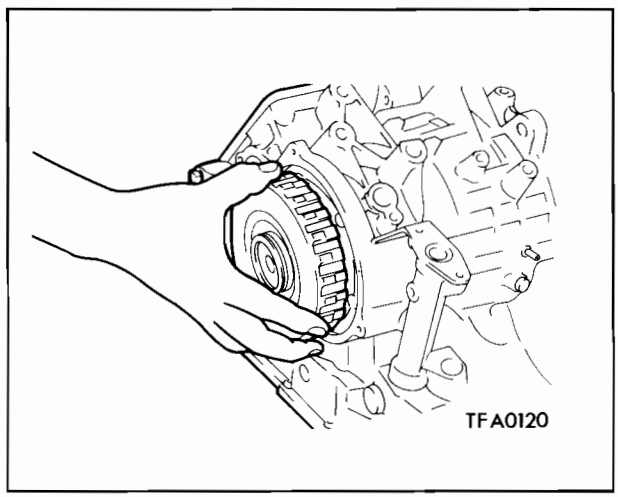


Fig. 22—End clutch removal

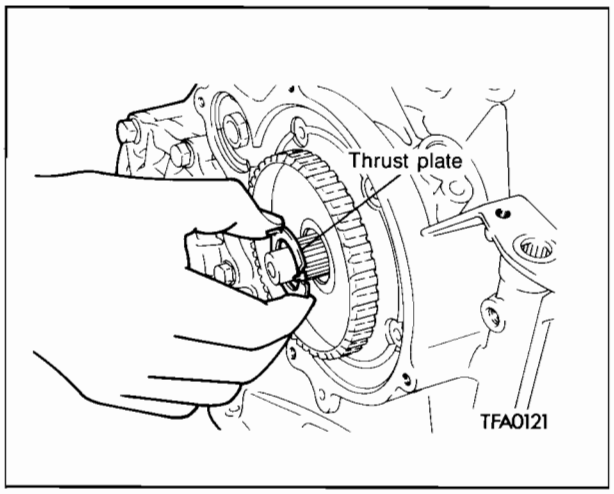


Fig. 23—End clutch thrust washer removal

(19) Remove the end clutch hub, refer Fig. 24.

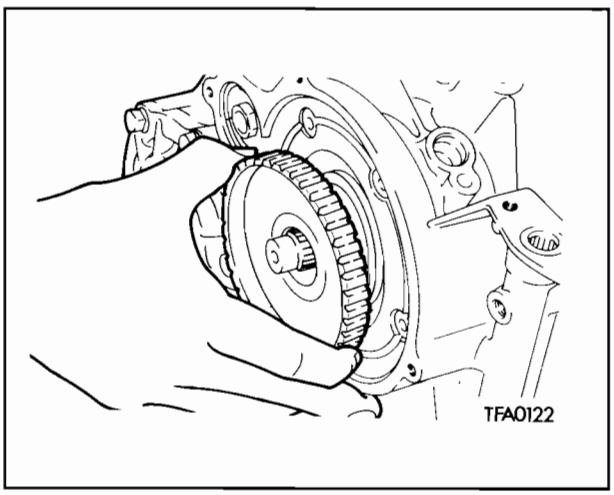


Fig. 24—End clutch hub removal

(20) Remove the thrust bearing #11.

NOTE: It may be stuck to the end clutch hub.

(21) Remove the end clutch shaft, refer Fig. 25.

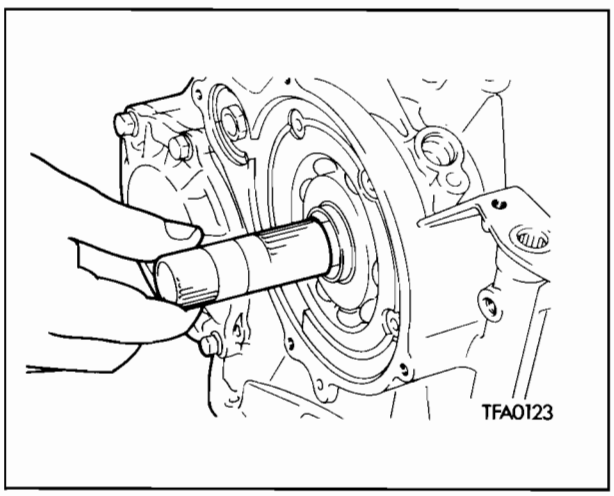


Fig. 25—End clutch shaft removal

(22) Remove the idler gear cover mounting bolts, refer Fig. 26, and remove cover and gasket.

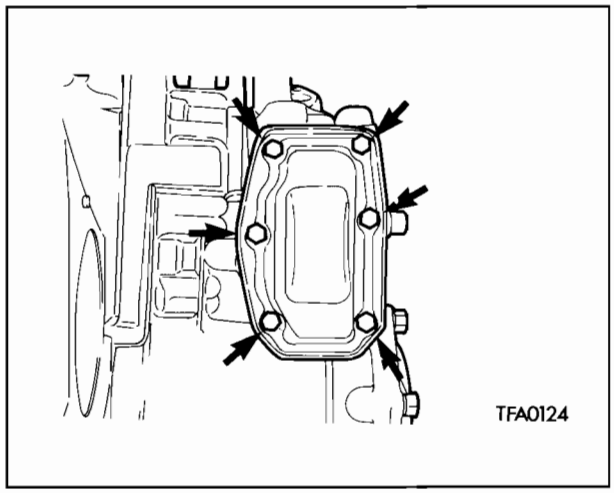


Fig. 26—Idler gear cover removal

(23) Disengage the idler shaft bolt locking plate, refer Fig. 27, and remove the bolt.

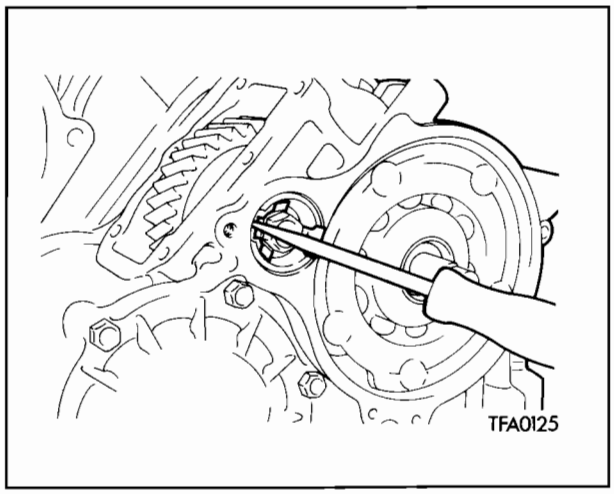


Fig. 27—Idler shaft bolt removal

(24) Using a suitable tool pull out the idler shaft, refer Fig. 28, and remove the idler gear and bearing.

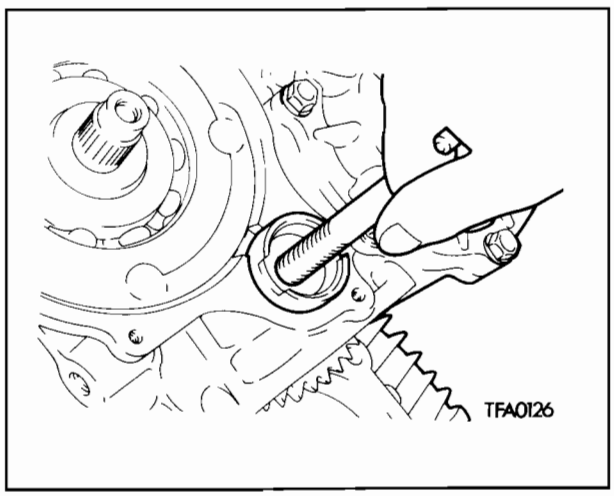


Fig. 28—Idler shaft removal

(25) Remove the idler gear spacer, refer Fig. 29.

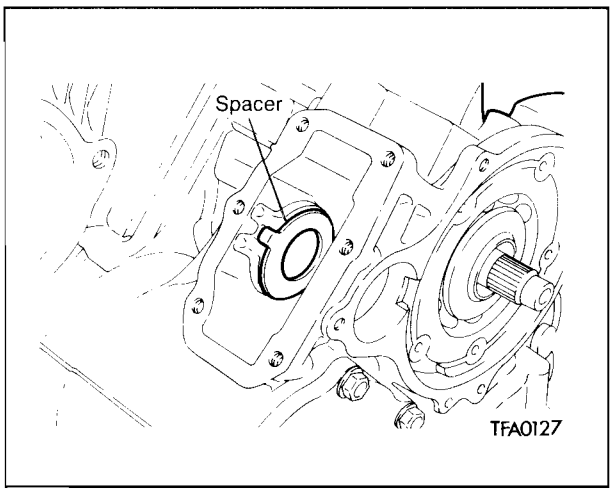


Fig. 29—Idler gear spacer

(26) Remove the oil pump mounting bolts, refer Fig. 30.

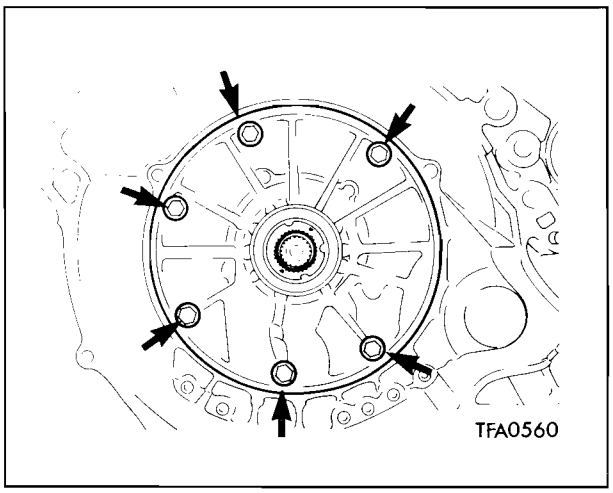


Fig. 30—Oil pump bolt removal

(27) Using Special Tool E23M11 remove the pump assembly, refer Fig. 31.

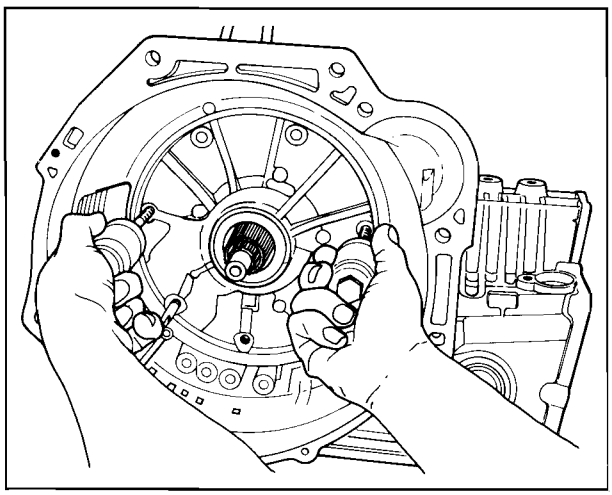


Fig. 31—Oil pump removal

(28) Remove thrust washer #1 and thrust race #3, refer Fig. 32.

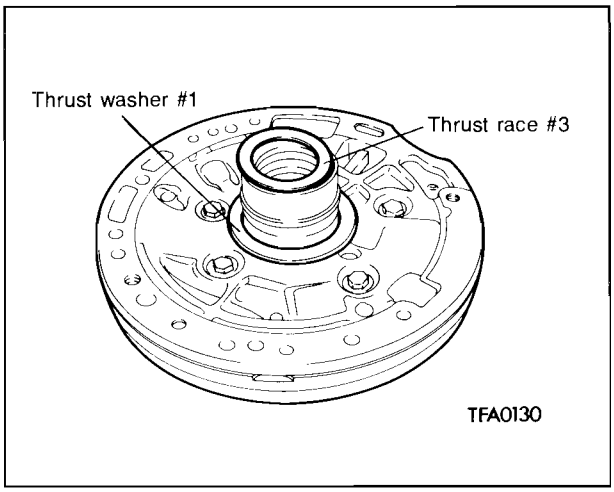


Fig. 32—Thrust washer removal

(29) Hold the input shaft and remove the front and rear clutch assemblies together, refer Fig. 33.

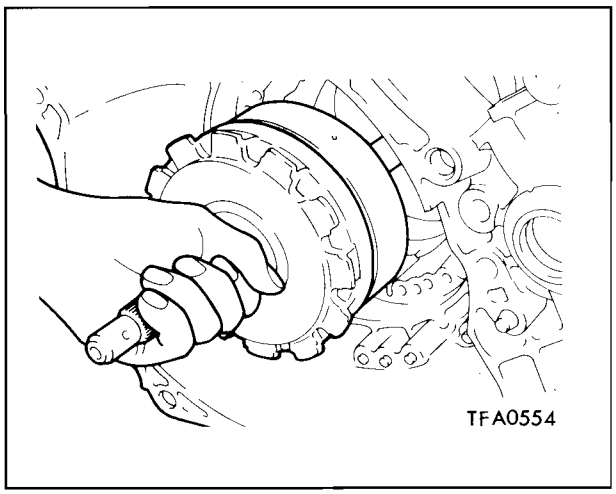


Fig. 33—Front and rear clutch removal

(30) Remove thrust bearing #5, refer Fig. 34.

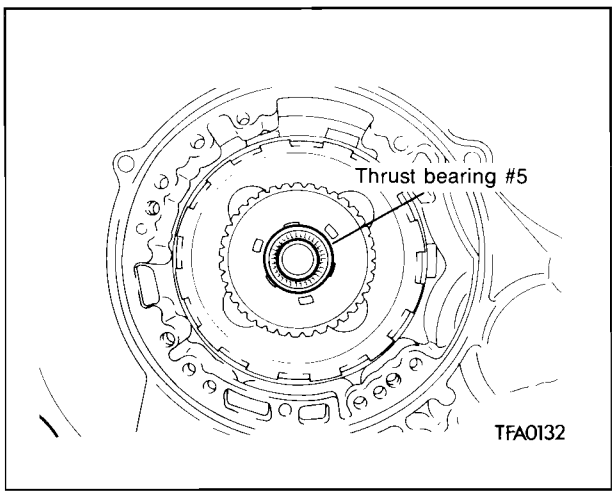


Fig. 34—Thrust bearing #5 removal

(31) Remove the rear clutch hub, refer Fig. 35.

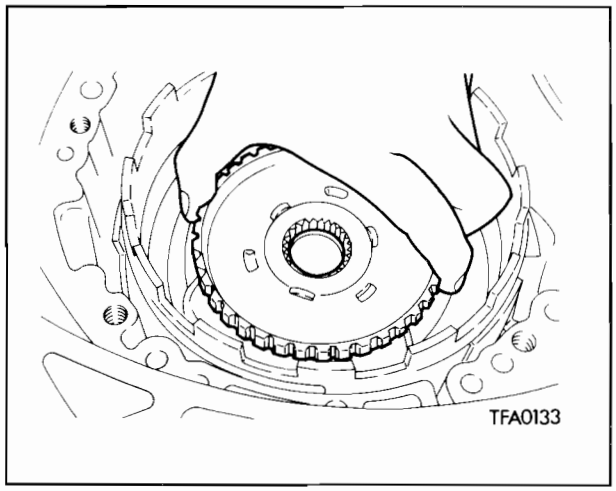


Fig. 35—Rear clutch hub removal

NOTE: The thrust race may be stuck to the back of the clutch hub.

(32) Remove thrust bearing #7, refer Fig. 36.

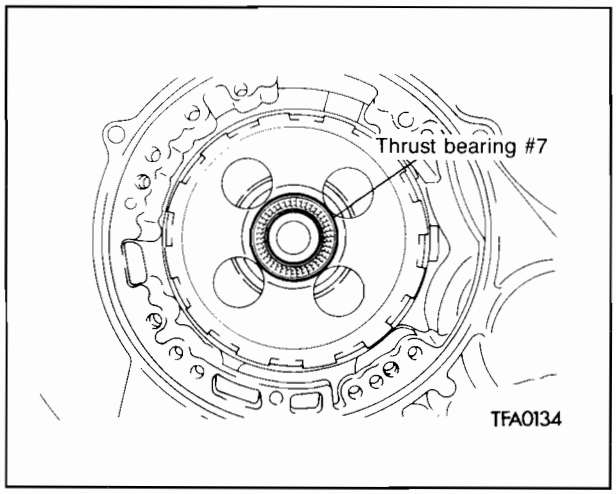


Fig. 36—Thrust bearing #7 removal

(33) Remove the kickdown drum, refer Fig. 37.

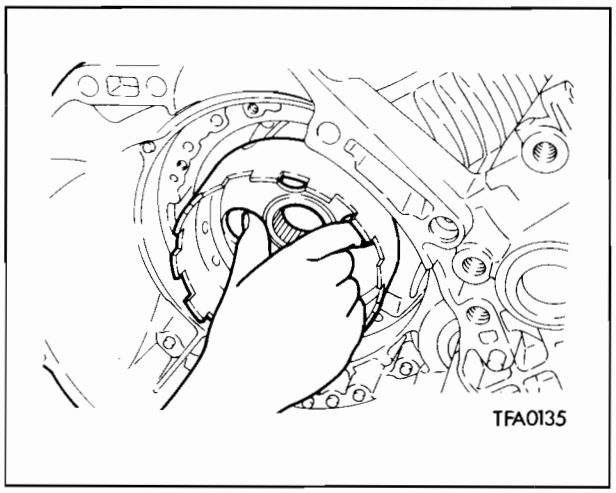


Fig. 37—Kickdown drum removal

(34) Remove the kickdown band, refer Fig. 38.

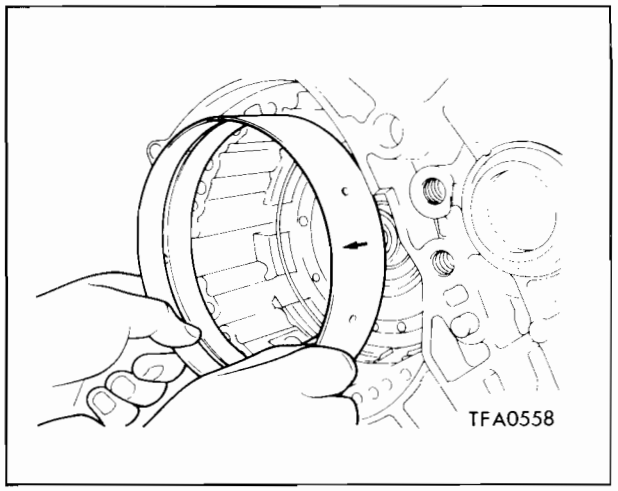


Fig. 38—Kickdown band removal

(35) Remove the kickdown servo cover snap ring, and then remove the kickdown servo switch, refer Fig. 39.

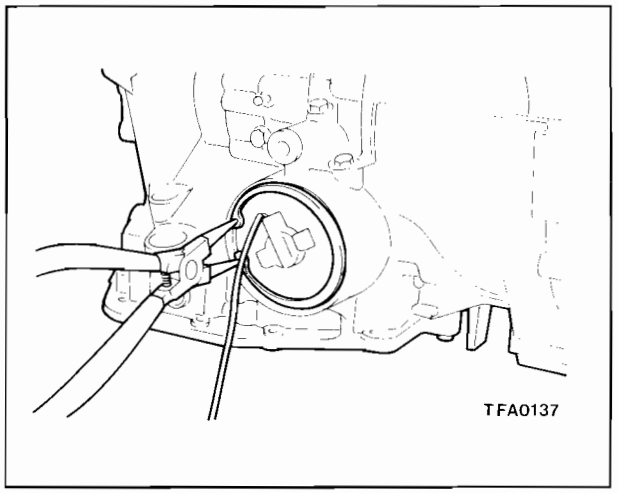


Fig. 39—Kickdown servo cover removal

(36) Using a valve spring compressor with a suitable adaptor compress the kickdown servo and remove the snap ring, refer Fig. 40.

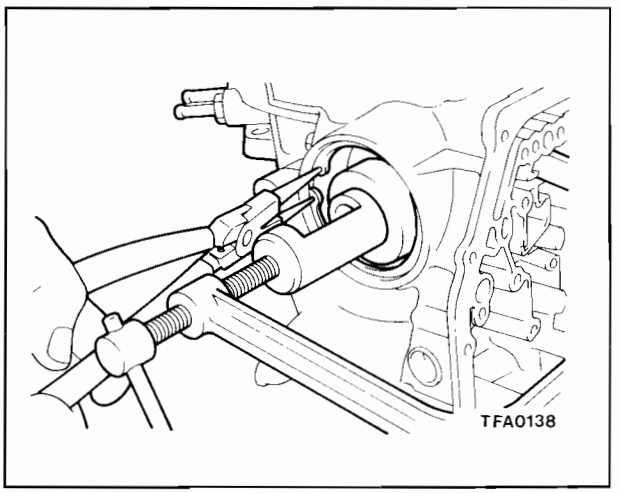


Fig. 40—Kickdown servo snap ring

(37) Remove the kickdown servo piston, refer Fig. 41.

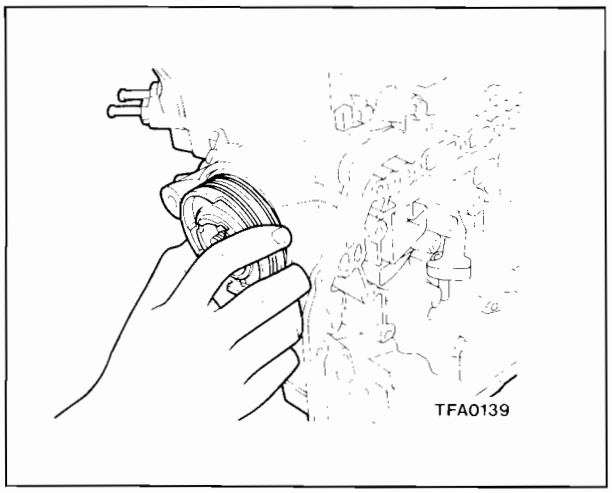


Fig. 41—Kickdown servo piston removal

(38) Remove the kickdown band anchor rod, refer Fig. 42.

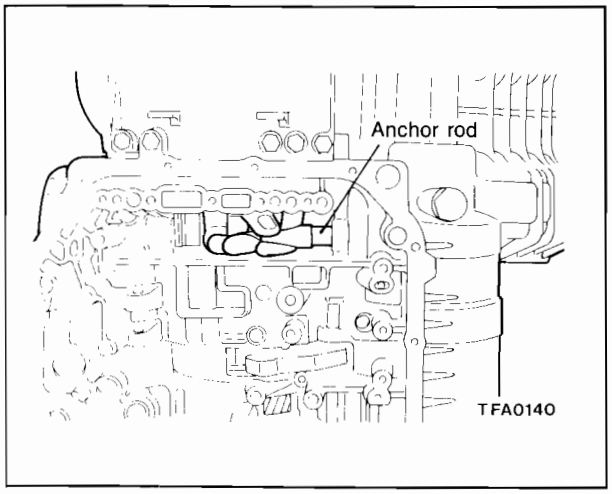


Fig. 42—Anchor rod removal

(39) Remove the kickdown servo air exhaust capping plug and then remove the air exhaust plug, refer Fig. 43.

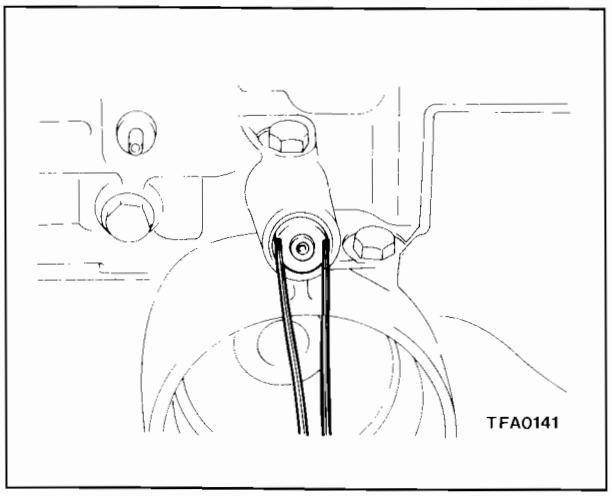


Fig. 43—Exhaust plug removal

(40) Remove the centre support snap ring, refer Fig. 44.

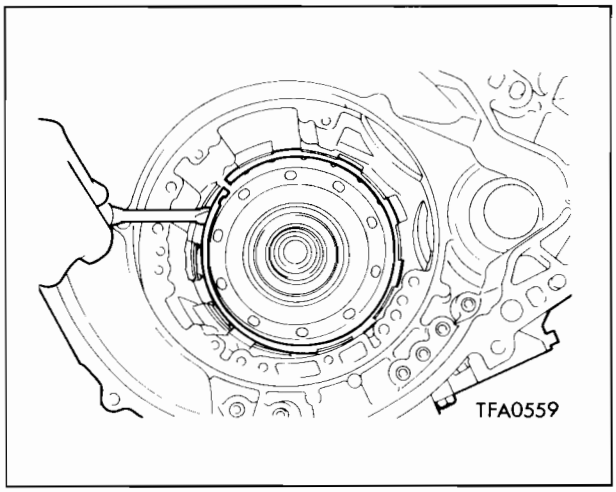


Fig. 44—Centre support snap ring removal

(41) Using Special Tool E21M41 attached to the centre support, remove the centre support by pulling straight upwards, refer Fig. 45.

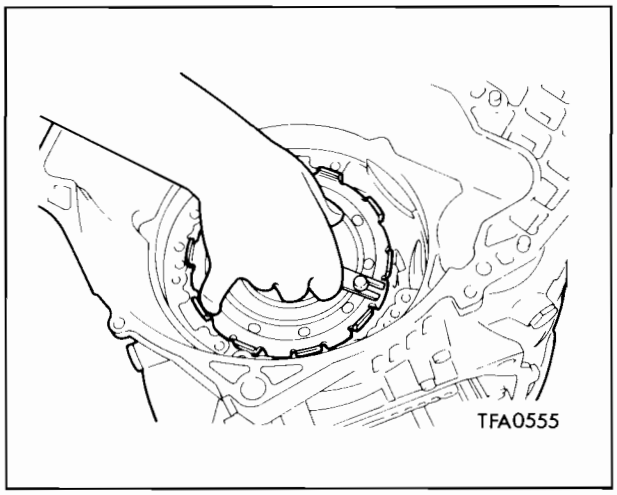


Fig. 45—Centre support removal

(42) Remove the reverse sun gear and forward sun gear together, refer Fig. 46.

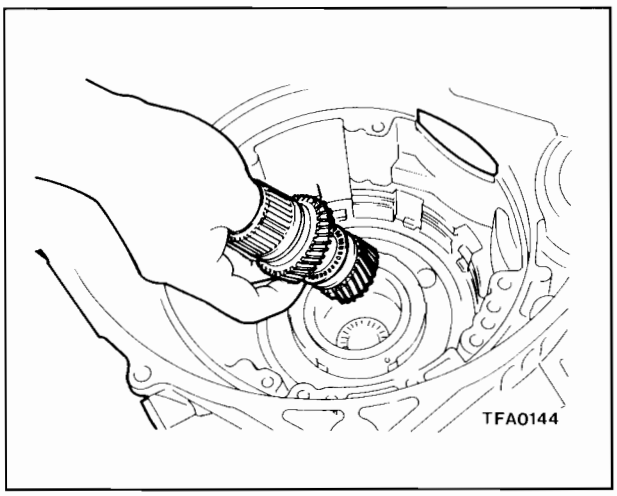


Fig. 46—Reverse and forward sun gear removal

(43) Remove the planet pinion carrier assembly, refer Fig. 47.

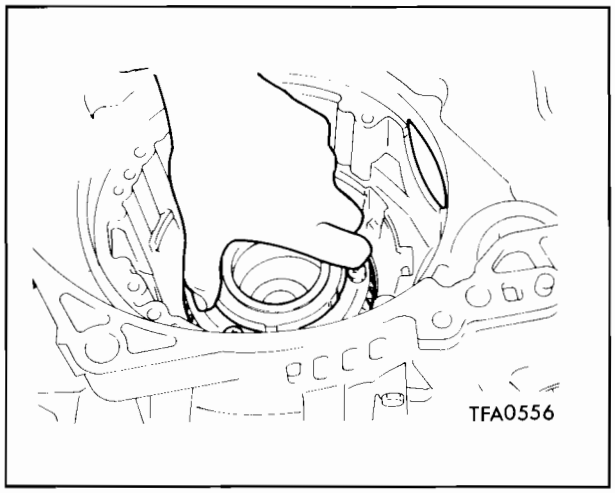


Fig. 47—Plant pinion carrier removal

(44) Remove the low reverse brake wave spring, return spring, reaction plate and brake discs, and plates, refer Fig. 48.

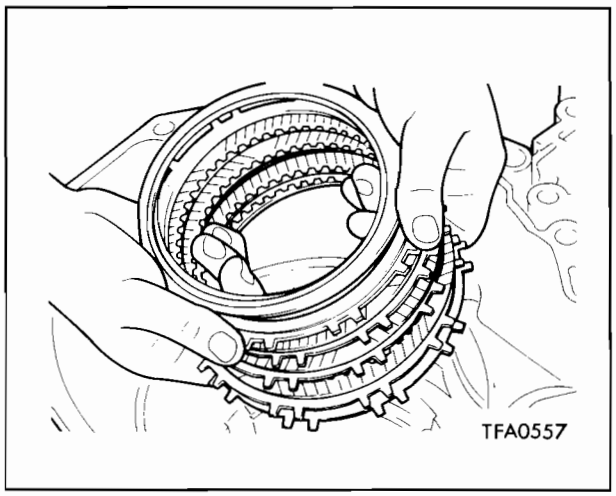


Fig. 48—Low reverse brake removal

(45) Using a TX40 star drive, loosen the rear bearing retainer bolts and remove, refer Fig. 49.

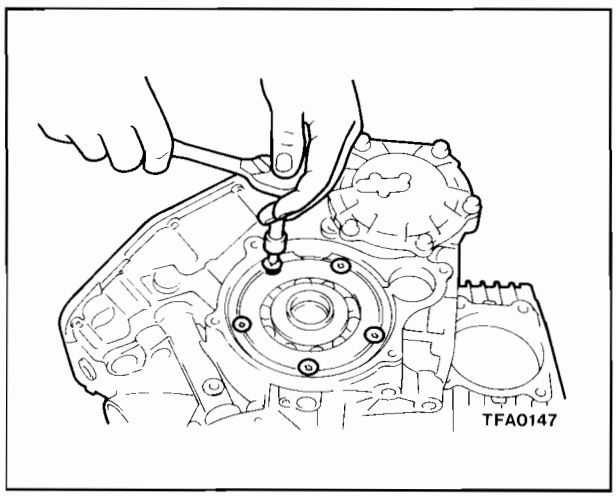


Fig. 49—Bearing retainer removal

(46) Remove the rear bearing snap ring, refer Fig. 50.

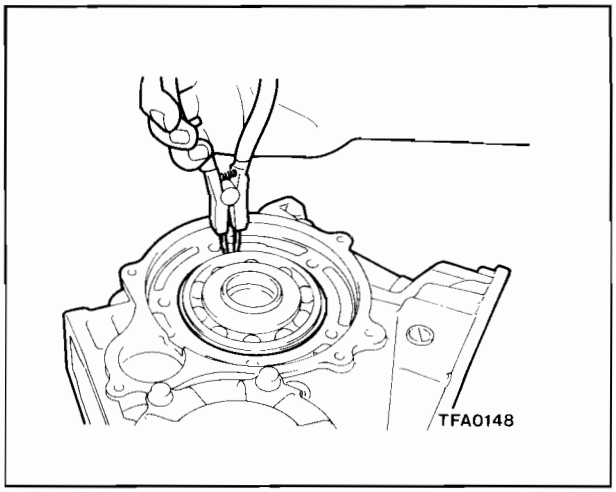


Fig. 50—Rear bearing snap ring removal

(47) Remove the transfer shaft output bearing retainer mounting bolts and then remove the output bearing retainer and outer race assembly, refer Fig. 51.

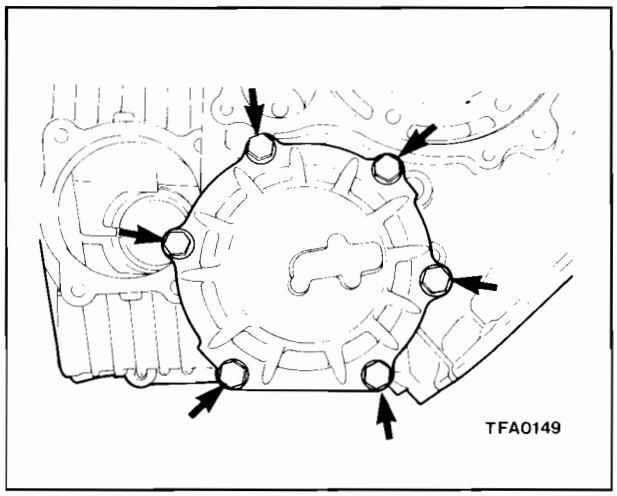


Fig. 51—Transfer shaft bearing retainer removal

(48) Remove the transfer shaft, refer Fig. 52.

(49) Using a suitable sliding hammer, remove the outer bearing race, refer Fig. 53.

(50) Remove all oil seals.

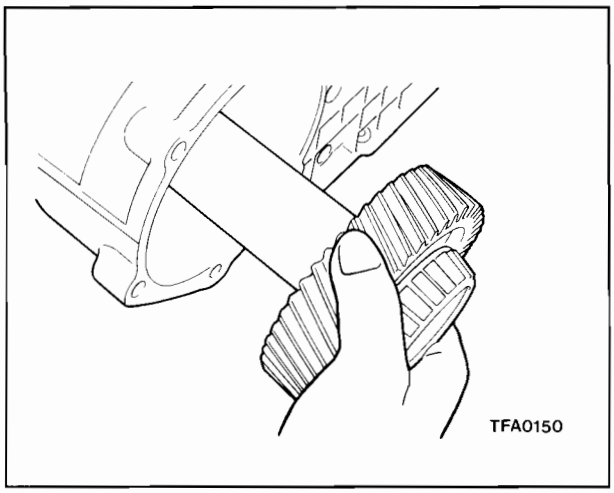


Fig. 52—Transfer shaft removal

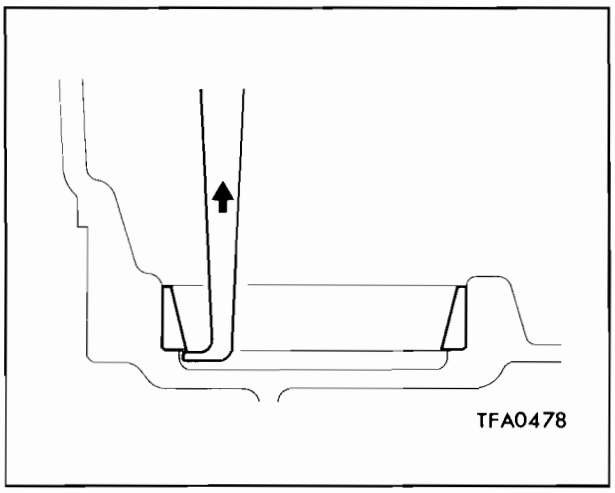


Fig. 53—Outer bearing race removal

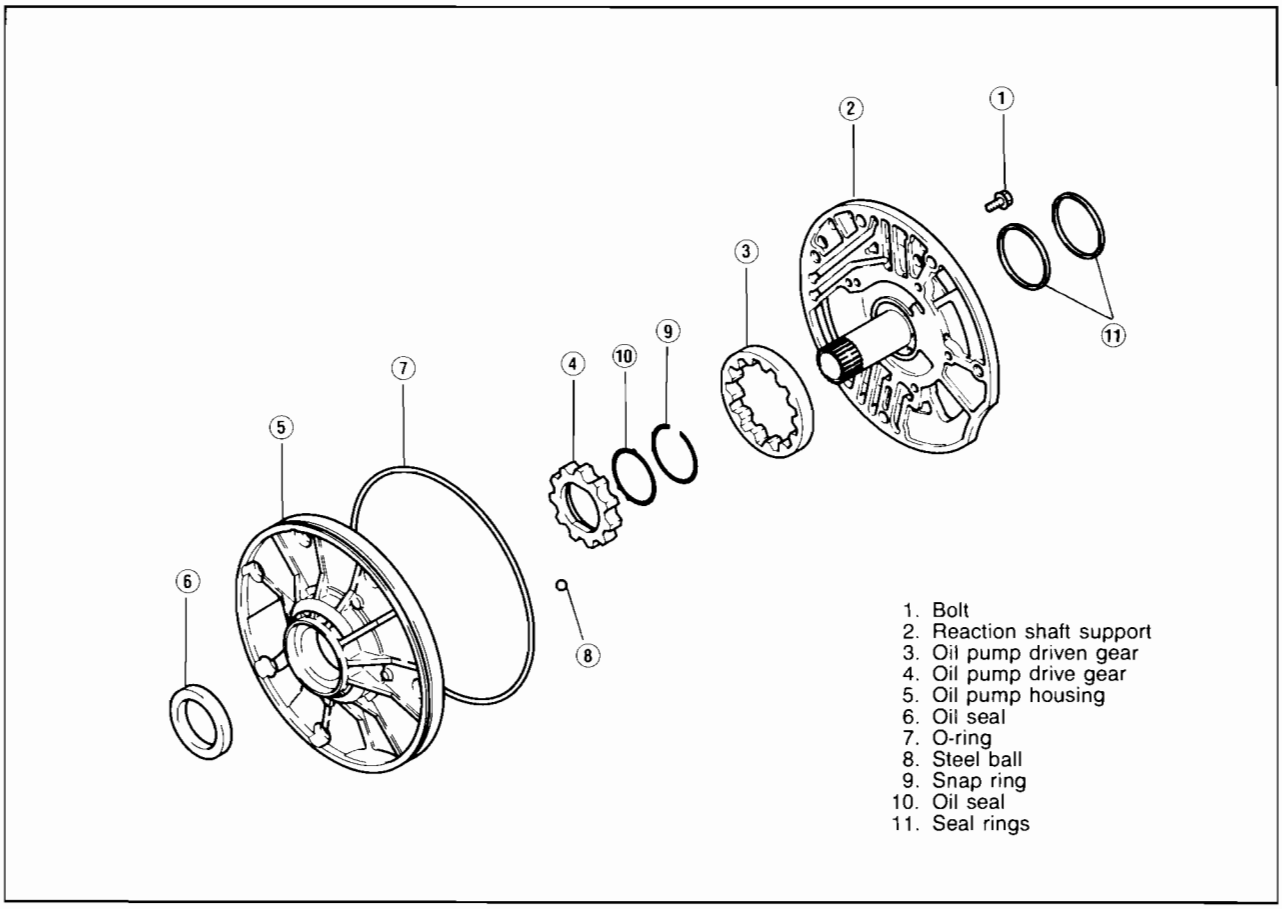


Fig. 54—Oil pump components

SUB ASSEMBLY OVERHAUL

OIL PUMP

Disassembly

(1) Remove the "O" ring from the oil pump housing.

(2) Remove the bolts from the pump assembly and separate the unit.

(3) Measure gear clearances, refer Specifications, if clearances are not within specifications replace the oil pump assembly.

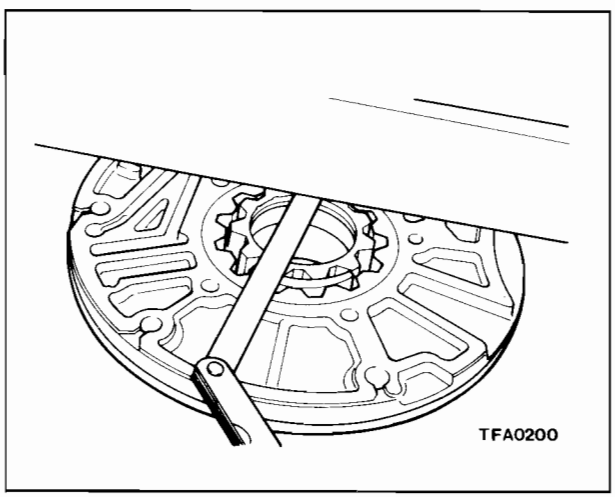


Fig. 55—Checking clearances

If clearances are within specifications, mark the relative position of the gears to ensure correct installation.

(4) Remove the steel ball the drive gear and the driven gear, refer Fig. 56.

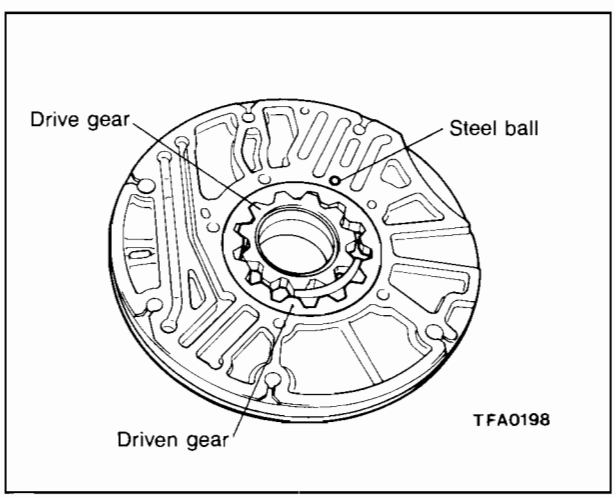


Fig. 56—Oil pump internal components

(5) Remove the seal rings from the reaction shaft support, refer Fig. 57.

(6) Remove and discard the pump housing oil seal, refer Fig. 58.

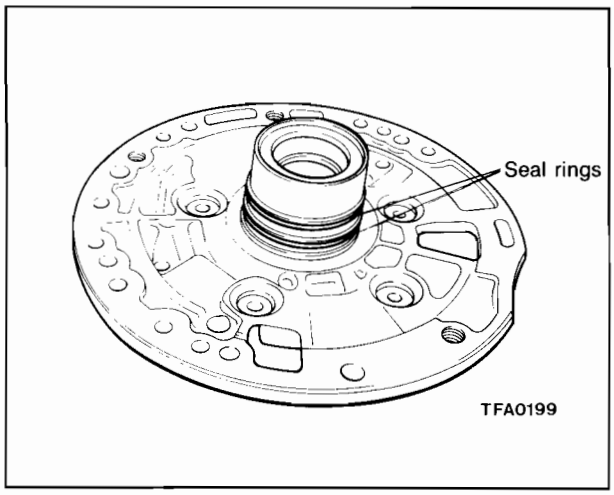


Fig. 57—Reaction shaft support seal rings

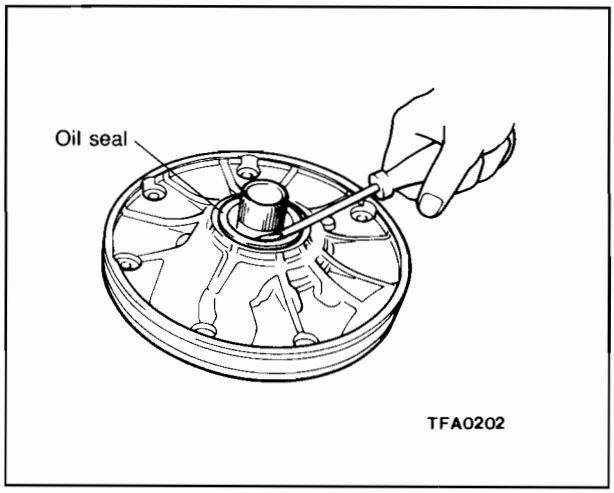


Fig. 58—Removing oil seal

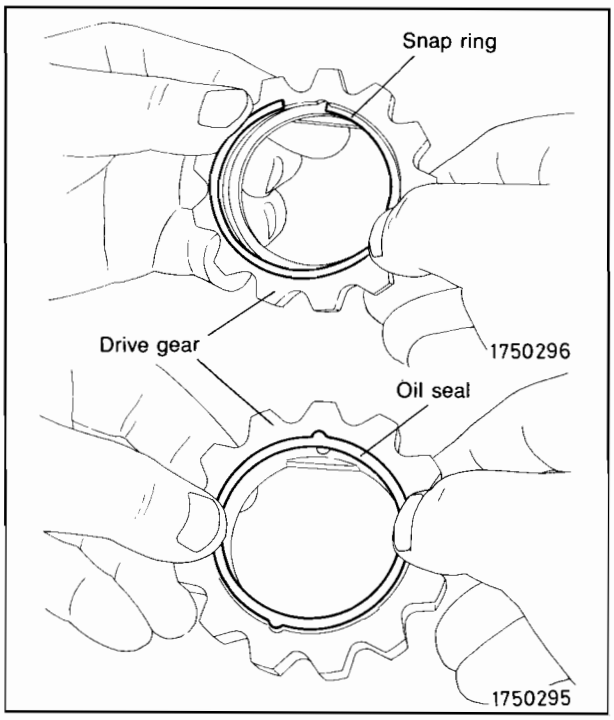


Fig. 59—Snap ring and oil seal removal

(7) Using a suitable probe remove the snap ring and oil seal from the oil pump drive gear, refer Fig. 59.

(8) Clean all components in suitable solvent and check for damage.

Assembly

(1) Apply a coat of A.T.F. to the oil seal lip and using Special Tool E9055, install a new oil seal in the pump housing, refer Fig. 60.

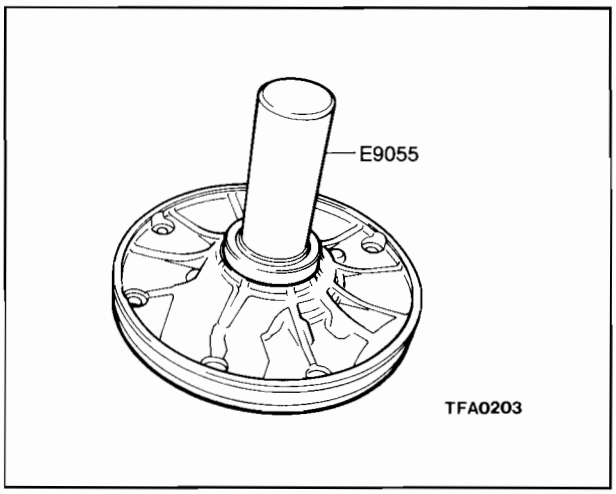


Fig. 60—Installing oil seal

(2) Immerse the drive gear and the driven gear in A.T.F. and install in the pump housing, ensuring that the mating marks are correctly aligned.

(3) Install a new oil seal and snap ring into the drive gear.

(4) Install the steel ball, refer Fig. 56.

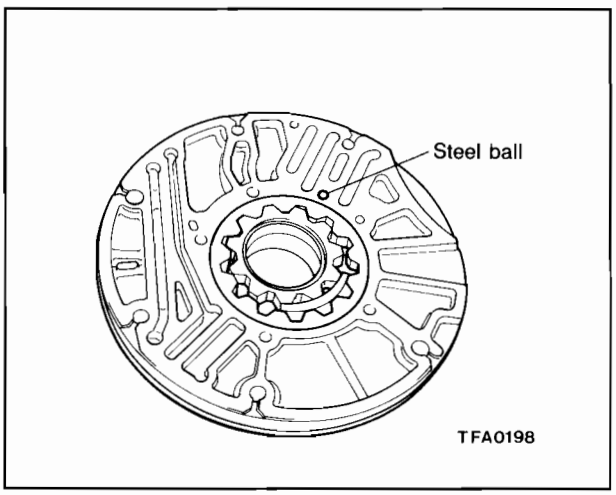


Fig. 61—Steel ball location

(5) Coat new seal rings with A.T.F. and fit onto the reaction shaft support.

(6) Fit the reaction shaft support onto the pump housing and install and finger tighten attaching bolts.

(7) With the reaction shaft support properly positioned on the pump housing, using Special Tool MD998336 and a suitable ring compressor tighten the pump housing to reaction shaft attaching bolts to the specified torque, refer Fig. 62.

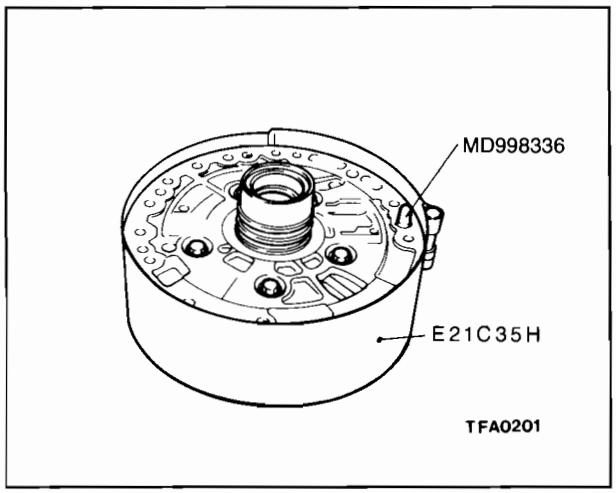


Fig. 62—Pump housing assembly

(8) Rotate the oil pump and check that the pump gears rotate freely.

(9) Install a new "O" ring in the groove on the circumference of the pump housing and coat with petroleum jelly.

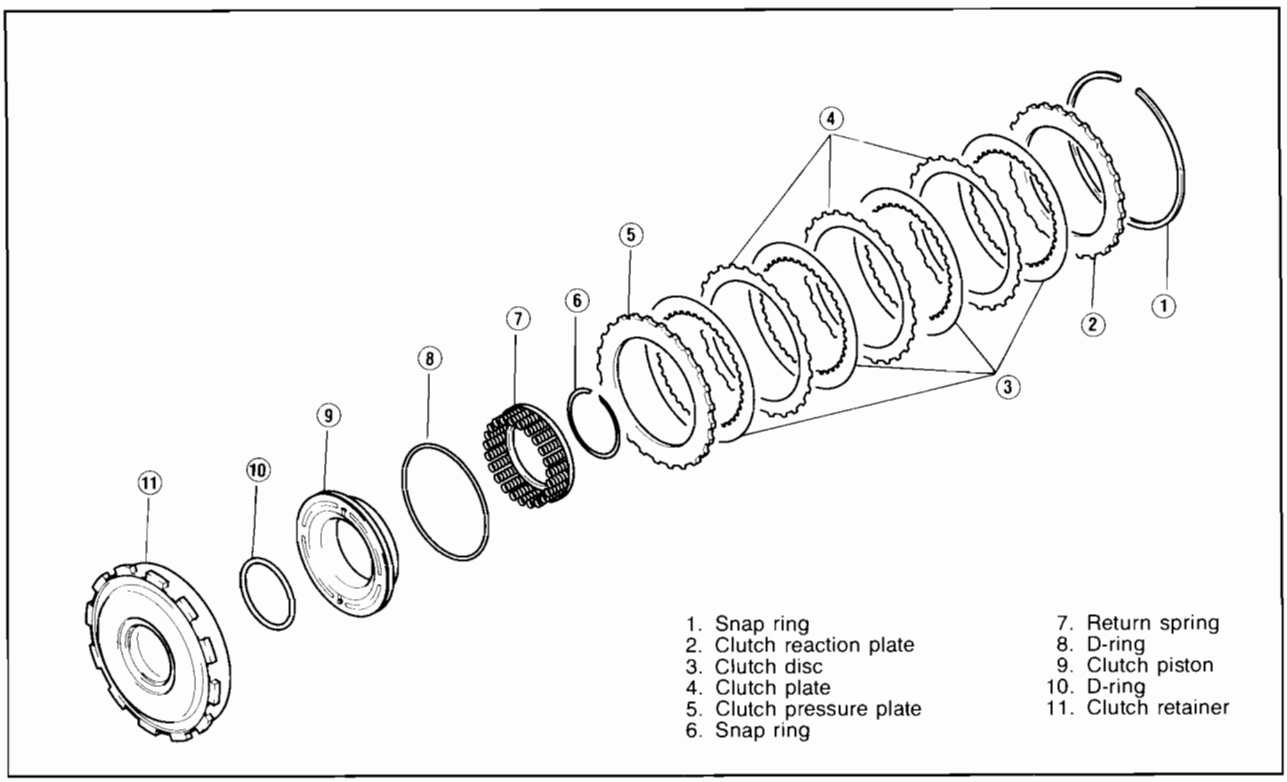


Fig. 63—Front clutch components

FRONT CLUTCH

Disassembly

(1) Remove the outer snap ring and remove the clutch discs and plates.

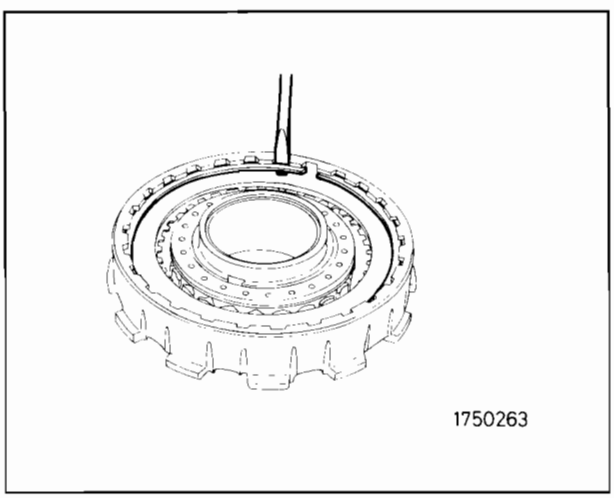


Fig. 64—Snap ring removal

(2) Using Special Tool E21M43 compress the return spring and remove the snap ring, refer Fig. 65.

(3) Slowly release the spring until the spring retainer is free of the hub.

(4) Remove the tool, the spring retainer and spring.

(5) Remove the piston by blowing air into the oil feed hole, refer Fig. 66.

(6) Remove and discard D-rings from around the piston and the clutch hub retainer.

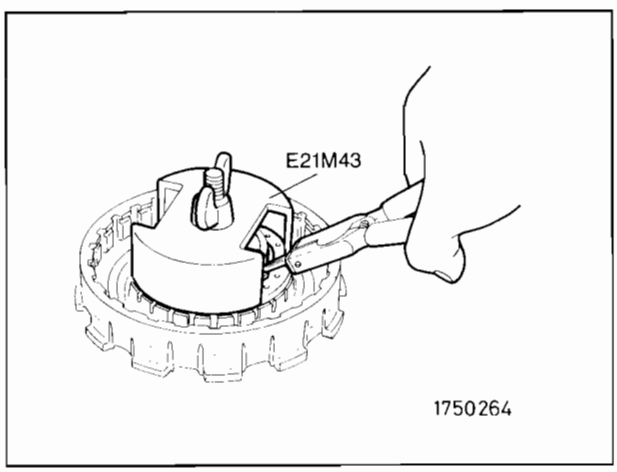


Fig. 65—Return spring removal

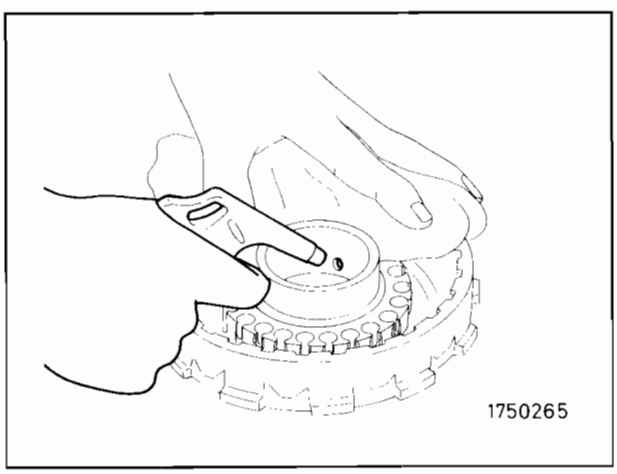


Fig. 66—Piston removal

Inspection

Inspect facing material on all driving discs. Replace discs that are charred glazed or heavily pitted. Discs should be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in grooves. Inspect contacting surface on the clutch retainers for scores, **the contact surface should be protected from damage during disassembly and handling.** Inspect piston seal ring surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of neoprene rings. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.

Inspect bore of piston for score marks, if light, remove with crocus cloth. Inspect seal ring grooves for nicks and burrs. Inspect neoprene rings for deterioration, wear and hardness. Inspect piston spring, retainer and circlip for distortion.

Thoroughly clean all components prior to assembly and installation.

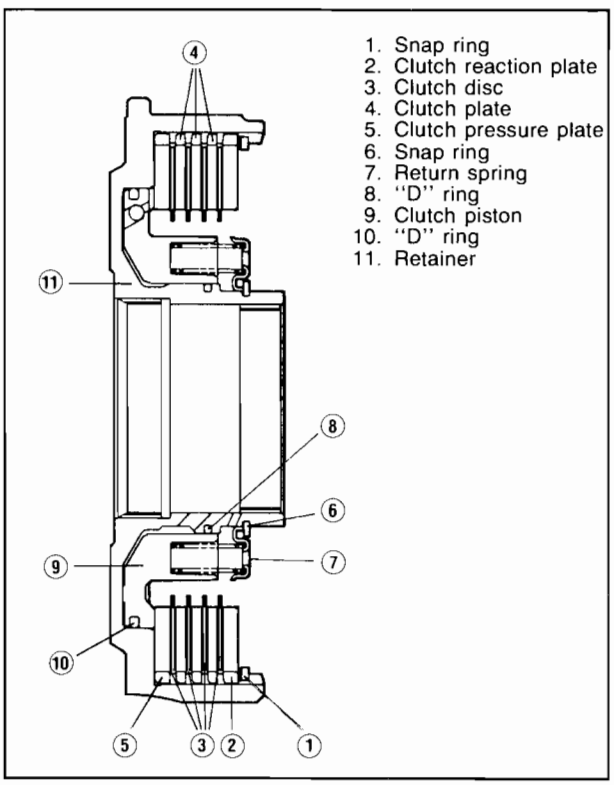


Fig. 67—Front clutch assembly

Assembly

(1) Install a new "D" section sealing ring to groove in outside surface of piston, with the round section facing out, refer Fig. 68. Install a new "D" section sealing ring to front clutch retainer.

(2) Coat outside surface of "D" rings with A.T.F. and push the piston into the front clutch retainer by hand.

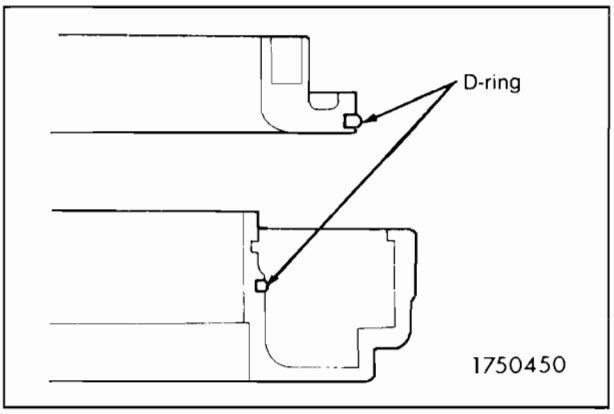


Fig. 68—"D" ring installation

(3) Install return spring and spring retainer. Compress return spring with Special Tool E21M43 and install snap ring, refer Fig. 69.

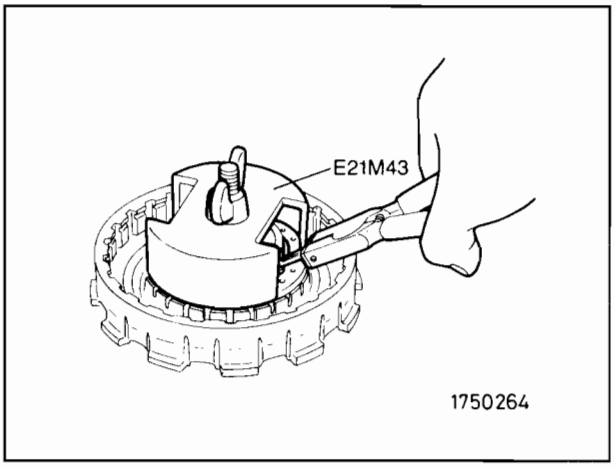


Fig. 69—Return spring installation

(4) Coat the clutch plates and the clutch discs with A.T.F. and install in the retainer as shown in Fig. 70.

NOTE: When new clutch discs are used immerse in A.T.F. for at least two hours prior to installation.

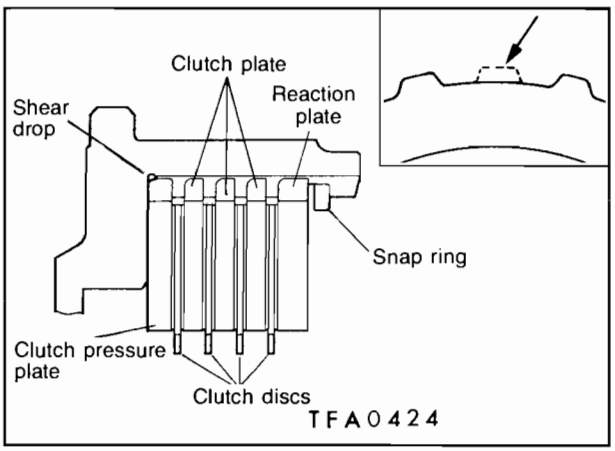


Fig. 70—Clutch disc and plate installation

NOTE: When the clutch reaction plates are installed, make sure that all their missing teeth are in alignment, refer Fig. 70.

(5) Install snap ring and check clearance between snap ring and clutch plate. To check clearance, hold circumerence of clutch plate down with a force of 5 kg. measure clearance with a feeler gauge, refer Fig. 71.

(6) If the clearance fails to meet specifications, select a suitable snap ring, refer to specifications, to give the required clearance.

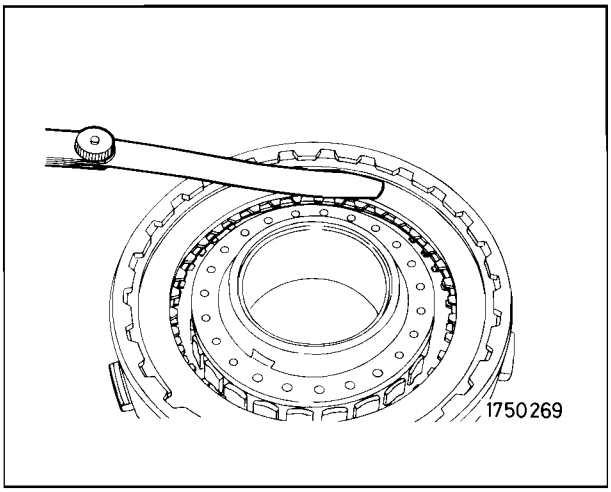


Fig. 71—Checking clutch plate clearance

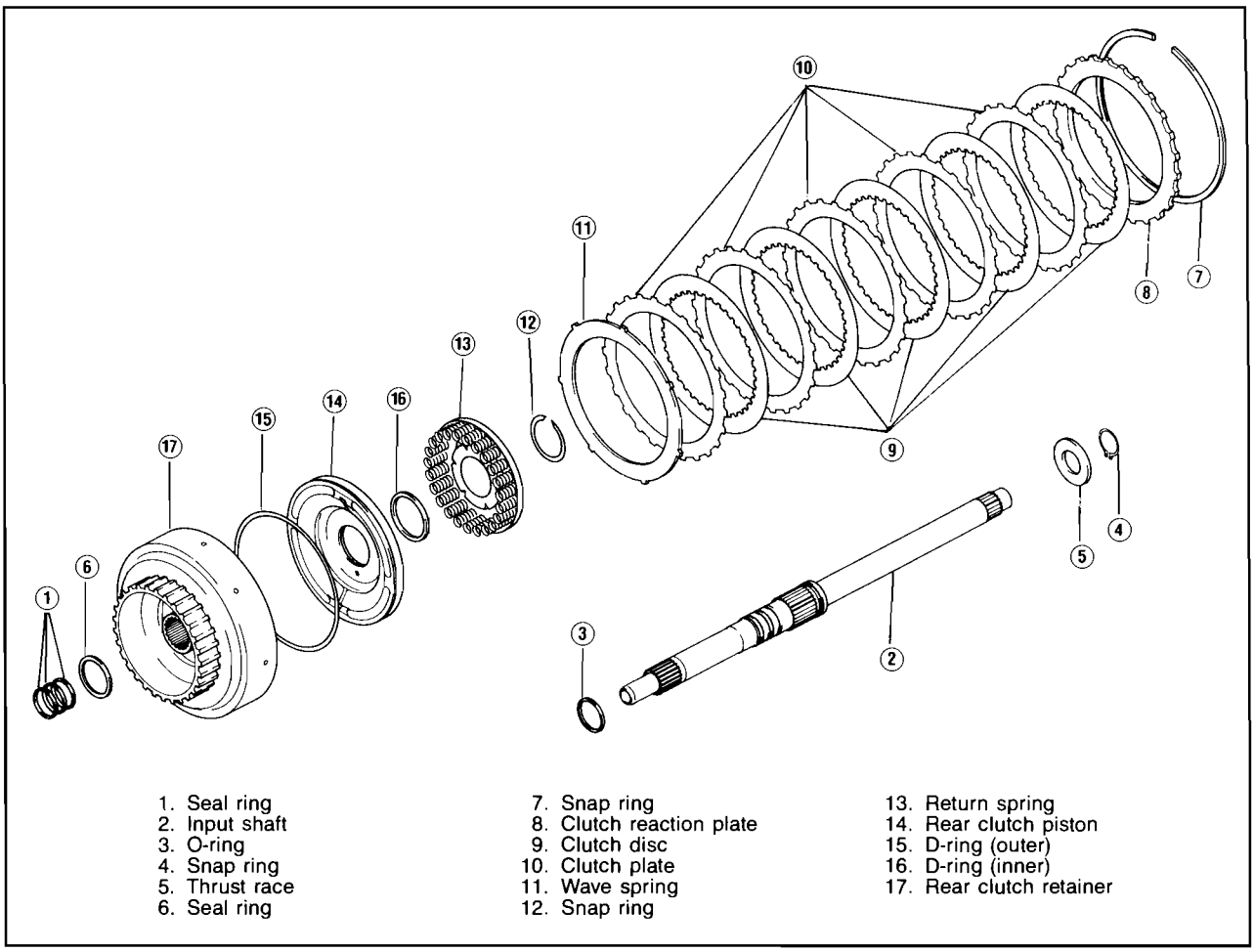


Fig. 72—Rear clutch components

REAL CLUTCH

Disassembly

(1) Remove the input shaft seal rings, refer Fig. 73.

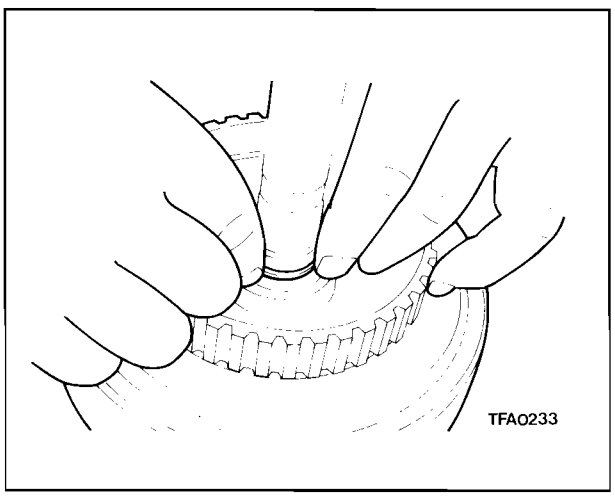


Fig. 73—Input shaft seal ring removal

(2) Remove the rear clutch from the input shaft, refer Fig. 74.

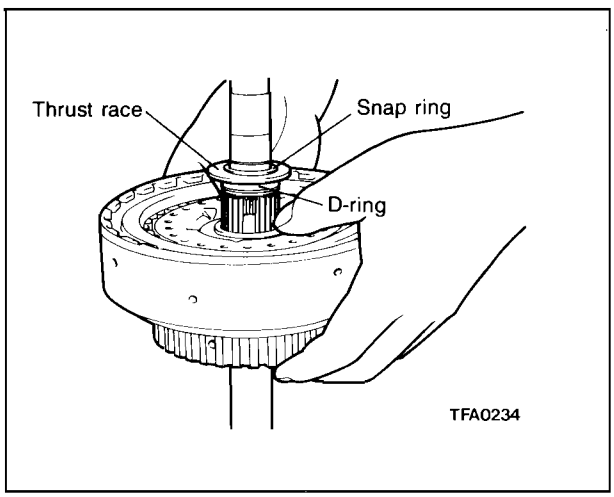


Fig. 74—Rear clutch removal

(3) Remove the input shaft snap ring, thrust race and D-ring, refer Fig. 74.

(4) Remove the snap, clutch reaction plate, clutch plates and wave spring, refer Fig. 75.

(5) Using Special Tool E21M43 to compress the return spring, remove the snap ring, refer Fig. 75.

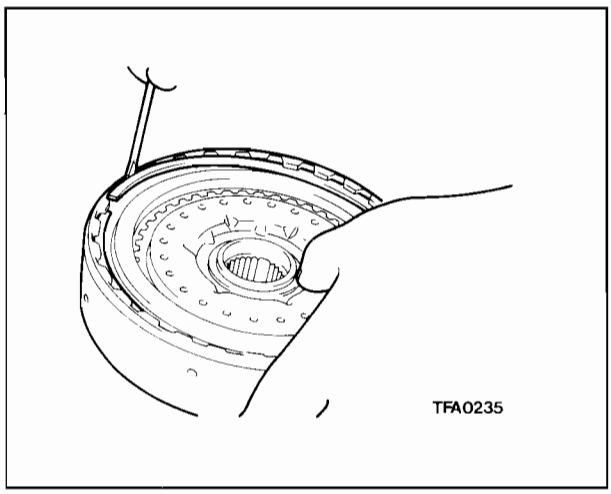


Fig. 75—Snap ring removal

(6) Slowly release the spring until the spring retainer is free of the hub.
(7) Remove the tool and the return spring assembly.

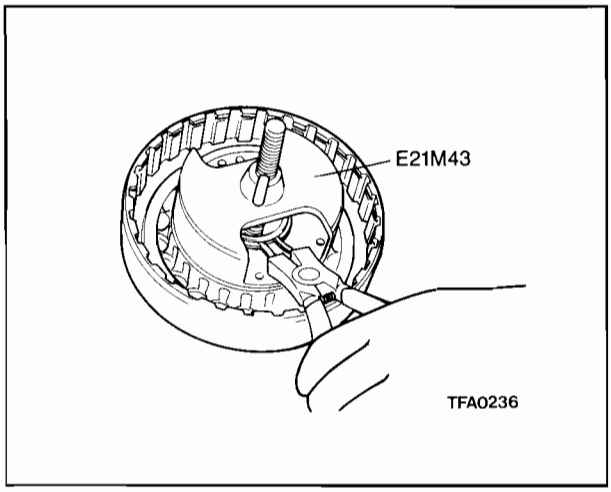


Fig. 76—Return spring removal

(8) Remove the piston, refer Fig. 77.
(9) Remove the D-ring and seal rings.

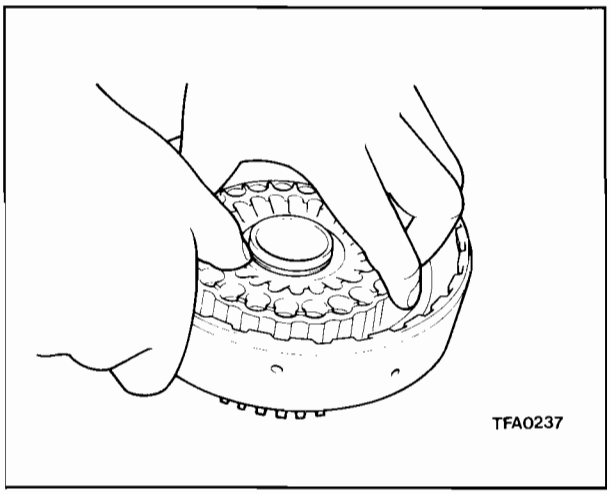


Fig. 77—Rear clutch piston removal

Inspection

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in grooves. Inspect band contacting surface on clutch retainers for scores, **the contact surface should be protected from damage during disassembly and handling.** Inspect piston seal ring surfaces in clutch retainer for nicks or deep scratches, light scratches will not interefere with sealing of neoprene rings. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.

Inspect bore of piston for score marks, if light, remove with crocus cloth. Inspect seal ring grooves for nicks and burrs. Inspect neoprene seal rings for deterioration, wear and hardness. Inspect piston spring, retainer, and circlip for distortion.

Thoroughly clean all components prior to assembly and installation.

Assembly

(1) Install new D-rings to the inside and outside of the piston with the round section facing out, refer Fig. 78.

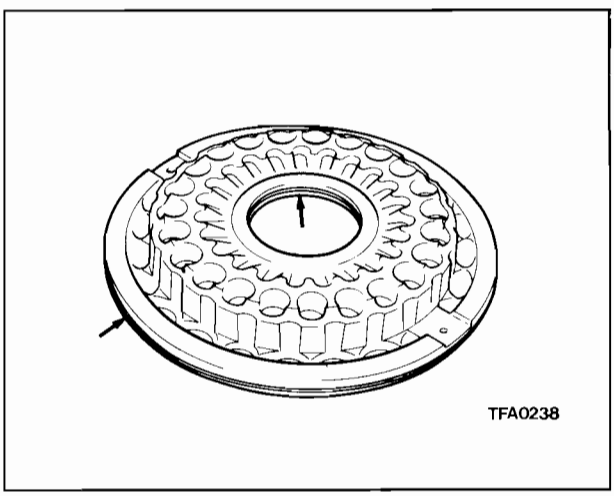


Fig. 78—D-ring fittment

(2) Coat the outside surfaces of the D-rings with A.T.F. and push the piston into the clutch retainer, refer Fig. 80.
(3) Install the return spring and spring retainer. Compress the return spring using Special Tool E21M43 and install the snap ring, refer Fig. 81.

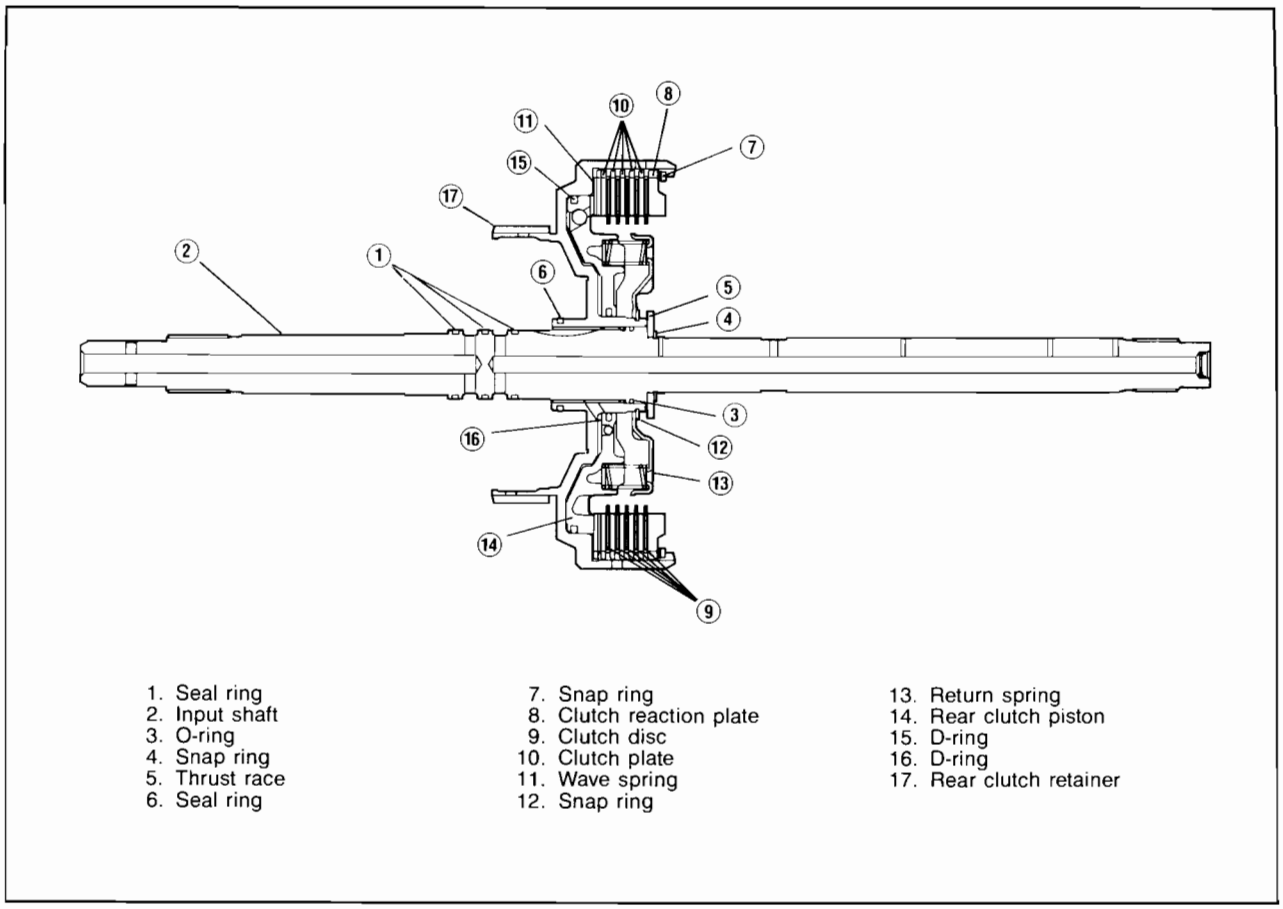


Fig. 79—Rear clutch assembly

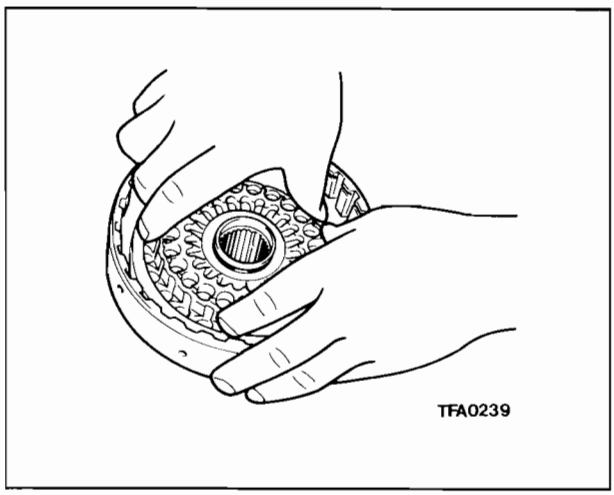


Fig. 80—Installing rear clutch piston

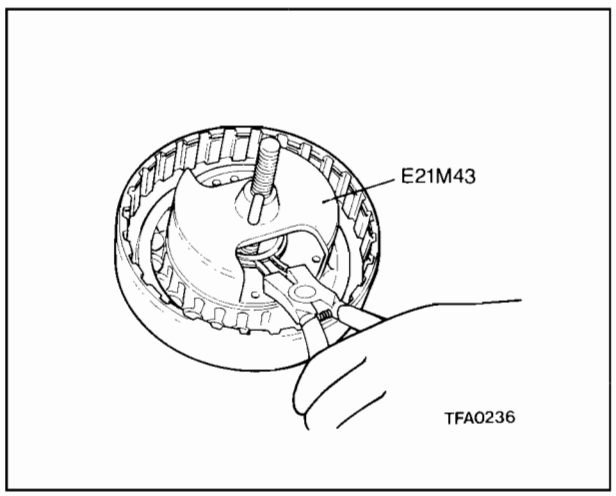


Fig. 81—Installing return spring

(4) Install the wave spring, clutch plate, clutch discs, clutch reaction plate and snap ring, refer Fig. 82.

NOTE: When new clutch discs are used immerse in A.T.F. for at least two hours prior to installation.

(5) Install snap ring and check clearance between snap ring and clutch plate. To check clearance, hold circumference of clutch plate down with a force of 5 kg. Measure clearance with a feeler gauge, refer Fig. 83.

(6) If the clearance fails to meet specifications, select a suitable snap ring, refer to specifications, to give the required clearance.

NOTE: When the clutch reaction plates are installed, make sure that all their missing teeth are in alignment, refer Fig. 82.

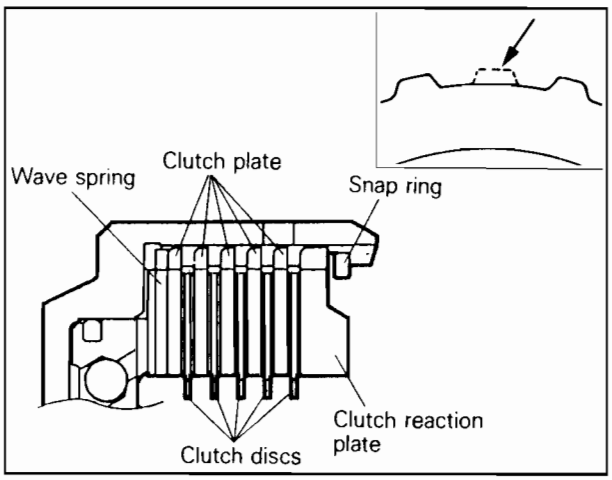


Fig. 82—Clutch plate installation

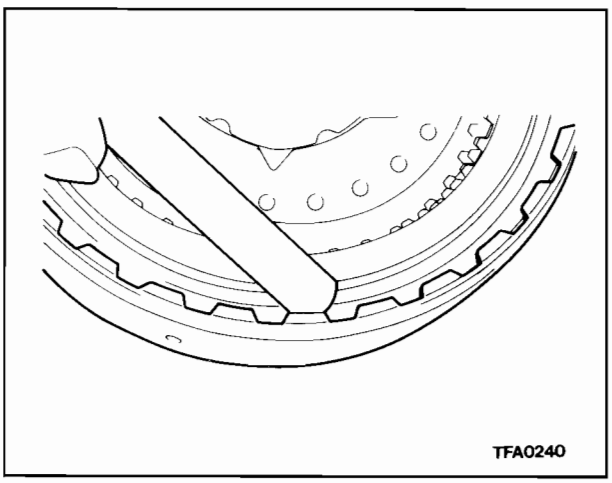


Fig. 83—Check clutch pack clearance

(7) Install the D-ring, thrust race and snap ring on the input shaft.

(8) Install the rear clutch on the input shaft so that the mating mark on the rear clutch retainer with the groove in the input shaft, refer Fig. 84.

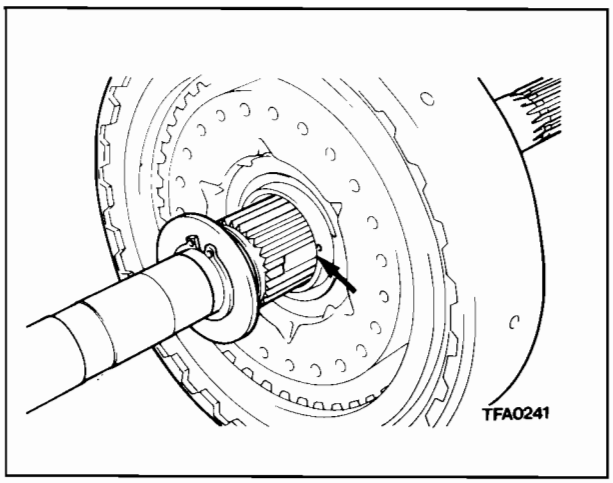


Fig. 84—Install input shaft to clutch

(9) Install new seal rings in the input shaft grooves, refer Fig. 85.

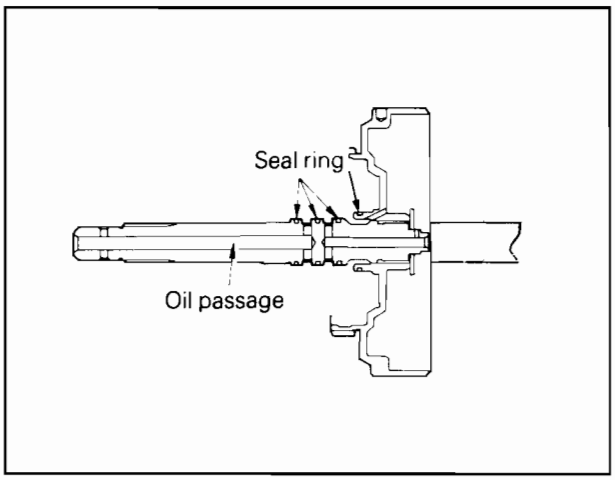


Fig. 85—Installing input shaft seal rings

END CLUTCH

Disassembly

(1) Remove the snap ring, the clutch reaction plate, clutch discs and clutch plates., refer Fig. 86.

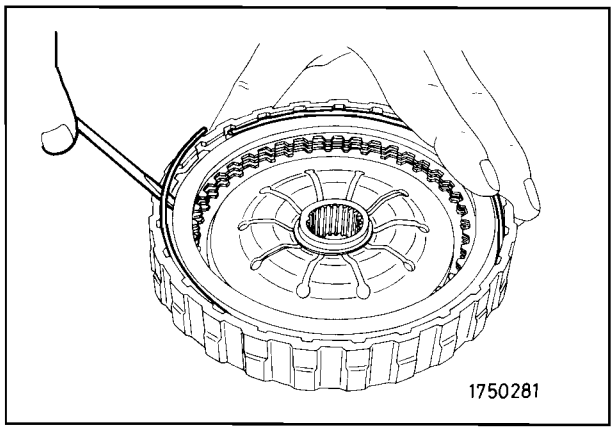


Fig. 86—End clutch outer snap ring removal

NOTE: If the clutch discs and clutch plates are to be reused, note and maintain the order of disassembly.

(2) Using suitable pliers remove the inner snap ring, refer Fig. 87, and remove the washer and return spring.

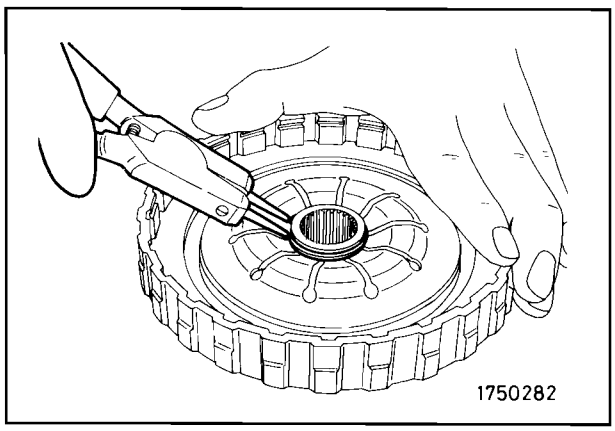


Fig. 87—Inner circlip removal

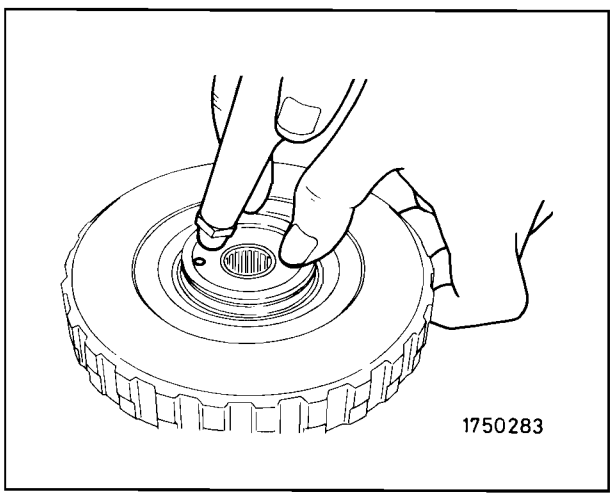


Fig. 88—End clutch piston removal

(3) Remove the piston by positioning the retainer on the bench, piston side down and applying compressed air through the oil passage in the rear of the retainer.

(4) Remove the inner and outer seal rings from the piston.

(5) Remove the oil seal from the rear of the end clutch retainer.

Inspection

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in grooves. Inspect band contacting surface on clutch retainers for scores, **the contact surface should be protected from damage during disassembly and handling.** Inspect piston seal ring surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of neoprene rings. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.

Inspect bore of piston for score marks, if light, remove with crocus cloth. Inspect seal ring grooves for nicks and burrs. Inspect neoprene seal rings for deterioration, wear and hardness. Inspect piston spring, retainer and circlip for distortion.

Thoroughly clean all components prior to assembly and installation.

Assembly

(1) Using a suitable installer, install a new oil seal into the rear of the end clutch retainer, refer Fig. 89.

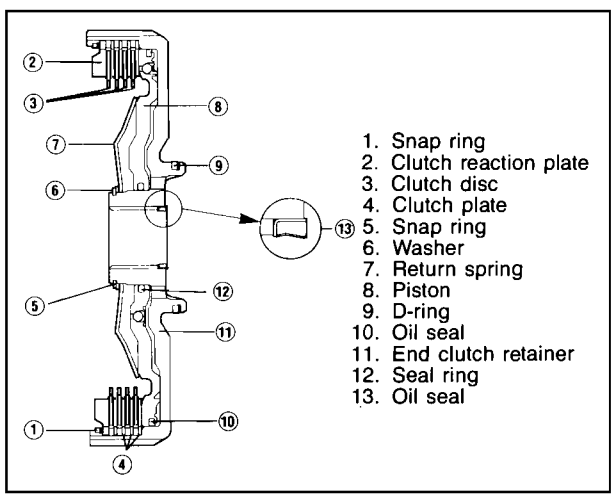


Fig. 89—End clutch rear seal position

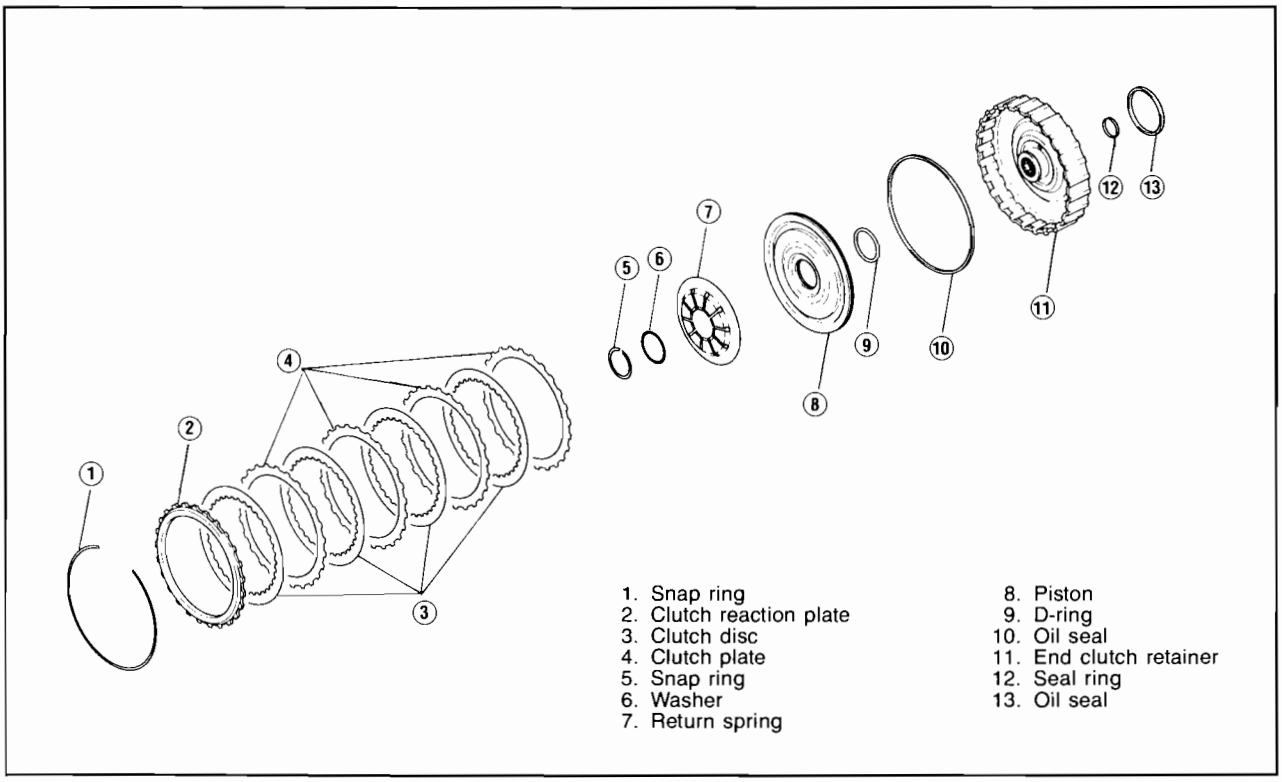


Fig. 90—End clutch components

(2) Install new "D" section ring to the inner groove of the piston, and a new lip seal to the outer groove of the piston.

(3) Coat the outer surface of the seal rings with A.T.F. and push the piston into the retainer by hand, refer Fig. 91.

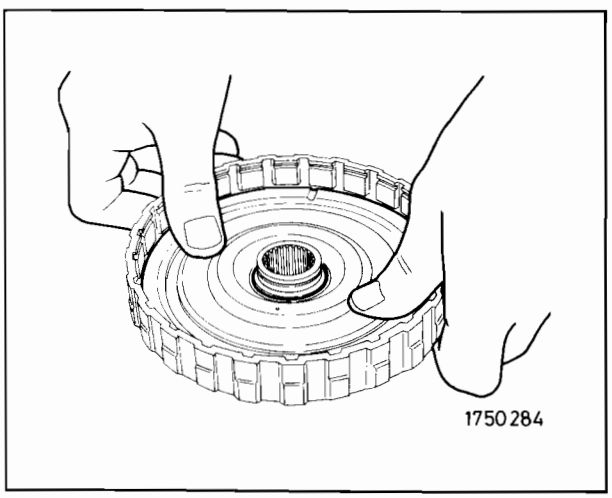


Fig. 91—Installing end clutch piston

(4) Install the return spring and washer.

(5) Fit a new snap ring onto the guide of special tool E23M10 and locate the guide in the retainer, refer Fig. 92.

(6) Support the retainer in a press, supported under the shaded area, refer Fig. 92.

NOTE: Do not support under the arrowed section.

(7) Position the installer on the guide and press the snap ring onto the retainer.

NOTE: Stop pressing immediately the snap ring is located in the retainer groove.

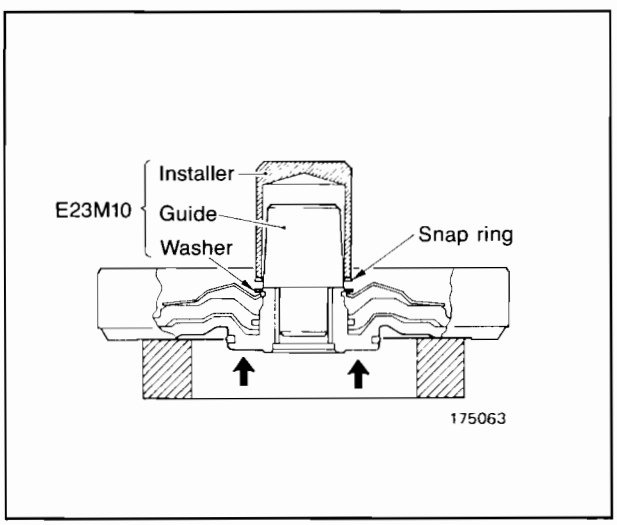


Fig. 92—Installing snap ring

(8) Coat the clutch discs, clutch plates and the reaction plate with A.T.F. and install in the retainer as shown in Fig. 93.

NOTE: When new clutch discs are used immerse in A.T.F. for at least two hours prior to installation.

(9) Install snap ring and check clearance between snap ring and clutch plate. To check clearance hold circumference of clutch plate down with a force of 5 kg. Measure clearance with a feeler gauge, refer Fig. 94.

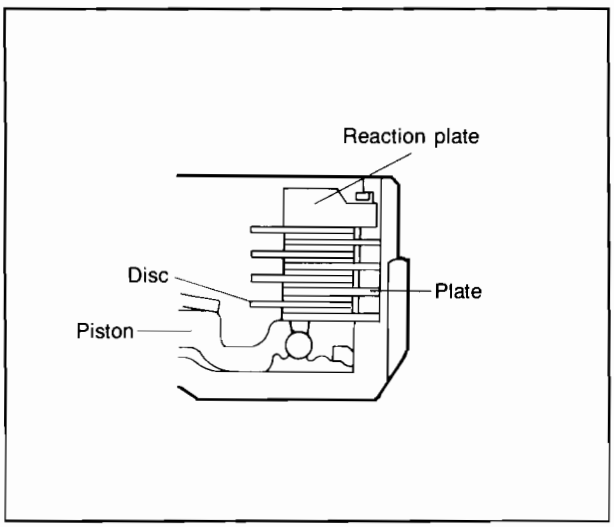


Fig. 93—Clutch disc and plate installation

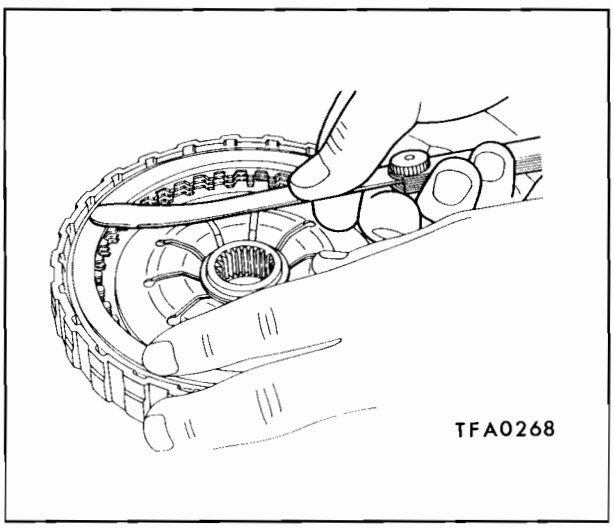


Fig. 94—Checking clutch plate clearance

(10) If the clearance fails to meet specifications, select a suitable snap ring, refer Specifications, to give the required clearance.

KICKDOWN SERVO

Disassembly

(1) Remove the lock nut and withdraw the adjusting screw.
(2) Remove the piston from the sleeve.
(3) Remove and discard the "O" and "D" rings.

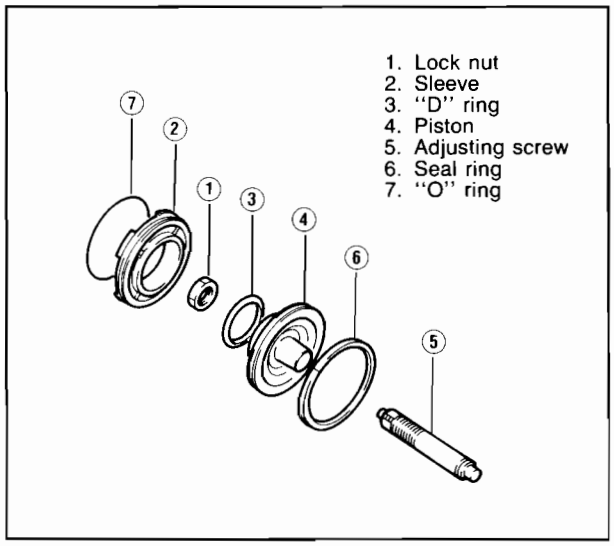


Fig. 95—Kickdown servo components

Inspection

Throughly clean all components and inspect the sliding surfaces of the piston and sleeve for scoring or wear. Replace faulty components.

Assembly

(1) Install new "D" ring and seal ring to piston.
(2) Install new "O" rings to sleeve.
(3) Coat "D" ring and seal ring with A.T.F. and insert into sleeve, refer Fig. 96.
(4) Install piston rod and adjusting screw.

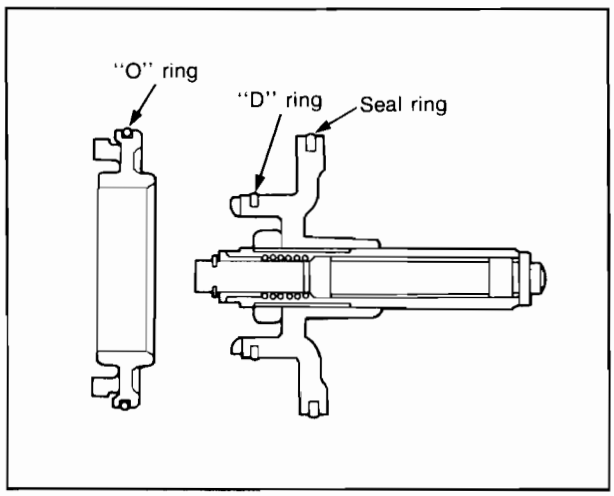


Fig. 96—"D" and "O" ring installation

NOTE: Adjust kickdown servo assembly after installation, refer Section 3 — "Maintenance and Adjustment".

PLANET PINION CARRIER

Disassembly

(1) Remove the thrust bearing, avoiding contact with the short pinion.
(2) Push out the one way clutch outer race attaching rivets, refer Fig. 97.

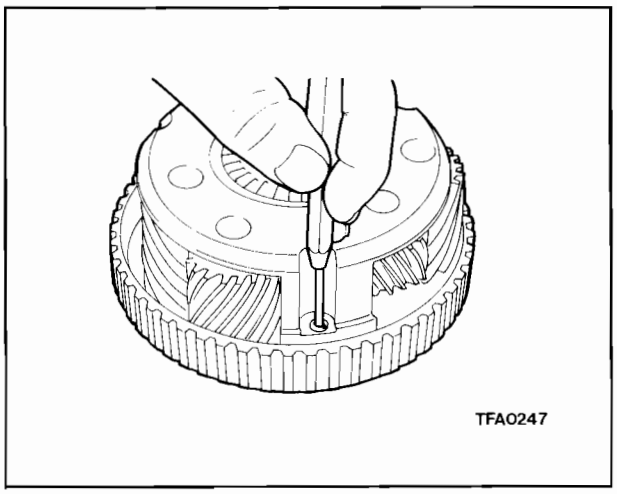


Fig. 97—Rivet removal

NOTE: Remove the rivets one at a time while turning the stopper plate so that the rivets are not in contact.

(3) Remove the one-way clutch outer race assembly, refer Fig. 98.

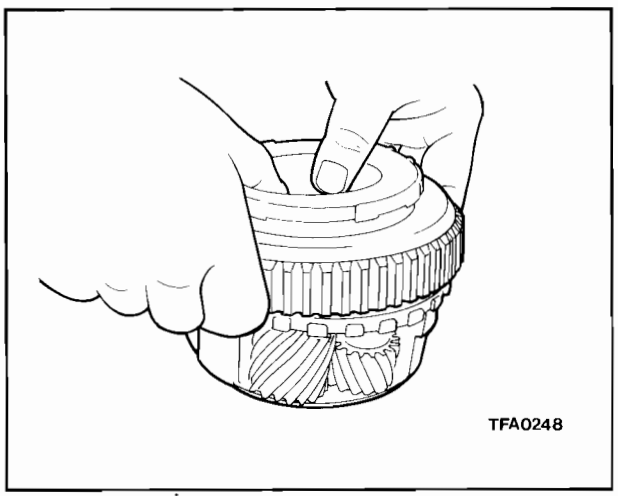


Fig. 98—One-way clutch outer race removal

(4) Remove the one-way clutch out of the outer race by pushing outwards by hand, refer Fig. 99.

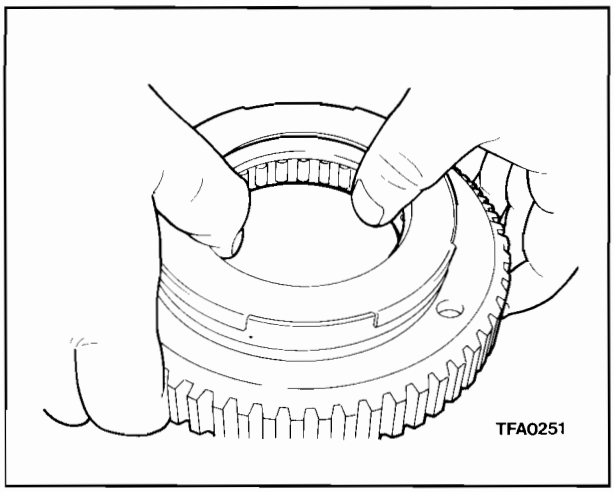


Fig. 99—Remove one-way clutch

NOTE: The planet pinion carrier is only services as an assembly. Do not dismantle the carrier.

Inspection

Thoroughly clean all components prior to inspection.

(1) Inspect thrust bearing and thrust surfaces for wear and damage, replace if necessary.

(2) Inspect planetary gear teeth for chips or wear.

(3) Inspect plant pinion carrier roller bearing for wear and score marks.

Assembly

(1) Install the end plate into the outer race, refer Fig. 101.

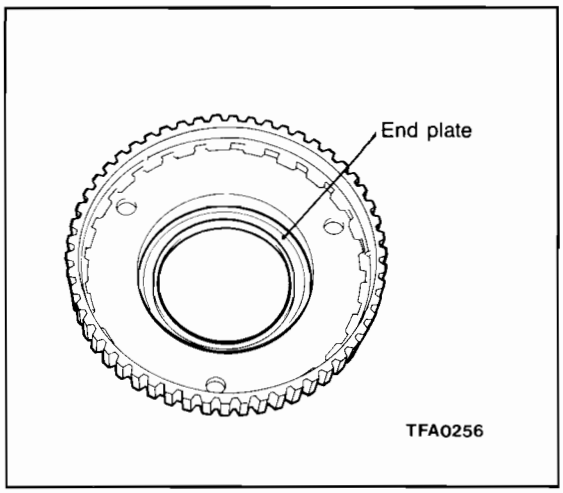


Fig. 101—End plate installation

(2) Push the one way clutch into the outer race by hand, ensuring the arrow on the outside of the cage is pointed upward, refer Fig. 102.

(3) Smear the one way clutch outer end plate with petroleum jelly and fix it to the one way clutch, refer Fig. 103.

(4) Install the one way clutch onto the carrier and align the rivet holes.

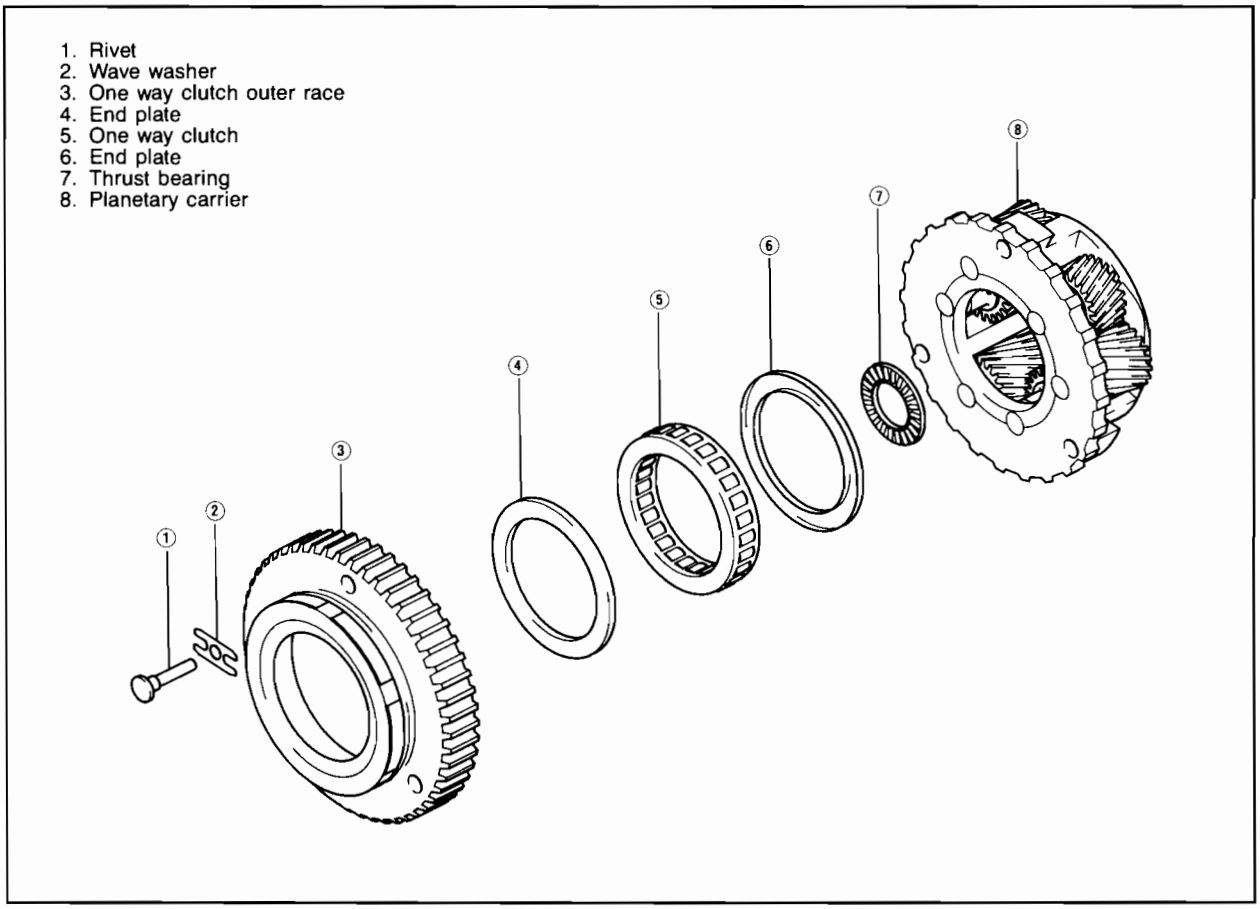


Fig. 100—Planet pinion carrier components

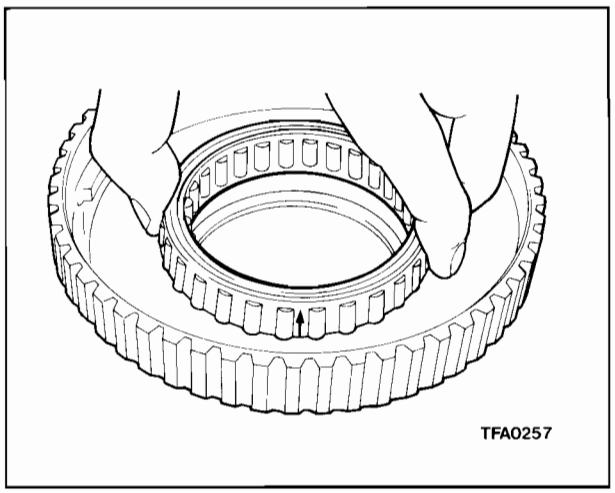


Fig. 102—Once way clutch installation

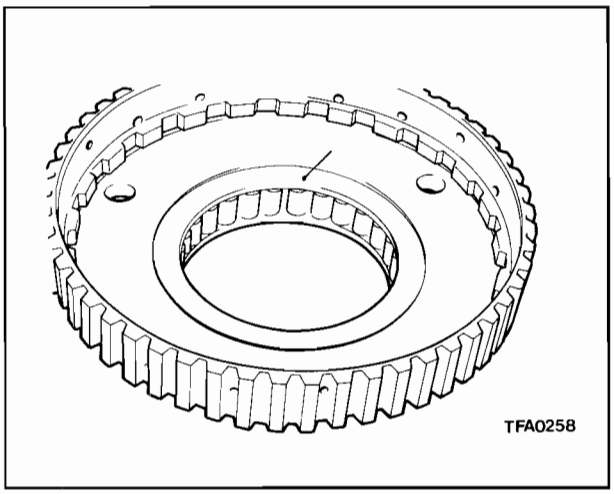


Fig. 1]3—Outer plate installation

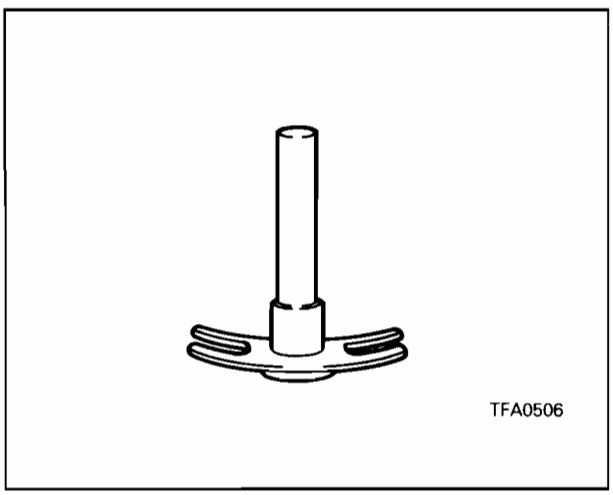


Fig. 104—Wave washer installation

(5) Install the wave washers and rivets.

CAUTION: Install the wave washers with the concave parts facing the outer race.

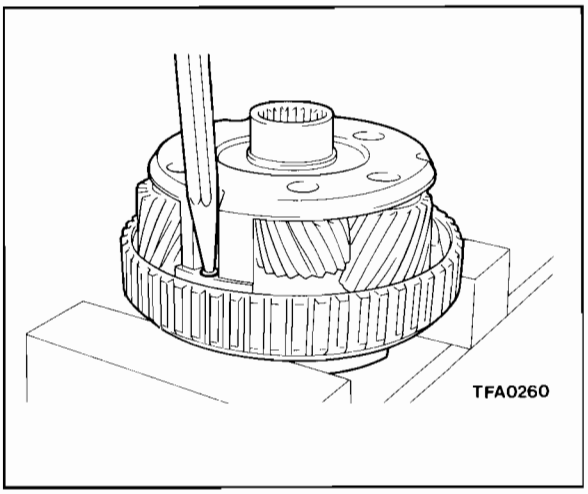


Fig. 105—Rivet installation

(6) Use a press and a suitable punch to fasten the rivets, refer Fig. 105.

NOTE: Use a punch with a face angle of 60°. Use a load of 11000N to 13000N to fasten the rivets.

(7) Install the thrust bearing on the carrier, making sure that the thrust bearing is correctly fitted into the concave part of the carrier.

ANNULUS AND TRANSFER DRIVE GEAR

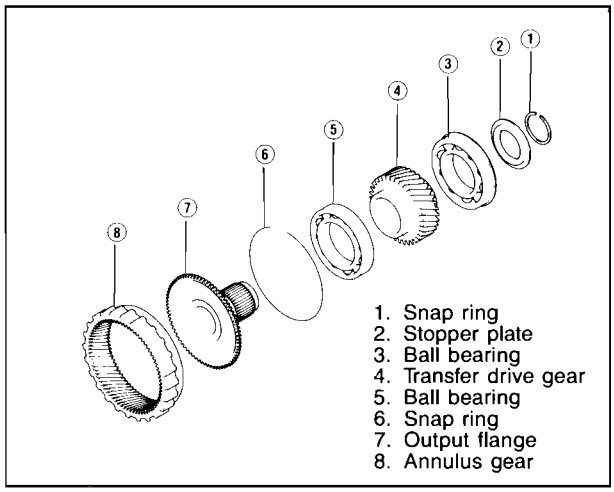


Fig. 106—Annulus gear and drive gear components

Disassembly

(1) Remove the snap ring adjacent to the bearing at the rear end of the output flange, refer Fig. 107, and remove stopper plate.

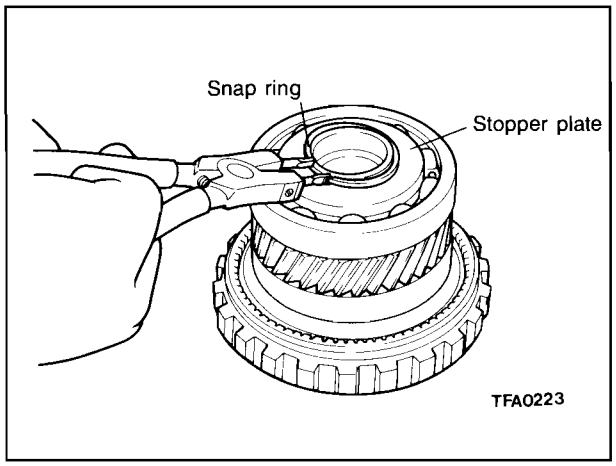


Fig. 107—Snap ring removal

(2) Using Special Tool E6673, remove the bearings and gear as a set from the output flange, refer Fig. 108.

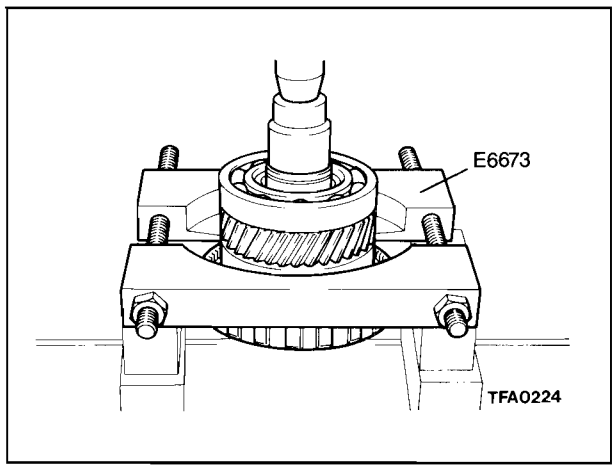


Fig. 108—Bearing removal

NOTE: Mount the jaws firmly between the output flange and bearing.

(3) Mount the Special Tool E6673 tool between the transfer drive gear and bearing, refer Fig. 109, and remove both bearings from the transfer drive gear.

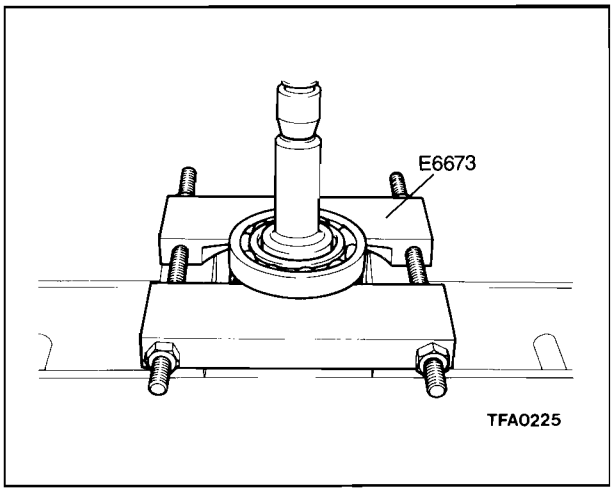


Fig. 109—Transfer drive gear bearing removal

(4) Remove the snap ring and remove the annulus gear from the output flange, refer Fig. 110.

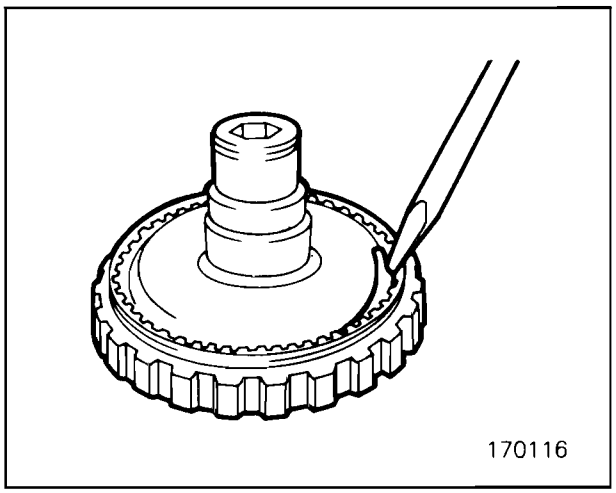


Fig. 110—Removing annulus gear snap ring

Inspection

Thoroughly clean all components prior to inspection.

(1) Check the bearings for smooth rotation.

(2) Check gear teeth for chips and wear.

Assembly

(1) Install the annulus drive gear onto the output flange and fit the snap ring.

(2) Install bearings onto both ends of the transfer drive gear.

(3) Using a suitable installer, install the transfer drive gear, refer Fig. 111.

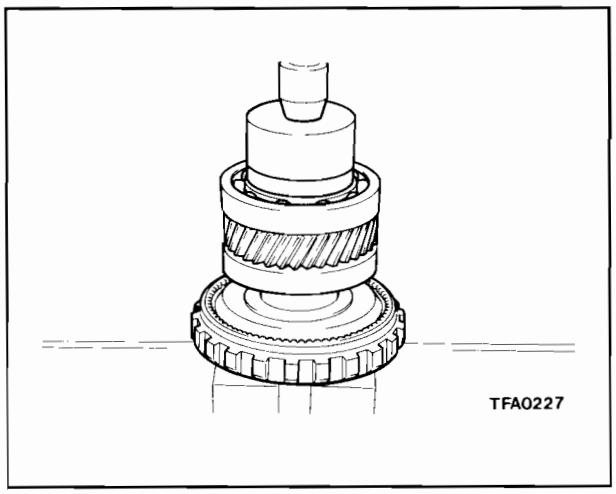


Fig. 111—Installing transfer drive gear

(4) Install the stopper plate and select the thickest spacer that will fit in the groove, refer specifications for spacer selection chart and install in the output flange groove, refer Fig. 112.

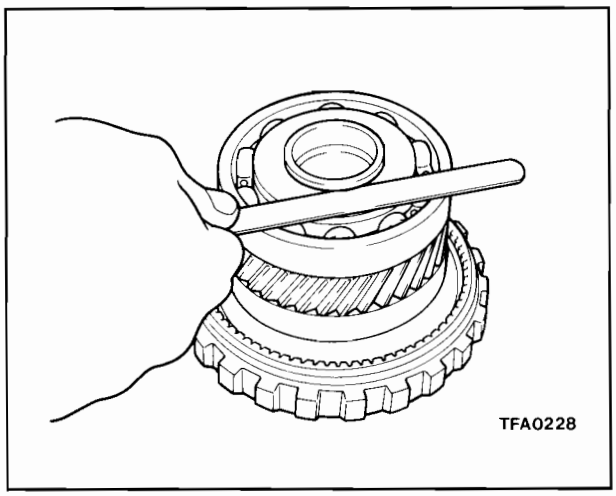


Fig. 112—Selecting snap ring

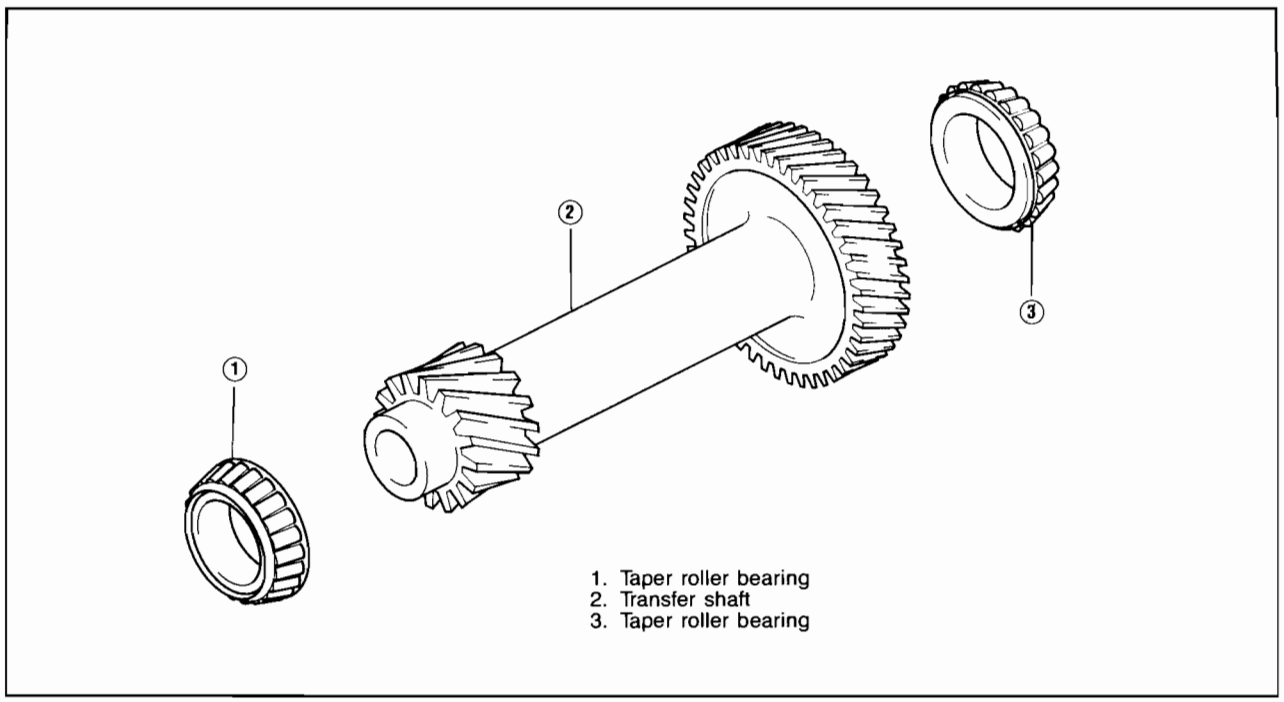


Fig. 113—Transfer shaft components

TRANSFER SHAFT

Output Bearing Removal

(1) Using Special Tool E1673MT with jaws E1673A15 remove output bearing, refer Fig. 114.

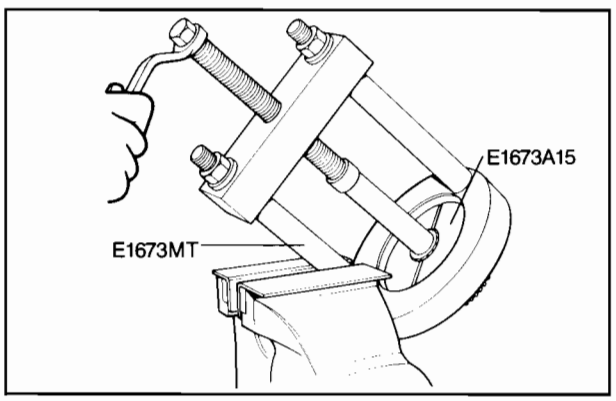


Fig. 114—Transfer shaft bearing removal

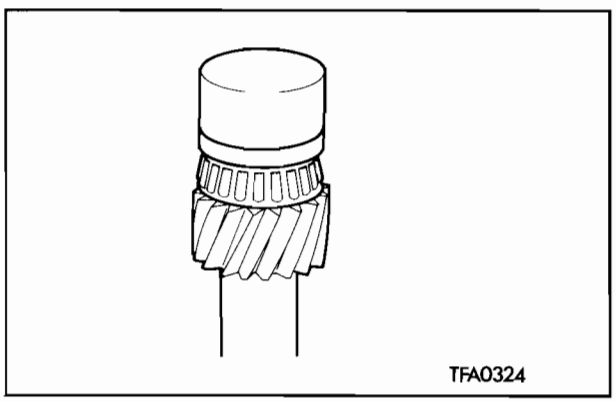


Fig. 115—Transfer shaft bearing installation

Output Bearing Installation

(1) Using a suitable installer press the bearing on to both ends of the transfer shaft, refer Fig. 115.

Input Bearing Removal

(1) Using Special Tool E167MT with jaws E1673R15A remove the input bearing, refer Fig. 116.

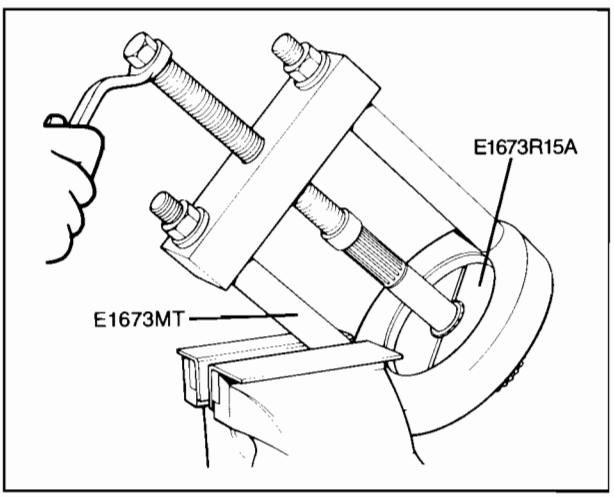


Fig. 116—Input bearing removal

Input Bearing Installation

(1) Using a suitable installer, press the bearing onto the transfer shaft, refer Fig. 117.

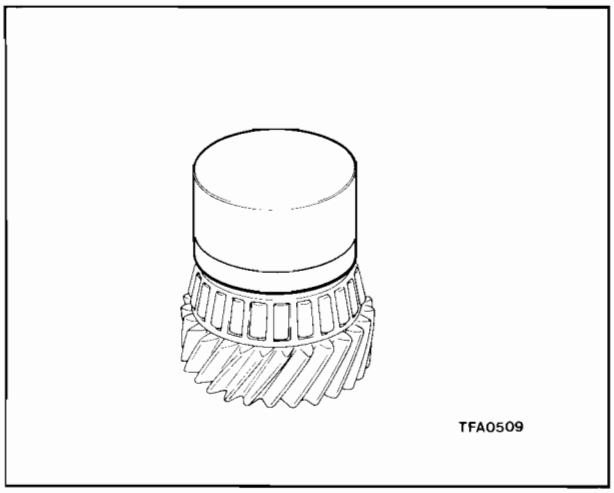


Fig. 117—Input bearing installation

DIFFERENTIAL

Disassembly

(1) Using special tools E1673MT, E1673B15 and E1673G16 remove both differential bearings, refer Fig. 118

(2) Remove the drive gear attaching bolts and remove the drive gear.

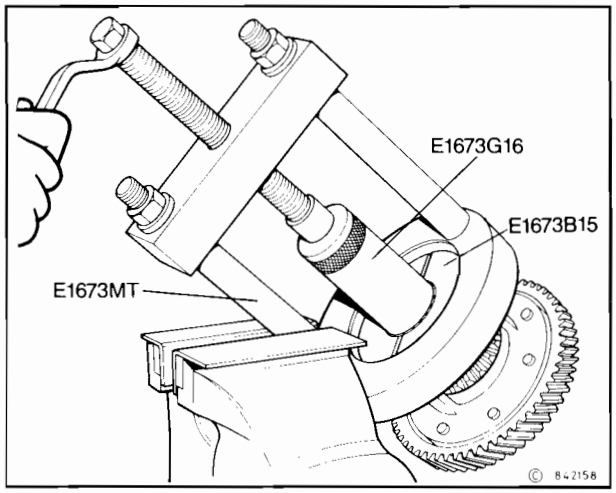


Fig. 118—Removing differential bearings

(3) Using a suitable punch drive out the pinion shaft lock pin, refer Fig. 103, it may be necessary to remove a small amount of metal to expose access hole A.

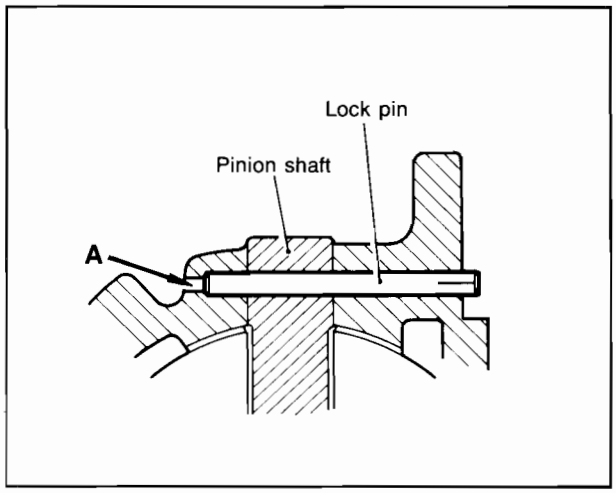


Fig. 119—Pinion shaft lock pin

NOTE: The lock pin must not be re-used.

(4) Remove the pinion shaft gears and spacers noting the location of the spacers.

Inspection

Perform the following inspection and replace any faulty components.

(1) Inspect all gears for wear, chips and other damage.

(2) Inspect thrust washers for scoring and wear.

(3) Check that all bearings rotate freely.

Assembly

(1) Install the side gears and spacers into the case.,

NOTE: If installing original spacers and gears, install in positions noted in disassembly. If new side gears are being installed, fit medium thickness spacers, refer to specifications.

(2) Install pinion gears, washers and pinion shaft.

(3) Measure the backlash between the side gear and pinion gear with a dial indicator, refer Fig. 120. Select suitable side gear spacers to achieve the specified side gear to pinion backlash, refer to specifications.

NOTE: The backlash of both left and right side gears must be equal.

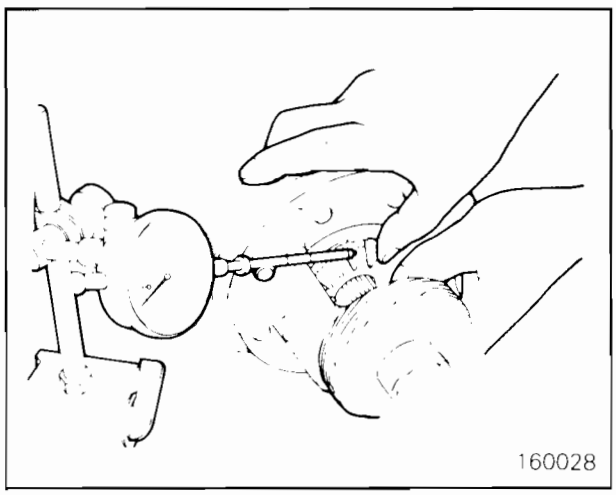


Fig. 120—Measuring backlash

(4) Install a new pinion shaft lock pin, drive the lock pin into the differential case until the head of the lock pin protrusion is less that 3 mm from the surface of the case, refer Fig. 122.

NOTE: A new lock pin must be installed.

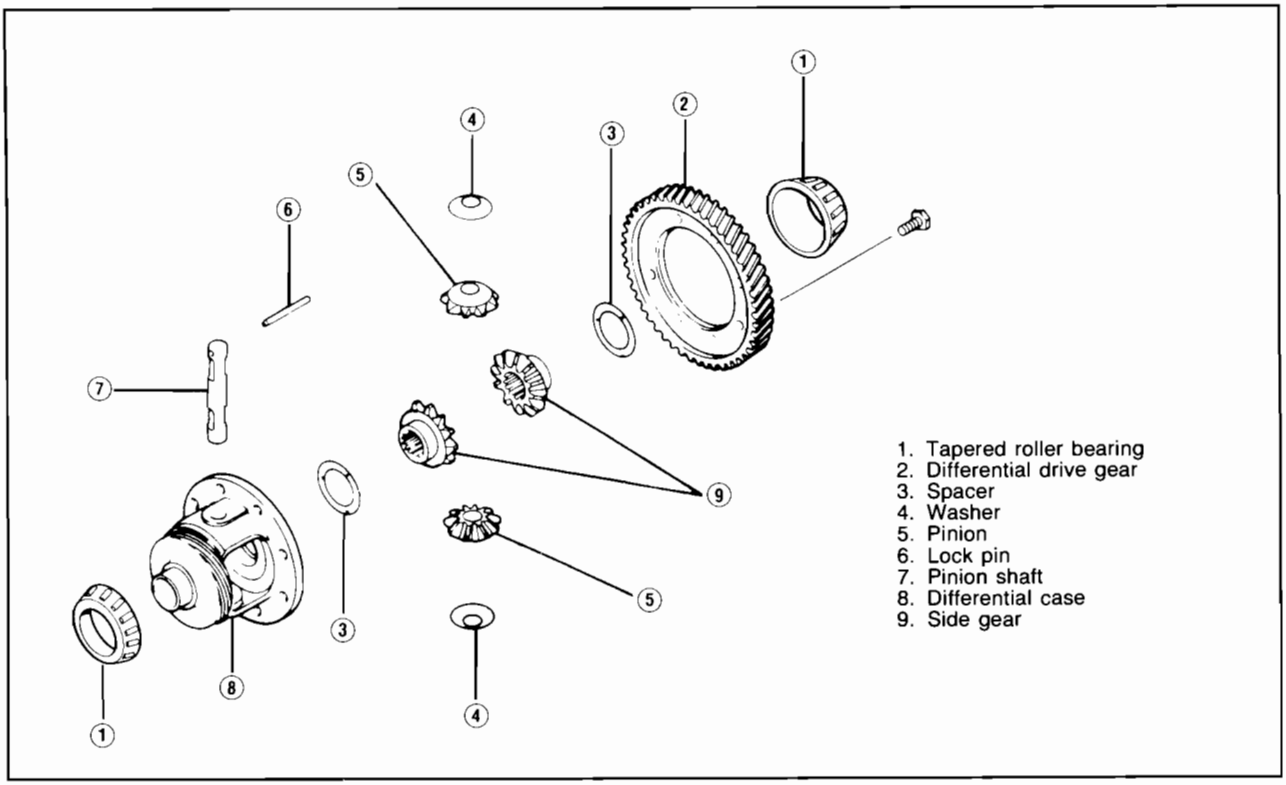


Fig. 121—Differential components

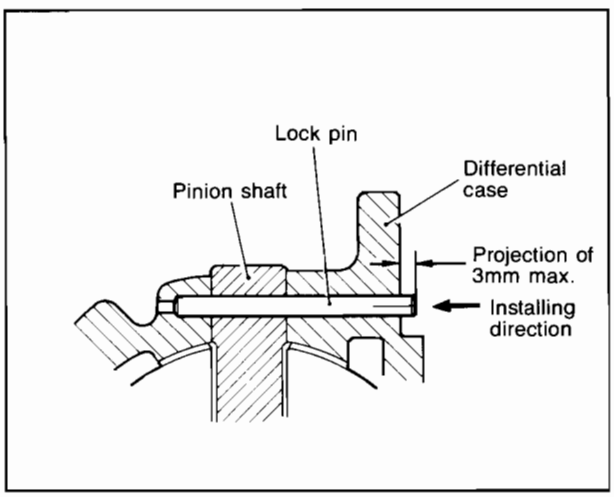


Fig. 122—Pinion shaft lock pin installation

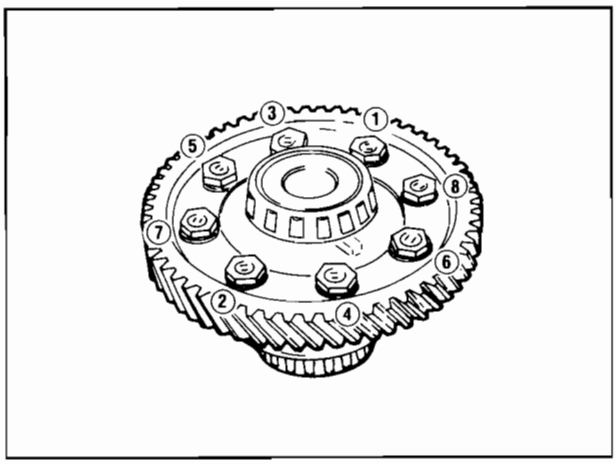


Fig. 123—Drive gear bolt tightening sequence

(5) Install the differential drive gear onto the case. Apply Loctite Threadlock 271 to the threads of the drive gear attaching bolts, install and tighten bolts to the specified torque in two stages and in the sequence shown in Fig. 123. Remove excess loctite sealer from the bolts.

(6) Using special tools E7511A or a suitable alternative, press the bearings onto the differential case, refer Fig. 124.

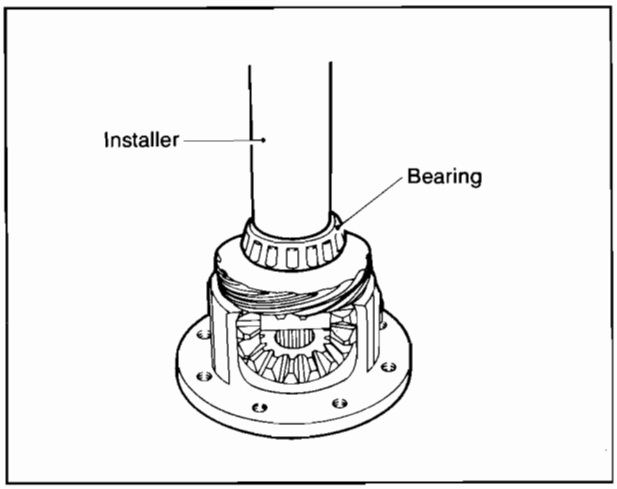


Fig. 124—Installing bearings

VALVE BODY

Disassembly

NOTE: Do not clamp any portion of the valve body or the transfer plate in a vice. Any distortion of the aluminium valve body or transfer plate will result in sticking valves, excessive leakage or both. When removing or installing valves or plugs, slide them in or out carefully. Do not use force. All springs and valves should be identified by a tag or placed in order of removal on a convoluted tray ready for cleaning and re-assembly.

(1) Remove the solenoid valve screws, refer Fig. 125, and remove the solenoid valves.

(2) Remove the manual valve from the valve body, refer Fig. 126.

(3) Remove the valve stopper and harness clamp, refer Fig. 127.

(4) Remove the N-D valve and sleeve from the upper valve body, refer Fig. 128.

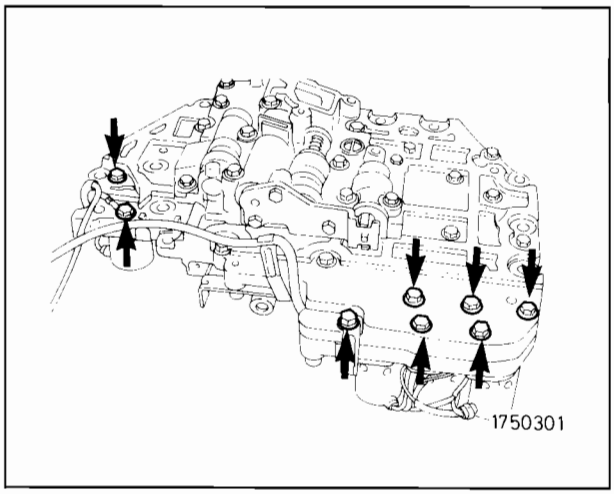


Fig. 125—Solenoid valve screws

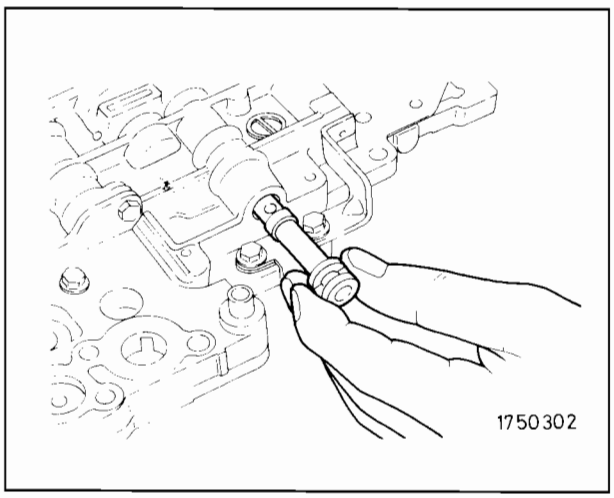


Fig. 126—Removing manual valve

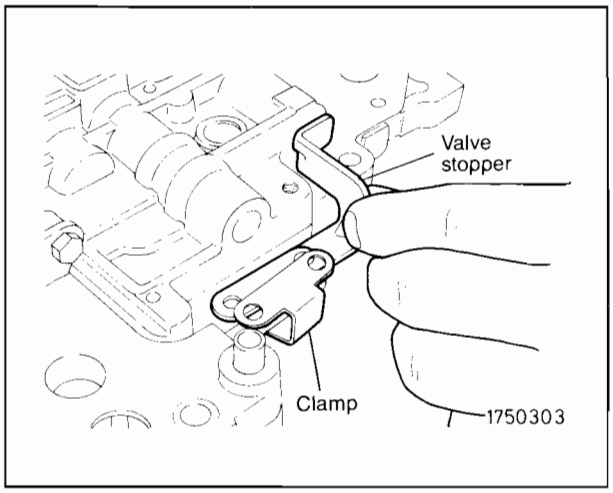


Fig. 127—Valve stopper

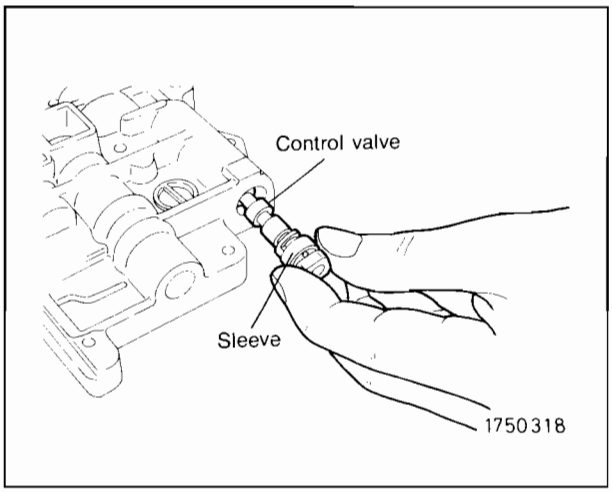


Fig. 128—Removing N-D control valve

(5) Remove the lower valve body attaching bolts, refer Fig. 129, and remove the lower valve body and separating plate.

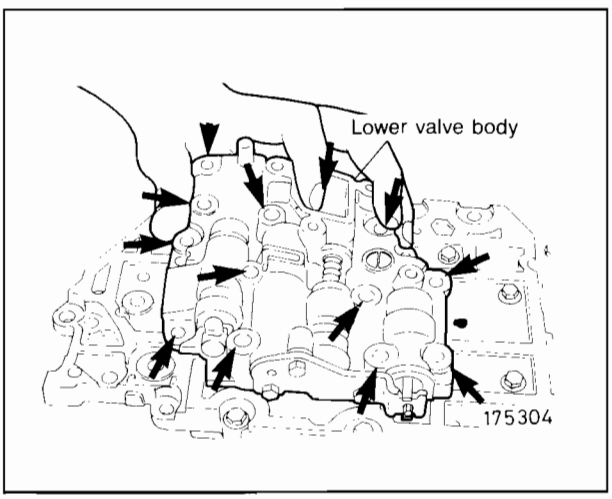
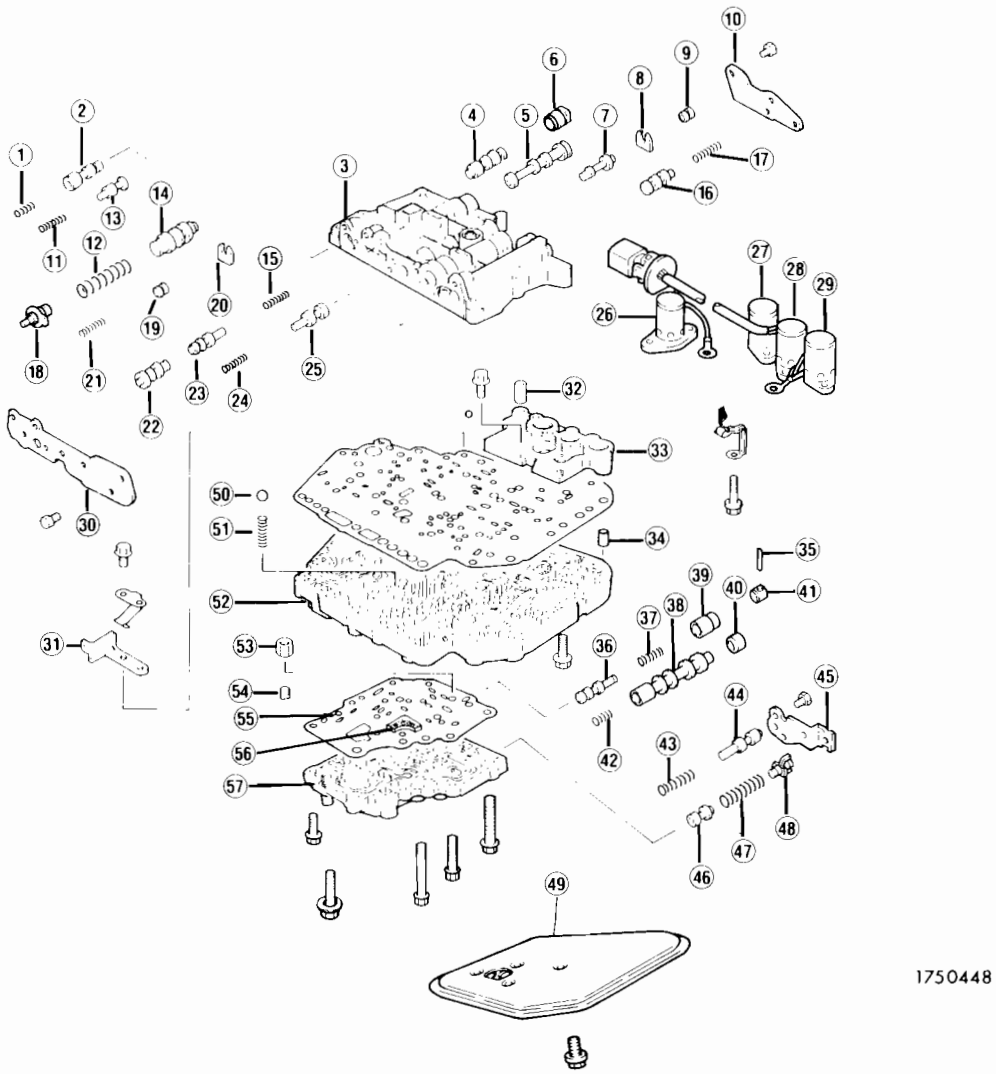


Fig. 129—Lower valve body attaching bolts



1. Pressure control spring
2. Pressure control valve
3. Upper valve body
4. N-D control valve
5. Manual valve
6. N-D control sleeve
7. Shift control valve
8. Stopper plate
9. Shift control plug B
10. Rear end cover
11. Torque convertor control spring
12. Regulator spring
13. Torque convertor control valve
14. Regulator valve
15. Rear clutch exhaust spring
16. 1-2 shift valve
17. 1-2 shift spring
18. Adjusting screw
19. Shift control plug
20. Stopper plate
21. Shift control spring
22. Rear clutch exhaust valve A
23. Rear clutch exhaust valve B
24. 2-3/4-3 shift spring
25. 2-3/4-3 shift valve
26. PCSV
27. LUCCSV
28. SCSV "A"
29. SCSV "B"
30. Front end cover
31. Valve stopper
32. Pipe
33. Block
34. Dowel bushing
35. Pin
36. End clutch valve
37. End clutch spring
38. Lock up clutch control valve
39. End clutch plug
40. Lock up clutch control sleeve
41. Stopper
42. Lock up clutch control spring
43. N-R control spring
44. N-R control valve
45. End cover
46. Reducing valve
47. Reducing spring
48. Adjusting screw
49. Filter
50. Steel ball
51. Relief spring
52. Intermediate plate
53. Nut
54. Restrictor
55. Lower separating plate
56. Filter
57. Lower valve body

Fig. 130—Valve body components

(6) Remove the two steel balls, spring and oil filter from the intermediate plate, refer Fig. 131.

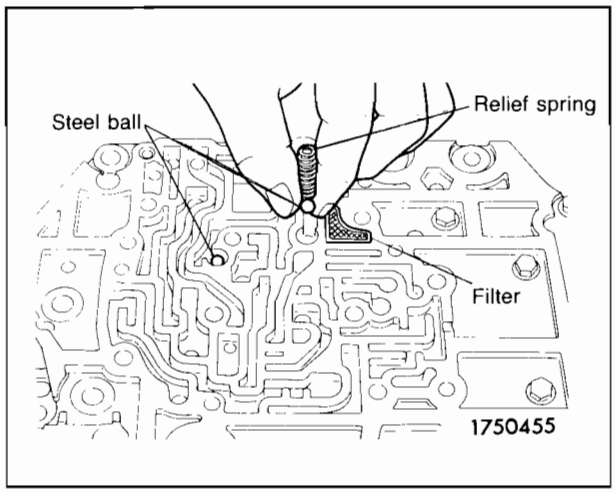


Fig. 131—Ball and filter removal

(7) Remove the intermediate plate attaching bolts, refer Fig. 132, and remove the plate.

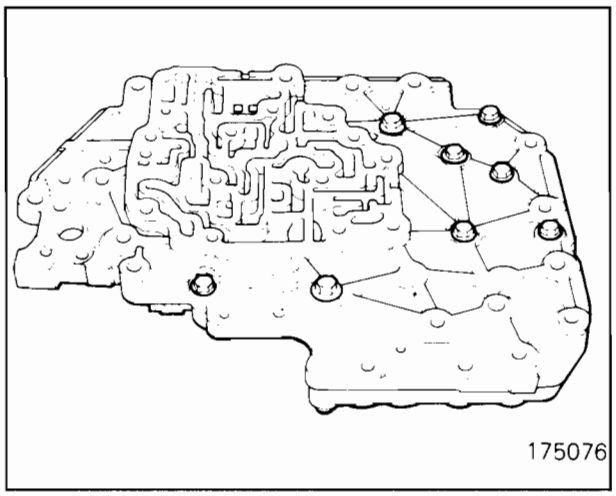


Fig. 132—Intermediate plate attaching bolts

(8) Remove the steel balls and the teflon ball and the stopper plates, refer Fig. 133.

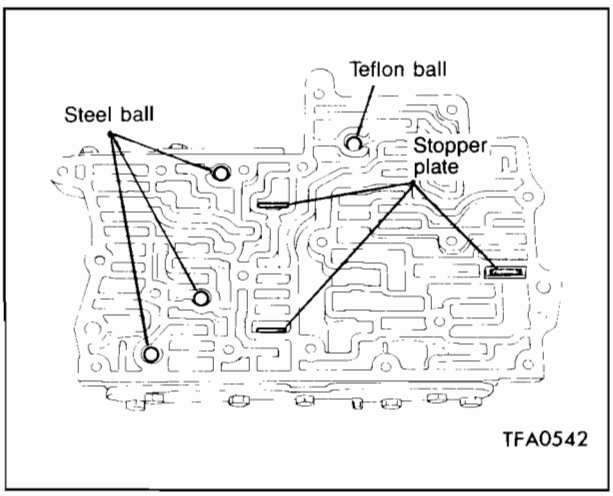


Fig. 133—Ball and stopper plate removal

(9) Remove the block and upper separating plate, refer Fig. 134.

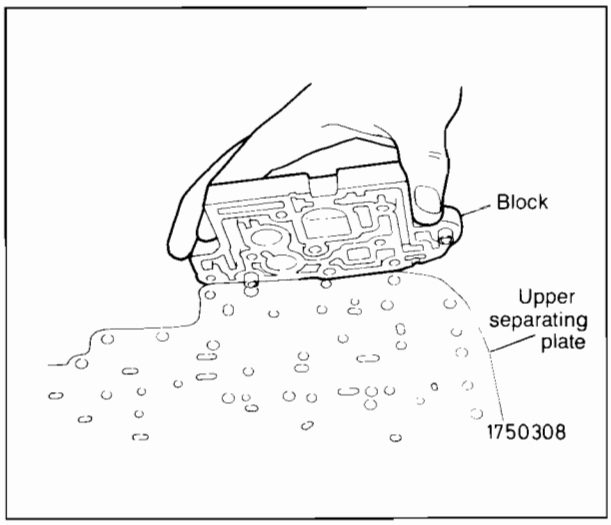


Fig. 134—Removing separating plate

(10) Remove the end cover then the 1-2 shift valve spring, shift control valve and plug from the upper valve body, refer Fig. 135.

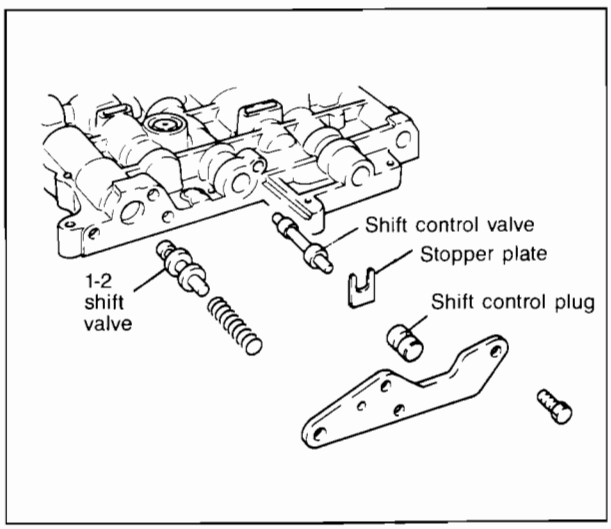
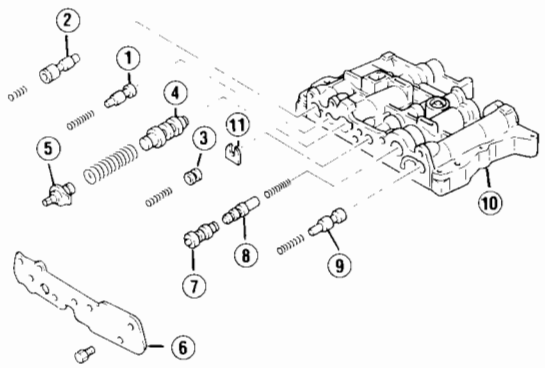


Fig. 135—Removing valves and spring

(11) Remove the end cover and then valves and springs, refer Fig. 136, from the upper valve body.

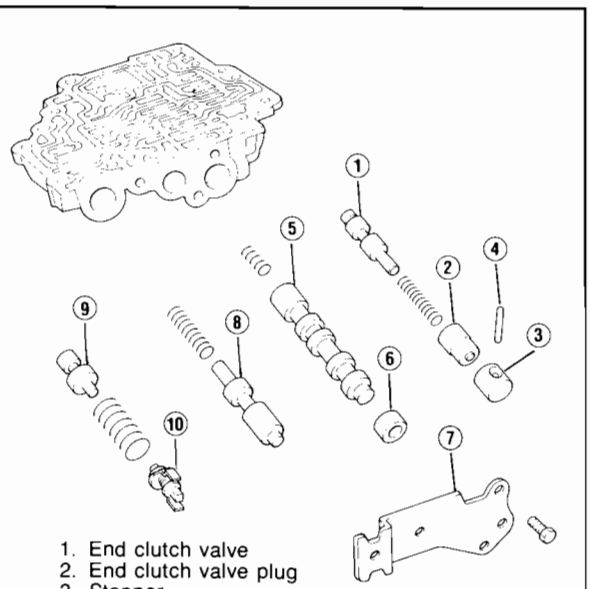
(12) Remove the pin, refer Fig. 137, and remove the stopper, plug, spring, and end clutch valve from the lower valve body.

(13) Remove the end cover and then the lock up clutch valve sleeve, valve, N-R control valve, reducing valve and springs from the lower valve body, refer Fig. 137.



1. Torque converter control valve
2. Pressure control valve
3. Shift control plug and spring
4. Regulator valve
5. Adjusting screw
6. Front end cover
7. Rear clutch exhaust valve A
8. Rear clutch exhaust valve B
9. 2-3 shift valve
10. Upper valve body
11. Stopper plate

Fig. 136—Upper valve body components



1. End clutch valve
2. End clutch valve plug
3. Stopper
4. Pin
5. Lock up clutch control valve
6. Lock up clutch valve sleeve
7. End cover
8. N-R control valve
9. Reducing valve
10. Adjusting screw

Fig. 137—Lower valve body components

Cleaning and Inspection

Allow all parts to soak for a few minutes in a suitable clean solvent. Wash thoroughly and dry with compressed air.

Inspect all mating surfaces for nicks, burrs and scratches. Using a straight edge inspect mating surfaces for warpage or distortion. Make sure all metering holes in the transfer plate and valve body are open. Using a pen light, inspect bores in valve body for scores, scratches, pits and irregularities.

Inspect all valve springs for distortion and collapsed coils. Inspect all valves and plugs for burrs, nicks and scores. Small nicks and scores may be removed with crocus cloth, providing extreme care is taken not to round off sharp edges. The sharpness of these edges is vitally important because it prevents foreign matter from lodging between valve and valve body, thus reducing possibility of sticking. Inspect all valves and plugs for freedom of operation in valve body bores.

When bores, valves and plugs are clean and dry, the valves and plugs should fall freely in the bores. **The valve body bores do not change dimensionally with use. Therefore, a valve body that was functioning properly when vehicle was new, will operate correctly if it is properly and thoroughly cleaned. There is no need to replace the valve body unless it is damaged in handling.**

Assembly

NOTE: Prior to assembly ensure all valves and plugs are well lubricated with clean A.T.F. Refer to specifications for valve spring identification chart.

(1) Install valves and springs in the order shown in Fig. 139, to the upper valve body. The line pressure adjusting screw should have its dimension "A", refer Fig. 138, preset at specified value. Specified value: 4 mm.

NOTE: Perform actual line pressure adjustment on the vehicle, measuring the actual pressure and adjust as necessary, refer section 3 for the procedure.

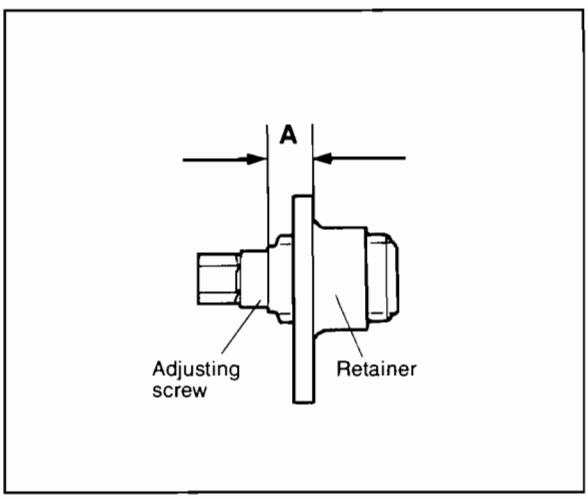
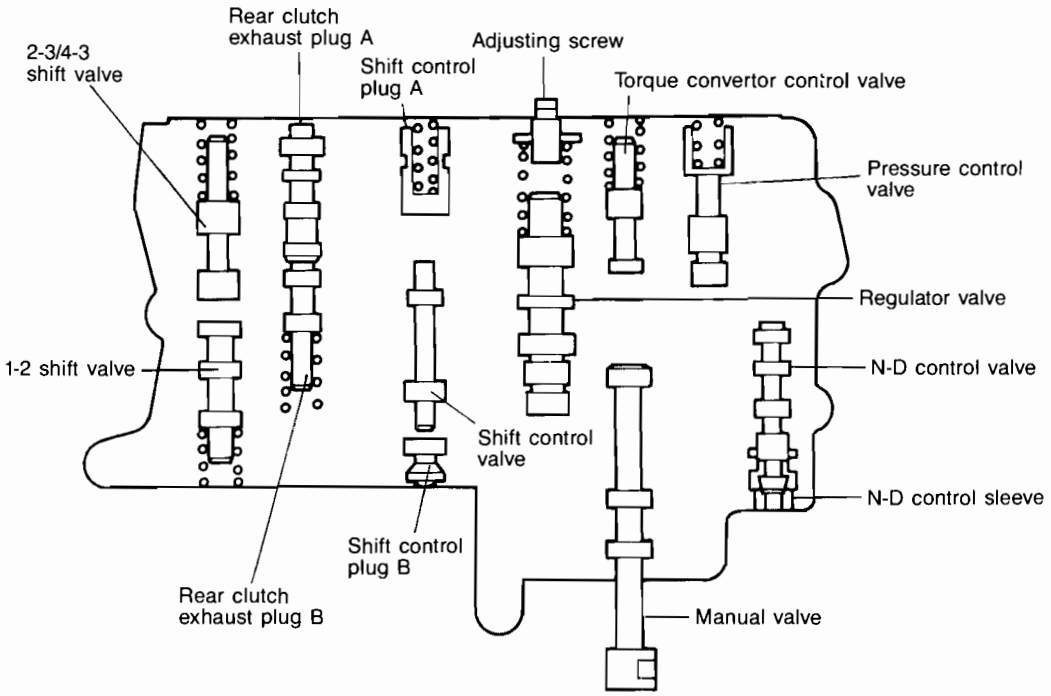


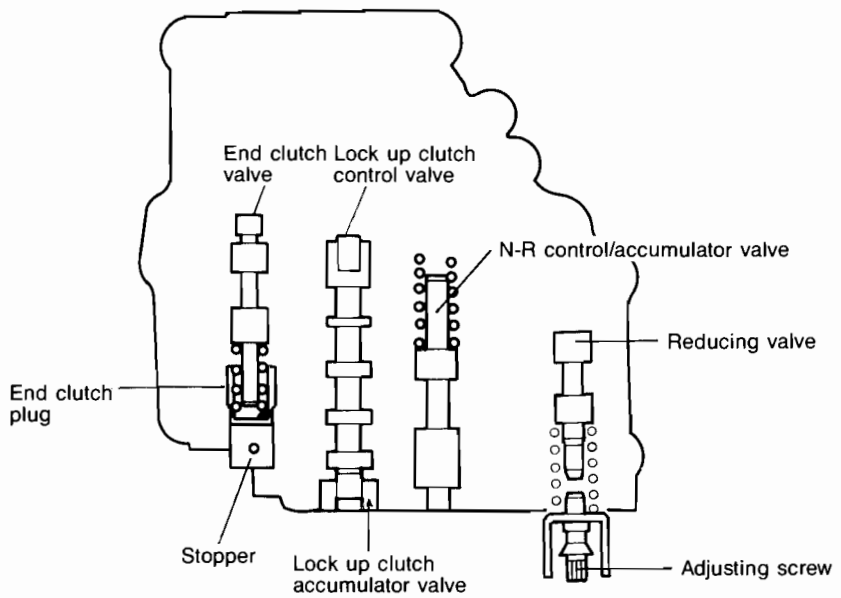
Fig. 138—Preseting adjusting screw

Upper valve body



TFA0420

Lower valve body



TFA0278

Fig. 139—Upper and lower valve body valve location

(2) Install the end cover and tighten bolts to the specified torque.

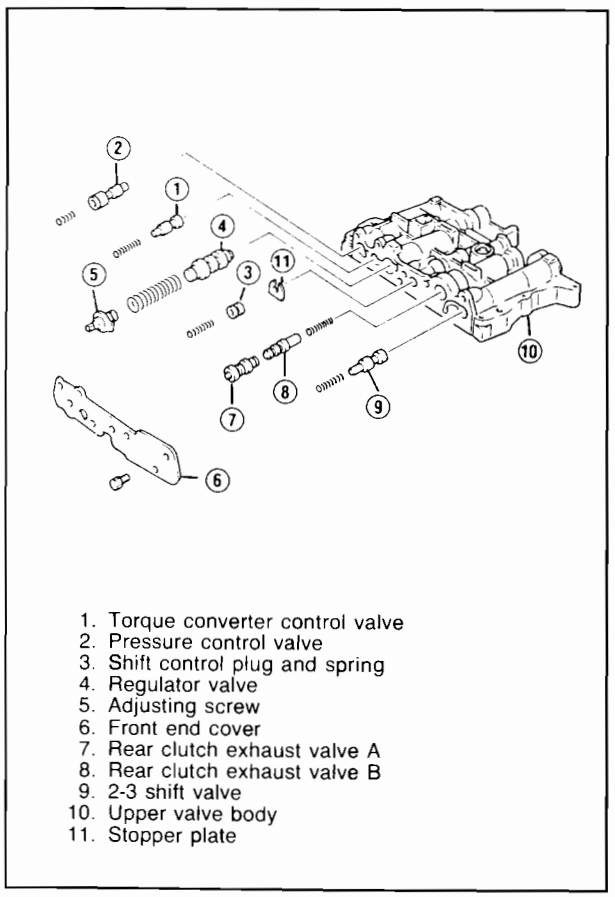


Fig. 140—Upper valve body components

(3) Install the 1-2 shift valve, spring, shift control valve and plug in the upper valve body, refer Fig. 141.

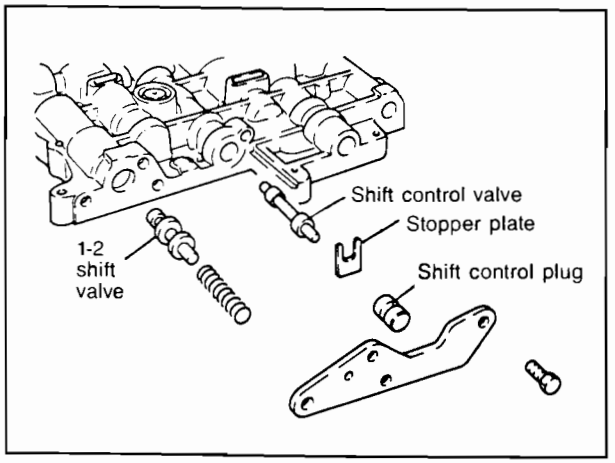


Fig. 141—Valve and spring installation

(4) Install end cover and tighten bolts to the specified torque.

(5) Install the three steel balls and one teflon ball and three stopper plates, refer Fig. 142, in the upper valve body, ensuring that the plates are correctly positioned on the shift control valve.

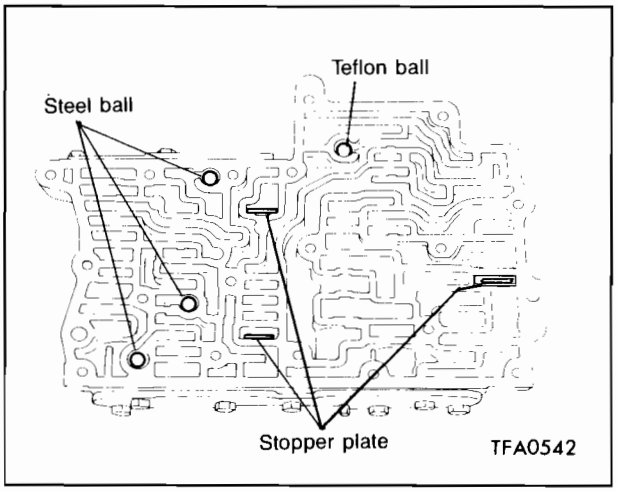


Fig. 142—Ball and stopper plate location

(6) Install the upper seperating plate and block to the intermediate plate, leaving the bolts finger tight, refer Fig. 143.

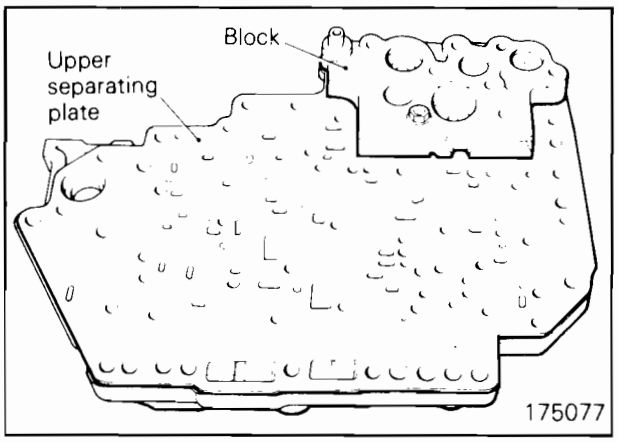


Fig. 143—Installing upper seperating plate

(7) Install the intermediate plate and upper separating plate assembly, refer Fig. 144, leaving all bolts finger tight.

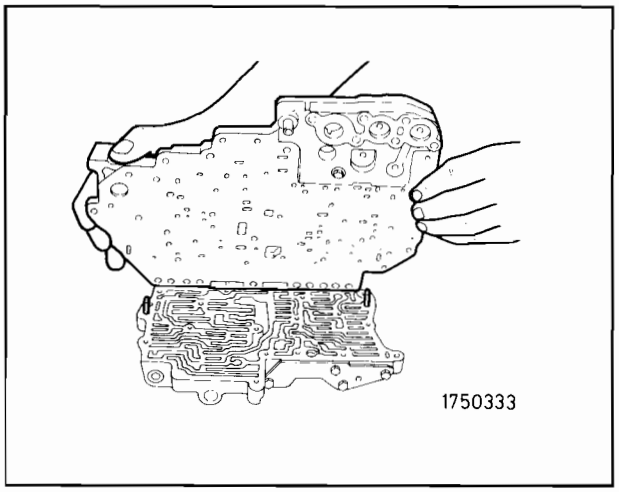


Fig. 144—Installing intermediate plate

(8) Install the end clutch valve, plug, stopper and pin in the lower valve body, refer Fig. 145.

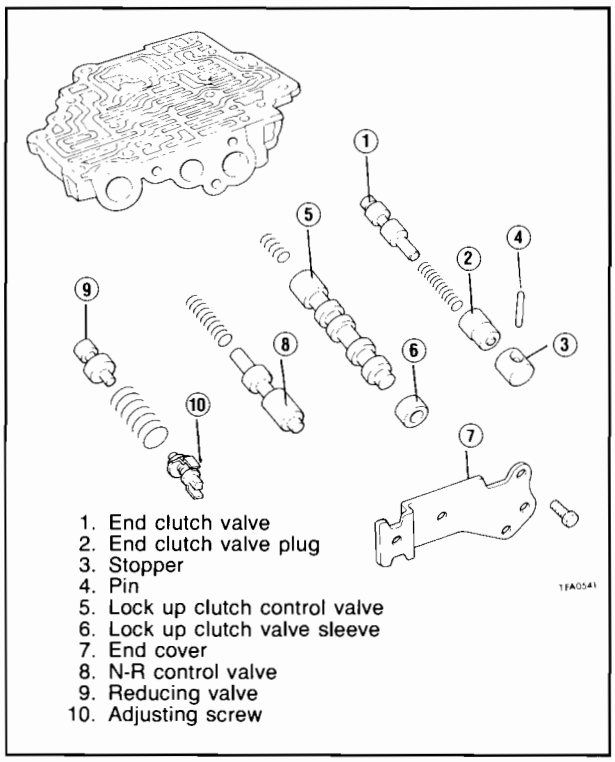


Fig. 145—Lower valve body components

(9) Install the reducing valve and spring, the N-R valve and spring, the lock up clutch control spring, valve and sleeve to the lower valve body, refer Fig. 145.

NOTE: The reducing pressure adjusting screw should have its dimension A (refer Fig. 146) preset at specified value: 10 mm. Check actual reducing pressure on vehicle and adjust as necessary, refer "maintenance and adjustment", section 3.

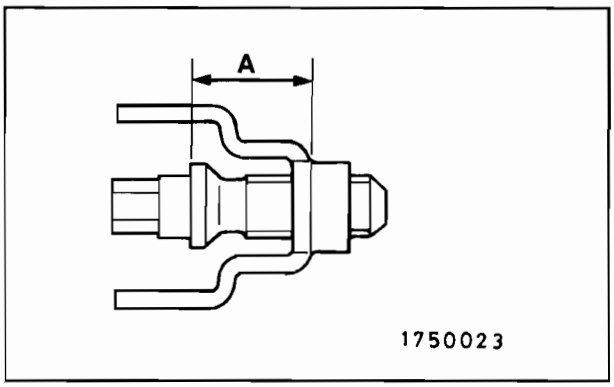


Fig. 146—Reducing valve adjusting screw adjustment

(10) Install end cover and tighten to the specified torque.

(11) Install the steel balls and spring in the intermediate plate, refer Fig. 147.

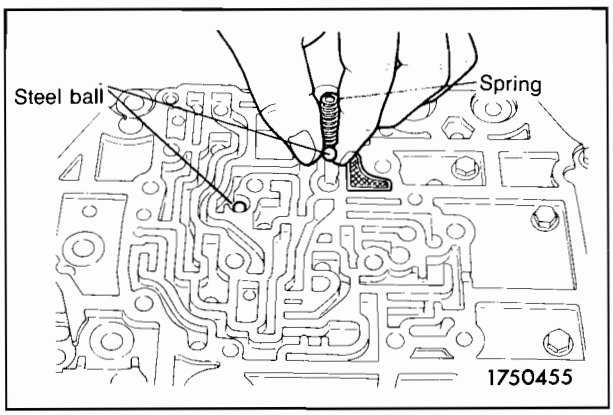


Fig. 147—Steel ball and spring location

(12) Position the lower separating plate and lower valve body on the valve body assembly, refer Fig. 148. Install retaining bolts, leaving bolts finger tight.

(13) Tighten all valve body assembly bolts to specifications.

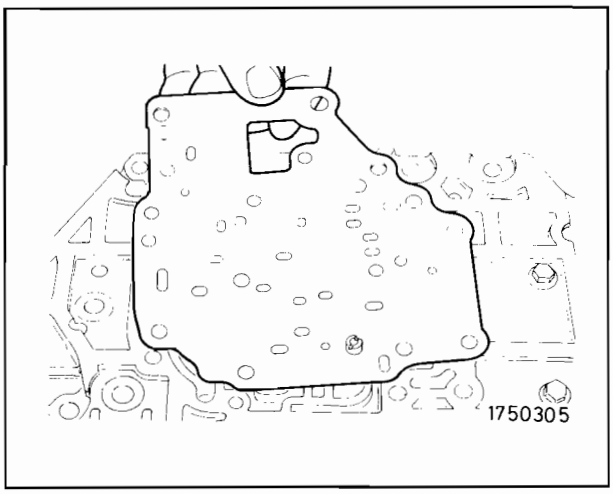


Fig. 148—Installing lower valve body

(14) Install the N-D control valve and sleeve in the upper valve body, refer Fig. 149.

(15) Install the valve stopper and harness clamp, refer Fig. 150.

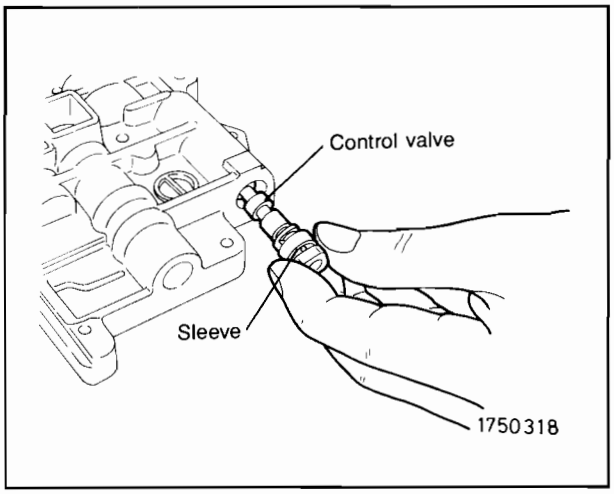


Fig. 149—Installing N-D control valve

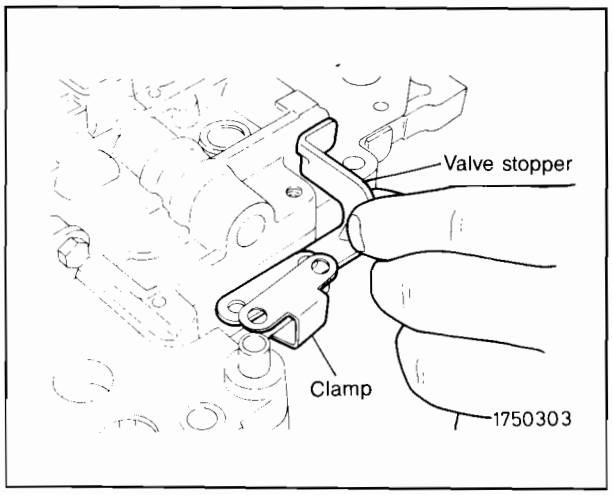


Fig. 150—Installing valve stopper

(16) Install the manual valve, refer Fig. 151.
(17) Clean the solenoid valve oil screens and replace the "O" rings, refer Fig. 152.

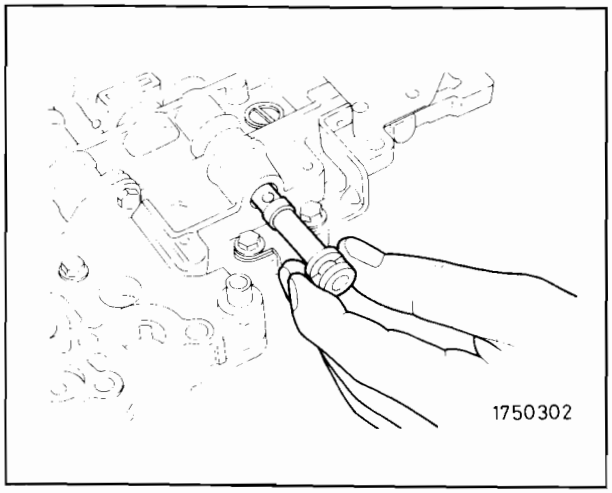


Fig. 151—Installing manual valve

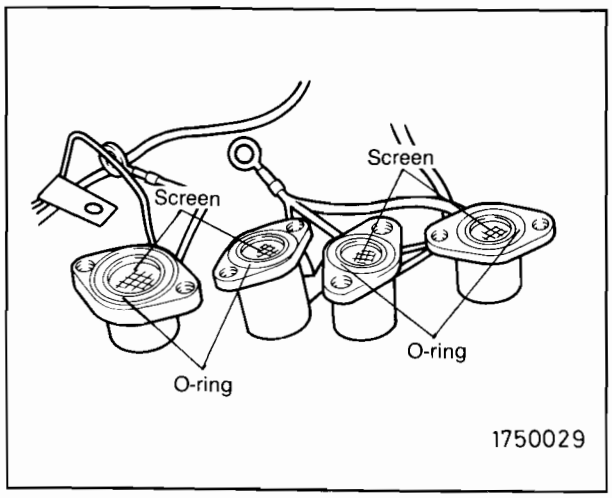


Fig. 152—Solenoid valves

(18) Apply a coat of A.T.F. to the "O" rings and install the solenoid valves in the valve body, refer Fig. 153.

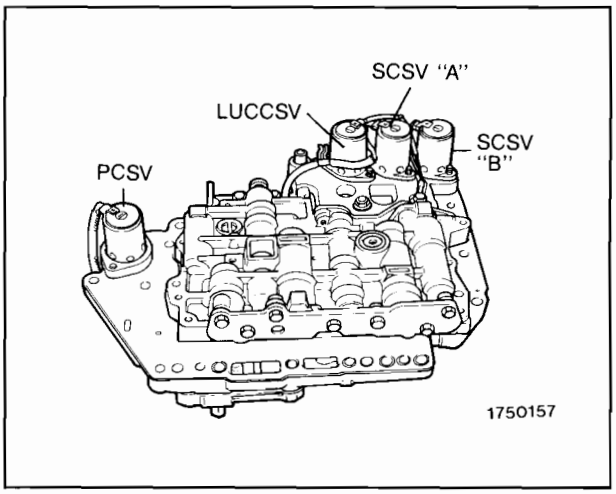


Fig. 153—Solenoid valve locations

TRANSAXLE ASSEMBLY

Always observe the following points when assembling the transaxle.

(a) Always use new gaskets, "O" rings and seals.

(b) Use only petroleum jelly for fixing spacers, thrust races, etc.

(c) Apply A.T.F. to friction elements, sliding and rotating components prior to assembly.

(d) Keep all components clean and free of cloth lint.

(e) The oil in the oil cooler should be replaced.

NOTE: Before assembly of the transaxle, measure the end play of the low-reverse brake, and select a pressure plate that will achieve the correct clearance, using the following procedure.

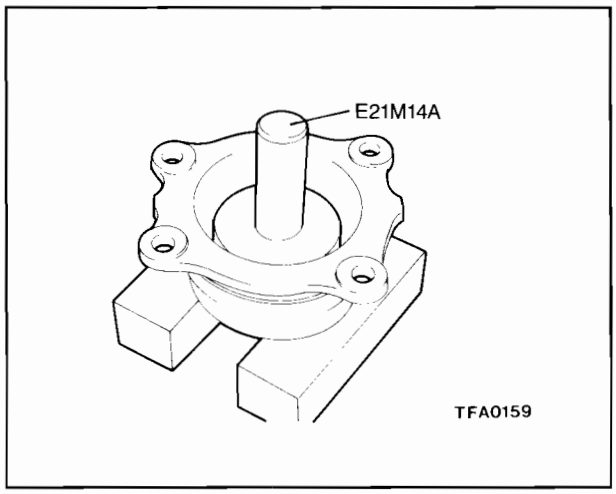


Fig. 154—Drive shaft oil seal installation

(1) Using Special Tool E21M14A install the drive shaft oil seal, refer Fig. 154.

(2) Using a suitable installer, install the transfer shaft outer race into the transaxle case, refer Fig. 155.

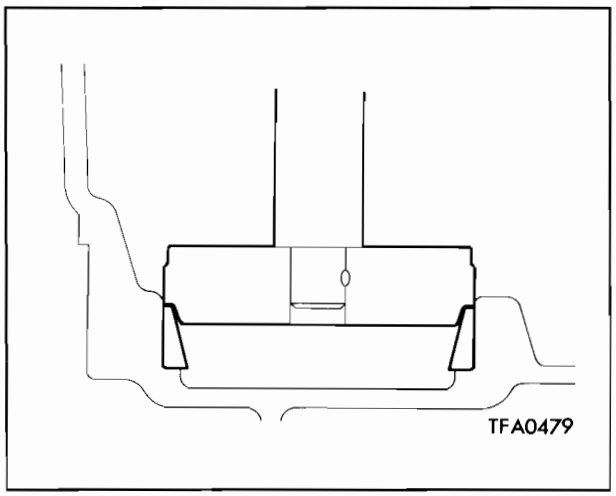


Fig. 155—Installing transfer shaft bearing outer race

(3) Install the transfer shaft, refer Fig. 156.

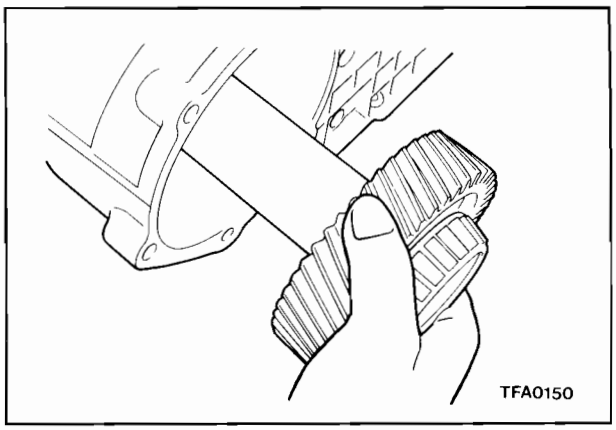


Fig. 156—Transfer shaft installation

(4) Bend two 10mm lengths of 1.6mm diameter resin cored solder to suit and position in the bottom outer circumference of the output bearing retainer, refer Fig. 157.

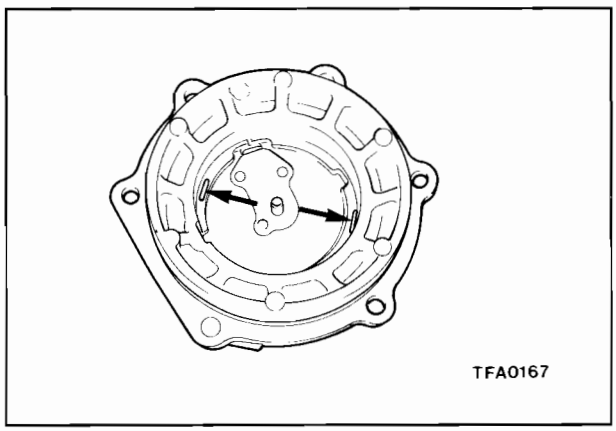


Fig. 157—Solder location

(5) Install the bearing cup and push fit to hold solder in place.

(6) Install the bearing retainer and tighten the bolts to the specified torque, refer Fig. 158.

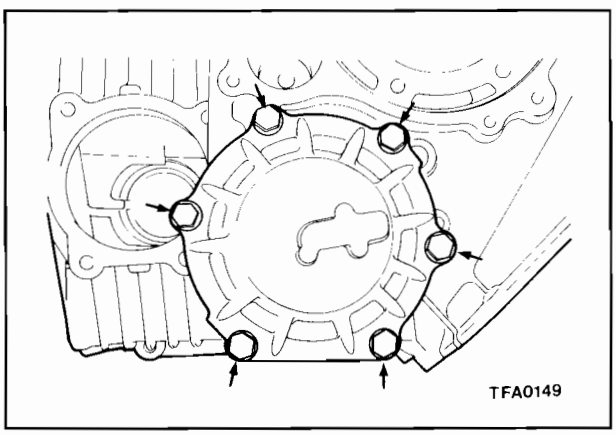


Fig. 158—Installing bearing retainer

(7) Progressively loosen and remove bolts and remove the output bearing retainer.
(8) Remove the outer race from the output bearing retainer and remove the solder.

NOTE: If the solder is not crushed, repeat steps 4 to 6, using 3 mm solder.

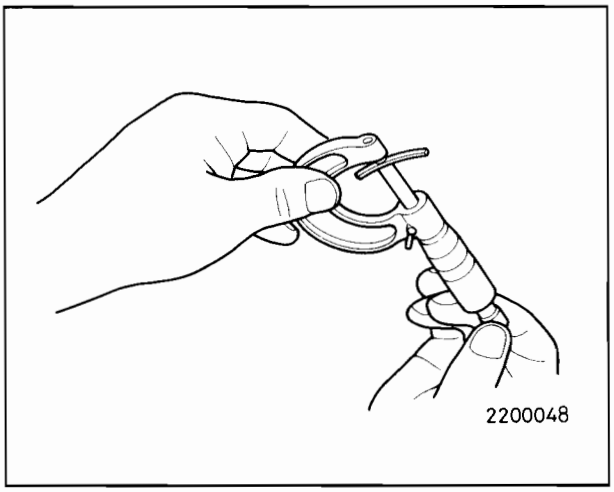


Fig. 159—Measuring solder strips

(9) Measure the thickness of the crushed solder with a micrometer and select a spacer with a thickness that will provide the standard valve of preload.
(10) Install the selected spacer into the output bearing retainer.
(11) Install the outer race into the output bearing retainer.
(12) Install a new O-ring around the outer circumference of the outer bearing retainer, refer Fig. 160.

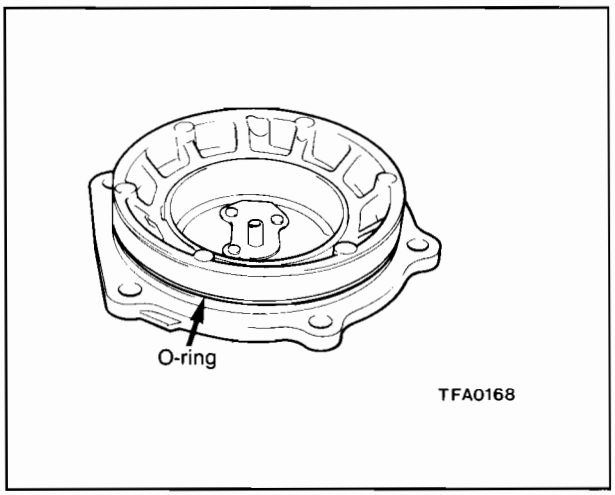


Fig. 160—O-ring installation

(13) Coat the O-ring with automatic transmission fluid.
(14) Install the output shaft bearing retainer onto the transaxle case, install attaching bolts and tighten bolts to the specified torque.
(15) Install annulus gear and output flange assembly into the case.
(16) Install the rear bearing snap ring, refer Fig. 161.

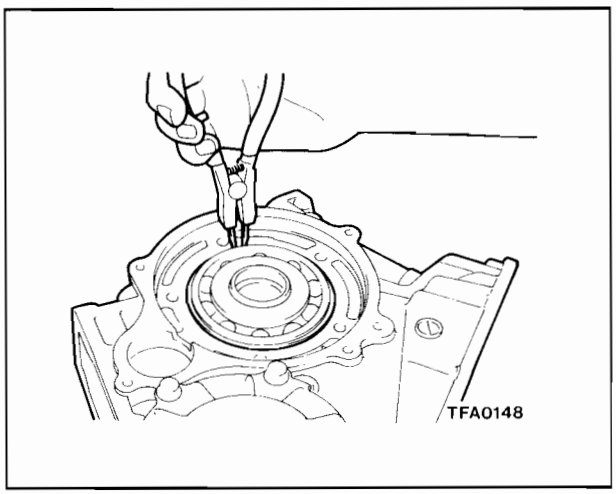


Fig. 161—Installing snap ring

(17) Using new bolts install the bearing retainer and tighten bolts to the specified torque, refer Fig. 162.

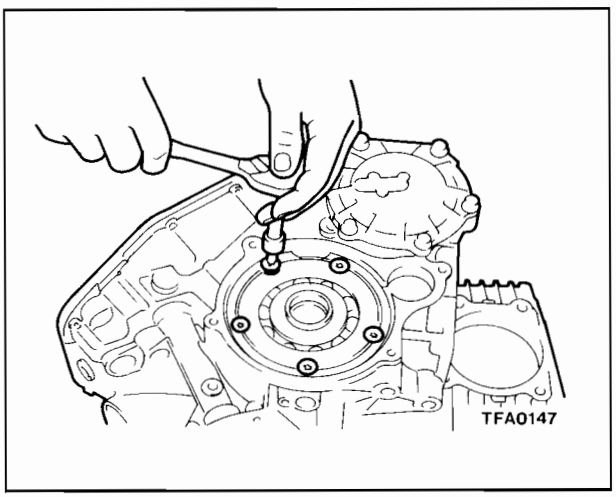


Fig. 162—Bearing retainer bolt installation

(18) Using a suitable punch, stake the bearing retainer screws, refer Fig. 163.
(19) Apply a coating of petroleum jelly to thrust bearing #10 and attach the thrust bearing to the planetary carrier, refer Fig. 164.
(20) Install the planet pinion carrier into the transaxle case, refer Fit. 165.
(21) Assemble the reverse sun gear and the forward sun gear in the following order:

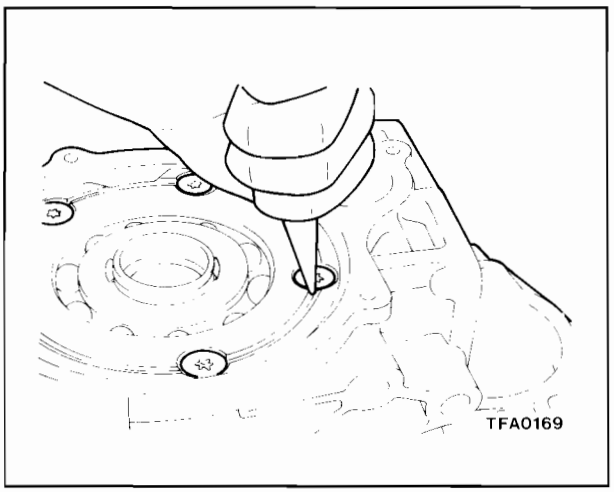


Fig. 163—Staking bearing retainer screws

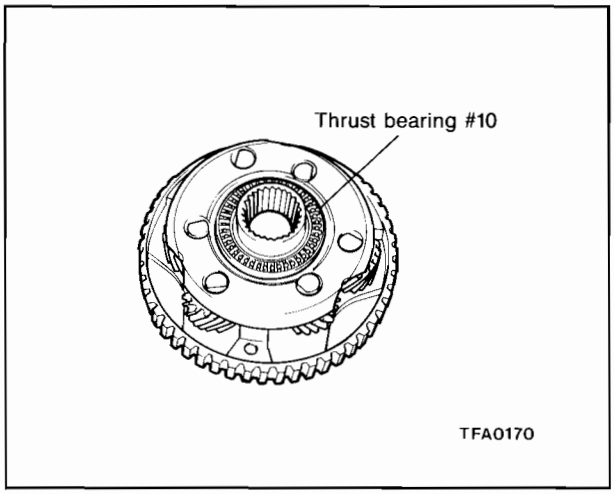


Fig. 164—Installing thrust bearing

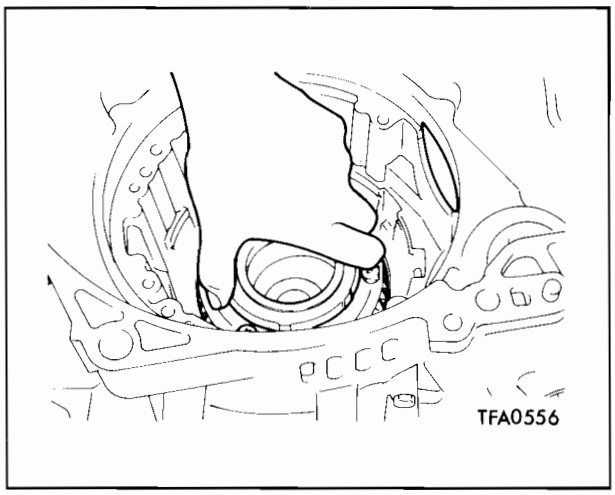


Fig. 165—Installing planet pinion carrier

(a) Attach the seal ring to the reverse sun gear. When attaching squeeze the seal ring as shown in Fig. 166.

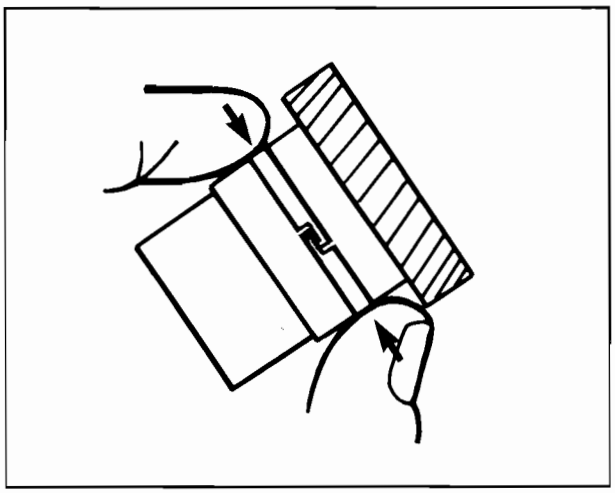


Fig. 166—Seal ring

(b) Attach the thrust race #9 to the forward sun gear.
(c) Attach the thrust bearing #8 to the forward sun gear, refer Fig. 167.

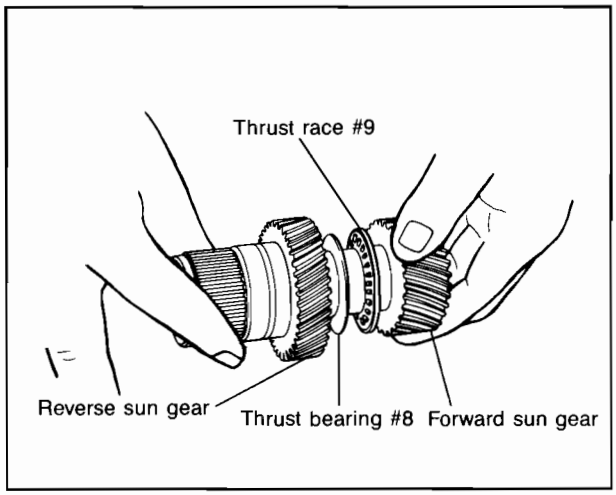


Fig. 167—Reverse/forward sun gear assembly

(22) Install the sun gears inside the planet pinion carrier, refer Fig. 168.

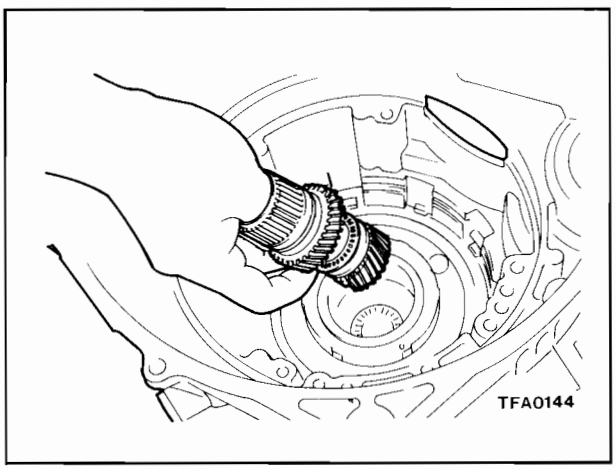
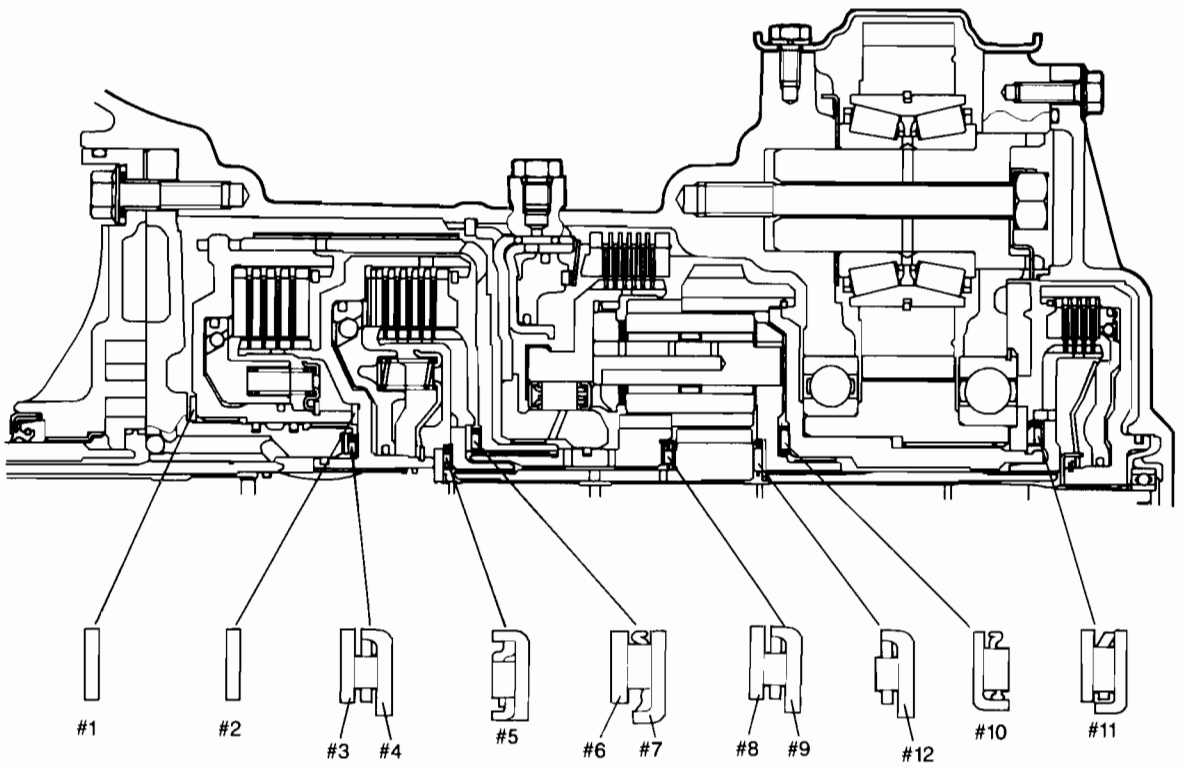


Fig. 168—Installing reverse/forward sun gear



D = Outside diameter, d = Inside diameter, t = Thickness unit: mm

D	d	t	Part No.	Symbol	D	d	t	Part No.	Symbol
70	55.7	1.4	*1	#1	48.1	34.4	—	MD707271	# 4
70	55.7	1.8	*2		42.6	28	—	MD720753	# 5
70	55.7	2.2	*3		54	38.7	1.6	MD704936	# 6
70	55.7	2.6	*4		52	36.4	—	MD720010	# 7
66	54	1.8	MD731212	#2	45	28	—	MD735062	# 8
48.9	37	1.0	MD997854 (Incl. #1)	#3	46	31	0.8	MD735063	# 9
48.9	37	1.2	MD997847 (Incl. #1)						
48.9	37	1.4	MD997848 (Incl. #2)		52	36.4	—	MD719846	#10
48.9	37	1.6	MD997849 (Incl. #2)						
48.9	37	1.8	MD997850 (Incl. #3)		58	44	—	MD724206	#11
48.9	37	2.0	MD997851 (Incl. #3)						
48.9	37	2.2	MD997852 (Incl. #4)		46	22	4	MD731170	#12
48.9	37	2.4	MD997853 (Incl. #4)						

Fig. 169—Thrust bearing and thrust race location and identification chart

(23) Install the low/reverse brake reation plate, brake discs and plates, refer Fig. 170.

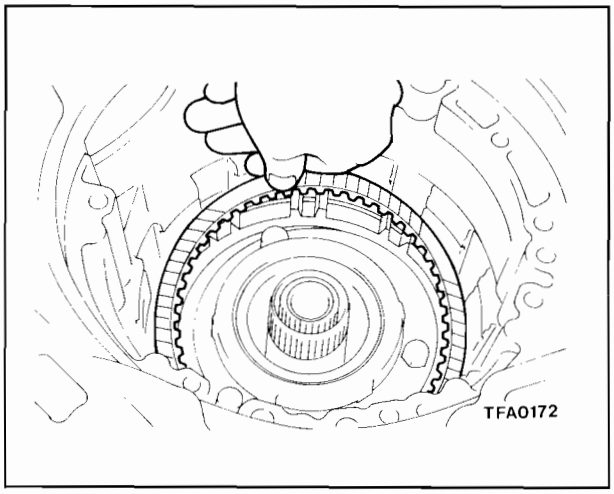


Fig. 170—Low/reverse brake installation

(24) Install the low/reverse brake pressure plate and return spring, refer Fig. 171.

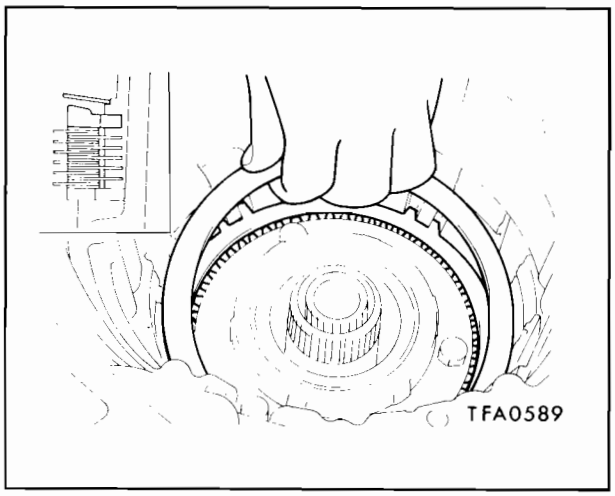


Fig. 171—Pressure plate/return spring installation

(25) Apply a coating of petroleum jelly to the wave spring and attach it to the centre support, refer Fig. 172.

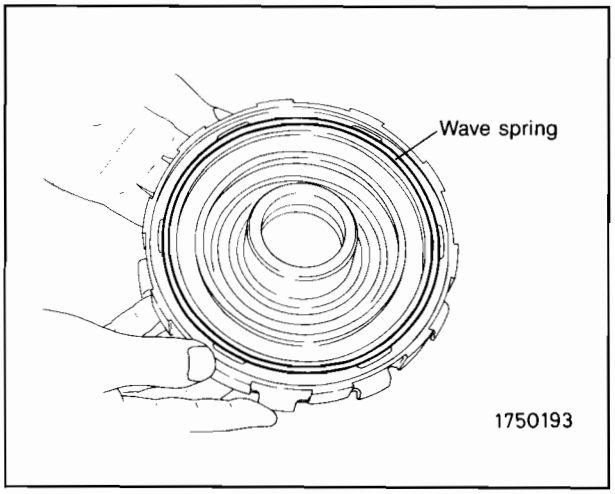


Fig. 172—Wave spring position

(26) Using Special Tool E21M41 attached to the centre support install 2 new O-rings to the support and install the centre support into the case, refer Fig. 173.

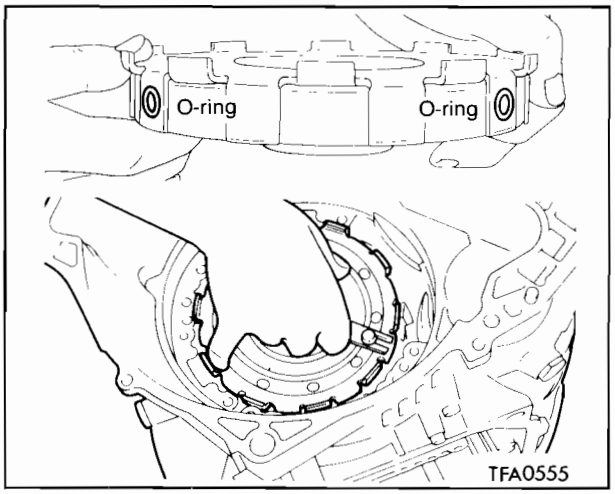


Fig. 173—Installing centre support

CAUTION: Coat the O-rings with auto trans fluid and align the oil holes. Do not move the wave spring out of position when installing the centre support.

(27) Install the centre support snap ring, refer Fig. 174.

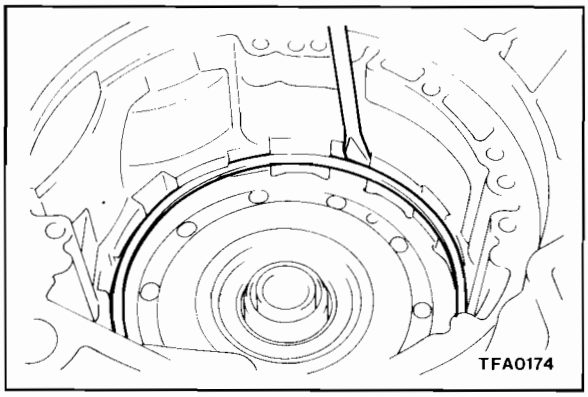


Fig. 174—Snap ring installation

(28) Measure the low/reverse brake end play with a feeler gauge, refer Fig. 175.

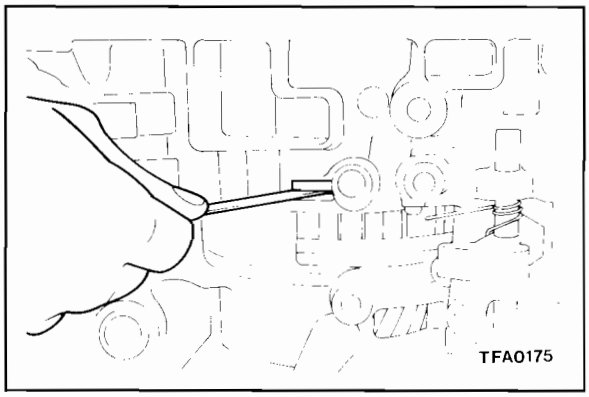


Fig. 175—Checking low/reverse brake end play

NOTE: If the low/reverse brake end play is not to specifications, adjust by selecting a pressure plate that will achieve the standard end play.

(29) Install the kickdown servo air exhaust plug and then install the plug, refer Fig. 176.

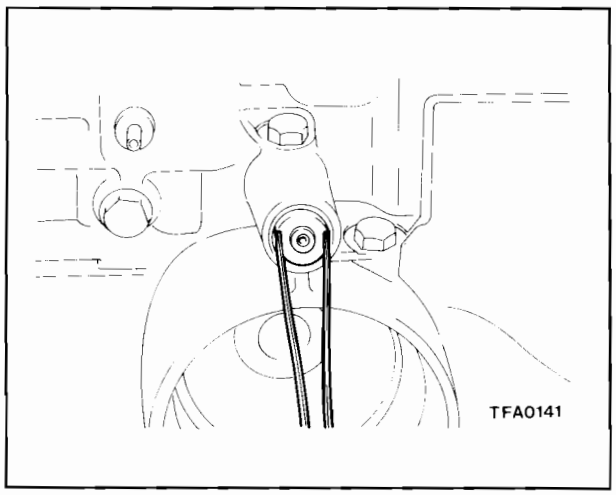


Fig. 176—Air exhaust plug installation

(30) Install the kickdown hand anchor rod, refer Fig. 177.

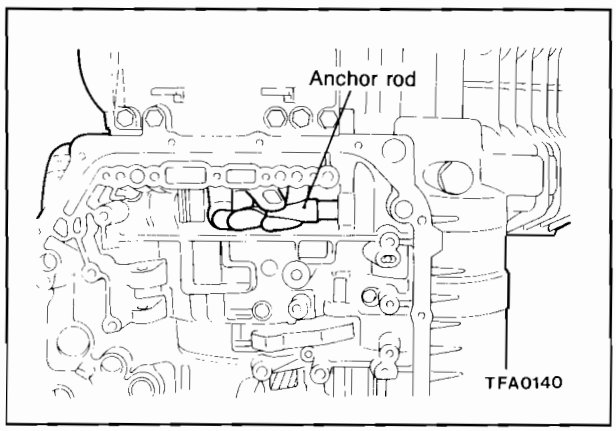


Fig. 177—Anchor rod installation

(31) Install the kickdown servo spring, piston and sleeve into the transaxle case, refer Fig. 178.

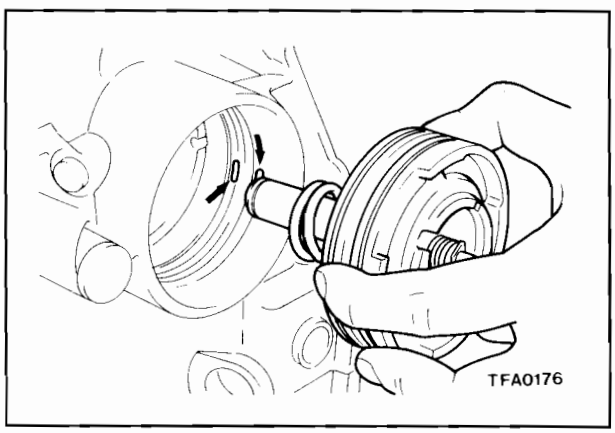


Fig. 178—Kickdown servo installation

NOTE: Position the kickdown servo seal ring gap so it does not overlap the oil filler ports, refer Fig. 178.

(32) Using a valve spring compressor and a suitable adaptor, compress the kickdown servo piston and sleeve, and install the snap ring, then release the spring compressor, refer Fig. 179.

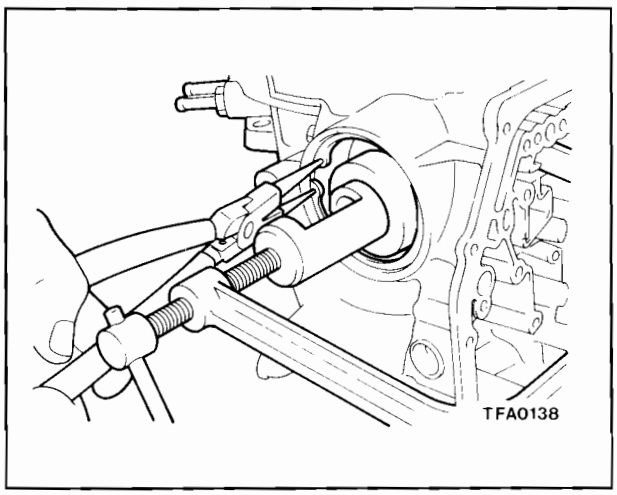


Fig. 179—Snap ring installation.

(33) Install the kickdown band, refer Fig. 180, attaching the ends of the band to the anchor and the servo piston adjusting rod.

NOTE: The kickdown band is only installed in one direction. The arrow mark indicates forward position.

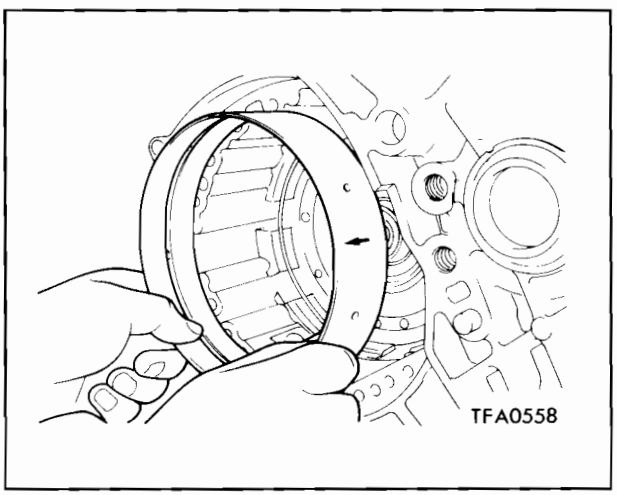


Fig. 180—Kickdown band installation

(34) Install thrust bearing #4 and thrust washer #2 on the rear clutch, refer Fig. 181.

NOTE: Apply pretroleum jelly to the thrust washer and bearing to attach them to the clutch assembly.

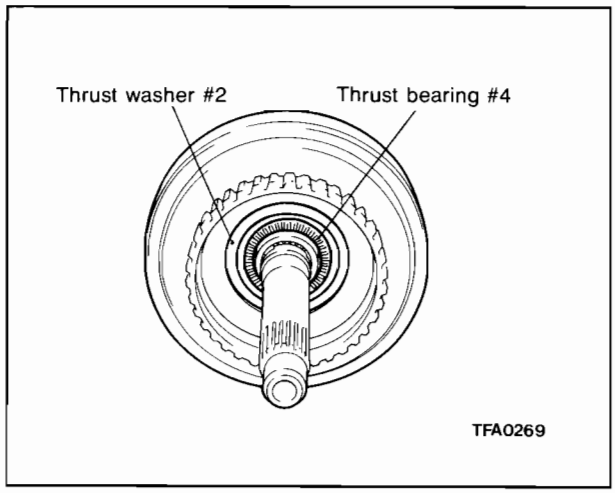


Fig. 181—Thrust bearing installation

(35) Assemble the front clutch to the rear clutch, refer Fig. 182.

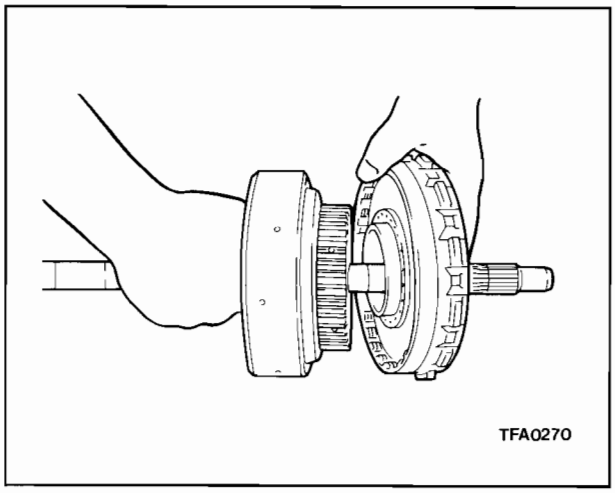


Fig. 182—Assembling front and rear clutch

(36) Apply petroleum jelly to thrust bearing #5 and install the thrust bearing on to the rear clutch hub, refer Fig. 183.

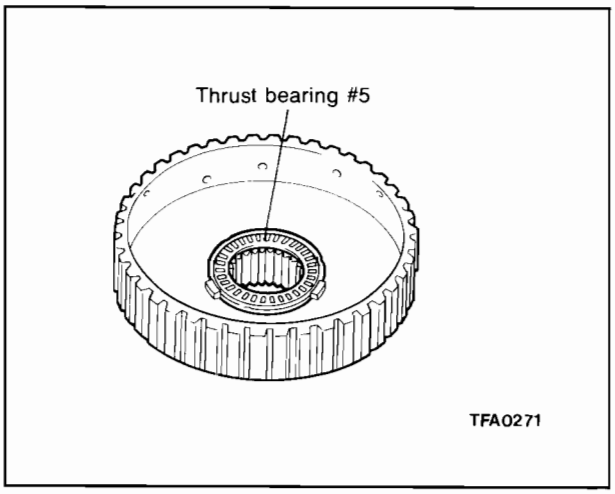


Fig. 183—Thrust bearing installation

(37) Install the rear clutch hub onto the rear clutch, refer Fig. 184.

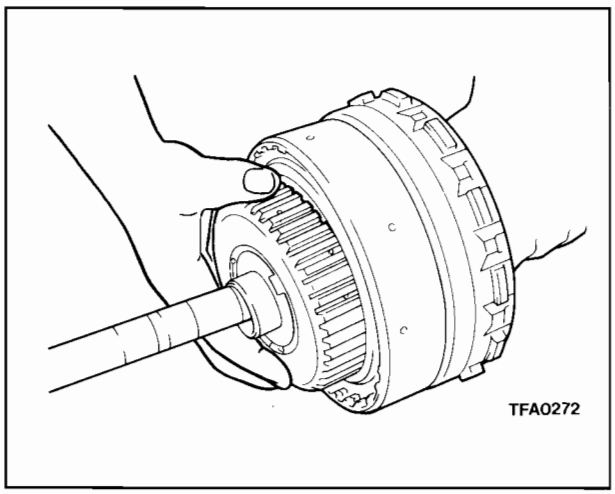


Fig. 187—Rear clutch hub installation

(38) Apply petroleum jelly to thrust race #6 and attach it to the end of the rear clutch hub, refer Fig. 185.

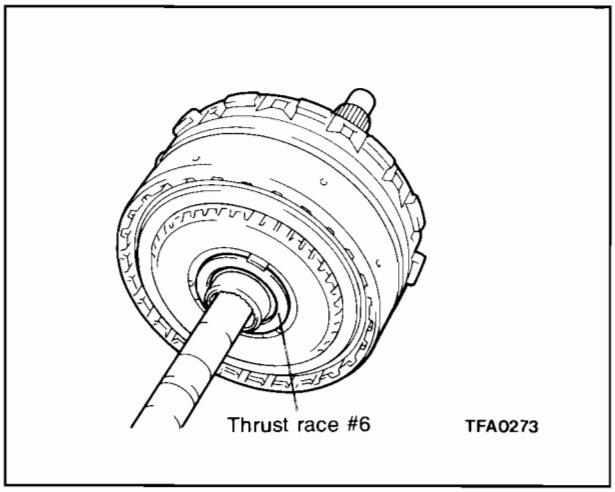


Fig. 185—Thrust race #6 installation

(39) Apply petroleum jelly to thrust bearing #7 and attach the thrust bearing to the kickdown drum, refer Fig. 186.

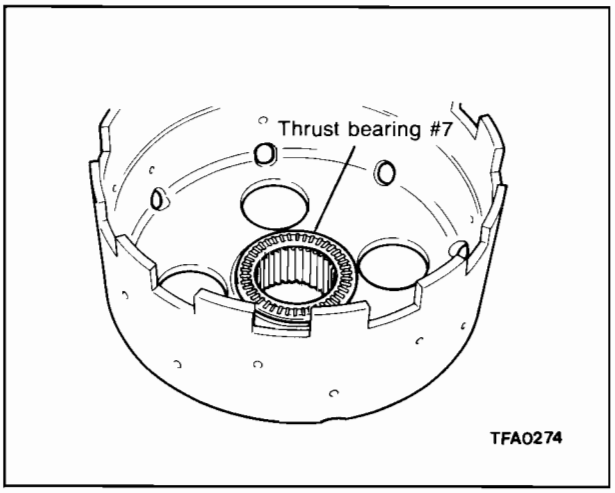


Fig. 186—Thrust bearing #7 installation

(40) Assemble the front and rear clutch assembly into the kickdown drum, refer Fig. 187.

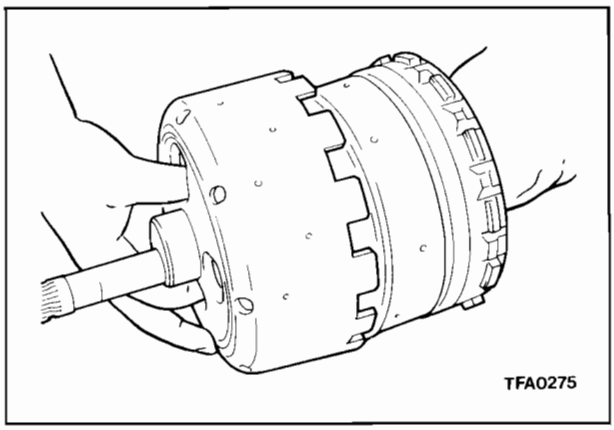


Fig. 187—Assembling kickdown drum

(41) Install the clutch and kickdown drum assembly into the transaxle case, refer Fig. 188.

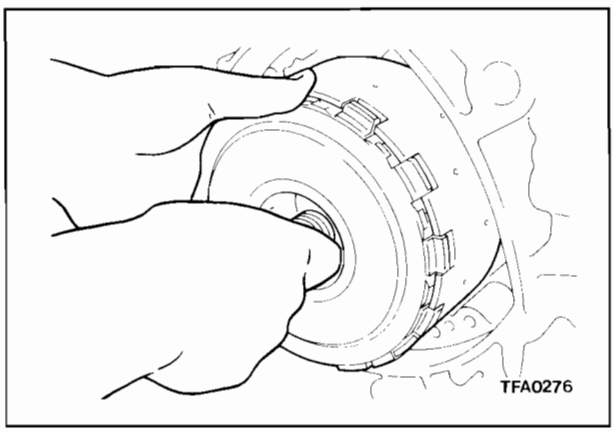


Fig. 188—Installing front/rear clutch and kickdown drum

(42) Apply petroleum jelly to thrust race #3 and thrust washer #1 and attach them to the back of the oil pump, refer Fig. 189.

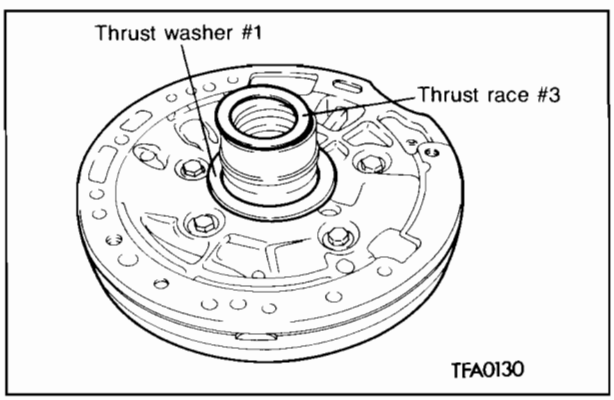


Fig. 189—Thrust race installation

(43) Fit a new oil pump gasket and install the oil pump ensuring that the bolt holes are correctly aligned, refer Fig. 190.

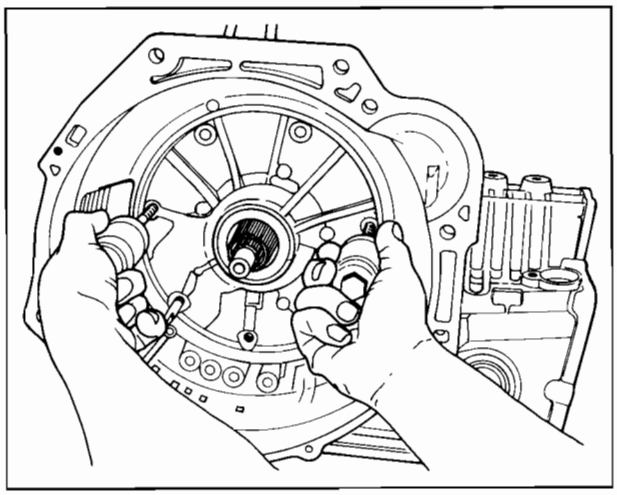


Fig. 190—Installing oil pump

(44) Install oil pump bolts and tighten evenly to the specified torque.

(45) Suitably mount a dial indicator and measure input shaft end play, refer Fig. 191.

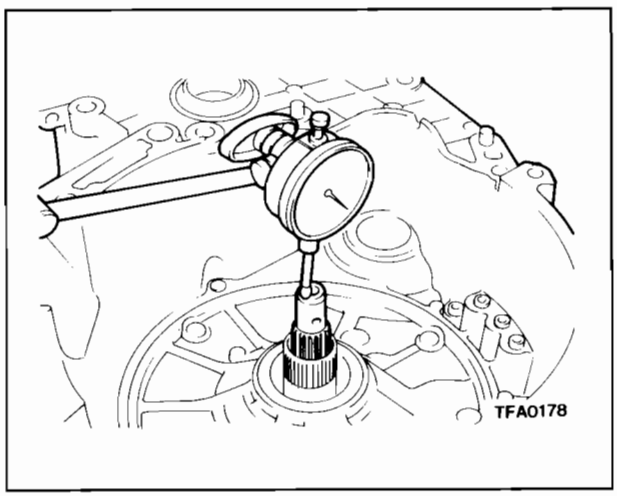


Fig. 191—Measuring input shaft end play

(46) If the end play is not within specifications, adjust by replacing thrust race #3 and thrust washer #1 with one of suitable thickness.

(47) Install the idler gear spacer, refer Fig. 192.

(48) Install the idler gear and bearing and then insert the idler shaft, refer Fig. 193.

NOTE: Install the idler gear with the identification groove facing the rear, refer Fig. 193.

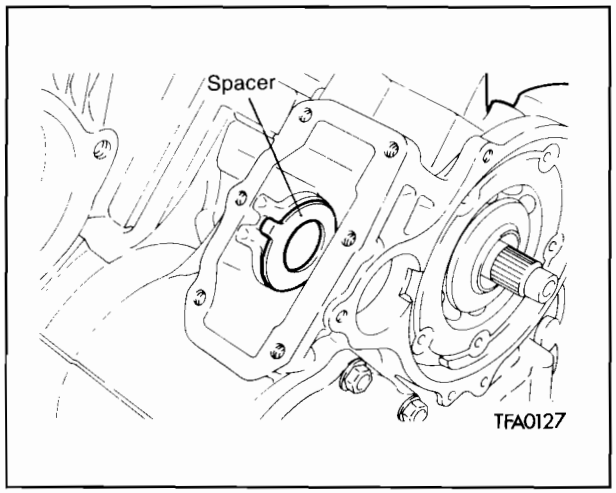


Fig. 192—Idler gear/shaft spacer installation

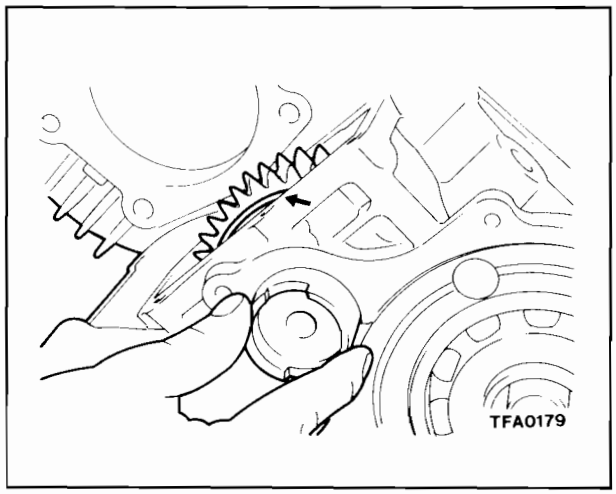


Fig. 193—Idler gear installation

(49) Tighten the idler shaft lock bolt together with a new lock plate to the specified torque. Bend the three fingers of the lock plate, refer Fig. 194.

(50) Install the idler gear cover and a new gasket and tighten cover bolts to specified torque, refer Fig. 195.

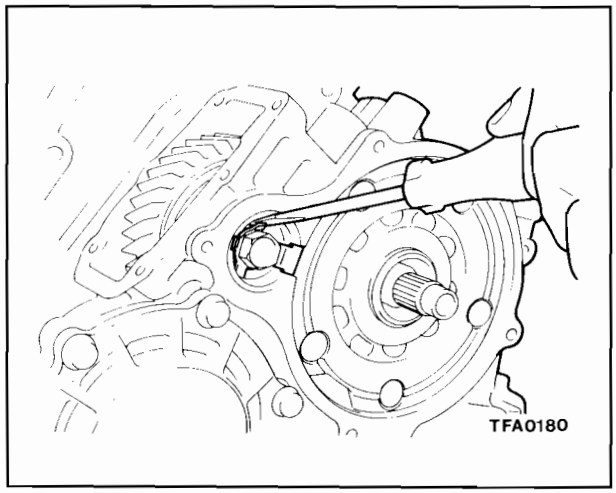


Fig. 194—Idler shaft lock bolt installation

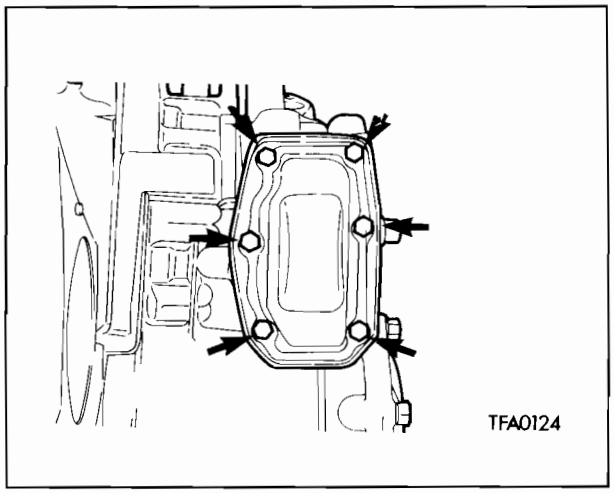


Fig. 195—Idler gear cover installation

(51) Install the end clutch shaft with its longest splines towards the front, refer Fig. 196.

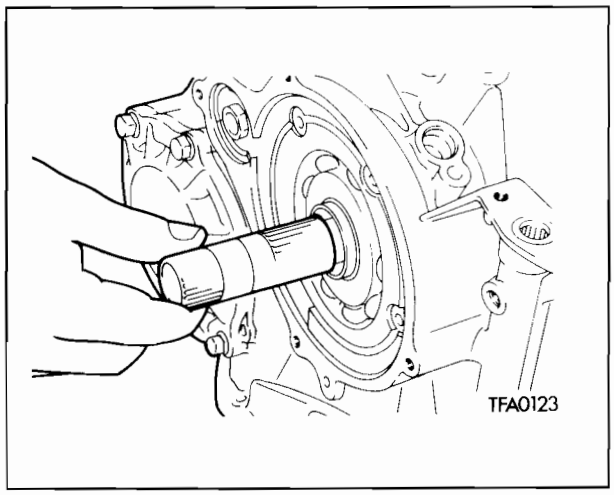


Fig. 196—End clutch shaft installation

(52) Install the thrust washer to return spring at the end clutch side, refer Fig. 197.

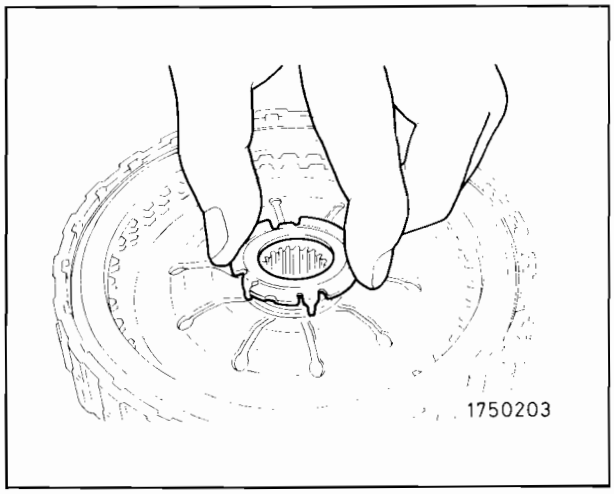


Fig. 197—Installing thrust washer

(53) Install the end clutch hub to the end clutch, refer Fig. 198.

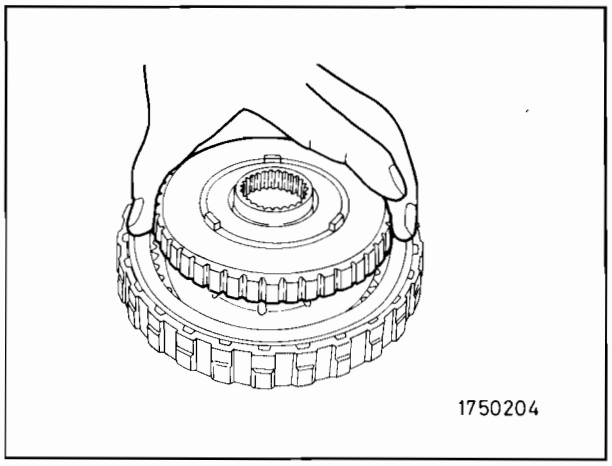


Fig. 198—Installing end clutch hub

(54) Apply petroleum jelly to thrust bearing #1 and attach bearing to the end clutch hub, refer Fig. 199.

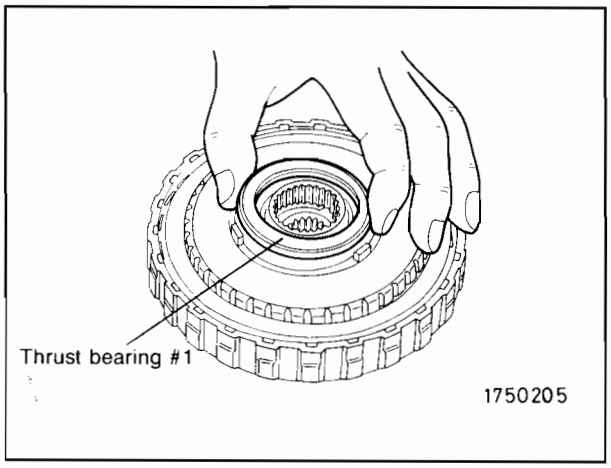


Fig. 199—Installing #1 thrust bearing

(55) Install the end clutch assembly, refer Fig. 200.

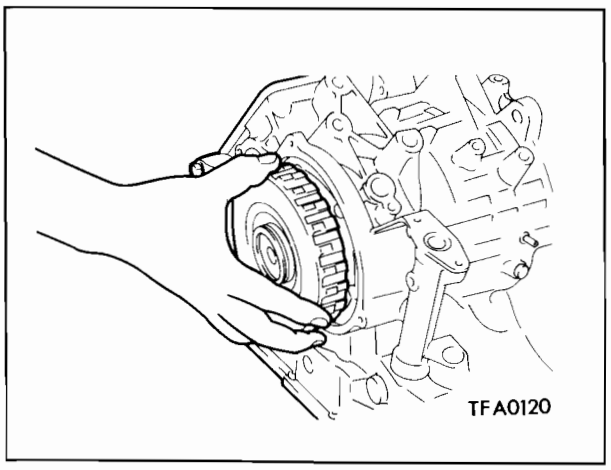


Fig. 200—Installing end clutch

(56) Install a new seal to the end clutch cover, refer Fig. 201, and coat the end clutch cover with A.T.F.

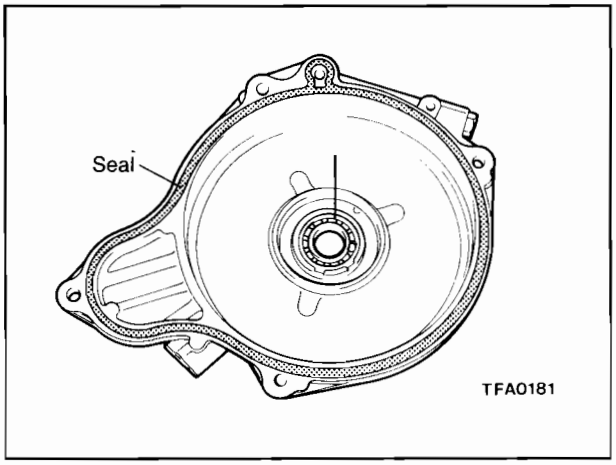


Fig. 201—End clutch cover seal location

(57) Install the end clutch cover and tighten bolts to the specified torque, refer Fig. 202.

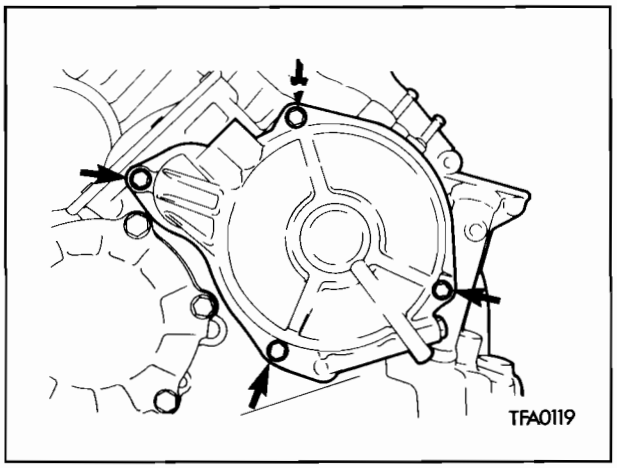


Fig. 202—End clutch cover installation

(58) Install the differential assembly, refer Fig. 203.

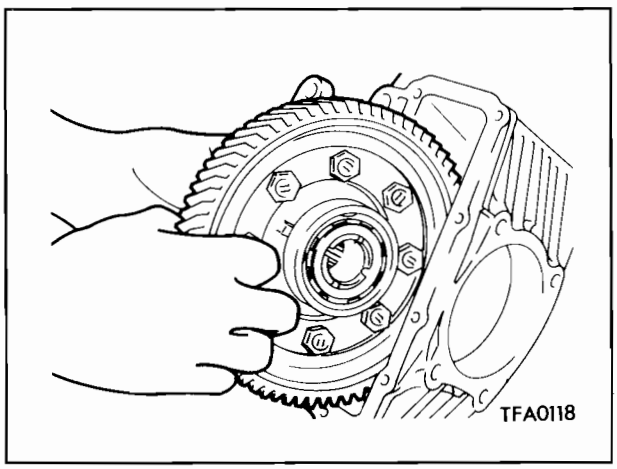


Fig. 203—Installing differential.

(59) Place two 10mm lengths of 1.6mm diameter resin cored solder on the bottom of the differential rear bearing retainer at the position shown in Fig. 204 and install the rear bear outer race.

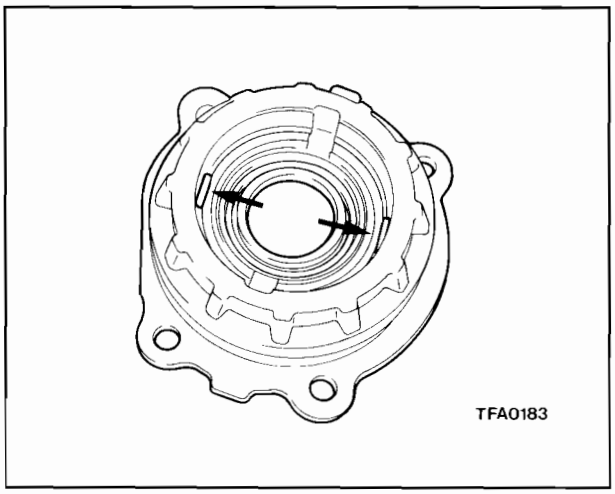


Fig. 204—Solder location

(60) Install the differential rear bearing retainer and tighten the bolts to the specified torque, refer Fig. 205.

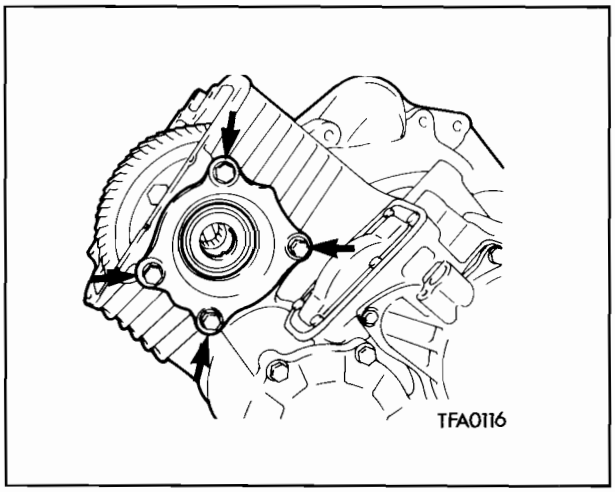


Fig. 205—Bearing retainer installation

(61) Progressively loosen and remove the bolts and remove the bearing retainer and remove the solder.

NOTE: If the solder is not crushed, repeat steps (59)-(61) with 3mm thick resin cored solder.

(62) Measure the thickness of the crushed solder with a micrometer, refer Fig. 206, and select a spacer with a thickness that will provide the standard value of the preload.

(63) Install a new O-ring on the differential rear bearing retainer, refer Fig. 207, and coat the O-ring with A.T.F.

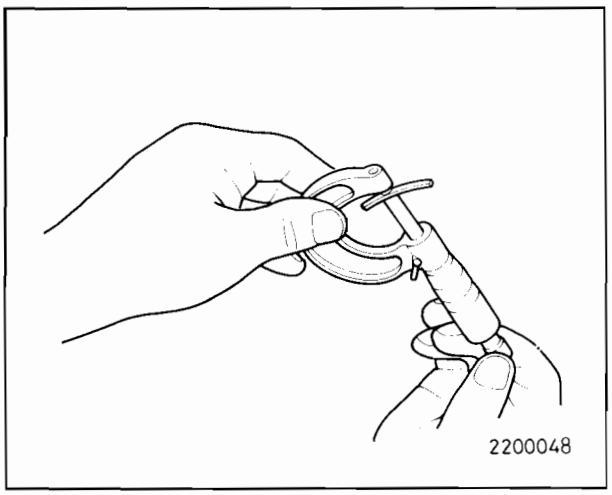


Fig. 206—Measure solder strips

(64) Install the bearing retainer in the transaxle case and tighten attaching bolts to the specified torque.

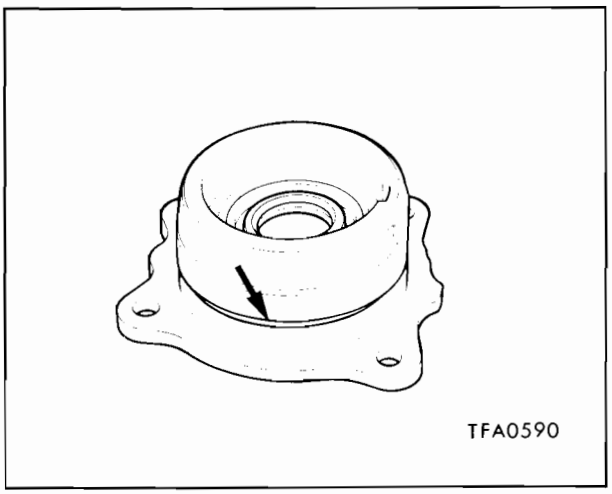


Fig. 207—O-ring location

(65) Install the front bearing cap and tighten the bolts to the specified torque, refer Fig. 208.

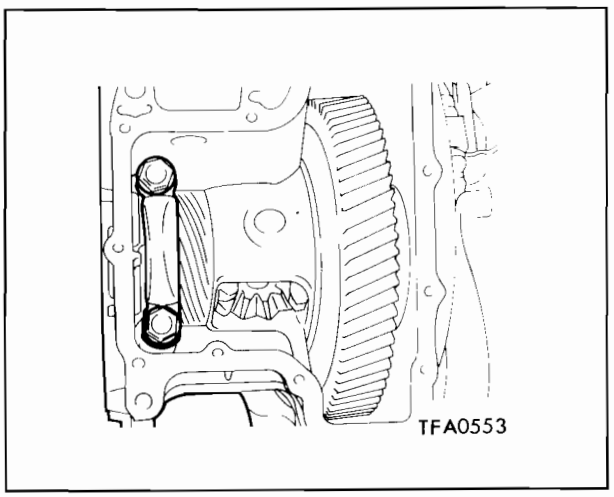


Fig. 208—Installing front bearing cap

(66) Install the differential cover with a new gasket and tighten cover bolts to the specified torque, refer Fig. 209.

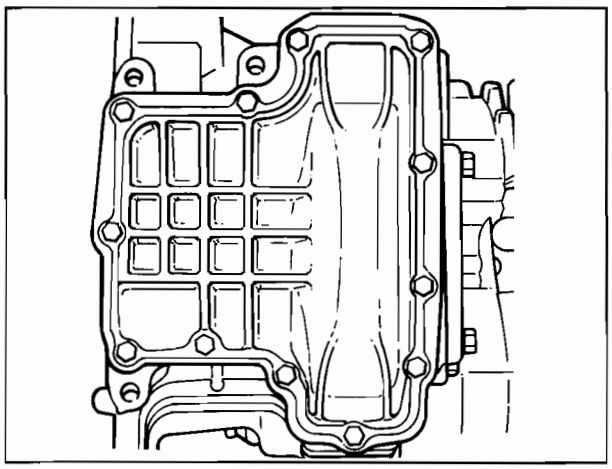


Fig. 209—Differential cover installation

(67) Install the detent assembly into the transaxle case, refer Fig. 210.

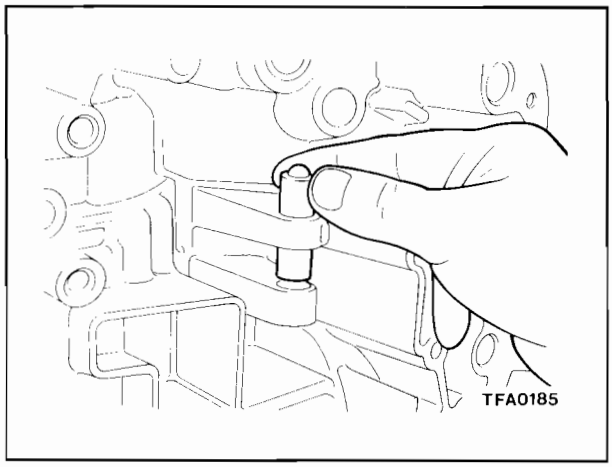


Fig. 210—Detent assembly installation

(68) Install a new O-ring onto the manual control shaft assembly, coat the O-ring with A.T.F. and then install the control shaft into the case, refer Fig. 211.

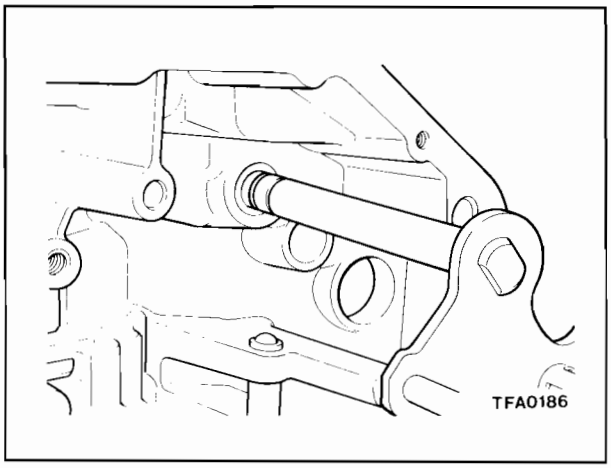


Fig. 211—Control shaft installation

(69) Align the groove in manual control shaft with the set screw hole in the transaxle case and install the set screw and tighten to the specified torque.

(70) Install the parking sprag rod roller support, refer Fig. 212.

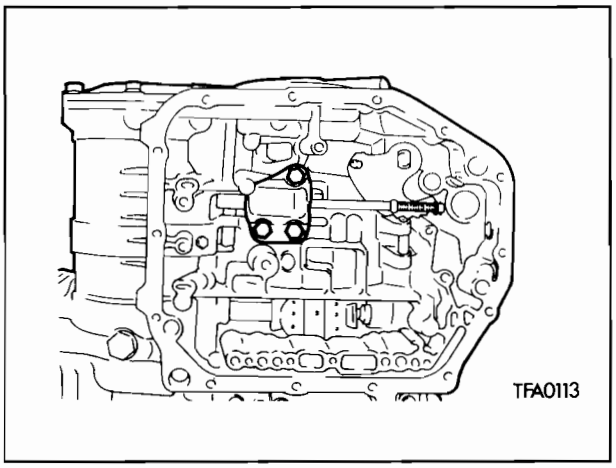


Fig. 212—Installing roller support

(71) Install the oil temperature sensor through the transaxle case hole, refer Fig. 213.

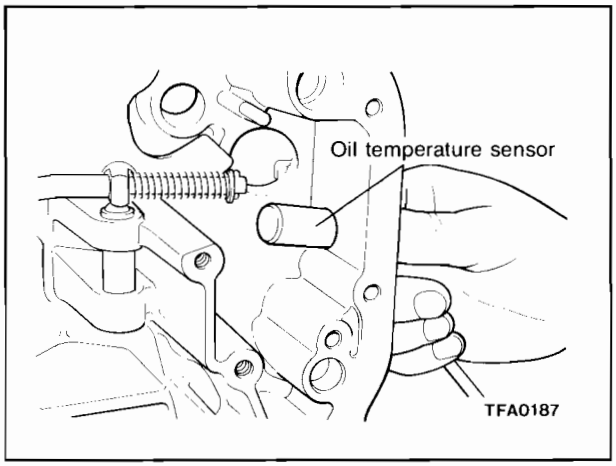


Fig. 213—Install oil temperature sensor

(72) Install a new O-ring on the valve body, refer Fig. 214.

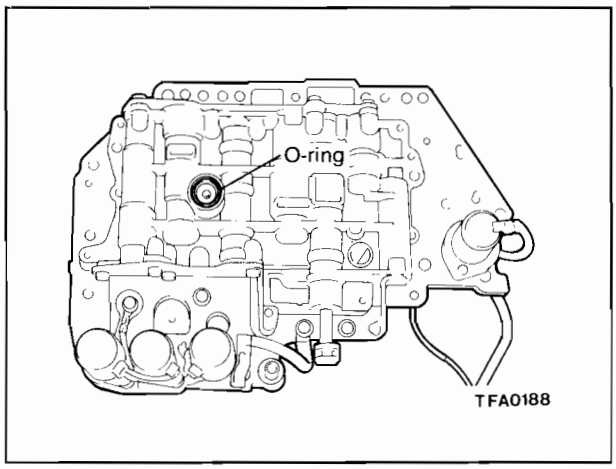


Fig. 214—Valve body O-ring location

(73) Install a new O-ring to the solenoid valve wiring harness grommet, pass the solenoid valve connector through the transaxle case hole from the inside.

(74) Push the solenoid valve harness grommet into the core hole, refer Fig. 215.

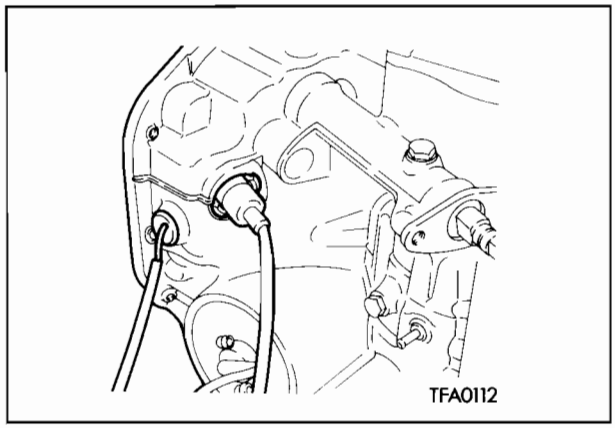


Fig. 215—Solenoid valve grommet installation

(75) Position the valve body in the transaxle, ensuring that the manual control shaft detent plate pin is correctly located in the manual control valve recess.

(76) Install the valve body bolts temporarily, install the oil temperature sensor and holder, then tighten the valve body mounting bolts to specification, refer Fig. 216.

NOTE: Valve body bolts are different lenghts, refer Fig. 216.

Bolt A = 18mm
Bolt B = 25mm
Bolt C = 40mm

NOTE: Clip oil temperature sensor loom as shown in Fig. 216.

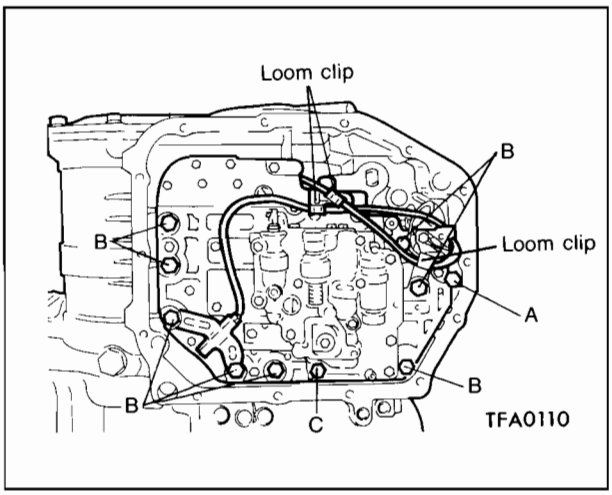


Fig. 216—Valve body installation

(77) Install the oil filter, refer Fig. 217, and tighten the attaching bolts to the specified torque.

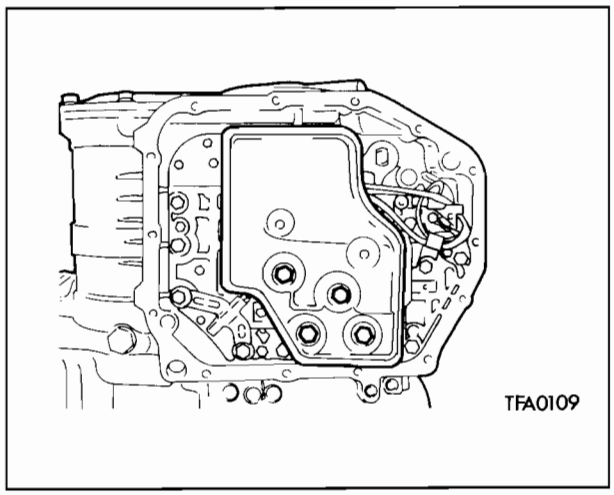


Fig. 217—Oil filter installation

(78) Install the magnets in the oil pan.

(79) Using a new gasket, fit the oil pan and tighten the bolts to the specified torque.

(80) Install the inhibitor switch and adjust using the procedure outlined in Section 3 this Group.

(81) Install the pulse generator A and B, refer Fig. 218, and tighten attaching bolts to specified torque.

NOTE: Do not attempt to "pull" the pulse generators into the case using the retaining bolts as they may break. Ensure the pulse generators are fuly based in the case before installing bolts.

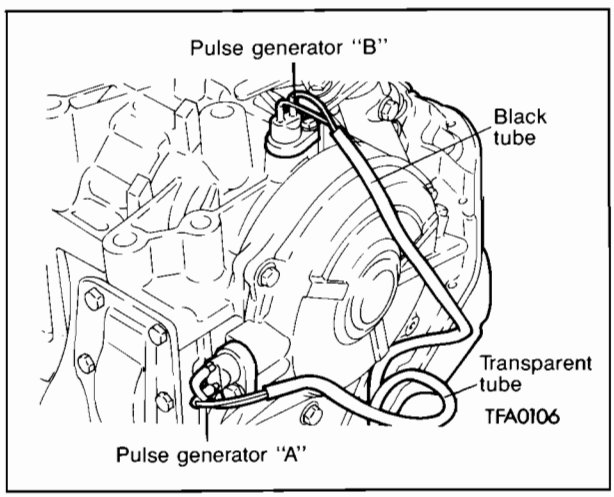


Fig. 218—Pulse generator location

NOTE: Install the black tube on the output gear side and the clear tube on the end clutch side.

(82) Install the oil filler tube and dip sticks.

(83) Install the brackets.

(84) Adjust the kick down band using the procedure outlined in Section 3 this Group.

(85) Install the kick down servo switch and snap ring, refer Fig. 219.

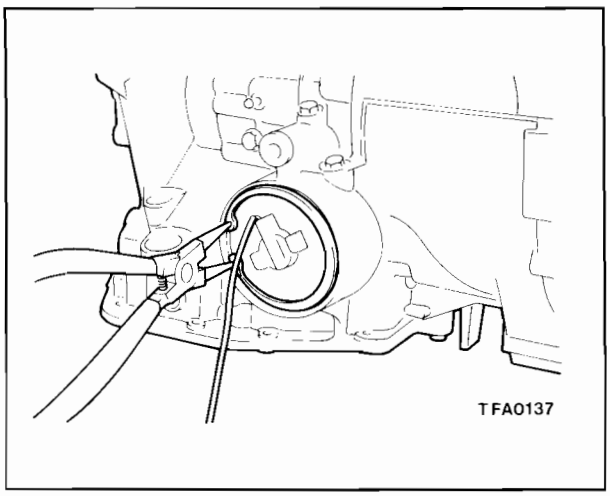


Fig. 219—Snap ring installation

(86) Apply A.T.F. to the torque converter tangs and carefully slide the converter assembly over the converter support and input shaft, ensuring that the pump seal is not damaged on installation.

(87) Check torque converter installed height. Distance between ring gear and converter housing mounting surfaces should be approximately 16.3 mm, refer Fig. 220.

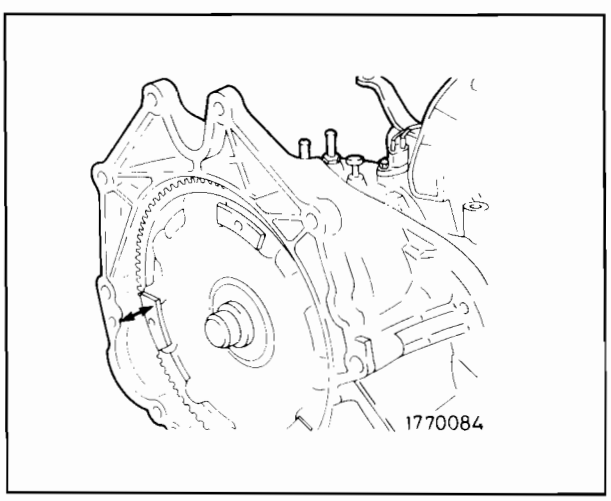


Fig. 220—Torque converter installed height

(88) Install the speedometer drive and tighten attaching bolt to the specified torque.

SECTION 5 — AUTOMATIC TRANSAXLE CONTROLS

SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
SELECTOR LEVER OPERATION STIFF	Lever cam incorrectly adjusted.	Adjust lever cam.
	Control cable incorrectly adjusted.	Adjust cable.
	Detent plate worn.	Replace detent plate.
	Contact surface of lever cam to slider worn.	Replace worn components.
	Insufficient lubrication at lever pivot.	Lubricate pivot.
	Pin on detent rod worn.	Replace pin.
STARTER DOES NOT OPERATE IN "P" OR "N"	Faulty inhibitor switch.	Replace inhibitor switch.
	Control cable incorrectly adjusted.	Adjust cable.

TORQUE SPECIFICATIONS

	Nm
Inhibitor switch mounting bolts	10 to 12
Selector lever pivot bolt	10 to 12
Lower cable mounting bracket bolt	12 to 14

ADJUSTMENTS

INHIBITOR SWITCH

(1) Disconnect the shift control cable from the manual control lever at the transaxle.

(2) Rotate the manual control lever clockwise to the Park position.

(3) Rotate the control lever anti-clockwise two detents to select the Neutral position, refer Fig. 1.

(4) Insert a 5 mm diameter rod or drill into hole "B" of the control lever to engage in the recess of the inhibitor switch, refer Fig. 1.

(5) If the rod or drill fails to engage in the inhibitor switch recess, loosen the switch mounting bolts and rotate the switch until the rod or drill can be engaged.

(6) Tighten mounting bolts to the specified torque and remove the rod or drill.

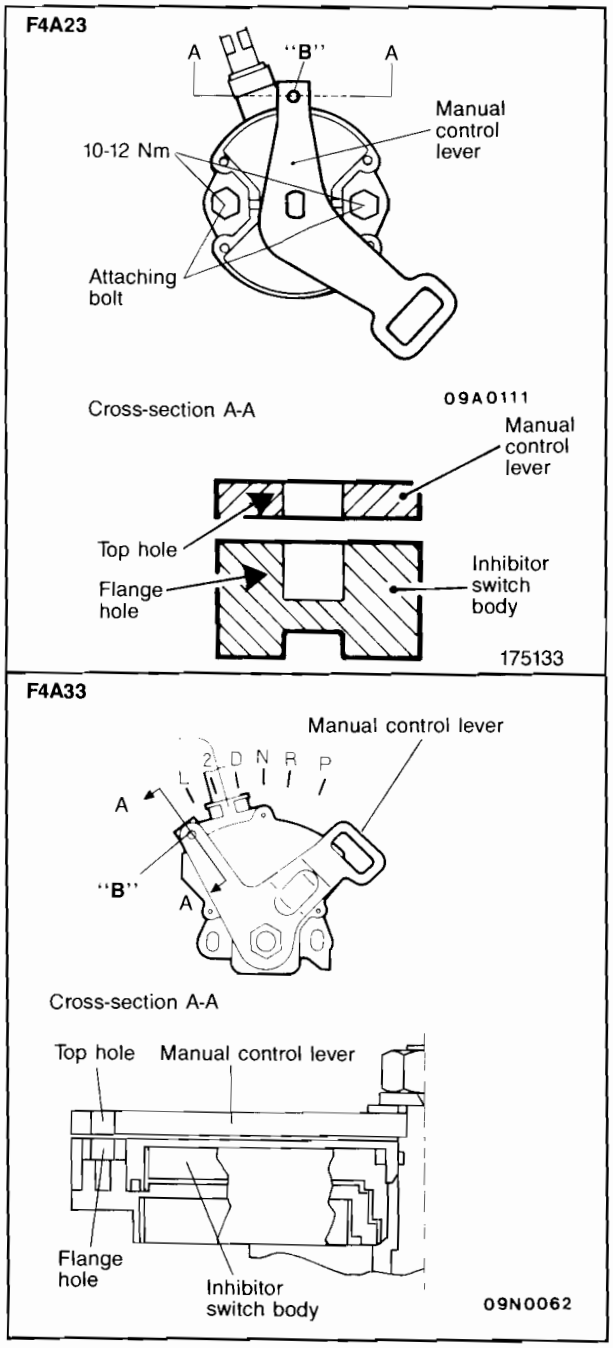


Fig. 1—Inhibitor switch adjustment

(7) Select "N" at the Selector lever and loosen the control cable to manual control lever coupling adjusting nut to set the cable and lever free.

(8) Gently pull the transmission control cable in the direction of the arrow in Fig. 2 and tighten the adjusting nut to the specified torque.

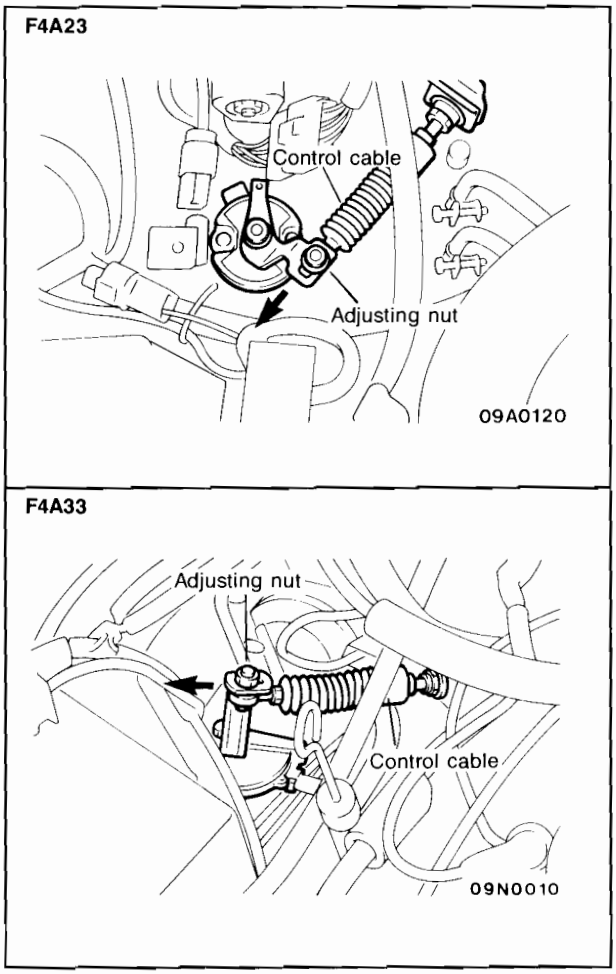


Fig. 2—Control cable adjusting nut

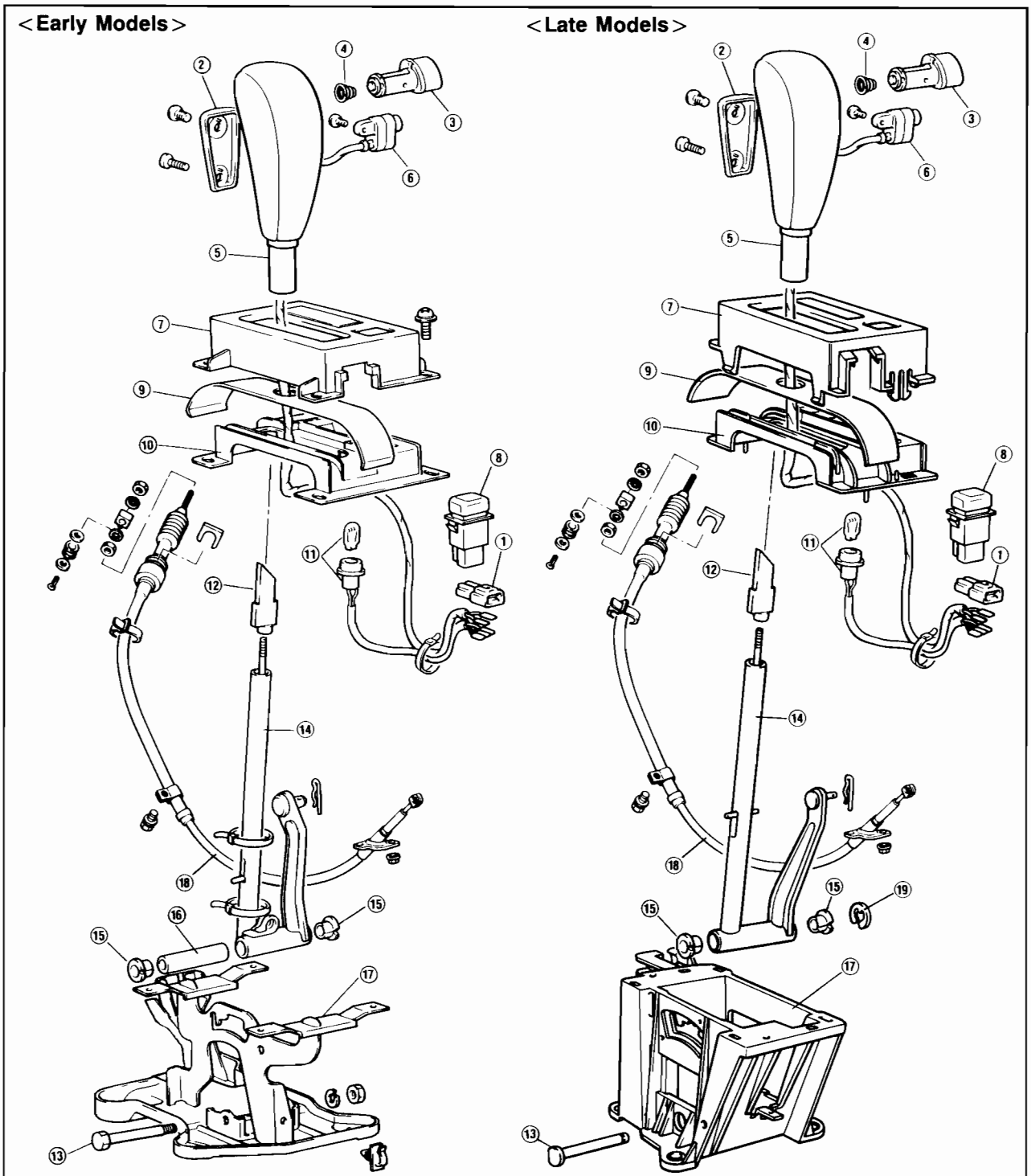
(9) Move the Selector lever through all positions and note that the indicator aligns with the gear ratio selected.

(10) Ensure the vehicle starter operates only in the "N" and "P" positions and the reverse lights operate in the "R" position.

SELECTOR LEVER INTERLOCK

(1) Place the selector lever in the "N" position.

(2) Remove the overdrive switch cover attaching screws and remove cover, refer Fig. 3.



1. OD switch connector
2. OD switch cover
3. Selector button
4. Spring
5. Selector knob
6. Overdrive switch
7. Upper panel
8. Power/Economy switch
9. Slider
10. Lower panel
11. Position indicator lamp
12. Sleeve
13. Pivot bolt
14. Selector lever assembly
15. Bush
16. Pipe
17. Bracket assembly
18. Control cable assembly
19. Circlip

Fig. 8—Gear shift lever components

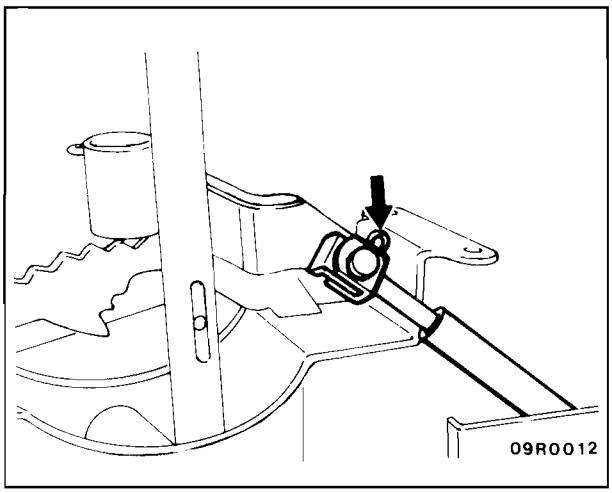


Fig. 9—Control cable attaching point

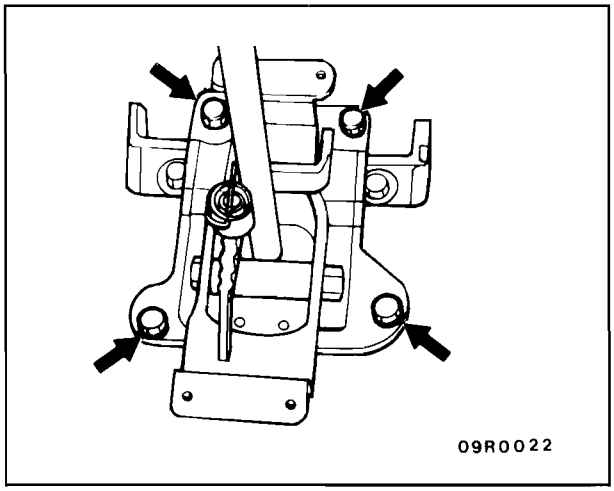


Fig. 10—Gear lever bracket attaching bolts

Installation

Install by reversing the removal procedure.

Disassembly

(1) Remove the detent ball retaining clip, the spring, ball support and ball.
(2) Remove the selector lever pivot bolt and remove the lever from the bracket.
(3) Using a suitable punch drive the pin out of the rod.
(4) Remove the rod and spring from the lever.

Inspection

Clean all components and check for worn components. Replace any component that is excessively worn.

Assembly

Assemble by reversing disassembly procedure noting the following:
(1) Apply chassis grease at the points indicated in Fig. 11.
(2) Apply multi-purpose grease (NLGI No. 3) to the gear lever pivot bushes, refer Fig. 12.

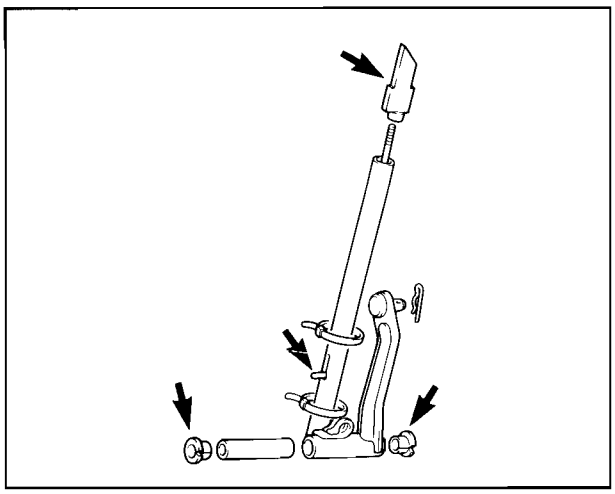


Fig. 11—Gear shift lever assembly lubrication points

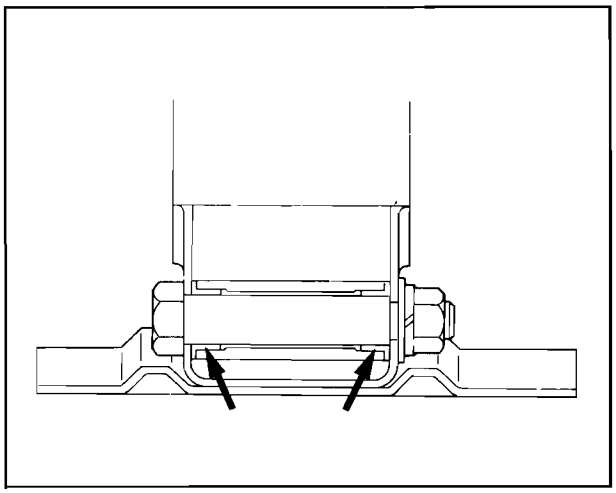


Fig. 12—Gear lever pivot lubrication points

(3) Adjust the "Selector Lever Interlock" as outlined earlier in this Section.

CONTROL CABLE

Removal

(1) Perform steps 1 to 5 as outlined in "Gear Shift Control Lever Removal".
(2) Remove the control cable to floor pan attaching bolts, refer Fig. 13.

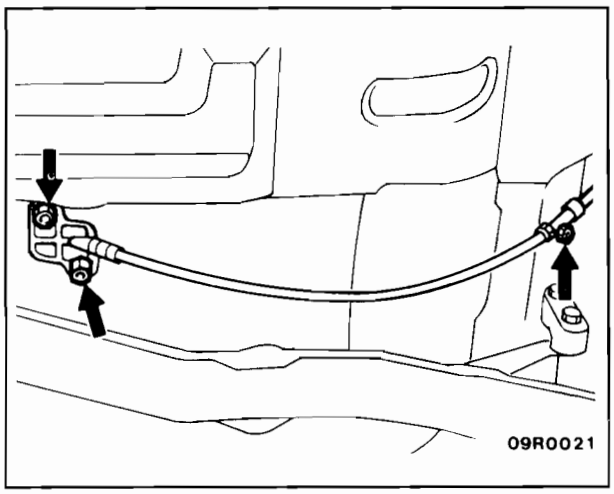


Fig. 13—Control cable to floor pan bolts

(3) Withdraw the cable from the vehicle interior.
(4) Disconnect the cable at the transaxle, refer Fig. 14.
(5) Remove the control cable from the vehicle.

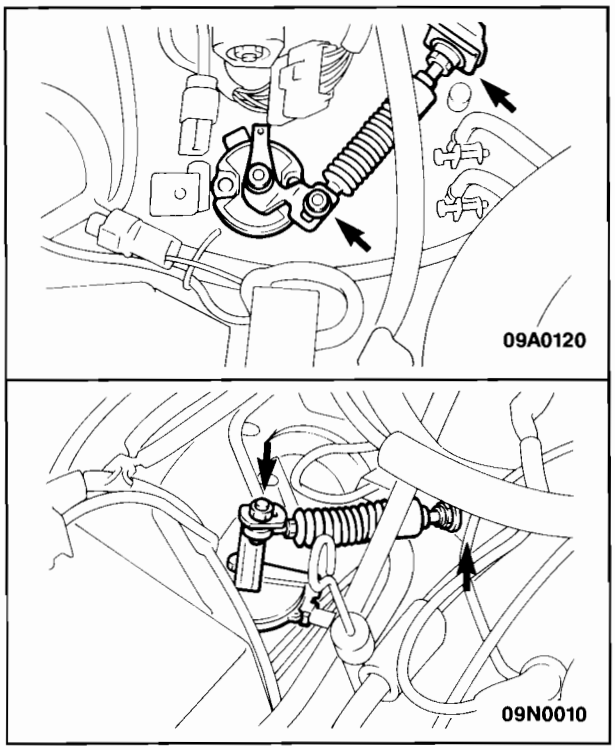


Fig. 14—Control cable to transaxle attaching points

Installation

Install by reversing the removal procedure ensuring that the cable is correctly adjusted as outlined in "Inhibitor Switch Adjustment" earlier in this Section.

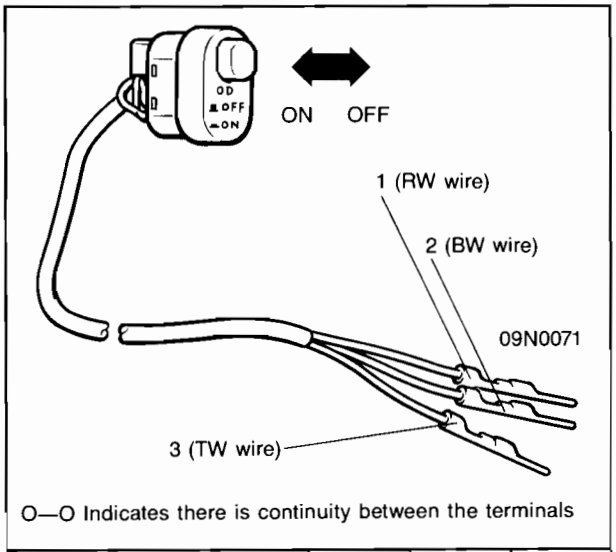
OVERDRIVE SWITCH

Removal

(1) Remove the front floor console, refer Group 52.
(2) Disconnect the overdrive switch wiring and unclip the harness from the gear lever bracket.
(3) Using a suitable tool lift the terminal retaining lugs in the switch wiring connector and remove the wires from the connector.
(4) Perform steps 3 to 6 as outlined in "Selector Lever Interlock Adjustment".
(5) Remove the switch and wiring by pulling the wiring through the lever cover.

Inspection

Check for continuity between terminals shown in Fig. 15.



Switch position \ Terminal 1	1	2	3
OD operating ON	O	O	
OD not operating OFF	O		O

Fig. 15—Overdrive switch continuity chart

Installation

Install by reversing the removal procedure noting the following:
(1) Insert wiring into the connector.
(2) Ensure wiring is correctly routed and clipped to avoid pinching.

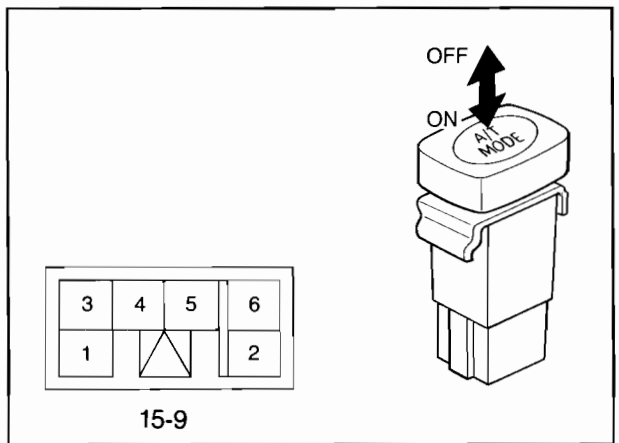
POWER/ECONOMY SWITCH

Removal

(1) Using suitable lever remove the power economy switch from the selector lever indicator assembly.
(2) Disconnect the switch wiring and remove the switch assembly.

Inspection

Check for continuity between the terminals shown in Fig. 16.



Terminal / Switch position	1	2	3	4	5	6
ON (PWR)	O	O				
OFF (ECO)		O		O		

NOTE
O-O indicates that there is continuity between the terminals.

Fig 16—Power/Economy switch continuity chart

Installation

Install by reversing the removal procedure.

TRANSAXLE CONTROL UNIT

Removal

(1) Remove the passenger side undercover. Refer Group 52.
(2) Remove the console LH and RH side covers. Refer Group 52.
(3) Remove foot cooler ducts LH and RH.

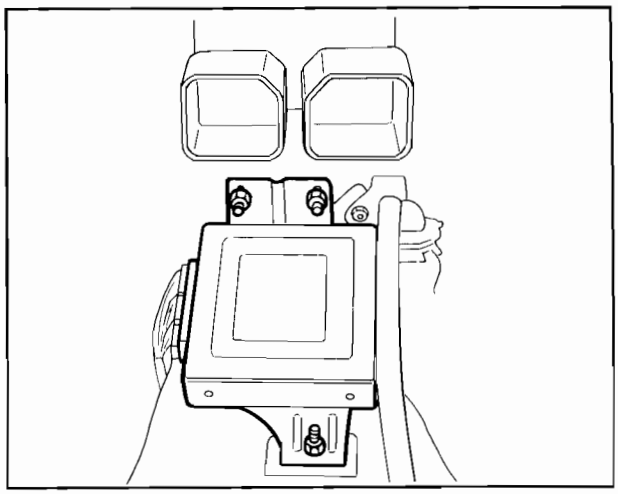


Fig. 17—Transaxle control unit attaching bolts

(4) Disconnect wiring from the control unit.
(5) Remove the control unit attaching nuts.
(6) Remove the control unit and the attaching bracket. Refer Fig. 17.

GROUP 26 — FRONT AXLE

SECTION 0 — INDEX

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SECTION 1 — FRONT AXLE

SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
VEHICLE PULLS TO ONE SIDE	Seizure of a drive shaft ball joint.	Replace.
	Abnormal wear, play or seizure of wheel bearing.	Replace.
	Malfunction of front suspension or steering.	Adjust or Replace.
VIBRATION	Bent, damaged or abnormal wear of drive shaft.	Replace.
	Play in drive shaft and hub splines.	Replace.
	Abnormal wear, play or seizure of wheel bearing.	Replace.
SHIMMY	Improper wheel alignment.	Check for faulty components. Repair/Replace as necessary.
	Malfunction of front steering or suspension.	Repair/Replace as necessary.
EXCESSIVE NOISE	Broken boot, grease leakage.	Replace, Repack grease.
	Bent, damaged or abnormal wear of drive shaft.	Replace.
	Play of drive shaft and hub spline.	Replace.
	Abnormal wear, play or seizure of centre bearing.	Replace.
	Loose wheel nuts.	Re-torque to Specification.
	Malfunction of front suspension and steering.	Adjust or Replace.

SECTION 2 — DRIVE SHAFTS AND TRANSFER SHAFT

SPECIFICATIONS

Drive shaft

Joint type — outer ..... Birfield Joint
— inner ..... Angular Contact Tripod Joint (4 cyl. models)
Free Ring Tripod Joint (6 cyl. models)

NOTE: From 22nd Nov. 1993 Angular Contact Tripod Joints (ACTJ) are fitted to the inner joints on TR 5,6 - 0 - 41/45 and KR 8,6 - 0 - 41/45.

F.T.J. and A.C.T.J. specified boot band length ..... 79 ± 3 mm
Spline sizes — 6 cyl. models ..... 27 tooth spline
— 4 cyl. models 15" wheels ..... 27 tooth spline
— 4 cyl. models 14" wheels ..... 25 tooth spline
LH and RH shaft diameter
— 6 cyl. models ..... 25.4 mm
— 4 cyl. models ..... 24 mm
Drive shaft run out ..... 1.2 mm max.

Transfer shaft

Diameter (ALL) ..... 29 mm
Bearing type ..... Radial ball bearing

Shaft-length and Joint type chart

*Model Eng/Trans Code	LH Shaft length	Transfer Shaft length	RH Shaft length	Outer Joints	Inner Joints
KR - 8	407 mm	287 mm	382 mm	BJ100	FTJ 100
KR - 7	407 mm	287.5 mm	394 mm	BJ100	FTJ 100
TR - 4 - X	482.5 mm	344.1 mm	370 mm	BJ100	ACTJ 95
TR - 4 - D/P	487 mm	344.1 mm	374.5 mm	BJ100	ACTJ 95
TR - 1, 3	487 mm	344.1 mm	374.5 mm	BJ100	ACTJ 95
TR - 2	487 mm	344.1 mm	374.5 mm	BJ100	ACTJ 95

***Refer to Group 00 for explanation of V.I.N. Eng/Trans code.**

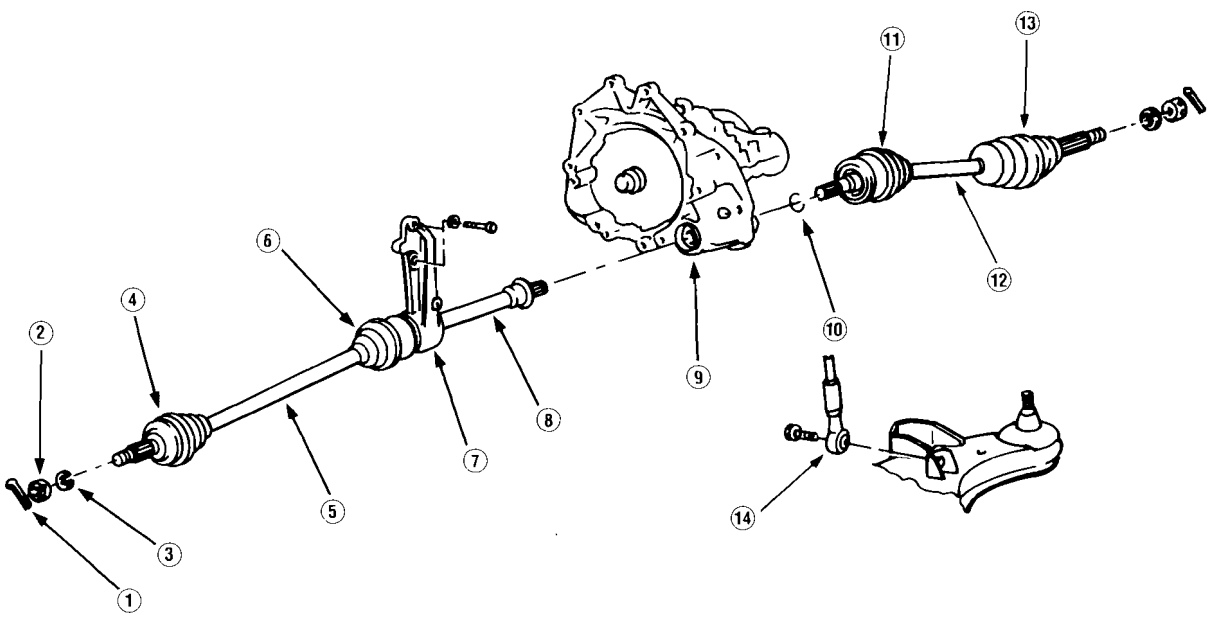
SPECIAL TOOLS

E2237	Puller — ball joint
MB990930	Remover/Installer — Transfer shaft bearing
MB991248	Remover — Transfer shaft
MB991172	Installer — Transfer shaft
E2M45A	Secure — wheel bearing
MB990938	Adaptor
MB990932	Installer — Centre bearing
MB990930	Remover — Centre bearing

TORQUE SPECIFICATIONS

	Nm
Drive shaft retaining nut	200-260
Centre bearing bracket to cylinder block bolt	45
Tie rod end to knuckle nut	24-33
Ball joint to knuckle nut	59-71
Wheel nuts	90-110
Front height sensor rod retaining bolt	22
Front speed sensor retaining bolt	12

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1. Split pin
2. Drive shaft retaining nut
3. Washer
4. L.H. Birfield joint
5. L.H. Drive shaft
6. L.H. Tripod joint
7. Centre bearing/bracket assembly
8. Transfer shaft
9. Transmission
10. Retainer
11. R.H. Tripod joint
12. R.H. Drive shaft
13. R.H. Birfield joint
14. — Vehicles with A.E.C.S. — Front height sensor

Fig. 1—Drive shaft and Transfer shaft layout

GENERAL INFORMATION

Drive is transmitted to the front wheels by drive shafts. Each shaft incorporates an Angular Contact Tripod Joint (A.C.T.J.)—(4 cyl.) or a Free Ring Tripod Joint (F.T.J.)-(6 cyl.), on the transmission end of the shaft and a Birfield Joint (B.J.)—(All models) on the hub end.

The applicable Tripod Joint on the right hand side shaft is splined to the differential side gear and the left hand joint is splined to a transfer shaft. The shafts are retained by an expanding ring.

The free ring tripod joint is a conventional tripod joint with a free ring added to the periphery of each of the rollers at the spider ends. The free rings are in line contact with the rollers and slide as they rotate along the groove in the outer race of the tripod joint.

The Birfield Joint on both shafts are splined to the front hub and retained by a nut.

The transfer shaft, which connects the left hand drive shaft to the differential side gear, is splined to the side gear and is supported by a bearing mounted on the cylinder block.

DRIVE SHAFTS

Removal

(1) Loosen the front wheels.
(2) Raise the front of the vehicle and support on safety stands in the locations outlined in Group 00—General Information and remove the wheels.
(3) Remove the two splash shields from underneath the front of the car.
(4) Disconnect the bottom mounting of the front height sensor. (Where fitted).
(5) Remove the drive shaft retaining nut split-pin and while applying the brakes, loosen and remove the retaining nut and washer.

NOTE: Do not apply vehicle load to the wheel bearing with the drive shaft loose or removed. If vehicle must be moved, etc., then temporarily secure the bearing with the special tool.

(6) Using a suitable puller, disconnect the lower arm ball joint from the knuckle, refer Fig. 2.

CAUTION: DO NOT STRIKE THE KNUCKLE AS DAMAGE WILL OCCUR.

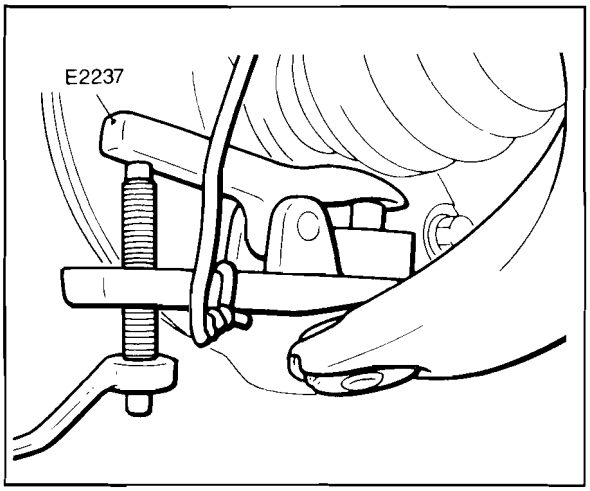


Fig. 2—Disconnecting lower arm ball joint

(7) Using a suitable puller, disconnect the tie-rod end ball joint from the knuckle.
(8) Drain the transmission to a level below the drive shaft seal lower lip.
(9) L.H.—Support the transfer shaft and remove the centre bearing bracket to cylinder block attaching bolts. If the centre bearing bracket is seized on the cylinder block, tap the centre bearing bracket lightly with a plastic hammer to remove the complete assembly.

NOTE: Do not allow the A.C.T.J. to come apart during removal of the shaft asembly.

(10) R.H.—Insert a prybar between the drive shaft and the transmission case and carefully remove, refer Fig. 3.

NOTE: Do not insert the prybar to a depth of more than 7 mm when removing the right hand shaft or the seal may be damaged.

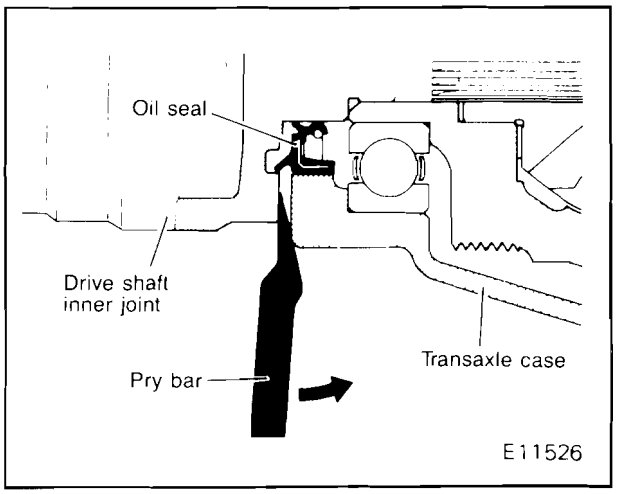


Fig. 3—Drive shaft removal

(11) Using a suitable puller or a soft-faced hammer, remove the drive shaft from the hub, refer Fig. 4.

NOTE: To prevent damage to the drive shaft thread when using a hammer, install the retaining nut onto the drive shaft so that the outer face of the nut is flush with the end of the thread.

NOTE: Do not pull on the drive shaft in an attempt at removing it. This may result in damage to the joint, circlip or the boot.

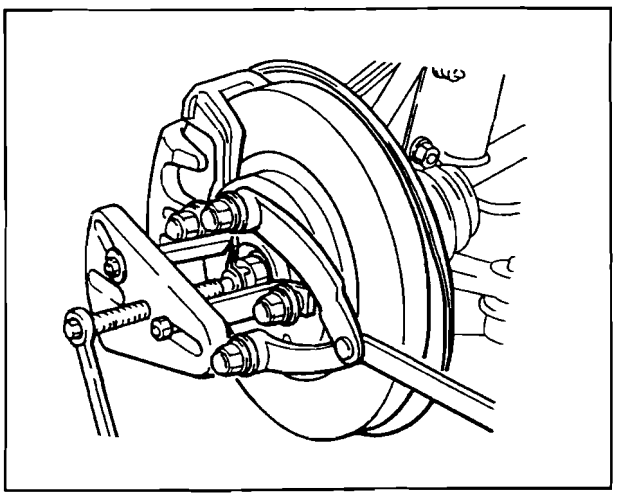


Fig. 4—Removing the drive shaft from the hub

Inspection

Perform the following inspection and replace any faulty components.

(1) Check splines for wear.
(2) Check boots for cracks, tears and deterioration.
(3) Check the joints for smooth operation.

Installation

Install by reversing the removal procedure, noting the following:

(1) Use new retaining clips.
(2) Ensure that the retaining nut washer is correctly installed, refer Fig. 5.
(3) Torque the retaining nut to the specified torque.

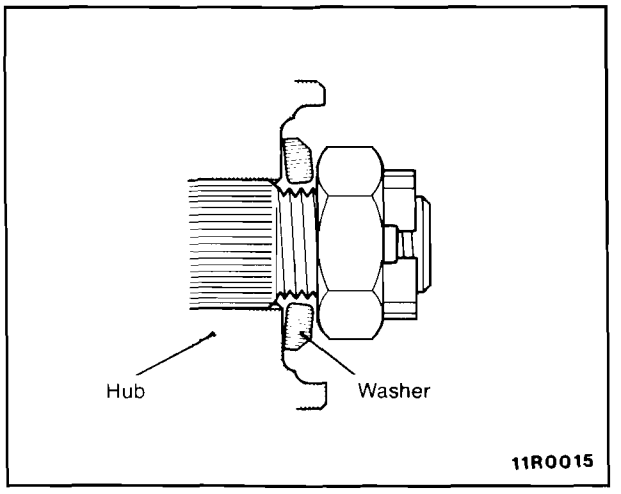


Fig. 5—Washer installation

TRANSFER SHAFT

NOTE: Always remove the complete left hand shaft assembly. Do not try to separate the drive shaft from the transfer shaft on the vehicle.

Removal

(1) Remove the complete left hand drive shaft assembly as previously described.
(2) Remove the T.J. large boot band and roll back the boot.

NOTE: When removing the large boot band from an A.C.T.J. take care to support the outer race, as when the band is removed the outer race will slide freely off the inner race.

(3) Vehicles with A.C.T.J.:—simply separate the shaft/tripod assembly from the joint housing.
(4) Vehicles with F.T.J.:—Refer to F.T.J. joint disassembly—this group.

(5) With either type of joint disassembled, use a suitable tool to aid the pressing out of the seal plate and subsequently the shaft, refer Fig. 6.

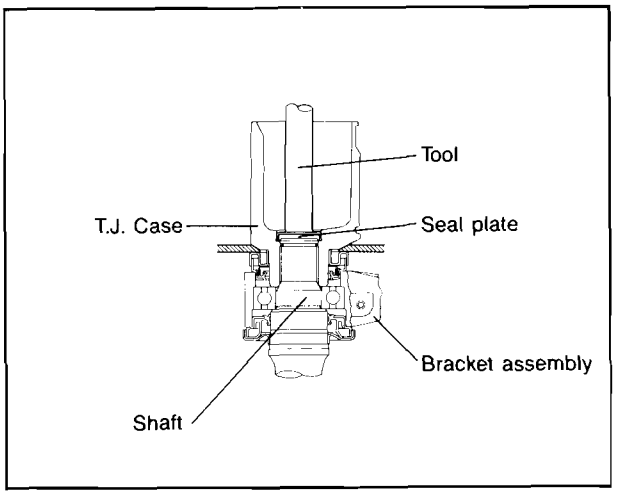


Fig. 6—Seal plate and shaft removal

(6) Press the tool directly against the seal plate. The tool under pressure will puncture and deform the seal plate and push out the transfer shaft underneath.

NOTE: Do not reuse seal plate. Use a new seal plate each time one is removed.

Bearing Replacement

(1) Remove the drive shaft retaining clip.
(2) Position the shaft assembly in a press, support the bearing housing and press the shaft out of the bearing, refer Fig. 7.

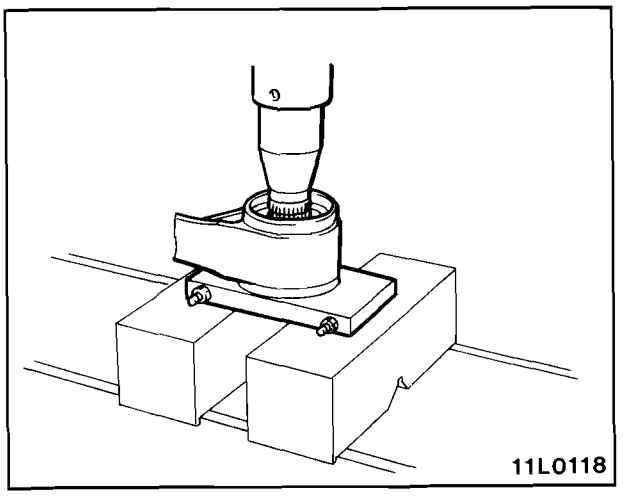


Fig. 7—Pressing the shaft from the bearing

(3) Remove the dust seals from the bearing housing using a suitable lever.
(4) Position the bearing housing in a press and using a suitable tool, press the bearing out of the housing, refer Fig. 8.

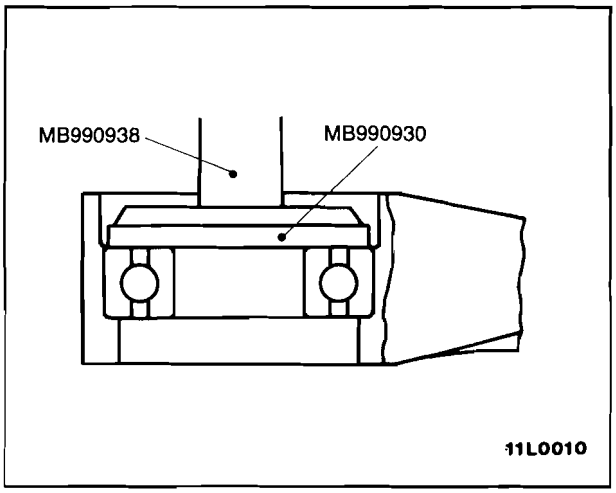


Fig. 8—Pressing the bearing out

(5) Apply multi-purpose grease to the centre bearing and inside the centre bearing bracket.
(6) Using a suitable tool, press the new bearing into the bracket housing, refer Fig. 9.

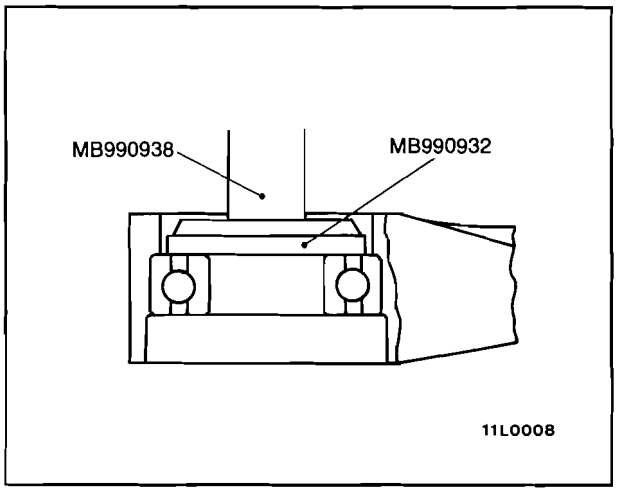


Fig. 9—Pressing a new bearing in

(7) Apply a coat of multi-purpose grease to the rear surfaces of the dust seals, refer Fig. 10.
(8) Using a suitable installer, install the dust seal so that its surface runs even with that of the centre bearing bracket.
(9) Apply multi-purpose grease to the transfer shaft spline and position the housing in a press, supported by a suitable tool and press the transfer shaft into the bearing, refer Fig. 11.

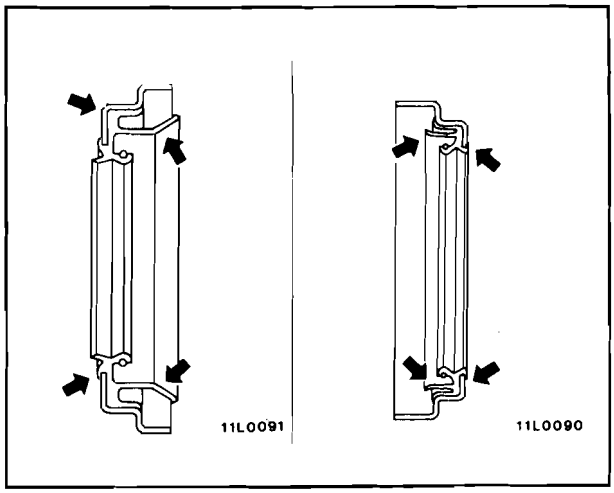


Fig. 10—Greasing dust seals

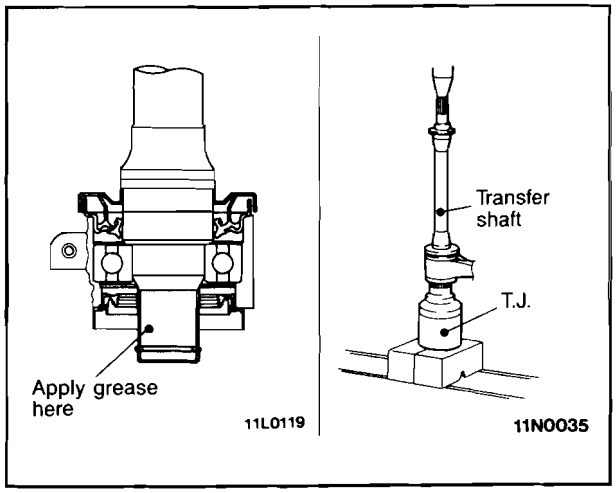


Fig. 11—Pressing the transfer shaft in

(10) Using a suitable tool and socket, press the seal plate into the T.J. case, refer Fig. 12.
(11) For joint assembly, refer to Drive shaft joint servicing — Section 3.

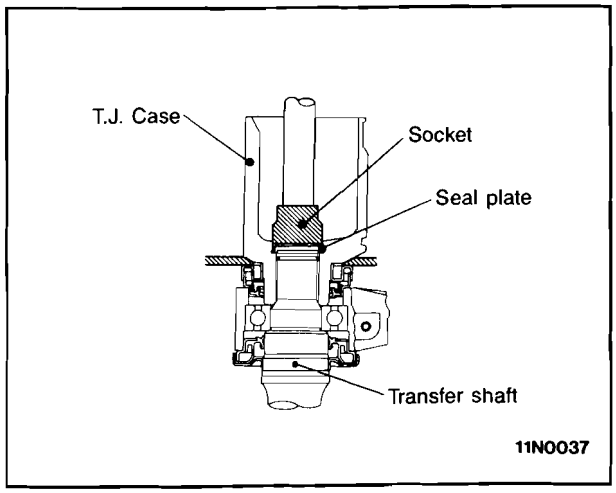


Fig. 12—Seal plate installation

SECTION 3—DRIVE SHAFT JOINT SERVICING

GENERAL INFORMATION

The following section contains the relevant information that allows you to remove, disassemble, inspect and reassemble the drive shaft joints. There is a number of kits available that will contain the necessary parts to complete the specific replacing or repairing job at hand.

BIRFIELD JOINT

NOTE: Always remove the complete left hand shaft assembly. Do not try to separate the drive shaft from the transfer shaft on the vehicle.

Disassembly

(1) Clamp the shaft in a soft jaw vice.
(2) Remove the large boot clamp, refer Fig. 1.
(3) Pull back the boot to expose the internals of the joint.

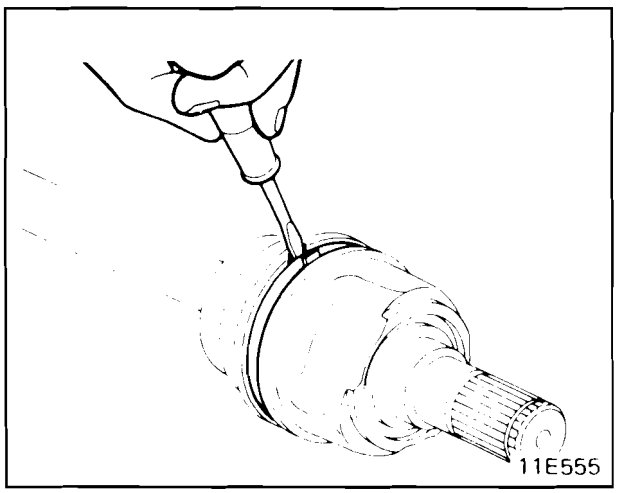


Fig. 1—Removing boot band

(4) Hold the stem of the joint and firmly strike the face of the B.J. with a soft faced hammer. The joint should begin to slide off the shaft. If no movement occurs, strike the B.J. again, refer Fig. 2.

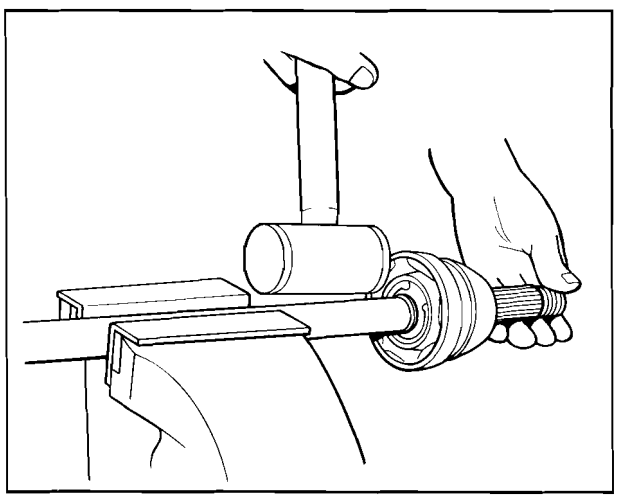


Fig. 2—Striking the B.J.

NOTE: The retaining clip on the end of the shaft should not be reused.

NOTE: Tape the spline before attempting to remove the boot.

Inspection

(1) Inspect joint for obvious damage. Replace joint if damage is found.
(2) Clean the joint with a suitable solvent. Inspect for excessive wear or free play and for the presence of rust or any internal damage. If any of these conditions are found, replace the joint.

NOTE: The joint should not be disassembled but replaced as a whole unit.

Assembly

(1) Place the shaft assembly in a soft jawed vice, refer Fig. 3.

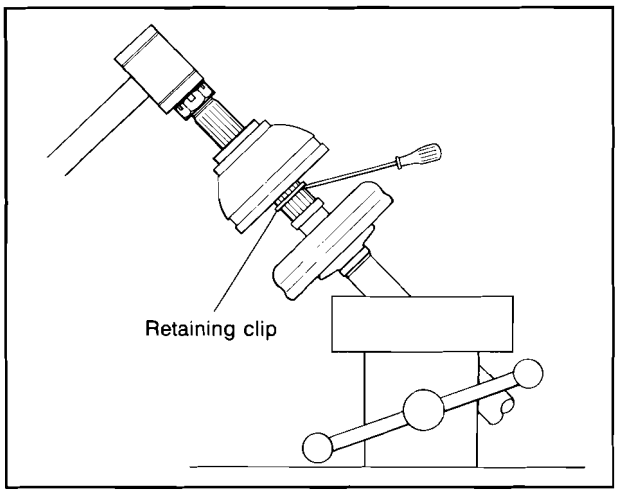


Fig. 3—Replacing the joint

NOTE: If fitting a new boot, install it on the shaft before the next step.

(2) Install new retaining clip on shaft, refer Fig. 3.
(3) Install the drive shaft retaining nut onto the shaft of the B.J. so that the outer face of the nut is flush with the end of the thread.
(4) Align the shaft spline with the joint internal spline and whilst compressing the retaining clip, lightly tap the joint shaft with a soft faced hammer. Ensure the retaining clip does not jam between the splines. Keep tapping until the circlip on the shaft presses hard-up against the inner race on the B.J., refer Fig. 3.
(5) Replace the grease in the joint. Any excess grease (from the supplied packs) should be placed in the boot, refer Fig. 4.

NOTE: The grease in the repair kit should be divided in half for use, respectively, at the joint and inside the boot. The drive shaft joints use special grease. Do not mix old and new or different types of grease.

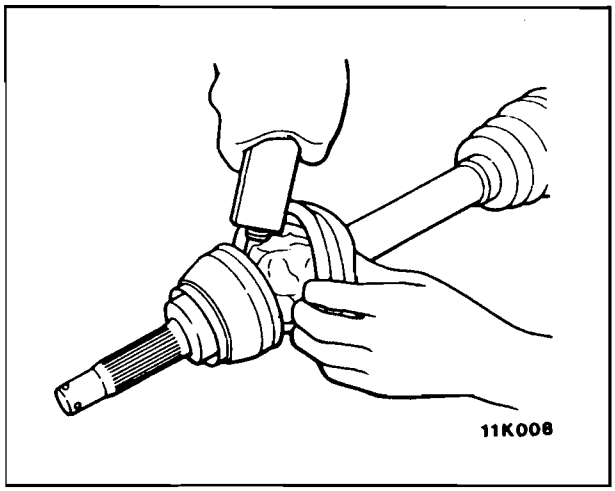


Fig. 4—Replacing the grease

(6) Refit the boot and fasten the boot clamps securely.

NOTE: Always use a new boot clamp when replacing or refitting boot.

ANGULAR CONTACT TRIPOD JOINT

Disassembly

(1) Remove the large boot clamp and roll the boot back, away from the joint.

NOTE: Support the outer race. When the boot comes off, the outer race will slide off the inner race freely.

(2) As you remove the inner race from the outer race, mark them both to gain correct alignment for assembly.

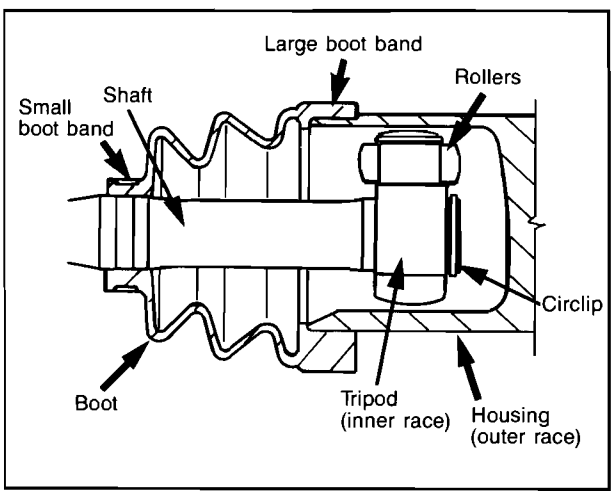


Fig. 5—A.C.T.J. components

(3) Remove the circlip from the end of the shaft and lightly tap the tripod until it is removed, refer Fig. 6.

NOTE: Do not disassemble the rollers from the tripod.

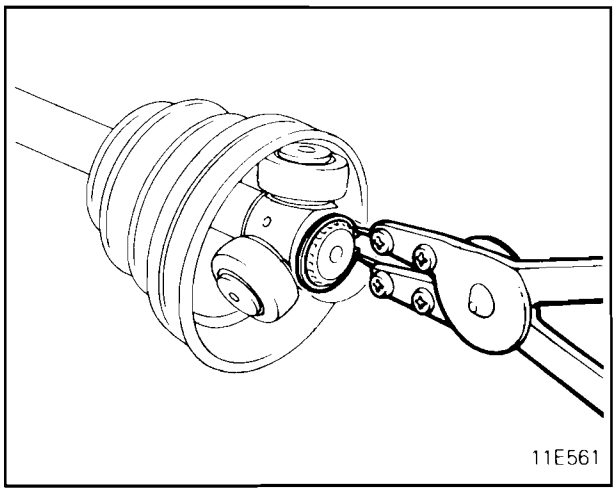


Fig. 6—Removing the tripod

(4) Tape the splines on the end of the shaft and then remove the boot, refer Fig. 7.

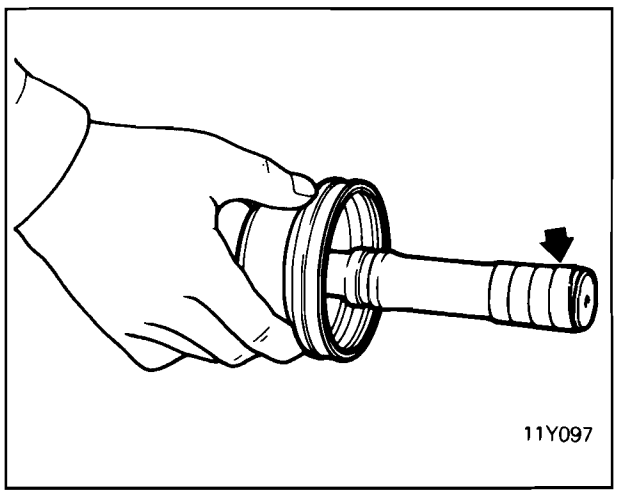


Fig. 7—Removing the boot

NOTE: The circlip on the end of the shaft and the boot bands must not be used again. Replace with new ones.

(5) Thoroughly clean all parts and be sure to remove all the old grease.

Inspection

(1) Check the rollers for excessive wear and pitting.
(2) Check the tracks for excessive wear and pitting.
(3) Check for roughness when rotating the rollers.
(4) If any of the above conditions have been observed, the A.C.T.J. should be replaced.
(5) Also check the boots for tears and deterioration.

Assembly

(1) Slide the boot and small boot clamp onto the shaft. (Do not tighten yet)! Remove tape.

(2) Press the inner race (tripod assembly) onto the shaft. This should press on with little manual pressure.
(3) Replace the circlip.

NOTE: Ensure that the inner race is aligned as shown in Fig. 8, with the chamfer facing away from the end of the shaft. The chamfer is on the tripod assembly around the shaft location hole.

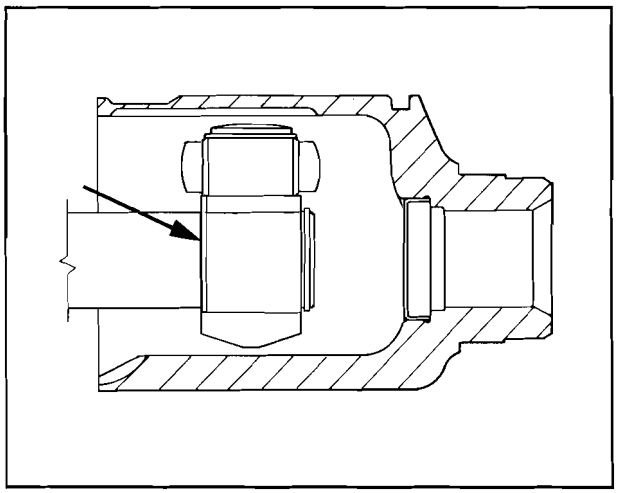


Fig. 8—Chamfer location

(4) Fill the outer race/housing with half of the grease supplied in the service kit.
(5) Lubricate the inner race in the positions shown in Fig. 9.
(6) Slide the outer race onto the inner race and align the boot.
(7) Tighten the small boot clamp and add the rest of the grease to the boot.
(8) With a suitable tool, lift the boot and slide the outer race to the mid position of its depth and remove the tool, refer Fig. 10.

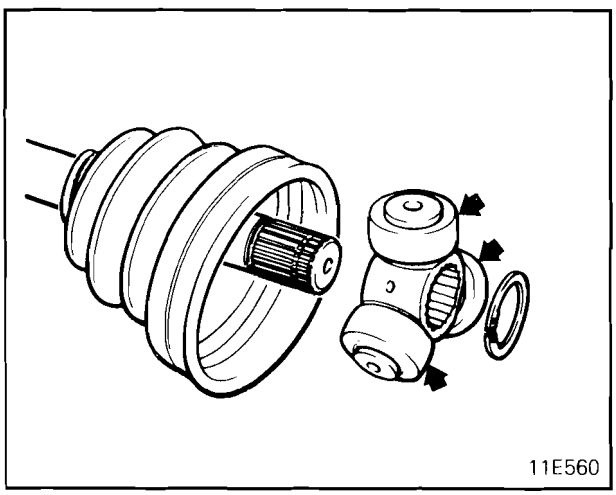


Fig. 9—Inner race lubrication

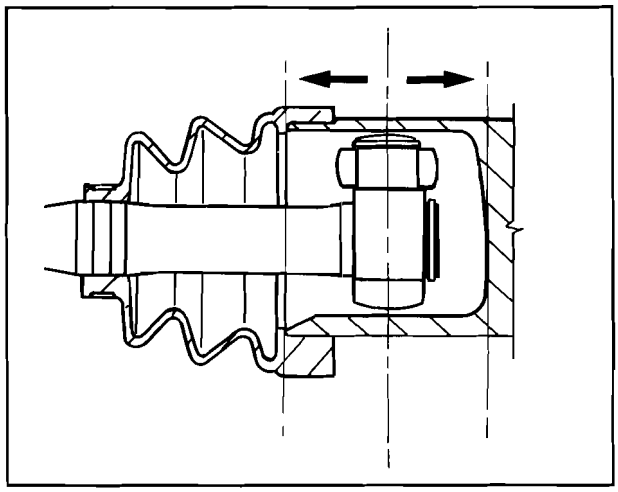


Fig. 10—Inner and outer race location

(9) Adjust the length from the small boot band to the large boot band to meet the specification, refer Fig. 11.
(10) Make sure that the bending part of the clamp is over the thin part of the boot, refer Fig. 12, and tighten large clamp.

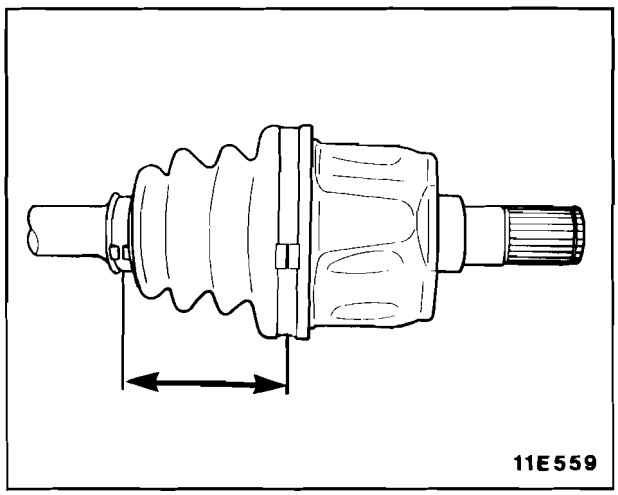


Fig. 11—Setting boot length

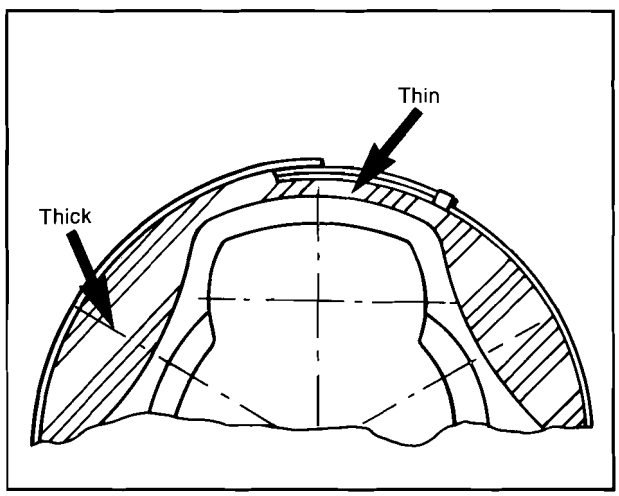


Fig. 12—Clamping detail

FREE RING TRIPOD JOINT

Disassembly

(1) Remove the large boot clamp and roll the boot back, away from the joint.
(2) Remove the retainer from the outer race/housing with a screwdriver.

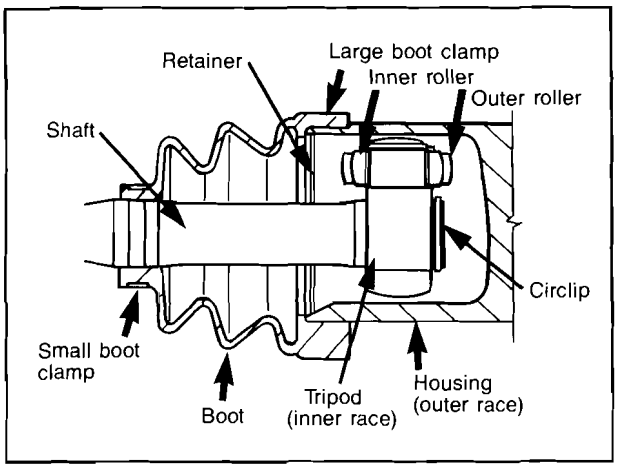


Fig. 13—F.T.J. component layout

(3) Carefully remove the outer race. It is important to do this slowly as the outer rollers will fall off of the inner rollers.

NOTE: Do not allow the outer rollers to fall to the floor or any other hard surface as damage could occur.

(4) Mark the inner race rollers and the outer race to ensure correct alignment if reassembly is required.
(5) Remove the circlip on the end of the shaft and carefully press the inner race off, refer Fig. 14.

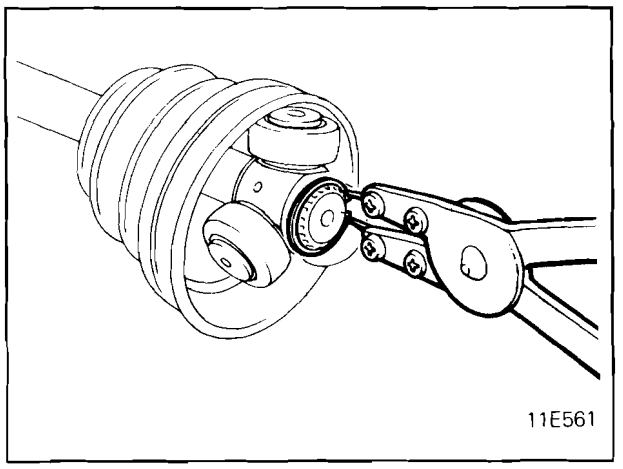


Fig. 14—Removing the inner race

(6) Remove small boot clamp and tape the splines.
(7) Remove the boot (if necessary).

NOTE: Do not disassemble the inner rollers from the tripod.

Inspection

(1) Check the rollers for excessive wear and pitting.
(2) Check the tracks for excessive wear and pitting.
(3) Check for roughness when rotating the inner rollers.
(4) If any of the above conditions have been found, replace the complete F.T.J. assembly.

Assembly

(1) Replace the boot (if required) and slide it on to the shaft.
(2) Locate small clamp position, install and tighten small clamp.
(3) Remove tape.
(4) Press the inner race onto the shaft. This should take little manual pressure to achieve.
(5) Install new circlip on shaft.

NOTE: Ensure that the inner race is aligned as shown in Fig. 15, with the chamfer facing away from the end of the shaft. The chamfer is on the tripod assembly around the shaft location hole.

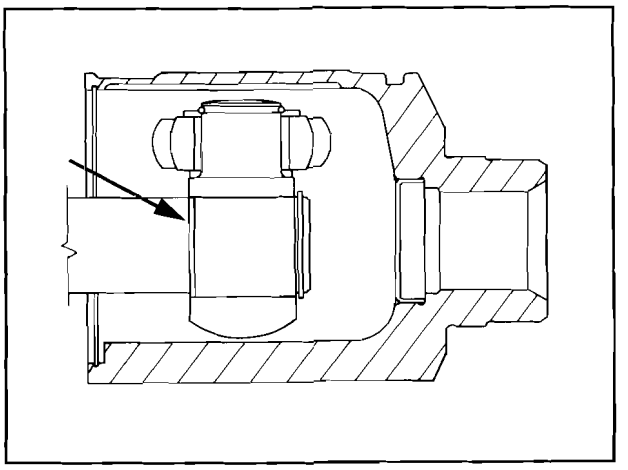


Fig. 15—Chamfer location

(6) Fill the outer race with half of the grease supplied in the service kit.
(7) Using some grease to hold them, place the outer rollers onto the inner rollers and guide the inner race into the outer race, refer Fig. 16.
(8) Install the large retainer into the outer race by hand.
(9) Add the rest of the grease to the F.T.J. boot.
(10) With a suitable tool, lift the boot and slide the outer race to the mid position of its depth and remove the tool.

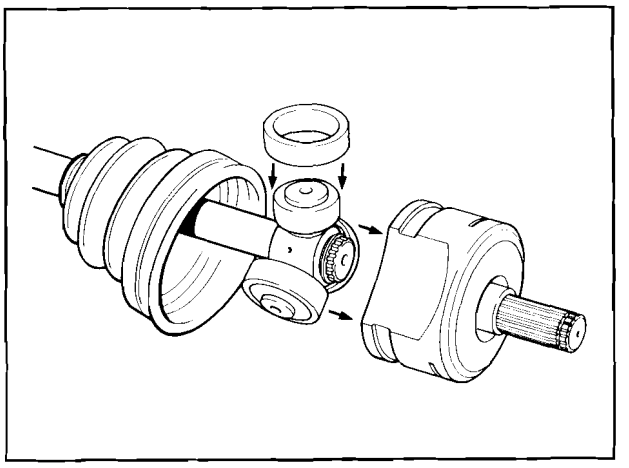


Fig. 16—F.T.J. assembly

(11) Locate the large boot clamp.
(12) After setting the F.T.J. clamp width to within specifications, tighten the clamp.

SECTION 4 — HUBS

SPECIFICATIONS

	256 mm Brake Disc (14" Wheels)	276 mm Brake Disc (15" Wheels)
Wheel bearing		
Type	Double row angular contact ball bearing	←
Dimensions	80 x 40 mm	84 x 45 mm
Axial play	0.008 mm	←
Starting torque	1.8 Nm	←
Axle assembly run-out—Lateral	0.05 mm (max)—measured at 8 mm from the outside diameter of the brake disc	←
—Radial	0.1 mm (max)—measured at the wheel spigot.	←
Number of internal splines	25	27
Front height sensor length (A.E.C.S.)	N/A	269.5 ± 0.5 mm
Speed sensor pole piece to rotor clearance	0.5 to 0.9 mm	←

SPECIAL TOOLS

E2M49	Remover—inner race
E2237	Puller-balljoint
E2M45A	Front hub remover/installer
E2M46	Hub knuckle arm bridge
MB990890	Installer—Front wheel bearing
MB990883	Handle—with MB990890
MB990932	Remover—front wheel bearing
MB990326	Adaptor

TORQUE SPECIFICATIONS

	Nm
Drive shaft retaining nut	200 to 260
Knuckle to strut bolt	88 to 103
Brake caliper to knuckle bolt	78 to 98
Ball joint to knuckle nut	59 to 71
Tie rod to knuckle nut	24 to 33
Stablizer bar link nuts	34 to 44
Wheel nuts	90 to 110
Height sensor rod retaining bolt	22
Front speed sensor retaining bolt	12
Front speed sensor rotor to hub bolt	9

GENERAL INFORMATION

The knuckle, which is mounted between the lower end of the strut and the lower arm assembly, supports the hub and disc assemblies. The front wheel bearing, a double row angular contact type, is located in the knuckle.

This bearing, featuring a two piece inner race, requires no adjustment as the preload is set by the drive shaft retaining nut torque.

HUB AND KNUCKLE

Removal

(1) Loosen the front wheel nuts, raise the front of the vehicle and support on safety stands in the locations shown in Group 00—General Information.

(2) Remove the front wheels.

NOTE: Remove bottom bolt from front height sensor (A.E.C.S.) where fitted.

Remove speed sensor bracket retaining bolts and remove speed sensor assembly (A.B.S.) where fitted.

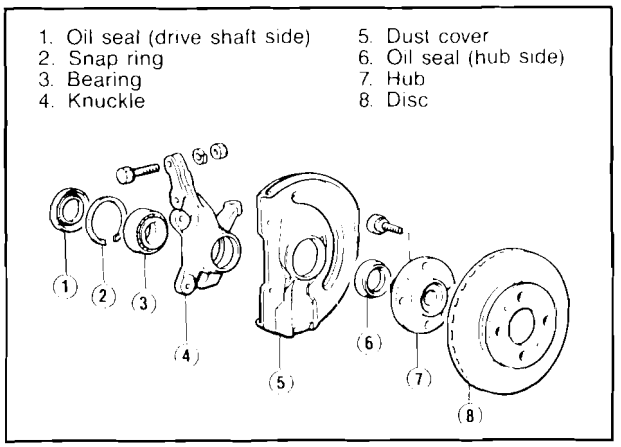


Fig. 1—Hub and knuckle components (typical)

(3) Remove the drive shaft split pin and while applying the brakes, loosen and remove the retaining nut and washer.

(4) Remove the brake caliper retaining bolts and remove the caliper.

NOTE: Suitably support the caliper to avoid any damage to the brake hose.

(5) Remove the disc assembly from the hub.

NOTE: Do not use a hammer to remove the disc as damage could occur.

(6) Disconnect the stablizer bar from the lower arm.

(7) Using a suitable puller, disconnect the ball joint from the knuckle, refer Fig. 2.

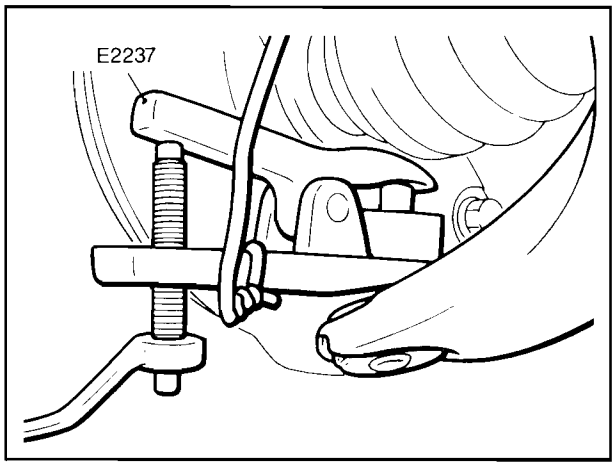


Fig. 2—Disconnecting the ball joint

(8) Disconnect the tie rod end from the knuckle using a suitable puller.

CAUTION: Do not strike the knuckle as damage will occur.

(9) Remove the drive shaft from the hub using a suitable puller, refer Fig. 3, or by driving the shaft out with a soft faced hammer.

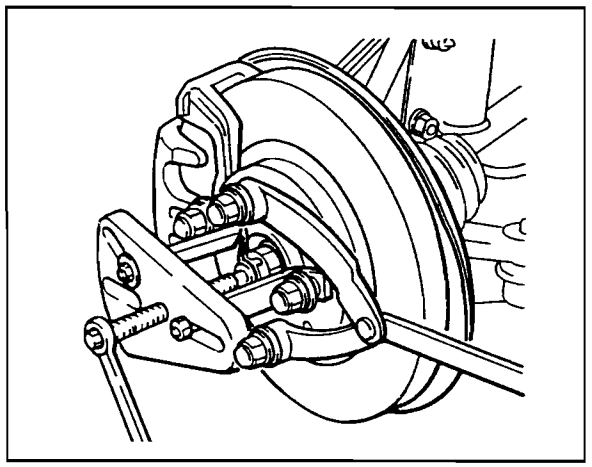


Fig. 3—Removing the drive shaft

NOTE: To prevent thread damage when using a hammer, install the retaining nut onto the thread so that the outer face of the nut is flush with the end of the thread.

NOTE: Care should be taken when removing the shaft from the hub as pulling on the drive shaft could result in damage to the joint, the circlip or the boot.

(10) Remove the knuckle to strut attaching bolts and remove the hub and knuckle as an assembly.

Installation

Install by reversing the removal procedure taking note of the following:

(1) When fitting the drive shaft retaining nut and washer, ensure that the washer is installed in the correct direction, refer Fig. 4.

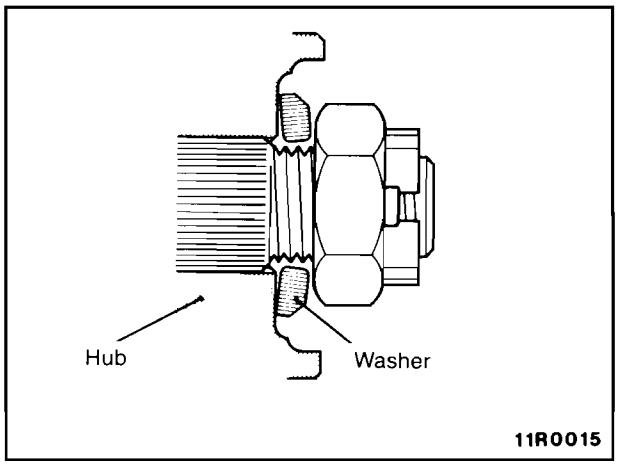


Fig. 4—Drive shaft washer installation

(2) Re-connect the stablizer bar — See Group 33A for procedure.

(3) When replacing the front height sensor (vehicles with A.E.C.S.) make sure that the length of the rod 'A' is to specification and the measurements 'B' are uniform. Height sensors must be installed so that the ball joint at the rod end is at rocking centre, refer Fig. 5.

(4) Install speed sensor assembly (A.B.S. where fitted) and check rotor to pole piece clearance as outlined in Group 35 — Section 7.

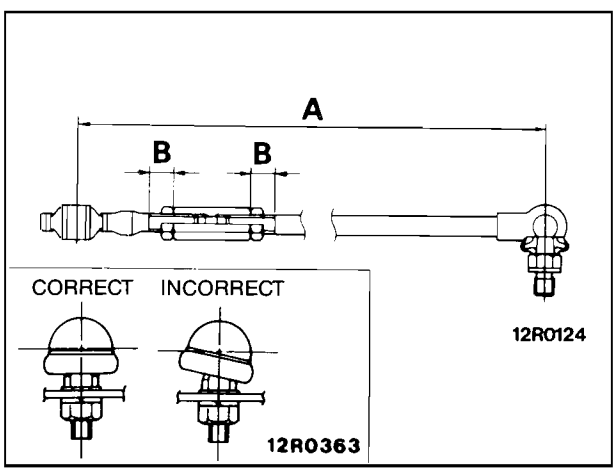


Fig. 5—Height sensor installation

Disassembly

(1) Secure the hub and knuckle assembly in a vice.
(2) Fit special tools E2M46 and E2M45A to the assembly. Insert the spigot in the ball joint hole and the bolt through the bottom knuckle to strut mounting hole, refer Fig. 6.

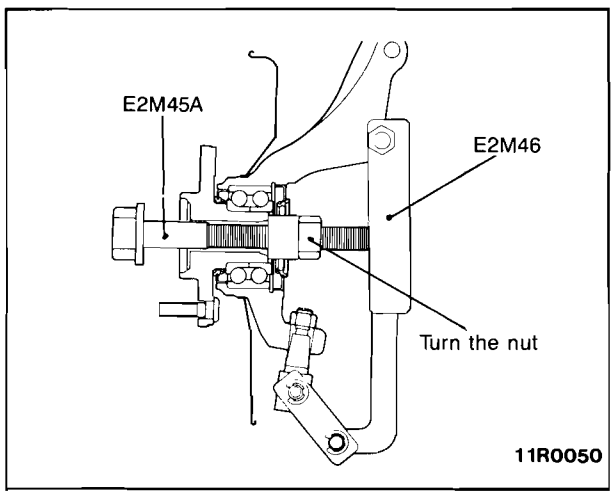


Fig. 6—Removing the hub from the knuckle

(3) Using the special tools, remove the hub from the knuckle.

NOTE: Always use the special tools when separating the hub from the knuckle. Any attempt to separate them by using a hammer will result in damage to the bearing.

(4) Crush the oil seal in two places as shown in Fig. 7, to allow for puller fitment.
(5) Using special tool E2M49 remove the outer section of the bearing inner race, refer Fig. 8

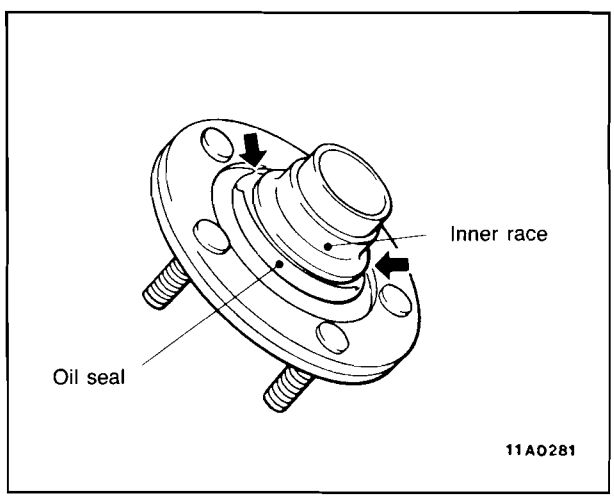


Fig. 7—Locations for inserting puller

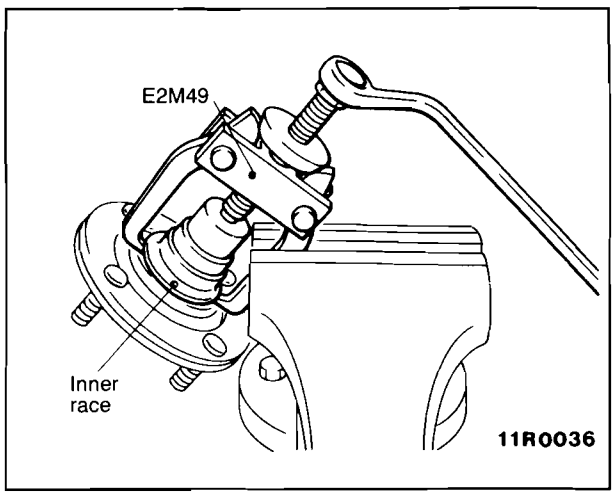


Fig. 8—Removing bearing inner race

(6) Remove the oil seal from the hub.
(7) Remove the oil seal from the knuckle.
(8) Remove the bearing snap ring, refer Fig. 9.
(9) Fit the outer section of the bearing inner race into the hub.
(10) Using special tools shown press out the bearing, refer Fig. 9.

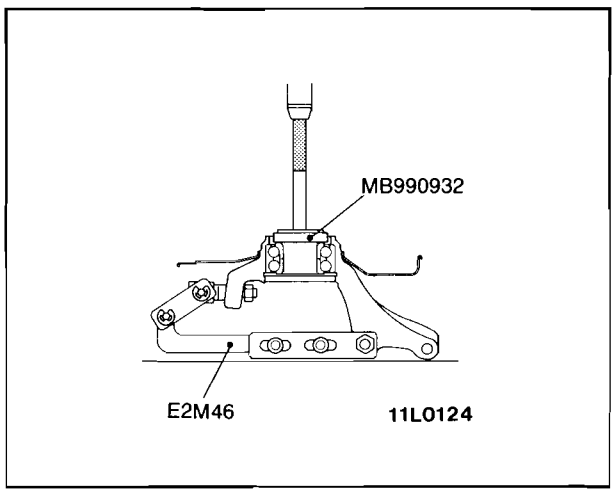


Fig. 9—Removing the front wheel bearing

Inspection

Using a suitable solvent, clean all components then perform the following inspection, replacing any faulty parts.
(1) Check the knuckle assembly for cracks and damage.
(2) Always use a new wheel bearing.
(3) Check the hub assembly for cracks, damage and worn drive shaft splines.

Assembly

NOTE: Always use new seals and wheel bearings. These are not to be reinstalled once removed.

(1) Pack the new bearing with the specified grease (multi-purpose, non-melt type No. 2).
(2) Apply a thin coating of multi-purpose grease to the knuckle and bearing contact surfaces.
(3) Using the special tools or a suitable alternative, press the bearing into the knuckle, refer Fig. 10, then refit the bearing snap ring.

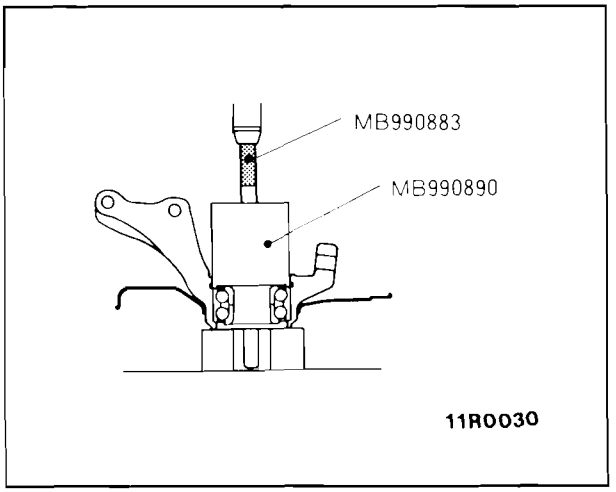


Fig. 10—Fitting the wheel bearing

(4) Using a suitable tool, drive the oil seal (hub side) into the knuckle until it is flush with the surface of the knuckle.
(5) Apply the specified grease to the lip and the hub contact surface of the oil seal and using special tool E2M45A, mount the hub onto the knuckle, refer Fig. 11.
(6) Tighten the nut on the special tool to 200-260 Nm and rotate the hub to seat the bearing.

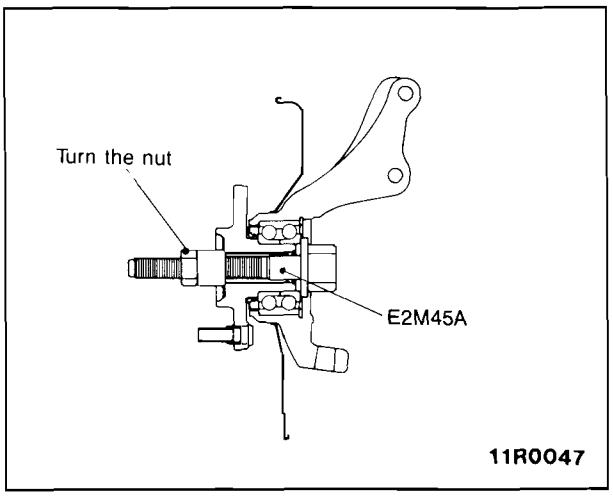


Fig. 11—Mounting the hub to the knuckle

(7) Using a suitable gauge, measure the wheel bearing starting torque. The torque should be within specifications and the hub should rotate freely and smoothly, refer Fig. 12.

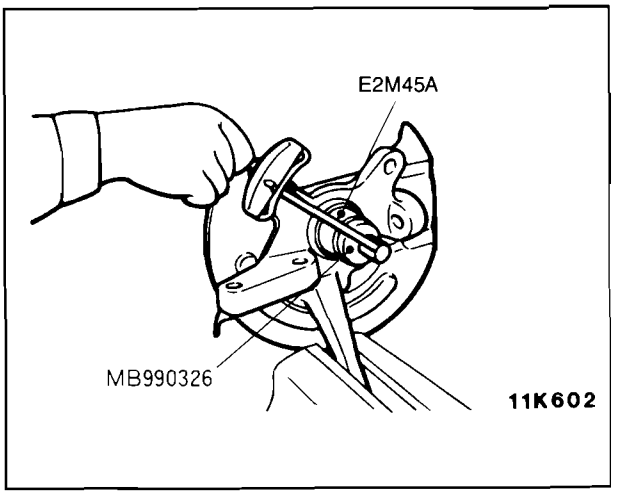


Fig. 12—Measuring bearing starting torque

(8) Using a dial indicator on a suitable support, check that the hub axial play is within specifications, refer Fig. 13.

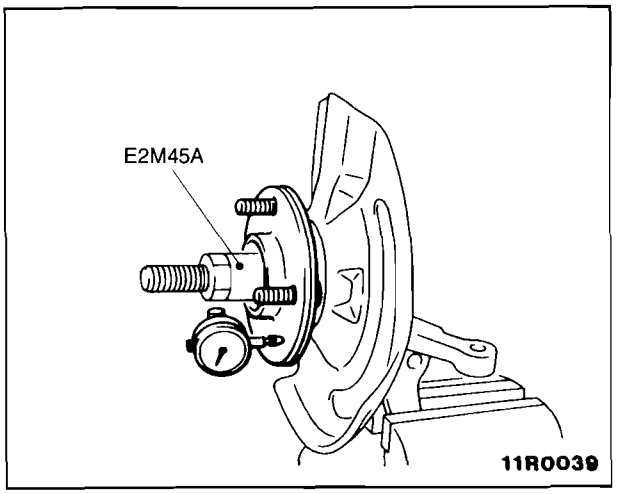


Fig. 13—Checking hub axial play

NOTE: If the bearing preload (starting torque) or hub axial play are not within specifications, then the bearing hub and knuckle have not been correctly assembled. In this case, the disassembly and assembly procedures should be repeated.

(9) Remove special tool from the knuckle assembly.
(10) Drive the oil seal (drive shaft side) into the knuckle until it contacts the snap ring, and apply the specified grease to the lip of the seal, refer Fig. 14.

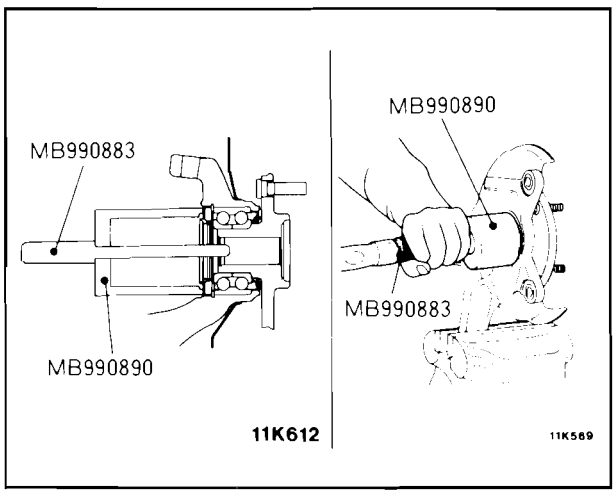


Fig. 14—Fitting oil seal to the knuckle

(11) Install the hub assembly to the vehicle and place the disc on the hub. Install 5 wheel nuts and torque to specification. Leaving the caliper off, mount the dial indicator and set the reading to be taken from 8 mm in from the disc edge (on the face). Check that the axle assembly run out is within specification, refer Fig. 15.

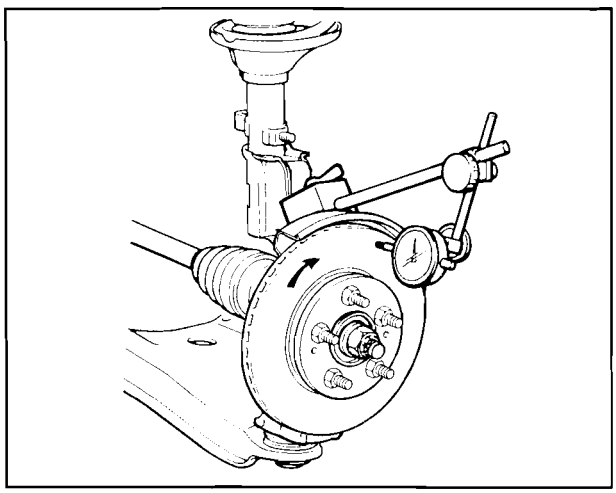


Fig. 15—Checking axle assembly run-out

GROUP 27 — REAR AXLE

SECTION 0 — INDEX

Subject	Section Number	Page Number
INDEX	0	
SERVICE DIAGNOSIS	1	
REAR AXLE	2	
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Torque Specifications		1
General Information		2
REAR AXLE HUB	3	
Wheel Bearing end Play, Rotary and Starting Torque		1
Rear Axle Hub Assembly		2

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
NOISY OPERATION	Lack of grease	Repair and replace as necessary
	Incorrect freeplay	Replace as necessary
	Incorrect turning torque	Replace as necessary
VIBRATIONS	Damaged rear wheel bearings	Replace as necessary
	Incorrect wheelbearing freeplay	Replace as necessary
	Axle assembly deformed	Replace axle assembly
	Lack of grease	Repair and replace as necessary
UNEVEN VEHICLE HEIGHT	Deformed or damaged axle assembly	Replace axle assembly

SECTION 2 — REAR AXLE

SPECIFICATIONS

Wheel bearing	
Type	Unit ball bearing
Wheel bearing end play	0.05 mm (or less)
Rear hub rotary resistance	31 N (or less)
Rear hub starting torque	1.8 Nm (or less)

TORQUE SPECIFICATIONS

	Nm
Wheel bearing lock nut	200-260
Caliper assembly mounting bolts	50-60
Wheel nuts	90-110
Vehicles with A.B.S.	
Rotor to hub bolts	9-14
Speed sensor mounting bolt	9-14

GENERAL INFORMATION

The rear hub incorporates a unit double row ball bearing which utilises the hub as the outer bearing race and is non-adjustable. Therefore, the complete hub/bearing assembly must be replaced as a unit if required.

Models equipped with an anti-skid brake system (A.B.S.), are provided with a rear rotor (for detecting the wheel speed) on the inner side of the hub.

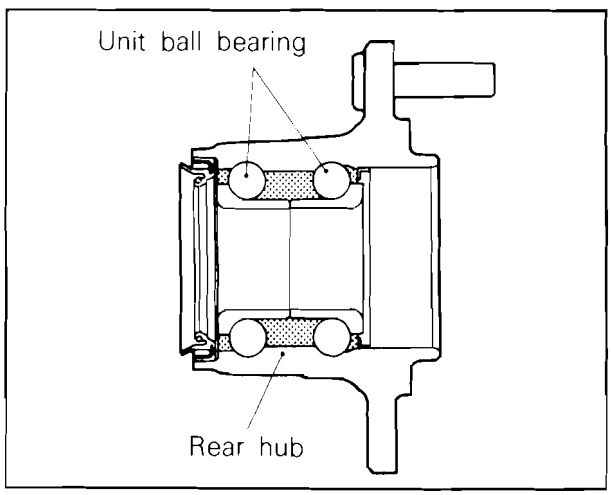


Fig. 1 — Hub assembly

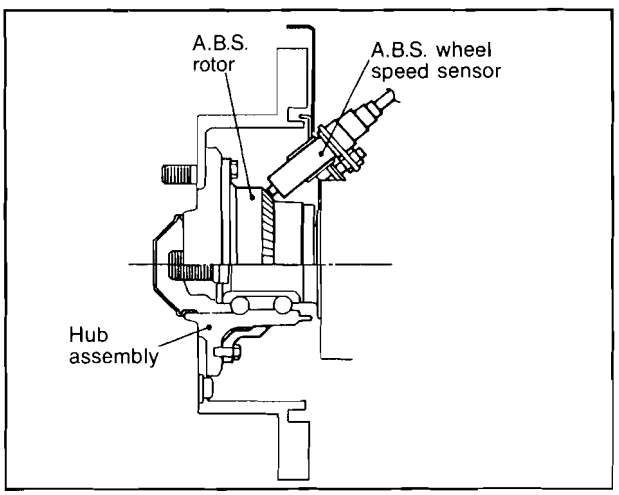


Fig. 3 — Hub with A.B.S.

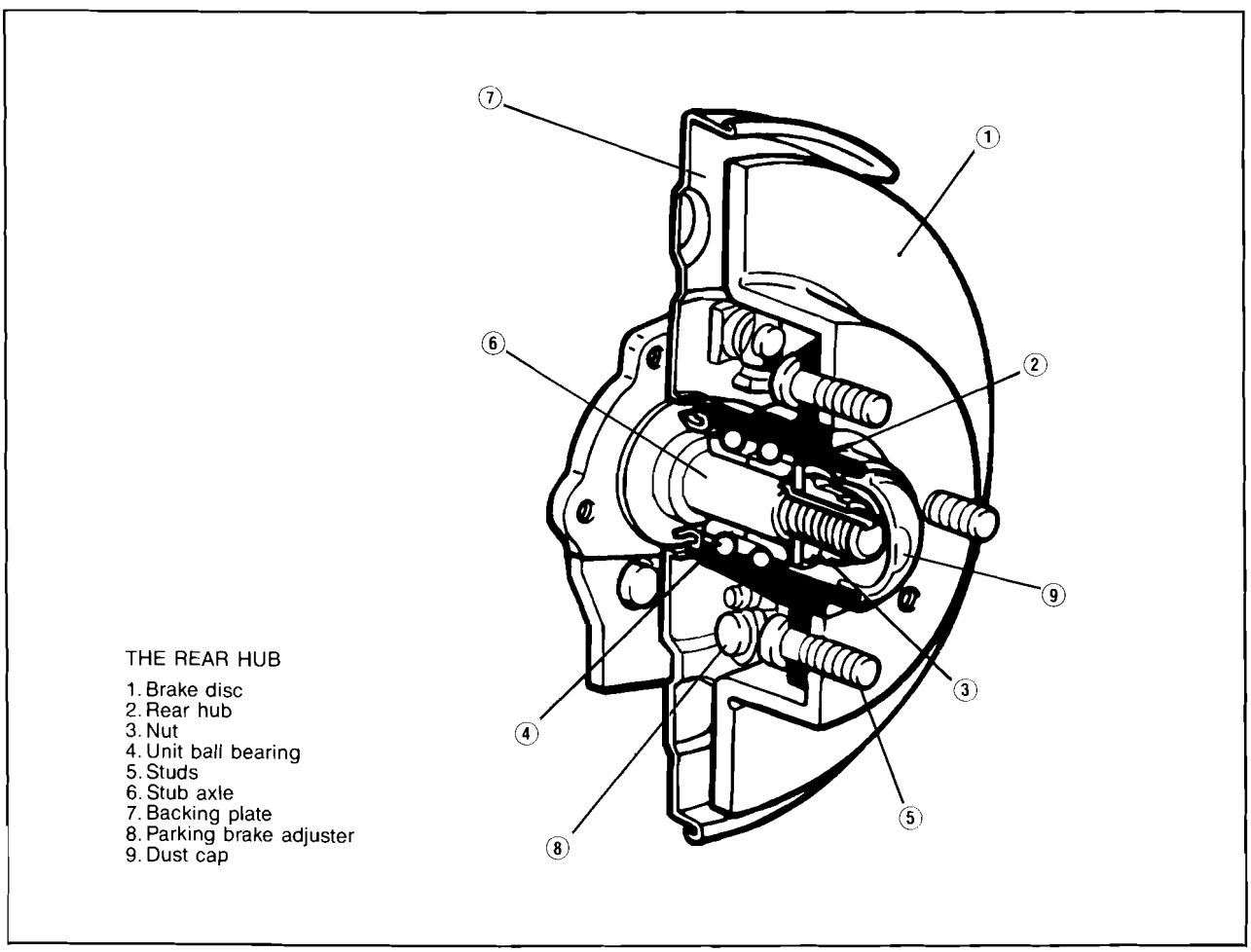


Fig. 2 — Rear hub assembly components

SECTION 3 — REAR AXLE HUB

WHEEL BEARING END PLAY, ROTARY AND STARTING TORQUE

(1) Raise rear of vehicle and support on jack stands (refer to Group 00 — General Information for jacking points).

(2) Remove rear wheel and release the parking brake.

(3) Remove brake caliper assembly and brake disc.

(4) Check bearing end play with a dial gauge plunger mounted against the hub surface; then move the hub in an axial direction and check that end play is within specifications.

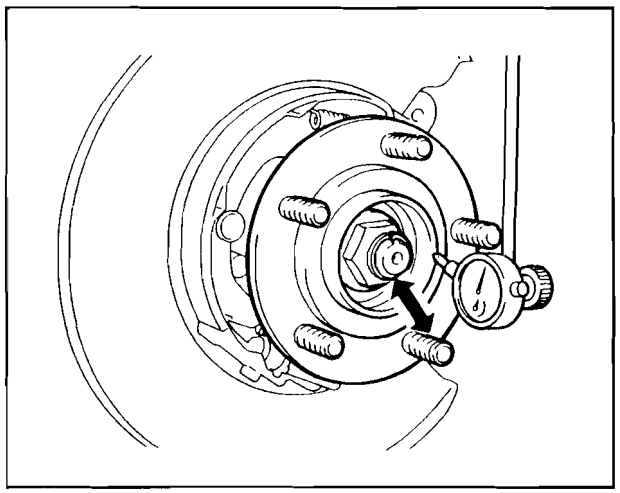


Fig. 1 — Checking bearing end play

(5) If end play is not within specifications, remove dust cap and retorque lock nut to the specified torque. If the specified end play is achieved, remove lock nut and install a new lock nut, tighten new nut to the specified torque.

NOTE: The nut is a non-reuseable part. Do not use the staked nut twice.

(6) If end play exceeds specifications, then the hub/bearing assembly must be replaced.

NOTE: Do not stake the nut until rotary and starting torque inspection has been completed.

(7) After turning the hub a few times to seat the bearing, attach a spring balance, via a length of string as shown in Fig. 2, to the hub stud, measure the rotary and starting torque of the rear hub.

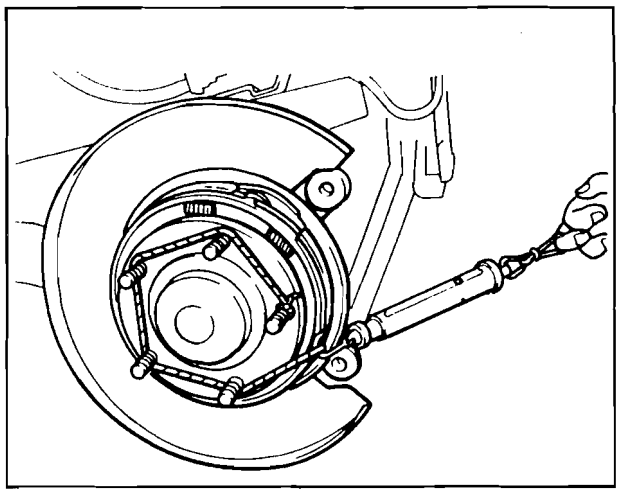


Fig. 2 — Rotary-sliding resistance check

(8) If torque is not within specifications, replace the hub/bearing assembly.

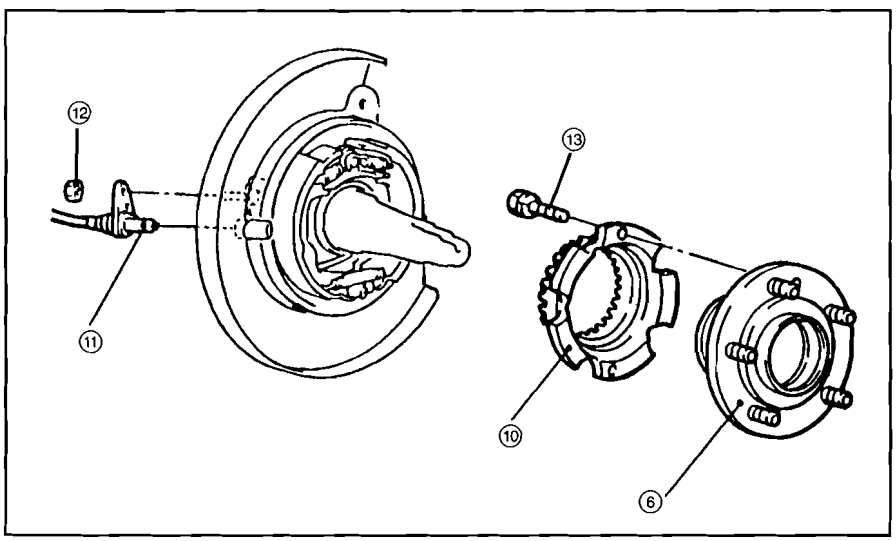
(9) Stake lock nut and install dust cap.

(10) Install brake disc and caliper assembly.

(11) Install wheel and remove jack stands.

1. Dust cap
2. Lock nut
3. Washer
4. Caliper
5. Brake disc
6. Hub
7. Wheel stud
8. Stub axle
9. Caliper mounting bolt
10. Rear rotor
11. Rear speed sensor
12. Rear speed sensor mounting nut
13. Rear rotor mounting bolt

VEHICLES WITH A.B.S.



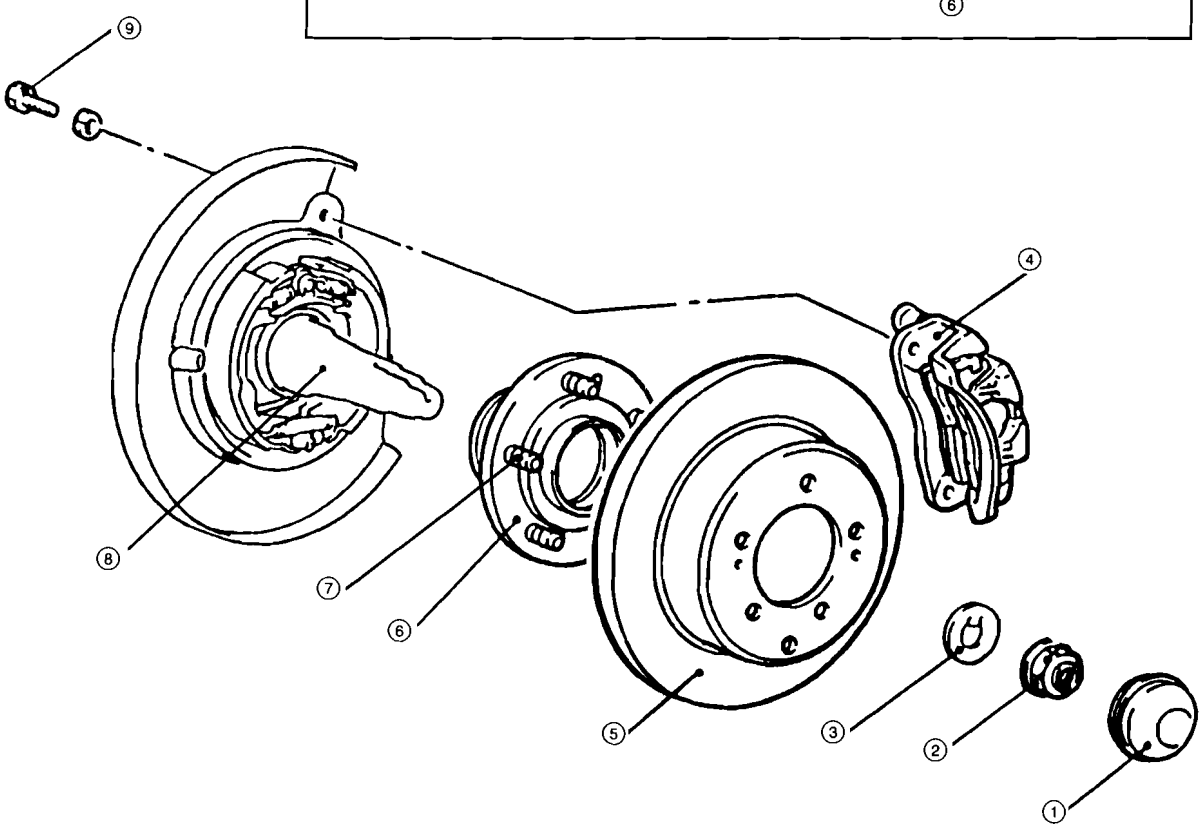


Fig. 3 — Rear axle hub assembly

REAR AXLE HUB ASSEMBLY

Removal

(1) Raise rear of vehicle and support on jack stands, refer to Group 00 — General Information for jacking points.

(2) Remove rear wheel and release parking brake.

(3) Remove brake caliper and disc assembly.

CAUTION: For vehicles with A.B.S. remove the rear speed sensor. Do not strike the end pole piece on the rotor teeth or any other parts, as damage may occur.

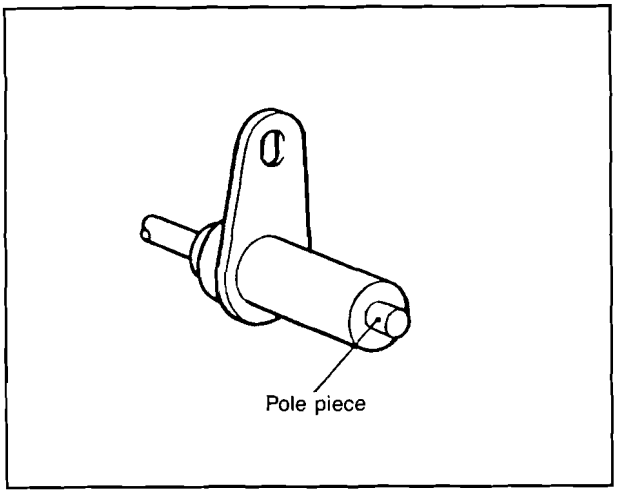


Fig. 4 — Rear speed sensor

(4) Remove the dust cap and lock nut.

(5) Remove the hub assembly.

NOTE: For vehicles with A.B.S. remove the rear rotor, taking care not to scratch or chip the teeth. If this happens, the A.B.S. system will not function normally.

Inspection

(1) Check the oil seal for cracking or damage.

(2) Check the rear hub for wear or damage.

Installation

Install by reversing removal procedure noting the following:

(1) Apply multipurpose grease to the inner lip of the seal.

(2) Install a new lock nut to the specified torque and stake nut to axle spindle.

(3) After installing the hub assembly (new or used) the wheel bearing end play, rotary and starting torque must be within specifications.

(4) Check rear speed sensor to rotor clearance as outlined in Group 35 — Section 7.

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

GROUP 31 — WHEELS AND TYRES

SECTION 0 — INDEX

Subject	Section Number	Page Number
INDEX	0	
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WHEELS AND TYRES	2	
Specifications		1
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Tyre Care		3
Wheel Balance		3
Tyre and Rim Runout		4
Tyre Replacement and Repair		5
Tyre Rotation		6

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
WEAK AT SHOULDER	Tyre under-inflated	Inflate to recommended pressures
	Vehicle overloaded	Do not operate vehicle over the maximum tyre load ratings
WEAR ON INSIDE SHOULDER	Excessive negative camber	Locate and correct cause
	Incorrect toe-in setting	Reset to specification
WEAR ON OUTSIDE SHOULDER	Excessive positive camber	Locate and correct cause
	Incorrect toe-in setting	Reset to specifications
WEAR AT CENTRE	Tyres over-inflated	Inflate to recommended pressures
FEATHERED EDGES	Incorrect toe-in setting	Reset to specifications
TYRE THUMP, TRAMP, SQUEAL	Tyre belts damaged	Replace tyre
	Out of balance condition	Balance wheel and tyre assembly
	Incorrect tyre inflation pressure	Inflate to recommended pressures
	Incorrect steering geometry	Adjust wheel alignment to specifications
ABRASIVE ROUGHNESS ACROSS TREAD	Excessive cornering speed	Reduce cornering speed
IRREGULAR SPOTTY WEAR	Tyres under-inflated	Inflate to recommended pressure
	Loose or worn suspension components or shock absorbers	Inspect, secure and replace any worn components
	Excessive tyre or rim run-out	Correct any non-standard conditions
	Wheel and tyre out of balance	Balance wheel and tyre assembly
STEERING WHEEL VIBRATION	Tyres worn unevenly	Replace tyres and rebalance
	Tyres worn bald	Replace tyres and rebalance
	Worn steering balljoints	Replace worn components
	Excessive tyre or rim run-out	Correct any non-standard conditions
	Incorrect wheel bearing freeplay	Reset to specifications
	Wheel and tyre out of balance	Balance wheel and tyre assembly
	Uniformity problem with tyre	Prove by fitting known good tyre and then discuss with tyre dealer
	Bent drive shaft or worn drive shaft joint	Refer Group 26

SECTION 2 — WHEELS AND TYRES

SPECIFICATIONS

Wheels

— 4cyl models	Steel disc with safety rims 14″ x 5.5J(ISO)
— W44 option	Cast alloy with safety rims 15″ x 6.0J(ISO)
— V6 model except V6Ei and V6Xi	Steel disc with safety rims 15″ x 6.0J(ISO)
— W37 option	Cast alloy with safety rims 15″ x 6.0J(ISO)
— V6Ei and V6Xi	Cast alloy with safety rims 15″ x 6.0J(ISO)

	Steel	Alloy
Material	Pressed steel	Aluminium alloy
Offset disc to rim	46 mm	←
No. of hub bolts	5	←
Bolt hole pitch circle diameter	114.3 mm	←
Maximum radial run-out	0.7 mm	0.3 mm
Maximum lateral run-out	1.0 mm	0.5 mm

Tyres

Type	Radial	←
Size — H, D & P (4 cyl) lines	P185/75R14	—
— P (6 cyl) line	P205/65R15	—
— X (4 & 6 cyl) lines and W37, W44 options	—	P205/65R15
Inflation pressures	Refer tyre placard attached to the inside of the fuel filler door.	
*Max. radial run-out	1.0 mm	←
*Max. lateral run-out	1.3 mm	←

*Maximum figures for tyres mounted on a true rim (refer to written text on following pages)

Maximum radial run-out — tyre and rim combined		
— Radial	1.7 mm	1.3 mm
— Lateral	2.5 mm	2.0 mm
Maximum imbalance		
— Tyre and rim combined	120 grams	←

NOTE: Tyre pressure and rim combinations are covered by Australian Design Rules. Approved combinations for each vehicle are listed on the tyre placard. Any deviation from these specifications, requires approval by State Registration Authorities prior to installation or the vehicle may subsequently be refused registration.

TORQUE SPECIFICATIONS

	Nm
Wheel nuts (in diagonal sequence)	
Steel and Alloy wheels	90 to 110

GENERAL INFORMATION

The factory fitted radial ply tyres are selected to provide the optimum performance in terms of handling, ride comfort and load carrying capacity under normal driving conditions when inflated to the pressures recommended on the tyre placard.

Tyre placard

The tyre placard is located on the inside of the fuel filler door. This placard lists the recommended tyre inflation pressures and maximum vehicle load for all driving conditions for the tyres fitted to the vehicle.

Tyre design

Radial ply tyres have belts circling the tyre under the tread, from tread shoulder to tread shoulder. The body cords cross the centre line of the tread at approximately right angles, from bead to bead. The body cords 'radiate' from the centre point of the tyre hence the term 'radial ply'.

Radial ply tyres provide improved tread life, better roadholding and smoother high speed ride, and are fitted to all models as standard equipment.

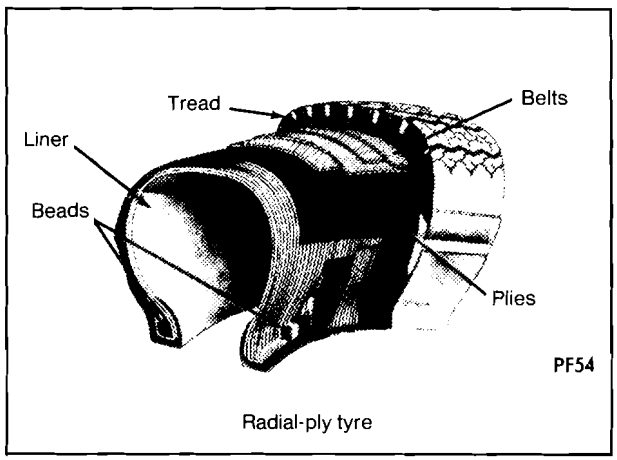


Fig. 1 — Radial ply tyre construction

CAUTION:

- **Do not mix Cross-ply, Belted-bias or Radial-ply tyres.**
- **Do not mix textile cord belt radials with steel cord belt radials.**
- **Do not use tyres with different profiles on the same axle.**

Tyre profile

Tyre profile is the tyre section height expressed as a percentage of the tyre section width, which is also called 'aspect ratio'. Reduction of tyre section height in relation to the section width results in a softer cushion ride. A variety of low, squat profile shapes are currently used and for this reason interchangeability of different make tyres is not always possible due to the variations in tyre diameters, tyre profile and tread depth.

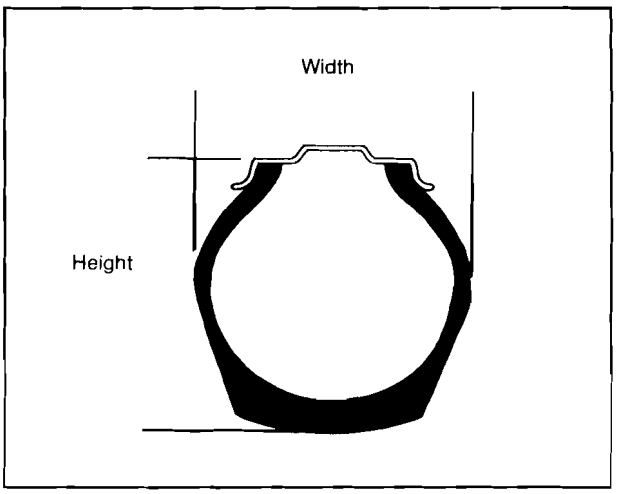


Fig. 2 — Tyre profile or aspect ratio

Tyre tread depth

The control of a vehicle in any weather conditions depends finally upon the frictional forces generated between the contact patches of the four tyres and the road surface. These contact patches are not large, being about the equivalent in area of a size 10 shoe.

On a dry road, a smooth rubber surface, such as on a bald tyre, has a high co-efficient of friction, quite sufficient to maintain the required degree of braking, accelerating and cornering control. However, in wet conditions the co-efficient of friction between a smooth tyre and the road surface falls to an extremely low value.

Grooves are incorporated in the tread pattern to clear water away from the contact patch area thus providing a relatively 'dry' surface so that a reasonable degree of road adhesion is maintained.

The inclusion of sipping slots in the tread, which provide edges to break through the film of water, also helps clear water from the contact patch.

Tyre tread wear indicators are moulded into the tyre tread. When these evenly and transversly set indicators are flush with the tread surface, the tyre must be replaced, refer Fig. 3. It is an offence to drive a vehicle with less tread depth than this.

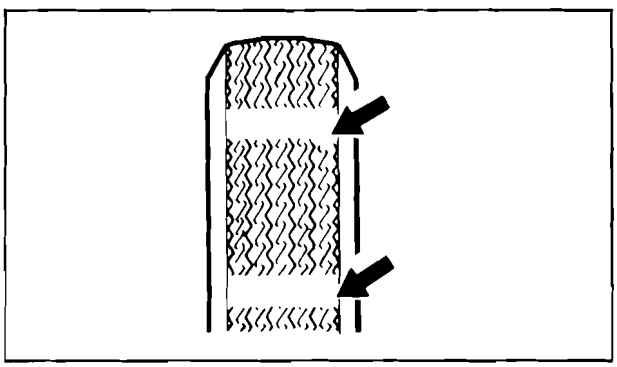


Fig. 3 — Tyre tread wear indicators

TYRE CARE

Correct inflation pressure is the basis of tyre care and is essential if satisfactory tyre life is to be obtained. It also has a direct bearing on vehicle safety as uneven or incorrect inflation pressures may lead to vehicle instability when braking and cornering or on uneven road surfaces.

Always check tyre pressures with a known accurate gauge and ensure that the tyre valve cap is installed to prevent the ingress of dirt or moisture.

New tyres should always be run in at speeds below 80 km/h for the first 100 km.

Factors Which Can Adversely Affect Tyre Life

Tyre Inflation Pressure

Under inflation is the most common fault affecting tyre life:

Under normal conditions a tyre flexes as it rolls along the road and this flexing in turn generates heat. If the tyre is correctly inflated this heat build-up is not detrimental to the tyre. However an under inflated tyre flexes far more than normal resulting in greater heat generation. Under these conditions the temperature of the tyre can rise to a point where the rubber compounds that bind the tyre together are softened and weakened. In extreme conditions this may result in the tread separating from the casing or the plies separating from each other.

Under inflation also reduces tyre life by causing excessive wear on the tyre edges.

Tyre damage and wear is accelerated if the vehicle is driven at high speed or in an overloaded condition.

Over inflation can result in damage to the casing and further reduces tyre life by causing excessive wear at the centre of the tyre tread.

Excessive inflation pressure exerts increased strain on the casing cords which subsequently reduces resistance to impact shocks. In addition, since the tyre tread is stretched tight, tread cracks can rapidly develop and the tread rubber is more prone to cutting.

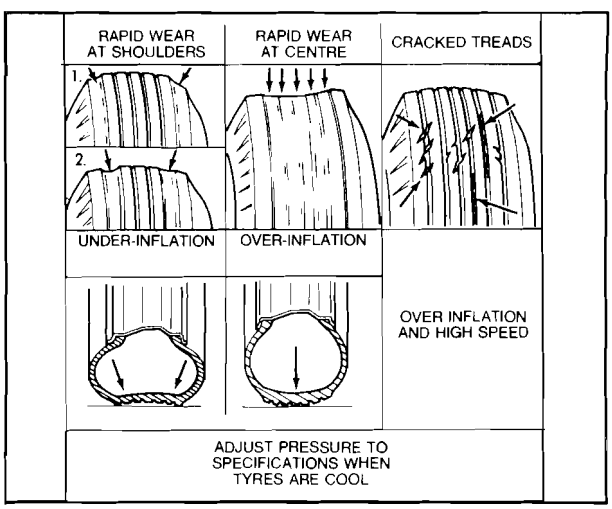


Fig. 4 — Indications of incorrect tyre pressure

NOTE: Tyre inflation pressures should be checked with the tyres cold. Never reduce tyre pressure when the tyres are hot.

Overloading has the same effect as under inflation causing excessive tyre flexing and subsequent heat generation.

Incorrect Wheel Alignment

Toe-in setting is an important factor in tyre life. Excessive toe-in results in tapered or feathered wear on the outside edge of the tyre tread while excessive toe-out has the same result on the inside edge. Under these conditions the tyre is actually dragged along the road instead of rolling freely.

For specifications and the correct procedure for adjusting toe-in refer to Group 33A — Front Suspension.

Wheel camber is not adjustable however the setting may alter as a result of damage to the front end. In this event the damaged component(s) must be replaced.

Excessive wheel camber either positive or negative, results in one side of the tyre wearing faster than the other.

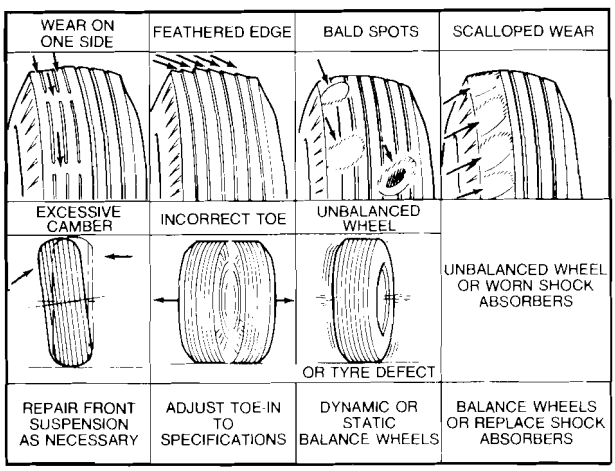


Fig. 5 — Abnormal tyre wear patterns

Out of balance wheels

Out of balance wheels can result in cupped or spotted wear around the tyre circumference. An out of balance tyre is usually accompanied by a vibration through the steering wheel when driving on smooth surfaces.

Faulty shock absorbers

Faulty or worn shock absorbers can also result in cupped or spotted wear. Faulty shock absorbers should be replaced in pairs.

It should be noted that in addition to the foregoing factors, driving habits, road conditions and the terrain over which the vehicle is operated will have a direct bearing on tyre life.

WHEEL BALANCE

Two types of wheel unbalance can be experienced they are:

(1) **Static unbalance** — this can cause the wheel to bounce or tramp along the road and is the result of a

heavy spot on the wheel and tyre assembly. This condition is corrected by placing equal weights on both sides of the rim opposite the heavy spot.

(2) **Dynamic unbalance** — this can cause the wheel to shake sideways about the axle and produces a shimmy effect. It is the result of a heavy spot on one side of the wheel centreline. This condition is corrected by placing a weight opposite the heavy spot on the rim.

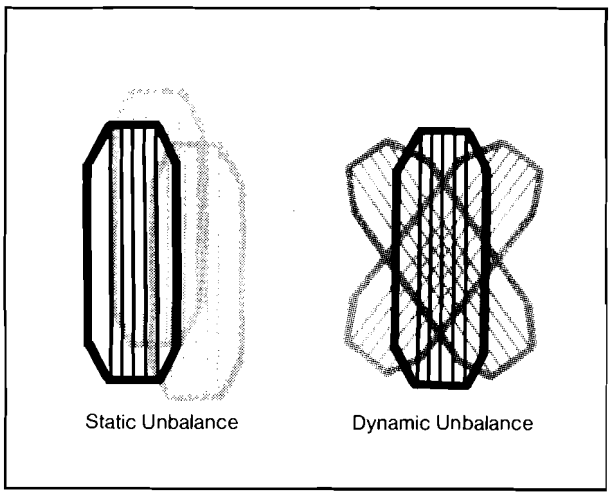


Fig. 6 — Types of wheel unbalance

Precision machines are required to measure static and dynamic unbalance.

When balancing wheels, the total unbalance allowable is 120 grams, i.e. wheel 40 g plus tyre 80 g. If any assembly requires more than 120 grams weight, the tyre should be removed, the rim checked for balance (must be below 40 g). If the rim is below this, then the tyre can be considered suspect and should be referred to the tyre manufacturer.

NOTE: All M.M.A.L. passenger car wheels MUST be balanced from the centre hole of the wheel with a parallel adaptor. Balancing via wheel stud holes or with tapered adaptors, will NOT be successful.

NOTE: To maintain correct wheel balance on the vehicle, always mark the wheel to hub/axle location prior to removing each wheel. This will ensure correct balance is maintained on re-assembly.

NOTE: Select and fit balance weights that provide adequate clearance to brakes, dust shields, steering parts, trim rings and wheel covers. Use care when removing stick-on type balance weights from the alloy wheels. Failure to do so may lead to damage to the rim surface.

If the wheel and tyre cannot be balanced by conventional methods or if an "out of round" condition is evident the tyre and rim runout should be checked.

TYRE AND RIM RUNOUT

Tyre and rim runout causes high speed/smooth road shake. Two types of runout can be experienced, they are:

(1) **Radial runout** — this is the difference between the high and low position on the circumference of the tyre or rim.

(2) **Lateral runout** — this is the difference between the high and low points on the side of the tyre or rim.

Before measuring the tyre and rim runout, the following checks should be made.

(1) Check that the rim mounting surface on the hub is clean.

(2) Check wheel bearing freeplay.

(3) Check that the wheel nuts are tightened to specifications in the correct sequence, refer Fig. 7.

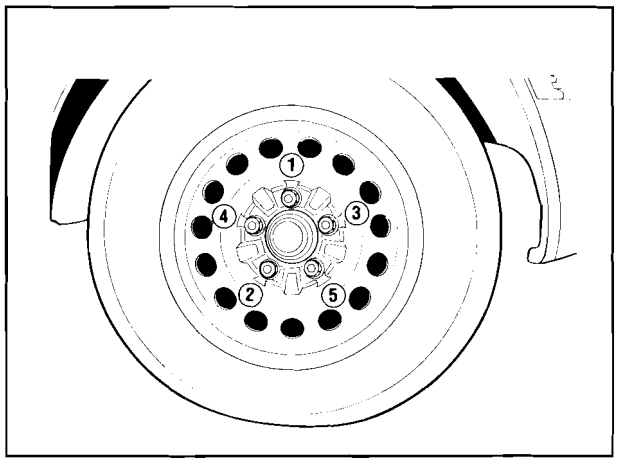


Fig. 7 — Wheel nut tightening sequence

(4) Check that the tyre is correctly seated at the bead on both sides of the rim. Visual inspection of the concentricity of the moulded indicator will confirm this. Tyres that are not seated correctly should be removed, refitted correctly and rebalanced, refer Tyre Replacement — this Section.

(5) Check that the tyres are system matched, refer Tyre Replacement — this Section.

(6) Check that the tyres are correctly fitted in regard to Serial Number location, refer Tyre Replacement — this Section.

NOTE: Prior to checking a tyre for runout the vehicle should be driven sufficient distances to warm up the tyre and immediately raised off the floor to avoid "flat spotting" which may affect runout readings.

Checking Procedure

Ensure the dial indicator is attached rigidly to a firm base when checking runout readings.

(1) To check tyre radial runout, place the dial indicator plunger against a centre rib in the tyre tread and rotate the wheel slowly. Maximum reading must not exceed specifications.

(2) To check lateral runout (wobble) position the dial indicator against the tyre side wall and rotate the wheel slowly.

(3) In some cases radial run out can be reduced by relocating the wheel 180° from its original position on the wheel studs. If excessive runout was caused by a stack-up of wheel and stud tolerances, this may bring the runout within specifications. Retorque the wheel nuts in the recommended sequence.

(4) If excessive runout is still evident, make a chalk mark (or similar) across the tyre sidewall and the rim. Mark the relationship of the rim to a wheel stud for re-mounting of the tyre and rim assembly to the original position. Remove the tyre from the rim, refer Tyre Replacement – this Section, and mount the rim in its original position. Tighten the wheel nuts to specifications in the correct sequence, refer Fig. 7.

(5) Check the rim for runout, refer Fig. 8 and check the reading obtained against specifications.

NOTE: When checking rim runout ensure that it is measured in the area where the tyre bead contacts the rim. The extreme outer edge of the rim should not be used as this metal has been sheared during the manufacturing process and is not an even surface.

(6) If the rim runout is not within specifications it must be replaced.

(7) If the rim runout is within specifications and the point of greatest runout is near the original chalk mark on the rim, re-mount the tyre with the tyre and rim chalk marks 180° apart. Re-check that the runout of the tyre and rim assembly is now within specifications.

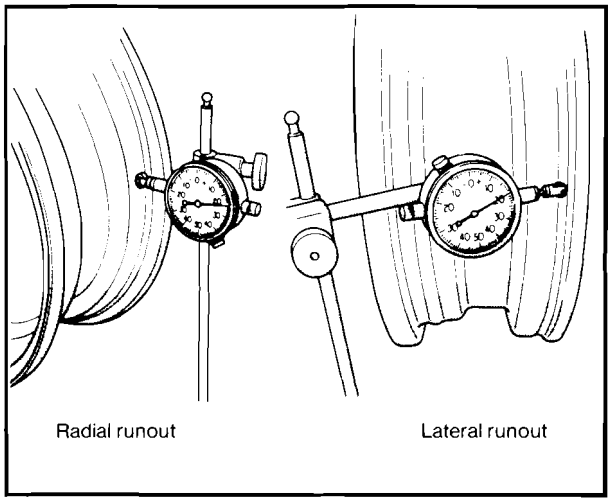


Fig. 8 – Checking rim runout

NOTE: Correcting radial runout by removing tread rubber with an off-car truer is not recommended. Removing tread rubber may not reduce the shake problem and there is a good chance that it will introduce or increase tyre roughness; a condition that can be heard as well as felt.

Tyre trueing to correct radial runout requires the removal of a significant amount of tread rubber. This reduces the useful life of the tyre and for that reason should not even be considered except as a possible last resort. Trueing should not be performed without the owner's knowledge and consent.

TYRE REPLACEMENT AND REPAIR

From a safety aspect, a tyre should not continue in service where any of the following conditions are evident.

(1) Where the tyre tread wear indicators are exposed. (See description earlier in this Section.)

(2) Fabric breaks, exposed or broken bead wires.

(3) Tread and side wall cracks, ruptures, cuts or localised wear, any of which are deep enough to expose the body cords.

(4) Tread, side wall and ply separation or partial casing failure as indicated by any bump or bulge on the tyre surface including the bead area.

(5) Regrooving or recutting below the original tread pattern depth.

(6) Where a tyre is matched on the same axle with a tyre of totally different construction, for example a cross ply tyre with a radial ply tyre.

(7) Where a tyre is operated at an inflation pressure less than the minimum recommended for the load being carried, taking into account the speed of operation.

(8) Where a tyre is fitted to a damaged rim, a rim of incorrect size, or is not properly seated on its rim.

(9) Where a tyre is fitted with a tube of a size not recommended by the manufacturer.

NOTE: Any tyre that has been damaged as mentioned, should be inspected internally and externally by a competent technician to establish whether it could be repaired or should be scrapped.

Tyre Removal

(1) If the tyre is to be removed for repair the leak should be located and marked and the tyre to rim position marked prior to removal.

NOTE: Small holes in the tread such as nail holes must not under any circumstances be plugged. Repairs should only be made from inside the tyre using an approved cold vulcanizing method.

(2) Remove the valve core and exhaust all the air from the tyre.

(3) In the absence of a suitable tyre machine break the seal at the tyre bead using a rubber mallet.

NOTE: Due to the design of the rim each tyre bead must be pushed well away from the rim flange, over the seating hump and into the well of the rim.

(4) Lubricate the bead and the bead seat to facilitate removal.

One part liquid detergent to four parts water is a good lubricant.

(5) Insert levers under the top bead and ease it over the rim in small bites.

(6) Repeat the action for the second bead.

NOTE: Tyres can be damaged by the use of wrong tools, or by using tools in poor condition. Steel hammers or mallets should never be used directly on a tyre — a rubber mallet is ideal. Tyre levers should have smooth edges, free of nicks or burrs. The use of poor tools can easily damage the beads, ruining the air seal in a tubeless tyre.

Tyre Fitment

(1) Prior to fitting the tyre ensure that the rim flanges are clean and in good condition. Remove any burrs or sharp edges with a file.

(2) It is advisable to fit a new valve when fitting a new tyre. Ensure that the new valve is the correct diameter and length. Lubricate the valve body with soapy solution to aid fitment.

NOTE: Tyre valve protection sleeves are used on some models to prevent the trim ring/wheel cover cutting into the valve core, always refit the sleeves whenever removal has been necessary.

(3) Inspect the inside of the tyre and remove all foreign material.

(4) Ensure that when fitting the tyre the Serial Number on the tyre faces the outside of the rim.

(5) Lubricate the tyre beads and rim flanges.

(6) Slip one section of the bead over the side of the rim, so that it rests in the well of the rim. The remaining section of the bead should be eased over the rim flange in small bites using a rubber mallet, levers or fitting tool.

(7) Repeat the operation for the second bead, again making sure that the beads are resting in the centre of the rim well.

(8) Prior to inflating the tyre ensure that the tyre is correctly positioned on the rim with regard to the radial force variation high point on the tyre.

The yellow "F" (on Goodyear tyres) or dot on other brands (when marked) should be positioned in line with the 3 mm dot on the wheel (steel and alloy) rim — refer Fig. 9.

(9) Centre the tyre on the rim and inflate. Do not lean over the tyre during inflation. The tyre beads may be expanded using the method shown in Fig. 10 when necessary. Inflate the tyre to a maximum of 300 kPa to seat the tyre on the bead.

(10) Check that the bead is correctly seated. This can be confirmed by checking the concentricity of the moulded indicator on the tyre sidewall. If the tyre is not seated correctly, deflate the tyre, break the bead and check that the bead seat is clean and not damaged. Apply lubricant to the bead and seat and reinflate the tyre.

(11) On tubeless tyres, after checking the bead seat deflate the tyre to the correct pressure.

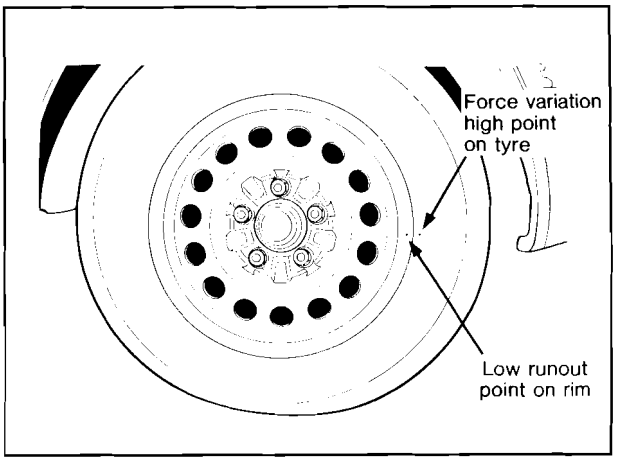


Fig. 9 — Positioning tyre on rim

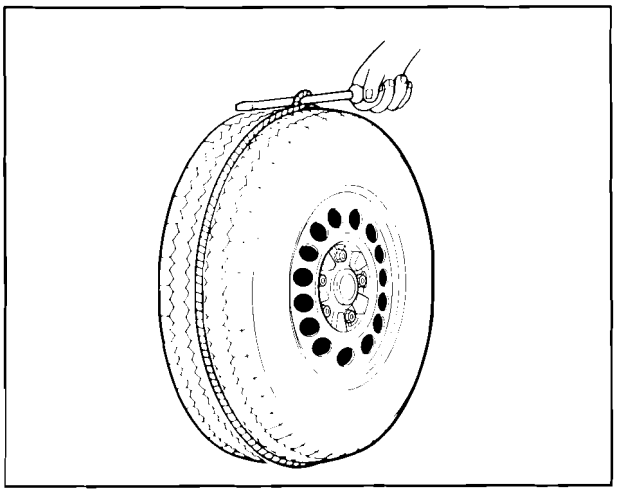


Fig. 10 — Expanding tyre beads with a rope type torniquet

For tubed tyres, remove the valve core and exhaust all air. This will allow the tube to seat itself correctly inside the tyre. Replace the valve core and inflate to the correct pressure.

NOTE: When fitting a tubed type tyre, make sure the tube is of the correct size. Dry the tube and dust it with talc (French chalk) and slightly inflate before putting it inside the tyre after the first bead has been slipped on to the rim.

Radial ply tyres require special tubes, and care must be taken to ensure that the correct tube is fitted.

Valve caps should always be used to keep dirt and moisture out of the valve core.

(12) When fitting the wheel, locate on the hub with the lined up marks at the 12 o'clock position, prior to tightening the wheel nuts.

TYRE ROTATION

Due to the front wheel drive format of the vehicle, slightly accelerated tyre wear may be experienced on

the front wheels. Tyre wear can be minimized with accurate front wheel alignment, correct tyre inflation pressures and careful driving habits. However if it is deemed necessary to rotate the tyres the sequence shown in Fig. 11 should be used.

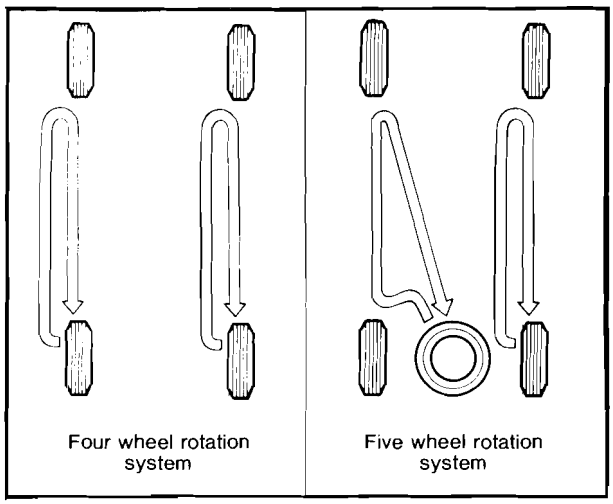


Fig. 11 – Wheel rotation patterns

GROUP 32 — POWER PLANT MOUNTINGS

SECTION 0 — INDEX

Subject	Section Number	Page Number
INDEX	0	
SERVICE DIAGNOSIS	1	
ENGINE MOUNTINGS	2	
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Rear Roll Stopper		1
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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
EXCESSIVE ENGINE WOBBLE OR VIBRATION (ENGINE STATIC)	Cracks in insulator rubber or damaged brackets.	Replace defective parts.
	Mounting bolts loose.	Tighten mounting bolts to specification.
EXCESSIVE VIBRATION DURING IDLE OR NORMAL RUNNING	Extreme twisting of front and rear roll stoppers.	Install mountings correctly, refer Mounting Installation 4G54 or 6G72.
	Mounting bolts loose.	Tighten mounting bolts to specification.
ABNORMAL NOISE	Mounting bolts loose.	Tighten mounting bolts to specification.

SECTION 2 — SPECIFICATIONS

TORQUE SPECIFICATIONS

4G54 ENGINE

ENGINE MOUNTING	Nm
Front roll stopper through-bolt nut	50-65
Front roll stopper mounting bolt	60-70
Engine mounting bolt (4)	50-60
Engine mounting through-bolt nut — large	60-80
Engine mounting through-bolt nut — small	30-40
Engine damper bolt — lower	30-40
Engine damper bolt — upper	45-55
Rear roll stopper through-bolt nut	40-50
Rear roll stopper mounting bolt	40-50

TRANSAXLE MOUNTING	
Transaxle mounting bracket to transaxle bolts	60-80
Transaxle mounting bracket to body bolts	40-50
Transaxle mounting through-bolt nut	60-80

6G72 ENGINE

ENGINE MOUNTING	
Engine mounting bracket to engine block — 10 x 35 mm bolts	35-50
— 10 x 45 mm bolts	35-50
— 10 x 68 mm bolts	65-75
— 10 x 97 mm bolts	67-75
— 12 x 71 mm bolts	105-115
Engine mounting through-bolt	60-80
Engine mounting through-bolt to bracket nuts	30-40
Engine mounting to front mounting bracket nuts	100-120
Front roll stopper bracket to cylinder block — 10 x 25 mm bolts	35-50
— 12 x 30 mm bolts	65-85
Front roll stopper through-bolt nut	50-65
Front roll stopper bracket to front member bolts	60-70
Front roll stopper stay nuts	65-85
Rear roll stopper bracket to cylinder block — 10 x 25 mm bolts	35-50
— 12 x 30 mm bolts	65-85
Rear roll stopper through-bolt nut	40-50
Rear roll stopper stay to surge tank	35-55
Engine damper bolt — lower	30-40
— upper (7T)	30-40
(10T)	70-80

TRANSAXLE	
Transaxle mounting through-bolt nut	60-80
Transaxle mounting bracket to body bolts	40-50
Transaxle mounting bracket to transaxle bolts	60-80

SECTION 3 — ENGINE MOUNTINGS 4G54

GENERAL INFORMATION

The mounting arrangement incorporates both engine and transaxle.

The front and rear roll stoppers are positioned to control roll during engine rotation. The axis support system supports the engine side top and transaxle side, suppressing both engine vibration and road surface reactions.

All insulators are designed to absorb both minute and large vibrations.

MOUNTING REMOVAL

Install lifting bracket and support engine and transaxle assembly with a suitable hoist.

Remove the mountings and roll stoppers as follows:

Front Engine Mounting

(1) Disconnect the power steering hose clamp and air conditioner hose clamp (if fitted) from front engine mounting bracket.

(2) Remove the front engine mounting through-bolt.

(3) Remove the bolts on the engine mounting bracket.

(4) Remove the engine mounting assembly.

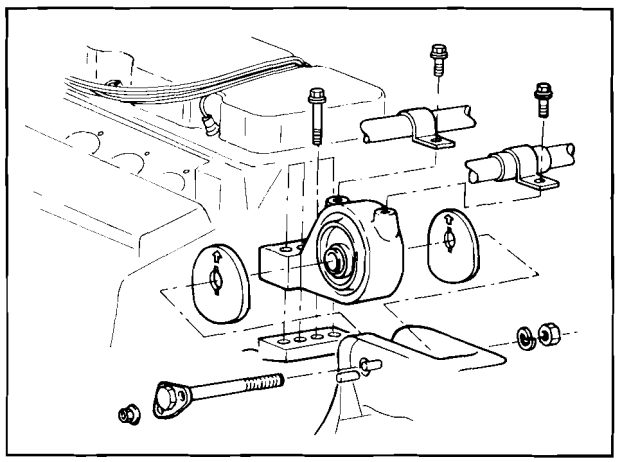


Fig. 1 — Front engine mounting

Transaxle Mounting

(1) Remove the mounting through-bolt, (disconnect the transaxle control cable on automatic models).

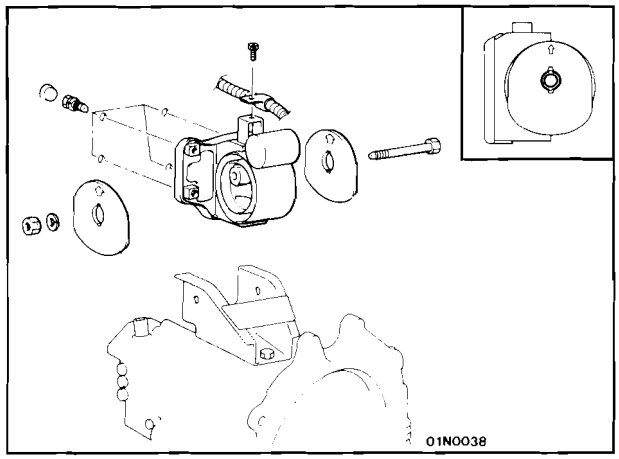


Fig. 2 — Transaxle mounting through-bolt (auto transaxle shown)

(2) Remove transaxle bracket bolts from the transaxle and remove the bracket.

(3) Prise out the caps from inside of right fender shield, remove the mounting bracket bolts and remove the mounting.

CAUTION: Use care when removing the mounting bolts, to ensure that they don't fall inside the fender.

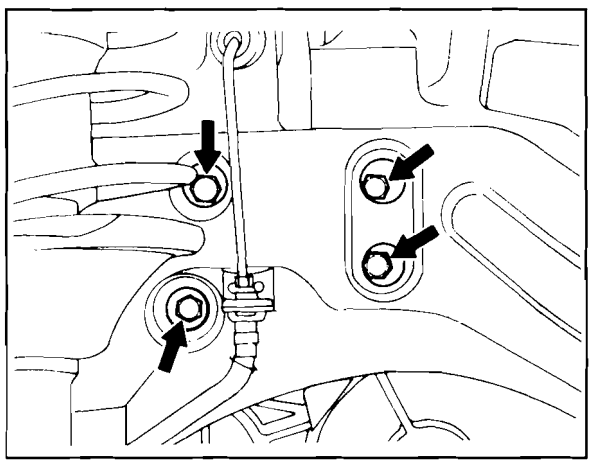


Fig. 3 — Transaxle mounting bolt location

Front Roll Stopper

(1) Remove the mounting through-bolt.
(2) Remove the mounting bolts from front crossmember.
(3) Remove front roll stopper assembly

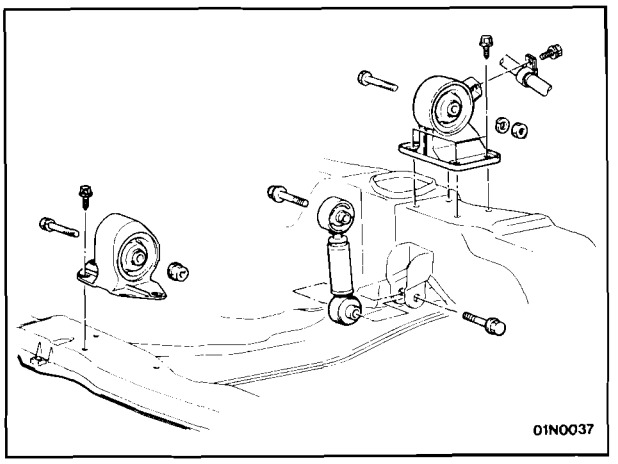


Fig. 4 — Front roll stopper

Rear roll stopper

(1) Remove the mounting through-bolt.
(2) Remove the mounting bolts from the rear crossmember.
(3) Remove the rear roll stopper assembly.

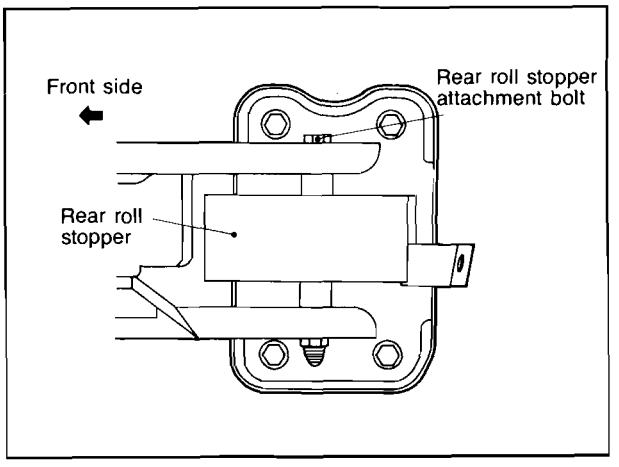


Fig. 5 — Rear roll stopper

Inspection

(1) Check each rubber insulator for cracks, damage or peeling.
(2) Check each bracket for deformation or damage.

If any of the above conditions are evident, the mounting must be replaced.

Mounting Installation

Install by reversing the removal procedure noting the following:

(a) Install all mounting brackets and mountings, leaving bolts loose.
(b) Install all through-bolts.
(c) Tighten all bracket bolts on the front engine mounting and transaxle mounting, to the specified torque.

Note: Do not tighten through-bolts to specified torque until lifting device has been released, as mounting distortion may occur.

(d) Release tension of lifting device and tighten front and rear roll stopper bolts to specified torque.
(e) Tighten all through-bolts to the specified torque.
(f) Remove lifting bracket.

SECTION 4 — ENGINE MOUNTINGS 6G72

GENERAL INFORMATION

The mounting arrangement incorporates both engine and transaxle.

The axial support system is structured to support the engine side top, and transaxle side to effectively dampen engine vibration and road surface reaction. The front and rear roll stoppers are positioned to control roll during engine rotation. Furthermore, the engine damper (shock absorber) installed between the rear roll stopper bracket and the crossmember, absorbs excessive engine roll during periods of acceleration.

All insulators are designed to absorb both minute and large vibrations.

Mounting Removal

Install lifting bracket and support engine and transaxle assembly with a suitable hoist, remove the mountings and roll stoppers as follows:

Front Engine Mounting

(1) Remove coolant recovery tank and bracket assembly (vehicles with ABS only).

(2) Remove the front engine mounting through-bolt.

(3) Remove the bolts on the engine mounting bracket.

(4) Remove the engine mounting assembly.

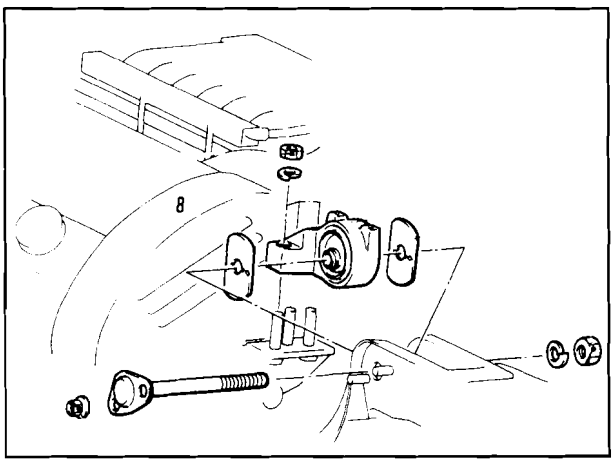


Fig. 1 — Front engine mounting

Transaxle Mounting

(1) Disconnect and remove battery and battery carrier.

(2) Remove air cleaner top and air intake hose from the throttle body.

(3) Remove all wiring connectors from transaxle mounting assembly.

(4) Remove the transaxle mounting through-bolt.

(5) Remove transaxle bracket bolts and remove the bracket.

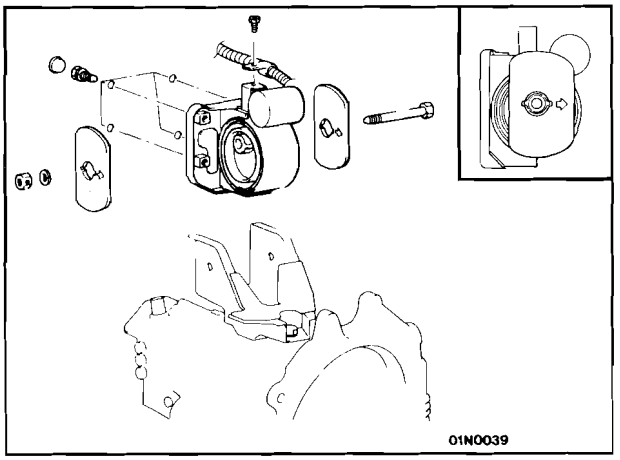


Fig. 2 — Transaxle mounting through-bolt

(6) Prise out the caps from inside of right fender shield, remove the mounting bracket bolts and remove the mounting.

CAUTION: Use care when removing the mounting bolts, to ensure that they don't fall inside the fender.

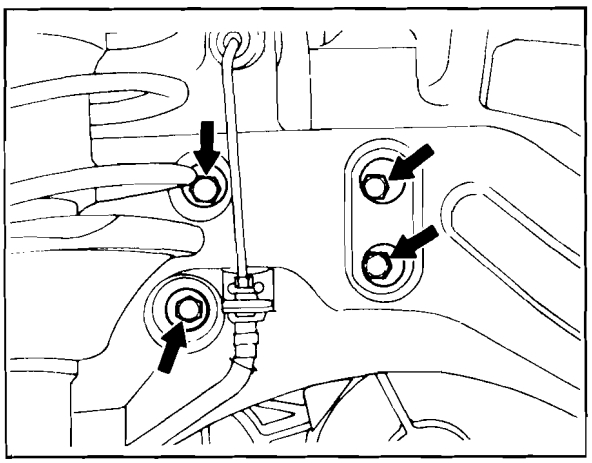


Fig. 3 — Transaxle mounting bolt location

Front Roll Stopper

(1) Remove the mounting through-bolt.

(2) Remove the mounting bolts from front crossmember.

(3) Remove front roll stopper assembly.

Rear Roll Stopper

NOTE: For easier access, the damper should be removed from underneath vehicle.

(1) Remove the damper (shock absorber) from rear crossmember and mounting bracket.

(2) Remove the mounting through-bolt.

(3) Remove the mounting bolt from the rear crossmember.

(4) Remove the rear roll stopper assembly.

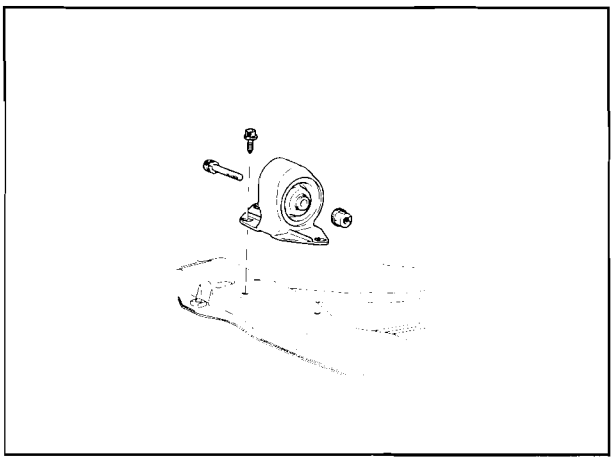


Fig. 4 — Front roll stopper

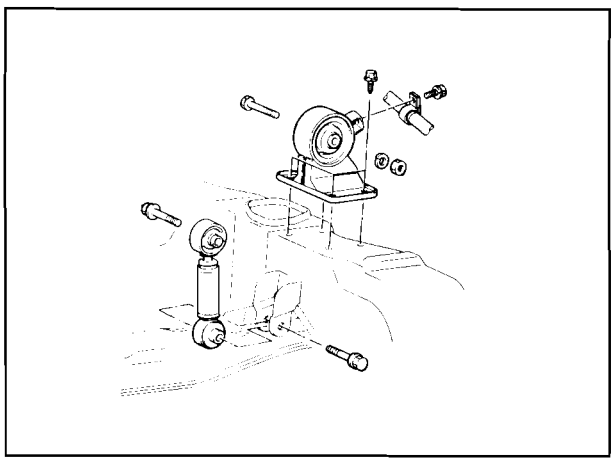


Fig. 5 — Rear roll stopper and damper

Inspection

(1) Check each insulator for cracks, damage or peeling.

(2) Check each bracket for deformation or damage.

(3) Check the operation of the shock absorber of the engine damper assembly for abnormality.

If any of the above conditions are evident, the mounting must be replaced as an assembly.

NOTE: Vehicles fitted with a Supplemental Restraint System (SRS) have hydraulic front engine mounts and transaxle mounts.

Mounting Installation

Install by reversing the removal procedure noting the following:

(a) Install all mounting brackets and mountings, leaving bolts loose.

(b) Install all through-bolts.

(c) Tighten all bracket bolts on the front engine mounting and transaxle mounting, to the specified torque.

NOTE: Do not tighten through-bolts to specified torque until lifting device has been released, as mounting distortion may occur.

(d) Release tension of lifting device and tighten front and rear roll stopper bolts to specified torque.

(e) Tighten all through-bolts to the specified torque.

(f) Remove lifting bracket.

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

GROUP 33A — FRONT SUSPENSION

SECTION 0 — INDEX

Subject	Section Number	Page Number
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FRONT SUSPENSION	2	
Specifications		1
General Information		3
Wheel Alignment		3
Suspension Strut Assembly		4
Lower Arm		6
Stabilizer Bar		8
No. 2 Crossmember		8

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
POOR VEHICLE 'RIDE'	Coil spring broken or deteriorated.	Replace.
	Shock absorbers defective.	Replace.
	Tyre inflation incorrect.	Inflate tyres to specification.
VEHICLE HEIGHT UNEVEN	Broken or sagging spring.	Replace.
	Bent strut piston rod.	Replace strut assembly.
EXCESSIVE BODY ROLL ON CORNERING	Defective shock absorber.	Replace.
	Stabilizer bar bent or broken.	Replace.
EXCESSIVE NOISE FROM FRONT SUSPENSION	Broken spring.	Replace.
	Insufficient lubrication of ball joints or wheel bearings.	Check and lubricate as necessary.
	Suspension components loose or worn.	Check all attaching bolts and nuts for tightness. Replace worn components as necessary.
	Defective shock absorbers.	Replace.
	Drive shaft splines loose in the hub or the differential side gear.	Replace worn components.
	Drive shaft boots torn.	Replace boot and repack the joint with grease.
	Drive shafts worn or insufficiently lubricated.	Repack or replace joint.

SECTION 2 — FRONT SUSPENSION

SPECIFICATION

	Sedan/Wagon D, H & P line Man and Auto	4X, 8P Sedan/Wagon	TR/KR V6 X Line Sedan
Suspension			
Type	McPherson strut	←	← with ECS
Wheel alignment			
Camber (non-adjustable)	0° ± 30'	←	←
Caster (non-adjustable)	2°45' ± 30'	←	←
Toe-in — measured at the centre of tyre tread	0 ± 3 mm	←	←
Toe-out on turns — measured on outer with inner wheel on 20°	22°	22°	22°
King pin offset	3.5 mm negative offset	←	←
Side slip	IN 3 mm OUT 3mm	←	←
Ball joint — starting torque	10 to 22 Nm	←	←
— turning torque	1.9 to 5 Nm		
Distance between end of stabilizer bar bolt and nut	5-7 mm	←	←
Stabilizer link ball joint starting torque	1.7 to 3.2 Nm	←	←

Maximum steering angle	Inner steering angle		Outer steering angle	
Models	Right Turn	Left Turn	Right Turn	Left Turn
TS/KS ALL	37° ± 2°	35° ± 2°	30°30'	29°45'
TR/KR 4 cyl auto/trans	37° ± 2°	35° ± 2°	30°30'	29°45'
TR/KR V6 and 4 cyl man/trans	37° ± 2°	37° ± 2°	30°30'	30°30'

Coil springs TS/KS

Spring Colour Code — Low Load range (Green)

Brown/Green
- TS1-H-41&45
- TS7-H-41&45
- TS3-D-41&45
- TS3-P-41&45
- TS5-0-41 &45(LH)

Orange/Green
- TS4-D-41&45(RH)
- TS8-0-45
- KS1-P-45(LH)
- KS5-D-41&45(LH)

Purple/Green
- TS6-P-41&45(LH)
- KS6-P-41(LH)
- KS8-P-41(LH)

Yellow/Green
- TS6-0-41&45(RH)
- TS8-0-41
- KS0-X-41(LH)
- KS1-0-41&45(RH)
- KS5-0-41&45(RH)
- KS2-P-45(LH)
- KS6-D-41&45(LH)
- KS6-P-41&45(LH)[X62]
- KS6-P-41(RH)
- KS8-P-41(RH)
- KS6-P-45
- KS8-P-45

Pink/Green
- TS2-H-41&45
- TS3-D-41
- TS3-P-41

Pink/Green
- TS6-P-41&45(LH)

Blue/Green
- KS0-X-41(RH)
- KS2-P-45(RH)
- KS6-D-41&45(RH)
- KS6-P-41&45(RH)[X62]

Spring Colour Code — High Load range (Yellow)

Brown/Yellow
- TS1-H-41&45
- TS7-H-41&45
- TS3-D-41&45
- TS3-P-41&45
- TS5-0-41 &45(LH)

Orange/Yellow
- TS4-D-41&45(RH)
- TS8-0-45
- KS1-P-45(LH)
- KS5-D-41&45(LH)

Purple/Yellow
- TS6-P-41&45(LH)
- KS6-P-41(LH)
- KS8-P-41(LH)

Yellow/Yellow
- TS6-0-41&45(RH)
- TS8-0-41
- KS0-X-41(LH)
- KS1-0-41&45(RH)
- KS5-0-41&45(RH)
- KS2-P-45(LH)
- KS6-D-41&45(LH)
- KS6-P-41&45(LH)[X62]
- KS6-P-41(RH)
- KS8-P-41(RH)
- KS6-P-45
- KS8-P-45

Pink/Yellow
- TS2-H-41&45
- TS3-D-41
- TS3-P-41

Blue/Yellow
- KS0-X-41(RH)
- KS2-P-45(RH)
- KS6-D-41&45(RH)
- KS6-P-41&45(RH)[X62]

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SPECIFICATION CONT

	Sedan/Wagon D, H & P line Man and Auto	4X, 8P Sedan/Wagon	TR/KR V6 X Line Sedan LH	TR/KR V6 X Line Sedan RH
Coil springs TR/KR				
Rate—kN/M	20 ± 1	←	15.7 ± 1	16.6 ± 1
Load range				
—low—N	4045—4170	←	—	
—high—N	4170—4295	←	—	
Colour / Code TR/KR				
— Low	Orange/Green	←	Blue	Blue
— High	Orange/Yellow	←	Blue	Blue
Free Height(mm)	409 ± 5	←	448 ± 5	443 ± 5
Shock absorbers				
Type	Hydraulic cylindrical double acting			
Maximum length	506 ± 3 mm	←	485 ± 3 mm	
Minimum length	352 ± 3 mm	←	341 ± 3 mm	
Stroke	154 mm	←	144 mm	
Piston rod				
—diameter	22 mm	25 mm	←	
—maximum bend	0.2 mm	←	←	
Colour Code				
TR/KR	Black	←	←	
TS 1,7-H-41&45	White	TS 2,8-H-41&45	Yellow	
TS 3-0-41&45	White	TS 5,6,7,8-D,P-41&45	Blue	
TS 4-0-41&45	Yellow	KS 0-0-41&45	Blue	

Stabilizer bar	**R&S 4cyl/H,D,P-41**	**R&S V6-41**	**TR X41**	**R&S Wagon 4cyl/V6**
—diameter	20 mm	22 mm	22 mm	23 mm

SPECIAL TOOLS

E2237	Puller—ball joint Compressor—coil spring
E2M31	Remover/installer—front cross-member bush
E33M1	Kit—ball joint replacement
E33M2	Kit—lower control arm bush replacement
MB991176	Spring seat holding tool

TORQUE SPECIFICATIONS

	Nm
Ball joint to knuckle nut	59 to 71
Knuckle to strut bolt	88 to 103
Stabilizer bar bracket to crossmember	34 to 44
Crossmember to body (bushings 'A' and 'B') bolts	80 to 100
Crossmember stay bolts	60 to 70
Lower arm through bolt	98 to 118
Lower arm to crossmember nut	34 to 44
Lower arm to crossmember clamp bolt	78 to 98
Lower arm shaft clamp to body bolt	98 to 118
Strut support to piston rod nut	60 to 70
Strut assembly to body nut	39 to 49
Steering rack to crossmember bolt	60 to 80
Tie rod end to knuckle nut	24 to 34
Brake caliper to knuckle bolt	95 to 105
Drive shaft retaining nut	196 to 255
Wheel nuts	90 to 110
Stabilizer bar link nut	34 to 44
Left member to No. 1 crossmember bolts	59 to 69
No. 1 crossmember to body bolt	98 to 118
No. 2 crossmember to body nut	78 to 98
Lower arm shaft clamp nut	34 to 44
Centre member rear installation bolts	59 to 69
Centre member front installation bolts	59 to 69
Rear bush attaching nut	100

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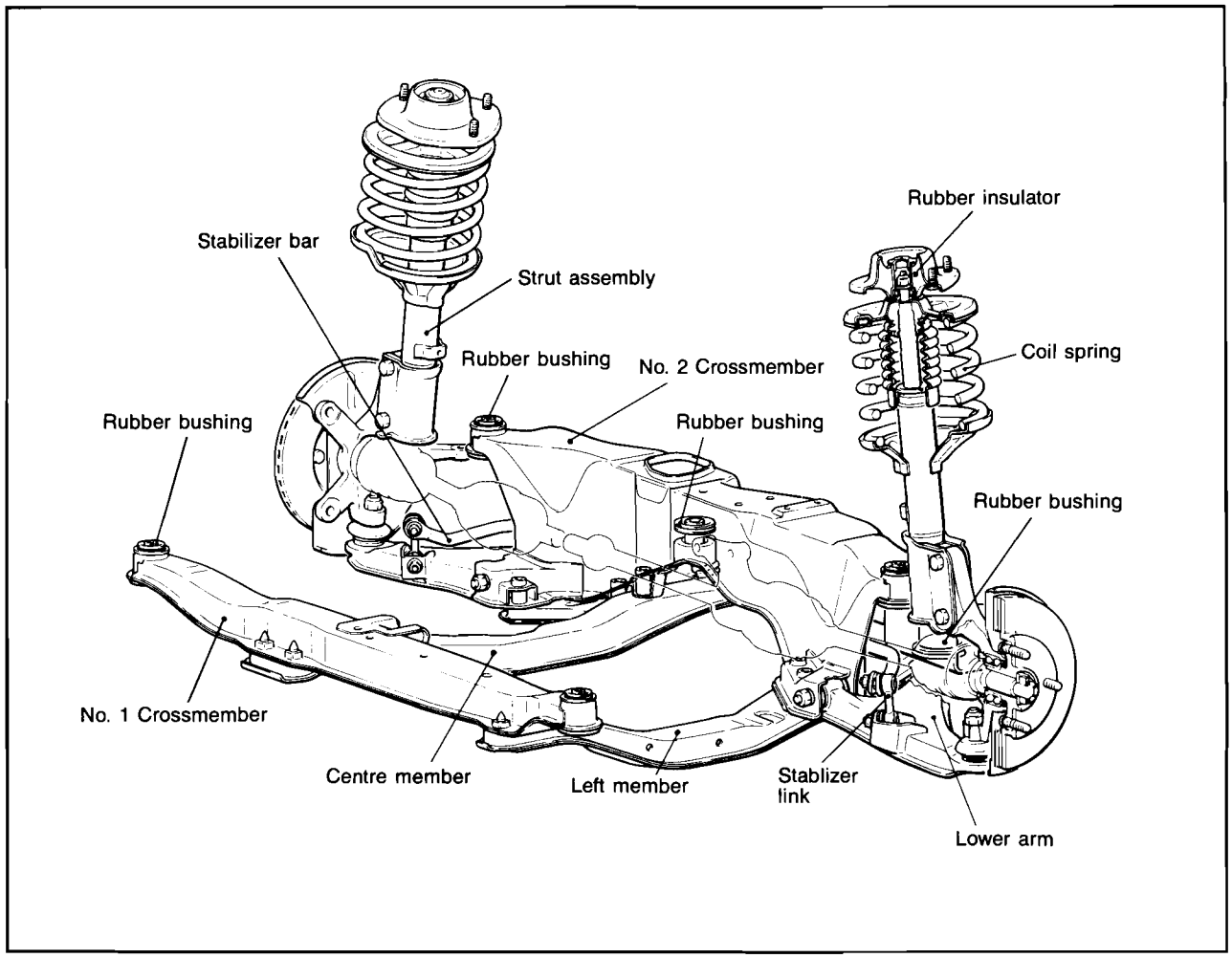


Fig. 1—Front suspension components

GENERAL INFORMATION

The front suspension, a McPherson strut type, incorporates many features designed to ensure good ride characteristics, combined with a high level of steering response and directional stability.

The suspension system comprises of two vertically mounted Mcpherson strut units, a single crossmember, a centre member and a stabilizer bar.

Each suspension unit consists of a strut assembly, coil spring, a hub and knuckle assembly and a lower control arm and is mounted to the inner fender panel at the top and at two points, to the crossmember at the bottom. Each unit pivots around the rubber mounted upper strut bearing and the lower arm ball joint.

Each strut assembly houses a double acting hydraulic damper, which incorporates a stop tube to limit the rebound stroke of the strut. The compression stroke is controlled by the spring and limited by a bump rubber fitted onto the piston rod.

The coil spring is a monorate spring and is used to give good ride and handling characteristics for all load carrying requirements.

The knuckle, which is mounted between the lower end of the strut and the lower arm, houses the front wheel bearing and supports the hub and disc assemblies.

The lower arm, which incorporates the lower ball joint, pivots on rubber bushes at two points on the crossmember.

The crossmember, which also houses the steering gearbox, is attached to the body at six points through rubber bushings and is braced longitudinally to the chassis by detachable members which are also mounted on rubber bushes at body attaching points.

The stabilizer bar, which is fitted to reduce any vehicle body roll tendencies when cornering, is mounted to the crossmember and lower control arm by pillow ball, ball joints.

WHEEL ALIGNMENT

Inspection and adjustment

The wheel alignment should be checked with the vehicle positioned on a level surface and with the front wheels in the straight ahead position. Prior to performing any adjustment ensure that all front suspension and steering components are in a serviceable condition and that the wheels and tyres are free of defects and correctly inflated.

Toe-in

Measure the toe-in with a suitable gauge, refer Fig. 2. If toe-in is not within specifications adjust by using the following procedure.

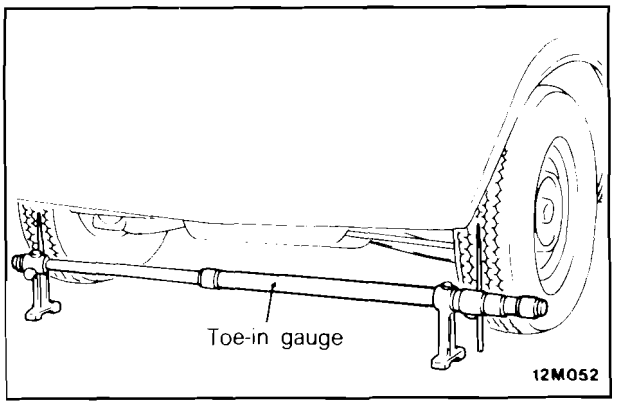


Fig. 2—Checking toe-in

(1) Compress the small bellows clips with pliers and slide the clip onto the tie rod.

(2) Loosen the tie rod lock nuts.

NOTE: Hold the tie rod end with a spanner while loosening the lock nut or the tie rod end may be damaged, refer Fig. 3.

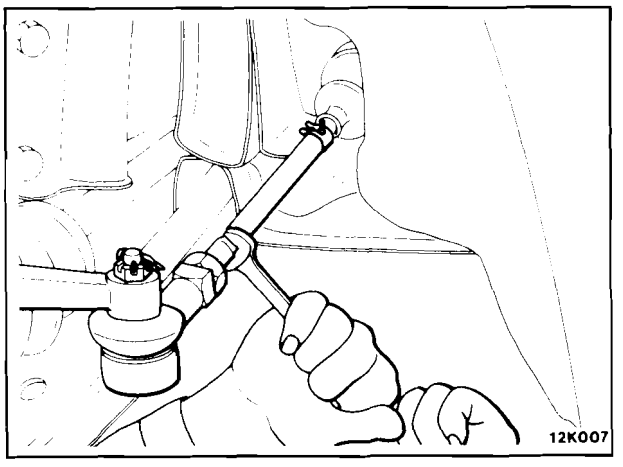


Fig. 3—Holding the tie rod

(3) Adjust the toe-in to specifications by rotating both tie rod ends an equal amount.

(4) Tighten the lock nuts and refit the bellows clips securely.

(5) Using a turning radius gauge check that the steering angle is within specifications. If necessary, adjust by altering the length of each tie rod by an equal and opposite amount. If the angle cannot be adjusted to within specifications then the linkage should be checked for bend or damage.

(6) Check the steering wheel "spoke position", if necessary reset by removing and repositioning the steering wheel.

Toe-out on turns

To check that the steering linkage is not bent, the toe-out on turns can be measured. This angle should be measured on both left and right hand turns. Refer to specifications for correct figures.

Caster and Camber

Both of these angles are preset to specifications at manufacture and are not adjustable. If they are found to be incorrect when checked, all suspension components should be checked for damage and replaced if necessary.

SUSPENSION STRUT ASSEMBLY

The strut assembly is a sealed unit and cannot be disassembled or repaired. If a strut is faulty it must be replaced as a unit.

Since the performance characteristics of the front strut assemblies gradually deteriorate when a vehicle has covered large distances, it is recommended, that when it becomes necessary, struts are replaced in pairs.

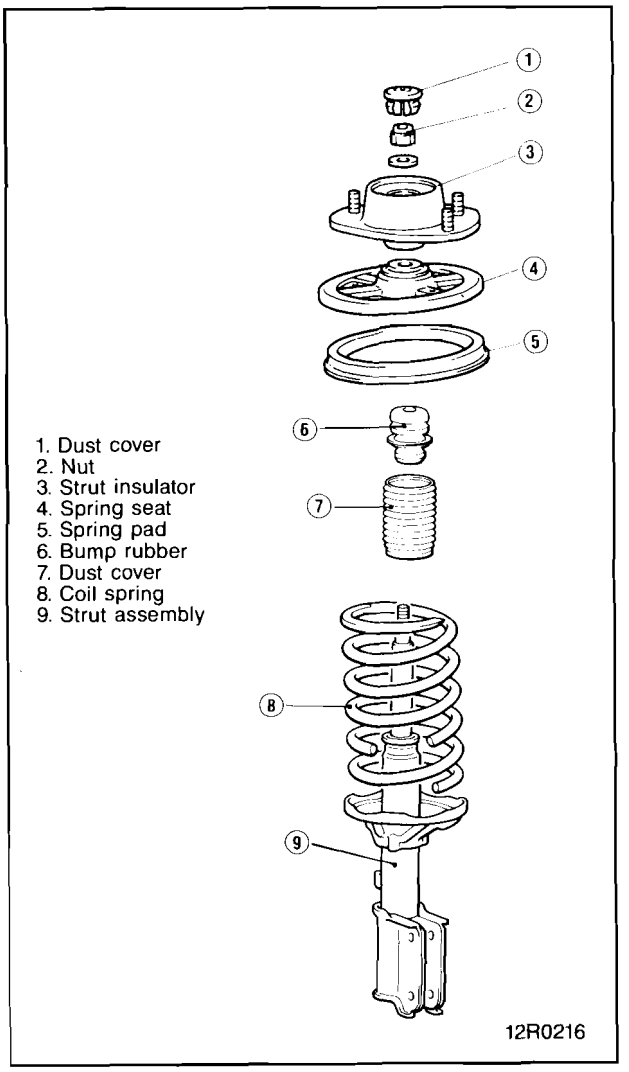


Fig. 4—Strut assembly components

Removal

NOTE: For vehicles fitted with Active Electronic Control Suspension, refer to Group 33B.

(1) Loosen the wheel nuts, raise the front of the vehicle and support on safety stands in the locations outlined in Group 00—General Information.

(2) Detach the brake line and front sensor clamp (vehicles with ABS) from the strut assembly.

(3) Support the knuckle assembly and remove the strut to knuckle attaching bolts, refer Fig. 5.

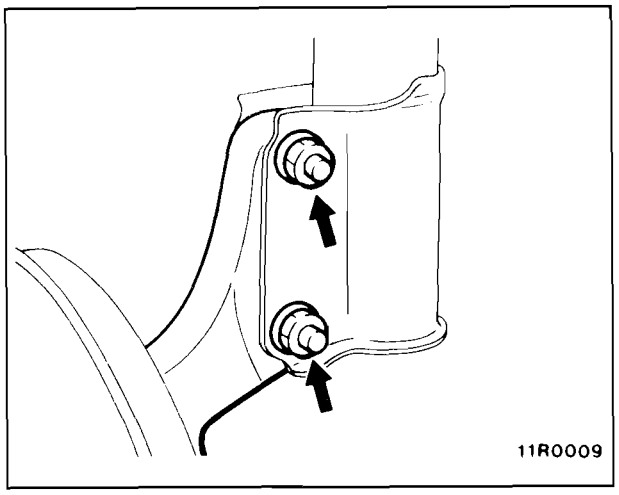


Fig. 5—Strut to knuckle attaching bolts

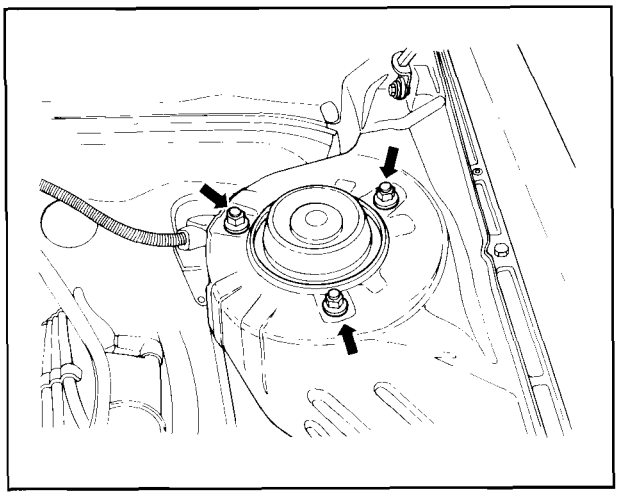


Fig. 6—Insulator attaching nuts

(4) Support the strut assembly, remove the strut insulator to body nuts and remove the strut from the vehicle.

Installation

Install by reversing the removal procedure.

Disassembly

(1) Support the strut assembly in a vice.
(2) Using special tool MB991176 and a suitable wrench, loosen insulator attaching nut, refer Fig. 7.
(3) Using a suitable spring compressor compress the coil spring, refer Fig. 8 and remove the insulator nut and insulator.
(4) Remove the strut, spring seat, spring pad, bump rubber dust cover and coil spring from the strut.

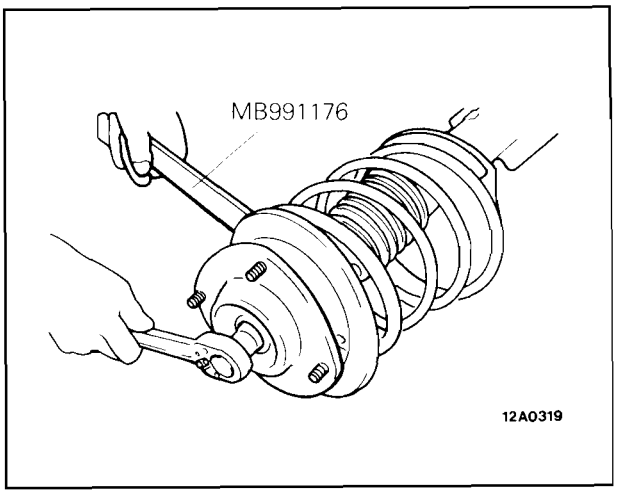


Fig. 7—Loosening insulator nut

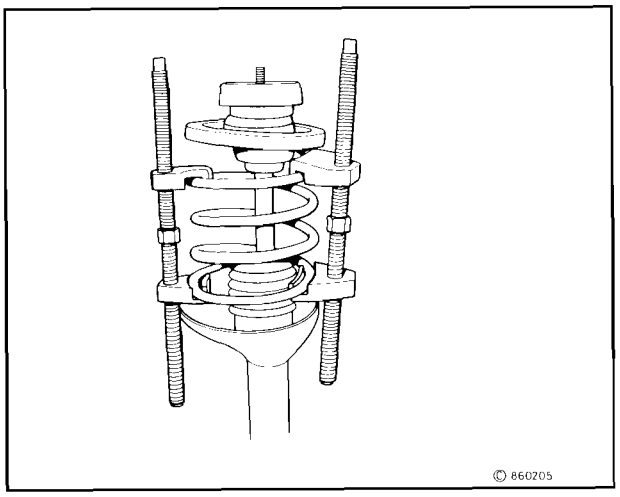


Fig. 8—Compressing the coil spring

Inspection

Perform the following inspection and replace any faulty components.

(1) Check the upper strut bearing for wear.
(2) Check all rubber components for wear, damage and deterioration.
(3) Check springs for cracks, fractures, loss of tension and other signs of deterioration.
(4) Check the strut for fluid leaks and the piston rod for bend.

NOTE: If a spring is to be replaced ensure that the correct specification spring is fitted.

NOTE: Springs or struts should always be replaced in pairs.

(5) Check the strut support, stopper and stopper rubber for damage or deterioration.

Reassembly

(1) Using a suitable tool compress the coil spring and install onto the strut.

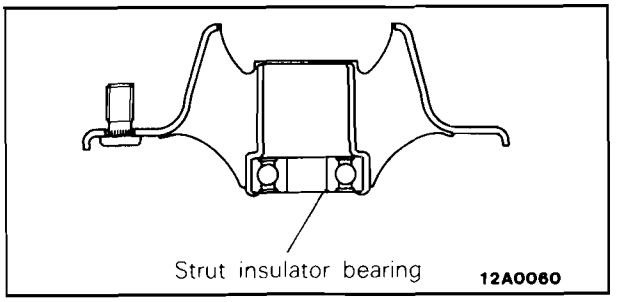


Fig. 9—Strut insulator and bearing

(2) Install the dust cover, bump rubber and spring pad.

(3) Fit the spring seat onto the piston rod, ensure that the cut out on the seat is correctly aligned to the piston rod.

(4) Assemble the strut insulator onto the piston rod and fit the retaining nut.

(5) Remove the spring compressor and tighten the insulator nut to the specified torque, ensuring that the spring does not twist in its seats.

LOWER ARM

Removal

(1) Raise the front of the vehicle, support on safety stands in the locations outlined in Group 00—General Information and remove the front wheels.

(2) Remove the stabilizer bar link to lower arm attaching nuts and disconnect the link.

(3) Loosen the ball joint to knuckle retaining nut and, using a suitable puller, disconnect the ball joint, refer Fig. 11.

(4) Remove the lower arm through bolt, the rear bush clamp bolts and nuts, refer Fig. 10, and remove the lower arm.

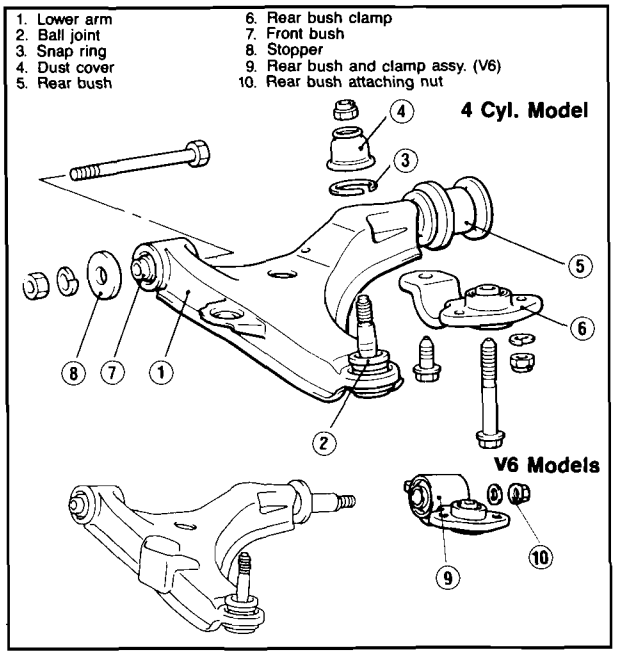


Fig. 10—Lower arm components

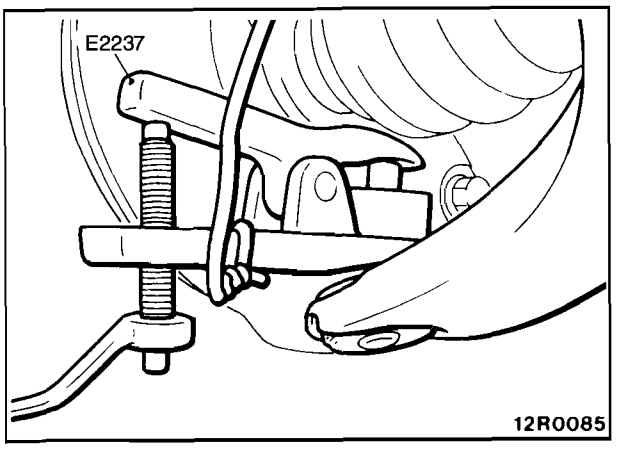


Fig. 11—Disconnecting lower arm ball joint

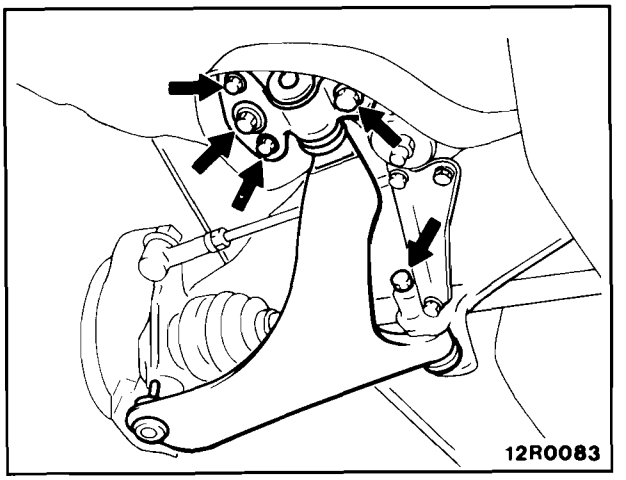


Fig. 12—Removing lower arm

Inspection

Perform the following inspection and replace any faulty components.

(1) Check the lower arm for cracks and other damage.

(2) Check the lower arm front bolt for distortion and damage.

(3) Check the lower arm bushes for damage and deterioration.

(4) Check the rear bush clamp for wear and distortion.

(5) Check the ball joint dust cover for splits.

(6) Check the ball joint turning torque.

Installation

Install by reversing the removal procedure noting the following:

(1) The lower control arm through bolt and the rear bush clamp to crossmember bolts and nuts should be torqued after the vehicle is lowered to the floor (4 cyl. models).

(2) On V6 models the rear bush clamp to crossmember bolts and nuts may be torqued leaving only the rear bush nut and lower control arm through bolt to be torqued once the vehicle is on the floor.

Measuring ball joint turning torque

(1) Install the ball joint retaining nut onto the ball joint stud.

(2) Move the ball joint stud in all directions several times.

(3) Using a suitable socket and torque wrench, turn the ball joint stud at approximately 2 revs/min. and measure the turning torque, refer Fig. 13.

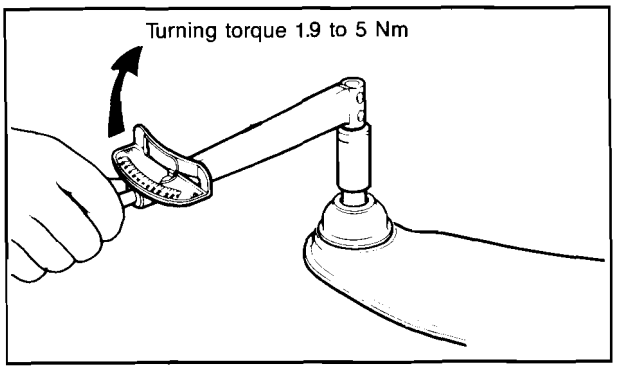


Fig. 13—Measuring ball joint turning force

NOTE: Ball joint "turning torque" is the force required to maintain turning and should not be confused with the higher value of "starting torque".

NOTE: The ball joint should be replaced if the measured value is not within specifications, or if there is any axial or diametral play.

Ball joint replacement

(1) Remove the ball joint dust cover.

(2) Remove the snap ring.

NOTE: The dust cover and snap ring should not be reused.

(3) Using special tool E33M1 press out the ball joint, refer Fig. 14.

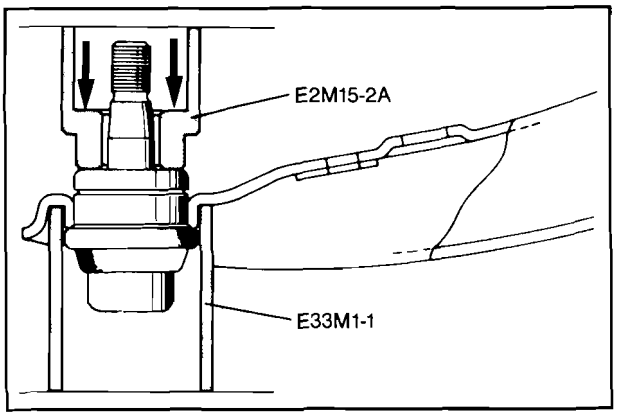


Fig. 14—Removing ball joint

(4) Using a special tool E33M1 press in the ball joint, refer Fig. 15.

NOTE: If the standard ball joint installation pressure is not obtained the lower arm must be replaced.

The initial pressure should be more than 700 kg at an installation depth of 3 to 6 mm with a final pressure of 5000 kg.

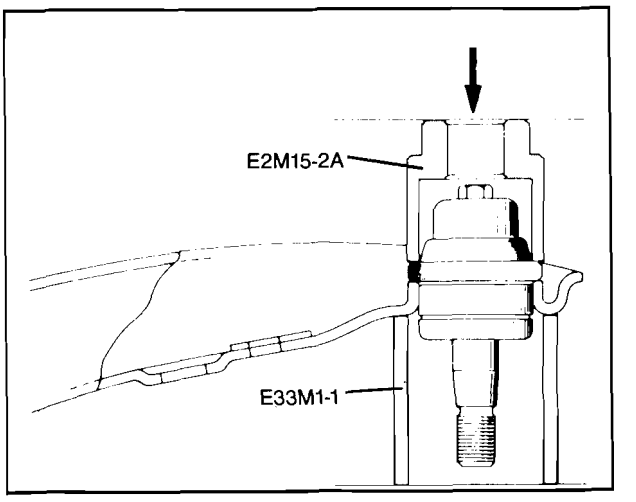


Fig. 15—Installing ball joint

(5) Install the snap ring taking care to avoid opening the snap ring wider than necessary.

NOTE: The snap ring should not be loose in the snap ring groove. Always use a new snap ring and dust cover.

(6) Fill the ball joint dust cover with specified grease (Multi-purpose, non-melt type No. 2) and apply grease to the lip of the seal.

(7) Using a special tool E33M1-1, support the lower arm and press the dust cover on, refer Fig. 16.

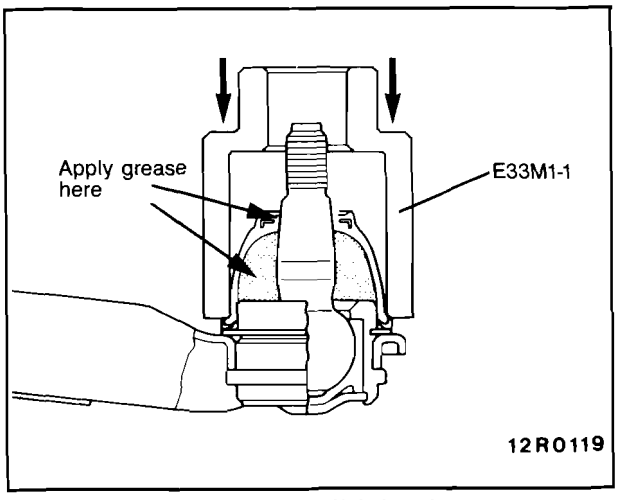


Fig. 16—Installing ball joint dust cover

Lower arm front bush replacement.

(1) Remove the bush flange.

NOTE: Use care to avoid damaging the lower arm.

(2) Position the lower arm in a press and using special tools, kit E33M2, as shown in Fig. 17 press out the bush.

(3) Using special tools, kit E33M2, as shown in Fig. 17, press in the new bush.

NOTE: The press in force required should be a minimum of 800 kg. If press in force is below this value the lower arm should be replaced.

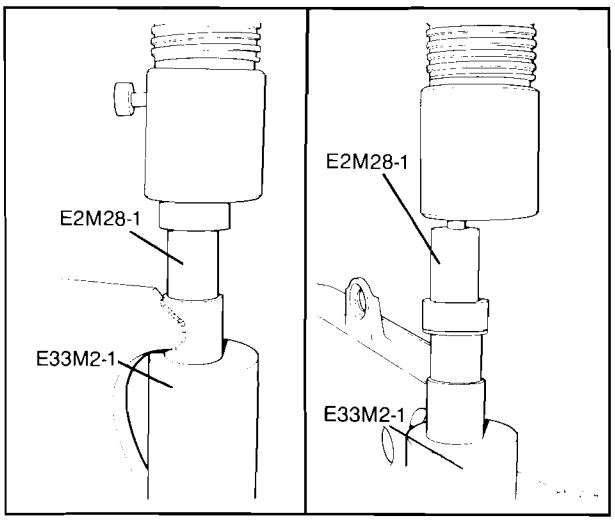


Fig. 17—Lower arm bush replacement

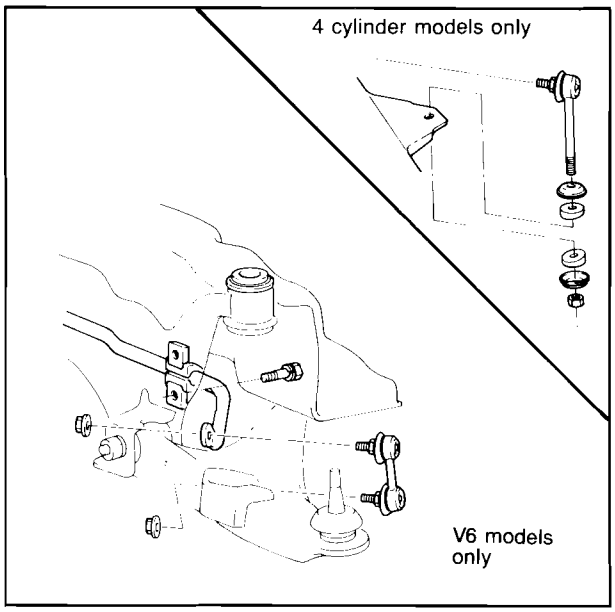


Fig. 18—Stabilizer bar attaching points and components

STABILIZER BAR

Removal

(1) Remove front exhaust pipe.

(2) Remove the centre and left members, refer Fig. 22.

(3) Remove the stabilizer bar link to lower arm nuts, refer Fig. 18.

(4) Remove the stabilizer bar to cross member clamp bolts, refer Fig. 18 and remove the stabilizer bar.

Inspection

Perform the following inspection and replace any faulty components.

(1) Check the stabilizer bar for distortion and damage.

(2) Check all bushes, clamps and bolts for distortion, damage and deterioration.

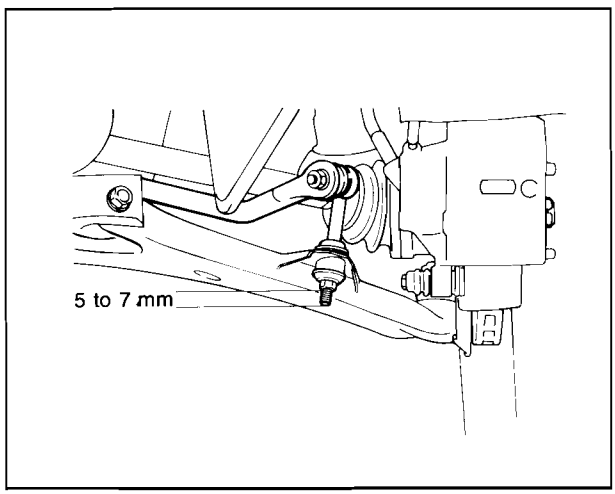
Installation

Install by reversing the removal procedure, noting the following.

(1) Assemble components as shown in Fig. 18.

(2) Ensure that the paint marks on the stabilizer bar are positioned as shown in Fig. 20.

(3) When tightening the stabilizer bar lower link nut (4 cylinder models only) only tighten the nut sufficiently to expose 5 to 7 mm of thread, refer Fig. 19.



Fig, 19—Lower link nut installation

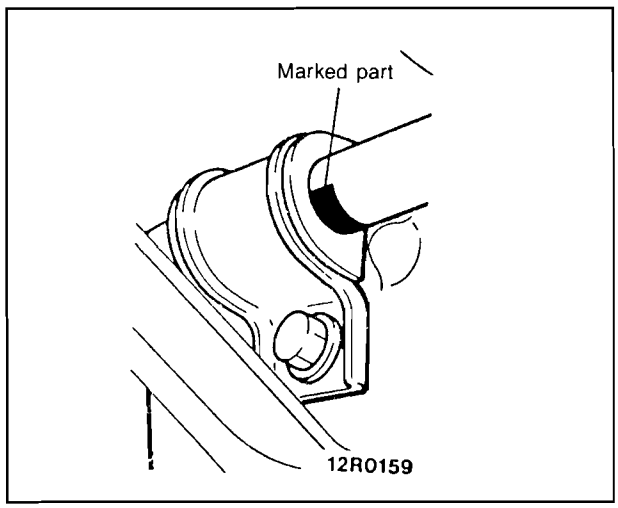


Fig. 20—Stabilizer bar installation

No. 2 CROSS MEMBER

Removal

(1) Loosen the front wheels.

(2) Raise the front of the vehicle, support on safety stands in the locations outlined in Group 00—General Information and remove the wheels.

(3) Remove the engine front roll stopper to engine bracket bolt.

(4) Remove the splash shield to centre member bolts.

(5) Remove the centre and left member attaching bolts and remove the members from the vehicle, refer Fig. 22.

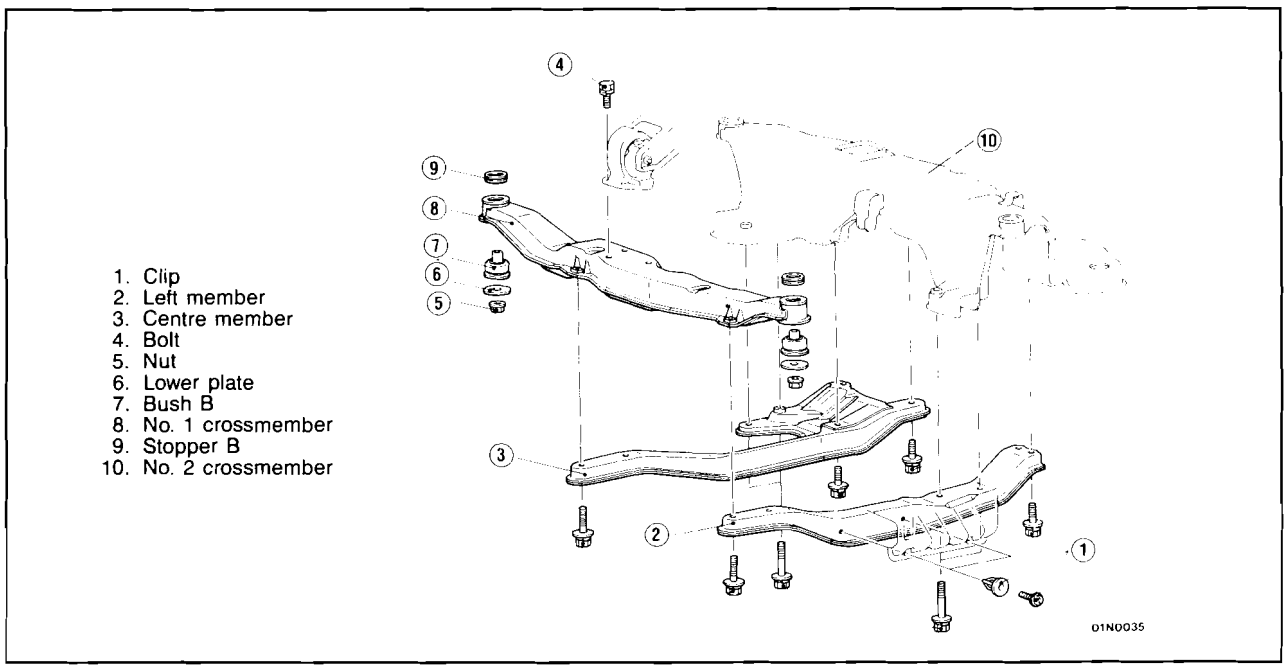


Fig. 21—Cross member components

NOTE: On vehicles with manual transaxle a dynamic damper is attached the centre member rear bolts, DO NOT DROP the damper.

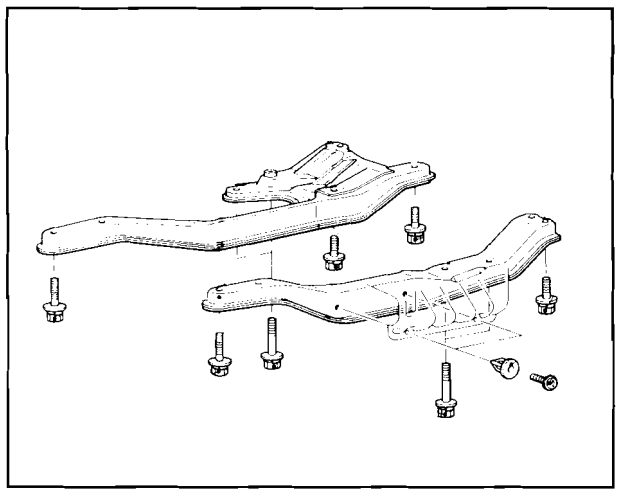


Fig. 22—Left and centre member attaching bolts

(6) For vehicles fitted wih E.C.S. remove the front height sensor assembly.

(7) Remove the front exhaust pipe from the vehicle, refer Group 15.

(8) Disconnect the steering coupling from the rack and pinion assembly, refer Fig. 23.

(9) Using a suitable puller disconnect the tie rod ends from the knuckles, refer Fig. 24.

(10) Disconnect the power steering fluid return and pressure hoses from the rack and pinion assembly. Plug the hoses and the connectors to prevent the ingress of dirt and water. Remove hose to crossmember clamps.

(11) If the crossmember is to be replaced remove the rack and pinion to crossmember clamp bolts and remove the rack and pinion from the vehicle.

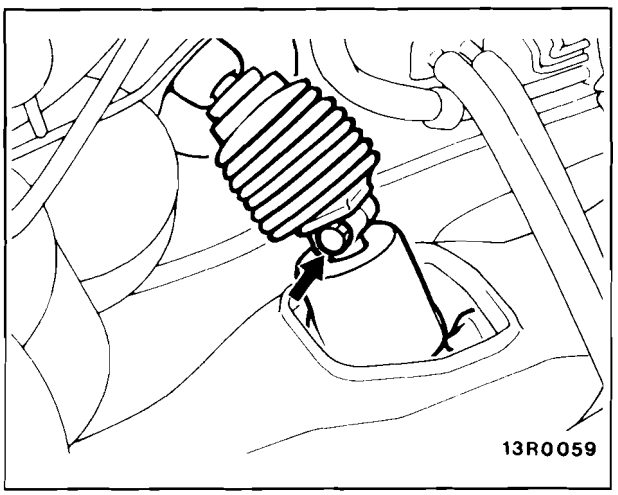


Fig. 23—Disconnecting the steering coupling

(12) Remove the stabilizer bar link to lower arm attaching nuts and remove the link.

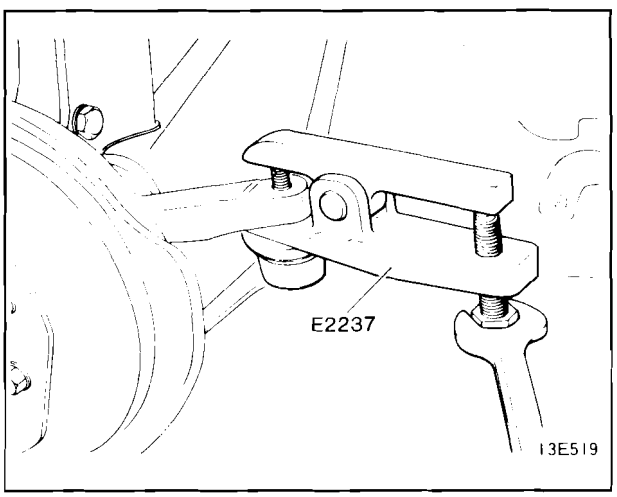


Fig. 24—Disconnecting tie rod end ball joint

(13) If the crossmember is to be replaced, remove the stabilizer bar to crossmember clamp bolts and remove the stabilizer bar.
(14) Remove the lower arm to crossmember front bolts and rear bush clamp bolts.
(15) Remove the rear engine stopper to engine bracket bolt.
(16) Remove the crossmember attaching bolts, refer Fig. 25 and remove the crossmember from the vehicle.

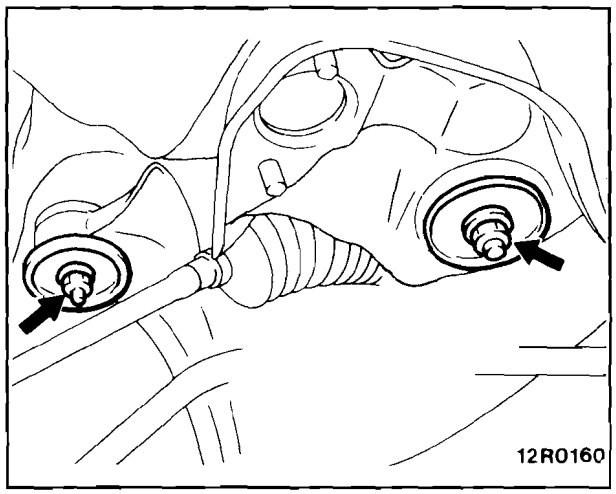


Fig. 25—Crossmember attaching bolts

Inspection

Perform the following inspection and replace any faulty components.
(1) Check the crossmember and the centre member for cracks and distortion.
(2) Check bushes for cracks and deterioration.
(3) Check the dynamic damper for cracks and deterioration.

Installation

Install by reversing the removal procedure, noting that the lower arm through bolt and the rear bush clamp to crossmember bolt should be torqued after the vehicle is lowered to the floor.

Bush replacement

(1) Using a special tool E2M31 press out the bush, refer Fig. 26.

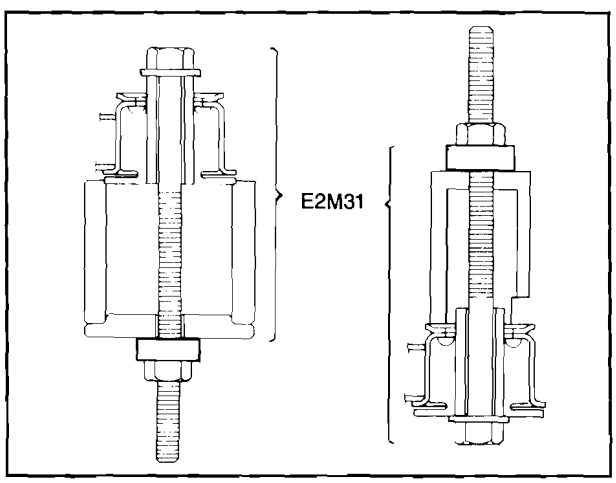


Fig. 26—Replacing crossmember bush

(2) Apply soap solution to the outside of the bush and using special tool E2M31 press the bush in until the bush is based, refer Fig. 27.

NOTE: It is important to avoid any stoppage when pressing in the bush as due to the close tolerance fit of the bush it may be impossible to recommence the pressing in operation.

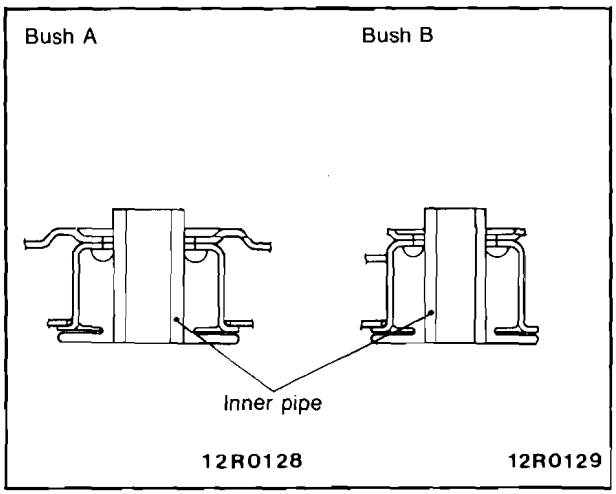


Fig. 27—Crossmember bush projection

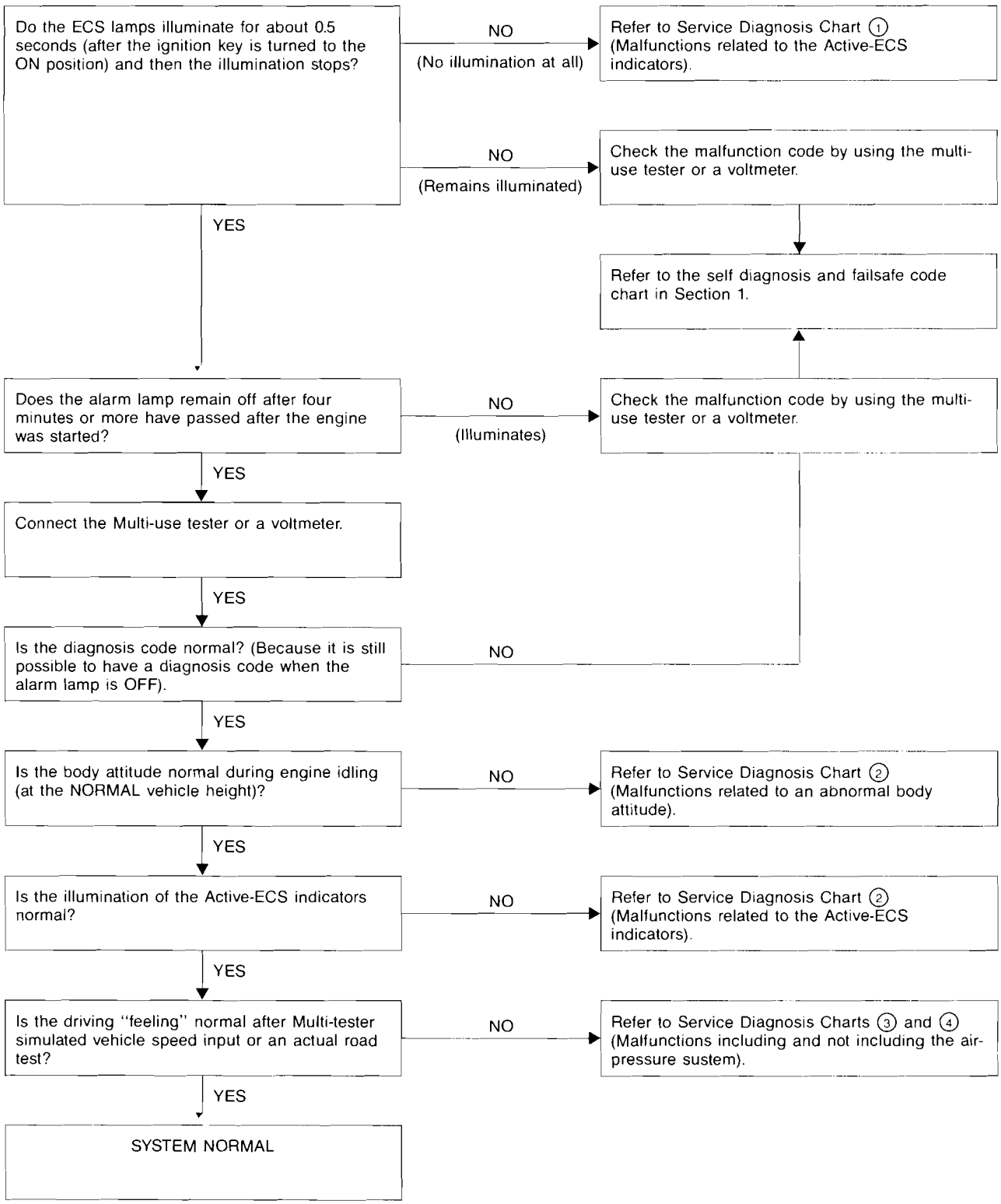
GROUP 33B — ACTIVE-ELECTRONIC CONTROL SUSPENSION <R SERIES MODELS>

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SECTION 1 — SERVICE DIAGNOSIS

SELECTION OF THE SERVICE DIAGNOSIS CHART



MALFUNCTIONS RELATED TO THE ACTIVE-E.C.S. INDICATORS (CHART 1)

Condition	Possible Cause	Corrective Action
ALL INDICATOR LAMPS WONT ILLUMUNATE	Fuse blown	Replace fuse
	Power relay malfunction	Test relay — replace if necessary
	Connector disconnected	Re-connect connector
	Wiring harness fault	Repair or replace wiring/harness
NO CONTROL MODE SWITCHING	Malfunction of the ECU	Check ECU with MUT
	Wiring harness fault	Repair or replace wiring/harness
NO INDICATOR LAMP ILLUM. WHEN CONTROL MODE SWITCH IS PRESSED	Malfunction of the ECU	Check ECU with MUT
	Indicator lamps inoperative	Replace lamps
	Wiring harness fault	Repair or replace wiring/harness
THE CORRECT INDICATOR LAMP DOES NOT ILLUMINATE	Indicator lamps inoperative	Replace lamps
	Wiring harness fault	Repair or replace wiring/harness
	Faulty manual ECS switch	Remove and test switch
	Malfunction of the ECU	Check ECU with MUT
AN INDICATOR THAT SHOULD NOT BE ILLUMINATED REMAINS ILLUMINATED	Indicator lamps inoperative	Replace lamps
	Wiring harness fault	Repair or replace wiring/ harness
	Faulty manual ECS switch	Remove and test switch
	Malfunction of the ECU	Check ECU with MUT
THE INDICATOR LAMPS DO NOT BECOME DIMMER WHEN THE HEADLAMPS ARE SWITCHED ON	Faulty tail lamp relay	Test relay — replace as necessary
	Wiring harness fault	Repair or replace wiring/harness

MALFUNCTIONS RELATED TO AN ABNORMAL BODY ATTITUDE (CHART 2)

Condition	Possible Cause	Corrective Action
THE BODY REMAINS TILTED TO ONE SIDE WHEN THE VEHICLE HAS STOPPED	Incorrectly adjusted G-Senor	Check output voltage from G-Sensor and adjust to specification
	G-Sensor wiring or circuit damaged	Repair/replace wiring or G-Sensor
	G-Sensor connector disconnected	Connect connector
	Malfunction of the ECU	Check ECU with MUT
THE VEHICLE HEIGHT INCREASES AFTER THE ANTI-ROLLING CONTROL ACTION	A front or rear flow control solenoid valve is stuck open	Repair or replace the applicable flow control solenoid valve assembly
	Wiring harness fault	Repair or replace wiring/harness
	Malfunction of the ECU	Check ECU with MUT
THE VEHICLE HEIGHT DECREASES AFTER THE ANTI-ROLLING CONTROL ACTION	A front or rear flow control solenoid valve is stuck closed	Repair or replace the applicable flow control solenoid valve assembly
	A front or rear (air supply) solenoid valve is stuck closed	Repair or replace the front or rear solenoid valve assemblies
	Wiring harness short circuit	Repair or replace wiring/harness
	Malfunction of ECU	Check ECU with MUT
THE VEHICLE HEIGHT INCREASES AT THE FRONT OR REAR OF THE VEHICLE WHEN LEFT UNATTENDED	Leakage at the front or rear (air supply) solenoid valve seat	Repair or replace the front or rear solenoid valve assemblies
THE VEHICLE HEIGHT DECREASES AT THE FRONT OR REAR OF THE VEHICLE WHEN LEFT UNATTENDED	Air leakage to the outside from the (air supply) solenoid valves	Repair or replace the front or rear solenoid valve assemblies
THE VEHICLE HEIGHT DECREASES AT ONE WHEEL ONLY WHEN THE VEHICLE IS LEFT UNATTENDED	Air leakage to the outside or at the valve seat of a control solenoid valve	Repair or replace the front or rear solenoid valve assemblies

MALFUNCTIONS INCLUDING THE AIR-PRESSURE SYSTEM (CHART 3)

Condition	Possible Cause	Corrective Action
COMPRESSOR IS ACTIVATED FREQUENTLY	Low pressure switch malfunction or air leakage	Locate air leak and/or test applicable components. Repair or replace as necessary
	High pressure switch malfunction or air leakage	
	Rear pressure sensor malfunction or air leakage	
	Flow control solenoid valve malfunction or air leakage	
	Front or rear solenoid valve assembly malfunction or air leakage	
	Compressor malfunction or air leakage	
	Air tube leakage	
ANTI-ROLL CONTROL IS NOT FUNCTIONING	High pressure switch malfunction or air leakage	Locate air leak and/or test high pressure switch
	Front or rear exhaust valve (in flow control valve assembly) stuck open	Test flow control valve assembly. Repair or replace as necessary
	Air tube either leaking or clogged	Clear air tube or locate leak
ANTI-ROLL CONTROL EFFECT IS INSUFFICENT	High pressure switch malfunction or air leak	Locate air leak and/or test high pressure switch
	Rear pressure sensor malfunction or air leak	Locate air leak and/or test high pressure switch
	Flow control solenoid valve is stuck closed	Test and repair/replace flow control solenoid valve assembly
	Front or rear exhaust valve (in flow control valve assembly) stuck open	Test and repair/replace flow control solenoid valve assembly
	Air supply valve (in front or rear solenoid valve assembly) stuck closed. Possibly from wiring short circuit	Test applicable solenoid valve assembly. Repair/replace as necessary. Repair/replace wiring as necessary
	Air tube either leaking or clogged	Clear air tube or locate leak
VEHICLE HEIGHT EXCEEDS ITS SELECTED POSITION	Flow control solenoid valve is stuck open	Test and repair/replace flow control solenoid valve assembly
VEHICLE HEIGHT ADJUSTMENTS HAVE NOT BEEN COMPLETED WITHIN THREE MINUTES (SYSTEM APPEARS NORMAL)	Vehicle height exhaust valve (on the compressor) is stuck closed	Test and repair/replace the compressor assembly as necessary
	Front or rear exhaust valve (in flow control valve assembly) stuck closed. Possibly from wiring short circuit	Test and repair/replace flow control solenoid valve assembly. Repair/replace wiring as necessary
	Air supply valve (in front or rear solenoid valve assembly) stuck closed. Possibly from wiring short circuit	Test applicable valve assembly. Repair/replace as necessary. Repair/replace wiring as necessary
	A control valve (in the front or rear solenoid valve assemblies) stuck closed	Test applicable solenoid valve assembly. Repair/replace as necessary
	Air tube clogged	Clear air tube
	Malfunction of the ECU	Test ECU with MUT
VEHICLE HEIGHT ADJUSTMENTS HAVE NOT BEEN COMPLETED WITHIN THREE MINUTES. (COMPRESSOR INOPERATIVE OR COMPRESSOR HAS OPERATED CONTINUOUSLY FOR FOUR MINUTES OR LONGER)	Low pressure switch malfunction or air leakage	Locate air leak and/or test applicable components. Repair or replace as necessary
	High pressure switch (contacts fused) malfunction or air leakage	
	Rear pressure sensor malfunction or air leakage	
	Flow control solenoid valve malfunction or air leakage	
	Front or rear solenoid valve assembly malfunction or air leakage	
	Compressor malfunction or air leakage	
	Air tube leaking	

MALFUNCTIONS NOT INCLUDING THE AIR-PRESSURE SYSTEM (CHART 4)

No.	Check Points (Functions)	Item No. or Diagnosis Code	Service Data		Malfunction			
			Condition and Indicated Data	Indication (Standard Value)	Anti-rolling control action is activated frequently	System operates with the ignition key ON (with the engine stopped).	No control when stopped	No anti-squat control
1	G sensor (detection of body lateral Gs)	11	Stop the vehicle at a horizontally level place	(2.5)	Air leakage			
2	Alternator "L" terminal (detection of engine rotation)	12	Engine rotation	HIGH		Harness wiring damaged or disconnected	Harness short circuit	
			Engine stop	LOW				
3	Throttle-position sensor (detection of sudden acceleration or deceleration)	14	Throttle fully open	V (0.25)				Damaged or disconnected wiring — short circuit
4	High-pressure switch (detection of high-pressure tank pressure)	15	760 kPa or less	ON				
			950 kPa or more	OFF				
5	Headlight switch (detection of headlight Illumination)	18	Headlight switch ON/OFF	ON				
				OFF				
6	Steering wheel sensor (detection of steering direction and angular velocity)	21	STR. 1 and STR. 2 each ON/OFF	ON				
				OFF				
7	Vehicle speed sensor (detection of vehicle speed)	24	Vehicle speed input to ECU	km/h				Malfunction of sensor or ECU. Short/open circuit in wiring
8	Stop light switch (detection of braking)	26	Stop light switch ON/OFF	ON				
				OFF				
9	Accel switch	34	Back-up light switch ON/OFF	ON				
				OFF				
10	A/T inhibitor switch	31	R range ON All other ranges OFF	ON				
				OFF				
11	Door switch	33	Door switch ON/OFF	ON				
				OFF				
12	Damping force switching actuator	41	—	—				
13	Compressor relay	43	—	—				
14	Compressor	—	—	—				
15	Return pump relay	44	—	—				
16	Return pump							

CHART 4 — Continued

No.	Malfunction												
	Compressor motor non-activation	Front does not become lower when headlights are turned ON	Front only becomes lower when Low vehicle height is selected at night (with headlights ON)	No anti-rolling control	No anti-drive control	Vehicle speed response function doesn't operate		No A/T shift squat control	Anti-squat control doesn't function during reverse	Vehicle-height adjustment starts late when passengers get in or out	Vehicle-height adjustment frequency increases when vehicle is stopped	Damping force switching doesn't function	Non-operation of return pump
						Damping force automatic switching	Vehicle-height adjustment						
1													
2													
3													
4	Damaged or dis-connected wiring												
5		Harness wiring damaged or dis-connected	Harness short circuit										
6				Harness short circuit									
7				Malfunction of sensor or ECU. Short/ open circuit in wiring	Malfunction of sensor or ECU. Short/ open circuit in wiring	Malfunction of sensor or ECU. Short/ open circuit in wiring	Malfunction of sensor or ECU. Short/ open circuit in wiring						
8					Damaged or dis-connected wiring								
9								Damaged or dis-connected wiring					
10								Damaged or dis-connected wiring. Harness short circuit	Damaged or dis-connected wiring				
11										Damaged or dis-connected wiring circuit	Short circuit		
12												Damaged or dis-connected wiring. Short circuit	
13	Damaged or dis-connected wiring												
14	Damaged or dis-connected wiring												
15													Damaged or dis-connected wiring
16													Damaged or dis-connected wiring

SECTION 2 — SPECIFICATIONS AND GENERAL INFORMATION

SPECIFICATIONS

Items	Front Suspension	Rear Suspension
SUSPENSION SYSTEM	MacPherson strut with coil spring and compression rod type	3-link with coil spring type
Wheel Alignment		
Camber	0° ± 30'	– 45' ± 10'
Castor	2°45' ± 30' (must not be more than 30' difference from LH to RH	—
Toe-in	0 ± 3 mm	0 ± 3 mm
Coil Springs		
Wire diam. x O.D. x free Length	LH = 13.8 x 193.8 — 183.3 x 448 mm RH = 14.2 x 194.2 — 184.2 x 443 mm	10.3 x 125.6 x 405 mm
Coil spring identification colour	LH = Blue x 1 spot RH = Blue x 2 spots	Blue x 1 spot
Spring constant	LH = 12.65 ± 0.59 Nm 11.77 ± 0.59 Nm RH = 14.42 ± 0.69 Nm	
Shock Absorber		
Type	Hydraulic, cylindrical double-acting type	Hydraulic, cylindrical double-acting type
Maximum length	485 ± 3 mm	520 ± 3
Minimum length	341 ± 3 mm	379 ± 3
Stroke	144 mm	141 mm
Damping force (at 0.3 m/sec)		
Expansion — Newtons		
HARD	1500	1400
MEDIUM	1100	1000
SOFT	700	600
Contraction — Newtons		
HARD	750	800
MEDIUM	550	550
SOFT	300	300
Vehicle Height — Normal (Measured between the top of the wheel arch and the centre of the wheel on the right side front and left side rear)	396 ± 5 mm	367 ± 5 mm
Height sensor rod-installation length	269-270 mm	135-136 mm
Rear height sensor rod — mounting position (Measured between the LH lateral rod mounting bolt and the LH edge of the rear sensor rod mounting bracket)	335 ± 1 mm	
G-Sensor output voltage	2.5 ± 0.02V	
High pressure switch		
Pressure switch shut off pressure	900 kPa or more	
Pressure switch operation pressure	710-810 kPa	
Low pressure switch		
Return pump activation pressure	110-170 kPa	
Return pump stop pressure	40-100 kPa or less	

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SPECIFICATIONS (Cont.)

Air compressor relief pressure ..... 1000-1300 kPa

Lower arm ball joint
- Starting Torque ..... 10-22 Nm
- Turning Torque ..... 1.9-5 Nm

SPECIAL TOOLS

MB991502	Multi-use tester
MRP-A	ROM pack
E2M12	Remover — Air pressure pipe connector
MB991075	Kit — Air pressure gauge
MB991226	Kit — Air pressure gauge adaptors
MB991176	Holder — Spring seat
E2237	Puller — Ball joint
E33M1	Kit — Ball joint replacement

TORQUE SPECIFICATIONS

	Nm
Air tube to strut assembly nut	9
Front height sensor to lower arm bolt	22
Front strut assembly to strut tower nuts	45
Strut to knuckle bolt and nut	90-105
Strut insulator mounting nut	80-100
Actuator bracket mounting nut	40-60
Lower arm ball joint and knuckle nut	60-72
Rear bush clamp (large) bolt	100-120
Rear bush clamp (small) bolt	90
Stabiliser link to lower arm nut	40
Stabiliser link to No. 2 cross member nut	40
Lower arm mounting bolt and nut	100-120
Rear bush clamp to No. 2 cross member nut	40
Rear shock absorber to axle bolts	80-100
Air tank bracket nuts	12
Air tube to air tank nuts	9
Air tube to air compressor joint	9
Compressor mounting bolts	6
Air tube to dryer joint	9
Lateral rod attaching bolts	80-100
Trailing arm mounting bolts	80-100
Front height sensor adjusting lock nut	12
Front height sensor to rod nut	20
Rear height sensor rod to axle bolt	22
Rear height sensor to rod bolt	22
Lower arm clamp mounting nuts (self locking)	100

GENERAL INFORMATION

The Active Electronic Control Suspension system introduces controlling energy externally in the form of pneumatic pressure, as well as computer controlled shock damping, to create ideal suspension characteristics.

The operator is able to select two different vehicle ride qualities, i.e. Auto or Sport and three different vehicle heights, i.e. Normal, High and Extra High. This is achieved by one select switch located on the centre console.

The system also had indicator lamps which are located in the instrument panel. These show the system's selected vehicle height mode and control mode. If an electronic system fault occurs, the 'Alarm' lamp on the instrument panel will illuminate.

This system also features a self-diagnosis system and multi-use tester compatability.

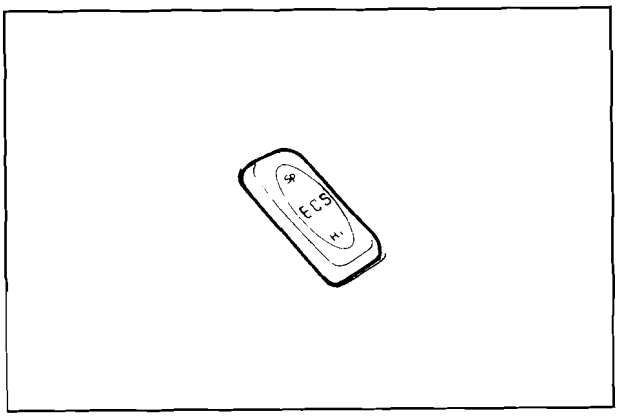


Fig. 2 — E.C.S. switch

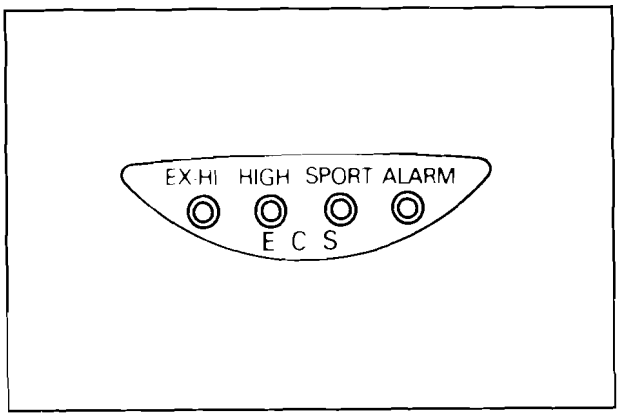


Fig. 3 — E.C.S. indicators

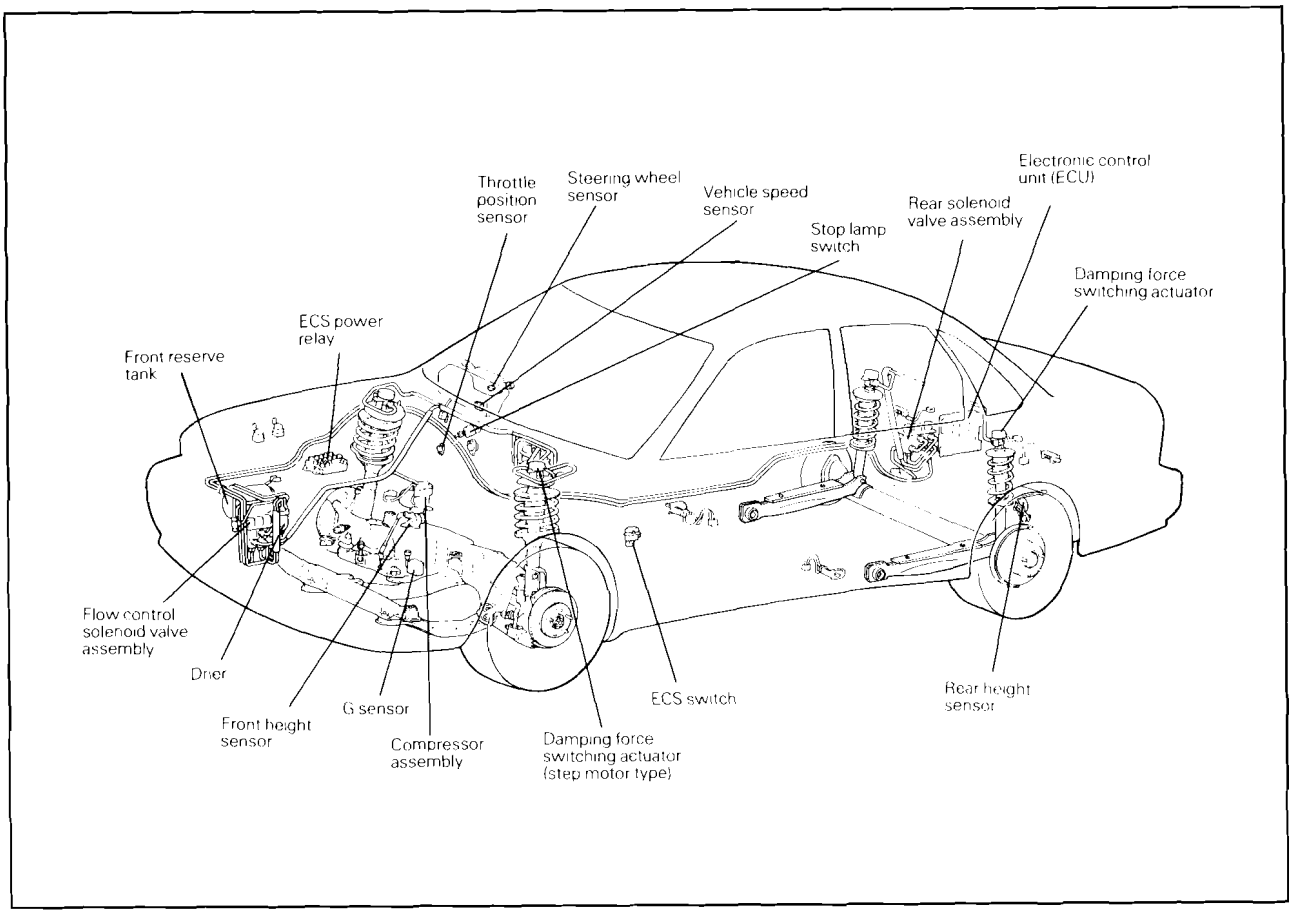


Fig. 1 — E.C.S. system components

SECTION 3 — DIAGNOSIS AND TESTING

SERVICE DIAGNOSIS PROCEDURE

Active — E.C.S. problems/failures usually occur as a result of:

(a) Wiring harness or connector faults/shorts.
(b) Electronic component faults.
(c) Air leaks.
(d) Incorrect adjustments.

NOTE: The "Self-Diagnosis" system outlined in this section is only provided to assist in fault diagnosis. It cannot indicate all E.C.S. system faults and does not eliminate the need to follow standard diagnosis procedures.

STEP 1 —

Obtain all possible information on the fault

- **When**
- **Where**
- **How often**
- **What kind**
- **Where possible — conduct simulation test with owner.**

↓

STEP 2 —

Follow the Service Diagnosis flow chart at the start of Section 1.

↓

STEP 3 —

Check for self-diagnosis code output

- **Read code using MUT or voltmeter**
- **Continue with flow chart in Section 1 or refer Self Diagnosis Code Chart.**

↓

STEP 4 —

Using the service diagnosis charts and/or the Self Diagnosis Chart, locate and rectify the system fault.

TEST PROCEDURE

The E.C.S. system electronic control unit has up to 22 self diagnosis codes.

These codes can be read by connecting a voltmeter (analog type) or the Multi-use tester to the diagnosis connector of the vehicle.

The vehicle diagnosis plug is located alongside the junction block on the lower RHS of the instrument panel. Refer Fig. 1.

The only test equipment that should be connected to the diagnosis plug is a voltmeter or the Multi-use tester.

If other test equipment is used which has too high a current draw, ECU damage can result.

The maximum safe current draw is only a few milliamps.

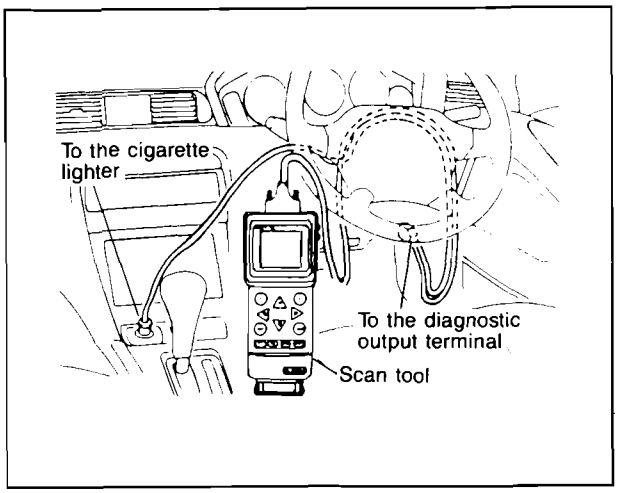


Fig. 1 — Diagnosis connector location

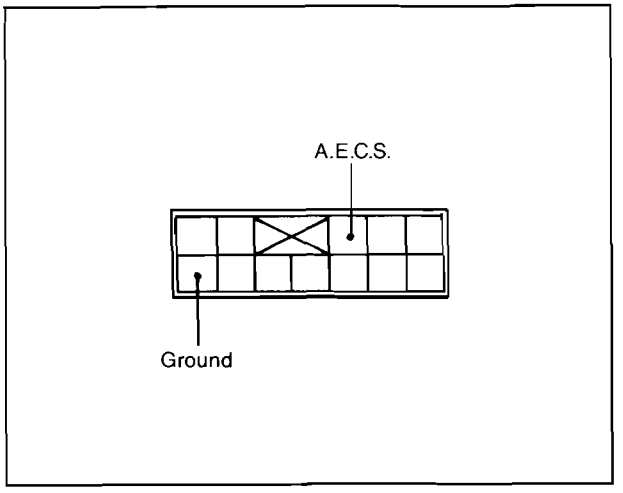


Fig. 2 — Self diagnosis terminals

Voltmeter Test

(1) Connect a voltmeter across the terminals shown in Fig. 2.

(2) Turn the ignition switch ON.

(3) If the diagnosis item has been stored in the memory, the code is shown on the voltmeter in the format illustrated in Fig. 3.

(4) Refer Self Diagnosis Code Chart this section.

NOTE: It is possible to have a system fault and not have a Self Diagnosis code omitted or the 'Alarm' lamp illuminated.

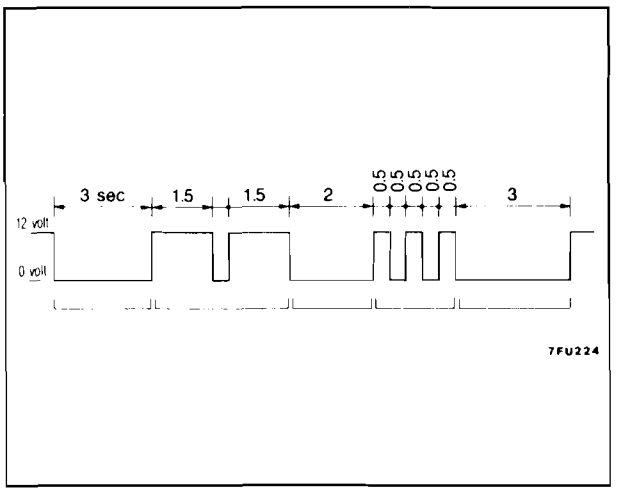


Fig. 3 — Fault diagnosis code (example)

FAIL-SAFE SYSTEM

If a detectable electronic system fault occurs, the Alarm lamp on the instrument panel will illuminate, warning the operator of a system malfunction.

When a self diagnosis fault is detected (except Code 56), the system will operate in a 'fail safe' condition.

Refer to the self diagnosis code chart for the fail safe condition applicable to the fault.

SELF DIAGNOSIS SYSTEM

The E.C.S. self diagnosis system features an Alarm lamp self check function. When the ignition is switched ON or the engine is started, the alarm lamp will illuinate for 0.5 seconds and then turn OFF.

It is possible for the alarm lamp to come ON in some circumstances when there is no actual fault.

If this condition occurs and the engine is switched OFF, then restarted and the alarm lamp stays OFF after the engine has been running for 4 minutes, the system is normal.

Listed below are a couple of circumstances that can cause this condition:

- When frequent vehicle height adjustments are required causing compressor overheating.
- When frequent anti-roll corrections are required causing return pump overheating.

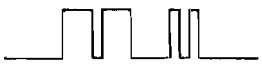
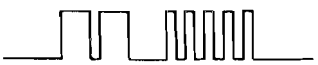
Any self diagnosis codes are retained in the memory as long as the battery and ECU leads remain connected. To clear the diagnosis codes, disconnect the battery negative terminal for 5 seconds or more or use the diagnosis code erase feature of the MUT. The system will display multiple codes in numerical order and a system normal code is also featured, e.g. No self diagnosis codes detected.

If a fault code identified by '*' occurs due to an intermittent contact, the alarm lamp will switch OFF and normal condition will be restored if the fault ceases to exist.

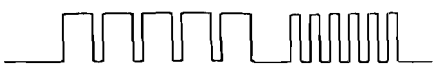
SELF DIAGNOSIS CODE CHART

Output code		Diagnosis items	Fail-safe function [or vehicle state]
No.	Display pattern		
0	ON / OFF — Same repeated	[Normal] **No Trouble Code**	[Normal]
*11		Faulty G sensor [including disconnected connector, open or short circuit in harness]	Roll control among attitude controls is inhibited
12		Abnormal alternator (L terminal) output voltage [excluding open circuit in harness]	[System does not operate when vehicle is at rest or vehicle speed approx. 3 km/h (2 mph) or less. Charging warning lamp lights steadily.]
*13		Faulty low pressure switch [including disconnected connector, open or short circuit in harness].	Attitude control is inhibited.

Diagnosis Codes (Cont.)

Output code		Diagnosis items	Fail-safe function [or vehicle state]
No.	Display pattern		
*21		Open circuit in steering angular velocity sensor [including disconnected connector, open circuit in harness]	Attitude control is stopped and damping force is fixed to MEDIUM and vehicle height is fixed to NORMAL.
*22		Faulty front height sensor [including disconnected connector, open circuit in harness]	Damping force is fixed to MEDIUM and vehicle height and attitude controls are stopped.
*23		Faulty rear height sensor [including disconnected connector, open circuit in harness]	Damping force is fixed to MEDIUM and vehicle height and attitude controls are stopped.
*24		Open circuit in vehicle speed sensor [including disconnected connector, open circuit in harness]	Attitude control is stopped and damping force is fixed to MEDIUM and vehicle height is fixed to NORMAL.
*25		Faulty rear pressure sensor [including disconnected connector, open or short circuit in harness]	Attitude and vehicle height controls are stopped. (Vehicle height can be reduced.)
41		Faulty actuator (step motor) [open circuit in harness or shorted ECU output transistor]	Damping force select and attitude control are stopped and vehicle height is fixed to NORMAL.
42		Faulty solenoid valve power relay [including disconnected connector and open or short circuit in harness]	Damping force is fixed to MEDIUM and attitude and vehicle height controls are stopped.
43		Faulty compressor relay [including disconnected connector and open or short circuit in harness]	
44		Faulty return pump relay [including disconnected connector and open or short circuit in harness]	
45		Faulty exhaust valve for vehicle height adjustment [including disconnected connector and open or short circuit in harness]	
46		Faulty flowrate changeover valve [including disconnected connector and open or short circuit in harness]	
47		Faulty front or rear air discharge valve for active control [including disconnected connector and open or short circuit in harness]	
51		Faulty front or rear air supply valve [including disconnected connector, open circuit in harness]	

Diagnosis Codes (Cont.)

Output code		Diagnosis items	Fail-safe function [or vehicle state]
No.	Display pattern		
52		Faulty front valve [including disconnected connector, open circuit in harness]	Damping force is fixed to MEDIUM and attitude and vehicle height controls are stopped.
53		Faulty rear valve [including disconnected connector, open circuit in harness]	
54		Faulty vehicle height adjustment (when high pressure switch OFF) [overladen, mechanical failure of vehicle height adjusting valve, etc.]	
55		Faulty vehicle height adjustment (when high pressure switch ON) [faulty compressor, air leaks, etc.]	
56		Air leaks from front or rear valve	Control is not stopped [Alarm lamp does not come on but vehicle height will decrease if this state is left uncorrected.]

DIAGNOSIS PROCEDURE USING MULTI-USE TESTER (MUT)

(1) Connect the MUT to the self diagnosis connector, located near the fuse box on the drivers side.

(2) Connect the MUT to power supply.

(3) With the ignition ON or the engine running, select the model using the NO key or the 'UP-arrow' key or by model number, i.e.

VERADA
3.0 V6 KR MDL

(4) Then the yes key.

(5) Then select the system, i.e. —ACTIVE—ECS using the YES key.

(6) Then select the desired function, i.e.
- 1. Self Diagnosis Code
- 2. Service Data
- 3. Actuator Test
- 4. Special Test
- 5. Erase Code

(7) To return to this menu from a function just press the CLEAR key.

(8) The features of the above functions are:

• 1. Self Diagnosis

a. If no self diagnosis fault is recorded in the memory, the MUT will display 'NO TROUBLE CODE' on the screen.
b. If a self diagnosis fault is recorded, the tester will identify the faulty system by fault code, number and name. Repair the fault displayed.

NOTE: Multiple faults can be displayed.

CAUTION: If no self diagnosis fault is displayed, it does not necessarily mean there is 'NO FAULT' to be found. It is advisable to perform a service data test.

• 2. Service Data

a. Select desired component to be tested by using the Up/Down arrowed keys.
b. Refer to service data chart for available outputs.
c. If a service data item tested is faulty, repair/replace as necessary.

• 3. Actuator Test

a. Test as per actuator chart.
b. If fault is found, repair/replace as necessary.

• 4. Special Test

a. The only two functions that can be selected in special test for the ECS system are 'Simulated Vehicle Speed' and 'Drive Recorder'.
b. To use the 'Simulated Vehicle Speed' function, refer to Section 4 — Service Adjustment Procedures.
c. To use 'Drive Recorder' you must first choose the sensors you wish to record.

NOTE: Maximum of 4 sensors at a time can be recorded.

Select the trigger method and drive the vehicle. Set the trigger if necessary and complete the road test. Review the recorded data and identify the fault. Repair/replace as necessary.

- **5. Erase Code**

DIAGNOSIS PROCEDURE USING MULTI-USE TESTER (MUT)

The diagnosis erase is available on systems with diagnosis codes. Use the diagnosis erase feature as follows:-

(1) Connect the MUT to the self diagnosis connector, located near the fuse box on the drivers side.

(2) Turn the ignition switch OFF and then turn it ON.

(3) Select the vehicle model and then select the system.

(4) Select 4 "Special Test".

(5) Select 5 "Diagnosis Erase".

(6) To the prompt "Erase Diagnosis Code?" and press YES.

(7) Enter the code nominated on the tester and press YES.

(8) If successful, the diagnosis codes will be erased.

(9) Press clear to return to the menu.

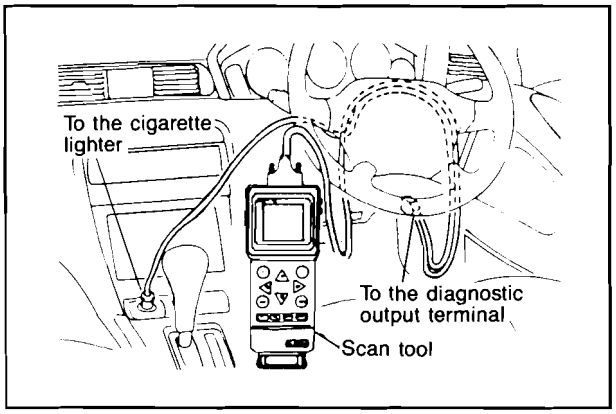


Fig. 4 — Multi-use tester

SERVICE DATA

This function outputs the control unit input/output data to the diagnosis connector as a serial signal. This signal can be read by connecting the multi-use tester to the self diagnosis connector.

Item No.	Service Data Items		Indication (Unit)
11	G Sensor		2.5V approx. when level
12	Alternator L terminal		HIGH/LOW
13	Low pressure switch		ON/OFF
14	Throttle position sensor	At idle position	450 — 550mV
		Slowly depress the accelerator speed	4500 — 5500mV
15	High pressure switch		ON/OFF
16	Ignition switch		ON/OFF
17	Control mode select switch, Open		5V approx.
	Control mode select switch, Sport switch ON		0V approx.
	Control mode select switch, High switch ON		2.5V approx.
18	Headlamp switch		ON/OFF
21	Steering angular velocity sensor		ON/OFF
22	Front height sensor		Vehicle height indication code or error code
23	Rear hight sensor		Vehicle height indication code or error code
24	Vehicle speed sensor		km/h, mph
25	Rear pressure sensor (when body is shaken from side to side)		0.5 Volts to 4.5 Volts
	Front seats: 2 persons	When EXTRA HIGH	Approx. 2.45V
		When HIGH vehicle height	Approx. 1.60V
		When NORMAL vehicle height	Approx. 0.90V
		When LOW vehicle height	Approx. 0.86V
26	Stop lamp switch		ON/OFF
27	Park brake switch		ON/OFF
28	A/T shift — D		ON/OFF
29	A/T shift — N		ON/OFF
31	A/T shift — R		ON/OFF
32	Backup lamp switch		ON/OFF
33	Door switch		ON/OFF
34	Accelerator pedal switch		ON/OFF

ACTUATOR TEST

This function activates the actuator on a compulsory basis by sending the signal from the Multi-use tester to the control unit.

Item No.	Actuator Test Items		Remarks
01	Drive of damping force select actuator	SOFT	Damping force change can be checked by shaking the vehicle body
03		MEDIUM	
04		HARD	
05	Compressor relay: ON		Facilitates on-vehicle check of air pressure system
06	Return pump relay: ON		
07	Vehicle height decrease control		For vehicle height adjustment simulation
08	Vehicle height increase control		
09	Anti-roll control (left turn)		For anti-roll simulation
10	Anti-roll control (right turn)		

SECTION 4 — SERVICE ADJUSTMENT PROCEDURES

ALARM LAMP CHECK

Check if the alarm lamp illuminates for approximately 0.5 second when the ignition key is turned to ON and the engine has been started.

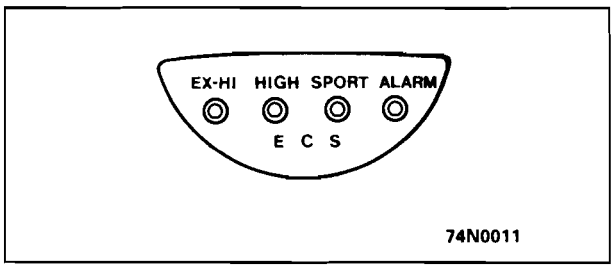


Fig. 1 — Alarm lamp

SYSTEM CHECKING BY USING ALARM LAMP

(1) After checking that the alarm lamp bulb has not failed, let the engine idle for approximately 4 minutes or more to check that the alarm lamp does not illuminate.

(2) While the alarm lamp is on, connect the multi-use tester or a voltmeter to the diagnosis check terminal of the wiring harness and check the diagnosis output code.

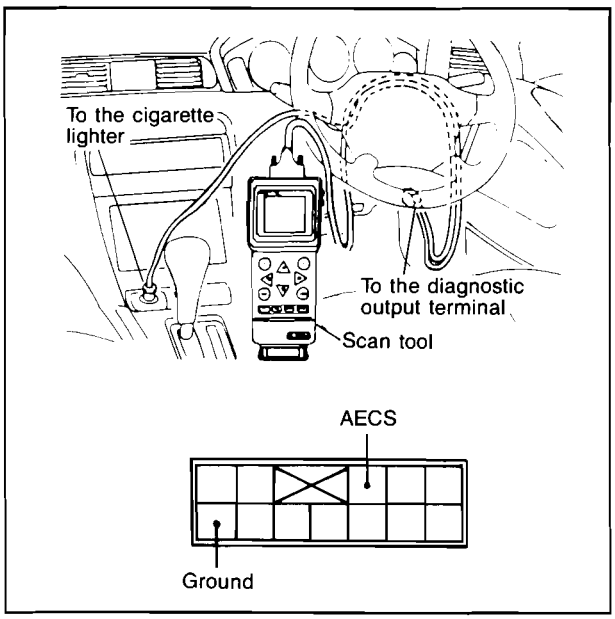


Fig. 2 — M.U.T. connection

NOTE: Although the alarm lamp illuminates under the following circumstances, there is no actual malfunction if, after the following procedures have been followed and the alarm lamp does not illuminate after waiting about four minutes or more.

(1) When there is an overload. Stop the engine, unload the cargo and then restart the engine.

(2) When the vehicle is stopped (with the engine running) on a steep hill or slope. Move the vehicle to a horizontal place and stop; then stop the engine and restart it.

(3) When vehicle-height adjustments are made frequently. After stopping the engine, open the hood and allow the compressor to cool; then restart the engine.

(4) When the vehicle is driven on winding roads in the mountains continously for 18 minutes or longer. To protect the return pump from damage, stop the engine and then restart it.

CHECKING SELF-DIAGNOSIS USING M.U.T.

(1) Inspect the self-diagnosis codes.

(2) After completion of repairs of the malfunction, erase the self-diagnosis codes.

(3) Carry out a repeat self-diagnosis output inspection and check if the self-diagnosis codes are normal.

Checking Self-Diagnosis Using a Voltmeter

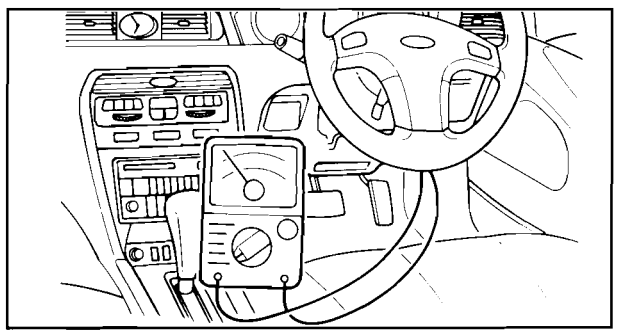


Fig. 3 — Voltmeter connection

(1) Set the ignition switch to OFF.

(2) Connect the positive (+) terminal of the voltmeter to the No. 3 terminal of the diagnosis connector beside the junction block and connect the negative (−) terminal of the voltmeter to the No. 12 terminal.

(3) Set the ignition switch to ON.

(4) Read the self-diagnosis code on the basis of the deflection of the pointer of the voltmeter.

(5) Based on the self-diagnosis code, repair the associated defective portion.

(6) Set the ignition switch to OFF.

(7) Disconnect the battery cables from the battery terminals and reconnect them more than 10 seconds thereafter.

(8) Set the ignition switch to ON, perform self-diagnosis check again, and check that the self-diagnosis code is good.

NORMAL VEHICLE HEIGHT CHECK AND ADJUSTMENT

(1) Park the vehicle on a flat surface.

(2) Measure dimension 'L' (refer Fig. 4) of the rear height sensor mounting bracket installation location.

Rear height sensor mounting bracket installation length:

Standard value (L): 334-336 mm (13.15-13.23 in.).

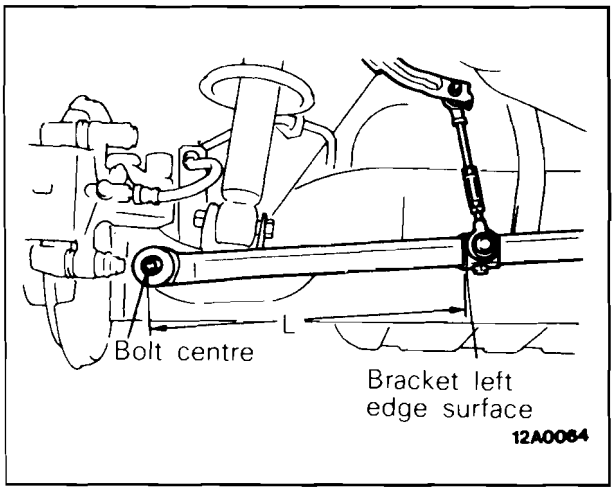


Fig. 4 — Rear height sensor bracket installation

(3) If dimension is not within the standard value, loosen the bracket mounting bolt and make the adjustment to within the standard value.

(4) With the vehicle unladen, start the engine and after vehicle height adjustment, is completed, check if the vehicle height is at NORMAL.

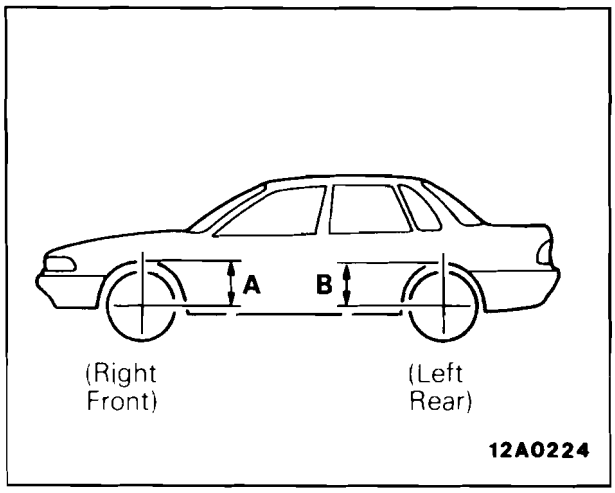


Fig. 5 — Vehicle height measuring points

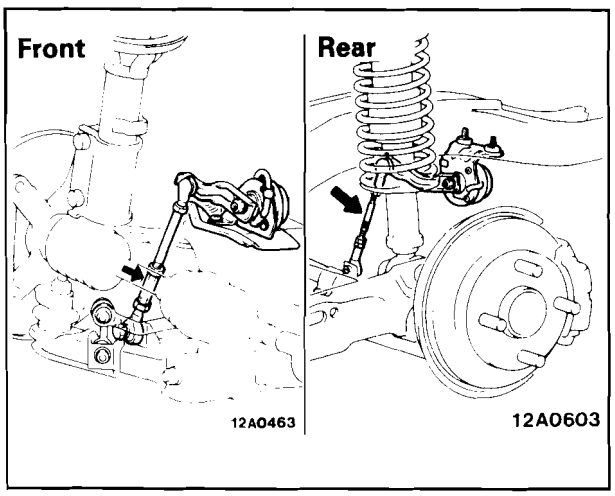


Fig. 6 — Front/Rear sensor rod adjustment

(5) Measure the distance between the wheel arch and the centre of the axle for both the right front and left rear.

Standard value:

A (Front)	381-391 mm (15.0-15.4 in.)
B (Rear)	362-372 mm (14.3-14.6 in.)

(6) If the vehicle height is not within the standard value, loosen the turnbuckles of the front and rear height sensor rods and then make the adjustment by changing the length of the rods. (One turn of the nut will raise or lower the front vehicle height by approximately 6 mm (0.24 in.) and the rear vehicle height by approximately 3 mm (0.12 in.). The vehicle height becomes higher when the rods are lengthened.

CAUTION:

1. Both the front and rear heights must be checked, because, even though only the front or the rear is adjusted, the other height (rear or front) is also changed.

2. The adjustments of the vehicle height must be made while the engine is idling (vehicle stopped).

ROLLING DIAPHRAGM CHECKING

Under normal conditions, the rolling diaphragm is as shown in the "normal condition", refer Fig. 7. If, however, the vehicle is jacked up while there is no air in the air springs and then let down suddenly, the diaphragm may become double folded, as shown in the "abnormal condition", refer Fig. 7.

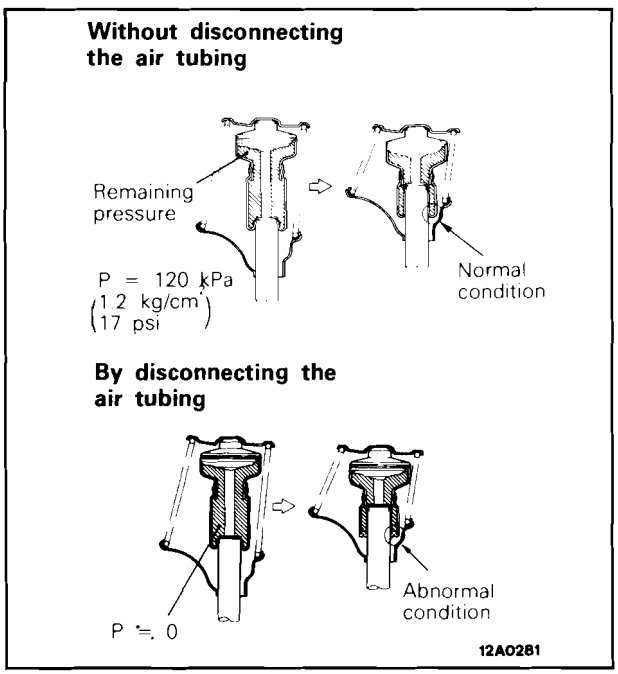


Fig. 7 — Diaphragm checking

If the vehicle is driven in the abnormal condition, the diaphragm will be damaged, so the following procedure should be used to prevent this.

Checking Method

Front: Jack the front end up and check visually or feel the diaphragm.
Rear: Check that the movement is smooth when the rear part of the body is bounced up and down.

Repair Method

(1) Jack up the vehicle and start the engine.
(2) Press the HIGH vehicle-height switch for two seconds or longer so as to set to the EXTRA HIGH vehicle-height.
(3) Supply air to each air spring so as to return the diaphragm to the normal form.

NOTE: The diaphragm will return if a solution of soap and water is applied to the diaphragm.

CAUTION: In order to prevent double-folding of the diaphragm, if the air tubing is disconnected in the course of servicing, follow step 2 above after connecting the tubing in order to introduce air into the air springs.

SYSTEM OPERATION CHECK

The checking procedures described below are for the purpose of actually acivating the system so as to verify whether or not the system's function is normal.

CAUTION:

1. For checks conducted by an actual road test, do so in a safe place and observe the speed limit.

For tests that require high-speed driving, such tests can be conducted while the vehicle is stopped by using the special tool (multi-use tester) to input simulated vehicle-speed signals.

2. Never drive the vehicle while the simulated vehicle-speed signals are still being used.

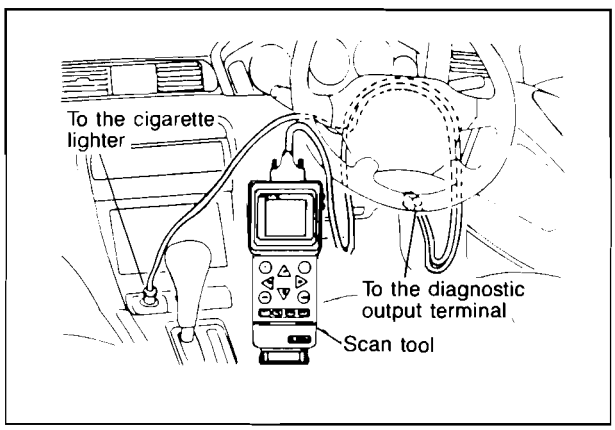


Fig. 8 — Multi-Use Tester

CHECKING THE DAMPING FORCE

(1) Move the wheel to the straight-ahead position.
(2) Start the engine.
(3) Set to the AUTO mode (normal vehicle height).
(4) Press the control mode switch and check that there is a difference of the damping force for each control mode when the vehicle is moved up and down at the rate of twice per second.

Control mode	Damping force
AUTO	SOFT
SPORT	MEDIUM

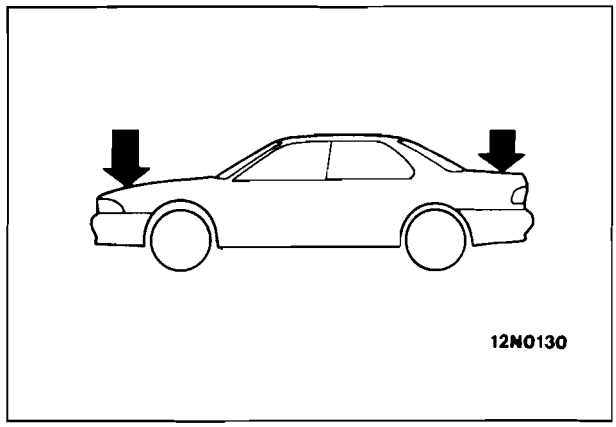


Fig. 9 — Damping force checking

CHECKING THE ANTI-ROLLING FUNCTION

(1) Move the wheels to the straight-ahead position.
(2) Turn the ignition key to ON.
(3) When simulated vehicle-speed signals of 35 km/h or higher are input and the steering wheel is turned 45° or more, check if the damping force will change to MEDIUM or HARD, depending on the speed at which the steering wheel is turned.

Check that the sensitivity increases (for each control mode) as the vehicle speed increases.

CHECKING THE ANTI-DIVE FUNCTION

(1) Turn the ignition key to ON.
(2) Input a simulated vehice-speed signal of 3 km/h or more.
(3) With the brake pedal depressed (the stop lamp is ON), check if the damping force changes to HARD when the simulated vehicle-speed input signal is suddenly decreased from 100 km/h or higher and that there is air supply at the front and exhaust at the rear.

CHECKING THE ANTI-SQUAT FUNCTION

(1) Turn the ignition key to ON.
(2) Input a simulated vehicle-speed signal that 3 km/h or higher and is less than 100 km/h.
(3) Check if the damping force changes to HARD when the accelerator pedal is suddenly depressed and that there is air exhaust at the front and supply at the rear.

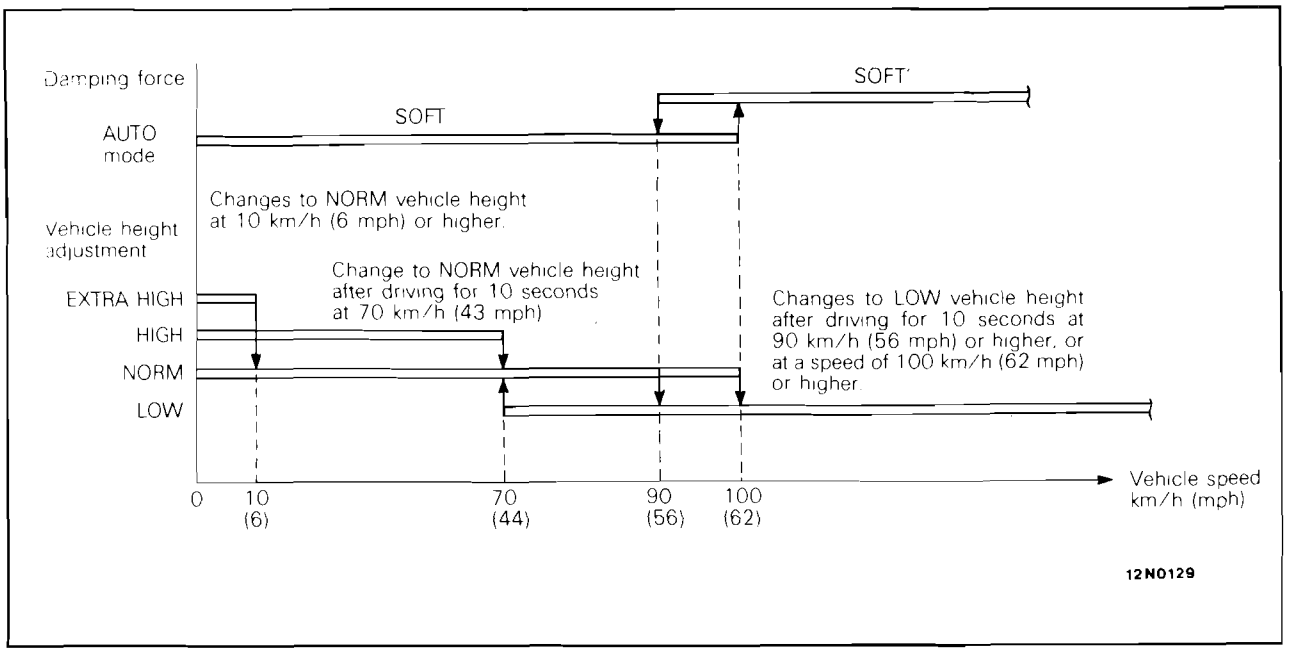


Fig. 10 — Vehicle height chart

CHECKING THE VEHICLE-SPEED RESPONSE FUNCTION

(1) Start the engine.

(2) Input simulated vehicle-speed signals and check whether or not there are changes of the damping force and of the vehicle height (as shown in Fig. 10) according to changes in the vehicle speed.

LOW-PRESSURE SWITCH (LOW-PRESSURE TANK SIDE) ACTUATION PRESSURE CHECK

(1) Remove joint H of the blue-marked air tube (for the left front valve) of the front solenoid valve assembly.

(2) Connect the special tool (air-pressure gauge) between the disconnected air tube and the front solenoid valve assembly by using the special tools (adaptors E and C).

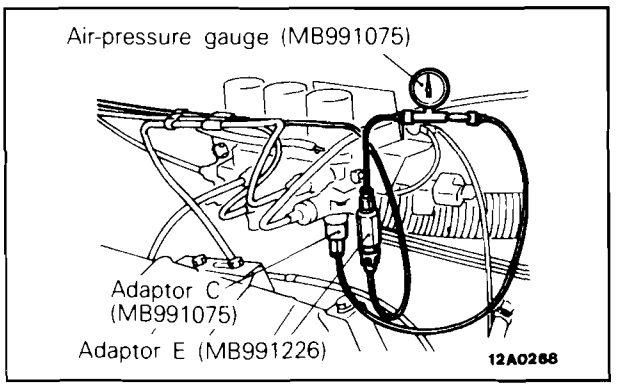


Fig. 11 — Air pressure gauge

(3) Connect the multi-use tester (MUT), start the engine and wait until the compressor stops (the high-pressure switch is OFF).

(4) Input simulated vehicle-speed signals (3 km/h or higher).

(5) With the simulated vehicle-speed signals still being input, conduct actuator test No. 09 (left turn) or No. 10 (right turn) so as to increase the pressure within the low-pressure tank chamber.

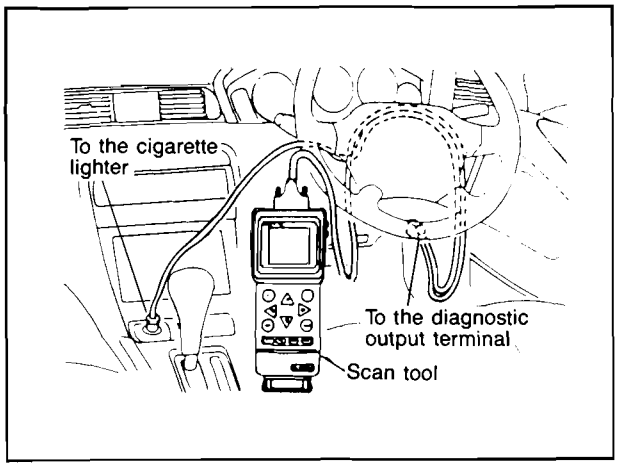


Fig. 12 — MUT connection

(6) During the actuator test, monitor the pressure gauge indication and check whether or not the pressure when the return pump activation starts (i.e., the maximum gauge reading) and the pressure when the return pump stops are both within the standard value.

Standard value:

Return pump actuation pressure:

110-170 kPa (16-24 psi)

Return pump cut-off pressure:

40-100 kPa (6-14 psi) or lower.

(7) If the internal pressure of the low-pressure tank is not within the standard values when the return pump operation is actuated (i.e. the low-pressure switch is OFF) or when the operation of the return pump is stopped (low-pressure switch ON), remove the reserve tank assembly and replace the low-pressure switch.

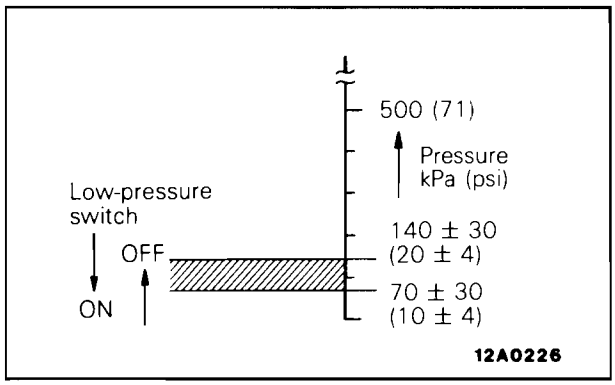


Fig. 13 — Low pressure tank pressure

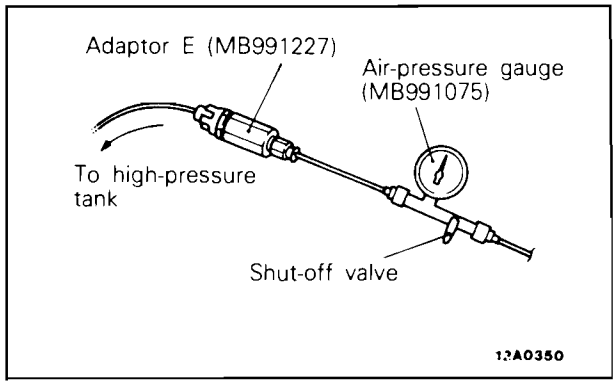


Fig. 16 — Pressure gauge

HIGH-PRESSURE SWITCH (HIGH-PRESSURE TANK SIDE) ACTUATION PRESSURE CHECK

(1) Remove joint A of the yellow-marked air tube (for the front air-supply valves) of the front solenoid valve assembly.

NOTE: Removal is easier is the special tool is used to pull the air tube out, and then a socket wrench is used for removal.

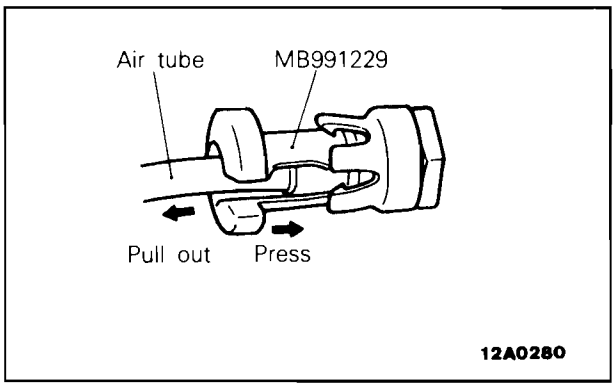


Fig. 14 — Special tool application

(2) Connect the gauge side air tubes of the special tool (air-pressure gauge) to the disconnected air tube and joint, connecting them via the special tube (adaptor E).

NOTE: The shut-off valve of the air-pressure gauge should be closed.

(3) Start the engine and activate the compressor.

NOTE: If the system is in normal condition, the compressor will be activated after the engine is started, because the pressure within the high-pressure tank has decreased.

(4) After activation of the compressor, the pressure within the high-pressure tank will increase; check whether or not the pressure is the standard value when the compressor is stopped.

Standard value:

900 kPa (128 psi) or higher.

(5) Gradually open the shut-off valve of the air-pressure gauge, while watching the indicator of the air-pressure gauge, check whether or not the pressure that actuates the compressor's operation (when the pressure within the high-pressure tank has dropped) is within the standard value range.

Standard value:

710-810 kPa (101-115 psi).

NOTE: The ON/OFF status of the high-pressure switch at this time can be checked by the Multi-Use-Tester.

(6) If the pressure within the high-pressure tank is not within the standard value range when the compressor is stopped (high-pressure switch OFF) or the compressor is activated (high-pressure switch ON), remove the reserve tank assembly and replace the high-pressure switch.

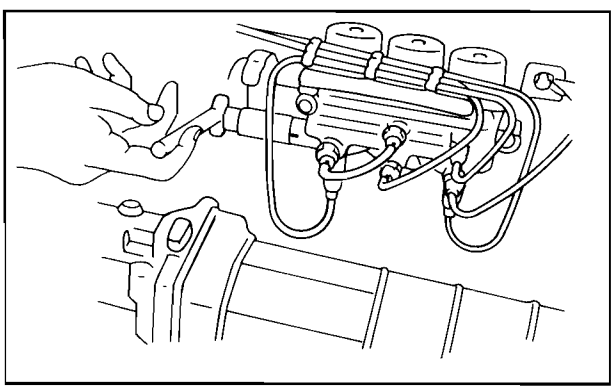


Fig. 15 — Air line removal

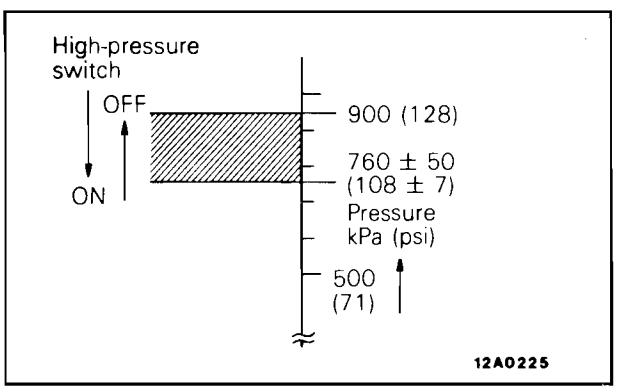


Fig. 17 — High pressure tank

G-SENSOR OUTPUT VOLTAGE CHECK

(1) Unload the vehicle and move it to a horizontal surface.

(2) Connect the multi-use tester and start the engine.

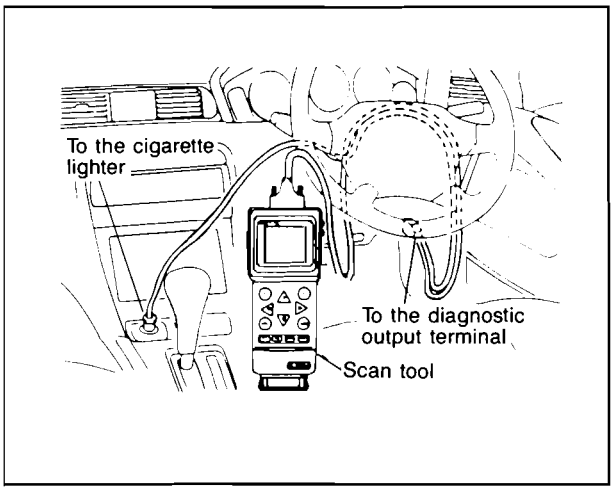


Fig. 18 — Multi-Use-Tester connection

(3) Check whether the G-sensor output voltage is within the standard value range when the vehicle-height is the NORMAL vehicle-height.

Standard value: 2.5 ± 0.16V.

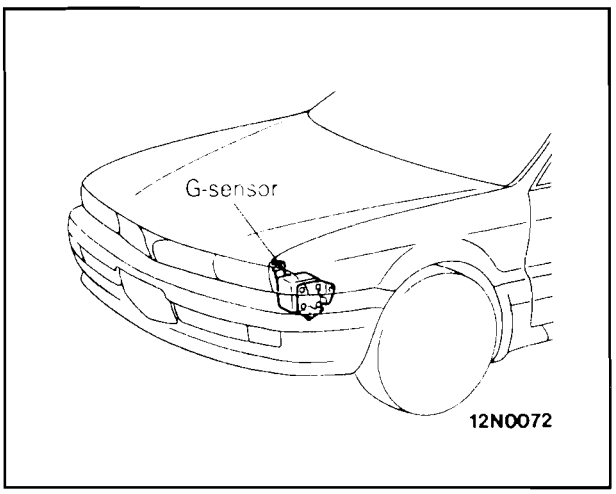


Fig. 19 — G-sensor

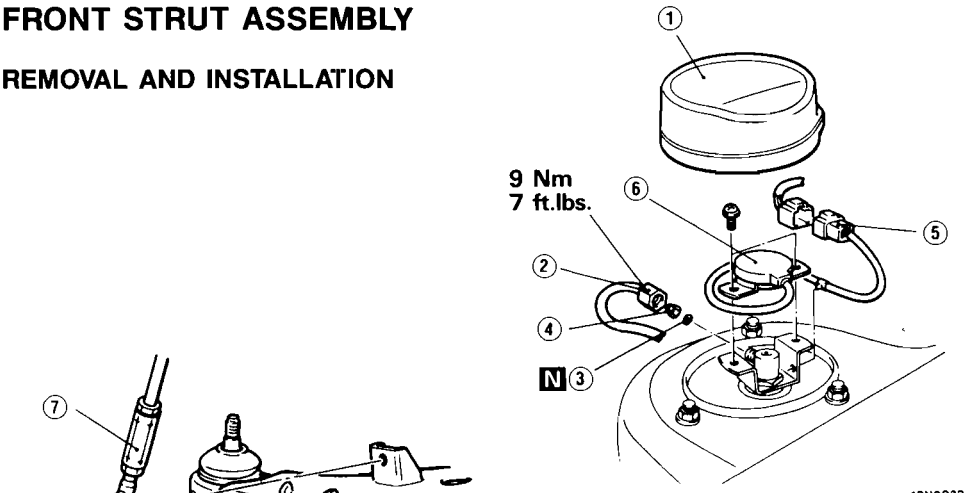
(4) If the G-sensor output voltage is not within the standard value range, check the installation condition of the G-sensor; if there is a bolt loose, deformation of the body, etc., repair it. If the problem is not repairable, replace the G-sensor.

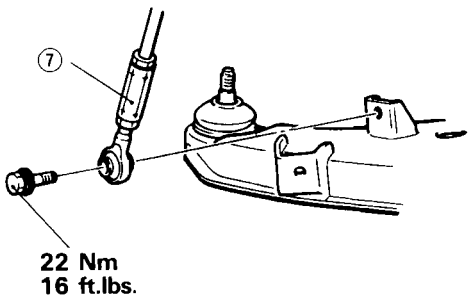
NOTE: If the G-sensor installation surface is at an angle (tilted) due to body deformation or some other cause, a washer(s) or shim(s) may be used to make an adjustment so that the output voltage is within the standard value range.

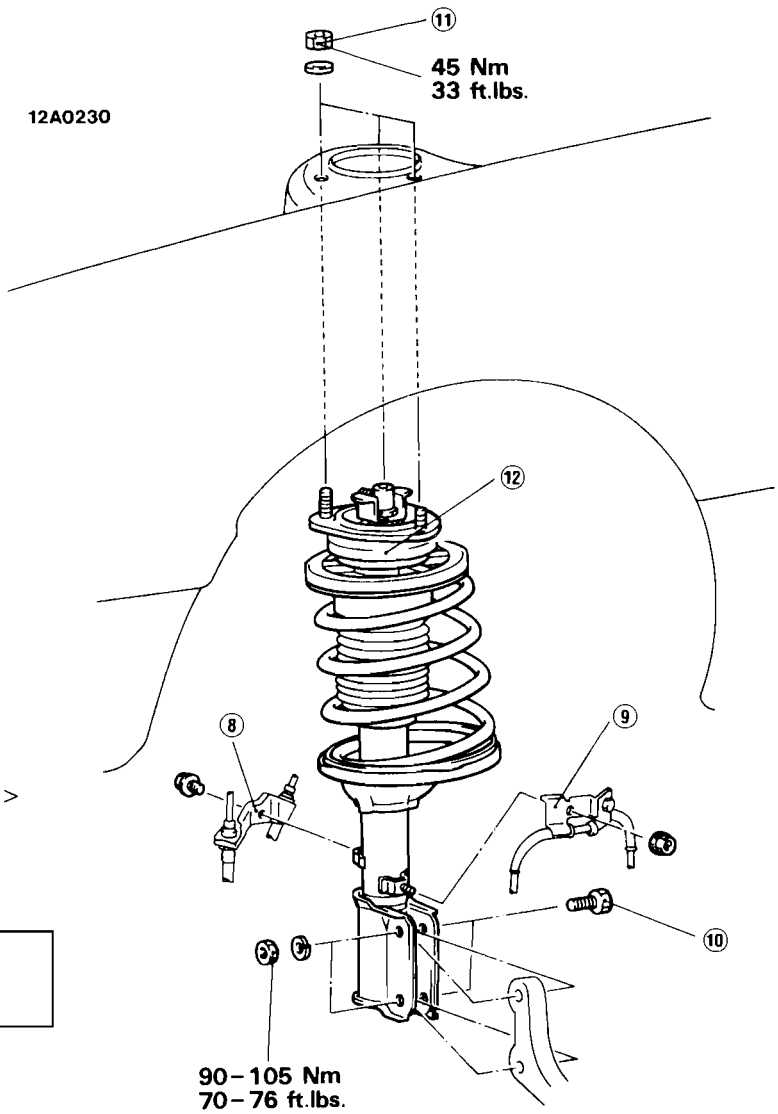
SECTION 5 — A.E.C.S. SYSTEM COMPONENTS

FRONT STRUT ASSEMBLY

REMOVAL AND INSTALLATION







Removal steps

1. Dust cover
* 2. Air tube
3. O-ring
4. Bush
5. Actuator connector
6. Actuator
7. Front height sensor rod
8. Brake hose and tube clamp
9. Front speed sensor clamp
   <Vehicle with anti-lock brake system>
10. Front strut lower mounting bolts
11. Front strut upper mounting nuts
12. Strut assembly

Post-installation Operation
- Operation Check of ECS System.
- Front Wheel Alignment Adjustment.

* Refer to service point of installation.

N Non-reusable part.

Fig. 1 — Front strut assembly

Inspection

Checking for Strut Assembly Air Leakage

(1) Disconnect the flow-control solenoid valve's air tube (connected to the high-pressure side of the reservoir tank) shown in Fig. 2 and then take off the joint assembly.

NOTE: This air tube is connected, via the reservoir tank and the dryer, to the compressor assembly.

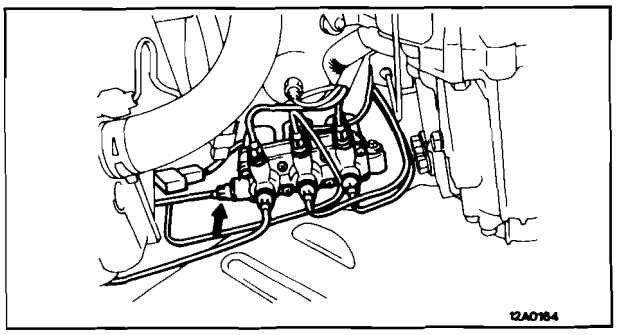


Fig. 2 — Air tube removal

(2) Install the removed joint assembly to the special tool (adaptor set) and then connect to the disconnected air tube.

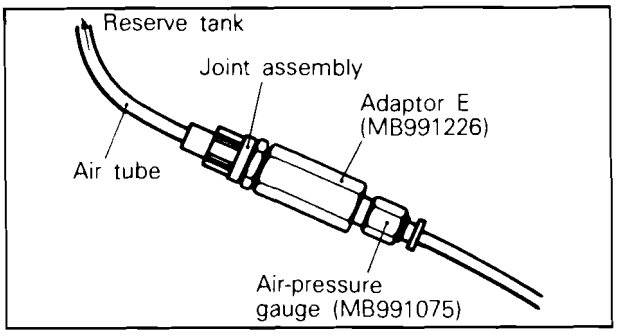


Fig. 3 — Adaptor connection

(3) Connect the air tube at the shut-off valve side of the special tool (air-pressure gauge) to the air tube side and the other one to the strut assembly.

The installation at the strut side is done by using the special tool (adaptor set).

CAUTION: To prevent the entry of moisture during the strut assembly air leak check, utilise air from the dryer.

(4) Remove the compressor connector, then operate it by connecting it directly to the battery.

NOTE: Refer to page 10 for compressor connector array.

(5) Insert the strut assembly into a water tank and check for air leakage at a pressure of about 500 kPa (71 psi).

CAUTION:

1. Don't mistake the rise of bubbles attached to the outside of the strut for air leakage.

2. Dry the strut with an air blower after the check has been completed.

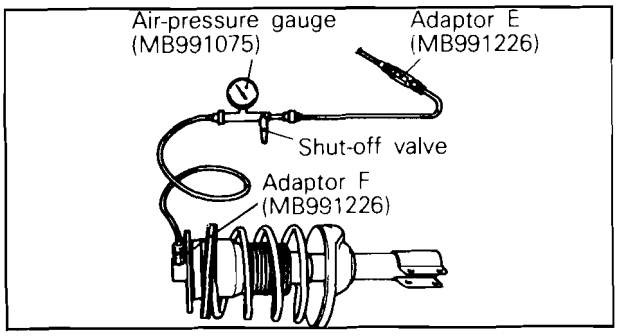


Fig. 4 — Gauge connection

(6) When air leakage is found, check the strut assembly and replace it as necessary.

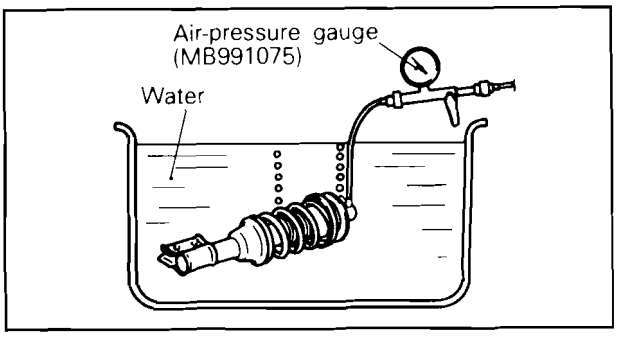


Fig. 5 — Strut test

SERVICE POINTS OF INSTALLATION

Installation of Air Tube

(1) After coating the O-ring with rubber grease, install the O-ring, bush and flare nut to the strut assembly.

CAUTION:

1. The O-ring may be damaged if it is installed at the air tube side when the connection is made.

2. The bush must be installed so that the projection part is facing in the direction indicated in Fig. 6.

(2) First insert the air tube until resistance is felt, and then push the tube in until the painted place on the air tube.

CAUTION: Air leakage may occur if the air tube connection is not complete and secure.

(3) After connecting the air tube, in order to prevent double-folding of the diaphragm, while still in the lifted condition, press the vehicle-height switch (HIGH switch) for two seconds or longer to select the EXTRA-HIGH mode so that air will be supplied to the air springs.

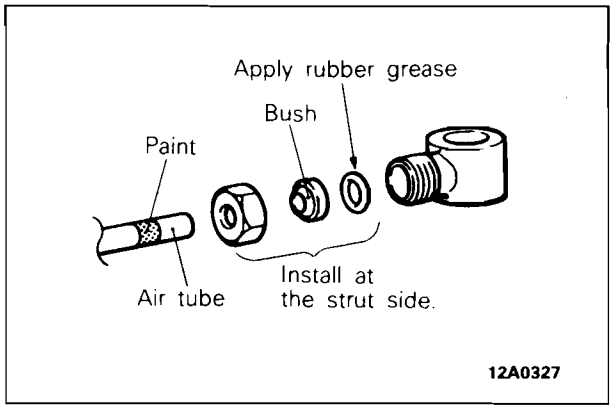
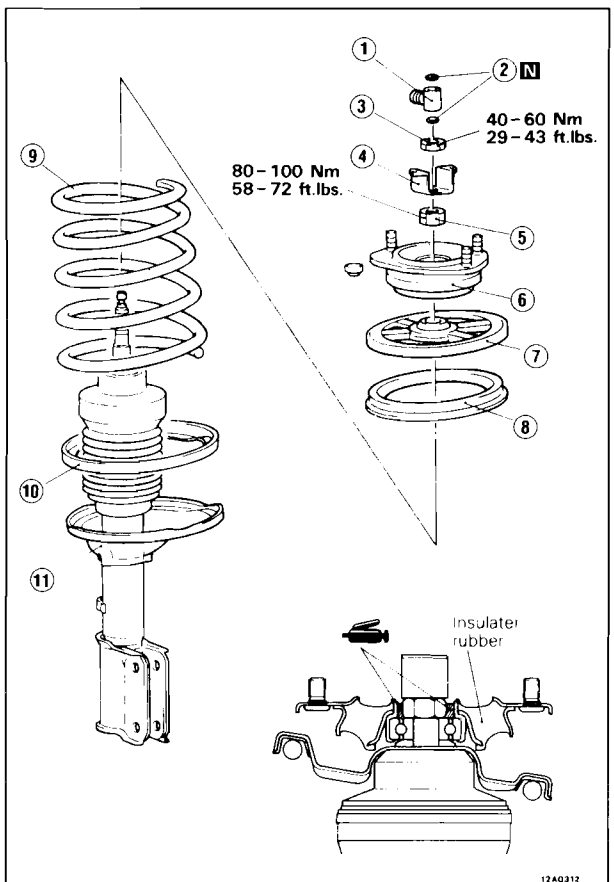


Fig. 6 — Air tube installation

FRONT STRUT DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Joint
2. O-ring
3. Actuator bracket mounting nut
4. Actuator bracket
5. Strut insulator mounting nut
6. Strut insulator
7. Upper spring seat
8. Upper spring pad
9. Coil spring
10. Lower spring pad
11. Strut assembly

Fig. 7 — Front strut

SERVICE POINTS OF DISASSEMBLY

Removal of Strut Insulator Mounting Nut

(1) Using the special tool, loosen (but do not remove) the strut insulator installation nut while holding the spring seat (upper).

CAUTION: Take care: Do not remove the nut.

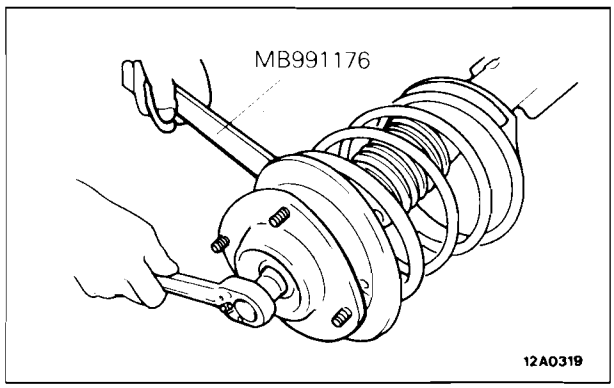


Fig. 8 — Insulator removal

(2) Using the special tool, compress the coil spring and then remove the strut insulator installation nut.

CAUTION: Do not use an air tool to tighten the bolt of the special tool.

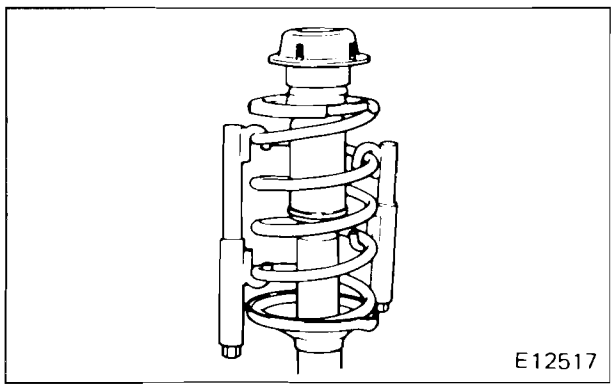


Fig. 9 — Compressing the coil spring

Inspection

- Check the rubber parts for damage or deterioration.
- Check the coil spring for deformation, deterioration or damage.
- Check the strut insulator bearing for wear.
- Check the shock absorber for deformation.

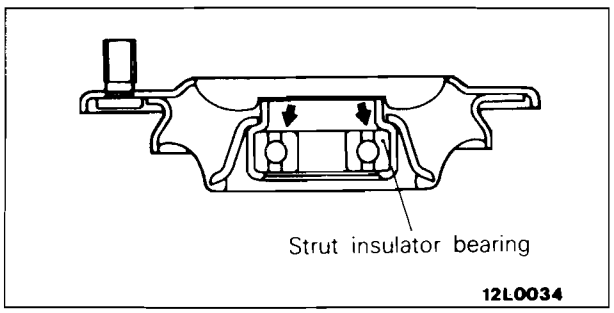


Fig. 10 — Strut insulator

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SERVICE POINTS OF REASSEMBLY

Installation of Coil Spring

Attach the special tool to the coil spring and compress the spring and then install to the strut.

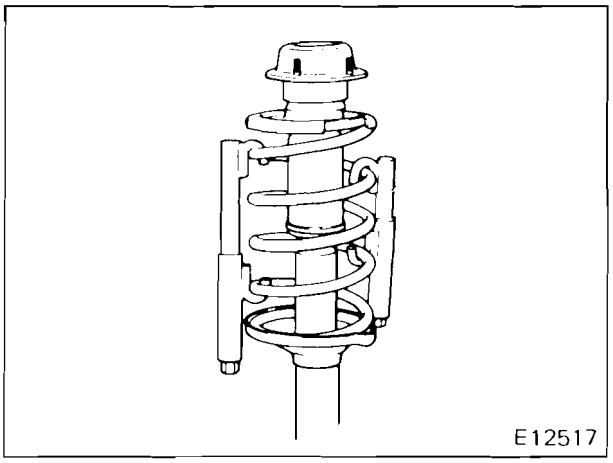


Fig. 11 — Compressing the coil spring

Installation of Upper Spring Seat

(1) Install the spring upper seat to the piston rod and align the notched part of the piston rod and the hole in the spring seat.

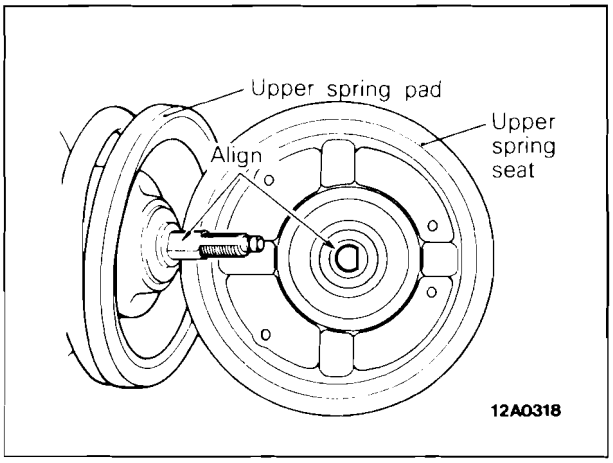


Fig. 12 — Upper spring seat installation

(2) Align the bead of the spring upper seat and the facing direction of the knuckle bracket.

Installation of Strut Insulator Mounting Nut

(1) Loosely attach the strut insulator installation nut to the strut assembly.

(2) Correctly align both ends of the coil spring with the groove in the spring seat and then loosen the special tool.

(3) Using the special tool, hold the spring upper seat in place and tighten the strut insulator installation nut.

(4) Apply a coating of multipurpose grease to the insulator bearing channel.

CAUTION: When coating with grease, take care that the grease does not adhere to the insulator rubber part.

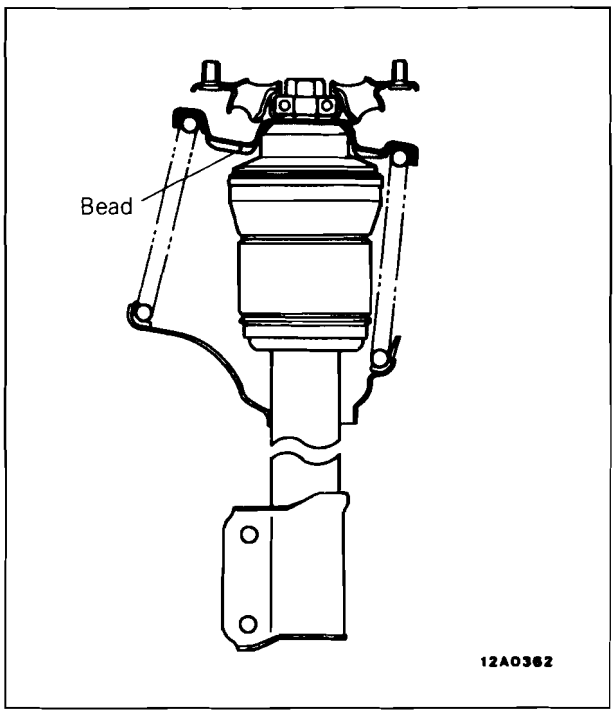


Fig. 13 — Spring seat alignment

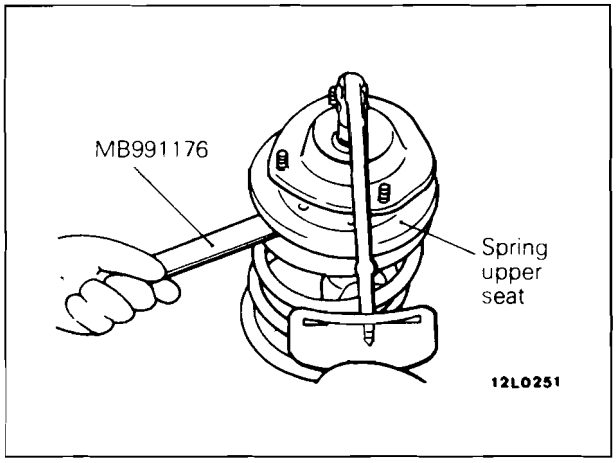


Fig. 14 — Insulator installation

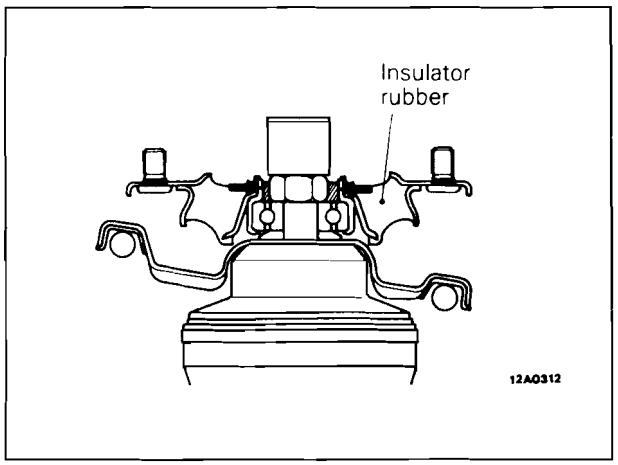
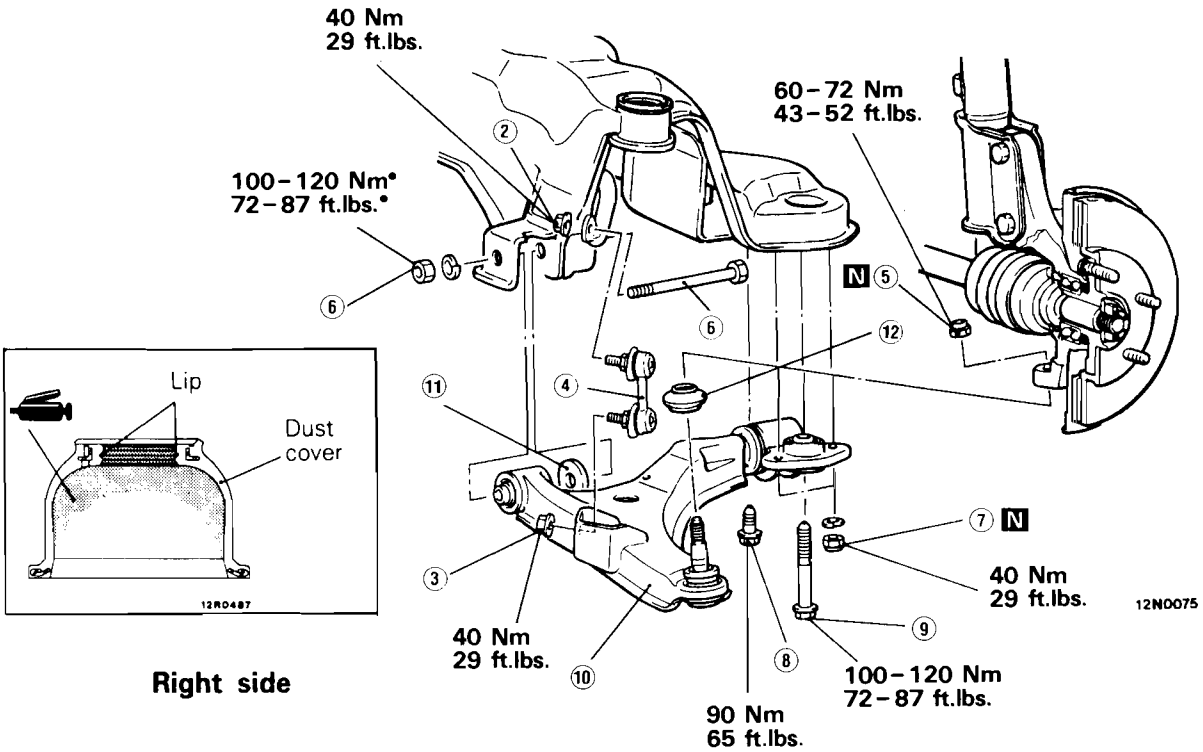


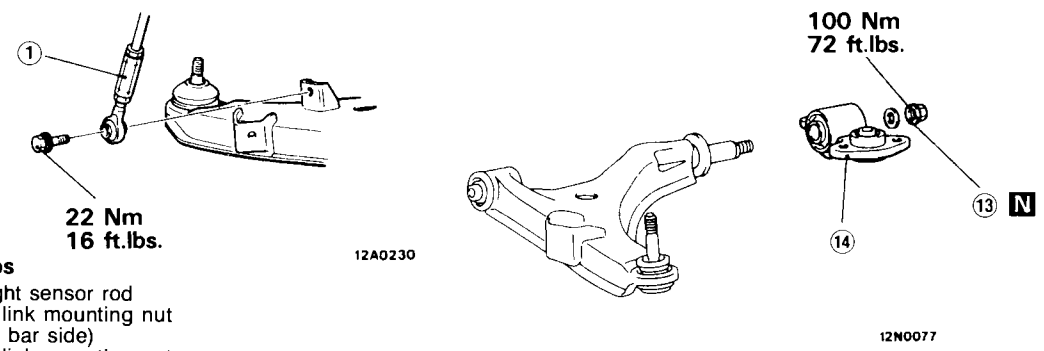
Fig. 15 — Insulator rubber

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LOWER ARM

REMOVAL AND INSTALLATION





Removal steps

1. Front height sensor rod
2. Stabiliser link mounting nut (Stabiliser bar side)
3. Stabiliser link mounting nut (Lower arm side)
4. Stabliser link
* 5. Lower arm ball-joint and knuckle coupling self-locking nut
6. Lower arm mounting bolt and nut
7. Clamp mounting self locking nut
8. Clamp mounting bolt (small)
9. Clamp mounting bolt (large)
10. Lower arm assembly
11. Stopper
12. Dust cover
*13. Lower arm clamp mounting self locking nuts
14. Lower arm clamp

Post-installation Operation
- Operation Check of ECS System.
- Front Wheel Alignment Adjustment.

NOTE
- Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle in the unladen condition.

* Refer to service points of removal and installation.

N Non-reusable part.

Fig. 16 — Lower arm components

SERVICE POINTS OF REMOVAL

Removal of Lower Arm Ball Joint

Using the special tool, disconnect the lower arm ball joint from the knuckle.

NOTE:

1. Always tie the cord of the special tool to the nearby part.

2. Loosen the nut but do not remove it.

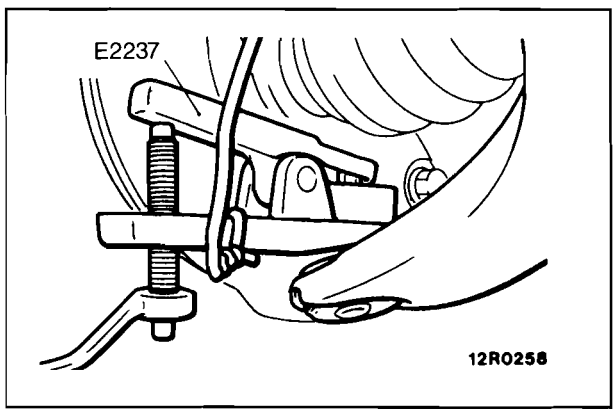


Fig. 17 — Disconnecting lower arm ball joint

Inspection

- Check the lower arm for bend or breakage.
- Check the lower arm for cracks and damage.
- Check the clamp for deterioration or damage.
- Check the bushing for wear and deterioration.
- Check the ball joint dust cover for cracks.

Ball Joint Checking for Starting Torque

(1) If a crack is noted in the dust cover, replace it, adding grease.

(2) Shake the ball joint stud several times.

(3) Mount two nuts on the ball joint and then measure the ball joint starting torque.

Standard value: 10-22 Nm (87-191 in.lbs)

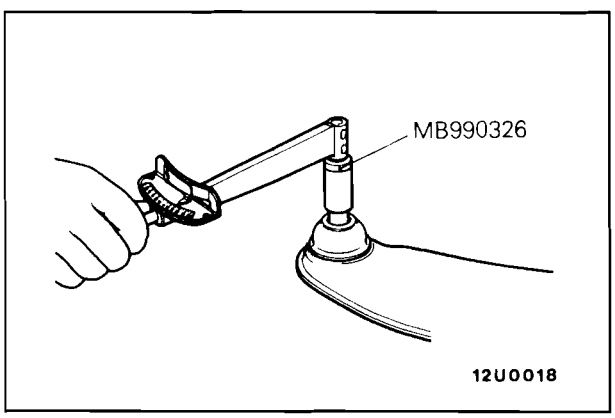


Fig. 18 — Measuring ball joint starting torque

(4) If the starting torque exceeds the upper limit of standard value, replace the lower arm assembly.

Even if the starting torque is below the lower limit of the standard value; the ball joint may be reused unless it has drag and excessive play.

BALL JOINT DUST COVER REPLACEMENT

(1) Remove the dust cover.

(2) Apply multipurpose grease to the lip and inside of the dust cover.

(3) Drive in the dust cover with special tool until it is fully seated.

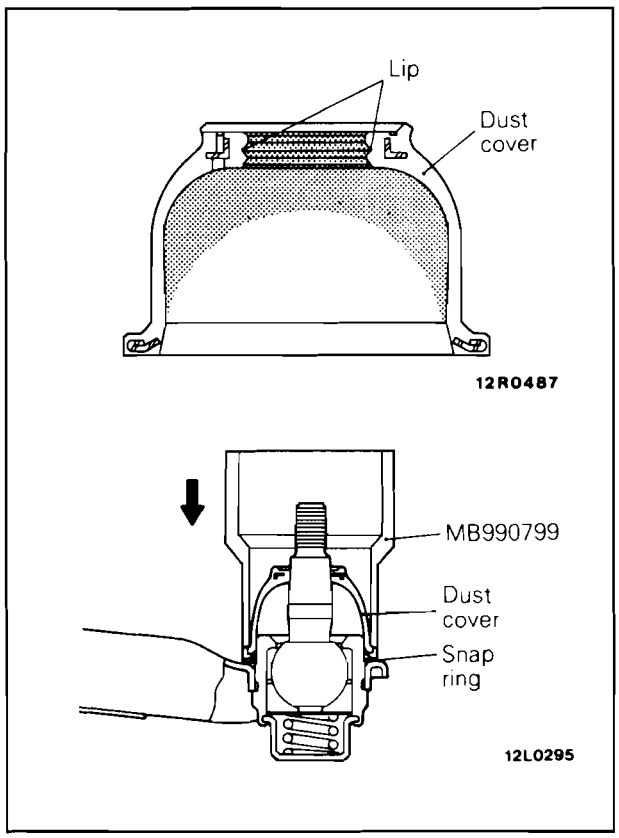


Fig. 19 — Dust cover replacement

SERVICE POINTS OF INSTALLATION

Installation of Lower Arm Clamp Mounting Self-Locking Nut

Tilt the mounting surface of the lower arm clamp 6° ± 1° to the lower arm lower surface, set the lower arm clamp and install the self-locking nut.

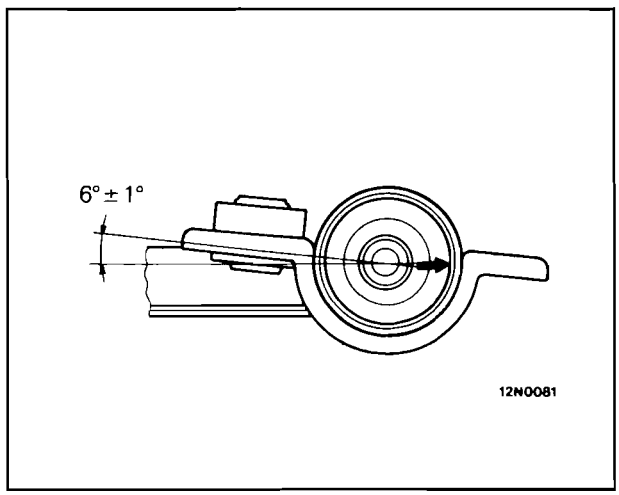


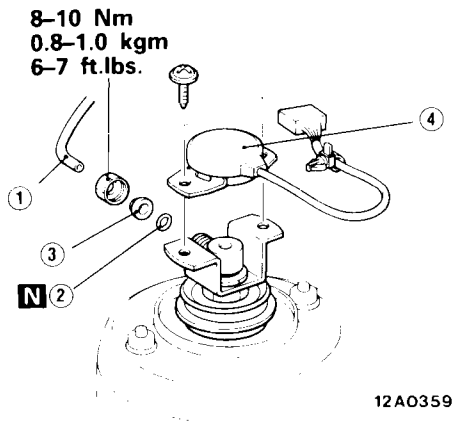
Fig. 20 — Lower arm clamp mounting

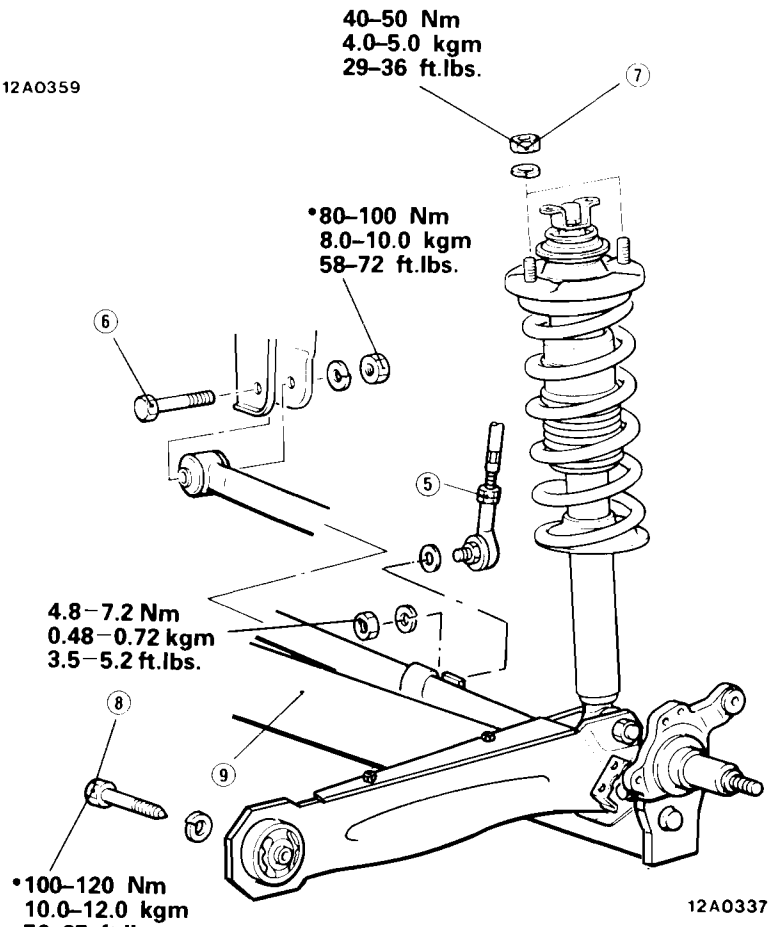
REAR SHOCK ABSORBER ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of Trunk Room Side Trim (Refer to GROUP 52)

Post-installation Operation
- Installation of Trunk Room Side Trim (Refer to GROUP 52)
- Operation Check of ECS System
- Rear Wheel Alignment





Removal steps
- *1. Air tube
- 2. O-ring
- 3. Bush
- 4. Actuator
- 5. Rear height sensor rod
- *6. Lateral rod mounting bolt (body side)
- *7. Shock absorber upper mounting nuts
- *8. Trailing arm mounting bolts
- *9. Rear suspension assembly

NOTE
- Points marked with a dot should first be tightened provisionally, then tightened fully when the vehicle is empty on the ground and in the unladen condition.

*Refer to service points of removal and installation.

[N] Non-reusable part.

Fig. 21 — Rear shock absorber assembly

SERVICE POINTS OF REMOVAL

Removal of Lateral Rod Mounting Bolt (Body Side)

(1) Remove the lateral rod from the body.
(2) Secure and hold the lateral rod to the axle beam with wire, etc.

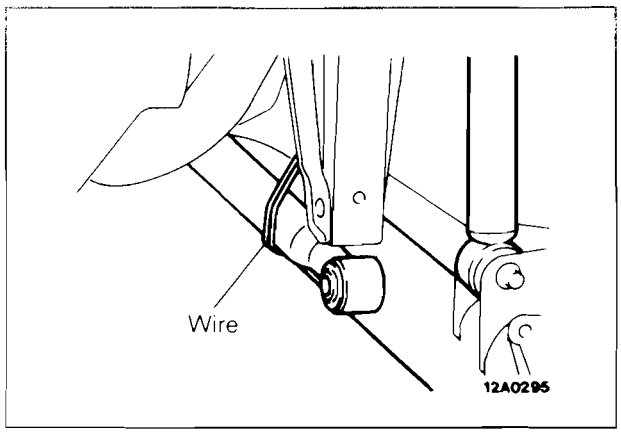


Fig. 22 — Lateral rod support

SERVICE POINTS OF INSTALLATION

Connection of Air Tube

(1) After applying a coating of rubber grease to the O-ring, install the O-ring, bush and joint at the shock absorber assembly side.

CAUTION:
1. The O-ring might be damaged if it is installed at the air tube side and then the insertion is made.
2. The bush must be installed so that the projection part is facing in the direction indicated in Fig. 23.

(2) First insert the air tube until resistance is felt and then push in the tube until the painted place on the air tube.

CAUTION: Air leakage may occur if the air tube connection is not complete and secure.

(3) After connecting the air tube, in order to prevent double-folding of the diaphragm, while still in the lifted condition, press the vehicle-height switch (HIGH switch) for two seconds or longer to select the EXTRA HIGH mode so that air will be supplied to the air springs.

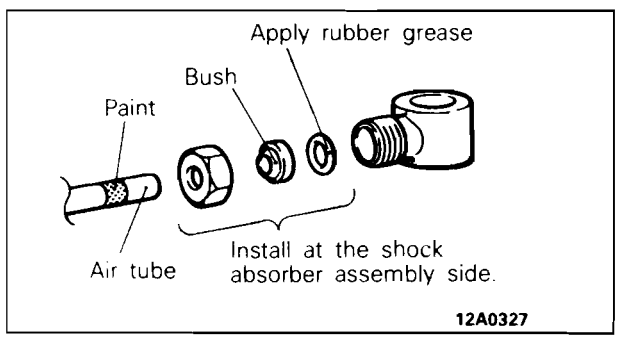


Fig. 23 — Air tube connection

REAR SHOCK ABSORBER

Disassembly and Reassembly

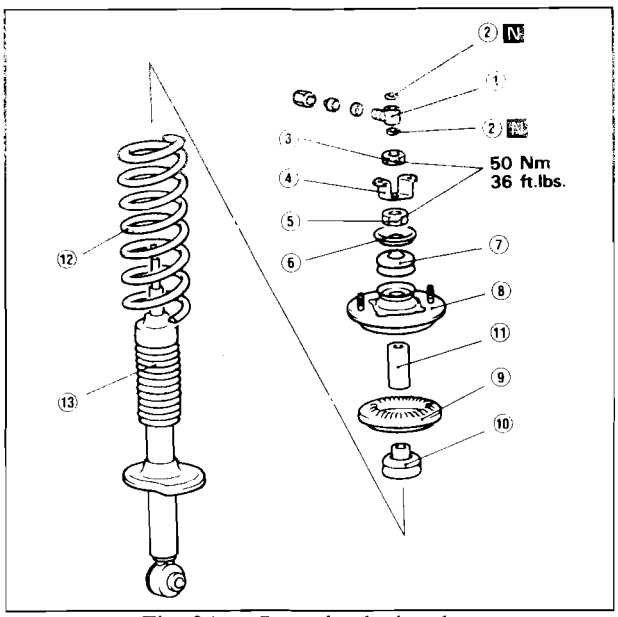


Fig. 24 — Rear shock absorber

Disassembly

(1) Joint.
(2) O-ring.
(3) Actuator bracket mounting nut.
(4) Actuator bracket.
(5) Piston rod tightening nut.
(6) Washer.
(7) Upper bushing (A).
(8) Bracket assembly.
(9) Spring pad.
(10) Upper bushing (B).
(11) Collar.
(12) Coil spring.
(13) Shock absorber.

SERVICE POINTS OF DISASSEMBLY

Removal of Piston Rod Tightening Nut

(1) Compress the coil spring using the special tool.

CAUTION: Do not use an air tool to tighten the bolt of the special tool.

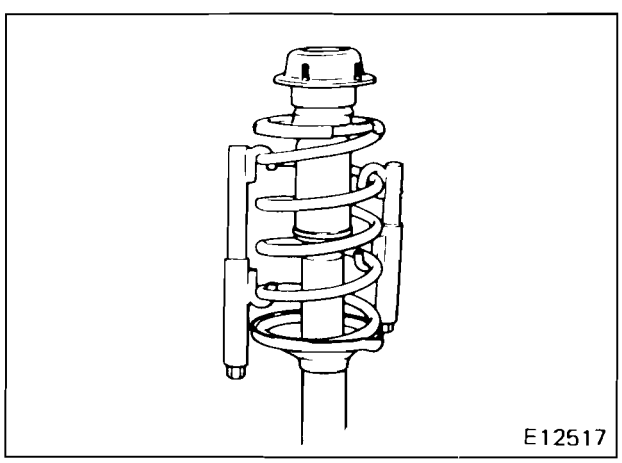


Fig. 25 — Compressing coil Spring

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(2) While holding the piston rod, remove the piston rod tightening nut.

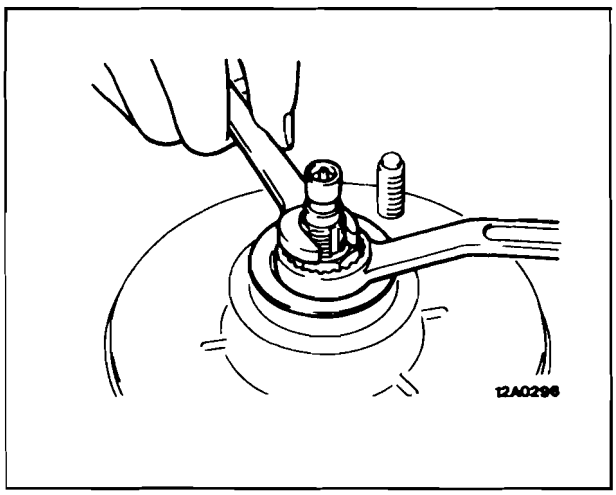


Fig. 26 — Piston rod tightening nut removal

Inspection

- Check the rubber parts for damage.
- Check the coil springs for cracks, damage or deterioration.
- Check the shock absorber for oil leakage malfunction and abnormal sound.

SERVICE POINTS OF REASSEMBLY

Installation of Coil Spring

(1) Use the special tool to compress the coil spring and insert it in the shock absorber.

(2) Align the edge of the coil spring to the position of the shock absorber spring seat as shown.

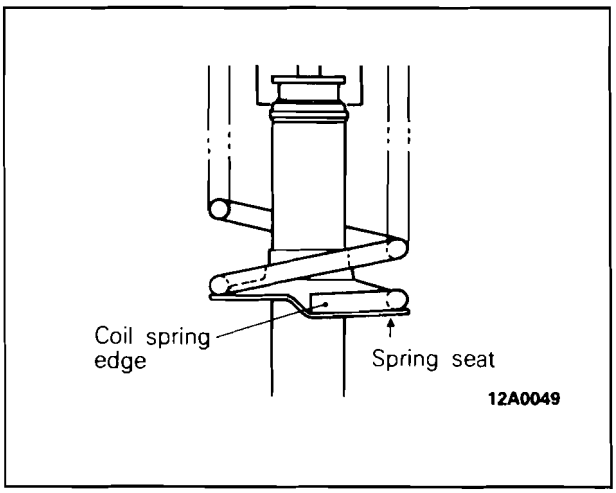


Fig. 27 — Coil spring position

Installation of Bracket Assembly/Piston Rod Tightening Nut

(1) With the position of the bracket assembly as shown in Fig. 28, tighten the tightening nut to the specified torque.

(2) Install the coil spring so that the lower edge fits into the spring seat groove and the upper edge fits into the spring pad groove, then remove the special tool.

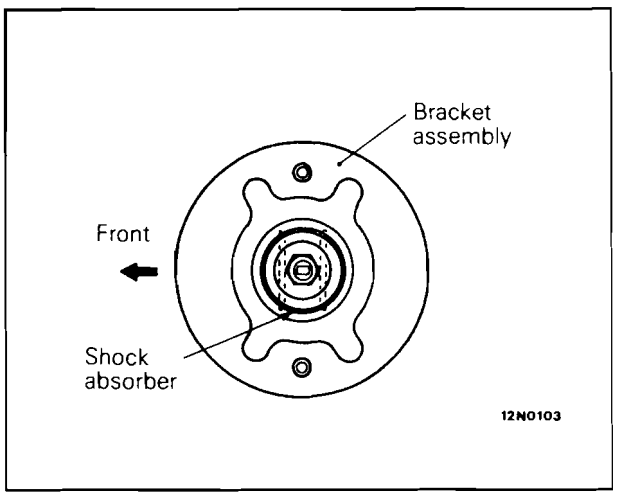


Fig. 28 — Bracket assembly position

Installation of O-Ring Joint

Apply a coating of rubber grease to the O-ring, install it to the joint and then install to the piston rod.

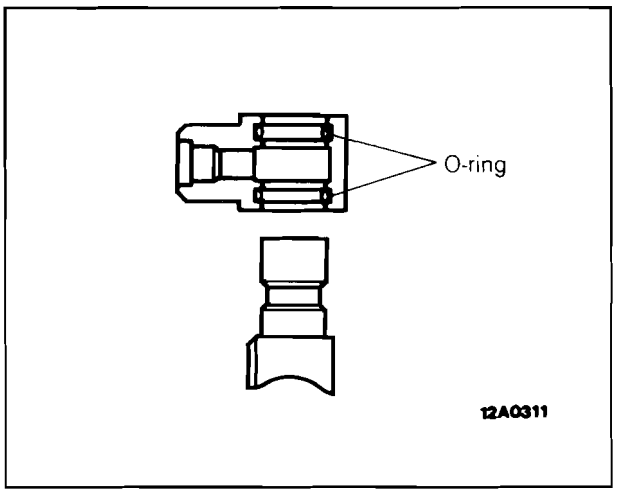
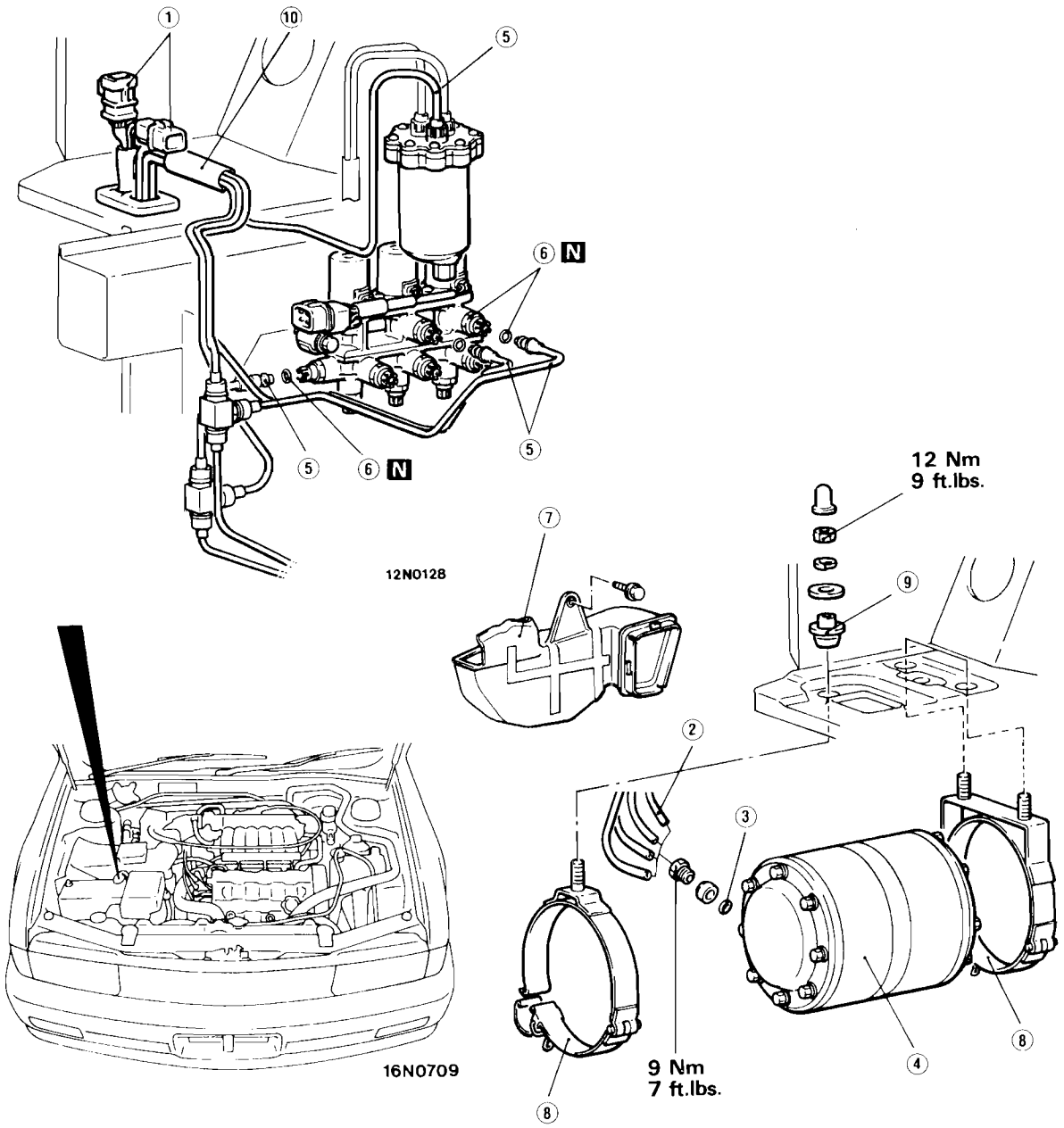


Fig. 29 — O-ring piston

RESERVE TANK ASSEMBLY

REMOVAL AND INSTALLATION



Removal steps

1. Reserve tank connector
* 2. Air tube
3. O-ring
4. Reserve tank
5. Air tube
6. O-ring
7. Air intake tube
8. Tank holder
9. Bush
10. Air tube

N Non-reusable part.

Post-removal Operation
- Removal of Battery and Battery Tray
- Removal of Underguard

Post-installation Operation
- Installation of Underguard
- Installation of Battery and Battery Tray
- Operation Check of ECS System

* Refer to service points of removal and installation.

Fig. 30 — Reserve tank assembly

SERVICE POINTS OF REMOVAL

Removal of Air Tube

(1) Remove the splash shield clip and bolt, as shown in Fig. 31.
(2) Remove the bumper stay.

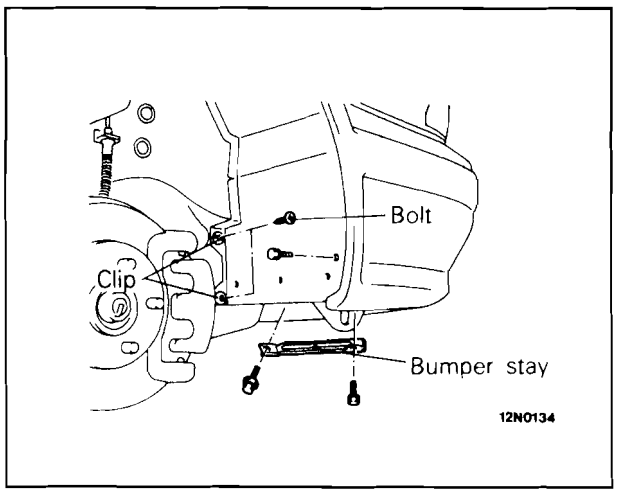


Fig. 31 — Splash shield removal

(3) Remove the reserve tank from the tank holder and after pulling it downwards, being careful not to damage the air tubes, remove the air tube and reserve tank connections.

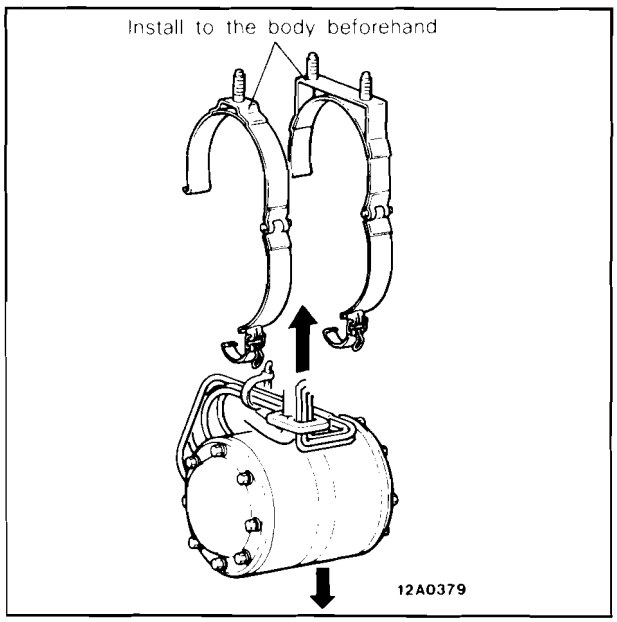


Fig. 32 — Reserve tank removal

Removal of Air Tubes

(1) Push the special tool inward, in direction ① shown in Fig. 33, in order to expand the tabs of the joint.
(2) Pull out the air tube, together with the special tool, in direction ②, refer Fig. 33.

CAUTION: To prevent dust, dirt and other foreign material from getting into the air tubes, dryer or solenoid valve openings, use vinyl tape or similar material to cover these openings.

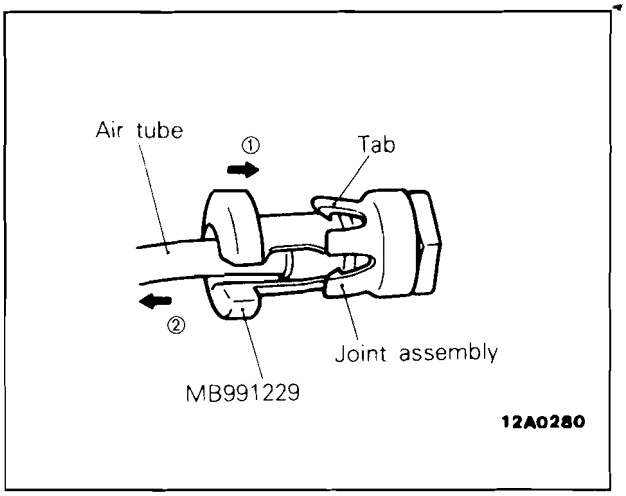


Fig. 33 — Air tube removal

Inspection

For detailed information concerning the checking of the return pump, the high-pressure switch and the low-pressure switch, refer to the troubleshooting guide and service adjustment procedures section.

SERVICE POINTS OF INSTALLATION

Installation of Air Tubes

Push the air tube inward to the joint assembly at the device side until a "click" is heard and then check that the tabs of the joint assembly are securely affixed to the air tube.

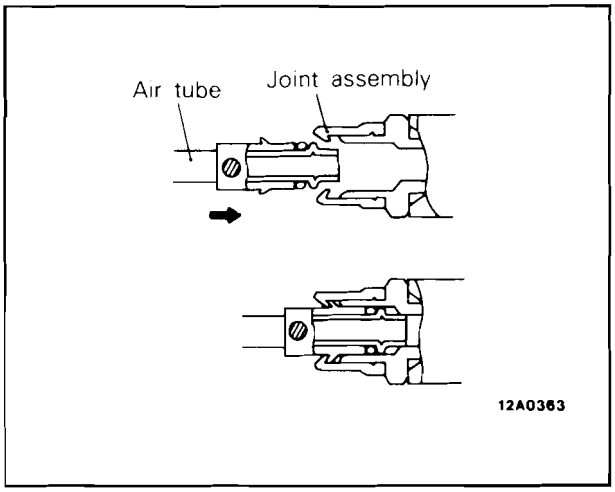


Fig. 34 — Joint installation

Connection of Air Tube

Connect the air tube securely, all the way to the painted mark.

CAUTION: Be sure that the connection is secure; if it is not, an air leak may result.

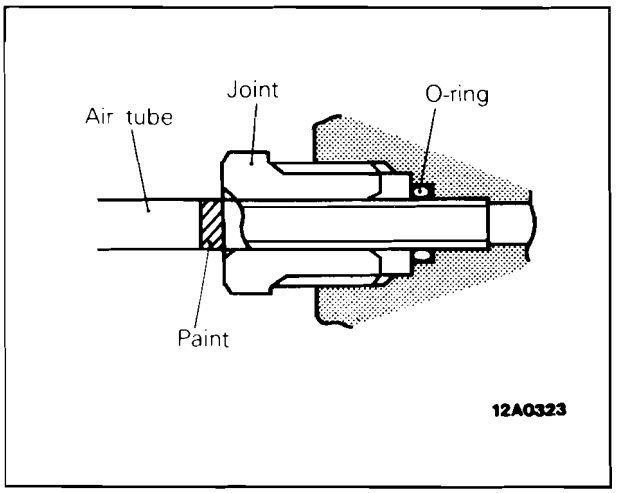
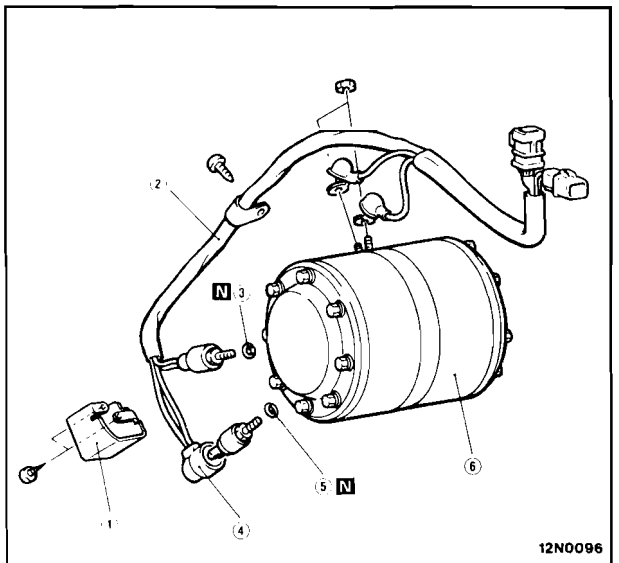


Fig. 35 — Air tube installation

RESERVE TANK

Disassembly and Reassembly



Disassembly steps
1. Cover
2. Wiring harness (incorporated with high pressure switch)
3. O-ring
4. Low pressure switch
5. O-ring
6. Reserve tank

N Non-reusable part

Fig. 36 — Air tank

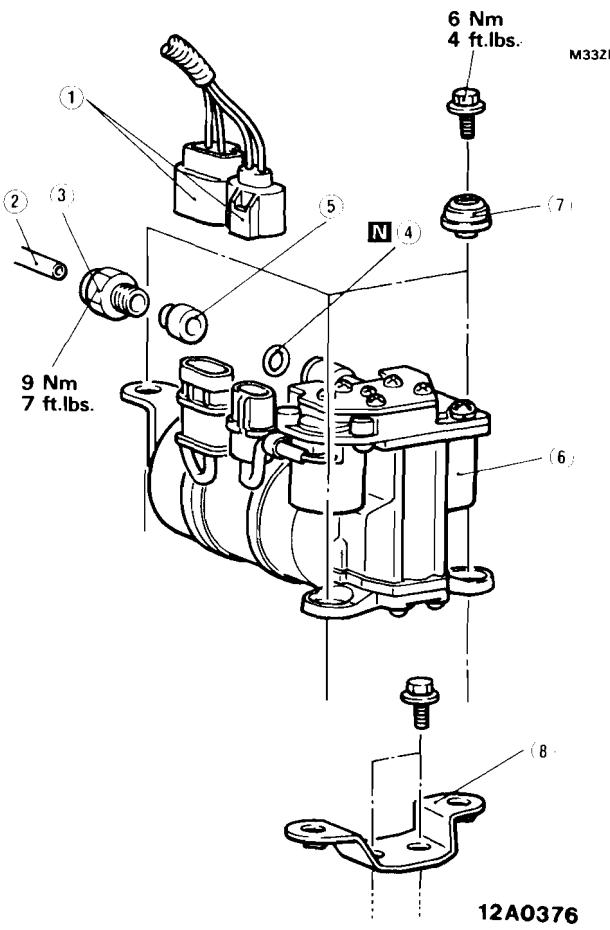
NOTE: The reserve tank is only serviced as an assembly do not disassemble the tank.

AIR COMPRESSOR ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of Air Cleaner (Refer to GROUP 15)

Post-installation Operation
- Installation of Air Cleaner (Refer to GROUP 15)
- Operation Check of ECS System



Removal steps
1. Front wiring harness connector
*2. Air tube
3. Joint
4. O-ring
5. Connector
6. Air compressor assembly
7. Compreessor mounting rubbers
8. Compressor mount bracket

[N] Non-reusable part.

*Refer to service points of removal and installation

Fig. 37 — Air compressor assembly

SERVICE POINTS OF REMOVAL

Removal of Air Tube

CAUTION:

1. In order to prevent dust, dirt and other foreign material from getting into the air tube and air compressor openings, cover these openings with vinyl tape or similar material.

2. Be careful not to bend the air tubes.

Inspection

(1) Using special tool (adaptor C), connect the air tube on the gauge side of the special tool to the air compressor.

(2) Apply battery voltage (12V) between terminals (1) and (2), refer Fig. 38.

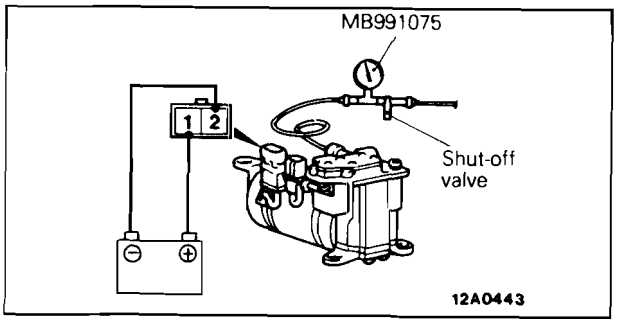


Fig. 38 — Pressure gauge test

(3) Check whether the relief pressure of the air compressor is the standard value.

Standard value: 1,000-1,300 kPa (142-185 psi)

NOTE: Because of pulsation caused by the opening and closing of the exhaust solenoid valve combined with the relief valve, the gauge's indicator will show a reading which fluctuates within a range of 200-300 kPa (29-43 psi). Use the mid-point of this fluctuation to make the gauge reading.

(4) Stop the air compressor and with the pressure held, apply battery voltage (12V) between air compressor terminals (3) and (4), refer Fig. 39. At this time, check that the exhaust solenoid valve makes a "click" sound and the pressure is gradually decreasing.

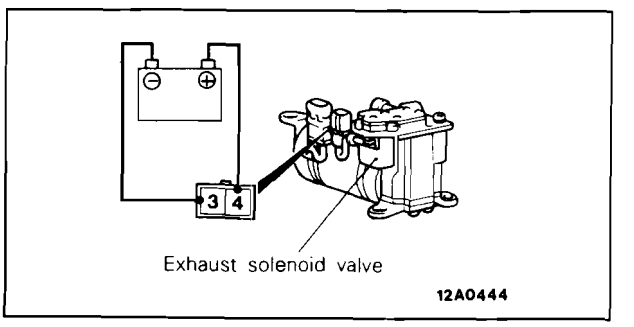


Fig. 39 — Exhaust solenoid valve testing

(5) If air compressor relief pressure is not within the standard value, or if there is a malfunction of the exhaust solenoid valve, replace the air compressor.

CAUTION: When the air compressor is replaced, first check that there is no air leakage at air tube joints, no poor contacts of wiring, and the the thermo switch is not in operation.

SERVICE POINTS OF INSTALLATION

Installation of Air Tube

(1) First insert the air tube at the lower part of the dryer until resistance is felt and then press the tube further inward to the paint mark on the air tube.

CAUTION: Air leakage may occur if the air tube connection is not complete and secure.

(2) Connect air tubes correctly to the air compressor. Apply a soap-and-water solution to the air tube connections to check that there is no air leakage.

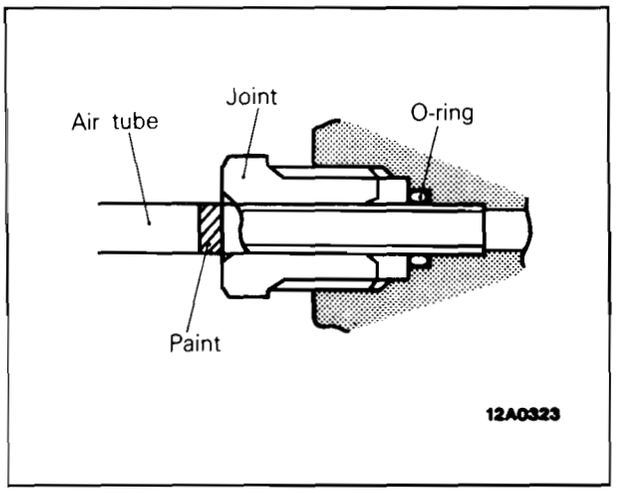
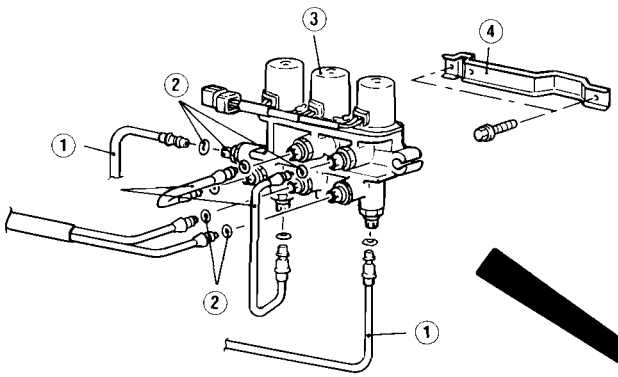


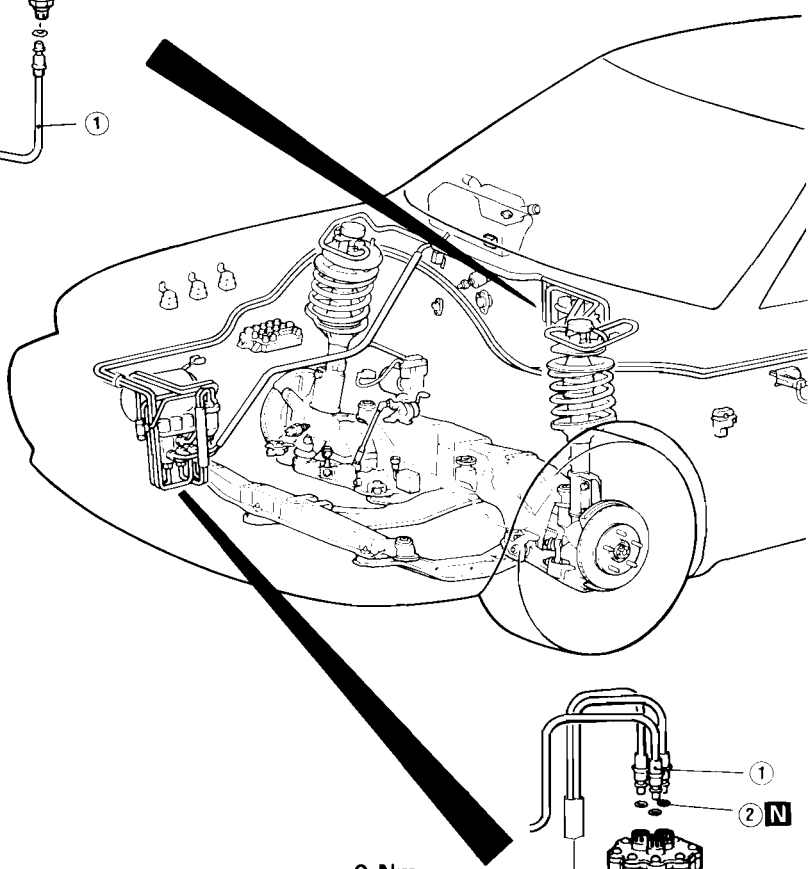
Fig. 40 — Air tube installation

SOLENOID VALVE AND DRYER

REMOVAL AND INSTALLATION



Front solenoid valve removal steps
- • Removal of Air intake hose
- *1. Air tubes
- 2. O-ring
- 3. Front solenoid valve assembly
- 4. Front solenoid valve bracket



Dryer removal steps
- *1. Air tubes
- 2. O-rings
- 5. Joint assembly
- 6. Bush
- 7. O-ring
- 8. Dryer

Flow control solenoid valves removal steps
- • Battery and Battery tray
- • Washer tank assembly
- *1. Air tubes
- 2. O-rings
- 9. Flow control solenoid valves

Post-installation Operation
- • Operation Check of ECS System

*Refer to service points of removal and installation.

[N] Non-reusable parts.

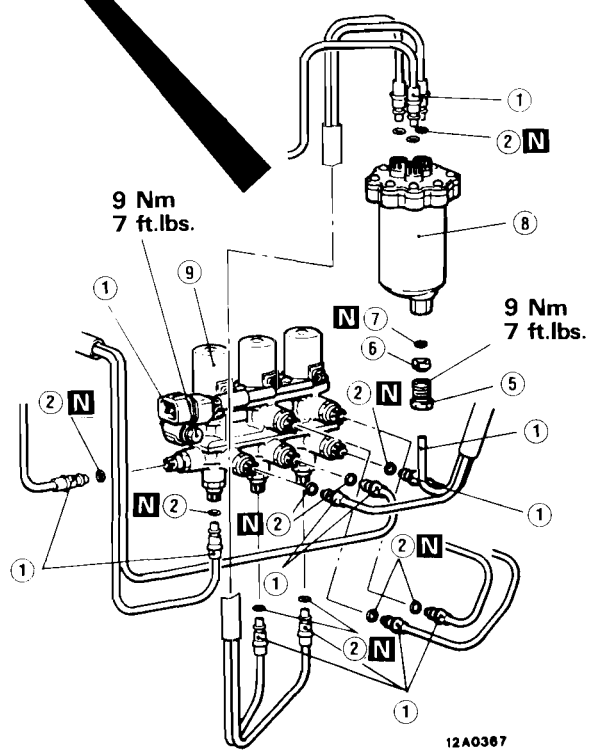
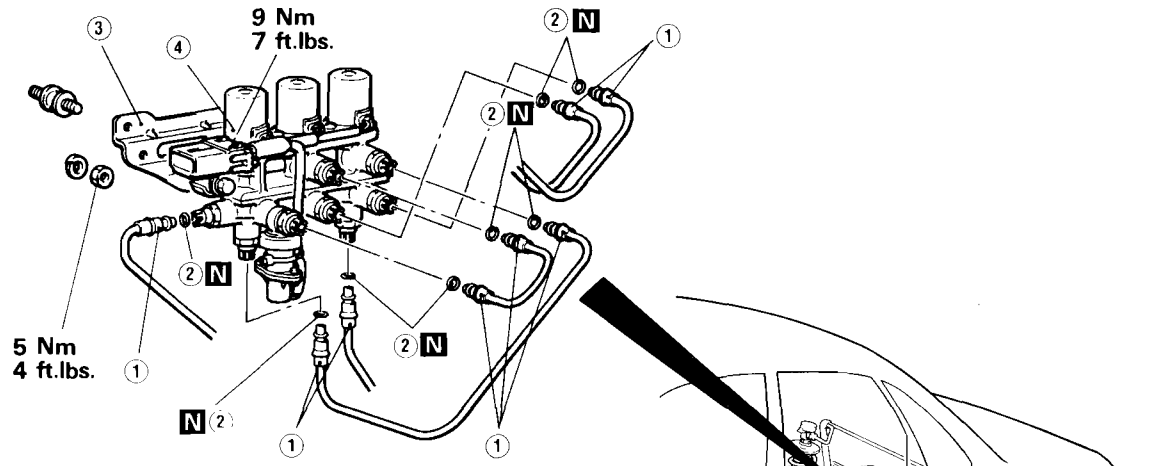


Fig. 41 — Solenoid valves and dryer assembly

REAR SOLENOID VALVE ASSEMBLY



Rear solenoid valve removal steps

- Removal of Trunk Side Trim (Refer to GROUP 52)

*1. Air tubes
2. O-rings
3. Rear solenoid valve assembly
4. Rear solenoid valve bracket

*Refer to service points of removal and installation

N Non-reusable parts.

Fig. 42 — Rear solenoid valve assembly

SERVICE POINTS OF REMOVAL

Removal of Air Tubes

(1) Push the special tool inward, in direction ① shown in Fig. 43, in order to expand the tabs of the joint.

(2) Pull out the air tube, together with the special tool, in direction ②.

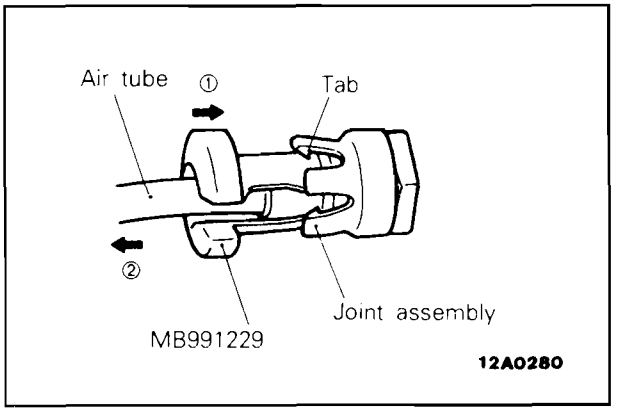


Fig. 43 — Air tube removal

CAUTION: In order to prevent dust, dirt and other foreign material from getting into the air tubes, solenoid valve and dryer openings. Cover these openings with vinyl tape or similar material.

(3) For the air tube at the lower part of the dryer, loosen the joint and then pull off.

NOTE: When loosening the joint, use a spanner at the hexagonal part of the joint installation part so as to prevent it from turning.

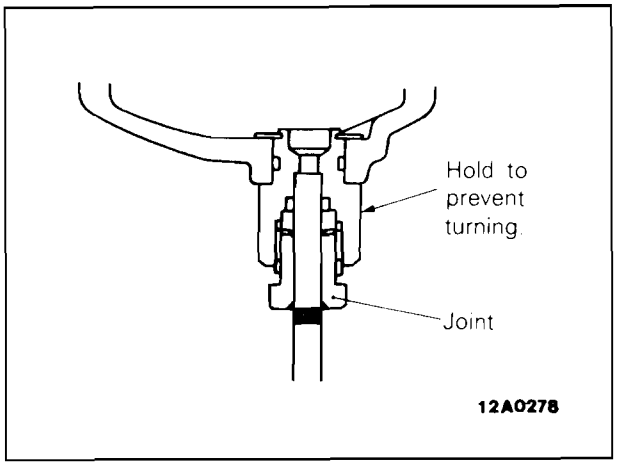


Fig. 44 — Drier air tube removal

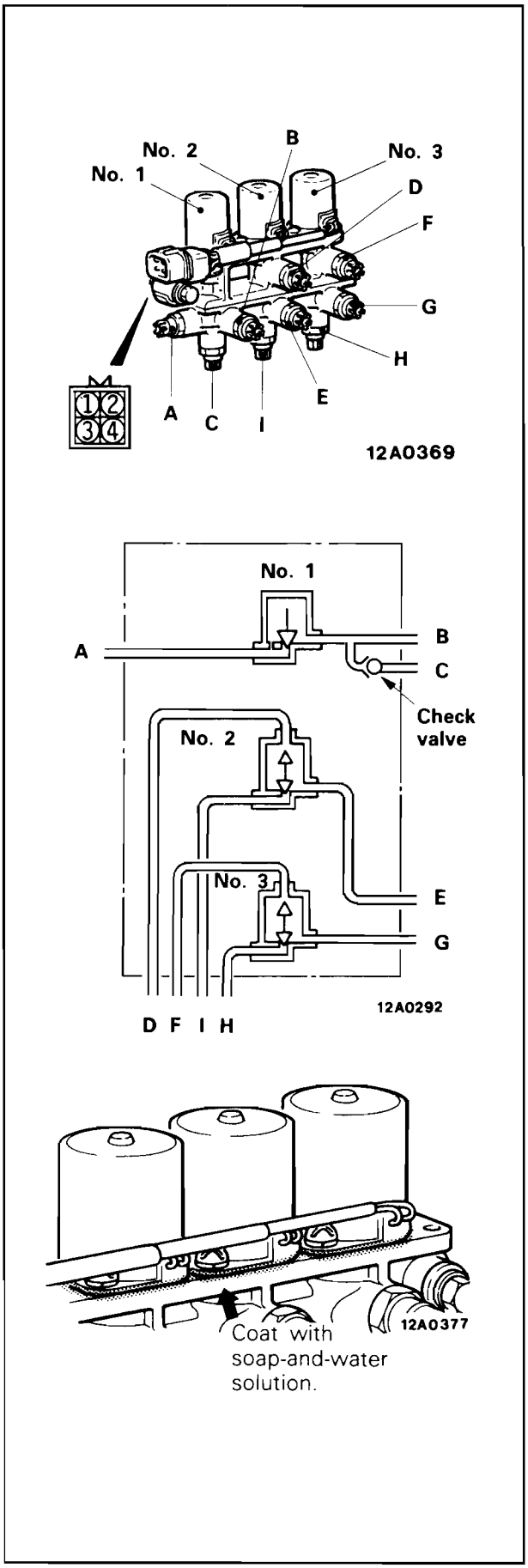


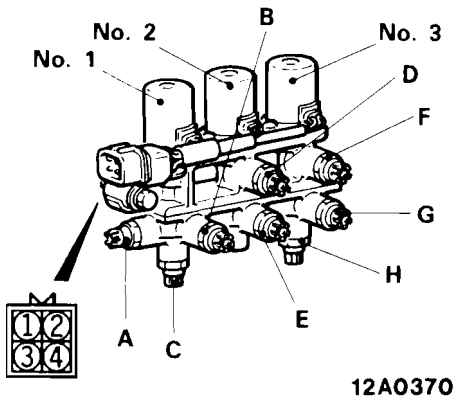
Fig. 45 — Flow control solenoid valve

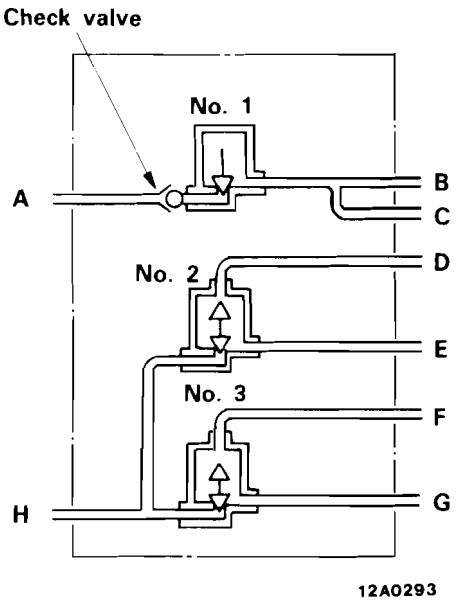
Inspection

1. Flow Control Solenoid Valve

Check the No. 1-3 solenoid valves shown in the figure for correct operation and air leakage.

Check item	Condition	Result
Inject air from Part A and apply battery voltage to terminal ② and then earth terminal ①.	A "click" noise will be heard, and the volume of air blown out from joints B and C will become greater.	Good
	Other than as described above.	Malfunction of No. 1 solenoid valve.
Blow air in at joint E, apply battery voltage (12V) to terminal ③, and then earth terminal ①.	A "click" noise will be heard, and the air being blown out will change from joint D to joint I.	Good
	Other than as described above.	Malfunction of No. 2 solenoid valve.
Inject air from part G and apply battery voltage (12V) to terminal ④, and then earth terminal ①.	A "click" noise will be heard, and the air being blown out will change from joint F to joint H.	Good
	Other than as described above.	Malfunction of No. 3 solenoid valve.
Inject air from part C.	Air is not blown out.	Good
	Air is blown out from joint B.	Malfunction of check valve.
With an air pressure of 1,000 kPa (142 psi) from parts B, H and I, apply a soap-and-water solution where shown in the illustration.	No air leakage.	Good
	Air leakage.	Malfunction of solenoid valve seal.





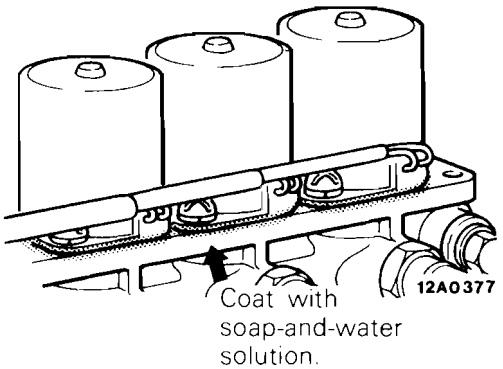


Fig. 46 — Front solenoid valve

2. Front Solenoid Valve

Check the No. 1-3 solenoid valves shown in Fig. 46 for correct operation and air leakage.

Check item	Condition	Result
Inject air from Part A and apply battery voltage to terminal ② and then earth terminal ①.	A "click" noise will be heard, and the volume of air blown out from joints B and C will become greater.	Good
	Other than as described above.	Malfunction of No. 1 solenoid valve.
Blow air in at joint E, apply battery voltage (12V) to terminal ③, and then earth terminal ①.	A "click" noise will be heard, and the air being blown out will change from joint D to joint H.	Good
	Other than as described above.	Malfunction of No. 2 solenoid valve.
Inject air from part G and apply battery voltage (12V) to terminal ④, and then earth terminal ①.	A "click" noise will be heard, and the air being blown out will change from joint F to joint H.	Good
	Other than as described above.	Malfunction of No. 3 solenoid valve.
Apply battery voltage (12V) to terminal ② and, with terminal ①. earthed, blow air in at joint B or C.	Air is not blown out from joint A.	Good
	Air is blown out from joint A.	Malfunction of check valve.
With an air pressure of 1,000 kPa (142 psi) from parts B, H and I, apply a soap-and-water solution where shown in the illustration.	No air leakage.	Good
	Air leakage.	Malfunction of solenoid valve seal.

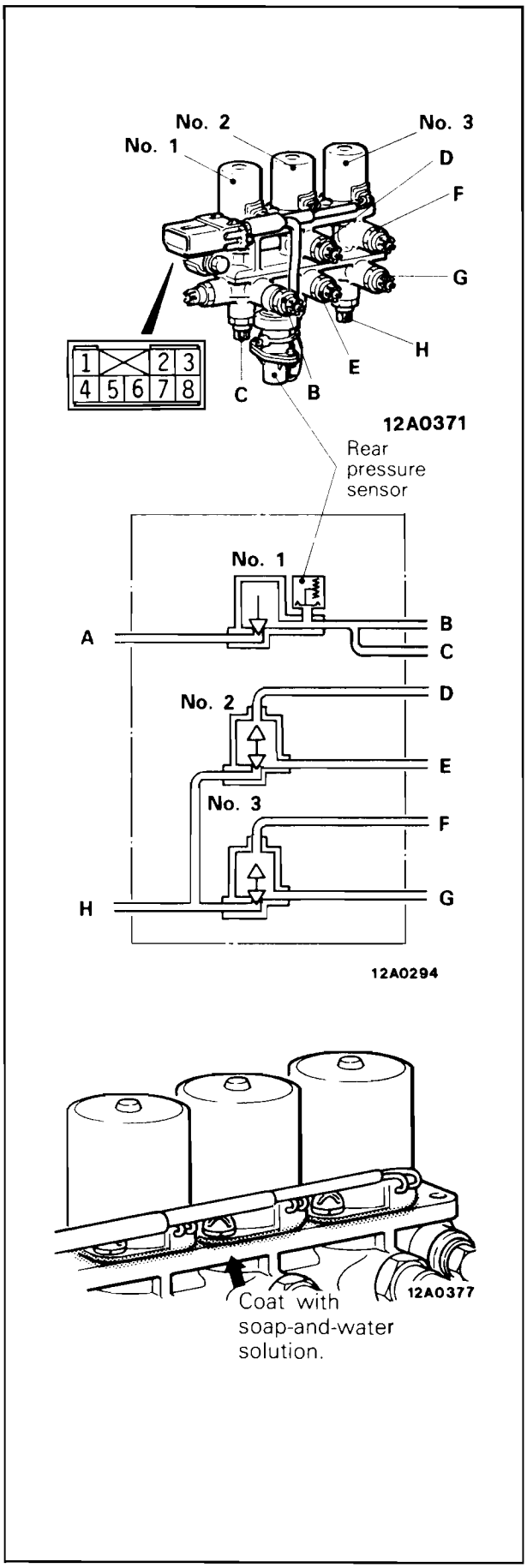


Fig. 47 — Rear solenoid valves

3. Rear Solenoid Valve

Check the No. 1-3 solenoid valves shown in Fig. 47 for correct operation and air leakage.

Check item	Condition	Result
Inject air from Part A and apply battery voltage (12V) to terminal and ② then earth terminal ①.	A "click" noise will be heard, and the air will be blown out from joints B and C.	Good
	Other than as described above.	Malfunction of No. 1 solenoid valve.
Blow air in at joint E, apply battery voltage (12V) to terminal ③, and then earth terminal ①.	A "click" noise will be heard, and the air being blown out will change from joint D to joint H.	Good
	Other than as described above.	Malfunction of No. 2 solenoid valve.
Inject air from part G and apply battery voltage (12V) to terminal ④, and then earth terminal ①.	A "click" noise will be heard, and the air being blown out will change from joint F to joint H.	Good
	Other than as described above.	Malfunction of No. 3 solenoid valve.
With an air pressure of 1,000 kPa (142 psi) from parts A and H, apply a soap-and-water solution where shown in the illustration.	No air leakage.	Good
	Air leakage.	Malfunction of solenoid valve seal.

SERVICE POINTS OF INSTALLATION

Installation of Air Tubes

(1) For the one-touch of air tube, press in to the joint assembly at the device side until a "click" is heard and then check that the tabs of the joint assembly are securely affixed to the air tube.

CAUTION: Before connecting the air tube, check that the identification colour of the tube and the colour at the joint agree.

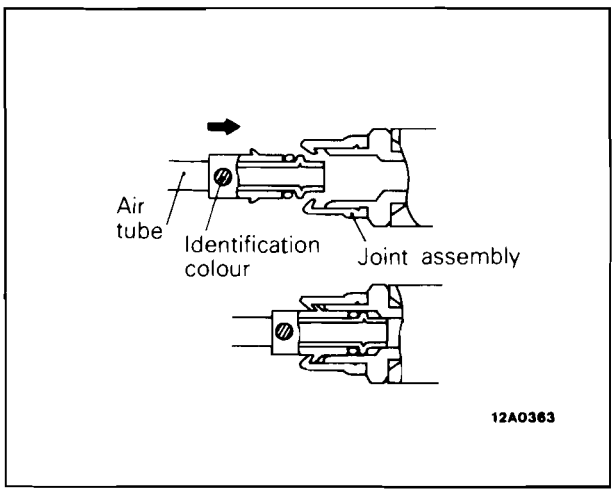


Fig. 48 — One-touch type joint

(2) First insert the air tube at the lower part of the dryer until resistance is felt and then press the tube further inward to the paint mark on the air tube.

CAUTION: Air leakage may occur if the air tube connection is not complete and secure.

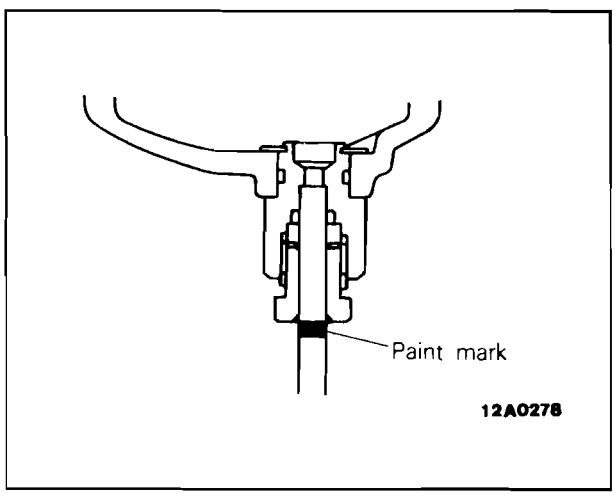


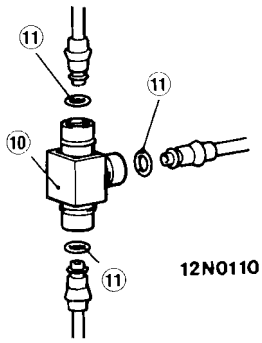
Fig. 49 — Dryer tube installation

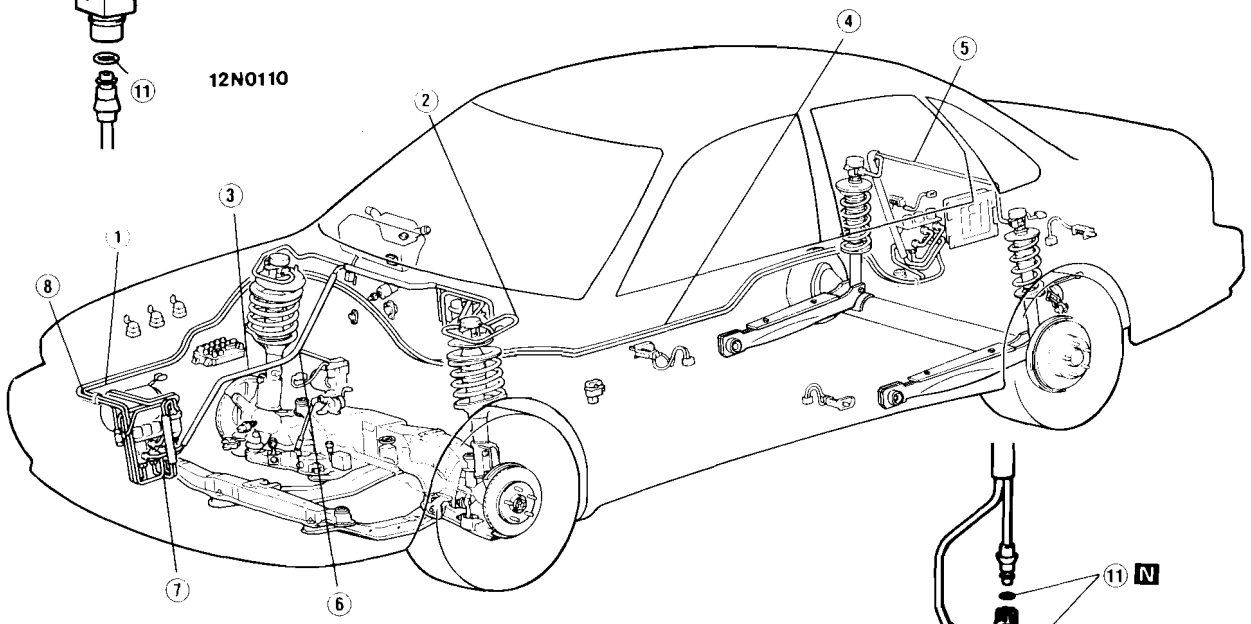
(3) After connection of the air tube, check for double-folding of the rolling diaphragm. (Refer to page 2.)

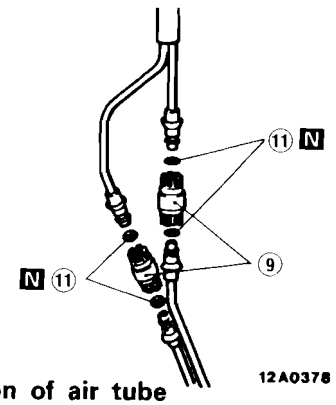
AIR TUBE

Post-installation Operation
- Operation Check of ECS System

REMOVAL AND INSTALLATION

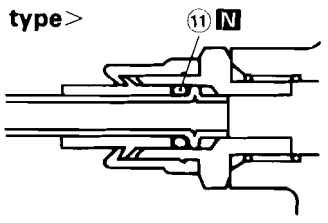




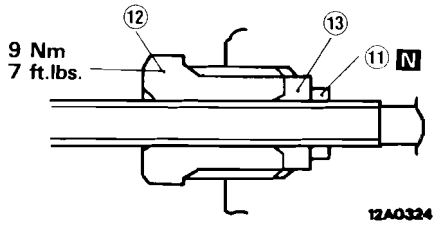


Cross-section of air tube joint

<One-touch type>



<Flare-nut type>



1. *Air tubes (flow control solenoid valve to joint assembly)
2. Air tubes (front solenoid valve to actuator)
3. Air tubes (flow control solenoid valve to front solenoid valve)
4. *Air tubes (joint assembly to rear solenoid valve)
5. Air tube (rear solenoid valve to actuator)
6. Air tubes (flow control solenoid valve to air compressor)
7. Ait tubes (dryer to flow control solenoid valve)
8. Air tubes (to reserve tank)
9. Joint assembly A
10. Joint assembly B
11. O-ring
12. Joint
13. Bush

NOTE
(1) Connections within ( ) are air tube connections.
(2) Air tubes indicated by the * symbol are interwound with the harness.

Fig. 50 — Component location

SERVICE POINTS OF REMOVAL

Removal of Air Tubes

One-touch type

(1) Push the special tool inward, in direction ①. shown in Fig. 51, in order to expand the tabs of the joint.
(2) Pull out the air tube, together with the special tool, in direction ②, refer Fig. 51.

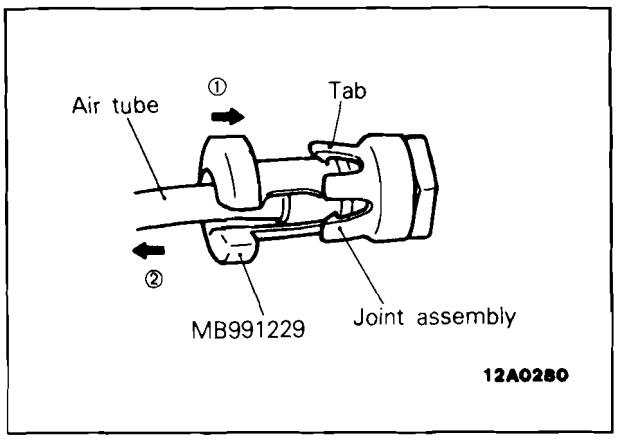


Fig. 51 — One-touch type air tube removal

Flare-nut type

Loosen the joint and pull out the air tube.

NOTE: When loosening the joint at the lower part of the dryer, use a spanner to hold the hexagonal part of the joint installation part to prevent it from turning.

CAUTION: In order to prevent the entry of dust, foreign material, etc., use vinyl tape or similar material to close the end of the air tube and the opening at the device side.

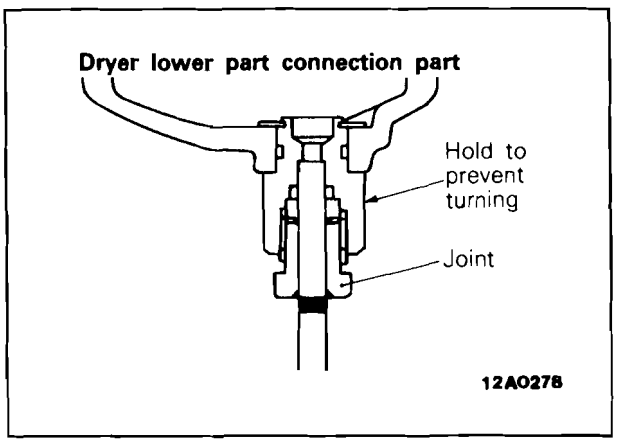


Fig. 52 — Flare-nut type air tube removal

SERVICE POINTS OF INSTALLATION

Installation of Air Tubes

One-touch type

Push the air tube in the joint assembly at the device side until a "click" is heard and then check that the tabs of the joint assembly are securely affixed to the air tube.

CAUTION: Before connecting the air tube, check that the identification colour of the tube and the colour at the joint agree.

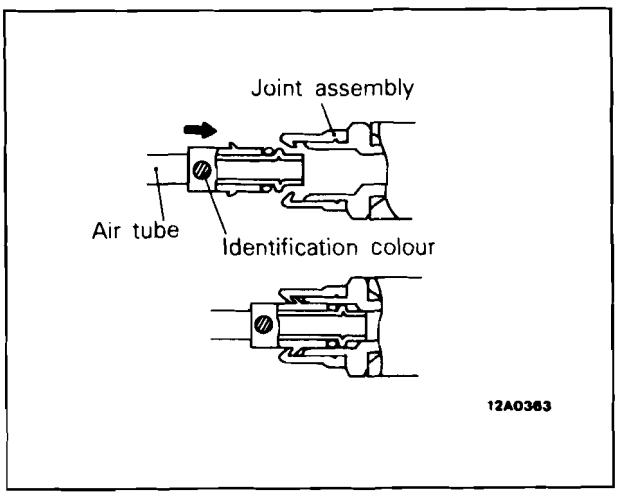


Fig. 53 — Air pipe installation

Flare-nut type

First insert the air tube until resistance is felt and then press the tube further inward to the paint mark on the air tube.

CAUTION: Air leakage may occur if the air tube connection is not complete and secure.

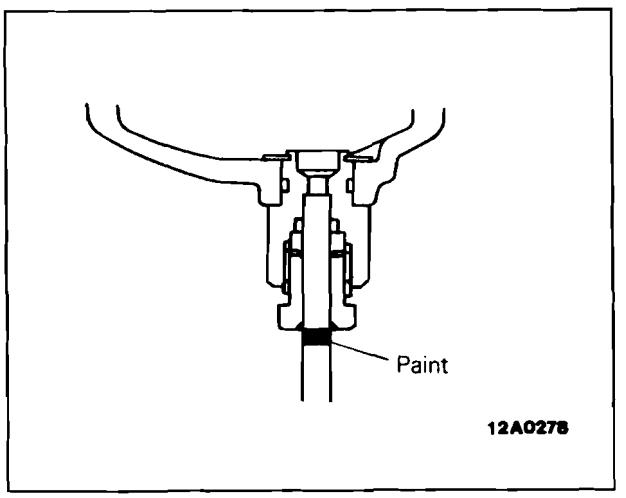


Fig. 54 — Flare-nut air tube installation

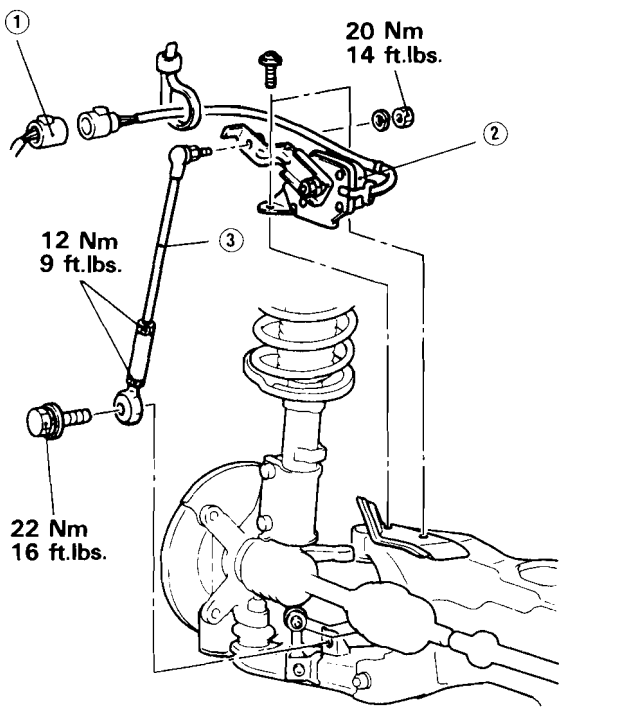
Inspection After Air Tub Installation

(1) Check for double-folding at the rolling diaphragm. (Refer to page 2.)
(2) Apply a soap-and-water solution to the joint part to check for air leakage; also visually check the air tube for breakage, crushing, pinching, etc.

HEIGHT SENSORS

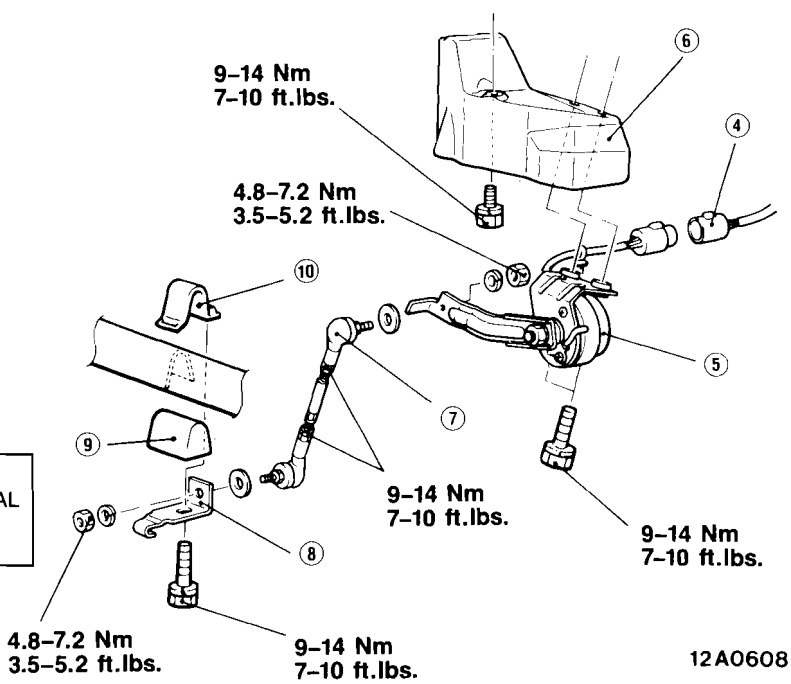
REMOVAL AND INSTALLATION

FRONT



Front height sensor removal steps
- Removal of compressor assembly
1. Front wiring harness connector
2. Front height sensor
*3. Front rod assembly

REAR



Rear height sensor removal steps
4. Body wiring harness connector
5. Rear height sensor
6. Protector
* 7. Rear rod assembly
8. Rear height sensor bracket (B)
9. Spacer
10. Rear height sensor bracket (A)

*Refer to service points of removal and installation.

Post-installation Operation
- Checking and Adjustment of the NORMAL Vehicle-height.
- Operation Check of ECS System

Fig. 55 — Front and rear height sensor

Inspection

- Check the rod and link plate for bending or damage.
- Check the rod adjustment lock nut for looseness.

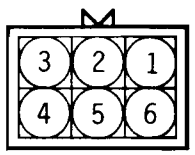
Checking The Sensor Terminal Voltage

Connect the height sensor to the body harness and then check that each terminal voltage changes as shown in the table below when, with the ignition key at the ON position, the sensor's link plate is turned.

NOTE: To check the sensor terminal voltage, one method which can be used is to move the rod up and down while the sensor is installed to the chassis.

FRONT HEIGHT SENSOR TERMINAL VOLTAGE

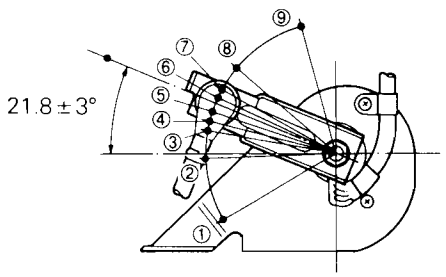
Front height sensor connector terminal array



12N0065

No. 1 Sensor A
No. 2 Sensor B
No. 3 Sensor C
No. 4 Ground
No. 5 Sensor D
No. 6 Sensor power supply (+5V)

Front height sensor position



12N0035

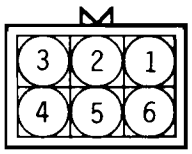
[V]

Vehicle height level	Sensor link position	Terminal No.			
		1	2	3	5
Maximum level	①	0–0.5	4.5–5	0–0.5	4.5–5
Higher than HIGH	②				0–0.5
HIGH (target height)	③			4.5–5	
Higher than NORMAL	④		0–0.5		
NORMAL (target height)	⑤	4.5–5		0–0.5	
Lower than NORMAL	⑥			0–0.5	
LOW (target height)	⑦		4.5–5		
Lower than LOW	⑧			4.5–5	
Minimum level	⑨				4.5–5

Fig. 56 — Front height sensor testing

REAR HEIGHT SENSOR TERMINAL VOLTAGES

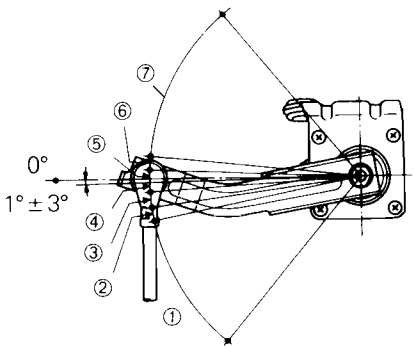
Rear height sensor connector terminal array



12N0065

1 Sensor A
2 Sensor B
3 Sensor C
4 Ground
5 Power supply
6 –

Rear height sensor position



12R0325

[V]

Vehicle height level	Sensor link position	Terminal No.		
		1	2	3
Higher than HIGH	①	0–0.5	4.5–5	0–0.5
HIGH (target height)	②			4.5–5
Higher than NORMAL	③		0–0.5	
NORMAL (target height)	④			0-0.5
Lower than NORMAL	⑤	4.5–5		
LOW (target height)	⑥		4.5–5	
Lower than LOW	⑦			4.5–5

Fig. 57 — Rear height sensor testing

SERVICE POINTS OF INSTALLATION

Installation of Rear Rod Assembly/Front Rod Assembly

(1) Adjust the front and rear height sensors so that dimension A of the rod in Fig. 58 is within specification.

Rod assembly length (A)	
Front	269-270 mm (10.5-10.6 in.)
Rear	135-136 mm (5.3-5.4 in.)

CAUTION:

1. When adjusting the length of the rod, adjust so that dimension B is uniform.

2. Height sensors must be installed so that the ball joint at the rod end is at rocking centre.

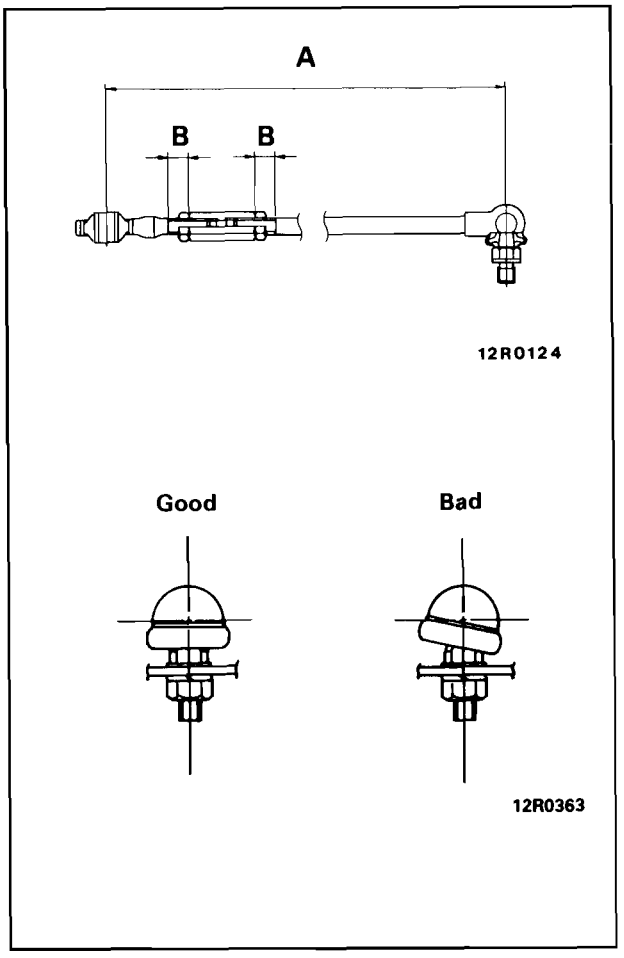
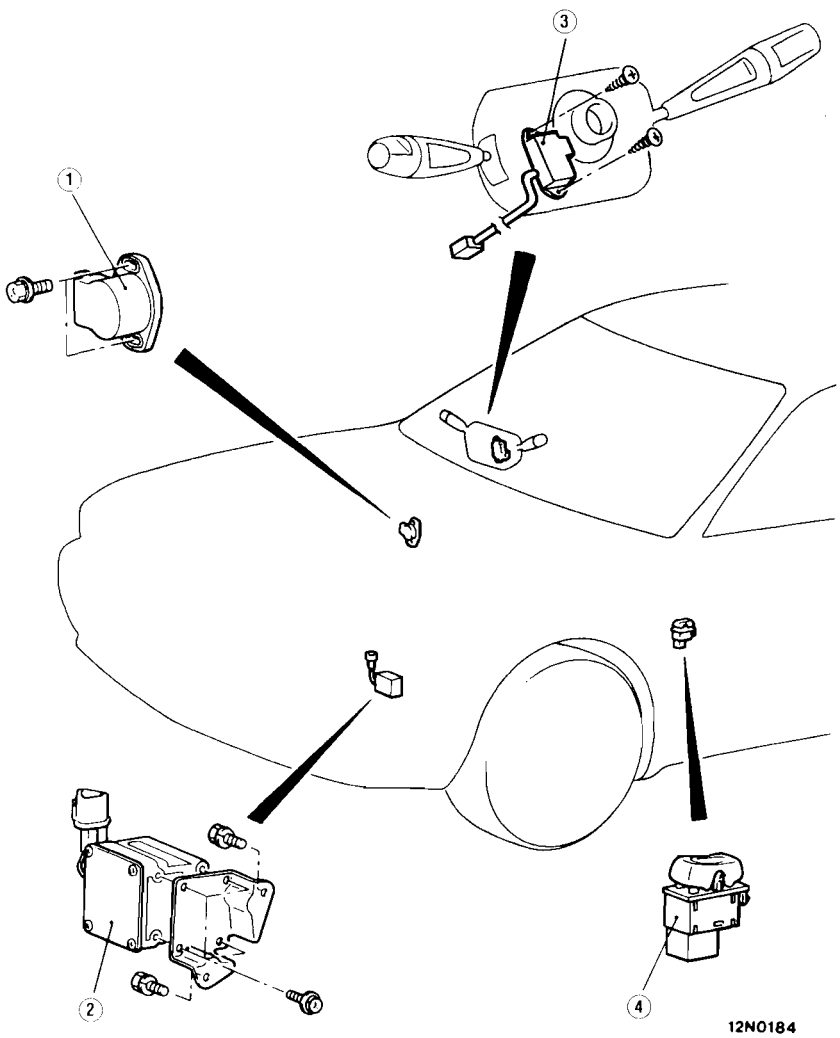


Fig. 58 — Rod assembly length

ACTIVE-ECS SENSOR AND SWITCH

REMOVAL AND INSTALLATION



1. Throttle position sensor
2. G sensor

Steering wheel sensor removal steps

- Removal of steering wheel and column cover. Refer to GROUP 37.
- Column switch. Refer to GROUP 54.

3. Steering wheel sensor
4. ACTIVE-ECS switch

Fig. 59 — Sensor location

SERVICE POINTS OF REMOVAL

Removal of Throttle Position Sensor

Disconnect the harness connector, then remove the throttle position sensor from the throttle body.

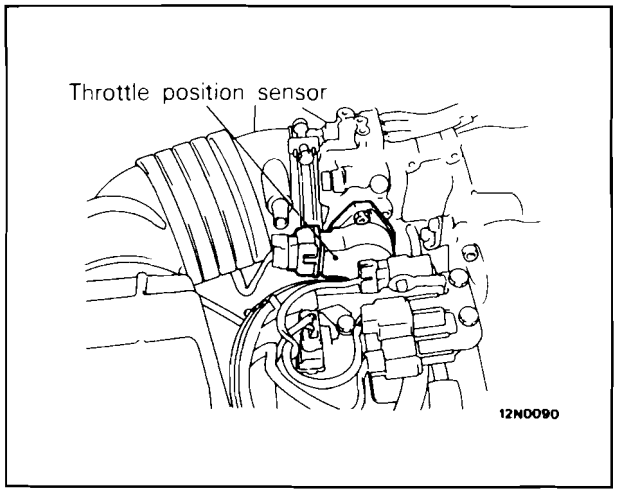


Fig. 60 — TPS removal

Removal of G Sensor

Disconnect the connection of the harness connector and then remove the G Sensor.

CAUTION: When removing the G sensor, take care not to drop it or subject it to severe impact.

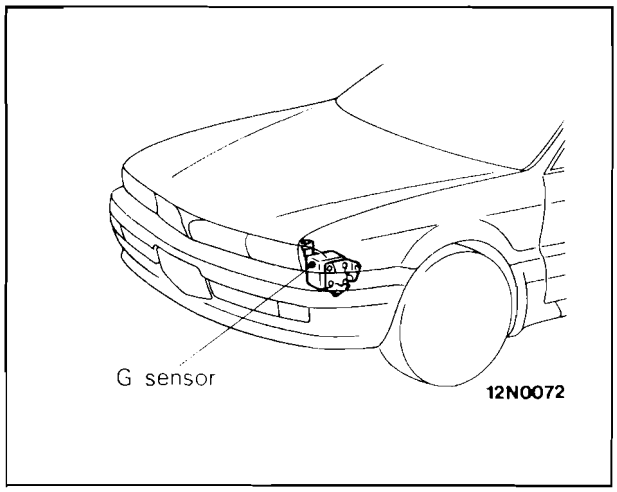


Fig. 61 — G Sensor removal

Removal of Steering Wheel Sensor

Remove the pin terminal from the column switch connector, then remove the steering wheel sensor from the column switch.

CAUTION:

1. The steering wheel sensor utilizes a photo coupler and care should be paid to ensure that no dust or grease are allowed to come into contact with it.

2. Be careful and ensure that the column switch side slit panel is not bent nor oil allowed to come into contact with it.

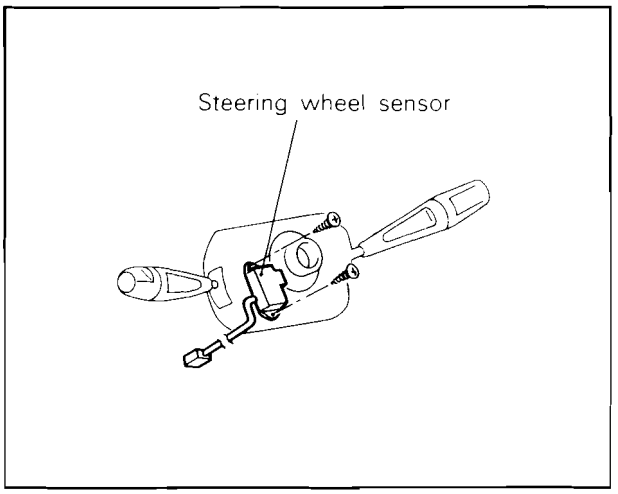
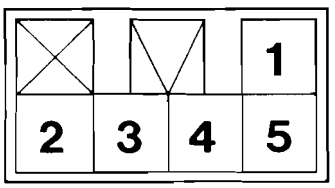


Fig. 62 — Steering wheel sensor

Inspection

Inspection of Active-ECS Switch

Activate the switch and check for continuity between the terminals.



12N0132

Operation / Terminal	No operation	Switched to HI	Switched to SP
1		○	
2		○	○
3	○	○	○
4	○	○	○
5			○

NOTE
○—○ indicates that there is continuity between the terminals

Fig. 63 — Active-ECS switch continuity chart

CONTROL UNIT

SERVICE POINTS OF REMOVAL

(1) Remove the trunk side trim. Refer to Group 52.

(2) Remove the installation bolts and connectors and then remove the control unit.

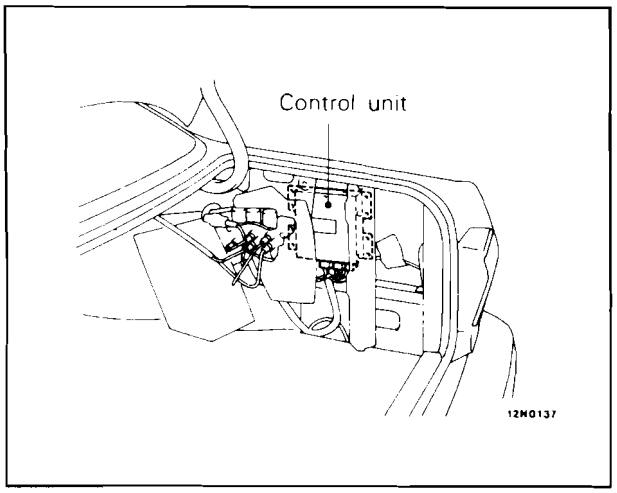


Fig. 64 — Control unit location

ACTIVE-ECS RELAY

Removal and Installation

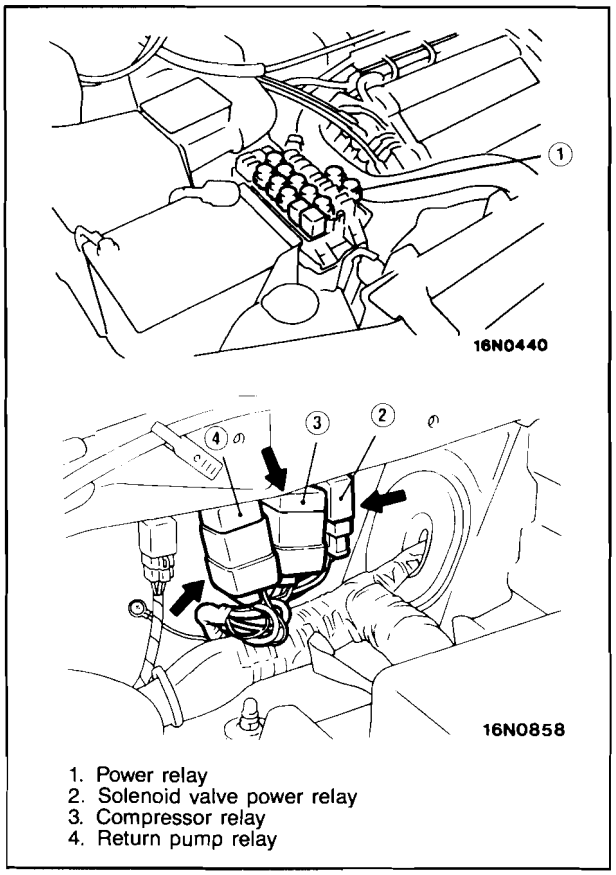
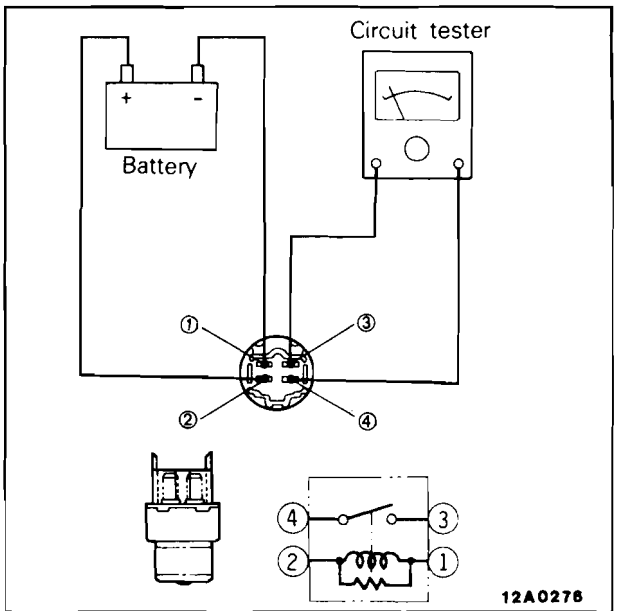


Fig. 65— Relay location

Inspection

1. Power Relay

Connect battery power source to terminal 1. Check circuit between terminals with terminal 2 grounded, refer Fig. 66.

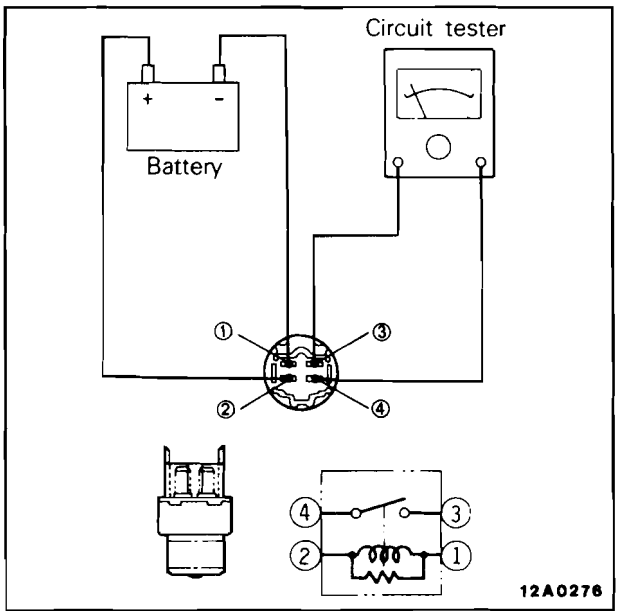


Power is supplied	Between terminals 3–4	Continuity
Power is not supplied	Between terminals 1–2	Continuity
	Between terminals 3–4	No continuity

Fig. 66 — Power relay testing

2. Solenoid Valve Power Relay

Connect battery power source to terminal 1. Check circuit between terminals with terminal 2 grounded, refer Fig. 67.



Power is supplied	Between terminals 3–4	Continuity
Power is not supplied	Between terminals 1–2	Continuity
	Between terminals 3–4	No continuity

Fig. 67 — Solenoid valve relay testing

GROUP 34 — REAR SUSPENSION

SECTION 0 — INDEX

Subject	Section Number	Page Number
INDEX	0	
SERVICE DIAGNOSIS	1	
REAR SUSPENSION — SEDAN	2	
Specifications Sedan and Wagon		1
General Information		3
Torsion Axle and Trailing Arm Assembly		3
Bush Replacement		4
Shock Absorber Assembly	5	
REAR SUSPENSION WAGON	3	
General Information		1
Coil Spring and Control Arm		1
Bush Replacement		4

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
POOR RIDE comes standard!	Weak or broken spring	Replace spring
	Faulty shock absorber	Replace shock absorber
NOISY OPERATION	Suspension components loose	Tighten loose components
	Bushes worn	Replace faulty components
	Faulty shock absorber	Replace shock absorber
	Worn or damaged wheel bearings	Replace wheel bearings
BODY ROLL	Weak or broken spring	Replace spring
	Weak or deteriorated rubber bushes	Replace rubber bushes
	Weak or broken torsion bar	Replace axle assembly
	Faulty shock absorber	Replace shock absorber
UNEVEN VEHICLE HEIGHT	Axle assembly deformed	Replace axle assembly
	Weak or broken spring	Replace spring
	Bent shock absorber piston rod	Replace shock absorber

SECTION 2 — REAR SUSPENSION

SPECIFICATION

	Sedan — all Except < R-Series > 8-X-41	< R-Series > 8-X-41	Wagon-all
Suspension type	3-link torsion axle with coil spring and lateral rod	←	5-link tubular axle with coil springs and lateral rod
Spring type	Monorate	←	←
Rate — kN/m	19.6 ± 1	12.9 ± 0.5	55 ± 3
Load range —low	2045 to 2140 N	—	3085 to 3285 N
—high	2141 to 2235 N	—	3286 to 3485 N
Colour Code—low	Brown/Green	—	Brown/Green
—high	Brown/Yellow	—	Brown/Yellow
—low (TS/KS 0-0-41)	Brown/Green	—	—
—high (TS/KS 0-0-41)	Brown/Yellow	—	—
— low (TS 1,2,3,4,7,8,-0-45)	—	—	Purple/Green
—high (TS 1,2,3,4,7,8,-0-45)	—	—	Purple/Yellow
— low (TS 5,6,-0-45)	—	—	Pink/Green
—high (TS 5,6,-0-45)	—	—	Pink/Yellow
— low (KS 0-D,P,X-45)	—	—	Pink/Green
—high (KS 0-D,P,X-45)	—	—	Pink/Yellow
Shock Absorber type	Double acting telescopic	← with ECS	Double acting telescopic
Maximum length	535 ± 3 mm	520 ± 3 mm	495 ± 3 mm
Minimum length	362 ± 3 mm	379 ± 3 mm	311 ± 3 mm
Stroke	173 mm	141 mm	184 mm
Bore	30 mm	30 mm	25 mm
Colour Code (TR/KR)	Black	←	←
(TS/KS)	Green	—	Blue
Rear Wheel Alignment			
Toe in (mm) — measured at centre of tyre tread	0 ± 3 (total)	←	←
Camber	Neg. 45' ± 15'	←	0 ± 30'

SPECIAL TOOLS

E17M15	Bushing removal and installation kit (wagon)
E17M15/16	Arbor—lateral rod bush remover/replacer
E17M17-1	Adaptor—lateral rod bush remover/replacer
E17M15/19	Receiver—lateral rod bush remover/replacer
E34M1	Bush remover/replacer—trailing arm

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TORQUE SPECIFICATIONS

Sedan	Nm
Trailing arm to body attaching bolts	80 to 100
Lateral rod to axle bolt	100 to 120
Lateral rod to body	80 to 100
Shock absorber to axle bolts	80 to 100
Spring upper retainer to body nut	40 to 50
Spring upper retainer to piston rod nut	20 to 25
Wheel nuts (alloy and steel wheels)	90 to 110
Wheel bearings	200 to 260
Brake caliper assembly mounting bolts	50 to 60
Brake caliper guide pin bolts	30 to 34
Brake hose support bracket bolts	17 to 26
Backing plate attaching bolts	50 to 60

Wagon	Nm
Lateral rod attaching bolt to body	80 to 100
Lateral rod attaching bolt to axle	140 to 160
Wheel nuts	90 to 110
Wheel bearing nut	200 to 260
Brake caliper mounting bolt	50 to 60
Lower control arm to body	220 to 240
Lower control arm to axle	220 to 240
Upper control arm	220 to 240
Shock absorber — Upper	40 to 50
— Lower	60 to 80
Backing plate attaching bolts	50 to 60
Backing plate reaction bolt and nut	70 to 90
Brake caliper guide pin bolts	30 to 40

1. Cap
2. Washer
3. Upper bushing (A)
4. Spring upper retainer
5. Collar
6. Spring pad
7. Upper bushing (B)
8. Cup assembly
9. Bump rubber
10. Dust cover
11. Coil spring
12. Shock absorber assembly
13. Arm bushing
14. Torsion axle and arm assembly
15. Lateral rod bushing
16. Lateral rod
17. Plate

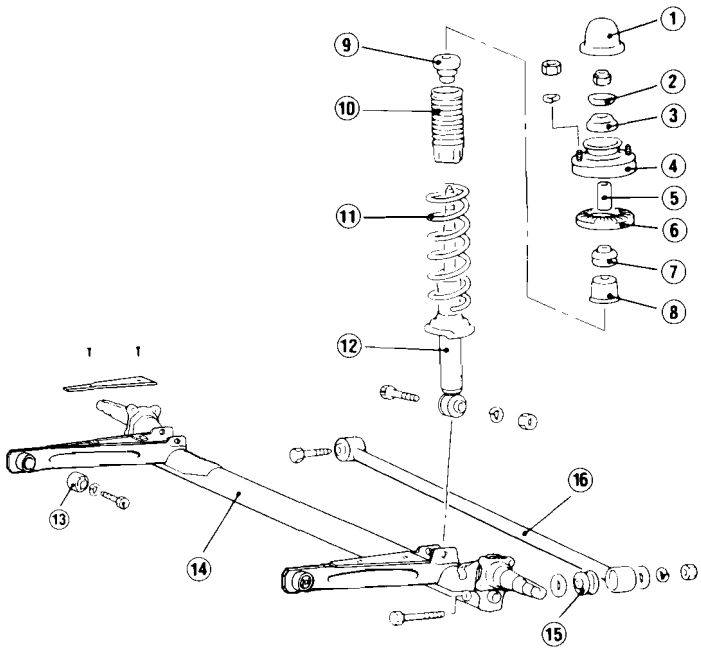


Fig. 1—Rear suspension components (sedan)

GENERAL INFORMATION

The rear suspension is a three link torsion axle type. It consists of a beam axle which incorporates the trailing arms and the torsion bar, a lateral rod, coil springs and double acting shock absorbers.

The axle is located longitudinally by the trailing arms, and laterally by a rod fixed at one end to the axle and at the other end to the body.

Road shocks are absorbed by the shock absorbers which are mounted onto the axle assembly and the body. The shock absorbers also carry the coil springs.

Vari-rate springs are used to ensure that good ride and handling characteristics are maintained for all vehicle load carrying requirements.

TORSION AXLE AND TRAILING ARM ASSEMBLY

Removal

(1) Loosen the wheel nuts, raise the rear of the vehicle and support on safety stands in the locations outlined in Group 00 — General Information.

NOTE: Do not raise the vehicle by using a jack under the axle assembly.

(2) Remove the wheels.

(3) Disconnect the park brake cable assemblies, remove the bolts from the cable clamps on the trailing arms and withdraw the cables from the trailing arms.

(4) Remove the brake hose support brackets from the axle assembly.

(5) Remove the caliper attaching bolts and remove the calipers.

NOTE: The caliper assembly should be suitably supported to avoid any damage to the brake hose.

(6) If the rear axle assembly is to be replaced, remove the disc assemblies, backing plates and caliper adaptor plates, refer Groups 35 and 36.

(7) Support the axle assembly on a jack, raised sufficiently to relieve any tension on the attaching bolts.

(8) Remove the lateral rod to body attaching bolt, refer Fig. 2, and the lateral rod to axle attaching bolt and remove the lateral rod.

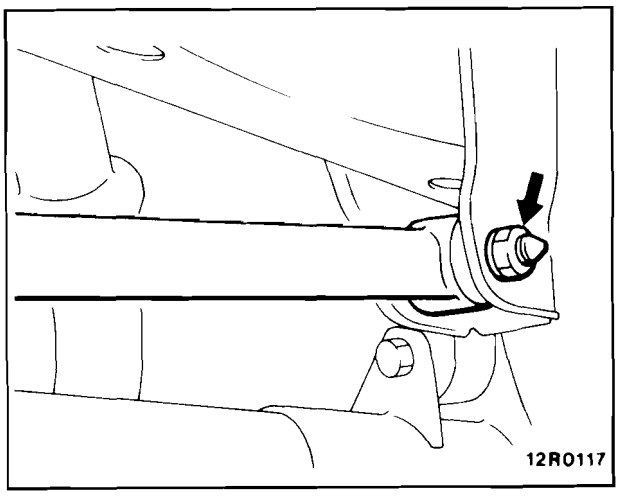


Fig. 2—Lateral rod attaching bolt

(9) Remove the shock absorber to axle attaching bolts, refer Fig. 3.

(10) Remove the trailing arm to body attaching bolts, refer Fig. 3.

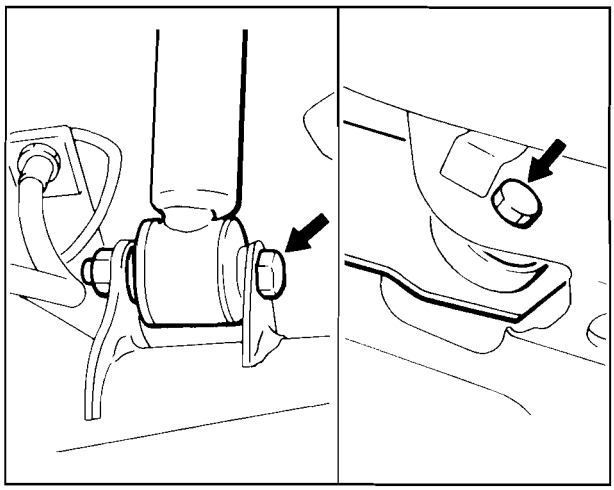


Fig. 3—Rear axle attaching points

(11) Lower the jack and remove the axle assembly from the vehicle.

Inspection

Perform the following inspection and replace any faulty components.

(1) Check the trailing arm and axle beam for cracks, deformation and damage.

(2) Check the torsion bar for distortion, bend or damage.

(3) Check the lateral rod for bend or damage.

(4) Check all bushes for damage, wear or distortion.

Installation

Install by reversing the removal procedure.

NOTE: The vehicle should be lowered to floor before suspension attaching bolts are torqued.

BUSH REPLACEMENT

Trailing Arm Bush

(1) Loosen the wheels, raise the rear of the vehicle and support on safety stands in the locations outlined in Group 00 — General Information.

NOTE: Do not raise the vehicle by using a jack under the axle assembly.

(2) Remove the wheels.

(3) Remove the lateral rod to axle attaching bolt.

(4) Remove the park brake cable to body clamp bolts.

(5) Remove the brake hose support bracket from the axle assembly.

(6) Loosen the shock absorber to axle attaching bolts.

(7) Suitably support the axle assembly and remove the trailing arm to body attaching bolts.

(8) Lower the axle sufficiently to permit the use of bush remover/installer tool.

(9) Using special tool E34M1 press out the trailing arm bush, refer Fig. 4.

(10) Press in the new bush from the beveled side of the trailing arm pipe, refer Fig. 5, by reversing the removal procedure. Ensure that the bush is positioned as shown in Fig. 5 and protrudes an equal amount each side of the trailing arm pipe.

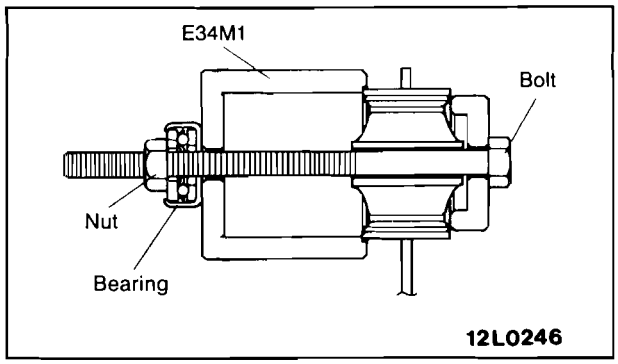


Fig. 4—Trailing arm bush removal

NOTE: If trailing arm bush is extremely tight and unable to be removed with the special tool in situ, it will be necessary to remove the axle assembly and remove the bush with the aid of a press.

(11) Reverse steps (1) to (8), noting that the suspension attaching bolts should be torqued after the vehicle is lowered to the floor.

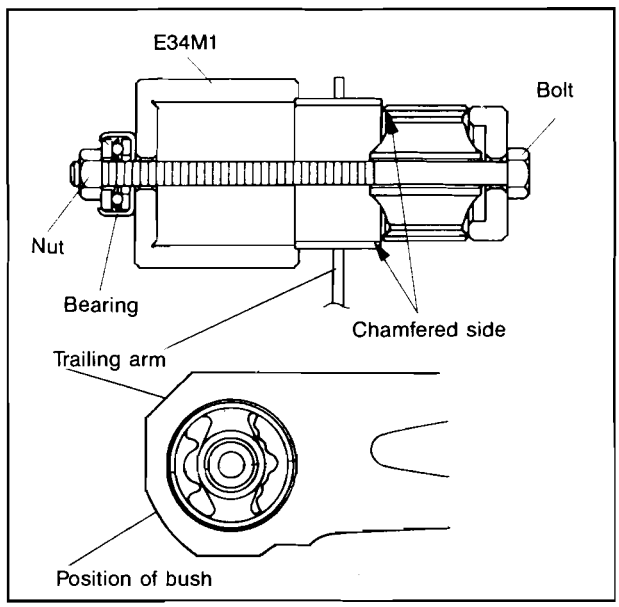


Fig. 5—Installing trailing arm bush

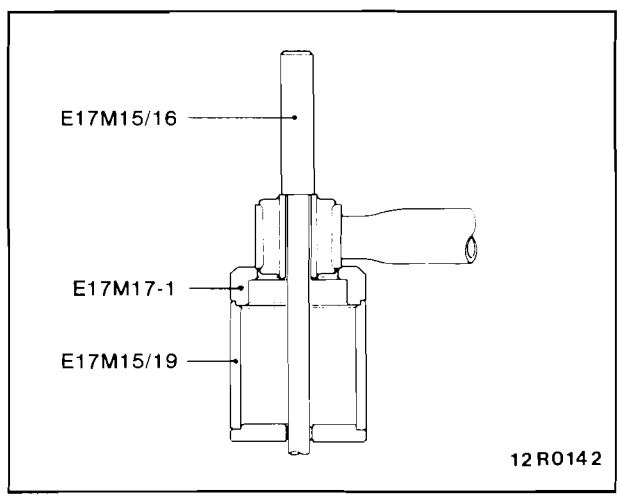


Fig. 6—Lateral rod bush replacement

Lateral Rod Bush

(1) Remove the lateral rod from the vehicle.
(2) Using special tools E17M15/16, E17M15/19 and E17M17-1 press out the lateral rod bush, refer Fig. 6.
(3) Press the new bush in by reversing the removal procedure ensuring that the bush projection on each side is equal.
(4) Install the lateral rod to the vehicle.

SHOCK ABSORBER ASSEMBLY

Removal

(1) Loosen the rear wheel nuts, raise the rear of the vehicle and support on safety stands in the locations outlined in Group 00 — General Information.

NOTE: Do not raise the vehicle by using a jack under the axle assembly.

(2) Remove the wheels.
(3) Support the axle assembly on a jack, raised sufficiently to relieve any tension on the attaching bolts.
(4) Remove the luggage compartment front trim, refer Group 52 — Interior.
(5) Remove the shock absorber top cover and two attaching nuts, refer Fig. 7.

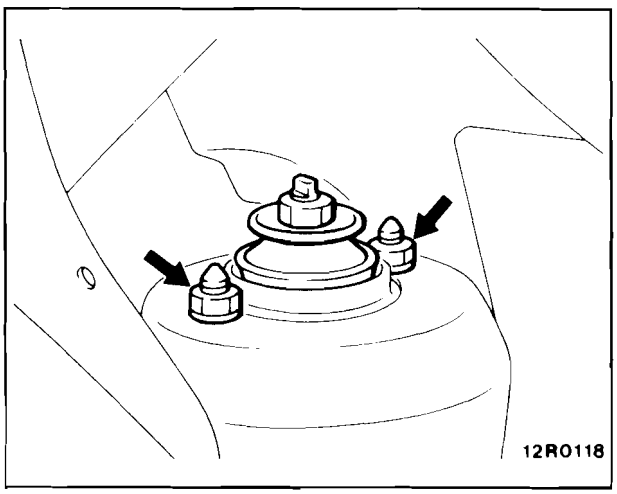


Fig. 7—Shock absorber attaching nuts

(6) Remove the shock absorber to axle attaching bolt and remove the shock absorber assembly from the vehicle.

Installation

(1) Install the shock absorber assembly to the body and fit the attaching nuts.
(2) Raise the axle assembly on a jack to align the mounting bolt holes and fit the attaching bolts and nuts.
(3) Fit the wheels and lower the vehicle to the floor.
(4) Torque all mountings and wheel nuts to specifications.
(5) Fit the shock absorber top cover and the luggage compartment front trim, refer Group 52 — Interior.

Disassembly

(1) Compress the coil spring using a suitable tool, refer Fig. 8.

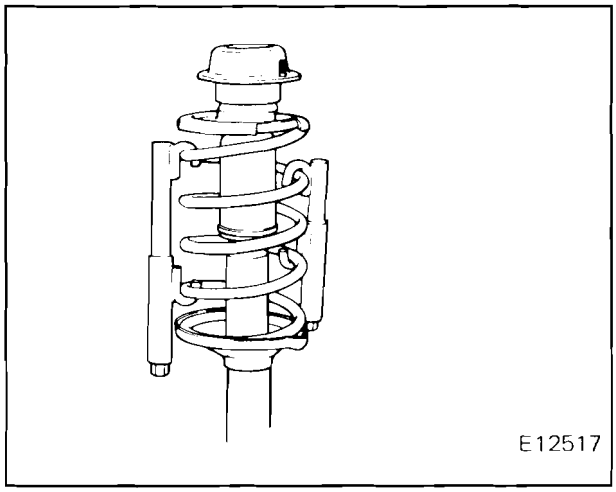


Fig. 8—Compressing coil spring

(2) Remove the upper spring retainer to piston rod attaching nut, refer Fig. 9, and remove components 3-12 in the order shown in Fig. 10.

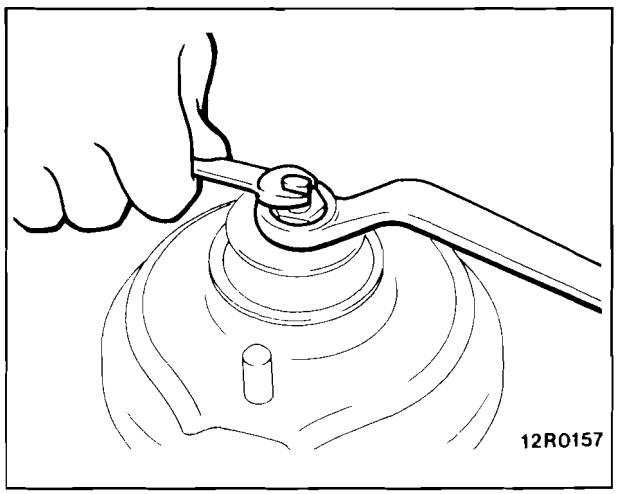


Fig. 9—Removing spring retainer to piston rod nut

Inspection

Perform the following inspection and replace any faulty components.
(1) Check the springs for cracks, fractures, loss of tension and other signs of deterioration.
(2) Check the shock absorbers for leaks and the piston rod for bend or damage.
(3) Check all rubber components for signs of damage or deterioration.

NOTE: Coil springs or shock absorbers should always be replaced in pairs.

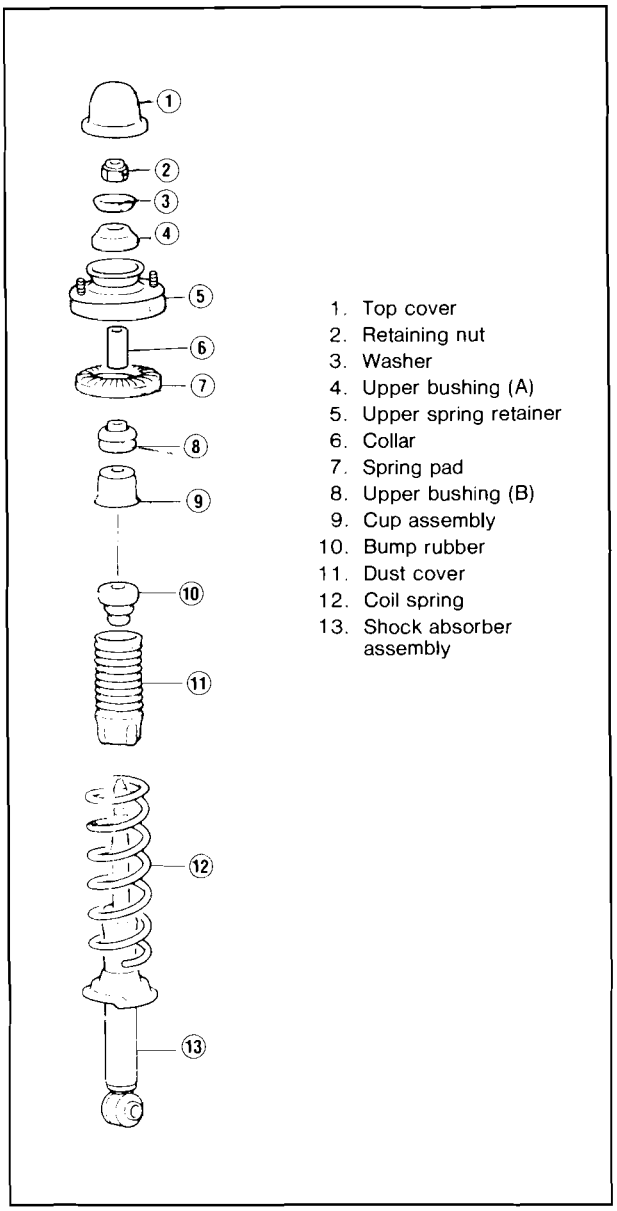


Fig. 10—Shock absorber components

Reassembly

(1) Compress the coil spring using a suitable tool, refer Fig. 8.

(2) Install components 3-12 in the order shown in Fig. 10.

(3) Install the upper spring retainer to piston rod attaching nut, remove the spring compressor and torque the retaining nut, ensuring that the spring does not twist in its seat.

SECTION 3 — REAR SUSPENSION — WAGON

GENERAL INFORMATION

The rigid axle is retained by upper and lower control arms. Lateral location of the axle is maintained by the lateral rod.

Coil springs are mounted on the lower control arms of Wagon models, refer Fig. 1.

Monorate springs are used to ensure good ride and handling characteristics, for all load carrying requirements.

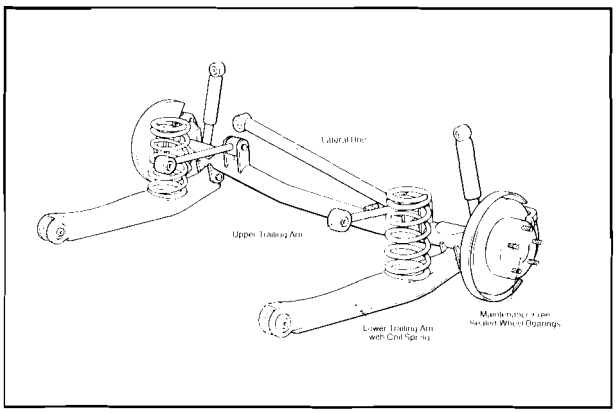


Fig. 1—Rear suspension

COIL SPRING AND CONTROL ARM

Removal

(1) Loosen road wheels, raise rear of the vehicle and support on safety jacks placed under the body.

(2) Remove the rear wheels.

(3) Place a jack under the axle and raise the axle slightly.

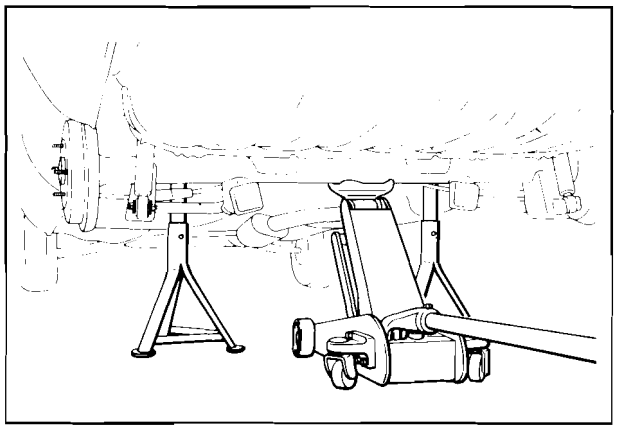


Fig. 2 — Supporting the vehicle typical **(Wagon only)**

NOTE: If the rear axle assembly is to be replaced, remove the disc assemblies and backing plates, refer Groups 35 and 36.

(4) Remove the lateral rod to body attaching bolt, refer Fig. 3 and the lateral rod to axle attaching bolt and remove the lateral rod.

(5) Disconnect the park brake cable assemblies, remove the bolts from the cable clamps on the trailing arms and withdraw the cables from the trailing arms.

(6) Remove the brake hose support brackets from the axle assembly.

(7) Remove the caliper attaching bolts and remove the calipers.

NOTE: The caliper assembly should be suitably supported to avoid any damage to the brake hose.

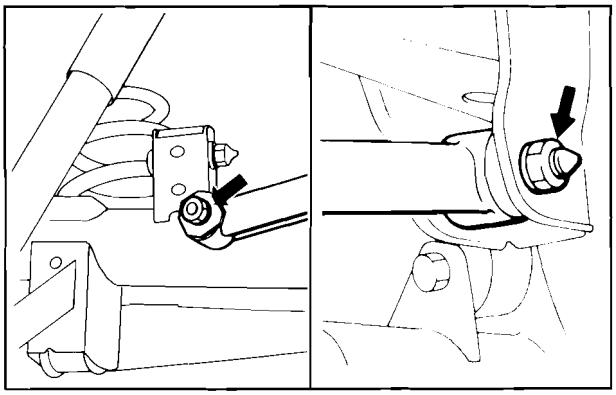


Fig. 3—Lateral rod attaching bolt

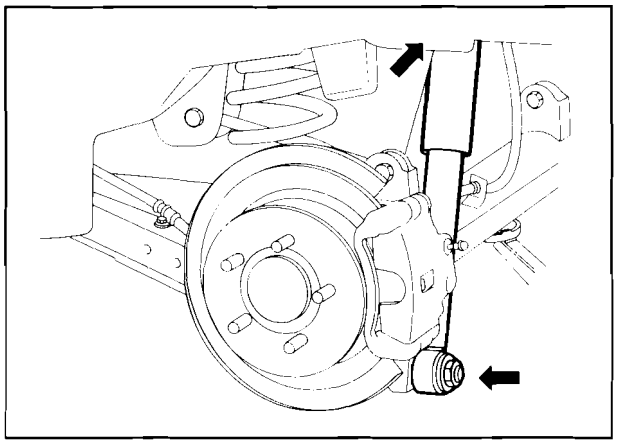


Fig. 4—Removal of the shock absorber

(5) Disconnect shock absorber lower links and lower the jack, refer Fig. 4. The coil springs can now be removed, refer Fig. 5.

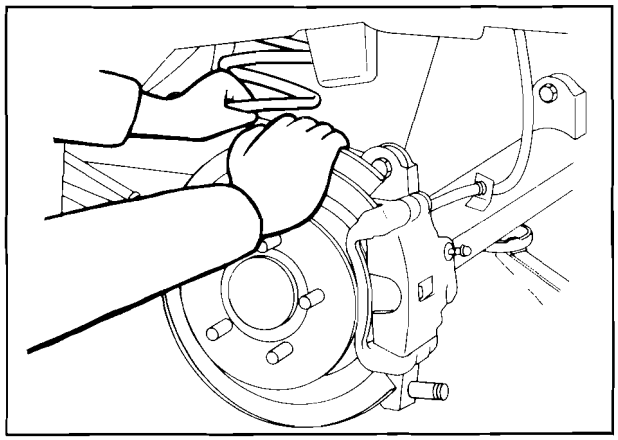


Fig. 5—Removal of the coil spring

(9) Raise the jack slightly and remove the bolts securing the lower control arm, assist link and upper arm, the arms and links can now be removed, refer Figs. 6 and 7.

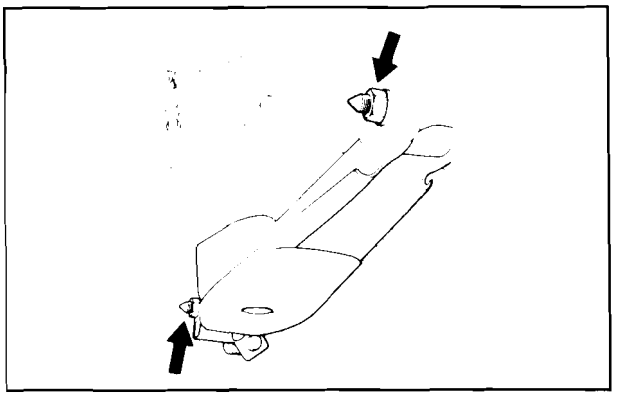


Fig. 6 — Removal of lower control arm

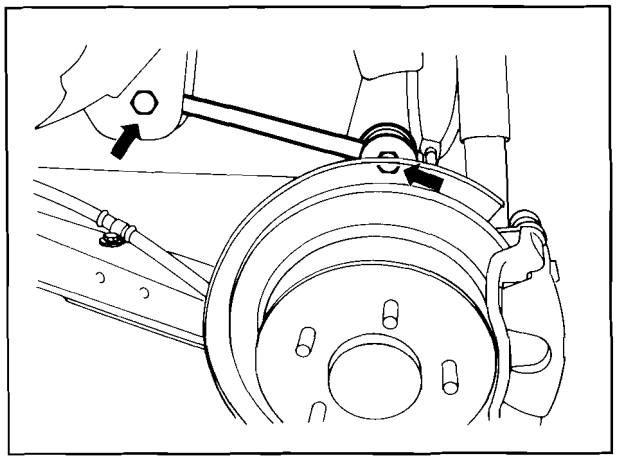


Fig. 7 — Removal of the upper control arm

CAUTION: If both the upper and lower control arms are removed, provide suitable support for the rear axle to prevent it falling from jack.

(10) Remove the rear axle bumper if necessary, refer Fig. 8.

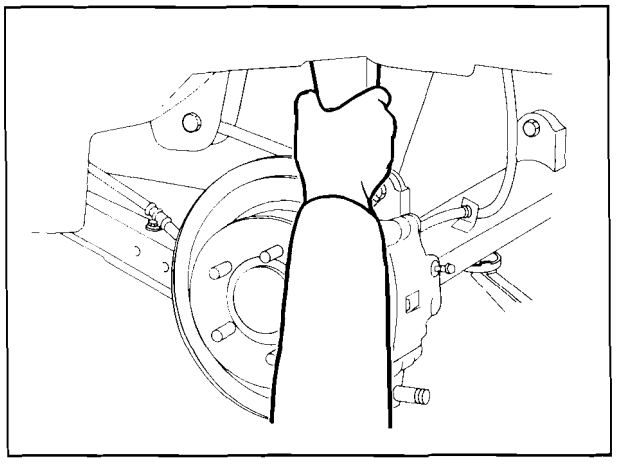


Fig. 8 — Removing rear axle bumper

Inspection

Check the coil springs for bends, cracks and deterioration and the spring pad for breakage.

To test shock absorber, manually move the absorber assembly throughout its full stroke. The absorber assembly must move smoothly, with uniform resistance, refer Fig. 11.

Installation

Install by reversing the removal procedure noting the following:

(1) Coat all suspension attaching bolts with Loctite 262.

(2) The vehicle should be lowered to floor before suspension attaching bolts are torqued.

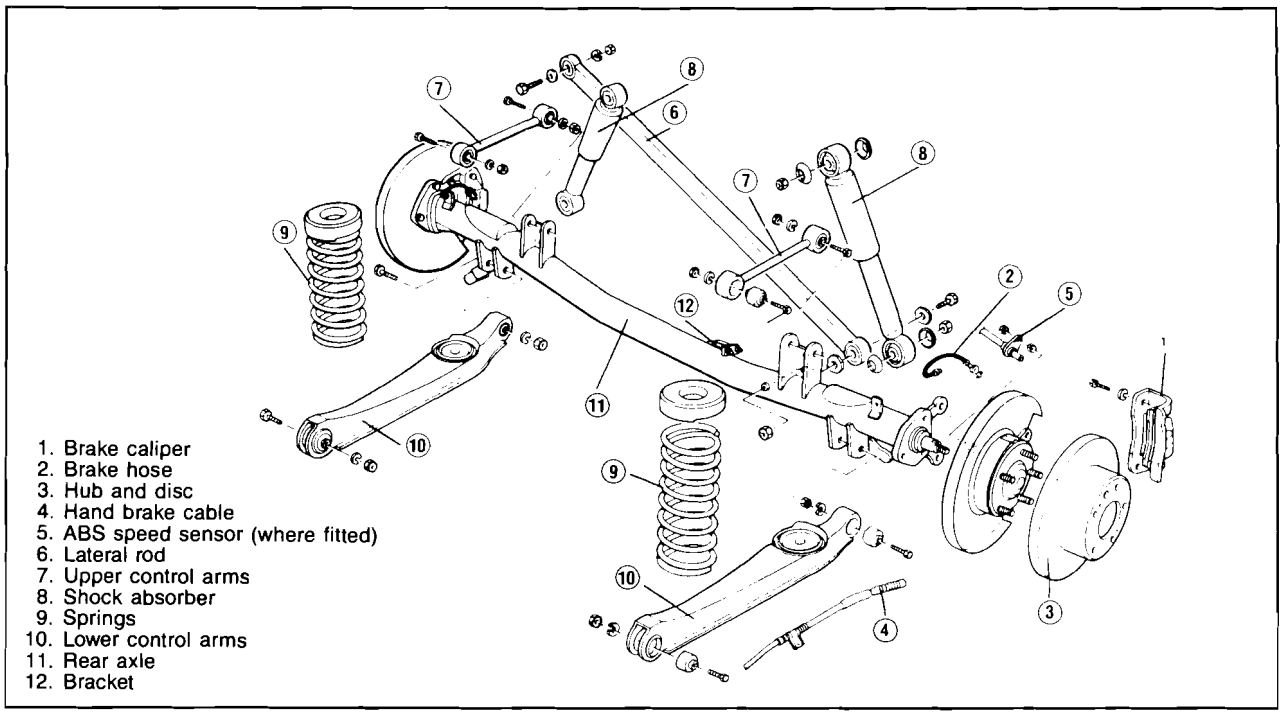


Fig. 9—Components of wagon rear suspension

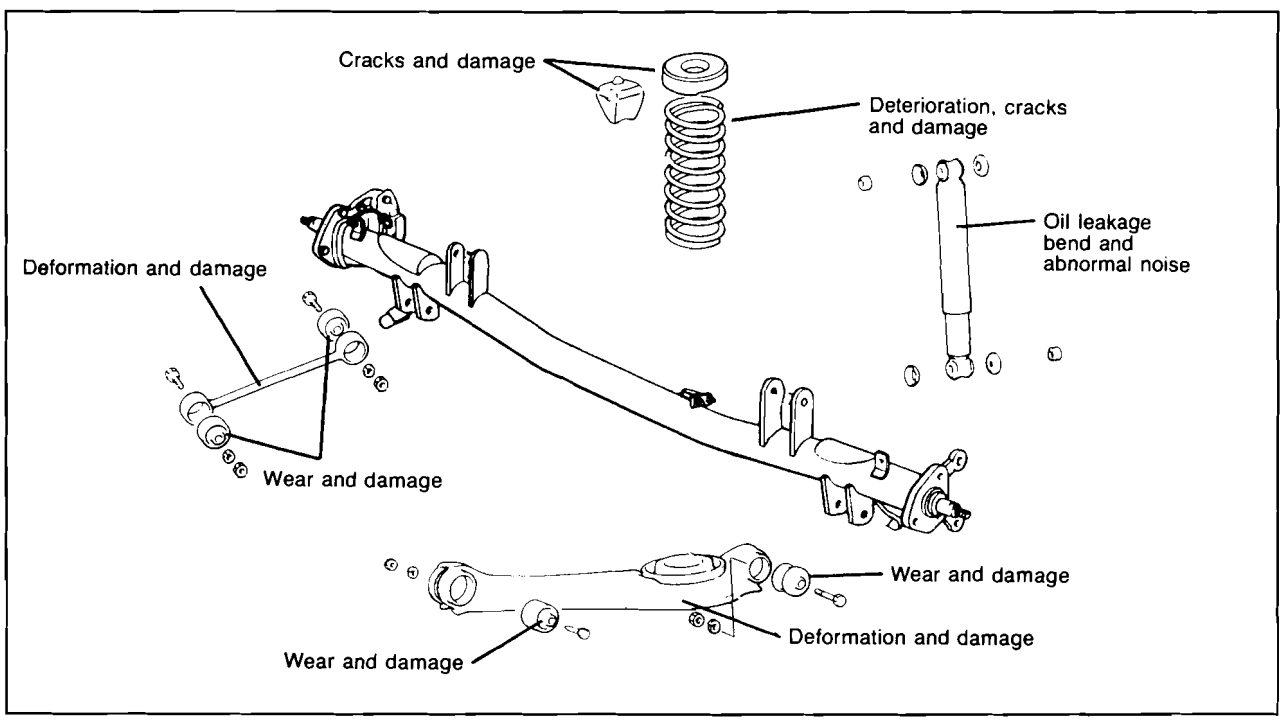


Fig. 10—Suspension inspection points

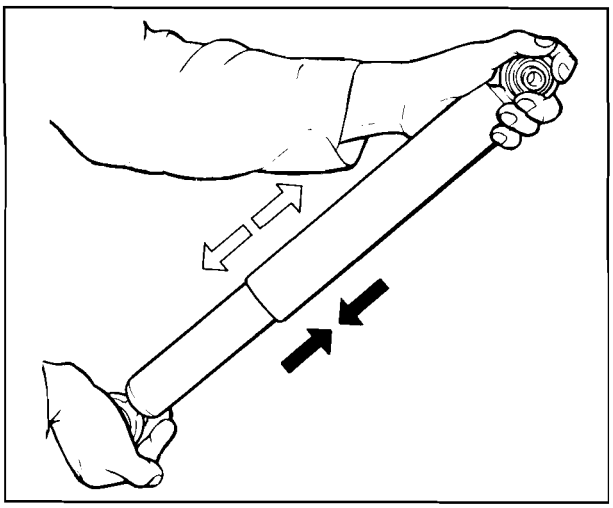


Fig. 11—Checking shock absorber operation

Check the upper and lower control arms and lateral rod for bends and damage and check each bushing for deterioration, cracks and spalling.

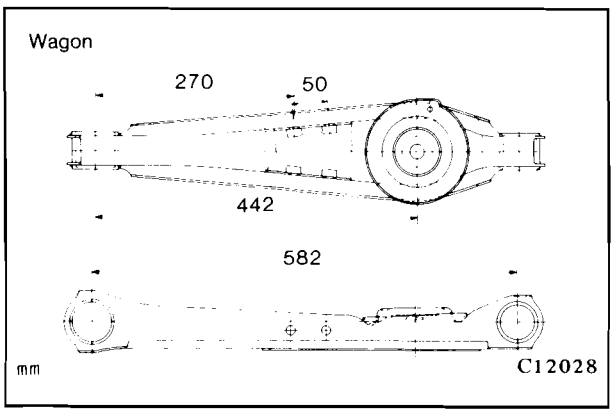


Fig. 12—Rear control arm alignment

Upper and lower control arm and lateral rod bushes should not be removed unless they are worn or damaged. Then they should be replaced with new bushes.

Installation

(1) With the rear axle slightly jacked up, install the upper and lower control arms. Do not tighten any bolts at this point. Leave finger tight.

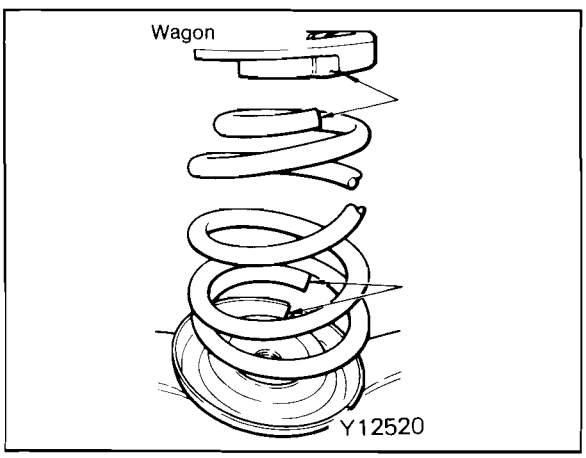


Fig. 13—Spring installation

(2) Lower the rear axle and install the springs, i.e. (small end to the top) mating the step in the pad with the end of the spring, refer Fig. 13.

(3) Each spring has an indentification mark for load classification, to maintain the correct vehicle attitude the springs should be fitted with matching identification marks on both sides of the vehicle.

NOTE: Intermixing of springs is permissible if problems are experienced in attaining the correct vehicle attitude.

(4) Raise the axle slightly and install the shock absorber.

(5) Install the lateral rod and leave nuts and bolts finger tight.

(6) Install the wheels and lower the vehicle to the floor.

(7) With the vehicle in an unladen condition tighten all control arm and lateral rod nuts and bolts to the specified torque.

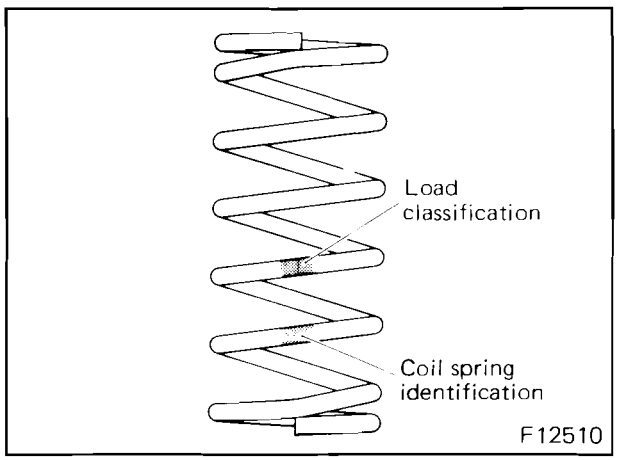


Fig. 14—Spring identification

BUSH REPLACEMENT

Lower Control Arm

(1) With the lower control arm removed, remove the bushing with the aid of a press and components from special tool kit E17M15 refer Fig. 15, 18.

(2) Install the front bush using a press and components of Special Tool Kit E17M15, refer Fig. 15. Install the bush into the chamfered end of the bush hole of the control arm, (refer Fig. 16), the large cut in the bush facing the rear of vehicle, refer Fig. 17.

(3) Install the lower control arm rear bush using a press and components of Special Tool Kit E17M15 as shown in Figs. 18, except for an additional sleeve (E17M15-14) that is used to guide and compress the new bush during installation. Lubricate the bush, sleeve (E17M15-14) and bush hole with a soapy solution prior to installation. When installed, ensure that the bush projects equally past either side of the arm, refer Fig. 20.

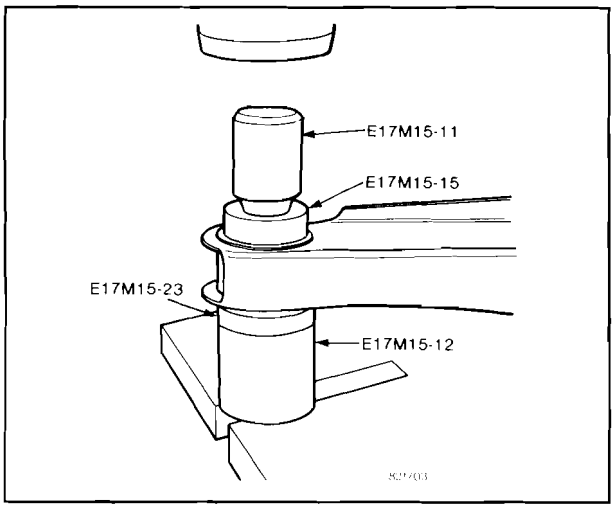


Fig. 15—Removing/replacing lower control arm-front bush (wagon)

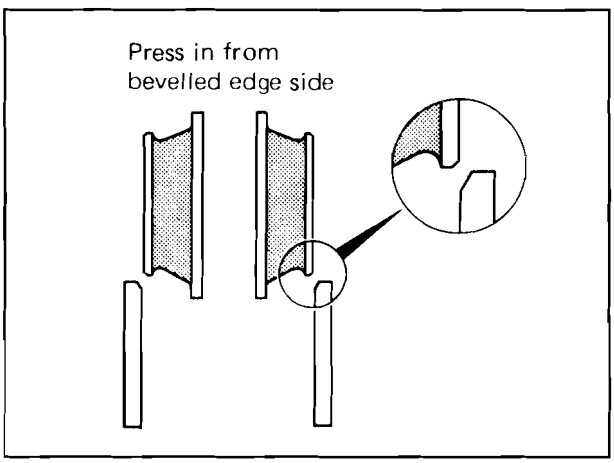


Fig. 16—Installing bushing

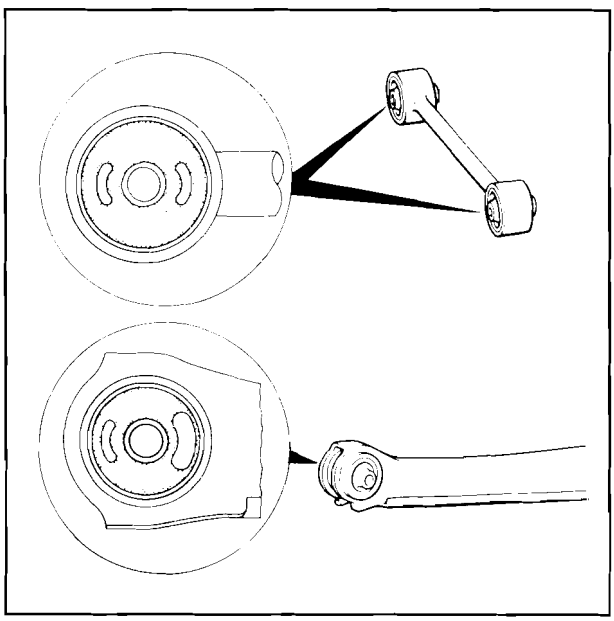


Fig. 17—Position of control arm bushing

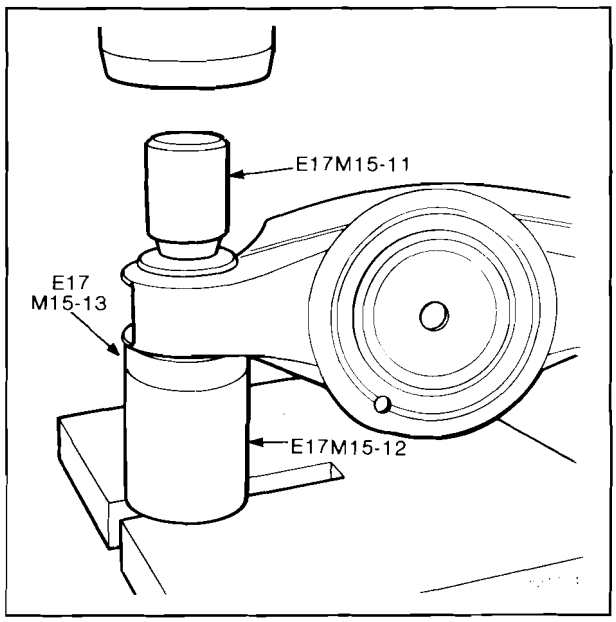


Fig. 18—Removing lower control arm bush

Lateral Rod

(1) With the lateral rod removed, remove the bushing with the aid of a press and components of Special Tool Kit E17M15, refer Fig. 19.

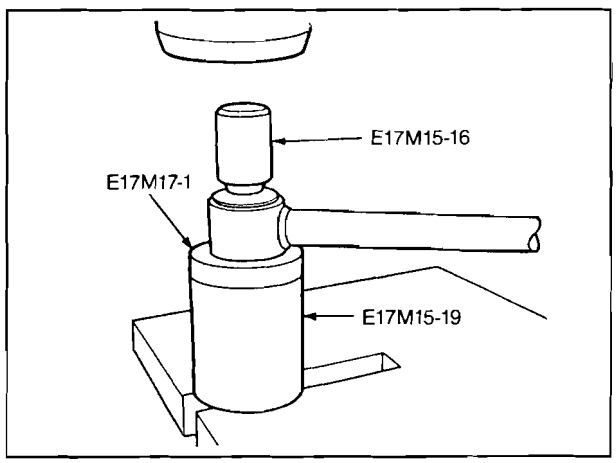


Fig. 19—Removing lateral rod bush

(2) Install the bush using a press and components of Special Tool E17M15 as shown in Fig. 19. Lubricate the bush, sleeve and bush hole with a soapy solution prior to installation. When installed, ensure that the bush projects equally past either side of the arm, refer Fig. 20.

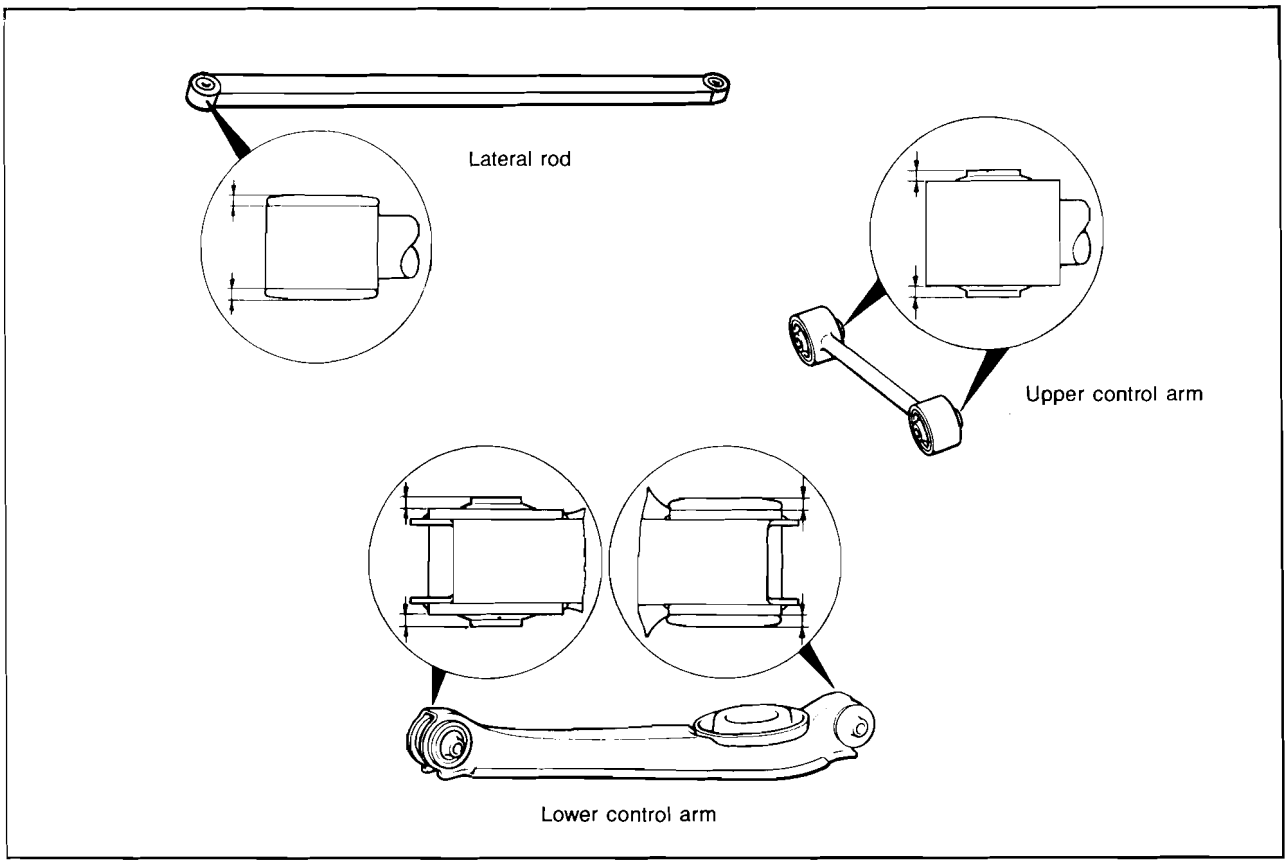


Fig. 20—Bushing alignment

Upper Control Arm

(1) With the upper control arm removed, remove the bushings with the aid of a press and components of Special Tool Kit E17M15, refer Fig. 21.

(2) When installing upper control arm bush, use the same Special Tool Kit E17M15 with Special Tool E17M15-15. When installed, ensure that the bush projects equally past either side of the arm, refer Fig. 20.

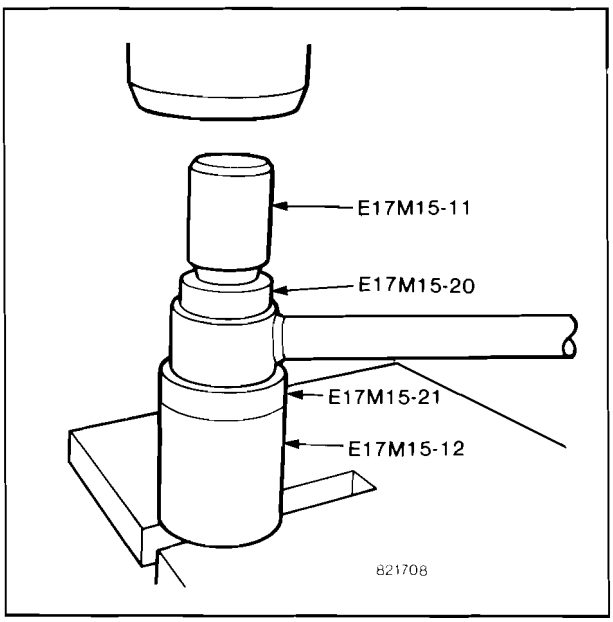


Fig. 21—Removing upper control arm bush

NOTE: Late model vehicles with voided bushes must be installed as shown in Fig. 17. Early model vehicles without voided bushes may be installed in any position.

GROUP 35 — BRAKES

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(2) Remove guide pin. Lift caliper assembly and retain with wires.

CAUTION: Do not wipe off the special grease that is on the guide pin or allow it to contaminate the guide pin.

(3) Remove the following parts from caliper support.
① Outer shim
② Pad assembly
③ Pad and wear indicator assembly
④ Clip
⑤ Inner shim A
⑥ Inner shim B

(4) Measure hub torque with pad removed to measure brake drag torque after pad installation.

NOTE: To secure the disc to the hub, tighten the nuts.

(5) Secuerly attach the pad clip to the caliper support.

CAUTION: Do not deposit grease or other dirt on pad or brake disc friction surfaces

(6) Clean the piston and insert into cylinder.
(7) Be careful that the piston boot does not become caught when lowering the caliper assembly and install the lock pin.
(8) Apply repair kit grease to both sides of the inner shim and outer shim and to the non friction surface of the brake pad.
Specified grease: Brake grease SAE J310, NLGI no. 1

CAUTION: 1. Make sure that the friction surfaces of pads and brake discs are free of grease and other contaminants.
2. The grease should never squeeze out from around the shim.

(9) Check brake drag torque as follows:
1. Start engine and hold brake pedal down for 5 seconds. Pedal depression force approx. 200 N [44 lbs.].
2. Stop engine.
3. Turn brake disc forward 10 times.
4. Check drag torque with spring balance.

(10) If the difference between brake drag torque and hub torque exceeds the standard value, disassemble piston and clean piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.
Standard value: 70 N (15.4 lbs.) or less
4 Nm (3 ft.lbs.) or less

Rear Brake Disc Thickness Check

(1) Remove dirt and rust from brake disc surface.
(2) Measure thickness at 4 locations or more.
Standard value: 18.0 mm (0.710 in.)
Limit: 16.4 mm (0.650 in.)
Replace the discs and pad assembly for both sides left and right of the vehicle if they are worn beyond the specified limit.

Rear Brake Disc Run-Out Check

(1) Remove the caliper support, raise the caliper assembly, and secure it by using a wire, etc.

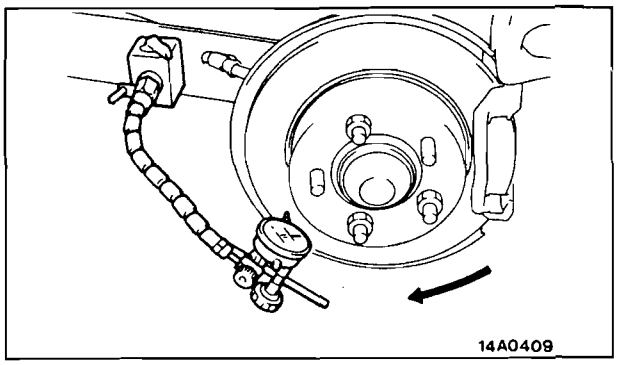


Fig. 27 — Checking disc run-out

(2) Place a dial gauge approximately 5 mm (0.200 in.) from the outer circumference of the brake disc and measure the run-out of the disc.
Limit: 0.08 mm (.0031 in.) or less

NOTE: To secure the disc to the hub, tighten the nuts.

Rear Brake Disc Run-Out Correction

(1) If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.

NOTE: The procedures for checking by changing the installation phase of the disc are the same as those for the front brake discs. (Refer to P. 43).

(2) If the problem cannot be corrected by changing the phase of the brake disc, replace the disc.

Brake Lining Thickness Check

(1) Remove the rear brake assembly, raise the rear brake assembly and secure it by using a wire, etc.
(2) Remove the brake drum.
(3) Measure the wear of the brake lining at the place worn the most.
Standard value: 2.8 mm (0.110 in.)
Limit: 1.0 mm (0.040 in.)

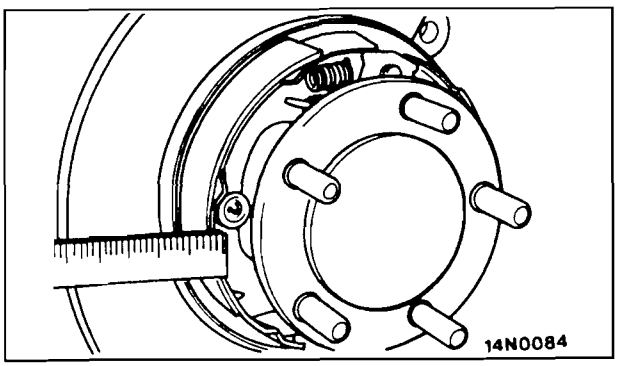


Fig. 28 — Checking lining thickness

(4) Replace the shoe and lining assembly if brake lining thickness is less than the limit if it is not worn evenly.

CAUTION: Whenever the shoe lining assembly is replaced, replace both RH and LH assemblies as a set to prevent car from pulling to one side when braking.

Brake Drum Inside Diameter Check

(1) Remove the rear brake assembly, raise the rear brake assembly and secure it by using a wire, etc.
(2) Remove the brake drum.
(3) Measure the inside diameter of the hub and drum at two or more locations.
Standard value: 168 mm (6.600 in.)
Limit: 169 mm (6.700 in)
(4) Replace brake drums and shoe and lining assembly when wear exceeds the limit or is badly imbalanced.

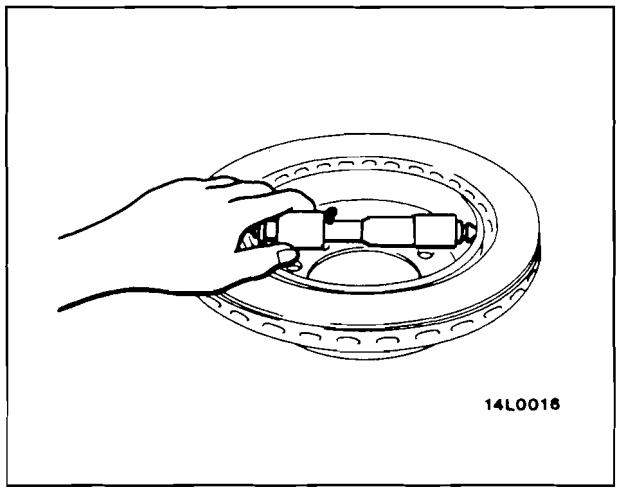


Fig. 29 — Measuring drum diameter

Brake Lining and Brake Drum Connection Check

(1) Remove the rear brake assembly, raise the rear brake assembly and secure it by using a wirc, etc.
(2) Remove the brake drum.
(3) Remove the shoe and lining assembly.
(4) Chalk inner surface of brake drum and rub with shoe and lining assembly.
(5) replace shoe and lining assembly or brake drums if very irregular contact area.

NOTE: Clean off chalk after check.

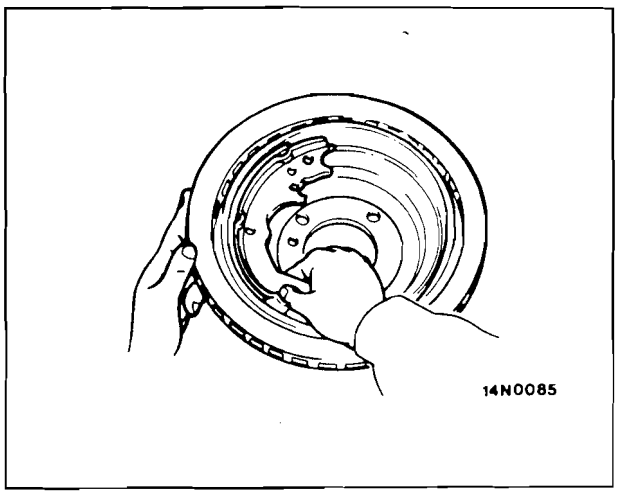


Fig. 30 — Drum chalking

CHECKING OPERATION OF THE ABS (ANTI-LOCK BRAKING SYSTEM)

Wheel Speed Sensor Output Voltage Check

(1) Check that the clearance between the wheel speed sensor and the rotor are within the standard values.

(2) Raise up the wheels and release the parking brake.

(3) Remove the control unit harness connector and measure from the harness side connector.

CAUTION: Be sure to remove the connector double lock and insert the probe into the harness side. Inserting it into the terminal side will result in a bad connection.

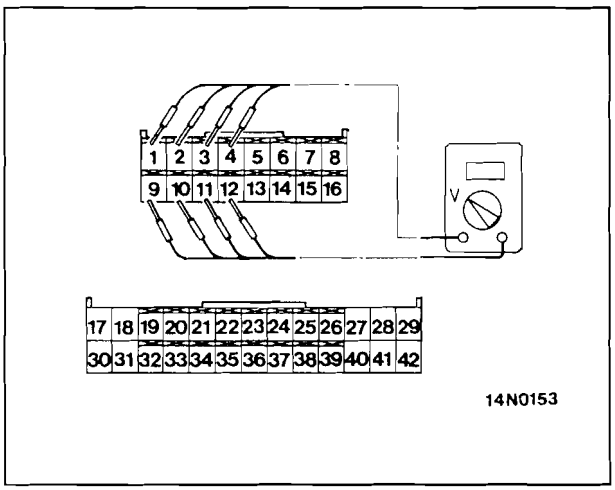


Fig. 30 — Speed sensor checking

(4) Rotate the wheel to be measured at approximately ½-1 rotations per second, and check the output voltage using a circuit tester (AC mV range) or an oscilloscope.

Front		Rear	
LH	RH	LH	RH
1	3	4	2
9	11	12	10

Output voltage
When measuring with a circuit tester:
70 mV or more
When measuring with an oscilloscope:
200 mV p-p or more

(5) If the output voltage is lower than the above values, the reason could be as follows:

- Excessive clearance between the wheel speed sensor pole piece and the rotor.
- Faulty wheel speed sensor.

so adjust the wheel speed sensor or replace it.

Inspecting Wave Forms with an Oscilloscope

Use the following method to observe the output voltage wave form from each wheel sensor with an oscilloscope.

Start the engine, and rotate the front wheels by engaging D range. Turn the rear wheels manually so that they rotate at a constant speed.

NOTE:

1. Check the connection of the sensor harness and connector befor using the oscilloscope.

2. The wave form measurements can also be taken while the vehicle is actually moving.

3. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

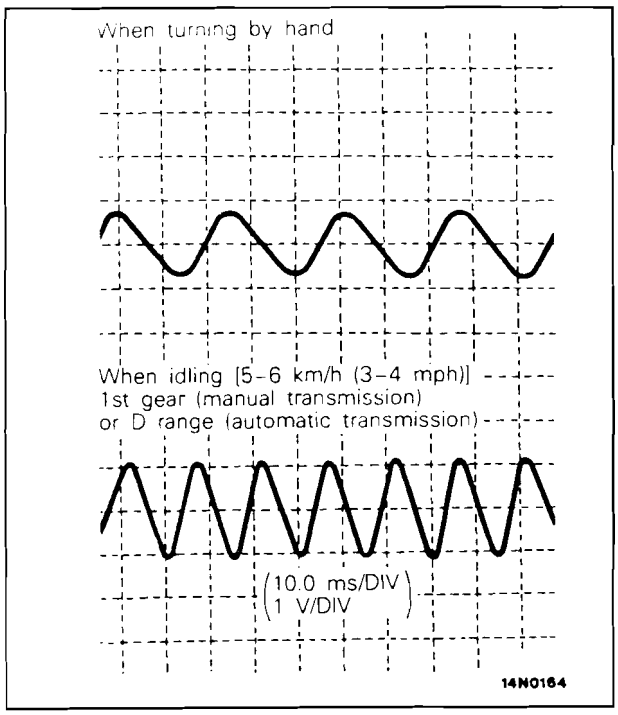


Fig. 31 — Oscilloscope pattern

Wave Observation Points

Phenomenon	Cause	Suggested remedy
WAVE AMPLITUDE IS TOO SMALL, OR DOESN'T APPEAR AT ALL.	Wheel speed sensor is faulty.	Replace the sensor.
	Wrong clearance between the pole piece and rotor.	Adjust the clearance.
EXCESSIVE VARIATION IN THE WAVE AMPLITUDE. (HOWEVER, IF THE LOWEST AMPLITUDE OCCURS AT 100mV OR ABOVE, THERE IS NO PROBLEM).	Excessive runout or eccentricity in the axle hub.	Replace the hub.
NOISE OR INTERFERENCE IN THE WAVE PATTERN.	Broken sensor wire.	Replace the sensor.
	Broken harness wire.	Repair the harness.
	Faulty wheel speed sensor attachment.	Repair the sensor attachment.
	Chipped or broken rotor teeth.	Replace the rotor.

NOTE: As the wheel speed cable sensor moves in conjunction with the movement of the front and rear suspension, the wires might break while driving on rough roads, but may have continuity while driving on normal roads. Accordingly, when measuring the wave pattern of the wheel speed sensor voltage, take a measurement while shaking the sensor harness to simulate the special conditions of a rough road.

Inspection of the ABS Hydraulic System

(1) Jack up the vehicle, and support it on axle stands.
(2) Release the parking brake, and feel the drag force (drag torque) on each road wheel.
(3) Turn the ignition key to the OFF position and set the multi-use tester as shown in Fig. 32.

CAUTION: Make certain that the ignition switch is OFF when the multi-use tester is connected or disconnected.

(4) After checking that the selector lever is in neutral, start the engine.

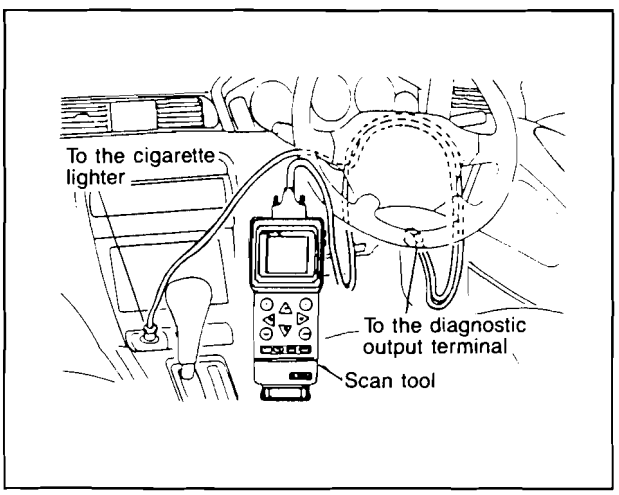


Fig. 32 — MUT connection

CAUTION: At this time, check that the ABS warning light illuminates for a brief period before turning off. If it doesn't turn off, refer to the "Troubleshooting" section (P. 7).

(5) Use the multi-use tester to force-drive the actuator.
(6) Turn the wheel by hand and check the change in braking force when the brake pedal is depressed.
The result should be as shown in the following table.

N (lbs.)

Front wheel	1,800 (397)
Rear wheel	650 (143)

NOTE:

1. When the multi-use tester is used and the ABS system is selected, the ABS system will switch to multi-use tester mode, and the ABS warning light will illuminate.

2. When the ABS function has been interrupted by the fail-safe the multi-use tester actuator testing cannot be used.

Inspecting the Motor Relay and Valve Relay

Remove the hydraulic unit connectors and connector bracket.

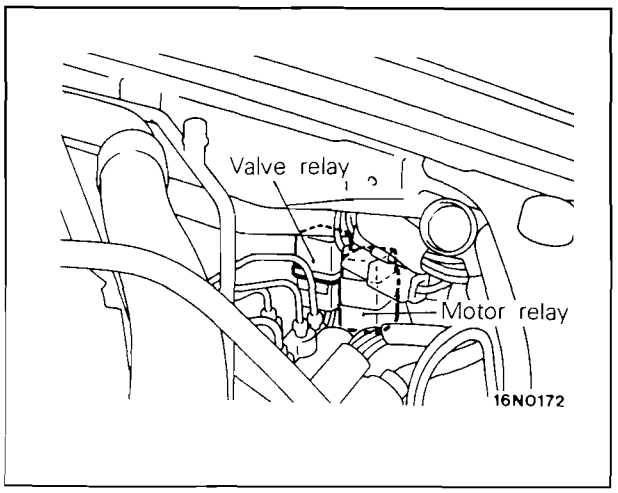
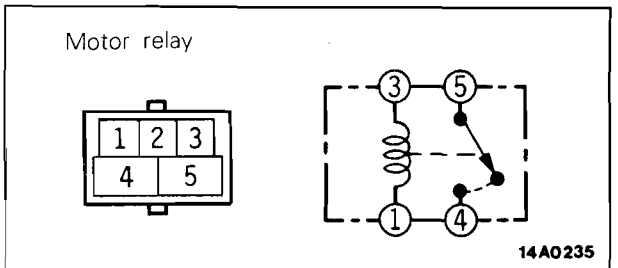


Fig. 33 — Relay location

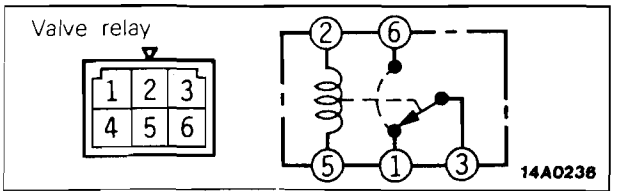
Motor Relay Continuity Check



When there is current	Between terminals ③ and ①	74 ± 25Ω
	Between terminals ④ and ⑤	No continuity (∞Ω)
When there is current between terminals ③ and ①	Between terminals ④ and ⑤	Continuity (approx. 0Ω)
(When energizing coil is at normal temperature (20° ± 15°C [68° ± 27°F]))		

Fig. 34 — Motor relay continuity

Valve relay continuity check



When there is no current	Between terminals ② and ⑤	80 ± 25Ω
	Between terminals ① and ③	No continuity (approx. Ω)
	Between terminals ③ and ⑥	No continuity (∞Ω)
When there is current between terminals ② and ⑤	Between terminals ① and ③	No continuity (∞Ω)
	Between terminals ③ and ⑥	Continuity (approx. 0Ω)
(When energizing coil is at normal temperature (20° ± 15°C [68° ± 27°F]))		

Fig. 35 — Valve relay continuity

BRAKE PEDAL

Removal and Installation

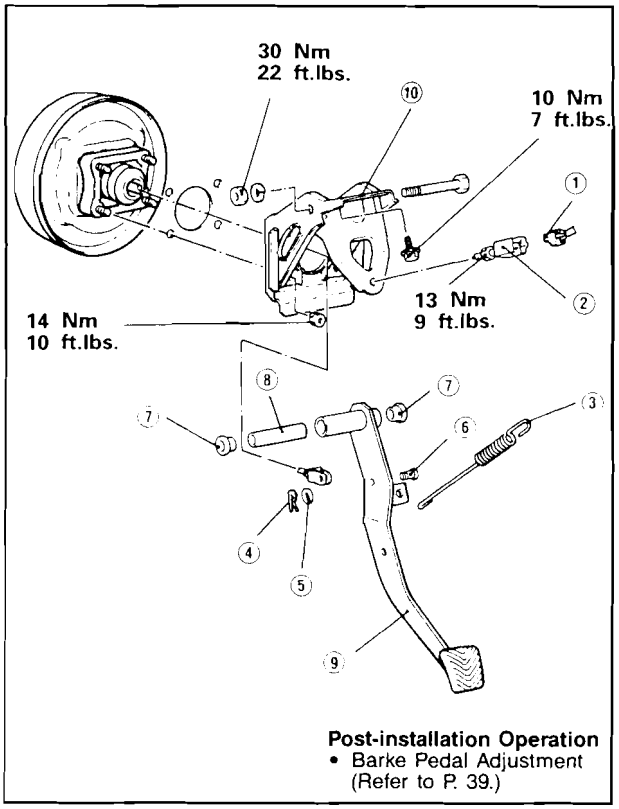


Fig. 36 — Pedal assembly

Stop Light Switch Removal steps

1. Stop light switch connector
2. Stop light switch

Brake Pedal Removal Steps

1. Stop light switch connector
2. Stop light switch
3. Brake pedal return spring
4. Snap pin
5. Washer
6. Clevis pin
7. Bushing
8. Spacer
9. Brake pedal
10. Member assembly

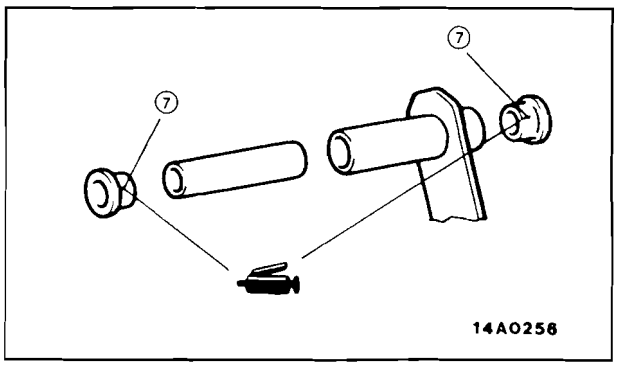


Fig. 37 — Grease location

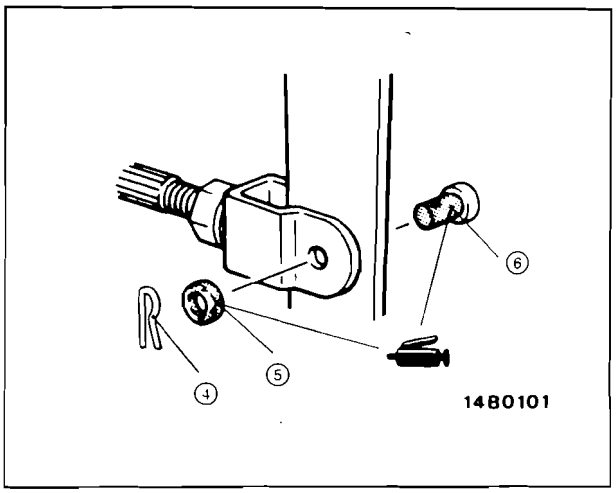


Fig. 38 — Clevis pin assembly

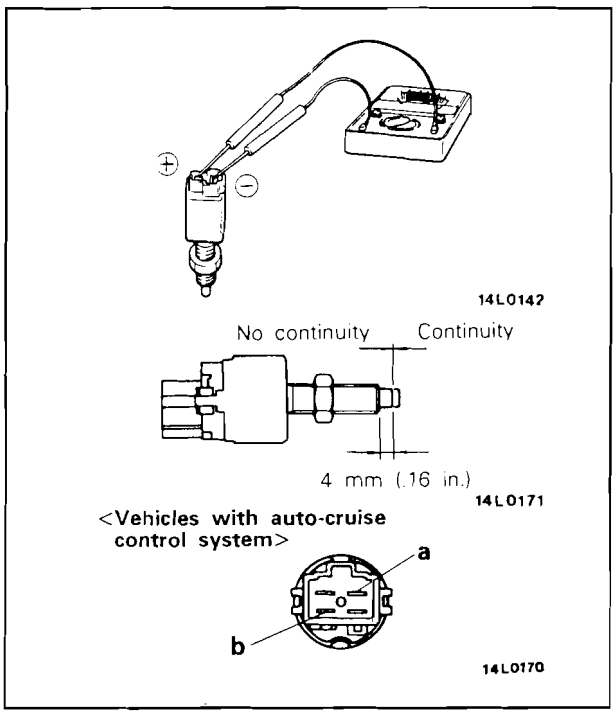


Fig. 39 — Switch testing

Inspection

- Check the bushing for wear.
- Check the brake pedal for bend or twisting.
- Check the brake pedal return spring for damage.

Stop Light Switch

Connect a circuit tester to the stop light switch, and check whether or not there is continuity when the plunger of the stop light switch is pushed in and when it is released.

The stop light switch is in good condition if there is no continuity when the plunger is pushed in to a depth of within 4 mm (0.160 in.) from the outer case edge surface, and if there is continuity when it is released.

For vehicles with auto-cruise control system, the check for continuity should be made at connectors "a" and "b" of the stop light switch.

MASTER CYLINDER AND BRAKE BOOSTER

Removal and Installation

Pre-removal Operation
- Draining of Brake Fluid

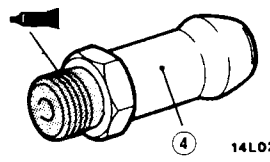
Post-installation Operation
- Supplying Brake Fluid
- Bleeding (Refer to P. 40)
- Adjustment of Brake Pedal (Refer to P. 39)

Brake tube flare nuts

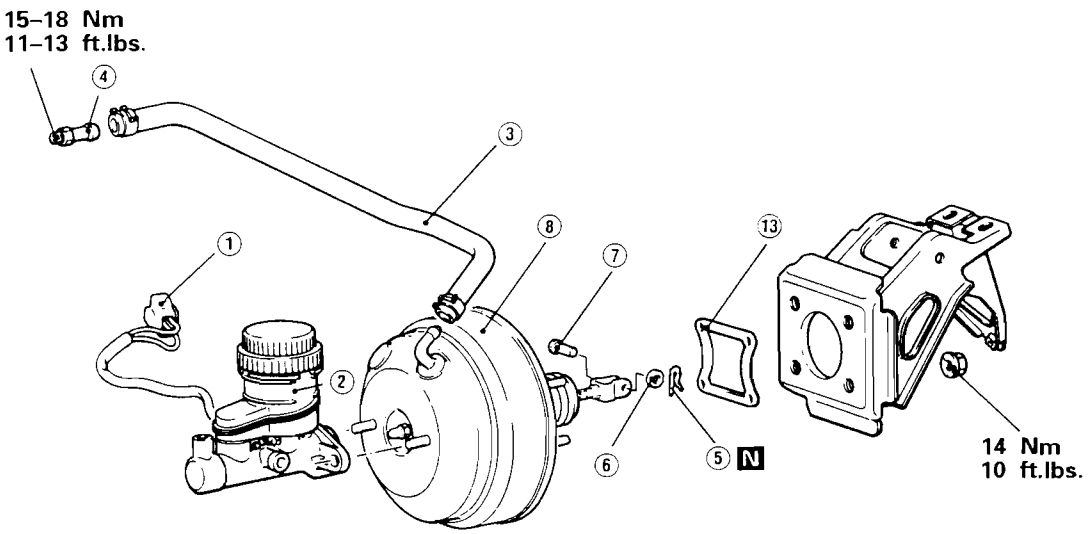


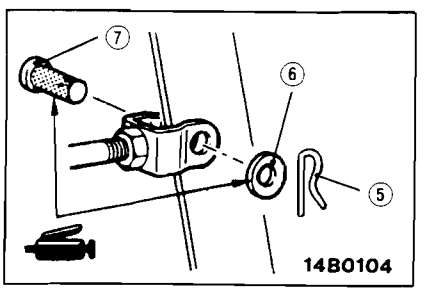
15 Nm
11 ft.lbs.

14F038



Sealant: 3M ATD Part No. 8663, 8661 or equivalent





Master cylinder removal steps
1 Brake fluid level sensor connector
2. Brake pipe and master cylinder
* Adjustment of clearance between brake booster push rod and primary piston

Brake booster removal steps
2. Brake pipe and master cylinder
* 3. Vacuum hose (with check valve)
4. Fitting
5. Snap pin
6. Washer
7. Clevis pin
8. Brake booster
9. Sealer

* Refer to service points of installation.

Fig. 40 — Master cylinder and brake booster components (LH drive shown)

SERVICE POINTS OF INSTALLATION

Connection of the Vacuum Hose

(1) Install to the pipe part of the brake booster so that the amount of insertion of the vacuum hose is as shown in Figure 41.

CAUTION: The check valve and the pipe part of the brake booster must not touch each other

(2) Insert securely and completely until the vacuum hose at the engine side contacts the edge of the hexagonal part of the fitting, and then secure by using the hose clip.

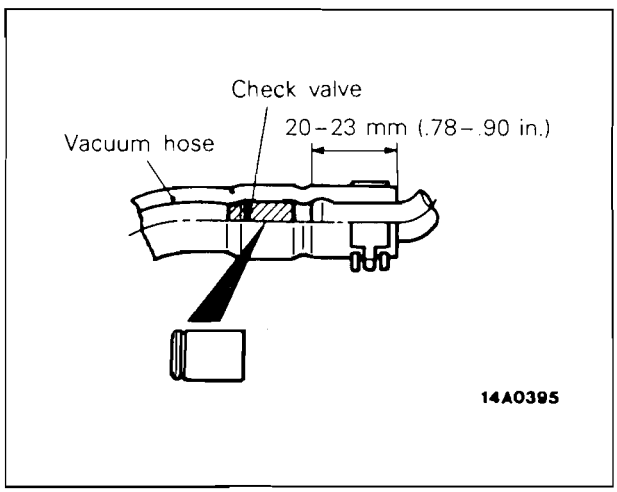


Fig. 41 — Check valve

Adjustment of Clearance Between Brake Booster Push Rod and Primary Piston

Adjust the clearance (A) between the brake booster push rod and primary piston.

Calculate clearance A from the B, C and D measurements A = B–C–D.

Standard value (A): 0.65-0.85 mm (0.026-0.033 in.)

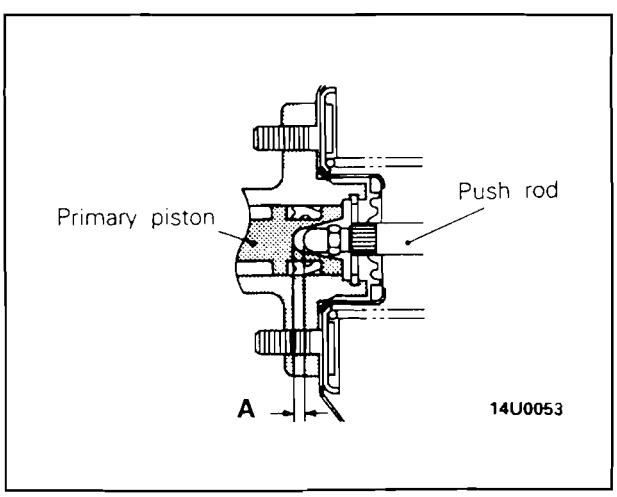


Fig. 42 — Push rod adjustment

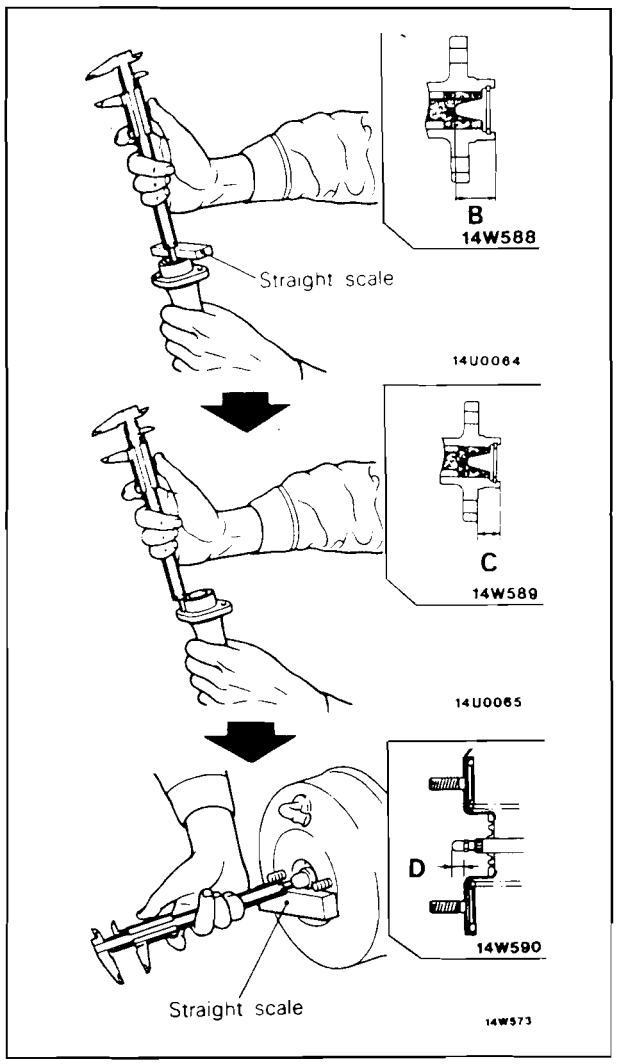


Fig. 43 — Push rod measuring procedure

If the clearance is not within the standard value range, adjust by changing the push rod length by turning the screw of the push rod.

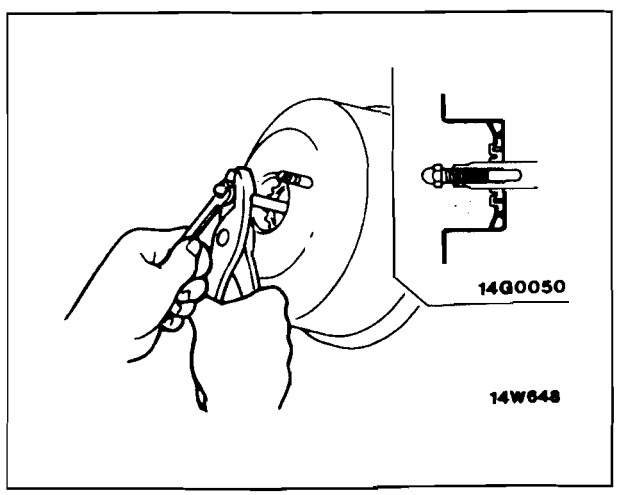
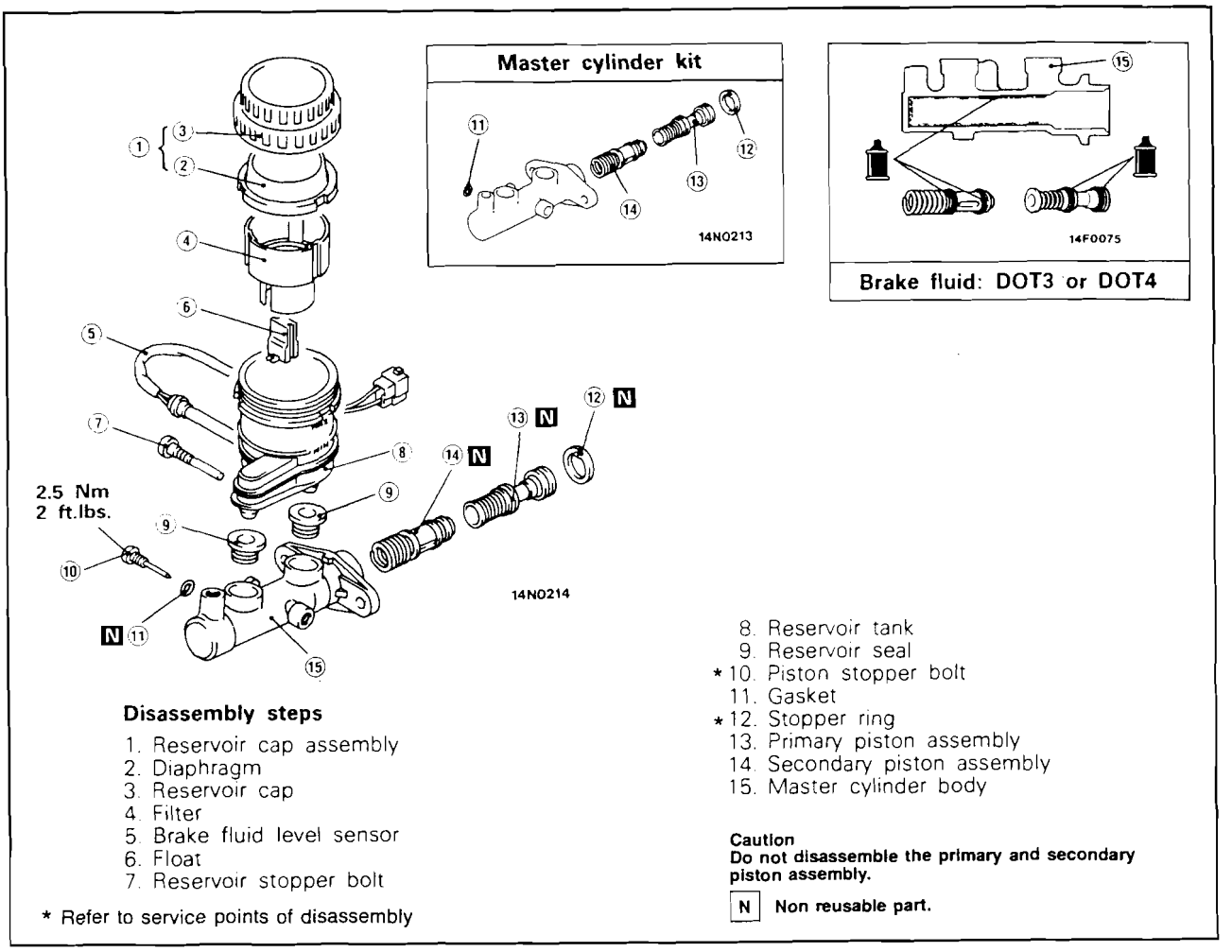


Fig. 44 — Push rod adjustment

DISASSEMBLY AND REASSEMBLY (MASTER CYLINDER)



Disassembly steps

1. Reservoir cap assembly
2. Diaphragm
3. Reservoir cap
4. Filter
5. Brake fluid level sensor
6. Float
7. Reservoir stopper bolt
8. Reservoir tank
9. Reservoir seal
* 10. Piston stopper bolt
11. Gasket
* 12. Stopper ring
13. Primary piston assembly
14. Secondary piston assembly
15. Master cylinder body

* Refer to service points of disassembly

Caution
Do not disassemble the primary and secondary piston assembly.

N **Non reusable part.**

Fig. 45 — Master cylinder components (LH drive shown)

SERVICE POINTS OF DISASSEMBLY

Disassembly of Piston Stopper Bolt

Remove the piston stopper bolt, while depressing the piston.

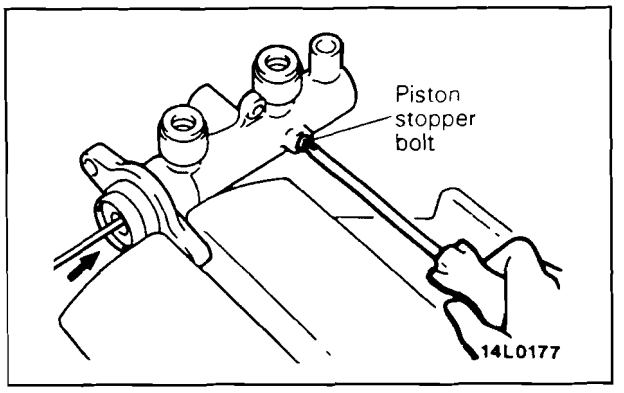


Fig. 46 — Stopper bolt location

Disassembly of Piston Stopper Ring

Remove the piston stopper ring, while depressing the piston.

Inspection

- Check the inner surface of master cylinder body for rust or pitting.
- Check the primary and secondary pistons for rust, scoring, damage or wear.
- Check the diaphragm for cracks and wear.

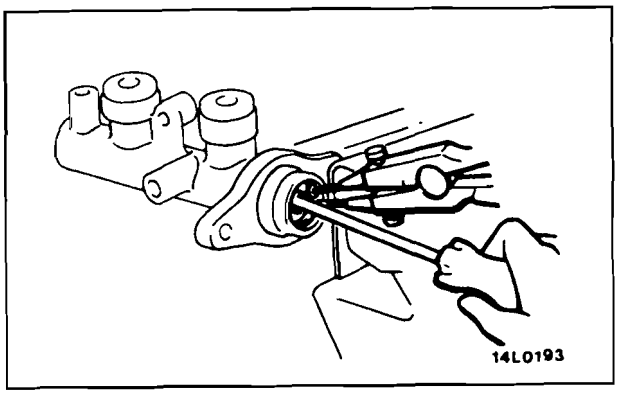


Fig. 47 — Circlip removal

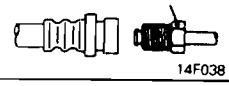
Pre-removal Operation
- Draining of Brake Fluid

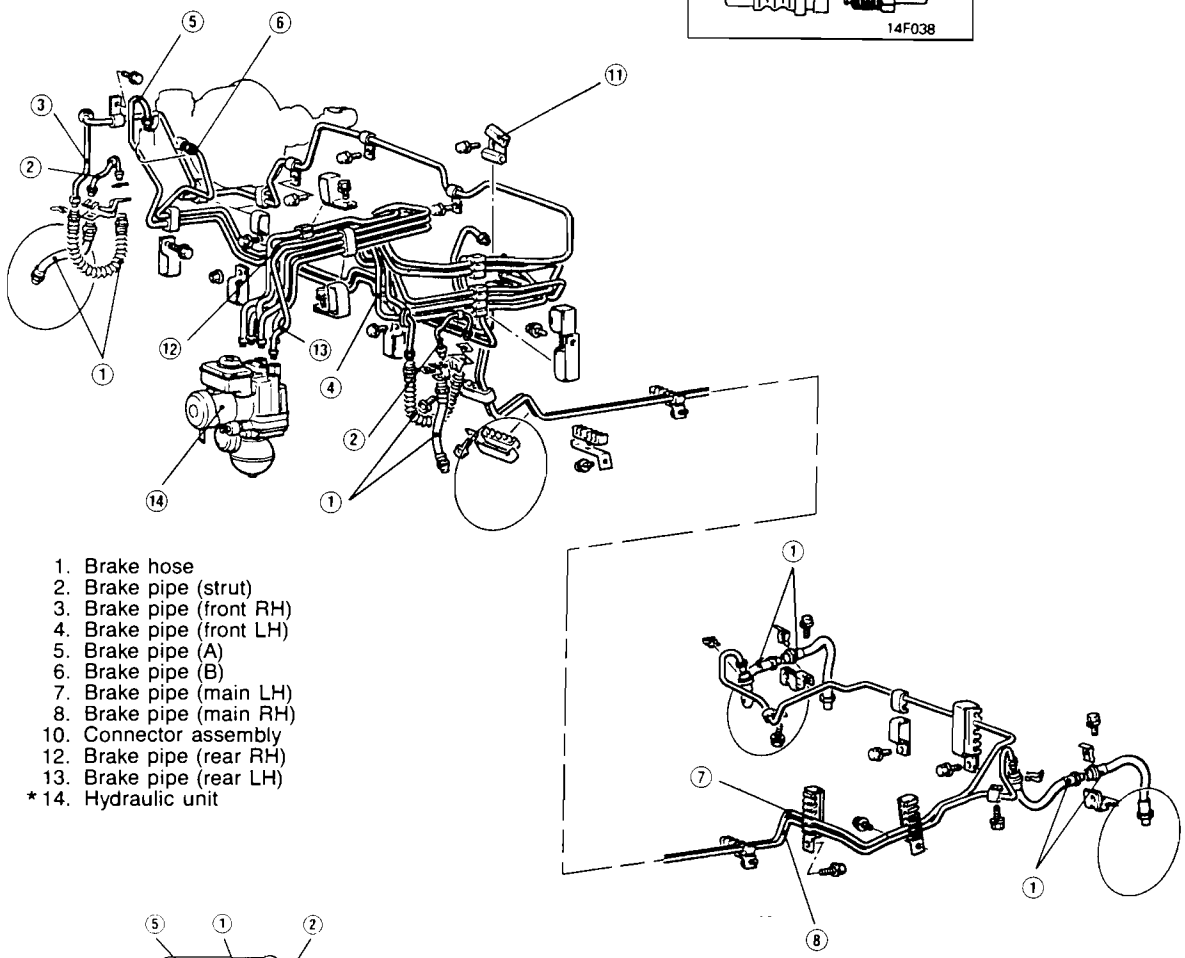
Post-installation Operation
- Supplying Brake Fluid
- Bleeding Brake Lines
(Refer to P. 40)

Inspection

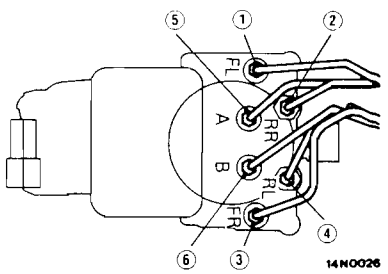
- Check the brake pipes for cracks, crimps and cossosion.
- Check the brake hoses for cracks, damage and leakage.
- Check the flared brake line nuts for damage and leakage.

Flared brake line nuts
15 Nm
1.5 kgm
11 ft.lbs.





1. Brake hose
2. Brake pipe (strut)
3. Brake pipe (front RH)
4. Brake pipe (front LH)
5. Brake pipe (A)
6. Brake pipe (B)
7. Brake pipe (main LH)
8. Brake pipe (main RH)
10. Connector assembly
12. Brake pipe (rear RH)
13. Brake pipe (rear LH)
* 14. Hydraulic unit



1. Hydraulic unit – front brake (L.H.)
2. Hydraulic unit – rear brake (R.H.)
3. Hydraulic unit – front brake (R.H.)
4. Hydraulic unit – rear brake (L.H.)
5. Hydraulic unit – master cylinder (for left front and right rear)
6. Hydraulic unit – master cylinder (for right front and left rear)

SERVICE POINTS OF INSTALLATION

Connection of the Pipes to the Hydraulic Unit

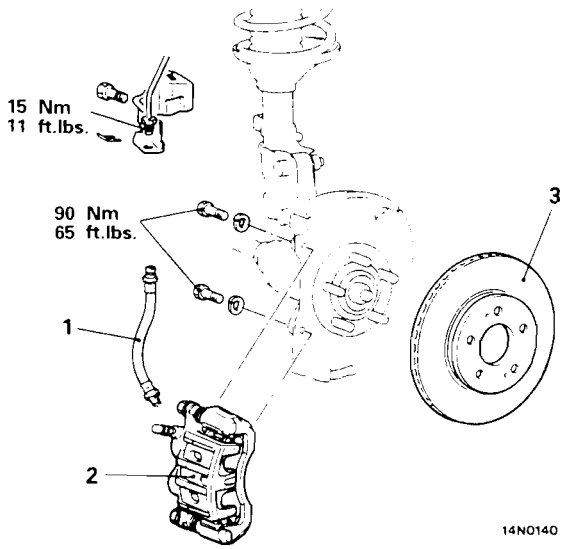
Connect the pipes to the hydraulic unit as shown in the illustration.

* Refer to service points of installation

Fig. 48 — System components

FRONT DISC BRAKE

Removal and Installation



1. Connection for brake hose and the brake tube
* 2. Front brake assembly
3. Brake disc

* Refer to service points of installation

Fig. 49 — Front caliper removal

Inspection

- Check the brake disc for damage.

Service Points of Installation

Installation of Front Brake Assembly

(1) Measure hub torque with pad removed to measure brake drag torque after pad installation.

NOTE: To secure the disc to the hub. Tighten the nuts.

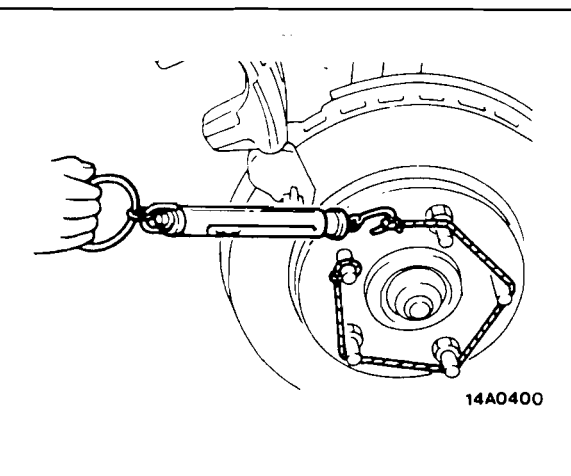


Fig. 50 — Hub turning torque

(2) After installing the caliper support to the knuckle, compress the piston, and then install the caliper body.

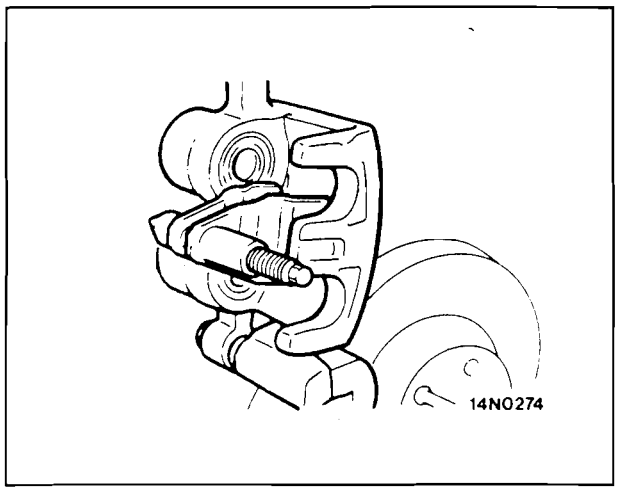


Fig. 51 — Piston compressing

(3) Check brake drag torque as follows:
1. Start engine and gold brake pedal down for 5 seconds. Pedal depression force approx. 200 N [44 lbs].
2. Stop engine.
3. Turn brake disc forward 10 times.
4. Check brake drag torque with spring balance.

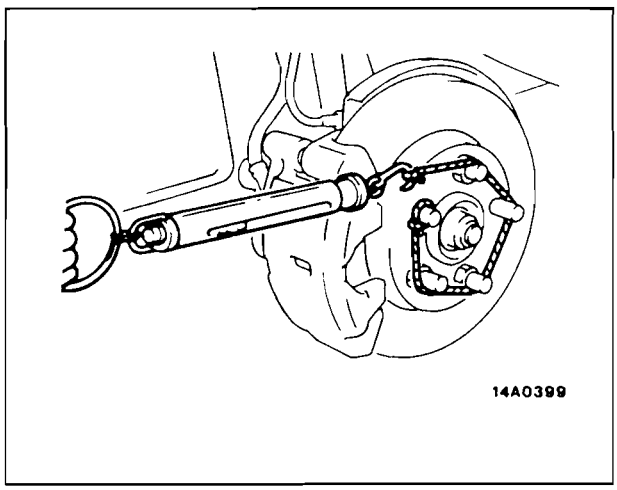
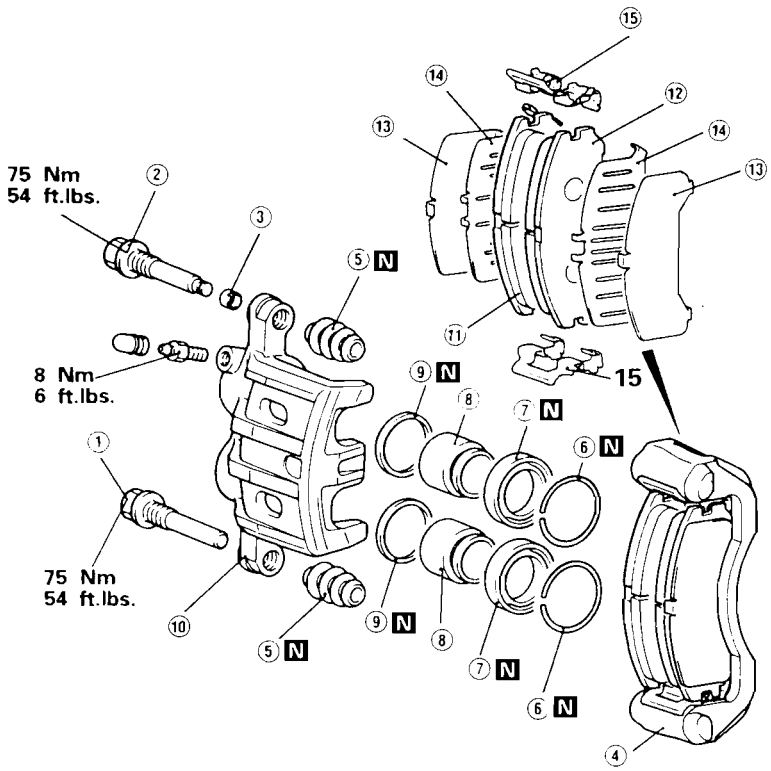


Fig. 52 — Assembly torque test

(4) If the difference between brake drag torque and hub torque exceeds the standard value, disassemble piston and clean the piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.

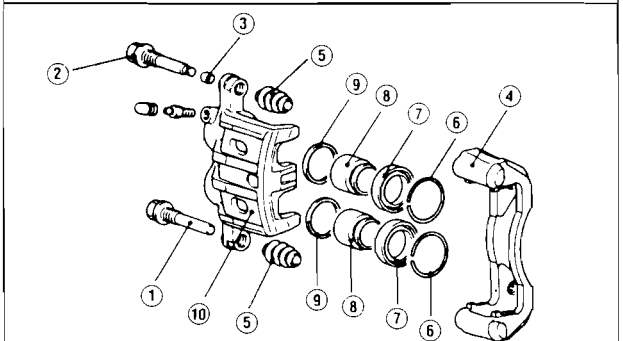
Standard value: 70 N (15.4 lbs.) or less
4 Nm (3 ft.lbs.) or less

FRONT DISASSEMBLY AND REASSEMBLY



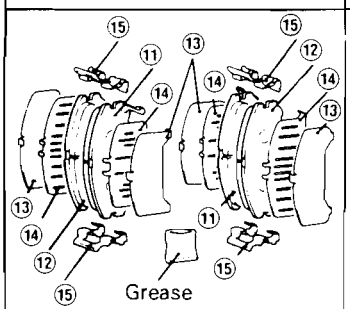
14N0286

Brake caliper kit



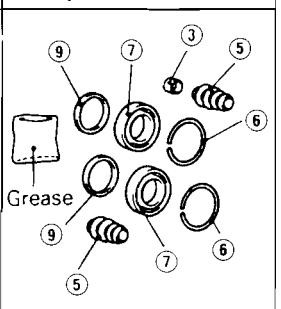
14L0296

Pad repair kit



14N0283

Seal and boots repair kit



14L0298

Caliper assembly disassembly steps

* 1. Guide pin
* 2. Lock pin
* 3. Bushing
4. Caliper support (pad, clip, shim)
* 5. Boot
6. Boot ring
* 7. Piston boot
* 8. Piston
* 9. Piston seal
10. Caliper body

Pad assembly disassembly steps

* 1. Guide pin
* 2. Lock pin
* 3. Bushing
4. Caliper support (pad, clip, shim)
11. Pad assembly (with wear indicator)
12. Pad assembly
13. Outer shim
14. Inner shim
15. Clip

N Non reuseable part

* Refer to service points of Assembly/disassembly

Fig. 53 — Front caliper components

LUBRICATION POINTS

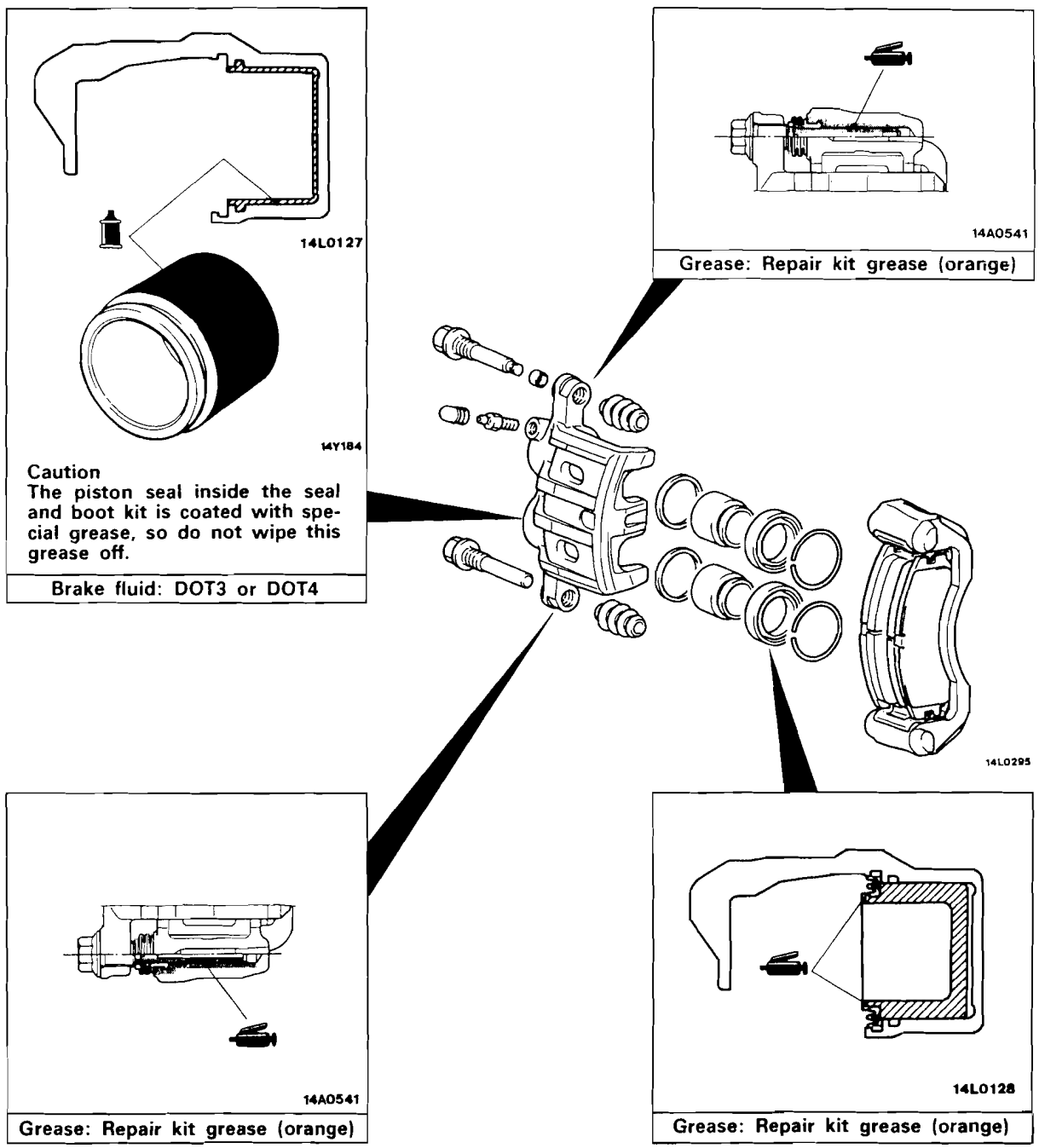


Fig. 54 — Lubrication points

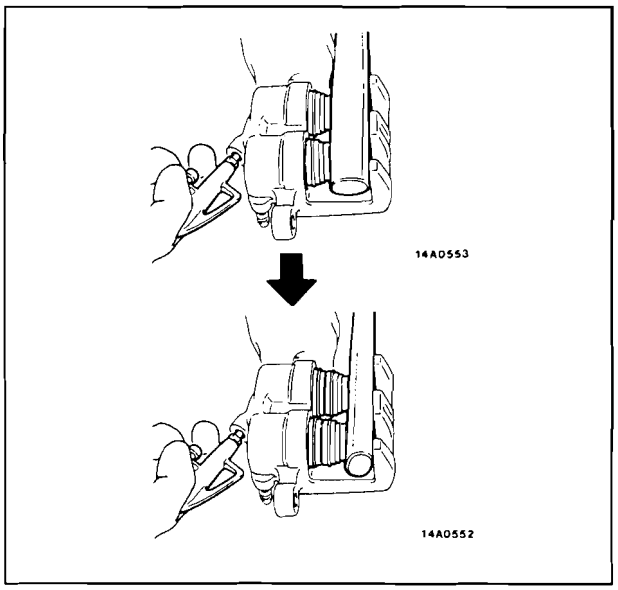


Fig. 55 — Piston removal

Service Points of Disassembly

When disassembling the rear disc brakes, disassemble both sides (left and right) as a set.

Removal of Piston Boot/Piston

Pump in compressed air through the brake hose installation hole and remove the pistons and piston boot.

CAUTION: When removing the pistons, be sure to use the handle of a plastic hammer and adjust the height of the two pistons while pumping in air slowly so that the pistons protrude evenly.
Do not remove one piston completely before trying to remove the other piston because it will become impossible to remove the second piston.

Removal of Piston Seal

(1) Remove piston seal with finger tip.

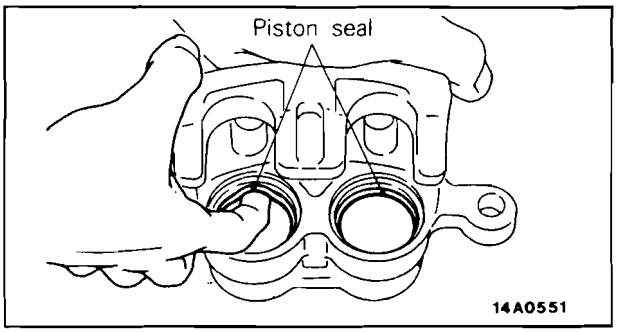


Fig. 56 — Seal removal

CAUTION: Do not use a screwdriver or other tool to prevent damage to inner cylinder.

(2) Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.
Specified brake fluid: DOT4.

Inspection

- Check cyinder for wear damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.
- Check wear indicator for damage.

Pad Wear Check

Measure thickness at the thinnest and worn area of the pad. Replace pad assembly when pad thickness is less than the limit value.
Standard value: 10 mm (0.390 in.)
Limit: 2.0 mm (0.080 in.)

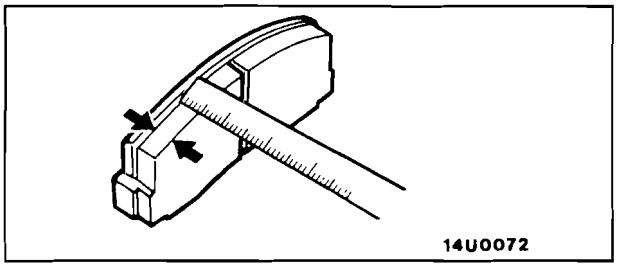


Fig. 57 — Pad thickness

Service Points of Reassembly

Installation of Boot/Bushing/Lock Pin/Guide Pin

(1) Grease parts as illustrated with specified grease.
Specified grease: Repair kit grease (orange).
(2) Install the guide pin and lock pin as illustrated so that each head mark of the guide pin and the lock pin matches the indication mark ("G" or "L") located on the caliper body.

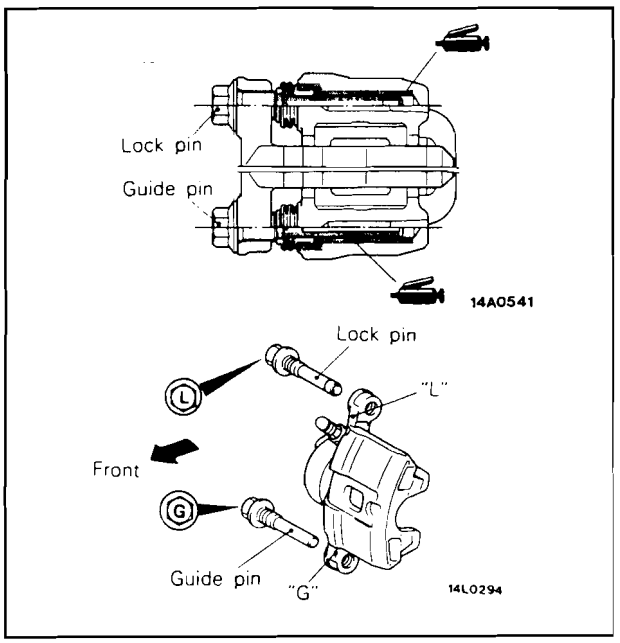


Fig. 58 — Grease application

REAR DISC BRAKE

Removal and Installation

Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Brake Fluid Filling
- Brake Line Bleeding
(Refer to P. 40)

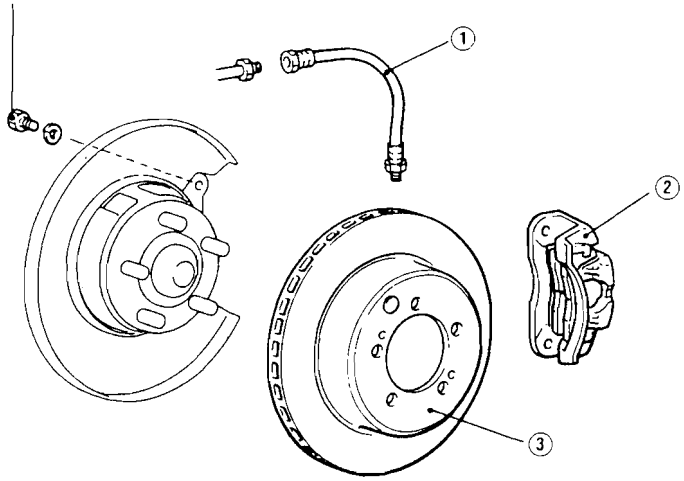
Flared brake line nuts

15 Nm
11 ft.lbs.



14F038

50–60 Nm
36–43 ft.lbs.



14N0035

Removal steps

1. Connection for the brake hose
* 2. Rear brake assembly
3. Brake disc

Inspection
- Check the brake disc for damage

Service Points of Installation

Installation of Rear Brake Assembly

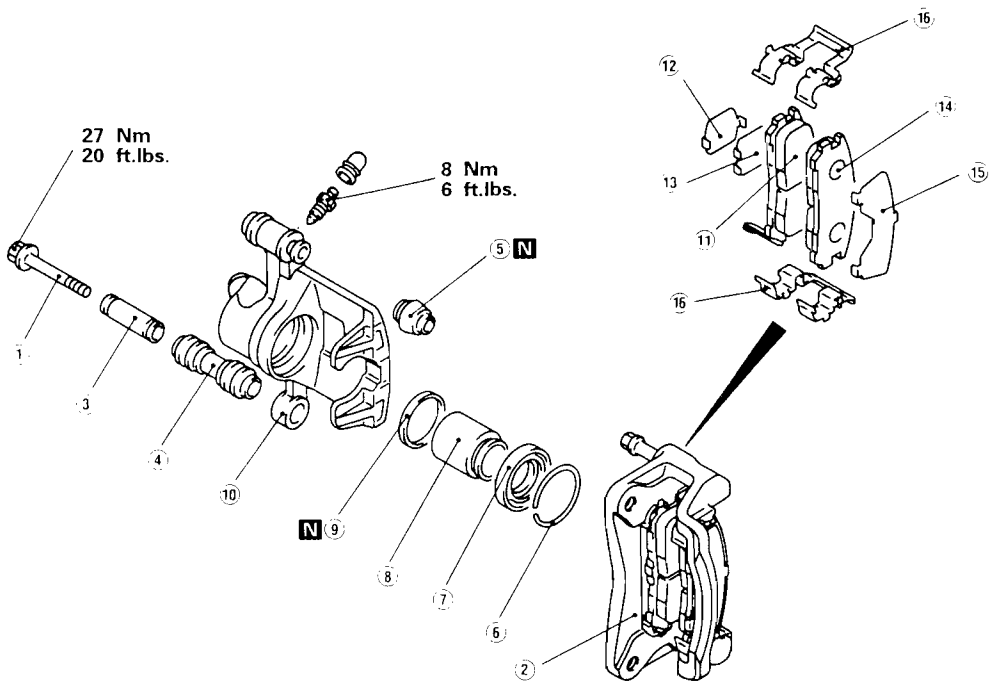
Install by the same procedure as for the front brake assembly.
(Refer to P. 54).

* Refer to service point of installation

Fig. 59 — Rear disc brake

REAR DISASSEMBLY AND REASSEMBLY <Sedan>

M35NA--



14N0154

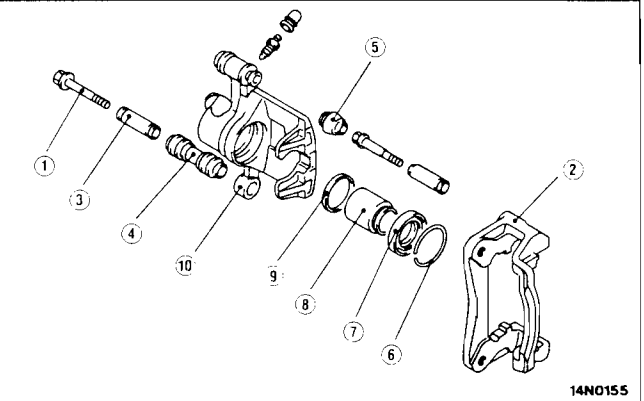
Caliper assembly disassembly steps

* 1. Lock pin
2. Caliper support (pad, clip, shim)
3. Sleeve
4. Lock pin boot
5. Guide pin boot
6. Boot ring
* 7. Piston boot
* 8. Piston
* 9. Piston seal
10. Caliper body

Pad assembly disassembly steps

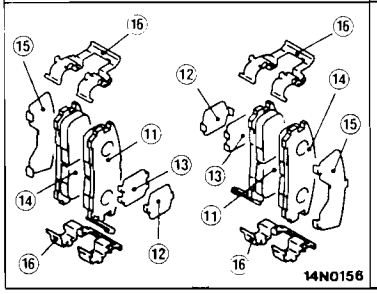
* 1. Lock pin
2. Caliper support (pad, clip, shim)
11. Pad and wear indicator assembly
12. Inner shim B
13. Inner shim A
14. Pad assembly
15. Outer shim
16. Clip

Brake caliper kit



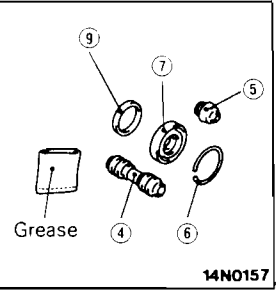
14N0155

Pad kit



14N0156

Seal and boot repair kit

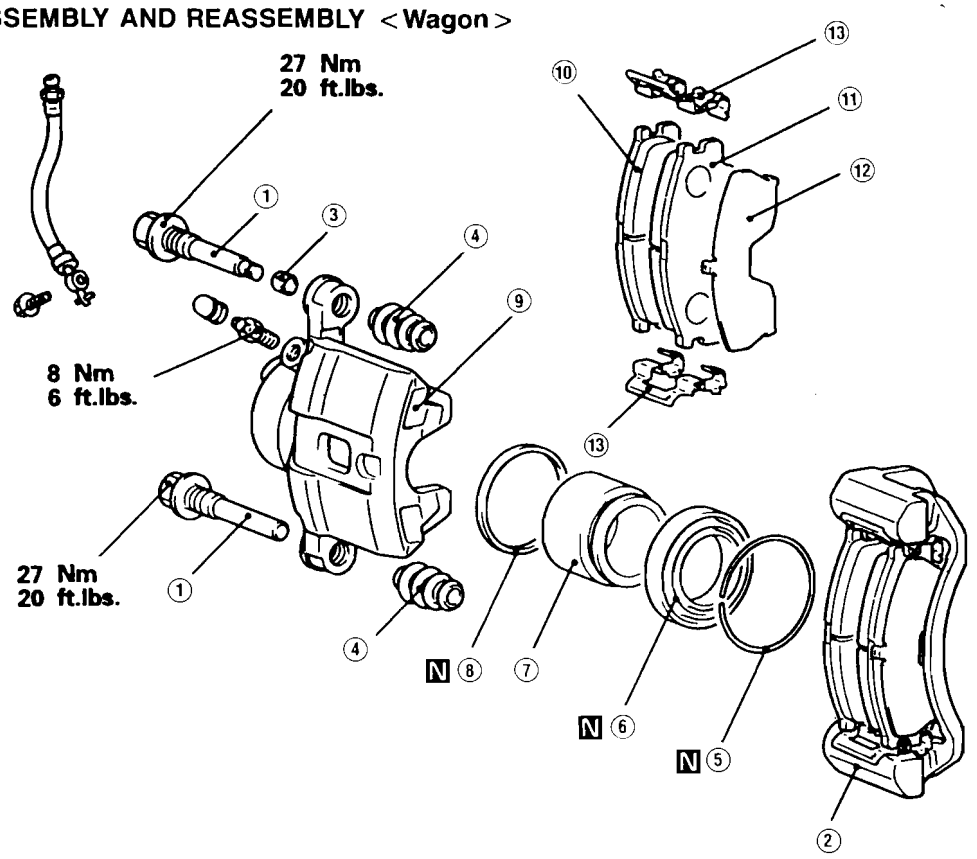


14N0157

* Refer to service points of disassembly

Fig. 60 — Rear caliper components

REAR DISASSEMBLY AND REASSEMBLY <Wagon>



Caliper assembly disassembly steps

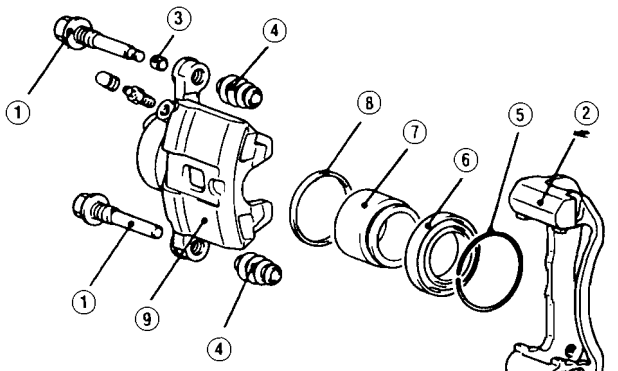
1. Lock pin
2. Caliper support (pad, clip, shim)
3. Sleeve
4. Lock pin boot
5. Boot ring
* 6. Piston boot
* 7. Piston
* 8. Piston seal
9. Caliper body

Pad assembly disassembly steps

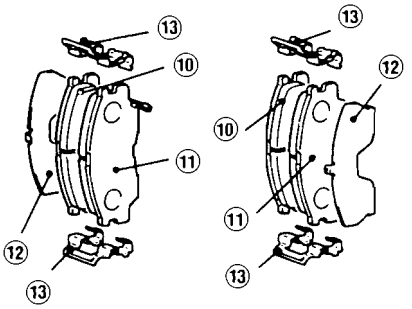
* 1. Lock pin
2. Caliper support (pad, clip, shim)
10. Pad assembly
11. Pad and wear indicator assembly
12. Outer shim
13. Clip

* Refer to service points of disassembly

Brake caliper kit



Pad kit



Seal and boot repair kit

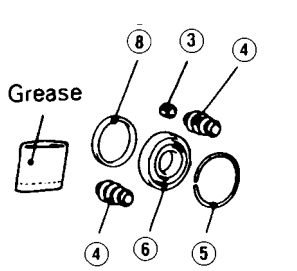


Fig. 61 — Rear caliper components

LUBRICANT POINTS

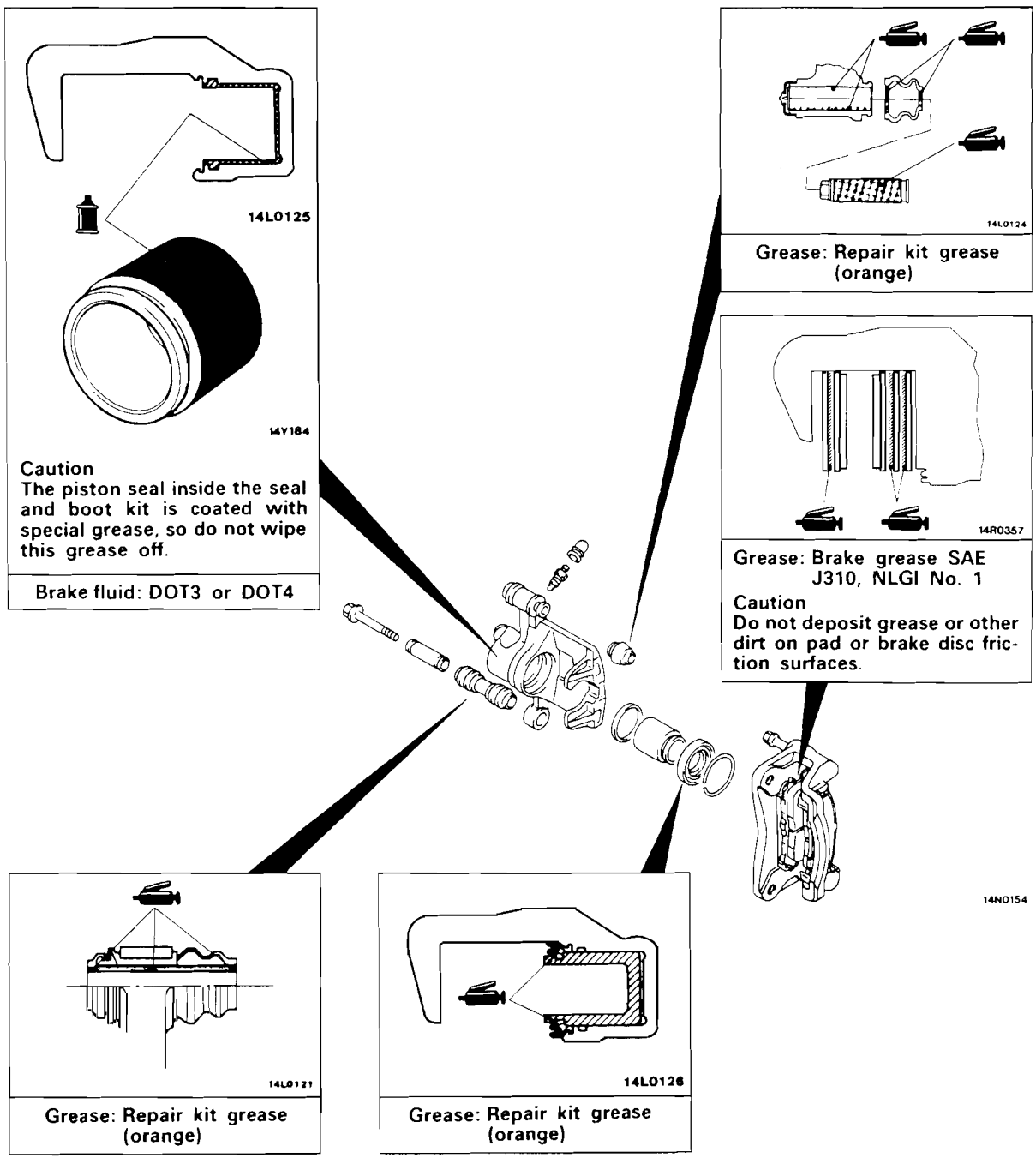


Fig. 62 — Repair grease application

Service Points of Disassembly

When disassembling the rear disc brakes, disassemble both sides (left and right) as a set.

Removal of Piston Boot/Piston

Protect caliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

CAUTION: Blow compressed air gently.

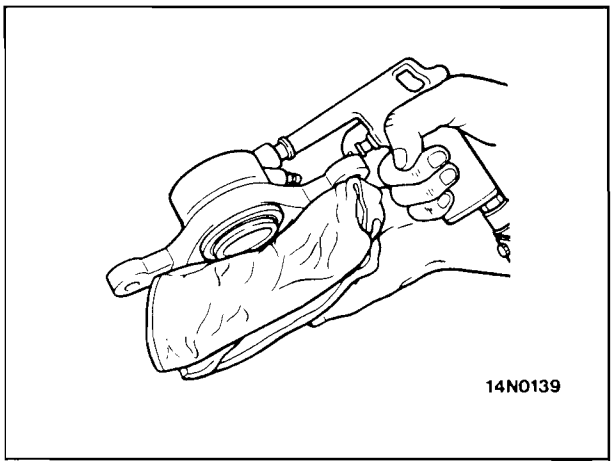


Fig. 63 — Piston removal

Removal of Piston Seal

(1) Remove piston seal with finger tip.

CAUTION: Do not use (−) screwdriver or other tool to prevent damage to inner cylinder.

(2) Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.
Specified brake fluid: DOT4.

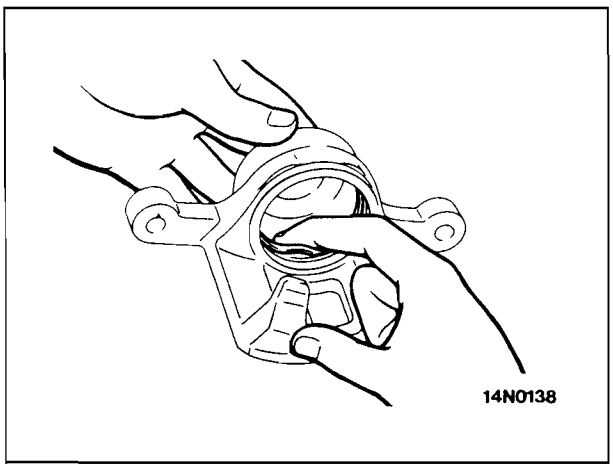


Fig. 64 — Seal removal

Inspection

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.
- Check wear indicator for damage.

Pad Wear Check

Measure thickness at the thinnest and worn area of the pad. Replace pad assembly when pad thickness is less than the limit value.
Standard value: 10 mm (0.390 in.)
Limit: 2.0 mm (0.080 in.)

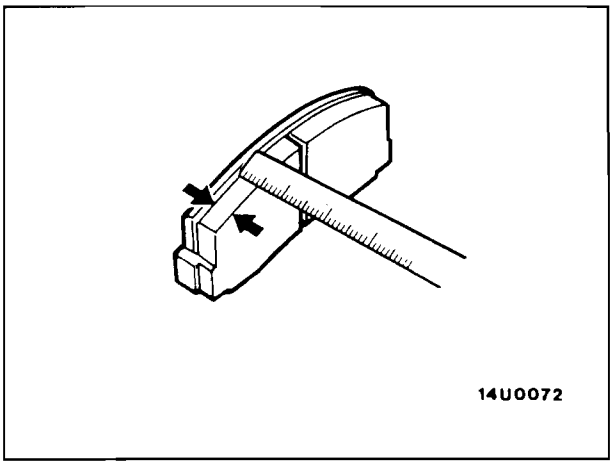


Fig. 65 — Pad thickness

A.B.S. HYDRAULIC UNIT

Removal and Installation

Flared brake line nuts

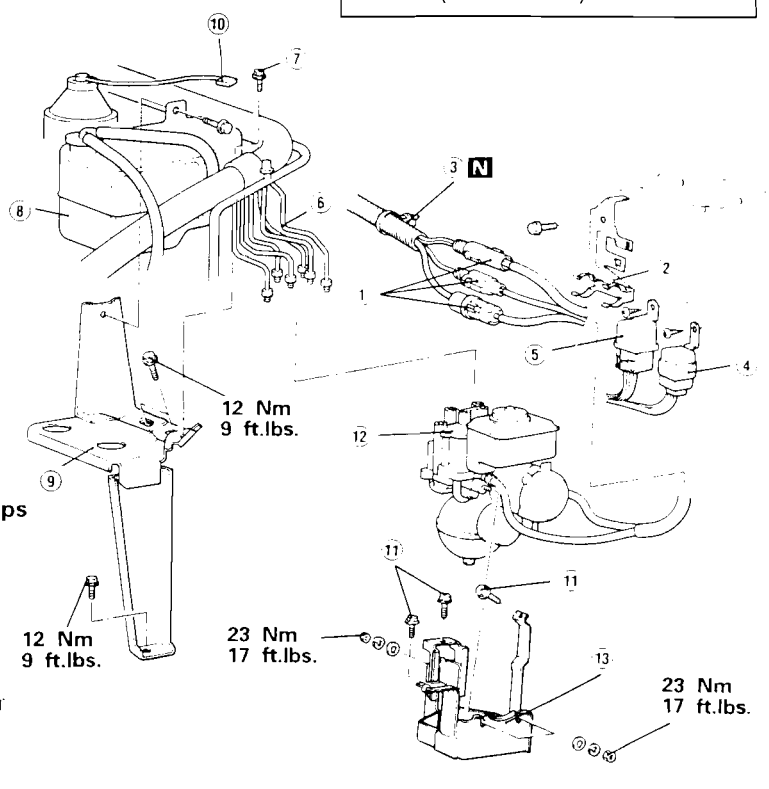
15 Nm
11 ft.lbs.



14F038

Pre-removal Operation
- Draining of Brake Fluid

Pre-installation Operation
- Supplying Brake Fluid
- Bleeding Brake Lines (Refer to P. 40)
- Checking by Using the Multi-Use Tester (Refer to P. 47)



14N0208

Relay removal steps

1. Hydraulic unit connector
2. Connector bracket
3. Clip
4. Motor relay
5. Valve relay

Hydraulic unit removal steps

1. Hydraulic unit connector
2. Connector bracket
3. Clip
6. Brake pipe
7. A/C pressure clamp bolt
8. Condense tank
9. Condense tank bracket
10. 4WS oil lever connector
11. Bolt
* 12. Hydraulic unit
13. Hydraulic unit bracket

* Refer to service points of removal.

Caution

1. **Do not dismantle the hydraulic unit, as the inside contains high pressure brake fluid.**
2. **Do not refill the hydraulic unit reserve tank, even if the fluid level drops. When the fluid level drops below the MIN line, the hydraulic unit should be replaced.**
3. **The accumulator contains high pressure nitrogen gas, so keep it away from flames.**
4. **Do not loosen or remove the safety plug in the lower section of the accumulator, except when disposing of the hydraulic unit.**
5. **Do not throw the accumulator into fire, drill holes, press, or weld without first releasing the gas.**
6. **When disposing of the hydraulic unit, first release the gas by turning the safety plug two or three times to loosen it, and wait about 3 minutes until the hissing sound can no longer be heard and all the gas has escaped. Remove the plug before disposal.**

Fig. 66 — Hydraulic unit

Service Points of Removal

Removal of Hydraulic Unit

Remove the hydraulic unit by pushing it backwards so that it doesn't touch the piping of the A/C receiver.

CAUTION:

1. Be careful during removal of the hydraulic unit as the unit is heavy.

2. Do not dismantle the hydraulic unit, as the inside contains high pressure brake fluid. Also, the brake pipes shown contain high pressure brake fluid, so this pipe should never be disconnected.

3. Do not drop the hydraulic unit or subject it to shocks.

4. Do not turn the hydraulic unit upside down or put it on its side.

5. Do not refill the hydraulic unit reserve tank, even if the fluid level drops. When the fluid level drops below the MIN line, the hydraulic unit should be replaced.

6. The accumulator contains high pressure nitrogen gas, so keep it away from flames.

7. Do not loosen or remove the safety plug in the lower section of the accumulator, except when disposing of the hydraulic unit.

8. Do not throw the accumulator into fire, drill holes, press, or weld without first releasing the gas.

9. When disposing of the hydraulic unit, first release the gas by turning the safety plug two or three times to loosen it, and wait about 3 minutes until the hissing sound can no longer be heard and all the gas has escaped. Remove the plug before disposal.

Inspection

For inspection of the motor relay and the valve relay, refer to P. 48.

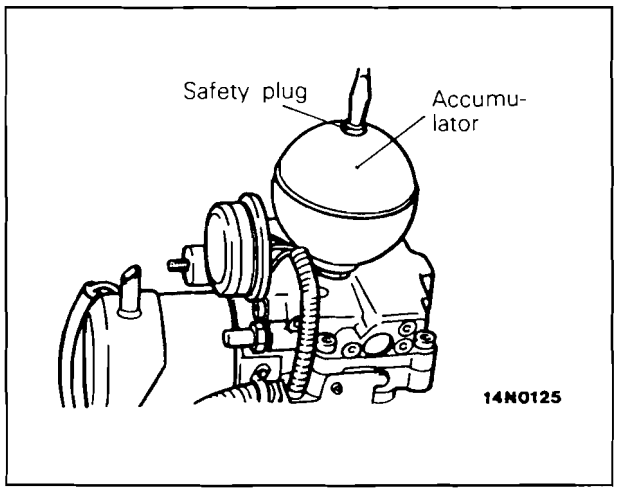


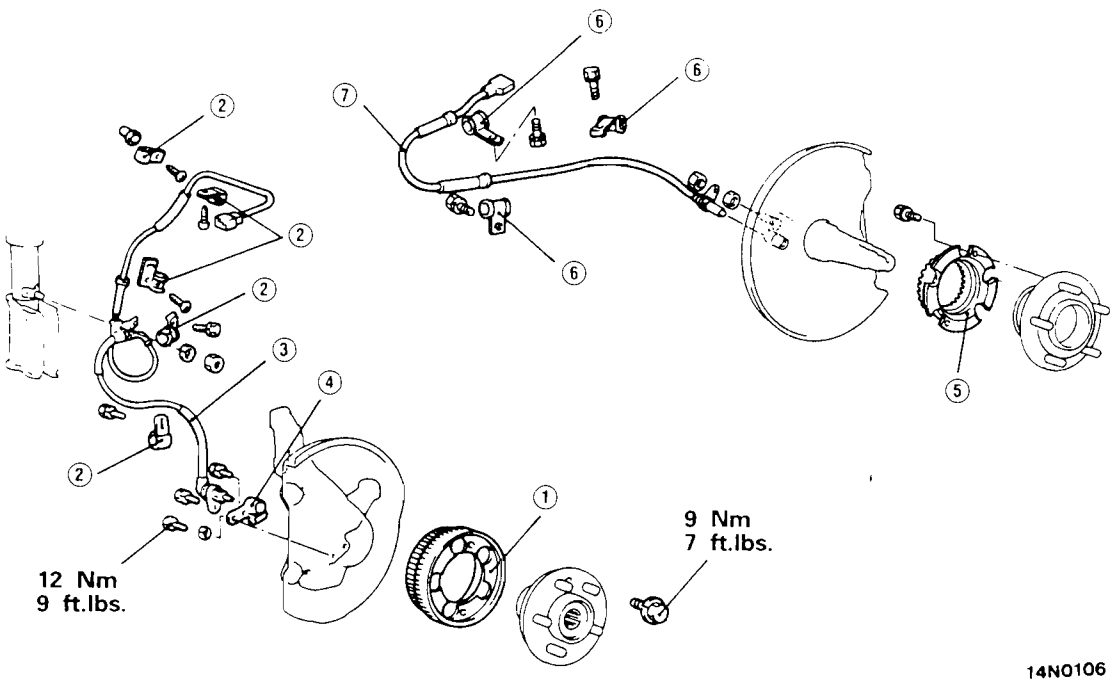
Fig. 67 — Accumulator decommissioning

A.B.S. WHEEL SPEED SENSOR

Removal and Installation

Pre-removal Operation
- Removal of the Splash Shield (Refer to Group 42)

Post-installation Operation
- Checking of the Wheel Speed Sensor Output Voltage (Refer tp P. 46)
- Installation of the Splash Shield (Refer to Group 42)



Front speed sensor removal steps
* 1. Front toothed rotor
2. Clip
* 3. Front speed sensor
* 4. Frot speed sensor bracket

Rear speed sensor removal steps
* 5. Rear toothed rotor
6. Clip
* 7. Rear speed sensor

* Refer to service points of removal/installation.

Fig. 68 — Wheel speed sensors

Service Points of Removal

Removal of Toothed Rotor Speed Sensor

CAUTION:

1. Be careful when handling the pole piece at the tip of the speed sensor and the toothed edge of the rotor so as not to damage them, as they are easily chipped if knocked.

2. Care must be taken not to scratch or scar the rotor's toothed surface, and not to drop it.

If the rotor's toothed surface is chipped or the rotor is deformed, it might not be able to accurately sense the wheel rotation speed and as a result the system might not perform normally.

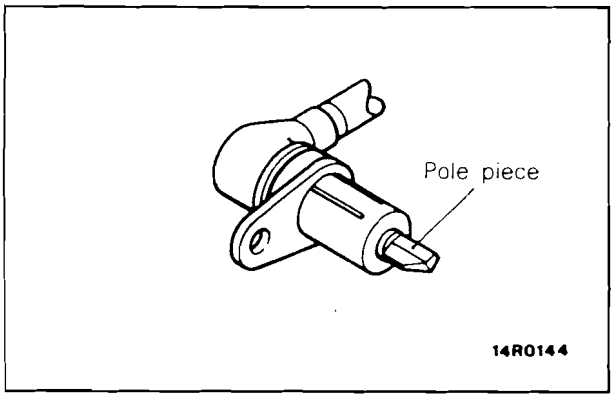


Fig. 69 — Speed sensor pole

Inspection

Speed Sensor Check

(1) Check whether any metallic foreign material has adhered to the pole piece of the speed sensor tip, and if so, remove it.

Also check whether the pole piece is damaged, and if so, replace it with a new one.

CAUTION: The pole piece is magnetized because of the magnet built into the speed sensor, with the result that metallic foreign material easily adheres to it. Moreover, the pole piece may not be able to function and correctly sense the wheel rotation speed if it is damaged.

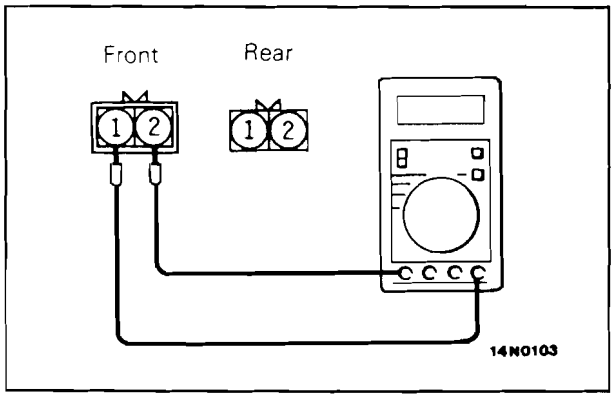


Fig. 70 — Sensor check

(2) Measure the resistance between the speed sensor terminals.

Standard value: Front 1.4-2.2 kΩ
Rear 1.3-2.1 kΩ

If the internal resistance of the speed sensor is not within the standard value, replace it with a new speed sensor.

(3) Check the speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.

NOTE: When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not temporary disconnection occurs.

Toothed Rotor Check

Check whether rotor teeth are broken or deformed, and if so, replace the rotor.

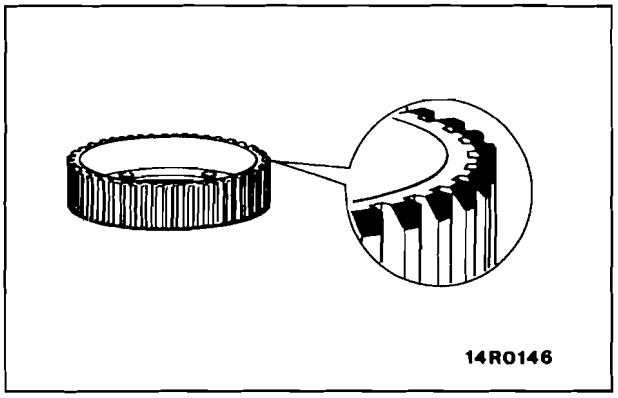


Fig. 71 — Rotor inspection

Service Points of Installation

Installation of Rear Speed Sensor

Insert a feeler gauge into the space between the speed sensor's pole piece and the rotor's toothed surface and then tighten the speed sensors at the position where the clearance is the standard value.

Standard value: 0.2-0.7 mm (0.008-0.028 in.)

NOTE: Check to be sure that there is no contact of the speed sensor's pole piece and the rotor's toothed surface when the rear hub assembly is slowly rotated one full turn. If there is contact, it is probable that the rotor or the rear hub is installed incorrectly, recheck installation.

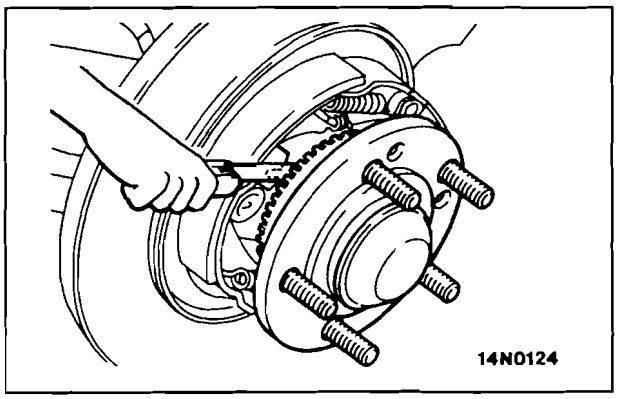


Fig. 72 — Rotor clearance

Installation of Front Speed Sensor Bracket

Assemble the speed sensor and the speed sensor bracket.

NOTE:

1. The shapes are different for the left and right speed sensor brackets. Each bracket has an identification symbol, so be sure to note these symbols and install correctly.

FR: Indicates that the bracket is for the front speed sensor.

R: Indicates that the bracket is for the right wheel.

L: Indicates that the bracket is for the left wheel.

Check to be sure, when installing the speed sensor to the bracket, that the letters 'FR' are visible.

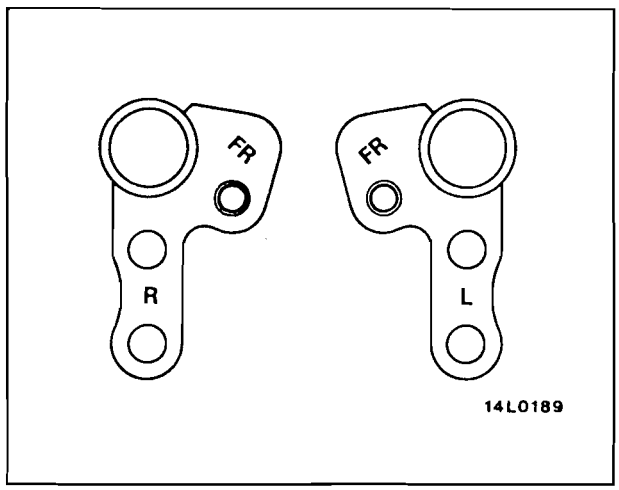


Fig. 73 — Sensor bracket identification

Installation of Front Speed Sensor

Insert a feeler gauge into the space between the speed sensor's pole piece and the rotor's toothed surface and then tighten the speed sensor at the position where the clearance is the standard value all around.

Standard value: 0.3-0.9 mm (0.012-0.035 in.)

NOTE: If the clearance between the speed sensor's pole piece and the rotor's toothed surface is not within the standard value range, it is possible that the rotor is incorrectly installed, recheck installation.

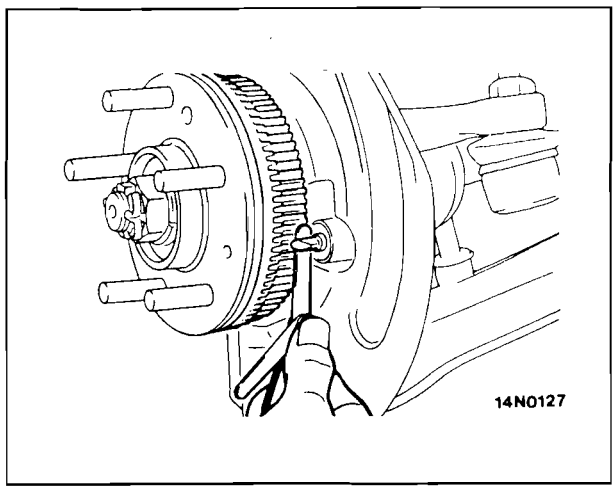


Fig. 74 — Rotor clearance

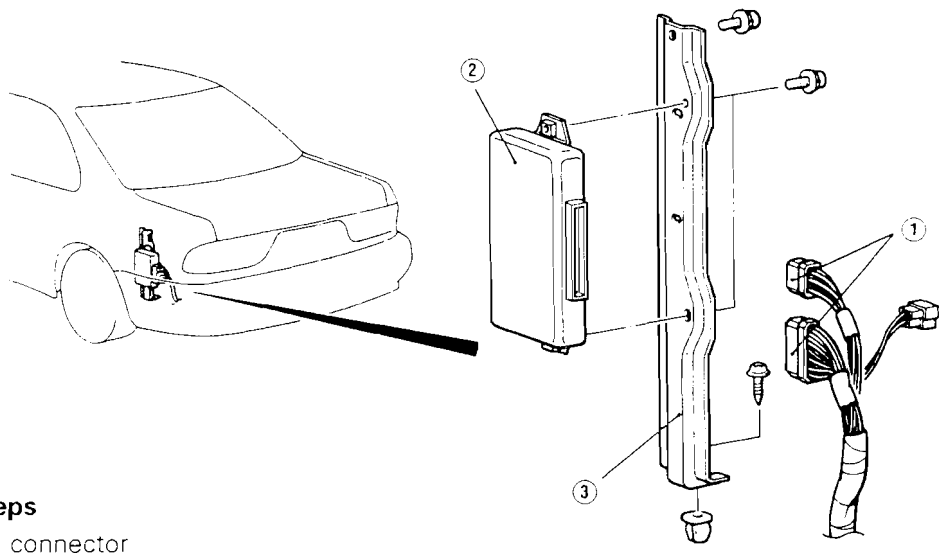
A.B.S. ELECTRONIC CONTROL UNIT

Removal and Installation

Pre-removal Operation
- Removal of the Trunk Side Trim (L.H.) (Refer to Group 52)

Post-installation Operation
- Checking of the Anti-lock Brake System (Refer to P. 7)
- Installation of the Trunk Side Trim (L.H.) (Refer to Group 52)

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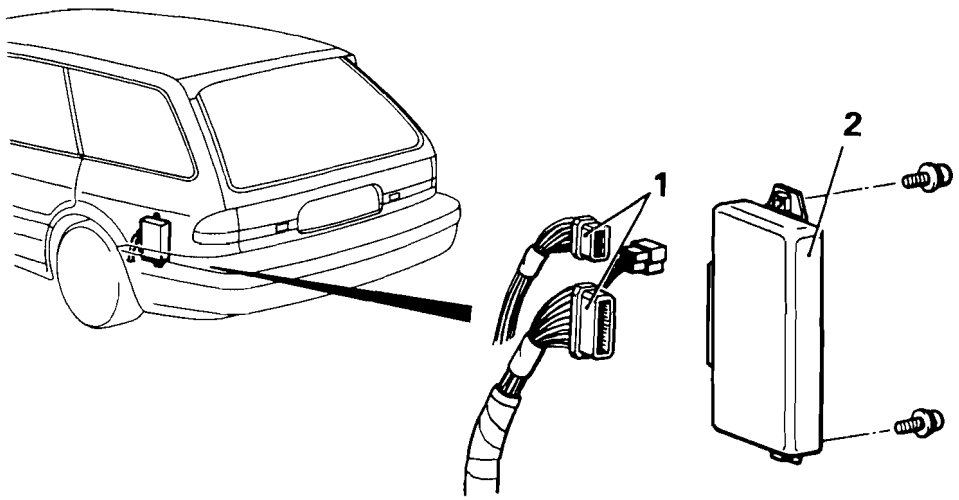
Removal steps
1. ABS-ECU connector
2. ABS-ECU
3. Bracket

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Pre-removal Operation
- Removal of the Trunk Side Trim (L.H.) (Refer to Group 52)

Post-installation Operation
- Checking of the Anti-lock Brake System (Refer to Group 35)
- Installation of the Cargo area Side Trim (L.H.) (Refer to Group 52)

<Wagon>



Removal steps
1. ABS-ECU connector
2. ABS-ECU

Fig. 75 — ECU location

GROUP 36 — PARKING BRAKES

SECTION 0 — INDEX

Subject	Section Number	Page Number
INDEX	0	
SERVICE DIAGNOSIS	1	
SPECIFICATIONS AND GENERAL INFORMATION	2	
Specifications		1
Torque Specifications		1
General Information		2
SERVICE CHECKS AND ADJUSTMENTS	3	
Parking Brake Shoe Adjustment		1
Parking Brake Lever Switch Check		1
Parking Lever Stroke Check and Adjustment		2
Parking Brake Burnishing Procedure		2
PARKING BRAKE ASSEMBLY	4	
Parking Brake Lever		1
Parking Brake Cables		1
Drum-in-Disc Brake Assembly		3

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Corrective Action
INEFFECTIVE PARKING BRAKE	Broken cable	Replace cable
	Seized cable	Lubricate or replace cable
	Incorrect cable adjustment	Adjust cable to specification
BRAKES DRAGGING	Distorted drum-in-disc	Machine and or replace disc
	Parking brake still engaged	Disengage parking brake
	Incorrect shoe adjustment	Adjust to specification
	Unmatched brake shoes	Replace brake shoes
PARKING BRAKE LEVER VERY HARD TO ENGAGE	Incorrect cable adjustment	Adjust cable to specification
	Cable seized	Lubricate or replace cable

SECTION 2 — SPECIFICATIONS AND GENERAL INFORMATION

SPECIFICATIONS

Parking brake type	Mechanical brake acting on the rear wheels. Drum-in-disc arrangement
Parking brake control	Lever type
Cable arrangement	V-type
Parking brake lever stroke	3-5 notches @ 196N-force
Maximum diameter of park brake (inner) drum	169.0 mm
Specified grease	Brake grease SAE J310, NLGI 0
Shoes and linings	
Type	Duo servo
Adjustment	Manual
Lining length x width x thickness	159mm x 30mm x 3mm
Lining service replacement thickness	1 mm
Lining material type	L610 Non-Asbestos
Cable identification	L.H.S.-White, R.H.S.-No colour

TORQUE SPECIFICATIONS

	Nm
Caliper to stub axle bolts	50-60
Caliper guide pin bolts	30-34
Backing plate to stub axle bolts	50-60
Wheel nuts	90-110
Vehicles with ABS	
Rear toothed rotor mounting bolts	9-14
Rear speed sensor nut	9-14
Reaction bolt and nut	70-90
Parking brake drag	4.3-4.5 kgf

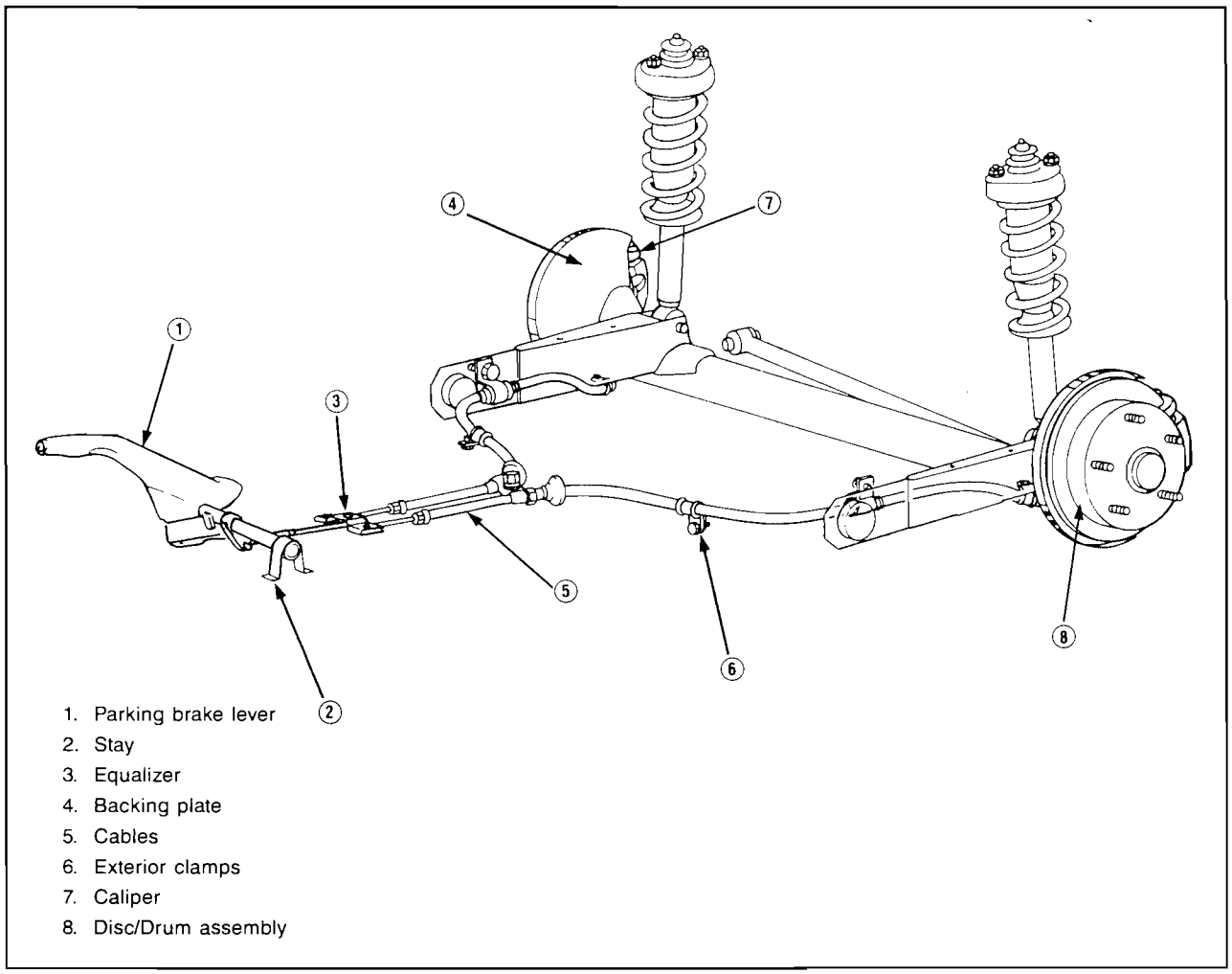


Fig. 1 — Parking brake component location

GENERAL INFORMATION

The rear disc assembly incorporates an internal drum which is used for the parking brake mechanism.

The parking brake drum assembly operates on the duo servo principal, whereby the primary or front shoe, is forced against the drum by pressure from the actuator. The force is then transferred into the secondary shoe, which results in a very high multiplication of forces, due to the two shoes self-wrapping with drum rotation.

The self-wrapping action is a direct result of the shoes being allowed to pivot freely at the adjuster end.

Access for adjustment of the shoes is through a hole in the wheel mounting face of the disc.

NOTE: The adjusters on both sides have a right-hand thread. This means in order ro reduce the shoe-to-drum clearance, the adjuster wheel must be turned down.

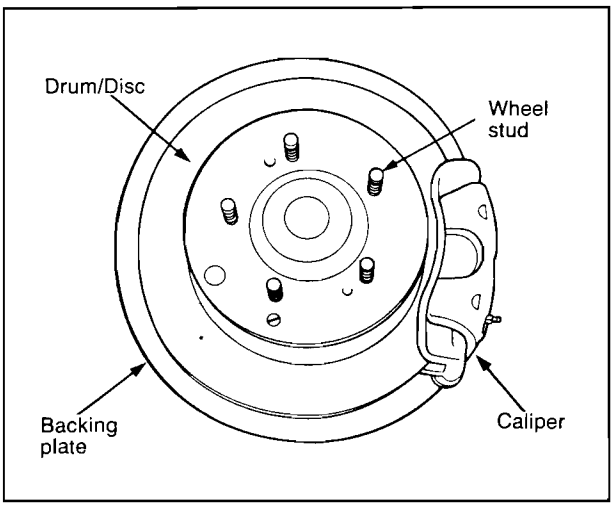


Fig. 2 — Disc assembly components

SECTION 3 — SERVICE CHECKS AND ADJUSTMENTS

PARKING BRAKE SHOE ADJUSTMENT

It will be necessary, to adjust the lining to drum clearance when there is excessive travel in the parking brake.

(1) With the rear of the vehicle raised and supported on jack stands (see Group 00 — General Information for jacking points), remove the wheel and tyre assemblies.

NOTE: Under no circumstances should the parking brake cable be adjusted before the shoes are adjusted.

(2) Install two wheel nuts diagonally opposite and tighten them.

(3) Align one disc drum access hole with the adjuster star wheel.

(4) Insert a suitable flat tool through the hole and adjust the brake shoes in both rear brakes until they just contact the disc/drums. (Move the star wheel down to tighten), refer Fig. 1.

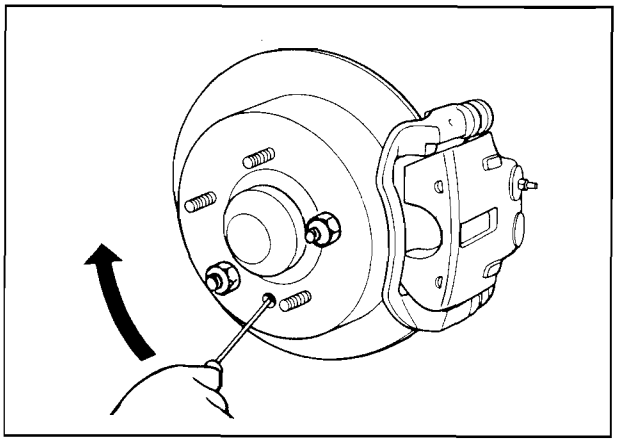


Fig. 1 — Adjusting shoe-to-drum clearance

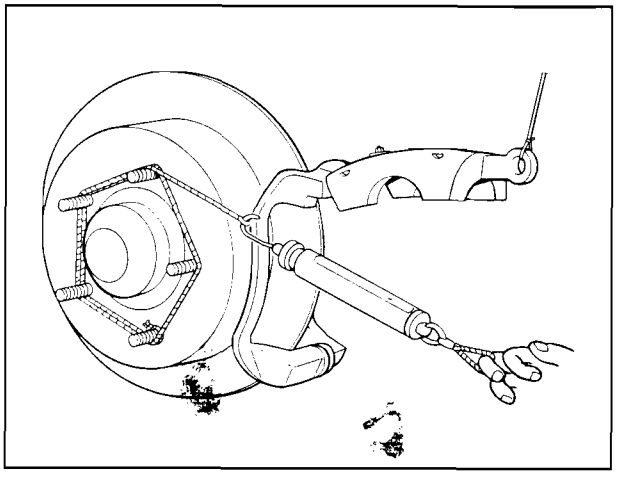


Fig. 2 — Parking brake drag check

(5) Remove the bottom guide pin bolt of the caliper and the brake hose retaining clip.

(6) Swing the caliper up and support so that it is no longer in contact with the disc.

(7) Remove the pads.

(8) Tie a piece of string to a wheel stud and wrap it around the other studs a couple of times, refer Fig. 2.

(9) Attach the spring scale.

NOTE: Make sure that the string is perpendicular to the centre line of the last stud it touches before commencing the check, refer Fig. 3.

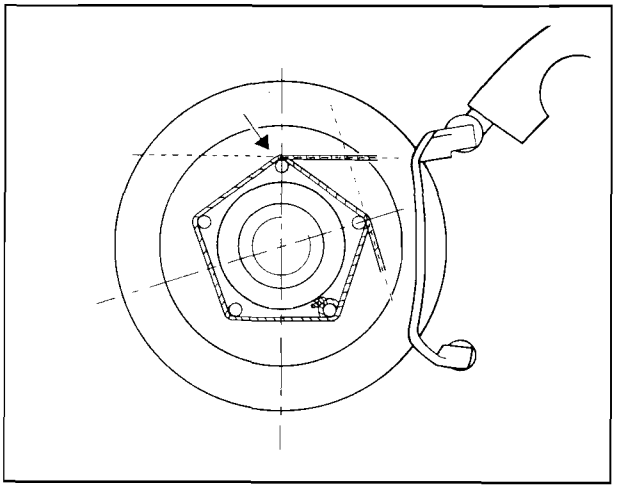


Fig. 3 — Correct testing angle

(10) Slowly pull the spring scale so that the disc assembly rotates and take a reading from the scale.

(11) Move the adjuster gradually (whichever direction applicable) until the parking brake drag is within specifications.

(12) Once this has been achieved, back off the adjuster another 5 notches.

(13) Adjust the parking lever stroke (detailed this section) within specifications.

(14) Install brake pads into caliper mounting bracket and swing caliper down over pads. Install lower guide pin bolt and tighten to specified torque.

CAUTION: Ensure both inner and outer pads are correctly located in the caliper mounting bracket.

(15) Remove the two wheel nuts and reinstall the wheel and tyre assemblies. Then tighten the nuts to the specified torque in a diagonal sequence.

(16) Turn the rear wheels to confirm that the rear brakes are not dragging.

PARKING BRAKE LEVER SWITCH CHECK

(1) Remove the console assembly, refer Group 52.

(2) Disconnect the connector of the parking brake switch, and connect an ohmmeter to the parking brake switch and a suitable earth, refer Fig. 4.

(3) The parking brake switch is functional if there is continuity when the parking lever is applied and no continuity when it is released.

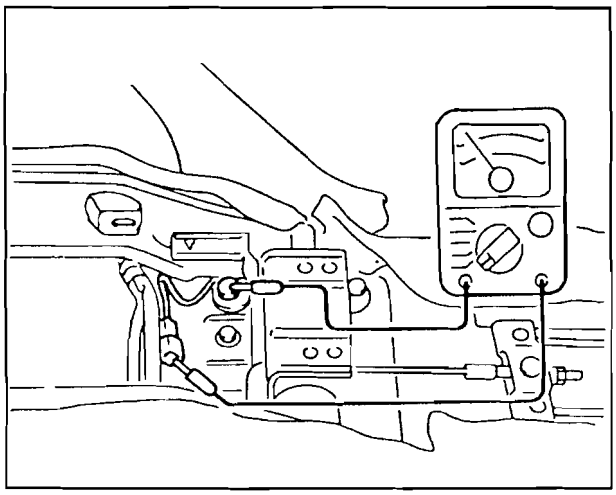


Fig. 4 — Ohmmeter connection

PARKING LEVER STROKE CHECK AND ADJUSTMENT

(1) Pull the parking brake lever with a force of approximately 196N and count the number of notches.

(2) If the parking brake lever stroke is not within specifications, adjust as follows.

(3) Remove the floor consol, refer Group 52.

(4) Loosen the adjusting nut to the end of the rod, thus freeing the parking brake cables, refer Fig. 5.

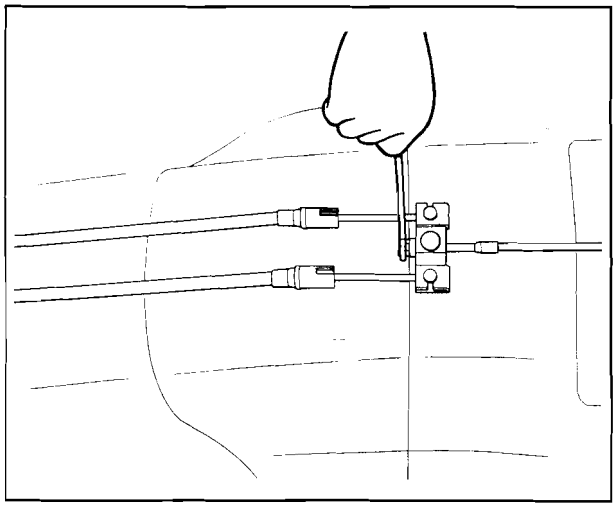


Fig. 5 — Loosening the parking brake cable

(5) Jack up the vehicle, support on jack stands (see Group 00-General Information for jacking points), remove the tyre and wheel assemblies and install two wheel nuts diagonally apposite and tighten.

(6) Refer to parking brake shoe adjustment this section and perform the adjustment.

(7) Turn the adjusting nut on the Parking lever assembly rod to bring the lever stroke within specifications.

NOTE: If the number of notches engaged is less than specified, the cable is adjusted too tight. This will result in brake drag and shoe glazing.

(8) After making the adjustment, be sure that there is no play between the adjusting nut and the pin. Also check that the adjusting nut is securely held at the nut holder.

(9) After adjusting the parking lever stroke and with the parking brake lever released, turn the rear wheels to confirm that the rear brakes are not dragging.

PARKING BRAKE BURNISHING PROCEDURE

NOTE: This procedure must be performed whenever the parking brake shoes are replaced.

(1) Drive the vehicle at 50 km/hr in a forwards direction and pull the parking brake lever with a force of 100N and drive for 100m. Repeat 5 times.

(2) Drive the vehicle at 5 km/hr in reverse and pull the parking brake lever with a force of 100N and drive for 100m. Repeat twice.

(3) These steps will ensure normal parking brake operation.

SECTION 4 — PARKING BRAKE ASSEMBLY

PARKING BRAKE LEVER

Removal

(1) Remove the floor console, refer Group 52.

(2) Loosen the adjusting nut right off the cable rod.

(3) Unbolt the parking brake assembly from the floor and remove the stay and bush from the assembly.

(4) Remove the parking brake switch from the lever by undoing the bolts.

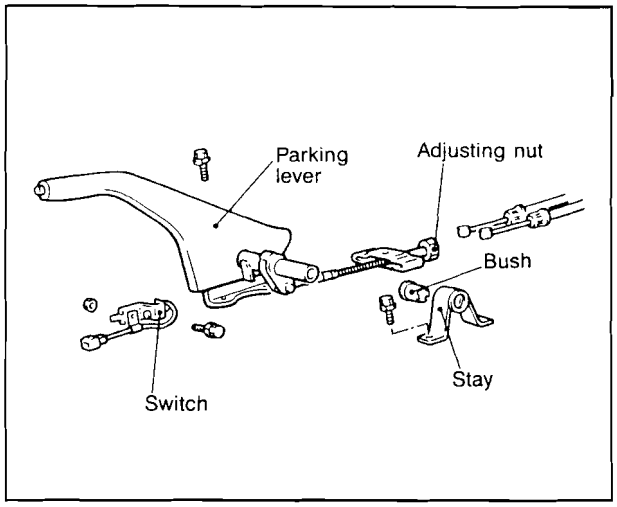


Fig. 1 — Parking brake lever assembly components

(5) Inspect the parking brake lever ratchet for wear.

Installation

(1) Apply a coating of the specified grease to the inner surface of the bushing, refer Fig. 2.

(2) Apply a coating of the specified grease to each sliding part of the ratchet plate and the ratchet pawl, refer Fig. 3.

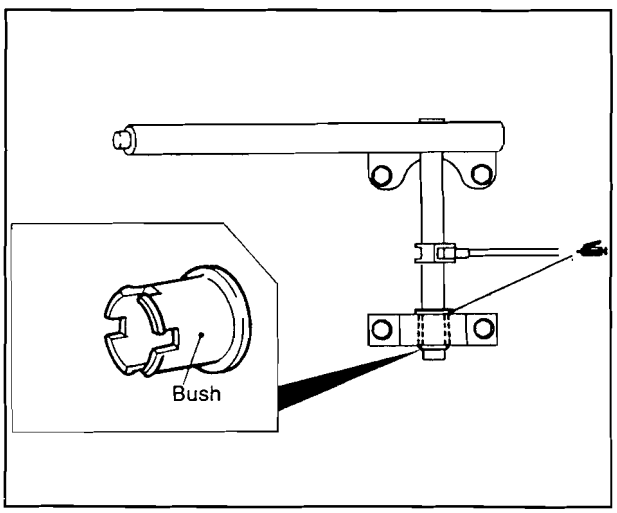


Fig. 2 — Applying grease to bush

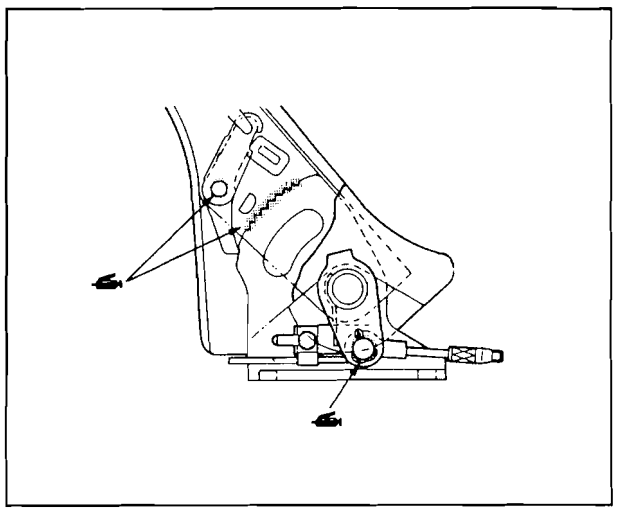


Fig. 3 — Applying grease to lever assembly

(3) Install the switch and stay (with the bush installed) to the lever assembly.

(4) Bolt assembly to floor.

(5) Install the adjusting nut and adjust the cable to give you the correct lever stroke specification.

(6) Replace the console.

NOTE: It is important that you remember to perform the parking lever stroke adjustment after installing the assembly.

PARKING BRAKE CABLES

Removal

(1) Remove the floor console, refer Group 52.

(2) Remove the adjusting nut from the end of the cable rod and cables from the equalizer.

(3) Remove the rear seat cushion, refer Group 52.

(4) Remove the parking brake cable clamps, refer Fig. 4.

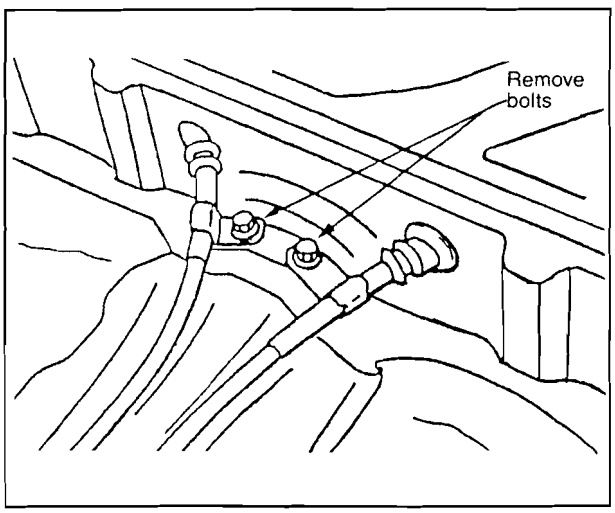


Fig. 4 — Removing cable clamps

(5) Remove the grommets from the body.

(6) Jack the vehicle up at the rear and remove the wheel assemblies.

(7) Remove the caliper attaching bolts and support the caliper assembly. Remove the disc/drum assembly, refer Fig. 5.

NOTE: Do not let the caliper hang from the brake hose.

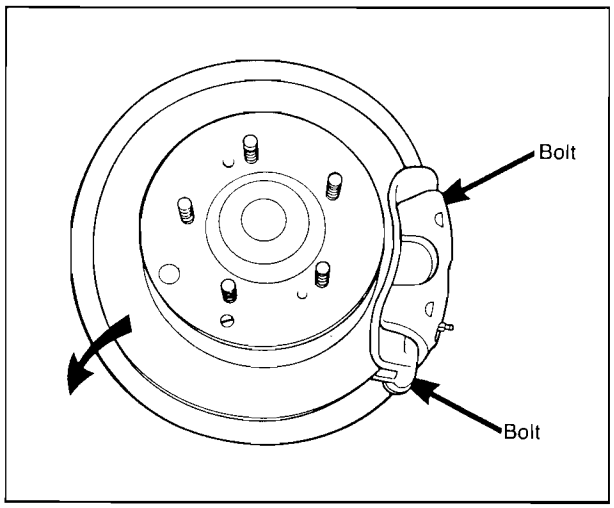


Fig. 5 — Removing caliper and disc/drum

(8) Remove the hub and brake shoes (refer to Drum-in-Disc assembly — this section).

(9) Remove the parking brake cable from the actuator attached to the shoe and lining assembly.

(10) Remove the circlip from the back of the backing plate to release the cable, refer Fig. 6.

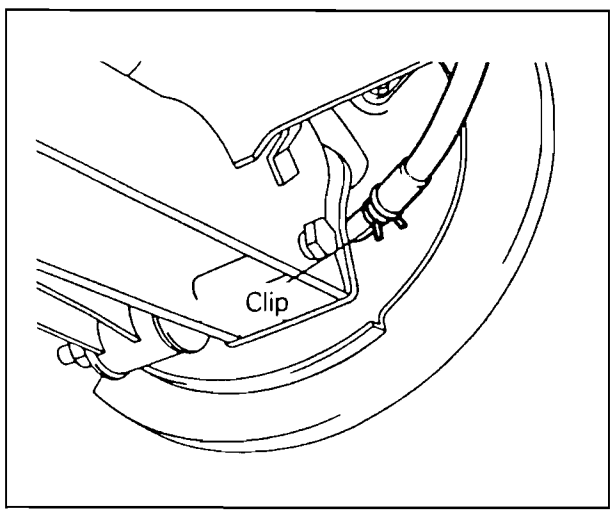


Fig. 6 — Circlip removal

(11) Remove all of the cable mounting clamps from underneath the vehicle and remove the parking brake cables, refer Fig. 7.

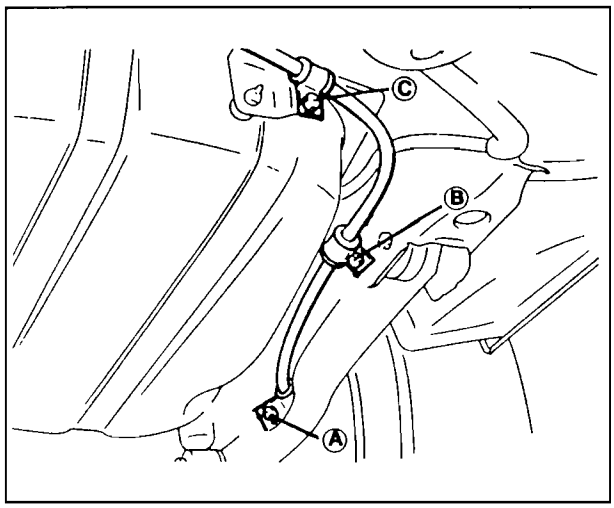


Fig. 7 — Exterior mounting clamp location (left hand-sedan shown)

Installation

NOTE: Before installing cables, check for the identification mark so as to put the cables on the appropriate sides.

To install the parking brake cables, simply reverse the removal steps noting the following:

(1) Add a suitable sealant to the two body-to-cable grommets before installing. Also pay attention to grommet mounting direction.

(2) When tightening exterior cable clamps, tighten clamps "A" and "C" both sides (refer Fig. 7) first, then apply the hand brake before tightening "B" to give you the natural routing of the cable.

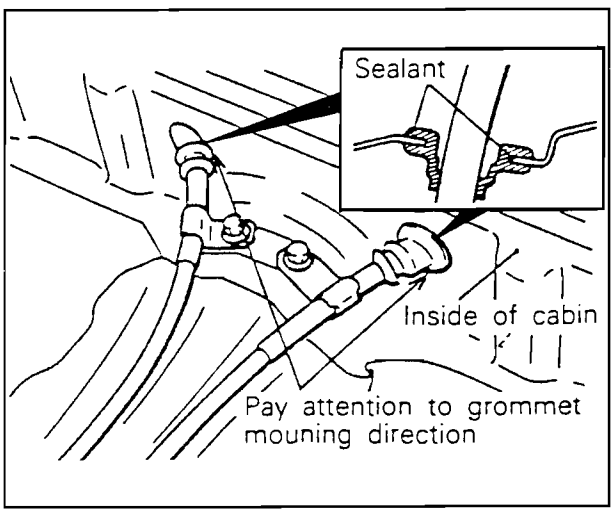


Fig. 8 — Sealant application

DRUM-IN-DISC BRAKE ASSEMBLY

Removal

(1) Jack up the rear of the vehicle and place on safety stands. (Refer to Group 00 for jacking points.)

(2) Remove the wheel assemblies.

NOTE: Vehicles with A.B.S. remove the rear speed sensor. Do not damage the pole piece of the sensor.

(3) Remove the caliper attaching bolts and support the caliper assembly.

NOTE: Do not let the caliper hang from the brake hose.

(4) Remove the disc. If removal is difficult, insert bolts into the threaded holes of the disc and tighten the bolts to remove the disc.

(5) Remove the hub dust cover and remove the staked lock nut.

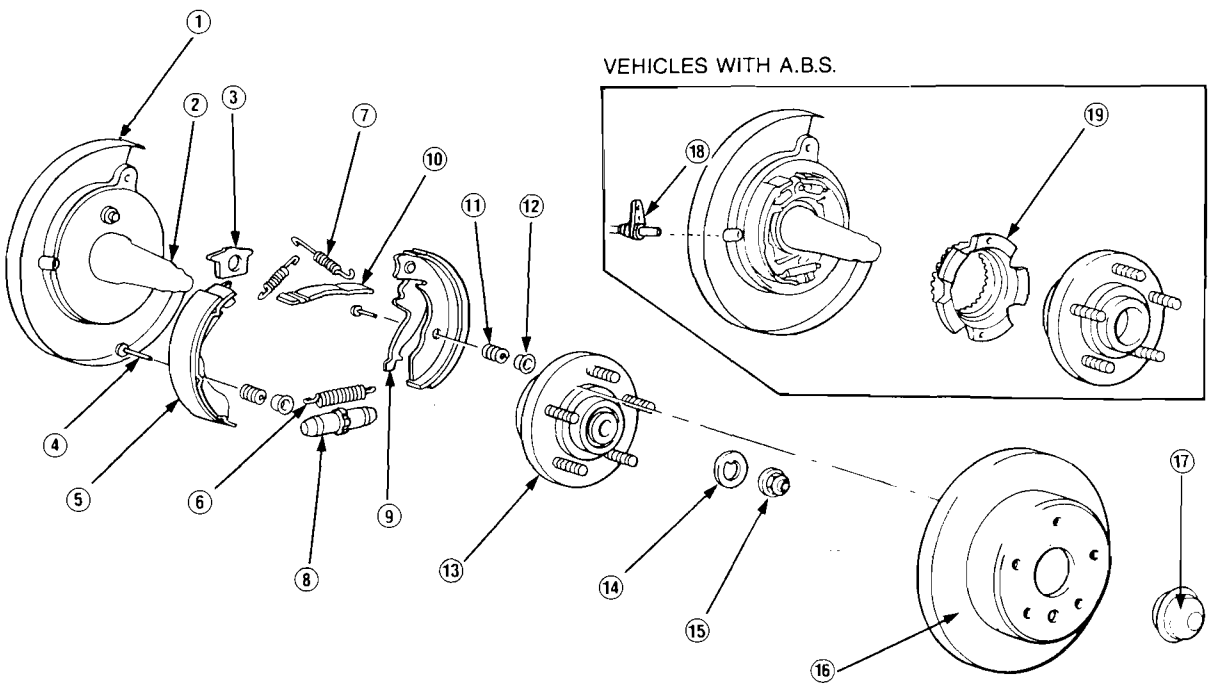
NOTE: The lock nut is a non-reuseable item and must be replaced each time it is removed.

(6) Remove the hub assembly from the stub axle.

(7) Vehicles with A.B.S., remove the rear toothed rotor from the hub.

NOTE: Care must be taken to avoid damage or scratching of rotor teeth.

(8) Remove the return springs and the metal stay, refer Fig. 9.



1. Backing plate
2. Stub axle
3. Stay
4. Guide pin
5. Shoe/lining assembly
6. Adjuster spring
7. Return spring
8. Adjuster
9. Actuator
10. Strut
11. Shoe hold-down spring
12. Shoe hold-down lock cap
13. Hub
14. Lock washer
15. Lock nut
16. Disc/Drum
17. Dust cap
18. A.B.S.-rear speed sensor
19. A.B.S.-rear toothed rotor

Fig. 9 — Exploded diagram of drum-in-disc assembly

(9) Remove the adjusting screw spring and then the adjuster, refer Fig. 10.

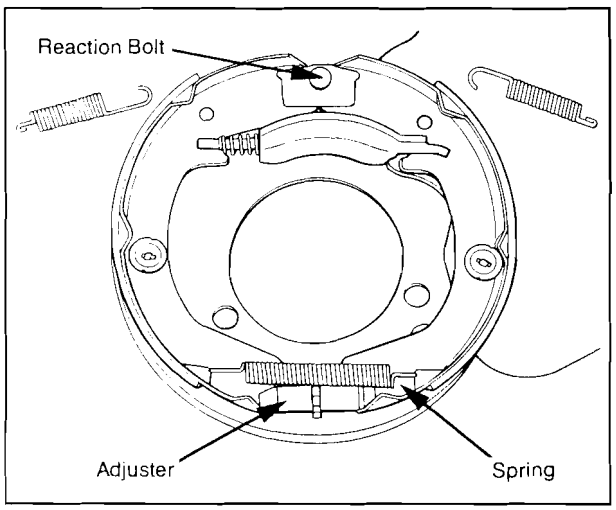


Fig. 10 — Spring and adjuster removal

(10) Remove the strut and strut spring.

(11) Remove the two shoe hold-down springs to release the shoes.

NOTE: Uncouple the parking brake cable from the actuator attached to the brake shoe.

If the backing plate is then to be removed the following steps are to be taken.

(a) Remove the circlip from the back of the backing plate to release the parking brake cable. (Refer to parking brake cables this section).

(b) Remove the two bolts holding the backing plate to the axle.

(c) Remove the nut that is on the back of the reaction bolt and which locates through the stub axle face, refer Fig. 10.

To remove the actuator from the shoe assembly, use a suitable flat tool to open the retainer. Remove the actuator from the pin, refer Fig's. 11 and 12.

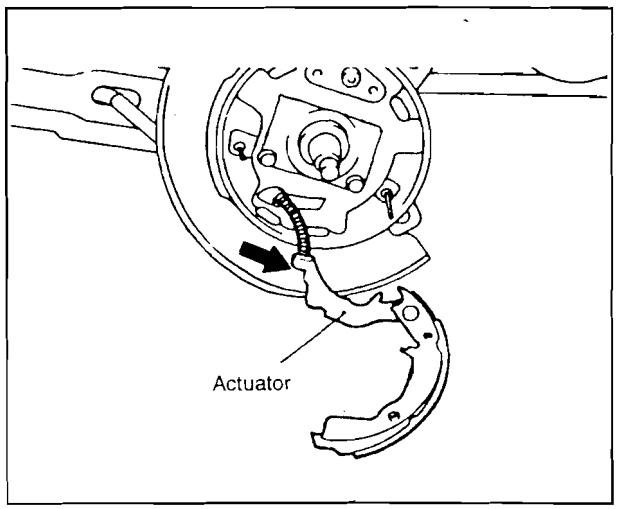


Fig. 11 — Parking brake actuator

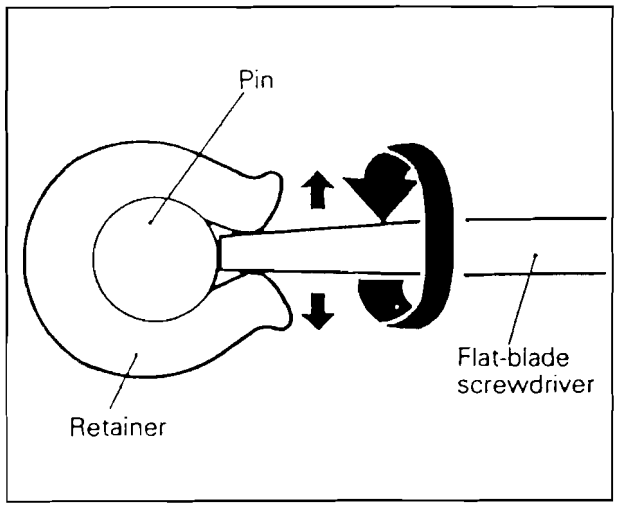


Fig. 12 — Retainer removal

Inspection

After the removal of the brake shoes and disc/drum the following inspections are required:

(1) Measure the brake lining thickness at several locations, refer Fig. 13.

(2) Replace the shoe assembly, if the brake lining thickness is less than the specified limit or it has worn unevenly.

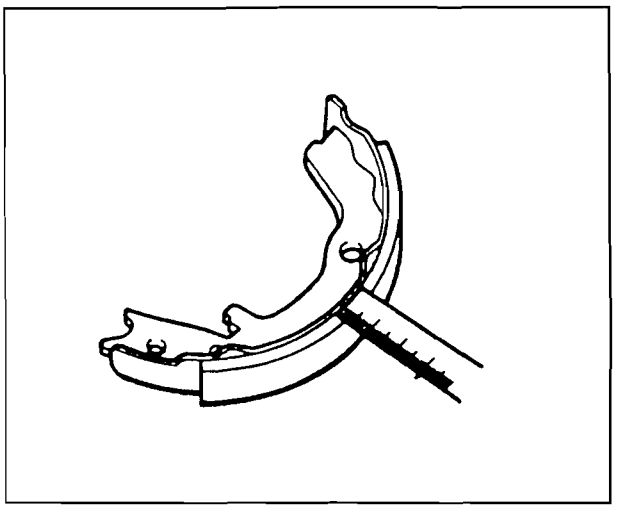


Fig. 13 — Brake lining measurement

(3) Use an inside micrometer or a dial caliper gauge to measure the brake disc inner diameter (drum) at two or more places.

(4) Replace disc/drum if its diameter exceeds the specification.

Installation

Install by reversing the removal procedures, noting the following:

(1) Apply the specified grease to the surfaces of the backing plate that contacts the shoe and lining asemblies before installing them.

(2) Install the wave washer in the direction shown in Fig. 14 for the actuator to shoe connection.

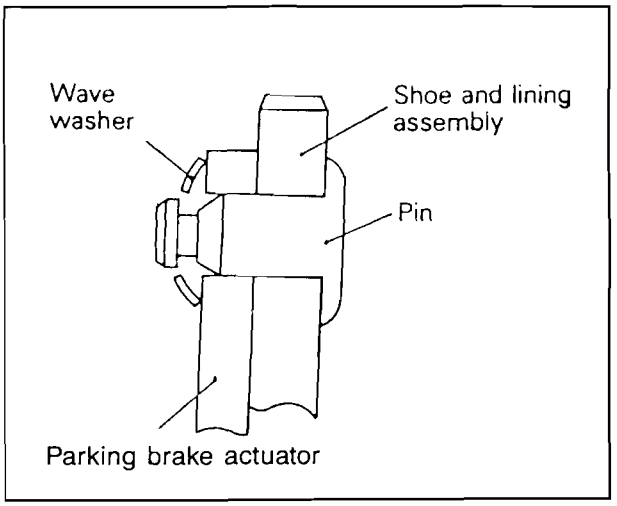


Fig. 14 — Wave washer fitment

(3) Use a pair of pliers to attach the retainer to the pin securely, refer Fig. 15.

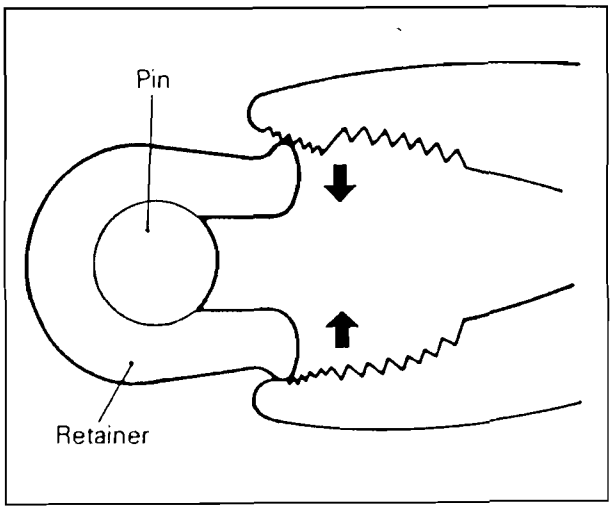


Fig. 15 — Retainer attachment

(4) Before installing the shoe and lining assemblies, apply the specified grease to the surfaces that come in contact with the adjuster and the strut.

(5) Apply the specified grease to the surfaces of the strut that contact the shoe assemblies.

(6) Apply the specified grease to the shoe adjusting bolt, the shoe support piece and to the surfaces of the adjuster that contact the shoe assemblies, refer Fig. 16.

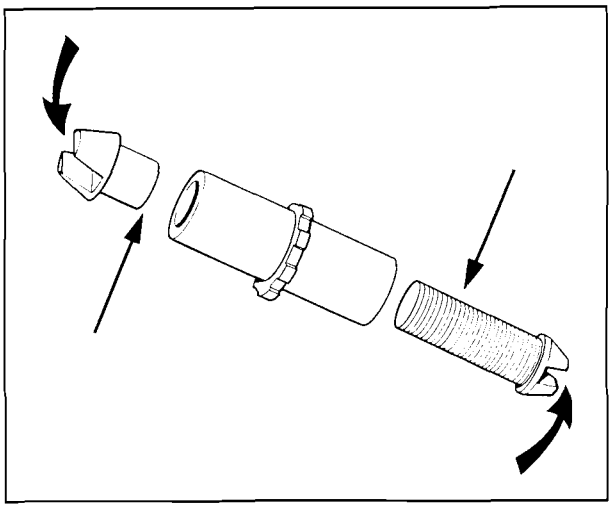


Fig. 16 — Adjuster greasing

NOTE: Turn the shoe adjusting bolt all the way in before fitment.

(7) When installing the right hand side adjuster, follow the same procedure as for the left hand side adjuster and install in a non-symmetrical position. This keeps the adjusting direction the same on both sides.

(8) When installing the return springs, use the sequence shown in Fig. 17. The left wheel is shown but the symmetrically opposite position applies for the right rear wheel.

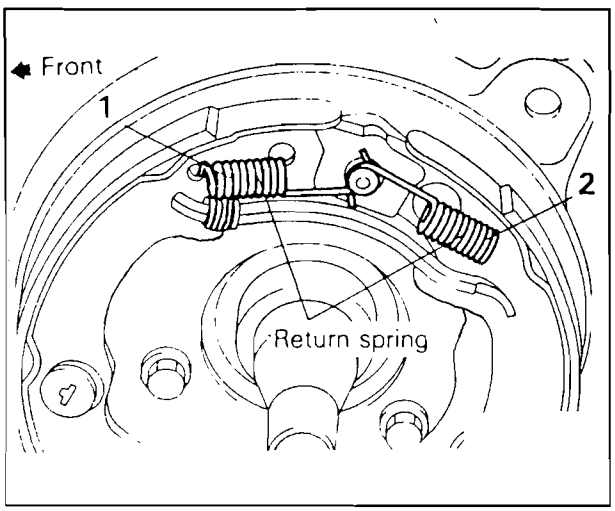


Fig. 17 — Return spring installation

(9) Multipurpose grease must be applied to the oil seal lip before fitting the hub.

NOTE: Whenever the hub assembly is removed or replaced, the appropriate adjustments must be performed, refer Group 27 — Rear Axle.

When replacing shoe assemblies, the lever stroke adjustment and the shoe-to-drum clearance adjustment must be within specification.

GROUP 37 — STEERING

SECTION 0 — INDEX

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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

SECTION 1 — SERVICE DIAGNOSIS — POWER STEERING

Condition	Possible Cause	Corrective Action
STEERING OPERATION IS HEAVY AT LOW SPEED OR TORQUE UNEVENNESS WHEN THE STEERING WHEEL IS TURNED	Damaged drive belt	Replace drive belt
	Low fluid level	Top-up fluid*
	Fluid leakage	Repair leakage and top up fluid**
	Oil pump malfunction	Repair or replace oil pump***
	Steering gearbox incorrectly mounted	Loosen and tighten mounting bolts to the specified torque.
	Rack support overtightened	Check pinion starting torque. Adjust or replace the rack support
	Excessive friction in steering linkage	Replace tie rod end or tie rod
	Pinion and valve malfunction (seal damage)	Replace the seal or pinion and valve assembly***
	Rack piston seal damage	Replace the seal
	Tight steering shaft or column bearings	Lubricate or replace
STEERING WHEEL DOES NOT RETURN PROPERLY	Incorrect front wheel alignment	Adjust wheel alignment
	Friction in steering shaft joints and/or body grommet	Repair or replace faulty component
	Rough operation of tie rod joint and/or tie rod end	Lubricate or replace tie rod or tie rod end
	Rack support over-tightened	Check pinion starting torque. Adjust or replace the rack support as required
	Pinion gear and/or rack damaged	Replace defective component
	Steering gearbox incorrectly mounted	Loosen and tighten mounting bolts to the specified torque****
	Loose rack support	Adjust the rack support. Replace the rack support or support spring if required
STEERING SYSTEM NOISY (Hissing, whistling sounds)	Air in system due to insufficient fluid	Top-up fluid and bleed system
	Air trapped in hoses	Check hose connections for fluid leakage. Bleed the system
	Crushed suction hose	Check hoses for deformation. Repair or replace as necessary
(Squeaking, creaking sounds)	Slipping drive belt	Adjust drive belt tension, replace if necessary
	Damaged drive belt	Replace drive belt
	Seized or damaged oil pump	Replace oil pump
(Rattling, clunking sounds)	Loose gearbox mounting	Tighten mounting bolts to the specified torque
	Loose oil pump bracket and/or oil pump mounting bolts	Tighten bolts to the specified torque
	Loose steering linkage or ball joint	Tighten to the specified torque

Condition	Possible Cause	Corrective Action
STEERING WHEEL VIBRATION	Loose hub nut	Retighten hub nut
	Excessive wheel or tyre runout	Replace wheel or tyre
	Improperly adjusted yoke assembly (or deteriorated yoke spring)	Adjust or replace yoke spring
	Damaged wheel bearing	Replace wheel bearing
	Loose or deformed lower arm	Retighten or replace lower arm
	Damaged tie rod	Repair or replace tie rod
	Loose tie rod connections	Retighten tie rod connections
	Worn or damaged ball joints	Replace ball joints
	Damaged front suspension	Check and adjust. Replace components if necessary
	Faulty installation or internal damage in gearbox	Correct or replace steering gearbox
	Faulty shock absorber	Replace shock absorber
ROAD SHOCK IN STEERING WHEEL	Insufficient steering wheel freeplay	Adjust steering wheel freeplay
	Insufficient tyre pressure	Inflate tyres to correct pressure
	Uneven worn or deformed tyre/s	Rotate the wheels or replace the tyre/s
	Faulty shock absorber	Replace shock absorber
STEERING WHEEL PULLS TO ONE SIDE	Excessive steering wheel play (deteriorated yoke spring)	Replace
	Dragging brakes	Check brake operation
	Deteriorate or broken front spring	Replace the spring
	Deformed knuckle	Replace the knuckle
	Damaged wheel bearing	Replace wheel bearing
	Deformed or loose lower arm	Retighten or replace the lower arm
	Loose tie rod connections	Retighten tie rod connections
	Seized or damaged ball joint	Replace the ball joint
	Damaged or deteriorated lower arm bushing	Replace the lower arm bushing
	Faulty installation or internal damage in gearbox	Correct or replace steering gearbox
	Faulty shock absorber	Replace shock absorber
	Uneven wheelbase	Adjust body alignment

* Check for fluid leakage into the bellows

** Check for leakage from oil pump or gearbox seals. Check pipe to gearbox coupling O-rings

*** Check fluid pressure as outlined in Section 2A

**** Check that the projection on the mounting rubber is correctly aligned with the mounting surface, refer "Installation", Section 2B. A soft humming can be heard from the oil pump when the steering wheel is turned while the vehicle is stationary. The sound is caused by the pulsing of the fluid in the pump and is not a malfunction. If the steering wheel is turned while the brake pedal is depressed some sound may be heard from the brakes. The sound is caused by slight rotation of the wheel against the brake pads and is not a malfunction. When the steering wheel is turned while the vehicle is stationary, a hissing sound may be heard. The sound is caused by fluid flowing through the pressure control valve and is not a malfunction.

SECTION 2A — POWER STEERING PUMP

SPECIFICATIONS

Type	Vane pump
Displacement	9.6 cc/rev.
Relief pressure	7845 kPa
Oil pump pressure—test gauge valve closed	6500 to 7200 kPa
—test gauge valve open	800 to 1000 kPa
Pulley shaft to bush clearance	0.1 mm
Lubricant—type	Mitsubishi Power Steering Fluid
—quantity	800 ml

SPECIAL TOOLS

MB990925	Installer, oil seal
MB990662	Oil pressure gauge, power steering
MB990993	Pump adaptor, oil pressure gauge power steering
MB990994	Hose adaptor, oil pressure gauge power steering

TORQUE SPECIFICATIONS

	Nm
Suction plate	6 to 10
Connector nut—pump	50 to 70
Pressure hose nut	20 to 27
Oil pump cover	18 to 22
Oil pump bracket—Long bolt	20 to 27
—Short bolt	35 to 45

POWER STEERING OIL PUMP

Removal

(1) Remove the suction hose from the oil pump and drain the fluid into a container, refer Fig. 1.

(2) Remove the pressure hose from the oil pump, refer Fig. 1.

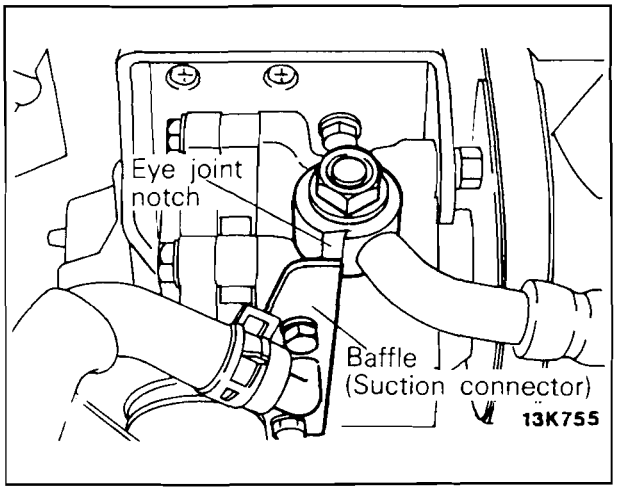


Fig. 1—Oil pump hose removal

(3) Loosen the drive belt tensioner lock nut, refer Fig. 2.

(4) Loosen the drive belt tensioner adjusting bolt sufficently to allow removal of drive belt from the oil pump pulley, refer Fig. 2.

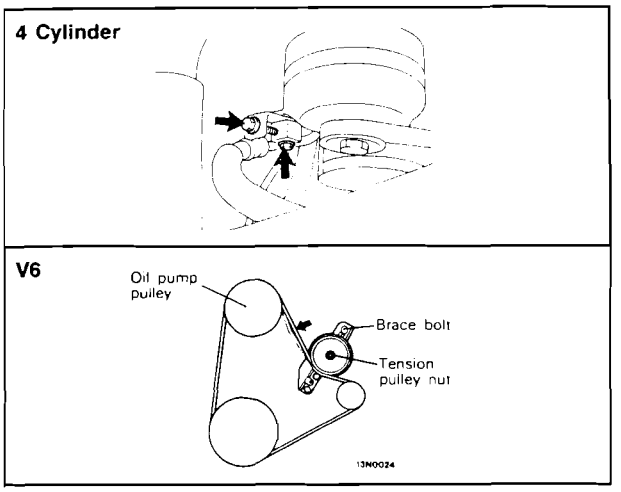


Fig. 2—Alternator drive belt removal

(5) Remove the two oil pump mounting bolts and remove the oil pump.

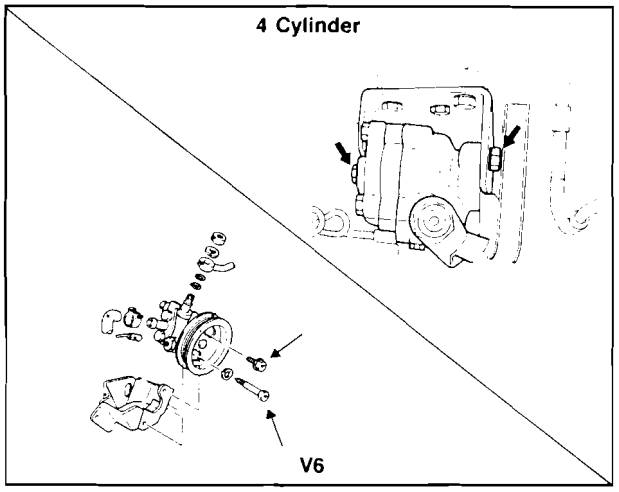


Fig. 3—Oil pump removal

Installation

(1) Install the pump to the mounting bracket on the engine and tighten mounting bolts to specified torque.

(2) Install the alternator drive belt and adjust the drive belt tension as follows:

(a) Tension the belt by turning the adjusting bolt.

(b) Check the drive belt deflection by applying a 10 kg load at the centre of top run of belt, the deflection should be 9-10 mm (4 cylinder models) and 6-9 mm (V6 models). If necessary, adjust the drive belt tension to the specified deflection by turning the adjusting bolt as required.

(c) Tighten the drive belt tensioner lock nut, refer Fig. 2.

(3) Reconnect the suction hose and pressure hose to the oil pump.

NOTE: The hoses should be positioned to avoid twisting and chafing.

(4) Fill the reservoir with the recommended fluid to the MAX. level on the dipstick.

(5) Bleed the power steering system as described in Section 2B in this group.

(6) Check the power steering oil pump pressure as outlined below.

Pressure Testing of Pump

(1) Disconnect the pressure hose from the oil pump and connect in the special tools, refer Fig. 4.

(2) Bleed the air as described in Section 2B in this group.

(3) With the engine at idle turn the steering wheel from lock to lock several times while the vehicle is stationary, so that the temperature of the fluid rises to approximately 50-60°C.

(4) Adjust the idle speed to 1000 ± 100 r.p.m.

(5) Fully close the shut off valve of the pressure gauge and measure the fluid pressure to confirm that it is within specifications.

(6) Repeat step(5) but this time open the shut off valve.

(7) Remove the special tools, connect pressure hose and tighten to specified torque.

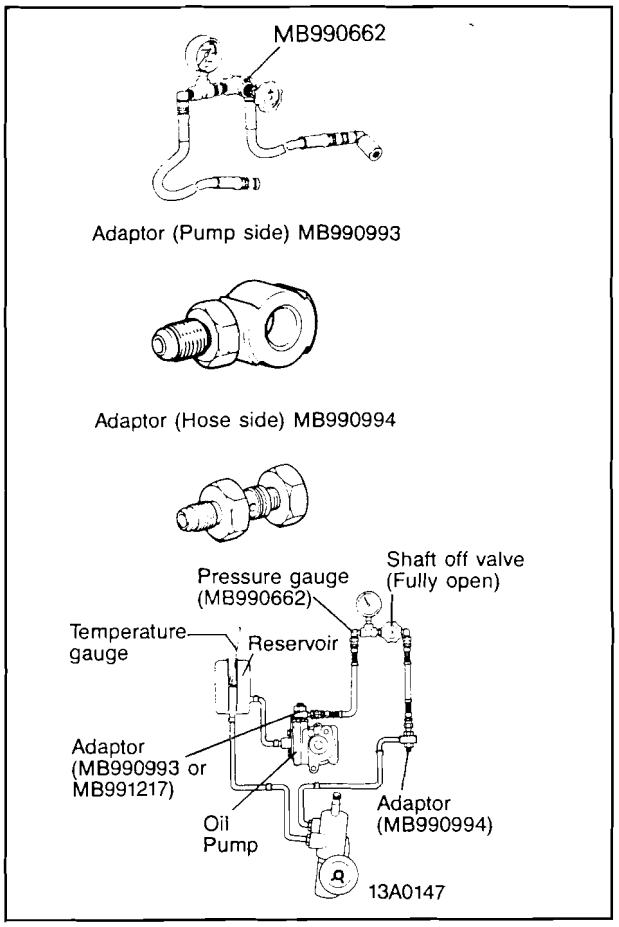


Fig. 4—Pressure testing system

(8) Adjust the idle speed back to the specified speed.

(9) Bleed the system as described in section 2B of this group.

DISASSEMBLY

(1) Remove the suction plate retaining bolts and remove suction connector along with "O" ring from the pump body, refer Fig. 11.

(2) Remove the four retaining bolts from the oil pump cover (refer Fig. 5) and remove the cover.

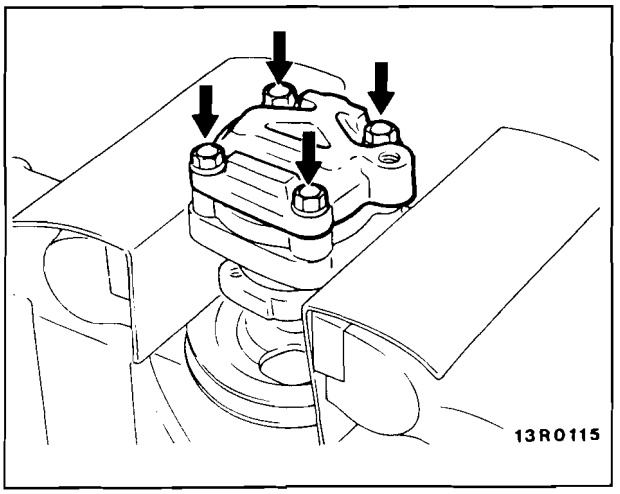


Fig. 5—Removing oil pump cover

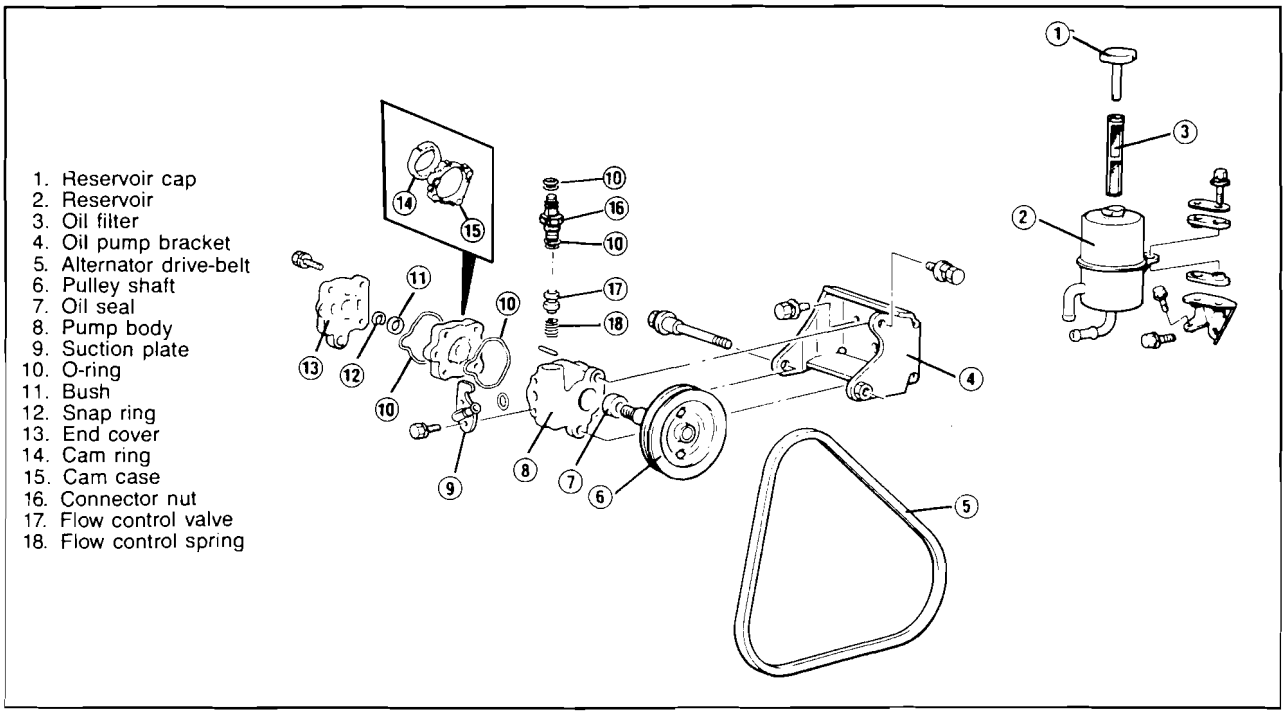


Fig. 6—Power steering oil pump components

(3) Remove the cam case and remove the O-rings from the cam case. Lift off the cam ring from the rotor.

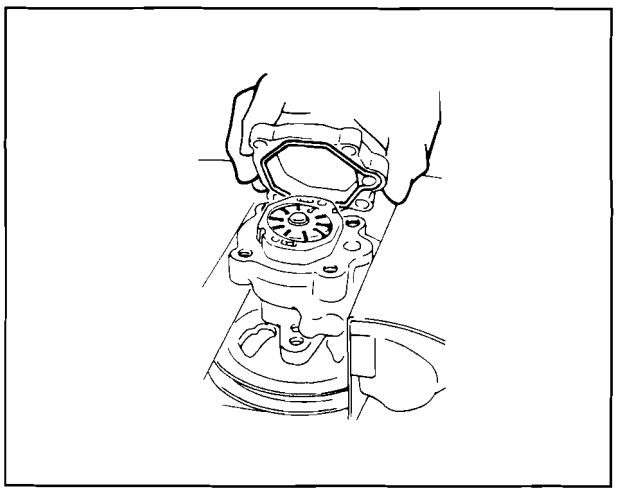


Fig. 7—Removing cam ring

(4) Carefully remove the vanes from the rotor.

(5) Remove the snap ring from the shaft and remove the rotor assembly, refer Fig. 8.

(6) Tapping the rotor side of the shaft lightly with a plastic hammer, remove the pulley shaft assembly, refer Fig. 9.

NOTE: The pulley is press fitted to the shaft, do not attempt to disassemble the pulley from the shaft.

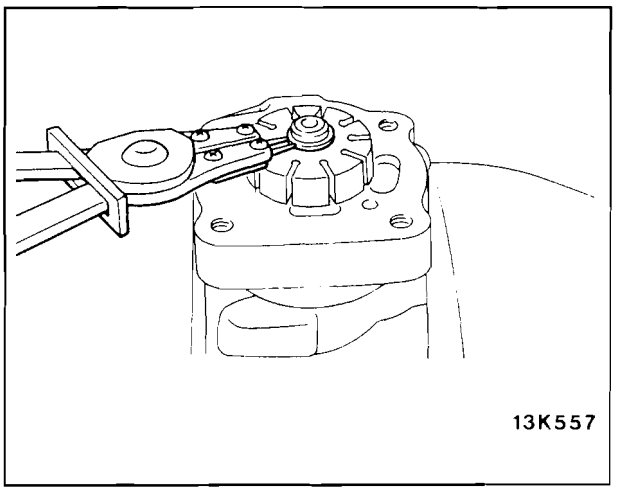


Fig. 8—Snap ring removal

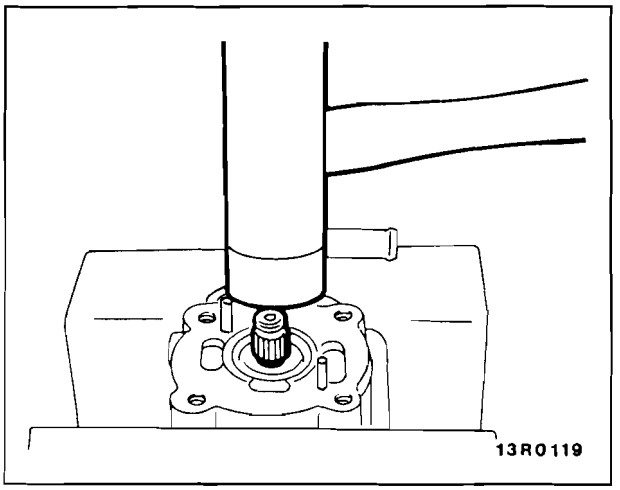


Fig. 9—Removing the pulley shaft assembly

(7) Remove the oil seal from the front of the pump body, refer Fig. 10.

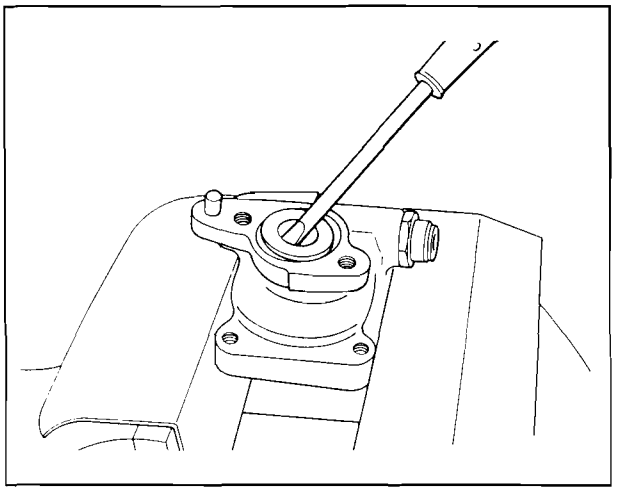


Fig. 10—Removing oil seal

(8) Remove the high pressure connector nut from the pump body and remove the flow control valve and flow control spring, refer Fig. 11.

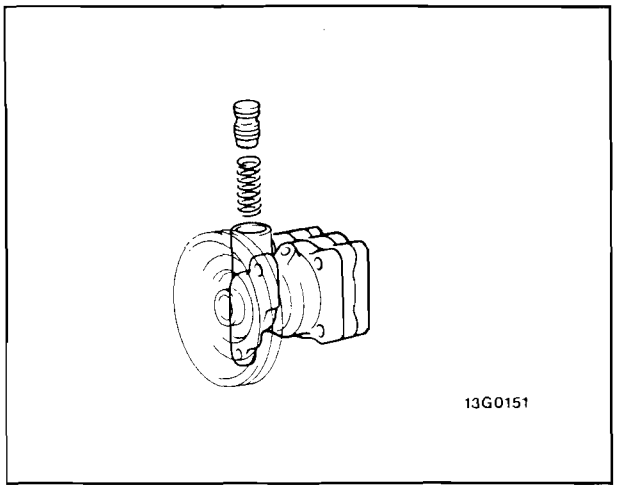


Fig. 11—Removing flow control valve

(9) Remove the O-ring from the control valve.

NOTE: Do not attempt to disassemble the flow control valve.

Inspection

(1) Check the flow control control valve for any signs of deterioration.
(2) Check the flow control valve for clogging and foreign material.
(3) Check the pulley shaft for wear and damage.
(4) Check the alternator drive belt for wear and deterioration.
(5) Check the grooves on the rotor for "stepped wear".
(6) Inspect the contact surface of the vanes and the cam ring for "stepped wear".
(7) Check the vanes for damage.
(8) Check the contact surface of the pump body and pump cover with the rotor, for "streak" like abrasions.

ASSEMBLY

(1) Ensure that the oil pump parts are clean by using a suitable solvent.
(2) Using special tool No. MB990925 or a suitable alternative, drive the oil seal into the pump body, refer Fig. 12.

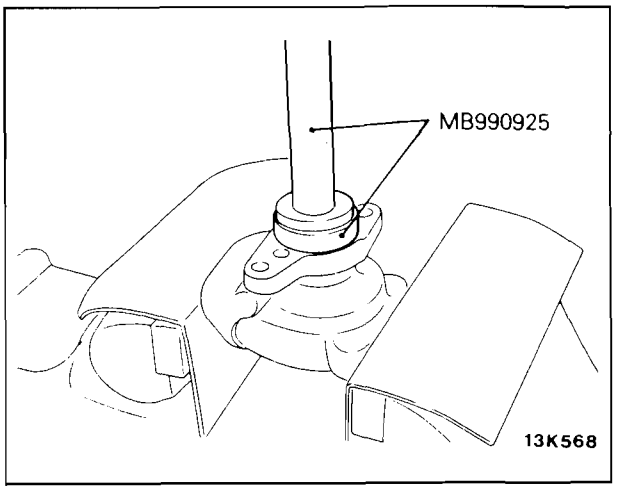


Fig. 12—Oil seal installation

(3) Lightly lubricate the pulley shaft and pump body bushing with the specified power steering fluid.
(4) With a dial indicator suitably positioned on the end of the pulley shaft, move the shaft up and down to measure the clearance between the shaft and the bush, refer Fig. 13. If the clearance exceeds specification, the housing and the oil seal must be replaced.

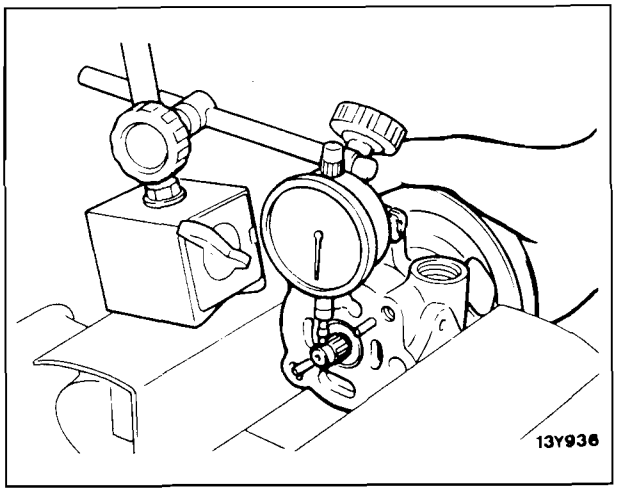


Fig. 13—Measuring shaft to bush clearance

(5) Lubricate the outside of the flow control valve with power steering fluid and install the valve with its spring and connector nut into the pump body.

(6) Mount the rotor onto the shaft and install a new snap ring, taking care to avoid opening the snap ring wider than necessary.

NOTE: The countersunk side of the rotor should face towards the pump cover, refer Fig. 14. A punch mark is also located on the pump cover side of the rotor.

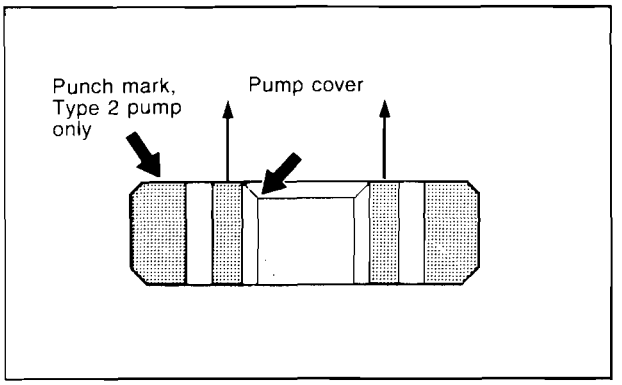


Fig. 14—Rotor installation

(7) Lift the rotor and check to ensure the snap ring is seated correctly in the groove of the shaft, refer Fig. 15.

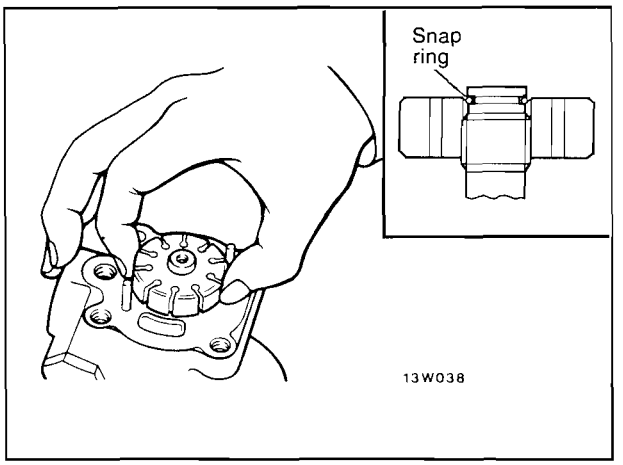


Fig. 15—Checking rotor installation

(8) Install the cam ring, aligning the dowel pins of the pump body with the dowel pin holes of the cam ring and also so that the punch mark on the cam ring is facing to the pump body, refer Fig. 16. Apply power steering fluid to the O-rings. Attach the O-rings to the cam case and install the cam case.

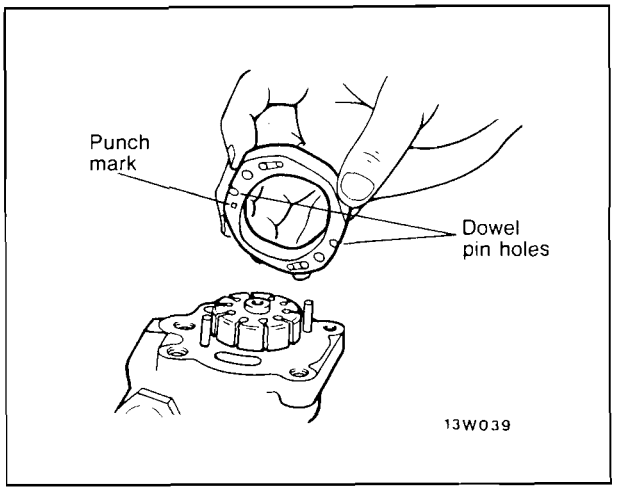


Fig. 16—Installing cam case

(9) Apply power steering fluid to the vanes and install the vanes in the rotor, ensuring that the rounded edge of the vanes contacts the cam ring, refer Fig. 17.

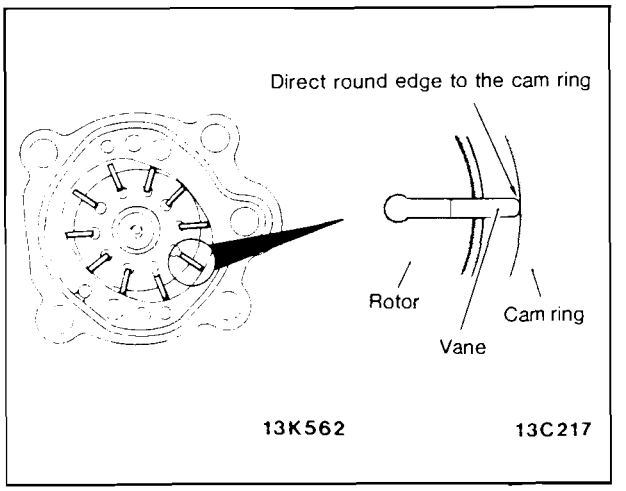


Fig. 17—Installation of rotor vanes

(10) Install the pump cover and tighten bolts to the specified torque.

(11) Apply power steering fluid to the suction tube and O-ring and install suction plate and tighten to the specified torque.

SECTION 2B — POWER STEERING — RACK AND PINION TYPE

SPECIFICATIONS

Steering gear type	Torsion bar type, power assisted rack and pinion
Rack stroke — V6 models	144 mm
— 4 cyl man/trans models & TS/KS (ALL)	144 mm
— 4 cyl auto/trans models	141.5 mm
Number of turns lock to lock	
— V6 models	3.15
— 4 cyl man/trans models & TS/KS (ALL)	3.15
— 4 cyl auto/trans models	3.09
Steering wheel freeplay — measured at steering wheel circumference	0 to 30 mm
Stationary steering effort fluctuation range	0.6 kg or less
Stationary steering effort	3.1 kg or less
Pinion starting torque — 60° to 180°	0.7 to 1.2 Nm near centre rack strokes
— 0 to 60°	1.3 to 1.8 Nm near full LH or RH lock
Rack support cover adjustment	0 to 25 Nm and back off 30 to 60°
Tie rod swing torque	2 to 5 Nm (spring balance reading-0.8 to 2.0 kg)
Tie rod end to boot length	197.6 ± 1 mm
Tie rod end starting torque	0.5-2.5 Nm
Tie rod continuous rotating torque	0.4 to 2.5 Nm
Tie rod end axial play (max.)	0.7 mm @ ± 1000N load
Tie rod end side play (max)	0.3 mm @ ± 1.5 1000N load
Tie rod end ball joint end play	1.5 mm max

Models	Inner steering angle		Outer steering angle	
	Right Turn	Left Turn	Right Turn	Left Turn
TS/KS ALL	37° ± 2°	35°30' ± 2°	30°30'	29°45'
4 cyl auto/trans	37° ± 2°	35°30' ± 2°	30°30'	29°45'
V6 and 4 cyl man/trans	37° ± 2°	37° ± 2°	30°30'	30°30'

NOTE: For complete wheel alignment specification, refer to Group 33A.

Lubrication — rack and pinion section	Multipurpose grease NLGI Grade No. 3
— hydraulic assist section	Mitsubishi Power Steering Fluid

SPECIAL TOOLS

E19M10A	Steering wheel puller
E2237	Tie rod end remover
E19M25	Pinion preload socket
E37M1S	Power steering kit
—E37M01-1	Rack stopper
—E37M01-2	Oil seal installer/remover
—E37M01-3	Installer—pinion bearing and seal
—E37M01-4 Use with E3701-3	Installer—pinion oil seal
—E37M01-5	Pinion, needle bearing installer
—E37M01-6	Rack seal protector
—E19M50-9	Installer—pinion seal protector

TORQUE SPECIFICATIONS

	Nm
Mounting bolts	60 to 80
Rack support plug lock nut	50 to 70
Pinion housing end plug	50 to 70
Pinion housing attaching bolts	17 to 26
Pinion self locking nut	20 to 30
Tube nuts	12 to 18
Tie rod to rack	80 to 100
Tie rod end lock nut	50 to 55
Tie rod to knuckle attaching nut	24 to 34
Feed tube flare nut	15

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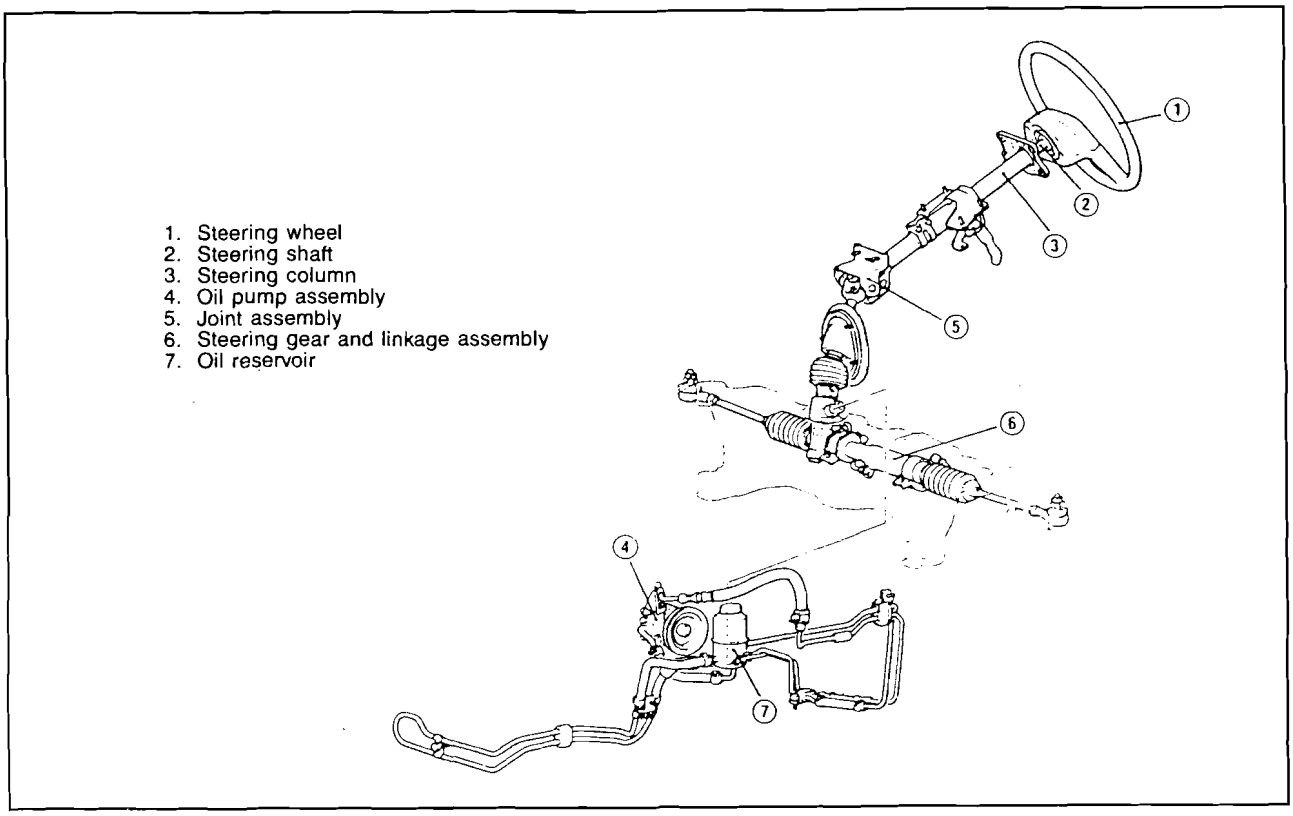


Fig. 1—Power steering components

GENERAL INFORMATION

The rack and pinion power steering is designed to be speed related i.e. high boost is provided at low speeds for ease in city driving and parking and low boost at high speeds for maximum control. A vane type pump driven from the crankshaft via the alternator drive belt, supplies fluid under pressure to the rack and pinion steering gear.

INSPECTION AND ADJUSTMENT

Steering Wheel Free Play

(1) With the engine running and the steering wheel in the straight ahead position, measure the distance (at the steering wheel circumference) which the steering wheel moves, when gently moved to the left and right, before the tyres begin to move.

(2) If the free play exceeds the required limit, check for play at each connection of the steering shaft, joint assembly and steering linkage. Repair as necessary.

(3) If after making the above checks the freeplay still exceeds the limit switch the engine off and with the steering wheel in the straight ahead position, check the free play while applying a 5 N force in either direction to the steering wheel circumference, refer Fig. 3.

(4) If the free play exceeds the required limit remove the steering gear assembly and check and adjust the pinion starting torque.

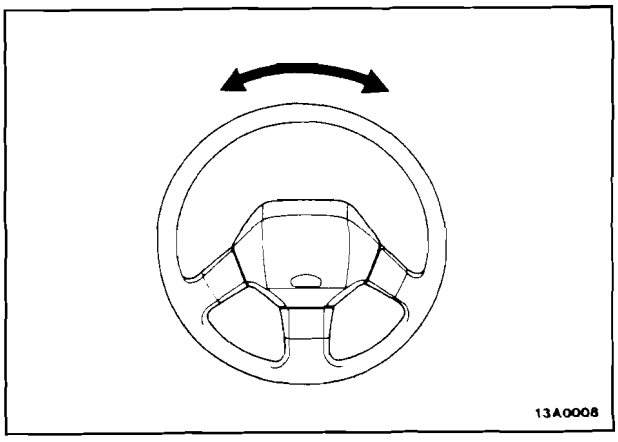


Fig. 2—Steering wheel free play

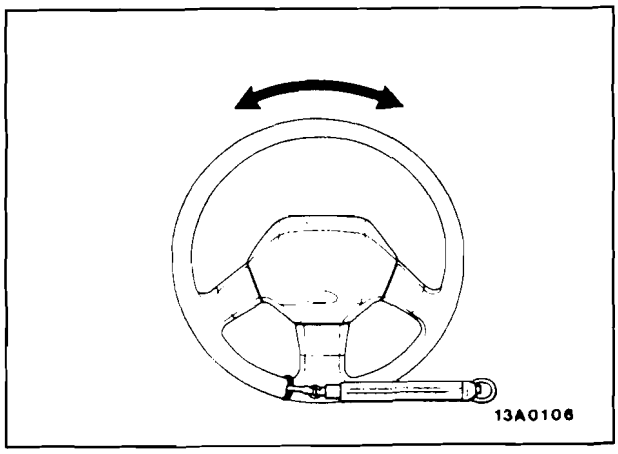


Fig. 3—Checking free play with applied force

Stationary Steering Effort

(1) Position the vehicle on a flat paved surface with the steering wheel in the straight ahead position.
(2) Start the engine and set to a speed of 1000 ± 100 r.p.m.
(3) Attach a spring scale to the outer circumference of the steering wheel and measure the force required to turn the steering wheel from the straight ahead position to the left and right (within a range of 1¼ turns). Check also, to ensure there is no significant fluctuation while measuring the force.

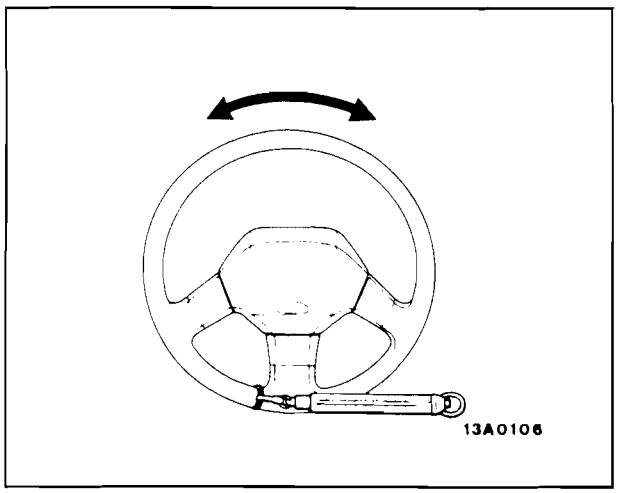


Fig. 4—Checking stationary steering effort

(4) If the measured force, exceeds the required specification, refer to "Steering Operation is Heavy", in Service Diagnosis—Power Steering and make the required adjustments.

NOTE: On completion of all checks, ensure the idle speed is reset to specification.

Steering Wheel Return

(1) Conduct a road test and check as follows:-
(a) Make both gradual and sudden turns and check the steering "feeling" to ensure there is no difference in the steering force required and the wheel returns between left and right turns.
(b) At a speed of 35 km/h turn the steering wheel 90° and release after 1 or 2 seconds. If the steering wheel returns 70° or more, the system is operating correctly.

NOTE: There will be a momentary feeling of "heaviness" when the steering wheel is turned quickly due to the low discharge rate of the oil pump at low engine speed. This is not a malfunction.

(c) If the steering wheel does not return correctly, refer to Service Diagnosis—Power Steering and make the required adjustments.

Checking Power Steering Fluid Level

(1) Park the vehicle on a flat level surface and start the engine.
(2) Turn the steering wheel several times in either direction to raise the fluid temperature (50-60°C).
(3) Check the fluid in the reservoir for foaming or milkiness.
(4) Check the fluid level using the dipstick on the reservoir cap. Top-up if necessary through the filter in the reservoir neck.

NOTE: Use only Mitsubishi Power Steering Fluid.

Replacement of Power Steering Fluid

(1) Raise the front of the vehicle and support on jack stands.
(2) Disconnect the return hose from the reservior and drain the fluid into a container.
(3) Disconnect the **primary** cable from the coil and while operating the starter motor intermittently, turn the steering wheel from lock to lock several times to drain all the fluid.

NOTE: Ensure the primary cable is not positioned near the fuel system.

(4) Fit the return hose onto the reservoir and secure it with a clip.
(5) Fill the reservoir with fluid until it appears in the bottom of the filter.
(6) Bleed the air from the system.

Bleeding the System

(1) Disconnect the **primary** cable from the coil and while operating the starter motor intermittently, turn the steering wheel from lock to lock 5 or 6 times (for 15 to 20 seconds).

NOTE: During the bleeding operation, ensure the fluid level does not fall below the bottom of the reservoir filter.

NOTE: Carry out the bleeding only while cranking the engine. If bleeding is done while the engine is idling, the air will be broken up and absorbed into the fluid.

(2) Connect the primary cable to the coil and start the engine (idling).
(3) Turn the steering wheel from left to right until there are no air bubbles visible in the reservoir.
(4) Check that the fluid is not milky and the level is correct on the dipstick.
(5) Check that there is only a slight change in fluid level when the steering wheel is turned left and right. If the fluid level changes considerably, bleed the system again.

NOTE: If the fluid level rises suddenly when the engine is stopped it indicates there is still air in the system. If there is air in the system, a jingling noise may be heard from the pump, while the control valve may also make strange noises. Air in the system will shorten the useful life of the pump and other components.

STEERING GEARBOX

Removal

(1) Raise the vehicle and support on jack stands at the required points.

(2) Remove the road wheels.

(3) Remove the tie rod end split pin and nut. Using Special Tool E2237, disconnect the tie rod end from the knuckle.

(4) Disconnect the return hose from the reservoir and drain the fluid as outlined in Fluid Replacement, this Section.

(5) Remove the lower column joint clamp bolt, refer Fig. 5.

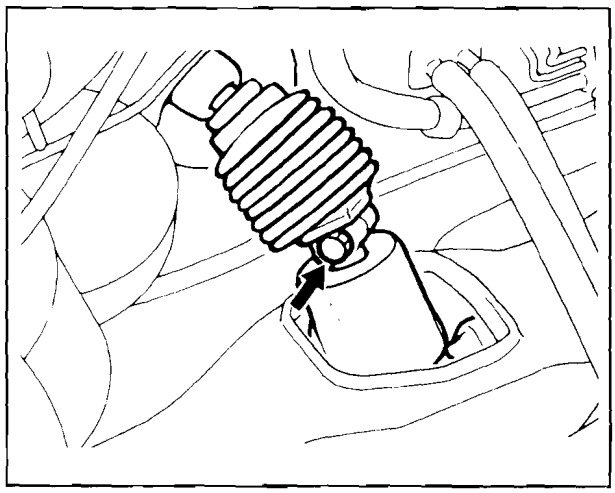


Fig. 5—Lower column joint bolt

(6) Disconnect the pressure and return tubes from the top of the gearbox.

(7) Remove the right and left crossmember mounting bolts, refer Fig. 6.

(8) Remove front sway bar mounting bolts to gain access to steering box mounting bolts.

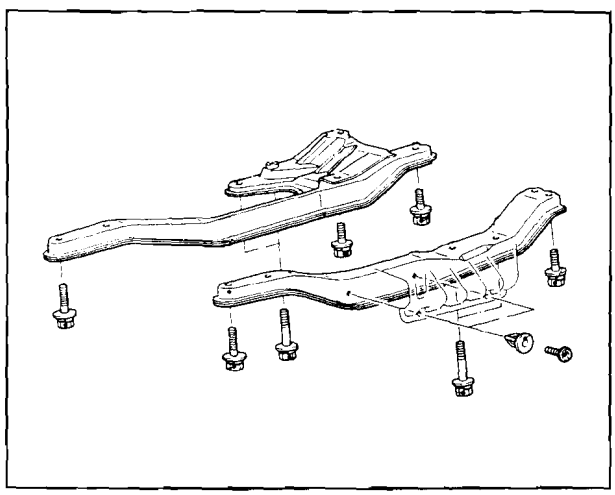


Fig. 6—Cross member mounting bolts

NOTE: To aid steering gearbox removal it may be necessary to remove the rear RH lower control arm mounting bolts and move lower control arm for clearance.

(9) Remove the four steering box mounting bolts, refer Fig. 7. Move the assembly completely to the left pull down on the centre member, tilt the steering box downward and remove it to the right.

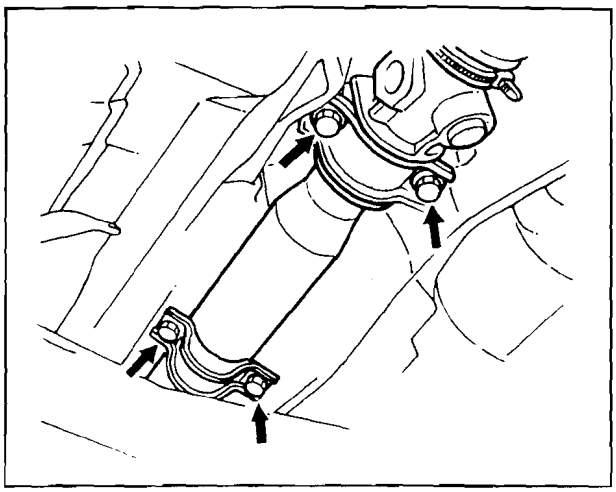


Fig. 7—Gearbox mounting bolts

Installation

Install the gearbox assembly by reversing the removal procedure noting the following:

(1) Align the projection of the housing end mounting end rubber with the indentation in the cross-member, install the mounting bolts and tighten to the specified torque.

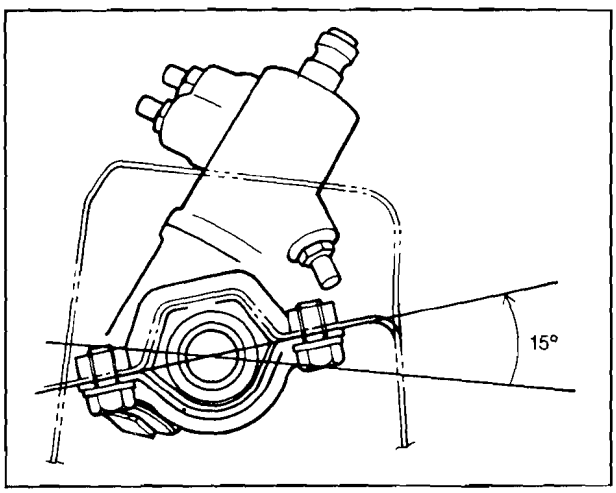


Fig. 8—Mounting rubber installation

(2) Tighten tie rod end nuts to the specified torque and install new split pins.

(3) Adjust the wheel alignment to specification.

NOTE: Ensure the steering gearbox bellows are not twisted after adjusting the tie rods.

(4) Fill the system with the specified lubricant and bleed off the air as previously outlined in this Section.

Inspection Prior to Disassembly

Secure the gearbox assembly at the mounting positions in a vice with protective plates on the jaws and carry out the following checks:-

• Pinion Starting Torque

(1) With the aid of Special Tool E19M25 and a preload gauge, turn the pinion at a slow steady rate through the whole stroke of the rack to measure the turning torque of the pinion, refer Fig. 9.

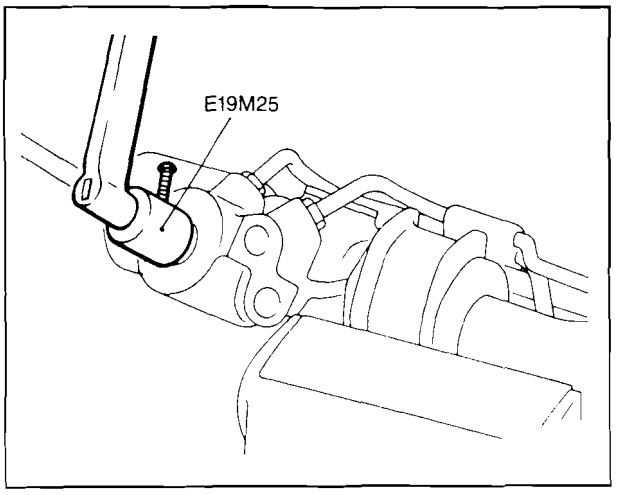


Fig. 9—Measuring pinion starting torque

(2) If the torque is not within the specified range, adjust the rack support cover (refer to "Assembly" this section) and recheck the torque. If the torque cannot be adjusted to the specified range, check the rack support assembly and replace any parts necessary.

• Tie Rod Assembly Swing Torque

(1) Place the tie rod in a vertical position and swing the rod back and forth 10 times.

(2) Use a spring balance to measure the tie rod swing torque at the position shown in Fig. 10.

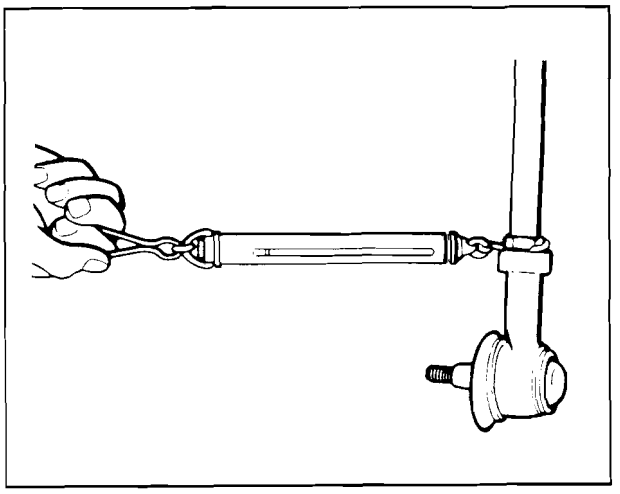


Fig. 10—Measuring tie rod swing torque

(3) If the torque reading is not within the specified range, replace the tie rod.

• Tie Rod End Ball Joint Starting Torque

(1) Attach a nut and lock nut to the ball joint and rotate stub 5 times to the right and then to the left and wait 30 seconds, then using a socket and preload gauge measure the starting and continuous rotation torque, refer Fig. 11.

(2) If the torque reading is not within the specified range, replace the tie rod end.

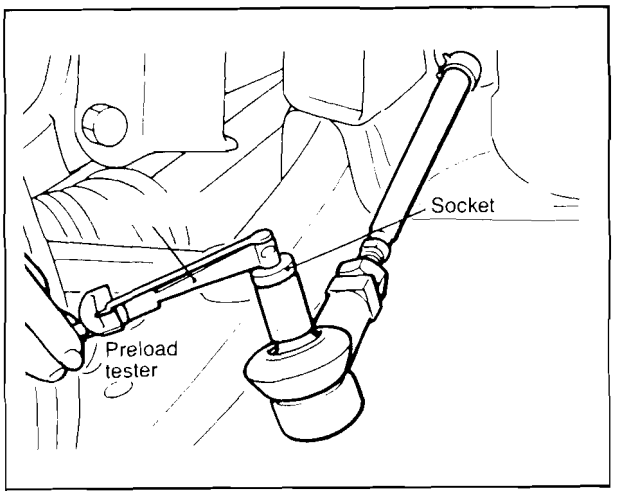


Fig. 11—Measuring ball joint starting and continuous rotation

• Bellows inspection

(1) Flex the bellows by hand and inspect for cuts and damage. Replace if necessary.

(2) Check that the bellows are secured in the correct position. Adjust if necessary.

DISASSEMBLY

(1) Remove the tie rod ends from the tie rods.

(2) Carefully remove the clip rings and remove the dust covers from the tie rod ends.

(3) Using a screwdriver, remove the inside bellows clip, refer Fig. 12.

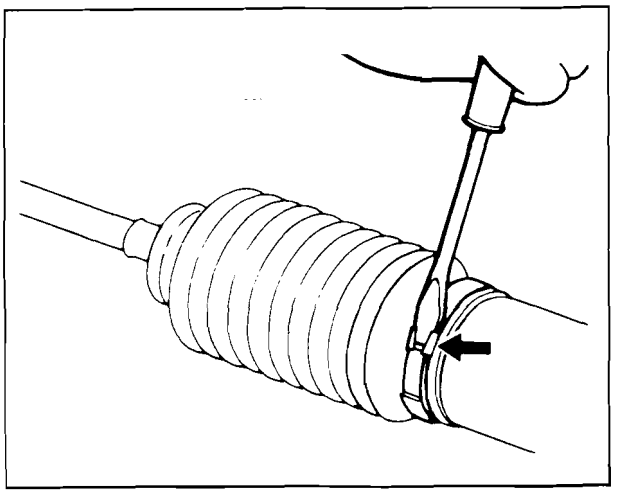


Fig. 12—Removing inside bellows clip

(4) Using multigrips remove the outside bellows securing clip. Remove the bellows.

(5) Disconnect the feed tubes from the lower part of the gearbox housing. Move the rack slowly to remove any fluid from the gear housing and tube.

1. Tie-rod end locking nuts
2. Tie-rod ends
3. Feed tubes
4. Dust covers
5. Bellows clips
6. Bellows bands
7. Bellows
8. Tab washers
9. Tie-rods
10. Feed tubes
11. O-rings
12. End plugs
13. Self locking nuts
14. Lock nut
15. Rack support cover
16. Rack support spring
17. Rack support
18. Valve housing
19. Oil seal
20. Pinion and valve assembly
21. Seal rings
22. Ball bearing
23. Oil seal
24. Circlip
25. Rack stopper
26. Rack bushing
27. Rack
28. O-ring
29. Oil seal
30. Seal rings
31. O-ring
32. Ball bearing
33. Needle roller bearing
34. Oil seal
35. Back up washer
36. Rack housing

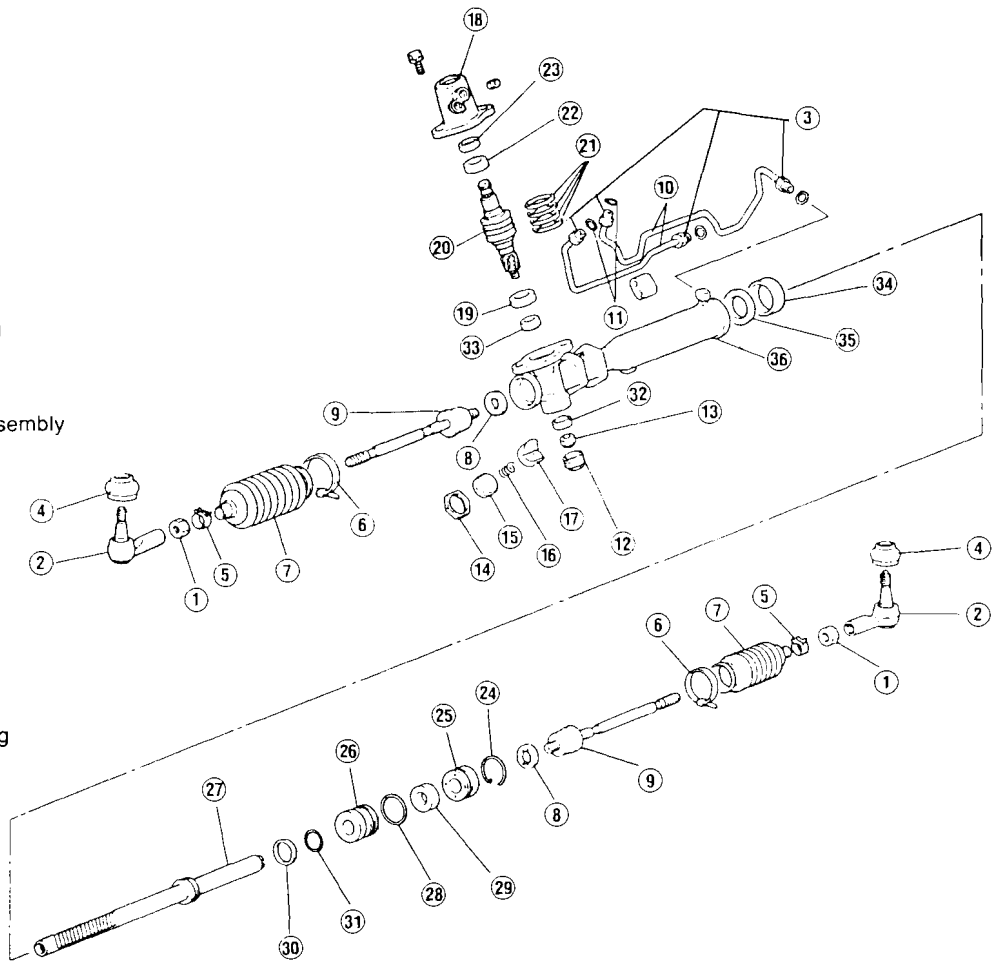


Fig. 13—Steering gearbox components

(6) Using a chisel, bend back the tab washers securing the tie rods to the rack, refer Fig. 14.

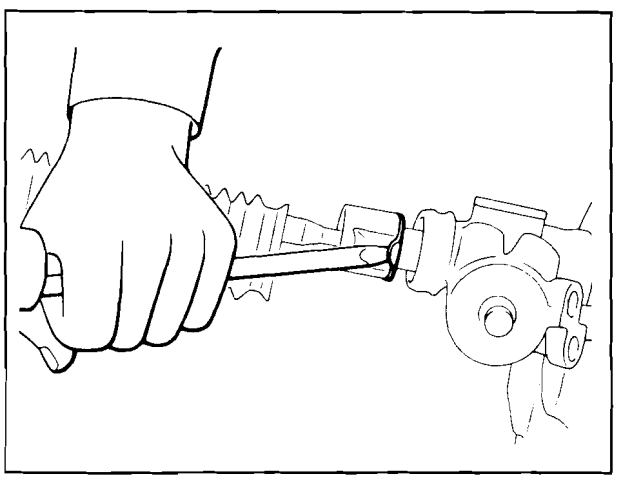


Fig. 14—Bending back tab washer

(7) Remove the end plug from the lower part of the gear housing.

(8) Remove the self locking nut from the lower end of the pinion, refer Fig. 15.

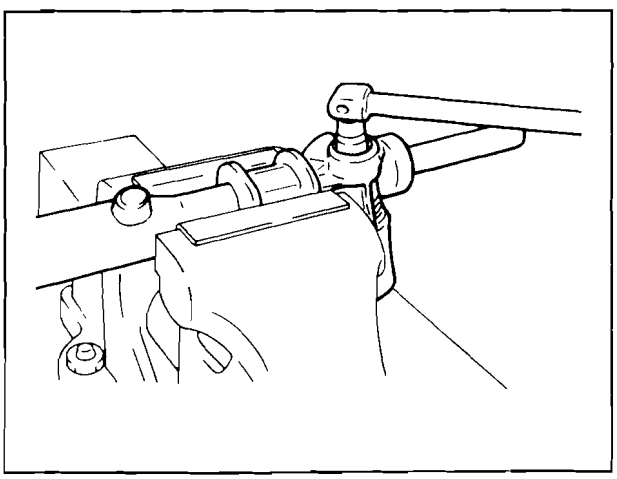


Fig. 15—Removing self locking nut

(9) Unscrew and remove the tie rods from the rack.
(10) Remove the rack support cover lock nut.

(11) Using a suitable tool remove the rack support cover from the gearbox. Remove the rack support and support spring, refer Fig. 16.

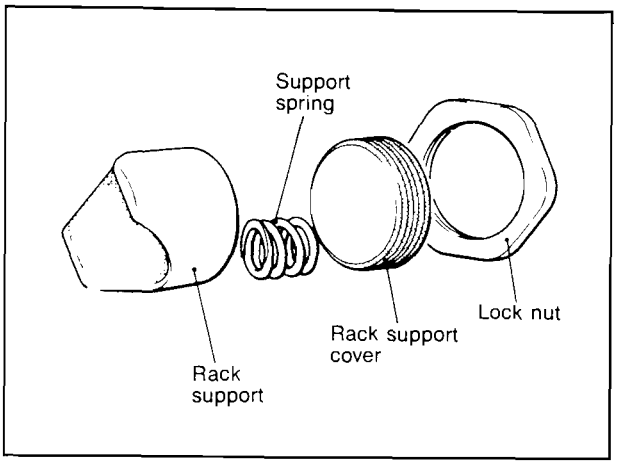


Fig. 16—Rack support assembly

(12) Remove the valve housing retaining bolts and remove the housing.
(13) Using a suitable plastic hammer gently tap the pinion to remove it from the housing.

NOTE: Be careful not to drop and damage the pinion and valve assembly.

(14) Fit the two projections on Special Tool E37M01-1 into the holes located in the rack stopper, refer Fig. 17.
(15) Turn the rack stopper clockwise until the straight end of the spring clip protrudes through the opening in the tube. Reverse the direction of rotation and withdraw the clip from the slot, refer Fig. 17.

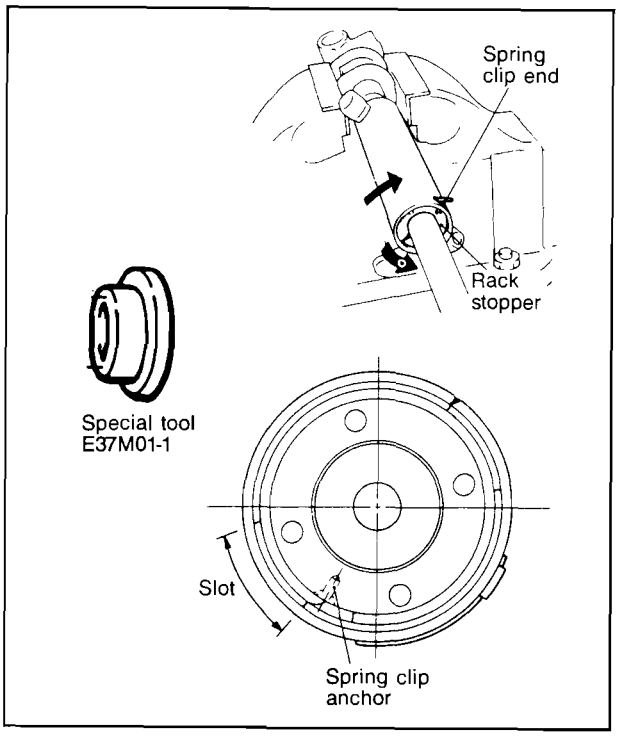


Fig. 17—Removing spring clip

(16) Remove the rack stopper, rack bushing and rack from the housing.

NOTE: If the rack is removed, the oil seal at the pinion end of the tube must be replaced.

(17) Using a screwdriver, remove the O-ring from the rack bushing.
(18) Secure the rack bushing in a vice fitted with protective jaws and prise out the oil seal with a screwdriver, refer Fig. 18.

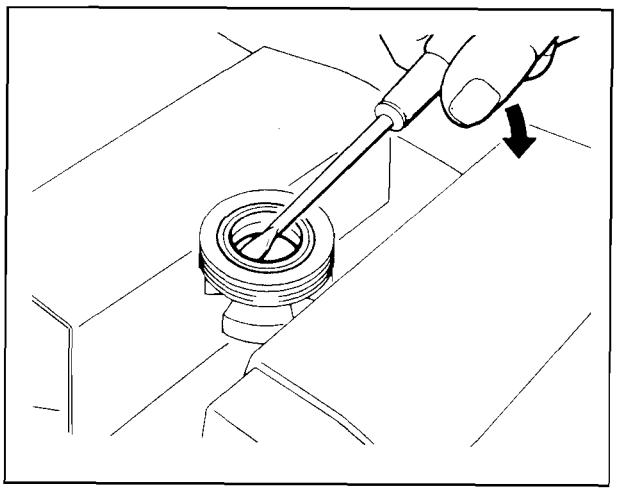


Fig. 18—Removing rack support oil seal

(19) Using a brass bar or a suitable drift, remove the ball bearing, needle bearing and oil seal from the housing, refer Fig. 19.

NOTE: Be careful not to damage the wall of the pinion valve cylinder while removing the bearings.

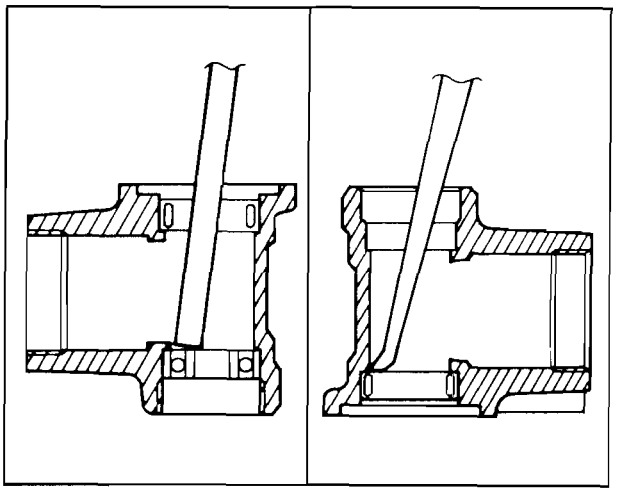


Fig. 19—Removing bearings

(20) Using Special Tool E3701-2 (Bearing remover/installer), remove the back-up washer and oil seal from the housing tube, refer Fig. 20.

CAUTION: When removing the inner rack seal backup washer the inner diameter of the washer may become burred, ensure when re-using the back washer that all burring is removed so as not to damage the seal protector tool E37M01-6.

(21) Using a screwdriver, carefully remove the seal rings from the rack piston and pinion and valve assembly.

NOTE: While removing the seal rings, take care not to damage the grooves.

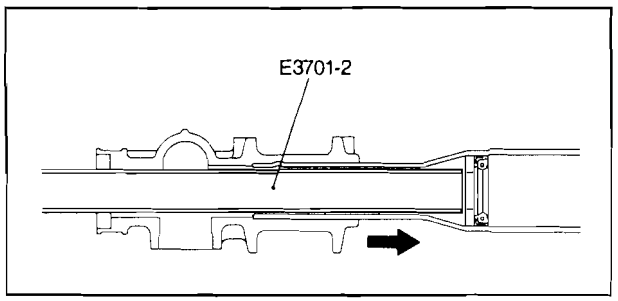


Fig. 20—Removing housing tube oil seal

Inspection

- **Rack**

(1) Check the rack teeth for wear and damage.
(2) Check the oil seal contact surfaces for uneven wear.
(3) Check the seal ring for wear or damage. Replace if necessary.
(4) Check the oil seal for wear or damage. Replace if necessary.
(5) Check the rack for bend.

- **Pinion and Valve Assembly**

(1) Check the pinion gear teeth faces for wear or damage.
(2) Check the oil seal contact surfaces of the pinion and valve assembly for damage.
(3) Check the seal rings for wear or damage, replace if necessary.
(4) Check the oil seal lip for wear or damage, replace if necessary.

- **Bearings**

(1) Check the bearings for roughness or abnormal noise during operation.
(2) Check the bearings for wear.
(3) Check the needle roller bearing for wear.

- **Housing and Mountings**

(1) Check the cylinder inner surface of the pinion and valve housing for damage.
(2) Check the bellows for damage, cracking or deterioration.
(3) Check the mounting rubbers for cracks or damage.
(4) Check the rack support for uneven wear.
(5) Check the rack bushing for uneven wear or damage.

ASSEMBLY

(1) Apply a coating of the specified power steering fluid to the seal rings and install them into the seal grooves of the pinion and valve assembly.
(2) Use special tool E19M50-9 to compress the seal rings, so they are well seated into the grooves, refer Fig. 21.

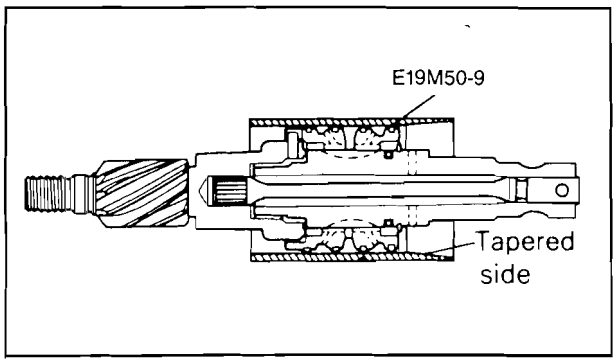


Fig. 21—Kneading pinion seals

(3) Apply a coating of the specified power steering fluid to a new housing tube inner seal. Using Special Tools E37M01-3 and 4, press the back-up washer and oil seal into the housing tube until the washer bottoms out on the end of the tube, refer Fig. 22.

NOTE: Remove any burring from inner diameter at back up washer before reassembly so as not to damage seal protector tool E37M01-6.

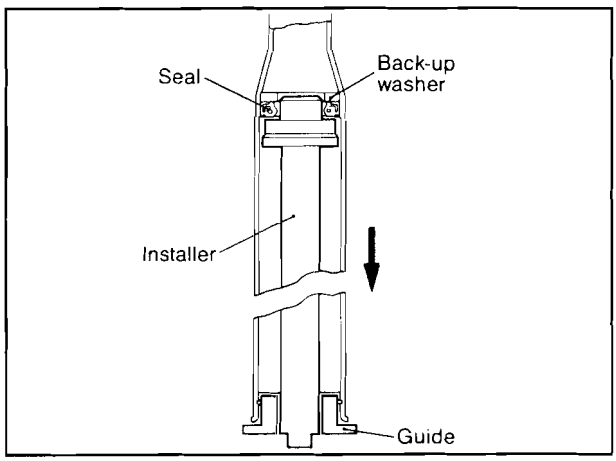


Fig. 22—Installing housing tube inner seal

(4) Apply a coating of Mitsubishi Power Steering Fluid to the needle bearing. Using Special Tools E37M01-5. Press the bearing into the housing until it bottoms out on its seat, refer Fig. 23.

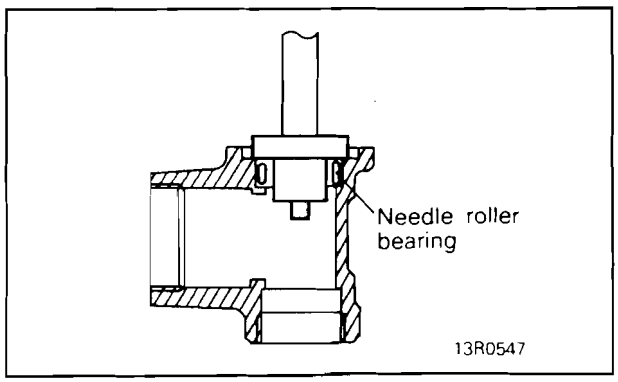


Fig. 23—Installing needle bearing

(5) Apply a coating of Mitsubishi power steering fluid over the pinion oil seal, press the seal into the housing.

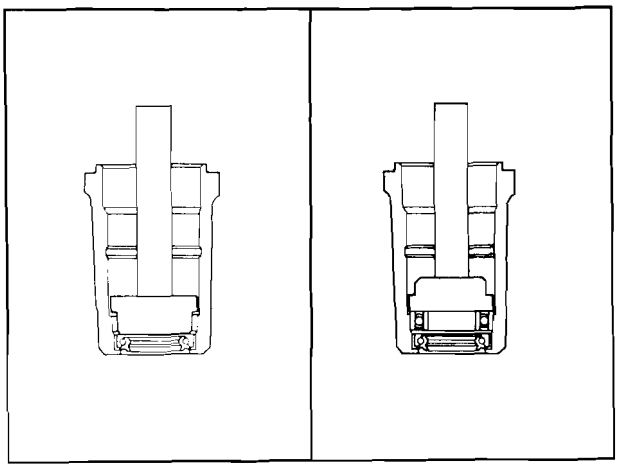


Fig. 24—Installing pinion housing ball bearing and seal

(6) Apply a coating of the specified power steering fluid to the lower pinion bearing. Using Special Tool E37M01-3, press the bearing into the lower end of the housing.

(7) Apply a coating of power steering fluid over the rack bushing oil seal and press the seal into the bushing. Ensure the seal lip is facing toward the inner end of the bushing.

(8) Apply a coating of power steering fluid over the O-ring and install on the rack bushing.

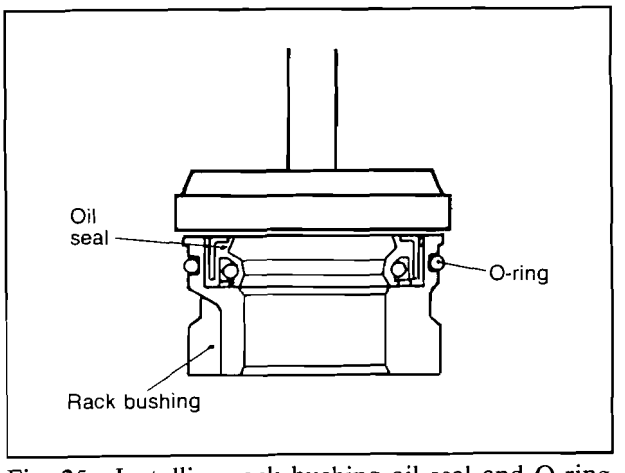


Fig. 25—Installing rack bushing oil seal and O-ring

(9) Apply a coating of power steering fluid over the rack piston O-ring and install on the rack piston.

(10) Apply a coating of the specified multipurpose grease to the rack teeth.

NOTE: Ensure the grease does not clog the ventilation holes in the rack.

(11) Apply a liberal coating of the specified power steering fluid to all surfaces of Special Tool E37M01-6, cover rack teeth with special tool then carefully insert the rack into the gear housing, refer Fig. 26, then remove the special tool.

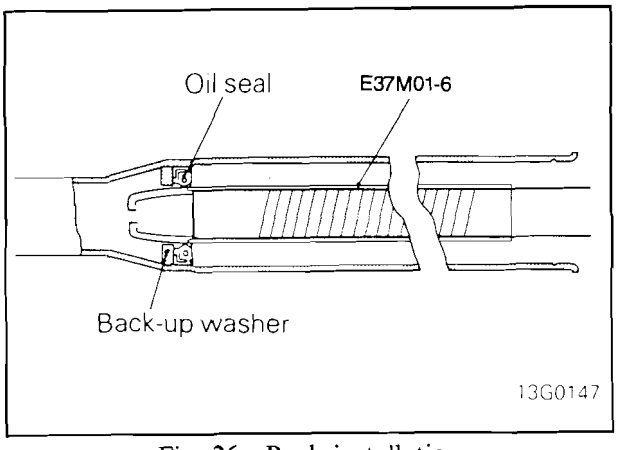


Fig. 26—Rack installation

(12) Smear the end of the rack protruding from the tube with petroleum jelly and carefully install the rack bushing and stopper, refer Fig. 27.

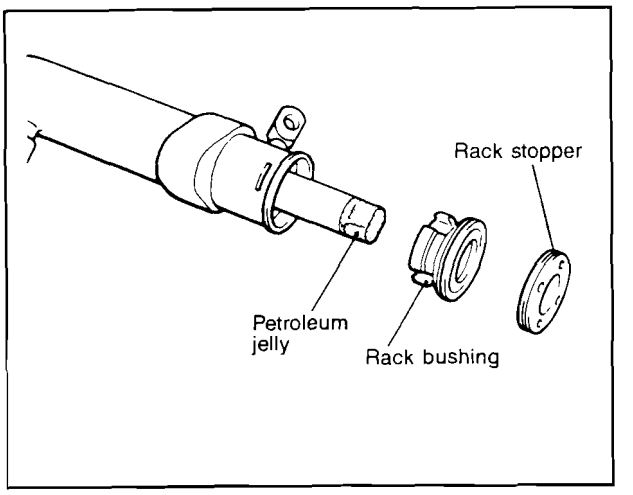


Fig. 27—Installing rack bushing and stopper

(13) Using Special Tool E37M01-1 rotate the rack bushing until the spring clip anchor hole is showing in the slot of the housing tube. Fit the hooked end of the clip in the anchor hole so that clockwise rotation of the rack bushing will feed the clip into the tube. Feed the clip into the tube until neither end of the clip is visible in the slot, refer Fig. 28.

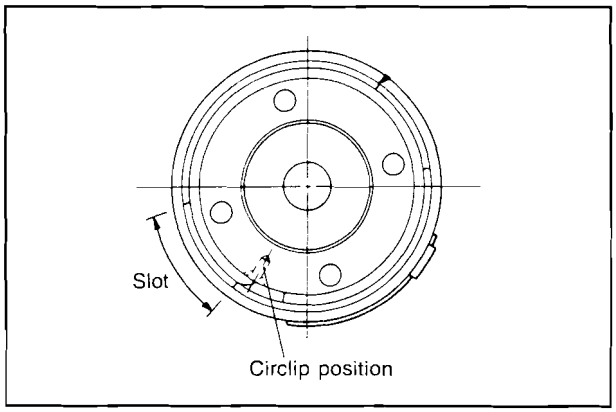


Fig. 28—Installed spring clip position

(14) Apply the specified multipurpose grease to the pinion teeth surfaces. Apply power steering fluid to the pinion valve seal ring surfaces. Install the pinion and valve assembly into the gear housing.

(15) Apply power steering fluid to the pinion shaft surface which contacts the oil seal. Using a suitable installer press the oil seal into the housing.

CAUTION: In order to eliminate a seal malfunction at the valve housing alignment surface, the upper surface of the oil seal should project outward approximately 1 mm (0.039 in.) from the housing edge surface.

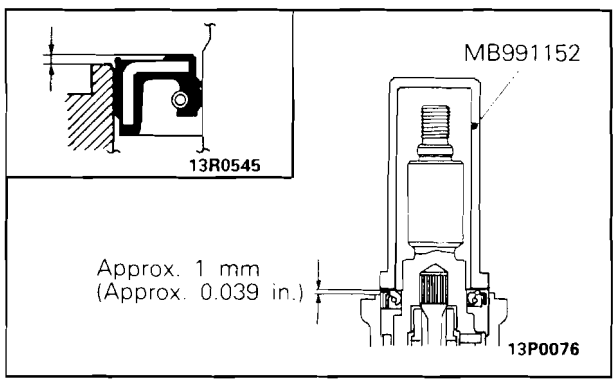


Fig. 29—Installing upper pinion oil seal

(16) Apply the specified multipurpose grease to the rack support surface in contact with the rack. Apply semi-drying sealant to the threaded part of the rack support cover.

(17) Install the rack support, spring support cover and locknut. **Do not tighten.**

(18) Check the ventilation holes in the tie rod threaded sections are clear and screw the tie rods into the rack using a new tab washer for each tie rod. Temporarily tighten the L.H. tie rod only.

(19) Install a new self locking nut to the pinion thread and tighten to the specified torque.

(20) Apply semi-drying sealant to the threaded part of the end plug. Tighten the plug to the specified torque. Using a punch, secure the end plug at two places.

NOTE: A new end plug should be used.

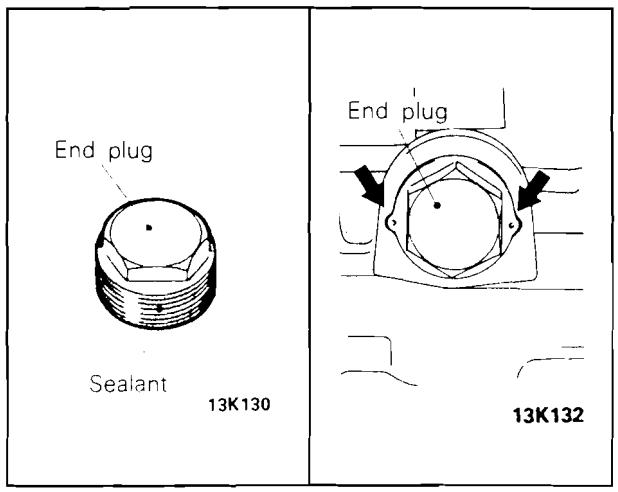


Fig. 30—Installing end plug

NOTE: Adjust total pinion pre-load as follows:

A. Position rack at its centre. Tighten rack support cover to 15 Nm.

NOTE: For an E.P.S. gear box, use the special tool.

B. In neutral position, rotate pinion shaft clockwise one turn/4-6 seconds with special tool. Return rack support cover 30°-60° and adjust torque to the standard value.

C. Using the special tools, rotate the pinion gear at the rate of one rotation in approximately 4 to 6 seconds to check the total pinion pre-load.

Standard value:

		Total pinion preload	Change in torque
Conventional power steering gear box	0° (Neautral position) - 60°	1.3 - 1.8 Nm	0.3 Nm
	60° - 180°	0.7 - 1.2 Nm	0.3 Nm

CAUTION:

1. When adjusting, set the standard value as its highest value.

2. Assure no ratcheting or catching when operating rack towards the shaft direction.

NOTE: When it cannot be adjusted within the specified return angle, check rack support cover components or replace.

D. After adjusting, lock rack support cover with lock nut.

(21) Tighten the tie rods to the specified torque and bend over the tab washer onto the notches in the tie rod, refer Fig. 31.

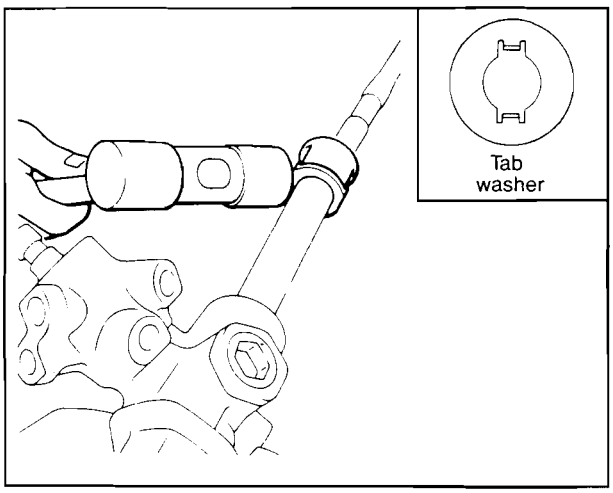


Fig. 31—Installing tie rods

(22) Install and tighten the feed tubes to the specified torque.

(23) Apply silicon grease to the bellows retaining positions on the housing and tie rods.

(24) Slide a new band onto the housing and install the bellows into position. Install the large inner band and small outer clip.

NOTE: On completion of the fitment ensure the bellows are not twisted.

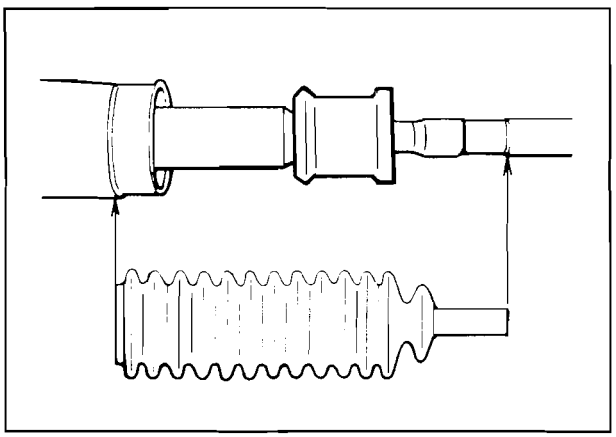


Fig. 32—Silicon grease application

(25) Fill the inside and the lip of the dust cover with multipurpose grease. Install the dust cover on the tie rod end, ensuring the clip ring is securely fitted into the tie rod end groove, refer Fig. 33.

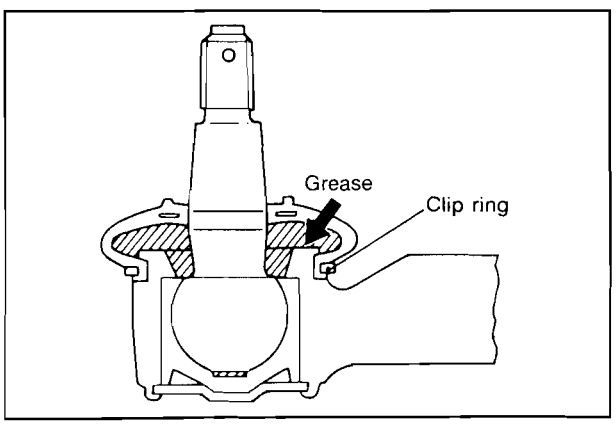


Fig. 33—Dust cover installation

Install the tie rod ends and adjust both to the specified length, refer Fig. 34.

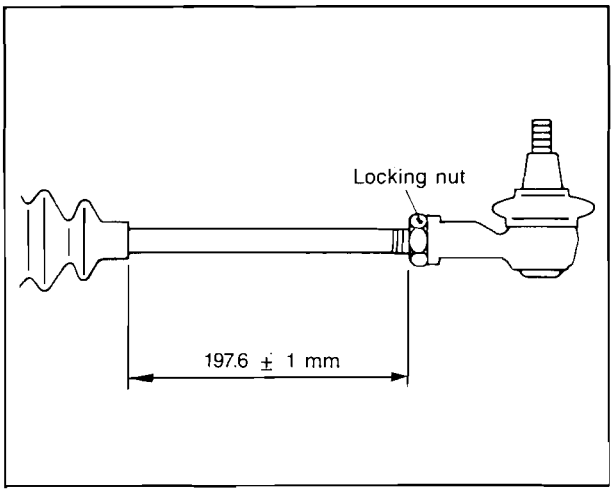


Fig. 34—Tie rod length

(26) Check the pinion starting torque as outlined in "Inspection Prior to Disassembly" to ensure correct rack support adjustment.

(27) Check ball joints by compressing the ball stud with multigrips and measuring end play, refer Fig. 35.

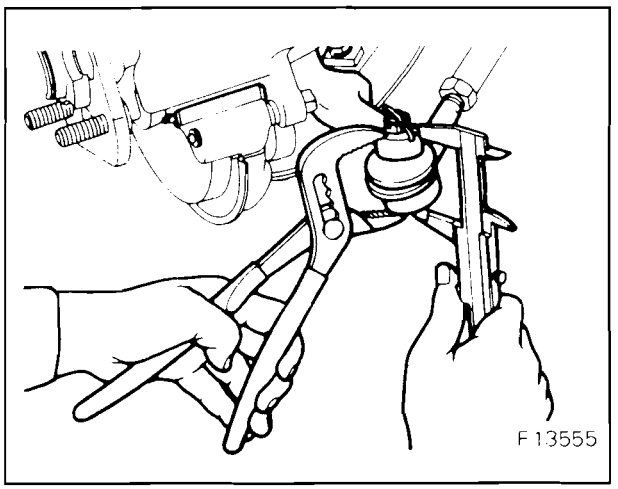


Fig. 35—Measuring ball joint play

SECTION 3 — STEERING COLUMN (VEHICLES WITHOUT A SUPPLEMENTAL RESTRAINT SYSTEM)

SPECIFICATIONS

Steering wheel—type	Three spoke
—diameter	380 mm
Steering wheel free play	0 to 30 mm
Steering shaft length	570 to 571 mm
Steering shaft bend	0.5 max.
Joint assembly length	
—Spider shaft centre to centre	244.4 mm
—Overall	337.9 mm
Lubrication	
—Joint bearings	Chassis grease
—Other moving parts	Multipurpose grease NLGI No. 3
—Column tube bearing	Multipurpose grease NLGI No. 3

SPECIAL TOOLS

E19M10A	Steering wheel puller
Apex 440-TX-40H	Special tilt bracket screw remover

TORQUE SPECIFICATIONS

	Nm
Steering wheel nut	34 to 44
Column tube clamp	4 to 5
Tilt bracket	8 to 12
Lower bracket	8 to 12
Joint assembly	25 to 35

1. Horn pad
2. Steering wheel
3. Bearing spacer
4. Steering shaft
5. Tilt bracket
6. Column tube, upper
7. 'C' clip
8. Snap ring
9. Joint assembly
10. Cover assembly
11. Column tube clamp
12. Column tube, lower
13. Bearing
14. Boot
15. Bushing
16. Clevis pin
17. Lower bracket
18. Stopper
19. Column bushing
20. Steering lock
21. Steering lock bracket
22. Column switch
23. Damper

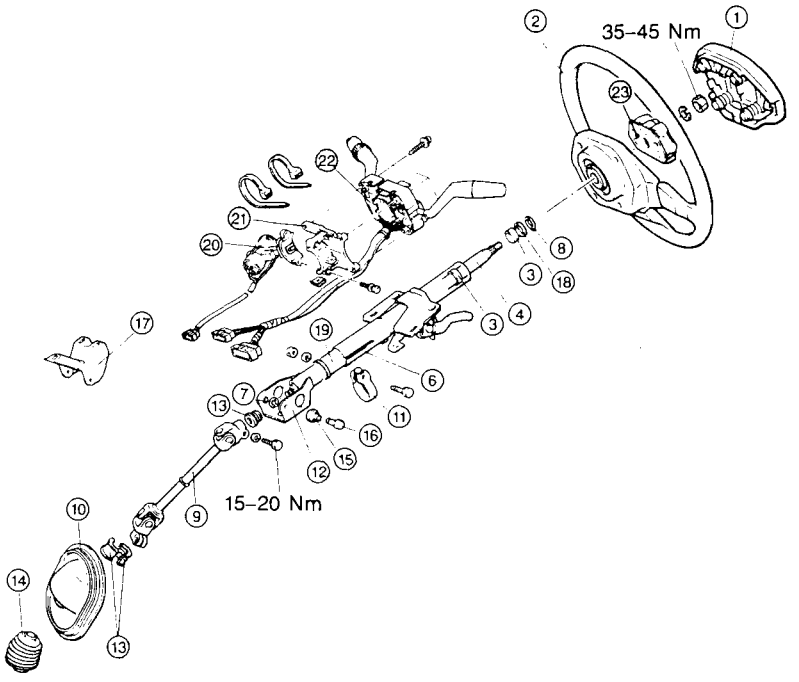


Fig. 1—Steering column components

GENERAL INFORMATION

The steering column consists of a "bellows type" collapsible shaft contained within a tubular column. The tube contains support bearings at either end for the shaft and incorporates a steering lock.

Drive to the rack and pinion steering gear is transfered from the steering shaft via universal joints.

STEERING COLUMN

Removal

(1) Remove the horn pad by gently prising upwards, or remove the 3 attaching screws (where fitted), refer Fig. 2.

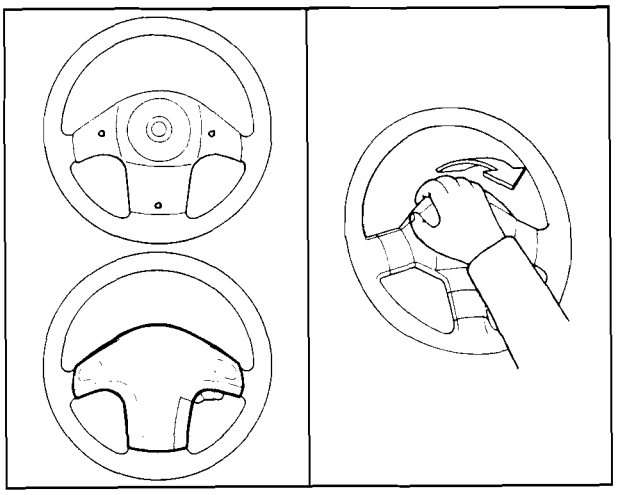


Fig. 2—Removing horn pad

(2) Remove the steering wheel nut and lift out the dynamic damper (where fitted).

NOTE: The dynamic damper is a precision component. Handle it with care and ensure it is not dropped.

(3) Using special tool E19M10A or a suitable puller remove the steering wheel, refer Fig. 3.

NOTE: Do not apply impact force to the steering wheel during removal or replacement. Doing so can damage the collapsing section of the steering shaft.

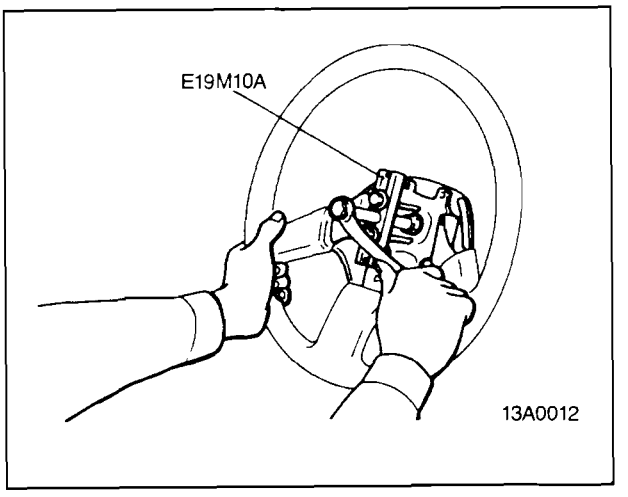


Fig. 3—Removing steering wheel

(4) Remove the holding screws (in the lower cover) and remove the lower cover.

(5) Disconnect the wiring connectors and lift off the top cover.
(6) Remove the installation screws and remove the combination switch.

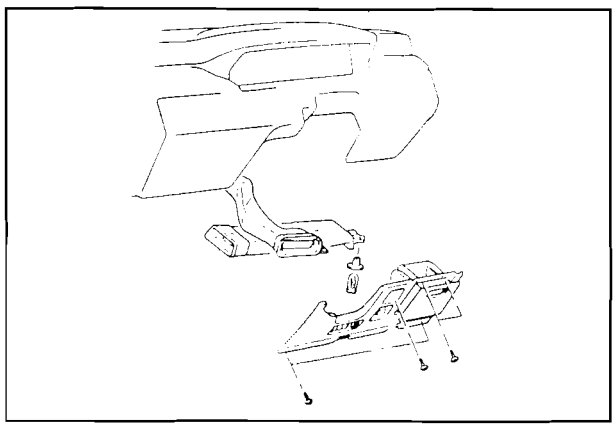


Fig. 4 — Dash under cover removal

NOTE: After removal care should be taken not to scratch or damage the switches and controls.

(7) Remove the column undercover installation screws directly below the column and remove the cover.
(8) Remove the underframe and the heater duct.
(9) Remove the tilt bracket installation bolts, refer Fig. 5.
(10) Remove the column lower mounting bracket bolts, refer Fig. 6.

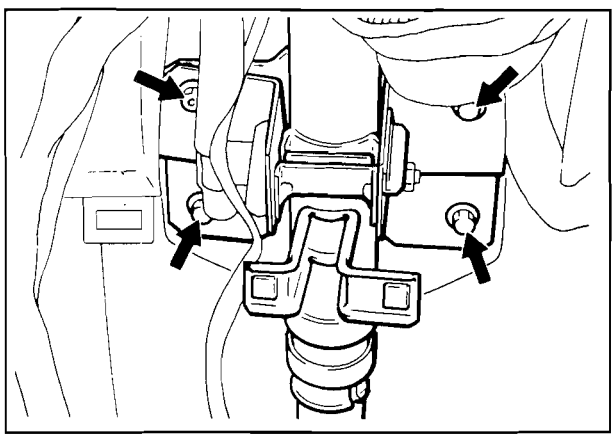


Fig. 5—Tilt bracket installation bolts

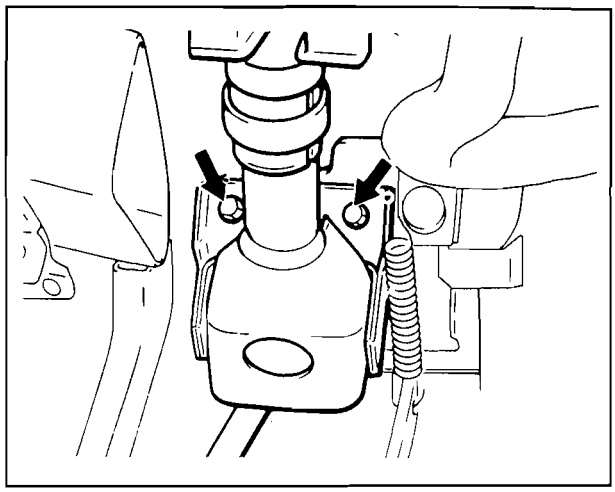


Fig. 6—Column lower mounting bracket bolts

(11) Remove the joint cover to dash panel attaching bolts, refer Fig. 7.

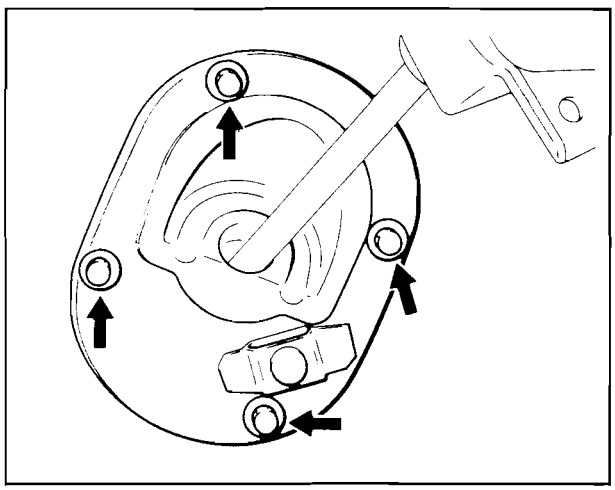


Fig. 7—Joint cover attaching bolts

(12) Remove the bolt which holds the joint assembly to the steering gear, refer Fig. 8.

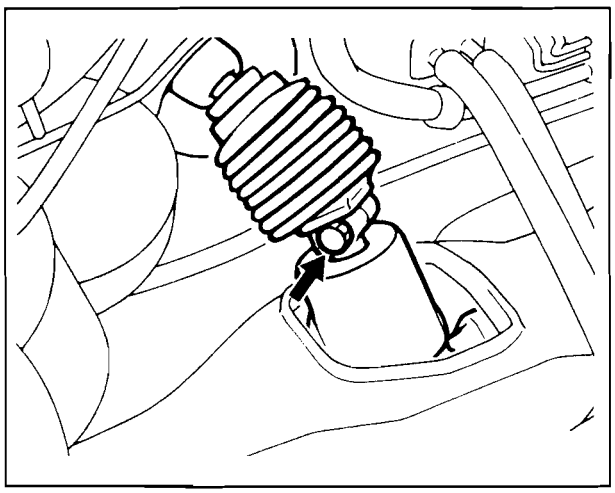


Fig. 8—Joint to steering gear holding bolt

(13) Lift out the steering column assembly.

Installation

Installation is a reversal of the removal procedure noting the following:-

Ensure that the steering joint is installed with the undercut end of the joint shaft fitted to the steering gear.

DISASSEMBLY

(1) Remove the steering joint holding bolt and remove the joint from the steering shaft.

(2) Remove the split bearing from the cover (refer Fig. 9) and slide the cover off the joint.

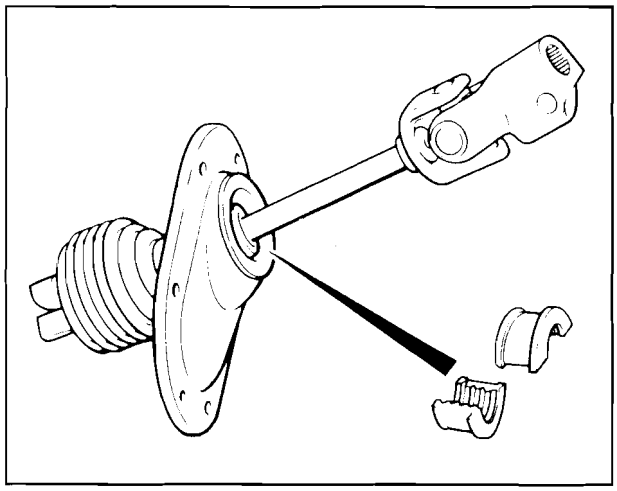


Fig. 9—Steering joint bearing

(3) Remove the column tube clamp (refer Fig. 10) and separate the upper and lower tubes.

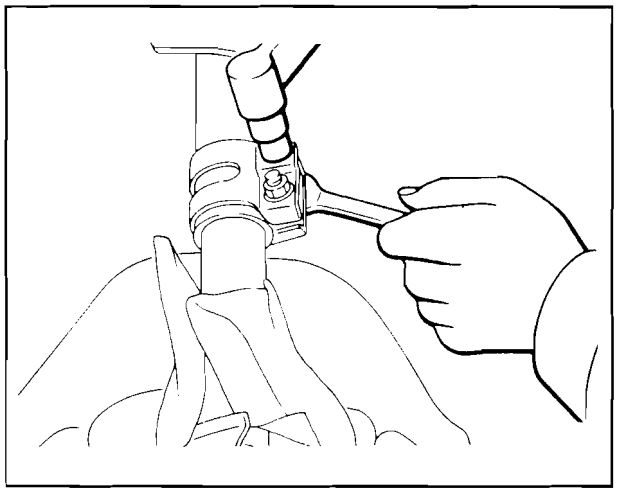


Fig. 10—Removing the column clamp

(4) Insert the key in the ignition switch and turn to the ACC or On position to free the steering column lock.

(5) Remove the snap ring from the steering shaft at the top of the upper tube and withdraw the washer and rubber spacer from the steering shaft.

(6) Pull the steering shaft out from the lower end of the tube.

(7) Remove the rubber spacer from above, the locking collar and remove the bush from the tube.

(8) If it is necessary to remove the bracket from the lower tube, remove the snap rings and lift off the bracket, refer Fig. 11.

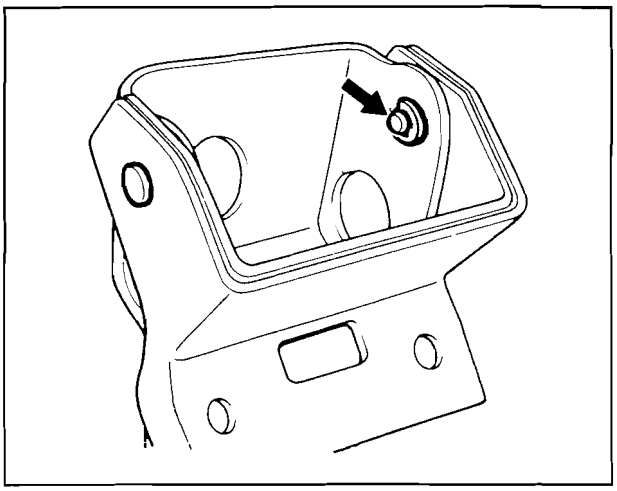


Fig. 11—Lower bracket snap rings

(9) If it is necessary to remove the steering lock/ignition switch assembly, use a hacksaw to cut the special bolts at the steering lock bracket side, refer Fig. 12.

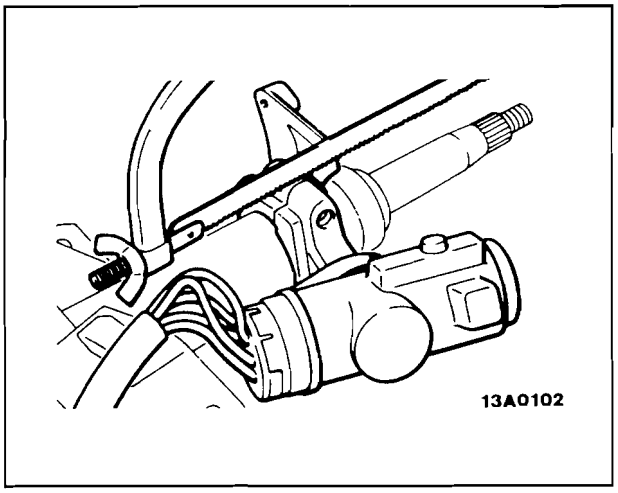


Fig. 12—Removing ignition switch

(10) If it is necessary to disassemble the tilt lock mechanism proceed as follows:-

(a) Loosen the tilt lock lever.

(b) Remove the lever retaining screw (L.H. thread) and remove the lever.

(c) Unscrew the lever mounting boss (L.H. thread) and remove the spacer from the bolt.

(d) Withdraw the bolt from the bracket and remove the bracket assembly.

(e) If required, remove the bolt positioning clips by prying with a screwdriver.

Inspection

(1) Check the steering shaft for damage or deformation.

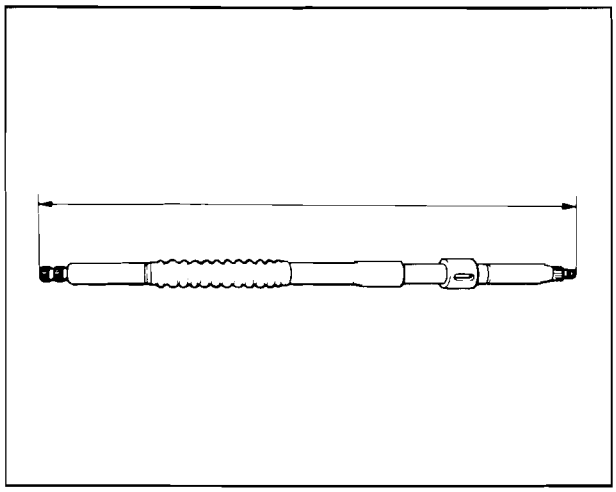


Fig. 13—Checking steering shaft

(2) Check steering joint for play damage or rough movement and joint bearings for wear and damage.

NOTE: The steering joint assembly cannot be disassembled if wear or damage is evident the joint must be replaced as an assembly.

(3) Check tilt bracket for cracks or damage.
(4) Check the column bushing for damage.
(5) Check the dust cover for cracks or damage.

ASSEMBLY

Assembly is a reversal of the disassembly procedure, noting the following:-

(1) On assembly of the tilt bracket, lubricate all moving parts with multipurpose grease. Ensure the bolt is installed with the raised portion of the head fitted correctly in the slot of the bracket. Ensure the tilt lever is adjusted by screwing in the lever mounting boss (L.H. thread) to lock the column in the desired position.

(2) Apply a coating of multipurpose grease to the surfaces of the bearing spacer and bearing which contact the steering shaft.

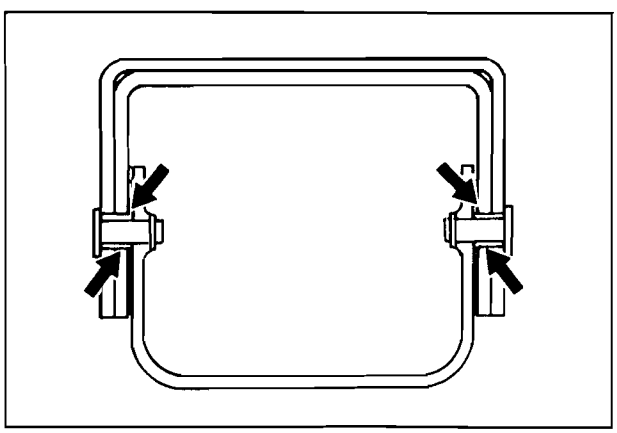


Fig. 14—Grease application to lower bracket

(3) Apply multipurpose grease to the pin bushings of the lower bracket prior to securing them with the snap rings, refer Fig. 14.

(4) Temporarily install the steering lock/ignition switch. Check that the steering lock works correctly and tighten the special bolts until the heads twist off, refer Fig. 15.

NOTE: A new bracket and special bolts must be used when the steering lock/ignition switch is installed.

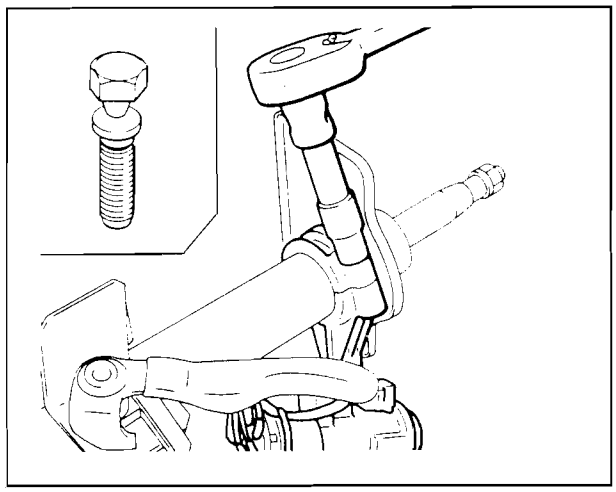


Fig. 15—Installing steering lock/ignition switch

(5) Install the cover and retainer on the joint assembly. Fill the inside of the bearing halves with chassis grease. Install the bearing halves onto the joint shaft and wrap vinyl tape around the circumference of the bearing approximately one and a half times. Press the bearing into the cover.

Apply chassis grease to the mating surfaces of the joint and cover assemblies.

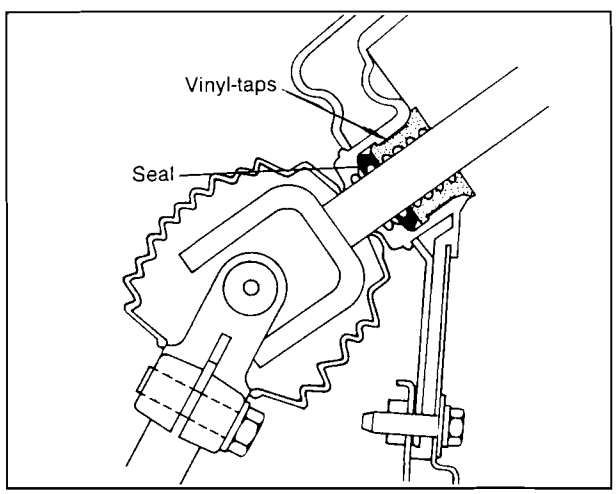


Fig. 16—Installing joint cover and bearing

SECTION 4 — STEERING COLUMN (VEHICLES FITTED WITH A SUPPLEMENTAL RESTRAINT SYSTEM)

SPECIFICATIONS

Steering wheel — type	Four spoke
— diameter	386 mm
Steering wheel free play	0 to 30 mm
Steering shaft length	571 to 573 mm
Steering shaft bend	0.5 mm max.
Joint assembly length	
— Spider shaft centre to centre	244.4 mm
— Overall	337.2 mm to 338.6 mm
Lubrication	
— Joint bearings	Chassis grease
— Other moving parts	Multipurpose grease NLGI No. 3
— Column tube bearing	Multipurpose grease NLGI No. 3

SPECIAL TOOLS

E19M10A	Steering wheel puller

TORQUE SPECIFICATIONS

	Nm
Steering wheel nut	39 to 49
Tilt bracket	8 to 12
Lower bracket	8 to 12
Joint assembly (upper and lower holding bolts)	25 to 35
Air bag module attaching nuts	5

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1. Air bag module and horn pad
2. Steering wheel retaining nut
3. Steering wheel
4. Air bag module retaining nuts
5. Steering shaft
6. Tilt lever
7. Tilt bracket
8. Column bushing
9. Joint assembly holding bolt
10. Bearing
11. Joint assembly universal joint
12. Retainer
13. Inner cover
14. Outer cover
15. Boot
16. Joint assembly
17. Spring
18. Steering lock cylinder
19. Steering lock bracket
20. Special bolt
21. Clockspring and column switch

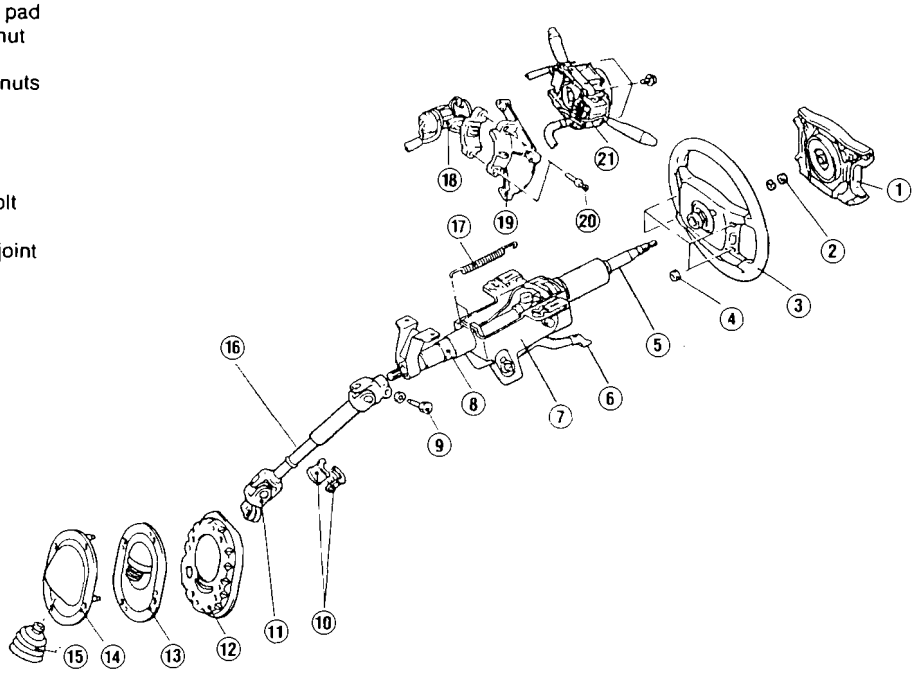


Fig. 1 — Steering column components

GENERAL INFORMATION

The steering column consists of a "bellows type" collapsible shaft contained within a tubular column. The tube contains support bearings at either end for the shaft and incorporates a steering lock.

Drive to the rack and pinion steering gear is transfered from the steering shaft via universal joints.

STEERING COLUMN

Removal

(1) Place the front wheels in a straight ahead position and turn the ignition key to the "LOCK" position.

(2) Disconnect the negative battery cable and tape the terminal, refer Fig. 2.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer Group 52B — Service Precautions.

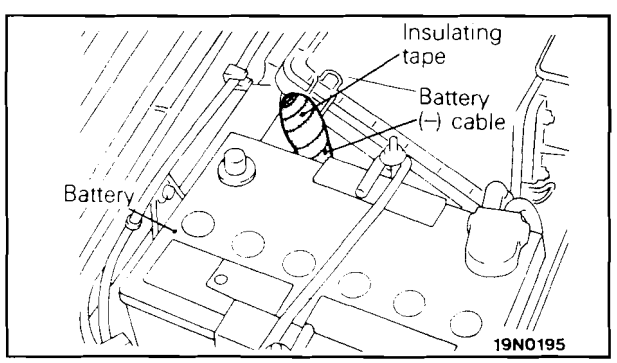


Fig. 2 — Insulating battery cable

(3) Remove the air bag module nuts using a socket, then lift the air bag module from the steering wheel.

(4) Disconnect the connector of the clock spring from the air bag module, press the air bags lock toward the outer side to spread it open. Use a screwdriver to pry so as to remove the connector gently, refer Fig. 3.

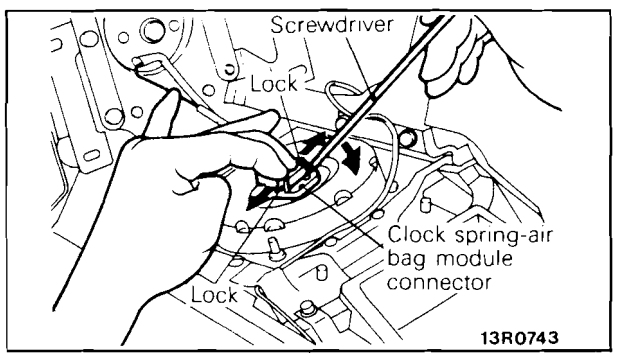


Fig. 3 — Removing clockspring connector

NOTE:

(1) When disconnecting the air bag module — clockspring connector, take care not to apply excessive force to it.

(2) The removed air bag module should be stored in a clean dry place with the pad cover up.

(5) Remove the steering wheel retaining nut.

(6) Disconnect audio and cruise control connectors (if applicable).

(7) Using special tool E19M10A or a suitable puller, remove the steering wheel, refer Fig. 4.

(8) Remove the holding screws (in the lower cover) and remove the lower cover.

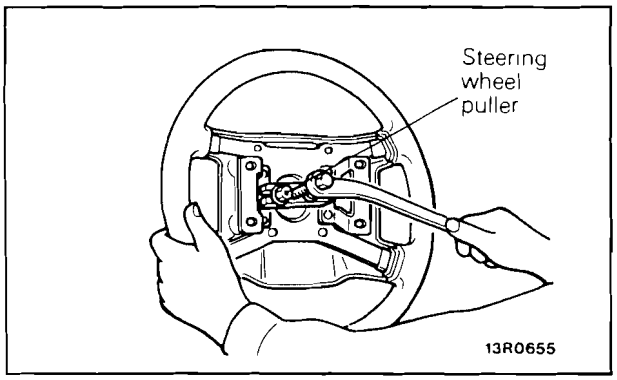


Fig. 4 — Removing steering wheel

(9) Disconnect all wiring connectors (including clockspring connectors) and lift off the top cover.
(10) Remove the installation screws and remove the clockspring.

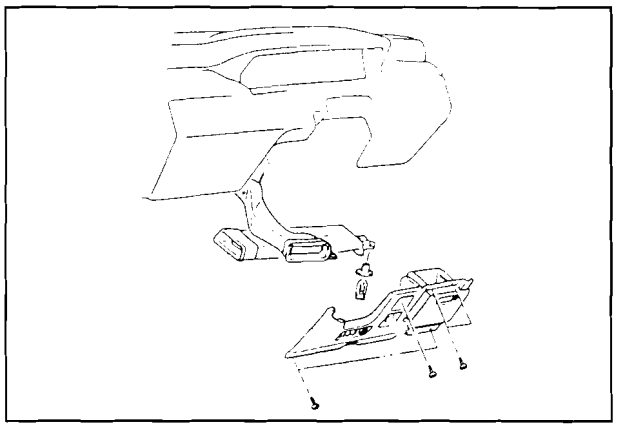


Fig. 5 — Dash under cover removal

NOTE: After removal care should be taken not to scratch or damage the switches and controls.

(11) Remove the column undercover installation screws directly below the column and remove the cover.
(12) Remove the underframe and the heater duct.
(13) Remove the tilt bracket installation bolts, refer Fig. 6.
(14) Remove the column lower mounting bracket bolts, refer Fig. 7.

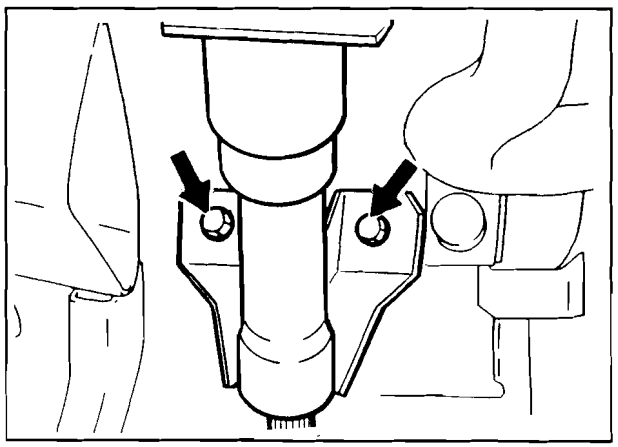


Fig. 6 — Tilt bracket installation bolts

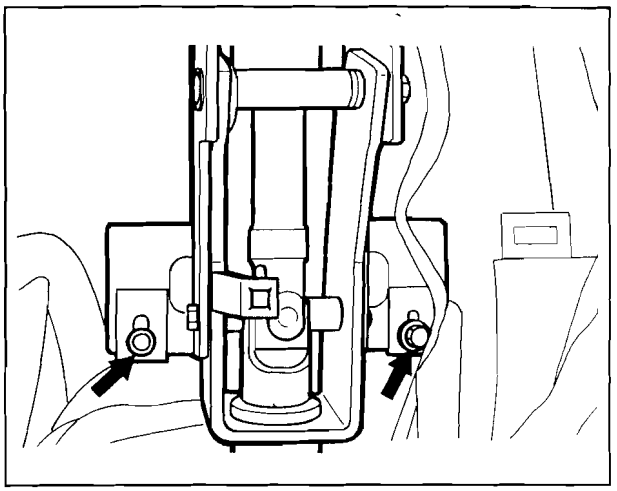


Fig. 7 — Column lower mounting bracket bolts

(15) Remove the joint cover to dash panel attaching bolts, refer Fig. 8.

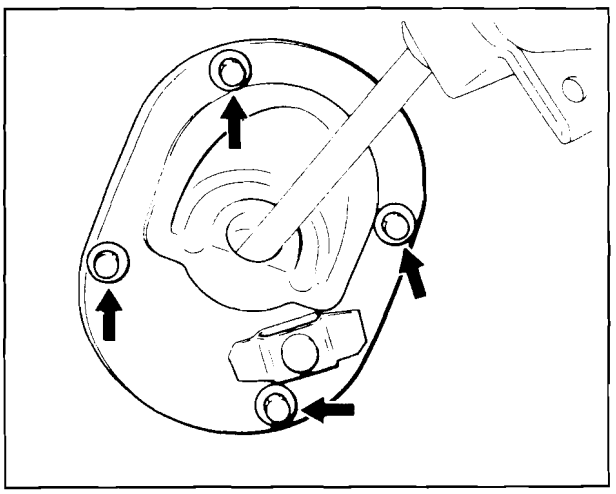


Fig. 8 — Joint cover attaching bolts

(16) Remove the bolt which holds the joint assembly to the steering gear, refer Fig. 9.

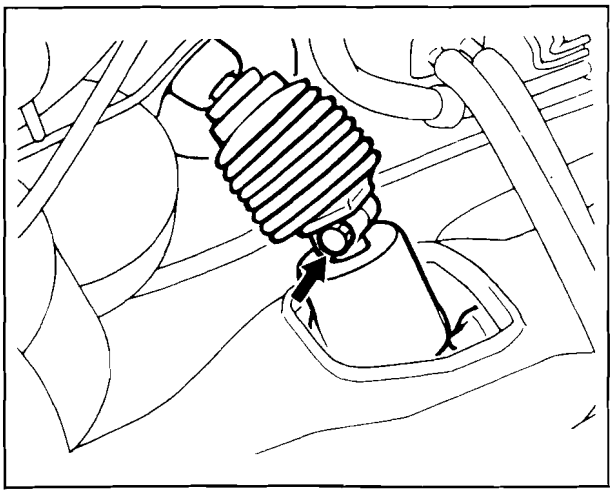


Fig. 9 — Joint to steering gear holding bolt

(17) Lift out the steering column assembly.

Installation

Installation is a reversal of the removal procedure noting the following:-

(1) Ensure that the steering joint is installed with the undercut end of the joint shaft fitted to the steering gear.

(2) Thoroughly read 52B Section 5 — INDIVIDUAL COMPONENT SERVICE in the areas relating to the installation of the air bag module and clockspring before attempting to install these components.

DISASSEMBLY

(1) Remove the steering joint holding bolt and remove the joint from the steering shaft.

(2) Remove the split bearing from the cover (refer Fig. 10) and slide the cover off the joint.

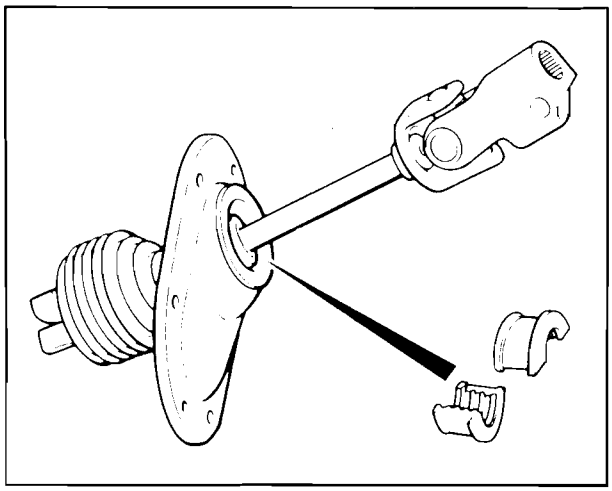


Fig. 10—Steering joint bearing

(3) Insert the key in the ignition switch and turn to the ACC or On position to free the steering column lock.

(4) If it is necessary to remove the steering lock/ignition switch assembly, use a hacksaw to cut the special bolts at the steering lock bracket side, refer Fig. 11.

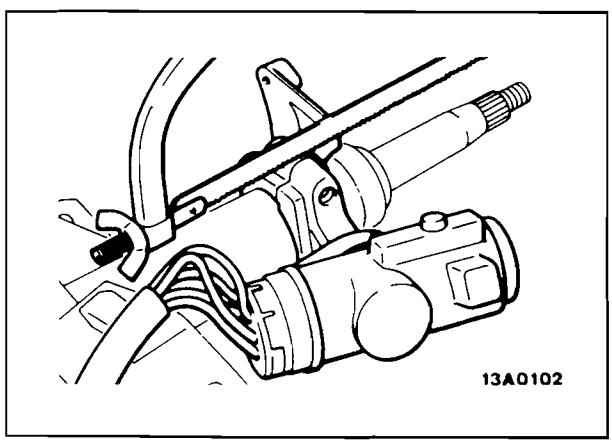


Fig. 11 — Removing ignition switch

NOTE: The steering column assembly is only serviced as an assembly and MUST NOT be disassembled.

ASSEMBLY

Assembly is a reversal of the disassembly procedure, noting the following:—-

(1) Temporarily install the steering lock/ignition switch. Check that the steering lock works correctly and tighten the special bolts until the heads twist off, refer Fig. 12.

NOTE: A new bracket and special bolts must be used when the steering lock/ignition switch is installed.

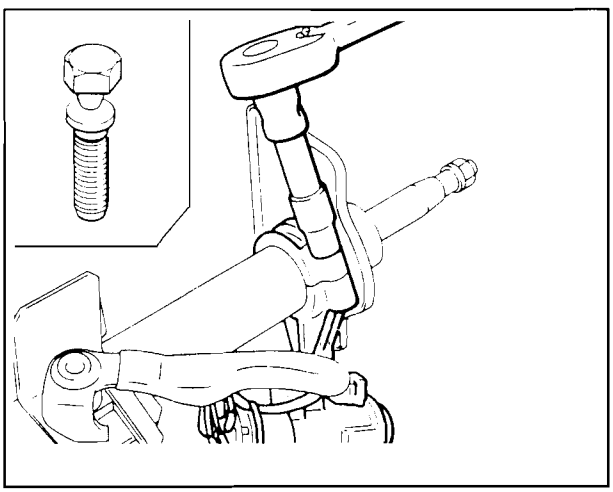


Fig. 12—Installing steering lock/ignition switch

(2) Install the cover and retainer on the joint assembly. Fill the inside of the bearing halves with chassis grease. Install the bearing halves onto the joint shaft and wrap vinyl tape around the circumference of the bearing approximately one and a half times. Press the bearing into the cover.

Apply chassis grease to the mating surfaces of the joint and cover assemblies.

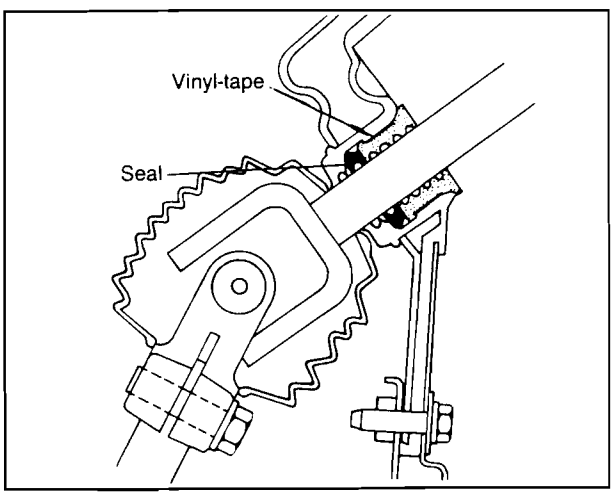


Fig. 13—Installing joint cover and bearing

GROUP 42A — BODY

SECTION 0 — INDEX

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Rear Door Latch and Handle		2
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Rear Door Glass and Regulator		3
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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

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Powder Testing		5
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Body Sealing Tips		6
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SECTION 1 — SPECIFICATIONS

GENERAL SPECIFICATIONS

Hood
- Type ..... Rear hinged (gas spring) front opening type

Front and Rear Door
- Construction ..... Front hinged, sash construction
- Regulator system ..... Wire type
- Locking system ..... Pin-fork type

Trunk Lid
- Hinge ..... Single arm type (torsion bar type)

Tailgate
- Hinge ..... Top hinge (gas spring type)

Glass Installation Method
- Windshield glass ..... Adhesive — polyurethane
- Rear window glass ..... Adhesive — polyurethane
- Rear quarter ..... Adhesive and stud-nut mount
- Rear quarter window glass — wagon ..... Adhesive — polyurethane
- Tailgate window glass ..... Adhesive — polyurethane

Glass Thickness
- Windshield glass ..... 5.3 mm
- Rear window glass ..... 4.0 mm
- Front door glass ..... 3.5 mm
- Rear door glass ..... 3.5 mm
- Rear quarter window glass — sedan ..... 3.5 mm
- Rear quarter window glass — wagon ..... 3.5 mm
- Tailgate window glass ..... 3.5 mm

Power Window Motor
- Type ..... Permanent magnet type with a built in circuit breaker
- Revolutions under no load ..... 80 rpm (LHR 75 rpm)
- Revolutions under load
  - At 1 Nm ..... 65-95 rpm
  - At 2 Nm ..... 50-80 rpm
- Direction of rotation ..... Clockwise and Anticlockwise

TORQUE SPECIFICATIONS

	Nm
Hood hinge to hood	9-14
Hood hinge to body	9-14
Hood latch to body	5-6
Gas spring to body	17-26
Gas spring to hood/tailgate	9-14
Trunk hinge to trunk lid	9-14
Trunk hinge to body	5-6
Trunk striker and latch attaching bolts	5-6
Tailgate hinge to tailgate	12-15
Tailgate hinge to body	12-15
Tailgate latch to tailgate	7-11
Tailgate striker to body	12-15
Door hinges to body	35-45
Door hinges to doors	20-30
Door latch to door	5-6
Door striker to body	9-14
Check links to door	5-6
Outside door handle to door	5-6
Regulators to doors	5.5-7
Actuators to doors/tailgate	5-6
Delta piece to rear doors	5-6
Fuel filler door to body	5-6
Rear quarter window nuts	2-3

SPECIAL TOOLS

Window moulding remover	E980
Ornament remover	E23M6
Torsion bar remover and installer	MB991244
Door trim remover	E310
Glass holder (suction)	MB990480

SECTION 2 — SHEETMETAL

1. Front hood weatherstrip
2. Air conditioner weatherstrip
3. Hood heat protector
4. Rear hood weatherstrip
5. Hood damper
6. Hood lock release handle
7. Hood lock release cable
8. Hood latch
9. Hood bumper
10. ETACS hood switch (where fitted)
11. Hinge to hood bolts
12. Hood hinge
13. Hood gas spring

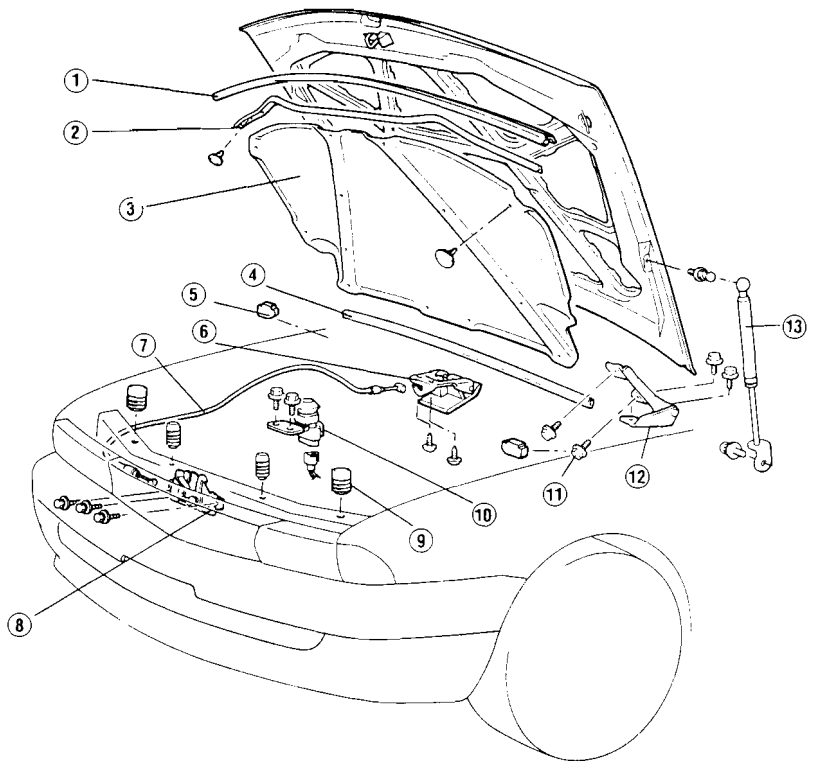


Fig. 1 — Hood Assembly

HOOD AND RELEASE CABLE

The hood is attached to the body by two hinges which have oversize bolt holes permitting movement of the hood for alignment purposes.

Removal

(1) Open the hood and disconnect the windscreen washer hose.

(2) Mark the location of the hinge to hood panel with a pencil.

(3) While protecting the paint finish in the lower hood area and with the aid of an assistant, remove the two gas spring to body bolts and the hood to hinge bolts.

(4) Remove the hood from the vehicle.

Hood Installation and Adjustment

(1) While protecting the paint finish and with the aid of an assistant, place hood on hinges and install attaching bolts.

(2) Install gas spring to body bolts and tighten to specification.

(3) Align the pencil marks and tighten the attaching bolts.

(4) Check and note the alignment and margins of all sides of the hood.

(5) Hood margins can be adjusted at the hinges or the lock and the alignment can be adjusted at the hood bumpers, refer Figs. 2 and 3.

(6) Reconnect the windscreen washer hose and check for correct operation of the hood and lock assembly.

Hood Lock

The hood lock/catch assembly is adjustable to ensure correct operation of the lock and accurate hood alignment.

The hood lock is released by a pull release cable operated from the inside of the vehicle situated below the driver's side lower panel.

Adjustment

(1) To adjust the hood lock, loosen the retaining bolts and adjust the position of the catch to coincide with the latch on the hood, refer Fig. 3.

NOTE: It may be necessary to bend the latch to align with the hood lock if insufficient hood lock adjustment is found.

(2) Tighten the retaining bolts and open and close the hood several times to ensure that the hood is locking and latching securely.

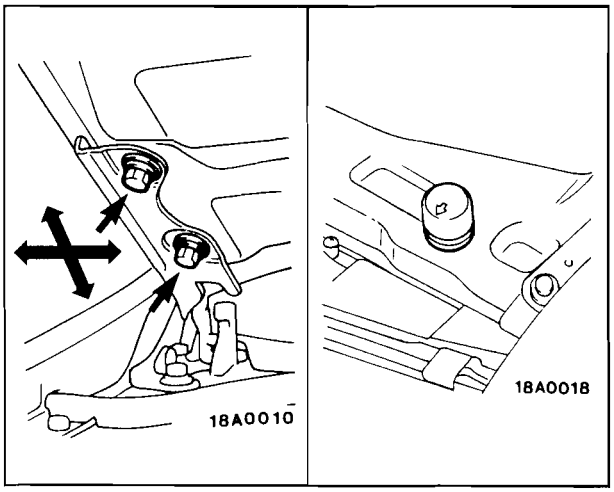


Fig. 2 — Hood adjustment

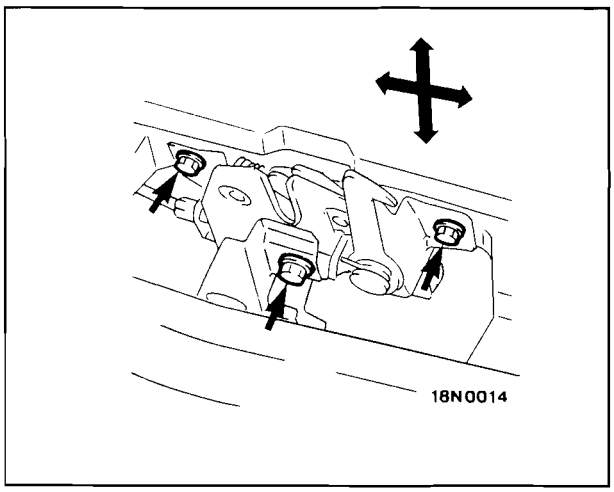


Fig. 3 — Hood lock adjustment

Hood Release Cable

Replacement

(1) Disconnect the cable from the release lever inside the vehicle.

(2) Jack the vehicle up and put RHF of vehicle on a support stand.

(3) Remove all of the splash shield bolts and clips except for the two lower rear bolts and the mud flap retaining bolts.

(4) Release the splash shield and rest it on the tyre.

(5) Remove the tape from the cable underneath the splash shield where it is attached to the loom. Refer Fig. 5.

(6) Remove the battery clamp and the battery.

(7) Remove the front air intake duct by removing the retaining bolt and releasing it from the main intake duct.

(8) Remove the radiator grille, refer Group 51 — Exterior for procedure.

(9) Remove the RH headlight assembly, refer Group 54 — Chassis Electrical.

(10) Remove the cable from the latch assembly, refer Fig. 4.

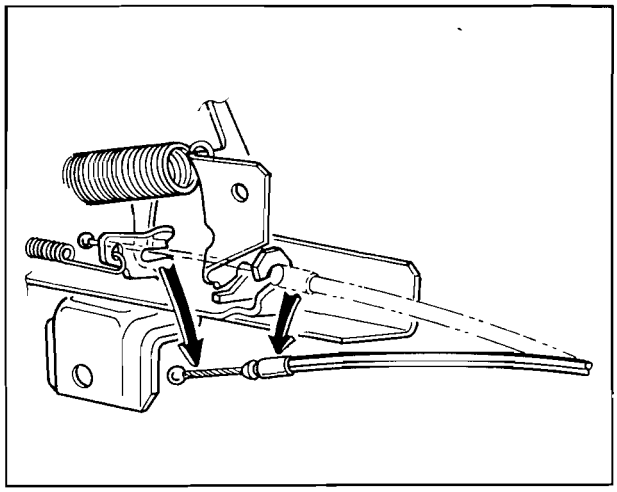


Fig. 4 — Cable removal — from latch

(11) Release the cable retaining clips and remove the clips from the cable. Refer Fig. 5 for location.

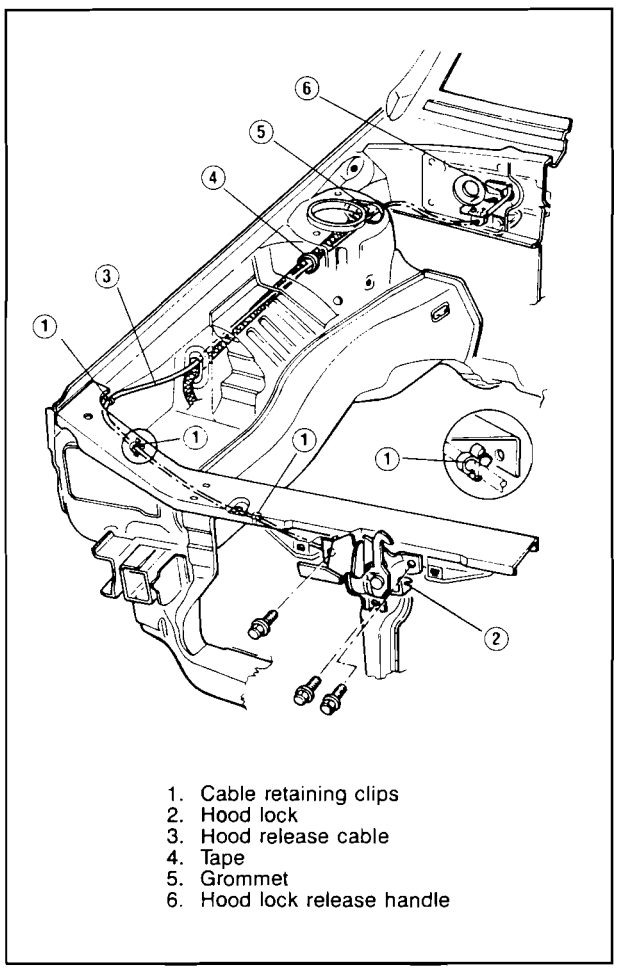


Fig. 5 — Hood cable routing

(12) Attach the new cable by the bonnet latch end to the release lever end by using string, etc.

NOTE: Do not increase the width of the cable during attachment because the cable must pass through a small hole in the grommet.

(13) Pull the old cable from the outside of the vehicle until the new cable is basically in place.
(14) Disconnect the old cable from the new one.
(15) Connect the cable to the hood latch.
(16) Check that the routing of the cable is correct and without kinks. Refer Fig. 5.
(17) Replace the three retaining clips.
(18) Re-tape the cable to the loom underneath the splashshield.
(19) Connect cable to release lever assembly.
(20) Install all of the components that were removed.

Adjustment

The hood cable can be adjusted at the release lever end. This is done by selecting the notch necessary to obtain normal hood release. Refer Fig. 6.

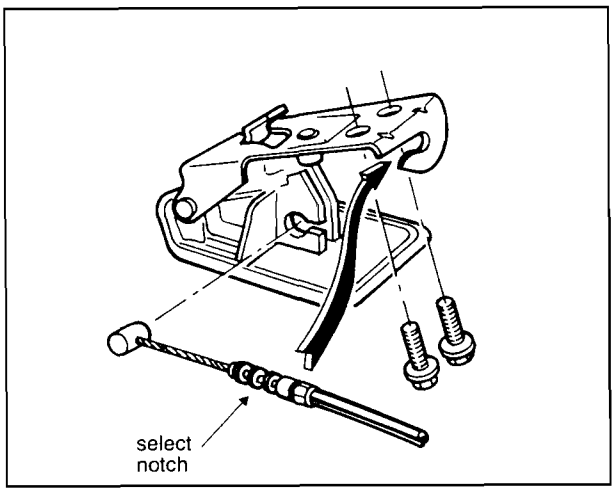
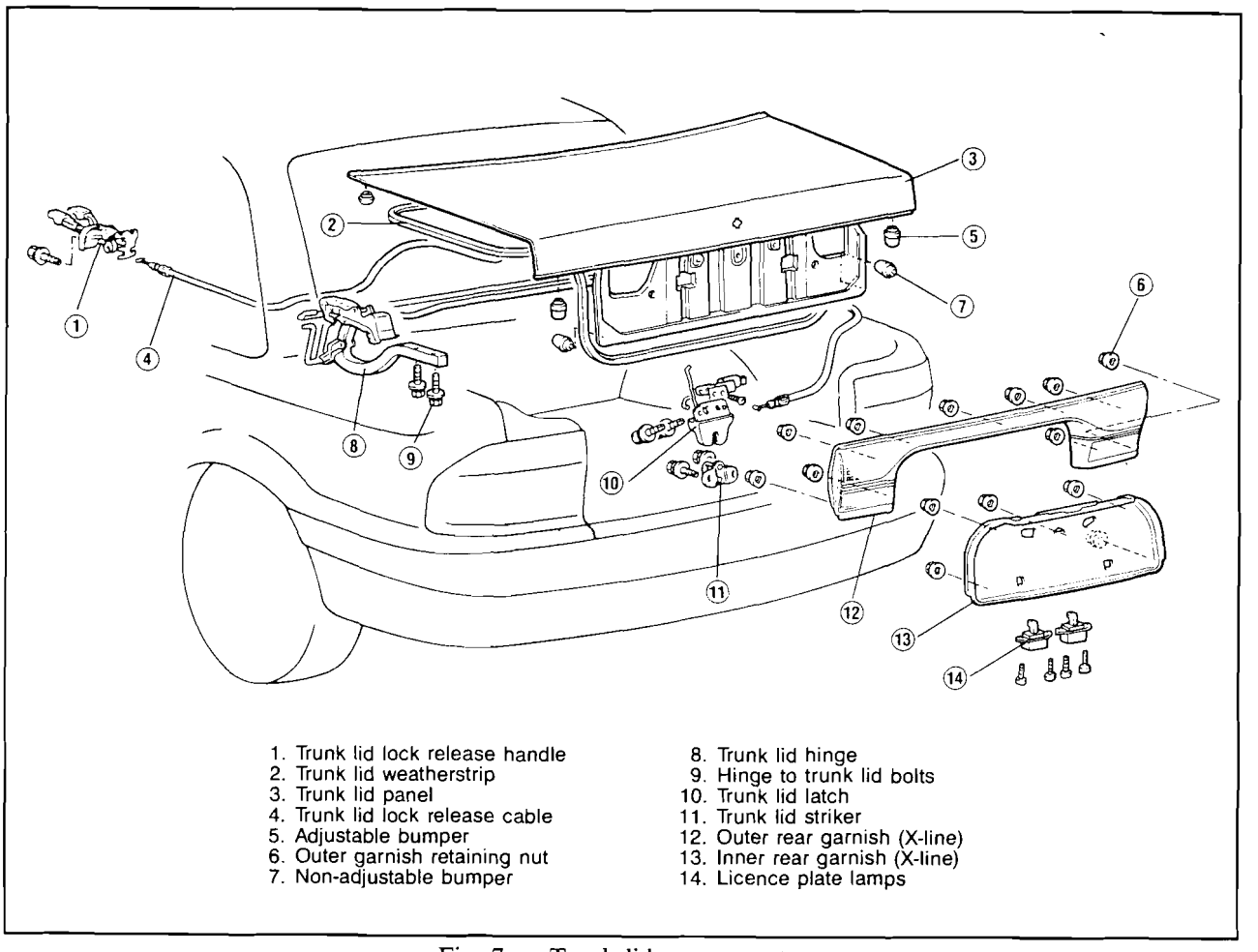


Fig. 6 — Cable adjustment



1. Trunk lid lock release handle
2. Trunk lid weatherstrip
3. Trunk lid panel
4. Trunk lid lock release cable
5. Adjustable bumper
6. Outer garnish retaining nut
7. Non-adjustable bumper
8. Trunk lid hinge
9. Hinge to trunk lid bolts
10. Trunk lid latch
11. Trunk lid striker
12. Outer rear garnish (X-line)
13. Inner rear garnish (X-line)
14. Licence plate lamps

Fig. 7 — Trunk lid components

TRUNK LID AND RELEASE CABLE

Removal

(1) Remove the trunk lid trim (where fitted). Refer Group 52 — Interior.

(2) Disconnect the loom connector to free the licence plate illumination wiring from the body and the trunk lid hinges.

(3) Disconnect the wiring from the electric trunk lid release solenoid (where fitted).

(4) Disconnect and remove the trunk lid lock release cable (where fitted) from the trunk lid assembly.

(5) Mark the location of the hinge to trunk lid position with a pencil.

(6) With an assistant supporting one side of the trunk lid, remove the trunk lid to hinge retaining bolts.

(7) Remove the trunk lid from the vehicle.

Installation

(1) With an assistant supporting one side of the trunk lid, place it on the hinges and install the attaching bolts.

(2) Align the pencil marks with the hinges and tighten the attaching bolts.

(3) Check for correct alignment and operation of the trunk lid.

(4) Connect all appropriate wiring and cables.

(5) Replace trunk lid trim (where fitted).

Adjustment

(1) Trunk lid clearances can be adjusted at the hinges, refer Fig. 8.

(2) Trunk lid height can be adjusted by rotating the trunk lid bumpers clockwise or anticlockwise, refer Fig. 9.

(3) The trunk lid striker can also be adjusted by loosening the retaining bolts and moving the striker horizontally or vertically to help with height adjustment or ease the closing force of the trunk lid. Refer Fig. 10.

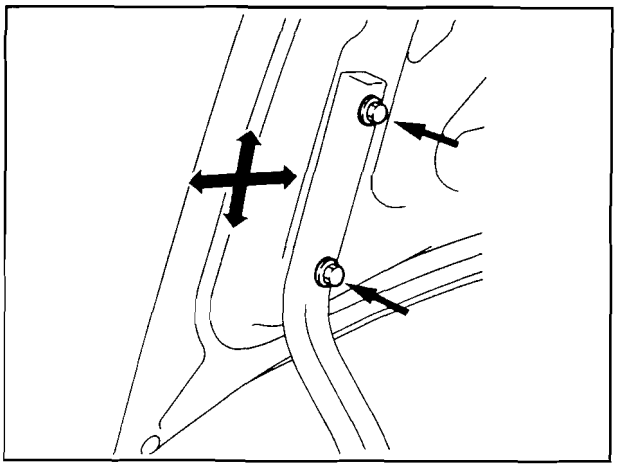


Fig. 8 — Trunk lid hinge adjustment

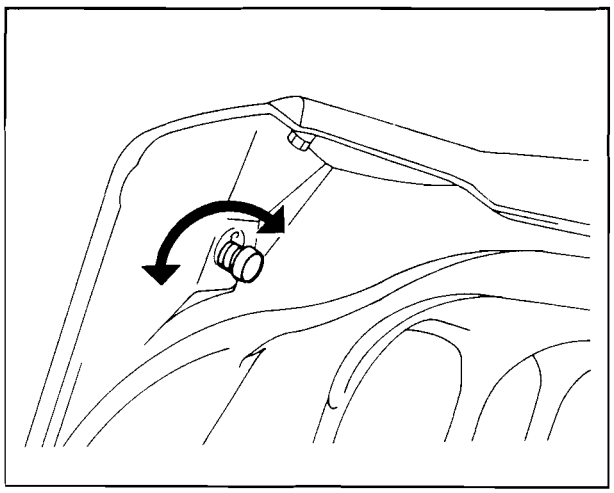


Fig. 9 — Trunk lid bumper adjustment

NOTE: Ensure that the adjustable bumper is installed in the correct position if removed, refer Fig. 9.

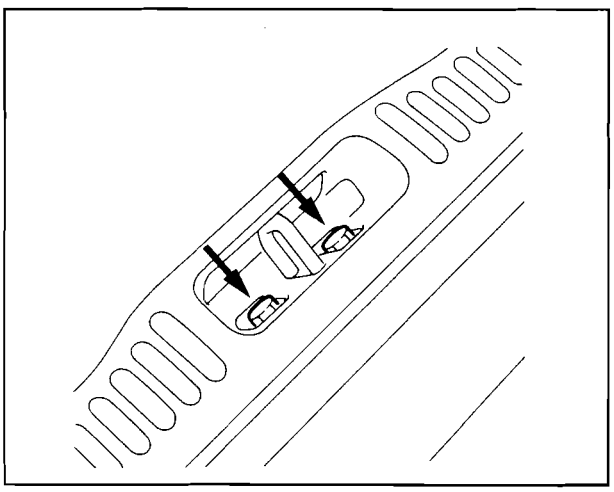


Fig. 10 — Trunk lid striker adjustment

Trunk Lid Release Cable

Removal

(1) Remove the RHF and RHR scuff plates.
(2) Remove the centre pillar lower trim, rear seat back, rear seat squab, lower seat belt mounting bolt and the RHR wheelhouse trim. Refer Group 52 — Interior for procedures.
(3) Disconnect the cable retaining clips in the trunk compartment and on the trunk lid. Remove latch cover.
(4) Release the cable from the latch assembly.
(5) Release the cable from all other clips and clamp locations.
(6) Remove the lever assembly from the body by releasing the retaining bolt.
(7) Disconnect the cable from lever assembly.
(8) Carefully remove the cable assembly from the vehicle.

Installation

To install, reverse the removal procedure noting the following:
(1) Ensure cable routing is correct and free of kinks. Refer Figs 11, 12 and 13.
(2) Ensure all components removed are replaced and if necessary, torqued to specification.

Adjustment

(1) To adjust the cable, select the appropriate notch at the latch end of the cable to obtain best operation. Refer Fig. 14.

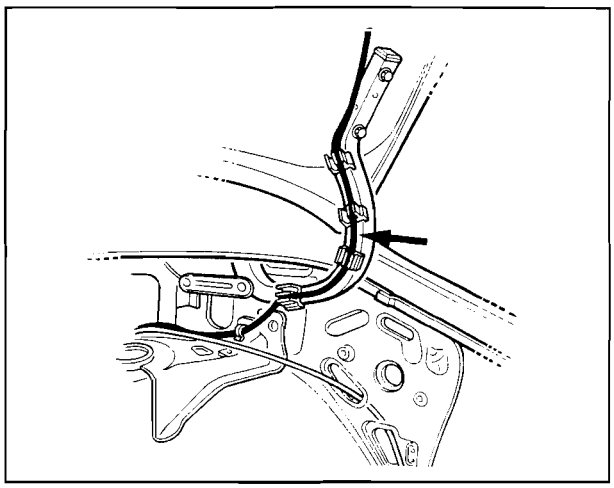


Fig. 11 — Cable routing — Trunk lid hinge

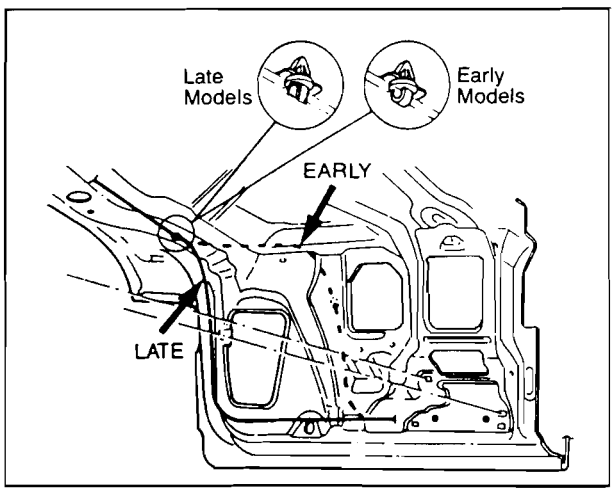


Fig. 12 — Cable routing — Trunk lid

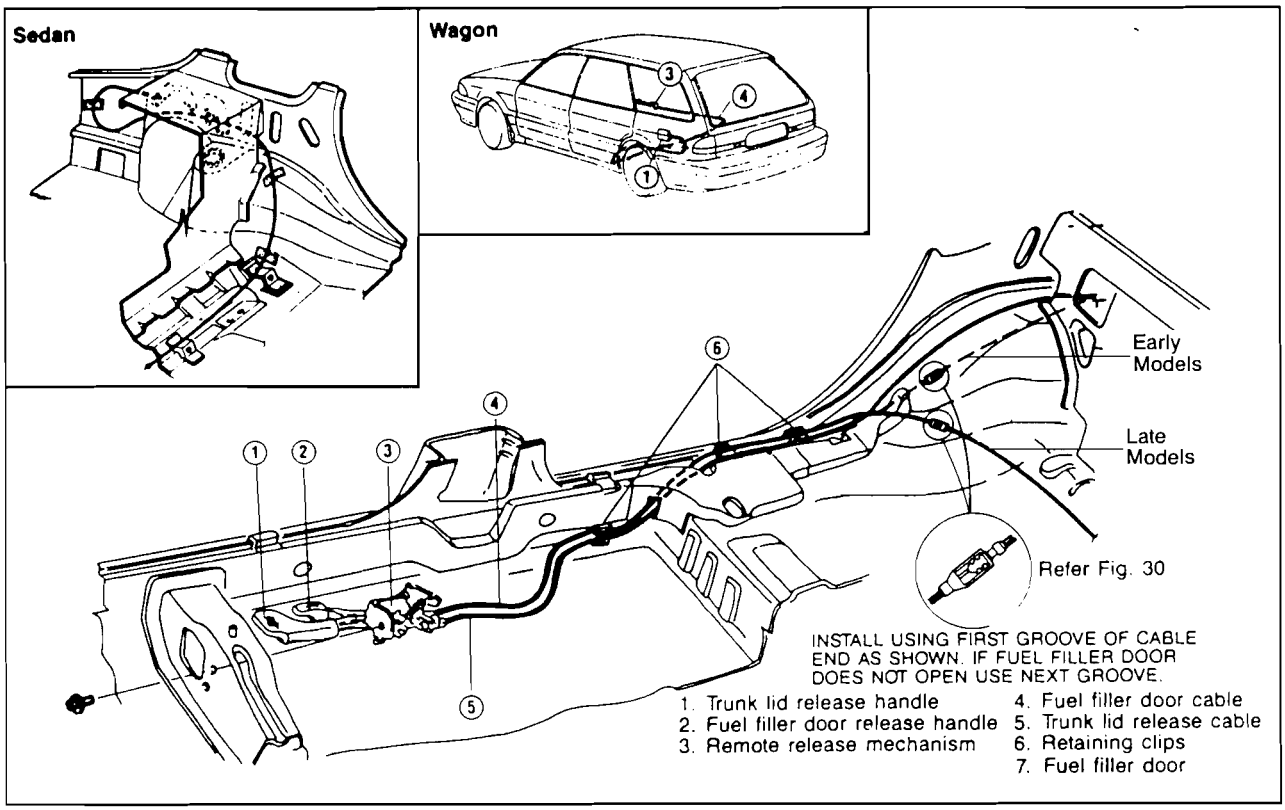


Fig. 13 — Cable routing

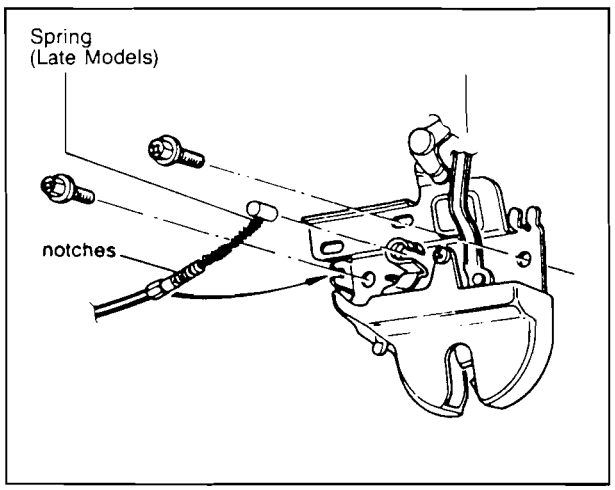


Fig. 14 — Cable adjustment

Torsion Bar Removal

(1) Disconnect the body harness and the harness connector of the rear shelf lower panel.

(2) Attach special tool MB991244 to the link side of the torsion bar as shown in Fig. 15 and push downwards to remove the torsion bar from the link.

NOTE: When removing the torsion bars, remove the bar which is located at the bottom of the central mounting bracket first (usually RH).

CAUTION: ENSURE THAT THE SPECIAL TOOL IS CORRECTLY FITTED TO THE TORSION BARS.

(3) Raise the opposite end of the torsion bar and remove it from the bracket channel and while pulling it out of the oblong hole manoeuvre the torsion bar from the link side mounting hole. Refer Fig. 16.

(4) Remove the torsion bar.

(5) Remove the other torsion bar by using the same procedure.

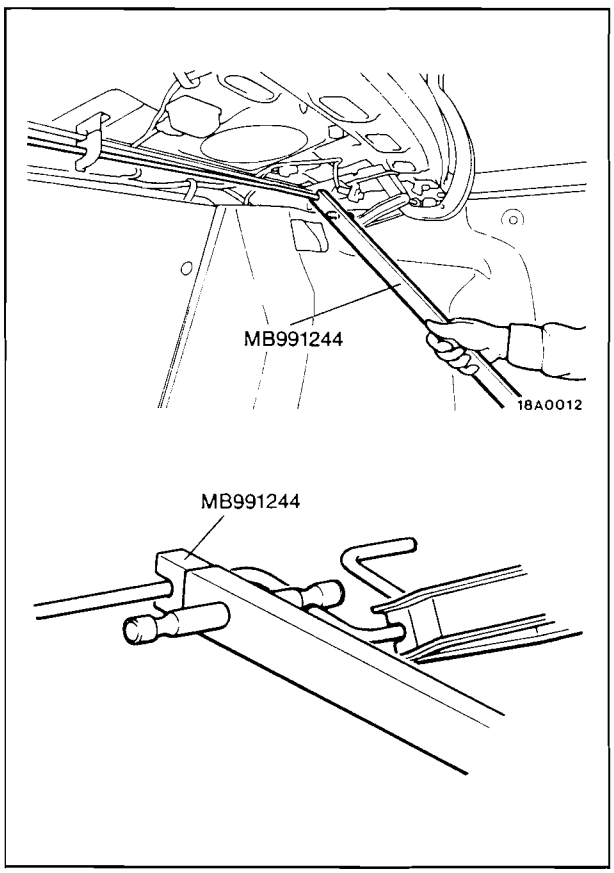


Fig. 15 — Special tool location

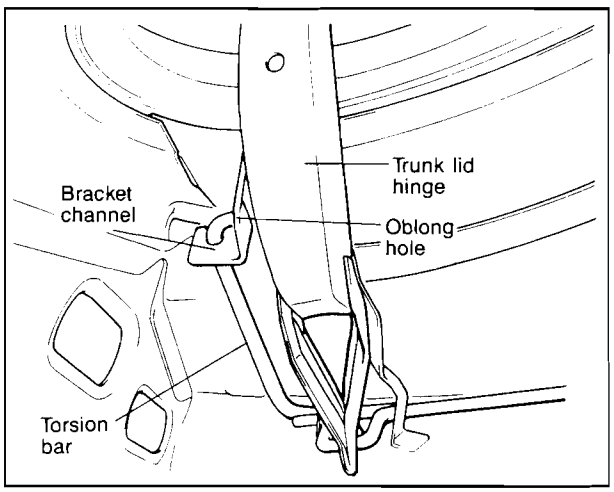


Fig. 16 — Torsion bar removal

Torsion Bar Installation

To install, reverse the removal procedure noting the following:

(1) Ensure that the harness and the harness connector are connected and returned to their original position.

CAUTION: ENSURE THAT THE SPECIAL TOOL IS CORRECTLY FITTED TO THE TORSION BARS.

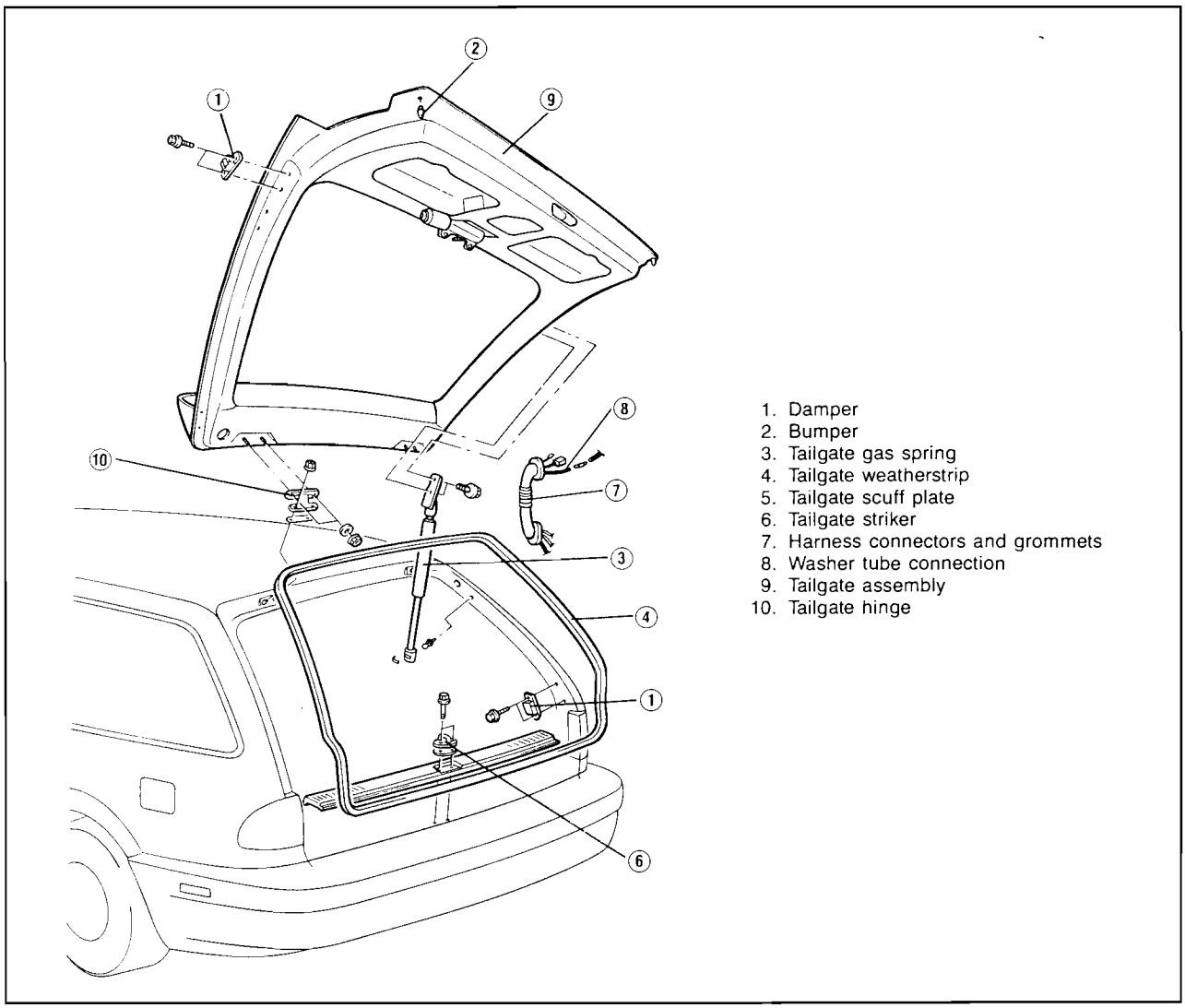


Fig. 17 — Tailgate removal

TAILGATE AND TAILGATE HINGE (WAGON)

Removal

(1) Remove the two rubber grommets surrounding the harness connectors.

(2) Disconnect the harness connectors and the washer tube.

(3) Remove the tailgate gas springs by removing the two bolts attached to the tailgate and gently levering out the metal clip from the bottom end of the gas spring, refer Fig. 18.

(4) Scribe or pencil in a line around the tailgate hinges as an aid in reassembly.

(5) With the aid of an assistant remove the hinge to body nuts, refer Fig. 19 and carefully remove the tailgate.

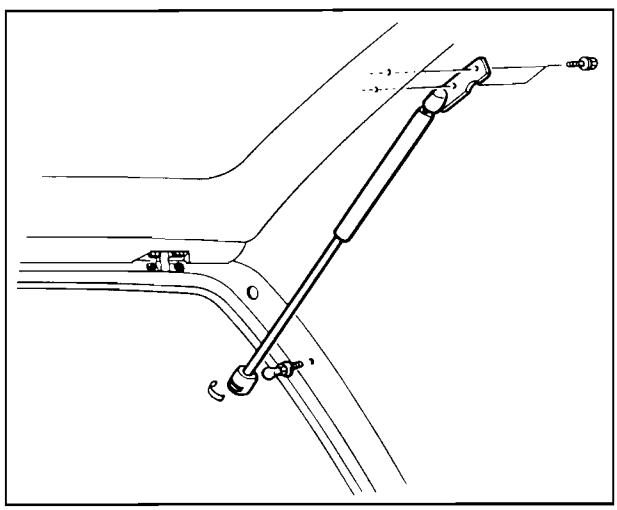


Fig. 18 — Tailgate gas spring removal

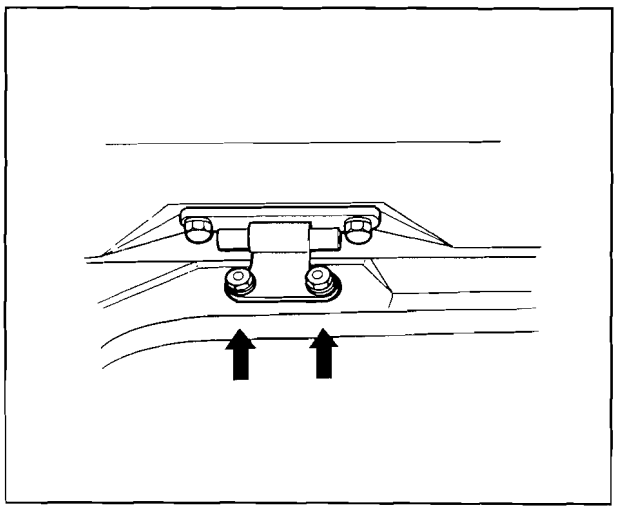


Fig. 19 — Removal of tailgate hinge nuts

Installation

Instal by reversing the removal procedure noting the following:

(1) Lubricate the tailgate hinges and the ball joints of the tailgate gas springs.

Adjustment

(1) Loosen the tailgate mounting nuts, adjust the tailgate by moving it so that the clearance is equal on all sides, refer Fig. 20.

(2) Loosen the tailgate striker mounting bolts, and then adjust the alignment of the latch and striker by adjusting the horizontal and vertical positioning of the striker, refer Fig. 20.

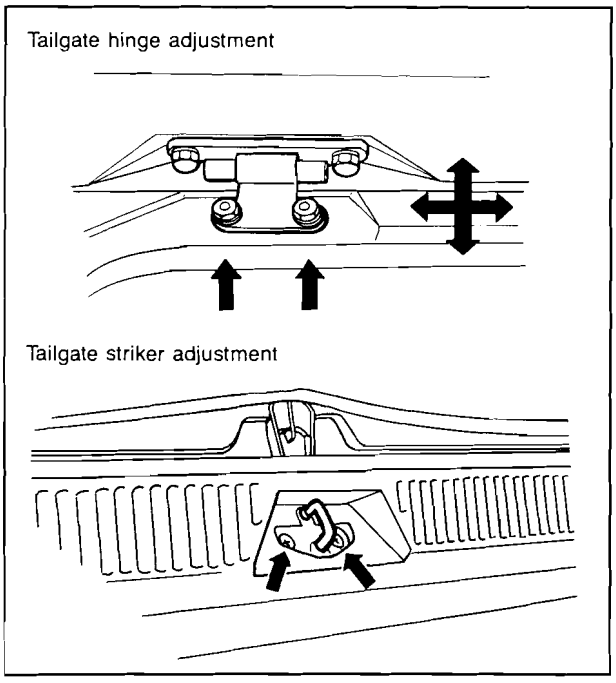


Fig. 20 — Tailgate adjustment

NOTE:

Disposal of Gas Springs (Hood and Tailgate)

The gas springs are under pressure and must be vented in accordance with the following instructions before being discarded, refer Fig. 21.

(1) The pressure tube must be clamped between two "V"-blocks without being deformed. Dimension "X" as shown in Fig. 21 must be at least 25mm and left unobstructed by the V-blocks.

(2) Suitable safety measures must be taken before performing the above venting operations. Full face visor, leather gloves and protective clothing must be worn by the person performing the venting operations. Any persons in close vicinity of the area must also observe these safety measures.

(3) To vent the pressure tube, drill a 3mm diameter hole 20mm from the bottom cover as shown in Fig. 21.

(4) The cylinder is correctly vented when the piston rod can be moved in and out without the use of force.

(5) The gas springs are partially filled with oil. Be sure to comply with the laws of your state regarding the disposal of oil.

If correct disposal in accordance with these instructions is not possible please return the gas springs to your local Mitsubishi dealer.

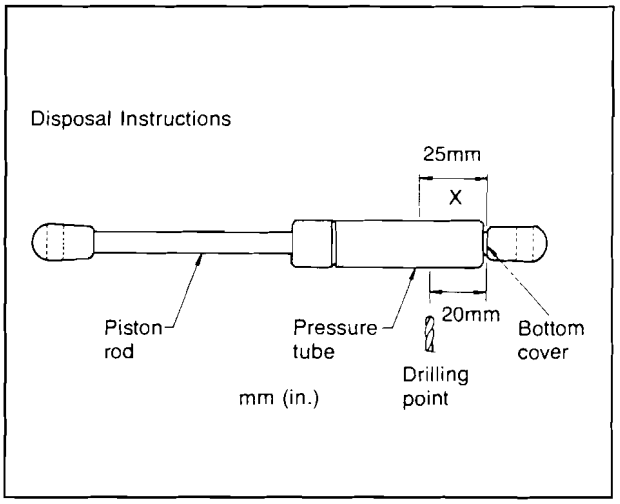


Fig. 21 — Tailgate/Hood gas spring disposal

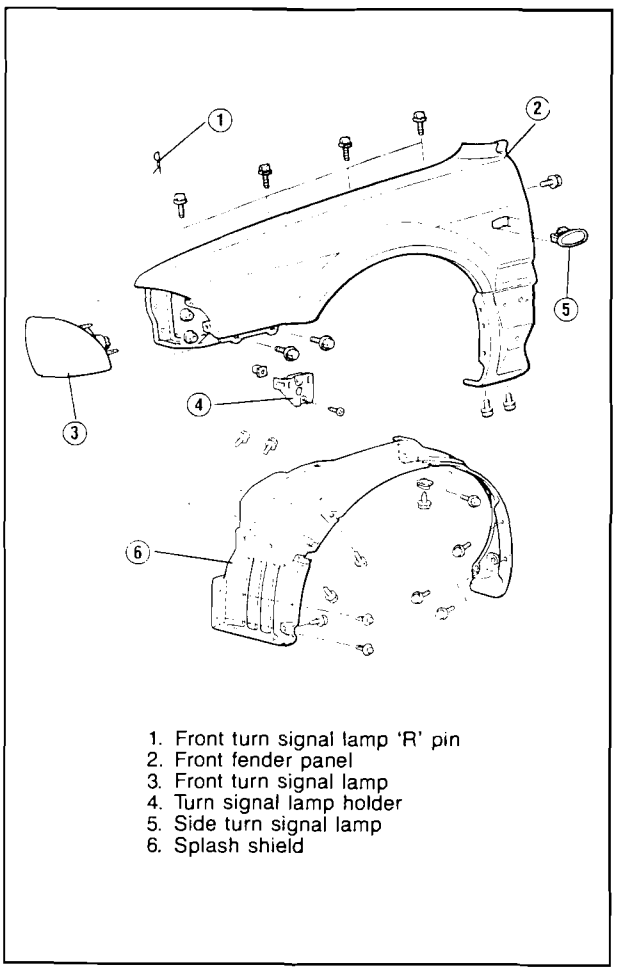


Fig. 22 — Front fender assembly

FRONT FENDERS

Removal

(1) Remove mudflap — refer Group 51 — Exterior.
(2) Remove the front fender splash shield retaining bolts.
(3) Remove the front fender splash shield.
(4) Using a small screwdriver with a piece of cloth on the tip, remove the side turn signal, refer Fig. 23.

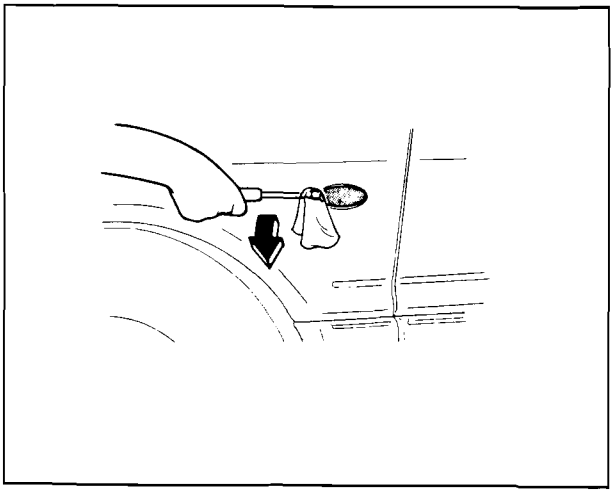


Fig. 23 — Side turn signal lamp removal

(5) Remove the front turn signal lamp by removing the retaining pin and releasing the clip, refer Fig. 22.
(6) Remove the front turn signal lamp holder by removing the screw and releasing the clip, refer Fig. 22.
(7) Remove the two fender to headlight assembly mounting nuts.
(8) Remove the front bumper, refer Group 51 — Exterior for procedure.
(9) Remove the front side protection moulding as per procedure in Group 51 — Exterior.
(10) Remove all the remaining fender mounting bolts as illustrated in Fig. 22 and remove the front fender.

Installation

(1) Ensure that all the old sealant is removed from fender flange and then apply new sealant making sure not to cover the bolt holes on fender flange. Refer Fig. 24.
(2) Mount the fender and partially tighten the bolts.

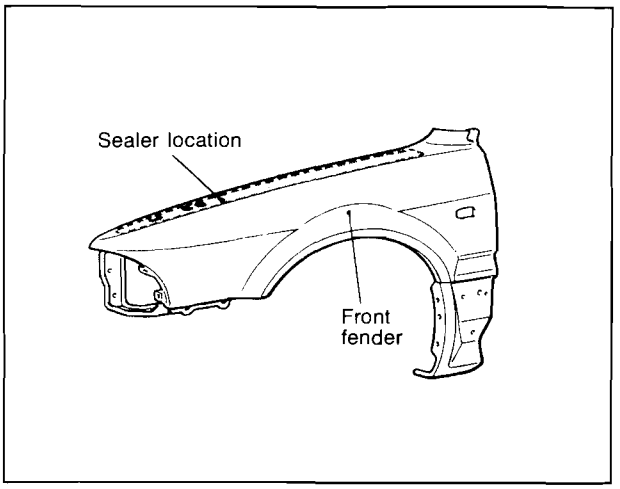


Fig. 24 — Sealer application

(3) Check fender for alignment and correct clearance with corresponding panels.
(4) Tighten all fender mounting bolts.
(5) If necessary, apply suitable sealer to the fender lip that the splash shield rests on. Refer Fig. 25 for splash shield sealant contact area.

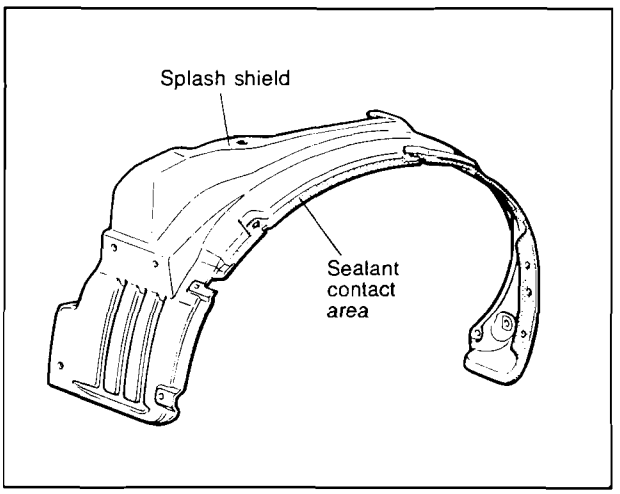
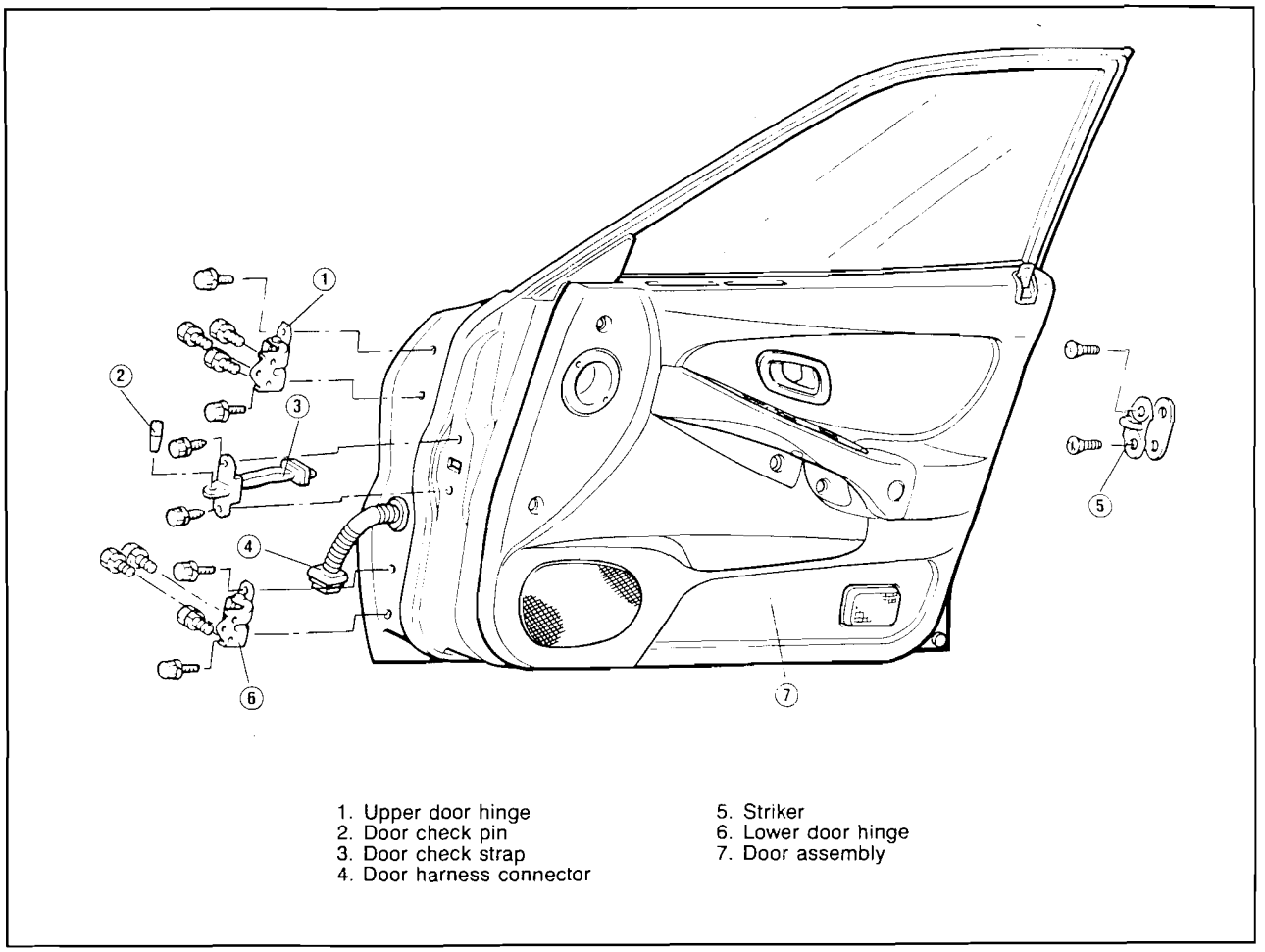


Fig. 25 — Splash shield sealer contact area



1. Upper door hinge
2. Door check pin
3. Door check strap
4. Door harness connector
5. Striker
6. Lower door hinge
7. Door assembly

Fig. 26 — Door removal (X-line front door shown)

DOORS

Front Door Removal

(1) With the door in a wide open position, sufficiently support the door without causing any damage to the door.

(2) Pencil a line around the upper and lower hinges on the door panel.

(3) Remove the door check pin and disconnect door check.

(4) Vehicles with power windows, power mirrors, central locking or door lamps:

Remove the glovebox undercover, the glovebox and the glovebox housing. Free the door power loom from the flexible clamp on the ECI computer bracket. Remove the grommet from the front door pillar and withdraw the connector/s. Disconnect connector/s.

(5) Remove the door hinge to door mounting bolts and remove the door from the vehicle.

Installation

Install by reversing removal procedure and note the following:

(1) Align the door to the hinges using the pencil mark and install bolts.

(2) With door closed, check door margins and adjust if necessary. Torque bolts to specification.

(3) Reconnect the connectors (where fitted) and replace grommet, wiring, glovebox, etc.

(4) Adjust door striker if necessary to gain best alignment and door opening/closing effort.

Rear Door Removal

(1) Attach a rag to the rear door body panel (as shown in Fig 27) to prevent scratches and lower the rear window as far as possible.

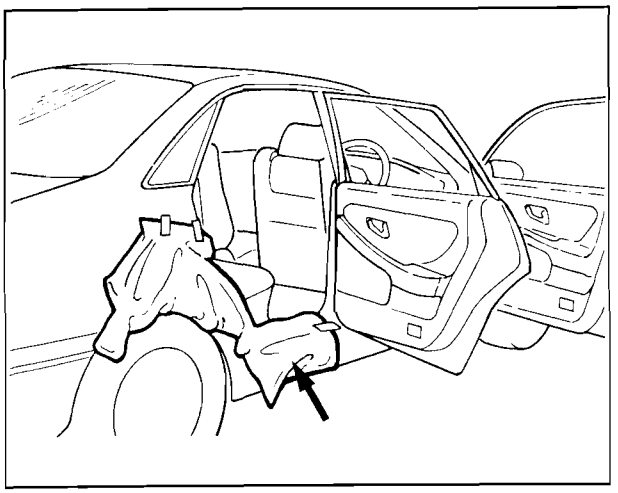


Fig. 27 — Rag location

(2) Remove the door check pin and disconnect the door check. Close the door.
(3) Pencil a line around the door hinge on the door assembly.
(4) Remove the wiring loom grommet (where fitted) from the centre pillar and after removing the connector/s from the body, disconnect them.

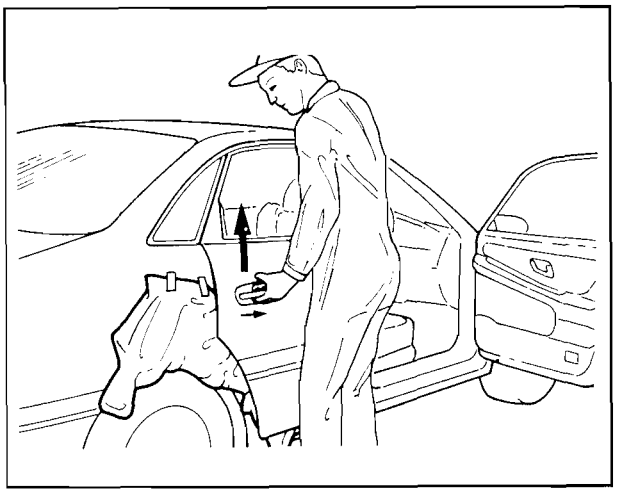


Fig. 28 — Rear door removal

(5) Remove the rear door hinge to door mounting bolts, pull the outer handle to open the latch and then remove the rear door. Refer Fig. 28.

Installation

Install by reversing the removal procedure noting the following:
(1) Install the rear door using the pencil mark and close the latch.
(2) Install the rear door mounting bolts.
(3) With the door closed, check door margins and adjust if necessary.
(4) Check wiring has been connected and replaced in pillar.
(5) Ensure check strap is reconnected.
(6) Remove rag from body.

Check Strap Removal

(1) Remove the door trim and waterproof film, refer Section 3 for procedure.
(2) Remove the spring pin and remove the check strap to door retaining bolts.
(3) Remove check strap.

Installation

Install by reversing the removal procedure.

Door Hinge Removal

NOTE: To remove the front door hinges you must first remove the front fender.

(1) Remove door as described earlier in this section.
(2) Mark location of hinge to body and remove hinge to body attaching bolts.

Installation

Install by reversing the removal procedure noting the following:
(1) The rear door hinges differ according to where they are used. Check the identification mark before installing.

LOCATION		I.D. MARK
RHR DOOR	Upper Hinge	H1
	Lower Hinge	Z
LHR DOOR	Upper Hinge	G1
	Lower Hinge	Y

Door Hinge Adjustments

Always mark hinge to panel location with a pencil before carrying out any adjustments.
This will assist in determining how far the hinge has been moved.
(1) Vertical and horizontal alignment of the rear door can be gained by moving the hinge to body position.

NOTE: This is only possible on the front door if the front fender is removed first.

(2) The front of the door to panel alignment can be adjusted by moving hinge to door position.
(3) The rear of the door to panel alignment can be adjusted by moving striker in a horizontal plane.

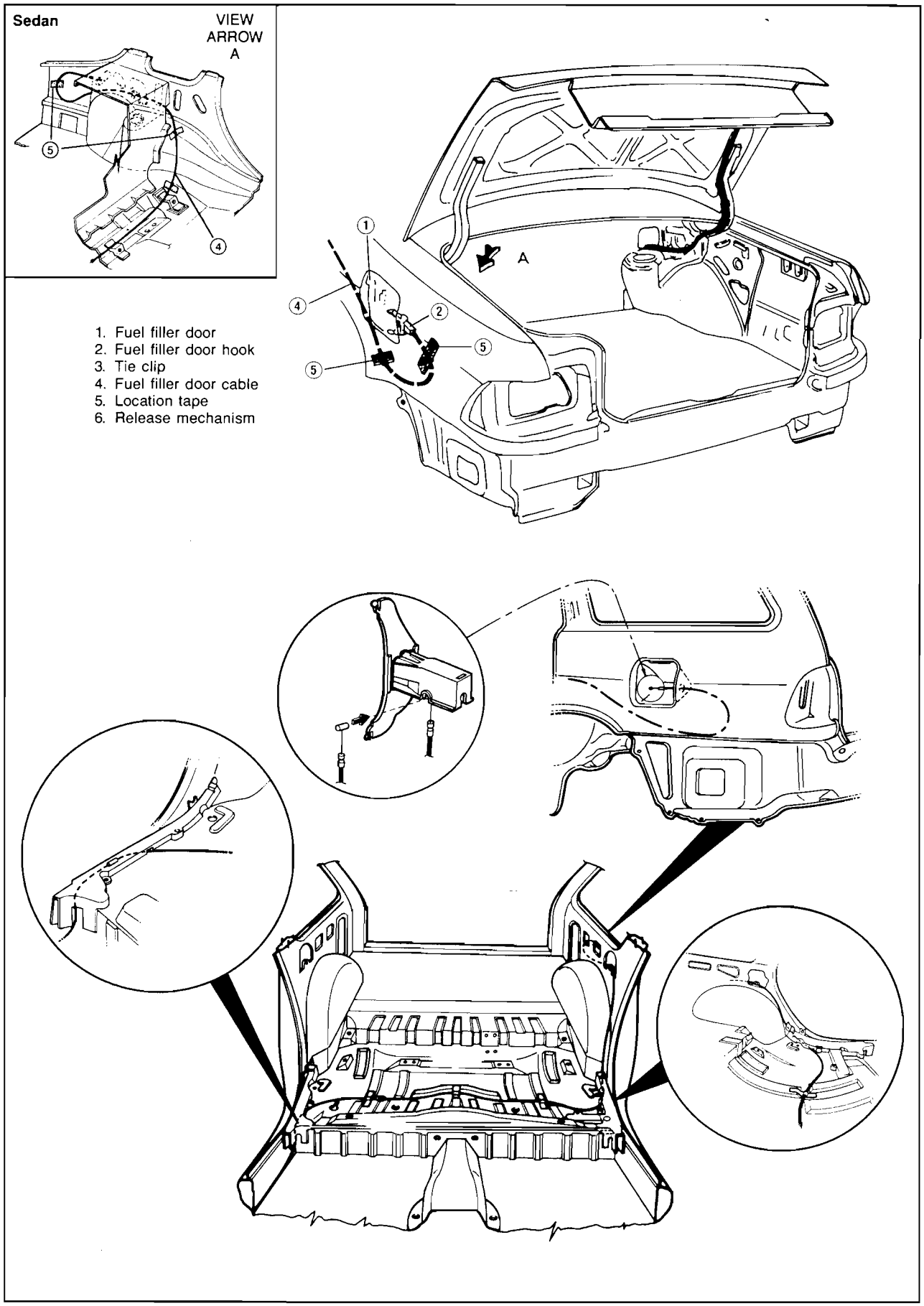


Fig. 29 — Fuel filler door cable routing sedan and wagon

FUEL FILLER DOOR AND CABLE

Removal — Door

(1) Remove filler door retaining bolts.
(2) Remove door.

Installation

Reverse removal procedure.

Adjustment

The filler door is adjustable at its mounting position for best body margins.

Removal — Cable

(1) Remove the RHF and RHR scuff plates.
(2) Remove the centre pillar lower trim, rear seat back, rear seat squab, lower front seat belt mounting bolt and the RHR wheelhouse trim. Refer Group 52 — Interior for procedures.
(3) Remove the lever assembly from the body by releasing the retaining bolt.
(4) Disconnect the cable from the lever assembly and remove the cable from the clip-on locations under the carpet.
(5) Remove the two trunk side trims and the rear trunk trim. Refer Group 52 — Interior for procedure.
(6) Remove the tape and snap clip from the locations shown in Fig. 29.
(7) Remove the fuel filler door lock from the body by compressing the spring clips on either side of the lock mechanism.
(8) Feed lock and cable out of its slot and disconnect the cable.
(9) Remove the cable from the vehicle.

Installation

To install, simply reverse the removal procedure noting the following:
(1) Ensure cable routing is correct and free from kinks.
(2) Ensure all tape and clips are replaced in original position.
(3) Ensure all components removed are replaced and if necessary torqued to specification.
(4) Check that the fuel filler door lock is located in the body correctly.

Adjustment

(1) Remove the rear seat back, rear seat squab and RHR wheelhouse trim to gain access to the adjuster.
(2) Move the adjuster to the position that ensures correct operation of the fuel filler door. Refer Fig. 30.
(3) This is achieved by releasing the clip and changing the notch that it locates in.
(4) Replace all of the components that were removed.

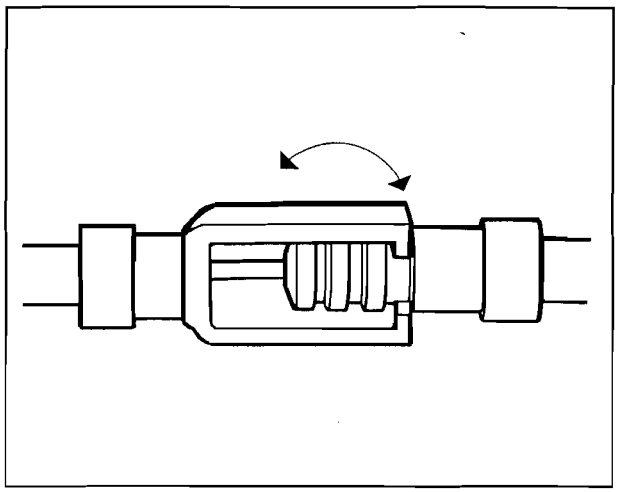


Fig. 30 — Cable adjuster

SECTION 3 — DOOR TRIMS

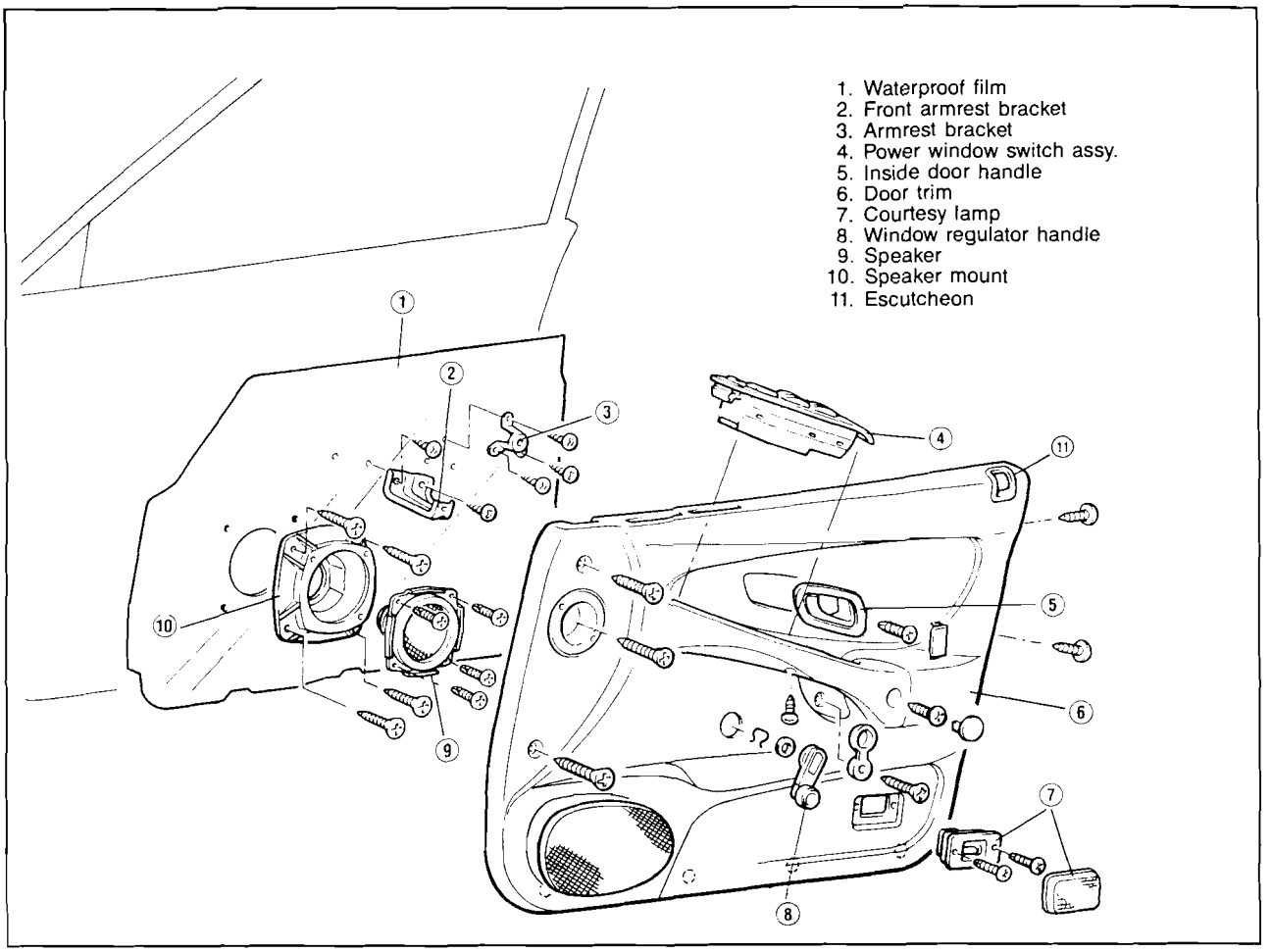


Fig. 1 — Front door trim removal (X-line shown)

FRONT DOOR TRIM

Removal

(1) Put the window in the down (open) position.

(2) Remove the retaining clip and then remove window regulator handle assembly where fitted. Refer Fig. 2.

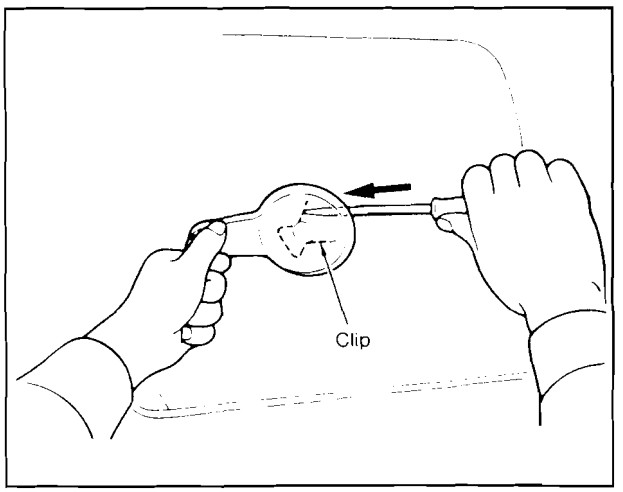


Fig. 2 — Regulator handle clip removal

(3) Release power window switch assembly (where fitted), disconnect wiring and remove the switch assembly.

(4) Remove the retaining screw covers from over the heads of the screws. Refer Fig. 1.

(5) Remove the inside door handle retaining screw, depress door trim to avoid damage before removing handle and move the handle forwards and out of the trim.

(6) Disconnect rod assembly from the handle and remove handle.

(7) Remove all other retaining screws from the door trim assembly. Refer Fig. 1 and remove the escutcheon.

(8) Using Fig. 1 for location, remove the door trim clips from the door by using special tool E310 to release them.

(9) Disconnect any wiring that is connected to the door trim.

(10) While pulling the base of the door trim out, lift and remove the door trim.

Waterproof Film Removal

(1) With the door trim off, remove the two front door armrest brackets.

(2) "X" line only — Remove the speaker retaining screws and the speaker mount screws and disconnect the wiring. Remove speaker and speaker mount.

(3) Remove the waterproof film.

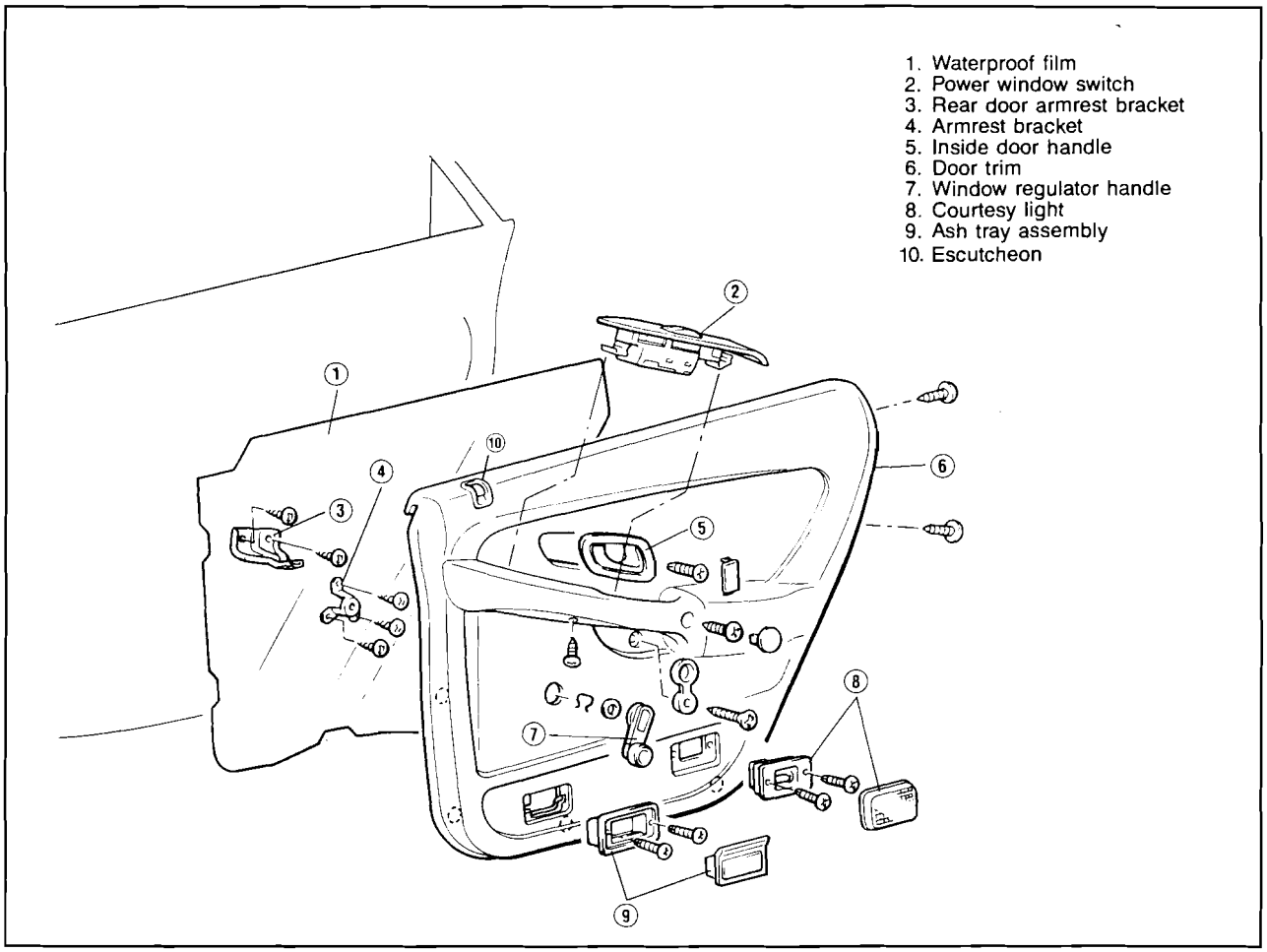


Fig. 3 — Rear door trim removal

Installation

To install, reverse the removal procedure noting the following:

(1) Ensure waterproof film is secured firmly in place.

(2) All information, testing procedures, etc. on speakers and power window switch — refer Group 54 — Chassis Electrical.

REAR DOOR TRIM

Removal

(1) Put the window in the down (open) position.

(2) Remove the retaining clip and then remove the window regulator handle, where fitted. Refer Front Door Trim for clip removal.

(3) Release the power window switch assembly (where fitted), disconnect wiring and remove the switch assembly and remove the escutcheon.

(4) Remove the retaining screw covers from over the heads of the screws. Refer Fig. 3. Remove screws.

(5) Remove the inside door handle retaining screw.

(6) Slide the handle forwards (to the front of the vehicle) and out of the trim.

(7) Disconnect the rod from the inside handle and remove handle.

(8) Remove any remaining screws.

(9) Using Fig. 3 for location, remove the door trim clips by inserting special tool E310 or similar and lever to remove them.

(10) Once the clips are released, disconnect any wiring associated with the door trim.

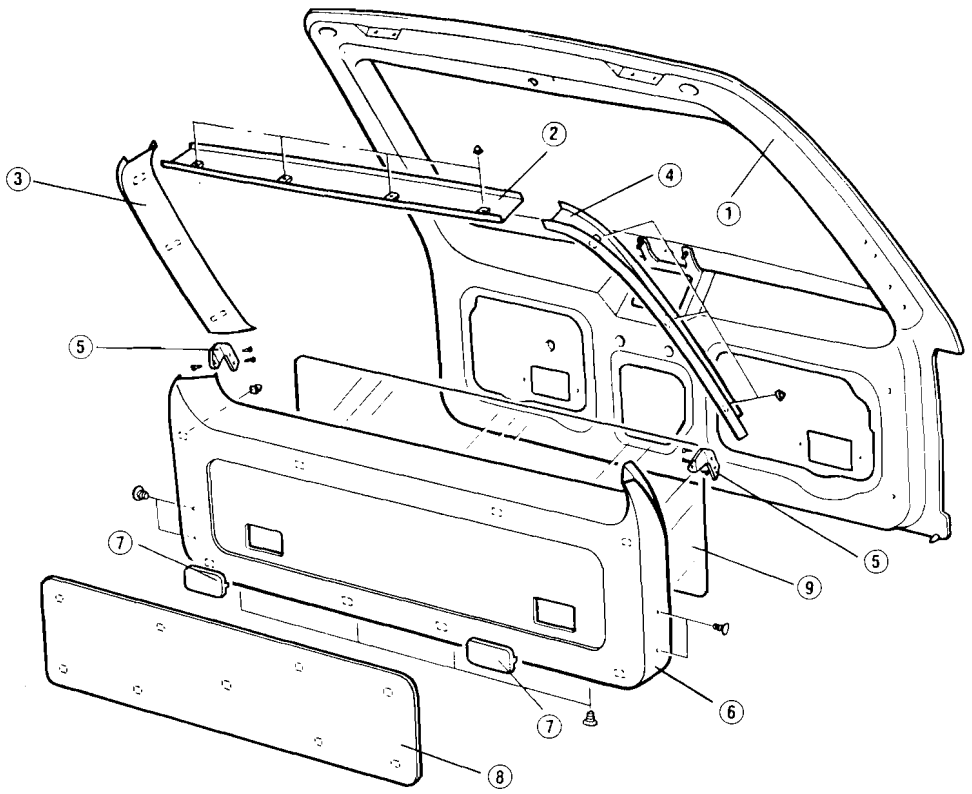
(11) While pulling the base of the door trim out, lift up and remove door trim.

Waterproof Film Removal

(1) To remove the waterproof film simply remove the two armrest brackets and peel back film.

Installation

Reverse removal procedure.



1. Tailgate
2. Tailgate upper trim
3. Tailgate sidetrim R.H.
4. Tailgate side trim L.H.
5. Retaining bracket
6. Tailgate lower trim
7. Tailgate lower trim insert (H & D line only)
8. Tailgate lower trim insert (P line only)
9. Waterproof film

:: Indicates clip positions

Fig. 4 — Tailgate trim

TAILGATE TRIM

Removal

(1) Using a screwdriver and a pair of long nosed pliers remove the external retaining clips from the lower trim.

(2) Remove the two retaining screws, one on each side and carefully pull the trim away from the tailgate releasing the internal retaining clips.

(3) Carefully pry the upper trim away from the tailgate.

(4) Carefully pry the side trims away from the tailgate.

Waterproof Film Removal

Remove the waterproof film by carefully peeling away from the tailgate. when refitting film ensure it is secured firmly in place.

Installation

Reassemble by reversing the removal procedure noting the following:

(1) Snap on the trim panels after fitting new retainers if necessary.

(2) Align and interlock all trim panels to attain a neat appearance.

SECTION 4 — OPERATING HARDWARE

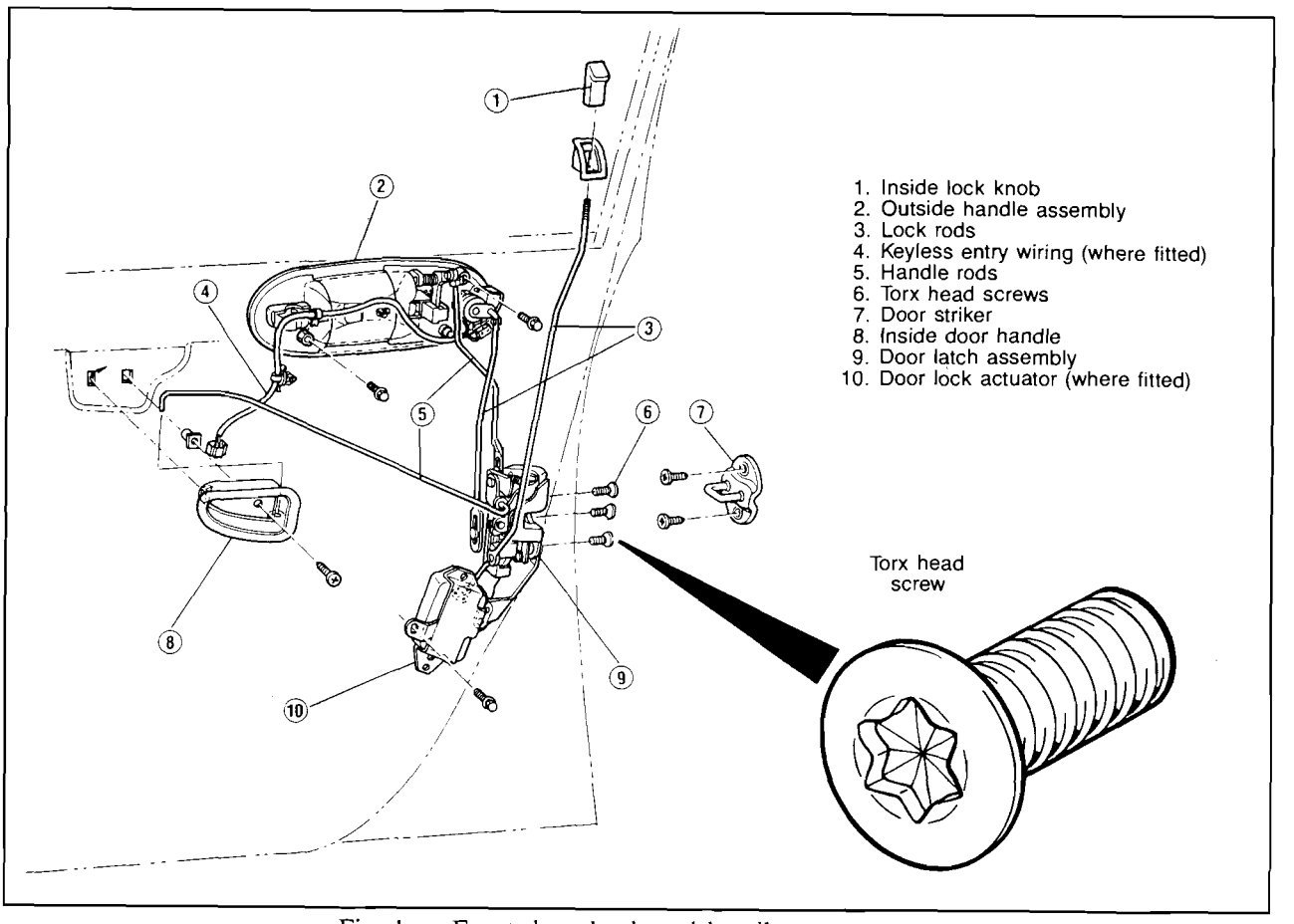


Fig. 1 — Front door latch and handle components

FRONT DOOR LATCH AND HANDLE

Removal

(1) Remove the door trim and waterproof film as described earlier in this group.

NOTE: The inside door handle will already be removed.

(2) Disconnect the outside handle and lock rods.
(3) Disconnect the wiring connector for the keyless entry system (where fitted).
(4) Remove the two retaining bolts and remove the outside handle assembly by pushing towards the front of the vehicle then pulling it out.
(5) Remove the inside lock knob and surround by unscrewing it.
(6) Using a TORX head tool, remove the three latch retaining bolts (plus normal bolt for actuator, where fitted) and remove the assembly.

NOTE: The torx head screws are non-reuseable. Once removed, they must be replaced.

NOTE: To remove the barrel from the front outside door handle assembly, remove the snap ring and remove the barrel. Refer Fig. 2.

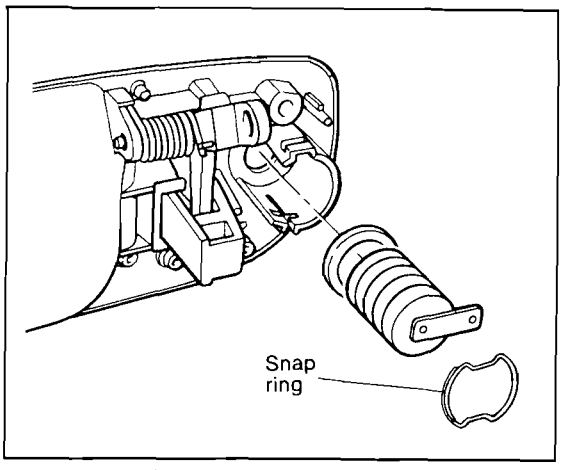


Fig. 2 — Barrel removal

Installation

To install, reverse the removal procedure noting the following:

(1) Ensure that all rods and wiring (where fitted) is re-connected.
(2) Ensure all handles and locks (keyless entry system — where fitted) operate correctly.

Inspection

For door lock actuator, handle, ETACS, etc. testing refer Group 54 — Chassis Electrical.

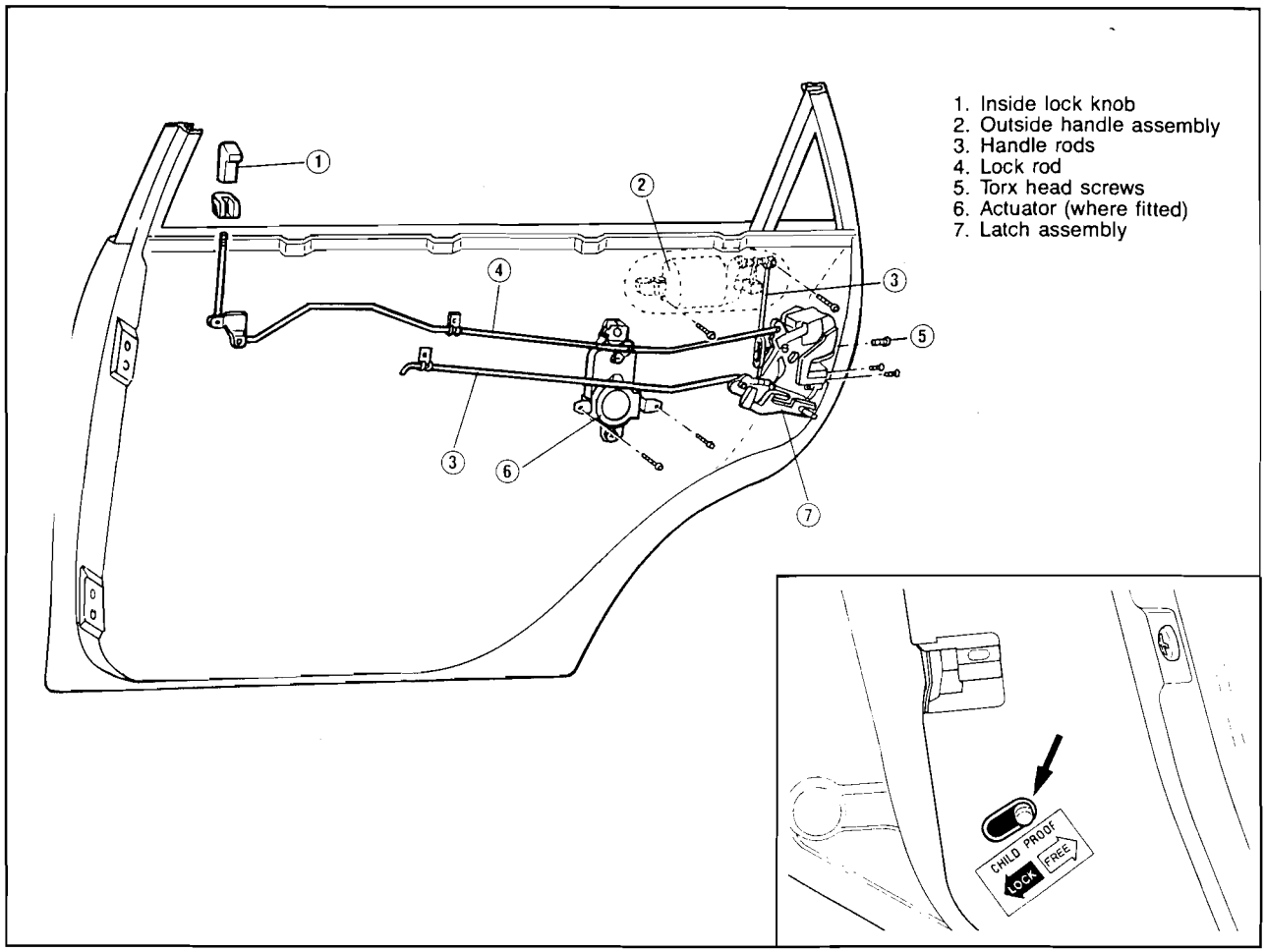


Fig. 3 — Rear door latch and handle components

REAR DOOR LATCH AND HANDLE

Removal

(1) Remove the door trim and waterpoof film as described earlier in this group.

NOTE: The inside door handle will already be removed.

(2) Remove the inside lock knob and surround.
(3) Disconnect the outside handle rod from the handle assembly.
(4) Remove the outside handle assembly by removing the retaining bolts. Push towards front of vehicle, then out.
(5) Disconnect inside lock rod from the door at the lock knob end and disconnect from the actuator (where fitted).
(6) Disconnect the wiring loom and remove the actuator by its two retaining bolts (where fitted).
(7) Disconnect any remaining clips that retain the rods.
(8) Using a torx head tool, remove the three latch retaining screws.

NOTE: The torx head screws are non-reuseable. Once removed they must be replaced.

(9) Carefully manoeuvre the latch assembly from the door.

Installation

To install, reverse the removal procedure noting the following:
(1) When installing the inside lock rod to the actuator, ensure the rod is in the unlocked position (towards the front of the vehicle) and then push the rod into the clamp on the actuator.
(2) Ensure that all components that were removed are replaced and operate correctly.

Inspection

To test actuator, refer Group 54 — Chassis Electrical.

CHILD PROOF DOOR LOCKS

The rear doors have a child proof lock incorporated into the door lock.

If the lever is placed in lock position the door cannot be opened from the inside, however normal outside operation is maintained.

If the lock is placed in the free position the door may be opened from both inside and outside handles.

The unit is non-serviceable and if faulty the door lock assembly should be replaced. To remove the child proof lock use the same procedure described in Door Lock Removal in this section.

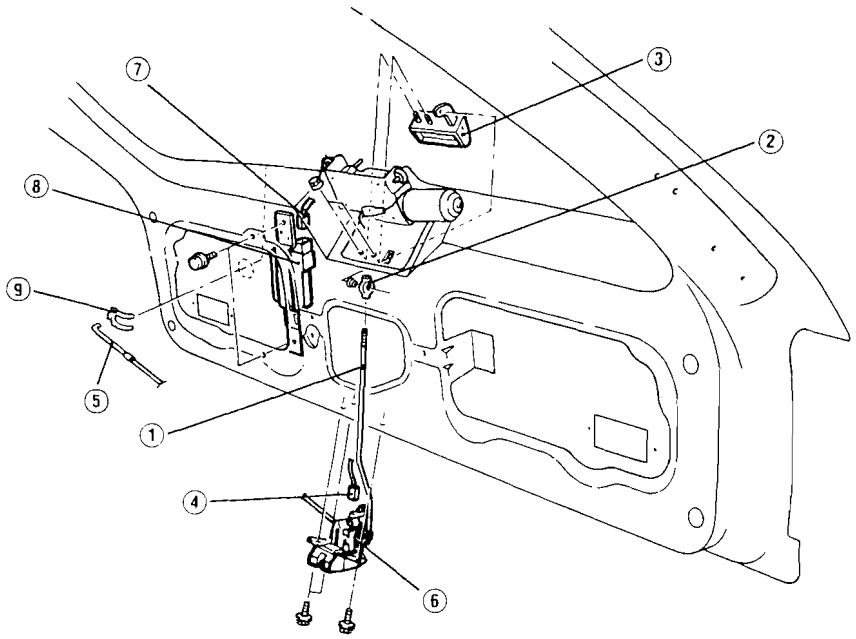


Fig. 4 — Tailgate latch assembly

TAILGATE LATCH AND HANDLE

Removal

(1) Remove the tailgate trim and waterproof film as described earlier in this group.

(2) Remove the rod and rod holder from the tailgate handle.

(3) Remove the tailgate handle by removing the two retaining nuts and pulling away from the tailgate.

(4) Uncouple the harness connector from the tailgate latch.

(5) Disconnect the lock rod from the clamp at the rear of the tailgate lock actuator and the lock cylinder.

(6) Using a torx head tool (T x 27), remove the three retaining bolts from the tailgate latch assembly and then remove the latch from the tailgate.

(7) To remove the tailgate lock actuator from the vehicle remove the two retaining bolts and uncouple the connector.

(8) To remove the tailgate lock cylinder, carefully lever the lock retainer from position and remove the lock cylinder from the tailgate.

NOTE: The torx head screws are non re-usable. Once removed they must be replaced.

Installation

To install, reverse the removal procedure noting the following:

(1) When installing the lock rod to the actuator, ensure the rod is in the unlocked position (towards the right hand side of the vehicle) and then push the rod into the clamp on the actuator.

(2) Ensure that all components that were removed, are replaced and operate correctly.

Inspection

To test actuator, refer Group 54 — Chassis Electrical.

SECTION 5 — OPENING SIDE GLASS

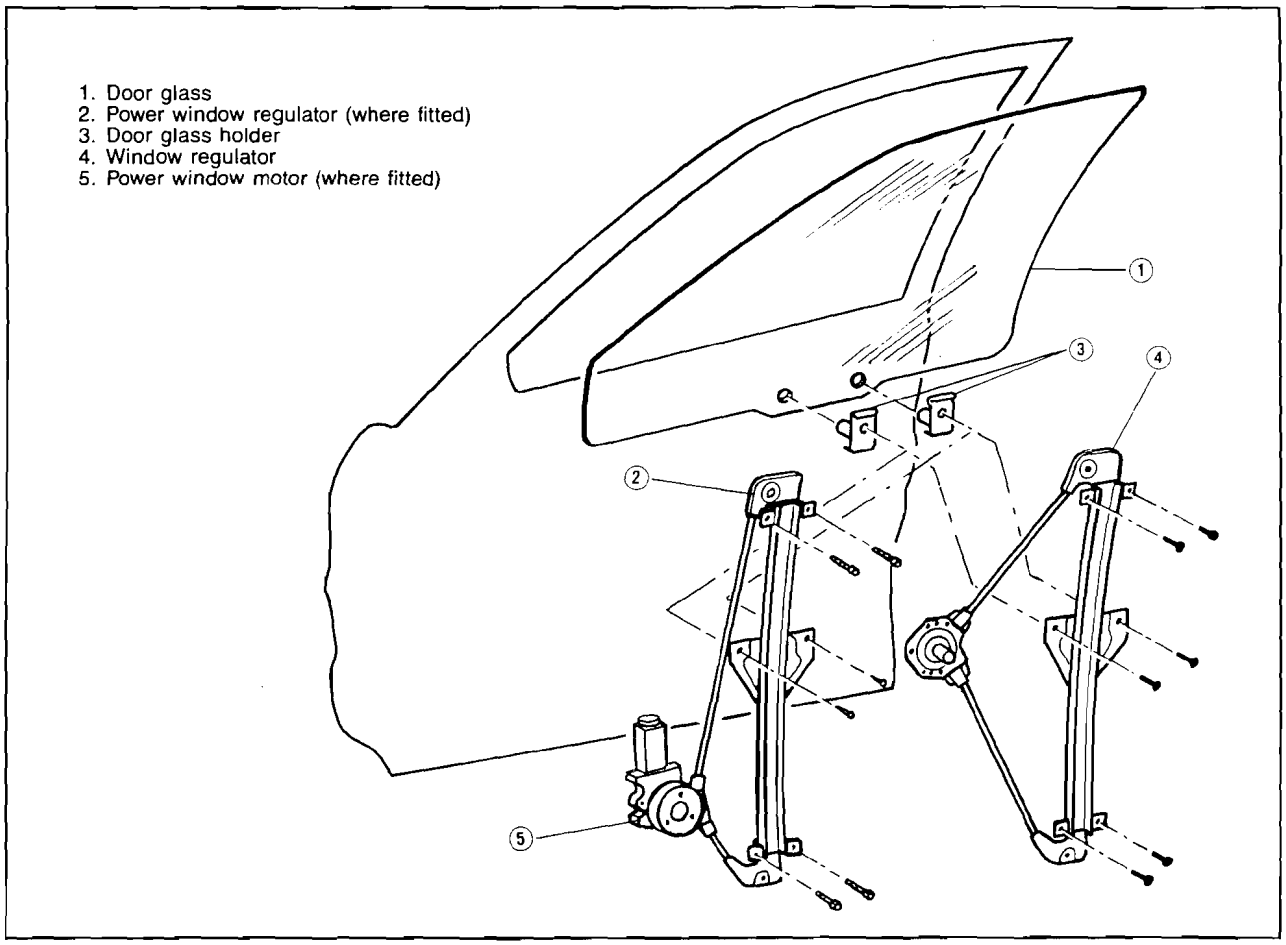


Fig. 1 — Front door glass and regulator components

FRONT DOOR GLASS AND REGULATOR

Removal

(1) Remove the door trim and waterproof film — refer Section 3, this group.

(2) Lower the door glass until the retaining screws are aligned with the service hole. Refer Fig. 2.

(3) While supporting the door glass, remove the retaining screws and lift the glass up and out of the door, refer Fig. 3.

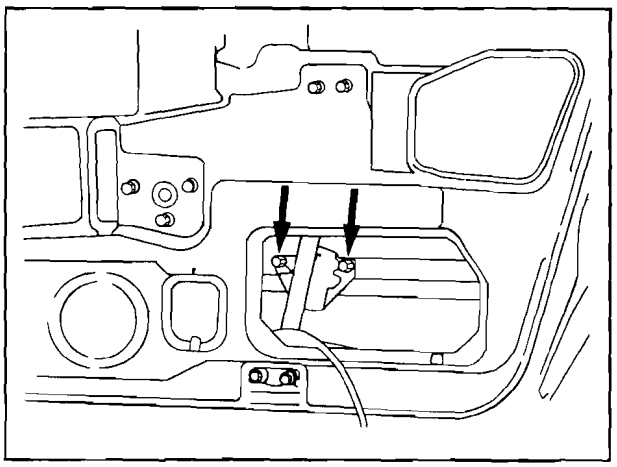


Fig. 2 — Front door glass retaining screws

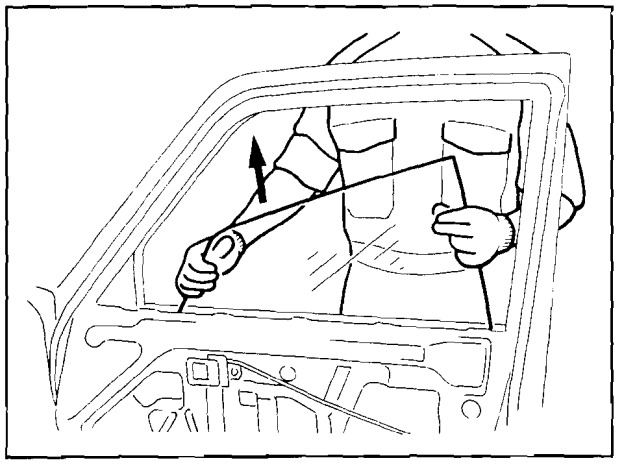


Fig. 3 — Front door glass removal

(4) Remove the seven (7) regulator retaining bolts and carefully remove the assembly from the door.

Installation

To install, reverse the removal procedure noting the following:

(1) When installing the regulator mounting bolts tighten the one indicated with an arrow in Fig. 4 FIRST.

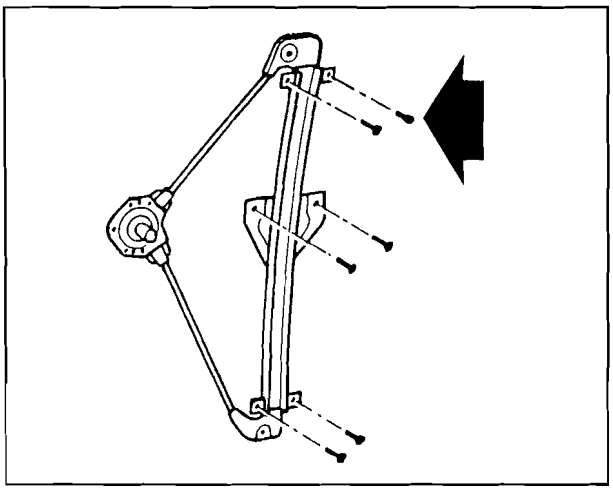


Fig. 4 — First bolt to tighten

(2) Ensure that the door glass is seated correctly in the door run channel. If not, proceed to the following adjustment information.

Adjustment

To adjust the door glass to run channel alignment, follow these procedures:

(1) Loosen the regulator installation bolts that are indicated by arrows in Fig. 5.

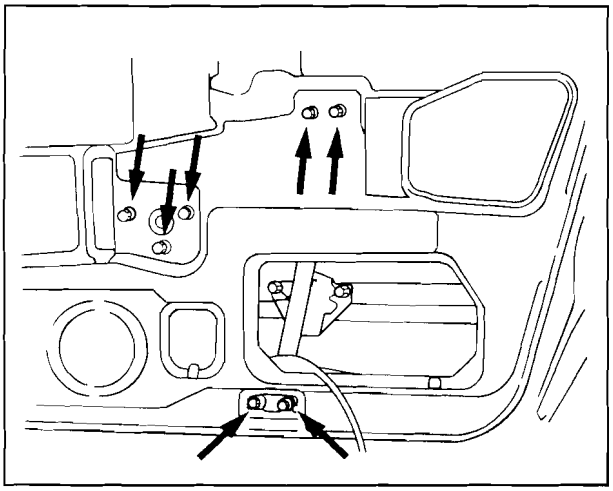


Fig. 5 — Bolts to loosen

(2) Move the upper section of the regulator towards the front or rear of the vehicle to adjust the tilt angle of the door glass.

(3) Lower the door glass in order to gain access to the retaining screws through the service hole.

(4) Loosen the door glass retaining screws (refer Fig. 6) and adjust the forward or backward position of the glass.

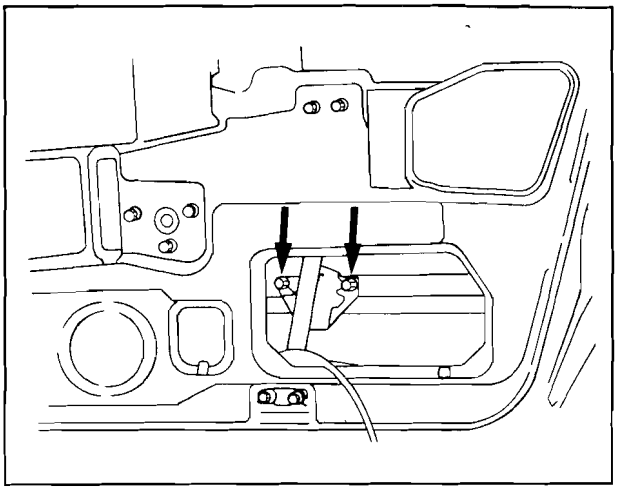


Fig. 6 — Retaining screws

(5) Ensure that the door glass seals correctly into the run channel or re-adjust door glass.

Inspection

For power window regulator testing or electrical check, refer Group 54 — Chassis Electrical.

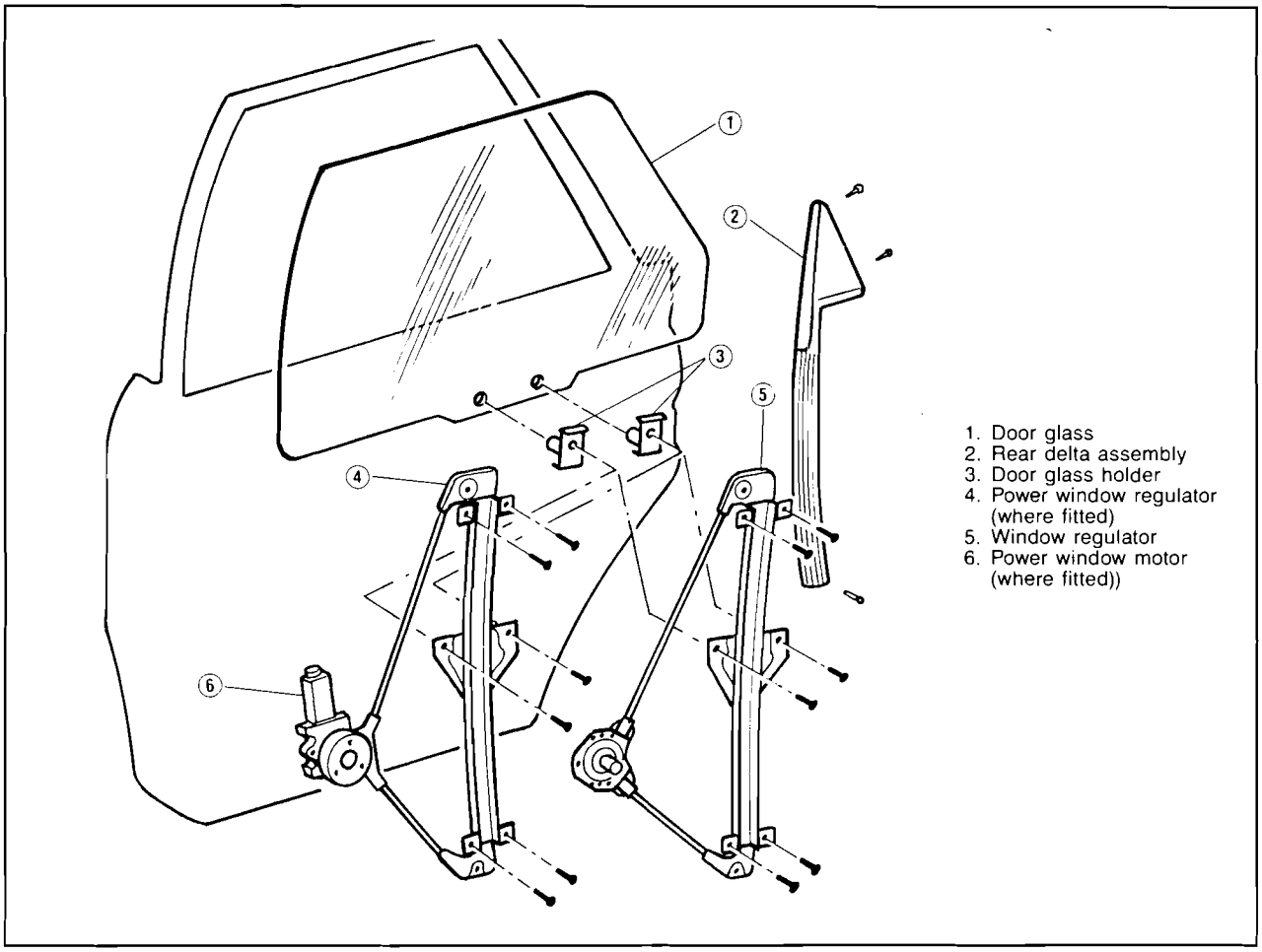


Fig. 7 — Rear door glass and regulator components

REAR DOOR GLASS AND REGULATOR

Removal

(1) Remove the door trim and waterpoof film — refer Section 3, this Group.

(2) Lower the rear door glass to the end of its travel.

(3) After moving the rear door inner opening weatherstrip to one side, remove the two screws and bolt that retains the rear door delta assembly, refer Fig. 8.

(4) Remove the delta assembly from the door.

(5) Ensure the door glass retaining screws are accessable. Refer Fig. 9.

(6) While supporting the door glass, remove the retaining screws and remove the glass from the door. Refer Fig. 10.

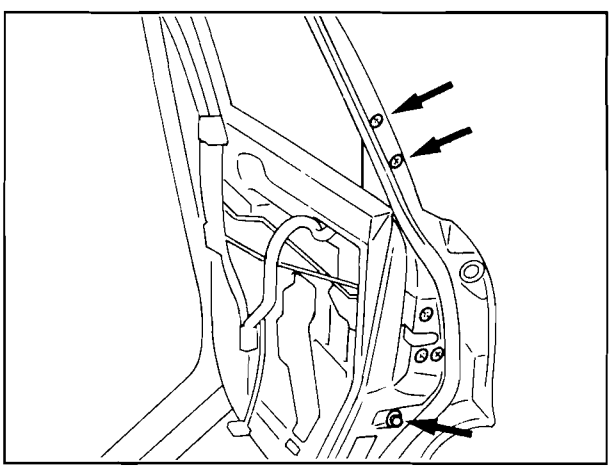


Fig. 8 — Rear door delta removal

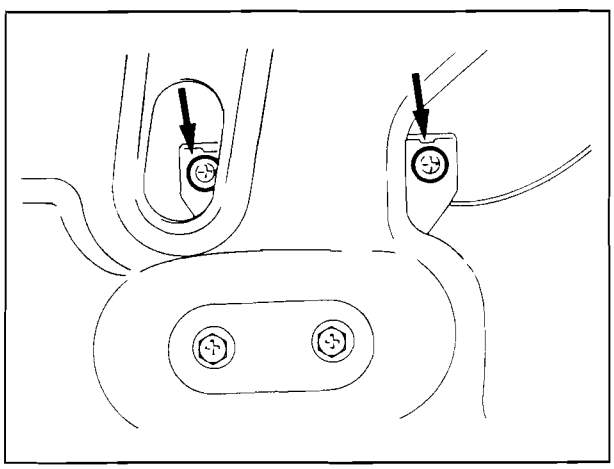


Fig. 9 — Retaining screw location

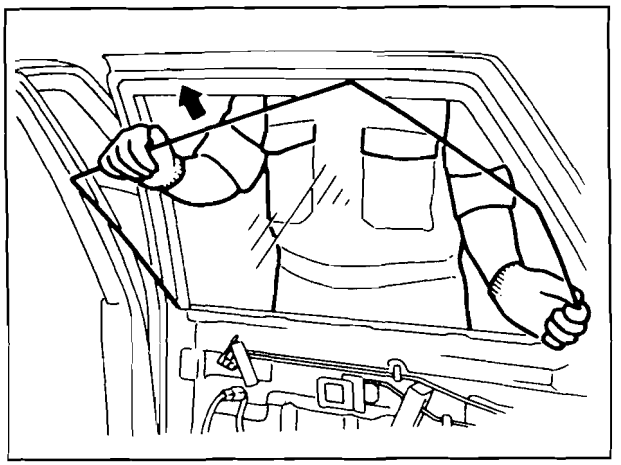


Fig. 10 — Rear door glass removal

(7) Remove the seven (7) regulator retaining bolts and carefully remove the assembly from the door. Refer Fig. 11.

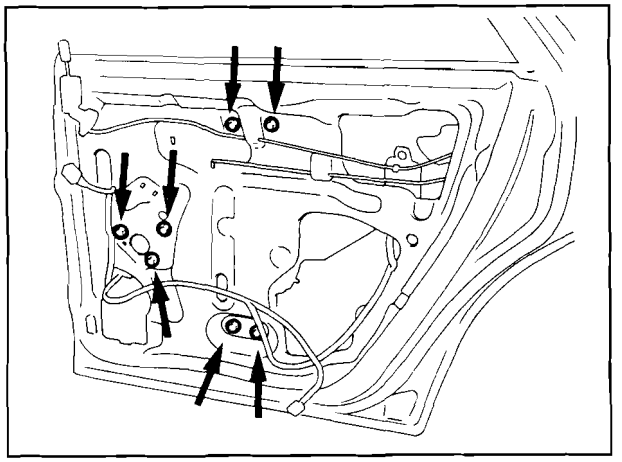


Fig. 11 — Retaining bolts

Installation

To install, reverse the removal procedure noting the following:

(1) When installing the regulator mounting bolts, tighten the one indicated with an arrow in Fig. 12 FIRST.

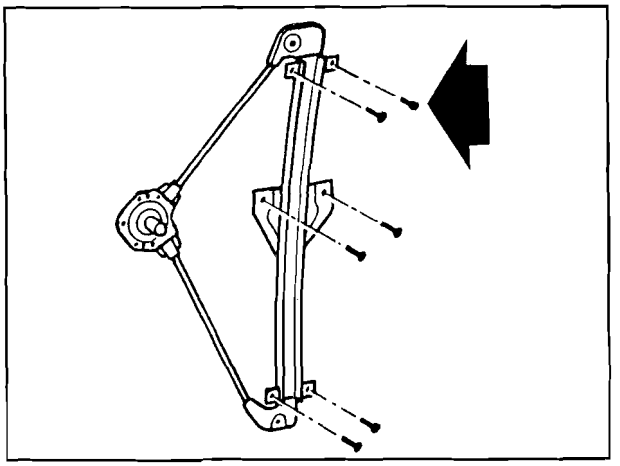


Fig. 12 — First bolt to tighten

(2) With door glass installed and in the "down" position, insert the rear door delta assembly into position and install retaining screws and bolt.

(3) Ensure that the door glass is seated correctly in the door run channel. If not, proceed to the following adjustment information.

Adjustment

To adjust the door glass to run channel alignment, follow the front door glass and regulator adjustment instructions.

Inspection

For power window regulator testing or electrical check, refer Group 54 — Chassis Electrical.

SECTION 6 — STATIONARY GLASS

GENERAL INFORMATION

The windscreen is a laminated type which has a plastic lamination between two layers of safety glass. If struck hard enough it will crack into large sections enabling the driver to stop the vehicle safely.

The factory fitted windscreen and rear window are held in position by an air cured polyurethane adhesive.

When replacing the windscreen, rear window or fixed quarter window, use BOSTIK AUTOSEAL 130 FC-LV, AUTOSEAL PAINT PRIMER 5083 and AUTOSEAL GLASS PRIMER 5082 or equivalent system.

WINDSCREEN

Removal

(1) Remove the windscreen wiper arms and the air inlet grilles, refer Group 51.

(2) Remove the sun visors, interior rear vision mirror, front pillar trims and the front headlining trim as described in Group 52.

(3) Remove the upper windscreen moulding by using special tool No. E980, refer Group 51.

(4) Remove the side windscreen mouldings being careful not to break the plastic clips.

(5) Remove the plastic moulding retainers from the weld studs on the glass opening perimeter.

(6) Apply cloth tape around the opening perimeter of the windscreen to protect the paint finish.

(7) Using a sharp instrument, make a hole in the adhesive in the upper corner of the windscreen and insert a braided cutting wire (available from windscreen specialists) approximately 0.6 mm in diameter into the adhesive from the inside of the vehicle.

(8) With the aid of an assistant, use a sawing motion to move the wire up one side, across the top and down the other side with a steady, even pressure to cut the adhesive, refer Fig. 1.

NOTE: The use of safety glasses and heavy duty gloves are recommended to prevent injury in case of wire breakage.

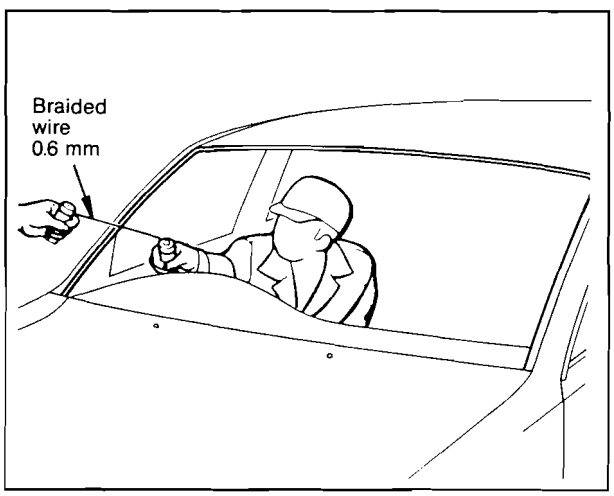


Fig. 1 — Windscreen removal

(9) After cutting the adhesive on the sides and top of the windscreen, with the aid of an assistant, push the top of the windscreen out and cut the lower adhesive with a long, sharp bladed tool.

NOTE: The use of suction type holders on the outside of the glass will assist in the handling of the windscreen.

(10) With the aid of an assistant, remove the windscreen from the vehicle.

NOTE: An alternate removal method is to cut through the bonding material from the inside using a sharpened paint scraper. This is accomplished by cutting through the top, sides and bottom corners, then easing glass forward to an upright position and cutting through the bottom material.

(11) If the glass is to be reused, remove all loose adhesive without damaging the glass or ceramic surface.

(12) Remove all loose adhesive from the body fence flange without causing damage to the flange.

NOTE: Old adhesive that is sound and has good adhesion can remain, as it serves as a foundation for the new adhesive.

Body Opening Preparation

(1) Clean the fence flange and any remaining loose adhesive with X55 solvent or similar and allow to dry for 10 to 15 minutes. Prime any bare metal that is showing with a suitable metal primer.

(2) Apply body primer (Autoseal 5083) over the fence flange to give a total "blacked-out" appearance. Allow to dry for 10 minutes, refer Fig. 2.

(3) Fit moulding retainers to weld studs, refer Fig. 3.

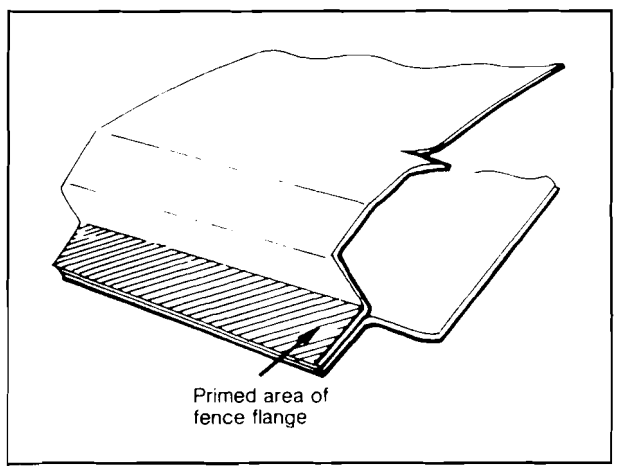


Fig. 2 — Priming fence flange

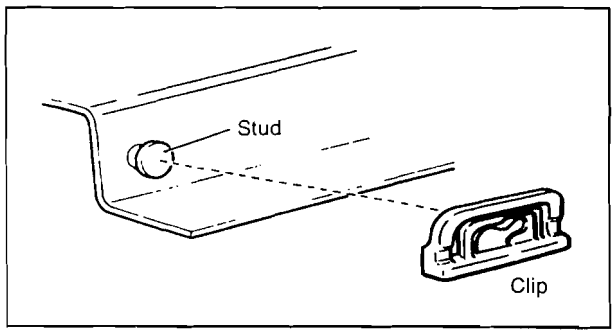


Fig. 3 — Moulding retainers

NOTE: If the adhered clips come away from the body, prepare the surface and glue the clips back into place. Approximately 240 mm up from the T-stud for the front and 130 mm up from the T-stud on the rear. Refer Fig. 4.

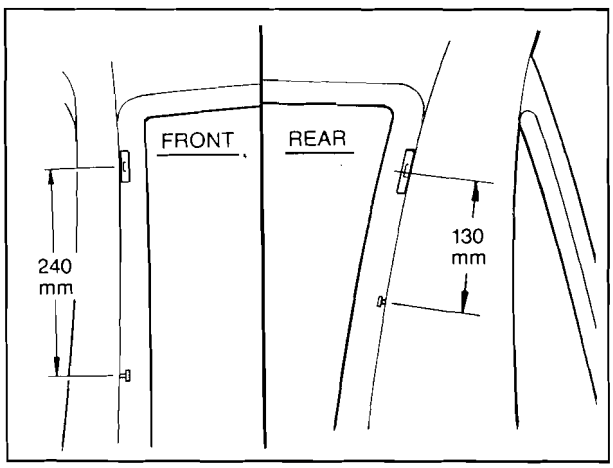


Fig. 4 — Clip replacement

Weld Stud Repair — Windscreen and Rear Window

In the event of a broken weld stud a satisfactory repair can be achieved by riveting and sealing the plastic moulding retainer clips to the windscreen rebate.

If replacement of a front or rear window moulding clip retainer ('T' stud) is required, the following procedure is recommended.

(1) Remove the existing retainer by carefully grinding back to the roof panel.

(2) Mark a point in the windscreen rebate approximately 25 mm from the existing 'T' stud and 6±0.3 mm from the flange surface.

(3) Drill a hole in the rebate to accept a 3.0 mm rivet.

(4) Remove all burrs from around the drilled hole.

(5) Apply primer to all bare metal and touch up the repaired area or refinish the area as necessary ensuring that adequate coverage is achieved on the inside section of the panel.

(6) Allow sufficient time for the paint to dry then apply a neutral cure silicone sealer around the drilled hole.

(7) Rivet the moulding clip to the rebate area using a 3.0 mm closed end, all aluminium rivet.

(8) Apply "Tectyl" wax, or similar, across the entire rebate area prior to installing the moulding.

(9) Apply body primer "Autoseal 5083" over the fence flange to give a total "blacked out" appearance. Allow to dry for 10 minutes, refer Fig. 2.

Glass preparation

(1) Degrease the glass bonding surface 20 mm around the perimeter of the sides and top of the glass. Also degrease in a line across the lower section of the windscreen, 85 mm from the edge. Solvent: e.g. X55.

NOTE: This line is indicated by two notches on either side and a line of clear dots through the ceramic, refer Fig. 5.

(2) Apply a thin coating of Autoseal 5082 glass primer around the glass on the bonding surface. (Approx. 12 mm width.) Refer Fig. 6.

NOTE: If adhesive must remain on the windscreen to avoid damaging it, ensure all bare glass receives a coating of Autoseal 5082 glass primer.

(3) Allow to dry for 10-15 minutes. If the surface is touched, it must be reprimed.

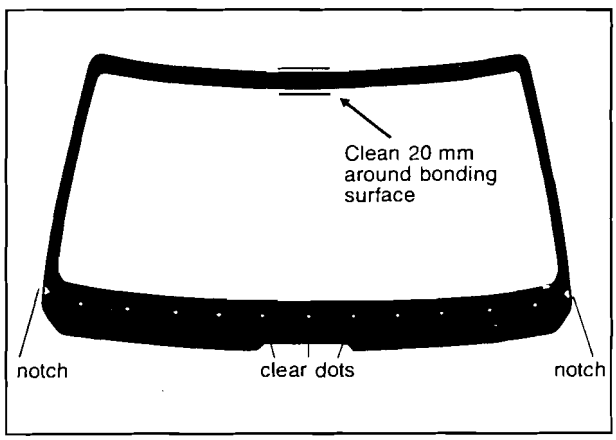


Fig. 5 — Lower bonding surface

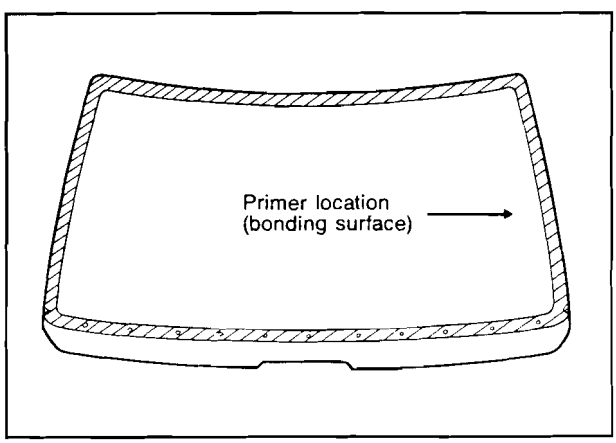


Fig. 6 — Windscreen primer ocation

(4) Install the window dam in position (refer Fig. 7) by removing the backing tape and presssing into place.

NOTE: Ensure that the dam is fitted in the right direction.

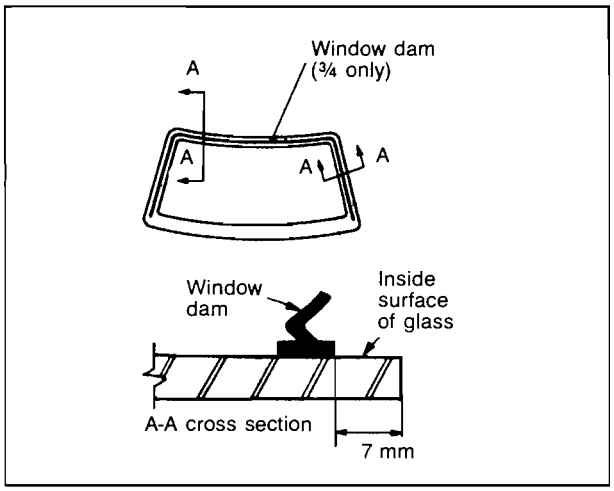


Fig. 7 — Dam installation

(5) Apply an even bead of adhesive around the bonding surface of the windscreen. This bead is to be approx. 7 mm wide and 12-15 mm high and between the edge of the glass and the window dam. Refer Fig. 8.

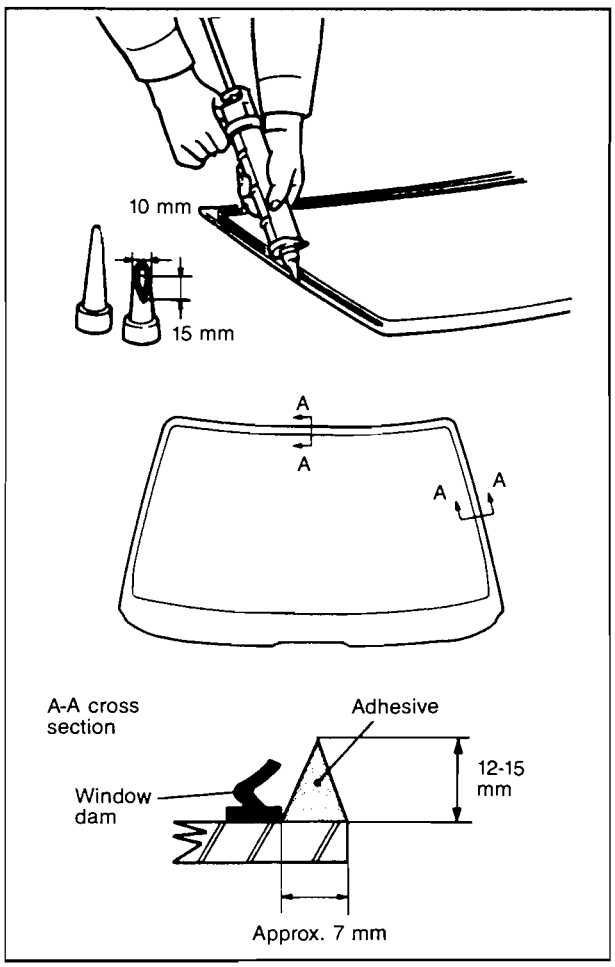


Fig. 8 — Adhesive application

NOTE: Cut the nozzle of the adhesive cartridge as shown in Fig. 8 to ease adhesive application.

Installation

(1) With the aid of an assistant and suction type holders if available, centrally locate the windscreen in the opening and on the spacer blocks, refer Fig. 9.

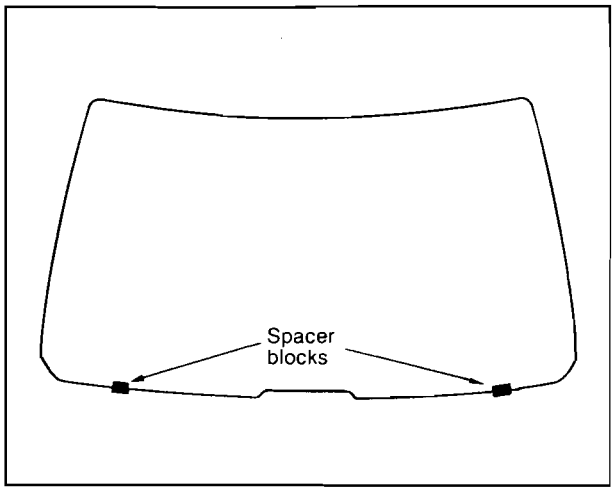


Fig. 9 — Positioning glass to spacers

(2) Using light, even pressure, work your way around the windscreen and ensure a good fit.

(3) With the aid of a plastic tool, force any extruded adhesive back under and towards the windscreen centre.

(4) After removing any adhesive that has stuck to the body or the glass, install windscreen mouldings before the adhesive sets. Refer Fig. 10.

(5) Leave vehicle for approx. 30 minutes and water test windscreen as described in Section 8 — Sealing.

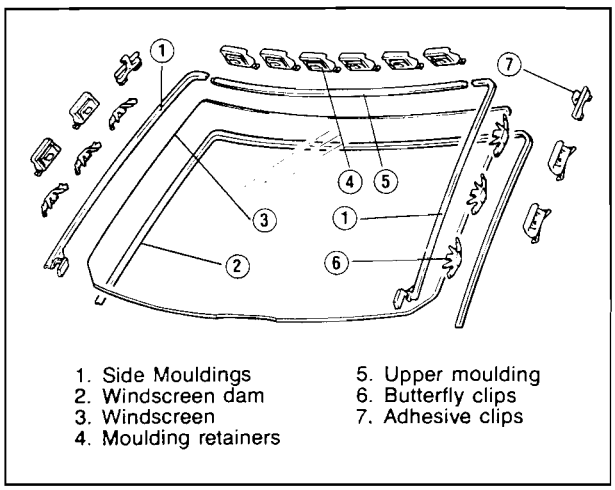


Fig. 10 — Windscreen mouldings

(6) Install the following by reversing their removal procedures:
(a) Front headlining trim
(b) Front pillar trims
(c) Interior rear vision mirror
(d) Sunvisors
(e) Air inlet grilles
(f) Windscreen wiper arms (torque to specification)

Approximate Hardening Time of Adhesive

After approximately 1 hour the can can be driven away if the ambient temperature during cure is at least 23°C and relative humidity 50%. The time for complete hardening of BOSTIK AUTOSEAL 130 FC SEALANT/ADHESIVE to occur varies according to ambient temperature, humidity and construction of the joint.

REAR WINDOW

Removal

(1) Disconnect the rear window defogger wiring.
(2) Remove the rear pillar trims, rear parcel shelf and rear headlining trim as described in Group 52 — Interior.
(3) Remove the rear window mouldings as described in Group 51 — Exterior.
(4) The remaining procedure is the same as windscreen removal.

Glass and Body Preparation

The procedure is the same as windscreen, noting the following:
(1) When cleaning the rear window for primer application, clean around the perimeter of the rear window at a width of 20 mm instead of being 85 mm inset at the bottom.

Glass Fitment

(1) Glass bonding is carried out using the procedure detailed in Windscreen section.
(2) Install the following by reversing the removal procedure.
(a) Rear window mouldings.
(b) Headlining rear trim.
(c) Rear parcel shelf.
(d) Rear pillar trims.
(3) Connect the rear window defogger wiring.

REAR QUARTER WINDOW — SEDAN

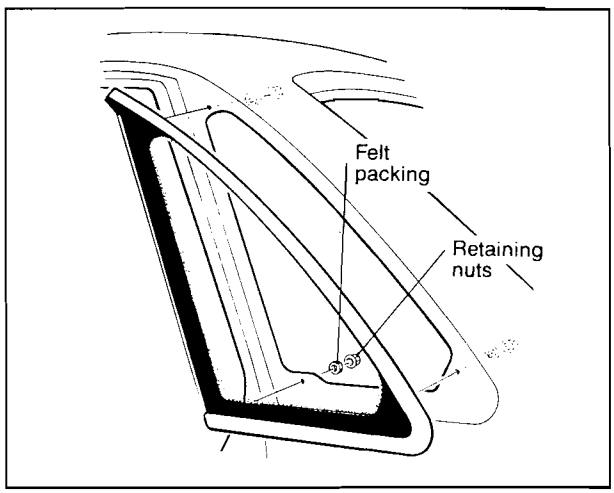


Fig. 11 — Rear quarter window assembly

Removal

(1) Remove the rear pillar trim, refer Group 52 — Interior.
(2) Remove the three quarter window retaining nuts.
(3) Remove the dripline moulding from the rear quarter window moulding, refer Group 51 — Exterior.
(4) Using a sharp tool, cut the adhesive around the window from the inside.
(5) Remove rear quarter window assembly.

NOTE: The rear quarter glass cannot be replaced on its own, it is available as a complete assembly (including moulding) only.

Body Preparation

(1) Ensure all of the old sealant has been removed from the body flange.
(2) Ensure all areas of the body that are taken back to bare metal are suitably primed and allowed to dry before installation of the rear quarter windows.

Installation

(1) Using a 6 mm diameter butyl (non-hardening) ribbon or tape, surround the rear quarter window assembly in the sealant location shown in Fig. 12.

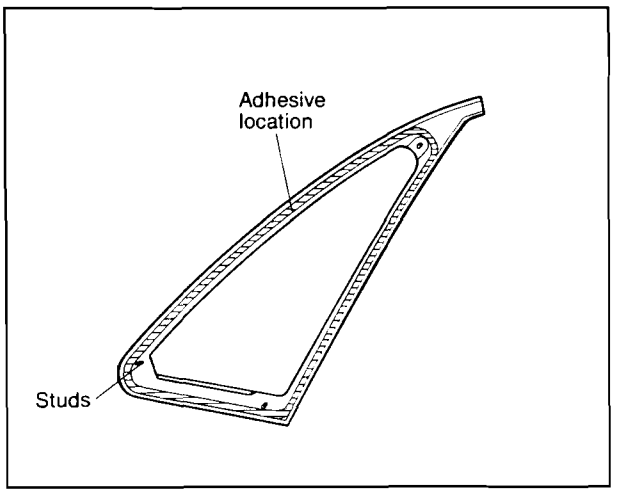


Fig. 12 — Seal and location

(2) Locate the three studs into the holes in the body and press the rear quarter window into place.
(3) Install retaining nuts and felt packing and torque to 2-3 Nm (slightly tighter than finger tight).
(4) Water test for leaks once the window assembly has been installed.
(5) Replace all other components that were removed during the operation.

REAR QUARTER WINDOW — Wagon

Removal

(1) Remove upper cargo trim.
(2) Remove pillar garnishes, refer Section 10 and glass retaining clips.
(3) Remove rear quarter window retaining clips, refer Fig. 13.
(4) Remove rear quarter glass mouldings carefully, making sure not to damage the paint finish.

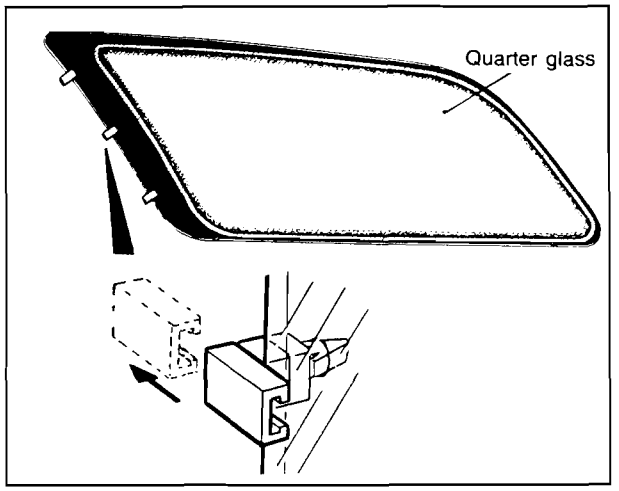


Fig. 13 — Rear quarter glass removal (typical)

(5) Following steps 7 through 12 of windscreen removal described earlier in this section, remove the rear quarter window glass.

Glass and Body Preparation

Procedure is the same as the windscreen.

Glass Fitment

(1) Glass bonding is carried out using the procedure detailed in windscreen section.
(2) Install the following by reversing the removal procedure:
(a) Upper quarter window moulding.
(b) Glass retaining clips and pillar garnishes.
(c) Quarter panel belt moulding.
(d) Upper cargo trim panel.

TAILGATE GLASS

Removal

(1) Disconnect the rear defogger cable terminals.
(2) Remove trim panels from inside the tailgate.
(3) Remove the rear wiper arm and blade and motor assembly.

NOTE: The moulding will have to be replaced when replacing glass.

(4) Apply a cloth tape around the opening perimeter as shown in Fig. 14, to protect the painted surface of the body.
(5) Using a sharp bladed instrument make a hole in the adhesive in the lower corner of the windscreen and insert a piano wire 0.6 mm diameter into the adhesive from the inside of vehicle.
(6) Wrap the wire around a suitable blunt ended tool handle and with the aid of an assistant move the wire around the perimeter of the window, with a steady even pressure to cut the adhesive, refer Fig. 14.

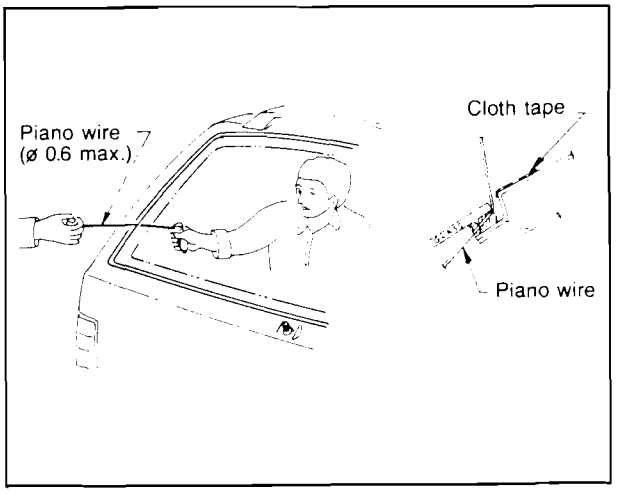


Fig. 14 — Tailgate glass removal

NOTE: The use of blunt ended tools and heavy duty gloves are recommended to prevent injury to the operators in case of piano wire breakage.

NOTE: The use of suction type holders on the outside of the glass will assist in the handling of the glass.

(7) If the glass is to be reused, remove all loose adhesive being careful not to damage the glass surface.

(8) Remove as much adhesive, from the body fence flange as possible without cutting the paint finish of the fence flange or the body.

NOTE: Old adhesive that is sound and has good adhesion can remain, as it serves as a foundation for the new adhesive.

Body Preparation

Clean the fence flange and any remaining adhesive with oil-free solvent and allow to dry for 5 to 10 minutes e.g. X55 or equivalent.

Glass Preparation

(1) Degrease the bonding surface of the glass 20 mm around the perimeter, using an oil free cleaning solvent.

(2) Position the foam strip adhesive dam material onto glass as shown in Fig. 15.

(3) Apply the new moulding onto the glass edge as shown in Fig. 15, with the joint at bottom centre between marks in ceramic.

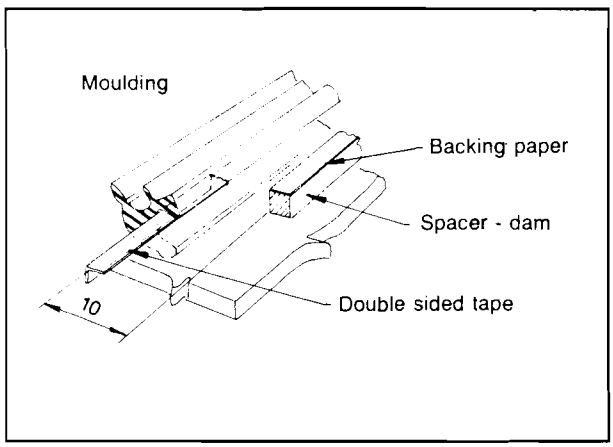


Fig. 15 — Moulding fitment tailgate glass

Use approximately 50 mm of double sided tape (6 mm wide) on glass edge, at joint only, to assist assembly.

(4) Apply a uniform bead of 'Polyurethane' sealant between Dam and Moulding around periphery of glass, refer Fig. 16.

(5) Remove backing paper from dam material.

Glass Fitment

(1) Locate glass centrally into body opening and carefully press into position until the adhesive dam strip comes into contact with the fence flange.

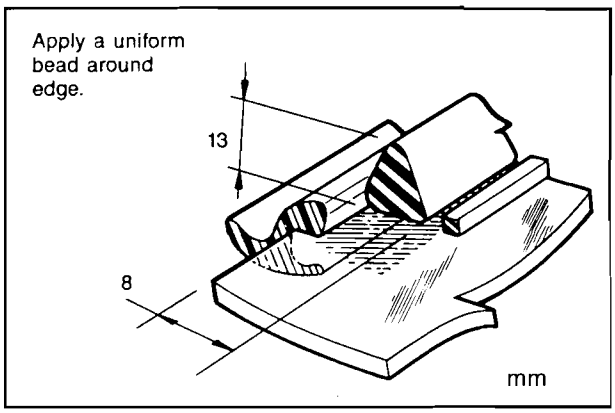


Fig. 16 — Sealant application tailgate glass

(3) Any leaks can be remedied by applying a bead of sealant from inside opening, around periphery between the dam and the fence flange. DO NOT Disturb Moulding.

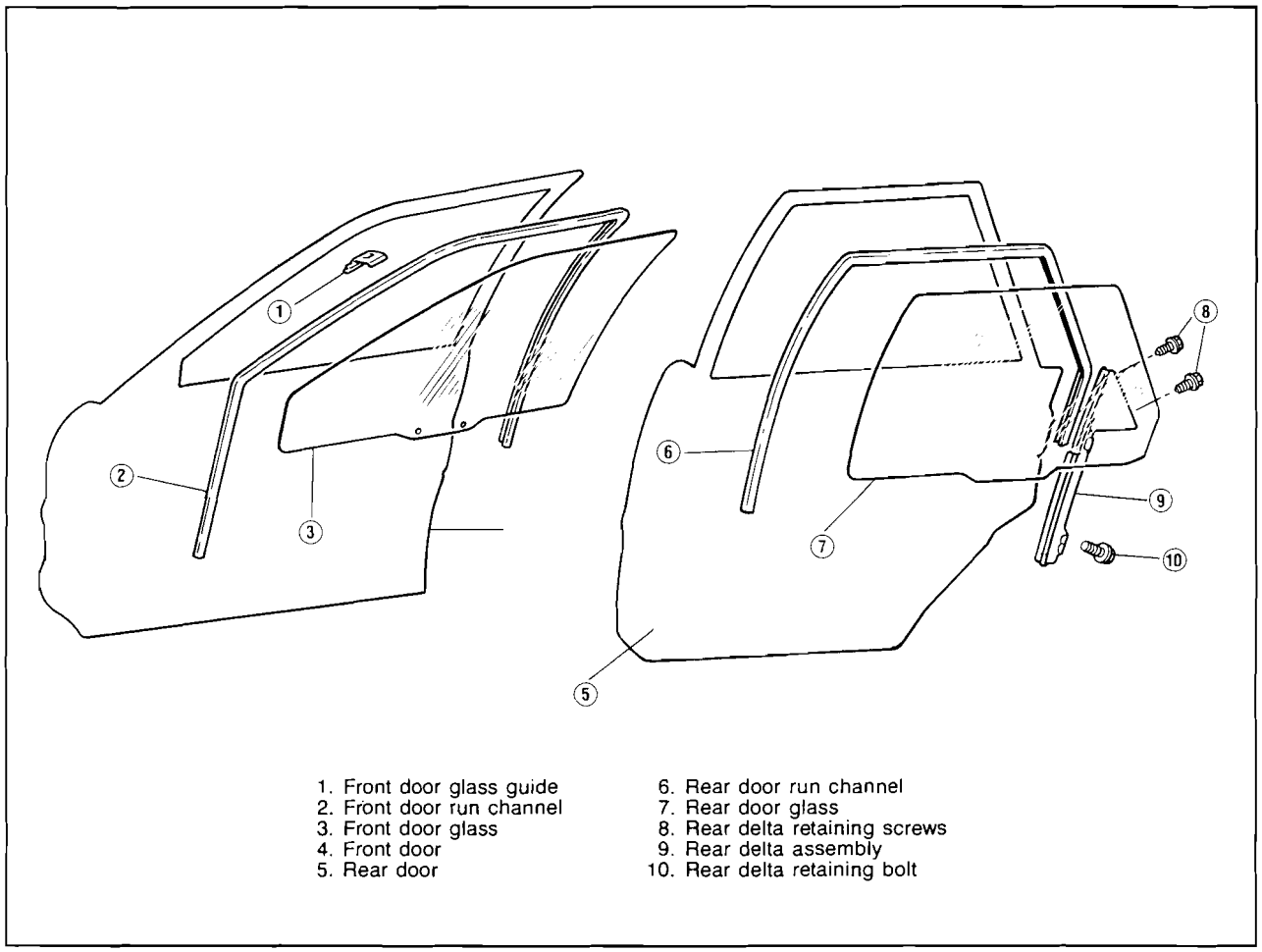
(4) Re-assemble plastic trims and connect wiring terminals.

(5) Re-fit wiper arm and blade.

NOTE: After approximately 1 hour the car can be driven away if the ambient temperature during cure is at least 23°C and relative humidity 50%. The time for complete hardening of Bostik Autoseal 130 FC Sealant/Adhesive to occur varies according to ambient temperature, humidity and construction of the joint.

NOTE: DUE TO CURING TIME REQUIRED FOR POLYURETHANE SEALANT, DO NOT DRIVE THE VEHICLE WITH THE WINDOWS DOWN FOR AT LEAST 2 DAYS OR THE TAILGATE GLASS MAY DISLODGE.

SECTION 7 — WEATHERPROOF SEALING



1. Front door glass guide
2. Front door run channel
3. Front door glass
4. Front door
5. Rear door
6. Rear door run channel
7. Rear door glass
8. Rear delta retaining screws
9. Rear delta assembly
10. Rear delta retaining bolt

Fig. 1 — Door runchannel location

DOOR RUNCHANNEL

Removal — Front Door

(1) Remove the door trim and weather proof film as described in Section 3.
(2) Remove the door glass as described in Section 5.
(3) Remove the run channel, refer Fig. 1.

Installation

Reverse removal procedure.

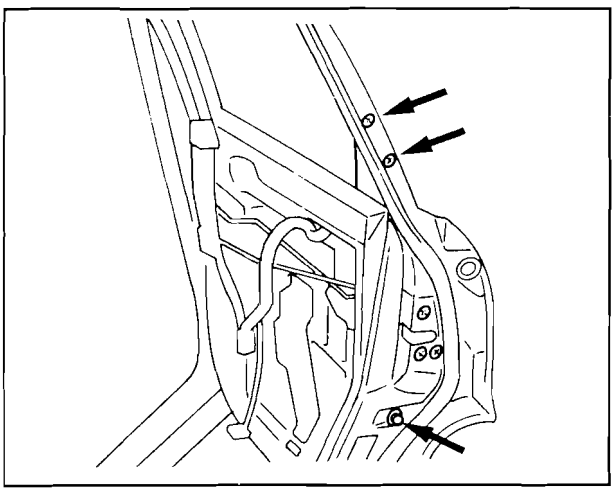


Fig. 2 — Rear delta removal

Removal — Rear Door

(1) Remove the door trim and waterproof film as described in Section 3.
(2) Remove the rear delta assembly by removing the two screws and one bolt that retains it, refer Fig. 2.
(3) Remove the rear door glass.
(4) Remove the rear door runchannel.

Installation

Reverse removal procedure noting that Section 5 should be referred to for rear door glass installation.

INNER/OUTER DOOR OPENING WEATHERSTRIPS

Removal — Front Door Inner Weatherstrip

(1) Remove the scuff plate, cowl side trim and the centre pillar lower trim. Refer Group 52 — Interior for procedures.
(2) Remove the inner door opening weatherstrip, refer Fig. 3.

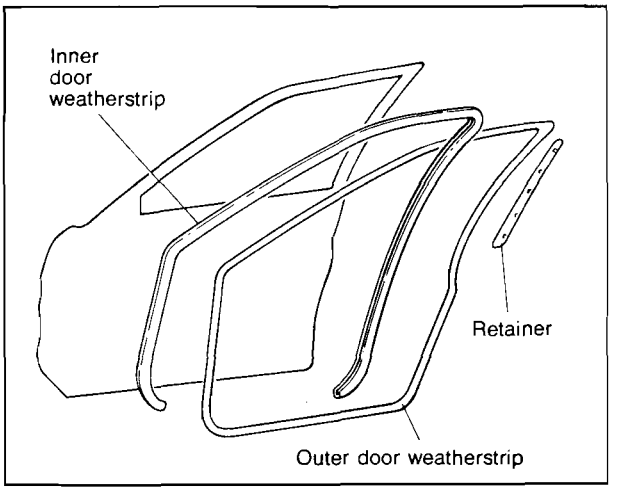


Fig. 3 — Front door inner and outer weatherstrips

Installation

Reverse removal procedure.

Removal — Front Door Outer Weatherstrip

NOTE: Try not to remove the weatherstrip unless replacing due to damage that may be caused when releasing the clips.

(1) Remove door check pin, refer Section 2.
(2) Remove the weatherstrip retainer.
(3) Remove the outer weatherstrip by carefully pulling it away from the door at the clip locations. Refer Fig. 3.

NOTE: The clips used on the lower section of the weatherstrip are not to be re-used. Replace them before installing weatherstrip.

Installation

Reverse the removal procedure making sure that all clips are located properly.

Removal — Rear Door Inner Weatherstrip

(1) Remove the scuff plate, centre pillar lower trim, rear seat and rear wheelhouse trim. Refer Group 52 — Interior for procedures.
(2) Remove the inner door opening weatherstrip, refer Fig. 4.

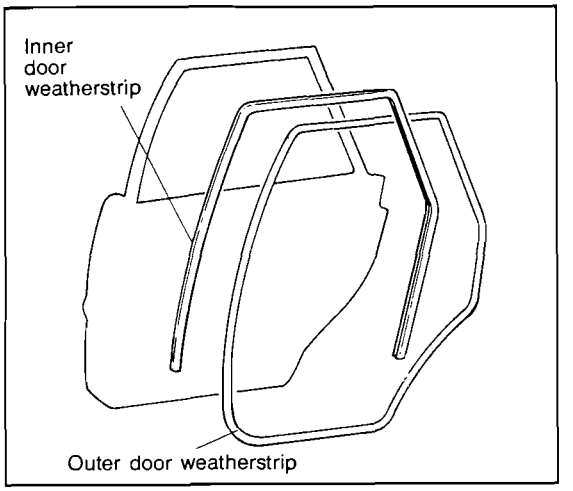


Fig. 4 — Rear door inner and outer weatherstrip

Installation

Reverse removal procedure.

Removal — Rear Door Outer Weatherstrip

The procedure is the same as Front Door Outer Weatherstrip excluding the weatherstrip retainer.

Installation

Same as Front Door.

TRUNK WEATHERSTRIP

Removal

(1) Remove the weatherstrip from its location around the trunk compartment.
(2) Manouvre the weatherstrip over the trunk lid and off the vehicle.

Installation

(1) Install the weatherstrip at the points indicated in Fig. 5 first.
(2) Install the rest of the weatherstrip ensuring that the marker is aligned with the edge of the bumper seat landing as shown in Fig. 6.
(3) Ensure that the weatherstrip is pressed fully home.

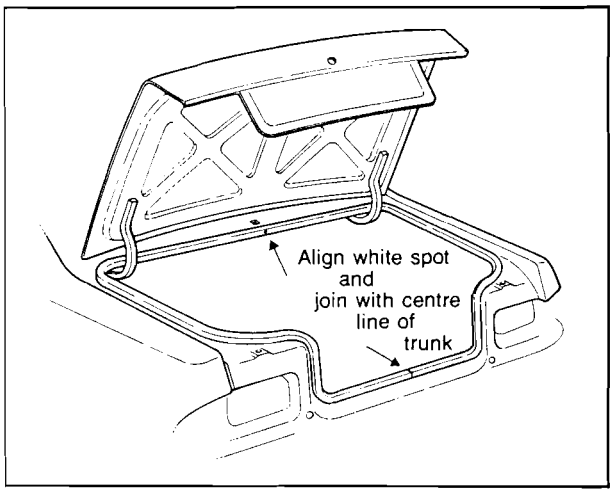


Fig. 5 — Trunk weatherstrip location

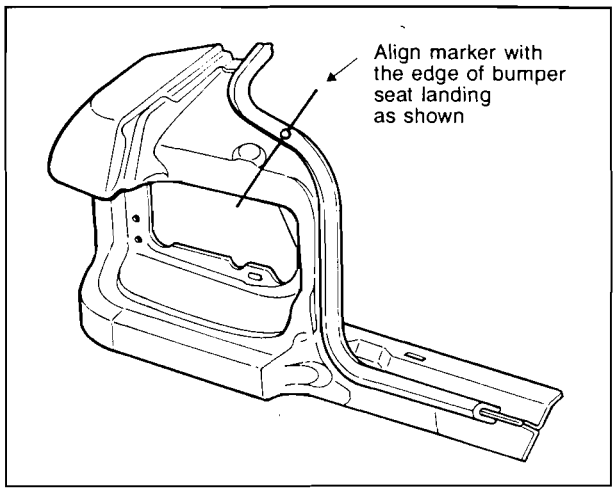


Fig. 6 — Weatherstrip alignment

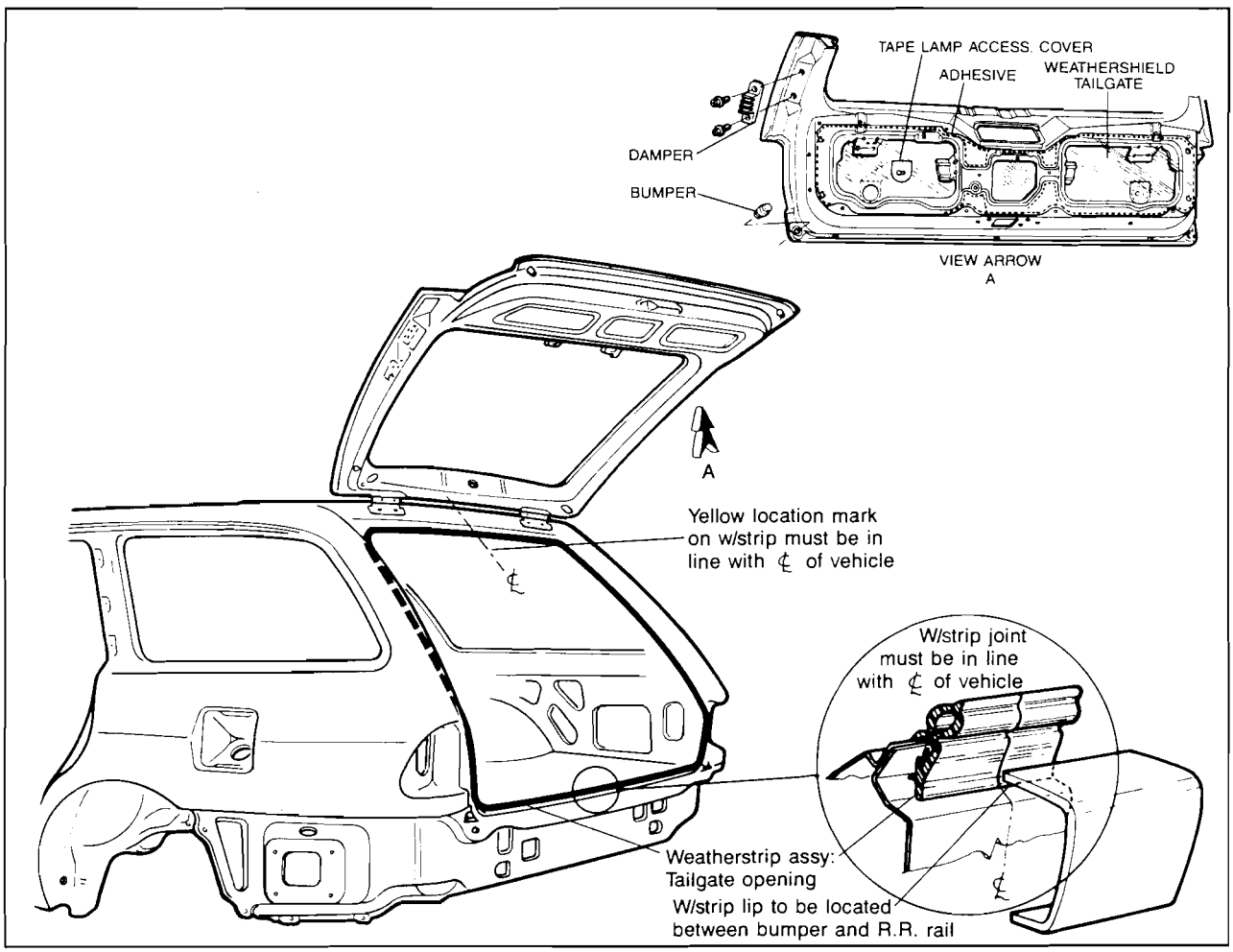


Fig. 7 — Tailgate weather strip

Tailgate Weatherstrip

Removal

(1) Remove the weatherstrip from its location around the cargo compartment opening.

Installation

(1) Install the weatherstrip at the points indicated in Fig. 7 first.

(2) Install the rest of the weatherstrip ensuring that the marker is aligned with the edge of the bumper seat landing as shown in Fig. 7.

(3) Ensure that the weatherstrip is pressed fully home.

SECTION 8 — SEALING

GENERAL INFORMATION

To help save time, the most widely used method of finding vehicle body leaks are described.

In addition to describing testing procedures, there are also included a number of suggestions for pin pointing and fixing water, dust and air leaks. These service hints are of a general nature, but common sense will suggest their application to specific cases.

Wind noise is the sound produced by air velocity or turbulence to the extent that it is objectionable inside the vehicle. Wind noise and its cause varies from one vehicle to another even within a given body style. What may be true on one body is not necessarily true on another.

PURPOSE OF SEALERS

Sealers are used to close openings in the body metal structure, to prevent noise, dust, water and fumes entering the body. In order to accomplish this purpose, they must be used in the locations and manner described on sealer drawings and MMAL specifications. Careful consideration has been given to all sealing problems contained on these drawings. The importance of sealing becomes obvious when it is realised that an automobile in motion creates an increased pressure on the body exterior and with the windows closed, establishes an interior pressure lower than atmospheric pressure. This causes air to be drawn into the body area from all body surfaces where openings exist.

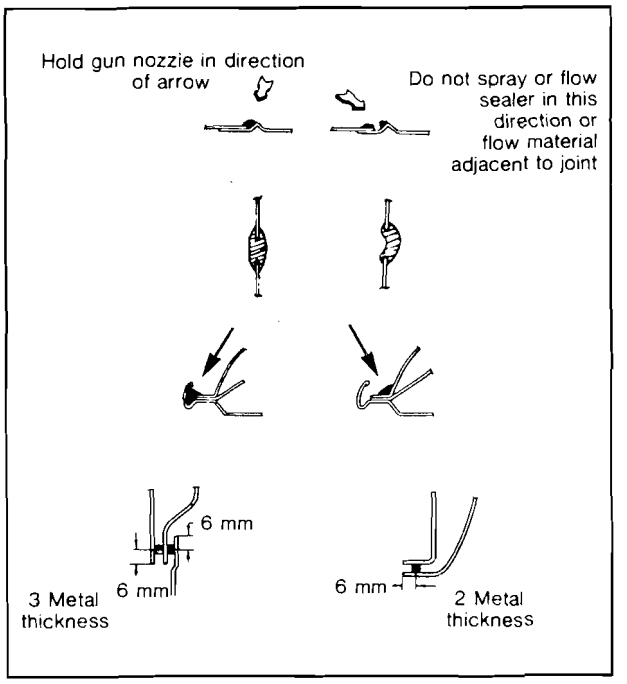


Fig. 1 — Method of applying sealer

WIND NOISE — AIR LEAK SEALING AND DIAGNOSIS MATERIAL

There are many ways to cure a leak or noise situation. The materials shown are the basic materials that should be used to cure the leak or noise area, refer Fig. 2.

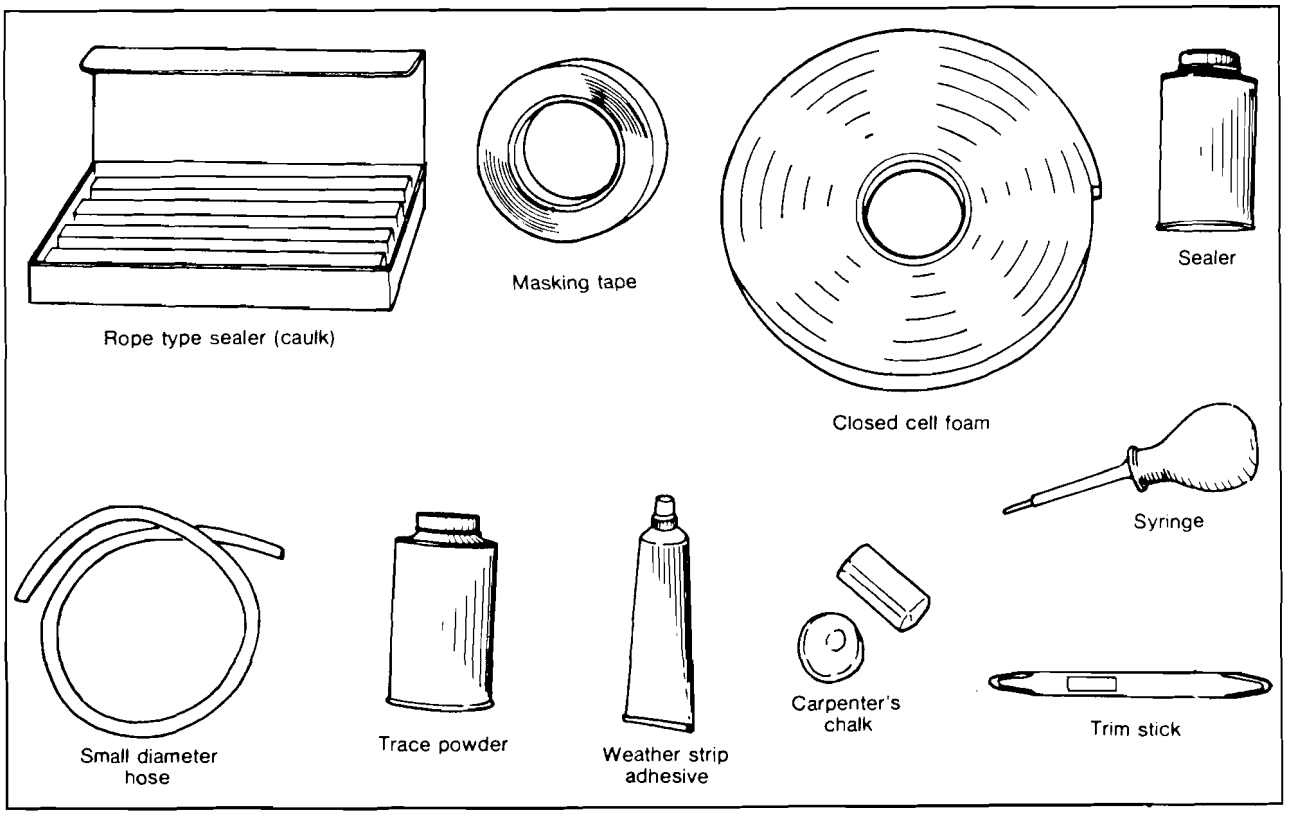


Fig. 2 — Diagnosis and repair material (typical)

SERVICE PROCEDURES

WATER AND DUST LEAK TESTING

Preliminary Inspection

Before testing, look over the general area where the water or dust seems to be coming in. Check for things which are obviously wrong, like weatherstrips that have come loose, are torn or badly distorted. Look for gaps or holes at body joints or corners which should be closed or sealed.

Traces of rust can be a sign of an open seam, even though the opening is not visible. A small crack hidden by poor solder bonding at body joints. Partial adhesion or air holes in sealing materials at body seams can also account for some leaks.

In some cases a water leak point can be located by examining the door opening surfaces, especially after the vehicle has been driven in wet weather. Look at the dried road splash around the areas outside the weatherstrip contact line. If the weatherstrip is sealing properly, there will not be any trace of splash inside the contact line.

Alignment

When inspecting for visible defects be sure to check the alignment of the door to see how well it fits the opening. If the door is not lined up properly, or the lock striker needs resetting, the weatherstrip may not be able to make a good seal.

Where the door is properly fitted and aligned, the weatherstrip compresses when the door is fully closed. This compression allows the weatherstrip edge to make firm even contact around the door opening so it can seal without being crushed.

Don't try to compensate for poor alignment by moving the striker inward. Such an adjustment may stop a leak temporarily, but it will also cause the weatherstrip to bottom out. With repeated crushing the strip will lose its resiliency and eventually break down.

As with doors, checking for the obvious also applies to the decklid weatherstrip. Here again, proper alignment and closing are the basic requirements for good weatherstrip sealing, especially where a vehicle has had body repairs.

WATER LEAK TEST

Water testing for body leaks is simple to do and will help locate most leak points quickly. It also provides a proof-test of work after being fixed.

Other tests can be used for checking door and decklid weatherstrip sealing. However, water testing is the only practical way to check for leaks around the windshield and rear window, at inner door panel watershields and at body joints or seams.

Water Hose Adjustment

Only a small stream of water is needed to find a leak. If too much pressure is used the water can force past even a good-fitting weatherstrip. It can also splash over the suspected area, creating difficulty in finding the leak source.

The actual test is easy. Remove the hose spray nozzle (where equipped) and hold the pressure down to get the proper stream. The water will gush when it's turned on, so point the nozzle away from the test area to prevent over-wetting.

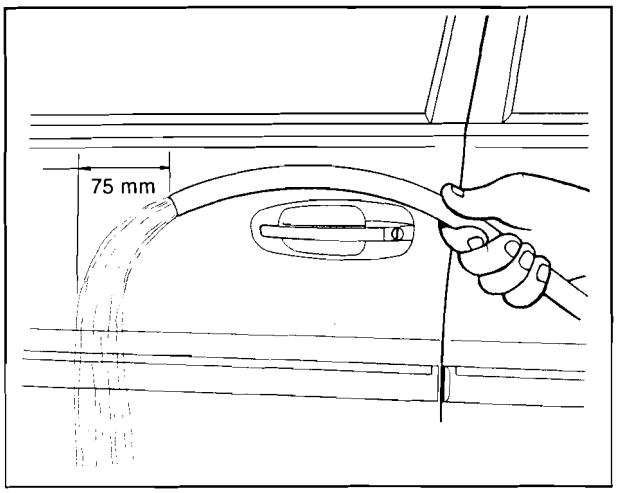


Fig. 3 — Adjusting water pressure

Windshield and Rear Window Leakage and Repair

Start water hose test (refer Fig. 4), commencing at the lower corners, slowly move up the sides across the top, noting the position of the leakage area. Having detected the leak, remove the appropriate moulding and reseal the glass using an appropriate sealant.

Tailgate and Side Window Leakage — Wagon

The rear window leakage test and repair as described above, can be applied to the tailgate and side glass windows.

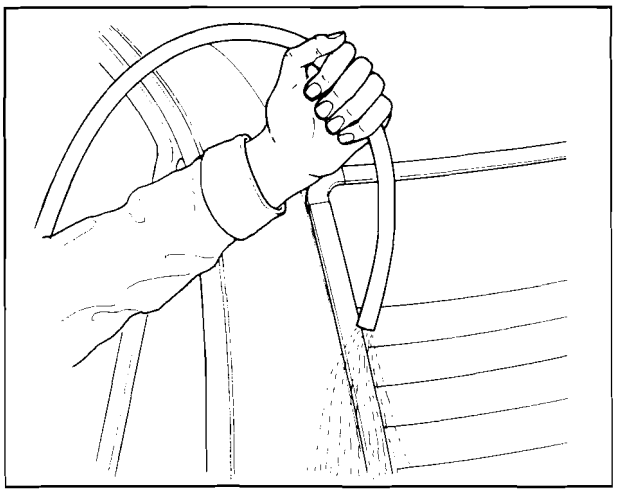


Fig. 4 — Water test rear window

Water Testing Doors

When ready to test, have an assistant sit in the vehicle and watch for water coming in as the hose is worked around the gap at door edge on the outside.

Start the check at lower edge of the door (refer Fig. 5) and then work upward. If water testing is begun at the top, the run-off will wet the untested area and can make a leak hard to find.

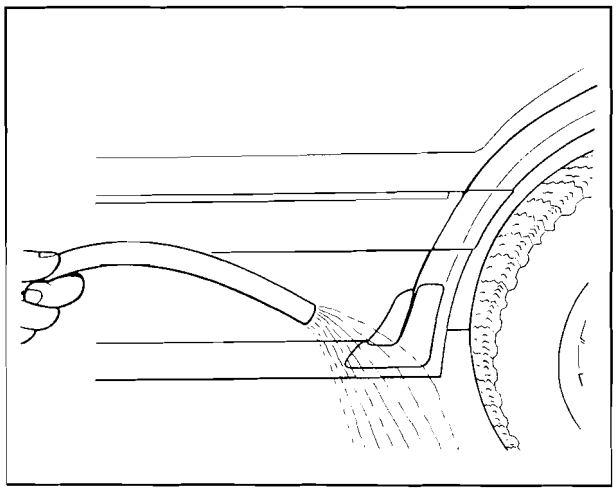


Fig. 5 — Testing lower points

If the weatherstrip doesn't seal properly it's easy to see where the water comes in at the door edge. Mark the leak points with chalk or tape so you can find them when the door is open.

Since there may be more than one leak, correct any leaks you find in lower areas before you test higher.

If the water test shows the weatherstrip is sealing correctly, run water along the side glass at the belt line weatherstrips (refer Fig. 6) and check the inside trim panels for dampness, especially at the bottom. This water normally runs out of the door drain holes, however, the inside trim panel can get soaked if the plastic water/dust shield under the trim is torn, missing or not properly installed.

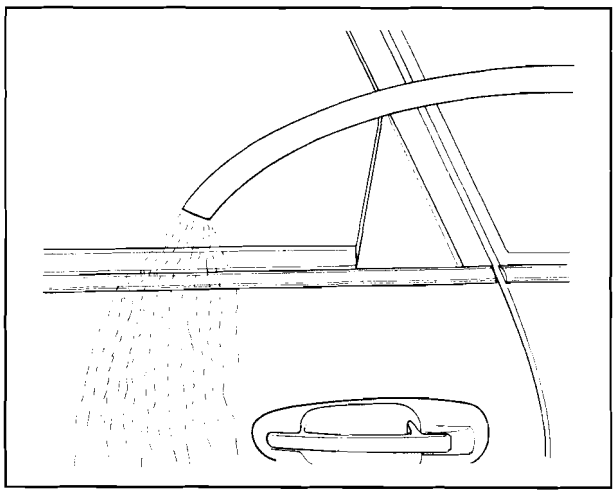


Fig. 6 — Belt line test

LUGGAGE COMPARTMENT LEAKAGE

(1) First check to see if the decklid is flush with the surrounding metal surfaces.

(2) Open the decklid and examine the weatherstrip flange for distortion. Check weatherstrip for splits or improper alignment, correct as necessary. Water test as shown in Fig. 7.

(3) If seams or pin holes are the cause of leakage, repair with an air-dry vinyl sealer or equivalent and touch up paint.

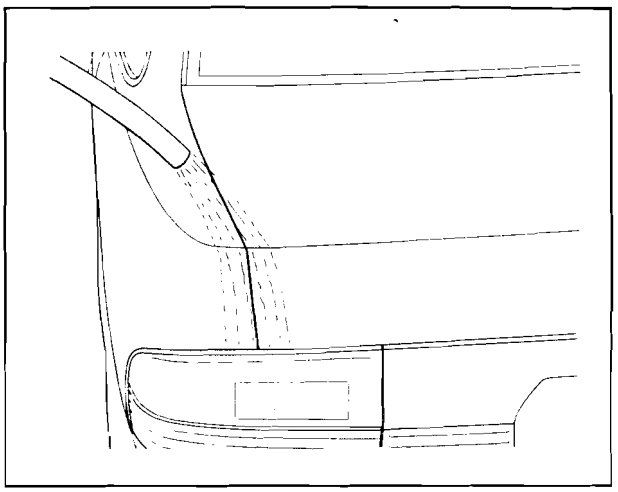


Fig. 7 — Decklid water test

(4) If the rear quarter panel or deck-lid lower panel areas are the cause of leakage, check for loose or missing retaining nuts, if necessary, remove nuts and apply a small quantity of rope caulking type sealer to the studs and refit nuts.

(5) Ensure the power antenna (where fitted) grommet is correctly located and check if any water is leaking into luggage compartment by running water over the surface of the grommet.

(6) If leakage is not found in any of the preceding areas check the remaining panels, seams and rear window for leakage.

TAILGATE LEAKAGE — Wagon

(1) Check tailgate adjustment.

(2) Check the sealing of the tailgate against the body, using the chalk test as described in this section.

(3) Open tailgate and examine the weatherstrip for splits, distortion or improper alignment.

(4) Start water hose test, refer Fig. 8, commencing at the lower corners, slowly move up the sides, across the top, noting the position of the leakage area.

(5) If the water test shows the weatherstrip is sealing correctly, run the water over the spoiler and tailgate window. Check inside panels for dampness, especially at the bottom.

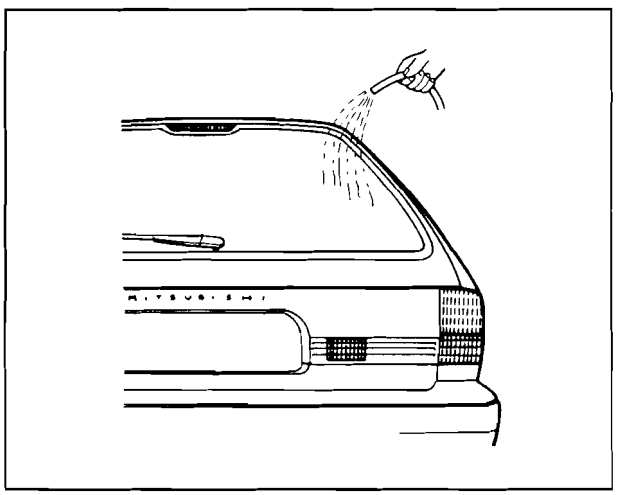


Fig. 8 — Tailgate water test

TAIL LIGHT TESTING

Whilst applying the water stream to the tail light, watch inside the luggage compartment for signs of leakage around the bulb holder cutout seal. Make sure there is no water inside the tail light assembly.

Ensure the lower clearance area of the rear quarter panel extension housing is free from mud or obstruction, which if left, could cause corrosion inside the enclosure.

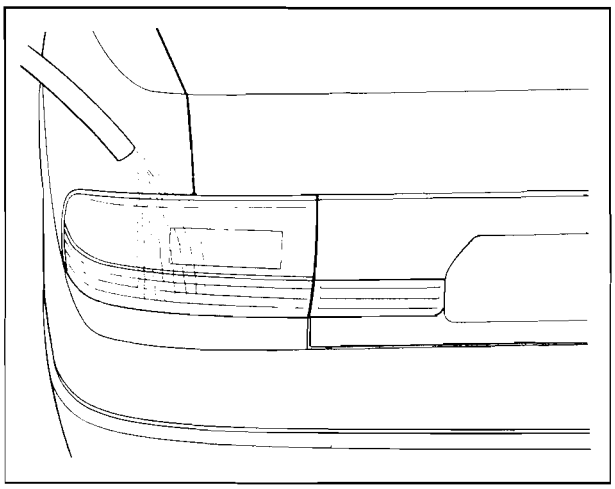


Fig. 9 — Tail light water test — sedan

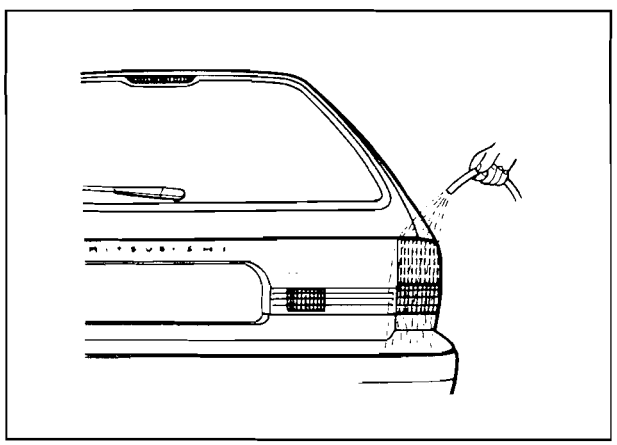


Fig. 10 — Tail light water test — wagon

COWL TESTING

The water test can also be used to check for leaks in the front or cowl area of the body. Raise the engine hood and direct the flow of water through the cowl air inlet grille with the hose outlet facing the rear of the vehicle, refer Fig. 11.

Also check for water leaks in the lower cowl chamber area by flowing water over the body seams and joints in the cowl structure, refer Fig. 12.

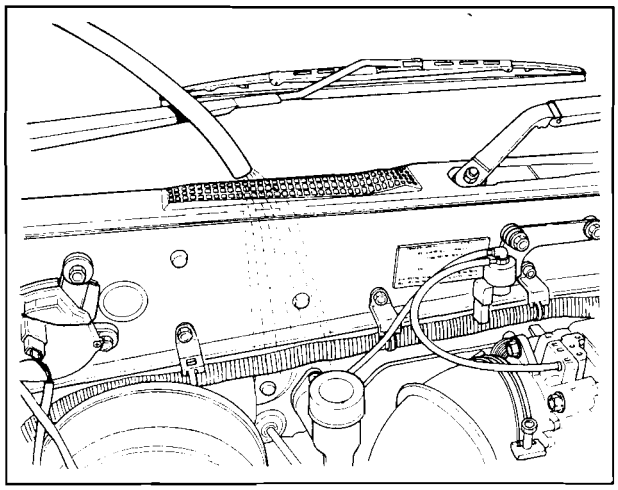


Fig. 11 — Water testing cowl

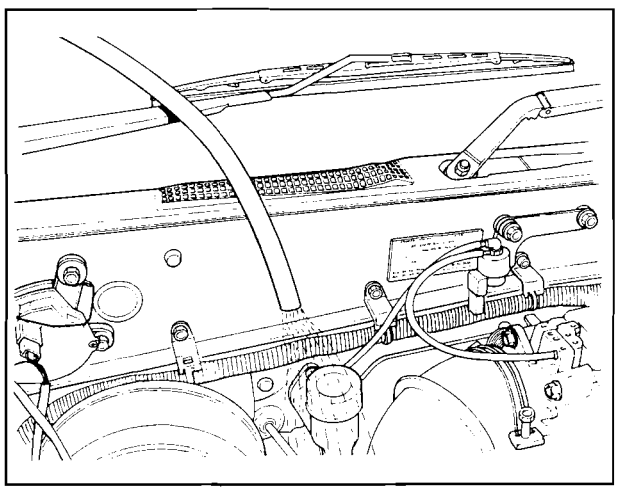


Fig. 12 — Water testing cowl

When checking for leaks in the cowl area, you may have to remove inside trim panels at the front and sides to see where the water is coming in.

FLOOR PLAN TESTING

A common result of body leaks is soaked underfelt and/or carpet and it's not unusual to find the water is getting in through the floor pan or some other low point in the body. However, it is possible for water to enter higher up and run down to soak the floor covering.

Since a soaked floor covering should be removed for drying, it's a good way to start the check. Removal of the floor covering necessitates the removal of step plates, seats and console etc., this gives a clear field for action. Check body seam sealing and plugs in the floor pan.

It's usually not practical to water-test for floor pan or wheel housing leaks unless a special underbody water spray arrangement is available and all mounting holes are effectively sealed.

As an alternative, the best way to locate these leak points is to look for rusty seam edges or other traces of leaks after the seats and floor coverings are removed. Traces of mud are an indication that water is coming in from below.

BODY SEAM SEALING

When inspecting body seams or joints for leaks don't assume that a generous coating of sealant automatically means a water tight seal. It only takes a small bubble of trapped air to cause a pin hole which can let water and dust in. In time, even a small leak can undermine heavy sealant applications. For a long term fix, it's safer to clean off and reseal any doubtful spots in the sealant.

CHALK TESTING

Weatherstrips

Another weatherstrip leak check that's widely used is the chalk test. This test is easy and it's dry. Simply open the door and rub soft carpenter's chalk on the sealing surface of the weatherstrip (refer Fig. 13) all the way around. Blue chalk shows up best on light-coloured body paint, and white does the job for dark colours. If carpenter's chalk is not available, ask for soft chalk at an art supply store. Ordinary blackboard chalk doesn't go on as easily and may not leave a good contact mark.

With the chalk applied, close the door in the normal manner and then reopen it. The chalk should transfer to the door surface contacted by the weatherstrip edge in a continuous, unbroken line if the seal is satisfactory.

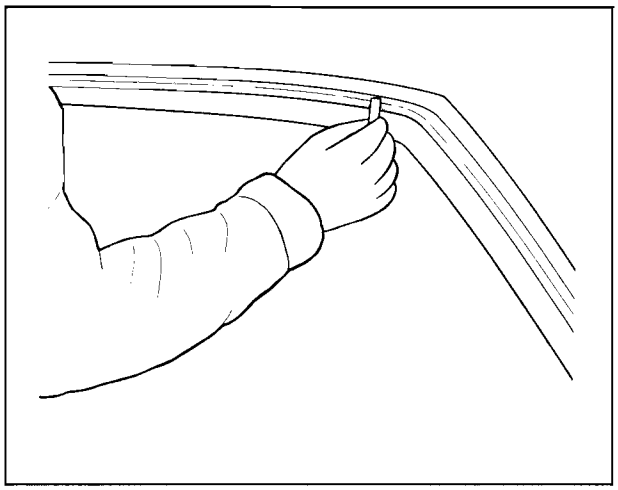


Fig. 13 — Chalk application

Wax Test

Should it be difficult to get a good chalk transfer, coat the body with a thin film of body wax where it is contacted by the weatherstrip. The wax will pick up chalk and leave a distinct imprint. The wax also removes chalk from the weatherstrip at the contact line so in effect, there is a double check. If rechalking is needed to get a more distinct transfer, it will be necessary to wipe off any wax which has transferred to the weatherstrip so the chalk can leave a good mark.

Corrections

Where the chalk test shows **low spots** at door joints or other places around the door, it will be necessary to build up these low points to get a good seal. Level any low spots with plastic body filler, smooth and repaint repaired area.

The chalk test will also show up **high spots** on the door contact surface. These may be lumps of solder, weld or seam overlap. In either case, the raised places must be finished smooth and repainted.

Where **gaps** of sizeable length show up on the chalk test it may be necessary to pack the weatherstrip slightly so it can make a good contact seal.

Deck Lid/Tailgate

The chalk test also works well on deck lid/tailgate weatherstrips. However, just like doors, their alignment must be correct before any leak test can be effective.

POWDER TESTING

White powder can also be used for leak testing around weatherstrips. Just as with chalk, the powder test is simple. All that's needed is the powder and a syringe to blow it around the door and deck lid edges. Use white trace powder available from body sealing suppliers, or any fine dusting powder which will cling to painted body surfaces.

Application

Blow the powder between the weatherstrip and the edge of the door or decklid. If the powder leaves an unbroken line outside the weatherstrip, the seal is good.

If the test shows traces of powder inside the weatherstrip, or on its contact surface, the strip is not sealing properly at these points. The powder test sometimes shows up causes of leaks which are not easy to spot with water or chalk tests. After testing with powder or chalk, be sure to clean up the test area.

WIND NOISE LEAK TESTING

Leaks which cause wind noise inside the vehicle seldom produce damage or the mess possible with water and dust leaks. However, a persistent wind noise can be very irritating.

Outgoing Air

Most wind noise is caused by air leaking out of the vehicle. When doors and windows are closed, and the cowl air inlet open, with the heater or air conditioning on, forward motion of the vehicle pressurizes the interior, and a vacuum is created on the outside at the side windows. In fact, with the air inlet open, air can enter faster than it can leave, so pressure builds up inside, especially at high speeds.

Weatherstrip Seals

If the weatherstrips seal properly, pressurizing the interior will not cause troublesome wind noises. However, any seal which does not make good contact can let the pressurized air force its way out in an area causing objectionable noise.

Turbulence

Turbulence outside the vehicle. This noise can be caused by loose mouldings, mouldings with protruding ends, gaps between trim mouldings and rubber sealing strips. Loose grilles, open bolt holes, roof cracks and radio antennas have also caused whistling sounds when the wind has passed over them.

Correction

Use tape to close off or change the shape of suspected areas when hunting for the source of turbulence noise. Corrections can be made if tape application changes the sound.

Road-Test for Wind Noise Leaks

As with water and dust leak testing, diagnosis of the wind noise leaks should begin with a quick inspection for the obvious. Check weatherstrip condition, door and glass alignment. Look for poor fitting mouldings, and open holes or gaps. If all these are in order, the next step is a road test to locate the leak.

Road-Test Where It's Quiet

Try to make the road test in a low-traffic, open area where the vehicle can be driven up to cruising speeds. This will enable checking the effect of driving into and away from the wind and also whether the noise changes when the wind is on opposite sides of the vehicle.

Preparation

To begin the test, push the antenna down as far as it will go and close the doors and windows correctly. Make sure the radio and blower motors are shut off so they won't interfere with the test. Move heater control lever to open inlet air vents so body pressure can build up and start test run.

Inlet Air Vents Open — Outgoing Air

If the noise only occurs when the vents are open, the sound is probably caused by outgoing air. This kind of noise may also vary as the vehicle speeds up or slows down.

Inlet Air Vents Closed — Incoming Air

Where the noise starts when the vents are closed, the noise is usually caused by air coming into the vehicle, the noise will be loudest on the windy side. An air draft may be felt if the leak is large.

No Change — Turbulence

When opening and closing the face level vents does not affect the noise, it's probably caused by turbulence somewhere outside the vehicle and may be hard to find.

Most Disturbing Level

Most causes of wind noise can be found in the upper areas of the vehicle sides, down to about 300 mm below the belt line, or across the windshield, refer Fig. 14.

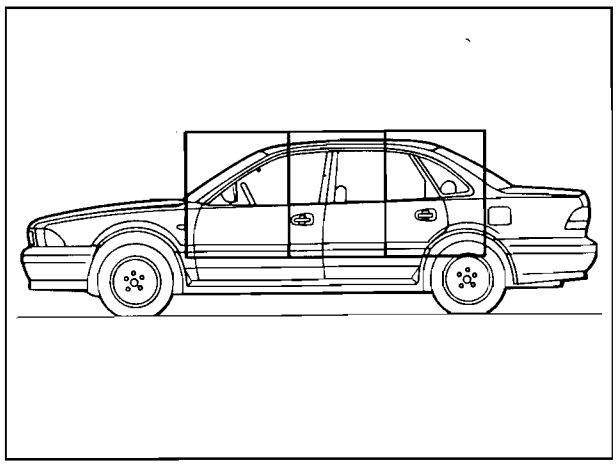


Fig. 14 — Most disturbing wind noise area (typical)

Listen Method

In some cases of wind leak noise around the windows, it may be possible to find the source by using a length of small-diameter hose as a noise pick up. Simply move the free end of the hose around the suspected area and listen for the sound at the other end.

BODY SEALING TIPS

A combination of common sense and application of testing procedures should help locate most body leaks quickly. However, experience shows that leaks in certain areas are sometimes related to specific conditions which can be corrected without the need of testing. Here again, visual inspection should be the first step, but the evidence may not be as obvious as an open hole or improperly fitted weatherstrip.

Roof Line

Look for voids or pin holes in the roof line sealant (refer Fig. 15). Air bubbles trapped under the seal bead can rise to the top and form a hole which will admit water. If water gets under the sealant, it can enter the roof area at a body seam and soak the headlining.

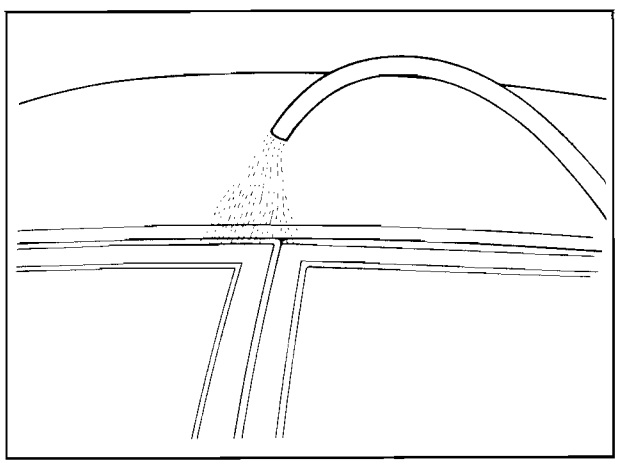


Fig. 15 — Roof line testing

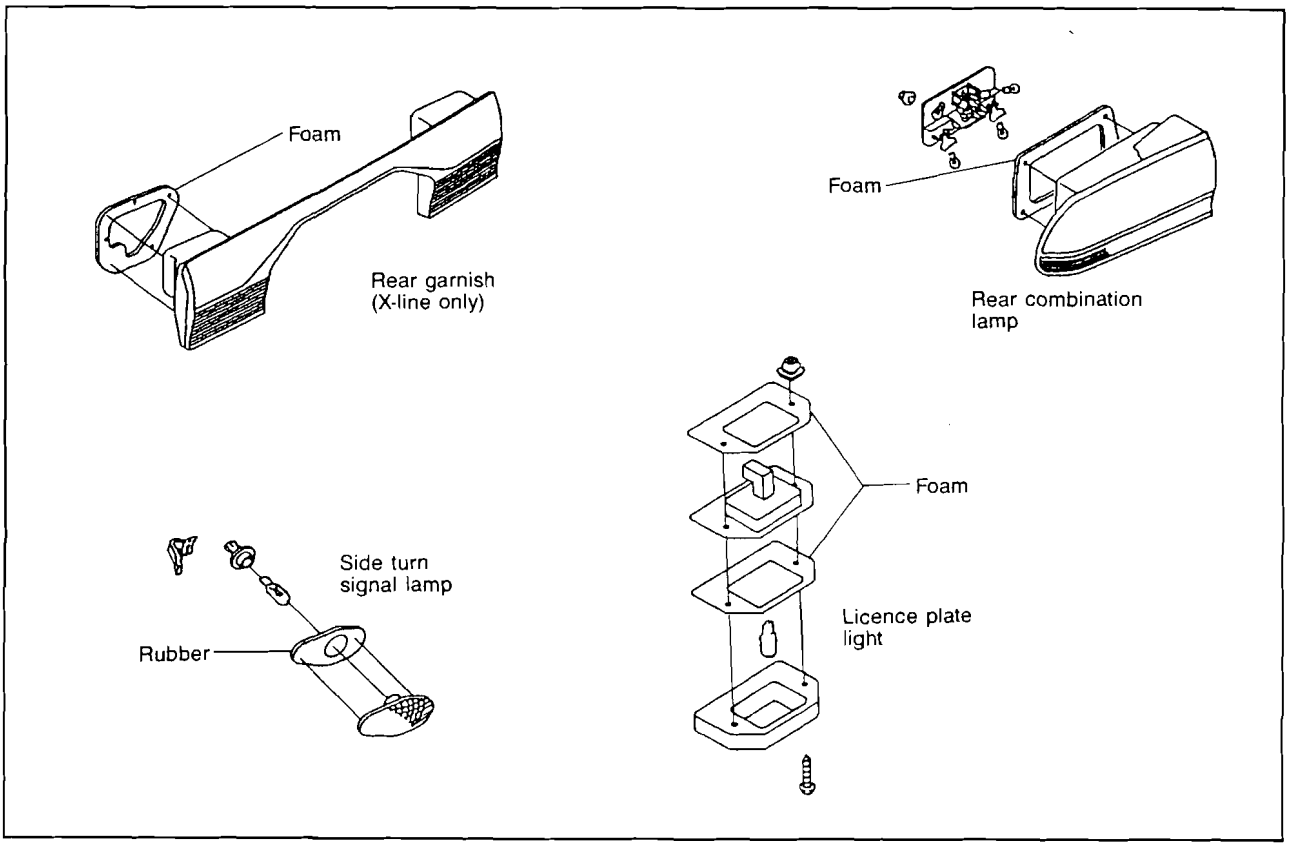


Fig. 16 — Sealing of exterior lights — sedan shown

SEALING OF EXTERIOR LIGHTS

To ensure the correct operation of all exterior lights, prevention of water entry is essential. If any lamp assembly is removed, inspect the gasket for damage and replace if necessary, refer Fig. 16.

Moulding and Screw Holes

In some cases water may be found leaking past a loose moulding retainer screw, or through small holes at the windshield or rear window body joints. These leaks can be found by flowing on water and then applying air pressure to the areas.

Weatherstrips

Door and decklid weatherstrips should only be cemented at the joint ends. They are attached to the door or decklid opening flange by means of a dry friction push fit.

Cleaning

As a final step in any body sealing job, make sure to clean up the glass weatherstrip, or other places which have been cemented or sealed.

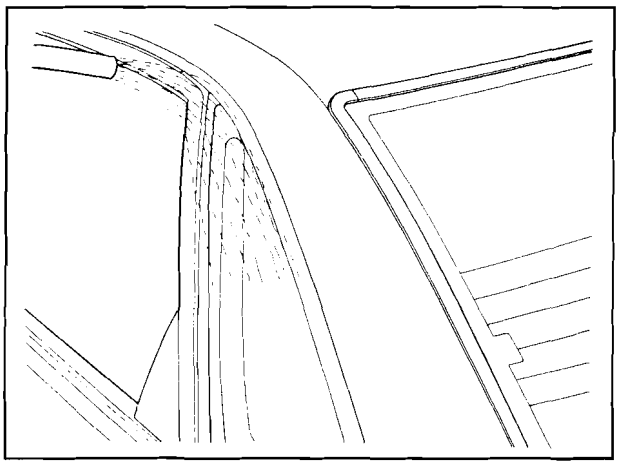


Fig. 17 — Rear quarter window test

REAR QUARTER WINDOW TEST

Remove the rear pillar trim and run water around the perimeter of the rear quarter window. Check for any leaks. Repair any leakages in the sealant with an appropriate sealer.

GROUP 42B — BODY REPAIR

SECTION 0 — INDEX

Subject	Section Number	Page Number
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Corrosion Protection		2
Plastic Component Heat Deformation Chart		4
Paint Colours and Repair Codes		5
CARGO BARRIER ANCHORAGE REPAIR	2	
Inspection and repair procedure for cargo barrier anchorages		1

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

SECTION 1 — BODY AND PAINT REPAIR

FACTORY PAINT FINISHES

M.M.A.L. uses three paint finishes on its locally manufactured vehicles, acrylic enamel for solid colours and clear over base (C.O.B.) metallic or pearlescent.

All paint finishes are oven baked to 130°C to achieve a high gloss, deep lustre finish.

In addition, extra primer coats are applied to body side panels, i.e., doors and fenders up to the waist line to provide a high degree of stone chip resistance and a special "anti-chip" primer is applied to the sill panels.

PAINT REFINISHING

M.M.A.L. does not recommend any particular brand of material for refinishing but repairs can be conducted using either acrylic lacquer or a two-pack process. Refinishing procedures should be obtained from your paint supplier.

Irrespective of what method or material brand is used for the repair, the following points should be noted:

- All traces of polish, wax and other greasy contaminents must be removed using a suitable wax and grease remover.
- To obtain a surface suitable for satisfactory refinishing, the original finish should be sanded using P360 grade (solid colours) or P1200 (C.O.B. colours).
- On solid colours, any area sanded through to base coat, primer or bare metal must be treated with metal conditioner and/or primed prior to refinishing.

Special procedures and materials are required for refinishing bumper bars, etc. Detailed information is available from paint manufacturers.

NOTE: Refer to the plastic component heat deformation chart to identify the material used for these components.

REPAIR OF CLEAR COAT MARRING

Scratches and marring in the paint suraface of C.O.B. finishes which appear to be under the clear coat are, in many cases, actually confined to the clear coat and can be repaired by careful polishing of the affected area.

These scratches which are typically whitish in colour, similar in appearance to a scratch in perspex, are generally more apparent on darker colours.

Procedure

This method is recommended for removal of small nibs, scratches, runs and other minor defects in the clear film.

(1) Solvent wipe the whole area to remove polishes, waxes and other greasy contaminents.

(2) Using a hand rubbing ball and cutting compound, carefully compound the affected area.

(3) If the defect still remains, carefully wet rub with P1200 wet and dry paper, or a No. 1500 "Crystal Block", taking care to avoid rubbing through to the metallic base coat. Only remove the minimum thickness of clear necessary to make the defect unnoticeable.

(4) Compound the area with cutting compound to restore the gloss and finish by polishing to the nearest break line with final liquid polish.

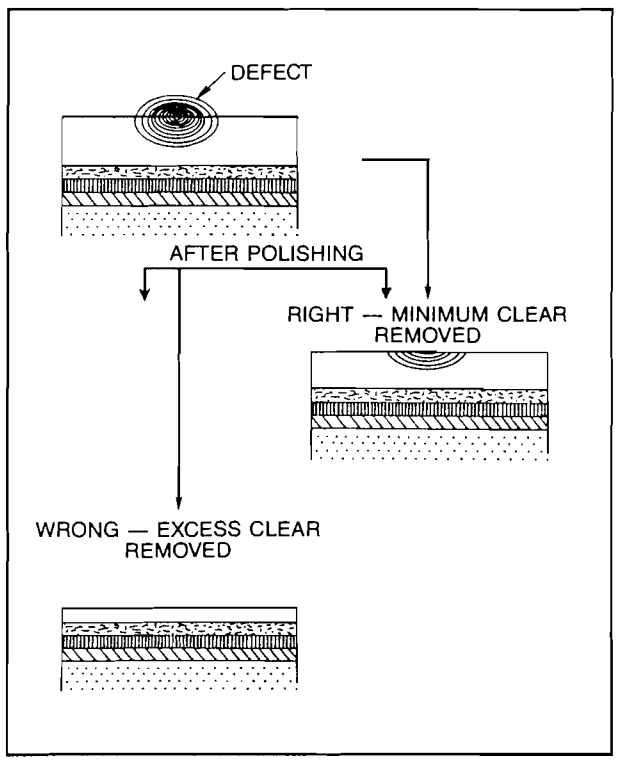


Fig. 1 — Polishing

When conducting this type of repair, the following precautions should be observed:

(a) Repairs should be confined to localised areas only. If large areas are affected, repairs should be effected in the normal manner.

(b) To maintain the durability of the paint finish, remove only the minimum material required to remove the defect.

(c) If the clear coat is removed down to the base coat, the area must be refinished according to the paint manufacturers directions.

BODY CORROSION REPAIR

Body corrosion is always a concern to a vehicle owner, not only because the corrosion has occurred in the first place, but also because of the doubt which may exist with regard to the durability of the repair.

It is possible to instil in the owner a high level of confidence in the long term effectiveness of the repair provided some basic points are observed:

(1) Corrosion damage should be corrected at the earliest opportunity, preferably as soon as corrosion becomes apparent.

(2) Adequate care must be taken to avoid damage around the repair site when removing mouldings, ornamentation, glass, etc., or when it is necessary to remove body sealer or similar.

(3) Close attention must be paid to to ensure that all traces of corrosion are eliminated from the corrosion site.

Procedure

The following procedure is presented as a recommended method of repair for body corrosion.

(1) Remove all mouldings and ornamentation from around the corrosion site to gain access to the corrosion site.

NOTE: Inspect parts removed to determine if corrosion has been caused by moulding or component contact. This will allow counter measures to be taken when the vehicle is re-assembled.

(2) Remoave all traces of corrosion from the area using one of the following methods:

(a) **Surface Corrosion** (Defined as any corrosion which has not reached perforation stage):—

Removal of surface corrosion is best achieved using a spot sandblasting unit which is the most effective means of cleaning corrosion out of the surface pitting.

Other available methods may achieve the same end result if carefully applied but it is possible to "trap" corrosion under what appears to be a clean surface particularly if grinding or wire brushing is used.

(b) **Perforation Corrosion**

Effective repair of perforation corrosion can only be achieved by replacing the corroded section of the panel or replacing the panel.

If perforation has occurred, it is essential that sufficient material is removed to ensure that any corrosion which may have "crept" under the inner surface of the panel has been eliminated.

(3) Carefully clean the area with a wax/grease remover and check that no trace of corrosion remains.

(4) Apply a metal conditioner such as "Deoxidene" to the affected area to remove all traces of oxidising agents and chemically prepare the surface for painting.

NOTE: Pay particular attention to the manufacturers recommendations.

(5) Sand the area smooth and re-clean.

(6) Finish the repair site with plastic filler.

(7) Prime and refinish the panel in accordance with the paint manufacturers directions.

(8) If access is possible, apply fish oil or "Tectyl" wax or similar material to the inside of the panel.

(9) If the corrosion site was located under a moulding or ornament, apply fish oil or "Tectyl" wax under the moulding.

CORROSION PROTECTION

To achieve optimum corrosion protection, each body undergoes a phosphate cleaning process which applies a zinc phosphate coating to the body. The body then undergoes a cathodic electro-coat primer process which results in a tough metal to primer bond.

The cathodic electro-coating system is a special automotive metal-priming process designed to protect metal against rust and corrosion — particularly in otherwise difficult to reach places like body flanges, hidden or deeply recessed spaces, and box-sections of the car.

In addition, wax treatment is applied to the inner surfaces of doors, fender panels, etc., to provide further protection against rust.

Any repair or replacement of panels will result in a reduction in the level of corrosion protection and steps should be taken during any repair to maintain corrosion resistance.

Application of Anti-Corrosion Agents

- Any bare metal surface must be chemically treated with a suitable metal conditioner prior to the application of any paint sealer or wax treatment.
  If used according to manufacturers recommendation, this will remove all oxidising agents from the surface and chemically condition the panel for painting.
- An anti-corrosion agent should be applied to all box sections, sill panels, pillars, etc. Use an aerosol type material to apply the anti-corrosion agent utilizing trim mounting holes. Particular attention should be taken where welding has been performed.
- Anti-corrosion wax should be applied to the inside surfaces of doors and fenders after refinishing.
- Zinc rich primer should be applied to the following areas when re-assembling panels:—
  (a) Attaching surfaces of the fender to body.
  (b) Attaching surfaces of door hinges to door and body.
  (c) Attaching surfaces of deck lid to hinge arm.

Panel Sealing

When replacing doors, engine hoods, deck lids or any panel with a hemming flange, the replacement panel flanges should be sealed prior to refinishing.

Anti-Chip Coatings

Anti-chip primer is applied to the side sills, a suitable anti-chip material should be applied to the sill panels when refinishing to the primer coat is being performed.

PLASTIC COMPONENT HEAT DEFORMATION CHART			
Part Name	**Type of Plastic**	**Abbreviation**	**Heat Deformation Temp. °C**
Cowl side trim Air inlet grille Front pillar trim Centre pillar lower trim Centre pillar upper trim Rear pillar trim Rear wheelhouse trim Rear scuff plate Front scuff plate Front wheel splash shield Room mirror Accelerator pedal Cooling fan Battery case Lamp bodies	Polypropylene	PP	100 max.
Radiator grille Door mirror Rear panel garnish Console box Glove box	ABS Resin	ABS	80 max.
Crash pad Assist grip Steering wheel pad Arm rests Window glass mouldings Seats Head lining	Polyvinyl Chloride	PVC	80 max.
Rear mud flap Front mud flap	Thermoplastic Synthetic Rubber	TPR	100 max.
Rear bumper face Front bumper face Side protection moulding Air cleaner snorkel	Thermoplastic Elastomer	TPE	100 max.
Rear door outside handle Front door outside handle Harness connectors Seat belt buckles Oil filler cap	Polyamide	PA	100 max.
Floor console Instrument panel	Mineral Filled Polypropylene	PPF	100 max.
Steering wheel	Urethane (Foam)	U	80 max.
Lamp lenses	Polyacrylic	PMMA	80 max.
Heater duct Washer tank Condenser tank	Polyethylene	PE	100 max.
Air outlet garnishes Instrument panel insert Tail lamp housings	Reinforced Thermoplastic	RTP	100 max.
Window regulator components Window regulator handles Ball joint seats	Polyacetal	POM	125 max.
Trunk rear trim Trunk rear trim cover	Resonated Felt	—	100 max.

PAINT REPAIR COLOURS AND REPAIR CODES

Body Colour Code	Colour	Colour Number	Repair lacquer number		
			Berger	Dulux	Spartan
WP	Sarajevo White	8042FW1	-	42909	19147
QS	Monarch Blue Metallic	8026EB2	-	42604	19147
AC	Chianti Red Pearlescent	8026FR3	-	43900	19524
QT	Aspen Green Metallic	8026EG1	-	42605	19142
AY	Strato Grey Pearlescent	8026EA1	-	42610	-
QZ	Quartz Silver Metallic	8026ES2	-	42925	-
JW	Cameo	-	-	42603	19144
JX	Calypso Red	8017ER1	-	42602	19143
QM	Cascade Blue Metallic	8026EB1	-	42608	19145
JZ	Stardust Silver Metallic	8026ES1	-	42606	19150
QU	Gold Leaf Metallic	8026	-	42609	19146
JA	Regency Red Pearlescent	8026	HA5589	39748	18146
AE	Misty Rose	8026FY2	-	43805	19525
CU	Seamist Blue Metallic	8040GB4	-	45201	20157
CV	Mirage Silver Metallic	8040GS3	-	45204	20039
AB	Alaska Blue	8039FB3	-	43290	19523
DA	Inca Green Pearlescent	8040GG2	-	45203	20040
DF	Atlantis Blue Pearlescent	8040GB5	-	45202	20038

Two Tone Code	UPPER COLOUR (Code) / LOWER COLOUR (Code)
MV	Aspen Green Metallic (QT) / Quartz Silver Metallic (QZ)
MV	Sarajevo White (WP) / Quartz Silver Metallic (QZ)
MP	Cascade Blue Metallic (QM) / Quartz Silver Metallic (QZ)
MQ	Monarch Blue Metallic (QS) / Quartz Silver Metallic (QZ)
MR	Stardust Silver Metallic (JZ) / Quartz Silver Metallic (QZ)
MT	Regency Red Pearlescent (JA) / Quartz Silver Metallic (QZ)
MU	Strato Grey Pearlescent (AY) / Quartz Silver Metallic (QZ)
AV	Chianti Red Pearlescent (AC) / Quartz Silver Metallic (QZ)
GB	Atlantis Blue (DF) / Quartz Silver Metallic (QZ)
DT	Seamist Blue Metallic (CU) / Quartz Silver Metallic (QZ)
GA	Inca Green Pearlescent (DA) / Quartz Silver Metallic (QZ)
DS	Mirage Silver Metallic (CV) / Quartz Silver Metallic (QZ)

Note: Sarajevo white with Dulux repair code 42909 is for R/S Models only (not C.B.U vehicles).
Note: Quartz Silver Metallic is a lower two tone colour only.

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SECTION 2 — CARGO BARRIER REPAIR

INSPECTION AND REPAIR PROCEDURE

Access

(1) Remove headlining, refer Group 52.
(2) Remove cargo floor carpets, refer Group 52.
(3) Remove wheel house trim carpets, refer Group 52.

Upper Anchorages

(1) Inspect for any panel deformations on the areas shown hatched in Fig. 1.

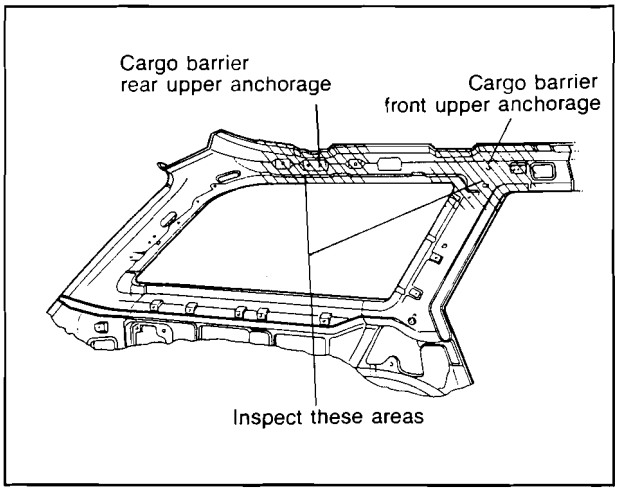


Fig. 1 — Upper anchorages

(2) Rework panels to original shape if required.
(3) Inspect the area for any splitting of panels. Drill a 3 mm hole at the end of each split. Weld the entire length of each split, refer Fig. 2.
(4) Inspect the spotwelds marked ⊕ on Fig. 3. Repair all damaged or pulled spotwelds in accordance to the following procedure.

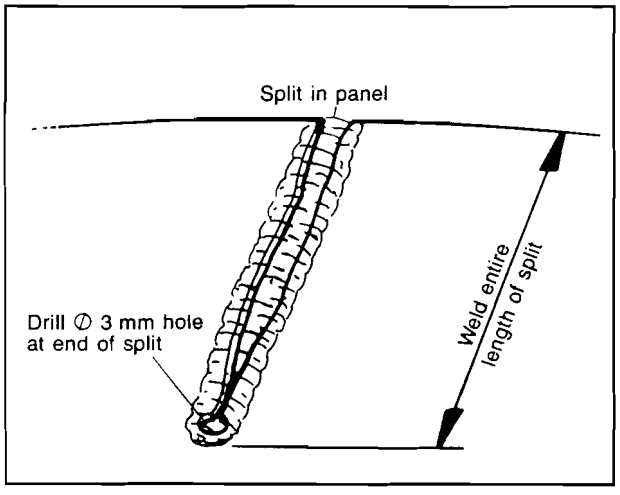


Fig. 2 — Split panel

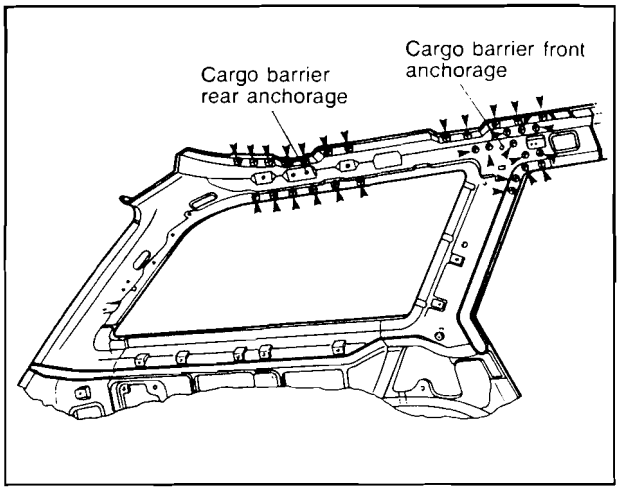


Fig. 3 — Spot weld positions

(5) Paint the repaired areas.

Floor Anchorages

(1) Remove an area of the floor melt sheet as shown on Fig. 4.
(2) Remove an area of the wheelhouse silencer pad as shown on Fig. 4.

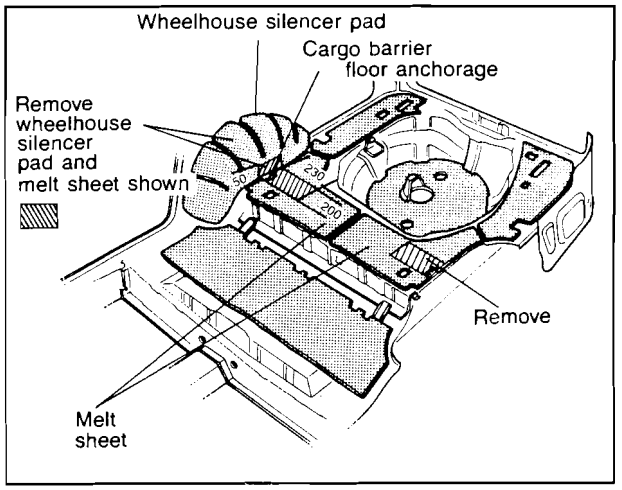


Fig. 4 — Melt pad removal

(3) Inspect for any panel deformations.
(4) Rework panels to original shape if required.
(5) Inspect the area for any splitting of panels. Drill a 3 mm hole at the end of each split, weld the entire length of each split, refer Fig. 2.
(6) Inspect the spotwelds marked ⊕ on Fig. 5. Repair all damaged or pulled spotwelds in accordance to the following procedure.
(7) Inspect the two MIG welds as shown in Fig 5, if damaged, grind off the welds and replace with a MINIMUM 30 mm of MIG welding.
(8) Paint the repaired areas.
(9) Replace the floor and wheelhouse melt sheet as required.

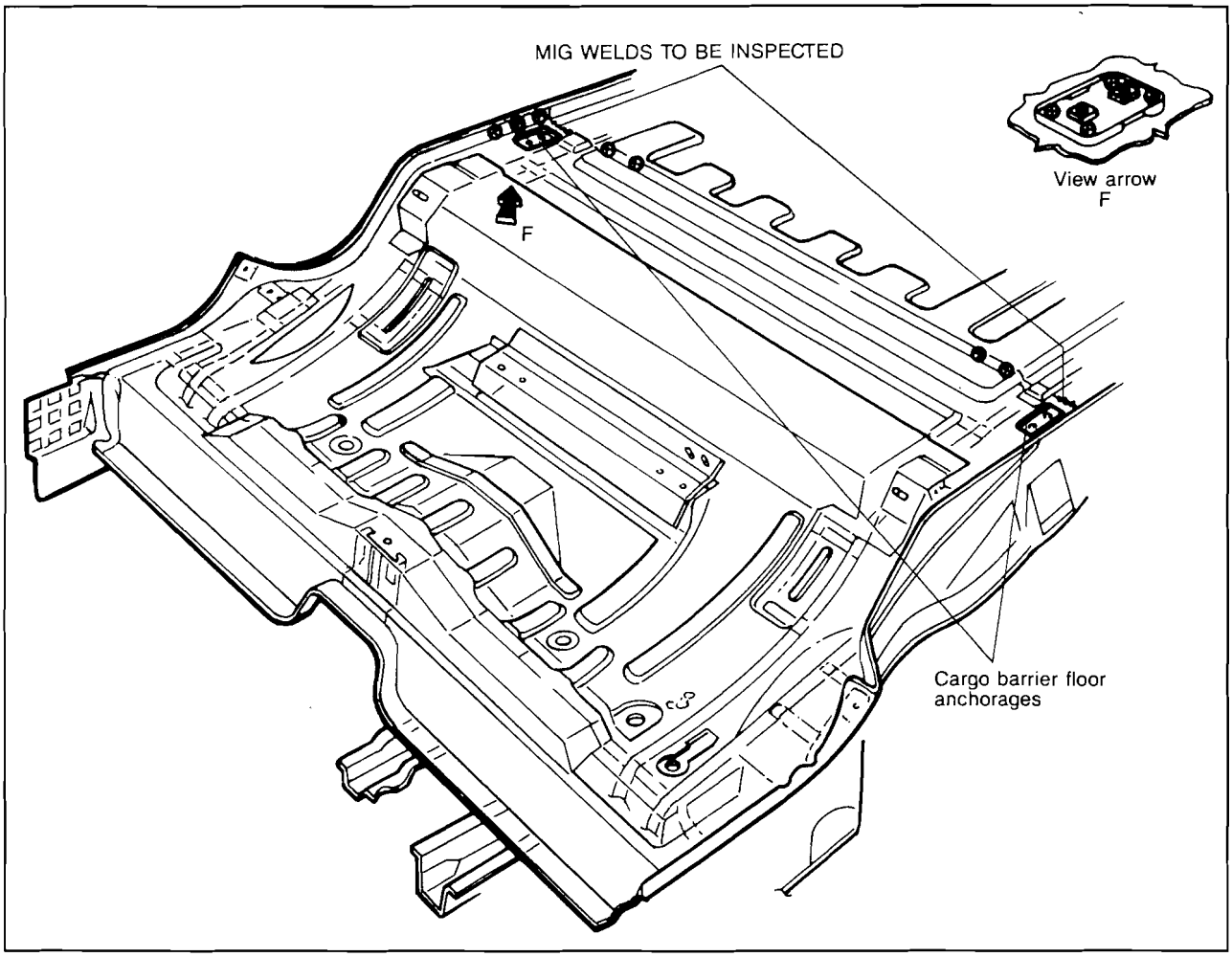


Fig. 5 — MIG weld inspection point

Repair of Spotwelds

(1) Using a 8 mm panel drill, remove the damaged or pulled spotwelds.

NOTE: DO NOT DRILL THROUGH THE PANELS. ONLY REMOVE THE UPPERMOST PANEL, REFER FIG. 6.

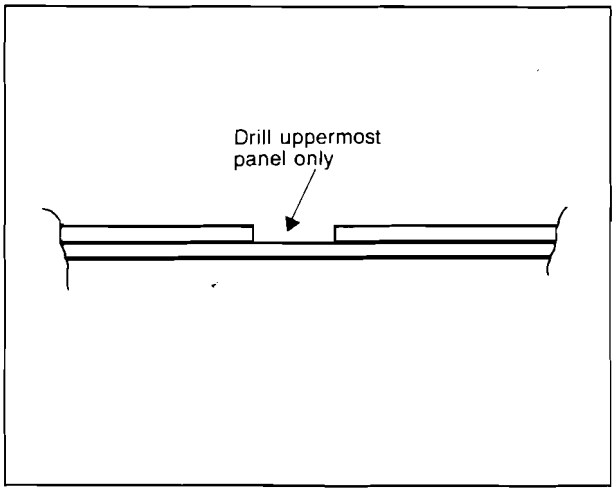


Fig. 6 — Spot weld removal

(2) Puddle weld the area as shown in Fig. 7. MINIMUM size of puddle weld to be 10 mm in diameter.

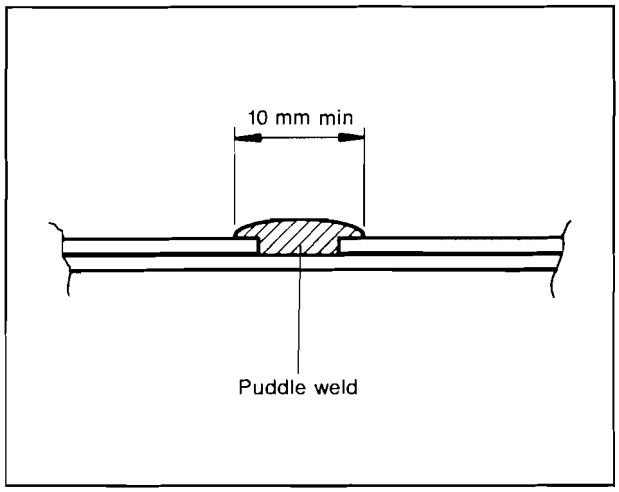


Fig. 7 — Puddle weld

GROUP 51 — EXTERIOR

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SECTION 1 — SPECIFICATIONS

GENERAL SPECIFICATIONS

Wiper motor

RPM at load of 1 Nm	
low speed	48 ± 4 rpm
high speed	75 ± 7 rpm
Nominal torque	28 Nm
No-load current	4A or less

Window washer motor and pump

Motor type	Direct current ferrite magnet type
Pump type	Centrifugal type
Power consumption	4A or less
Time of continuous use	
with washer fluid	Max. 60 secs
empty operation	Max. 20 secs
Nozzle jet pressure	110 kPa or more
Tank capacity	1.7 ltrs
Wiper arm stop position specification — RH	80 ± 5 mm
— LH	95 ± 5 mm

TORQUE SPECIFICATIONS

	Nm
Linkage to body bolts	5
Spoiler attaching nuts	2-3
Tailgate door handle attaching nuts	5-6
Tailgate actuator attaching bolts	5-6
Tailgate strut to body	17-26
Tailgate strut to tailgate	8-12
Tailgate striker to body	12-15
Tailgate hinge to tailgate	12-15
Tailgate hinge to body	12-15
Wiper arm retaining nuts	16-21

SPECIAL TOOLS

Ornament remover	E23M6
Rear window moulding remover	E980
Windscreen moulding installer	Rubber stamp
Roof rack bolt remover/installer	E42M3
Power aerial nut remover/installer	E42M2

SECTION 2 — BUMPER BARS

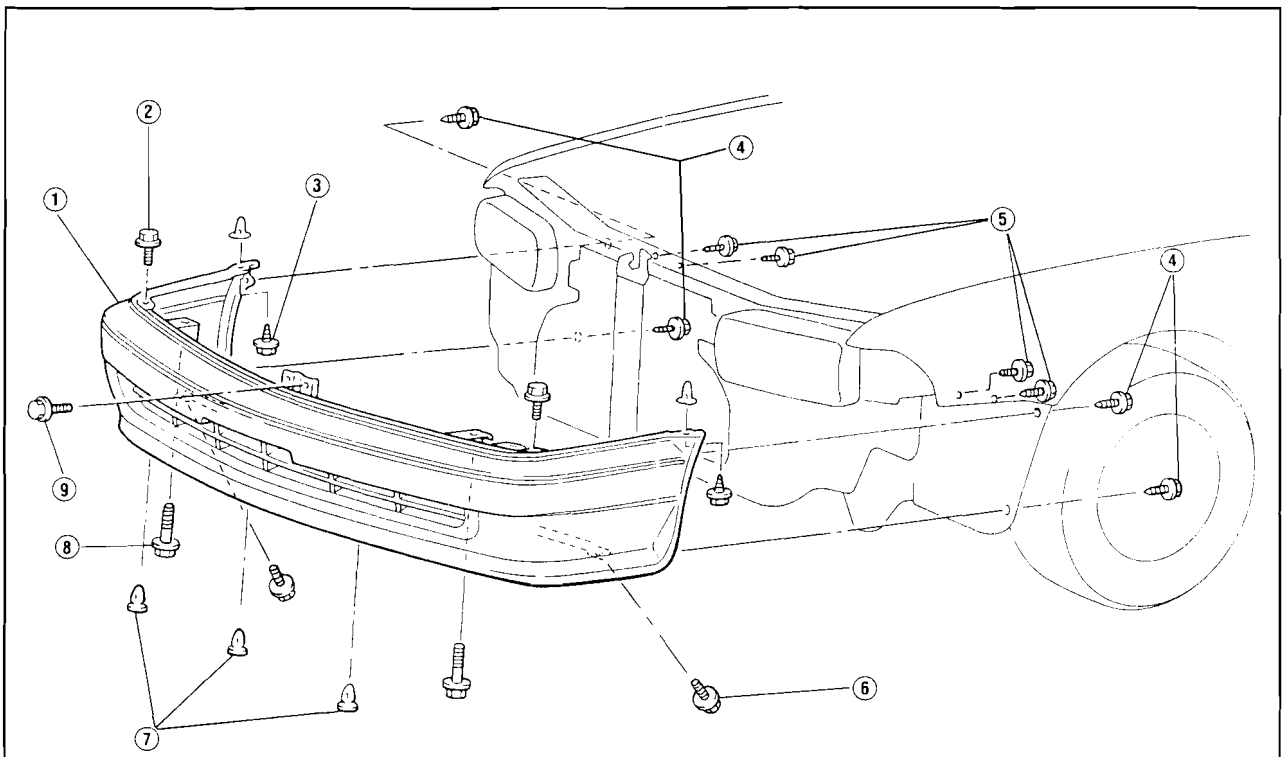


Fig. 1 — Front bumper bar sedan and wagon

FRONT BUMPER

Removal — Sedan and Wagon

(1) Remove the radiator grille assembly, refer Section 3.

(2) Remove the front indicator assemblies, refer Group 42A — Body.

(3) Remove the two front bumper mounting bolts that are located in the indicator location cavities, refer Fig. 2.

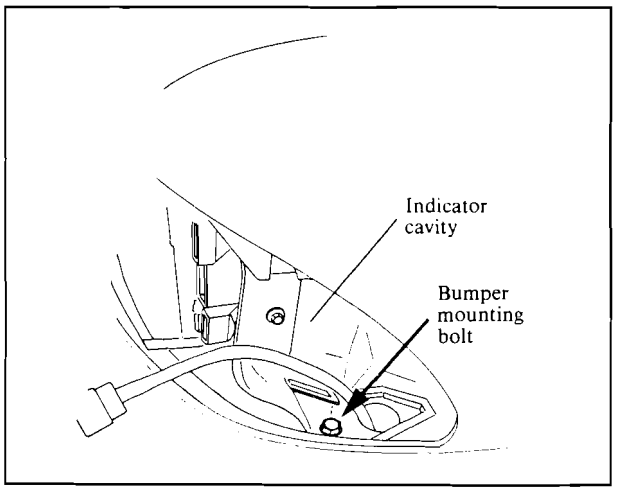


Fig. 2 — Mounting bolt location

(4) Remove the centre bumper mounting bolt which is located behind the radiator grille mounting position, refer Fig. 3.

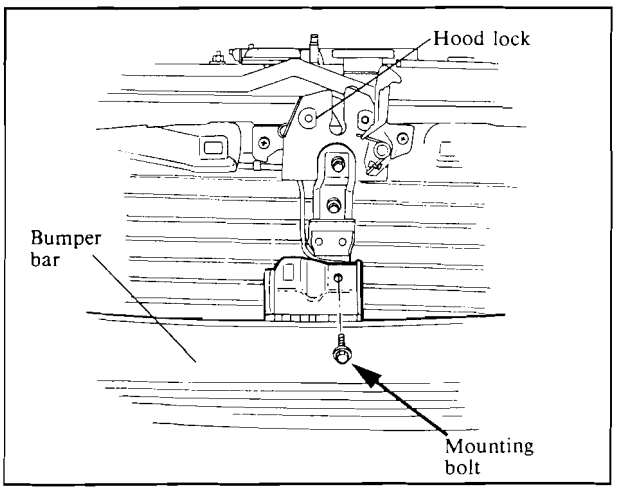


Fig. 3 — Centre mounting bolt location

(5) Using a pair of pointy nose pliers, remove the three black plastic clips that attach the lower bumper to the radiator lower support panel, refer Fig. 4.

(6) Remove the bumper to side stay retaining bolt on each side of the assembly, refer Fig. 1.

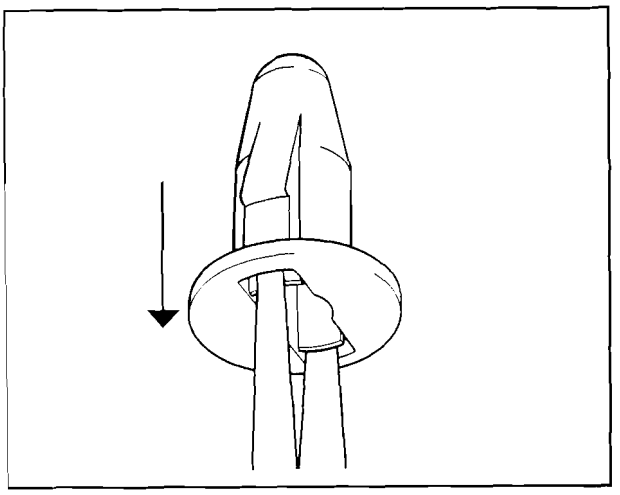


Fig. 4 — Removing clips

(7) Remove the four forward splash shield retaining bolts on each side as shown in Fig. 5.

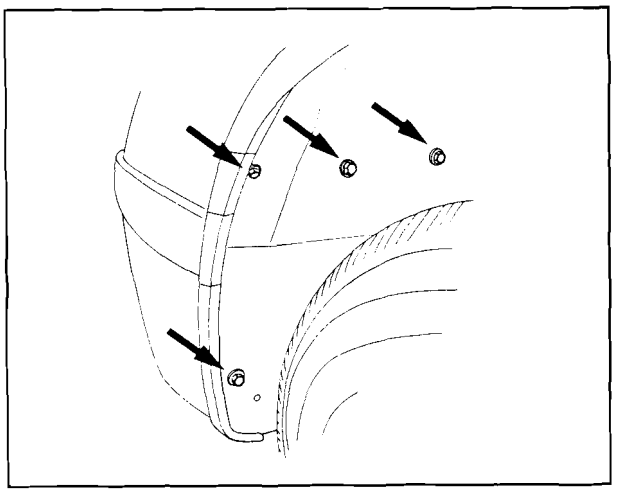


Fig. 5 — Bolt location

(8) Move the splash shield to gain access to the upper corner location screws as in Figs 1 and 6.

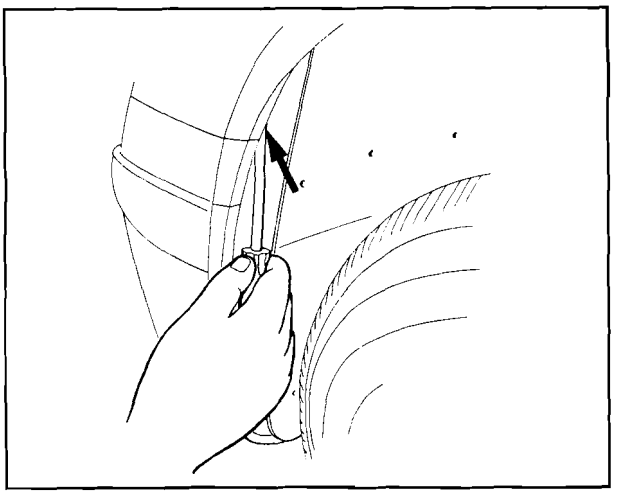


Fig. 6 — Upper corner screw access

(9) Remove the two long bumper reinforcement to chassis bolts and remove the front bumper assembly, refer Fig. 1.

Installation

To install, reverse the removal procedure taking note of the following:

(1) When replacing the plastic clips, ensure that they are pressed firmly into their location holes.

(2) Be careful not to scratch the bumper skin or the vehicle paint when installing the bumper bar assembly.

Disassembly

(1) Remove the bumper moulding from the bumper assembly if necessary.

NOTE: The bumper moulding cannot be reused and must be replaced if removed.

(2) Remove the reinforcement panel from the bumper bar assembly by removing the seven black plastic clips (see Fig. 4) and the eight screws from the assembly, refer Fig. 8.

(3) Remove the upper and lower splash shield brackets by removing the retaining screws, refer Fig. 8.

(4) The side upper bracket can also be removed by taking out the three retaining screws, refer Fig. 8.

Assembly

To assemble, reverse the disassembly procedure noting the following:

(1) Clean away any oil, dirt or grease that is on the bumper moulding installation surface.

(2) Peel off the backing paper and install the moulding along the installation channel, refer Fig. 7.

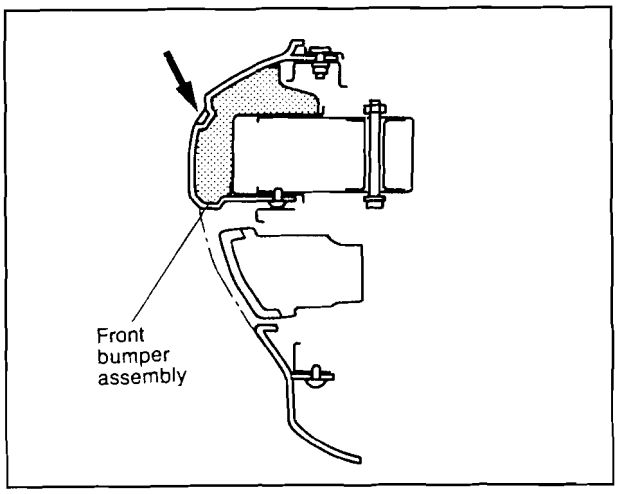
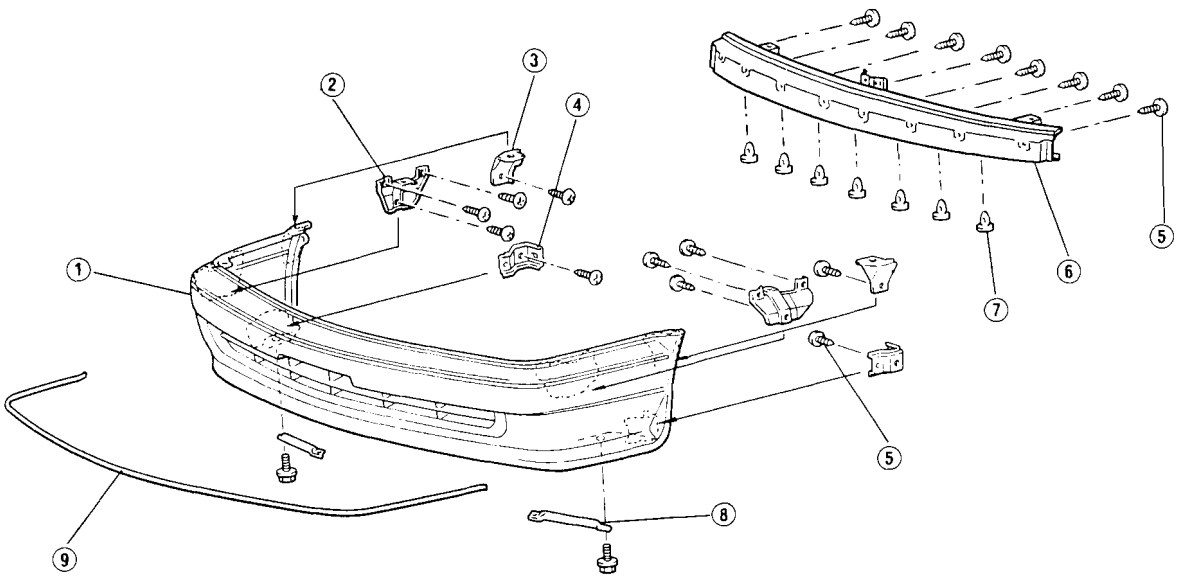


Fig. 7 — Bumper moulding location



1. Front bumper skin.
2. Side upper bracket.
3. Upper splash shield bracket.
4. Lower splash shield bracket.
5. Screws.
6. Bumper reinforcement.
7. Black plastic clips.
8. Side stay.
9. Bumper moulding.

Fig. 8 — Front bumper assembly sedan and wagon

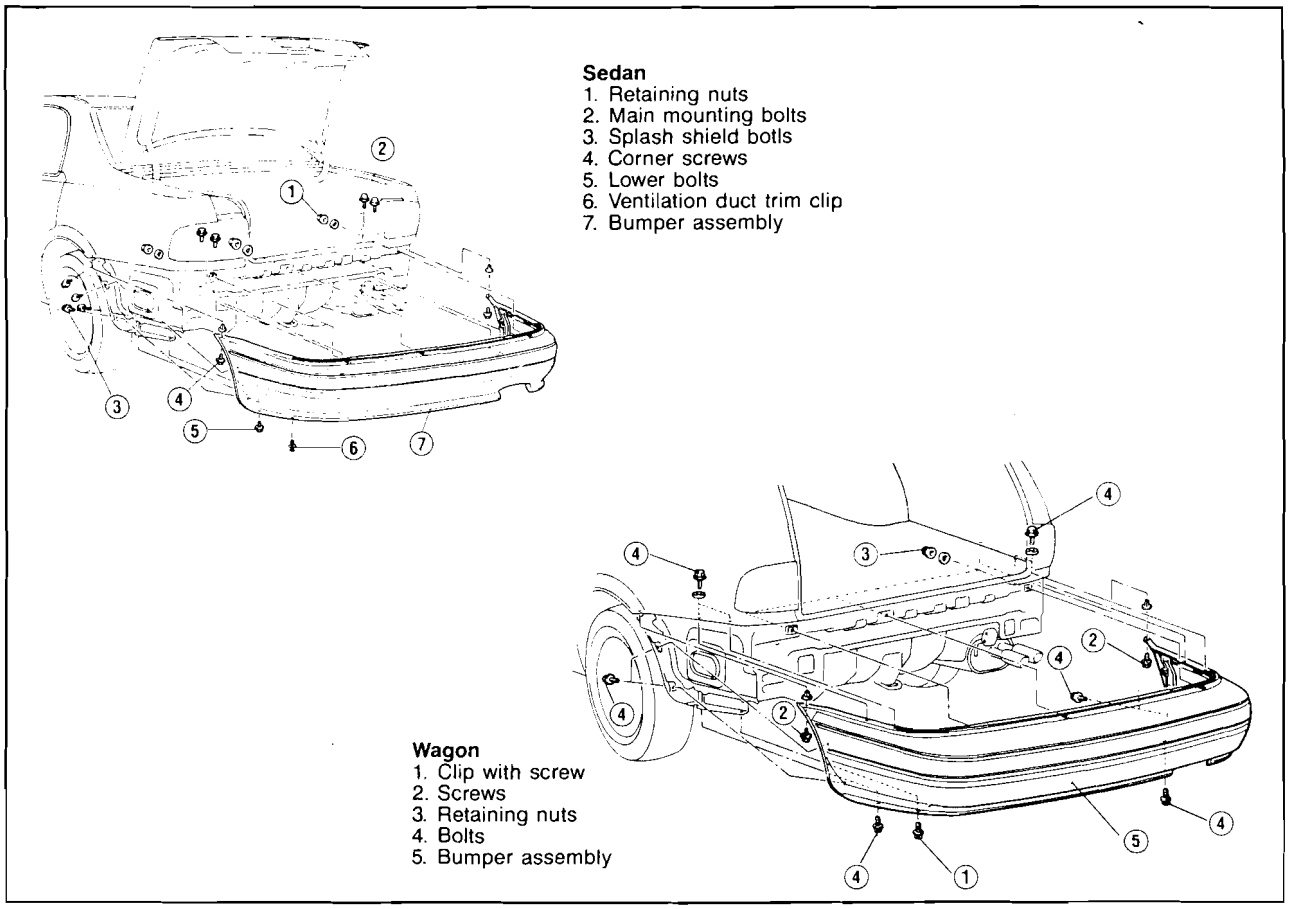


Fig. 9 — Rear bumper bar sedan and wagon

REAR BUMPER

Removal — Sedan and Wagon

(1) Remove the bolts from the left and right hand rear splash shields, refer Fig. 10.

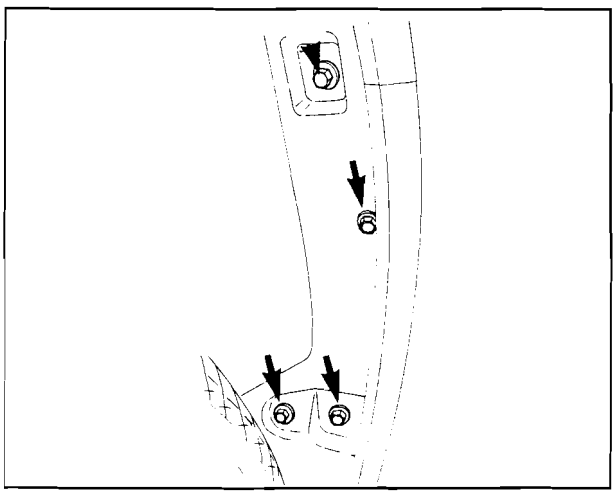


Fig. 10 — Bolt location

(2) Remove the lower (inner mounting bolts and remove the splash shields, refer Fig. 11.

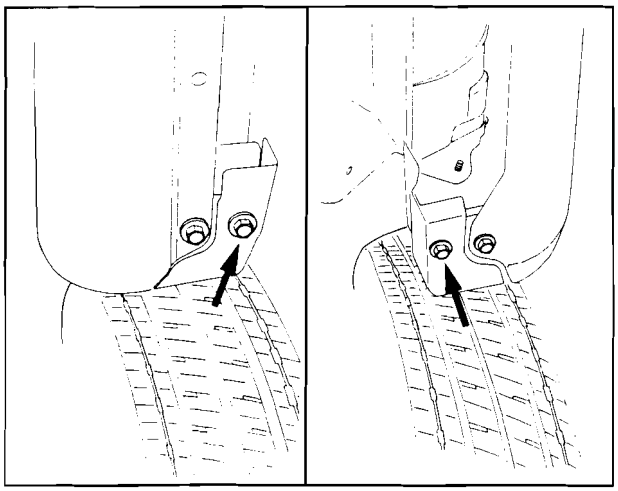


Fig. 11 — Lower bolt location

(3) Remove the corner screws from either side of the bumper, refer Fig. 9.

(4) Remove the lower screw clip from the rear ventilation duct by unscrewing it with a phillips head screwdriver, refer Fig. 12.

(5) Next, remove the rear boot/cargo trim, refer Group 52 — Interior.

(6) Remove the retaining nuts/bolts shown in Fig. 9.

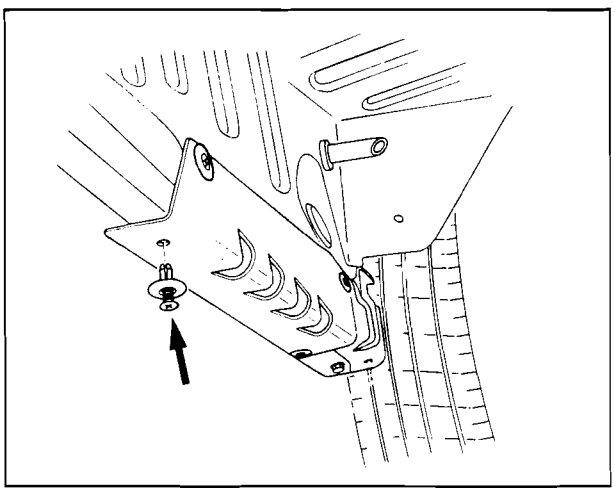


Fig. 12 — Ventilation duct trim clip

NOTE: If vehicle is fitted with a towbar, loosen the four towbar to chassis rail bolts, to allow removal.

(7) Remove the main bumper bar mounting bolts, refer Fig. 9.
(8) Remove the rear bumper bar assembly.

Installation

Install by reversing the removal procedure noting the following:
(1) When replacing the screw clips, insert the grommet into the hole, then press the screw in, refer Fig. 13.

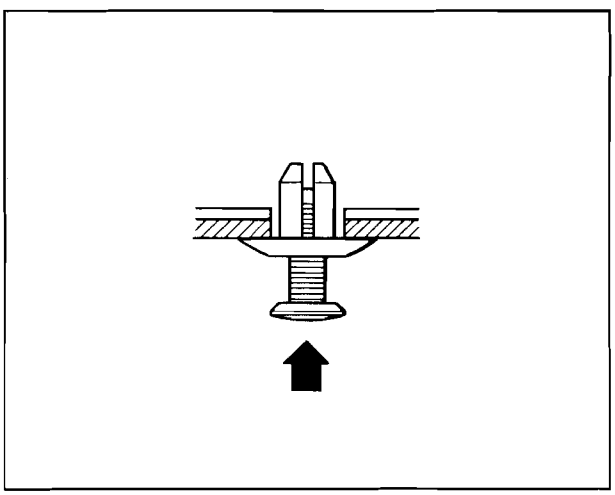
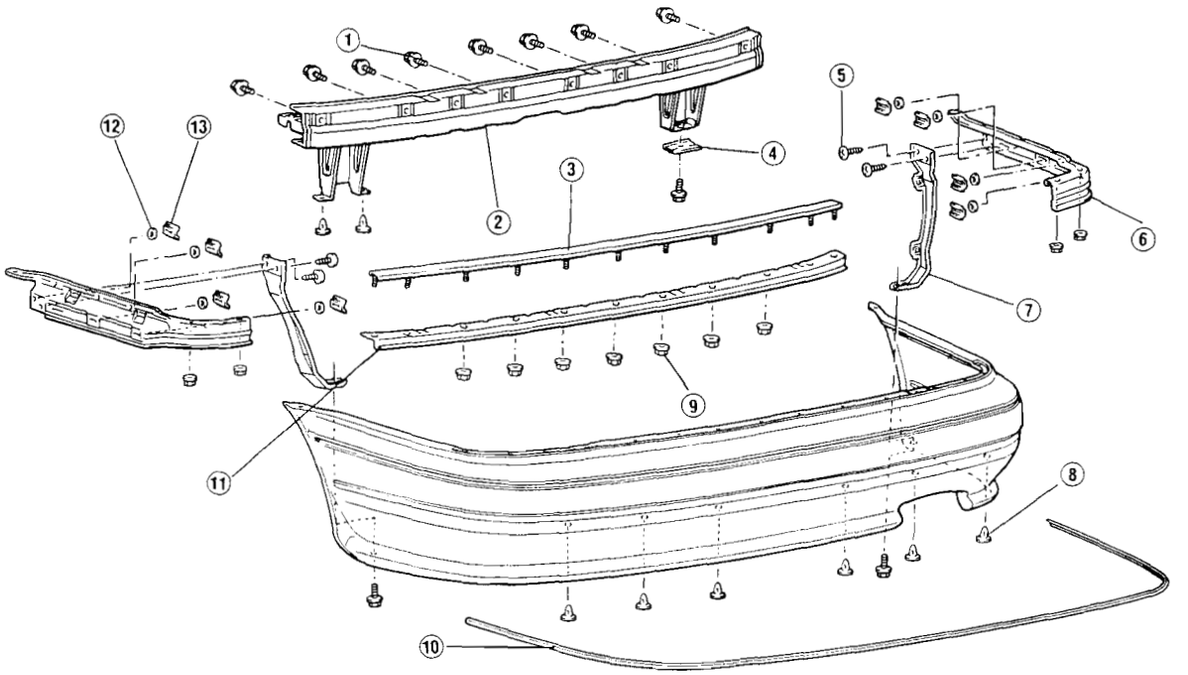


Fig. 13 — Screw clip installation

(2) Refer to Group 52 — Interior for boot trim installation.

NOTE: Ensure that towbar bolts are retightened after bumper installation is complete, (where fitted).



1. Reinforcement screws.
2. Reinforcement assembly.
3. Upper plate.
4. Muffler plate.
5. Mounting screws.
6. Upper side reinforcement.
7. Front side reinforcement.
8. Black plastic clips.
9. Upper support mounting nuts.
10. Bumper moulding.
11. Upper support.
12. Clip packing.
13. Retaining clip.

Fig. 14 — Rear bumper assembly sedan and wagon

Disassembly — Sedan and Wagon

(1) Remove the bumper moulding from the bumper assembly if necessary.

NOTE: The bumper moulding cannot be reused and must be replaced if removed.

(2) Remove the muffler plate and bolt from the assembly, refer Fig. 14.

(3) Using a pair of pointy nose pliers, remove all eight black plastic clips that attach the reinforcement to the bumper, refer Fig. 14 for location and Fig. 15 for procedure.

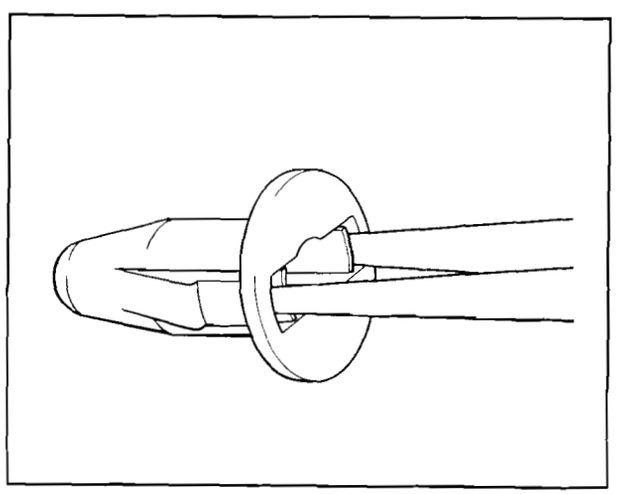


Fig. 15 — Removing clips

(4) After removing the eight screws that mount the reinforcement to the bumper, remove the reinforcement, refer Fig. 14.

(5) Remove the front side reinforcements by removing the retaining bolt at the base of each side and the two screws at the top of each side, refer Fig. 16.

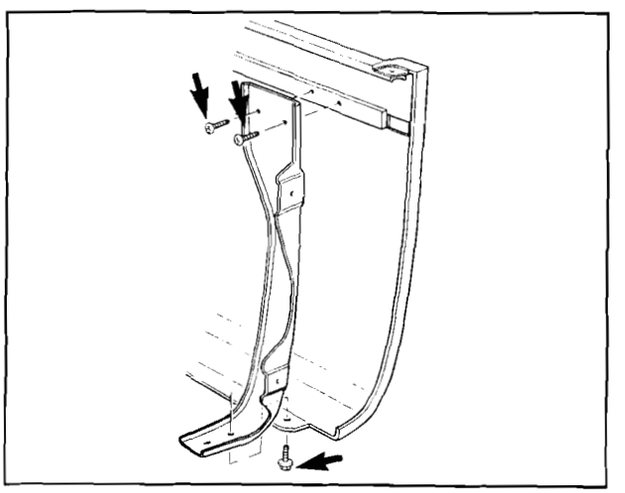


Fig. 16 — Bolt and screw location

(6) Using a screwdriver, lever off the four retaining clips (either side of the assembly) which retain the upper side reinforcements, refer Fig. 14 for location and Fig. 17 for procedure.

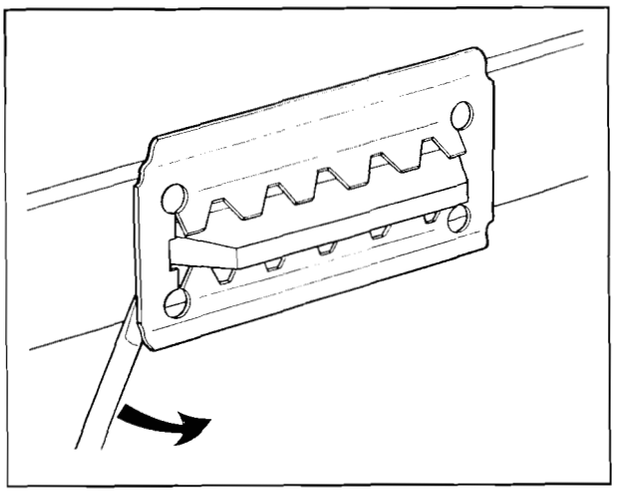


Fig. 17 — Clip removal

NOTE: Do not lose the small pieces of packing that go between the clip and the bracket.

NOTE: When the metal toothed clips are removed from the assembly, always replace with a new clip.

(7) Remove the eleven nuts located underneath the upper support, refer Fig. 14.

(8) Remove the upper plate, upper side reinforcements and the upper support from the bumper, refer Fig. 14.

Assembly

To assemble, reverse the disassembly procedure noting the following:

(1) Clean away any oil, dirt or grease that is on the bumper moulding installation surface.

(2) Peel off the backing paper and install the moulding along the installation channel, refer Fig. 18.

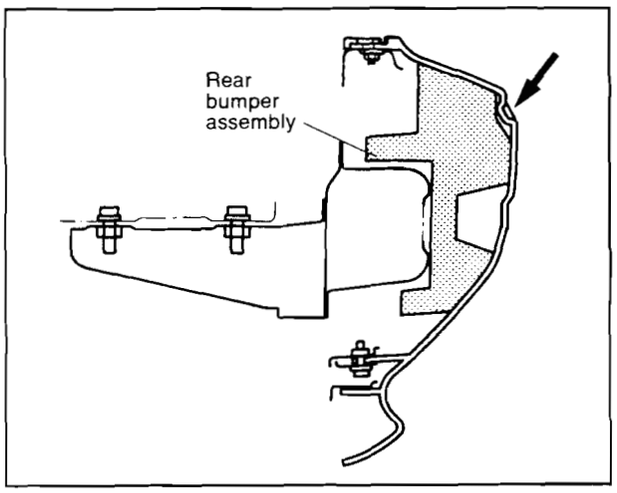


Fig. 18 — Bumper moulding location

(3) Ensure that the painted surface of the bumper is not damaged during assembly.

(4) When installing the black plastic clips, ensure that they are correctly located into the assembly.

(5) When installing the metal toothed clips, ensure that they are located in the correct position and pushed on firmly, refer Fig. 19.

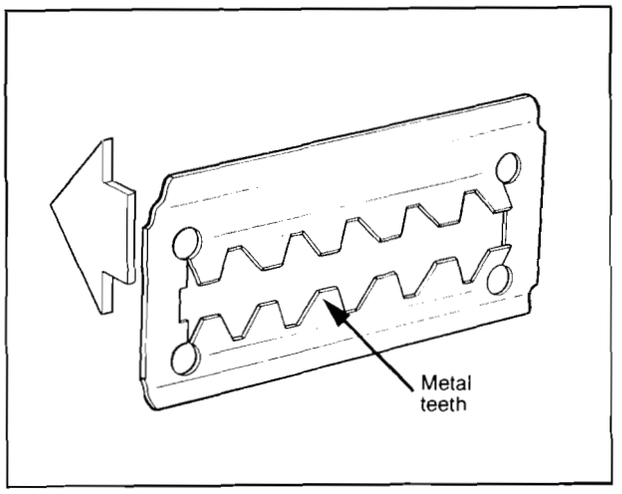


Fig. 19 — Clip installation direction

SECTION 3 — GRILLES, GARNISHES AND MOULDINGS

RADIATOR GRILLE

Removal

(1) With the bonnet open, use a flat tipped screwdriver to free the retaining clips. Move the centre black part of the clip in the direction of the arrows in Fig. 1.

(2) As you are freeing the clips, pull lightly on the grille until all the clips are removed.

(3) Remove radiator grille assembly.

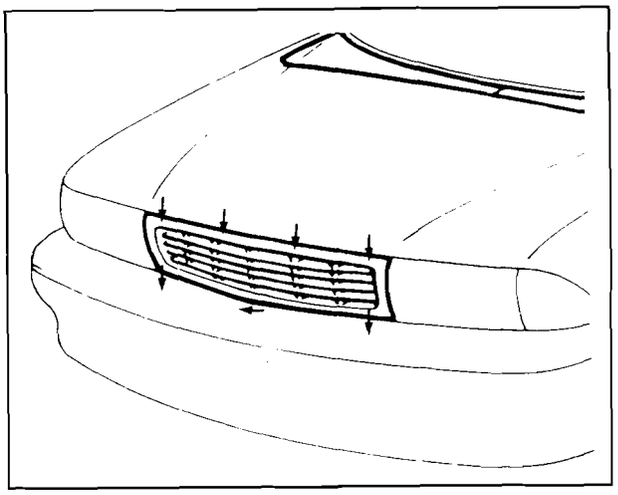


Fig. 1 — Clip removal direction

Installation

To install, reverse the removal procedure noting the following:

(1) If the black piece of the clip remains on the vehicle, remove it and refit it to the grille assembly before trying to install the grille to the vehicle.

AIR INLET GRILLES

Removal

(1) Remove the two wiper arm assemblies by removing the retaining nuts, refer Fig. 2.

(2) Remove the seven screw clips by unscrewing them with a phillips head screwdriver and then remove the grilles.

Installation

Install by reversing the removal procedure, noting the following:

(1) When installing the screw clips, insert the grommet into the hole then press the screw in, refer Fig. 3.

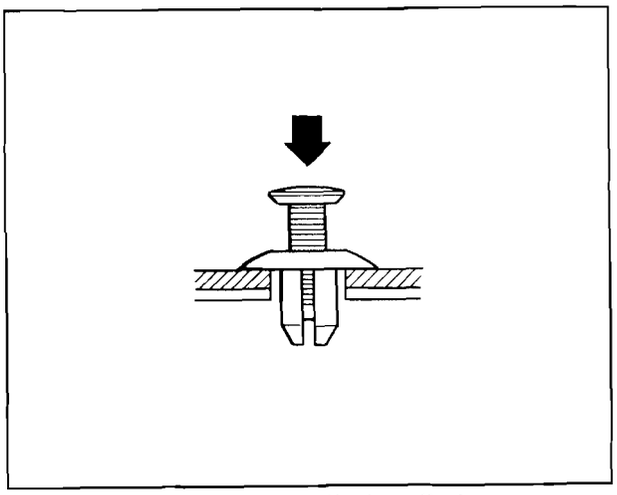


Fig. 3 — Screw clip installation

(2) Ensure that the wiper arms are tightened to the correct torque. Refer this group for specification.

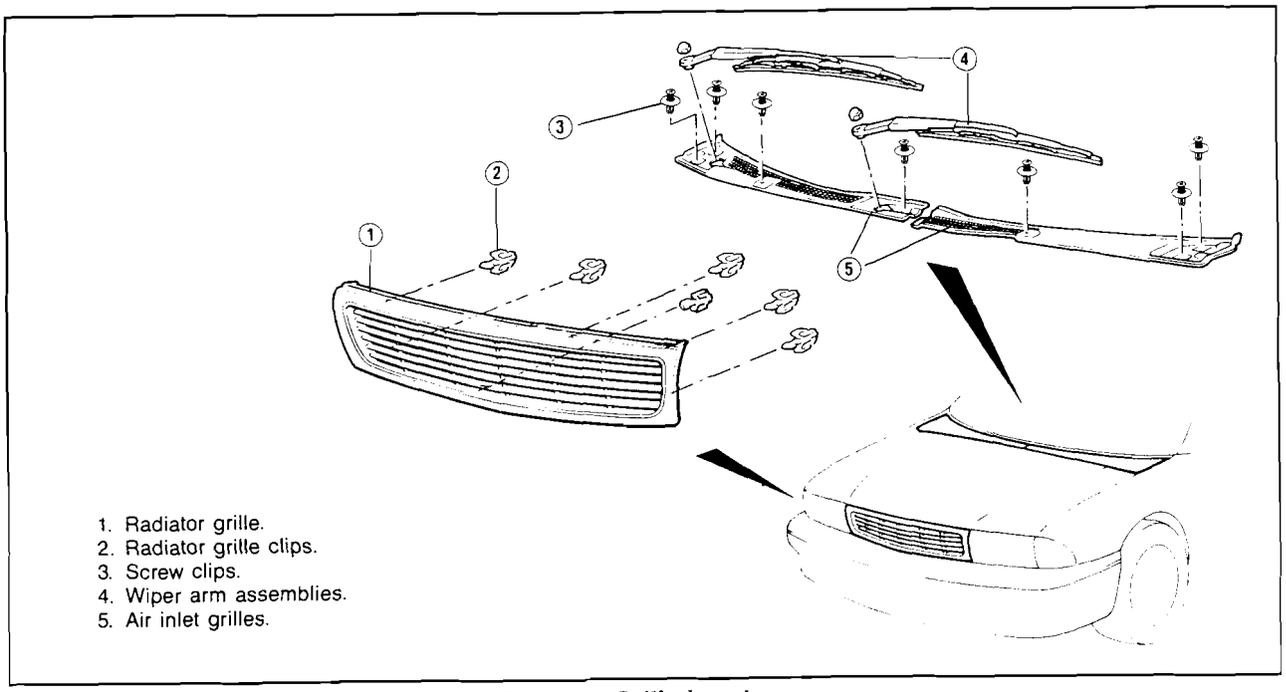


Fig. 2 — Grille locations

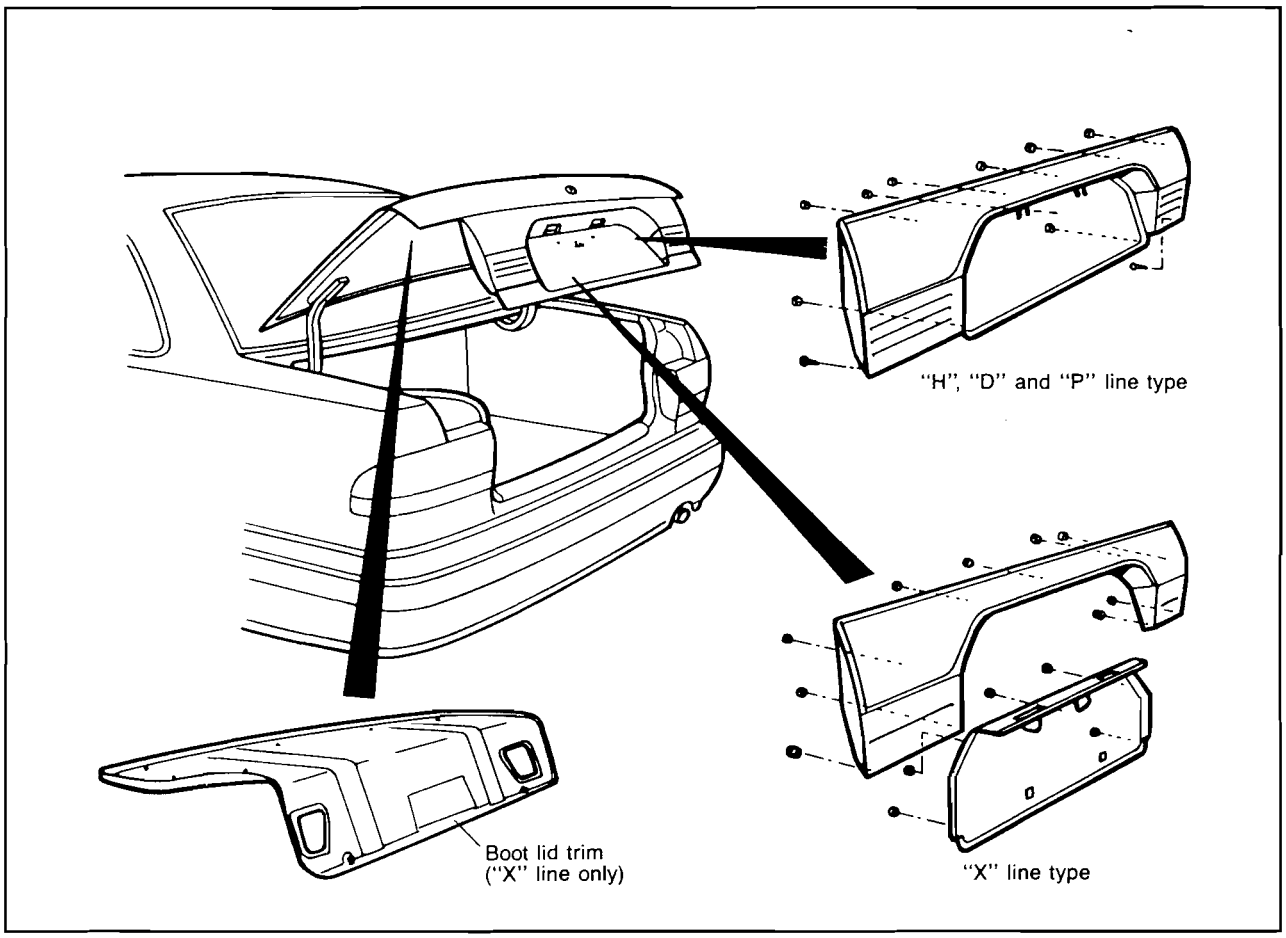


Fig. 4 — Rear garnish removal and installation

REAR GARNISH

Removal "H", "D" and "P" line

(1) Remove the trunk lid trim (where fitted), refer Group 52 — Interior for removal procedure.

(2) Remove the eight rear garnish retaining nuts which are located inside the trunk lid, refer Fig. 4.

(3) Remove the phillips head screws that are located in the lower corners of the trunk lid, refer Fig. 4.

(4) Carefully remove the rear garnish.

Installation "H", "D" and "P" line

To install, reverse the removal procedure noting that when installing the trunk lid trim, refer to Group 52 — Interior for procedure.

Removal "X" line

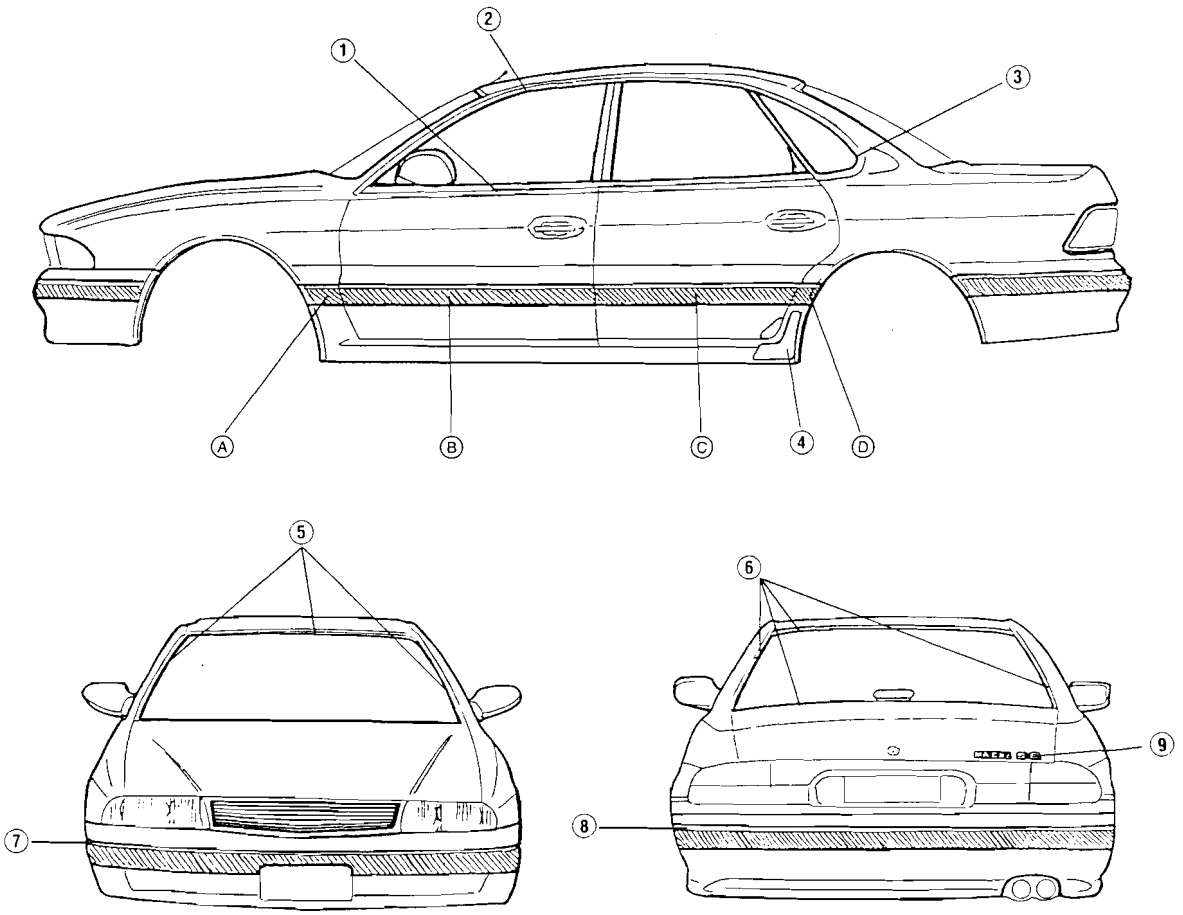
(1) Remove the trunk lid trim, refer Group 52 — Interior for removal procedure.

(2) Remove the outer garnish piece by releasing the nine retaining nuts and two stud thread covers, refer Fig. 4.

(3) Remove the inner garnish piece by releasing the 5 retaining nuts, refer Fig. 4.

Installation "X" line

To install, reverse the removal procedure noting that the inner garnish must be installed before the outer garnish.



Side protection mouldings:

A. Front side protection moulding.
B. Side door protection moulding (front).
C. Side door protection moulding (rear).
D. Rear side protection moulding.

1. Belt moulding.
2. Drip moulding.
3. Rear quarterglass moulding.
4. Lower rear door moulding.
5. Front windscreen mouldings.
6. Rear windscreen mouldings.
7. Front bumper moulding.
8. Rear bumper moulding.
9. Model badges.

Fig. 5 — Moulding locations

SIDE PROTECTION MOULDINGS

Removal

(1) To remove the side protection mouldings, (mouldings "B", "C" and "D" on Fig. 5), simply lever the mouldings with special tool E23M6 carefully from the vehicle, refer Fig. 6.

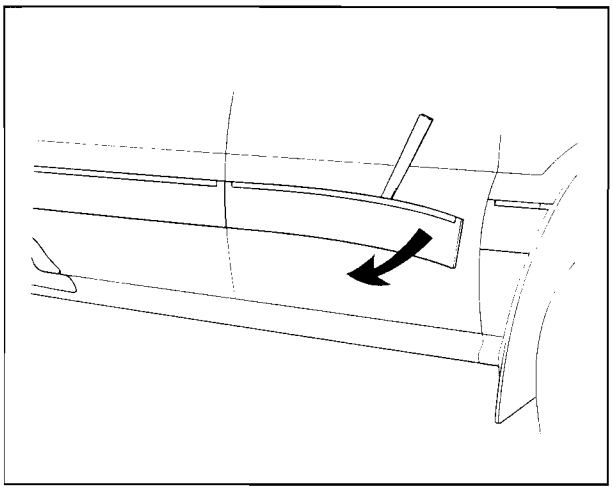


Fig. 6 — Side moulding removal

(2) Remove the retaining bolt (in moulding "A" on Fig. 5), and carefully lever the clips from the body and remove moulding, refer Fig. 7.

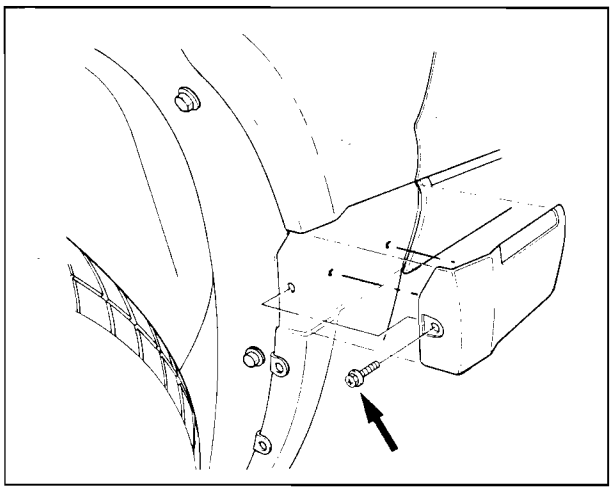


Fig. 7 — Moulding "A" removal

(3) To remove the lower rear door moulding (as indicated in Fig. 5), carefully lever from the body with special tool E23M6 to release the clips.

Installation

(1) Clean the protection moulding location areas with a suitable solvent to remove any old adhesive, dust or grease.

(2) When replacing mouldings for new one's, peel backing paper off, locate clips and press into place.

(3) If you are replacing the original mouldings, use a suitable double sided tape in the positions shown in Fig. 8.

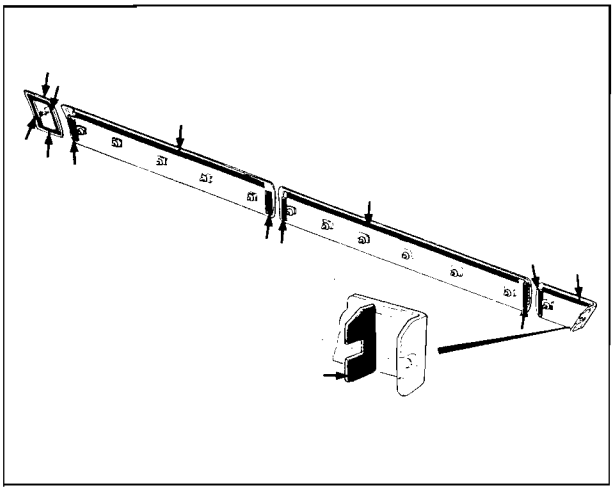


Fig. 8 — Tape location

DRIP MOULDINGS

Removal

(1) To remove the drip mouldings (location shown in Fig. 5), simply pull the lower edge of the moulding outwards and up and work your way along until all the clips are carefully released.

(2) Remove the drip moulding from the rear quarter window moulding by sliding it towards the front of the vehicle, refer Fig. 9.

(3) Remove drip moulding from the vehicle.

Installation

(1) Ensure the clips are undamaged and attached to mouldings.

(2) Locate the rear of the drip moulding into the rear quarter window moulding.

(3) Locate the clips from the back to the front of the vehicle, one at a time, being careful not to damage the moulding.

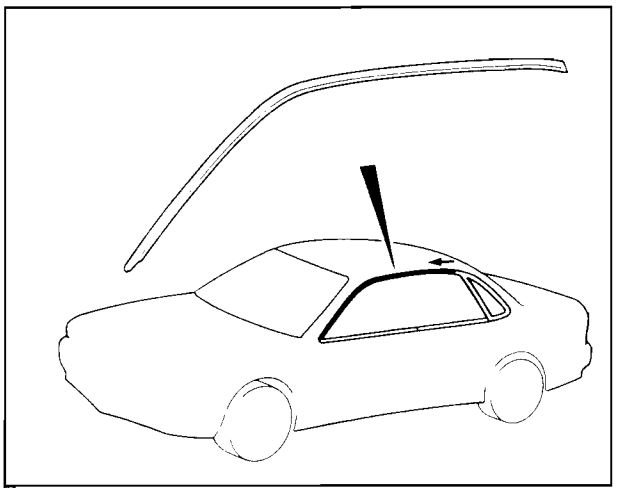


Fig. 9 — Moulding location

DOOR BELT MOULDINGS

Removal

(1) Remove the screws that are located inside the doors, adjacent to the "B" pillar, refer Fig. 10.

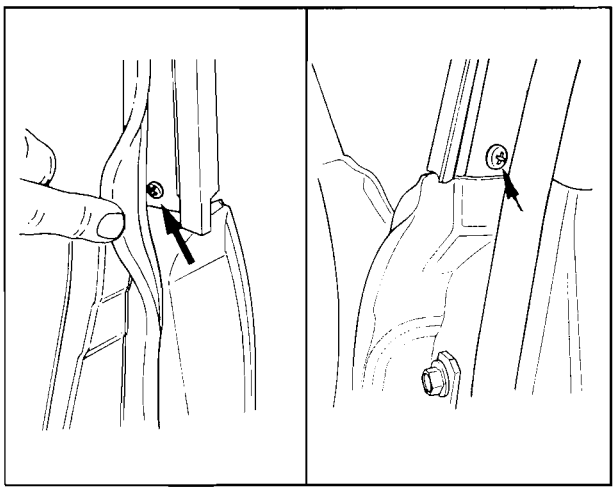


Fig. 10 — Screw location

(2) Remove the moulding by pulling upwards, releasing the retaining clips.

Installation

NOTE: When removing the belt moulding, replace the clips with new ones before installation.

(1) Replace moulding with new clips into the correct locating position, refer Fig. 5 and lock clips into place.
(2) Replace the retaining screw in every moulding removed.

REAR QUARTER GLASS MOULDING

Removal and Installation

For removal and installation procedure of the rear quarter glass moulding, refer Group 42A — Body, due to the moulding and glass being one complete assembly.

FRONT WINDSCREEN MOULDINGS

Removal

(1) Remove the side windscreen mouldings using special tool E23M6. Pull rubber base out from under air grille and slide the top out of the corner join, refer Fig. 11.
(2) Remove the top moulding the same way.

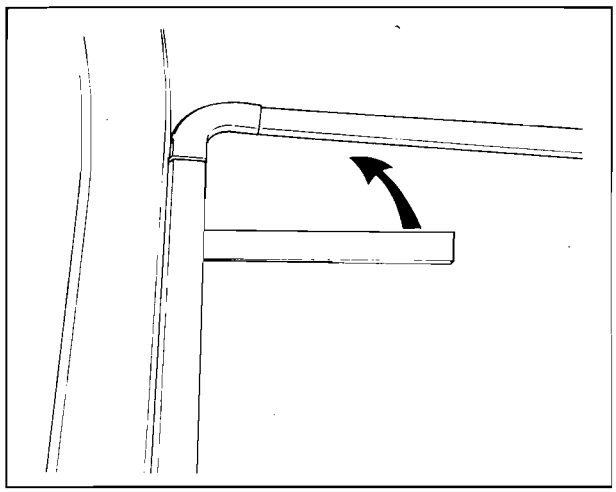


Fig. 11 — Moulding removal

Installation

(1) Ensure that the clips are undamaged and fitted to the moulding.
(2) Locate top moulding first.

NOTE: It is suggested that moulding fitment can be aided (with less chance of damage) by using a clean rubber stamp, refer Fig. 12.

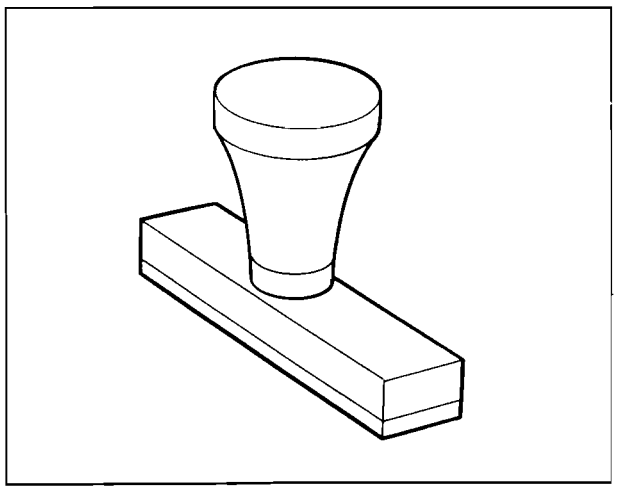


Fig. 12 — Rubber stamp — windscreen moulding installer

(3) Position top moulding over the clip location, pressing firmly into place.
(4) Locate side mouldings in corner joins and install by the same method.
(5) Ensure that the lower rubber sections are located below the air grille assemblies.

NOTE: Be careful not to trap the rubber edge underneath the moulding during fitment.

REAR WINDOW MOULDINGS

Removal

(1) Open the trunk lid and remove the five lower moulding retaining screws, refer Fig. 13.
(2) Remove lower moulding.
(3) Using special tool E980, carefully remove off the two side mouldings and slide them out of the corner join, refer Fig. 13.

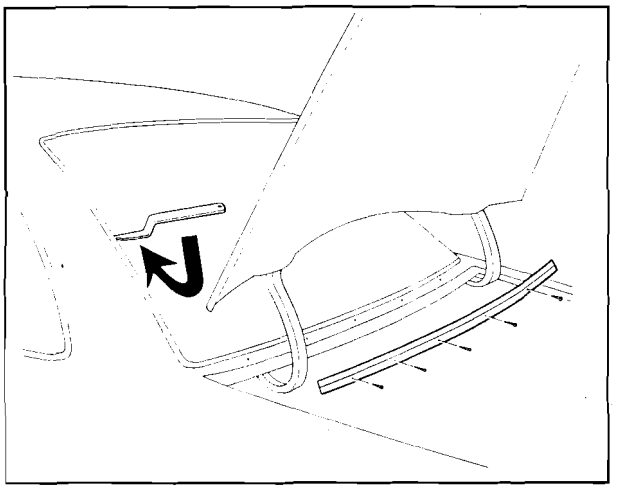


Fig. 13 — Rear moulding removal

(4) Remove the top moulding in the same fashion, releasing the clips.

Installation

(1) Ensure all clips are undamaged and attached to the "T" studs correctly.
(2) Locate the top moulding first and lock in by applying force over the clip, refer Fig. 14.

NOTE: See front windscreen mouldings for a moulding installation aid.

(3) Slide the side moulding corner pieces into the top moulding and lock side clips, refer Fig. 14.
(4) Replace lower moulding and install the five retaining screws.

NOTE: Be careful not to trap the rubber edge underneath the moulding during fitment.

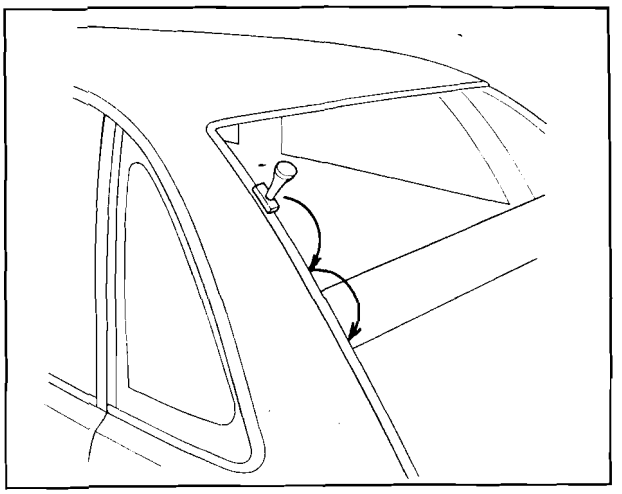


Fig. 14 — Moulding installation

MUD FLAPS

Removal — Front and rear

(1) Remove the three retaining bolts from the mud flap assemblies, refer Fig. 15.
(2) Remove mud flaps.

NOTE: If removal is difficult due to the double sided tape, use special tool E23M6 to help remove the mud flaps from the body.

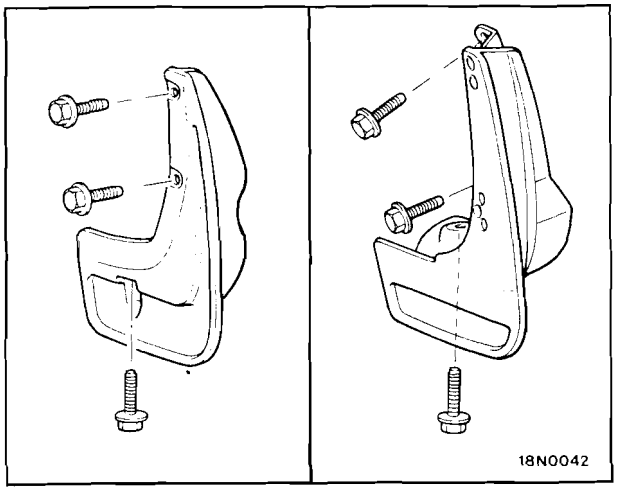


Fig. 15 — Mud flap removal

Installation

To install, reverse the removal procedure noting the following:
(1) Ensure that the double sided tape location area on the body is free from dirt, oil, etc.
(2) When installing new mud flaps, ensure that the backing paper is removed from the double sided tape before intallation.
(3) If installing an old mud flap that has unserviceable tape, replace with a suitable type of double sided tape before installation.

TAILGATE SPOILER

Removal — Wagon

(1) Remove the upper tailgate trim.
(2) Remove the spoiler to tailgate retaining nuts, refer Fig. 16.
(3) Disconnect the high mounted stop lamp wiring harness and rear washer tube.
(4) Remove the spoiler noting the position of the sealing washers to the tailgate.

Installation

Install by reversing removal procedure noting the following:
The spoiler sealing washers are seated in the correct position.

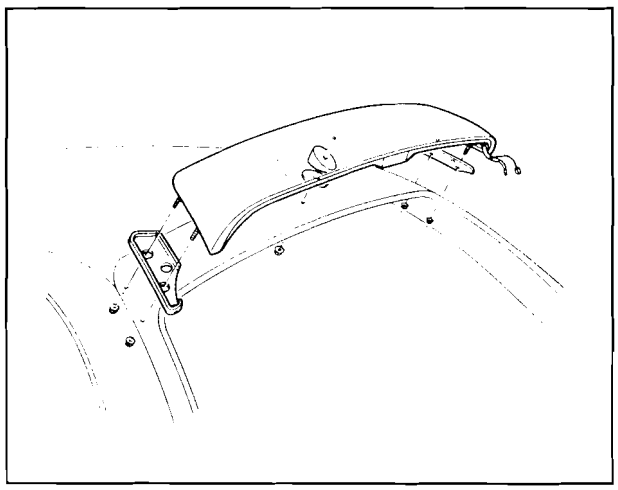


Fig. 16 — Tailgate spoiler removal

Disassembly

(1) Remove the LH and RH deflector cover by first prying along the front edge to release the adhesive tape then lever off at attaching clip points.

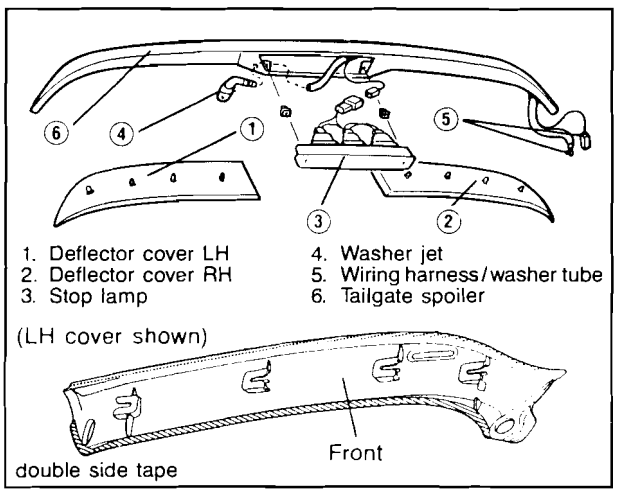


Fig. 17 — Spoiler disassembly

(2) Remove the stop lamp attaching screws and disconnect the wiring harness and remove the stop lamp.
(3) Disconnect the washer tube from the washer jet and remove the washer jet.

REAR QUARTER WINDOW MOULDING

Removal

(1) Remove the quarter window front moulding attaching screws.
(2) Remove the quarter front moulding.
(3) Remove the top quarter window drip gutter moulding.
(4) Remove the quarter window corner moulding.
(5) Remove the quarter window beltline moulding.

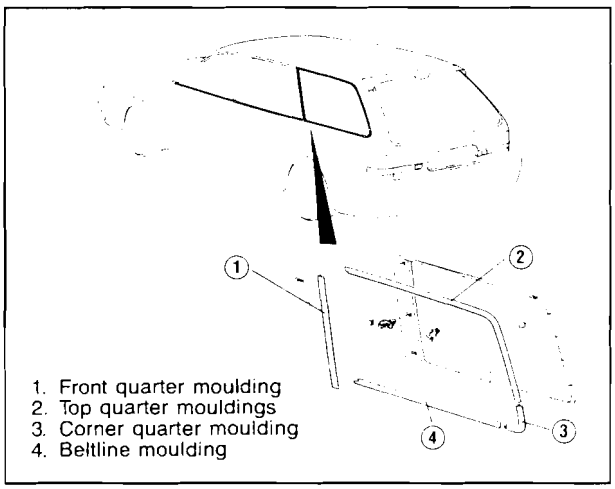


Fig. 18 — Rear quarter window mouldings

Installation

Install by reversing the removal procedure, replacing any broken moulding clips and before installing the quarter window front moulding, remove any old tape from the moulding and glass and replace with new double sided tape, refer Fig. 19.

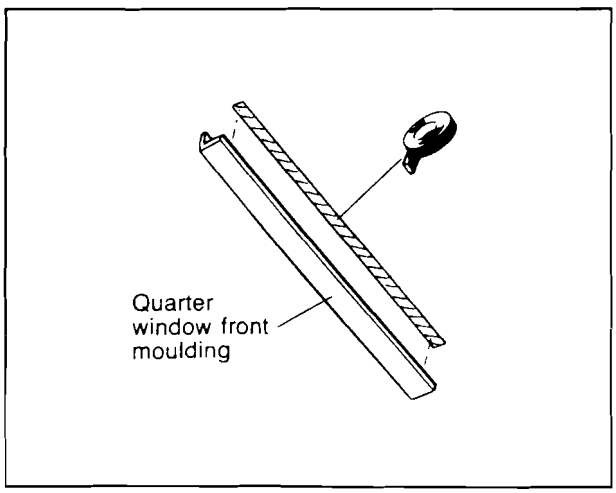


Fig. 19 — Front moulding tape position

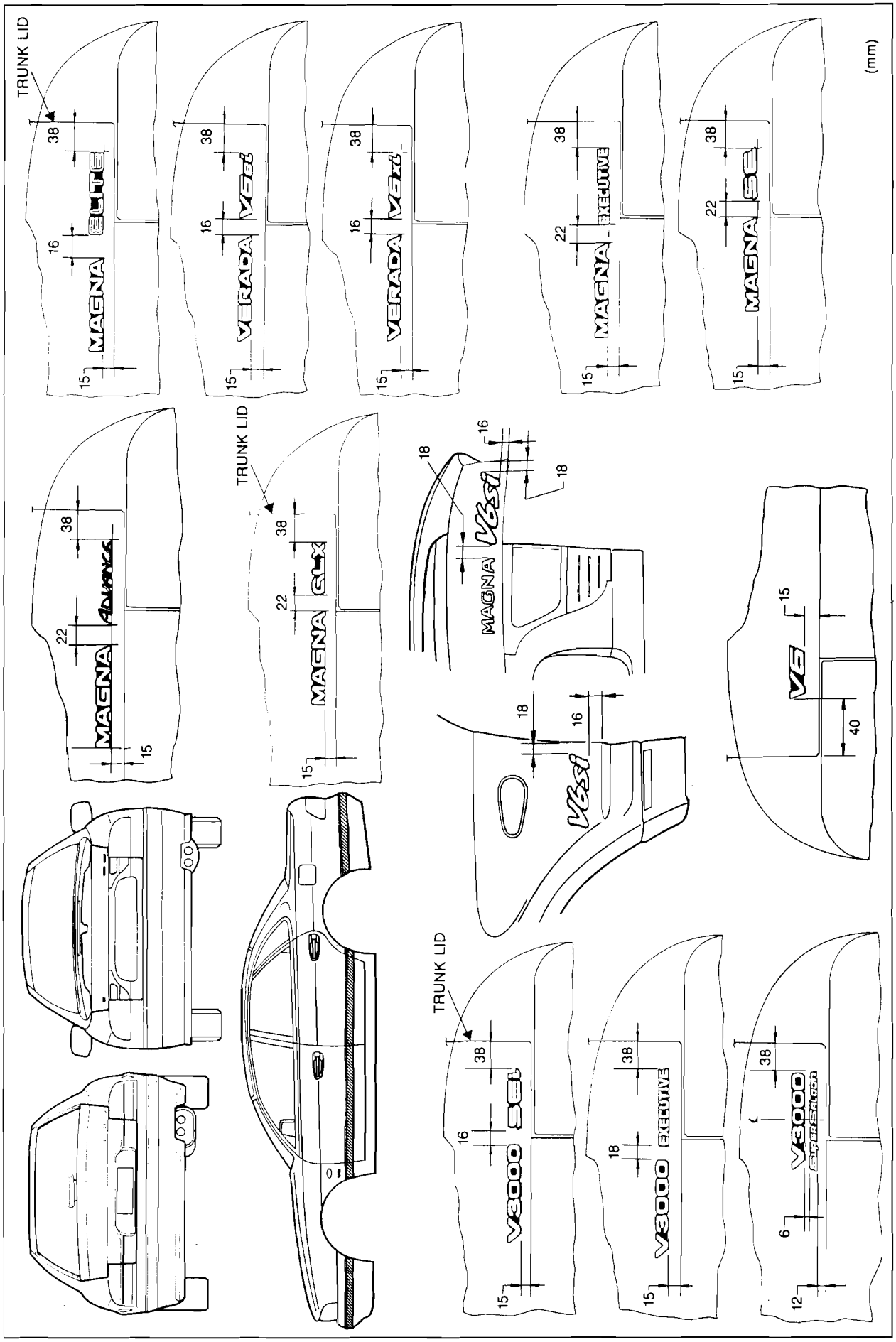


Fig. 20 — Name plate location sedan

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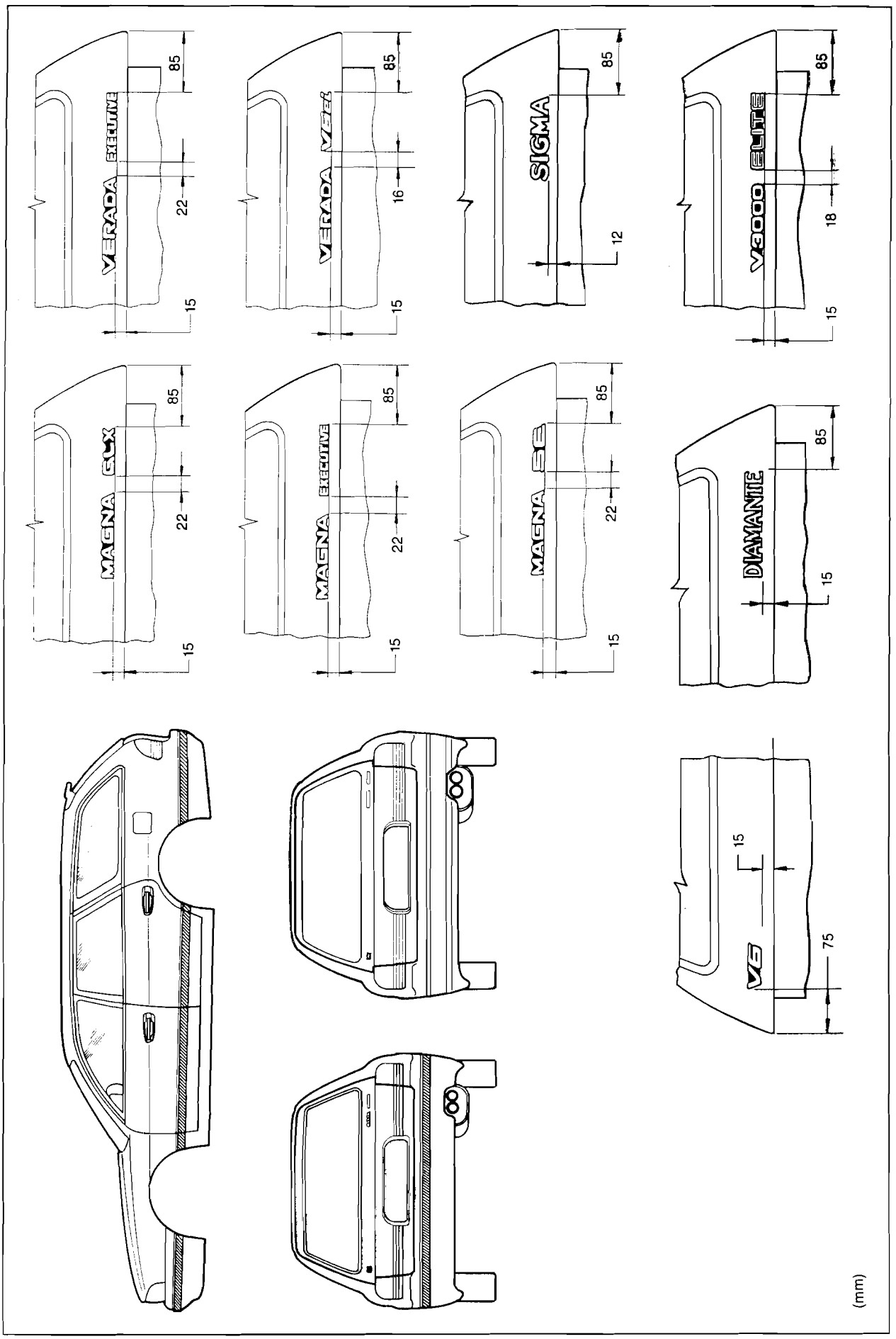


Fig. 20 — Name plate location wagon

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ROOF RACK <Where Fitted>

Removal

(1) Remove covers with a small screwdriver, refer Fig. 22.

(2) Loosen and remove the 8 roof rack attaching bolts (2 per stanchion) with Special Tool E42M3.

Installation

(1) Apply "Loctite 242" to all bolts prior to installation. Care should be taken to avoid spillage of "Loctite" onto roof panel.

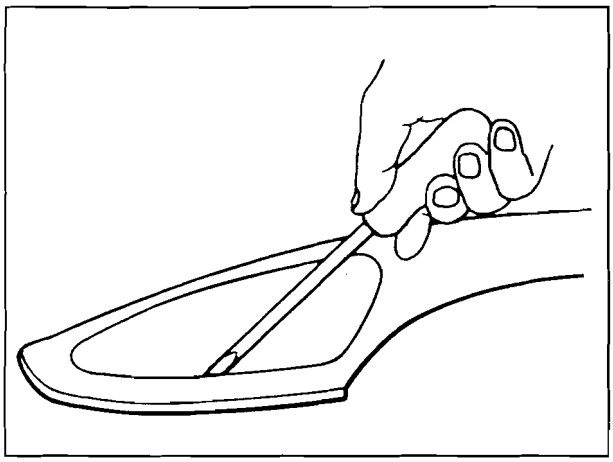


Fig. 22 — Roof rack stanchion cover removal

(2) Install front bolt of rear stanchions first to locate assembly, then install remain attaching bolts and tighten to the specified torque.

Specified torque: 4 to 6 Nm

(3) Apply a piece of double-sided tape 15mm by 20mm (3M-VHB 7-9473) on cover, refer Fig. 24.

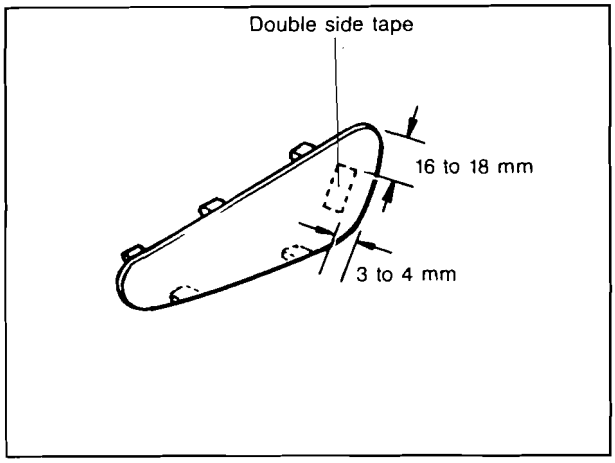


Fig. 24 — Double-side tape location

(4) Snap on covers and press the double-sided tape area to ensure proper adhesion.

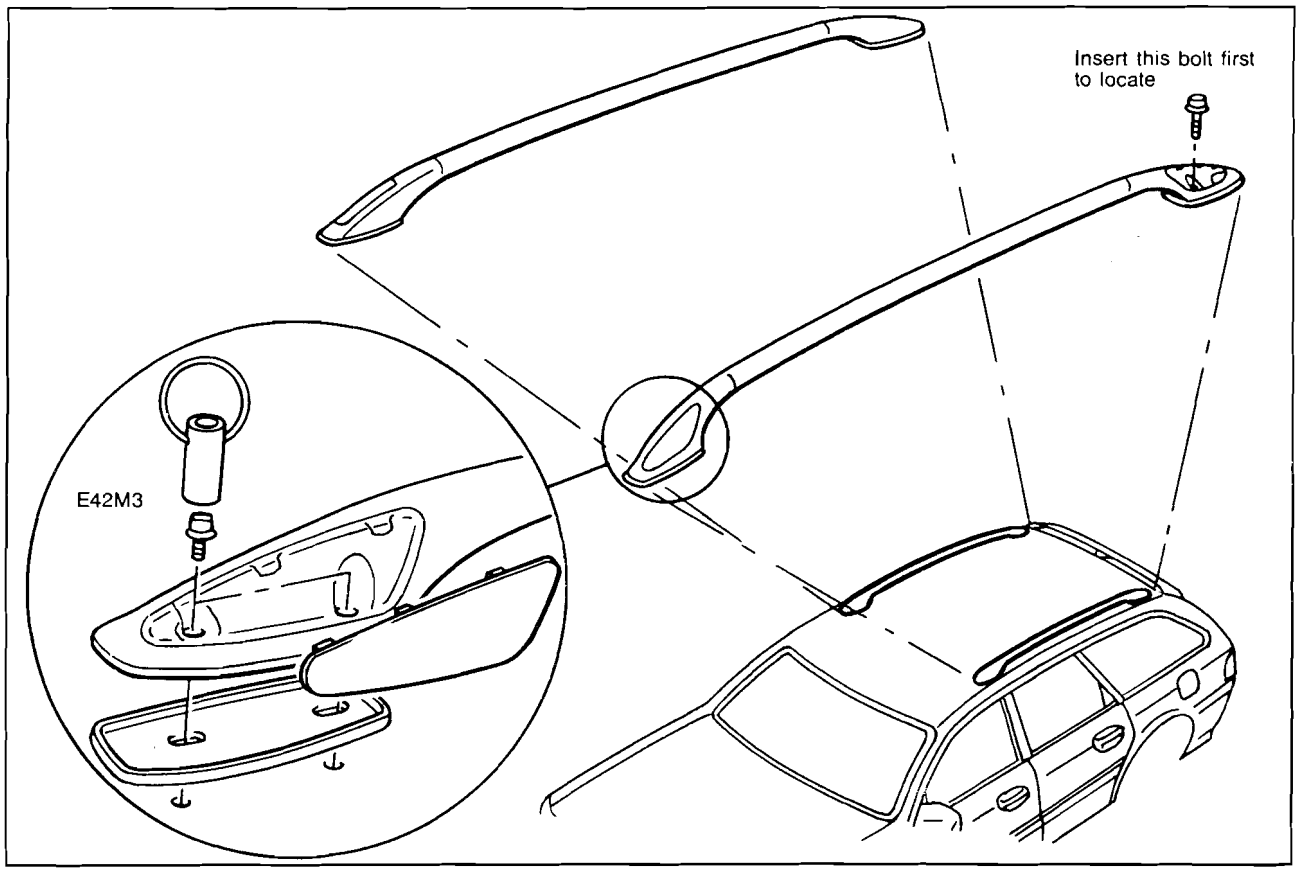
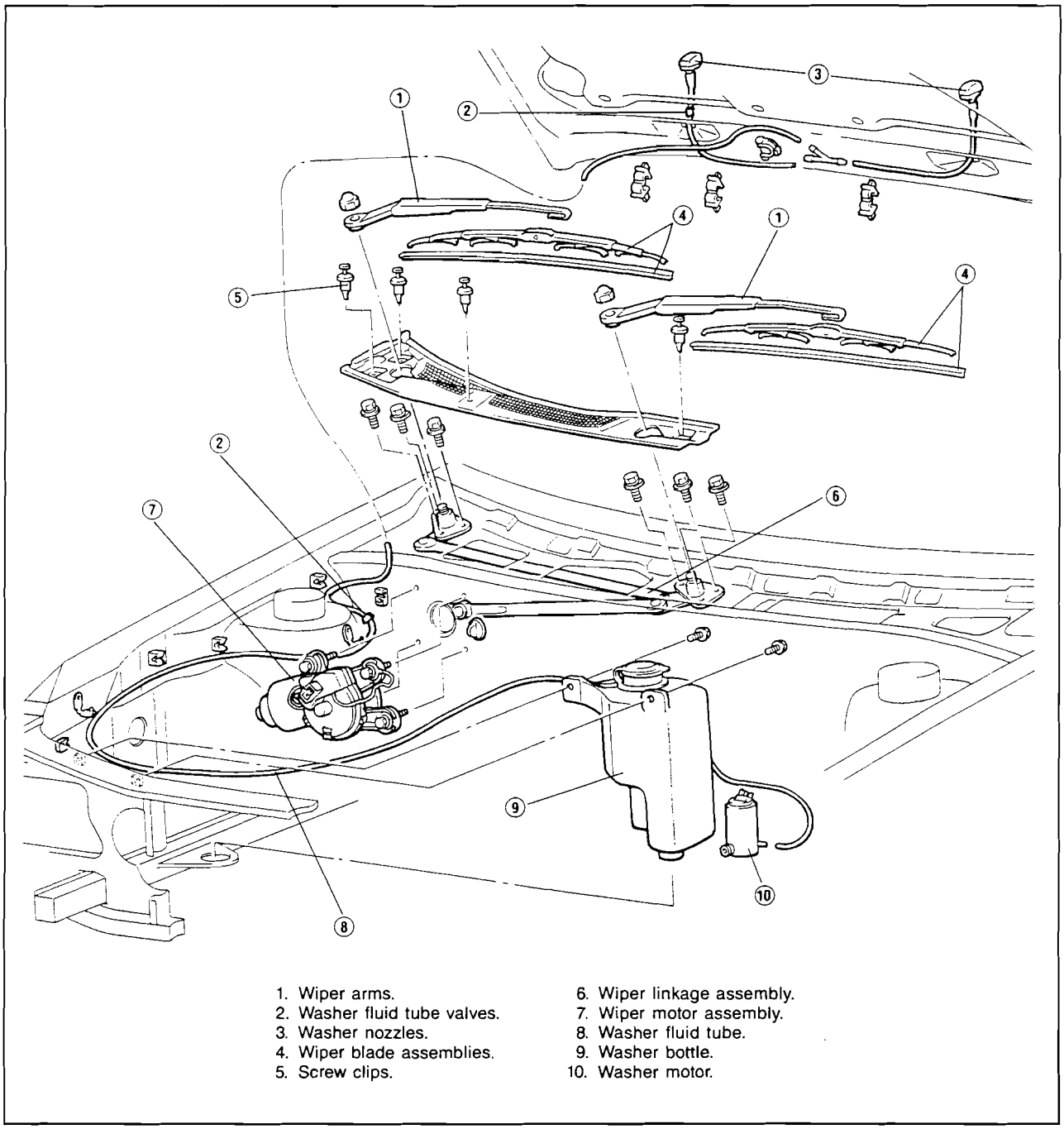


Fig. 23 — Roof rack installation

SECTION 4 — WINDSHIELD WIPERS AND WASHERS



1. Wiper arms.
2. Washer fluid tube valves.
3. Washer nozzles.
4. Wiper blade assemblies.
5. Screw clips.
6. Wiper linkage assembly.
7. Wiper motor assembly.
8. Washer fluid tube.
9. Washer bottle.
10. Washer motor.

Fig. 1 — Wiper/Washer part location

GENERAL INFORMATION

The wiper motor is a two speed permanent magnet type and incorporates a parking switch which is activated when the wipers are switched off.

The windscreen washer bottle is located in the engine compartment in front of the left hand strut housing. The washer pump, a centrifugal type driven by a DC ferrite magnet type motor is mounted in the washer bottle.

Control switches for high speed, low speed, intermittent operation and the windscreen washers are mounted on the steering column.

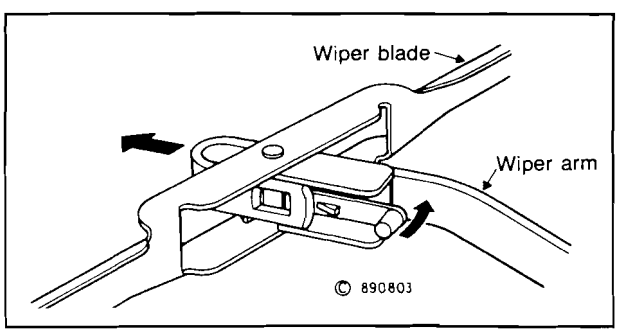


Fig. 2 — Wiper blade removal

WIPER BLADES

Replacement

(1) Lift the spring loaded clip, refer Fig. 2, and push out the wiper blade assembly.

(2) Remove the wiper insert retaining clip by squeezing the tangs together and pulling it from the blade.

(3) The insert and backing blade can now be removed from the wiper blade.

(4) Install by reversing the removal procedure.

NOTE: Wiper insert rubbers deteriorate as a result of environmental conditions, such as atmospheric pollution and road grime, temperature extremes and the natural ageing of the rubber. It is therefore recommended that wiper inserts are replaced every twelve months.

WIPER ARMS

Replacement

(1) Remove the wiper arm retaining nut.

(2) Remove the wiper arm by lifting the arm then turning and pulling the arm at the pivot.

(3) Install by reversing the removal procedure noting the following:

(A) Ensure that the arm is correctly positioned, refer Fig. 3.

(B) A spacer block must be used to ensure the correct clearance is achieved between the spring and windscreen as shown in Fig. 4. 8mm RHS 13mm LHS.

NOTE: The wiper arm assembly pin or similar must be left in the arm until the arm is positioned correctly and the retaining nut is tightened to 16-21 Nm.

NOTE: The arm and blade must be positioned correctly to conform to Australian Design Rule No. 16.

NOTE: Right and left wiper arms are not interchangeable, refer Group 51, Section 4.

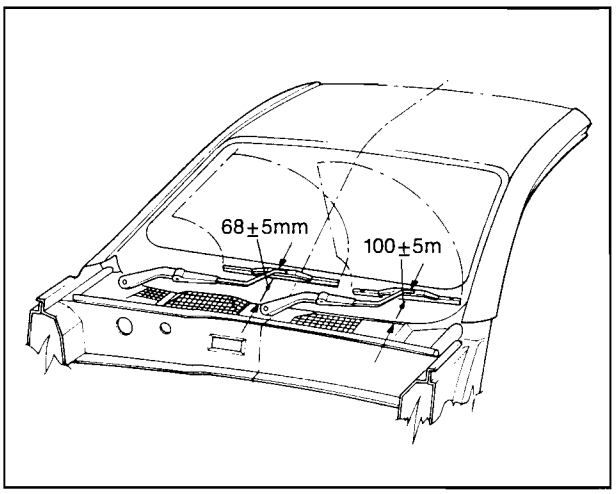


Fig. 3 — Correct wiper arm positioning

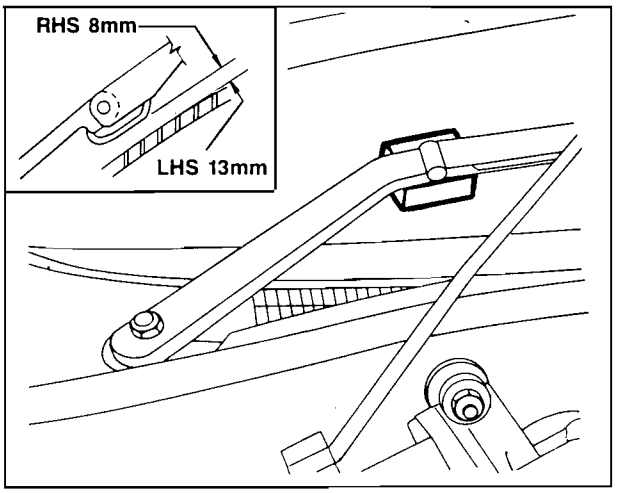


Fig. 4 — Wiper arm clearance using spacer block

Checking Wiper Arm to Windscreen Alignment

This check should be performed if the wiper inserts are serviceable but the wipers shudder or are jerky in operation.

(1) Operate the wipers and then, by turning the ignition switch off, position the wipers as shown in Fig. 5.

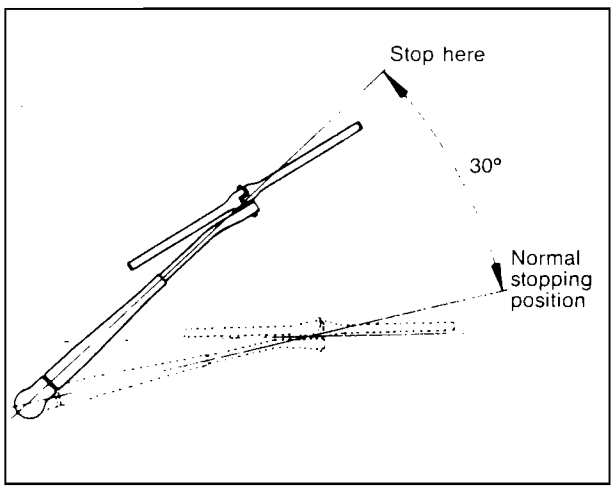


Fig. 5 — Positioning wiper arm for alignment check

(2) Remove the wiper blade and check that the end of the wiper arm is square to the windscreen, refer Fig. 6.

(3) If the arm is not square, gently twist the end of the arm to achieve the correct alignment.

(4) Refit the wiper blades.

(5) Turn the ignition switch on and allow the wiper arms to return to the normal position.

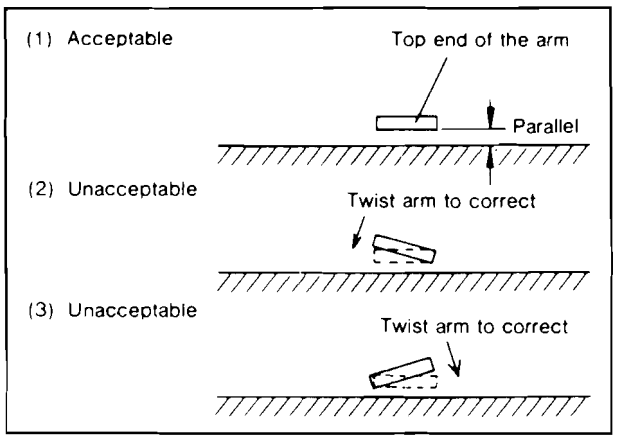


Fig. 6 — Checking wiper arms to windscreen alignment

Removal

(1) Disconnect the wiring harness from the washer motor.
(2) Disconnect the washer fluid hose from the washer pump.
(3) Remove the attaching nuts and remove the washer bottle.

Installation

Install by reversing the removal procedure.

WINDSCREEN WASHERS

The windscreen washer bottle is located in the engine compartment forward of the left hand strut housing.

Washer Nozzle Adjustment

(1) Check that the washer fluid contact points are as shown in Fig. 7.

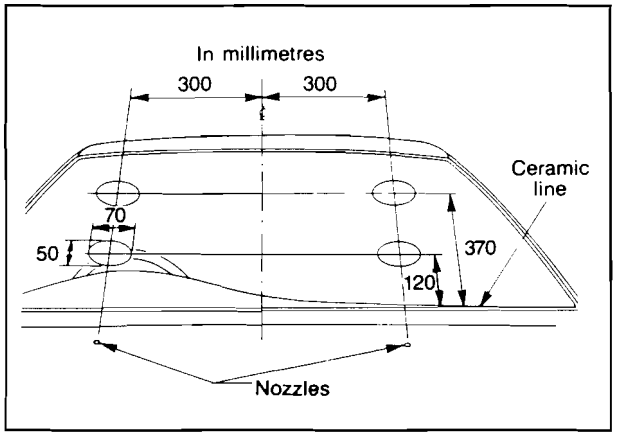


Fig. 7 — Washer fluid contact points

(2) If adjustment is necessary use a metal wire or pin 1.0 mm or less in diameter inserted in the nozzle ball.
(3) If insufficient washer fluid is supplied check the system for clogged, bent or crushed hoses.

NOTE: Do not operate the washer motor for more than 20 seconds continuously or when the washer bottle is empty as the motor or pump could be damaged.

WASHER FLUID TUBE VALVES (where fitted)

Valve Opening Operation Check

(1) Disconnect the tube to the rear washer nozzle from the stop valve.
(2) Check to make sure that a sufficient amount of washer fluid is ejected from the stop valve when the rear washer is pressed, refer Fig. 9.

NOTE: Be sure to reinstall the stop valve in the proper direction, as shown in the illustration, refer Fig. 8.

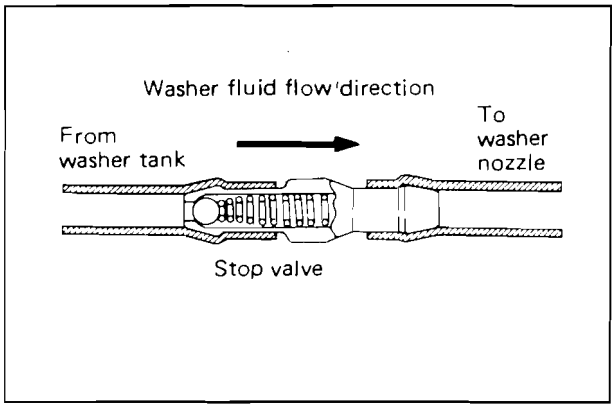


Fig. 8 — Connection of the stop valve

CAUTION: Operating the washer switch for 20 seconds or more continuously, or operating it when there is no washer fluid in the tank, could cause the motor to burn out.

Simple Test to Stop Valve

Valve Closing Operation Check

(1) Disconnect the tube on the washer tank from the stop valve.
(2) Check to make sure that washer fluid does not drip out of the stop valve, refer Fig. 9.

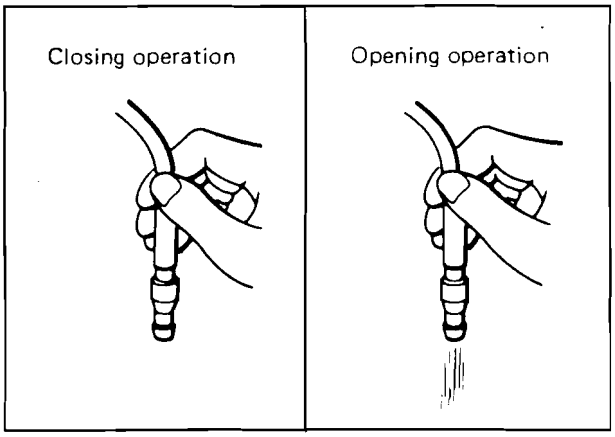


Fig. 9 — Checking of the stop valve operation

WIPER MOTOR

NOTE: The wiper motor is serviced as an assembly and should not be disassembled except by a qualified automotive electrician.

Removal

(1) Remove the wiper arms.
(2) Disconnect the wiring from the wiper motor.
(3) Remove the bolts securing the motor to the body and pull the motor out slightly.
(4) Disconnect the wiper linkage from the motor crank arm using a screwdriver or suitable lever, refer Fig. 10.

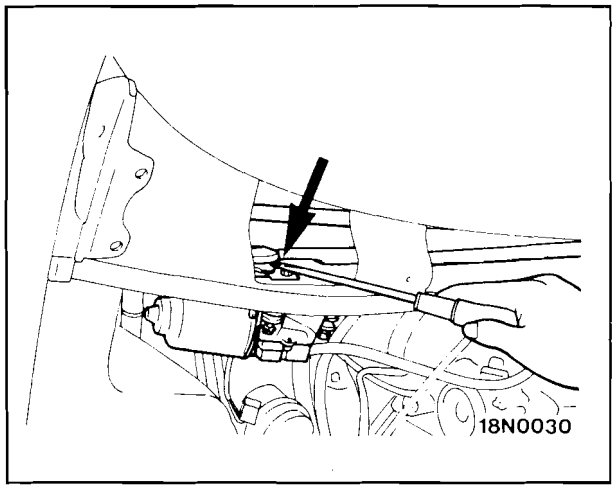


Fig. 10 — Disconnecting wiper linkage

Installation

Install by reversing the removal procedure, noting the following:
(1) Ensure the wiper motor is properly earthed.
(2) Position the wiper arms as described previously.

WIPER LINKAGE

Removal

(1) Remove the wiper motor as previously described in this section.
(2) Remove the front deck and inlet garnishes, refer Group 51.
(3) Remove the pivot shaft attaching bolts, refer Fig. 11, and push the shaft inwards.
(4) Remove the linkage from the vehicle.

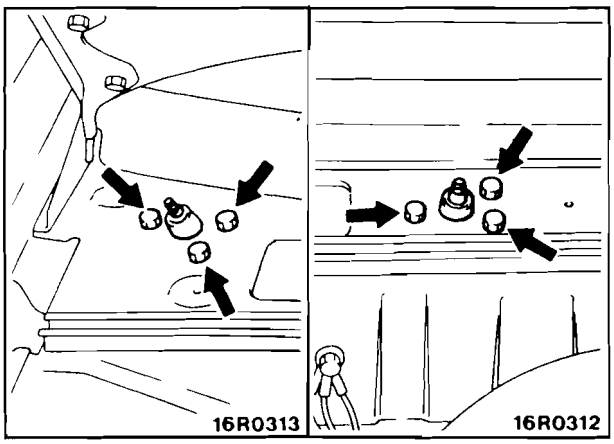


Fig. 11 — Wiper pivot attaching bolts

Installation

Install by reversing the removal procedure, noting the following:
(1) Check the wiper linkage for adequate lubrication at the points shown in Fig. 12.
(2) Ensure that the wiper motor is properly earthed.
(3) Position the wiper arms as described previously.

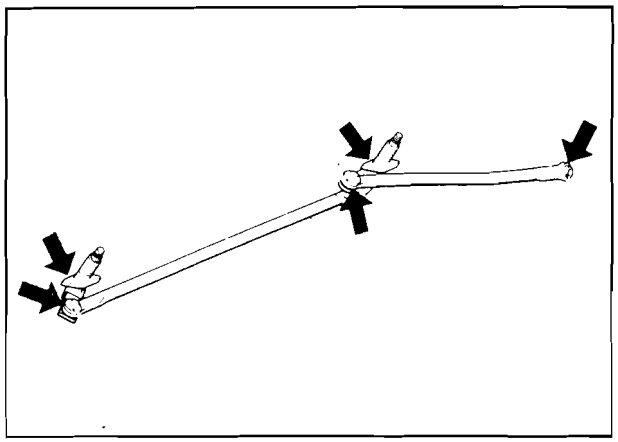


Fig. 12 — Wiper linkage lubrication points

WIPER RELAY

For relay location refer to Section 1.

Testing

This relay is a transistorised type and must be replaced if identified as faulty during diagnosis.

REAR WIPER/WASHER SYSTEM (WAGON)

The system receives its water from a washer bottle located in the right hand rear side of the luggage compartment behind the quarter panel trim. It has a electric pump controlled by a switch mounted in the centre console.

A non return valve is fitted in the line to the rear washer jet. The wiper motor is mounted in the tailgate and is a permanent magnet type.

NOTE: The wiper motor is serviced as an assembly and should not be disassembled except by a qualified automotive electrician.

Wiper Motor Removal

(1) Remove the wiper arm.
(2) Remove the wiper arm pivot lock nut and shaft related parts.
(3) Remove the trim and water proof film from the tailgate, refer Group 52.
(4) Disconnect the wiring connector of wiper motor.
(5) Remove the wiper motor mounting bolts.
(6) Remove the wiper motor from the tailgate.

Installation

Install by reversing removal procedure noting the following:
(1) Operate rear wiper motor ensuring the motor returns to the park position.
(2) Tighten pivot arm lock nut to 6 to 9 Nm.
(3) Position wiper arm correctly and tighten lock nut, refer Fig. 13.

REAR WINDOW WASHER

Inspection and Adjustment

(1) Adjust the washer nozzle ejection position as shown in Fig. 13 by inserting a metal wire in the outlet jet and rotating the ball.

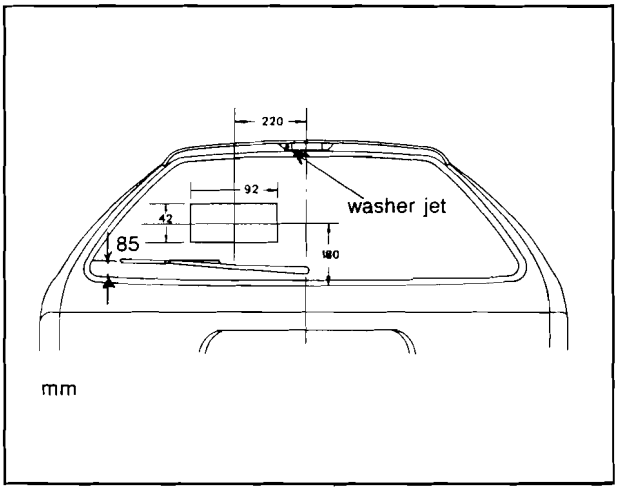


Fig. 13 — Adjustment of the nozzle ejection angle

(2) If the rear window washer jet does not supply sufficient fluid, and the wiring, fuses and pump motor are operating satisfactorily, check for bent or broken piping, and or failure of the non return valve.

CAUTION: Operating the washer switch for 20 seconds or more continuously, or operating it when there is not washer fluid in the tank, could cause the motor to burn out.

Wiper/Washer Switch

The rear wiper/washer is operated by a two-step type switch. Press the top section of the switch in one notch for the rear wiper to operate. By pressing the switch to the next notch, it will operate the rear washer, and when released, it will return to the wiper ON position, refer Fig. 14.

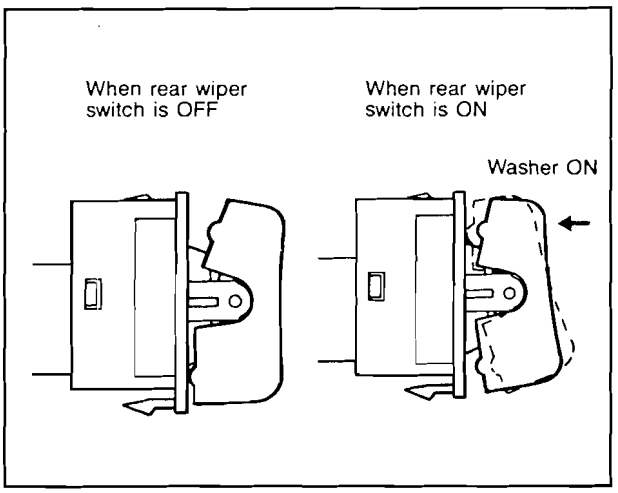


Fig. 14 — Operation of the rear washer switch

Removal

(1) Remove centre console, refer Group 52.
(2) Remove audio panel.
(3) Remove console switch panel from the rear of the audio panel.
(4) Remove the wiper switch from the console switch panel.

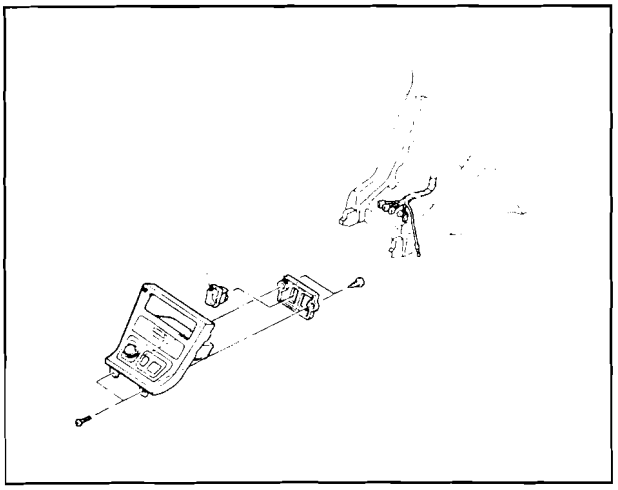


Fig. 15 — Washer/wiper switch removal

Installation

Install by reversing removal procedure.

SECTION 5 — EXTERIOR MIRRORS

1. Inner delta cover.
2. Outer packing.
3. Mirror assembly.
4. Mirror glass.
5. Power connector.
6. Mirror mounting screws.
7. Inner delta cover cap.

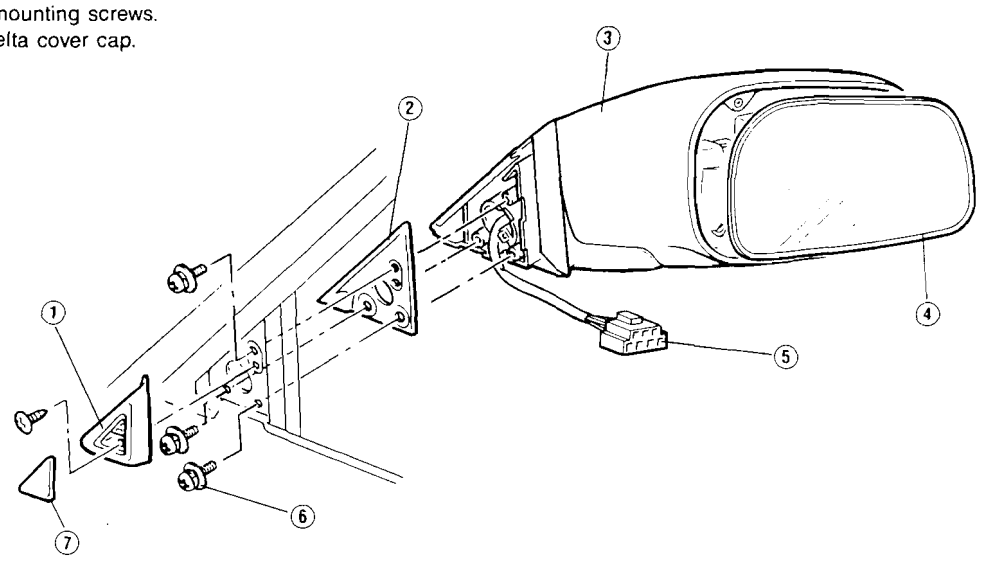


Fig. 1 — Electric mirror components

MIRROR — ELECTRIC TYPE

Removal

(1) Using a suitable tool (small screwdriver with tape wrapped around the tip), remove the inner delta cover cap.

(2) remove the retaining screw and then remove the inner delta cover, refer Fig. 1.

(3) Disconnect the harness to mirror connector.

(4) While supporting the mirror assembly, remove the three retaining screws and carefully remove the mirror assembly.

NOTE: Ensure that the outer packing is intact and with the mirror assembly.

Installation

Install by reversing the removal procedure noting that all components must be included in installation in their original order.

Disassembly

To remove the mirror glass from the assembly, face the mirror upwards and insert a screwdriver (with tape on the end) into the notched section and lever out the mirror, refer Fig. 2.

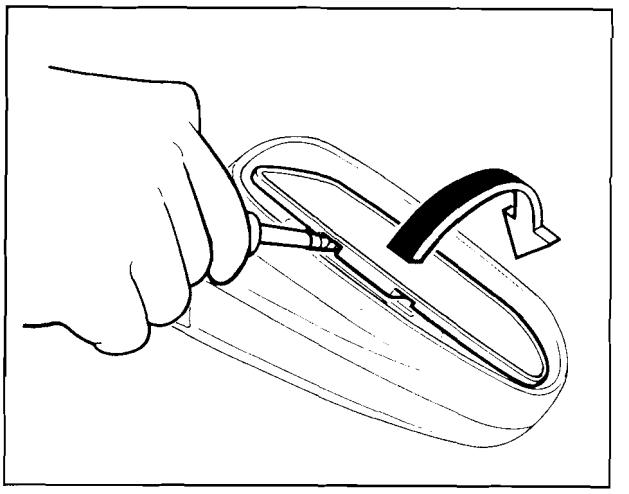


Fig. 2 — Mirror glass removal

Inspection

For testing procedures — refer Group 54 — Chassis Electrical.

Assembly

To assemble, reverse the disassembly procedure being careful not to damage the mirror when trying to install it into the pivot.

EXTERIOR MIRRORS — MANUAL

Removal

(1) Remove the adjusting knob clip cover.

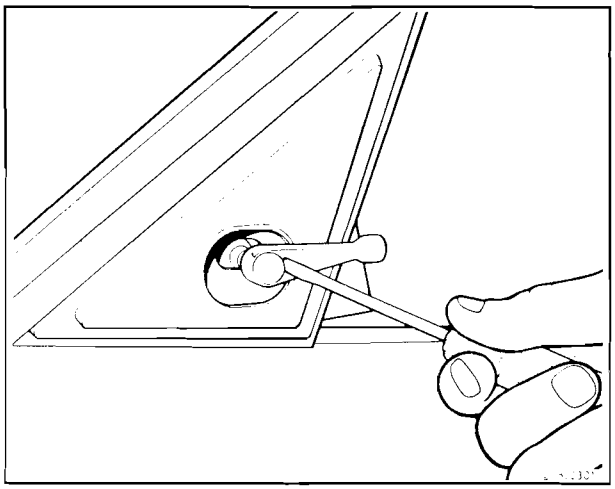


Fig. 3 — Removing adjusting knob cover

(2) Spread the internal clip, refer Fig. 4, and then remove adjusting knob.

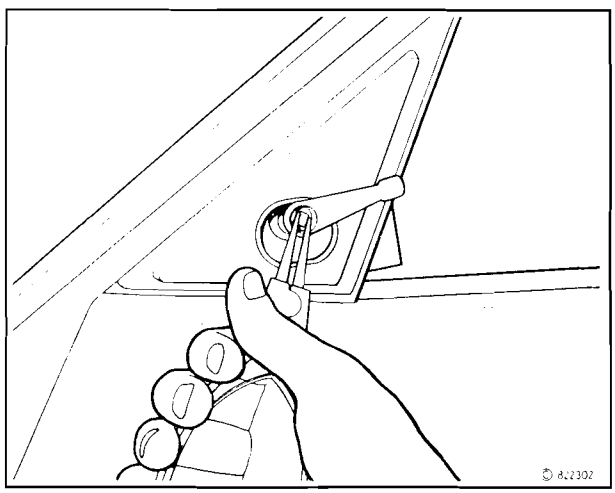


Fig. 4 — Removing the adjusting knob

(3) Remove the internal cover by prying off with a suitable tool.

(4) Remove the retaining nuts, refer Fig. 5, and remove the mirror.

Disassembly

(1) Remove the spring from spring retaining plate, refer Fig. 7. The mirror will now fall into two pieces.

(2) With a suitable lever positioned inside the mirror gently prise the glass upward.

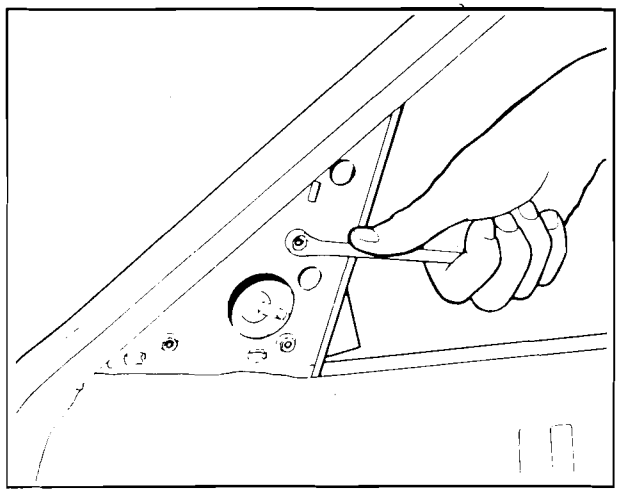


Fig. 5 — Removing mirror retaining nuts

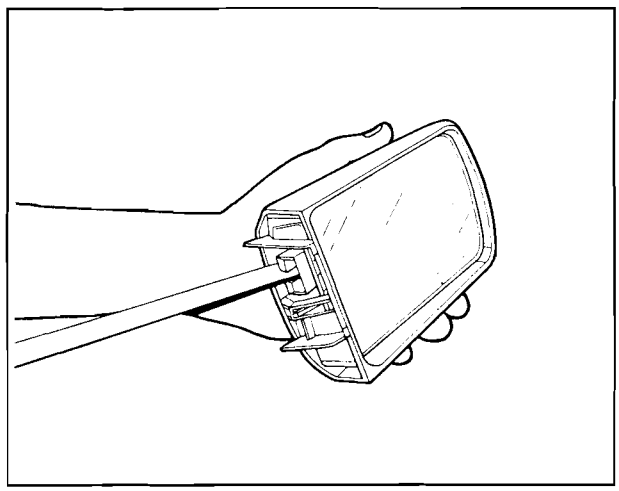


Fig. 6 — Removing mirror glass

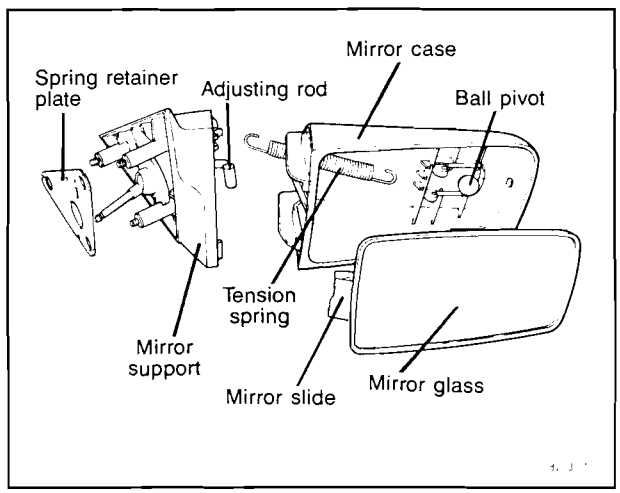


Fig. 7 — Disassembled view of mirror

Assembly

(1) Connect the spring to the spring retainer plate.

(2) Assemble the mirror and connect spring to the retainer lug situated on the ball base.

(3) Place the mirror glass socket in hot water for approximately five minutes before locating socket on the pivot ball. By placing the palm of the hand over the end section of mirror glass and pressing firmly, the socket will locate on pivot ball.

NOTE: To insert mirror glass the adjusting rod must be located in the mirror slide and the mirror socket located over the retaining ball, refer Fig. 7.

GROUP 52 — INTERIOR

SECTION 0 — INDEX

Subject	Section Number	Page Number
INDEX	0	
TORQUE SPECIFICATIONS	1	
Special Tools		1
INTERIOR TRIM	2	
Glovebox		2
Instrument Cluster		2
Floor Console		3
Instrument Panel		3
Trims		6
Headlining — Sedan		8
Headlining — Wagon		9
Floor Covering		9
Tailgate Trim		11
SEATS	3	
Front Seat Assembly		1
Rear Seat Assembly Sedan		5
Rear Seat Assembly Wagon		6
SEAT BELTS	4	
Automatic Retractors		1
Seat Belt Inspection and Testing		1
Fitting Instructions for Seat Belts		1
Front Retractor		1
Front Seat Belt Stalks		2
Rear Retractor		2
Rear Buckle Assemblies		4
Child Restraint Mounting Points		4

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

SECTION 1 — TORQUE SPECIFICATIONS

INTERIOR TRIM

	Nm
Seat frame to seat back (two bolts)	25-30
Underframe to cushion assembly	15-20
Seat belt buckle to seat	33-47
Seat belt retaining bolts	33-47
Seat belt retractor bolts	33-47
Seat mounting — front (bolts)	25-30
— front (nuts)	25-30
— rear (squab - outer)	5
— rear (squab - inner)	22
Spoiler attaching nuts	2-3
Tailgate door handle attaching nuts	5-6
Tailgate actuator attaching bolts	5-6
Tailgate strut to body	17-26
Tailgate strut to tailgate	8-12
Tailgate striker to body	12-15
Tailgate hinge to tailgate	12-15
Tailgate hinge to body	12-15

SPECIAL TOOLS

Ornament remover	E23M6

SECTION 1 — TORQUE SPECIFICATIONS

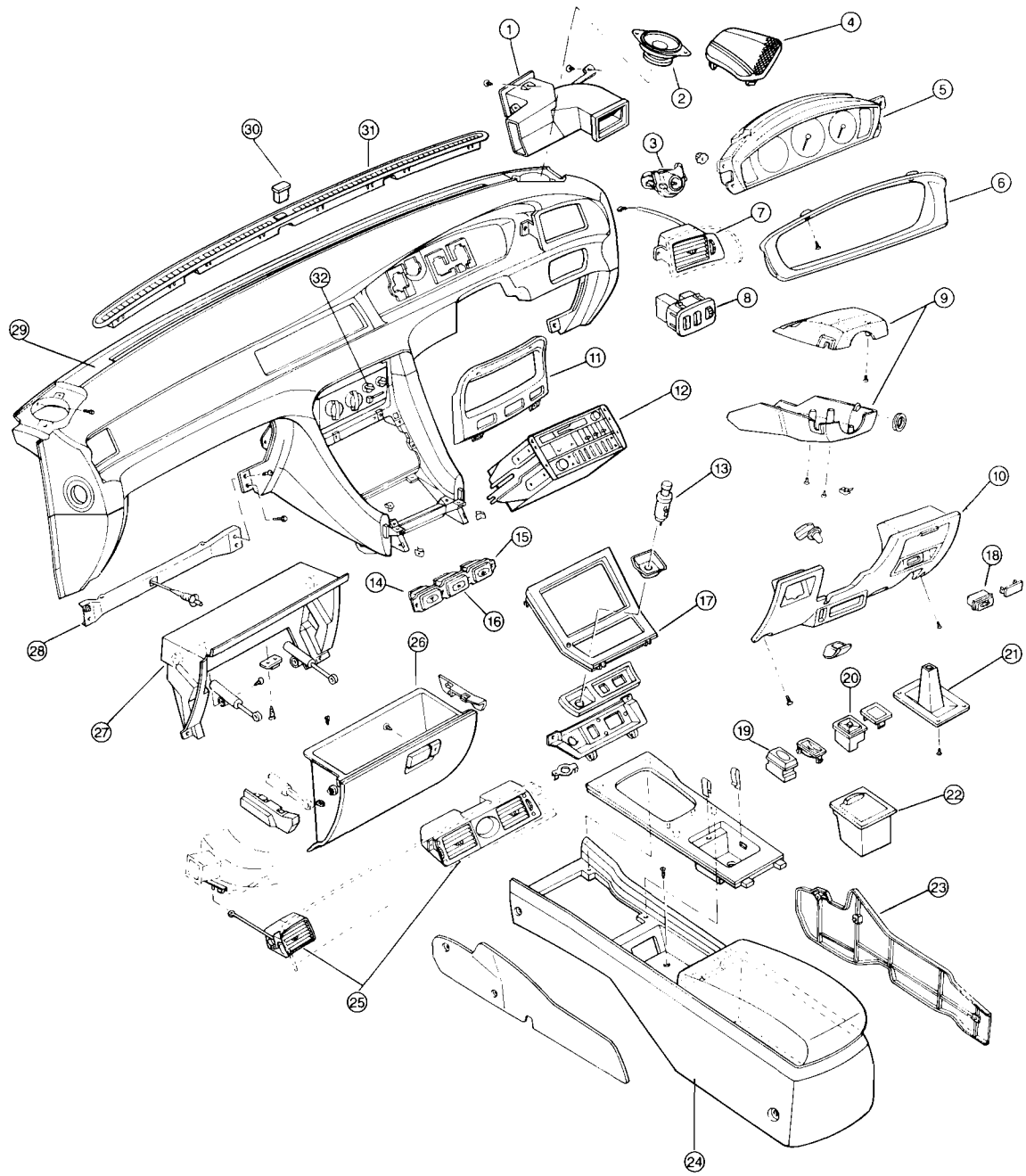
INTERIOR TRIM

	Nm
Seat frame to seat back (two bolts)	25-30
Underframe to cushion assembly	15-20
Seat belt buckle to seat	33-47
Seat belt retaining bolts	33-47
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— front (nuts)	25-30
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Tailgate hinge to tailgate	12-15
Tailgate hinge to body	12-15

SPECIAL TOOLS

Ornament remover	E23M6

SECTION 2 — INTERIOR TRIM



1. Side ventilation duct
2. Speaker
3. Speedo cable adaptor
4. Speaker garnish
5. Instrument cluster
6. Instrument hood
7. Side oulet assembly RH
8. Instrument panel side switch
9. Column cover
10. Drivers side lower panel
11. Heater control garnish
12. Radio/cassette unit
13. Cigarette lighter
14. Halfway antenna switch (where fitted)
15. Hazard lights switch
16. Rear demist switch
17. Audio panel garnish
18. Boot release switch (where fitted)
19. A.E.C.S. switch (where fitted)
20. Electric mirror switch (where fitted)
21. Gearstick cover
22. Ash tray
23. Console side covers
24. Floor console
25. Centre and side air outlet assemblies
26. Glove box
27. Glove box housing
28. Metal glovebox support
29. Instrument panel
30. Temperature sensor (where fitted)
31. Defroster garnish
32. Heater control panel

Fig. 1—Instrument and floor console components

GLOVEBOX

Removal

(1) Remove the two under-cover retaining screws, unhook clips then remove under-cover. (Underneath the glovebox).

(2) Open the glovebox and release the two air dampers (where fitted) from the sides of the glovebox.

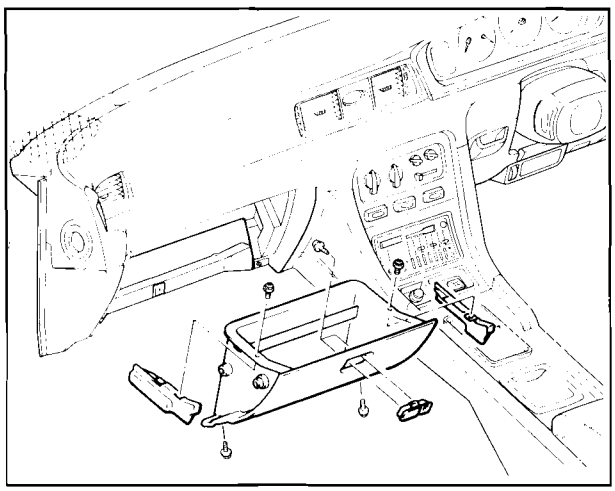


Fig. 2—Removing the glovebox

(3) Remove the two glovebox hinge screws and remove glovebox, refer Fig. 2.

(4) Remove the two striker bolts and remove striker.

(5) Remove the four glovebox housing screws and remove the housing, refer Fig. 3.

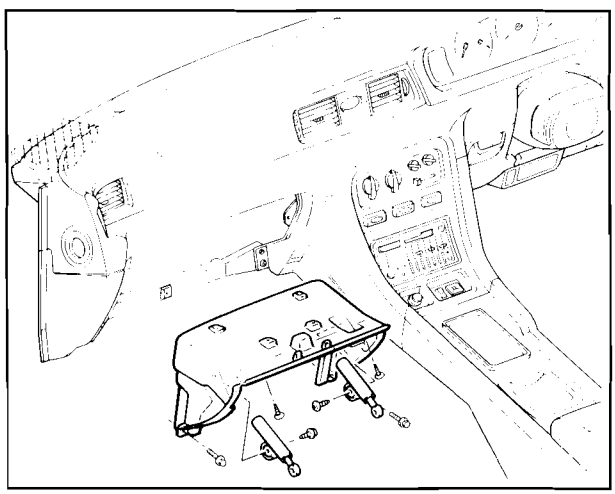


Fig. 3—Removing the glovebox housing

Installation

Install by reversing the removal procedure and note the following:

(1) Check for correct operation of the glovebox lock.

(2) Check for correct alignment and clearance of glovebox face in instrument panel. Adjust if necessary.

INSTRUMENT CLUSTER

Removal

CAUTION: THE INSTRUMENT CLUSTER MUST NOT BE ALLOWED TO FACE DOWN AT ANY TIME. THE TACHO MECHANISM USED HAS A SILICONE DAMPENING DEVICE WHICH WILL LEAK.

NOTE: When removing the instrument hood, be careful not to damage the trip meter reset switch.

(1) Set the steering column height adjuster on its lowest setting.

(2) Remove the two instrument hood retaining screws, refer Fig. 4 and carefully remove the hood.

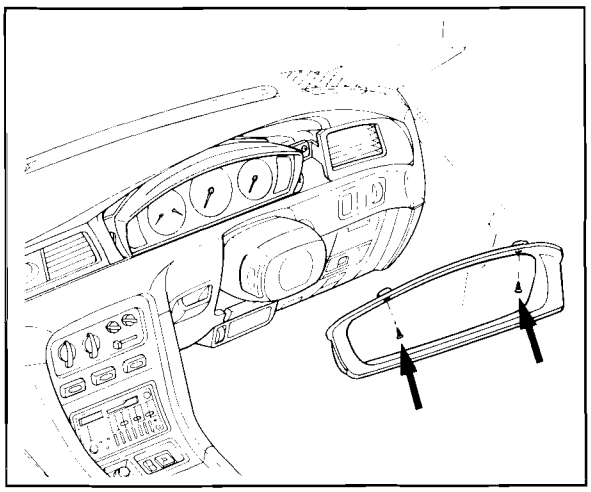


Fig. 4—Instrument hood removal

(3) Remove the four instrument cluster retaining screws, refer Fig. 5, and gently pull the cluster forward and out.

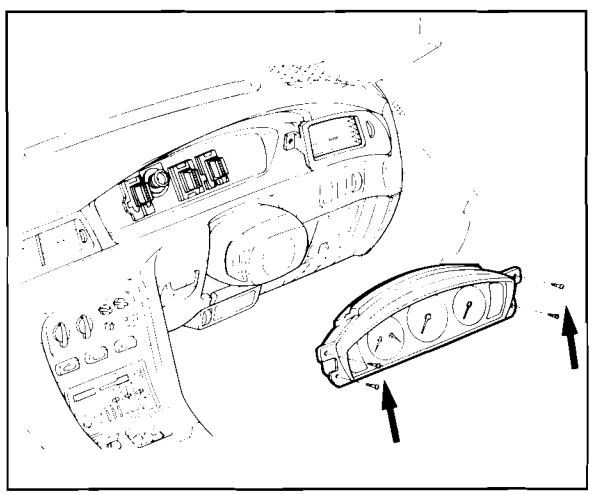


Fig. 5—Instrument cluster removal

Installation

Install by reversing the removal procedure and make sure that all instrument cluster lights are operative and speedometer is functioning correctly.

FLOOR CONSOLE

Removal

(1) Remove shift knob — (manual trans. only).
(2) Remove ashtray — if applicable.
(3) Refer to Fig. 6 and remove all six floor console retaining screws and remove console.

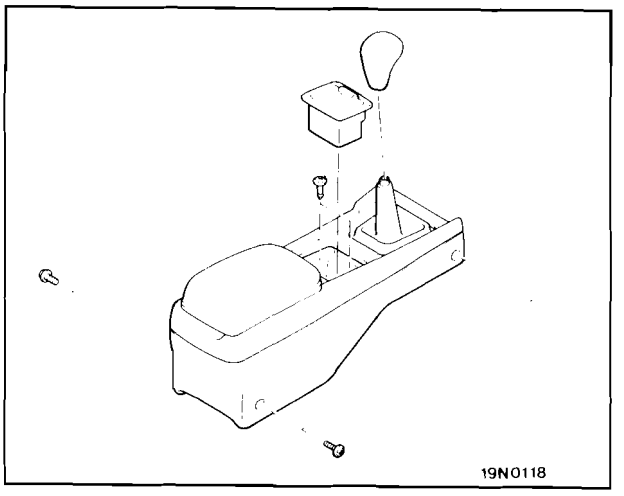


Fig. 6 — Removing floor console (typical)

(4) Remove the console side cover attaching screws and trim clips, refer Fig. 7, and remove covers.

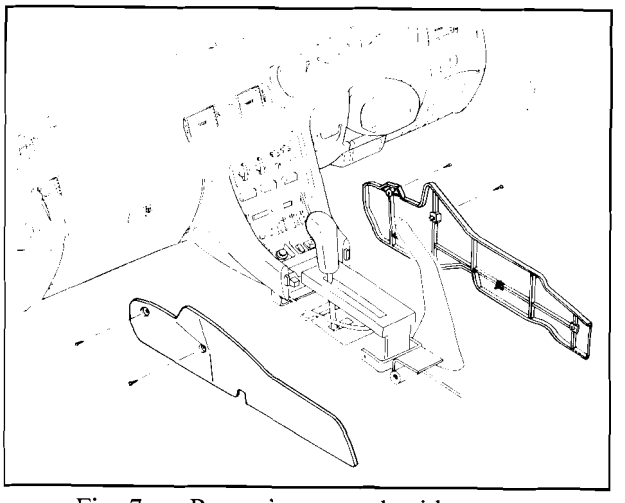


Fig. 7 — Removing console side covers

Disassembly

(1) Remove lid assembly and inner box — where fitted.
(2) Remove console panel and shift lever boot — manual transmission.

Assembly

Assemble by reversing disassembly procedure.

Installation

Install by reversing the removal procedure.

INSTRUMENT PANEL

Removal

(1) Remove the floor console assembly as described earlier in this section.
(2) Remove the glovebox and glovebox housing as described earlier in this section.
(3) Remove the metal support bar that the glovebox hinge mounts onto, refer Fig. 8.

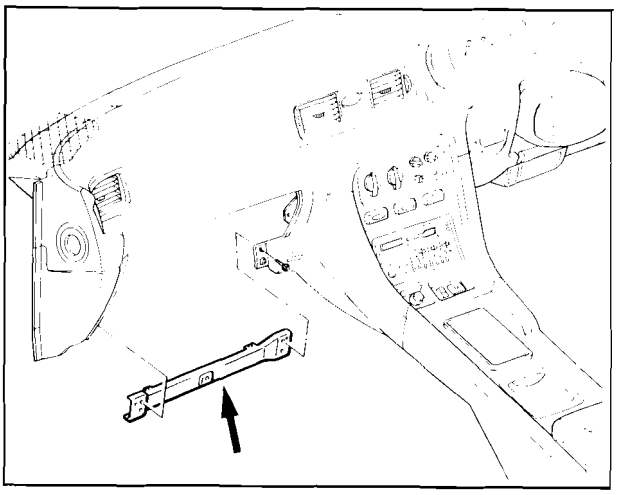


Fig. 8 — Metal support removal

(4) Disconnect the glovebox light connector and release metal support.
(5) Remove the instrument cluster assembly as described earlier this section, then remove the two instrument panel retaining bolts.
(6) Remove the two audio trim panel retaining screws and remove the audio trim panel.
(7) Remove the four radio/cassette mounting screws, refer Fig. 9, and after disconnecting all necessary wiring, remove the radio/cassette unit.

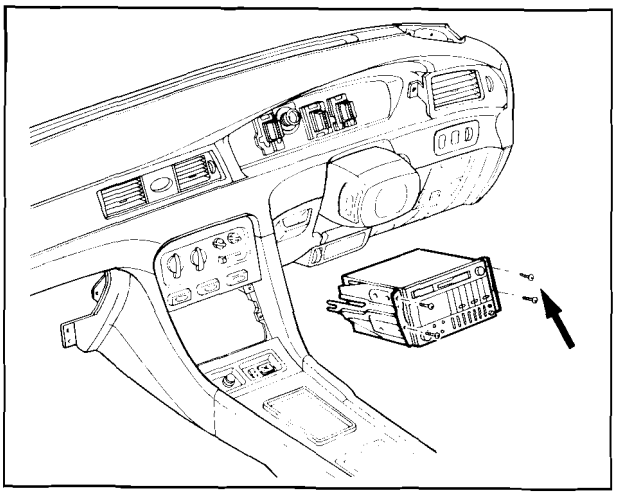


Fig. 9 — Removing the radio/cassette

(8) Remove the cigarette lighter panel and disconnect wiring loom connectors.
(9) Open the coin box, then remove the five drivers side lower panel retaining screws and remove the panel, refer Fig. 10.

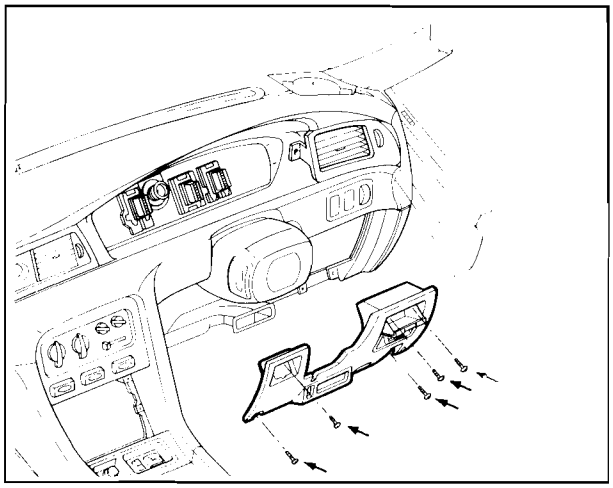


Fig. 10 — Removing lower panel

(10) Pop out the two front speaker trim covers and remove the two speaker mounting screws.

NOTE: When removing the front speaker screws be careful not to damage the windscreen with the tools used.

(11) Disconnect the wiring and remove the speakers.
(12) Remove the instrument panel mounting bolts that are located in the speaker holes on either side of the instrument panel, refer Fig. 11.

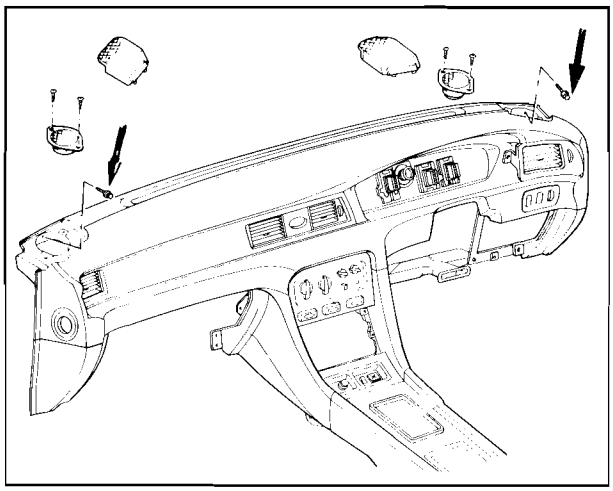


Fig. 11 — Removing instrument panel bolts

(13) Remove the four heater control panel trim retaining screws and remove the trim.
(14) Then remove the four heater control panel screws and ease panel backwards free of the instrument panel, refer Fig. 12.
(15) Remove the two lower centre console bolts, refer Fig. 12.
(16) Disconnect the wiring associated with the instrument panel on the passenger side and around the fuse box on the drivers side.

(17) After removing the retaining screw, remove the lower vent assembly from underneath the left hand side of the steering column, refer Fig. 13.

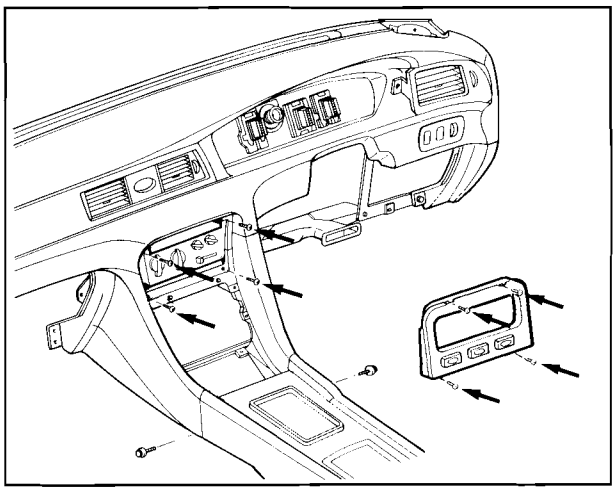


Fig. 12 — Heater control panel screws

(18) Remove the two instrument panel mounting bolts, refer Fig. 14.

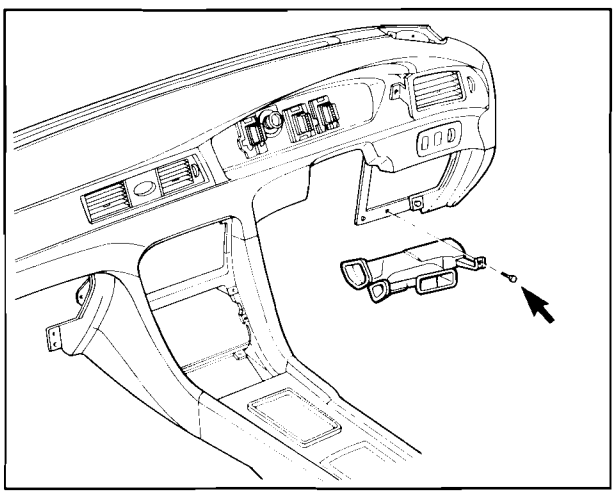


Fig. 13 — Removing the vents

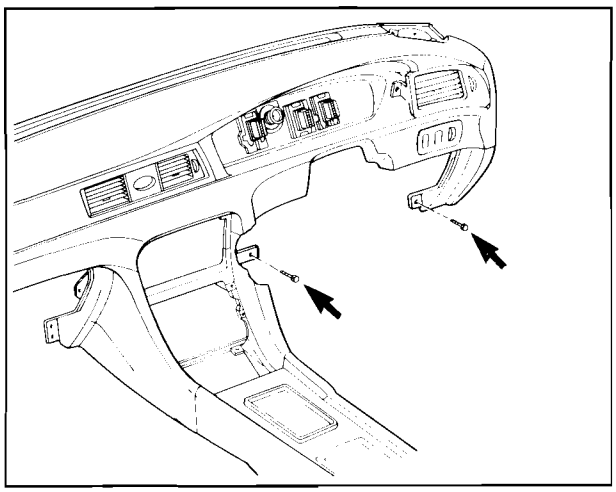


Fig. 14 — Instrument panel bolt location

(19) Remove the upper and lower steering column trim screws then remove the trims.

(20) Remove the four steering column mounting bolts and lower the steering column.

(21) Disconnect the speedometer cable at the transmission and remove the cable adaptor by releasing the lock, refer Fig. 15.

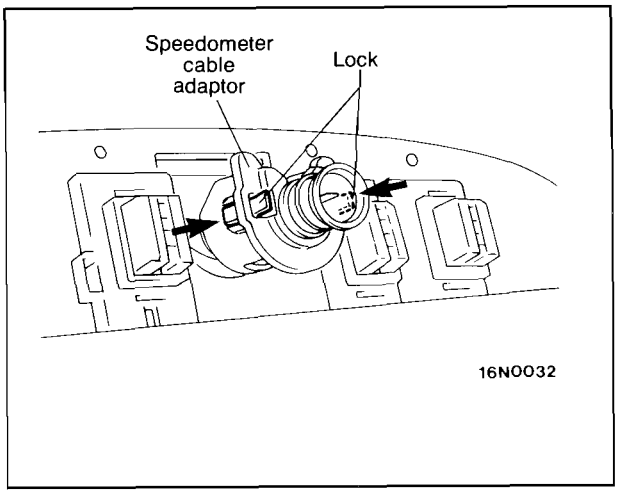


Fig. 15 — Removing cable adaptor

NOTE: Automatic vehicles only — To aid in the removal of the instrument panel, remove the four shift lever assembly mounting bolts and lay the complete assembly on its side.

(22) Ensure all wiring loom connectors are disconnected and carefully remove the instrument panel, making sure not to damage the exterior surface.

Disassembly

(1) Remove the heater ducts, defroster garnish and photo sensor — if applicable — refer Group 55.

(2) Remove the instrument panel wiring harness.

(3) Remove the electronic boot opener switch — where fitted.

(4) Remove the centre air outlet assembly, refer group 55.

(5) Remove the instrument trim panel 'A' by removing the two wing nuts and retaining screw, refer Fig. 16.

(6) Remove trim panel 'B' by removing the retaining screw, refer Fig. 17.

(7) Remove the side air outlet assembly, refer Group 55.

(8) Remove the centre and side reinforcement struts, refer Fig. 18.

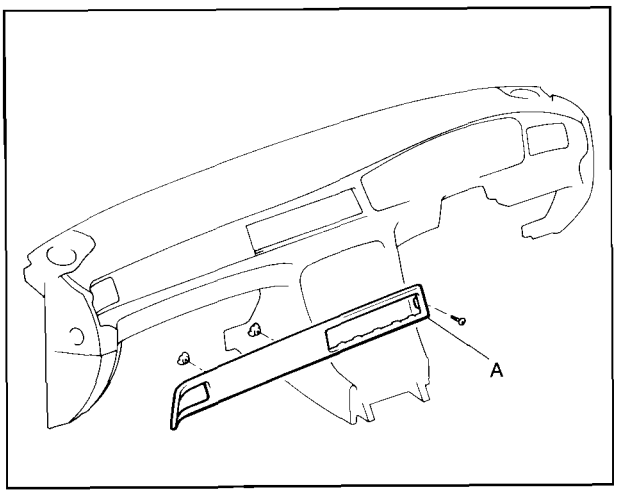


Fig. 16 — Removing trim panel 'A'

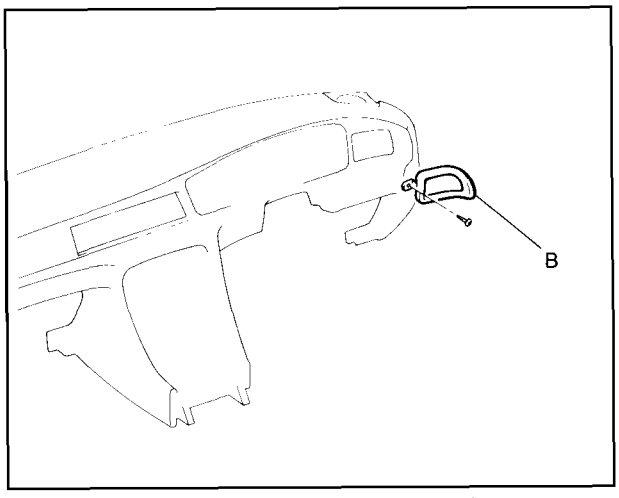


Fig. 17 — Removing trim panel 'B'

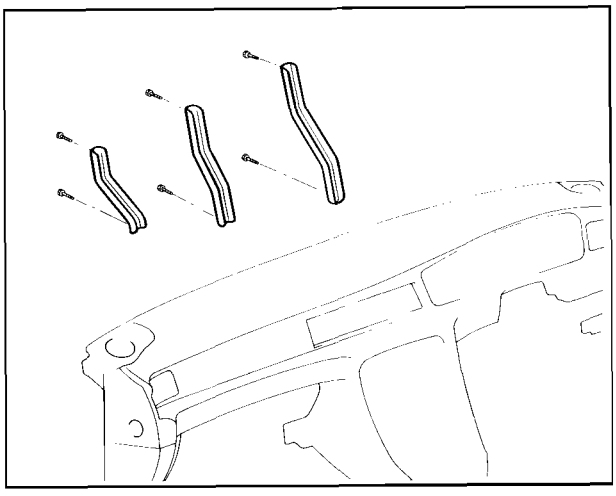


Fig. 18 — Reinforcement strut removal

(9) When the self tapping screws are removed, the crash pad will come away from the instrument panel.

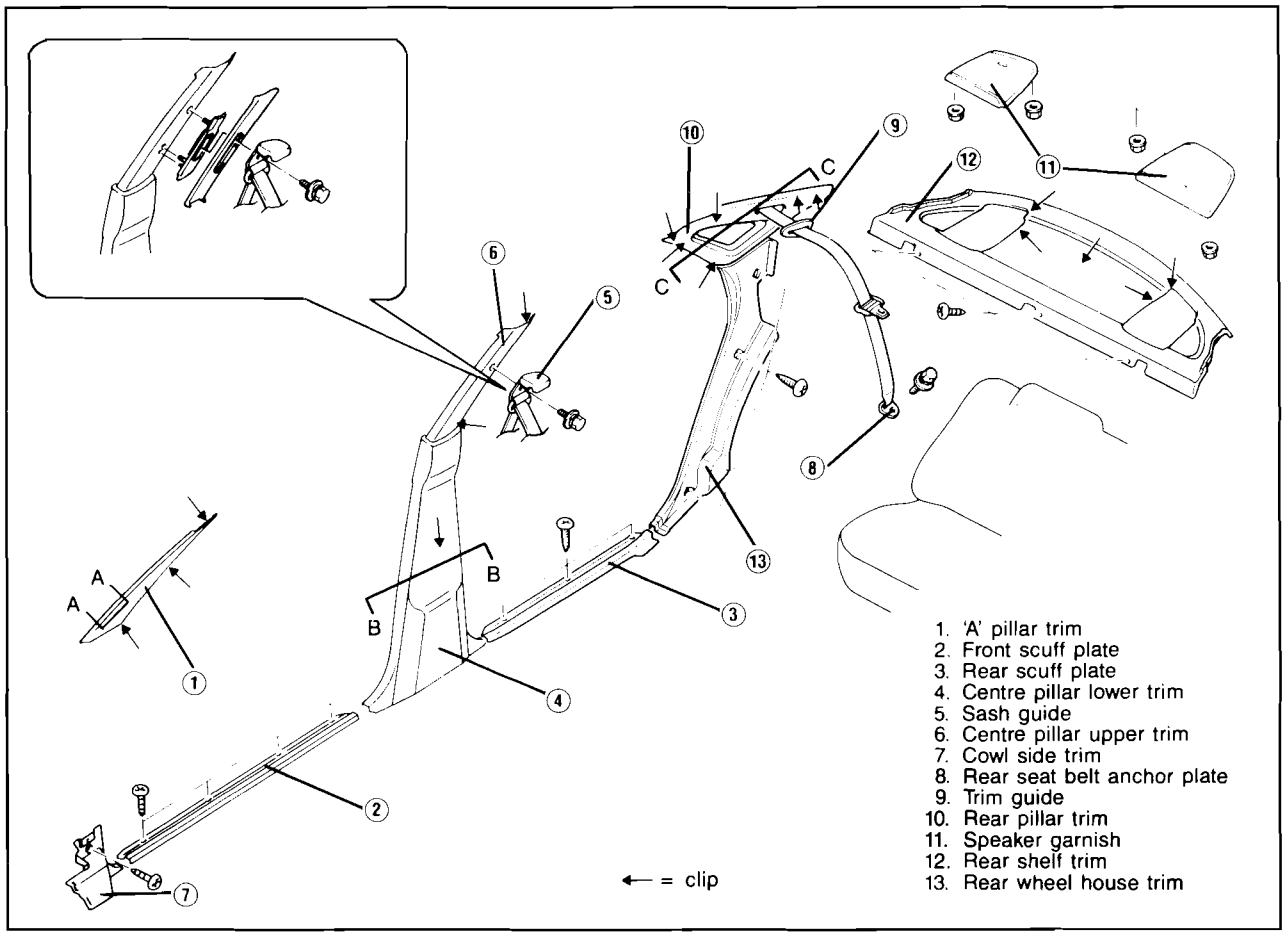


Fig. 19 — Interior trim locations

TRIMS

Removal — 'A' pillar trim

(1) Remove the 'A' pillar trim, refer Fig. 20 for clip type and removal direction.

Installation

Reverse the removal procedure.

Removal — Centre pillar trim

(1) Remove the front and reaf scuff plates.

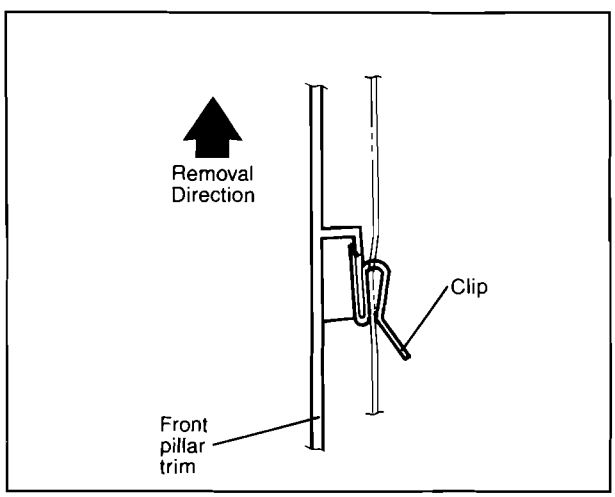


Fig. 20 — Sect A-A refer Fig. 19

(2) Remove the centre pillar lower trim, refer Fig. 21 for clip type and removal direction.

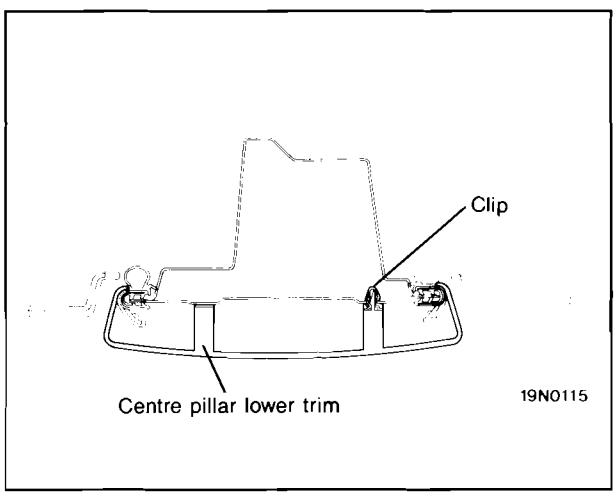


Fig. 21 — Sect B-B refer Fig. 19

(4) Remove the sash guide.
(5) Then remove the centre pillar upper trim.

Installation

Reverse the removal procedure.

Removal — Cowl side trim

(1) Remove the front scuff plate.
(2) Then remove the cowl side trim.

Installation

Reverse the the removal procedure.

Removal — Rear pillar trim and rear shelf trim

(1) Remove the rear seat cushion, refer Section 3.
(2) Remove the rear seat belt anchor plate, refer Fig. 19.
(3) Unclip the trim guide, refer Fig. 19.
(4) Remove the rear pillar trim, refer Fig. 22 for clip type and removal direction.
(5) Remove the rear speaker garnish, refer Fig. 19.
(6) Then remove the rear shelf trim.

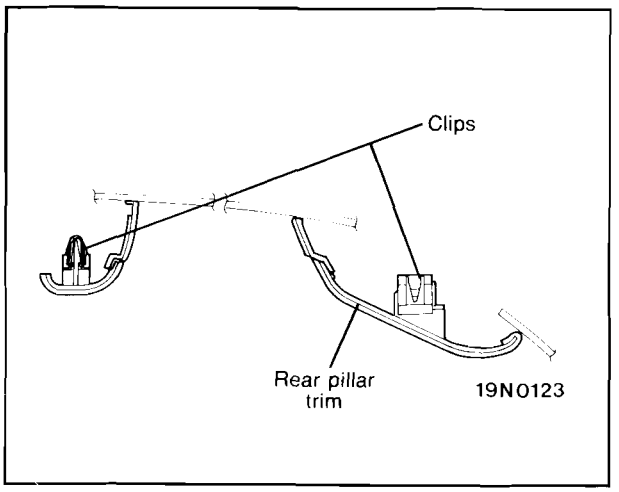


Fig. 22 — Sect. C-C refer Fig. 19

Installation

Reverse the removal procedure.

Removal — Rear wheelhouse trim

(1) Remove the rear scuff plate.
(2) Remove the rear seat, refer Section 3.
(3) Then remove the rear wheelhouse trim.

Installation

Reverse the removal procedure.

Removal — Trunk lid trim (where fitted)

(1) Remove the trunk lid trim screws and remove trim by releasing the clips, refer Fig. 24.

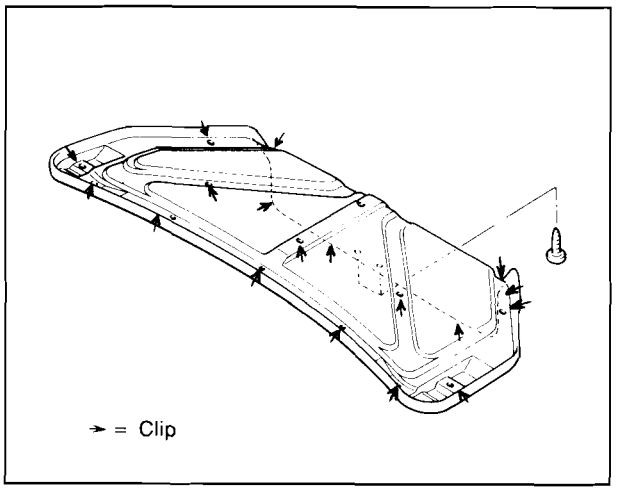


Fig. 24 — Trunk lid trim location

Installation

Reverse the removal procedure.

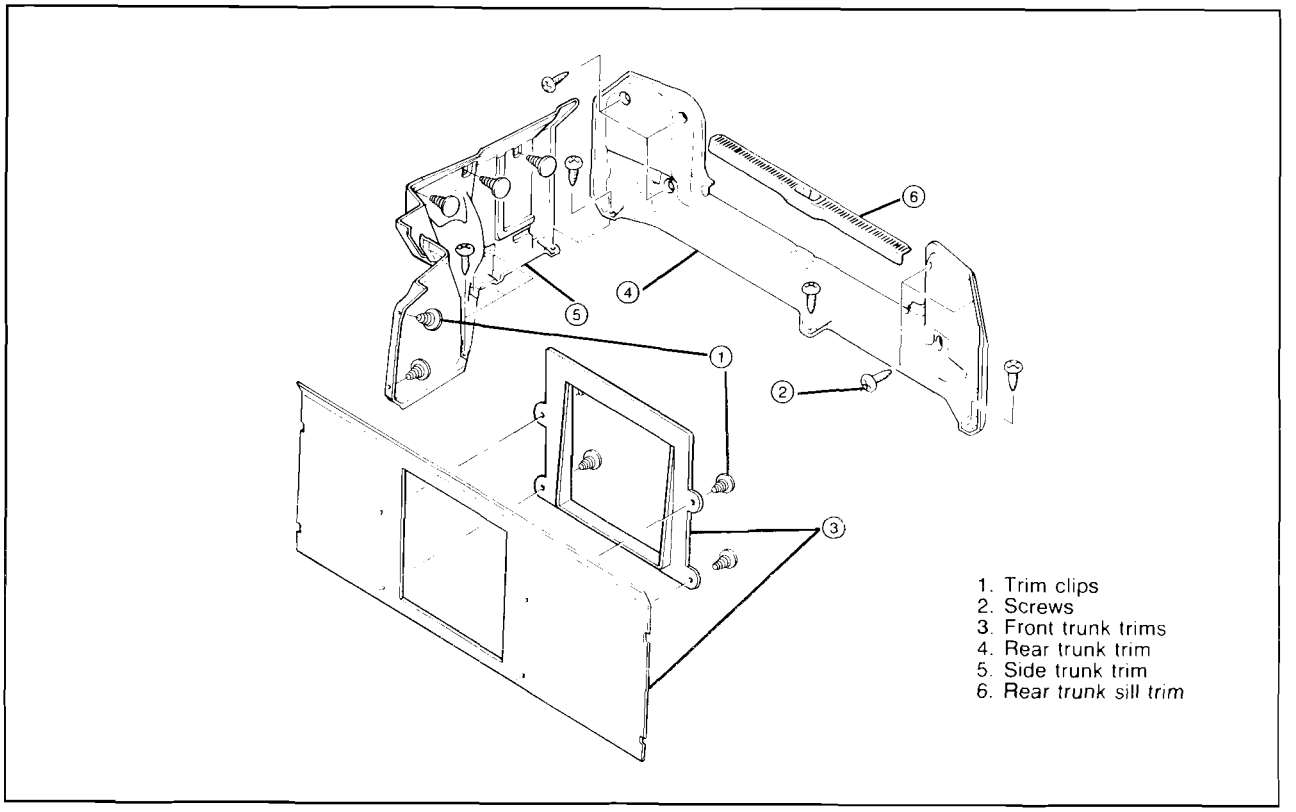


Fig. 23 — Trunk trim clip and screw mounting locations

Removal — Trunk trims

(1) Remove the rear trunk sill trim, refer Fig. 23.

(2) Remove the retaining screws from the rear trunk trim and remove the complete panel, refer Fig. 23.

(3) Remove the retaining screws, clips and then trim panels from the front and sides of the trunk, refer Fig. 22 for clip and screw locations.

Installation

Reverse the removal procedures.

HEADLINING

Removal

(1) Remove the front pillar trims and the centre pillar upper trims, refer this section.

(2) Remove the RH front seat and place the gear lever in its rearmost position, apply hand brake, shift

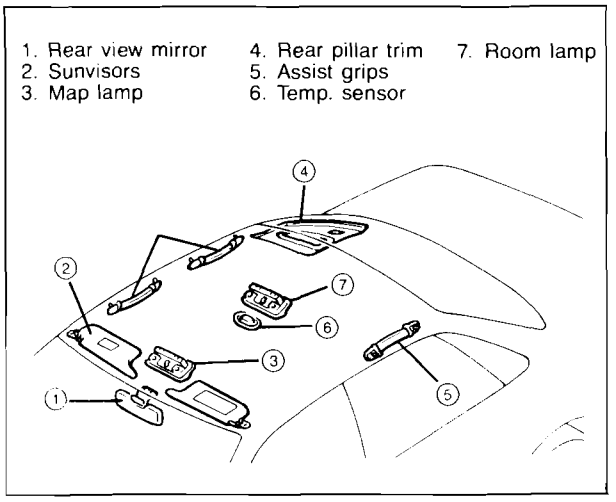


Fig 25 — Part location

the passenger front seat to its rear position and recline the seat back fully.

(3) Remove the sunvisors and sunvisor bracket.

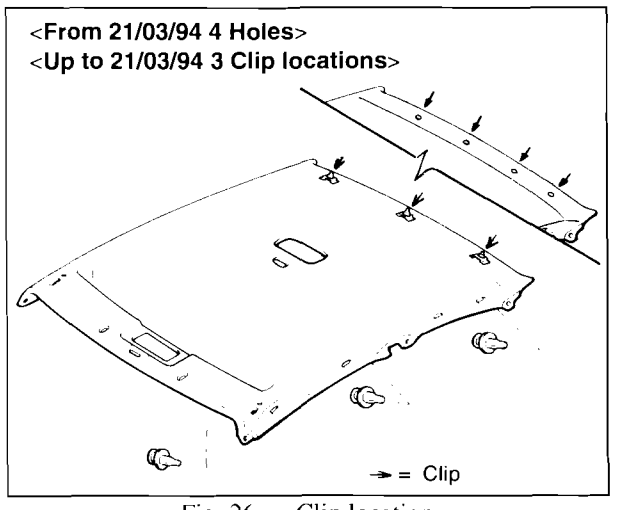


Fig. 26 — Clip location

(4) Remove the room lamp and the map lamp assemblies, refer Group 54 — Chassis Electrical.

(5) Remove the plastic cover by pulling it

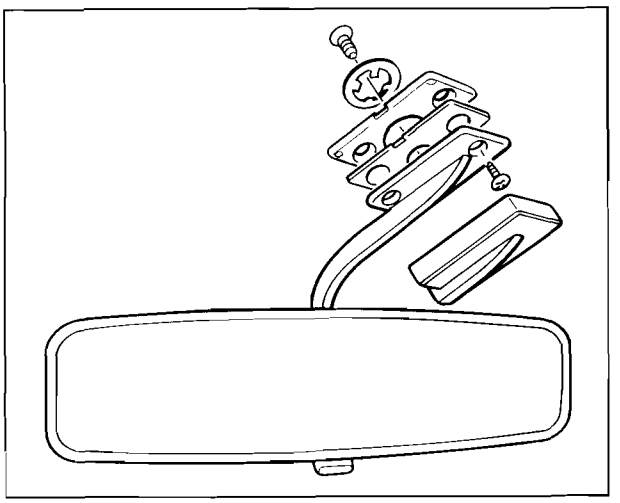


Fig. 27 — Rear view mirror

downwards and remove the attaching screws and remove the mirror.

(6) Remove the assist grips.

(7) Remove the temperature sensor (where fitted). Refer Group 55 — Heater, Air Conditioner and Ventilation.

(8) Remove the rear pillar trims, refer this section.

(9) Then remove the headlining from the roof by removing the clips from the body and the lining from the centre pillar notched flange, refer Figs. 26 and 28.

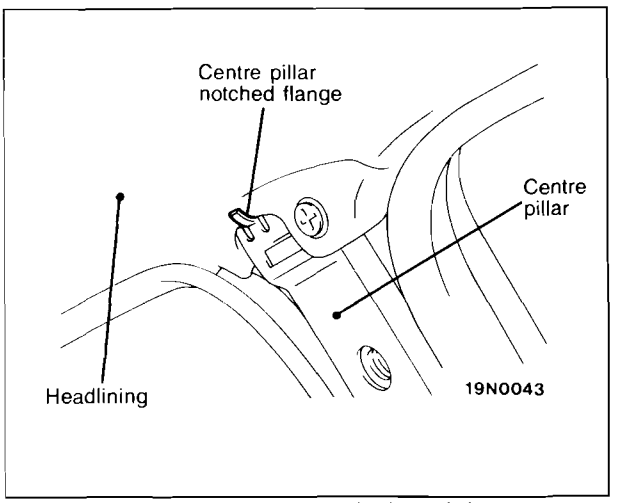


Fig. 28 — Removing the headlining

CAUTION: Protect the centre console with tape or cloth to prevent damage, as the headlining is removed.

(10)Remove the headlining through the passenger front door opening, refer Fig. 29.

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Fig. 29 — Headlining access

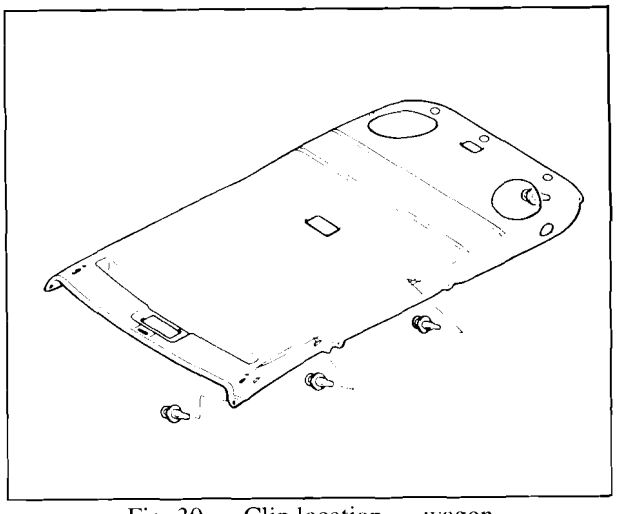


Fig. 30 — Clip location — wagon

Installation

Reverse the removal procedure.

Removal — Wagon

(1) Remove the following parts as described earlier in this section.

(a) Interior rear vision mirror.
(b) Sunvisors.
(c) Assist grips.
(d) Interior lamps.
(e) Front pillar trims.
(f) Upper cargo area trims.

(2) Carefully pries out cabin temperature sensor with a screwdriver and uncouple the connector (automatic temperature control models only).

(3) Remove the headlining from the roof by removing the clips from the body and the lining from the centre pillar notched flange, refer Fig. 26 and 28.

(4) Remove front and rear headlining trims by gently pulling in downward direction.

(5) Carefully pries out child restraint plugs with a screwdriver.

(6) Pull the headlining gently towards the rear of the vehicle. The headlining will now come away from the roof.

(7) Remove the headlining from the vehicle through the tailgate door opening.

Installation

Install by reversing the removal procedure noting the following:

(1) Ensure all electrical connections are accessible.

(2) Early fitment of headlining, side rail retaining clips and child restraint plugs will ensure correct positioning during installation.

FLOOR COVERING

Removal

(1) Remove the following as described in this group.

(a) Both front seats.
(b) Rear seat cushion.
(c) Front scuff plates.
(d) Drivers footrest.
(e) Rear scuff plates.
(f) Floor console assembly.
(g) Seatbelt/retractor anchor bolts.

(2) The floor covering can now be removed from the vehicle.

Installation

Install by reversing the removal procedure.

NOTE: Ensure that the front and rear mounting bolts and nuts are correctly torqued.

Cargo Floor Covering

Removal — Wagon

(1) Remove the plugs retaining the floor covering to the body.

(2) Release the velcro tabs retaining the floor covering to the rear seat squabs and fold back.

(3) Release the velcro tabs retaining the floor covering to the cargo floor and remove the floor covering from the vehicle.

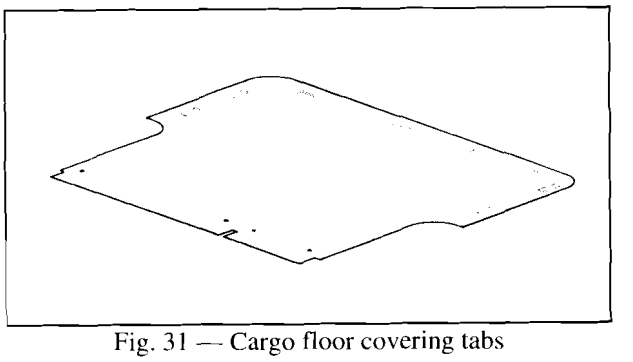


Fig. 31 — Cargo floor covering tabs

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Installation

Install by reversing the removal procedure.

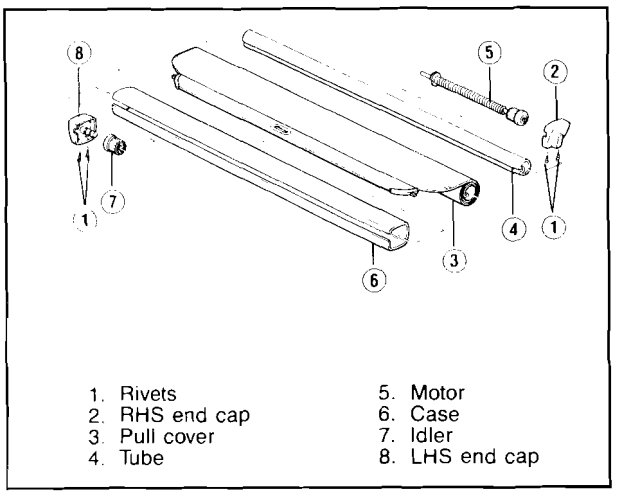
Cargo Compartment Blind

Removal

(1) Move both rear seat backs forward.
(2) Ensure the blind is fully rewound.
(3) Carefully remove the blind from the retaining slots in the lower cargo trims by lifting in a vertical direction.
(4) Remove the cargo blind from the vehicle.

Installation

Install by reversing the removal procedure.



1. Rivets
2. RHS end cap
3. Pull cover
4. Tube
5. Motor
6. Case
7. Idler
8. LHS end cap

Fig. 32 — Cargo blind components

Disassembly

(1) Remove the rivets from the RH end cap and remove the end cap.

CAUTION: WHEN REMOVING THE END CAPS USE CAUTION AS THE RETRACTOR SPRING WILL UNWIND IN A DANGEROUS MANNER.

(2) Remove the pull cover from the tube by sliding the cover side ways to remove it from the retaining groove.
(3) Remove the tube from case.
(4) Remove the LH End cap rivets and remove the end cap.
(5) Remove the idler.

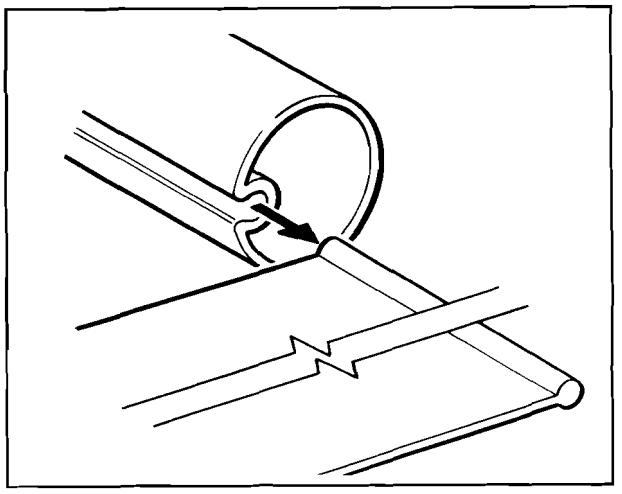


Fig. 33 — Pull cover removal

Assembly

(1) Slide the pull cover assembly into the cover case until it engages.
(2) Wind the end cap clockwise 27 times to put tension on the retractor spring.
(3) Then push the cap on and rivet with new rivets.

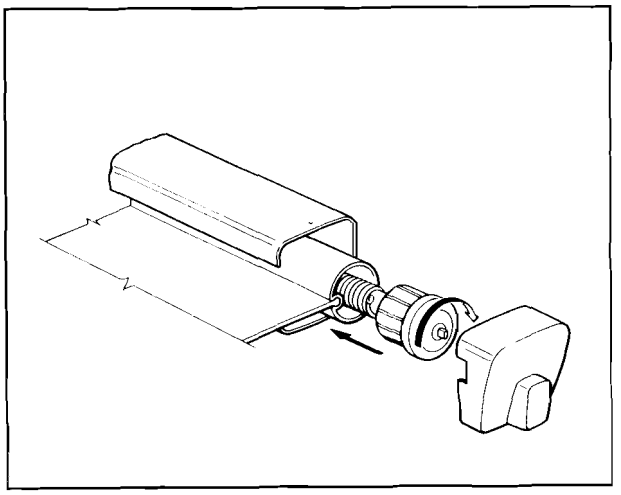


Fig. 34 — Tensioning of cargo blind motor

Rear Cargo Trims

Removal — Wagon

(1) Remove cargo area scuff plate, floor covering, floor panelling and rear seat belt upper loop.
(2) Remove the rear headlining trim panel.
(3) Remove the tailgate weather seal.
(4) Remove the rear seat cushion.
(5) Remove the rear scuff plate.
(6) Gently pull the lower edge of the upper trim panel outward to release snap clips.
(7) Remove the trim flange from rear door pillar and remove the upper trim panel.
(8) Gently pull the upper edge of the lower trim panel outwards to release snap clips.

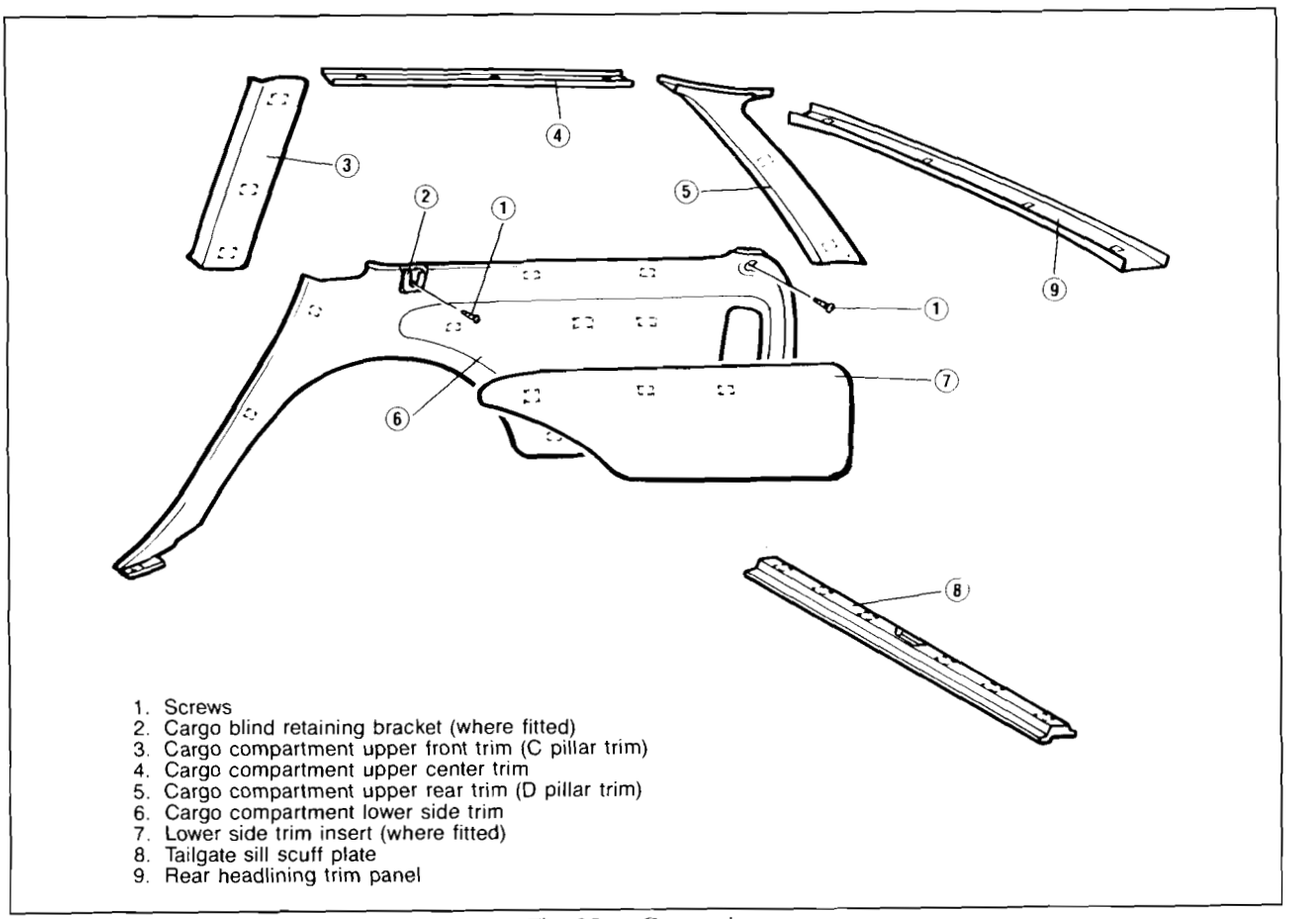


Fig. 35 — Cargo trims

(9) Remove the trim flange from the wheel arch retaining guide and remove the lower trim panel.

Installation

Install by reversing the removal procedure noting the following:

Snap on the trim panels after fitting new retainers if necessary.

Tailgate Trim

Removal — Wagon

(1) With the aid of a screwdriver and a pair of long nosed pliers remove the external retaining clips from the lower trim.

(2) Gently pull the trim away from the tailgate releasing the internal retaining clips, refer Fig. 36.

(3) Gently pry the top edge of the upper trim away from the tailgate to release the retaining clips.

(4) Gently pry side panels away from the tailgate to release the retaining clips.

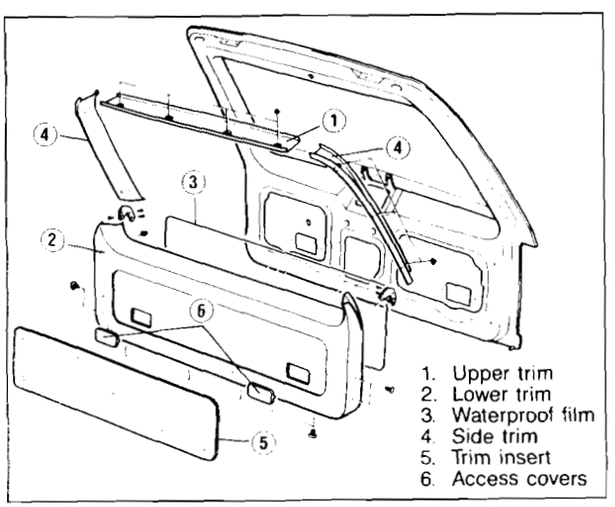


Fig. 36 — Tailgate trim clip positions

Installation

Reassemble by reversing the removal procedure noting the following:

(1) Snap on the trim panels after fitting new retainers if necessary.

(2) Align and interlock all panels to attain a neat appearance.

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SECTION 3 — FRONT SEATS

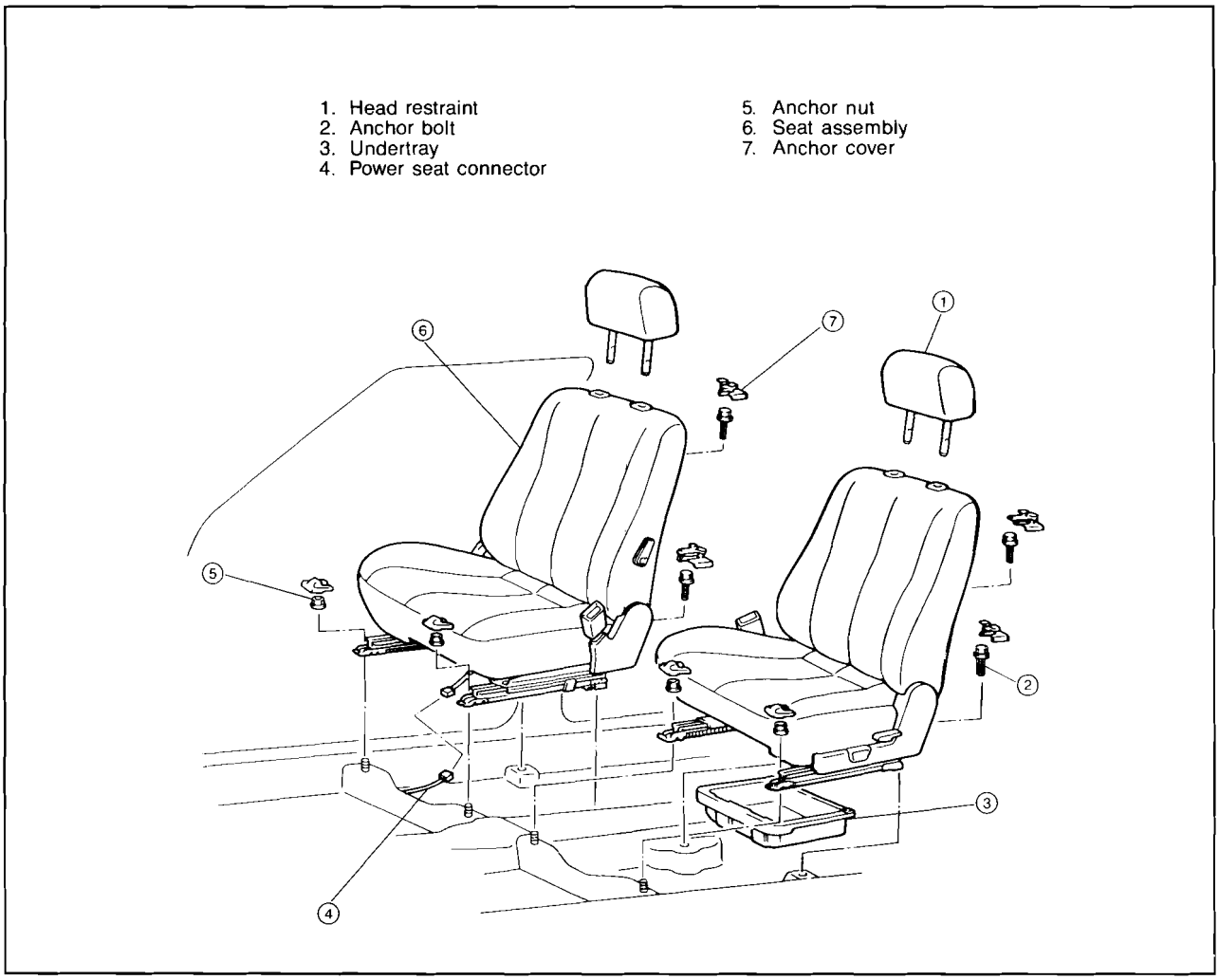


Fig. 1 — Front seat assemblies — sedan and wagon

FRONT SEAT ASSEMBLY

Removal — Sedan and Wagon

(1) Remove the head restraint by holding the adjustment button in.

(2) Remove the undertray (where fitted).

(3) Remove the seat anchor covers, refer Installation Instructions this Section.

(4) Remove the seat anchor nuts and bolts.

(5) Disconnect the power seat connector (where fitted).

(6) With the seat-back upright, carefully remove the front seat assembly.

Installation

Install by reversing the removal procedure noting the following:

(1) When installing a front seat, ensure that the left and right seat rails are lined up equally and lock them in place with the seat slide adjuster.

(2) Lightly tighten the seat anchor bolts and then torque to specifications in the order 'A', 'B', 'C' and 'D' shown in Fig. 2.

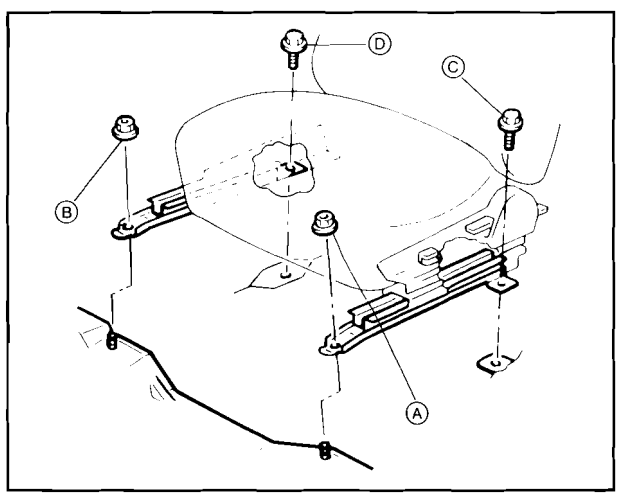


Fig. 2 — Seat tightening sequence

(3) After securely inserting the front seat anchor cover forward tab into the front seat forward anchor bracket (opposite for removal), turn it in the direction shown in Fig. 3 to install the side tab into its bracket hole.

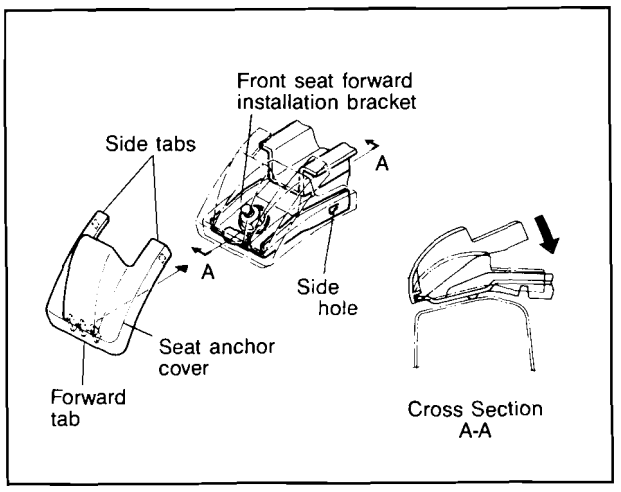


Fig. 3 — Front anchor cover installation

(4) After securely inserting the front seat rear anchor cover (outside) rear tab into its bracket, turn it in the direction shown in Fig. 4, to install the side tab into its bracket hole.

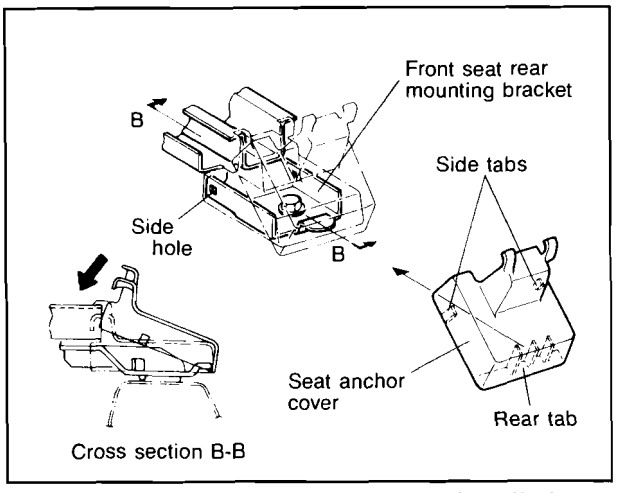


Fig. 4 — Outside rear anchor cover installation

(5) Insert the front seat rear anchor cover (inner side) to its anchor bracket and attach each tab of the cover to the bracket. Refer Fig. 5.

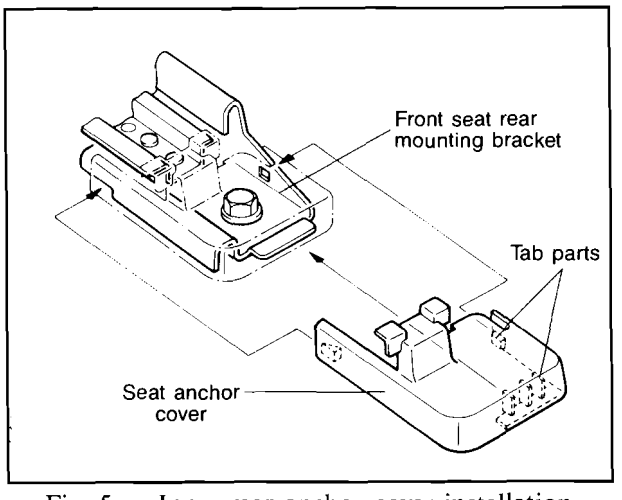


Fig. 5 — Inner rear anchor cover installation

NOTE: The manual seat with height adjuster and lumbar support does not apply to 'H' and 'D' line. Lumbar support only applies to the driver's seat of 'H' and 'D' line.

Disassembly

(1) Remove the lumbar support lever trim piece (where fitted), then remove the screw and lever.

(2) Remove the inner hinge cover screw and remove the cover, refer Fig. 6.

(3) Remove the seat squab back plate by pulling the bottom out and down.

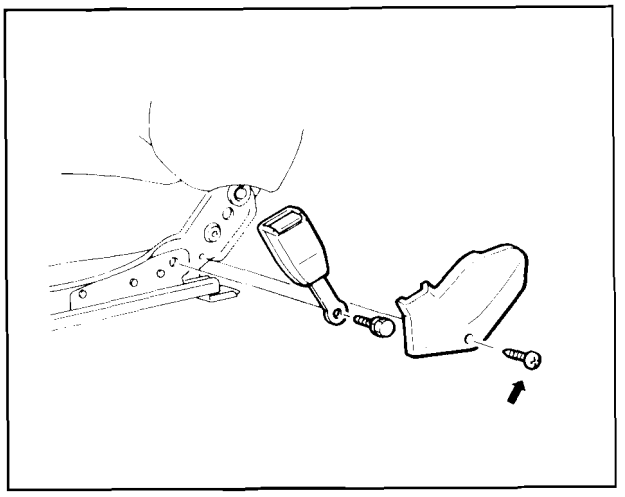


Fig. 6 — Inner hinge cover

(4) Remove the seat belt stalk assembly from the seat.

(5) Remove the height adjuster (where fitted) by removing the trim piece and then the screw.

(6) After removing the two retaining screws, carefully remove the outer shield cover from around the seat controls, refer Fig. 8.

(7) Cut and remove the two corner 'C'-clips from the seat back frame and remove the three long plastic material retainers by peeling away from the frame. Refer Fig 7.

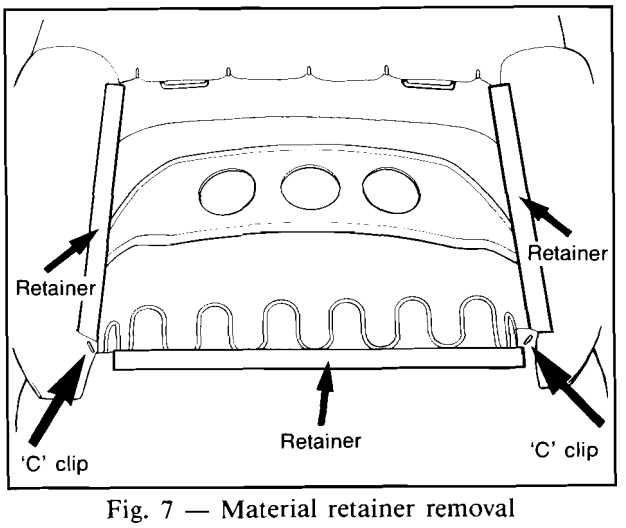
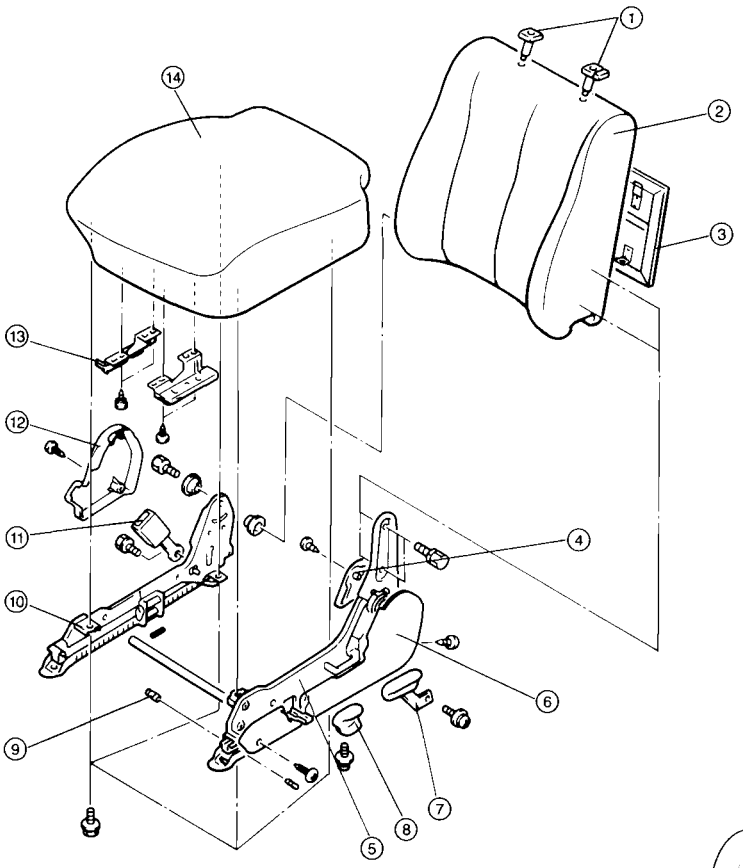


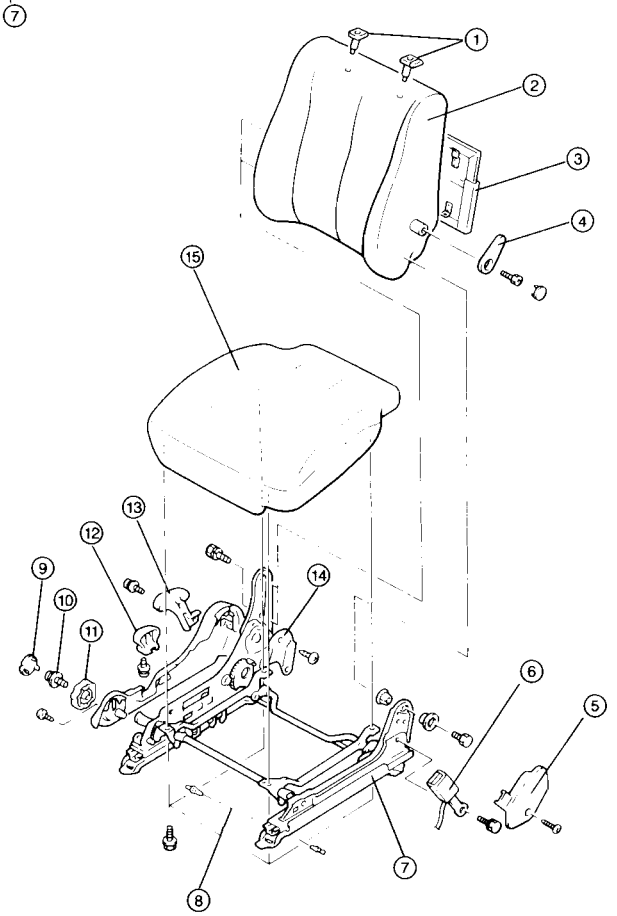
Fig. 7 — Material retainer removal

"H" and "D" Line (Passenger side)



1. Head restraint guide
2. Seat back assembly
3. Back panel assembly
4. Reclining adjuster inner cover
5. Seat adjuster (outer)
6. Front seat slide shield cover
7. Reclining lever
8. Seat adjuster lever
9. Pull wire
10. Seat adjuster (inner)
11. Seat belt stalk
12. Front seat hinge cover
13. Under tray rail
14. Seat cushion assembly

"P" and "X" (Drivers side)



1. Head restraint guide
2. Seat back assembly
3. Back panel assembly
4. Lumbar support lever
5. Front seat hinge cover
6. Seat belt stalk
7. Height adjuster assembly
8. Pull wire
9. Height adjuster lever cap
10. Height adjuster lever
11. Front seat side shield cover
12. Seat adjuster lever
13. Reclining lever
14. Reclining adjuster inner cover
15. Seat cushion assembly

Fig. 8 — Front seat component location — sedan and wagon

(8) Peel back the cushion trim around the two 14 mm seat squab mounting bolts and remove them.
(9) Remove the single 10 mm seat squab mounting bolt and remove the seat squab.

NOTE: Do not lose the nylon washer underneath the single seat squab mounting bolt and take note on direction of installation.

(10) Remove the head restraint guides by reaching up the rear of the seat back and squeezing the two lugs on the guides together and pushing them out.
(11) Remove all remaining C clips carefully and remove the cushion trim.
(12) Turn the cushion slide assembly over and remove the two C clips which hold the material flap in place, refer Fig. 9.

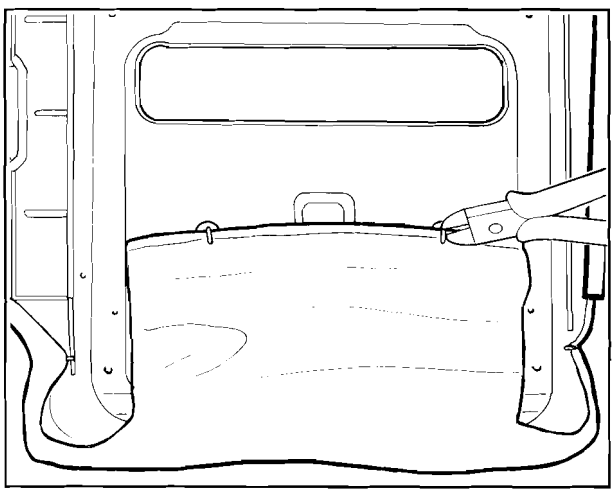


Fig. 9 — Removing C clips

(13) Remove the four seat cushion to slide assembly retaining bolts and remove the slide assembly.
(14) Remove the four plastic material retainers (lever carefully if necessary) from the metal frame, refer Fig. 10.

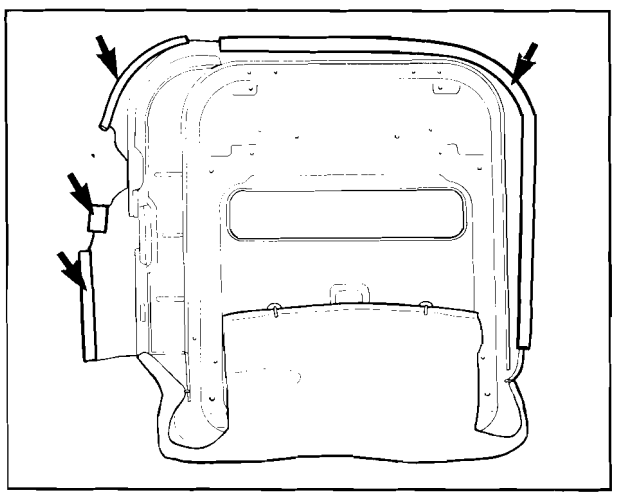


Fig. 10 — Material retainer removal

(15) Remove the two C clips located in Fig. 11.

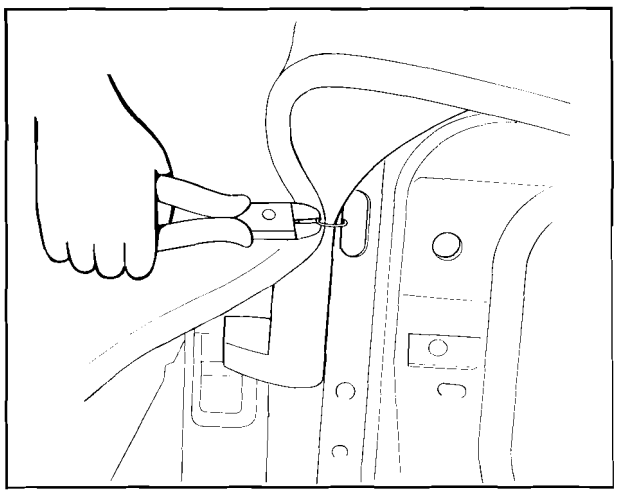


Fig. 11 — Corner C clip location

(16) Carefully peel off the cushion trim and remove all the remaining C clips as you go.
(17) Remove cushion trim.

Assembly

To assemble, reverse the removal procedure taking note of the following:
(1) When refitting the C clips, ensure that all the C clips are put in the same position as where they came out.
(2) When fitting the cushion trim, ensure that the material is not creased or bunched in any spots.
(3) When installing the seat slide assembly to the cushion, align the seat slide runners and lock them into position with the slide adjuster.
(4) Insert the seat belt stalk fixing tab securely into its location hole before tightening. Refer Section 4 for specifications.

Head restraint disassembly

(1) 'H' and 'D' line models have a stapled-on trim for the head restraint so carefully remove the staples then the trim.
(2) 'P' and 'X' line models have plastic retainers that interlock under the head restraint. Unhook retainers, cut the 'C' clips and remove the trim.

Assembly

To assemble simply reverse the disassembly procedure, taking note that the trim must fit without creases or bunching in the material.

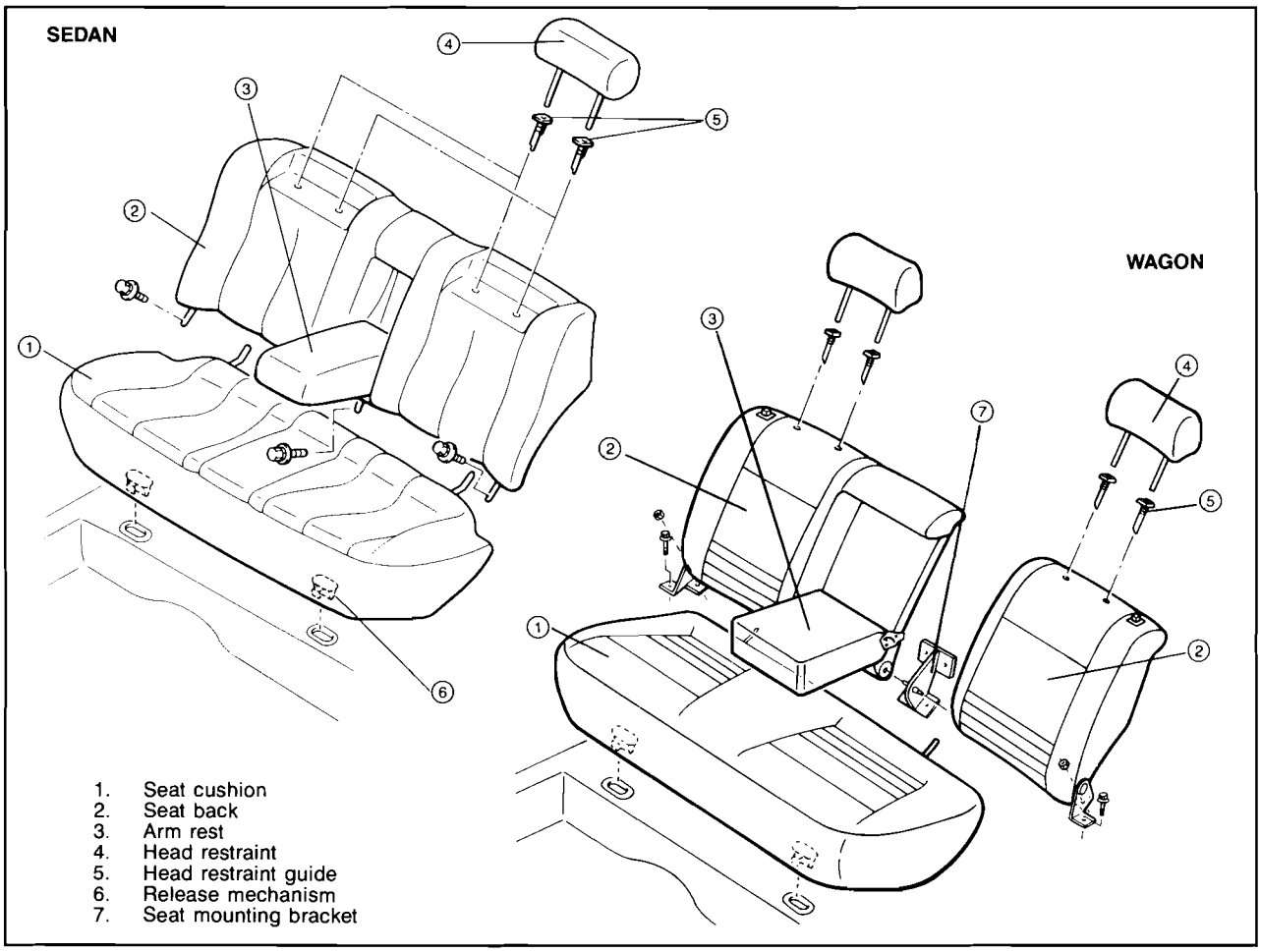


Fig. 12 — Rear seat components — sedan and wagon

REAR SEAT ASSEMBLY

Removal — Sedan

(1) Remove the rear seat head restraints (where fitted).

(2) Remove the seat cushion by pulling the release lever out and lifting on the front of the seat. When disengaged, repeat with the other side and remove the seat cushion from the vehicle. Refer Fig. 13.

(3) Remove the three rear seat back retaining bolts.

(4) Remove the rear seat back by lifting upwards and remove from the vehicle, refer Fig. 14.

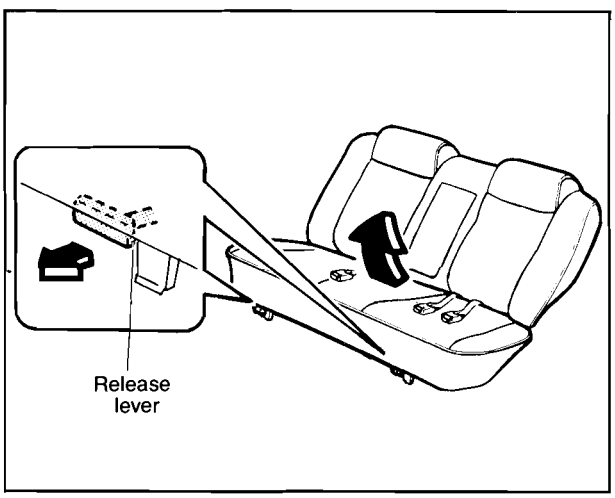


Fig. 13 — Rear seat cushion removal

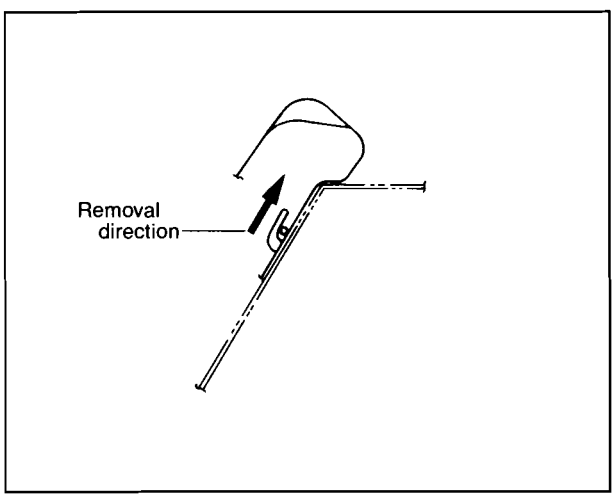


Fig. 14 — Seat back removal direction

Installation

(1) To install reverse the removal procedure taking note of the seat cushion installation diagram in Fig. 15.

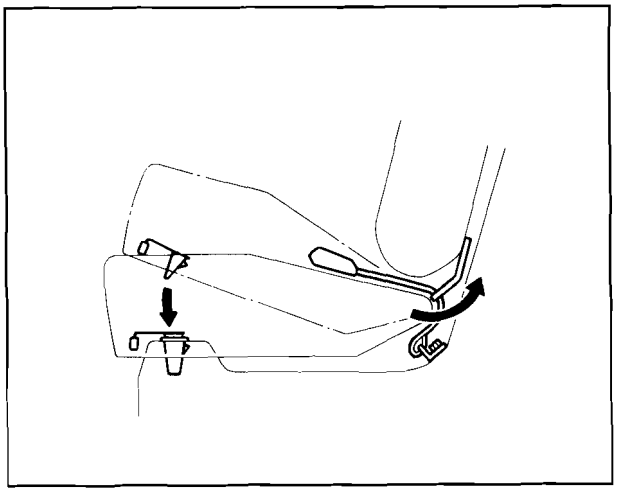


Fig. 15 — Seat cushion installation

Removal — Wagon

(1) Remove to two cushion retaining bolts.
(2) Remove the cushion, releasing seat belt buckles from the elastic retainers.
(3) Lay the rear seat squabs forward and release the velcro tabs retaining the cargo floor covering to the rear seat squab backs.
(4) Remove the nut and bolt from the outer seat squab retaining bracket.
(5) Remove the seat squab section from the vehicle.
(6) Repeat this procedure to remove the other seat squab.

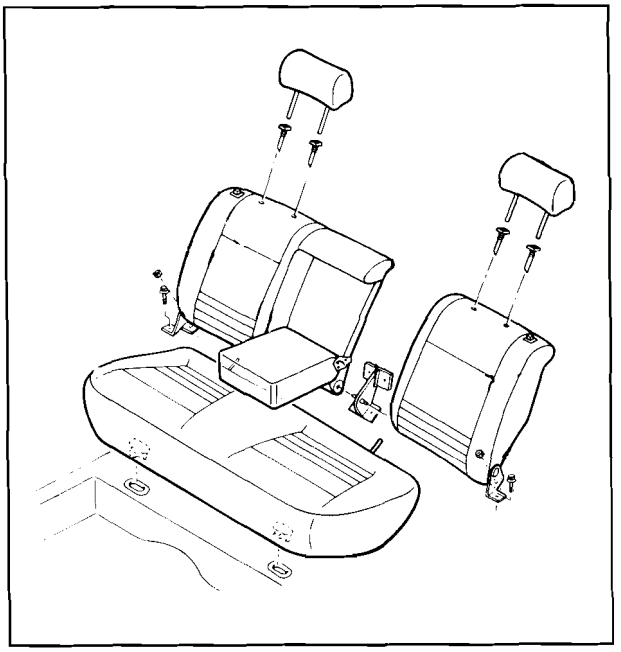


Fig. 16 — "P" line rear seat assembly — wagon

Installation

Install by reversing the removal procedure noting the following:

(1) Ensure seat squabs are located correctly on the centre pivot bracket.
(2) Tighten all nuts and bolts to the correct torque, see specifications.

SECTION 5 — SEAT BELTS

AUTOMATIC RETRACTORS

The design of this belt allows the occupant to move the upper portion of his or her body to reach various controls, the glove compartment, etc. Locking of this type of belt is automatic and is activated by rapid speed changes, changes in vehicle direction or rapid belt withdrawal.

On occasions, when the vehicle is parked or ranked on a particularly steep kerb or hill, the locking mechanism of the retractor may be activated. This will prevent the occupant from pulling the belt out of the retractor. This condition is rectified by placing the vehicle on a more level surface.

Whenever fitting the seat belts, ensure that they are adjusted so that the webbing that passes across the occupants body is not twisted and that the seat belt buckle is at or below the occupants hip.

SEAT BELT INSPECTION AND TESTING

Seat Belts, which have become an integral part of motor vehicles, are often not thought of as requiring regular inspection and testing to check for deterioration due to age and/or continued usage.

The following guide lines will assist when inspecting and testing seat belts.

(1) **Webbing** Inspect all webbing for abrasion, burns, cuts etc. Even small cuts on the webbing, particularly in the edge or centre of the webbing can weaken it significantly and affected belts should be replaced. Similarly, abraded belts showing signs of fibres lifting or "furing" should be replaced and the cause of abrasion located and corrected. Belts that are "roping" or have a permanent twist are dangerous to the occupant and should be replaced.

Webbing that has faded to a "silvery" look through continued exposure to sunlight may have suffered significant strength loss and should be replaced. Belt webbing should be examined for evidence of damage due to the vehicle being involved in an accident. Distorted tongues, burn or melt marks on the webbing or pillar loops are good indications that the belt is unserviceable.

(2) **Retractors** All retractors should return the belt to the fully stowed position, pillar loops should swivel freely on their mounting bolts and pillar guides should be in good condition and operate correctly. Belts should extract freely for fitment to the occupant. Retractors have a locking device that is sensitive to rapid webbing withdrawal — this is in addition to the locking that occurs due to inertia during braking. A simple test for the retractor inertia function is to attempt to extract the belt slowly whilst the vehicle is subjected to sharp braking at walking speed. This test should be conducted in an area free of traffic. Check the rapid belt withdrawal locking mechanism whilst the vehicle is stationary by simply pulling the belt rapidly from the retractor assembly — the belt will lock.

(3) **Adjusters (Manual Belts)** Check manual belts for ease of lengthening and shortening (aged Webbing or adjuster malfunctions cause difficulty in adjustment). The free "end" of the belt should be in good condition and must not be able to pass through the adjuster.

(4) **Buckles** The buckle must provide full engagement (without excessive load) and positive retention of the tongue and must release the tongue without undue load on the button. After engaging the tongue, the button must return fully. Also the buckles should be inspected for presence of foreign objects which may cause malfunctions.

The vehicle speed change/direction change locking mechanism is pendulum actuated. If vehicle is parked on a steep slope or with the road wheels of one side in a deep gutter, the belt may lock. However, with retractor correctly installed, vehicle attitudes between 10°-24° off level in any direction are possible before the pendulum actuates the locking mechanism.

The tongue should be stowed in a visible and accessible location when the belt is not in use, and should be on the side of the webbing closest to the centre of the car.

FITTING INSTRUCTIONS FOR SEAT BELTS

When fitting seat belts or new replacement parts ensure the following:

(1) **Replacement belt must match.**

(2) Refit the seat belt ensuring that any defective attachments have been replaced with genuine M.M.A.L. replacement parts.

(3) When refitting a retractor seat belt, the running loop must be free to swivel around the retaining bolt.

(4) When fitting rear buckles ensure that they are routed through the elastic restraints attached to the seat squab.

(5) **Assemblies must not be altered, modified or re-routed in any way.**

FRONT RETRACTOR

Removal

NOTE: When removing the seat belts from the anchor points, it is essential to identify the individual bolt, spacer and wave washers, etc., in order to place them in their relevent position upon re-assembly. This is necessary due to some differences in bolt and spacer dimensions.

(1) Remove the centre pillar lower trim as described in Section 2.

(2) Lift the running loop cover to gain access to the retaining bolt.

(3) Remove the retaining bolt from the running loop.

(4) Remove the centre running loop retaining screw.

(5) Slide back the plastic retractor bolt cover and remove the retractor/webbing anchor bolt.

(6) Remove the retractor plate retaining screw then remove the front seat belt.

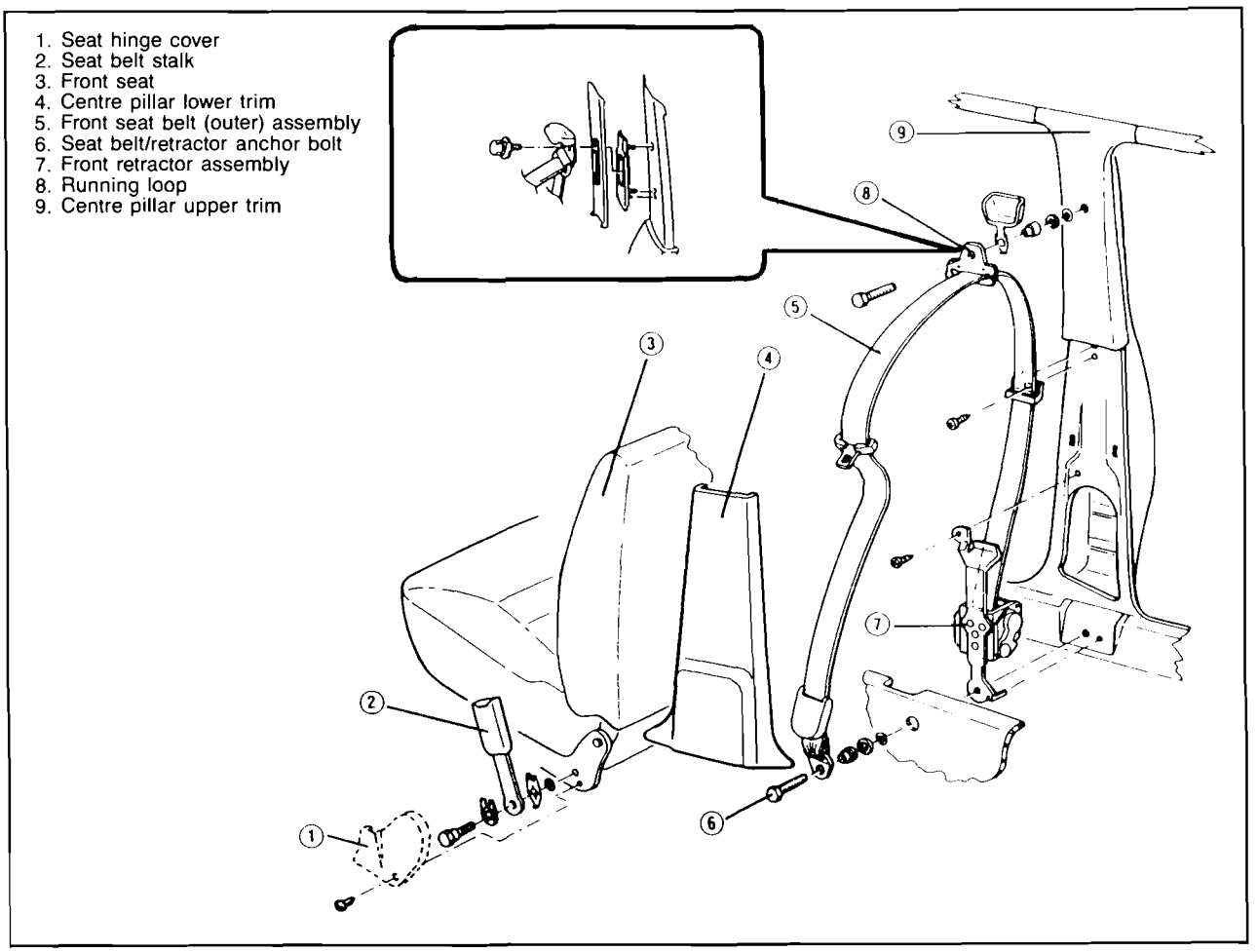


Fig. 1 — Front seat belt components

Installation

Install by reversing the removal procedure noting the following:

(1) It is essential that the screw fitted to the retractor retaining bracket is installed.

(2) Tighten all retaining bolts to 40 Nm ± 7 Nm.

(3) Check for correct operation of seat belt assembly.

NOTE: When tightening bolts ensure that components are not jammed incorrectly under bolt head. Sash guide must swivel freely.

NOTE: If difficulties are experienced with belt extraction and retraction, recheck for correct installation. Under no circumstances should the retractor unit be tampered with in any way. The retractor unit is sealed to preclude unauthorised repairs. If the retractor unit is found to be faulty, a replacement retractor belt assembly must be fitted.

FRONT SEAT BELT STALKS

Removal

(1) Remove the floor console assembly as described in Section 2.

(2) Remove the trim cover retaining screw and remove the cover, refer Fig. 1.

(3) Remove the seat belt stalk retaining bolt and remove from the vehicle.

Installation

Install by reversing the removal procedure noting the following:

(1) Ensure that the stalk pawl which is fitted to prevent rotation is located correctly.

(2) Ensure that the retaining bolts are correctly torqued to 40 Nm ± 7 Nm.

REAR RETRACTOR

Removal

(1) Remove the rear cushion and squab assembly, refer Section 4.

(2) Carefully lever the trim guide out from the bottom to free it from the rear pillar trim, refer Fig. 3.

(3) Remove the rear pillar trim, refer to Section 2.

(4) Remove the rear wheel cover, refer to Section 2.

(5) Remove the running loop retaining bolt.

(6) Remove the retractor assembly mounting bolt.

(7) Remove the anchor plate retaining bolt and the seat belt assembly from the vehicle. Refer Fig. 2.

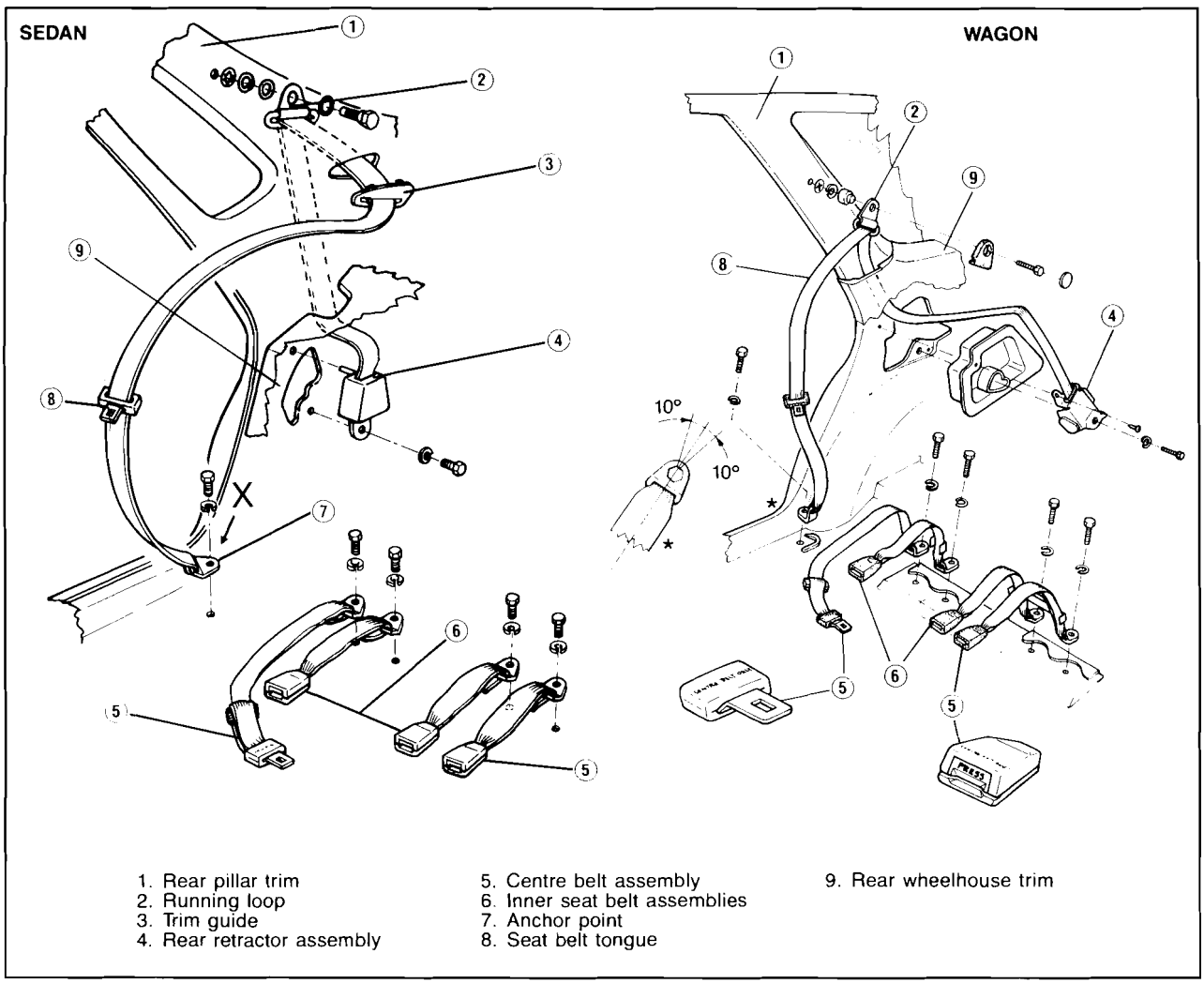


Fig. 2 — Rear seat belt components — sedan and wagon

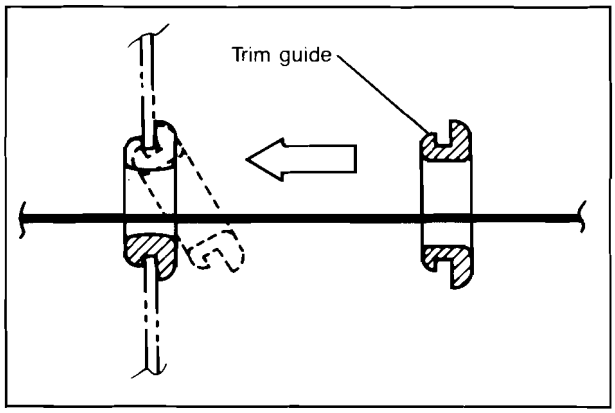


Fig. 3 — Trim guide removal and installation

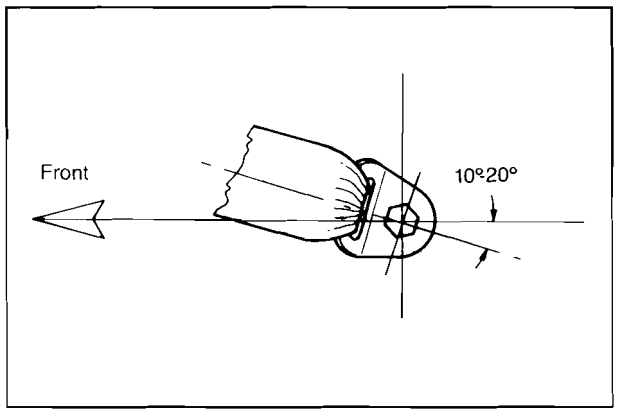


Fig. 4 — View "X" on Fig. 2

Installation

Install by reversing the removal procedure noting the following:

(1) When tightening the running loop mounting bolt, ensure that components are not jammed under the bolt head. Running loop must swivel freely.

(2) Ensure that the location pin is correctly positioned when tightening the retractor mounting bolt.

(3) When tightening the anchor plate retaining bolt, ensure that is it positioned according to Fig. 4.

(4) Check that all seat belt mounting bolts are torqued to specification.

(5) Ensure that the seat belt is not twisted after installation. If this occurs, remove and then install correctly.

REAR BUCKLE ASSEMBLY

Removal

(1) Remove the rear seat cushion assembly as described earlier in this section.

(2) Remove the necessary retaining bolt(s) and then remove the necessary buckle assembly.

Installation

Install by reversing the removal procedure.

NOTE: When installing the rear buckle assembly and front seat belt stalk, make sure that the bolts, washers, etc., are correctly fitted. Tighten all anchorage bolts to 40 ± 7 Nm.

CHILD RESTRAINT MOUNTING POINTS

All vehicles have provision for the attachment of child restraints to the rear seat area.

The three points are located on the rear parcel shelf behind the rear seat. Access to the bolt holes can be obtained by removing the cover plugs.

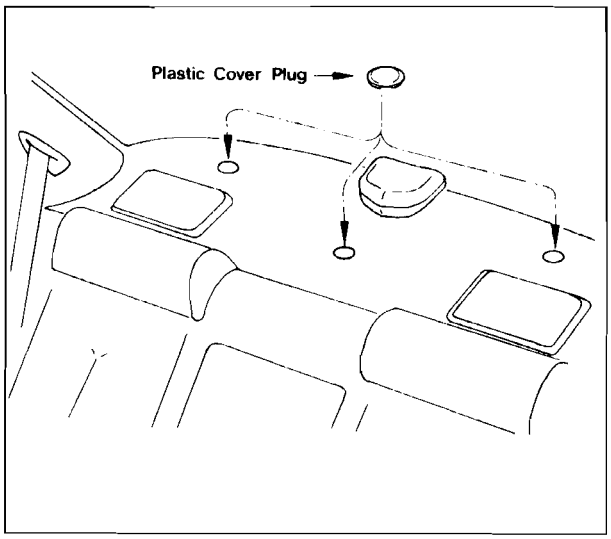


Fig. 5 — Child restraint mounting points

Installation

When fitting child restraint devices ensure the anchorage bolt is fitted and torqued to meet the suppliers recommendations.

NOTE: Under all circumstances the attaching bolt must be engaged at least five full threads in the bolt holes. If you are in doubt with any aspect of this installation contact the restraint manufacturer. Child restraint anchorages are designed to withstand only those loads imposed by correctly fitted restraints. Under no circumstances are they to be used for adult seat belts or harnesses.

Wagon Models

The three points are located in the rear roof panel. Access can be obtained by removal of cover plugs, refer Fig. 6.

Installation

When fitting child restraint devices ensure the anchorage bolt is torqued to meet the suppliers recommendations.

NOTE: Under all circumstances the attaching bolt must be engaged at least five full threads in the bolt holes. If you are in doubt with any aspect of this installation contact the restraint manufacturer. Child restraint anchorages are designed to withstand only those loads imposed by correctly fitted restraints. Under no circumstances are they to be used for adult seat belts or harnesses.

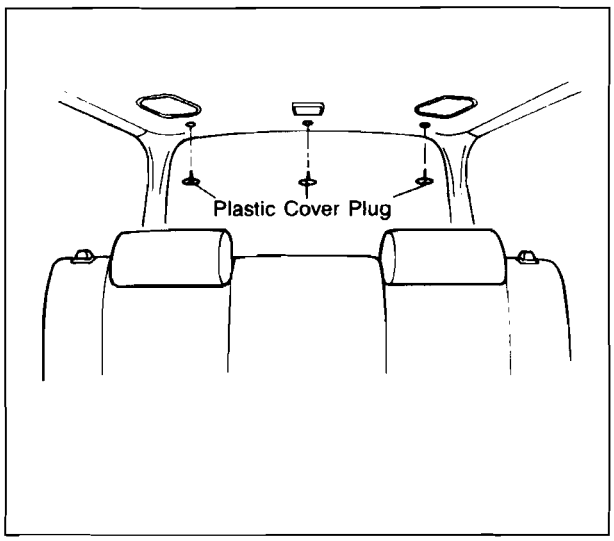
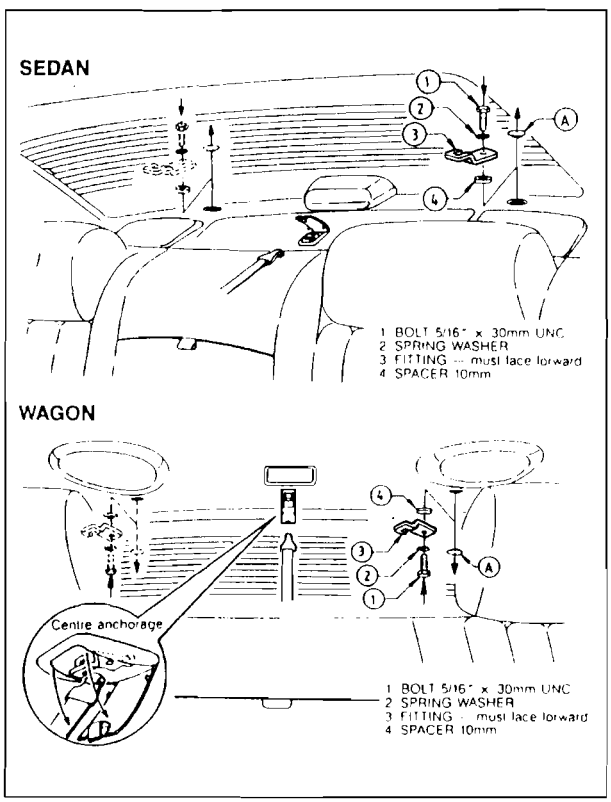


Fig. 6 — Child restraint mounting points — wagon



Child restraint mounting points from Jan.1st 1995

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GROUP 52B — SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

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CAUTION!

- **Carefully read and observe the information in the SRS SERVICE PRECAUTIONS 52B Section 4 Prior to any service.**
- **For information concerning Service Diagnosis and Testing, always observe the procedures in the Service Diagnosis and Testing Sections 52B section 3.**
- **If any SRS components are removed or replaced in connection with any service procedures, be sure to follow the procedures in the INDIVIDUAL COMPONENT SERVICE Section 6 for the components involved.**
- **If you have any questions about the SRS, please contact your authorised MITSUBISHI dealer.**

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SECTION 1 — SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

SPECIFICATIONS

Front impact sensor resistance	2,000 ± 40Ω
Clock spring resistance	less than 0.4Ω

TORQUE SPECIFICATIONS

	Nm
Steering wheel retaining nut	40
Air bag module retaining nuts	5
Radio control retaining screws	2.5

SPECIAL TOOLS

MB991349	SRS Check Harness Multi-use Tester Assembly (MUT II) Rom Pack for Multi-use Tester Assembly Digital Multi-meter with maximum test current of 2mA or less
MB686560	SRS Air Bag Adapter harness A
MB628919	SRS Air Bag Adapter harness B

SECTION 2 — GENERAL INFORMATION

INTRODUCTION

The Supplemental Restraint System (SRS) is designed to supplement the driver's seat belt to help reduce the risk or severity of injury to the driver by activating and deploying a driver's-side air bag in certain frontal collisions.

The SRS consists of: left front and right front impact sensors located, one each on the right and left lower side members an air bag module located in the center of the steering wheel, which contains the folded air bag and an inflator unit; the SRS diagnosis unit located under the floor console assembly, which monitors the system and which contains a safing impact sensor; an SRS warning light located on the instrument panel, (refer Fig. 1) which indicates the operational status of the SRS; a clock spring interconnection located within the steering column, system wiring and wiring connectors.

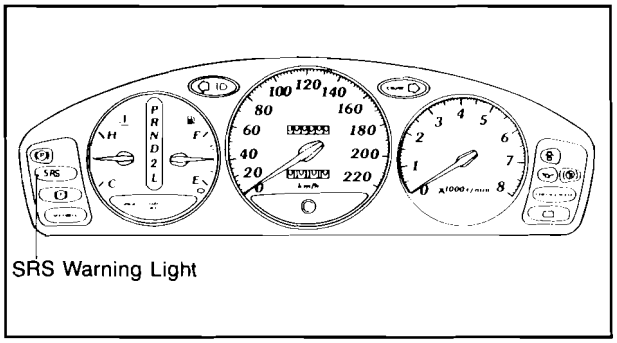


Fig. 1 — SRS Warning Light

The SRS is designed so that the air bag will deploy when the safing sensor, plus either or both of the left front and right front impact sensors simultaneously activate while the ignition switch is "ON".

That is designed to occur in frontal or near-frontal impacts of moderate to severe force.

Only authorized service personnel should do work on or around the SRS components. Those service personnel should read this manual carefully before starting any such work. Extreme care must be used when servicing the SRS, to avoid injury to the service personnel (by inadvertent deployment of the air bag) or the driver (by rendering the SRS inoperative).

SELF-DIAGNOSIS/SRS WARNING LIGHT FUNCTION

The diagnosis unit monitors the SRS system and stores data concerning any detected faults in the system. When the ignition key is in "ON" or "START" position, the SRS warning light should illuminate for about 7 seconds and then turn off. That indicates that the SRS system is in operational order. If the SRS warning light does any of the following, immediate inspection by an authorized dealer is needed.

(1) The SRS warning light does not illuninate as described above.

(2) The SRS warning light stays on for more than 7 seconds.

(3) The SRS warning light illuminates while driving.

If a vehicle's SRS warning light is in any of these three conditions when brought in for inspection, the SRS system must be inspected, diagnosed and serviced in accordance with this manual.

CONSTRUCTION AND COMPONENT LOCATION

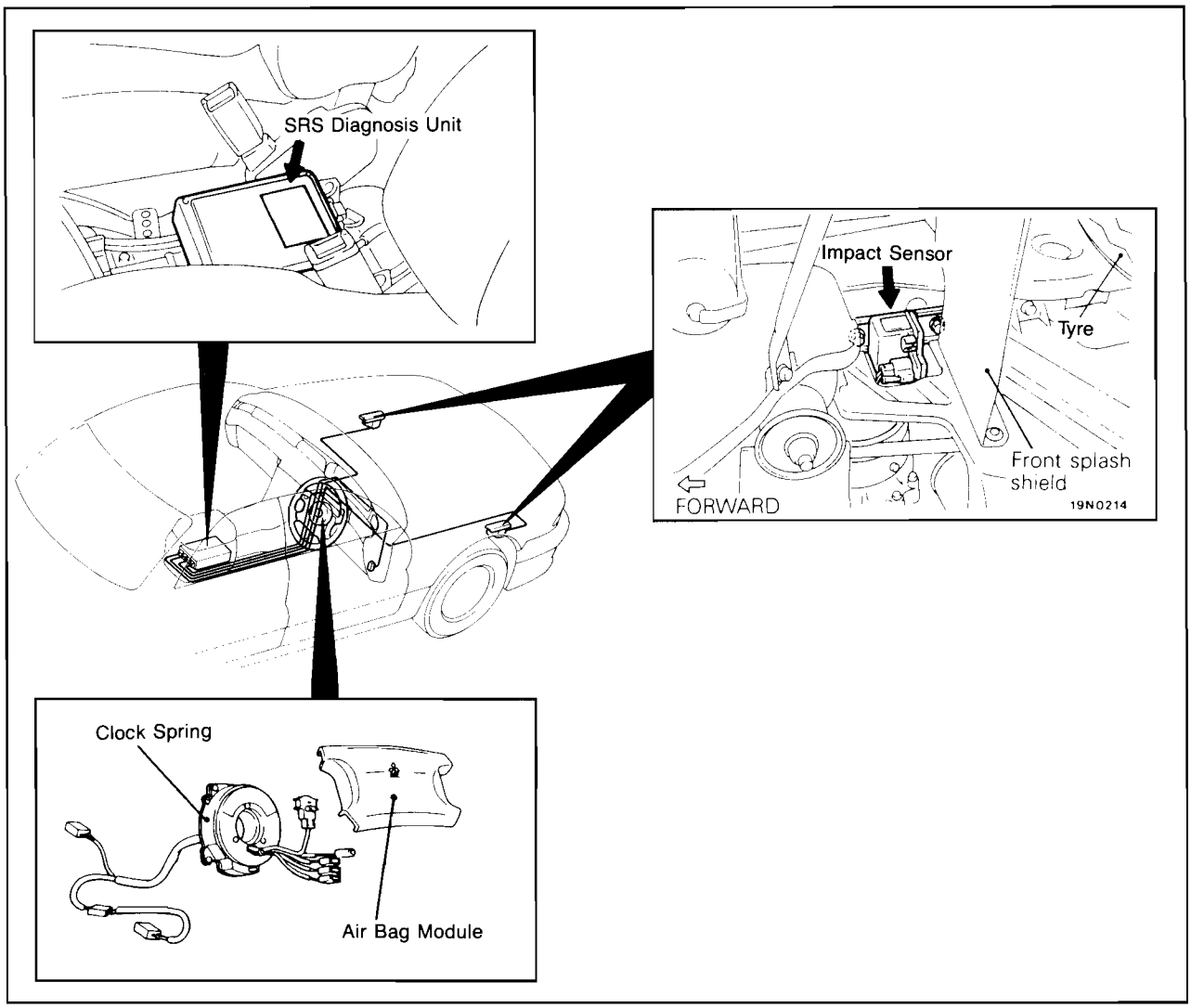


Fig. 2 — Construction and component location diagram

WARNING/CAUTION LABELS

A number of caution labels relating to the SRS are found in the vehicle, as shown in the following illustrations. Follow label instructions when servicing SRS.

NOTE: If labels are dirty or damaged, replace them with new ones.

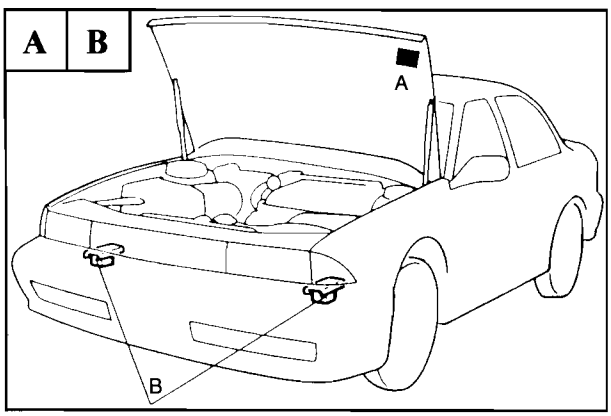


Fig. 3 — Bonnet and impact sensor decal location

A **WARNING: This vehicle has an air bag system. Refer to service manual before servicing or disassembling underhood components.**

Read the "SRS" section of manual for important · instructions. Improper service procedures can result in the air bag firing or becoming inoperative. Possibly leading to injury.

B **SRS CAUTION**
Read service manual
Do not drop
Do not tamper or disassemble.

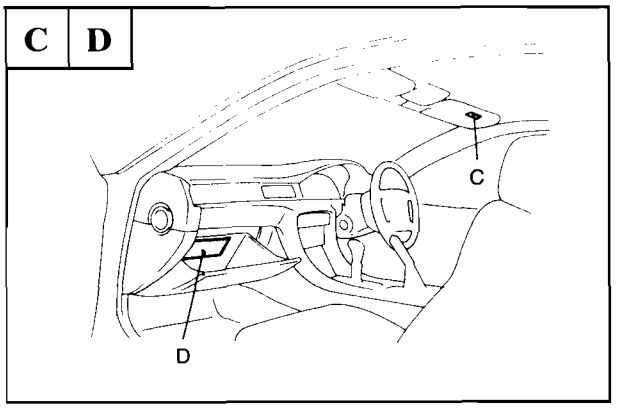


Fig. 4 — Sunvisor and glovebox decal location

C **This vehicle has a driver's side air bag to supplement the driver's seatbelt in certain frontal collisions.**

The driver and all other occupants must wear seatbelts at all times to reduce possible injury.

D **AIR BAG SYSTEM INFORMATION**

This vehicle has an air bag system which will supplement the seatbelt in certain frontal collisions. The air bag is not a substitute for the seatbelt in any type of collision. The driver and all other occupants should wear seatbelts at all times.

WARNING! If the "SRS" warning light does not illuminate for several seconds when the ignition key is turned to "ON" or the engine is started, or if the warning light stays on while driving, take the vehicle to your nearest authorized dealer immediately. Also, if the vehicle's front end is damaged or if the air bag has deployed, take the vehicle for service immediately. The air bag system must be inspected by an authorised dealer ten years after the date of vehicle registration. Read the "SRS" section of your owner's manual before driving for important information about operation and service of the air bag system. When you are going to discard your gas generator or vehicle, please see your Mitsubishi Dealer.

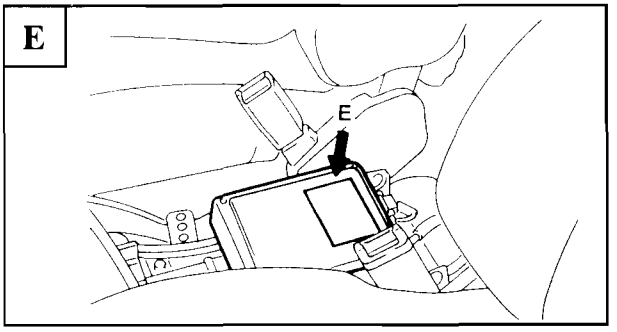


Fig. 5 — SRS diagnostic unit decal location

E **CAUTION: SRS diagnostic unit**

This unit cannot be repaired.

If defective, remove and replace entire unit per service manual instructions.

Do not diassemble or tamper.

See service manual for handling and storage instructions.

Do not drop: keep dry.

Failure to follow instructions could render air bag inoperative and result in driver injury.

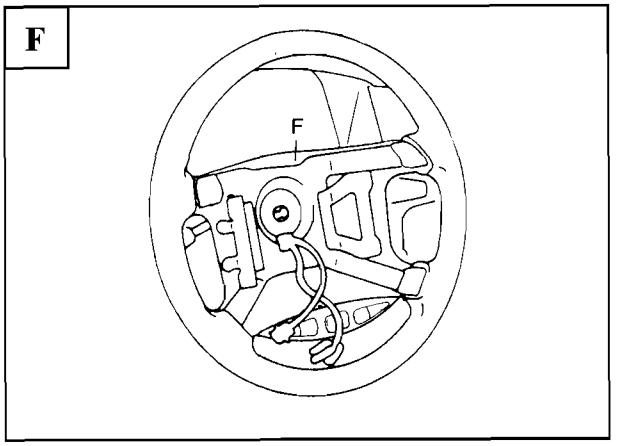


Fig. 6 — Steering wheel decal location

F **CAUTION: SRS**

Before replacing steering wheel, read service manual, center front wheels and align SRS clock spring neutral marks.

Failure to do so may render SRS system inoperative, risking serious driver injury.

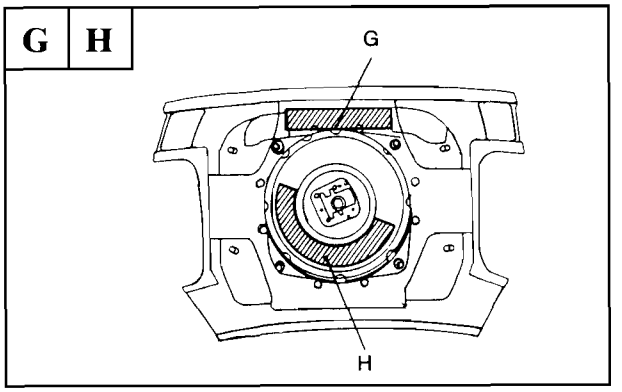


Fig. 7 — SRS module decal location

G **WARNING: SRS**

This air bag module cannot be repaired. Do not disassemble or tamper.

Do not perform diagnosis. Do not touch with electrical test equipment or probes. Refer to service manual for further instructions, and for special handling, storage and disposal procedures.

Tampering or mishandling can result in injury.

H **DANGER! Poison. Keep out of the reach of children.**

Contains sodium azide and potassium nitrate contents are poisonous and extremely flammable. Contact with acid, water, or heavy metals may produce harmful and irritating gases or explosive compounds. Do not dismantle, incinerate, bring into contact with electricity or store at temperatures exceeding 200°F.

First aid: If contents are swallowed induce vomiting. For eye contact flush eye with water for 15 minutes. If gases from acid or water contact are inhaled, seek fresh air. In every case, get prompt medical attention.

For additional information, see material safety data sheet (MSDS) for this product.

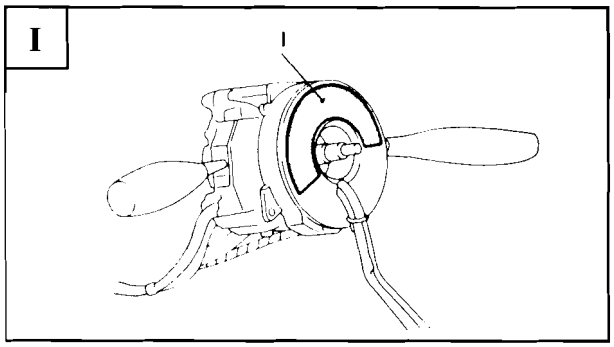


Fig. 8 — Clock spring decal location

I **CAUTION: SRS clock spring**

This is not a repairable part. Do not disassemble or tamper.

If defective, remove and replace entire unit per service manual instructions.

Before replacement, read service manual, center front wheels and align neutral marks. Failure to follow instructions may render SRS system inoperative, risking serious driver injury.

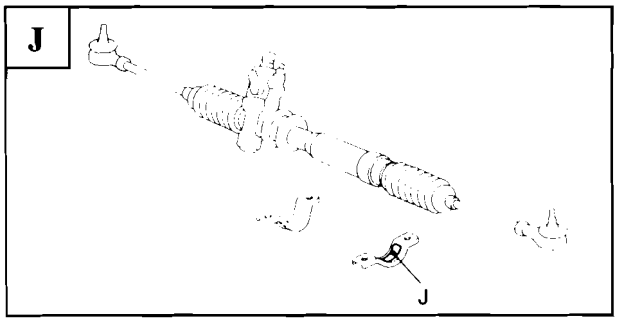


Fig. 9 — Steering rack bracket decal location

J **CAUTION: SRS**

Before removal of steering gearbox, read service manual, center front wheels and remove ignition key.

Failure to do so may damage SRS clock spring and render SRS system inoperative, risking serious driver injury.

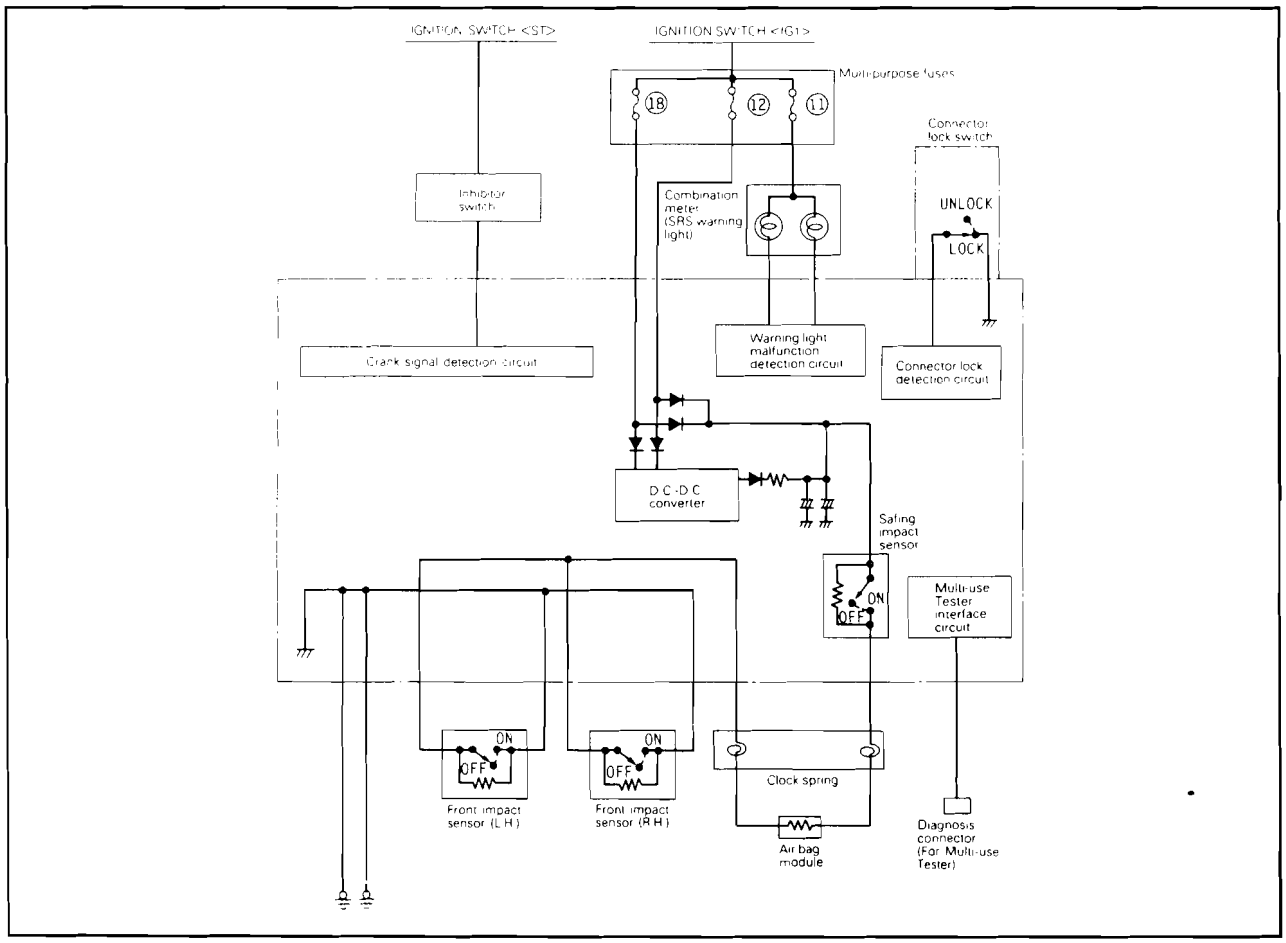


Fig. 10 — SRS schematic diagram

SRS CONNECTOR CONSTRUCTION

The SRS diagnosis unit has three connector mechanisms, a double lock mechanism, a fit verification mechanism and a connector shorting mechanism. These are designed to facilitate safe operation and service of the SRS unit.

NOTE: Another shorting mechanism is used between the body wiring harness and the clock spring to protect against inadvert firing of the air bag.

DOUBLE LOCK MECHANISM

The mechanism is composed of two mechanisms: each connector of the SRS diagnosis unit is locked to the connector of the harness, then these connectors (of four harnesses) are locked with the secondary lock lever mounted on the connector of the SRS diagnosis unit side.

The secondary lock lever locking is done as the lock spring fits in the notch of the connector, refer Fig. 11.

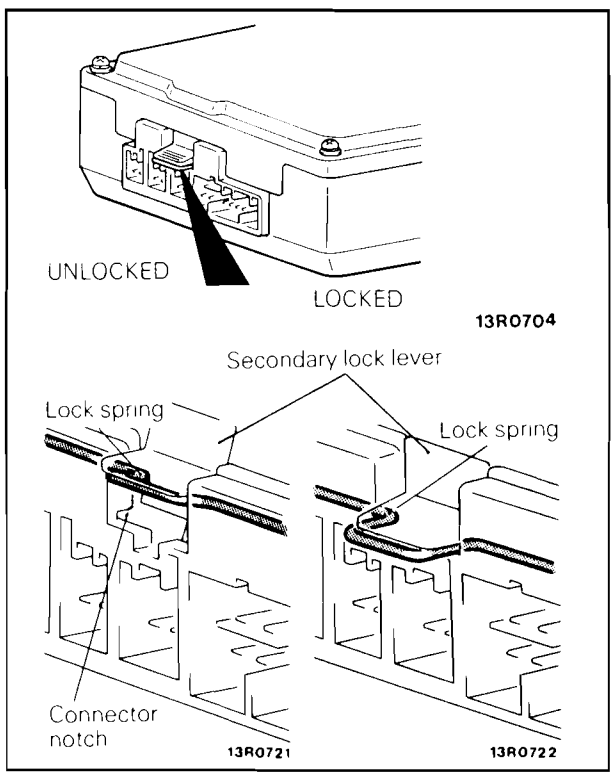


Fig. 11 — Secondary lock lever

When Connectors are to be Fitted

(1) The SRS diagnosis unit and harness side connectors are fitted. (Primary lock)

(2) The secondary lock lever mounted to the SRS diagnosis unit side connector is pressed down until a click is heard indicating that the connectors have been locked, (Secondary lock) refer Fig. 12.

If the harness and SRS diagnosis unit connectors do not properly fit, the secondary lock lever side projection and the harness side connector projection interfere with each other, making it impossible to lock the connectors.

When Connectors are Unlocked

(1) Press in the lock spring with a flap tip (—) screwdriver to disengage the lock spring from the notch area of the connector and release the lock (secondary lock) of the secondary lock lever.

CAUTION: Forced removal of the connector without releasing the secondary lock lever will result in a damaged lock lever.

(2) Press the primary lock of each of the harness side connectors and remove the harness side connector.

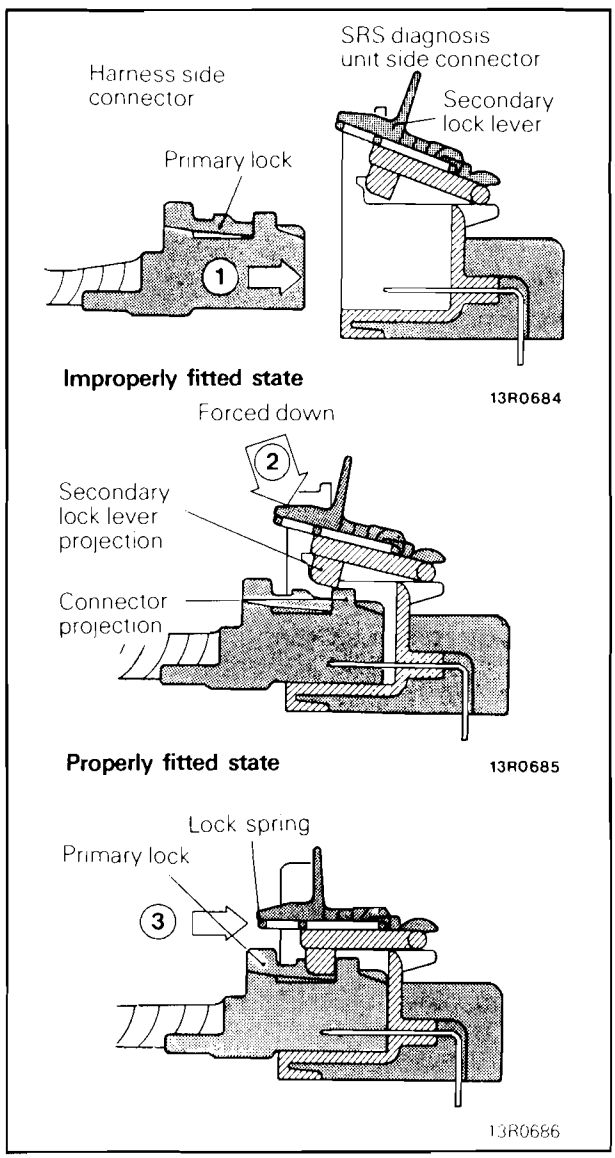


Fig. 12 — Connector fitment

FIT VERIFICATION MECHANISM

The mechanism is used to electrically check the engagement of the connector between the SRS diagnosis unit and the body wiring harness. The operating principle is described below.

(1) Securely connect the SRS diagnostic unit and harness side connectors and press the secondary lock lever down to lock the connectors.

(2) At this time, the short bar provided on the rear surface of the secondary lock produces a short circuit across terminals No. ⑦ and ⑧ of the SRS diagnosis unit. The SRS diagnosis unit supplies monitoring current to the circuit to electrically verify that the connectors have been locked, refer Fig. 13.

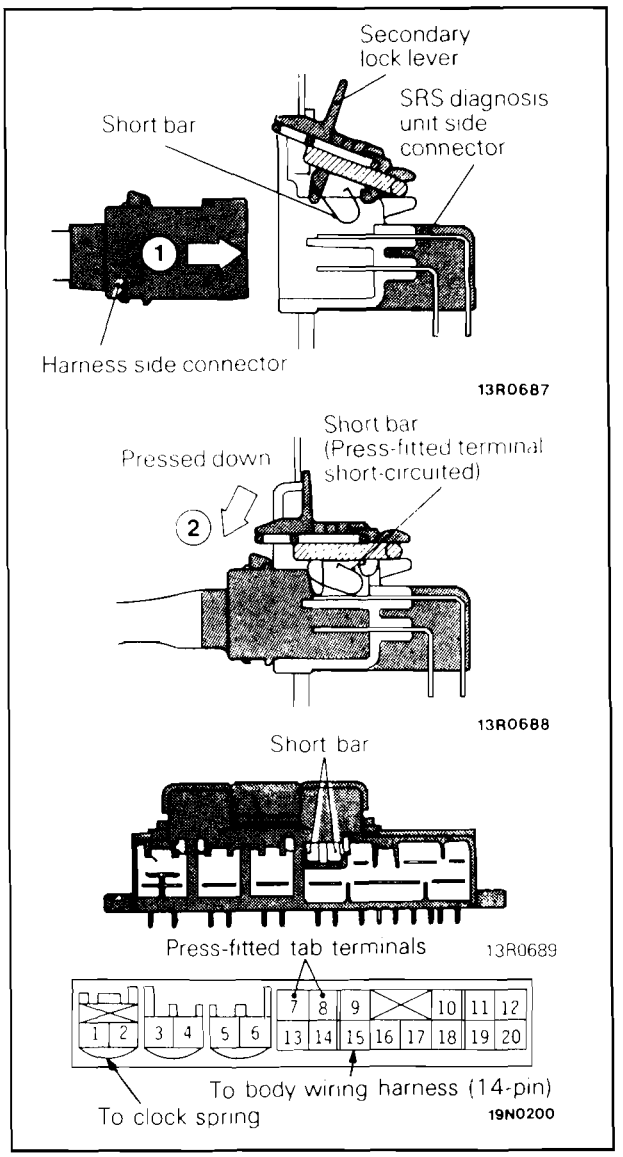


Fig. 13 — Fit verification mechanism

CONNECTOR SHORTING MECHANISM

The mechanism is designed for prevention of accidental explosion of the inflator when the clock spring connector (for the squib circuit) is removed from the SRS diagnosis unit. The operating principle is described below.

When Connectors are Fitted

When the SRS diagnosis unit and clock spring connector are coupled, the circuit between the short terminals and clock spring connector terminals are kept in the OFF state, by the partition plate provided in the connector of the SRS diagnosis unit, refer Fig. 14.

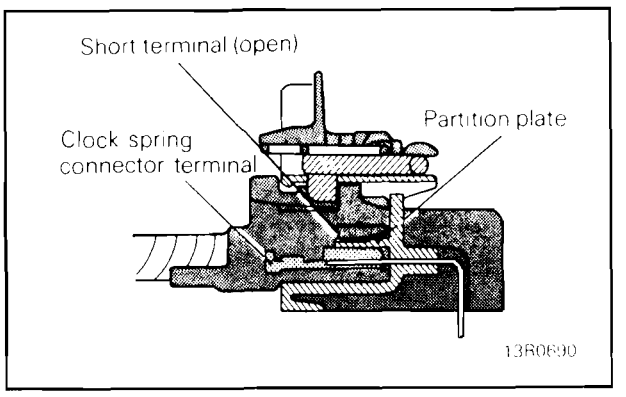


Fig. 14 — Short terminal open

When Connectors are Disconnected

When the clock spring connectors are disconnected from the SRS diagnosis unit, the partition plate between the short terminals and clock spring connector terminals is removed. As a result, a short circuit is formed between the two poles of the clock spring connector terminals to prevent generation of a potential difference (current) between the squib terminals, refer Fig. 15.

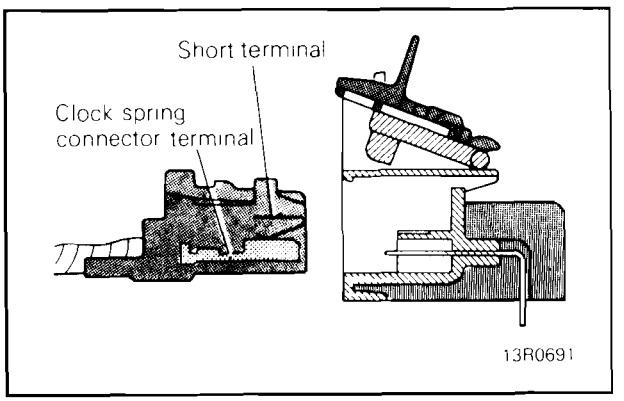


Fig. 15 — Short terminal closed

SECTION 3 — SERVICE DIAGNOSIS AND TESTING

SRS DIAGNOSTIC PROCEDURES — INITIAL STEPS

NOTE: Follow these steps when beginning any SRS service:

(1) Check the SRS fuses (multi-purpose fuses No. 11, No. 12 and No. 18).

If either is loose, tighten it; if damaged or blown, replace it.

(2) After performing step 1, start engine. Does "SRS" warning light illuminate for about 7 seconds and then turn OFF? If yes, SRS system is functioning properly.

If no, continue with following steps.

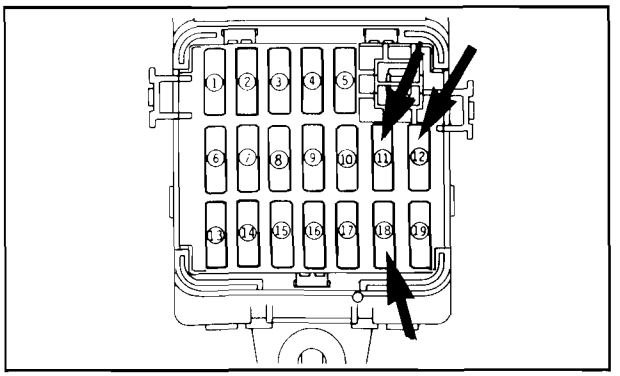


Fig. 1 — SRS fuse locations

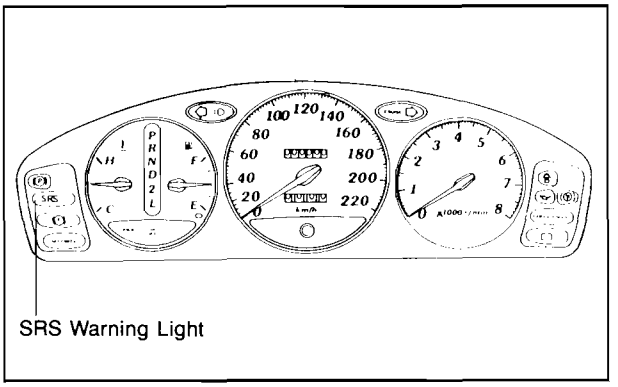


Fig. 2 — SRS warning light

NOTE: If the vehicle has a discharged battery or the battery power supply (multi-purpose fuses No. 12 or No. 18) is disconnected with the ignition key in the "ON" position, the SRS warning light will continue to illuminate even after the battery is recharged or the fuses are replaced in their original positions.

In this case, the SRS warning light can be extinguished by turning the ignition switch ON and OFF 10 times.

(3) Turn the ignition key to the "LOCK" position.

(4) Connect the Multi-use tester to the diagnosis connector located on the junction block.

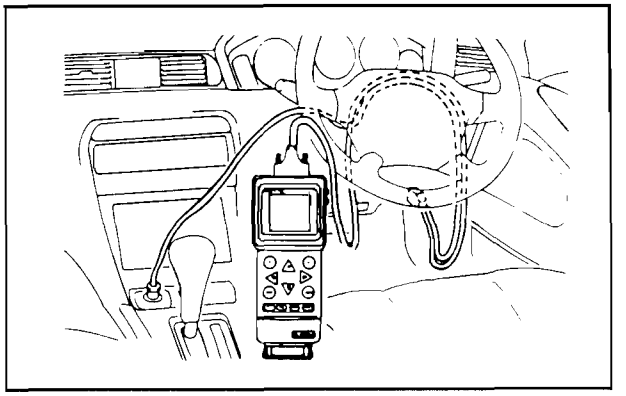


Fig. 3 — Multi-use tester connection

CAUTION: Make certain that the ignition switch is in the "OFF" position when the Multi-use Tester is connected or disconnected.

(5) Start the SRS diagnosis, by conducting TEST 1 (SRS warning light does not extinguish) or TEST 2 (SRS warning light does not illuminate).

DIAGNOSTIC SEQUENCE

TEST 1 —
SRS Warning light does not extenguish.

(1) Turn the ignition key to the "ON" position.

(2) The Multi-use Tester display section successfully passes the self-check and the main menu is displayed.

(3) Select "SYSTEM CHECK AND ADJUST".

(4) Select "SRS AIR BAG SYSTEM".

(5) Select the "SELF DIAG CODE" function and read (and write down) all displayed diagnosis codes.

(6) Press "S" to display the special menu and select "ERASE SELF DIAG CODE" and follow Multi-use Tester instructions.

(7) Start engine.

Does "SRS" warning light illuminate for about 7 seconds, turn off then remain extinguished for at least 45 seconds?

If yes, SRS system is functioning properly now.

If no, check the diagnosis quick reference chart and perform service as indicated.

TEST — 2
SRS Warning light does not illuminate.

(1) Turn the ignition key to the "ON" position.

(2) The Multi-use Tester successfully passes the self-check and the main menu is displayed.

(3) Select "SYSTEM CHECK AND ADJUST".

(4) Select "SRS AIR BAG SYSTEM".

(5) Select the "SELF DIAG CODE" function and read (and write down) all displayed diagnosis codes.

(6) Check diagnosis codes against self diagnosis quick reference chart and perform service as indicated.

SERVICE DIAGNOSIS QUICK REFERENCE CHART

Diagnosis code No.	Explanation	Service
—	Normal, The SRS is in good order.	—
11	The circuits for the front impact sensor are shorted to each other.	Perform TEST 5
12	Right or left impact sensor circuit is open or the wire from the sensor to the SDU is open-circuit.	
13	Right and left impact sensor circuits are open or the wires from the sensors to the SDU are open-circuit.	
21	The circuits for the air bag module (squib) are shorted to each other or the circuit is grounded.	Perform TEST 6
22	The air bag module (squib) circuit is open or the wire from the air bag to the SDU (clock spring) is open-circuit.	
31	The capacitor (integrated in the SDU) terminal voltage is higher than the specified value for 5 seconds.	Replace the SDU.
32*	The capacitor (integrated in the SDU) terminal voltage is lower than the specified value for 5 seconds. Or the battery runs short.	If the battery voltage is normal, replace SDU. If the battery is run down, turn the ignition key to the "LOCK" position, disconnect the negative battery cable and wrap the terminal with tape for insulation. Then, charge the battery.
33	The circuit for the cranking signal is shorted to some power supply circuits. It takes at least 45 seconds till the SDU detects this fault.	Perform TEST 7
34	The lock switch (short bar) of the SDU double lock connector is open.	Perform TEST 8
41*	The multi-purpose fuse (No. 12) is blown or the wire from the fuse to the SDU is open-circuit or its resistance value is increased, or the battery runs short. It takes at least 5 seconds till the SDU detects this fault.	If the battery voltage is normal, perform TEST 9. If the battery is run down, turn the ignition key to the "LOCK" position, disconnect the negative battery cable and wrap the terminal with tape for insulation. Then, charge the battery.
42*	The multi-purpose fuse (No. 18) is blown or the wire from the fuse to the SDU is open-circuit or its resistance value is increased, or the battery runs short. It takes at least 5 seconds till the SDU detects this fault.	If the battery voltage is normal, perform TEST 10. If the battery is run down, turn the ignition key to the "LOCK" position, disconnect the negative battery cable and wrap the terminal with tape for insulation. Then, charge the battery.
43	The SRS warning light circuits are open or the wire from the light to the SDU is grounded. It takes at least 5 seconds with the light OFF till the SDU detects this fault	When SRS warning light does not extinguish: Perform TEST 11. When SRS warning light does not illuminate: Perform TEST 12.
44	The SRS warning light drive transistor (integrated in the SDU) is open-circuit.	Replace the SDU.
45	The EEP ROM or A/D converter (integrated in the SDU) is defective.	

NOTE:

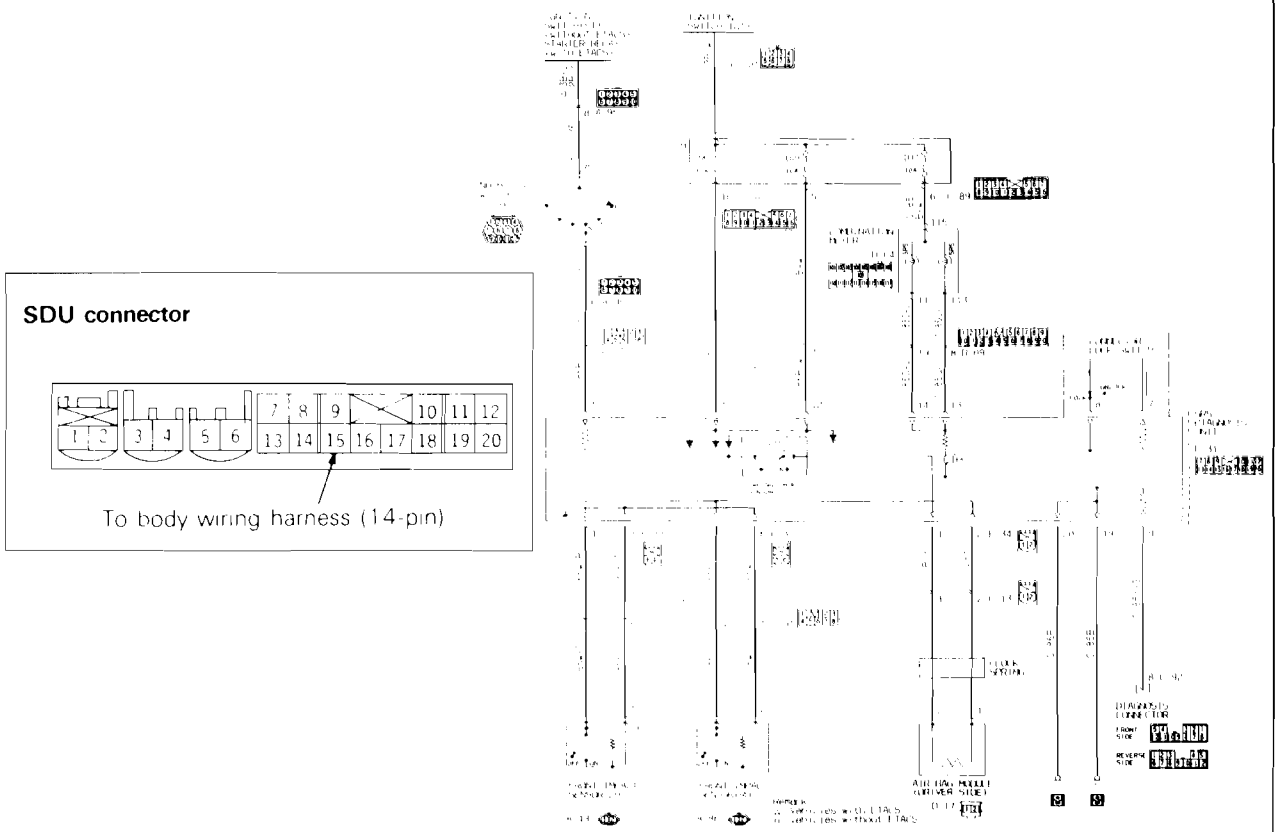
(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly (refer to TEST 1).

(2) SDU = SRS Diagnosis Unit.

(3) *: If the vehicle has a discharged battery it will store the fault codes 32, 41 or 42. When these diagnosis codes are displayed, check the battery.

TEST 3: NO COMMUNICATION BETWEEN MULTI-USE TESTER AND SDU

(SRS warning light does not extinguish)



(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 4.

CAUTION:
Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

(2) Remove the floor console assembly, refer to GROUP 52.

(3) Disconnect the red 14-pin connector from the SDU, refer to Fig. 5.

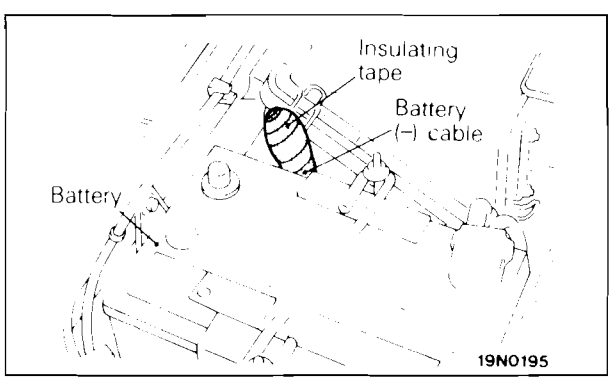


Fig. 4 — Insulating the battery cable terminal

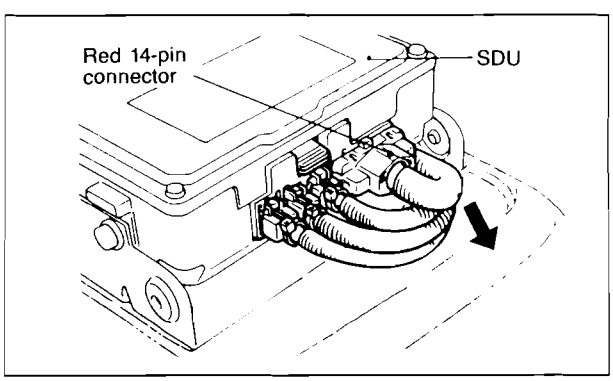


Fig. 5 — SDU 14-pin connector

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(4) Connect the now disconnected red harness-side SDU connector (14-pin) to the connector ③ of the SRS Check Harness, refer Fig. 6.

(5) Check according to the flow chart below, using the specified digital multi-meter.

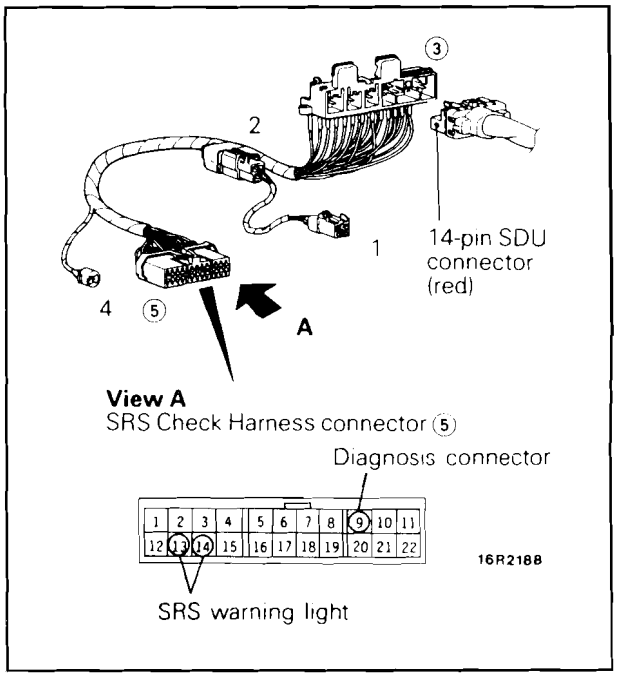
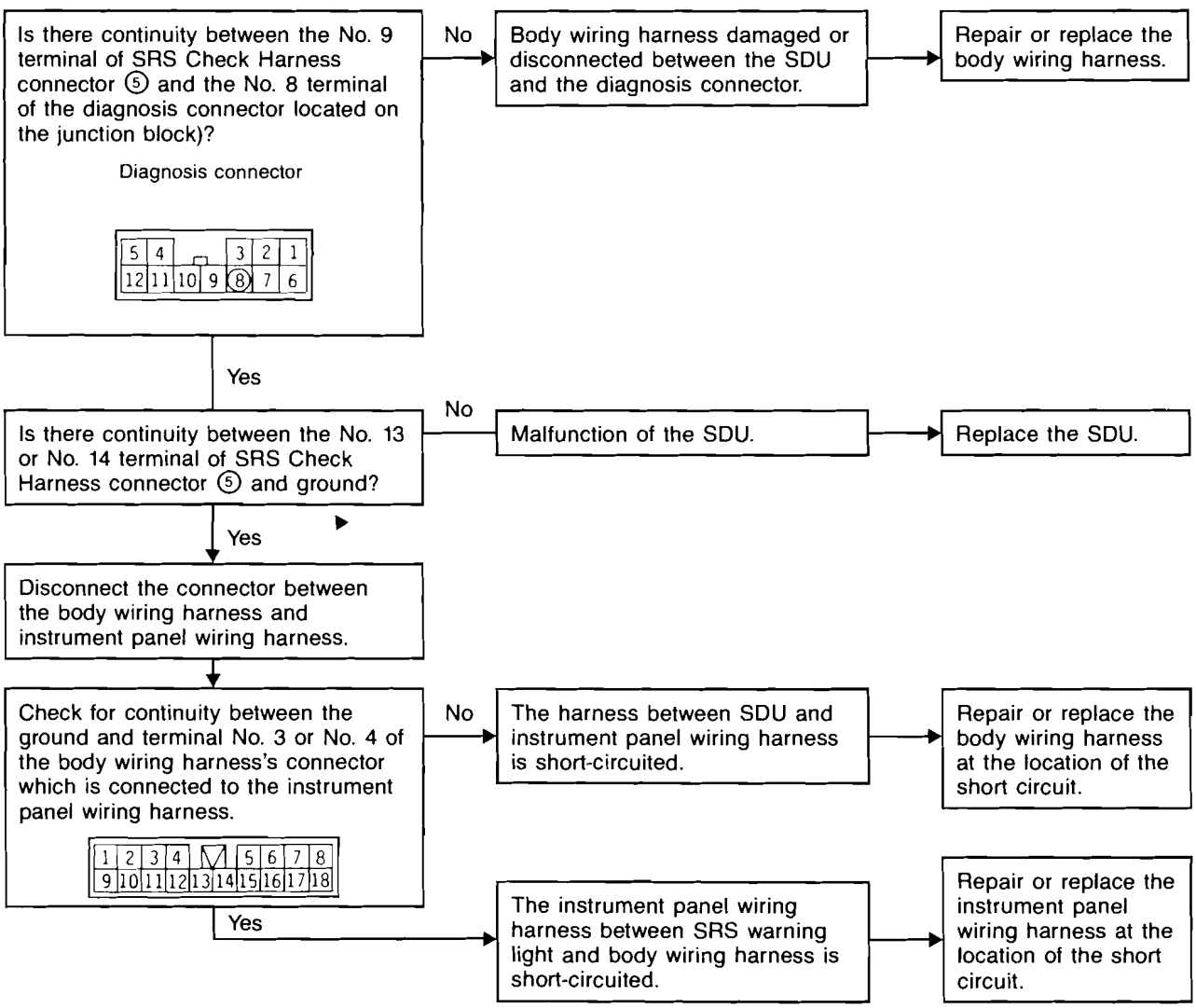


Fig. 6 — SRS check harness



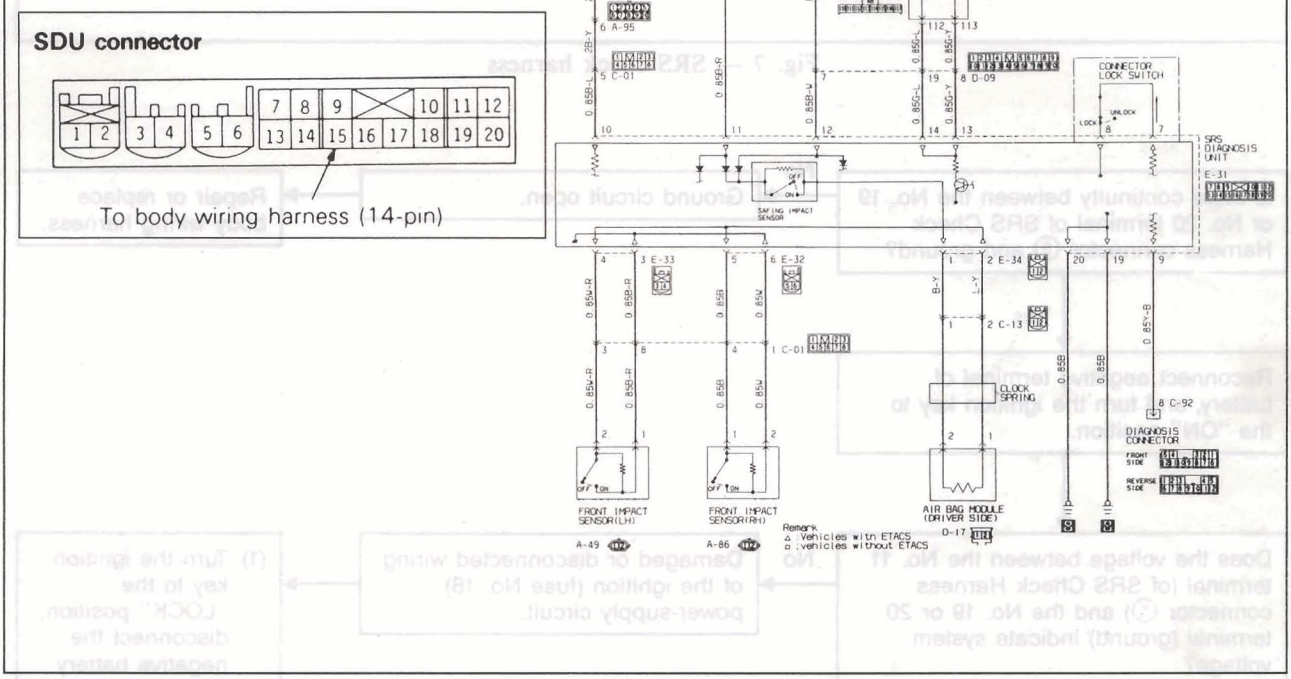
NOTE:

(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1).

(2) SDU = SRS Diagnosis Unit.

TEST 4: NO COMMUNICATION BETWEEN MULTI-USE TESTER AND SDU

(SRS warning light does not extinguish)



(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 4.

(2) Remove the floor console assembly, refer to GROUP 52.

(3) Disconnect the red 14-pin connector from the SDU, refer to Fig. 19.

(4) Connect the now disconnected red harness-side SDU connector (14-pin) to the connector ③ of the SRS Check Harness.

(5) Check according to the following flow chart, using the specified digital multi-meter.

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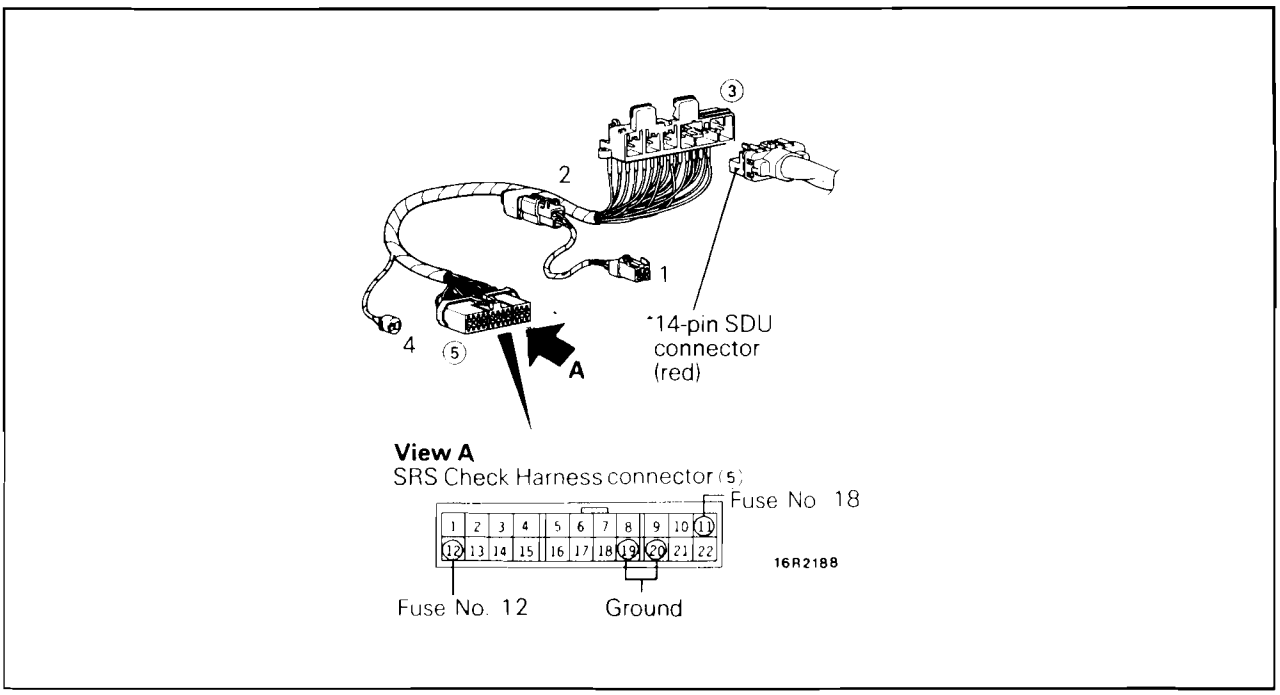
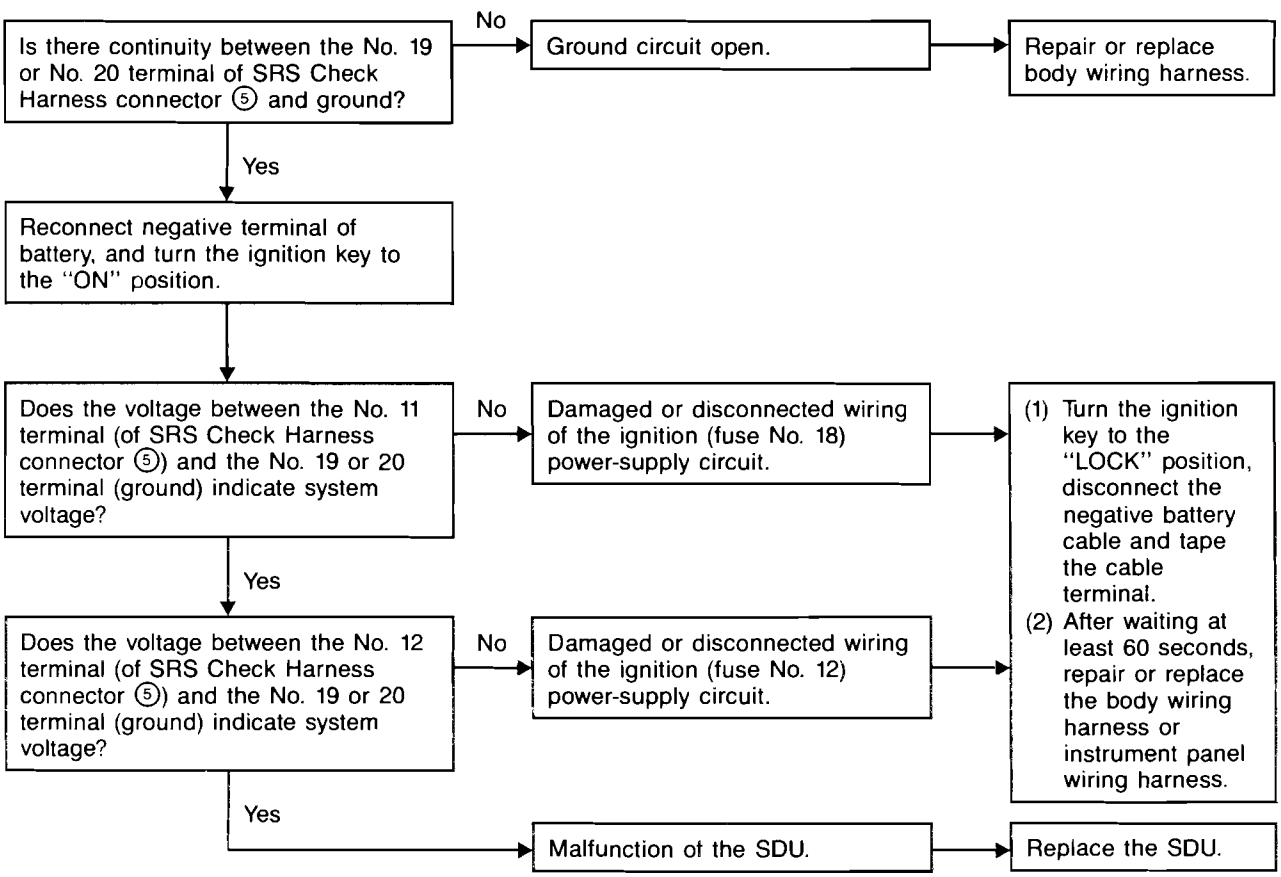


Fig. 7 — SRS check harness

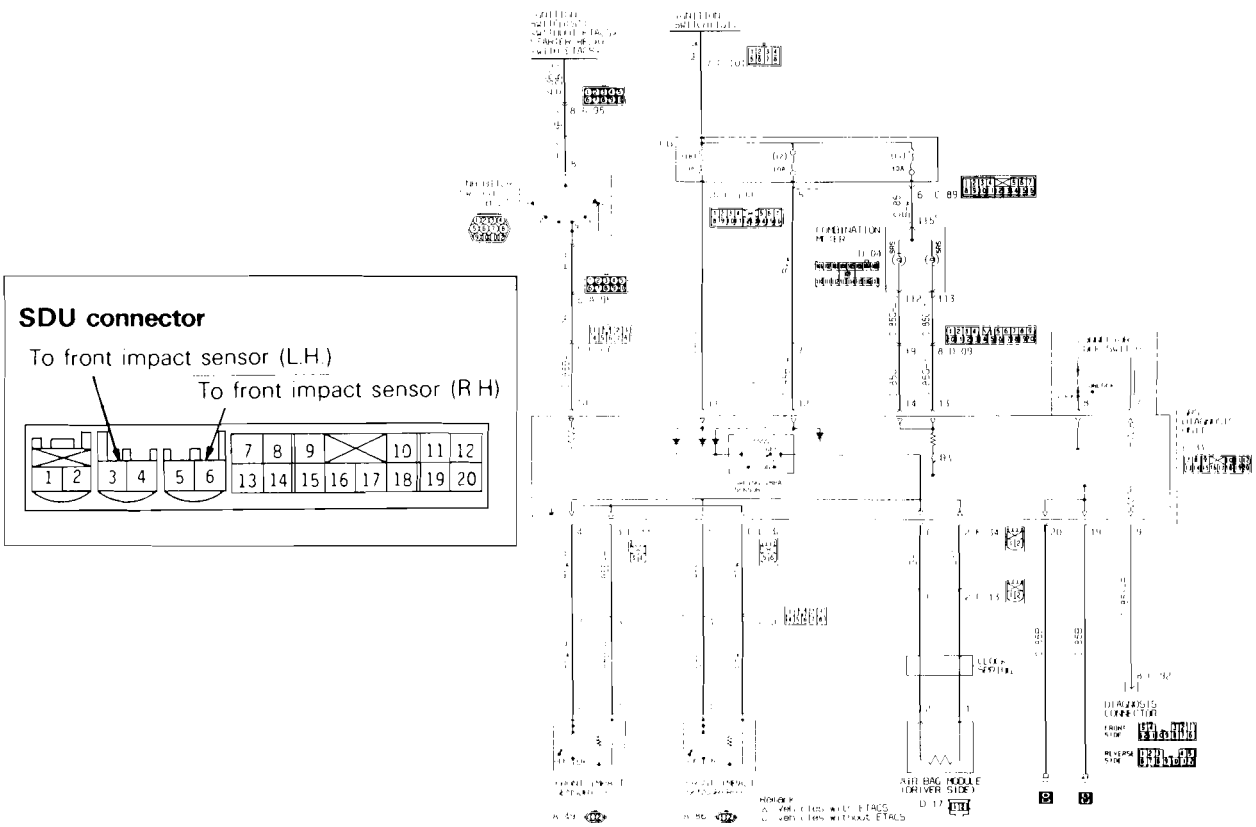


NOTE:

(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1).

(2) SDU = SRS Diagnosis Unit.

TEST 5: WHEN DIAGNOSIS CODE No. 11, No. 12 OR No. 13 IS DISPLAYED



		Front impact sensors		
		Short-circuited	One open-circuited	Two open-circuited
Air bag module (Squib)	Short-circuited	11 and/or 21	12 and/or 21	13 and/or 21
	Open-circuited	11 and/or 22	12 and/or 22	13 and/or 22
The numbers in the boxes are diagnosis codes numbers, refer to Quick Reference Chart.				

NOTE: If combined front impact sensor and air bag module (squib) failure modes simultaneously occur in two places the preconditions for the respective detection circuits will go out of order. For this reason, both diagnosis codes may not be stored, but only one of them may be indicated.
Their relationships are shown in the above table.

(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 8.

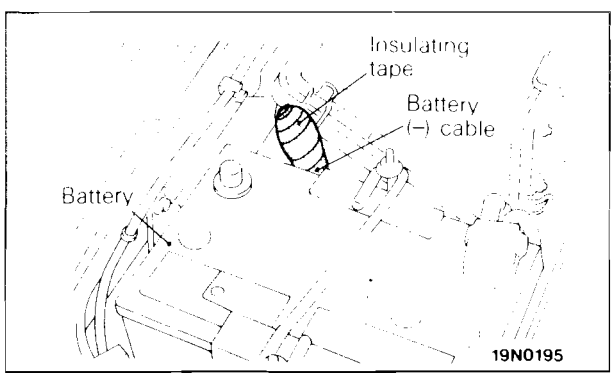


Fig. 8 — Insulating the battery cable terminal

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CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

(2) Remove the floor console assembly, refer GROUP 52.

(3) Disconnect each connector other than 14-pin connector from SDU, refer Fig. 9.

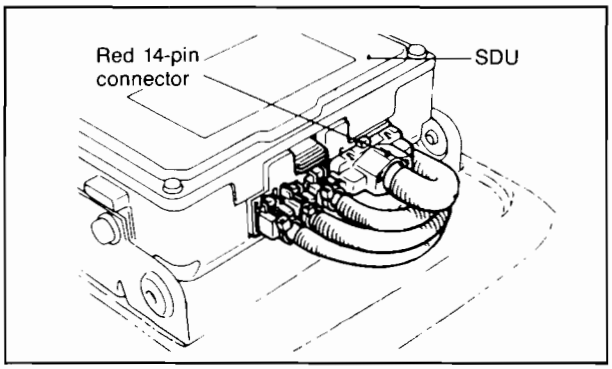


Fig. 9 — SDU 14-pin connector

(4) Locate the blue and yellow connectors (refer Fig. 10) for the wiring leading to the front impact sensors, which were connected to the now disconnected harness side connector of the SDU. Connect the blue and yellow connectors to connector ③ of the SRS Check Harness.

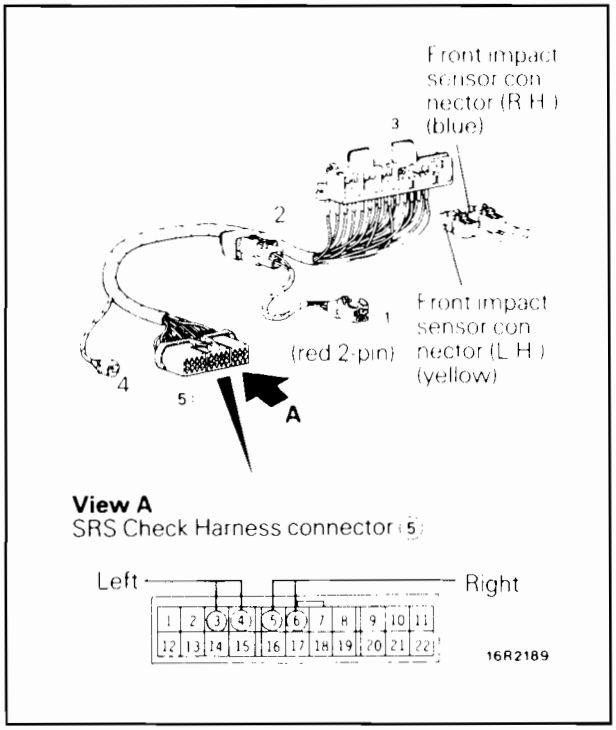
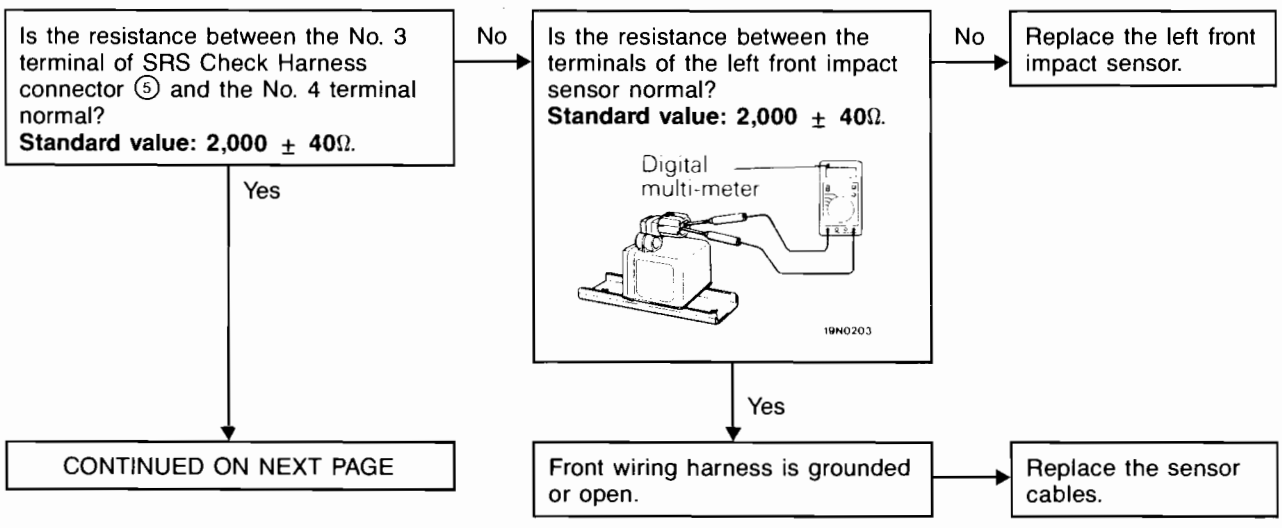


Fig. 10 — SRS Check Harness

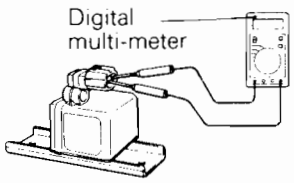
(5) Check according to the flow chart below, using the specified digital multi-meter and Multi-use tester.



CONTINUED FROM PREVIOUS PAGE

Is the resistance between the No. 5 terminal of SRS Check Harness connector ⑤ and the No. 6 terminal normal?
Standard value: 2,000 ± 40Ω.

No → Is the resistance between the terminals of the right front impact sensor normal?
Standard value: 2,000 ± 40Ω.

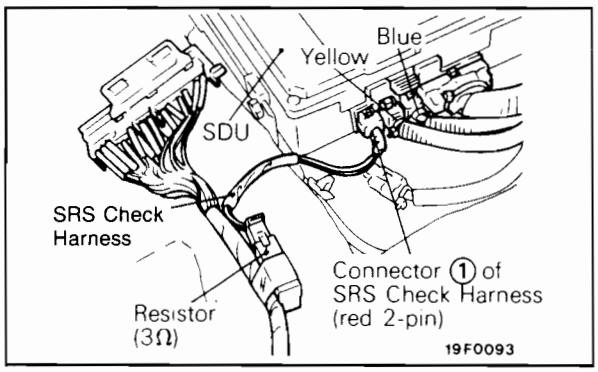


No → Replace the right front impact sensor.

Yes → Front wiring harness is grounded or open. → Replace the sensor cables.

Yes

(1) Connect the red 2-pin connector ① of the SRS Check Harness to the SDU in place of the now disconnected clock spring-SDU connector.



NOTE: A 3-Ohm resistor that corresponds to the resistance of the air bag module (squib) and the wiring resistance is connected between the terminals of the connector ① of the SRS Harness.

(2) Reconnect blue and yellow connectors, for the wiring leading to the front impact sensors, to the SDU and double lock them, refer to p. 52B-2-5.

NOTE: If double locking cannot be made, the connector is incorrectly or incompletely inserted; re-check to insert the connector correctly and securely.

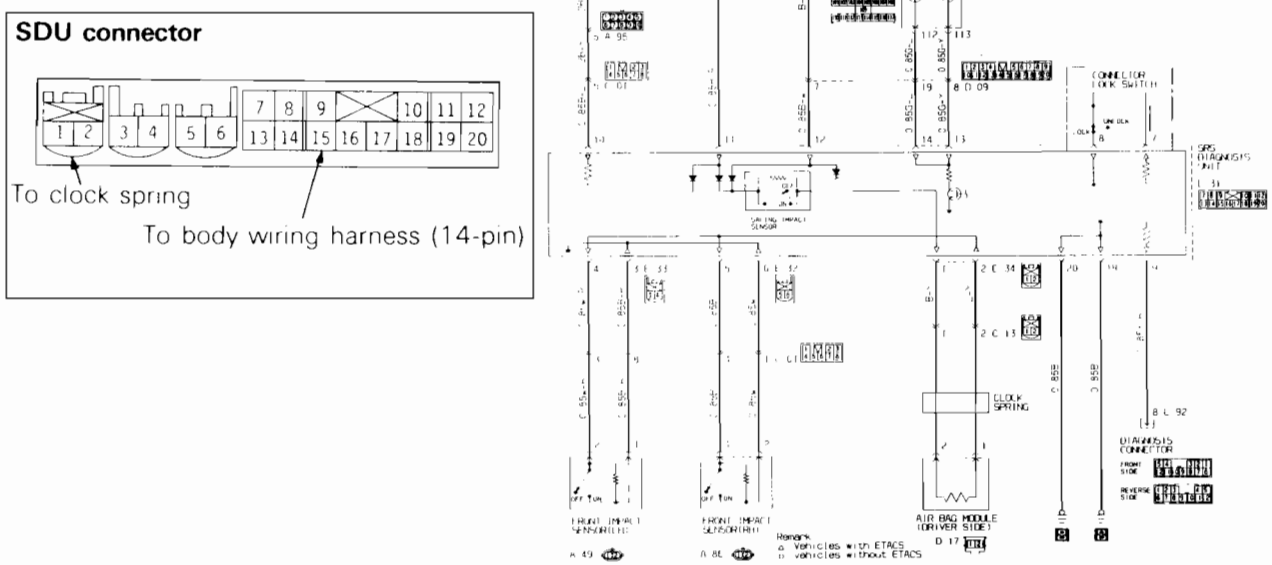
CONTINUED ON P. 52B-3-11 * (TEST 6)

NOTE:

(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1).

(2) SDU = SRS Diagnosis Unit.

TEST 6: WHEN DIAGNOSIS CODE No. 21 OR No. 22 IS DISPLAYED



CAUTION: Never attempt to measure the circuit resistance of the air bag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental air bag deployment will result in serious personal injury.

Have the other diagnosis code test(s) been finished?

No → Perform the other diagnosis code test(s) prior to this test.

Yes

NOTE: If combined front impact sensor and air bag module (squib) failure modes simultaneously occur in two places, the preconditions for the respective detection circuits will go out of order. For this reason, both diagnosis codes may not be stored but only one of them may be indicated.

Their relationships are shown in the following table.

Perform TEST 5 if the problem is not rectified even though TEST 6 has been executed.

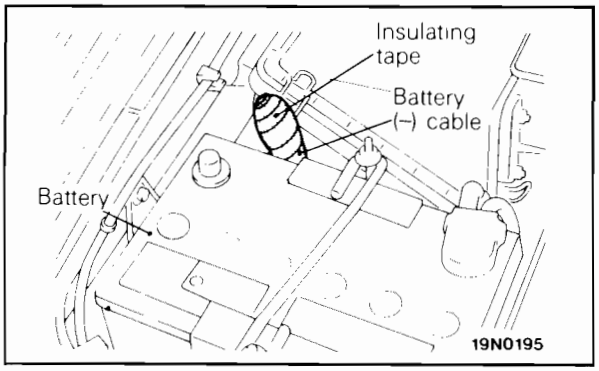
		Front impact sensors		
		Short-circuited	One open-circuited	Two open-circuited
Air bag module (Squib)	Short-circuited	11 and/or 21	12 and/or 21	13 and/or 21
	Open-circuited	11 and/or 22	12 and/or 22	13 and/or 22
The numbers in the boxes are diagnosis codes numbers, refer to Quick Reference Chart.				

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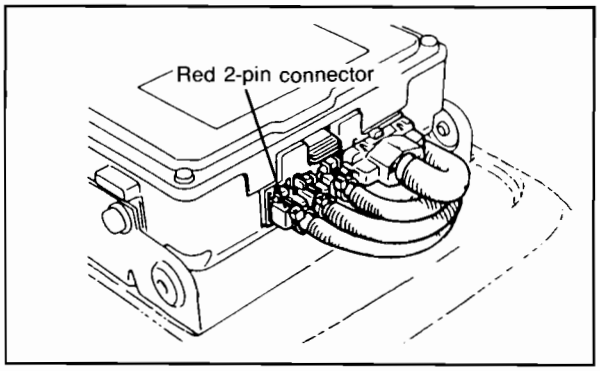
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(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal.

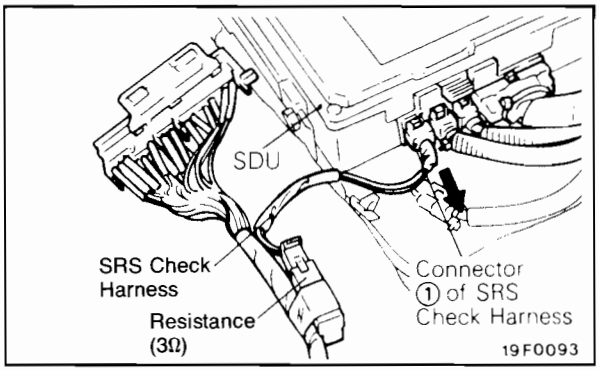


CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

(2) Remove the floor console assembly, refer GROUP 52.
(3) Disconnect the red 2-pin connector from the SDU.



(4) Connect the red connector ① of the SRS Check Harness to the SDU instead of the now-disconnected harness-side connector of the SDU, which were connected to the air bag module (squib) through the clock spring.



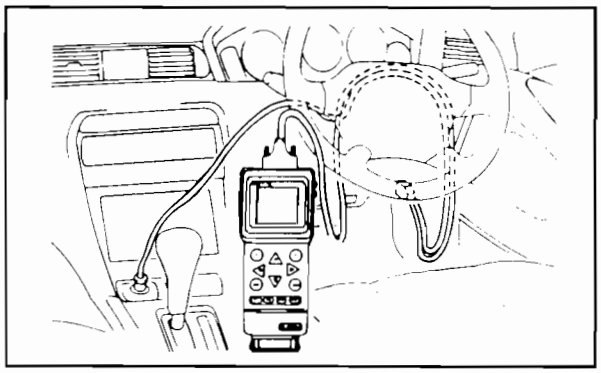
NOTE: A 3-Ohm resistor that corresponds to the resistance of the air bag module (squib) and the wiring resistance is connected between the terminals of the connector ① of the SRS Check Harness.

(5) Secure the connector by double locking.

NOTE: If double locking cannot be made, the connector is incorrectly or incompletely inserted; re-check to insert the connector correctly and securely.

* CONTINUED FROM P. 52B-3-9.

(1) Reconnect negative terminal of battery, and turn the ignition key to the "ON" position.
(2) Using the Multi-use Tester, erase the diagnosis code memory. (Refer to TEST 1).
(3) Return the ignition key from the "ON" to the "LOCK" position and then back to the "ON" position.



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Is the SRS warning light operation normal?

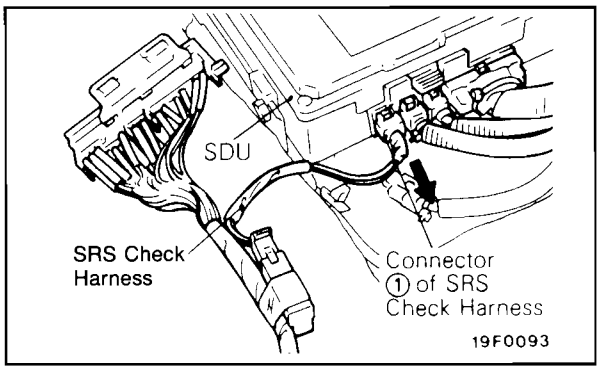
No → Malfunction of the SDU. → Replace the SDU.

Yes

(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to Service Precautions.)

(2) Disconnect the red 2-pin connector ① of the SRS Check Harness from the SDU, refer to figure.

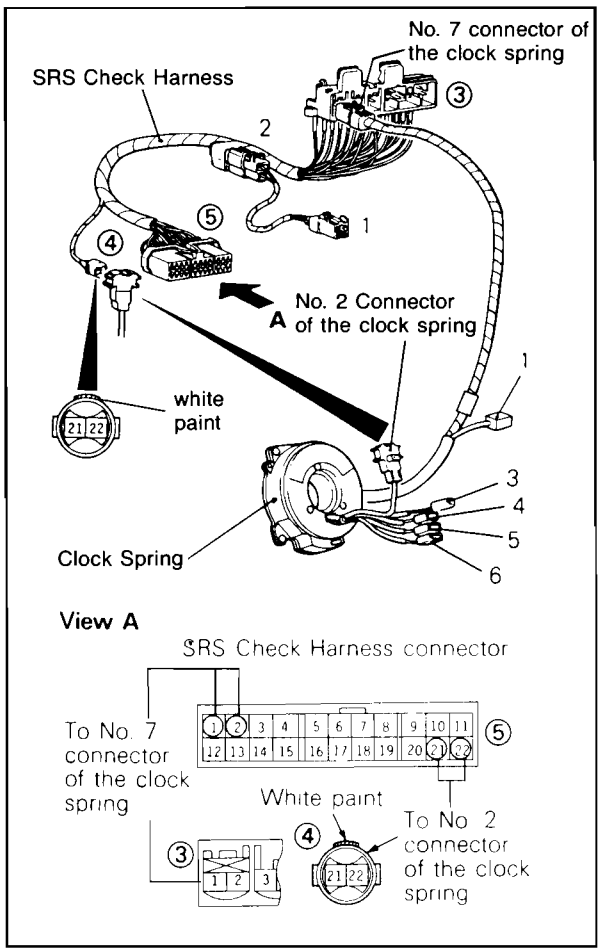


(1) Remove the air bag module.
(2) Join the No. 2 and No. 7 connectors of the clock spring to SRS Check Harness connector ④ and SRS Check Harness connector ③, respectively.

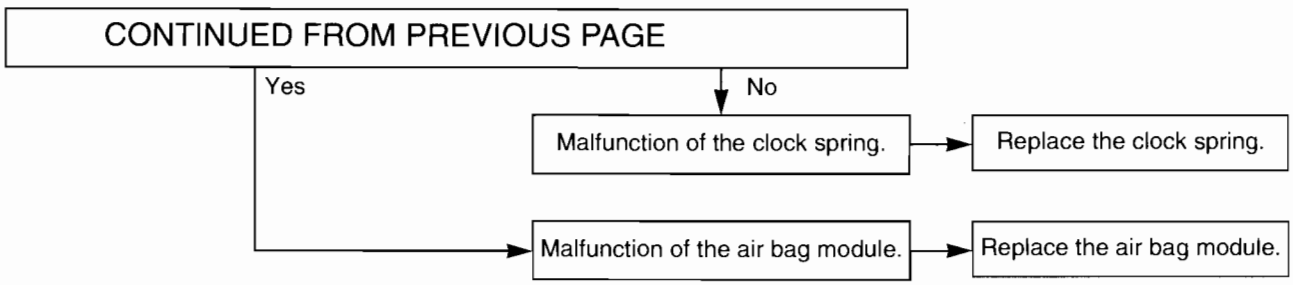
NOTE: When joining SRS Check Harness connector ④, align its white paint with the hollow portion of the No. 2 connector of the clock spring.

(3) Is the resistance between terminal 1 and terminal 21 of SRS Check Harness connector ⑤, and between terminal 2 and terminal 22 of SRS Check Harness connector ⑤ normal?

Standard value: less than 0.4Ω



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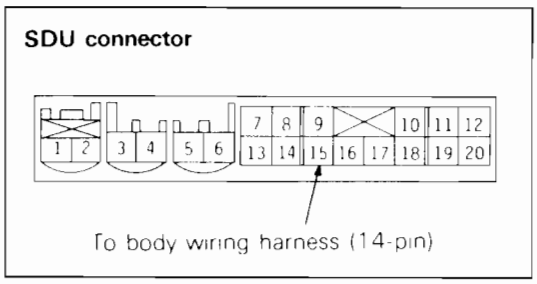
CAUTION: Never attempt to measure the circuit resistance of the air bag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental air bag deployment will result in serious personal injury.

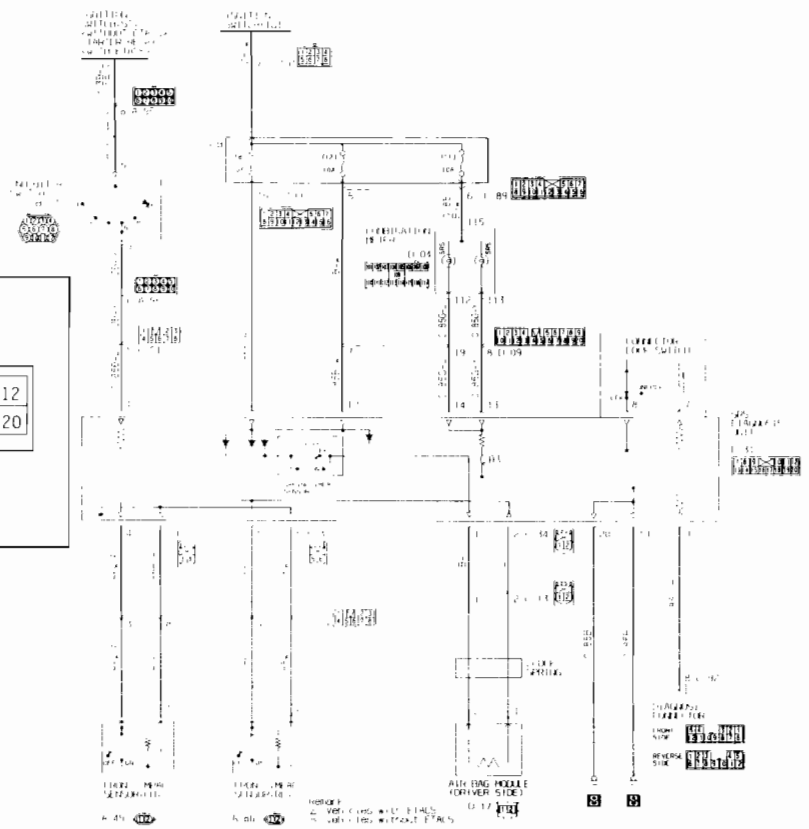
NOTE:

(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1).

(2) SDU = SRS Diagnosis Unit.

TEST 7: WHEN DIAGNOSIS CODE No. 33 IS DISPLAYED





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(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 11.

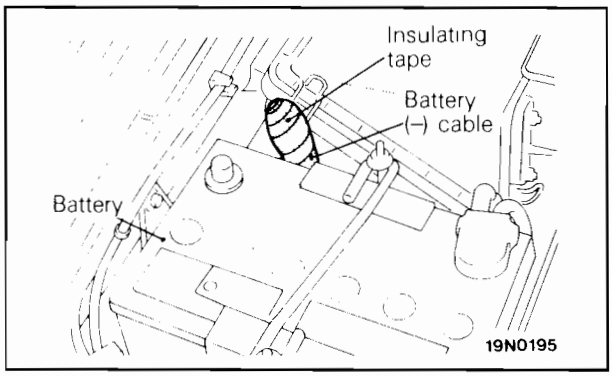


Fig. 11 — Insulating battery cable

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to Service Precautions.)

(2) Remove the floor console assembly, refer to GROUP 52.

(3) Disconnect the red 14-pin connector from the SDU, refer to Fig. 12.

(4) Connect the now disconnected red harness-side SDU connector (14-pin) to the connector ③ of the SRS Check Harness, refer Fig, 13.

(5) Check according to the flow chart below, using the digital multi-meter.

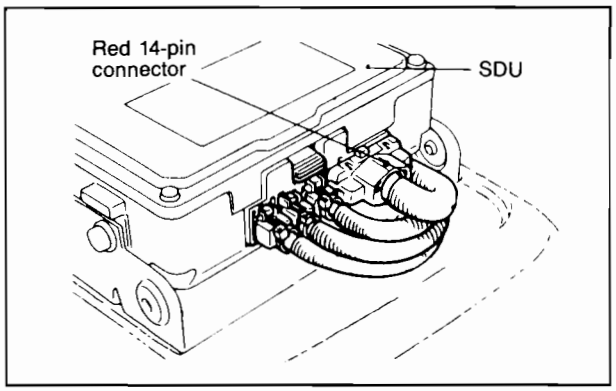


Fig. 12 — SDU 14-pin connector

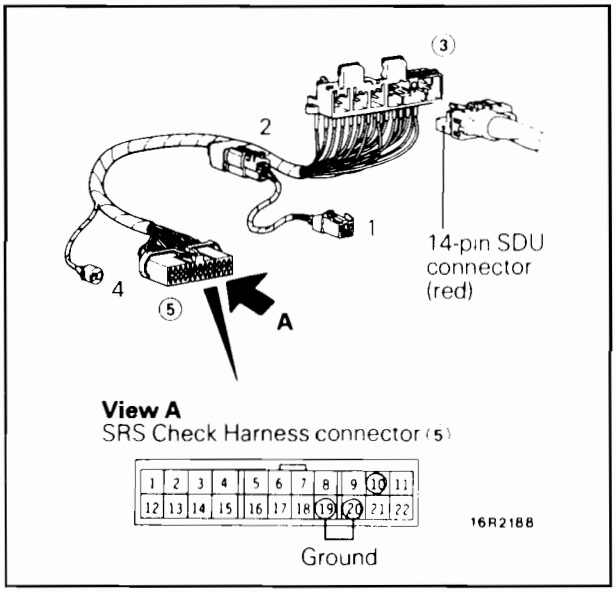
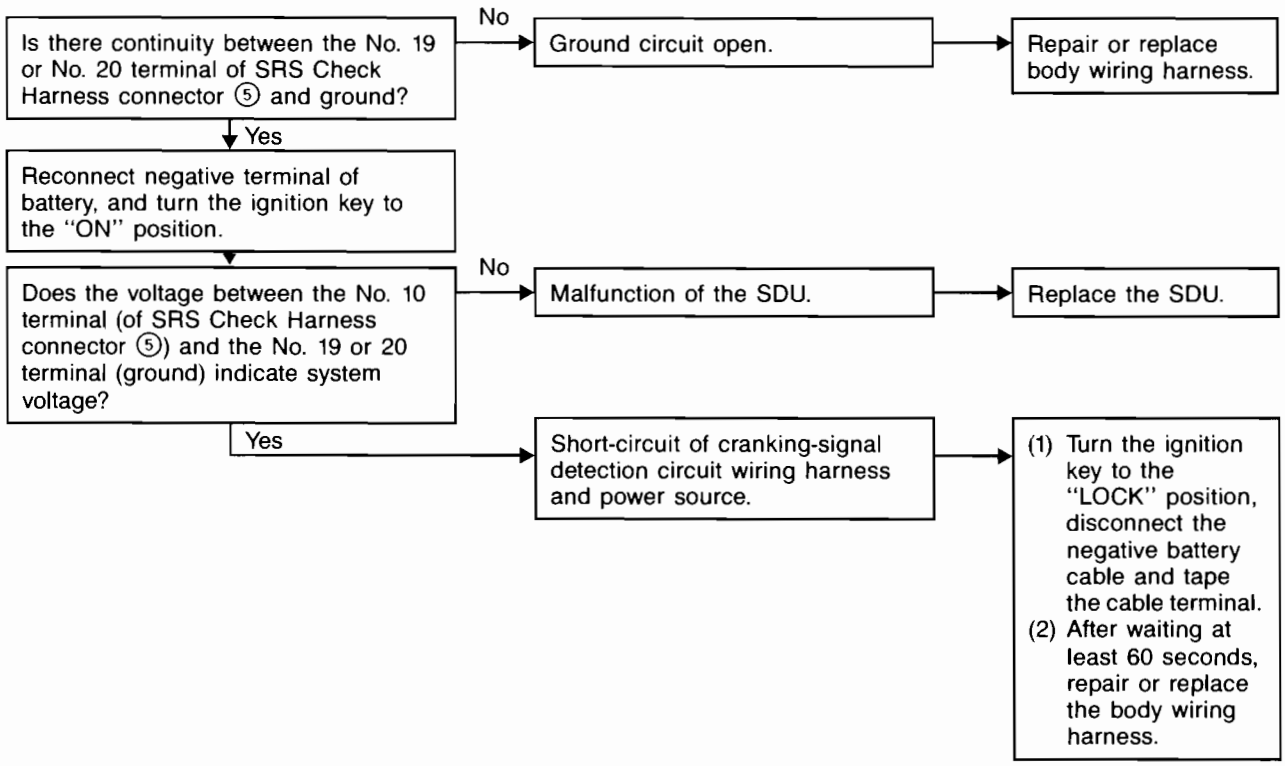


Fig. 13 — SRS Check Harness



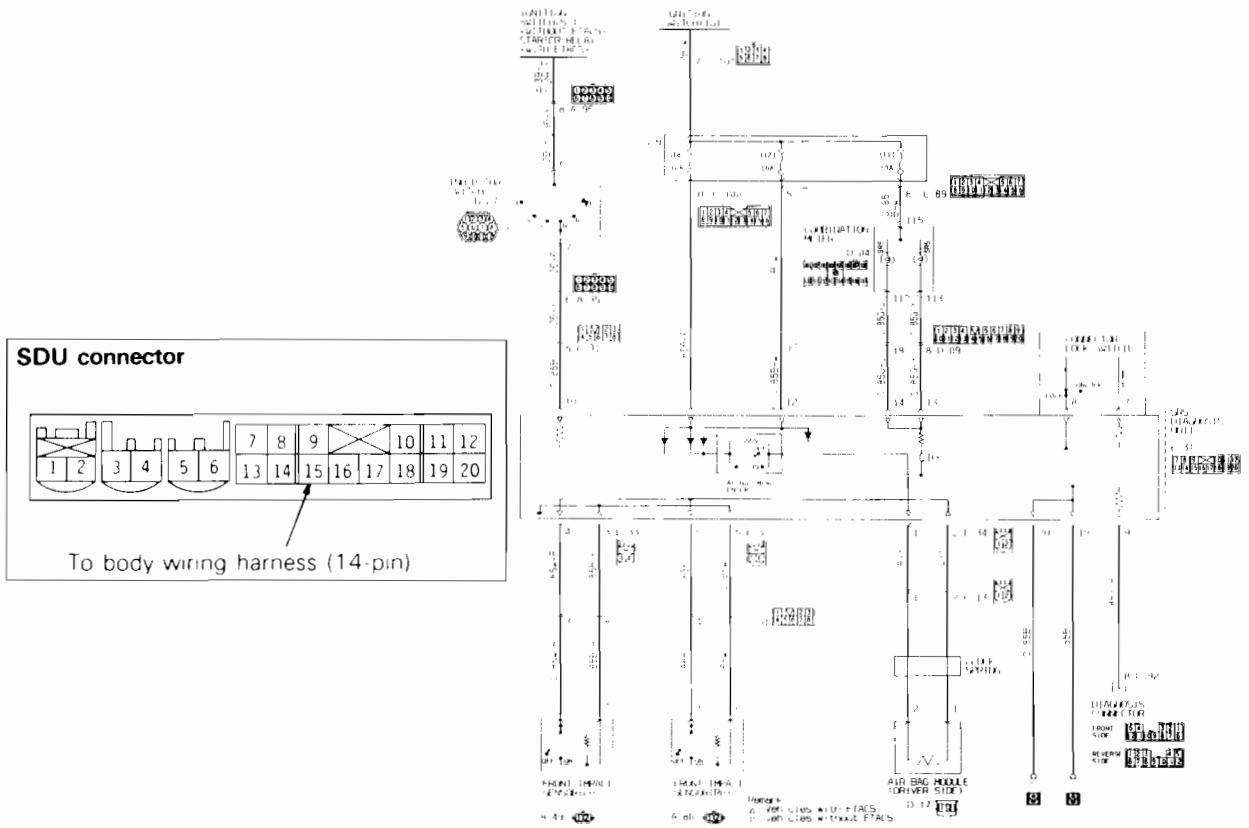
NOTE:

(1) If more than 45 seconds of cranking is required to start up the engine, the diagnosis code will be stored in memory, but if there is no problem, the diagnosis code will be cleared and the SRS will return to normal.

(2) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1.)

(3) SDU = SRS Diagnosis Unit.

TEST 8: WHEN DIAGNOSIS CODE No. 34 IS DISPLAYED



(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 4.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

(2) Remove the floor console assembly, refer to GROUP 52.

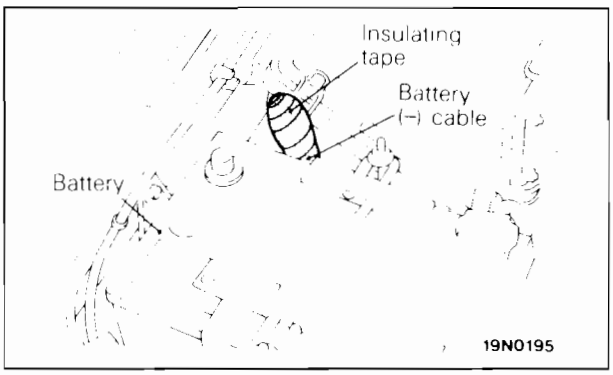
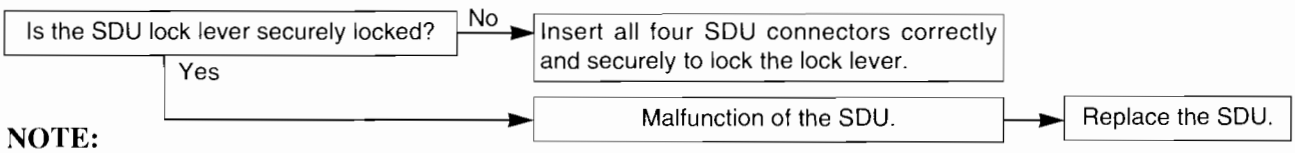


Fig. 14 — Insulating the battery cable terminal



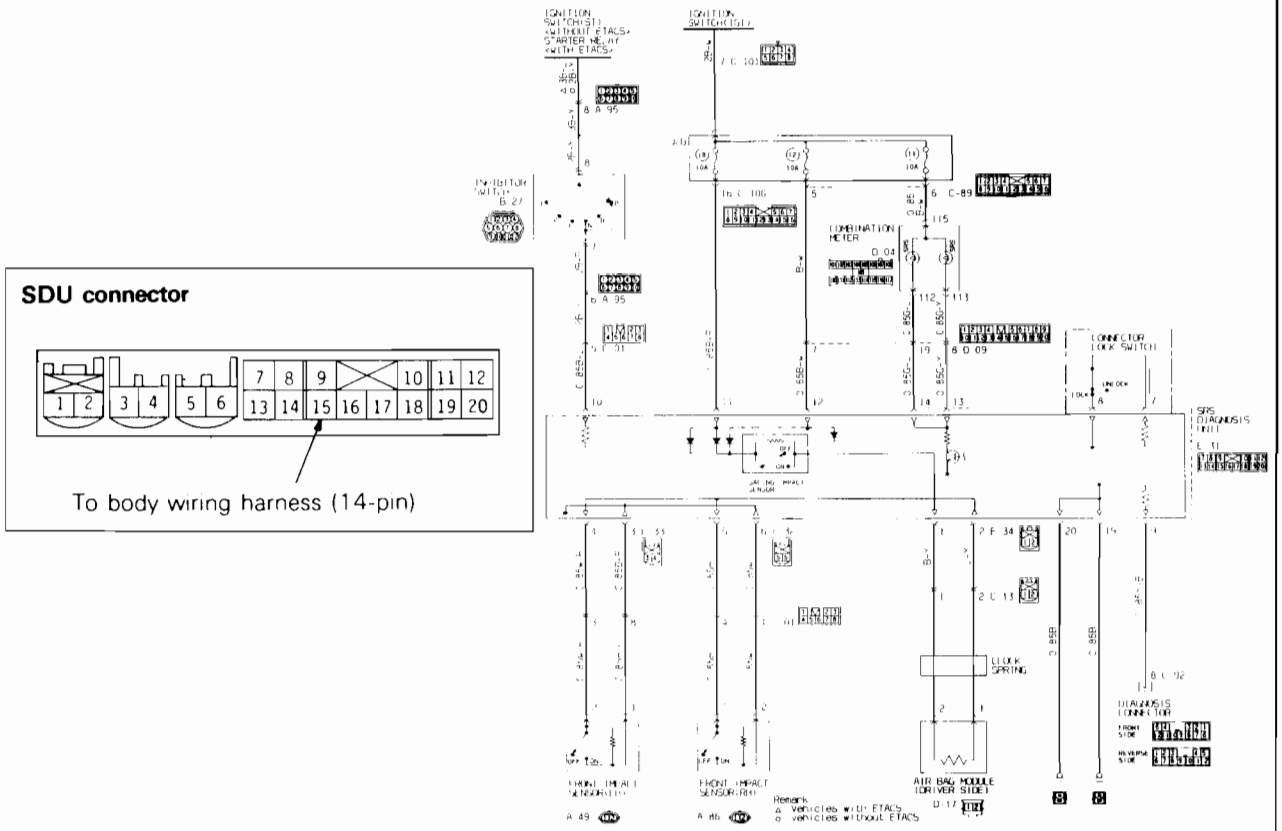
NOTE:

(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1.)

(2) SDU = SRS Diagnosis Unit.

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TEST 9: WHEN DIAGNOSIS CODE No. 41 IS DISPLAYED
TEST 10: WHEN DIAGNOSIS CODE No. 42 IS DISPLAYED



(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 15.

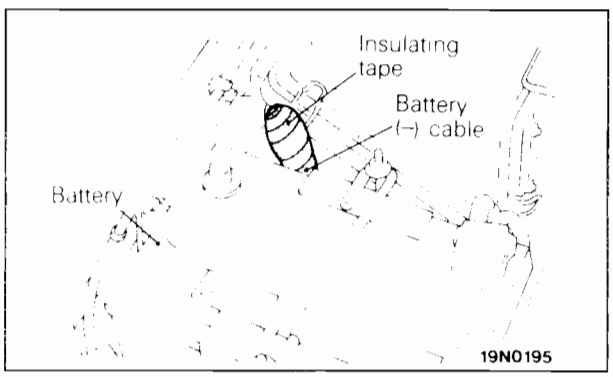


Fig. 15 — Insulating the battery cable terminal

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

(2) Remove the floor console assembly, refer to GROUP 52.

(3) Disconnect the red 14-pin connector from the SDU, refer to Fig. 16.

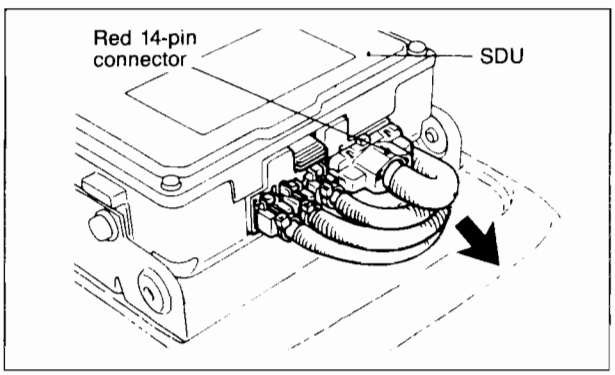


Fig. 16 — 14-pin connector

(4) Connect the now disconnected red harness-side SDU connector (14-pin) to the connector ③ of the SRS Check Harness, refer Fig. 17.

(5) Check according to the following flow chart, using the specified digital multi-meter.

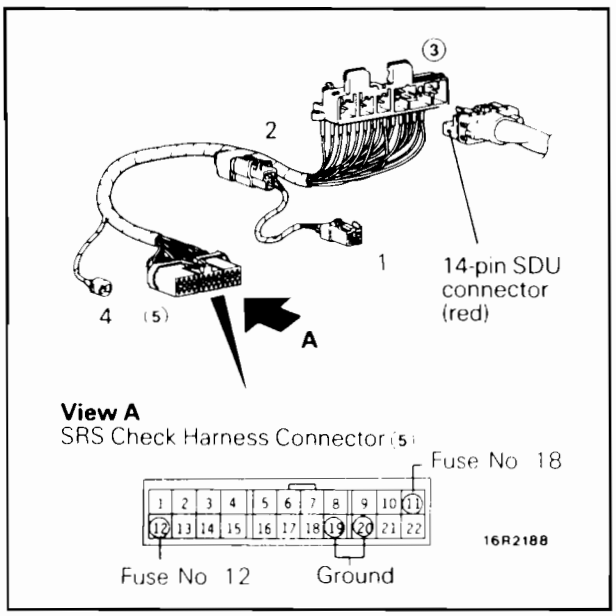
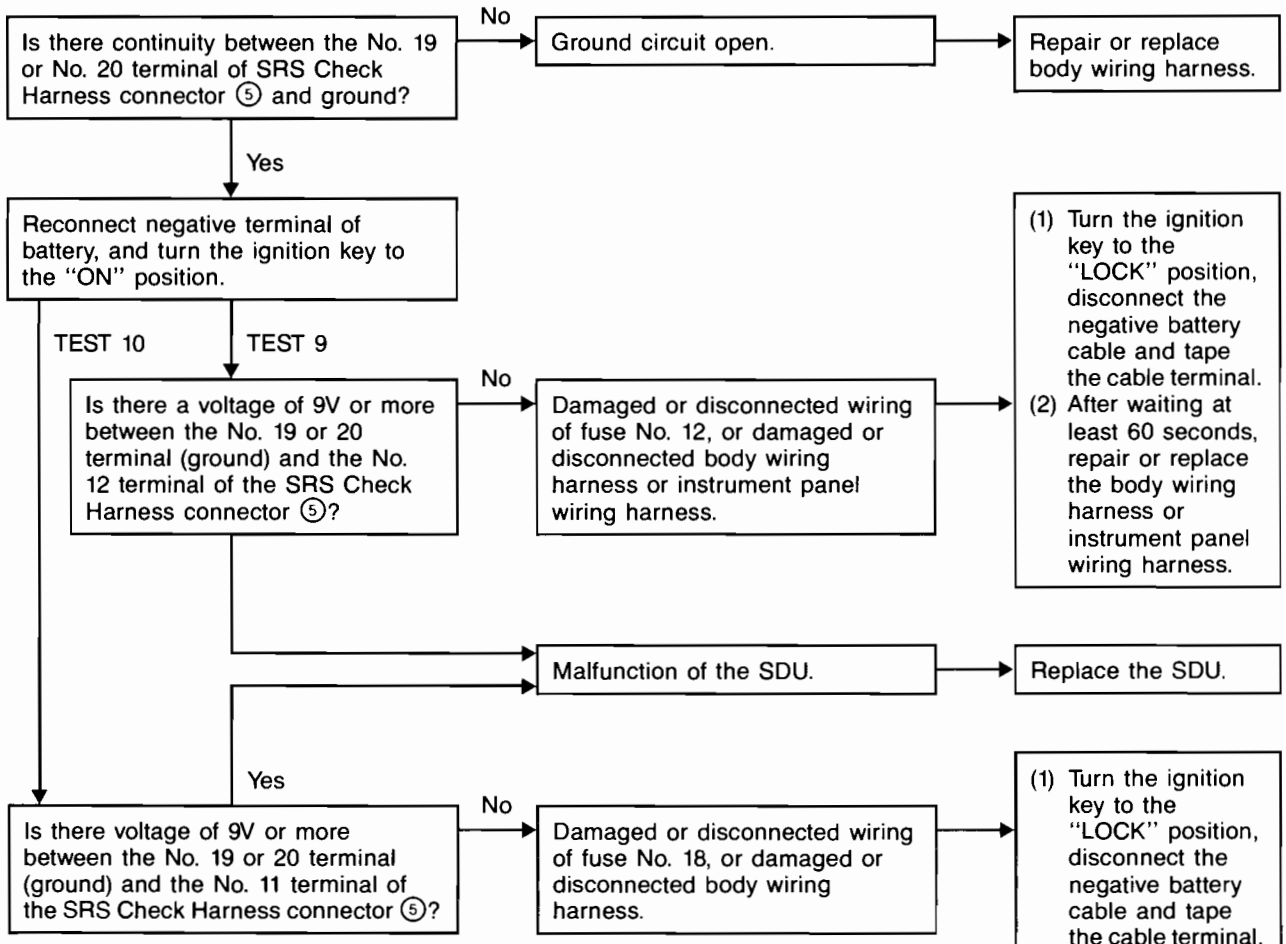


Fig. 17 — SRS Check harness



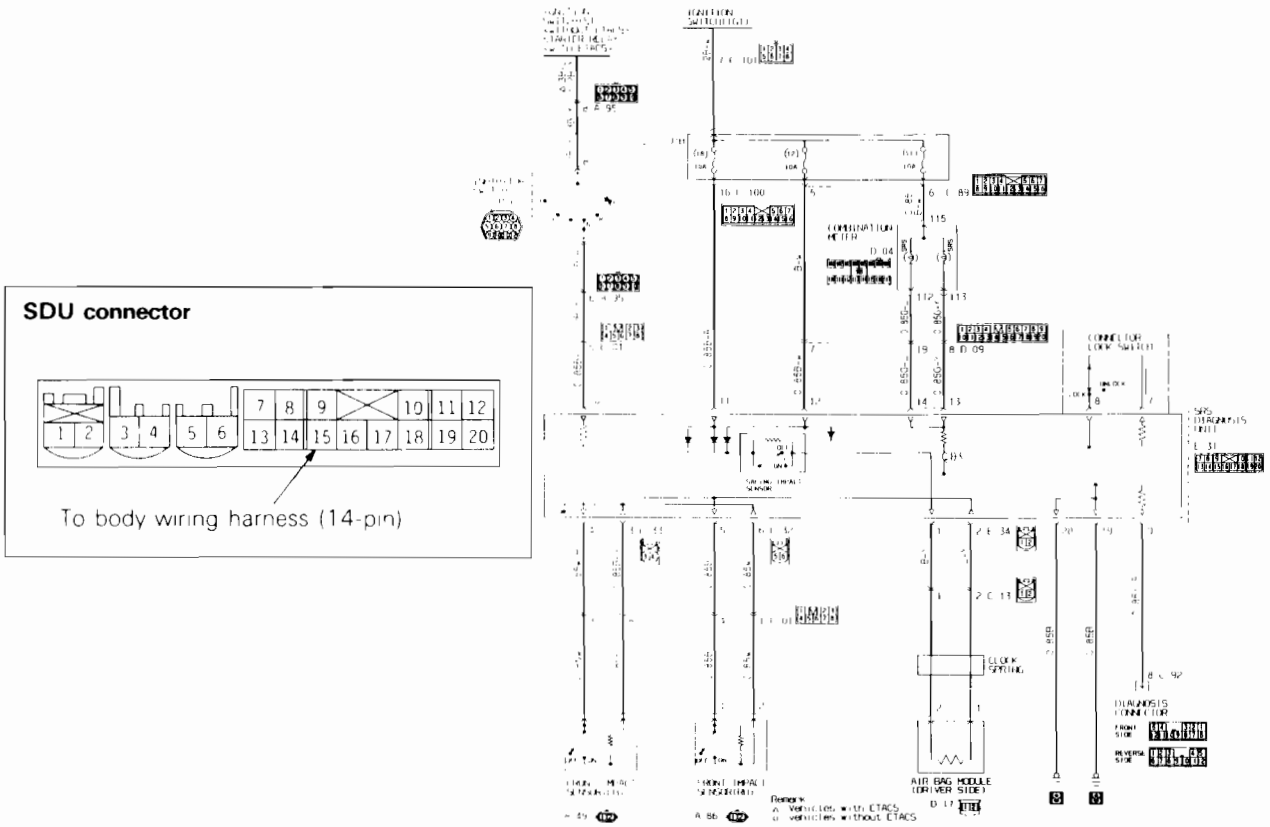
NOTE:

(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1.)

(2) SDU = SRS Diagnosis Unit.

TEST 11: WHEN DIAGNOSIS CODE No. 43 IS DISPLAYED

(SRS warning light does not extinguish)



(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 18.

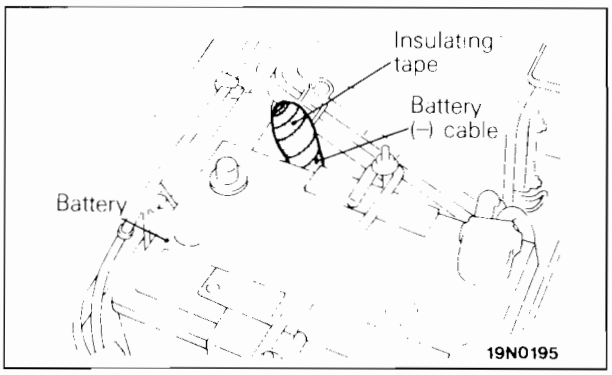


Fig. 18 — Insulating the battery cable terminal

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

(2) Remove the floor console assembly, refer to GROUP 52.

(3) Disconnect the red 14-pin connector from the SDU, refer to Fig. 19.

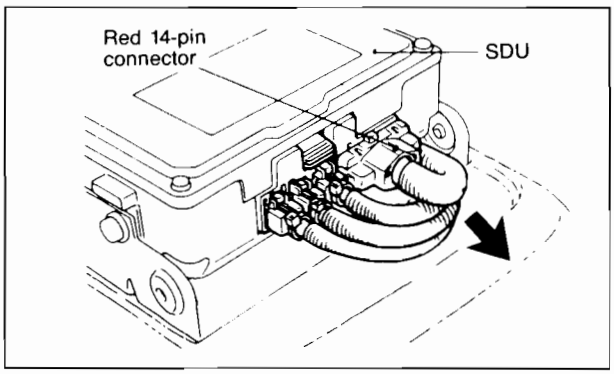


Fig. 19 — 14-pin connector

(4) Reconnect negative terminal of battery, and turn the ignition key to the "ON" position.

(5) Check according to the following flow chart.

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Does the SRS warning light remain illuminated when the red 14-pin connector of the SDU is disconnected?

No → Malfunction of the SDU. → Replace the SDU

Yes → Body wiring harness or instrument panel wiring panel wiring harness between SRS waring light and SDU is grounded.

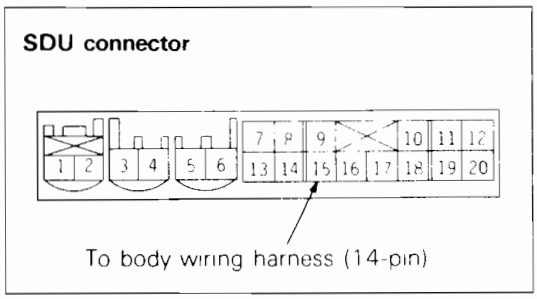
→ (1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape cable terminal.
(2) After waiting at least 60 seconds, repair or replace the body wiring harness or instrument panel wiring harness.

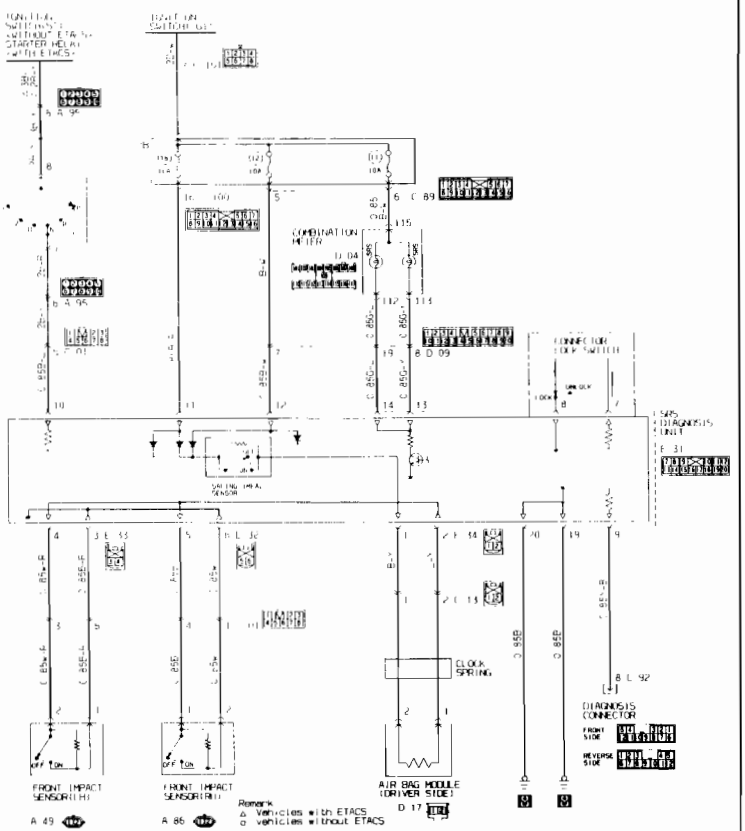
NOTE:

(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1.)

(2) SDU = SRS Diagnosis Unit.

TEST 12: WHEN DIAGNOSIS CODE No. 43 IS DISPLAYED





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(1) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 20.

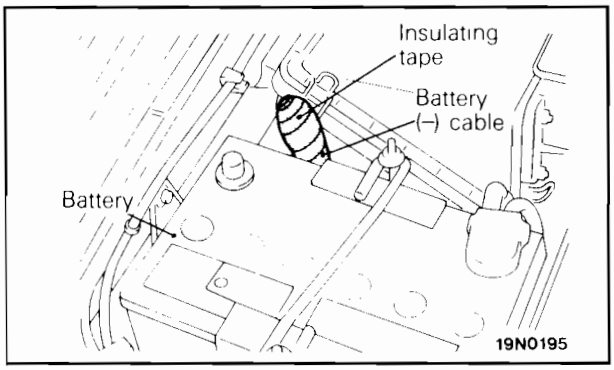


Fig. 20 — Insulating battery cable

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

(2) Remove the floor console assembly, refer GROUP 52.

(3) Disconnect the red 14-pin connector from the SDU, refer to Fig. 21.

(4) Connect the now disconnected red harness-side SDU connector (14-pin) to the connector ③ of the SRS Check Harness, refer Fig. 22.

(5) Check according to the following flow chart, using the specified digital multi-meter.

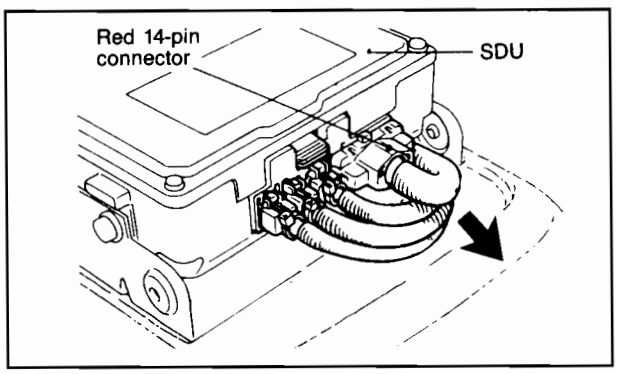


Fig. 21 — SDU 14-pin connector

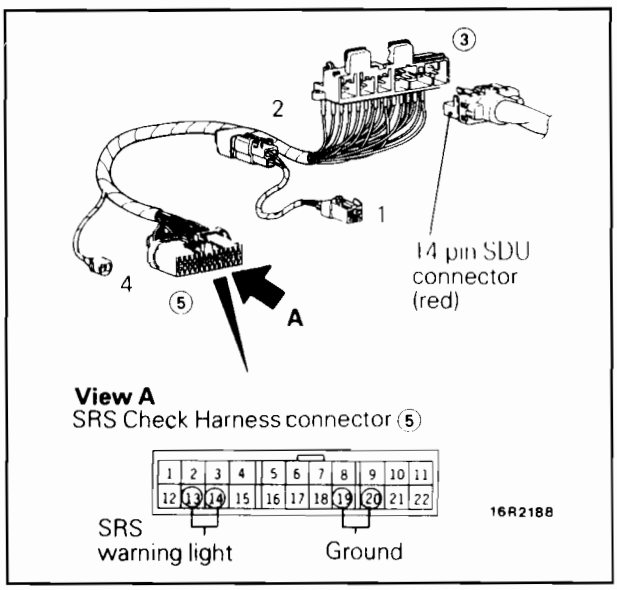
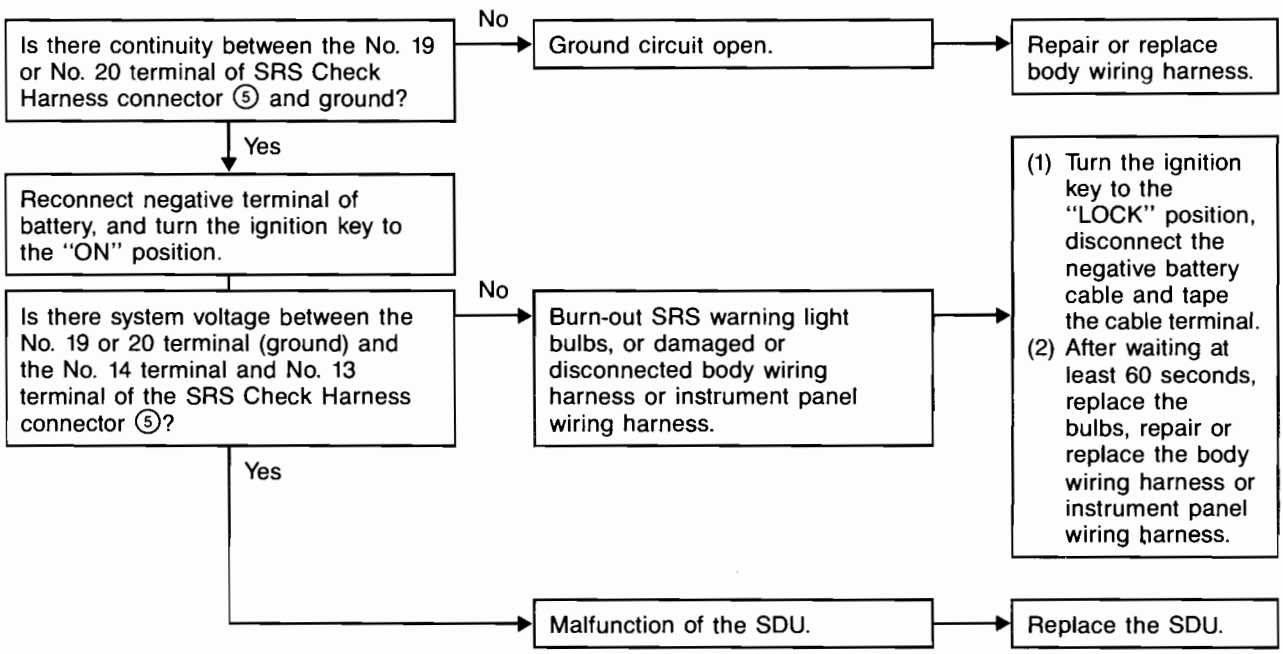


Fig. 22 — SRS check harness



NOTE:

(1) After repairing the SRS, reconnect the battery cable, erase the diagnosis code memory using the Multi-use Tester and check the SRS warning light operation to verify the system functions properly. (Refer to TEST 1).

(2) SDU = SRS Diagnosis Unit.

SRS WIRING DIAGRAMS

CAUTION

(1) Do not repair, splice or modify SRS wiring (except for specific repairs to the body wiring harness) replace wiring if necessary, after reading and following all precautions and procedures in this manual.

(2) Do not use an analogue Ohmmeter to check SRS wiring or components; use only special tools and the digital multi-meter listed in Special Tools.

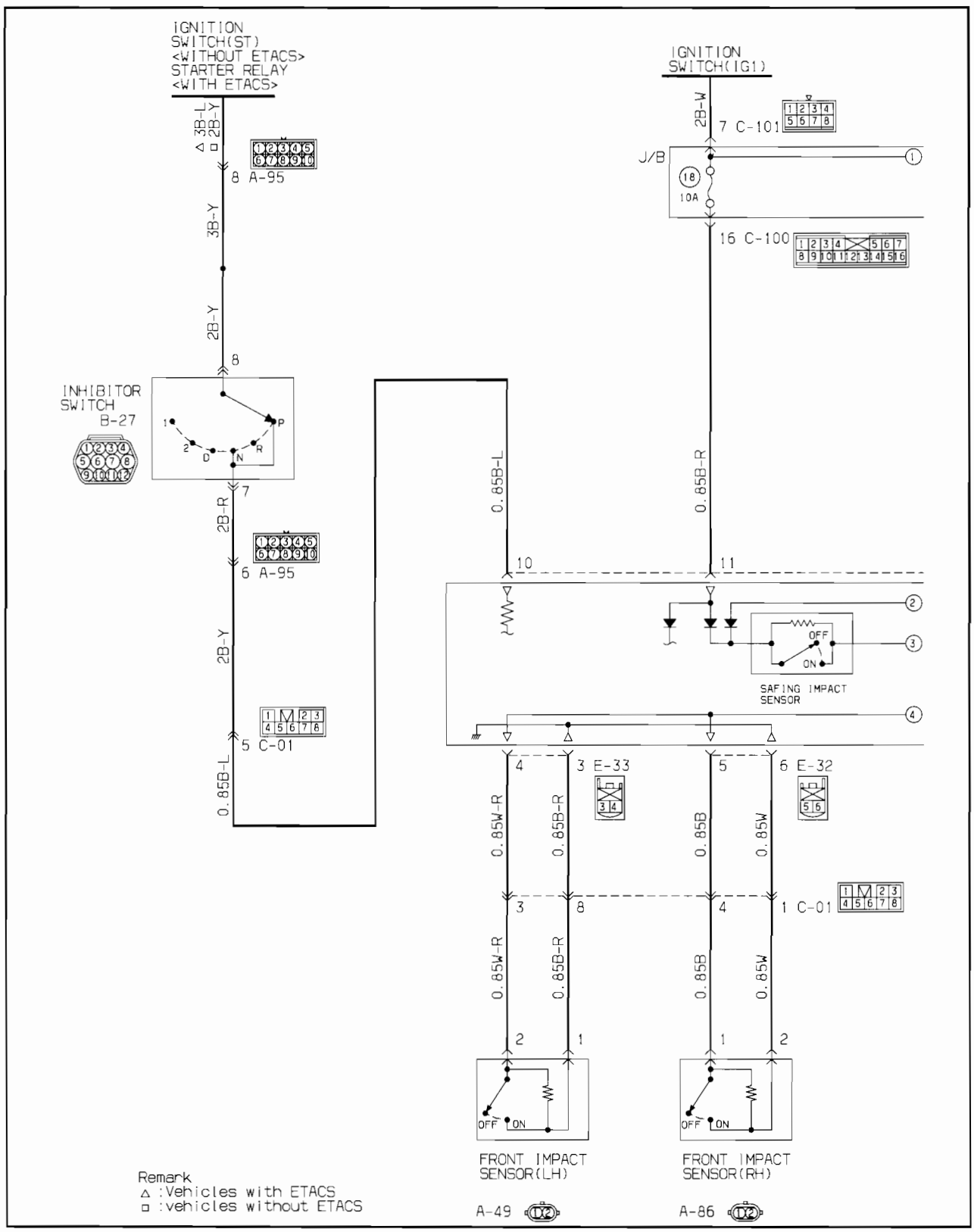


Fig. 23 — SRS (AIR BAG) Wiring diagram

Caution:
Carefully read and observe the SRS SERVICE PRECATIONS (Refer to GROUP 52B – Service Precautions) prior to any service.

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

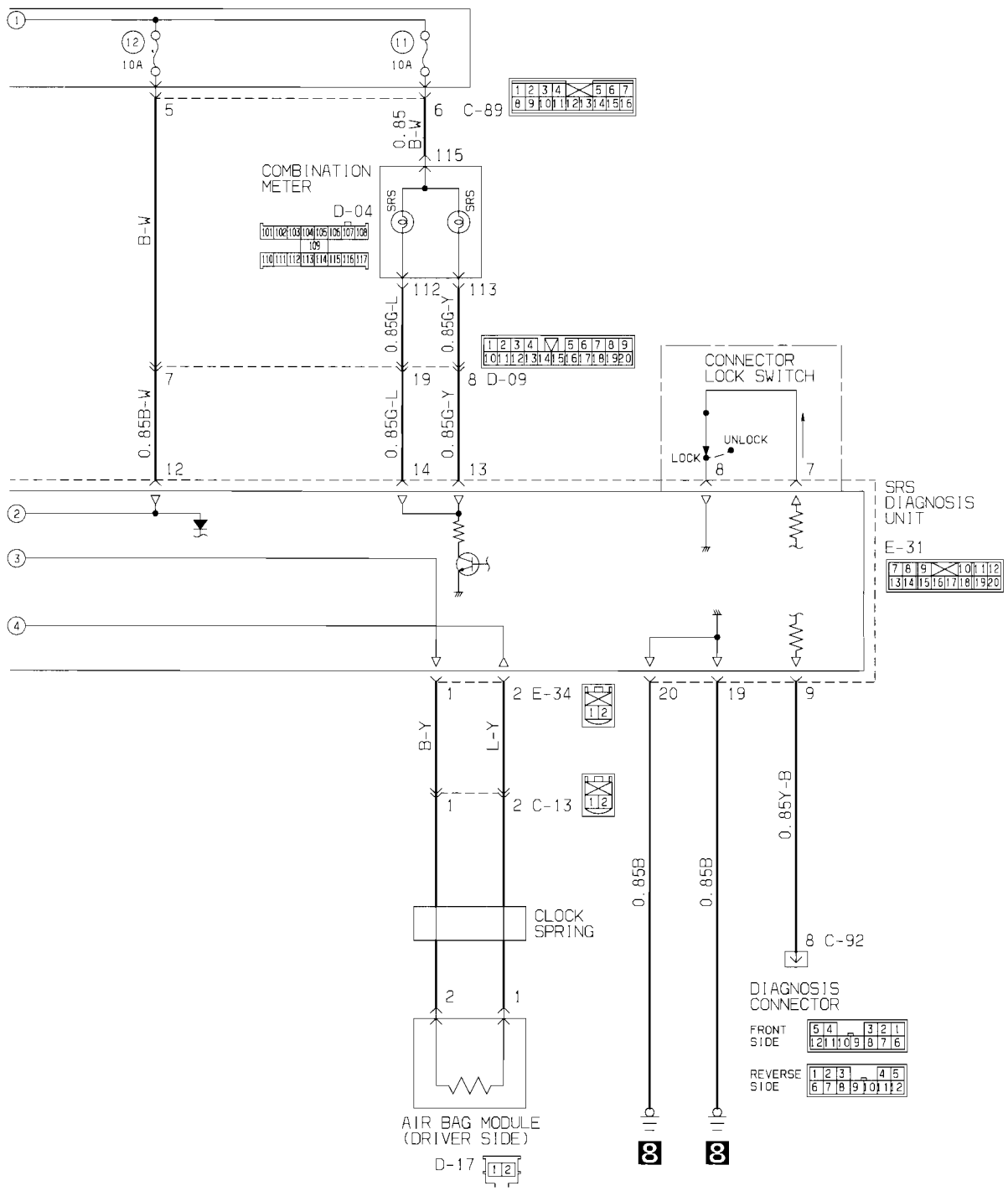


Fig. 24 — SRS (AIR BAG) Wiring diagram

SECTION 4 — SRS SERVICE PRECAUTIONS

(1) In order to avoid injury to yourself or others from accidental deployment of the air bag during SRS servicing, read and carefully follow all the precautions and procedures described in this manual.

(2) Do not use any electrical test equipment on or near SRS components, except those specified.

Never use an analogue Ohmmeter.

(3) Never attempt to repair the following components:

- Front Impact Sensors
- SRS Diagnosis Unit (SDU)
- Clock Spring
- Air Bag Module.

If any of those components are diagnosed as faulty, they should only be replaced, in accordance with the INDIVIDUAL COMPONENT SERVICE procedures in this manual.

(4) Do not attempt to repair the wiring harness connectors of the SRS. If any of the connectors is diagnosed as faulty, replace the wiring harness. If the wires are diagnosed as faulty, replace or repair the wiring harness according to the following table.

SDU Terminal No.	Harness Connector (No. of Terminals, Color)	Destination of Harness	Corrective Action
1 2	2 pins, red	Clock spring	Replace clock spring.
3 4	2 pins, yellow	Front wiring harness → Front impact sensor (LH)	Replace with sensor cable.
5 6	2 pins, blue	Front wiring harness → Front impact sensor (RH)	
7 and 8	14 pins, red	—	—
9		Body wiring harness → Diagnosis check pin	Correct or replace each wiring harness.
10		Body wiring harness → Front wiring harness → Control wiring harness → Front wiring harness → Body wiring harness → Ignition switch (ST)	
11		Body wiring harness → Junction block (fuse No. 18)	
12		Body wiring harness → Instrument panel wiring harness → Junction block (fuse No. 12)	
13 14		Body wiring harness → Instrument panel wiring harness → SRS warning light	
15 to 18		—	—
19 20		Body wiring harness → Ground	Correct or replace body wiring harness.

(5) After disconnecting the battery cable, wait 60 seconds or more and proceed with the following:

CAUTION: The SRS system is designed to retain enough voltage to deploy the air bag for a short time even after the battery has been disconnected, so serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cable is disconnected.

(6) SRS components should not be subjected to heat over 93°C (200°F), so remove the front impact sensors, SRS diagnosis unit and air bag module and clock spring before drying or baking the vehicle after painting.

Recheck SRS system operability after re-installing them.

(7) Whenever you finish servicing the SRS, check the SRS warning light operation to make sure that the system function properly.

(8) Make certain that the ignition switch is at OFF when the Multi-use Tester is connected or disconnected.

NOTE: Serious injury can result from unintended air bag deployment. So use only the procedures and equipment specified in this manual.

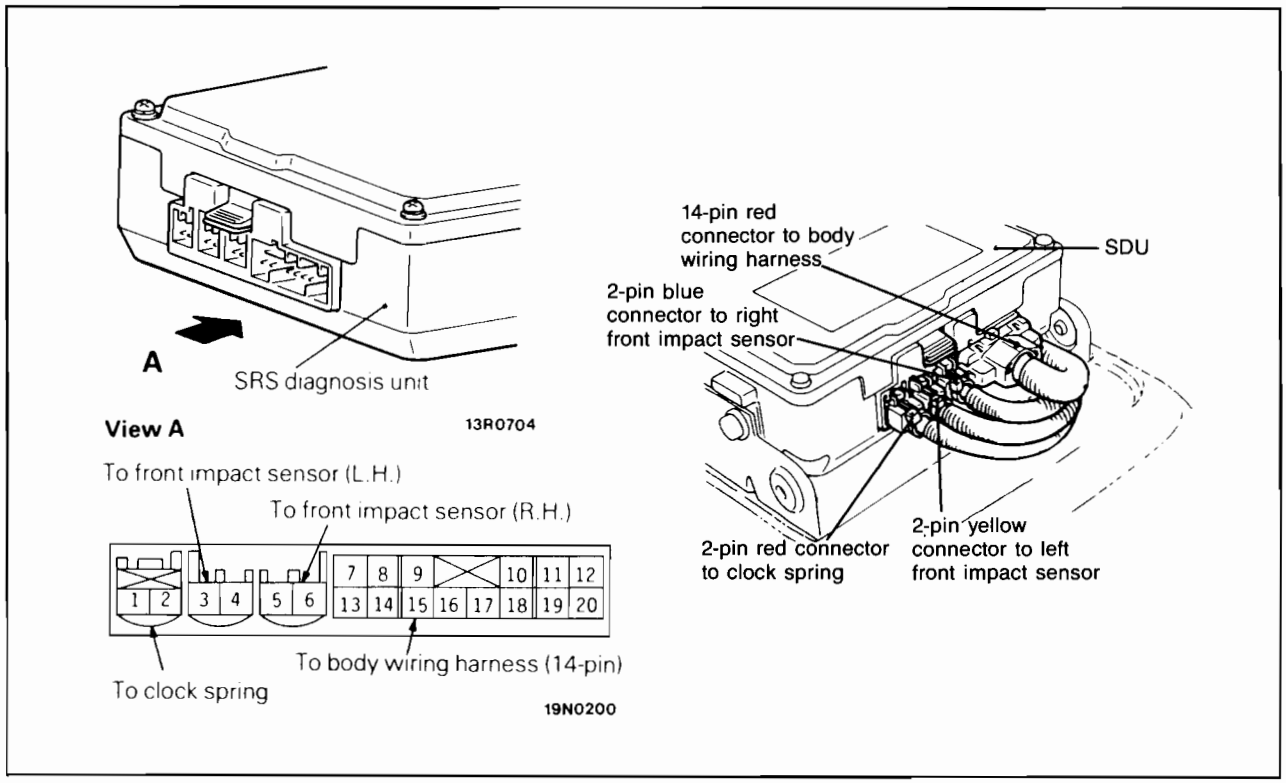


Fig. 1 — SRS diagnosis unit wiring layout

SECTION 5 — SRS MAINTENANCE

POST-COLLISION DIAGNOSIS

To inspect and service the SRS after a collision (whether or not the air bag has deployed), perform the following steps.

SRS Diagnosis Unit Memory Check

(1) Connect the Multi-use Tester to the diagnosis connector located on the junction block, refer Fig. 1.

CAUTION: Make certain that the ignition switch is at OFF when the Multi-use Tester is connected or disconnected.

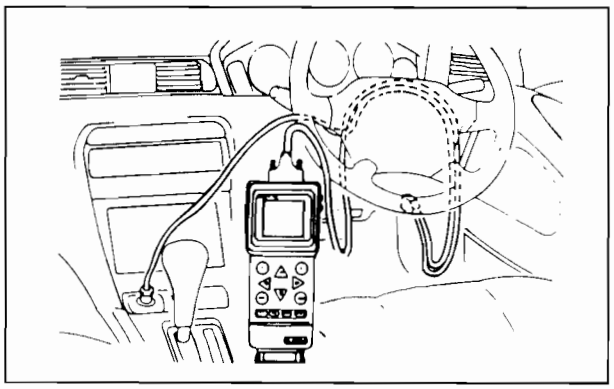


Fig. 1 — Connecting the multi-use tester

(2) Read (and write down) all displayed diagnosis codes, refer to Diagnosis Quick Reference Chart.

NOTE: If the battery power supply has been disconnected or disrupted by the collision, the Multi-use Tester cannot communicate with the SRS diagnosis unit. Inspect and, if necessary, repair the body wiring harness before proceeding further.

NOTE:
(1) Maximum stored period: 9999 minutes (approximately 7 days).
(2) Maximum number of times to be stored: 250.

(3) Erase the diagnosis codes and after waiting 45 seconds or more read (and write down) all displayed diagnosis codes, refer to Diagnosis Quick Reference Chart.

Repair Procedure

When air bag deploys in a collision

(1) Replace the following parts with new ones.
- Front impact sensors.
- SRS diagnosis unit (SDU).
- Air bag module.

(2) Replace the following parts with new if they fail inspection procedures listed this Group:
- Clock spring.
- Steering wheel, steering column and intermediate joint, refer to GROUP 37 — Steering, for replacement procedure.

NOTE: New replacement parts should be installed in accordance with Section 6— INDIVIDUAL COMPONENT SERVICE in this Group.

(3) Check harnesses for binding, connectors for damage, poor connections and terminals for deformities.

When air bag does not deploy in low-speed collision

Check to SRS components.

If the SRS components are showing any visible damage such as dents, cracks or deformation, replace them with new ones.

Concerning parts removed for inspection, replacement with new parts and cautionary points for working, refer to SECTION 6 — INDIVIDUAL COMPONENT SERVICE.

Front Impact Sensors

(1) Check side member for deformities or rust.

(2) Check front impact sensor for dents, cracks deformities or rust, refer Fig. 2.

(3) Check sensor harnesses for binds, connectors for damage, and terminals for deformities.

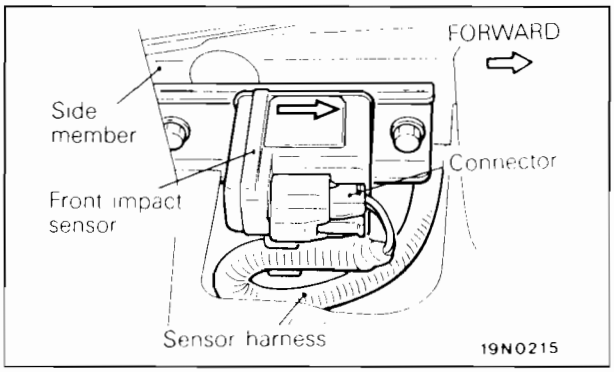


Fig. 2 — Front impact sensors

SRS Diagnosis Unit (SDU)

(1) Check SDU case and brackets for dents, cracks or deformities, refer Fig. 3.

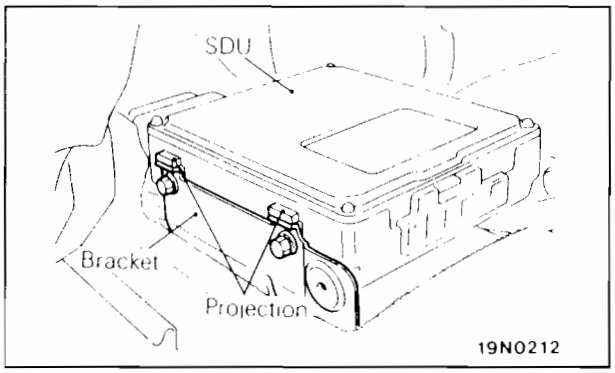


Fig. 3 — SDU case and brackets

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(2) Check connectors and lock lever for damage, and terminals for deformities, refer Fig. 4.

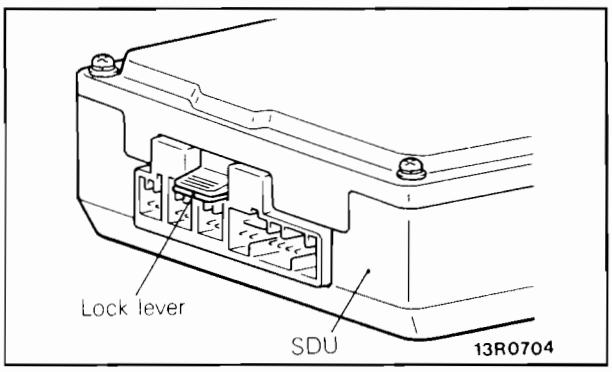


Fig. 4 — SDU lock lever

Air Bag Module

(1) Check pad cover for dents, cracks or deformities, refer Fig. 5.

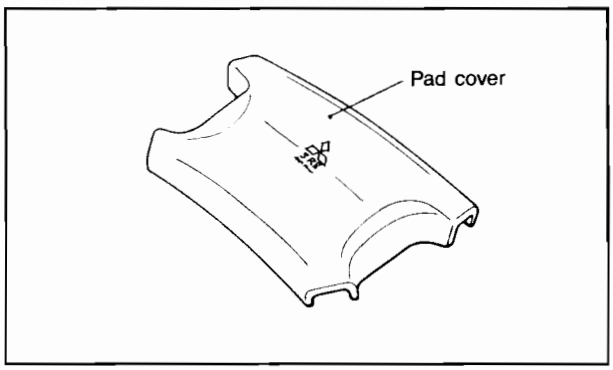


Fig. 5 — Pad cover

(2) Check hooks and connectors for damage, terminal deformities and harness for binds, refer Fig. 6.

(3) Check air bag inflator case for dents, cracks or deformities, refer Fig. 6.

(4) Install air bag module to steering wheel to check fit or alignment with the wheel.

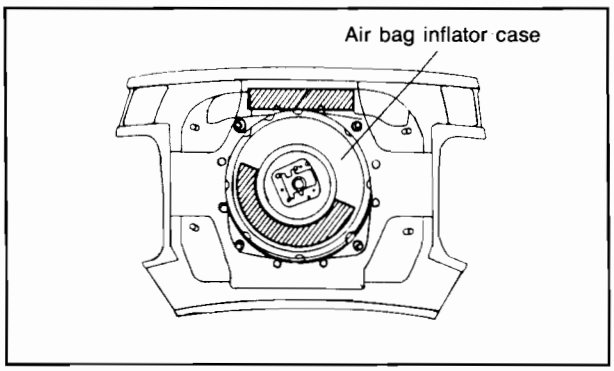


Fig. 6 — Air bag module underside

Clock Spring

(1) Check clock spring connectors and protective tube for damage and terminals for deformities, refer Fig. 7.

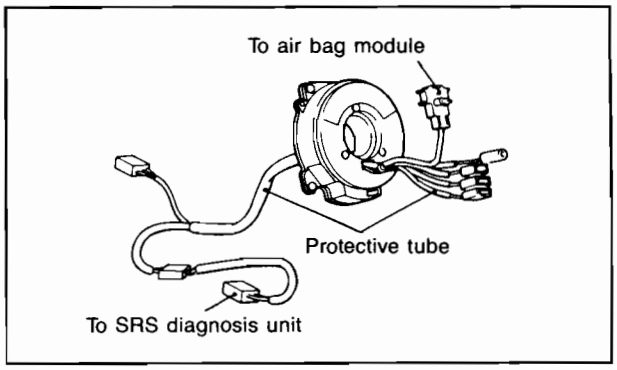


Fig. 7 — SRS clock spring

(2) Visually check the case and the gears for damage, refer Fig. 8.

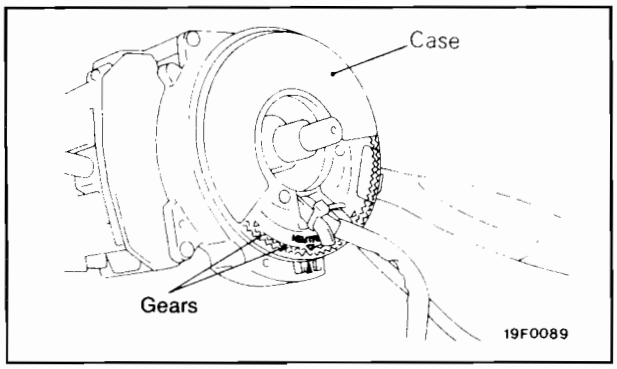


Fig. 8 — Clock spring gears and case

Steering Wheel, Steering Column and Intermediate Joint

(1) Check wiring harness (built into steering wheel) and connectors for damage and terminals for deformities.

(2) Install air bag module to check fit or alignment with steering wheel.

(3) Check steering wheel for noise, binds or difficult operation and excessive free play.

Harness Connector (Body and Front wiring harness)

Check harnesses for binding, connectors for damage, poor connections, and terminals for deformities.

SECTION 6 — INDIVIDUAL COMPONENT SERVICE

If the SRS components are to be removed or replaced as a result of maintenance, troubleshooting, etc. follow each procedure.

CAUTION:

(1) SRS components should not be subjected to heat over 93°C (200°F), so remove the front impact sensors, SRS diagnosis unit and air bag module and clock spring before drying or baking the vehicle after painting. Recheck SRS system operability after re-installing them.

(2) If the SRS components are removed for the purpose of check, sheet metal repair, painting, etc., they should be stored in a clean, dry place until they are reinstalled.

FRONT IMPACT SENSORS

CAUTION:

(1) Never repair or disassemble a front impact sensor. If faulty, replace it.

(2) Handle the front impact sensors very carefully, taking care not to drop them or otherwise subject them to impact. If a sensor is seen to be dented, cracked, deformed or rusted, replace it with a new one.

(3) Replace sensors with new ones after the air bag has deployed.

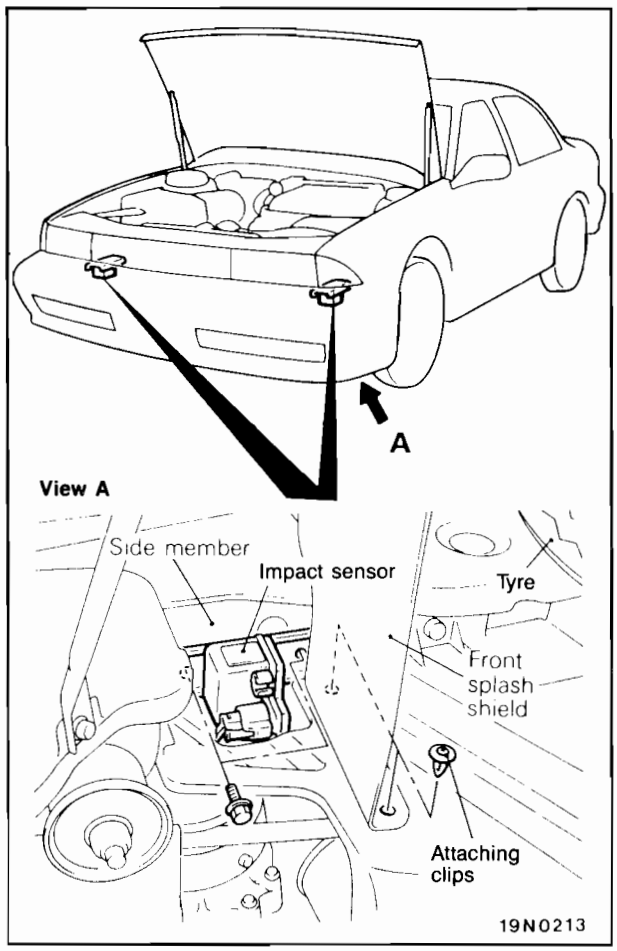


Fig. 1 — Front impact sensor location

Pre-Removal Procedures

(1) Turn the ignition key to the lock position.

(2) Disconnect the negative battery cable and tape the cable terminal, refer Fig. 2.

CAUTION:

Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to service precautions.

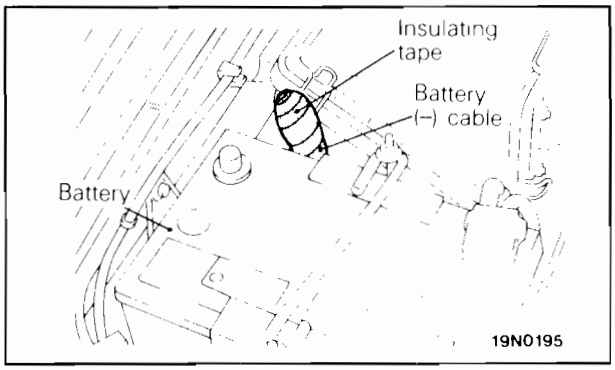


Fig. 2 — Insulating battery cable

Removal

(1) Check side member for deformities of rust, refer Fig. 3.

(2) Check sensor harness for binds, connectors for damage and terminals for deformities.

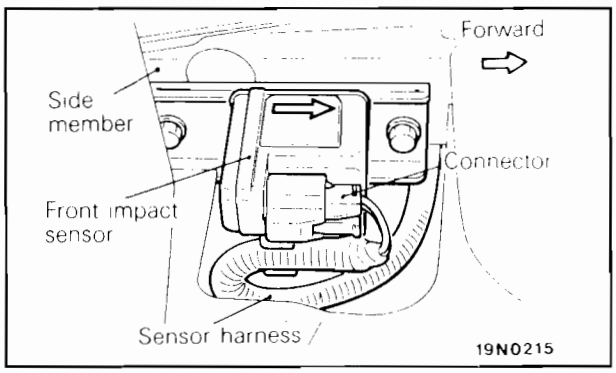


Fig. 3 — Side member and sensor

(3) Check for dents, cracks, deformation or rust of the front impact sensor.

CAUTION: If a dent, crack deformation or rust is detected, replace with a new sensor.

(4) Measure the front impact sensor resistance between terminals and check whether it is within the standard value, refer Fig. 4.

Standard value: 2,000 ± 40Ω

CAUTION: Always replace the sensor with a new one if the resistance is not within the standard value.

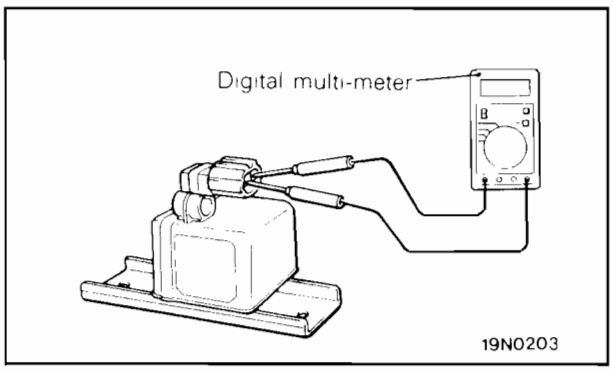


Fig. 4 — Testing impact sensors

Installation

(1) Before mounting the new front impact sensor, visually check it and measure the resistance between the terminals.

(2) Install the front impact sensor with the arrow facing to the front of the vehicle.

CAUTION: The SRS may not activate properly if a front impact sensor is not installed properly, which could result in serious injury or death to the vehicle's driver.

(3) Bend the wiring harness slightly (to the extent that there is no slack) and clip the right side securely by using the clip of the front impact sensor, refer Fig. 5.

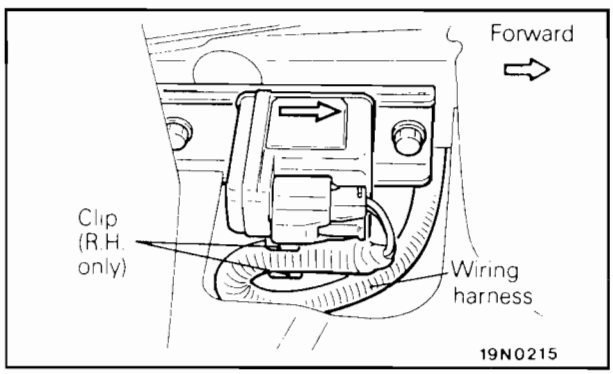


Fig. 5 — Wiring harness clip

(4) Reconnect the negative battery terminal. Turn the ignition switch to "ON". Does the "SRS" warning light illuminate for about 7 seconds, turn OFF and then remain extinguished for a least 45 seconds? (refer Fig. 6). If yes, SRS system is functioning properly. If no, refer Section 3 — Test 1.

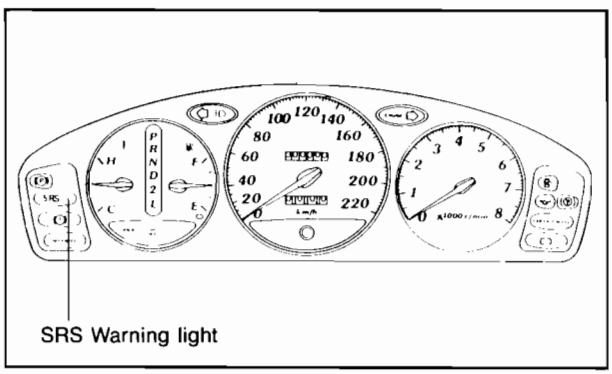


Fig. 6 — SRS warning light

SRS DIAGNOSIS UNIT (SDU)

CAUTION:

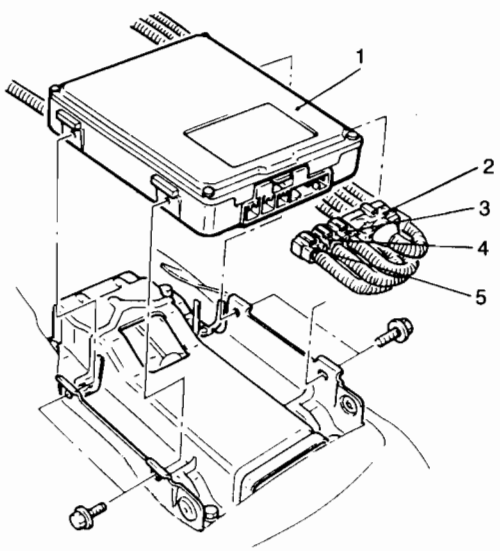
(1) Never attempt to disassemble or repair the SDU. If faulty, replace it.

(2) Do not drop or subject the SDU to impact or vibration.

If denting, cracking, deformation, or rust are discovered in the SDU, replace it with a new SDU. Discard the old one.

(3) After deployment of an air bag, replace the SDU with a new one.

(4) Never use an Ohmmeter on or near the SDU, and use only the specified test equipment.



1. SDU
2. 14-pin red connector to body wiring harness
3. 2-pin blue connector to right front impact sensor
4. 2-pin yellow connector to left front impact sensor
5. 2-pin red connector to clock spring

Fig. 7 — SDU wiring configeration

Removal

(1) Turn ignition key to the "LOCK" position.

(2) Disconnect the negative battery cable and tape the cable terminal, refer Fig. 8.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

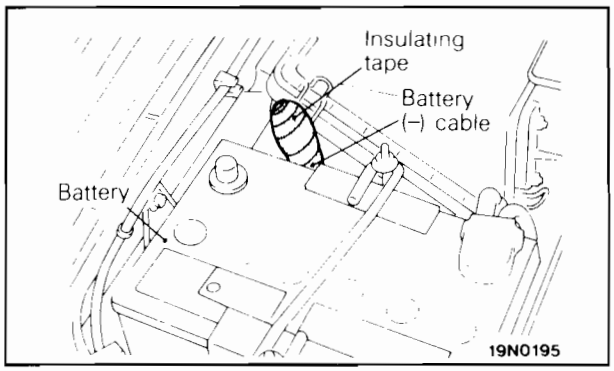


Fig. 8 — Insulating battery cable

(3) Remove ashtray.
(4) Remove floor console assembly.
(5) Remove connectors from the SDU.
(6) Remove the SDU's four retaining bolts and remove SDU.

Inspection

(1) Check the SDU case and brackets for dents, cracks or deformities.
(2) Check connectors and lock lever for damage, and terminals for deformities, refer Fig. 9.

CAUTION: If a dent, cracks, deformation or rust is discovered, replace the SDU with a new one.

NOTE: When checking the SDU other than described above, refer Section 3 — Service Diagnosis and Testing.

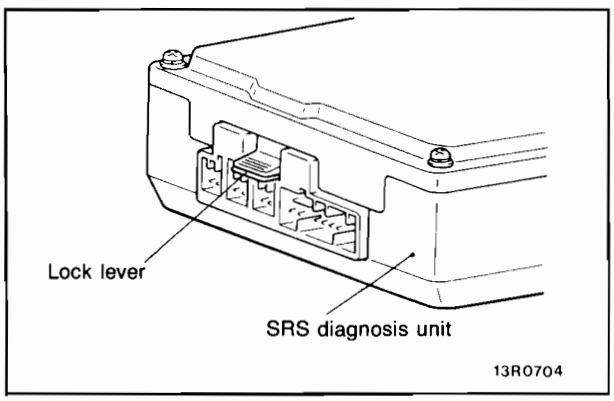


Fig. 9 — SDU locking lever and case

Installation SRS Diagnosis Unit (SDU)

(1) With the projection part of the SDU placed against the bracket as shown in Fig. 10, securely install the SDU.

CAUTION: The SRS may not activate properly, if SDU is not installed properly, which could result in serious injury or death to the vehicle's driver.

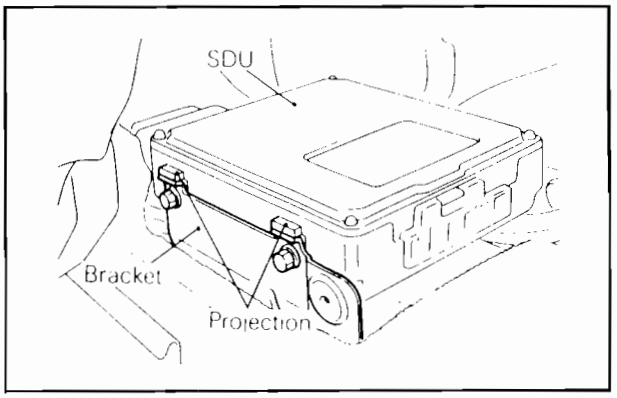


Fig. 10 — SDU installation

(2) Reconnect the negative battery terminal. Turn the ignition switch to "ON". Does the "SRS" warning light illuminate for about 7 seconds, turn OFF and then remain extinguished for at least 45 seconds? (refer Fig. 11). If yes, SRS system is functioning properly. If no, refer Section 3 — Test 1.

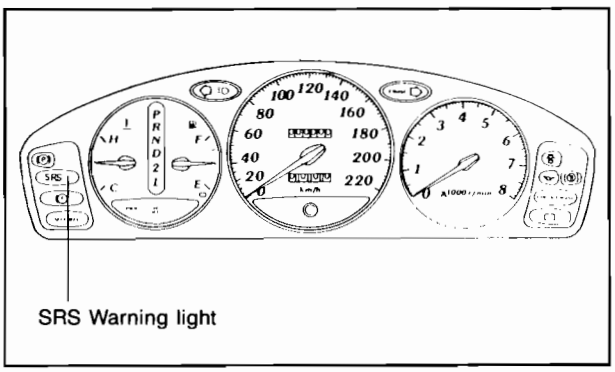


Fig. 11 — SRS warning light

AIR BAG MODULE AND CLOCK SPRING

CAUTION:

(1) Never attempt to disassemble or repair the air bag module or clock spring.
If faulty, replace it.
(2) Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace it if a dent, crack, deformation or rust are detected.
(3) The air bag module should be stored on a flat surface and placed so that the pad surface is facing upward.
Do not place anything on top of it.
(4) Do not expose the air bag module to temperature over 93°C (200°F).
(5) After deployment of an air bag, replace the clock spring with a new one.
(6) Wear gloves and safety glasses when handling an air bag that has already deployed.
(7) An undeployed air bag module should only be disposed of in accordance with the procedures in Section 7.

Removal (air bag module)

(1) Set the steering wheel and front wheels to the straight ahead position, then remove the ignition key.
(2) Disconnect the negative battery cable and tape the cable terminal, refer Fig. 12.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to Service Precautions.)

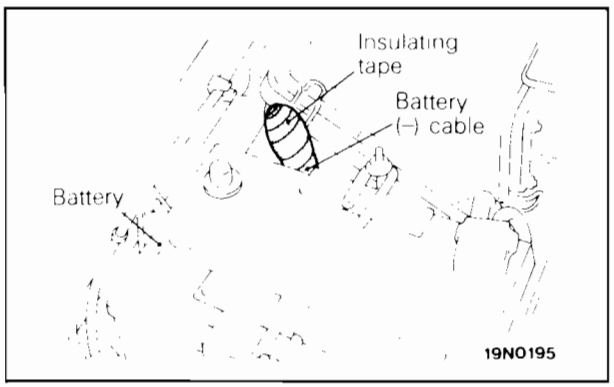


Fig. 12 — Insulating battery cable

(3) Remove the air bag module mounting nuts.
(4) When disconnecting the connector of the clock spring from the air bag module, press the air bag's lock toward the outer side to spread it open. Use a screwdriver (refer to Fig. 13), to pry so as to remove the connector gently.

CAUTION:
(1) When disconnecting the air bag module-clock spring connector, take care not to apply excessive force to it.
(2) The removed air bag module should be stored in a clean, dry place with the pad cover face up.

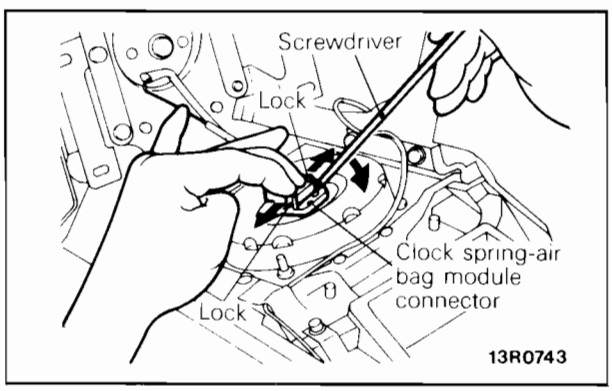


Fig. 13 — Removing clock spring connector

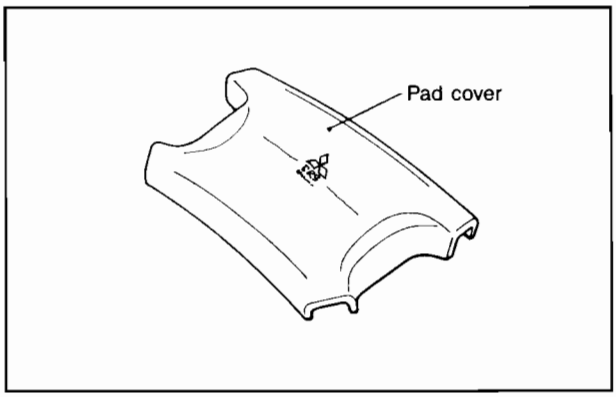


Fig. 14 — Pad cover

Inspection (air bag module)

If any improper part is found during the following inspection, replace the air bag module with a new one.
Dispose of the old one according to the specified procedure, refer to Section 7.

CAUTION: Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental air bag deployment will result in serious personal injury.

(1) Check pad cover for dents, cracks or deformities, refer Fig. 14.
(2) Check the air bag module for denting, cracking or deformation.
(3) Check hooks and connectors for damage, terminals for deformities, and harness for binds.
(4) Check air bag inflator case for dents, cracks or deformities.
(5) Install the air bag module to steering wheel to check fit or alignment with the wheel, refer Fig. 15.

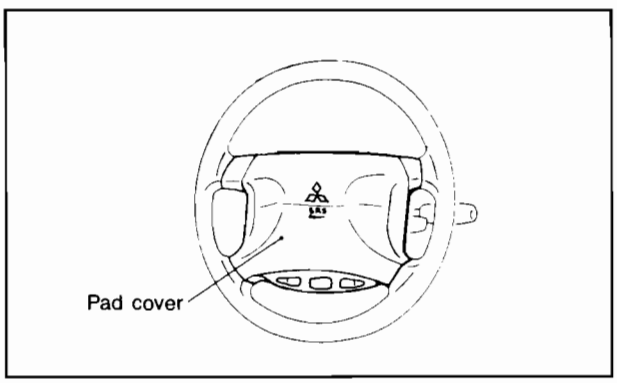


Fig. 15 — Air bag module fitment

Installation (air bag module)

(1) Connect the Multi-use Tester to the diagnosis connector located on the junction block, refer Fig. 16.

CAUTION: Make certain that the ignition switch is at OFF when the Multi-use Tester is connected or disconnected.

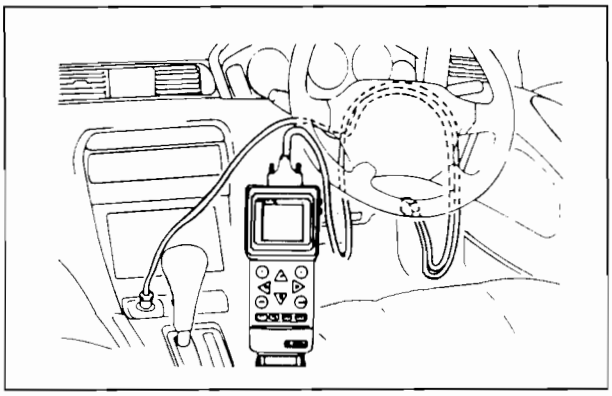


Fig. 16 — Connection of multi-use tester

(2) Reconnect negative terminal of battery and turn the ignition key to the "ON" position.

(3) Conduct self-diagnosis using Multi-use Tester to ensure entire SRS operates properly, except open circuit of air bag module (Diagnosis code No. 22). (Refer to Quick Reference Chart.)

(4) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 17.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

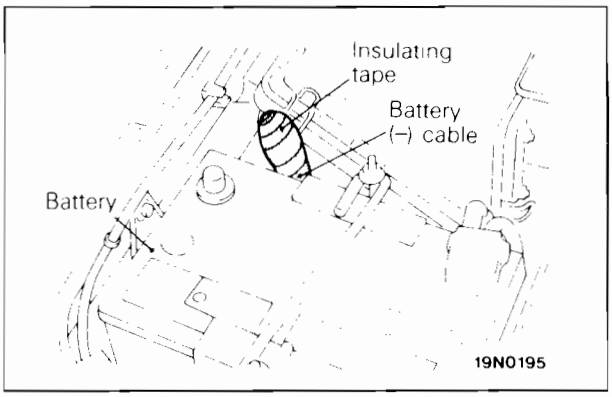


Fig. 17 — Insulating battery cable

(5) Reconnect the air bag module to the clock spring connector.

(6) Install the air bag module and retaining nuts taking care that no wiring is caught by it.

(7) Reconnect the negative battery terminal, erase any fault codes using Multi-Use-Tester turn the ignition switch to "ON". Does the "SRS" warning light illuminate for about 7 seconds, turn OFF and then remain extinguished for at least 45 seconds? (refer Fig. 18). If yes, SRS system is functioning properly.
If no, refer to Section 3 — Test 1.

CAUTION: Dispose of an air bag module only according to the specified procedure in Section 7.

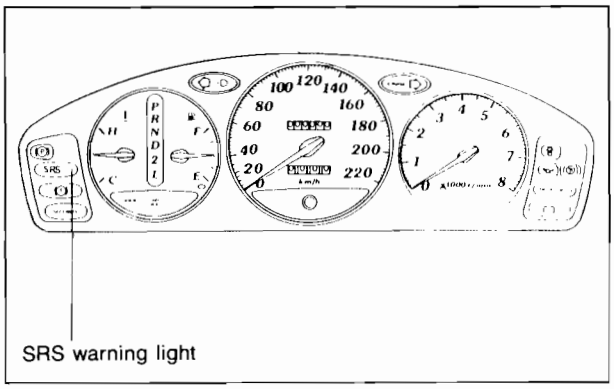


Fig. 18 — SRS warning light

Removal (clock spring)

(1) Set the steering wheel and front wheels to the straight ahead position, then remove the ignition key.

(2) Disconnect the negative battery cable and tape the cable terminal, refer Fig. 17.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer Service Precautions.

(3) Remove air bag module.

(4) Disconnect audio and cruise control connectors.
(5) Remove the steering wheel by using a steering wheel puller, refer Fig. 19.

CAUTION: Do not hammer on the steering wheel. Doing so may damage the collapsible column mechanism.

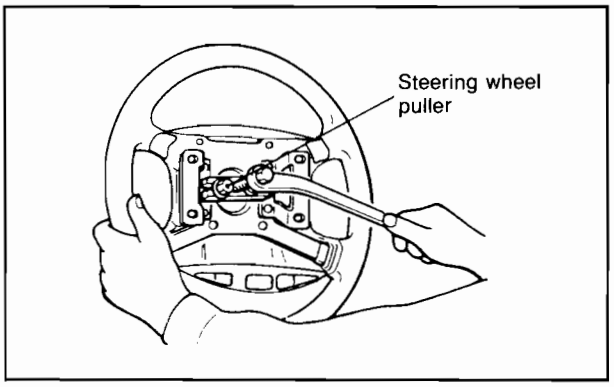


Fig. 19 — Steering wheel removal

(6) Remove the column undercover.
(7) Remove the holding screws in the column lower cover and remove the lower cover.
(8) Disconnect the two clock spring connectors from the body harness.
(9) Remove clock spring retaining screws and remove clock spring.

Inspection (clock spring)

If, as a result of following checks, even one abnormal point is discovered, replace the clock spring with a new one.

(1) Check connectors and protective tube for damage and terminals for deformities.

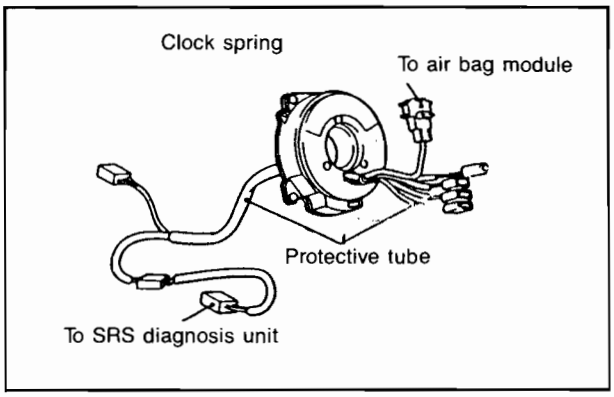


Fig. 20 — Clock spring connectors

(2) Visually check the case and the gears for damage, refer Fig. 21.

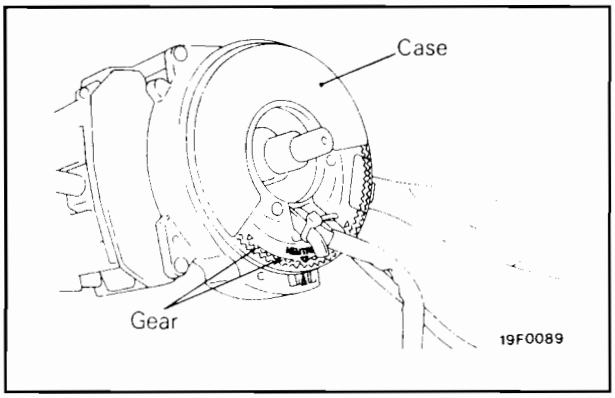


Fig. 21 — Clock spring gears and case

(3) Check for continuity between the No. 1 connector of the clock spring and connectors No. 3, 4, 5, and 6, refer table below, refer Fig. 20.

No. 1 connector				No. 3 connector	No. 4 connector	No. 5 connector	No. 6 connector	
Terminal 1	Terminal 2	Terminal 3	Terminal 4				Terminal 1	Terminal 2
To cruise control unit	To ACC power	To horn relay	To radio	To horn switch	To steering remote control switch		To cruise control switch	

NOTE: O—O indicates that there is continuity between the terminals.

(4) Check of resistance between the terminals.
(a) Join the No. 2 connector and No. 7 connector of the clock spring to connector ④ and connector ③, respectively, of the SRS Check Harness, refer Fig. 22.

NOTE: When joining SRS Check Harness connector ④, align its white paint with the hollow portion of the No. 2 connector of the clock spring.

(b) Check for continuity between terminal 1 and terminal 21 and terminal 2 and terminal 22, of SRS Check Harness connector ⑤, using a digital multimeter.

Standard value: less than 0.4Ω

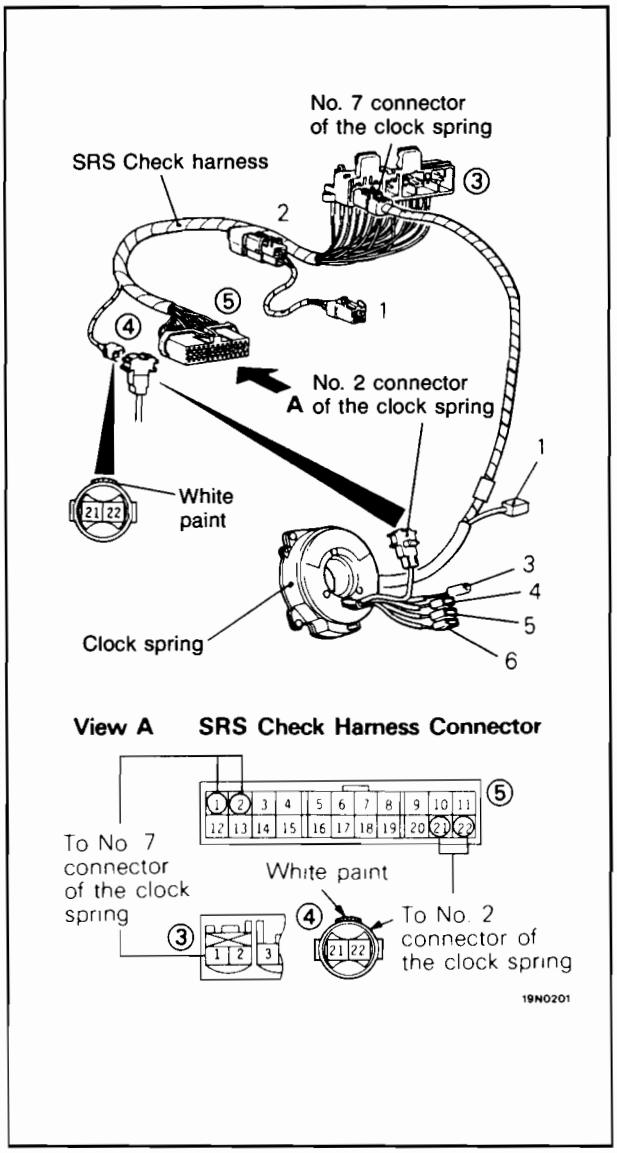


Fig. 22 — SRS check harness

Installation (clock spring)

(1) Align the mating mark and "NEUTRAL" position indicator of the clock spring, refer Fig. 23. Ensure the front wheels are at the straight-ahead position, install the clock spring to the column switch.

CAUTION: If the clock spring's mating mark is not properly aligned, the steering wheel may not be completely rotational during a turn, or the flat cable within the clock spring may be severed, obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver.

(2) Connect clock spring connectors to the body harness.
(3) Fit the column lower cover.
(4) Fit the column under cover.

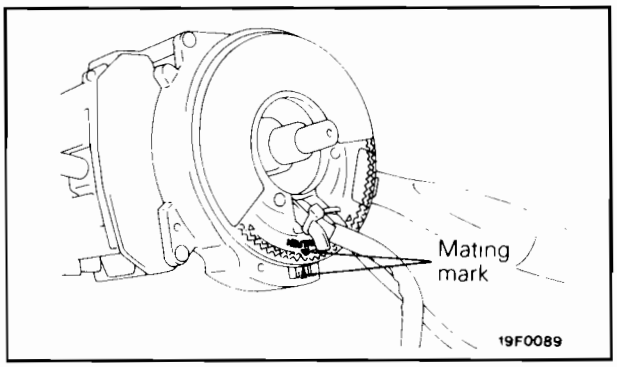


Fig. 23 — Neutral aligning marks

(5) Ensure the vehicles wheels are at the straight ahead position and the mating mark and "NEUTRAL" position indicator of the clock spring are correctly aligned, then install the steering wheel, after clamping turn the steering wheel all the way in both directions to confirm that steering is normal.

CAUTION: Be sure when installing the steering wheel, that the harness of the clock spring does not become caught or tangled.

(6) Install the air bag module.
(7) Reconnect the negative battery terminal. Turn the ignition switch to "ON". Does the "SRS" warning light illuminate for about 7 seconds, turn OFF and then remain extinguished for at least 45 seconds? (refer Fig. 24). If yes, SRS system is functioning properly. If no, refer to Section 3 — Test 1.

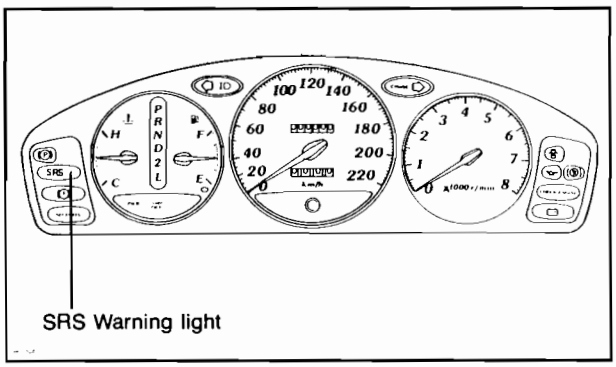
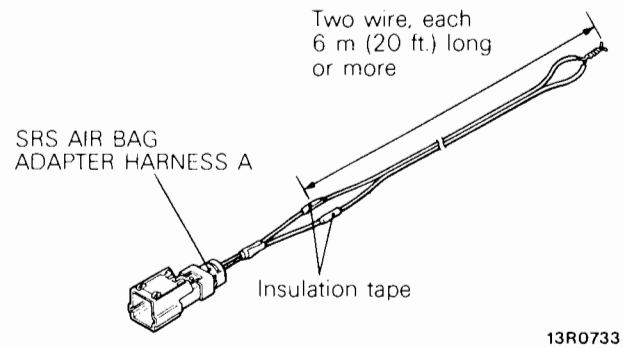
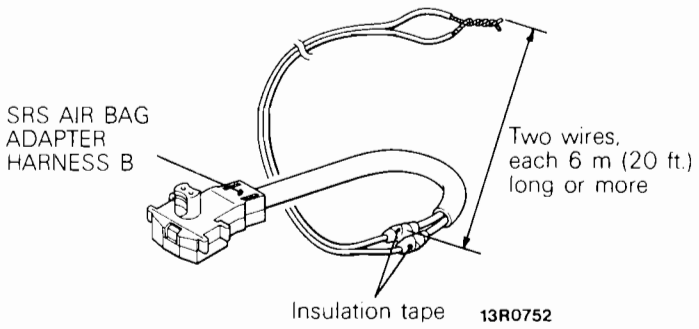


Fig. 24 — SRS warning light

SECTION 7 — AIR BAG MODULE DISPOSAL PROCEDURES

Before either disposing of a vehicle equipped with an air bag, or prior to disposing of the air bag module, be sure to first follow the procedures described below to deploy the air bag.

AIR BAG REMOTE DEPLOYMENT DEVICES

Tool	Use
	• Deployment inside the vehicle (when vehicle will no longer be driven)
	• Deployment outside the vehicle

UNDEPLOYED AIR BAG MODULE DISPOSAL

CAUTION:

(1) If the vehicle is to be scrapped, junked, or otherwise disposed of, deploy the air bag inside the vehicle.

If the vehicle will continue to be operated and only the air bag module is to be disposed of, deploy the air bag outside the vehicle.

(2) Since there is a loud noise when the air bag is deployed, avoid residential areas whenever possible. If anyone is nearby, give warning of the impending noise.

(3) Since a large amount of smoke is produced when the air bag is deployed, select a well-ventilated site. Moreover, never attempt the test near a fire or smoke sensor.

DEPLOYMENT INSIDE THE VEHICLE (when vehicle will no longer be driven)

(1) Open all windows and doors of the vehicle. Move the vehicle to an isolated spot.

(2) Disconnect the negative (−) and positive (+) battery cables from the battery terminals, and then remove the battery cables from the battery terminals, and then remove the battery from the vehicle.

CAUTION: Wait at least 60 seconds after disconnecting the battery cables before doing any further work, refer to Service Precautions.

(3) Remove floor console assembly.

(4) Disconnect the clock spring connector from the SRS diagnosis unit, refer Fig. 1.

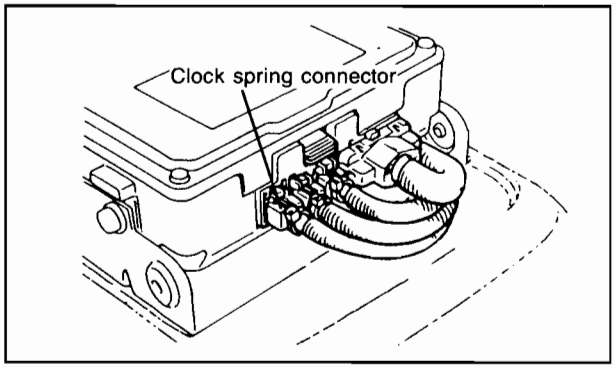


Fig. 1 — Clock spring connector

(5) Connect two wires each six meters (20 feet) long or more, to the two leads of SRS AIR BAG ADAPTER HARNESS A and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the air bag, refer Fig. 2.

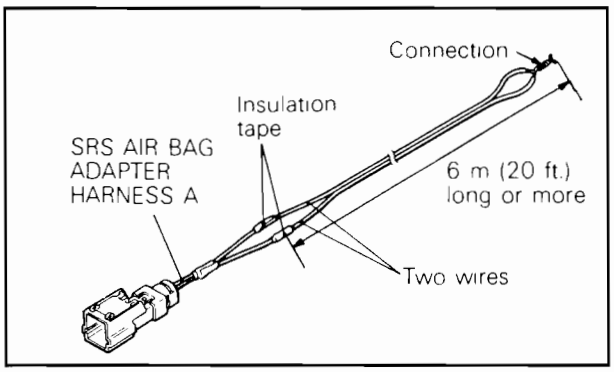


Fig. 2 — SRS air bag harness

(6) Connect the SRS AIR BAG ADAPTER HARNESS A to the clock spring connector, refer Fig. 3 (which has been disconnected from the SRS diagnosis unit), and then lead the two connected wires outside the vehicle.

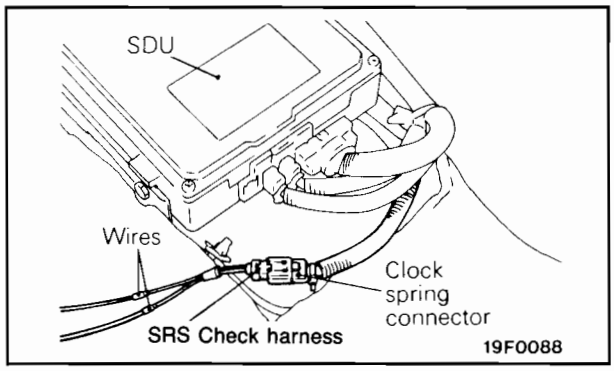


Fig. 3 — Connecting SRS air bag harness

(7) At a location as far away from the vehicle as possible, disconnect the two connected wires from each other and connect them to the two terminals of the battery (removed from the vehicle) to deploy the air bag, refer Fig. 4.

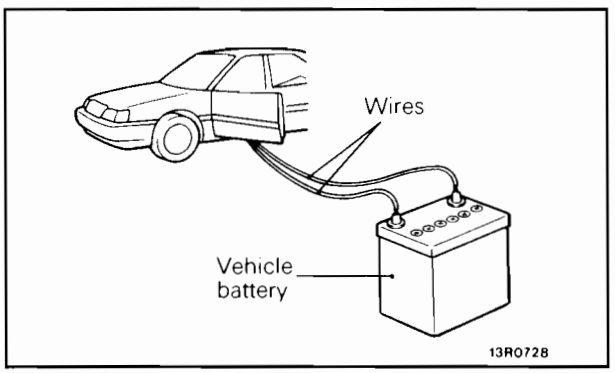


Fig. 4 — Remote air bag deployment

CAUTION:

(1) Before deploying the air bag in this manner, first check to be sure that there is no one in or near the vehicle. Wear safety glasses.

(2) The inflator will be quite hot immediately following the deployment, so wait at least 30 minutes to allow it to cool before attempting to handle it.

Although not poisonous, do not inhale gas from air bag deployment.

See Deployed Air Bag Module Disposal Procedures for post-deployment handling instructions.

DEPLOYMENT OUTSIDE THE VEHICLE

(1) Disconnect the negative (−) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

CAUTION: Wait at least 60 seconds after disconnecting the battery cables before doing any futher work, refer to Service Precautions.

(2) Remove the air bag module for the vehicle.

CAUTION: The air bag module should be stored on a flat surface and placed so that the pad cover face up (refer Fig. 5). Do not place anything on top of it.

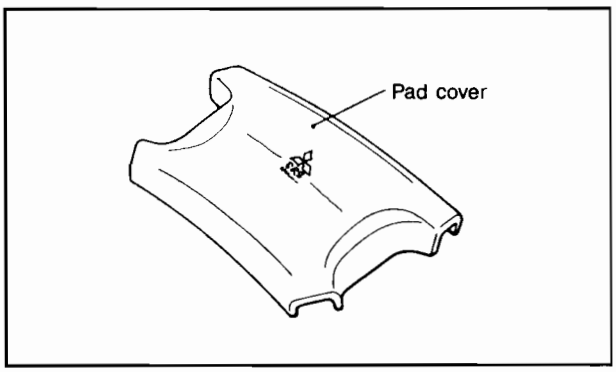


Fig. 5 — Pad cover

(3) Connect two wires each six meters (20 feet) long or more, to the two leads of SRS AIR BAG ADAPTER HARNESS B, and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the air bag, refer Fig. 6.

SECTION 1 — GENERAL INFORMATION

ELECTRONIC COMPONENT PROTECTION

Many of the electrical systems on the vehicle incorporate electronic components, i.e. micro-processors, semi-conductors, transistors, etc.

Many of these components operate on low voltages and current draws. To prevent voltage peaks and/or excessive current draw which may damage the component the following precautions should be observed:

(a) Ensure that the ignition and vehicle lighting switches are turned OFF before disconnecting wiring from a component or the battery.

(b) When disconnecting the battery, always disconnect the negative cable first.

(c) Do not disconnect the battery with the engine running.

(d) Ensure correct polarity is maintained when "jump" starting.

(e) Always disconnect the battery before performing electrical welding.

(f) The use of a conventional 12V test lamp should be restricted to checking fuses etc. The recommended test lamp for all other circuits is special tool E8M15-L.E.D. test lamp.

(g) When performing continuity, voltage or current draw testing, ensure that all the usual precautions are taken, i.e. connect voltmeters in parallel, ammeters in series and ensure that the circuit is "dead" when using an ohmmeter.

In addition to the above precautions it should be noted that sensors, relays, control units, etc. are sensitive to shocks, impact and high temperatures.

To prevent physical damage, handle all electrical components with care and avoid dropping or striking them.

CIRCUIT CHECKING

Harness checking should be performed in the following order:

(1) Check for continuity between terminals or voltage at terminal.

(2) Check terminal security in connector and terminal to terminal contact.

CAUTION: In instances where electrical system testing requires the battery to remain connected, it is essential for safety reasons to unplug the starter motor solenoid lead, from the starter motor solenoid. This procedure will inhibit accidental engagement of the starter motor, thus preventing possible injury.

Continuity and Voltage Check

When performing continuity or voltage checks, it is recommended that harness connectors remain coupled. This will facilitate identification of faults and reduce the possibility of terminal or wiring damage.

To check circuits with the connectors coupled, insert a suitable probe into the back of the connector.

NOTE: If the connector is a waterproof, i.e. sealed type, ensure that the finest probe available is used.

Insert the probe through the wire hole in the seal taking care to avoid damaging the seal and the wire insulation.

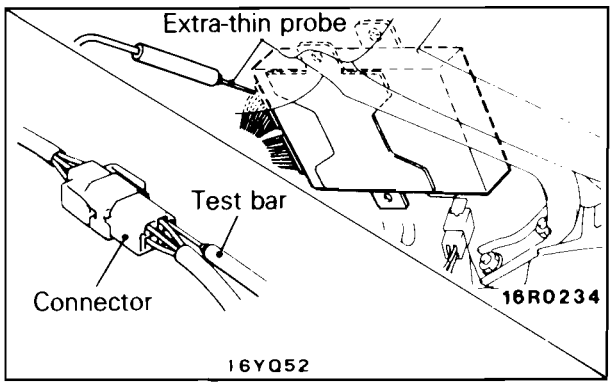


Fig. 1—Using test probe

In cases where it is necessary to uncouple the connector to insert the probe the following points should be noted:

(a) When uncoupling connectors, pull on the connector body not the wiring. If the connector incorporates a locking catch release the catch prior to uncoupling.

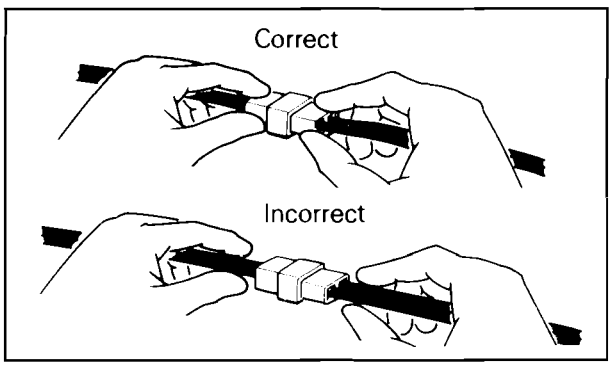


Fig. 2—Uncoupling connectors

(b) When inserting probes into the female terminal use the finest probe available. DO NOT force the probe in. This practice will open up the terminal resulting in poor contact and/or high resistance.

Checking Connector Terminal Security and Terminal to Terminal Contact

Although connectors may be engaged correctly an individual terminal may not be engaged securely or poor contact may exist between male and female terminals.

(1) Check that the wire(s) is securely located by pulling firmly on the wire, refer Fig. 3.

(2) Check that good contact exists between male and female terminals as follows:

(a) Uncouple connector by releasing catch (where fitted) and pulling on connector.

(b) Insert a wire fitted with a suitable size male terminal into the female terminal.

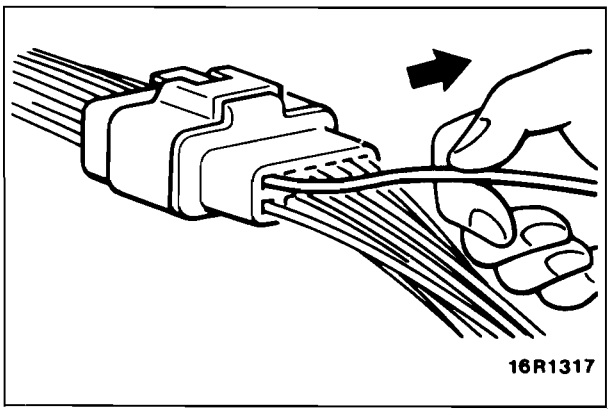


Fig. 3—Checking terminal security

(c) Check that a reasonable amount of force is required to pull out the wire.

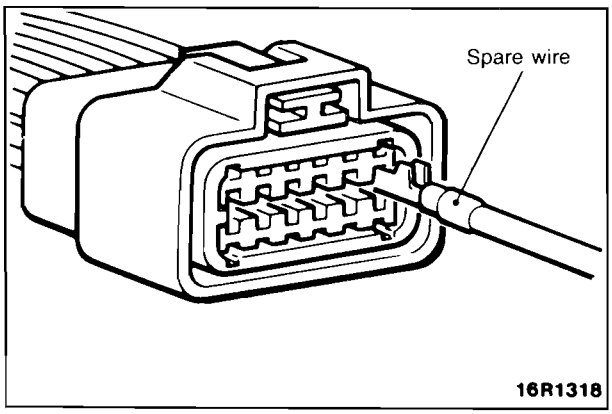


Fig. 4—Checking terminal contact

Connector Terminal Repair

Suspect terminals should be rectified by removing the female terminal from the connector and adjusting the male terminal contact point, and/or connector lance.

Round Waterproof Type

(1) Carefully pry out the waterproof cap and pull back.

(2) Insert the tip of a suitable size screwdriver into the connector as shown in Fig. 5, lift the connector lance slightly and pull the wire out of the connector.

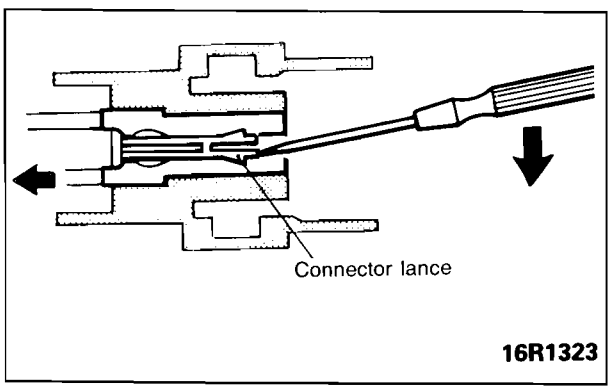


Fig. 5—Removing terminal (round waterproof type)

(3) Insert a screwdriver through the hole in the terminal, refer Fig. 6, and raise the male terminal contact point.

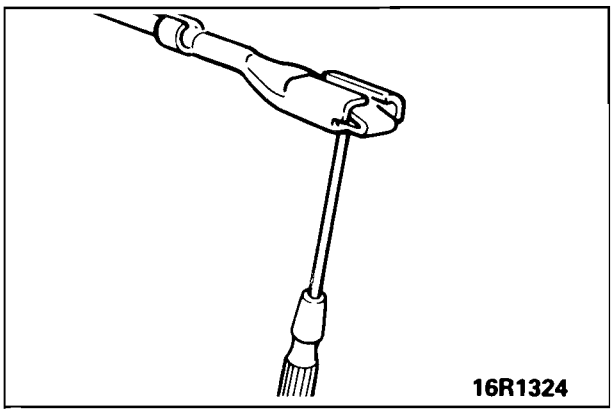


Fig. 6—Adjusting terminal contact point

(4) Insert the terminal into the connector, ensuring that it is secure.

(5) Carefully fit the waterproof seal ensuring the seal is correctly based.

Injector Connector Type

(1) Remove the waterproof cap from the connector by pulling back, refer Fig. 7.

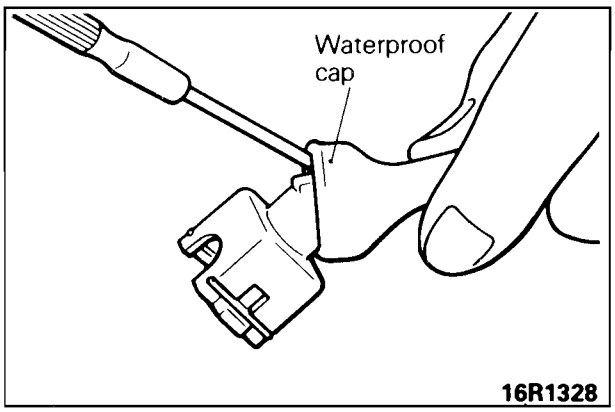


Fig. 7—Removing injector waterproof cap

(2) Insert a suitable size screwdriver tip into the connector, refer Fig. 8, press down the terminal lance and pull out the wire.

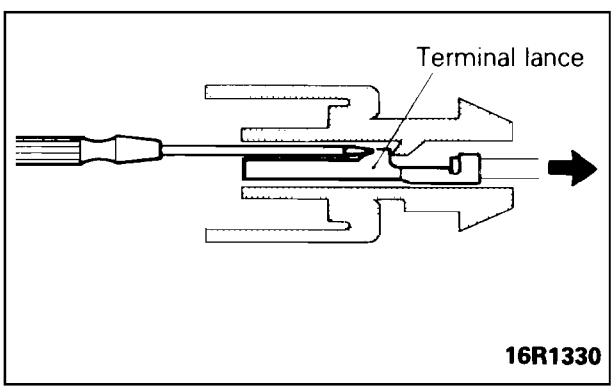


Fig. 8—Removing terminal (injector connector type)

(3) Using a screwdriver as shown in Fig. 9, press the male terminal contact point down.

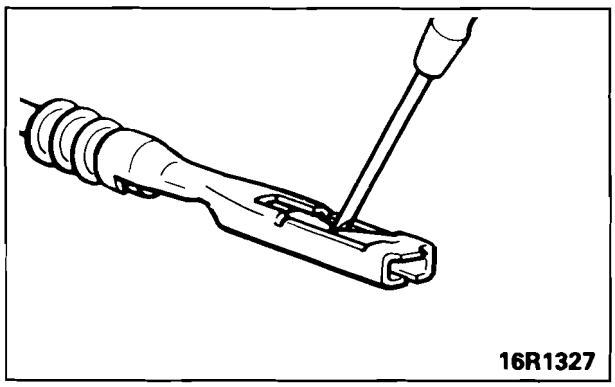


Fig. 9—Adjusting male terminal contact point

(4) Ensure that the terminal lance is correctly set and insert the terminal into the connector, ensuring that it is secure.

Rectangular Waterproof Type

(1) Remove the connector front holder using a suitable screwdriver to disengage it from the connector, refer Fig. 10.

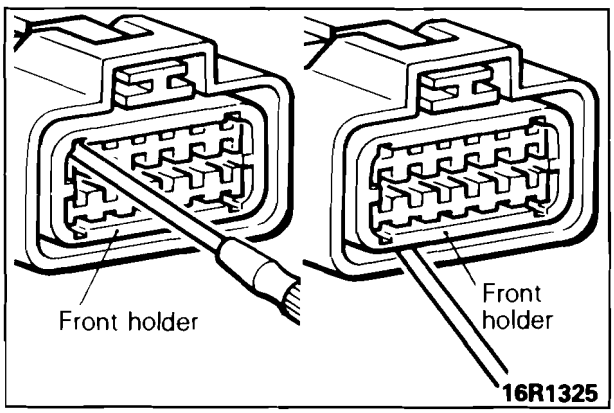


Fig. 10—Removing front holder

(2) Insert a suitable size screwdriver into the connector, as shown in Fig. 11, push lightly to lift the lance and pull out the wire.

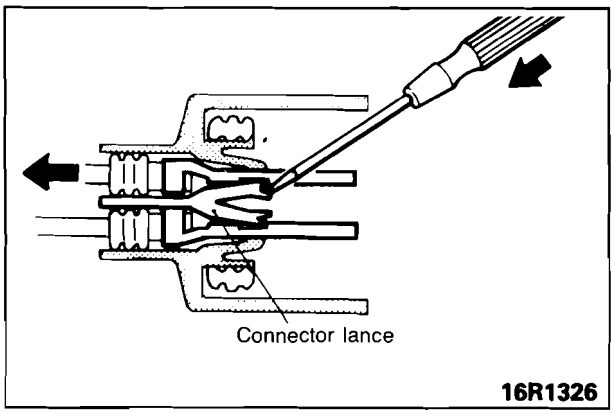


Fig. 11—Removing terminal (rectangular waterproof type)

(3) Using a screwdriver as shown in Fig. 12, press down the male terminal contact point.

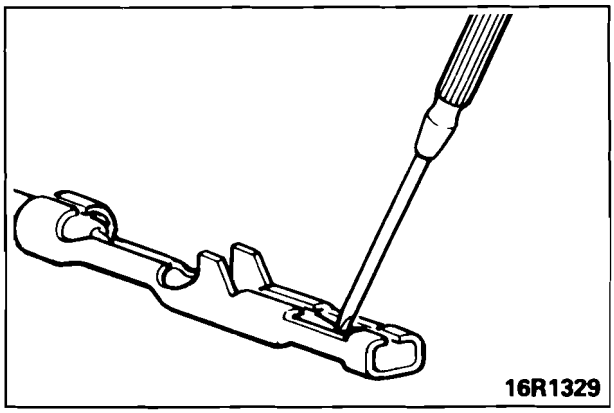


Fig. 12—Adjusting male terminal contact point

(4) Insert the terminal into the connector ensuring that it is securly located.

Control Unit Connector with Front Holder

(1) Using a suitable size screwdriver, remove the front holder from the connector, refer Fig. 13.

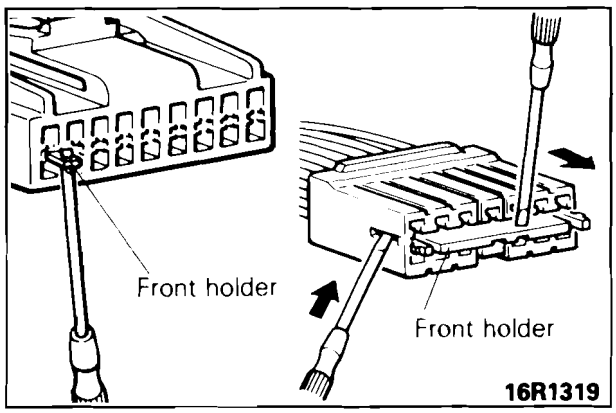


Fig. 13—Removing front holder

(2) Push the wire in towards the connector and hold it there.

(3) Insert a suitable size screwdriver into the connector, as shown in Fig. 14, raise the connector lance and pull out the wire.

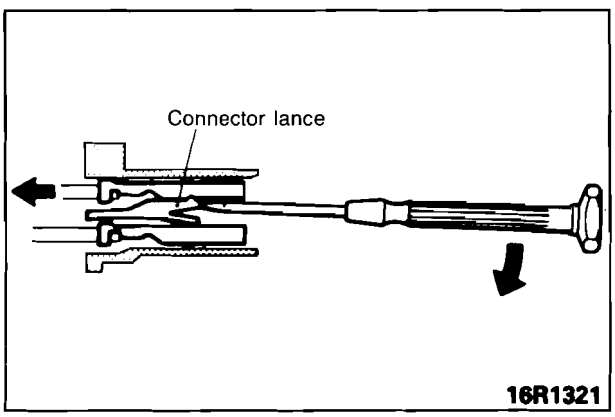


Fig. 14—Removing terminal (control unit type)

(4) Using a needle inserted through the terminal hole, as shown in Fig. 15, raise the male terminal contact point.

(5) Insert the terminal into the connector, ensuring that it is securely located and insert front holder.

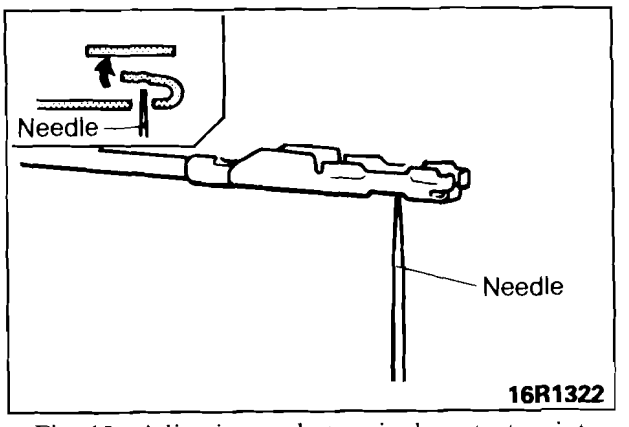


Fig. 15—Adjusting male terminal contact point

FUSES AND FUSIBLE LINKS

Replacement

When replacing a fuse or fusible link ensure that the cause of the failure has been located and rectified before fitting the new fuse.

Use only a fuse or link of the specified rating for replacement noting that using one of a higher rating may result in damage to components or wiring.

Fuse Testing

The blade type fuses used have test taps provided to facilitate fuse testing.

With the circuit switched on, use a 12V test lamp to check for 12V at both sides of the fuse.

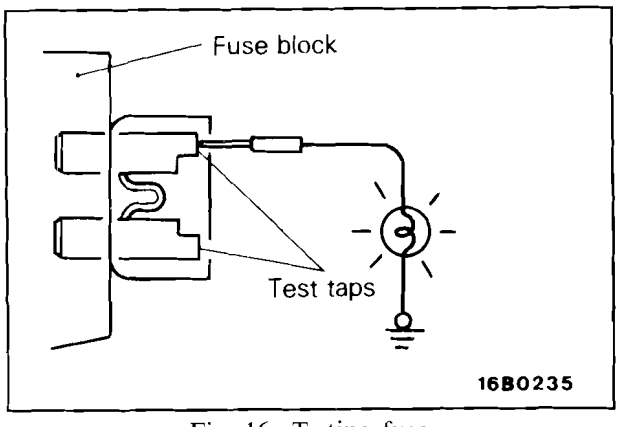


Fig. 16—Testing fuse

SECTION 2 — BATTERY AND FUSES

SPECIFICATIONS

Battery	TR	KR
Type	12Volt negative earth	12Volt negative earth
Cold cranking (amps)*	390	400
Reserve capacity (mins.)*	71	95
Location	Engine compartment	Engine compartment

*As per Australian Standard 2149

Battery	TS	KS
Type	12Volt negative earth	12Volt negative earth
Cold cranking (amps)*	390	420
Reserve capacity (mins.)*	75	95
Location	Engine compartment	Engine compartment

*As per Australian Standard 2149

BATTERY MAINTENANCE

Service Precautions

• Battery electrolyte is a highly corrosive acid which may on contact, cause personal injury or damage paint surfaces. Any spillage must be immediately diluted and flushed away with clean water.

• Ensure that ignition and vehicle lighting switches are turned OFF before battery cables are disconnected. Failure to do this may result in damage to electronic components used in some systems.

• When disconnecting battery cables always disconnect the negative cable first.

Regular Maintenance

(1) Check the battery electrolyte level at regular intervals. Maintain the electrolyte at a level approximately 6 mm above the plate using mineral free water.

(2) Disconnect the battery cables and clean the battery terminal and cable terminal using a suitable tool, refer Fig. 1.

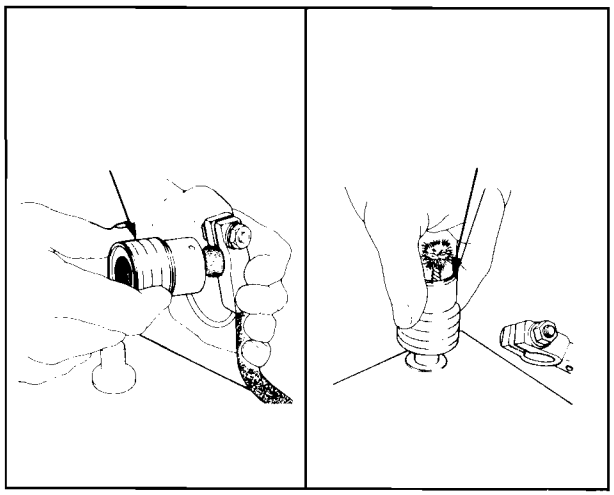


Fig. 1—Cleaning terminals

Periodic Maintenance

(1) Ensure that the paint finish is adequately protected.

(2) Disconnect the battery cables.

(3) Loosen the battery clamp nuts and remove the clamp.

(4) Remove the battery from the vehicle.

(5) Inspect the battery carrier for acid damage. If necesary remove corrosion by using a solution of bicarbonate of soda in warm water and scrubbing the area with a stiff brush, taking care to avoid spreading the corrosion residue, and flush the area with clean water. Damaged areas should be repainted to avoid further corrosion.

(6) Clean the battery cover by the same method.

NOTE: Do not allow any cleaning solution or water to enter the battery cells as this will dilute the electrolyte.

(7) Check the battery cables for damage and fraying and replace if necessary.

(8) Check the battery case, cover and vents for damage.

(9) Install the battery and hold down clamp.

NOTE: To avoid cracking the case do not over-tighten the hold down clamp.

(10) Connect the battery cables and tighten cable terminal clamps to 2.5 Nm.

NOTE: Ensure that battery polarity is not reversed.

(11) Coat terminals with light mineral grease.

BATTERY TESTING

Checking Specific Gravity

A hydrometer should be used to determine the specific gravity of the battery electrolyte. The reading obtained indicates the amount of unused sulphuric acid remaining in the electrolyte and the state of charge of the battery.

Since the reading will vary depending on electrolyte temperature, actual specific gravity can be calculated as follows:

(1) The point of zero correction is 26.5°C.

(2) For every 5.5°C above the zero point add 4 points (0.004) to the specific gravity reading.

Example:-	Hydrometer reading	1.225
	Electrolyte temperature	38°C
	Correction required	+ .008
	Actual specific gravity	1.233

(3) For every 5.5°C below the zero point subtract 4 points from the specific gravity reading.

Example:-	Hydrometer reading	1.260
	Electrolyte temperature	- 6.5°C
	Correction required	- .024
	Actual specific gravity	1.236

Fig. 2 may be used as a guide to calculate the correction required.

Using the Hydrometer

(1) Liquid level of battery cell should be at normal height and electrolyte should be thoroughly mixed with any battery water which may have just been added by charging battery before taking hydrometer readings.

(2) Using a suitable thermometer, record electrolyte temperature.

NOTE: A battery immersion type mercury in glass thermometer with a scale reading up to 52°C designed for bulb immersion of not more than 25 mm should be used.

(3) Draw electrolyte in and out of the hydrometer barrel several times to bring the temperature of the hydrometer float to that of the acid in the cell.

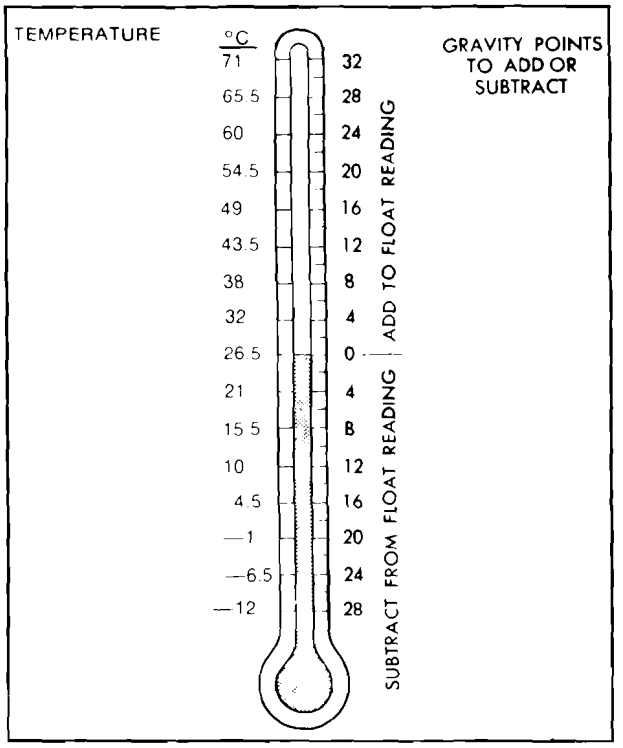


Fig. 2—Hydrometer reading correction chart

(4) Draw sufficient electrolyte into the hydrometer barrel with the pressure bulb fully expanded to lift the float so that it does not touch the sides the bottom or the top of the barrel.

(5) Take the reading with eyes at the same level as the electrolyte level in the hydrometer barrel.

NOTE: Do not tilt the hydrometer when taking a reading.

(6) Measure the electrolyte temperature and calculate the specific gravity as previously described.

Test Result Indications

Electrolyte specific gravity	State of charge
1.240 to 1.260	100%
1.210 to 1.240	75%
1.180 to 1.210	50%
Below 1.130	Completely discharged

A battery should be charged if the specific gravity is less than 1.210.

If there is more than 0.025 specific gravity variation between cells then an internal fault is indicated. This can be confirmed by performing a high rate discharge test.

If battery charge is low and the battery is serviceable, check alternator operation and all electrical connections.

High Rate Discharge Test

A high rate discharge test can be performed using a commercial tester according to the manufacturers instructions.

Satisfactory capacity tests can be made only when battery equals or exceeds 1.220 specific gravity at 26.5°C. If the reading is below 1.220 the battery should be slow charged until fully charged in order to secure proper test results.

BATTERY CHARGING

WARNING: When batteries are being charged explosive gas mixture forms beneath the cover of each cell. Do not smoke near batteries on charge or which have recently been charged. Do not break live circuits at the terminals of the batteries on charge. A spark will occur where the live circuit is broken. Keep all open flames away from the battery.

Fast Charging

Fast charging will provide sufficient charge after one hour to enable the battery and alternator to carry the load, however, whenever possible **slow charging is preferable.**

When fast charging a battery the following points should be noted.

(1) If the battery is being charged in the vehicle, the battery **MUST BE DISCONNECTED.**

(2) Battery electrolyte temperature **must NEVER exceed 45°C.**

(3) Do not allow excessive gassing to continue during charging.

(4) Do not continue fast charging longer than one hour.

(5) If battery does not show a significant change in specific gravity after one hour of "FAST" charge, the slow charge method should be used.

(6) Remember to use temperature correction when checking specific gravity.

NOTE: The manufacturers of high rate charging equipment generally outline the necessary precautions and some models have thermostatic temperature limiting and time limiting controls.

Slow Charging

Many discharged batteries can be brought back to good condition by slow charging.

The average time required to charge a battery by the slow charge method at normal rates is from 12 to 16 hours, however, when a battery continues to show an increase in specific gravity, battery charge should be continued even if it takes 24 hours or more. **Watch the temperature of batteries carefully and if the temperature of any one of them reaches 43°C, lower the charging rate.**

Safe slow charging rates can be calculated by allowing one ampere per positive plate per cell i.e. 4 amperes for a 9 plate battery and 5 amperes for an 11 plate battery.

Battery should be tested with a hydrometer and a record kept of the readings taken at regular intervals throughout the charge. When a cell has a specific gravity that is 0.025 or more below other cells, that cell is faulty and battery should be replaced.

Battery will be fully charged when it is gassing freely and when there is no further rise in specific gravity after three successive readings taken at hourly intervals. Make sure hydrometer readings are corrected for temperature.

Sulphated batteries can often be returned to useful condition by slow charging at half the normal charge rate for 60 to 100 hours. This long charging period is necessary to convert crystalline lead sulphate into active material.

FUSIBLE LINKS

Main link

Power to all circuits except the starter motor, is supplied through the fusible link.

The fusible link will burn out within 15 seconds if current flow through the link is higher than its fusing current.

In the event of a total electrical failure check that the fusible link is not burnt out. It may be necessary to check the link with an ohmmeter.

A fusible link will only burn out in the event of a short circuit in the vehicle wiring. Locate and repair the short circuit before replacing the link.

NOTE: The link must be replaced with one of the specified rating.

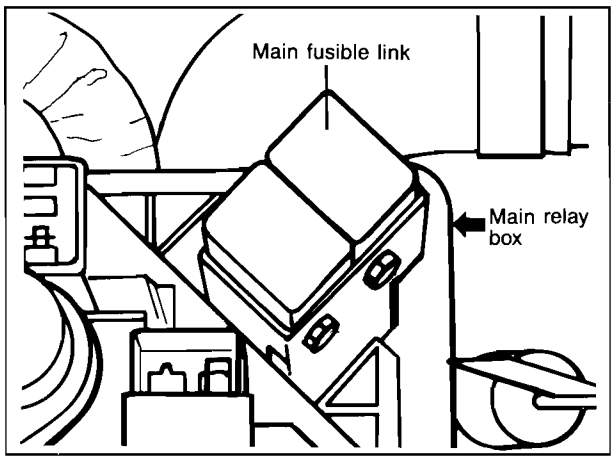


Fig. 3—Main fusible link location

Sub-links

Some circuits, refer Specifications are also protected by sub-links located in the engine compartment relay box.

The sub-links will burn out within one second if current flow through the link is higher than its fusing current.

In the event of a sub-link burning out only the circuit protected by the link will be isolated.

NOTE: Only replace the link with one of the specified rating.

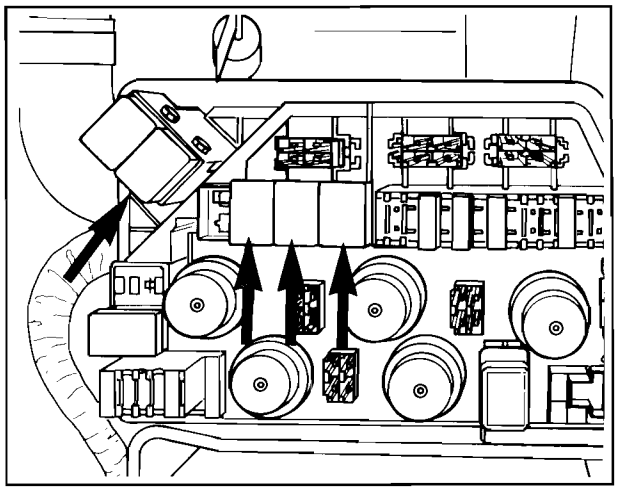


Fig. 4—Sub-link location

FUSES

Main Fuses

The main fuse box is located at the right of the steering column in front of the drivers seat. Additional fuses are located in the engine compartment relay box.

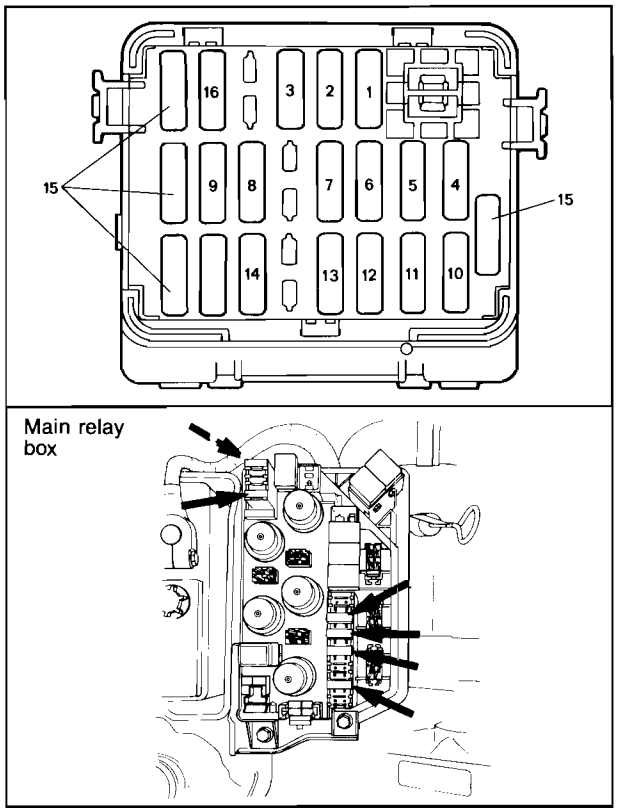


Fig. 5—Fuse locations

For fuse capacity and application refer Specifications.

NOTE: Spare fuses are contained in the fuse box cover. Only replace a fuse with one of the specified capacity.

In Line Fuses

Radio/Cassette

Located on the audio unit. Remove the unit cover panel to gain access.

ETACS Alarm Relay (where fitted)

Between alarm relay and the harness to relay. Located in console with A/C control unit and cruise control unit.

SECTION 3A – HOW TO READ THE WIRING DIAGRAMS

	Page Number
COMPOSITION AND CONTENTS OF WIRING DIAGRAMS . . .	54-3A-2
HOW TO READ CONFIGURATION DIAGRAMS	54-3A-3
HOW TO READ CIRCUIT DIAGRAMS	54-3A-4
MARKINGS FOR CONNECTOR EARTHING.	54-3A-6
SYMBOLIC MARKS	54-3A-8
WIRE COLOUR CODES	54-3A-8
ABBREVIATION SYMBOLS	54-3A-9
APPLICABLE MODEL CATEGORIES	54-3A-10

COMPOSITION AND CONTENTS OF WIRING DIAGRAMS

(1) These sections consists of wiring harness diagrams, installation locations of individual parts, circuit diagrams and wiring diagram.
(2) In each of the sections, all specifications are listed, including optional specifications. Accordingly, some specifications may not be applicable for individual vehicles.

Section	Basic contents
Wiring harness configuration diagrams	Connector locations and harness wiring configurations on actual vehicles are illustrated.
Single part installation position	Locations are shown for earth points of relays, control units, fusible links, fuses, etc.
Circuit diagrams	Circuits from power supply to earth are shown completely, classified according to system. There is a main division into power circuits and circuits classified by system The circuits classified by system also include operation and trouble shooting hints. • Power supply Circuits • Circuits from the battery to fusible link, dedicated fuses, ignition switch, general purpose fuses, etc. • Circuits classified by system For each system, the circuits are shown from fuse to earth, excluding the power supply sections. • Junction block/Jumper connector Here is the circuit for the entire junction block or jumper connector since only the part of the junction block or jumper connector needed is normally show in each circuit diagram.
Wiring diagram	All the harnesses and connectors are shown together so that the circuit diagrams and wiring harnesses of the entire vehicle can be seen at a glance.

HOW TO READ CONFIGURATION DIAGRAMS

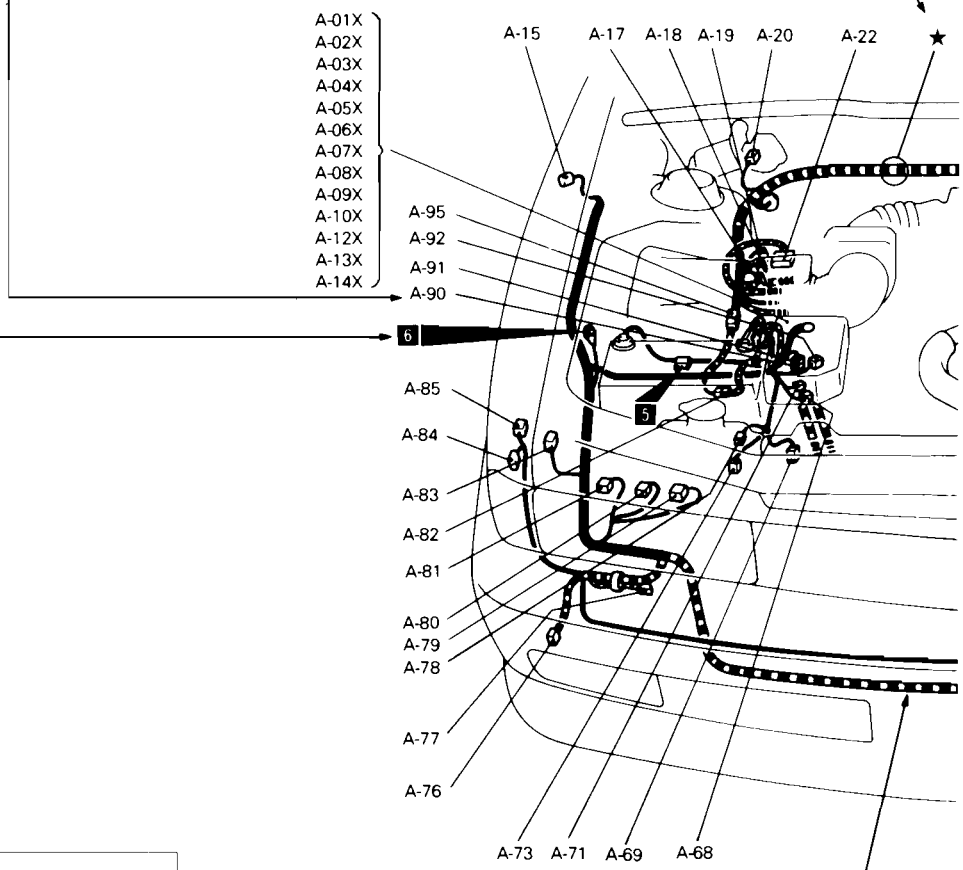
The wiring harness diagrams clearly show the connector locations and harness routings at each site in actual vehicles.

Denotes connector No.
The same connector No. is used throughout the circuit diagrams to facilitate connector location searches.
The first alphabetical symbol indicates the location site of the connector and a number that follows is the unique number. Numbers are assigned to parts in clockwise order on the diagram.
When the connectors are centralised in one place the connector colours are shown for easy identification.

Example: A - 12 (black)

- Connector colour
- Number specific to connector (serial number)
- Connector location site symbol
  - A: Engine compartment
  - B: Engine and transmission
  - C: Dash panel
  - D: Instrument panel
  - E: Interior
  - F: Doors
  - G: Luggage compartment
  - H: Tailgate / Trunk lid
  - J: Under rear floor

The mark ★ shows the standard mounting position of wiring harness.

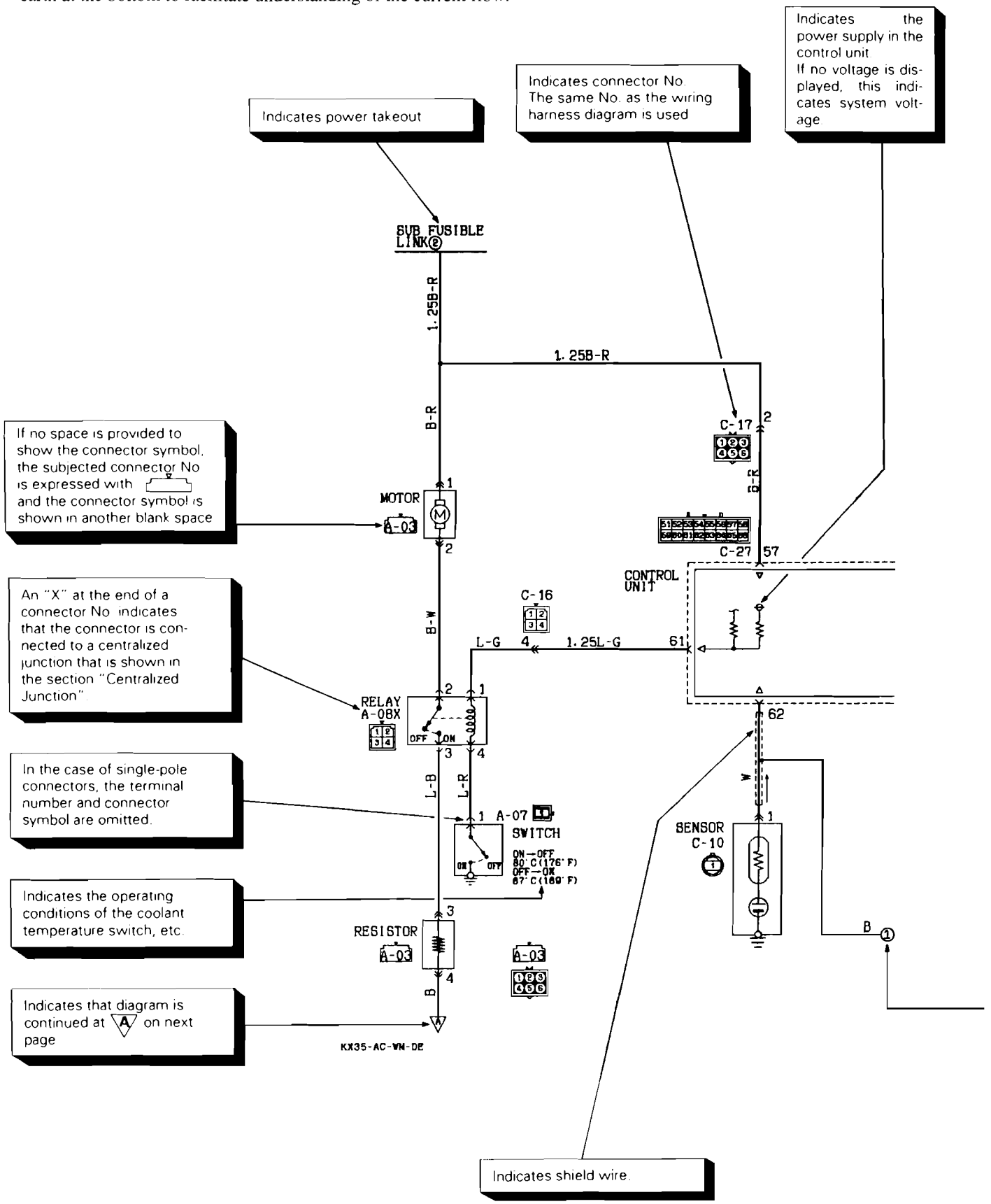


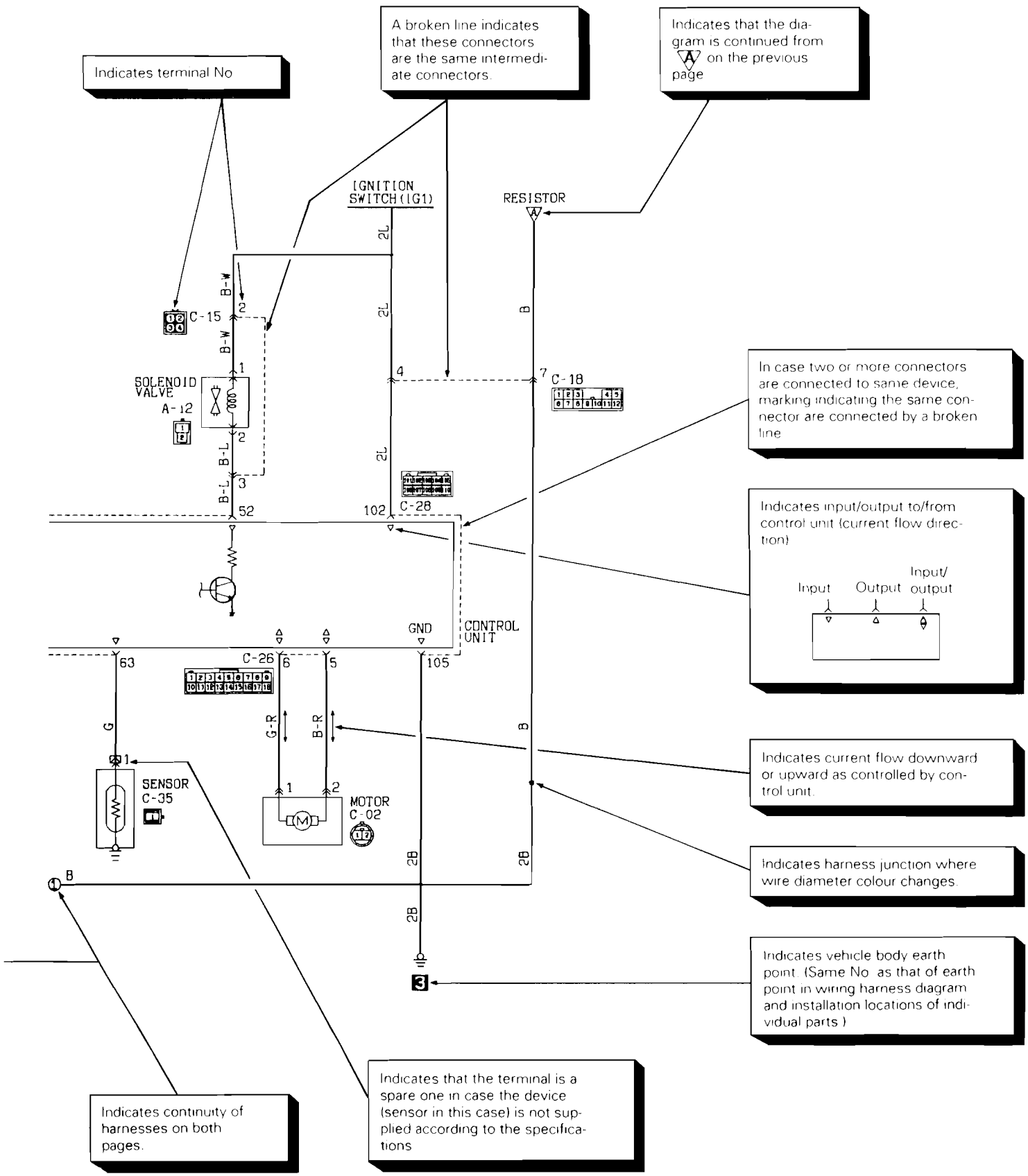
Denotes earth point.
Same earth number is used throughout circuit diagrams to facilitate search of earth point Refer to SECTION 3C SINGLE PART INSTALLATION POSITION EARTH MOUNTING LOCATIONS for details of earth point.

Denotes a section covered by a corrugated tube.

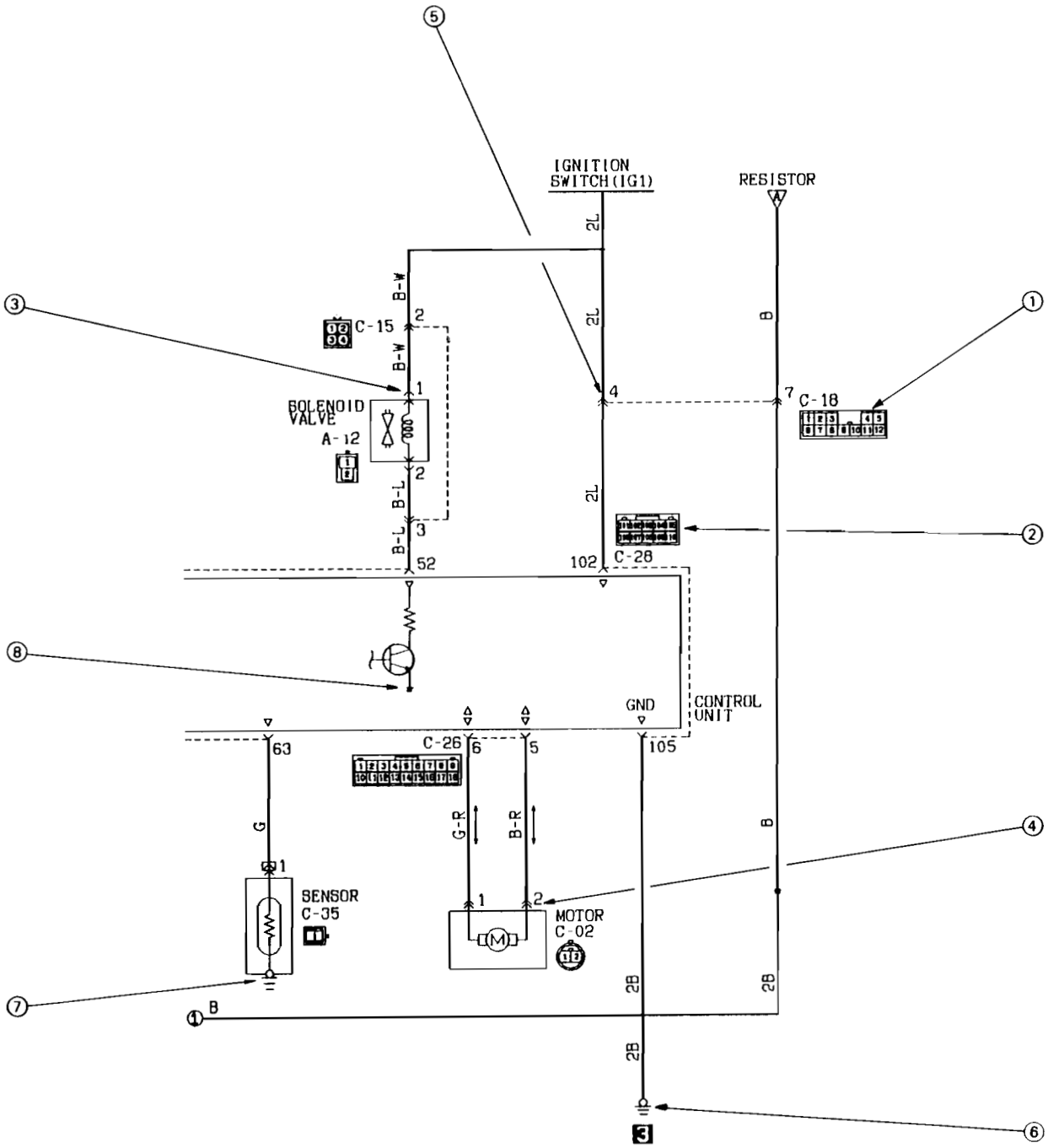
HOW TO READ CIRCUIT DIAGRAMS

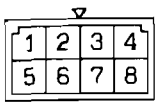
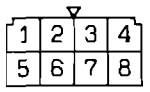
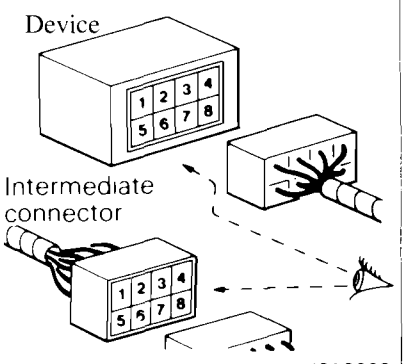
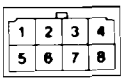
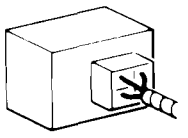
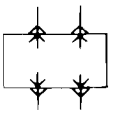
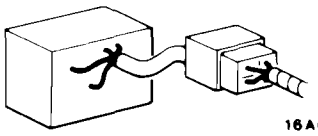
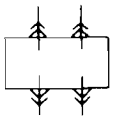
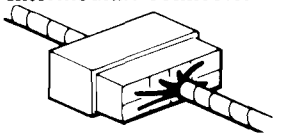
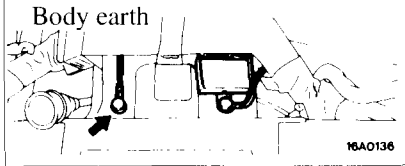
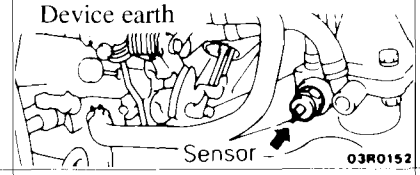
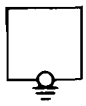
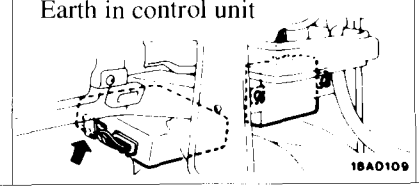
The circuit of each system from fuse (or fusible link) to earth is shown. The power supply is shown at the top and the earth at the bottom to facilitate understanding of the current flow.




Indicates terminal No
A broken line indicates that these connectors are the same intermediate connectors.
Indicates that the diagram is continued from A on the previous page
IGNITION SWITCH (IG1)
RESISTOR
2L
B
B-W
C-15
SOLENOID VALVE A-12
B-L
C-18
C-28
52
102
CONTROL UNIT
GND
105
C-26
63
6
5
G
G-R
B-R
SENSOR C-35
MOTOR C-02
2B
3
In case two or more connectors are connected to same device, marking indicating the same connector are connected by a broken line
Indicates input/output to/from control unit (current flow direction)
Input
Output
Input/ output
Indicates current flow downward or upward as controlled by control unit.
Indicates harness junction where wire diameter colour changes.
Indicates vehicle body earth point. (Same No. as that of earth point in wiring harness diagram and installation locations of individual parts.)
Indicates continuity of harnesses on both pages.
Indicates that the terminal is a spare one in case the device (sensor in this case) is not supplied according to the specifications

MARKINGS FOR CONNECTOR EARTHING



	No	Item	Symbol	Contents
Connector marking	1	Male 		Double connector contour lines indicate male connector terminals and single contour line indicates female terminals as illustrated here.
	–	Female 		
Connector symbol marking	2	Device 		The symbol indicates the connector as viewed from illustrated direction. At the connection with a device, the connector symbol on the device side is shown, and for an intermediate connector, male connector symbol is shown.
Connector connection marking	3	Direct connection type 		A connection between a device and connector on the harness side is either by direct insertion in the device (direct connection type) or by connection with a harness connector on the device side furnished (harness connection type). The two types are indicated as illustrated.
	4	Harness connection type 		
	5	Intermediate connector 		
Earth markings	6	Body earth 		Earth is either by body earth, device earth or control unit interior earth. These are indicated as illustrated.
	7	Device earth 		
	8	Earth in control unit 		

SYMBOLIC MARKS

Devices appearing in circuit diagrams are indicated by the following symbols.

Battery	Body earth	Single bulb	Resistor	Diode	Capacitor
Fuse	Equipment earth	Dual bulb	Variable resistor	Zener diode	Crossing of wires without connection
Fusible link earth	ECU interior	Speaker	Coil	Transistor	Crossing of wires with connection
Connector Female side Male side	Motor	Horn	Pulse generator	Buzzer	Chime
Thyristor	Piezo-electric device	Thermistor diode	Light emitting	Photo diode	Photo transistor

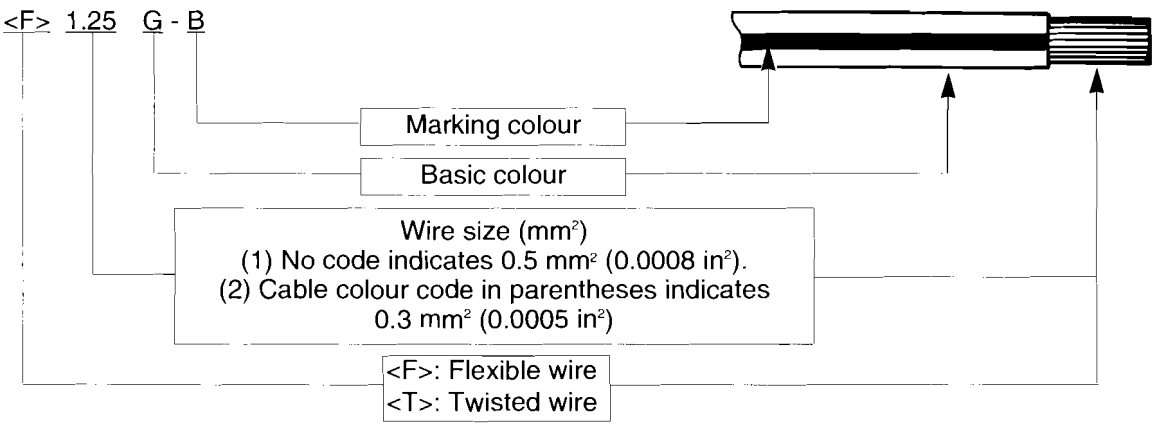
WIRE COLOUR CODES

Wire colours are identified by the following colour codes.

Code	Wire colour	Code	Wire colour
B	Black	PK	Pink
BR	Brown	R	Red
G	Green	LI	Light blue
GY	Grey	V	Violet
L	Blue	W	White
LG	Light green	Y	Yellow
O	Orange		

NOTE
If a cable has two colours the first of the two colour code characters indicates the basic colour (colour of the cable coating) an the second indicates marking colour.

Example: <F> 1.25 G - B



ABBREVIATION SYMBOLS

The abbreviation symbols used in wiring diagrams are defined below.

Abbreviation symbol	Meaning	Abbreviation symbol	Meaning
ABS	Anti-lock brake system	ILL	Illumination lamp
ELC-4 A/T	Electronic control 4-speed automatic transmission	IND	Indicator lamp
		J/C	Jumper connector
GND	Earth	J/B	Junction block
ETACS	Electronic time and alarm control	SRS	Supplemental Restraint System
ECS	ACTIVE-electronic control suspension		

Abbreviation symbols used for combination meters

Abbreviation symbol	Meaning	Abbreviation symbol	Meaning
ABS	Anti-lock brake system warning lamp	OIL	Oil pressure warning lamp
BEAM	Upper beam indicator lamp	P/BRAKE	Parking brake indicator lamp
BRAKE	Brake warning lamp	REED	Reed switch (vehicle speed sensor)
CHECK ENGINE	Check engine warning lamp	SPEED	Speedometer
CHG	Charging warning lamp	TACHO	Tachometer
DOOR	Door warning lamp	T/GA	Engine coolant temperature gauge
F/GA	Fuel gauge	TURBO	Turbo indicator lamp
FUEL	Fuel (remaining) warning lamp	TURN (LH)	Turn signal indicator lamp (L.H.)
HAZARD	Hazard warning indicator lamp	TURN (RH)	Turn signal indicator lamp(R.H.)

Abbreviation symbols used for switches and relays

Name of switches and relays	Abbre-viation symbol	Operation	Name of switches and relays	Abbre-viation symbol	Operation
Dimmer/ passing switch	LO	Low beams ON	Blower switch	LO	Blower operates at low speed
	HI	High beams ON		ML	Blower operates at medium low speed
Lighting switch	TAIL	Position, tail, licence-plate and instrument panel lamps ON		MH	Blower operates at medium high speed
	HEAD	Headlamps ON		HI	Blower operates at high speed
Room lamp switch	DOOR	Room lamp ON when a door is open	Air conditioner switch	ECONO	1st pos (economical operation)
				DRY	2nd pos (full load operation)
Condenser fan motor control relay	HI	Condenser fan motor operates at high speed	Wiper switch speed	LO	Wipers operate at low speed
	LO	Condenser fan motor operates at low speed		HI	Wipers operate at high speed
				INT	Wipers operate intermittently

Abbreviation symbols used for switches and relays continued

Name of switches and relays	Abbre-viation symbol	Operation	Name of switches and relays	Abbre-viation symbol	Operation
Turn signal switch	LH	L.H. turn signal lamps ON	Remote control mirror switch	LH	L.H. mirror operates
	RH	R.H. turn signal lamps ON		RH	R.H. mirror operates
Power window switch	UP	Window closed	Sunroof switch	UP	Sunroof tilted up
	DOWN	Window opened		DOWN	Sunroof tilted down
Door lock actuator/ Door lock control unit/Door cylinder	LOCK	Door locked		OPEN	Sunroof slides open
				CLOSE	Sunroof slides to close
	UN/ LOCK	Door unlocked	Others	ON	Switched on
				OFF	Switched off

APPLICABLE MODEL CATEGORIES

The applicable model categories are indicated below for easy identification.

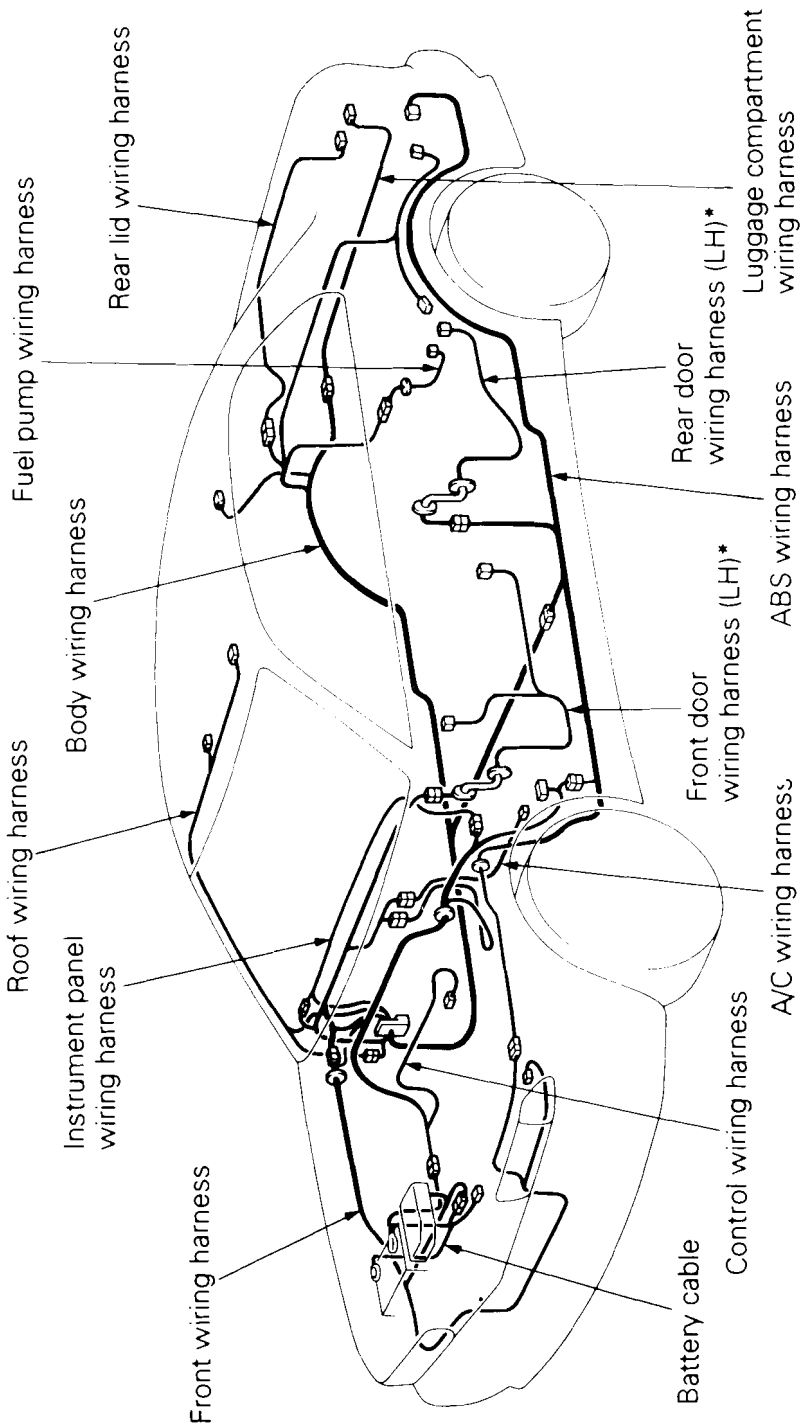
Division	Contents
4G54	Indicates vehicles with 4G54-SOHC engine
6G72	Indicates vehicles with 6G72-SOHC engine
MPI	Indicates vehicles with multi-point injection
SOHC	Indicates vehicles with single overhead camshaft engine
T/C	Indicates vehicles with turbocharger
A/C	Indicates vehicles with air conditioner
A/T	Indicates vehicles with automatic transmission
M/T	Indicates vehicles with manual transmission
2WD	Indicates front wheel-drive vehicles
TCS	Indicates vehicles with Total Control System
M O T	New Zealand Ministry Of Transport vehicles
SRS	Indicates vehicles with Supplemental Restraint System (Air Bag)
4WD	Indicates 4 wheel-drive vehicles

SECTION 3B – WIRING HARNESS CONFIGURATION DIAGRAMS

	Page Number
OVERALL WIRING DIAGRAM	
Sedan	54-3B-2
Wagon	54-3B-4
ENGINE COMPARTMENT	
4G54 4 cylinder SOHC-MPI	54-3B-6
4G54 4 cylinder SOHC-Carburettor	54-3B-8
6G72 6 cylinder SOHC-MPI (without ECS)	54-3B-10
6G72 6 cylinder SOHC-MPI (with ECS)	54-3B-10
ENGINE and TRANSMISSION	
4G54 4 cylinder carburettor	54-3B-14
4G54 4 cylinder SOHC-MPI	54-3B-15
6G72 6 cylinder SOHC-MPI	54-3B-16
DASH PANEL	54-3B-18
INSTRUMENT PANEL	54-3B-20
INTERIOR	
Sedan	54-3B-22
Wagon	54-3B-24
DOOR	54-3B-25
LUGGAGE COMPARTMENT	
Sedan	54-3B-26
Tailgate Wagon	54-3B-27
Trunk lid	54-3B-28
UNDER REAR FLOOR	
Sedan	54-3B-29
Wagon	54-3B-30

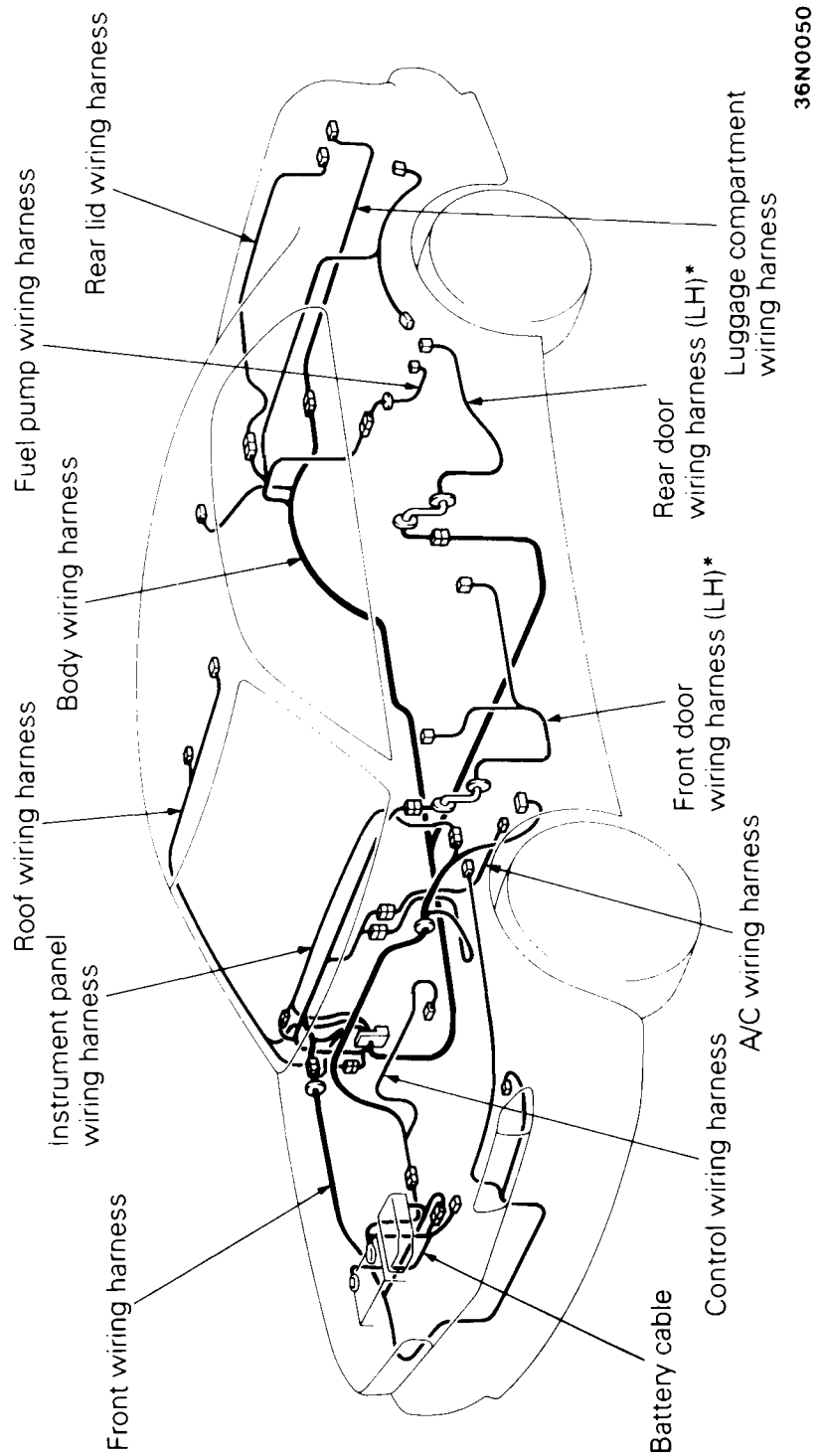
1 OVERALL WIRING DIAGRAM

Sedan Vehicles without <ABS or SRS>



NOTE
(1) These illustrations show only major wiring harnesses
(2) * also equipped at the right side

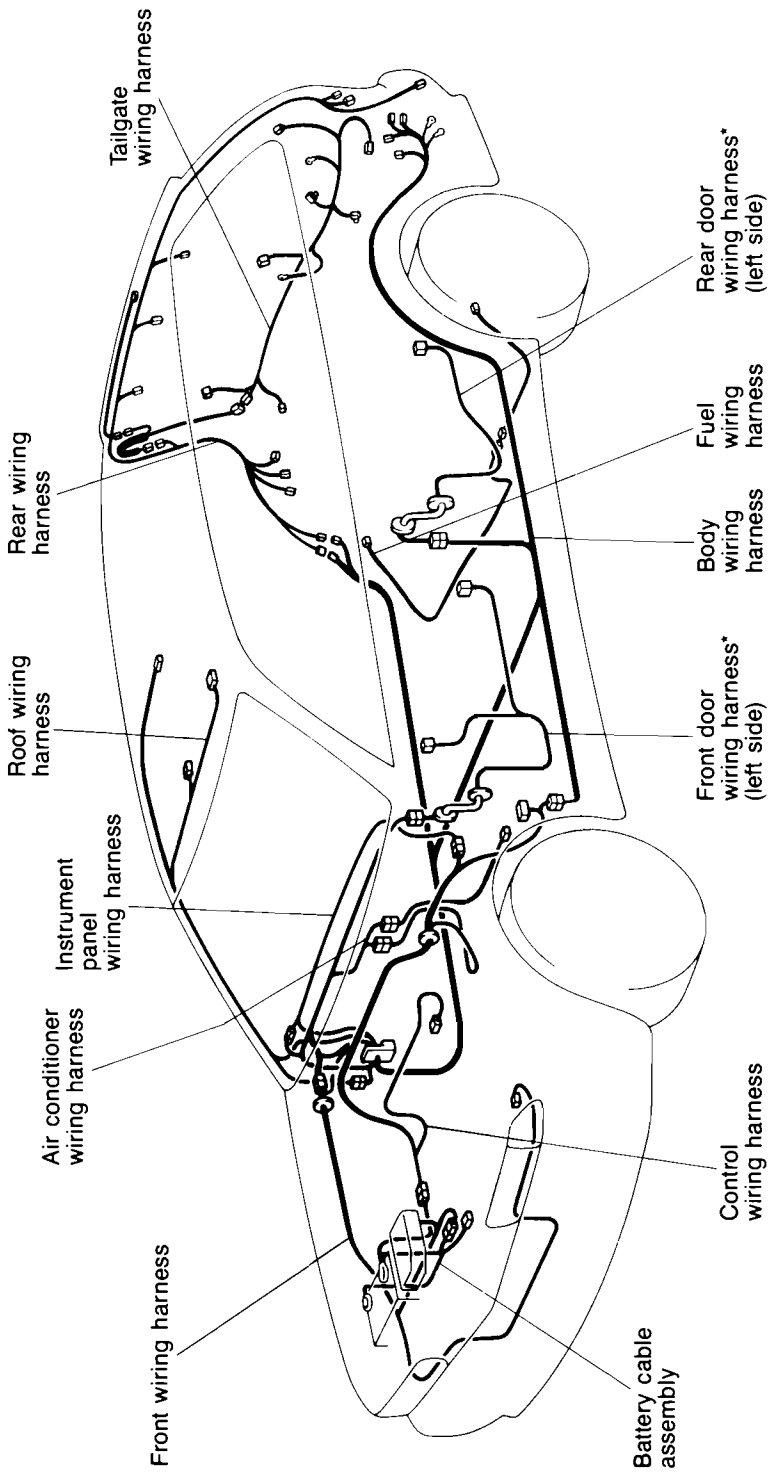
<Sedan Vehicles with ABS or SRS>.



NOTE
(1) These illustrations show only major wiring harnesses
(2) * also equipped at the right side

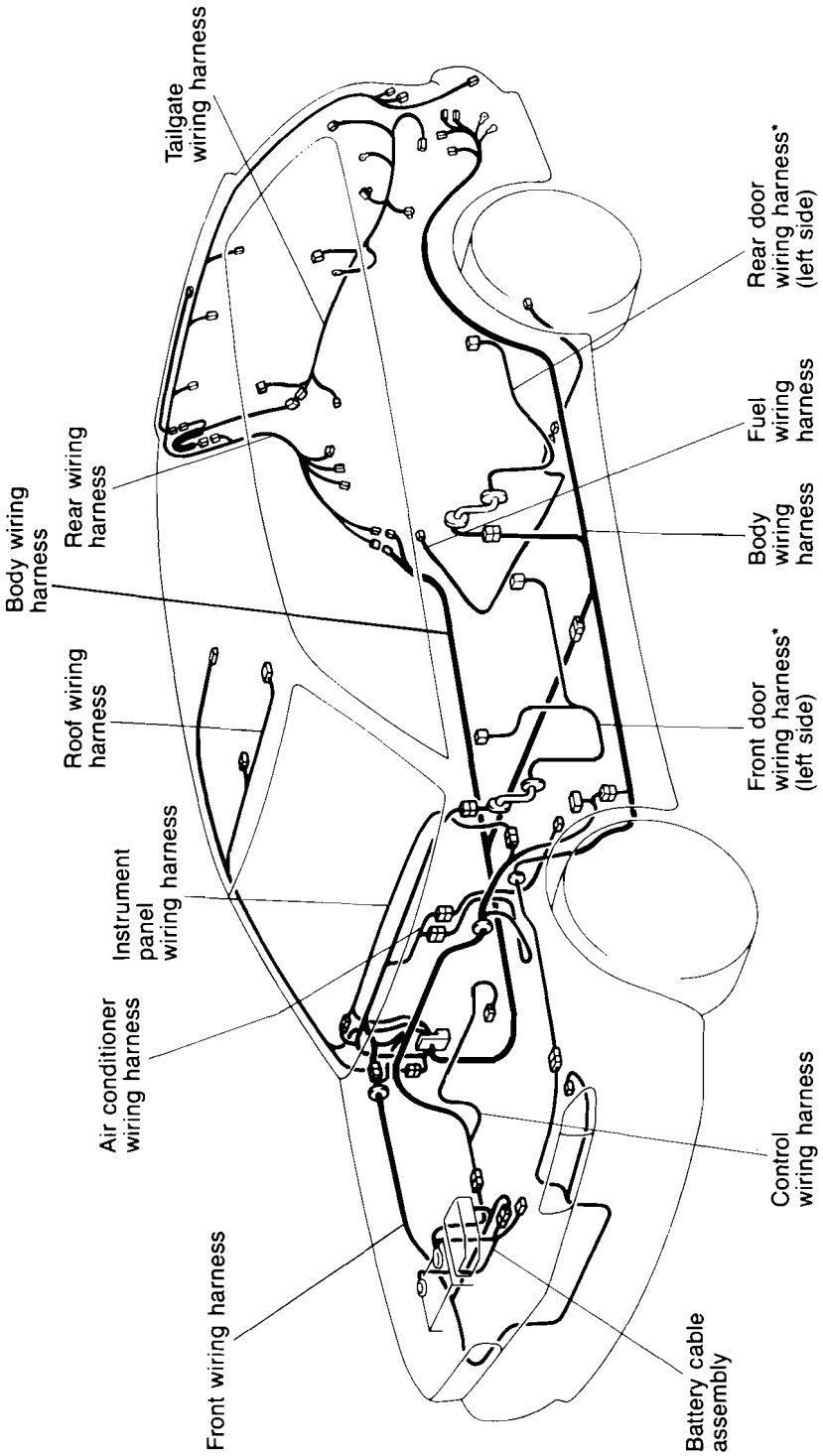
OVERALL WIRING DIAGRAMS

Wagon <vehicles without ABS or SRS>



OVERALL WIRING DIAGRAMS

Wagon <vehicles with ABS or SRS>

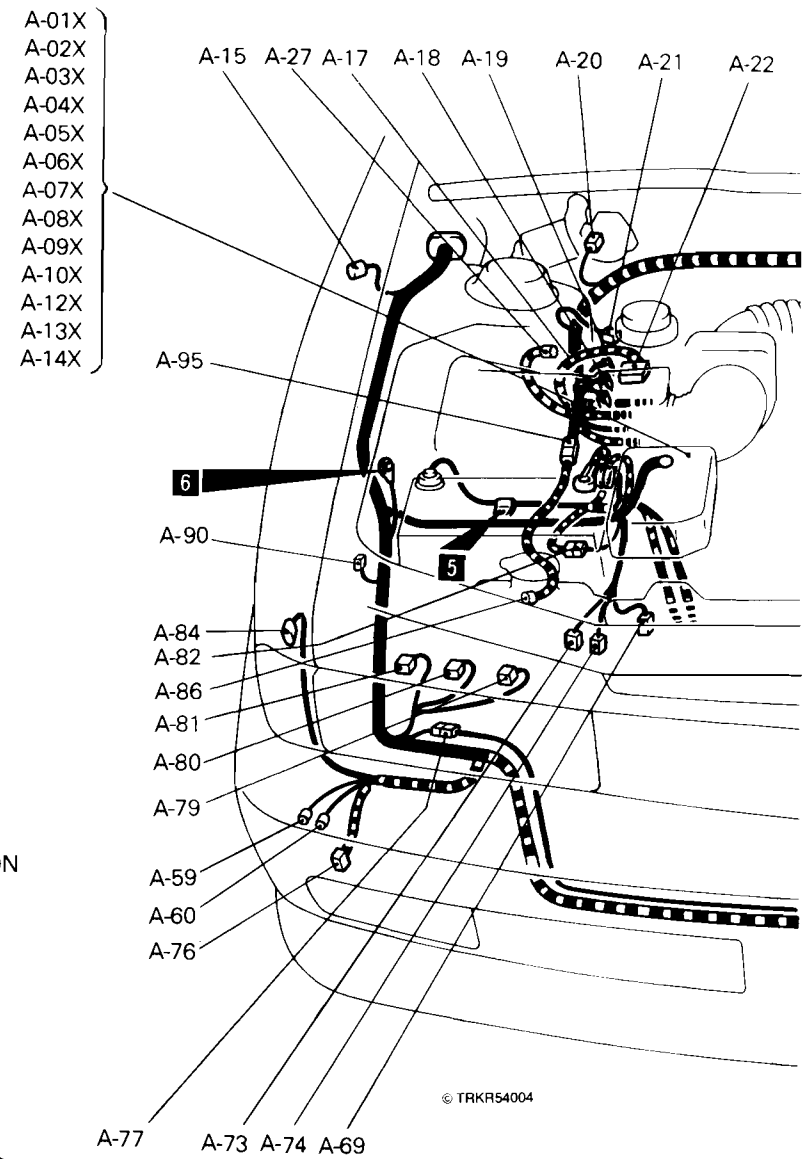


2 Engine Compartment

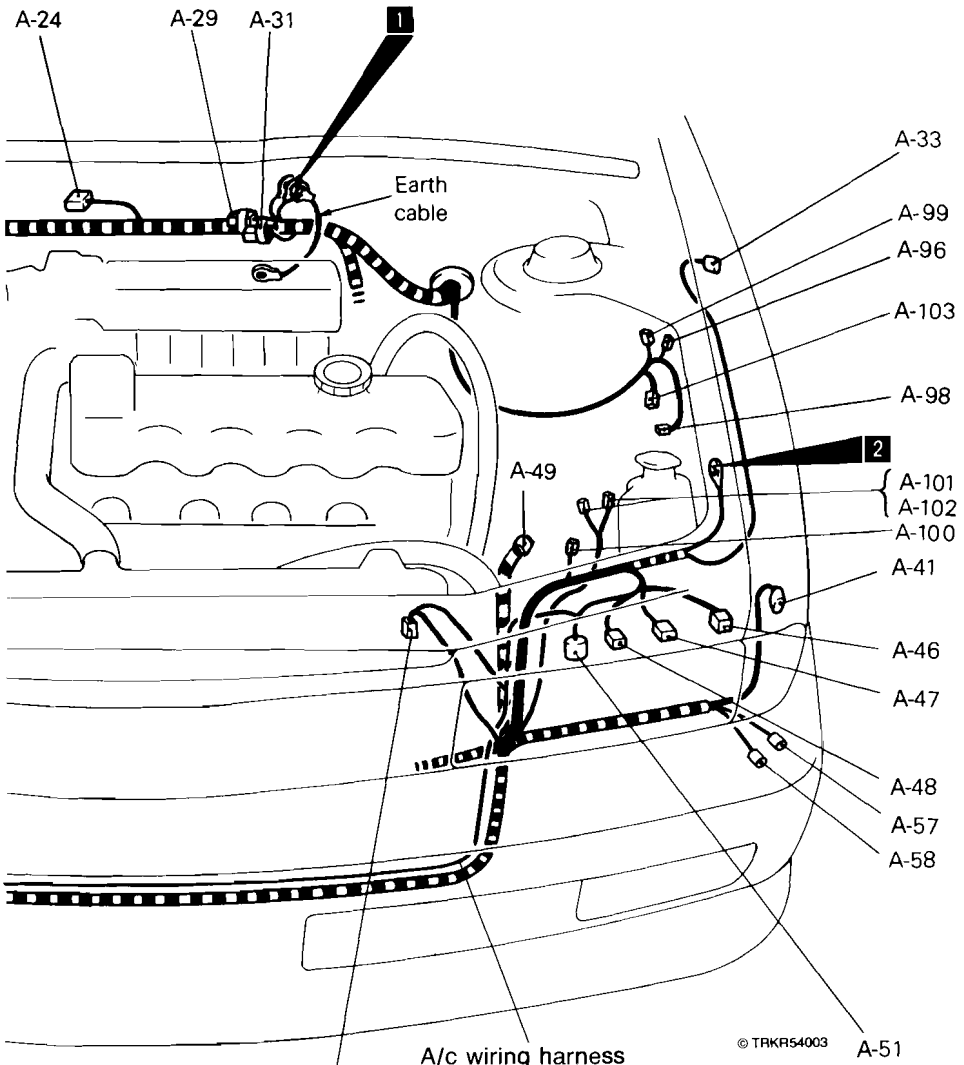
MPI 4 Cylinder

Connector Symbol

A



A-01X A-02X A-03X A-04X A-05X A-06X A-07X A-09X A-10X A-11X A-12X A-13X A-14X	Refer to CENTRALISED JUNCTION
A-15	Side turn signal lamp (RH)
A-16	-
A-17	Pulse generator <A/T>
A-18	Kickdown servo switch <A/T>
A-19	A/T fluid temperature sensor <A/T>
A-20	Windshield wiper motor
A-21	Brake Pressure Switch
A-22	Air flow sensor
A-23	-
A-24	Auto cruise control actuator
A-25	-
A-26	-
A-27	Variable resistor <New Zealand models>
A-28	-
A-29	Ignition timing adjustment connector
A-30	-
A-31	Fuel pump check connector
A-32	-
A-33	Side turn signal lamp (LH)
A-34 to A-39	-
A-40	-
A-41	Front turn signal lamp (LH)
A-42	-
A-43 to A-45	-
A-46	Front Position Lamps (LH)
A-47 to A-48	Headlamp (LH) -
A-49	Front impact sensor (LH) <SRS>
A-50	-
A-51	Dual pressure switch <A/C>
A-52	-
A-53	-
A-54	-
A-55	Condenser fan motor <A/C>
A-56	-
A-57 to A-60	Horn
A-61 to A-63	-



A-64 -
A-65 -
A-66 -
A-67 -
A-68 -
A-69 Radiator fan motor
A-70 -
A-71 -
A-72 -
A-73 Windshield washer motor
A-74 Rear window washer motor <Wagon>
A-75 -
A-76 -
A-77 A/C horn and front horn combination <dealer fitted A/C>
A-78 -
A-79 to A-80 Headlamp (RH)

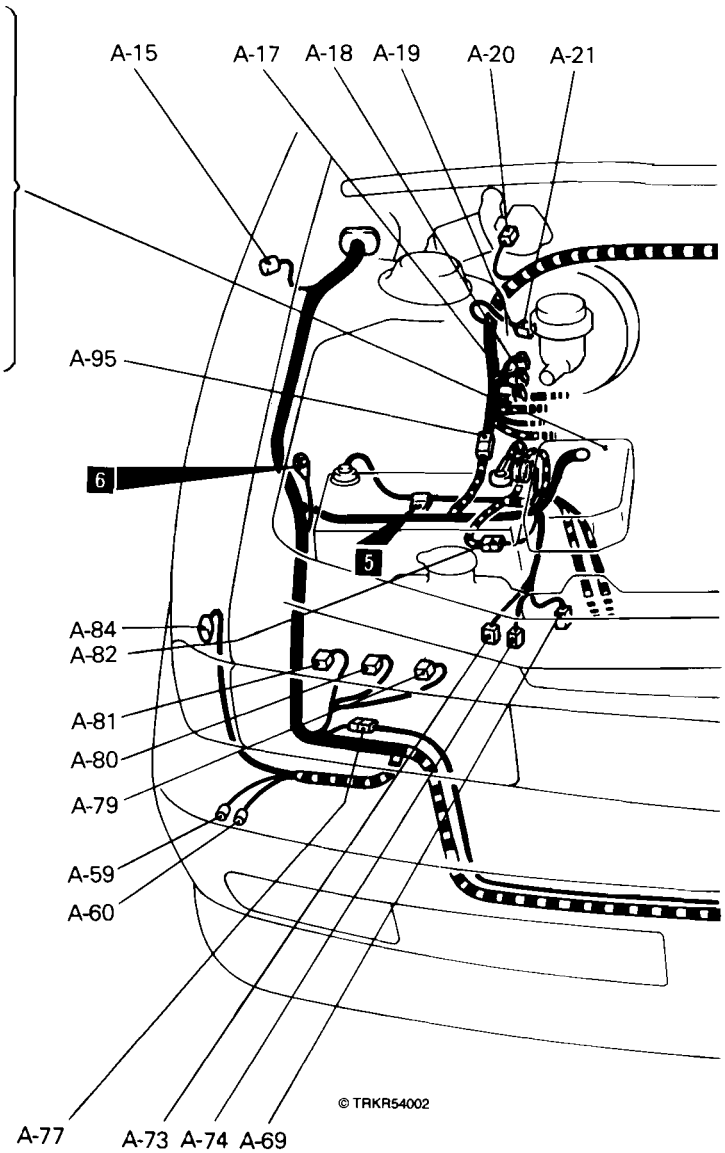
A-81 Front position lamp(RH)
A-82 Front wiring harness and battery cable combination
A-83 -
A-84 Front turn signal lamp (RH)
A-85 -
A-86 Front impact sensor (RH) <SRS>
A-87 to A-89 -
A-90 Starter relay <1992,1993 models>
A-91 -
A-92 -
A-93 -
A-94 -
A-95 Front wiring harness and control wiring harness combination
A-96 No connection
A-97 -
A-98 Ignition coil
A-99 Noise filter
A-100 Hood switch <1992,1993 models>
A-101 Theft alarm horn <1992,1993 models>
A-102 -
A-103 Power transistor

Remark
For details concerning the earth point (example, 2 refer to P.3C-7)

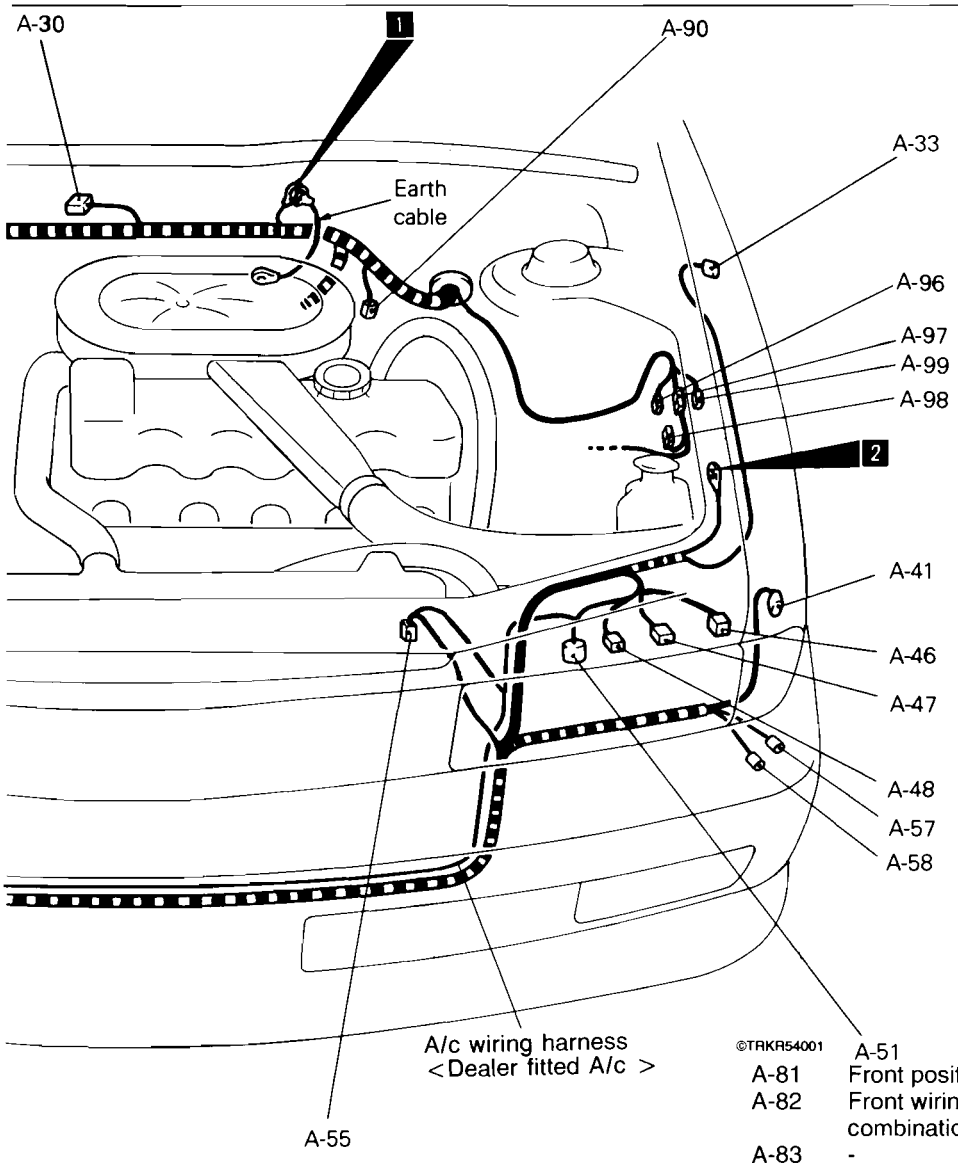
2 Engine Compartment

4 Cylinder engine with Carburettor

Connector Symbol **A**



A-01X A-02X A-03X A-04X A-05X A-06X A-07X A-09X A-10X A-11X A-12X A-13X A-14X	Refer to CENTRALISED JUNCTION
A-15	Side turn signal lamp (RH)
A-16	-
A-17	Pulse generator <A/T>
A-18	Kickdown servo switch <A/T>
A-19	A/T fluid temperature sensor <A/T>
A-20	Windshield wiper motor
A-21	Brake Pressure Switch
A-22	-
A-23	-
A-24	-
A-25	-
A-26	-
A-27	-
A-28	-
A-29	-
A-30	Vacuum switch
A-31	-
A-32	-
A-33	Side turn signal lamp (LH)
A-34 to A40	-
A41	Front turn signal lamp (LH)
A-42 to A-45	-
A-46	Front Position Lamps(LH)
A-47 to A-48	Headlamp (LH)
A-49	-
A-50	-
A-51	Dual pressure switch <A/C>
A-52	-
A-53	-
A-54	-
A-55	Condenser fan motor<A/C>
A-56	-
A-57 to A-60	Horn
A-61 to A-63	-



A-64	-
A-65	-
A-66	-
A-67	-
A-68	-
A-69	Radiator fan motor
A-70	-
A-71	-
A-72	-
A-73	Windsheild washer motor
A-74	Rear window washer motor <Wagon>
A-75	-
A-76	-
A-77	A/C horn and front horn combination <dealer fitted A/C>
A-78	-
A-79 to A-80	Headlamp (RH)

A-81	Front position lamp(RH)
A-82	Front wiring harness and battery cable combination
A-83	-
A-84	Front turn signal lamp (RH)
A-85	-
A-86	-
A-87 to A-89	-
A-90	-
A-91	-
A-92	-
A-93	-
A-94	-
A-95	Front wiring harness and control wiring harness combination
A-96	No connection
A-97	Ignition coil harness and control harness combination
A-98	Ignition coil
A-99	Noise filter
A-100	-
A-101	-
A-102	-
A-103	-

Remark

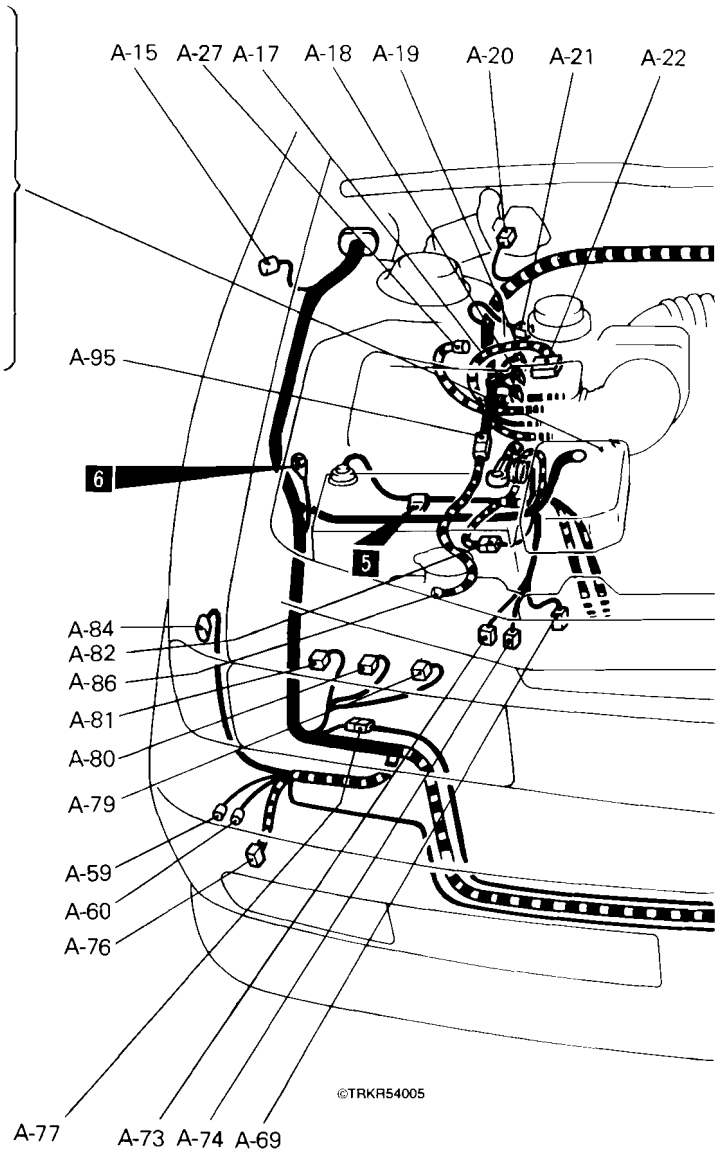
For details concerning the earth point (example, 2 refer to P.3C-7)

2 Engine Compartment

MPI 6 Cylinder without ECS

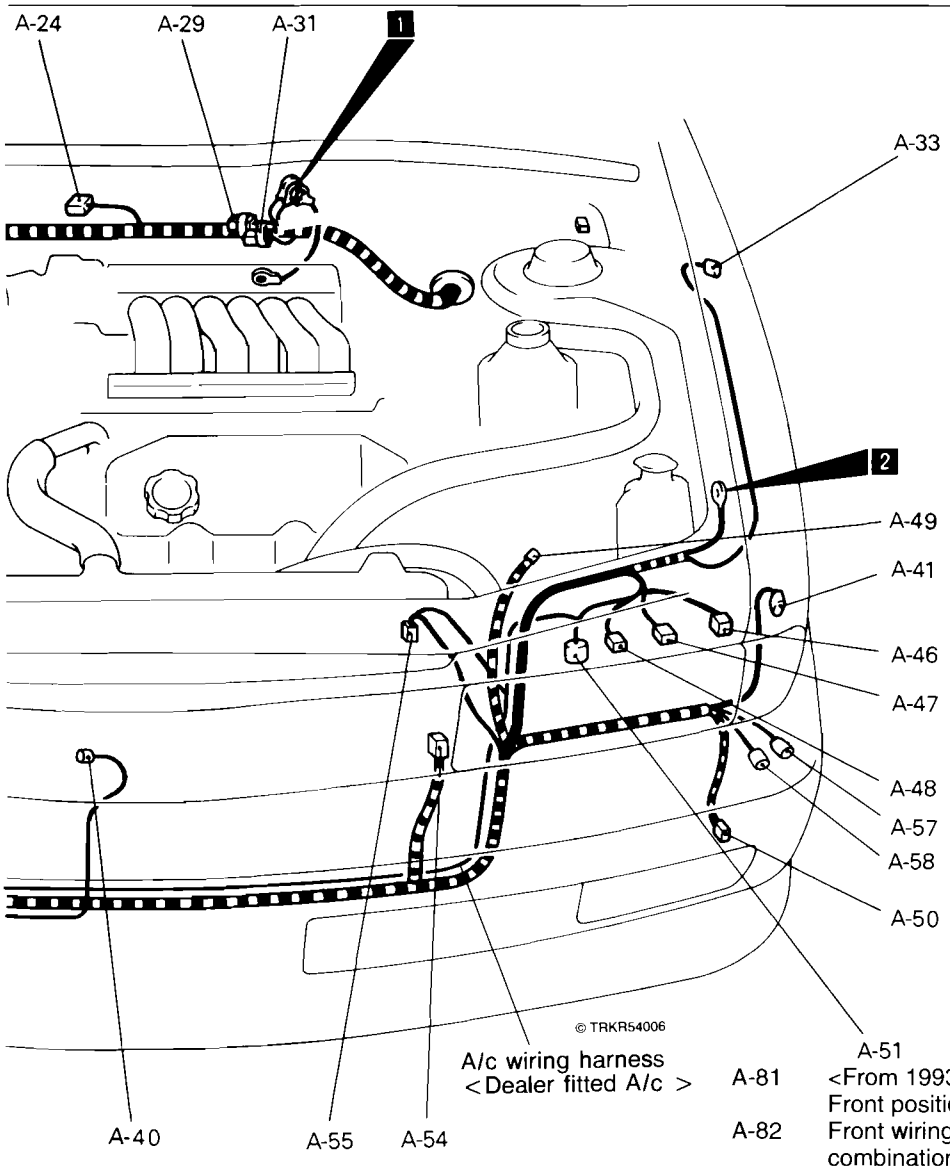
Connector Symbol

A



A-01X, A-02X, A-03X, A-04X, A-05X, A-06X, A-07X, A-09X, A-10X, A-11X, A-12X, A-13X, A-14X — Refer to CENTRALISED JUNCTION

A-15 Side turn signal lamp (RH)
A-16 -
A-17 Pulse generator <A/T>
A-18 Kickdown servo switch <A/T>
A-19 A/T fluid temperature sensor <A/T>
A-20 Windshield wiper motor
A-21 Brake Pressure Switch
A-22 Air flow sensor
A-23 -
A-24 Auto-cruise control actuator
A-25 -
A-26 -
A-27 Variable Resistor <New Zealand models>
A-28 -
A-29 Ignition timing adjustment connector
A-30 -
A-31 Fuel pump check connector
A-32 -
A-33 Side turn signal lamp (LH)
A-34 to A-39 -
A-40 Emergency Lamps <MOT>
A-41 Front turn signal lamp (LH)
A-42 to A-45 -
A-46 <From 1993 Magna & NZ MODELS> Front Position Lamps (LH)
A-47 to A-48 Headlamp (LH)
A-49 Front impact sensor (LH)<SRS>
A-50 Front position lamp (LH) <1992 & 1993 Australian models>
A-51 Dual pressure switch <A/C>
A-52 -
A-53 -
A-54 A/C compressor
A-55 Condenser fan motor <A/C>
A-56 -
A-57 to A-60 Horn
A-61 to A-63 -



A-64	-
A-65	-
A-66	-
A-67	-
A-68	-
A-69	Radiator fan motor
A-70	-
A-71	-
A-72	-
A-73	Windsheild washer motor
A-74	Rear window washer motor<Wagon>
A-75	-
A-76	Front position lamp (RH)<1992,1993Australian models>
A-77	A/C harness and front harness combination <dealer fitted A/C>
A-78	-
A-79 to A-80	Headlamp (RH) -

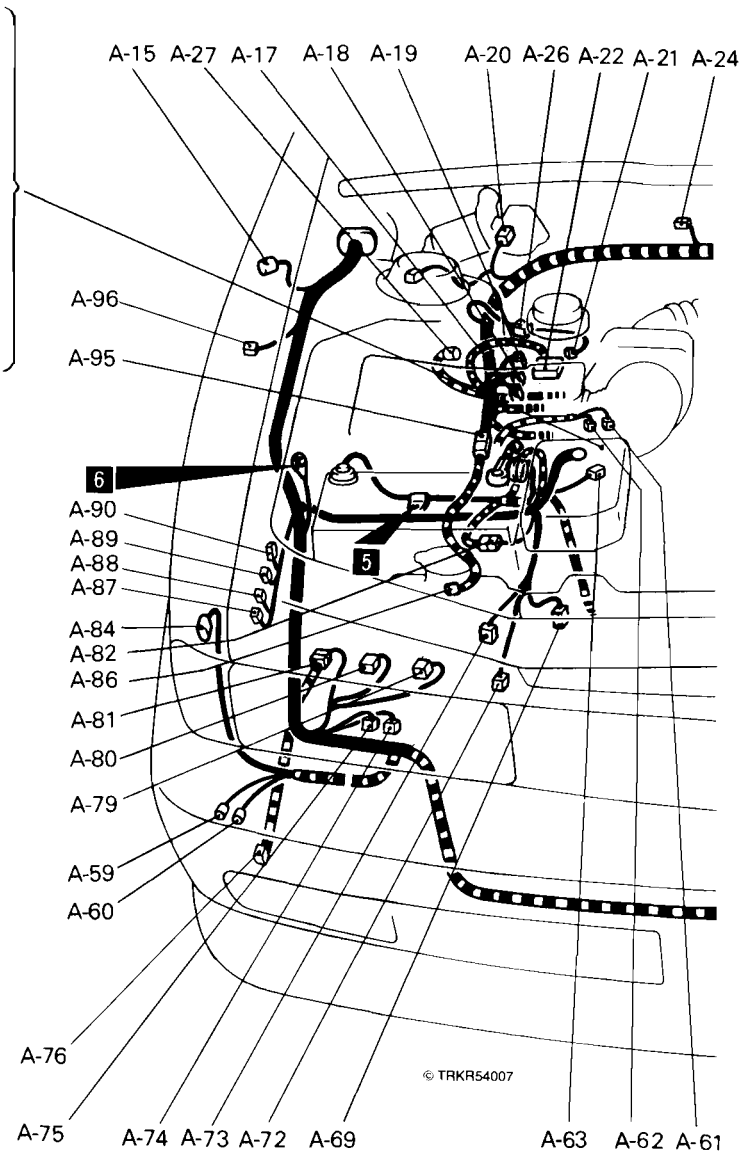
A-81	<From 1993 Magna & NZ models> Front position lamp(RH)
A-82	Front wiring harness and battery cable combination
A-83	-
A-84	Front turn signal lamp (RH)
A-85	-
A-86	Front impact sensor (RH)<SRS>
A-87 to A-89	-
A-90	-
A-91	-
A-92	-
A-93	-
A-94	-
A-95	Front wiring harness and control wiring harness combination
A-96	-
A-97	-
A-98	-
A-99	-
A-100	-
A-101	-
A-102	-
A-103	-

Remark
For details concerning the earth point (example, 2 refer to P.3C-7)

2 Engine Compartment

MPI 6 Cylinder with ECS

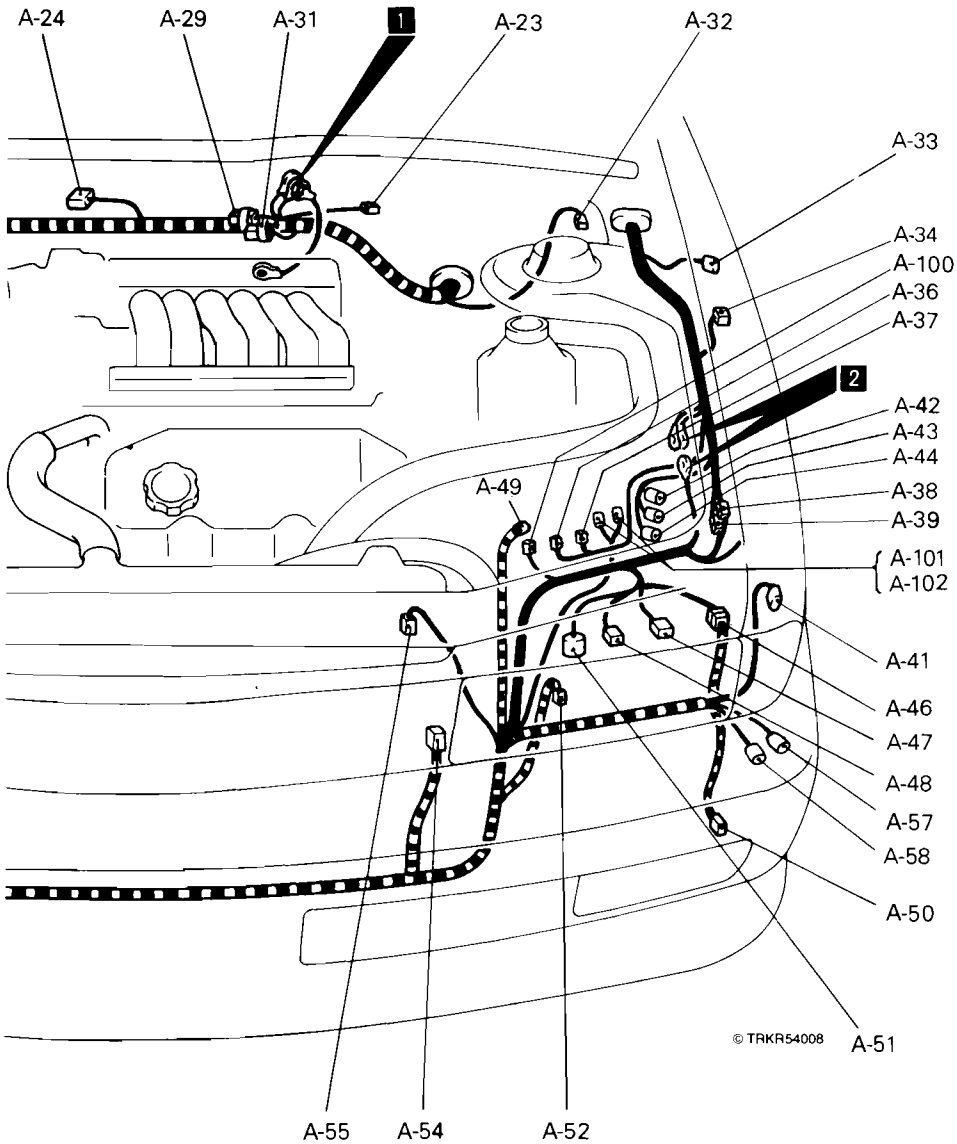
Connector Symbol **A**



A-01X, A-02X, A-03X, A-04X, A-05X, A-06X, A-07X, A-09X, A-10X, A-11X, A-12X, A-13X, A-14X: Refer to CENTRALISED JUNCTION

A-15 Side turn signal lamp (RH)
A-16 -
A-17 Pulse generator <A/T>
A-18 Kickdown servo switch <A/T>
A-19 A/T fluid temperature sensor <A/T>
A-20 Windshield wiper motor
A-21 Brake fluid level sensor <ABS> or Brake pressure switch <Non ABS>
A-22 Air flow sensor
A-23 ACTIVE-ECS front solenoid valve
A-24 Auto-cruise control actuator
A-25 -
A-26 Master cylinder and control harness combination <without ABS>
A-27 Variable resistor<New Zealand models>
A-28 -
A-29 Ignition timing adjustment connector
A-30 -
A-31 Fuel pump check connector
A-32 -
A-33 Side turn signal lamp (LH)
A-34 to A-39 -
A-40 -
A-41 Front turn signal lamp (LH)
A-42 to A-45 -
A-46 Front Position Lamps(LH) and Front harness combination <Australian models> Front position lamp (LH) <New Zealand and 1994 Australian models>

A-47 to A-48 Headlamp (LH)
A-49 Front impact sensor (LH) <SRS>
A-50 Front position lamp (LH) <1992,1993 Australian models>
A-51 Dual pressure switch <A/C>
A-52 -
A-53 -
A-54 A/C compressor
A-55 Condenser fan motor<A/C>
A-56 -
A-57 to A-60 Horn
A-61 to A-63 -



A-64	-
A-65	-
A-66	-
A-67	-
A-68	-
A-69	Radiator fan motor
A-70	-
A-71	-
A-72	Active-ECS flow control solenoid valve
A-73	Windsheild washer motor
A-74	ACTIVE-ECS return pump
A-75	ACTIVE-ECS pressure switch 1992,1993
A-76	Front position lamp (RH) <Aust models>
A-77	-
A-78	-
A-79	Headlamp (RH)
A-80	-
A-81	Front position lamp(RH) & front harness 1992,1993 <Aust models> front position lamp(RH)<NZ models> and <1994 Aust models>
A-82	Front wiring harness and battery cable combination
A-83	-
A-84	Front turn signal lamp (RH)
A-85	-
A-86	Front impact sensor (RH) <SRS>
A-87	ACTIVE-ECS return pump relay
A-88	ACTIVE-ECS compressor relay
A-89	ACTIVE-ECS solenoid valve relay
A-90	Starter relay
A-91	-
A-92	-
A-93	-
A-94	-
A-95	Front wiring harness and control wiring harness combination
A-96	ABS speed sensor (Front: RH)
A-97	-
A-98	-
A-99	-
A-100	Hood switch
A-101	Theft alarm horn
A-102	Theft alarm horn
A-103	-

Remark
For details concerning the earth point (example, 2 refer to P.3C-7)

(2) Check connectors and lock lever for damage, and terminals for deformities, refer Fig. 4.

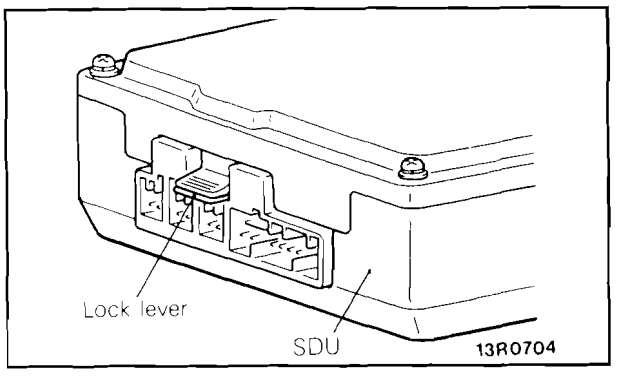


Fig. 4 — SDU lock lever

Air Bag Module

(1) Check pad cover for dents, cracks or deformities, refer Fig. 5.

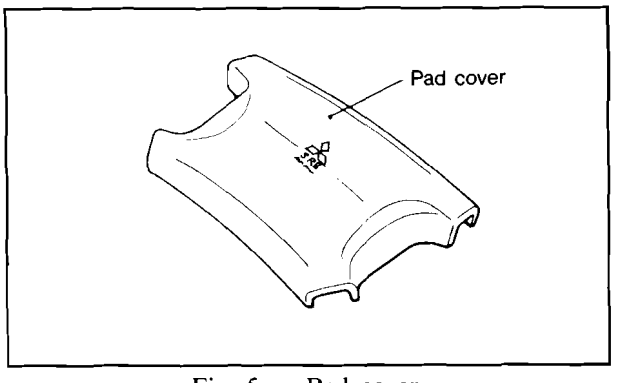


Fig. 5 — Pad cover

(2) Check hooks and connectors for damage, terminal deformities and harness for binds, refer Fig. 6.

(3) Check air bag inflator case for dents, cracks or deformities, refer Fig. 6.

(4) Install air bag module to steering wheel to check fit or alignment with the wheel.

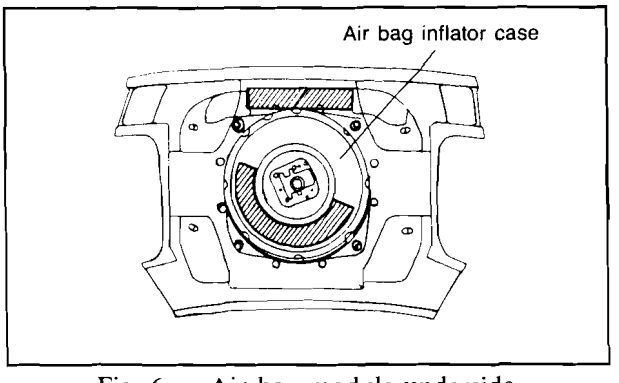


Fig. 6 — Air bag module underside

Clock Spring

(1) Check clock spring connectors and protective tube for damage and terminals for deformities, refer Fig. 7.

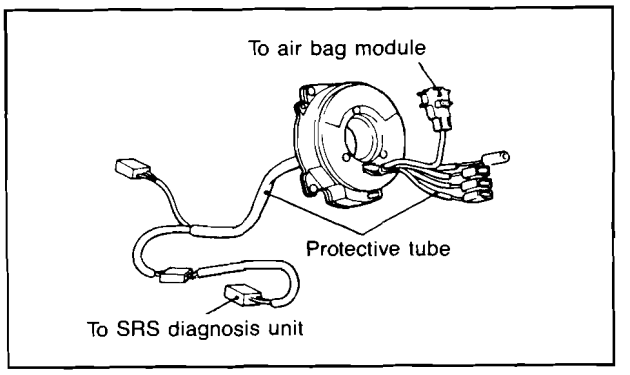


Fig. 7 — SRS clock spring

(2) Visually check the case and the gears for damage, refer Fig. 8.

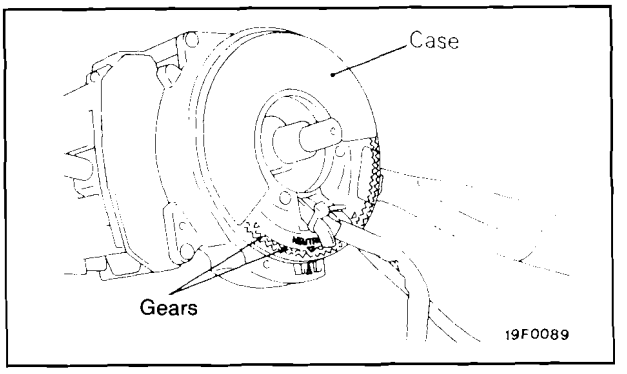


Fig. 8 — Clock spring gears and case

Steering Wheel, Steering Column and Intermediate Joint

(1) Check wiring harness (built into steering wheel) and connectors for damage and terminals for deformities.

(2) Install air bag module to check fit or alignment with steering wheel.

(3) Check steering wheel for noise, binds or difficult operation and excessive free play.

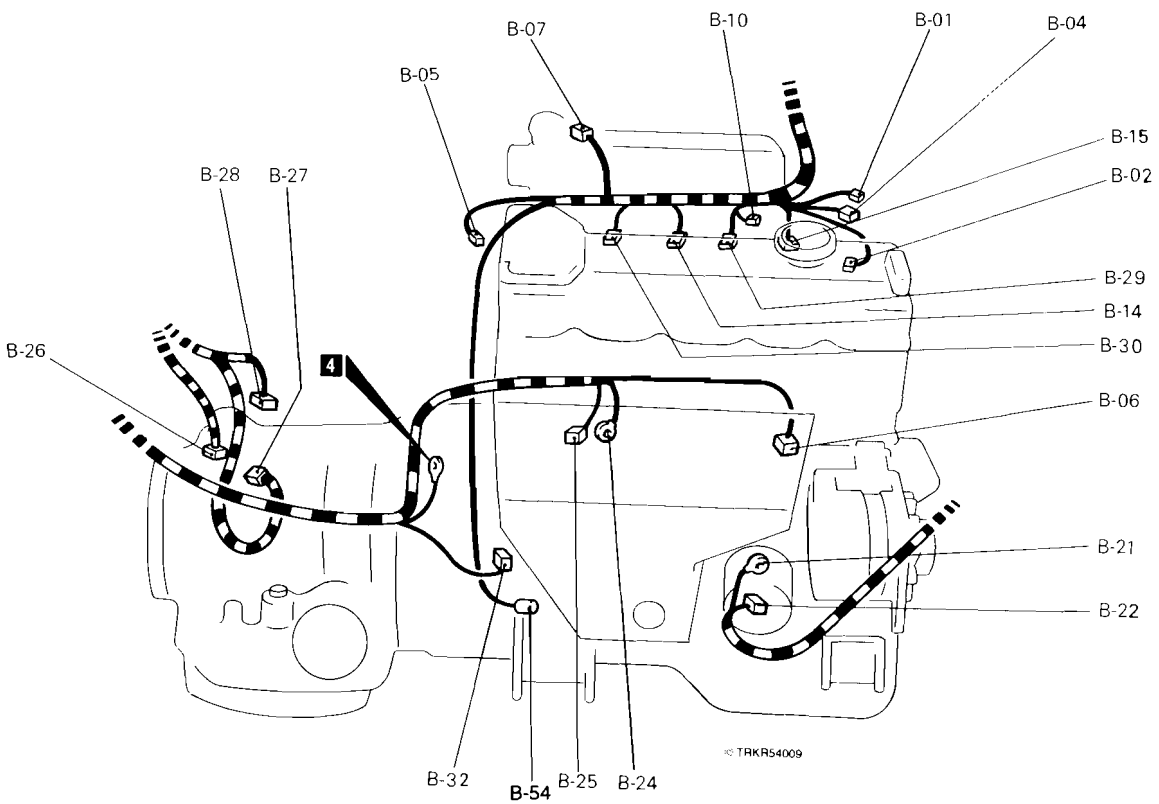
Harness Connector (Body and Front wiring harness)

Check harnesses for binding, connectors for damage, poor connections, and terminals for deformities.

4 Cylinder MPI engine and Transmission

Connector Symbol

B

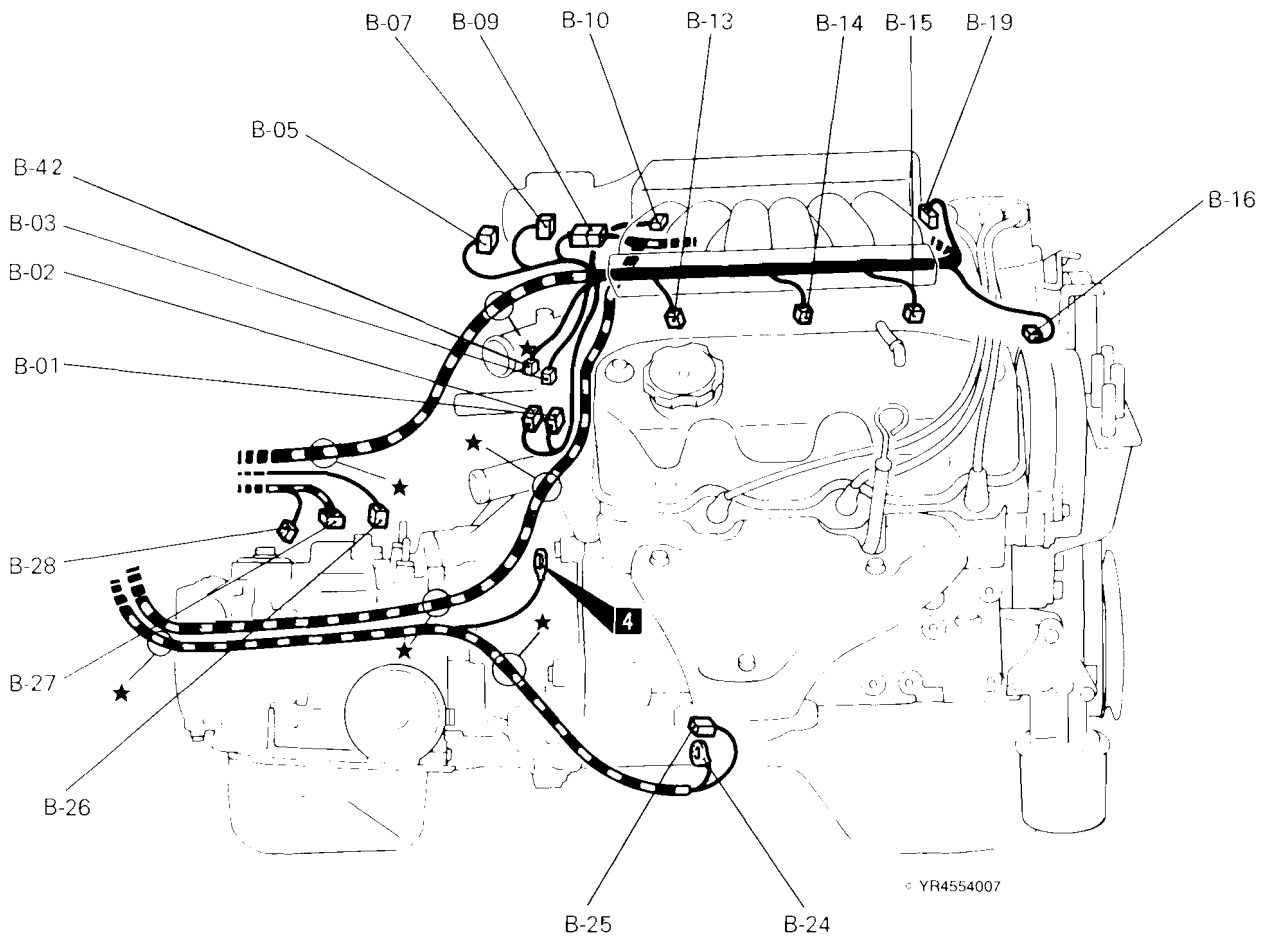


B-01	Engine coolant temperature gauge unit	B-19	-
B-02	Engine coolant temperature sensor (for engine control)	B-20	-
B-03	-	B-21	Alternator
B-04	Crank angle sensor and top dead centre sensor	B-22	Alternator
B-05	Idle speed control sensor	B-23	-
B-06	A/C compressor	B-24	Starter
B-07	Throttle position sensor	B-25	Starter
B-08	-	B-26	Back up lamp switch <M/T>
B-09	-	B-27	Inhibitor Switch <A/T>
B-10	Detonation sensor	B-28	ELC-A/T control solenoid valve
B-11 to B-13	-	B-29	Injector No. 2
B-14	Injector No. 3	B-30	Injector No.4
B-15	Injector No. 1	B-31	-
B-16	-	B-32	Engine oil pressure switch
B-17	-	B-33 to B-44	-
B-18	-	B-45	Oxygen Sensor <Australian models>

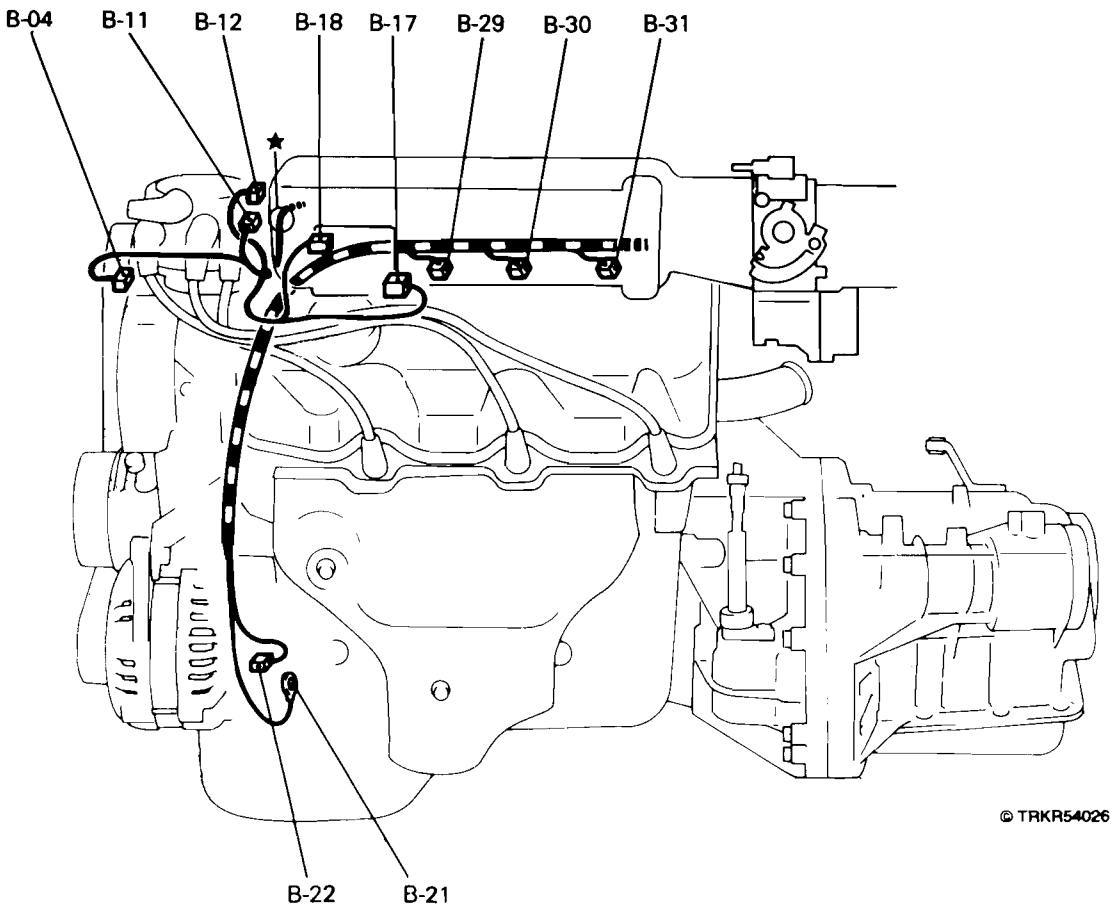
6 Cylinder MPI engine and Transmission

Connector Symbol

B



B-01	Engine coolant temperature gauge unit	B-12	Variable induction control servo
B-02	Engine coolant temperature sensor (for engine control)	B-13	Injector No. 5
B-03	-	B-14	Injector No. 3
B-04	Crank angle sensor and top dead centre sensor	B-15	Injector No. 1
B-05	Idle speed control servo	B-16	Power steering oil pressure switch
B-06	-	B-17	Ignition coil
B-07	Throttle position sensor	B-18	Capacitor
B-08	-	B-19	Power transistor
B-09	Control wiring harness and injector wiring harness combination	B-20	-
B-10	Detonation sensor	B-21	Alternator
B-11	Variable induction servo	B-22	Alternator

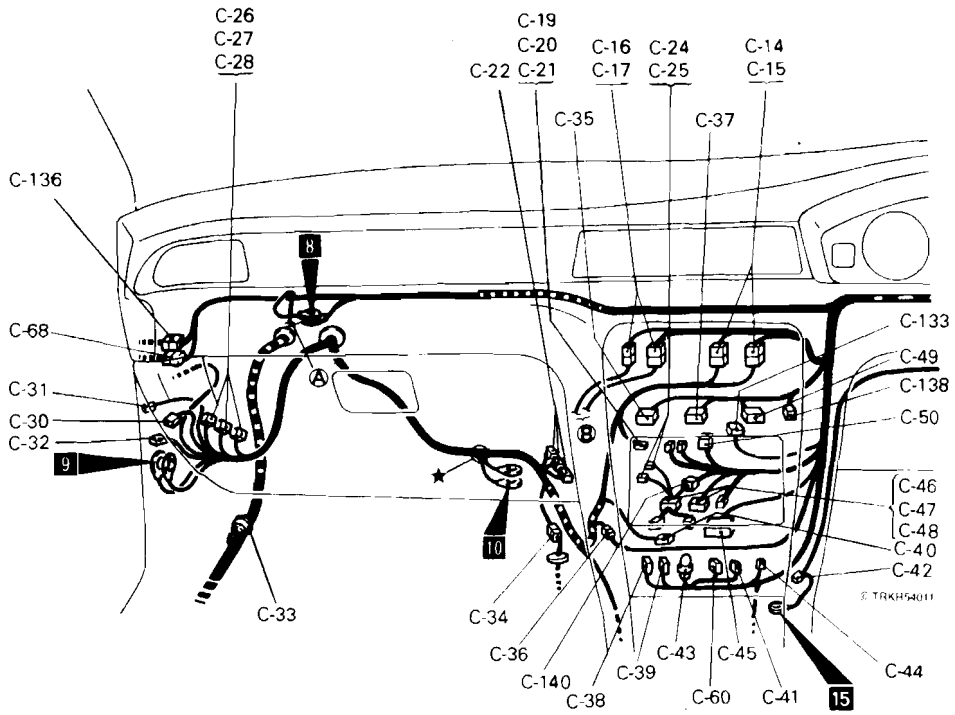


B-23 -
B-24 Starter
B-25 Starter
B-26 Back-up lamp switch <M/T>
B-27 Inhibitor switch < A/T >
B-28 ELC-4 A/T control solenoid valve
B-29 Injector No. 2
B-30 Injector No. 4
B-31 Injector No. 6
B-32 -
B-33 -
B-34 to B-40 -
B-41 -
B-42 Engine coolant temperature switch <LHD> (for A/C compressor control)<Auto temp control>

Remarks
(1) For details concerning the earth point (example: 4 refer to P.3C-7.)
(2) The mark ★ shows the standard mounting position of wiring harness.

Dash panel

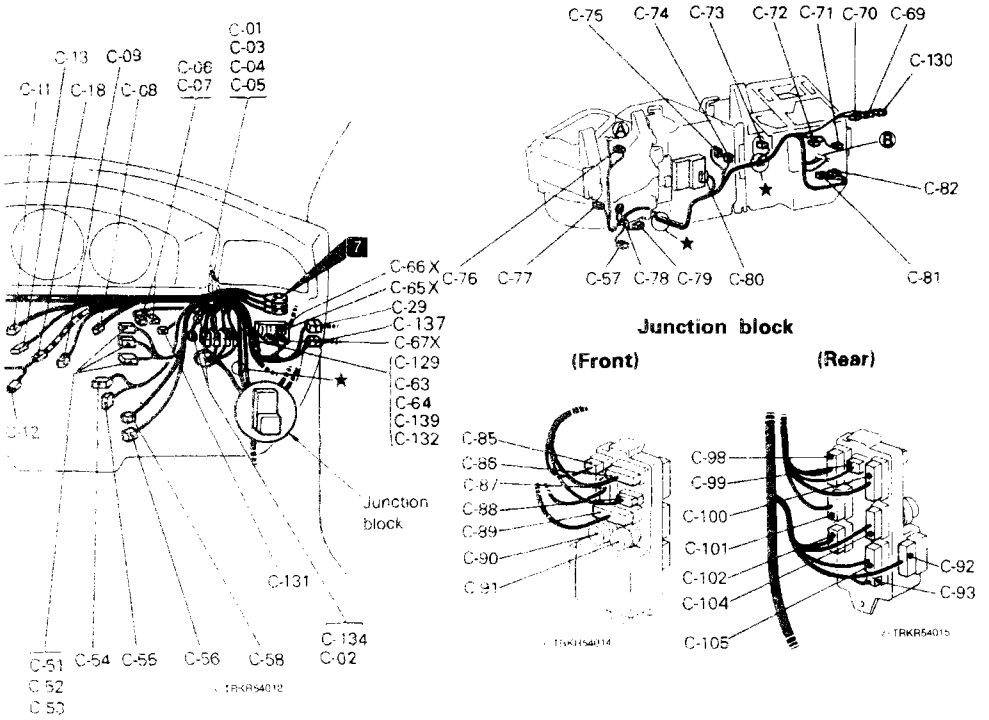
Connector Symbol **C**



C-01	Body wiring harness and front wiring harness combination <SRS>
C-02	Diode (ABS circuit) <1992,1993 models>
C-03	Body wiring harness and front wiring harness combination
C-04	—
C-05	Body wiring harness and front wiring harness combination <ACTIVE-ECS>
C-06 to C-07	ETACS unit
C-08	Accelerator pedal switch <1992,1993 models>
C-09	Stop lamp switch
C-10	—
C-11	Clutch pedal switch <Auto-cruise control M/T>or Jumper Connector (Auto-cruise control A/T)
C-12 to C-13	Clock spring <SRS>
C-14	Body wiring harness & control wiring harness combination
C-15	—
C-16	Body wiring harness and A/C wiring harness combination
C-17	—
C-18	Body wiring harness & clockspring wiring<SRS>
C-19	ELC-4A/T control unit <carby>
C 20 to C-21	ELC-4A/T control unit
C-22	IMMOBILISER UNIT <CARBY>
C-23	—
C-24	Jumper connector <M O T>
C-25	Jumper connector <M O T>
C-26 to C-28	Engine control unit
C-29	Body wiring harness and front door wiring harness (RH) combination
C-30	Engine control relay
C-31	EES Relay <carby>
C-32	IMMOBILISER UNIT <MPI>
C-33	Diode (for ABS circuit)
C-34	Oxygen sensor <6 cylinder>
C-35	Antenna switch
C-36	Body wiring harness and control wiring harness combination <ACTIVE-ECS>
C-37	Defogger switch
C-38 to C 39	Cigarette lighter
C-40	Engine immobiliser relay <Carby>
C-41	ACTIVE-ECS SWITCH
C-42	Horn relay <SRS>
C-43	Cigarette lighter illumination lamp
C-44	Remote control mirror switch
C-45	Auto-cruise control unit
C-46 to C-48	Audio
C-49	Hazard warning switch
C-50	2 way radio <M O T>
C-51 to C-53	Column switch
C-54	Ignition switch
C-55	Key reminder switch
C-56	Foot lamp (RH)
C-57	Foot lamp (LH)
C-58	Trunk lid opener switch
C-59	—
C-60	Rear wiper and washer switch <wagon>
C-61	—
C-62	—
C-63	Diode (ACTIVE-ACES circuit)
C-64	Diode (theft alarm)
C-65X to C-67X	Refer to CENTRALIZED JUNCTION

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Vehicles with air conditioner



C-68	Body wiring harness and front door wiring harness (LH) combination
C-69 thru C-70	Heater control panel assembly
C-71	Mode selection damper control motor
C-72	Air mixing damper control motor
C-73	Power transistor <auto> or resistor <man>
C-74	Water temperature sensor
C-75	Fin thermo sensor
C-76	Air inlet sensor
C-77	Air selection damper control motor
C-78	Blower motor
C-79	Blower motor high relay
C-80	A/C control unit <man>
C-81 thru C-82	A/C control unit <Auto>
C-83	A/C wiring harness and Jumper harness connector <Dealer fitted A/C>
C-84	—
C-85	Front wiring harness and junction block
C-86	combination
C-87	Roof wiring harness and junction block combination
C-88	Front wiring harness and junction block combination
C-89	Instrument panel wiring harness and junction block combination
C-90	Defogger relay
C-91	Blower motor relay
C-92	Diagnosis connector
C-93	Diagnosis connector Immoblisation
C-94 thru C-97	—
C-98 thru C-102	Body wiring harness and junction block combination
C-103	—
C-104	Body wiring harness and junction
C-105	block combination
C-106 thru C-128	—
C-129	Diode (theft alarm)
C-130	Heater control panel assembly <man>
C-131	Door Key illumination control unit
C-132	Resistor
C-133	Theft alarm hazard relay
C-134	Diode harness and body harness combination (ABS circuit) <1992,1993 models>
C-135	—
C-136	Body wiring harness and front door wiring harness (LH) combination
C-137	Body wiring harness and front door wiring harness (RH) combination
C-138	Rear intermittent wiper relay <wagon>
C-139	Diode (theft alarm)
C-140	Radio jumper harness and body harness combination

Remarks

(1) For details concerning the earth point (example: 7) refer to P.3C-7

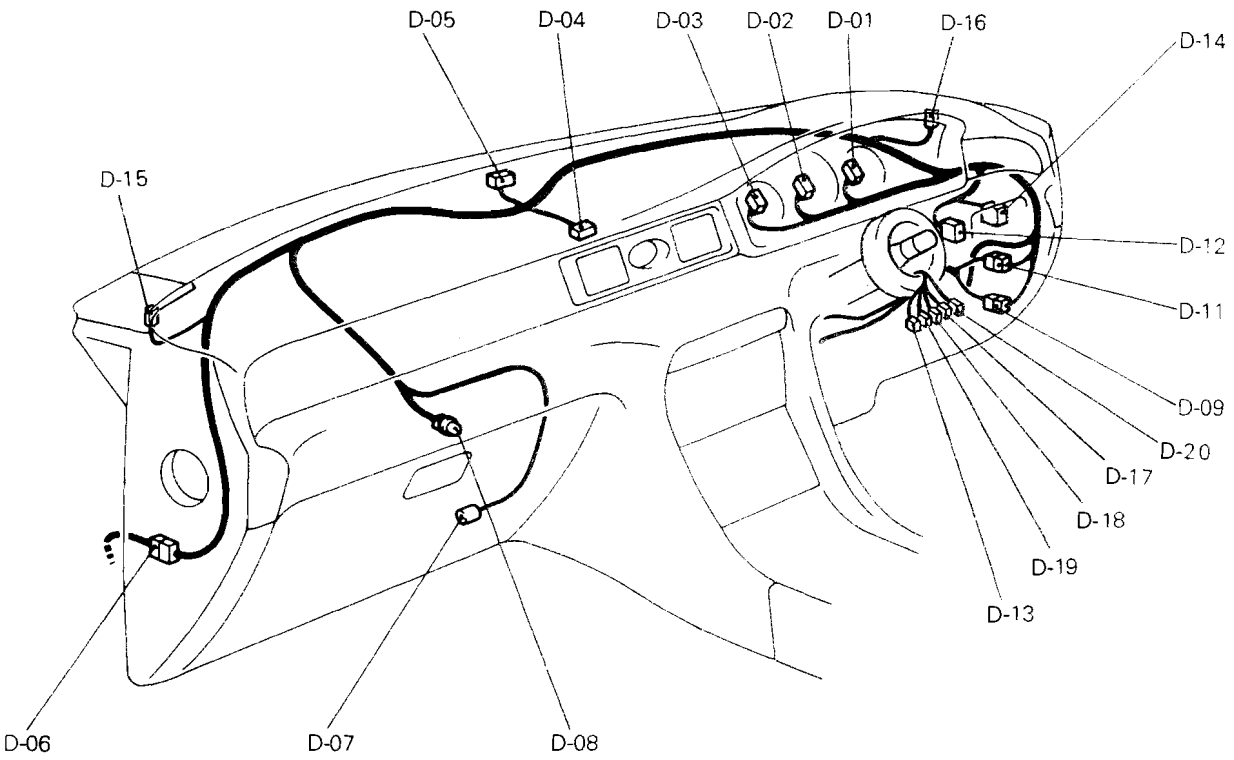
(2) The mark ★ shows the standard mounting position of wiring harness.

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Instrument Panel

Connector Symbol

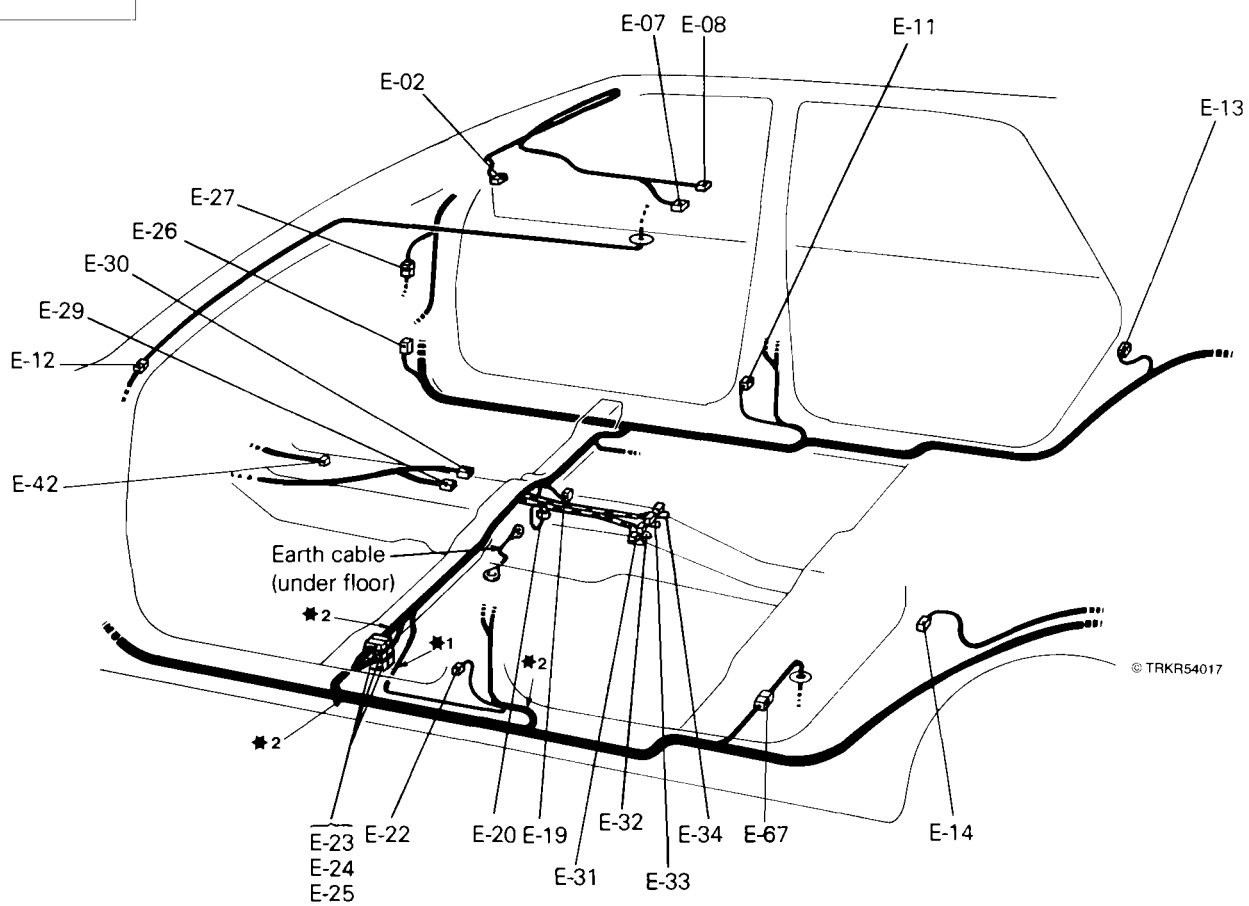
D



D-01 to D-03	Combination meter
D-04	Clock
D-05	Photo sensor
D-06	Control wiring harness and instrument panel wiring harness combination <A/T>
D-07	Glove box lamp switch
D-08	Glove box lamp
D-09	Body wiring harness and instrument panel wiring harness combination
D-10	-
D-11	Body wiring harness and instrument panel wiring harness combination
D-12	Rheostat
D-13	Auto-cruise control switch <SRS>
D-14	Auto-cruise control main switch
D-15	Front speaker (LH)
D-16	Front speaker (RH)
D-17	Squib <SRS>
D-18 to D-19	Radio remote control <SRS>
D-20	Horn switch <SRS>

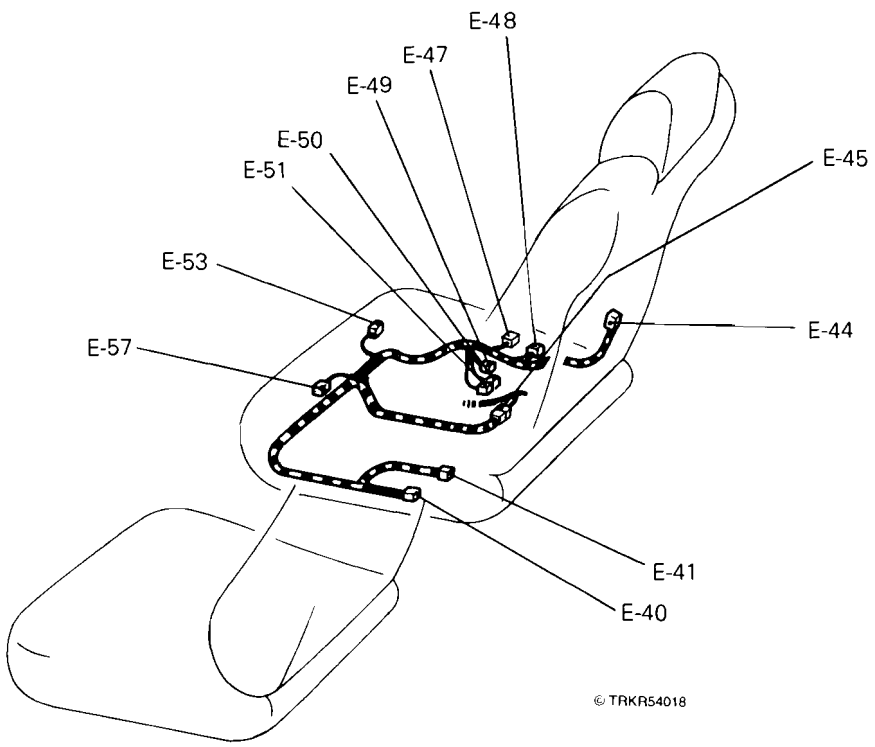
Interior

Connector Symbol **E**



E-01	-
E-02	Map lamp
E-03	-
E-04	-
E-05	-
E-06	-
E-07	Interior temperature sensor <Auto temp>
E-08	Room lamp
E-09	-
E-10	-
E-11	Front door switch (RH)
E-12	Roof harness and body combination <M O T>
E-13	Rear door switch (RH)
E-14	Rear door switch (LH)
E-15 to E-18	-
E-19	Parking brake switch
E-20	Front ashtray illumination lamp harness
E-21	-
E-22	Front door switch (LH)
E-23 to E-24	Body wiring harness and ABS wiring harness combination
E-25	-
E-26	Door lock control relay
E-27	Body wiring harness and roof wiring harness combination
E-28	-
E-29	Overdrive switch <A/T>
E-30	Power/Economy changeover switch <A/T>
E-31 to E-34	SRS Diagnosis unit
E-35	-
E-36	-
E-67	Fuel harness and body wiring harness combination <wagon>

<Vehicles with power seat>



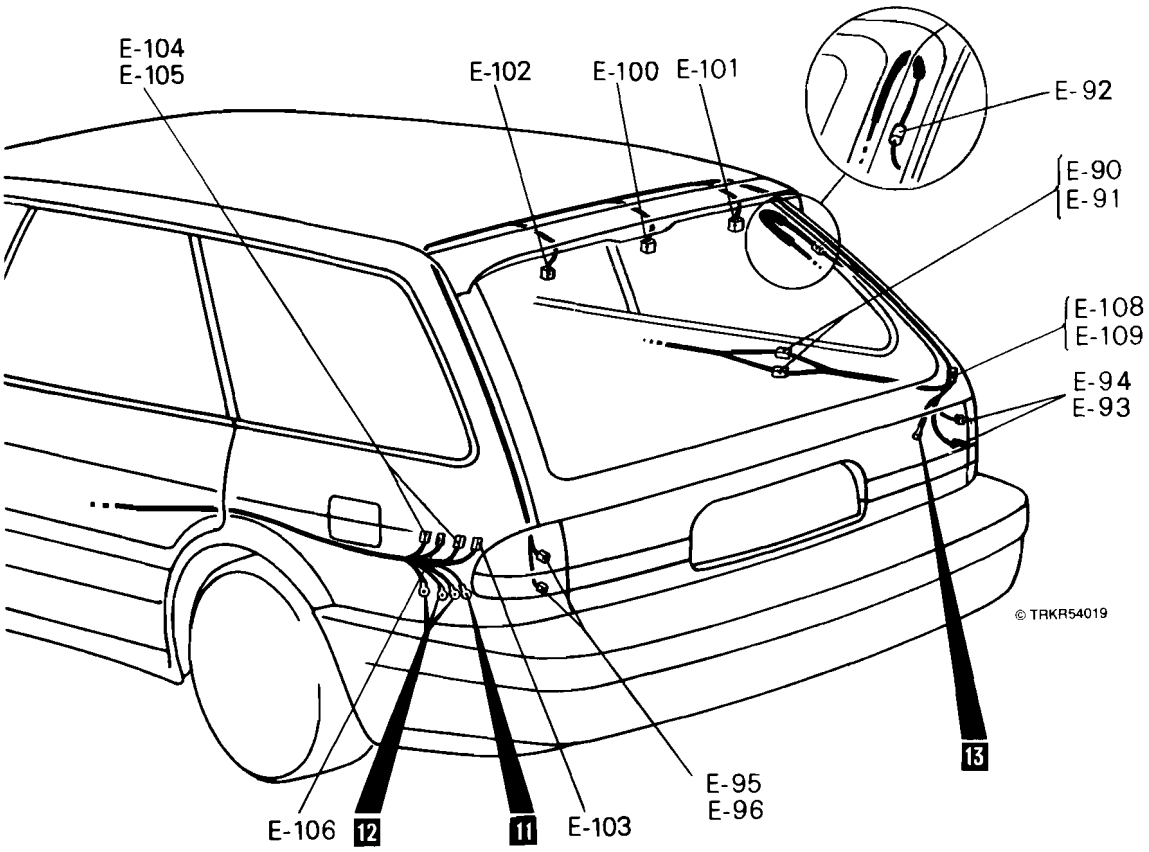
E-37 to E-39	-
E-40	Slide position limit switch (Driver's side)
E-41	Reclining position limit switch (Driver's side)
E-42	Emergency lamp switch <M O T>
E-43	-
E-44	Rear height limit switch (Driver's side)
E-45	Body wiring harness and power seat wiring harness combination (Driver's side)
E-46	-
E-47 to E-48	Power seat switch (Driver's side)
E-49	Reclining position adjusting motor (Driver's side)
E-50	Rear height adjusting motor (Driver's side)
E-51	Front height limit switch (Driver's side)
E-52	-
E-53	Front height adjusting motor(Driver's side)
E-54	-
E-55	-
E-56	-
E-57	Slide position adjusting motor (Drivers side)
E-58 to E-61	-
E-62	-
E-63	-
E-64	-

Remarks
(1) *1: Vehicles without ABS or SRS
(2) *2: Vehicles with ABS or SRS

Interior Wagon

Connector Symbol

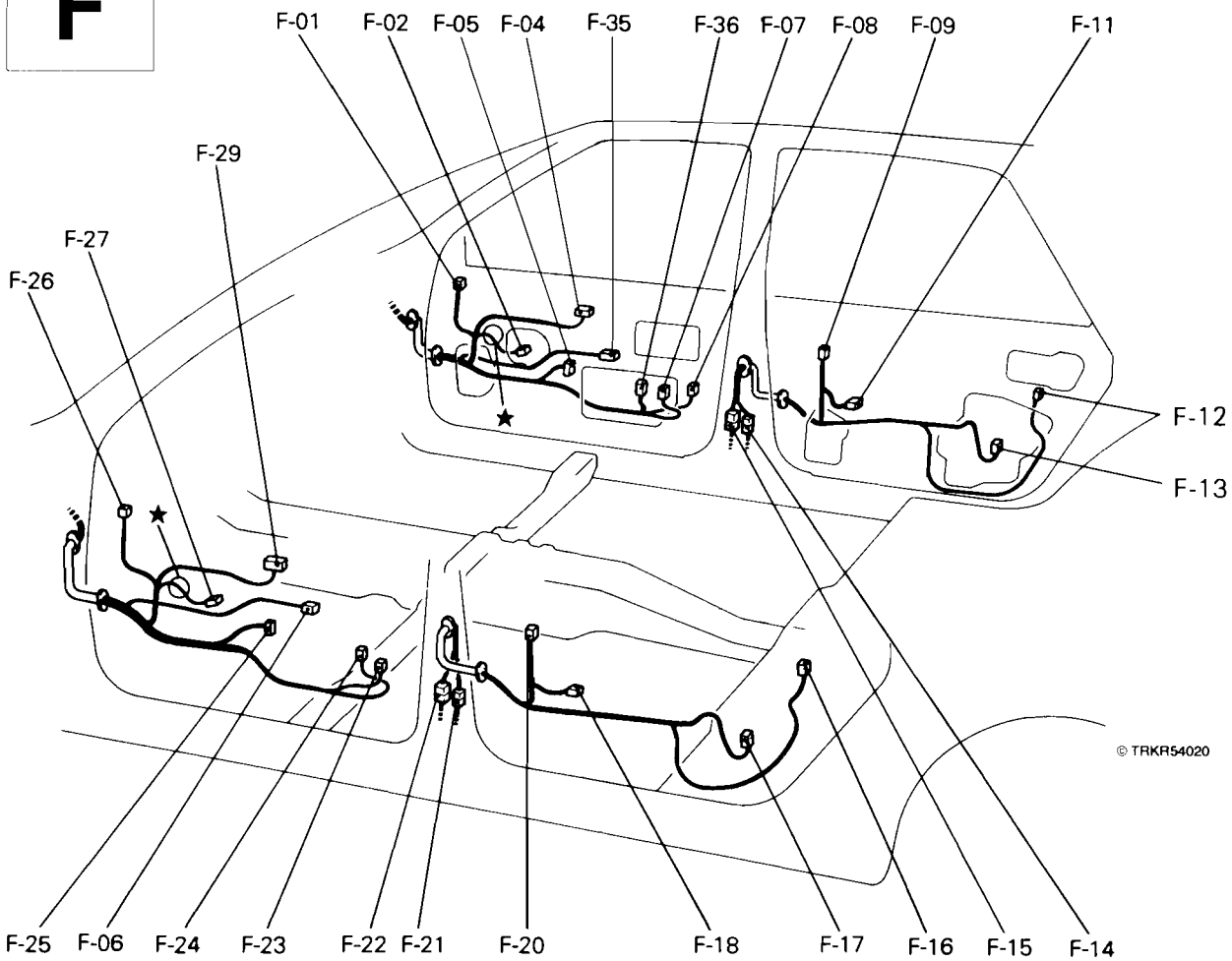
E



E-90	Body wiring harness and rear wiring harness combination
E-91	Body wiring harness and rear wiring harness combination
E-92	Rear wiring harness and tailgate wiring harness 'A' combination
E-93	Rear combination lamp (right side)
E-94	Rear combination lamp (right side)
E-95	Rear combination lamp (left side)
E-96	Rear combination lamp (left side)
E-97	-
E-98	-
E-99	-
E-100	Cargo compartment light
E-101	Rear speaker (right side)
E-102	Rear speaker (left side)
E-103	Motor antenna
E-104 to E-105	ABS control unit
	-
E-106	ABS Diagnosis code erasure connector
E-107	-

Doors

Connector Symbol **F**

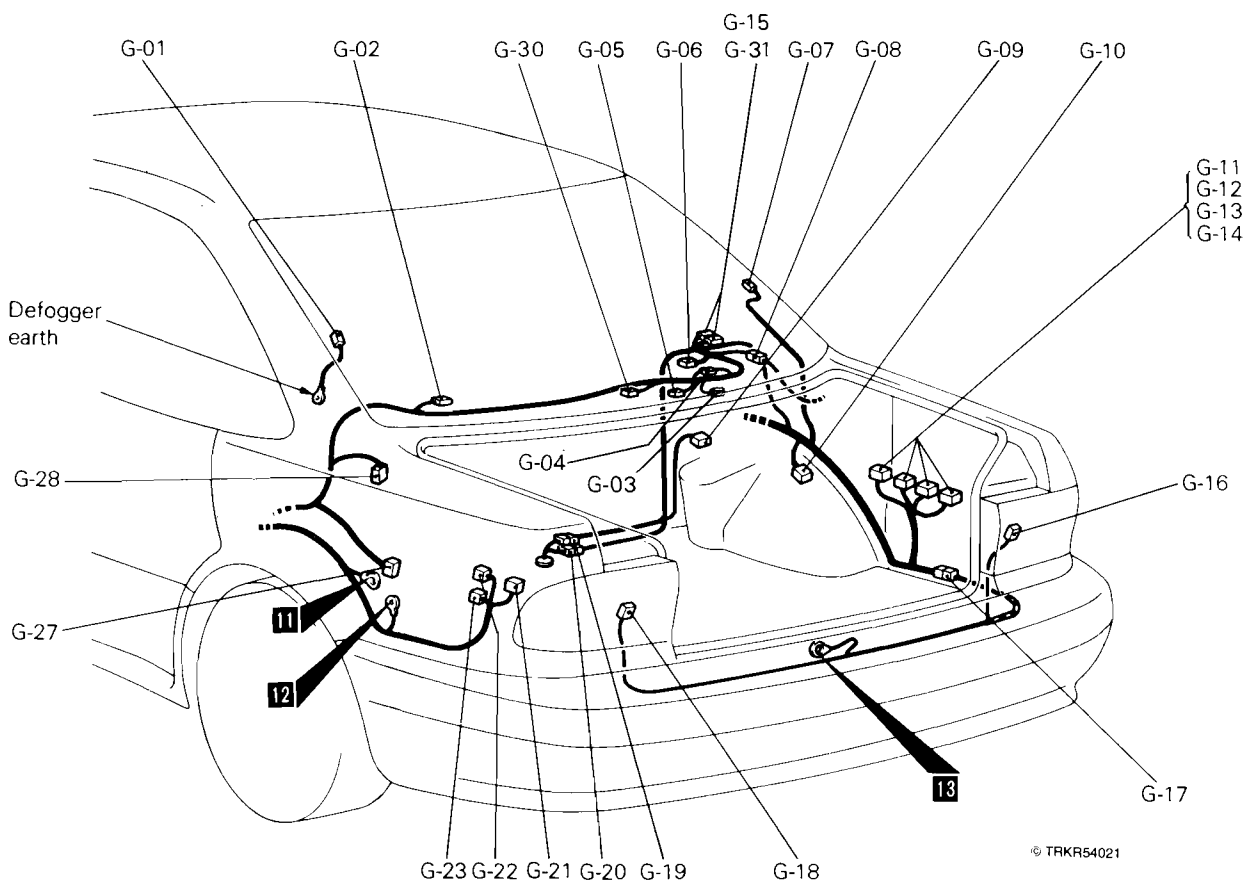


F-01	Door mirror (R.H.I
F-02	Door speaker (R.H.I
F-03	-
F-04	Front power window switch
F-05	Power window motor (Front: R.H.)
F-06	Door lock key cylinder switch (LH)
F-07	Door lamp (Front: R.H.)
F-08	Door lock actuator (Front: R.H.)
F-09	Rear power window switch
F-10	-
F-11	Power window motor (Rear: R.H.)
F-12	Door lock actuator (Rear: R.H)
F-13	Door lamp (Rear: R.H.)
F-14	Body wiring harness and rear door wiring
F-15	harness (R.H.) combination
F-16	Door lock actuator (Rear: L.H)
F-17	Door lamp (Rear: L.H.)
F-18	Power window motor (Rear: L.H.)
F-19	-
F-20	Rear power window (L.H.)
F-21	ABS wiring harness and rear door wiring
F-22	harness (L.H.) combination
F-23	Door lock actuator (Front: L.H.)
F-24	Door lamp (Front: L H.)
F-25	Power window motor (Front: L.H.)
F-26	Door mirror (L.H.)
F-27	Door speaker (L.H.)
F-28	-
F-29	Front power window switch
F-35	Door key illumination assembly(RH) or receiver assy <ETACS>
F-36	Keyless entry control unit

Remark
The mark ★ shows the standard mounting position of wiring harness.

Sedan luggage compartment

Connector Symbol
G



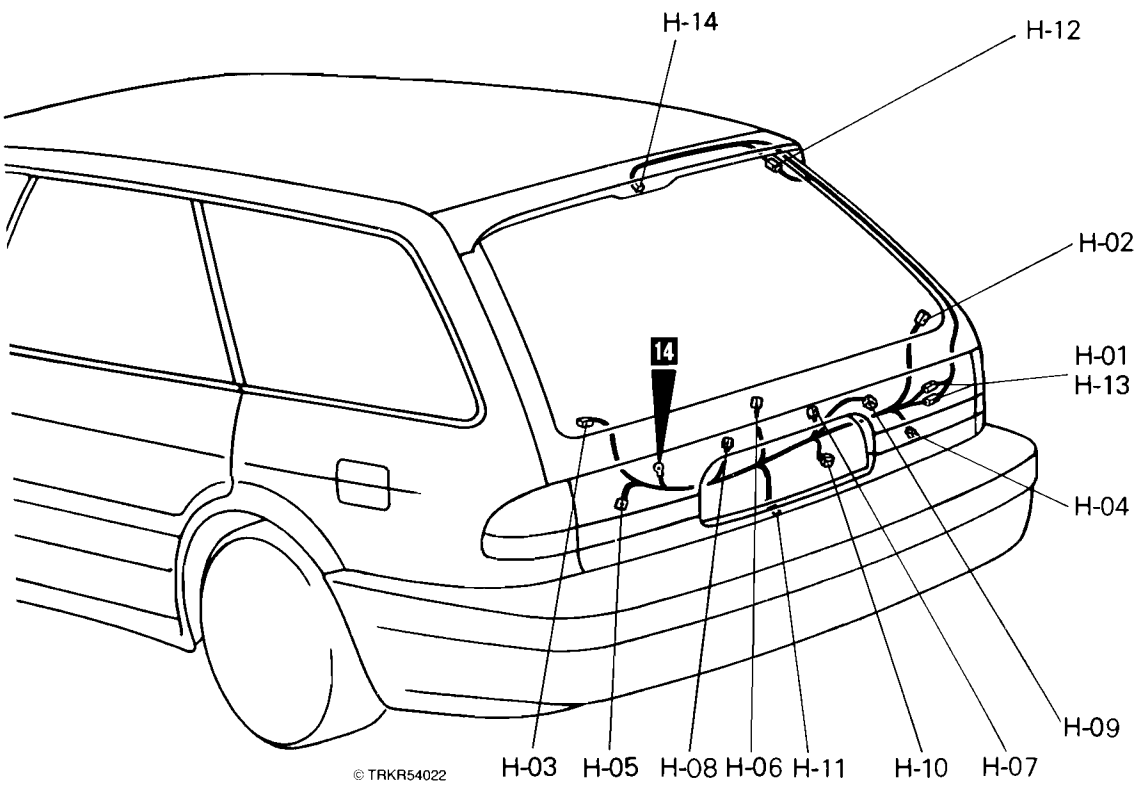
G-01	Defogger (-)
G-02	Rear speaker (L.H)
G-03	Keyless entry control unit <from 1994 models>
G-04	Jumper link (keyless entry)<from 1994 models>
G-05	Trunk room lamp
G-06	Rear speaker (R.H)
G-07	Defogger (+)
G-08	Body wiring harness and rear lid wiring harness combination
G-09	ACTIVE-ECS damping force switching actuator (Rear: R.H)
G-10	ACTIVE-ECS rear solenoid valve assembly
G-11 to G-14	ACTIVE-ECS control unit
G-15	Diode (keyless entry)<from 1994 models>
G-16	Rear combination lamp (R H)
G-17	Body wiring harness and trunk room wiring harness combination
G-18	Rear combination lamp (L H)
G-19	Body wiring harness and fuel pump wiring harness combination
G-20	Body wiring harness and fuel pump wiring harness combination <ABS>
G-21	Diagnosis code erase connector <ABS>
G-22	ABS control unit
G-23	ABS control unit
G-24 to G-26	-
G-27	Motor antenna
G-28	ACTIVE-ECS damping force switching actuator (Rear: L.H.)
G-29	-
G-30	High mounted stop lamp
G-31	Diode (theft alarm)

Remark
For details concerning the earth point (example: 11) refer to P.3C-7

Tailgate

Connector Symbol

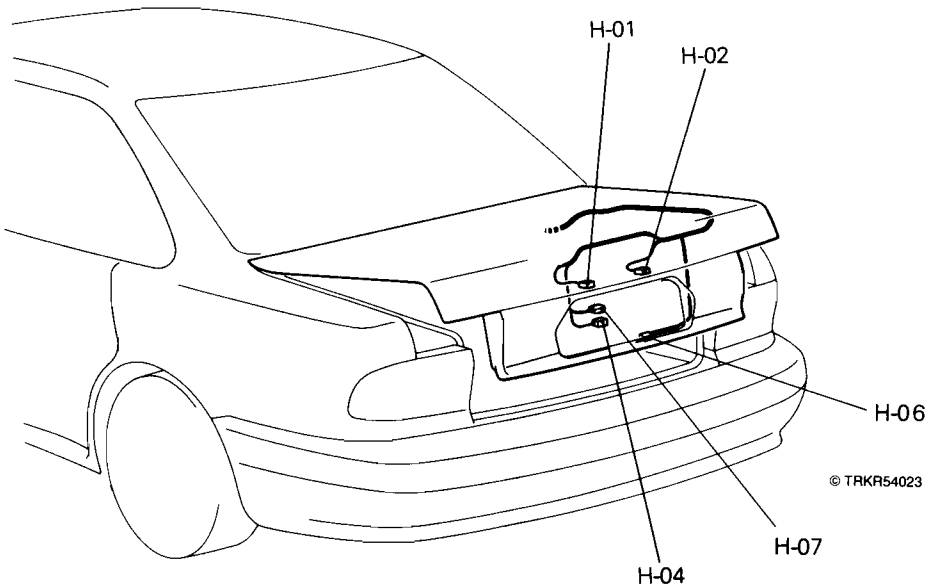
H



H-01 Tailgate wiring harness 'A' and tailgate wiring harness 'B' combination
H-02 Defogger (+)
H-03 Defogger (-)
H-04 Back up lamp (RH)
H-05 Back up lamp (LH)
H-06 Rear window wiper motor
H-07 Licence plate lamp (right side)
H-08 Licence plate lamp (left side)
H-09 -
H-10 Tailgate lock actuator
H-11 Tailgate latch switch
H-12 Tailgate wiring harness 'A' and air deflector wiring harness combination
H-13 Tailgate wiring harness 'A' and tailgate wiring harness 'B' combination
H-14 High mounted stop lamp

Trunk Lid

Connector Symbol
H



H-01 Licence plate (LH)
H-02 Licence plate (RH)
H-03 -
H-04 Trunk room lamp switch
H-05 -
H-06 Trunk lid solenoid
H-07 Trunk lid key cylinder switch

SECTION 6 — INDIVIDUAL COMPONENT SERVICE

If the SRS components are to be removed or replaced as a result of maintenance, troubleshooting, etc. follow each procedure.

CAUTION:

(1) SRS components should not be subjected to heat over 93°C (200°F), so remove the front impact sensors, SRS diagnosis unit and air bag module and clock spring before drying or baking the vehicle after painting. Recheck SRS system operability after re-installing them.

(2) If the SRS components are removed for the purpose of check, sheet metal repair, painting, etc., they should be stored in a clean, dry place until they are reinstalled.

FRONT IMPACT SENSORS

CAUTION:

(1) Never repair or disassemble a front impact sensor. If faulty, replace it.

(2) Handle the front impact sensors very carefully, taking care not to drop them or otherwise subject them to impact. If a sensor is seen to be dented, cracked, deformed or rusted, replace it with a new one.

(3) Replace sensors with new ones after the air bag has deployed.

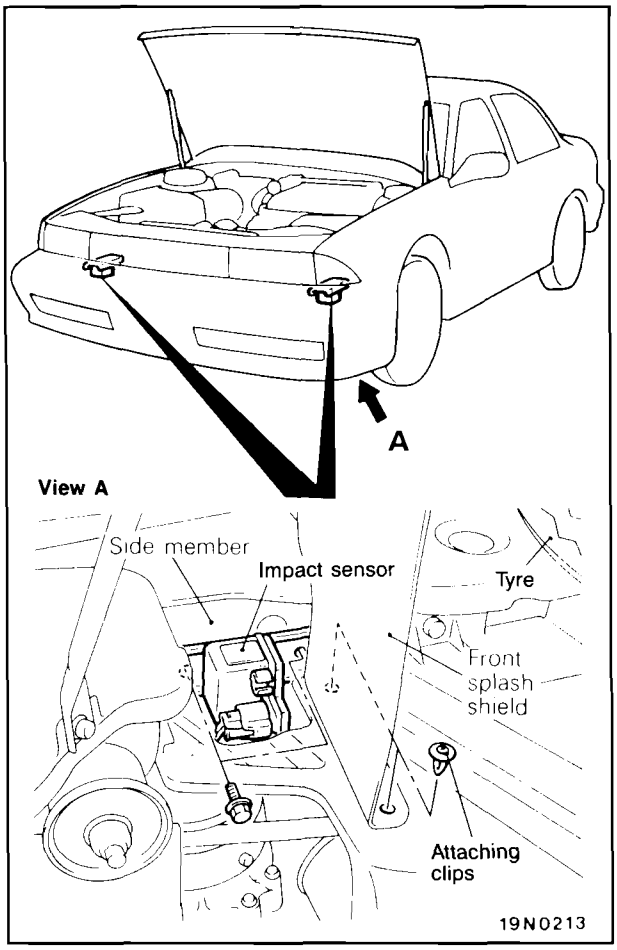


Fig. 1 — Front impact sensor location

Pre-Removal Procedures

(1) Turn the ignition key to the lock position.

(2) Disconnect the negative battery cable and tape the cable terminal, refer Fig. 2.

CAUTION:

Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to service precautions.

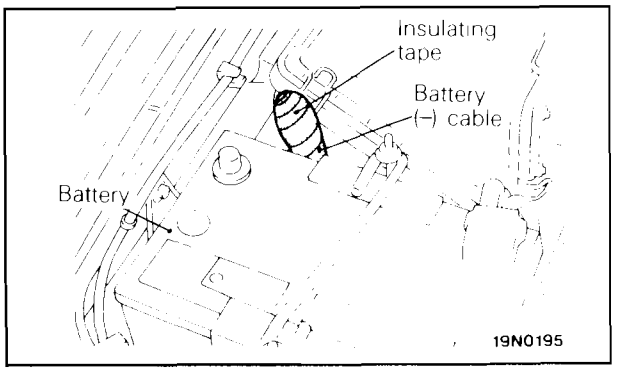


Fig. 2 — Insulating battery cable

Removal

(1) Check side member for deformities of rust, refer Fig. 3.

(2) Check sensor harness for binds, connectors for damage and terminals for deformities.

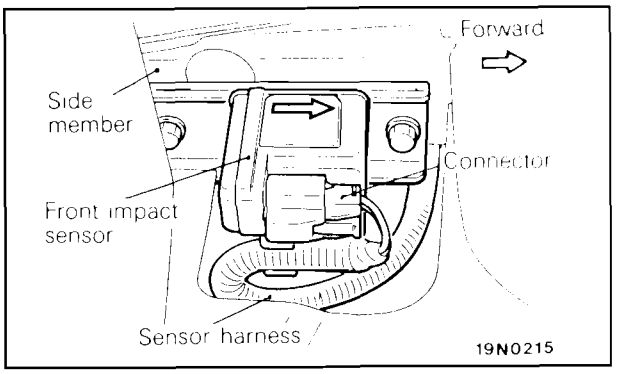


Fig. 3 — Side member and sensor

(3) Check for dents, cracks, deformation or rust of the front impact sensor.

CAUTION: If a dent, crack deformation or rust is detected, replace with a new sensor.

(4) Measure the front impact sensor resistance between terminals and check whether it is within the standard value, refer Fig. 4.

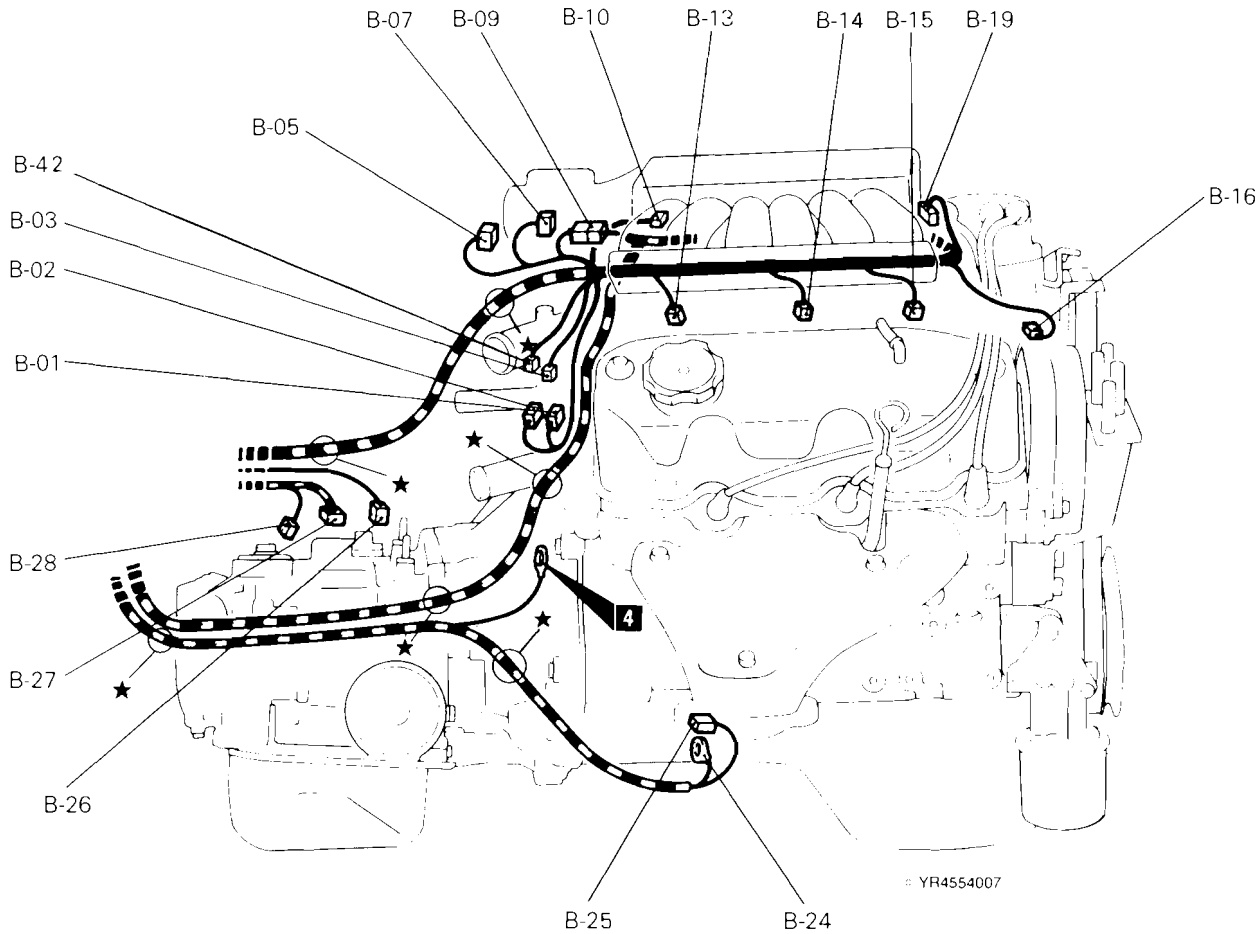
Standard value: 2,000 ± 40Ω

CAUTION: Always replace the sensor with a new one if the resistance is not within the standard value.

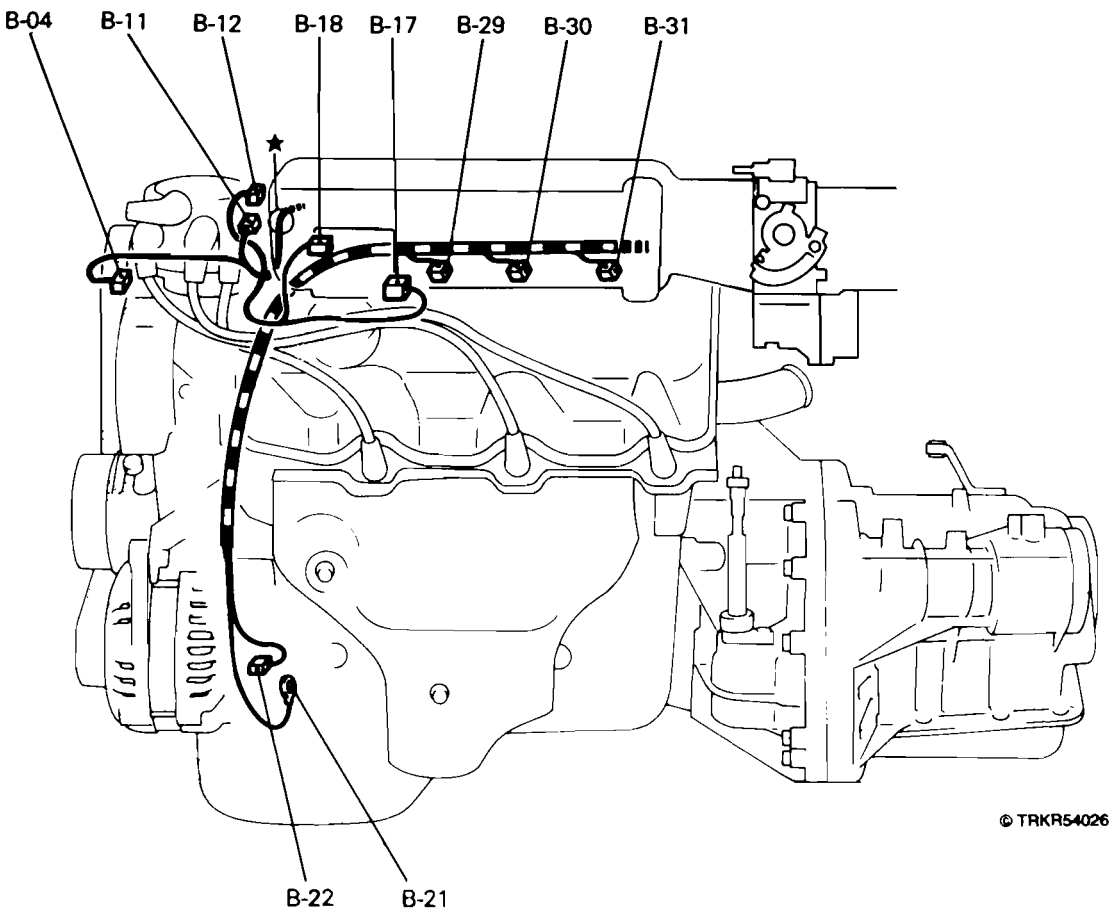
6 Cylinder MPI engine and Transmission

Connector Symbol

B



B-01	Engine coolant temperature gauge unit	B-12	Variable induction control servo
B-02	Engine coolant temperature sensor (for engine control)	B-13	Injector No. 5
B-03	-	B-14	Injector No. 3
B-04	Crank angle sensor and top dead centre sensor	B-15	Injector No. 1
B-05	Idle speed control servo	B-16	Power steering oil pressure switch
B-06	-	B-17	Ignition coil
B-07	Throttle position sensor	B-18	Capacitor
B-08	-	B-19	Power transistor
B-09	Control wiring harness and injector wiring harness combination	B-20	-
B-10	Detonation sensor	B-21	Alternator
B-11	Variable induction servo	B-22	Alternator



B-23 -
B-24 Starter
B-25 Starter
B-26 Back-up lamp switch <M/T>
B-27 Inhibitor switch < A/T >
B-28 ELC-4 A/T control solenoid valve
B-29 Injector No. 2
B-30 Injector No. 4
B-31 Injector No. 6
B-32 -
B-33 -
B-34 to B-40 -
B-41 -
B-42 Engine coolant temperature switch <LHD> (for A/C compressor control)<Auto temp control>

Remarks
(1) For details concerning the earth point (example: 4 refer to P.3C-7.)
(2) The mark ★ shows the standard mounting position of wiring harness.

Removal (air bag module)

(1) Set the steering wheel and front wheels to the straight ahead position, then remove the ignition key.

(2) Disconnect the negative battery cable and tape the cable terminal, refer Fig. 12.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to Service Precautions.)

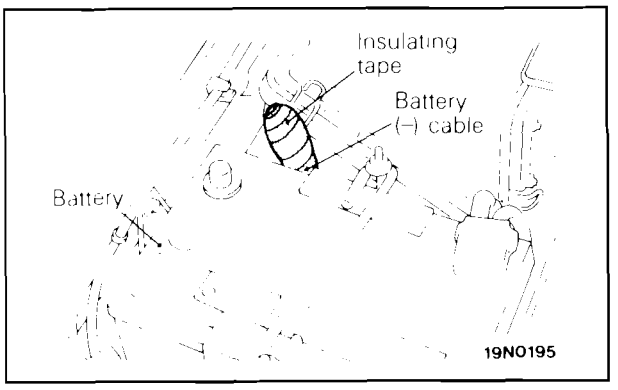


Fig. 12 — Insulating battery cable

(3) Remove the air bag module mounting nuts.

(4) When disconnecting the connector of the clock spring from the air bag module, press the air bag's lock toward the outer side to spread it open. Use a screwdriver (refer to Fig. 13), to pry so as to remove the connector gently.

CAUTION:

(1) When disconnecting the air bag module-clock spring connector, take care not to apply excessive force to it.

(2) The removed air bag module should be stored in a clean, dry place with the pad cover face up.

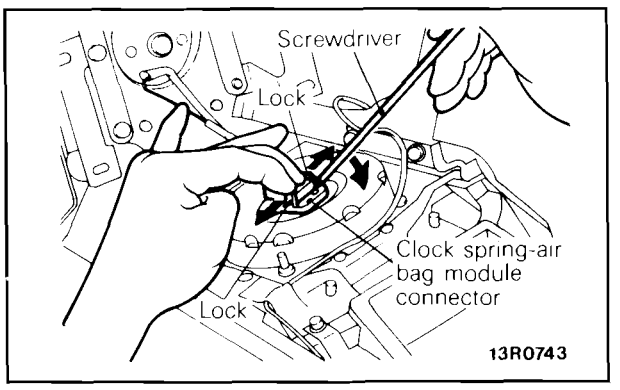


Fig. 13 — Removing clock spring connector

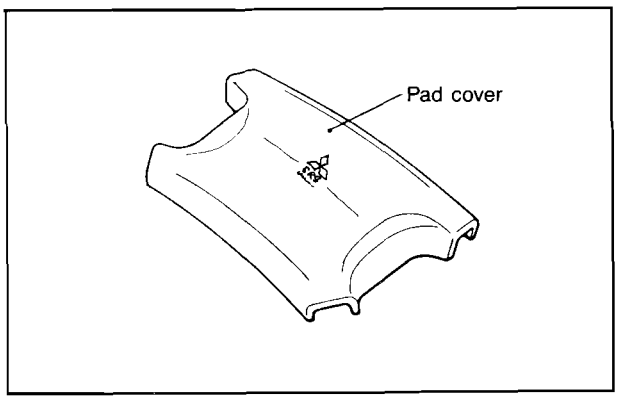


Fig. 14 — Pad cover

Inspection (air bag module)

If any improper part is found during the following inspection, replace the air bag module with a new one.

Dispose of the old one according to the specified procedure, refer to Section 7.

CAUTION: Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental air bag deployment will result in serious personal injury.

(1) Check pad cover for dents, cracks or deformities, refer Fig. 14.

(2) Check the air bag module for denting, cracking or deformation.

(3) Check hooks and connectors for damage, terminals for deformities, and harness for binds.

(4) Check air bag inflator case for dents, cracks or deformities.

(5) Install the air bag module to steering wheel to check fit or alignment with the wheel, refer Fig. 15.

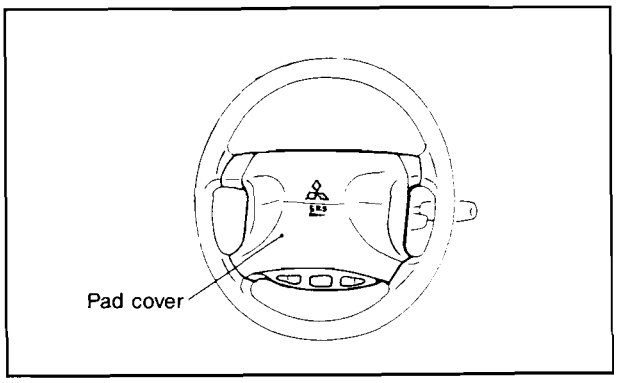


Fig. 15 — Air bag module fitment

Installation (air bag module)

(1) Connect the Multi-use Tester to the diagnosis connector located on the junction block, refer Fig. 16.

CAUTION: Make certain that the ignition switch is at OFF when the Multi-use Tester is connected or disconnected.

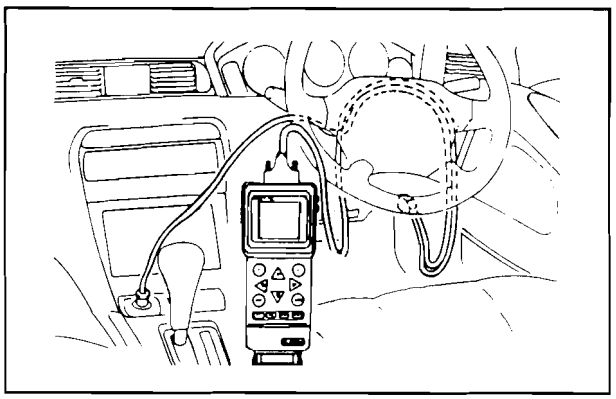


Fig. 16 — Connection of multi-use tester

(2) Reconnect negative terminal of battery and turn the ignition key to the "ON" position.

(3) Conduct self-diagnosis using Multi-use Tester to ensure entire SRS operates properly, except open circuit of air bag module (Diagnosis code No. 22). (Refer to Quick Reference Chart.)

(4) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the cable terminal, refer Fig. 17.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer to Service Precautions.

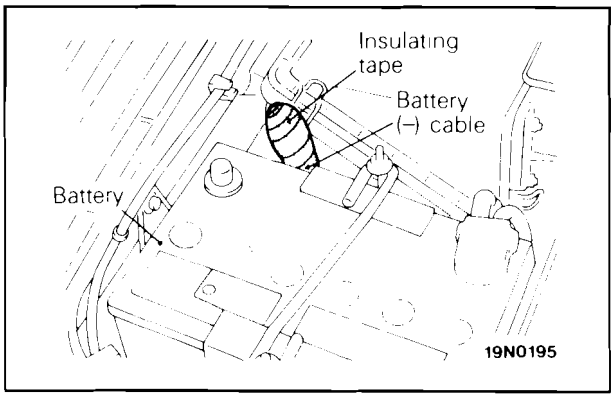


Fig. 17 — Insulating battery cable

(5) Reconnect the air bag module to the clock spring connector.

(6) Install the air bag module and retaining nuts taking care that no wiring is caught by it.

(7) Reconnect the negative battery terminal. Turn the ignition switch to "ON". Does the "SRS" warning light illuminate for about 7 seconds, turn OFF and then remain extinguished for at least 45 seconds? (refer Fig. 18). If yes, SRS system is functioning properly. If no, refer to Section 3 — Test 1.

CAUTION: Dispose of an air bag module only according to the specified procedure in Section 7.

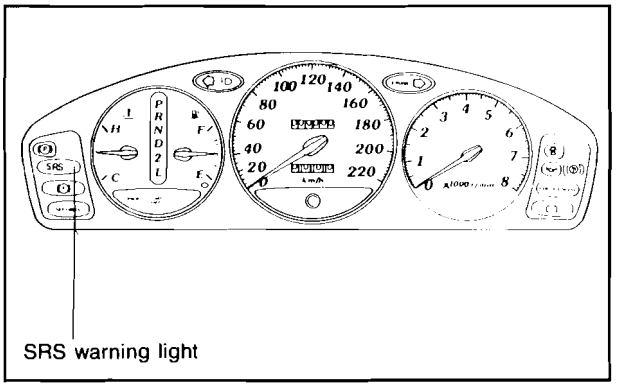


Fig. 18 — SRS warning light

Removal (clock spring)

(1) Set the steering wheel and front wheels to the straight ahead position, then remove the ignition key.

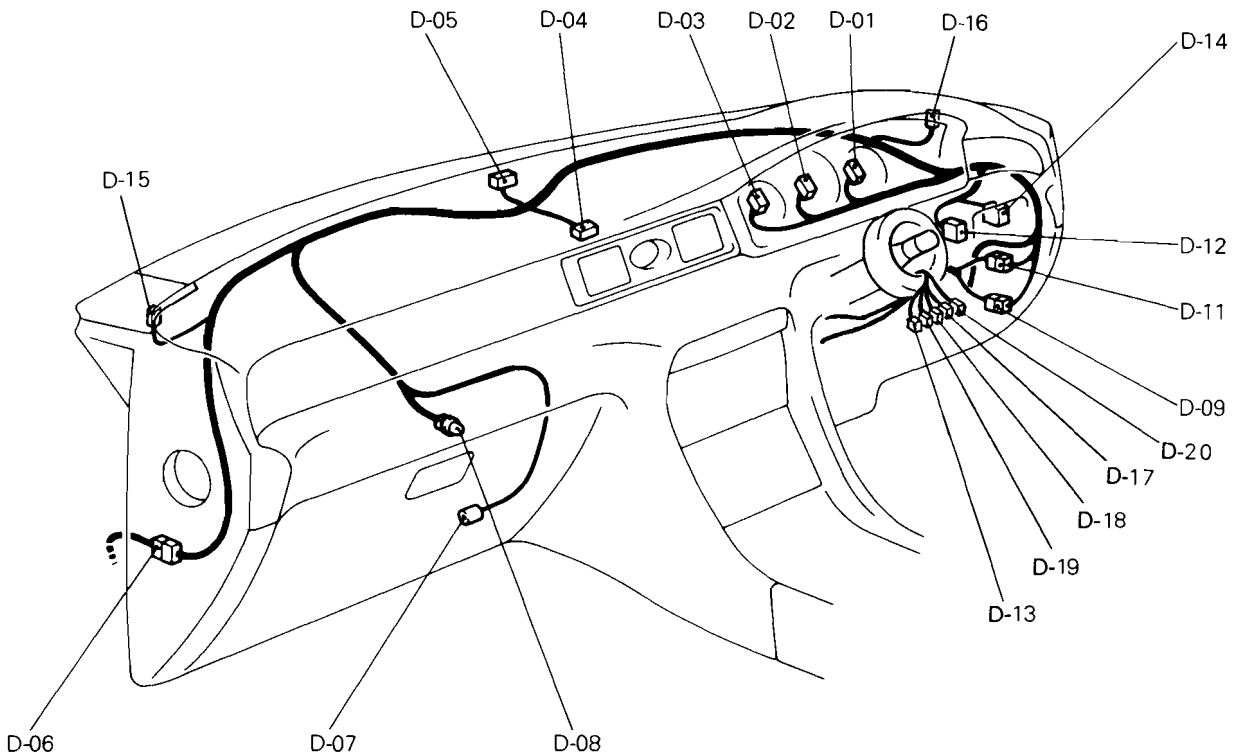
(2) Disconnect the negative battery cable and tape the cable terminal, refer Fig. 17.

CAUTION: Wait at least 60 seconds after disconnecting the battery cable before doing any further work, refer Service Precautions.

(3) Remove air bag module.

Instrument Panel

Connector Symbol
D

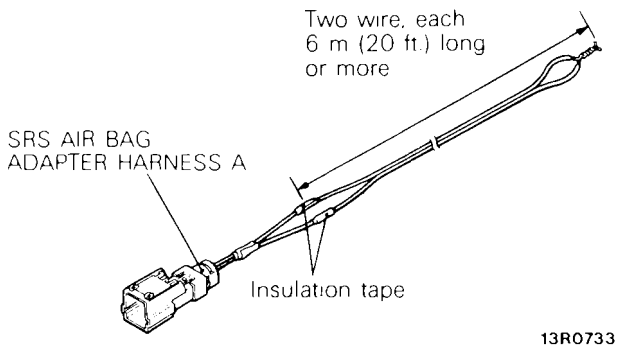
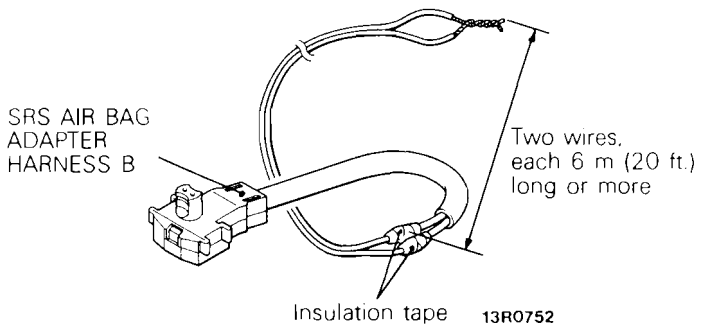


D-01 to D-03	Combination meter
D-04	Clock
D-05	Photo sensor
D-06	Control wiring harness and instrument panel wiring harness combination <A/T>
D-07	Glove box lamp switch
D-08	Glove box lamp
D-09	Body wiring harness and instrument panel wiring harness combination
D-10	-
D-11	Body wiring harness and instrument panel wiring harness combination
D-12	Rheostat
D-13	Auto-cruise control switch <SRS>
D-14	Auto-cruise control main switch
D-15	Front speaker (LH)
D-16	Front speaker (RH)
D-17	Squib <SRS>
D-18 to D-19	Radio remote control <SRS>
D-20	Horn switch <SRS>

SECTION 7 — AIR BAG MODULE DISPOSAL PROCEDURES

Before either disposing of a vehicle equipped with an air bag, or prior to disposing of the air bag module, be sure to first follow the procedures described below to deploy the air bag.

AIR BAG REMOTE DEPLOYMENT DEVICES

Tool	Use
	• Deployment inside the vehicle (when vehicle will no longer be driven)
	• Deployment outside the vehicle

UNDEPLOYED AIR BAG MODULE DISPOSAL

CAUTION:

(1) If the vehicle is to be scrapped, junked, or otherwise disposed of, deploy the air bag inside the vehicle.

If the vehicle will continue to be operated and only the air bag module is to be disposed of, deploy the air bag outside the vehicle.

(2) Since there is a loud noise when the air bag is deployed, avoid residential areas whenever possible. If anyone is nearby, give warning of the impending noise.

(3) Since a large amount of smoke is produced when the air bag is deployed, select a well-ventilated site. Moreover, never attempt the test near a fire or smoke sensor.

DEPLOYMENT INSIDE THE VEHICLE (when vehicle will no longer be driven)

(1) Open all windows and doors of the vehicle. Move the vehicle to an isolated spot.

(2) Disconnect the negative (−) and positive (+) battery cables from the battery terminals, and then remove the battery cables from the battery terminals, and then remove the battery from the vehicle.

CAUTION: Wait at least 60 seconds after disconnecting the battery cables before doing any further work, refer to Service Precautions.

(3) Remove floor console assembly.

(4) Disconnect the clock spring connector from the SRS diagnosis unit, refer Fig. 1.

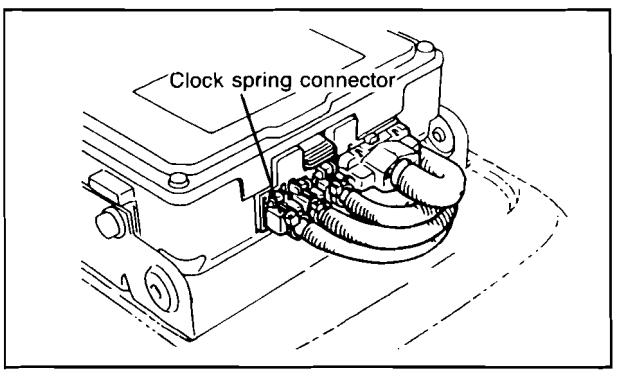
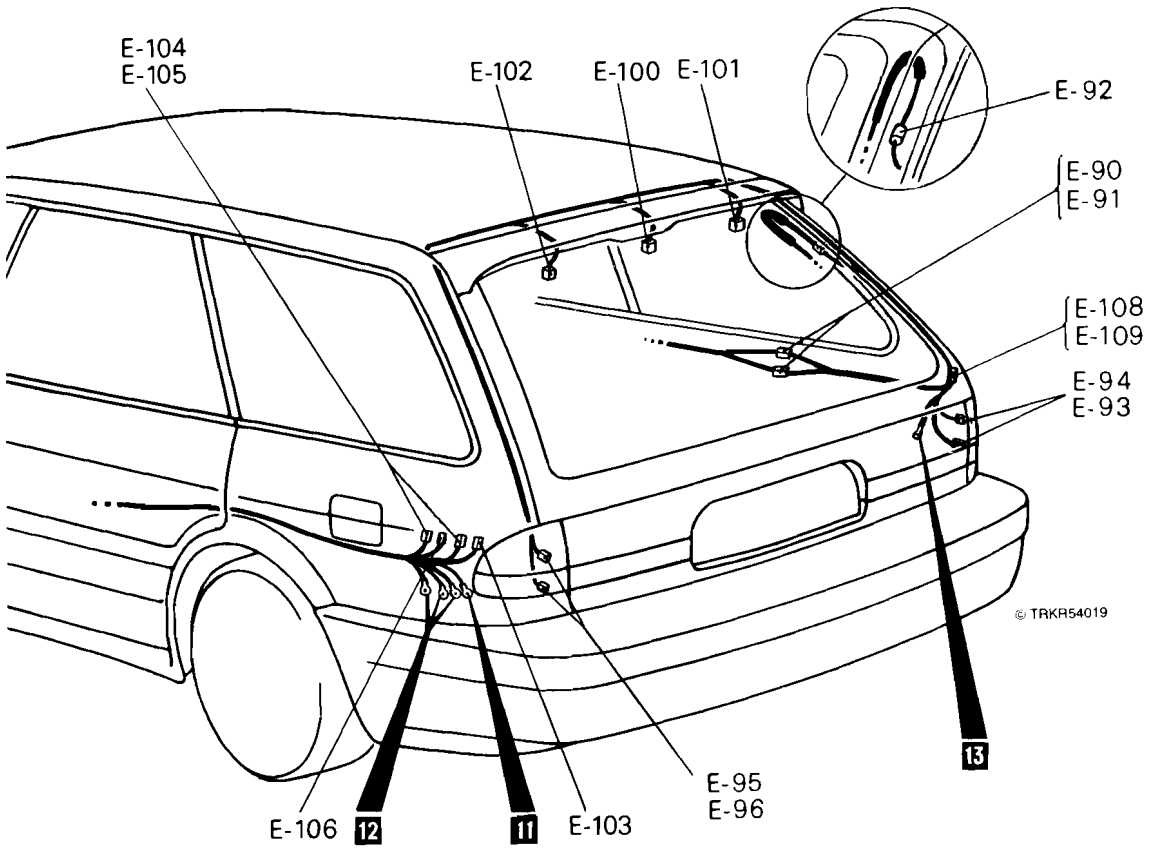


Fig. 1 — Clock spring connector

Interior Wagon

Connector Symbol

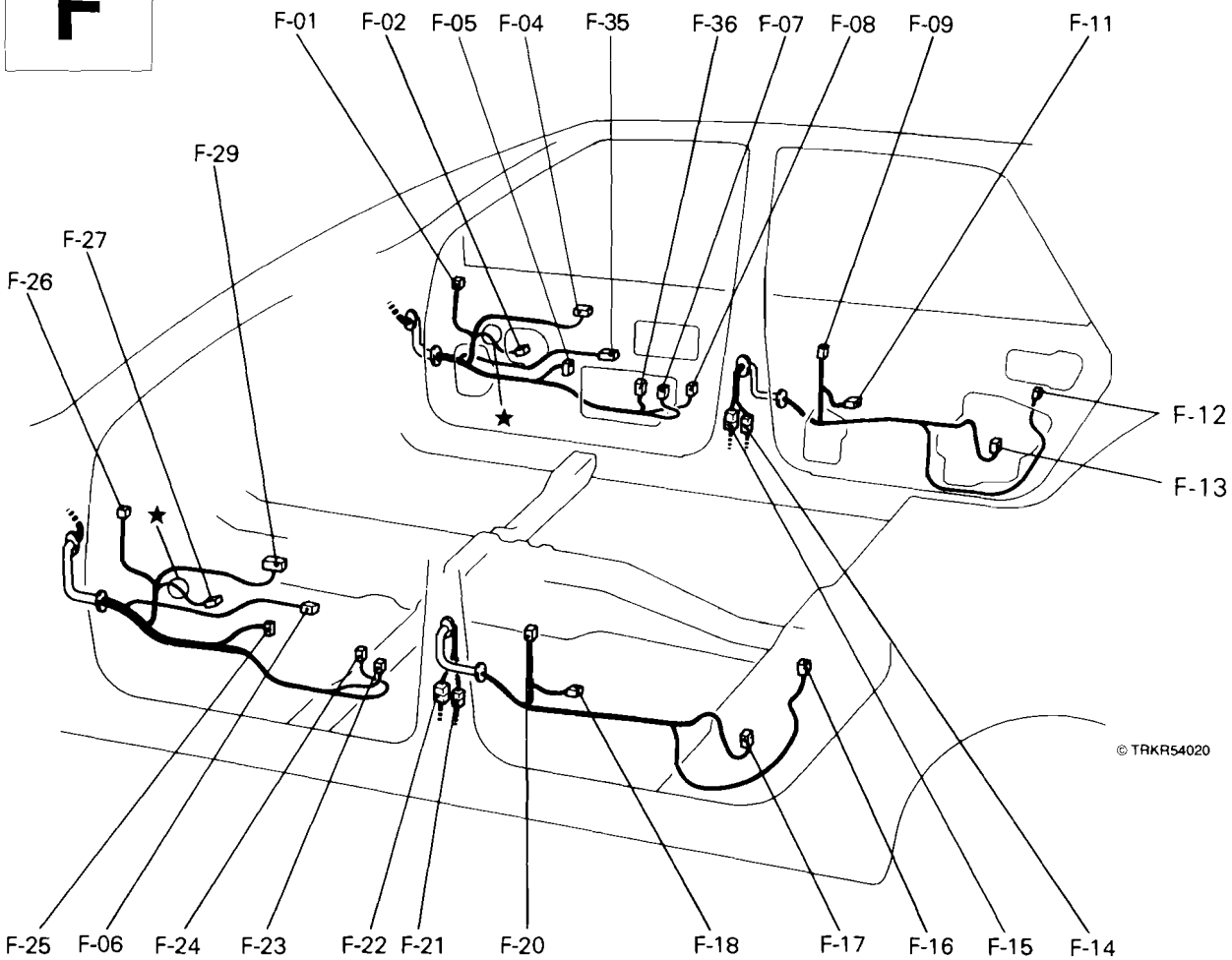
E



E-90	Body wiring harness and rear wiring harness combination
E-91	Body wiring harness and rear wiring harness combination
E-92	Rear wiring harness and tailgate wiring harness 'A' combination
E-93	Rear combination lamp (right side)
E-94	Rear combination lamp (right side)
E-95	Rear combination lamp (left side)
E-96	Rear combination lamp (left side)
E-97	-
E-98	-
E-99	-
E-100	Cargo compartment light
E-101	Rear speaker (right side)
E-102	Rear speaker (left side)
E-103	Motor antenna
E-104 to E-105	ABS control unit
	-
E-106	ABS Diagnosis code erasure connector
E-107	-

Doors

Connector Symbol **F**



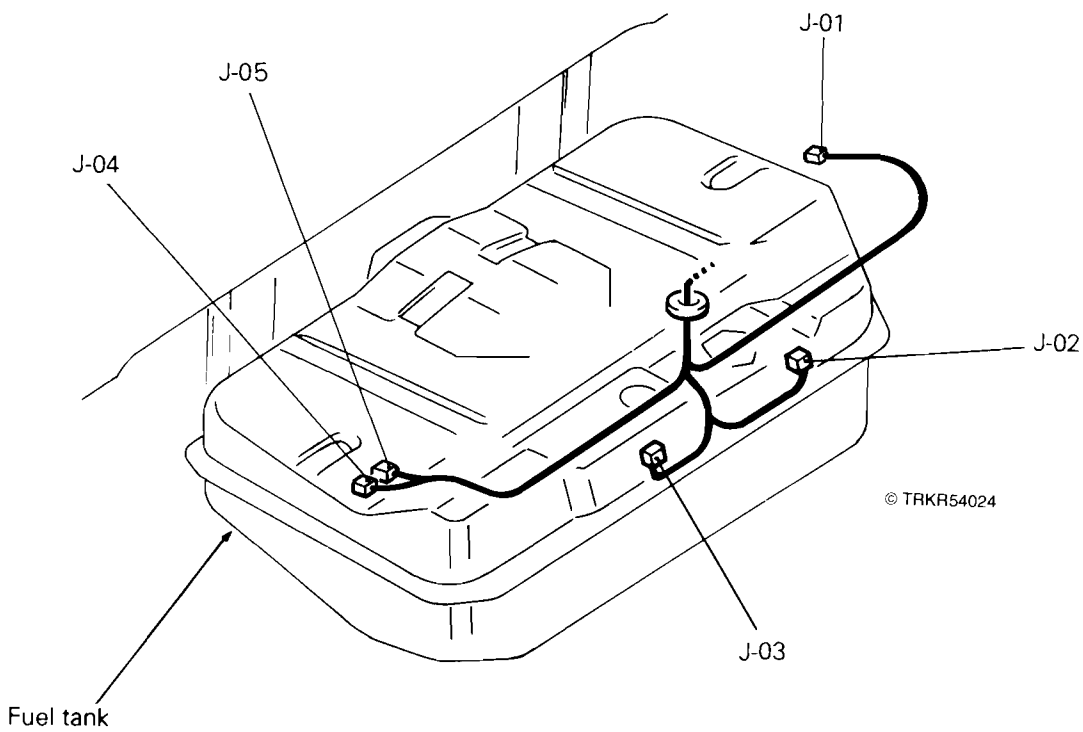
F-01 Door mirror (R.H.I
F-02 Door speaker (R.H.I
F-03 -
F-04 Front power window switch
F-05 Power window motor (Front: R.H.)
F-06 Door lock key cylinder switch (LH)
F-07 Door lamp (Front: R.H.)
F-08 Door lock actuator (Front: R.H.)
F-09 Rear power window switch
F-10 -
F-11 Power window motor (Rear: R.H.)
F-12 Door lock actuator (Rear: R.H)
F-13 Door lamp (Rear: R.H.)
F-14 Body wiring harness and rear door wiring
F-15 harness (R.H.) combination
F-16 Door lock actuator (Rear: L.H)
F-17 Door lamp (Rear: L.H.)
F-18 Power window motor (Rear: L.H.)
F-19 -
F-20 Rear power window (L.H.)
F-21 ABS wiring harness and rear door wiring
F-22 harness (L.H.) combination
F-23 Door lock actuator (Front: L.H.)
F-24 Door lamp (Front: L H.)
F-25 Power window motor (Front: L.H.)
F-26 Door mirror (L.H.)
F-27 Door speaker (L.H.)
F-28 -
F-29 Front power window switch
F-35 Door key illumination assembly(RH) or receiver assy <ETACS>
F-36 Keyless entry control unit

Remark
The mark ★ shows the standard mounting position of wiring harness.

Sedan

Connector Symbol

J

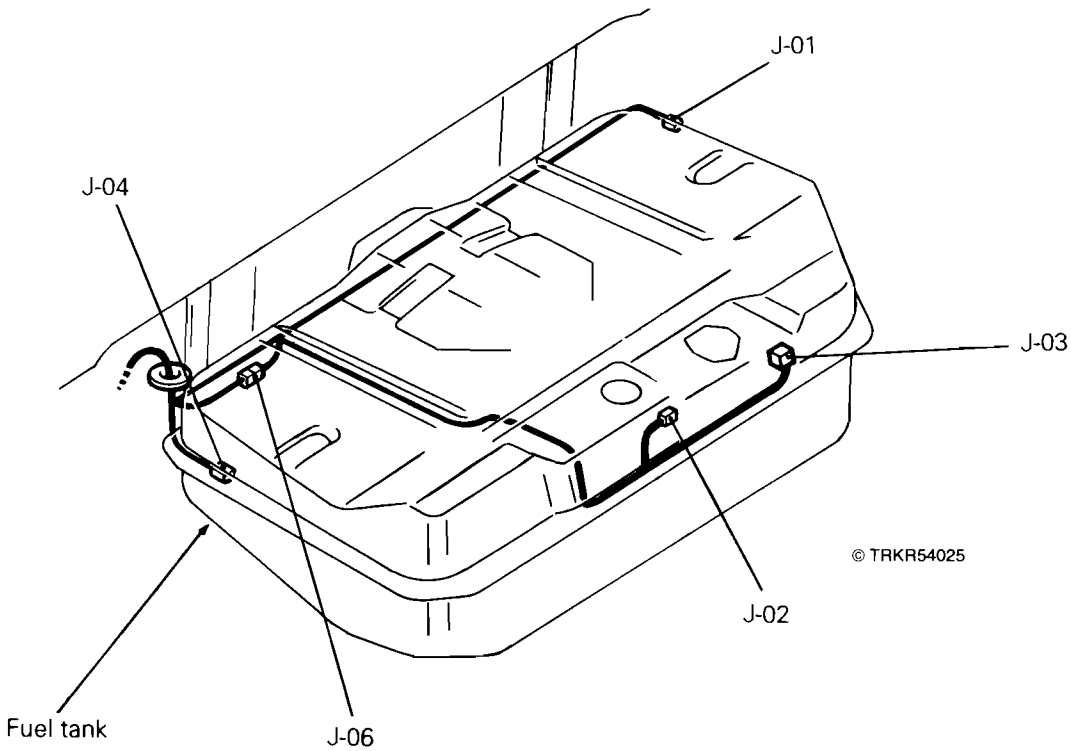


J-01 ABS speed sensor (Rear RH) <ABS>
J-02 Fuel pump
J-03 Fuel gauge unit
J-04 ABS speed sensor (Rear: LH) <ABS>
J-05 ACTIVE-ECS rear height sensor

Wagon

Connector Symbol

J



J-01 ABS speed sensor (Rear RH) <ABS>
J-02 Fuel pump
J-03 Fuel gauge unit
J-04 ABS speed sensor (Rear: LH) <ABS>
J-05 -
J-06 Fuel pump jumper wiring harness and Fuel pump harness combination

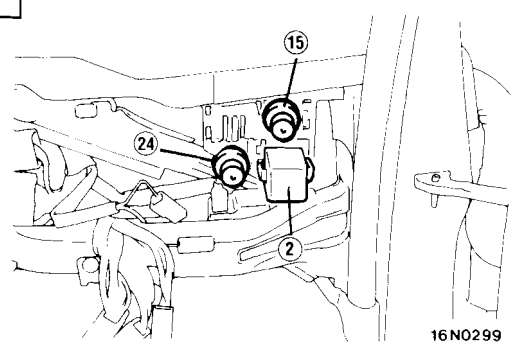
SECTION 3C – SINGLE PART INSTALLATION POSITION

	Page Number
Relay	54-3C-1
Control Unit	54-3C-5
Fusible Link and Fuse	54-3C-6
Earth Points	54-3C-7

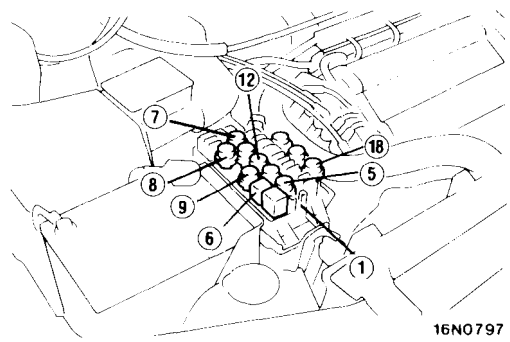
RELAY

Number	Box	Component	Number	Box	Component
1	C	I.O.D. connector	14	G	Door key lamp timer relay
2	A	Flasher unit	15	A	Horn theft alarm relay (ETACS)
3	B	Defogger relay	16	H	Hazard lamp—theft alarm relay (ETACS)
4	B	Heater relay	17	I	Start inhibitor—theft alarm relay (ETACS)
5	C	A/C compressor relay	18	C	AECS—relay
6	C	Headlamp relay	19	J	AECS—return pump relay
7	C	A/C condensor fan relay	20	J	AECS—compressor pump relay
8	C	Power window relay	21	J	AECS—solenoid valve relay
9	C	Tail lamp relay	22	K	ABS—valve relay
10	D	Door lock relay	23	K	ABS—motor relay
11	E	Intermittent wiper relay	24	A	Trunk lid opener relay <from 1994 models>
12	C	Radiator fan relay	25	H	Horn relay <SRS>
13	F	ESS relay (Carby models)			

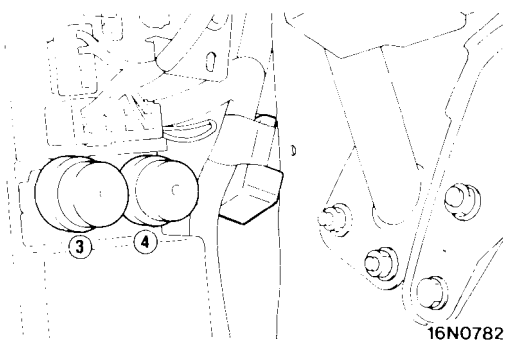
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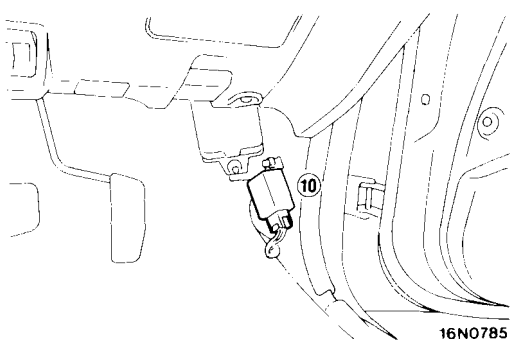
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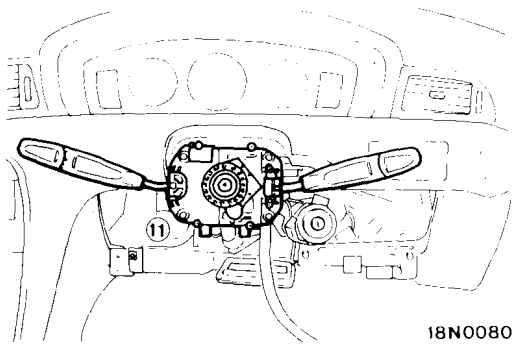
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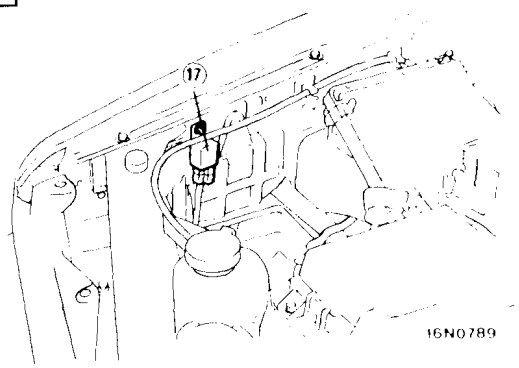
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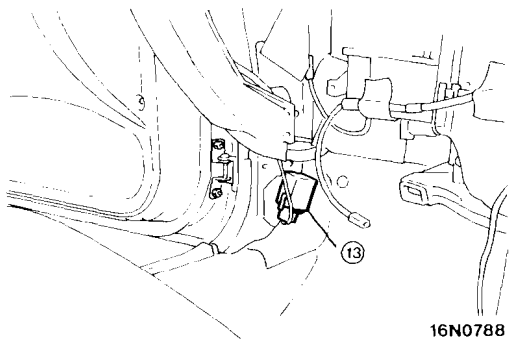
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11
18N0080

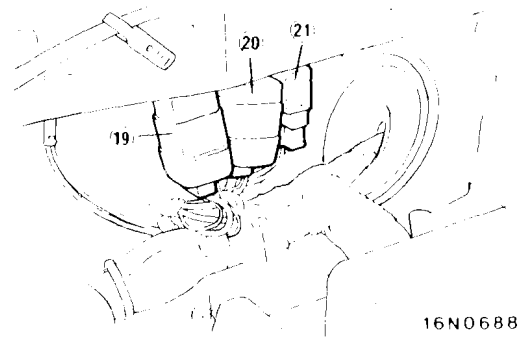
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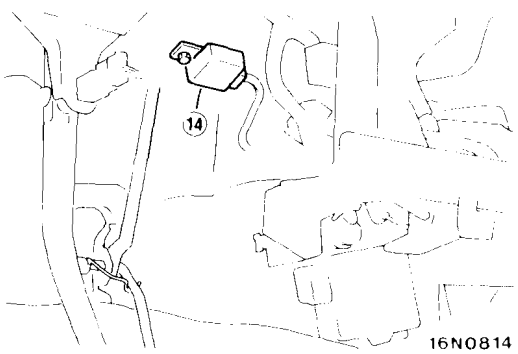
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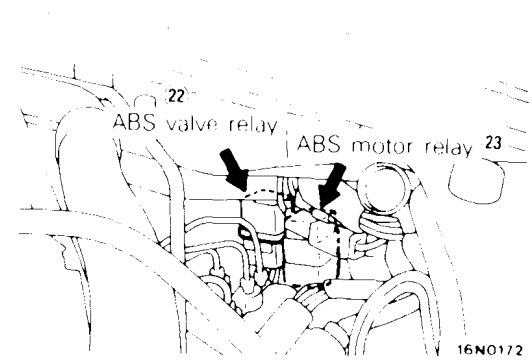
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21
19
16N0688

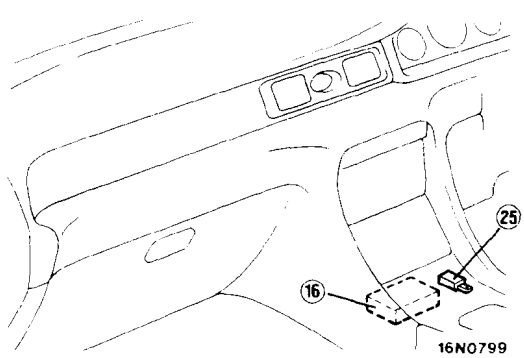
G


14
16N0814

K


22
ABS valve relay
ABS motor relay
23
16N0172

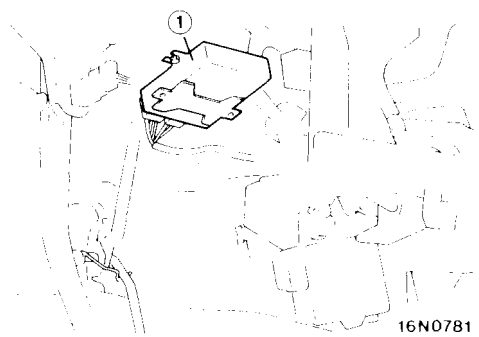
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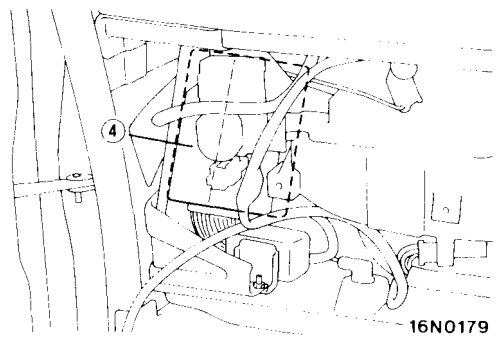
CONTROL UNIT

Number	Box	Component	Number	Box	Component
1	A	ETACS control unit	7	F	Keyless entry control unit
2	B	Auto trans control unit	8	G	AECS control unit
3	C	Fuel pump control unit	9	H	ABS control unit
4	D	ECI-Multi control unit	10	I	Keyless entry control unit <1994>
5	E	Cruise control unit	11	J	SRS Diagnosis unit
6	E	Auto air control unit			

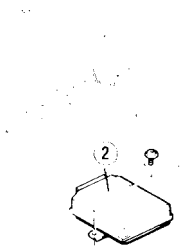
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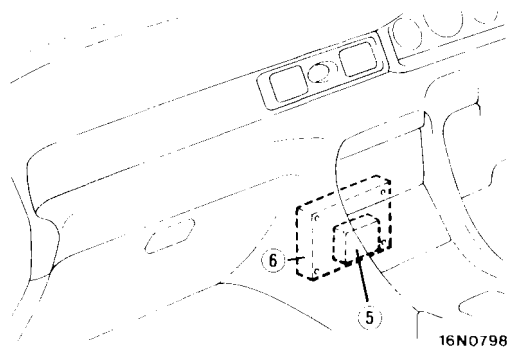
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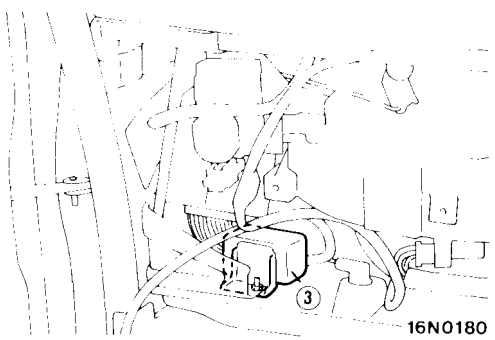
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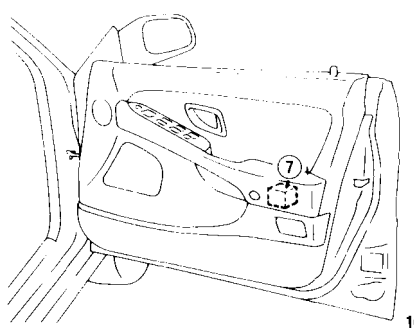
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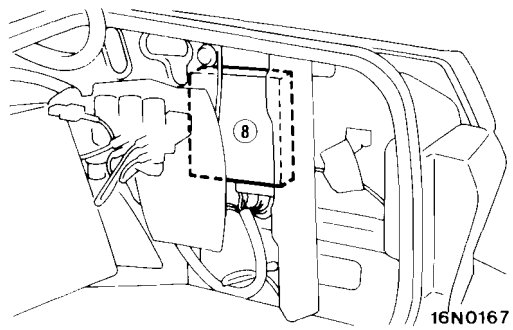


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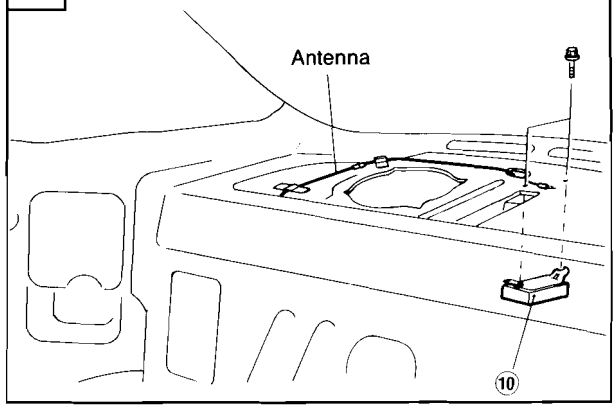


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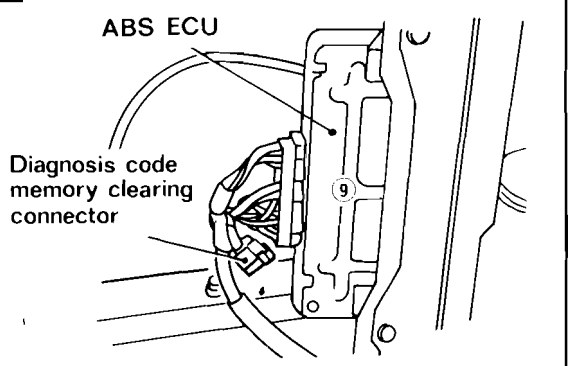
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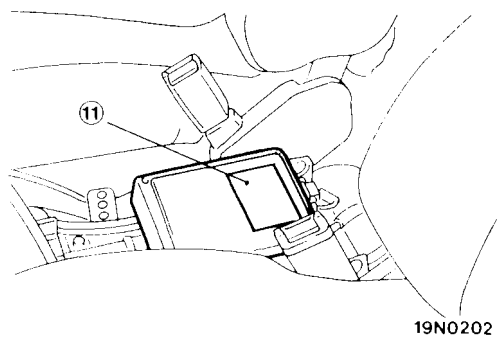
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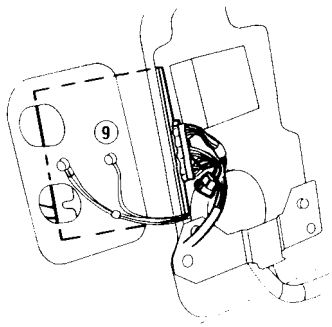
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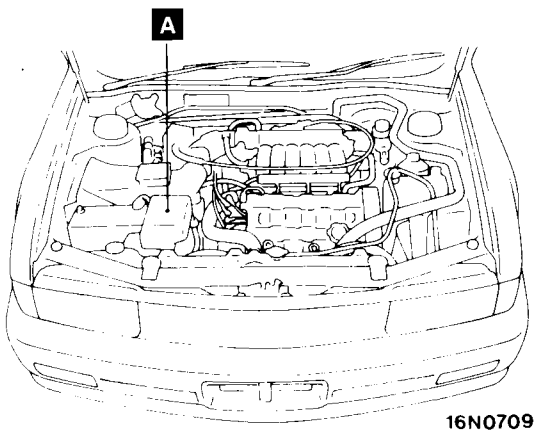
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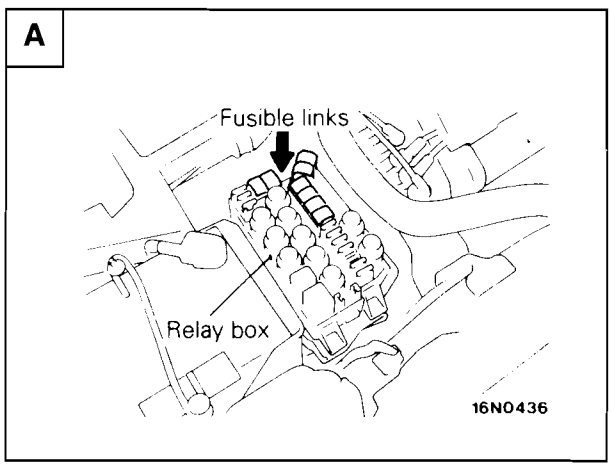


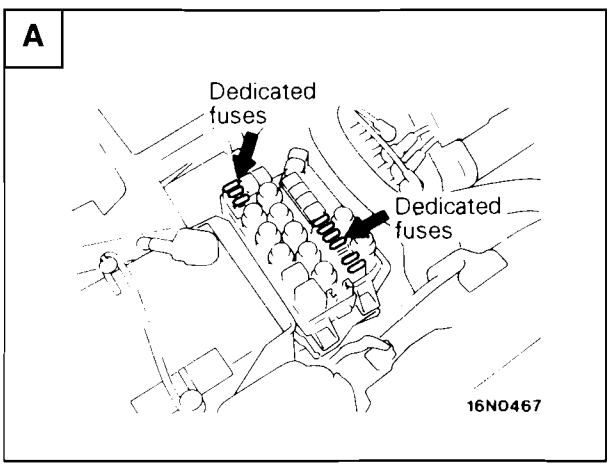
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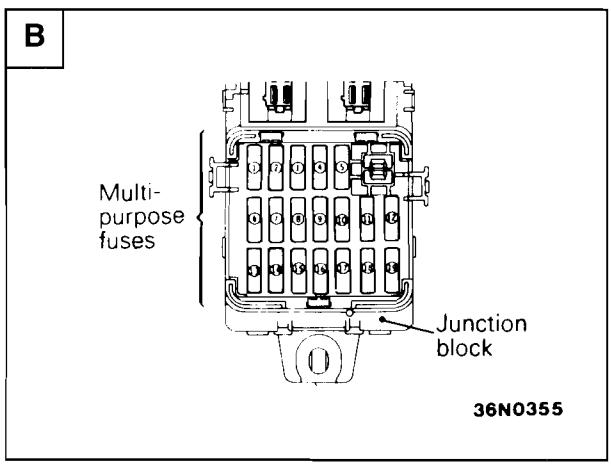
FUSIBLE LINK and FUSE

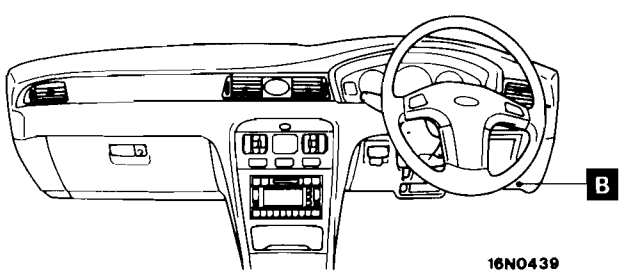
Name	Symbol
Dedicated fuses	A
Fusible links	A
Multi-purpose fuses	B





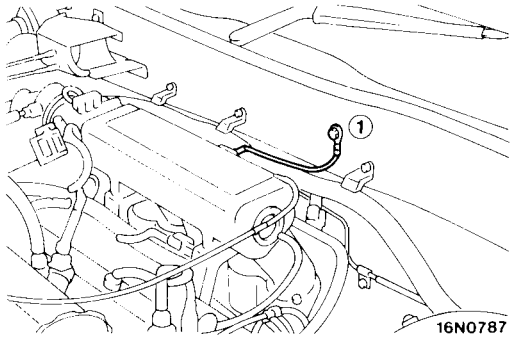




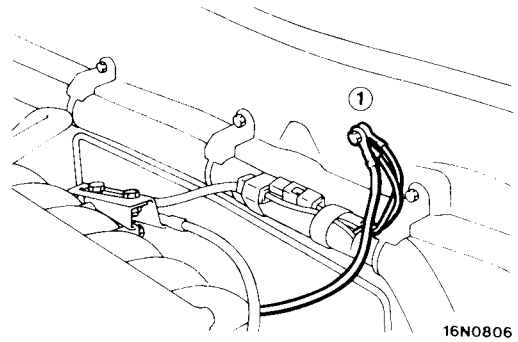


EARTH POINTS

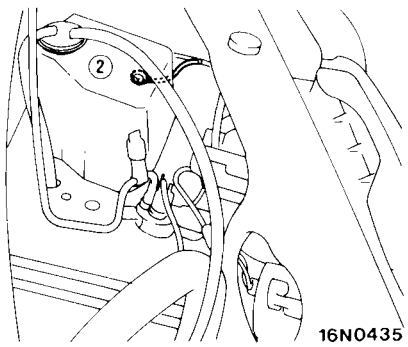
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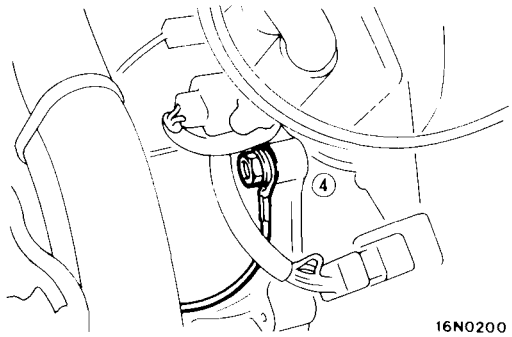
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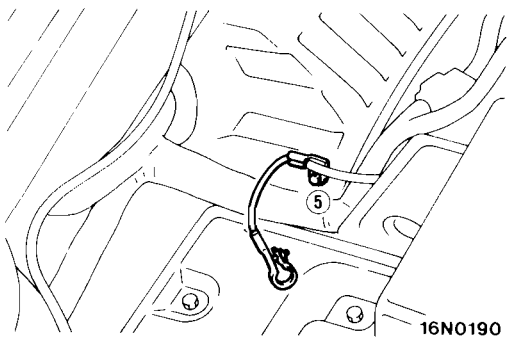
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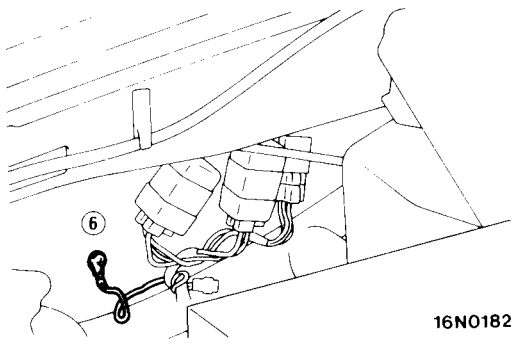
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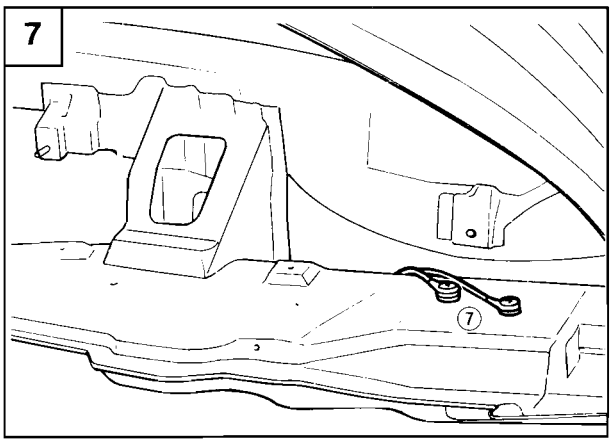
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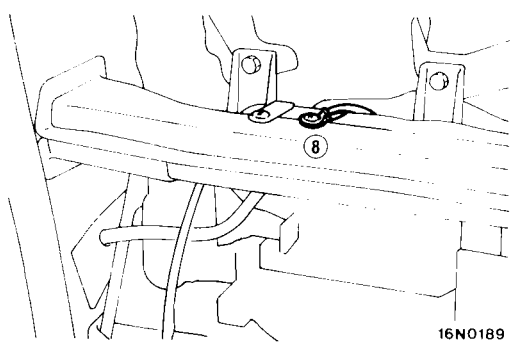
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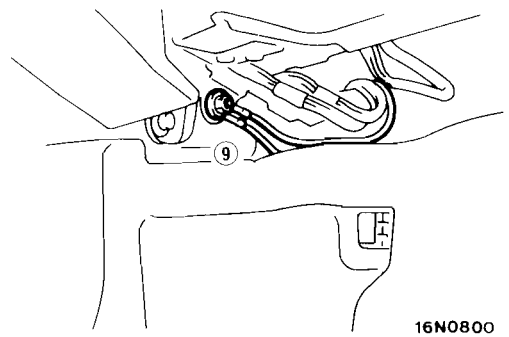
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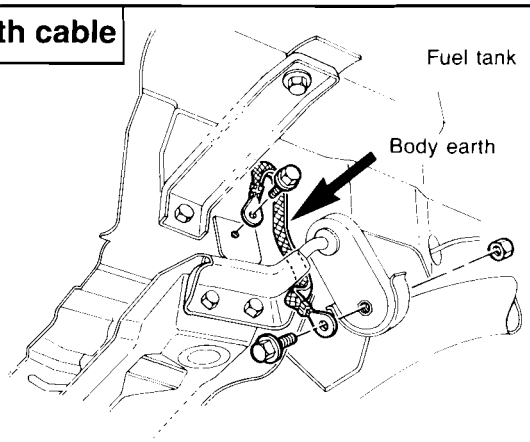
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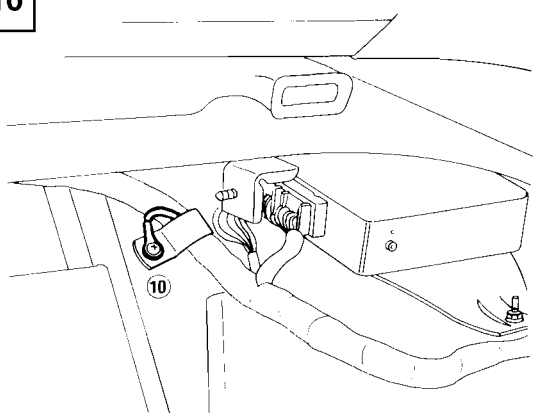
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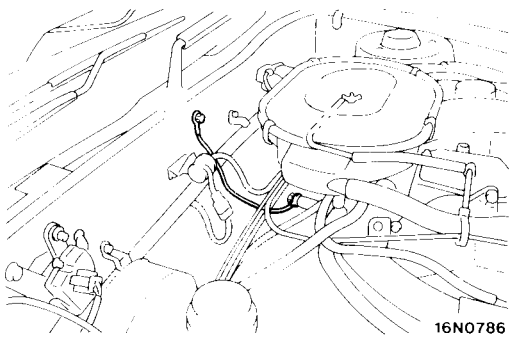
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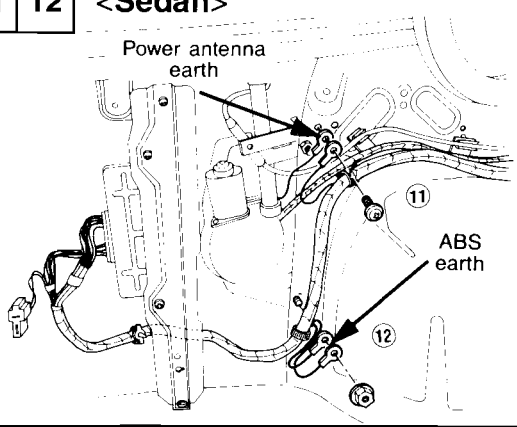
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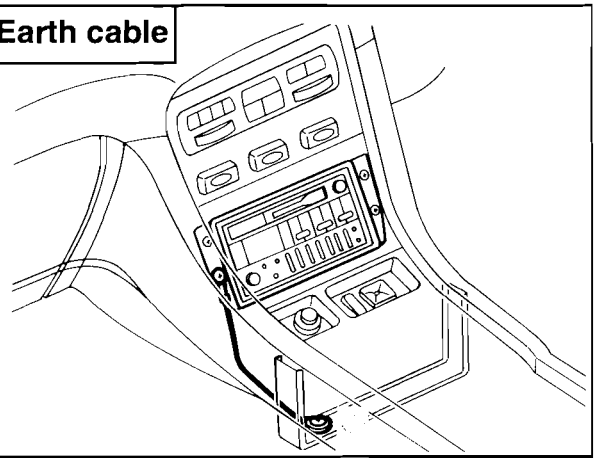
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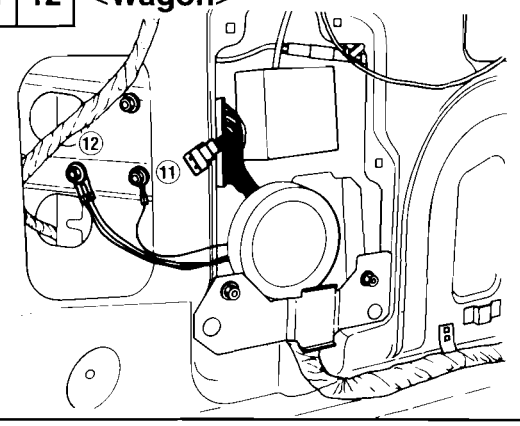
11 **12** **<Sedan>**



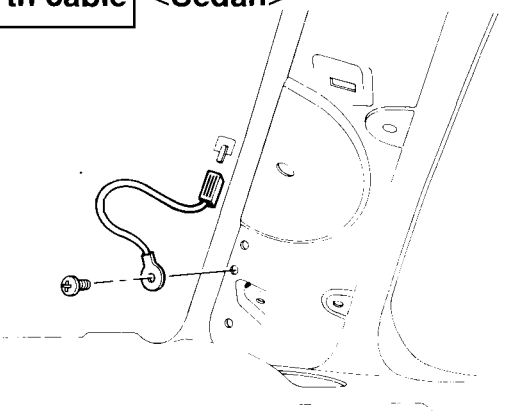
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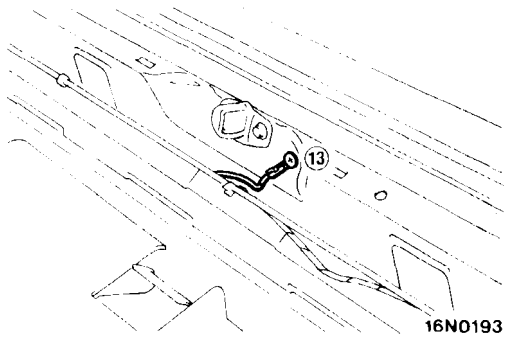
11 **12** **<Wagon>**



Earth cable **<Sedan>**

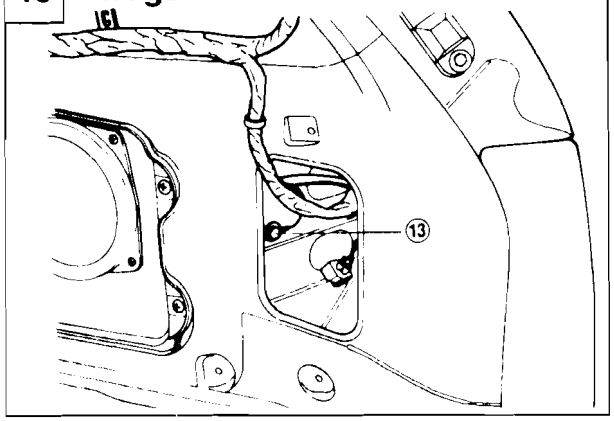


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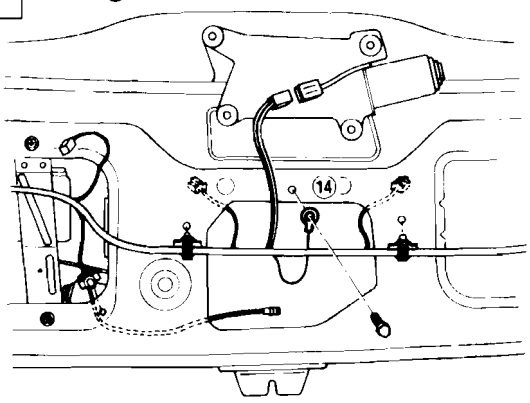


Trunk lamp earth

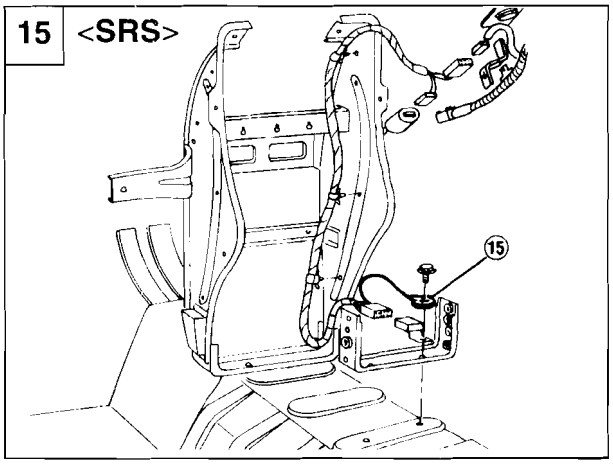
13 <Wagon>



14 <Tailgate>



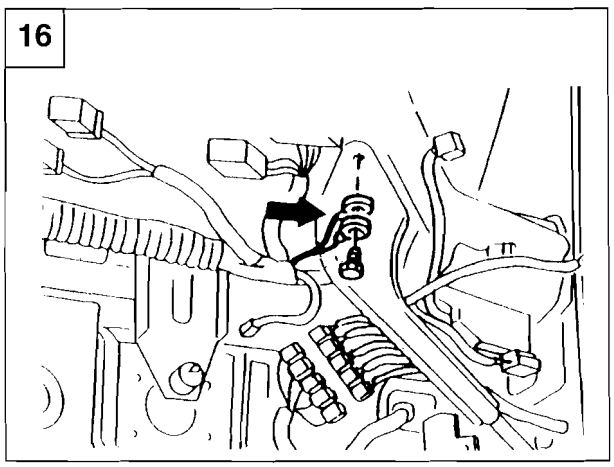
15 <SRS>



EARTH POINT LOCATION

1. Engine Compartment (cowl top)
2. Engine Compartment (left side)
3. —
4. Engine Compartment (battery cable -Ve engine earth)
5. Engine Compartment (battery cable -Ve body earth)
6. Engine Compartment (right side)
7. Interior (deck crossmember drivers side)
8. Interior (deck crossmember passengers side)
9. Interior (cowl side passengers side)
10. Interior (ELC 4 speed auto trans control unit)
11. Cargo Compartment (power antenna)
12. Cargo Compartment (ABS control unit)
13. Cargo Compartment (right side)
14. Tailgate
15. Interior (floor)
16. Interior (deck crossmember drivers side)

16



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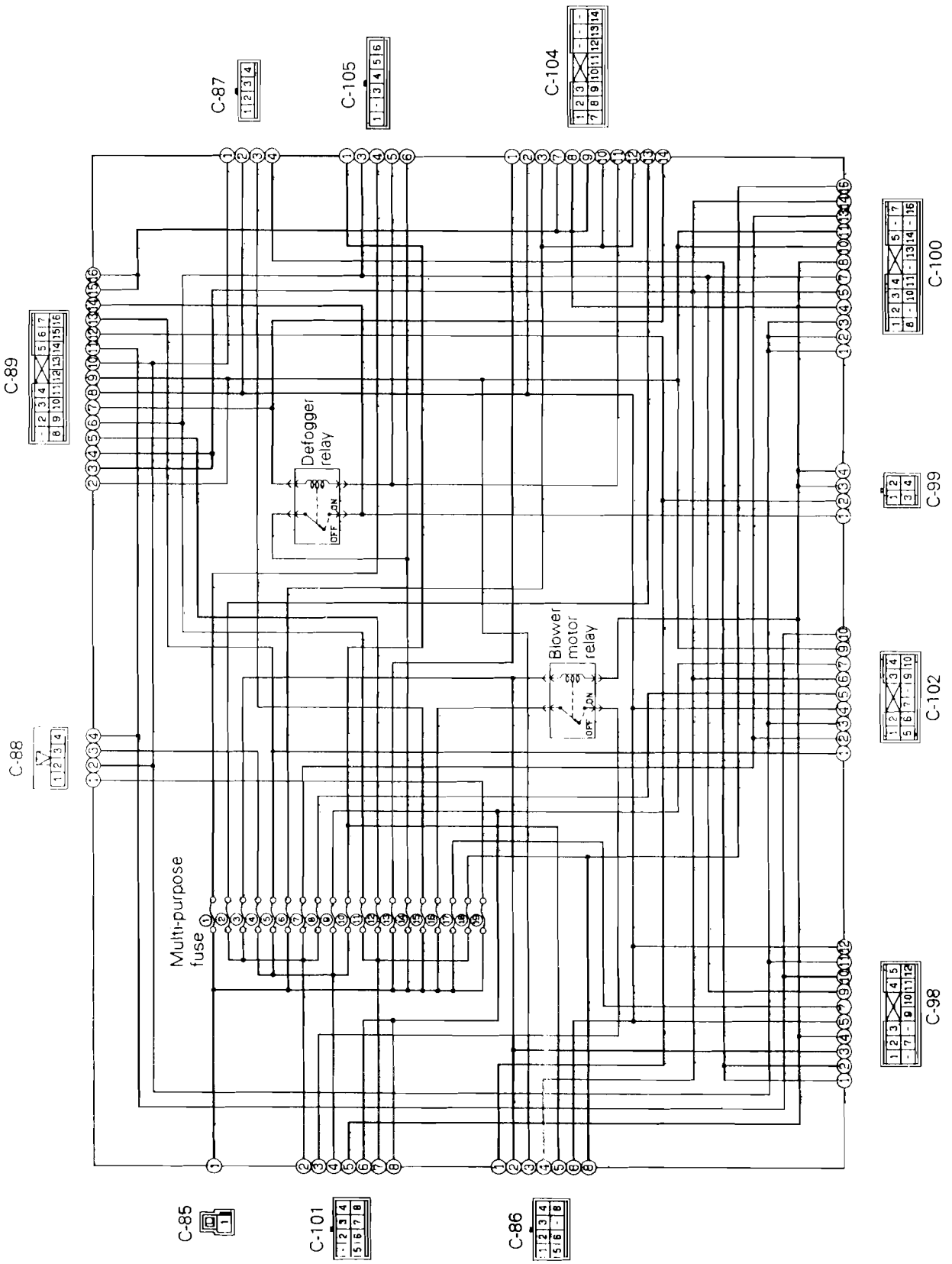
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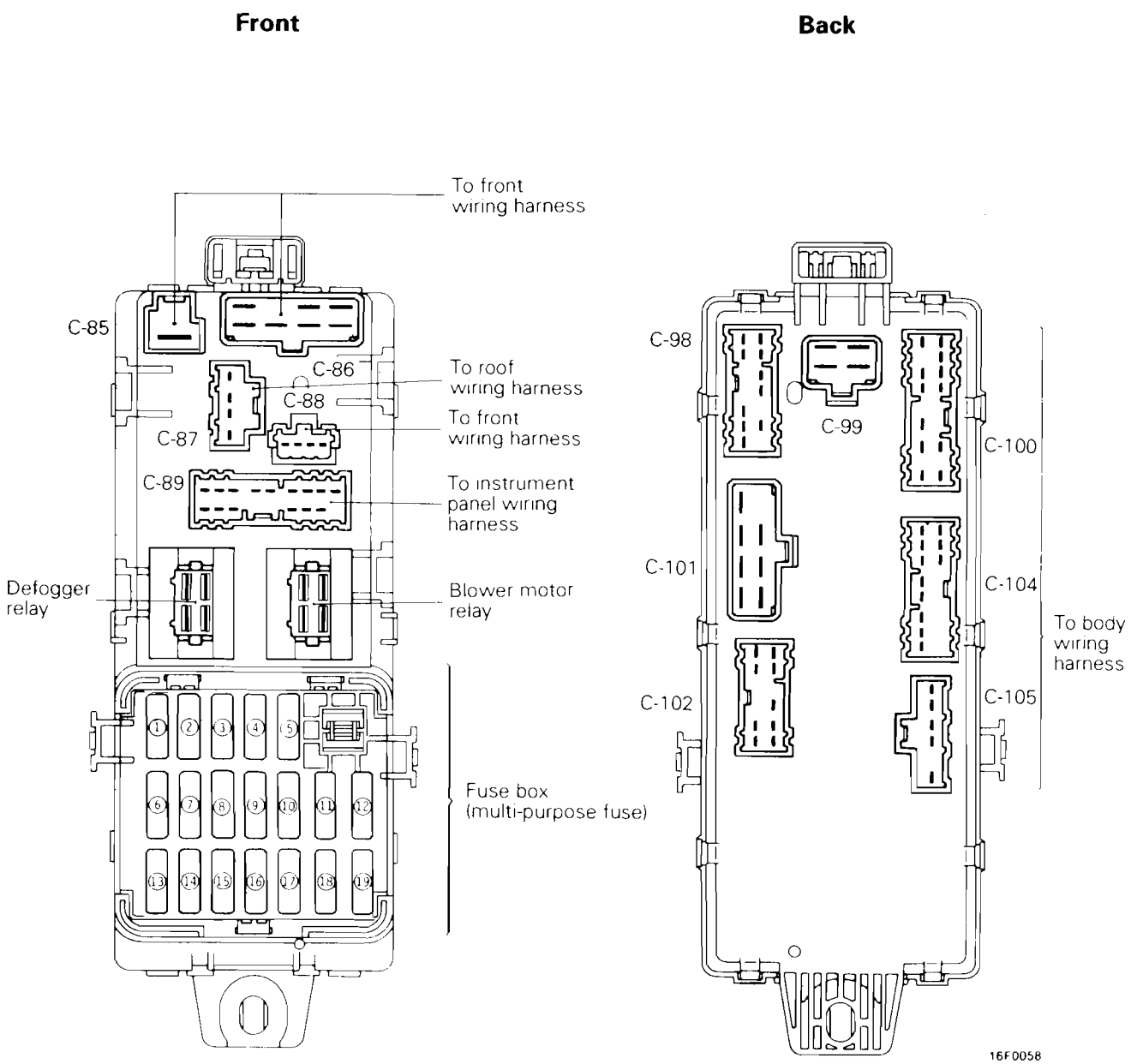
CIRCUIT DIAGRAM – Junction Block



Remark

- Connector numbers are keyed to the configuration diagram (dashboard panel) and each circuit diagram.

CIRCUIT DIAGRAM – Junction Block

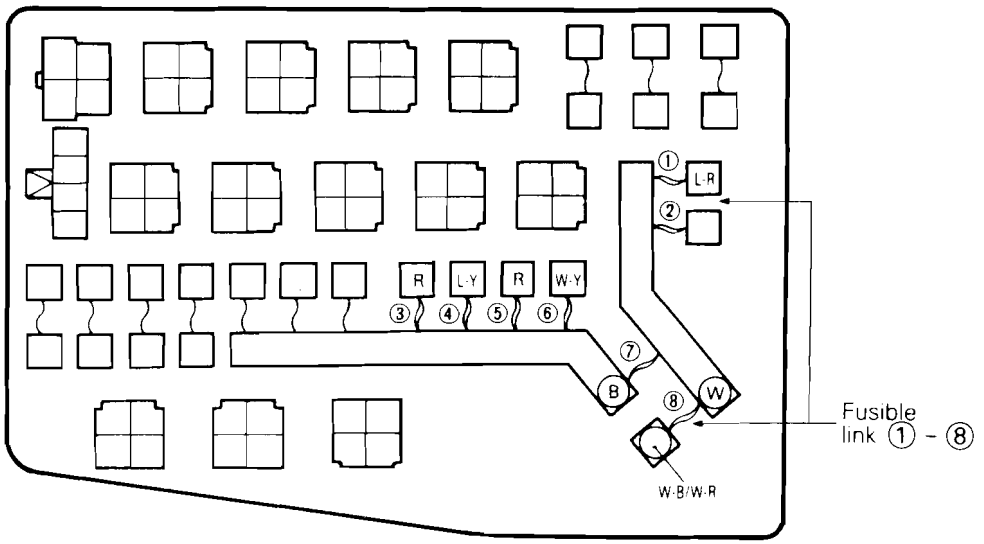


CIRCUIT DIAGRAM – Centralised Junction

CENTRALISED JUNCTION

FUSIBLE LINK (Relay box in engine compartment)

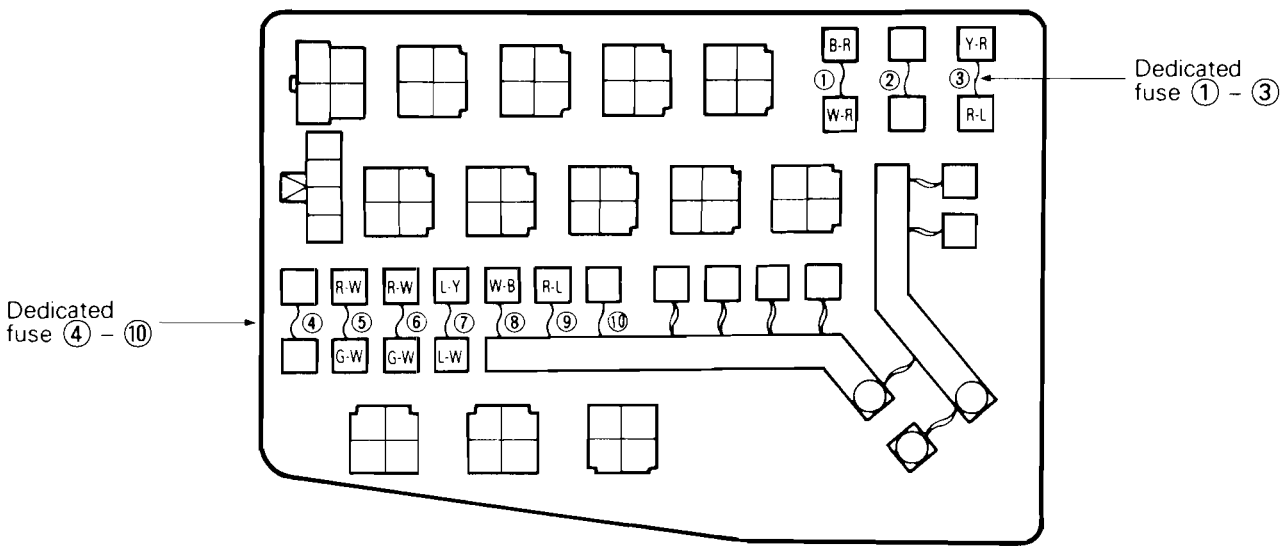
No.	Circuit	Housing colour	Rated capacity (A)
1	Power window circuit	Pink	30
2	–	–	–
3	Ignition switch circuit	Pink	30
4	Radiator fan and condenser fan circuit	Green	40
5	Headlamp, tail lamp and alternator circuit	Green	40
6	ABS Circuit	Yellow	60
7	Fusible link No. 1, 2, 8 and alternator circuit	Blue	100
8	Multi-purpose fuse No. 6, 13, 14, 15, 16, 17, 19 and A/C compressor	Yellow	60



CIRCUIT DIAGRAM – Centralised Junction

DEDICATED FUSE 1 – 10 (Relay box in engine compartment)

Power supply circuit	No.	Rated capacity (A)	Housing colour	Circuit
Battery	1	10	Red	A/C compressor circuit
	2	–	–	–
Headlamp relay (Battery)	3	10	Red	Upper beam indicator
Battery	4	–	–	–
Tail lamp relay (Battery)	5	15	Blue	Tail lamp and illumination circuit
	6	–	–	–
Battery	7	30	Green	Condenser fan circuit
	8	20	Yellow	MPI circuit
	9	15	Blue	Hazard lamp circuit
	10	–	–	–

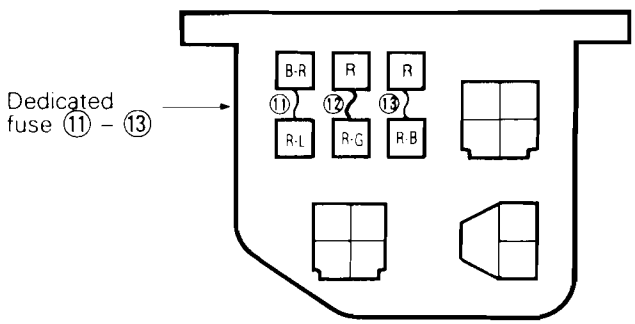


CIRCUIT DIAGRAM – Centralised Junction

DEDICATED FUSE 11 – 13 (relay box in passenger compartment)

Power supply circuit	No.	Rated capacity (A)	Housing colour	Circuit
Theft alarm Hazard lamps	11	10	Red	Theft alarm circuit
Theft alarm hazard lamps	12	10	Red	Theft alarm circuit
Theft alarm horn	13	10	Red	Theft alarm circuit

R.H. drive vehicles

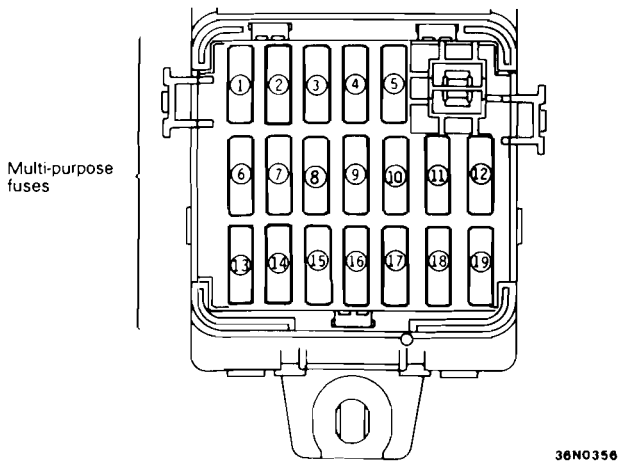


MULTI-PURPOSE FUSE (IN JUNCTION BLOCK)

Power supply circuit		No.	Rated capacity (A)	Load circuit
–		1	10	Horn
Ignition Switch	IG2	2	10	ABS control unit, ABS valve relay
	IG2	3	10	A/C control panel assembly, A/C control unit, blower motor relay, blower motor high relay defogger relay
	ACC	4	10	Clock, radio, motor antenna and ETACS unit
	ACC	5	15	Cigarette lighter and remote control mirror
Battery		6	15	Door lock control relay
Battery	IG2	7	10	Auto-cruise control unit , combination meter ELC-4AT control unit
	IG2	8	10	–

CIRCUIT DIAGRAM – Centralised Junction

Power supply circuit		No.	Rated capacity (A)	Load circuit
Ignition Switch	ACC	9	20	Rear wiper, rear window, windshield wiper and windshield washer
	ACC	10	–	–
	IG1	11	10	Alternator relay, auto-cruise control unit, combination meter, engine, ETACS unit, motor antenna
	IG1	12	10	Clock, radio, motor antenna and ETACS unit <RHD>
Battery		13	–	–
		14	30	Defogger
		15	–	–
		16	25	Blower motor
		17	15	Stop lamp
Ignition switch	IG1	18	10	Back-up lamp
Battery		19	10	A/C control unit, auto-cruise control, clock, combination meter, door lamp ELC-4A/T control unit, engine control unit, ETACS unit, foot lamp, ignition key cylinder illumination lamp, radio, room lamp, cargo compartment lamp and map lamp



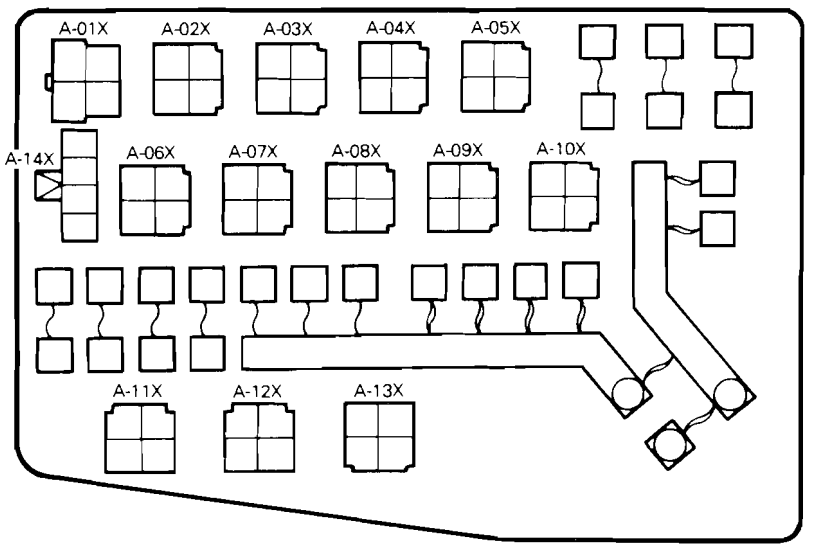
CIRCUIT DIAGRAM – Centralised Junction

CENTRALISED RELAY

Classification		Name	Classification		Name
Relay box in engine compartment	A-01X	Alternator relay	Relay box in engine compartment	A-09X	Condenser fan motor relay (LO) *
	A-02X	Head lamp relay(l)		A-10X	Condenser fan motor relay (HI)
	A-03X	Tail lamp relay		A-11X	ACTIVE-ECS relay
	A-04X	–		A-12X	–
	A-05X	Power window relay		A-13X	–
	A-06X	A/C compressor relay		A-14X	Jumper connector
	A-07X	–	Relay box in passenger compartment	C-65X	Theft alarm – horn relay
	A-08X	Radiator fan motor relay (HI)		C-66X	Trunk Lid opener relay *
				C-67X	Turn and hazard flasher unit

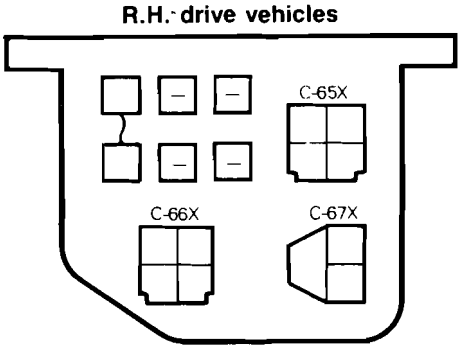
*<1994 Models>

<Relay box in engine compartment>



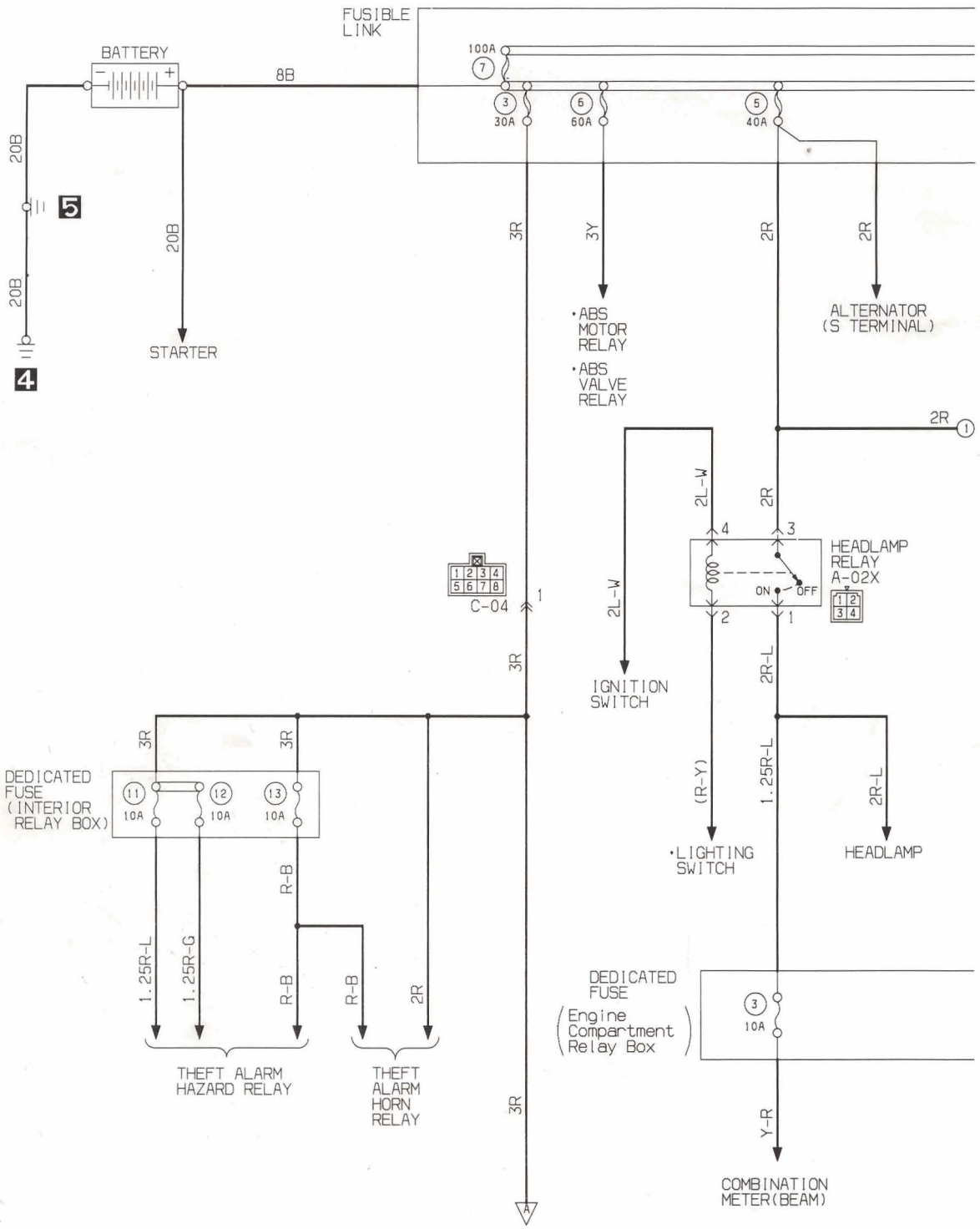
16N0763

<Relay box in passenger compartment>



16N0231

CIRCUIT DIAGRAM – Power distribution circuit <1991-1994 Models>



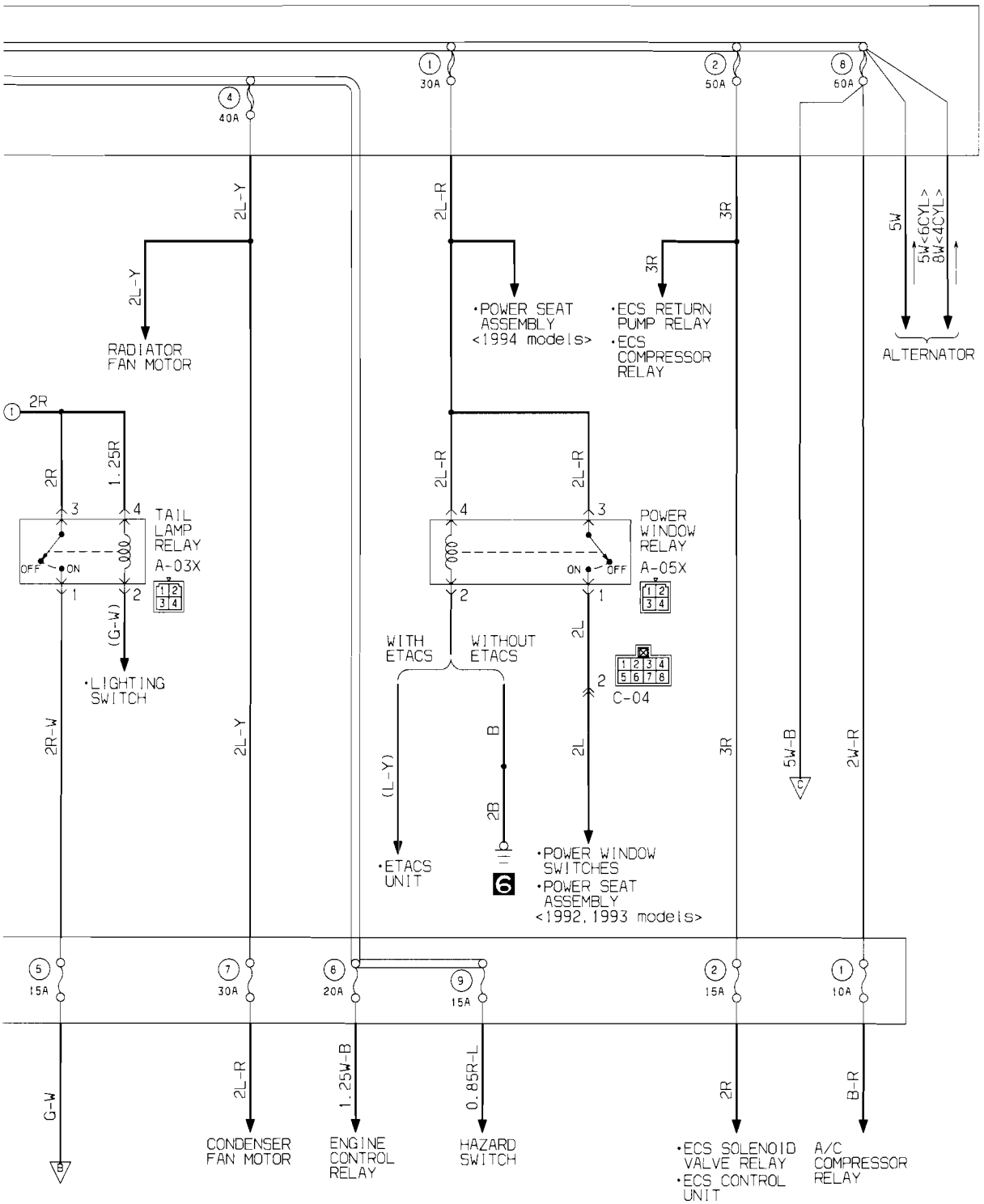
93-124

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Power distribution circuit <1991-1994 Models>

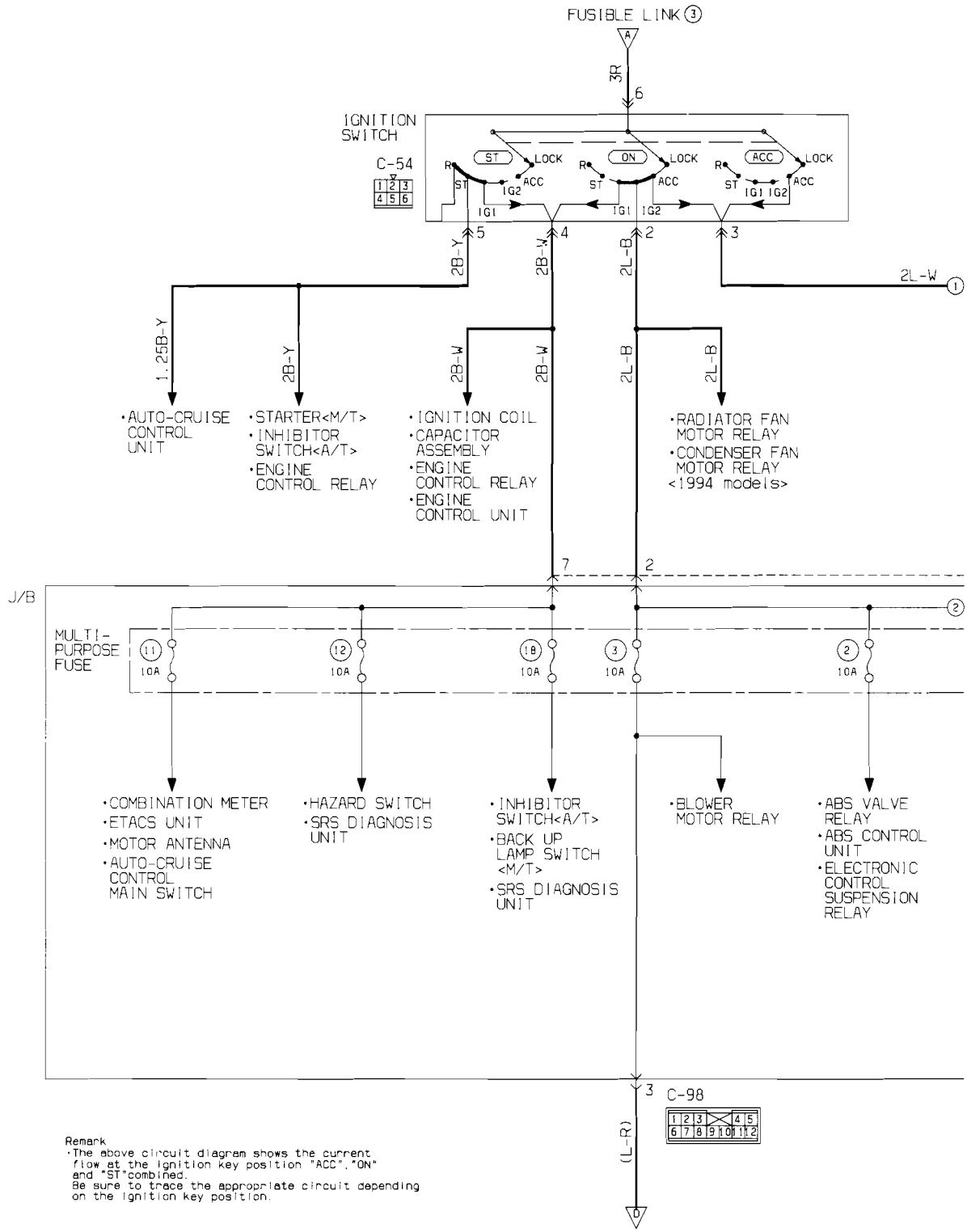


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CIRCUIT DIAGRAM – Power distribution circuit <1991-1994 Models> Cont;

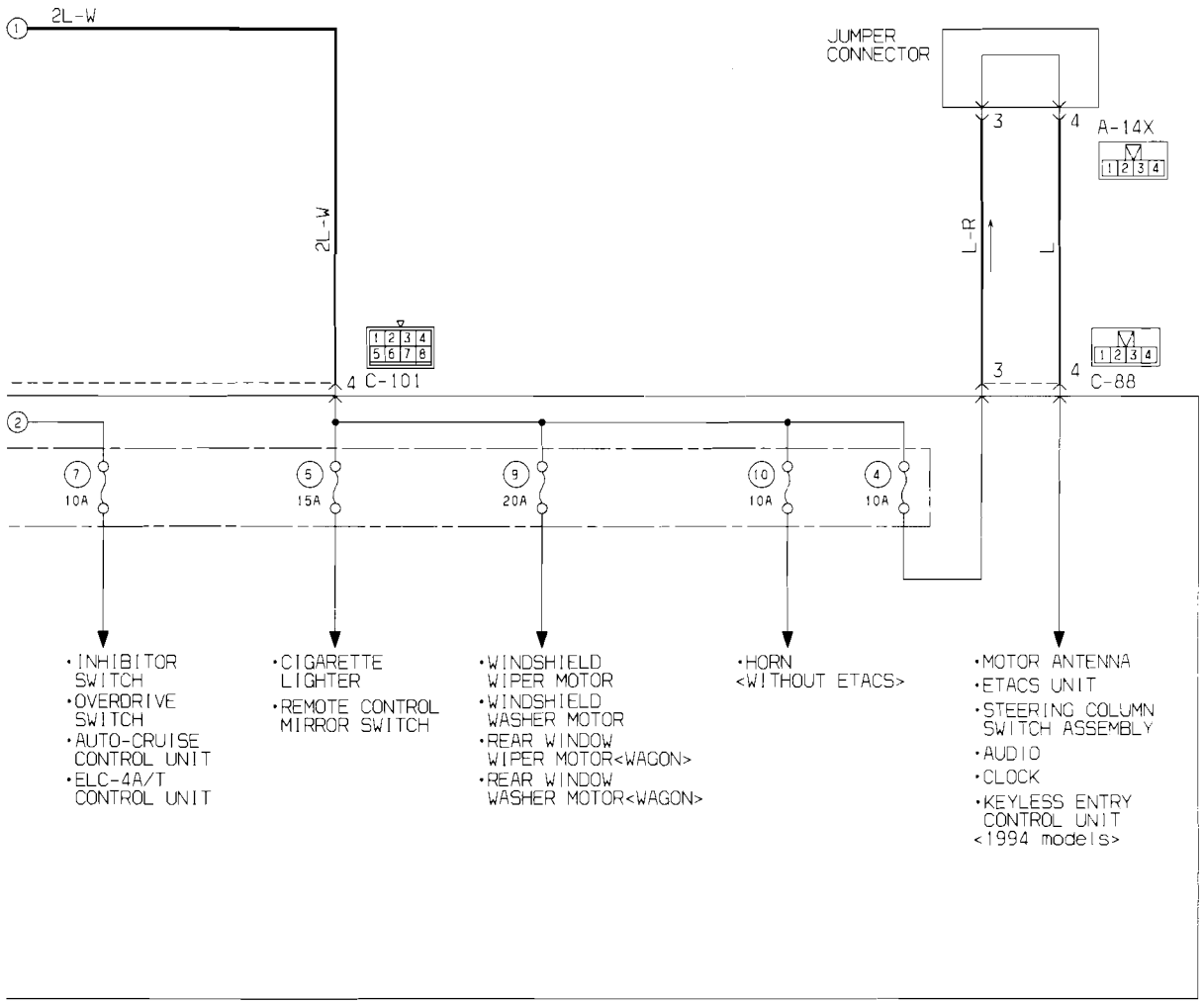


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CIRCUIT DIAGRAM – Power distribution circuit <1991-1994 Models>

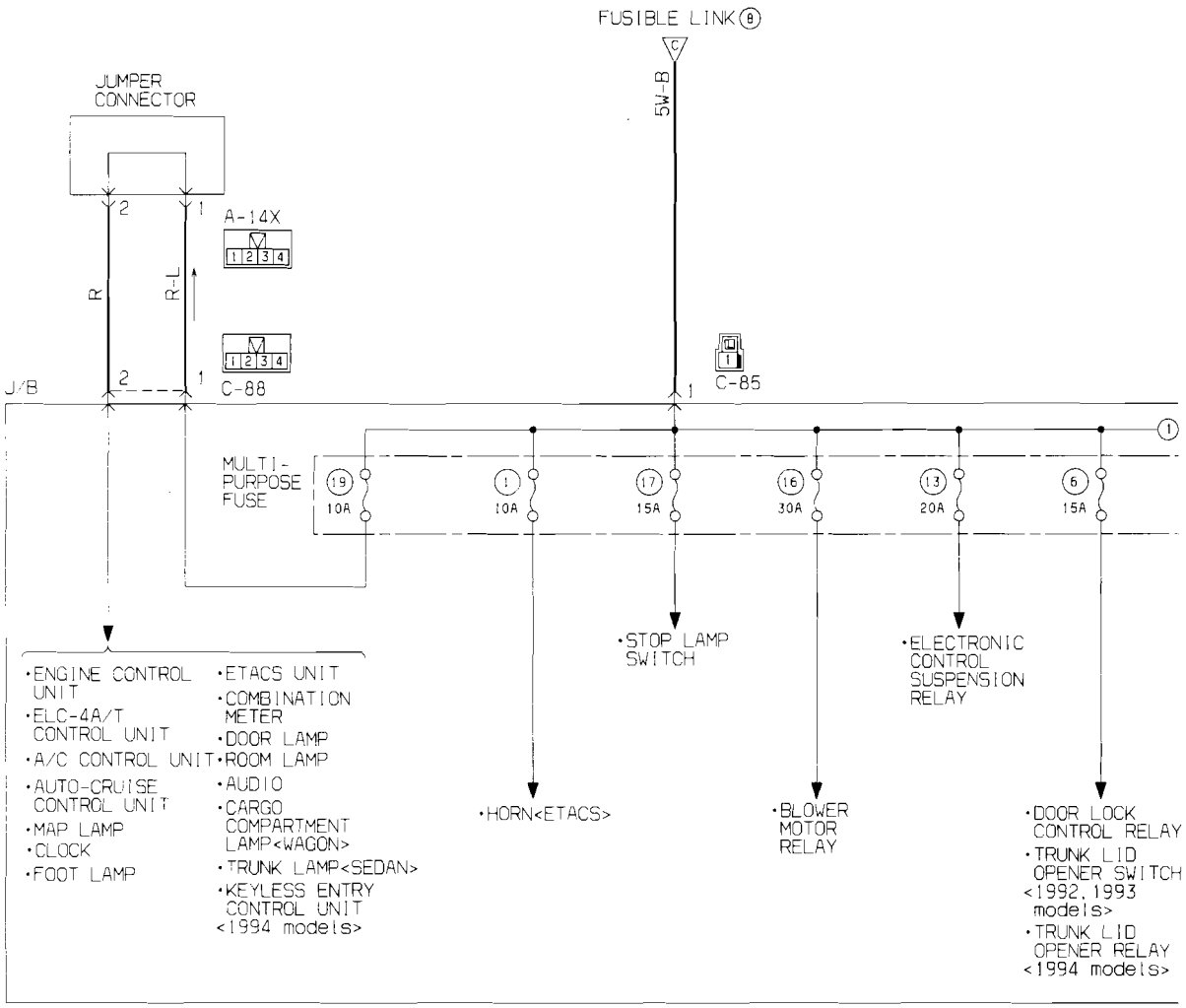


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CIRCUIT DIAGRAM – Power distribution circuit <1991-1994 Models> Cont;



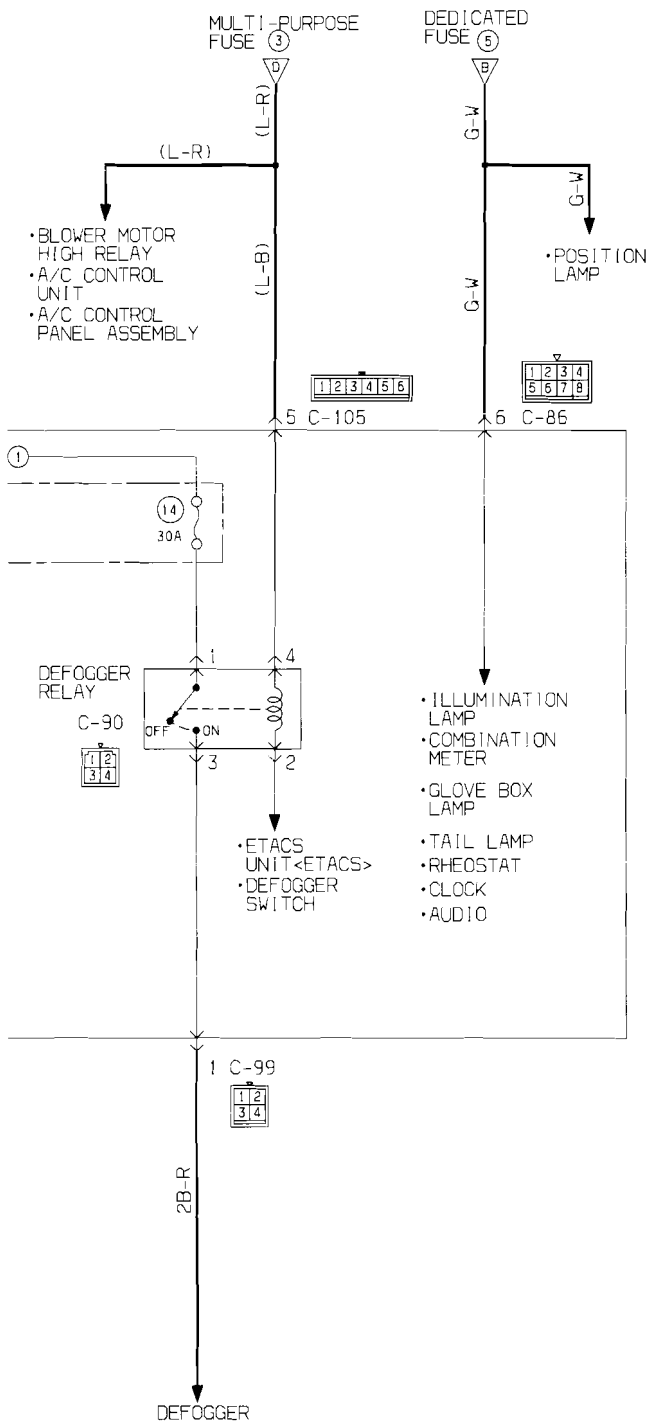
93-124-B

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
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CIRCUIT DIAGRAM – Power distribution circuit <1991-1994 Models>

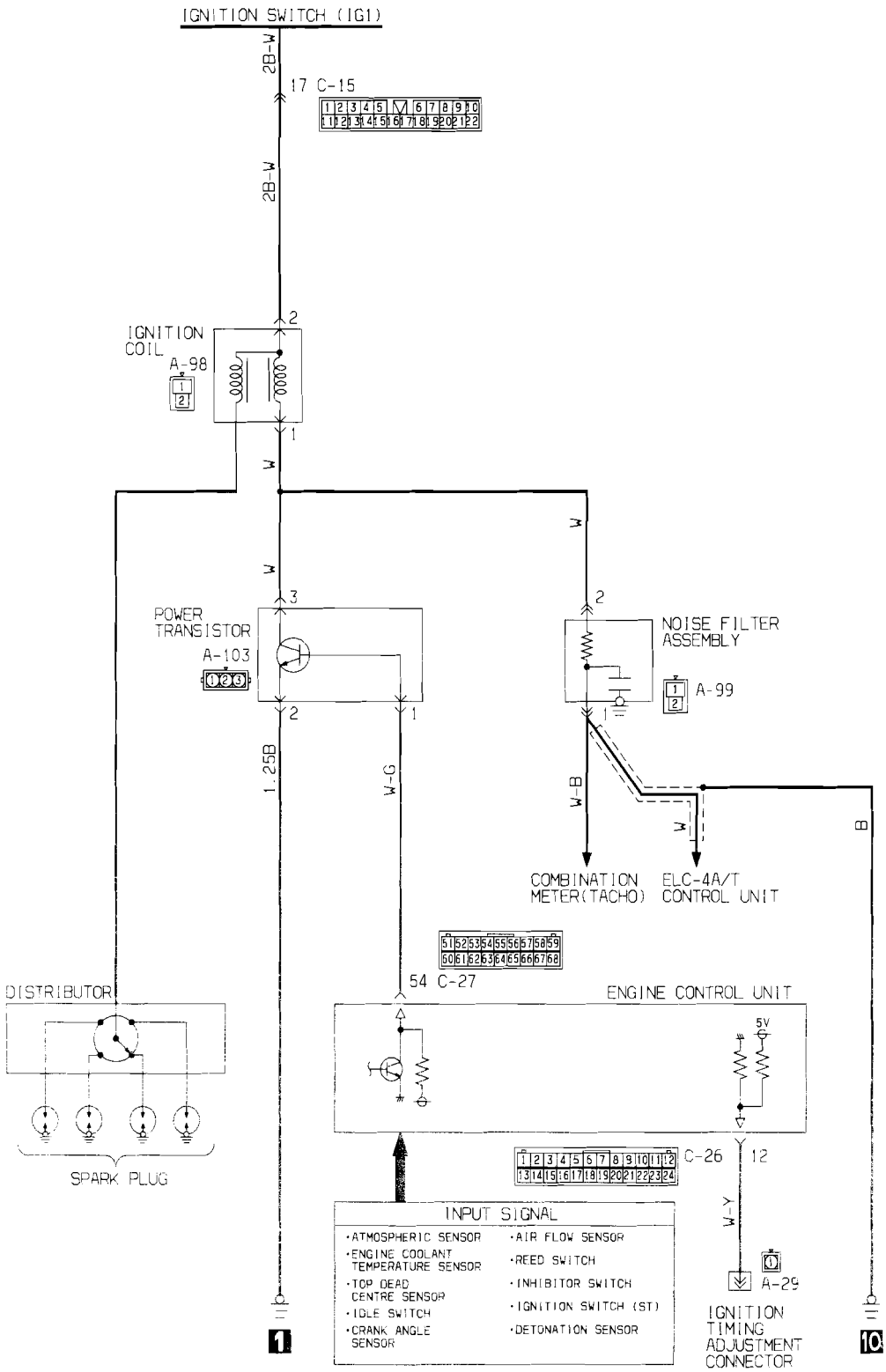


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CIRCUIT DIAGRAM – Ignition system circuit (4 cyl) <1991-1994 Models>

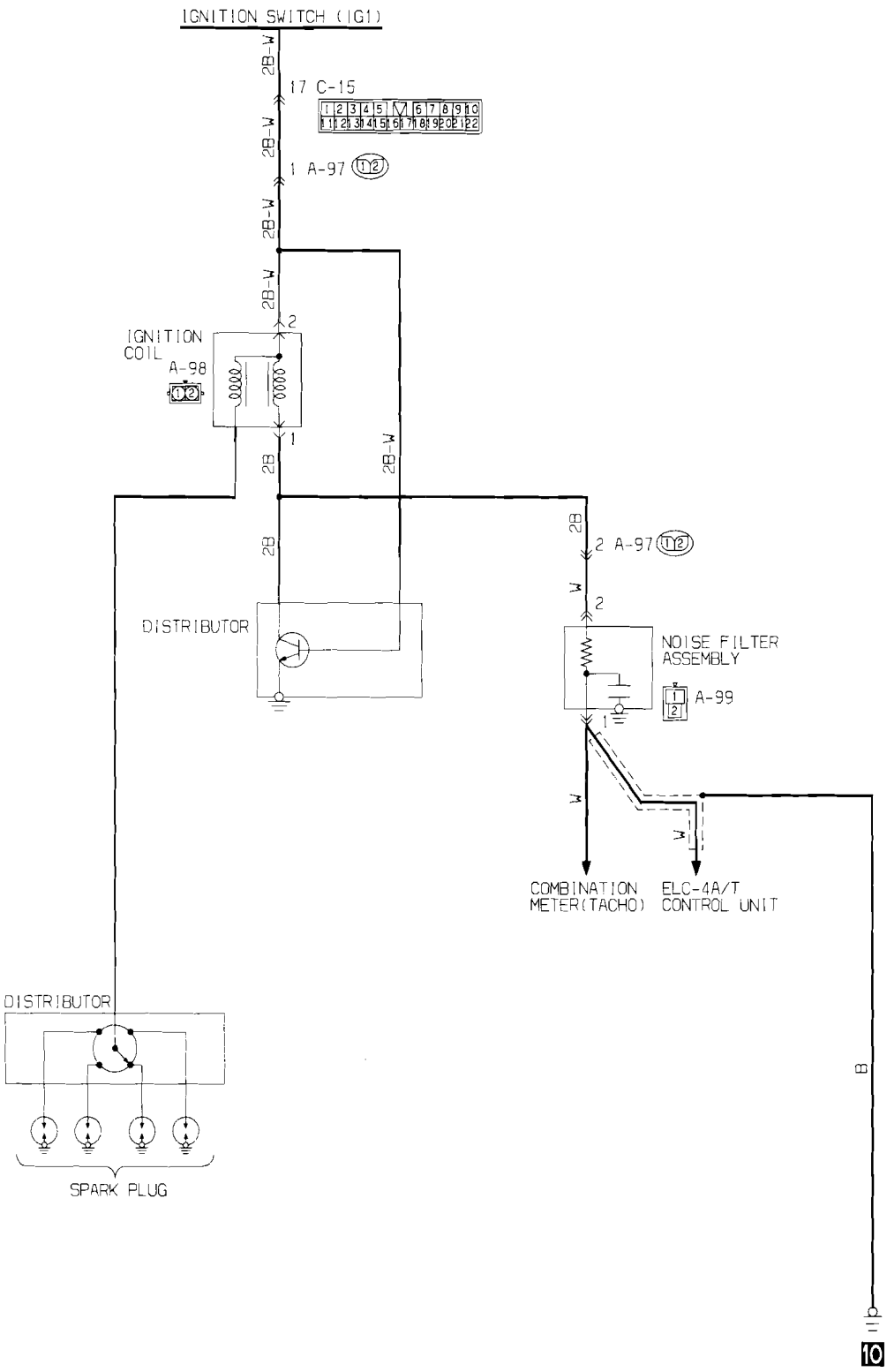


Wire colour code

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BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Ignition system circuit (4 cyl carby) <1991-1994 Models>

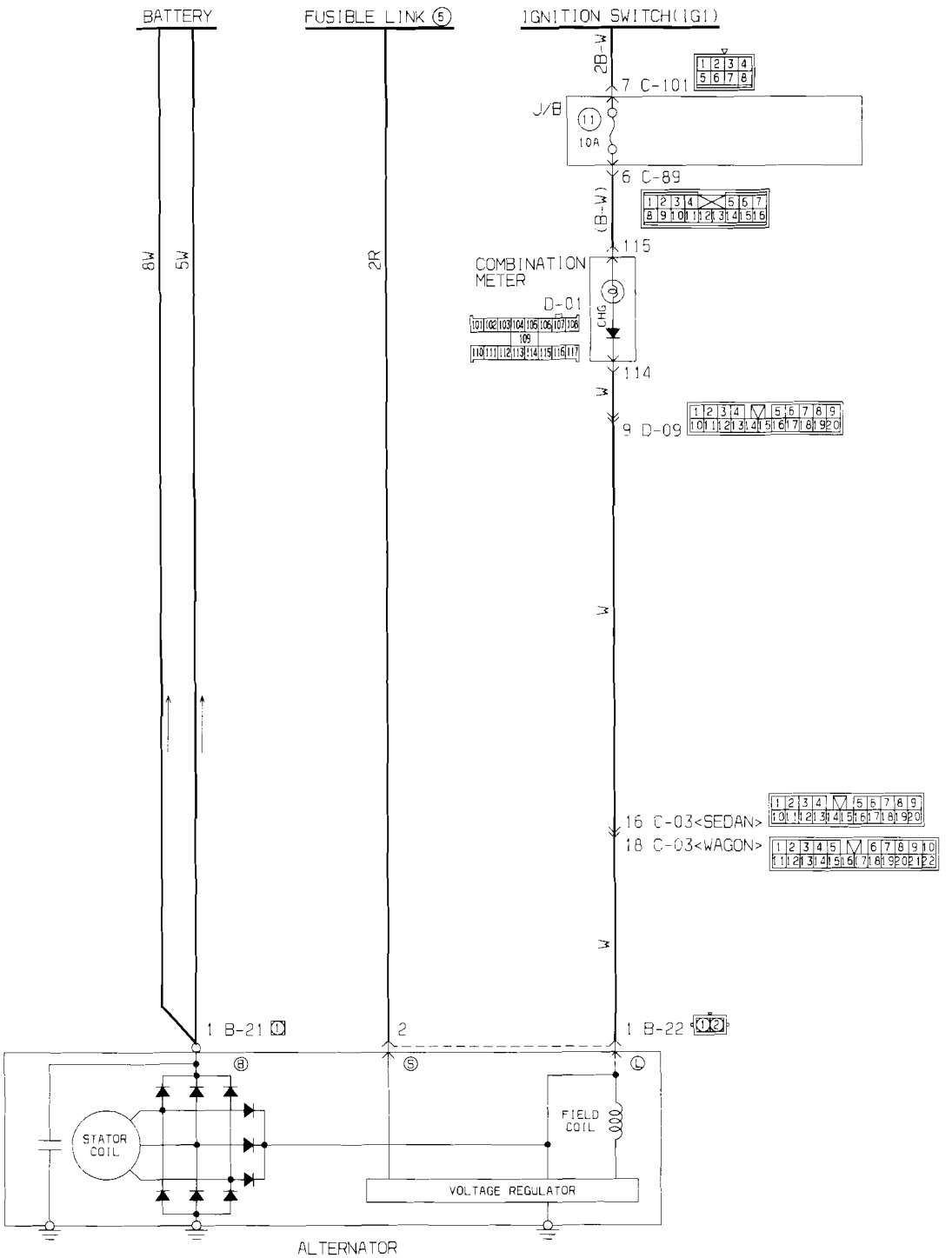


Wire colour code

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CIRCUIT DIAGRAM – Charging system circuit (4 cyl) <1991-1994 Models>



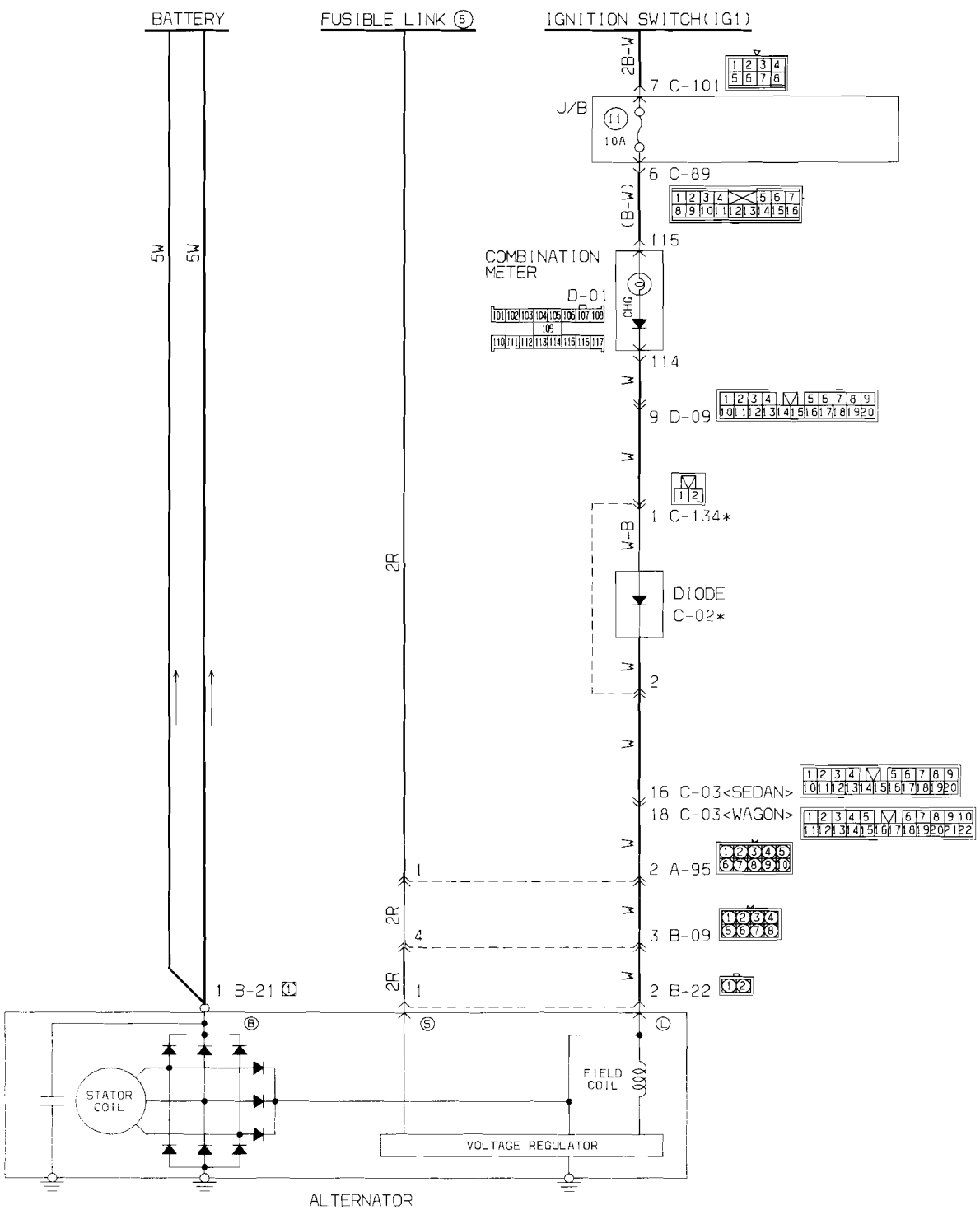
93-156

Wire colour code

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CIRCUIT DIAGRAM – Charging system circuit (6 cyl) <1992-1994 Models>

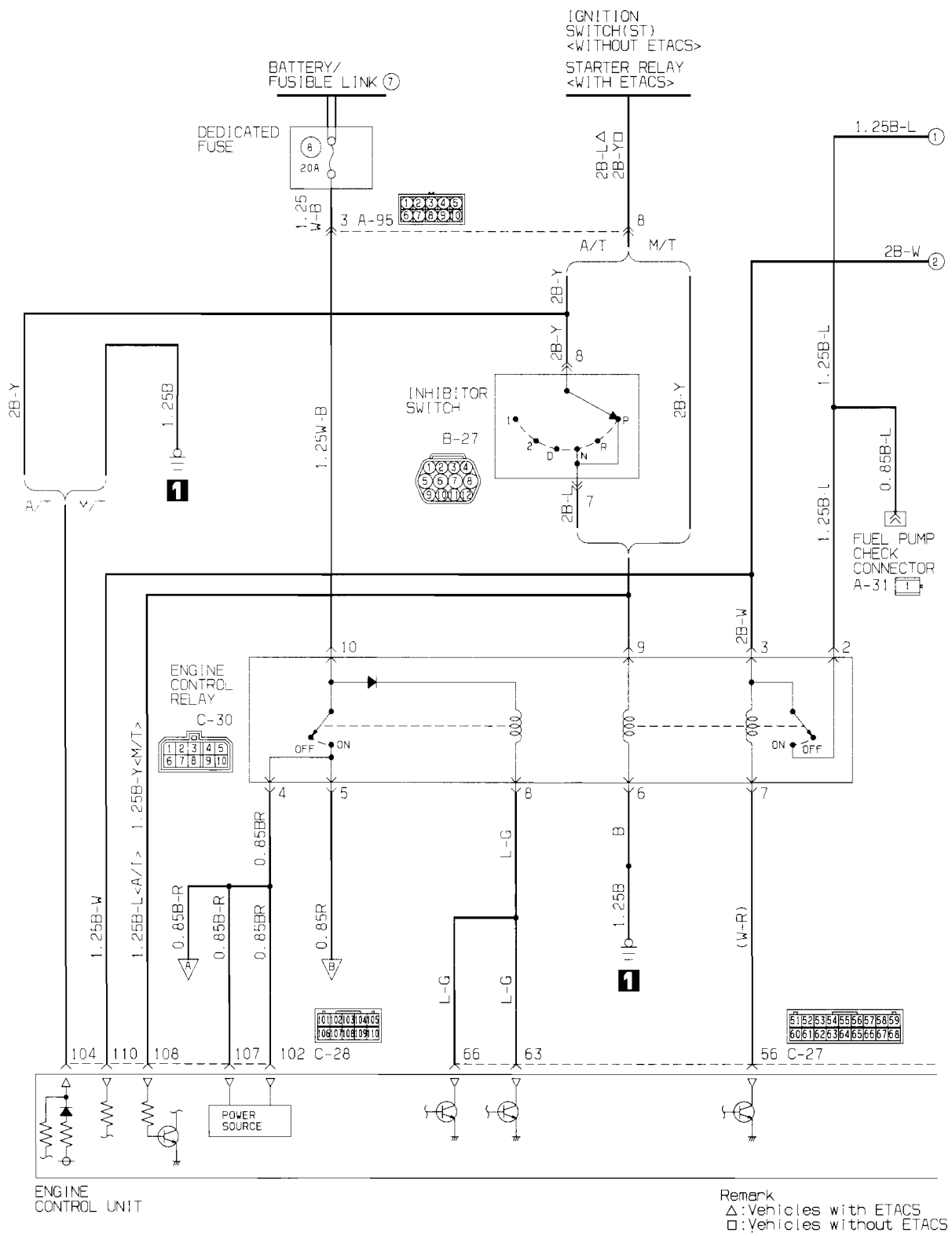


93-157

Wire colour code

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CIRCUIT DIAGRAM – MPI circuit 4 cyl <1991-1994 Models>

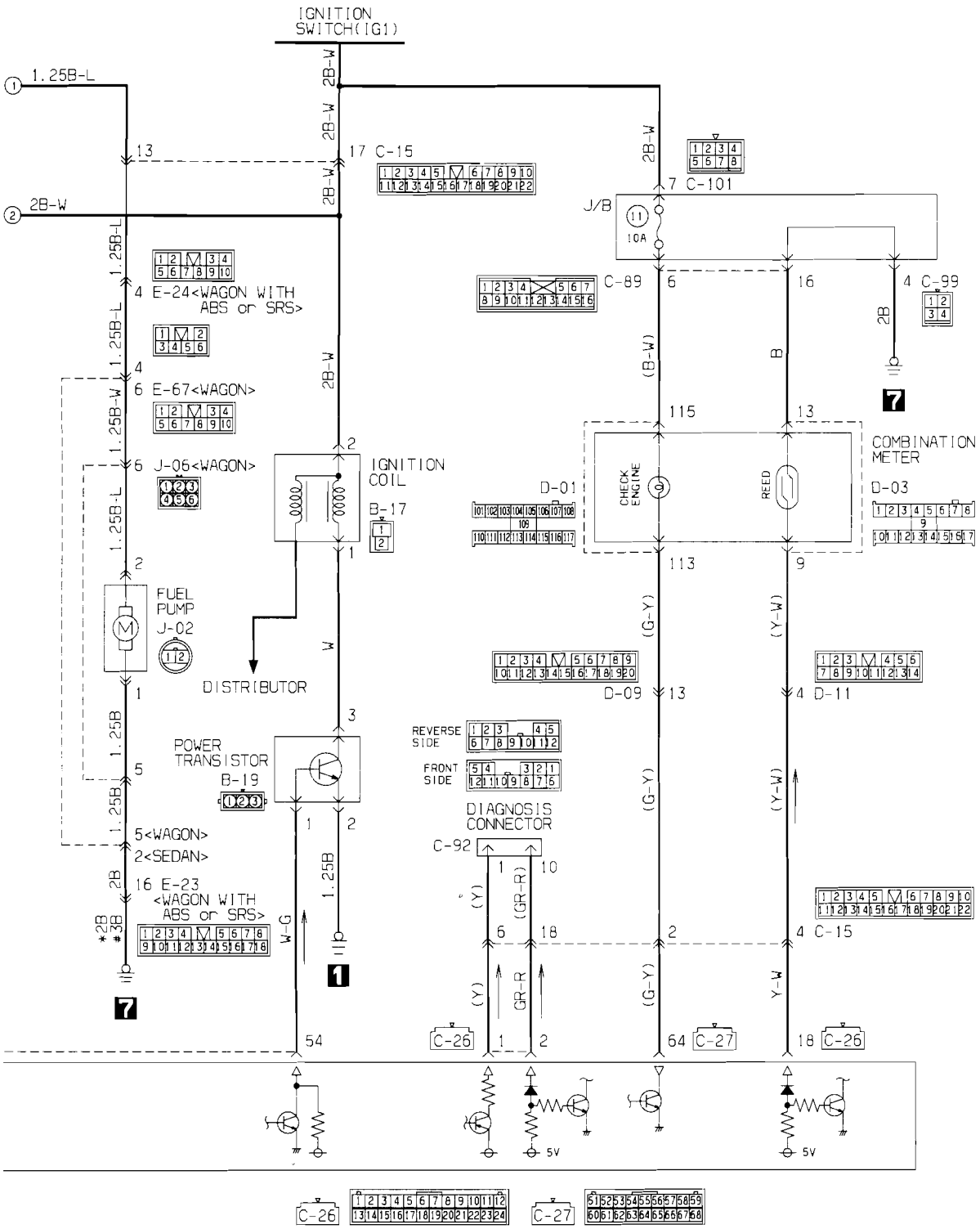


Wire colour code

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CIRCUIT DIAGRAM – MPI circuit 4 cyl <1991-1994 Models>

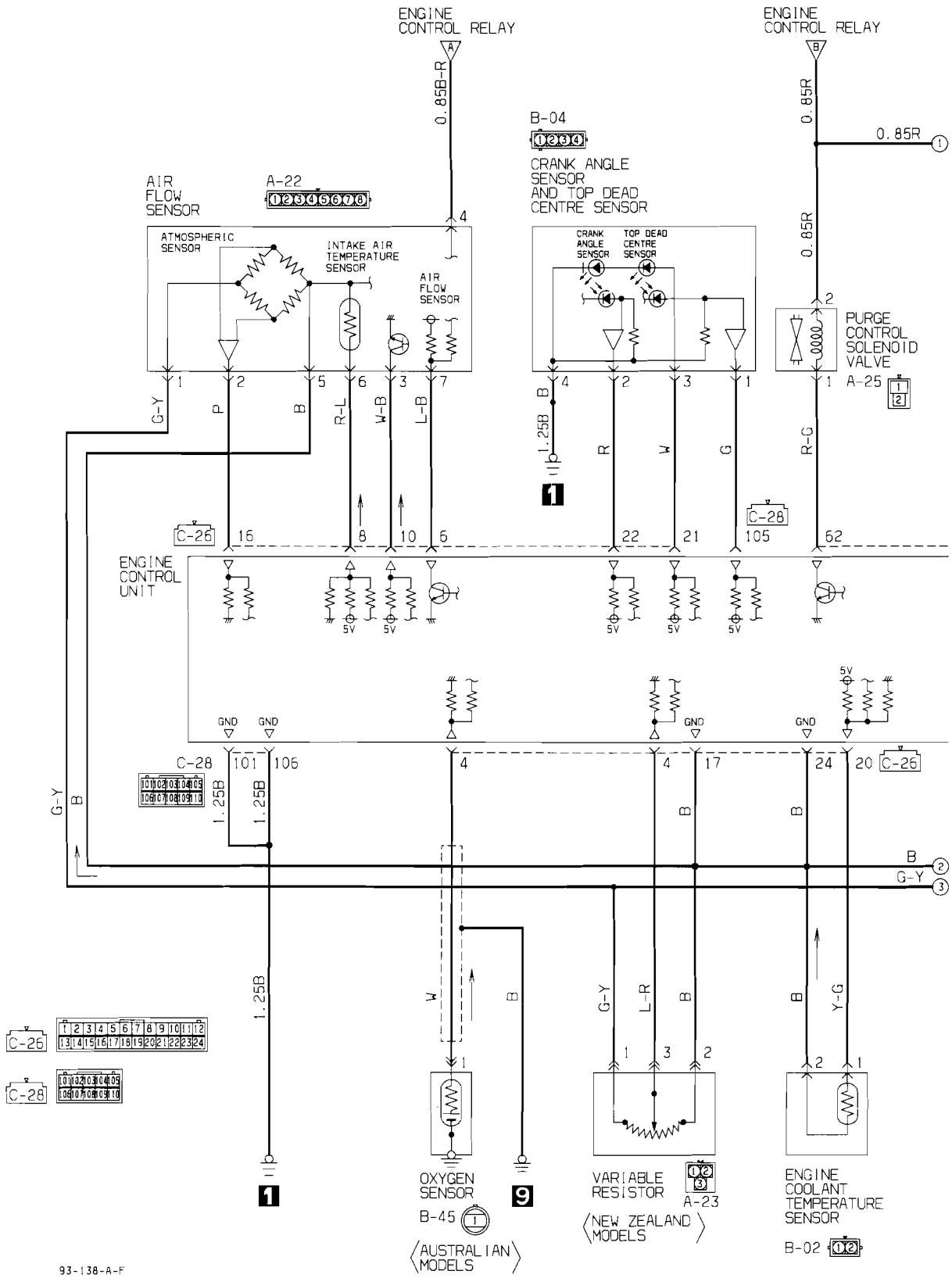


Wire colour code

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CIRCUIT DIAGRAM – MPI circuit 4 cyl <1991-1994 Models> Cont;

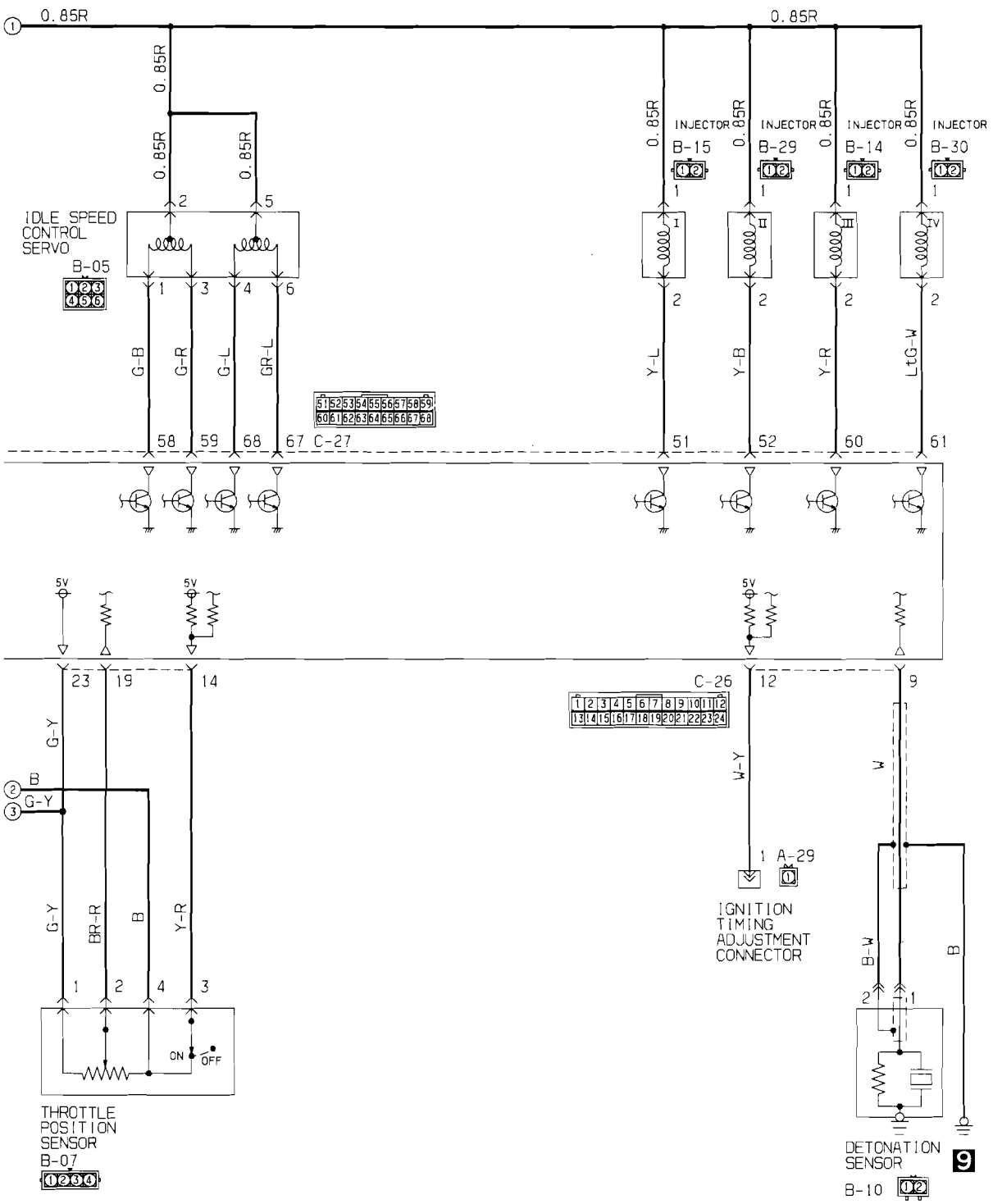


Wire colour code

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CIRCUIT DIAGRAM – MPI circuit 4 cyl <1991-1994 Models>

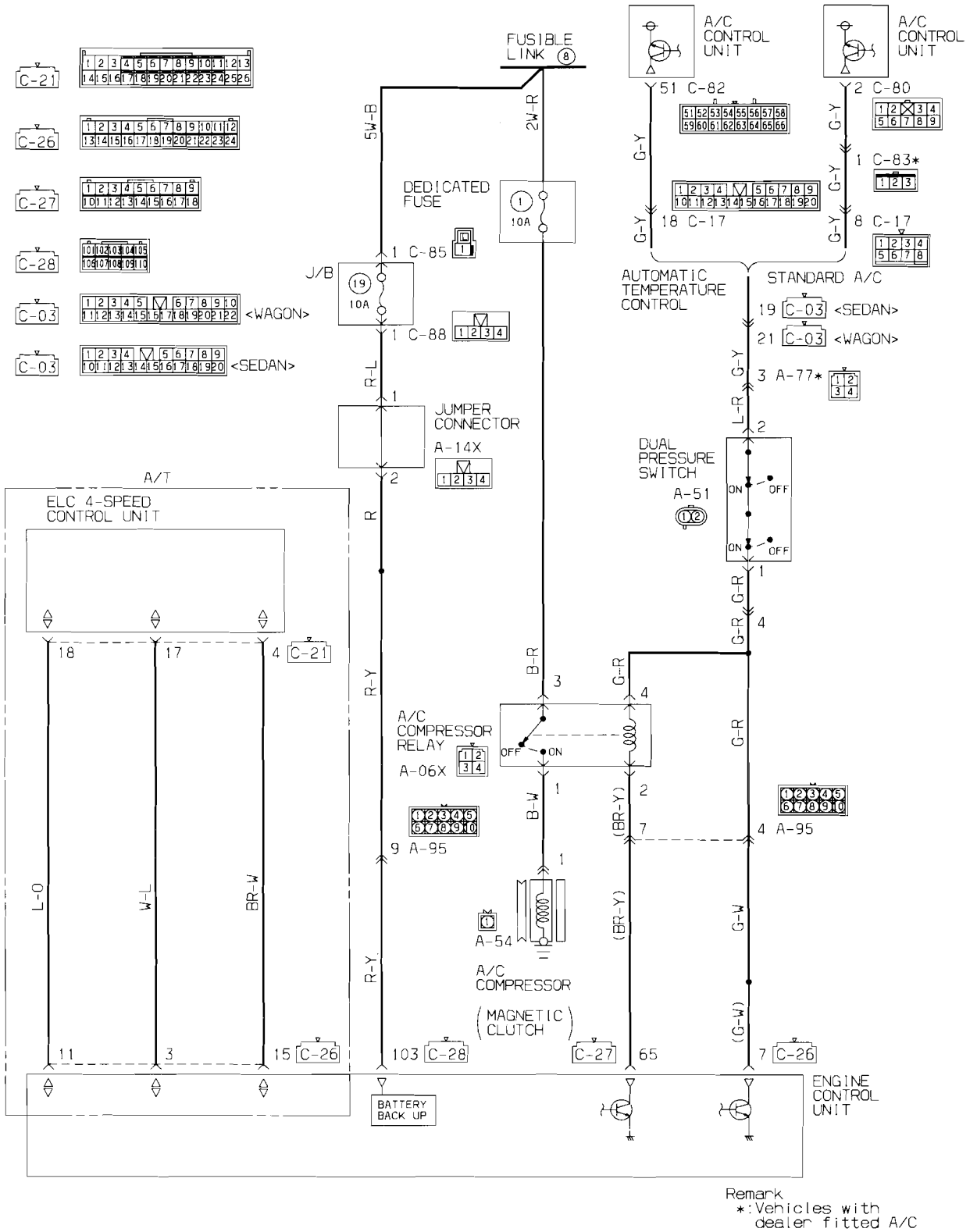


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CIRCUIT DIAGRAM – MPI circuit 4 cyl <1991-1994 Models> Cont;

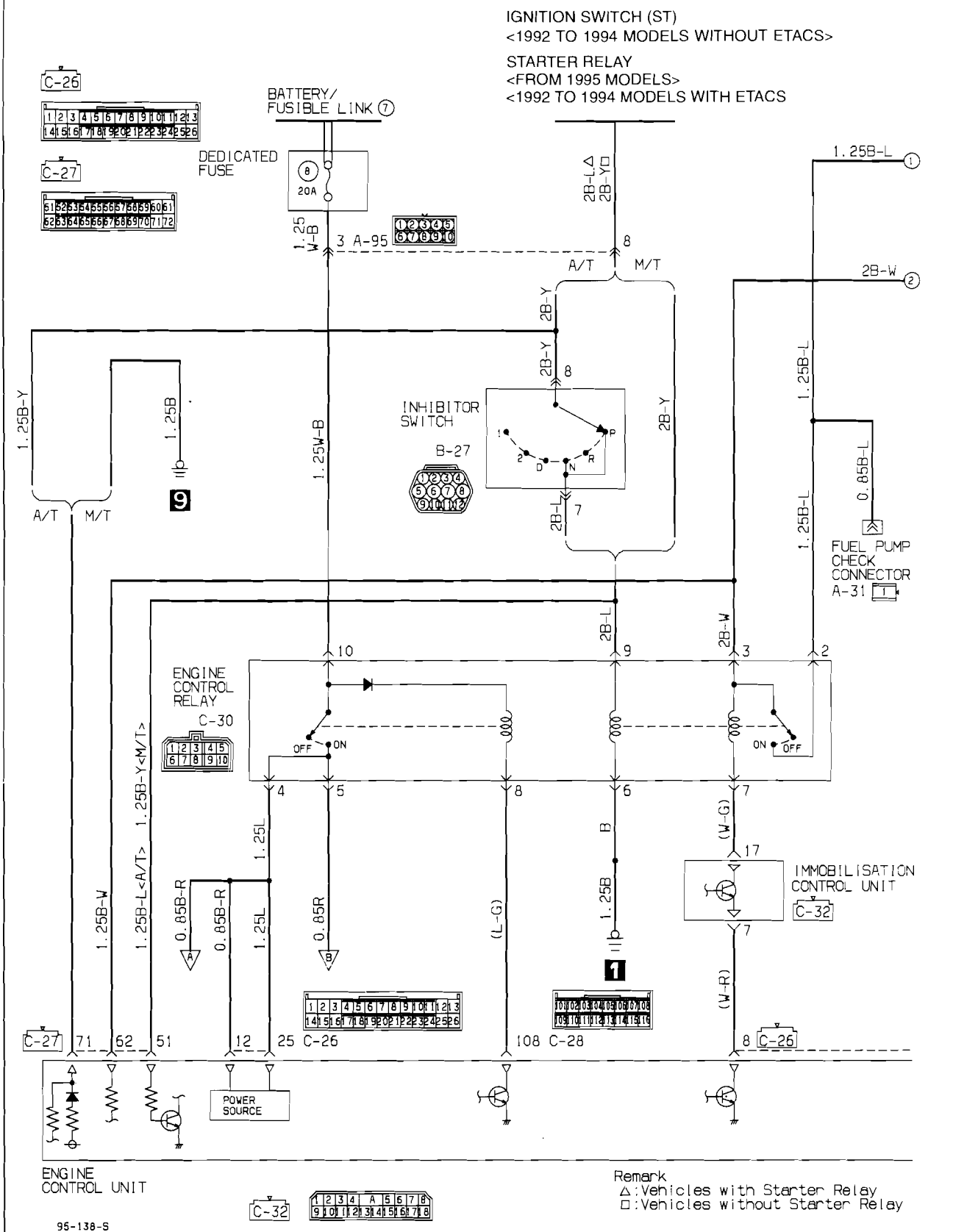


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
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CIRCUIT DIAGRAM — MPI circuit 6 cyl <1992-1995 Models>

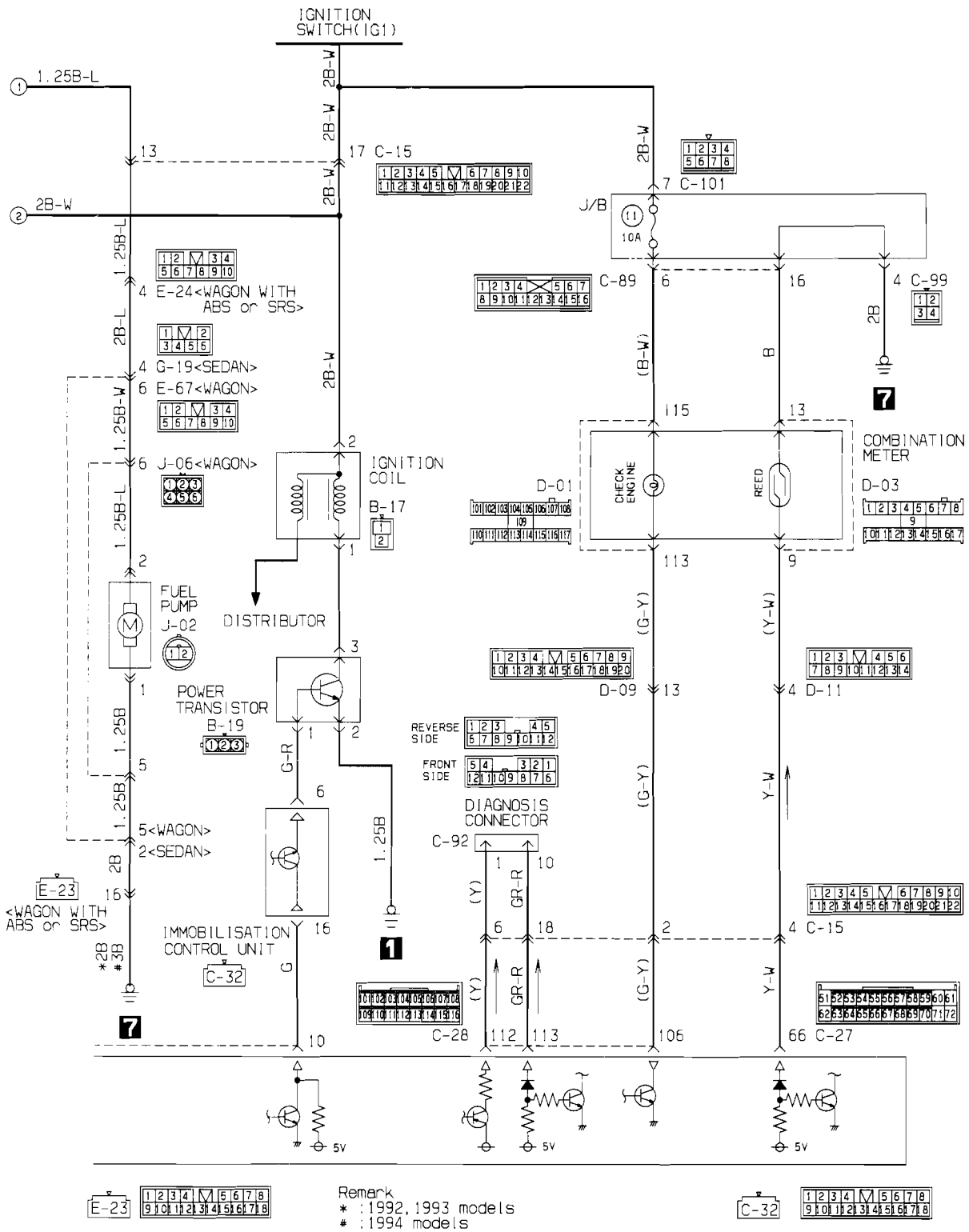


Wire colour code

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CIRCUIT DIAGRAM — MPI circuit 6 cyl <1992-1995 Models>

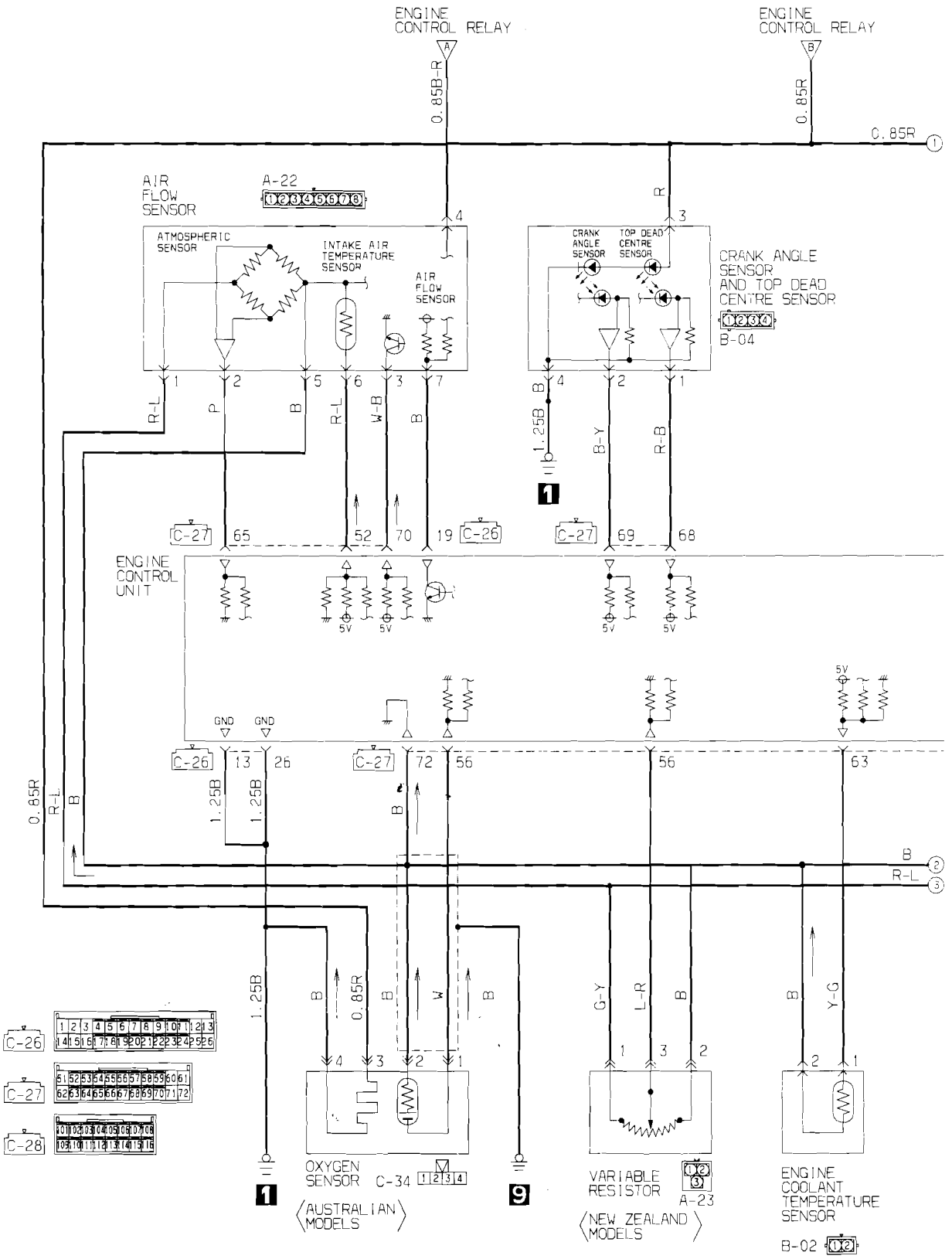


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
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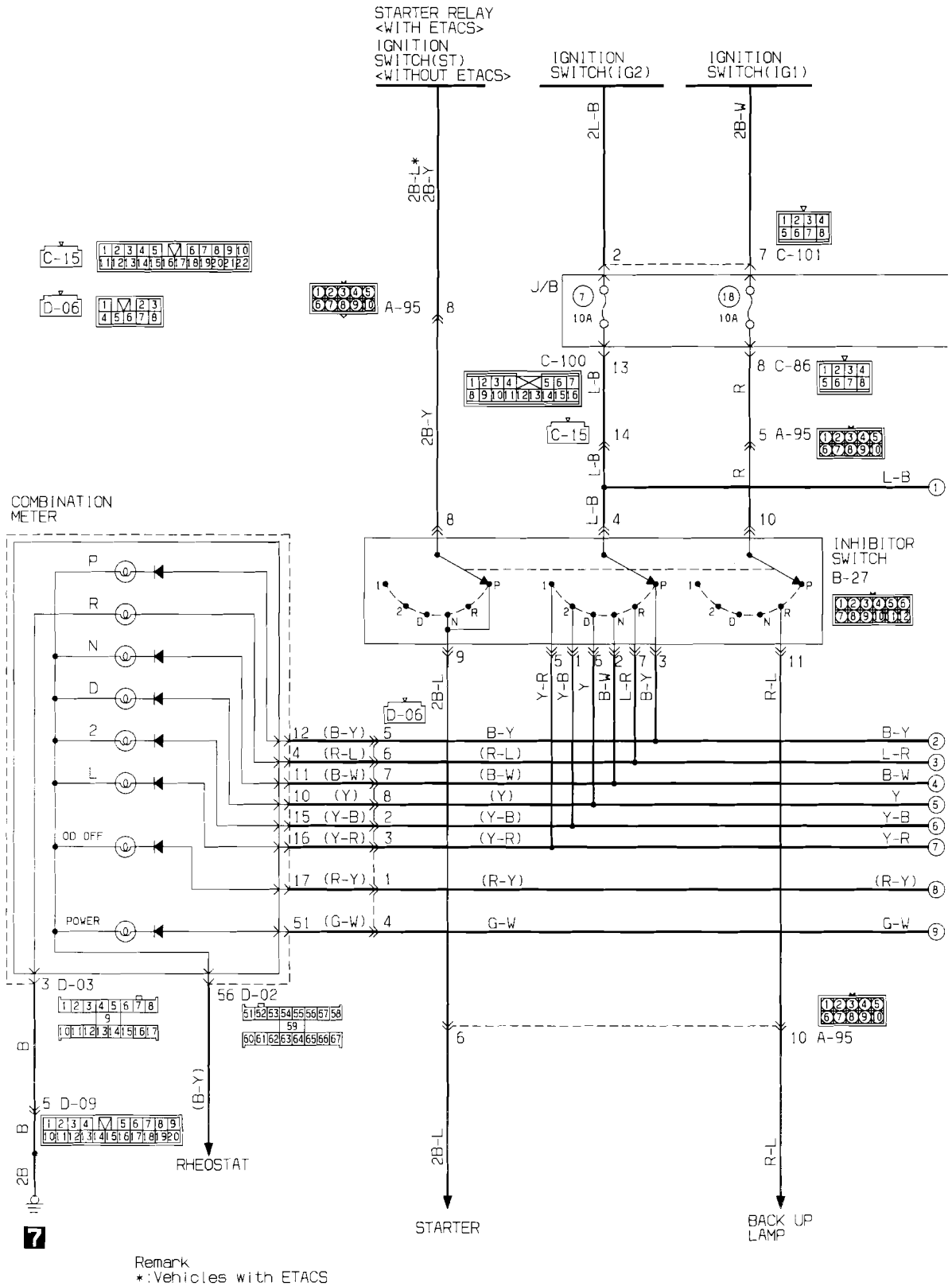
CIRCUIT DIAGRAM – MPI circuit 6 cyl <1992-1994 Models> Continued



Wire colour code

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CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (91-92 4 cyl Models)

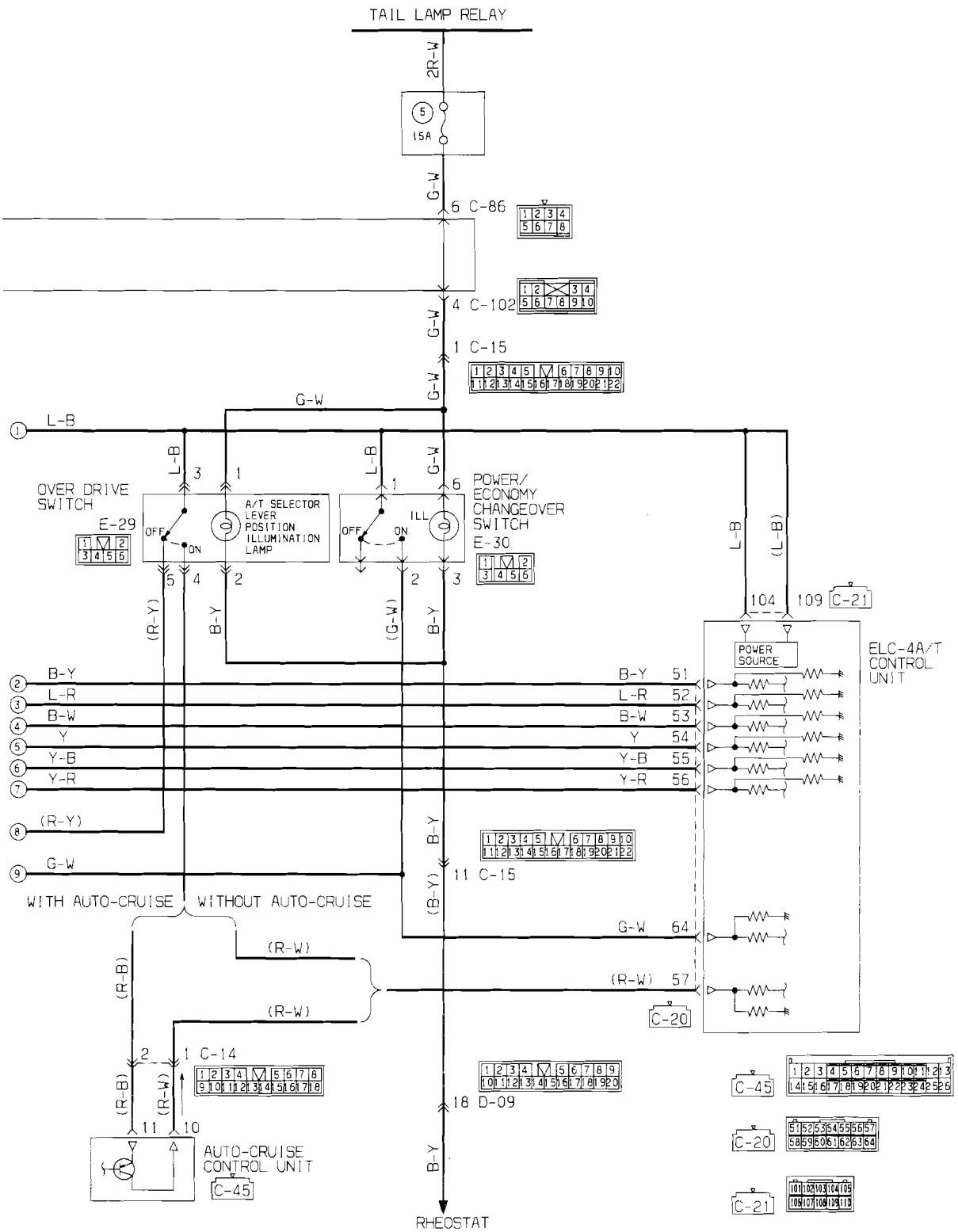


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (91-92 4 cyl Models)

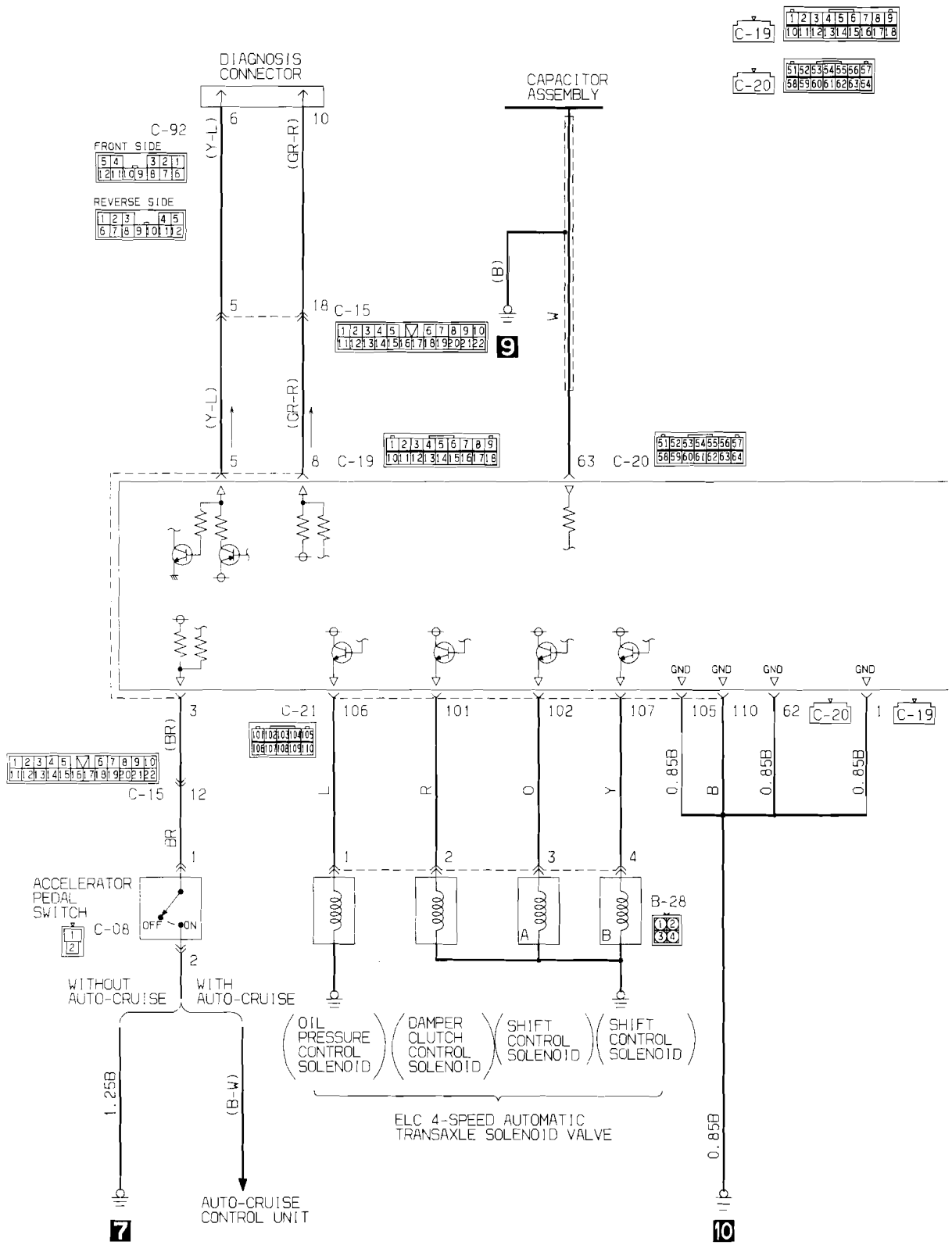


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (91-92 4 cyl Models) Cont;

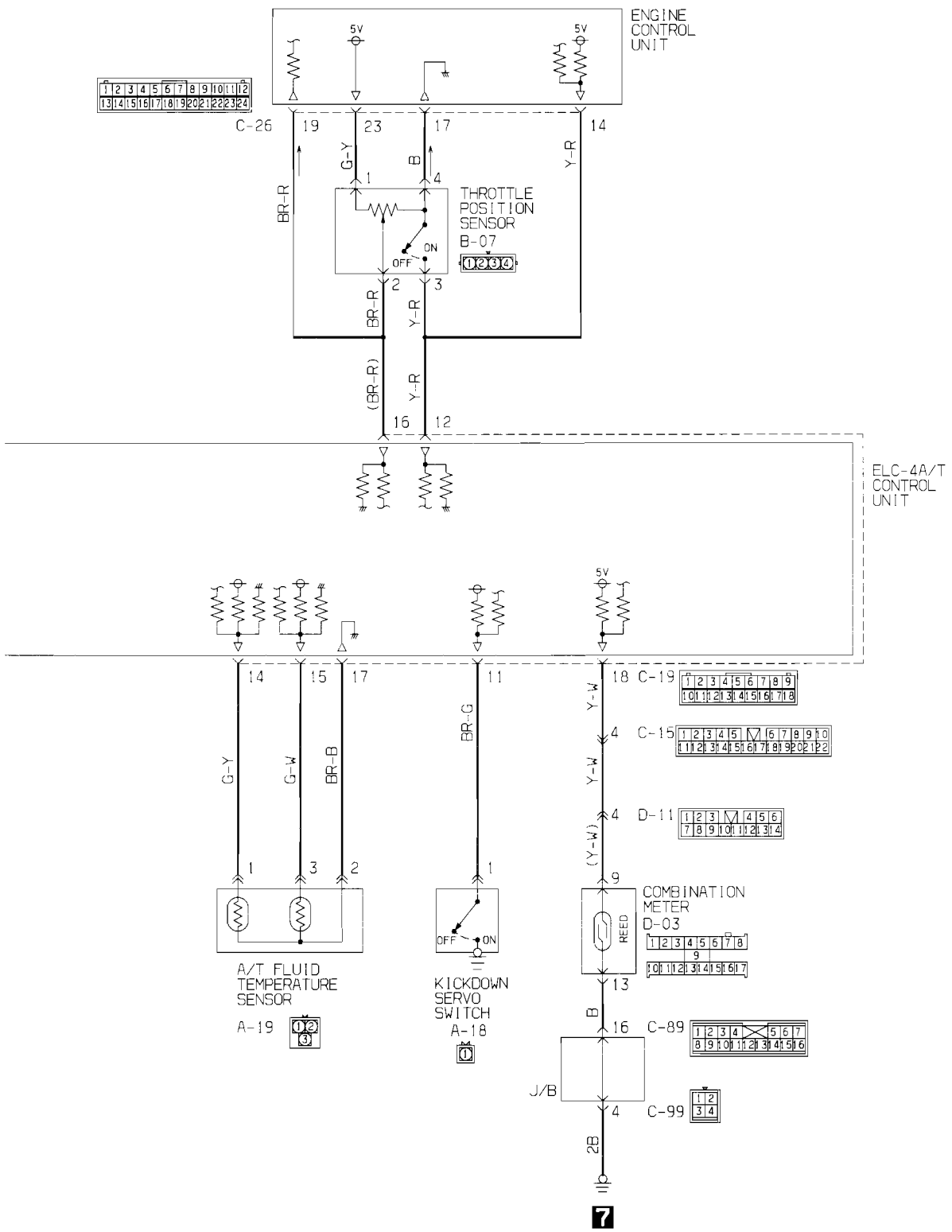


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
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CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (91-92 4 cyl Models)

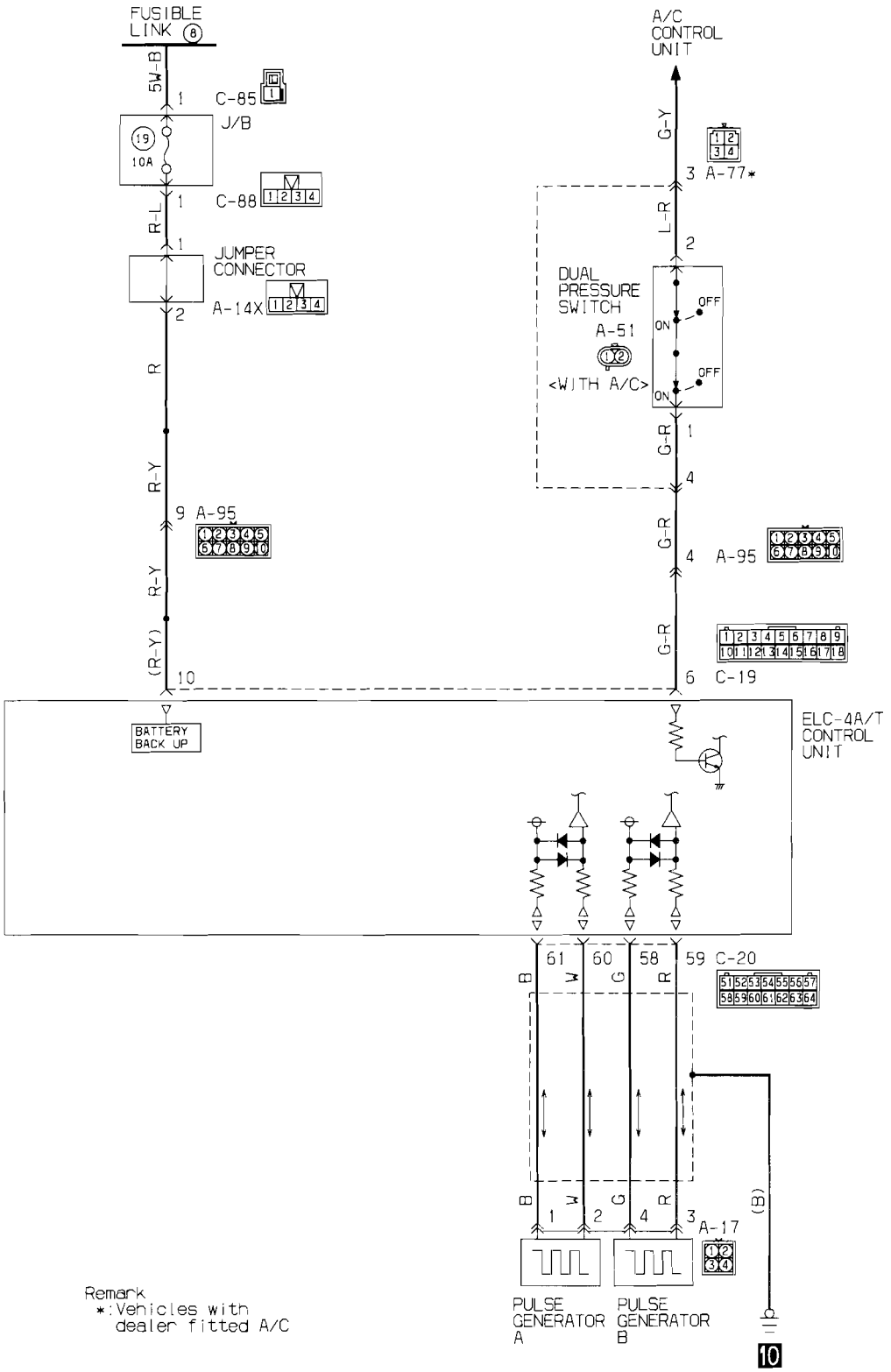


Wire colour code

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BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (91-92 4 cyl Models) Cont;



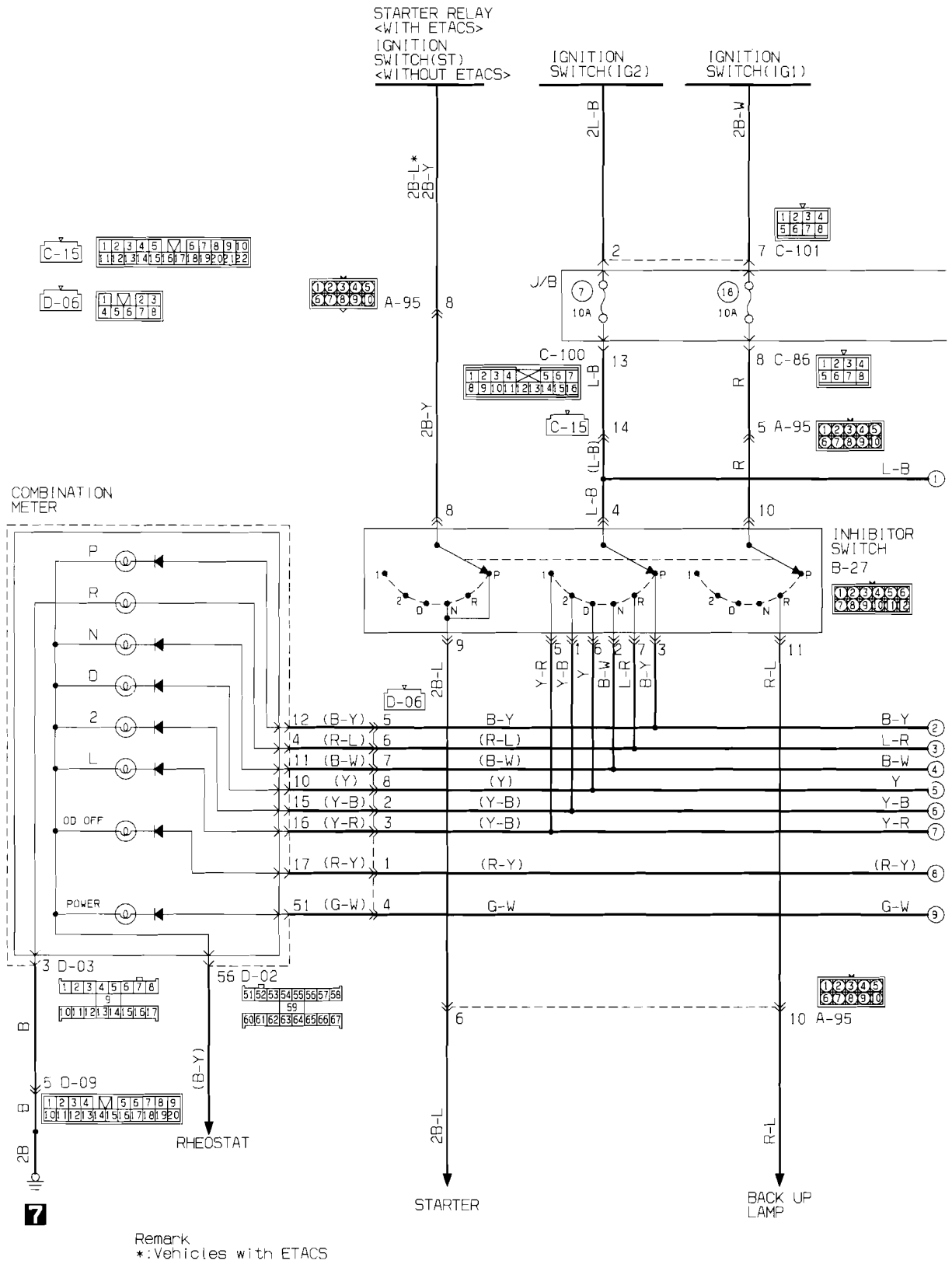
93-164-B-F

Wire colour code

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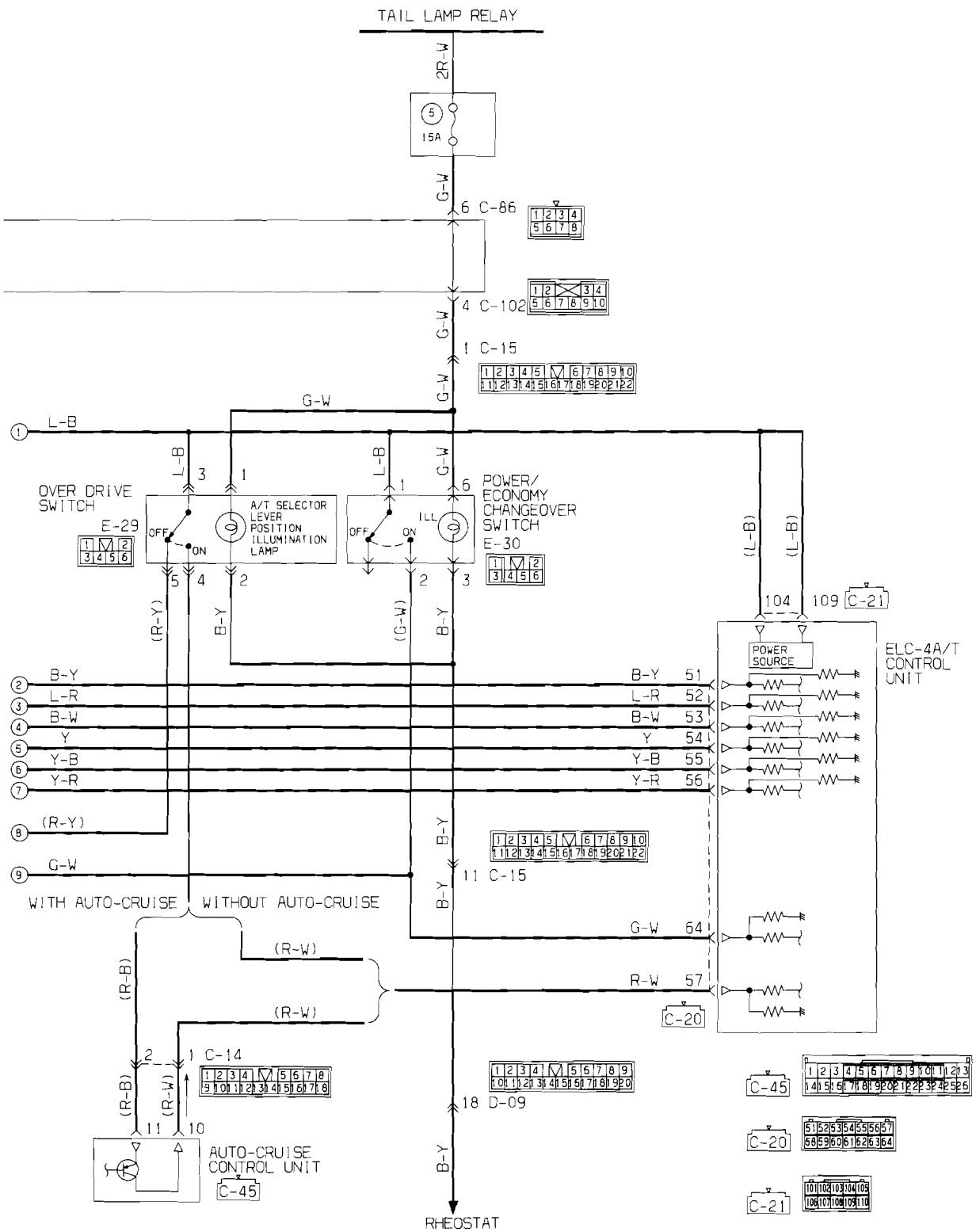
CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit ('92 6 cyl Models)



Wire colour code

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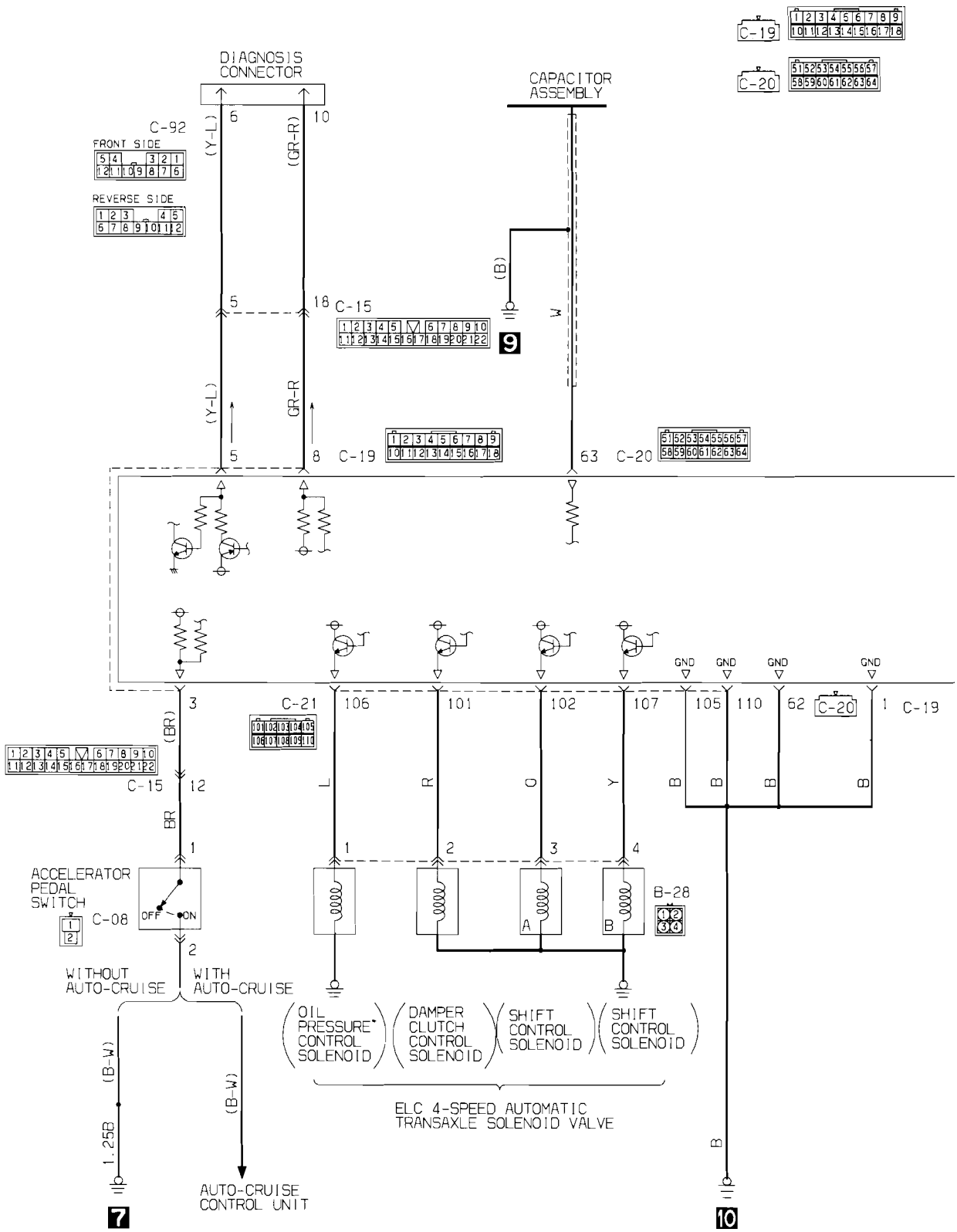
CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit ('92 6 cyl Models)



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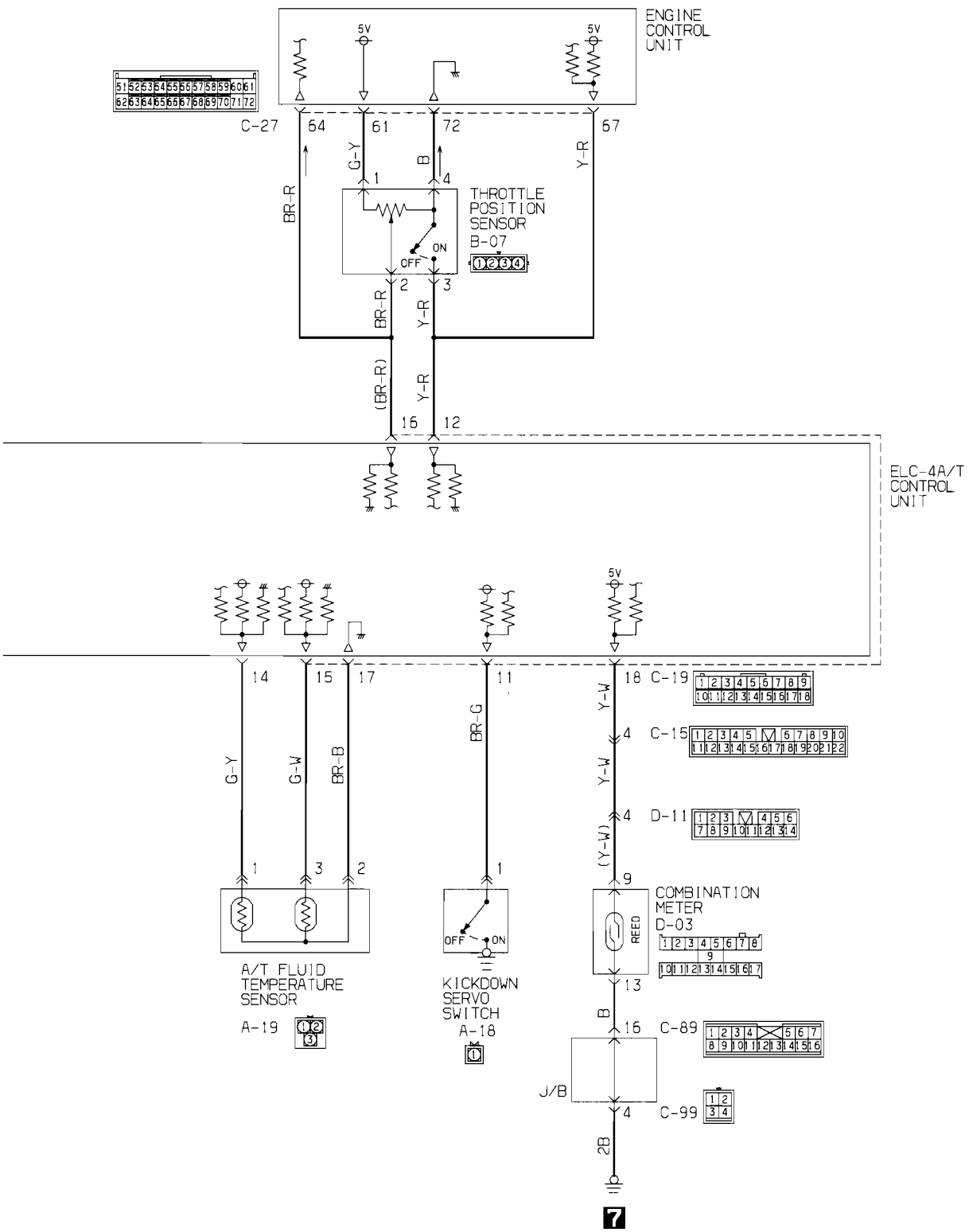
CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit ('92 6 cyl Models) Continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

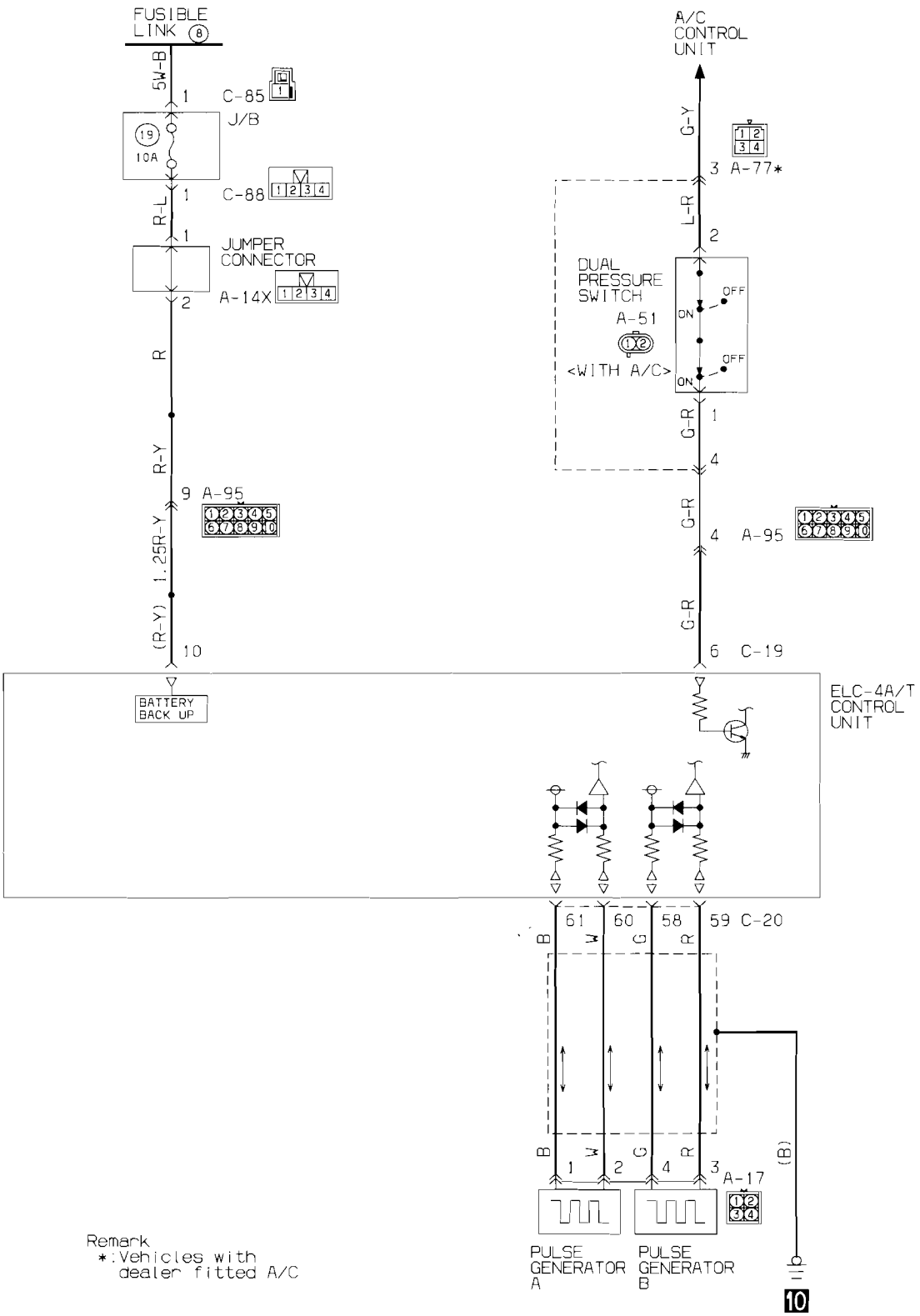
CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit ('92 6 cyl Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit ('92 6 cyl Models) Continued



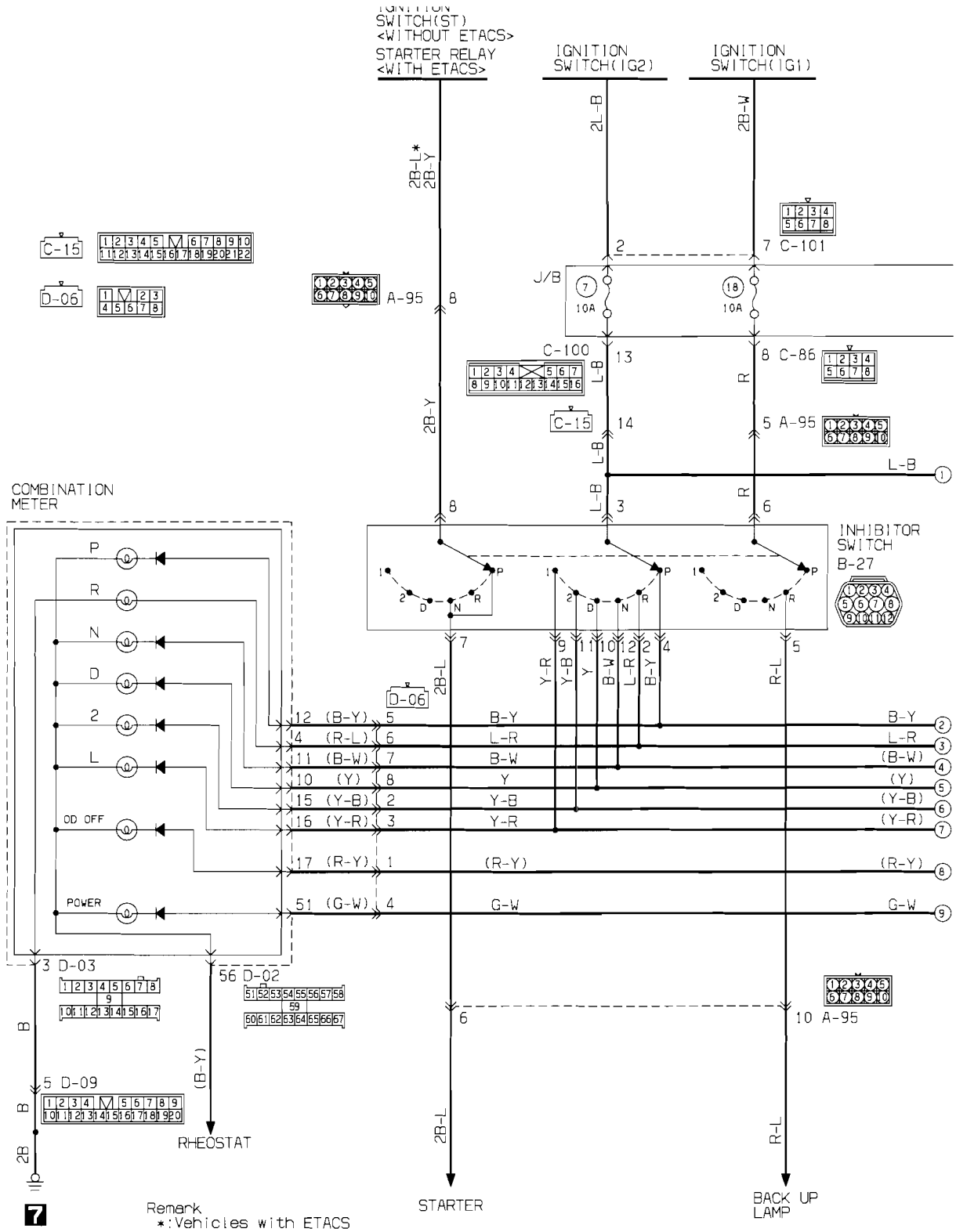
Remark
*: Vehicles with dealer fitted A/C

93-164-B-5

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (93-94 4 cyl MPI Models)

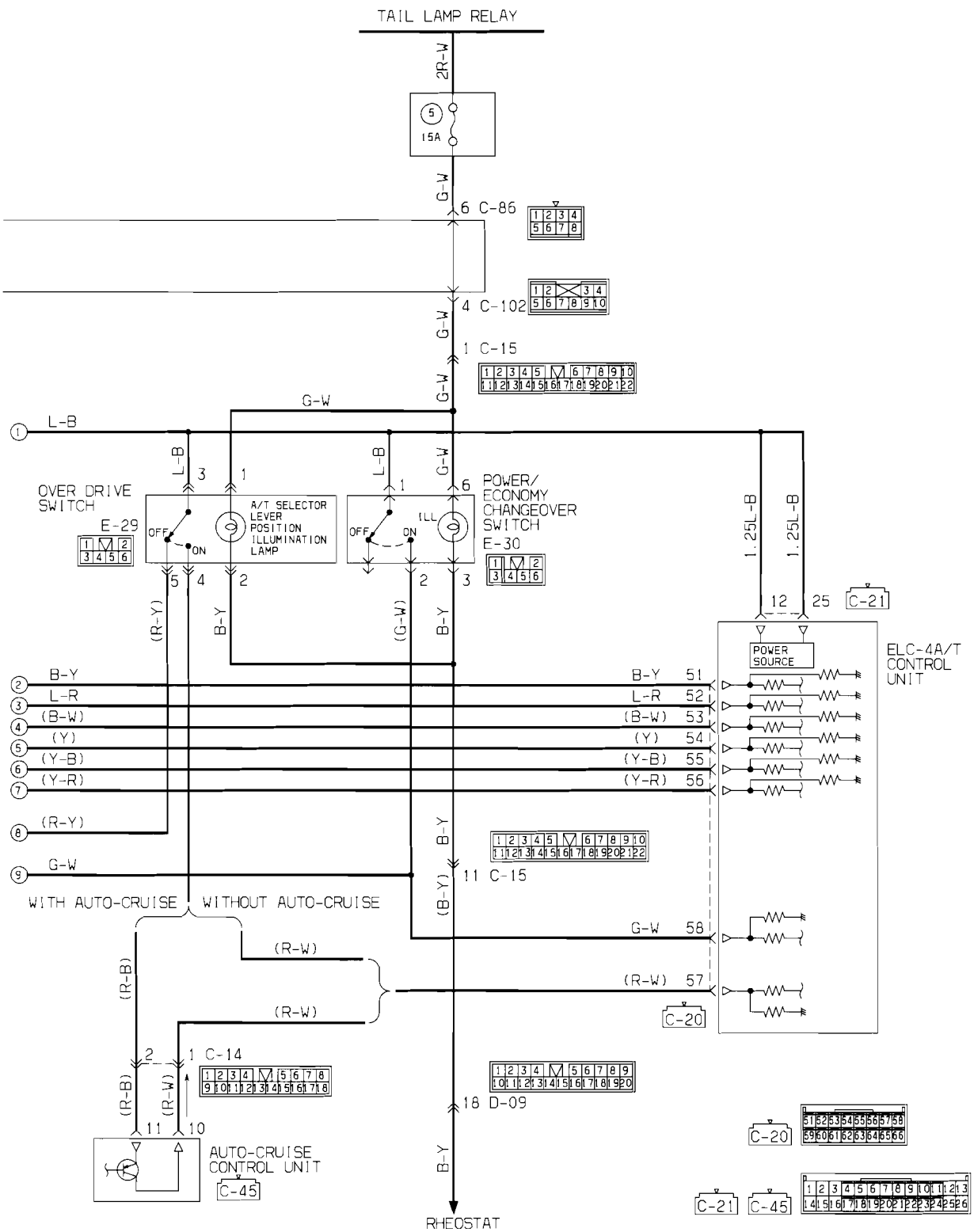


93-139-F

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

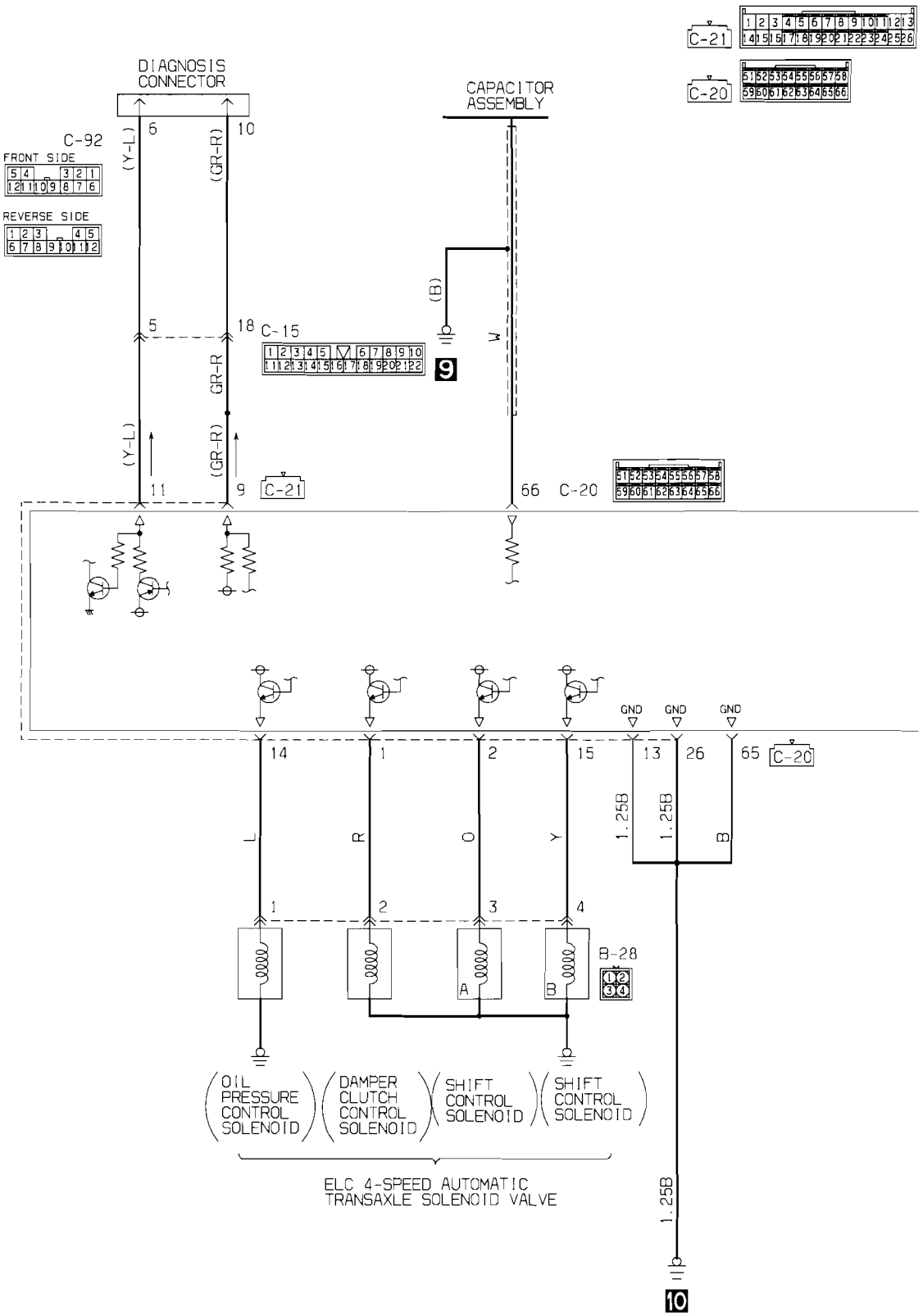
CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (93-94 4 cyl MPI Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (93-94 4 cyl MPI Models) Cont;

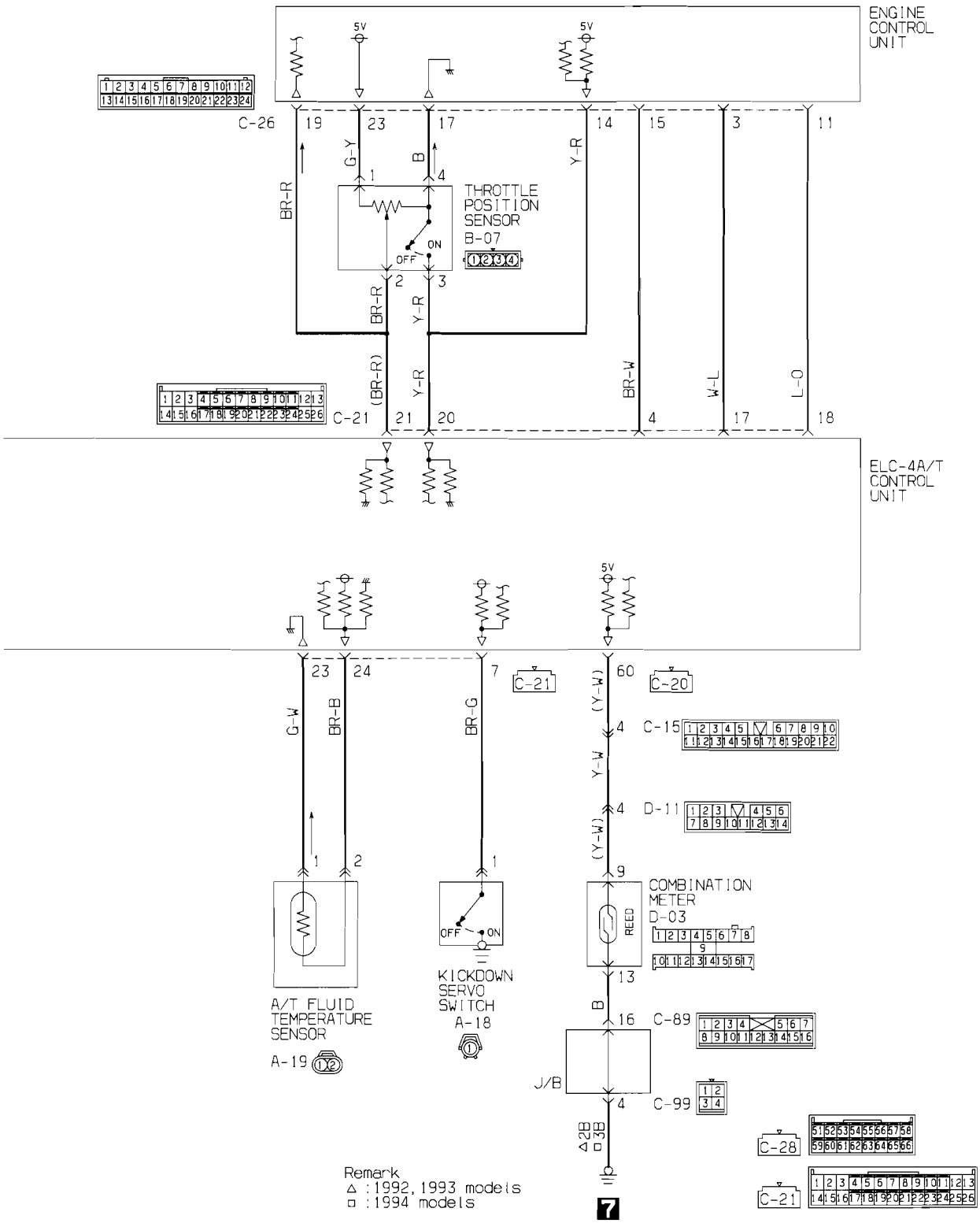


93-139-A-F

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

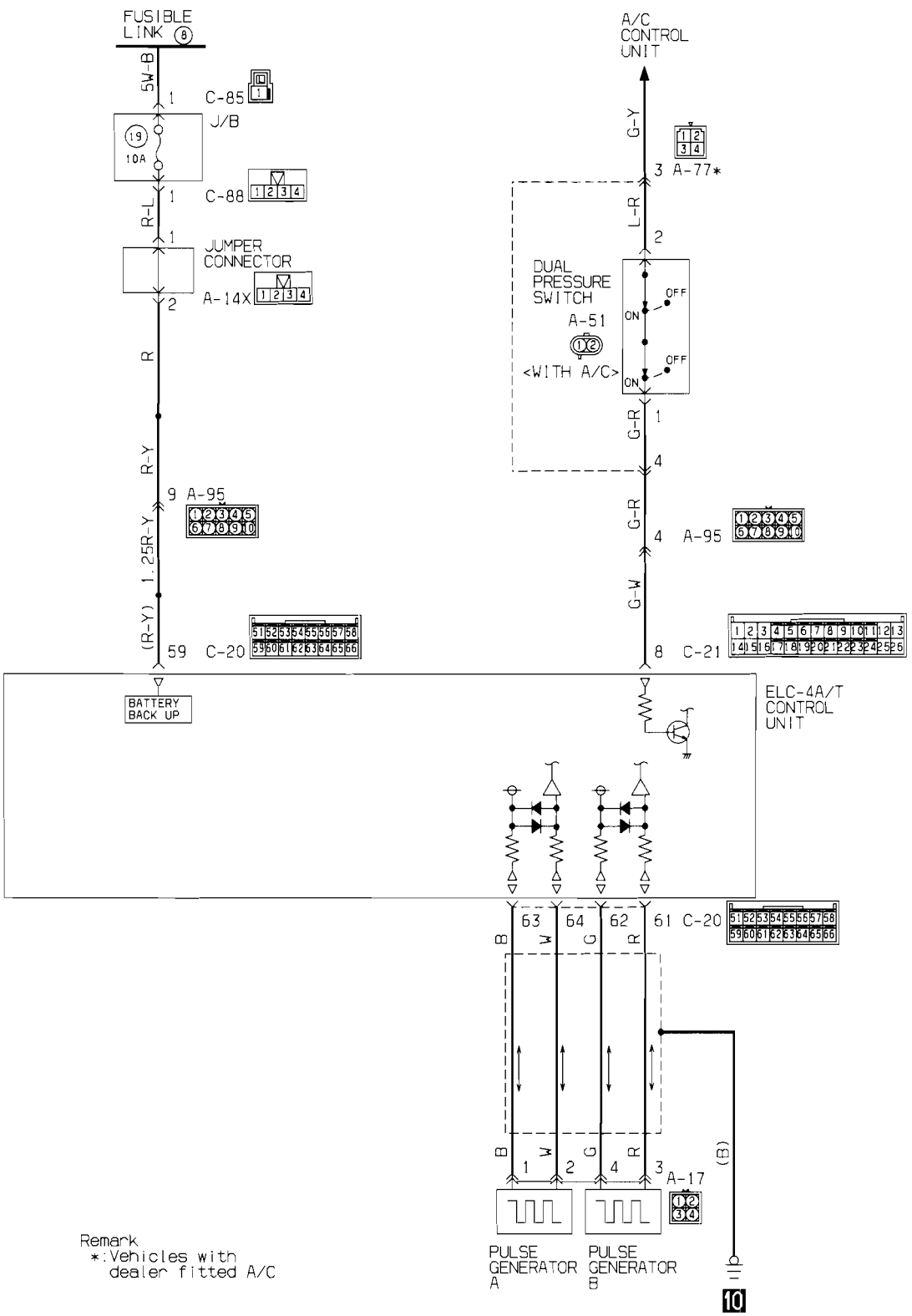
CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (93-94 4 cyl MPI Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

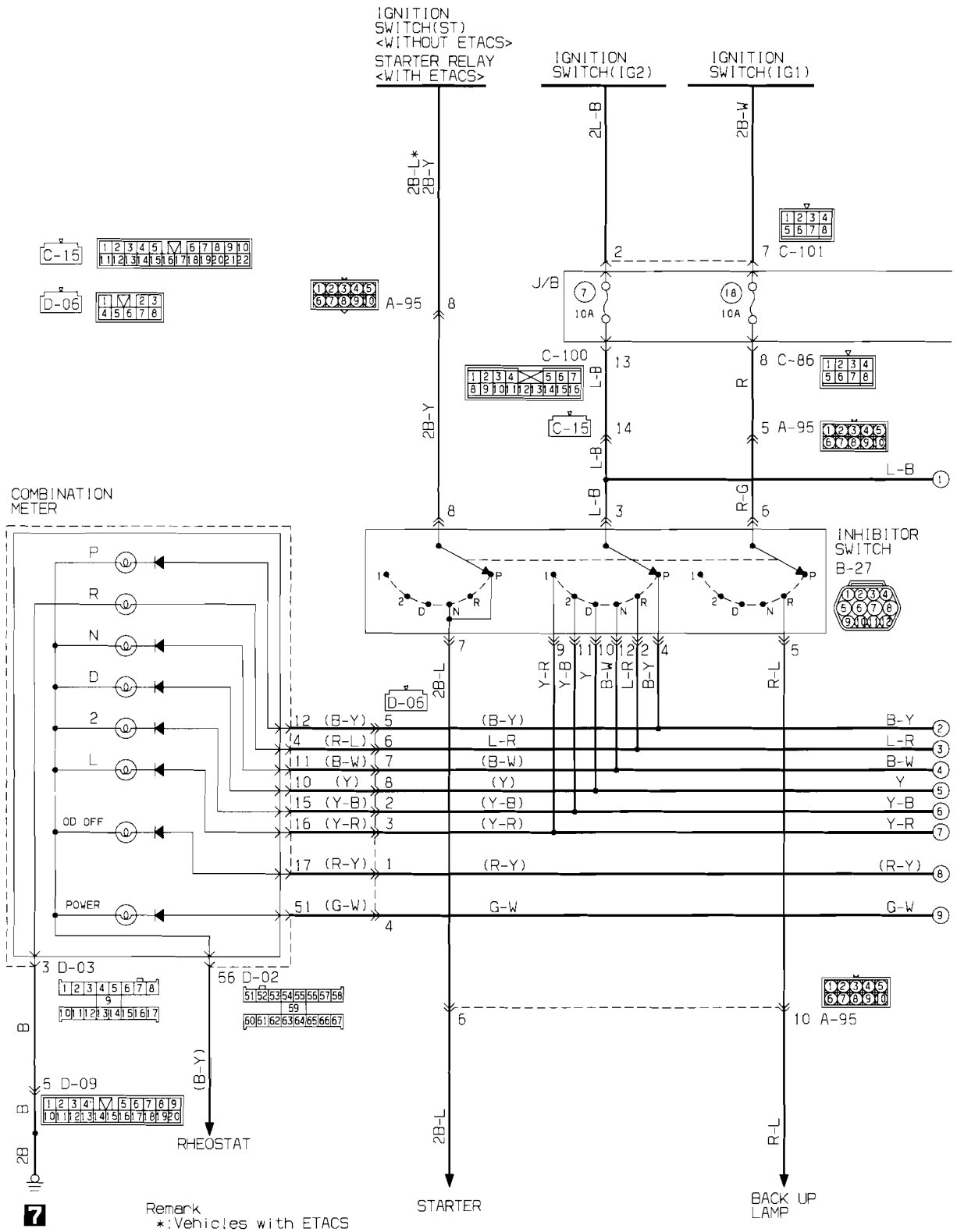
CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (93-94 4 cyl MPI Models) Continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (93-94 6 cyl Models) Cont;

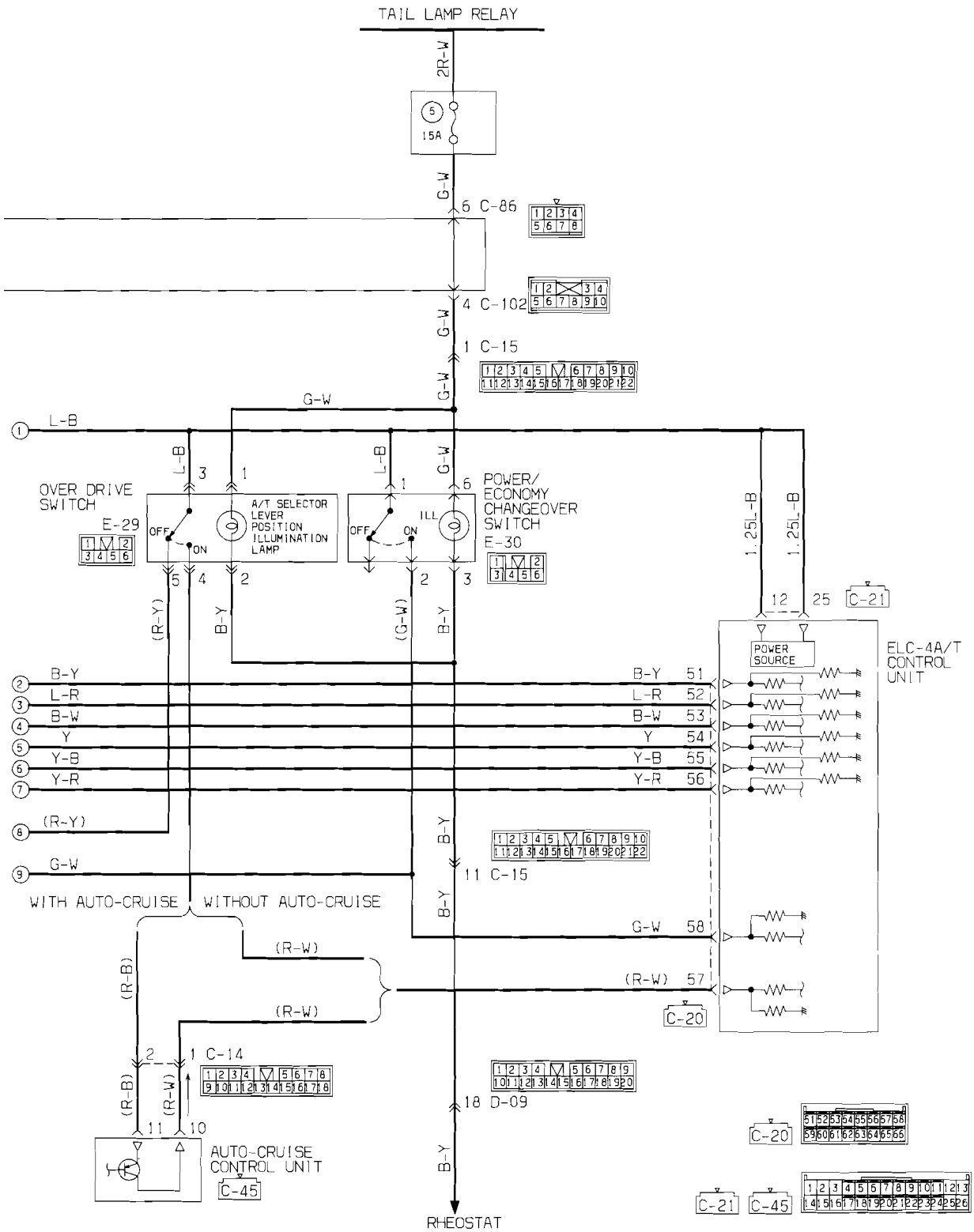


93-139-S

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

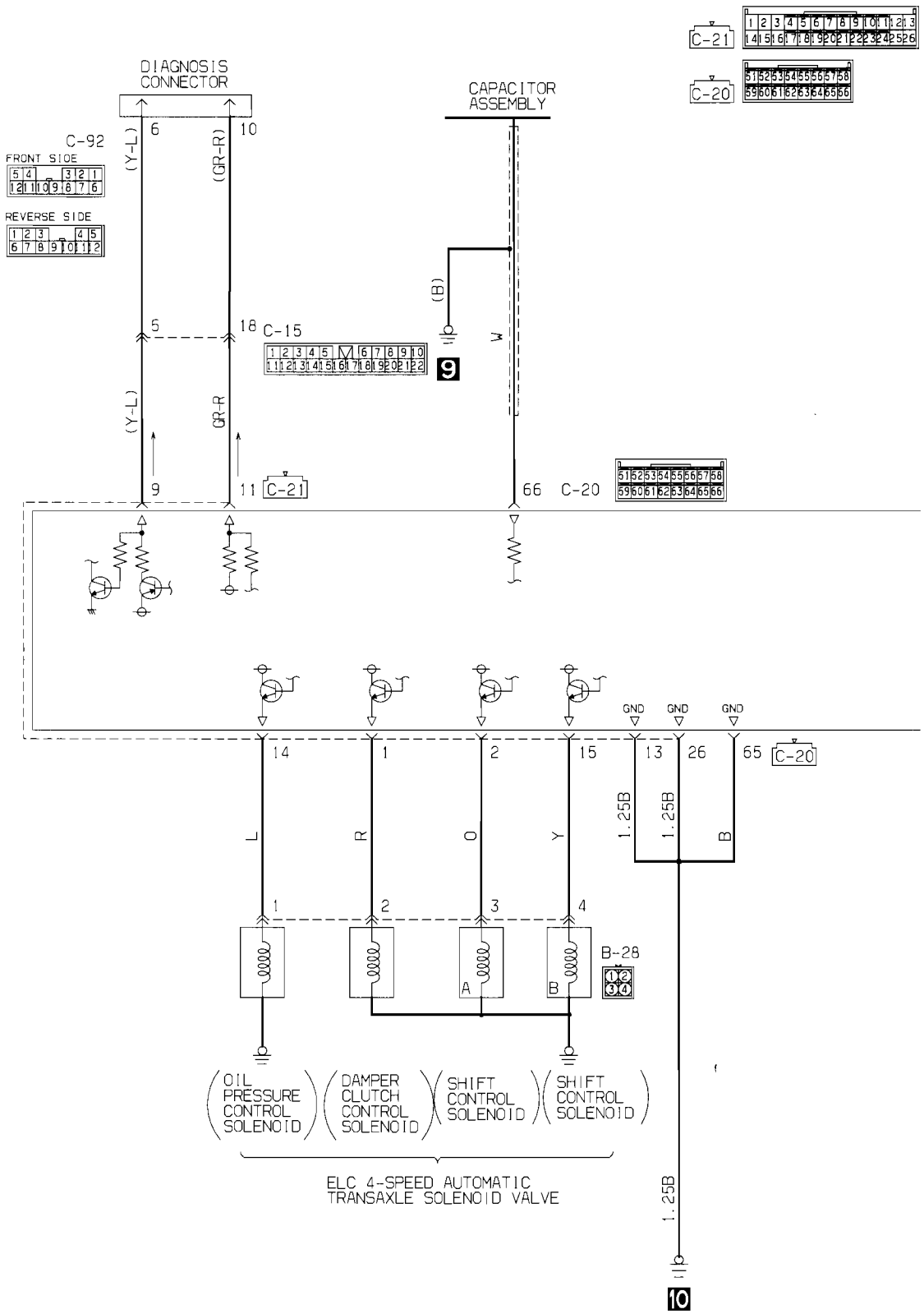
CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (93-94 6 cyl Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (93-94 6 cyl Models) Cont;

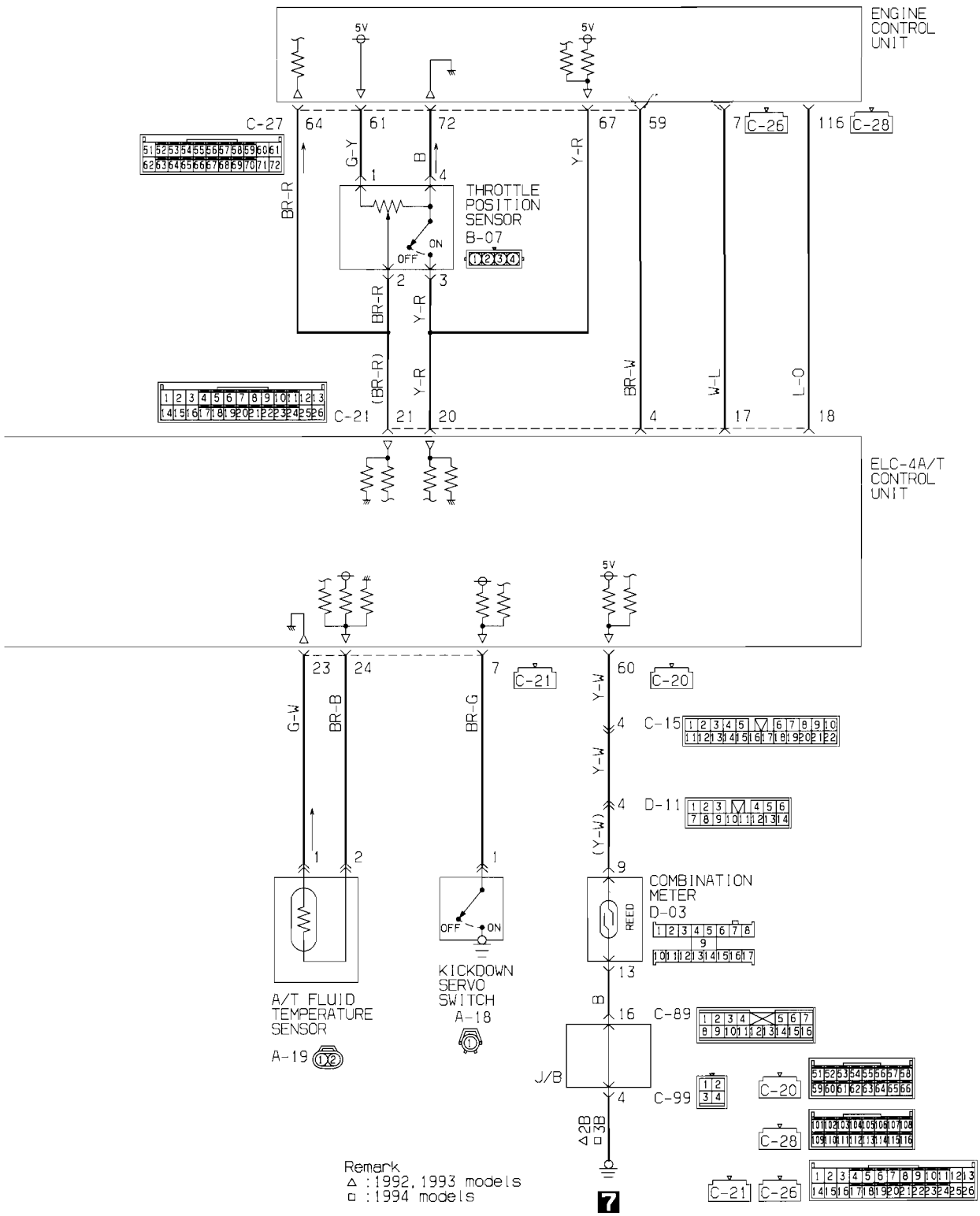


93-139-A-S

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

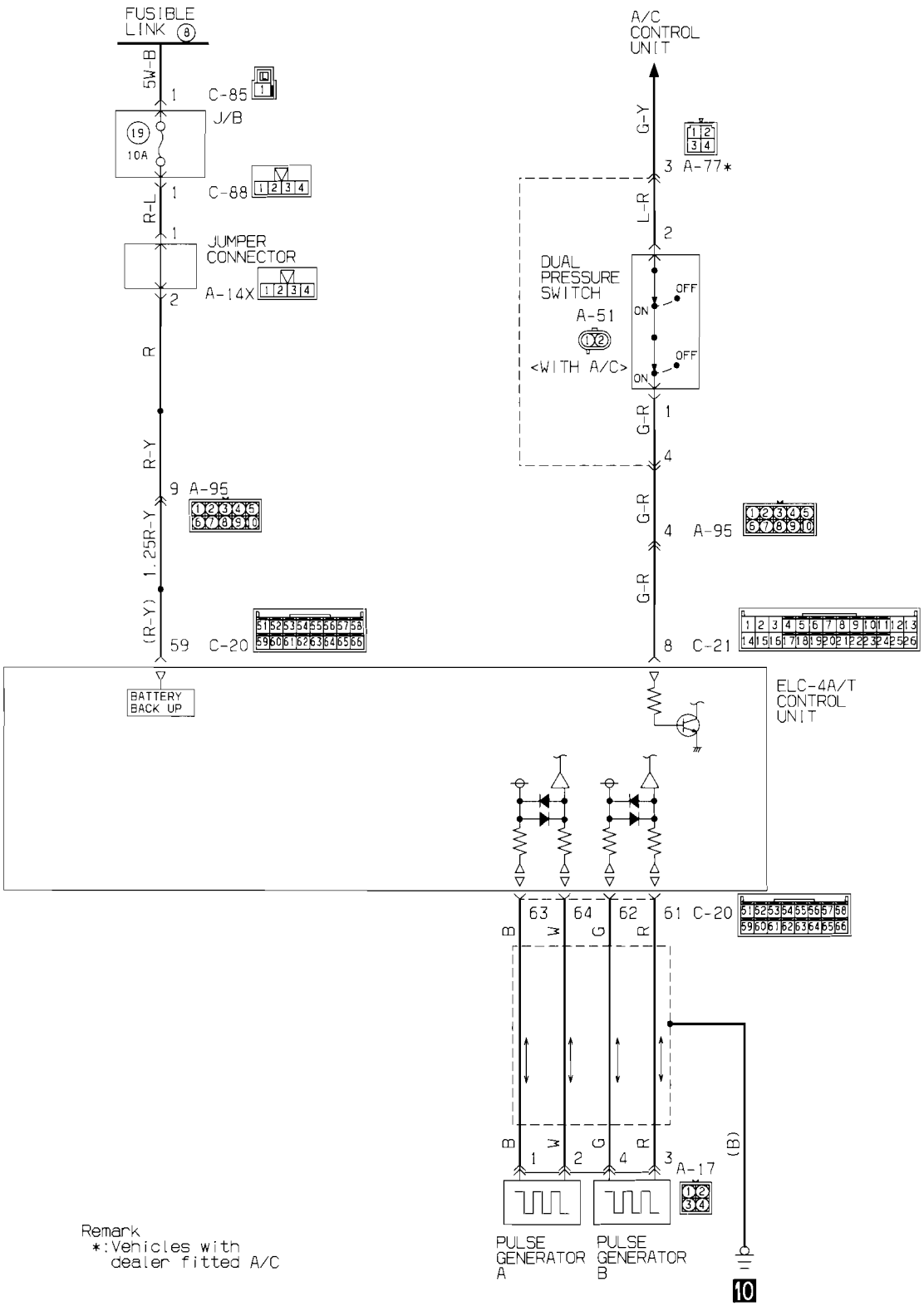
CIRCUIT DIAGRAM – ELC 4-speed auto trans circuit (93-94 6 cyl Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (93-94 6 cyl Models) Cont;

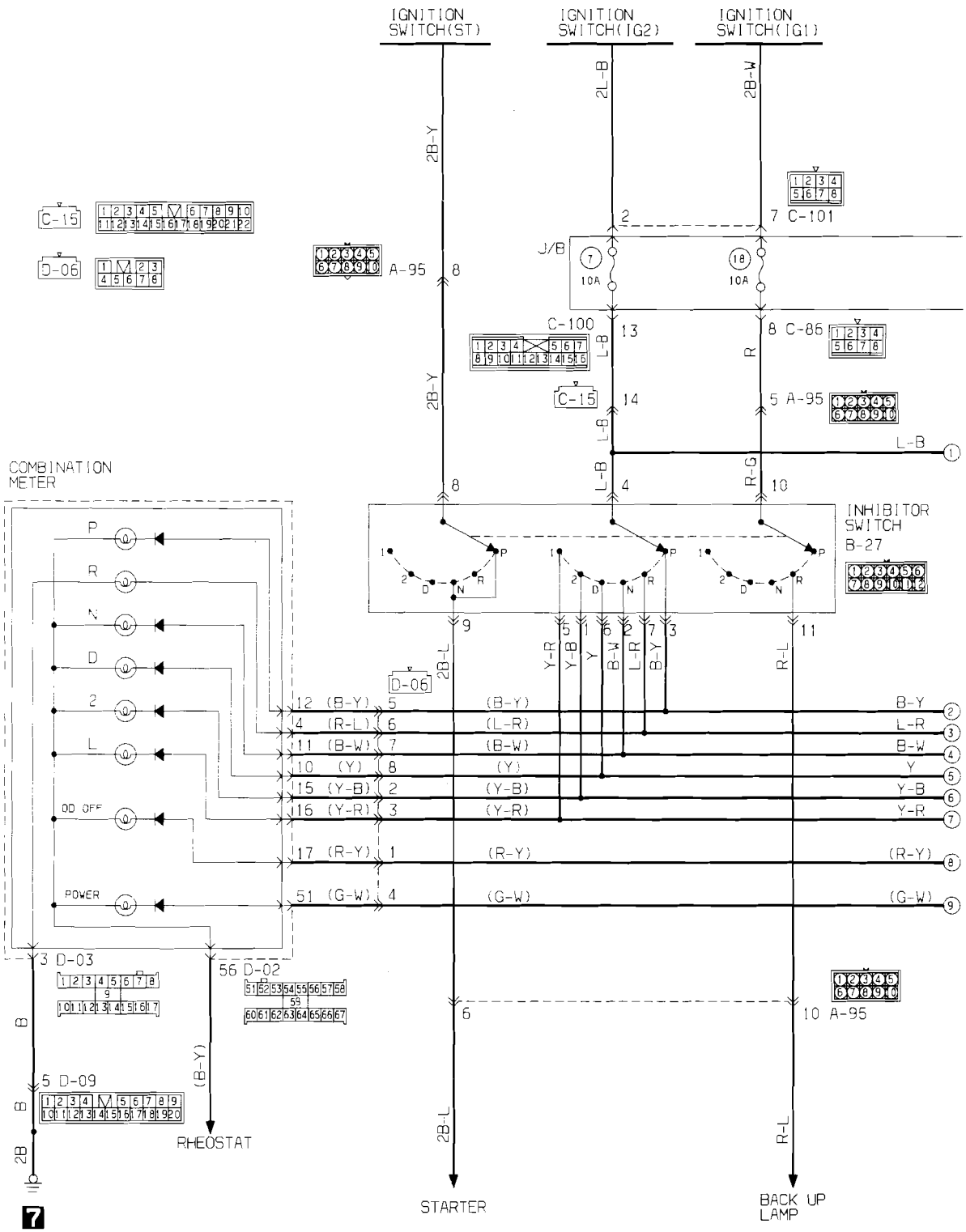


93-139-B-S

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (91-93 4 cyl Carby)



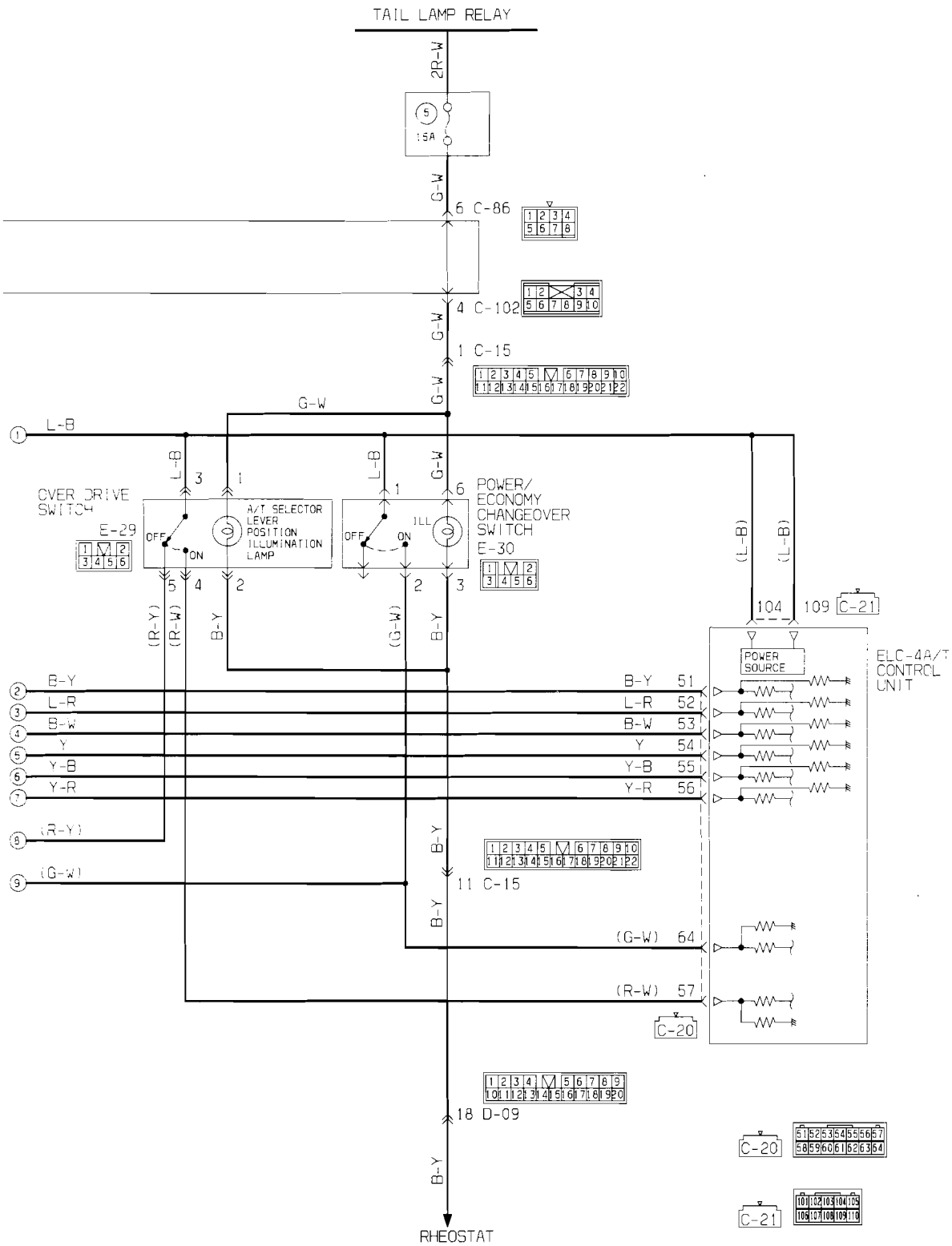
93-140

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (92-93 4 cyl Carby)

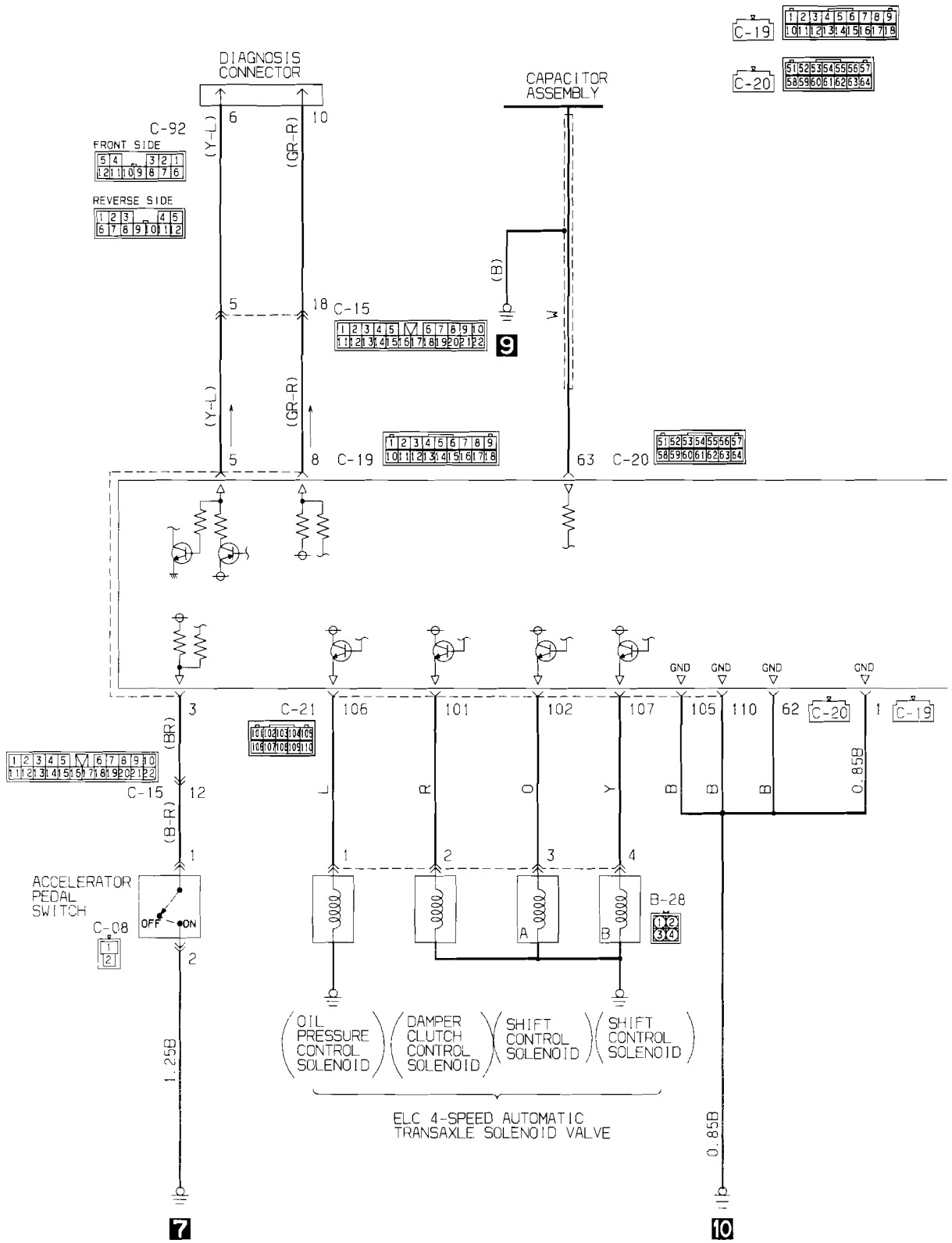


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (91-93 4 cyl Carby) Cont;

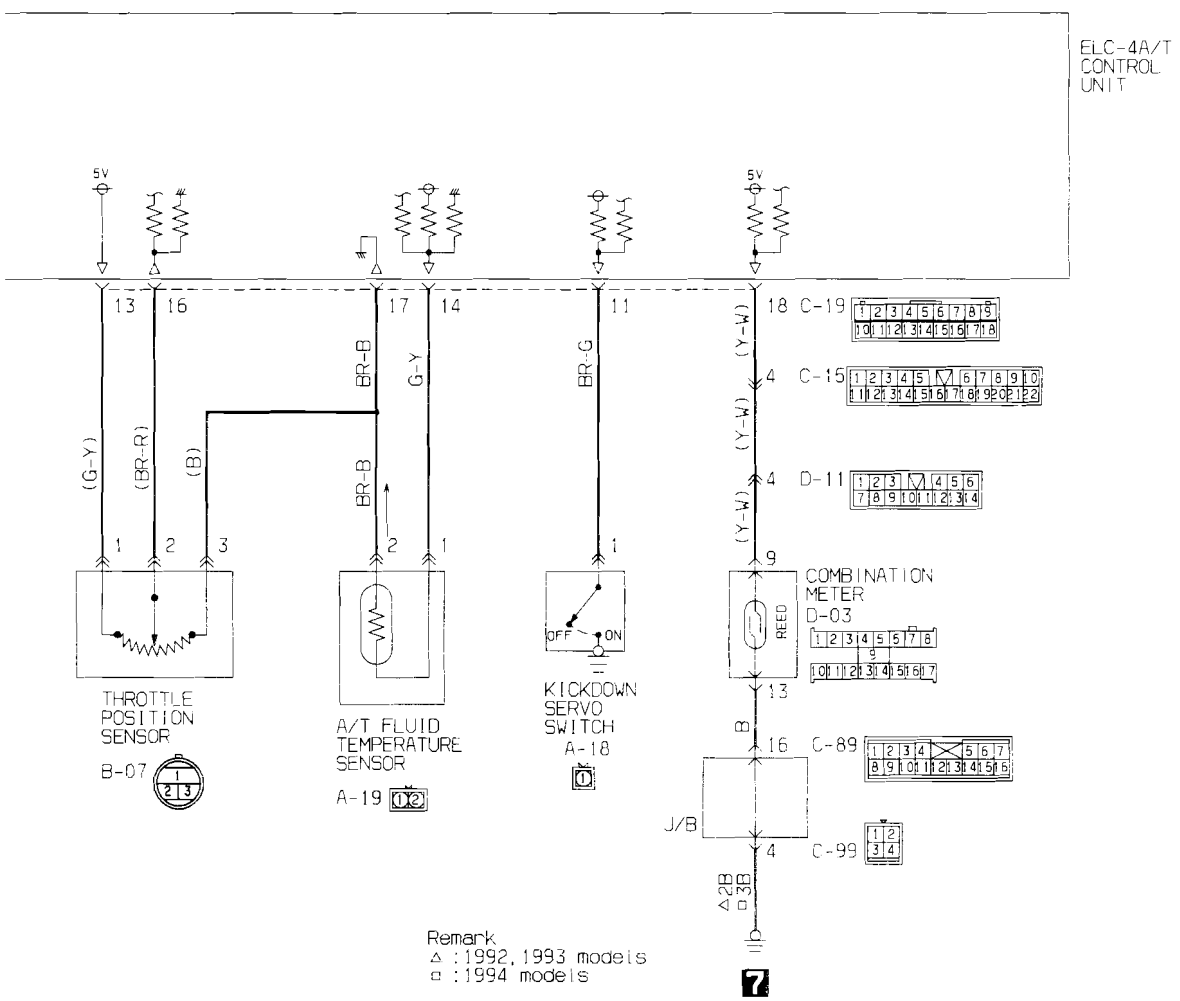


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (91-93 4 cyl Carby)

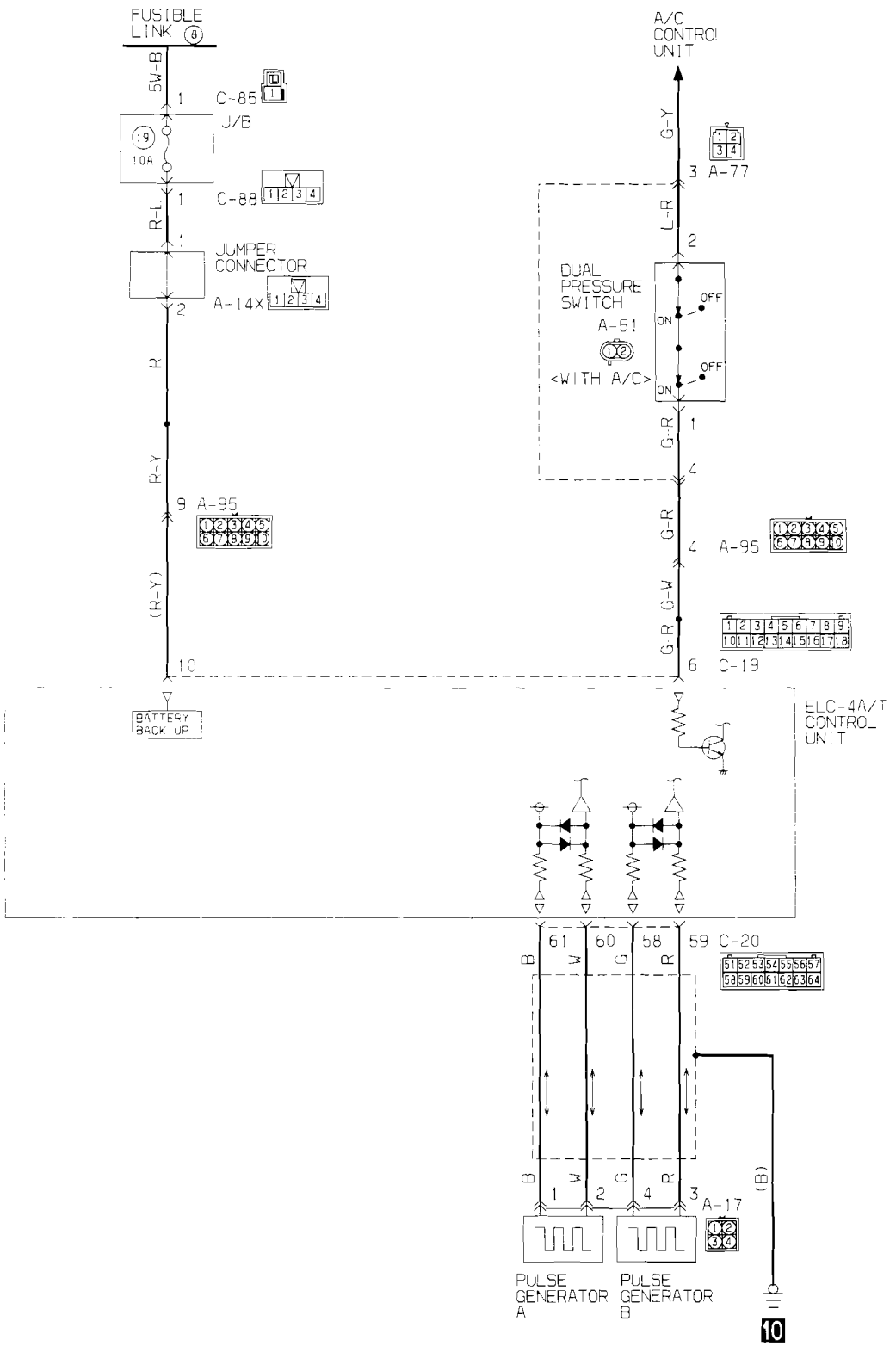


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – ELC 4-speed auto transaxle circuit (91-93 4 cyl Carby) Cont;



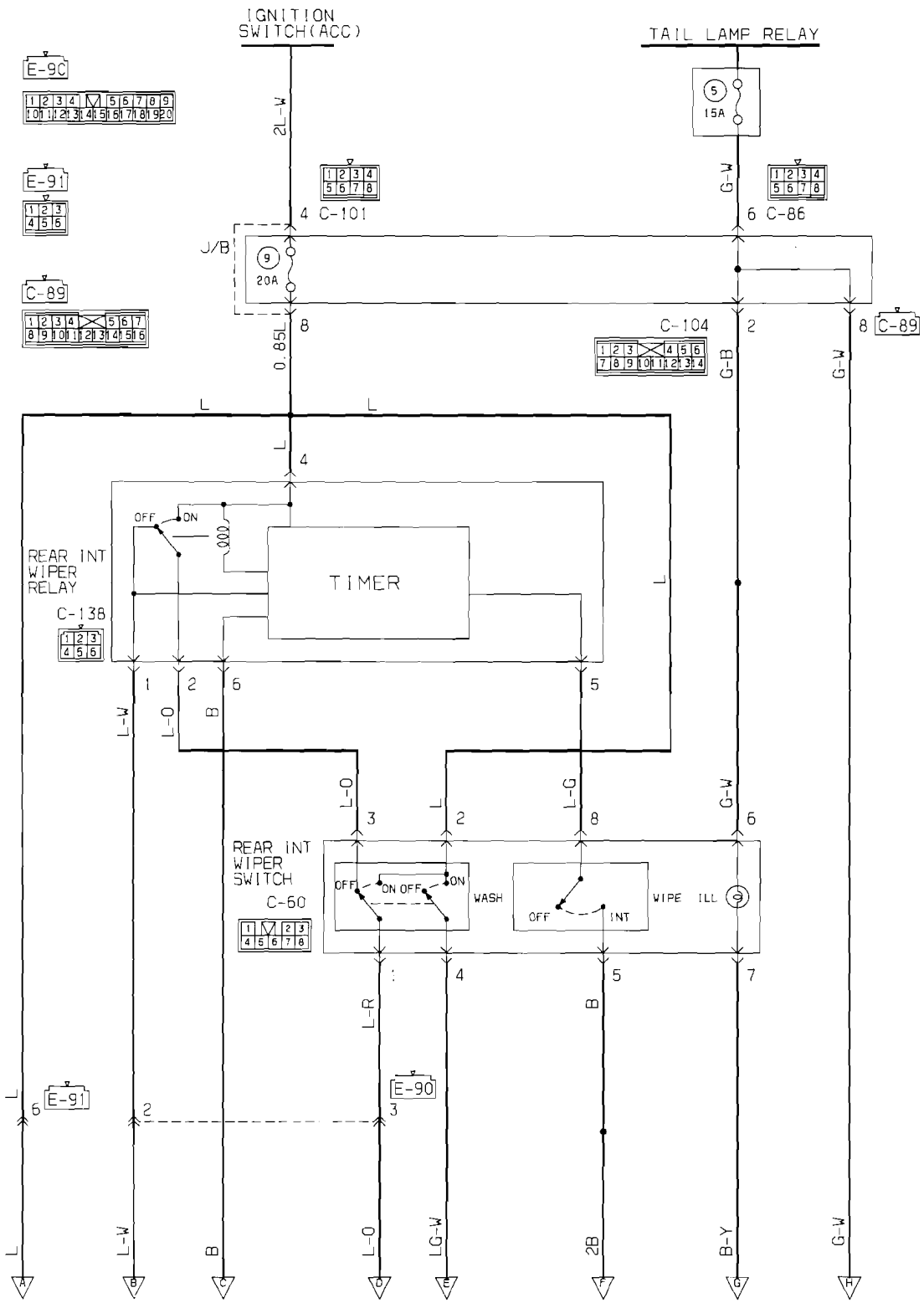
93-140-B

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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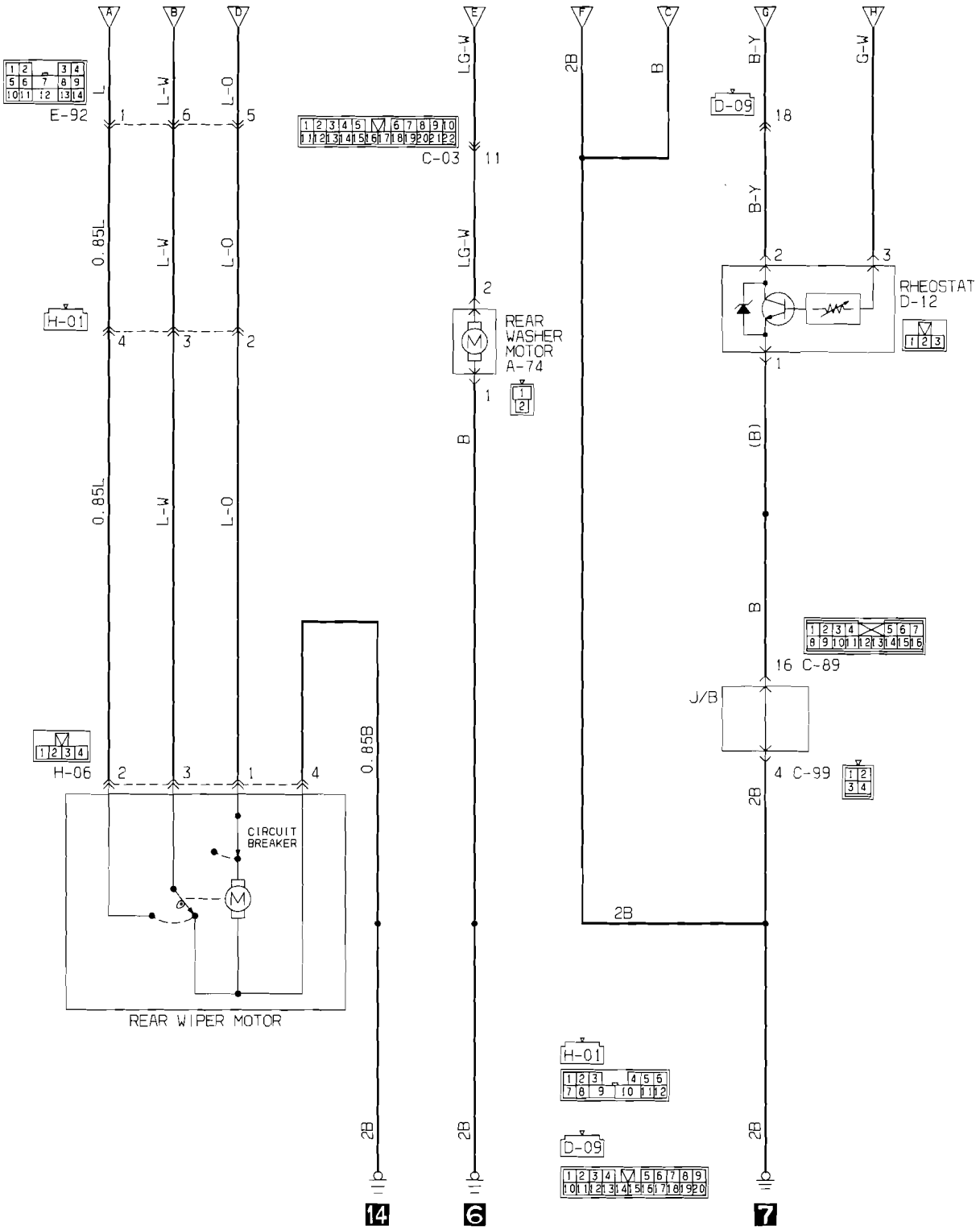
CIRCUIT DIAGRAM – Rear window wiper & washer circuit ('92 wagon Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

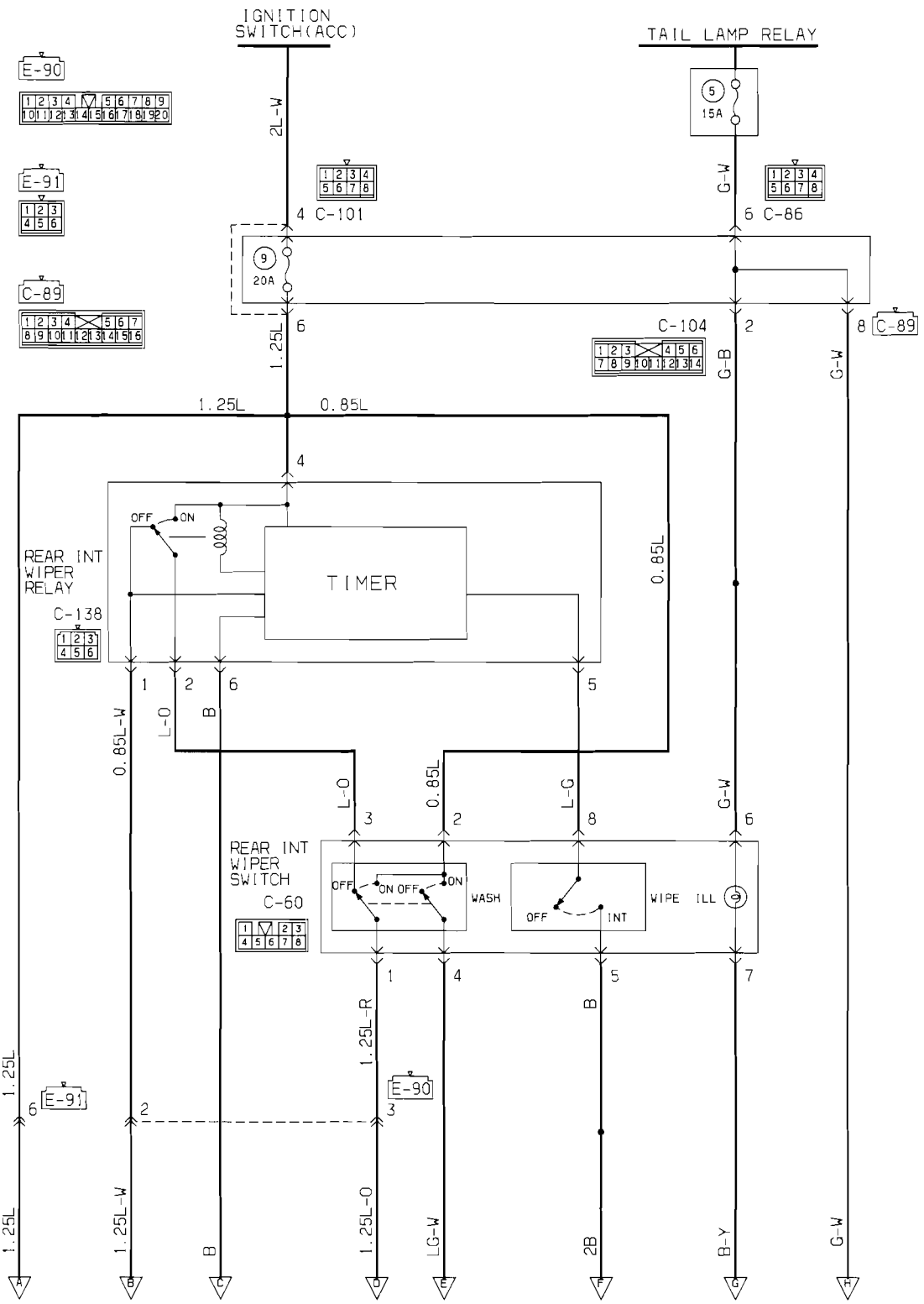
CIRCUIT DIAGRAM – Rear window wiper & washer circuit ('92 wagon)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Rear window wiper & washer circuit (93-94 wagon Models)

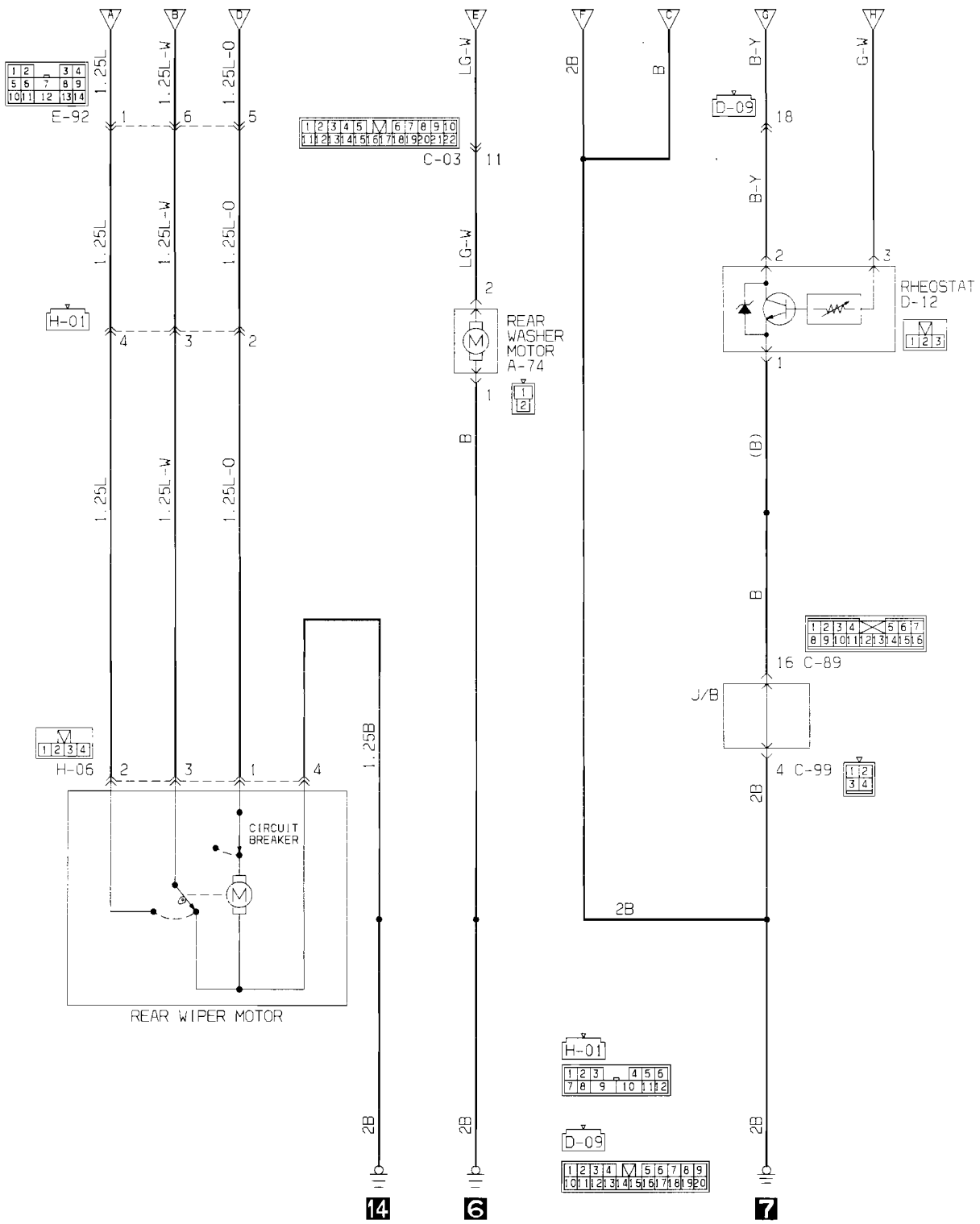


93-101

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

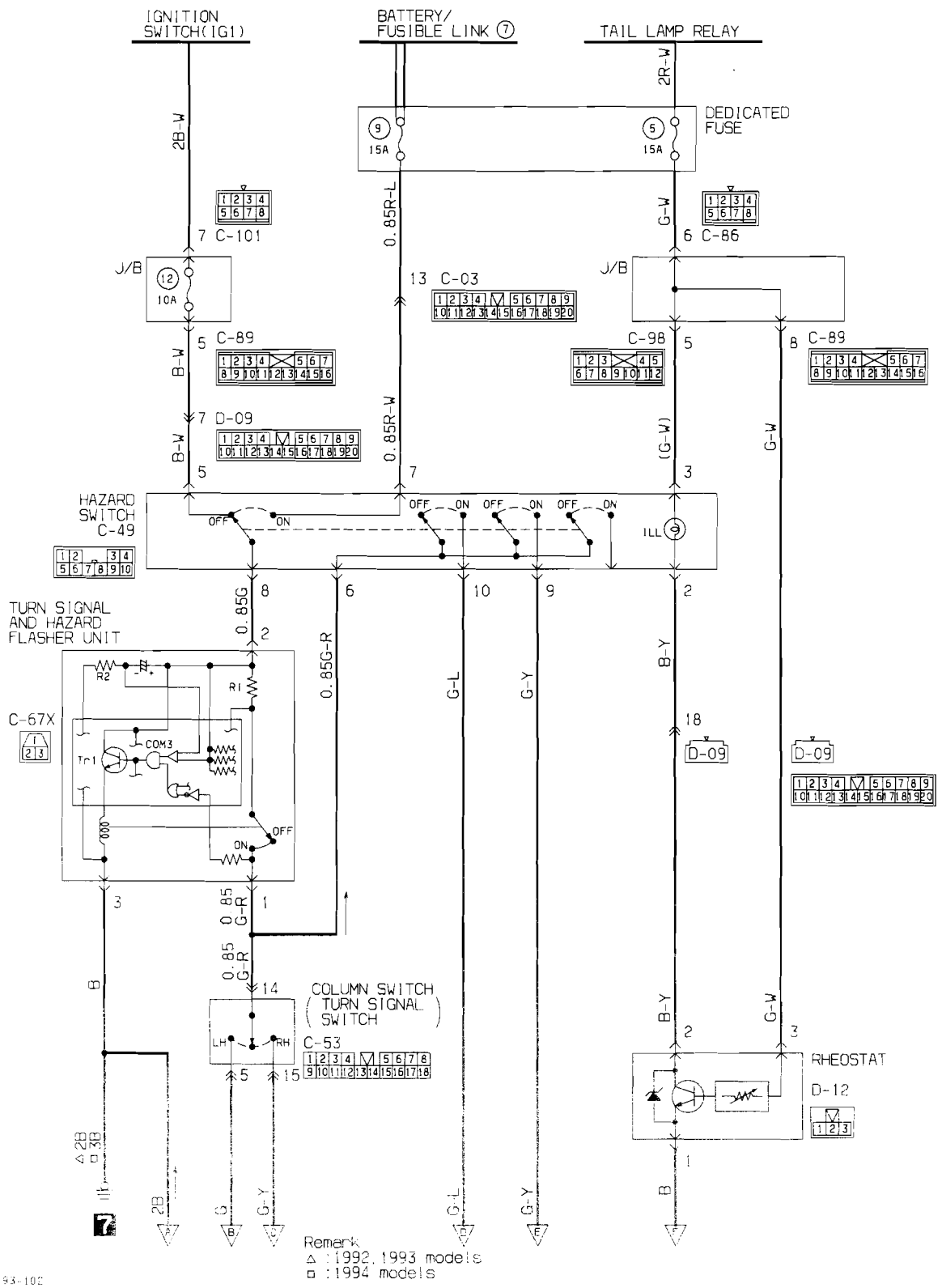
CIRCUIT DIAGRAM – Rear window wiper & washer circuit (93-94 wagon Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Turn signal & hazard lamp circuit (91-94 H,D,P Sedan Models)

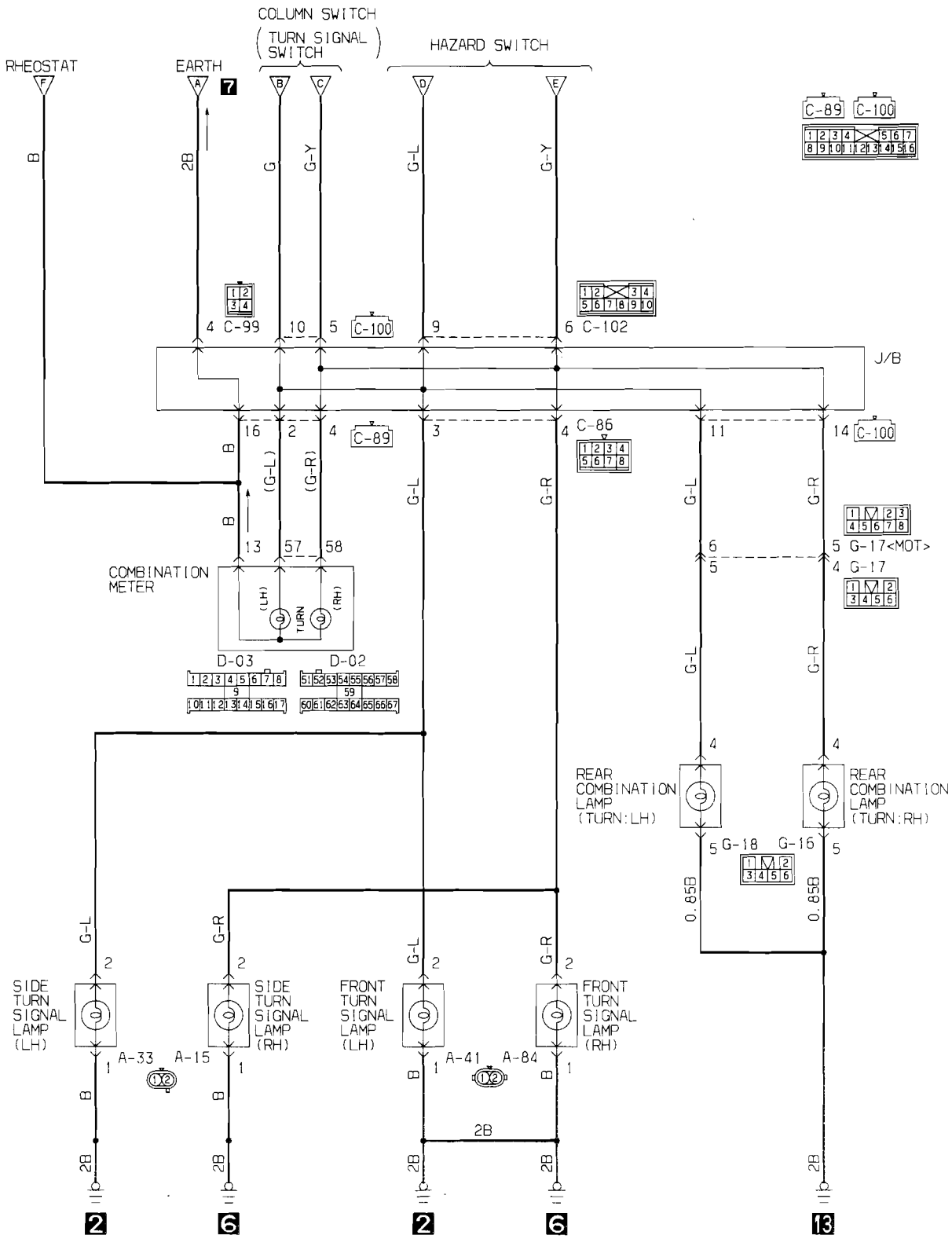


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Turn signal & hazard lamp circuit (91-94 H,D,P Sedan Models)

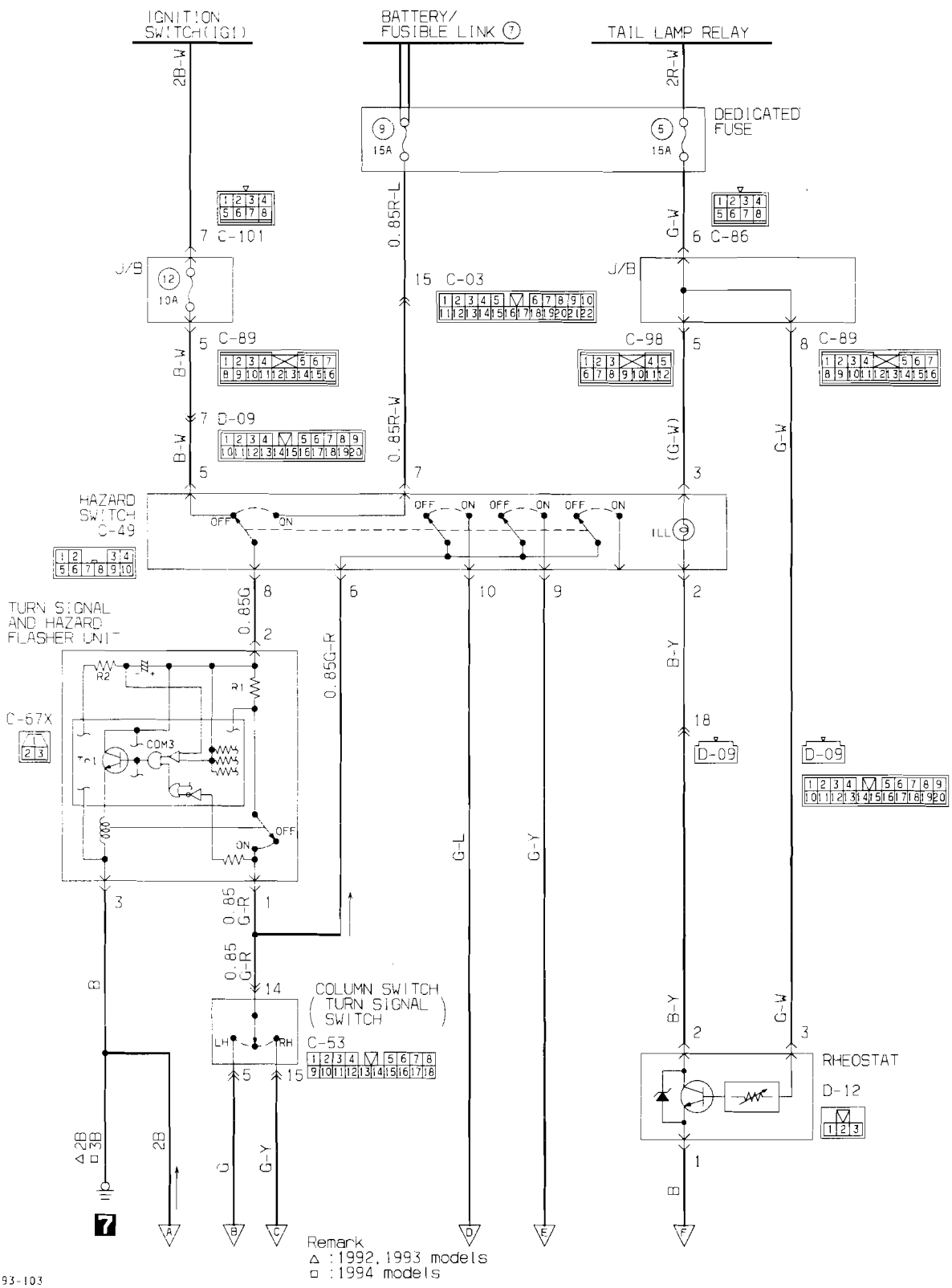


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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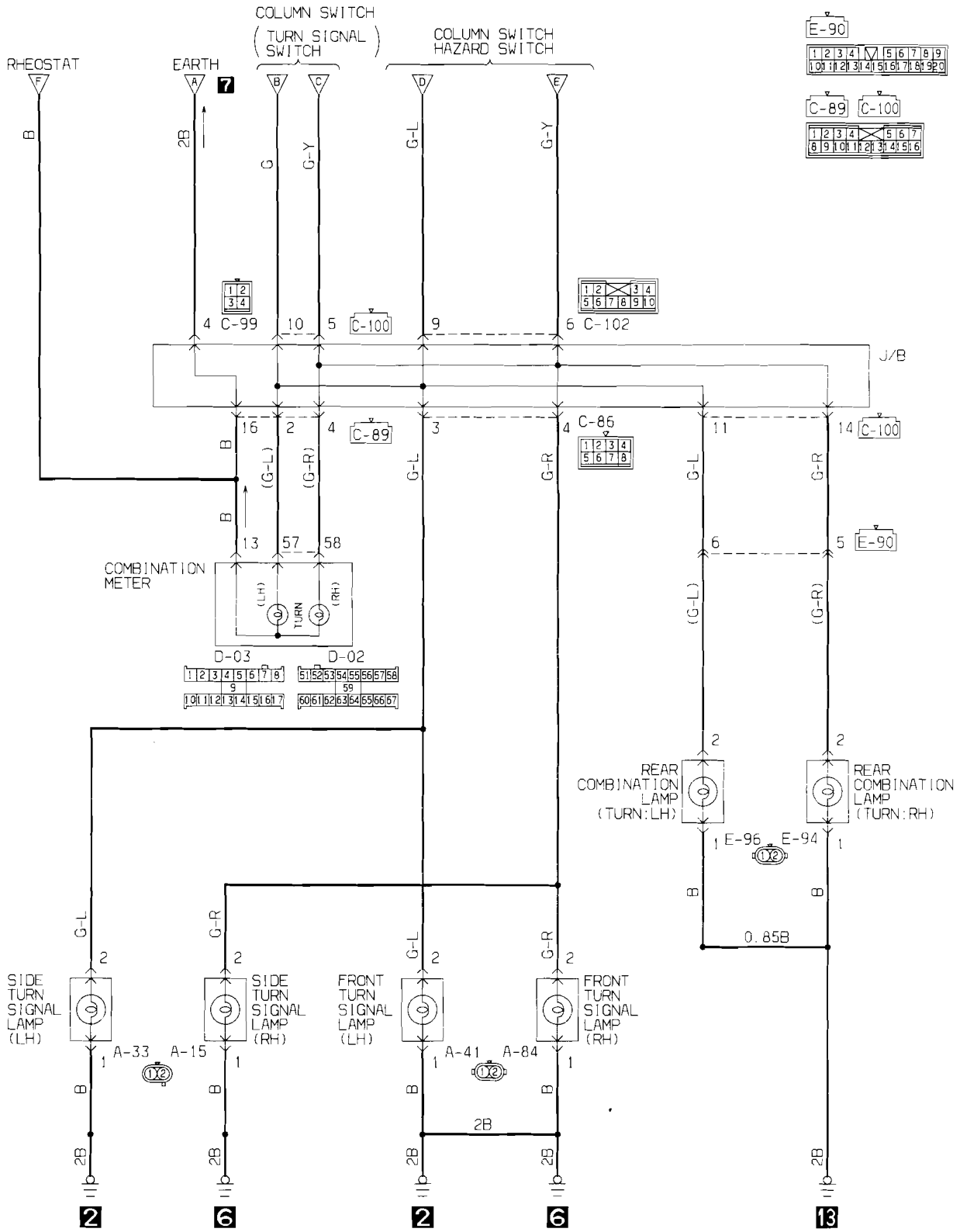
CIRCUIT DIAGRAM – Turn signal & hazard lamp circuit (92-94 wagon Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

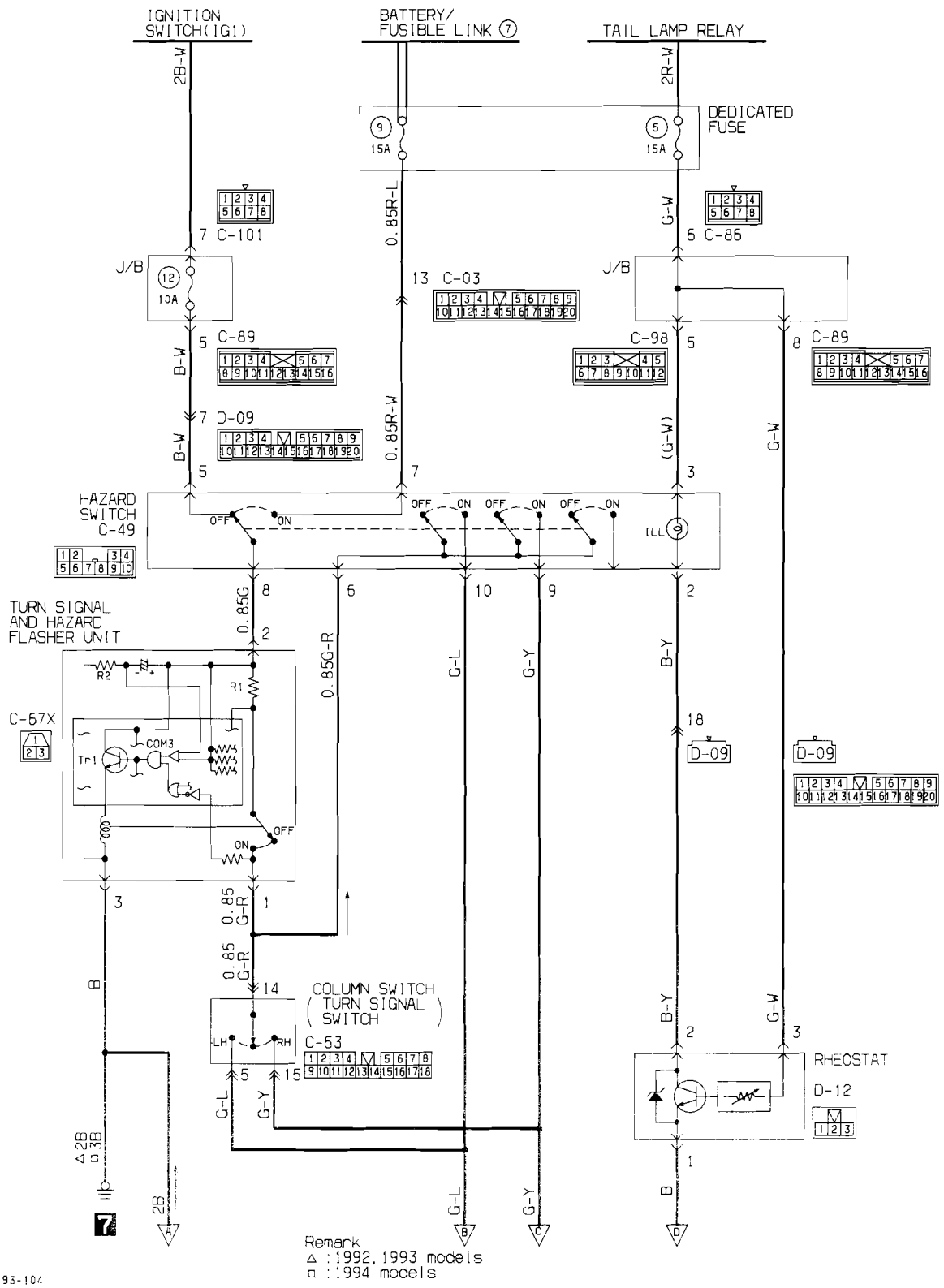
CIRCUIT DIAGRAM – Turn signal & hazard lamp circuit (92-94 wagon Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Turn signal & hazard lamp circuit ('X' line 91-94 Models)

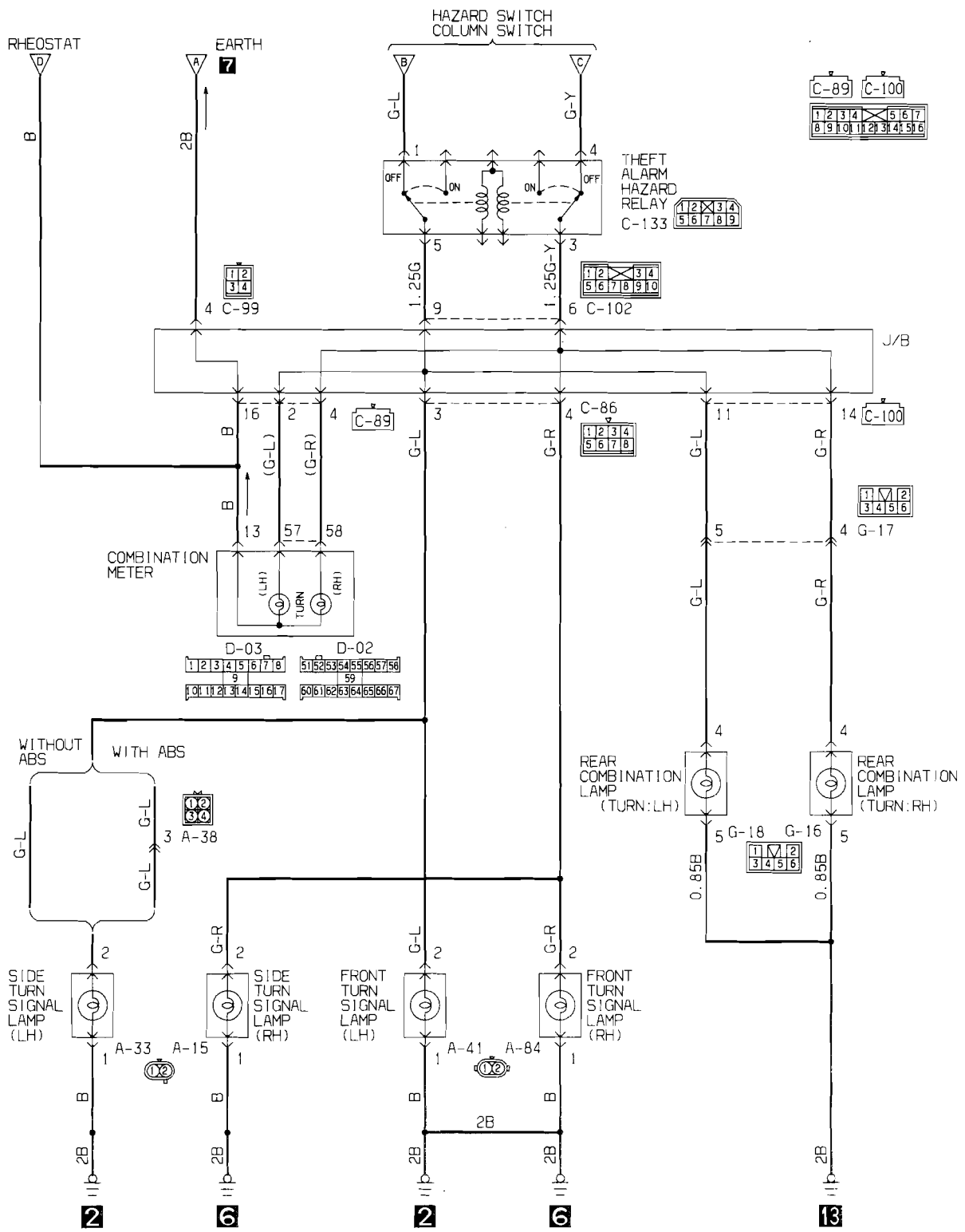


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Turn signal & hazard lamp circuit ('X' line 91-94 Models)

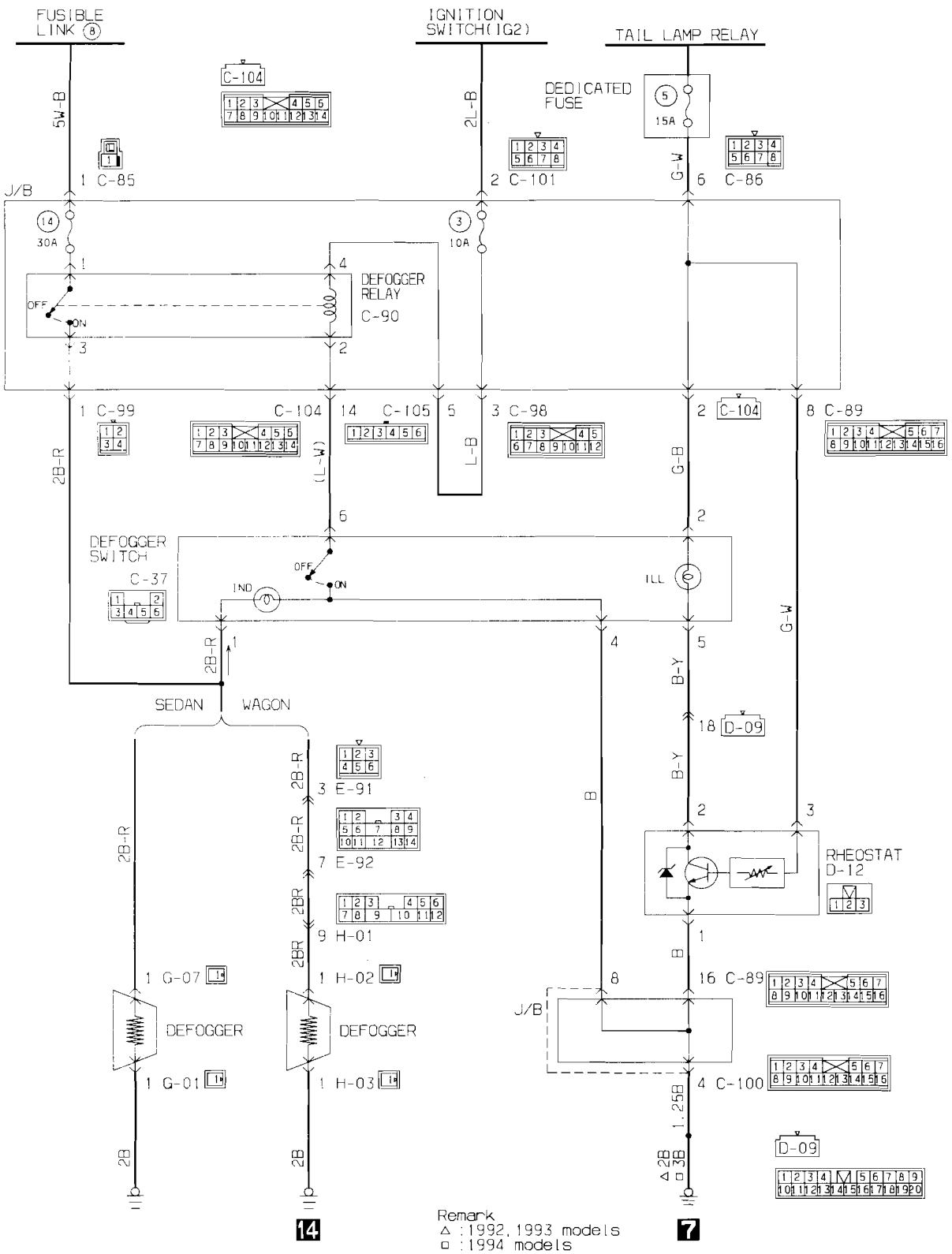


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Defogger circuit (91-94 H,D,P sedan/wagon models)

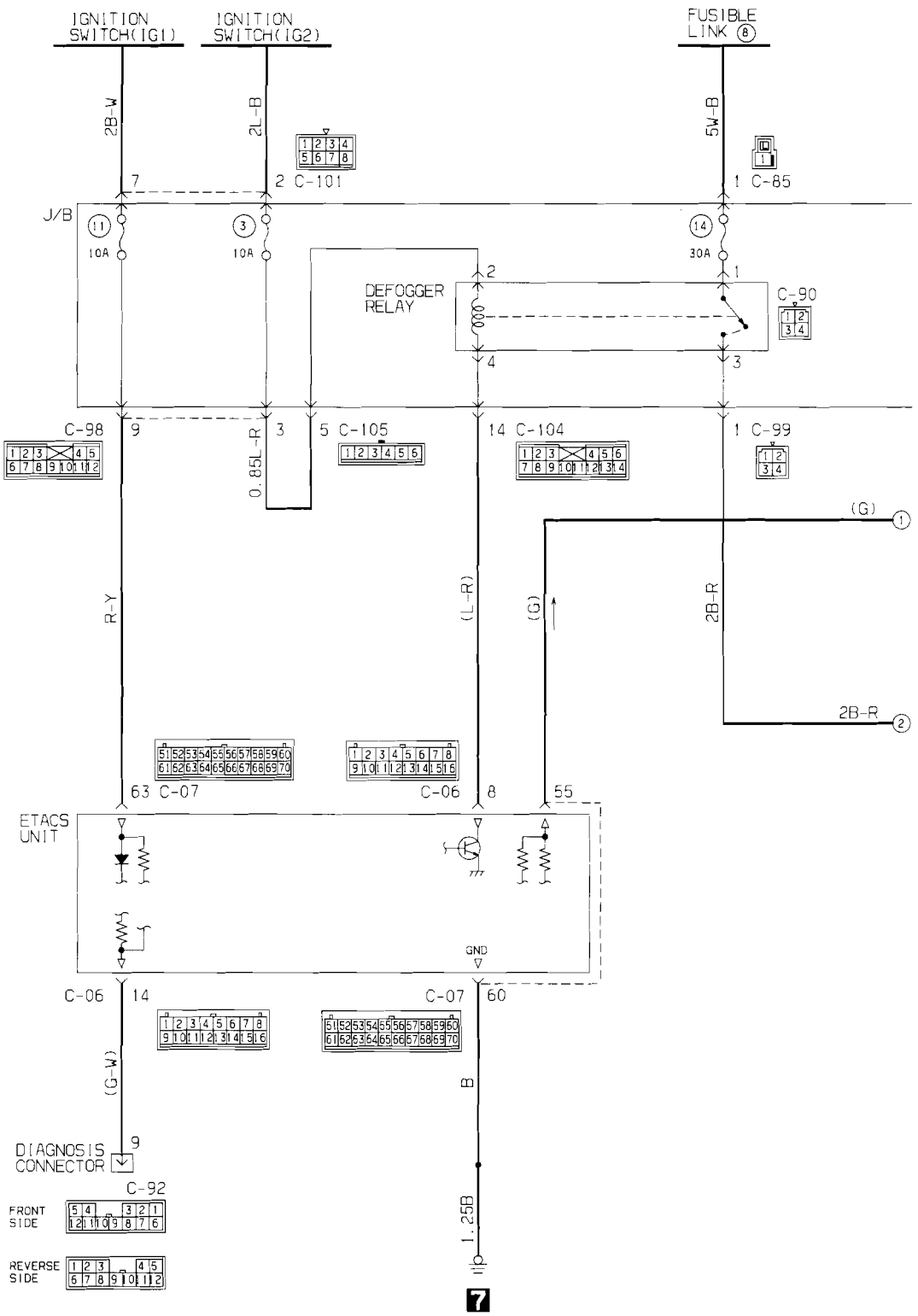


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Defogger circuit (91-94 model 'X' line)

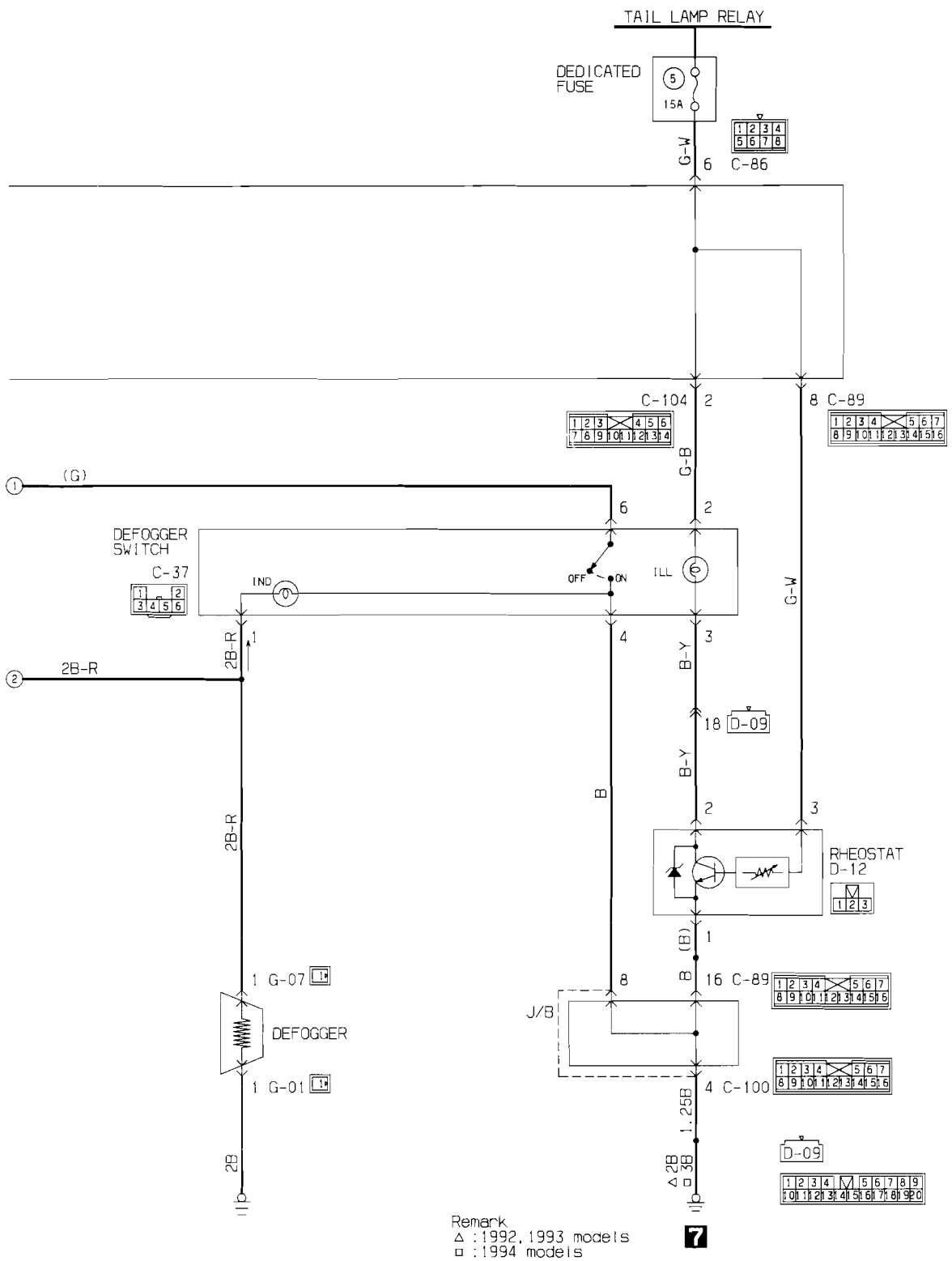


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Defogger circuit (91-94 model 'X' line) Cont;

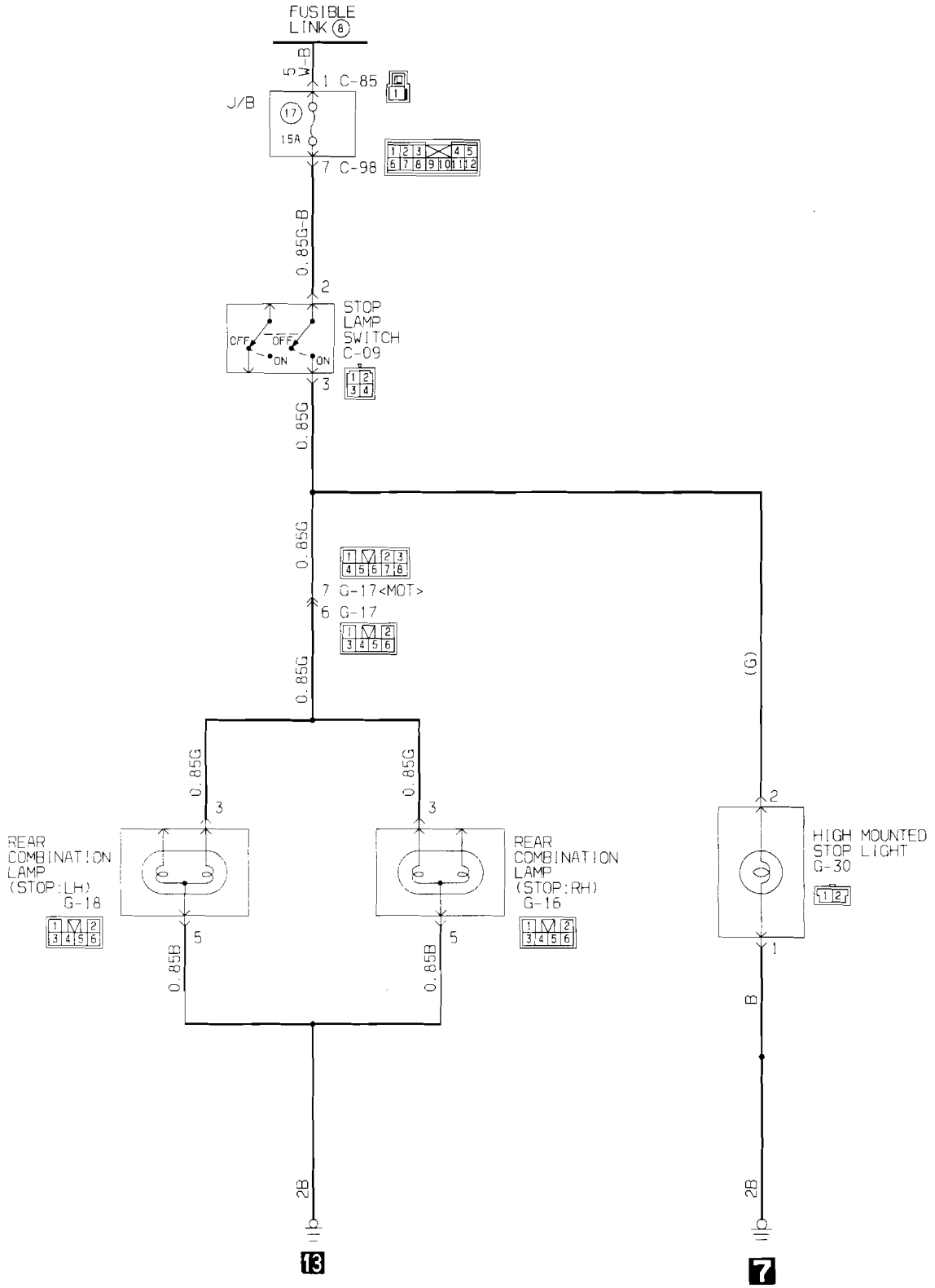


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Stop lamp circuit (91-94 sedan models)

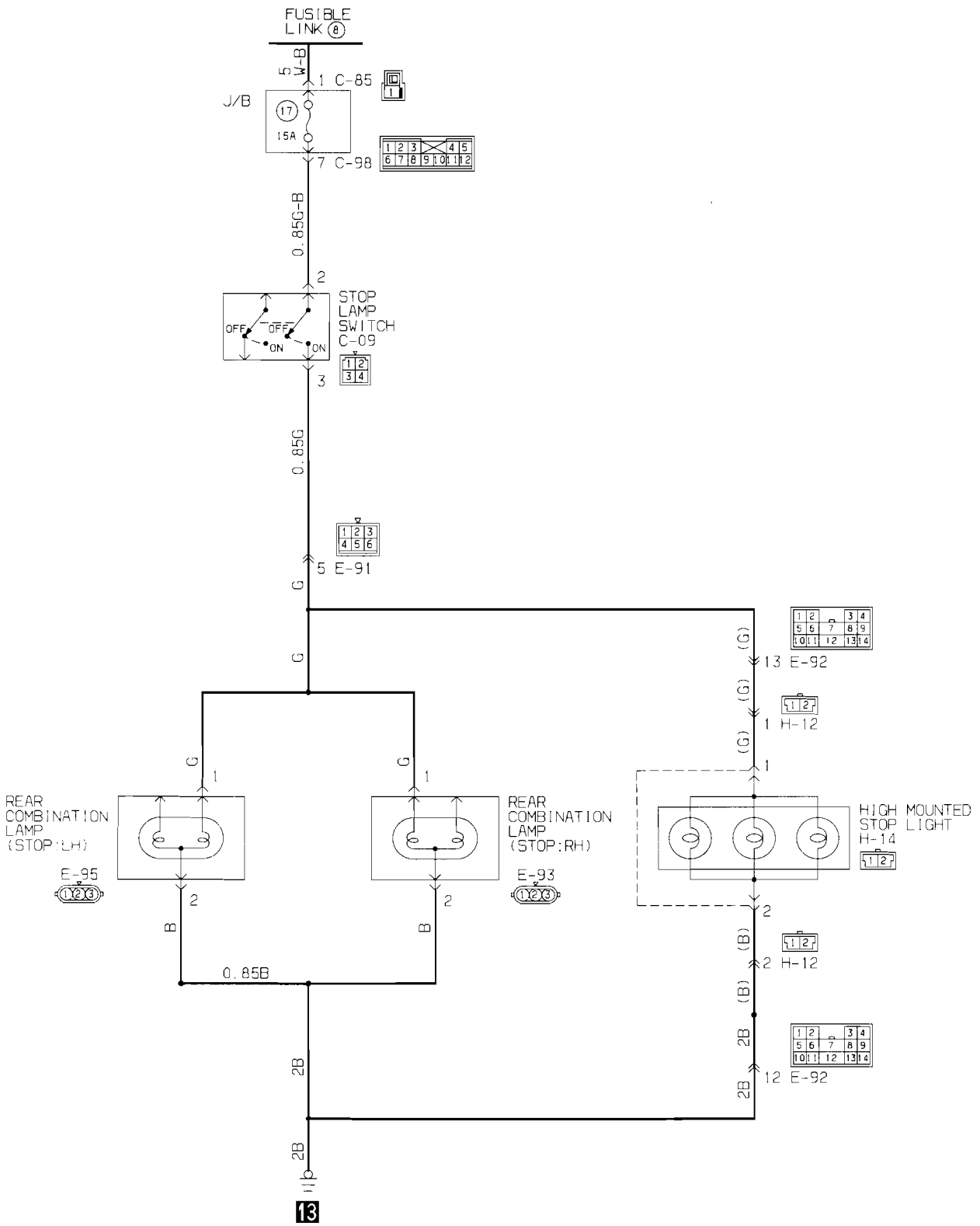


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

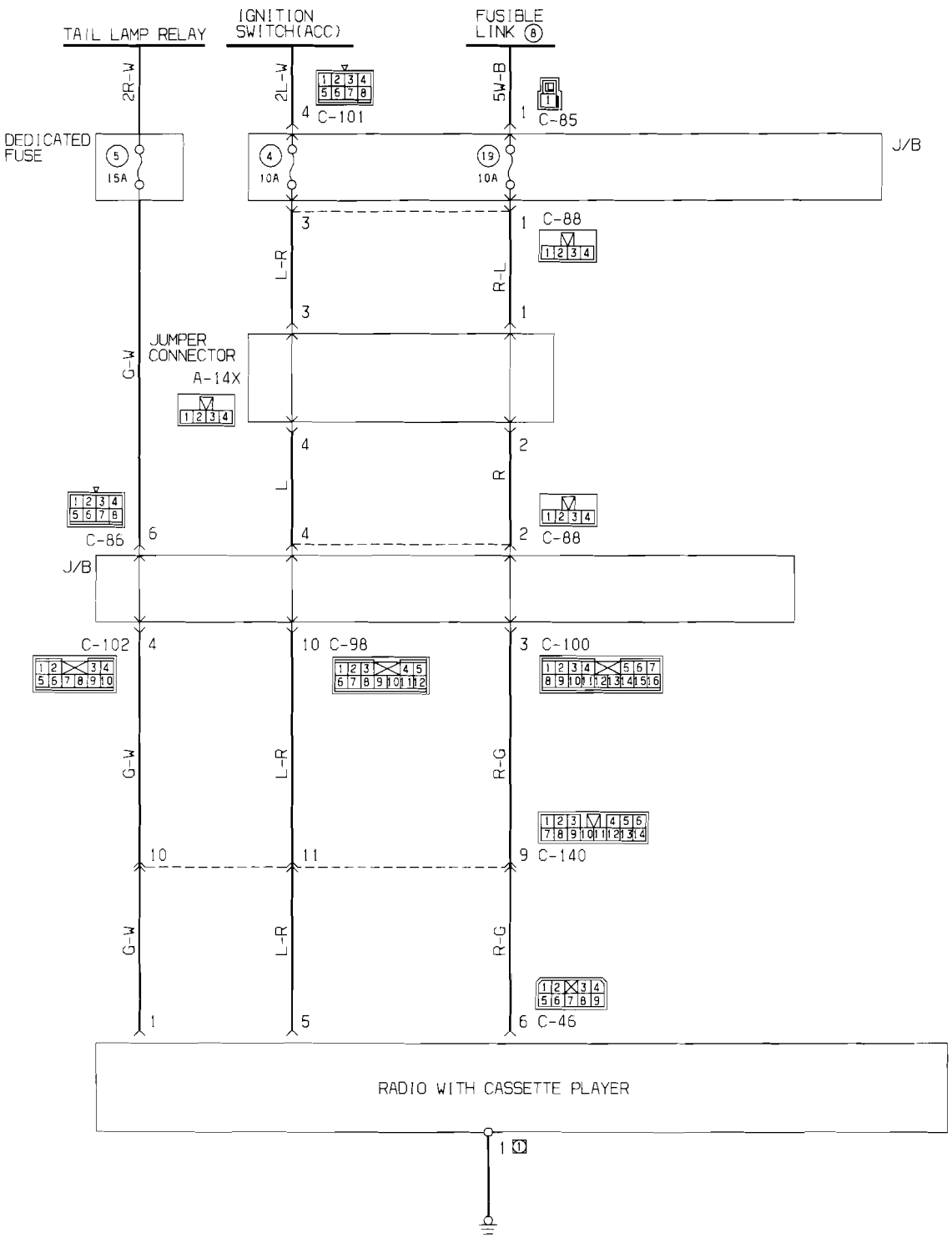
CIRCUIT DIAGRAM – Stop lamp circuit (92-94 wagon Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Audio circuit 2 speakers (91-94 models)



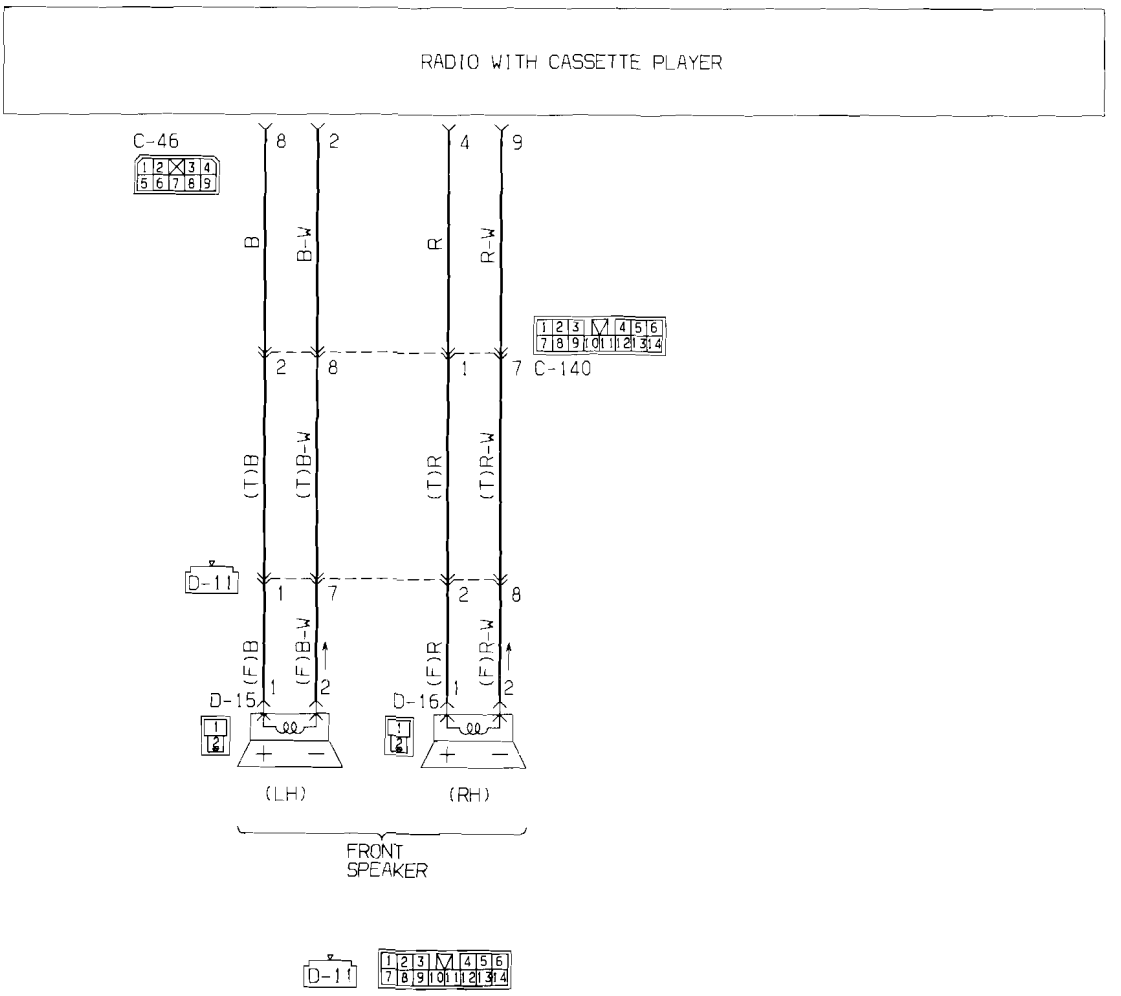
93-109

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Audio circuit 2 speakers (91-94 models)

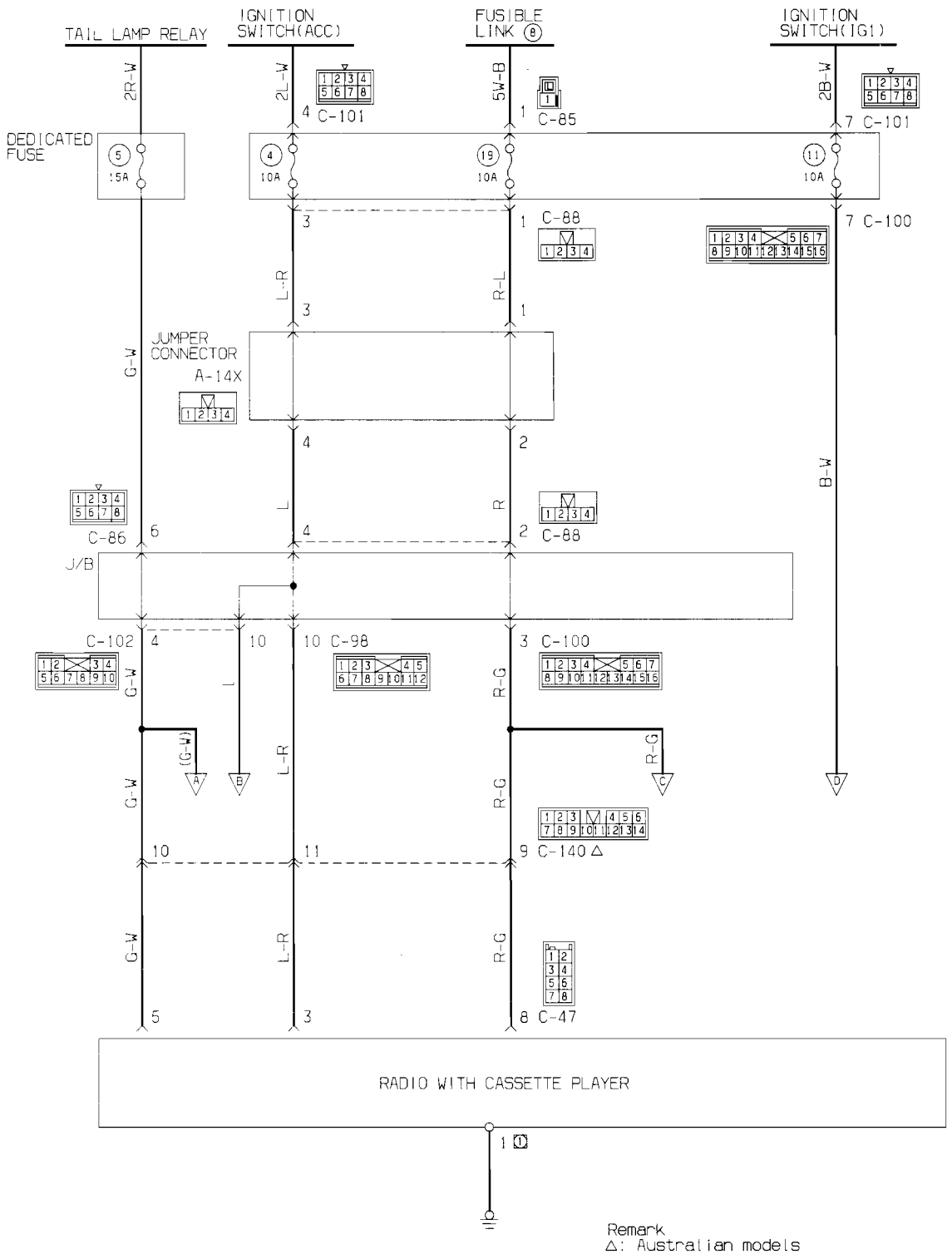


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Audio circuit 4 speakers (91-93 Models)

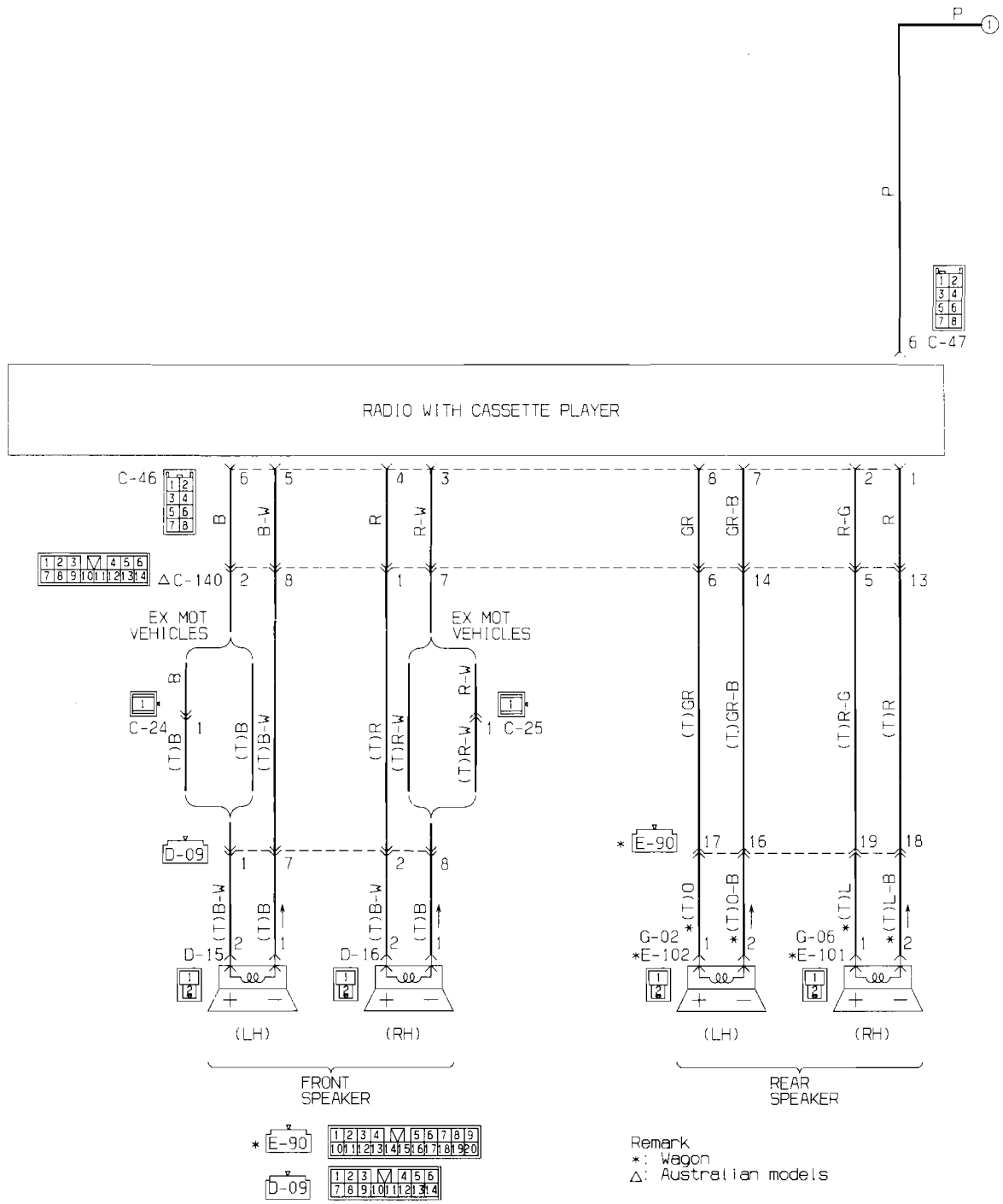


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Audio circuit 4 speakers (91-93 Models)

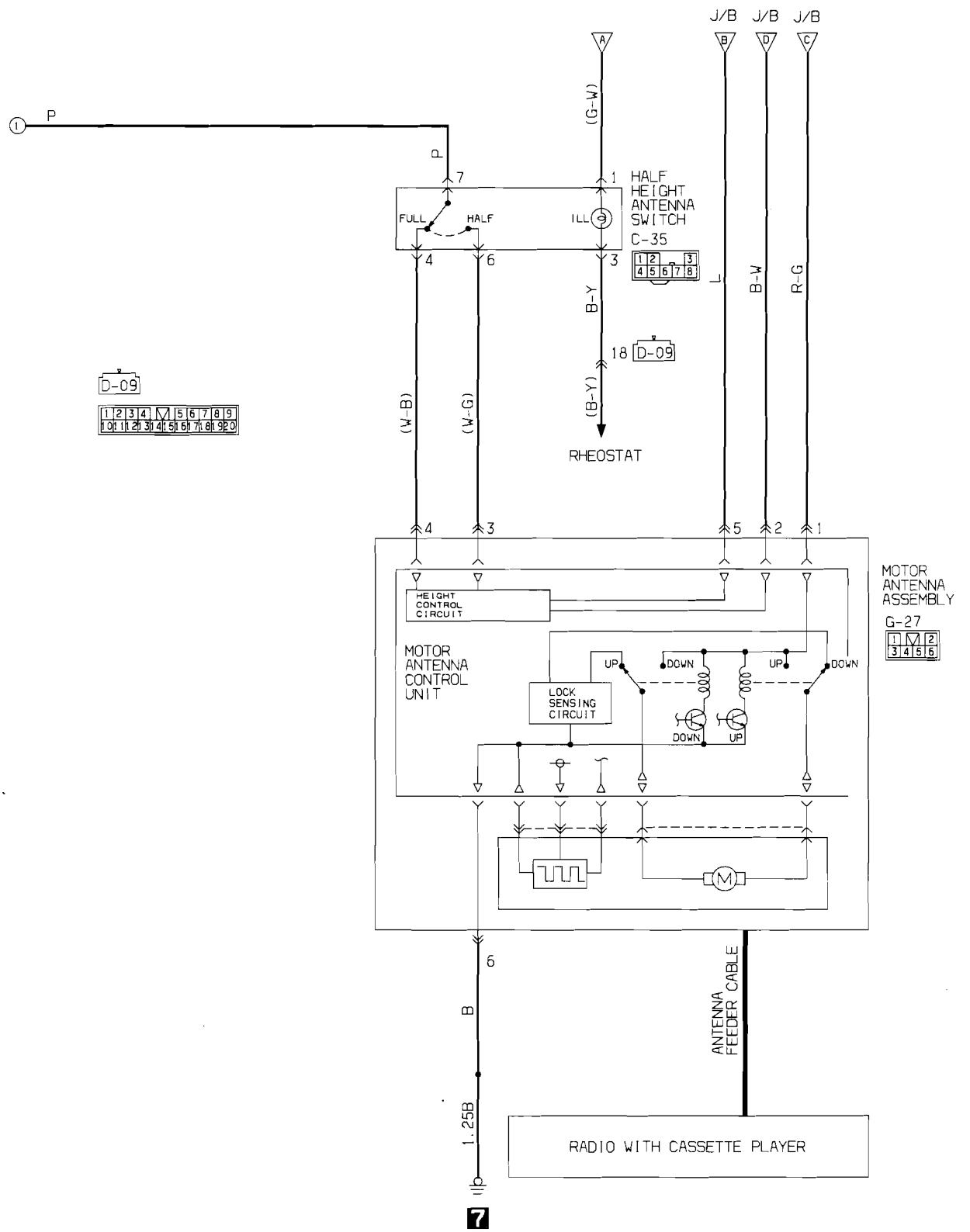


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Audio circuit 4 speakers (91-93 Models) Cont;



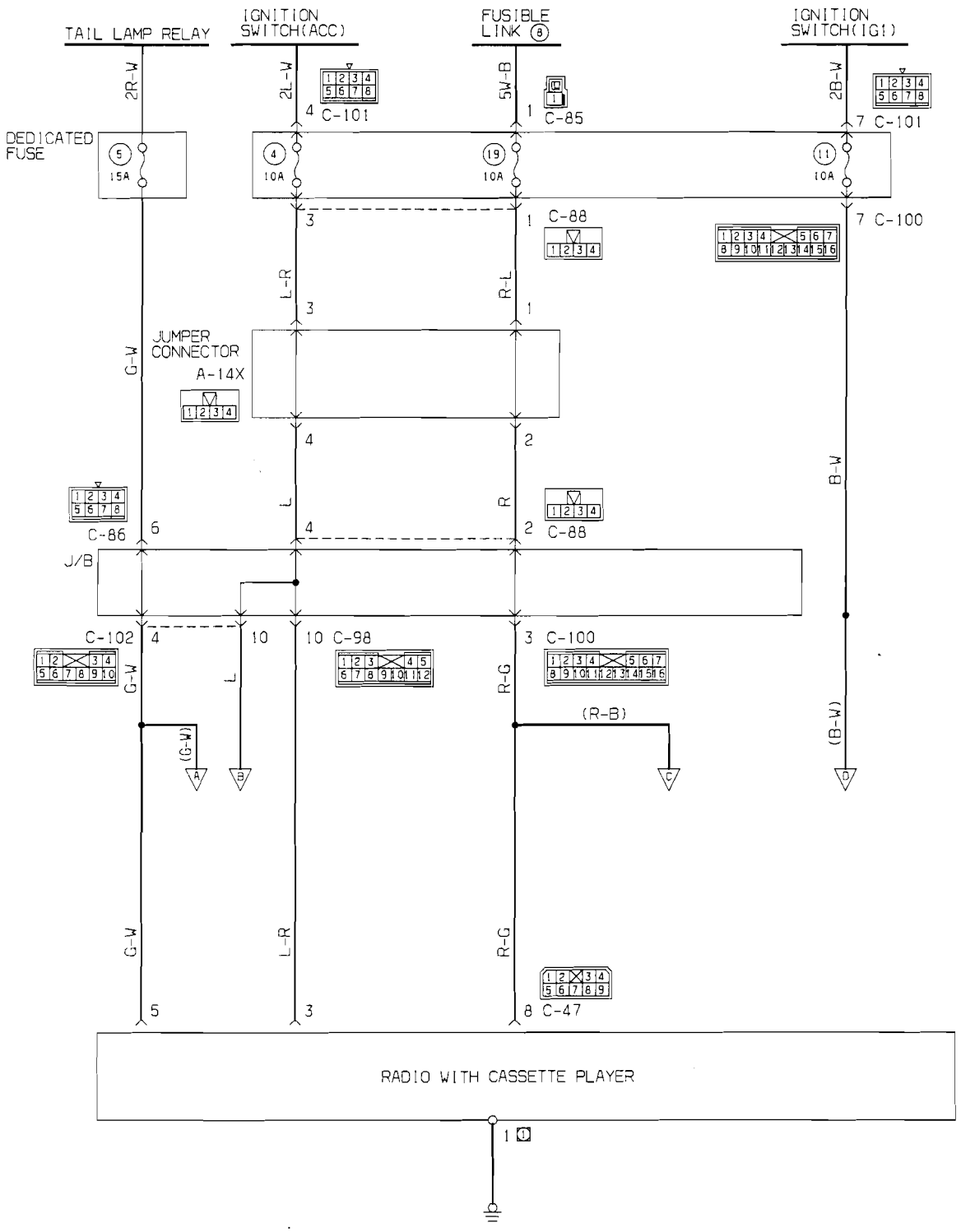
Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Notes

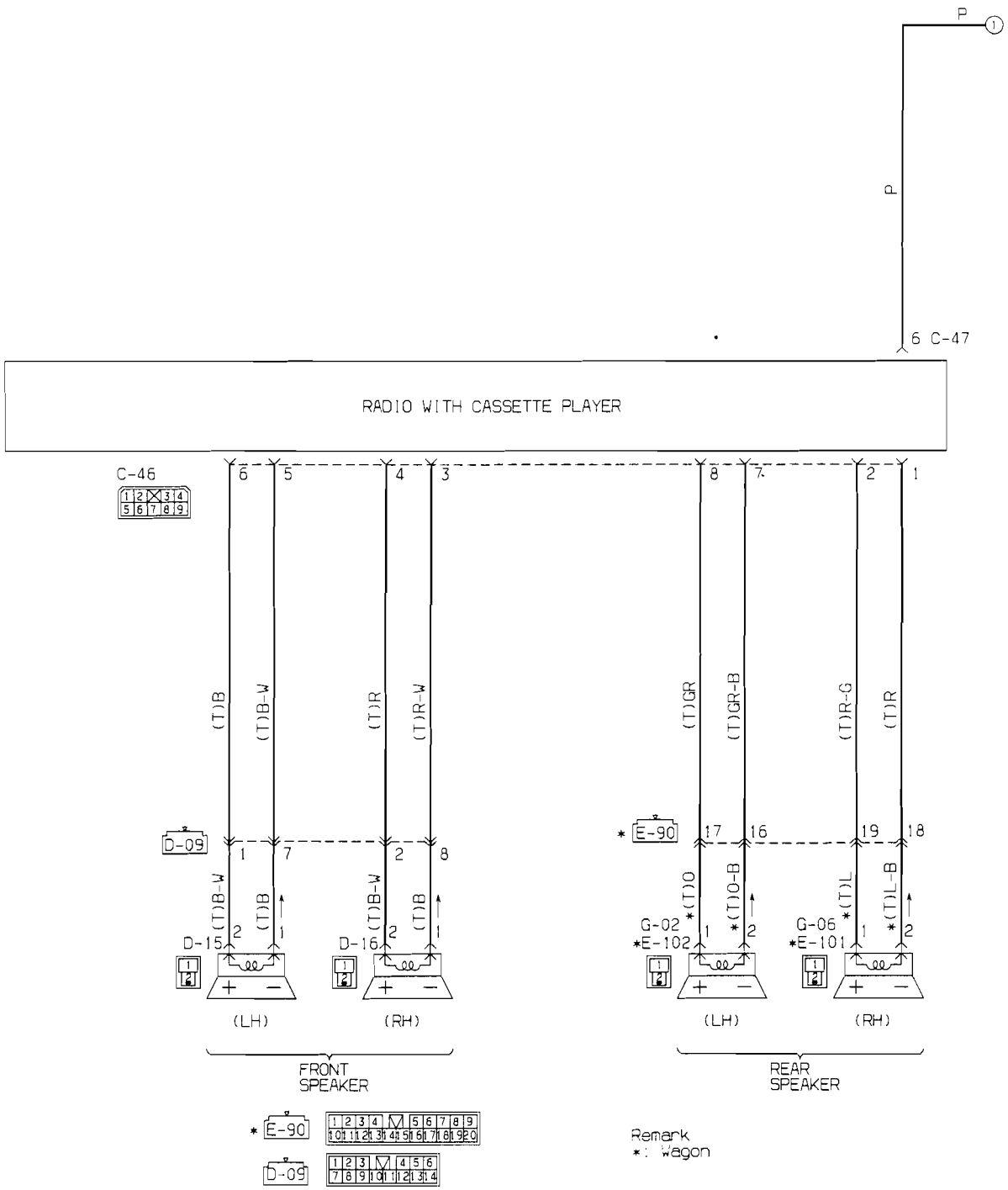
CIRCUIT DIAGRAM – Audio circuit 4 speakers (94 Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

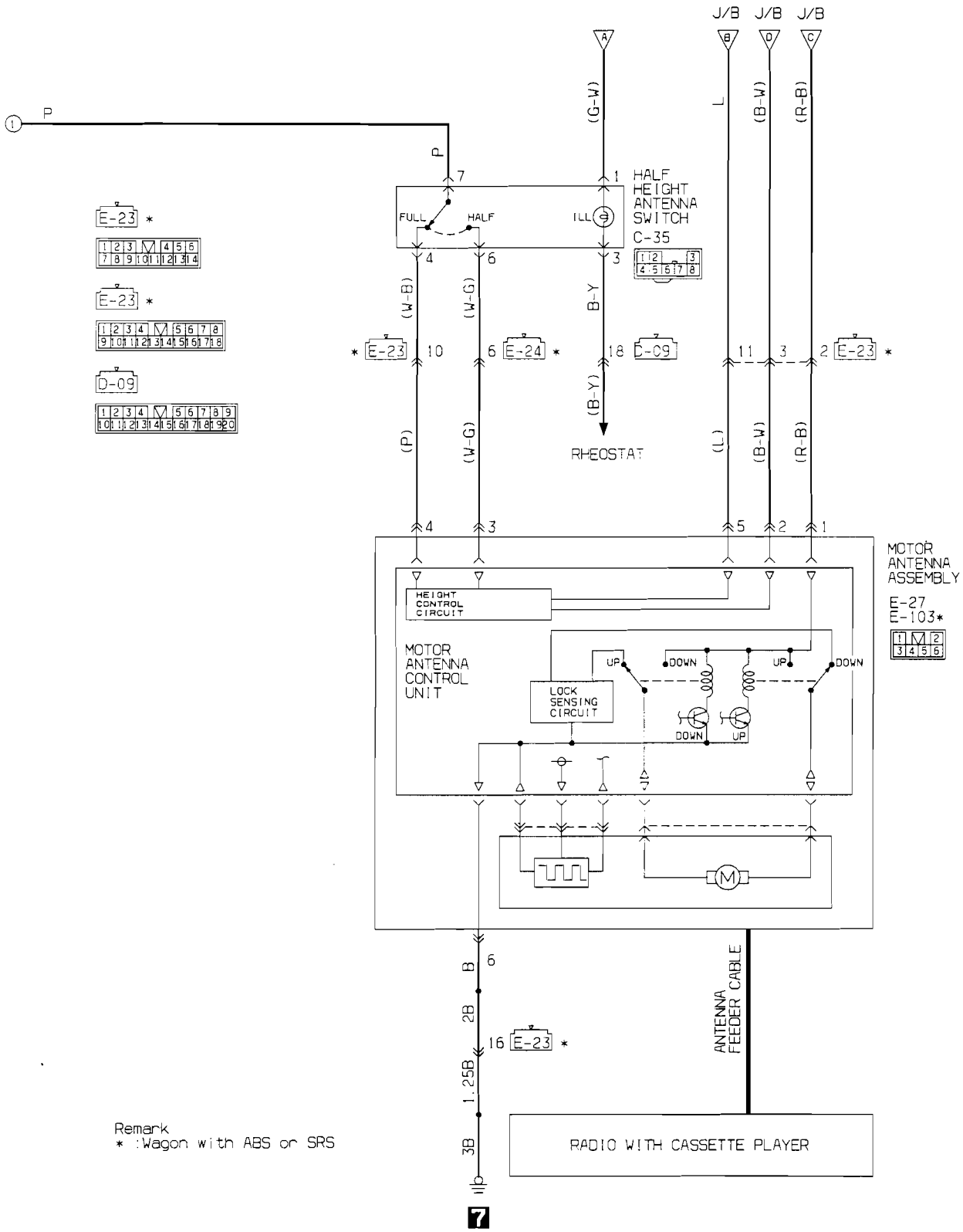
CIRCUIT DIAGRAM – Audio circuit 4 speakers (94 Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Audio circuit 4 speakers (94 Models) Continued

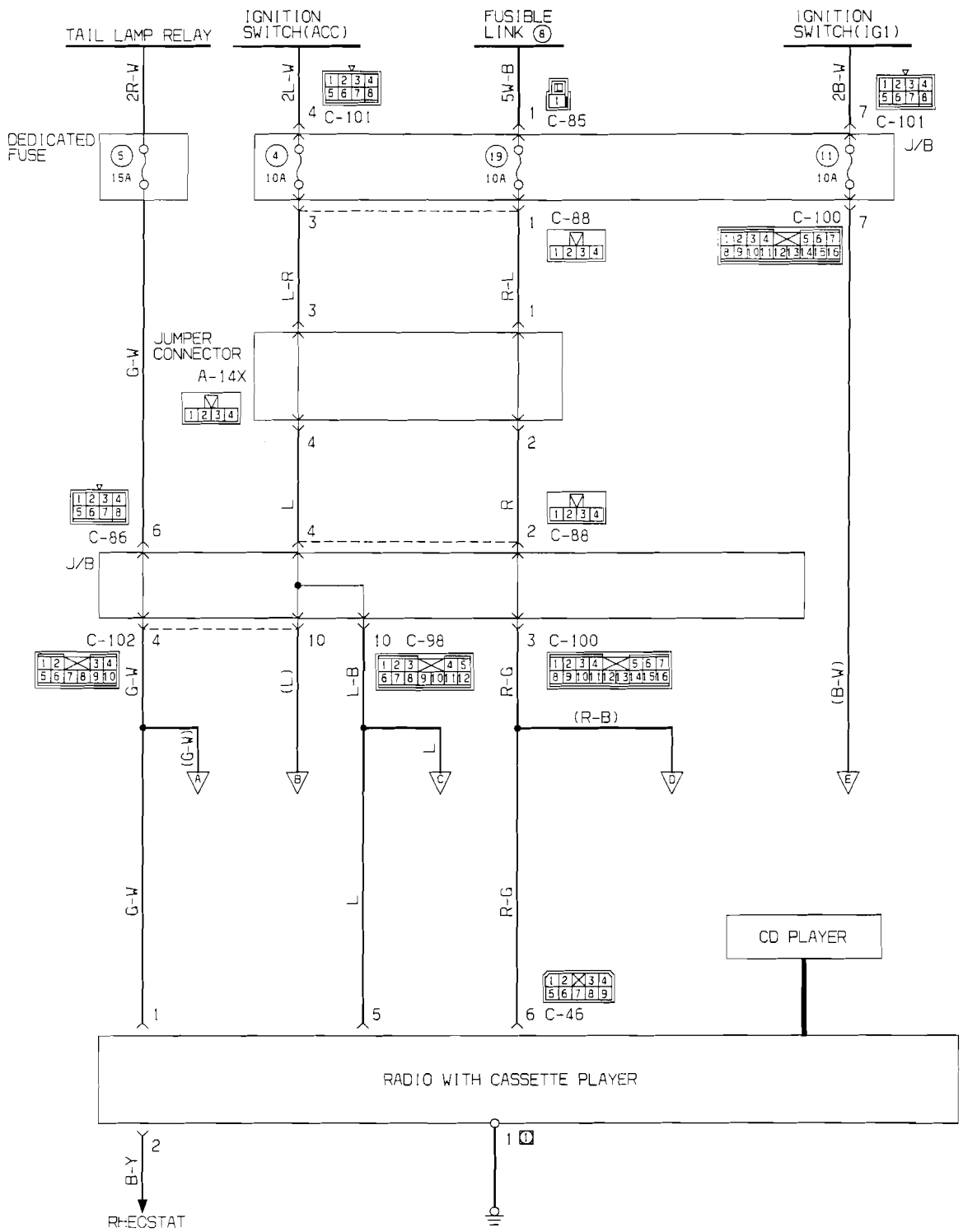


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Notes

CIRCUIT DIAGRAM – Audio circuit 'X' line w/o SRS (92-93 Models)

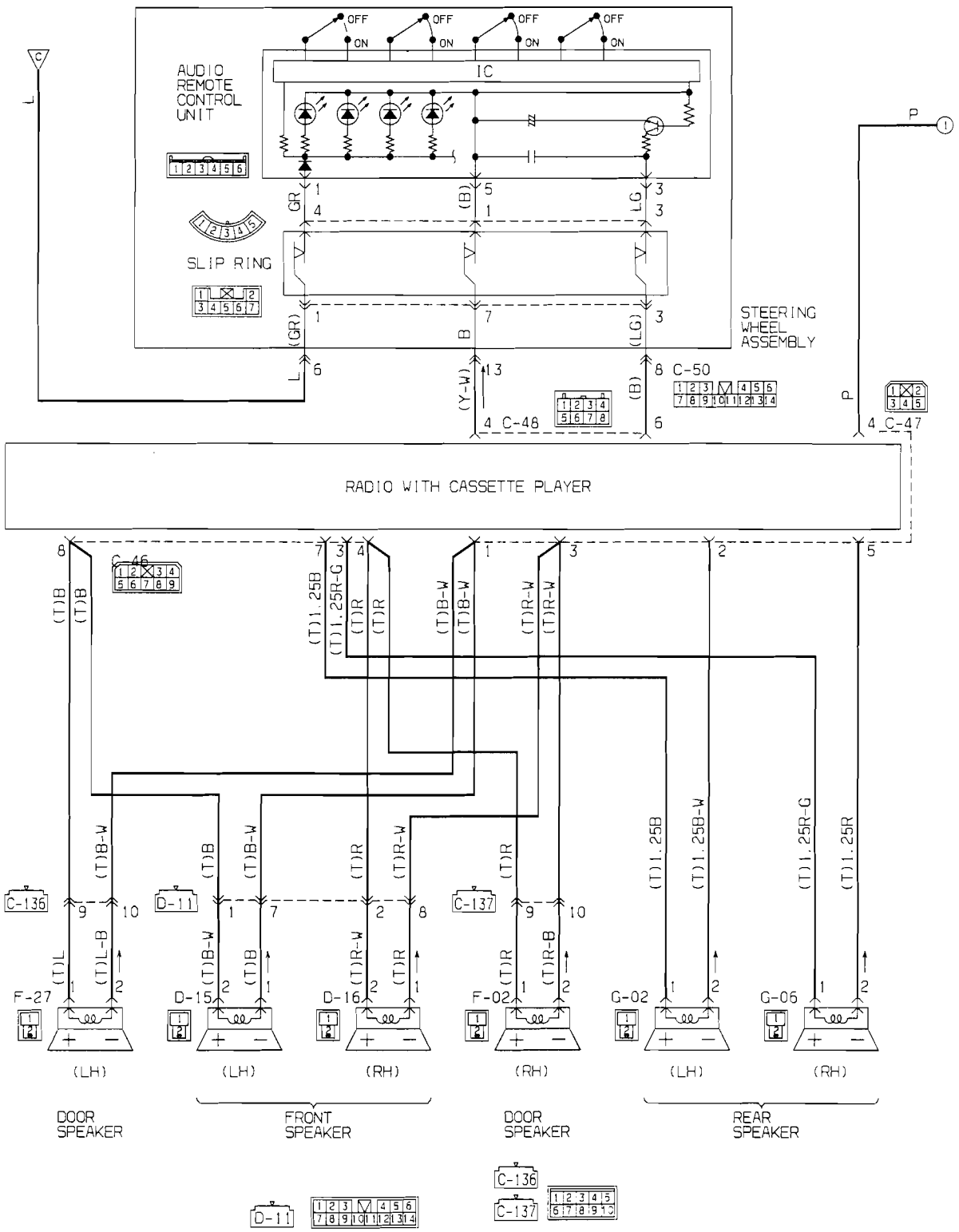


93-111

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

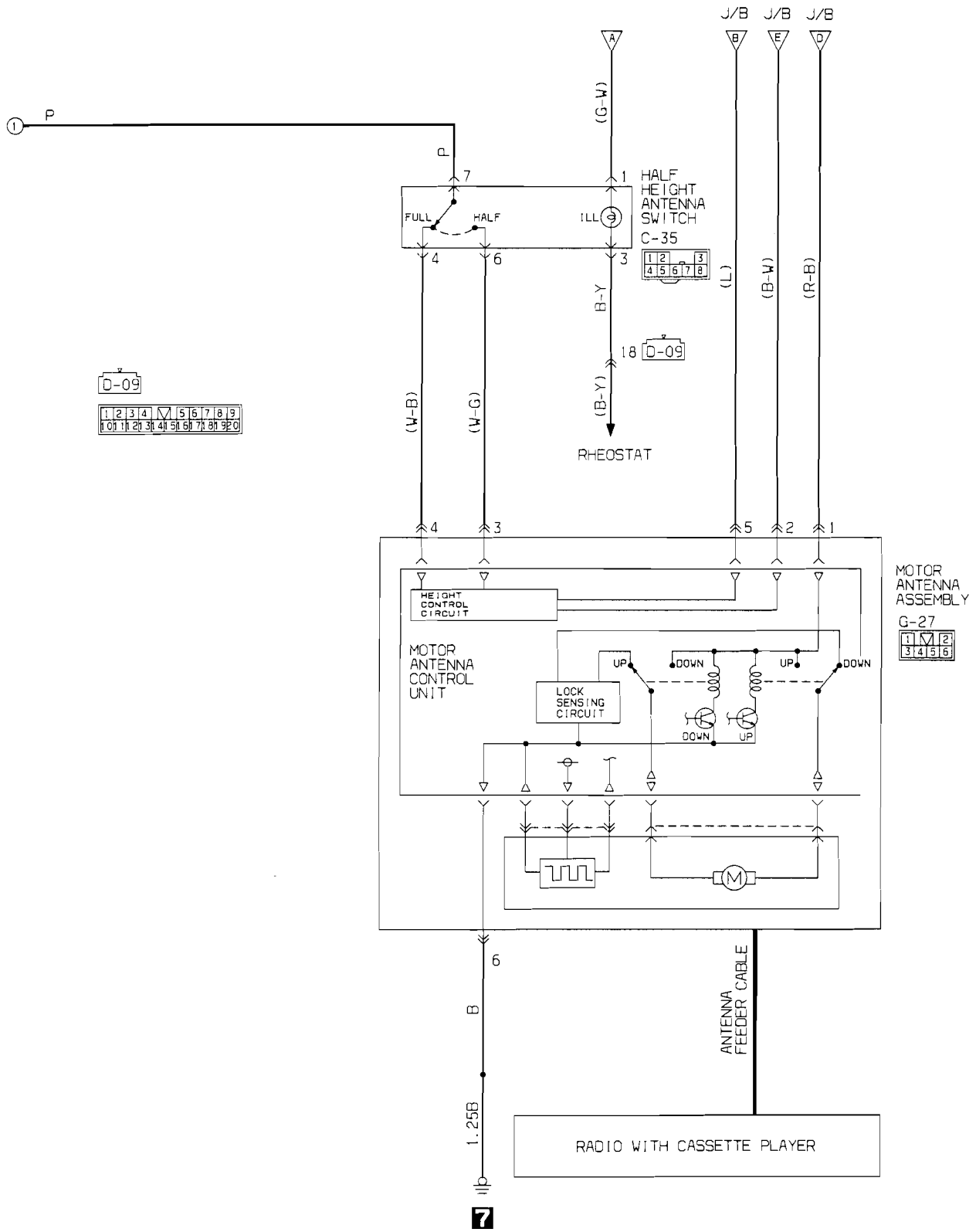
CIRCUIT DIAGRAM – Audio circuit 'X' line w/o SRS (92-93 Models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

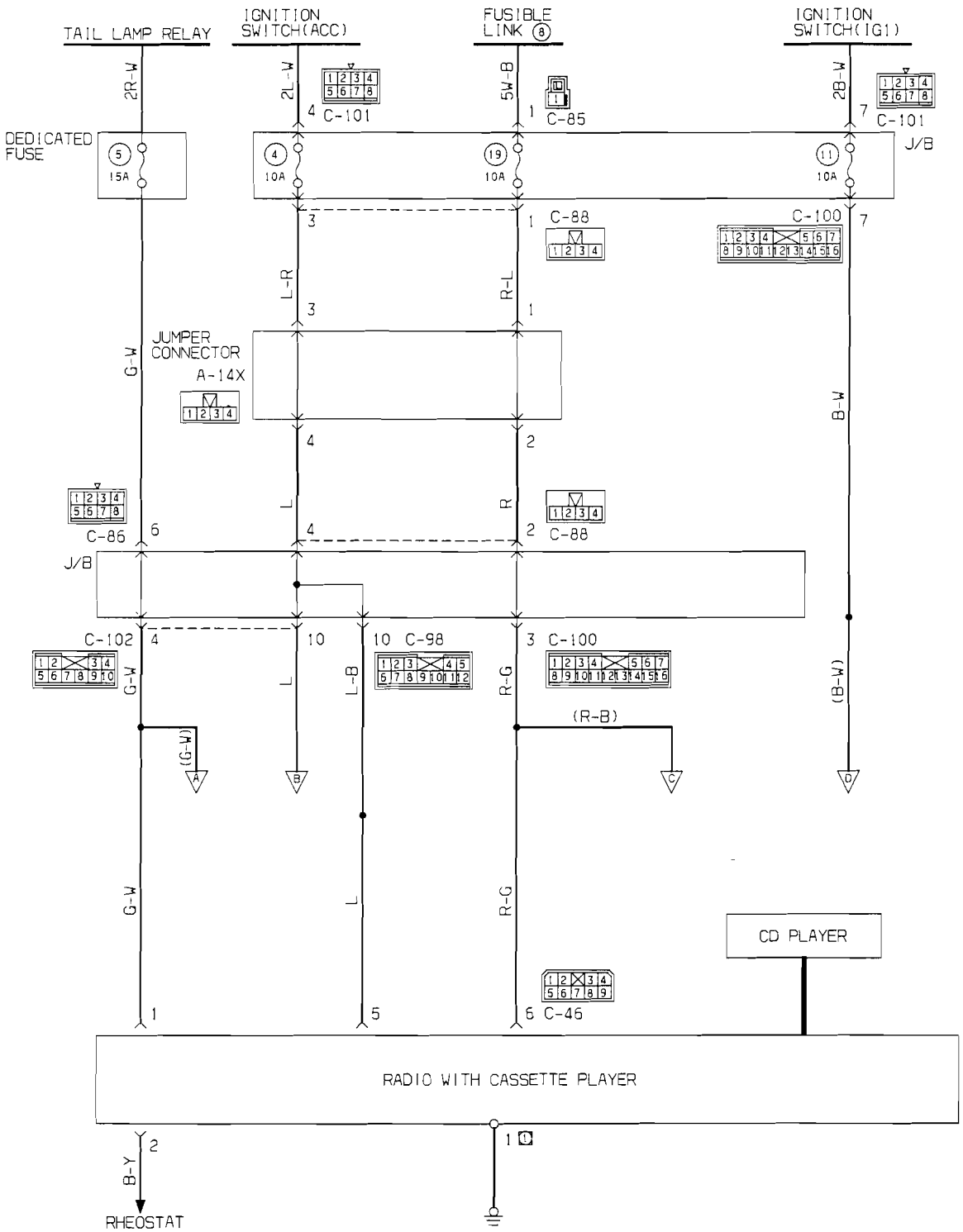
CIRCUIT DIAGRAM – Audio circuit 'X' line w/o SRS (92-93 Models) Continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Audio circuit 6 speakers 94 Models

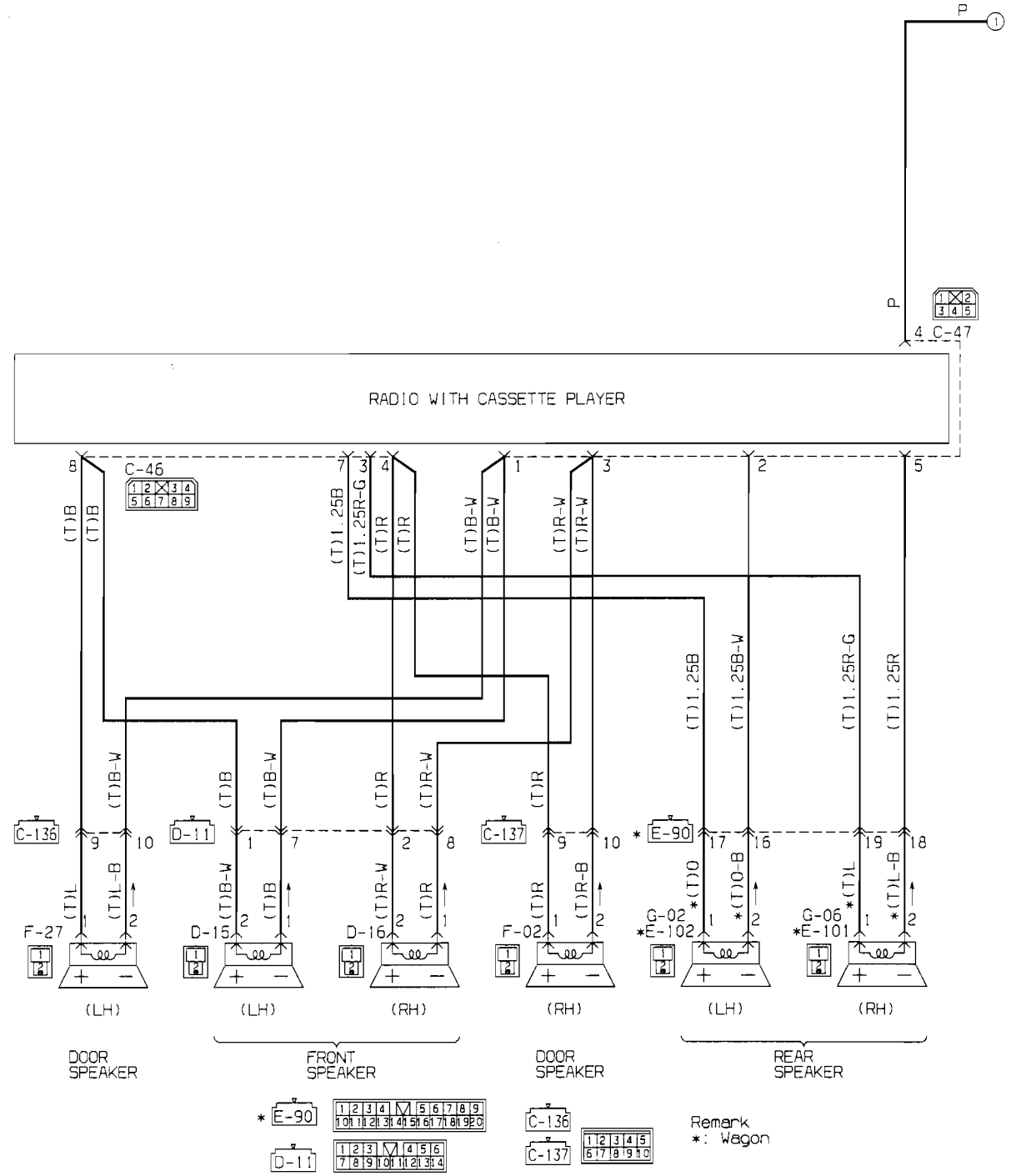


94-111

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

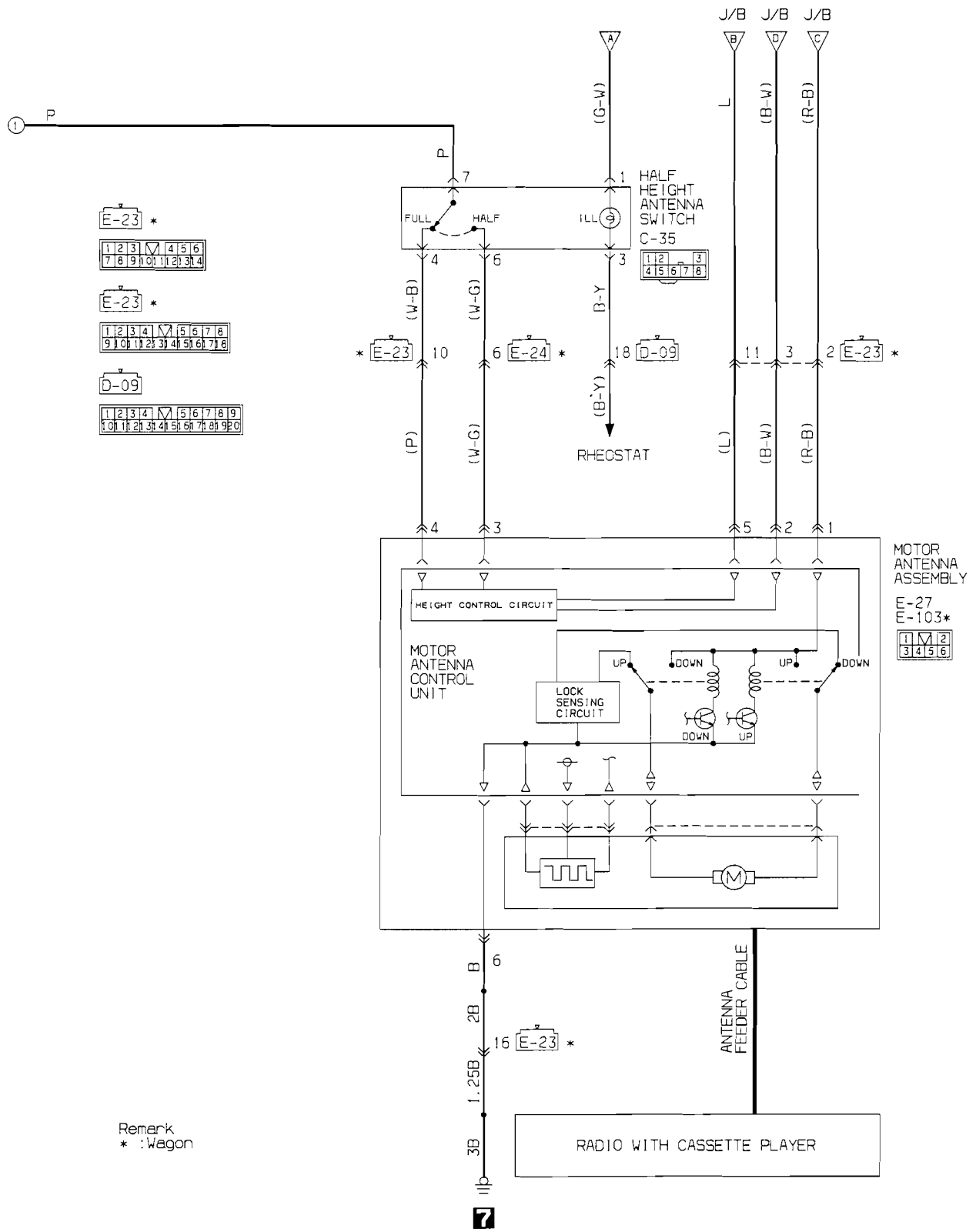
CIRCUIT DIAGRAM – Audio circuit 6 speakers 94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

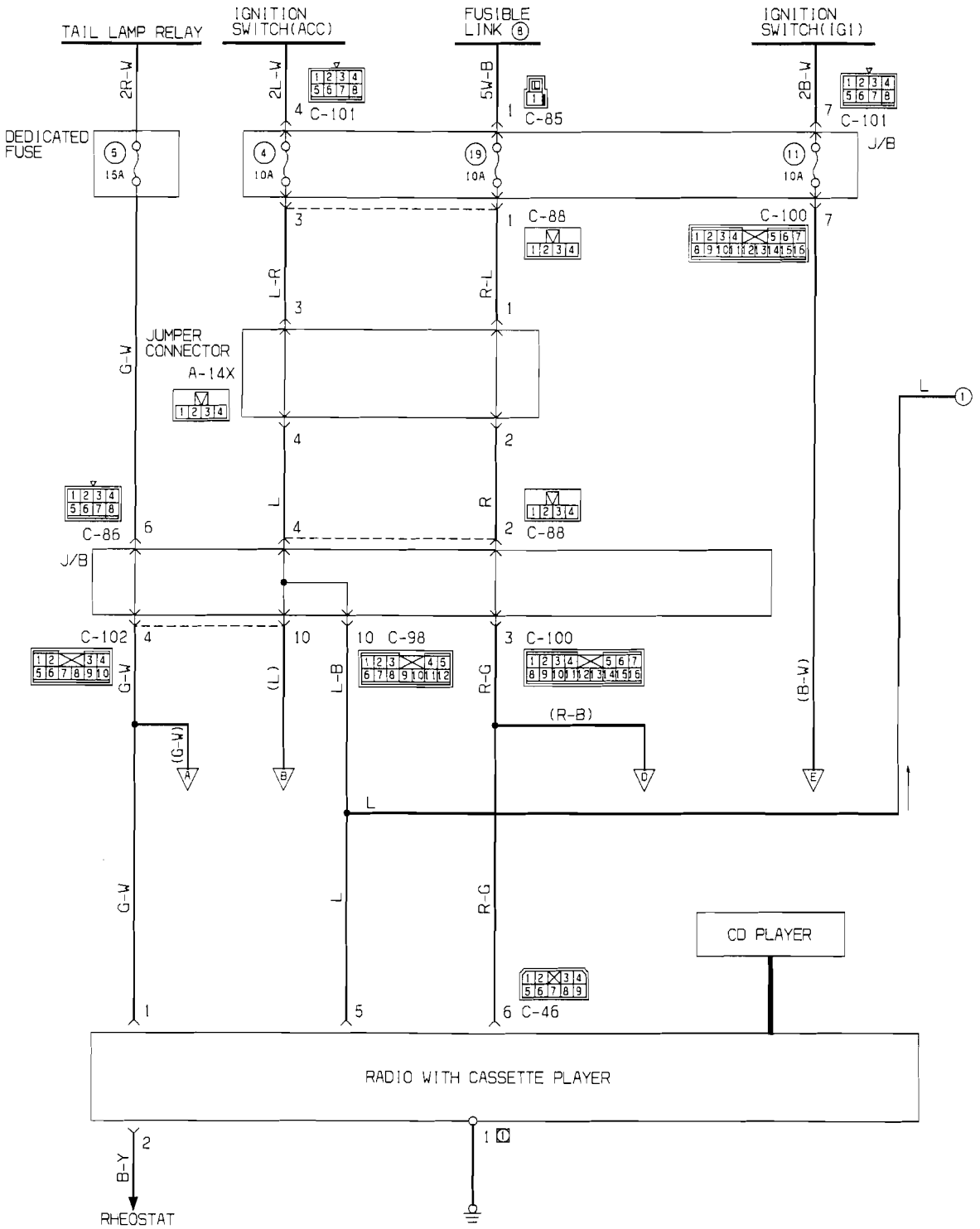
CIRCUIT DIAGRAM – Audio circuit 6 speakers 94 Models Continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

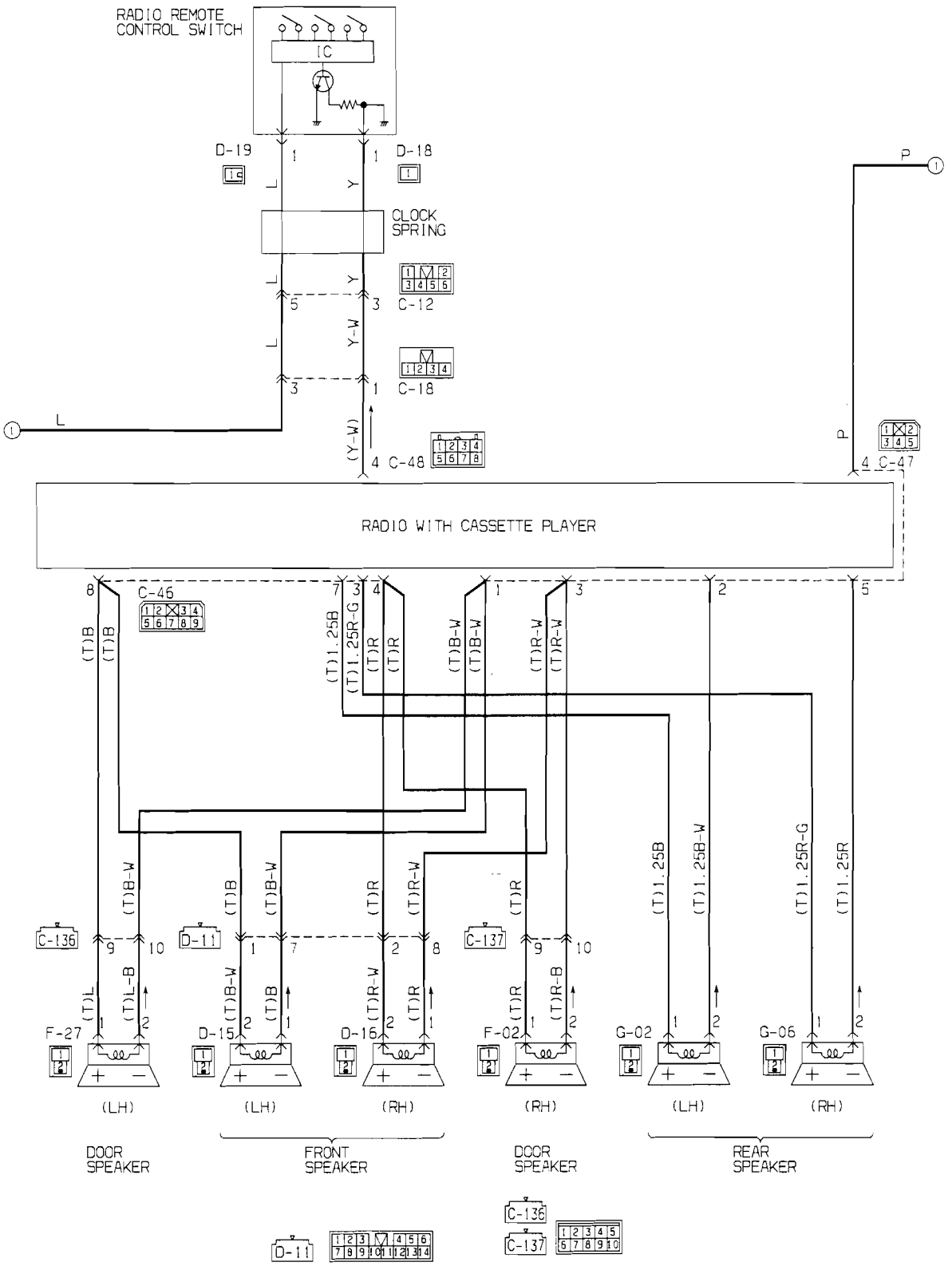
CIRCUIT DIAGRAM – Audio circuit 'X' line w/- SRS 94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

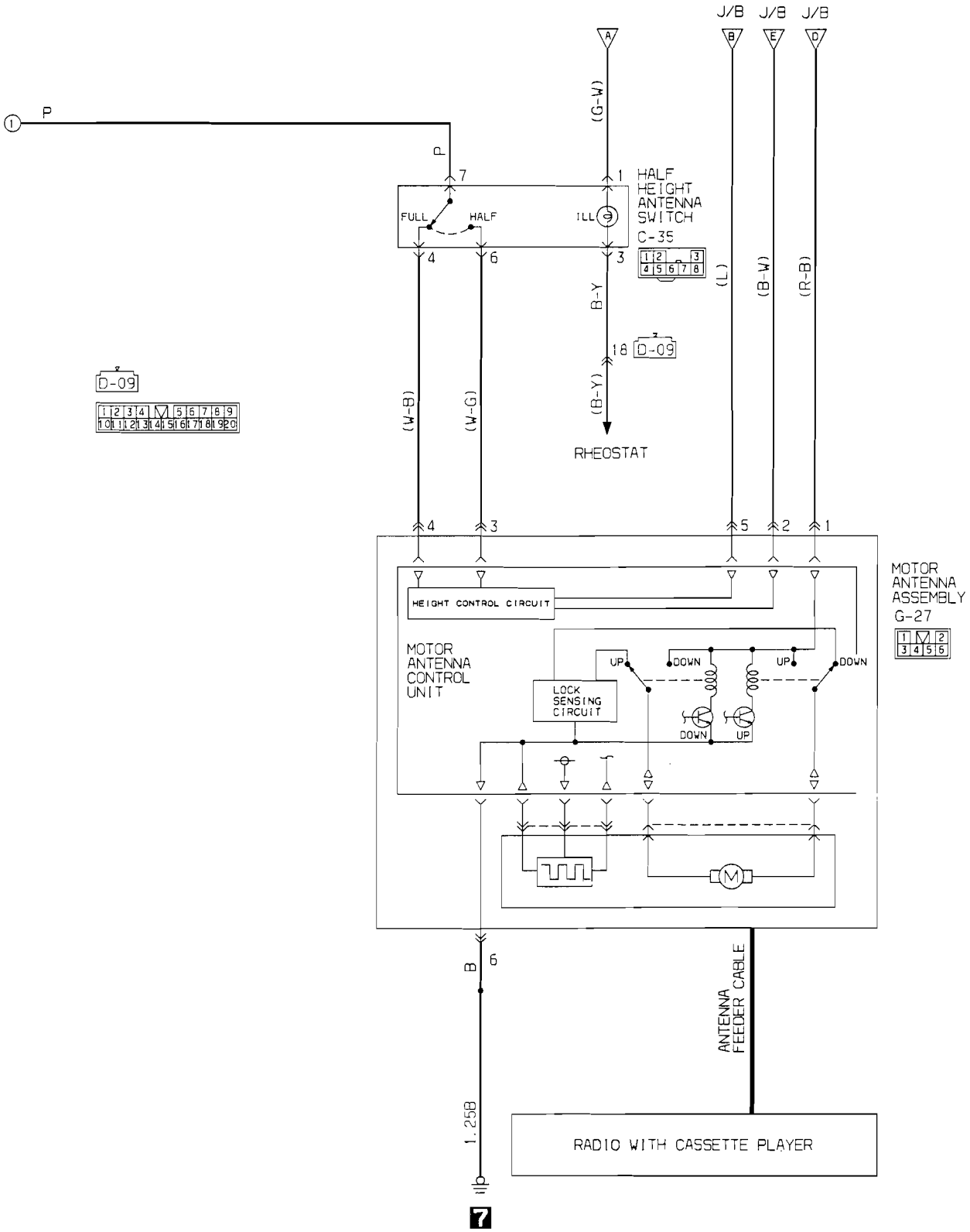
CIRCUIT DIAGRAM – Audio circuit 'X' line w/- SRS 94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

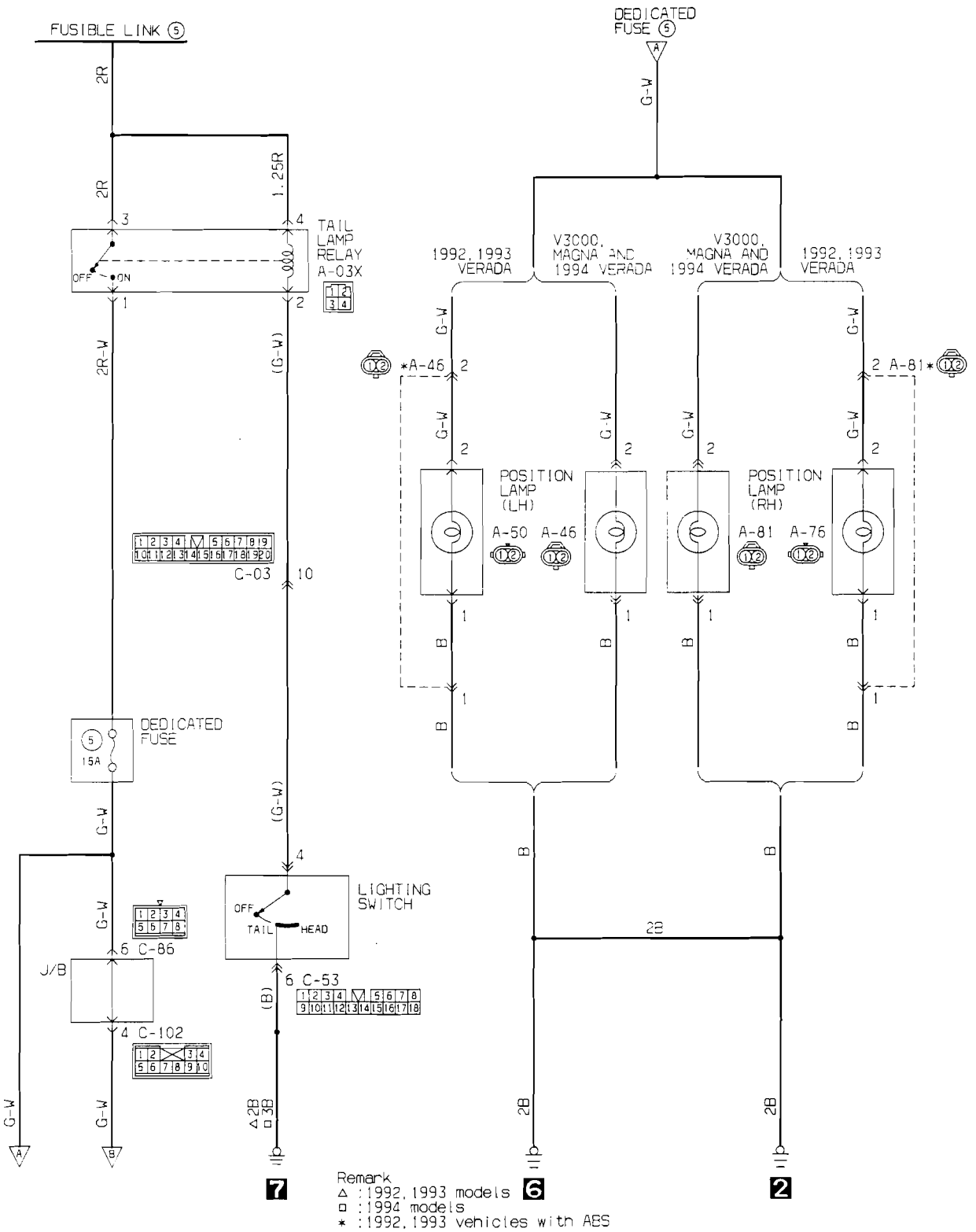
CIRCUIT DIAGRAM – Audio circuit 'X' line w/- SRS 94 Models Continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Tail, position & licence plate circuit (sedan) 91-94 Models

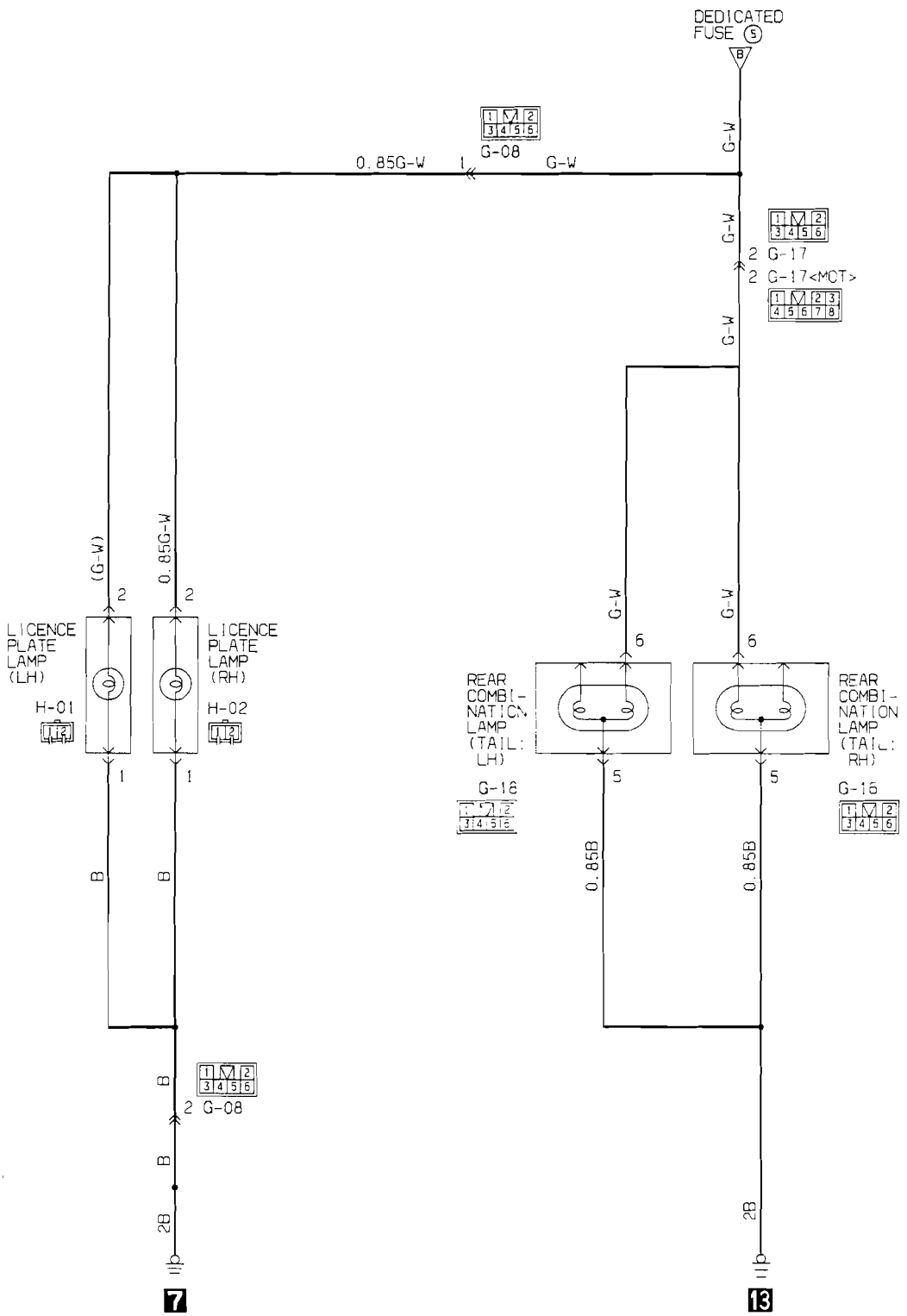


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Tail, position & licence plate circuit (sedan) 91-94 Models

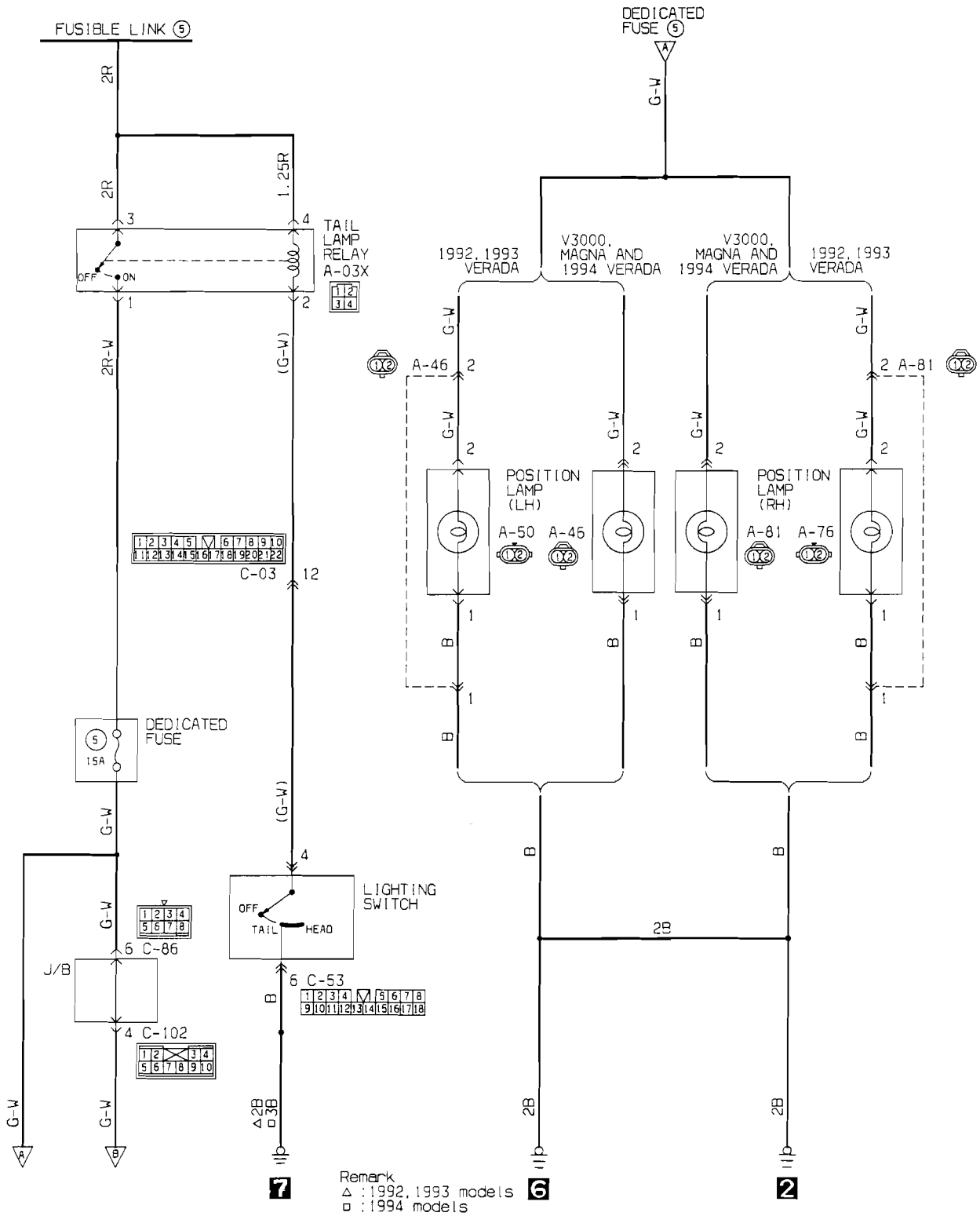


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Tail, position & licence plate lamp circuit (wagon) 92-94 Models

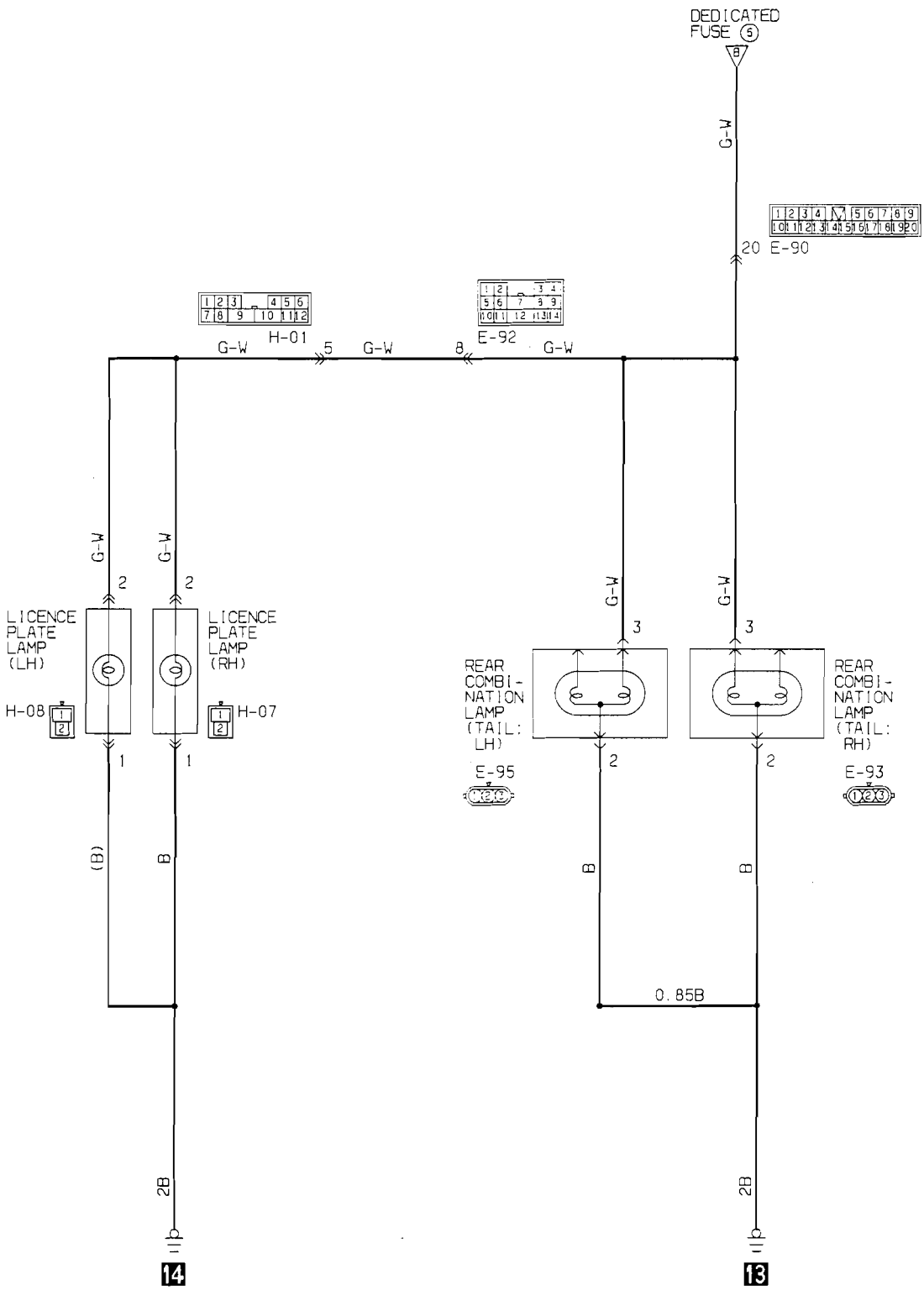


93-113

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

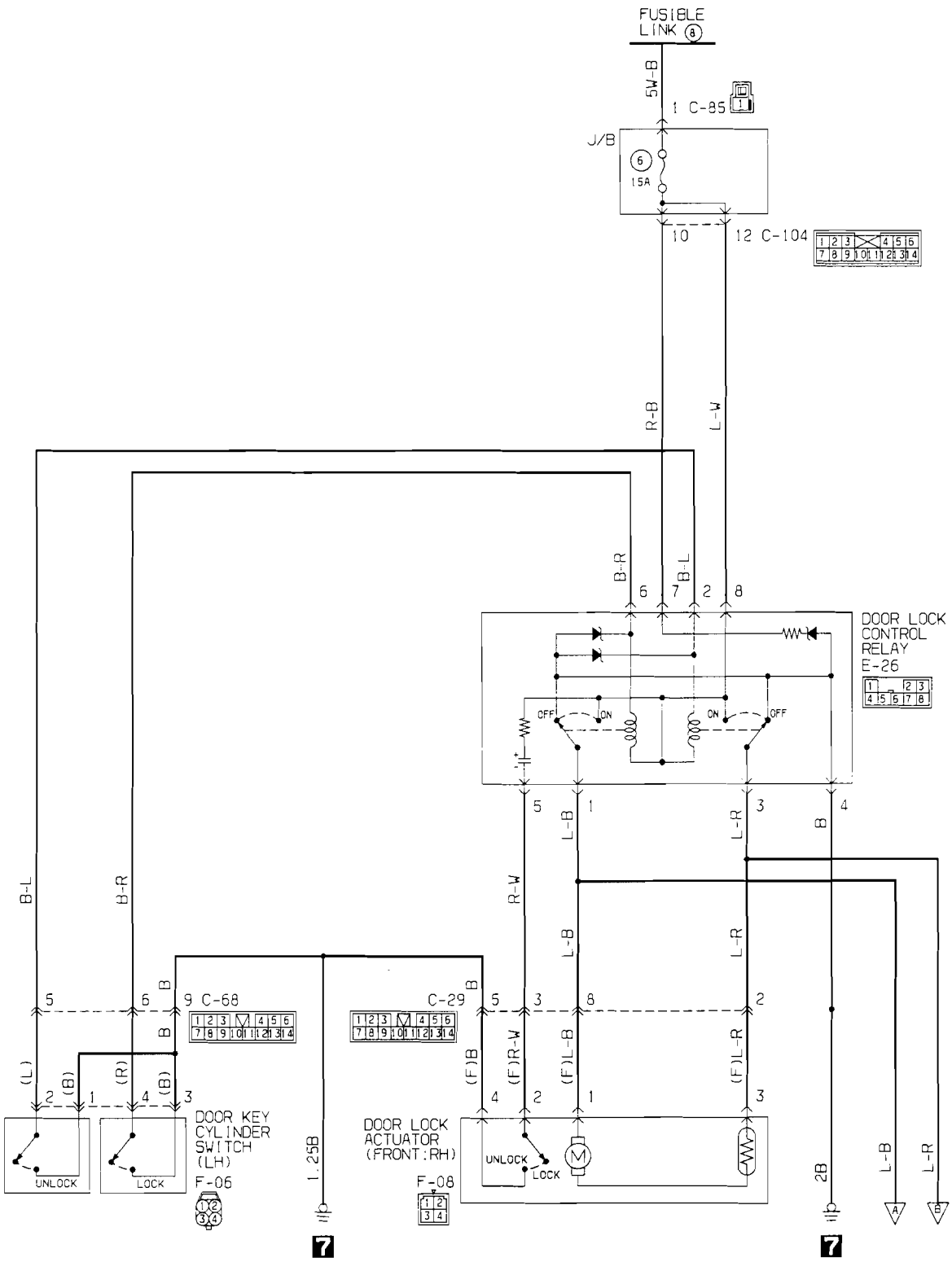
CIRCUIT DIAGRAM – Tail, position & licence plate lamp circuit (wagon) 92-94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Central door locking (H,D,P 91-94 Models)

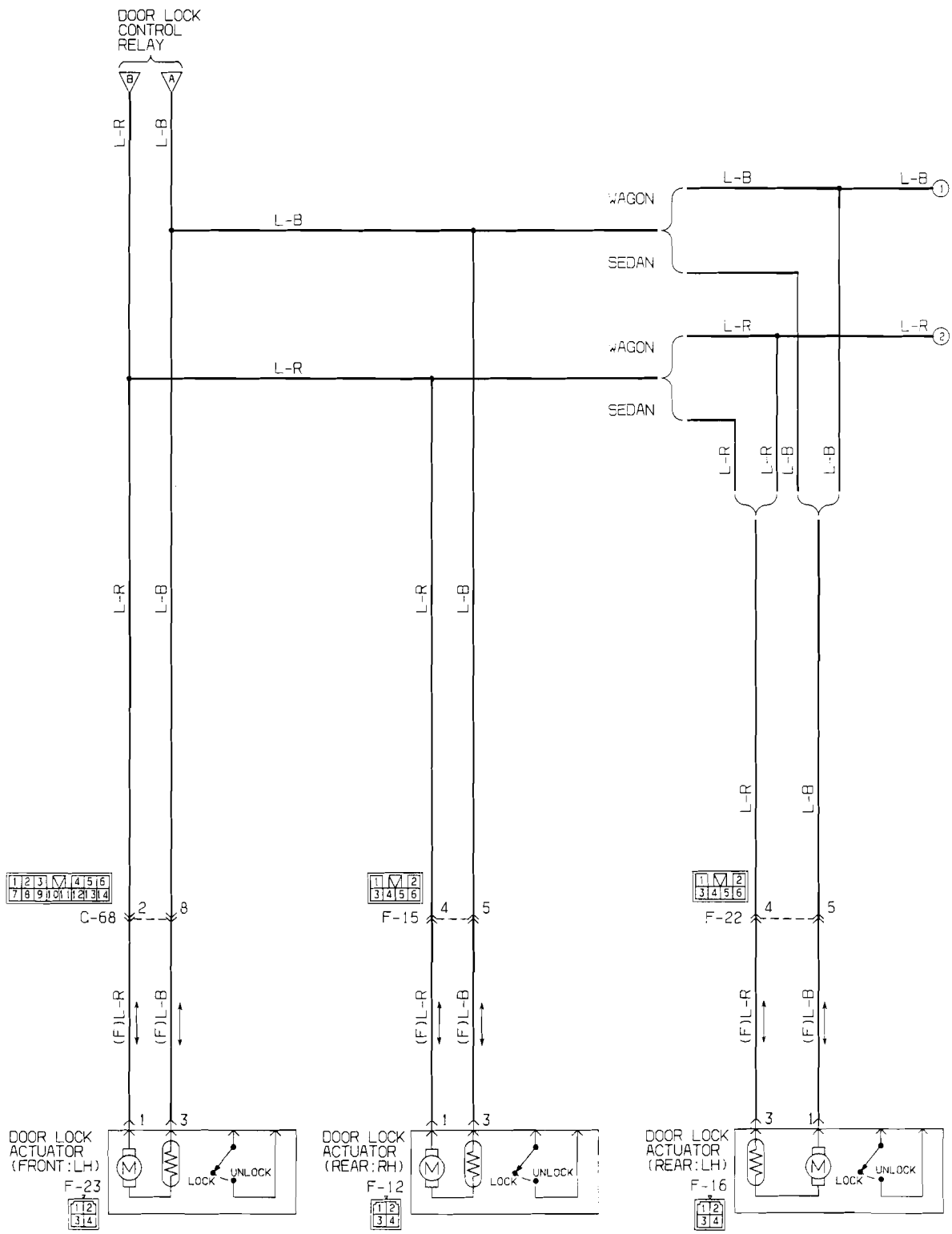


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Central door locking (H,D,P 91-94 Models)

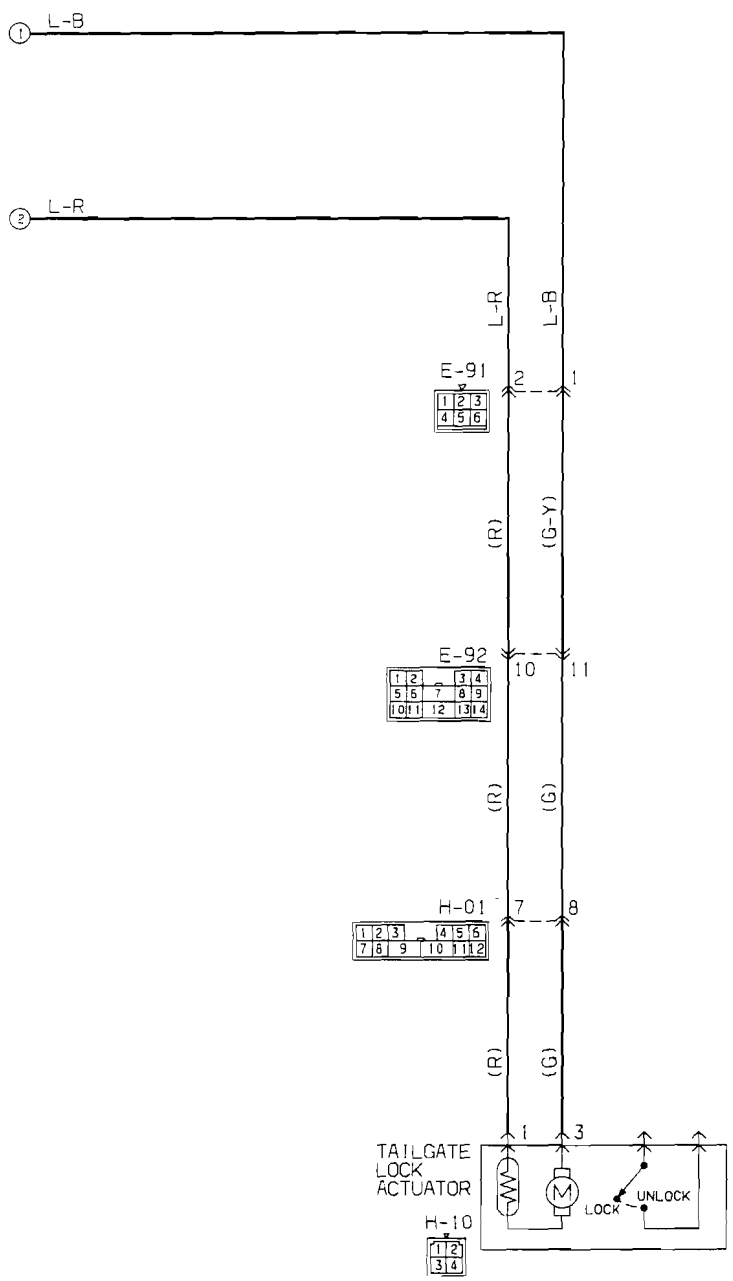


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Central door locking (H,D,P 91-94 Models) Cont;

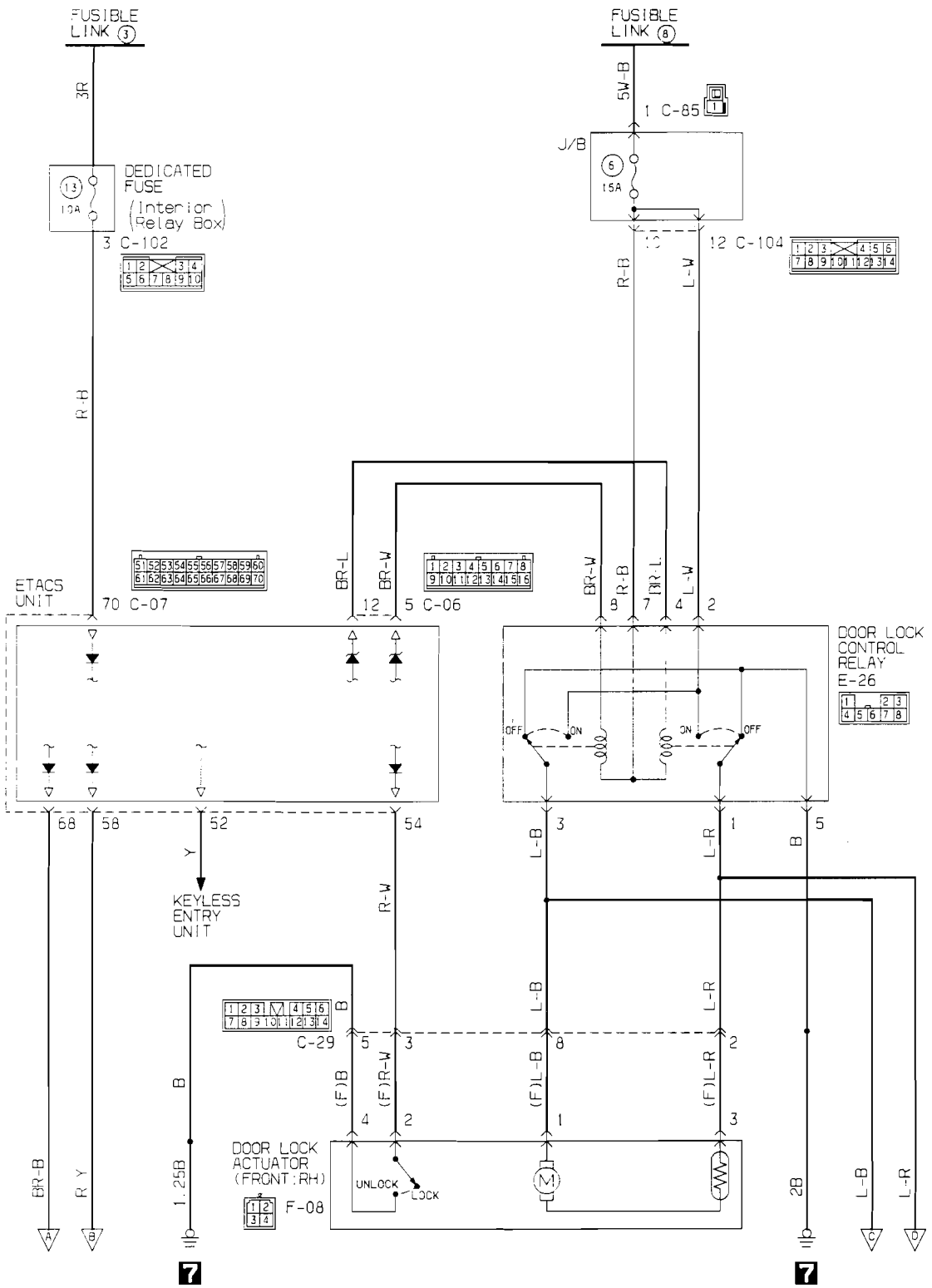


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Central door locking 'X' line (91-93 Models)

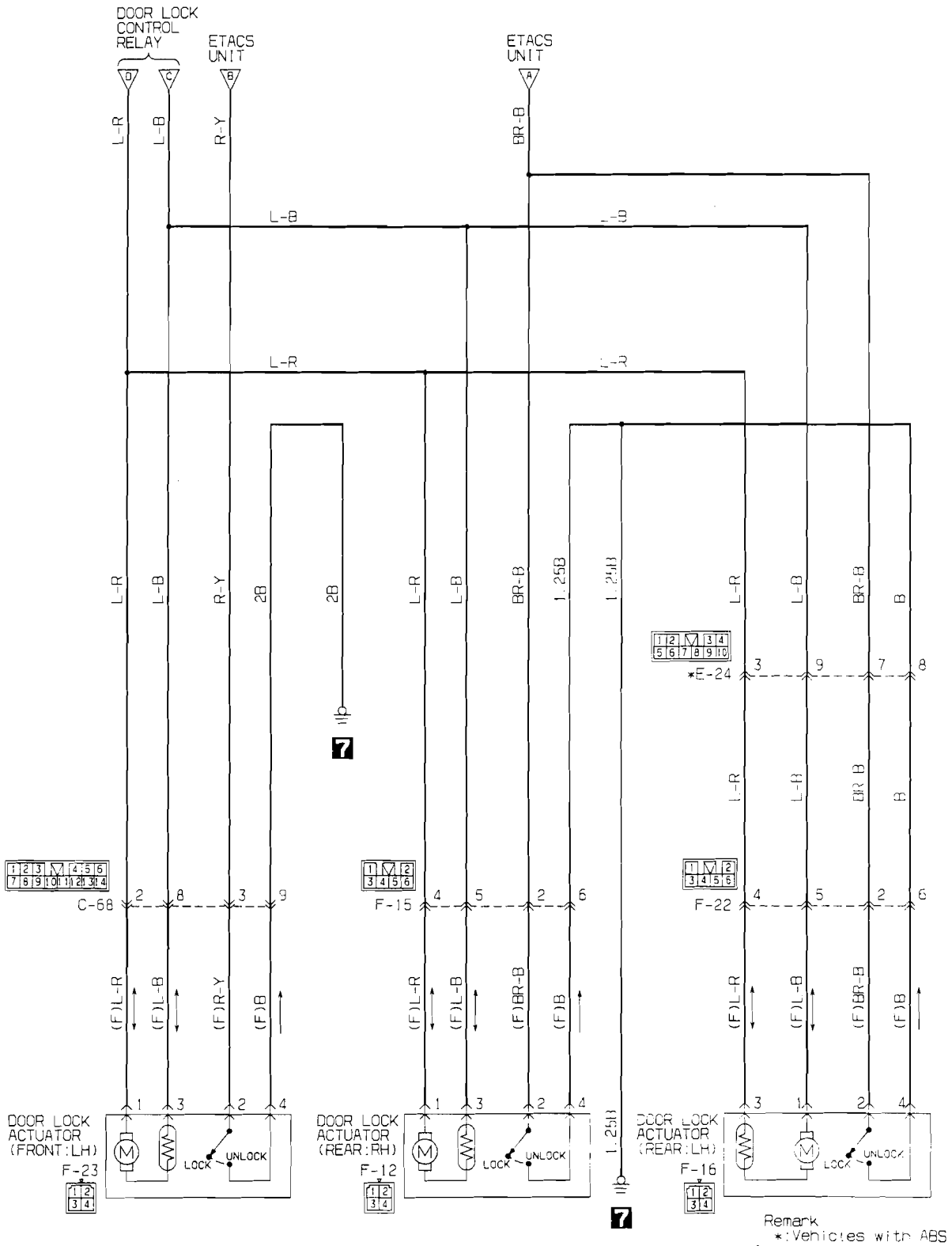


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Central door locking 'X' line (91-93 Models)

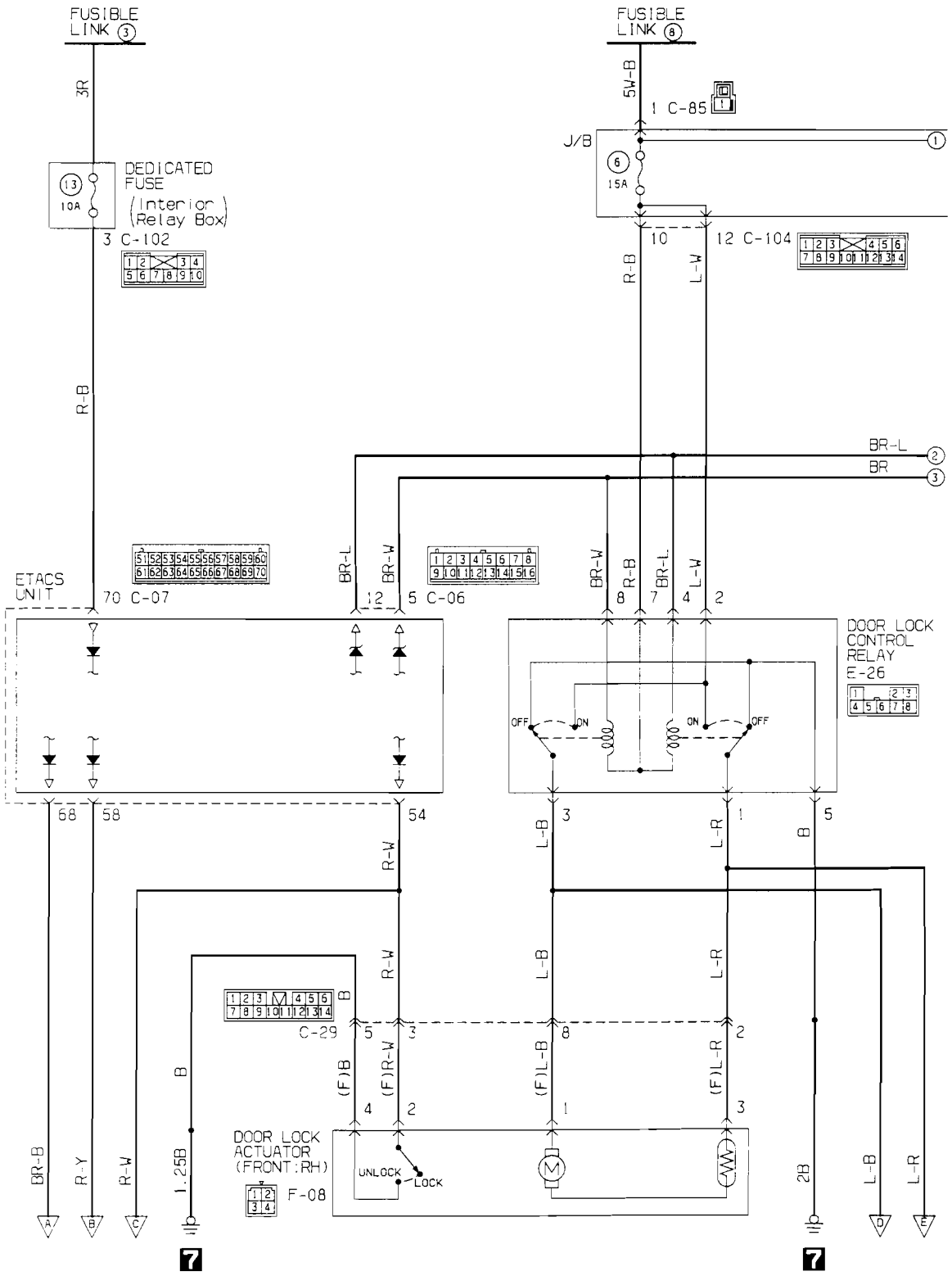


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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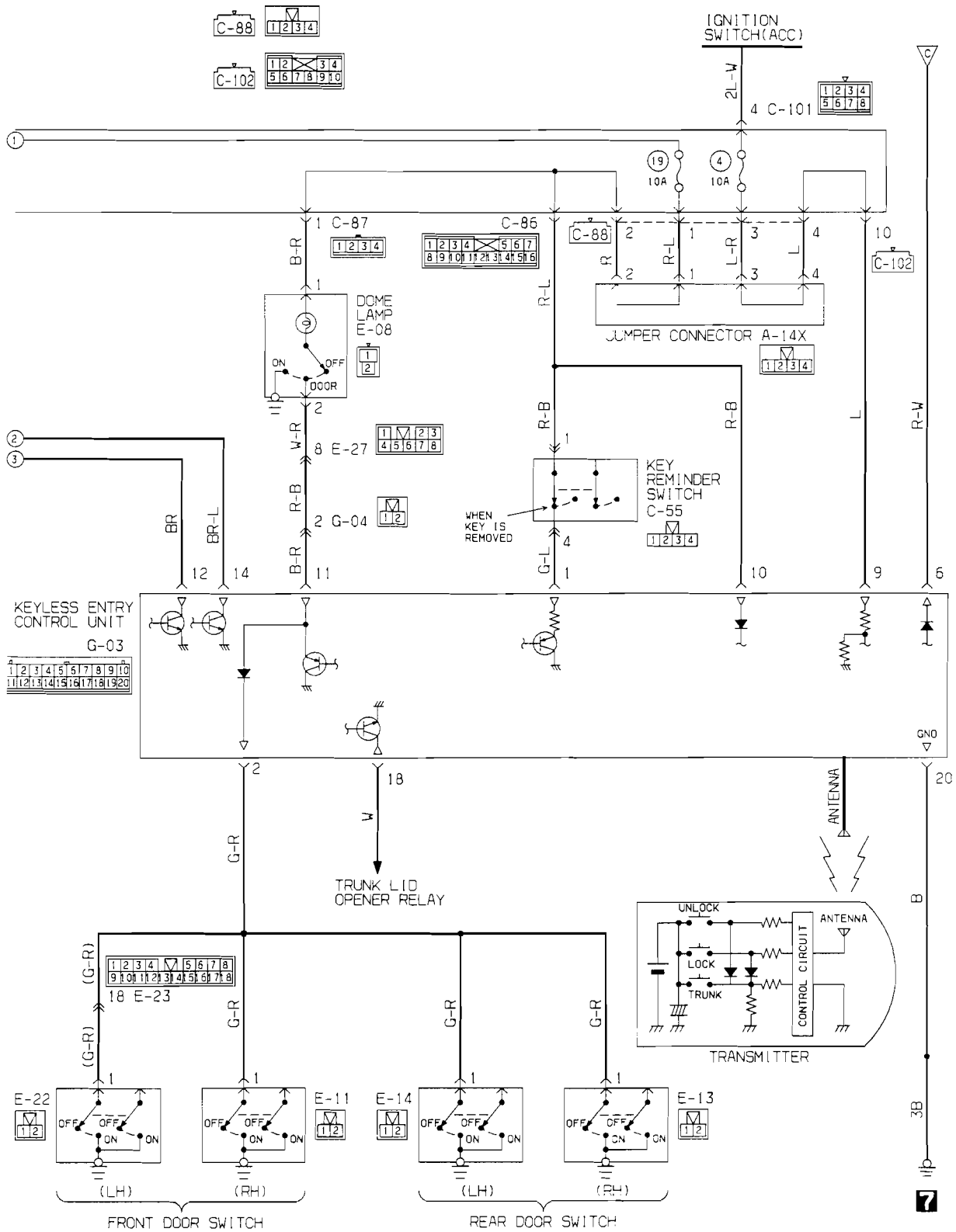
CIRCUIT DIAGRAM – Central door locking circuit 'X' line (94 models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

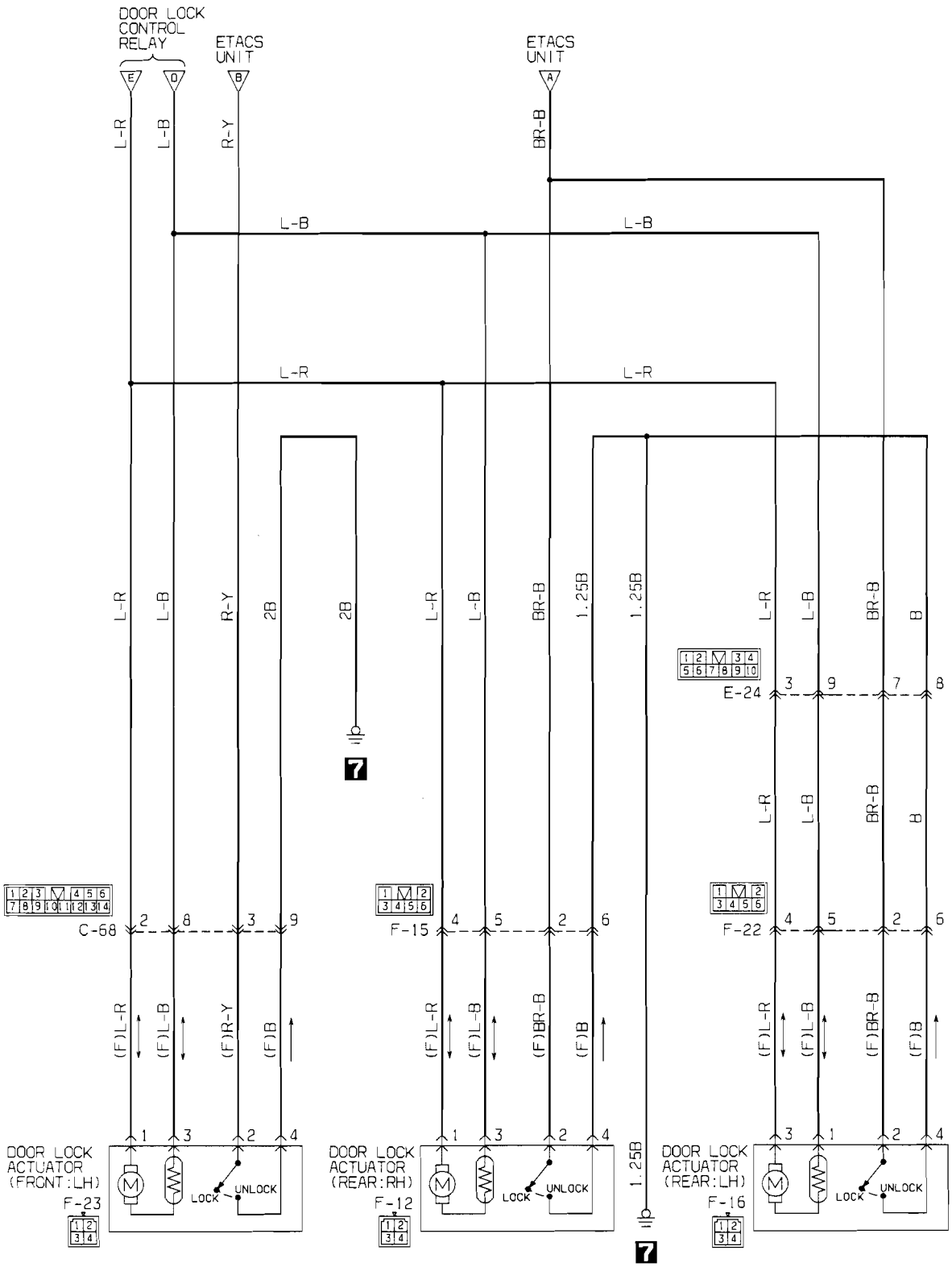
CIRCUIT DIAGRAM – Central door locking circuit 'X' line (94 models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Central door locking circuit 'X' line (94 models) Continued

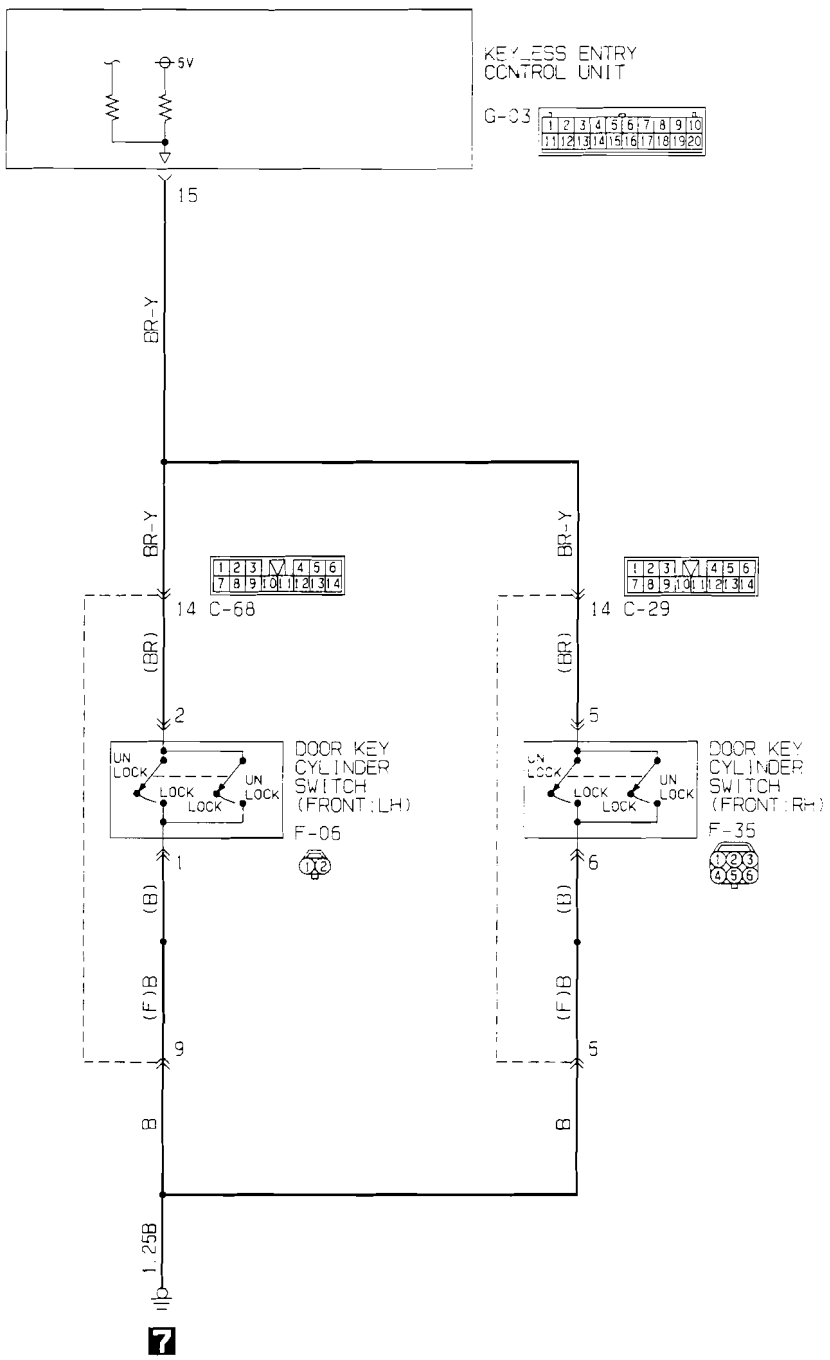


94-116-A

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

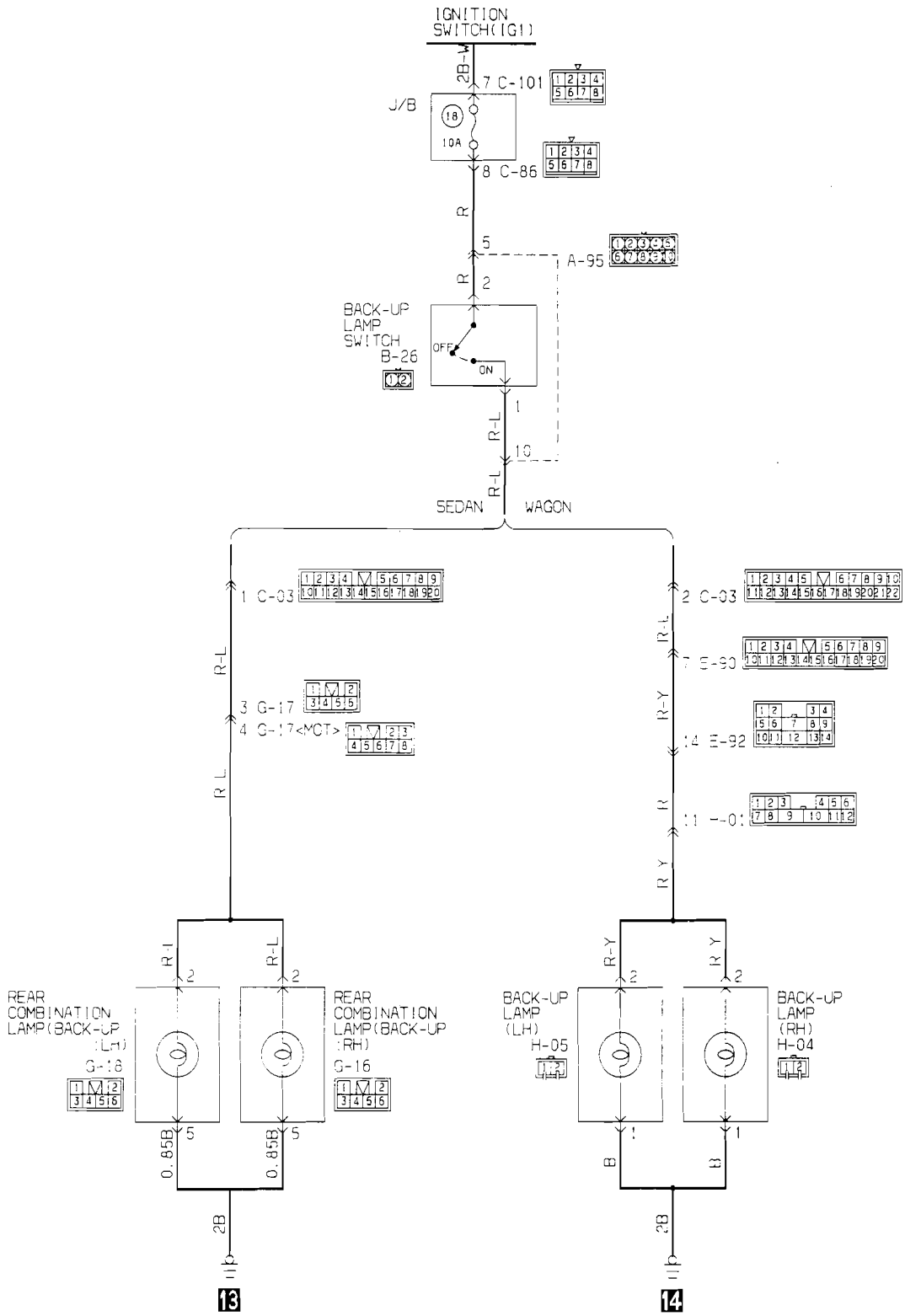
CIRCUIT DIAGRAM – Central door locking circuit 'X' line (94 models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Back-up lamp circuit M/T 91-94 Models

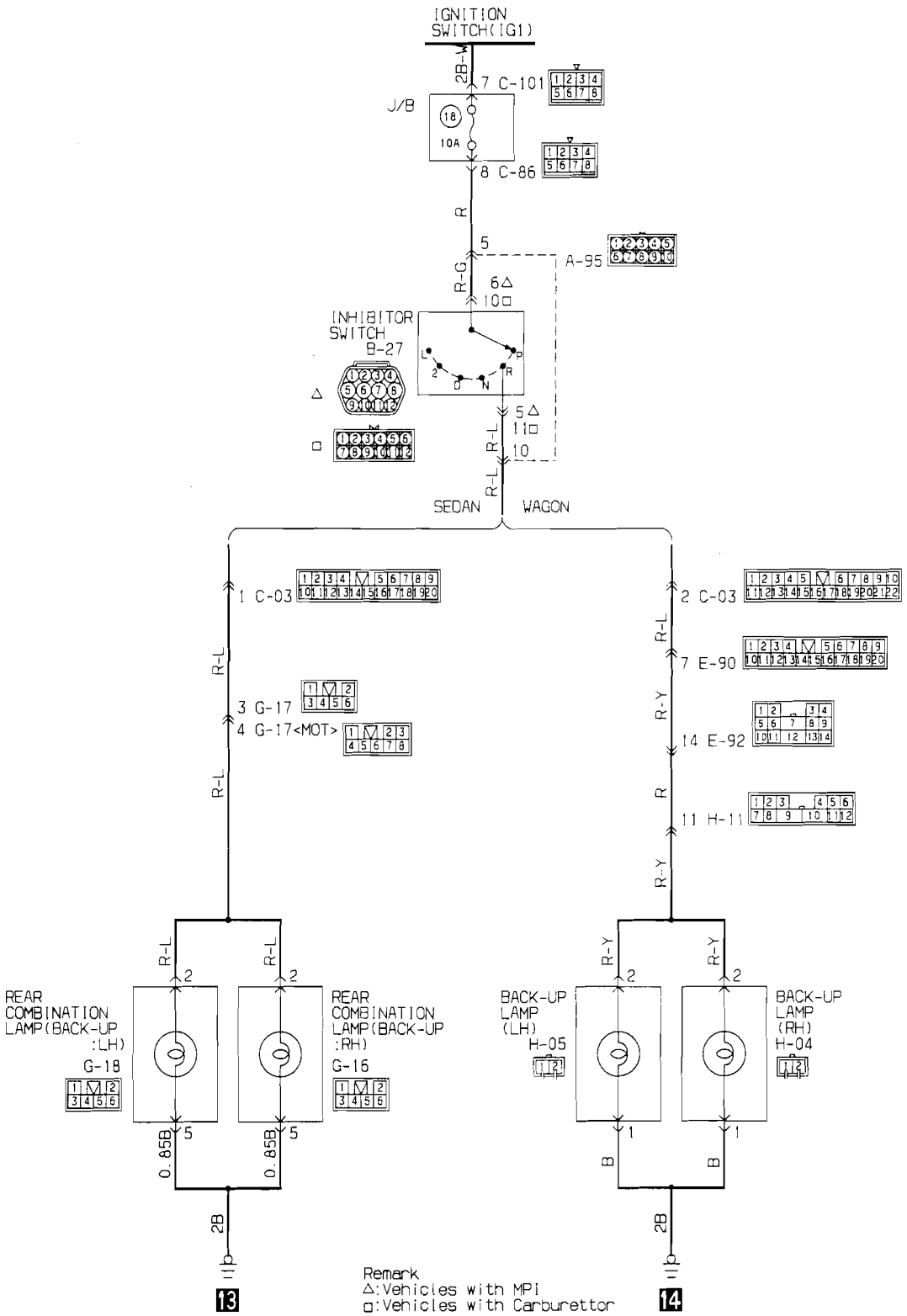


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Back-up lamp circuit A/T 91-94 Models



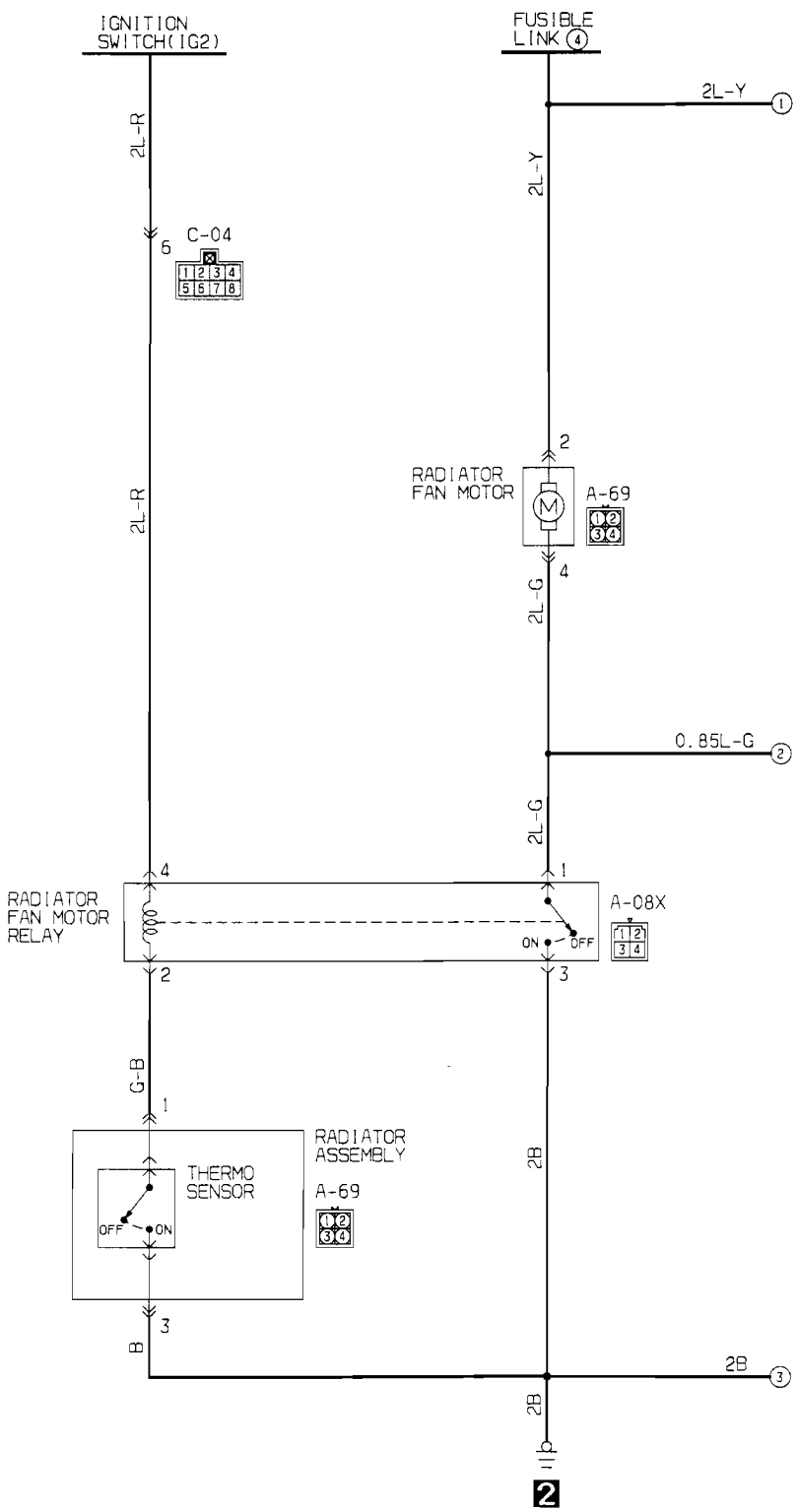
93-118

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Cooling circuit 91-93 Models



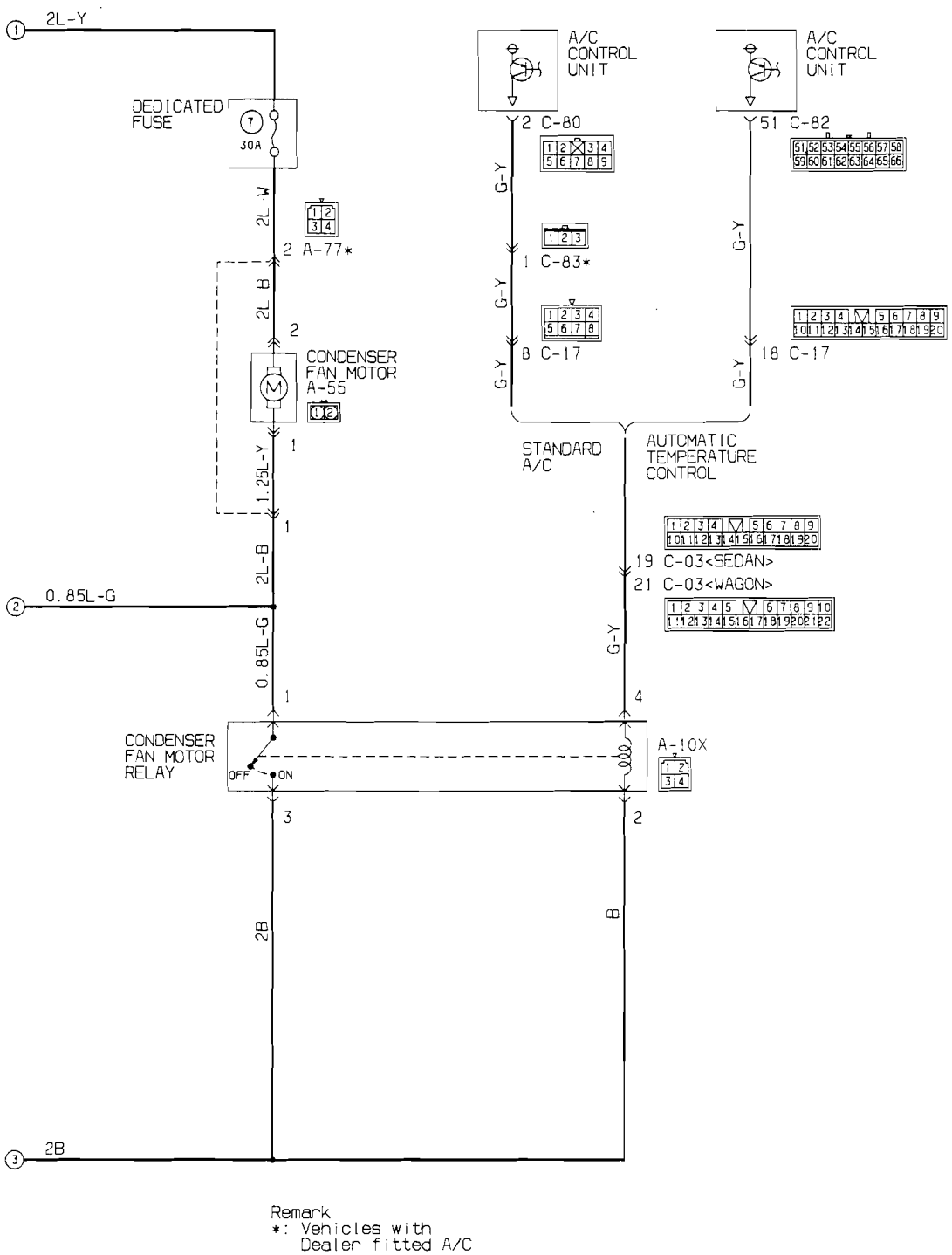
93-121

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Cooling circuit 91-93 Models

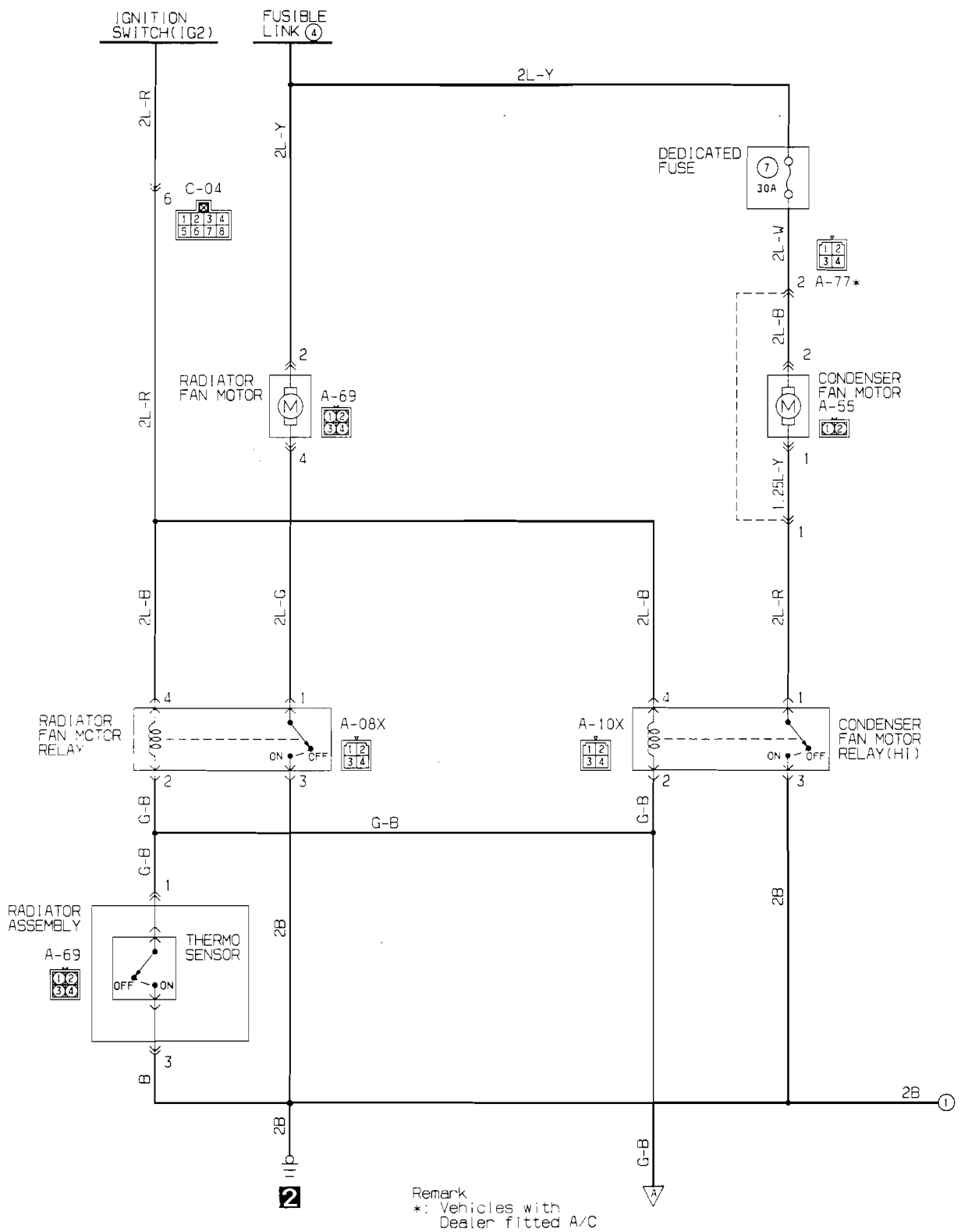


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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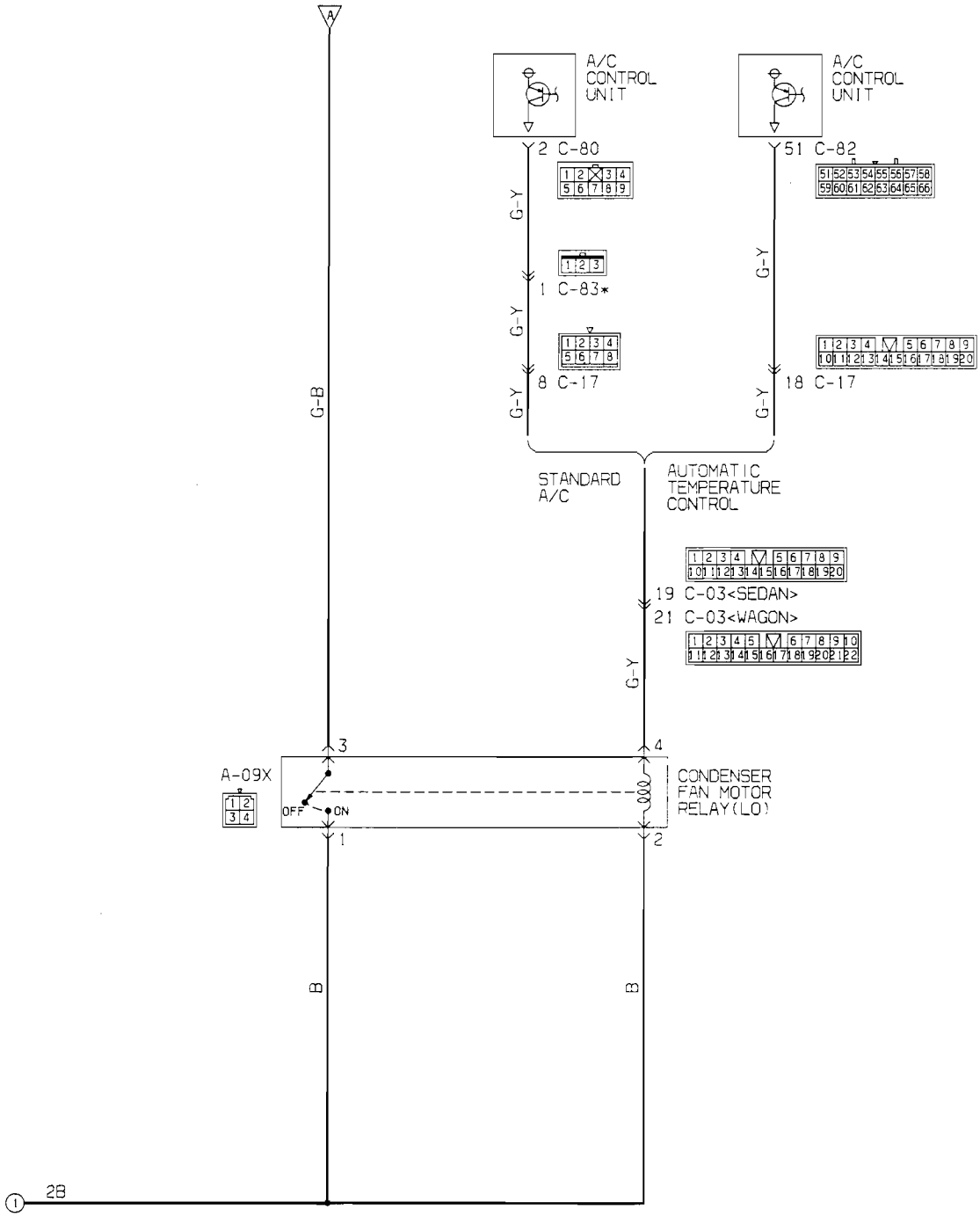
CIRCUIT DIAGRAM – Cooling circuit 94 Models



Wire colour code

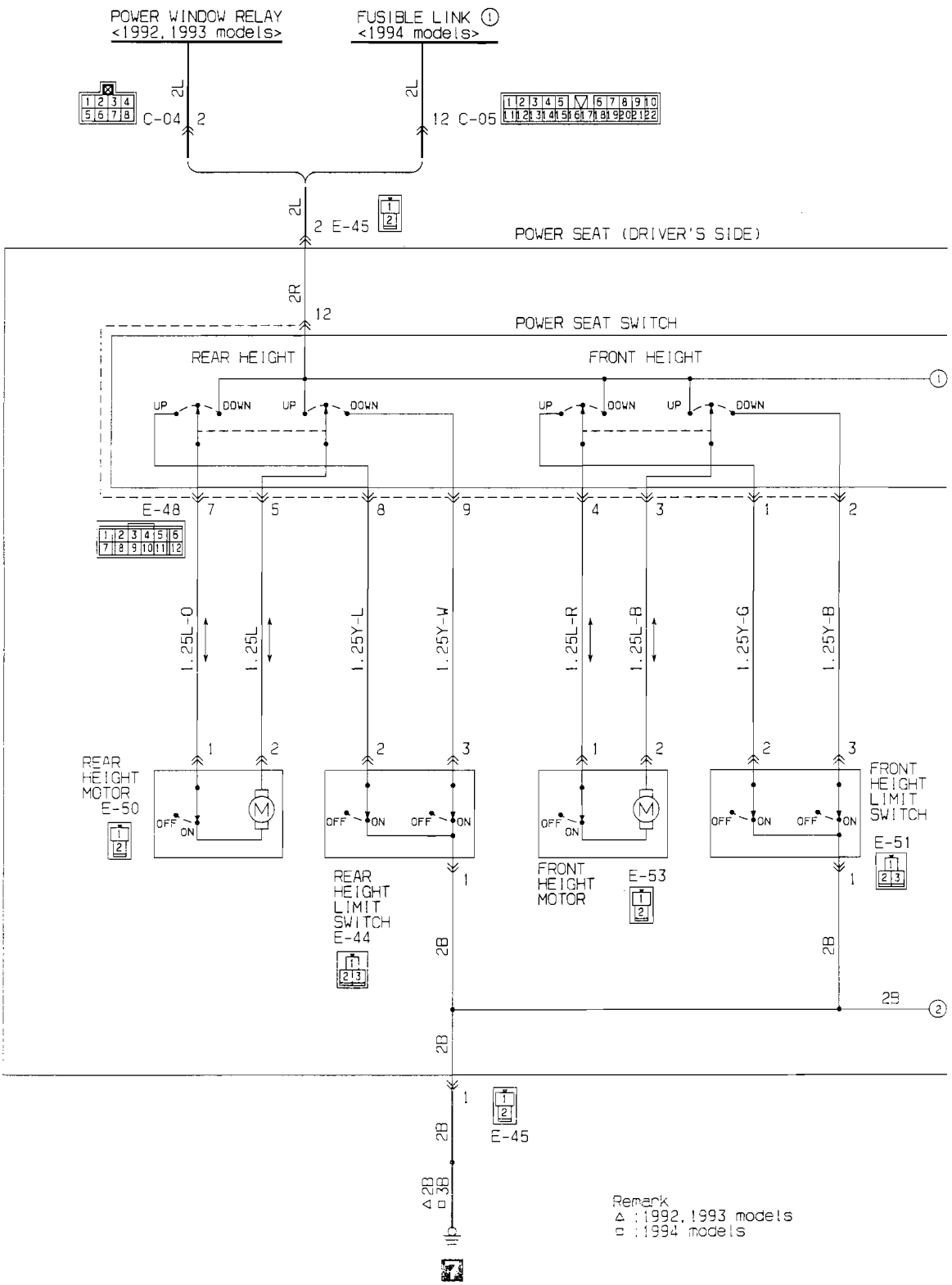
B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Cooling circuit 94 Models



Wire colour code					
B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Power seat circuit 'X' line 91-94 Models

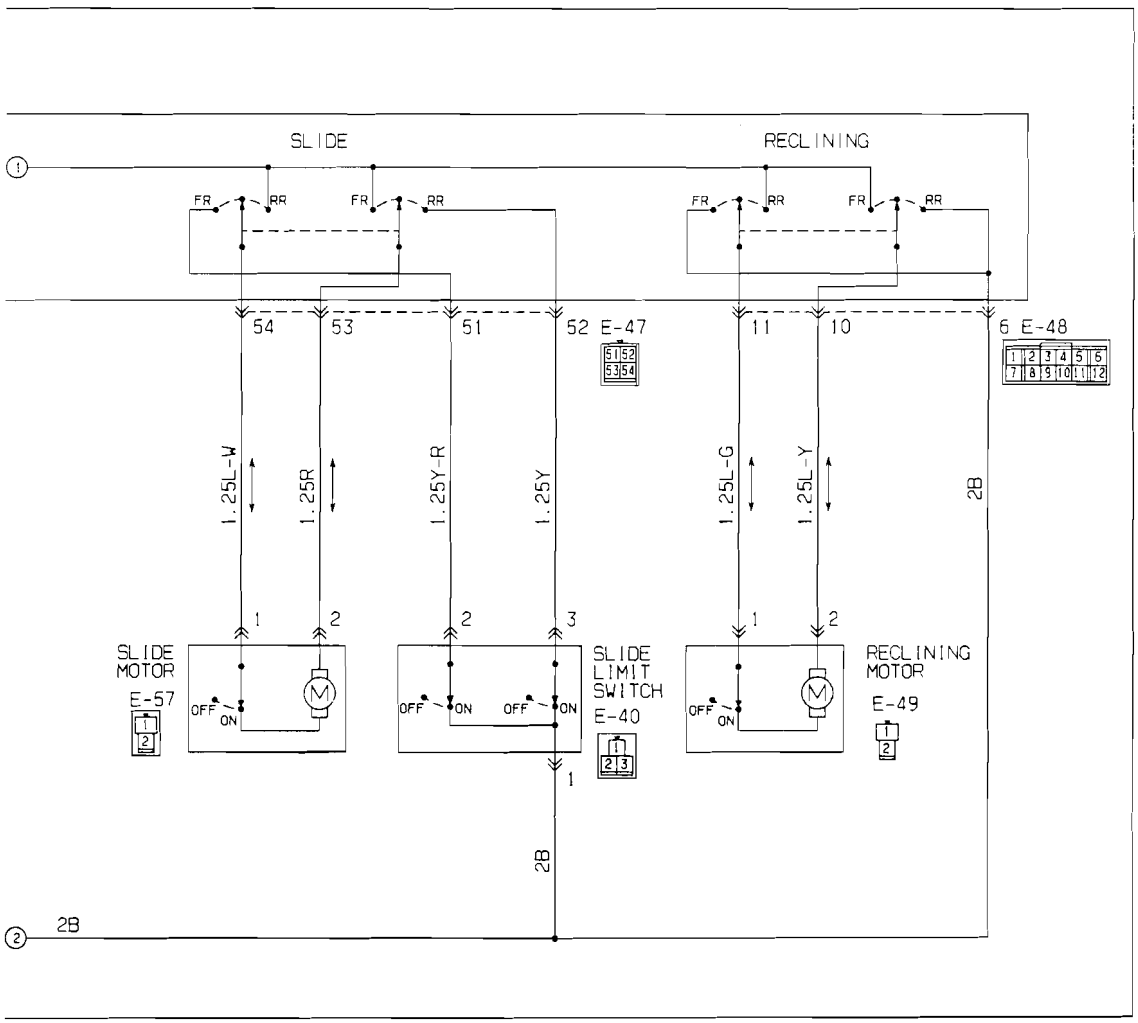


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Power seat circuit 'X' line 91-94 Models

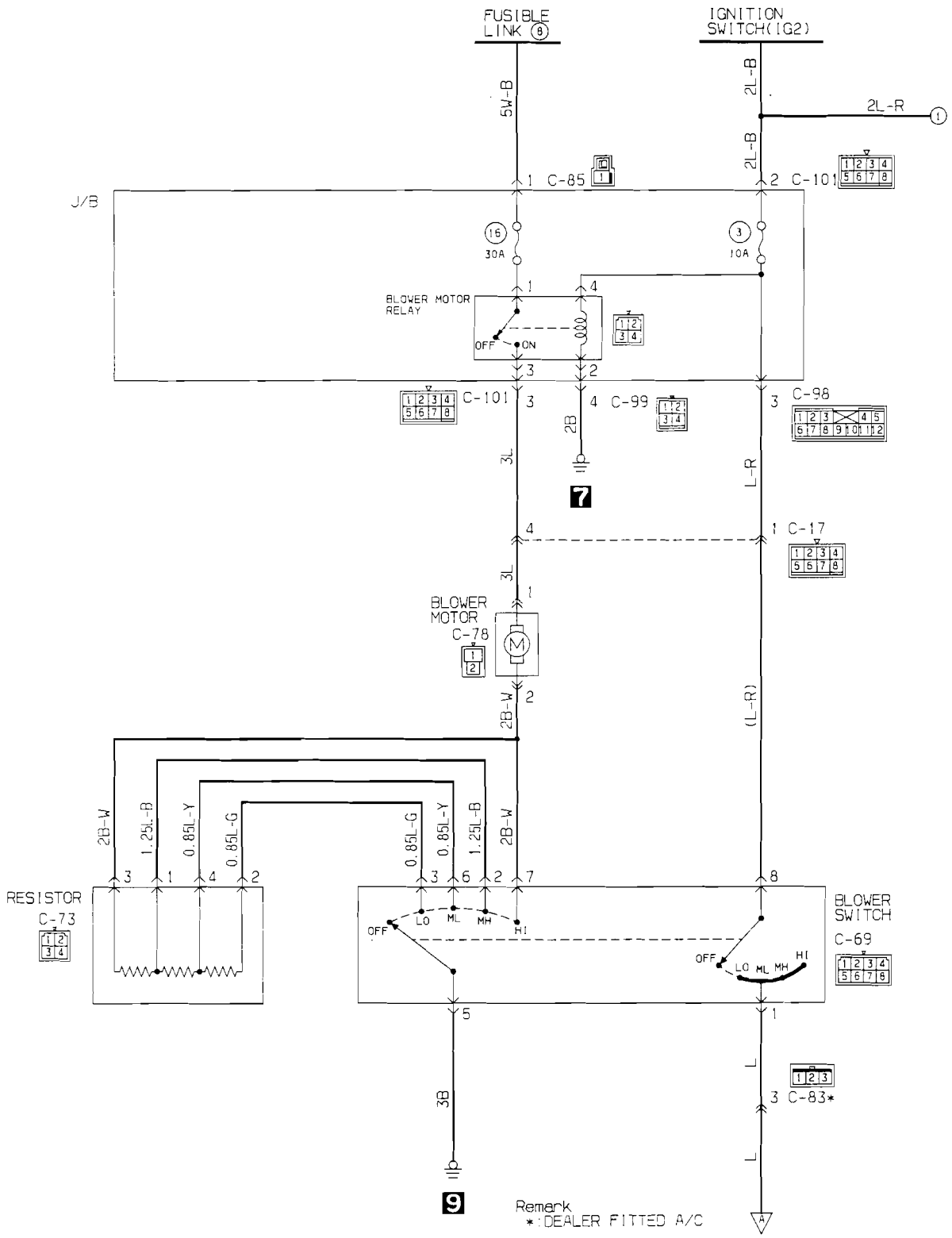


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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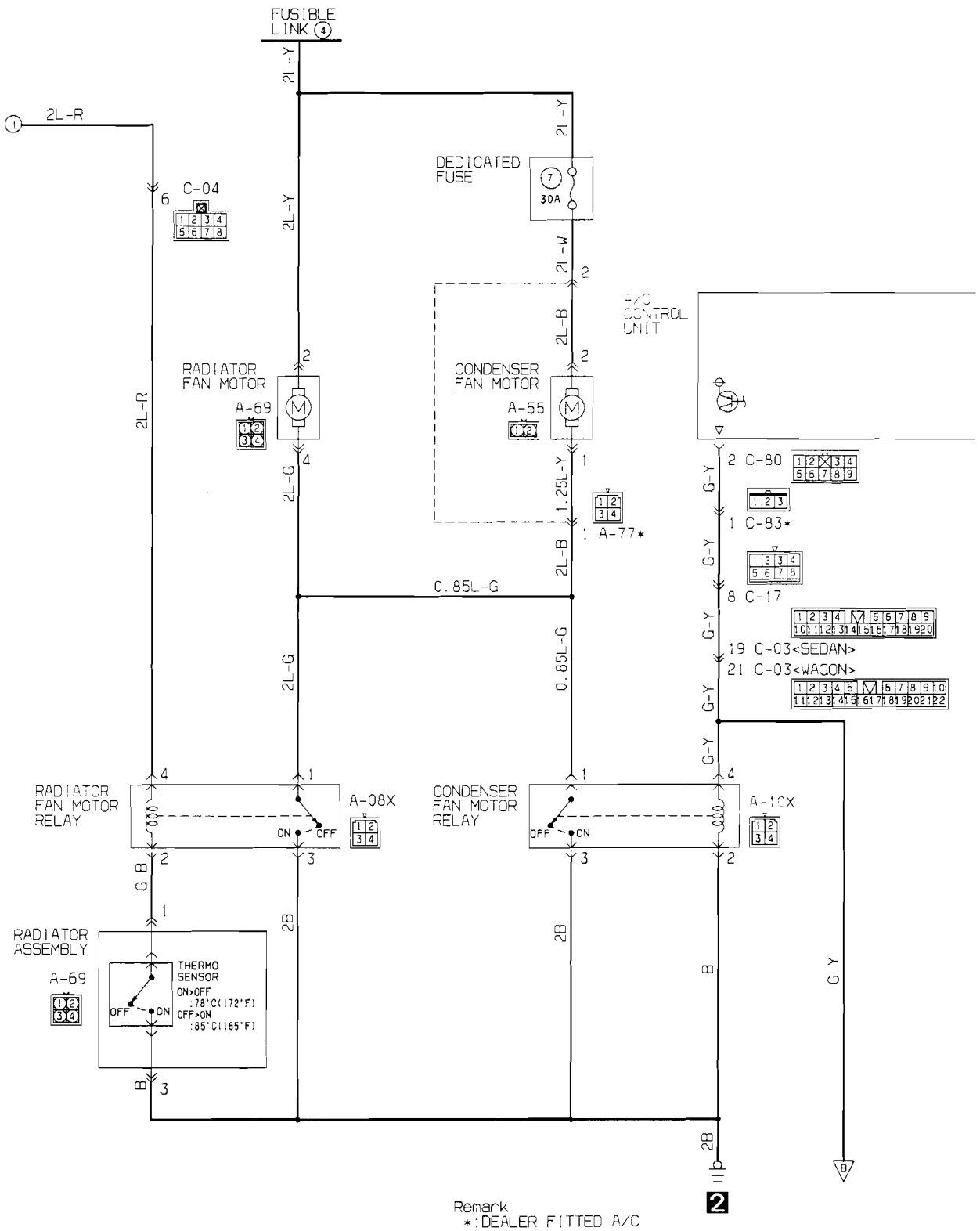
CIRCUIT DIAGRAM – A/C & heater circuit (H,D,P sedan/wagon) 92-93 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

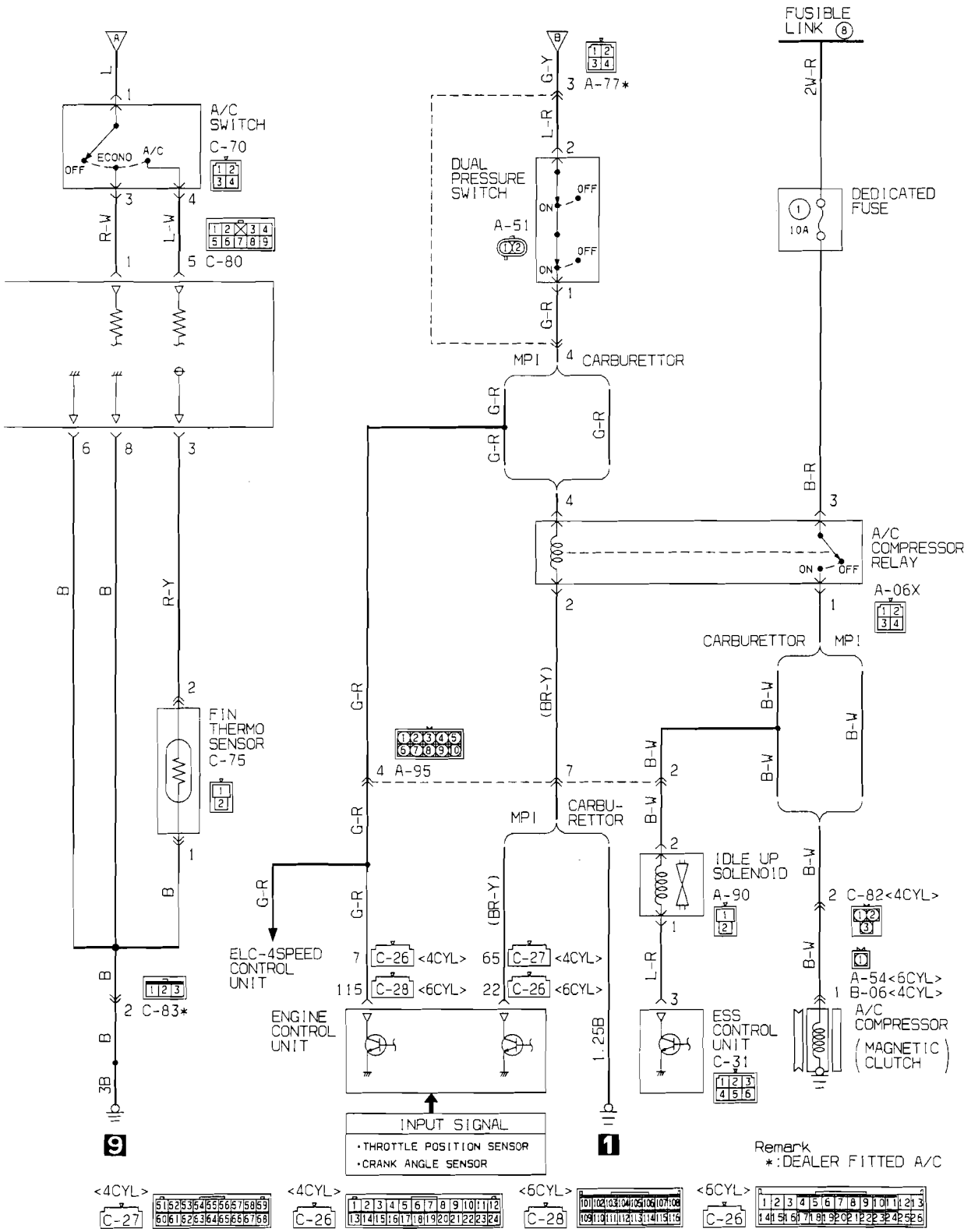
CIRCUIT DIAGRAM – A/C & heater circuit (H,D,P sedan/wagon) 92-93 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

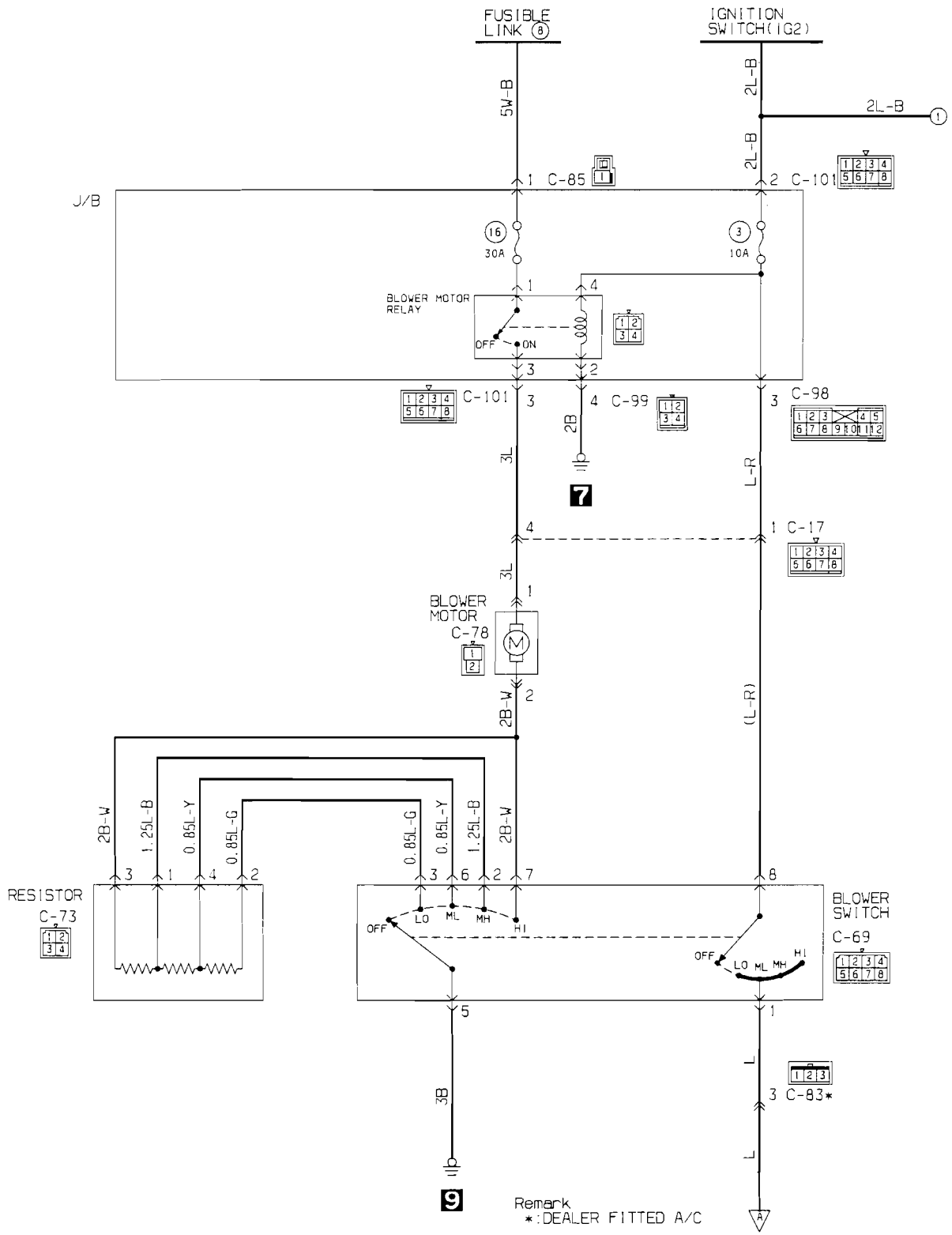
CIRCUIT DIAGRAM – A/C & heater circuit (H,D,P sedan/wagon) 92-93 Models Continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

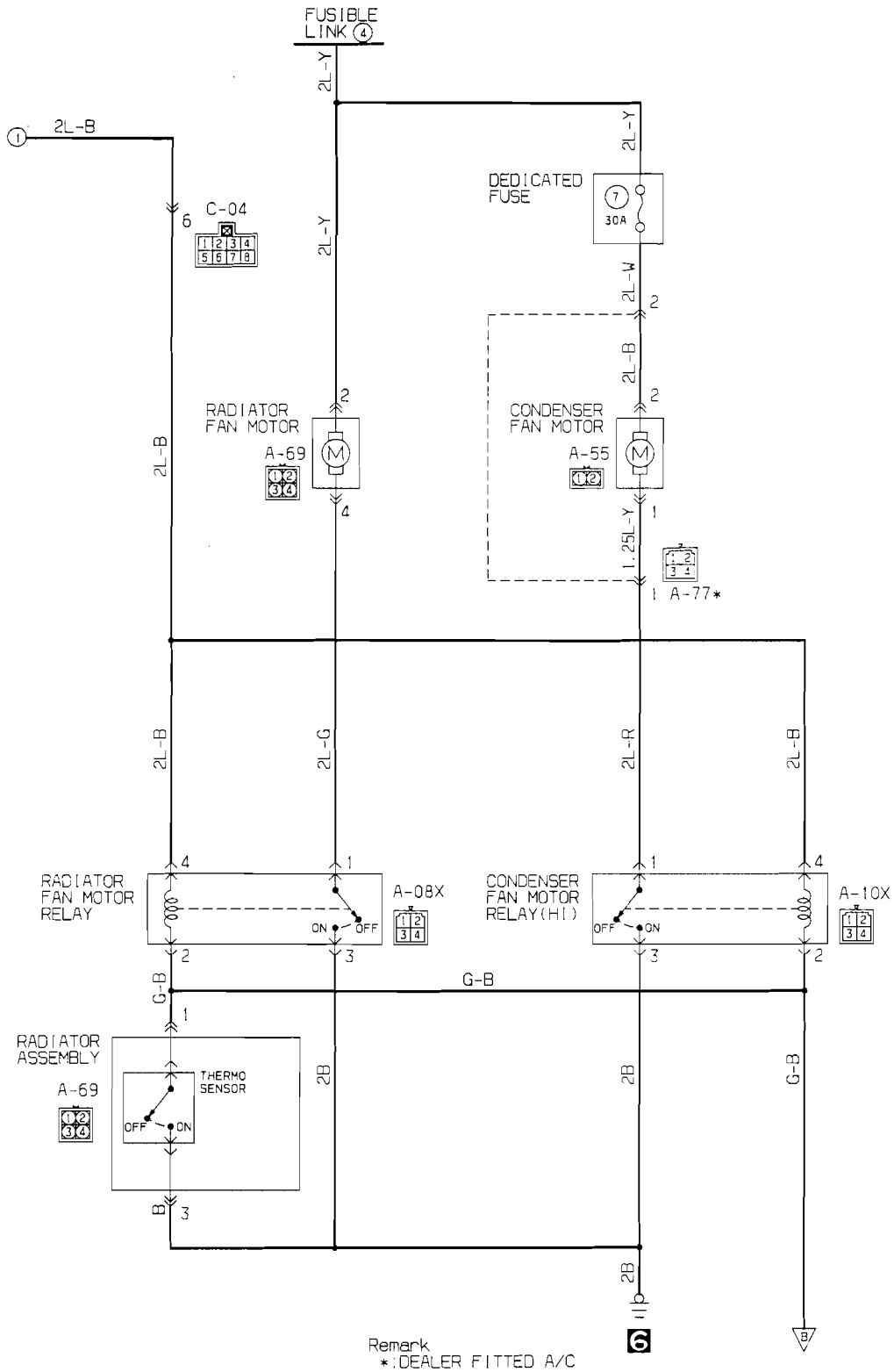
CIRCUIT DIAGRAM – A/C & heater circuit (H,D,P sedan/wagon) 94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

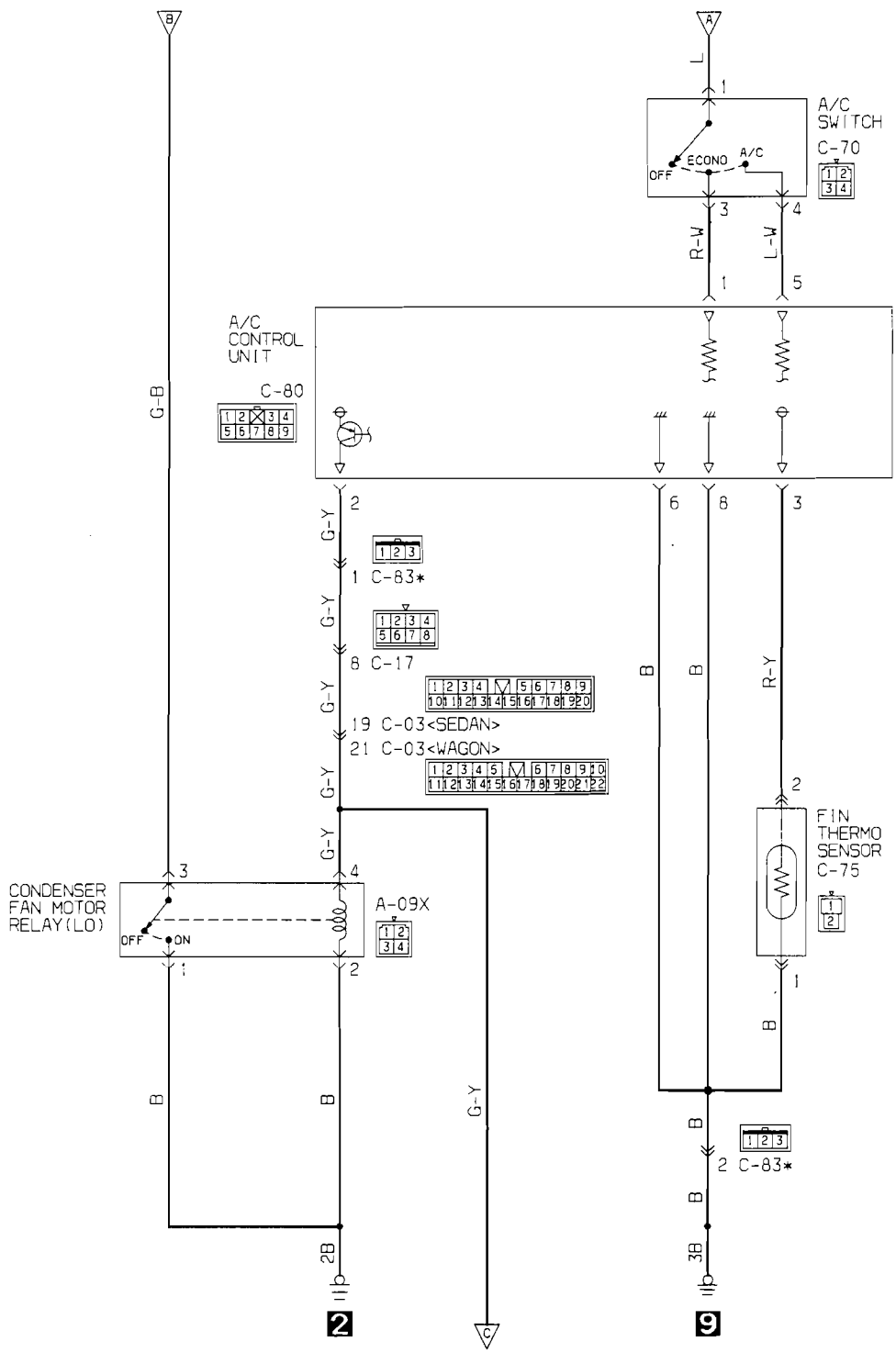
CIRCUIT DIAGRAM – A/C & heater circuit (H,D,P sedan/wagon) 94 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – A/C & heater circuit (H,D,P sedan/wagon)
94 Models Continued



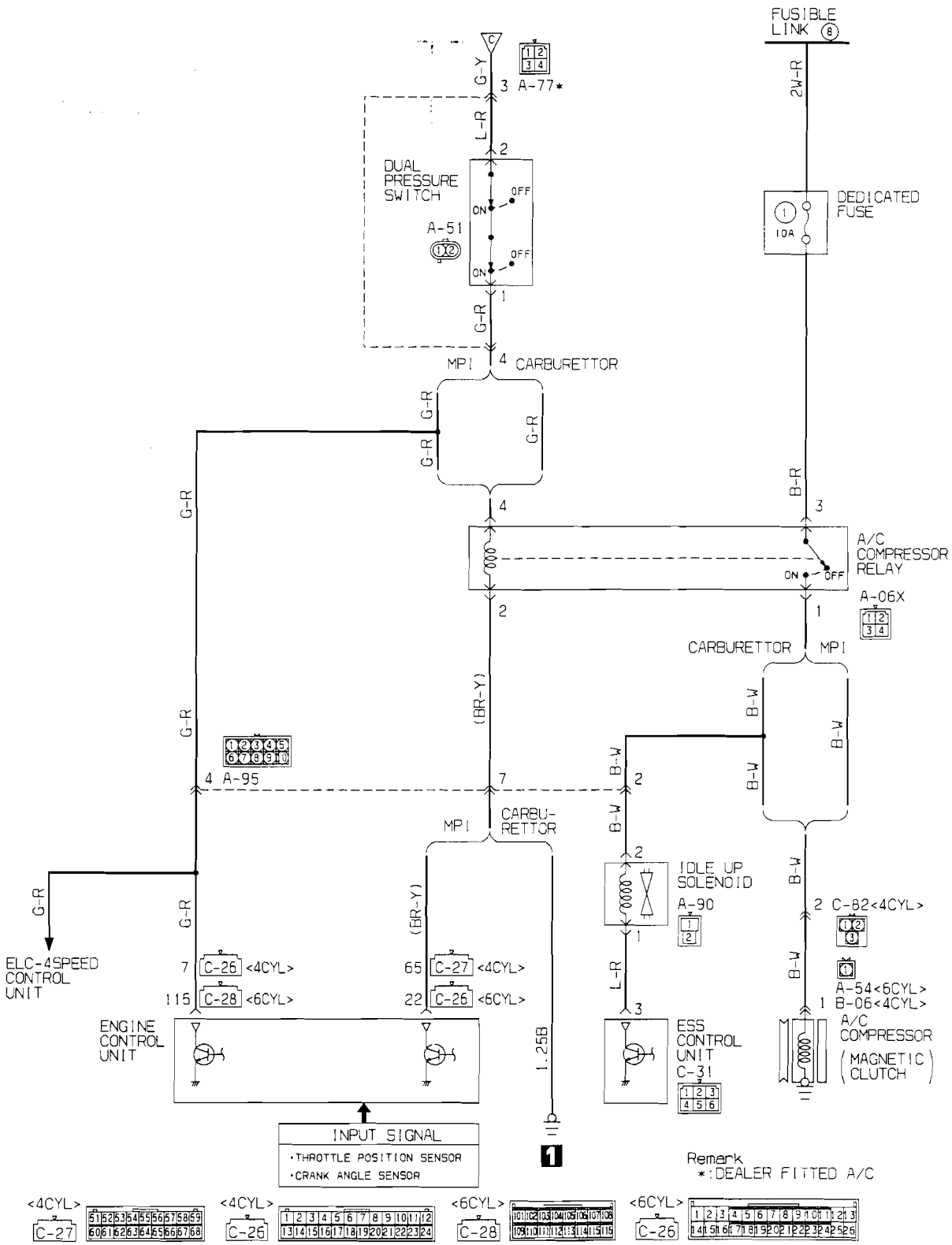
Remark
*:DEALER FITTED A/C

94-126-A

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

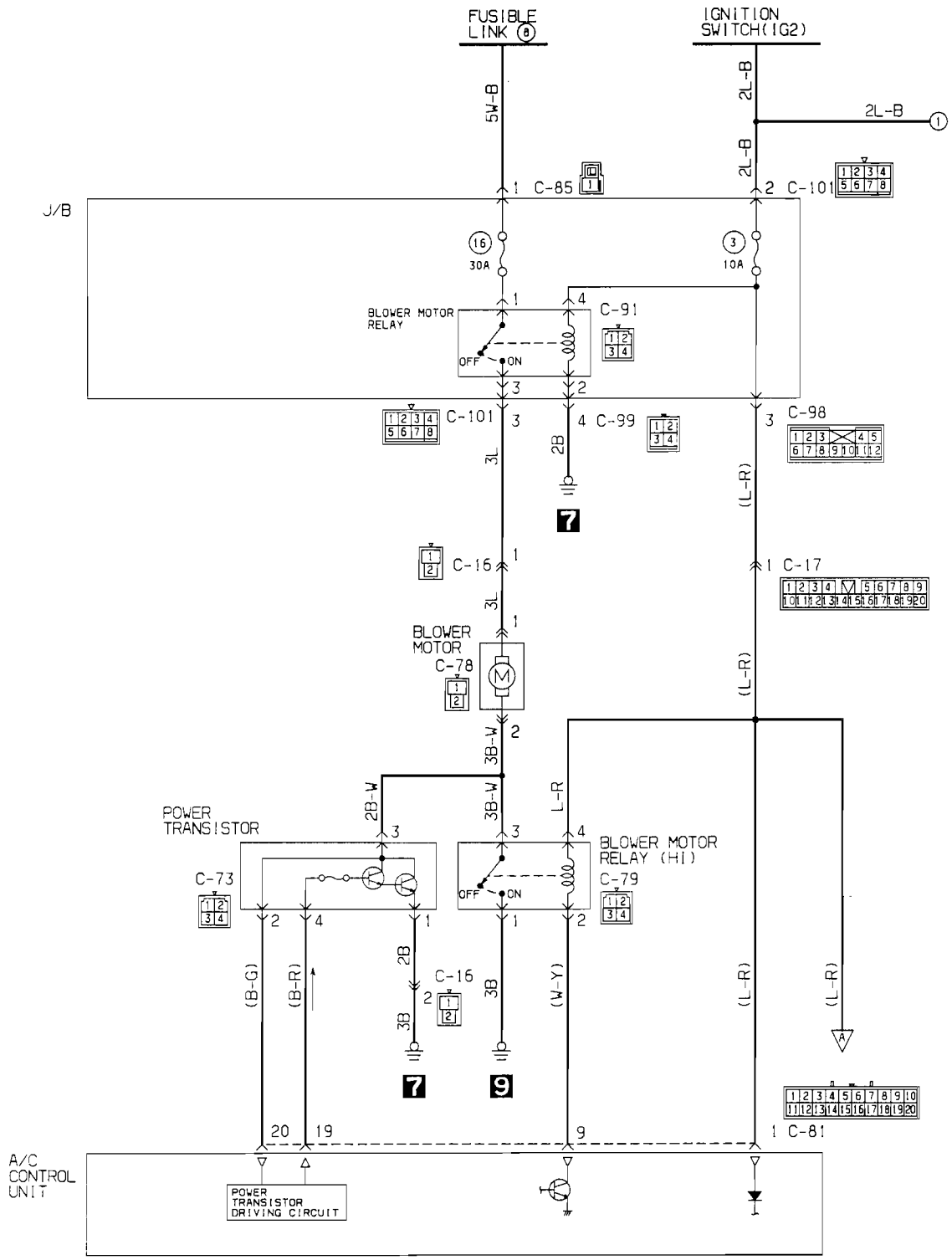
CIRCUIT DIAGRAM – A/C & heater circuit (H,D,P sedan/wagon) 94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 91-93 Models



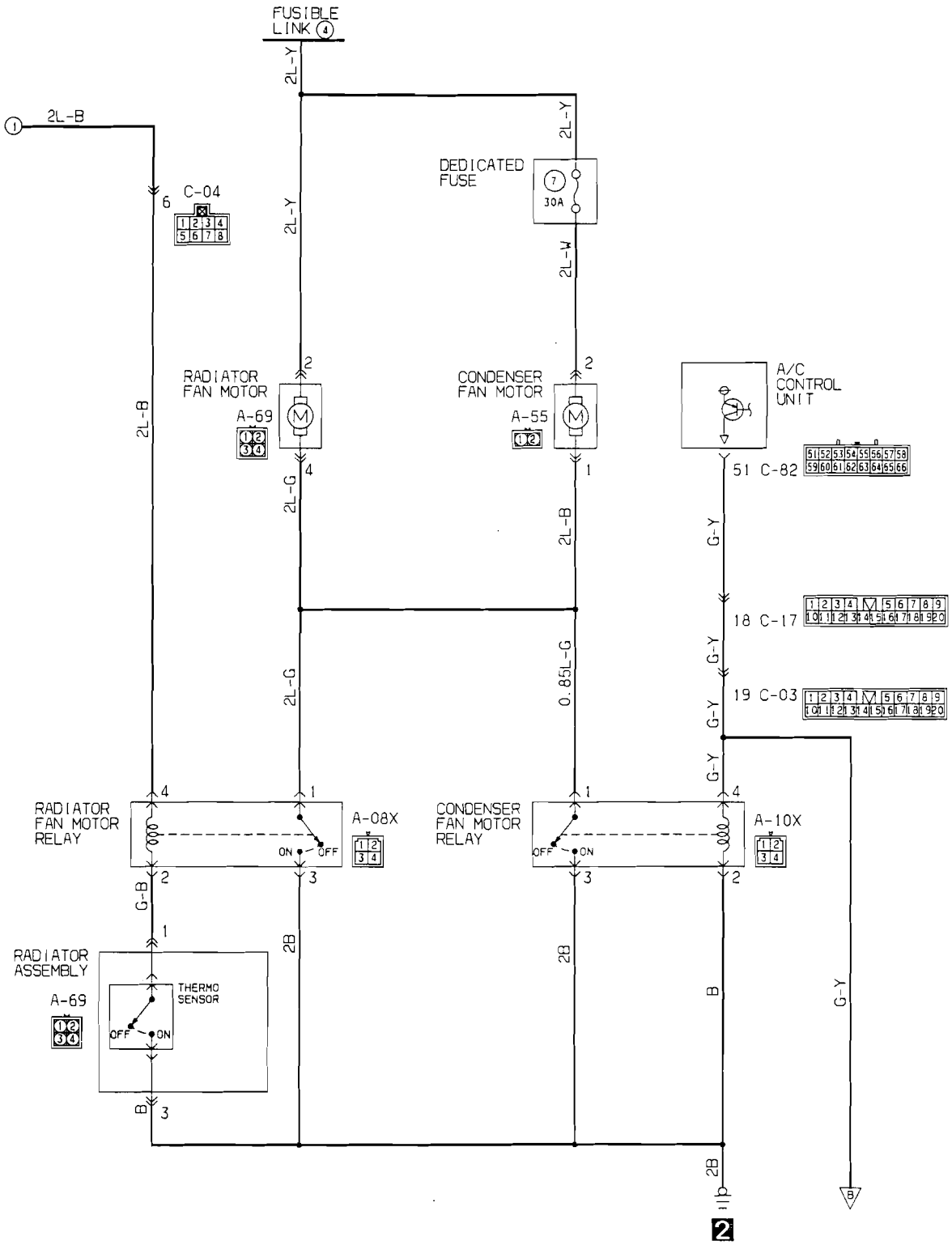
93-127

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 91-93 Models

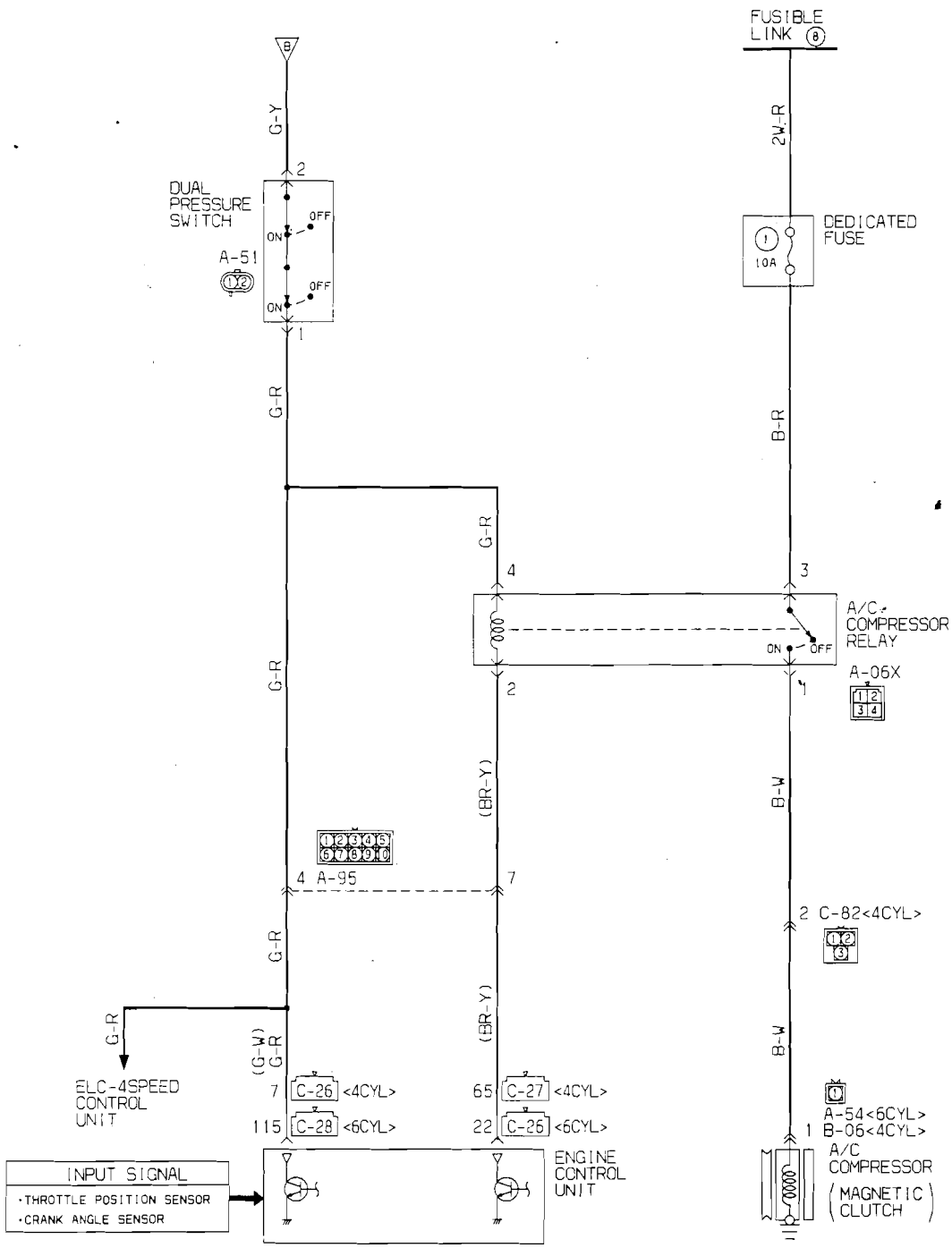


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 91-93 Models Cont;



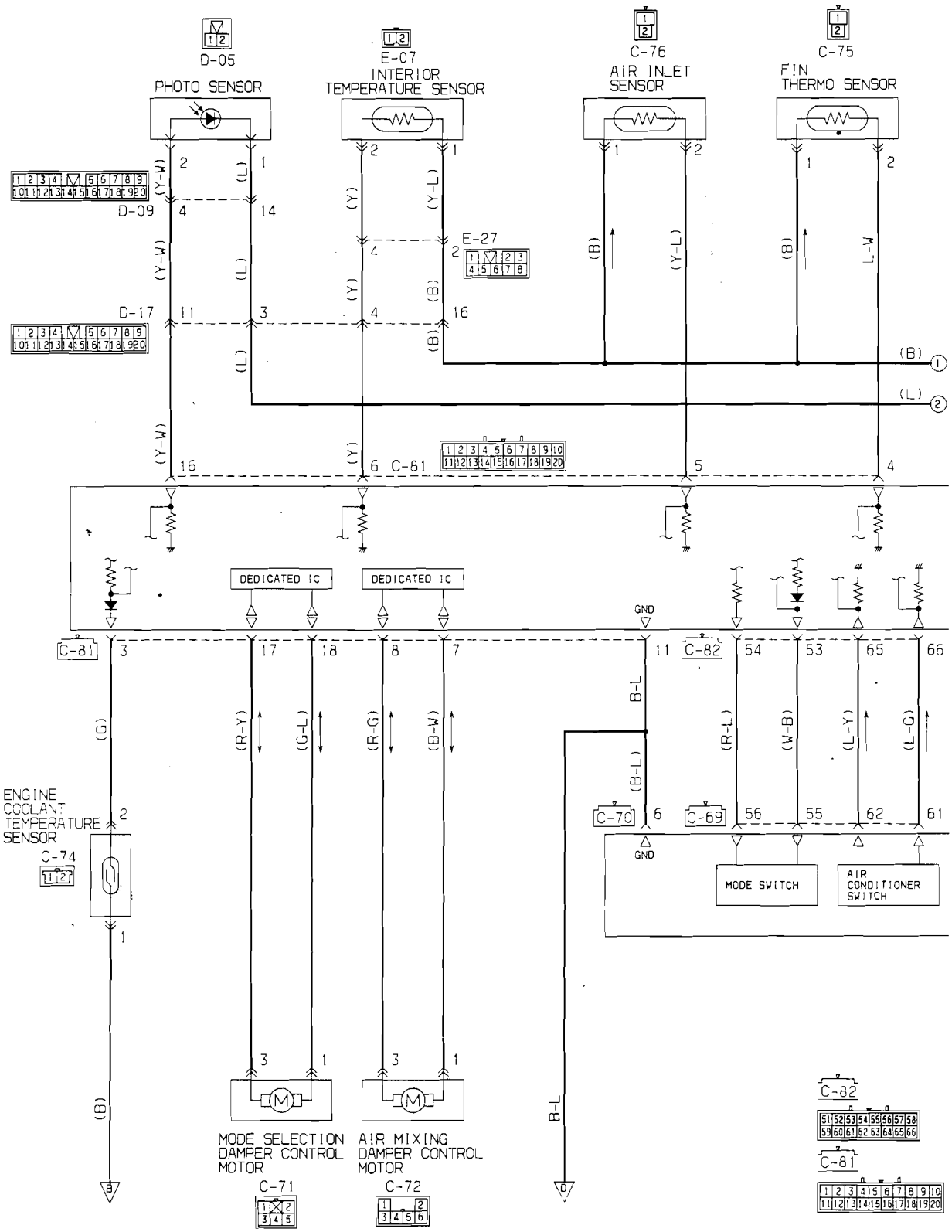
93-127-A

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 91-93 Models

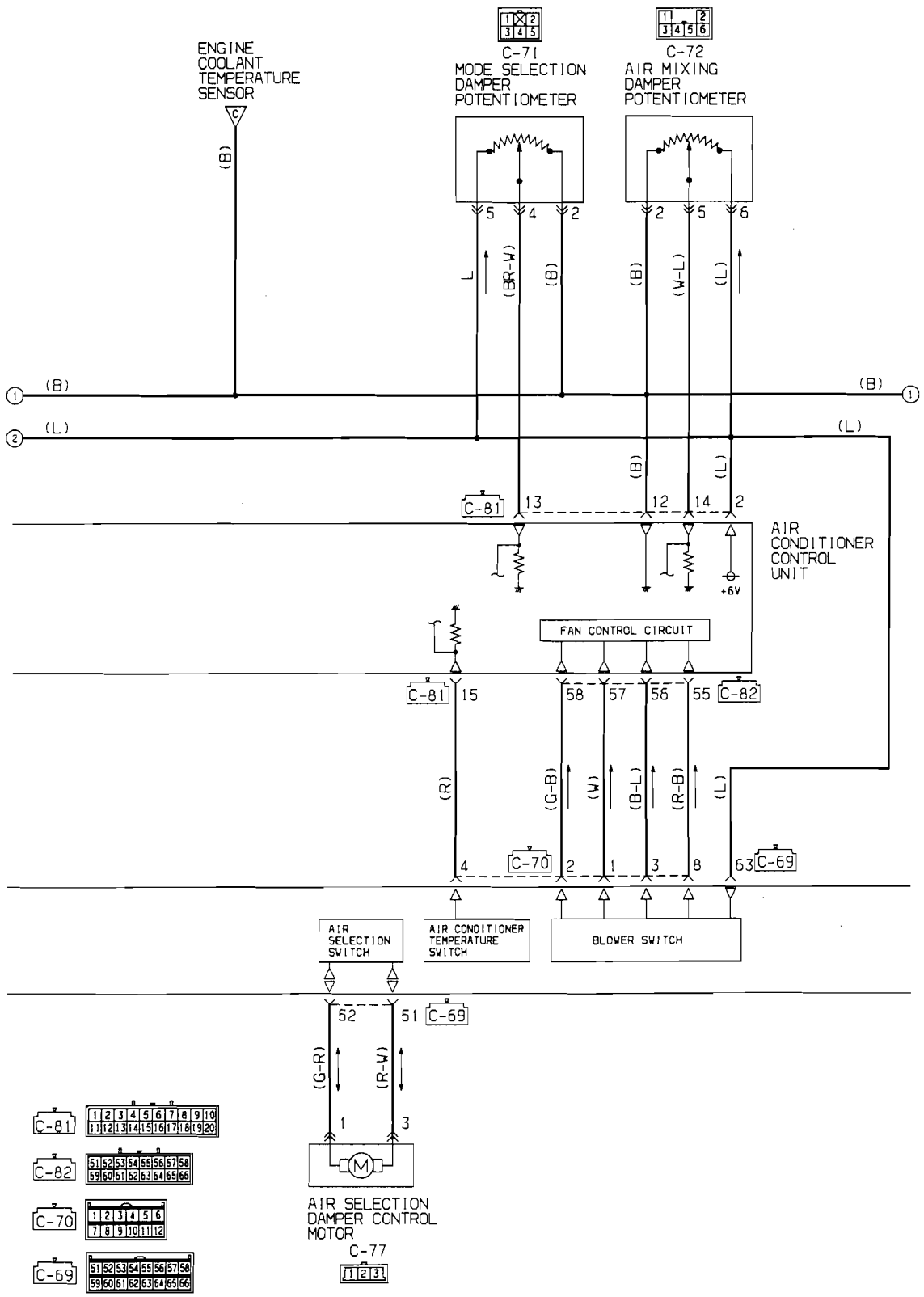


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 91-93 Models cont;

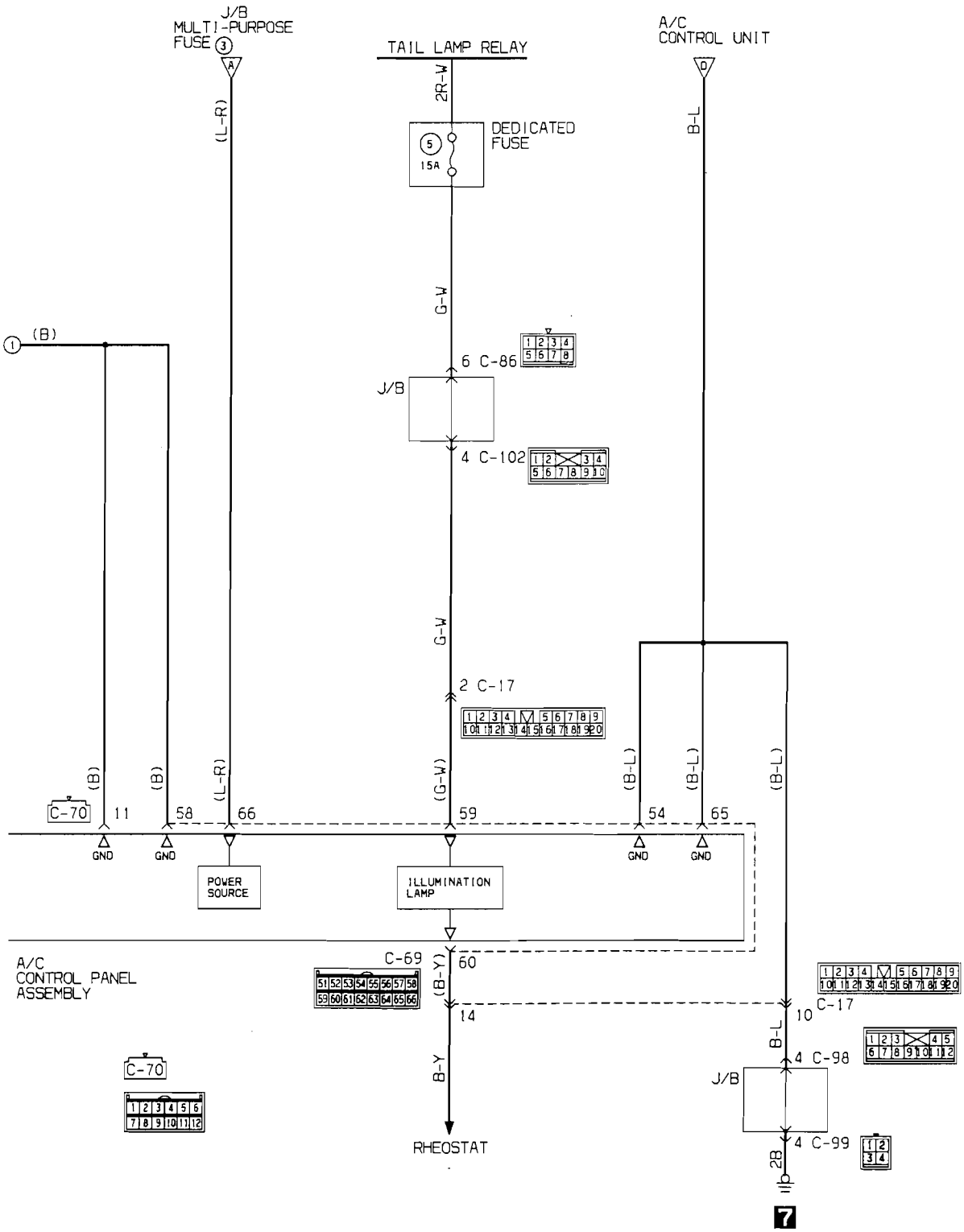


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 91-93 Models

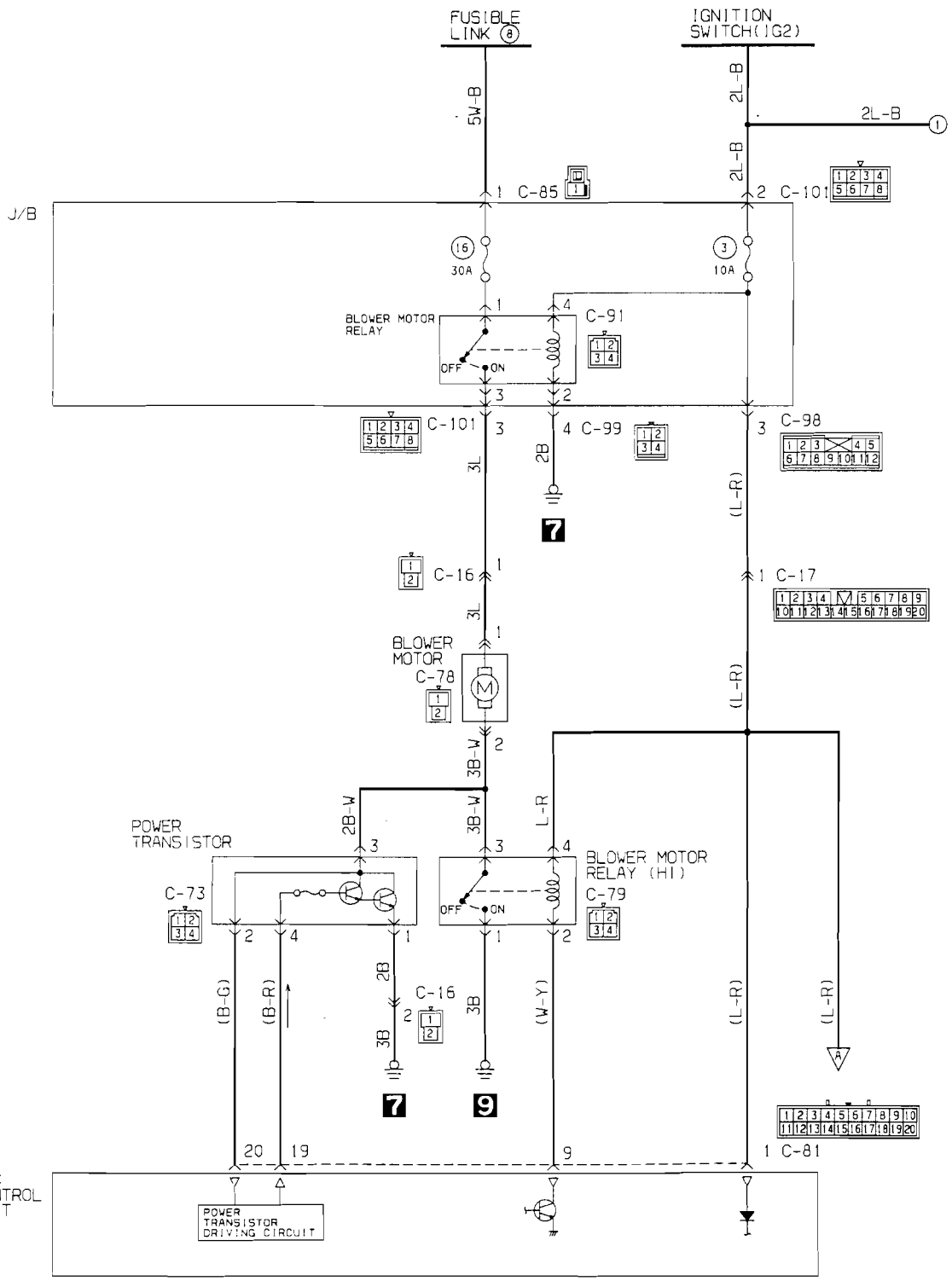


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 94 Models

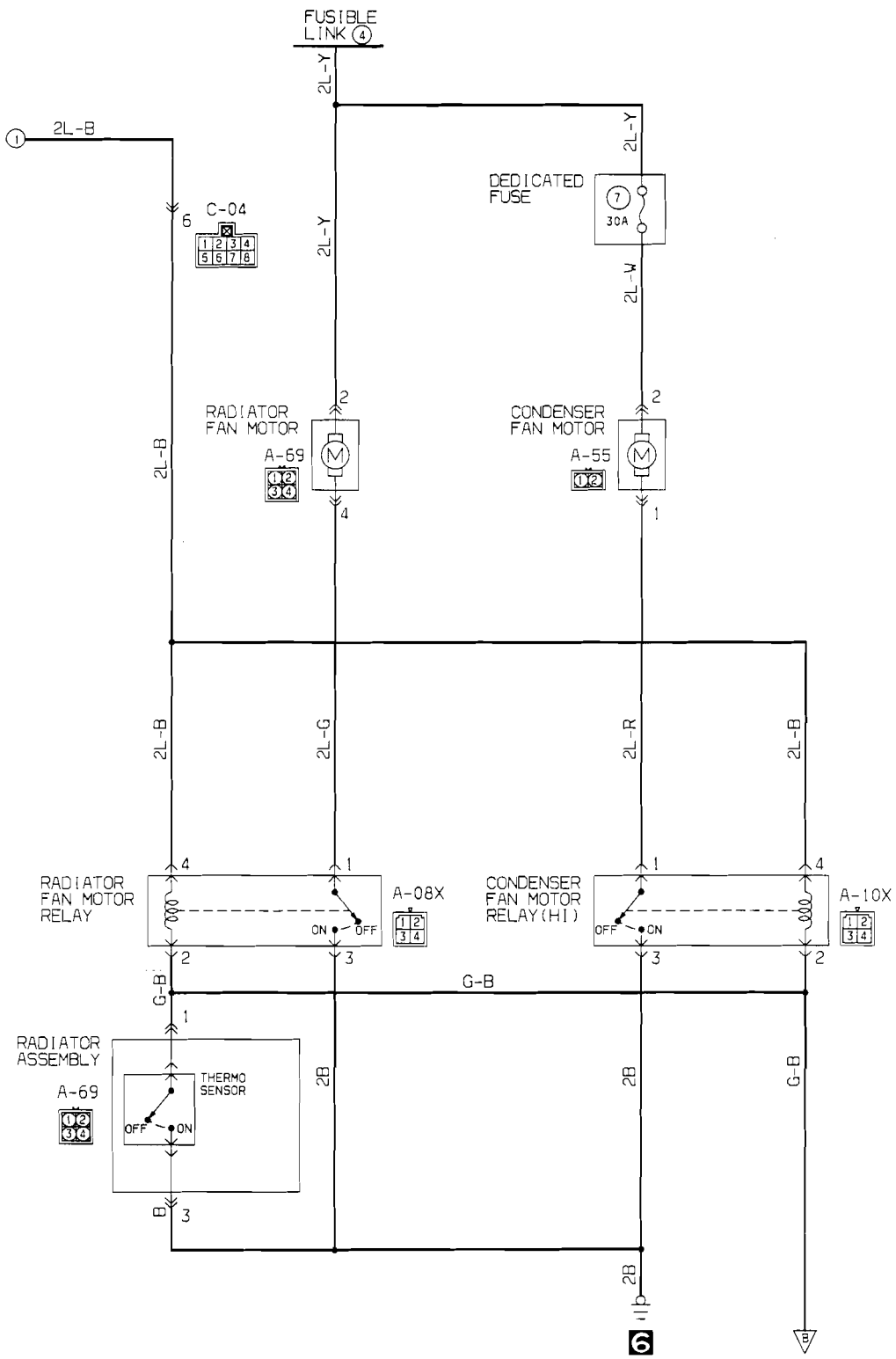


94-127

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

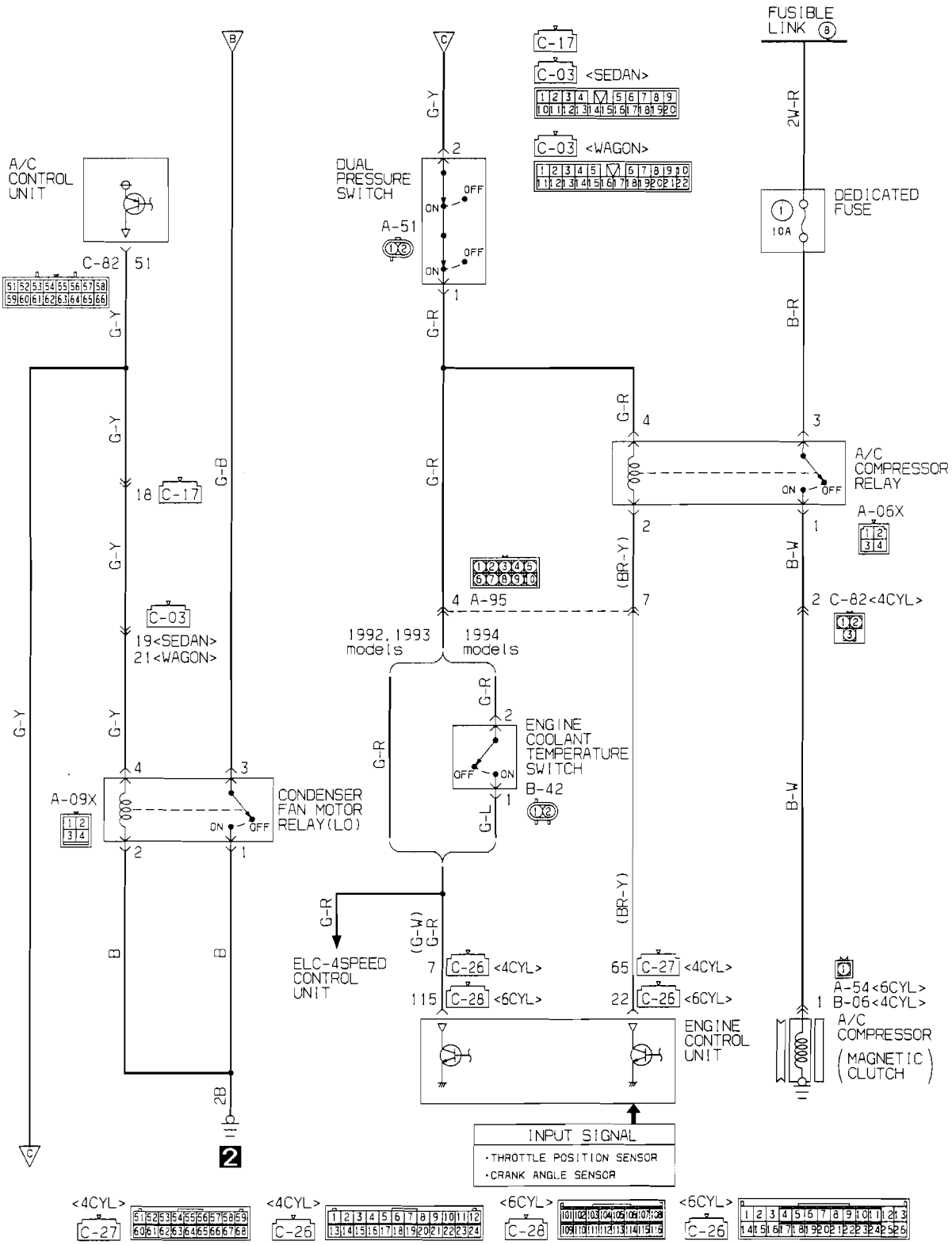
CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

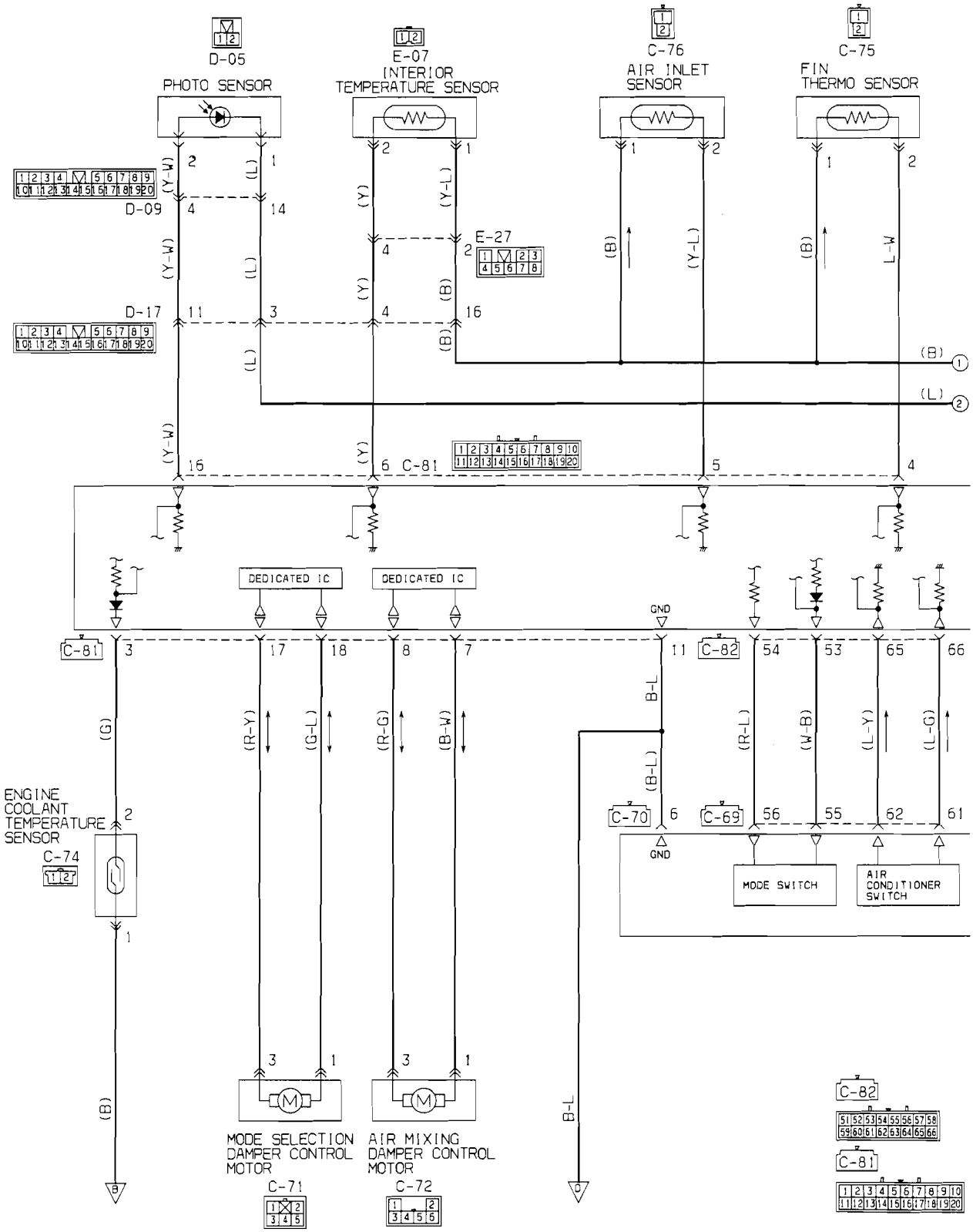
CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 94 Models Continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

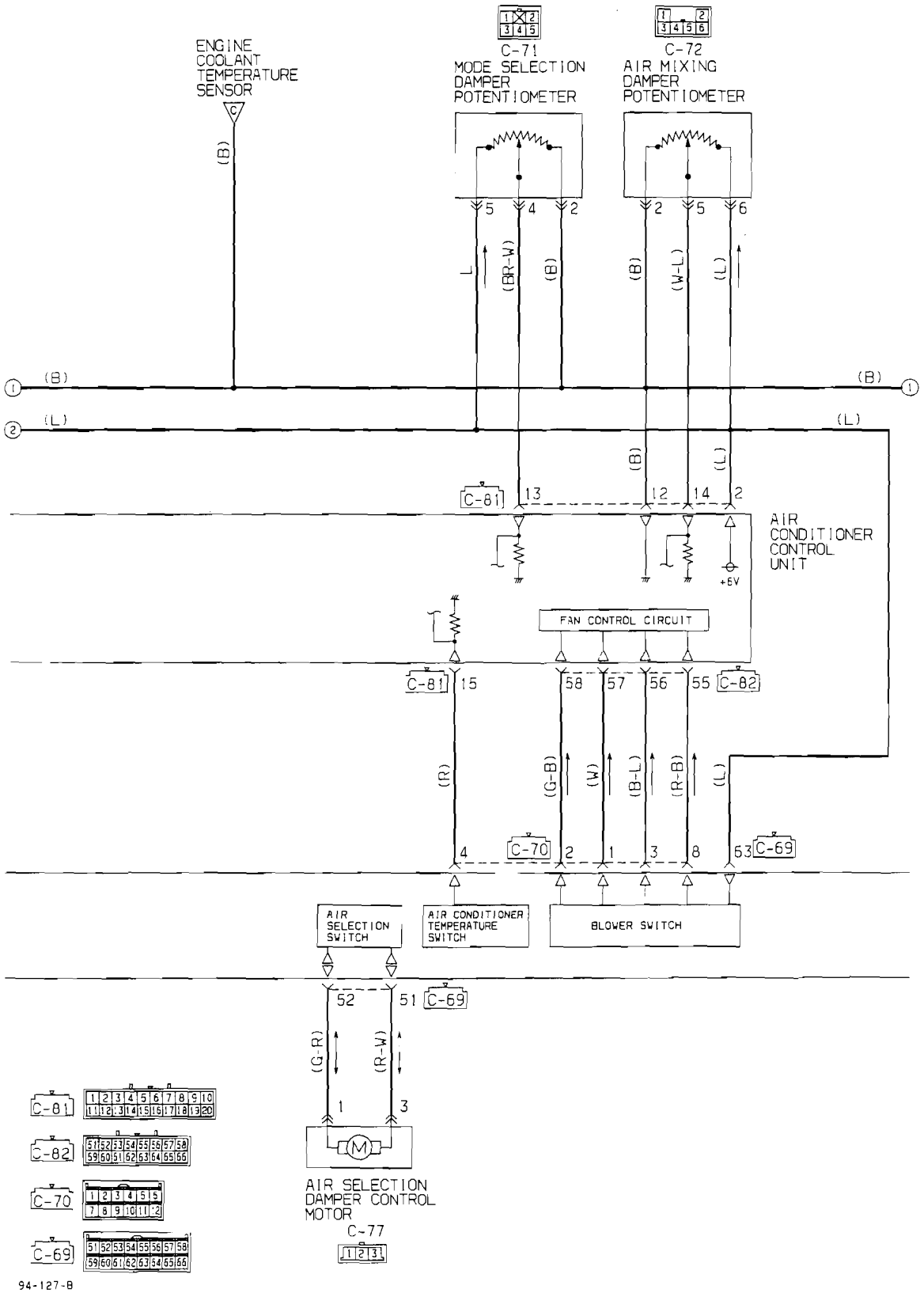
CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

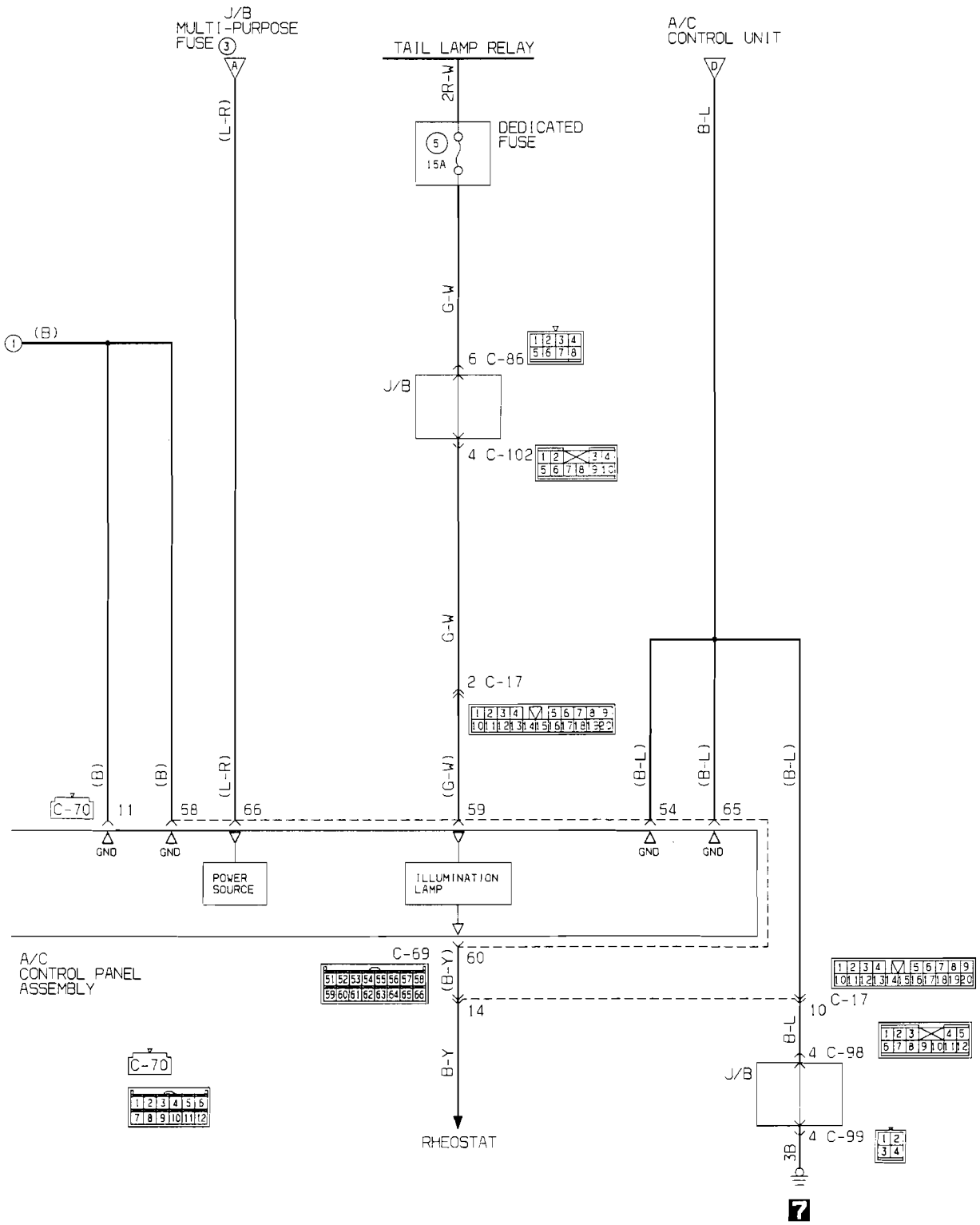
CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 94 Models Continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
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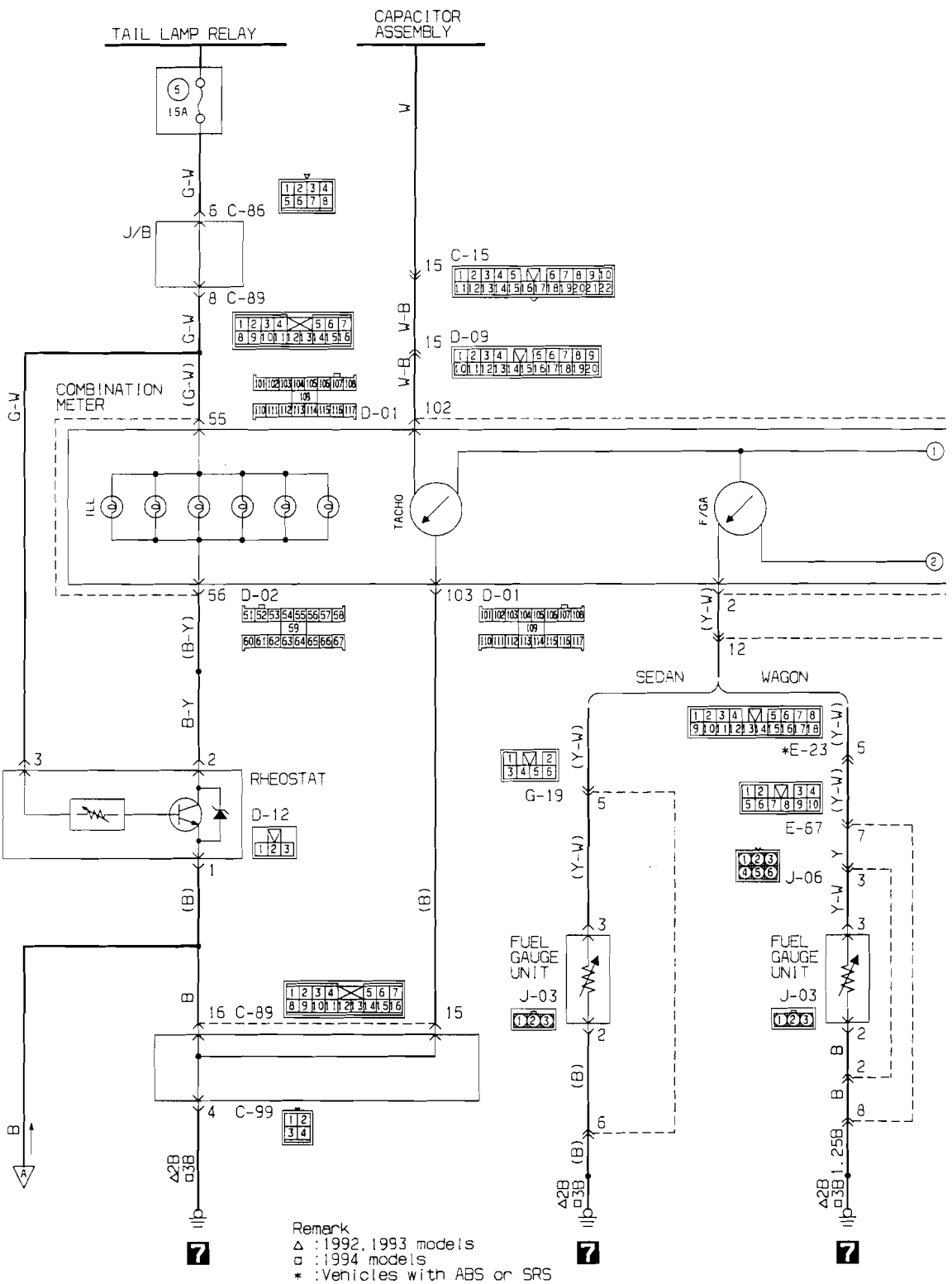
CIRCUIT DIAGRAM – A/C & heater circuit 'X' line 94 Models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Meters & Gauges circuit 91-94 Models

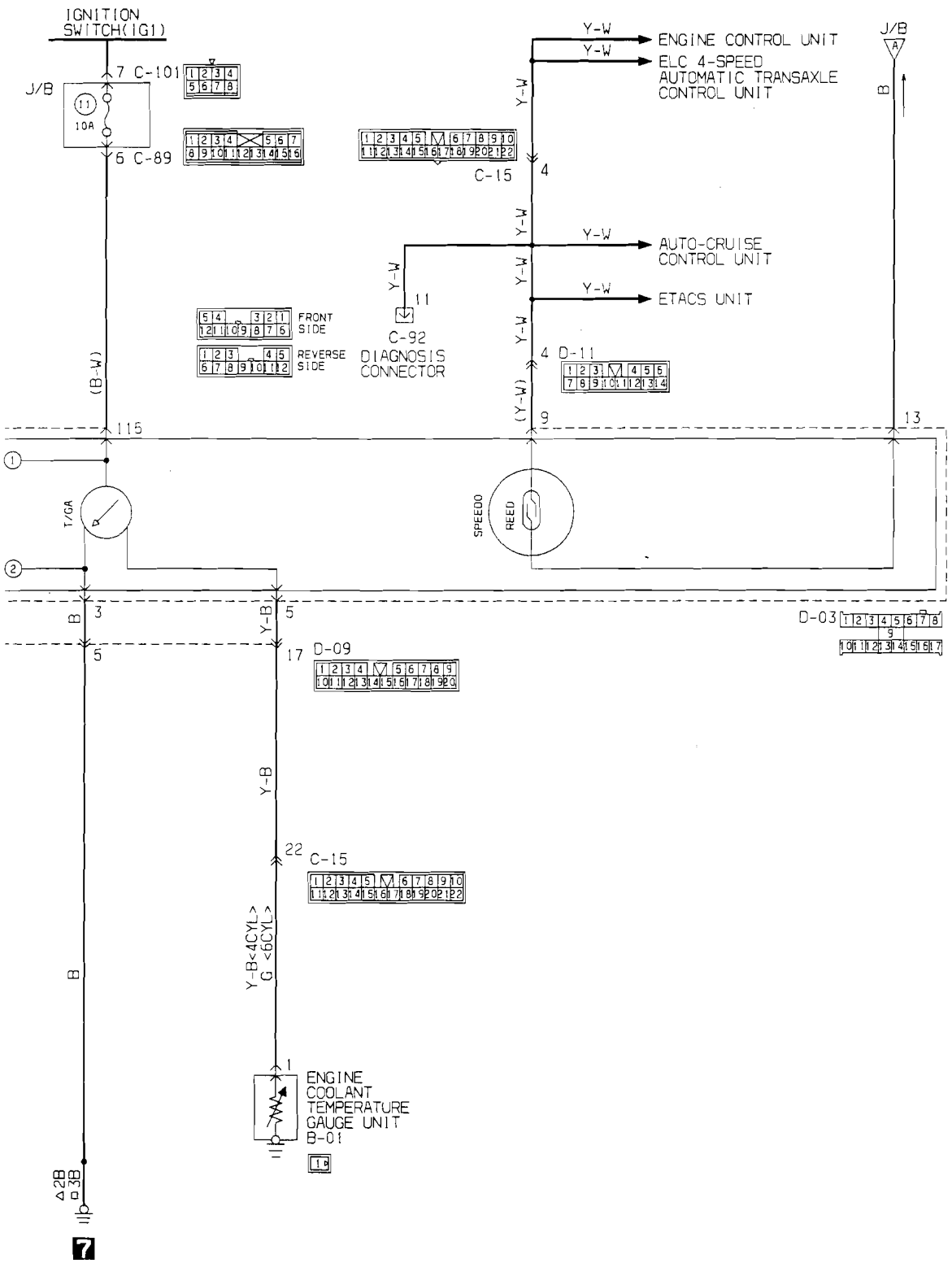


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Meters & Gauges circuit 91-94 Models

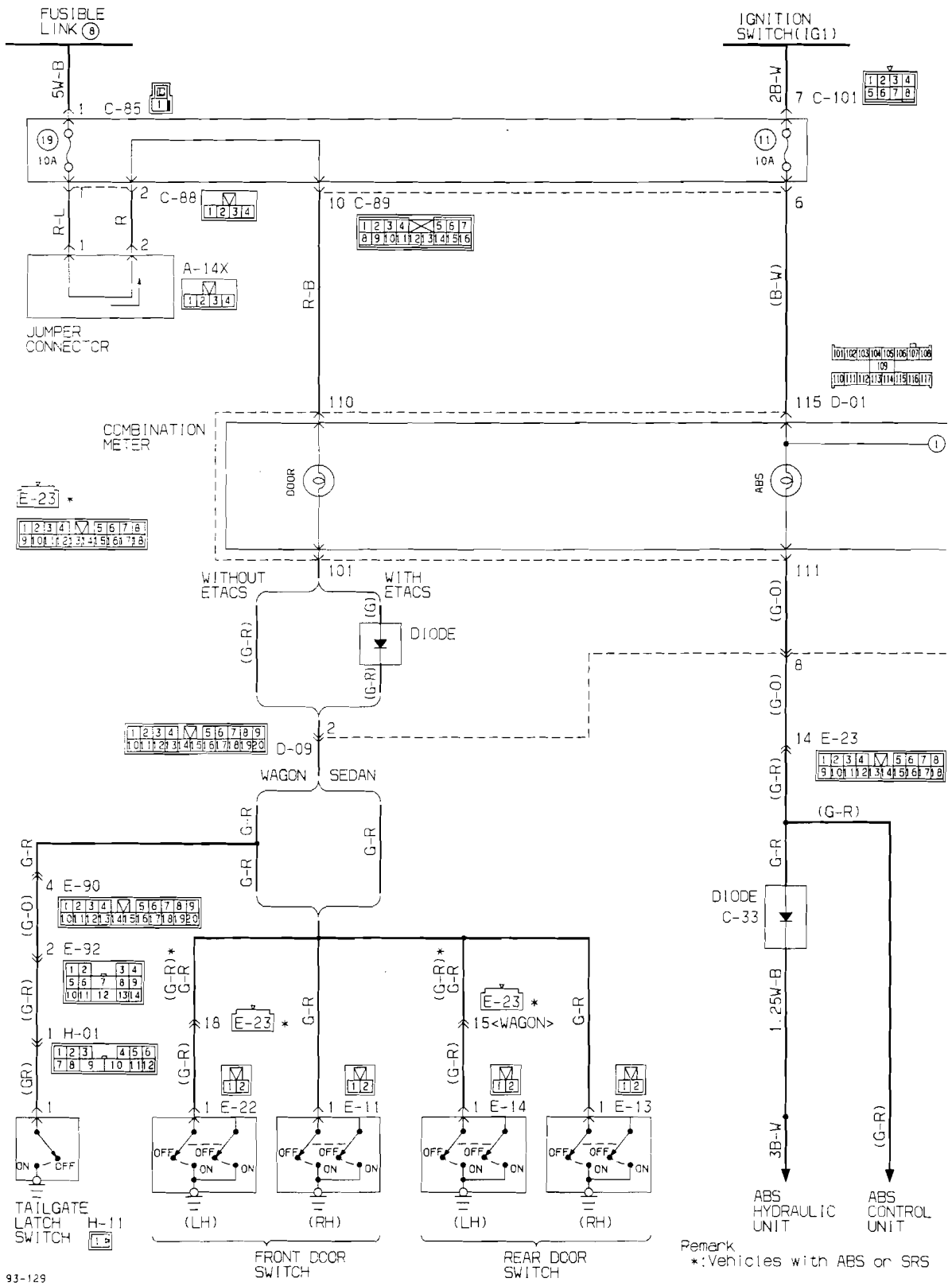


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Warning lamps circuit 91-94 Models

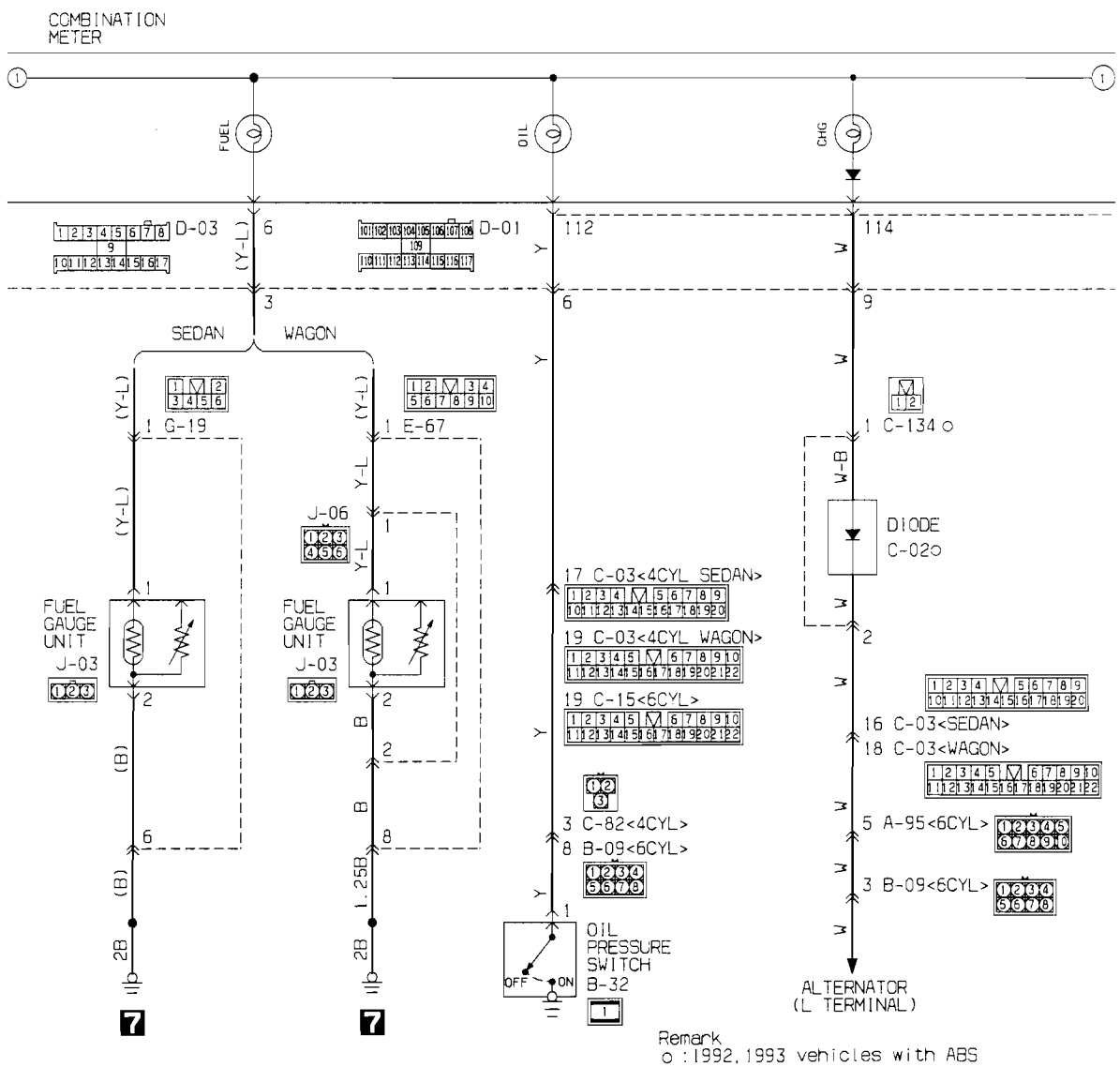


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Warning lamps circuit 91-94 Models

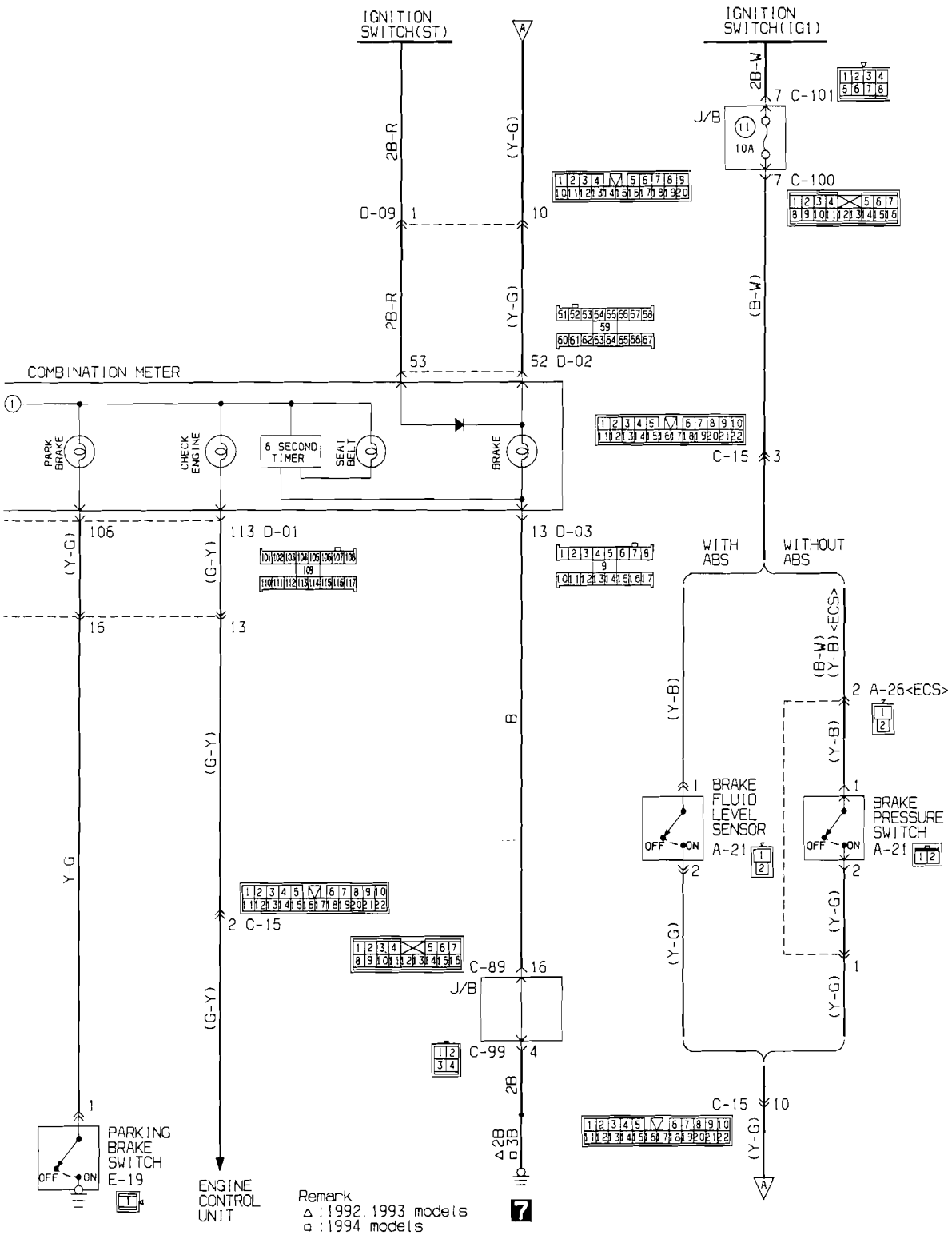


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Warning lamps circuit 91-94 Models Cont;

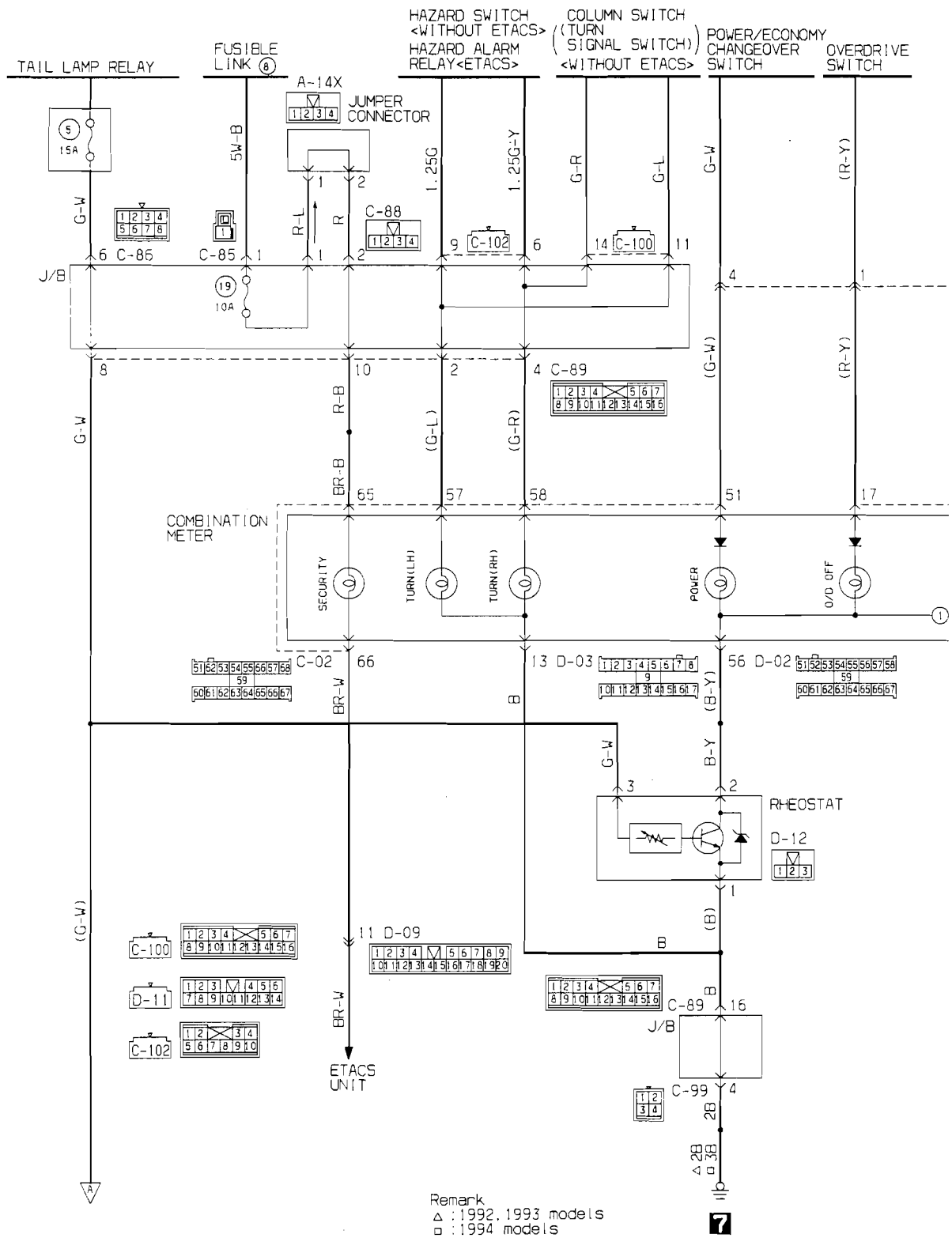


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Indicator lamps circuit 91-94 Models



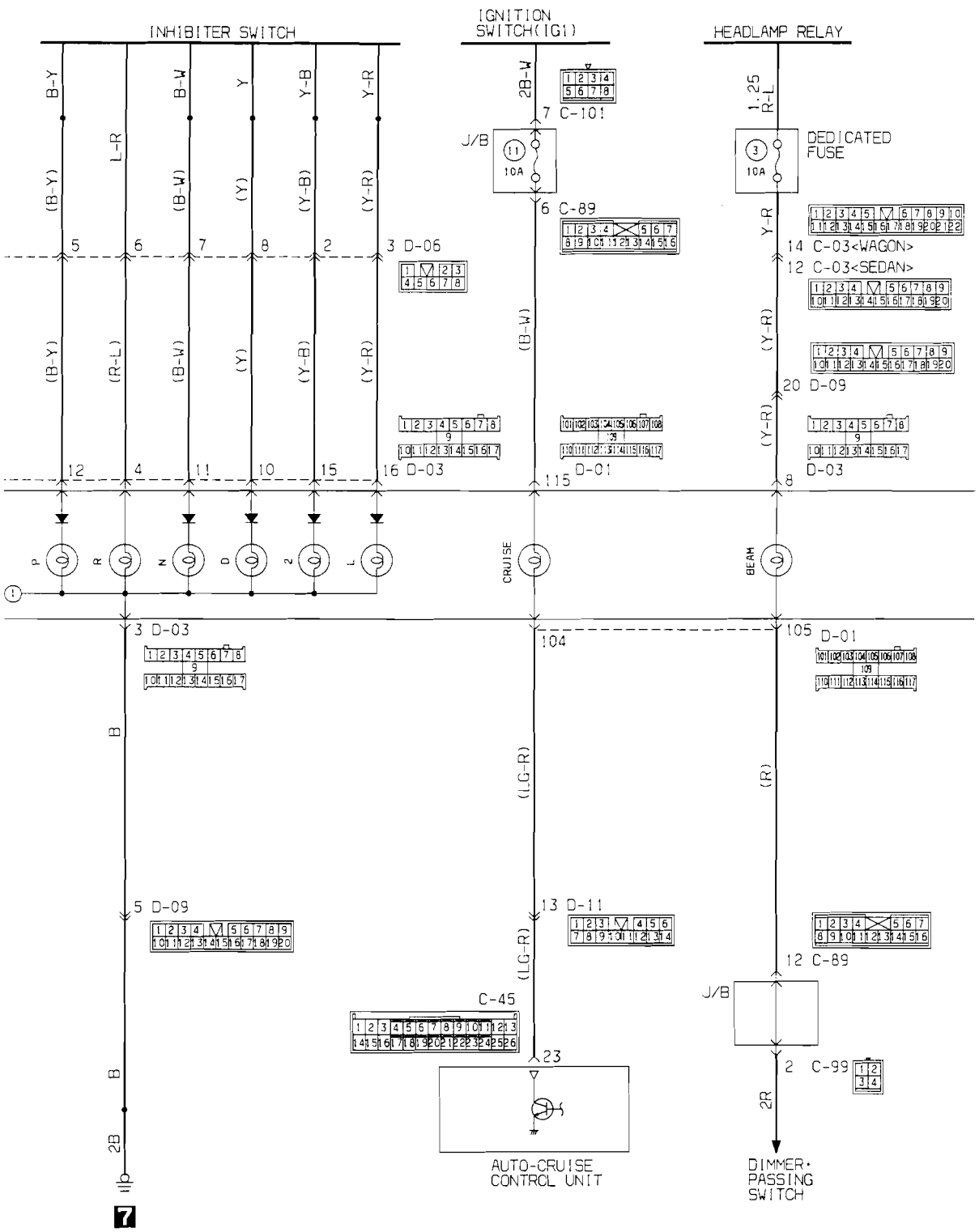
93-130

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Indicator lamps circuit 91-94 Models

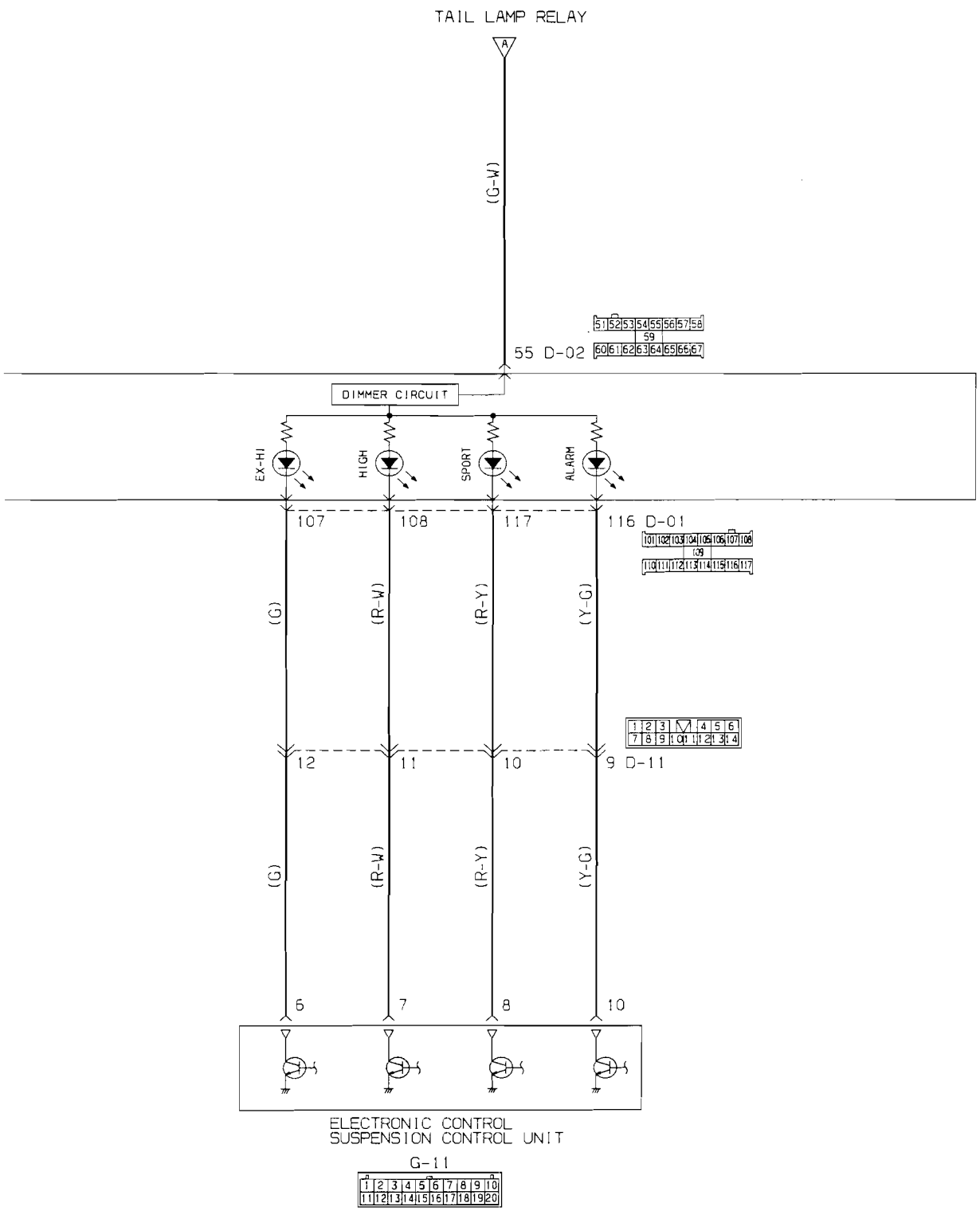


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Indicator lamps circuit 91-94 Models Cont;

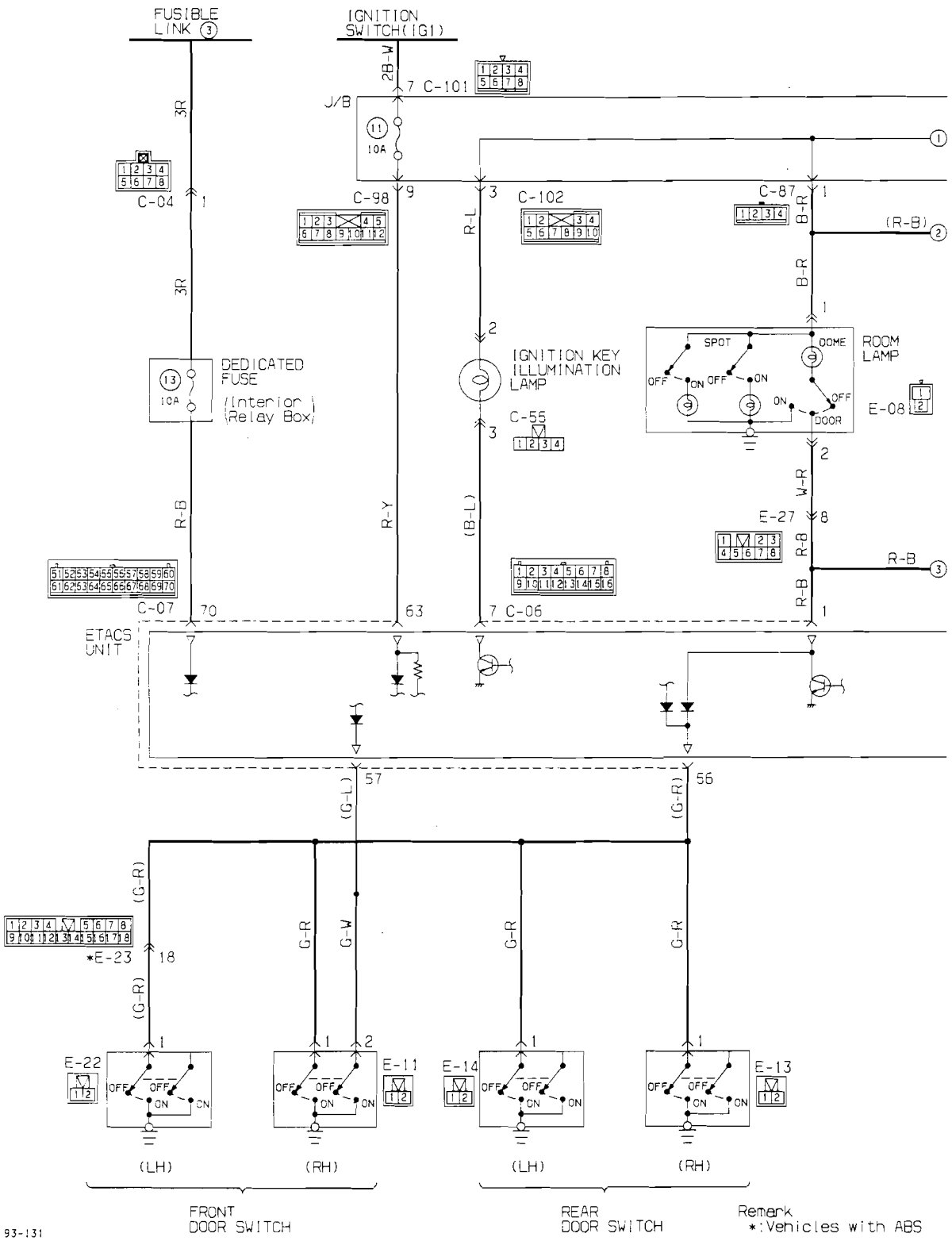


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Room, map & ign key illum circuit 'X' line 91-94 Models

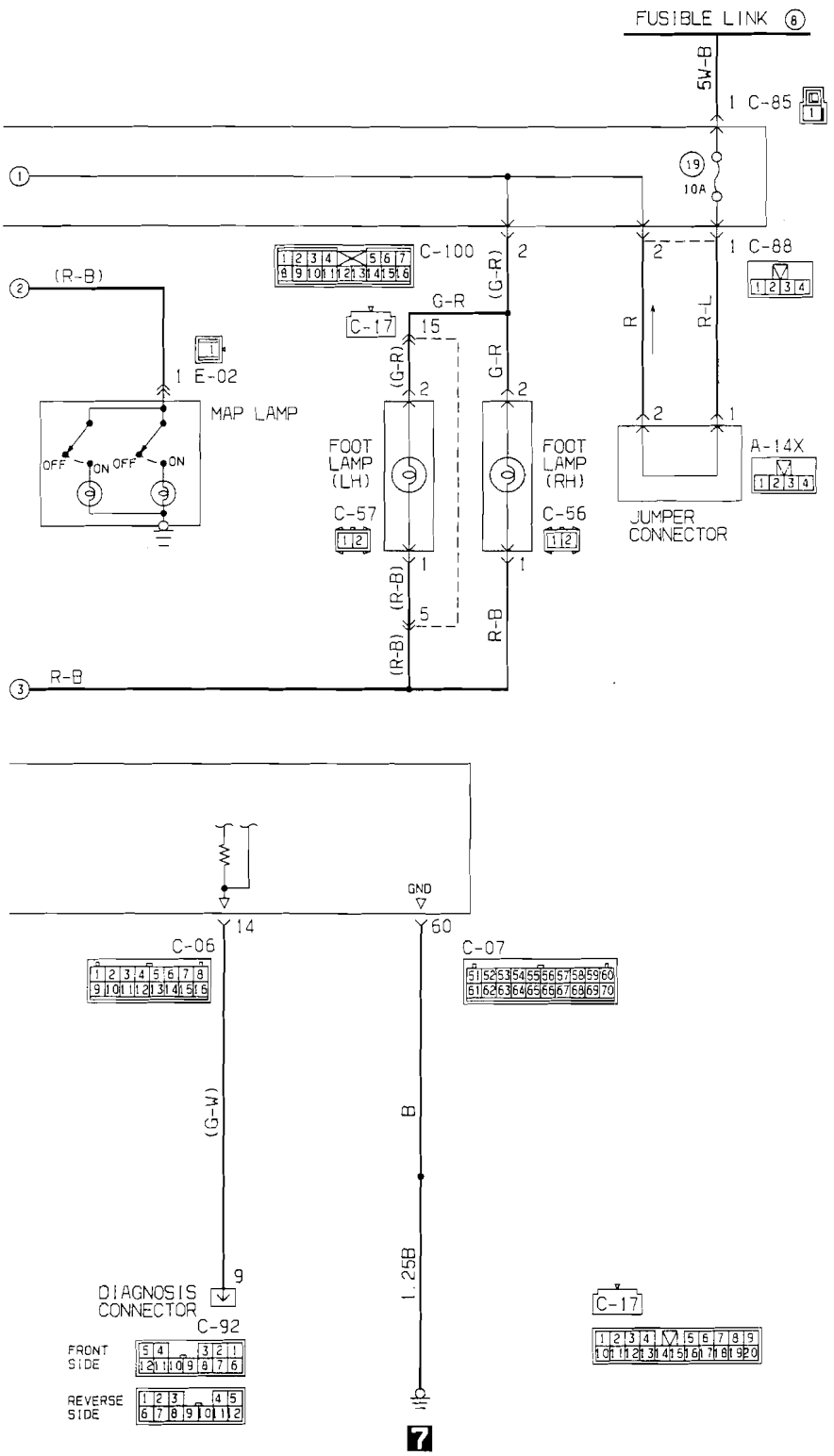


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Room, map & ign key illum circuit 'X' line 91-94 Models

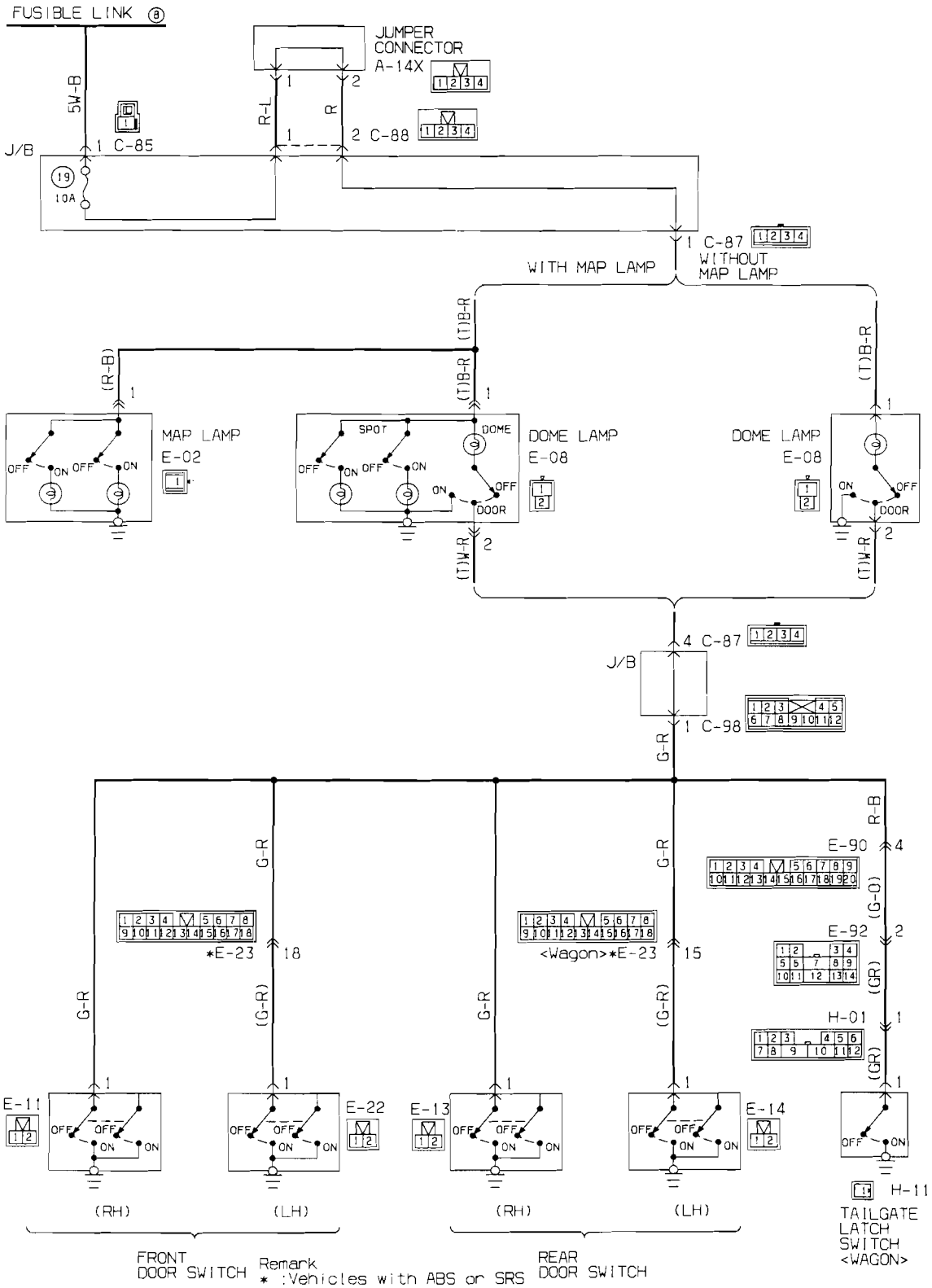


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Room, map & ign key illum circuit H,D,P line 91-94 Models

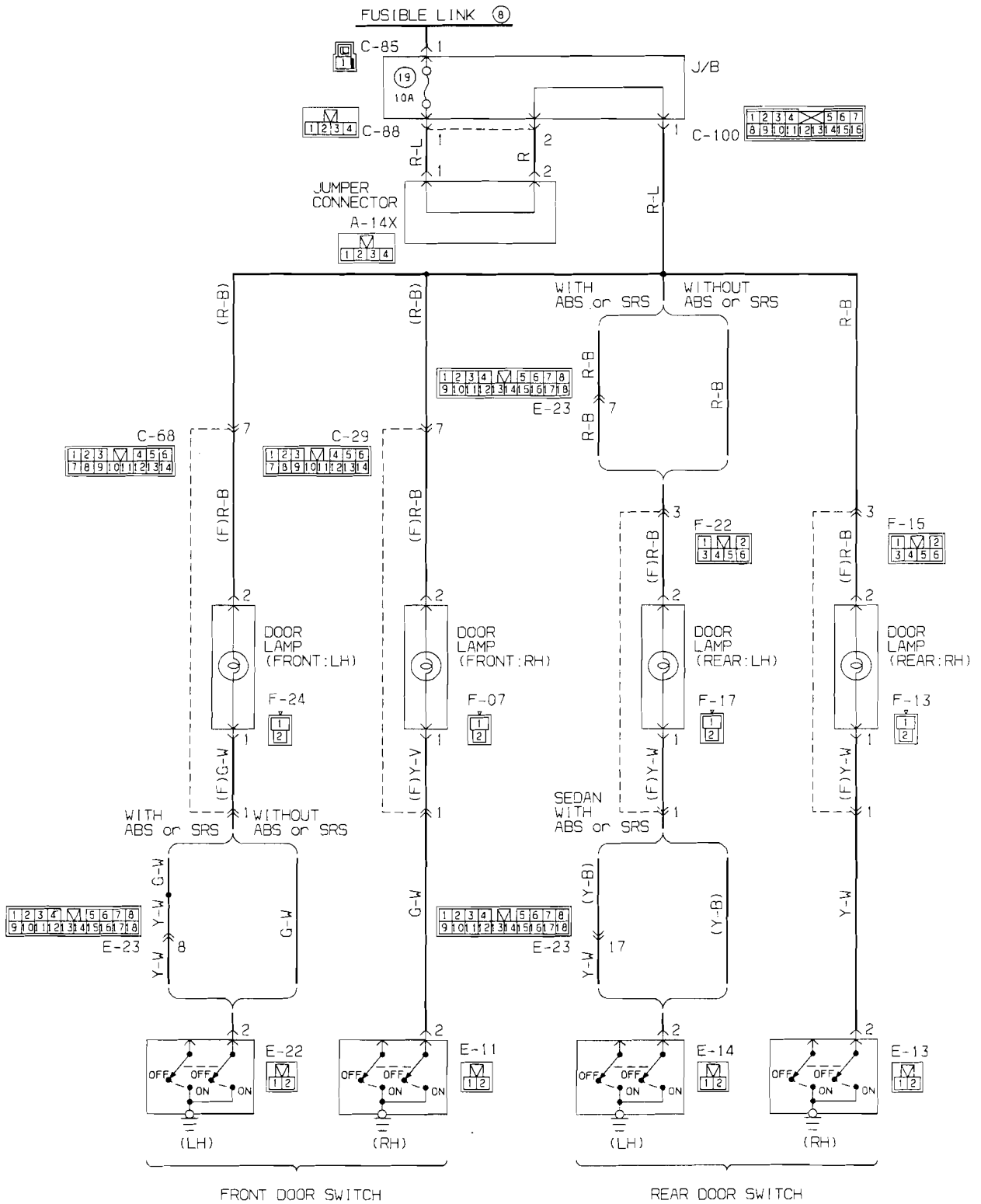


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Door lamp circuit 91-94 Models

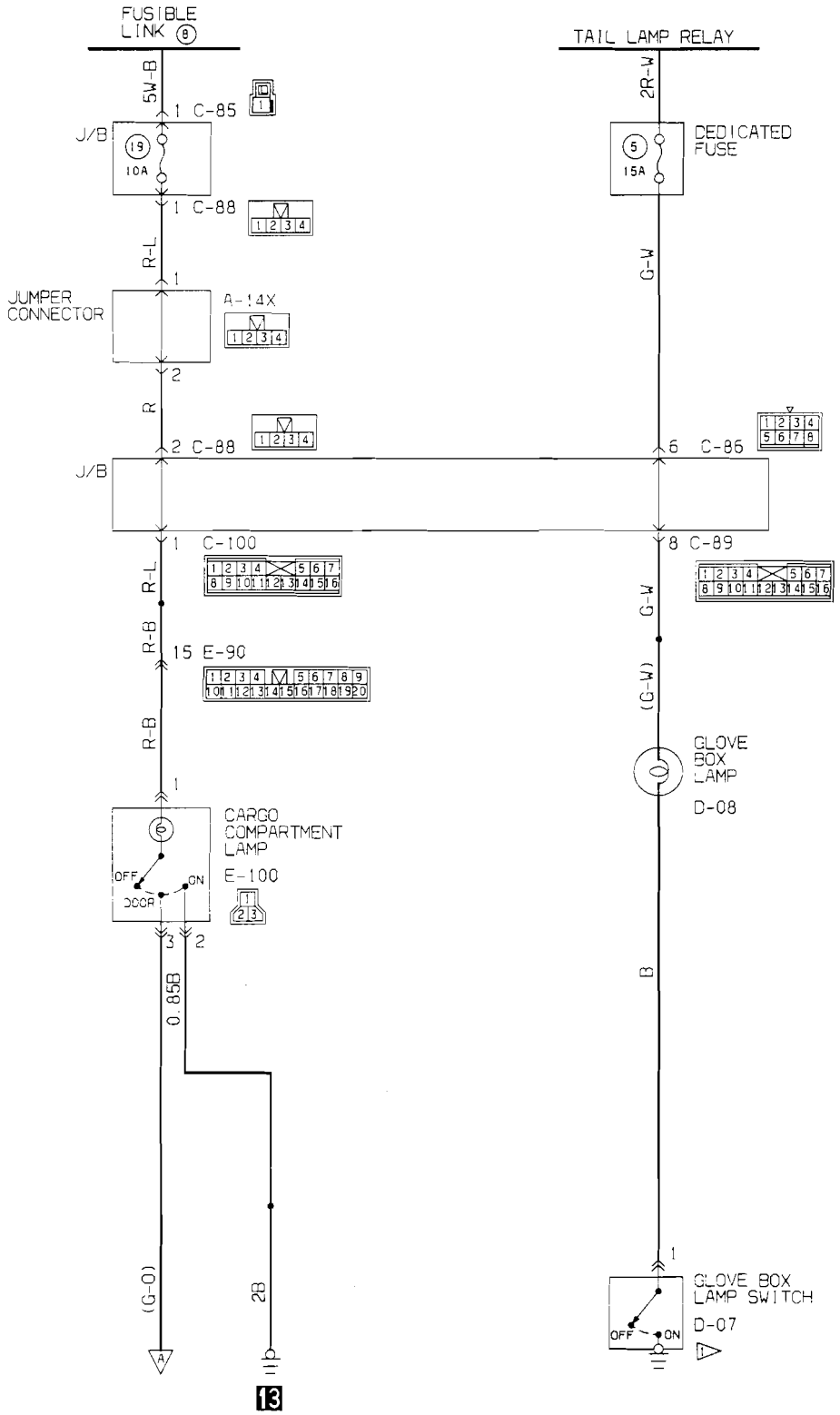


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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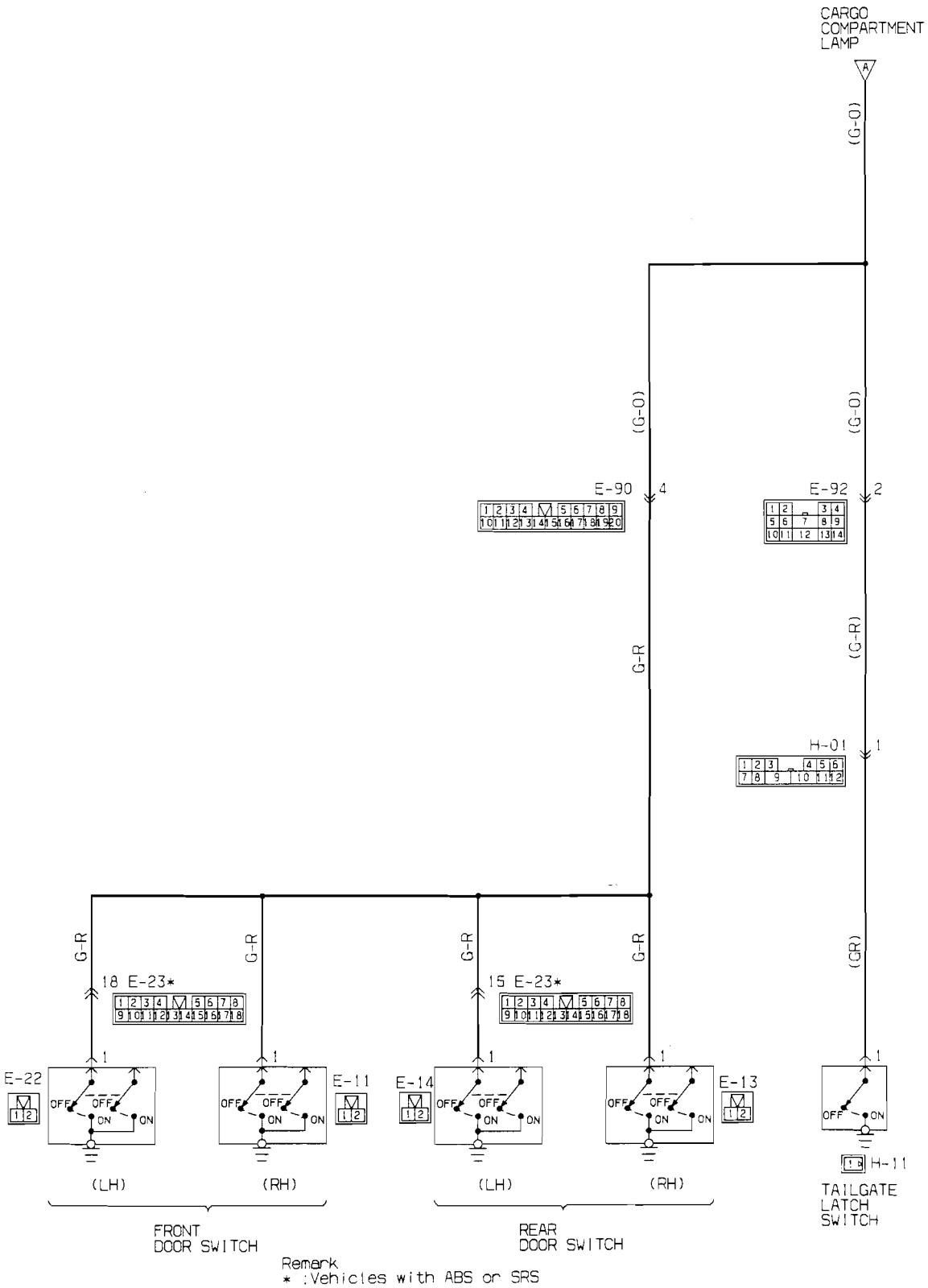
CIRCUIT DIAGRAM – Cargo lamp & glove box lamp circuit (92-94 wagon models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

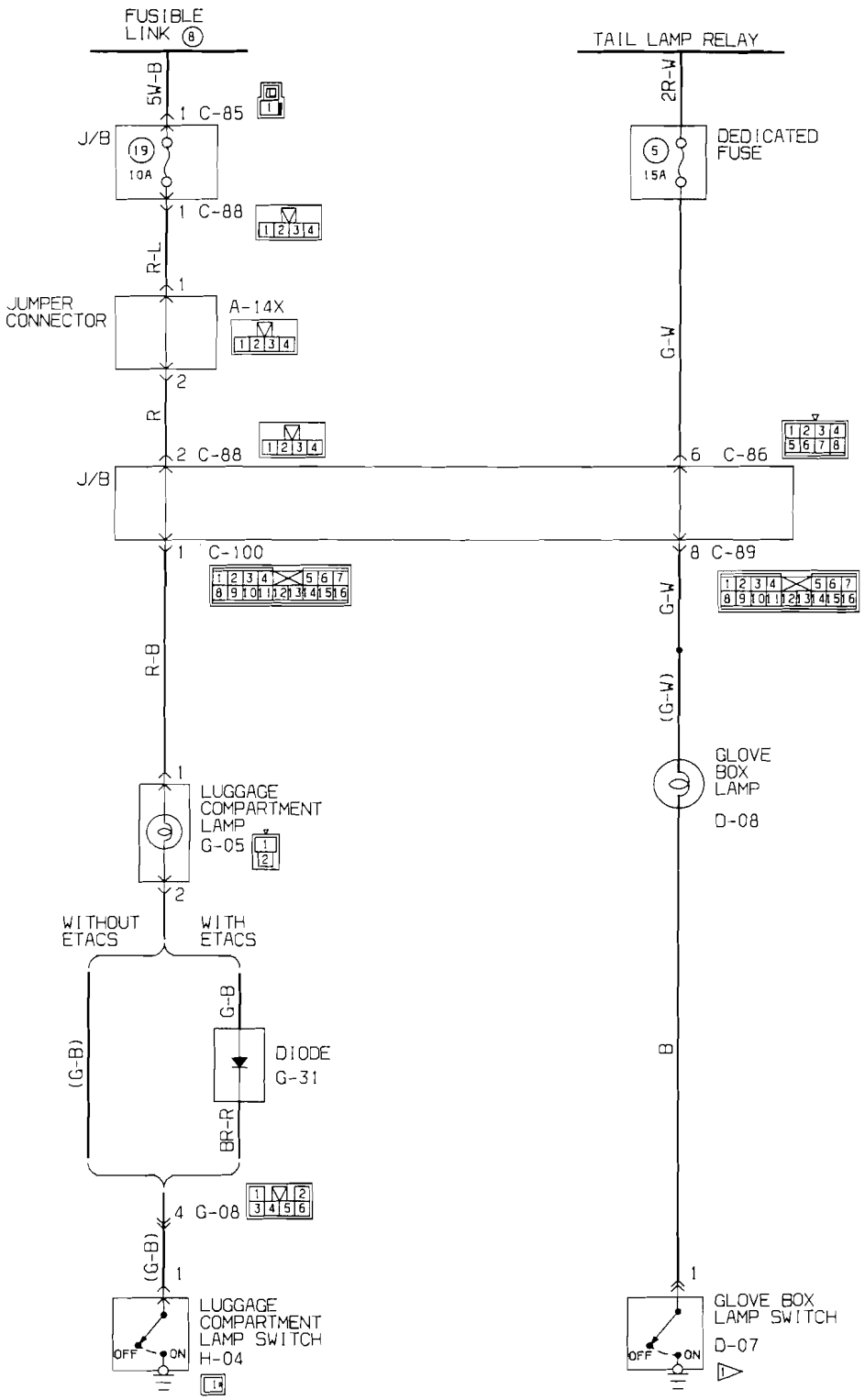
CIRCUIT DIAGRAM – Cargo lamp & glove box lamp circuit (92-94 wagon models)



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Luggage lamp & glove box lamp circuit 91-94 sedan Models



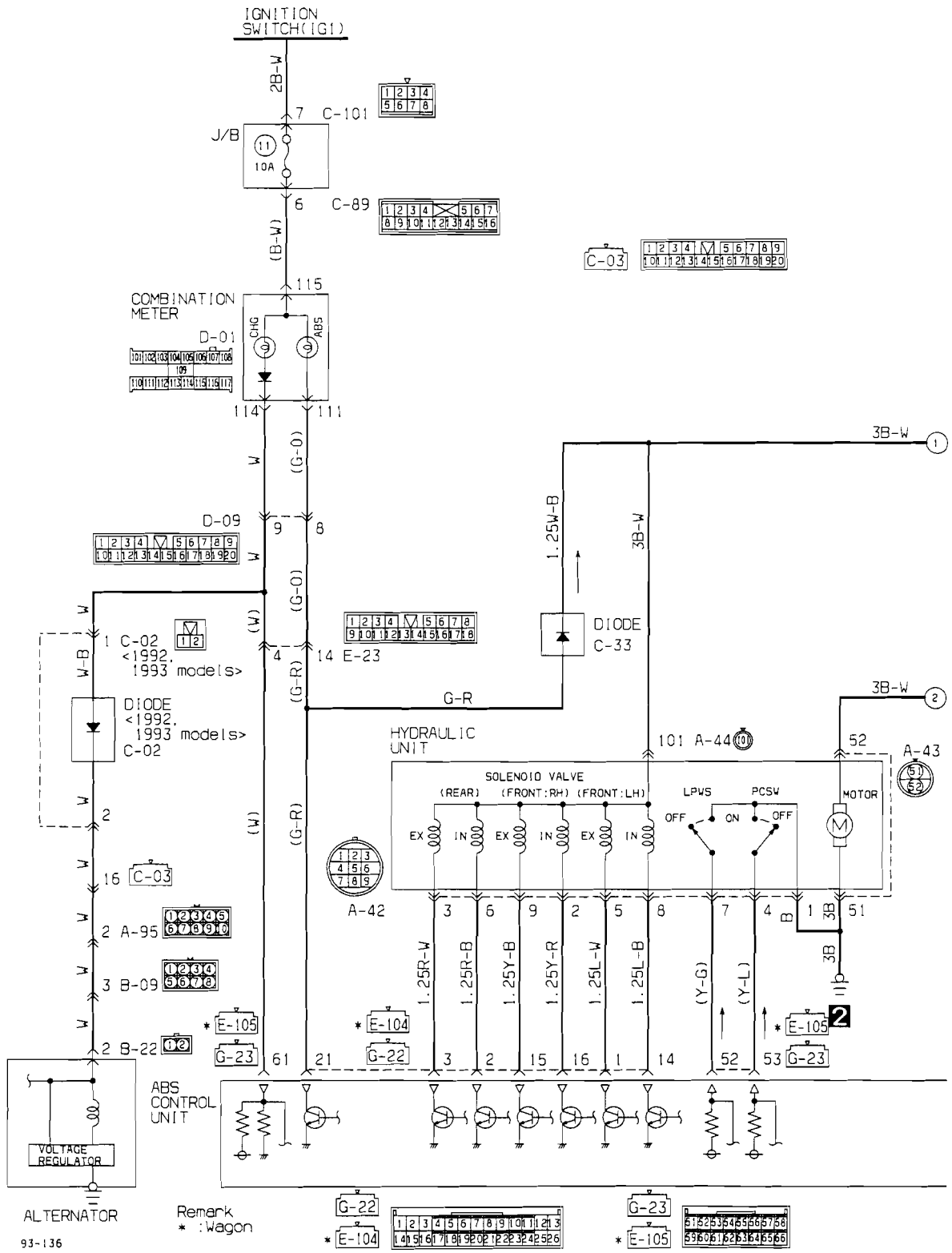
93-135

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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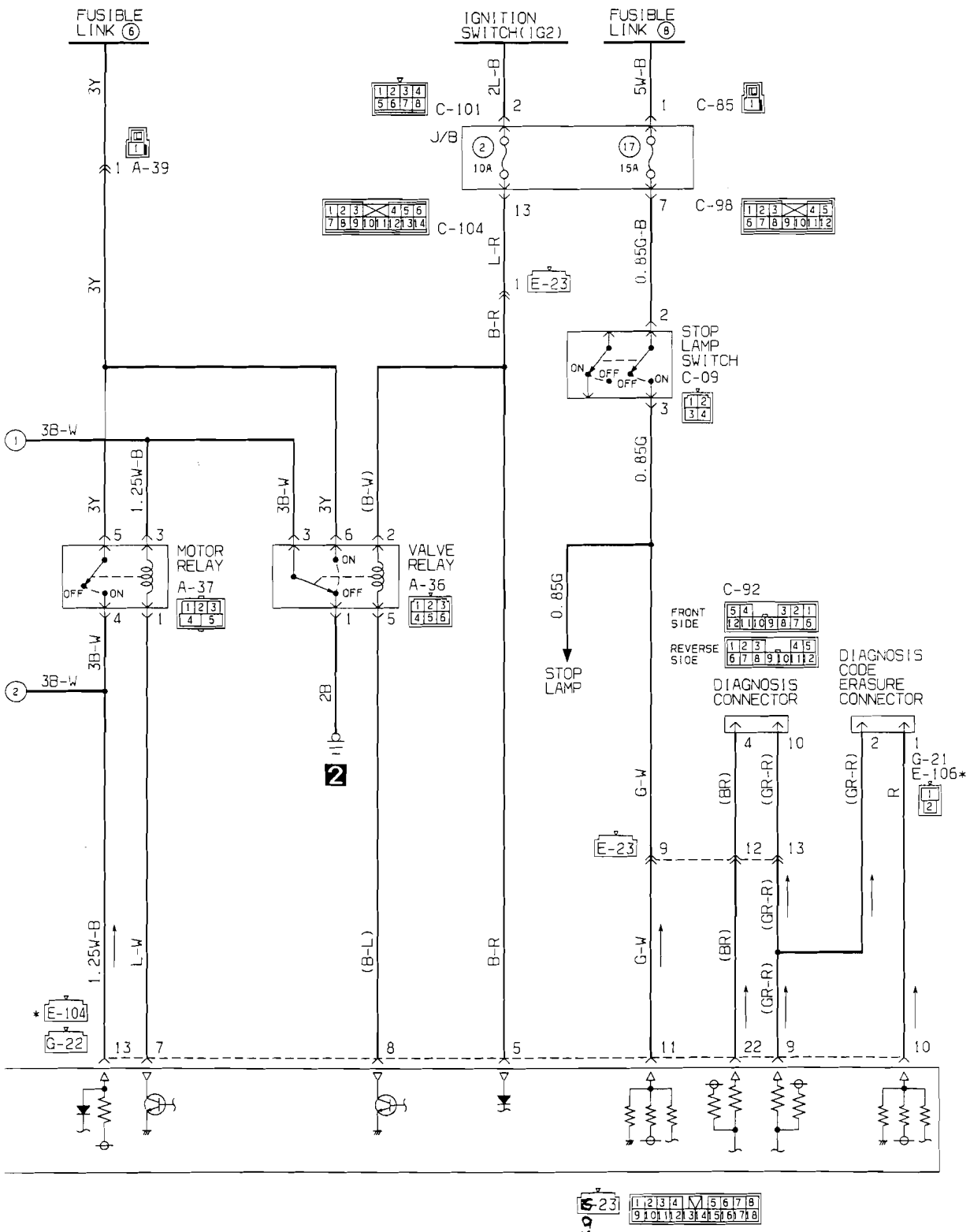
CIRCUIT DIAGRAM – Anti-lock braking system circuit 92-94 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

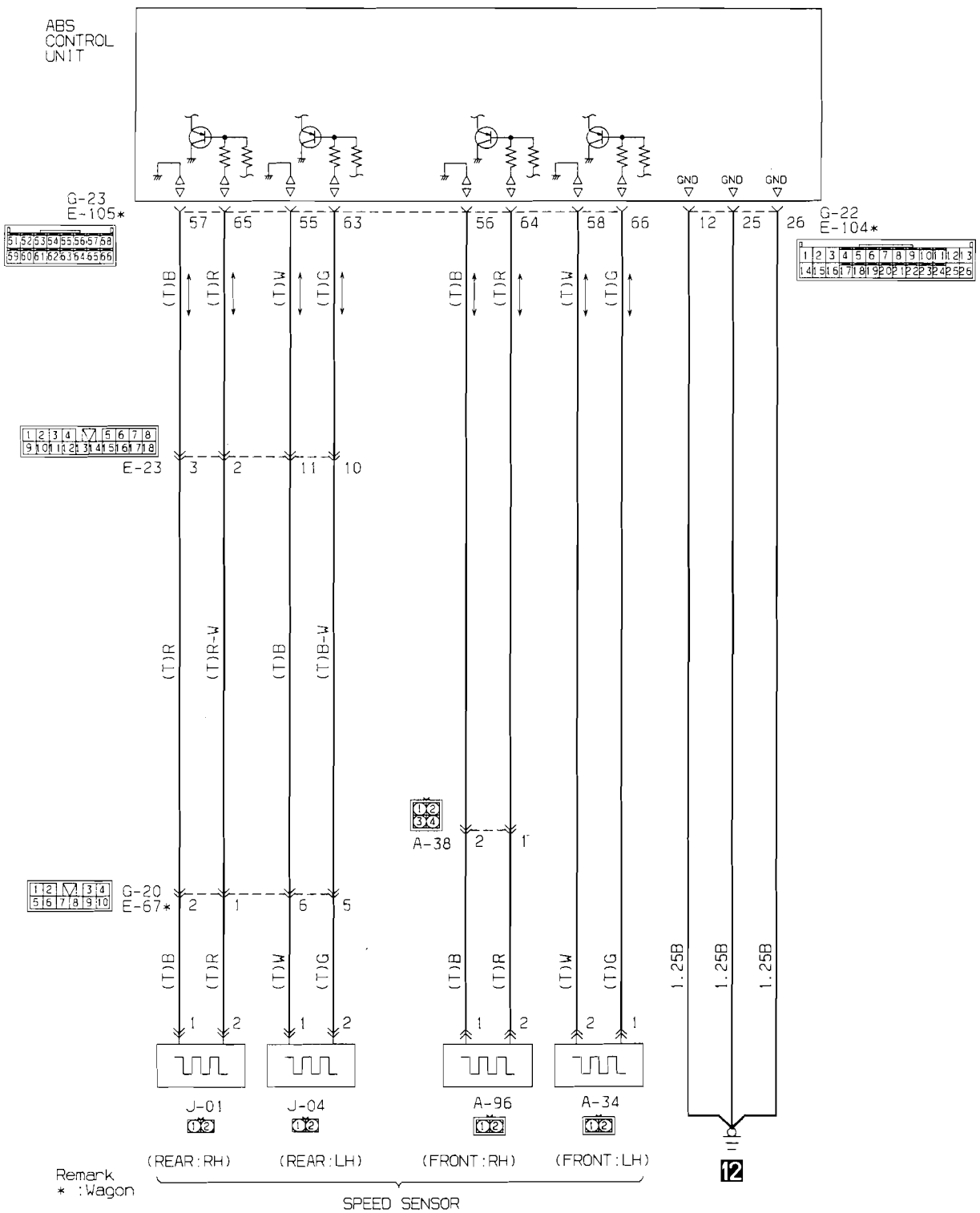
CIRCUIT DIAGRAM – Anti-lock braking system circuit 92-94 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

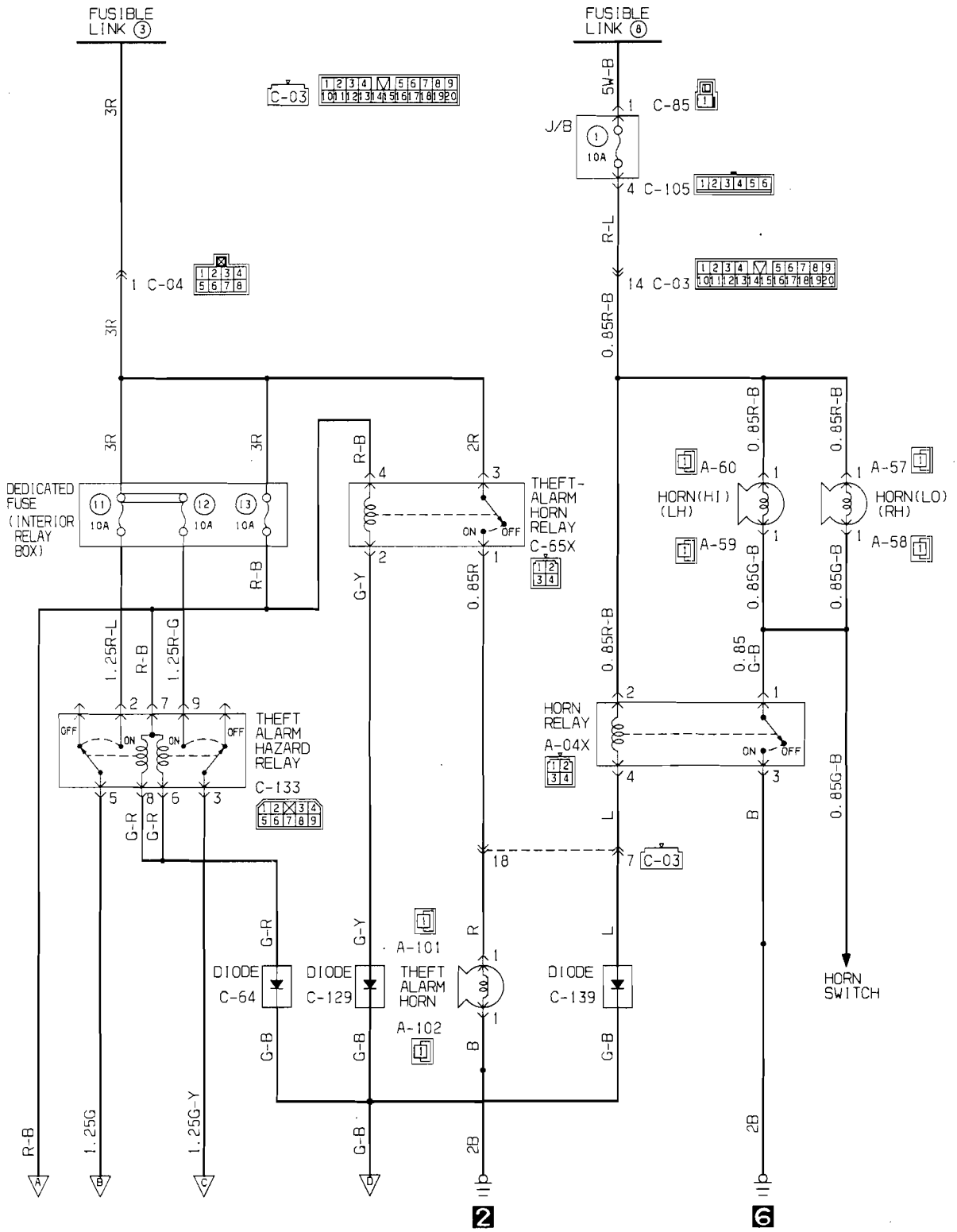
CIRCUIT DIAGRAM – Anti-lock braking system circuit 92-94 models continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Theft-alarm system circuit 'X' line 91-94 Models

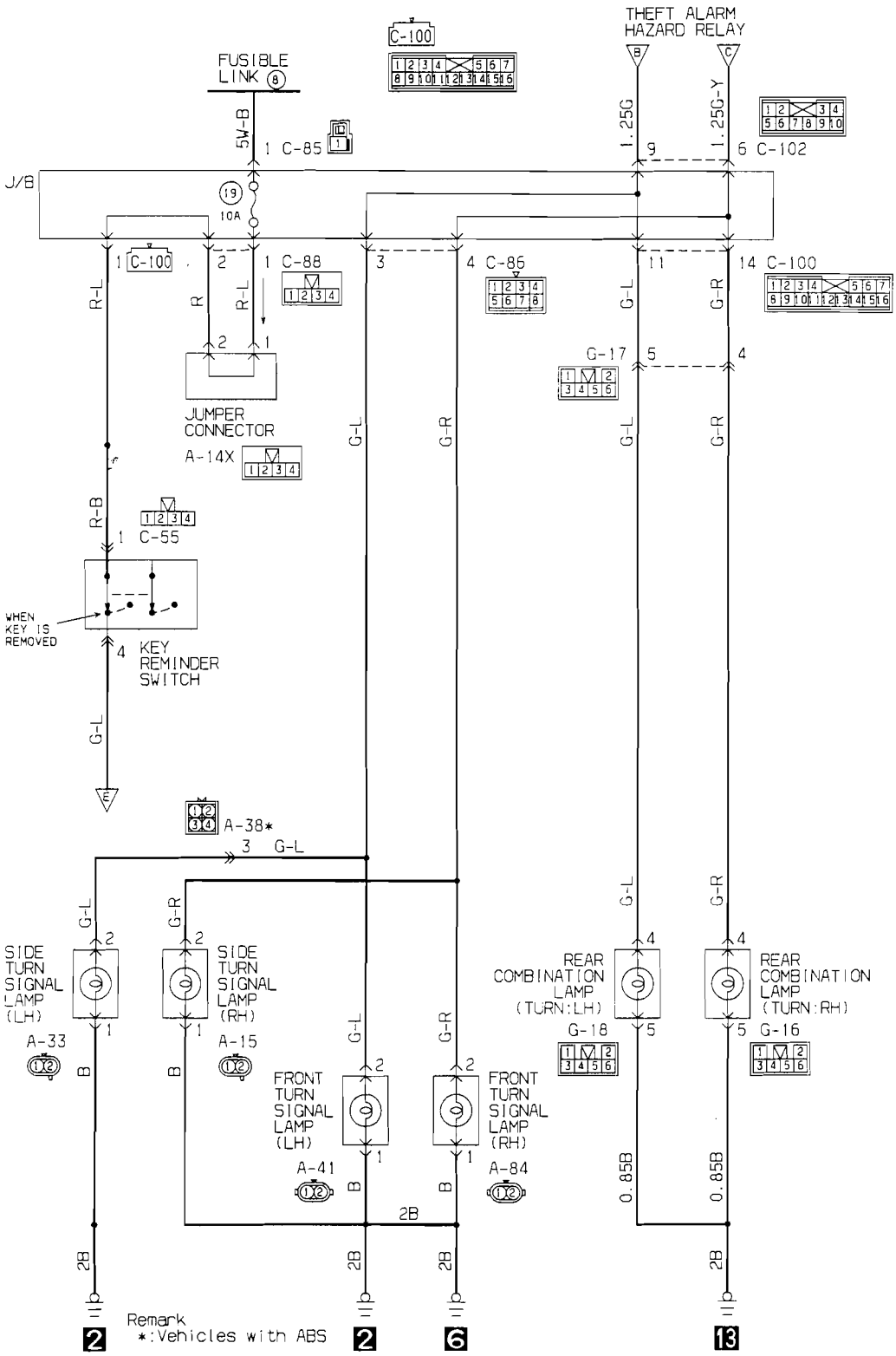


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Theft-alarm system circuit 'X' line 91-94 Models

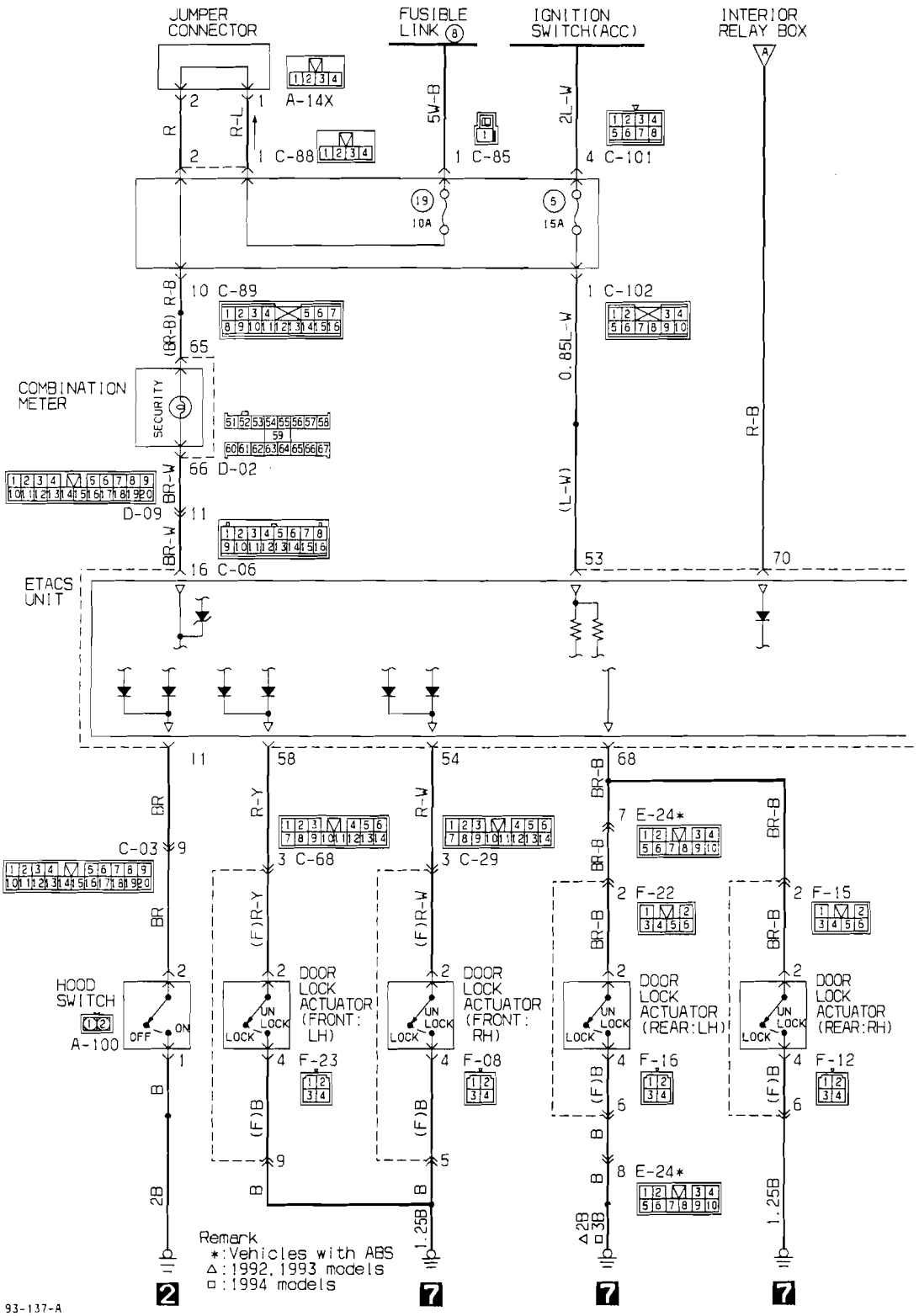


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Theft-alarm system circuit 'X' line 91-94 Models Cont;

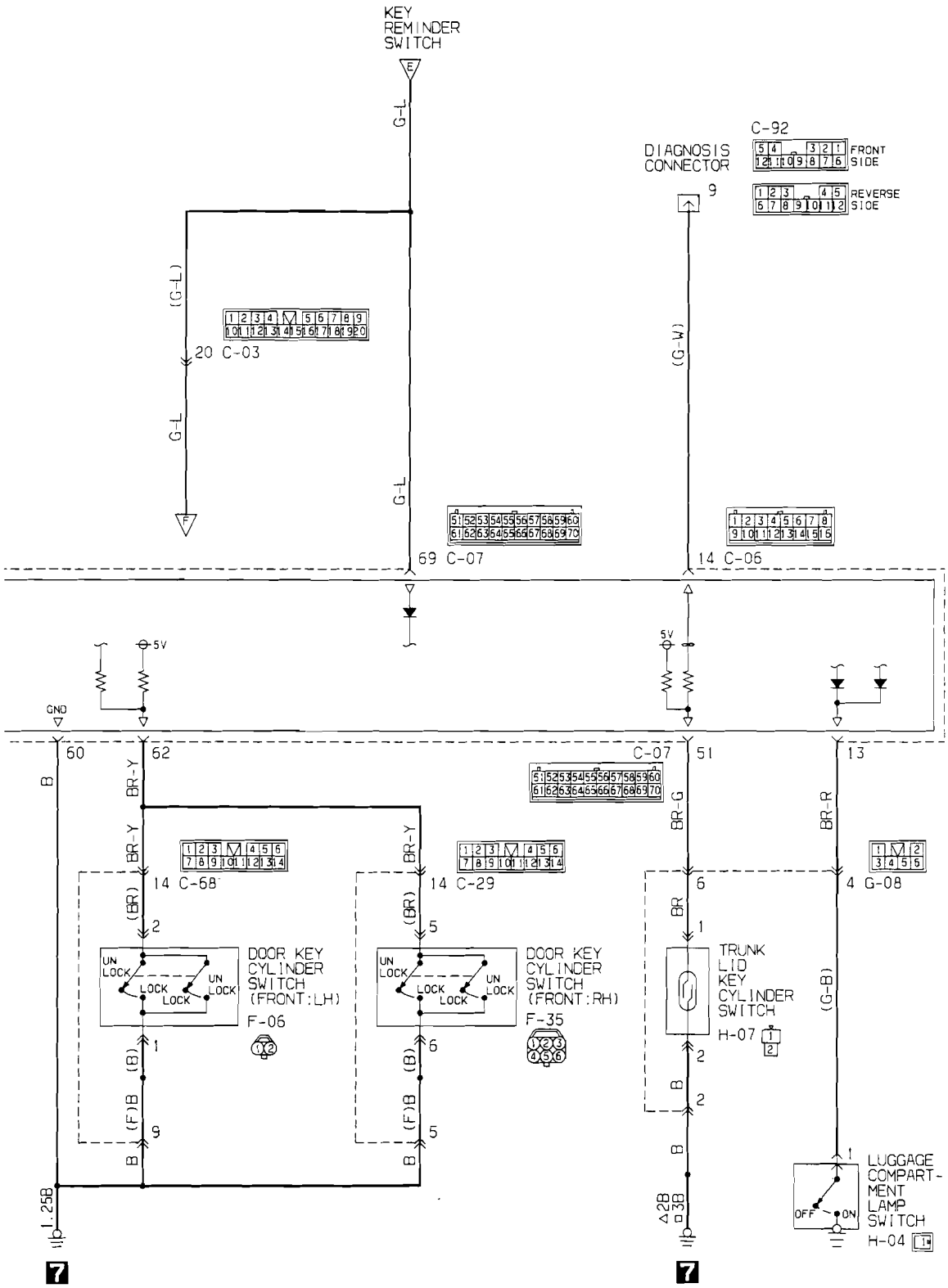


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Theft-alarm system circuit 'X' line 91-94 Models

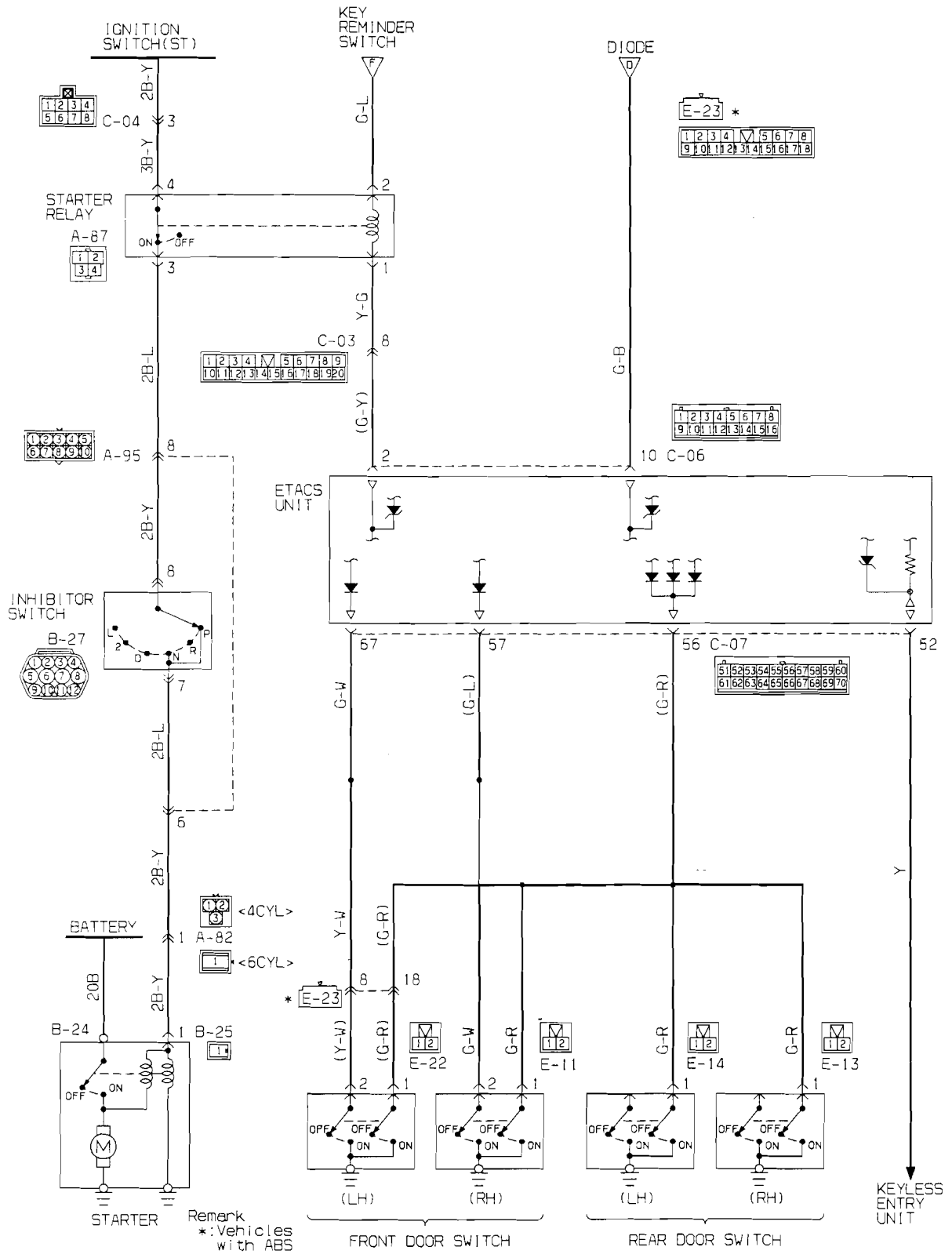


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Theft-alarm system circuit 'X' line 91-94 Models Cont;

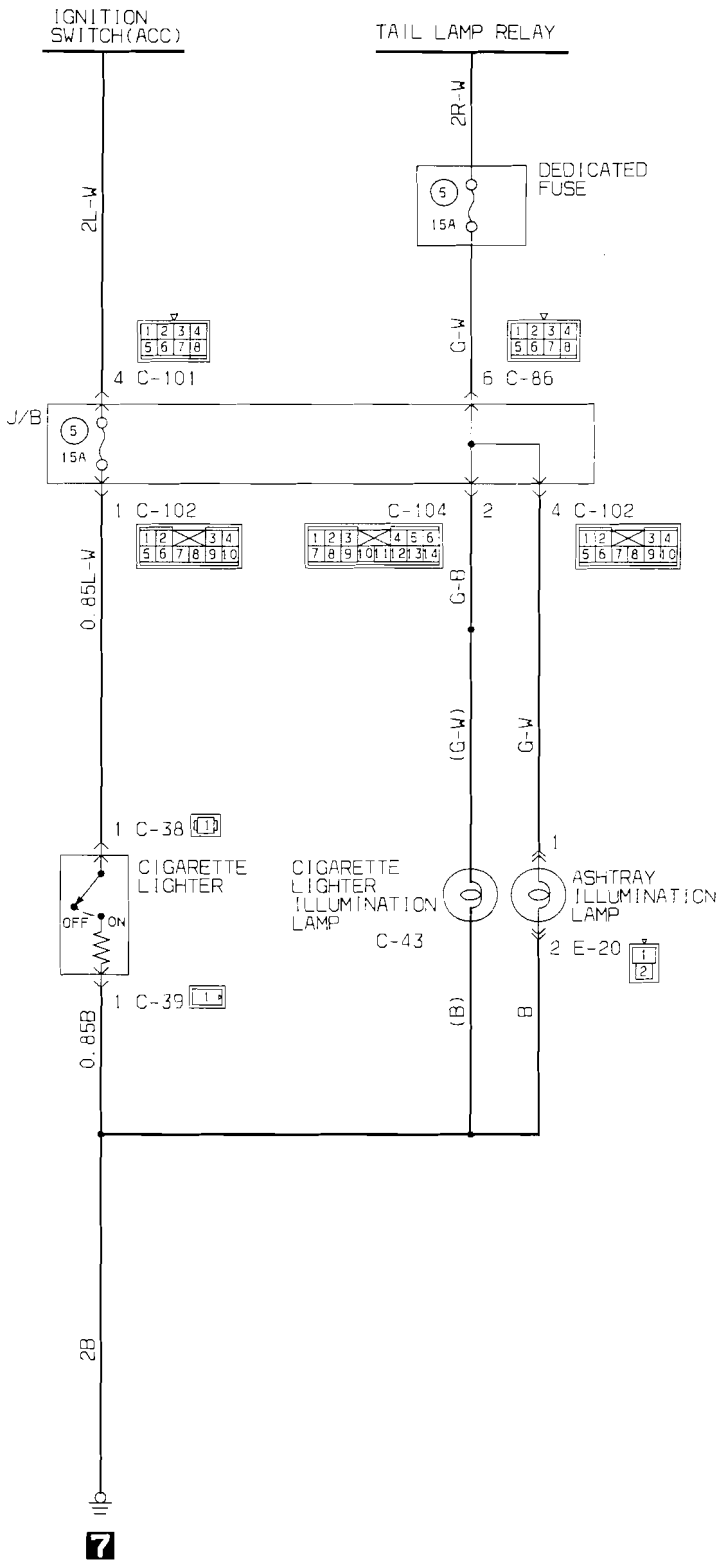


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Cigarette lighter circuit 91-94 models

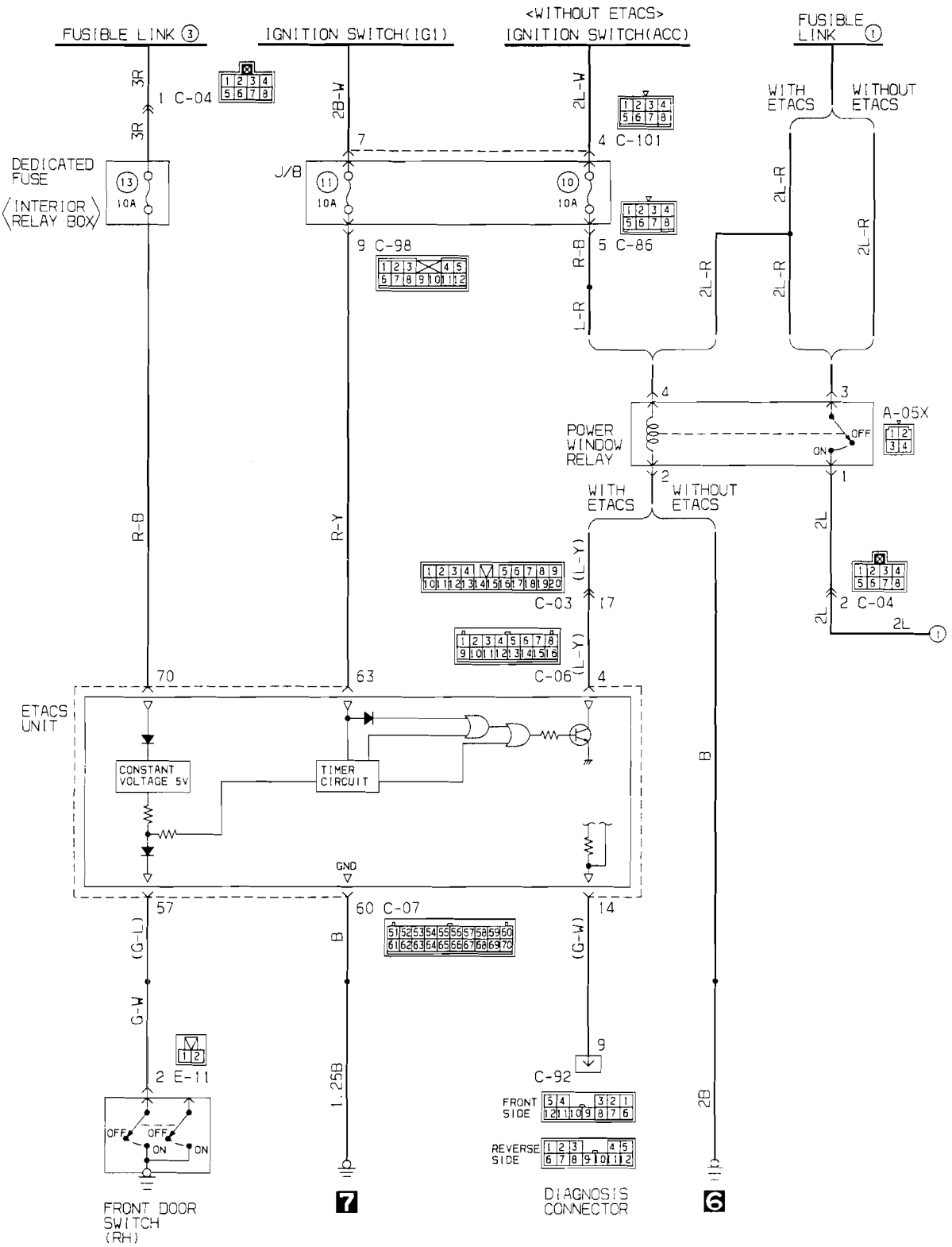


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Power window circuit 91-94 Models

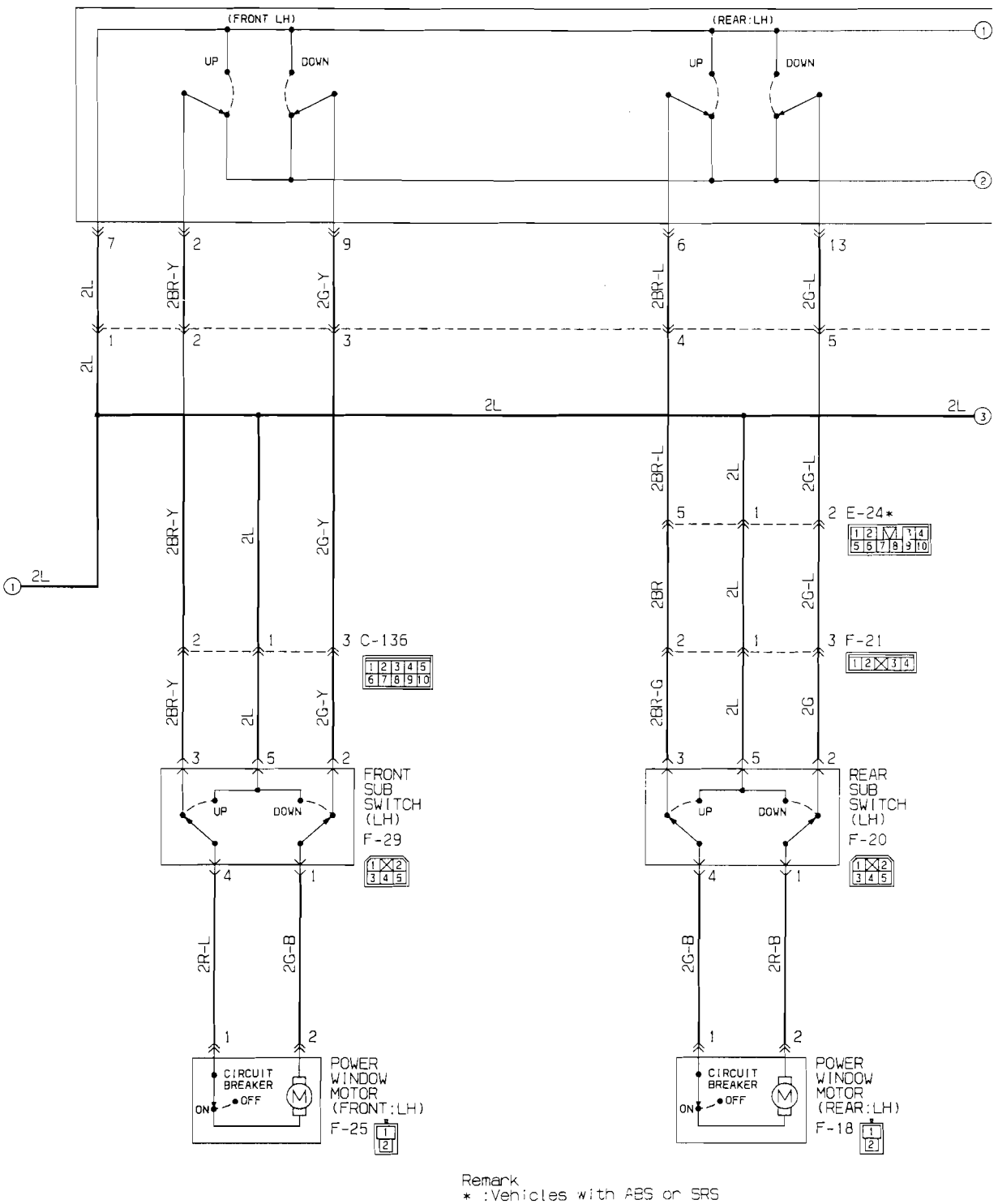


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Power window circuit 91-94 Models



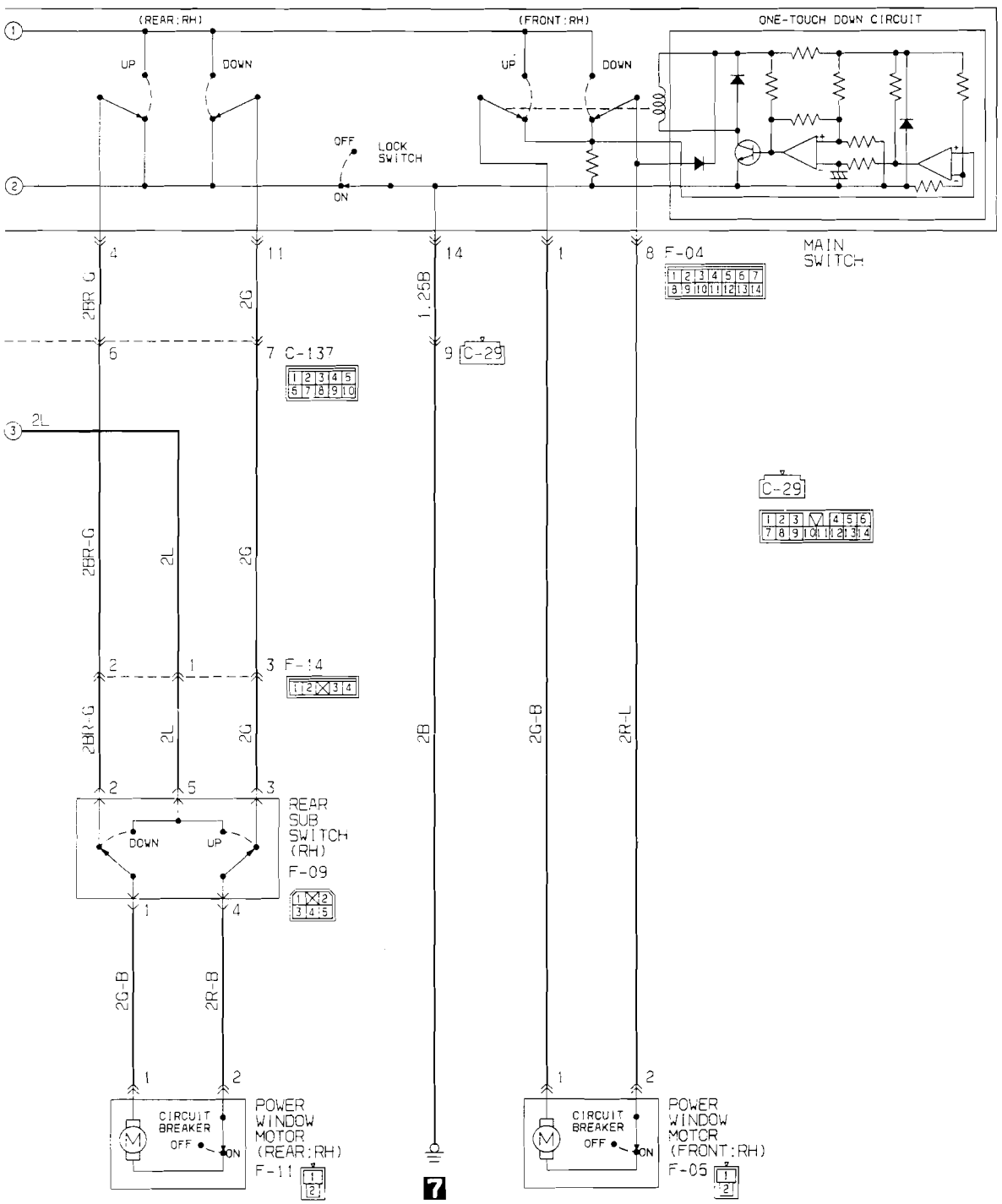
93-142-A

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Power window circuit 91-94 Models Cont;

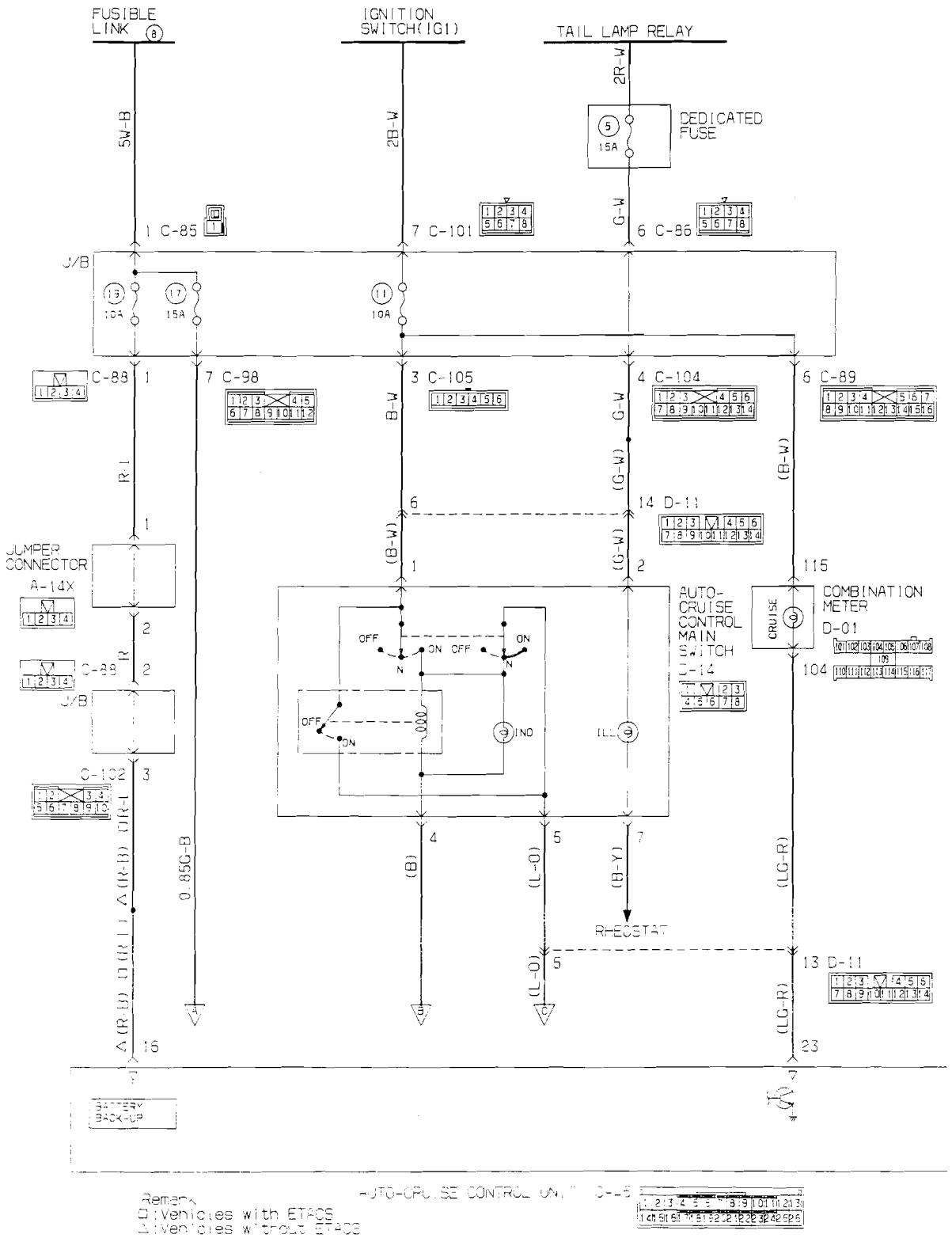


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Auto-cruise circuit w/o SRS 91-94 models

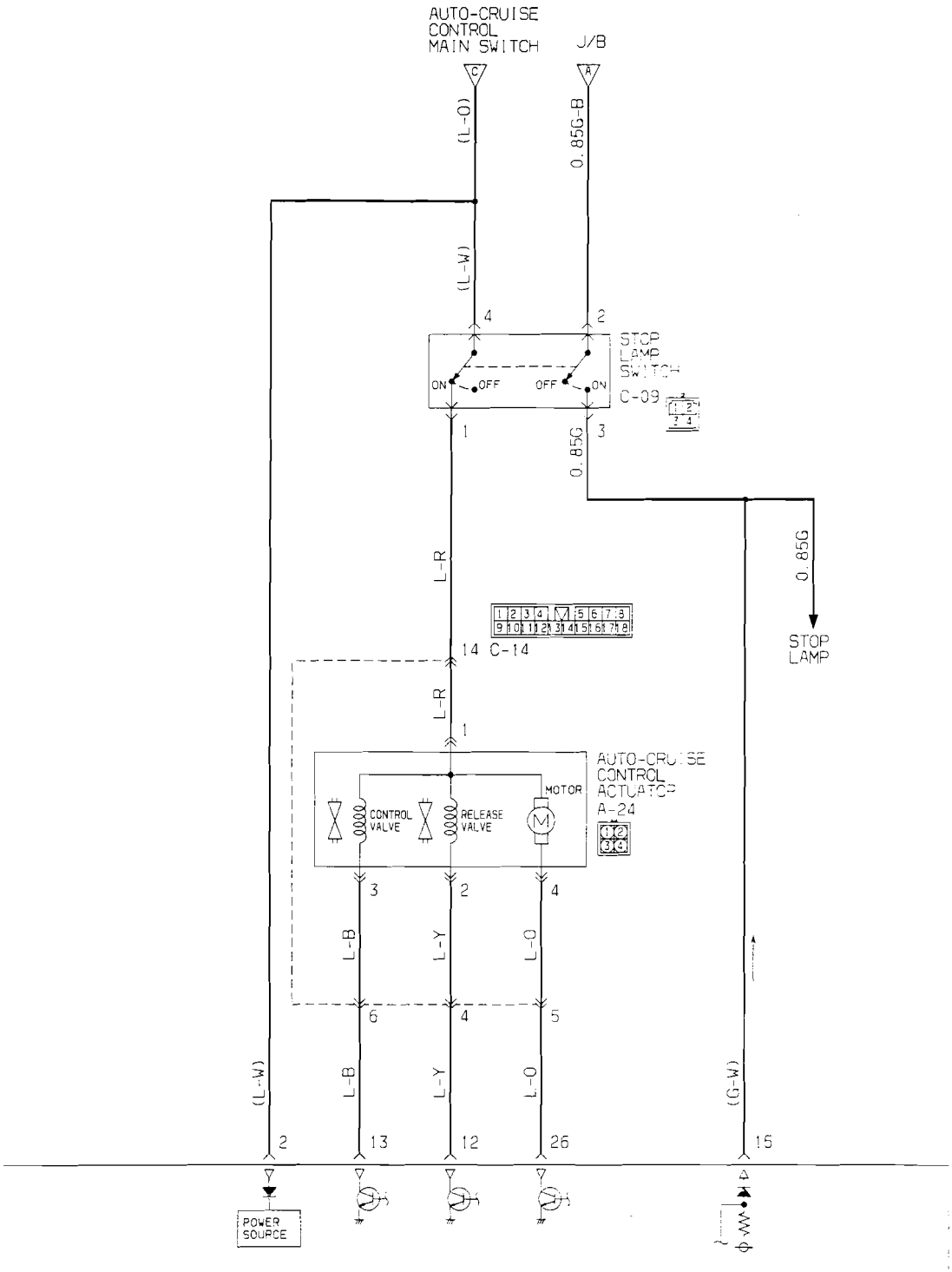


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Auto-cruise circuit w/o SRS 91-94 models

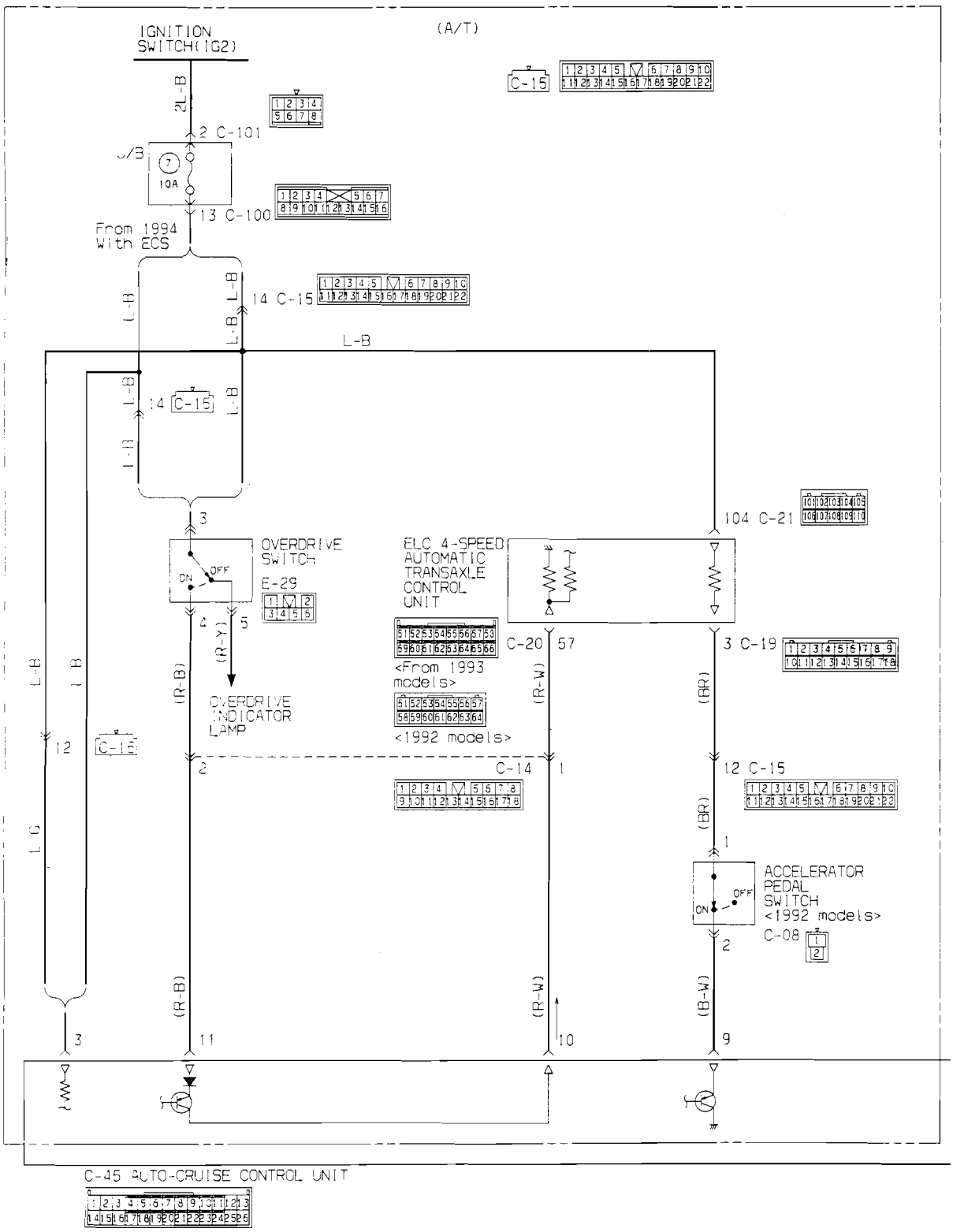


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Auto-cruise circuit w/o SRS 91-94 models Cont;

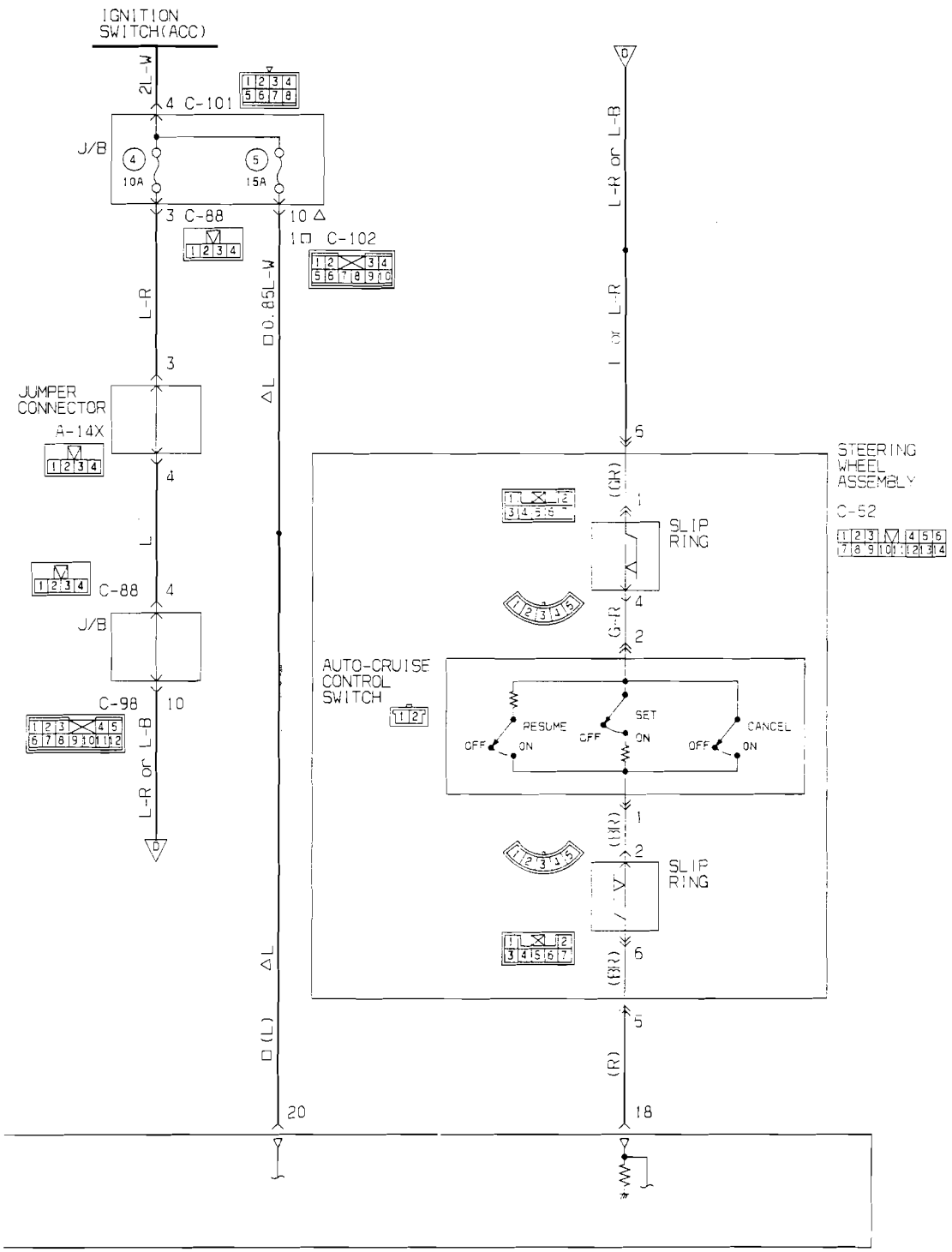


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Auto-cruise circuit w/o SRS 91-94 models



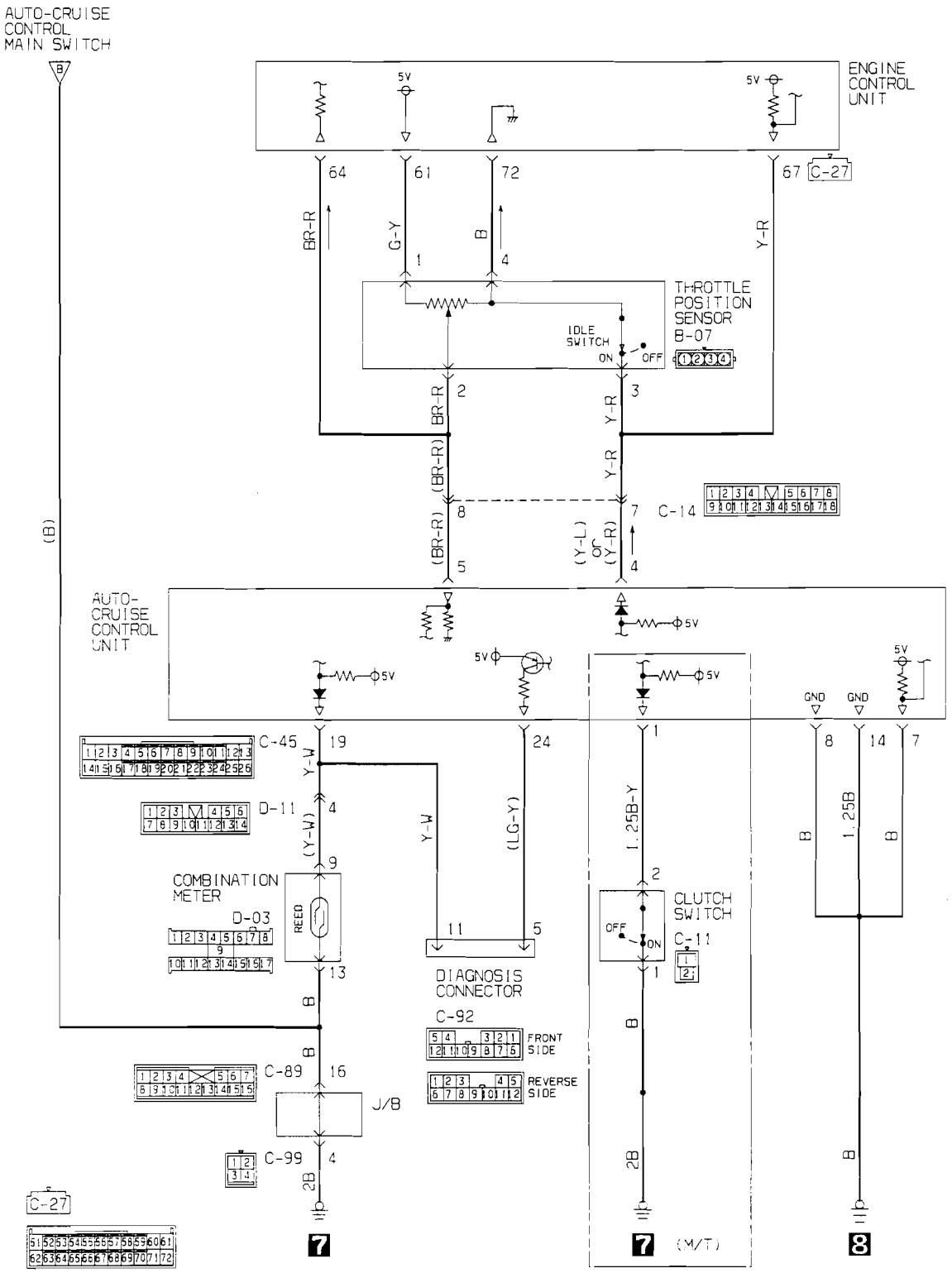
Remark
□ : Vehicles with ETACS
△ : Vehicles without ETACS

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

CIRCUIT DIAGRAM – Auto-cruise circuit w/o SRS 91-94 models



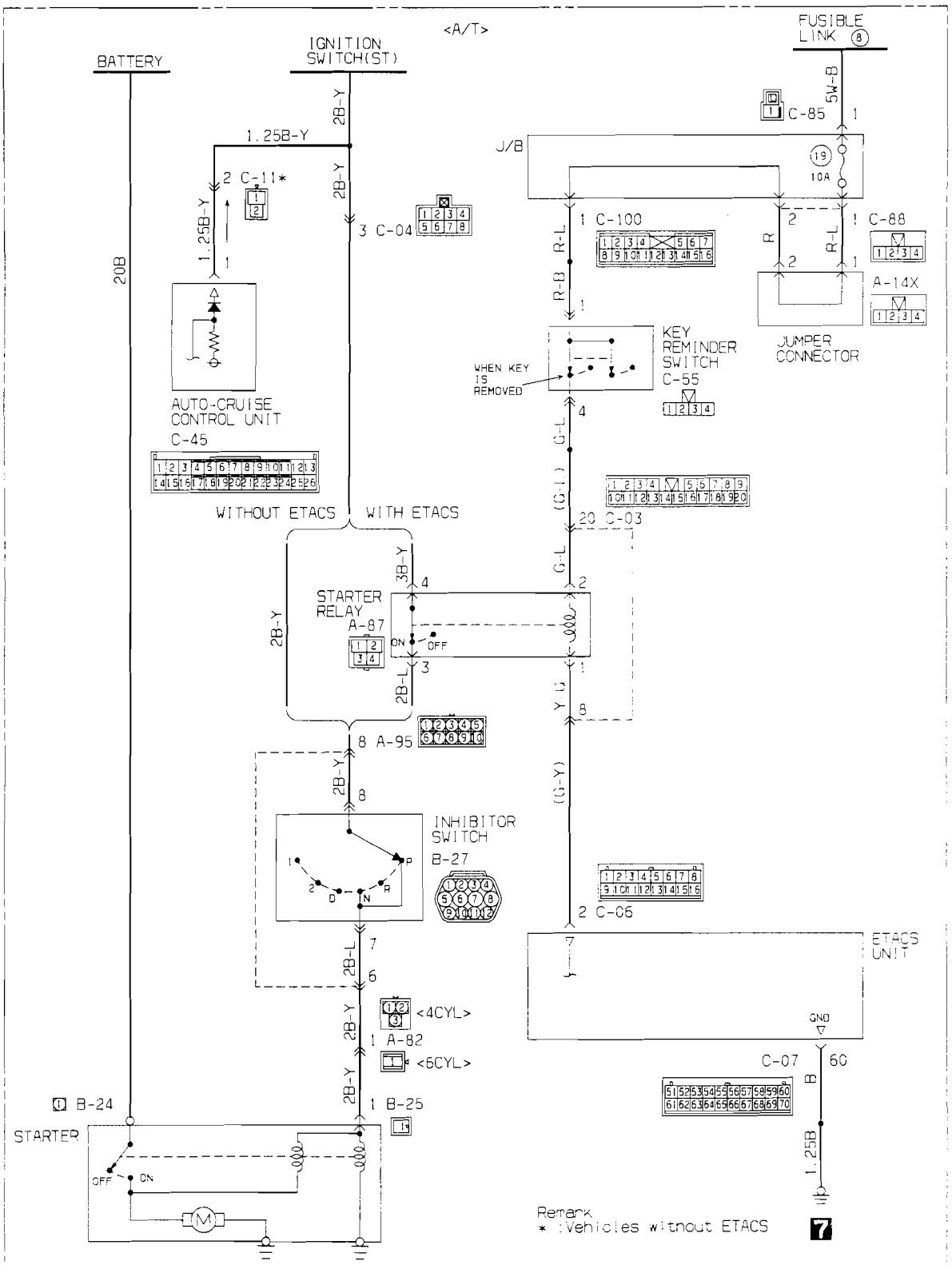
93-143-B

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Auto-cruise circuit w/o SRS 91-94 models

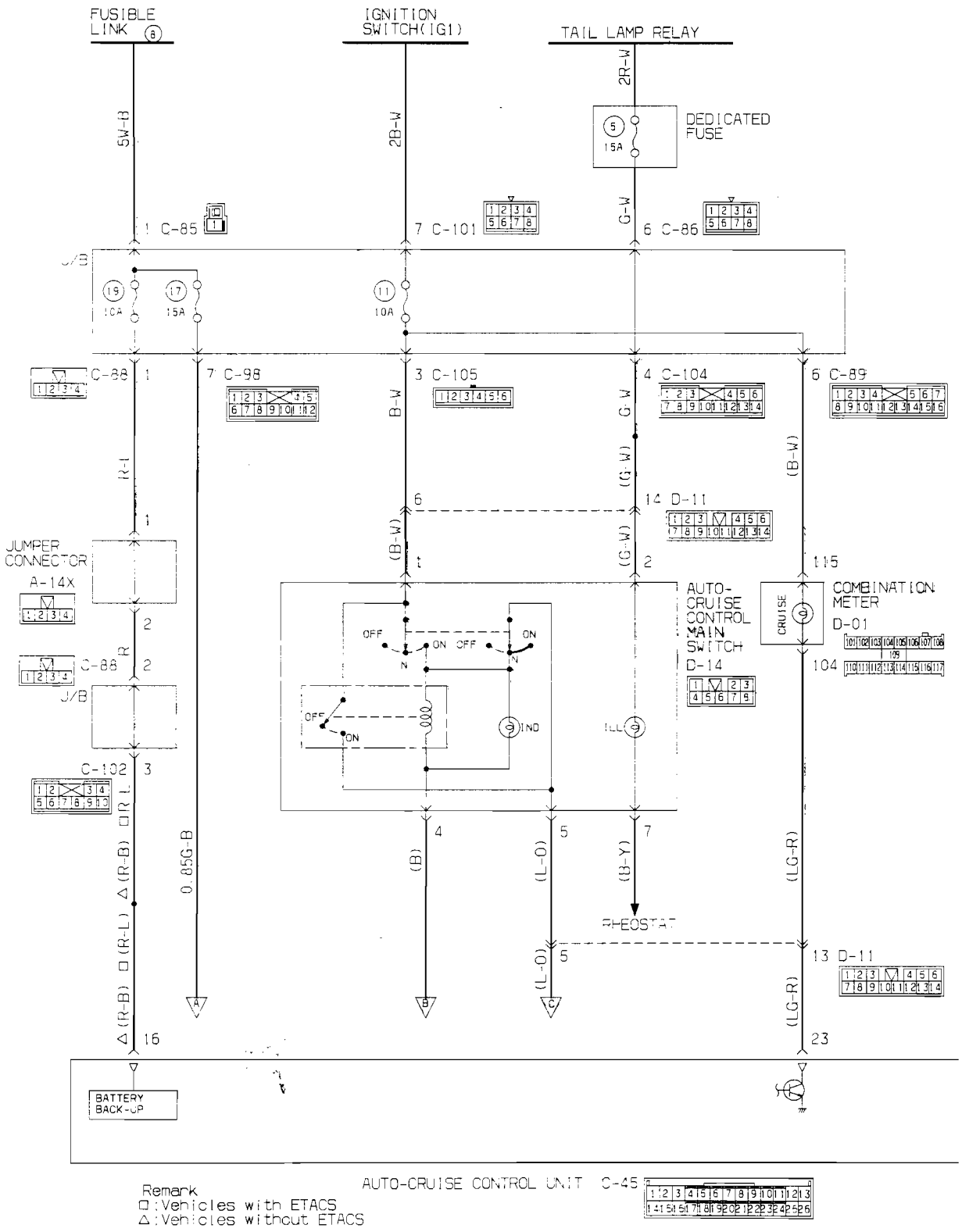


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

© Mitsubishi Motors Australia Ltd. Sept. 1994

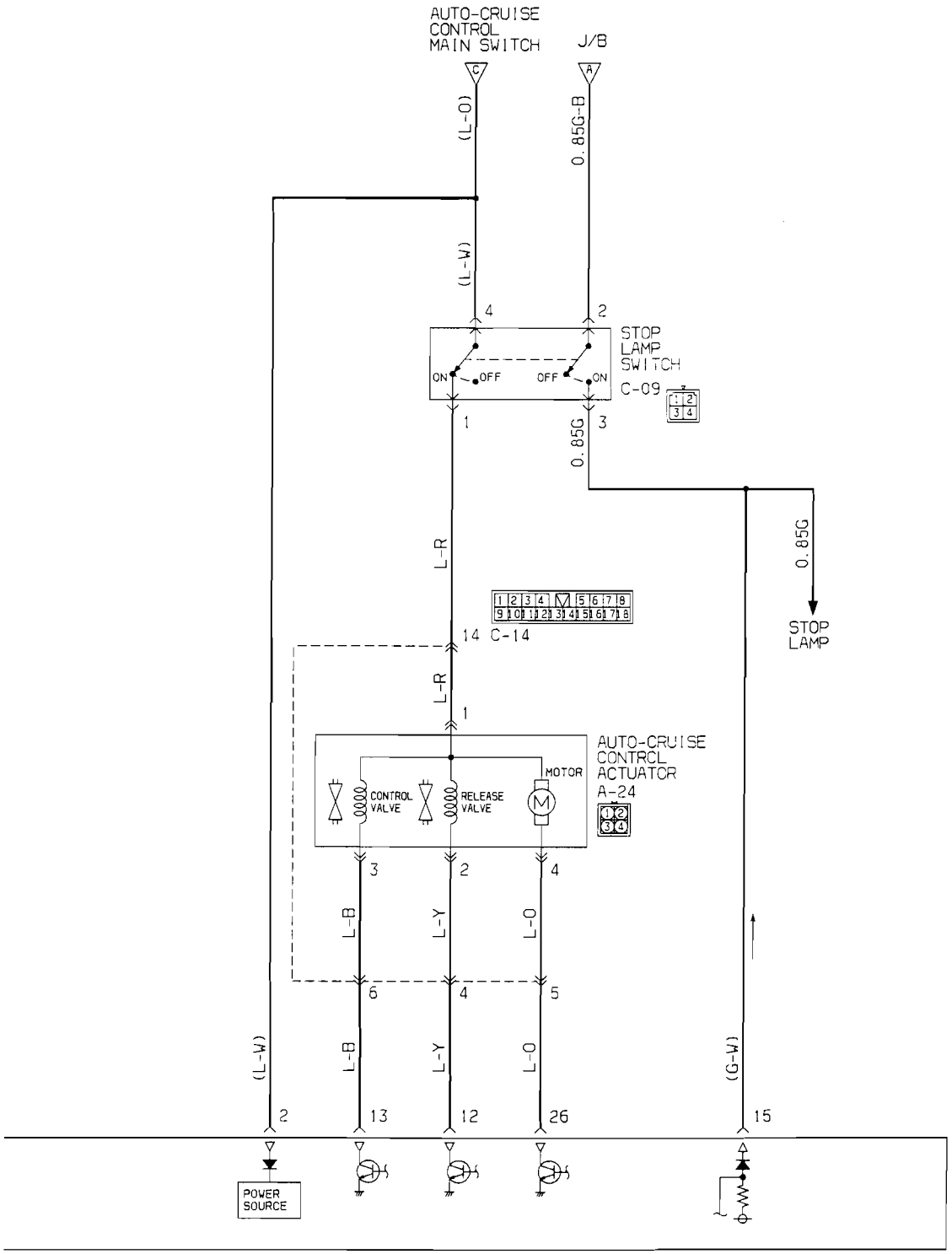
CIRCUIT DIAGRAM – Auto-cruise circuit w/- SRS 94 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

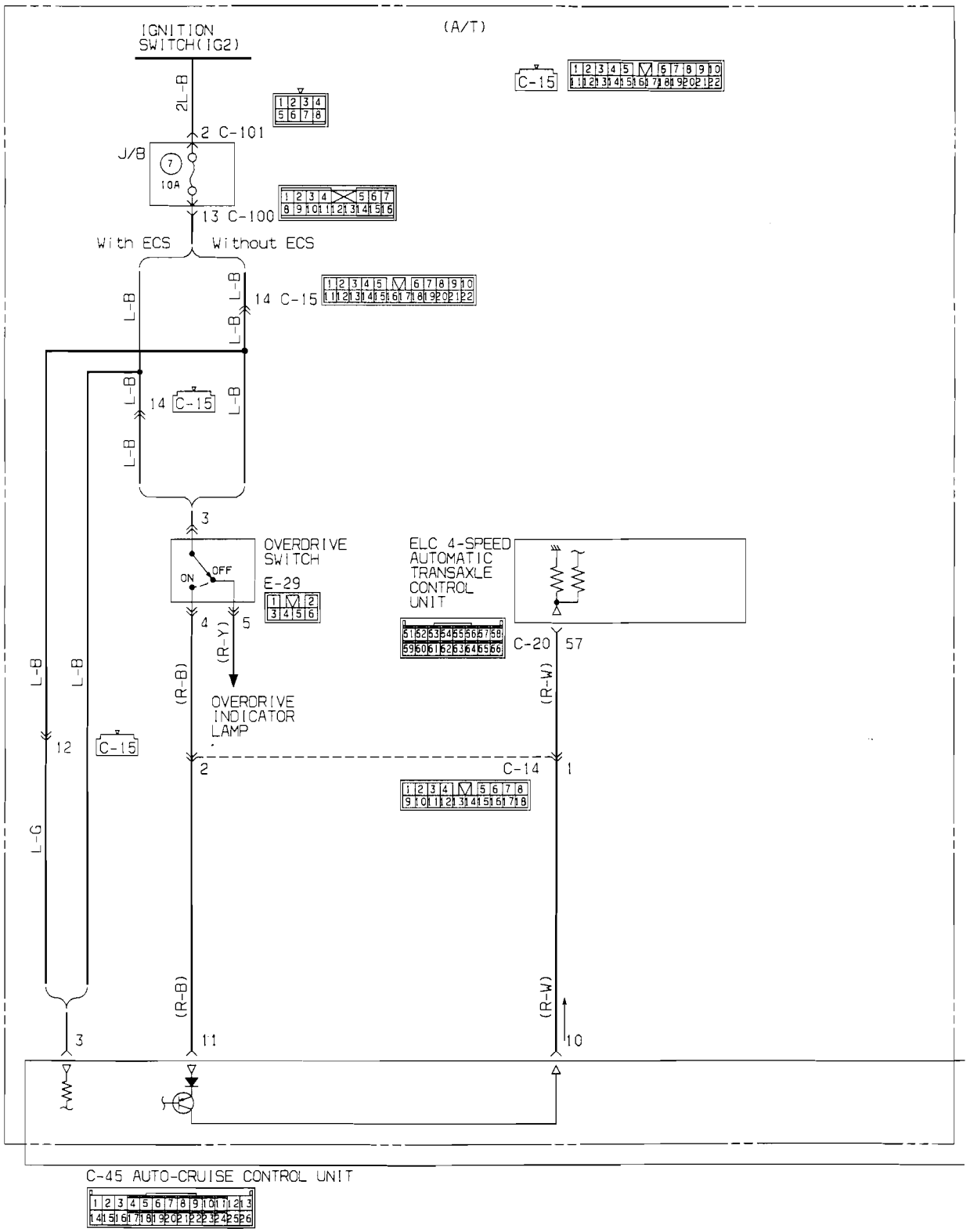
CIRCUIT DIAGRAM – Auto-cruise circuit w/- SRS 94 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

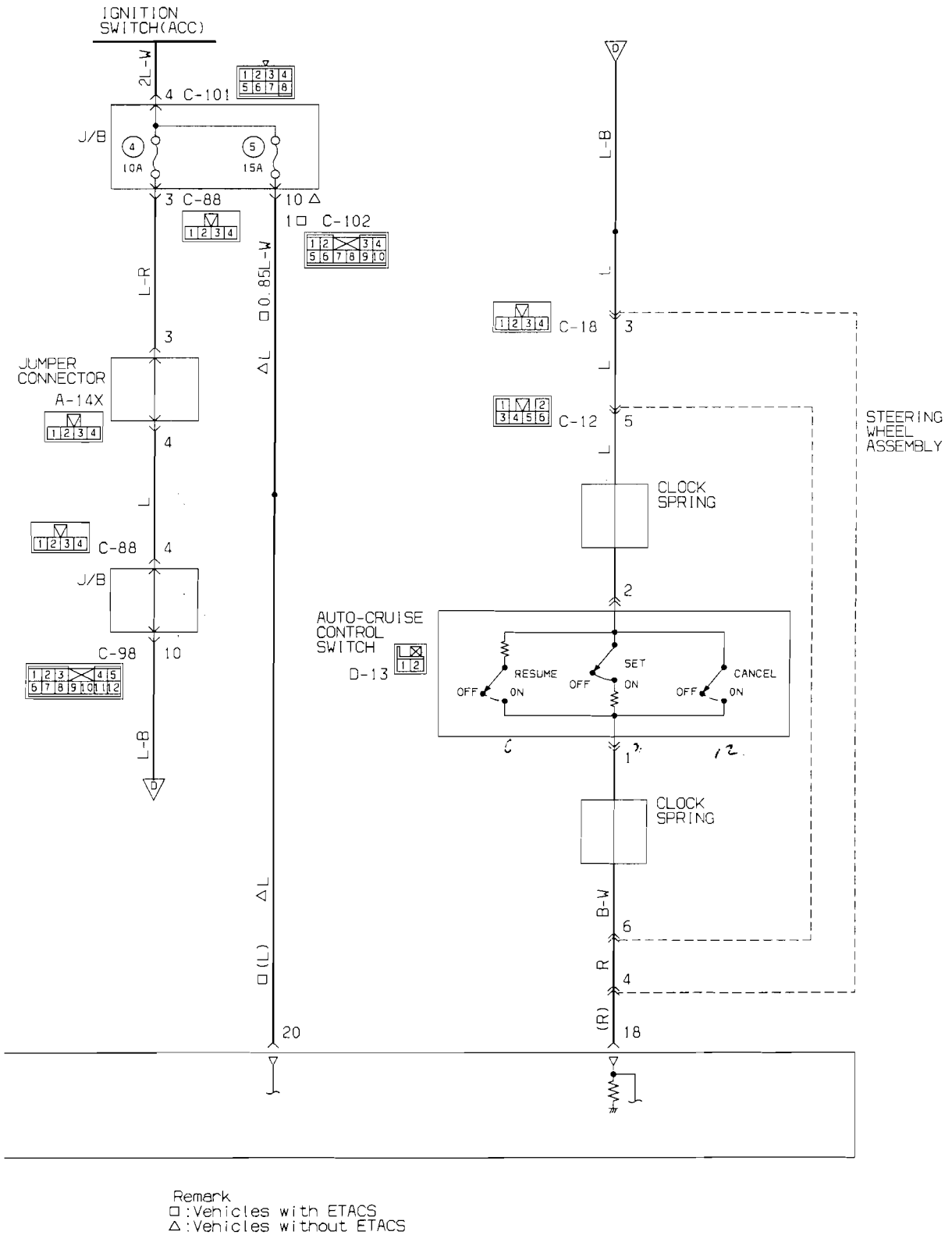
CIRCUIT DIAGRAM – Auto-cruise circuit w/- SRS 94 models continued



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Auto-cruise circuit w/- SRS 94 models

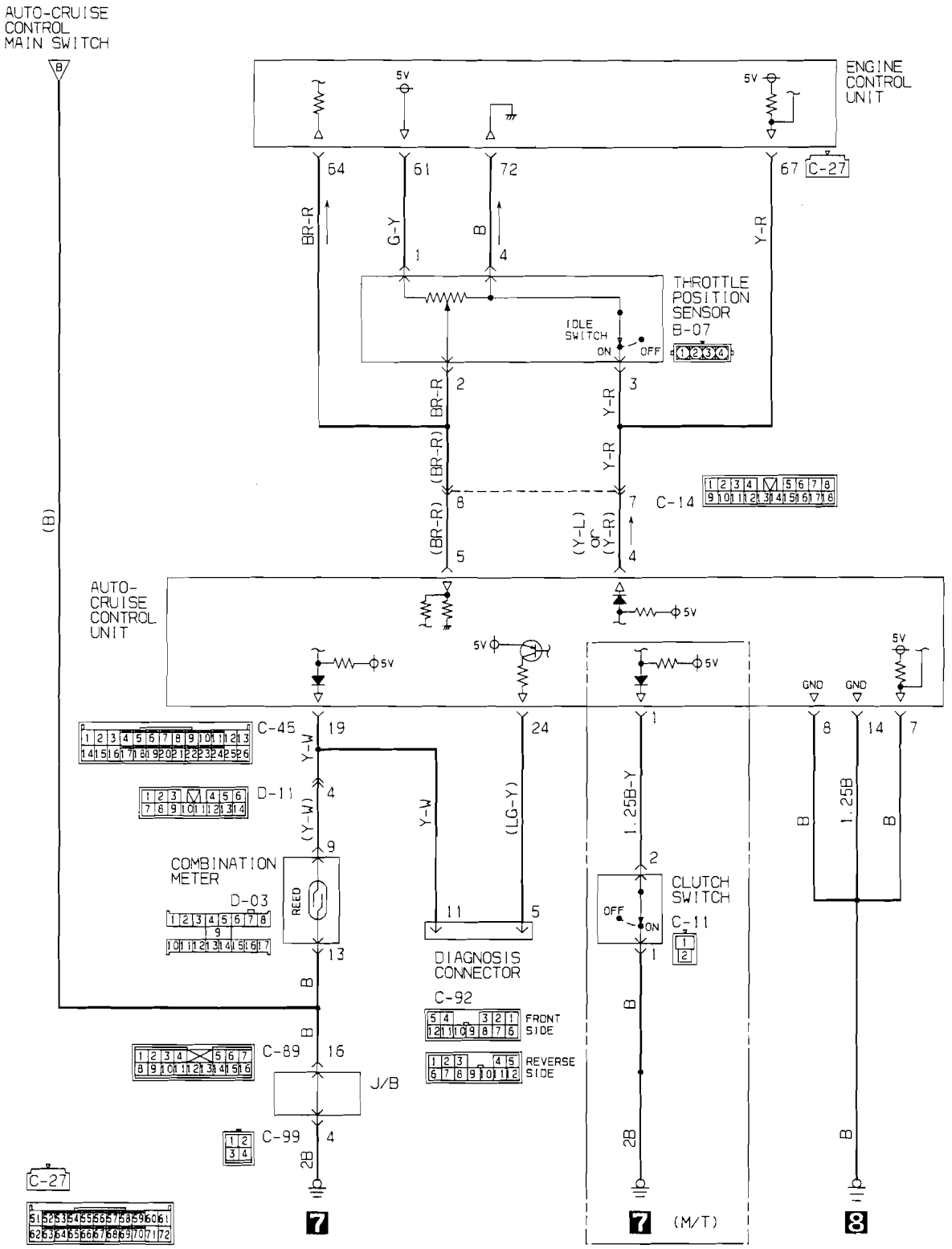


Remark
□ : Vehicles with ETACS
△ : Vehicles without ETACS

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

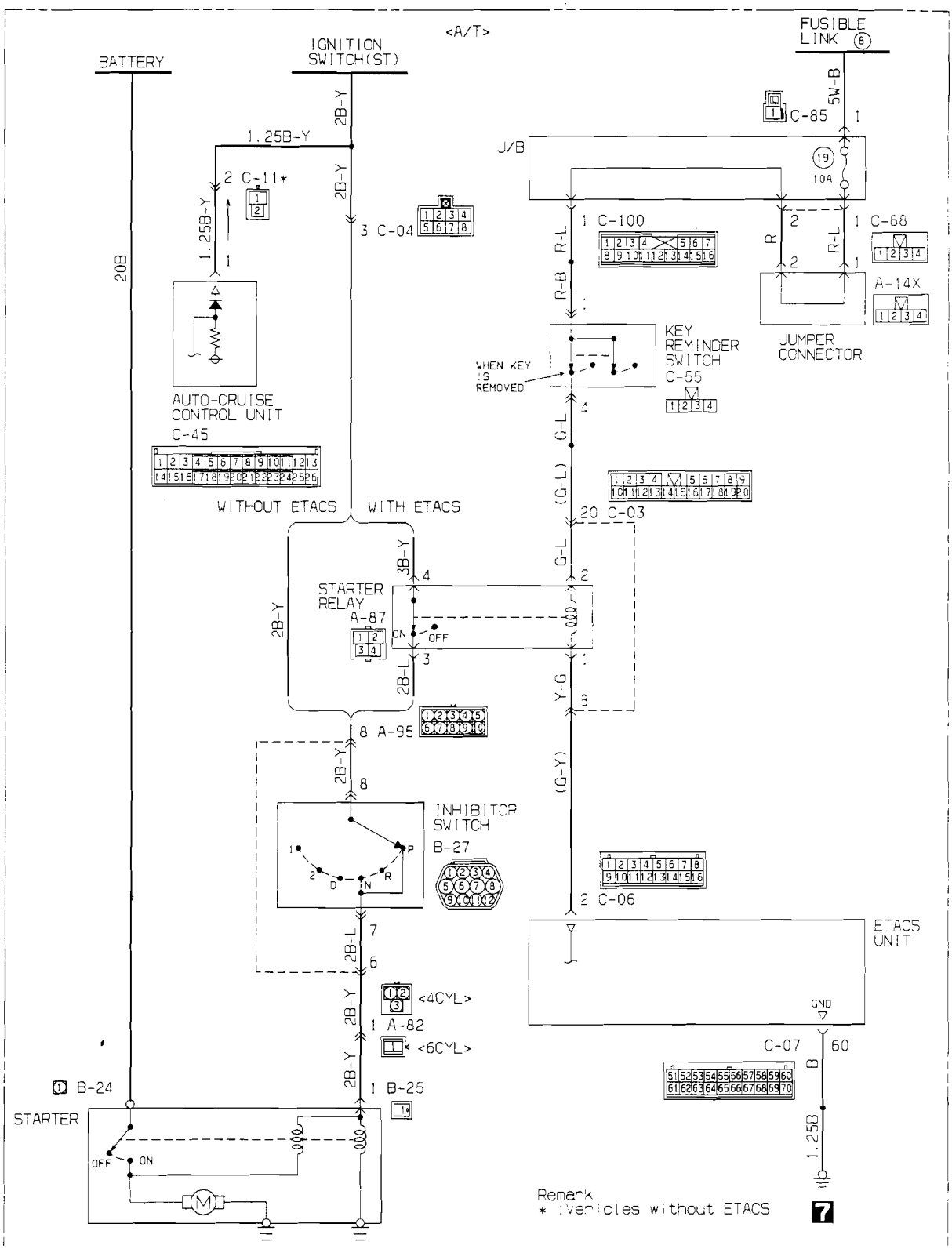
CIRCUIT DIAGRAM – Auto-cruise circuit w/- SRS 94 models cont;



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

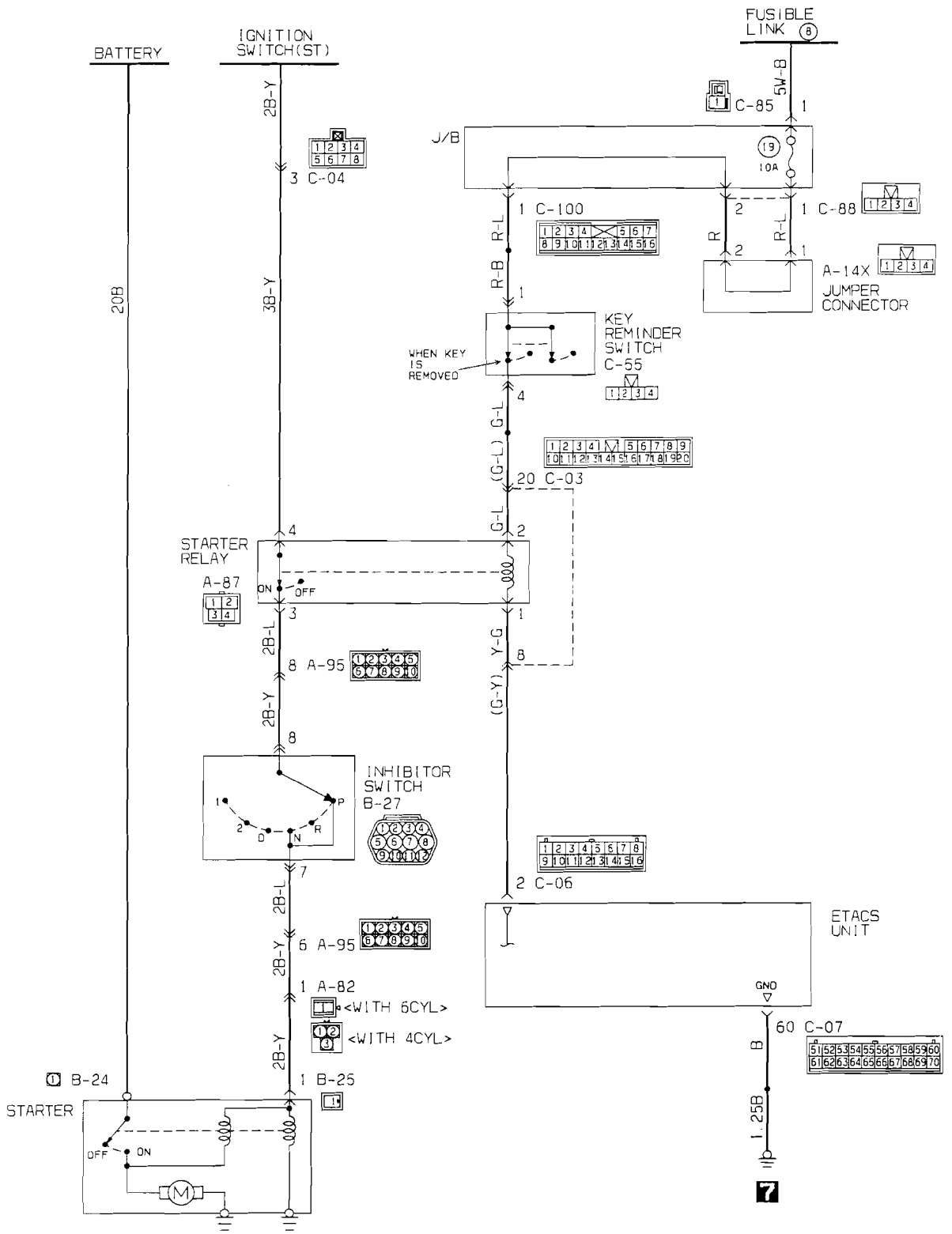
CIRCUIT DIAGRAM – Auto-cruise circuit w/- SRS 94 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Starting circuit 'X' line 91-94 models



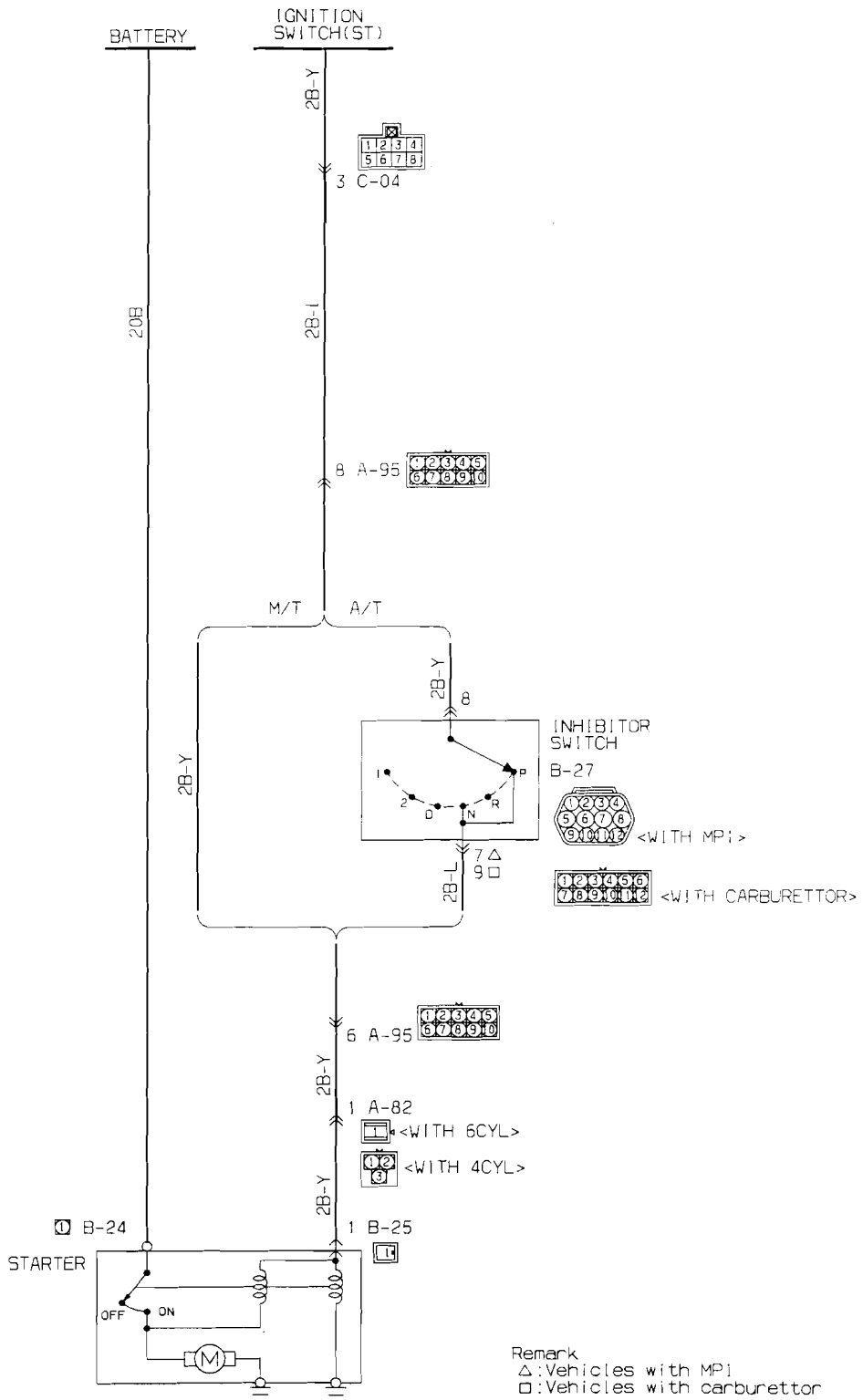
93-144

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Starting circuit 'H,D,P line 91-94 models



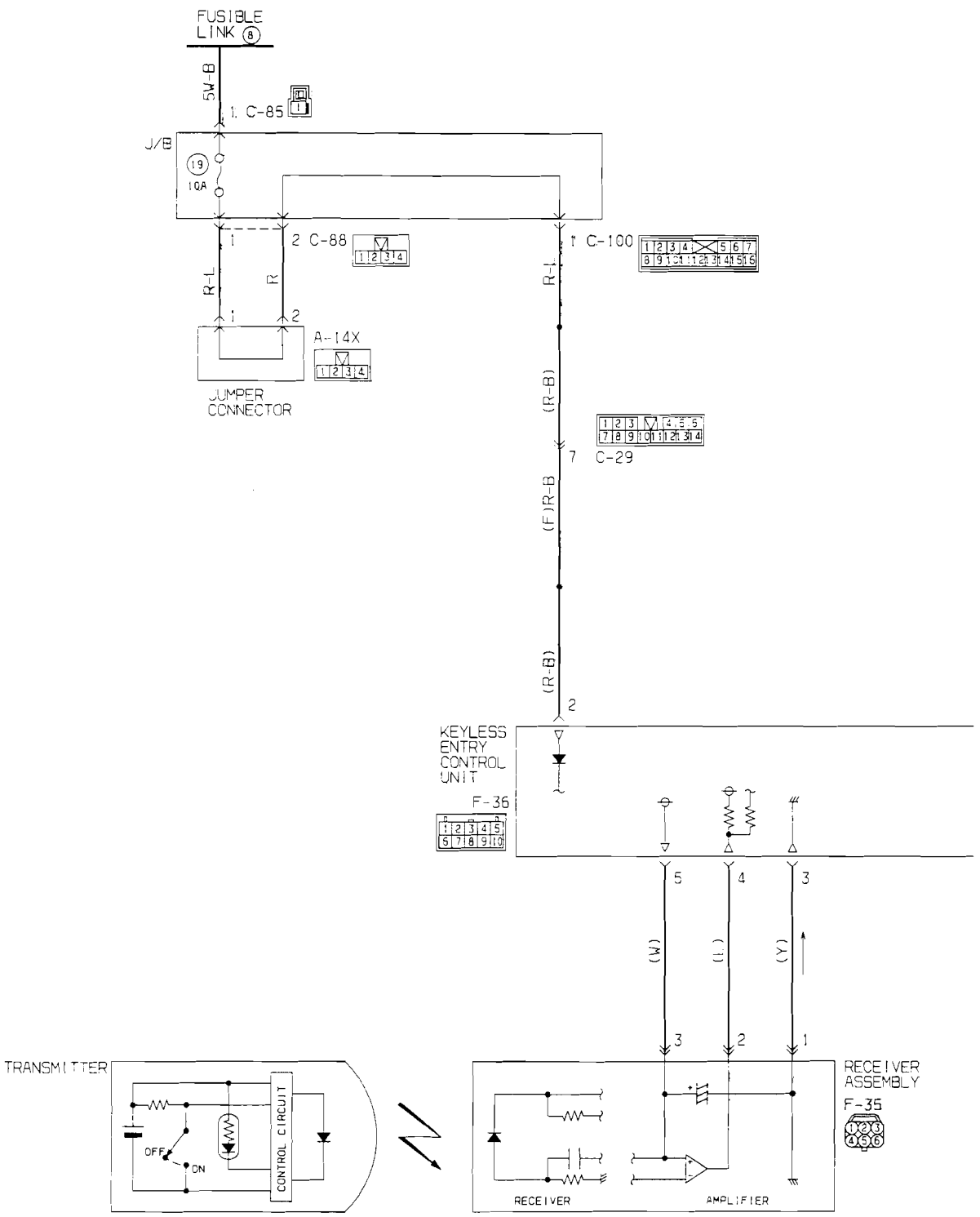
93-145

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Keyless entry circuit 'X' line 91-93 models



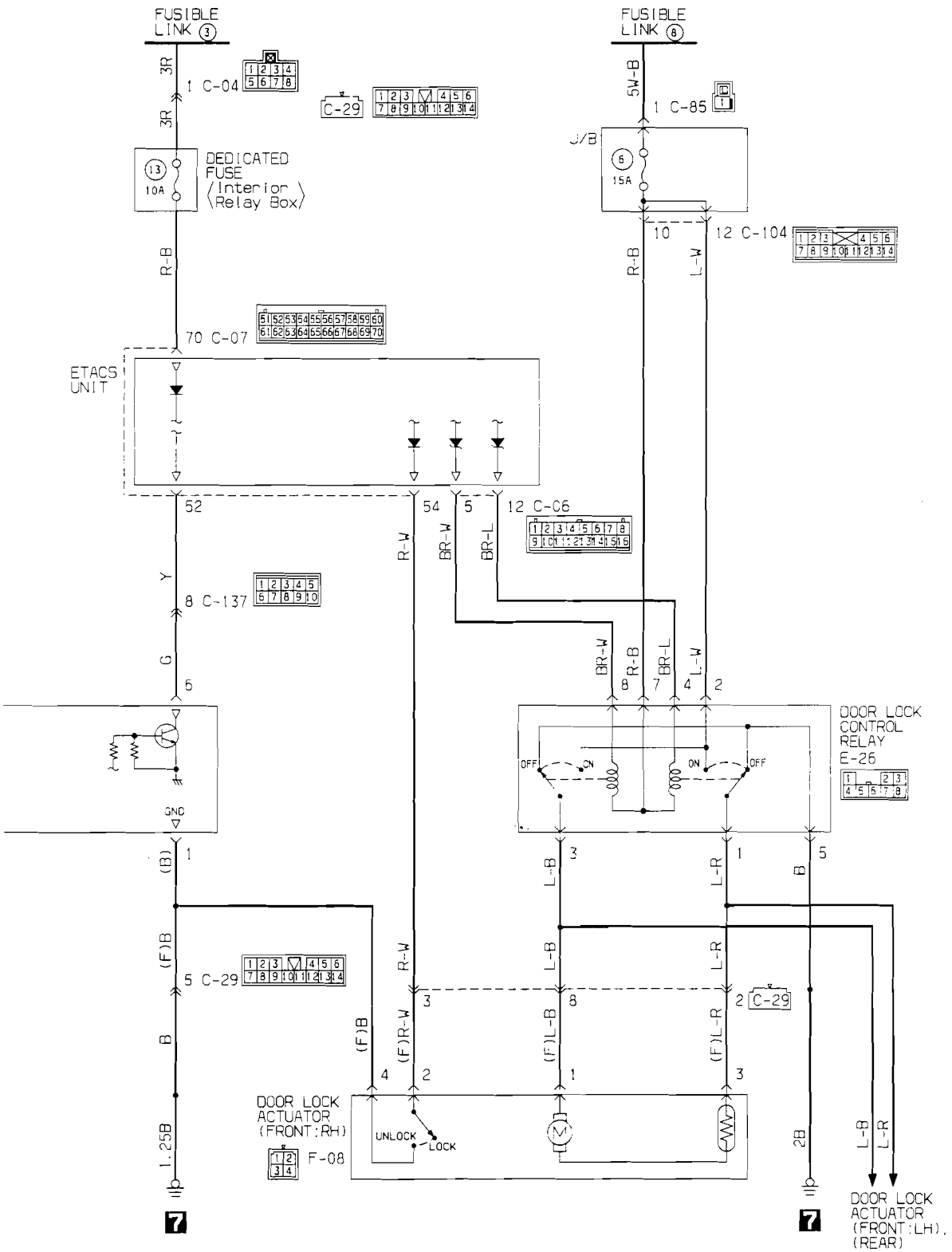
93-146

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Keyless entry circuit 'X' line 91-93 models

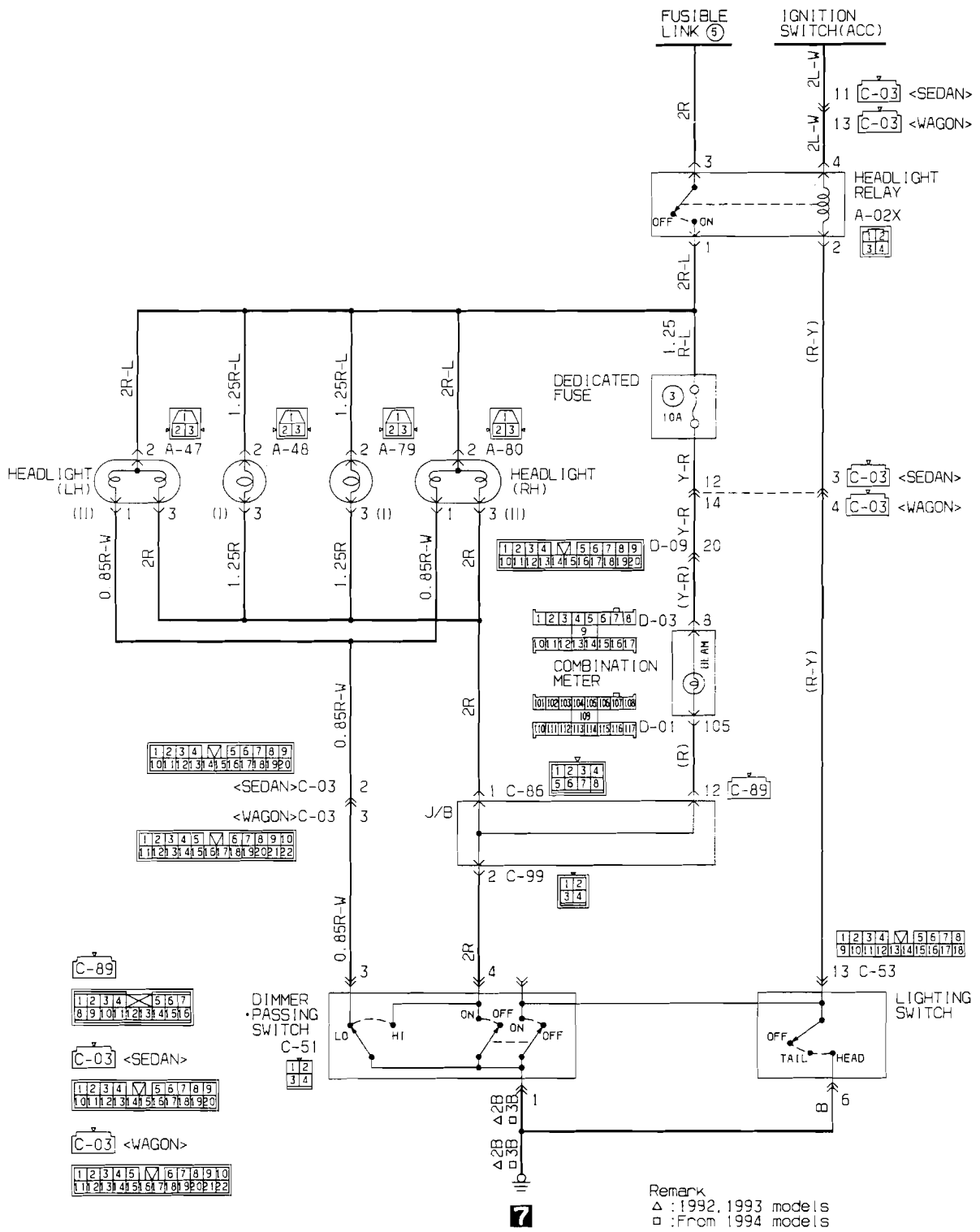


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Headlamp circuit 91-94 models



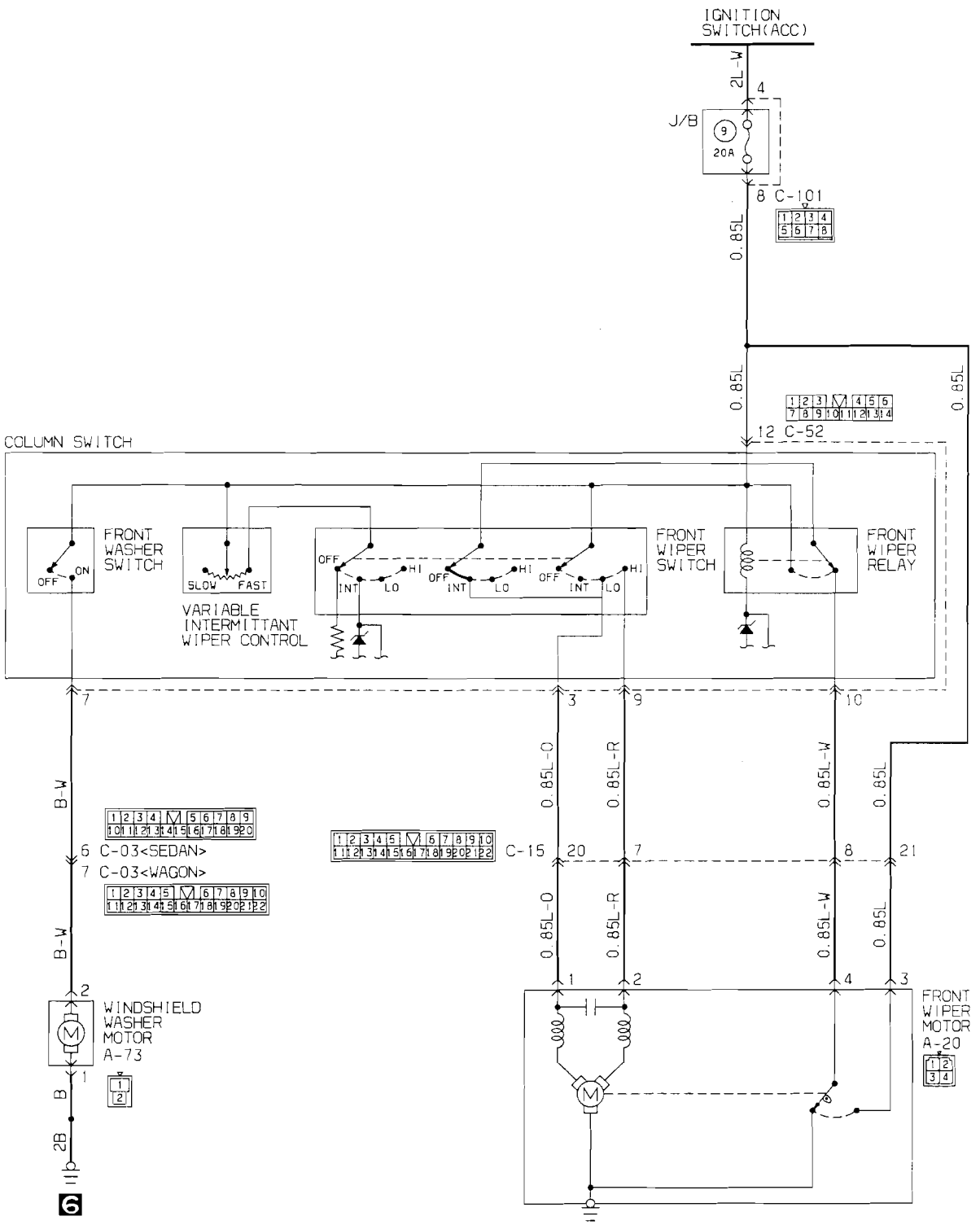
93-147

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Windshield wiper & washer circuit 91-94 models



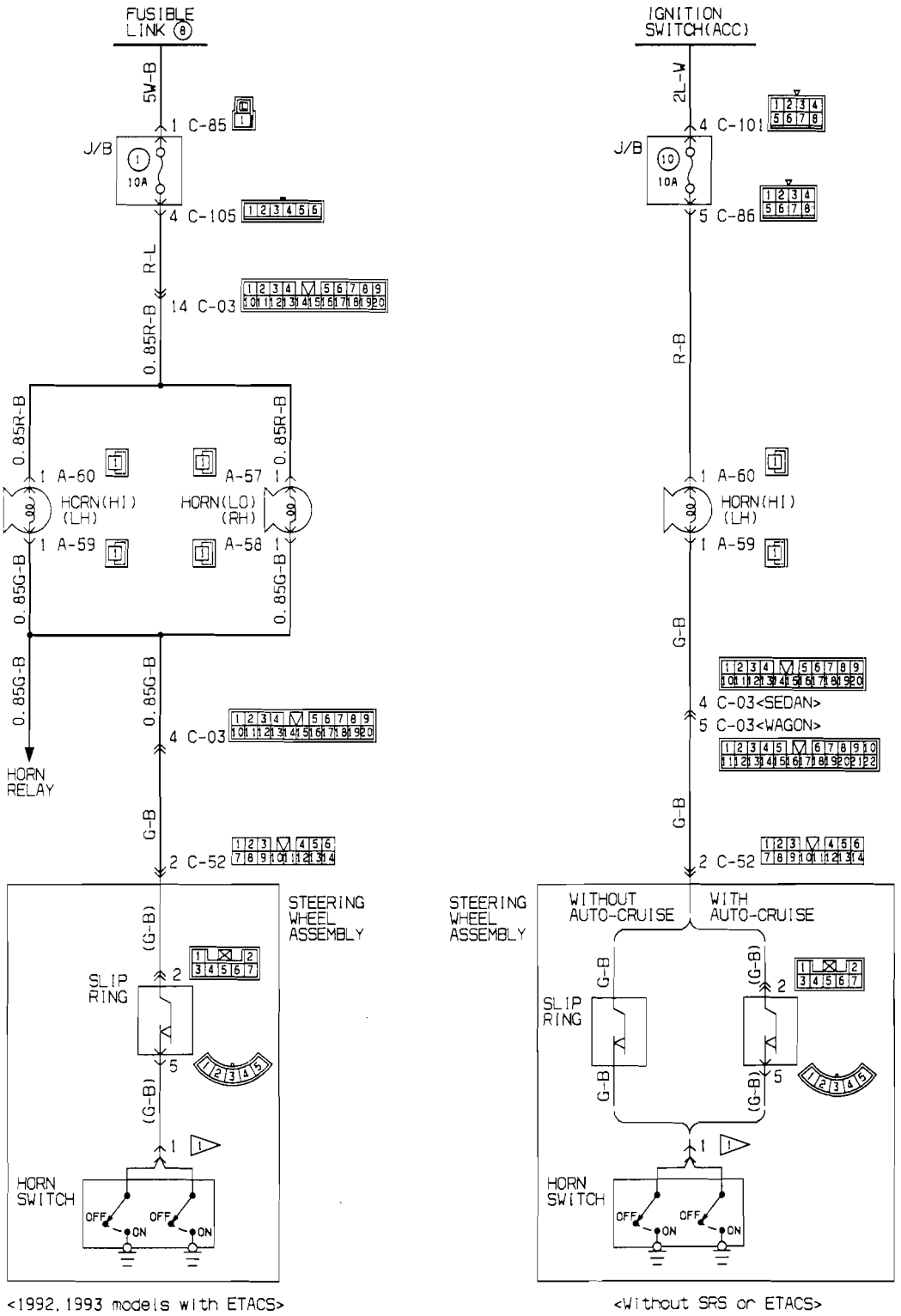
93-148

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Horn circuit 91-93 models



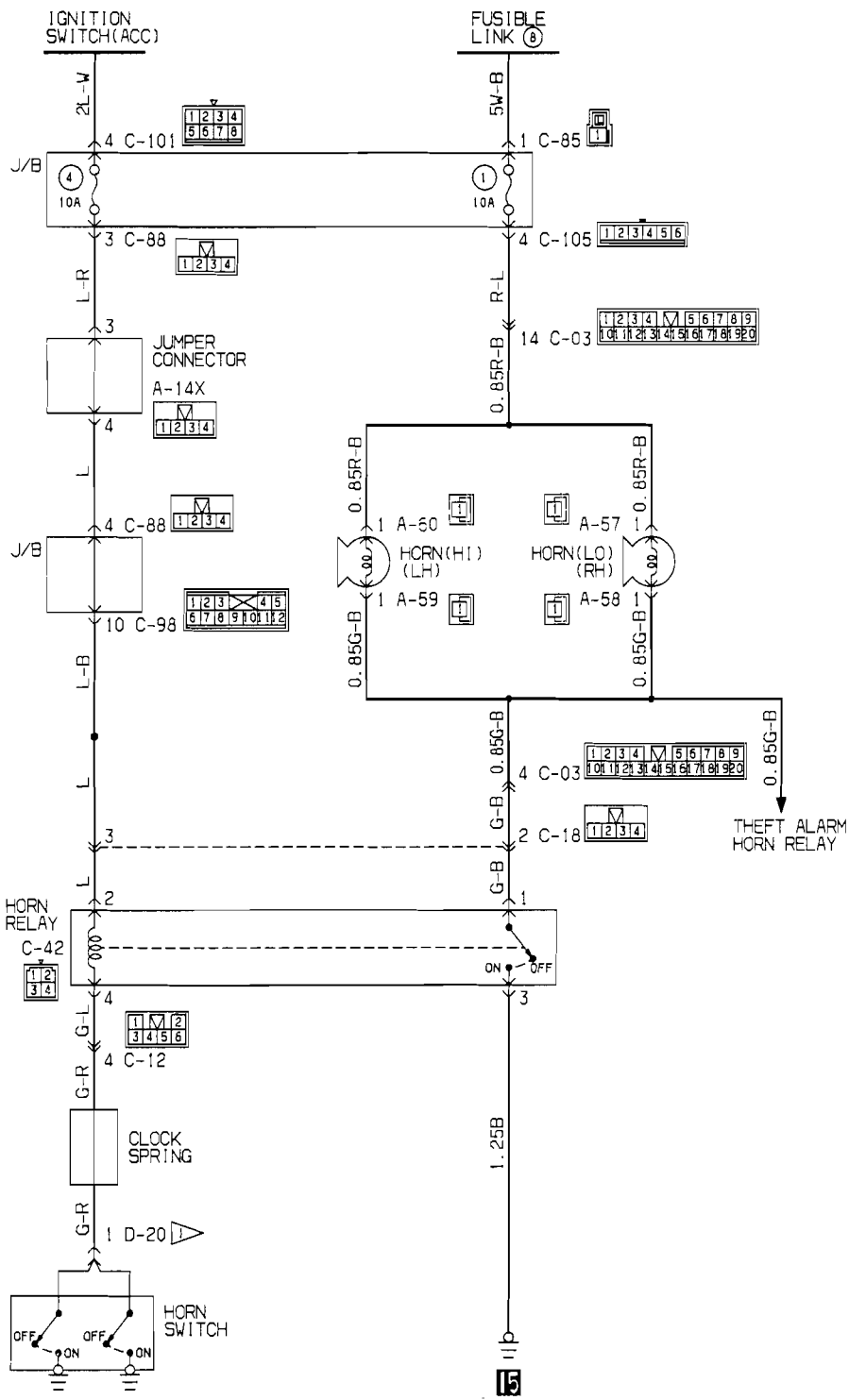
93-149

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Horn circuit 94 models



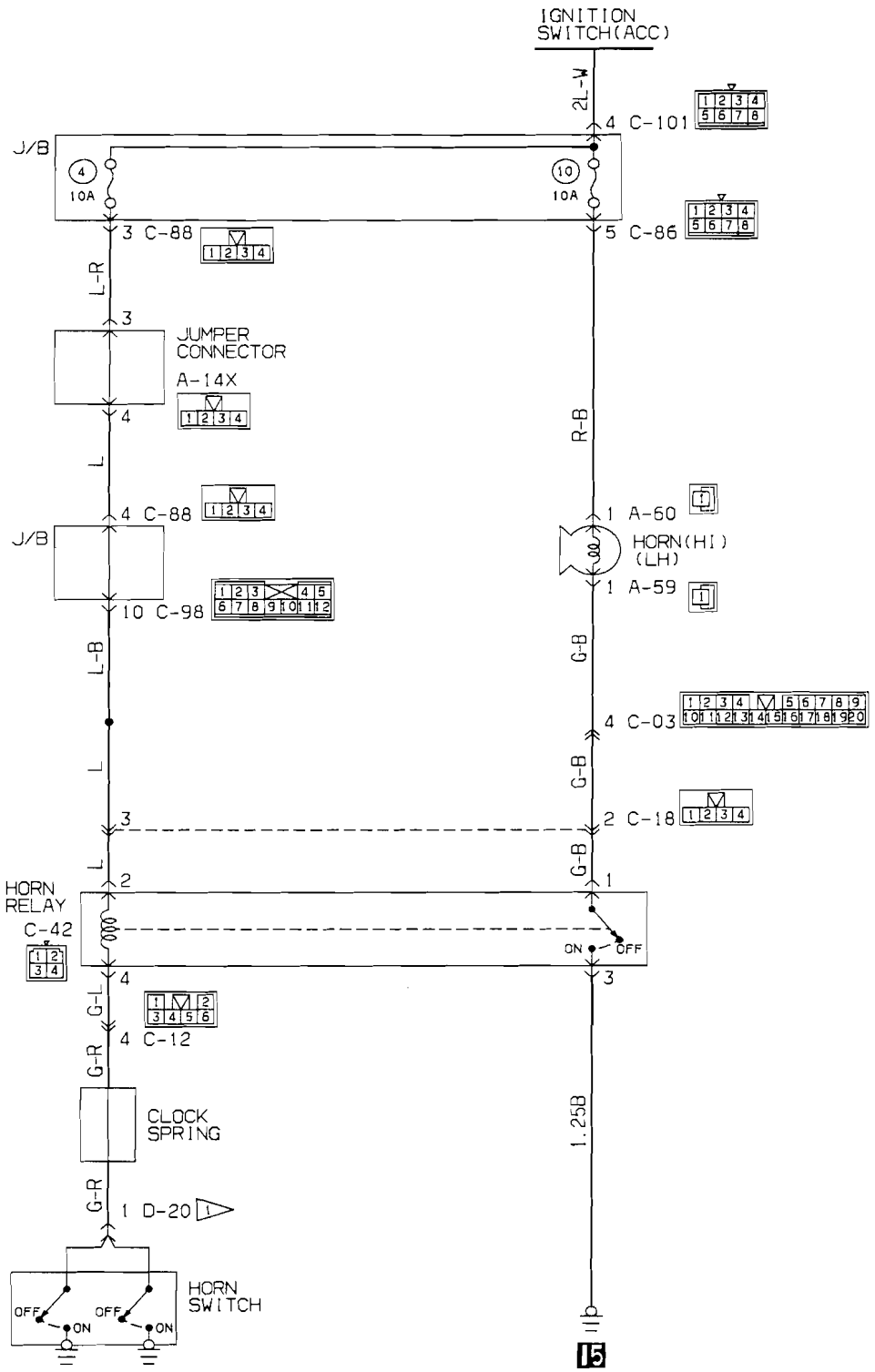
<1994 models with ETACS>

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Horn circuit 94 models



<With SRS, Without ETACS>

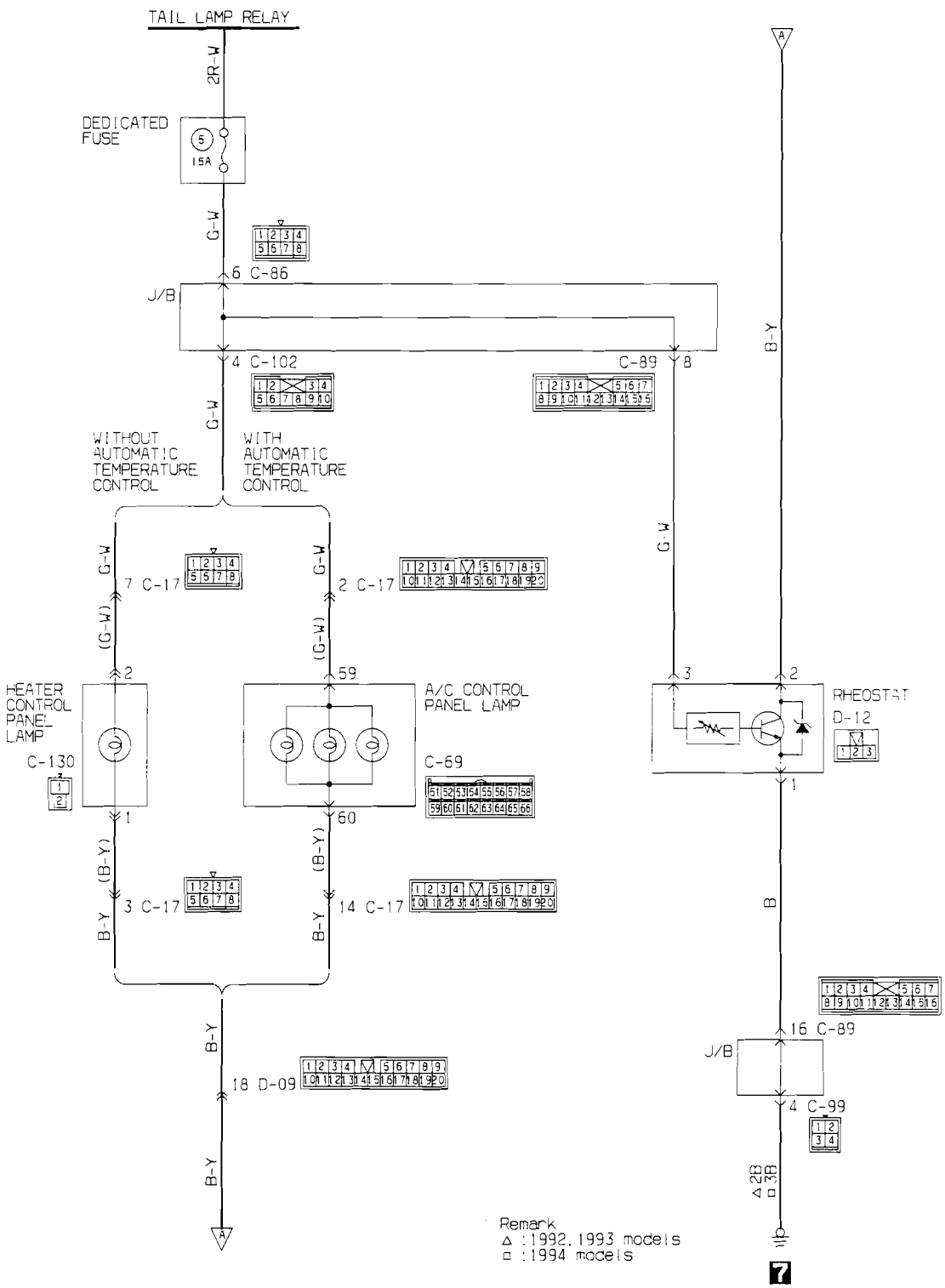
93-149-A

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – A/C control panel lamp circuit 91-94 models

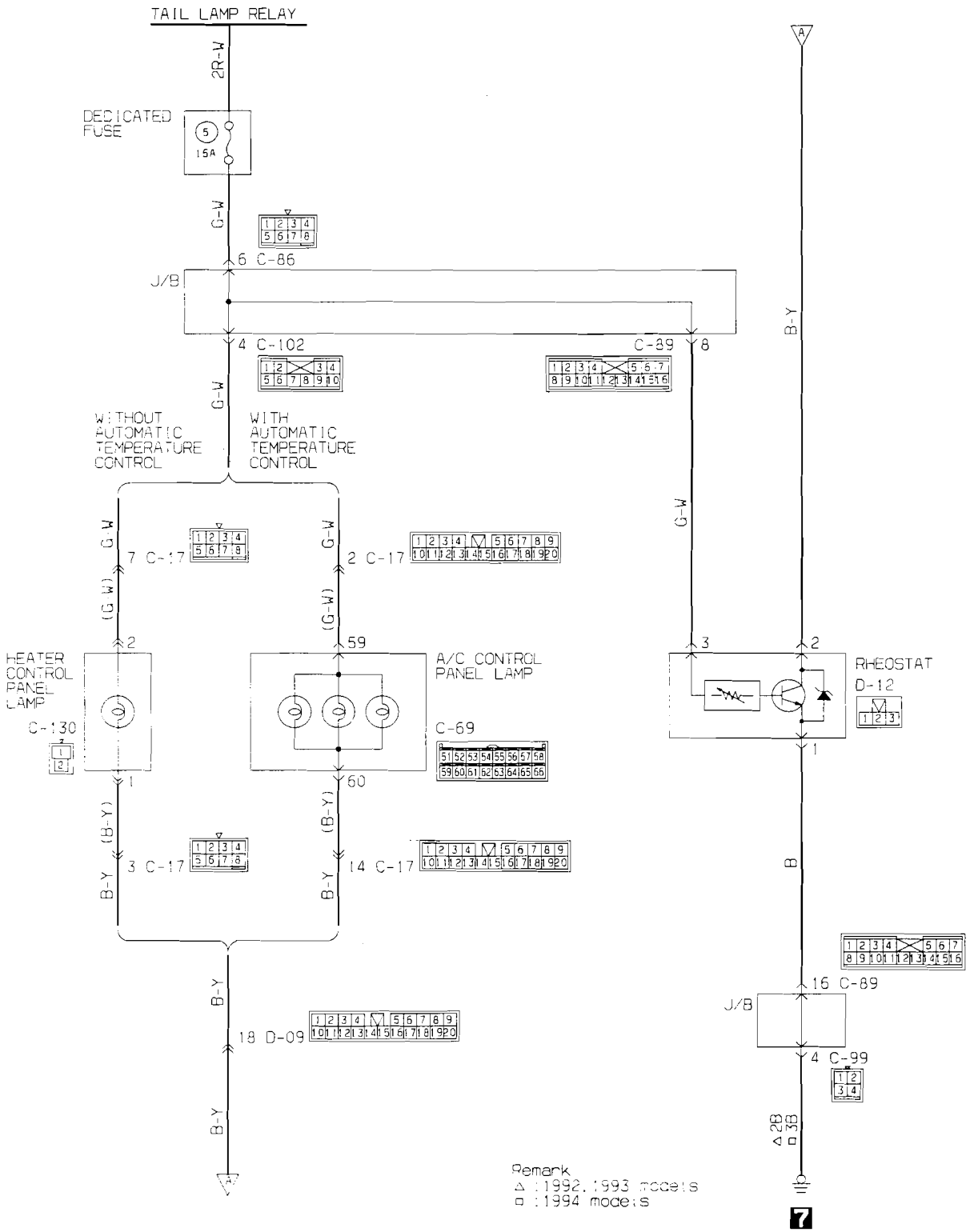


93-150

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Remote control mirror circuit 91-94 models

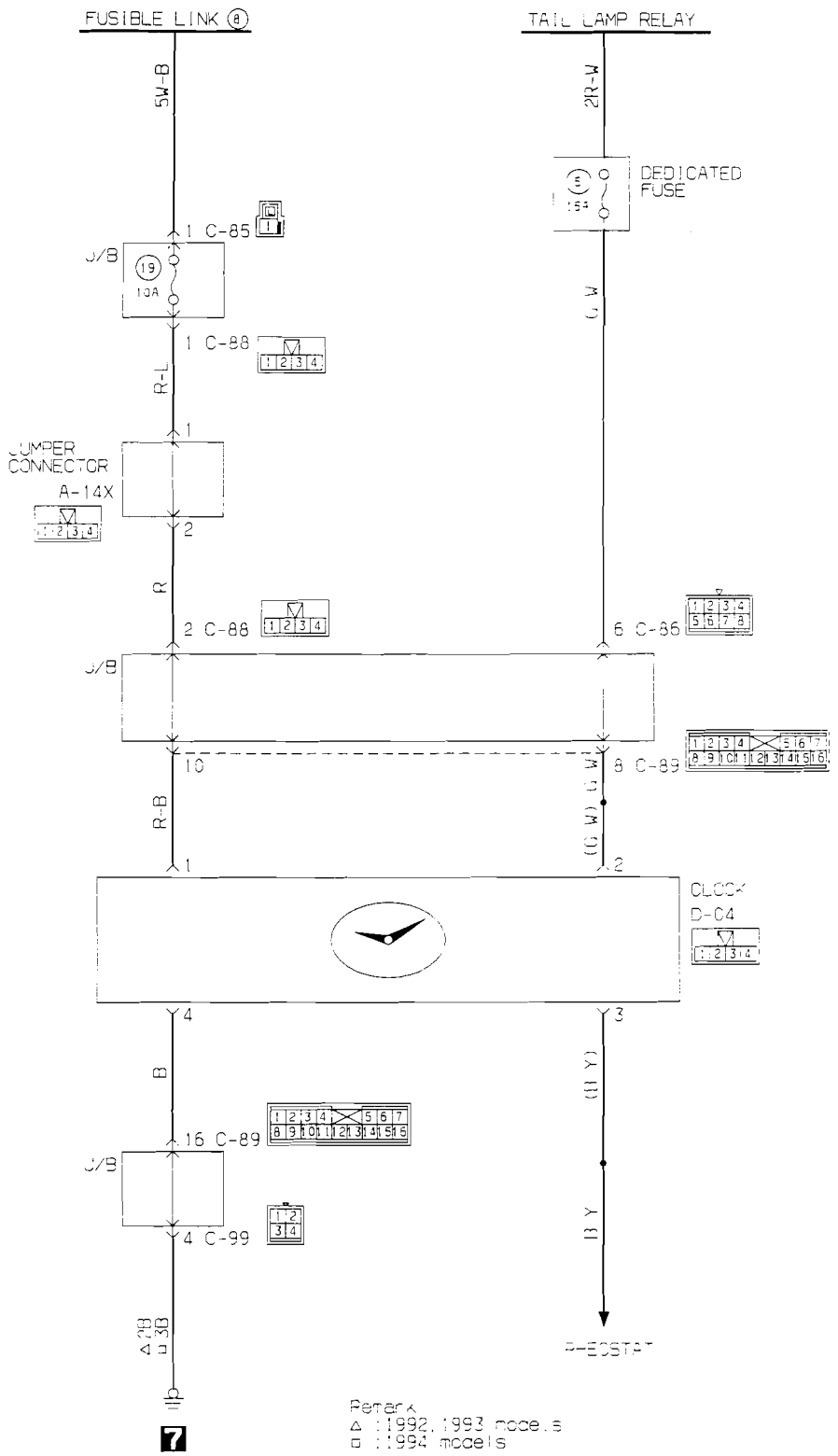


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Clock circuit 91-94 models



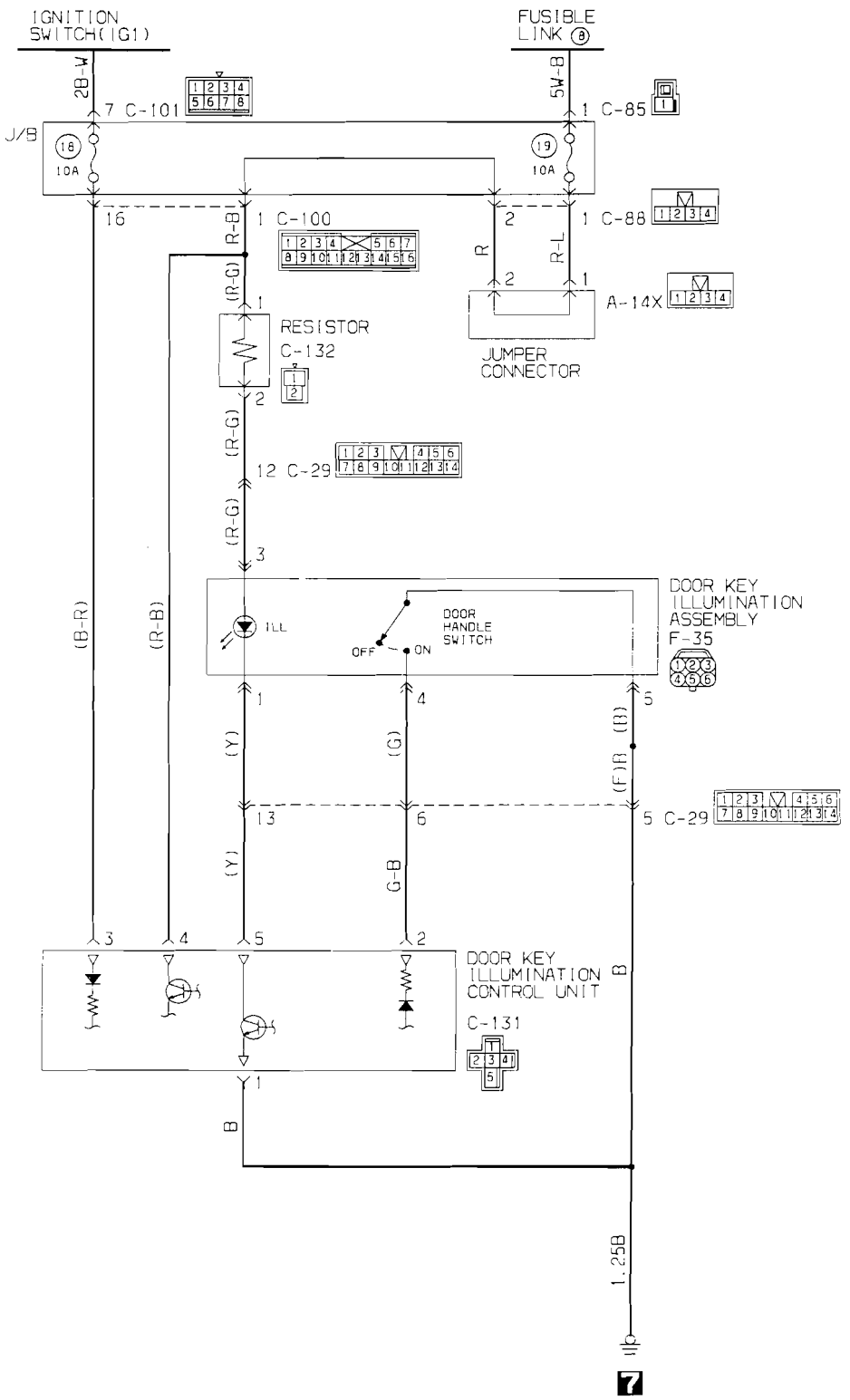
93-152

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Door key illumination circuit 'P' line 91-94 models



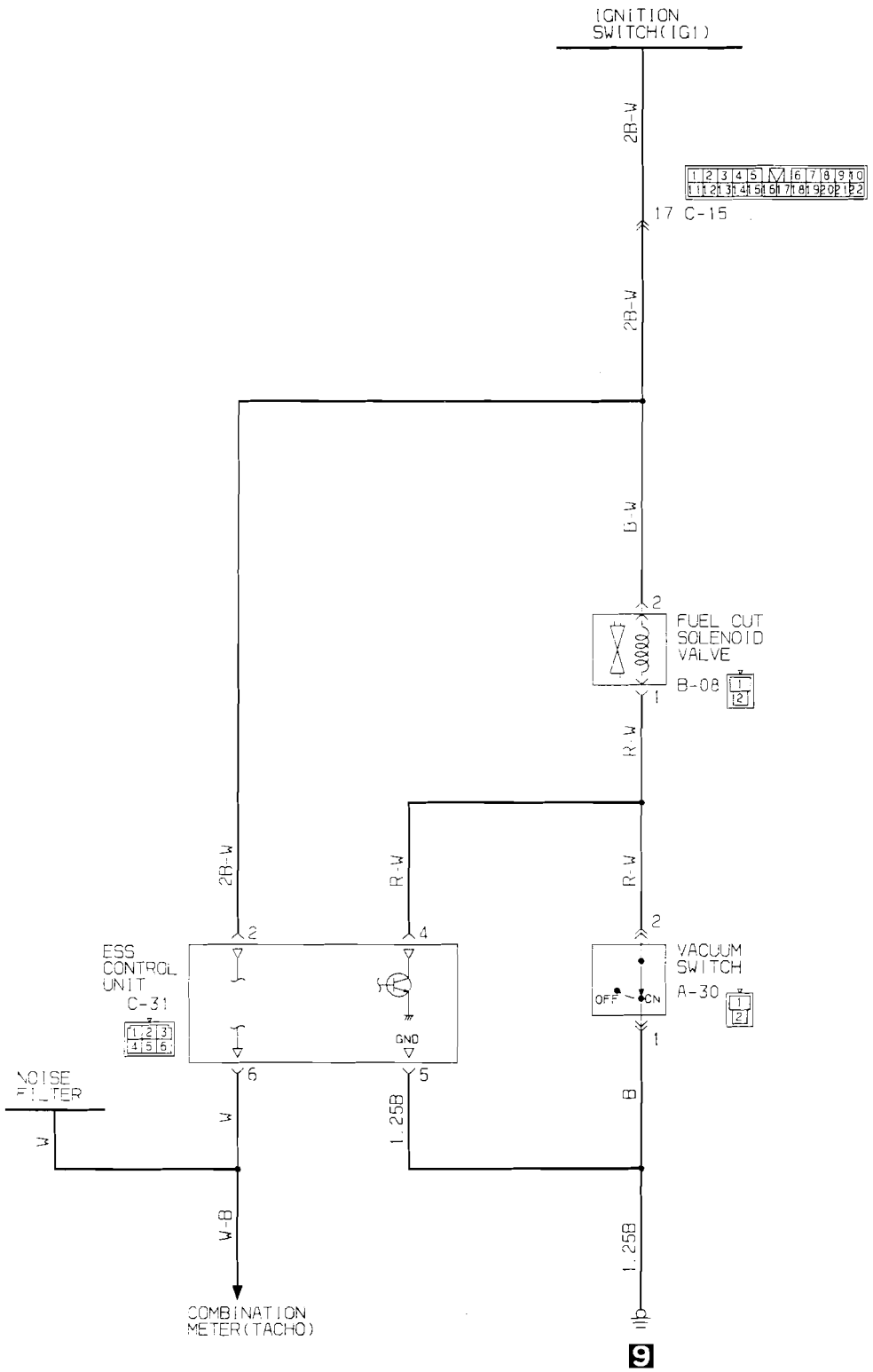
93-158

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Conventional 4cyl carburettor circuit 91-94 models



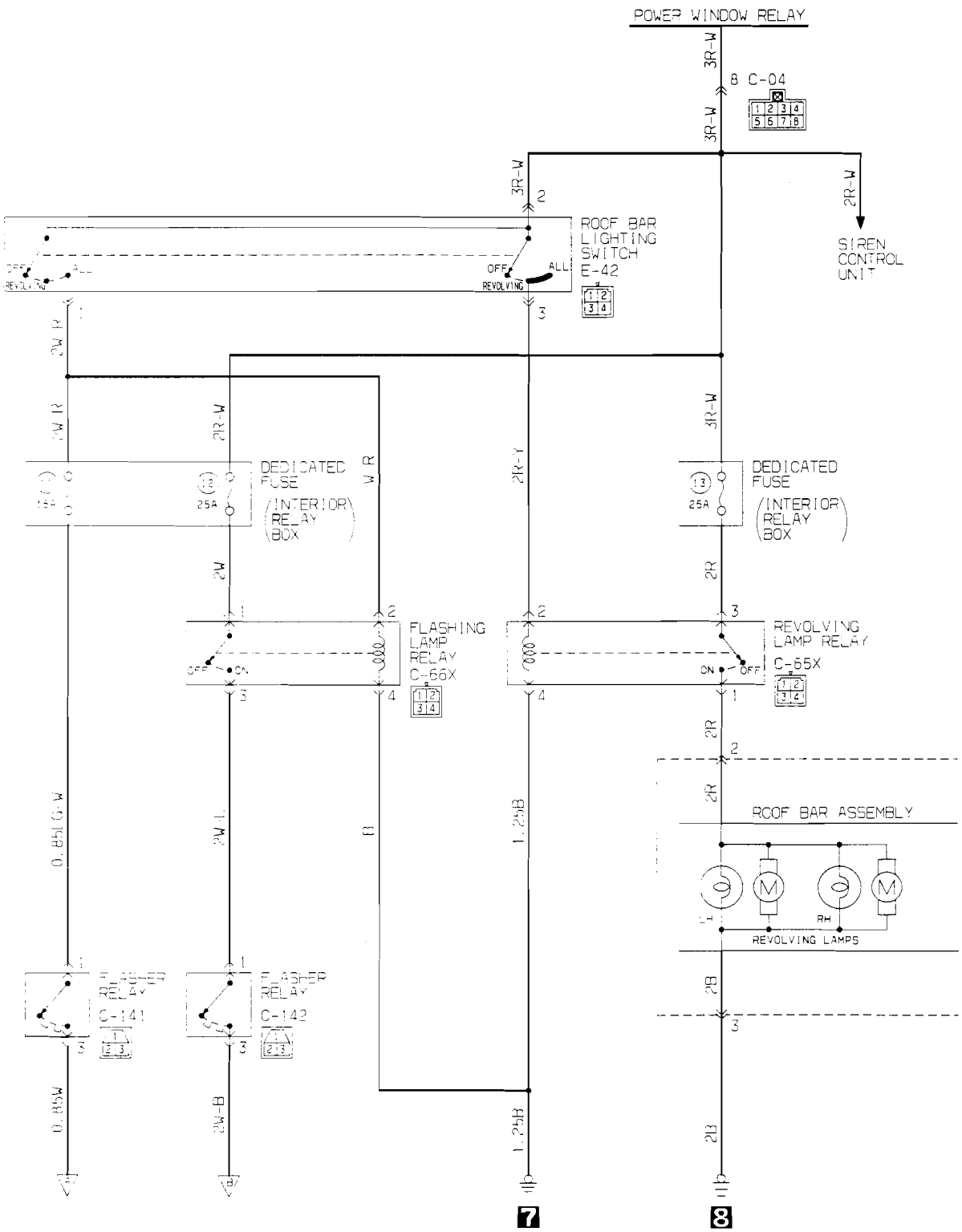
93-159

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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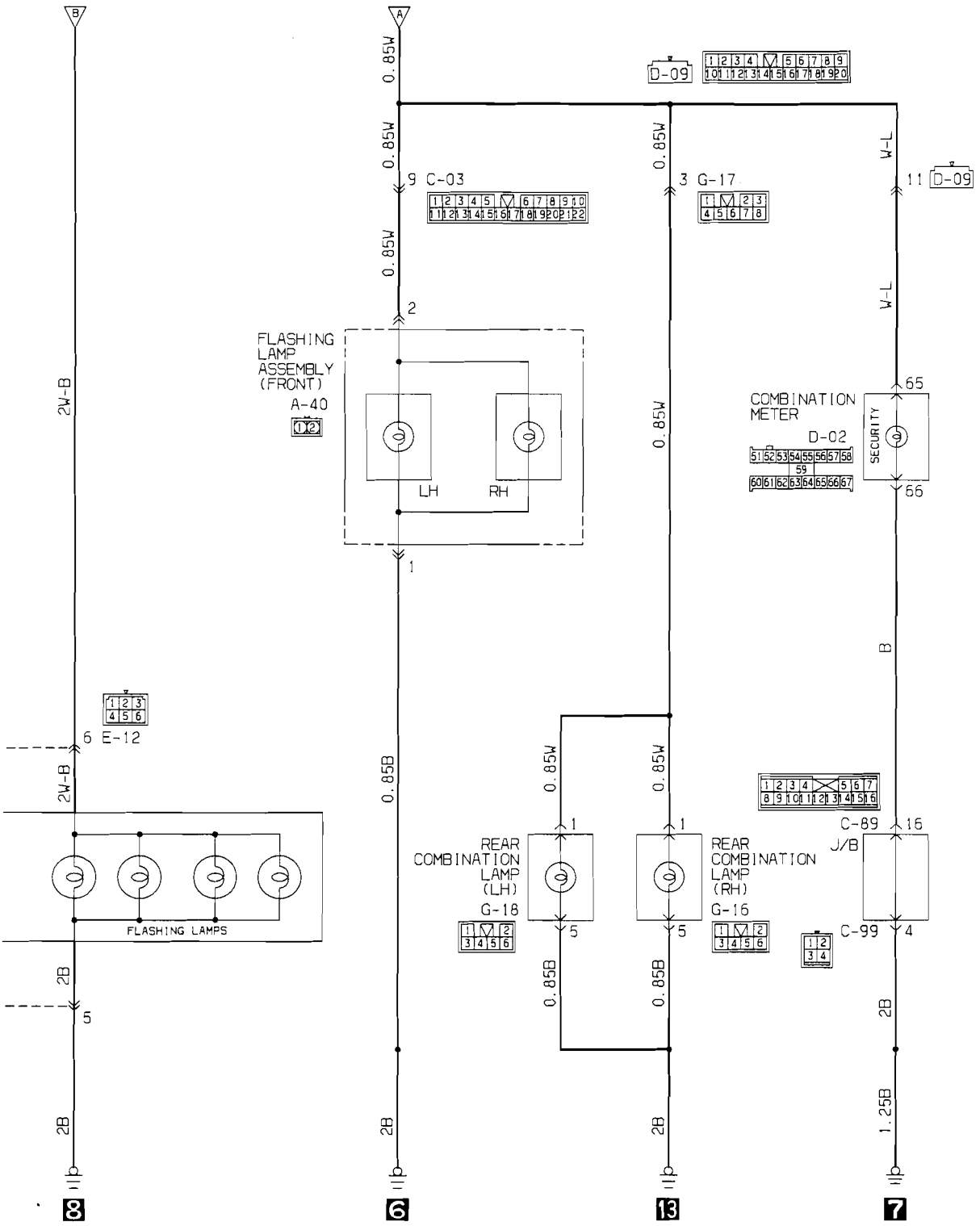
CIRCUIT DIAGRAM – Emergency lamps circuit MOT 92-93 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

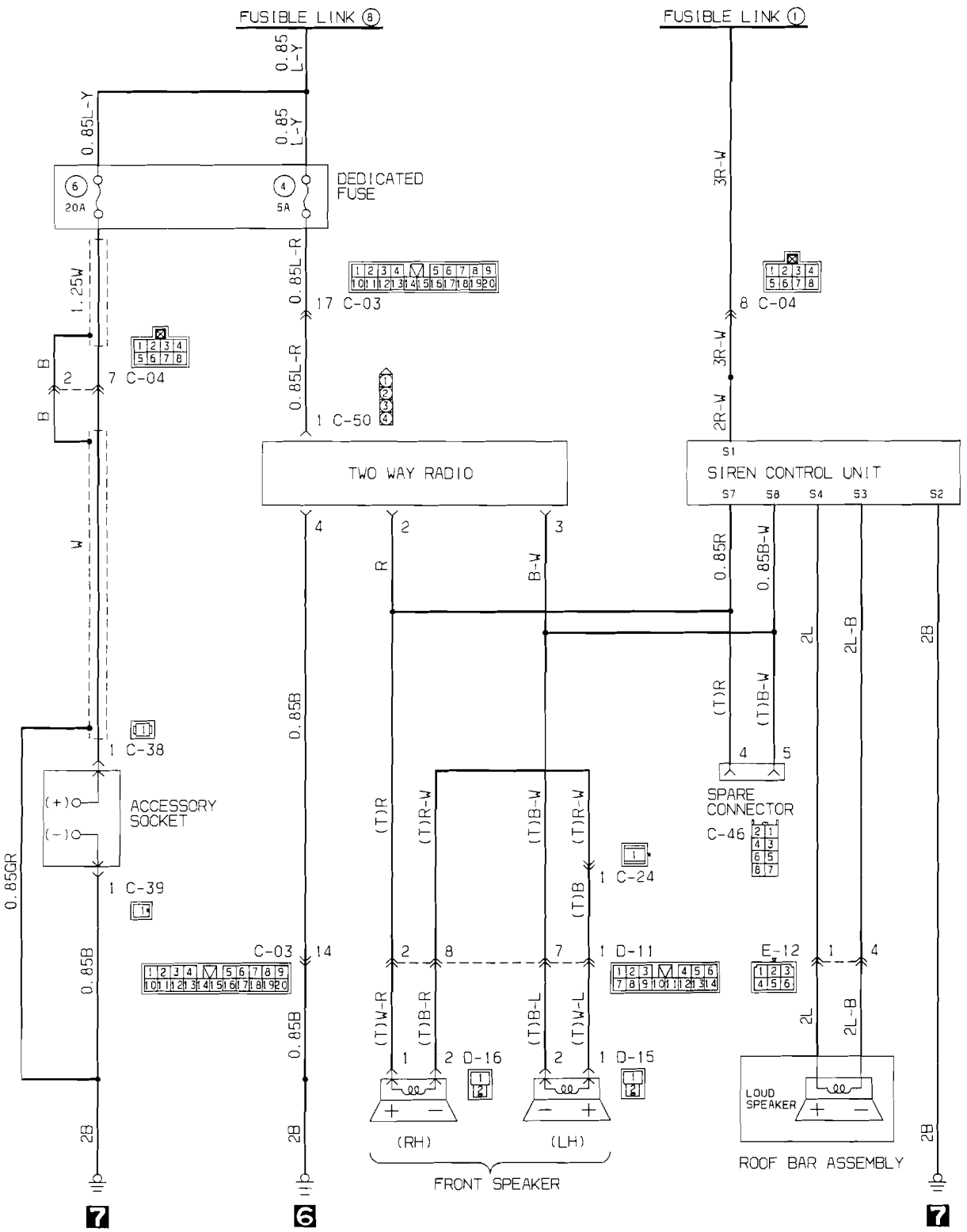
CIRCUIT DIAGRAM – Emergency lamps circuit MOT 92-93 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

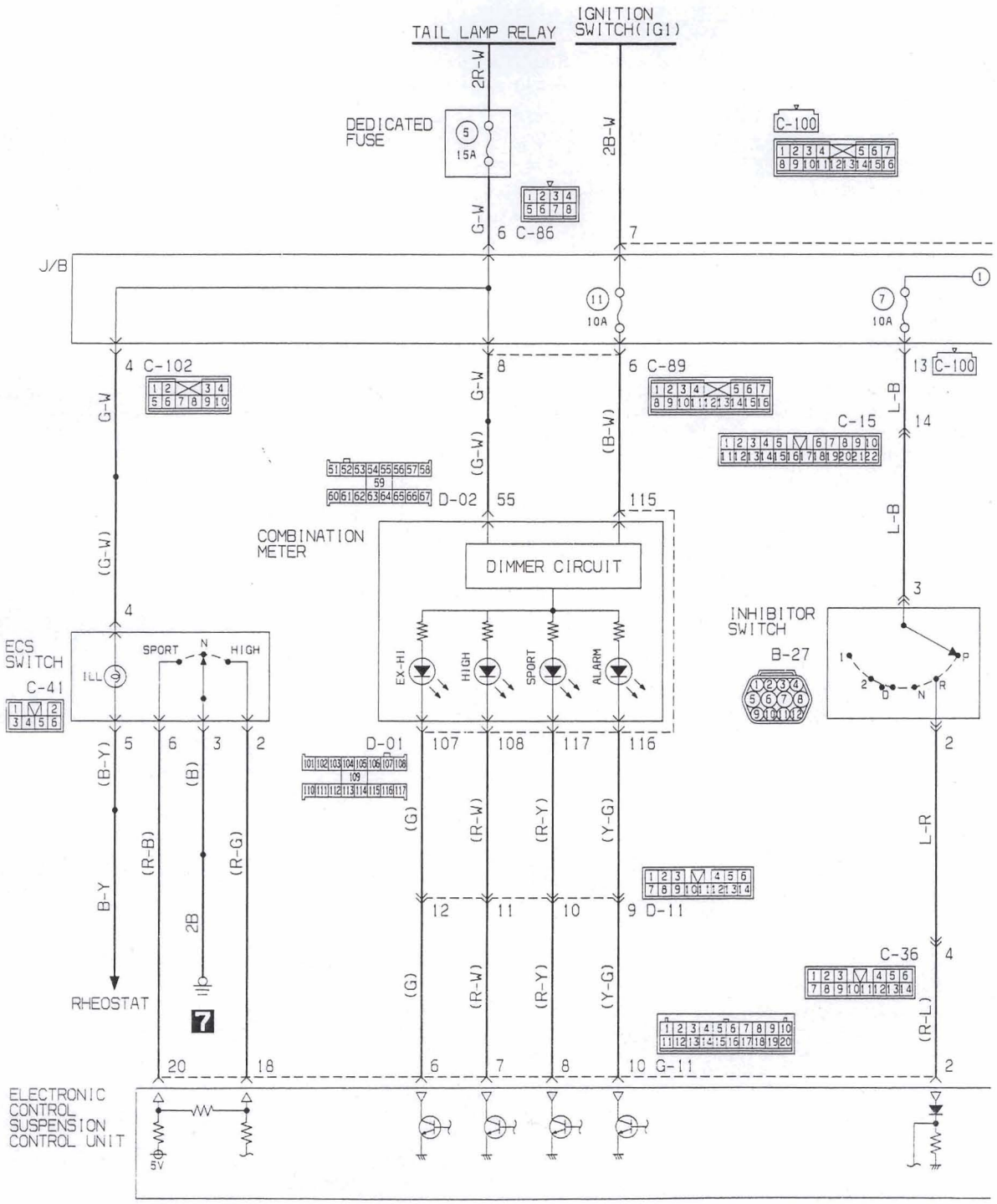
CIRCUIT DIAGRAM – Police siren & 2 way radio circuit MOT 92-93 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – Electronic control suspension circuit X,P line 6 cyl 92-93 models



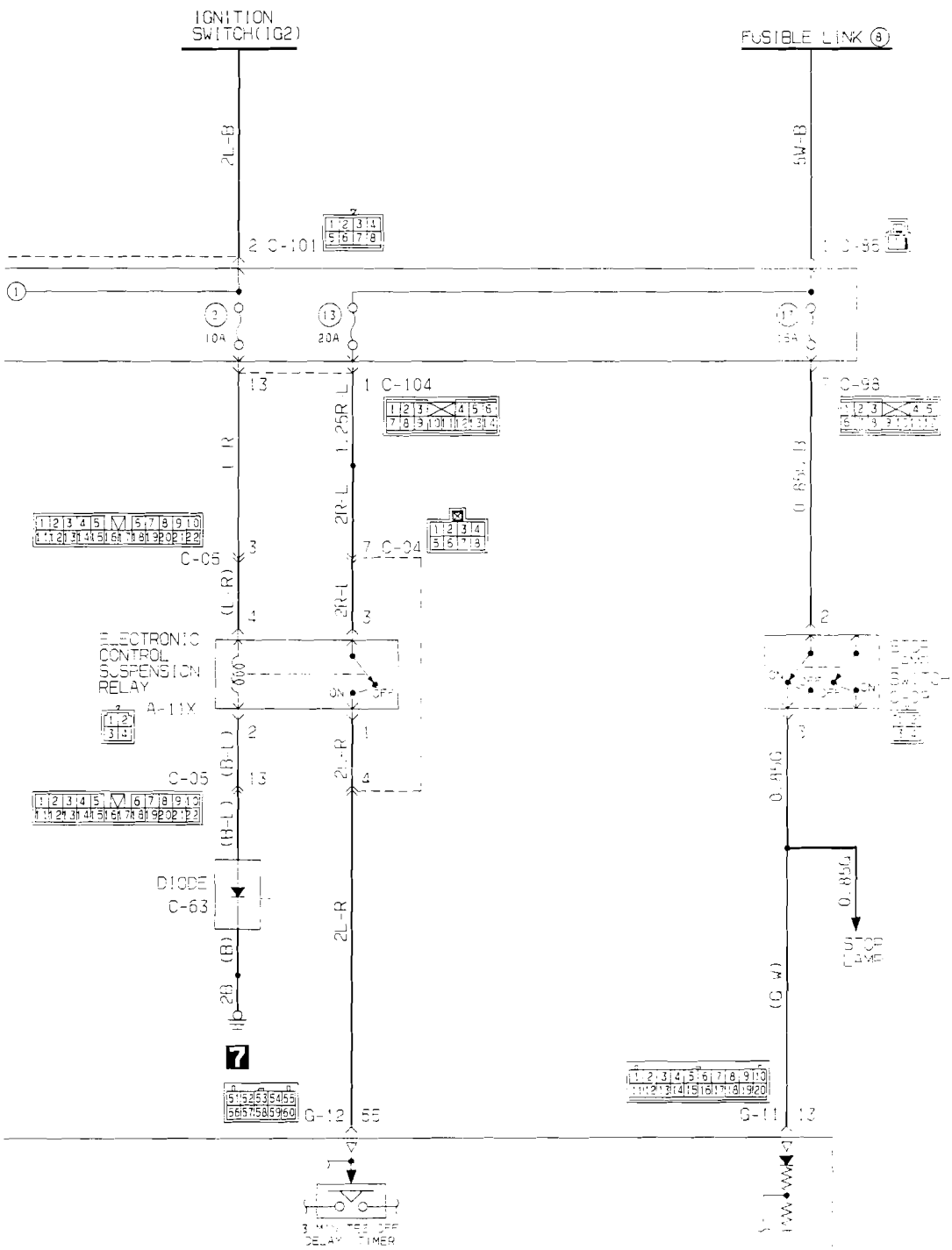
93-162

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Electronic control suspension circuit X,P line 6 cyl 92-93 models

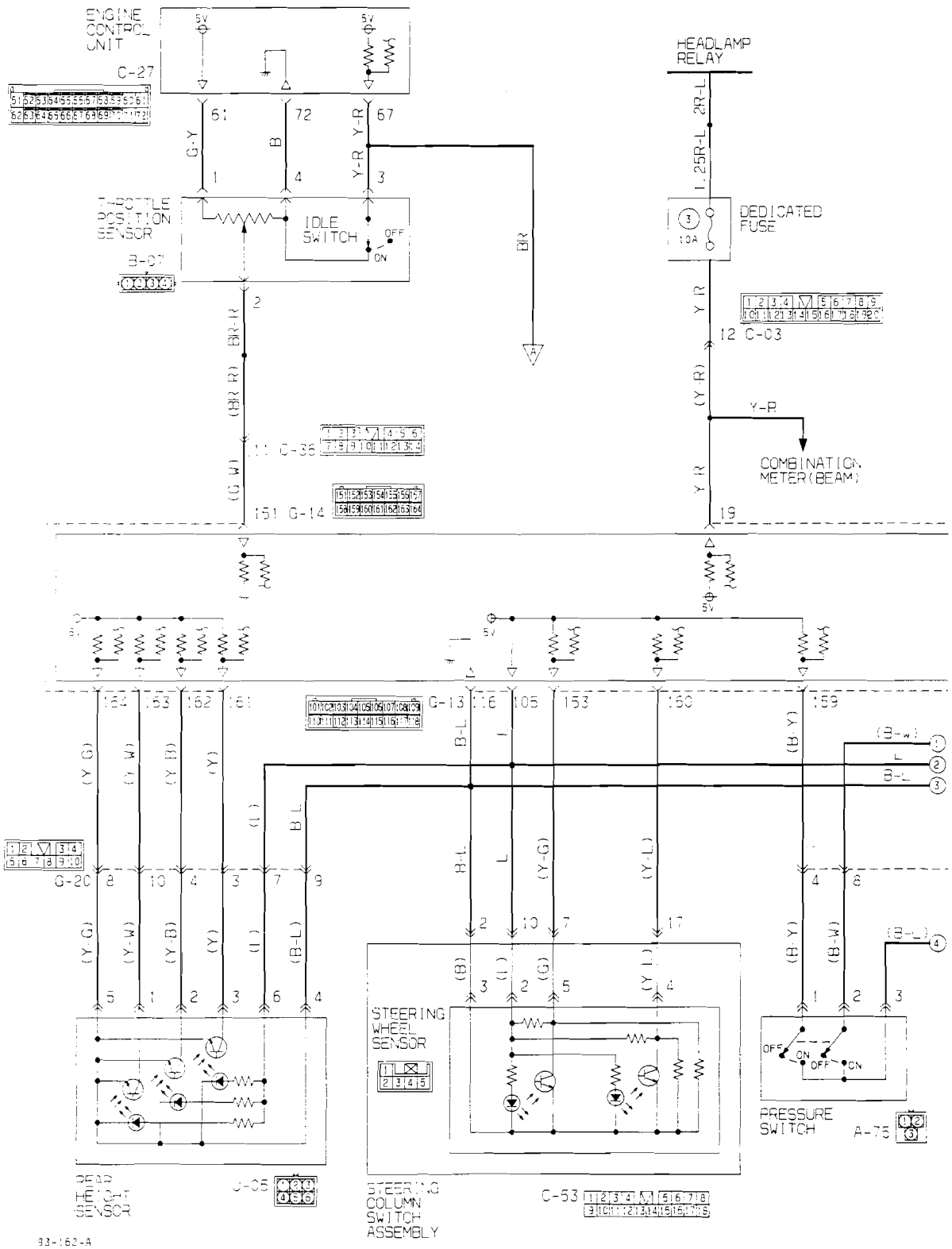


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Electronic control suspension circuit X,P line 6 cyl 92-93 models

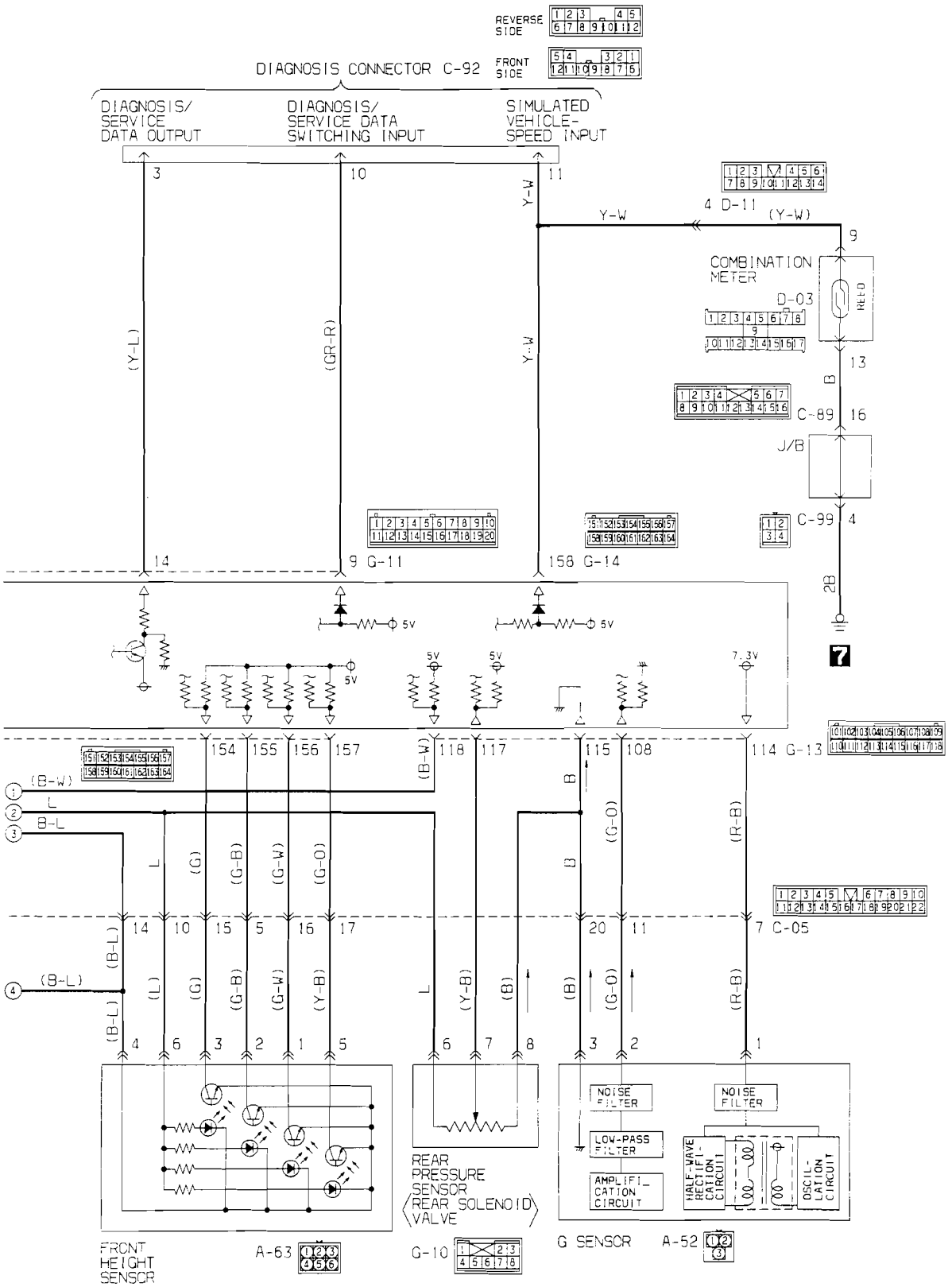


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Electronic control suspension circuit X,P line 6 cyl 92-93 models

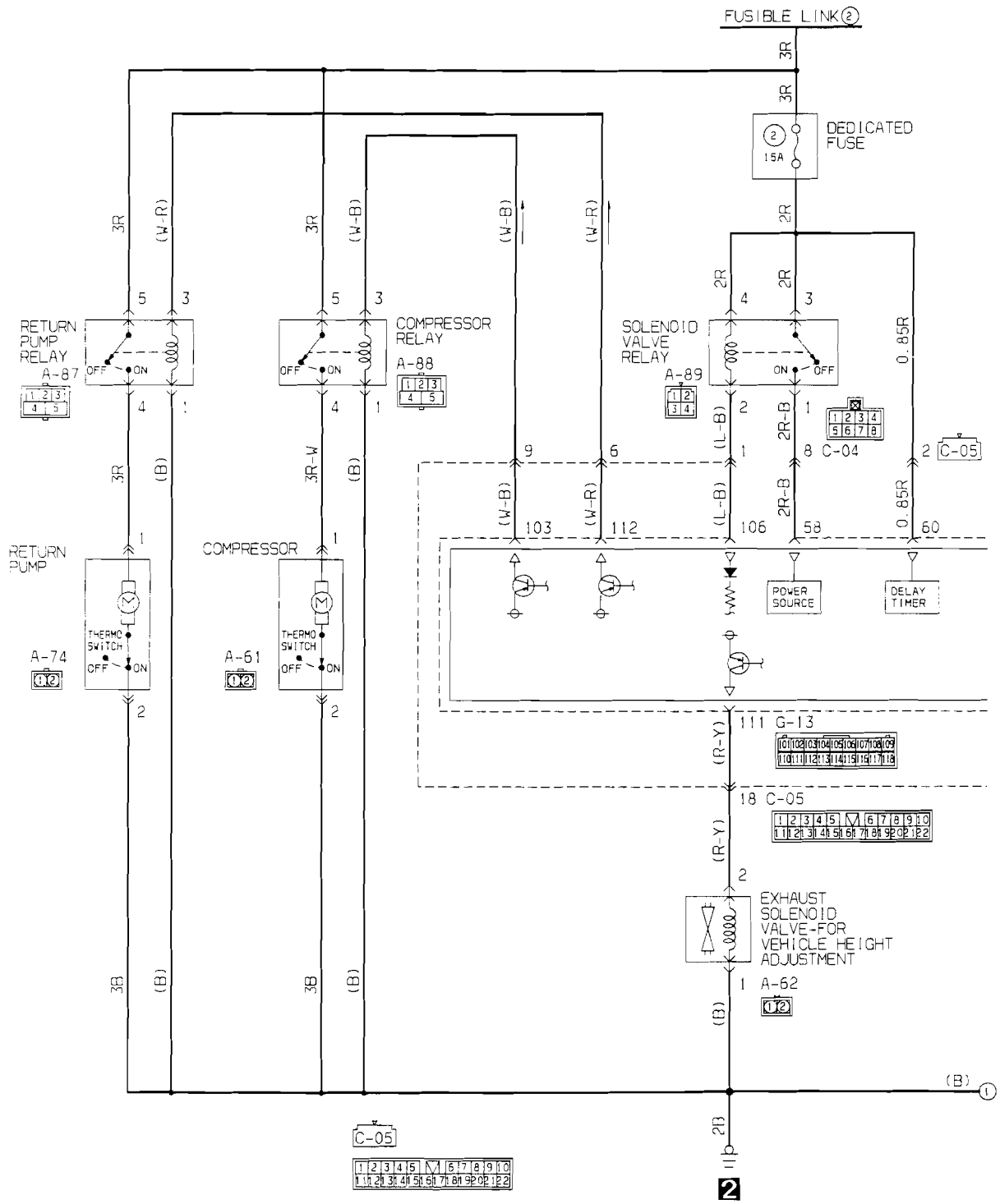


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Electronic control suspension circuit X,P line 6 cyl 92-93 models

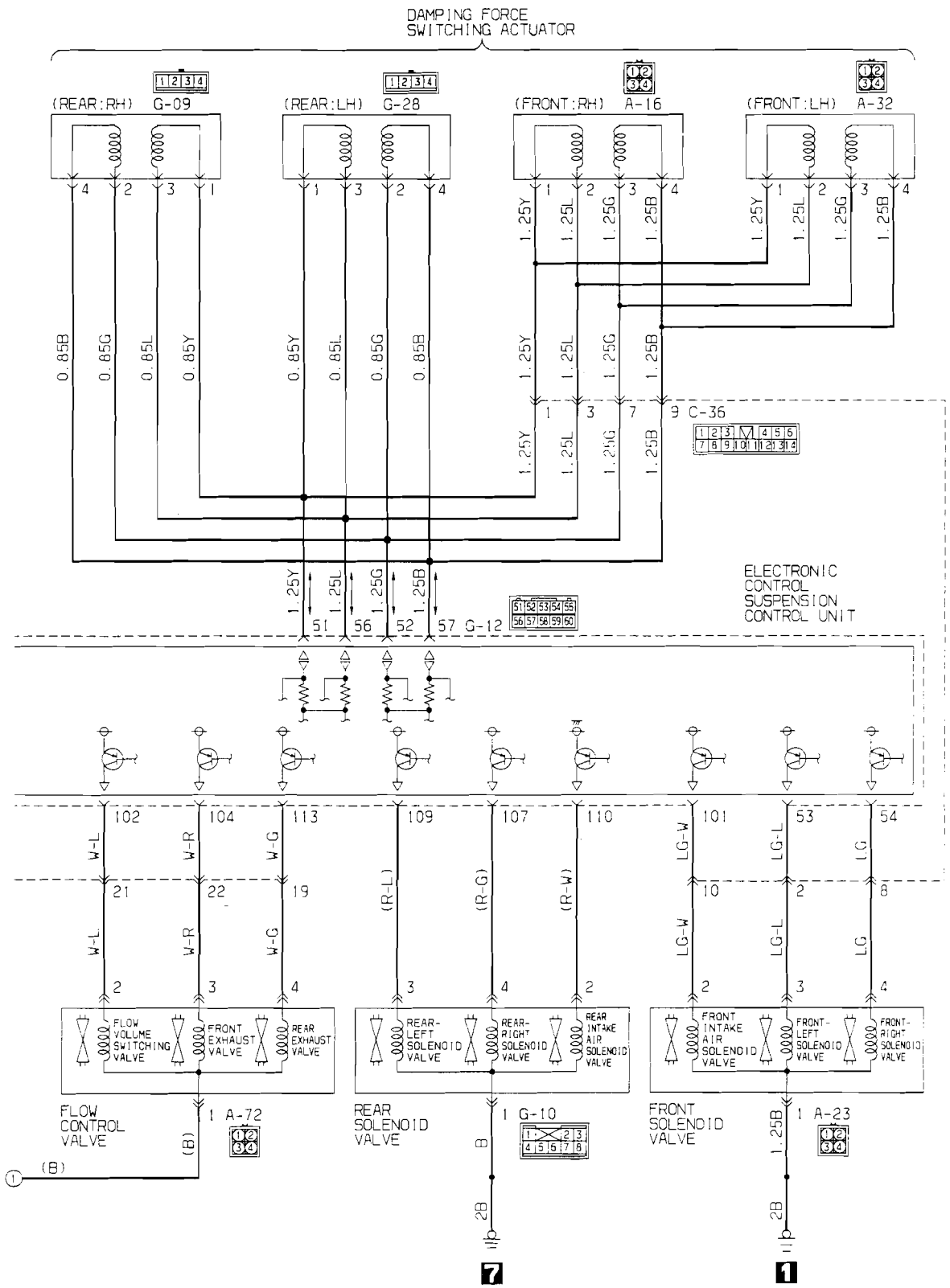


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Electronic control suspension circuit X,P line 6 cyl 92-93 models

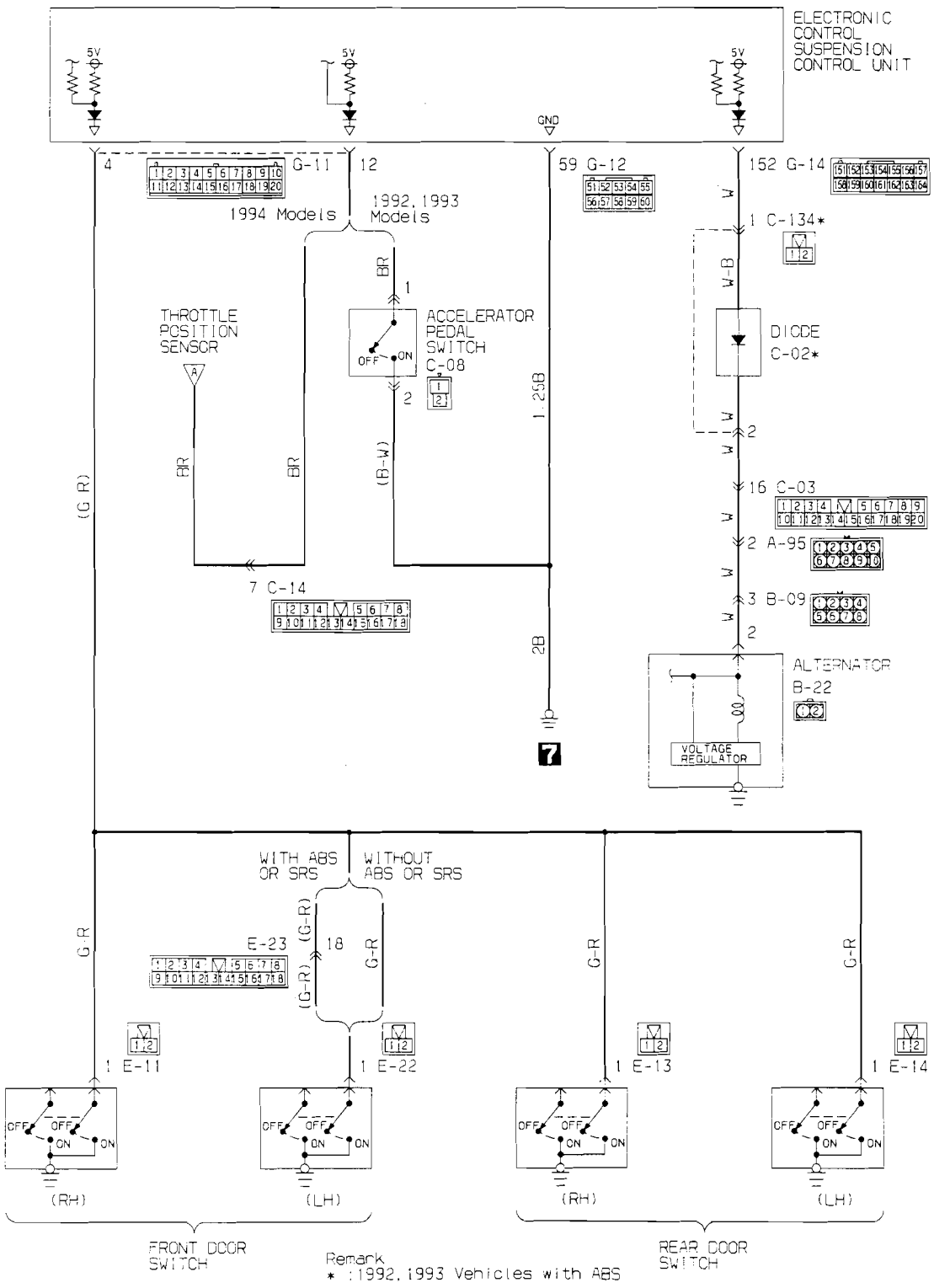


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Electronic control suspension circuit X,P line 6 cyl 92-93 models

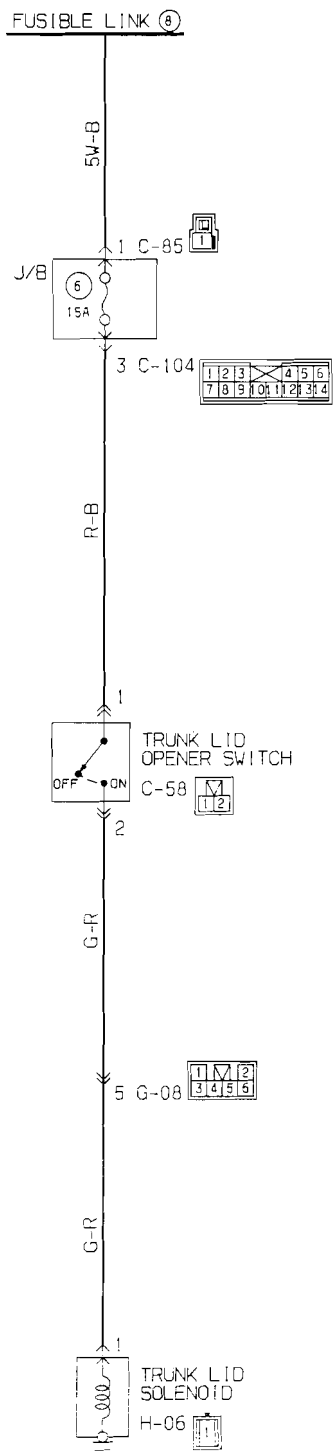


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Trunk lid opener circuit 'X' line 91-93 models

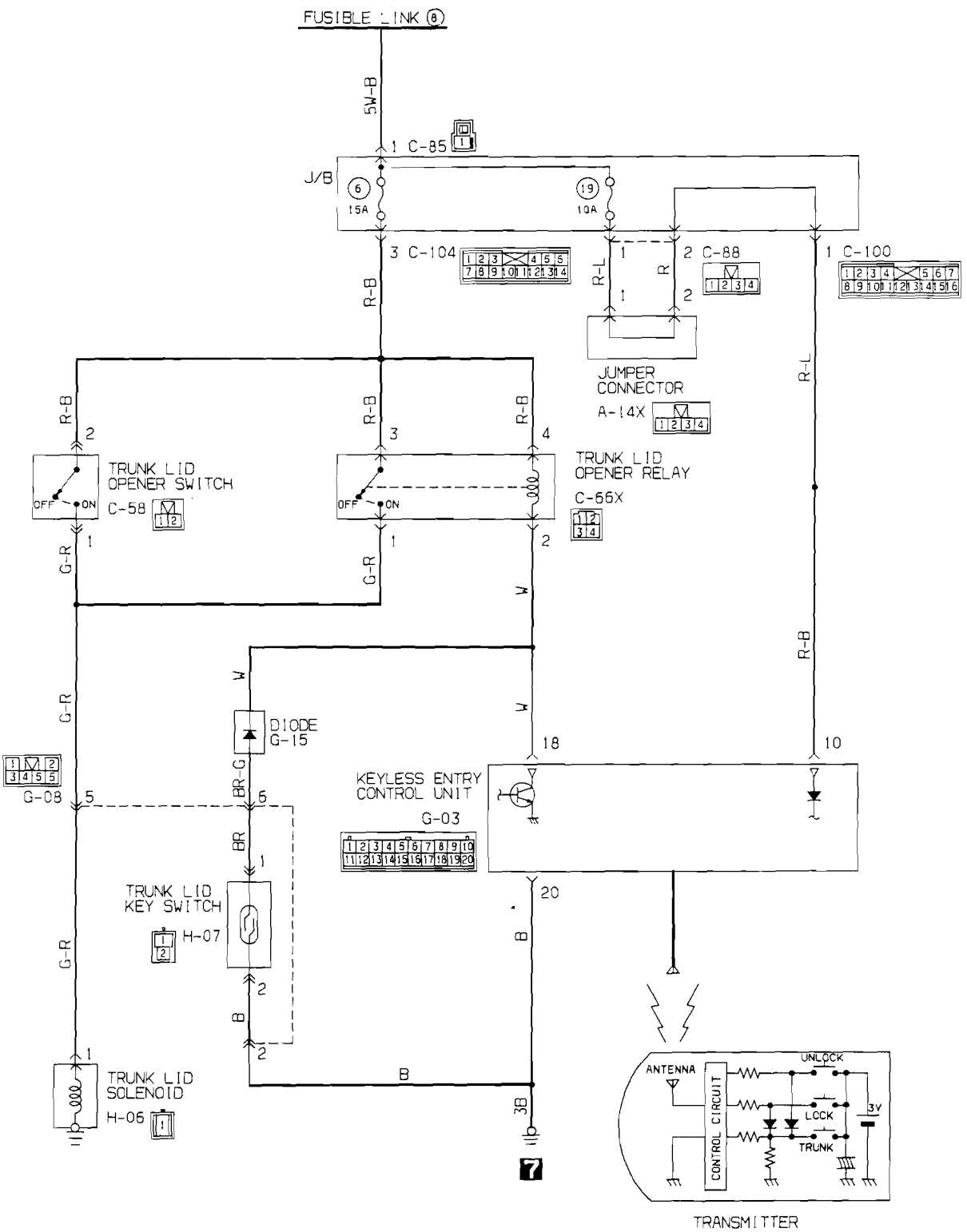


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM – Trunk lid opener circuit 'X' line 94 models

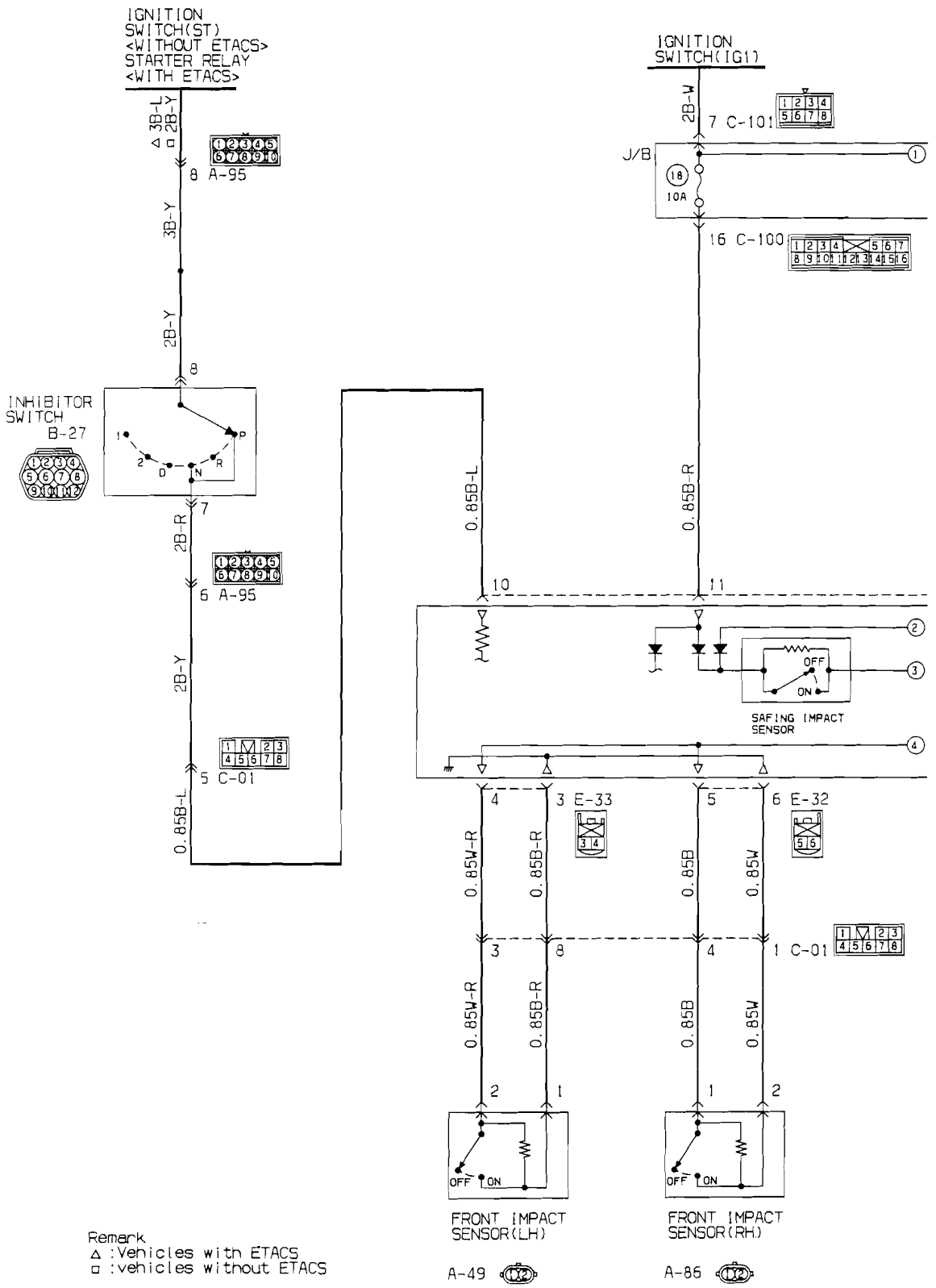


94-163

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – SRS Air Bag 94 models



94-167

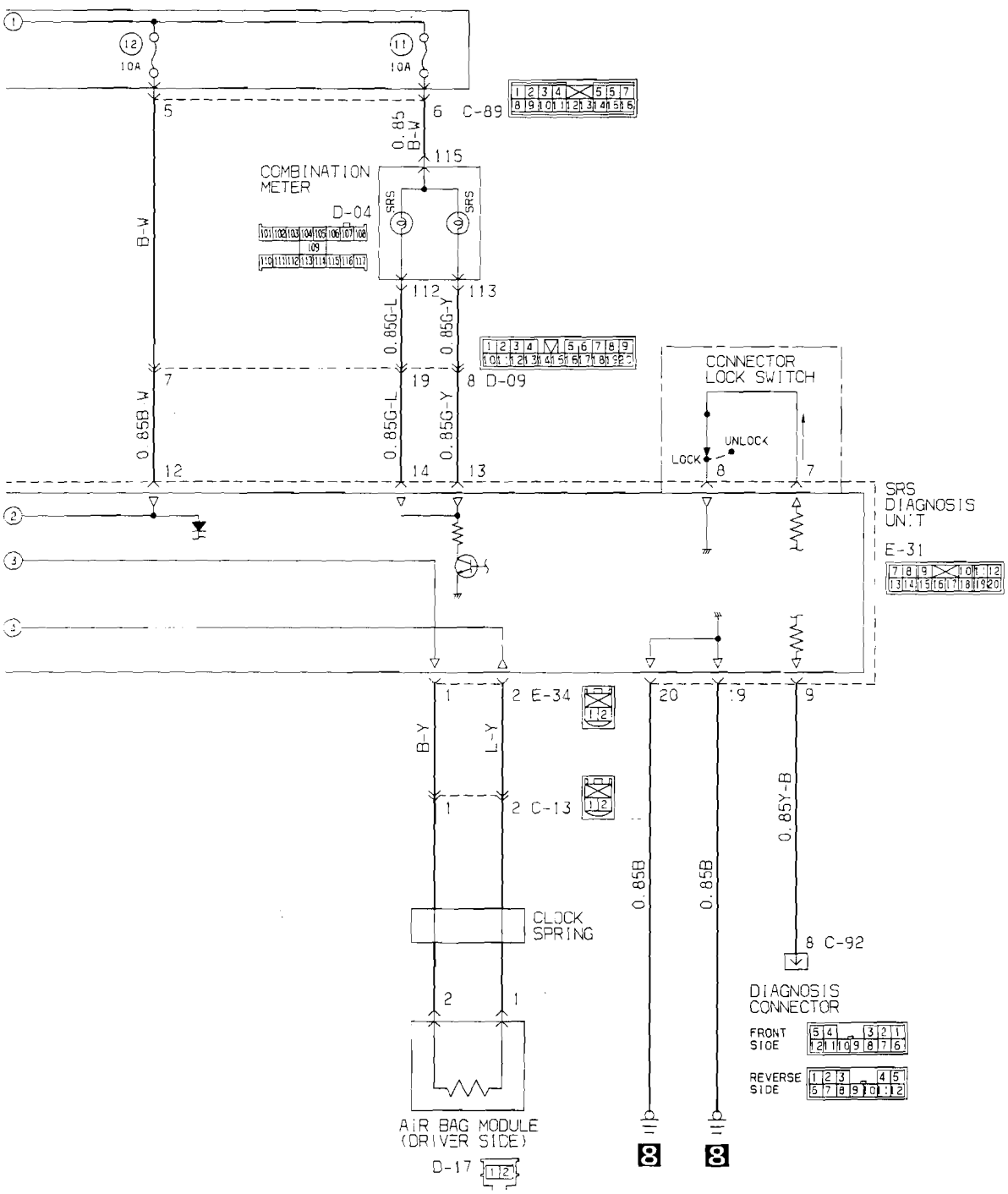
Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM – SRS Air Bag 94 models

Caution:

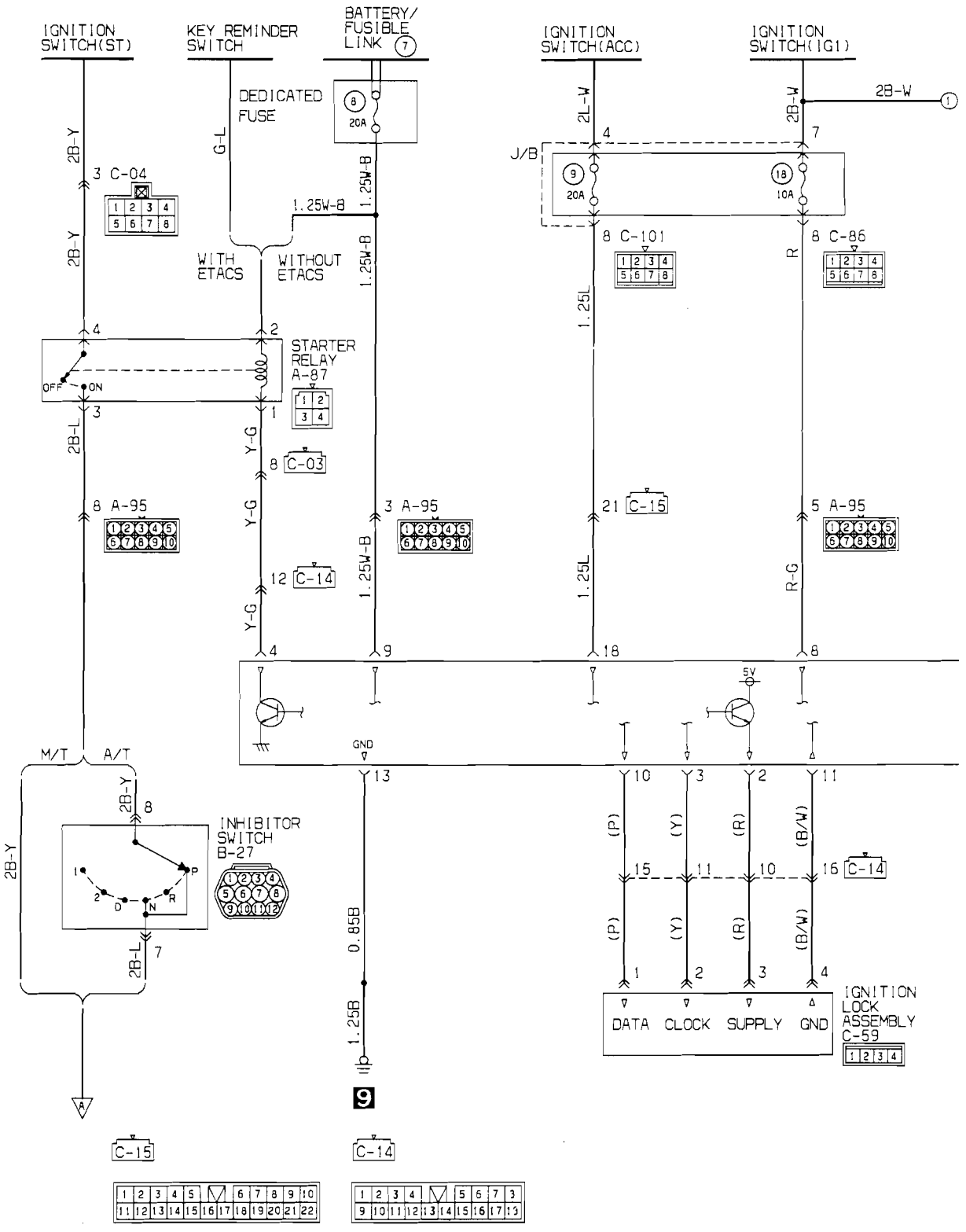
Carefully read and observe the SRS SERVICE PRECAUTIONS (Refer to GROUP 52B – Service Precautions) prior to any service.



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

CIRCUIT DIAGRAM — Immobilisation circuit with MPI <95 models>

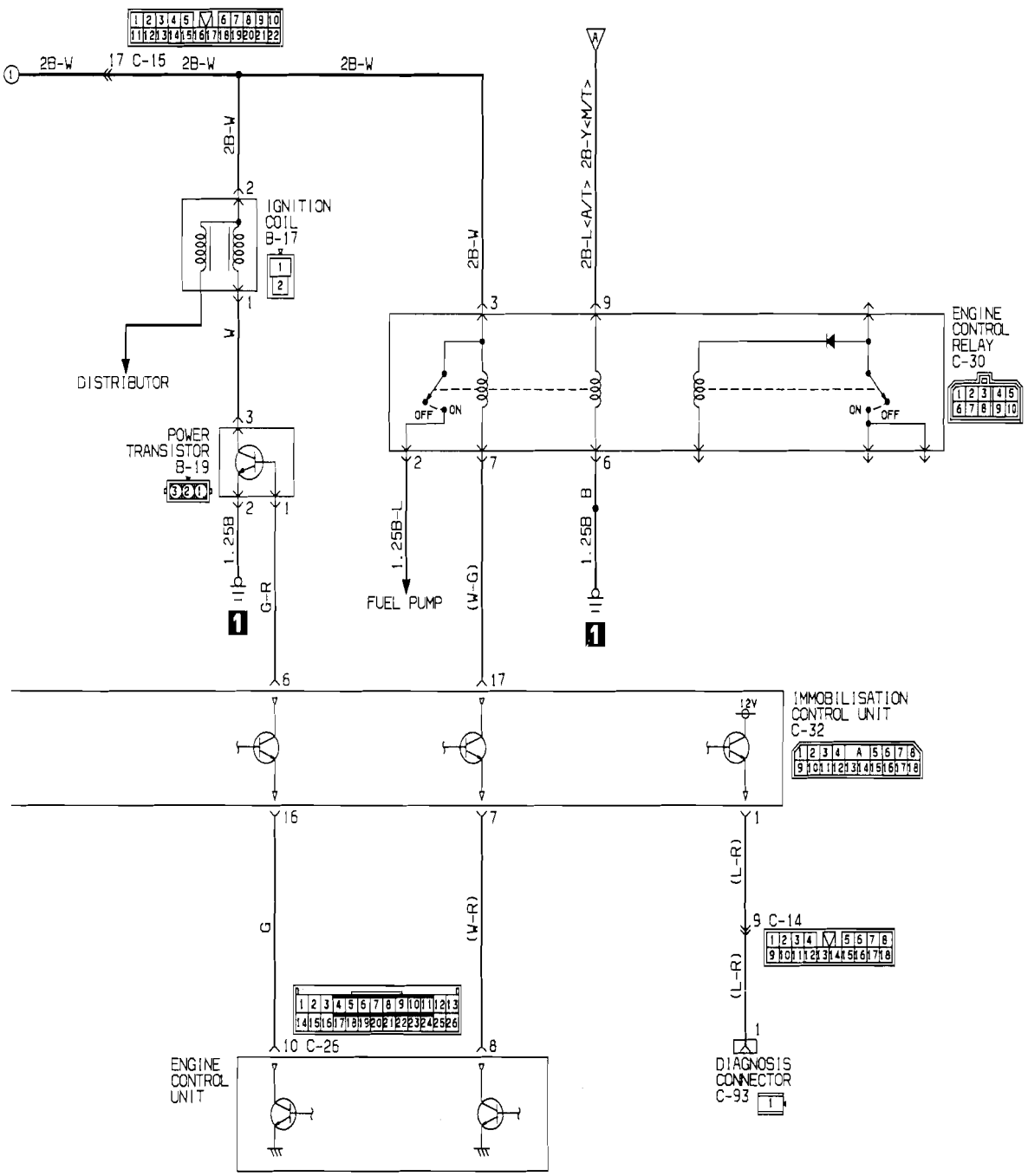


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Immobilisation circuit with MPI <95 models>

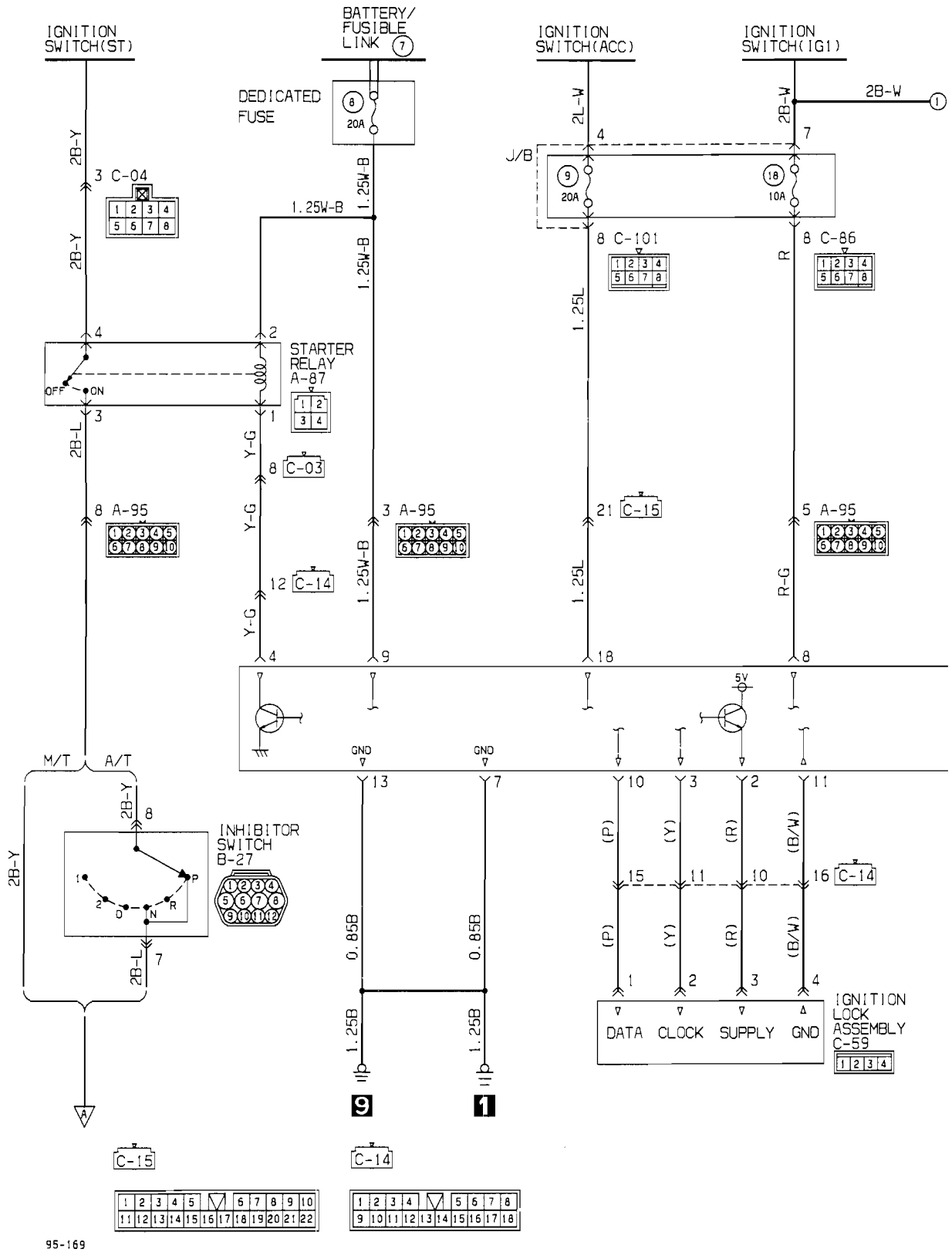


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Immobilisation circuit with Carby <95 models>

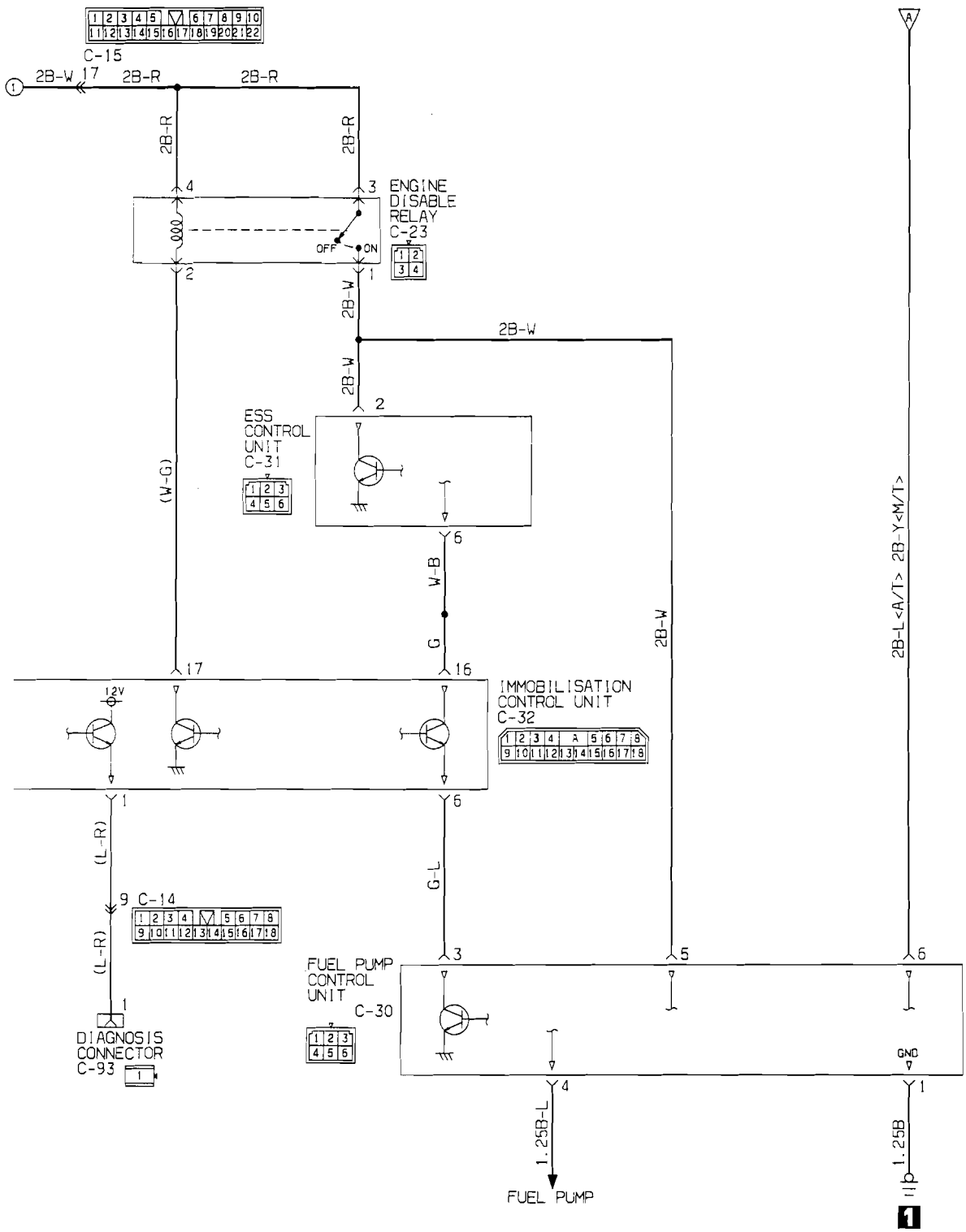


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Immobilisation circuit with Carby <95 models>

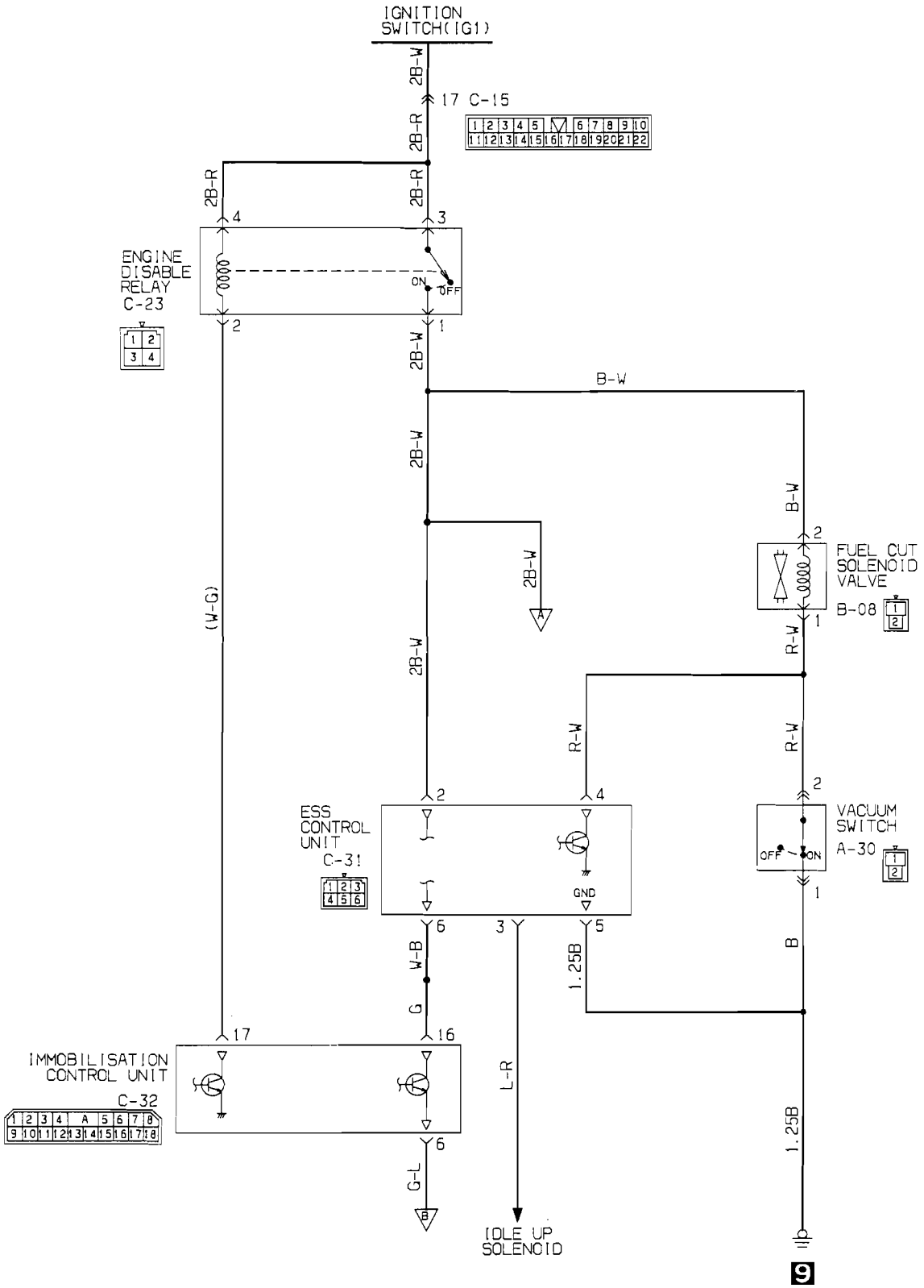


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Conventional Carburettor circuit <95 models>



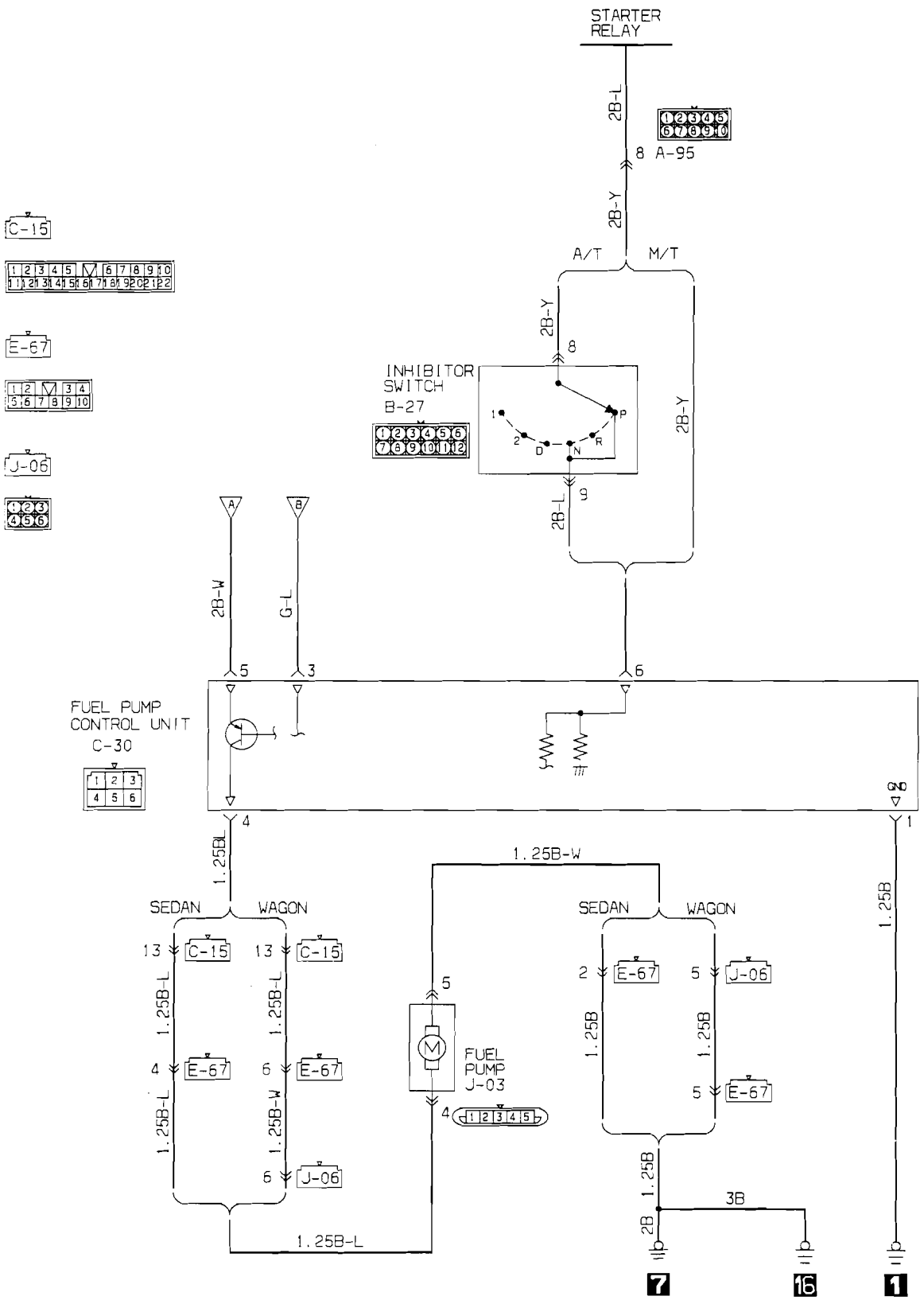
95-171

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Conventional Carburettor circuit <95 models>

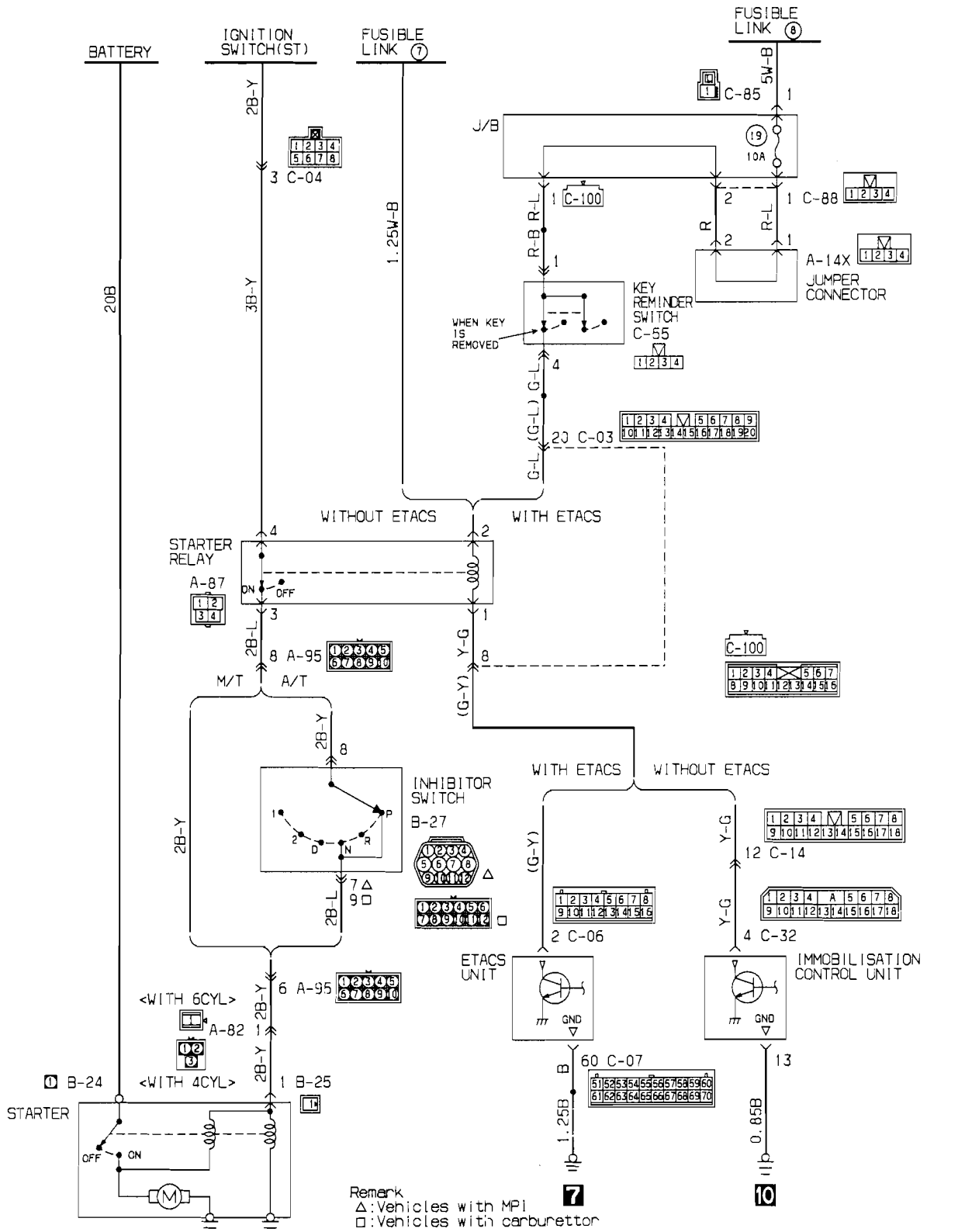


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Starting circuit <All 1995 Models>



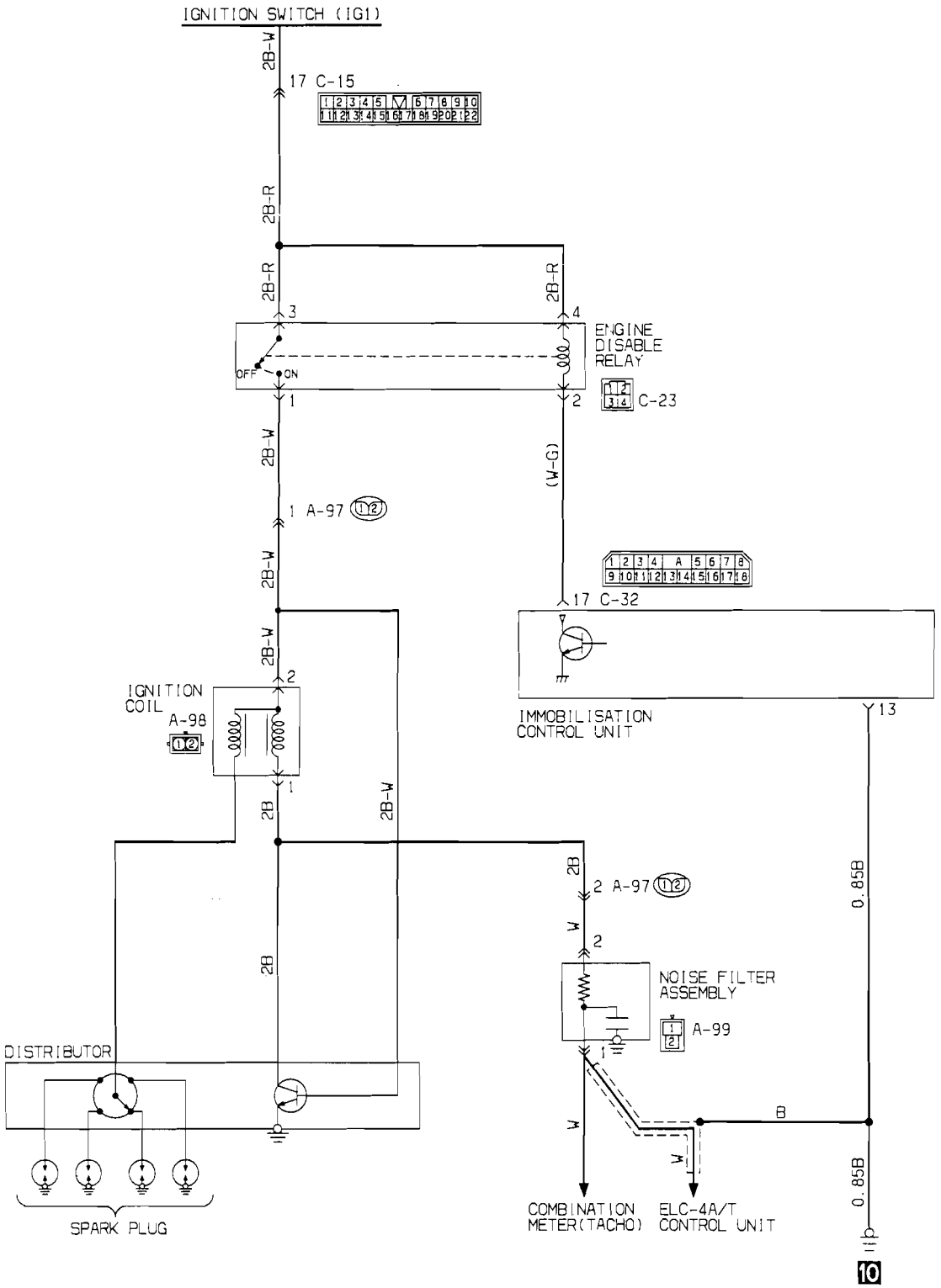
95-172

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Carburettor Ignition circuit <95 models>



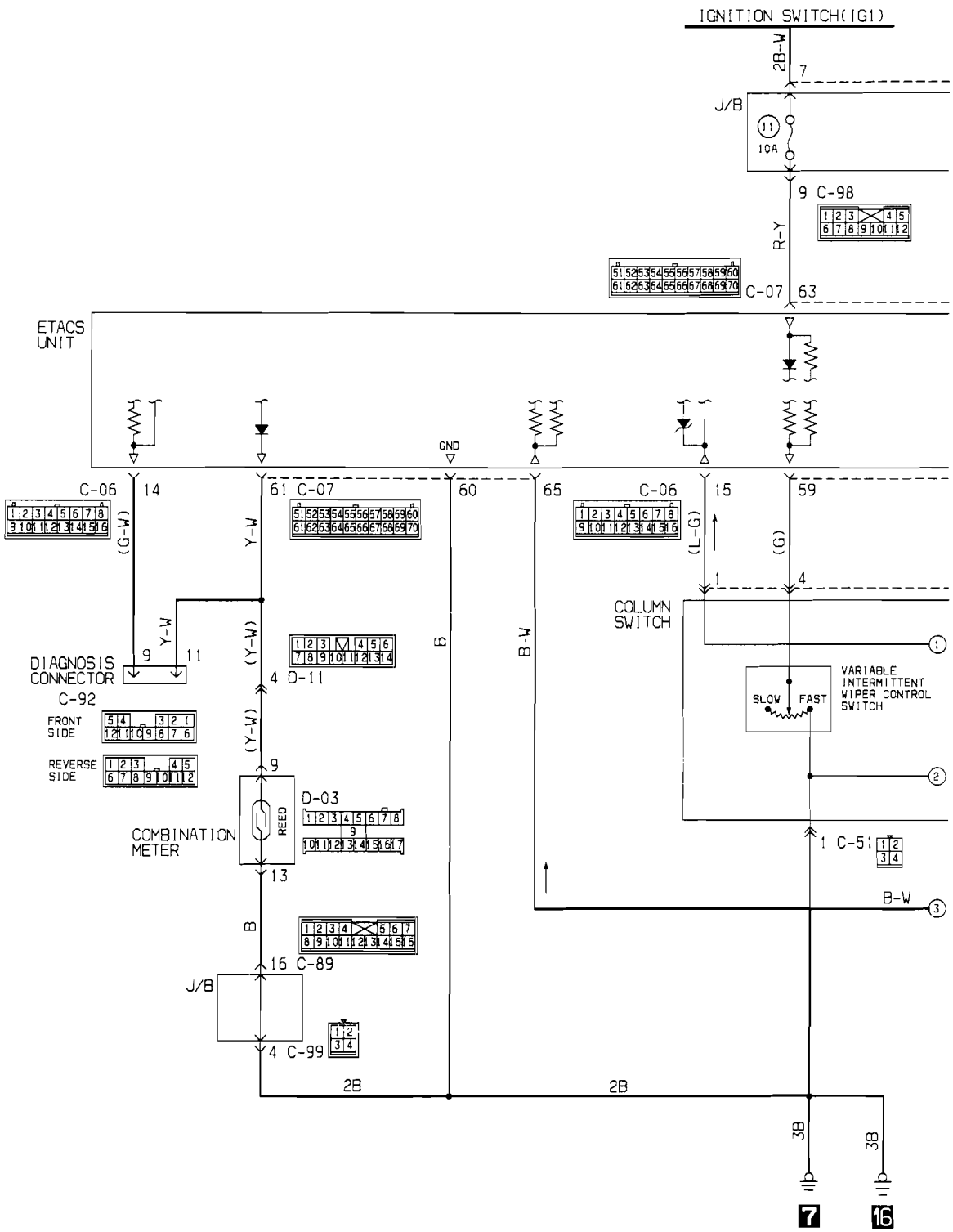
95-173

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Speed related windshield wiper circuit <95 model>



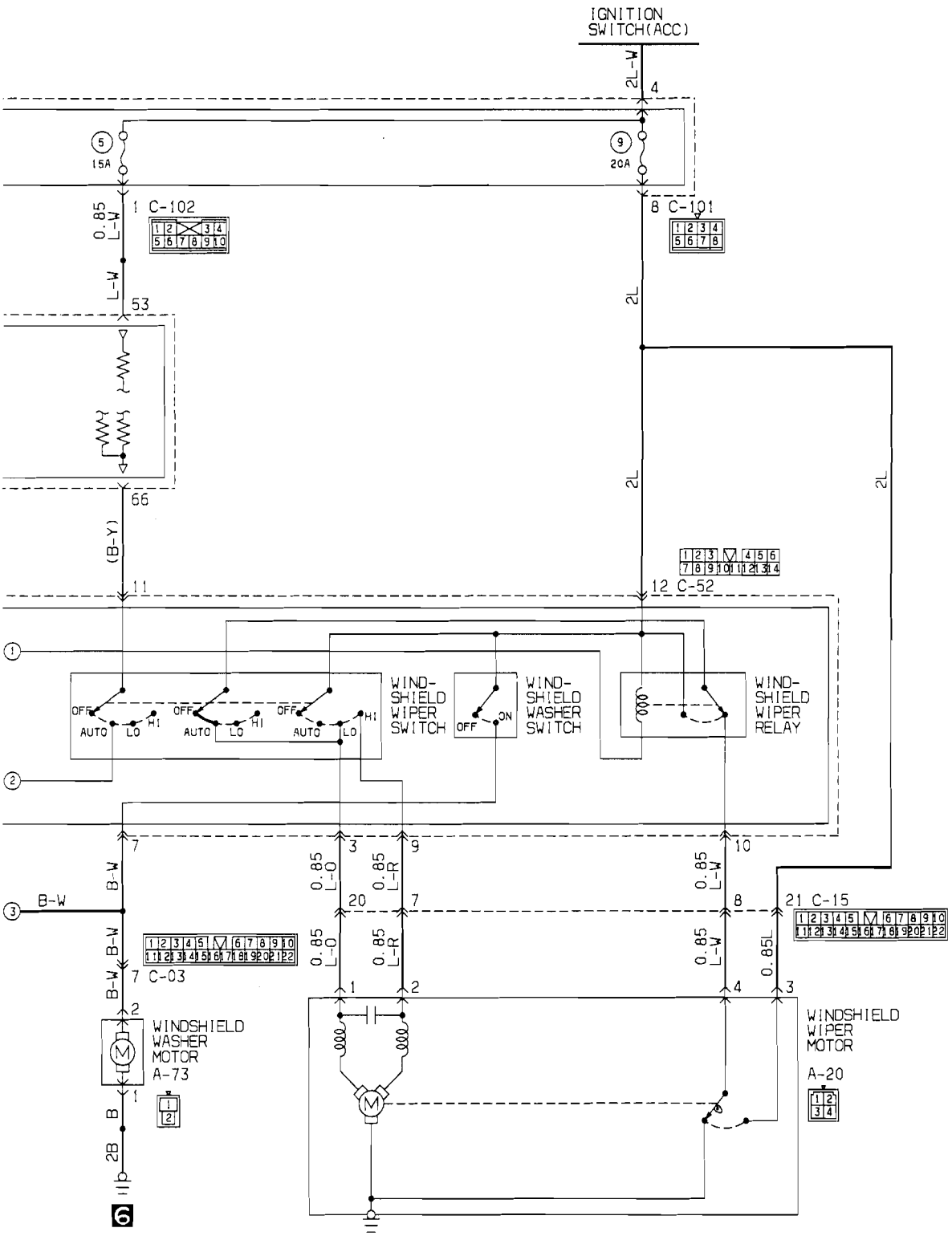
95-174

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Speed related windshield wiper circuit <95 model>

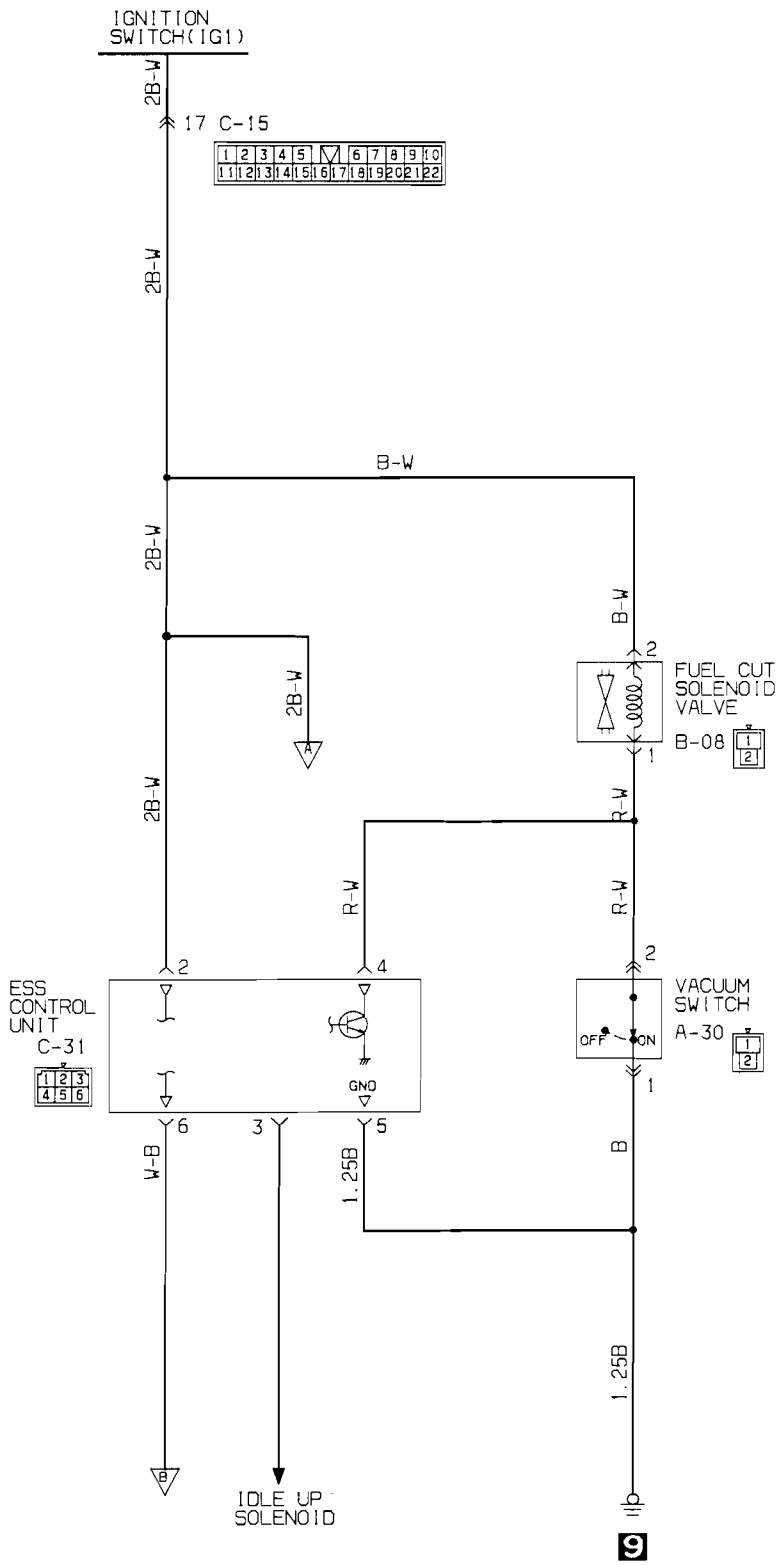


Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Conventional 4 cyl carburettor circuit 91-94 models



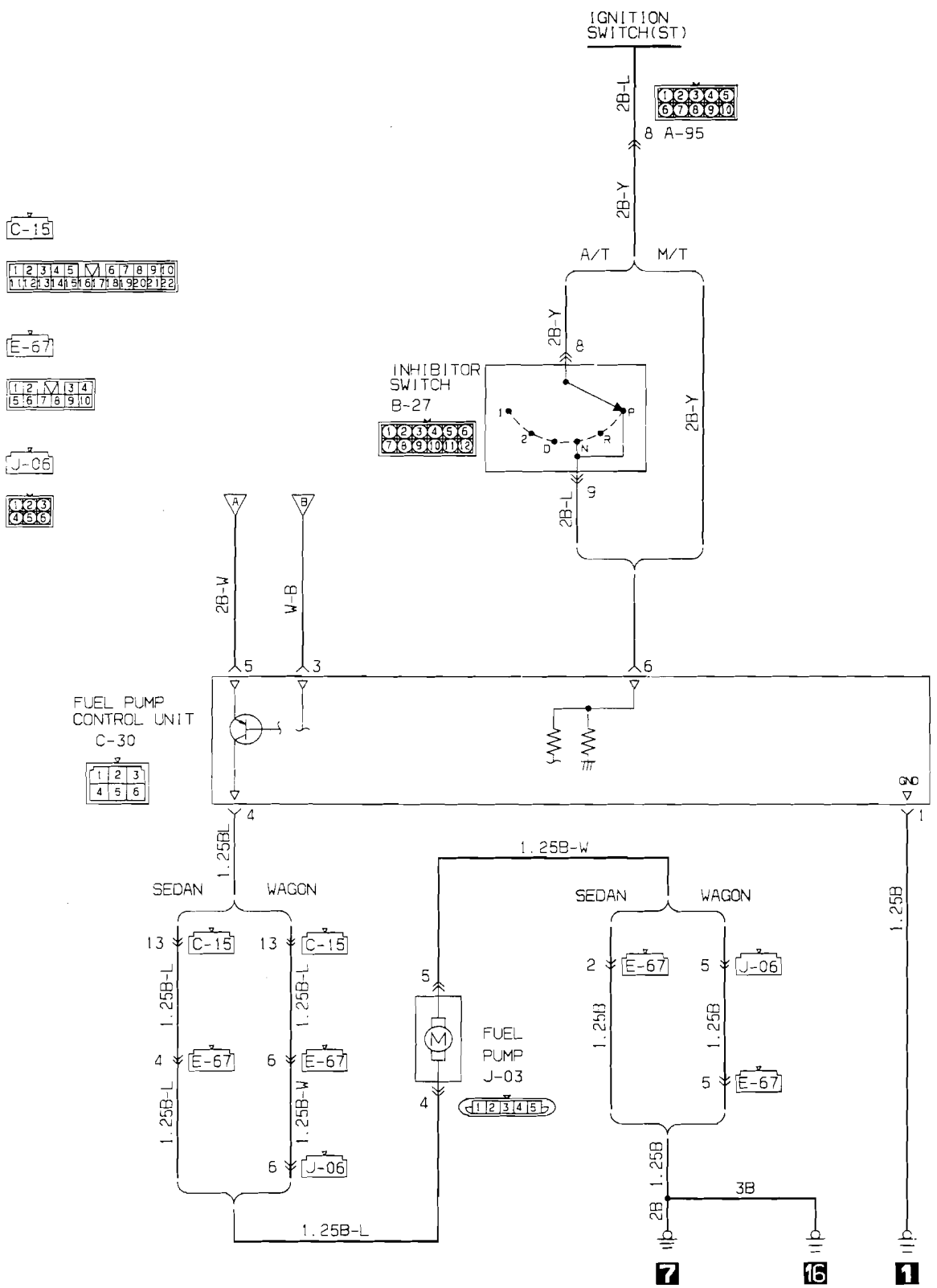
93-159

Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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CIRCUIT DIAGRAM — Conventional 4 cyl carburettor circuit 91-94 models



Wire colour code

B: Black	LG: Light Green	G: Green	L: Blue	W: White	Y: Yellow
BR: Brown	GR: Grey	O: Orange	P: Pink	R: Red	LI: Light Blue

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SECTION 4 — AUDIO SYSTEMS

SPECIFICATIONS

<R Series>

Audio Unit			
Make	Philips	A.W.A.	Mitsubishi
Type	AM/FM Stereo Radio Cassette	AM/FM Stereo Radio/Cassette	AM/FM Stereo Radio Cassette with Graphic Equalizer
Model	DC610/73	78926-079	RX335AL
Speakers	"P" line	"D","H" line	"X" line
Type — Front	2 x single cone	2 x single cone	2 x twin cone
— front doors	—	—	2 x twin cone
— rear	2 x twin cone	—	2 x three axial
Nominal input power — front	15W	15W	12W
— front door	—	—	15W
— rear	—	20W	20W
Antenna			
Type — "D", "H" and "P" line	Pole		
— "X" line	Power		
Location —"D", "H" and "P" line	RH "A" pillar		
— "X" line	LH rear fender		

<S Series>

Audio Unit			
Make	Mitsubishi	A.W.A.	Mitsubishi
Type	AM/FM Stereo Radio/Cassette	AM/FM Stereo Radio/Cassette	AM/FM Stereo Radio/Cassette
Model	RX245AL	78926-079	DX262AL
Speakers	"P" line	"D", "H" line	"X" line
Type — Front	2 x single cone	2 x single cone	2 x twin cone
— front doors	—	—	2 x twin cone
— rear	2 x twin cone	—	2 x twin cone
Nominal input power — front	15W	15W	12W
— front door	—	—	15W
— rear	20W	20W	20W
CD Unit			
Make	Mitsubishi		
Model	305AL		
Antenna			
Type — "D", "H" and "P" line	Pole		
— "X" line	Power		
Location — "D", "H" and "P" line	RH "A" pillar		
— "X" line	LH rear fender		

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GENERAL INFORMATION — RADIO RECEPTION AND SOUND QUALITY

FM Reception

FM radio waves are transmitted at very high frequency (VHF) in straight lines (line light waves). Tall buildings, hills or other obstructions may cause "shadows" with loss of signal noted by a momentary "ZZT ZZT" noise in reception. FM signals can also be reflected by obstructions. Direct and relected radio signals from the station arriving together at the antenna may cause a similar noise (multipath interference). This may occur in **any** FM receiver in a moving vehicle.

Cassette Sound Reproduction

Poor Sound reproduction may result if a cassette is warped, the tape is wound too tight or if there is dust or grime on the tape or the cassette head.

To overcome these problems, the following points should be noted:

- Cassettes need to be stored in a cool location, and not on the seats or instrument panel.
- Cassettes should never be left in direct sunlight, and in hot weather, it is advisable to take cassettes inside.
- Do not leave cassette in player while not in use, as this will permit dust entry to both the cassette and tape player.
- Should a tape be wound too tight, (expecially thin tapes), it may be relieved by a few light taps of the cassette on a suitable surface. Alternatively, if the tape becomes slack, tighten by rotating a pencil in the drive hole as shown, refer Fig. 1. For these reasons, it is recommended that C30, C60, C90 tapes be used.
- Clean the magnetic head by playing a cleaning cassette at regular intervals.

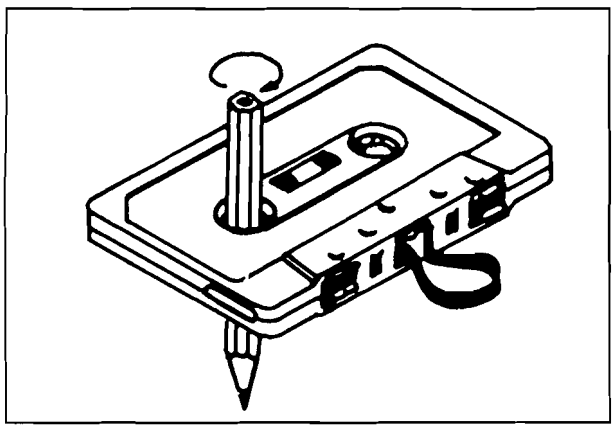


Fig. 1 — Removing slack in tape

Signal Noise/Interference

Noise interference during cassette and/or radio operation can be generated from various sources.

(a) Outside the vehicle — other vehicles, neon signs, etc.

(b) Within the radio — thermal noise from transistor etc.

(c) Other equipment on the vehicle — ignition system, alternator, accessories, etc.

The audio system fitted as standard equipment has devices built in to suppress audio unit internal noise and interference from outside the vehicle. The system is also designed to be compatible with the vehicle electrical system.

AUDIO UNIT

NOTE: Pre-removal and post-installation operation, removal and installation of floor console — refer Group 52.

Removal

(1) Remove the two audio trim panel retaining screws and remove the audio trim panel.

NOTE: Ensure ignition is switched OFF before disconnecting wiring.

(2) Remove the four radio/cassette mounting screws, refer Fig. 2 and after disconnecting all necessary wiring, remove the radio/cassette unit.

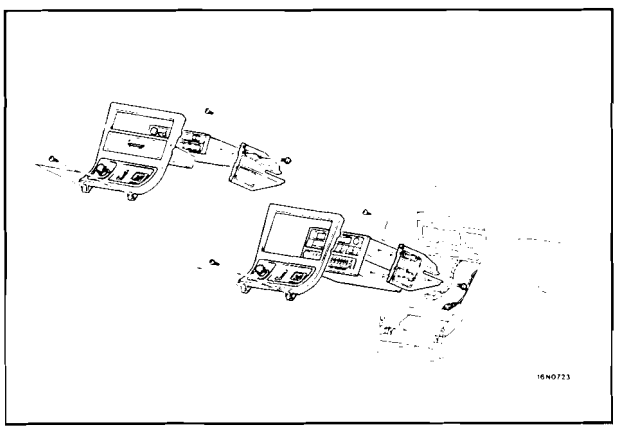


Fig 2 — Removing the radio/cassette

NOTE: Security coded radios will require the code to be re-entered into the radio.

Installation

Install by reversing removal procedure then re-set radio pre-select buttons.

REMOTE CONTROL SYSTEM

General Information

The system consists of a switch mounted in the steering wheel. As the radio remote-control switch is pressed the digital signal from the operated switch is sent through the slip ring to control the audio functions.

Switch Assembly

Removal

(1) Remove the switch retaining screws from the steering wheel.
(2) Disconnect all wiring from the switch assembly and remove the switch from the vehicle.

Installation

Install by reversing removal procedure.

SPEAKER REPLACEMENT

Front

(1) Using a suitable lever, remove the speaker cover, refer Fig. 3.

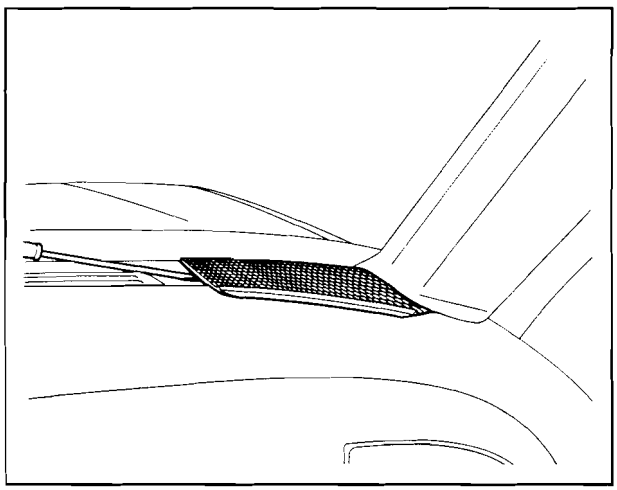


Fig. 3 — Remove front speaker cover

(2) Remove the speaker retaining screws.
(3) Lift out the speaker, disconnect from the wiring harness and remove the speaker from the vehicle.
(4) Install by reversing the removal procedure.

Front Door Speakers

Removal

(1) Remove the door trim.
(2) Remove the speaker garnish attaching screws and remove the garnish.
(3) Remove the speaker retaining screws.
(4) Lift out the speaker, disconnect from the wiring harness and remove the speaker from the vehicle.
(5) Install by reversing the removal procedure.

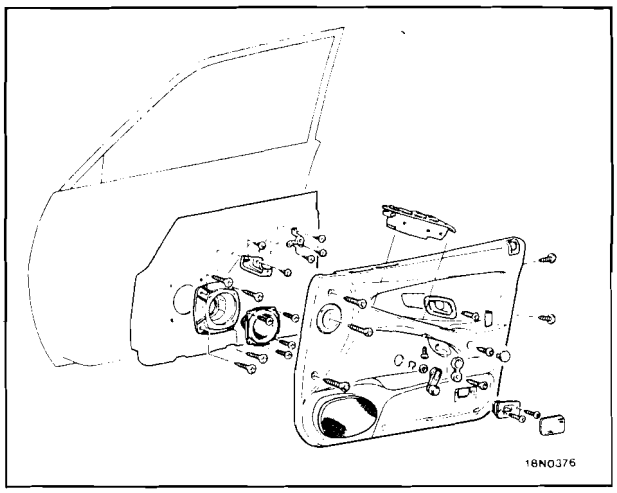


Fig. 4 — Removing front door speaker

Rear

(1) Using a suitable lever pry off the speaker cover, refer Fig. 5.
(2) Remove the speaker retaining screws.
(3) Lift the speaker out, disconnect the wiring and remove the speaker.
(4) Install by reversing removal procedure.

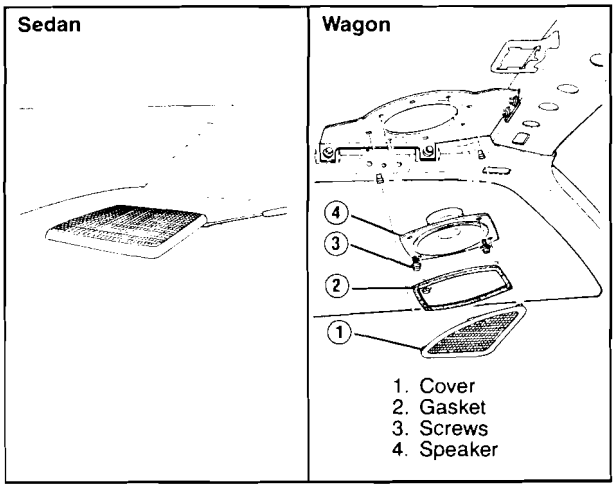


Fig. 5 — Removing rear speaker cover

ANTENNA

Removal

(1) Remove the right hand cowl side trim and right hand scuff plate, refer Group 52.
(2) Remove the floor console, refer Group 52.
(3) Lift up the carpet sufficiently to gain access to the antenna cable securing tape and remove the tape.
(4) Remove the antenna retaining screws.
(5) Withdraw the antenna and cable from the pillar.

NOTE: Tapping a suitable length of electrical wire to the old cable before removal will facilitate fitment of the new antenna and cable.

Installation

Install by reversing the removal procedure, ensuring that the cable follows the original routing.

Installation

Install by reversing the removal procedure, ensuring that the lead is correctly routed to avoid sharp bends and pinching.

POWER ANTENNA

Removal

(1) Remove the luggage compartment side trim, refer Group 52.
(2) Disconnect the wiring harness and antenna cable from the antenna.
(3) Remove the antenna mounting nuts, refer Fig. 6, and remove the antenna.

NOTE: The antenna should be fully retracted before removal.

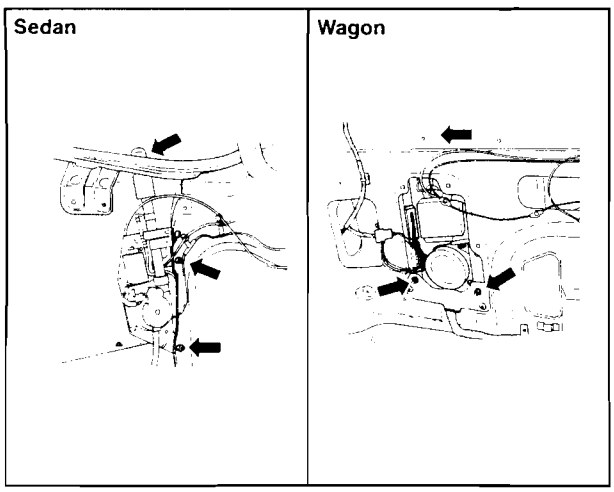


Fig. 6 — Electric antenna attaching nuts

Installation

Install by reversing the removal procedure.

Antenna Cable Replacement

Removal

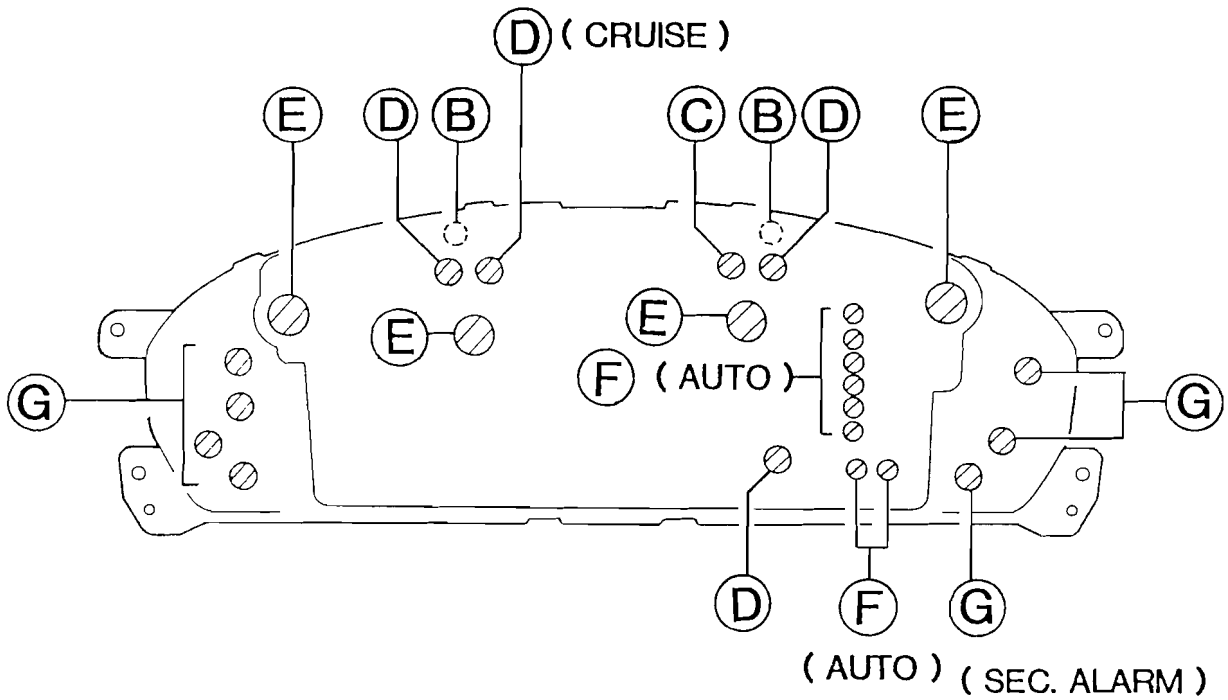
(1) Remove the luggage compartment side trim, refer Group 52.
(2) Disconnect the antenna lead from the antenna.
(3) Remove the rear seat cushion, the right hand front seat and the centre console, refer Group 52.
(4) Remove the front and rear scuff plates and lift the carpet sufficiently to gain access to the antenna cable.
(5) Remove the antenna cable.

SECTION 5 — HEADLAMPS AND LIGHTING

GLOBE CHART

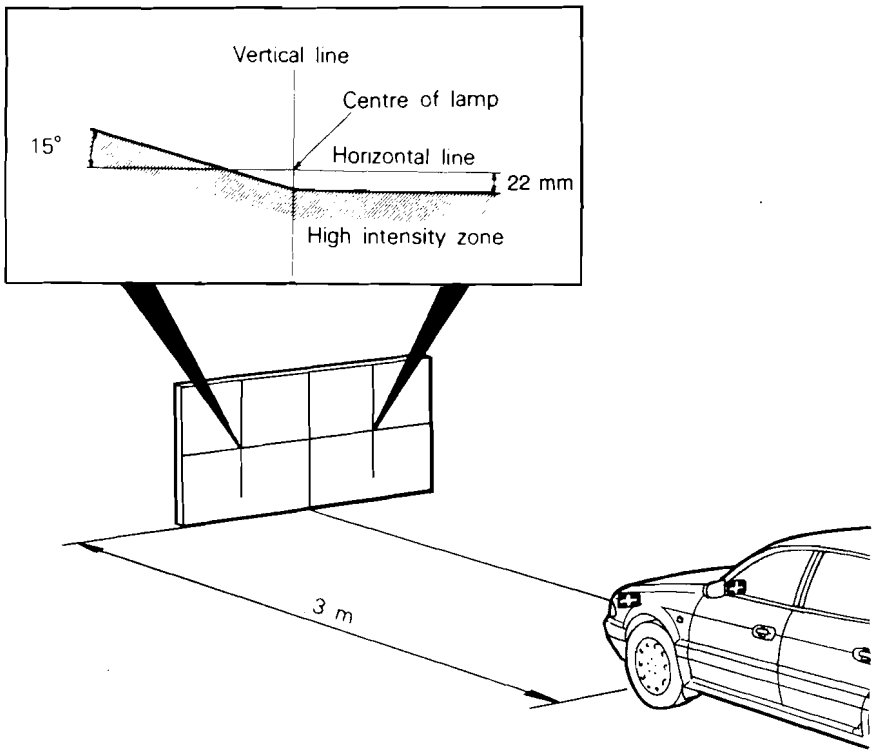
Globe Location	Globe type	Mitsubishi Replacement Part No.	Quantity
Headlamp (Hi/Lo beam)	12V 60W/55W	4067764	2
Headlamp (Hi beam)	12V 55W	4156780	2
Turn signal lamps			
—Front	12V 21W	382	2
—Front side	12V 5W	AS820090	2
—Rear combination lamp	12V 21W	382	4
Park lamps — front combination lamp	12V 5W	AS820090	2
Reversing lamp	12V 21W	382	2
Licence plate lamp	12V 5W	AS820090	2
Licence plate lamp (wagon)	12V 10W	04066764	2
Stop/tail lamp	12V 21/5W	380	2
High mounted stop lamp sedan	12V 21CP Wedge base	MS820079	1
High mounted stop lamp wagon	12V 5W	AS820090	3
Interior lamp — "D" and "H" line	12V 10W Festoon	MF820512	1
— "P" and "X" line	12V 8W Festoon	MF820513	2
Map lamp ("P" and "X" line)	12V 8W Festoon	MF820513	2
Luggage compartment lamp	12V 5W Festoon	MS820071	1
Cargo lamp (wagon)	12V 10W Festoon	3646458	1
Door lamps ("P" and "X" line)	12V 5W Festoon	MS820071	4
Instrument illumination lamps — refer 54-5-2			
Heater panel illumination lamp	12V 1.4W	MS820083	1
Glove box illumination lamp	12V 3.4W	9421330	1
Shift indicator illumination lamp	12V 1.7W Wedge	AW323565	1
Radio illumination	To be serviced by an approved Radio Service Agent.		

REAR VIEW



	Part Number	Colour	Application
B	AW328834 AW328841	Blue Green	TR-D, TR-P TR-X
B	AW328834 AW328841	Blue Green	KR-P KR-X
C	AW328834	Blue	All
D	AW328832	Clear	All
E	AW328843 AW328842	Blue Green	KR-P KR-X
E	AW328843 AW328842	Blue Green	TR-D, TR-P TR-X
F	AW328833	Frosted	Auto
G	AW328831	Clear	All

Instrument illumination lamp chart



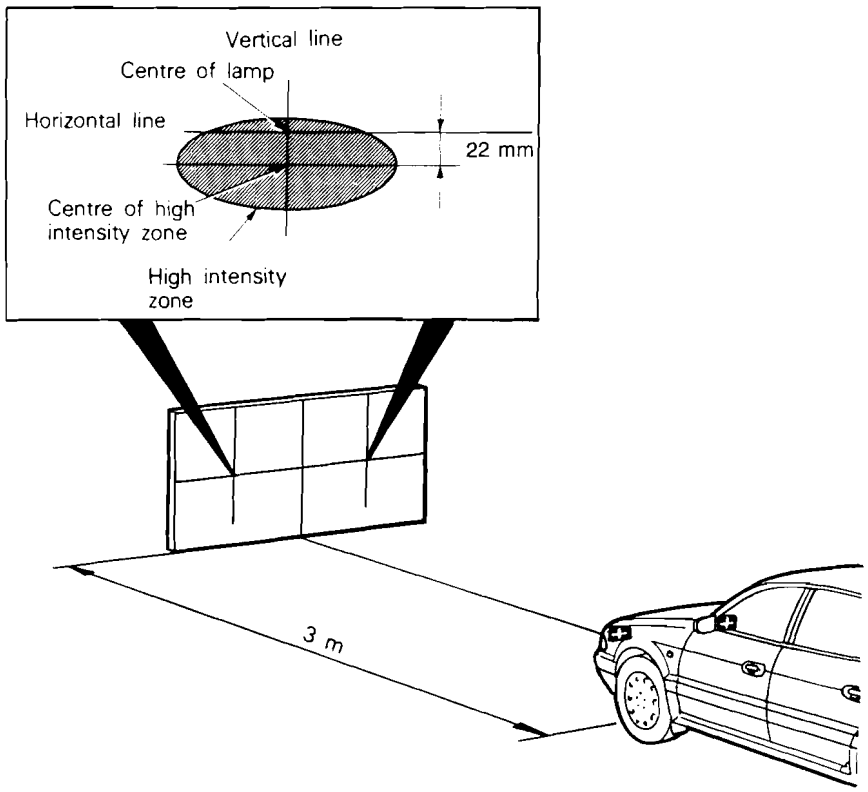


Fig. 1—Headlamp aiming specifications

HEADLAMP AIMING

NOTE: When aiming headlamps due regard must be given to State laws relating to headlamp aiming.

Prior to aiming headlamps the following procedure should be followed:

(1) Check tyres are correctly inflated.
(2) Clean headlamp lenses.
(3) Ensure that the vehicle is positioned on a level floor.
(4) Jounce the vehicle to ensure the vehicle assumes its normal attitude.
(5) If the fuel tank is not full, place sufficient weight in the luggage compartment to simulate full load conditions (1 litre of fuel = 0.72 kg).

Adjustment

Using the screws located at the rear of the headlamp assembly in the engine compartment, refer Fig. 2, adjust headlamps as follows:

Outer Lamp

(1) Adjust vertically by turning screw 1.
(2) Adjust horizontally by turning screw 2.

Inner Lamp

(1) Adjust vertically by turning screw 3.
(2) Adjust horizontally by turning screw 4.

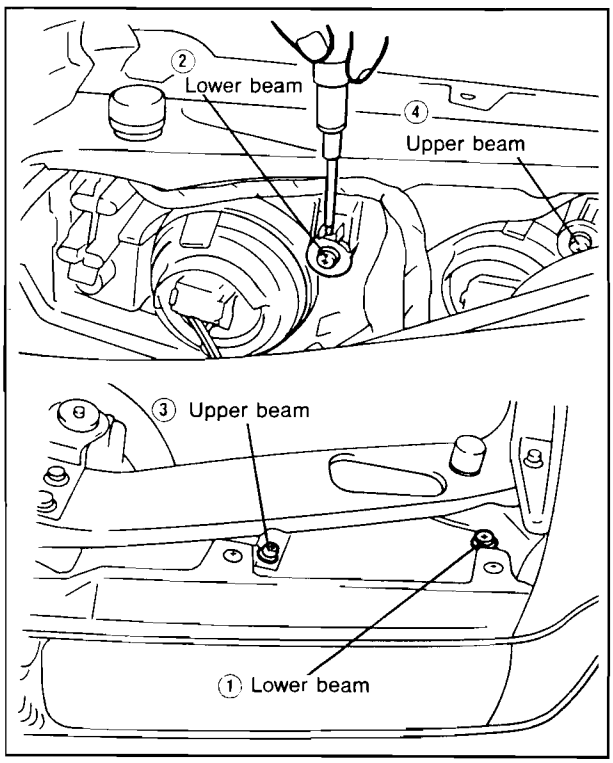


Fig. 2—Headlamp aiming screws

Using a commercial headlamp aimer

When using commercial type aiming equipment follow the manufacturers instructions.

Using an aiming screen

(1) Manufacture a aiming screen or mark a light coloured wall as shown in Fig. 1.
(2) Align the vehicle centre line with the centre line of the screen.
(3) Switch the headlamps onto low beam and aim the outer lamps.
(4) Switch the headlamps onto high beam, mask the outer lamps and aim the inner lamps.

HEADLAMP GLOBE REPLACEMENT

Removal

(1) Disconnect the wiring from the lamp.
(2) Remove the globe cover.
(3) Unhook the globe retaining clip and remove the globe, refer Fig. 3.

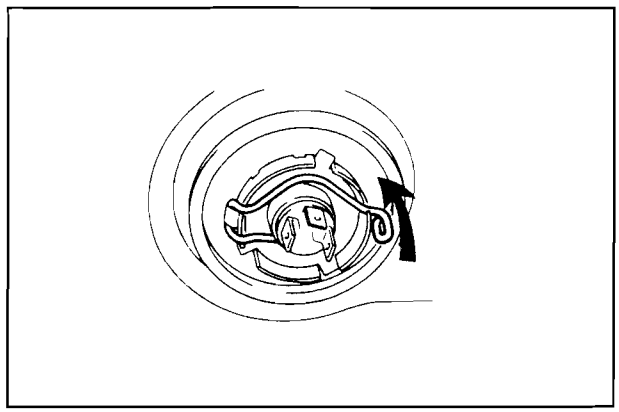


Fig. 3—Removing headlamp globe

CAUTION: Never touch the bulb with bare hands while they are illuminated, or immediately after turning them off. Never hold the halogen bulb with bare hands, dirty gloves, etc., or premature bulb failure will occur. If the glass surface is dirty, be sure to clean it with alcohol, and install after air drying thoroughly.

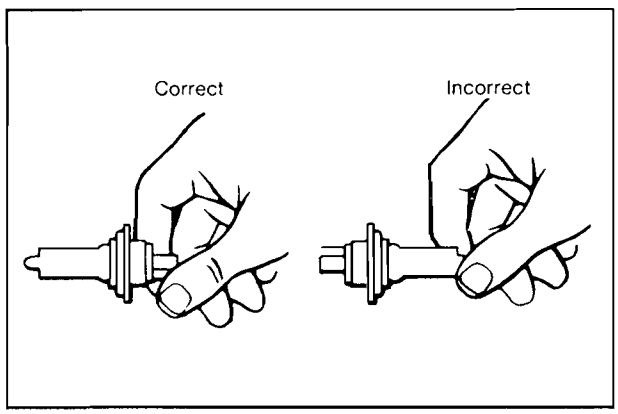


Fig. 4—Correct method of handling globe

Installation

Install by reversing the removal procedure, noting the following.

(1) Ensure that the globes are correctly indexed to allow assembly.

(2) Ensure that the globe cover is correctly installed to prevent water entry.

(3) Always aim the headlamps after globe replacement.

HEADLAMP REPLACEMENT

The headlamp lens is permanently fixed to the headlamp unit and is only serviced with the headlamp unit.

(1) Remove the front combination lamp by compressing the retaining clip, refer Fig. 5, and pulling the lamp outwards and forwards, refer Fig. 6.

NOTE: Use care when removing the lamp to avoid breaking the retaining lugs. DO NOT attempt to remove the lamp by hitting straight off.

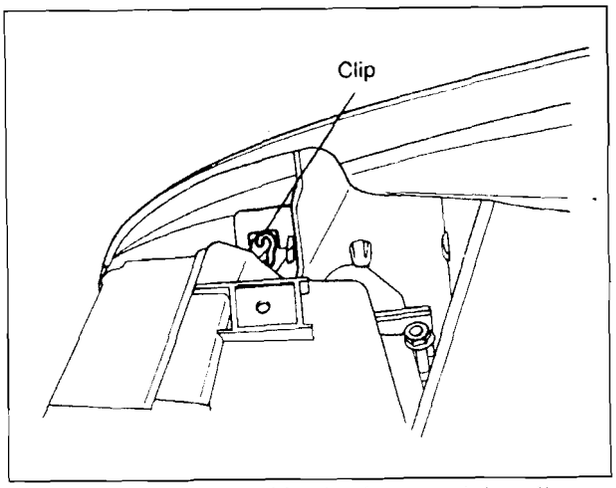


Fig. 5 — Front combination lamp retaining clip

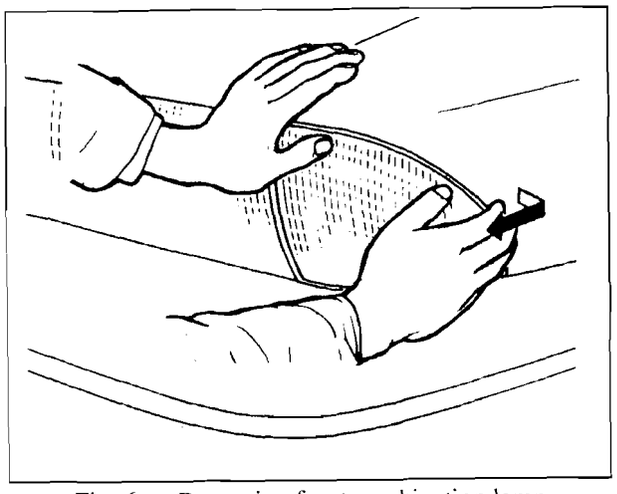


Fig. 6 — Removing front combination lamp

(2) Remove the grille by removing the retaining clips, refer Fig. 7.

(3) Disconnect the wiring from the headlamp.

(4) Remove the headlamp retaining screws, refer Fig. 8, and remove the headlamp from the vehicle.

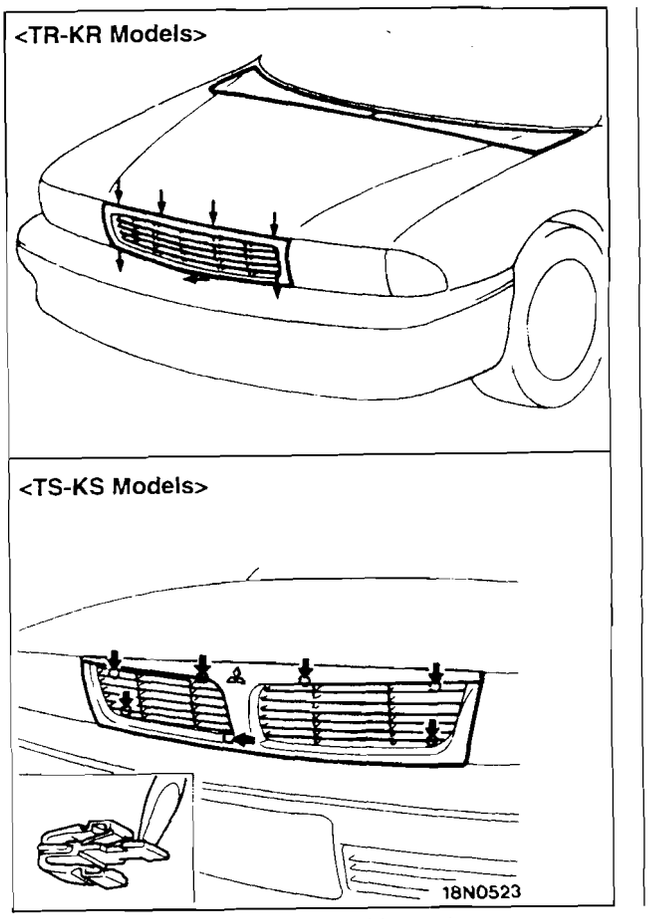


Fig. 7 — Grille attaching points

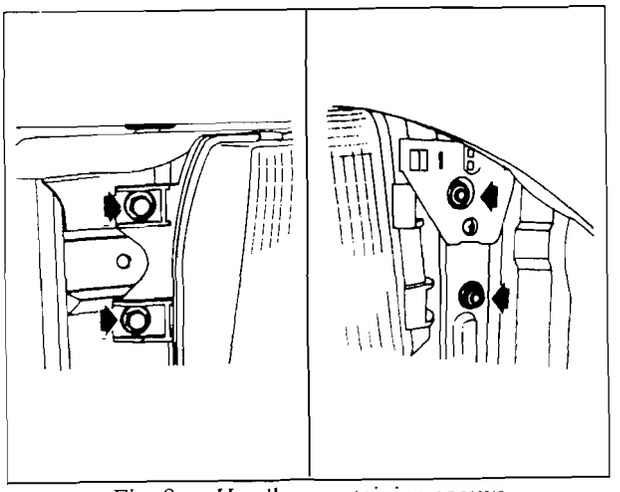


Fig. 8 — Headlamp retaining screws

Installation

Install by reversing the removal procedure, noting the following:

(1) Ensure that the front combination lamp is correctly positioned and secure.

(2) Always aim the headlamps if a headlamp has been replaced.

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HEADLAMP AND DIMMER SWITCHES

For testing and servicing procedures refer to Section 7.

HEADLAMP RELAY

For relay location, refer to Section 1.

Testing (refer Fig. 9)

(1) Remove the relay from the vehicle.
(2) Check for continuity between terminals 1 and 3 and no continuity between terminals 2 and 4.
(3) Apply battery voltage between terminals 1 and 3 and check that there is continuity between terminals 2 and 4.

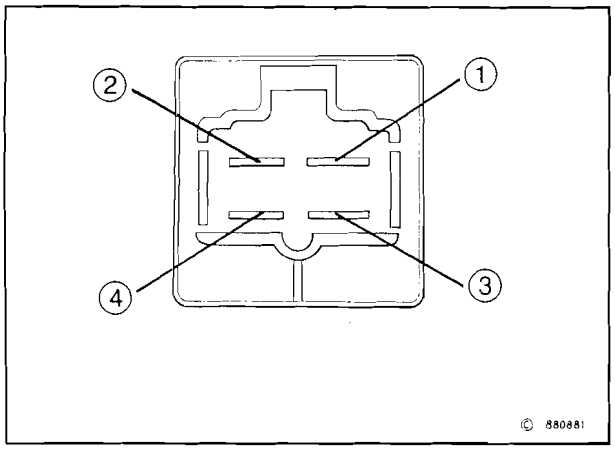


Fig. 9—Headlamp relay terminals

HEADLAMP INTERLOCK SYSTEM

When the ignition switch is turned from the ON or ACC to the OFF or LOCK position the headlamp relay is deactivated, switching off the headlamps. The parking lamps will remain on.

POSITION LAMPS (where fitted)

Removal

(1) Remove the lens mounting screws, refer Fig. 10, and remove the lens.
(2) To remove the globe press inwards and turn anti-clockwise.
(3) To remove the housing pull out from the bumper bar and disconnect the wiring.

Installation

Install by reversing the removal procedure.

FRONT COMBINATION LAMP

(1) Open the engine hood, remove the retaining clip, refer Fig. 11, remove the lamp by pulling the lamp outwards and forwards, refer Fig. 12.

NOTE: Use care when removing the lamp to avoid breaking the retaining lugs. DO NOT attempt to remove the lamp by hitting straight off.

(2) Remove the globe socket by turning anti-clockwise then remove the globe by pulling out.

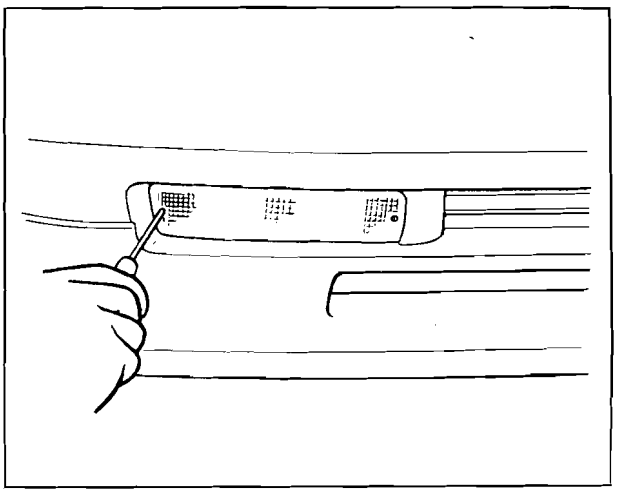


Fig. 10—Removing position lamps

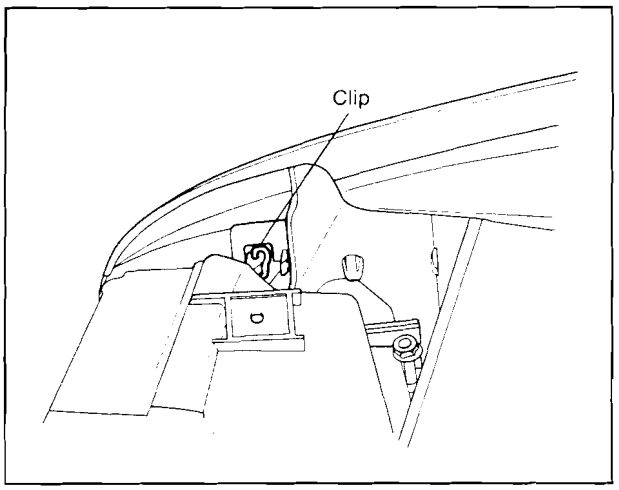


Fig. 11—Front combination lamp retaining clip

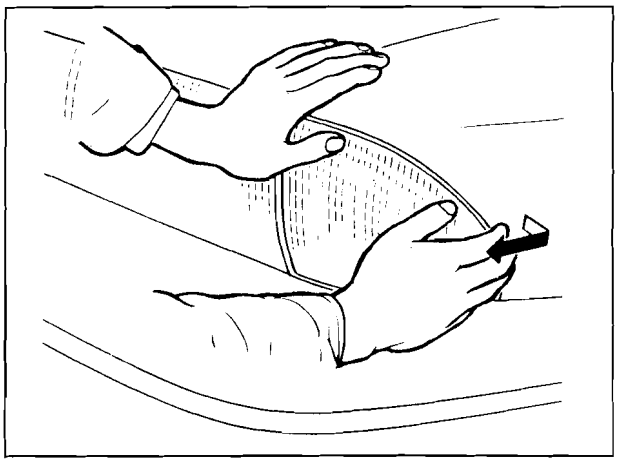


Fig. 12—Removing front combination lamp

Installation

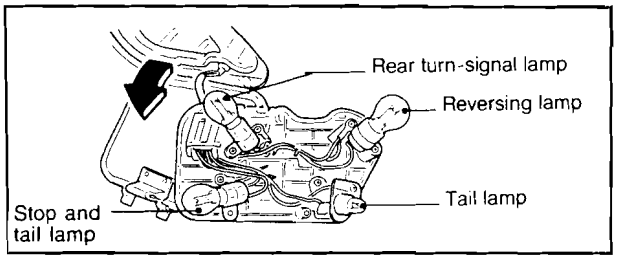
Install by reversing the removal procedure ensuring that the retaining lugs are correctly located.

REAR COMBINATION LAMP

The lamp lens and the housing are a one piece unit and must be replaced as an assembly if either is damaged.

Globe Replacement Sedan

(1) Disconnect the wiring loom from the lamp assembly.
(2) Compress the retaining lugs and remove the mounting cover and socket assembly, refer Fig. 13.
(3) Remove the globe by pressing inward and turning anti-clockwise.



Fig, 13 — Removing cover and globe socket assembly

Globe Replacement Wagon

(1) On D and H-line models, remove the lamp access cover located in the trim panel adjacent to the tailgate opening.
(2) To remove the lamp cover refer, Fig. 13A ①, insert the blade of a screwdriver into the small slot at the rear of the cover and lever the cover forward to spring the cover from the trim panel.
(3) On P-line models, remove the trim panel insert to gain access to the lamp access cut-out.
(4) To remove the trim panel insert, locate the trim clip/s, refer Fig. 13A. Early models have a clip at the front position ① only. (To locate the clip/s, feel through the foam and fabric). At the retaining clip point, gently ease the insert away from the trim by hand.
(5) Continue to ease the insert away from the trim to unfasten the Velcro tabs. Once the Velcro has been unfastened, slide the insert forward to disengage the brackets at the rear of the trim.
(6) Remove the required bulb holder through the access cut-out, refer Fig. 13A ③, by turning it anti-clockwise and remove the bulb by turning it anti-clockwise while pushing it inward.

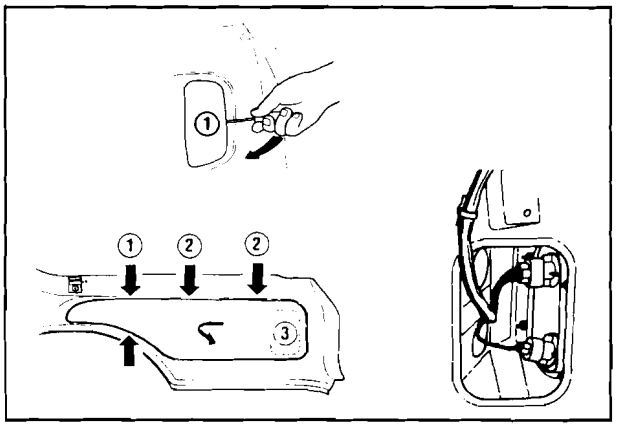


Fig. 13A — Wagon globe removal

Lens/Housing Replacement Sedan

Removal

(1) Remove the rear luggage compartment trim, refer Group 52.
(2) Remove the rear panel centre garnish, refer Group 52.
(3) Disconnect the wiring loom from the lamp assembly.
(4) Remove the lamp assembly retaining nuts, refer Fig. 14, and remove the lamp.

Installation

Install by reversing the removal procedure.

NOTE: Failure to tighten retaining nuts will result in dust and/or water entry.

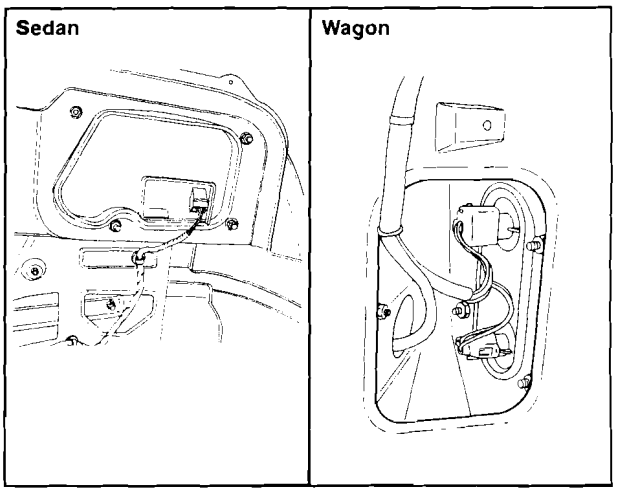


Fig. 14 — Rear combination lamp retaining nuts

LUGGAGE COMPARTMENT LAMP SEDAN

Removal

(1) Remove the lens by squeezing together at the sides.
(2) Remove the globe.
(3) Remove the retaining screws, disconnect the wiring loom and remove the lamp assembly.

Installation

Install by reversing removal procedure.

LUGGAGE COMPARTMENT LAMP WAGON

Removal

(1) Using a suitable lever pry off the lamp lens, refer Fig. 15.
(2) Carefully pry out lamp assembly from hood lining and disconnect the wiring loom and remove lamp assembly.

Installation

(1) Connect wiring to lamp assembly.
(2) Push lamp assembly back into hoodlining.
(3) Refit lamp lens.

TAILLAMP RELAY

For relay location refer to Section 1.

Testing

Use testing procedure as outlined in "Headlamp Relay", this Section.

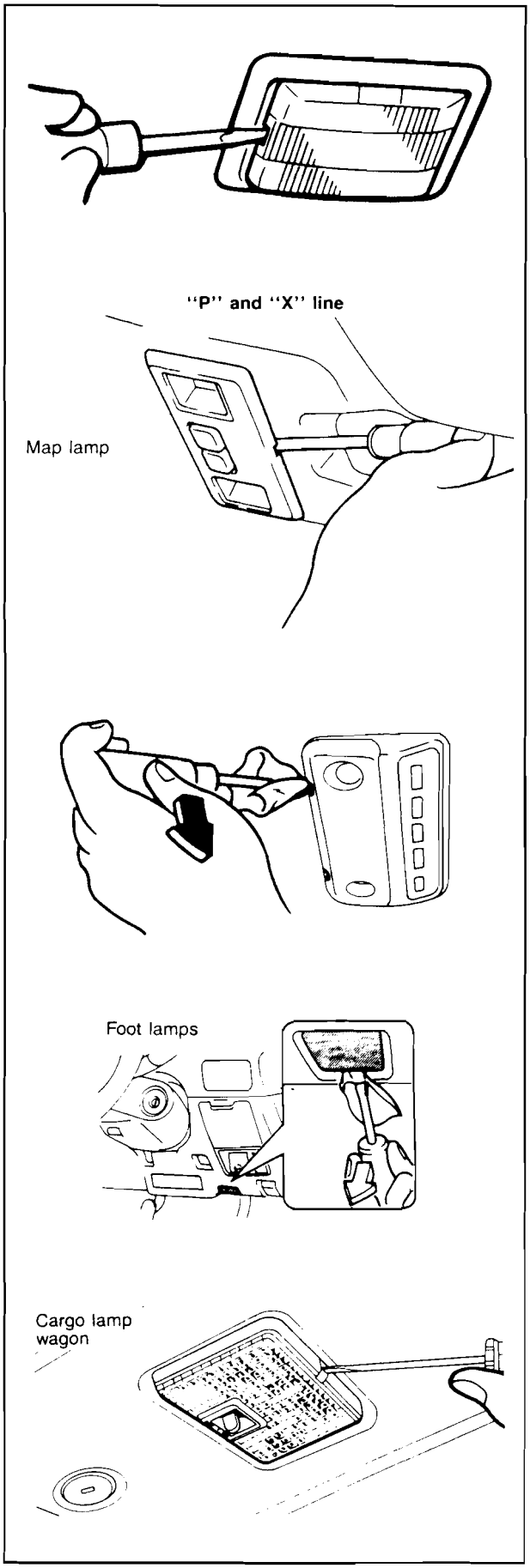


Fig. 15—Removing interior lamp lens

INTERIOR LAMPS

Roof and Map Lamps

Removal

(1) Using a suitable lever pry off the lamp lens, refer Fig. 15.
(2) Remove the globe.
(3) Remove the retaining screw(s), disconnect the wiring loom and remove the lamp assembly.

Installation

Install by reversing the removal procedure.

Door Lamps (where fitted)

Removal

(1) Carefully pry off the lens with a screwdriver, refer Fig. 16.
(2) Remove the globe.
(3) Remove the retaining screws, disconnect the wiring loom and remove the lamp.

Installation

Install by reversing the removal procedure.

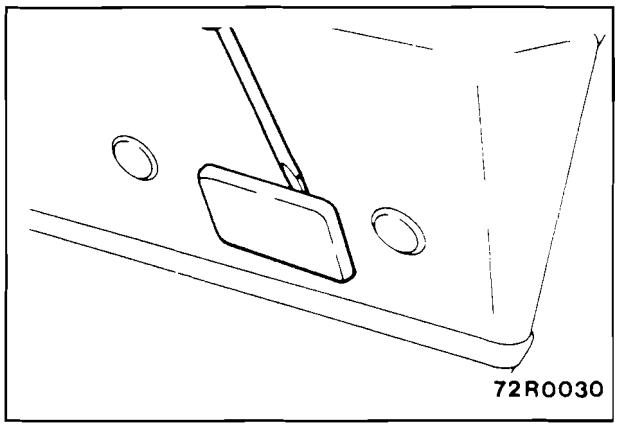


Fig. 16 — Removing door lamp lens

INSTRUMENT CLUSTER ILLUMINATION

For globe replacement refer to Section 9, for globe chart, refer 54-5-2.

Foot Lamps (where fitted)

Removal

(1) Insert the tip of a screwdriver at the edge of the lens and pry gently to remove the lens.
(2) Reach behind the assembly to the globe holder and twist slightly to remove.
(3) Remove the globe from the holder.

Installation

Install by reversing the removal procedure.

Heater panel illumination

Removal

(1) Remove the heater panel, refer Group 55.
(2) Remove the globe holder by twisting slightly and carefully pulling out.
(3) Remove the globe from the holder.

NOTE: On Auto Air models, to remove the globe, a small screwdriver is needed. Turn the globe holder a couple of times and then carefully pull out.

Installation

Installation is a reversal of the removal procedure.

Cigarette lighter illumination

Removal

(1) Remove the audio panel garnish and cigarette lighter panel, refer Group 52 for removal procedure.
(2) Remove the cigarette lighter globe holder by twisting slightly and pulling out.
(3) Remove the globe.

Installation

Installation is a reversal of the removal procedure.

Ash tray illumination

Removal

(1) Remove the ash tray by opening and pulling upwards with the lid.
(2) Remove the globe by carefully pulling out from the holder.
(3) To remove the globe holder, remove the floor console installation to enable access, refer Group 52 for console removal.

LICENCE PLATE LAMPS

Removal

(1) Remove the two lamp retaining screws.
(2) Pull the lamp assembly from its mounting, disconnect the wiring and remove the lamp assembly.
(3) To remove the globe, remove the globe holder from the lamp and pull the globe out of the holder.

Installation

Install by reversing removal procedure.

HIGH MOUNTED STOP LAMP (SEDAN)

Removal

(1) Using a suitable lever pry off the lamp assembly screw cover.
(2) Remove the attaching screws.

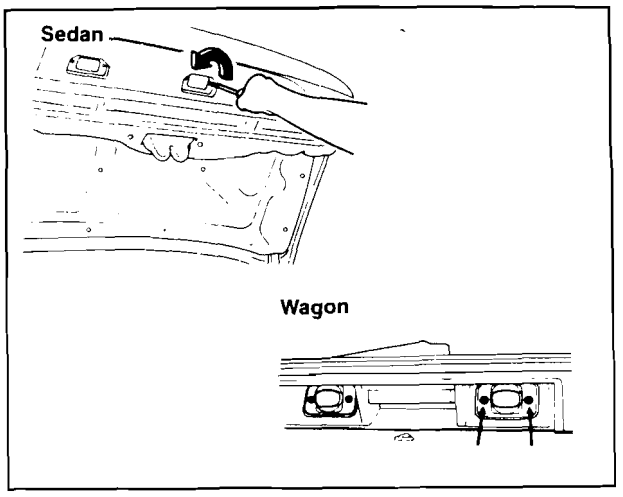


Fig. 16 — Licence plate lamp removal

(3) Lift the lamp assembly from the base.
(4) To remove the globe holder, gently twist in an anti-clockwise direction and pull out.
(5) To remove the lens, remove the two retaining screws located in the lamp assembly.
(6) The lens holder can be split into two halves by removing the two retaining screws in the lower half, refer Fig. 18.
(7) To remove the base, remove the two retaining nuts on the underside of the parcel shelf in the trunk and disconnect the wiring.

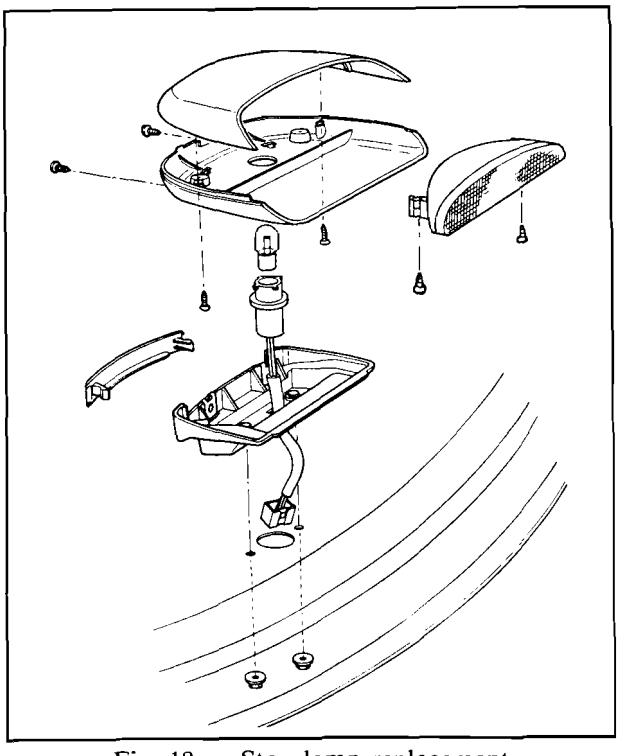


Fig. 18 — Stop lamp replacement

Installation

Installation is a reversal of the removal procedure.

HIGH MOUNTED STOP LAMP (WAGON)

Removal

(1) Remove the attaching screws, refer Fig. 19.
(2) Pull the lamp assembly forward to expose the bulb holders.
(3) Remove the bulb holder from the assembly by turning it anti-clockwise then pull the bulb out of the holder.

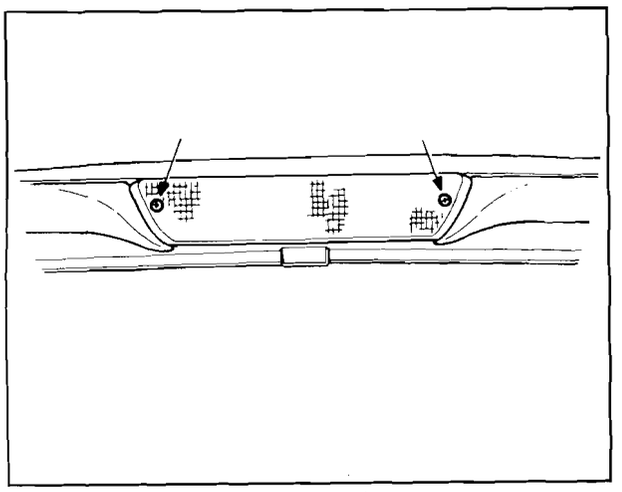


Fig. 19 — Stop lamp replacement wagon

Installation

Install by reversing removal procedure.

SECTION 6 — REAR WINDOW DEFOGGER

GENERAL INFORMATION

The defogger system consists of an electrical grid baked onto the inside surface of the rear window glass, an ON/OFF switch and a switching relay.

TESTING GRID

Voltmeter Test

NOTE: Due to the high current draw of the circuit the defogger should only be operated with the engine running and extended use should be avoided.

(1) Start engine and switch on defogger.

(2) Using a suitable voltmeter check voltage between the centre point of each grid line and earth. Voltage should be approximately 6V.

(3) If 12V is indicated, the grid line is broken between the centre point and the negative terminal. To locate the break move the test probe towards the negative terminal. The break will be at the point that voltage drops to OV.

(4) If 0V is indicated the grid is broken between the centre point and the positve terminal. To locate the break in the grid move the test probe towards the positive terminal. The break will be at the point where voltage rises to 12V.

NOTE: The positive terminal is located on the drivers side of the rear window and the negative terminal on the passenger side.

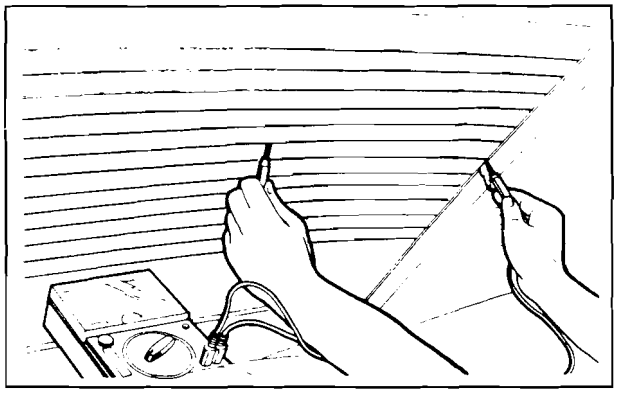


Fig. 1—Testing rear window grid

Ohmmeter Test

(1) Using an Ohmmeter measure the resistance between the centre point and both ends of each grid line.

(2) If an Ohmmeter reading of ∞ is indicated at any point there is a break in the grid line.

(3) To locate the break move the probe from the end of the grid towards the centre point. The break will be at the point where resistance drops.

REAR WINDOW REPAIR

Grid Repair

The use of a M.M.A.L. rear window defogger repair kit is recommended. Repair instructions are provided with each kit.

Terminal Repair

An effective repair of broken rear window defogger wiring terminals can be carried out with the use of ACME conductive adhesive E-Solder No. 3201, available from C.I.B.A. GEIGY, Plastics Division.

(1) Clean both areas to be glued, using steel wool and gently rubbing an area approximately 50 mm square.

(2) Remove all contaminants from the cleaned area with a clean cloth and oil free solvent, e.g. X55 solvent or similar.

(3) Prepare sufficient adhesive to carry out an effective repair by dispensing both adhesive components on to a clean surface and mixing with a spatula.

(4) Apply the mixed adhesive to the connector and press the connector onto the cleaned area of the glass. Support connector in position, allowing an even film of adhesive 0.4 mm thick to remain between the glass and connector. Remove excess adhesive.

(5) Adhesive curing can take 24 hours in low ambient temperatures. A hair dryer or heat gun can be used to reduce curing times, but removal of the connector support prior to 24 hours is not recommended.

DEFOGGER SWITCH

For removal and testing procedures refer to Section 7 this Group.

DEFOGGER RELAY

Refer to Section 1 for relay location.

Testing

(1) Remove the relay from the vehicle.

(2) Using an Ohmmeter check that continuity exists between terminals 1 and 3, refer Fig. 2, but not between terminals 2 and 4.

(3) Apply 12V across terminals 1 and 3, positive to terminal 1, and check that continuity exists between terminals 2 and 4.

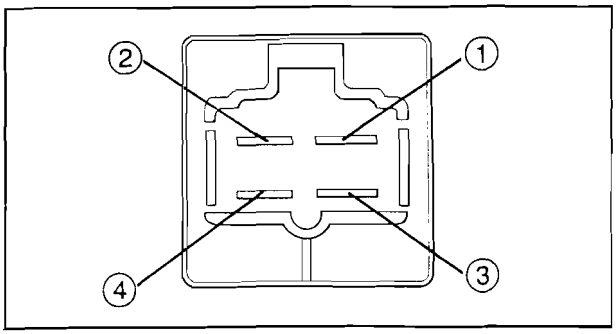
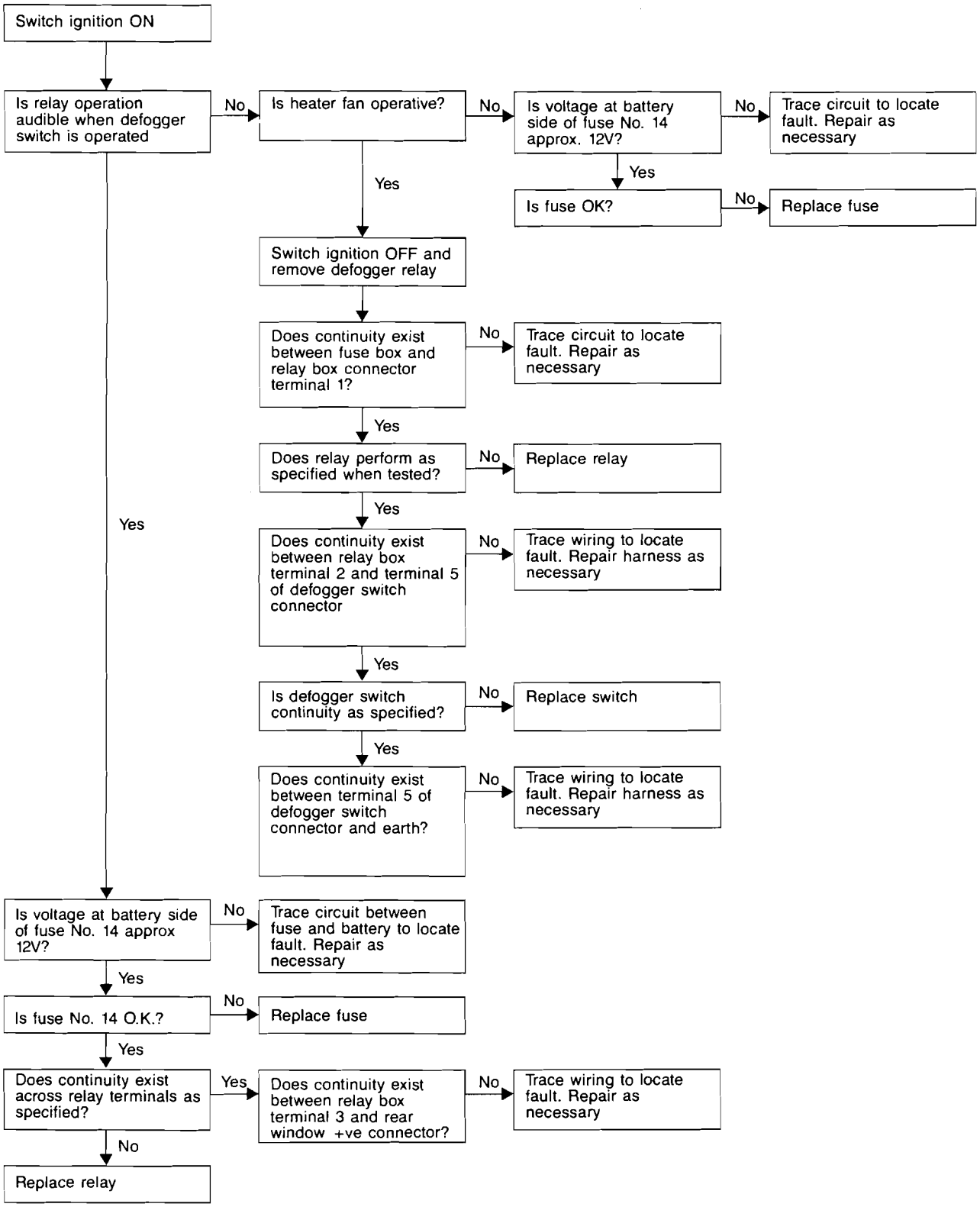


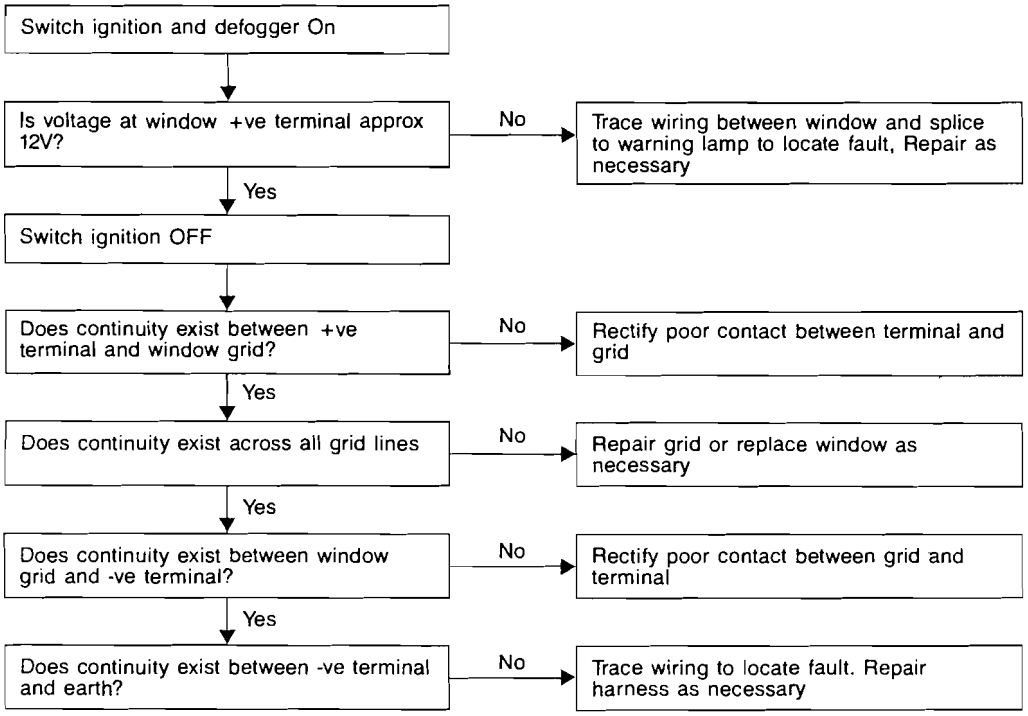
Fig. 2—Relay terminal locations

SERVICE DIAGNOSIS

DEFOGGER INOPERATIVE — INDICATOR LAMP DOES NOT ILLUMINATE



DEFOGGER INOPERATIVE — INDICATOR LAMP ILLUMINATES

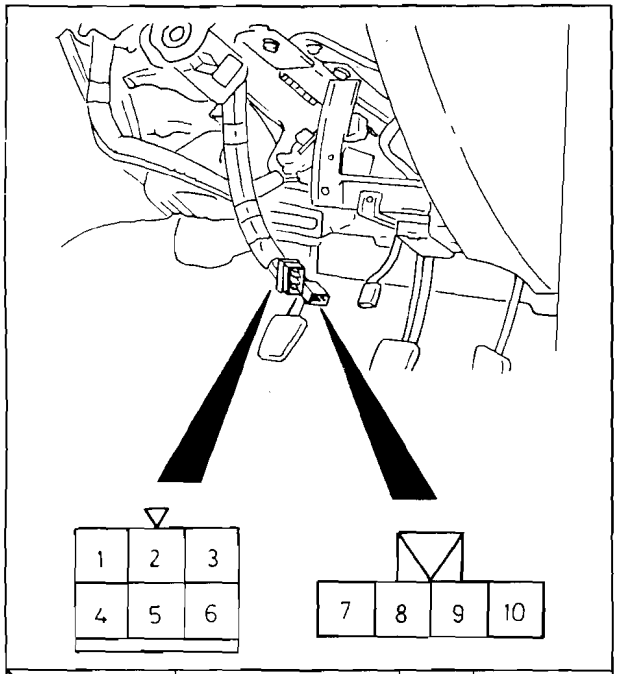


SECTION 7 — SWITCHES

IGNITION SWITCH

Testing

(1) Disconnect the negative battery lead.
(2) Remove the steering column cover, refer Group 37 — Steering.
(3) Disconnect the wiring from the ignition switch.
(4) Using an Ohmmeter check for continuity between switch terminals, refer Fig. 1.



Position \ Terminal No. / Key	Ignition switch 1	2	3	4	5	6	Key reminder switch 7	10	Illumination lamp 8	9
LOCK	Removed						○	○		
ACC	Inserted		○			○			○	○
ON		○	○	○		○				
START		○		○	○	○				

○—○ **indicates that there is continuity between the terminals.**

Fig. 1 — Ignition switch continuity chart

(5) Using a small philips head screwdriver, push the lock pin of the steering lock cylinder inwards and then pull the steering lock cylinder towards you.

AUTOMATIC TRANSAXLE INHIBITOR SWITCH
AUTOMATIC TRANSAXLE OVERDRIVE SWITCH
ACCELERATOR PEDAL SWITCH

For removal and testing precedures for these switches refer to Group 23 — Automatic Transmission.

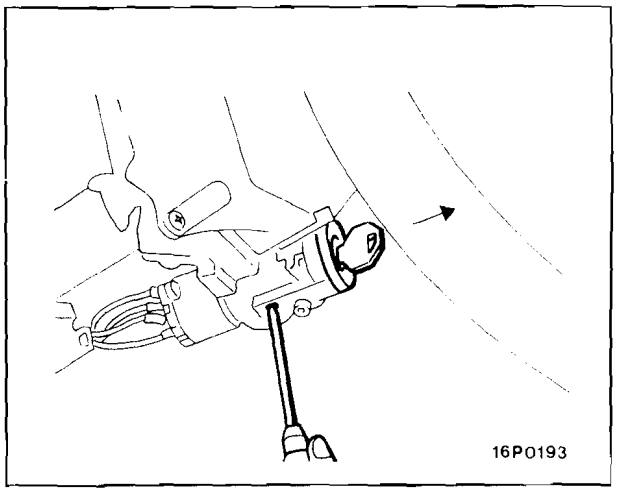


Fig. 2 — Ignition key removal

STOP LAMP SWITCH

Testing

(1) Disconnect the wiring from the switch.
(2) Using the Ohmmeter check that there is no continuity between the terminals with the pedal in the rest position.
(3) Depress the pedal and check for continuity between the terminals. If there is no continuity replace the switch.

Replacement

(1) Disconnect the wiring from the switch.
(2) Loosen the switch lock nut.
(3) Remove the switch from the pedal bracket.
(4) Install the new switch by reversing the removal procedure and adjust using the procedure outlined in Group 35 — Brakes.

PARK BRAKE WARNING LAMP SWITCH

Removal

(1) Remove the centre console rear section, refer Group 52.
(2) Disconnect the wiring from the switch.
(3) Remove the switch retaining screw and remove the switch.

Installation

Install by reversing the removal procedure and adjust the switch so that the warning light is lit with the park brake lever engaged one notch and is off with the lever disengaged.

DOOR LIGHT SWITCH

Removal

(1) Remove the switch cover.
(2) Remove the switch retaining screw.
(3) Pull the switch out and disconnect the wiring.

Installation

Install by reversing the removal procedure. Ensure that the switch is properly earthed.

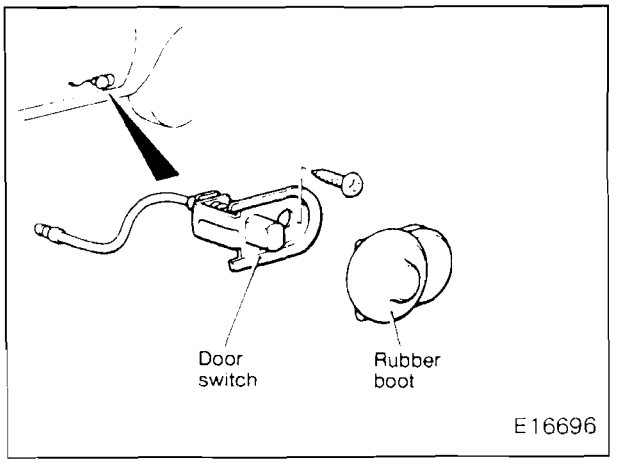


Fig. 3 — Door light switch

Installation

Install by reversing the removal procedure.

GLOVE BOX LAMP SWITCH

Removal

(1) Open the glove box, remove the stoppers by pulling rearwards and lower the glove box.

(2) Disconnect the wiring and remove the switch.

Installation

Install by reversing the removal procedure.

LUGGAGE COMPARTMENT LAMP SWITCH

Removal

(1) Is mounted in the boot lock assembly.

(2) Remove the lock assembly cover, disconnect the key actuating levers remove the lock assembly, disconnect the wiring and remove the switch.

COMBINATION SWITCH

The combination switch controls turn signal, headlamp and wiper operation.

The unit is not repairable and, if faulty must be replaced as an assembly.

Removal

(1) Remove the horn pad, vibration damper and steering wheel, refer Group 37 — Steering.

(2) Set the steering column tilt mechanism to the lowest position.

(3) Remove the steering column cover attaching screws, disconnect the switch wiring and remove the cover.

(4) Disconnect the combination switch wiring and remove the harness clips.

(5) Remove the combination switch attaching screws and remove the switch assembly.

Installation

(1) Position the switch assembly on the column and secure the attaching screws.

(2) Position the wiring loom along the steering column and secure with loom clips to prevent fouling.

(3) Connect switch wiring and fit the steering column cover.

(4) Ensure that the front wheels are in the straight ahead position and the cancelling cam is positioned.

(5) Fit the steering wheel, ensuring that the cancelling pins on the combination switch cam are located in the holes on the bottom of the steering wheel.

(6) Fit the vibration damper and tighten the steering wheel retaining nut to 35 to 45 Nm.

(7) Fit the horn pad.

(8) Check combination switch operation.

Testing, Turn, Headlight, Dimmer switches

Check for continuity between terminals as shown in Figs. 2 to 5, refer to Fig. 4 for connector terminal position.

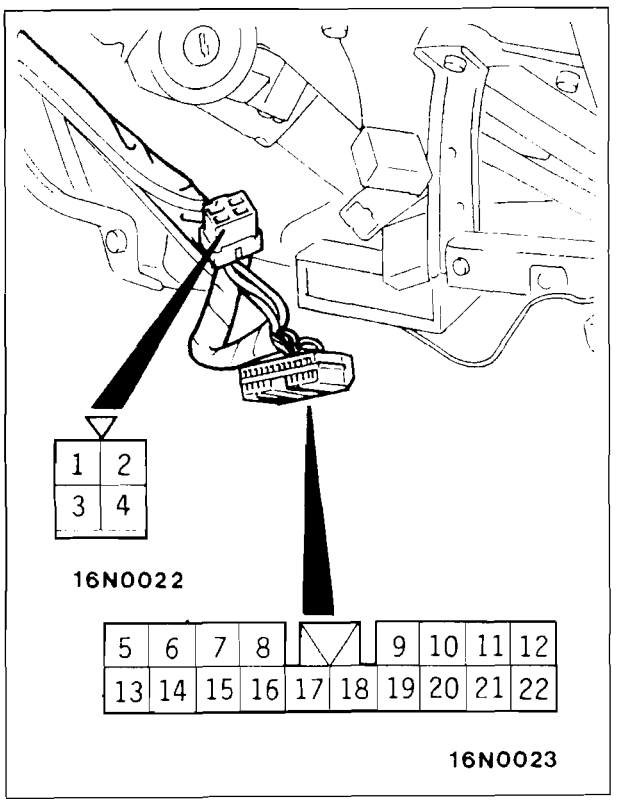


Fig. 4 — Combination switch terminals

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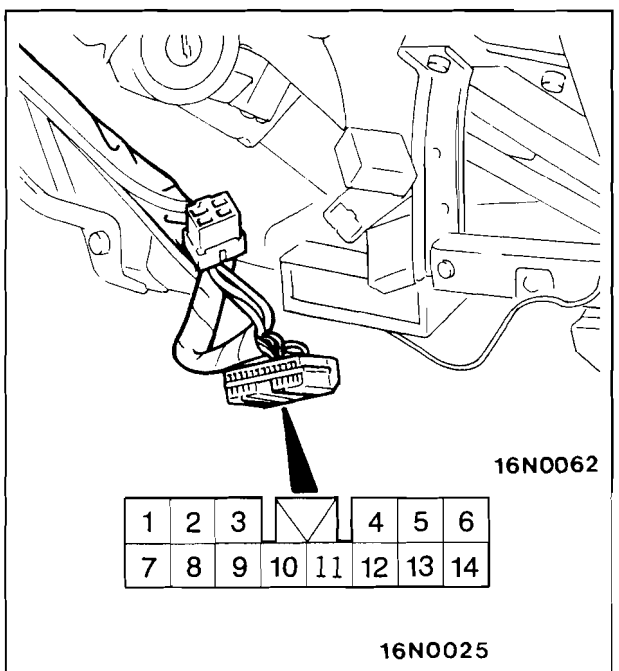
Switch Position \ Terminal No.		1	3	4	8	9	10	17	18	19
TURN SIGNAL	RH								○	○
	OFF									
	LH					○			○	
LIGHTING	OFF									
	TAIL				○		○			
	HEAD				○		○	○		
DIMMER/ PASSING	LOWER	○	○							
	UPPER	○		○						
	PASSING	○		○				○		

NOTE
○—○ indicates that there is continuity between terminals.

Fig. 5 — Turn, headlight, dimmer continuity chart

WIPER AND WASHER SWITCH

Disconnect the column switch connector and check the continuity between the terminals for each switch position.



Switch position \ Terminal		3	7	9	12
Wiper switch	1	○			○
	2			○	○
Washer switch	ON		○		○

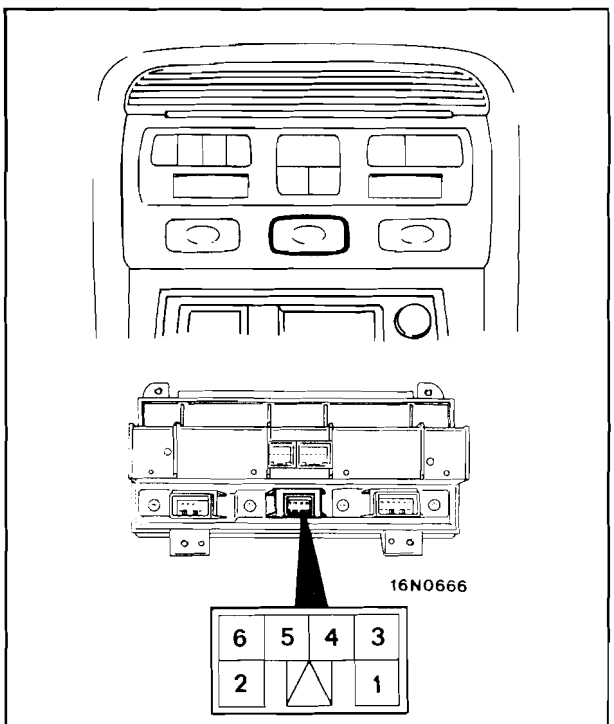
Fig. 6 — Wiper/washer switch continuity chart

Intermittent Wiper Operation Inspection

(1) Connect the column switch connector.
(2) Turn the ignition switch to "ACC" position.
(3) Inspect the intermittent operation when the wiper switch is turned to "INT" and the variable intermittent wiper control switch is turned to FAST or SLOW, i.e.
FAST = approx. 3 seconds
SLOW = approx. 12 seconds

REAR WINDOW DEFOGGER SWITCH

(1) Remove the air conditioner control panel assembly, refer Group 52.
(2) Operate the switch and check for continuity between terminals, refer Fig. 7.



Switch position \ Terminal Nos.	4	6		1	5		2
OFF	○		IND ○	○		ILL ○	○
ON	○	○	IND ○	○			

○—○ indicates that there is continuity between terminals.

Fig. 7 — Defogger switch

RHEOSTAT

(1) Remove the instrument panel side switch from the instrument panel.
(2) Connect the battery and test bulb (40w) as shown in Fig. 8.

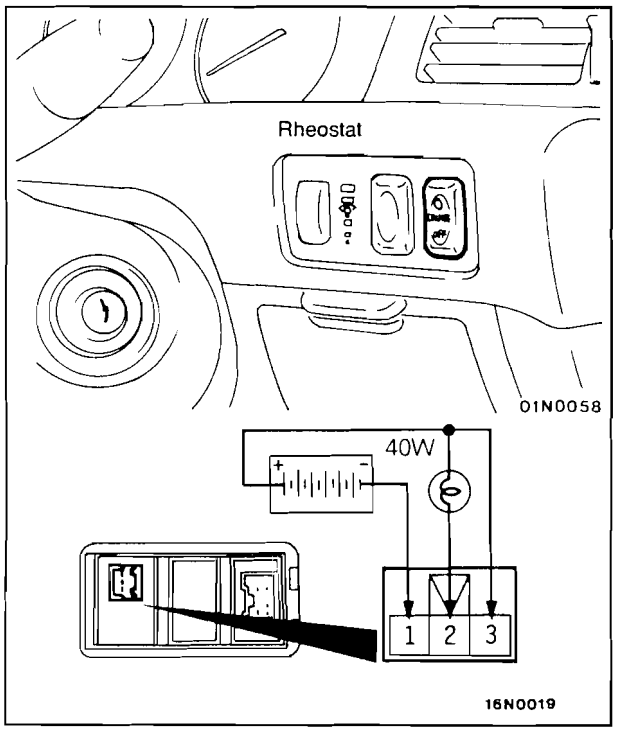


Fig. 8 — Rheostat inspection

(3) Operate the rheostat and if the brightness of the 40w bulb changes smoothly without switching OFF, then the rheostat function is normal.

HAZARD SWITCH

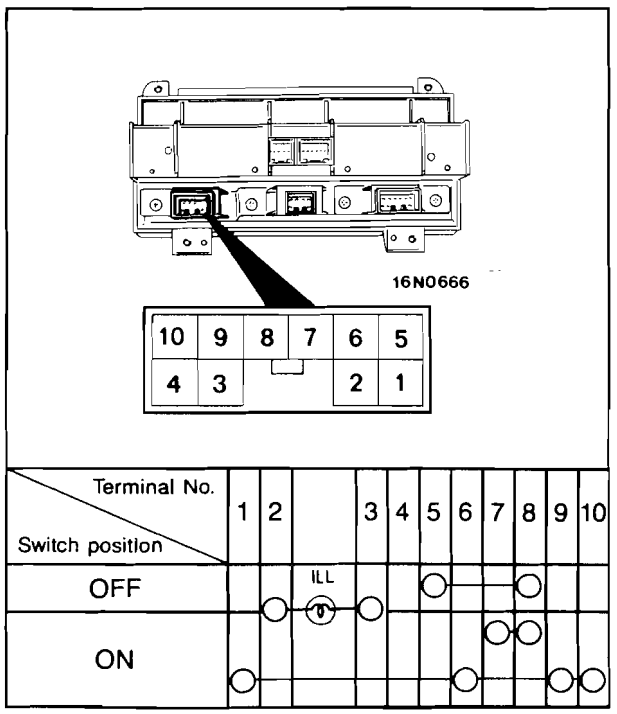


Fig. 9 — Hazard switch testing

(1) Remove the switch control panel, refer Group 52.
(2) Operate the switch and check for continuity between the terminals.

ANTENNA SWITCH

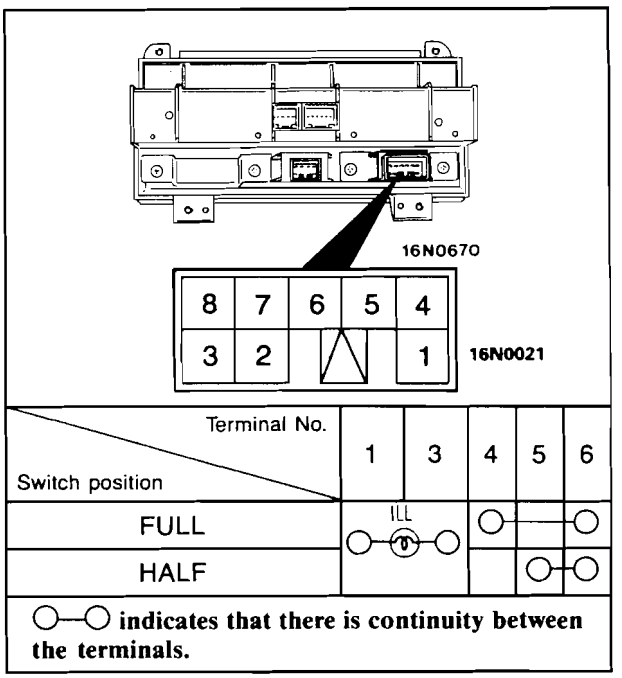


Fig. 10 — Antenna switch testing

Operate the switch to check for continuity between terminals.

AUDIO, CRUISE CONTROL, HORN & SLIP RING

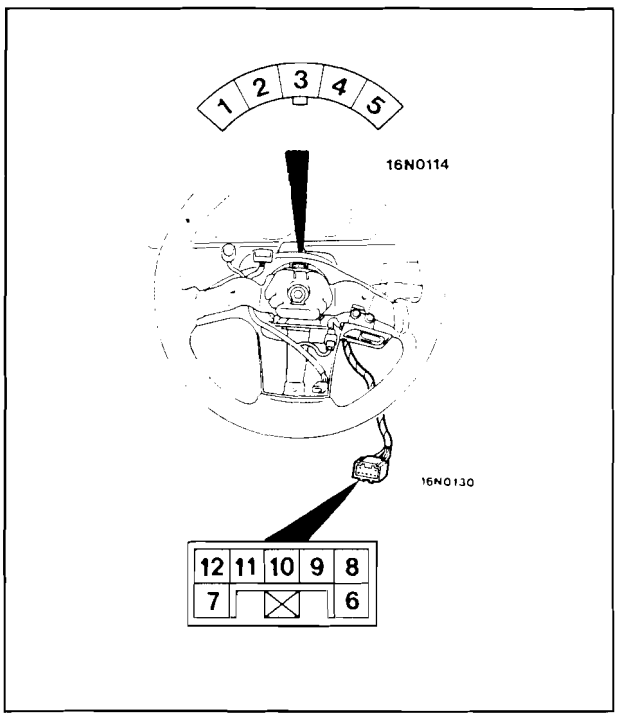


Fig. 11 — Slip ring continuity

Switch position		Terminal No. 1	2	3	4	5	6	7	8	11	12
AUDIO	ACC		○				○				
	SIGNAL			○					○		
	EARTH					○					○
AUTO-CRUISE					○					○	
HORN		○						○			

Fig. 11A — Slip ring continuity (continued)

Switch position		Terminal No. 1	2	3	4	5	6	7	9	11	13	14
AUDIO OR A/C	ACC				○						○	
	SIGNAL			○						○		
	EARTH	○							○			
AUTO-CRUISE	ACC				○		○					
	SIGNAL		○					○				
HORN						○						○

Fig. 12A — Steering harness continuity

(1) Remove the driver side lower panel, refer Group 52.
(2) Remove the column switch and slip ring assembly connector.
(3) Remove the horn pad.
(4) Remove the steering harness and slip ring assembly connector.
(5) Check for continuity between each of the terminals, refer Fig. 11.
(6) ○—○ indicates that there is continuity between the terminals.
(7) Check that there is no change in the continuity when the steering wheel is turned.

Steering Harness

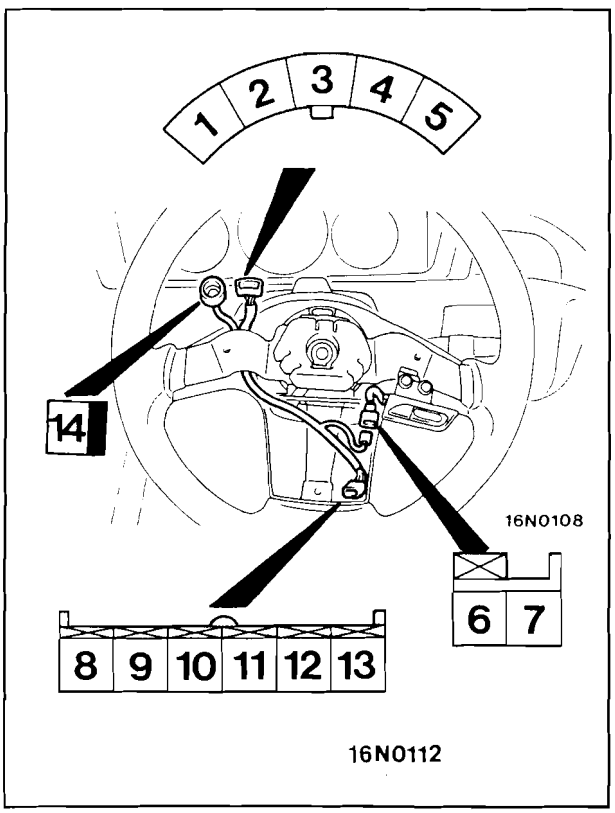


Fig. 12 — Steering harness connectors

(1) Remove the horn pad.
(2) Remove the slip ring and steering harness assembly connector.
(3) Disconnect the connector for each switch assembly.

POWER SEAT SWITCHES

Seat switch

Removal

(1) Gently pry the adjusting knobs from the seat switch.
(2) Gently lever the seat switch panel from the seat, using a screwdriver or similar wrapped in a cloth.
(3) To remove the switch assembly, remove the two retaining screws and uncouple the loom.

Inspection

Operate the power seat switch and check for continuity between the terminals, refer Fig. 14.

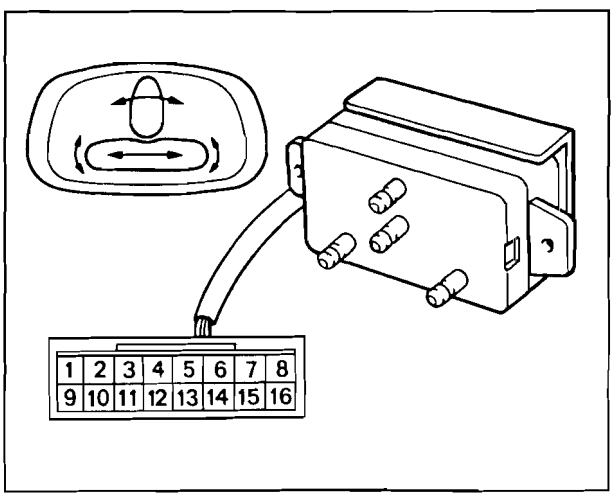


Fig. 13 — Seat switch and connector

Switch position \ Terminal No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Reclining switch	Front								○					○	○		○
	Rear								○					○	○		○
Slide switch	Front	○		○	○												○
	Rear		○	○	○												○
Front height switch	Up									○		○	○				○
	Down										○	○	○				○
Rear height switch	Up					○	○	○									○
	Down					○	○									○	○
All switches	Off																

NOTE: ○—○ indicates that there is continuity between the terminals

Fig. 14 — Seat switch continuity chart

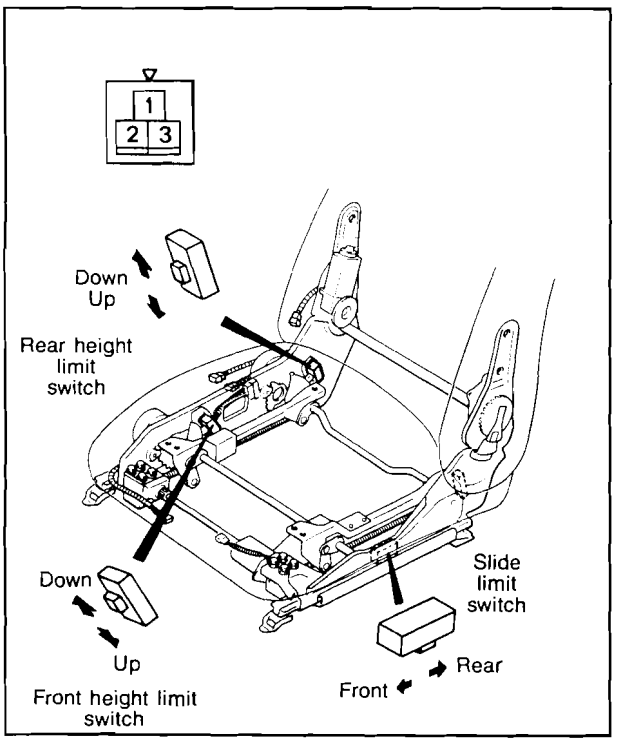


Fig.15 — Limit switch locations

Installation

Installation is a reversal of the removal procedure.

Limit switches

(1) Uncouple each limit switch connection and connect a circuit tester to the terminals.

(2) Operate each switch and check for continuity between the terminals, refer Fig. 16.

(3) If there is an abnormality, replace the power height adjuster assembly.

Switch \ Switch Position \ Terminal No.		1	2	3
Slide limit switch	Front	○	○	
	Rear	○		○
Front height, rear height limit switches	Up	○		○
	Down	○	○	
All limit switches	Middle (ON)	○	○	○

NOTE: ○—○ indicates that there is continuity between the terminals.

Fig. 16 — Limit switch continuity chart

POWER SEAT MOTORS

Inspect the operation of each motor according to the following instructions.

(1) Disconnect the connectors for each motor.

(2) Connect battery voltage directly to the motor terminals.

(3) Check if the motor runs smoothly and check if each setting mechanism runs in the directions shown in Fig. 17, for each motor.

CAUTION: Cut off the voltage if the motor does not run when battery voltage is applied.

(4) If there is an abnormality, replace the power height adjuster assembly.

Name of motor \ Direction of operation		Terminal No. 1	Terminal No. 2	Stop Position
Front height	Bottom side	⊕	⊖	Stops when limit switch is OFF
Rear height	Top side	⊖	⊕	
Slide	Rear side	⊕	⊖	
	Front side	⊖	⊕	
Reclining	Rear side	⊕	⊖	Stops at operating range limit
	Front side	⊖	⊕	

Fig. 17 — power seat motor continuity chart.

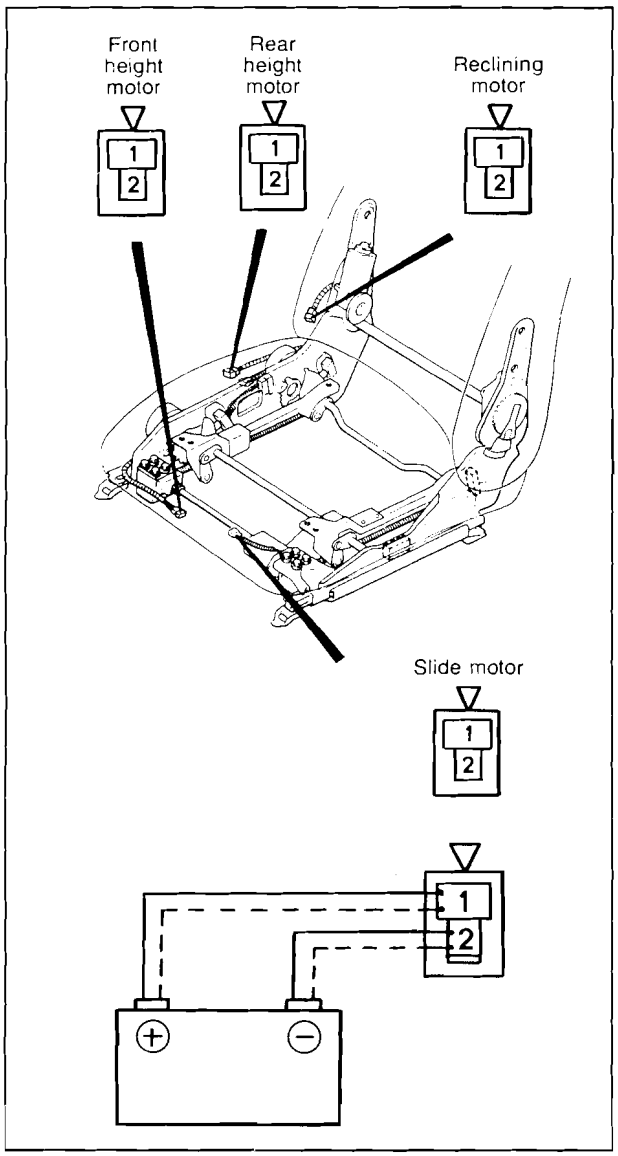
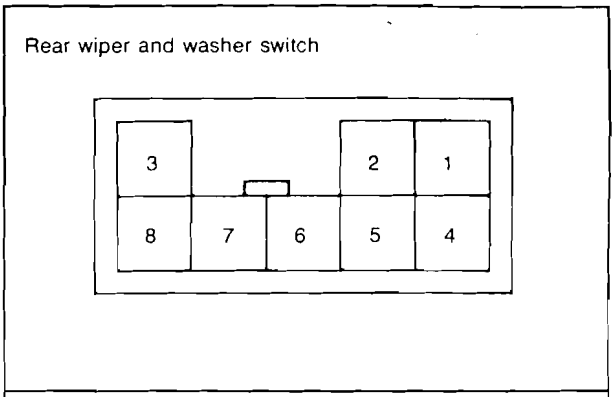


Fig. 18 — Motor connector locations

REAR WIPER AND WASHER SWITCH

(1) Remove the wiper/washer switch from the audio panel, refer section 8 this Group.

(2) Check the continuity between the terminals, refer Fig. 19.



Note

○—○ indicates that there is continuity between the terminals.

Switch Position \ Terminal	1	2	3	4	5	6	7	8
Off	○		○			○	○	
Int				○			○	
Wash		○						○

Fig. 19 — Wiper/washer switch testing

DOOR KEY ILLUMINATION

(1) Apply battery voltage across terminals 1 and 3 and key illumination light should come on, refer Fig. 20.

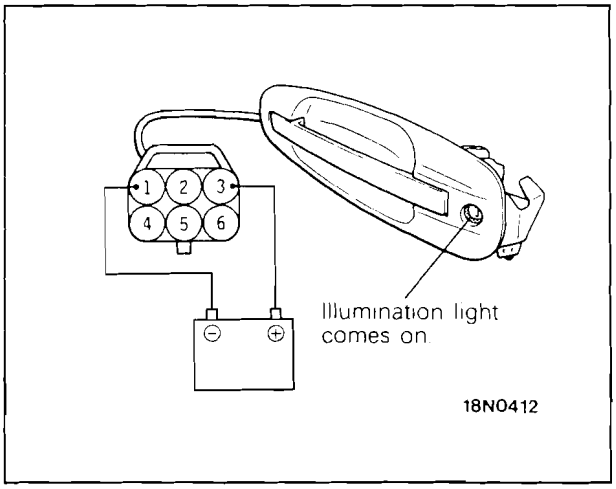


Fig. 20 — Key illumination light testing

(2) Operate the outer door handle to turn ON/OFF the switch and check continuity between terminals, refer Fig. 21.

(3) Operate the key from lock to unlock, refer Fig 21 and check continuity between the terminals.

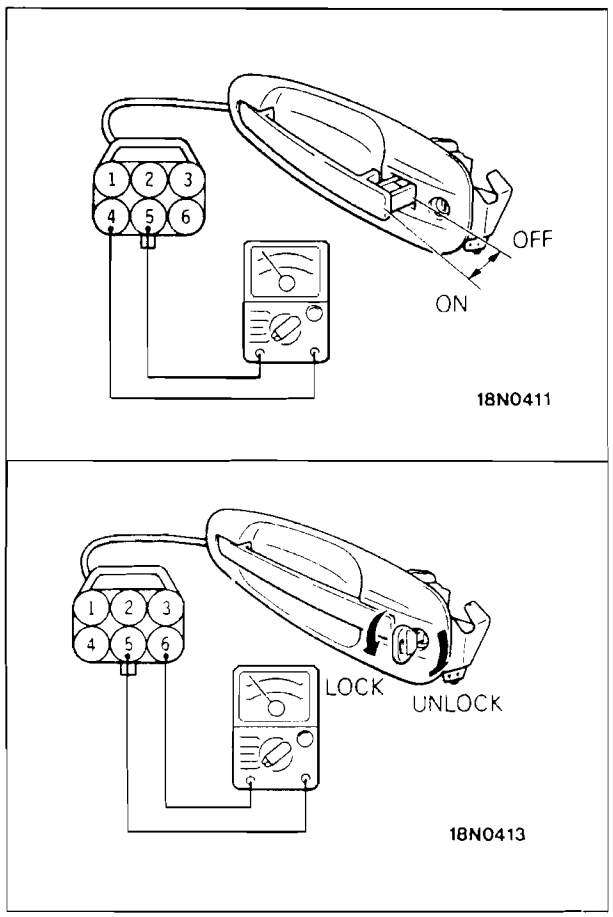
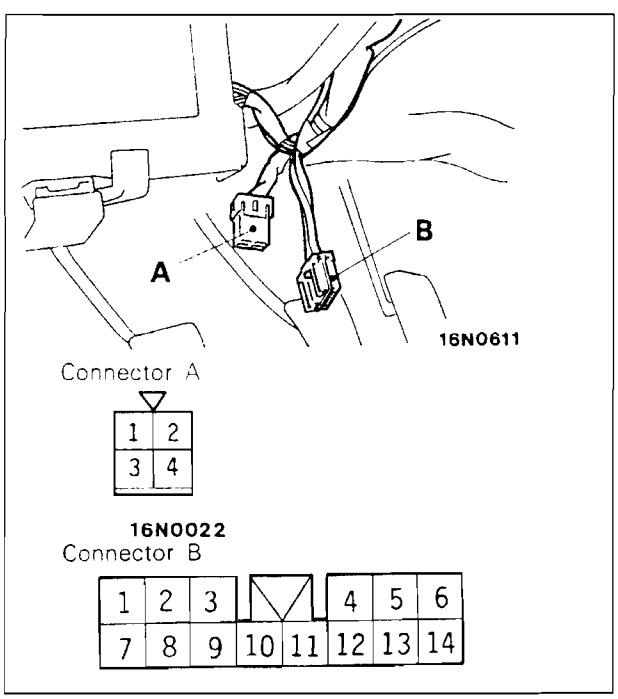


Fig. 21 — Door key /illumination

SPEED RELATED WINDSHIELD WIPER AND WASHER SWITCH INSPECTION

Disconnect the column switch connector and check the continuity between the terminals for each switch.



Switch position	Connector / Terminal	A 1	B 3	4	7	9	10	11	12
Wiper switch	OFF		○				○		
	AUTO		○				○	○	
	1		○				○		○
	2					○			○
Intermittent variable volume switch		○		○					
Washer Switch	ON				○				○

○—○ Indicates that there is continuity between the terminals.

If there is a malfunction, and there is an abnormality in the switch or in the switch input circuit, inspect the following:

- Ignition switch
- Wiper switch (AUTO)
- Intermittent variable-volume switch
- Washer switch
- Vehicle-speed sensor

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VEHICLE-SPEED-RESPONSE TYPE INTERMITTENT WIPERS DIAGNOSIS

Problem	Probable cause (s)	Checking procedure	Remedy
The wipers don't operate when the wiper switch is set to the "AUTO" position. (The wipers do operate, however, when the wiper switch is set to the "1" (low speed) position.)	Damage or disconnection of the wiring of the wiper switch (AUTO) input circuit.	Conduct Test No. 2 of the individual part and circuit.	Repair the wiring harness, or replace the column switch.
	Damage or disconnection of the wiring of the wiper switch ("AUTO").		
	Damage or disconnection of the wiring of the ignition switch input circuit.	Conduct Test No. 1 of the individual part and circuit.	Repair the wiring harness.
	Damage or disconnection of the wiring of the wiper relay activation circuit.	Conduct Test No. 5 of the individual part and circuit.	Repair the wiring harness, or replace the wiper relay.
	Malfunction of the wiper relay.		
	Malfunction of the electronic control unit.	–	Replace the electronic control unit.
The wipers don't stop when the wiper switch is switched OFF. (This problem occurs at the low speed of the wipers.) NOTE If the wipers continue operating (without stopping) at the "2" position (high speed) of the wiper switch, there is a short-circuit in the circuit at the wiper motor high speed side.	Short-circuit in the wiper switch ("AUTO") input circuit.	Conduct Test No. 2 of the individual part and circuit.	Repair the wiring harness, or replace the column switch.
	Short-circuit in the wiper switch ("AUTO").		
	Short-circuit in the wiper relay activation circuit.	Conduct Test No. 5 of the individual part and circuit.	Repair the wiring harness.
	Malfunction of the electronic control unit.	–	Replace the electronic control unit
When the wiper switch is set to the "AUTO" position, the wipers operate continuously at low speed, not intermittent operation. (The wipers stop, however, when the wiper switch is set to "OFF".)	Short-circuit in the wiper switch ("AUTO") input circuit.	Conduct Test No. 2 of the individual part and circuit.	Repair the wiring harness, or replace the column switch.
	Short-circuit in the wiper switch ("AUTO").		
	Malfunction of the electronic control unit.	–	Replace the electronic control unit.

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Problem	Probable cause (s)	Checking procedure	Remedy
The intermittent time does no change when the intermittent variable volume switch setting is changed. (The vehicle speed is a constant speed.)	Damage or disconnection of the wiring of the intermittent variable volume switch input circuit.	Conduct Test No. 3 of the individual part and circuit.	Repair the wiring harness, or replace the column switch.
	Damage or disconnection of the wiring of the intermittent variable volume switch.		
	Malfunction of the electronic control unit.	–	Replace the electronic control unit.
The wipers' intermittent time does not change according to changes in the vehicle speed. (The intermittent variable volume switch setting is fixed.)	Damage or disconnection of the wiring of the vehicle speed sensor input circuit, or a short circuit.	Conduct Test No. 4 of the individual part and circuit.	Repair the wiring harness, or replace the vehicle speed sensor.
	Malfunction of the vehicle speed sensor.		
	Malfunction of the electronic control unit.	–	Replace the electronic control unit.

Test 1 – Electronic control unit terminal voltage. Disconnect the ECU connector and check at the wiring harness side.

ECU terminal No.	Signal		Status		Standard
63 (With Theft Alarm)	Ignition switch	ON	Ignition switch	OFF	0 Volts
				ON	System voltage
53 (With Theft Alarm)		OFF		OFF	0 Volts
				ACC	System voltage

Test 2 – Electronic control unit terminal voltage (Connection status of electronic control unit connector.)

ECU terminal No.	Signal	Status	Standard
66 (With Theft Alarm)	Wiper switch "AUTO" signal	Wiper switch "OFF"	5 Volts
		Wiper switch "AUTO"	0 Volts

Test 3 – Electronic control unit terminal voltage (Connection status of electronic control unit connector.)

ECU terminal No.	Signal	Status	Standard
59 (With Theft Alarm)	Intermittent variable volume switch signal	Intermittent variable volume switch FAST → SLOW	0 → 2.5 Volts

Test 4 – Electronic control unit terminal voltage (Connection status of electronic control unit connector.)

ECU terminal No.	Signal	Status		Standard
61 (With Theft Alarm)	Vehicle-speed sensor signal	Vehicle speed sensor	When ON	0 Volts
			When OFF	5 Volts

Test 5 – Electronic control unit terminal voltage (Connection status of electronic control unit connector.)

ECU terminal No.	Signal	Status		Standard
15 (With Theft Alarm)	Wiper relay signal	Wiper switch OFF	Ignition Switch OFF	0 Volts
			Ignition switch ACC	System Voltage

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SECTION 8 — WINDSHIELD WIPERS AND WASHERS

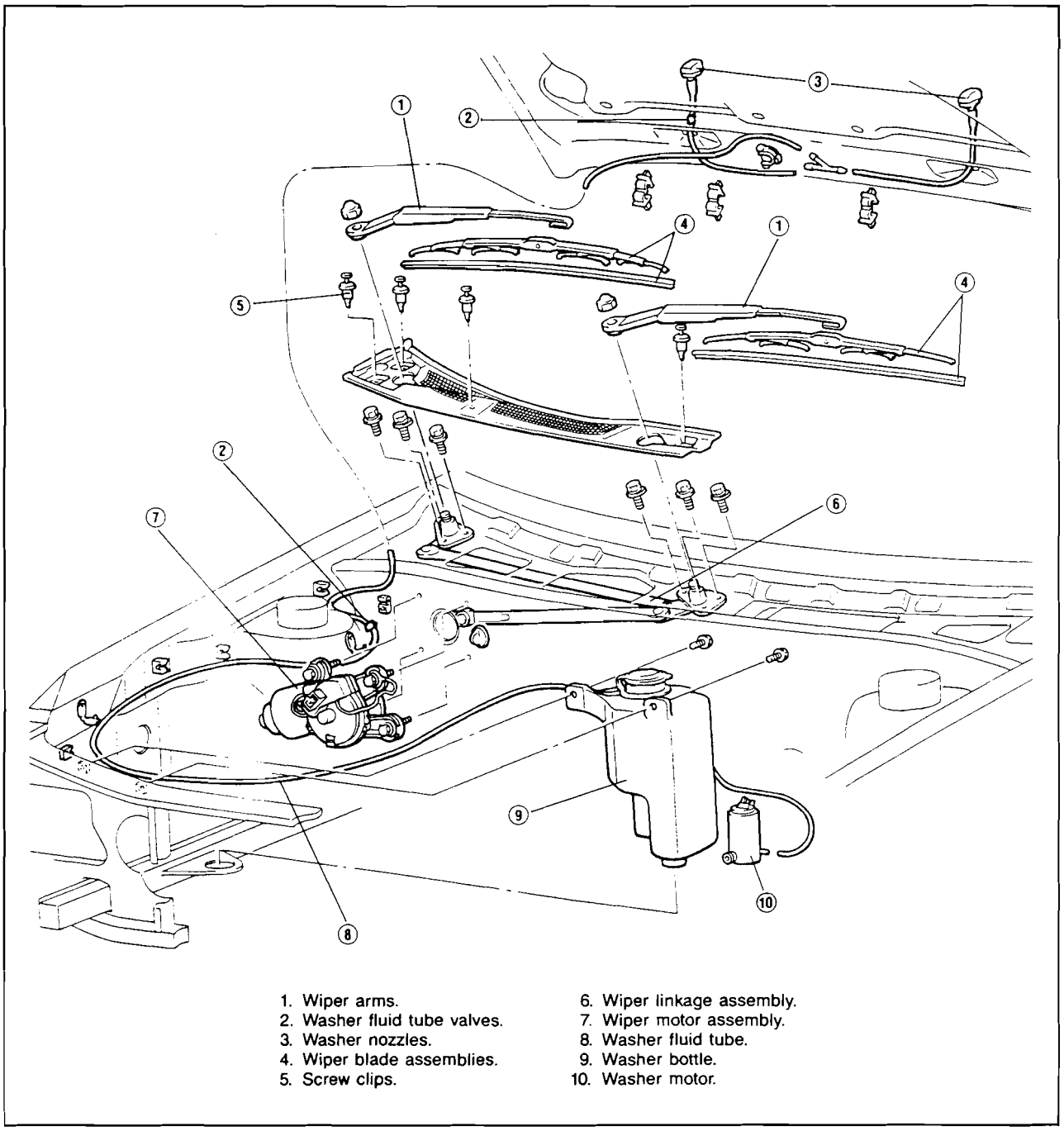


Fig. 1 — Wiper/Washer part location

GENERAL INFORMATION

The wiper motor is a two speed permanent magnet type and incorporates a parking switch which is activated when the wipers are switched off.

The windscreen washer bottle is located in the engine compartment in front of the left hand strut housing. The washer pump, a centrifugal type driven by a DC ferrite magnet type motor is mounted in the washer bottle.

Control switches for high speed, low speed, intermittent operation and the windscreen washers are mounted on the steering column.

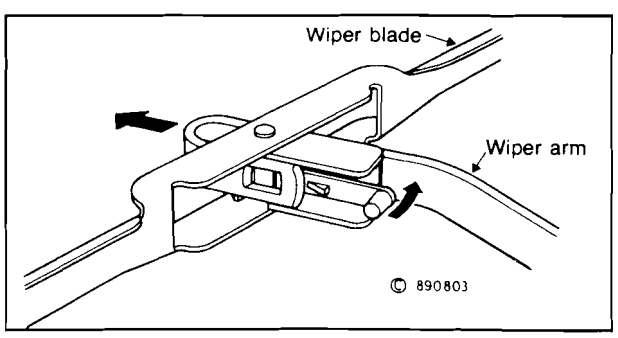


Fig. 2 — Wiper blade removal

WIPER BLADES

Replacement

(1) Lift the spring loaded clip, refer Fig. 2, and push out the wiper blade assembly.

(2) Remove the wiper insert retaining clip by squeezing the tangs together and pulling it from the blade.

(3) The insert and backing blade can now be removed from the wiper blade.

(4) Install by reversing the removal procedure.

NOTE: Wiper insert rubbers deteriorate as a result of environmental conditions, such as atmospheric pollution and road grime, temperature extremes and the natural ageing of the rubber. It is therefore recommended that wiper inserts are replaced every twelve months.

WIPER ARMS

Replacement

(1) Remove the wiper arm retaining nut.

(2) Remove the wiper arm by lifting the arm then turning and pulling the arm at the pivot.

(3) Install by reversing the removal procedure noting the following:

(A) Ensure that the arm is correctly positioned, refer Fig. 3.

(B) A spacer block must be used to ensure the correct clearance is achieved between the spring and windscreen as shown in Fig. 4. (8mm RHS 13mm LHS.)

NOTE: The wiper arm assembly pin or similar must be left in the arm until the arm is positioned correctly and the retaining nut is tightened to 16-21 Nm.

NOTE: The arm and blade must be positioned correctly to conform to Australian Design Rule No. 16.

NOTE: Right and left wiper arms are not interchangeable, refer Group 51, Section 4.

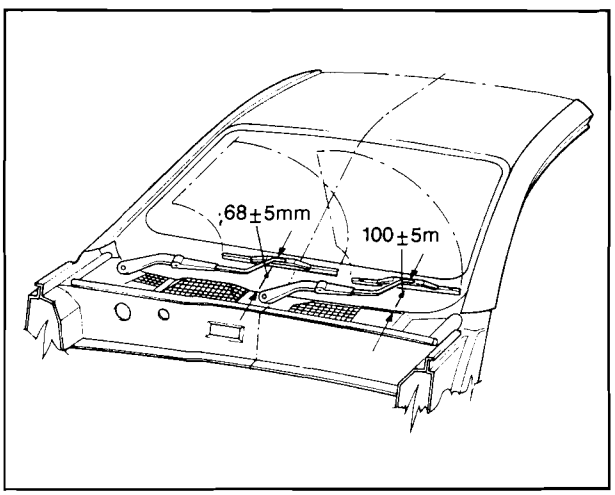


Fig. 3 — Correct wiper arm positioning

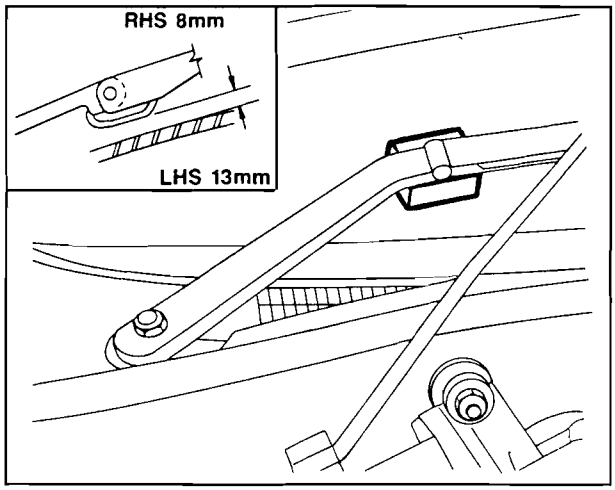


Fig. 4 — Wiper arm clearance using spacer block

Checking Wiper Arm to Windscreen Alignment

This check should be performed if the wiper inserts are serviceable but the wipers shudder or are jerky in operation.

(1) Operate the wipers and then, by turning the ignition switch off, position the wipers as shown in Fig. 5.

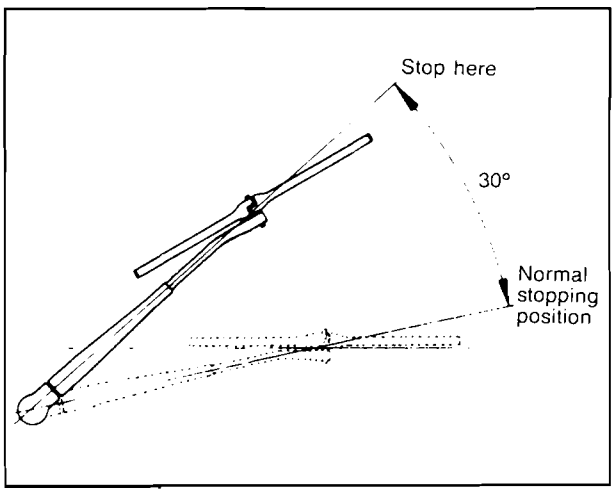


Fig. 5 — Positioning wiper arm for alignment check

(2) Remove the wiper blade and check that the end of the wiper arm is square to the windscreen, refer Fig. 6.

(3) If the arm is not square, gently twist the end of the arm to achieve the correct alignment.

(4) Refit the wiper blades.

(5) Turn the ignition switch on and allow the wiper arms to return to the normal position.

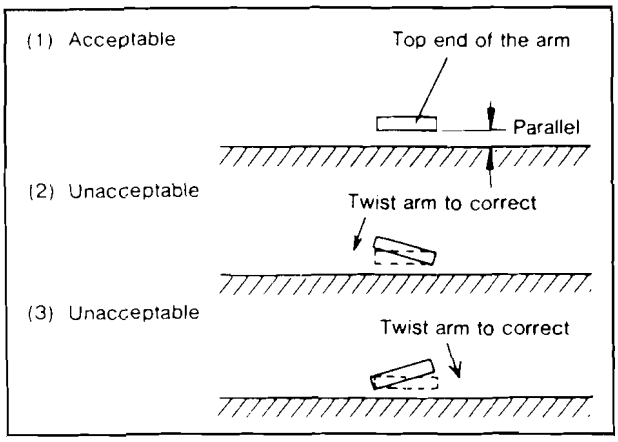


Fig. 6 — Checking wiper arms to windscreen alignment

Removal

(1) Disconnect the wiring harness from the washer motor.
(2) Disconnect the washer fluid hose from the washer pump.
(3) Remove the attaching nuts and remove the washer bottle.

Installation

Install by reversing the removal procedure.

WINDSCREEN WASHERS

The windscreen washer bottle is located in the engine compartment forward of the left hand strut housing.

Washer Nozzle Adjustment

(1) Check that the washer fluid contact points are as shown in Fig. 7.

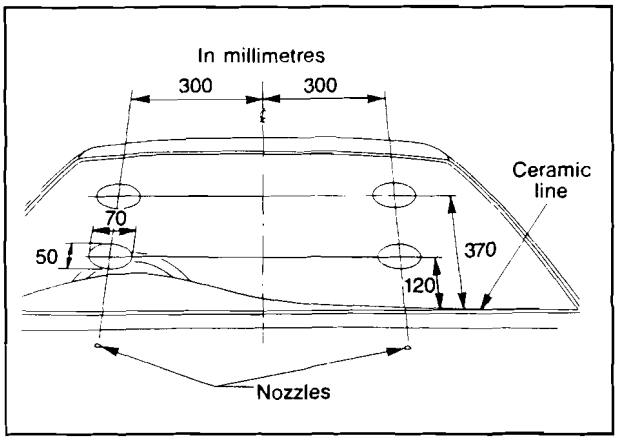


Fig. 7 — Washer fluid contact points

(2) If adjustment is necessary use a metal wire or pin 1.0 mm or less in diameter inserted in the nozzle ball.
(3) If insufficient washer fluid is supplied check the system for clogged, bent or crushed hoses.

NOTE: Do not operate the washer motor for more than 20 seconds continuously or when the washer bottle is empty as the motor or pump could be damaged.

WASHER FLUID TUBE VALVES (where fitted)

Valve Opening Operation Check

(1) Disconnect the tube to the rear washer nozzle from the stop valve.
(2) Check to make sure that a sufficient amount of washer fluid is ejected from the stop valve when the rear washer is pressed, refer Fig. 9.

NOTE: Be sure to reinstall the stop valve in the proper direction, as shown in the illustration, refer Fig. 8.

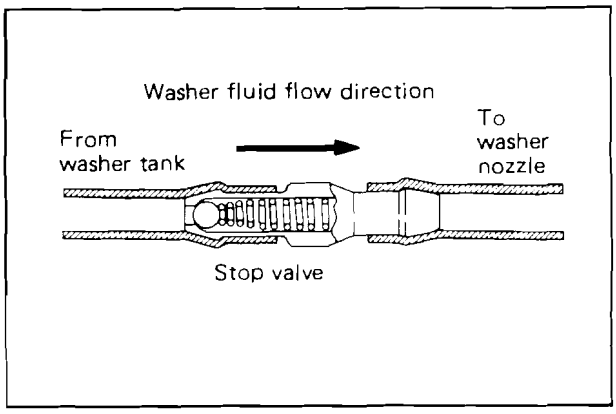


Fig. 8 — Connection of the stop valve

CAUTION: Operating the washer switch for 20 seconds or more continuously, or operating it when there is no washer fluid in the tank, could cause the motor to burn out.

Simple Test to Stop Valve

Valve Closing Operation Check

(1) Disconnect the tube on the washer tank from the stop valve.
(2) Check to make sure that washer fluid does not drip out of the stop valve, refer Fig. 9.

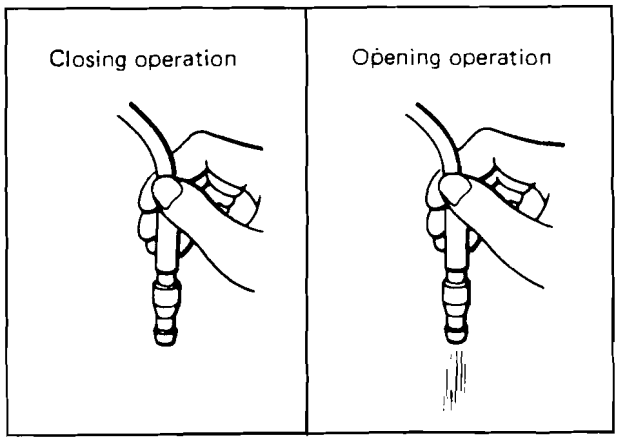


Fig. 9 — Checking of the stop valve operation

WIPER MOTOR

NOTE: The wiper motor is serviced as an assembly and should not be disassembled except by a qualified automotive electrician.

Removal

(1) Remove the wiper arms.
(2) Disconnect the wiring from the wiper motor.
(3) Remove the bolts securing the motor to the body and pull the motor out slightly.
(4) Disconnect the wiper linkage from the motor crank arm using a screwdriver or suitable lever, refer Fig. 10.

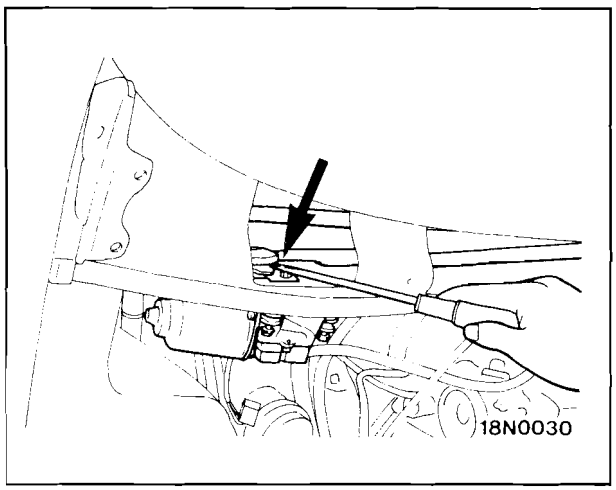


Fig. 10 — Disconnecting wiper linkage

Installation

Install by reversing the removal procedure, noting the following:
(1) Ensure the wiper motor is properly earthed.
(2) Position the wiper arms as described previously.

WIPER LINKAGE

Removal

(1) Remove the wiper motor as previously described in this section.
(2) Remove the front deck and inlet garnishes, refer Group 51.
(3) Remove the pivot shaft attaching bolts, refer Fig. 11, and push the shaft inwards.
(4) Remove the linkage from the vehicle.

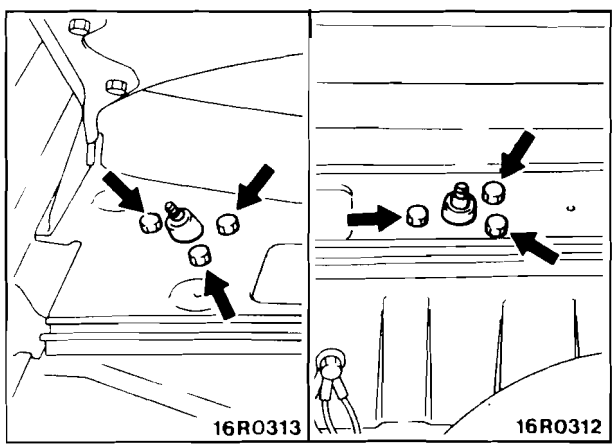


Fig. 11 — Wiper pivot attaching bolts

Installation

Install by reversing the removal procedure, noting the following:
(1) Check the wiper linkage for adequate lubrication at the points shown in Fig. 12.
(2) Ensure that the wiper motor is properly earthed.
(3) Position the wiper arms as described previously.

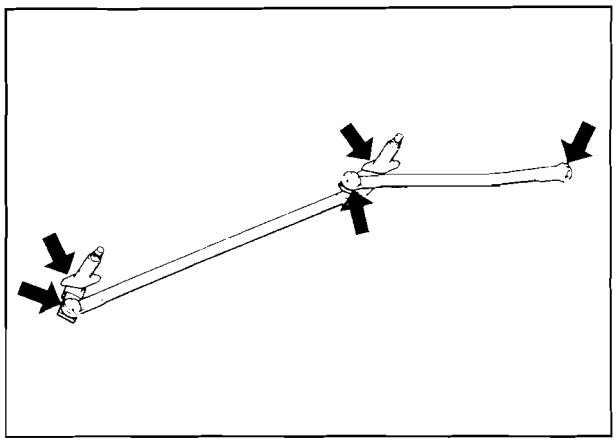


Fig. 12 — Wiper linkage lubrication points

WIPER RELAY

For relay location refer to Section 1.

Testing

This relay is a transistorised type and must be replaced if identified as faulty during diagnosis.

REAR WIPER/WASHER SYSTEM (WAGON)

The system receives its water from a washer bottle located in the right hand rear side of the luggage compartment behind the quarter panel trim. It has a electric pump controlled by a switch mounted in the centre console.

A non return valve is fitted in the line to the rear washer jet. The wiper motor is mounted in the tailgate and is a permanent magnet type.

NOTE: The wiper motor is serviced as an assembly and should not be disassembled except by a qualified automotive electrician.

Wiper Motor Removal

(1) Remove the wiper arm.
(2) Remove the wiper arm pivot lock nut and shaft related parts.
(3) Remove the trim and water proof film from the tailgate, refer Group 52.
(4) Disconnect the wiring connector of wiper motor.
(5) Remove the wiper motor mounting bolts.
(6) Remove the wiper motor from the tailgate.

Installation

Install by reversing removal procedure noting the following:
(1) Operate rear wiper motor ensuring the motor returns to the park position.
(2) Tighten pivot arm lock nut to 6 to 9 Nm.
(3) Position wiper arm correctly and tighten lock nut, refer Fig. 13.

REAR WINDOW WASHER

Inspection and Adjustment

(1) Adjust the washer nozzle ejection position as shown in Fig. 13 by inserting a metal wire in the outlet jet and rotating the ball.

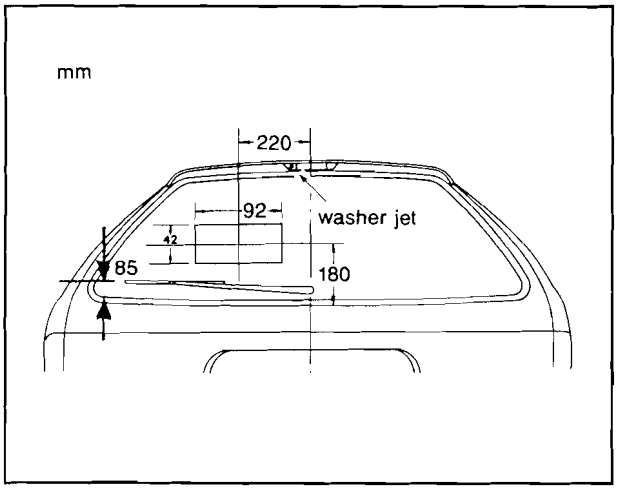


Fig. 13 — Adjustment of the nozzle ejection angle

(2) If the rear window washer jet does not supply sufficient fluid, and the wiring, fuses and pump motor are operating satisfactorily, check for bent or broken piping, and or failure of the non return valve.

CAUTION: Operating the washer switch for 20 seconds or more continuously, or operating it when there is not washer fluid in the tank, could cause the motor to burn out.

Wiper/Washer Switch

The rear wiper/washer is operated by a two-step type switch. Press the top section of the switch in one notch for the rear wiper to operate. By pressing the switch to the next notch, it will operate the rear washer, and when released, it will return to the wiper ON position, refer Fig. 14.

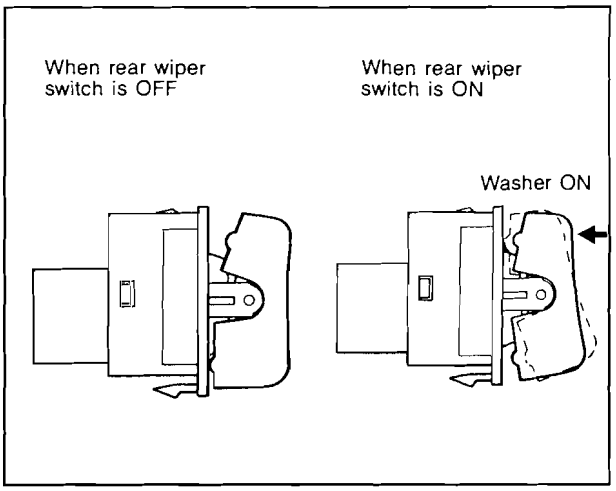


Fig. 14 — Operation of the rear washer switch

Removal

(1) Remove centre console, refer Group 52.
(2) Remove audio panel.
(3) Remove console switch panel from the rear of the audio panel.
(4) Remove the wiper switch from the console switch panel.

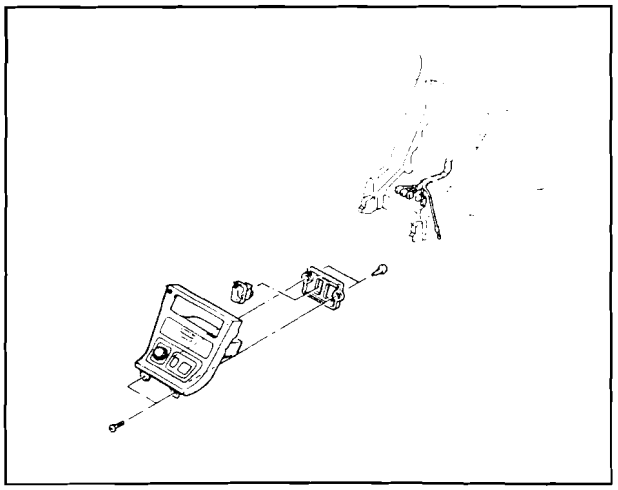


Fig. 15 — Washer/wiper switch removal

Installation

Install by reversing removal procedure.

SECTION 9 — INSTRUMENTS, METERS AND GAUGES

SPECIFICATIONS

Speedometer				
Type	Mechanical rotary needle			
Rotary needle speed @ road speed	637 r.p.m. @ 60 km/h			
Tolerance (km/h)	40	80	120	160
	36–44	72–88	108–132	144–176
Odometer				
Type	Mechanical link to speedometer			
Distance travelled per rotary needle speed	1 km per 637 revolutions			
Tachometer				
Tolerance (r.p.m.) @ 13.5V (25°C)	1000	3000	5000	6000
	±100	±150	±250	±300
Clock				
Type	Analogue			
Fuel gauge				
Type	Constant reading			
Gauge resistance				
— between power supply and earth	274 ± 27 Ohms			
— between power supply and fuel gauge terminal	86 ± 8 Ohms			
— between fuel gauge terminal and earth	188 ± 18 Ohms			
Fuel sender unit				
Type	Variable resistance			
Resistance — float at upper stop	3 ± 2 Ohms			
— float at lower stop	110 ± 7 Ohms			
Setting — float at highest point	40.95 mm			
— float at lowest point	173.25 mm			
Low fuel warning system				
Type	NTC thermister on sender unit			
Operating voltage	11V to 15V			
Rated load	3.4W (lamp load)			
Temperature gauge				
Type	Bi-metalic			
Gauge resistance — between power supply terminal and temperature gauge terminal	51 ± 5 Ohms			
—between power supply terminal and earth terminal	130 ± 13 Ohms			
—between temperature gauge terminal and earth terminal	181 ± 18 Ohms			
Temperature sender unit				
Type	NTC resistance			
Test resistance @ 60°C	152 ± 20 Ohms			
@ 70°C	104 ± 13.5 Ohms			
@ 100°C	37.4 ± 2 Ohms			
Oil pressure switch				
Type	Diaphragm			
Contact opening pressure	30 kPa			

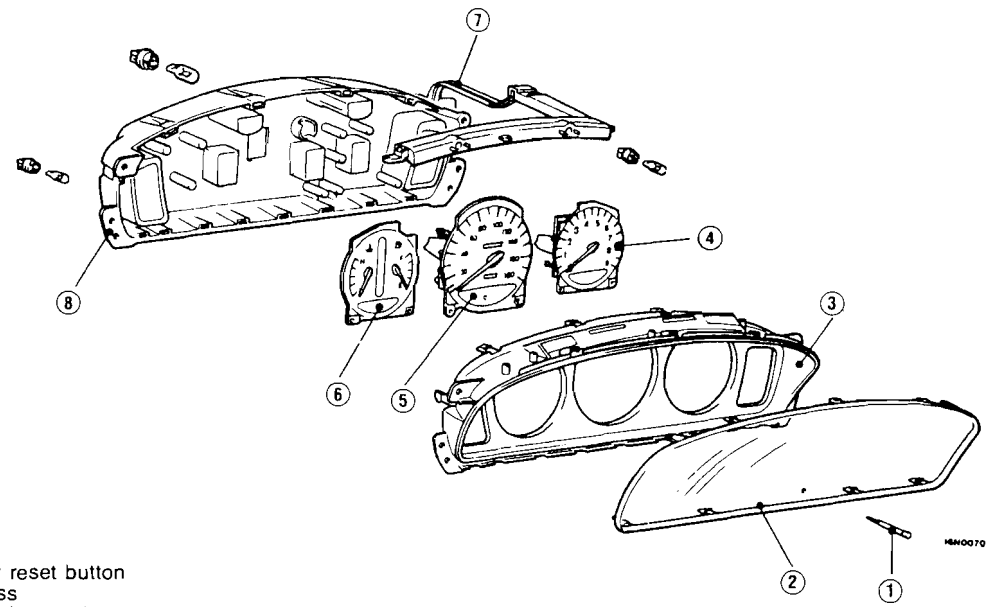


Fig. 1 — Instrument cluster components

INSTRUMENT CLUSTER

Removal

CAUTION: THE INSTRUMENT CLUSTER MUST NOT BE ALLOWED TO FACE DOWN AT ANY TIME. THE TACHO MECHANISM USED HAS A SILICONE DAMPENING DEVICE WHICH WILL LEAK.

NOTE: When removing the instrument hood, be careful not to damage the trip meter reset switch.

(1) Set the steering column height adjuster on its lowest setting.

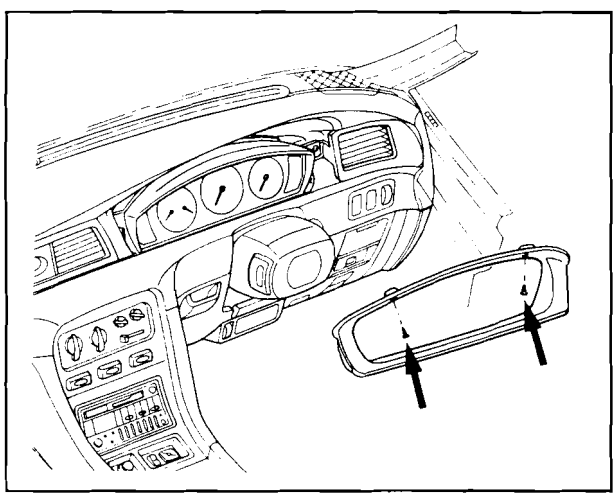


Fig. 2 — Instrument hood removal

(2) Remove the two instrument hood retaining screws, refer Fig. 2, and carefully remove the hood.

(3) Remove the four instrument cluster retaining screws, refer Fig 3, and gently pull the cluster forward and out.

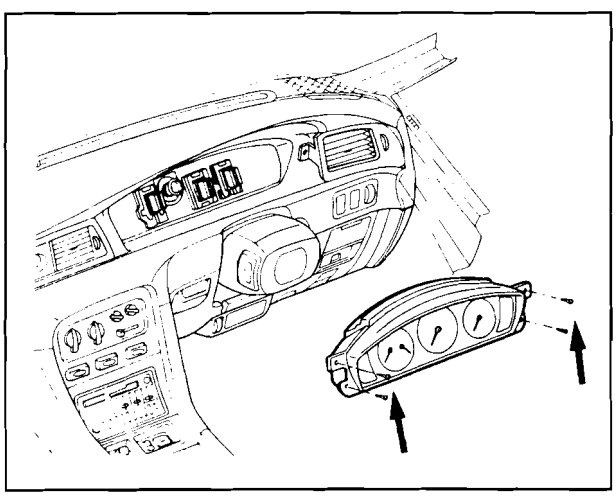


Fig. 3 — Instrument cluster removal

Installation

Install by reversing the removal procedure, ensuring that all instrument cluster lights are operative and speedometer is functioning correctly.

Disassembly

(1) Remove the instrument illumination and indicator panel globe sockets.

(2) Remove the trip meter knob by carefully pulling it off.

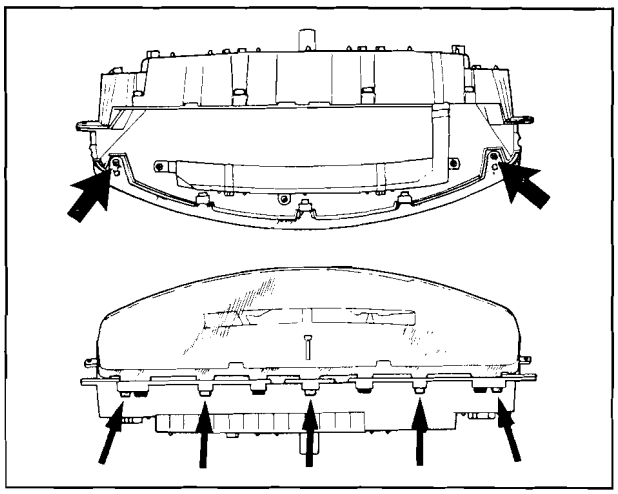


Fig. 4 — Lens attaching screws and retaining tabs

(3) Remove the lens by removing the top attaching screws and depressing the retaining tabs, refer Fig 4.

(4) Depress the cluster facia panel retaining tabs, refer Fig. 5, located at the top and bottom of the cluster case.

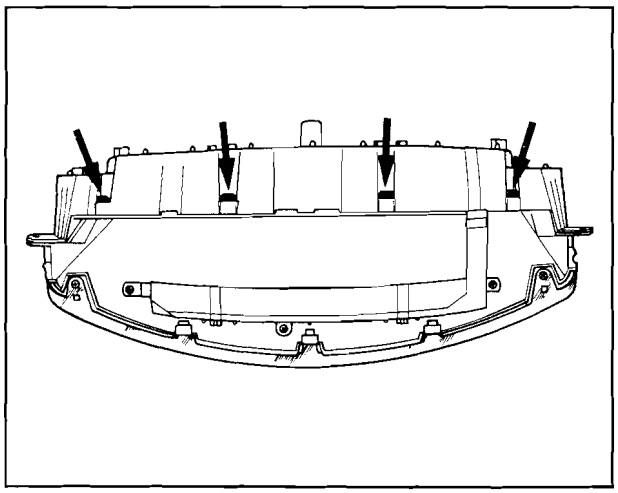


Fig. 5 — Cluster facia panel

(5) Remove the tachometer, speedometer, fuel/temp gauge attaching screws and remove the gauges.

(6) Remove the circuit board attaching screws and remove the circuit boards, refer Fig. 6.

NOTE: The speedometer and tachometer have highly sensitive surfaces and if touched, even with clean hands, a permanent imprint will be left.

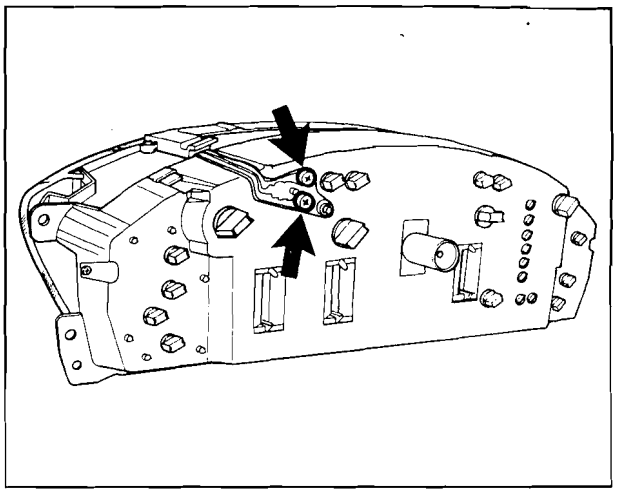


Fig. 6 — Circuit board attaching screws

Assembly

Assemble by reversing disassembly procedure noting the following:

(1) Ensure that all retaining tabs are correctly located and secure.

(2) Ensure that the printed circuit is correctly aligned and that there are no kinks or sags in it.

SPEEDOMETER

The speedometer is a mechanical type with a rotary needle. The odometer measures the distance travelled via a mechanical link with the speedometer.

The tripmeter operates through the driving shaft of the odometer and indicates distance travelled per trip.

To reset the trip meter push in the reset button.

A reed switch is incorporated in the speedometer to provide a vehicle speed signal to the cruise control, fuel injection and automatic transaxle control units.

Calibration Testing

If speedometer indication is suspect it should be tested by comparing reading with a master gauge or by road testing the vehicle behind a vehicle fitted with a known accurate gauge.

If faulty, the gauge should be removed and sent to an instrument repair specialist for calibration.

Reed Switch Testing

(1) Remove the instrument cluster as previously described.

(2) Connect an Ohmmeter (preferably analogue) across the terminals shown in Fig. 7.
(3) Rotate the speedometer drive.
(4) The Ohmmeter should fluctuate between an open and closed circuit four times per revolution, i.e. 4 pulses/rev.

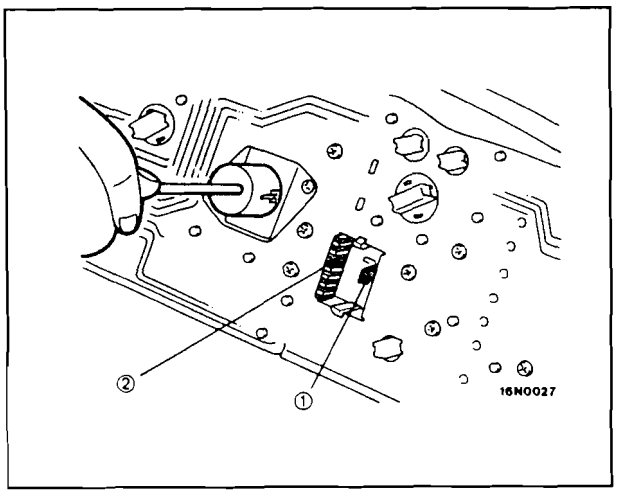


Fig. 7 — Reed switch testing

Speedometer Cable

Removal

(1) Remove the instrument cluster as outlined previously.
(2) Disconnect the speedometer cable at the transaxle.
(3) Pull the cable towards the vehicle interior.
(4) Remove the adaptor by twisting to the right or the left, refer Fig. 8.

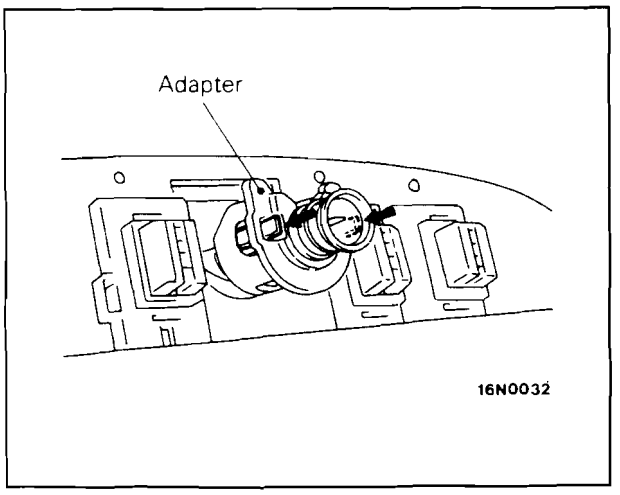


Fig. 8 — Removing speedometer cable adaptor

(5) Remove the cable by pulling into the engine compartment.

Installation

Install by reversing the removal procedure noting the following:

(1) Use wide and gradual curves when routing the cable to the transaxle.
(2) Ensure that the adaptor is correctly located in the dash panel.
(3) Ensure that the cable is correctly located and tightened at the transaxle.

NOTE: Loose installation could cause needle fluctuation, noise and damage to the speedometer head.

TACHOMETER

The tachometer is calibrated to display the engine speed in revolutions per minute (r.p.m.) by converting the ignition pulses from the coil into a proportional voltage which will be shown by a calibrated movement of the tachometer needle.

NOTE: The tachometer is a negative earth type. If incorrectly connected, electronic components could be damaged.

Calibration Testing

Connect an accurate test tachometer (preferably digital) to the engine and compare readings. If speed variations are greater than specified remove the unit and have it repaired by an instrument repair specialist.

NOTE: Do not test tachometer on a distributor test rig as damage will occur to the meter movement.

FUEL GAUGE RESISTANCE

(1) Remove the power supply retaining screw.
(2) Use a circuit tester to measure the resistance value between the terminals.

CAUTION: When inserting the testing probe into the power supply terminal, be careful not to touch the printed board.

Standard value:

Power supply — earth:	274 ± 27Ω
Power supply — fuel gauge:	86 ± 8Ω
Fuel gauge — earth:	188 ± 18Ω

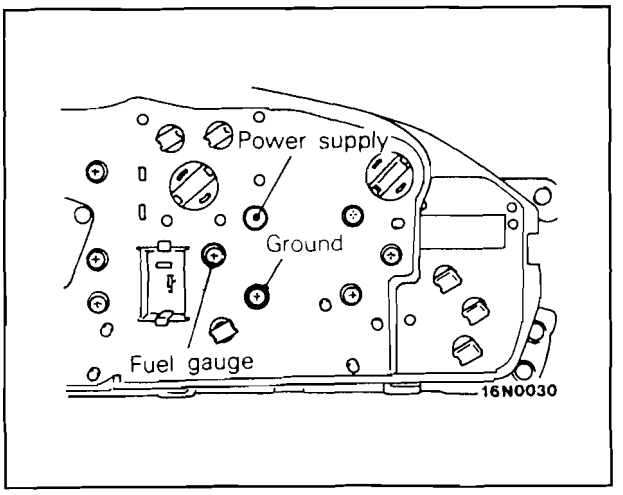


Fig. 9 — Fuel gauge circuit

Fuel Gauge Sender Unit

Removal

(1) Drain the fuel tank to a level below the sender unit.
(2) Disconnect the wiring from the sender unit.
(3) Remove the three retaining screws, refer Fig. 10, and remove the unit.

Installation

Install by reversing the removal procedure, noting the following:
(1) Use a new seal and ensure it is correctly located.
(2) Ensure that the retaining screws are evenly tightened.

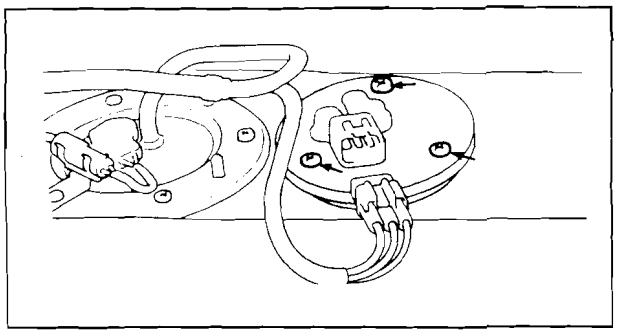


Fig. 10 — Fuel gauge sender unit removal

TEMPERATURE GAUGE RESISTANCE

(1) Remove the power supply retaining screw.
(2) Use a circuit tester to measure the resistance value between the terminals.

CAUTION: The measured current should be 4 mA or less.

CAUTION: When inserting the testing probe into the power supply terminal, be careful not to touch the printed board.

Standard values:

Power supply — water temp gauge:	51 ± 5Ω
Power supply — earth:	130 ± 13Ω
Temperature gauge — earth:	181 ± 18Ω

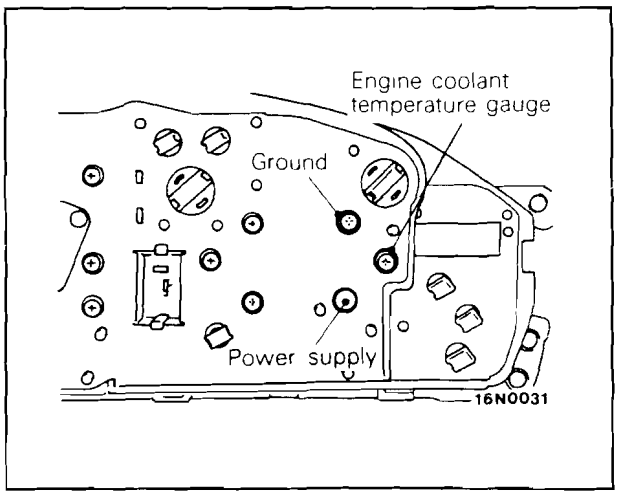


Fig. 11 — Temperature gauge circuit

Temperature Sender Unit Testing

(1) Remove the sender unit from the engine.
(2) Immerse the sender unit in a container of water, refer Fig. 12, and raise the temperature of the water while stirring to ensure even heat distribution.
(3) Connect an Ohmmeter across the sender unit, using a suitable thermometer to measure the water temperature, check that the sender unit performs within the specified range, refer specifications.

NOTE: The sender unit and thermometer should be supported to ensure that they do not contact the container.

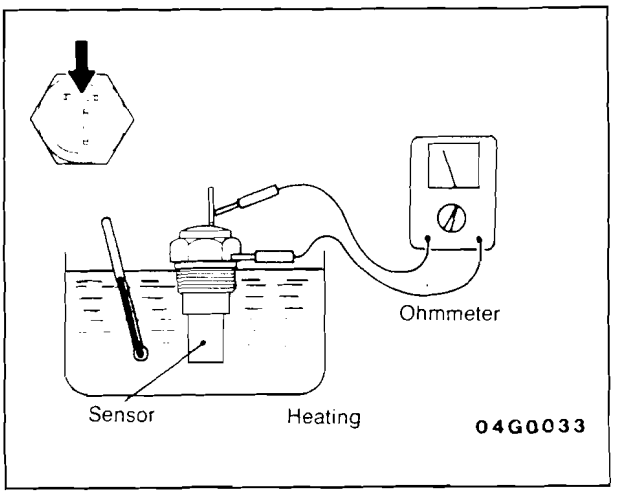


Fig. 12 — Testing temperature sender unit

VOLTMETER

Testing

(1) Connect a test voltmeter across the battery terminals.
(2) Start the engine.
(3) Check that the cluster voltmeter and test voltmeter readings are the same. If readings differ the voltmeter should be replaced.

WARNING LAMPS

Low Fuel Warning Lamp

The low fuel warning lamp is activated by a thermister unit located on the fuel gauge sender unit.

Testing

(1) Remove the fuel gauge sender unit as previously described.
(2) Connect the gauge unit to a battery with a 3.4W test light in the circuit, refer Fig. 13.
(3) Immerse the sender unit in water.
(4) The light should remain OFF while the unit is immersed and illuminate when the unit is removed from the water.

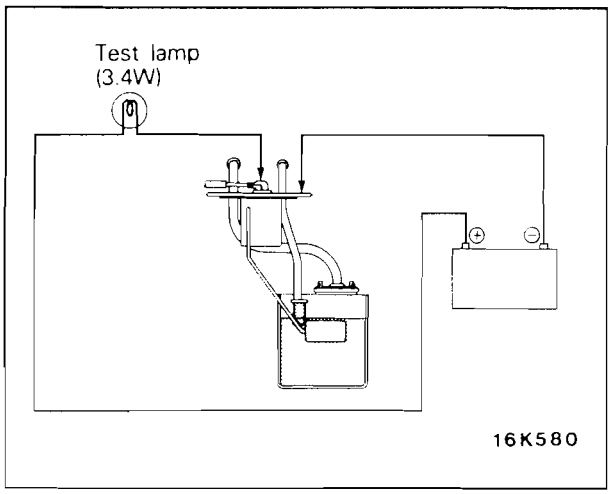


Fig. 13 — Testing low fuel warning unit

(5) If faulty the sender unit must be replaced as an assembly.

(6) Install the sender unit as previously described.

NOTE: Dry the unit prior to installation.

Fuel Gauge Unit (float height) — Sedan

(1) Remove the fuel gauge sender unit as previously described.

(2) Move the float and measure the height A at point F (highest) and B at point E (lowest) with float arm touching stopper, refer Fig. 14.

Float setting: point A — 40.95 mm
point B — 173.25 mm

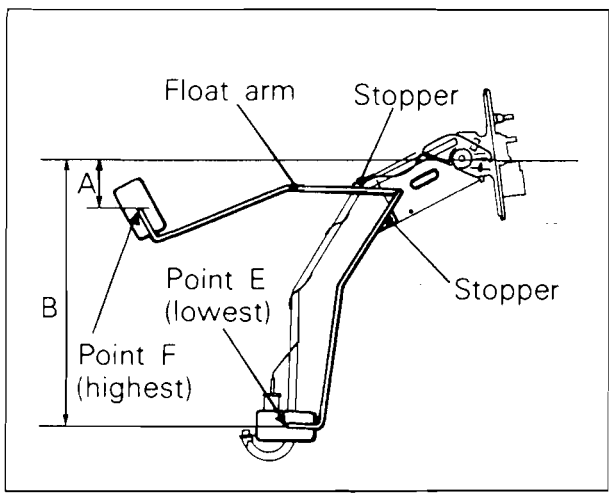


Fig. 14 — Float height check—sedan

Install the sender unit as previously described.

Fuel Gauge Unit (float height) — Wagon

(1) Remove the fuel gauge sender unit as previously described.

(2) Move the float and measure the height A at point F (highest) and B at point E (lowest) with float arm touching stopper, refer Fig. 15.

Float setting: point A — 11.90 mm
point B — 173.90 mm

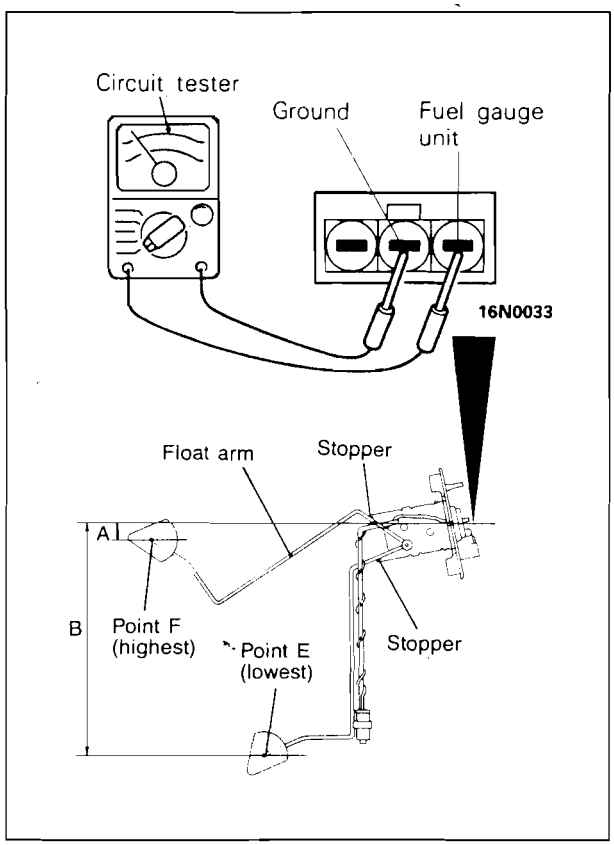


Fig. 15 — Float height check — wagon

(3) Check the resistance value between the fuel gauge terminal and ground terminal is within the standard value when the fuel gauge unit float is at point "F" (highest) and point "E" (lowest).

Point F — 3 ± 2 Ohms
Point E — 110 ± 7 Ohms

(4) Check that the resistance changes smoothly when the float moves slowly between both points.

Install the sender unit.

Fuel Gauge Unit (Float height — with combined pump and sender unit)

(1) Remove the fuel gauge sender/pump unit.

(2) Move the float and measure the height A at point F (highest) and B at point E (lowest) with float arm touching stopper, refer Fig. 16.

	Sedan	Wagon
Float setting: point A —	12.75 mm	-5.0 mm
point B —	147.25 mm	187.16 mm

(3) Check the resistance value between the fuel gauge terminal and ground terminal is within the standard value when the fuel gauge unit float is at point "F" (highest) and point "E" (lowest).

	Sedan	Wagon
Point F —	3 ± 2 Ohms	3 ± 2 Ohms
Point E —	110 ± 7 Ohms	110 ± 7 Ohms

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(4) Check that the resistance changes smoothly when the float moves slowly between both points.

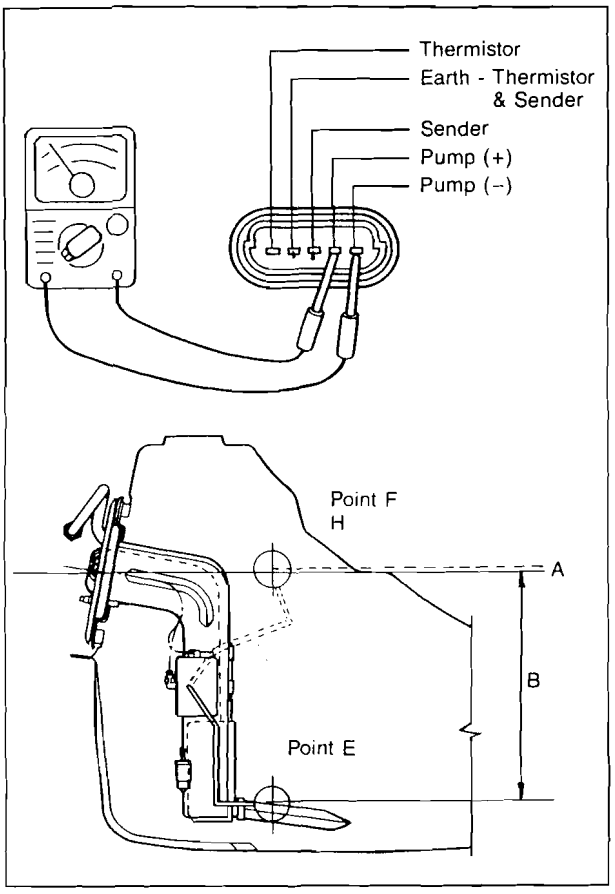


Fig. 16 — Testing combined fuel pump/sender unit

Install the sender/pump unit.

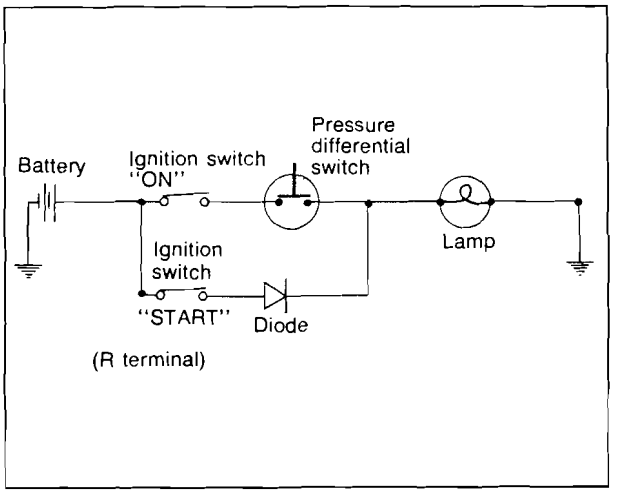


Fig. 17 — Brake failure warning lamp circuit

Brake Failure Warning Lamp

The brake failure warning lamp illuminates in the event of a failure in the brake hydraulic system and each time the vehicle is started, to check the lamp globe and circuit.

The brake failure warning system consists of a non-earthing type pressure differential switch, a diode and a globe in the instrument cluster.

Operation

The circuit diode is soldered to the printed circuit.

When the ignition switch is turned to the START position current flows from the battery through the ignition switch "R" terminal, the diode and the globe to earth.

In the event of a failure in one of the brake hydraulic circuits with the ignition switch in the ON position the pressure differential switch will be closed by the spool valve in the master cylinder. This completes the circuit from the ignition switch through the globe to earth. The diode prevents current flow back through the ignition switch "R" terminal.

Oil Pressure Warning Lamp

The oil pressure warning lamp is operated by a diaphragm type pressure switch mounted on the cylinder block.

When oil pressure exceeds 30 kPa the contacts in the switch open and the warning lamp goes off.

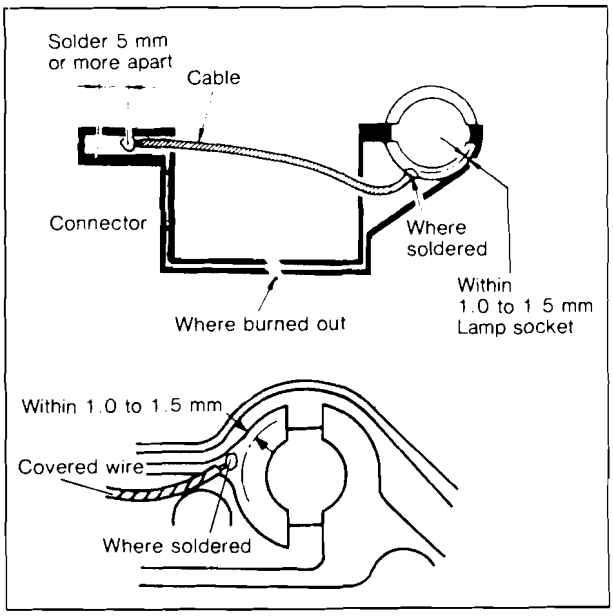


Fig. 18 — Printed circuit repair

INSTRUMENT PANEL LAMPS

All instrument panel and warning lamps are contained in twist-in sockets. To replace globes it is necessary to remove the instrument cluster.

PRINTED CIRCUIT

The printed circuit board is made up of a thin layer of copper (0.03 to 0.05 mm) printed to a polyester film. If there is a short circuit, instantaneous fusing will occur and the printed circuit board will have to be replaced. If one is not available, temporary repair may be carried out by the following procedure.

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Repair Procedure

If no spare board is available solder a cable (0.5 mm^2) to the open or burnt circuit to effect a temporary repair.

CAUTION: If the printed wiring is burned out, be sure to locate the cause and correct it, otherwise a repeated failure of the same nature will occur.

(1) Trace both ends of the burnt-out circuit and solder a cable (covered wire) to the copper deposited over a wide area around the lamp socket.

(2) Soldering should be done within 1 to 1.5 mm from the circumference of the copper deposition around the lamp socket. Also, solder the cable to the copper at the connector terminal, about 5 to 7 mm from the connector, refer Fig. 18. Ensure that the connector does not interfere with the soldered joint.

(3) Use the copper rivet head as the soldering point if necessary.

(4) Using fine sandpaper, lightly polish the area to be soldered. Hard polishing will damage the thin copper film of the printed circuit.

(5) Cut any part of the copper wire not adhered to the board.

(6) Insulate the soldered connections with clear lacquer.

CLOCK

Removal

(1) Gently lever the clock away from the centre outlet assembly using two small screwdrivers covered in cloth.

(2) Disconnect the wiring.

CAUTION: Care must be taken so as not to damage the outlet assembly or instrument panel.

Installation

Installation is a reversal of the removal procedure.

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SECTION 10 — HORN

SPECIFICATIONS

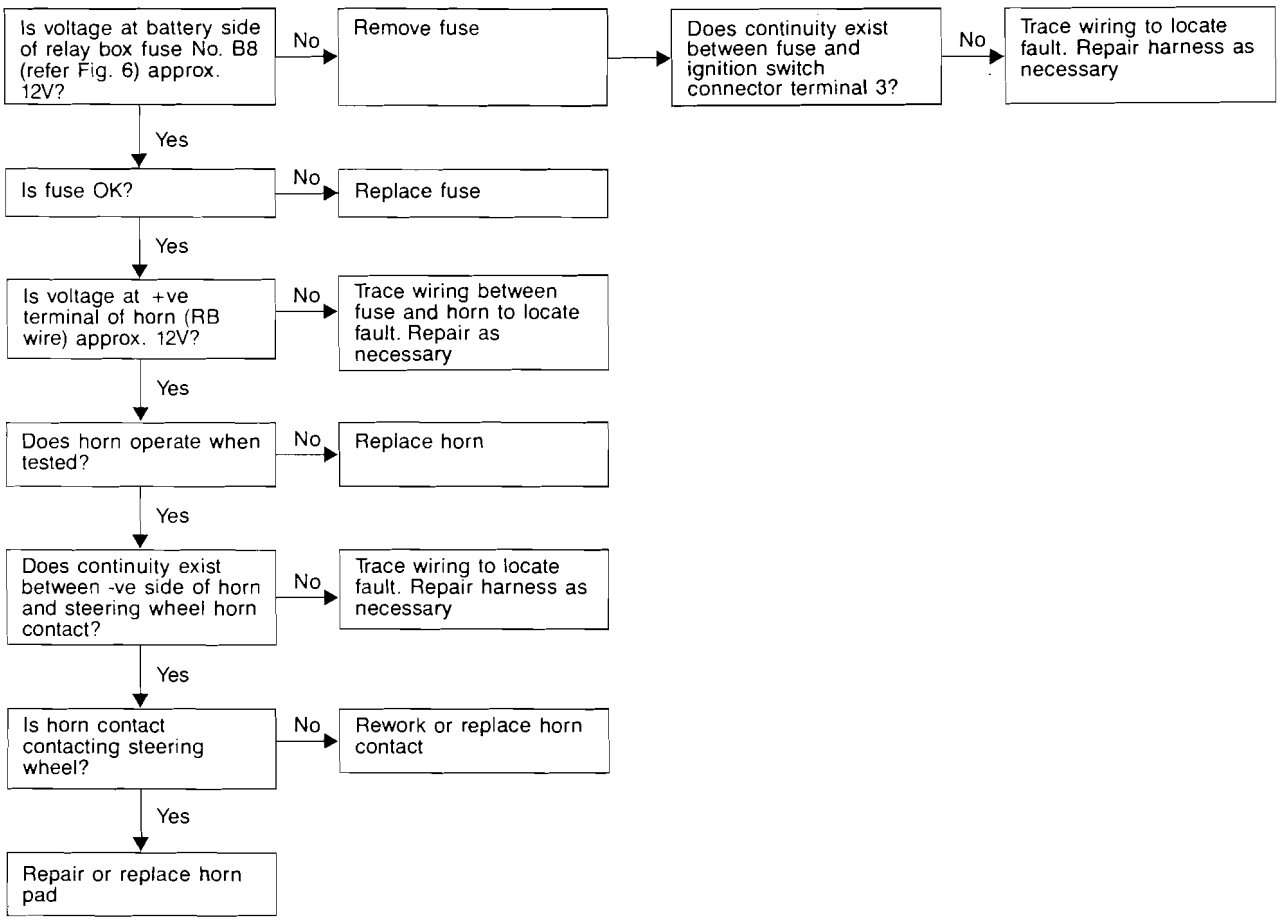
Type	Flat diaphragm
Voltage operating range	11 to 14.5 V
Current draw @ 12V	3.5A (max.)
Frequency—High note	420 ± 20 Hz
—Low note	360 ± 20 Hz

TORQUE SPECIFICATIONS

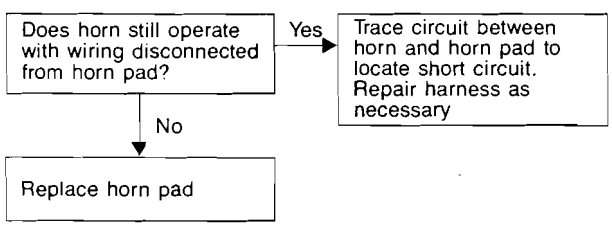
Steering wheel retaining nut	35 to 45 Nm

SERVICE DIAGNOSIS

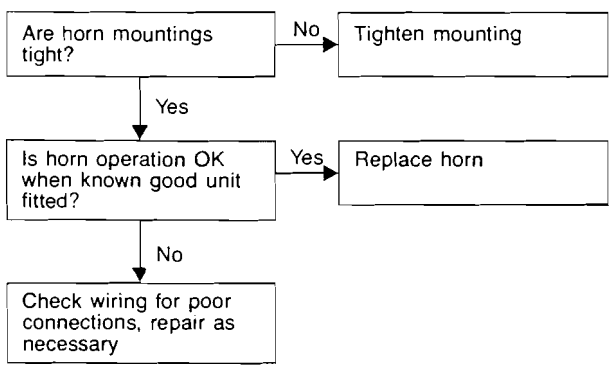
HORN(S) DO NOT OPERATE



HORN OPERATION CONTINUOUS



HORN TONE UNSATISFACTORY



HORN

Removal

(1) Disconnect the wiring harness from the horn.
(2) Remove the horn attaching bolt, refer Fig. 1, and remove the horn.

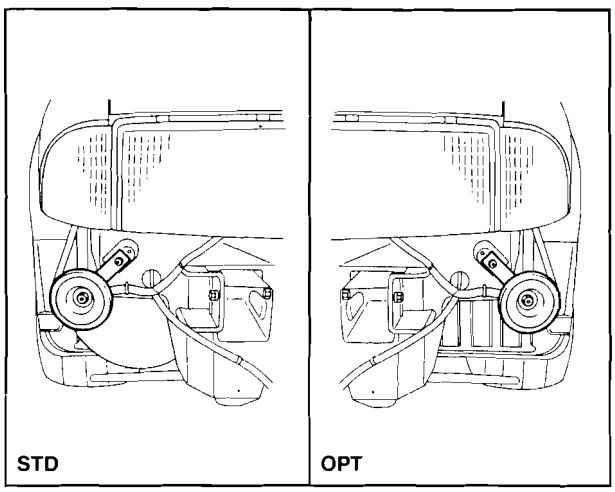


Fig. 1—Horn attaching bolts

Installation

Install by reversing the removal procedure.

Testing

(1) Remove the horn from the vehicle and secure in a vice.
(2) Connect the horn, in series with an ammeter and suitable horn button, to a battery.
(3) Operate the horn, maximum current draw allowed is 3.5 Amps @ 12 Volts.
(4) If the current draw is greater than 3.5 Amps replace the horn.
(5) Install the horn.

SECTION 11 — POWER WINDOW SYSTEM

SPECIFICATIONS

Power Window Motor

Type	Permanent magnet type with built in circuit breaker
Revolutions under load (revs/min)	
@ 1 Nm — Front	65 to 95
— Rear	67 to 97
@ 2 Nm — Front	50 to 80
— Rear	47 to 77
Bound current	34A or less
Direction of rotation	Clockwise and anti-clockwise

Main Switch

Rated load current	
—Lock switch	20A
—Window switch	10A

Sub Switch

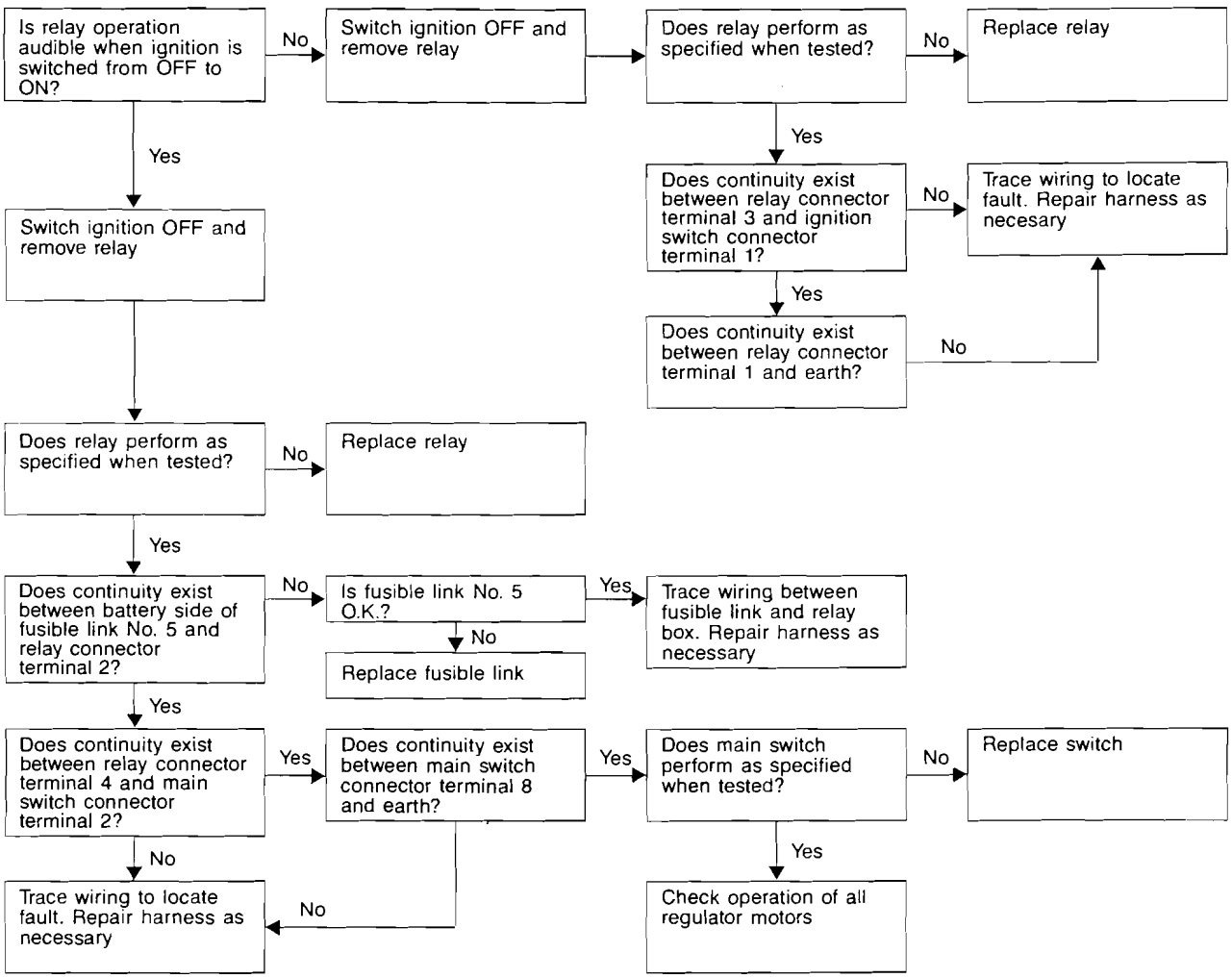
Rated load current	10A (max 25A)
Voltage drop between terminals	0.15V or less

Relay

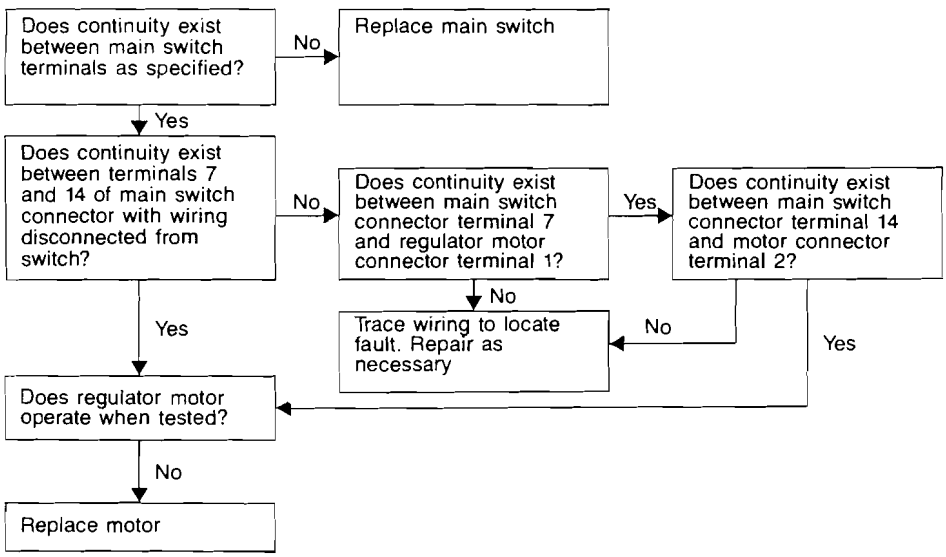
Rated coil current	0.135 – 0.215A
Maximum contact current capacity	22A
Voltage operating range	10 to 16V
Voltage drop between terminals	0.25V maximum

SERVICE DIAGNOSIS

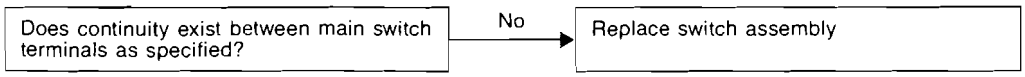
ALL WINDOWS INOPERATIVE



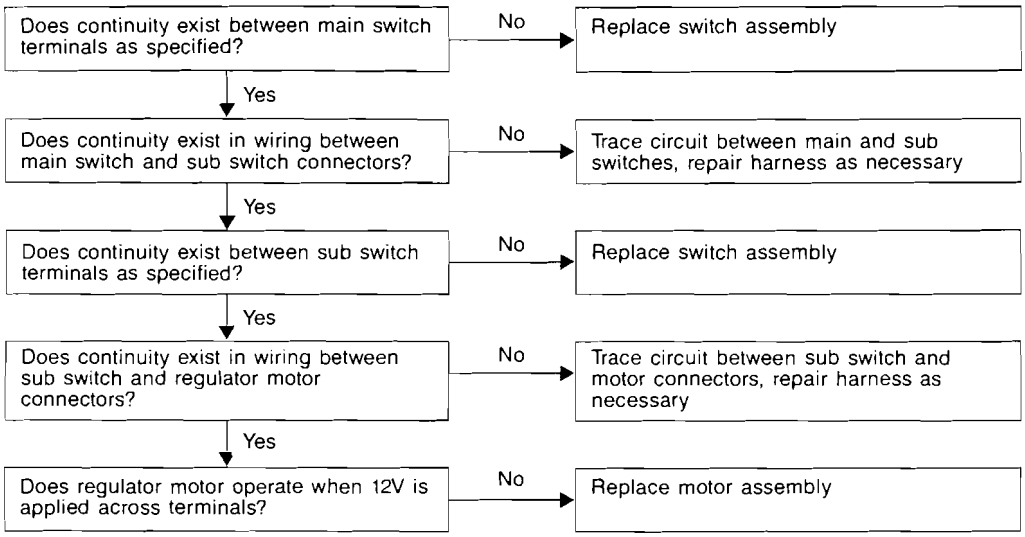
DRIVERS WINDOW ONLY INOPERATIVE



ALL EXCEPT DRIVERS WINDOW INOPERATIVE



ANY ONE PASSENGER WINDOW INOPERATIVE



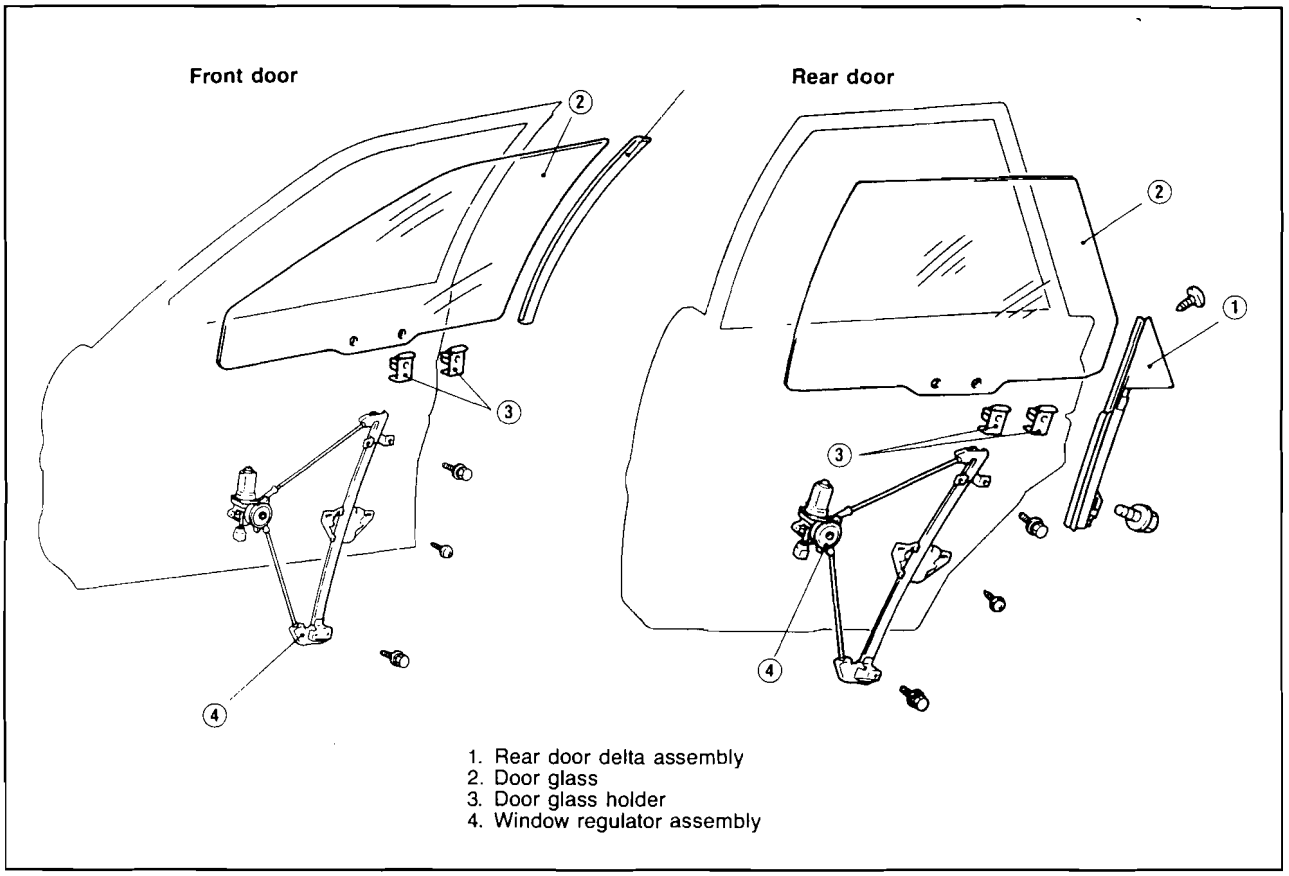


Fig. 1—Power window system components

GENERAL INFORMATION

Power window operation is achieved by means of 12V electric motors attached to the window regulators.

The main switch panel, located in the drivers door arm rest, allows control of front and rear door glass travel. Individual switches located in the front passenger and rear door arm rests allow control of the respective door glass.

A lock switch incorporated in the main switch allows the individual switches to be made non-operational if desired.

REGULATOR MOTOR

Removal

(1) Remove the regulator from the door, refer Group 42A—Body.

Testing

(1) Using an auxilliary battery, supply battery voltage between the motor terminals and check that the motor operates smoothly, refer Fig. 2.
(2) Reverse the polarity at the terminals and check that the motor operates smoothly in the reverse direction.

Installation

Install by reversing the removal procedure.

POWER WINDOW RELAY

For relay location refer to Section 1 of this Group.

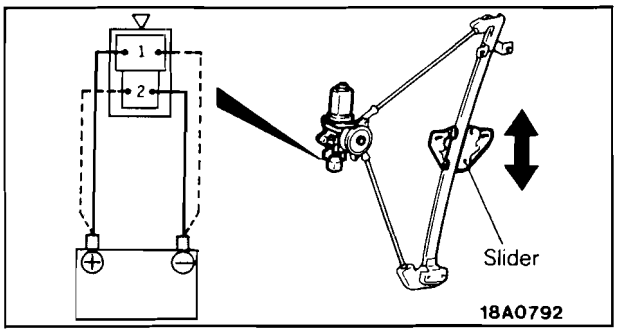


Fig. 2 — Testing regulator motor

Testing (refer Fig. 4)

(1) Disconnect the wiring harness from the relay.
(2) Using an Ohmmeter check that the resistance between terminals 1 and 3 is 55 to 90 Ohms.
(3) Check that there is no continuity between terminals 2 and 4.
(4) Apply battery voltage between terminals 1 and 3 and check that there is continuity between terminals 2 and 4.

MAIN SWITCH ASSEMBLY

Removal

(1) Using a screwdriver or suitable lever, pry the switch out of the arm rest by levering at the rear of the switch.

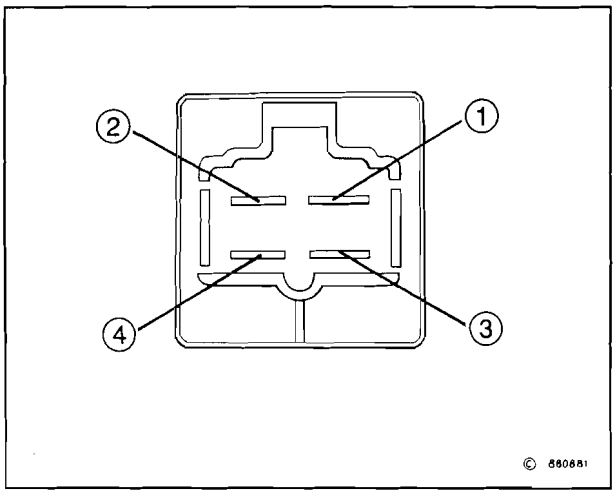


Fig. 3—Relay terminal locations

NOTE: Position a rag between the screwdriver and the arm rest to prevent damage to the arm rest.

(2) Disconnect the wiring and remove the switch.

Installation

Install by reversing the removal procedure.

Testing

Using an Ohmmeter check the switch assembly for continuity in accordance with the chart shown in Fig. 4. Perform each test with the relevant switch operated in the up and down position.

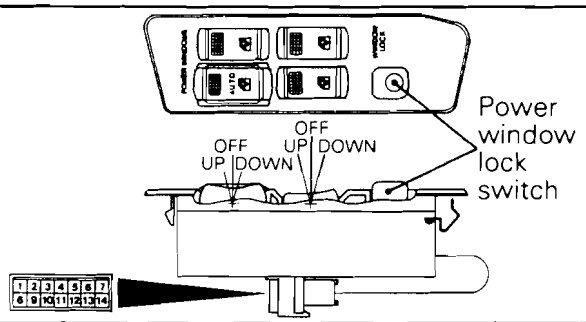
SUB SWITCH ASSEMBLY

Removal and Installation

Use the procedures outlined in "Main Switch Assembly".

Testing

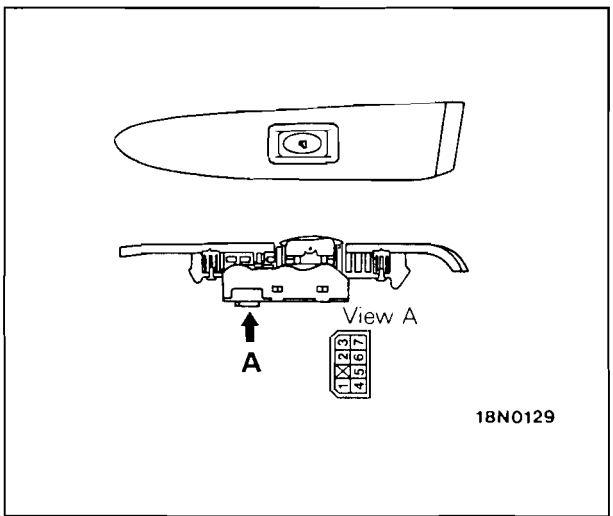
Using an Ohmmeter check the switch assembly for continuity in accordance with the chart shown in Fig. 5. Perform each test with the switch operated in the up and down position.



Terminal \ Switch position		Power window switch (normal)			Power window switch (lock)		
		UP	OFF	DOWN	UP	OFF	DOWN
Front (Driver's side)	7	○		○	○		○
	1	○	○	○	○	○	○
	8	○	○	○	○	○	○
	14	○	○	○	○	○	○
Front (Passenger's side)	7	○		○	○		○
	2	○	○	○	○	○	
	9	○	○	○		○	○
	14	○	○	○			
Rear (LH)	7	○		○	○		○
	6	○	○	○	○	○	
	13	○	○	○		○	○
	14	○	○	○			
Rear (RH)	7	○		○	○		○
	4	○	○	○	○	○	
	11	○	○	○		○	○
	14	○	○	○			

NOTE
○—○ indicates that there is continuity between the terminals.

Fig. 4 — Main switch continuity chart



Switch Position / Terminal	UP	OFF			DOWN
		No Continuity	Continuity		
1			○	○	
2	○	○		⊕	○
3	○	○		⋮	○
4	○	○		⋮ ○	○
5	○	○	○	⋮	○
6	○	○	⊖	⊖	○
7	○	○	⊕		○

NOTE
(1) ○—○ indicates that there is continuity between the terminals.
(2) ⊕—⊖ indicates connection of battery voltage.

Fig. 5 — Sub switch continuity chart

SECTION 12 — CENTRAL LOCKING SYSTEM

SPECIFICATIONS

Door Lock Control Unit

Voltage operating range	10 to 16V
Current consumption (when not operating)	3mA or less
Rated load current @ 13.5V	5A
Rated coil current	0.2A max.
Voltage drop between terminals	0.3V or less

Front door actuator

Bound current @ 12V	2.5-4.5A
Operating voltage range	9 to 15V
Switch stroke	2.5 to 6.5 mm
Switch contact resistance @ 1 mA	100 ohms or less

Rear door actuator

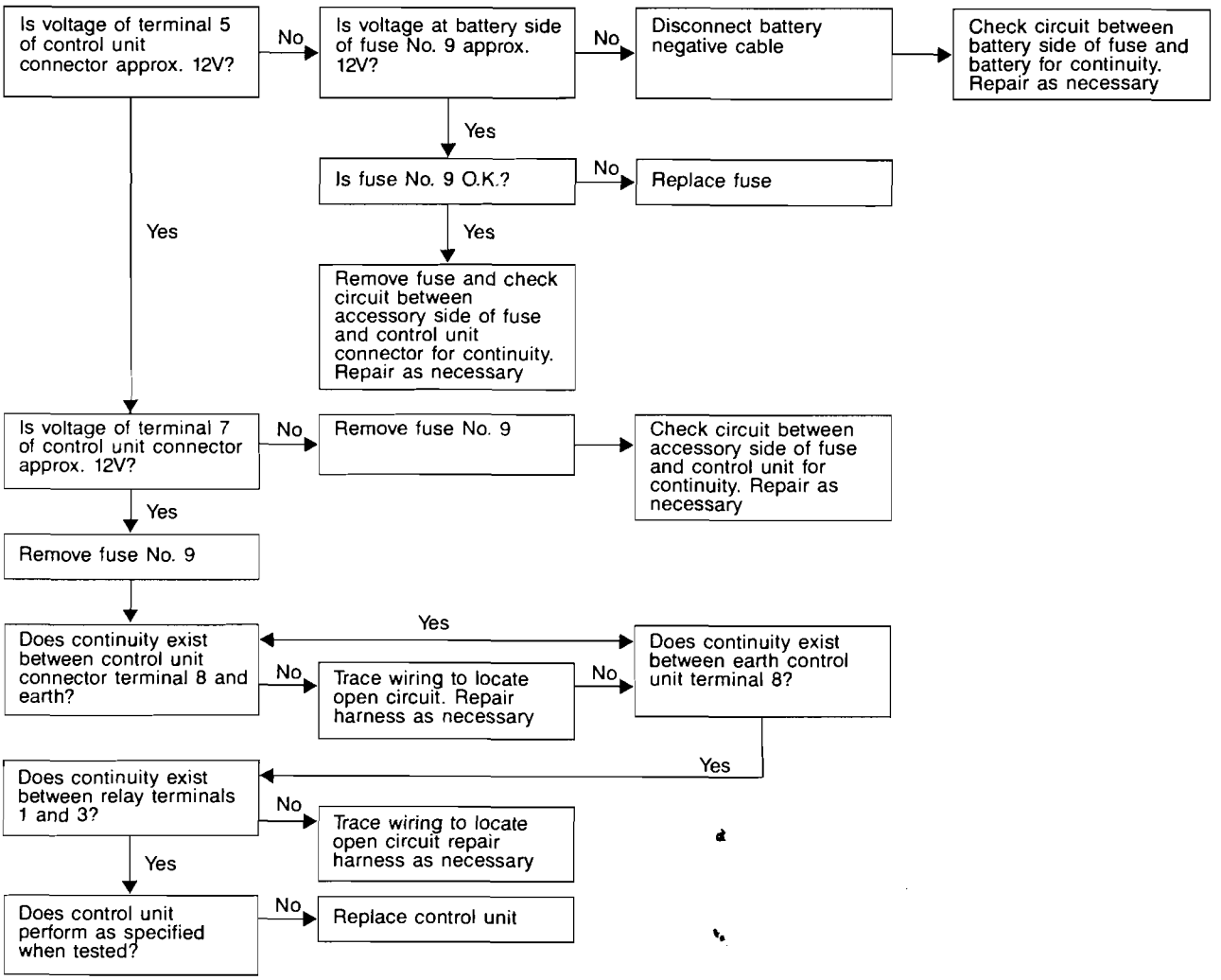
Bound current @ 12V	2.5-4.5A
Operating voltage range	9 to 15V

Tailgate actuator

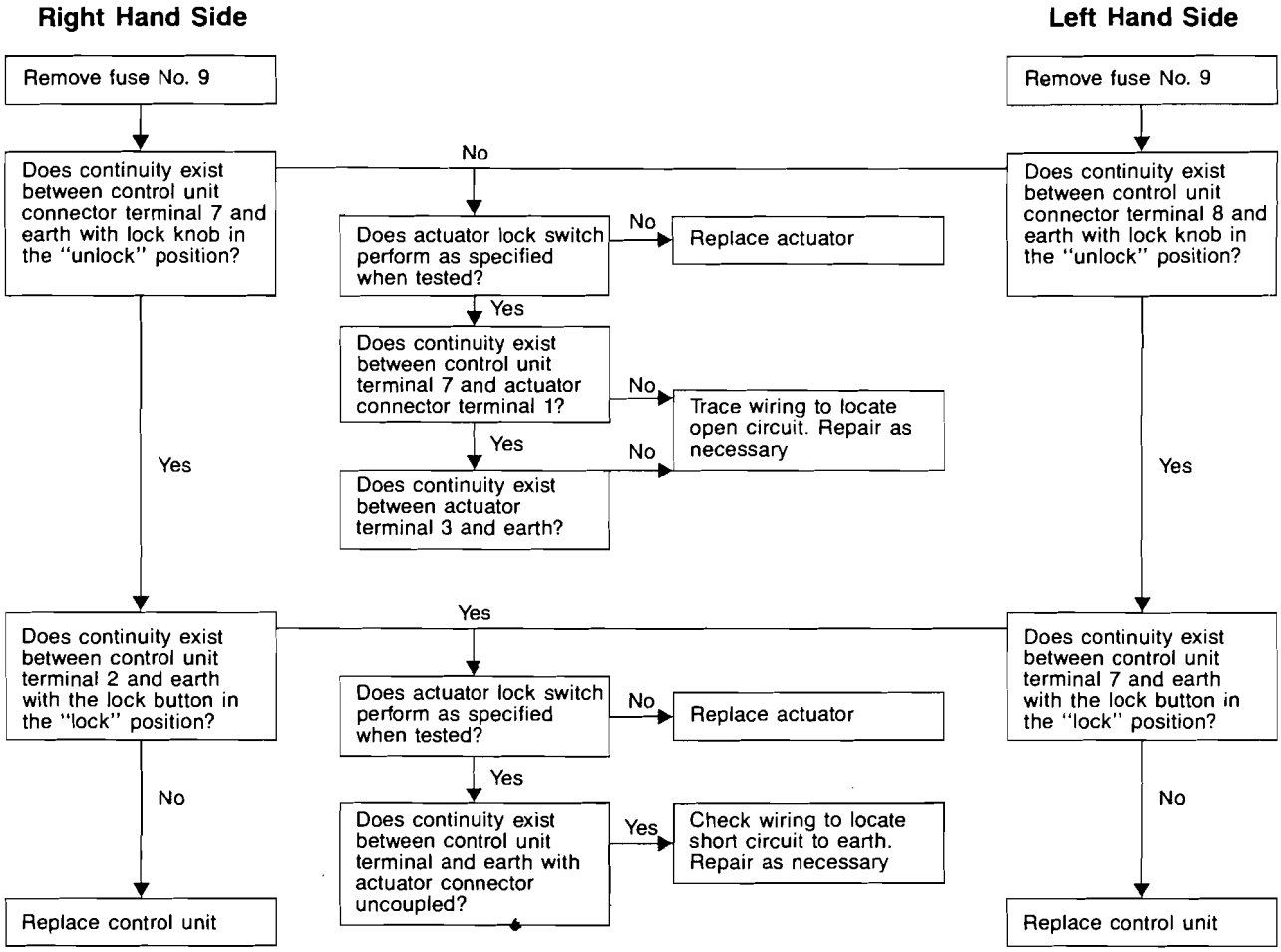
Bound current @ 12V	2.5-4.5A
Operating voltage range	9 to 15V

SERVICE DIAGNOSIS

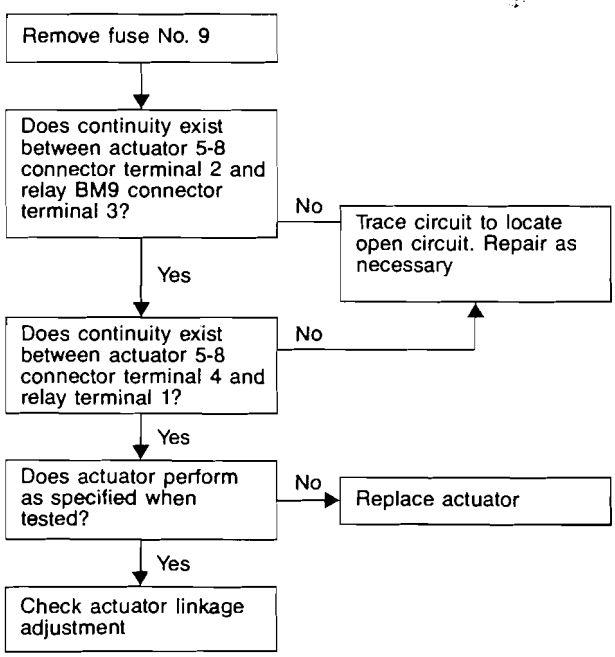
LOCKING SYSTEM INOPERATIVE FROM EITHER FRONT DOOR



LOCKING SYSTEM INOPERATIVE FROM ONE FRONT DOOR ONLY



ANY ONE DOOR LOCK INOPERATIVE



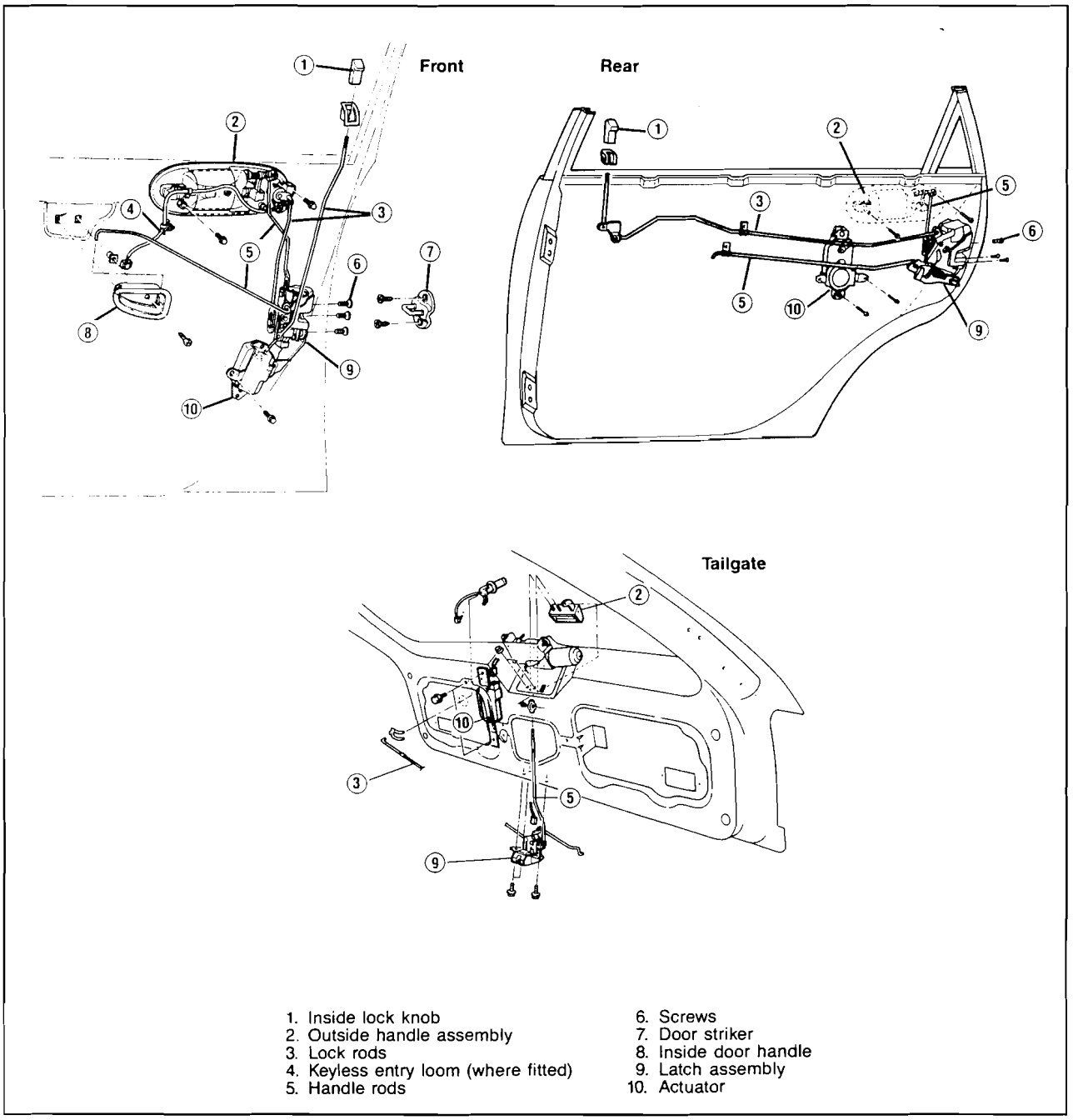


Fig. 1—Central locking — door components

GENERAL INFORMATION

Operation is controlled by the actuators located in the front doors which incorporate a switch, a motor and a worm drive. The switch is activated when either the key or the trip lock is operated.

Locking the right front door only, activates all other door actuators. A control relay cuts the power supply to the actuators when the locking operation on all doors is complete.

Independent operation of the left front and both rear door locks operates only that particular door lock.

DOOR LOCK ACTUATOR

Front

Removal

(1) Remove the door trim, refer Group 42A—Body.

(2) Disconnect the trip lock, interior release and exterior release linkages from the door latch.

(3) Disconnect the wiring from the actuator.

(4) Remove the door latch and actuator attaching bolts, refer Fig. 2.

(5) Remove the door latch and actuator assembly.

(6) Disconnect the actuator to door latch linkage.

(7) Remove the actuator to door latch attaching bolts.

NOTE: Do not attempt to dismantle and repair the actuator. It must be replaced as an assembly.

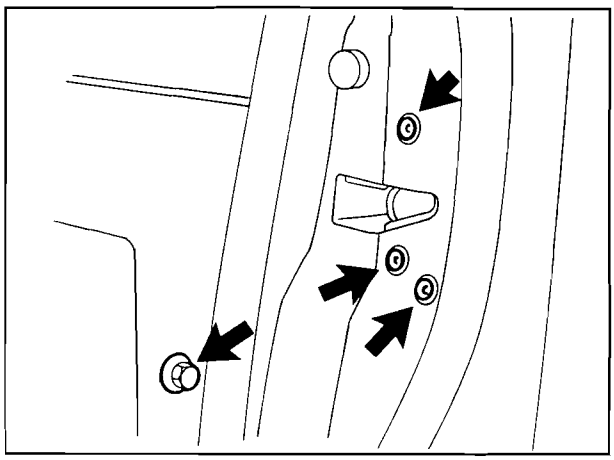


Fig. 2—Door latch and actuator attaching bolts

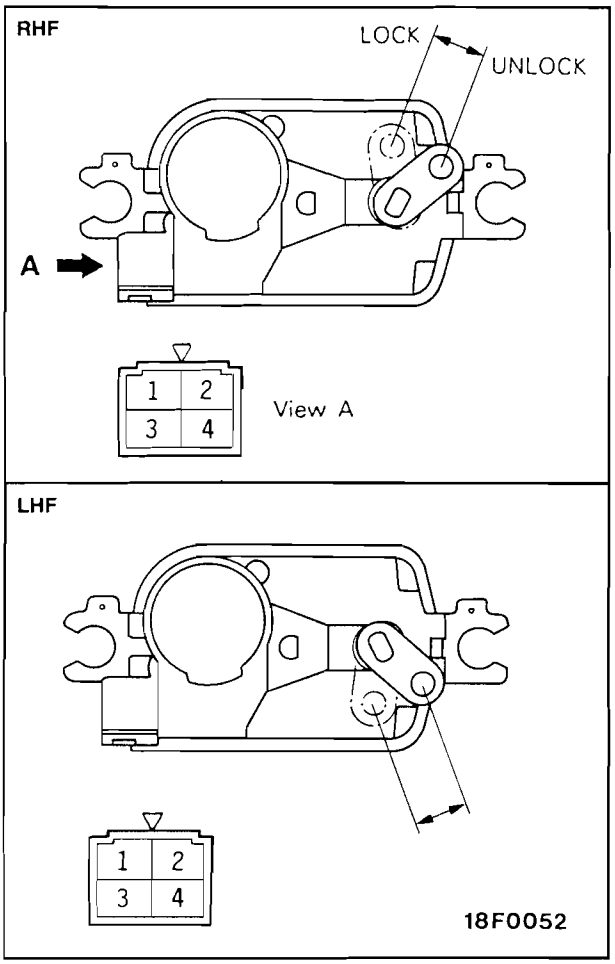


Fig. 3 — Testing front door actuator

Testing (refer Fig. 3 RHF)

(1) Set the actuator rod in the "lock" position.

(2) Apply battery voltage to terminal 3 and earth terminal 1. The rod should move to the "unlock" position.

(3) With the actuator rod in the "unlock" position apply battery voltage to terminal 1 and earth terminal 3. The rod should move to the "lock" position.

(4) Using an Ohmmeter check the door lock switch for continuity between terminals 2 and 4.

(a) With the actuator rod in the "unlock" position there should be continuity.

(b) With the actuator rod in the "lock" position there should be no continuity.

Testing (refer Fig. 3 LHF)

(1) Set the actuator rod in the "lock" position.

(2) Apply battery voltage to terminal 1 and earth terminal 3. The rod should move to the "unlock" position.

(3) With the actuator rod in the "unlock" position apply battery voltage to terminal 1 and earth terminal 3. The rod should move to the "lock" position.

(4) Using an Ohmmeter check the door lock switch for continuity between terminals 2 and 4.

NOTE: Discontinue power supply to the actuator immediately each test is complete.

Installation

(1) Connect the actuator rod to the door latch.

(2) Set the actuator rod and latch lock lever in the "lock" position.

(3) Locate the actuator in the slots in the latch and fit the attaching bolts, refer Fig. 4.

(4) Check actuator operation by performing steps (2) and (3) of testing procedure.

(5) Install the door latch and actuator into the door.

(6) Connect the wiring to the actuator.

(7) Connect all linkages to the door latch and check for correct operation.

(8) Fit the door trim.

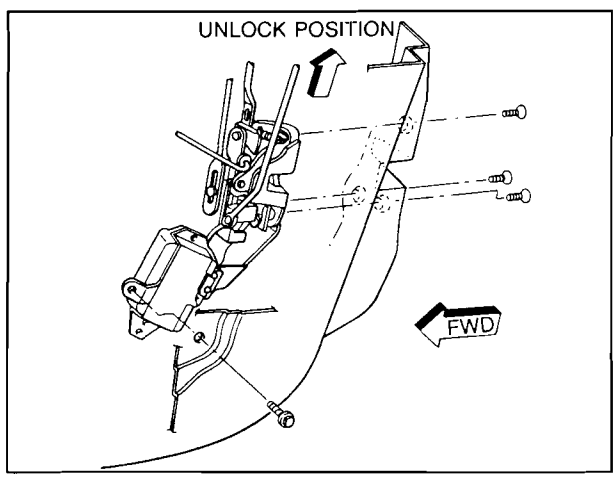


Fig. 4 — Fitting actuator to door latch

Rear Door

Removal

(1) Remove the door trim, refer Group 42A—Body.
(2) Disconnect the wiring harness from the actuator.
(3) Unclip the actuator from the lock rod, refer Fig. 5.
(4) Remove the actuator attaching bolts and remove the actuator, refer Fig. 5.

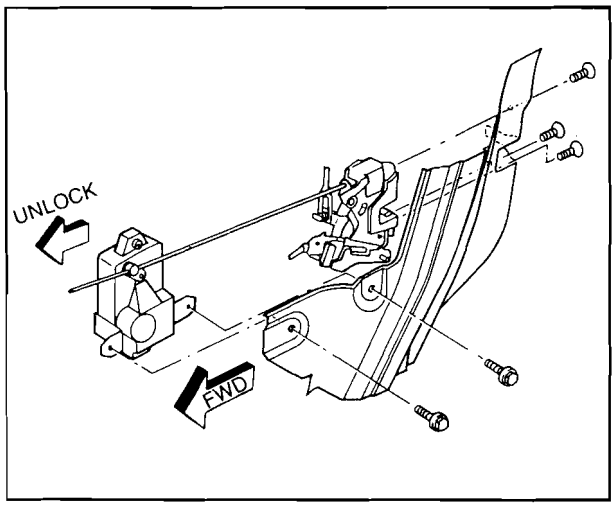


Fig. 5 — Actuator attaching points

Testing (refer Fig. 6)

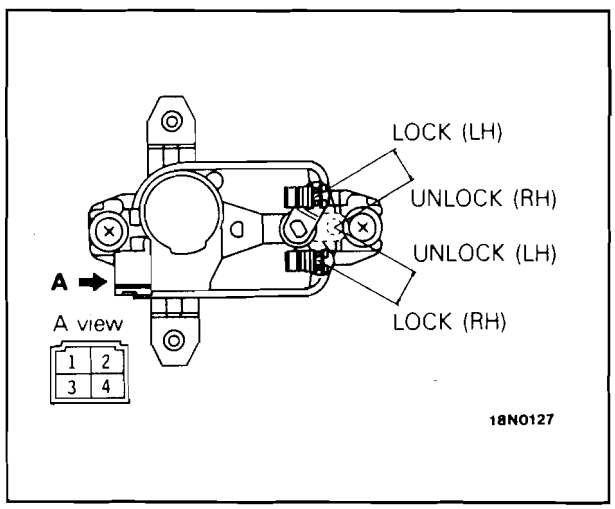


Fig. 6 — Testing rear door actuator

(1) Set the actuator rod in the "lock" position.
(2) Apply battery voltage to terminal 3 and earth terminal 1. The rod should move to the "unlock" position.
(3) With the rod in the "unlock" position apply battery voltage to terminal 1 and earth terminal 3. The rod should move to the "lock" position.

NOTE: Discontinue power supply to the actuator immediately each test is complete.

Installation

(1) Install the actuator into the door.
(2) Set the actuator rod and the door latch in the unlock position and clip the lock rod to the actuator.

NOTE: A new actuator rod clip must be used.

(3) Connect the wiring to the actuator.
(4) Check locking system operation.
(5) Fit the door trim.

DOOR LOCK CONTROL UNIT

For control unit location refer to Section 1.

Testing (refer Fig. 7)

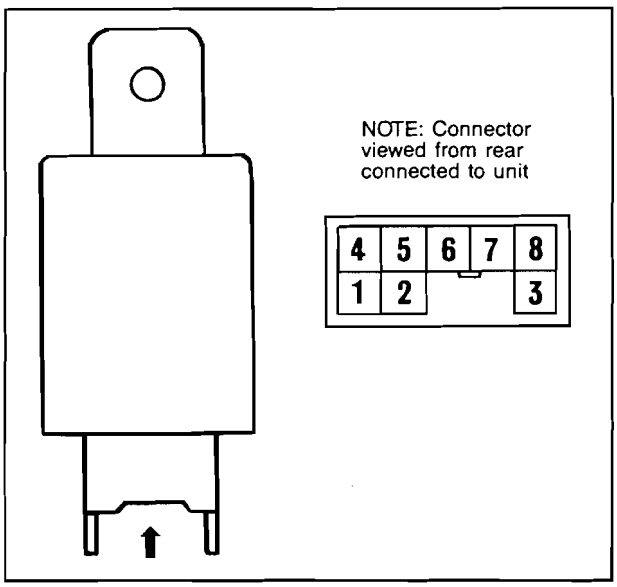


Fig. 7 — Testing control unit

(1) With the wiring harness connected to the control unit check that the voltage at terminals 1 and 3 is 12V.
(2) Earth terminal 2 and check that voltage at terminal 1 is reduced to 1.5V (approximately) and then returns to 12V after 0.5 seconds.
(3) Disconnect terminal 2 from earth and check that voltage at terminal 3 is reduced to 1.5V (approximately) and returns to 12V after 0.5 seconds.
(4) Repeat tests (2) and (3) on terminal 7.

REMOTE TAILGATE SYSTEM

The remote tailgate release system consists of a solenoid mounted in the tailgate, which can be actuated by the front door trip lock when central locking is fitted, or by key at the tailgate.

TAILGATE RELEASE SOLENOID

Removal

(1) Remove the tailgate trim (refer Group 42A).
(2) Disconnect the solenoid to latch linkage.
(3) Loosen the solenoid retaining bolts.
(4) Uncouple the solenoid connector and remove the solenoid from the tailgate.

Testing

Test as per testing procedure outlined in "Central Door Locking System" for rear door.

Installation

Install by reversing removal procedure.

KEYLESS ENTRY SYSTEM

Transmitter (Key) Disassembly

(1) Remove battery cover mounting screw.
(2) Remove the battery cover.
(3) Remove the battery.

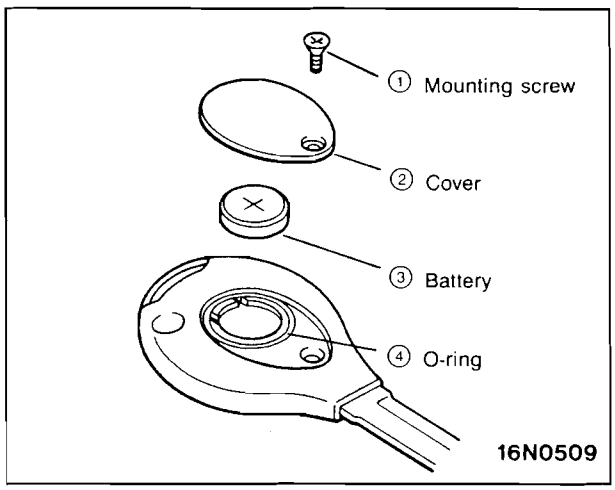


Fig. 8 — Transmitter (Key) disassembly

Assembly

Assemble by reversing removal procedure noting the following:

(1) Wipe the surface of the battery with a dry cloth and insert the battery with the (+) pole face upwards, being careful not to bend the upper tab at the (+) pole, refer Fig. 9.

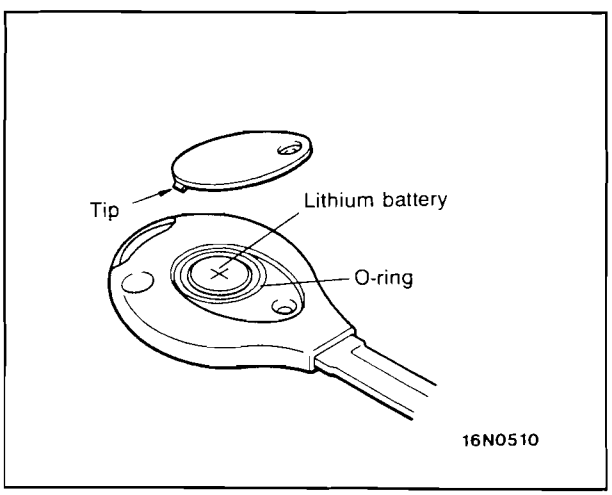


Fig. 9 — Battery installation

(2) Install the battery cover by inserting the tip first, being careful that the O-ring does not twist or slip.

NOTE: When installing the battery be careful that the poles are not damaged and that no water or dirt gets inside. Also be careful that the printed circuit board is not touched with the fingers.

Testing

(1) Press the transmit switch on the transmitter (key) and check that the three diamond mark on the transmitter flashes.

(2) If the three diamond mark on the transmitter (key) does not flash, remove the battery and measure its voltage. Voltage should be 3V.

(3) If the battery is dead replace the battery. (Replacement Battery CR1220). If the battery isn't dead, then replace the tansmitter (key).

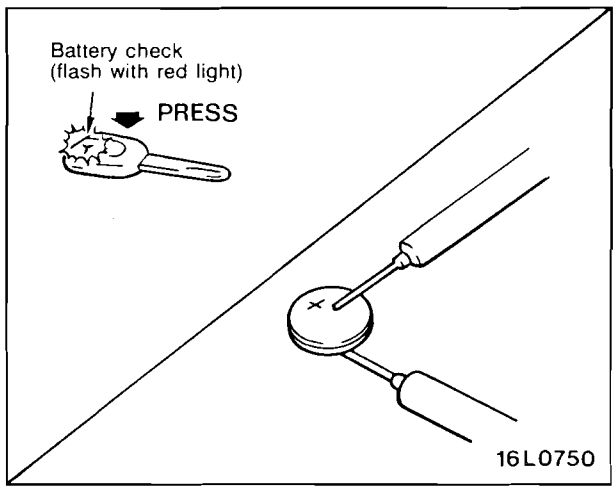


Fig. 10 — Battery testing

RADIO WAVE REMOTE CONTROL SWITCH BATTERY REPLACEMENT

(1) Remove the screw from the back of the remote control switch and open the switch.

(2) Remove the discharged battery.

(3) Install a new battery with its positive (+) side down.

Battery type CR2032

CAUTION: Avoid contact of the battery surfaces with the hands. To insert the new battery, hold it with a tissue or the like.

(4) Insert the pawls first. Then, taking care not to dislocate the O-ring, assemble the switch.

(5) Check the operation of the switch on the vehicle.

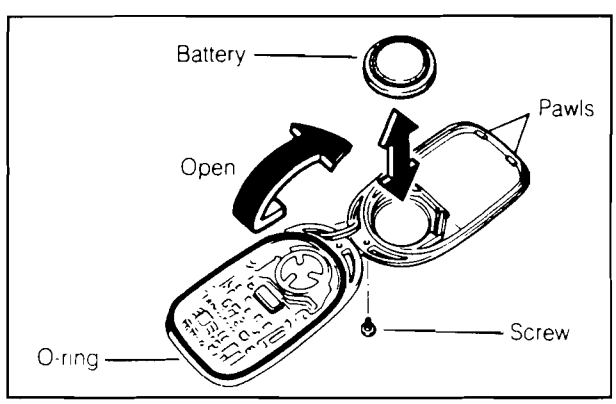


Fig. 11 — Battery replacement

TROUBLESHOOTING — KEYLESS ENTRY

Condition	Possible Cause	Inspection Method	Corrective Action
Unstable operating distance	Transmitter is defective	Check that the transmitter is not dirty.	Clean the relevant part.
	Receiver is defective.	Check that the receiver is not dirty.	
	Transmitter battery is dead.	Check that the ⅄ mark on the transmitter flashes with a red light when the transmit switch on the transmitter is pressed.	Replace the battery.
	Malfunction in transmitter.	—	Replace the transmitter.
Central door locking system does work, but the keyless entry system function. When the transmitter and receiver assemblies are brought together and the transmit switch is pressed, the system does not function.	Transmitter battery is dead.	Check that the ⅄ mark on the transmitter flashes with a red light when the transmit switch on the transmitter is pressed.	Replace the battery.
	Secret code is incorrectly programmed into the control unit.	—	After checking that the door can be opened and closed by normal key operation, re-programme the secret code.
	Keyless entry system circuit is defective.	Inspect the harnesses at every keyless entry system connector.	Repair the harness.
	Receiver assembly is defective.	—	Replace the receiver assembly.
	Control unit is defective.	—	Replace the control unit.
Input check OK but system still does not lock.	Wiring or Switch connectors.	Check and or switch connectors for security and condition.	Repair or replace as necessary

NOTE

(1) For each trouble symptom, carry out the inspections in order starting from the top of the table to narrow down the cause of the problem.
(2) If the central locking system and the keyless entry system both are not working, the problem is probably outside the keyless entry system.

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Key Programming Method

As each transmitter (key) is programmed wih a code that is unique to that transmitter, if the transmitter or control unit is replaced, or if there appears to be a problem with the code programming, it is necessary to programme the code into the memory inside the contol unit.

There is space in the unit memory to store a maximum of 2 different codes, so the programming procedure should be carried out twice to ensure that the old code can no longer be used.

Furthermore, programming of the code should be carried out after first checking that the door lock operates by normal key operation.

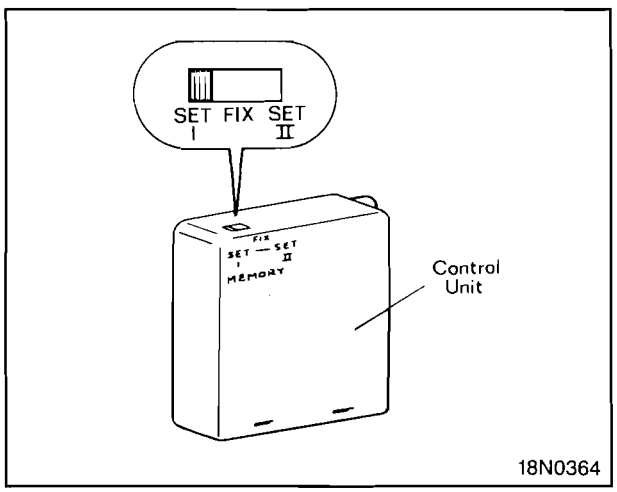


Fig. 12 — Set I position

(1) Move the code programme switch on the control unit to the SET I (programme mode side).

(2) Point the transmitter (key) towards the receiver part inside the outer door handle and press the transmit switch.

NOTE: Radio wave models (S Series only) have the receiver mounted under the parcel shelf (sedans) and don't require the transmitter to be pointed directly at the receiver, at step (2) just press the transmit switch.

NOTE: The signal is transmitted and received best if the transmitter is directly in front of the receiver port at a distance of 100 mm or less. (R Series only.)

(3) Move the code programme switch on the control unit to the FIX position, refer Fig. 14.

(4) Check that the keyless entry system is working properly. If it is working, then code programming is completed.

If it does not work properly, repeat steps (1) to (4).

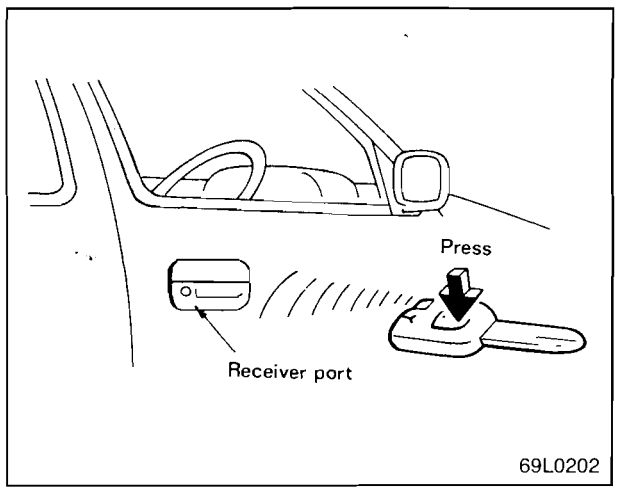


Fig. 13 — Signal transmission

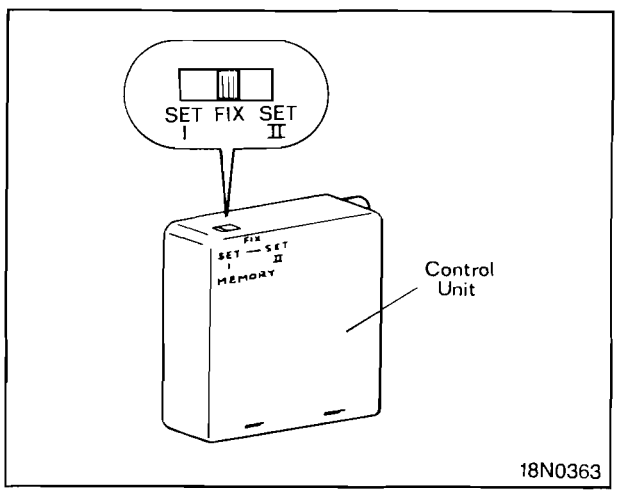


Fig. 14 — FIX position

NOTE: After the code is programmed, check that the programme switch has been moved to the FIX position. If there are two transmitters (keys), move the programme switch to SET II and repeat the same procedure as SET I to programme the code.

RADIO WAVE KEYLESS ENTRY

OPERATION

With all doors (except the trunk lid) unlocked, press the lock switch of the transmitter so that the door lock signal can be output from the keyless entry control unit. (Terminal No.12). Close the door lock relays to lock all doors (except the trunk lid).

With all doors (except the trunk lid) locked press the unlock switch of the transmitter once so that the door unlock signal can be output from the keyless entry control unit (Terminal No.13). Close the door lock relays of the driver's side to unlock the driver's side door.

With the trunk lid locked, press the trunk switch of the transmitter twice within five seconds so that the trunk unlock signal can be output from the keyless entry control unit (Terminal No.18). Close the trunk lid opener relay to operate the solenoid valve and unlock the trunk lid.

- When the keyless entry system is operated to turn the driver's door lock switch from the UNLOCK position to the LOCK position, the dome light/foot light blinking signal output (system Voltage) will be sent twice from the keyless entry control unit terminal No.11 when the door lock switch is turned from the LOCK position to the UNLOCK position, the lighting signal output (0 Volts) will be provided for approx. 3 seconds.

NOTE: Besides the above mentioned operations, the keyless entry control unit has the following functions.

- If any door is not opened or closed within 30 seconds from unlocking the door by means of the keyless entry system, the door is automatically locked. In addition, if the cryptographic code other than the code stored in the receiver memory is received 30 times in one minute continuously, operation of the unit is suspended for 10 minutes.
- Operation is also suspended if the ignition key remains inserted (key reminder switch: OFF) and either door is left open (door switch: ON).

TROUBLESHOOTING HINTS

- The indicator does not blink after pressing the transmission switch of the transmitter.
  (1) Check or replace the battery.
  (2) Replace the transmitter.
- Transmitted wave is being sent from the transmitter (indicator is blinking) but the system does not operate. (trunk lid is unlocked only).
  (1) Check the cryptographic code registering method.
  (2) Check the keyless entry control unit terminal voltage.
  (3) Check the coaxial cable of antenna and the ground wire for connection.
- Either RH door or LH door and trunk lid can be locked or unlocked. (trunk lid is unlocked only).
  (1) Check the door lock actuator.
  (2) Check the harness.
  (3) Check the trunk lid opener relay.
- All doors and the trunk can be locked and unlocked by the transmitter but the dome light and foot light do not blink or come on. (Interlocked lighting of the dome light and foot light by means of the dome light switch or door opening and closing is normal). (Trunk lid is unlocked only).
  (1) Check the keyless entry control unit terminal voltage.
  (2) Check the harness.

NOTE: Perform this check when replacement of the transmitter and/or keyless entry control unit or faulty storage of cryptographic code has been made.

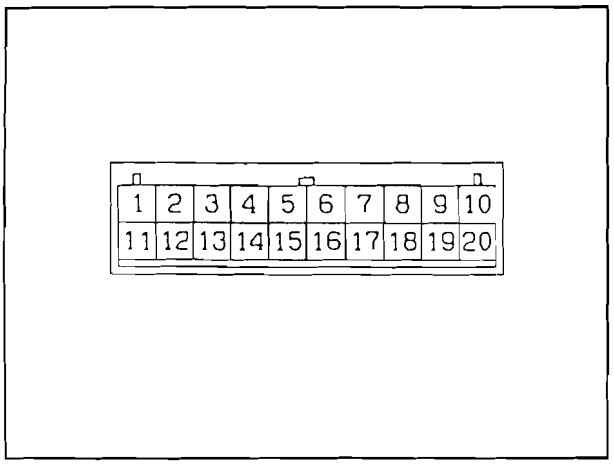


Fig. 15 – Control unit terminals

INSPECTION OF KEYLESS CONTROL UNIT

Disconnect the receiver and inspect the connector on the wire harness side as shown in the control unit terminal chart.

Terminal No.	Signal	Conditions		Terminal voltage
1	Key reminder switch	ON (Key removed)		0 Volts
		OFF (Key installed)		Battery voltage
2	Door switch	Door open (door switch ON)		0 Volts
		Door closed (door switch OFF)		Battery voltage
6	Door lock actuator (L.H.)	LOCK		5 V (*pulse output)
		UNLOCK		0 Volts
9	Keyless entry control unit power source	Ignition switch (ACC)		Battery positive voltage
10	Keyless entry control unit power source	Always		Battery positive voltage
11	Dome light	All doors (door switch: OFF)	Room lamp switch: OFF/ON	0 volts
			Room lamp switch: door	Battery voltage
12	Door lock output (all doors)	Operative		0 Volts
		Inoperative		Battery voltage
13	Door lock output (all doors)	Operative		0 Volts
		Inoperative		Battery voltage
14	Door unlock output (drivers side)	Operative		0 Volts
		Inoperative		Battery voltage
18	Trunk lid opener relay	ON		0 volts
		OFF		Battery voltage
20	Ground	–		0 volts

NOTE: * Measure by using an oscilloscope. When using a voltmeter 0-0.03 volts appear repeatedly.

Control unit terminal chart

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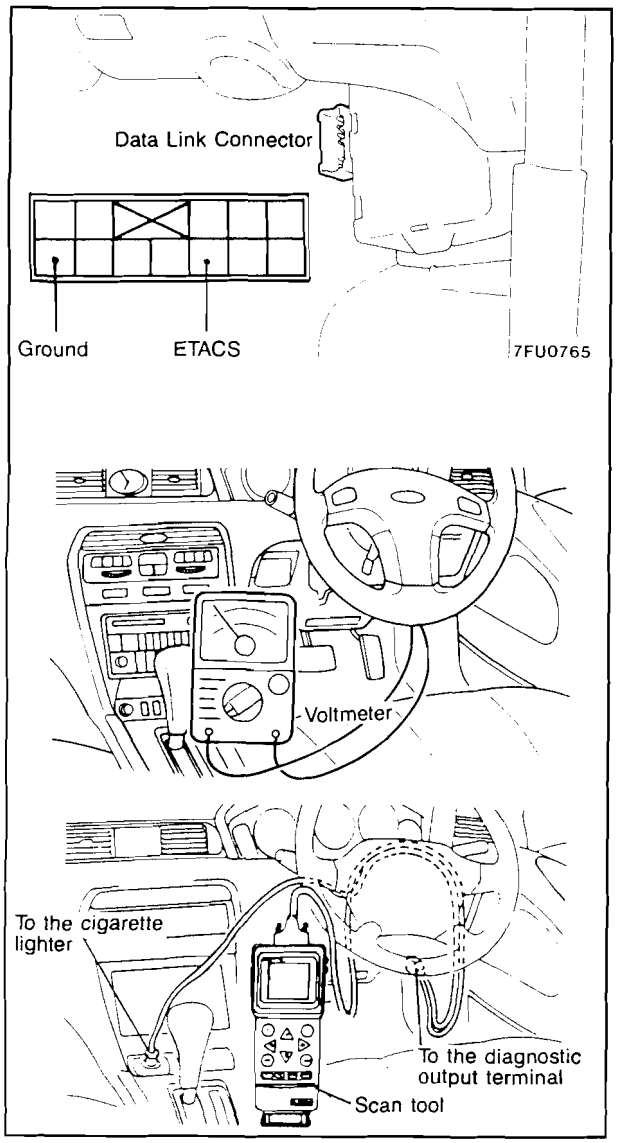


Fig. 16 – Input signal checking

INPUT SIGNAL
<From 1994 models>

Using the scan tool or voltmeter, check whether or not the input signals from each switch are being input to the ETACS unit.

(1) Connect the scan tool to the data link connector or connect the voltmeter between the ETACS terminal and the ground terminal.

Caution: The ignition switch should always be turned OFF when connecting and disconnecting the scan tool.

(2) Check if the buzzer of the scan tool sounds or the needle of the voltmeter moves when each switch noted below is operated.

If the buzzer sounds or the needle moves, the input signals are being input to the ETACS unit, so that switch can be considered to be functioning normally. If not, the switch or switch input circuit is faulty. Check the switch and the switch input circuit.

SECTION 13 — ELECTRIC MIRRORS

GENERAL INFORMATION

Mirror operation is controlled by means of a master switch, mounted in the centre console.

Each mirror assembly incorporates two motors one for vertical movements and one for horizontal movement. Changes of direction through a particular plane i.e. left/right, up/down is achieved by reversing motor polarity.

MIRROR TESTING

(1) Using a suitable tool (small screwdriver with tape wrapped around the tip), remove the inner delta cover cap.

(2) Remove the retaining screw and then remove the inner delta cover.

(3) Disconnect the harness to mirror connector.

(4) Apply battery voltage to the mirror as shown in the chart below and check that the mirrors operate as specified.

Terminal / Direction	10-2 connector type (F 1 2 3)		
	1	2	3
Up	+ve		-ve
Down	-ve		+ve
Left		+ve	-ve
Right		-ve	+ve

Chart — motor testing connections

(4) If the mirror does not operate as specified refer to Group 51 for removal and repair procedures.

MIRROR SWITCH

Removal

(1) Using a suitable lever, pry the switch assembly out of the console taking care not to damage the console.

(2) Disconnect the wiring from the switch and remove the switch from the vehicle.

Installation

Install by reversing the removal procedure.

Testing

Check that switch continuity is as specified in the chart below, if not replace the switch assembly.

Terminal / Direction	Left switch					Right switch				
	1	8	6	2	7	1	8	3		7
UP	O	O			O	O		O		O
DOWN	O		O		O	O		O		O
LEFT	O		O		O	O			O	O
RIGHT	O		O		O	O		O		O

3-24 type connector

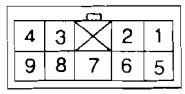


Chart — mirror switch continuity

SECTION 14 — ELECTRONIC TIME ALARM CONTROL SYSTEM (ETACS) SERVICE DIAGNOSIS

1. ARMING / DISARMING RELATIONSHIP

Condition	Possible Cause	Corrective Action
The system is not armed. (The SECURITY light doesn't illuminated, and the alarm doesn't function.) (The central door locking system functions normally.	Damaged or disconnected wiring of ECU power supply circuit	Replace the sub fusible link No. ① or the fuse No. ⑩ Repair the harness.
	Damaged or disconnected wiring of door switch input circuit	Repair the harness or replace the door switch.
The arming procedure are followed, but the SECURITY light does not illuminate. (There is an alarm, however, when an alarm test is conducted after about 20 seconds have passed.)	Damaged or disconnected wiring of SECURITY light activation circuit	Replace the fusible link No. ① or the fuse No. ⑩ Repair the harness.
	Blown SECURITY light bulb	Replace the bulb.
	Malfunction of the ECU.	Replace the ECU.
The alarm sounds in error when, while the eystem is armed, a door or the trunk lid is unlocked by using the key.	Damaged or disconnected wiring of a door or the trunk lid key cylinder switch input circuit.	Repair the harness or replace a door or the trunk lid key cylinder switch.
	Malfunction of a door or the trunk lid key cylinder switch.	
	Malfunction of the ECU.	Replace the ECU.

2. ACTIVATION / DEACTIVATION RELATIONSHIP

Condition	Possible Cause	Corrective Action
There is no alarm when, as an alarm test, a door is opened without using the key. (The arming and disarming are normal, and the alarm is activated when the trunk lid or hood is opened.)	Damaged or disconnected wiring of door switch (all doors) input circuit	Repair the harness or replace the door switch.
	Malfunction of the door switch	
	Malfunction of the ECU	Replace the ECU.
There is no alarm when, as an alarm test, the trunk lid is opened without using the key. (The alarm is activated, however, by opening a door or the hood.)	Damaged or disconnected wiring of luggage compartment lamp switch input circuit	Repair the harness or replace the luggage compartment lamp switch.
	Malfunction of the luggage compartment lamp switch.	
	Malfunction of the ECU	Replace the ECU.
There is no alarm when, as an alarm test the hood is opened from within the vehicle. (The alarm is activated, however, by opening a door or the trunk lid.)	Damaged or disconnected wiring of hood switch input circuit.	Repair the harness or replace the hood switch.
	Malfunction of the hood switch.	
	Malfunction of the ECU.	Replace the ECU.

Condition	Possible Cause	Corrective Action
Engine would not start.	Malfunction of the starter relay Damage or disconnected wiring of starter relay activation circuit	Repair the harness. Replace the starter relay. Replace the magnet switch.
	Malfunction of the ECU	Replace the ECU
When, as a test of the alarm, a door or the trunk lid is opened without using the key, or the hood is opened from within the vehicle, the horn and the theft-alarm horn sound but the turn signal lamps don't flash.	Damaged or disconnected wiring of hazard alarm power supply circuit or hazard alam activation circuit.	Repair the harness. Replace the fusible link ④ or the fuse ⑨ Replace the hazard alarm relay or the turn signal lamp
The turn signal lamps flash during an alarm test but the horn or the theft alarm horn does not sound.	Damaged or disconnected wiring of the theft-alarm horn relay power supply circuit or the theft-alarm horn activation circuit.	Repair the harness. Replace the horn. Replace dedicated fuse No. ⑨
	Malfunction of the ECU.	Replace the ECU.
The system is not deactivated when, during an alarm test in which the alarm is intenionally activated, the door or the trunk lid is unlocked by using the key. (The system also cannot be disarmed.)	Damaged or disconnected wiring of door or trunk lid key cylinder switch input circuit	Repair the harness. Replace the key cylinder switch.
	Malfunction of door or trunk lid key cylinder switch	
	Malfunction of the ECU	Replace the ECU.

ECU : ETACS unit

GENERAL INFORMATION

The ETAC system provides various timer and alarm facilities which provide improved operator convenience. The system is controlled through a centralised electronic control unit (ECU) located under the RHS of the instrument panel.

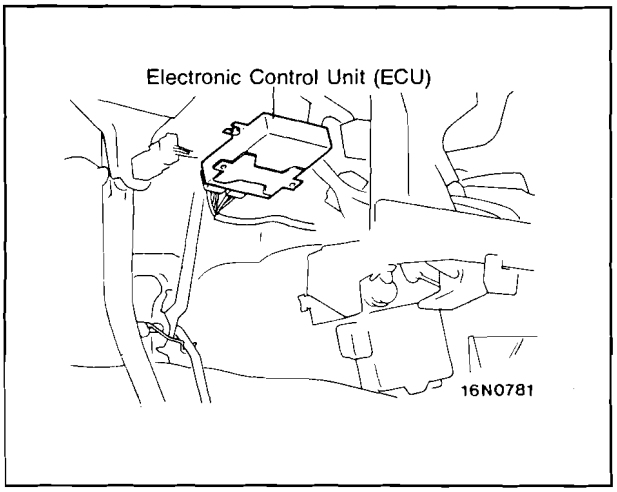


Fig. 1 — ECU location

The system also features a diagnosis ability which allows you to check the input signals received by the ETACS control unit. This check is performed at the diagnosis plug located near the fuse box on the drivers side of the cabin.

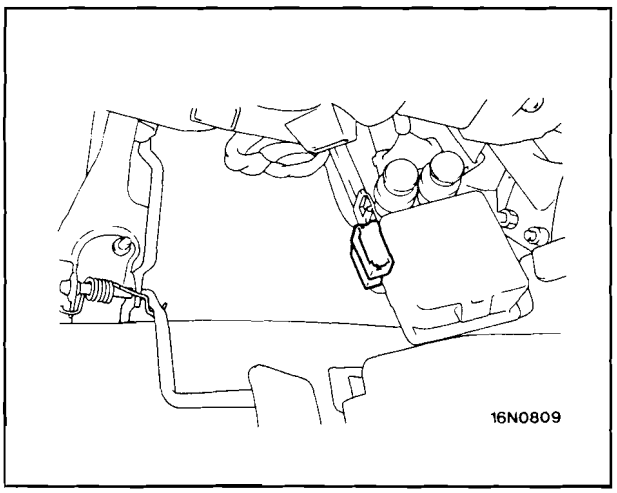


Fig. 2 — Diagnosis plug location

The features controlled by the ETACS are:
- Delayed interior lamp switching.
- Ignition switch illumination.
- Rear window defogger.
- Door lock prevention.
- Power window timer.
- Theft alarm.
- Central locking.

Each of these systems are connected to the ETACS control unit and when signalled by the appropriate switch, the control unit activates the circuit to achieve the desired control.

Delayed Interior Lamp Switching

When the doors are closed the switching OFF of the interior lamp is delayed by approximately six seconds, the lamp actually dims prior to switching OFF.

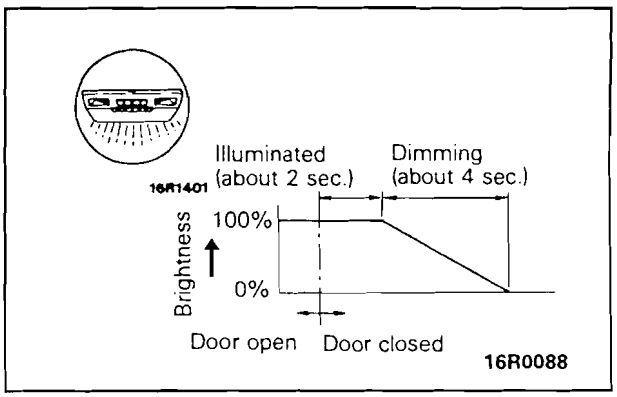


Fig. 3 — Interior lamp delay

Ignition Switch Illumination

The ignition switch illumination is controlled by the driver's door switch. The switch is illuminated when the door is open and switches OFF approximately 14 seconds after the door is closed.

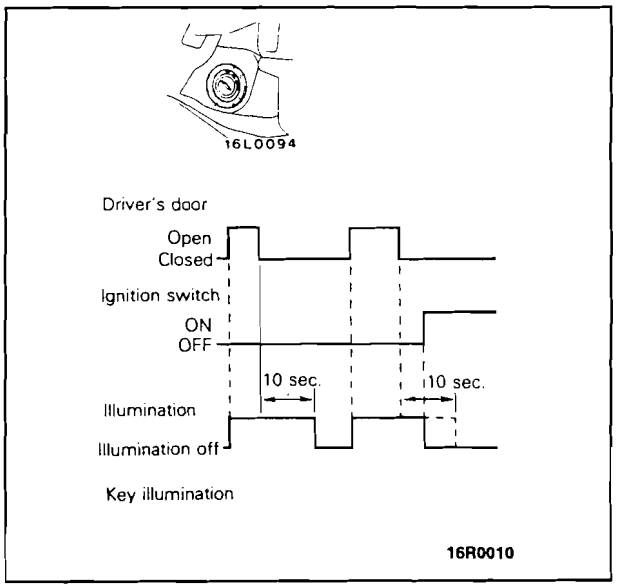


Fig. 4 — Ignition switch illumination

Rear Window Defogger

When the rear window defogger is turned ON it will operate for 20 minutes then switch OFF. In addition, when the switch is activated, an audible buzzer will sound.

Power Window Timer

The power windows can be operated for approximately 30 seconds after the ignition switch has been turned OFF. Additionally, if a door is opened within the 30 seconds, an additional 30 seconds delay is available. When the door is closed the delay is cancelled and the windows cannot be operated.

Door Lock Prevention

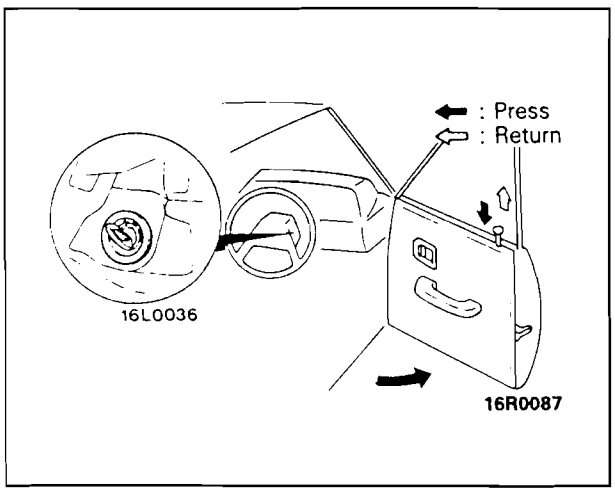


Fig. 5 — Door lock prevention

If the ignition key is left in the ignition switch, the central locking system will not lock if the vehicle is stationary. If either front door lock is activated in this condition, the locks will automatically be returned to the unlocked condition.

NOTE: The central door locking system can still be activated internally if the vehicle is moving.

Theft Alarm System

A theft alarm is incorporated into the ETACS system. When the alarm is activated, the hazard lamps flash, the horn sounds and the engine is inhibited from starting.

The alarm remains activated for 3 minutes and then resets.

NOTE: When the alarm resets, the engine remains inhibited from starting, until the system is deactivated.

Setting of the alarm is achieved by locking either of the front doors in the normal manner with or without the key.

The system will be armed after 20 seconds, this is confirmed by the security lamp on the instrument panel switching ON then going out.

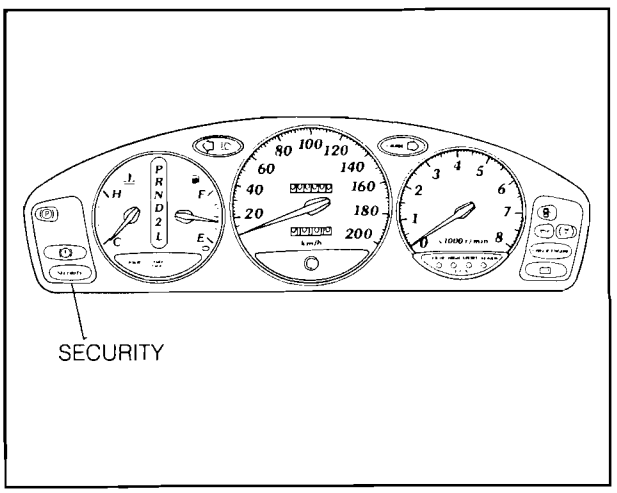


Fig. 7 — Security lamp

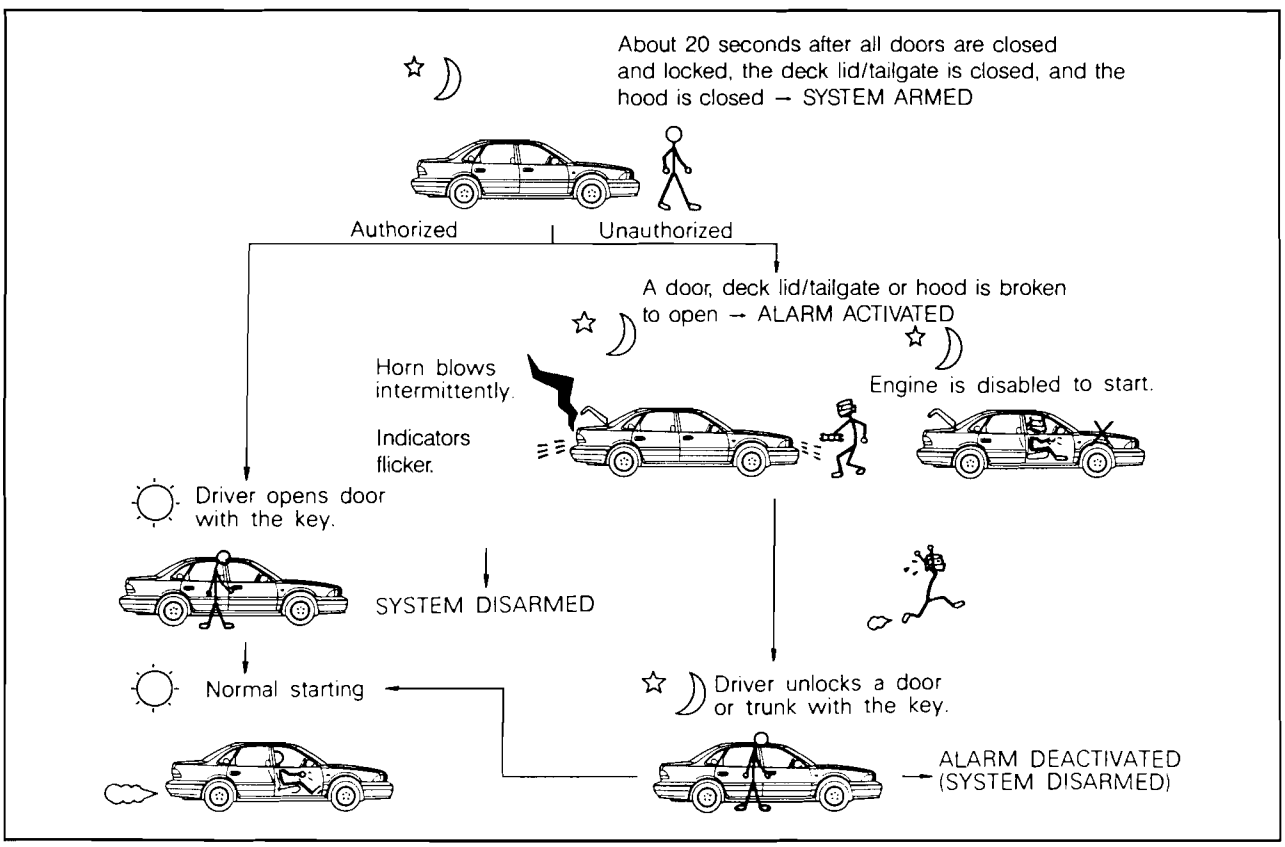


Fig. 6 — Theft alarm operation

NOTE: If a door is reopened within 20 seconds or a door is not properly closed when locking the vehicle, the alarm will not set properly.

When the alarm is set, access can still be gained to the luggage compartment by using the key, the alarm remains set after the compartment is closed and locked.

Activation of the alarm will result if any door or the engine hood, or the deck lid/tailgate is opened without using the key to unlock the vehicle.

Deactivating the alarm is achieved by unlocking with the key at either front door or tailgate.

FAULT DIAGNOSIS

When diagnosing and ETACS fault, the first thing to do is an input signal check as described, this will confirm if the ECU is receiving the input signal from the sensors

If an input signal fault is evident you can then check that system, the best place to start is at the ETACS control unit wiring plug and work your way back to the sensor.

If an input signal fault is not evident the problem is most probably associated with the component controlled by the ETACS system, i.e., power window relay, door lock relay etc. In this case it is still advisable to check the control unit plug wiring.

INPUT CHECK

The ETACS system has a diagnosis terminal located in the diagnosis plug located near the fuse box on the drivers side of the cabin.

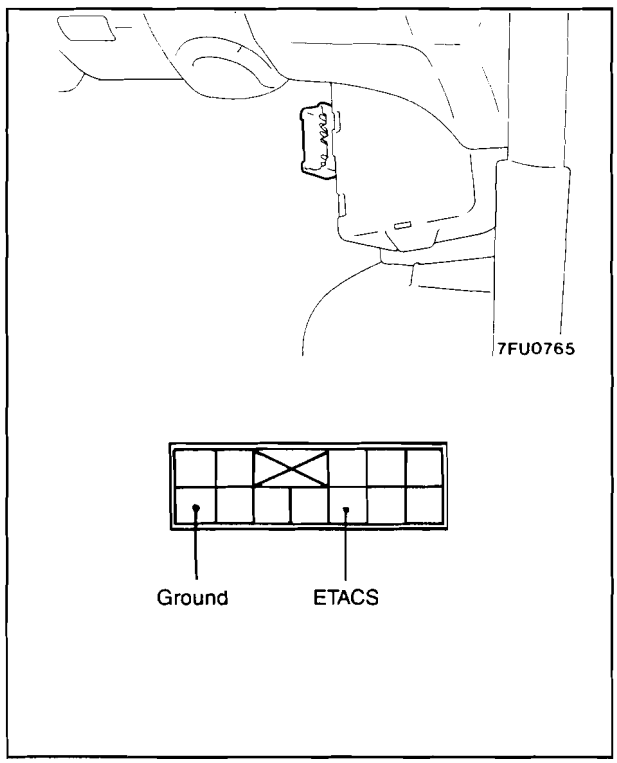


Fig. 8 — Diagnosis plug location

The input signal can be checked with:

- Voltmeter
- LED lamp
- Multi-Use-Tester (MUT)

NOTE: To check the input system the ignition switch must be OFF.

If a MUT is being used you must connect it to the battery terminals, then select the vehicle model, then any system, then select the Special Test followed by the Pulse Check.

If a voltmeter or LED is being used connect it to the ETACS terminal, refer fig 8, and ground terminal of the diagnosis connector.

To check the input signals you simply activate the switch/sensor of the ETACS system, if the system is functional, a voltage pulse will be available at the diagnosis terminal.

The following chart indicates the ETACS system switch/sensor that can be checked at the diagnosis plug and the number of voltage pulses for that sensor.

SWITCH/ SENSOR	CONDITION	NUMBER OF PULSES
Door/Tailgate Switch	Off-On	1
Front Door Trip Lock	Lock-Unlock	1
Front Door Key Lock	Lock-Unlock and Unlock-Lock	I
Deck Lid/ Tailgate	Lock-Unlock	I
Ignition Key	Key In-Key Out	1
Ignition Switch	On-Off	1
Rear Defogger	Off-On	1
Engine Hood Switch	Off-On	1
Vehicle Speed Sensor	Ignition On Rotate Speedo Drive	Flashing

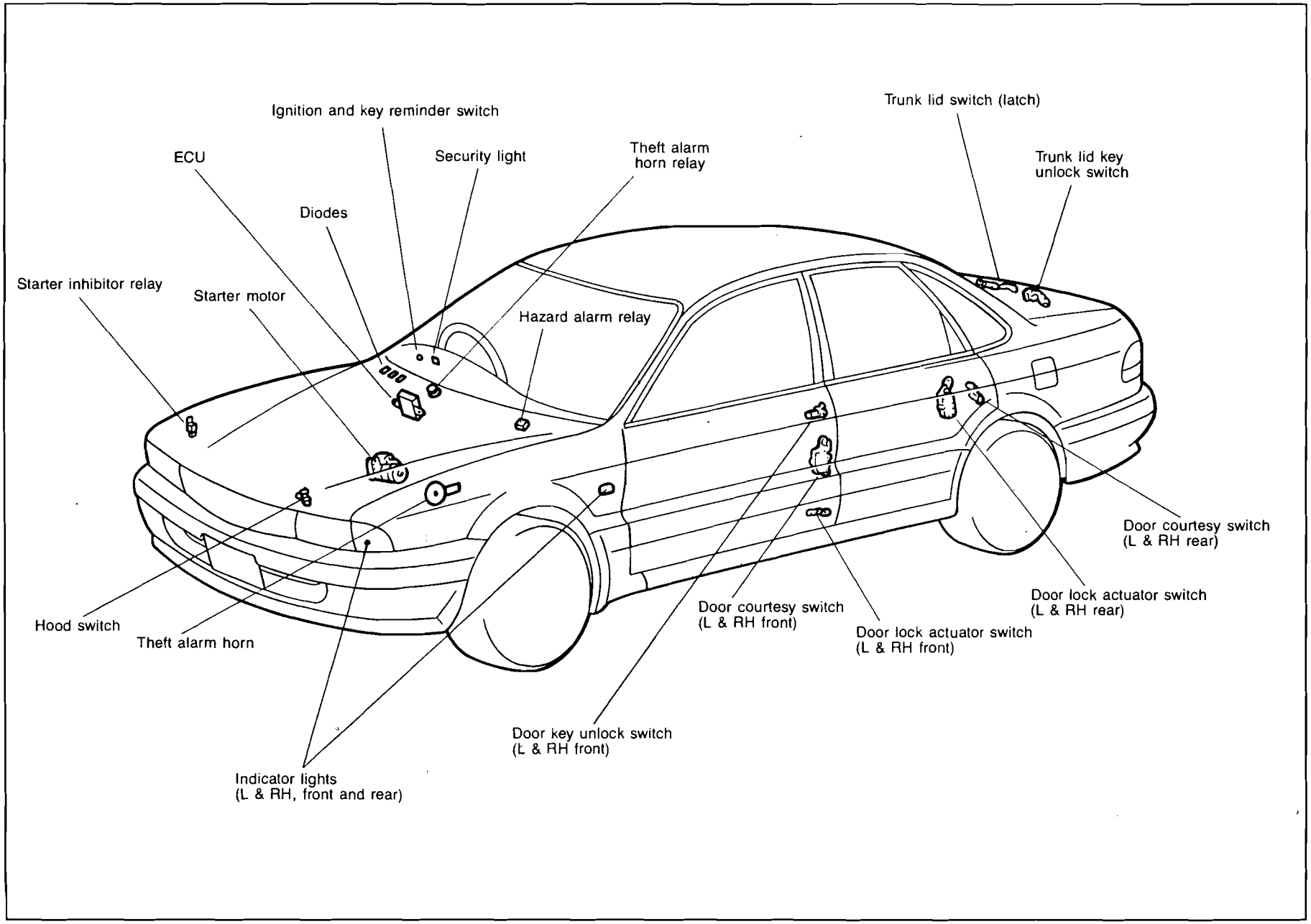


Fig. 9 — ETACS Component location (typical)

GROUP 55 — HEATER AND AIR CONDITIONING

SECTION 0 — INDEX

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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review the Workshop Manual and especially its Group 52B — Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE:

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents in Group 52B — Supplemental Restraint System (SRS).

Subject	Section Number	Page Number
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Airconditioning control unit		5
Power transistor		5

SECTION 1 — SERVICE DIAGNOSIS — HEATER

Condition	Possible Cause	Corrective Action
TEMPERATURE CANNOT BE REGULATED BY OPERATING THE TEMPERATURE CONTROL WIRE	Obstructed heater outlets.	Clear the obstruction from the heater outlets.
	Blend air dampers improperly adjusted or binding	Adjust and or free the dampers.
	Thermostat malfunction.	Replace the thermostat
	Obstructed heater hoses	Replace the heater hoses.
	Improperly adjusted control cables.	Adjust the control cables correctly.
	Plugged or partially plugged heater core.	Clean or replace the heater core.
NO VENTILATION WHEN MODE SELECTION KNOB IS OPERATED	Incorrect adjustment of the mode selection damper.	Adjust the mode selector wire.
	Incorrectly fitted duct.	Fit duct securely.
NOISY BLOWER MOTOR	Foreign matter inside blower.	Clean out blower housing.
	Blower motor or fan incorrectly balanced.	Replace blower motor or fan.
	Damaged blower.	Replace blower.
DUST ENTRY INTO VEHICLE THROUGH HEATER DUCTS	Incorrectly fitted duct.	Fit duct securely.
	Incorrect adjustment of recirculation/fresh air changeover damper.	Adjust the recirculation/fresh air change over cable.
BLOWER DOES NOT OPERATE ON ONE OF THE SPEED RANGES	Malfunction of blower switch.	Check for continuity between switch terminals. Replace switch.
	Damaged wiring between blower switch and blower resistor.	Repair the wiring.
	Malfunction of blower resistor.	Replace the blower resistor.
BLOWER DOES NOT OPERATE	Wiring harness short circuit indicated by burnt-out fuse.	Repair wiring harness and replace fuse.
	Broken wire between fuse block and heater relay.	Repair the wire.
	Heater relay malfunction.	Replace the relay.
	Malfunction of blower switch.	With ignition ON and blower switch connector disconnected, check for continuity between switch terminals. Replace blower switch if necessary.
	Broken wire or poor connection in wire between blower switch and motor.	With ignition ON and blower switch connector disconnected check for continuity in the wire from the blower switch to motor. Repair as necessary.
	Malfunction of blower resistor.	With ignition ON and blower switch connector disconnected check for continuity between resistor terminals. Replace resistor if necessary.

Condition	Possible Cause	Corrective Action
BLOWER DOES NOT OPERATE (CONT.)	Malfunction of blower motor.	With ignition ON and blower switch connector disconnected, check for continuity between blower motor terminals. Replace blower motor if necessary.
	Broken wire or poor connection to earth.	Repair the wire.

SECTION 2 — HEATER AND VENTILATORS

SPECIFICATIONS

Heater Unit	
Type	Three-way-flow full-air mix system
Heater Control Panel	
Blower switch resistance — kΩ	
— blower speed (min)	2 ± .2
— blower speed (max)	0.25

GENERAL INFORMATION

HEATER CONTROLS

The heater can be operated while the engine is running.

The heater performance is directly related to the temperature of the engine coolant, so operate the heater after the engine has had a chance to warm up. The amount of airflow can be regulated by adjusting the fan speed.

Operation of controls

1. Mode selection knob

— Air flows to the upper part of the passenger area (face position).

— Air flows to the upper part of the passenger compartment, and flows slightly to the leg area (foot/face position A).

— Air flows to the leg area and flows slightly to the upper area of the passenger compartment (foot/face position B).

— Air flows to the front and rear leg (where fitted) areas (foot position).

— Air flows to the front and rear leg (where fitted) areas, and windscreen and door windows (foot/defroster position).

— Air flows to the windscreen and the door windows (defroster position).

NOTE: At the foot position and foot/face position, a small amount of air will be directed to the windscreen and the door windows.

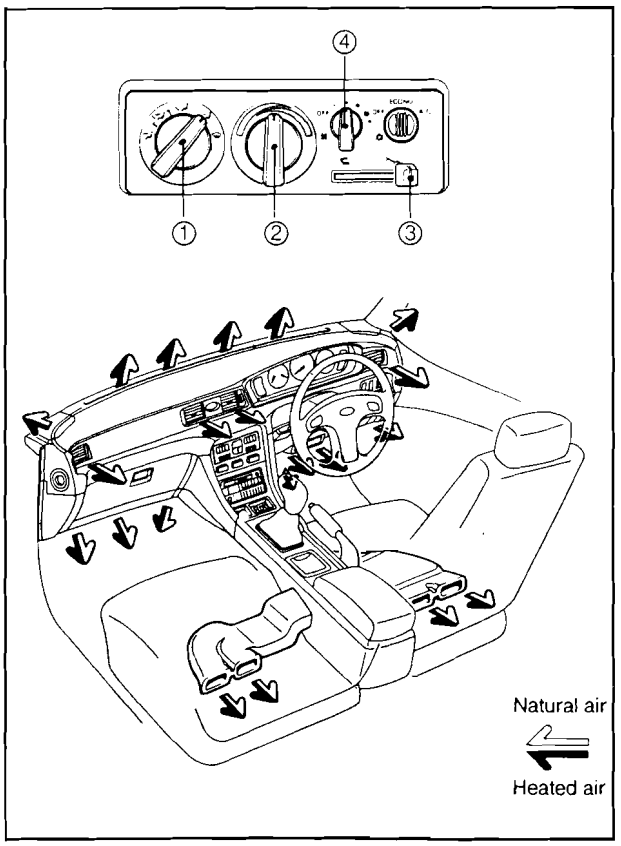


Fig. 1 — Heater operation

2. Temperature control knob

Rotate the knob to the right to increase the temperature.

3. Air selection lever

— (Outside position)
Outside air is introduced into the passenger compartment.

— (Recirculation position)
The inside air is recirculated. Select this position to keep the inside air free of dust or other contaminants from the outside air. However, the lever should only be left at this position for a short time.

NOTE: Especially during cold weather, the recirculation position should only be used for a short time in order to prevent the unnecessary formation of mist on the windows.

4. Fan Switch

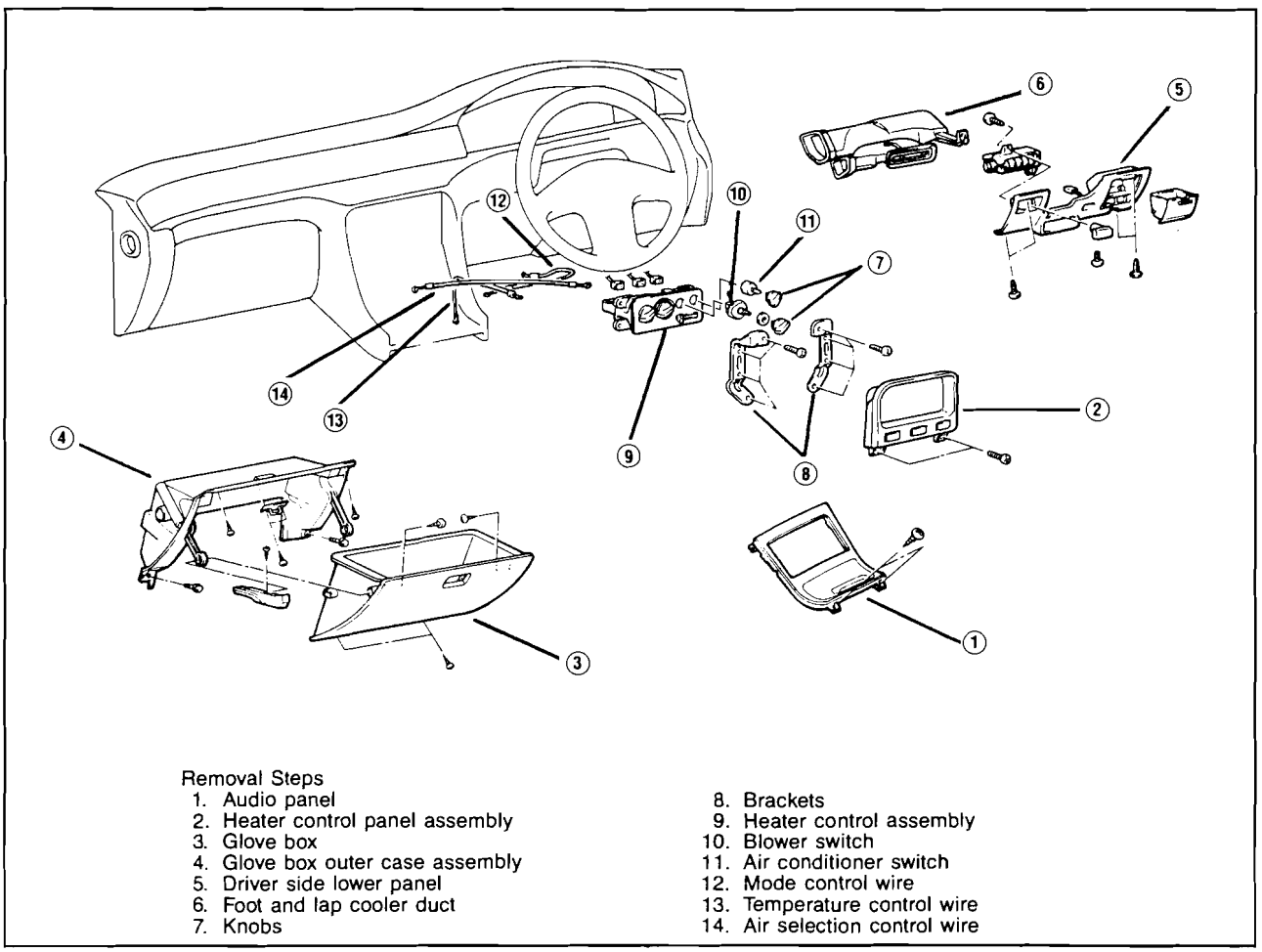
— Rotate to increase the air flow in four stages.

HEATER CONTROLS

NOTE: Pre-removal and post-installation operation removal and installation of floor console (refer Group 52).

Removal

(1) Remove audio panel garnish, refer to Group 52.
(2) Remove heater control garnish by removing the four self tapping screws (refer Fig. 12 Group 52).
(3) Remove glove box, refer to Group 52.
(4) Remove glove box outer case assembly, refer to Group 52.
(5) Disconnect the air selection control wire located on the front of the blower motor housing. Remove outer cable from retaining clip on housing and lift inner wire from selection lever (refer Fig. 3).
(6) Disconnect the temperature control wire attached to the front of the heater unit. Remove outer cable from retaining clip and lift inner wire from lever (refer Fig. 4).
(7) Remove driver side lower panel (refer to Group 52).



Removal Steps
1. Audio panel
2. Heater control panel assembly
3. Glove box
4. Glove box outer case assembly
5. Driver side lower panel
6. Foot and lap cooler duct
7. Knobs
8. Brackets
9. Heater control assembly
10. Blower switch
11. Air conditioner switch
12. Mode control wire
13. Temperature control wire
14. Air selection control wire

Fig. 2 — Heater control removal

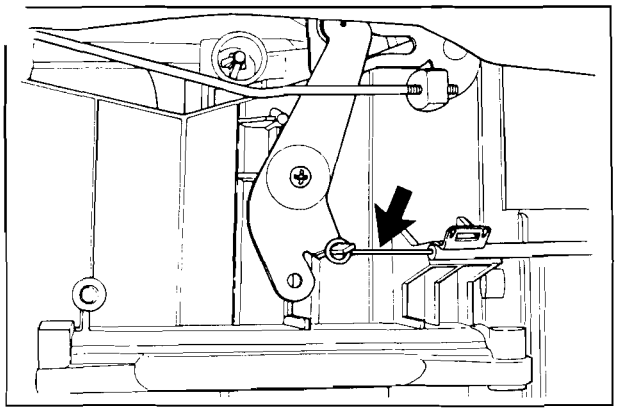


Fig. 3 — Air selection control wire

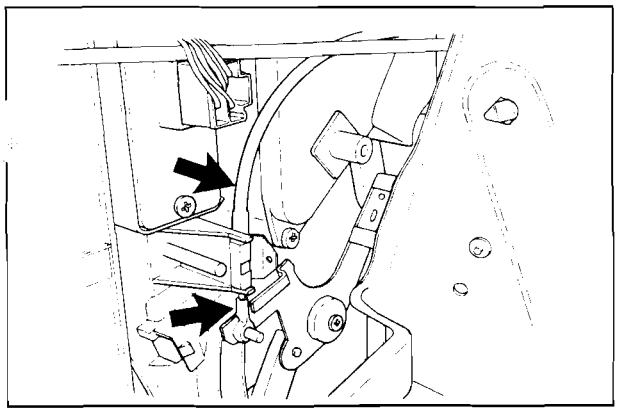


Fig. 4 — Temperature control wire

(8) Remove foot and lap cooler duct, refer to Group 52.

(9) Disconnect the mode control wire attached to the right hand side of the heater unit. Remove outer cable from retaining clip on unit, and lift inner wire from selection lever (refer Fig. 5).

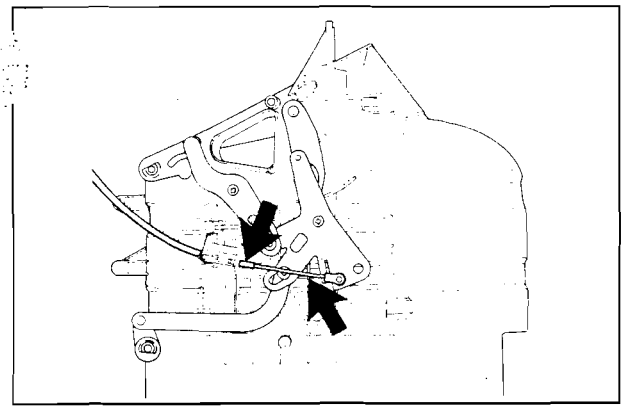


Fig. 5 — Mode control wire

(10) Pull out heater control knobs.

(11) Remove four self tapping screws to remove heater control panel from brackets.

(12) Heater control panel assembly can then be carefully pulled out.

(13) The blower and air conditioning switches can also be pulled out.

(14) To remove mode and temperature control wires, gently prise outer cables from retaining clips on control panel body and the inner wires will just lift off from the levers (see Fig. 6).

(15) To remove air selection control wire, gently prise outer cable out of retaining clip on control panel body and un-hook inner wire from control lever (see Fig. 6).

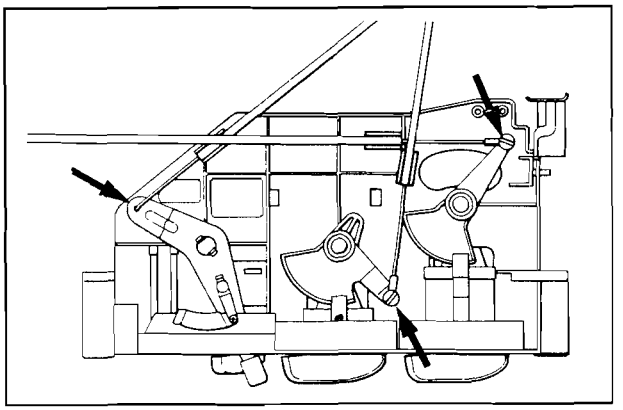


Fig. 6 — Heater control showing selector wires connected

Inspection

(1) Check control wires for ease of movement and attachment to the bracket.

(2) Check the bracket and levers for damage and deformation.

(3) Check the blower switch for continuity as outlined below:

- **"D" and "P" Line**

SWITCH POSITION \ TERMINAL	5	3	6	2	7	8	1	4
OFF								
• (LOW)	○—○					○—○		
• (MEDIUM FIRST STEP)	○—	—○				○—○		
● (MEDIUM SECOND STEP)	○—	—	—○			○—	—○	
● (HIGH)	○—	—	—	—○		○—	—○	

NOTE:
○—○ **Indicates that there is continuity between the terminals.**

Installation

Install by reversing the removal procedure noting the following:

(1) Apply multi purpose grease to the rotating and moving parts of each control lever.

(2) Adjust the control wires using the following procedures.

• Mode Selection Control Wire

(1) Move the mode selection lever to the position.

(2) With the mode selection damper lever pressed inward in the direction indicated by the arrow, connect the inner cable of the mode selection control wire to the end of the lever, and then secure the outer cable by using a clip.

(3) With the blower switch turned on, confirm the air discharge by moving the control lever through each position.

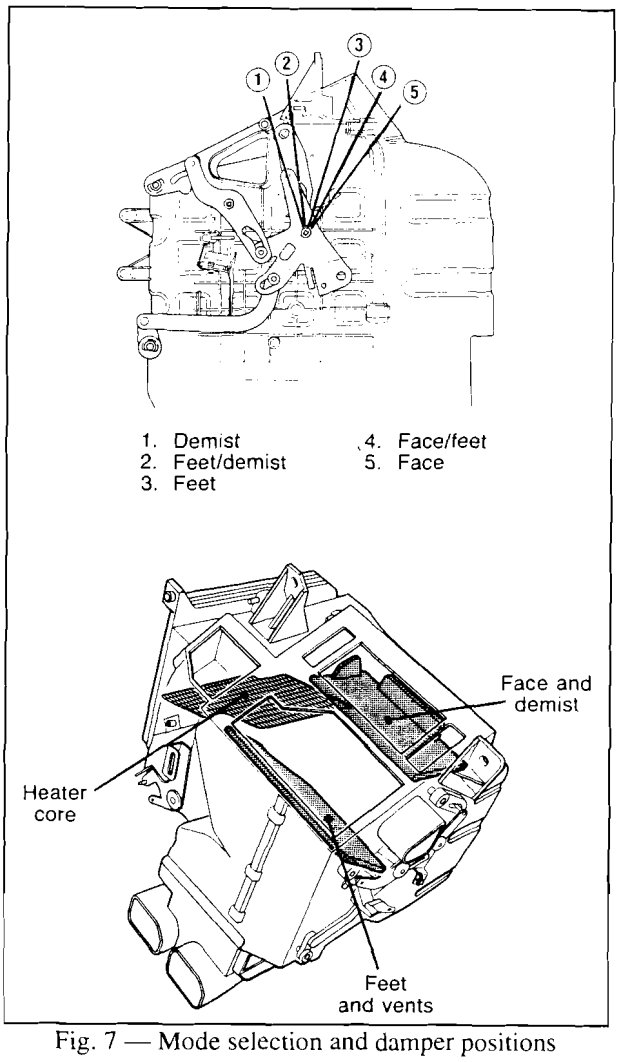


Fig. 7 — Mode selection and damper positions

• Air Selection Control Wire

(1) Move the air selection control lever to the recirculation position.

(2) With the air selection damper lever pressed inward in the direction indicated by the arrow, refer Fig. 8, connect the inner wire of the air selection control wire to the end of the air selection lever and then secure the outer cable by using a clip.

(3) Confirm that the damper operates properly by moving the control lever.

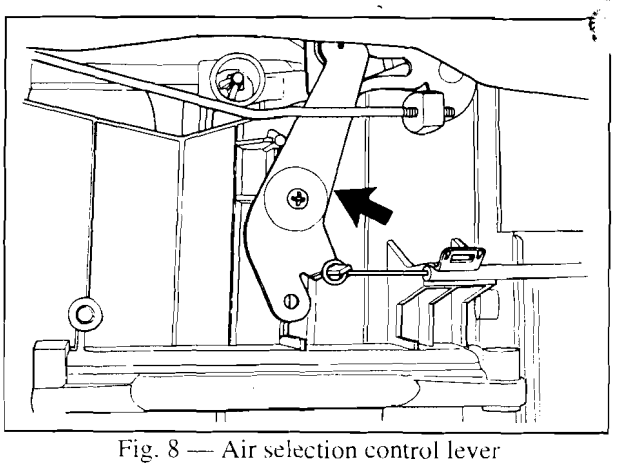


Fig. 8 — Air selection control lever

• Temperature Control Wire

(1) Move the temperature control lever to the left most position (cold position).

(2) With the blend air damper lever pressed completely upward in the direction indicated by the arrow, refer Fig. 9, connect the inner wire of the temperature control wire to the end of the lever and then secure the outer cable by using a clip.

(3) Cycle from cold to hot and back to check that there is full stroke.

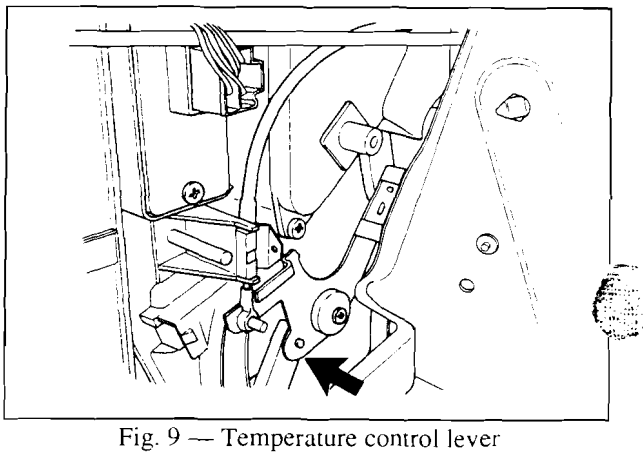


Fig. 9 — Temperature control lever

BLOWER MOTOR RESISTOR

Removal

(1) Remove glove box, refer Group 52.

(2) Remove glove box outer case assembly, refer Group 52.

(3) Un-couple the connector to the resistor, and remove the two retaining screws (refer to Fig. 10).

Inspection

Resistor Check

Using a circuit tester, measure the resistance between the terminals as indicated in adjoining chart.

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The condition can be considered satisfatory if the value measured at this time is equivalent to the standard value.

Standard Value

Terminals Measured	Standard Value Ω
Between terminals 1-2	Approx. 0.31
Between terminals 1-3	Approx. 0.87
Between terminals 1-4	Approx. 1.83

See Figure 11.

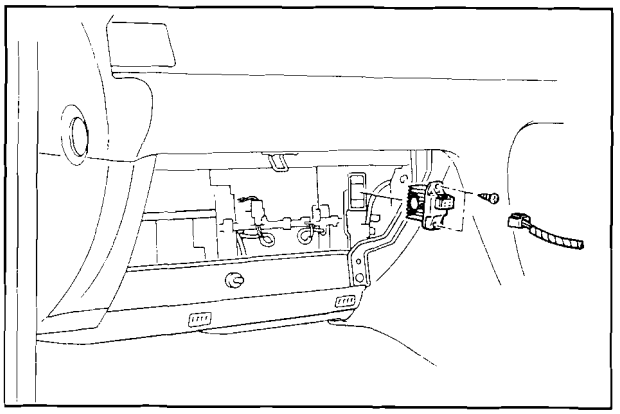


Fig. 10 — Resistor removal

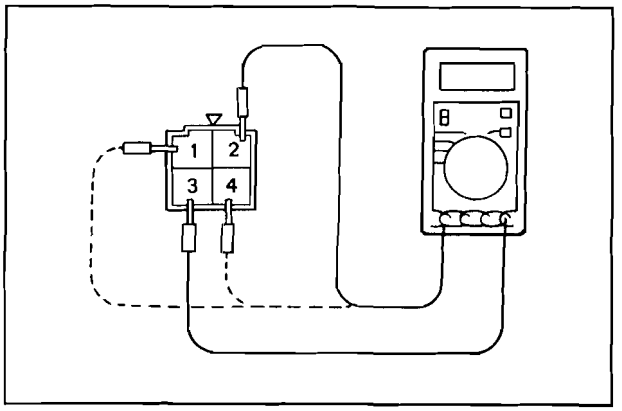


Fig. 11 — Resistor check

Installation

Install by reversing the removal procedures.

HEATER UNIT

NOTE: Pre-removal and Post-installation Operation. Drain and replenish the engine coolant (refer Group 14).

(1) Disconnect the cable from the negative terminal of the battery.
(2) Disconnect the heater hoses at the heater unit (refer Fig. 12).
(3) Remove LH and RH side console side covers (refer to Group 52).
(4) Remove the instrument panel (refer to Group 52).
(5) Remove the ducting attached to the heater unit.
(6) Remove the footrest on drivers side.
(7) Remove centre support bracket.
(8) Remove evaporator mounting bolt and nut.

NOTE: Vehicles with air conditioning only.

(9) Remove the retaining bolts and nuts and remove the heater unit (refer Fig. 13).

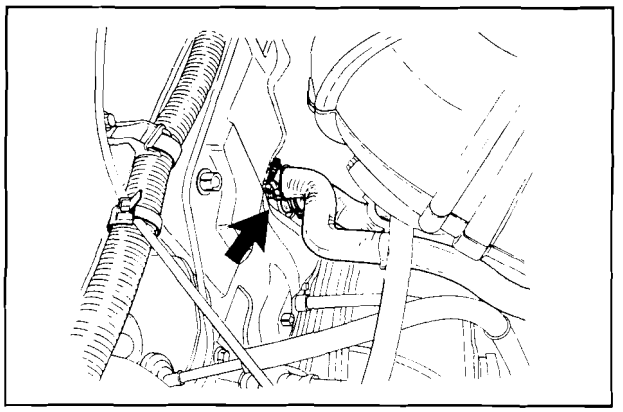


Fig. 12 — Heater hose removal

(10) If necessary to remove heater core, remove retaining plate by unfastening the three self tapping screws and the heater core can then be gently pulled out.

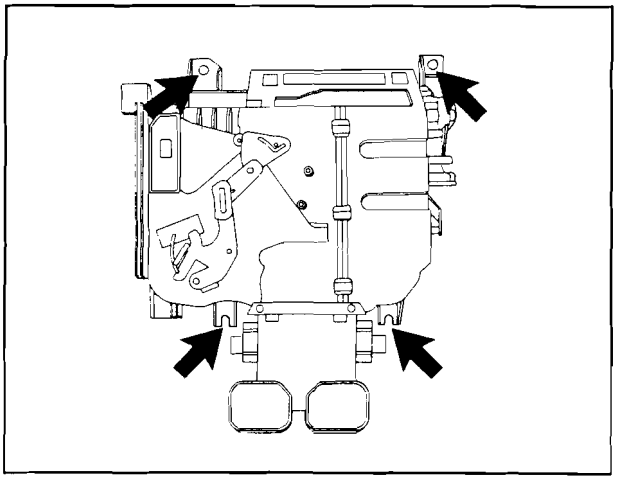
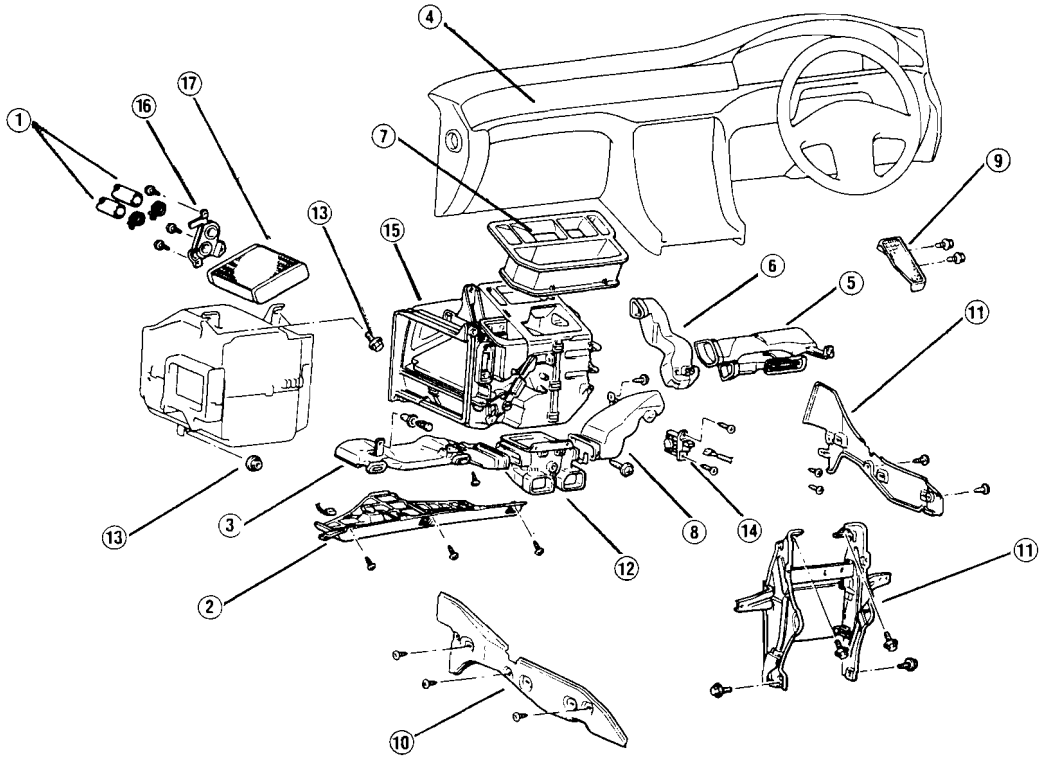


Fig. 13 — Heater unit mounting points

Inspection

(1) Check the dampers and link mechanism for ease of operation.
(2) Check the heater core for clogging or water leakage.



Removal Steps
1. Connection of water hoses
2. Passenger side under cover
3. Foot cooler duct (LH)
4. Instrument panel
5. Foot and lap cooler duct
6. Lap cooler duct A
7. Centre duct
8. Foot cooler duct (RH)
9. Foot rest
10. Side covers
11. Centre stay assembly
12. Distribution duct
13. Evaporator mounting bolt and nut (Vehicles with air conditioner)
14. Resistor
15. Heater unit
16. Plate
17. Heater core

Fig. 14 — Heater unit and components

Installation

Installation is a reversal of the removal procedure noting the following:

(1) Install each hose securely.

(2) Check for water leakage after the engine coolant has been replenished.

(3) Confirm that the air flow is correct after the control wires have been connected.

BLOWER ASSEMBLY

(1) Remove glovebox (refer to Group 52).

(2) Remove glovebox outer case assembly (refer to Group 52).

(3) Remove passenger side under dash cover.

(4) Remove foot and lap cooler duct.

(5) Remove metal support bar (refer to Group 52).

(6) Remove evaporator mounting bolt and nut (only vehicles with air conditioning).

(7) Remove joint duct on vehicles without air conditioning.

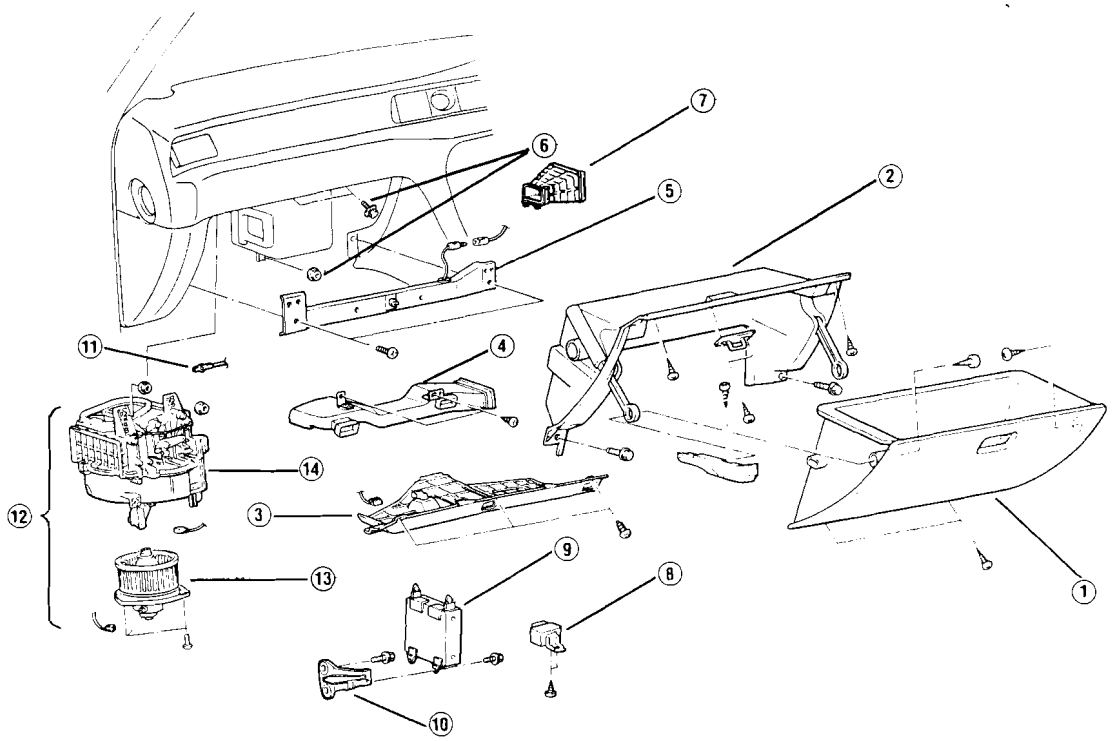
(8) The MPI control relay and MPI control unit should also be removed from vehicles with MPI fitted.

(9) Remove the LH lower instrument panel bracket.

(10) Disconnect the air selection control wire.

(11) The blower assembly can then be taken out by removing the retaining bolts and nuts (refer Fig. 16).

NOTE: The blower assembly can be dismantled for inspection if necessary.



Removal steps of blower case assembly
1. Glove box
2. Glove box outer case assembly
3. Passenger side under dash cover
4. Foot and lap cooler duct
5. Glove box frame
6. Evaporator mounting bolt and nut (Vehicles with air conditioner)
7. Joint duct (Vehicles without air conditioners)
8. MPI control relay (MPI)
9. MPI control unit (MPI)
10. Instrument panel lower bracket (LH)
11. Connection of the air-selection wire
12. Blower assembly
13. Blower motor assembly
14. Blower case assembly

Fig. 15 — Blower assembly components

Inspection

(1) Check for bending or abnormal deflection of the rotating shaft of the blower motor assembly.

(2) Check for cracking or deterioration of the packing.

(3) Check for damage to the fan.

(4) Check for damage to the blower case.

(5) Check the operation of the inside/outside air-selection damper, and for damage.

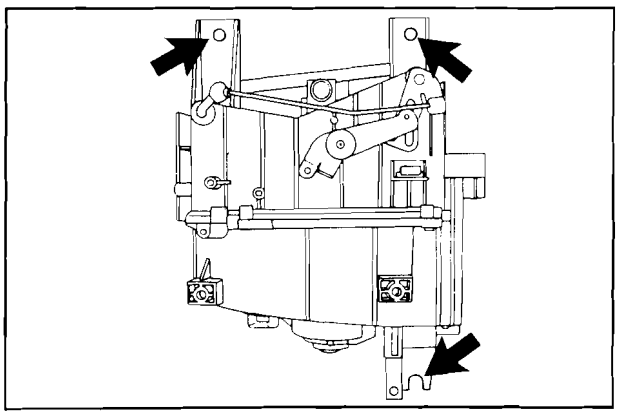


Fig. 16 — Blower assembly mounting points

Blower Motor Assembly Check

(1) Disconnect the blower motor terminals.

(2) Connect the blower motor terminals directly to the battery and check that the blower motor operates smoothly.

(3) Next, reverse the polarity and check that the blower motor operates smoothly in the reverse direction. Refer Fig. 17.

Installation

Installation is a reversal of the removal procedure noting the following:

(1) Before installing the blower motor assembly, carefully clean away any dust, dirt, etc., adhering to the inner surface of the blower case.

(2) Ensure the air selection control wire is correctly adjusted as described earlier in this section.

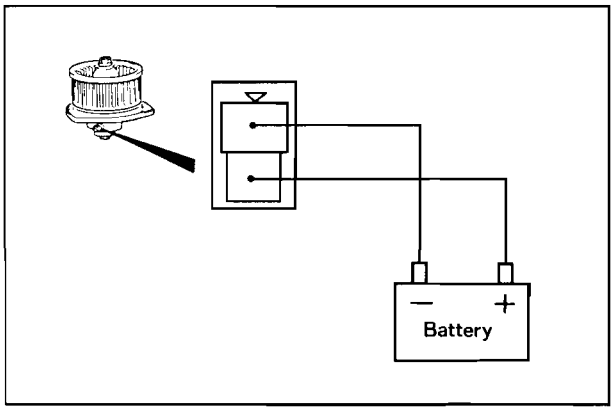


Fig. 17 — Blower motor assembly check

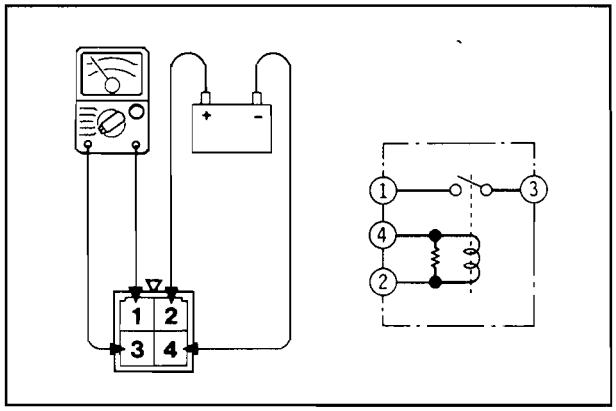


Fig. 19 — Blower motor relay terminals

BLOWER MOTOR RELAY

Removal

(1) To remove the blower motor relay, gently pull it out from the junction box (refer Fig. 18).

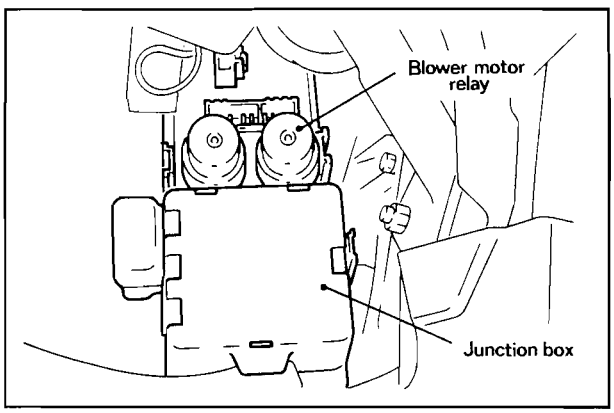


Fig. 18 — Blower motor relay location

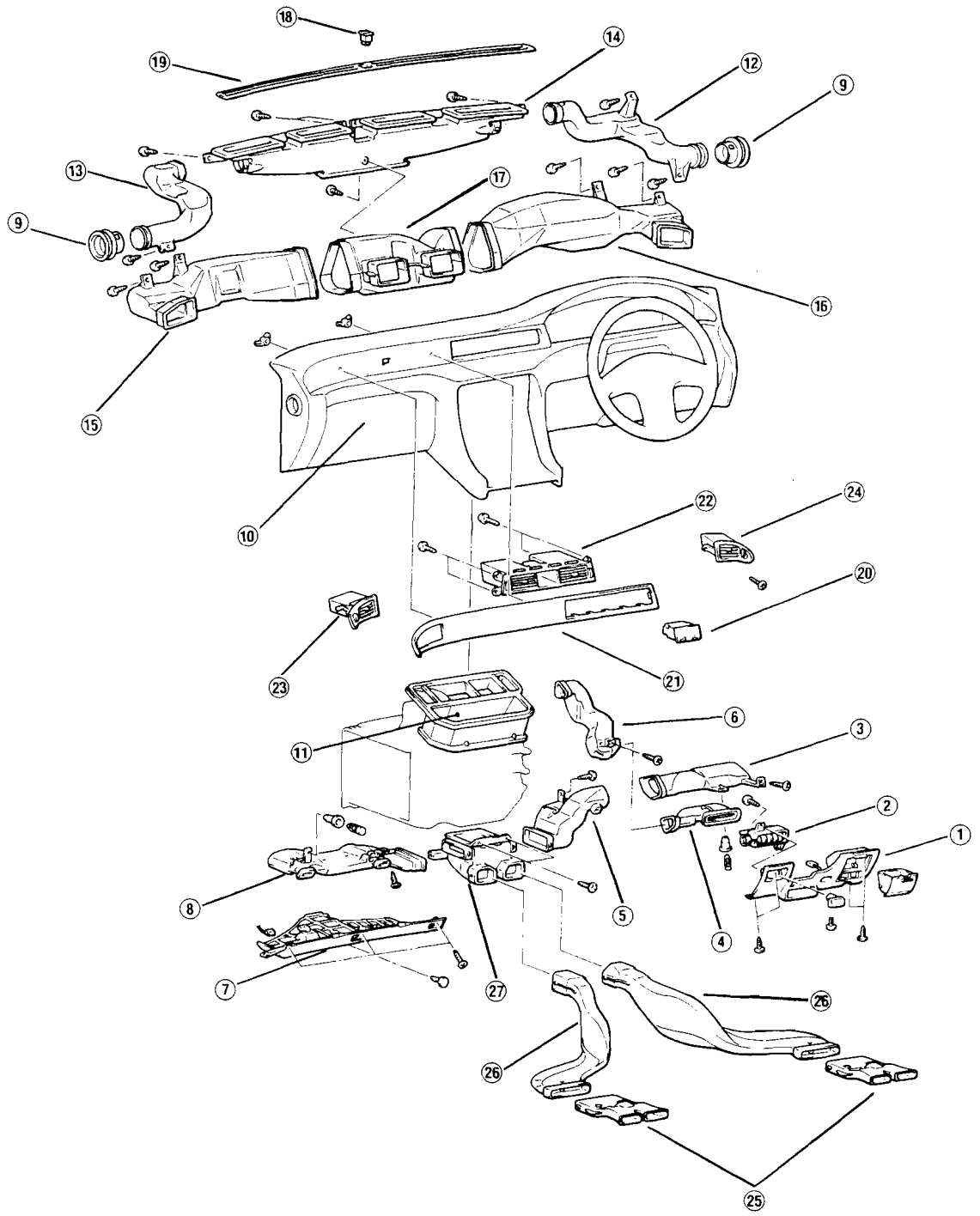
Inspection

(2) Inspect the continuity between the terminals when battery power is applied to terminal 2 and terminal 4 is earthed, or when there is no current flowing.

Current	Between Terminals 1 and 3	Continuity
No Current	Between Terminals 1 and 3	No Continuity
	Between Terminals 2 and 4	Continuity

Installation

Installation is a reversal of the removal procedure.



Removal Steps

1. Drivers side lower panel
2. Lap cooler grille assembly
3. Foot cooler nozzle
4. Lap cooler duct B
5. Foot Cooler duct (RH)
6. Lap cooler duct A
7. Passenger side under cover
8. Foot cooler duct (LH)
9. Defroster hose grommet
10. Instrument panel
11. Centre duct
12. Side defroster hose (RH)
13. Side defroster hose (LH)
14. Defroster nozzle
15. Side ventilation duct (LH)
16. Side ventilation duct (RH)
17. Distribution duct
18. Photo sensor or plug
19. Defroster garnish
20. Clock or plug
21. Instrument panel garnish
22. Centre outlet assembly
23. Side outlet assembly (LH)
24. Side outlet assembly (RH)
25. Rear heater nozzles
26. Rear heater ducts
27. Distribution duct (foot)

Fig. 20 — Ventilators

VENTILATORS

Removal

NOTE: (Post removal operation)

(1) Remove the front seats (refer to Group 52).
(2) Remove the floor console (refer to Group 52).
(3) Remove the front scuff plates and cowl side trims and then pull up the carpet (refer to Group 52) for removal procedures.

Removal

(1) Remove drivers side lower panel (refer to Group 52).
(2) Remove lap cooler grille assembly from panel if necessary.
(3) Remove foot cooler nozzle and lap cooler duct (B) as one piece. They can be separated by removing the pin if necessary.
(4) Remove foot cooler duct from right hand side.
(5) Remove lap cooler duct (A).
(6) Remove passenger side undercover.
(7) Remove passenger side foot cooler duct.
(8) Remove passenger and drivers side defroster hose grommets.
(9) Remove instrument panel (refer to Group 52) for removal procedure.
(10) Remove centre duct once instrument panel is removed.
(11) The left hand and right hand side defroster hoses, the defroster nozzle, the side ventilation ducts, and the distribution duct are all affixed to the instrument panel and can only be removed when the instrument panel has been taken out and carefully placed on a work bench or similar. All ducts etc. are held in place by retaining screws which can easily be removed as necessary.
(12) The photo sensor or plug depending on vehicle options and the defroster garnish can be carefully prised from the instrument panel, taking extra care to ensure no damage is done.
(13) Remove the clock or blanking plug, instrument panel garnish, centre outlet assembly and left hand side outlet assembly by removing the screw at the right side of the garnish and the two wing nuts at the rear of the garnish. Then gently pry from the right side until garnish and outlets can be lifted out as an assembly.

NOTE: If clock is fitted, loom must be disconnected before removal, and care must be taken during removal so as not to crack garnish or locating lug at left side of garnish.

This procedure can be carried out whilst the instrument panel and ducting are still in the car if necessary. This is done by removing the passenger side defroster hose grommet and removing the screw from the defroster hose, and gently pulling it out of the way to enable removal of the wing nuts. Care must be taken not to pull it out of the defroster nozzle however, to complete removal carry out procedure listed above.
(14) Remove right hand side outlet assembly by removing screw and pulling out from instrument panel, once again taking care not to damage the locating lug on the right side of the assembly.

NOTE: The garnish can be removed from the outlet assembly if necessary.

(15) Remove left hand side and right hand side rear heater nozzles, by separating from rear heater ducts.
(16) Remove rear heater ducts by pulling away from the distribution duct.
(17) To remove the distribution duct from the heater unit, remove the two self tapping screws from the front of the unit. Then gently push back and downwards to free from the two clips at the rear of the unit.

Installation

Installation is a reversal of the removal procedure.

INLET GARNISH (engine compartment)

Removal

(1) Remove the wiper arms (refer to Group 51).

(2) Remove the left hand and right hand side air inlet grilles by removing the seven screw clips as described in Group 51. See Fig. 21 of this Section for location.

(3) Remove the inlet garnish by gently levering it out from position.

(4) If necessary, to remove the air intake guide carry out the removal procedure for the blower assembly. Then with the intake guide exposed push in the clips at the top of the guide with a screwdriver or similar and it should then pull out (refer Fig. 22).

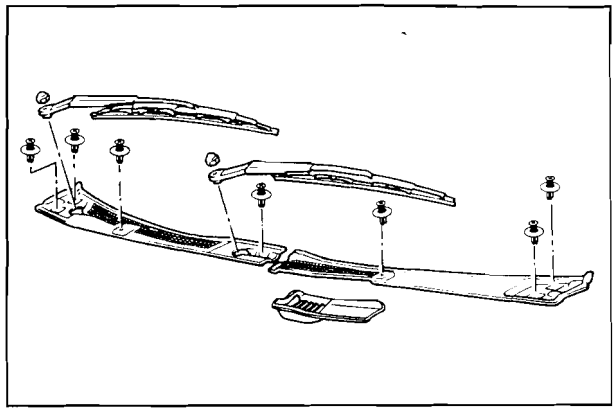


Fig. 21 — Inlet grilles and garnish

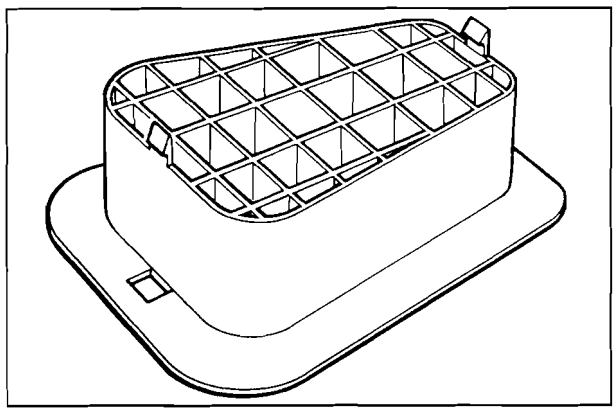


Fig. 22 — Air intake guide

Installation

Installation is a reversal of the removal procedure.

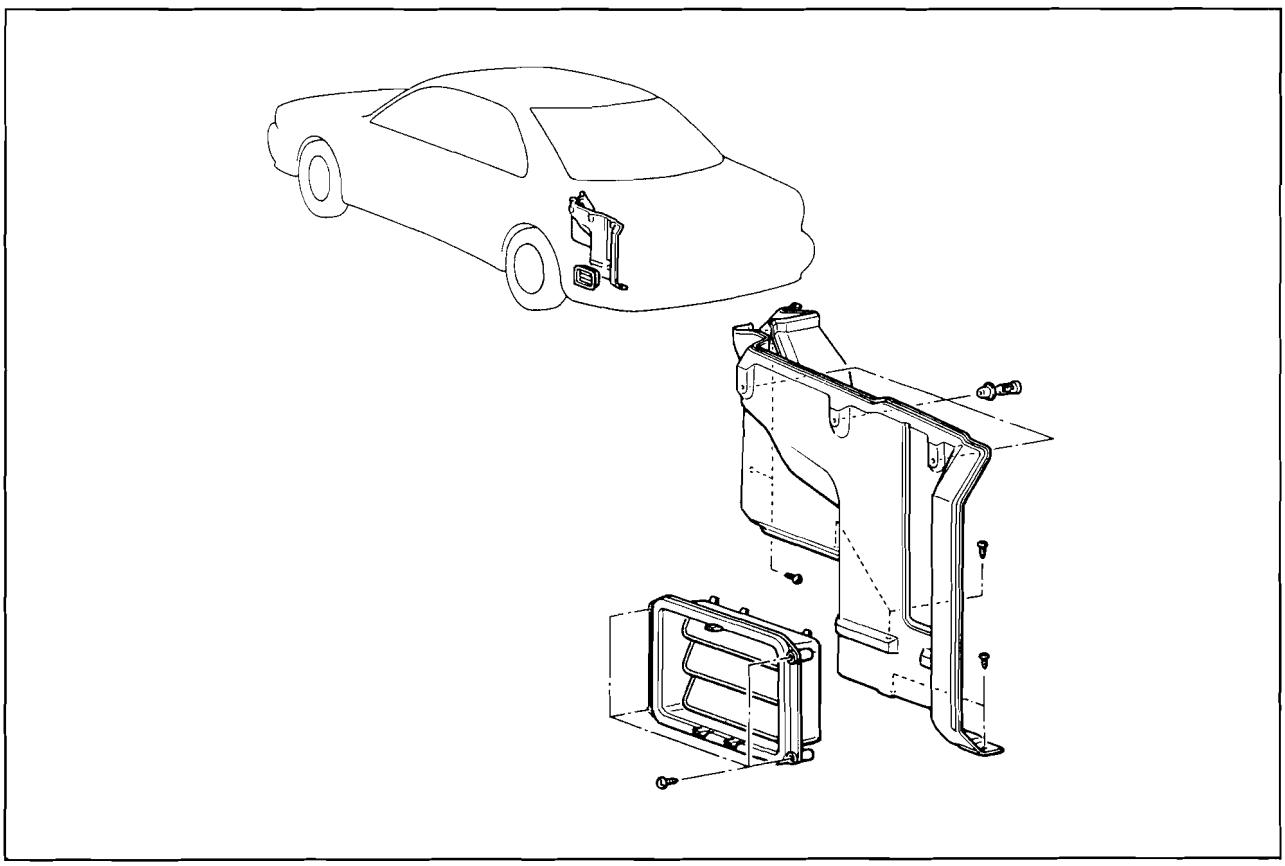


Fig. 23 — Rear ventilation ducts and locations

REAR VENTILATION DUCTS

Removal

(1) Remove rear bumper bar (refer Group 51) for removal procedure.

(2) Remove left hand side trunk trim by removing retaining screws and clips shown in Fig. 23.

(3) Remove rear ventilation duct assembly by removing the four self tapping screws which are located on the outside of the vehicle and unit. By carefully pushing the three locating tabs inwards the duct can then be pulled from its position from the inside of the trunk. The three rubber flaps in the duct assembly can be replaced if necessary.

(4) Remove the rear ventilation duct by firstly removing the garnish which is held in by one self tapping screw. The duct itself is held in by double sided tape and a retaining lug at the bottom and can be removed by lifting and pulling out.

SECTION 3 — SERVICE DIAGNOSIS — AIR CONDITIONING

Condition	Possible Cause	Corrective Action
COMPRESSOR ROTATING CORRECTLY		
DISCHARGE AND SUCTION PRESSURES HIGH Poor air flow across condensor.	Blocked condenser fins.	Remove blockages.
	Inoperative radiator/condenser fan.	Repair or replace the fans, fan motors, fuses or relays as necessay.
No bubbles in sight glass when condenser is cooled with water.	Excess refrigerant.	Discharge the excess refrigerant, ensuring you abide by your State Government legislation regarding ozone protection.
Discharge pressure drops to about 200 kPa quickly, when compressor is stopped.	Air in the system.	Evacuate and re-charge the system, ensuring you abide by your State Government legislation regarding ozone protection.
Suction hose fittings are abnormally cold.	Heat sensing tube dislodged from evaporative outlet tube.	Re-install the heat sensing tube.
	Expansion valve seized in the open position.	Replace the expansion valve.
DISCHARGE AND SUCTION PRESSURES LOW Bubbles are observed in sight glass.	Insufficient refrigerant.	Repair refrigerant leak if necessary an evacuate and recharge the system, ensuring you abide by your State Government legislation regarding ozone protection.
DISCHARGE PRESSURE IS LOW AND SUCTION SHOWS A VACUUM Frost or dew forms on the expansion valve and nearby piping.	Expansion valve blocked.	Remove the expansion valve and blow out the blockage with compressed air. If blockage cannot be removed, replace the expansion valve.
	Heat sensing tube leaking.	Replace the expansion valve.
DISCHARGE PRESSURE IS LOW AND SUCTION PRESSURE IS HIGH Both discharge and suction pressures tend to equalise. Compressor may be noisy.	Corroded or broken reed valves in compressor.	Replace the compressor.
DISCHARGE AND SUCTION PRESSURES VARY The discharge pressure varies between normal and low, suction pressure varies between normal and vacuum.	Moisture in the system.	Replace the receiver drier.
TEMPERATURE OF AIR FROM OUTLET VENTS IS A LITTLE HIGH (DISCHARGE AND SUCTION PRESSURES ARE NORMAL)	Heater controls not adjusted correctly.	Adjust heater controls. correctly.
	Thermostat defective.	Replace the thermostat.

Condition	Possible Cause	Corrective Action
COMPRESSOR NOT ROTATING CORRECTLY		
CLUTCH PRESSURE PLATE DOES NOT ROTATE The pressure plate is attracted to the stator.	Seized compressor.	Replace the compressor.
	Drive belt broken or missing.	Replace and adjust the drive belt.
	Drive belt slipping.	Adjust the drive belt to the correct tension.
The pressure plate is not attracted to the stator.	Stator malfunction.	Repair or replace the stator wiring, relays, fuses etc. as necessary.
THE PRESSURE PLATE ROTATES BUT SLIPS The pressure plate is attracted to the stator.	Excessive clearance between the pressure plate and rotor.	Adjust the clearance.
	Oil on pressure plate and rotor friction surfaces.	Clean the friction surfaces.
GENERAL		
INSUFFICIENT OR NO AIR FLOW FROM OUTLET VENTS The blower operates on all fan speeds.	Blocked inlet to blower assembly.	Remove the blockage.
The blower operates on certain fan speeds only.	Defective blower switch.	Replace blower switch.
	Defective blower resistor.	Replace the blower resistor.
The blower does not operate.	Defective blower switch.	Replace the blower switch.
	Defective blower resistor.	Replace the blower resistor.
	Blower malfunction.	Repair or replace the blower motor, wiring, fuse etc, as necessary.
NOISE APPEARS WHEN AIR CONDITIONER ONLY IS OPERATING Noise appears to originate from inside compressor.	Broken reed valves or worn bearings in compressor.	Replace the compressor.
Rattling noise appears to originate from clutch.	Worn Clutch bearing.	Replace the clutch bearing.
Scraping noise appears to originate from clutch.	Clutch slipping.	Rectify as described earlier.
NOISE APPEARS AT ALL TIMES Rattling noise appears to originate from compressor area.	Worn idle pulley bearing.	Replace idle pulley.
	Loose compressor or mounting bracket bolt.	Re-tension bolts.

SECTION 4 — AIR CONDITIONING

SPECIFICATIONS

Manufacturer		Nippondenso
Compressor	— model	10PA17C
	— type	10 cylinder swash plate
	— displacement	177 ml/rev.
	— valve type	Reed
	— refrigerant oil for R12	140 ml (Nippondenso 6 or equiv.)
	— refrigerant oil for R134a	140 ml (Nippondenso 8 or equiv.)
Clutch	— type	dry single disc magnetic
	— power consumption	40W
	— clearance	0.5 ± 0.15 mm
Condenser	— type	Dual pass aluminium fin and modine tube
Condenser fan	— type	Axial flow (behind radiator)
	— power consumption	120W
Evaporator	— type	Single pass aluminium fin and modine tube
Expansion valve	— type	Internally equalised
Refrigerant and quality		R12 750 to 800 grams
		R134a 750 to 800 grams

SPECIAL TOOLS

An approved evacuation, charging and recovery unit Torque wrench (and adaptors suitable for torquing refrigerant fittings)
A suitable leak detector
Thermometer
Safety goggles
Cooling system pressure test set
Clutch pressure plate puller
External circlip pliers

TORQUE SPECIFICATIONS

	Nm
Compressor bracket mounting bolts	40 to 55
Compressor mounting bolts	25 to 30
Clutch pressure plate retaining nut	15 to 17
Refrigerant fittings — threaded type (8 mm liquid)	13 to 15
(1/2" discharge)	20 to 25
(3/8" suction)	30 to 35
— bolted type (all)	20 to 30

SAFETY PRECAUTIONS <VEHICLES USING R-12>

R-12 refrigerant is a chloroflouro-carbon (CFC) that can contribute to The depletion of the ozone layer in the upper atmosphere.

Ozone filters out harmful radiation from the sun.To assist in protecting the ozone layer Mitsubishi Motors Australia Ltd. recommends that an approved R-12 refrigerant recycling device be used.

Contact an automotive service equipment supplier for refrigerant recycling equipment that is available in your area.

The refrigerant used in all air conditioners is (R-12). It is transparent and colourless in both the liquid and vapour state Since it has a boiling point of – 29.8°C at atmospheric pressure, it will be a vapour at all normal temperatures and pressures. The vapour is heavier than air, non-flammable and non-explosive It is non-poisonous except when it is in direct contact with an open flame. It is non-corrosive except when combined with water. The following precautions must be observed when handling R-12.

CAUTION: Wear safely goggles when servicing the refrigeration system.

R-12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes.

Always wear safety goggles when servicing the refrigeration part of the air conditioning system. Keep a bottle of sterile mineral oil handy when working on the refrigeration system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out. R-12 is rapidly absorbed by the oil.

Next splash the eyes with plenty of cold water. Call your doctor immediately even though irritation has ceased after treatment

CAUTION: Do not heat R-12 above 52°C (125.6° F).

Do not heat the refrigerant container with a blow torch or any other means that would raise temperature and pressure above this temperature.

Do not weld of steam clean on or near the system components or refrigerant lines.

CAUTION: Keep R-12 containers upright when charging the system.

When metering R-12 into the refrigeration system keep the supply tank in an upright position. If the refrigerant container is on it's side or upside down, liquid refrigerant will enter the system and damage the compressor.

CAUTION: Always work in a well ventilated room.

Good ventilation is vital in the working area. Although R-12 vapour is normally non-poisonous, contact with an open name can cause the vapour to become very poisonous A poisonous gas is produced when using the flame-type leak detector. Avoid inhaling the fumes from the leak detector

CAUTION: Do not allow liquid refrigerant to touch bright metal.

Refrigerant will tarnish bright metal and chrome surfaces and in combination with moisture can severely corrode all metal surfaces.

SAFETY PRECAUTIONS <VEHICLES USING R134a>

Because R-134a refrigerant is a hydrofluorocarbon (HFC) which contains hydrogen atoms in place of chlorine atoms. it will not cause damage to the ozone layer.

Ozone filters out harmful radiation from the sun. To assist in protecting the ozone layer, Mitsubishi Motors Australia Ltd recommends an R-134a refrigerant recycling device.

Refrigerant R-134a is transparent and colourless in both the liquid and vapour state. Since it has a boiling point of –29.8°C at atmospheric pressure, it will be a vapour at all normal temperatures and pressures. The vapour is heavier than air, non-flammable and nonexplosive. The following precautions must be observed when handling R-134a.

CAUTION: Wear safety goggles when servicing the refrigeration system.

R-134a evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes. Always wear safety goggles when servicing the refrigeration part of the A/C system. Keep a bottle of sterile mineral oil handy when working on the refrigeration system. Should any liquid refrigerant get in the eyes, use a few drops of mineral oil to wash them out.R-134a is rapidly absorbed by the oil. Next splash the eyes with plenty of cold water. Call your doctor immediately even though irritation has ceased after treatment.

CAUTION: Do not heat R-134a above 40°C

In most instances, moderate heat is required to bring the pressure of the refrigerant in its container above the pressure of the system when charging or

adding refrigerant. A bucket or large pan of hot water not over 40°C is all the heat required for this purpose.

Do not heat the refrigerant container with a blow torch or any other means that would raise temperature and pressure above this temperature. Do not weld or steam clean on or near the system components or refrigerant lines.

CAUTION: Keep R-134a containers upright when charging the system.

When metering R-134a into the refrigeration system keep the supply tank or cans in an upright position. If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor.

CAUTION:

1. The leak detector for R-134a should be used to check for refrigerant gas leaks.

2. Do not allow liquid refrigerant to touch bright metal.

Refrigerant will tarnish bright metal and chrome surfaces and in combination with moisture can severely corrode all metal surfaces.

SERVICE ADJUSTMENT PROCEDURES

Test Procedures

Sight Glass Refrigerant Level Test R12

The sight glass is a refrigerant level indicator. To check the refrigerant level, clean the sight glass and start the vehicle engine operate the air conditioner switch to engage the compressor, place the blower switch to high and move the temperature control lever to (max cool). After operating for a few minutes in this manner, check the sight glass.

(1) If the sight glass is clear, the magnetic clutch is engaged, the compressor discharge line is warm and the compressor inlet line is cool; the system has a full charge.

(2) If the sight glass is clear, the magnetic clutch is engaged and there is no significant temperature difference between compressor inlet and discharge lines, the system has lost some refrigerant.

(3) If the sight glass shows foam or bubbles, the system could be low on charge. The system has to be recharged with refrigerant.

Sight Glass Refrigerant Level Test R134a

(1) Set the following conditions:

Item	Condition
Doors	Completely Open
Temperature Setting	Maximum Cooling
Blower Speed	HI
Recirculation/fresh Air Change	Fresh Air
Engine Speed	1500rpm
A/C	ON

NOTE: If the ambient temperature is more than 40°C, and the high pressure side is more than 19kgf/cm² check the A/C system by running the vehicle at idle speed. If the pressures are still more than 19kgf/cm² place the vehicles in cool place and set the blower speed to LO.

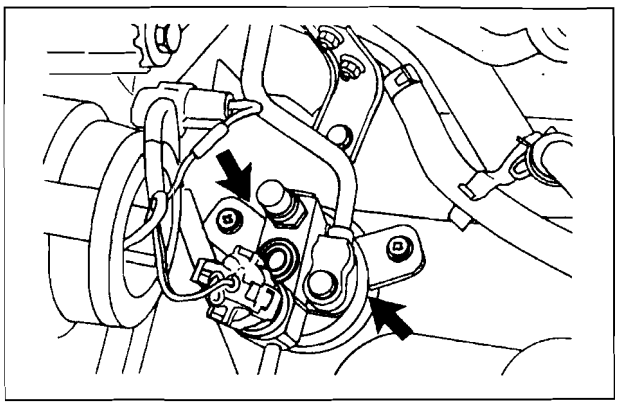
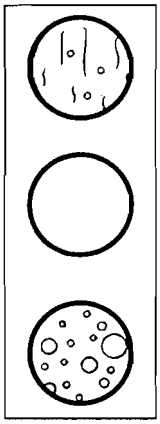


Fig. 1 — Sight glass location

(2) When the above conditions are met, use the sight glass to check the condition of the refrigerant which is circulating in the cycle.



Appropriate quantity — there are no visible bubbles.

Excessive quantity — there are no visible bubbles inside the flow. In this case, however, the high and low pressures will both be high, so the cooling will be inadequate.

Insufficient refrigerant — there are bubbles visible inside the flow (Bubbles are continuously flowing by).

Magnetic Clutch

(1) Disconnect the wiring to the magnetic clutch.

(2) Connect battery (+) voltage directly to the wiring for the magnetic clutch.

(3) If the magnetic clutch is normal, there will be a "click". If the pulley and armature do not make contact "click" there is a malfunction.

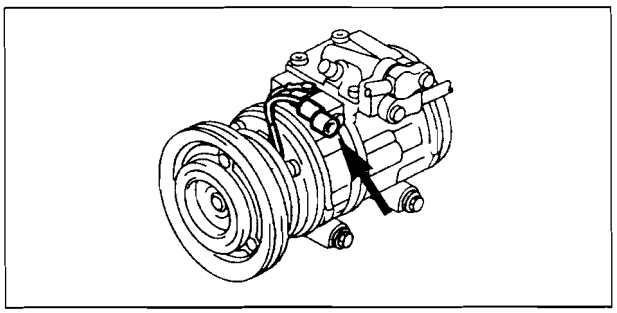


Fig. 2 — Magnetic clutch wiring

Receiver Drier

To test the receiver drier

(1) Operate the unit and check the piping temperature by touching the receiver drier outlet and inlet.

(2) If there is a difference in the temperatures, the receiver drier is restricted.

(3) Replace the receiver drier.

Dual Pressure Switch (Hi-Lo Switch)

(1) Turn back the adaptor valve handle all the way

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and install it to the low pressure side service valve.

(2) With the gauge manifold low pressure service valves closed, connect the gauge manifold high pressure side charging hose to the adaptor valve.

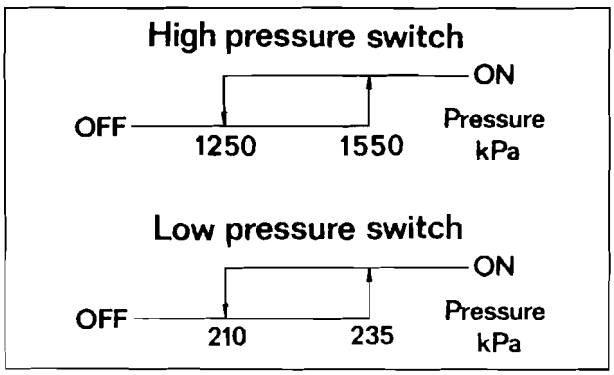


Fig. 3 — Dual pressure switch test

(3) Tighten the adaptor valve handle and open the service valve.

(4) If there is continuity between the dual pressure switch terminals when the pressure is at the level of switch ON (refer Fig. 3) the switch is functioning normally, if not, replace the switch.

EVACUATION AND CHARGING PROCEDURES

For the evacuation, charging or recovery of the air conditioning system, check with your State Government Department for procedures that do not contravene any laws put in place to help reduce ozone depletion.

Legislation is being passed in various States regarding the release of Chloro Flouro Carbons (CFC's) to atmosphere. Therefore a CFC recovery unit will be required to contain spent gases if the air conditioning hoses are disconnected.

This means only a specially trained, accredited technician can carry out maintenance on air conditioning systems.

CAUTION: Do not mix R134a and R12 refrigerant test equipment. Gauge manifold and hoses could contain oil which will contaminate and damage the system .

REFILLING OF OIL IN THE AIR CONDITIONER SYSTEM

Too little oil will provide inadequate compressor lubrication and cause oil compressor failure. Too much oil will increase discharge air temperature.

When a 10PA17C compressor is installed at the factory, it contains 140 mls of refrigerant oil. While the air conditioning system is in operation, the oil is carried through the entire system by the refrigerant.

Some of this oil will be trapped and retained in various parts of the system.

When the following system components are replaced, it is necessary to add oil to the system to replace the oil being removed with the component.

(1) Condenser — 8 ml
(2) Evaporator — 72 ml
(3) Piping — 10 ml
(4) Receiver drier— 7 ml

CAUTION: R134a and R12 refrigerant charged systems, require different oil, refer specifications.

PERFORMANCE TEST

(1) Park the vehicle in an area which is not exposed to direct sunlight.

(2) Connect a tachometer.

(3) Turn back the adaptor valve handle all the way and install the adaptor valves to the high pressure and low pressure service valves.

(4) Connect the gauge manifold to the adaptor valves.

(5) Tighten the adaptor valve handle and open the service valves.

(6) Start the engine.

(7) Set the controls to the air conditioner as follow:
- Air conditioning switch: ON position.
- Mode Selection: Face position.
- Temperature Control: Max. cooling position.
- Air Selection: Recirculation position
- Blower Switch: Hi (fast) position.

(8) Adjust engine speed to 1000 RPM with air conditioner clutch engaged.

(9) Engine should be warmed up with doors and windows closed and hood open.

(10)Insert a thermometer in the centre air conditioner outlet and operate the engine for approximately 20 minutes.

(11)Note the discharge air temperature. Refer to the Performance Temperature Chart (Fig. 4).

NOTE: If the clutch cycles, take the reading before the clutch disengages.

REFRIGERANT LEAK REPAIR PROCEDURE

Lost Charge

If the system has lost all charge due to a leak.

(1) Evacuate the system.

(2) Charge the system with approximately 200 grams of refrigerant.

(3) Check for leaks.

(4) Discharge the system.

(5) Repair leaks.

(6) Replace receiver drier.

Workshop ambient temperature °C	21	27	32	38	43
Discharge air temperature °C	0.0-4.0	0.0-4.0	0.0-0.4	0.0-5.0	0.0-5.0
Compressor discharge pressure kPa	780-890	900-1050	1000-1150	1300-1420	1500-1550
Compressor suction pressure kPa	110-140	100-150	90-150	100-170	100-170

Fig. 4 — Performance temperature chart

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CAUTION: Replacement filter-drier units must be sealed while in storage. The drier used in these units will saturate water quickly upon exposure to the atmosphere. When installing The drier, have all tools and supplies ready for quick reassembly to avoid keeping the system open any longer than necessary.

(7) Evacuate and charge the system.

NOTE: Ensure that you are aware of and abide by, your State Government Legislation regarding the use or refrigerant gas (R-12) and the servicing and maintenance of air conditioning systems.

HANDLING TUBING AND FITTINGS

Kinks in the refrigerant tubing or sharp bends in The refrigerant hose lines will greatly reduce the capacity of the entire system High pressures are produced in the system when it is operating.

Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement or lines or components.

The following precautions must be observed.

(1) The system must be completely discharged before opening any filling or connection in the refrigeration system.

(2) Open fittings with caution even after the system has been discharged. If any pressure is noticed as a fitting is loosened, allow trapped pressure to bleed off very slowly.

(3) Never attempt to rebend formed lines to fit. Use the correct line for the installation you are servicing.

(4) A good rule for the flexible hose lines is to keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant.

(5) The flexible hose lines should be routed so that they are at least 80 mm from the exhaust manifold. It is good practice to inspect all flexible hose lines every service to make sure they are in good condition and properly routed.

(6) For the plumbing connections with "O" rings.

NOTE: The "O" rings are not re-usable.

COMPRESSOR NOISE

When investigating an air conditioning related noise, you must first know the conditions when the noise occurs. These conditions are:

(1) the weather conditions,
(2) the vehicle speed,
(3) the gear selected, first or neutral etc,
(4) the engine temperature,
(5) or any other special conditions.

Incorrect air conditioning belt tension can be responsible for misleading noises when the compressor is engaged and little or no noise when the compressor is disengaged.

Drive belts are speed sensitive. That is, at different engine speeds and depending upon belt tension, belts can develop unusual noises that are often mistaken for mechanical problems within the compressor.

Noise Check Procedure

(1) Select a quiet area for testing. Duplicate conditions as much as possible. Switch compressor on and Off several times to clearly identify compressor noise.

To duplicate high ambient conditions (high head pressure)restrict air flow through the condenser.

Install the manifold gauge set to make sure discharge pressure doesn't exceed 2070 kPa.

(2) Tighten all compressor mounting bolts, clutch mounting bolt and compressor drive belt. Check to assure the clutch coil is tight (no rotation or wobble).

(3) Check refrigerant hoses for rubbing or interference that can cause unusual noises.

(4) Check refrigerant charge.

(5) Recheck the compressor noise as in Step 1.

(6) If noise still exist, loosen compressor mounting bolts and retorque. Repeat Step 1.

(7) If noise continues, replace compressor and repeat step 1.

ENGINE COOLANT, TEMPERATURE SWITCH CHECK (For Radiator Fan)

(1) Dip the engine coolant temperature switch into warm water up to the screw section, as shown in Fig. 5.

(2) Check the continuity when the temperature of the water changes with a circuit tester. If it is within the range shown in Fig. 6 then the sensor is normal.

ENGINE COOLANT TEMPERATURE SWITCH CHECK AIR CONDITIONER CUT

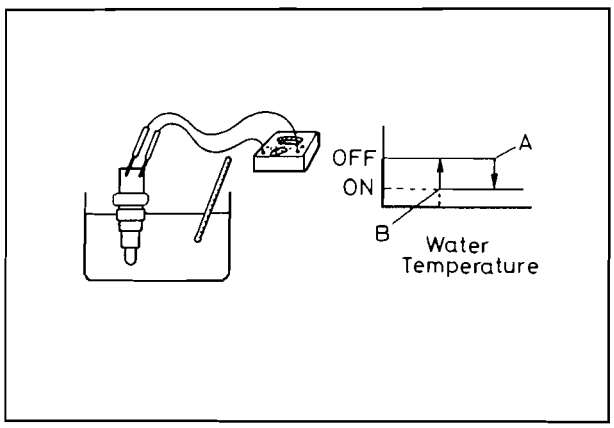


Fig. 5 — Temperature range chart

ITEM	Engine Coolant Temp. switch for Radiator Fan.
Continuity (Temperature)	85°C ± 3
No Continuity (Temperature)	81°C ± 3

Fig. 6—Temperature range chart

Remove the engine coolant temperature switch from the water outlet fitting.

Immerse the engine coolant temperature switch in oil and heat by a gas stove or similar method so as to increase the oil temperature.

Check that the engine coolant temperature switch is switched OFF when the oil temperature reaches the standard value.

Standard value: 108 - 115°C (226-239°F)

CAUTION: Use engine oil for this test; stir it well while heating and do not heat more than necessary.

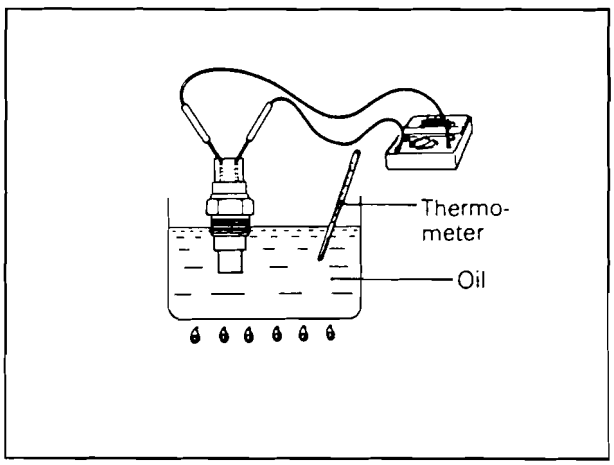


Fig. 7 — Engine coolant temperature switch test

IDLE-UP OPERATION CHECK

(4G54 Carburettor Model Only)

(1) Before inspection and adjustment set vehicle in the following condition.

(A) Engine coolant temperature 80-95°C.

(B) The lights, electric cooling ran and accessories are OFF.

(C) The transaxle is set in NEUTRAL. (N or P for vehicles with A/T).

(D) Steering wheel is set in straight forward position.

(2) Check that the idling speed is at the specified value — refer Group 13 for specifications.

(3) On carburettor models, check that the idling speed when the air conditioning is switched ON, is as specified.

NOTE: There is no necessity to make an adjustment to ECI multi models because the idling speed is automatically adjusted by the ISC — system. If however there occurs a deviation from the standard value for some reason check the "ISC" system. (ISC — Idle Speed Control.)

AIR CONDITIONER SWITCH CHECK

Operate the switch and check the continuity between the terminals.

Terminal / Switch Position	1	3	4
OFF Position			
ECONO Position	O	O	
A/C Position	O		O

NOTE:
O—O indicates that there is continuity between the terminals.

EVAPORATOR

Removal

Engine Compartment

(1) Disconnect the battery negative terminal.

(2) Discharge the refrigerant as described on Page 3 of this Section.

(3) Disconnect the liquid pipe and suction hose from the evaporator.

NOTE: Fit caps to all fittings immediately after they have been disconnected. (Do not use cloth etc.)

(4) Remove the drain hose.

Passenger Compartment

(1) Remove the glovebox, glovebox outer case assembly, the passenger side undercover, the foot cooler duct and the glovebox frame from the vehicle (refer to Group 52) for removal procedures.

(2) Remove the three evaporator retaining plugs, two retaining bolts and one retaining nut and the evaporator can be removed.

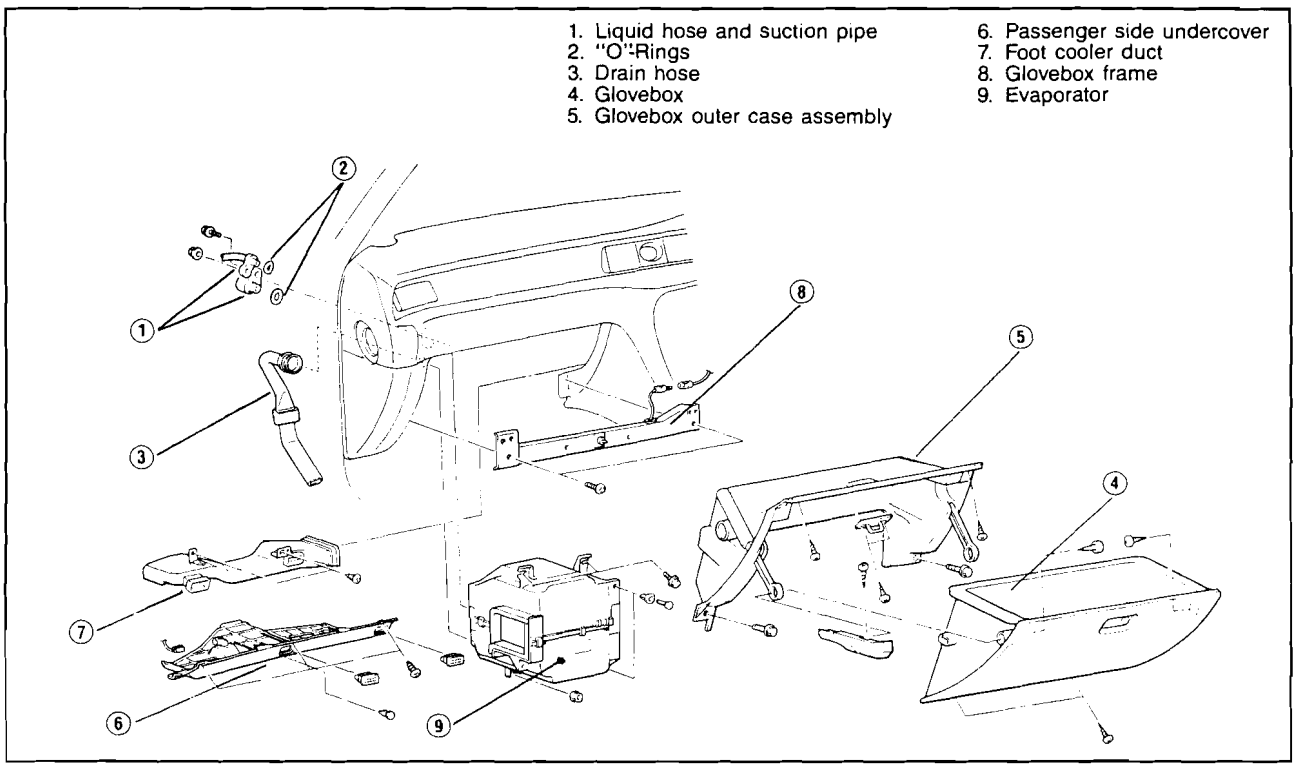


Fig. 8 — Evaporator removal

NOTE: It may be necessary to temporarily remove the blower assembly to enable the removal and fitment of the evaporator.

EVAPORATOR

Disassembly

(1) Remove the four clips, by gently prying off with a screwdriver covered with a cloth or similar to prevent damage to case surfaces (refer to Fig. 10).

(2) Remove the foam insulator from the housing.

(3) Lift off the upper evaporator case.

(4) Remove the air thermo sensor.

(5) Remove the lower evaporator case.

(6) Remove the rubber insulator from the suction pipe and expansion valve tube.

(7) Remove the retaining clip from the suction pipe and expansion valve tube.

(8) Remove the expansion valve.

NOTE: When removing the expansion valve, care must be taken to hold the valve firmly with a spanner whilst undoing the nuts on the pipes. To ensure the pipes are not twisted and damaged (refer to Fig. 11).

Inspection

(1) Check for damage of the evaporator fins.

(2) Check for damage or collapse of the drain hose.

(3) Check for peeling or cracking of the foam insulator.

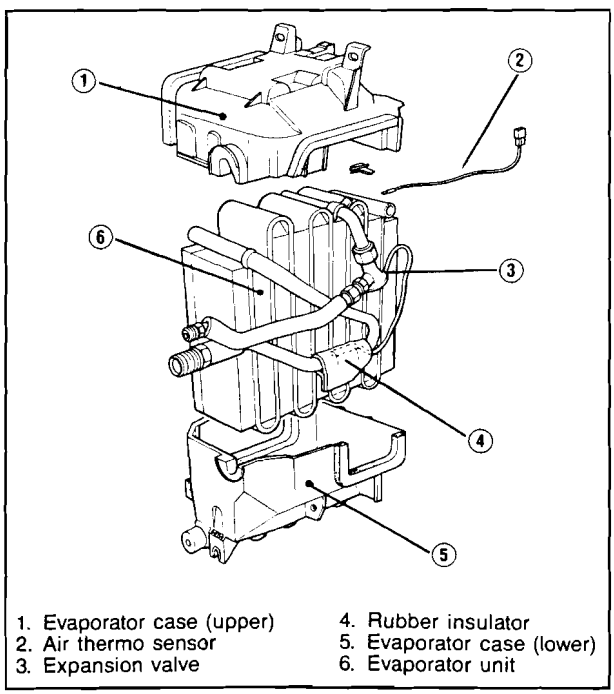


Fig. 9 — Evaporator disassembly

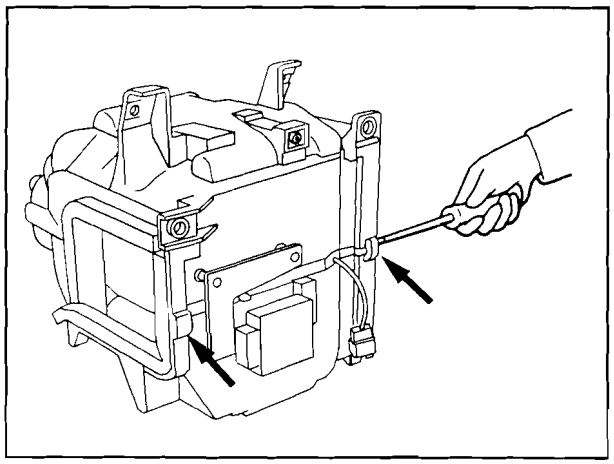


Fig. 10 — Removal of clips

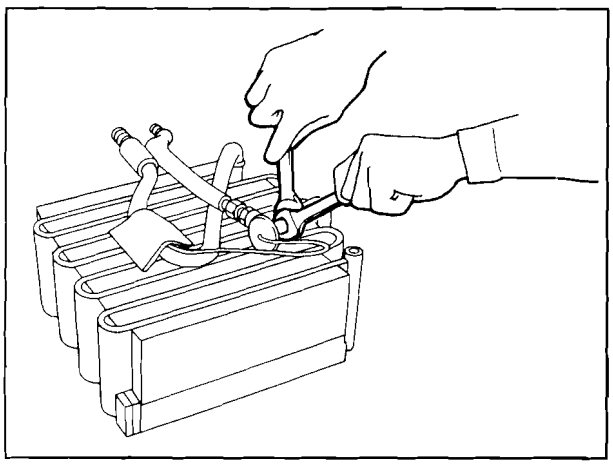


Fig. 11 — Removal of expansion valve

Air Thermo Sensor Check

(1) Use an Ohmmeter to measure the resistance across the connector of the thermistor.

(2) If the resistance is within ±10% of the value of the characteristic curve, the thermistor is functioning normally (refer to Fig. 12).

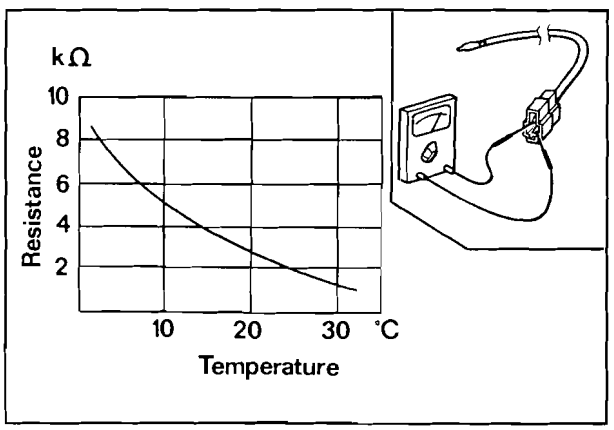


Fig. 12 — Air thermo sensor check

Assembly

Assembly is the reversal of the disassembly procedure noting the following:

(1) When assembling any fittings which require the fitment of "O" rings to make certain of an effective seal, ensure that new "O" rings are used. All "O" rings are to be replaced during the removal and disassembly of the evaporator as shown in Figures 13 and 14.

(2) Ensure that all "O" rings and fittings are lightly lubricated with a suitable refrigerant oil prior to assembly.

(3) Ensure that all refrigerant fittings are tightened to the specified torque.

(4) Before installing a replacement evaporator, approximately 8 ml of refrigerant oil should be added to the system.

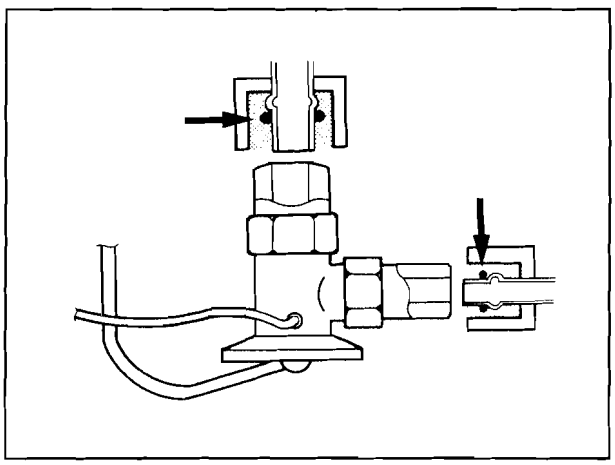


Fig. 13 — Expansion valve showing "O" ring locations

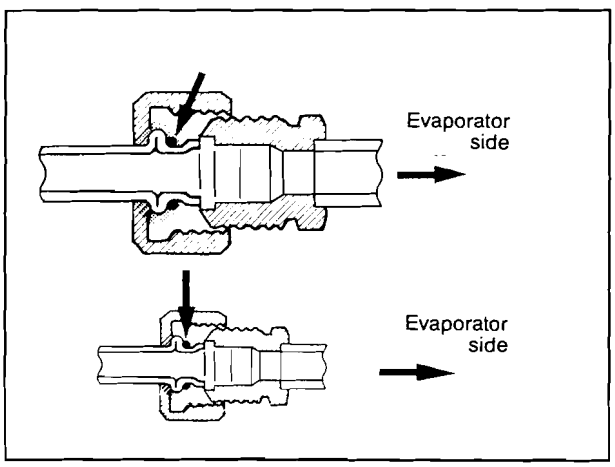


Fig. 14 — Liquid pipe and suction hose at evaorator end showing "O" ring locations

Installation

Installation is a reversal of the removal procedure, ensuring that all refrigerant fittings are tightened to the specified torque.

NOTE: Make sure that the evaporator seal is still firmly affixed to the evaporator and is not peeling or cracked. Once the evaporator has been installed check to make sure that there are no air leaks.

COMPRESSOR (4G54)

Removal

Pre-Removal Operation

Evacuate the refrigerant from the air conditioning system (refer to page 4 of this section).

(1) Disconnect the battery negative terminal.

(2) Remove the compressor drive belt.

(3) Disconnect the liquid pipe at the evaporator and position the pipe to facilitate with the removal of the compressor.

(4) Disconnect the clutch lead wire from the plug on the compressor.

(5) Remove the suction hose from the compressor.

(6) Remove the discharge hose from the compressor.

(7) Remove the compressor by removing the four bolts.

(8) To remove the compressor mounting bracket, remove the four retaining bolts.

(9) The belt tensioner can be disassembled if necessary.

NOTE: To remove the compressor drive belt loosen the pulley bolt which holds the tension pulley, then loosen the adjustment bolt until the drive belt can be removed.

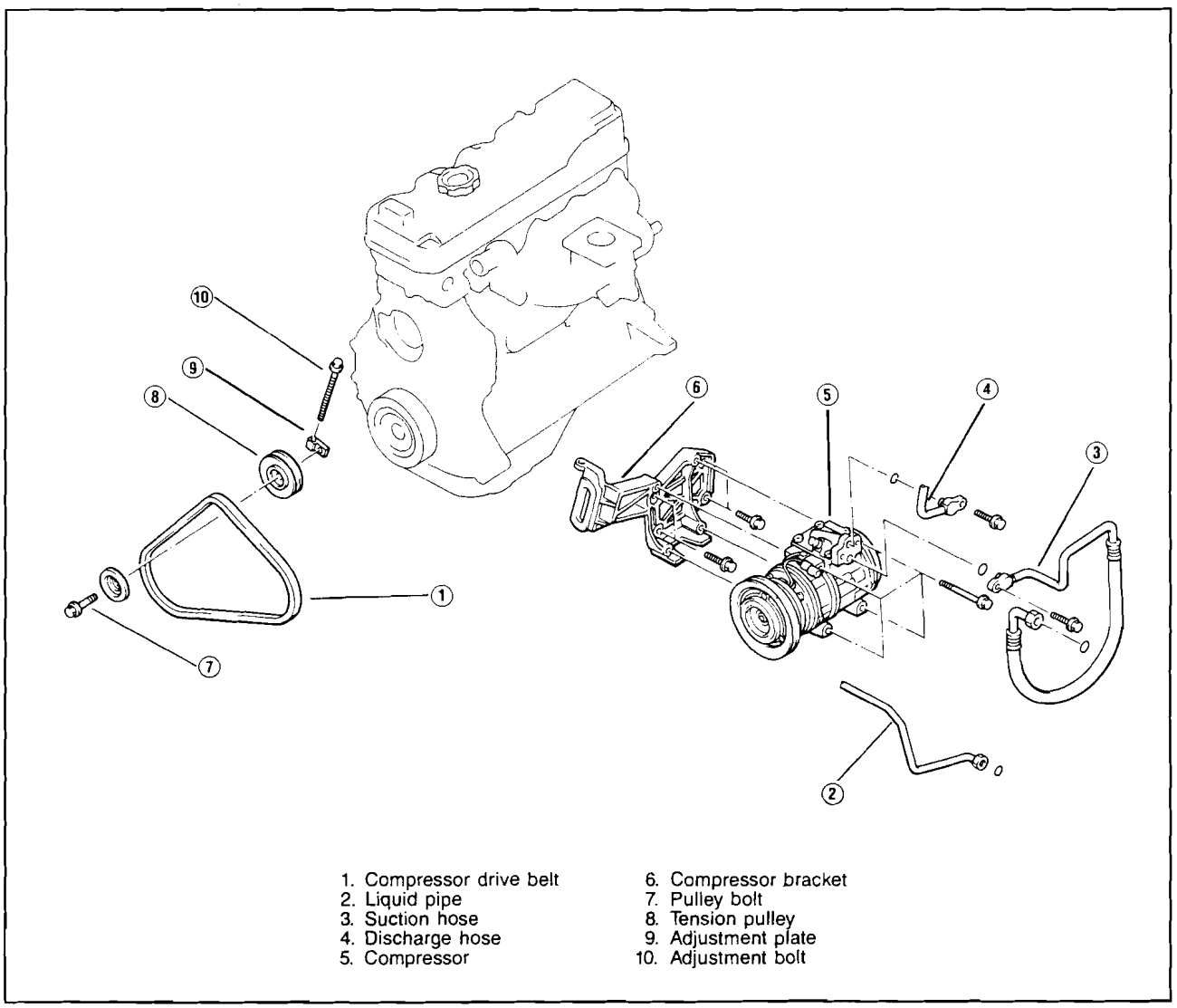
COMPRESSOR (6G72)

Removal procedures are basically the same as for the (4G54) motor. There is no need to disconnect and re-position the liquid pipe however.

Inspection

(1) Check for any heat damage, excess play, deflection or unusual wear of the tension pulley.

(2) Check for any unusual wear, abrasing or hardening of the air conditioner belt.



1. Compressor drive belt
2. Liquid pipe
3. Suction hose
4. Discharge hose
5. Compressor
6. Compressor bracket
7. Pulley bolt
8. Tension pulley
9. Adjustment plate
10. Adjustment bolt

Fig. 15 — Compressor removal 4G54

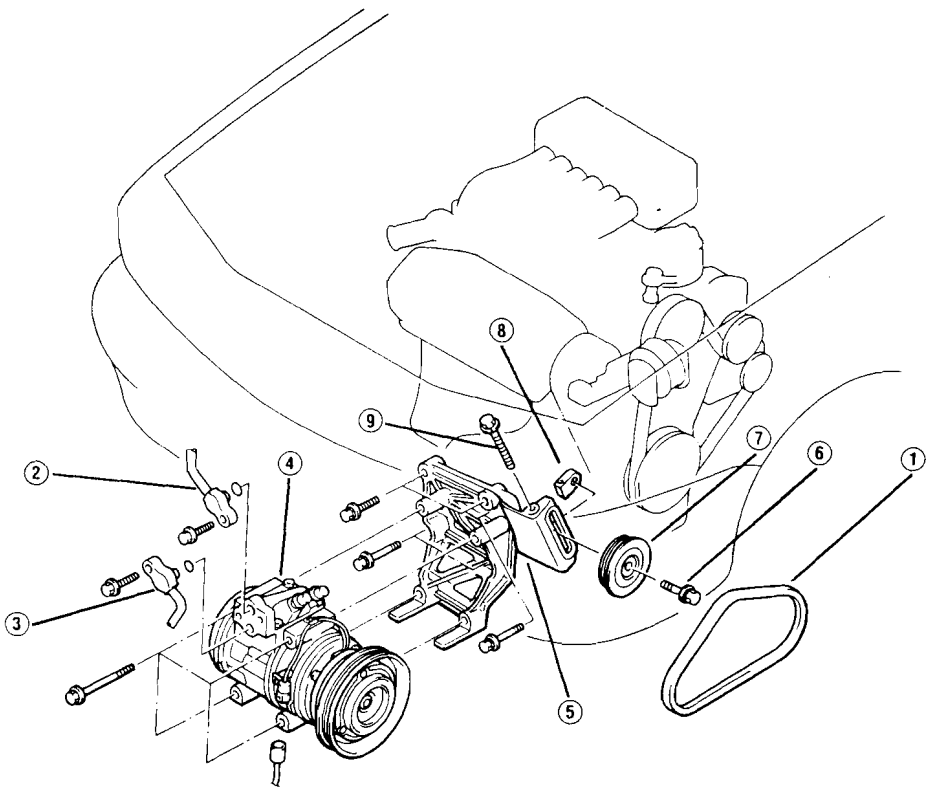


Fig. 16 — Compressor removal 6G72

Magnetic Clutch

(1) Connect the battery (+) voltage directly to the wiring of the magnetic clutch.

(2) If the magnetic clutch is normal, there will be a "click". If the pulley and armature do not make contact "click" there is a malfunction.

Oil Level Check

Whenever the compressor is removed or replaced for any reason, the oil level should be checked. This is done by tipping the compressor upside down and pouring the oil out through the service valves into a measuring container.

Under normal conditions the compressor will hold 50 ml of refrigerant oil.

Oil should be added to the removed compressor or drained from a new compressor so that the oil level remains at 50 ml. (All new compressors contain 80 ml of oil.)

Disassembly

Clutch Removal

(1) Secure the compressor in a vice.

(2) Remove the clutch hub retaining bolt. If the clutch hub cannot be pulled off by hand, screw in a 8 mm completely threaded bolt so the clutch hub can be raised to enable removal.

(3) Remove the rotor retaining circlip and withdraw the rotor from the compressor nose. If tight, lightly tap with a plastic hammer to remove.

(4) Remove the stator retaining circlip and remove the stator from the compressor body.

Clutch Assembly

Assembly is a reversal of the disassembly procedure, noting the following:

(1) When fitting the stator to the compressor housing ensure that it is aligned with the locating pin in the housing.

(2) When the clutch is reinstalled onto the compressor, check that the clearance between the clutch hub and rotor is 0.5 mm ± 0.15 mm. Where necessary use shims to adjust the clearance.

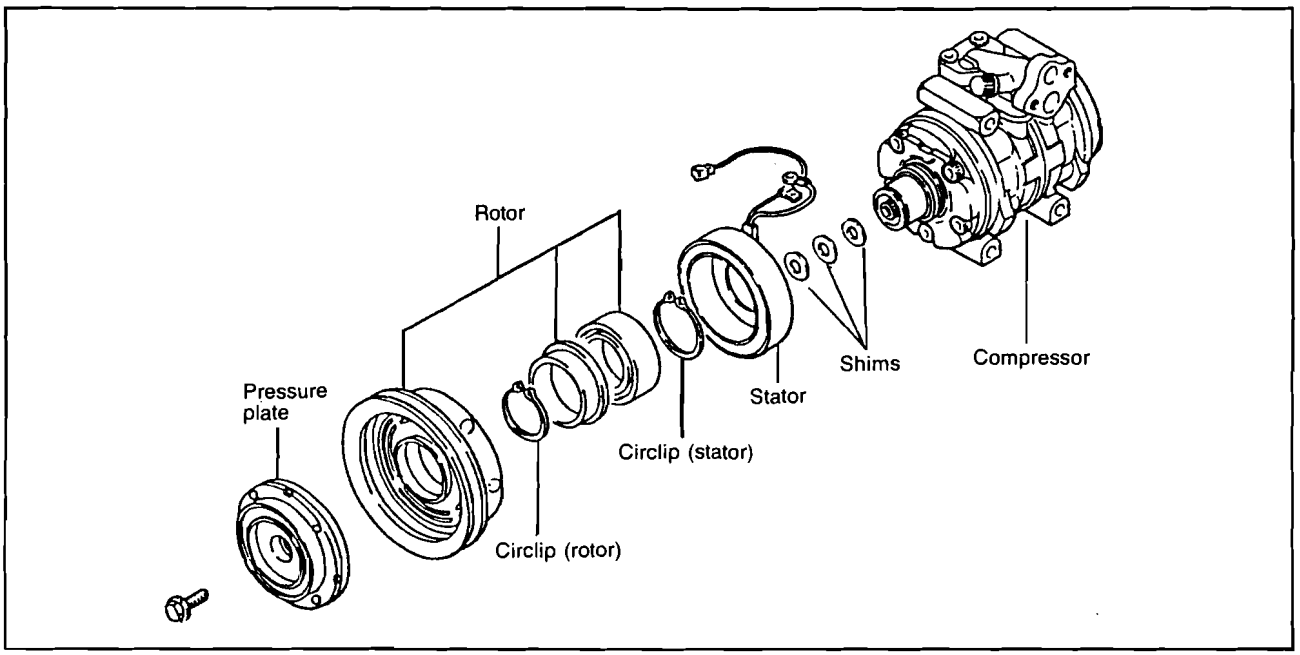


Fig. 17 — Compressor clutch assembly

Compressor Installation

Installation is a reversal of the removal procedure ensuring that all refrigerant fittings, mounting bolts and drive belts are tensioned to the specified torque.

CONDENSER AND CONDENSER FAN

Removal

Pre-Removal Operation

(1) Remove the radiator grille (refer to Group 51).
(2) Evacuate the refrigerant from the air conditioning system (refer to page 3 of this section).
(3) Remove the radiator (refer to Group 14).

Removal

(1) Remove the condenser fan.
(2) Disconnect the liquid pipe from the condenser.
(3) Disconnect the discharge hose from the condenser.

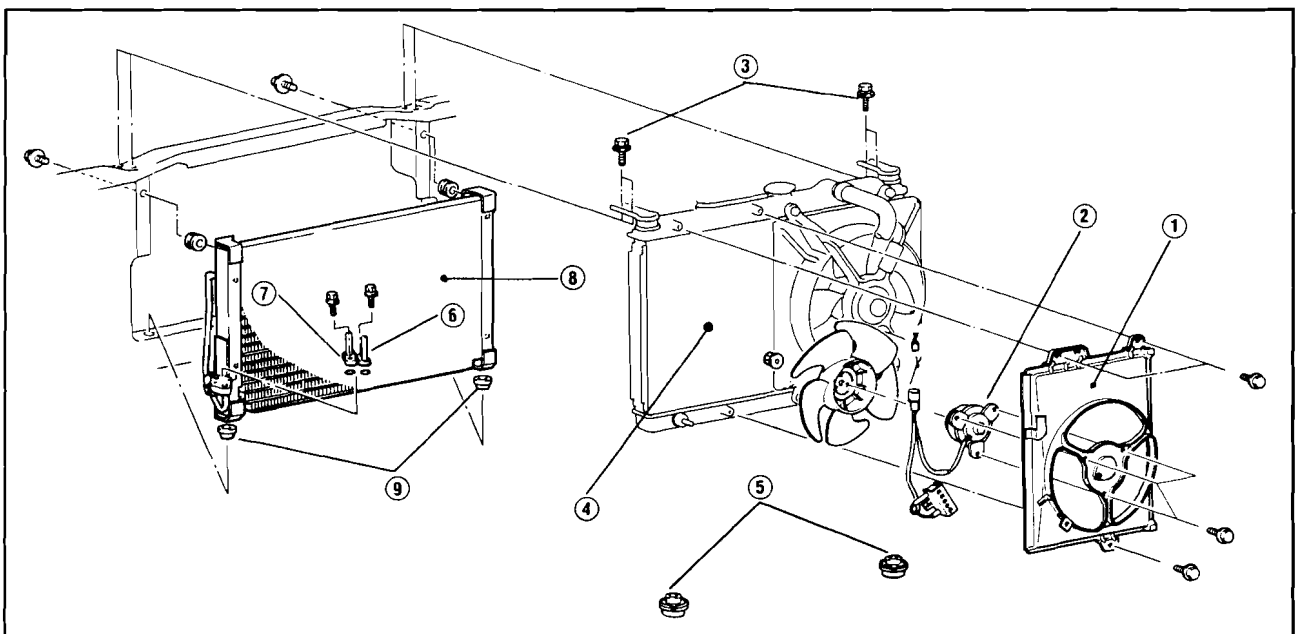


Fig. 18 — Condenser and condenser fan removal

(4) Remove the two radiator mounting bolts.Gently lift the radiator off its lower mounts and push back towards the engine (refer to Fig. 19).

NOTE: Take care not to lose the two rubber insulators from the lower radiator mounts.

(5) Remove the two condenser mounting bolts and lift the condenser from the vehicle, whilst still gently pushing the radiator back to aid in removal.

NOTE: (A) Take care not to lose the two rubber insulators from the lower condenser mounts.
(B) Fit caps to all refrigerant fittings immediately after they have been disconnected.
(Do not use cloth etc.)

Inspection

(1) Check the condenser fins for crushing, blockage from foreign articles or other damage.

(2) Check the condensers high pressure hose and pipe installation parts for damage or deformation.

(3) Check the condenser fan shroud for damage.

Condenser Fan Motor Check

Apply battery voltage to terminal (1) and check that the condenser fan motor turns when terminal (2) is earthed (refer to Fig. 20).

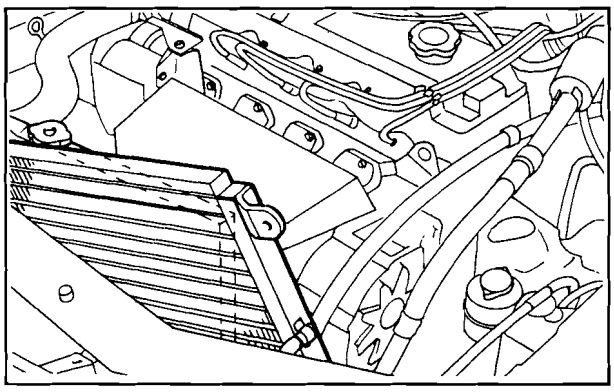


Fig. 19 — Removing the condenser

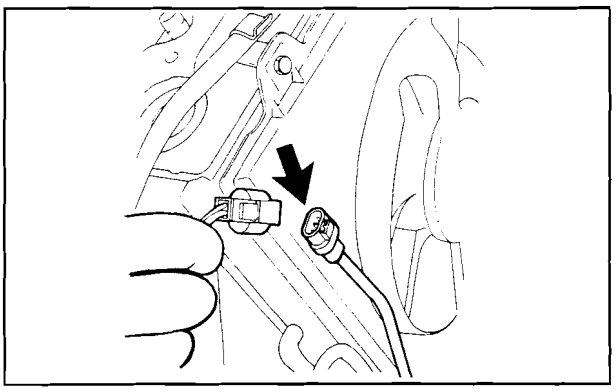


Fig. 20 — Condenser fan motor check

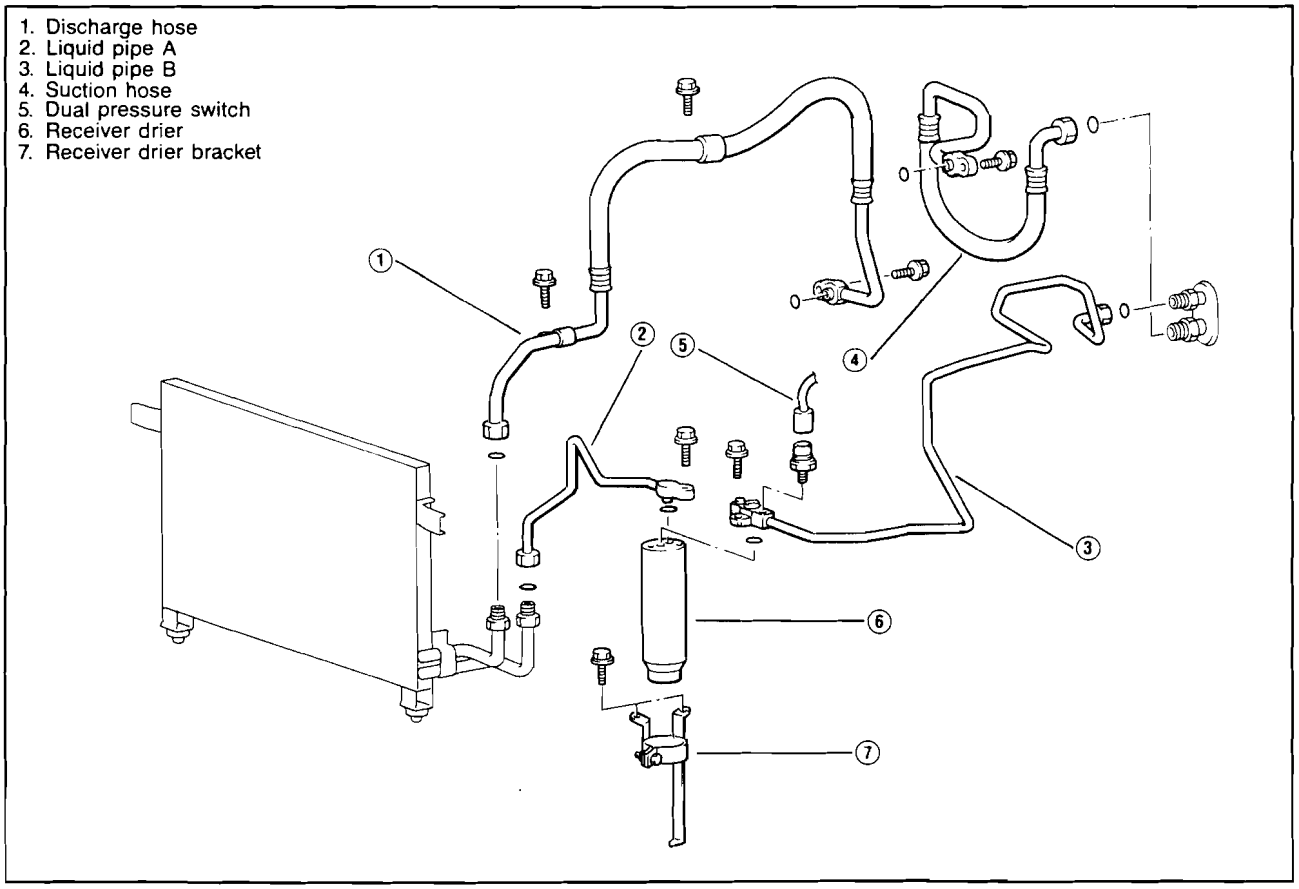
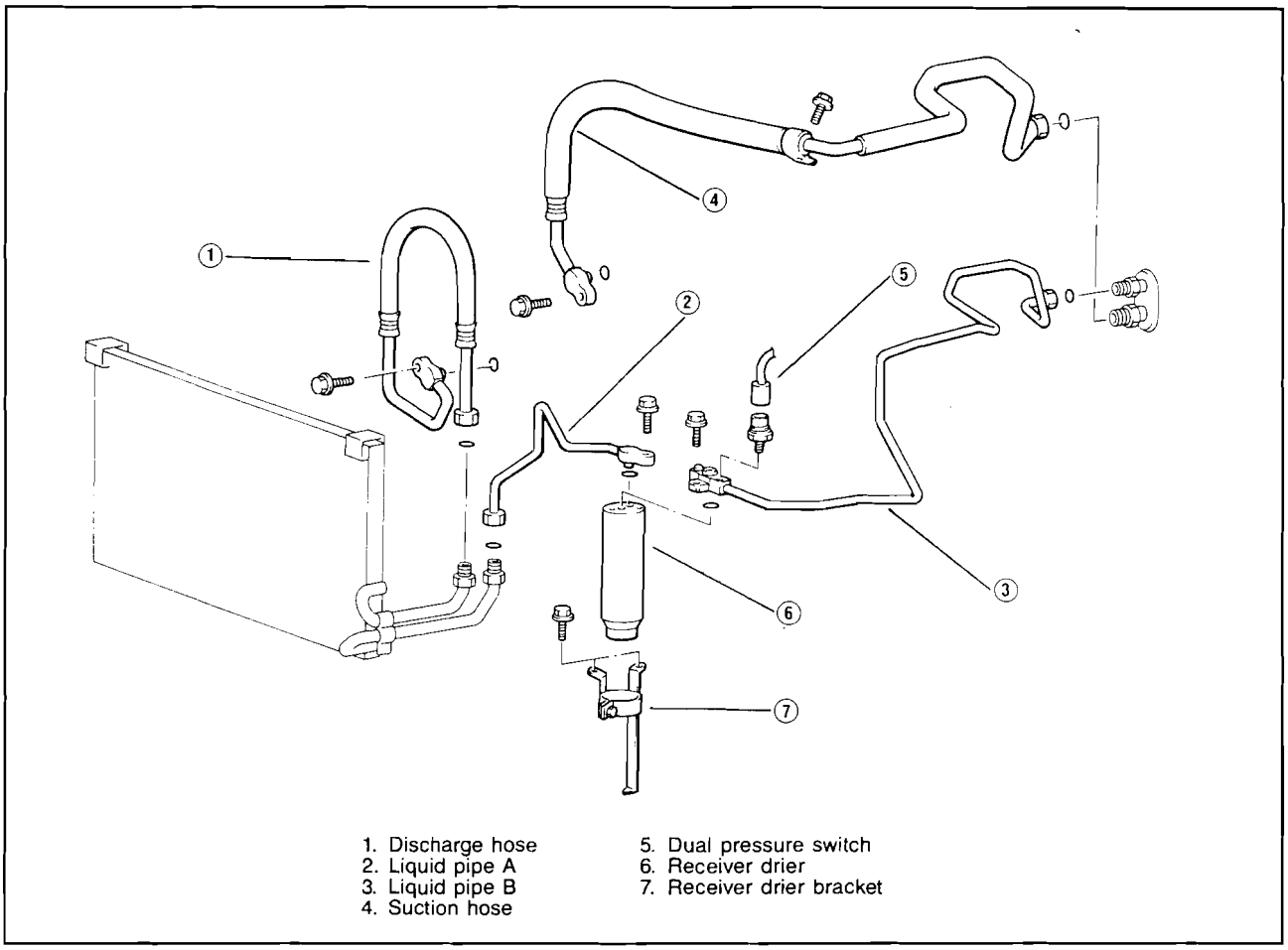


Fig. 21 — Refrigerant lines (4G54)



1. Discharge hose
2. Liquid pipe A
3. Liquid pipe B
4. Suction hose
5. Dual pressure switch
6. Receiver drier
7. Receiver drier bracket

Fig. 22 — Refrigerant lines (6G72)

REFRIGERANT LINES (4G54)

Removal

Pre-Removal Operation

Evacuate the refrigerant from the air conditioning system (refer to page 3 of this section).

Removal

(1) Remove the discharge hose located between the compressor and condenser.

(2) Remove liquid pipe "A" located between the receiver drier and condenser.

(3) Remove liquid pipe "B" located between the evaporator and receiver drier.

(4) Remove the suction hose located between the evaporator and compressor.

(5) Remove the dual pressure switch at the receiver drier end of liquid pipe "B".

(6) Take out the receiver drier and bracket assembly by removing the two locating bolts. To separate the receiver drier from the bracket, undo the retaining bolt located on the bracket.

NOTE: Fit caps to all refrigerant fittings immediately after removal to prevent any dust, dirt etc. from entering the system.

REFRIGERANT LINES (6G72)

Removal

Follow the same removal procedure as for the (4G54) motor.

Installation

Installation is a reversal of the removal procedure noting the following.

(1) All "O" rings must be replaced before installation of the refrigerant lines.

(2) Ensure all refrigerant fittings are tightened to the specified torque.

(3) All "O" rings and fittings should be lightly lubricated with a suitable refrigerant oil before assembly.

SECTION 5 — SERVICE DIAGNOSIS AND TESTING — AUTOMATIC AIR-CONDITIONING

SERVICE DIAGNOSIS

DIAGNOSIS PROCEDURE

(1) Check that the air ducts have not become blocked or dislodged.
(2) In carrying out the troubleshooting procedure, first look up the Troubleshooting Quick-Reference Chart to know which items to inspect. Then start the inspection procedure detailed in the following pages.
(3) When checking components make sure the connectors are uncoupled.

DIAGNOSIS — QUICK-REFERENCE CHART

NOTE: (1) ○ indicates the component requiring inspection.
(2) The numbers in the ○ are listed in a priority order to gain maximum benefit from this chart. It is recommended that you follow this order.

	Symptom / Inspection item	Fuse	Air-conditioner control unit	Harness (incl. connectors)	Air-conditioner control panel	Air mix damper motor and potentiometer	Heater relay	Power transistor	Blower motor	Blower motor relay	Compressor relay	Magnetic clutch	Inside/outside-air selector damper motor	Outlet selector damper motor/potentiometer	Dual pressure switch	Sensors	Condenser fan relay	Condenser fan motor	Refrigerant level	MPI control unit
1	Compressor does not operate when the car is running.	①	⑨	③	⑧						④	⑤			⑥	⑦			②	⑩
2	Interior temperature does not raise even when the air conditioner is operating. (No warm air coming out.)		⑤	①	④	③										②				
3	Interior temperature does not lower even when the air conditioner is operating. (No cold air coming out.)	①	⑦	③	⑥	⑤										④			②	
4	Blower motor does not rotate.	①	⑦	⑤	⑥		③	④	②											
5	Blower motor does not stop rotating.		⑤	①	④			③		②										
6	Inside/outside-air selector damper does not operate		④	①	③								②							
7	Outlet selector damper does not operate		⑤	①	④									②		③				
8	Condenser fan does not operate when the air conditioner is activated.	①	⑥	⑤												④	②	③		

SERVICE DIAGNOSIS CHART

No.	Condition	Possible Cause	Corrective Action
1	Air conditioner does not operate when the car is running	Open-circuited power circuit harness	Repair or replace harness.
		Defective control panel	Replace control panel.
		Defective air conditioner control unit.	Replace air-conditioner control unit.
		Defective engine coolant temperature switch (air conditioner cut)	Replace coolant temperature switch.
2	Interior temperature does not raise. (No warm air coming out.)	Defective room-temperature sensor input circuit.	Replace defective parts.
		Defective air mix damper potentiometer input circuit.	
		Defective air mix damper drive motor.	Replace air mix damper drive motor.
		Incorrect engagement of air mix damper drive motor lever and air mix damper.	Engage correctly.
		Sticking air mix damper.	Correct air mix damper.
		Open-circuited harness between air mix damper drive motor and air conditioner control unit.	Repair or replace harness.
		Defective control panel.	Replace control panel.
		Defective air conditoner control unit.	Replace air conditioner control unit.
3	Interior temperature does not lower. (No cold air coming out.)	Defective room-temperature sensor input circuit.	Replace defective parts.
		Defective outside-air-temperature sensor input circuit.	
		Defective air thermo sensor input circuit.	
		Defective refrigerant-temperature sensor input circuit.	
		Defective air mix damper potentiometer input circuit.	
		Defective photo sensor.	Replace photo sensor.
		Defective air mix damper drive motor.	Replace air mix damper drive motor.
		Incorrect engagement of air mix damper drive motor lever and air mix damper.	Engage correctly.
		Sticking air mix damper.	Correct air mix damper.
		Open-circuited harness between air mix damper drive motor and air conditioner control unit.	Repair or replace harness.
		Open-circuited harness between photo sensor and air conditioner control unit.	Repair or replace harness.
		Defective air-conditioner compressor relay in the relay box.	Replace relay.

SERVICE DIAGNOSIS CHART

No.	Condition	Possible Cause	Corrective Action
3	Interior temperature does not lower. (No cold air coming out.)	Defective water-temperature sensor.	Replace water-temperature sensor.
		Refrigerant leak.	Repair leak and recharge system.
		Defective air inlet sensor.	Replace air inlet sensor.
		Defective magnetic clutch.	Replace magnetic clutch.
		Defective belt lock controller.	Replace belt lock controller.
		Defective control panel.	Replace control panel.
		Defective air conditioner control unit.	Replace air conditioner control unit.
4	Blower motor does not rotate.	Defective blower motor.	Replace blower motor.
		Blown thermal fuse inside power transistor.	Replace power transistor.
		Defective heater relay.	Replace heater relay.
		Open-circuited harness between fuse and heater relay.	Repair or replace harness.
		Open-circuited harness between heater relay and blower motor.	
		Open-circuited harness between power transistor and air conditioner control unit.	Repair or replace harness.
		Defective control panel.	Replace control panel.
		Defective air conditioner control unit.	Replace air conditioner control unit.
5	Blower motor does not stop rotating.	Defective blower motor relay.	Replace power relay.
		Short-circuited harness between blower motor relay and power transistor air conditoner control unit.	Repair or replace harness.
		Defective control panel.	Replace control panel.
		Defective air conditioner control unit.	Replace air conditioner control unit.
6	Inside/outside-air selector damper does not operate.	Defective inside/outside-air selector drive motor.	Replace inside/outside-air selector drive motor.
		Incorrect engagement of inside/outside-air selector drive motor and inside/outside-air selector damper.	Engage correctly.
		Malfunctioning inside/outside-air selector damper.	Correct inside/outside-air selector damper.
		Open-circuited harness between inside/outside-air selector motor and air conditioner control unit.	Repair or replace harness.

SERVICE DIAGNOSIS CHART

No.	Condition	Possible Cause	Corrective Action
6	Inside/outside-air selector damper does not operate.	Defective control panel.	Replace control panel.
		Defective air conditioner control unit.	Replace air conditioner control unit.
7	Outlet selector damper does not operate.	Defective outlet selector damper potentiometer input circuit.	Replace defective parts.
		Defective outlet selector drive motor.	Replace outlet selector drive motor.
		Incorrect engagement of outlet selector drive motor and oulet selector damper.	Engage correctly.
		Malfunctioning DEF., FACE and FOOT damper.	Correct DEF., FACE, and FOOT damper.
		Open-circuited harness between outlet selector motor and control unit.	Repair or replace harness.
		Defective control panel.	Replace control panel.
		Defective air conditioner control unit.	Replace air conditioner control unit.
8	Condenser fan does not operate when the air conditioner is activated.	Defective condenser fan motor relay.	Replace power relay.
		Defective water temperature switch.	Replace water temperature switch.
		Defective condenser fan motor.	Replace condenser fan motor.

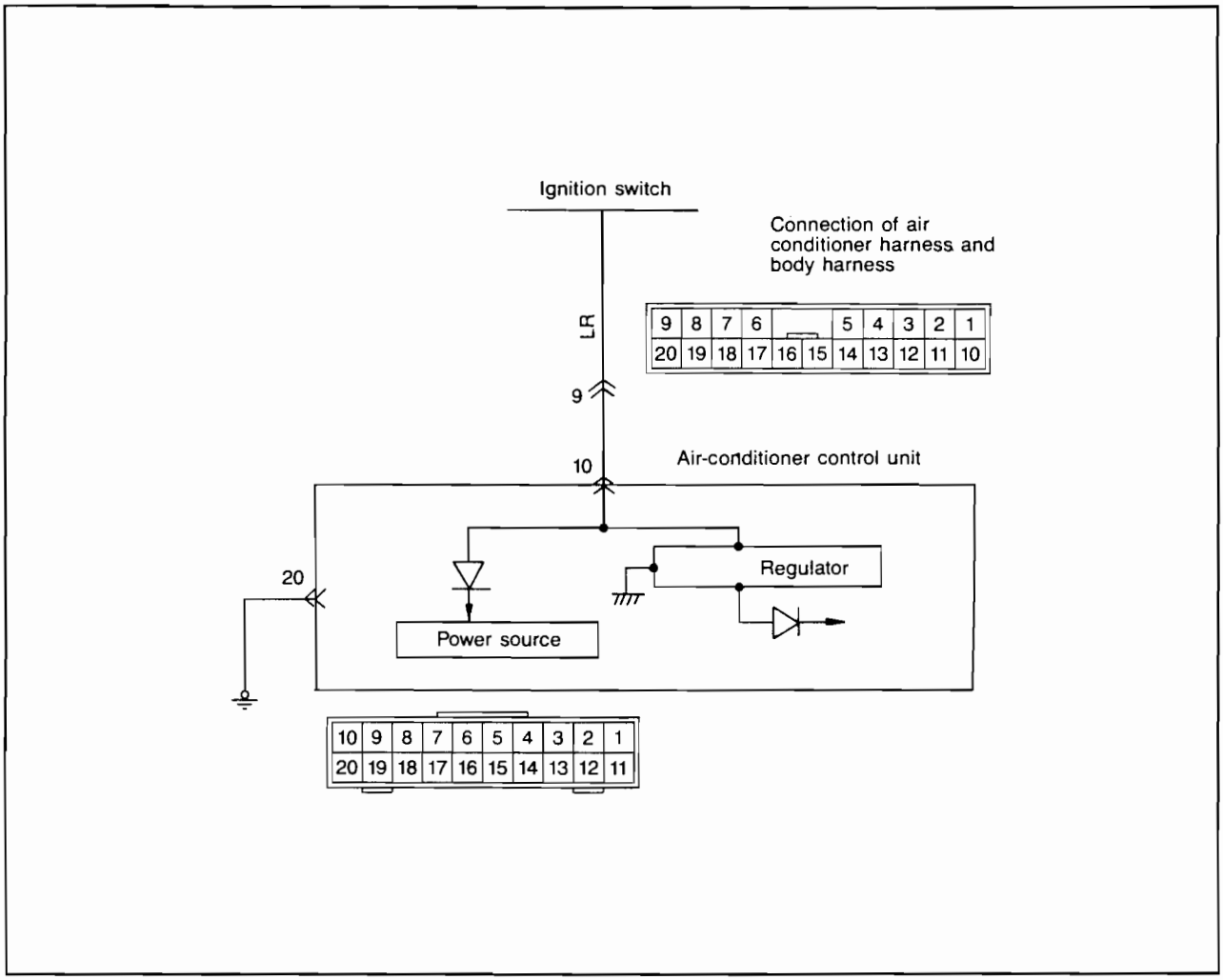
INSPECTION CHART

Inspection Point	Inspection Check	Condition		Possible Cause	Corrective Action
		Normal	Abnormal		
Room-temperature sensor	Measure resistance of sensor when room temperature is 25°C	Approx 1.7 kΩ	Largely deviates from approx. 1.7 kΩ	Defective room-temperature sensor	Replace room-temperature sensor.
	Measure voltage across terminal ⑮ of air conditioner control unit and ground when room temperature is 25°C	Approx. 2.7-3.1 V	—	Open-circuited harness between room-temperature sensor and air conditioner control unit	Replace or repair harness.
		—	Outside approx. 2.7-3.1 V	Poor connection of air conditioner control unit connector or defective air conditioner control unit	Correct connector connection or replace air conditioner control unit.
Outside-air-temperature sensor	Measure resistance of sensor when ambient temperature is 25°C	Approx. 1.5 kΩ	Largely deviates from approx. 1.5 kΩ	Defective outside-air sensor	Replace outside-air-temperature sensor.
	Measure voltage across terminal ⑥ of air conditioner control unit and ground when ambient temperature is 25°C	Approx. 2.6-3.1 V	—	Open-circuited harness between outside-air-temperature sensor and air conditioner control unit	Repair or replace harness.
		—	Outside approx. 2.6-3.1 V	Poor connection of air-conditioner control unit connector or defective air conditioner control unit	Correct connector connection or replace air conditioner control unit.
Water-temperature sensor	Measure resistance of sensor when water temperature is 22.5 to 30.5°C	Approx. 4-5.6 kΩ	Largely deviates from approx. 4-5.6 kΩ	Defective water-temperature sensor	Replace water-temperature sensor.
	Measure voltage across terminal ③ of air conditioner control unit and ground when water temperature is 22.5 to 30.5°C	Approx. 2.4-3.2 V	—	Open-circuited harness between water-temperature sensor and air conditioner control unit	Repair or replace harness.
		—	Largely deviates from approx. 2.4-3.2 V	Poor connection of air conditioner control unit connector or defective air conditioner control unit	Correct connector connection or replace air conditioner control unit.
Air thermo sensor	Measure resistance of sensor when sensor's sensing temperature is 25°C	Approx. 1.5 kΩ	Largely deviates from approx. 1.5 kΩ	Defective air thermo sensor	Replace air thermo sensor.
	Measure voltage across terminal ⑭ of air conditioner control unit and ground when sensor's sensing temperature is 25°C	Approx. 2.6-3.1 V	—	Open-circuited harness between air thermo sensor and air conditioner control unit	Repair or replace harness.
		—	Outside approx. 2.6-3.1 V	Poor connection of air conditioner control unit connector or defective air conditioner control unit	Correct connector connection or replace air conditioner control unit.
Air mix damper poteniometer				Defective air mix damper poteniometer	Replace air mix damper potentiometer
	Measure voltage across terminal ③ of air conditioner control unit and ground when potentiometer is in MAX. COOL position	Approx. 0.9-1.1 V	—	Open-circuited harness between air mix damper potentiometer and air conditioner control unit	Repair or replace harness.
		—	Outside approx. 0.9-1.1 V	Poor connection of air conditioner control unit connector or defective air conditioner control unit	Correct connector connection or replace air conditioner control unit.
Outlet selector damper poteniometer				Defective outlet selector damper potentiometer	Replace outlet selector damper poteniometer.
	Measure voltage across terminal ③ of air conditioner control unit and ground when potentiometer is in FACE position	Approx. 3.8-4.2 V	—	Open-circuited harness between outlet selector damper potentiometer and air conditioner control	Repair or replace harness.
		—	Outside approx. 3.8-4.2 V	Poor connection of air conditioner control unit connector or defective air conditioner control unit	Correct connector connection or replace air conditioner control unit.

CIRCUIT TESTING

NOTE: For the following tests in the circuit testing section, all tests are to be done from the rear of the loom connector with all connectors coupled.

1. Inspection of air conditioner control unit power source circuit.

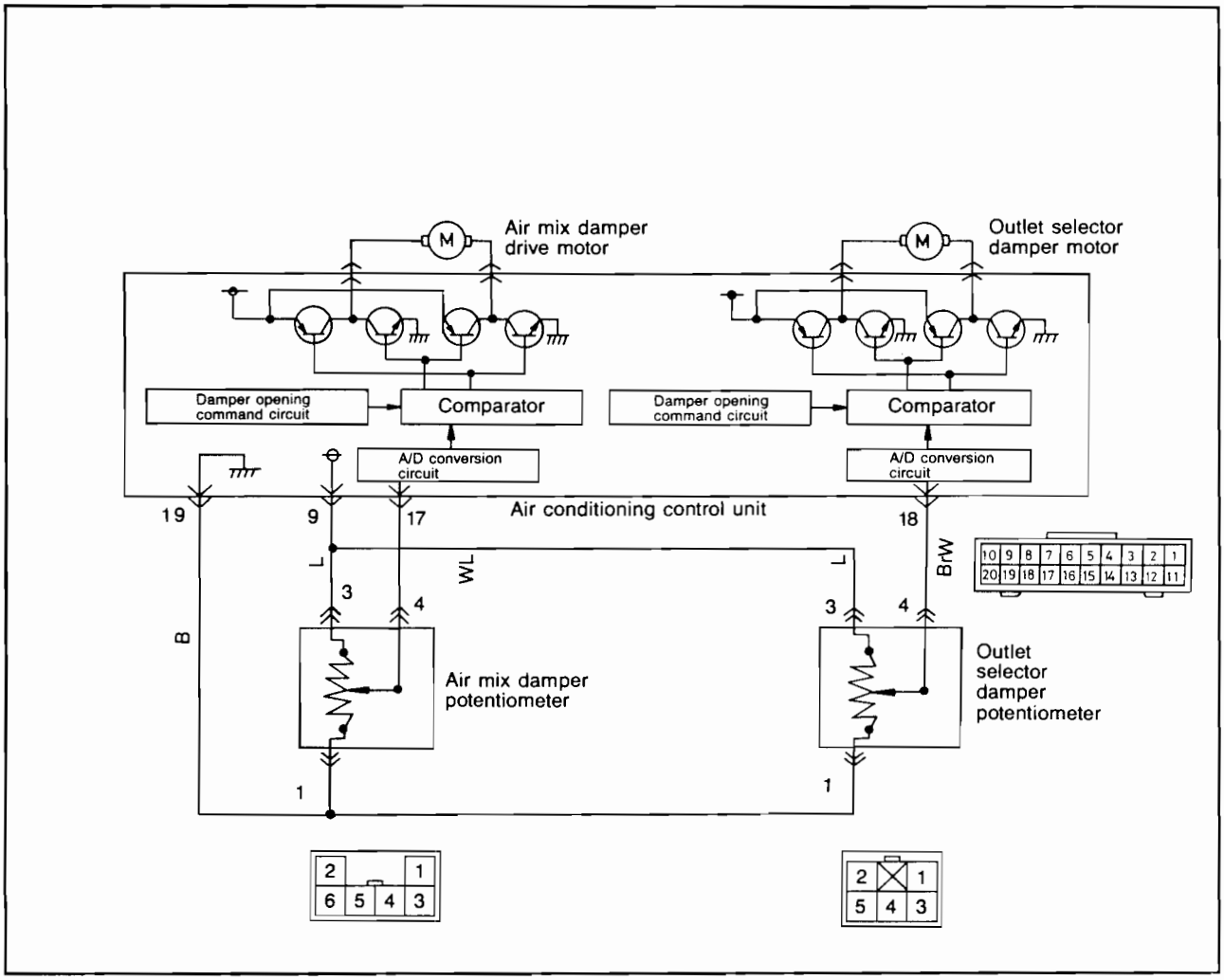


Troubleshooting Hints

- Air conditioner control unit terminal voltage

Terminal No.	Signal Name	Condition	Terminal Voltage
10	Air conditioner control unit power source	Ignition switch ON	Battery voltage
20	Air conditioner control unit ground	Ignition switch ON	0 V

2. Inspection of potentiometer circuit.

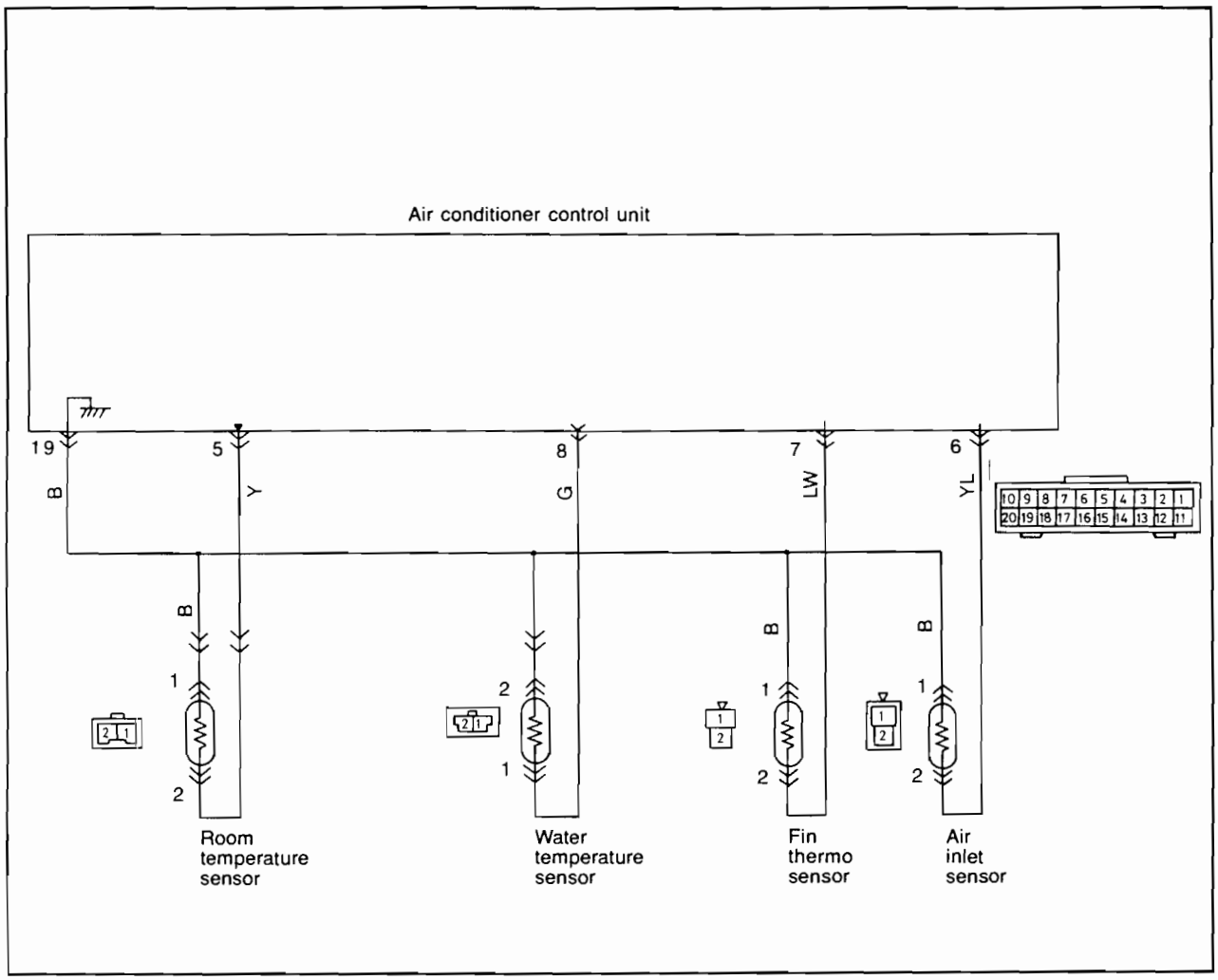


Troubleshooting Hints

- Air conditioner control unit terminal voltage

Terminal No.	Signal Name	Condition	Terminal Voltage
9	Sensor power source	Ignition switch ON	4.8–5.2 V
19	Air mix damper and outlet selector damper poteniometer ⊖	Ignition switch ON	0 V
18	Outlet selector damper poteniometer (input)	Outlet selector damper at FACE position	3.8–4.2 V
		Outlet selector damper at DEF. position	0.9–1.1 V
17	Air mix damper potentiometer (input)	Air mix damper at MAX. Cool position	0.9–1.1 V
		Air mix damper at MAX. HOT position	3.8–4.2 V

3. Inspection of water-temperature sensor, fin thermo sensor, air inlet and room-temperature sensor.

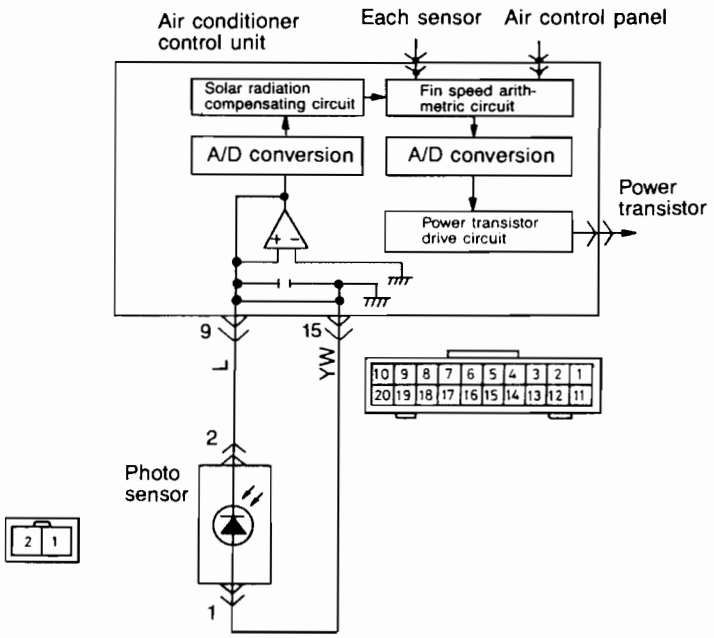


Troubleshooting Hints

- Air conditioner control unit terminal voltages

Terminal No.	Signal Name	Condition	Terminal Voltage
8	Water temperature sensor	25°C	2.7–3.0 V
7	Fin thermo sensor	25°C (A/C–OFF)	2.6–3.1 V
6	Air inlet sensor	25°C	2.6–3.1 V
5	Room temperature sensor	25°C	2.7–3.1 V
19	Sensor ground	Ignition switch ON	0 V

4. Inspection of photo sensor circuits.

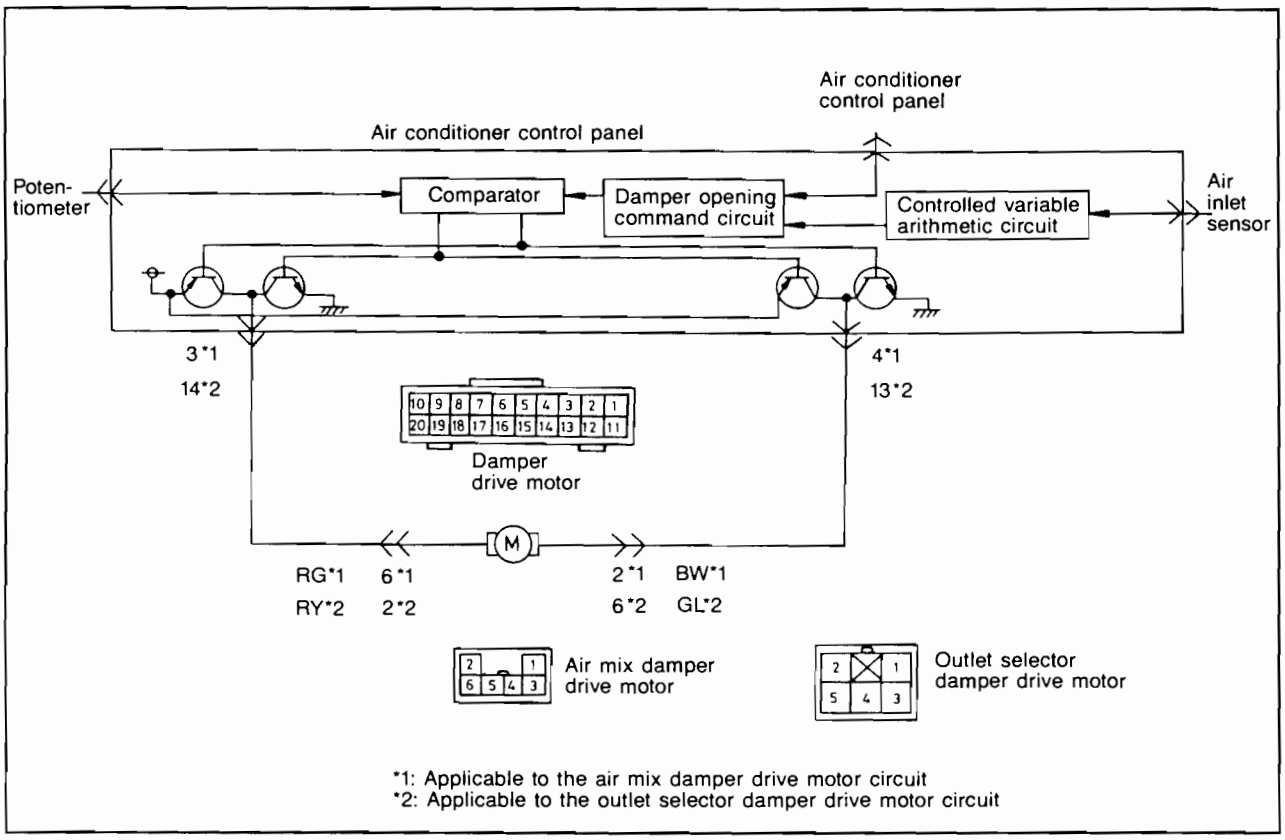


Troubleshooting Hints

- Air conditioner control unit terminal voltages

Terminal No.	Signal Name	Condition	Terminal Voltage
9	Photo sensor ⊕	Ignition switch ON	4.8–5.2 V
15	Photo sensor ⊖	Illuminance 1000 lux or more	0.06–2 V
		Illuminance less than 1000 lux	0.06 V

5. Inspection of air mix damper, outlet selector damper drive motor circuits.

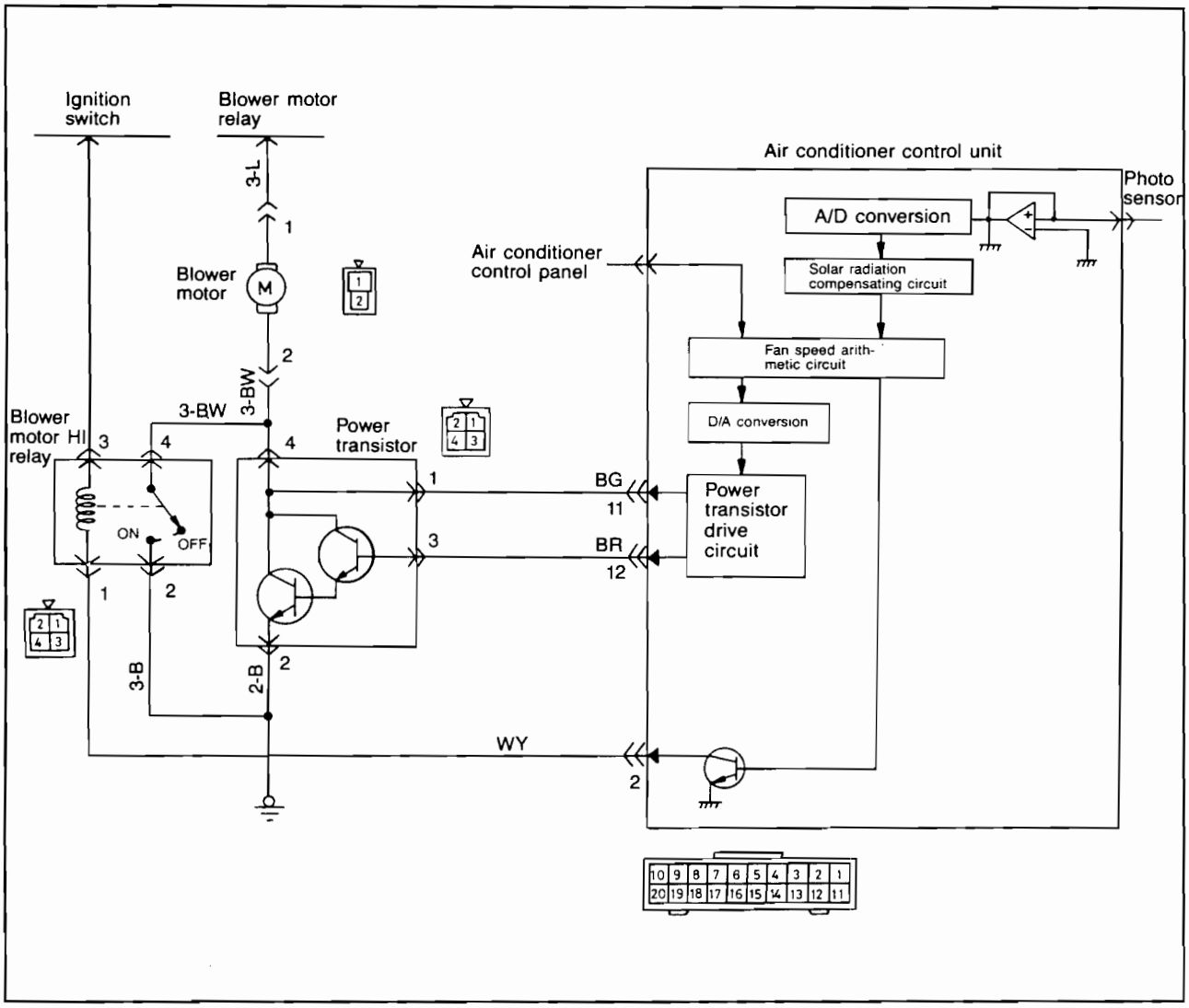


Troubleshooting Hints

- Air conditioner control unit terminal voltage

Terminal No.	Signal Name	Condition	Terminal Voltage
4	Air mix damper drive motor ⊕	Temperature is set at MAX. COOL (Output turns OFF 40 seconds after the damper moved to MAX. COOL position.)	1 V or less
		Temperature is set at MAX. HOT (Output turns OFF 40 seconds after the damper moved to MAX. HOT position.)	10 V – System voltage
3	Air mix damper drive motor ⊖	Temperature is set at MAX. COOL (Output turns OFF 40 seconds after the damper moved to MAX. COOL position.)	10 V – System voltage
		Temperature is set at MAX. HOT (Output turns OFF 40 seconds after the damper moved to MAX. HOT position.)	1 V or less
14	Outlet selector damper drive motor ⊖	FACE switch ON (Output turns OFF 40 seconds after the damper moved to FACE position.)	10 V – System voltage
		DEF. switch ON (Output turns OFF 40 seconds after the damper moved to DEF. position.)	1 V or less
13	Outlet selector damper drive motor ⊕	FACE switch ON (Output turns OFF 40 seconds after the damper moved to FACE position.)	1 V or less
		DEF. switch ON (Output turns OFF 40 seconds after the damper moved to DEF. position.)	10 V – System voltage

6. Inspection of power transistor and blower motor relay circuits.



Troubleshooting Hints

- Air conditioner control unit terminal voltages

Terminal No.	Signal Name	Condition	Terminal Voltage
2	Blower motor HI relay	Fan switch HI is ON.	1.5 V or less
		Fan switch in MED, LOW, or OFF.	System voltage
12	Power transitor base	Blower switch is turned OFF.	0 V
11	Power transistor collector	Switch is turned OFF.	System voltage
		Switch is placed in LOW.	Approx. 9 V
		Switch is placed in HI.	0 V

SECTION 6 — AUTOMATIC AIR-CONDITIONING

SPECIFICATIONS

Manufacturer	Nippondenso
Compressor — model	10PA17C
— type	10 cylinder swash plate
— displacement	177 ml/rev.
— valve type	Reed
— refrigerant oil	80 ml (Nippondenso 6 or equiv.)
Clutch — type	Dry single disc magnetic
— power consumption	40W
— clearance	0.5 ± 0.15 mm
Condenser — type	Dual pass aluminium fin and modine tube
Condenser fan — type	Axial flow (behind radiator)
— power consumption	120W
Evaporator — type	Single pass aluminium fin and modine tube
Expansion valve — type	Internally equalised

SPECIAL TOOLS

An approved evacuation, charging and recovery unit
Torque wrench (and adaptors suitable for torquing refrigerant fittings)
A suitable leak detector
Thermometer
Safety goggles
Cooling system pressure test set
Clutch pressure plate puller
External circlip pliers

TORQUE SPECIFICATIONS

	Nm
Compressor bracket mounting bolts	40 to 55
Compressor mounting bolts	25 to 30
Clutch pressure plate retaining nut	15 to 17
Refrigerant fittings — threaded type (8 mm liquid)	13 to 15
(½" discharge)	20 to 25
(⅜" suction)	30 to 35
— bolted type (all)	20 to 30

SAFETY PRECAUTIONS

Use the same safety precautions as those given in the Manual Air-conditioning Section, refer to page 55-4-2.

SERVICE ADJUSTMENT PROCEDURES

For detailed information concerning the inspection procedures described below, refer to Section 4 of this group.

(1) Test procedures.
(2) Compressor drive belt adjustment.
(3) Charging procedures
(4) Charging the refrigerant.
(5) Performance test.
(6) Refrigerant leak repair procedure.
(7) Handling tubing and fittings.
(8) Compressor noise.
(9) Inspection of engine coolant.
(10) Temperature switch for condenser.
(11) Fan and radiator fan.
(12) Idle-up operation check.

POWER RELAY CHECK

(1) Remove the blower motor "HI" relay attached to the lower part of the blower case, refer Fig. 1.

(2) Remove the radiator fan motor relay, condenser fan motor relay, compressor relay and the blower motor relay, for locations and removal procedures refer to Section 2 of this Group.

(3) Apply the battery voltage to terminal ② and check for continuity between the terminals when terminal ④ is earthed.

Power is supplied	Between terminals 1-3	Continuity
Power is not supplied	Between terminals 1-3	No Continuity
	Between terminals 2-4	Continuity

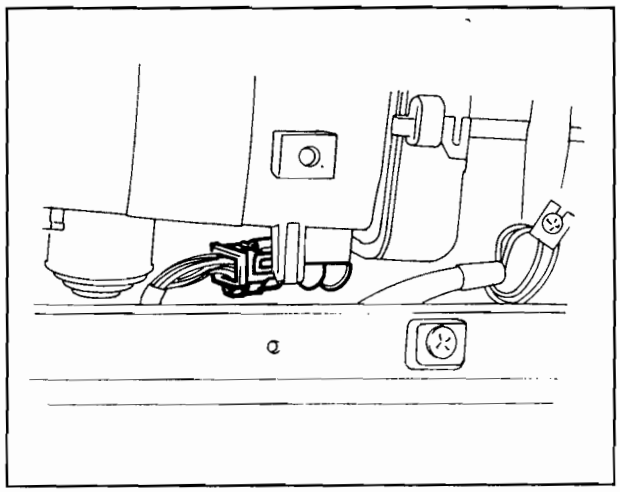


Fig. 1 — Blower motor "HI" relay location

AUTOMATIC AIR-CONDITIONING

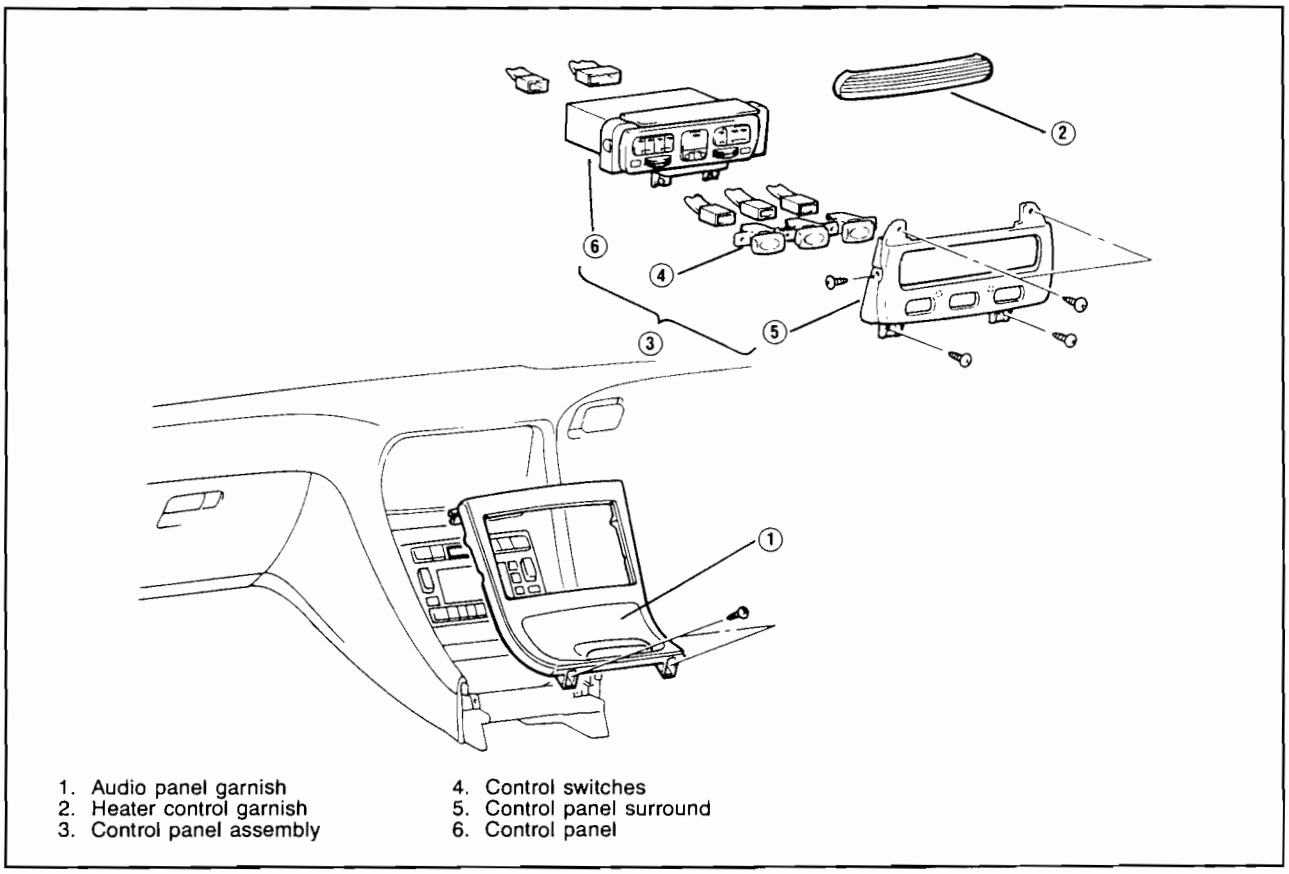


Fig. 2 — Control panel removal

CONTROL PANEL

Removal

Pre-removal operation
Remove the floor console, refer to Group 52.

(1) Remove the audio panel garnish, refer to Group 52.

(2) Remove the heater control garnish.

(3) Remove the control panel assembly by removing the four retaining screws, and disconnecting the five plugs going to the various components in the unit.

(4) To remove the control switches remove the four retaining screws and lift off of the control panel.

(5) To remove the control panel surround remove the two retaining screws on each side of the panel and pull away from the control panel.

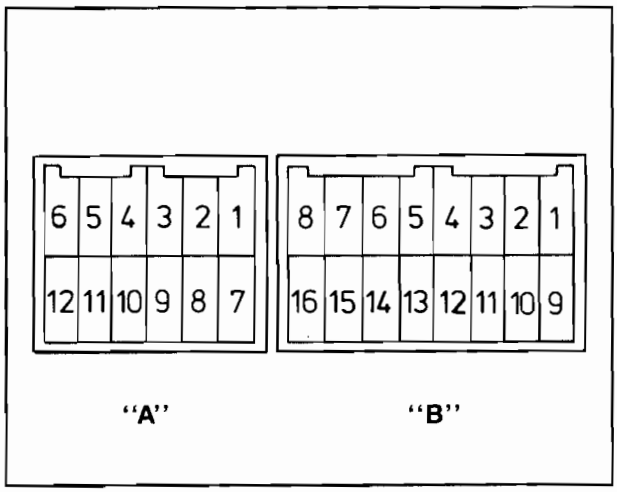


Fig. 3 — Temperature control switch connectors

Inspection

Blower switch

(1) When the AUTO mode switch is ON, check the continuity between terminals (12B) and (11A), refer Fig. 3.

(2) Operate the switch and measure the resistance between terminals (12B) and (11A), refer Fig. 3.

(3) The switch is operating correctly if the values are within the ranges shown in the following chart.

Switch Position	Resistance kΩ
Blower speed (MIN)	0.25
Blower speed (MAX)	2 ± 0.2

Switch Operation	Resistance kΩ
FOOT mode	0.33 ± 0.0165
FOOT/DEF mode	1 ± 0.05
FACE/FOOT mode	3.3 ± 0.165

Installation

Installation is a reversal of the removal prcoedure.

Temperature control switch

(1) Operate the switch and measure the resistance between terminals (8A) and (3B), refer Fig. 3.
(2) The switch is operating correctly if the values are within the ranges shown below.

Switch Position	Resistance kΩ
MAX. COOL	0.275
MAX. HOT	∞

Control panel switches

(1) Operate each switch and check for continuity between the terminals as shown.

Terminal / Switch	9 B	13 B	14 B	1 B	3 B	4 B	7 B	8 B	1 A
AUTO mode switch				○	○				
FACE mode switch DEF mode switch				○		○			
A/c switch	○		○						
ECONO switch	○	○							
Outside air inlet switch	○						○	○	○
Inside air circulation switch	○						○	○	○

NOTE: ○—○ indicates that there is continuity between the terminals.

(2) After checking the FACE mode switch, press the DEF mode switch and check the continuity between terminals (1B) and (4B), refer Fig. 3. If there is no continuity, it is normal.
(3) Operate the switch and measure the resistance between terminals (1B) and (4B), refer Fig. 3.
(4) If the switch is operating correctly, the values should be within the ranges shown on the following chart.

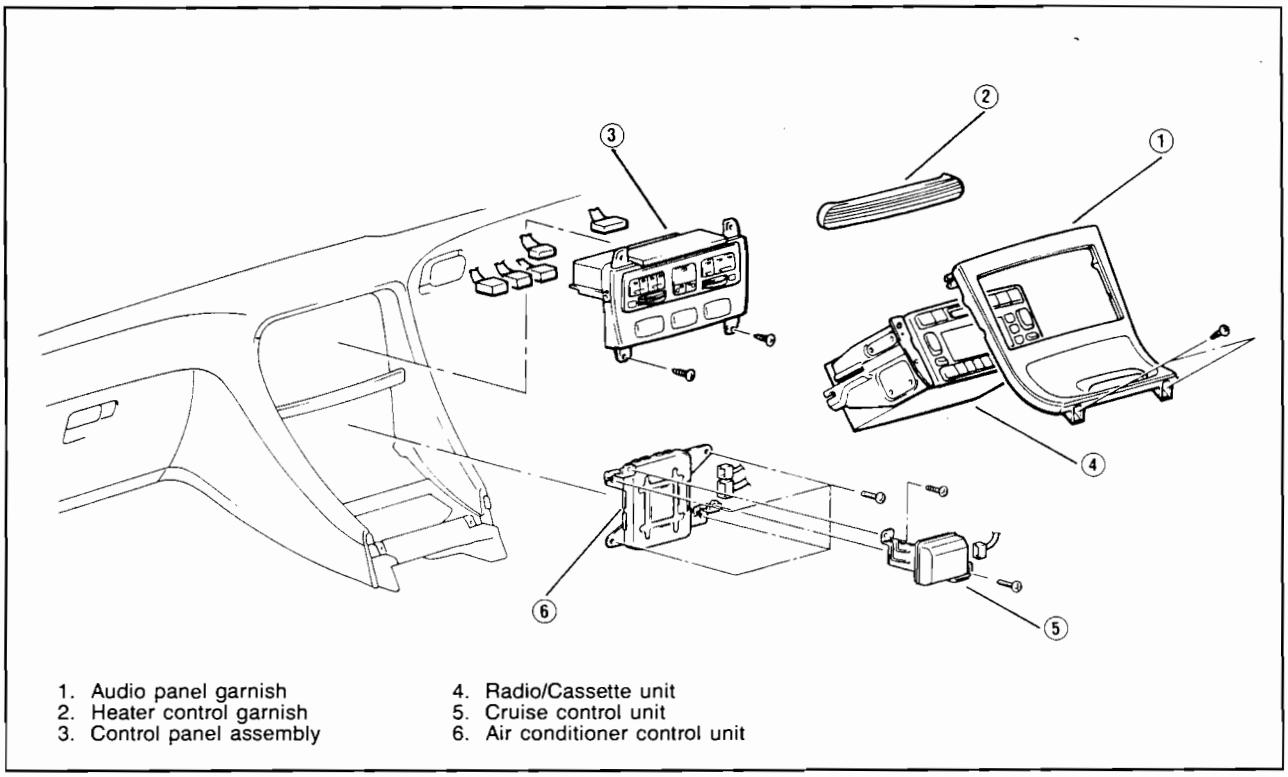


Fig. 4 — Air conditioner control unit removal

AIR CONDITIONER CONTROL UNIT

Removal

Pre-removal operation
Remove the floor console, refer to Group 52.

(1) Remove the audio panel garnish.
(2) Remove the heater control garnish.
(3) Remove the control panel assembly by removing the four retaining screws and disconnecting the five plugs going to the various components in the unit.
(4) Remove the radio/cassette unit, refer to Group 52 for removal procedures.
(5) Remove the cruise control unit by removing the connector and two retaining screws.
(6) Remove the air-conditioner control unit by removing the two connectors and four retaining screws, refer Fig. 4

Installation

Installation is a reversal of the removal procedure.

POWER TRANSISTOR

Removal

The power transistor is in the same position as the blower motor resistor would normally be, refer to page 55-2-4 of this Group. In an auto air-conditioning system, it takes the place of the resistor used in the standard system and should be removed and installed the same way, refer Fig. 5.

Inspection

If the power transistor is faulty, your blower motor will only operate in the high speed position. If this is the case the transistor should be replaced.

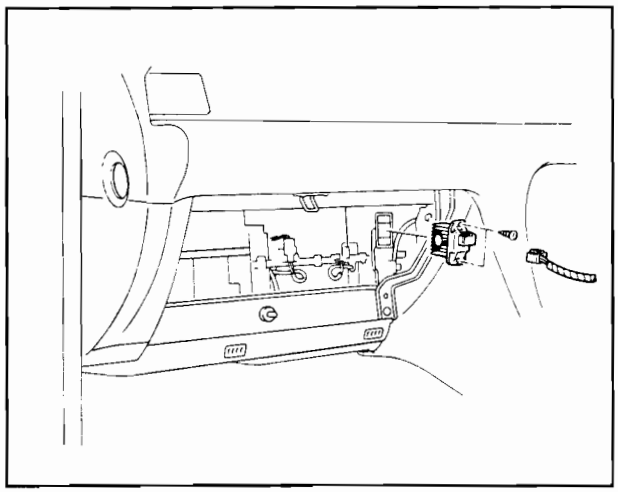
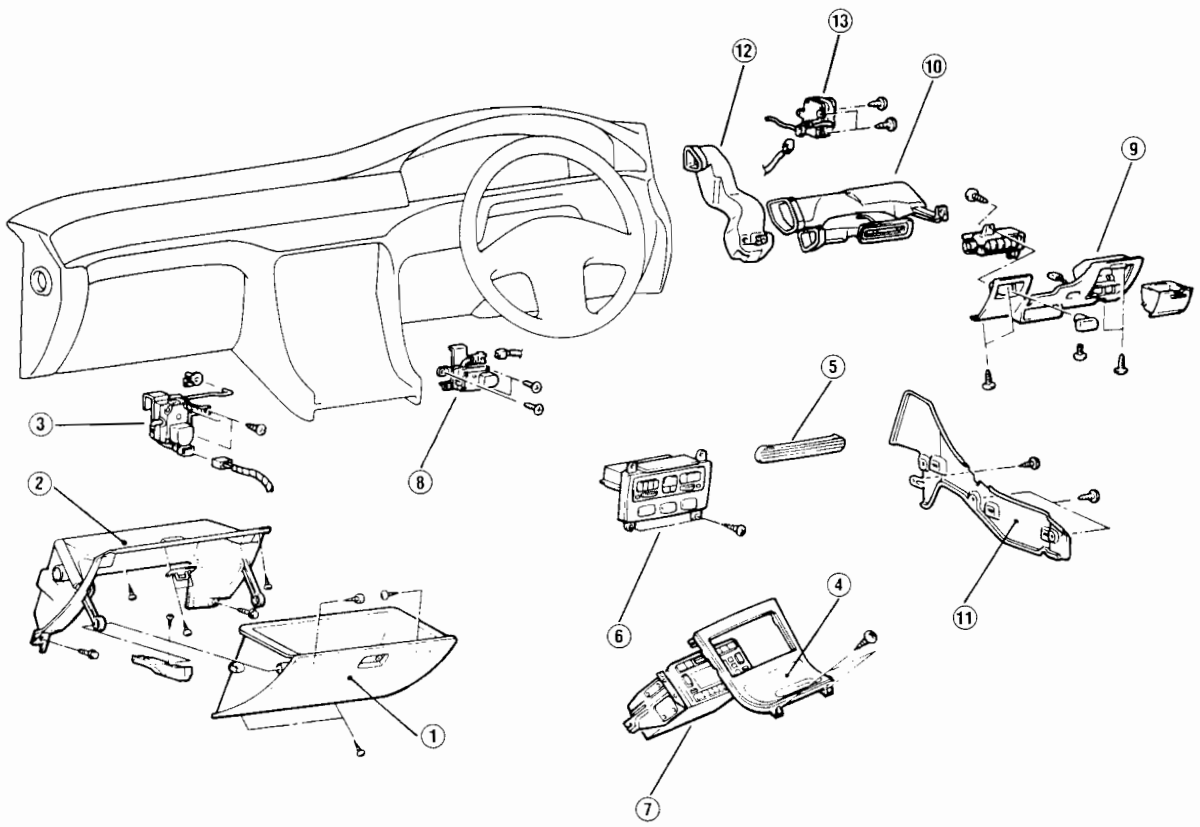


Fig. 5 — Power transistor removal



1. Glovebox
2. Glovebox outer case
3. Inside/Outside-air selector damper motor assembly
4. Audio panel
5. Heater control garnish
6. Heater control panel assembly
7. Radio/Cassette player
8. Air mix damper motor assembly
9. Driver side lower panel
10. Foot cooler nozzle and lap cooler duct B
11. Side cover
12. Lap cooler duct A
13. Outlet selector damper motor assembly.

Fig. 6 — Damper control motor assembly positions

INSIDE/OUTSIDE-AIR SELECTOR DAMPER MOTOR ASSEMBLY

Removal

(1) Remove the glovebox and glovebox outer case assembly, refer to Group 52 for removal procedures.

(2) To remove the damper motor assembly disconnect the loom and remove the three retaining screws. Also pull the control rod off its retaining clip.

Inspection

(1) Check that the motor rotates when battery voltage is applied across the terminals ① and ③ of the motor assembly connector, refer to Fig. 7.

(2) Also check that the motor rotates in the backward direction when the polarity is changed.

CAUTION: (1) To prevent damage to the unit, cut off the voltage when the damper is in the RECIRCULATION or FRESH position.

(2) Cut off the voltage if the motor does not turn when battery voltage is applied.

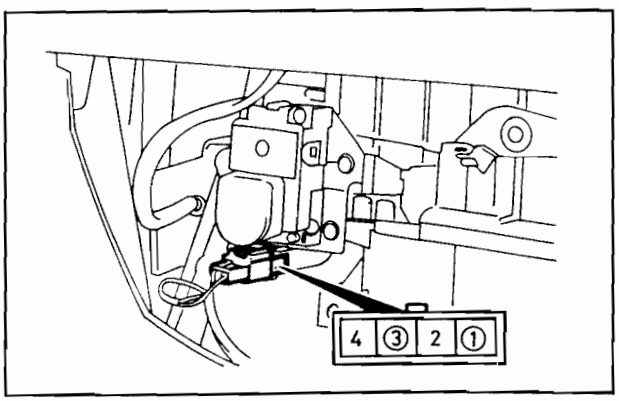


Fig. 7 — Inside/outside-air selector damper motor assembly check

Installation

Installation is a reversal of the removal procedure.

AIR MIX DAMPER MOTOR AND POTENTIOMETER

Air mix damper motor

Removal

Pre-removal operation

Remove the floor console, refer to Group 52 for removal procedures.

(1) Remove the audio panel.

(2) Remove the heater control garnish.

(3) Remove the heater control panel assembly and the radio/cassette player.

(4) Remove the air mix damper motor assembly by disconnecting the loom and removing the retaining screws, refer Fig. 6.

CAUTION

Inspection

(1) Check that the motor rotates when battery voltage is applied across terminals (1) and (3) of the motor assembly connector, refer Fig. 8.

(2) Also check that the motor turns in a backward direction when polarity is changed.

CAUTION: (1) To prevent damage to the unit, cut off the voltage when the damper is in the MAX. HOT or MAX. COOL position.

(2) Cut off the voltage if the motor does not turn when battery voltage is applied.

Air mix damper potentiometer

(1) Connect a circuit tester across terminals (5) and (2) of the motor assembly connector, refer Fig. 9.

(2) Check that the resistance gradually changes as the damper is moved from the MAX. HOT to MAX. COOL position. Values should be as shown.

MAX. HOT — approx. 4.8 kΩ

MAX. COOL — approx. 1.2 kΩ

Installation

Installation is a reversal of the removal procedure.

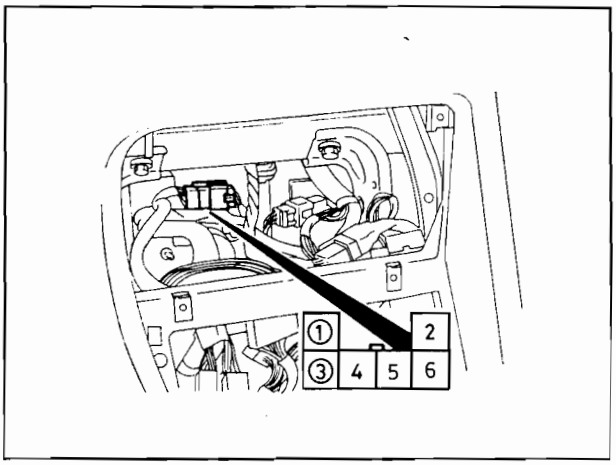


Fig. 8 — Air mix damper motor check

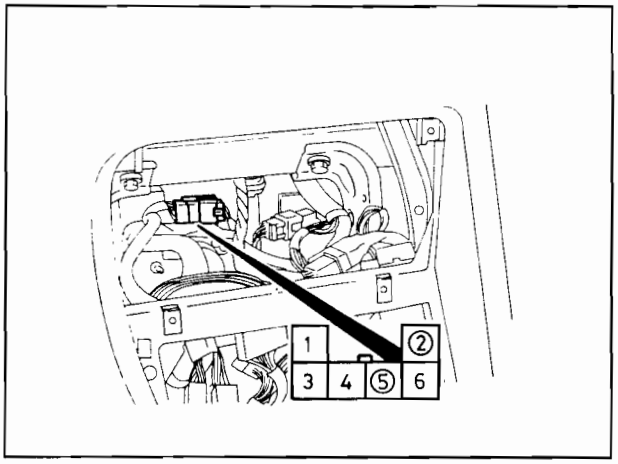


Fig. 9 — Air mix damper potentiometer check

OUTLET SELECTOR DAMPER MOTOR AND POTENTIOMETER

Outlet selector damper motor

Removal

(1) Remove the driver side lower panel.

(2) Remove the foot cooler nozzle and lap cooler duct B.

(3) Remove the side cover and lap cooler duct A.

(4) Remove the outlet selector damper motor assembly by disconnecting the loom and removing the retaining screws. The selector link should also be pulled out of the retaining clip, refer Fig. 6.

Inspection

(1) Check that the motor turns when battery voltage is applied across terminals (1) and (3) of the motor assembly connector, refer Fig. 10.

(2) Also check that the motor turns in a backward direction when polarity is changed.

CAUTION: (1) To prevent damage to the unit, cut off the voltage when the damper is in the DEF. or FACE. position.

(2) Cut off the voltage if the motor does not turn when battery voltage is applied.

Outlet selector damper potentiometer

Inspection

(1) Connect a circuit tester across terminals (4) and (2) of the motor assembly connector, refer Fig. 11.

(2) Check that the resistance gradually changes as the damper is moved from DEF. to FACE. position, values should be as shown

DEF. position — approx. 0.9 kΩ

FACE. position — approx. 3.6 kΩ

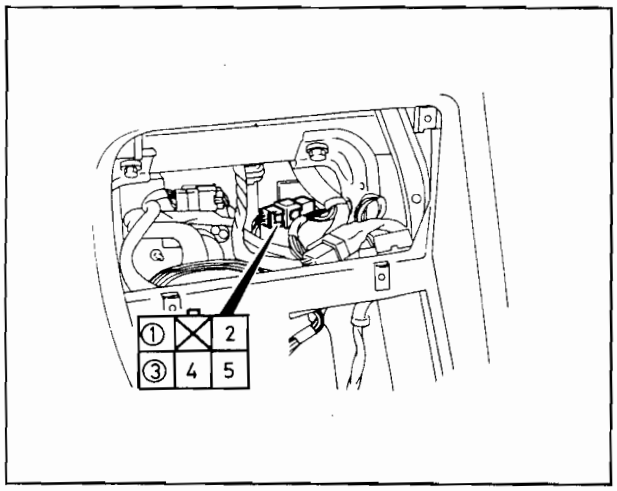


Fig. 10 — Outlet selector damper motor check

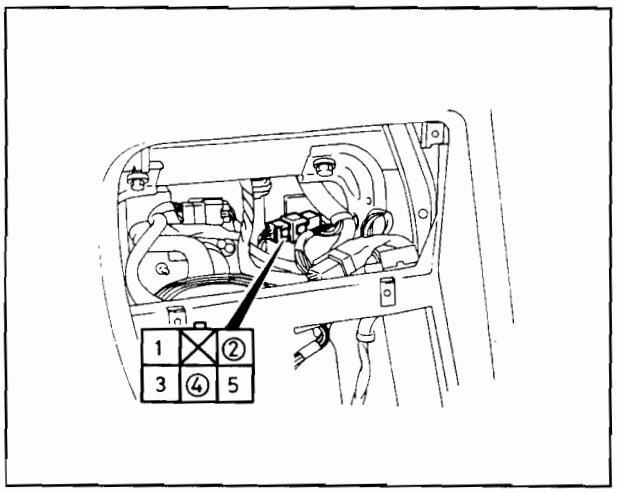


Fig. 11 — Outlet selector damper potentiometer check

Installation

Installation is a reversal of the removal procedure.

SENSORS

Room temperature sensor

Removal

Remove the room temperature sensor from the headlining by gently prying with a screwdriver, refer Fig. 12 and disconnecting the wiring.

CAUTION: Care must be taken so as not to damage the headlining whilst removing the room temperature sensor.

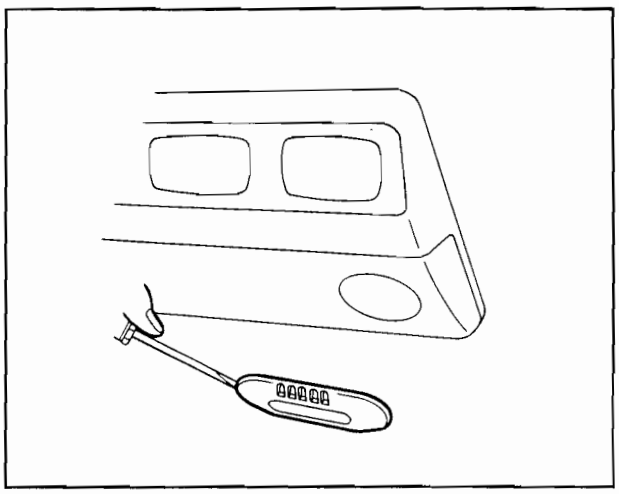


Fig. 12 — Room temperature sensor removal

Inspection

Using a circuit tester, measure the resistance between the terminals, refer Fig. 12. The values should be as shown.

Approx. 1700 ± 85Ω at 25°C

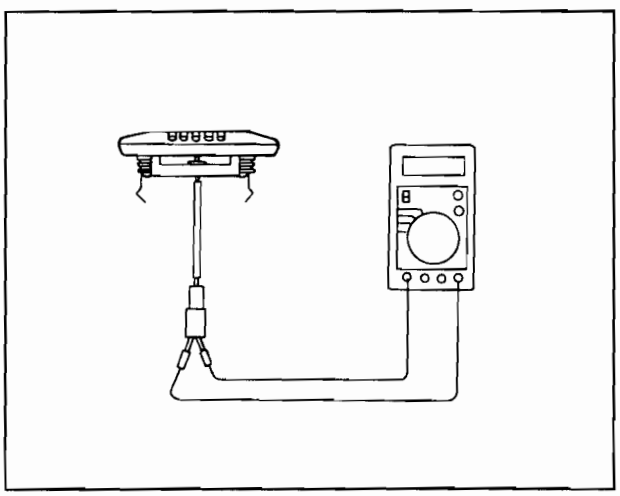


Fig. 13 — Room temperature sensor check

Installation

Installation is a reversal of the removal procedure.

Photo sensor

Removal

The photo sensor can be removed by gently prying away from the defroster garnish using a very fine screwdriver, refer Fig. 14 and disconnecting the wiring.

NOTE: Be careful not to damage the defroster garnish or instrument panel whilst removing the photo sensor.

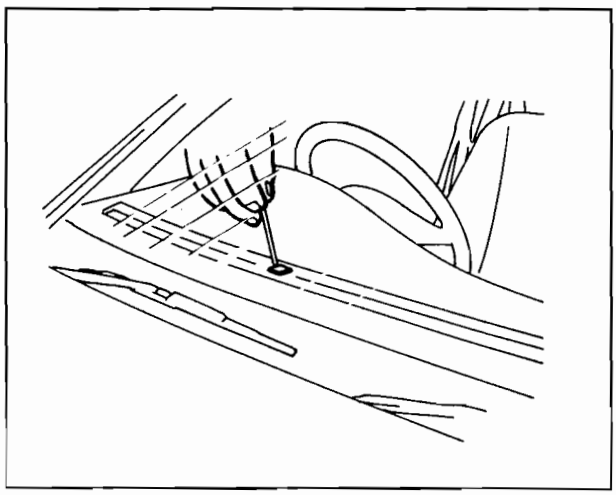


Fig. 14 — Photo sensor removal

Inspection

(1) Connect a battery and a circuit tester to the photo sensor as shown in Fig. 15.

(2) Compare the current between terminals (1) and (2) when the light receiver of the photo sensor is covered by hand. If the current is greater when the covering is removed, the sensor is normal.

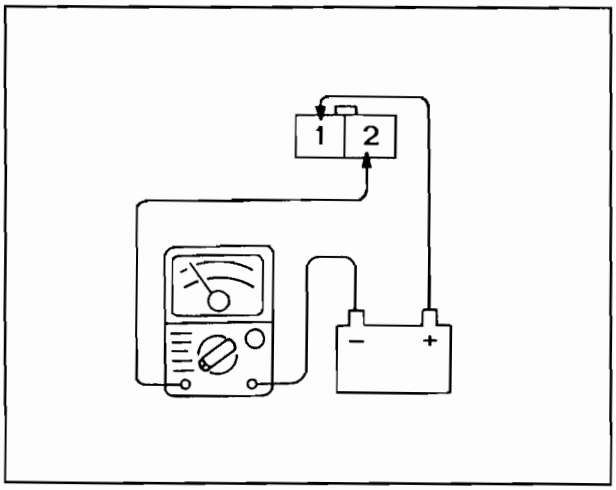


Fig. 15 — Photo sensor check

Installation

Installation is a reversal of the removal procedure.

Outside-air-temperature sensor

Removal

(1) Renove the glove box and glove box outer case assembly, refer to Group 52.

(2) Remove the outside-air temperature sensor by removing the retaining clip located at the top/front of the blower assembly case, and withdraw the sensor from the blower assembly, refer Fig. 16.

Inspection

The resistance values should be approximately the same as shown in Fig. 17 when the resistance values between the terminals are measured under two or more temperature conditions.

NOTE: The temperature conditions should not exceed the temperature shown in the characteristic graph at the time when the check is being made.

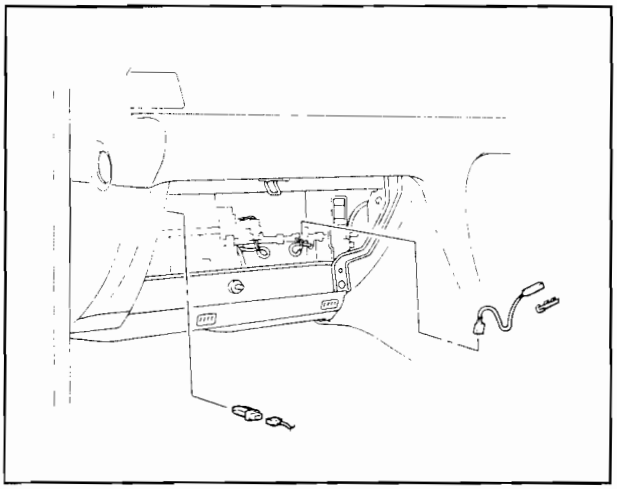


Fig. 16 — Outside-air and water temperature sensor locations

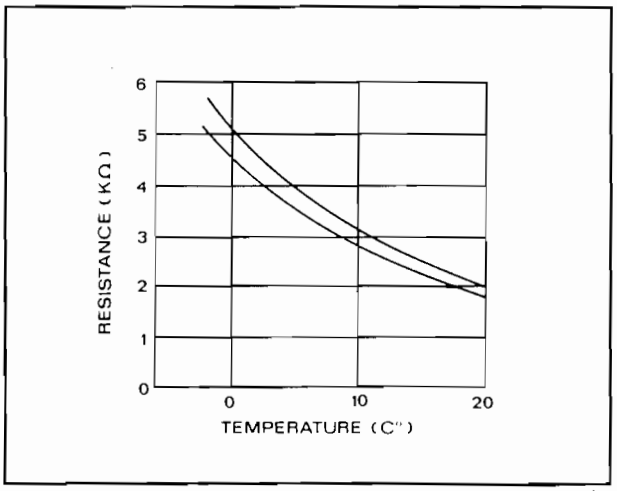


Fig. 17 — Characteristic graph

Installation

Installation is a reversal of the removal procedure.

Water temperature sensor

Removal

(1) Remove the glove box and glove box outer case assembly, refer to Group 52.

(2) Remove the water temperature sensor by removing the retaining clip located at the front of the heater unit, and withdrawing the sensor from its position alongside the heater core. The connector must also be disconnected from the A/C loom at the front of the evaporator, refer Fig. 16.

Inspection

(1) Place the water temperature sensor into a container of hot water and raise the water temperature to **40°C**, refer Fig. 18.

(2) The resistance should be **4.0–5.6 kΩ at (22.5–30.5°C)**.

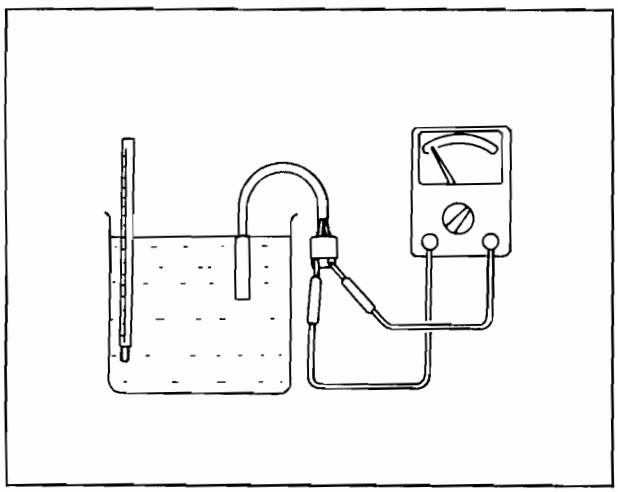


Fig. 18 — Water temperature sensor check

Installation

Installation is a reversal of the removal procedure.