Royal Nissan



DATSUN

1981 DATSUN PICK-UP

SERVICE MANUAL

THE NAME OF QUALITY
NISSAN
NISSAN MOTOR CO. LTD.

P/N 20085

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DATSUN PICK-UP

Model 720 Series

FOREWORD

This service manual has been prepared primarily for the purpose of assisting service personnel in providing effective service and maintenance of the 1981 DATSUN PICK-UP.

This manual includes procedures for maintenance, adjustments, removal and installation, disassembly and assembly of components, and trouble-shooting.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. If your DATSUN model differs from the specifications contained in this manual, consult your NISSAN/DATSUN dealer for information.

The right is reserved to make changes in specifications and methods at any time without notice.

NISSAN MOTOR CO., LTD.

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HOW TO USE THIS MANUAL

- This Service Manual is designed as a guide for servicing vehicles.
- This manual is divided into 20 sections. The first half of the manual presents sections which concern the engine, and the second half presents sections which deal with the chassis and body.
- **A QUICK REFERENCE INDEX** is provided on the first page. Refer to this index along with the index of the particular section you wish to consult.
- The first page of each section lists the contents and gives the page numbers for the respective topics.
- **SERVICE DATA AND SPECIFICATIONS** are contained in each section.
- **TROUBLE DIAGNOSES AND CORRECTIONS** are also included in each section. This feature of the manual lists the likely causes of trouble and recommends the appropriate corrective actions to be taken.
- A list of **SPECIAL SERVICE TOOLS** is included in each section. The special service tools are designed to assist you in performing repair safely, accurately and quickly. For information concerning how to obtain special service tools, write to the following address:

  Kent-Moore Corporation
  29784 Little Mack
  Roseville, Michigan 48066

  Kent-Moore of Canada, Ltd.
  2395 Cawthra
  Mississauga, Ontario
  Canada L5A 3P2

- The measurements given in this manual are primarily expressed with the SI unit (International System of Unit), and alternately expressed in the metric system and in the yard/pound system.
- The back cover of the manual provides maintenance data for quick reference.
- In the text, the following abbreviations are used:

S.D.S.:	Service Data and Specifications	M/T, A/T:	Manual Transmission, Automatic Transmission
Ⓣ :	Tightening Torque	2WD, 4WD:	2-wheel drive vehicle, 4-wheel drive vehicle
L.H., R.H.:	Left Hand, Right Hand	SST:	Special Service Tools

- The captions **CAUTION and WARNING** warn you of steps that must be followed to prevent personal injury and/or damage to some part of the vehicle.



IMPORTANT SAFETY NOTICE

The proper performance of service is essential for both the safety of the mechanic and the efficient functioning of the vehicle.
The service methods in this Service Manual are described in such a manner that the service may be performed safely and accurately.
Special service tools have been designed to permit safe and proper performance of service. Be sure to use them.

Service varies with the procedures used, the skills of the mechanic and the tools and parts available. Accordingly, anyone using service procedures, tools or parts which are not specifically recommended by NISSAN must first completely satisfy himself that neither his safety nor the vehicle's safety will be jeopardized by the service method selected.

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SECTION GI

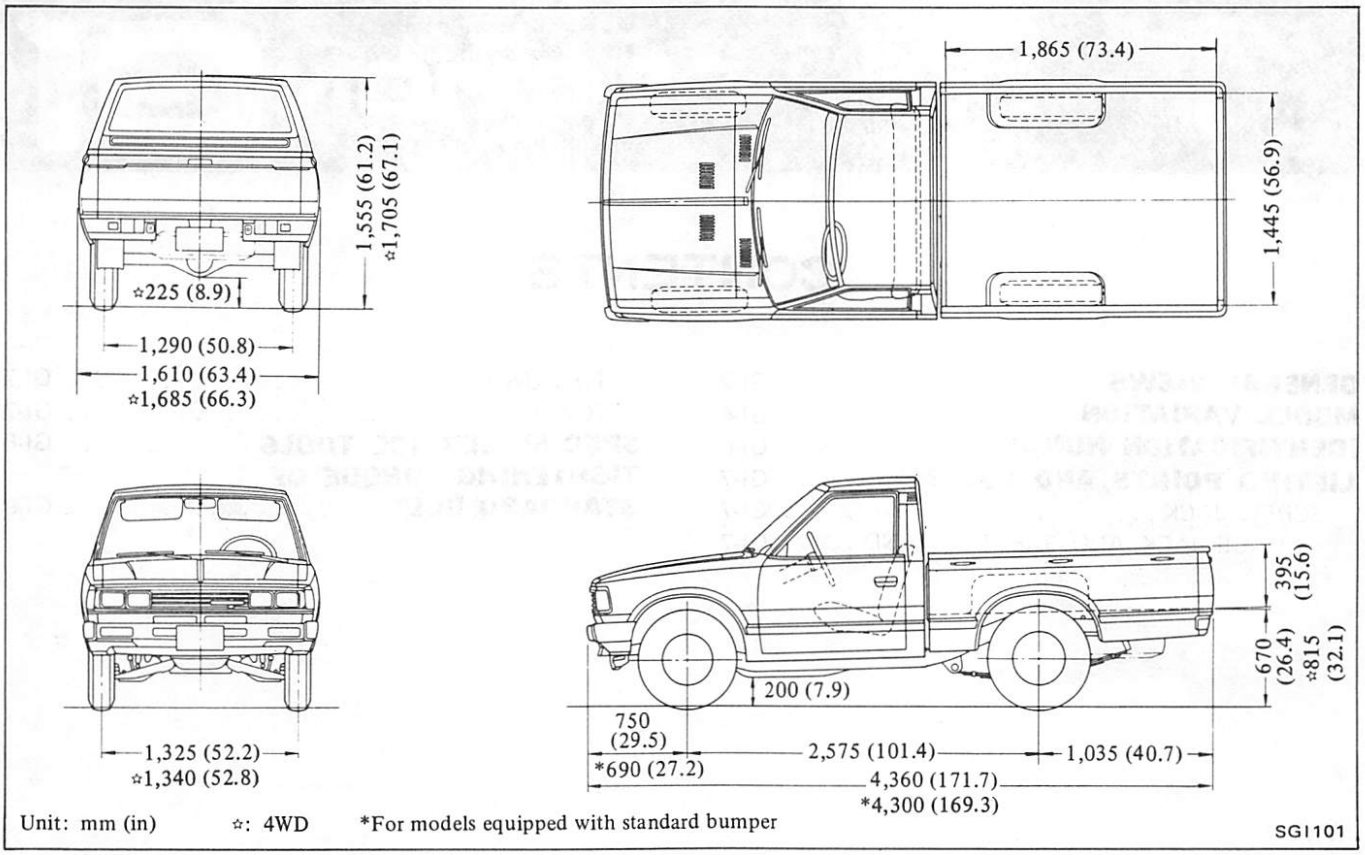
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GENERAL VIEWS

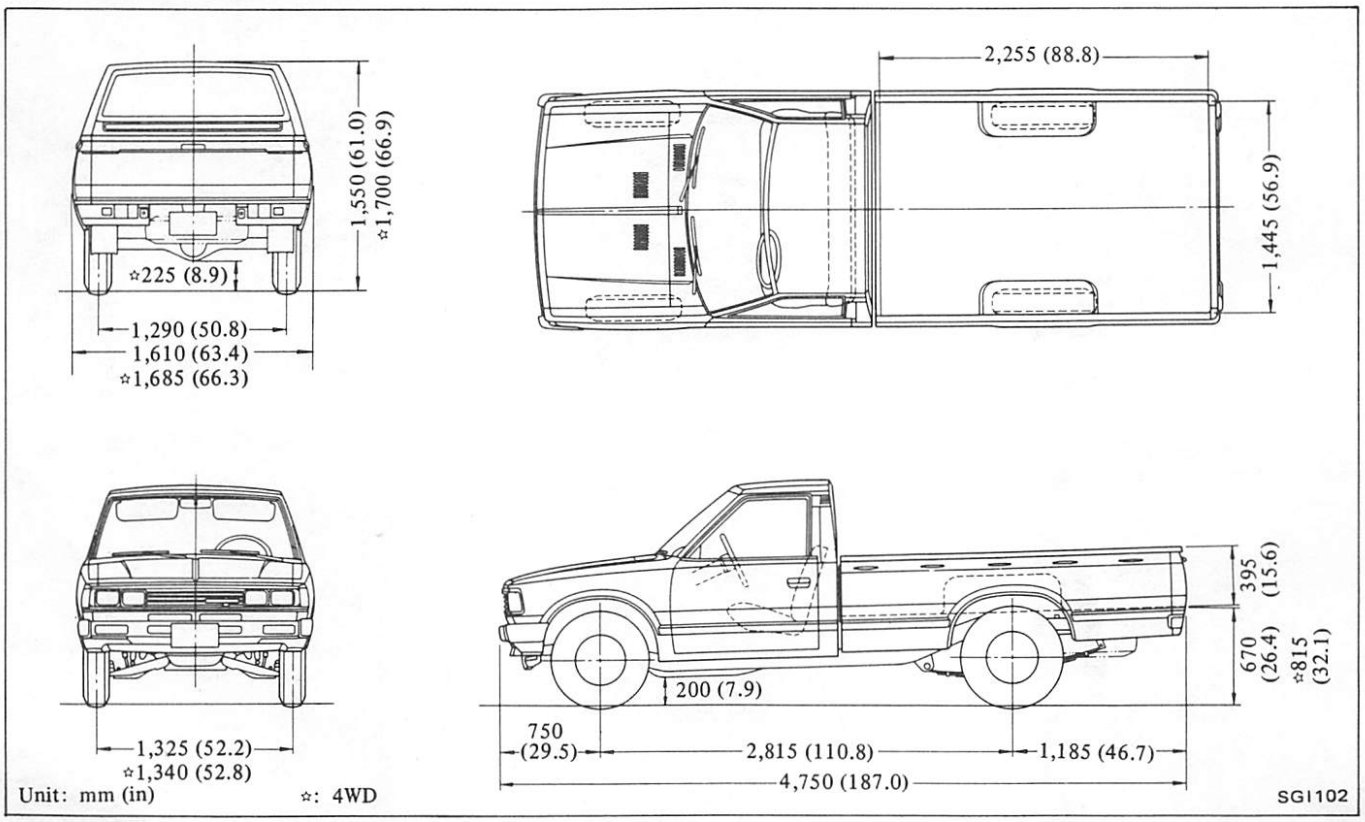
Regular Bed



Unit: mm (in) ☆: 4WD *For models equipped with standard bumper

SGI101

Long Bed and Heavy Duty

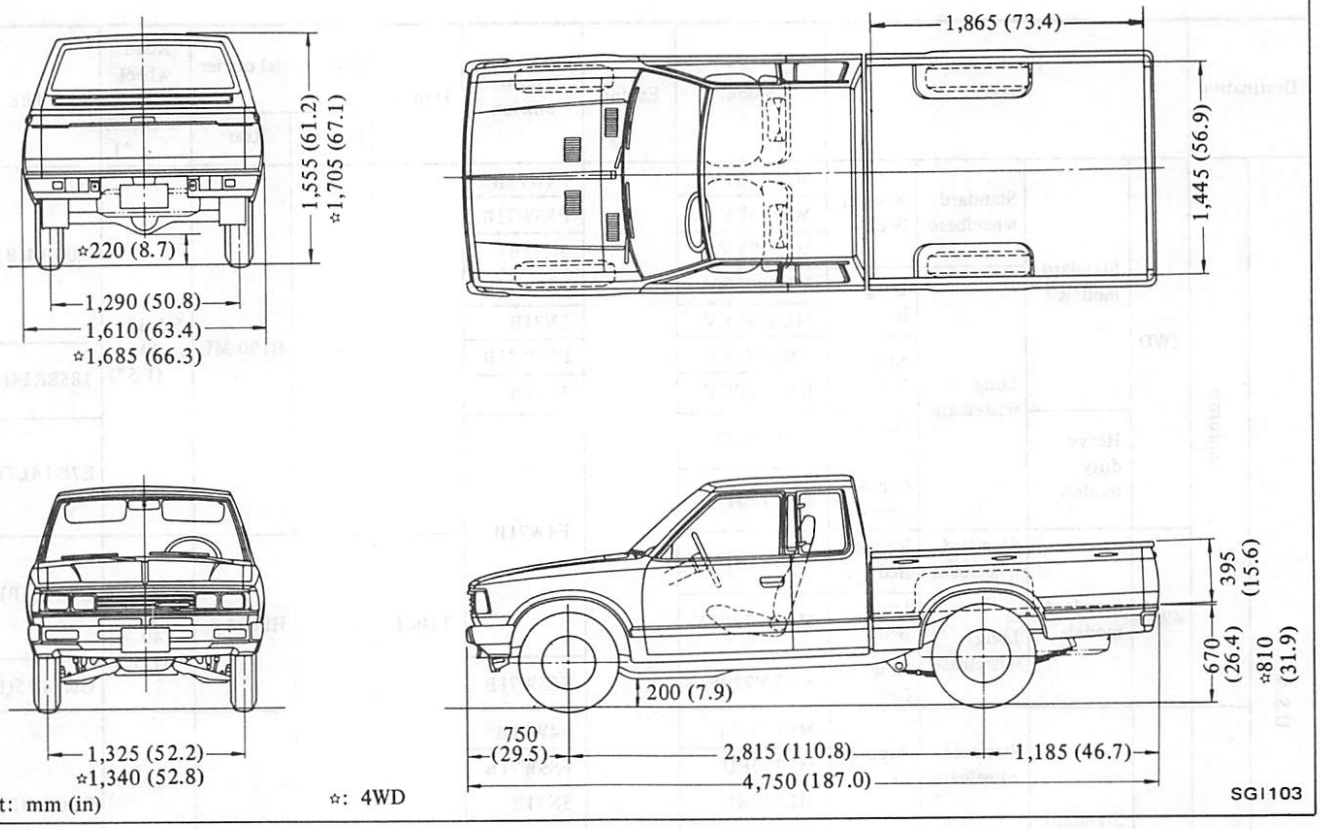


Unit: mm (in) ☆: 4WD

SGI102

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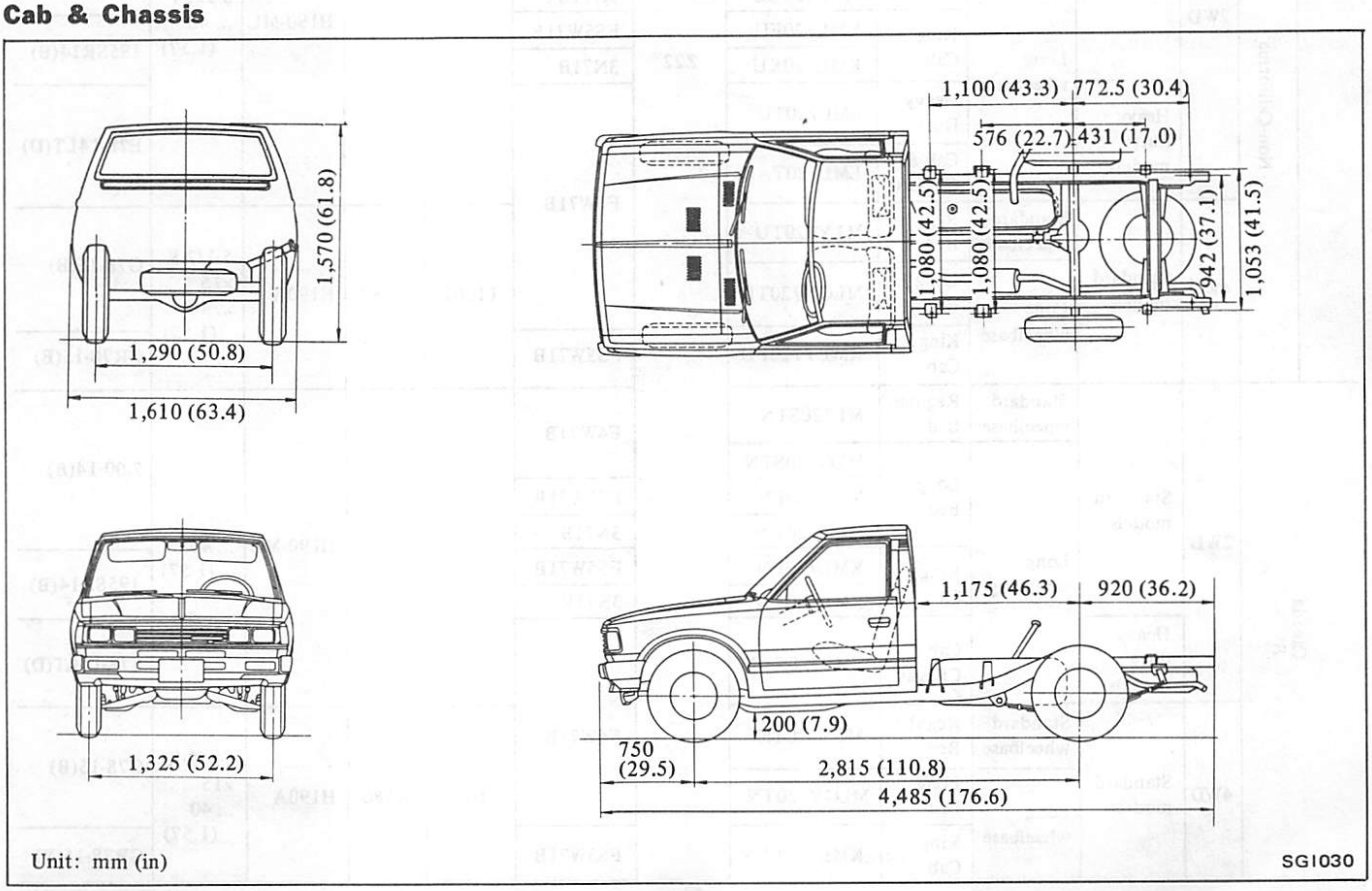
King Cab



Unit: mm (in)

☆: 4WD

Cab & Chassis



Unit: mm (in)

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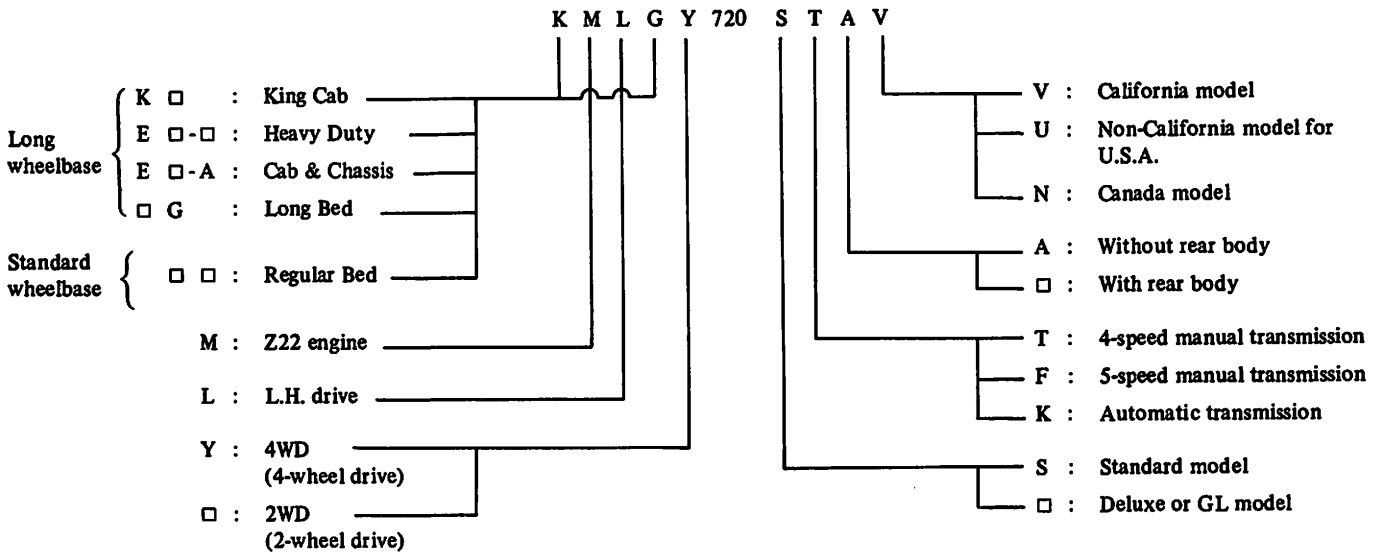
MODEL VARIATION

Destination		Class				Model	Engine	Trans-mission	Transfer	Differential carrier		Road wheel size ... Offset *1	Tire
										Front	Rear		
U.S.A.	California	2WD	Standard models	Standard wheelbase	Regular Bed	ML720STV	Z22	F4W71B	–	–	H190-ML	5-Jx14 ... 40 (1.57)	7.00-14(B)
						ML720FV		FS5W71B					
						ML720KV		3N71B					185SR14(B)
				Long wheelbase	Long Bed	MLG720FV		FS5W71B					
						MLG720KV		3N71B					
					King Cab	KML720FV		FS5W71B					
						KML720KV		3N71B					
			Heavy duty models		Heavy Duty	EML720TV		F4W71B					E78-14LT(D)
					Cab & Chassis	EML720TAV							
		4WD	Standard models	Standard wheelbase	Regular Bed	MLY720TV			T100L	R180	H190A	5-1/2-K x15 ... 40 (1.57)	G78-15(B)
				Long wheelbase	Long Bed	MLGY720TV							
					King Cab	KMLY720FV		FS5W71B					GR78-15(B)
	Non-California	2WD	Standard models	Standard wheelbase	Regular Bed	ML720STU		F4W71B	–	–	H190-ML	5-Jx14 ... 40 (1.57)	7.00-14(B)
						ML720FU		FS5W71B					
						ML720KU		3N71B					185SR14(B)
				Long wheelbase	Long Bed	MLG720FU		FS5W71B					
						MLG720KU		3N71B					
					King Cab	KML720FU		FS5W71B					
						KML720KU		3N71B					
			Heavy duty models		Heavy Duty	EML720TU		F4W71B					E78-14LT(D)
					Cab & Chassis	EML720TAU							
		4WD	Standard models	Standard wheelbase	Regular Bed	MLY720TU			T100L	R180	H190A	5-1/2-K x15 ... 40 (1.57)	G78-15(B)
				Long wheelbase	Long Bed	MLGY720TU							
					King Cab	KMLY720FU		FS5W71B					GR78-15(B)
Canada		2WD	Standard models	Standard wheelbase	Regular Bed	ML720STN		F4W71B	–	–	H190-ML	5-Jx14 ... 40 (1.57)	7.00-14(B)
				Long wheelbase	Long Bed	MLG720STN							
						MLG720FN		FS5W71B					195SR14(B)
						MLG720KN		3N71B					
					King Cab	KML720FN		FS5W71B					
						KML720KN		3N71B					
			Heavy duty models		Cab & Chassis	EML720TAN		F4W71B					E78-14LT(D)
		4WD	Standard models	Standard wheelbase	Regular Bed	MLY720TN			T100L	R180	H190A	5-1/2-K x15 ... 40 (1.57)	G78-15(B)
				Long wheelbase	Long Bed	MLGY720TN							
					King Cab	KMLY720FN		FS5W71B					GR78-15(B)

*1 Unit: mm (in)

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Prefix and suffix designations



□: means no indication.

– Reference –

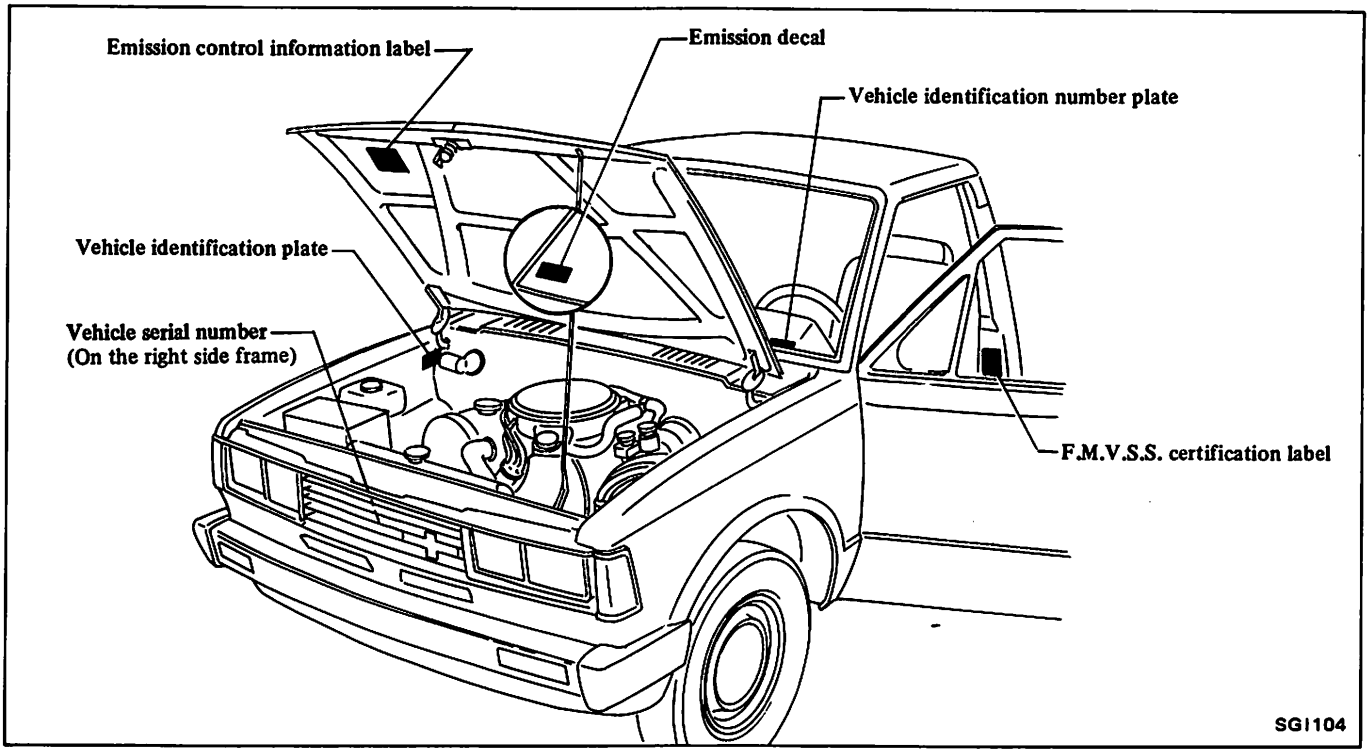
The model variations of the 720 series are as follows:

Class		Standard model			Heavy duty model	
Wheelbase		Standard wheelbase	Long wheelbase			
Model	2WD	Regular Bed	Long Bed	King Cab	*Heavy Duty	Cab & Chassis
	4WD	Regular Bed	Long Bed	King Cab	–	–
Cab type		Regular Cab		King Cab	Regular Cab	
Bed type		Regular Bed	Long Bed	Regular Bed	Long Bed	–
Chassis type		Standard chassis			Heavy chassis	

*: Except for Canada

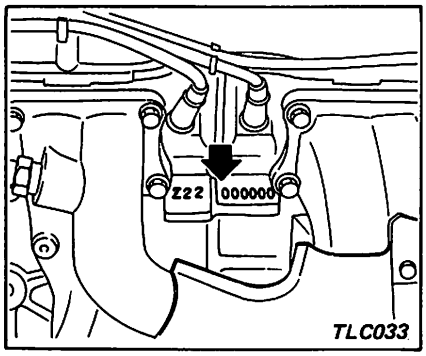
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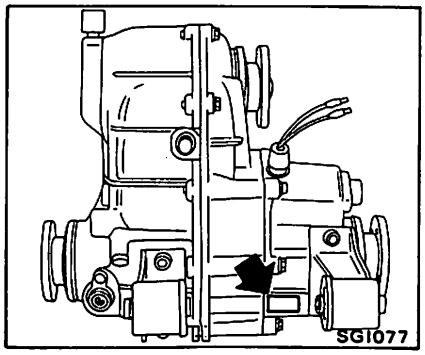
IDENTIFICATION NUMBER



ENGINE NUMBER

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



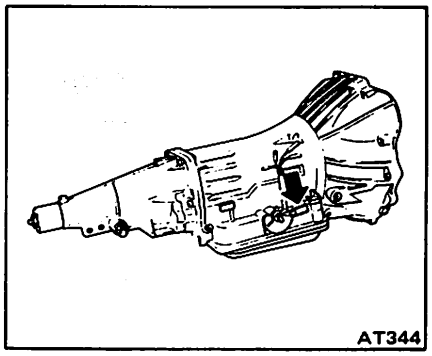


MANUAL TRANSMISSION NUMBER

The transmission serial number is stamped on the front upper face of the transmission case.

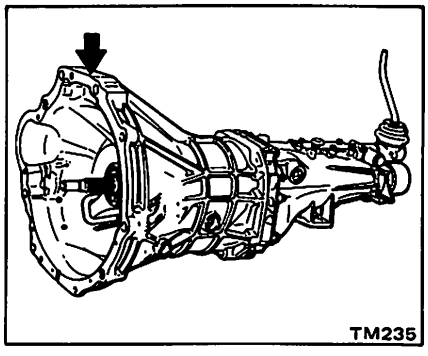
AUTOMATIC TRANSMISSION NUMBER

The transmission serial number is stamped on the right side of the transmission case.



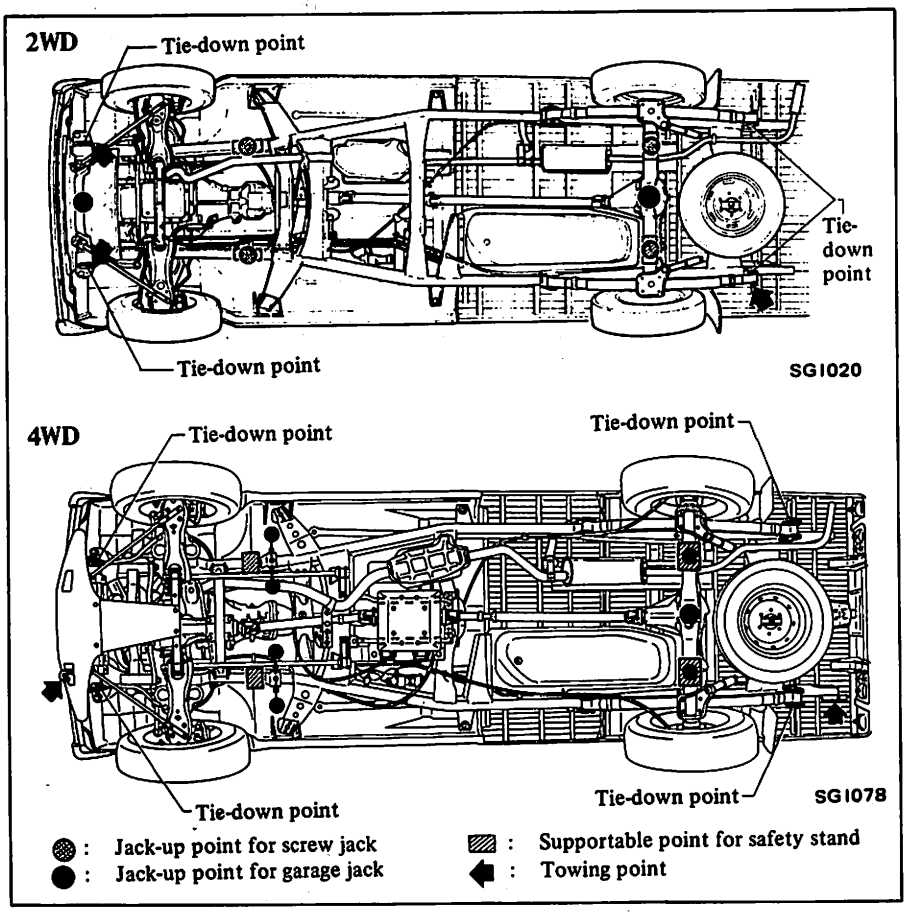
TRANSFER NUMBER

The transfer serial number is stamped on the front right face of the transfer case.



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LIFTING POINTS AND TOWING



SCREW JACK

WARNING:

a. Never get under the vehicle while it is supported only by the jack.
Always use safety stands to support frame or rear axle case when you have to get beneath the vehicle.
b. Place wheel chocks at both front and rear of the wheels diagonally opposite the jack position.

CAUTION:

a. When the yellow mark appears on the screw jack, it indicates the maximum permissible height. Do not jack up further.
b. When the jack is at lower limit, do not add large force downward.

Apply the screw jack furnished with the vehicle to the position indicated below in a safe manner.

GARAGE JACK AND SAFETY STAND

WARNING:

a. When carrying out operations with the garage jack, be sure to support the vehicle with safety stands.
b. When jacking up the rear (front) of the vehicle, place the chocks at the front (rear) of the front (rear) wheels to hold them.

Apply the garage jack and safety stand to the position indicated below in a safe manner.

TIE-DOWN

FRONT SIDE

Use front tie-down hooks.

REAR SIDE

Use rear spring shackle for tie-down.

TOWING

CAUTION:

a. It is necessary to use proper towing equipment to avoid possible damage to the vehicle during a towing operation.
Towing is in accordance with Towing Procedure Manual at dealer side.
b. All applicable State or Provincial (in Canada) laws and local laws regarding the towing operation must be obeyed.
c. The rear left leaf spring should not be used for towing.
d. Before towing, make sure that the transmission, transfer unit, axles, steering system and power train are in good order. If any unit is damaged, a dolly must be used.
e. If the transmission and transfer are inoperative, tow the vehicle with the rear wheels off the ground, or with the propeller shaft removed.
f. When the vehicle is towed with its front wheels on the ground, secure the steering wheel in a straight ahead position with the ignition key turned in "OFF" position.
g. Set the free-running hubs at the "FREE" position. (4WD)
h. When towing an automatic transmission model, try to restrict towing speed below 30 km/h (20 MPH) and towing distance less than 30 km (20 miles).
With manual transmission model, try to restrict towing speed 80 km/h (50 MPH) and towing distance less than 80 km (50 miles).
If the speed or distance must necessarily be greater, remove the propeller shaft beforehand to prevent damage to the transmission.
i. Release the parking brake and set the gearshift and transfer control levers in "Neutral" position before starting to two the vehicle.

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SPECIAL SERVICE TOOLS

Special Tools play very important role in the maintenannce of vehicles. These are essential to the safe, accurate and speedy servicing.

The working times listed in the column under FLAT RATE TIME in FLAT RATE SCHEDULE are computed based on the use of Special Tools.

The identification code of maintenance tools is made up of 2 alphabetical letters and 8-digital figures.

The heading two letters roughly classify tools or equipment as:

ST00000000: Special Tool
KV00000000: Special Tool

EM00000000: Engine Overhauling Machine
GG00000000: General Gauge
LM00000000: Garage Tool
HT00000000: Hand Tool

TIGHTENING TORQUE OF STANDARD BOLT

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

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

Grade	Mark
4T	4
7T	7
9T	9

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MAINTENANCE SCHEDULE

The following tables list the periodic maintenance servicing required to ensure good emission control performance, good engine performance and good mechanical condition in DATSUN.

The first 1,600 km (1,000 miles) service is one of the most important services required to ensure the maximum emission control performance and optimum engine condition.

MAINTENANCE OPERATION		MAINTENANCE INTERVAL							Reference page
Periodic maintenance should be performed at number of kilometers, miles or months, whichever comes first.	Kilometers x 1,000	1.6	12	24	36	48	60	72	
	(Miles x 1,000)	(1)	(7.5)	(15)	(22.5)	(30)	(37.5)	(45)	
	Months	–	6	12	18	24	30	36	

EMISSION CONTROL MAINTENANCE

Drive belts		I*		I*		I		I*	MA-6
Carburetor air cleaner filter	See NOTE: (2)					R			MA-6
Air induction valve filter	See NOTE: (2)					R			MA-6
** Positive Crankcase Ventilation (P.C.V.) filter	See NOTE: (3)								MA-7
** Vapor lines						I			MA-7
** Fuel lines (hoses, pipings, connections, etc.)						I			MA-8
** Fuel filter	See NOTE: (3)								MA-8
Engine coolant						R			MA-8
Engine oil & oil filter	See NOTE: (1)		R	R	R	R	R	R	MA-8
Spark plugs						R			MA-10
** Ignition wiring						I			MA-10
Intake & Exhaust valve clearance		A		A		A		A	MA-10
Carburetor idle rpm		I		I*		I*		I*	MA-12
*** Automatic temperature control (A.T.C.) air cleaner						I			EF-2

UNDERHOOD MAINTENANCE

Brake, clutch, steering gear & automatic transmission fluid or oil level & leaks			I		I		I	MA-20, 21, 26, 31
Brake fluid			R		R		R	MA-26
Brake booster vacuum hoses, connections & check valve					I			MA-26
Air conditioning system hoses, connections & refrigerant leaks					I			MA-34

Abbreviations: A = Adjust
R = Replace
I = Inspect, correct, replace if necessary.

NOTE: (1) If vehicle is operated under severe conditions: short distance driving extensive idling or driving in dusty conditions, change engine oil every 5,000 km (3,000 miles) or 3 months, whichever comes first.

(2) More frequent maintenance is required under dusty driving conditions.

(3) If vehicle is operated under extreme adverse weather conditions or in areas where ambient temperatures are either extremely low or extremely high, the filters might become clogged. In such an event, replace them immediately.

(4) Maintenance intervals with "*" are required on non-California and Canada models only.
Maintenance items with "" are recommended by NISSAN MOTOR CO., LTD.**
Maintenance item with "*" is recommended on non-California models only.**
Other maintenance items and intervals are required.

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MAINTENANCE OPERATION		MAINTENANCE INTERVAL							Reference page
Periodic maintenance should be performed at number of kilometers, miles or months, whichever comes first.	Kilometers x 1,000	1.6	12	24	36	48	60	72	
	(Miles x 1,000)	(1)	(7.5)	(15)	(22.5)	(30)	(37.5)	(45)	
	Months	–	6	12	18	24	30	36	

UNDER VEHICLE MAINTENANCE

Brake, clutch, fuel & exhaust systems for proper attachment, leaks, cracks, chafing, abrasion, deterioration, etc.			I		I		I	MA-20, 26
Manual transmission, transfer & differential gear oil	See NOTE: (5)		I		I		I	MA-20, 21, 22
Steering gear box & linkage, suspension parts, propeller shafts & front drive shafts for damaged, loose & missing parts & lubrication	See NOTE: (6)	I	I		I		I	MA-21, 22, 31
Underbody (flush and clean every 12 months)			I		I		I	–

OUTSIDE AND INSIDE MAINTENANCE

Rotate wheel position & inspect wheel balance & wheel alignment			I		I		I	MA-28, 29, 30, 31
Disc brake pads or brake drums, linings & other brake components for wear, deterioration & leaks	See NOTE: (7)		I		I		I	MA-26, 27
Front wheel bearing					I			MA-23, 24
Locks, hinges & hood latch	See NOTE: (7)		L		L		L	MA-33
Seat belts, buckles, retractors, anchors & adjuster			I		I		I	MA-32
Foot brake, parking brake & clutch for stroke, free play & operation			I		I		I	MA-20, 27, 28

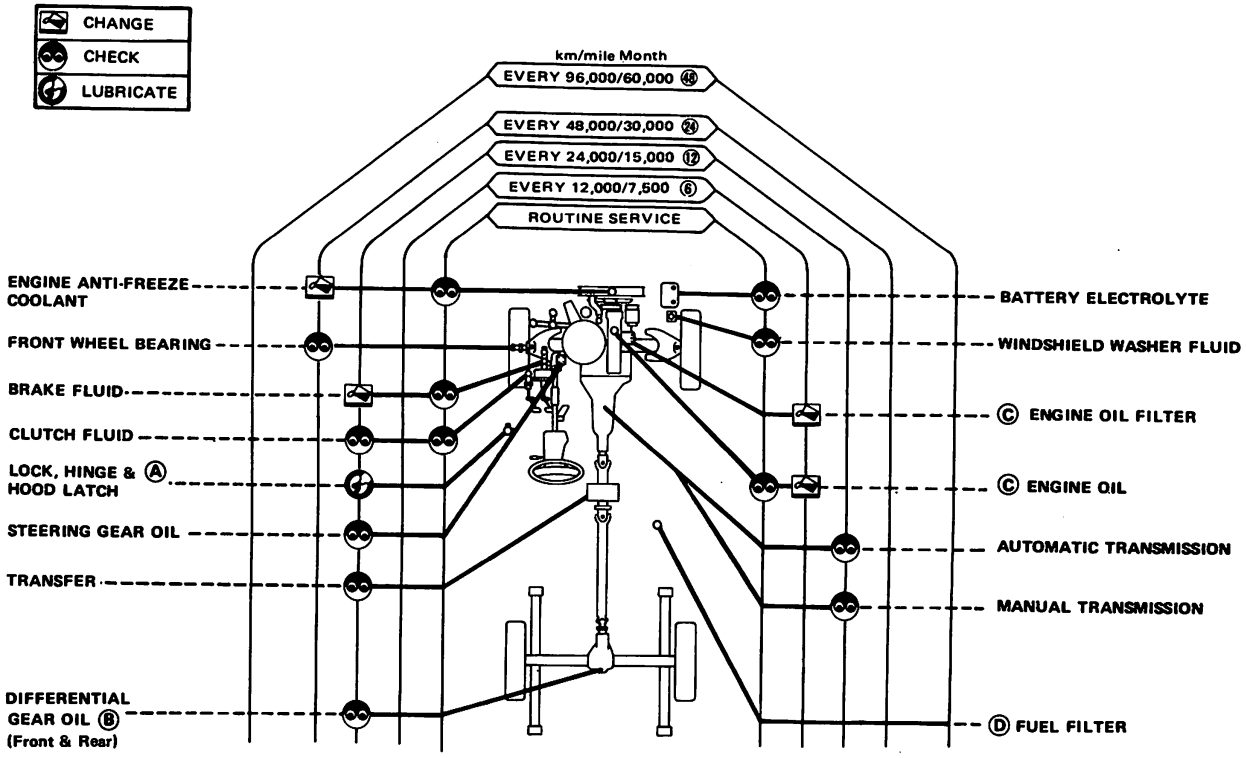
The above charts show the normal maintenance schedule. Depending upon weather and atmospheric conditions, varying road surfaces, individual driving habits and vehicle usage, additional or more frequent maintenance may be required.

Abbreviations: R = Replace L = Lubricate
I = Inspect, correct, replace if necessary

NOTE: (5) When towing a trailer, change oil in differential gear every 48,000 km (30,000 miles) or 24 months, whichever comes first.
(6) Steering linkage & front suspension ball joint inspection should be performed every 96,000 km (60,000 miles) or 4 years, whichever comes first.
(7) If vehicle is operated in areas using road salt or other corrosive materials, inspect every 5,000 km (3,000 miles) or 3 months, whichever comes first.

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LUBRICATION CHART



(A) If vehicle is operated in areas using road salt or other corrosive materials, inspect every 5,000 km (3,000 miles) or 3 months, whichever comes first.

(B) When towing a trailer, change oil in differential gear every 48,000 km (30,000 miles) or 24 months, whichever comes first.

(C) If vehicle is operated under severe conditions: short distance driving, extensive idling or driving in dusty conditions, change engine oil every 5,000 km (3,000 miles) or 3 months, whichever comes first.

(D) If vehicle is operated under extreme adverse weather conditions or in areas where ambient temperatures are either extremely low or extremely high, the filter might become clogged. In such an event, replace the filter immediately.

SMA811

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RECOMMENDED FUEL AND LUBRICANTS

FUEL

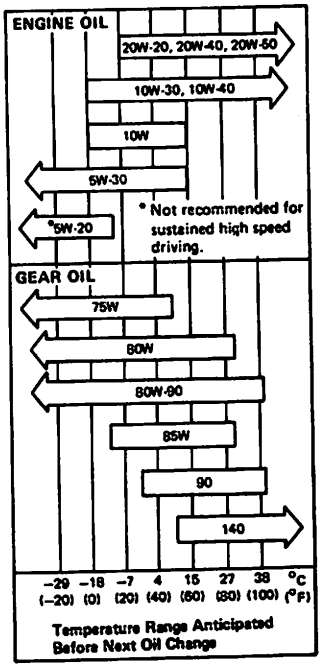
Gasoline		Gasoline octane number (minimum)	
		RON	(R + M)/2
All models	Unleaded	91	87

The fuel filler opening is designed for use with an unleaded fuel gun [nozzle diameter less than 21.3 mm (0.84 in)] only.

LUBRICANTS

Lubricant		Specifications	Remarks
Gasoline engine oil		API SE	Further details, refer to recommended SAE viscosity chart.
Gear oil	Transmission, transfer and steering	API GL-4	
	Differential	API GL-5	
Automatic T/M fluid		Type DEXRON	——
Multi-purpose grease		NLGI No. 2	Lithium soap base
Brake and clutch fluid		DOT 3	US FMVSS No. 116
Anti-freeze		——	Ethylene glycol base

SAE VISCOSITY NUMBER



APPROXIMATE REFILL CAPACITIES

			Liter	US measure	Imp measure
Fuel tank					
Standard wheelbase (including King Cab)		2WD	50	13-1/4 gal	11 gal
		4WD	60	15-7/8 gal	13-1/4 gal
Long wheelbase		2WD	64	16-7/8 gal	14-1/8 gal
		4WD	75	19-7/8 gal	16-1/2 gal
Coolant (including engine and reservoir tank)					
Manual transmission	With heater		10.2	10-3/4 qt	9 qt
	Without heater		9.5	10 qt	8-3/8 qt
Automatic transmission					
	With heater		10.1	10-5/8 qt	8-7/8 qt
	Without heater		9.4	10 qt	8-1/4 qt
Engine	With oil filter	2WD	4.4	4-5/8 qt	3-7/8 qt
		4WD	4.2	4-1/2 qt	3-3/4 qt
	Without oil filter	2WD	3.9	4-1/8 qt	3-3/8 qt
		4WD	3.7	3-7/8 qt	3-1/4 qt
Transmission	M/T	4-speed	1.7	3-5/8 pt	3 pt
		5-speed	2.0	4-1/4 pt	3-1/2 pt
	A/T		5.5	5-7/8 qt	4-7/8 qt
Transfer unit			1.4	3 pt	2-1/2 pt
Differential carrier		Front	1.0	2-1/8 pt	1-3/4 pt
		Rear	1.25	2-5/8 pt	2-1/4 pt
Steering gear			0.33	3/4 pt	5/8 pt
Windshield washer tank			1.85	2 qt	1-5/8 qt
Air conditioning system					
Compressor oil			0.15 139 g	5.1 fl oz 4.9 oz	5.3 fl oz 4.9 oz
Refrigerant			0.7 - 0.9 kg	1.5 - 2.0 lb	1.5 - 2.0 lb

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ENGINE MAINTENANCE

BEFORE ENGINE START

CHECKING AND ADJUSTING DRIVE BELTS

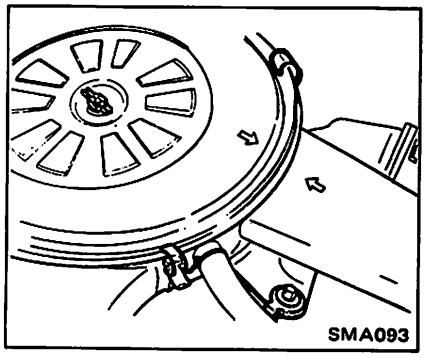
1. Visually inspect for cracks or damage.

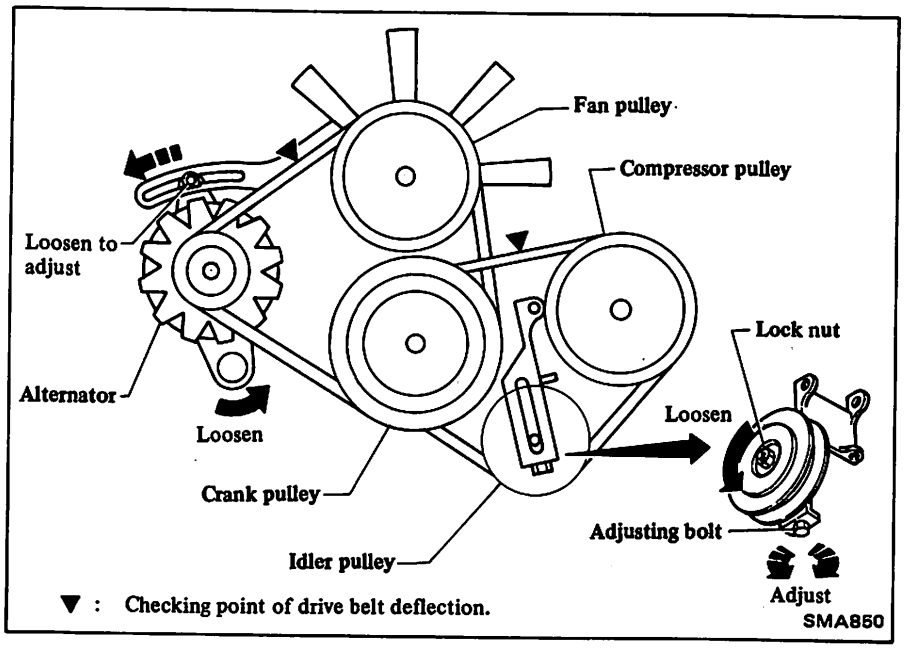
The belts should not touch the bottom of the pulley groove.

2. Check belt tension by pushing.

The belts should deflect by the specified amount.

Drive belt deflection:
8 - 12 mm
(0.31 - 0.47 in)
Pushing force:
98 N (10 kg, 22 lb)





3. Adjust belt tension as follows:

Fan and alternator belt

1. Loosen the upper and lower alternator securing bolts until the alternator can be moved slightly.
2. Move the alternator with a prying bar until the belt tension is the specified amount. Then tighten the bolts securely.

Air conditioner compressor belt

1. Loosen the idler pulley lock nut.
2. Adjust the adjusting bolt until the belt tension is the specified amount.
3. Tighten the idler pulley lock nut securely.

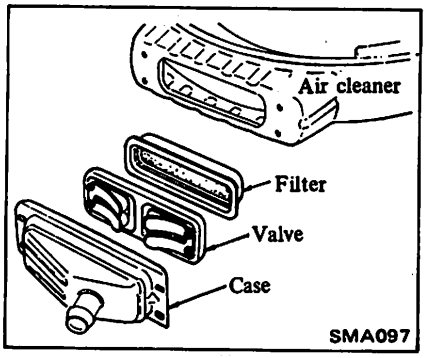
REPLACING AIR CLEANER FILTER

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

Remove air cleaner cover and replace air cleaner filter.

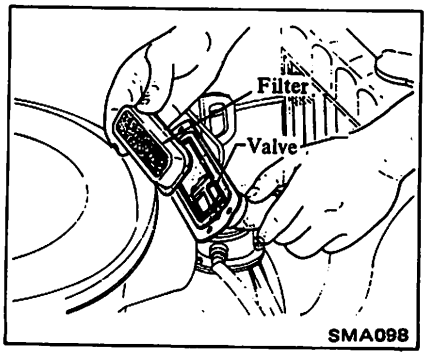
When installing air cleaner cover, align both marks of cover and intake pipe.

REPLACING AIR INDUCTION VALVE FILTER



Remove air induction valve case from air cleaner, and take out air induction valve filter. Then install new air induction valve filter.

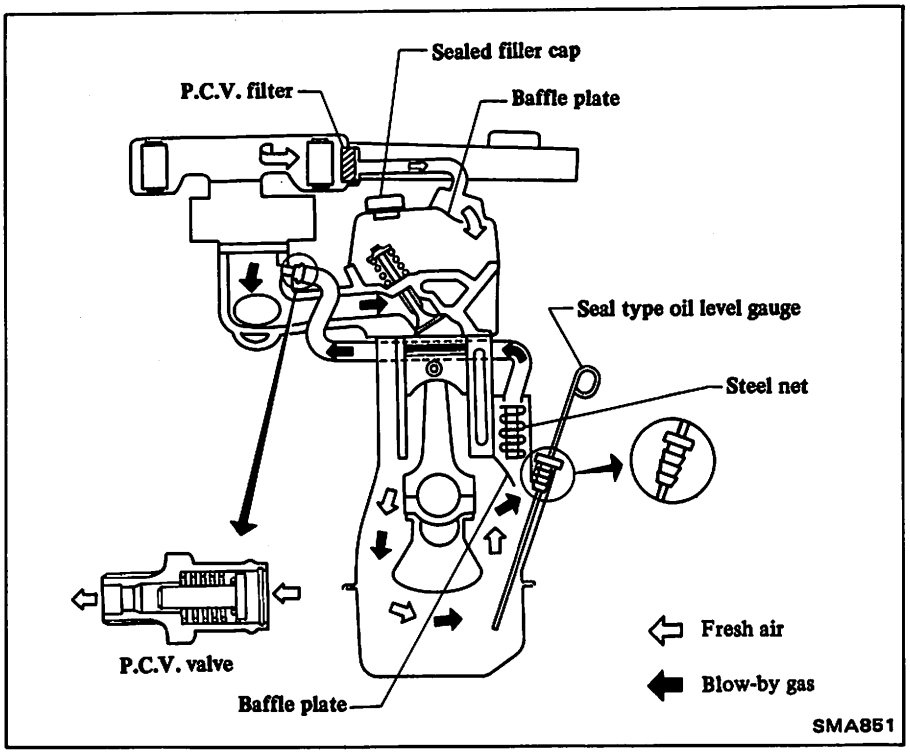
Pay strict attention to direction the valve is facing so that exhaust gas will not flow backward.



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REPLACING P.C.V. VALVE FILTER

When vehicle is operated under severe conditions, check P.C.V. filter and replace if necessary.



CHECKING VAPOR LINES

Check all hoses and fuel tank filler cap for leaks.

1. Disconnect the vapor vent line connecting carbon canister to fuel tank.
2. Connect a 3-way connector, a manometer and a cock (or an equivalent 3-way charge cock) to the end of the vent line.
3. Supply pressure into the vapor vent line through the cock little by little until pressure becomes to the below.

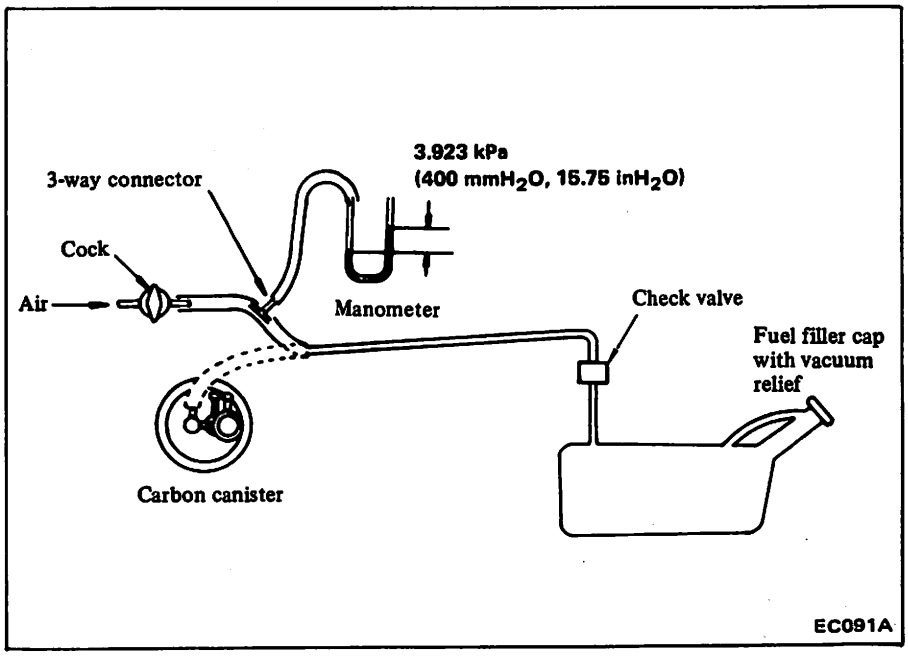
Leakage test pressure:
3.923 kPa (400 mmH_2O, 15.75 in H_2O)

4. Shut the cock completely and leave it unattended.
5. After 2.5 minutes, measure the height of the liquid in the manometer.

Pressure variation:
Less than 0.245 kPa (25 mmH_2O, 0.98 inH_2O)

(1) When filler cap does not close completely, the height should drop to zero in a short time.
(2) If the height does not drop to zero in a short time when filler cap is removed, it is the cause of a stuffy hose.

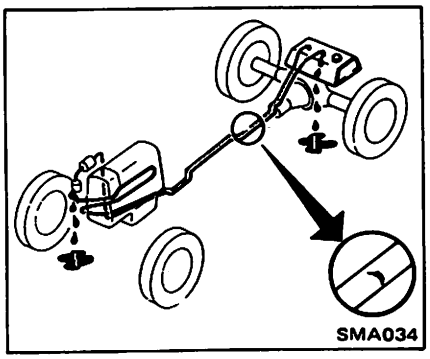
In case the vent line is stuffy, the breathing in fuel tank is not thoroughly made, thus causing insufficient delivery of fuel to engine or vapor lock. It must, therefore, be repaired or replaced.

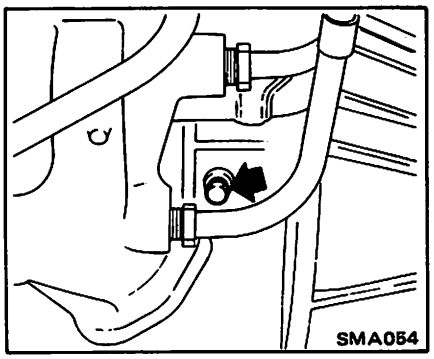


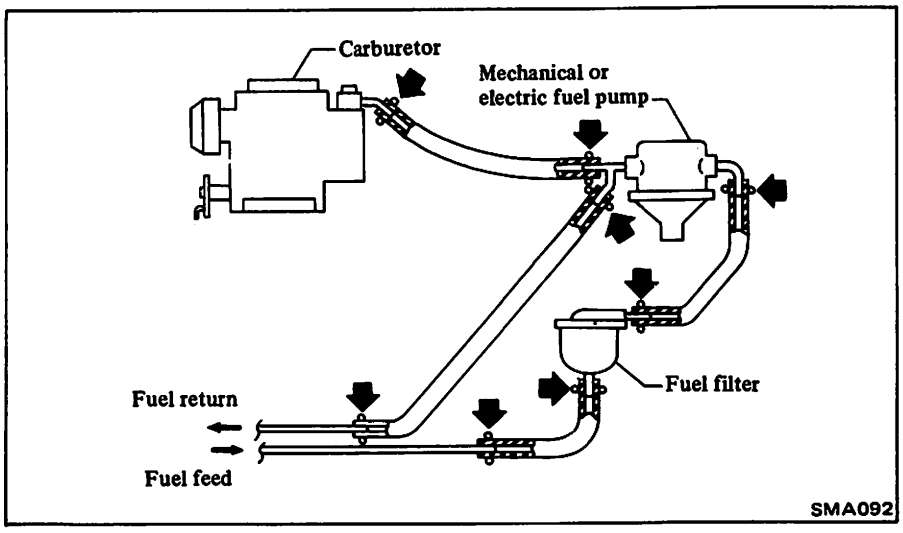
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CHECKING FUEL LINES (Hoses, piping, connections, etc.)

1. Check fuel line for leaks, particularly around connection of fuel pipe and fuel hose.
2. Retighten loose connections and replace any damage or deformed parts.

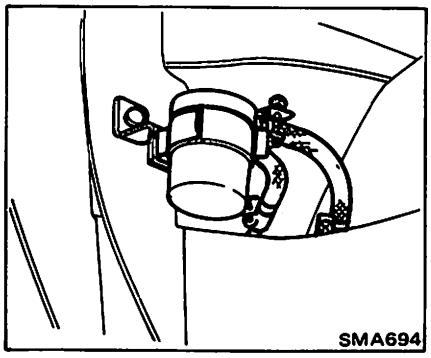






REPLACING FUEL FILTER

When vehicle is operated under severe conditions, check for a contaminated filter, and water deposit. Replace if necessary.

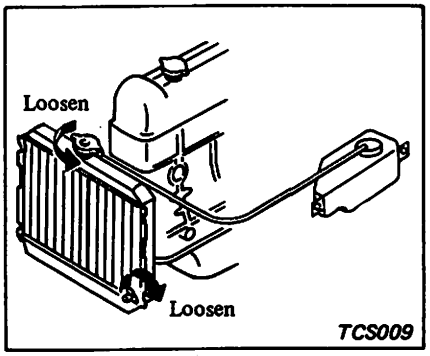


CHANGING ENGINE COOLANT

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

When changing engine coolant, on heater equipped models, set heater "TEMP" control lever at fully "HOT" position.

1. Open draincock at bottom of radiator, and remove radiator cap.



2. Remove cylinder block drain plug located at left rear of cylinder block.
3. Drain coolant completely. Then flush cooling system.
4. Close drain cock and plug.
5. Fill radiator with coolant up to filler opening, observing instructions attached to anti-freeze container for mixing ratio of anti-freeze to water.

Cooling water capacity:

Unit: liter (US qt, Imp qt)

M/T	With heater	10.2 (10-3/4, 9)
	Without heater	9.5 (10, 8-3/8)
A/T	With heater	10.1 (10-5/8, 8-7/8)
	Without heater	9.4 (10, 8-1/4)

6. Run engine for a few minutes. If necessary, add coolant.
7. Fill reservoir tank with coolant up to "MAX" level.
8. Install radiator cap.

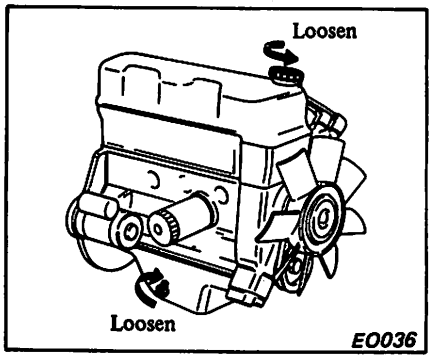
Check drain valve and plug for any sign of leakage.

CHANGING ENGINE OIL AND OIL FILTER

1. Start engine and warm up engine until water temperature indicator points to the middle of gauge, then stop engine.
2. Remove oil filler cap and oil pan drain plug, and allow oil to drain.

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WARNING:
Be careful not to burn yourself, as the engine oil may be hot.

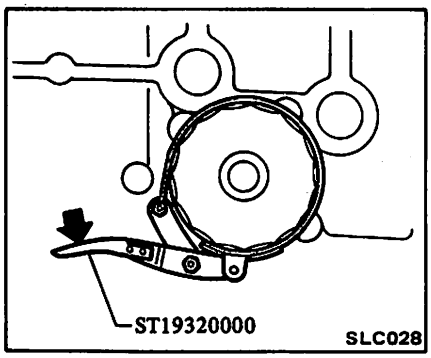


- **A milky oil indicates the presence of cooling water. Isolate the cause and take corrective measure.**
- **An oil with extremely low viscosity indicates dilution with gasoline.**

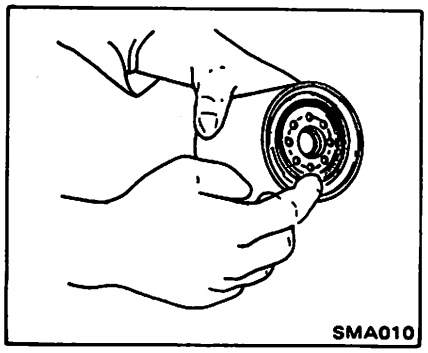
3. Clean and install oil pan drain plug with washer.

Ⓣ: Oil pan drain plug
20 - 29 N·m
(2.0 - 3.0 kg-m,
14 - 22 ft-lb)

4. Using Tool, remove oil filter.



5. Wipe oil filter mounting surface with a clean rag.
6. Smear a little engine oil on rubber gasket of new oil filter.



7. Install new oil filter. **Hand-tighten ONLY. DO NOT use a wrench to tighten the filter.**
8. Refill engine with new recommended engine oil, referring to Recommended Lubricants.
Check oil level with dipstick.

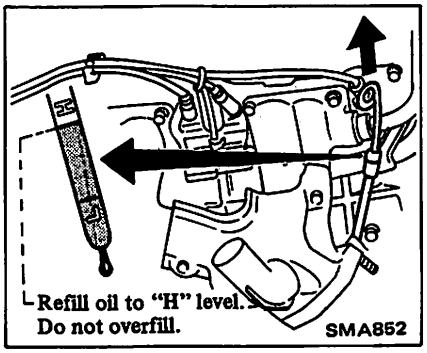
Oil capacity:

Unit: liter (US qt, Imp qt)

	2WD	4WD
With oil filter	4.4 (4-5/8, 3-7/8)	4.2 (4-1/2, 3-3/4)
Without oil filter	3.9 (4-1/8, 3-3/8)	3.7 (3-7/8, 3-1/4)

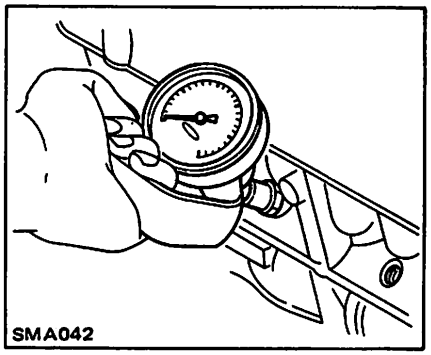
9. Start engine. Check area around drain plug and oil filter for any sign of oil leakage.
If any leakage is evident, these parts have not been properly installed.
10. Run engine until it reaches operating temperature. Then turn it off and wait several minutes. Check oil level. If necessary, add engine oil.

Oil level should be checked with vehicle parked on a level surface.



CHECKING ENGINE COMPRESSION PRESSURE

1. Warm up engine until water temperature indicator points to the middle of gauge.
2. Remove all spark plugs on one side.
3. Properly attach a compression tester to spark plug hole in cylinder being tested.



4. Depress accelerator pedal to open throttle valve fully.
5. Crank engine and read gauge indication.
- Run engine at about 350 rpm.
- Engine compression measurement should be made as quickly as possible.

Compression pressure:
kPa (kg/cm², psi)/at rpm
Standard 1,177
(12.0, 171)/350
Minimum 883
(9.0, 128)/350

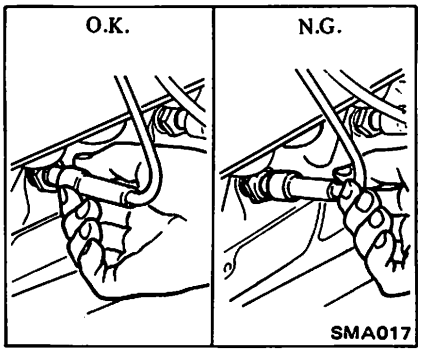
6. Cylinder compression in cylinders should not be less than 80% of the highest reading.
If cylinder compression in one or more cylinders is low, pour a small quantity of engine oil into cylinders through the spark plug holes and retest compression.
- **If adding oil helps the compression pressure,** chances are that piston rings are worn or damaged.
- **If pressure stays low,** valve may be sticking or seating improperly.
- **If cylinder compression in any two adjacent cylinders is low, and if adding oil does not help the compression,** there is leakage past the gasketed surface.
Oil and water in combustion chambers can result from this problem.

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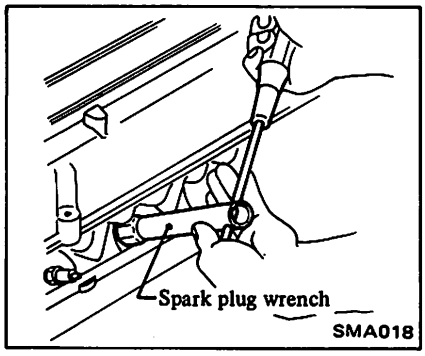
REPLACING SPARK PLUGS

1. Remove air cleaner and high tension cable.

Do not pull on the wires.

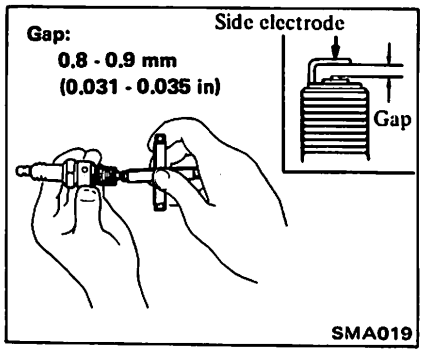


2. Remove spark plugs with spark plug wrench.



3. Using feeler gauge, check new spark plug gap.

If it is not within specified range, set gap by bending side electrode.



SPARK PLUG:

	U.S.A.	Canada
Standard type	**BP6ES**	**BPR6ES***
Hot type	BP5ES	BPR5ES*
Cold type	BP7ES	BPR7ES*

* Resistor built-in type is optional equipment for U.S.A. models.

4. Install new spark plugs.
5. Reconnect high tension cable and install air cleaner.

All cables are marked to identify their original locations.

Ⓣ: **Spark plug**
15 - 20 N·m
(1.5 - 2.0 kg-m,
11 - 14 ft-lb)

CHECKING IGNITION WIRING

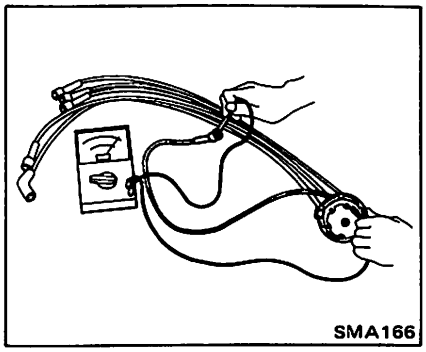
Use an ohmmeter to check resistance on high tension cables.

1. Disconnect cables from spark plugs and remove distributor cap together with high tension cables.

Do not remove cables from cap.

2. Measure resistance between cable terminal on the spark plug side and the corresponding electrode inside cap.

High tension cable resistance:
Less than 30,000 ohms



3. If the resistance is more than the limit, remove cable from cap and check the cable resistance only.

If resistance is still more than the limit, replace cable assembly.

AFTER ENGINE WARM-UP

ADJUSTING INTAKE AND EXHAUST VALVE CLEARANCE

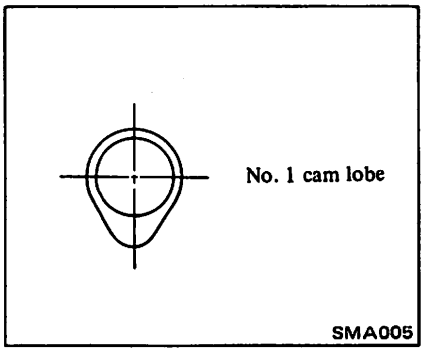
Adjustment should be made while engine is hot.

1. Start engine and warm up engine until water temperature indicator points to the middle of gauge, then stop engine.

Valve clearance adjustment cannot be made while engine is in operation.

2. Remove air cleaner, high tension cable and valve rocker cover.

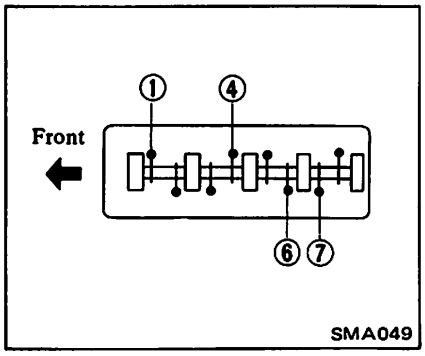
3. Set so that high point of No. 1 cam lobe points down.



When turning crankshaft with starter, remove high tension cable from ignition coil, then turn it.

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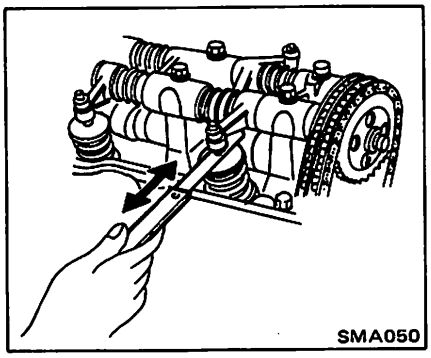
Adjust clearance of half of the valves. Adjust only ①, ④, ⑥, and ⑦ valves.



Valve clearance (Hot)
Intake ①④: 0.30 mm (0.012 in)
Exhaust ⑥⑦: 0.30 mm (0.012 in)

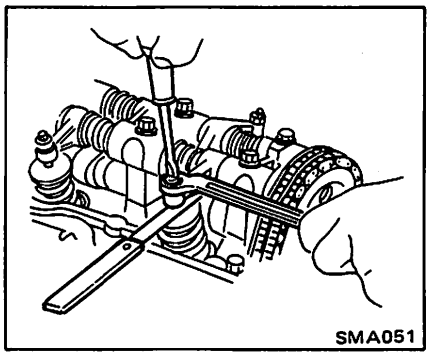
(1) Using feeler gauge, measure clearance between valve stem end and rocker arm screw.

Feeler gauge should move with a very slight drag.



(2) If the clearance is not within specified value, loosen rocker arm nut and turn rocker arm screw to provide proper clearance.

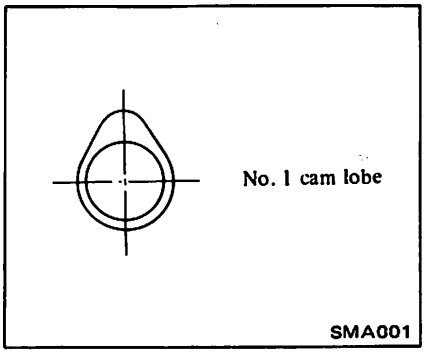
(3) Hold rocker arm screw and tighten rocker arm nut.



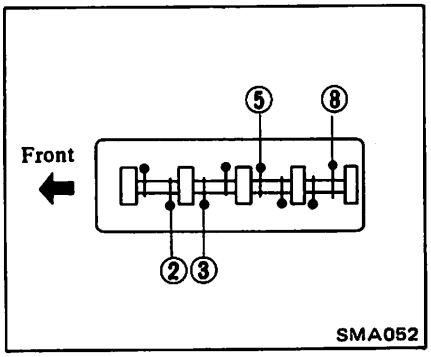
Ⓣ: Rocker arm nut
16 - 22 N·m
(1.6 - 2.2 kg-m, 12 - 16 ft-lb)

(4) Recheck clearance.

4. Turn crankshaft and set so that high point of No. 1 cam lobe points above.



Adjust ②, ③, ⑤, and ⑧ valves, using same procedure as for Step 3.



Valve clearance (Hot)
Intake. .⑤⑧: 0.30 mm (0.012 in)
Exhaust.②③: 0.30 mm (0.012 in)

5. Install in reverse order of removal.

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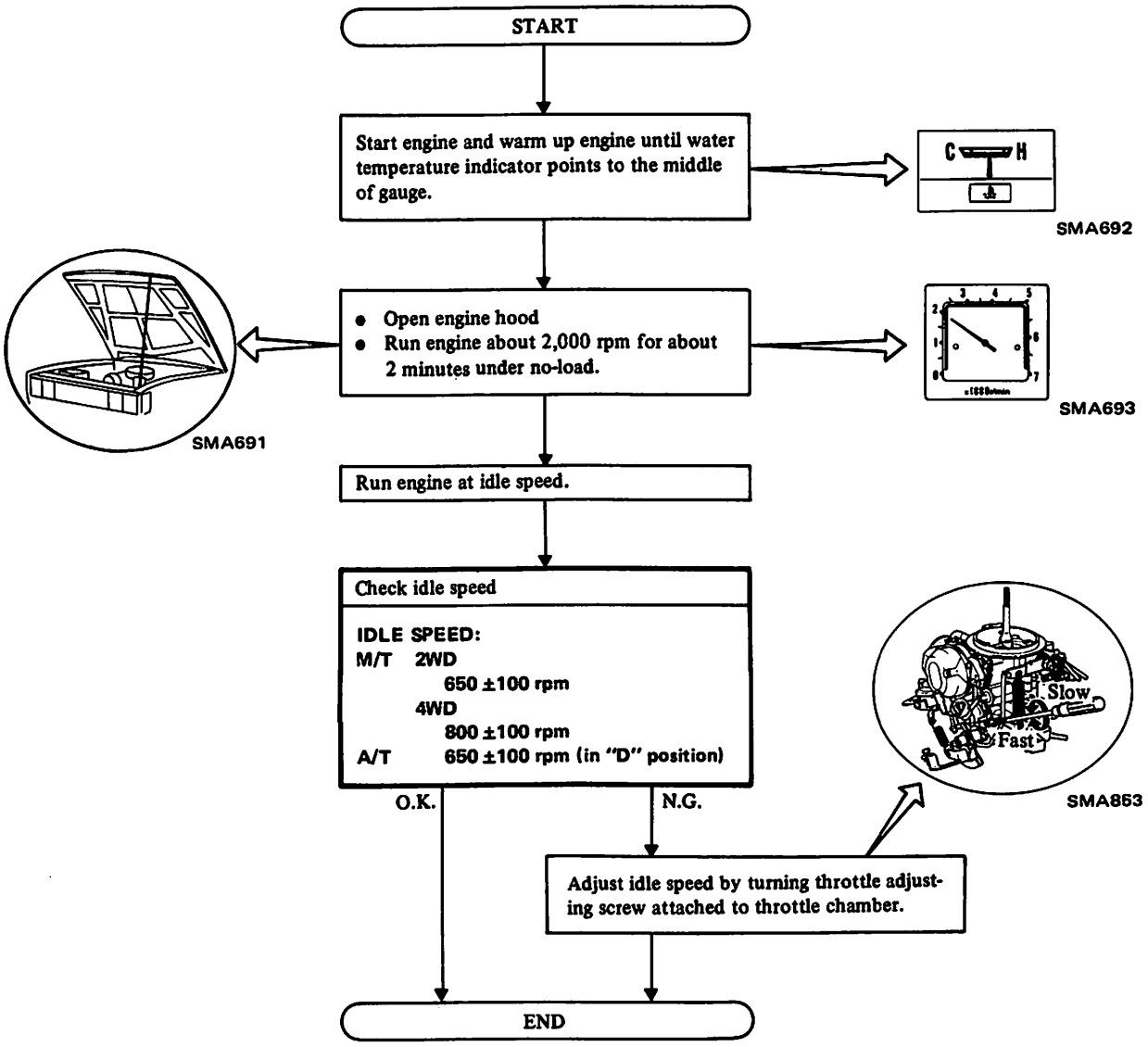
ADJUSTING IDLE RPM

Preparation

1. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".
2. On automatic transmission equipped models, checks should be carried out while shift lever is in "D" position.

WARNING:
a. When selector lever is shifted to "D" position, apply parking brake and block both front and rear wheels with chocks.
b. When racing engine on automatic transmission equipped models, make sure that shift lever is in "N" or "P" position and depress brake pedal to prevent forward surge of vehicle.
c. After the adjustment has been made, shift the lever to the "N" or "P" position and remove wheel chocks.

Maintenance procedure



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MINOR TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
CANNOT CRANK ENGINE OR SLOW CRANKING	Improper grade oil.	Replace with proper grade oil.
	Partially discharged battery.	Charge battery.
	Malfunctioning battery.	Replace.
	Loose fan belt.	Adjust.
	Trouble in charging system.	Inspect.
	Wiring connection trouble in starting circuit.	Correct.
	Malfunctioning ignition switch.	Repair or replace.
	Malfunctioning starting motor.	Repair or replace.

(Trouble-shooting procedures on starting circuit)
Switch on the starting motor with head lights "ON".

When head lights go off or dim considerably,

a. Check battery.
b. Check connection and cable.
c. Check starting motor.

When head lights stay bright,

a. Check wiring connection between battery and starting motor.
b. Check ignition switch.
c. Check starting motor.

ENGINE WILL CRANK NORMALLY BUT WILL NOT START

In this case, the following trouble causes may exist, but in many cases ignition system or fuel system is in trouble.

Ignition system in trouble
Fuel system in trouble
Valve mechanism does not work properly
Low compression

(Trouble-shooting procedure)
Check spark plug firstly by following procedure.
Disconnect high tension cable from one spark plug and hold it about 10 mm (0.39 in) from the engine metal part and crank the engine.

Good spark occurs.

a. Check spark plug.
b. Check ignition timing.
c. Check fuel system.
d. Check revolution trigger signal.
e. Check cylinder compression.

No spark occurs.	Very high current.	Check the current flow in primary circuit. Inspect primary circuit for short. Check distributor pick-up coil operation. Check ignition system.
	Low or no current.	Check for loose terminal or disconnection in primary circuit. Check for burned points.

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Condition	Probable cause	Corrective action
Ignition system in trouble	Malfunctioning distributor pick-up coil.	Replace.
	Improper air gap.	Adjust.
	Leak at rotor cap and rotor.	Clean or replace.
	Malfunctioning spark plug.	Clean, adjust plug gap or replace.
	Improper ignition timing.	Adjust.
	Malfunctioning ignition coil.	Replace.
	Malfunctioning high tension cable.	Replace.
	Loose connection or disconnection in primary circuit.	Repair or replace.
	Irregular revolution trigger pulse.	Replace IC ignition unit.
	Malfunctioning IC ignition unit.	Replace.
Fuel system malfunction	Lack of fuel.	Supply.
	Dirty fuel filter.	Replace.
	Dirty or clogged fuel pipe.	Clean and replace if necessary.
	Clogged fuel tank breather pipe.	Repair and clean.
	Malfunctioning fuel pump.	Repair or replace.
	Malfunctioning carburetor choke.	Replace.
	Improper adjustment of float level.	Correct.
	Dirty or clogged carburetor.	Clean.
	Malfunctioning anti-dieseling solenoid valve.	Check for loose terminal or wire harness.
Low compression	Incorrect spark plug tightening or damaged gasket.	Tighten to normal torque or replace gasket.
	Improper grade engine oil or low viscosity.	Replace with proper grade oil.
	Incorrect valve clearance.	Adjust.
	Compression leak from valve seat.	Lap valves.
	Sticky valve stem.	Correct or replace valve and valve guide.
	Weak or damaged valve springs.	Replace valve springs.
	Compression leak at cylinder head gasket.	Replace gasket.
	Sticking or defective piston ring.	Replace piston rings.
	Worn piston ring or cylinder.	Overhaul engine.

(Trouble-shooting procedure)
Pour the engine oil from plug hole, and then measure cylinder compression.

Compression increases.	Trouble in cylinder or piston ring.
Compression does not change.	Compression leaks from valve, cylinder head or head gasket.

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Condition	Probable cause	Corrective action
UNSTABLE ENGINE IDLING		
Ignition system in trouble	Malfunctioning ignition system (spark plug, high tension cable, distributor, IC ignition unit, ignition coil, etc.)	Replace.
	Incorrect basic ignition timing.	Adjust.
Engine mechanical system in trouble	Loose manifold and cylinder head bolts.	Retighten bolts.
	Incorrect valve clearance.	Adjust.
Fuel system malfunction	Clogged or damaged carburetor jets.	Clean or replace.
	Clogged air cleaner filter.	Replace filter.
	Damaged manifold gaskets or carburetor insulator.	Replace gasket or insulator.
	Improper float level adjustment.	Adjust.
	Loose or cracked vacuum hoses or air hoses from carburetor and intake manifold.	Check for loose connections or cracks and replace if necessary.
	Malfunctioning carburetor choke.	Replace.
	Malfunctioning anti-backfire valve.	Check for A.B. valve and loose connection of vacuum hose.
	Malfunctioning automatic temperature control air cleaner.	Check A.T.C. air cleaner for loose hoses or faulty components.
	Inoperative idle compensator.	Check for connection of idle compensator hose or replace idle compensator.
	Carbon canister purge line hose damaged or disconnected.	Correct or replace.
Low compression		Previously mentioned.
Others	Malfunctioning P.C.V. valve.	Check and replace if necessary.
	Malfunctioning E.G.R. control system.	Correct and replace if necessary.
HIGH ENGINE IDLE SPEED		
Fuel system malfunction	Malfunction of B.C.D.D.	Adjust operating pressure of B.C.D.D. and replace if necessary.
	Malfunctioning carburetor choke.	Replace.
	Improper dashpot adjustment.	Check and adjust.
Others	Incorrect idle adjustment.	Adjust idle speed.
	Worn throttle valve.	Replace throttle chamber.
	Malfunctioning F.I.C.D.	Replace.
	Dragged accelerator control wire.	Check and correct accelerator control wire.

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Condition	Probable cause	Corrective action
ENGINE POWER BELOW NORMAL		
Low compression		Previously mentioned.
Ignition system in trouble	Incorrect ignition timing.	Adjust.
	Malfunctioning spark plugs.	Clean, adjust or replace plugs.
	Malfunctioning distributor pick-up coil.	Replace.
Fuel system malfunction	Throttle valve does not open fully.	Adjust.
	Malfunction of choke system.	Replace.
	Clogged fuel pipe.	Clean or replace.
	Dirty or clogged float valve filter.	Clean or replace.
	Fuel pump will not work properly.	Repair or replace.
	Clogged carburetor jets.	Clean or replace.
	Malfunction of A.T.C. air cleaner.	Check, correct or replace if necessary.
	Dirty or clogged fuel filter.	Replace.
Air intake system malfunction	Clogged air cleaner filter.	Replace filter.
	Air leaking from manifold gasket or carburetor insulator.	Replace gasket or insulator.
Overheating	Insufficient coolant.	Replenish.
	Loose fan belt.	Adjust fan belt.
	Worn or damaged fan belt.	Replace.
	Malfunctioning thermostat.	Replace.
	Malfunctioning water pump.	Replace.
	Clogged or leaky radiator.	Flush, repair or replace.
	Malfunctioning radiator filler cap.	Replace.
	Air in cooling system.	Retighten each part of cooling system.
	Improper engine oil grade.	Replace with proper grade oil.
	Incorrect ignition timing.	Adjust.
Overcooling	Malfunctioning thermostat.	Replace.
Others	Improper octane fuel	Replace with specified octane fuel.
	Improper tire pressure.	Inflate to specified pressure.
	Dragging brake.	Adjust.
	Clutch slipping.	Adjust.
	Malfunctioning E.G.R. control system.	Correct or replace.

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Condition	Probable cause	Corrective action
NOISY ENGINE		
Engine knocking	Overloaded engine.	Use right gear in driving.
	Carbon knocking.	Disassemble cylinder head and remove carbon.
	Timing knocking.	Adjust ignition timing.
	Fuel knocking.	Use specified octane fuel.
	Preignition (misusing of spark plug).	Use specified spark plug.
Mechanical knocking		
Crankshaft bearing knocking.	This strong dull noise increases when engine is accelerated. To locate the place, cause a misfire in each cylinder. If the noise stops by the misfire, this cylinder generates the noise.	This is caused by worn or damaged bearings, or unevenly worn crankshaft. Renew bearings and adjust or change crankshaft. Check lubrication system.
Connecting rod bearing knocking.	This is a little higher-pitched noise than the crankshaft knocking, and also increases when engine is accelerated. Cause a misfire in each cylinder and if the noise diminishes almost completely, this crankshaft bearing generates the noise.	Same as the case of crankshaft bearings.
Piston and cylinder noise.	When you hear an overlapping metallic noise which increases its magnitude with the revolution of engine and which decreases as engine is warmed up, this noise is caused by piston and cylinder. To locate the place, cause a misfire in each cylinder.	This may cause an abnormal wearing of cylinder and lower compression which in turn will cause a lower out-put power and excessive consumption of oil. Overhaul engine.
Piston pin noise.	This noise is heard at each highest and lowest dead end of piston. To locate the place, cause a misfire in each cylinder.	This may cause a wear on piston pin, or piston pin hole. Renew piston and piston pin assembly.
Water pump noise.	This noise may be caused by worn or damaged bearings, or by the uneven surface of sliding parts.	Replace water pump with a new one.
Others.	An improper adjustment of valve clearance.	Adjust.
	Noise of timing chain.	Adjust the tension of chain.
	An excessive end-play on crankshaft.	Disassemble engine and renew main bearing.
	Wear on clutch pilot bushing.	Renew bushing and adjust drive shaft.
	This noise will be heard when clutch is disengaged.	
ABNORMAL COMBUSTION (backfire, after fire run-on etc.)		
Ignition system in trouble	Improper ignition timing.	Adjust ignition timing.
	Improper heat range of spark plugs.	Use specified spark plugs.

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Condition	Probable cause	Corrective action
Fuel system malfunction	Damaged carburetor or manifold gasket. (backfire, afterfire)	Replace them with new parts.
	Clogged carburetor jet.	Disassemble carburetor and check it.
	Improper function of the float.	Adjust the level, and check needle valve.
	Improperly adjusted B.C.D.D. operating pressure.	Adjust.
	Malfunction of anti-dieseling solenoid valve.	Check or replace.
	Malfunction of auto-choke.	Replace.
	Malfunction of vacuum switch for fuel shut-off system.	Check vacuum switch. Replace if necessary.
Defective cylinder head, etc.	Improperly adjusted valve clearance.	Adjust.
	Excess carbon in combustion chamber.	Remove head and get rid of carbon.
Others	Malfunction of A.T.C. air cleaner.	Check for loose vacuum hoses. Replace if necessary.
	Inoperative anti-backfire valve.	Replace.
	Malfunctioning E.G.R. control system.	Correct or replace.
EXCESSIVE OIL CONSUMPTION		
Oil leakage	Loose oil drain plug.	Tighten it.
	Loose or damaged oil pan gasket.	Renew gasket or tighten it.
	Loose or damaged chain cover gasket.	Renew gasket or tighten it.
	Damaged oil seal in front and rear of crankshaft.	Renew oil seal.
	Loosen or damaged rocker cover gasket.	Renew gasket or tighten it (but not too much).
	Improper tightening of oil filter.	Renew gasket and tighten it with the proper torque.
	Loosen or damaged oil pressure switch.	Renew oil pressure switch or tighten it.
Oil burning	Cylinder and piston wear.	Overhaul cylinder and renew piston.
	Improper location of piston rings or reversely assembled piston rings.	Remount piston rings.
	Damaged piston rings.	Renew rings. Repair or renew piston and cylinder if necessary.
	Worn piston ring groove and ring.	Renew piston and piston ring.
	Fatigue of valve oil seal lip.	Replace seal lip with a new one.
	Worn valve stem.	Renew valve or guide.
Others	Improper grade oil.	Replace with proper grade oil.
	Engine overheat.	Previously mentioned.

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Condition	Probable cause	Corrective action
POOR FUEL ECONOMY		
Engine power below normal		Previously mentioned.
Fuel system malfunction	Fuel leakage from fuel line.	Repair, replace or tighten the connection of fuel pipes.
TROUBLE IN OTHER FUNCTIONS		
Decreased oil pressure	Improper grade oil.	Replace with proper grade oil.
	Overheat.	Previously mentioned.
	Malfunctioning oil pump regulator valve.	Disassemble oil pump and repair or renew it.
	Functional deterioration of oil pump.	Repair or replace it with a new one.
	Blocked oil filter.	Renew it.
	Increased clearance in various sliding parts.	Disassembled and replace the worn parts with new ones.
	Blocked oil strainer.	Clean it.
	Malfunctioning oil gauge pressure switch.	Replace it with a new one.
Excessive wear on the sliding parts	Oil pressure decreases.	Previously mentioned.
	Damaged quality or contamination of oil.	Exchange the oil with proper one and change oil filter.
	Clogged air cleaner filter.	Replace filter.
	Overheat or overcool.	Previously mentioned.
	Improper fuel mixture.	Check the fuel system.
Scuffing of sliding parts	Decrease of oil pressure.	Previously mentioned.
	Insufficient clearances.	Adjust to the sufficient clearances.
	Overheat.	Previously mentioned.
	Improper fuel mixture.	Check the fuel system.

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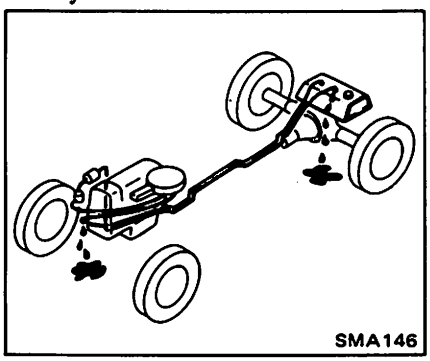
CHASSIS AND BODY MAINTENANCE

ENGINE CONTROL, FUEL AND EXHAUST SYSTEMS

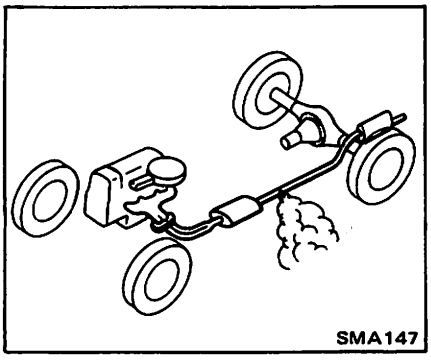
CHECKING FUEL AND EXHAUST SYSTEMS

Check fuel and exhaust systems for condition, connections and leaks.

Fuel system

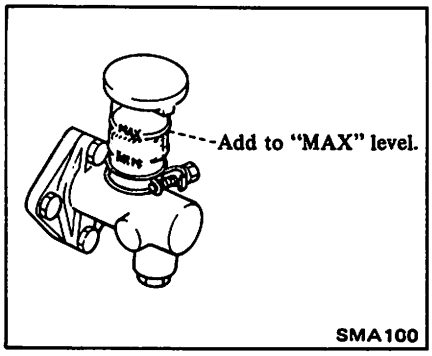


Exhaust system



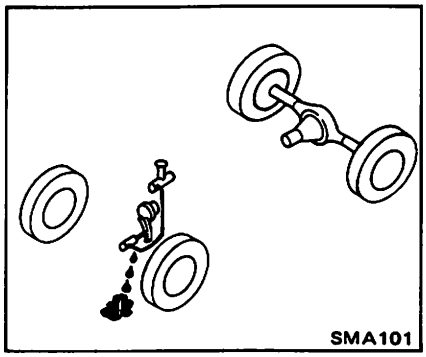
CLUTCH

CHECKING CLUTCH FLUID LEVEL AND LEAKS



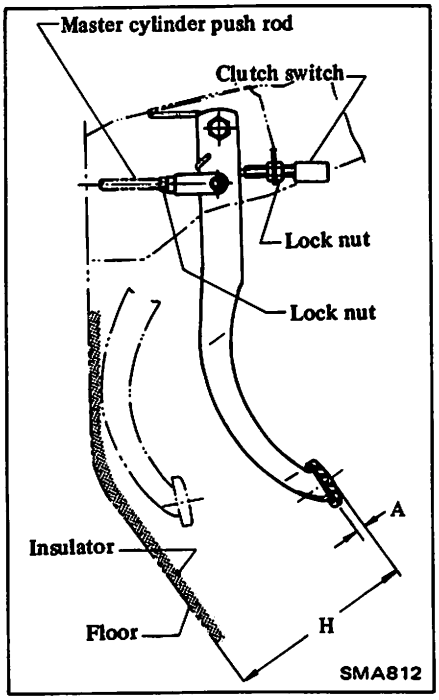
CHECKING CLUTCH SYSTEM

Check clutch system for proper attachment, leaks, chafing, abrasion, deterioration, etc.



CHECKING CLUTCH PEDAL HEIGHT AND FREE PLAY

Check clutch pedal height and free play. Adjust if necessary.



Pedal height "H":
171 - 177 mm (6.73 - 6.97 in)
Pedal free play "A":
1 - 5 mm (0.04 - 0.20 in)

1. Adjust pedal height with clutch switch. Then tighten lock nut.
2. Adjust pedal free play with master cylinder push rod. Then tighten lock nut.

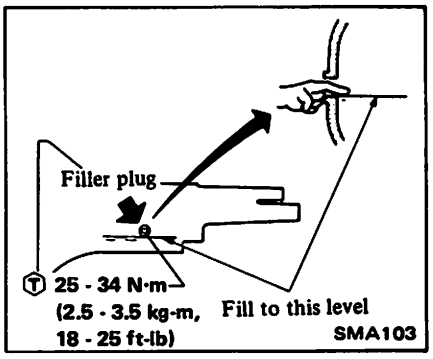
a. Pedal free play means the following total measured at position of pedal pad.
- **Play due to clevis pin and clevis pin hole in pedal lever.**
- **Play due to piston and piston rod.**

b. Depress and release clutch pedal over its entire stroke to ensure that the clutch linkage operates smoothly without squeak noise, interference and binding.

MANUAL TRANSMISSION

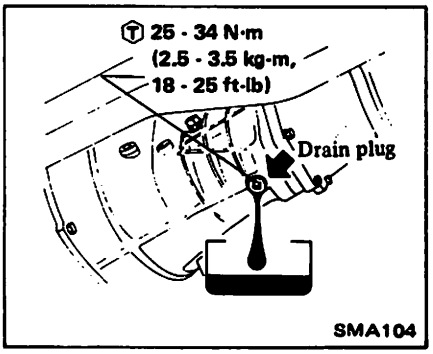
CHECKING MANUAL TRANSMISSION OIL LEVEL

Never start engine while checking oil level.



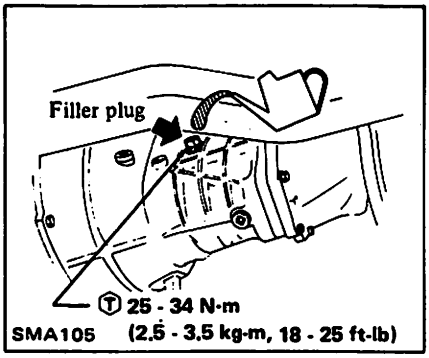
CHANGING MANUAL TRANSMISSION OIL

1. Drain oil completely.



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2. Refill transmission and check oil level.



Oil capacity:

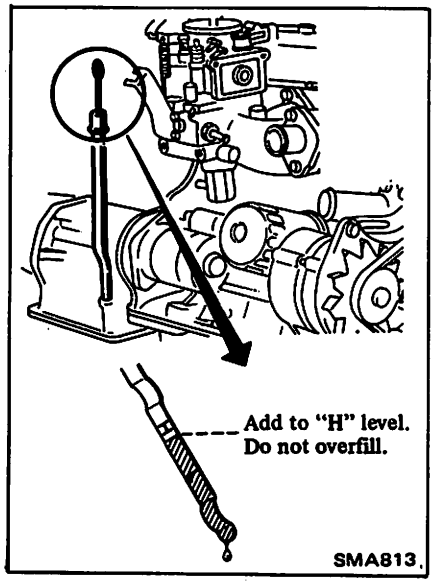
	Liters	US measure	Imp measure
4-speed	1.7	3-5/8 pt	3 pt
5-speed	2.0	4-1/4 pt	3-1/2 pt

AUTOMATIC TRANSMISSION

CHECKING AUTOMATIC TRANSMISSION FLUID LEVEL

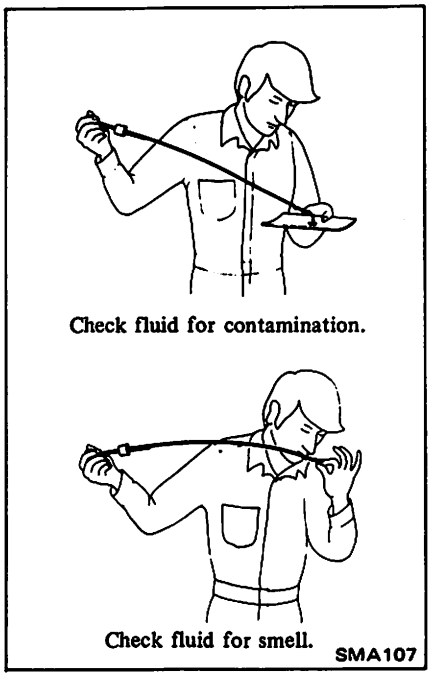
1. Check under following conditions.
(1) Place selector lever in "P" (PARK) position and idle engine.
(2) Maintain fluid temperature at 50 to 80°C (122 to 176°F).
2. Add fluid, if necessary.

Use only automatic transmission fluid having "DEXRON" identifications in 3N71B automatic transmission.



CHECKING AUTOMATIC TRANSMISSION FLUID CONDITION

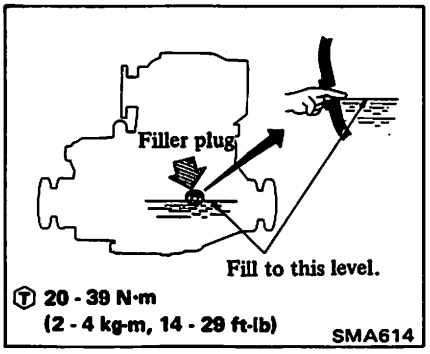
Check fluid for contamination to determine condition of automatic transmission. If fluid is very dark or smells burned, the frictional material (clutches, band, etc.) may need replacement.



TRANSFER

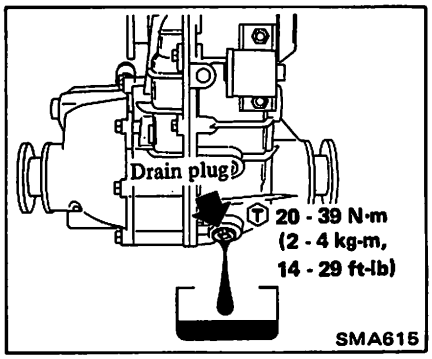
CHECKING TRANSFER OIL LEVEL

Never start engine while checking oil level.

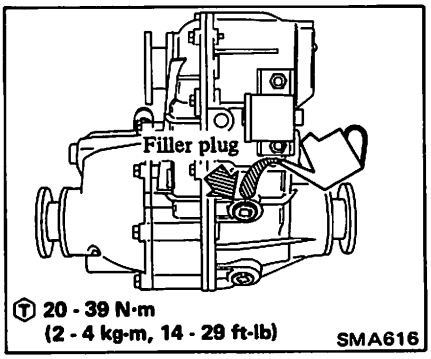


CHANGING TRANSFER OIL

1. Drain oil completely.



2. Refill oil and check oil level.

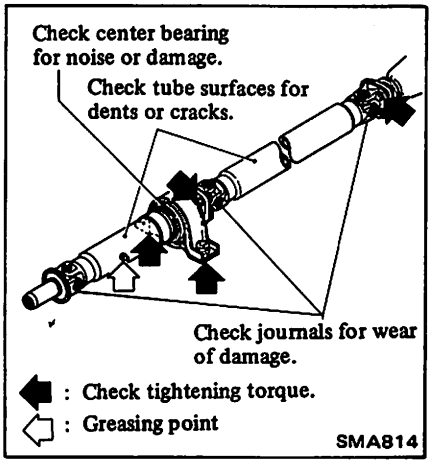


Oil capacity:
1.4 ℓ (3 US pt, 2-1/2 Imp pt)

PROPELLER SHAFTS AND DIFFERENTIAL CARRIER

CHECKING PROPELLER SHAFTS

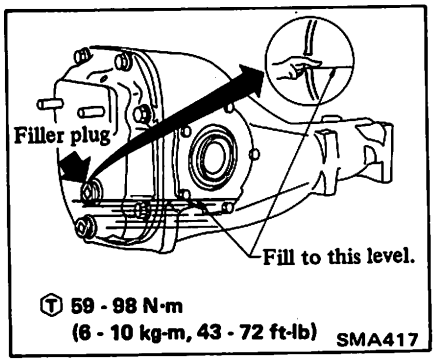
Check propeller shafts, replace if necessary.



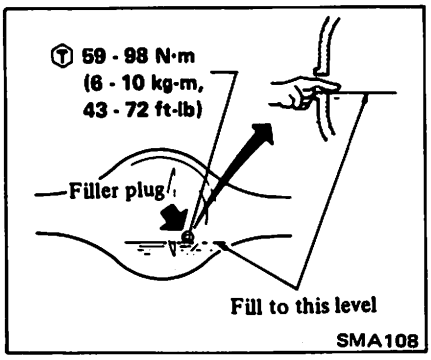
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CHECKING DIFFERENTIAL CARRIER OIL LEVEL

Front



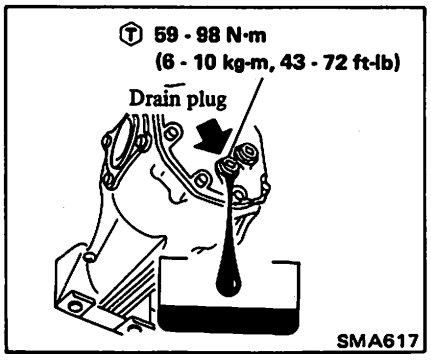
Rear



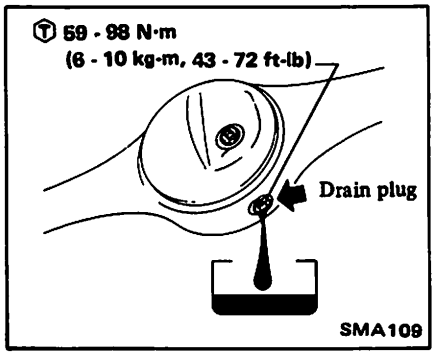
CHANGING DIFFERENTIAL CARRIER OIL

1. Drain oil completely.

Front

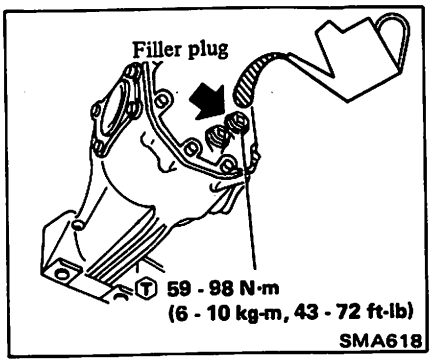


Rear

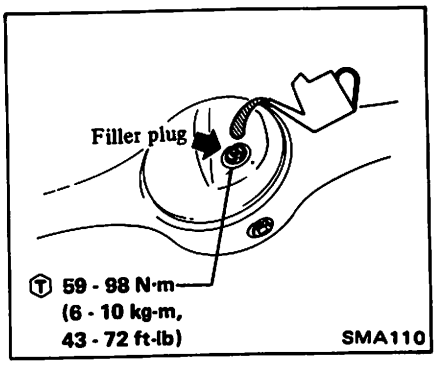


2. Refill differential carrier and check oil level.

Front



Rear



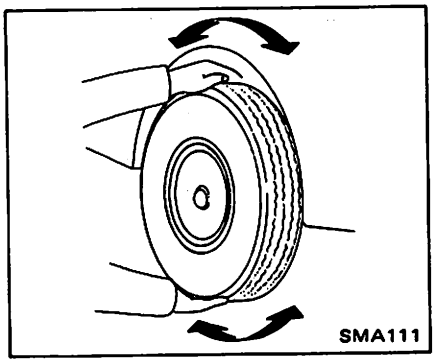
Oil capacity:

	Liters	US measure	Imp measure
Front	1.0	2-1/8 pt	1-3/4 pt
Rear	1.25	2-5/8 pt	2-1/4 pt

FRONT AXLE AND FRONT SUSPENSION

CHECKING FRONT AXLE AND SUSPENSION PARTS

1. Block rear wheels with chocks and raise front of vehicle, and then support it with safety stand. Refer to Lifting Points and Towing (Section GI).
2. Shake each front wheel by holding upper and lower surfaces of tires as shown.

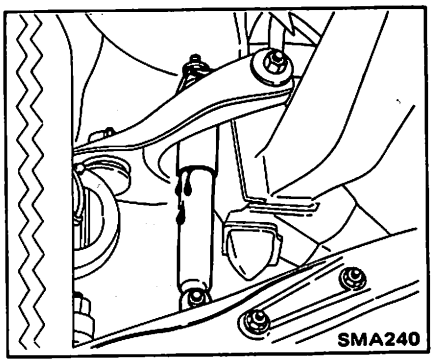


Check suspension parts for looseness, wear, or damage.

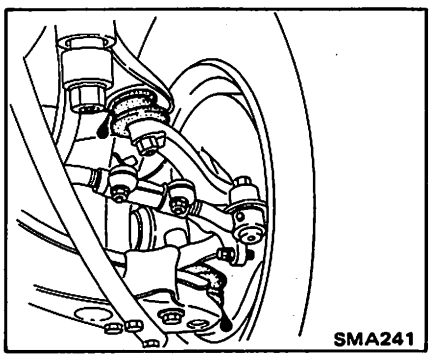
Retighten all loose nuts and bolts to the specified torque. Refer to Section FA for tightening torque.

Replace all worn parts as described under Front Suspension (Section FA).

3. Check shock absorber for oil leakage or damage.



4. Check suspension ball joint for grease leakage and ball joint dust cover for damage.



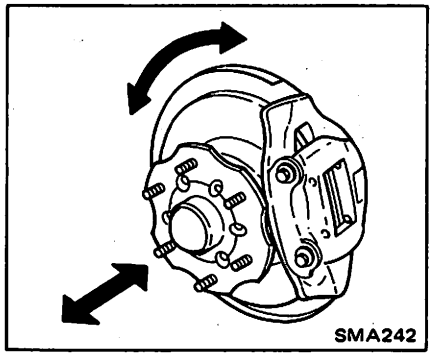
5. Remove wheel and tire assembly.
6. Check front axle parts for crack or damage.

Replace worn parts.

Refer to Front Axle (Section FA).

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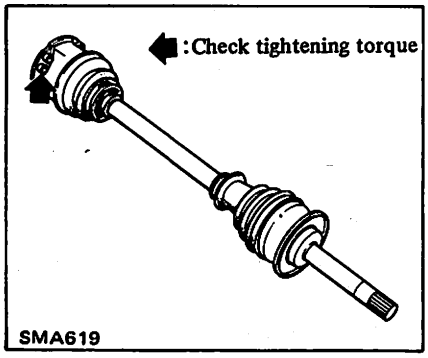
7. Remove brake pads.
   Refer to section BR.
8. Check wheel bearing.
   If there is any axial end play or if wheel bearing does not smoothly turn, adjust bearing to specifications.
   Replace worn or damaged bearings.
   Refer to Front Axle (Section FA).



CHECKING DRIVE SHAFTS

Check drive shaft parts for looseness, wear, damage or grease leakage.

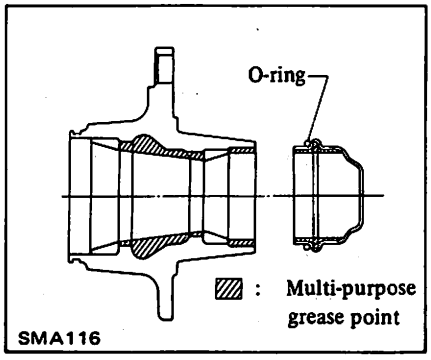
Retighten all loose bolts to the specified torque referring to Section FA for tightening torque. Replace all worn parts as described under Front Suspension (Section FA).



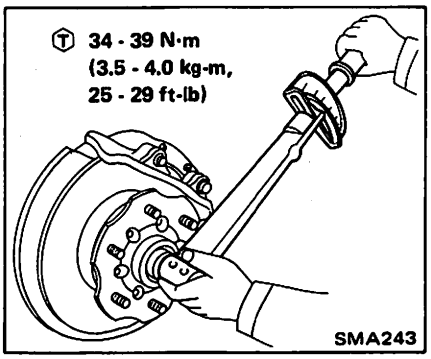
ADJUSTING WHEEL BEARING PRELOAD (2WD)

After wheel bearing has been replaced or front axle has been reassembled be sure to adjust wheel bearing preload as described below.

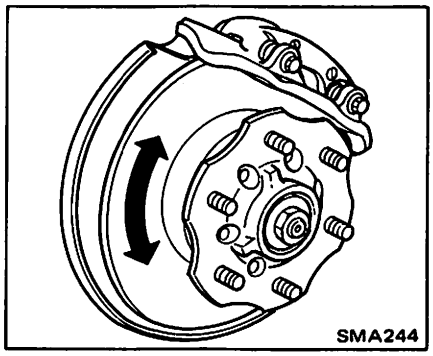
1. Before adjustment, thoroughly clean all parts to prevent possible entry of dirt.
2. Apply recommended multi-purpose grease sparingly to the following parts.
   - Threaded portion of spindle.
   - Contact surface between wheel bearing washer and outer wheel bearing.
   - Hub, hub cap and O-ring.
   - Grease seal lip.



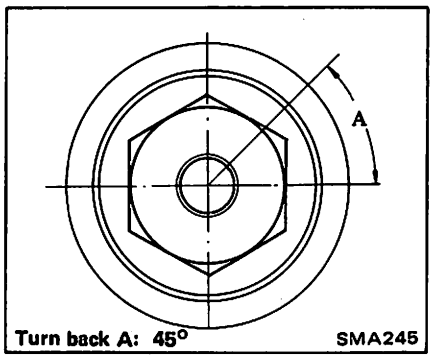
3. Tighten wheel bearing nut.



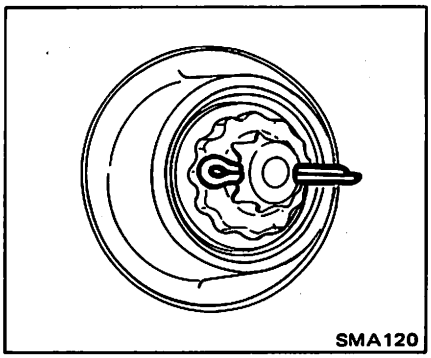
4. Turn wheel hub several times in both directions to seat wheel bearing correctly.



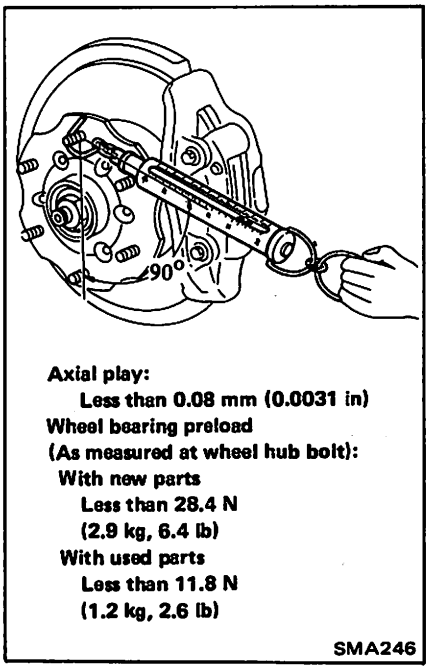
5. Again tighten wheel bearing nut.
6. Turn back wheel bearing nut 45 degrees.



7. Install adjusting cap and tighten until any of its grooves aligns with hole in spindle. If the above procedure fails to align hole and groove, then tighten lock nut as much as 15 degrees. Install new cotter pin.



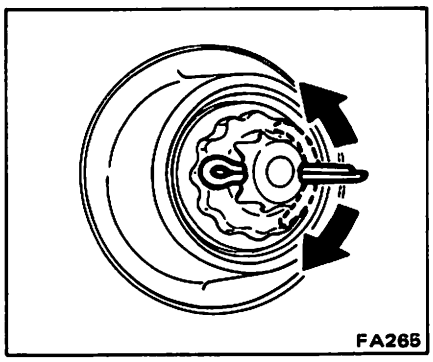
8. Measure wheel bearing preload and axial play.



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Repeat above procedures until correct starting torque is obtained.

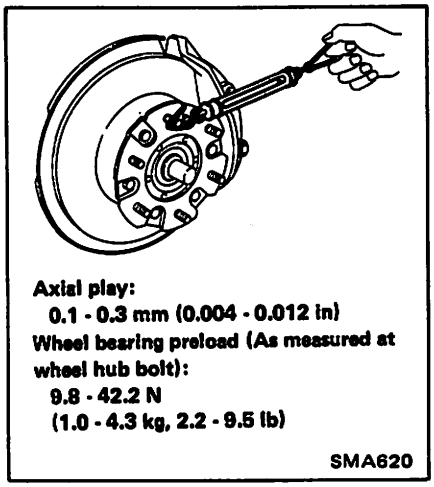
9. Spread cotter pin.



10. Install hub cap with new O-ring.

CHECKING WHEEL BEARING PRELOAD (4WD)

1. Block rear wheels with chocks and raise front of vehicle, and then support it with safety stand. Refer to Lifting Points and Towing (Section GI).
2. Remove wheel and tire assembly.
3. Remove free-running hub (refer to Section FA).
4. Remove brake pads.
   Refer to Section BR.
5. Measure wheel bearing preload and axial play.



6. If values exceed specifications, refer to Section FA and adjust.
7. Install free-running hub and brake pads in the reverse order of removal (refer to Sections FA and BR).

CHECKING WHEEL ALIGNMENT

Before checking front wheel alignment, be sure to make a preliminary inspection of all front end parts.

- **Tire pressure**
- **Wheel bearing axial play**
- **Suspension ball joint**
- **Steering gear housing looseness at frame**
- **Steering linkage and connections**
- **Shock absorber operation**
- **Tighten each front axle and suspension parts.**
- **Measure vehicle height (Unladen).**
- **Repair or replace the damaged portion or parts.**

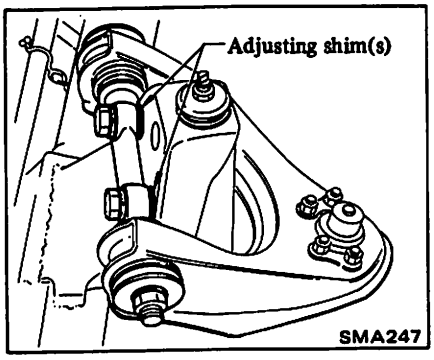
"Unladen"

- Fuel tank, radiator and engine oil tank all full.
- Spare tire, jack, hand tools, mats in position.
- All tires inflated to specified pressure.
- All accumulation of mud, dirt and road deposits removed from chassis and underbody.

Camber and caster

Measure camber and caster angles of both right and left wheels with a suitable alignment gauge and adjust in accordance with the following procedures if necessary.

Both camber and caster angles are adjusted by increasing or decreasing the number of adjusting shims inserted between upper link spindle and frame.

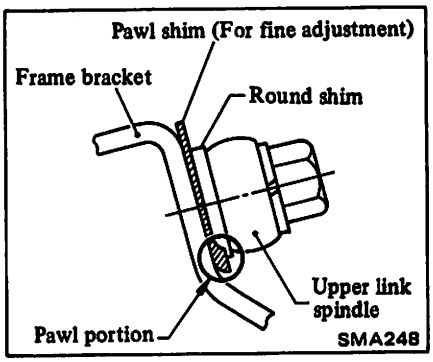


Before checking camber or caster, move vehicle up and down on turning radius gauge to minimize friction. Ensure that vehicle is in correct posture. Refer to Section FA for correct vehicle posture.

Adjusting shim:
Standard thickness
2.0 mm (0.079 in)
Adjusting shim thickness
1.0 mm (0.039 in)
2.0 mm (0.079 in)
4.0 mm (0.157 in)

WARNING:
Before removing or installing adjusting shim(s), be sure to place a jack under lower link.

- **Do not use more than three shims at one place.**
- **Total thickness of shims must be within 6.0 mm (0.236 in).**
- **When installing shims with pawls, always face the pawls towards spindle and insert them from bracket side. Use only one shim in a place.**



Camber

To adjust camber, equalizer thickness of front and rear shims by adding or removing shim(s).

Camber (Unladen):
0° to 1°

- When adding 1.0 mm (0.039 in) shim to each of the front and rear,
  Camber decreases 13′
  Caster decreases 3′

Caster

To adjust caster, make a difference in thickness between front and rear shims.

Caster (Unladen):

2WD	50′ - 1°50′
4WD	1°10′ - 2°10′

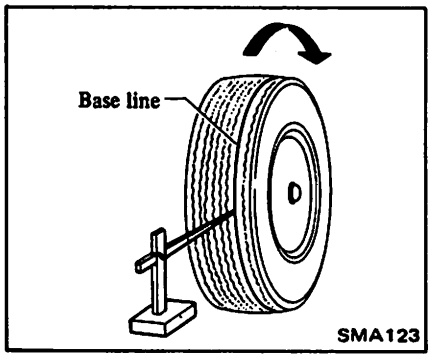
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- When front shim(s) is 1.0 mm (0.039 in) thicker than rear one(s),
  Caster decreases 32′
  Camber decreases 3′
- When rear shim(s) is 1.0 mm (0.039 in) thicker than front one(s),
  Caster increases 29′
  Camber decreases 7′
- **Difference of total thickness of the front and rear must be within 2.0 mm (0.079 in).**
- **When caster is adjusted, camber angle changes and camber has to be measured again. If necessary, adjust camber.**

Toe-in

Measure toe-in, and make necessary adjustments. Use the following procedure when making adjustments.

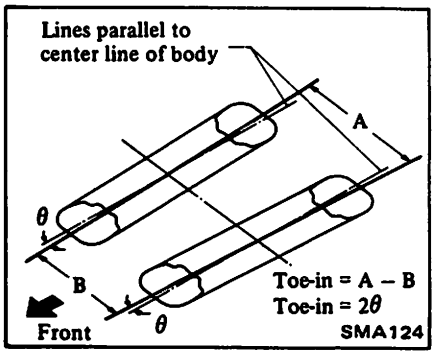
1. Raise front of vehicle and mark a base line across the tread of left and right wheels.



2. Set wheels in a straight-ahead position, and then lower front of vehicle.

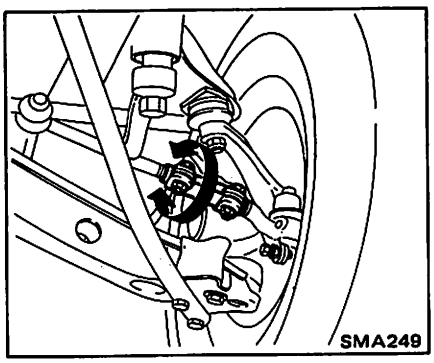
Lower front of vehicle and move vehicle back and forth.

3. Measure toe-in and make necessary adjustments.

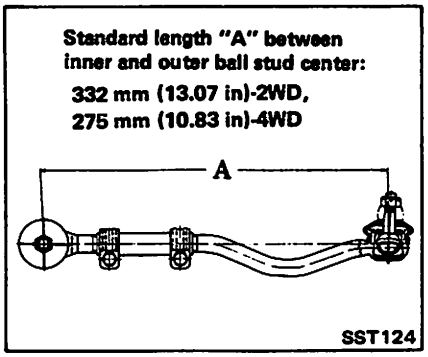


Toe-in (Unladen):
5 - 7 mm (0.20 - 0.28 in)
14′ - 19′ (On both sides)
Side slip (Reference data)
Out 3 mm - In 3 mm/m
(Out 0.036 in - In 0.036 in/ft)

Toe-in can be adjusted by varying the length of steering side rods.



(1) If side rods have been disassembled, set the distance between inner and outer ball stud centers to the specified value "A" prior to reassembling.



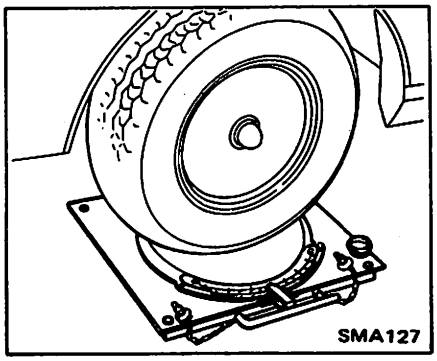
(2) Make sure that side rod bars are screwed into the adjusting bar more than 35 mm (1.38 in).

4. After correct toe-in has been obtained, tighten adjusting bar clamps.

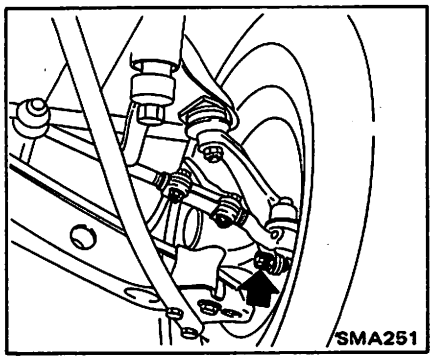
Ⓣ : **Adjusting bar clamps**
11 - 17 N-m
(1.1 - 1.7 kg-m,
8 - 12 ft-lb)

Front wheel turning angle

1. Set wheels in straight ahead position and then move vehicle forward until front wheels rest on turning radius gauge properly.



2. Remove stopper pin of turning radius gauge and then fully rotate steering wheel to the right and left; measure turning angle on inner wheel and make necessary adjustments.



Front wheel turning angle:
Toe-out turns (When inner wheel 20°-2WD, 18.5°-4WD)
Outer wheel 18°
Full turns

2WD	Inner wheel	34° - 36°
	Outer wheel	30° - 32°
4WD	Inner wheel	29° - 33°
	Outer wheel	27° - 29°

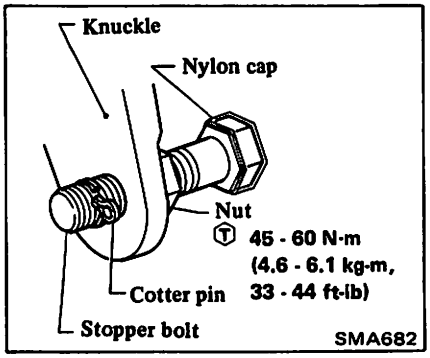
Turning angle of outer wheel will automatically be set by adjusting turning angle of inner wheel to specified values.

3. After adjustment, lock adjusting lock nut.

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– 4WD –

- The adjustment should be done with nylon cap off. After tightening lock nut to specified torque, install nylon cap on bolt.
- Bend cotter pin around bolt.



REAR AXLE AND REAR SUSPENSION

CHECKING REAR AXLE AND SUSPENSION PARTS

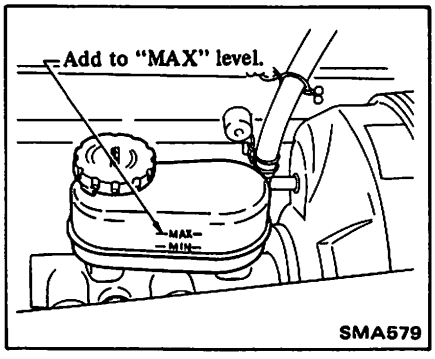
Check rear axle and suspension parts for looseness, wear or damage.

Retighten all loose nuts and bolts to the specified torque. Refer to Section RA for tightening torque.

Replace all worn parts as instructed under Rear Suspension (Section RA).

BRAKE SYSTEM

CHECKING BRAKE FLUID LEVEL AND LEAKS



If fluid level is extremely low, check brake system for leaks.

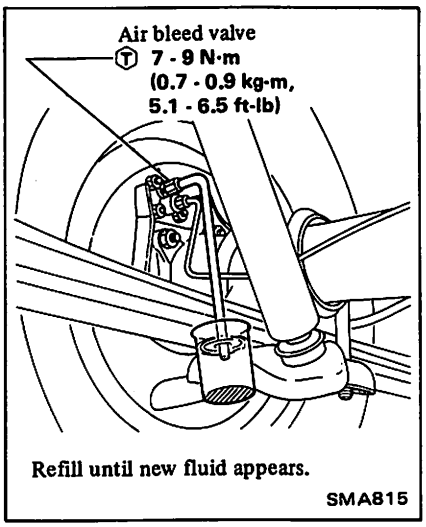
CHANGING BRAKE FLUID

1. Change brake fluid.

Use same procedure as in air bleeding to change brake fluid in system. This operation should be done for one wheel at a time. Refer to Section BR.

CAUTION:
Never reuse brake fluid because its characteristic is changed by oxidization as well as contains the foreign material and dirt.

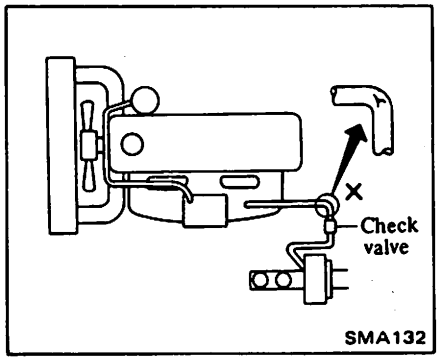
Recommended brake fluid specification:
DOT 3 (F.M.V.S.S. No. 116)



2. Check brake fluid level.
3. Check for leaks.

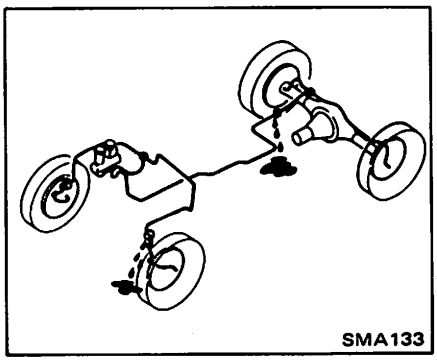
CHECKING BRAKE BOOSTER VACUUM HOSES, CONNECTIONS AND CHECK VALVE

1. Check condition of vacuum hoses and connections.
2. Check vacuum hoses and check valve for air tightness.



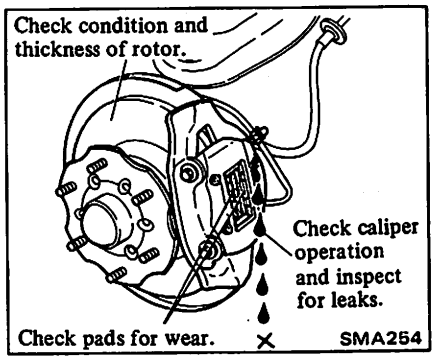
CHECKING BRAKE SYSTEM

Check brake system for proper attachment, leaks, chafing, abrasion, deterioration, etc.

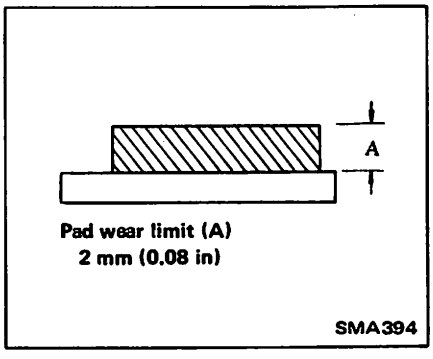


CHECKING DISC BRAKE

Check condition of disc brake components.



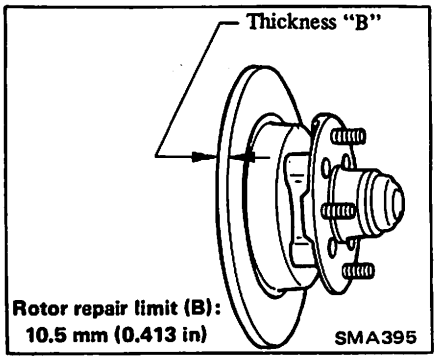
Pad wear limit



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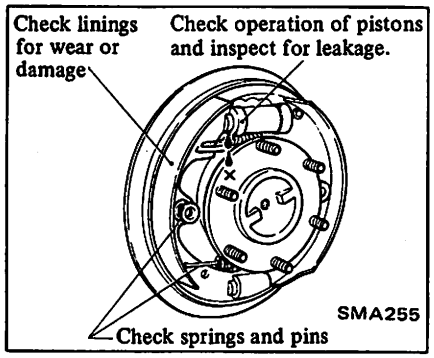
Refer to Section BR for pad replacement.

Rotor repair limit

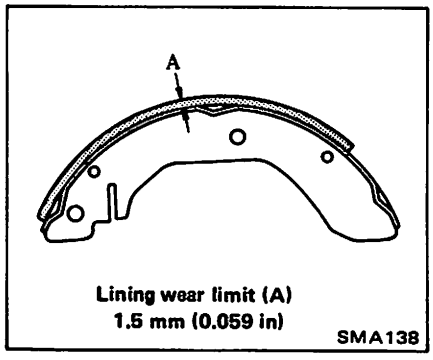


CHECKING DRUM BRAKE

Check condition of drum brake components.

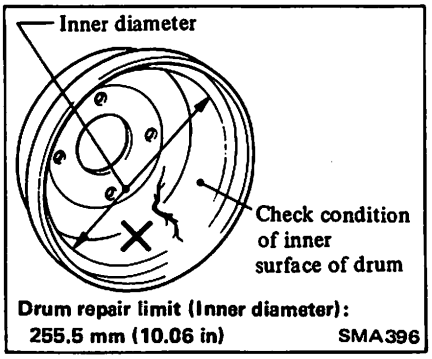


Lining wear limit



Refer to Section BR for shoe replacement.

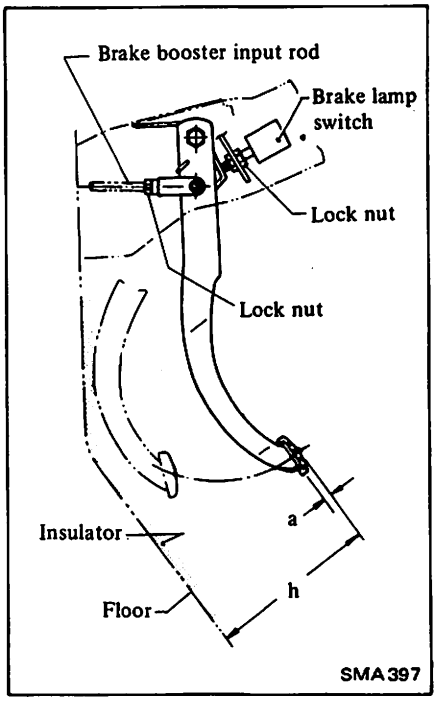
Drum repair limit



CHECKING FOOT BRAKE

1. Check brake pedal free height and free play.

Adjust if necessary.



Pedal free height "h":
168 - 174 mm (6.61 - 6,85 in)
Pedal free play "a":
1 - 5 mm (0.04 - 0.20 in)

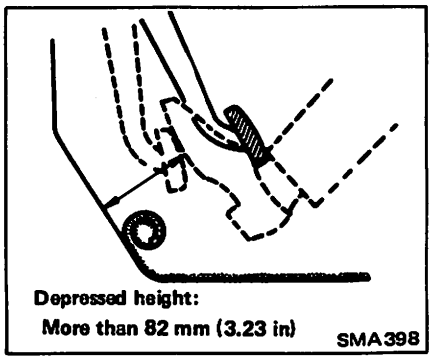
(1) Adjust pedal free height with brake lamp switch. Then tighten lock nut.

(2) Adjust pedal free play with brake booster input rod. Then tighten lock nut.

Pedal free play means the following total measured at position of pedal pad.

- **Play due to clevis pin and clevis pin hole in pedal lever.**
- **Play due to piston and piston rod.**

2. Check brake pedal depressed height.



If depressed height is below the specified value, check brake system for leaks, accumulation of air or any abnormality regarding component parts (master cylinder, adjuster, etc.), and make the necessary repairs.

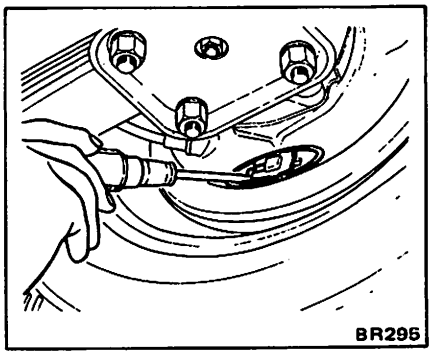
ADJUSTING FOOT BRAKE

Front disc brake does not require adjustment under normal conditions since pad to rotor clearance is automatically compensated for by elasticity of piston seal and gripper.

Rear brake

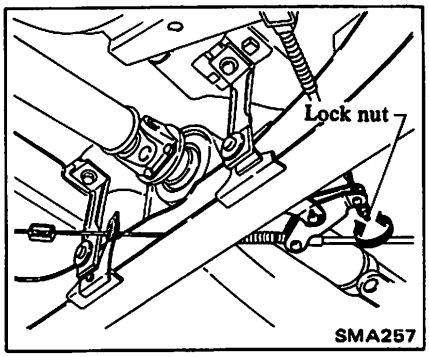
1. Raise vehicle until wheels clear floor.
2. Remove rubber boot from brake disc.
3. Lightly tap adjuster housing and move it forward. Turn down adjuster wheel with a screwdriver, and spread brake shoes. Stop turning adjuster wheel when a considerable drag is felt and lock up brake drum.

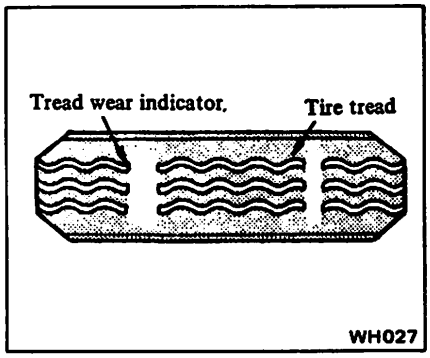
For both right and left brakes, brake shoes spread when adjuster wheel is turned downward.



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4. Return adjuster wheel 12 ratches to obtain correct clearance between brake drum and brake shoes. Turn brake drum, and make sure that brake drum turns without dragging when brake shoes interfere with brake drum, then readjust clearance.
5. Install rubber boot.

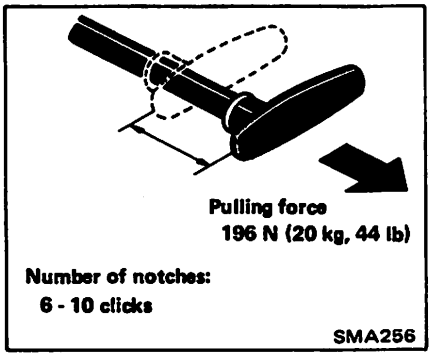




CHECKING PARKING BRAKE

1. Pull lever with specified amount of force.

Measure lever stroke with number of notches.



2. Use adjuster to adjust lever stroke.
3. Bend parking brake warning lamp switch plate down so that brake warning light comes on when ratchet at parking brake lever is moved back one notch and goes out when returned to its original position.

WHEEL AND TIRE

CHECKING TIRE CONDITION

Tire condition

1. Tires are provided with "tread wear indicator" at six places around tire circumference, indicating 1.6 mm (1/16 in) tread depth. When tires wear and then marks appear, replace them with new ones.
2. Remove pebbles, glass or any other foreign material embedded in tire treads.
3. Check tread and side walls for cracks, holes, separation or damage.
4. Check tire valves for air leakage.

Tire inflation

1. Check tire pressure. If necessary, adjust it to the specified value. Refer to S.D.S.

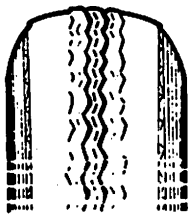
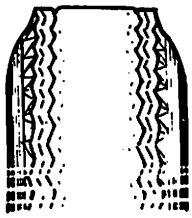
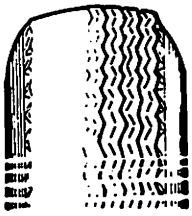
Tire pressure should be measured when tire is cold.

2. After inflating tires, valves should be checked for leakage. Whenever tire pressure is checked, be sure to tighten valve caps firmly by hand to keep dust and water out.

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Abnormal tire wear

Correct abnormal tire wear according to the chart shown below.

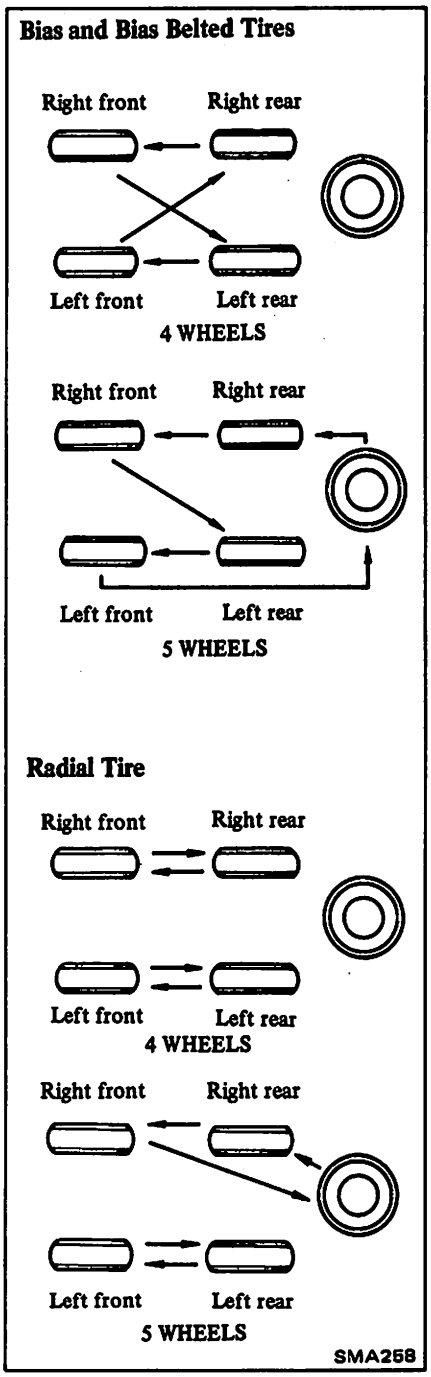
Condition	Probable cause	Corrective action
 Shoulder wear	• Underinflation (both sides wear) • Incorrect wheel camber (one side wear) • Hard cornering • Lack of rotation	• Measure and adjust pressure. • Adjust camber. • Reduce speed. • Rotate tires.
 Center wear	• Overinflation • Lack of rotation	• Measure and adjust pressure. • Rotate tires.
Feathered edge  Toe-in or toe-out wear	• Incorrect toe	• Adjust toe-in.
 Uneven wear	• Incorrect camber or caster • Malfunctioning suspension • Unbalanced wheel • Out-of-round brake drum • Other mechanical conditions • Lack of rotation	• Adjust camber or caster. • Repair, replace or, if necessary, reinstall. • Balance or replace. • Correct or replace. • Correct or replace. • Rotate tires.

SMA068

TIRE ROTATION

1. Tires tend to wear unevenly and become unbalanced after a certain running distance. Uneven tire wear often results in tire noise which is attributed to rear axle gears, bearing, etc. Front tires also tend to wear unevenly because of improperly aligned front wheels.

2. Accordingly, to equalize tire wear, it is necessary to **rotate tires periodically.**



TIRE REPLACEMENT

CAUTION:
Different types of tires, such as bias, bias belted and radial tires, must not be mixed under any circumstances. Mixed use of different types of tires can adversely affect vehicle handling and may cause driver to lose control.

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a. When replacing a worn or damaged tire, use a replacement tire of the same size and load carrying capacity as that with which the vehicle was equipped when manufactured. The use of different size and/or load capacity tires will not only shorten tire service life but may also result in a serious accident.

b. Do not use tires and wheels other than those recommended, and do not mix tires of different brands or tread patterns.
The use of tires and wheels other than those recommended or the mixed use of tires of different brands or tread patterns can adversely affect the ride, braking, handling, ground clearance, body-to-tire clearance, and speedometer calibration.

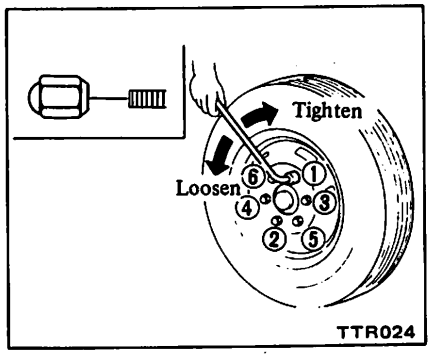
c. It is recommended that new tires be installed in pairs on the same axle. When replacing only one tire, it should be paired with the most tread, to equalize braking traction.

d. When replacing original tires with those tires of an optional recommended size and of different diameter, the speedometer must be recalibrated.

1. To replace a tire with a jack in a safe manner, refer to Lifting Points (Section GI) for jacking up.

WARNING:
Never get under vehicle while it is supported only by jack.
Always use safety stands to support side member of body construction when you must get beneath vehicle.

2. To install wheel, tighten wheel nuts in criss-cross fashion.



TTR024

TIRE REPAIR

Inspect tire, following the procedure shown below. If any defect is present, repair or replace as necessary.

1. Apply soapy solution or submerge tire and wheel or tube in water after inflating it to specified pressure.
2. Inspect for leaks.
3. Specially inspect for leaks around valve or wheel rim and along tread.
4. Note bead and rim where leakage occurs. Wipe water away from any area which leaks air bubbles and then mark place with chalk.
5. Remove object which caused puncture and seal the point.

a. When repairing a puncture, use a tire repair kit furnished by any tire dealer, following instructions provided with kit.

b. If a puncture is too large or there is some damage to tire fabric, repair should be carried out by authorized tire dealer.

6. Discard when any of the following problems occurs:
- Broken or damaged bead wire.
- Ply or tread separation.
- Worn fabric damage on tubeless tire.
- Cracked or damaged side wall.
- Tires with tread wear indicator showing, etc.

CAUTION:
When replacing tire, take extra care not to damage tire bead, rim-flange and bead seat.

Do not use tire irons to force beads away from wheel rim-flange; that is, always use tire replacement device whenever tire is removed.

7. Install tire, noting the following items:

a. Install valve core and inflate to proper pressure. Check the locating rings of the tire to be sure they show around the rim flanges on both sides.

b. Check valves for leakage after inflating tires.

c. Be sure to tighten valve caps firmly by hand.

WARNING:
When, while tire is being inflated, bead snaps over safety hump, it might break. Thus, to avoid serious personal injury, never stand over tire when inflating it. Never inflate to a pressure greater than the maximum value shown on the side wall of the tire. If beads fail to seat at that pressure, deflate the tire, lubricate it again, and then reinflate it. If the tire is overinflated, the bead might break, possibly resulting in serious personal injury.

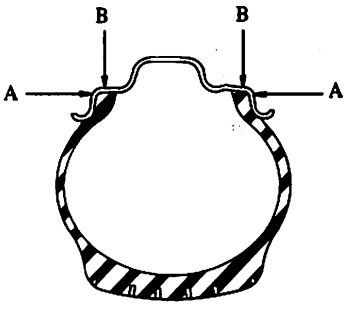
WHEEL INSPECTION

Inspect wheel, taking care of the following points, in order to ensure satisfactory steering condition as well as maximum tire life. If any defect is present, repair or replace as necessary.

1. Check wheel rim, especially rim flange and bead seat, for rust, distortion, cracks or other faults which might cause air leaks. Function of tubeless tire depends on a good seal between tire bead and wheel rim.
2. Thoroughly remove rust, dust, oxidized rubber or sand from wheel rim.

Rim bead seats should be cleaned with wire brush, coarse steel wool, etc.

3. Examine wheel rim for lateral and radial runout, using dial gauge.



Lateral runout (A) and radial runout (B):
Less than 1.2 mm (0.047 in)-2WD,
Less than 1.5 mm (0.059 in)-4WD
Difference between right and left lateral runout:
Less than 0.5 mm (0.020 in)
SMA399

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4. Replace wheel when any of the following problems occurs.
- Bent, dented or heavily rusted
- Elongated bolt holes
- Excessive lateral or radial runout
- Air leaks through welds
- Wheel nuts will not stay tight

Wheel balance

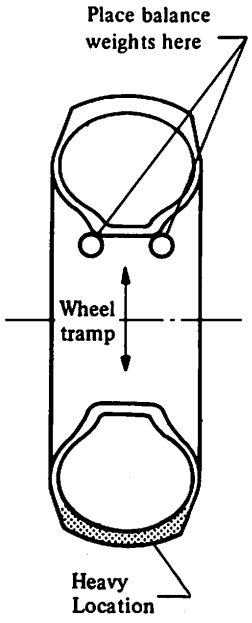
Inspect wheel and tire for wheel balance and correct it if unbalance is present, taking the following points into consideration.

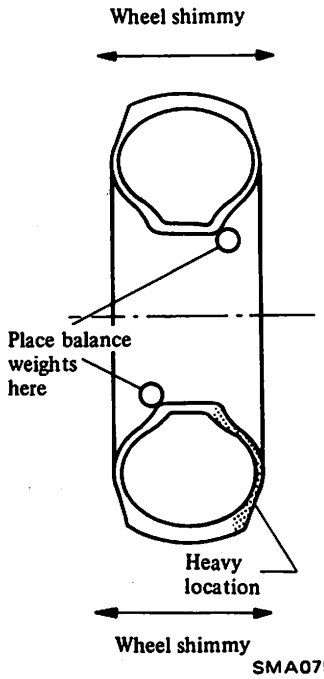
1. Correct unbalance when the symptom of unbalance appears as wheel tramps and wheel shimmy.
2. Balance wheel and tire both **statically and dynamically.**

Balancing wheels

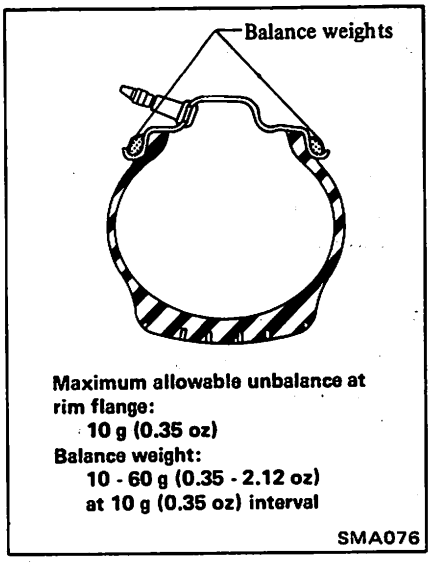
WARNING:
When balancing wheel and tire on the vehicle, be sure to observe the equipment manufacturers instructions carefully.

Cause	Wheel static unbalance	Wheel dynamic unbalance
Symptom of unbalance	Wheel tramp Wheel shimmy	Wheel shimmy
Corrective action	Balance statically	Balance dynamically





SMA075



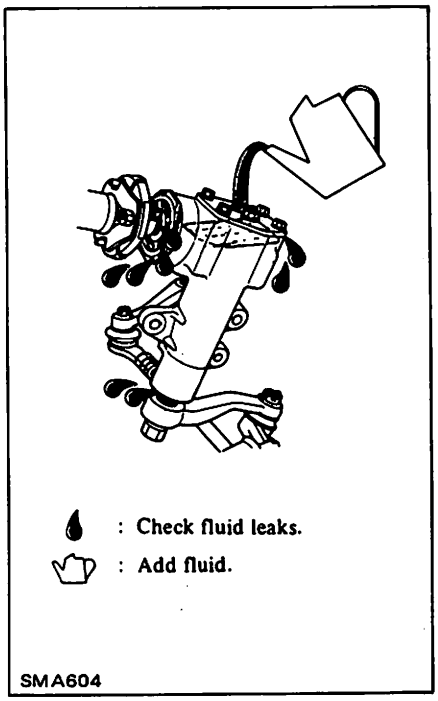
Maximum allowable unbalance at rim flange:
10 g (0.35 oz)
Balance weight:
10 - 60 g (0.35 - 2.12 oz)
at 10 g (0.35 oz) interval

SMA076

a. **Be sure to place correct balance weights on inner edge of rim.**
b. **Do not put more than two weights on each side.**
c. **Properly rebalance the wheel and tire whenever puncture is repaired.**

STEERING SYSTEM

CHECKING STEERING GEAR OIL LEVEL AND LEAKS



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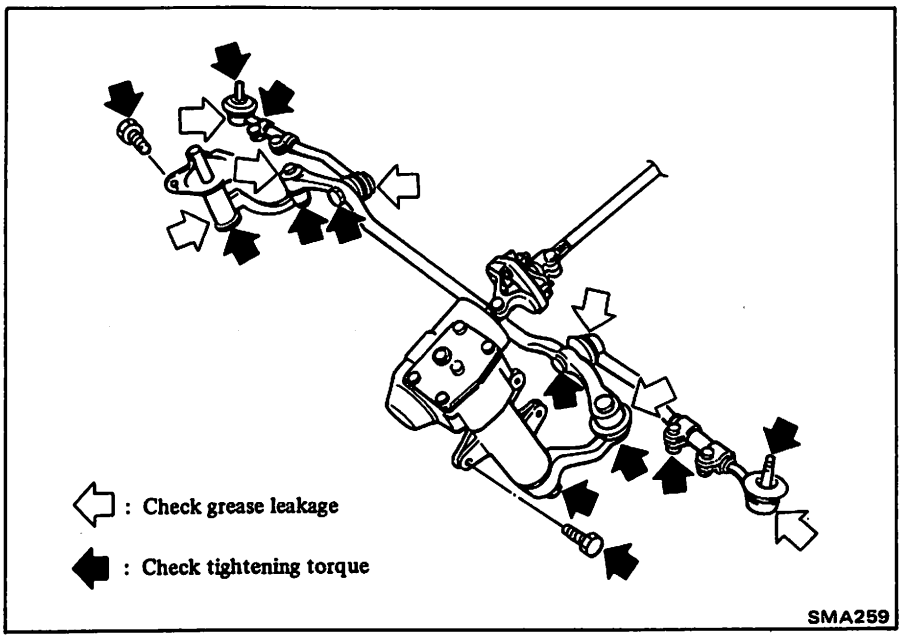
CHECKING STEERING GEAR BOX AND LINKAGE

Steering gear box

- Check parts for looseness, wear or damage. Retighten if neccessary. Refer to Section ST for tightening torque.

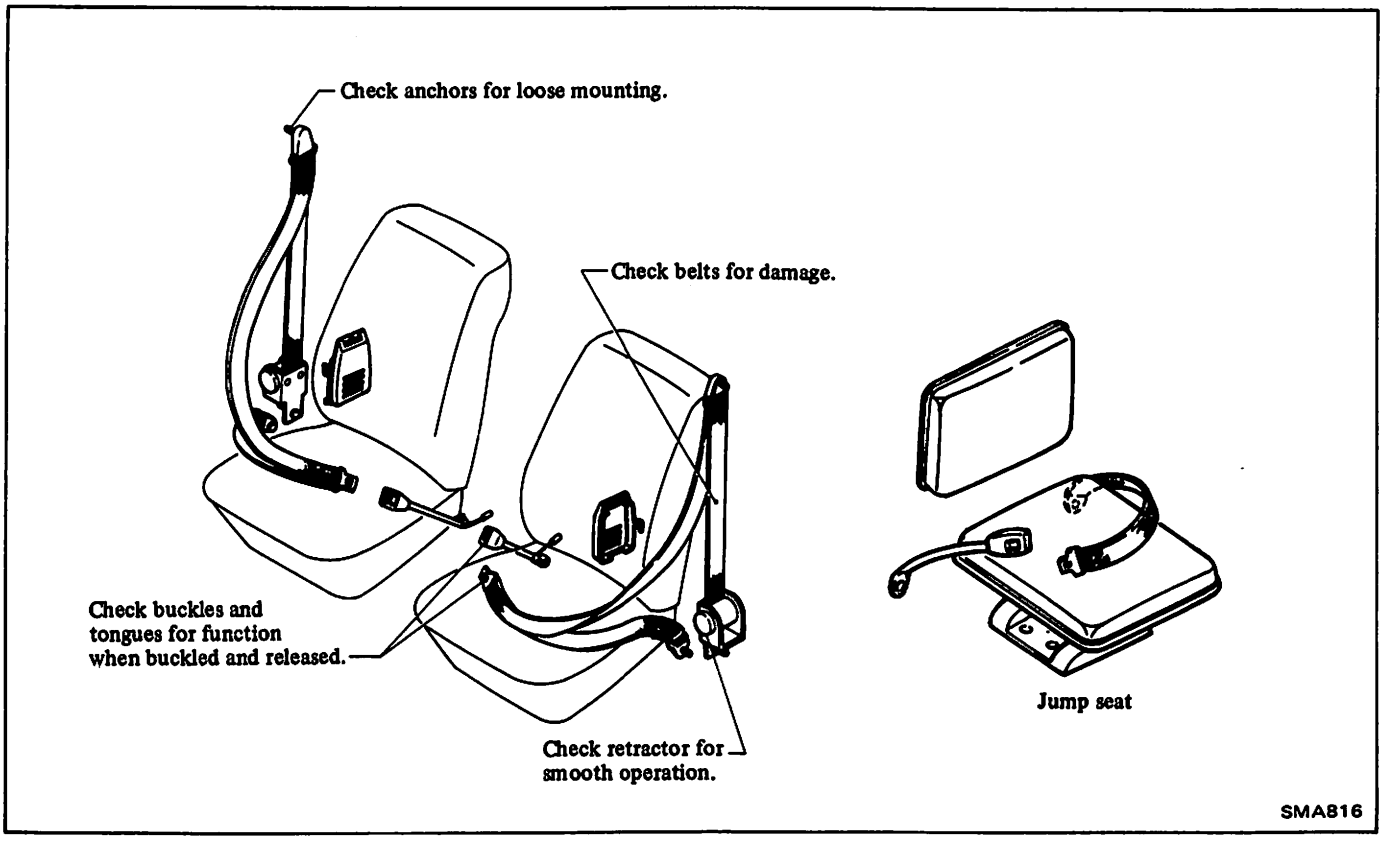
Steering linkage

- Check parts for looseness, wear or damage. Retighten if necessary. Refer to Section ST for tightening torque.
- Check ball joints and idler arm for grease leakage.
- Check for any missing parts (cotter pins, washer, etc.).



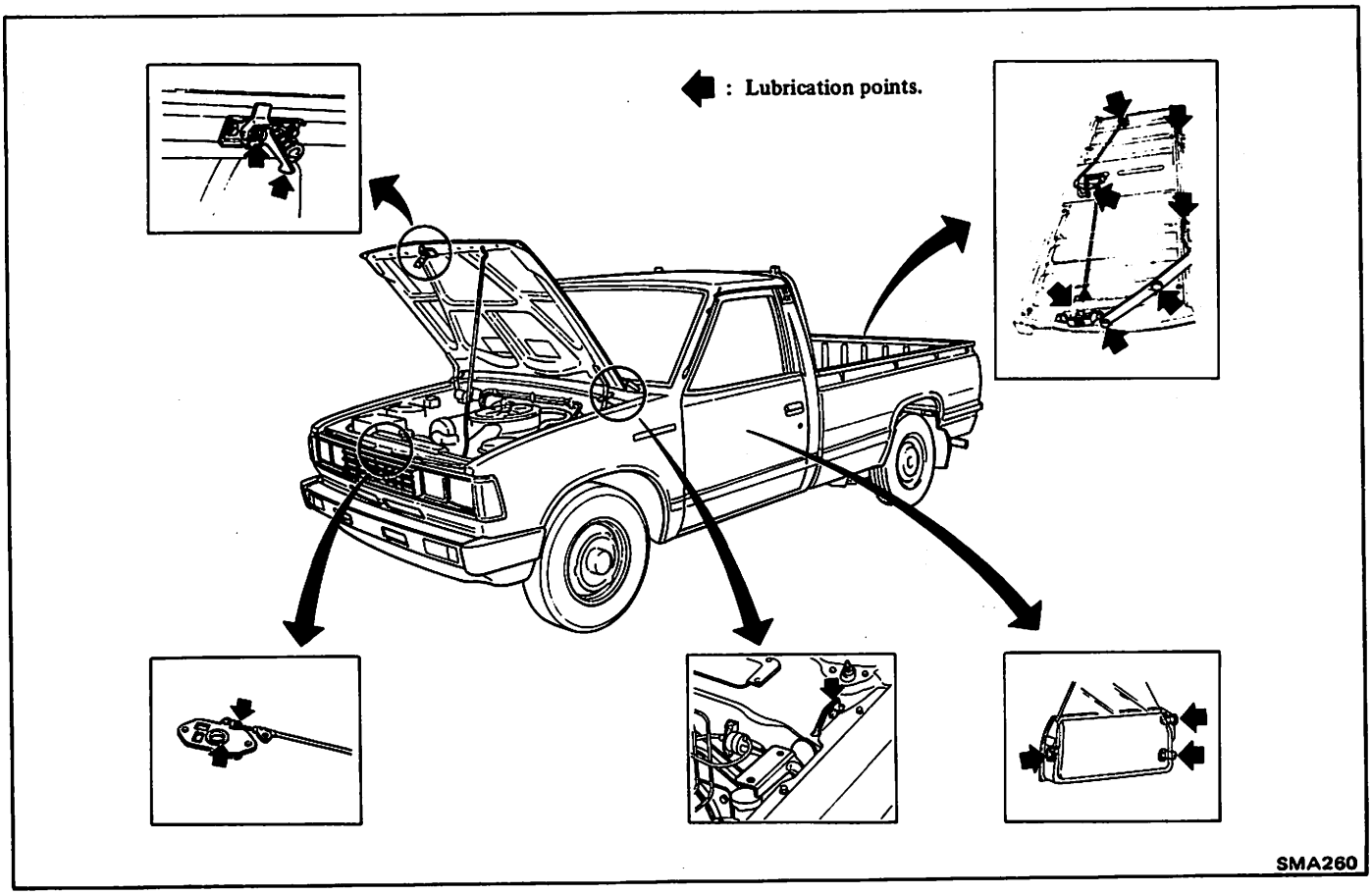
BODY

CHECKING SEAT BELTS, BUCKLES, ANCHORS AND ADJUSTER

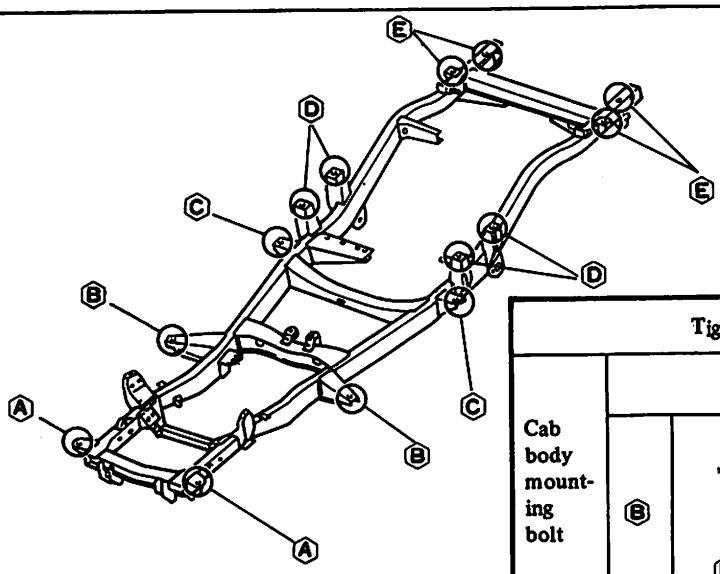


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LUBRICATING LOCKS, HINGES AND HOOD LATCH



RETIGHTEN BODY MOUNTINGS



Tightening torque			N·m	kg-m	ft-lb
Cab body mounting bolt	Ⓐ		19 - 23	1.9 - 2.3	14 - 17
	Ⓑ	Ⓑ -1	9.1 - 11.8	0.93 - 1.2	6.7 - 8.7
		Ⓑ -2	17 - 19	1.7 - 1.9	12 - 14
	Ⓒ		29 - 39	3.0 - 4.0	22 - 29
Rear body mounting bolt	Ⓓ, Ⓔ		27 - 35	2.8 - 3.6	20 - 26

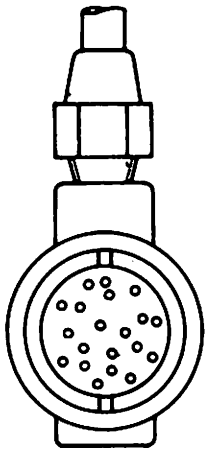
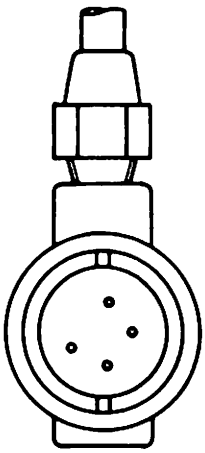
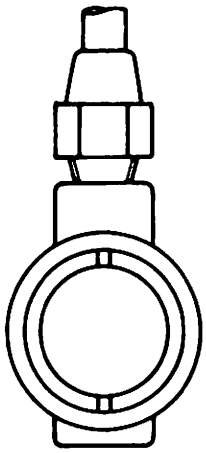
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HEATER AND AIR CONDITIONER

CHECKING REFRIGERANT LEVEL

1. Open doors fully.
2. Start the engine.
3. Set air conditioner switch to "ON" position.
4. Set temperature lever to maximum cold position.
5. Set blower to maximum speed.
6. Check sight glass after the lapse of about five minutes. Judge according to the following table.

Check item \ Amount of refrigerant	Almost no refrigerant	Insufficient	Suitable	Too much refrigerant
Temperature of high pressure and low pressure lines.	Almost no difference between high pressure and low pressure side temperature.	High pressure side is warm and low pressure side is fairly cold.	High pressure side is hot and low pressure side is cold.	High pressure side is abnormally hot.
State in sight glass.	Bubbles flow continuously. **Bubbles will disappear and something like mist will flow when refrigerant is nearly gone.**  AC256	The bubbles are seen at intervals of 1 - 2 seconds.  AC257	Almost transparent. Bubbles may appear when engine speed is raised and lowered. **No clear difference exists between these two conditions.**  AC258	No bubbles can be seen.
Pressure of system.	High pressure side is abnormally low.	Both pressure on high and low pressure sides are slightly low.	Both pressures on high and low pressure sides are normal.	Both pressures on high and low pressure sides are abnormally high.
Repair.	**Stop compressor immediately** and conduct an overall check.	Check for gas leakage, repair as required, replenish and charge system.		Discharge refrigerant from service valve of low pressure side.

a. The bubbles seen through the sight glass are influenced by the ambient temperature. Since the bubbles are hard to show up in comparatively low temperatures below 20°C (68°F), it is possible that a slightly larger amount of refrigerant would be filled, if supplied according to the sight glass. Be sure to recheck the amount when it exceeds 20°C (68°F). In higher temperature the bubbles are easy to show up.

b. When the screen in the receiver drier is clogged, the bubbles will appear even if the amount of refrigerant is normal. In this case, the outlet side pipe of the receiver drier becomes considerably cold.

CHECKING COMPRESSOR DRIVE BELT

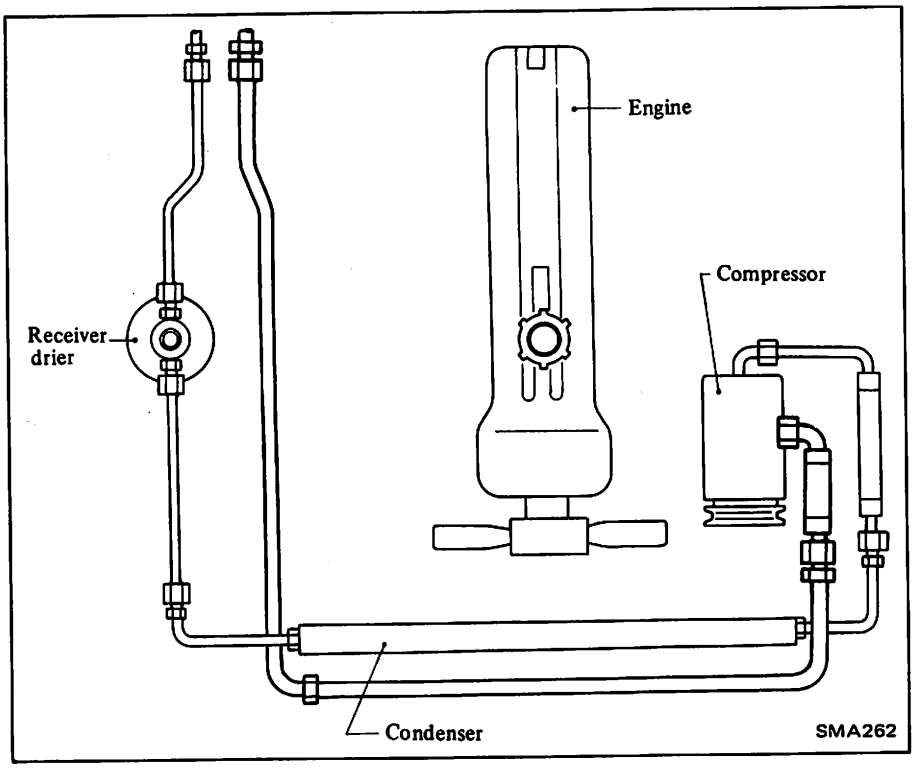
Refer to Engine Maintenance for inspection and adjustment.

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CHECKING HOSES AND PIPES

Check heater and air conditioner for damaged hoses or pipes due to interference or friction with adjoining parts. If damage is minor, repair those affected hose or pipes. If damage is major and if there is the possibility of encountering holes, replace the affected parts.

Carefully check hoses and pipes, especially those located close to moving parts or sharp edge of panel.



CHECKING REFRIGERANT LEAK

Conduct a leak test with halide or electric leak detector whenever leakage of refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening of connection fittings.

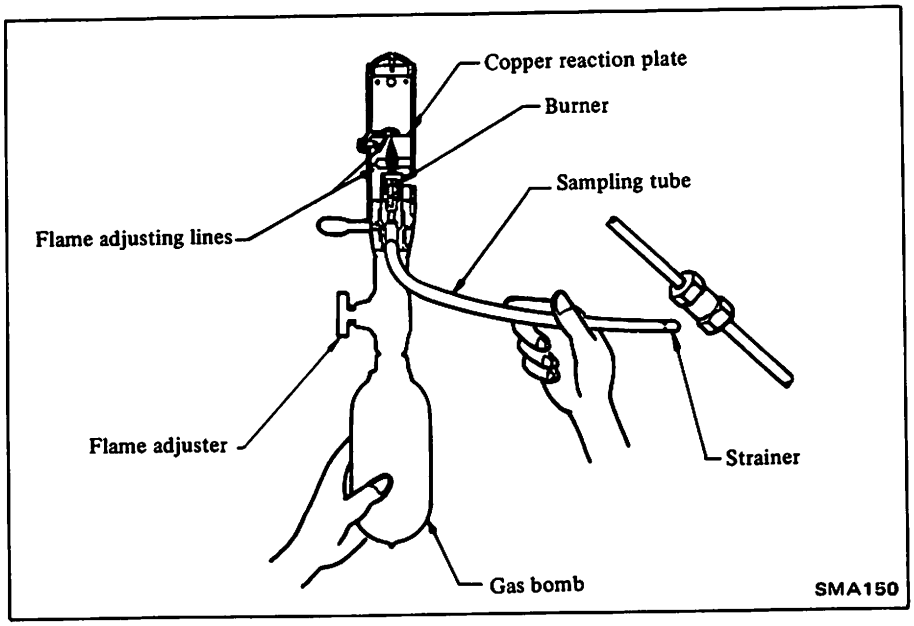
Major check points

(1) Compressor
- Compressor shaft seal (rotate the compressor by hand)
- Flexible hose connections
- Front and rear head gaskets
- Service valve

(2) Condenser
- Condenser pipe fitting
- Condenser inlet and outlet pipe connections

(3) Refrigerant lines
- Flared section of high pressure and low pressure flexible hoses.
- Line connections

(4) Evaporator housing
- Inlet and outlet line connections
- Expansion valve
- Suction throttle valve



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The following information and cautions should be kept in mind when checking for leakage.

- If a halide leak detector is used, determine whether or not there is gas leaking by the color of the flame, as indicated in the chart below.

	Propane type	Butane type
NO LEAK	Greenish blue	Pale blue
SMALL LEAK	Yellow	Bright blue
LARGE LEAK	Purple	Vivid green

WARNING:
a. Never inhale the fumes produced by combustion of refrigerant gas since they are toxic.
b. Never use halide torch in a place where combustible or explosive gas is present.

- **Since refrigerant gas is heavier than air, small leaks can be easily detected by placing sampling tube directly below the check point.**
- **If any trace of oil is noted at and around connection fittings, it is a sure indication that refrigerant is leaking.**

If a gas leak is detected, proceed as follows:

1. Check torque on the connection fitting and, if too loose, tighten to the proper torque. Refer to Section HA for tightening torque. Check for gas leakage with a leak detector.
2. If leakage continues even after the fitting has been retightened, discharge refrigerant from system, disconnect the fittings, and check its seating face for damage. Always replace even if damage is slight.
3. Check compressor oil and add oil if required.
4. Charge refrigerant and recheck for gas leaks. If no leaks are found, evacuate and charge system.

OFF-SEASON MAINTENANCE

Even in the off-season, turn the compressor for 10 minutes **at least once a month** by running the engine at idling rpm.

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

ENGINE MAINTENANCE

INSPECTION AND ADJUSTMENT

Valve clearance mm (in)	Hot	Cold*
Intake	0.30 (0.012)	0.21 (0.008)
Exhaust	0.30 (0.012)	0.23 (0.009)
Drive belt deflection Fan, Alternator and Air conditioner compressor mm (in)	8 - 12 (0.31 - 0.47)	
Applied pressed force N (kg, lb)	98 (10, 22)	
Compression pressure kPa (kg/cm^2, psi)/rpm Standard	1,177 (12.0, 171)/350	
Minimum	883 (9.0, 128)/350	

* **At ambient temperature 20°C (68°F). After checking valve clearance while engine is cold, also check it when engine is hot to see if it remains within the specified value. If it does not, readjust it.**

Spark plug

	Type			Plug gap mm (in)
	Standard	Hot type	Cold type	
U.S.A.	BP6ES	BP5ES	BP7ES	0.8 - 0.9 (0.031 0.035)
Canada	BPR6ES*	BPR5ES*	BPR7ES*	
High tension cable resistance ohm			Less than 30,000	

* **Resistor built-in type is optional equipment for U.S.A. models.**

Ignition timing, idle speed and idle "CO"%

Unit: degree/rpm

Manual transmission*	2WD	5 ±2° B.T.D.C./650 ±100
	4WD	5 ±2° B.T.D.C./800 ±100
Automatic transmission* (in "D" position)		5 ±2° B.T.D.C./650 ±100
"CO"% at idle speed (No air)		Idle mixture screw is preset and sealed at factory

* **Ignition timing should be checked with distributor vacuum hose disconnected and plugged up.**

Unit: kPa (mmH_2O, inH_2O)

Vapor line leakage test	Supplied pressure	3.923 (400, 15.75)
	Pressure variation	Less than 0.245 (25, 0.98)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Rocker arm nut	16 - 22	1.6 - 2.2	12 - 16
Oil pan drain plug	20 - 29	2.0 - 3.0	14 - 22
Spark plug	15 - 20	1.5 - 2.0	11 - 14

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CHASSIS AND BODY MAINTENANCE

INSPECTION AND ADJUSTMENT

Clutch

Unit: mm (in)

Pedal height "H"	171 - 177 (6.73 - 6.97)
Pedal free play "A"	1 - 5 (0.04 - 0.20)

Front axle and front suspension

Item \ Model	2WD	4WD
Axial play mm (in)	Less than 0.08 (0.0031)	0.1 - 0.3 (0.004 - 0.012)
Wheel bearing preload (As measured at wheel hub bolt)		
With new parts N (kg, lb)	Less than 28.4 (2.9, 6.4)	9.8 - 42.2 (1.0 - 4.3, 2.2 - 9.5)
With used parts N (kg, lb)	Less than 11.8 (1.2, 2.6)	
Wheel alignment (Unladen) Camber	0° - 1°	
Caster	50' - 1°50'	1°10' - 2°10'
Kingpin inclination	8°30' - 9°30'	10°30' - 11°30'
Toe-in	5 - 7 mm (0.20 - 0.28 in) 14' - 19' (On both sides)	
Side slip (Reference data)	Out 3 mm - In 3 mm/m (Out 0.036 in - In 0.036 in/ft)	
Standard side rod length "A" mm (in)	332 (13.07)	275 (10.83)
Front wheel turning angle Toe-out turns (When inner wheel is 20°-2WD, 18.5°-4WD) Outer wheel	18°	
Full turns Inner wheel	34° - 36°	29° - 33°
Outer wheel	30° - 32°	27° - 29°

Camber and caster adjusting shim

Unit: mm (in)

	Thickness	Part No.
Round shim	1.0 (0.039) 2.0 (0.079) 4.0 (0.157)	54544 B9500 54542 B9500 54541 B9500
Shim with pawls	1.0 (0.039) 2.0 (0.079)	54543 J0110 54544 J0110

Brake system

Unit: mm (in)

Pad wear limit	2 (0.08)
Rotor repair limit	10.5 (0.413)
Lining wear limit	1.5 (0.059)
Drum repair limit	255.5 (10.06)
Pedal height "h"	168 - 174 (6.61 - 6.85)
Pedal free play "a"	1 - 5 (0.04 - 0.20)
Pedal depressed height	More than 82 (3.23)
Parking brake [at pulling force: 196 N (20 kg, 44 lb)] Number of notches	6 - 10

Wheel and tire

Recommended cold tire inflation pressure psi (kPa)			
Tire size \ Load		Moderate	Heavy
7.00-14(B)	Front	22 (152)	22 (152)
	Rear	22 (152)	32 (221)
185SR14(B)	Front	24 (165)	24 (165)
	Rear	24 (165)	32 (221)
195SR14(B)	Front	24 (165)	24 (165)
	Rear	24 (165)	28 (193)
E78-14LT(D)	Front	26 (179)	26 (179)
	Rear	40 (275)	60 (414)
G78-15(B)	Front	28 (193)	28 (193)
	Rear	28 (193)	28 (193)
GR78-15(B)	Front	28 (193)	28 (193)
	Rear	28 (193)	28 (193)

Tire pressure should be checked when tires are COLD.

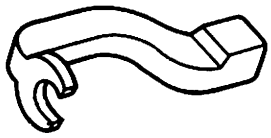
Wheel rim lateral and radial runout mm (in)	2WD	Less than 1.2 (0.047)
	4WD	Less than 1.5 (0.059)
Difference between right and left lateral runout mm (in)		Less than 0.5 (0.020)
Wheel balance (Maximum allowable unbalance at rim flange) gr (oz)		10 (0.35)
Tire balancing weight gr (oz)		10 - 60 (0.35 - 2.12) Spacing 10 (0.35)

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TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Manual transmission Drain and filler plugs	25 - 34	2.5 - 3.5	18 - 25
Transfer Drain and filler plugs	20 - 39	2 - 4	14 - 29
Differential carrier Drain and filler plugs Front	59 - 98	6 - 10	43 - 72
Rear	59 - 98	6 - 10	43 - 72
Front axle and front suspension Side rod adjusting bar clamps	11 - 17	1.1 - 1.7	8 - 12
Steering stopper bolt lock nut	45 - 60	4.6 - 6.1	33 - 44
Brake Air bleed valve	7 - 9	0.7 - 0.9	5.1 - 6.5
Wheel and tire Wheel nut	118 - 147	12 - 15	87 - 108

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name
ST10640001 (J25615-01)	Pivot adjuster 
ST19320000 (J25664)	Oil filter wrench 

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ENGINE MECHANICAL

SECTION EM

EM

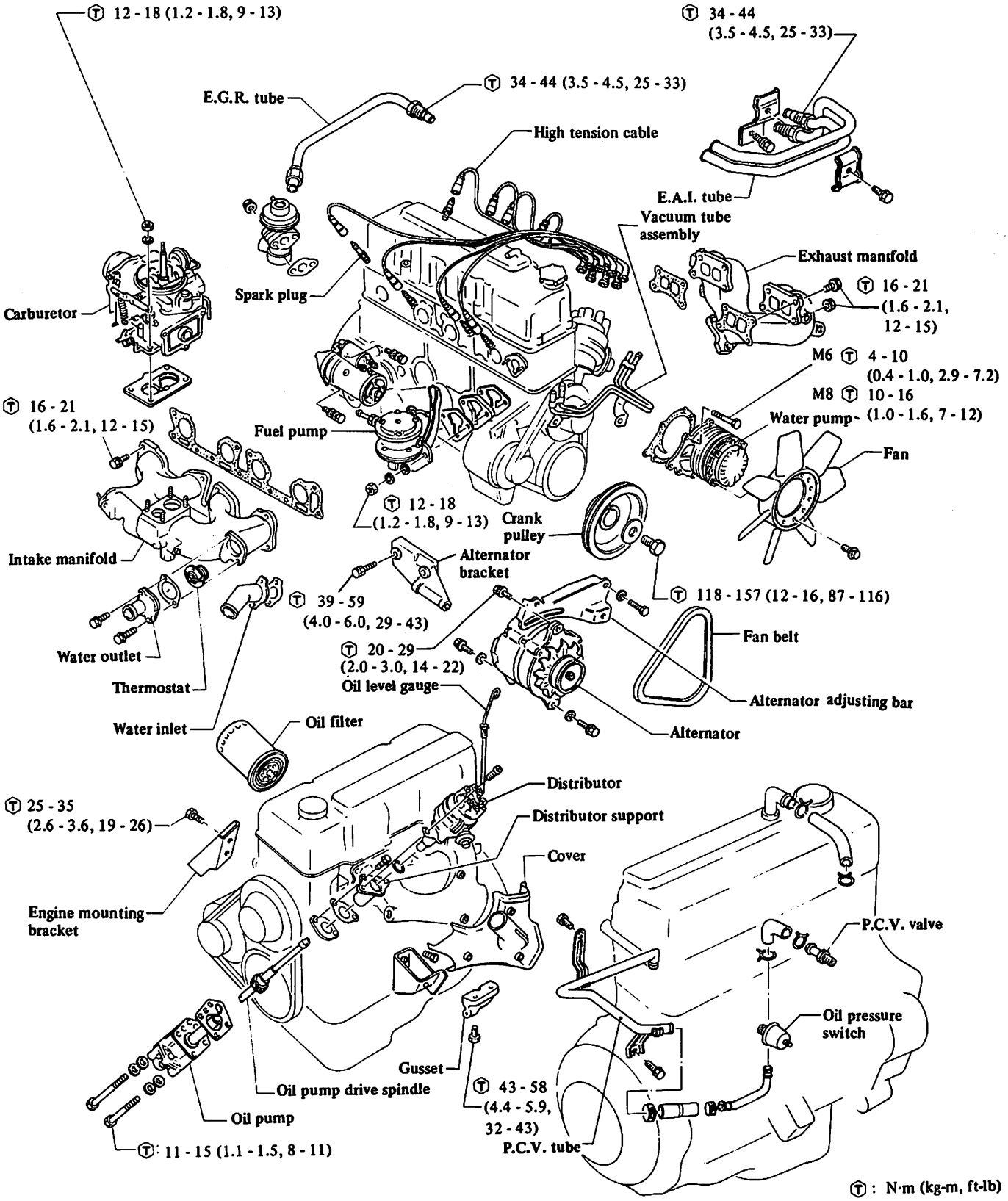
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SPECIAL SERVICE TOOLS EM-27

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ENGINE COMPONENTS (Outer parts)

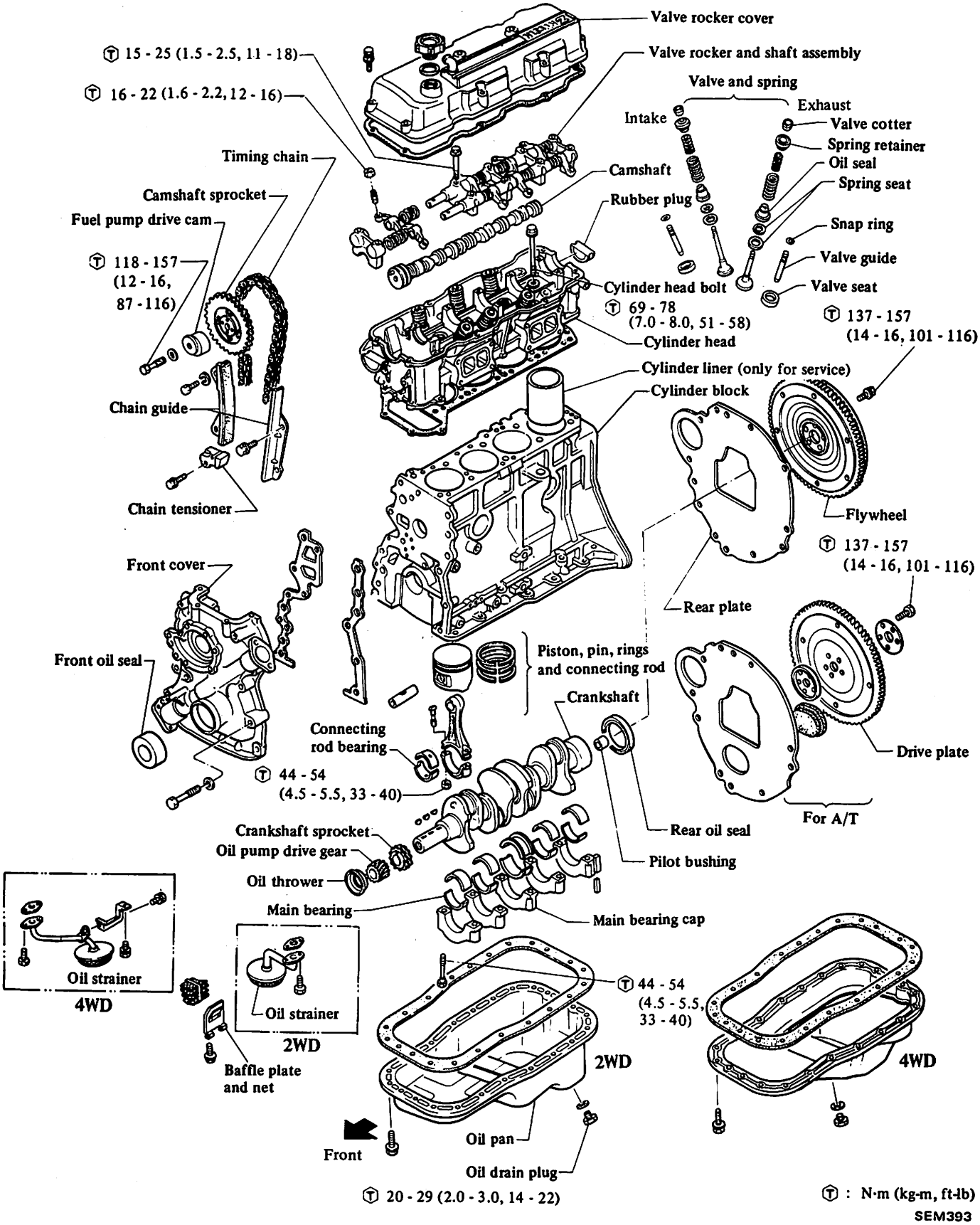
Z22 ENGINE



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ENGINE COMPONENTS (Body parts)

Z22 ENGINE

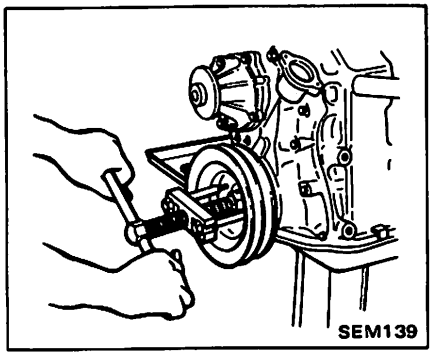


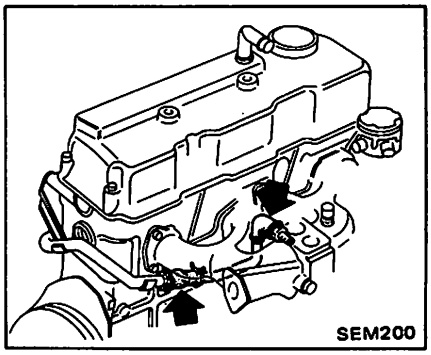
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ENGINE DISASSEMBLY

PRECAUTION

Arrange the disassembled parts on the parts stand in accordance with their assembled locations, sequence, etc., so that the parts will be reassembled to their original locations. Place mating marks on the parts if necessary.



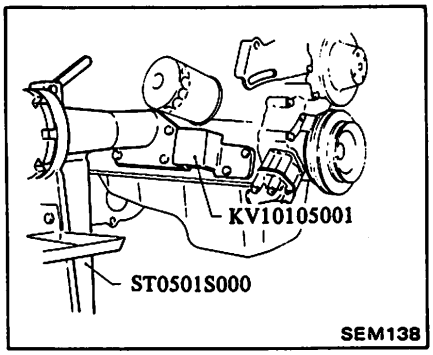


DISASSEMBLING ENGINE OVERALL

MOUNTING ENGINE ON WORK STAND

1. Remove following parts, located at rear and right side of engine.
- Starter motor
- Transmission
- Clutch cover assembly (using Tool KV30100100) or torque converter
- Alternator and its bracket
- Engine mounting bracket
- Oil filter (using Tool ST19320000)
- Oil pressure switch

2. Drain out engine oil and coolant.
3. Install engine attachment to cylinder block. Then, mount the engine on the work stand.



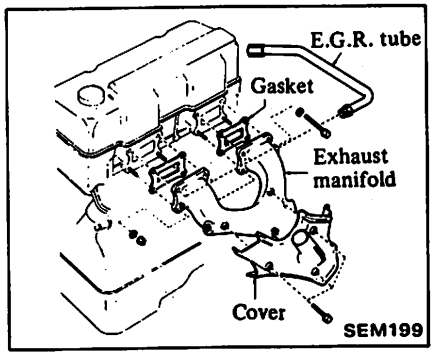
REMOVING OUTER PARTS

4. Remove following **engine front side parts.**
- Fan
- Drive belts
- Water pump
- Idler pulley for air conditioner (if equipped)
- Crankshaft pulley. Use suitable tool on air conditioner equipped models.

And remove following parts.
- Exhaust air induction tubes.
- Vacuum tube assembly for distributor and canister.
- Alternator adjusting bar.

5. Remove **engine left side parts**
- Distributor cap and high tension cables
- Distributor
- Engine mounting bracket.

And remove following parts.
- Oil level gauge
- Spark plugs
- Exhaust manifold with its cover and hot air duct, after removing E.G.R. tube.

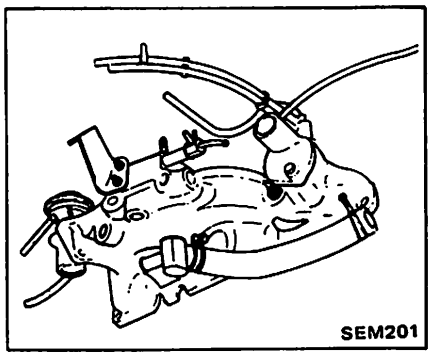


- Compressor bracket (if equipped).

6. Remove **engine right side parts.**
- Fuel pump.
- Spark plugs.
- Engine mounting bracket.
- Water inlet.

And remove following parts.
(1) A.B. valve with its hose.
(2) Carburetor and insulator.
(3) P.C.V. hose.

(4) Intake manifold assembly including E.G.R. valve, P.C.V. valve, water outlet, accelerator wire bracket, etc.

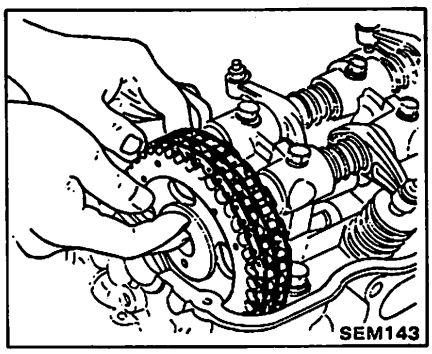


7. Remove **engine bottom side parts.**
- Oil pump and oil pump drive spindle.
- Gussets.

REMOVING BODY PARTS

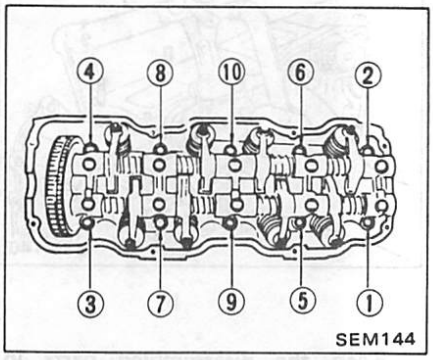
8. Remove oil pan and oil strainer.
9. Remove valve rocker cover.
10. Remove cylinder head assembly.

(1) Remove fuel pump drive cam.
(2) Remove camshaft sprocket and slowly lower timing chain.



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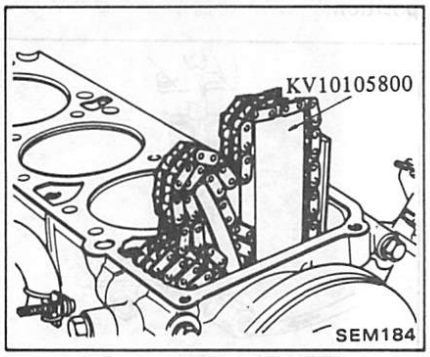
(3) Loosen cylinder head bolts in the sequence shown.



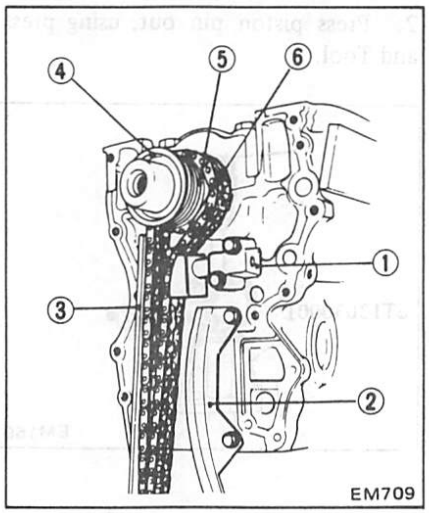
(4) Remove bolts securing cylinder head to front cover.
(5) Remove cylinder head.

When removing cylinder head from engine installed on vehicle, follow the instructions below.

a. Turn crankshaft until No. 1 piston is at T.D.C. on its compression stroke.
b. To facilitate assembling operation, scribe a mark on timing chain and camshaft sprocket with paint before removal.
c. Support timing chain by utilizing Tool between timing chains.

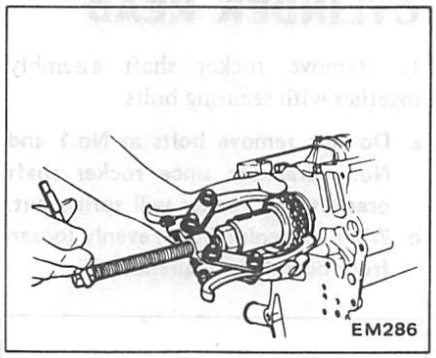


11. Remove front side parts.
(1) Front cover
(2) Chain tensioner and chain guide.
(3) Timing chain.
(4) Oil thrower, oil pump drive gear and crankshaft sprocket.

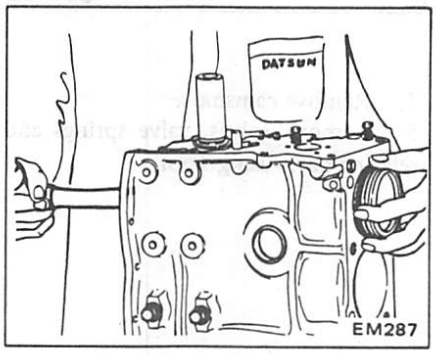


1 Chain tensioner
2 Slack side chain guide
3 Tension side chain guide
4 Oil thrower
5 Oil pump drive gear
6 Crankshaft sprocket

If it is hard to extract crankshaft sprocket, use a suitable puller.



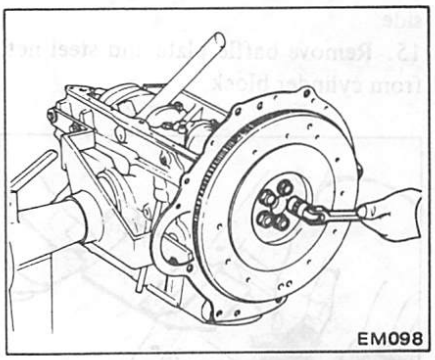
12. Remove piston and connecting rod assembly.
(1) Remove connecting rod bearing cap with bearing.
(2) Push out piston with connecting rod toward cylinder head side.



a. Piston can be easily removed by scraping carbon off top face of cylinder with a scraper.
b. Numbers are stamped on connecting rod and cap corresponding to each cylinder. Care should be taken to avoid wrong combination including bearing.

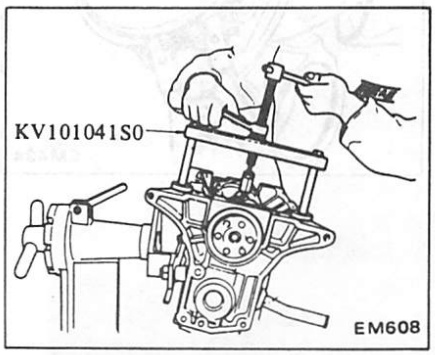
13. Remove flywheel or drive plate and end plate.

WARNING:
When removing flywheel or drive plate, be careful not to drop it.



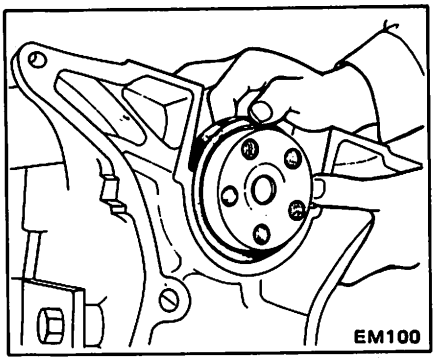
14. Remove crankshaft.
(1) Remove main bearing caps with bearings.

a. When loosening main bearing cap bolts, loosen from outside in sequence.
b. Use Tool to remove center and rear main bearing caps. Keep them in order.

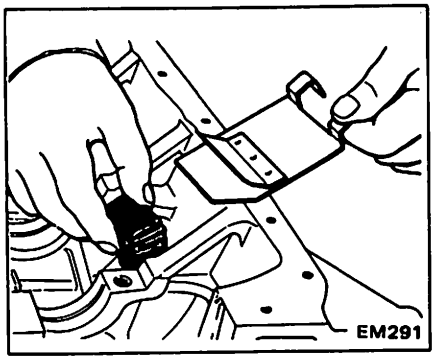


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(2) Remove rear oil seal.

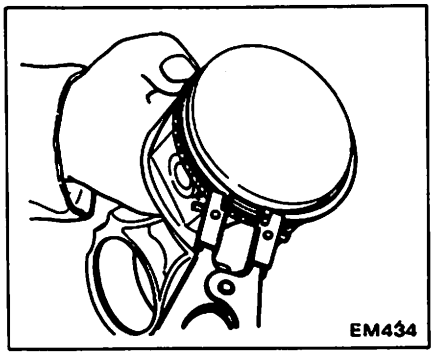


(3) Remove crankshaft.
(4) Remove main bearings at block side.
15. Remove baffle plate and steel net from cylinder block.

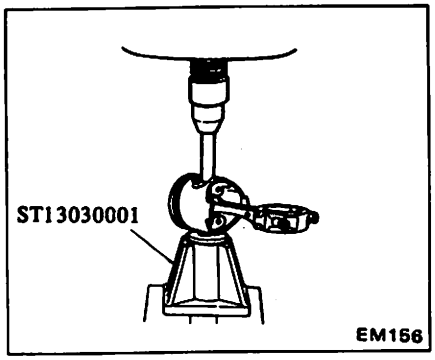


DISASSEMBLING PISTON AND CONNECTING ROD

1. Remove piston rings with a ring remover.



2. Press piston pin out, using press and Tool.

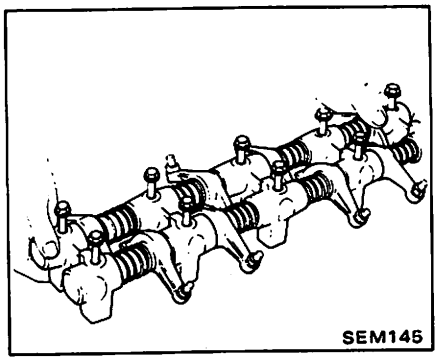


Keep the disassembled parts in order.

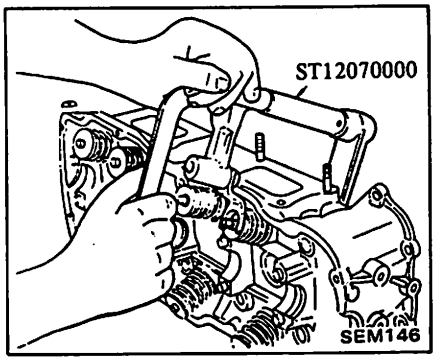
DISASSEMBLING CYLINDER HEAD

1. Remove rocker shaft assembly together with securing bolts.

a. Do not remove bolts at No.1 and No.5 brackets since rocker shaft bracket and rocker will spring out.
b. When loosening bolts, evenly loosen from outside in sequence.



2. Remove camshaft.
3. Remove valves, valve springs and relating parts using Tool.

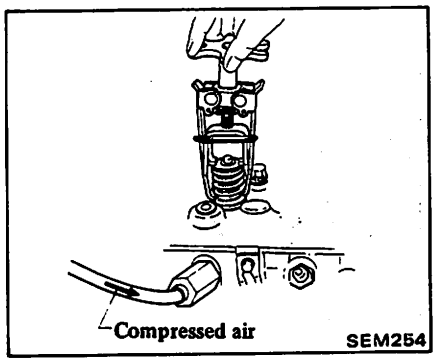


Keep the disassembled parts in order.

Replacement of valve spring/ oil seal (On-vehicle maintenance)

1. Remove rocker cover.
2. Remove rocker arm.
3. Install suitable tool in place of valve spring and valve retainer.
4. Remove spark plug.
5. Install air hose adapter into spark plug hole and apply air pressure to hold valves in place [Apply pressure of 490 kPa (5 kg/cm², 71 psi)].

When performing this operation, valves should be placed at overlapped position.



6. Remove valve spring and valve oil seal.
7. Install new part in the reverse order of removal.

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INSPECTION AND REPAIR

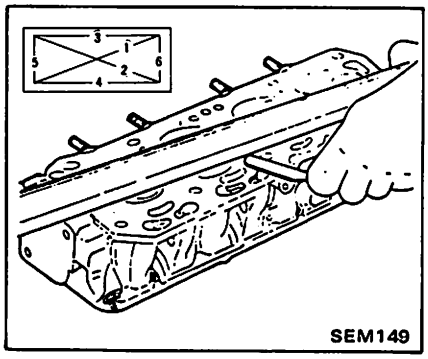
CYLINDER HEAD

CYLINDER HEAD MATING FACE

1. Make a visual check for cracks and flaws.
2. Measure the surface of cylinder head (on cylinder block side) for warpage.

If beyond the specified limit, correct with a surface grinder.

Warpage of surface:
Limit 0.1 mm (0.004 in)



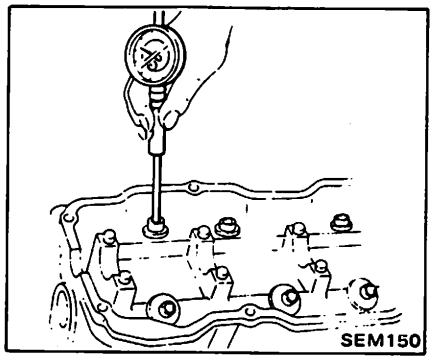
Surface grinding limit:
The grinding limit of cylinder head is determined by the cylinder block grinding in an engine.
Depth of cylinder head grinding is "A"
Depth of cylinder block grinding is "B"
Limit:
A + B = 0.2 mm (0.008 in)

VALVE GUIDE

Measure the clearance between valve guide and valve stem. If the clearance exceeds the specified limit, replace the worn parts or both valve and valve guide. In this case, it is essential to determine if such a clearance has been caused by a worn or bent valve stem or by a worn valve guide.

Determining clearance

1. Precise method:
(1) Measure the diameter of valve stem with a micrometer in three places; top, center and bottom.
(2) Measure valve guide bore at center using telescope hole gauge.



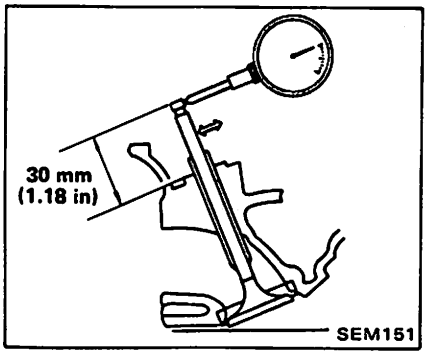
(3) Subtract the highest reading of valve stem diameter from valve guide bore to obtain the stem to guide clearance.

Stem to guide clearance:
Limit 0.1 mm (0.004 in)

2. Expedient method:
Pry valve in lateral direction, and measure deflection at stem end with dial gauge.

Stem end deflection:
Limit 0.2 mm (0.008 in)

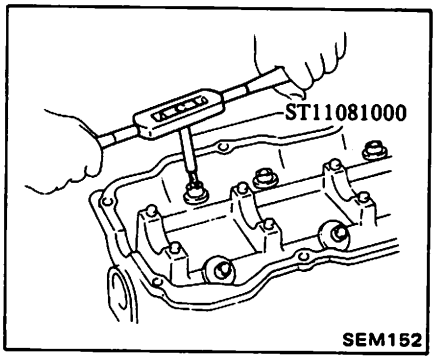
Valve should be moved in parallel with rocker arm. (Generally, a large amount of wear occurs in this direction.)



Replacing valve guide

1. To remove old guides, use Tool ST11320000 and a press (under a 2-ton pressure) or a hammer.
Drive them out toward rocker cover. Heated cylinder head will facilitate the operation.
2. Ream cylinder head valve guide hole using Tool at room temperature.

Reaming bore:
12.185 - 12.196 mm
(0.4797 - 0.4802 in)



3. Fit snap ring on new valve guide and press the guide into head until snap ring comes in contact with cylinder head surface after heating cylinder head to 150 to 200°C (302 to 392°F).
Valve guide of 0.2 mm (0.008 in) oversize diameter is available for service. Refer to S. D. S.
4. Ream the bore, using Tool ST11032000.

Reaming bore:
8.000 - 8.018 mm
(0.3150 - 0.3157 in)

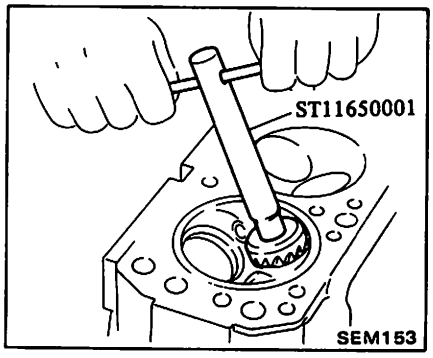
5. Correct valve seat surface with new valve guide as the axis.

VALVE SEAT INSERTS

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

Correct valve seat surface with Tool and grind with a grinding compound.

Valve seat insert of 0.5 mm (0.020 in) oversize is available for service.
Refer to S. D. S.



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a. When repairing valve seat, check valve guide for wear beforehand. If worn, replace it. Then correct valve seat.
b. The Tool should be used with both hands for uniform cutting.

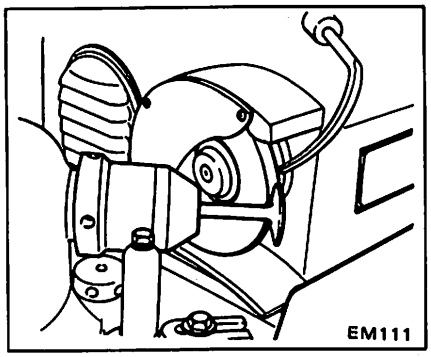
Replacing valve seat insert

1. Old insert can be removed by boring out until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the insert recess in cylinder head.
2. Select a suitable valve seat insert and check its outside diameter.
3. Machine cylinder head recess to the concentric circles to valve guide center.
4. Ream the cylinder head recess at room temperature. Refer to S.D.S.
5. Heat cylinder head to a temperature of 150 to 200°C (302 to 392°F).
6. Fit insert ensuring that it beds on the bottom face of its recess, and caulk more than 4 points.
7. Valve seats newly fitted should be cut or ground using Tool ST11650001 at the specified dimensions as shown in S.D.S.
8. Apply small amount of fine grinding compound to valve contacting face and put valve into guide. Lap valve against its seat until proper valve seating is obtained. Remove valve and then clean valve and valve seat.

VALVE

1. Check each of the intake and exhaust valve for worn, damaged or deformed valve head or stem. Correct or replace the valve that is faulty.
   Refer to S.D.S.
2. Valve face or valve stem end surface should be refaced by using a valve grinder.

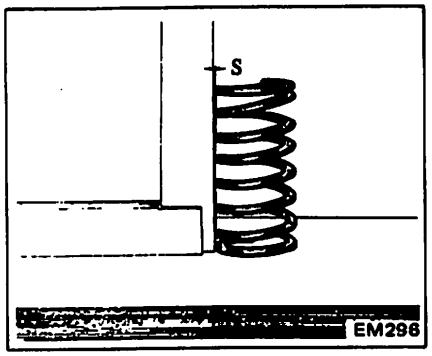
Valve head margin:
Limit 0.5 mm (0.020 in)
Grinding of valve stem end:
Limit 0.5 mm (0.020 in)



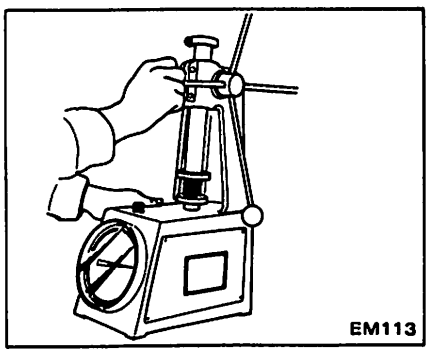
VALVE SPRING

1. Check valve spring for squareness using a steel square and surface plate. If spring is out of square "S" more than specified limit, replace with new ones.

Out of square ("S"):
Outer
Limit 2.2 mm (0.087 in)
Inner
Limit 1.9 mm (0.075 in)



2. Measure the free length and the tension of each spring. If the measured value exceeds the specified limit, replace spring.
   Refer to S.D.S.



ROCKER ARM AND ROCKER SHAFT

1. Check rocker arms and shafts for sign of wear or damage, and if worn excessively, replace rocker arm and/or shaft.
2. Check oil clearance between rocker arm and rocker shaft.

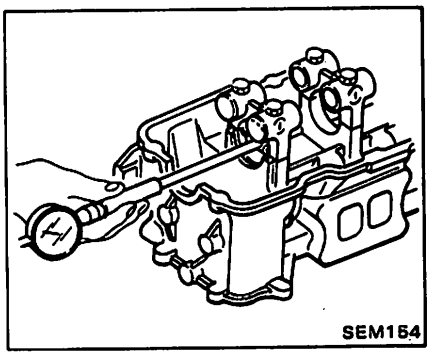
Rocker arm to shaft clearance:
0.007 - 0.049 mm
(0.0003 - 0.0019 in)

CAMSHAFT AND CAMSHAFT BEARING

CAMSHAFT BEARING CLEARANCE

Measure the inside diameter of camshaft bearing with an inside dial gauge and the outside diameter of camshaft journal with a micrometer. If any malfunction is found, replace camshaft or cylinder head assembly.

Camshaft bearing clearance:
Limit 0.1 mm (0.004 in)

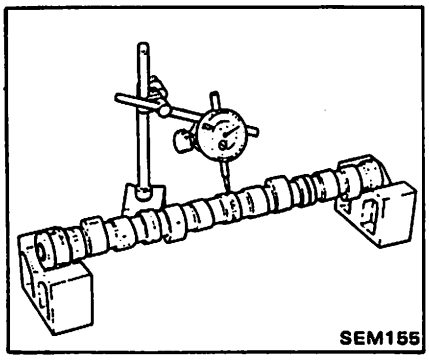


CAMSHAFT ALIGNMENT

1. Check camshaft, camshaft journal and cam surface for bend, wear or damage. If beyond the specified limits. replace the parts.

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Camshaft bend:
Limit 0.2 mm (0.008 in)

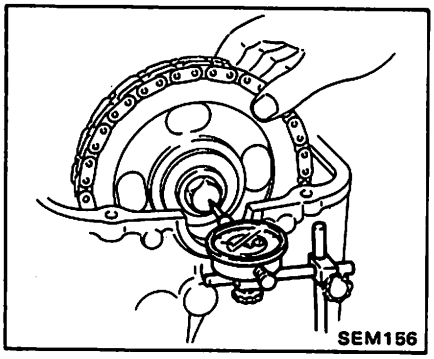


2. Measure camshaft cam height. If beyond the specified limit, replace camshaft.

Wear limit of cam height:
0.25 mm (0.0098 in)

3. Measure camshaft end play. If beyond the specified limit, replace camshaft or cylinder head assembly.

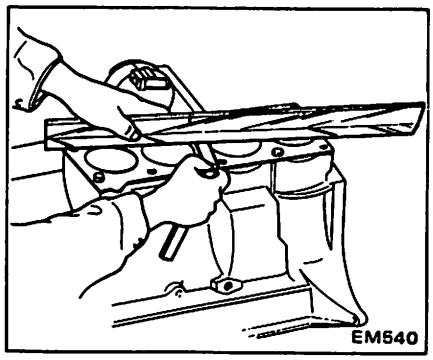
Camshaft end play:
Limit 0.2 mm (0.008 in)



CYLINDER BLOCK

1. Visually check cylinder block for cracks or flaws.
2. Measure the top of cylinder block (cylinder head mating face) for warpage. If it exceeds the specified limit, correct with a grinder.

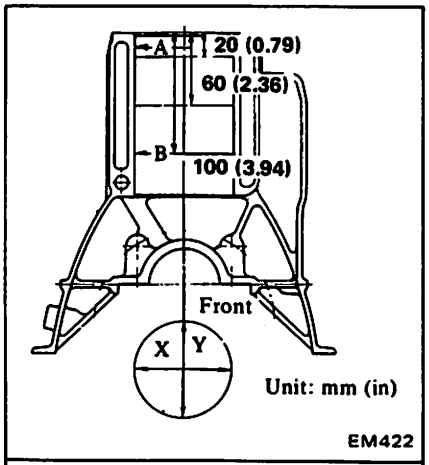
Warpage of surface:
Limit 0.1 mm (0.004 in)

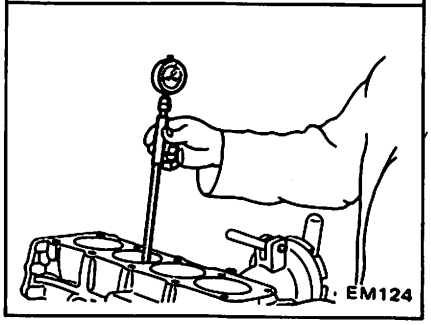


Surface grinding limit:
The grinding limit of cylinder block is determined by the cylinder head grinding in an engine.
Depth of cylinder head grinding is "A"
Depth of cylinder block grinding is "B"
Limit:
A + B = 0.2 mm (0.008 in)

3. Using a bore gauge, measure cylinder bore for wear, out-of-round or taper. If, those are excessive, rebore the cylinder walls by means of a boring machine. Measurement should be taken along bores for taper and around bores for out-of-round.
Refer to S.D.S.

Out-of-round	**X-Y**
Taper	**A-B**





4. When wear, taper or out-of-round is minor and within the limit, remove the step at the topmost portion of cylinder using a ridge reamer or other similar tool.

CYLINDER BORING

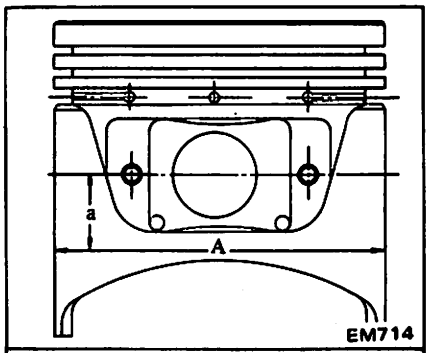
When any cylinder needs boring, all other cylinders must also be bored at the same time.

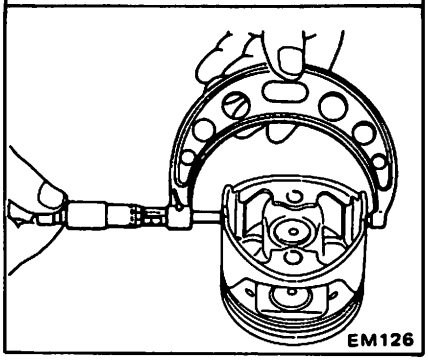
Determining bore size

1. Determine piston oversize according to amount of wear of cylinder.

Oversize pistons are available for service. Refer to S.D.S.

2. The size to which cylinders must be honed is determined by adding piston-to-cylinder clearance to the piston skirt diameter "A".





Dimension "a"
(Distance from center of pin):
Approximately
20 mm (0.79 in)

Rebored size calculation
D = A + B – C = A + [0.005 to 0.025 mm (0.0002 to 0.0010 in)]
where,
D : Honed diameter
A : Skirt diameter as measured
B : Piston-to-wall clearance
C : Machining allowance 0.02 mm (0.0008 in)

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Boring

CAUTION:
a. To prevent strain due to cutting heat, bore the cylinders in the order of 2-4-1-3.
b. Before boring any cylinder, install main bearing caps in place and tighten to the specification so that the crankshaft bearing bores will not become distorted from the boring operation.

3. Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.
4. As a final step, cylinders should be honed to size.
5. Measure the finished cylinder bore for out-of-round or tapered part.
Refer to S.D.S.

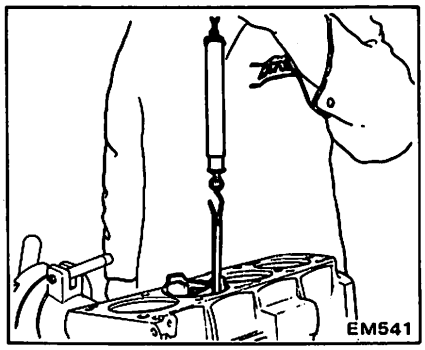
Measurement of a just machined cylinder bore requires utmost care since it is expanded by cutting heat.

Measuring piston-to-cylinder clearance

6. This clearance can be checked easily by using a feeler gauge and a spring balance hooked on feeler gauge, measuring the amount of force required to pull gauge out from between piston and cylinder.

Feeler gauge used:
0.04 mm (0.0016 in)
Extracting force:
2.0 - 14.7 N
(0.2 - 1.5 kg, 0.4 - 3.3 lb)

a. When measuring clearance, slowly pull feeler gauge straight upward.
b. It is recommended that piston and cylinder be heated to 20°C (68°F).



PISTON, PISTON PIN AND PISTON RING

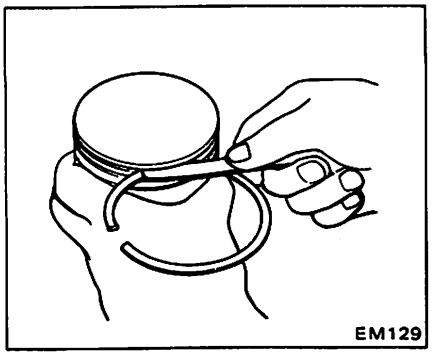
PISTON

1. Scrape carbon off piston and ring grooves with a carbon scraper and a curved steel wire. The wire will be useful in cleaning bottom land of ring groove. Clean out oil slots in bottom land of oil ring groove.
2. Check for damage, scratches and wear. Replace if such a fault is detected.

PISTON RING

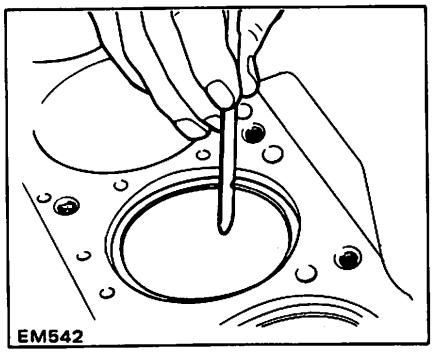
1. Measure the side clearance of rings in ring grooves as each ring is installed.
If side clearance exceeds the specified limit, replace piston together with piston ring.

Side clearance:
Limit 0.1 mm (0.004 in)



2. Measure ring gap with a feeler gauge, placing ring squarely in cylinder using piston.
Ring should be placed to diameter at upper or lower limit of ring travel.
If ring gap exceeds the specified limit, replace ring.

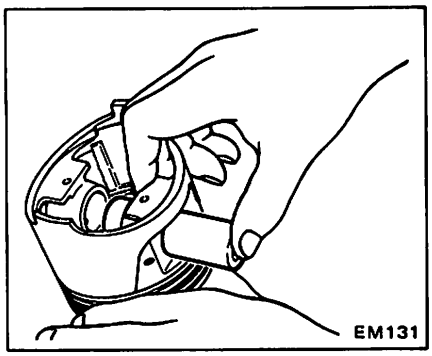
Ring gap:
Limit 1.0 mm (0.039 in)



a. When piston ring only is to be replaced, without cylinder bore being corrected, measure the gap at the bottom of cylinder where the wear is minor.
b. Oversize piston rings are available for service. [0.5 mm (0.020 in), 1.0 mm (0.039 in) oversize].

PISTON PIN

1. Check for the fitting of piston pin into piston pin hole to be such an extent that it can be pressed smoothly by finger at room temperature. This piston pin must be a tight press fit into connecting rod.



2. Measure oil clearance between piston pin and piston. If it is excessive, replace piston pin together with piston.

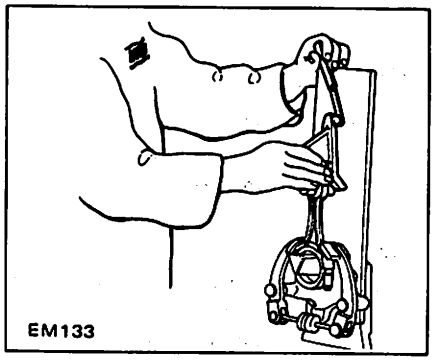
Piston pin to piston clearance:
0.006 - 0.013 mm
(0.0002 - 0.0005 in)

CONNECTING ROD

1. If a connecting rod has any flaw on both sides of the thrust face and the large end, correct or replace it.
2. Check connecting rod for bend or torsion using a connecting rod aligner. If bend or torsion exceeds the limit, correct or replace.

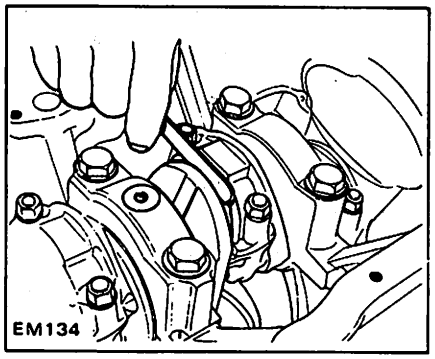
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Bend and torsion
[per 100 mm (3.94 in) length]:
Limit 0.05 mm (0.0020 in)



3. Install connecting rods with bearings on to corresponding crank pins and measure the thrust clearance. If the measured value exceeds the limit, replace such connecting rod.

Big end play:
Limit 0.6 mm (0.024 in)



When replacing connecting rod, select so that weight difference between each cylinder is within 7 g (0.25 oz), in the condition of piston and connecting rod assembly.

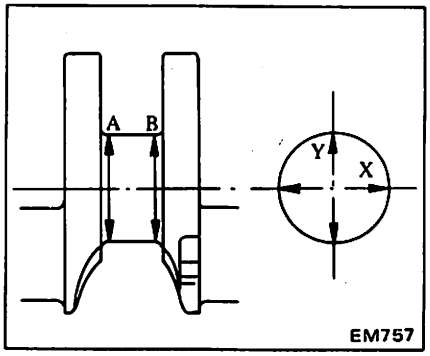
CRANKSHAFT

CRANK JOURNAL AND PIN

1. Repair or replace as required. If faults are minor, correct with fine crocus cloth.
2. Check with a micrometer journals and crank pins for taper and out-of-round. Measurement should be taken along journals for taper and around journals for out-of-round.

If out-of-round or taper exceeds the specified limit, replace or repair.

Out-of-round (X-Y):
Limit 0.03 mm (0.0012 in)
Taper (A-B):
Limit 0.03 mm (0.0012 in)



3. After regrinding crankshaft, finish it to the necessary size indicated in the chart under S.D.S. by using an adequate undersize bearing according to the extent of required repair.

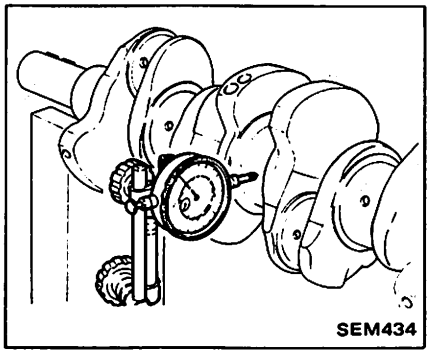
BEND AND END PLAY

1. Crankshaft can be checked for bend by placing it on V-blocks and using a dial gauge with its indicating finger resting on center journal.

Bend value is half of the total indicator reading obtained when crankshaft is turned one full revolution.

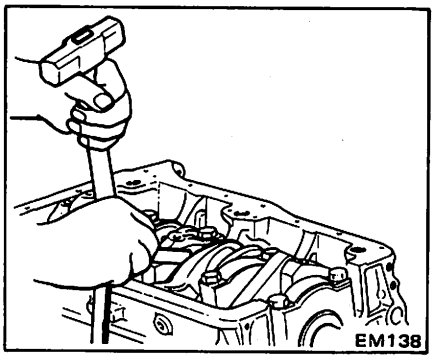
If bend exceeds the specified limit, replace or repair.

Bend:
Limit 0.05 mm (0.0020 in)



2. Install crankshaft in cylinder block and measure crankshaft free end play at center bearing.

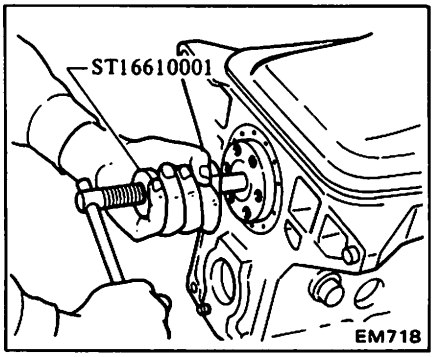
End play:
Limit 0.3 mm (0.012 in)



REPLACING PILOT BUSHING

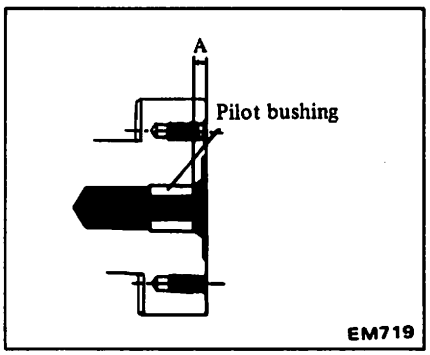
To replace crankshaft rear pilot bushing, proceed as follows:

1. Pull out bushing using Tool.



2. Before installing a new bushing, thoroughly clean bushing hole.
3. Insert pilot bushing until distance between flange end and pilot bushing is the specified distance "A".

Distance "A":
Approximately
4.0 mm (0.157 in)



When installing pilot bushing, be careful not to damage edge of pilot bushing and not to insert excessively.

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MAIN BEARING AND CONNECTING ROD BEARING

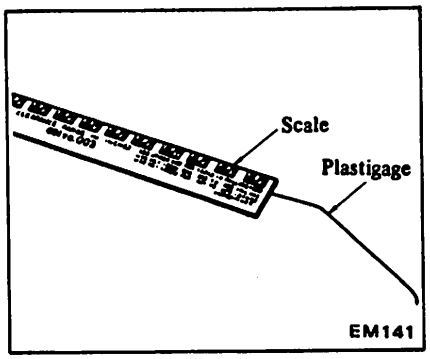
MAIN BEARING

1. Thoroughly clean all bearings and check for scratches, melt, score or wear.

Replace bearings, if any fault is detected.

2. Measure bearing clearance as follows:

(1) Cut a plastigage to the width of bearing and place it in parallel with crank journal axis, getting clear of the oil hole.



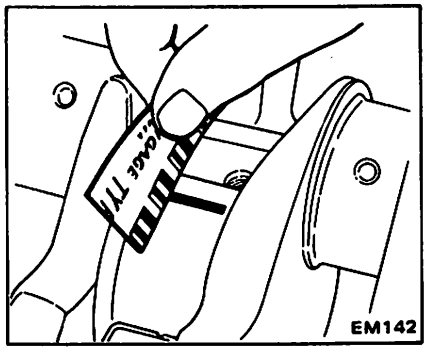
(2) Install bearing and bearing cap, with the bolts tightened to the specified torque.

Ⓣ : Main bearing cap bolt
44 - 54 N·m
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)

Do not turn crankshaft while the plastigage is being inserted.

(3) Remove bearing and cap compare width of plastigage at its widest part with the scale printed in plastigage envelope.

Main bearing clearance:
Limit 0.12 mm (0.0047 in)



3. If clearance exceeds the specified value, replace bearing with an undersize bearing and grind crankshaft journal adequately.

Refer to S.D.S.

CONNECTING ROD BEARING

1. Measure connecting rod bearing clearance in the same manner as above.

Ⓣ : Connecting rod bearing cap nut
44 - 54 N·m
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)

Connecting rod bearing clearance:
Limit 0.12 mm (0.0047 in)

2. If clearance exceeds the specified value, replace bearing with an undersize bearing and grind the crankpin adequately.

Refer to S.D.S.

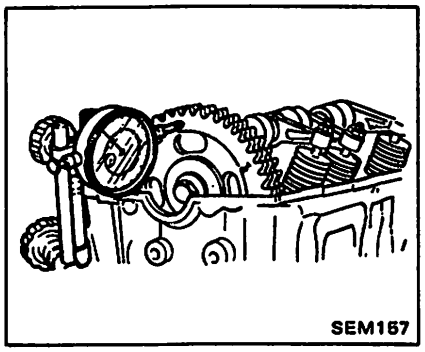
MISCELLANEOUS COMPONENTS

CAMSHAFT SPROCKET

1. Check tooth surface for flaws or wear. Replace sprocket if any fault is found.
2. Install sprocket on camshaft and check for runout.

If runout exceeds the specified limit, replace camshaft sprocket.

Runout:
(Total indicator reading)
Limit 0.1 mm (0.004 in)



CHAIN

Check chain for damage and excessive wear at roller links. Replace if faulty.

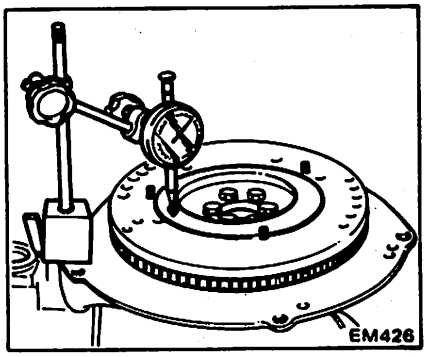
CHAIN TENSIONER AND CHAIN GUIDE

Check for wear and breakage. Replace if necessary.

FLYWHEEL OR DRIVE PLATE

1. Check the clutch disc contact surface on flywheel or the torque converter contact surface on drive plate for damage or wear. Repair or replace if necessary.
2. Measure runout of the clutch disc contact surface with a dial gauge. If it exceeds the specified limit, replace it.

Runout:
(Total indicator reading)
Limit 0.15 mm (0.0059 in)



3. Check tooth surfaces of ring gear for flaws or wear.

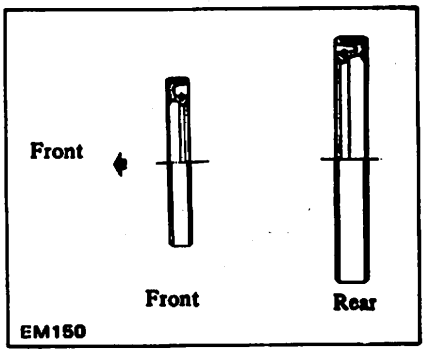
Replace if necessary.

Replace ring gear at about 180 to 220°C (356 to 428°F).

FRONT AND REAR OIL SEAL

Check front and rear oil seals for worn or folded over sealing lip or oil leakage. If necessary, replace with a new seal. When installing a new seal, pay attention to its mounting direction.

It is good practice to renew oil seal whenever engine is overhauled.



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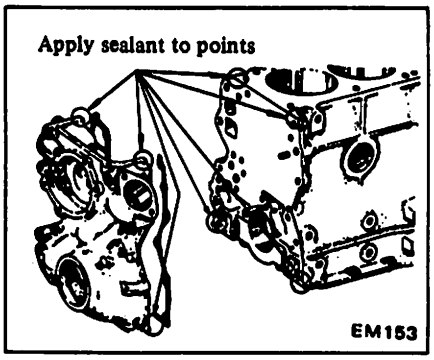
ENGINE ASSEMBLY

PRECAUTIONS

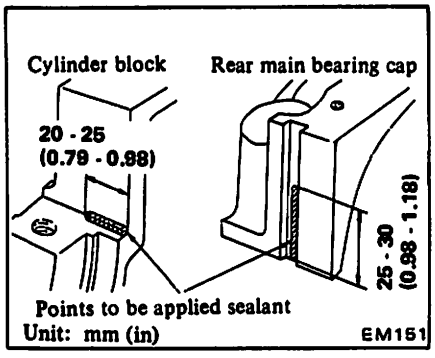
1. When installing sliding parts such as bearings, be sure to apply engine oil on the sliding surfaces.
2. Use new packings and oil seals.
3. Be sure to follow specified tightening torque and order.
4. Apply sealant to the following points.

Do not apply sealant too much.

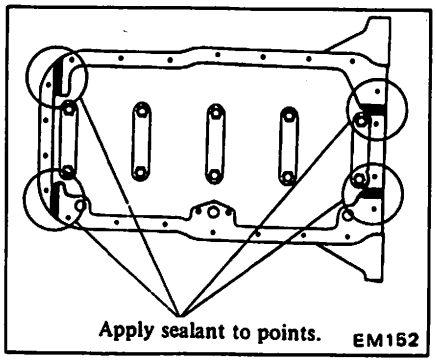
(1) Front side of cylinder block:
Mating surface with front cover and top of front cover.



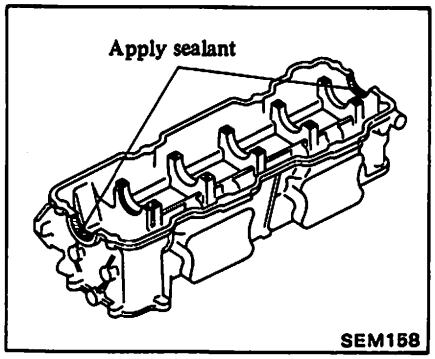
(2) Rear side of cylinder block:
Each side of rear main bearing cap and each corner of cylinder block.



(3) Bottom side of cylinder block:
Step portions at four mating surfaces (cylinder block to front chain cover and cylinder block to rear main bearing cap).

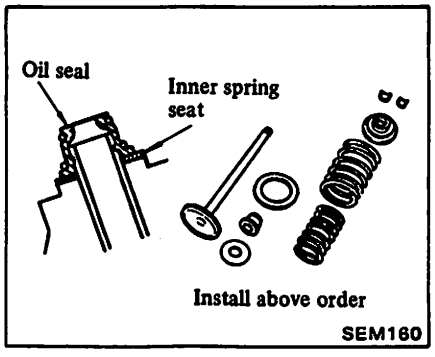


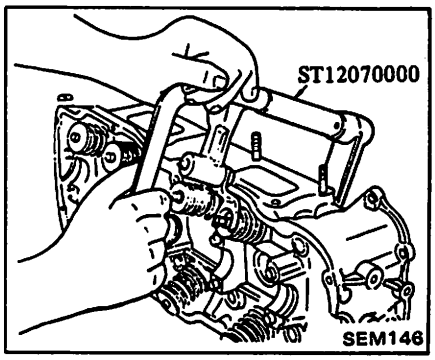
(4) Front and rear side of cylinder head:
Mating surfaces with rubber plug.



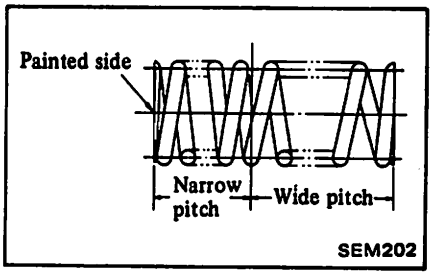
ASSEMBLING CYLINDER HEAD

1. Install valve and valve spring.
(1) Set valve spring inner and outer seat and valve oil seal.
Then insert valve into valve guide smoothly without scratching lip of seal.
(2) Install valve spring inner and outer, valve spring retainer and valve spring collets by using Tool.

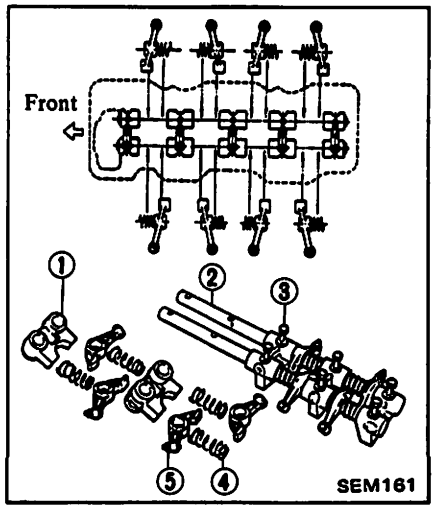




a. When installing valve, apply engine oil on the valve stem and lip of valve oil seal.
b. Check whether the valve face is free from foreign matter.
c. Inner and outer valve springs are of an uneven pitch type. Install valve spring with its narrow pitch side (painted) at cylinder head side.



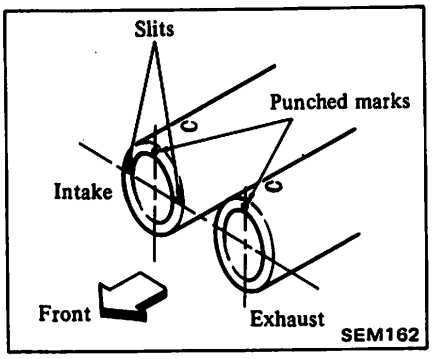
2. Make up valve rocker shaft assembly.
Install rocker shaft bracket, valve rocker, and spring on valve rocker shaft, observing the following.



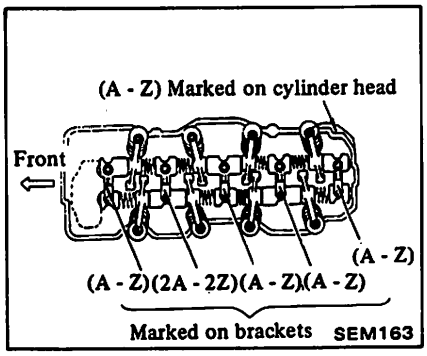
1 Rocker bracket
2 Rocker shaft
3 Bolt
4 Spring
5 Rocker arm

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(1) Intake rocker shaft has identification mark (slit on front surface), but exhaust rocker shaft does not.
(2) Both rocker shafts should be assembled so that punched marks on front surfaces come to upside. Marks are used to identify oil hole direction.

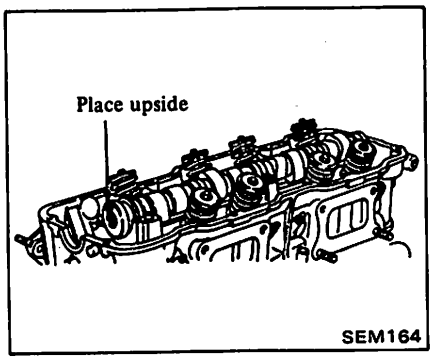


(3) Valve rocker is same for intake and exhaust and also No.1 and No.3 cylinder, and provides identification mark "1". Similarly, the one for No.2 and No.4 cylinder provides mark "2".
(4) Be careful not to miss original location of rocker shaft brackets. For this purpose, the same alphabetical identification marks are provided on each bracket and cylinder head.



To prevent rocker shaft brackets from slipping out of rocker shafts, insert bracket bolts (any bolt will do) into bolt holes of No.1 and No.5 rocker shaft bracket.

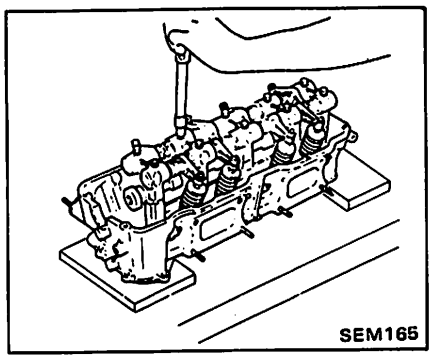
3. Mount camshaft onto cylinder head, placing dowell pin at front end to top position.



4. Mount valve rocker shaft assembly on cylinder head by accommodating to knock pin of the head. Then, tighten to the specified torque.

Ⓣ : Rocker shaft bracket bolt
15 - 25 N·m
(1.5 - 2.5 kg-m, 11 - 18 ft-lb)

a. Tighten bolts gradually, in two to three stages outwardly from center bracket.
b. When tightening bolts, make space under cylinder head since some valves will open and interfered.



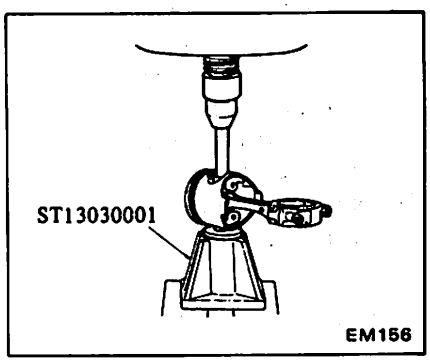
5. After assembling cylinder head, turn camshaft until No.1 piston is at T.D.C. on its compression stroke.

ASSEMBLING PISTON AND CONNECTING ROD

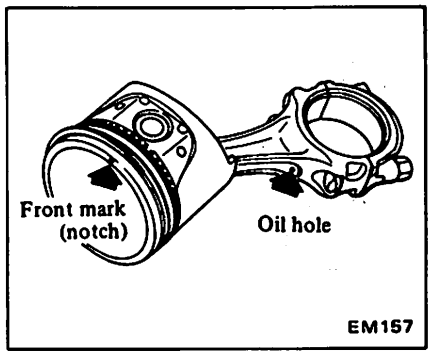
1. Assemble pistoins, piston pins and connecting rods of the designated cylinder.

a. Piston pin is pressed into connecting rod, and fitting force is from 4.9 to 14.7 kN (0.5 to 1.5 t, 0.6 to 1.7 US ton, 0.49 to 1.48 Imp ton) and the aid of Tool is necessary.

When pressing piston pin in connecting rod, apply engine oil to pin and small end of connecting rod.



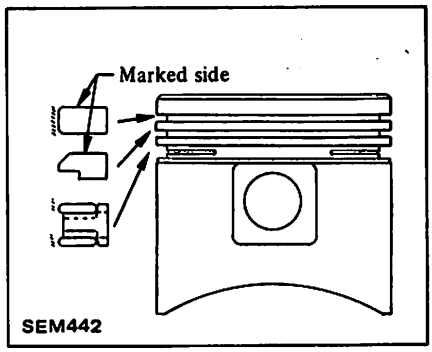
b. Arrange so that oil jet of connecting rod big end is directed toward the right side of cylinder block.



c. Connecting rods are marked at side of big end for identifying the designated cylinder.

2. Install piston rings.
Install so that stamped mark on ring faces upward.

a. Top ring is barrel face type.
b. Second ring is undercut type.
c. In the combined oil ring, upper rail is the same as lower one.



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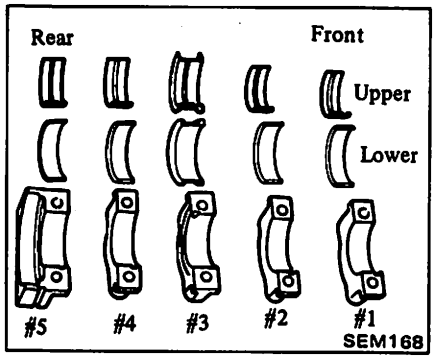
ASSEMBLING ENGINE OVERALL

INSTALLING BODY PARTS

1. In the first place, mount cylinder block on work stand. (refer to engine overall disassembly).
2. Install baffle plate and steel net into crankcase.
3. Install crankshaft.

(1) Set upper main bearings at the proper portion of cylinder block.

a. Only center bearing (No. 3) is a flanged type.
b. All inter-bearings (No. 2 and No. 4) are the same type.
c. Front bearing (No. 1) is also the same type as rear bearing (No. 5).
d. Upper and lower bearings are not interchangeable. Upper ones have oil groove.



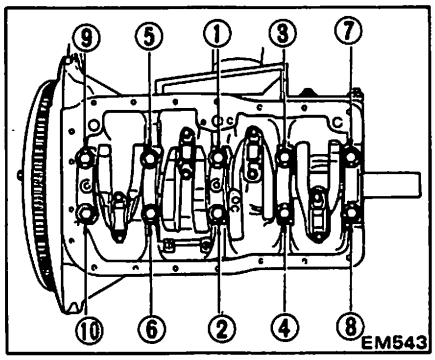
(2) Apply engine oil to main bearing surfaces on both sides of cylinder block and cap.

(3) Install crankshaft.

(4) Install lower main bearings and caps and tighten bolts to specified torque.

Ⓣ : Main bearing cap bolt
44 - 54 N·m
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)

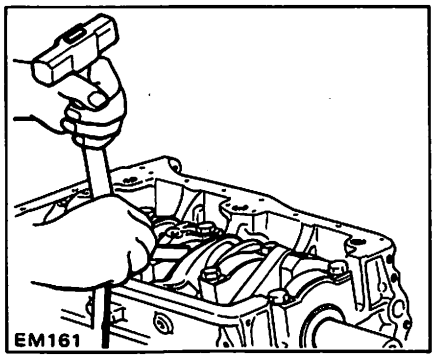
a. Apply sealant to each side of rear main bearing cap and each corner of cylinder block. Refer to Precautions.
b. Arrange the parts so that the arrow mark on bearing cap faces toward the front of engine.
c. Prior to tightening bearing cap bolts, place bearing cap in proper position by shifting crankshaft in the axial direction.
d. Tighten bearing cap bolts gradually in separating two to three stages and outwardly from center bearing in sequence.



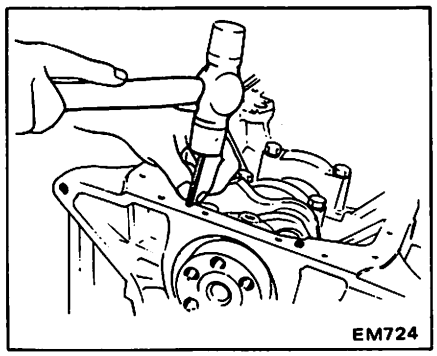
e. After securing bearing cap bolts, ascertain that crankshaft turn smoothly.

(5) Make sure that there exists proper end play of crankshaft at center bearing.

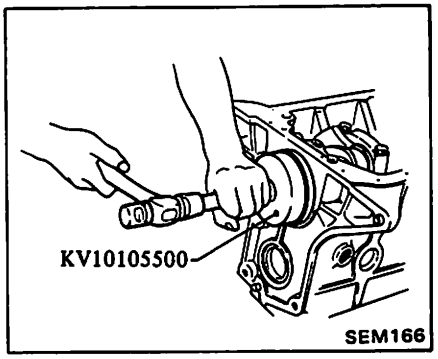
Crankshaft end play:
Limit 0.3 mm (0.012 in)



4. Apply sealant to side oil seals. Then install those into rear main bearing cap.



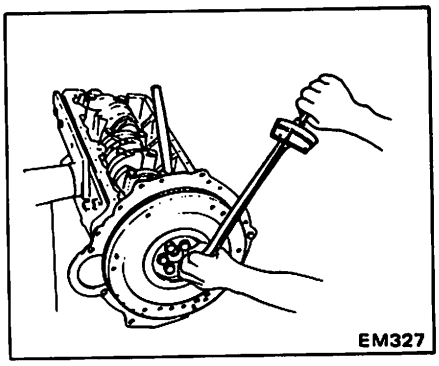
5. Install Rear oil seal using Tool.



a. When installing oil seal, give coating of engine oil to sealing lip and mating shaft to prevent scratches and folded lip. Also apply coating of oil to periphery of oil seal.
b. Install oil seal with its dust seal lip at outside.

6. Install rear end plate and flywheel or drive plate.

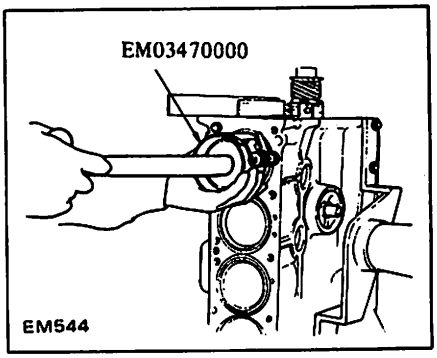
Ⓣ : Flywheel fixing bolt
137 - 157 N·m
(14 - 16 kg-m,
101 - 116 ft-lb)



When installing flywheel or drive plate, wipe oil or foreign matter away from fitting surfaces.

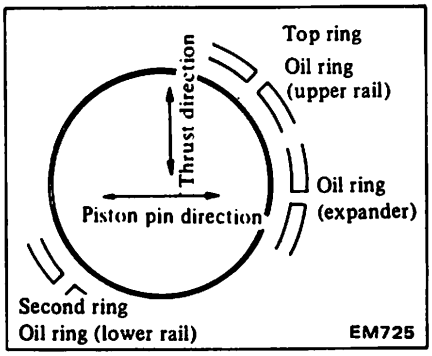
7. Install pistons with connecting rod.

(1) Install them into corresponding cylinder using Tool.



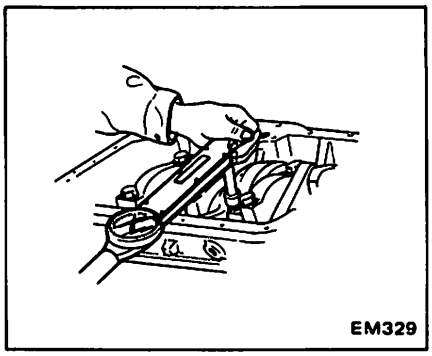
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a. Apply engine oil to sliding parts.
b. Arrange so that the front mark on piston head faces to the front of engine.
c. Install piston ring as shown below.

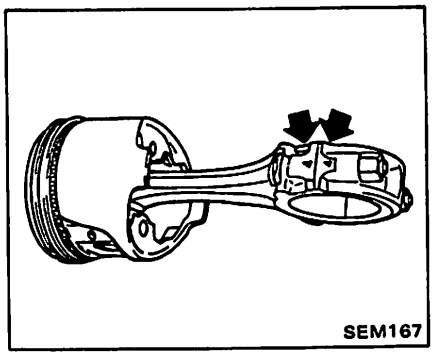


(2) Install connecting rod bearing caps.

Ⓣ : Connecting rod bearing cap nut
44 - 54 N·m
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)



Arrange connecting rods and connecting rod caps so that the cylinder numbers face in the same direction.



(3) Make sure that there exists proper end play at connecting rod big end.
Refer to Inspection and Repair.

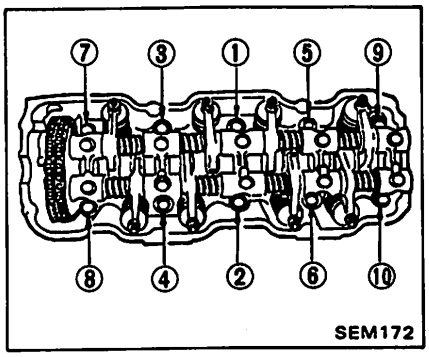
8. Install cylinder head assembly through gasket by accommodating knock pin of cylinder block as follows:
(1) Thoroughly clean cylinder block and head surface.

Do not apply sealant to mating surface of cylinder block and head.

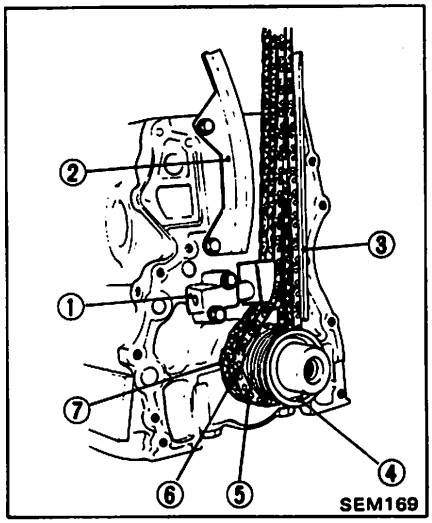
(2) Turn crankshaft until No. 1 piston is at T.D.C. on its compression stroke.
(3) When installing cylinder head, make sure that all valves are apart from head of pistons. If necessary, loosen adjusting screws of rocker arm to draw valves in.
(4) Temporarily tighten two center bolts.

Ⓣ : Cylinder head bolt (Temporary)
20 N·m
(2 kg-m, 14 ft-lb)

a. Final tightening should be carried out after installing chain and front cover.
b. Do not rotate crankshaft and camshaft separately, because valves will hit head of pistons.
c. Always use new cylinder head gasket.



9. Install front side parts.



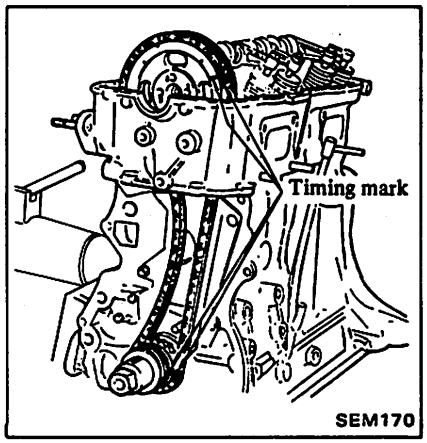
1 Chain tensioner
2 Slack side chain guide
3 Tension side chain guide
4 Oil thrower
5 Oil pump drive gear
6 Crankshaft sprocket
7 Timing chain

(1) Install crankshaft sprocket, oil pump drive gear and oil thrower.

a. Make sure that the mating marks of crankshaft sprocket faces to the front.
b. Install oil pump drive gear so that large chamfered inner faces rearward.

(2) Install chain guide to cylinder block.
(3) Set chain on camshaft sprocket and crankshaft sprocket by aligning each mating mark. Then install camshaft sprocket to camshaft.

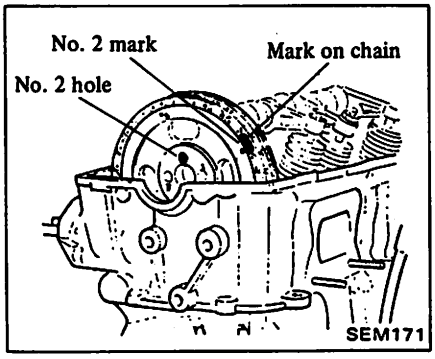
Ⓣ : Camshaft sprocket bolt
118 - 157 N·m
(12 - 16 kg-m,
87 - 116 ft-lb)



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a. Set timing chain by aligning its mating marks with those of crankshaft sprocket and camshaft sprocket on the right hand side.

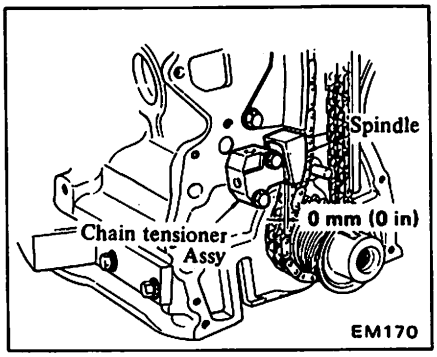
b. Camshaft sprocket should be installed by accommodating its No. 2 hole to knock pin of camshaft. And No. 2 timing mark must also be used.



(4) Install chain guide and chain tensioner.

Ⓣ : Chain guide and tensioner bolt
6 - 10 N·m
(0.6 - 1.0 kg-m,
4.3 - 7.2 ft-lb)

Adjust the protrusion of chain tensioner spindle to 0 mm (0 in) with slack side chain guide.



(5) Install front cover with gaskets, observing the following:

a. Before installing front cover, press new oil seal in the cover with dust seal lip at outside.

b. Apply sealant to the sealing portions designated. Refer to Precautions.

c. Apply lithium grease to sealing lip of oil seal.

d. Check the height difference between cylinder block upper face and front cover upper face. Its difference must be less than 0.15 mm (0.0059 in).

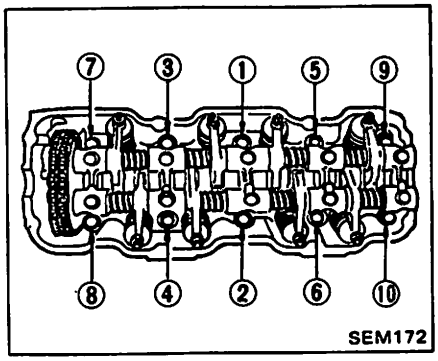
e. Note that different length of bolts are used.

Ⓣ : Front cover bolt
Size M8
10 - 16 N·m
(1.0 - 1.6 kg-m,
7 - 12 ft-lb)
Size M6
4 - 10 N·m
(0.4 - 1.0 kg-m,
2.9 - 7.2 ft-lb)

(6) Install crankshaft pulley.

Ⓣ : Crankshaft pulley bolt
118 - 157 N·m
(12 - 16 kg-m,
87 - 116 ft-lb)

10. Tighten cylinder head bolts to the specified torque in several steps and in the sequence shown below.



Ⓣ : Cylinder head
69 - 78 N·m
(7.0 - 8.0 kg-m,
51 - 58 ft-lb)

a. Be sure to tighten bolts securing cylinder head to front cover.

b. After engine has been operated for several minutes, retighten if necessary.

11. Adjust valve clearance to cold specifications, referring to Section MA.

Valve clearance (*Cold):

Unit: mm (in)

Intake	0.21 (0.008)
Exhaust	0.23 (0.009)

*At ambient temperature 20°C (68°F)

After engine has been assembled, finally adjust clearance to hot specifications.

12. Install valve rocker cover with gasket.

Ⓣ : Valve rocker cover bolt
8 - 10 N·m
(0.8 - 1.0 kg-m,
5.8 - 7.2 ft-lb)

a. Rocker cover bolts should be tightened in criss-cross fashion.

b. Always use new rocker cover gasket.

13. Install oil strainer and oil pan with gasket.

Ⓣ : Oil strainer bolt
10 - 16 N·m
(1.0 - 1.6 kg-m,
7 - 12 ft-lb)
Oil pan bolt
5 - 7 N·m
(0.5 - 0.7 kg-m,
3.6 - 5.1 ft-lb)

a. Apply sealant to the designated portions. Refer to Precautions.

b. Oil pan should be tightened in criss-cross pattern.

c. Always use new oil pan gasket.

INSTALLING OUTER PARTS

14. Install following parts in the reverse order of disassembly and with the specified torque if designated.

Refer to Disassembling Outer Parts and S.D.S. for tightening torque.

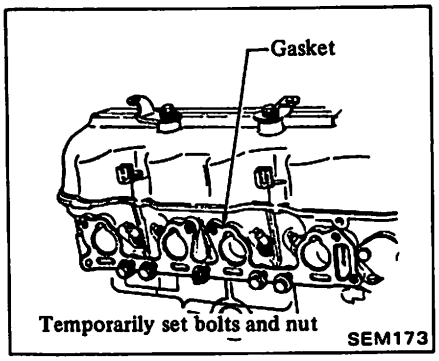
(1) Engine bottom side parts.

When installing oil pump and distributor driving spindle in front cover, refer to Section LC.

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(2) Engine right side parts.

a. When installing intake manifold, to facilitate work, previously set the securing bolts and nut with washers at lower and center side as illustrated.



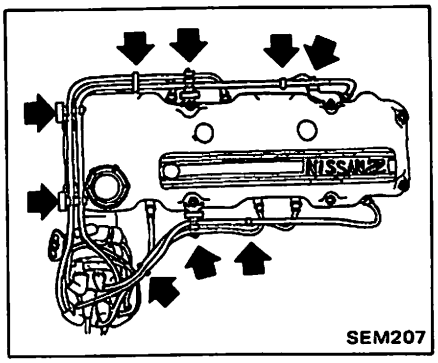
b. When installing emission control parts and vacuum pipes, refer to Section EC.

c. When installing oil filter, refer to Section LC.

(3) Engine left side parts.

a. When installing distributor, temporarily tighten ignition timing adjust screws at center of ajusting holes.

b. When installing high tension cables, clamp those as illustrated.



(4) Engine front side parts.

DISMOUNTING ENGINE FROM WORK STAND

15. Dismount engine in the reverse order of mounting and install engine right side and rear side parts remained with the specified torque if designated.

Refer to Mounting Engine on Work Stand and S.D.S. for tightening torque.

When installing clutch assembly, use Tool KV30100100.

16. Fill engine oil and coolant to the specified level, after engine has been installed on vehicle. Refer to Section MA.

ENGINE TUNE-UP

17. Referring to Section MA, finally adjust following items:

(1) Drive belts deflection.

(2) Valve clearance.

Warm up engine until water temperature indicator points to middle of gauge, then adjust clearance to hot specifications.

Valve clearance (Hot):

Unit: mm (in)

Intake	0.30 (0.012)
Exhaust	0.30 (0.012)

(3) Ignition timing.

(4) Idle rpm.

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

INSPECTION AND ADJUSTMENT

CYLINDER HEAD

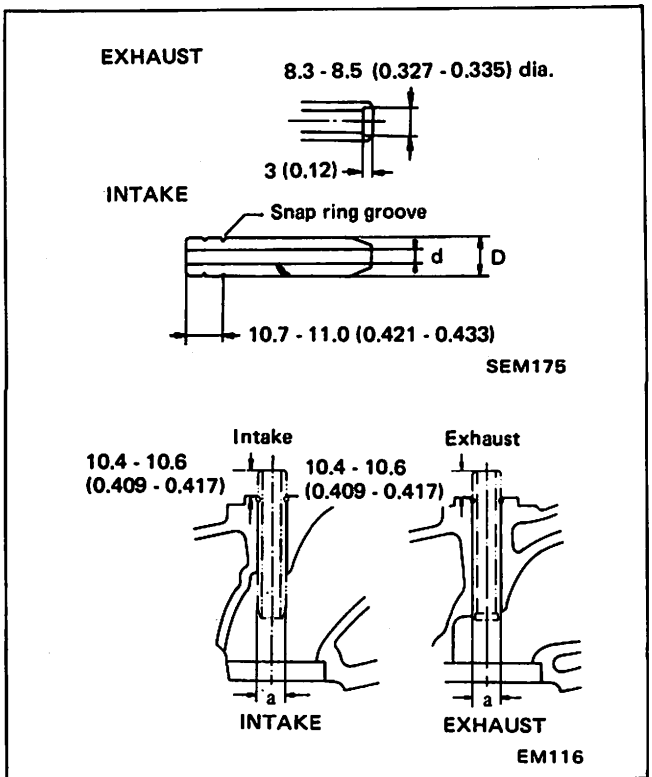
Cylinder head

Unit: mm (in)

	Limit
Head surface flatness	0.1 (0.004)

Valve guide

Unit: mm (in)



	Standard	Service
Valve guide Outer diameter "D"	12.023 - 12.034 (0.4733 - 0.4738)	12.223 - 12.234 (0.4812 - 0.4817)
Valve guide Inner diameter "d" [Finished size]	8.000 - 8.018 (0.3150 - 0.3157)	
Cylinder head valve guide hole diameter "a"	11.985 - 11.996 (0.4718 - 0.4723)	12.185 - 12.196 (0.4797 - 0.4802)
Interference fit of valve guide	0.027 - 0.049 (0.0011 - 0.0019)	

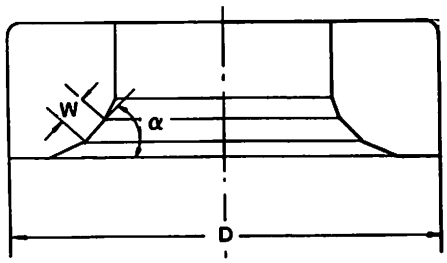
		Standard	Limit
Stem to guide clearance	In.	0.020 - 0.053 (0.0008 - 0.0021)	0.1 (0.004)
	Ex.	0.040 - 0.073 (0.0016 - 0.0029)	
Stem end deflection		—	0.2 (0.008)

Valve seat

Seat insert dimensions

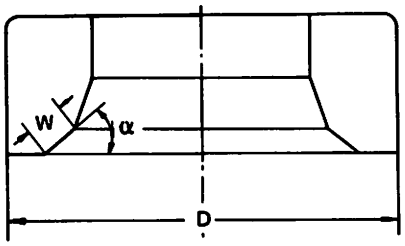
"Intake"

Unit: mm (in)

Profile	 SEM177
Contacting face angle "α"	45°
Contacting width "W" Standard	2.1 (0.083)
Outer diameter "D" Standard	45.097 - 45.113 (1.7755 - 1.7761)
Service	45.597 - 45.613 (1.7952 - 1.7958)

"Exhaust"

Unit: mm (in)

Profile	 SEM178
Contacting face angle "α"	45°
Contacting width "W" Standard	1.5 - 1.9 (0.059 - 0.075)
Outer diameter "D" Standard	40.080 - 40.096 (1.5779 - 1.5786)
Service	40.597 - 40.613 (1.5983 - 1.5989)

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Cylinder head seat recess diameter

Unit: mm (in)

In.	For standard insert	45.000 - 45.016 (1.7717 - 1.7723)
	For service insert	45.500 - 45.516 (1.7913 - 1.7920)
Ex.	For standard insert	40.000 - 40.016 (1.5748 - 1.5754)
	For service insert	40.500 - 40.516 (1.5945 - 1.5951)

Interference fit of seat insert

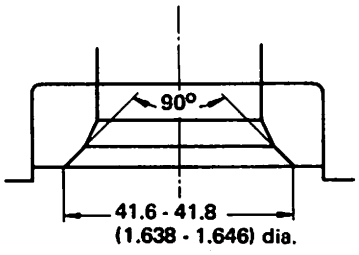
Unit: mm (in)

In.	Standard	0.081 - 0.113 (0.0032 - 0.0044)
	Service	
Ex.	Standard	0.064 - 0.096 (0.0025 - 0.0038)
	Service	0.081 - 0.113 (0.0032 - 0.0044)

Machining dimensions of service seat

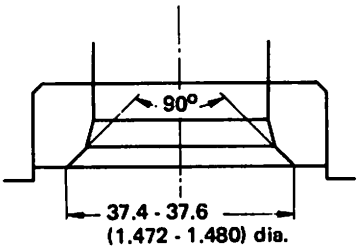
Unit: mm (in)

Intake



SEM179

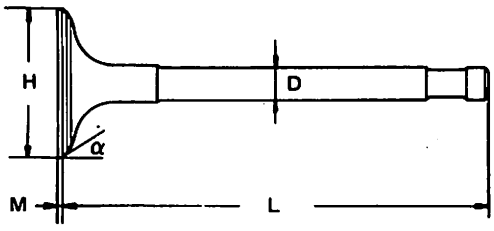
Exhaust



SEM180

VALVE

Unit: mm (in)



SEM181

		Standard	Limit
Valve head diameter "H"	In.	42.0 - 42.2 (1.654 - 1.661)	–
	Ex.	38.0 - 38.2 (1.496 - 1.504)	–
Valve length "L"	In.	122.8 - 123.1 (4.835 - 4.846)	–
	Ex.	123.6 - 123.9 (4.866 - 4.878)	–
Valve stem diameter "D"	In.	7.965 - 7.980 (0.3136 - 0.3142)	–
	Ex.	7.945 - 7.960 (0.3128 - 0.3134)	–
Valve face angle "α"	In.	45°30'	–
	Ex.		
Valve head margin "M"	In.	1.3 (0.051)	0.5 (0.020)
	Ex.	1.5 (0.059)	0.5 (0.020)
Grinding of valve stem end	In.	–	0.5 (0.020)
	Ex.		

VALVE SPRING

Following data are common to both intake and exhaust.

Unit: mm (in)

		Standard	Limit
Free height	Outer	49.77 (1.9594)	–
	Inner	44.10 (1.7362)	–
Assembled height/ tension	Outer mm/ N (kg), (in/lb)	40.0/225.6 (23.0), (1.575/50.7)	40.0/189.3 (19.3), (1.575/42.6)
	Inner mm/ N (kg), (in/lb)	35.0/107.9 (11.0), (1.378/24.3)	35.0/87.3 (8.9), (1.378/19.6)
Out of square	Outer	–	2.2 (0.087)
	Inner	–	1.9 (0.075)

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ROCKER ARM AND ROCKER SHAFT

Unit: mm (in)

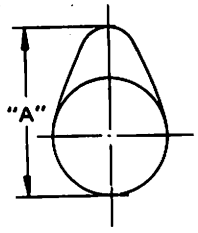
	Standard
Rocker arm to shaft clearance	0.007 - 0.049 (0.0003 - 0.0019)

CAMSHAFT AND CAMSHAFT BEARING

Camshaft

Unit: mm (in)

	Standard	Limit
Outer diameter of camshaft journal	32.935 - 32.955 (1.2967 - 1.2974)	–
Camshaft bend	–	0.2 (0.008)
Camshaft end play	–	0.2 (0.008)



EM671

		Standard	Wear limit
Cam height "A"	In.	38.477 - 38.527 (1.5148 - 1.5168)	0.25 (0.0098)
	Ex.		

Camshaft bearing

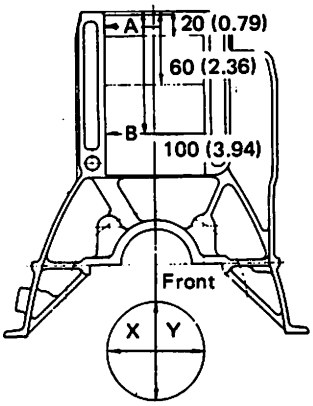
Unit: mm (in)

	Standard	Limit
Inner diameter	33.000 - 33.025 (1.2992 - 1.3002)	–
Camshaft journal to bearing clearance [Oil clearance]	0.045 - 0.090 (0.0018 - 0.0035)	0.1 (0.004)

CYLINDER BLOCK

Cylinder block

Unit: mm (in)



EM422

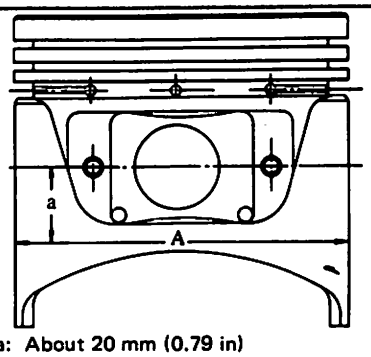
		Standard	Limit
Surface flatness		–	0.1 (0.004)
Cylinder bore	Inner diameter	87.000 - 87.050 (3.4252 - 3.4272)	*0.2 (0.008)
	Out-of-round (X-Y)	Less than 0.015 (0.0006)	–
	Taper (A-B)	Less than 0.015 (0.0006)	–
Difference in inner diameter between cylinders		Less than 0.05 (0.0020)	0.2 (0.008)
Piston to cylinder clearance		0.025 - 0.045 (0.0010 - 0.0018)	–
Feeler gauge extracting force [With gauge thickness N 0.04 mm (0.0016 in)] (kg, lb)		2.0 - 14.7 (0.2 - 1.5, 0.4 - 3.3)	–

* Wear limit

PISTON, PISTON RING AND PISTON PIN

Piston

Unit: mm (in)



a: About 20 mm (0.79 in)

EM714

Piston diameter "A"	Standard	86.985 - 87.035 (3.4246 - 3.4266)
	0.50 (0.0197) Oversize	87.465 - 87.515 (3.4435 - 3.4455)
	1.00 (0.0394) Oversize	87.965 - 88.015 (3.4632 - 3.4652)

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Side clearance of piston ring

Unit: mm (in)

	Standard	Limit
Top ring	0.040 - 0.073 (0.0016 - 0.0029)	0.1 (0.004)
Second ring	0.030 - 0.063 (0.0012 - 0.0025)	
Oil ring	–	–

Ring gap

Unit: mm (in)

	Standard	Limit
Top ring	0.25 - 0.40 (0.0098 - 0.0157)	1.0 (0.039)
Second ring	0.15 - 0.30 (0.0059 - 0.0118)	
Oil ring	0.30 - 0.90 (0.0118 - 0.0354)	

Piston pin

Unit: mm (in)

	Standard
Piston pin outside diameter	20.993 - 20.998 (0.8265 - 0.8267)
Piston pin hole diameter	21.001 - 21.008 (0.8268 - 0.8271)
Piston pin to piston clearance	0.006 - 0.013 (0.0002 - 0.0005)
Interference fit of piston pin to connecting rod	0.015 - 0.035 (0.0006 - 0.0014)

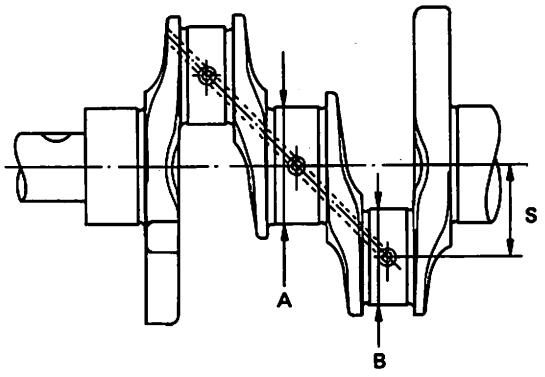
CONNECTING ROD

Unit: mm (in)

	Standard	Limit
Connecting rod bend or torsion [per 100 mm (3.94 in) length]	0.03 (0.0012)	0.05 (0.0020)
Big end play	0.2 - 0.3 (0.008 - 0.012)	0.6 (0.024)

CRANKSHAFT

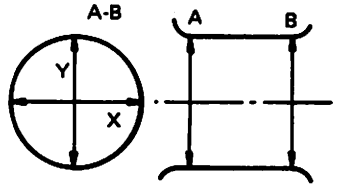
Unit: mm (in)



SEM394

Journal diameter "A"	54.942 - 54.955 (2.1631 - 2.1636)
Pin diameter "B"	49.961 - 49.974 (1.9670 - 1.9675)
"S"	45.97 - 46.03 (1.8098 - 1.8122)

Out-of-round X-Y
Taper A-B



EM715

	Standard	Limit
Taper of journal and pin "A-B"	Less than 0.01 (0.0004)	0.03 (0.0012)
Out-of-round of journal and pin "X-Y"	Less than 0.01 (0.0004)	0.03 (0.0012)
Crankshaft bend	Less than 0.025 (0.0010)	0.05 (0.0020)
Crankshaft free end play	0.05 - 0.18 (0.0020 - 0.0071)	0.3 (0.012)
Pilot bushing inserting distance	4.0 (0.157)	

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BEARING

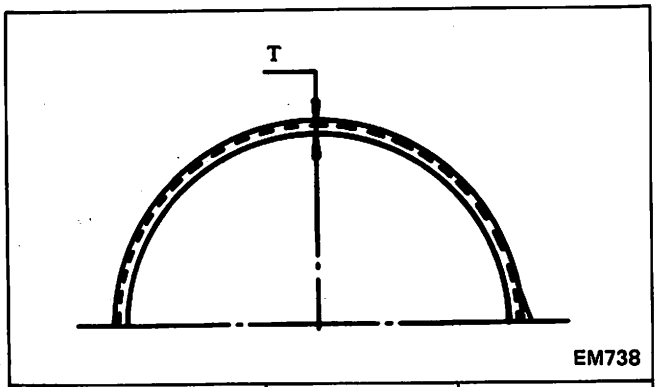
Bearing clearance

Unit: mm (in)

	Standard	Limit
Main bearing clearance	0.020 - 0.062 (0.0008 - 0.0024)	0.12 (0.0047)
Connecting rod bearing clearance	0.025 - 0.055 (0.0010 - 0.0022)	0.12 (0.0047)

Main bearing undersize

Unit: mm (in)



EM738

	Bearing top thickness "T"	Crank journal diameter
Standard	1.822 - 1.835 (0.0717 - 0.0722)	54.942 - 54.955 (2.1631 - 2.1636)
0.25 (0.0098) Undersize	1.947 - 1.960 (0.0767 - 0.0772)	54.692 - 54.705 (2.1532 - 2.1537)
0.50 (0.0197) Undersize	2.072 - 2.085 (0.0816 - 0.0821)	54.442 - 54.455 (2.1434 - 2.1439)
0.75 (0.0295) Undersize	2.197 - 2.210 (0.0865 - 0.0870)	54.192 - 54.205 (2.1335 - 2.1341)
1.00 (0.0394) Undersize	2.322 - 2.335 (0.0914 - 0.0919)	53.942 - 53.955 (2.1237 - 2.1242)

Connecting rod bearing undersize

Unit: mm (in)

	Bearing top thickness "T"	Crank pin diameter
STD	1.493 - 1.506 (0.0588 - 0.0593)	49.961 - 49.974 (1.9670 - 1.9675)
0.25 (0.0098) Undersize	1.618 - 1.631 (0.0637 - 0.0642)	49.711 - 49.724 (1.9571 - 1.9576)
0.50 (0.0197) Undersize	1.743 - 1.756 (0.0686 - 0.0691)	49.461 - 49.474 (1.9473 - 1.9478)
0.75 (0.0295) Undersize	1.868 - 1.881 (0.0735 - 0.0741)	49.211 - 49.224 (1.9374 - 1.9379)

MISCELLANEOUS COMPONENTS

Camshaft sprocket

Unit: mm (in)

Runout (Total indicator reading)	Limit 0.1 (0.004)

Flywheel

Unit: mm (in)

Runout (Total indicator reading)	Limit 0.15 (0.0059)

ENGINE TUNE-UP

Valve clearance

Unit: mm (in)

	Hot	*Cold
Intake	0.30 (0.012)	0.21 (0.008)
Exhaust	0.30 (0.012)	0.23 (0.009)

* At ambient temperature 20°C (68°F)

Whenever valve clearances are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.

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TIGHTENING TORQUE

Unit		N·m	kg-m	ft-lb
Engine front side				
Front cover bolt	M8	10 - 16	1.0 - 1.6	7 - 12
	M6	4 - 10	0.4 - 1.0	2.9 - 7.2
Chain guide bolt		6 - 10	0.6 - 1.0	4.3 - 7.2
Chain tensioner bolt		6 - 10	0.6 - 1.0	4.3 - 7.2
Water pump bolt	M6	4 - 10	0.4 - 1.0	2.9 - 7.2
	M8	10 - 16	1.0 - 1.6	7 - 12
Crank pulley bolt		118 - 157	12 - 16	87 - 116
Engine right side				
Water inlet bolt		10 - 16	1.0 - 1.6	7 - 12
Water outlet bolt		10 - 16	1.0 - 1.6	7 - 12
Intake manifold bolt and nut		16 - 21	1.6 - 2.1	12 - 15
Alternator bracket bolt		39 - 59	4.0 - 6.0	29 - 43
Alternator to adjusting bar bolt		20 - 29	2.0 - 3.0	14 - 22
Engine mounting bracket bolt (Same for left side)		25 - 35	2.6 - 3.6	19 - 26
Fuel pump nut		12 - 18	1.2 - 1.8	9 - 13
Carburetor nut		12 - 18	1.2 - 1.8	9 - 13
Engine left side				
Distributor support bolt		4 - 8	0.4 - 0.8	2.9 - 5.8
Exhaust manifold bolt and nut		16 - 21	1.6 - 2.1	12 - 15
E.G.R. tube nut		34 - 44	3.5 - 4.5	25 - 33
E.A.I. tube nut		34 - 44	3.5 - 4.5	25 - 33
Air conditioner compressor bracket bolt		44 - 54	4.5 - 5.5	33 - 40

Unit	N·m	kg-m	ft-lb
Engine top side			
Cylinder head bolt	69 - 78	7.0 - 8.0	51 - 58
Cylinder head to front cover bolt	4 - 8	0.4 - 0.8	2.9 - 5.8
Rocker shaft bracket bolt	15 - 25	1.5 - 2.5	11 - 18
Camshaft sprocket bolt	118 - 157	12 - 16	87 - 116
Rocker cover bolt	8 - 10	0.8 - 1.0	5.8 - 7.2
Spark plug	15 - 20	1.5 - 2.0	11 - 14
Rocker arm nut	16 - 22	1.6 - 2.2	12 - 16
Engine bottom side			
Main bearing cap bolt	44 - 54	4.5 - 5.5	33 - 40
Connecting rod big end nut	44 - 54	4.5 - 5.5	33 - 40
Oil strainer bolt	10 - 16	1.0 - 1.6	7 - 12
Oil pan bolt	5 - 7	0.5 - 0.7	3.6 - 5.1
Oil pan drain plug	20 - 29	2.0 - 3.0	14 - 22
Oil pump bolt	11 - 15	1.1 - 1.5	8 - 11
Gusset to cylinder block bolt	43 - 58	4.4 - 5.9	32 - 43
Engine rear side			
Flywheel bolt (M/T)	137 - 157	14.0 - 16.0	101 - 116
Drive plate bolt (A/T)	137 - 157	14.0 - 16.0	101 - 116
Clutch cover bolt (M/T)	16 - 21	1.6 - 2.1	12 - 15
Torque converter bolt (A/T)	39 - 49	4.0 - 5.0	29 - 36
Starter motor bolt	29 - 39	3.0 - 4.0	22 - 29
Transmission to cylinder block bolt	43 - 58	4.4 - 5.9	32 - 43
Transmission to gusset bolt	43 - 58	4.4 - 5.9	32 - 43

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TROUBLE DIAGNOSES AND CORRECTIONS

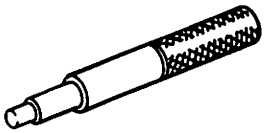
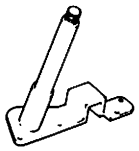
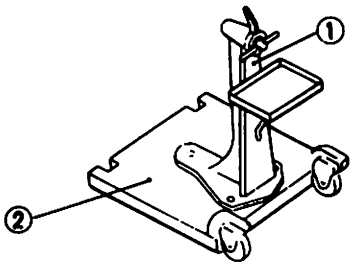
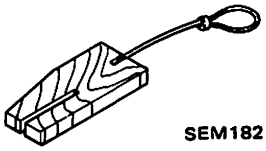
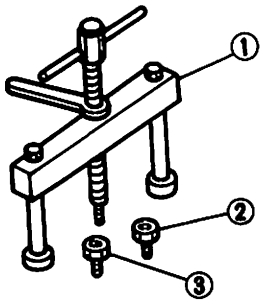
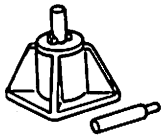
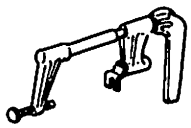
Condition	Probable cause	Corrective action
I. Noisy engine		
Piston and connecting rod knocking.	Seized piston pin.	Replace piston with pin.
	Seized piston in cylinder.	Recondition cylinder and replace piston with pin.
	Broken piston ring.	Replace ring and/or recondition cylinder.
	Improper connecting rod alignment.	Realign rod or replace rod.
	Seized or loose connecting rod bearing.	Replace.
Knocking of crankshaft and bearing.	Seized or loose main bearing	Replace.
	Bent crankshaft.	Repair or replace.
	Uneven wear of journal.	Correct.
	Excessive crankshaft end play.	Replace center bearing.
Timing chain noise.	Improper chain tension.	Adjust.
	Worn and/or damaged chain.	Replace.
	Worn sprocket.	Replace.
	Worn and/or broken chain guide and/or tension adjusting mechanism.	Replace.
Camshaft and valve mechanism knocking.	Improper valve clearance.	Adjust.
	Worn rocker bearing.	Replace.
	Worn rocker face.	Replace.
	Loose valve stem in guide.	Replace guide.
	Weakened valve spring.	Replace.
	Seized valve.	Replace.
Camshaft knocking.	Excessive camshaft bearing clearance.	Replace.
	Excessive axial play.	Replace thrust plate.
	Worn cam gear.	Replace.
Water pump knocking.	Improper shaft end play.	Replace water pump assembly.
	Broken impeller.	Replace water pump assembly.
II. Other mechanical troubles		
Stuck valve.	Improper valve clearance.	Adjust.
	Insufficient clearance between valve stem and guide.	Clean stem or ream guide.
	Weakened or broken valve spring.	Replace.
	Seized or damaged valve stem.	Replace or clean.
	Poor quality fuel.	Use good fuel.

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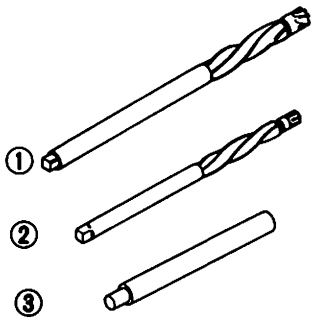
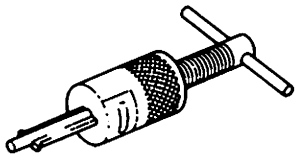
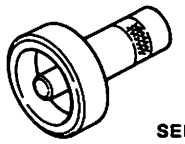
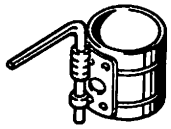
Condition	Probable cause	Corrective action
Seized valve seat.	Improper valve clearance.	Adjust.
	Weakened valve spring.	Replace.
	Thin valve head edge.	Replace valve.
	Narrow valve seat.	Reface.
	Overheating.	Repair or replace.
	Over speeding.	Drive at proper speed.
	Stuck valve guide.	Repair.
Excessively worn cylinder and piston.	Shortage of engine oil.	Add or replace oil.
	Dirty engine oil.	Clean crankcase, replace oil and oil filter element.
	Poor quality of oil.	Use proper oil.
	Overheating	Repair or replace.
	Wrong assembly of piston with connecting rod.	Repair or replace.
	Improper piston ring clearance.	Adjust.
	Broken piston ring.	Replace.
	Dirty air cleaner.	Clean.
	Mixture too rich.	Adjust.
	Engine over run.	Drive at proper speeds.
	Stuck choke valve.	Clean and adjust.
	Overchoking.	Start correct way.
Faulty connecting rod.	Shortage of engine oil.	Add oil.
	Low oil pressure.	Correct.
	Poor quality engine oil.	Use proper oil.
	Rough surface of crankshaft.	Grind and replace bearing.
	Clogged oil passage.	Clean.
	Bearing worn or eccentric.	Replace.
	Bearing improperly assembled.	Correct.
	Loose bearing.	Replace.
	Incorrect connecting rod alignment.	Repair or replace.
Faulty crankshaft bearing.	Shortage of engine oil.	Add or replace.
	Low oil pressure.	Correct.
	Poor quality engine oil.	Use specified oil.
	Crankshaft journal worn or out-of-round.	Repair.
	Clogged oil passage in crankshaft.	Clean.
	Bearing worn or eccentric.	Replace.
	Bearing improperly assembled.	Correct.
	Eccentric crankshaft or bearing.	Replace.

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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name
KV30100100 (–)	Clutch aligning bar 
KV10105001 (–)	Engine attachment 
ST0501S000 (J26023) ① ST05011000 (J26023-2) ② ST05012000 (J26023-1)	Engine stand assembly Engine stand Base 
ST19320000 (J25664)	Oil filter wrench  SLC036
KV10105800 (J25660-B)	Chain stopper  SEM182
KV101041S0 (J25647) ① ST16511000 (–) ② ST16512001 (–) ③ ST16701001 (–)	Crankshaft main bearing cap puller Crankshaft main bearing puller Adapter Adapter 
ST13030001 (J26365)	Piston pin press stand 
ST12070000 (J25631)	

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Tool number (Kent-Moore No.)	Tool name
KV101039S0 (J25618) ① ST11081000 (J25618-3) ② ST11032000 (J25618-2) ③ ST11320000 (J25618-1)	Valve guide reamer set Reamer [12.2 mm (0.480 in)] dia. Reamer [8.0 mm (0.315 in)] dia. Drift 
ST11650001 (–)	Valve seat cutter set 
ST16610001 (J23907)	Pilot bushing puller 
KV10105500 (J25640-01)	Crankshaft rear oil seal drift  SEM183
EM03470000 (–)	Piston ring compressor 

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ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

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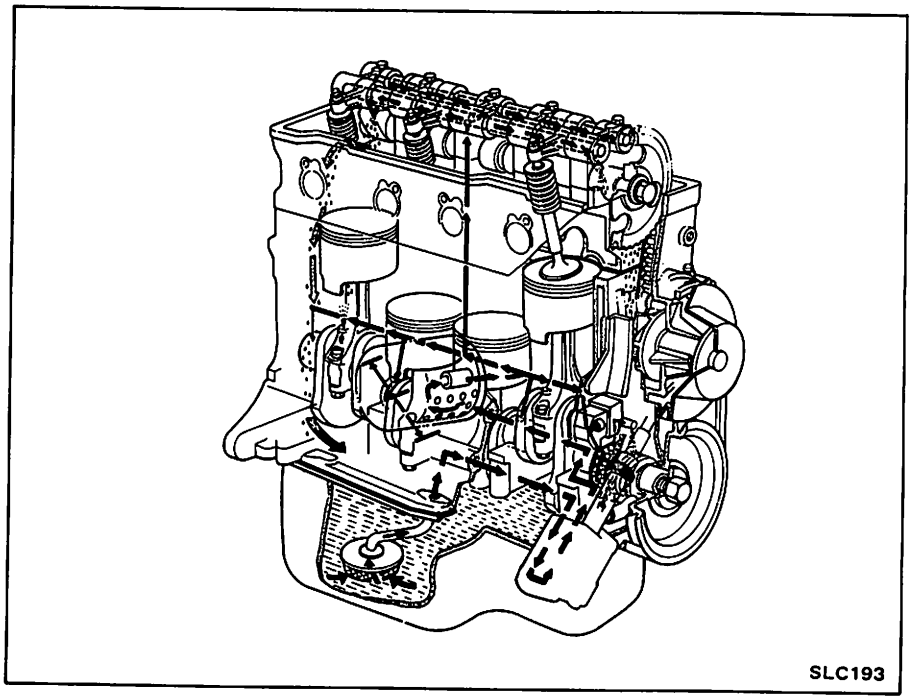
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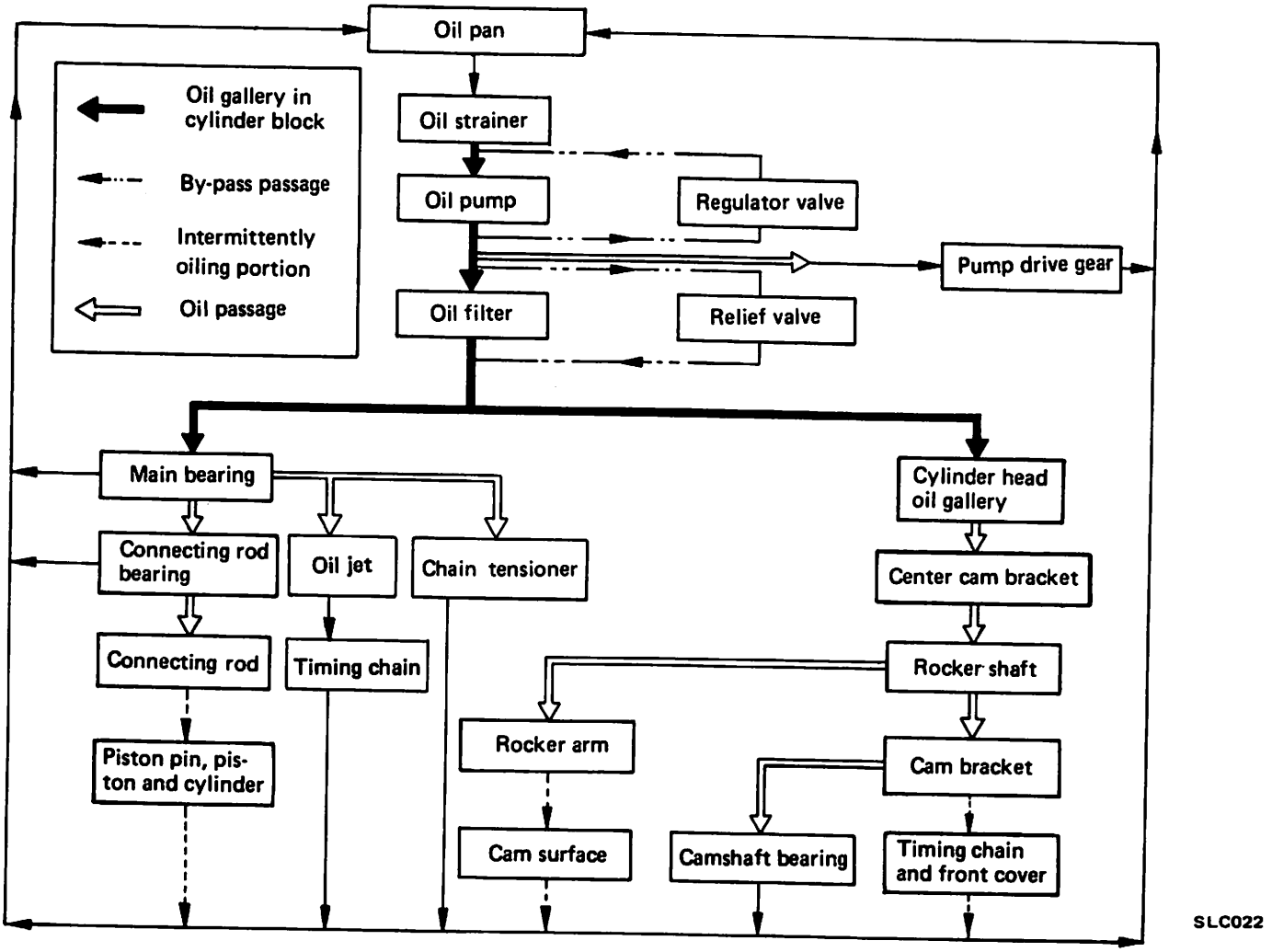
SPECIAL SERVICE TOOL LC-10

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ENGINE LUBRICATION SYSTEM

LUBRICATION CIRCUIT





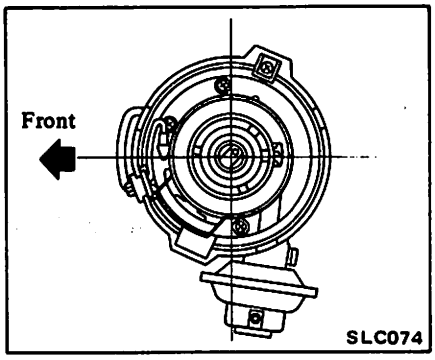
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OIL PUMP

REMOVAL

1. Remove distributor cap.
2. Turn crankshaft so that No. 1 piston is at T.D.C. on its compression stroke by ascertaining the position of distributor head rotor and timing mark on crank pulley.

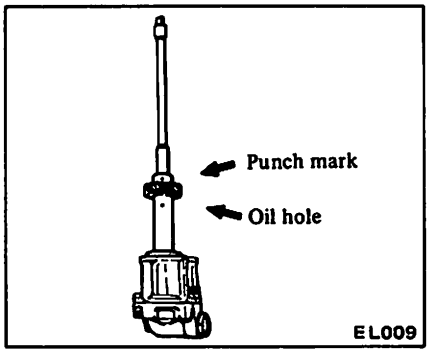
Remember position of head rotor under above condition.



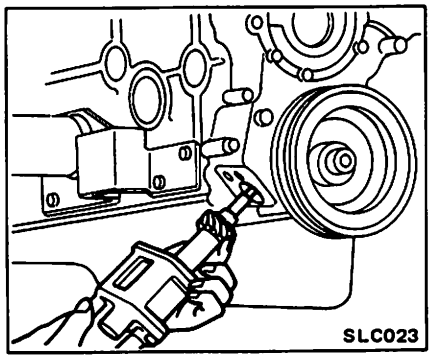
3. Remove oil pump body with drive spindle assembly.

INSTALLATION

1. Make sure that distributor head rotor is in the same position as it was before removal of oil pump.
2. Fill pump housing with engine oil, then align punch mark of drive spindle with hole in oil pump.



3. Using a new gasket, install oil pump and drive spindle assembly.

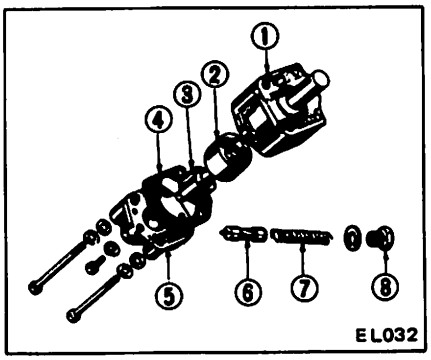


4. Make sure that the tip of the drive spindle fits distributor fitting hole securely.
5. Tighten bolts securing oil pump to front cover.

Ⓣ : Oil pump mounting bolts
11 - 15 N·m
(1.1 - 1.5 kg-m,
8 - 11 ft-lb)

6. Install distributor cap.

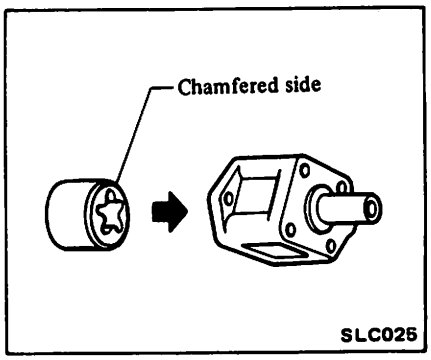
DISASSEMBLY AND ASSEMBLY



1 Oil pump body
2 Outer rotor
3 Inner rotor and shaft
4 Gasket
5 Oil pump cover
6 Regulator valve
7 Regulator spring
8 Regulator cap

Ⓣ : Oil pump cover bolts
7 - 10 N·m
(0.7 - 1.0 kg-m,
5.1 - 7.2 ft-lb)

a. Always replace with a new gasket.
b. Outer rotor should be assembled so that the chamfered side faces to oil pump body.

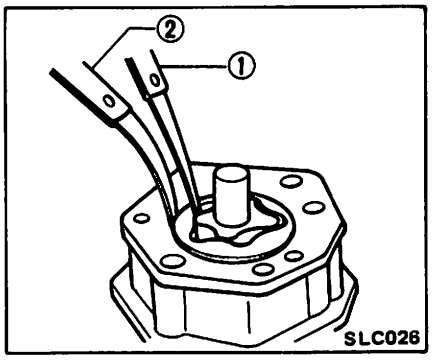


INSPECTION

1. Inspect the following for wear or damage.
- Pump body and cover
- Pump rotors and rotor shaft

2. Using a feeler gauge, check the following clearances.

Wear limit:
Rotor tip clearance ①
0.20 mm (0.0079 in)
Outer rotor to body clearance ②
0.50 mm (0.0197 in)



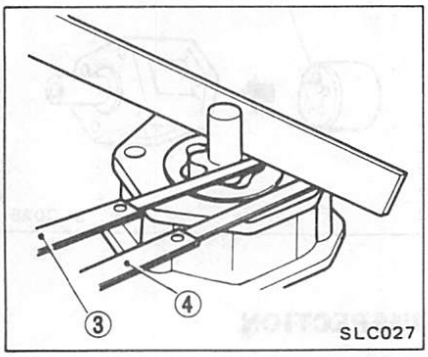
3. Using a feeler gauge and a straight edge, check the following gap, ③ or ④, without gasket.

Rotor to straight edge ③:
Less than
0.06 mm (0.0024 in)
Oil pump body to straight edge ④:
Less than
0.03 mm (0.0012 in)

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The rotor side clearance (rotor to bottom cover clearance) with gasket should satisfy the following specification.

Wear limit:
Rotor side clearance
0.20 mm (0.0079 in)

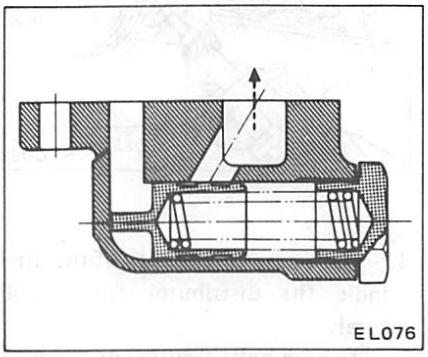


Pump rotors and body are not serviced separately. If pump rotors or body are damaged or worn, replace pump rotor set or entire oil pump assembly.

OIL PRESSURE REGULATOR VALVE

INSPECTION

Check valve sliding surface and valve spring, and replace entire valve assembly if necessary.

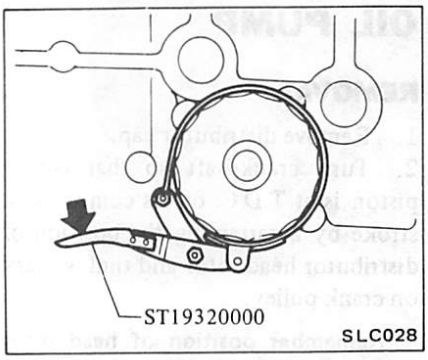


OIL FILTER

REMOVAL AND INSTALLATION

When removing oil filter, use Tool. When installing it, lightly coat oil on oil seal and **fasten it by hand.**

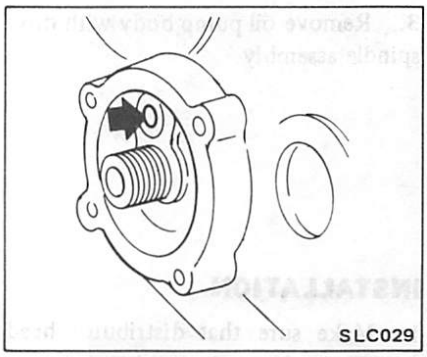
Do not overtighten filter, or oil leakage may occur.



OIL PRESSURE RELIEF VALVE

INSPECTION

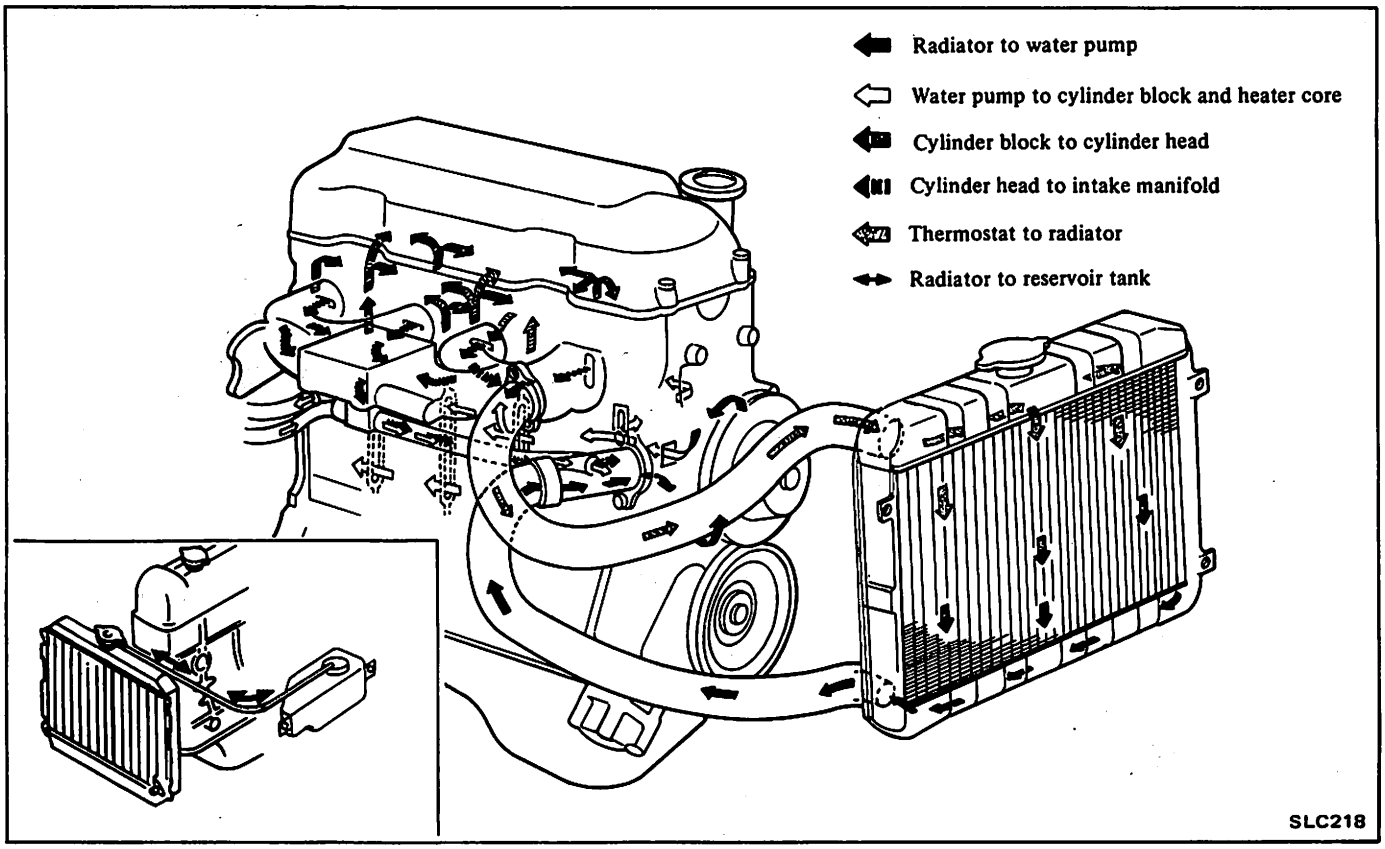
With oil filter removed, check the condition of the valve unit. Inspect for a cracked or broken valve. If replacement is necessary, remove valve by prying it out with a screwdriver. Install a new valve in place by tapping it.

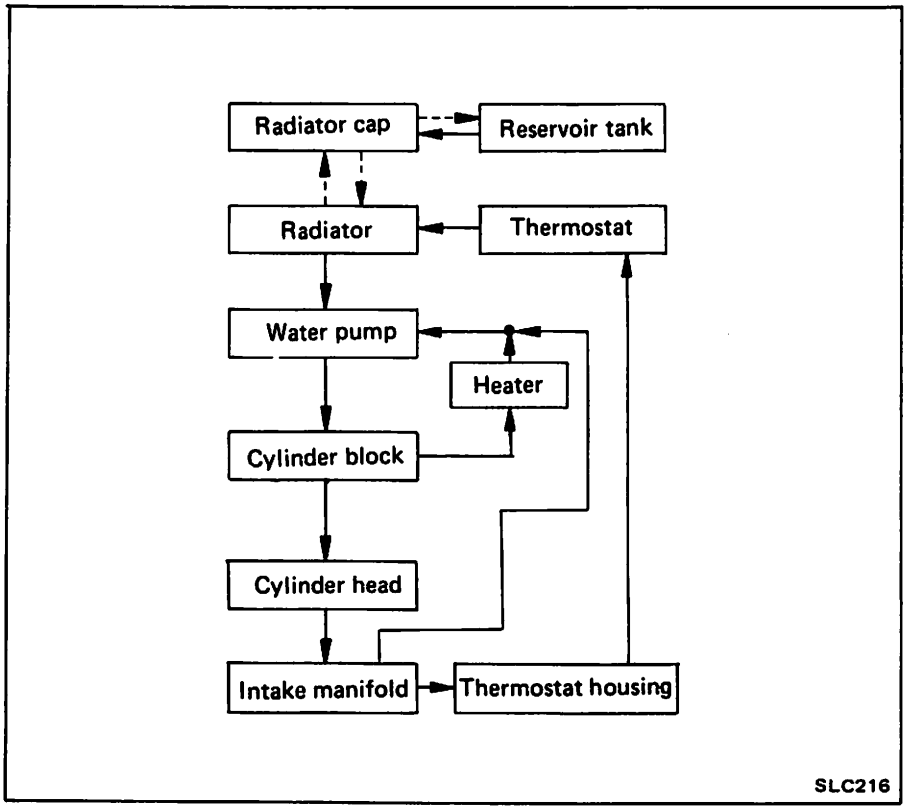


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COOLING SYSTEM

COOLING CIRCUIT





WARNING:
To avoid serious personal injury, never remove radiator cap quickly when engine is hot. Sudden release of cooling system pressure is very dangerous.
If it is necessary to remove radiator cap when radiator is hot, turn cap slowly counterclockwise to the first stop. After all pressure in the cooling system is released, turn cap passing the stop and remove it.

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RADIATOR

REMOVAL AND INSTALLATION

1. Drain coolant into a clean container.
2. Disconnect radiator upper and lower hoses, and reservoir tank hose.
3. Remove radiator shroud.
4. On vehicles with automatic transmission, disconnect cooler inlet and outlet lines from radiator.
5. Remove radiator.
6. Install radiator in the reverse order of removal and refill cooling system with coolant to specified level. (Refer to Section MA.)

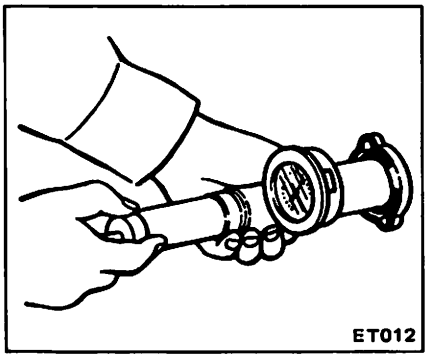
INSPECTION

Inspect radiator cap and water leakage using cap tester.

1. Inspection of radiator cap.

First, check rubber seal on cap for tears, cracks or deterioration after cleaning it. Then, install radiator cap on a tester. If cap does not hold or will not release at the specified pressure, replace cap.

Cap relief pressure:
88 kPa (0.9 kg/cm², 13 psi)

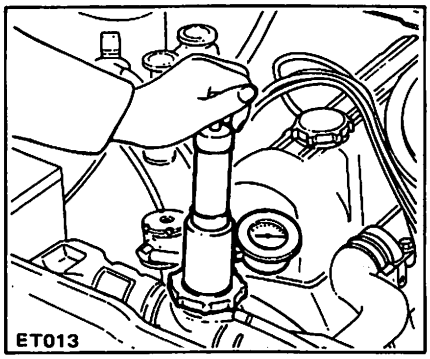


2. Inspection of water leakage.

With radiator cap removed, apply test pressure to radiator on the vehicle.

If leakage is detected, repair or replace radiator.

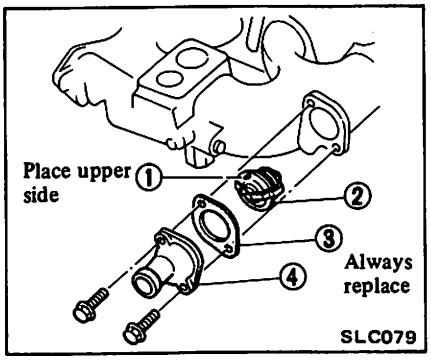
Leakage test pressure:
157 kPa (1.6 kg/cm², 23 psi)



THERMOSTAT

REMOVAL AND INSTALLATION

1. When removing, drain coolant partially and disconnect upper radiator hose at water outlet.
2. Install thermostat and water outlet as illustrated.

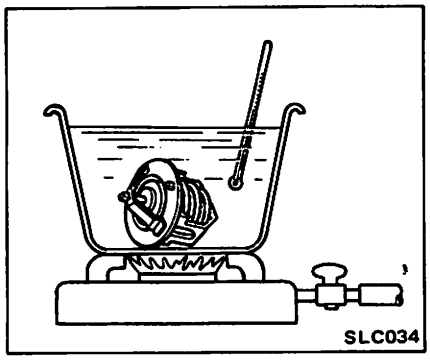


1 Jiggle valve
2 Thermostat
3 Gasket
4 Water outlet

INSPECTION

Inspect thermostat for the following and replace if necessary.

1. Valve seating condition at ordinary temperature. It should seat tightly.
2. Valve opening temperature and maximum valve lift. (Refer to S.D.S.)



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

It is necessary to check a new thermostat before installing it in engine.

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WATER PUMP

DISASSEMBLY

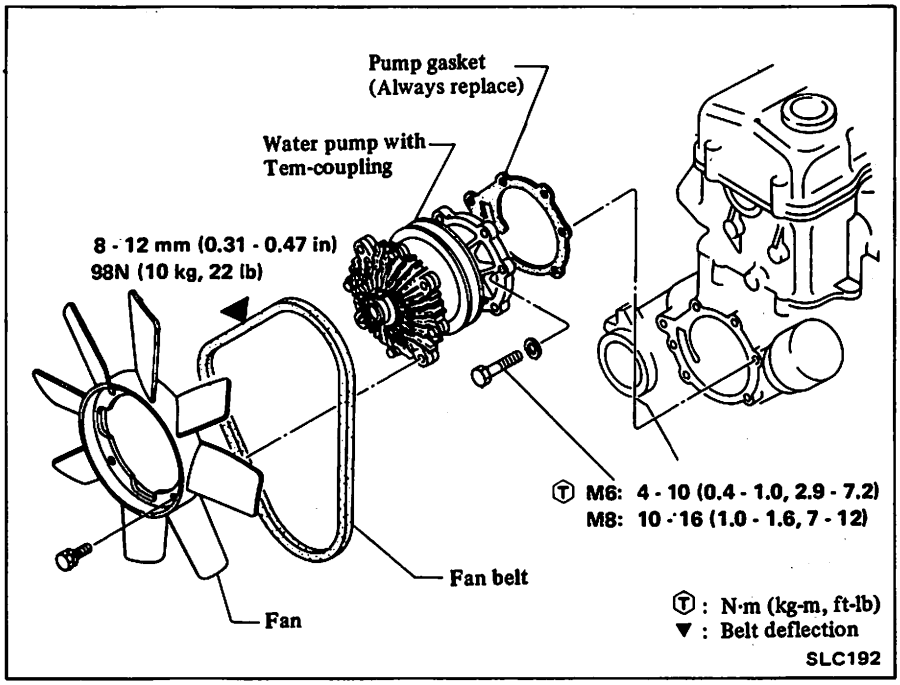
The water pump is made of aluminum and its bearing outer race is of a press fit type. For this reason, water pump should not be disassembled.

INSPECTION

Inspect pump assembly for the following conditions and replace if necessary.

1. Badly rusted or corroded body assembly and vane.
2. Excessive end play or roughness of bearings in operation.

If excessive mechanical seal squeak occurs when engine is running, use suitable water pump seal lubricant to prevent squeak.



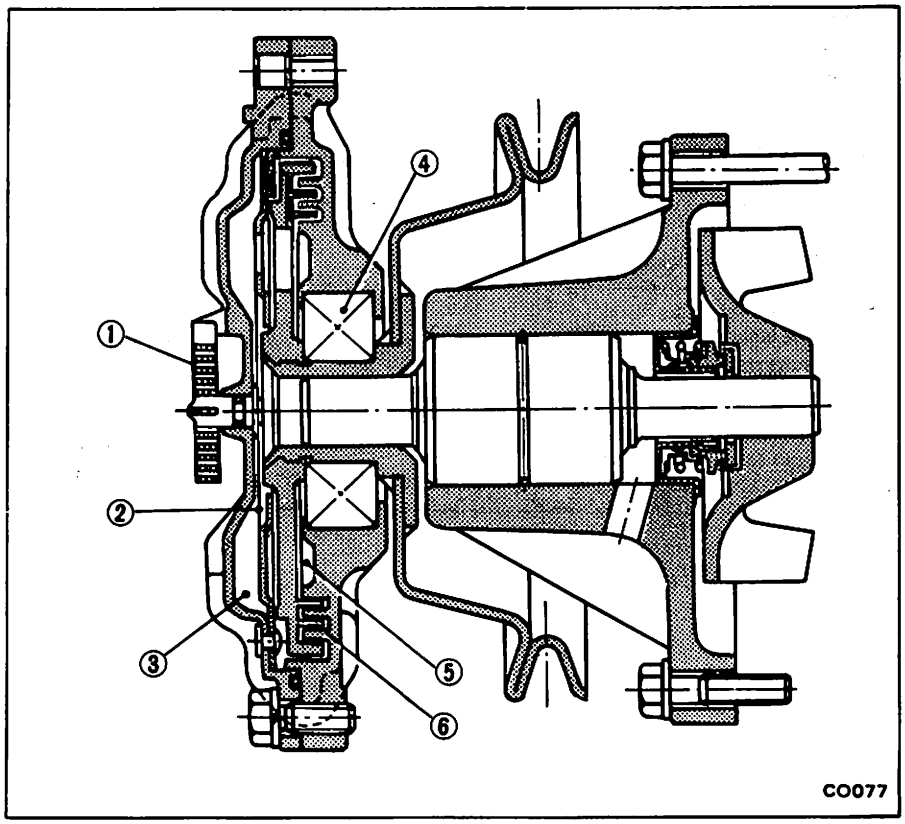
TEM-COUPLING

DISASSEMBLY

The coupling is so designed that it cannot be disassembled.

INSPECTION

Inspect the coupling for oil leakage or bend of bimetal. If necessary, replace as a pump assembly.



1 Bimetal thermostat
2 Slide valve
3 Reserve chamber for "OFF"
4 Bearing
5 Driving chamber for "ON"
6 Coupling part (Labyrinth)

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

Oil pump	Trochoid type
Oil filter	Full flow and cartridge type
Oil pressure relief valve Valve opening pressure kPa (kg/cm^2, psi)	58.8 - 73.6 (0.60 - 0.75, 8.5 - 10.7)
Radiator	Down flow, corrugated fin and tube type
Thermostat	Wax type
Water pump	Centrifugal type
Tem-coupling Fan speed (at water pump speed 4,000 rpm) rpm/°C (°F)	2,150/60 (140) Less than 1,650/ below 50 (122)

INSPECTION AND ADJUSTMENT

OIL PUMP

Unit: mm (in)

	Standard	Wear limit
Rotor tip clearance	Less than 0.12 (0.0047)	0.20 (0.0079)
Outer rotor-to-body clearance	0.15 - 0.21 (0.0059 - 0.0083)	0.50 (0.197)
Rotor side clearance (rotor to bottom cover)	0.04 - 0.08 (0.0016 - 0.0031)	0.20 (0.0079)

OIL PRESSURE REGULATOR VALVE

Regulator valve spring Free length mm (in)	52.5 (2.067)
Installed length/load mm/N (kg), (in/lb)	34.8/77.5 - 85.3 (7.9 - 8.7), (1.370/17.4 - 19.2)
Regulator valve opening pressure kPa (kg/cm^2, psi)/rpm	343 - 412 (3.5 - 4.2, 50 - 60)/3,000

RADIATOR

Unit: kPa (kg/cm^2 psi)

Cap relief pressure	88 (0.9, 13)
Leakage test pressure	157 (1.6, 23)

THERMOSTAT

	Standard	Frigid type	Tropical type
Valve opening temperature °C (°F)	82 (180)	88 (190)	76.5 (170)
Max. valve lift mm/°C (in/°F)	8/95 (0.31/203)	8/100 (0.31/212)	8/90 (0.31/194)

WATER PUMP

Fan belt deflection mm (in)/N (kg, lb)	8 - 12 (0.31 - 0.47)/98 (10, 22)

TIGHTENING TORQUE

Unit		N·m	kg-m	ft-lb
Oil pump mounting bolt		11 - 15	1.1 - 1.5	8 - 11
Oil pump cover bolt		7 - 10	0.7 - 1.0	5.1 - 7.2
Regulator valve cap		39 - 49	4 - 5	29 - 36
Water pump securing bolt	M6	4 - 10	0.4 - 1.0	2.9 - 7.2
	M8	10 - 16	1.0 - 1.6	7 - 12

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TROUBLE DIAGNOSES AND CORRECTIONS

LUBRICATION SYSTEM

Condition	Probable cause	Corrective action
Oil leakage	Damaged or cracked pump body cover.	Replace.
	Oil leakage from gasket and oil seal.	Replace.
	Oil leakage from regulator valve.	Tighten or replace.
	Oil leakage from blind plug.	Replace.
Decreased oil pressure	Lack of oil in engine oil pan.	Correct.
	Dirty oil strainer.	Clean or replace.
	Damaged or worn pump rotors.	Replace.
	Malfunctioning regulator.	Replace.
	Use of poor quality engine oil.	Replace.
Warning light remains "on" with engine running	Decreased oil pressure.	Previously mentioned.
	Oil pressure switch unserviceable.	Replace.
	Electrical fault.	Check circuit.
Noise	Excessive backlash in pump rotors.	Replace.

COOLING SYSTEM

Condition	Probable cause	Corrective action
Water leakage	Damaged radiator seams.	Repair.
	Leaks from heater connections or plugs.	Repair.
	Leak from water pump shaft seal.	Replace as pump assembly.
	Leak from water temperature gauge.	Tighten.
	Leaks from gaskets or small cracks.	Tighten or use Nissan Cooling System Sealer or equivalent.
	Loose joints.	Tighten.
	Damaged cylinder head gasket.	Replace. Check engine oil for contamination and refill as necessary.
Water leakage	Cracked cylinder block.	Replace. Check engine oil in crankcase for mixing with water by pulling oil level gauge.
	Cracked cylinder head.	Replace.
	Loose cylinder head bolts.	Tighten.

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Condition	Probable cause	Corrective action
Poor circulation	Restriction in system.	Check hoses for crimps, and clear the system of rust and sludge by flushing radiator.
	Insufficient coolant.	Replenish.
	Inoperative water pump.	Replace.
	Loose fan belt.	Adjust.
	Inoperative thermostat.	Replace.
Corrosion	Excessive impurities in water.	Use soft, clean water. (rain water is satisfactory).
	Infrequent flushing and draining of system.	Cooling system should be drained and flushed thoroughly at least twice a year. Permanent anti-freeze (Ethylene glycol base) can be used throughout the year.
Overheating	Malfunctioning thermostat, radiator cap and tem-coupling.	Replace.
	Radiator fin choked with mud, chaff, etc.	Clean out air passage thoroughly by using air pressure from engine side of radiator.
	Incorrect ignition and valve timing.	Adjust.
	Dirty oil and sludge in engine.	Refill.
	Inoperative water pump.	Replace.
	Loose fan belt.	Adjust.
	Restricted radiator.	Flush radiator.
	Inaccurate temperature gauge.	Replace.
	Impurities in water.	Use soft, clean water.
Overcooling	Malfunctioning thermostat.	Replace.
	Inaccurate temperature gauge.	Replace.
Noise	Squeak at water pump mechanical seal.	Use suitable water pump seal lubricant or replace as pump assembly.
	Damaged or worn water pump bearing.	Replace as pump assembly.

SPECIAL SERVICE TOOL

Tool number (Kent-Moore No.)	Tool name
ST19320000 (J25664)	Oil filter wrench  SLC036

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SECTION EF

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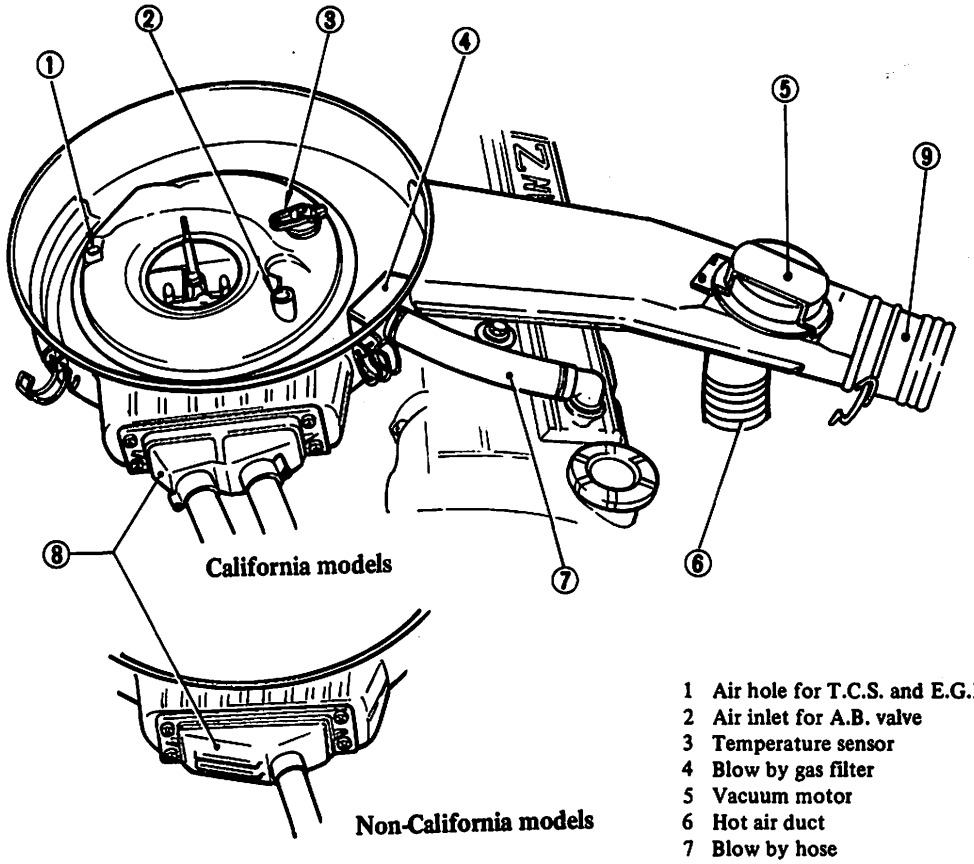
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AUTOMATIC TEMPERATURE CONTROL (A.T.C.) AIR CLEANER

DESCRIPTION

The automatic temperature control system maintains the temperature of air to be sucked in the carburetor within the constant range, thereby enabling lean setting for carburetor calibration. In addition to this, the automatic temperature control system is effective to improve warm-up characteristics of the engine and to remove carburetor icing.

In addition, idle compensator, vacuum hose for B.C.D.D. and some hoses for A.I.S. system are connected to the air cleaner. As for these devices, refer to Section EC or related parts of this section.



1 Air hole for T.C.S. and E.G.R. system
2 Air inlet for A.B. valve
3 Temperature sensor
4 Blow by gas filter
5 Vacuum motor
6 Hot air duct
7 Blow by hose
8 Air induction valve case
9 Fresh air duct

SEF812

Fig. EF-1 A.T.C. Air Cleaner

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OPERATION

The automatic temperature control system of the air cleaner is controlled by the inlet air temperature and the load condition of the engine. The inlet air temperature is detected by the sensor, and the vacuum motor is actuated by the engine intake vacuum.

Engine intake air temperature	Sensor vacuum at vacuum motor side	Air control valve operation	Sensor operation
Below 30°C (86°F)	Below 8.0 kPa (60 mmHg, 2.36 inHg)	Open (cold air)	Closed
	Above 25.3 kPa (190 mmHg, 7.48 inHg)	Closed (hot air)	
30 - 54°C (86 - 129°F)	———	Partially open (cold air + hot air)	Partially open
Above 55°C (131°F)	———	Open (cold air)	Open

HOT AIR OPERATION

When the engine intake air temperature is low, the sensor air bleed valve remains in the closed position, and establishes vacuum passage between the intake manifold and vacuum motor. With this condition, the vacuum at the intake manifold side actuates the air control valve attached to the vacuum motor diaphragm to introduce hot air into the air cleaner through the hot air duct on the exhaust manifold. See Fig. EF-2.

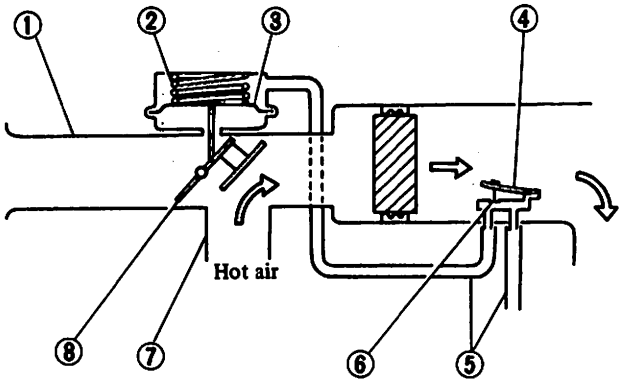


Fig. EF-2 Hot Air Delivery Mode (During cold engine operation)

COLD AIR OPERATION

1. When the vacuum is small, or when the engine is operating under heavy load, the air control valve opens widely, irrespective of the temperature around the sensor, to introduce the cold air for increased power of the engine.
2. When the engine intake air temperature is high:

The sensor air bleed valve opens fully to break the vacuum passage between the intake manifold and the vacuum motor. Due to the force of the vacuum motor diaphragm spring, the air control valve closes the hot air pipe of the air cleaner, and introduces the cold air.

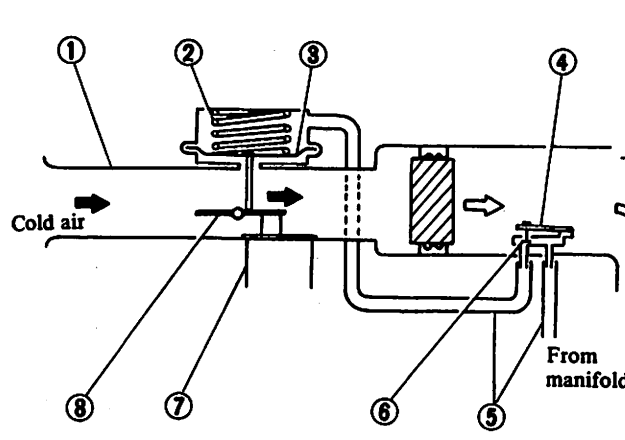
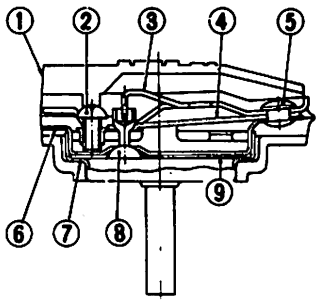


Fig. EF-3 Cold Air Delivery Mode (During hot engine operation)

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TEMPERATURE SENSOR

The temperature sensor is attached to the inside of the air cleaner. The bimetal built in the sensor detects the engine intake air temperature and opens or closes the vacuum passage in the sensor.



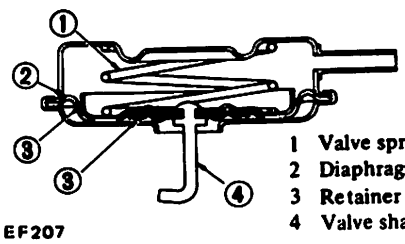
1 Protector cover
2 Screw
3 Adjusting frame
4 Air temperature bimetal
5 Rivet
6 Valve seat frame
7 Lower frame
8 Air bleed valve
9 Gasket

EF206

Fig. EF-4 Temperature Sensor

VACUUM MOTOR AND AIR CONTROL VALVE

The vacuum signal from the temperature sensor acts upon the vacuum motor diaphragm. The valve shaft attached to the diaphragm is then moved up or down in response to the vacuum on the diaphragm. This movement of the valve shaft actuates the air control valve to control the temperature of the air to be introduced into the air cleaner.



1 Valve spring
2 Diaphragm
3 Retainer
4 Valve shaft

EF207

Fig. EF-5 Vacuum Motor

REMOVAL AND INSTALLATION

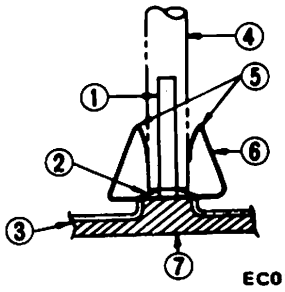
AIR CLEANER

1. Loosen bolts securing air cleaner to rocker cover.
2. Loosen air cleaner bolt and remove air cleaner from carburetor.
3. Disconnect the following parts.
1) Fresh air duct
2) Hot air duct
3) Vacuum hoses
4) Air hoses
5) Blow-by hose
4. To install, reverse the removal procedure.

TEMPERATURE SENSOR

Removal

1. Using pliers, flatten clip connecting vacuum hose to sensor vacuum tube.



1 Pipe
2 Catch
3 Fixed with adhesive
4 Hose
5 Tab
6 Clip
7 Gasket

EC019

Fig. EF-6 Removal of Sensor

2. Disconnect hose from sensor.
3. Take off clip from sensor vacuum tube, and dismount sensor body from air cleaner.

Note: The gasket between sensor and air cleaner is bonded to the air cleaner side, and should not be removed.

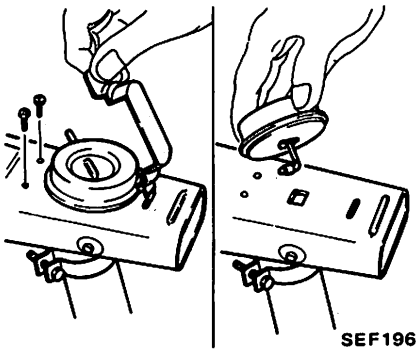
Installation

1. Mount sensor on the specified position.
2. Insert clip into vacuum tube of sensor. After installing each vacuum hose, secure hose with the clip.

Note: Be sure to install vacuum hose correctly. Correct position is: R.H. side to "Nissan" mark at the top face of sensor for intake manifold; L.H. side for vacuum motor.

VACUUM MOTOR

1. Remove screws securing vacuum motor retainer to air cleaner horn.
2. Disconnect valve shaft attached to vacuum motor diaphragm from air control valve, and remove vacuum motor assembly from air cleaner.
3. To install, reverse the removal procedures.



SEF196

Fig. EF-7 Removing Vacuum Motor

INSPECTION

AIR CLEANER FILTER

Viscous paper type air cleaner filter does not require any cleaning operation until it is replaced periodically. Brushing or blasting operation will cause clogging and result in enrichment of carburetor mixture, and should never be conducted. For replacement interval of air cleaner filter, refer to "Maintenance Schedule".

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AUTOMATIC TEMPERATURE CONTROL SYSTEM

Engine failures resulting from a malfunctioning A.T.C: system are manifest during cold weather operation. Such failures include:

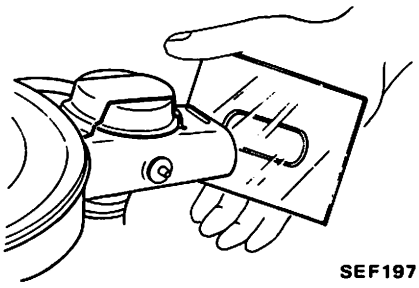
- Engine stall or hesitation
- Increase in fuel consumption
- Lack of power

If these phenomena should occur, check A.T.C. system as described in the following before carrying out inspection of carburetor.

1. Check that vacuum hoses are securely connected in correct position.
2. Check each hose for cracks or distortion.
3. Check A.T.C. system for proper function, as follows. Confirm that engine is cold before starting test:

With engine stopped, disconnect fresh air duct if so equipped.

Place a mirror at the end of air cleaner inlet pipe as shown, and check to see if air control valve is in correct position.



SEF197

Fig. EF-8 Inspecting Valve Position

Air control valve is in correct position if its cold air inlet is open and hot air inlet is closed.

4. Start engine and keep idling.

Immediately after engine starting, check air control valve for correct position as described above. In this case, correct position of air control valve is the reverse of step 3, underhood air inlet is closed, and hot air inlet is open.

5. Check that air control valve gradually opens to cold air inlet side as engine warms up. When environmental temperature around temperature sensor is low, spend more time for engine warming up operation to facilitate smooth operation of air control valve.

If the above test reveals any problem in the operation of air control valve, carry out the following test:

VACUUM MOTOR

1. With engine stopped, confirm that cold air inlet is open and hot air inlet is closed.

If not, check air control valve linkage for proper operation.

2. Disconnect vacuum motor inlet vacuum hose, and connect another hose to the inlet to apply vacuum to vacuum motor. Vacuum can be applied by breathing in the hose end as shown. Then, confirm that the air control valve moves.
3. With hot air inlet in open position, as described in step 2 above, pinch vacuum hose with fingers and cut off air from vacuum hose. In this condition, check that air control valve maintains the condition described in step 2 for more than 30 seconds, and that hot air inlet is open. If diaphragm spring actuates the air control valve by its spring force to close within 30 seconds, replace vacuum motor as an assembly since this may be resulted from air leak at vacuum motor diaphragm.

TEMPERATURE SENSOR

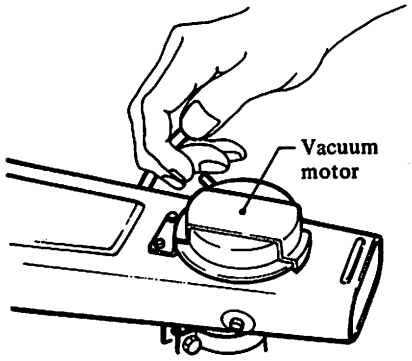
If tests indicate that A.T.C. system is malfunctioning and motor is functioning properly, check temperature sensor for proper operation.

Confirm that engine is cold before starting tests.

1. Start engine and keep idling.

Immediately after starting engine, disconnect vacuum motor inlet vacuum hose and make sure that intake vacuum is present at end of vacuum hose.

If vacuum is weak or is not present at all, check vacuum hoses for leakage. Replace temperature sensor if vacuum hoses are in good order.



SEF198

Fig. EF-9 Checking for Presense of Intake Vacuum

2. Reconnect vacuum hose to vacuum motor, and warm up engine.
3. Check that air control valve gradually opens to cold air inlet side as engine warms up. When environmental temperature around temperature sensor is low, spend more time for engine warming up operation to facilitate smooth operation of air control valve.

If air control valve does not open, check air control valve linkage for binding. Replace temperature sensor if air control valve linkage is functioning properly.

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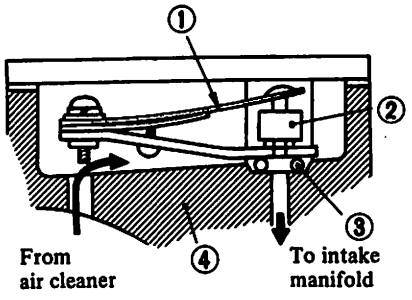
IDLE COMPENSATOR

DESCRIPTION

The idle compensator is basically a thermostatic valve which functions to introduce the air directly from the air cleaner to the intake manifold to compensate for abnormal enrichment of mixture in high idle temperature.

The bimetal attached to the idle compensator detects the temperature of intake air, and opens or closes the valve.

Idle compensator is installed on carburetor and opens at approximately 53°C (127°F) of compensator temperature.



1 Bimetal
2 Rubber valve
3 O-ring
4 Carburetor

SEF647

Fig. EF-10 Idle Compensator on

REMOVAL AND INSTALLATION

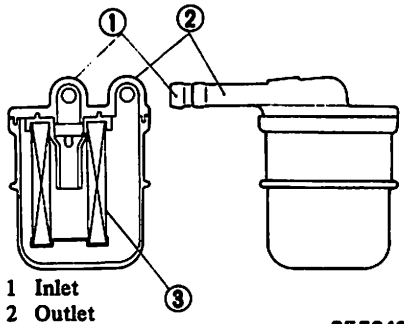
1. Remove air cleaner.
2. Loosen screws securing idle compensator cover to carburetor choke chamber, then remove idle compensator and seal ring.
3. To install, reverse the removal procedure.

Note: Be sure to install seal ring.

FUEL FILTER

DESCRIPTION

The fuel filter is a cartridge type. It uses a paper element which can be checked for condition from the outside.



1 Inlet
2 Outlet
3 Filter

SEF349

Fig. EF-11 Fuel Filter

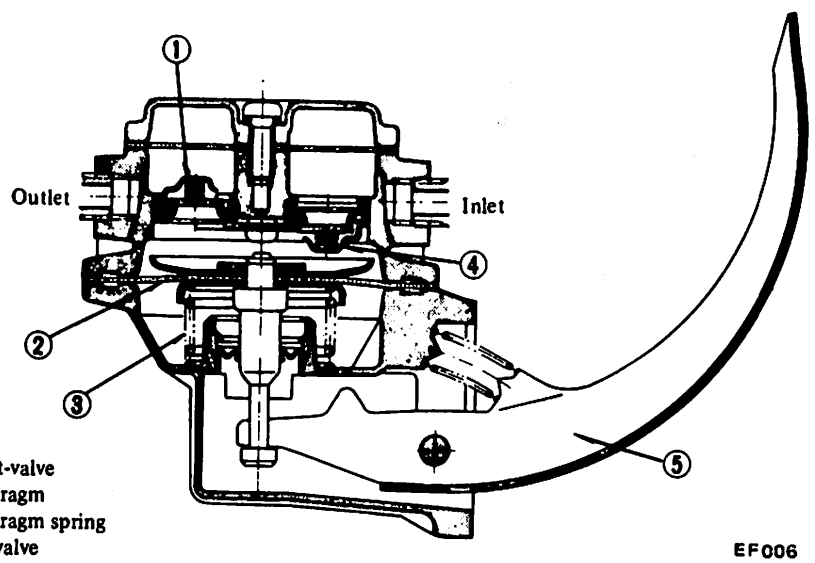
REMOVAL

Disconnect inlet and outlet fuel lines from fuel filter, and remove fuel filter.

Note: Before disconnecting fuel lines, use a container to receive the fuel remaining in lines.

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MECHANICAL FUEL PUMP



1 Outlet-valve
2 Diaphragm
3 Diaphragm spring
4 Inlet-valve
5 Rocker arm

EF006

Fig. EF-12 Fuel Pump

OPERATING TEST

Note: When disconnecting fuel hoses, use a container to receive fuel remaining in fuel hoses.

STATIC PRESSURE TEST

The static pressure test should be conducted as follows:

1. Disconnect fuel hose between carburetor and fuel pump.
2. Connect a rubber hose to each open end of a T-connector, and connect this connector-hose assembly between carburetor and fuel pump.

Note: Locate this T-connector as close to carburetor as possible.

3. Connect a suitable pressure gauge to the opening of T-connector, and fasten the hose between carburetor and T-connector securely with a clip.
4. Start and run the engine at various speeds.
5. The pressure gauge indicates static fuel pressure in the line. The gauge reading should be within the specified value.

Fuel pump pressure:
20.6 - 26.5 kPa
(0.21 - 0.27 kg/cm^2,
3.0 - 3.8 psi)

Note: If the fuel in the carburetor float chamber has run out and engine has stopped, remove clip and pour fuel into carburetor. Fasten clip securely and repeat static pressure test.

If pressure is not within the specified limit, remove pump as an assembly.

CAPACITY TEST

The capacity test is conducted only when static pressure is within the specification. To conduct this test, proceed as follows:

1. Disconnect pressure gauge from T-connector and, in its vacant place, install a suitable container as a fuel sump.
2. Start engine and run at 1,000 rpm.
3. Pump should deliver the specified amount of fuel.

If little or no fuel flows from open end of pipe, it is an indication that fuel line is clogged or pump is malfunctioning.

Fuel pump capacity:
1,700 mℓ
(57.5 US fl oz,
59.8 Imp fl oz)/min
at 1,000 rpm

REMOVAL AND INSTALLATION

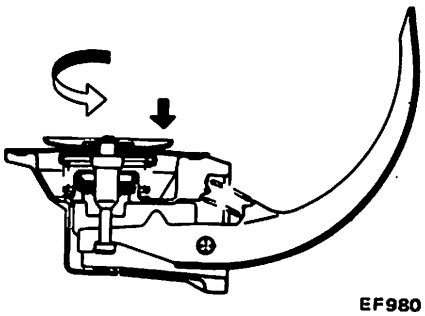
Note: When disconnecting fuel lines, use a container to receive fuel remaining in fuel hoses.

1. Disconnect inlet and outlet fuel hoses from fuel pump.
2. Remove fuel pump.
3. To install, reverse the order of removal.

DISASSEMBLY

1. Remove screws and detach upper and lower bodies.
2. Remove screws and take off cap and cap gasket from upper body.
3. Remove inlet and outlet connectors.
4. Remove valve retainer screws and take off valve retainer.
5. To remove diaphragm, press down its center against spring force. With diaphragm pressed down, rotate it about 90°. Then, release diaphragm to unhook push rod.

Note: Be careful not to damage diaphragm or oil seal.



EF980

Fig. EF-13 Removing Pull Rod

6. Drive rocker arm pin out with a press or hammer.

INSPECTION

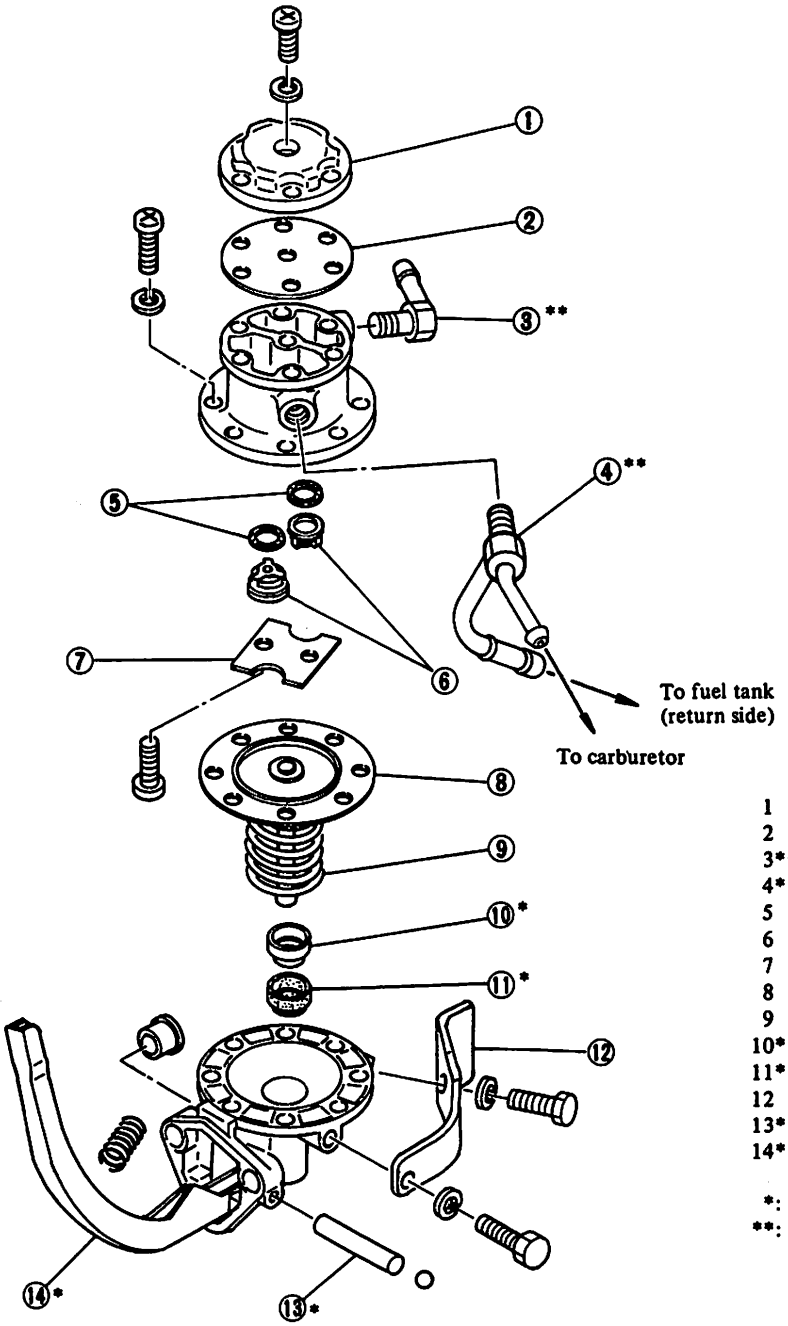
Check all components for cracks, wear or any abnormalities and replace with new parts if necessary.

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ASSEMBLY

1. To assemble, reverse the order of disassembly. Closely observe the following instructions:
- Use new gaskets.
- Lubricate rocker arm, rocker arm link and rocker arm pin before installation.

2. After assembly, test the function as follows.
a. Position fuel pump assembly about 1 meter (3.3 ft) above fuel level of fuel strainer and connect a pipe from strainer to fuel pump.
b. Operate rocker arm by hand. If fuel is drawn up soon after rocker arm is released, fuel pump is functioning properly.



1	Fuel pump cap
2	Cap gasket
3**	Inlet connector
4**	Outlet connector
5	Valve packing assembly
6	Fuel pump valve assembly
7	Valve retainer
8	Diaphragm assembly
9	Diaphragm spring
10*	Lower body seal washer
11*	Lower body seal
12	Fuel pump protector
13*	Rocker arm side pin
14*	Rocker arm

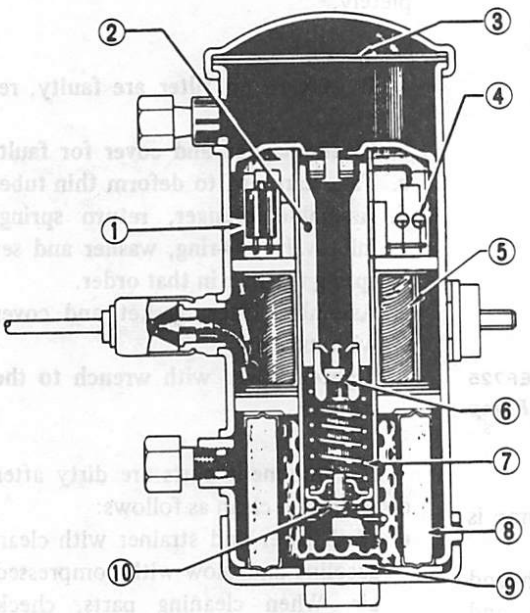
*: Do not disassemble.
**: Do not disassemble unless necessary.

SEF200

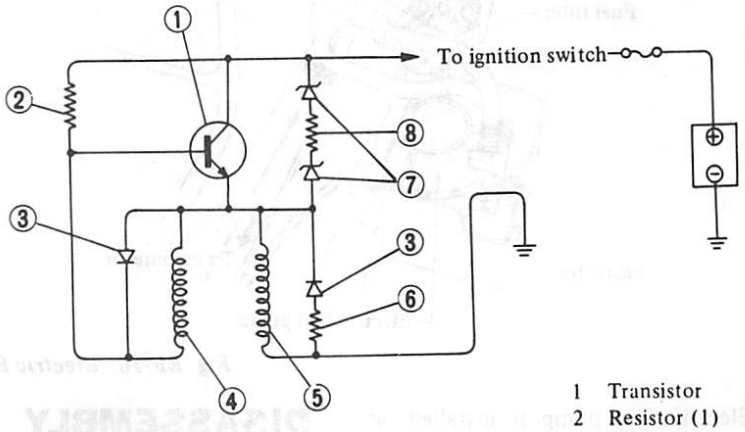
Fig. EF-14 Mechanical Fuel Pump Parts

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ELECTRIC FUEL PUMP



1 Transistor
2 Plunger
3 Diaphragm
4 Diode
5 Magnet coil
6 Outlet valve
7 Return spring
8 Filter
9 Magnet
10 Inlet valve



1 Transistor
2 Resistor (1)
3 Diode
4 Signal coil
5 Main coil
6 Resistor (3)
7 Zener diode
8 Resistor (2)

EF719

Fig. EF-15 Construction of Electric Fuel Pump

INSPECTION

1. Disconnect fuel hose at pump outlet.
2. Connect a suitable hose [approximately 6 mm (0.24 in) inner diameter] to pump outlet.

Note: If diameter is too small, the following proper delivery capacity cannot be obtained even if pump functions properly.

3. With hose outlet in a higher position than pump, operate pump and check delivery capacity for more than 15 seconds.
4. The capacity should be 1,400 mℓ (47.3 US fl oz, 49.3 Imp fl oz) in one minute or less.

If no gasoline, or only a little flows from open end of pipe with pump operated, or if pump does not work, perform the following diagnosis.

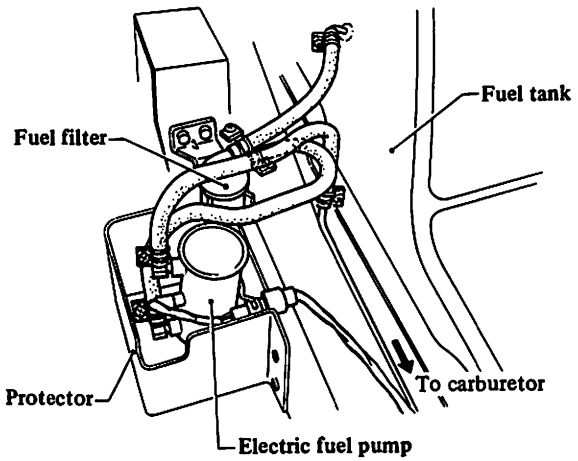
Note:

a. **Do not connect battery in reverse polarity which, if left for a long time, would damage transistor circuit and disable pump.**
b. **Do not let fall pump, as it may damage electronic components.**
c. **Do not apply overvoltage (max. 18V). Overvoltage starting by quick charge or overvoltage running would deteriorate or damage electronic components.**

Fuel pressure (maximum):
21.6 - 26.5 kPa
(0.22 - 0.27 kg/cm², 3.1 - 3.8 psi)

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REMOVAL AND INSTALLATION



SEF725

Fig. EF-16 Electric Fuel Pump

Electric fuel pump is installed on bracket with two bolts. This bracket is located on R.H. side member adjacent to fuel tank.

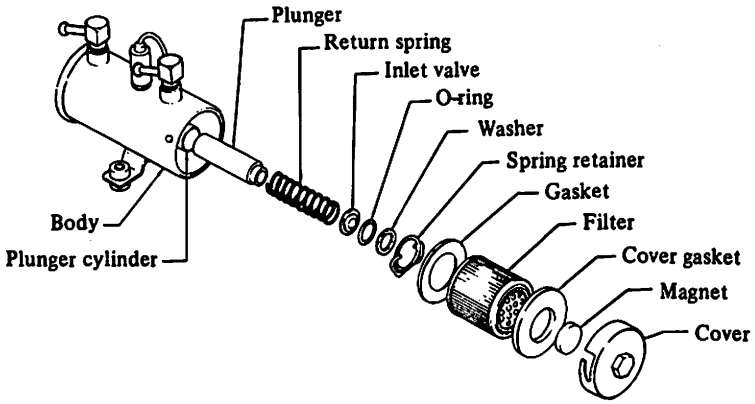
1. Remove fuel pump protector.
2. Remove inlet hose from fuel pump. Also remove outlet hose running to engine. Receive fuel remaining in fuel hose in a suitable container.
3. Disconnect harness at connector.
4. Remove bolts securing fuel pump to bracket, and detach fuel pump.
5. Installation is the reverse order of removal.

DISASSEMBLY

Do not disassemble unless pump is faulty.

1. Remove cover with wrench and take out cover gasket, magnet, and filter from pump body.
2. When removing plunger, take out spring retainer from plunger tube.
3. Then, take out washer, O-ring, inlet valve, return spring and plunger from tube.

Note: Do not disassemble electronic components. If necessary, replace with new ones.



SEF814

Fig. EF-17 Electric Fuel Pump

ASSEMBLY

1. Before assembly, clean all parts with gasoline and compressed air completely.

Note:

a. If gasket and filter are faulty, replace.
b. Clean magnet and cover for fault.
c. Take care not to deform thin tube.
d. Assemble plunger, return spring, inlet valve, O-ring, washer and set spring retainer in that order.
e. Assemble filter, gasket and cover with magnet.
f. Tighten cover with wrench to the stopper.

If component parts are dirty after disassembly, clean as follows:

- Wash filter and strainer with clean gasoline and blow with compressed air. When cleaning parts, check filter for fault. If faulty, replace.
- Wash plunger, plunger cylinder and inlet valve with clean gasoline, and blow dust off with compressed air.

2. Check component parts for wear or damage.

If they are found faulty, replace them.

3. Insert plunger assembly into plunger cylinder of body and apply electric current to it.

Move the assembly up and down.

If the assembly does not move, it shows that the electric unit is faulty, and it must be replaced.

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TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Fuel pump fails to operate.	Terminals or connections loose. Rust on terminals or grounding metal. Frozen liquid in plunger or pump.	Retighten. Clean. Clean plunger assembly. Replace pump if plunger is stuck or seized.
Fuel pump fails to discharge sufficient flow.	Clogged filter. Insufficient fuel.	Clean pump interior. Clean and, if necessary, replace filter. Replenish.
Insufficient fuel discharge during high speed travelling.	Air in fuel hose through connections.	Apply a coating of end sealing compound to connections, and retighten.
Low float level at idling.	Hose necked down or bent. Fuel tank breather tube bent or necked down. Weakened return spring.	Check and correct. Check and correct. Replace.
Fuel pump is actuated more frequently than under normal condition.	Air sucked through connection (fuel hose and fuel pump joint). Fuel hose (on suction side) bent. Clogged filter.	Apply a coating of end sealing compound to connection, and retighten. Check and correct. Clean or replace filter.
Rattling noise	Mounting bolts loose.	Retighten.

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CARBURETOR

DESCRIPTION

The carburetors are of down-draft two-barrel types which produce the optimum air-fuel mixture under all operating conditions.

They present several distinct features of importance to the vehicle owners.

A summary of the features is as follows:

1. A slow economizer to make a smooth connection with acceleration or deceleration during light load running.

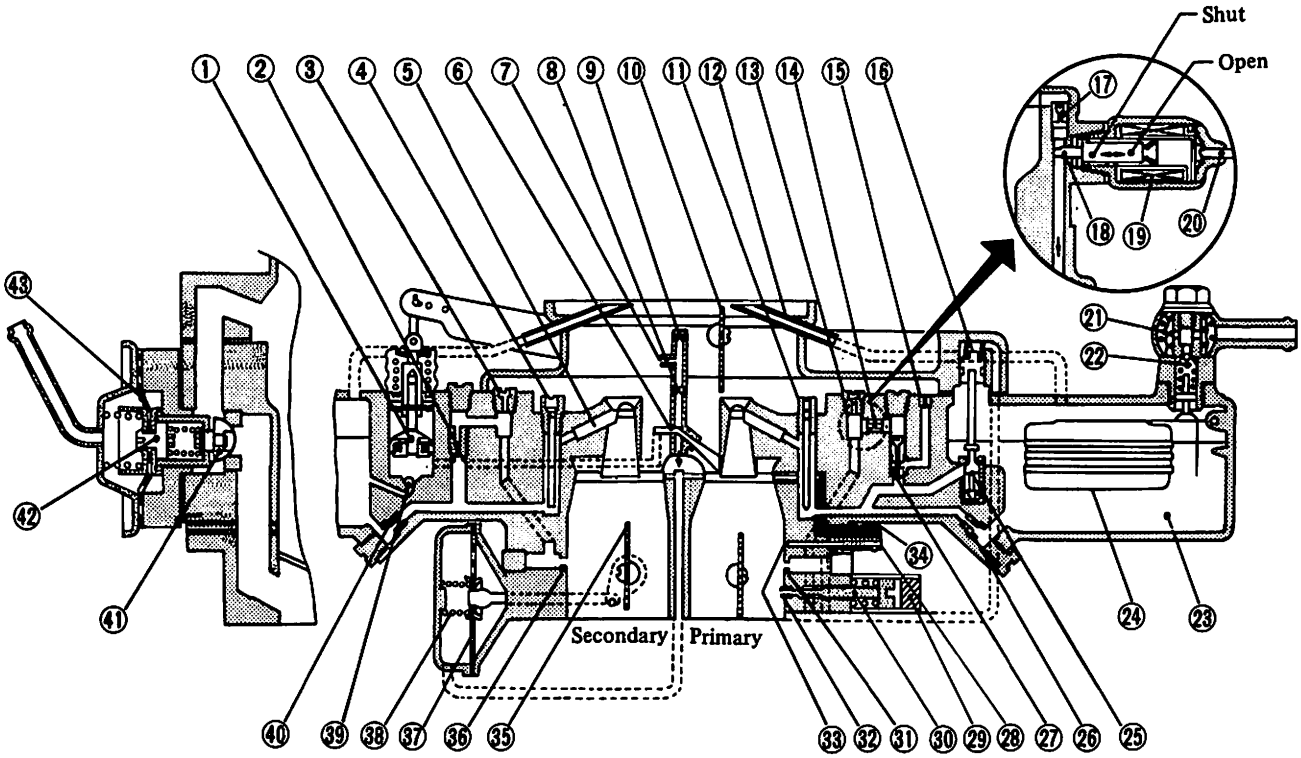
It also assures stable low speed performance.

2. An idle limiter to reduce harmful exhaust emissions to a minimum.
3. An electric automatic choke to facilitate cold starting and to reduce exhaust emissions.
4. An anti-dieseling solenoid to eliminate dieseling (run-on).
5. A power valve, or vacuum actuated booster, to ensure smooth high-speed operation.
6. A dash pot ensures smooth deceleration, without engine stall, under all operating conditions. (Except manual transmission)

STRUCTURE AND OPERATION

This carburetor consists of a main system for normal running, a slow system for idling, and an accelerating and power mechanism.

Some emission control devices are added.



1 Accelerating pump piston
2 Step jet
3 Step air bleed
4 Secondary main air bleed
5 Secondary main nozzle
6 Accelerating pump nozzle
7 High-speed richer nozzle
8 High-speed richer jet
9 High-speed richer air bleed
10 Choke valve
11 Primary main air bleed
12 Air vent
13 Slow air bleed
14 Slow economizer
15 Slow economizer bleed
16 Vacuum piston
17 Slow air bleed
18 Plunger
19 Coil
20 Lead wire
21 Strainer
22 Needle valve
23 Float chamber
24 Float
25 Power jet
26 Primary main jet
27 Slow jet
28 Vacuum pipe
29 Idle mixture adjusting screw plug
30 Idle mixture adjusting screw
31 Slow port (By-pass port)
32 Idle nozzle
33 Vacuum port
34 Venturi vacuum outlet
35 Secondary throttle valve
36 Step port
37 Secondary diaphragm
38 Diaphragm spring
39 Check valve
40 Secondary main jet
41 Air control valve
42 Vacuum control valve
43 Diaphragm

SEF648

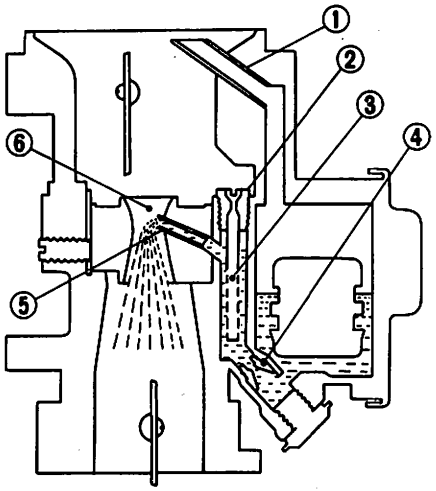
Fig. EF-18 Carburetor

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PRIMARY SYSTEM

Primary main system

Fuel flow as shown below through the main jet, mixing with air which comes in from the main air bleed and passes through the emulsion tube, and is pulled out into the venturi through the main nozzle.



1 Air vent pipe
2 Main air bleed
3 Emulsion tube
4 Main jet
5 Main nozzle
6 Small venturi

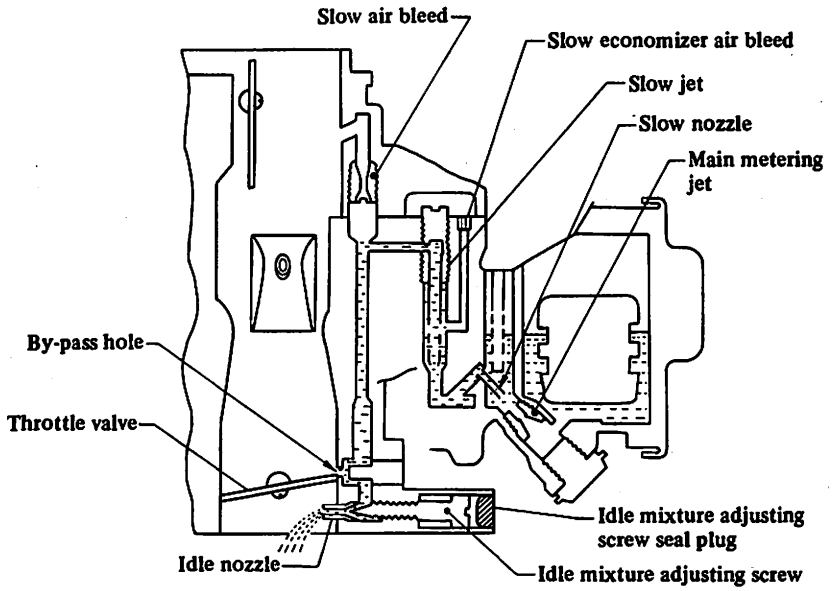
SEF202

Fig. EF-19 Primary Main System

Idling and slow system

During low engine speed, as shown below, fuel flows through the slow jet located on rear right side of main nozzle, mixing with air coming from the slow economizer bleed, again mixing with air coming from the slow air bleed and then is pulled out into the engine through the idle hole and by-pass hole.

Slow economizer system obtains smooth deceleration at high speeds.

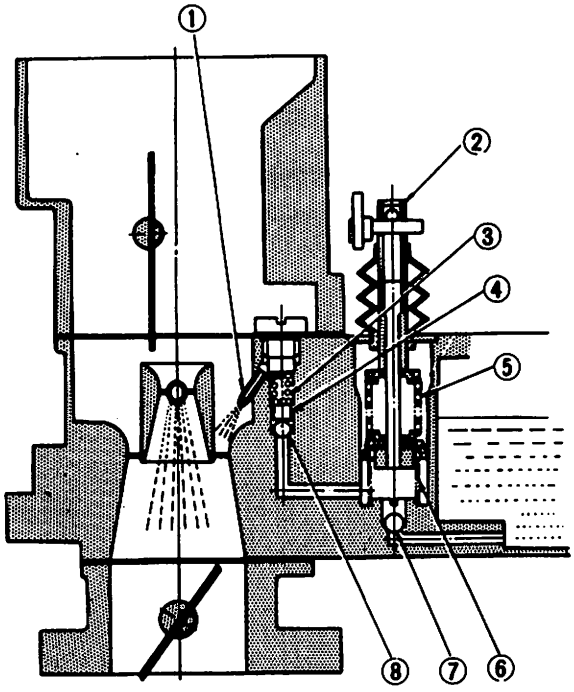


SEF649

Fig. EF-20 Primary Slow System

Accelerating mechanism

The carburetor is equipped with the piston type accelerating mechanism linked to the throttle valve. When the primary throttle valve is closed, the piston goes up, and fuel flows from the float chamber through the inlet valve into the space under the piston. When the throttle valve is opened, the piston goes down, opening the outlet valve, and fuel is forced out through the injector. See Fig. EF-21.



1 Pump injector
2 Piston
3 Spring
4 Weight
5 Damper spring
6 Piston return spring
7 Inlet valve
8 Outlet valve

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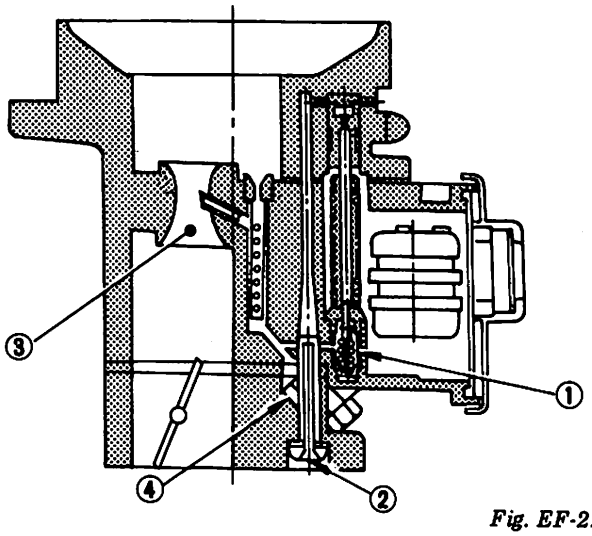
Fig. EF-21 Accelerating Mechanism

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Power valve mechanism

The power valve mechanism supplies additional fuel to primary main system during heavy load driving.

When the throttle valve is slightly opened during light load running, high vacuum is created in the intake manifold. This vacuum pulls the vacuum piston upward against the spring, leaving the power valve closed. When the vacuum below the throttle valve is lowered during full load or accelerating running, the spring pushes the vacuum piston downward, opening the power valve to furnish fuel.



1 Power valve
2 Vacuum take out port
3 Primary main nozzle
4 Main jet

SEF204

Fig. EF-22 Power Valve Mechanism

SECONDARY SYSTEM

Secondary main system

When the primary throttle valve is wide open and engine produces high power, the secondary throttle valve begins to open by the diaphragm.

Fuel-air mixture produced by the functions of the main jet, main air bleed and emulsion tube, in the same manner as in the primary system, is pulled out through the main nozzle into the venturi.

The structure is almost the same as the primary main system.

Secondary switchover mechanism

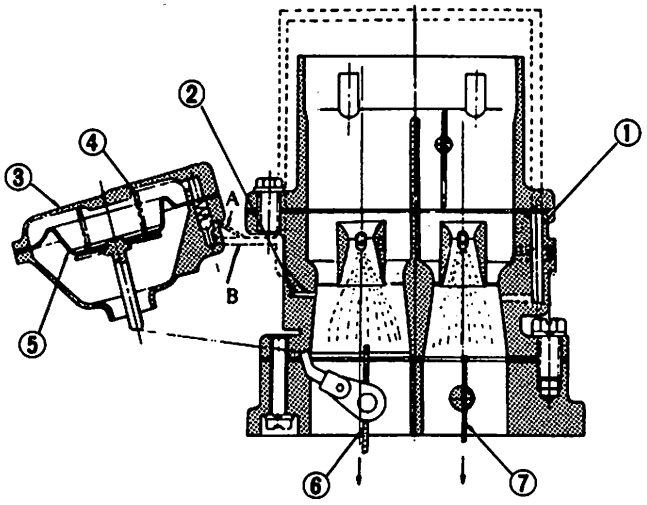
The secondary throttle valve is linked to the diaphragm which is actuated by the vacuum created in the venturi. A vacuum port is provided at each of the primary and secondary venturis, and the composite vacuum of these ports actuates the diaphragm.

As the linkage causes the secondary throttle valve to close until the primary throttle valve opening reaches approximately 50°, fuel consumption during normal operation is not excessive.

During high speed running, as the vacuum at the venturi is increased, the diaphragm is pulled against the diaphragm spring force, and then secondary throttle valve is opened.

The other side, during low speed running (as the primary throttle valve opening does not reach 50°), the secondary throttle valve is locked to close completely by the locking arm which is interlocked with primary throttle arm by linkage.

When the primary throttle valve opening reaches wider position than 50°, the secondary throttle valve is ready to open, because the locking arm revolves and leaves from the secondary throttle arm.



1 Primary vacuum port
2 Secondary vacuum port
3 Diaphragm chamber cover
4 Diaphragm spring
5 Diaphragm
6 Secondary throttle valve
7 Primary throttle valve

EF512

Fig. EF-23 Full Throttle at High Speed

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Secondary slow system (Step system)

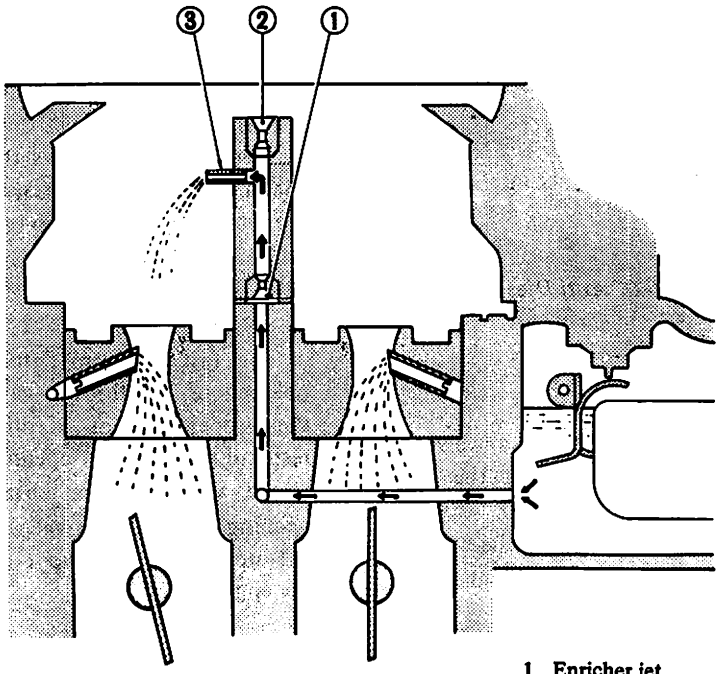
The construction of this system may correspond to the idling and slow system of the primary system.

This system aims at the proper filling up of the gap when fuel supply is transferred from the primary system to the secondary system. The step port is located near the secondary throttle valve edge in its fully closed state.

High speed enricher

The high speed enricher improves high engine output performance during high speed driving.

This enricher operates only when driving at high speed. It consists of an enricher jet, high speed enricher air bleed, and enricher nozzle. When the velocity of suction air flowing through the carburetor secondary bore increases, additional fuel is drawn out of the enricher nozzle.



1 Enricher jet
2 Enricher air bleed
3 Enricher nozzle

SEF205

Fig. EF-24 High Speed Enricher

FLOAT SYSTEM

There is only one float chamber, while two carburetor systems, primary and secondary, are provided.

Fuel fed from the fuel pump flows through the filter and needle valve into the float chamber. A constant fuel level is maintained by the float and needle valve.

Because of the inner air vent type of the float chamber ventilation, the fuel consumption will not be influenced by some dirt accumulated in the air cleaner.

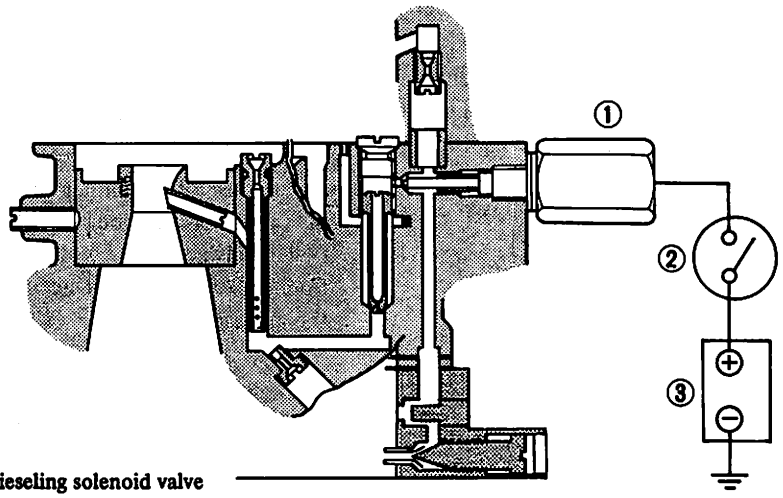
The needle valve includes special hard needle and will not wear for all its considerably long use. Besides, the insertion of a spring will prevent the flooding at rough road running.

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ANTI-DIESELING SYSTEM

The carburetor is equipped with an anti-dieseling solenoid valve. As the ignition switch is turned off, the valve is brought into operation, shutting off the supply of fuel to the slow circuit.

The following figure shows a sectional view of this control.



1 Anti-dieseling solenoid valve
2 Ignition switch
3 Battery

SEF826

Fig. EF-25 Anti-Dieseling System

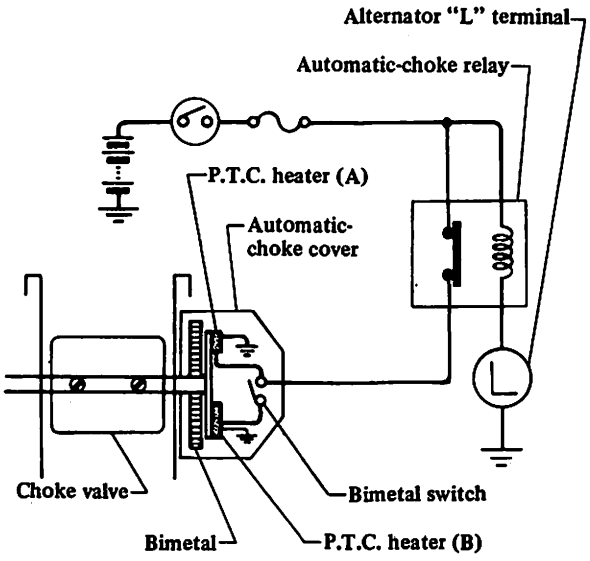
INTAKE MANIFOLD VACUUM CONTROL SYSTEM

Refer to Intake Manifold Vacuum Control System (Section EC).

ELECTRIC AUTOMATIC CHOKE

An electric heater warms a bimetal interconnected to the choke valve, and controls the position of the choke valve and throttle valve in accordance with the time elapsed, the warm-up condition of the engine, and the outside ambient temperature.

The construction and function of each part of this carburetor are as follows:



SEF726

Fig. EF-26 Electric Automatic Choke Heater

1. Electric heater.

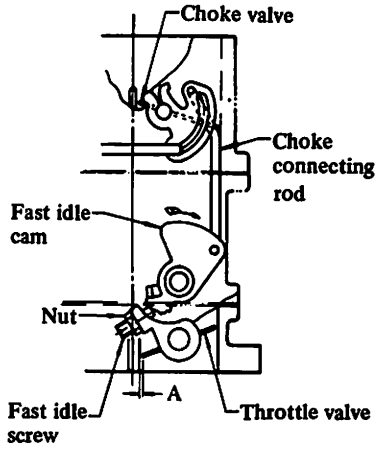
The double stage heating system is provided to obtain an optimum heating capacity. This system consists of a first and second stage heater. The first stage heater (A) always operates to heat the bimetal during the time when electric current flows through the auto-choke circuit, and in addition to the first stage operation, the second stage heater (B) begins to operate when the bimetal temperautre reaches to the level of about 15°C (59°F) so that the choke valve opens more early. This operation of the second stage heater is controlled by a thermo switch attached to the bimetal.

2. Bimetal

Electric current flows through the heater as the engine starts, and warms the bimetal. The deflection of the bimetal is transmitted to the choke valve through the choke valve lever.

3. Fast idle cam

The fast idle cam determines the opening of the throttle valve so that the proper amount of mixture corresponding to the opening of the choke valve will be obtained. The opening of the choke valve is dependent upon the warm-up condition of the engine.



SEF650

Fig. EF-27 Fast Idle System

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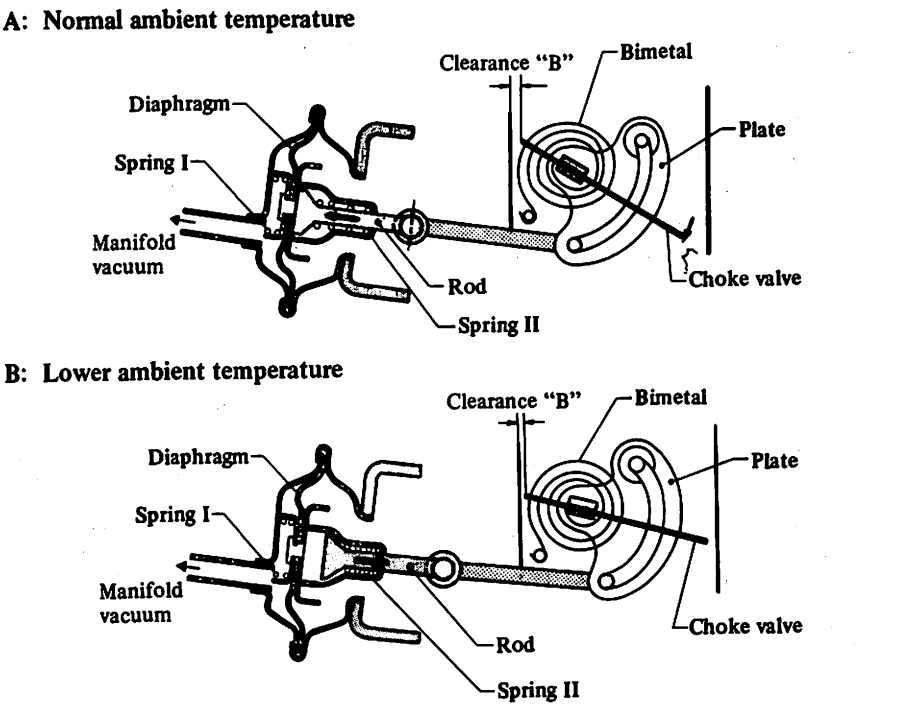
4. Choke unloader

When accelerating the engine during the warm-up period, that is, before the choke valve opens sufficiently, this unloader forces the choke valve open a little so as to obtain an adequate air-fuel mixture.

5. Vacuum break diaphragm

After the engine has been started by cranking, this diaphragm forces the choke valve open to the predetermined extent so as to provide the proper air-fuel ratio.

A two stage-acting type vacuum diaphragm is employed.



SEF651

Fig. EF-28 Vacuum Break Diaphragm

DASH POT SYSTEM

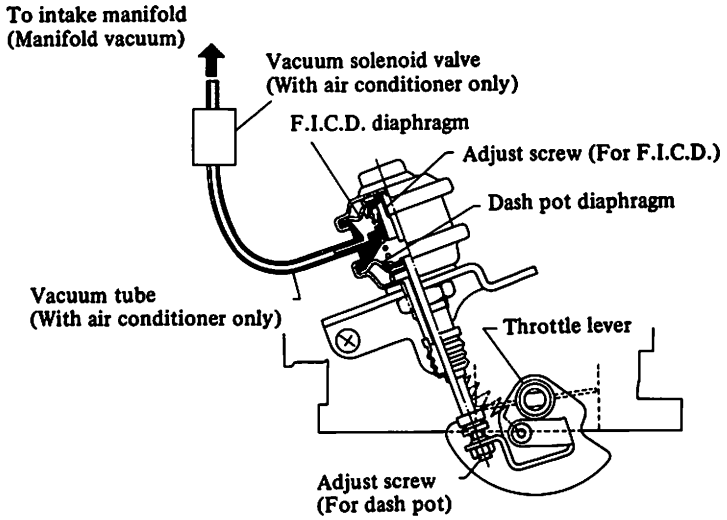
In automatic transmission models, it prevents engine stall resulting from quick application of the brake or from quick release of the accelerator pedal after it has been tread upon slightly.

The dash pot is a combination type which also serves as an F.I.C.D. actuator.

When the accelerator pedal is released during deceleration, the throttle valve lever taps on the dash pot stem.

With the air conditioning system in "OFF", diaphragm "I" gradually actuates as air leaks. This in turn causes the dash pot stem to retract, returning the engine to idling speed.

With the air conditioning system in "ON", vacuum is introduced, moving diaphragm "II" to the lower side. Engine speed gradually decreases as air leaks, and is held at a certain rpm (F.I.C.D. set revolution).



SEF208

Fig. EF-29 Dash Pot

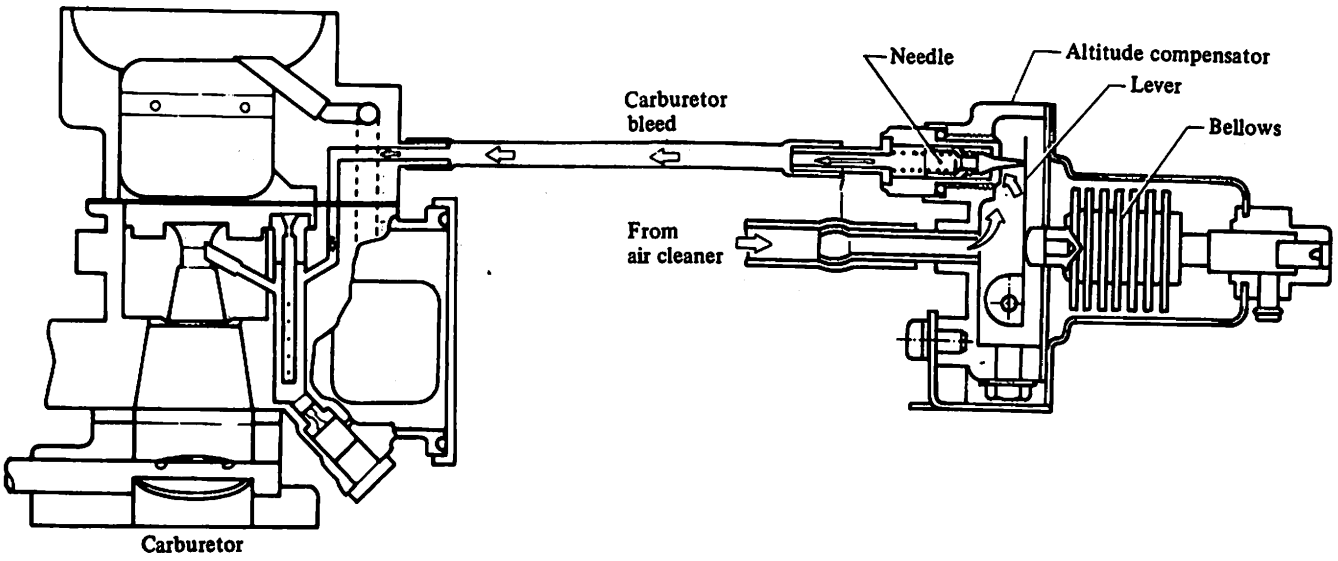
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ALTITUDE COMPENSATOR (California models)

The higher the altitude is, the thinner the density of air becomes. At a higher altitude, therefore, the carburetor produces too rich air-fuel mixture.

The altitude compensator automatically corrects air-fuel mixture to an optimum ratio. It operates in the following sequence when altitude is high.

1. The bellows in the altitude compensator extends.
2. The lever attached to the bellows then pushes up the needle.
3. When the needle is pushed up, the air passage becomes wider, allowing larger amount of air to flow from altitude compensator to the carburetor. As a result, the fuel becomes thinner.
4. With this additional air in the carburetor, air-fuel mixture becomes thin to a proper ratio.



SEF325

Fig. EF-30 Sectional View of Altitude Compensator

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INSPECTION AND ADJUSTMENT

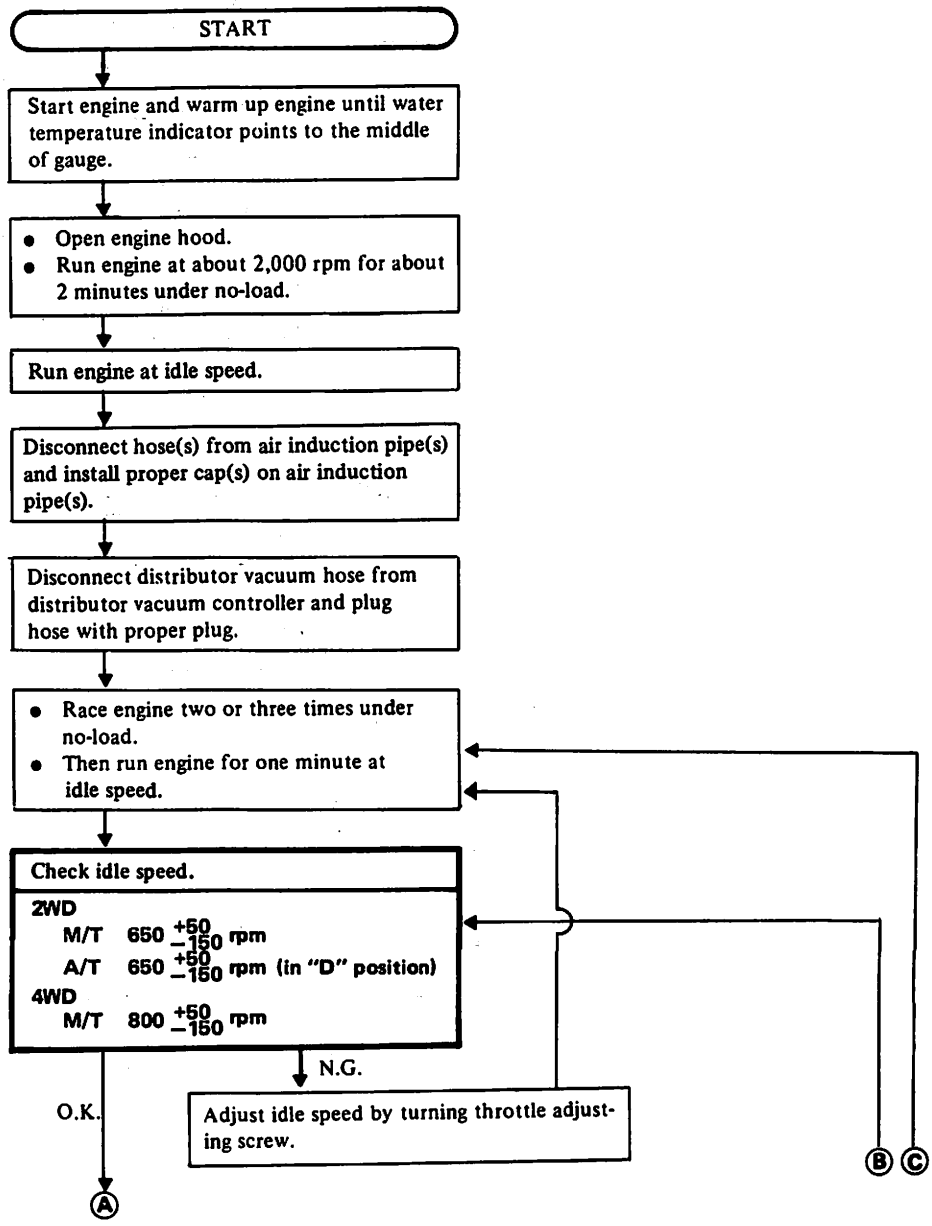
CARBURETOR IDLE-R.P.M. AND MIXTURE RATIO

Note: The idle mixture adjusting screw which has been preset at the factory should be adjusted only in the event of a major carburetor overhaul, throttle body replacement or to lower exhaust emissions as directed by official inspections. This screw should not be readjusted during routine maintenance. Adjusting mixture using other than the method below may violate Federal, or other state and Provincial laws.

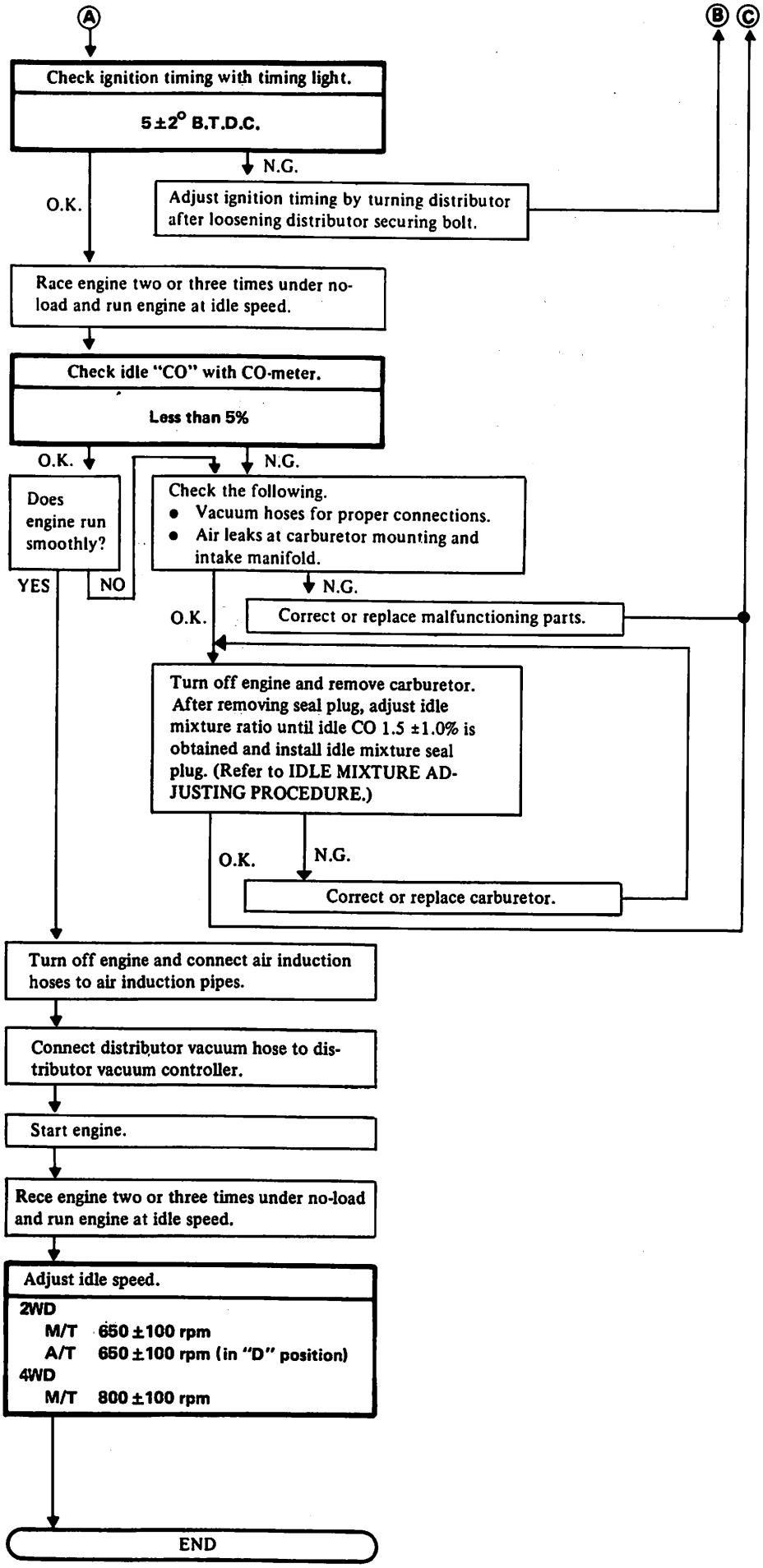
Preparation

1. Make sure that the following parts are in good order.
   - Ignition system
   - Engine oil and coolant levels
   - Valve clearance
2. Connect engine tachometer and timing light in their proper positions.
3. On air conditioner equipped models, the air conditioner system should be "OFF".
4. Apply parking brake and block both front and rear wheels with chocks.
5. When measuring "CO" percentage, insert probe more than 40 cm (15.7 in) into tail pipe.

WARNING:
a. Inspections should be carried out while shift lever is in "D" position on automatic transmission equipped models and in "Neutral" on manual transmission equipped models.
b. On automatic transmission equipped models, racing the engine should be carried out while shift lever is in "N" or "P" position and brake pedal should be depressed.
c. After adjustment has been made, shift the lever to "N" or "P" position.



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IDLE MIXTURE ADJUSTING PROCEDURE

CAUTION:

a. Removal of idle mixture seal plug should be performed only when idle mixture adjustment is necessary.

b. When installing carburetor, be sure to tighten to specified torque.

1. Turn off engine and remove carburetor from engine.
2. After removing carburetor, drill a hole in seal plug and remove plug with proper Tool.

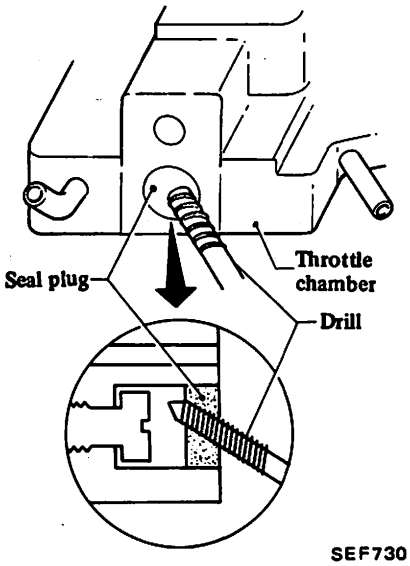


Fig. EF-31 Removing Idle Mixture Seal Plug

After drilling, be sure to remove shavings with compressed air.

3. After performing step 2, mount carburetor on engine.
4. Start engine, warm up engine sufficiently and race engine two or three times under no-load.
5. Then, run engine at idle speed and adjust idle CO% by turning idle adjusting screw.
6. If proper idle CO% is not obtained by adjustment, turn off engine and overhaul carburetor or replace it with a new one. Then adjust idle CO% by turning idle adjusting screw.
7. After adjusting idle CO% by step 5 or 6, turn off engine if engine runs smoothly and replace seal plug with a new one. But, if it doesn't, adjust idle CO% by step 5.

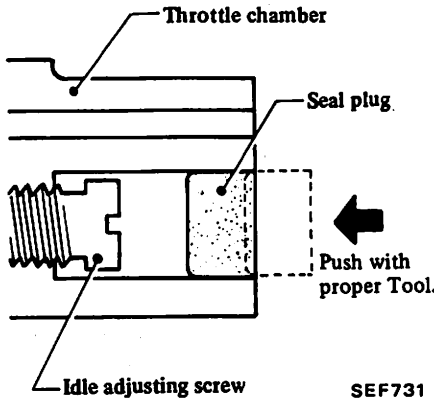


Fig. EF-32 Installing Idle Mixture Seal Plug

8. Finally, check idle CO% again. If idle CO% becomes abnormal, readjust it by starting from step 4.

FUEL LEVEL

1. With engine idling, visually check fuel level through sight window of float chamber. Fuel level is correct if it is at the indicator point.

Note: Fuel level indicator point is located 23 mm (0.91 in) below top of carburetor body (H' as shown in Figure below).

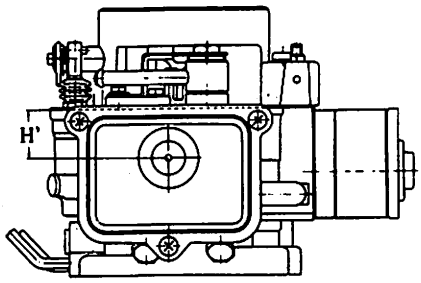


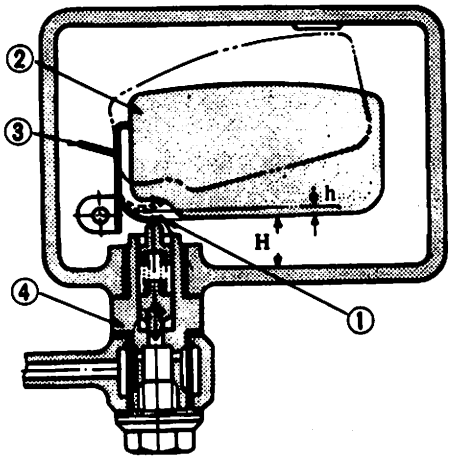
Fig. EF-33 Checking Fuel Level

To adjust fuel level, proceed as follows:

2. Remove level gauge cover.
3. Turn down float chamber to allow float to come into contact with needle valve, and measure "H" shown below.

When "H" is approximately 7.2 mm (0.283 in), top float position is correct.

The top float position can be adjusted by bending float seat.



1 Float seat
2 Float
3 Float chamber
4 Needle valve

Fig. EF-34 Adjusting Float Level

4. Adjust bottom float position so that clearance "h" between float seat and needle valve stem is 1.3 to 1.7 mm (0.051 to 0.067 in) when float is fully raised. Bend float stopper as required.
5. Install level gauge cover.
6. After adjustments in steps 3 and 4 above have been made, make sure that when fuel is delivered to the float chamber, the fuel level is maintained within the specified value H'.

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AUTOMATIC CHOKE MECHANISM

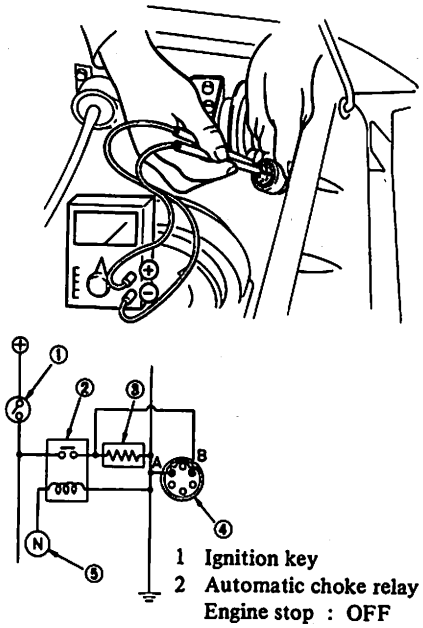
1. Before starting engine, fully depress accelerator pedal to ensure that choke valve closes properly.
2. Push choke valve with a finger, and check for binding.
3. Check automatic choke heater source wiring for proper connection, then start engine.
4. After warming up the engine, see that choke valve is fully open.
5. If automatic choke heater source wiring is normal and choke valve does not operate after warm-up, replace choke chamber assembly.

AUTOMATIC CHOKE HEATER CIRCUIT

Checking heater circuit with function connector

CAUTION:
Do not attach test leads of a circuit tester to those other than designated.

1. With engine not running, check for continuity between A and B as shown in Figure.
   - If continuity exists, heater is functioning properly.
   - If continuity does not exist, check for disconnected connector or open P.T.C. heater circuit.
2. With engine running at idle, check for presence of voltage across A and B as shown in Figure.
   - If voltmeter reading is 12 volts (d-c), heater circuit is functioning properly.
   - If voltmeter reading is zero, check for disconnected connector, open circuit, or faulty automatic choke relay.
3. Replace faulty parts.



1 Ignition key
2 Automatic choke relay
Engine stop : OFF
Engine start : ON
3 Automatic choke heater
4 Function test connector
5 Alternator

Fig. EF-35 Checking Automatic Choke Heater Circuit

AUTOMATIC CHOKE HEATER

1. Measure resistance of choke heater as shown in Figure below.

Resistance of choke heater:
3.7 - 8.9 ohms

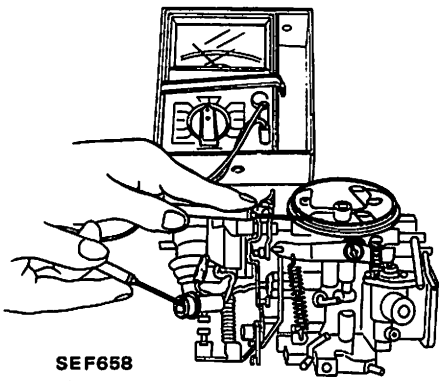


Fig. EF-36 Automatic Choke Heater Check

2. If measured value is not within the specification, replace choke chamber assembly.

AUTOMATIC CHOKE RELAY

1. Remove automatic choke relay. The relay is located in the relay bracket.

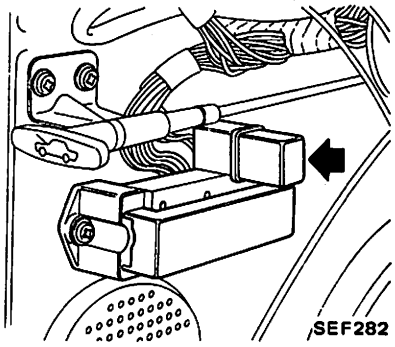
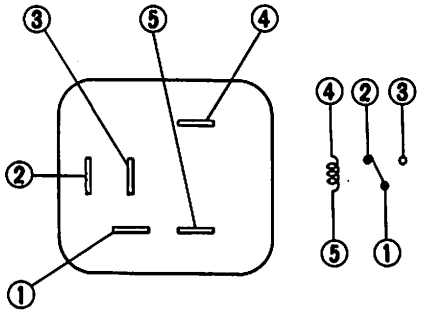


Fig. EF-37 Automatic Choke Relay

2. Check for continuity between ④ and ⑤. Continuity should exist.
   Check for continuity between ① and ②. Continuity should exist.
   Check for continuity between ① and ③. Continuity should not exist.
3. Apply a 12-volt d.c. across ④ and ⑤ to ensure that continuity exists between ① and ③ and that continuity does not between ① and ②. If test results do not satisfy the above, replace the automatic choke relay.



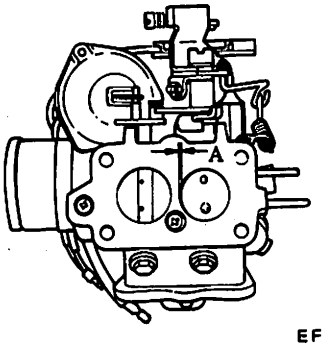
1 From "IG" position
2 To automatic choke heater
3 Useless
4 From alternator
5 From ignition switch

Fig. EF-38 Checking Automatic Choke Relay

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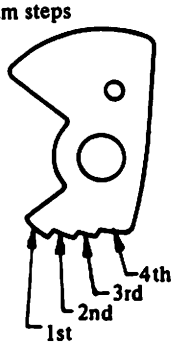
FAST IDLE

1. With carburetor assembly removed from engine, measure throttle valve clearance "A" with a wire gauge, placing the upper side of fast idling screw on the first step on the fast idling cam.



EF109A

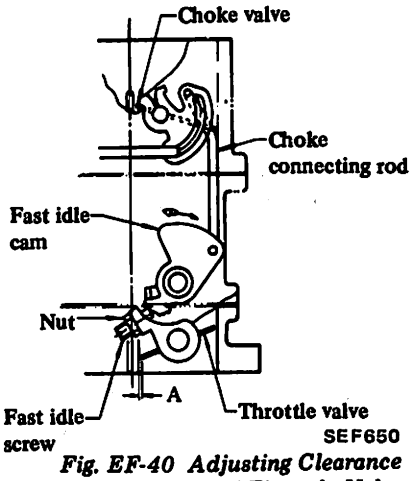
Fast idle cam steps



EC628

Fig. EF-39 Measuring Throttle Valve Clearance

2. The clearance should be specified value in the following table. If not, adjust the clearance by turning fast idle screw.



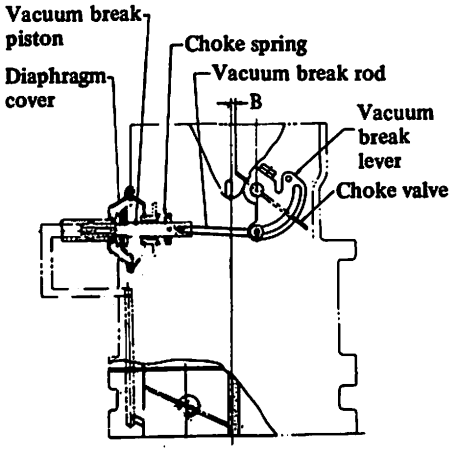
SEF650

Fig. EF-40 Adjusting Clearance of Throttle Valve

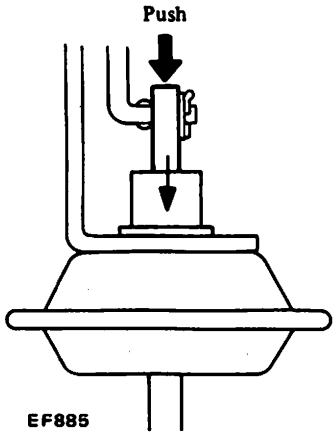
	Clearance "A" at 2nd step mm (in)	
	California	Non-California
M/T	0.81 - 0.95 (0.0319 - 0.0374)	0.81 - 0.95 (0.0319 - 0.0374)
A/T	0.98 - 1.12 (0.0386 - 0.0441)	1.00 - 1.10 (0.0394 - 0.0433)

VACUUM BREAK

1. Close choke valve completely.
2. Hold choke valve by stretching a rubber band between vacuum break lever and stationary part of carburetor.
3. Push vacuum break stem with pliers, and pull fully straight.
4. Under this condition, adjust gap (shown at "B" in illustration) between choke valve and carburetor body.



SEF654



EF885

Fig. EF-41 Checking Vacuum Break

Choke valve to carburetor body clearance (Vacuum break) B:
At 25°C (77°F)
California
3.12 - 3.72 mm
(0.1228 - 0.1465 in)
Non-California
2.62 - 3.22 mm
(0.1031 - 0.1268 in)

CHOKE UNLOADER

1. Close choke valve completely.
2. Hold choke valve by stretching a rubber band between vacuum break lever and stationary part of carburetor.
3. Pull throttle lever until full open. Under this condition, adjust clearance between choke valve and carburetor body to the specification by bending unloader tongue.

Choke valve to carburetor body clearance (Choke unloader):
B = 2.05 - 2.85 mm
(0.0807 - 0.1122 in)

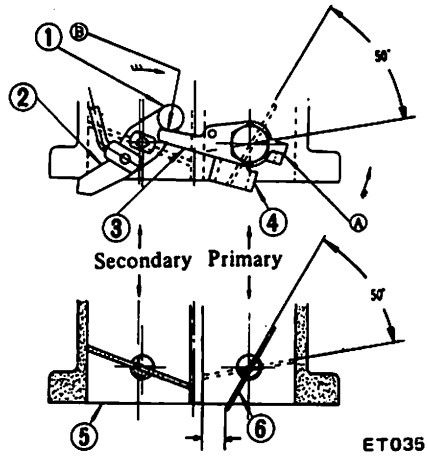
Note: Make sure that throttle valve opens when carburetor is mounted on the car.
If throttle valve fails to open, unloader becomes inoperative, resulting in poor acceleration just after engine is started.

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INTERLOCK OPENING OF PRIMARY AND SECONDARY THROTTLE VALVE

Fig. EF-42 shows primary throttle valve opened 50°. When primary throttle valve is opened 50° the adjust plate integrated with throttle valve is in contact with return plate at Ⓐ.

When throttle valve is opened further, locking arm Ⓑ is detached from secondary throttle arm, permitting secondary system to start operation.



7.38 - 8.38 mm (0.2906 - 0.3299 in)

1	Roller	4	Adjust plate
2	Connecting lever	5	Throttle chamber
3	Return plate	6	Throttle valve

Fig. EF-42 Adjusting Interlock Opening

Linkage between primary and secondary throttles will function properly if distance between throttle valve and inner wall of throttle chamber is 7.38 to 8.38 mm (0.2906 to 0.3299 in).

Adjustment is made by bending connecting link.

DASH POT

Note: Check dash pot with air conditioning system (if so equipped) "OFF".

1. Idle speed of engine and mixture must be well tuned up and engine sufficiently warm.
2. Turn throttle valve by hand, and read engine speed when dash pot just touches stopper lever.
3. Adjust position of dash pot by adjusting screw until engine speed is in the specified range.

Specified engine speed:

A/T 1,400 - 1,600 rpm

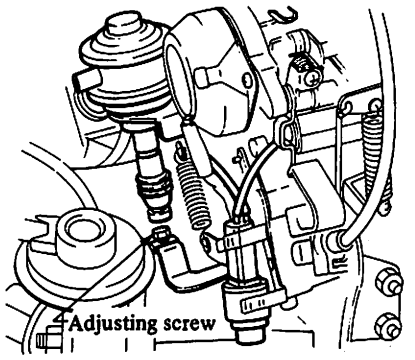


Fig. EF-43 Adjusting Dash Pot

4. Make sure that engine speed drops smoothly from 2,000 to 1,000 rpm in about three seconds.

Note: For adjustment of F.I.C.D. on air conditioner equipped models, refer to Section HA.

ALTITUDE COMPENSATOR (California models)

Notes:

a. **The altitude compensator is set to operate above an altitude of approximately 600 m (1,969 ft). It should be carefully checked.**
b. **When making this check, ensure that all other parts are working properly.**
c. **The altitude compensator cannot be adjusted; if it is found to be functioning unsatisfactorily, it must be replaced as an assembly.**
d. **The hoses are color-coded. When connecting them, be sure to align them with the proper color marks on the unit.**

Compensator at low altitudes

If the compensator should be operating at low altitudes, any of the following four symptoms may result:

1. Hesitation (a) and stumble (b) when engine is started.
2. Surge (c) when crusing at approximately 80 km/h (50 MPH).
3. Stumble (b) when accelerating in the 80 to 112 km/h (50 to 70 MPH) range.
4. Poor acceleration at full throttle (it takes too long to attain full acceleration.).

When the compensator is malfunctioning, check it by sucking or blowing air through the inlet and outlet hoses. If air flows through smoothly, replace the unit as an assembly.

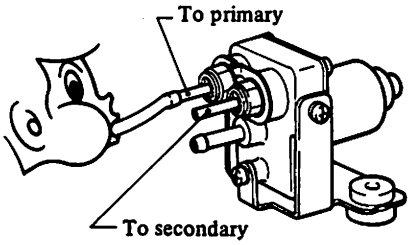


Fig. EF-44 Altitude Compensator Check

Compensator at high altitudes

If the compensator should not be operating at high altitudes, any of the following four symptoms may result:

1. Engine speed does not increase in proper response to accelerator depression under no-load condition.
2. Hesitation (a) and stumble (b) when engine is started.
3. Poor acceleration at full throttle (it takes too long to attain full acceleration.).
4. Smooth running at partial throttle begins to depend upon altitude.

When the compensator is malfunctioning, check it by sucking or blowing air through the inlet and outlet hoses. If air does not flow through smoothly, replace the unit as an assembly.

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Notes:

a. Hesitation:
A temporary lack of initial response in acceleration rate.

b. Stumble:
A short, sharp reduction in acceleration rate.

c. Surge:
A continued condition of short, sharp fluctuations in power. These may be cyclic or random, and can occur at any speed and/or load.
Surge is usually caused by excessively lean carburetor mixtures.

ACCELERATING PUMP

1. Visually inspect accelerating pump cover for any sign of fuel leaks.
2. If fuel leaks are found, check gasket, and replace if necessary.
3. Turn throttle valve by hand; make sure fuel is injected through injector nozzle.

Note: To check for fuel injection, peep into nozzle from upper side while directing flashlight beam toward primary barrel.

Accelerating pump adjusting screw

Note: Do not tamper with adjusting screw except when adjusting discharge amount of accelerating pump during overhaul, etc.

1. With carburetor removed from engine, pour gasoline into fuel float chamber.
2. Fully open choke valve.
3. Slowly turn throttle lever about 10 times, from fully closed position to fully open position, keeping throttle lever fully open at least 3 seconds per stroke.
4. Measure injection quantity of accelerating pump.

Injection quantity:
0.5 ±0.15 mℓ
(0.017 ±0.005 US fl oz,
0.018 ±0.005 Imp fl oz)/stroke

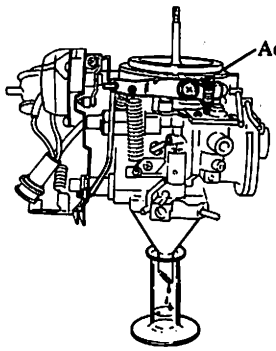


Fig. EF-45 SEF341

5. Adjust injection quantity by turning adjusting screw.

Turn counterclockwise
. . . . . quantity increases
Turn clockwise
. . . . . quantity decreases

6. Paint adjusting screw after adjustment.
7. If specified quantity is not obtained, check pump piston, pump seal and injection passage for leakage and clogging.

ANTI-DIESELING SOLENOID VALVE

Check this valve if engine continues to turn over after ignition switch has been turned off or if engine does not continue to run at idle.

1. Disconnect anti-dieseling solenoid connector to see if engine stops. If it does not, replace anti-dieseling solenoid valve assembly.
2. Make sure 12-volt d-c power is applied at harness side when ignition switch is turned on. If it is not, check harness.

If harness is in good condition, replace solenoid valve as a unit.

Ⓣ : **Anti-dieseling solenoid valve**
18 - 34 N·m
(1.8 - 3.5 kg-m,
13 - 25 ft-lb)

Note: After replacement, start engine and check to be sure that fuel is not leaking, and that anti-dieseling solenoid is in good condition.

MAJOR SERVICE OPERATION

The perfectly adjusted carburetor delivers the proper fuel and air ratios at all speeds for the particular engine for which it was designed. By completely disassembling which will allow cleaning of all parts and passages, the carburetor can be maintained its original condition and will continue to deliver the proper ratios.

To maintain accurate carburetion of passages and discharge holes, extreme care must be taken in cleaning.

CAUTION:
Use only carburetor solvent and compressed air to clean all passages and discharge holes. Never use wire or other pointed instrument to clean or carburetor calibration will be affected.

REMOVAL AND INSTALLATION

Remove carburetor from engine, taking sufficient care to the following:

CAUTION:
a. When disconnecting fuel lines, do not spill fuel from fuel pipe.
b. When removing carburetor, do not drop any nut or bolt into intake manifold.
c. Be careful not to bend or scratch any part.

1. Remove air cleaner.
2. Disconnect fuel lines and vacuum lines.
3. Disconnect lead wire connector for auto-choke heater, and anti-dieseling solenoid.
4. Disconnect accelerator wire from throttle lever.
5. Remove screws securing carburetor body to intake manifold.

Carburetor assembly can then be taken out.

6. Installation is in the reverse sequence of removal.

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DISASSEMBLY AND ASSEMBLY

Following instructions should be observed.

Disassembly

1. Properly fitting wrenches and screwdrivers must be used on the nozzles and jets as well as on the screws and nuts, and care must be exercised not to damage any parts.
2. Clean the carburetor thoroughly before disassembly.
3. Do not attempt to remove any parts marked with an asterisk (*) in the following illustrations.

Assembly

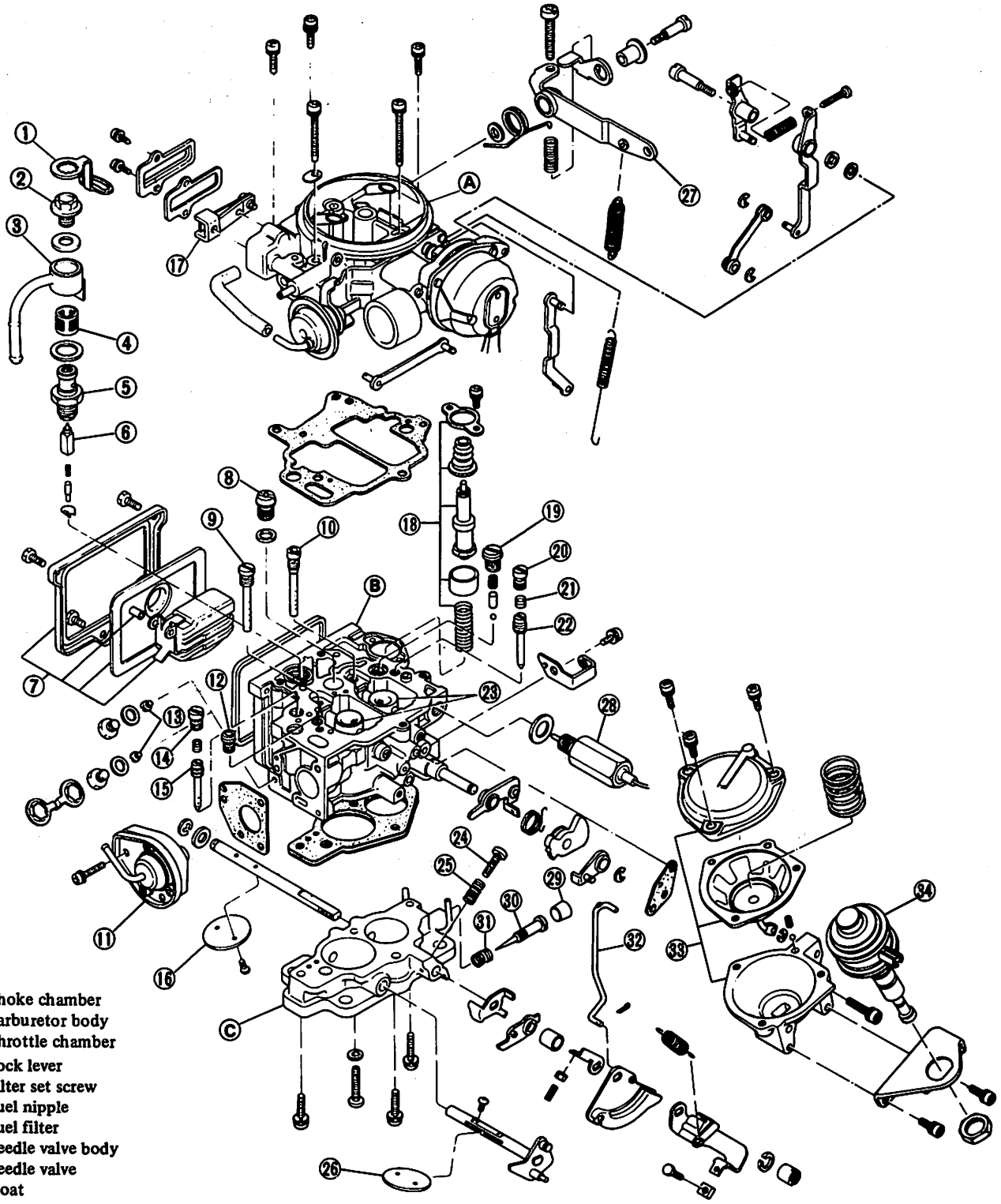
To assemble, reverse the disassembly procedure, noting the following:

1. Thoroughly wash all the parts before assembling.
2. Inspect gaskets to see if they appear hard or brittle or if edges are torn or distorted.

If any of such undesirable conditions is noted, they must be replaced.

3. Install jet and air bleed having the same size number as that of original one.
4. After reassembling carburetor, check each rotating portion or sliding portion for smooth operation.

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A Choke chamber
B Carburetor body
C Throttle chamber
1 Lock lever
2 Filter set screw
3 Fuel nipple
4 Fuel filter
5 Needle valve body
6 Needle valve
7 Float
8 Power valve
9 Secondary main air bleed
10 Primary main air bleed
11 B.C.D.D.
12 Secondary slow air bleed
13 Secondary main jet
14 Plug
15 Secondary slow jet
16 Primary throttle valve
17 Idle compensator
18 Accelerating pump parts
19 Plug for accelerating mechanism
20 Plug
21 Spring
22 Primary slow jet
23 Primary and secondary small venturi
24 Throttle adjusting screw
25 Throttle adjusting screw spring
26 Secondary throttle valve
27 Accelerating pump lever
28 Anti-dieseling solenoid valve
29 Blind plug
30 Idle adjusting screw
31 Idle adjusting screw spring
32 Choke connecting rod
33 Diaphragm chamber parts
34 Dash pot

SEF728

Fig. EF-46 Carburetor Parts

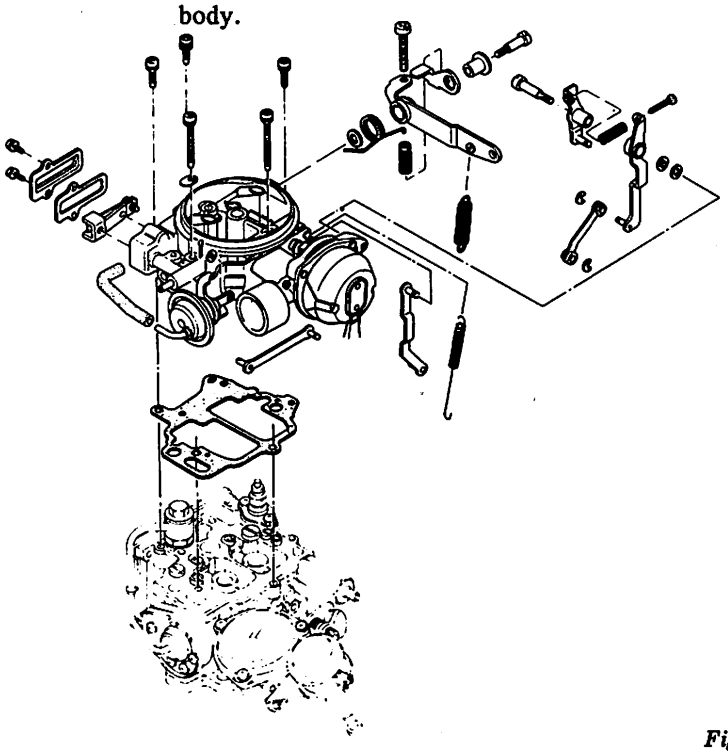
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Choke chamber parts

1. Disconnect accelerating pump rod and choke connecting rod.
2. Remove throttle return spring and vacuum hose for vacuum break diaphragm.
3. Remove four screws securing choke chamber assembly to center body.

Choke chamber assembly can then be taken out.

4. Installation is in the reverse sequence of removal.



SEF729

Fig. EF-47 Choke Chamber Parts

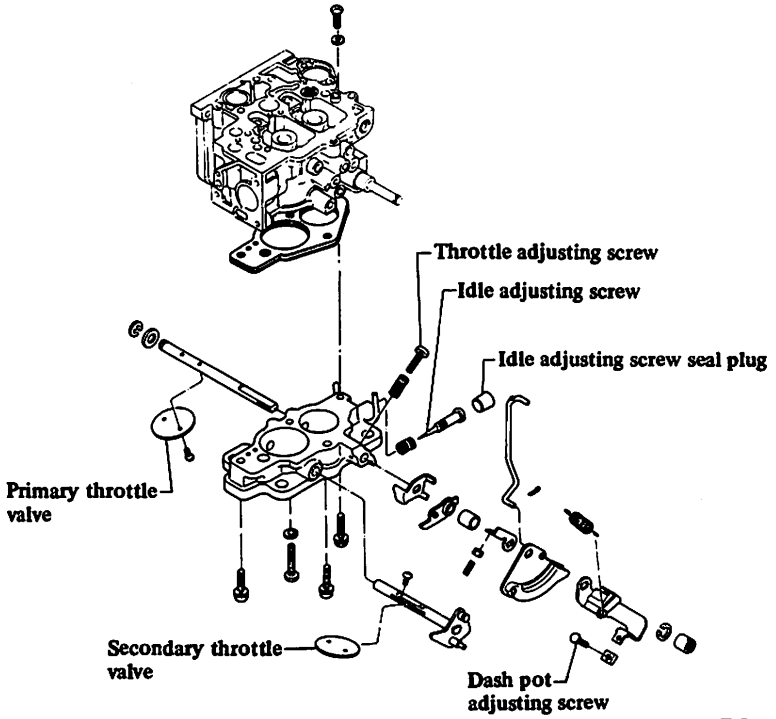
Throttle chamber parts

1. Remove three screws securing diaphragm chamber for secondary throttle valve.
2. Loosen four screws securing throttle chamber parts.

Throttle chamber can then be taken out.

3. Installation is in the reverse sequence of removal.

Note: One of three screws has a hole for power valve mechanism in itself. Take care not to confuse them.



SEF657

Fig. EF-48 Throttle Chamber Parts

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TROUBLE DIAGNOSES AND CORRECTIONS

In the following table, the symptoms and causes of carburetor troubles and remedies for them are listed to facilitate quick repairs.

There are various causes of engine malfunctions. It sometimes happens that a carburetor which has no fault appears to have some problems, when actually the electric system is at fault. Therefore, whenever the engine is malfunctioning, the electrical system should be checked first, before adjusting carburetor.

Condition	Probable cause	Corrective action
Overflow	Dirt accumulated on needle valve.	Clean needle valve.
	Fuel pump pressure too high.	Repair pump.
	Needle valve improperly seated.	Replace.
	Float damaged.	Replace.
	Fuel return tube clogged.	Replace.
Excessive fuel consumption	Fuel overflow.	See condition "overflow".
	Slow jet too large on each main jet.	Replace.
	Main air bleed clogged.	Clean.
	Choke valve does not open fully.	Adjust.
	Outlet valve seat of accelerator pump improper.	Lap.
	Linked opening of secondary throttle valve opens too early.	Adjust.
Power shortage	Main jets clogged.	Clean.
	Every throttle valve does not open fully.	Adjust.
	Idling adjustment incorrect.	Adjust.
	Fuel filter clogged.	Repair.
	Vacuum jet clogged.	Clean.
	Air cleaner clogged.	Clean.
	Diaphragm damaged.	Replace.
	Power valve operating improperly.	Adjust.
Improper idling	Slow jet clogged.	Clean.
	Every throttle valve does not close.	Adjust.
	Secondary throttle valve operating improperly.	Overhaul and clean.
	Throttle valve shafts worn.	Replace.
	Packing between manifold/carburetor faulty.	Replace packing.
	Manifold/carburetor tightening improper.	Correct tightening.
	Fuel overflow.	See condition "overflow".
	Electric automatic choke damaged.	Replace.
	B.C.D.D. adjustment incorrect.	Adjust.
	Anti-dieseling solenoid damaged.	Replace.
	Stuck dash pot.	Replace.

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Condition	Probable cause	Corrective action
Engine hesitation	Main jet or slow jet clogged.	Clean.
	By-pass hole, idle passage clogged.	Clean tube.
	Emulsion tube clogged.	Clean.
	Idling adjustment incorrect.	Adjust.
	Secondary throttle valve operating improperly.	Overhaul and clean.
Engine does not start.	Fuel overflows.	See condition "overflow".
	No fuel.	Check pump, fuel pipe and needle valve.
	Idling adjustment incorrect.	Adjust.
	Fast idle adjustment incorrect.	Adjust.
	Damaged anti-dieseling solenoid.	Replace.
Fuel filter	Fuel filter clogged.	Replace.
Air cleaner	Air cleaner filter clogged.	Replace filter.
Fuel tank	No fuel.	Refuel.

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

CARBURETOR

Destination		California			Non-California*1	
Class		Standard	Heavy duty	4WD	Standard	Heavy duty
Model	M/T	DCR342-11 DCR342-12*2	DCR342-21 DCR342-22*2	DCR342-17 DCR342-18*2	DCR342-14 DCR342-15*2	DCR342-23 DCR342-24*2
	A/T	DCR342-13	–	–	DCR342-16	–
Outer diameter mm (in)	Primary	32 (1.26)				
	Secondary	34 (1.34)				
Large venturi diameter mm (in)	Primary	24.1 (0.949)				
	Secondary	32 (1.26)				
Main jet	Primary	#112	#110		#105	
	Secondary	#155	#145	#155		
Main air bleed	Primary	#90			#80	
	Secondary	#60				
Slow jet	Primary	#47				
	Secondary	#100	#80	#100		
Power valve		#35			#40	

*1: Including Canada
*2: Air conditioner equipped models

INSPECTION AND ADJUSTMENT

A.T.C. AIR CLEANER

Unit: °C (°F)

Air control valve partially opens	30 - 54 (86 - 129)
Air control valve fully opens	Above 55 (131)

MECHANICAL FUEL PUMP

Fuel pressure kPa (kg/cm^2, psi)	20.6 - 26.5 (0.21 - 0.27, 3.0 - 3.8)
Fuel pump capacity mℓ (US fl oz, Imp fl oz)/min at 1,000 rpm	More than 1,700 (57.5, 59.8)

ELECTRIC FUEL PUMP

Fuel pressure (maximum) kPa (kg/cm^2, psi)	21.6 - 26.5 (0.22 - 0.27, 3.1 - 3.8)
Fuel pump capacity mℓ (US fl oz, Imp fl oz)/min	More than 1,400 (47.3, 49.3)

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CARBURETOR

		M/T	A/T
Fuel level adjustment Fuel level (from top of carburetor body) mm (in) H'		23 (0.91)	
Gap between valve stem and float seat mm (in) H		7.2 (0.283)	
h		1.3 - 1.7 (0.051 - 0.067)	
Fast idle adjustment (at 2nd cam step)	California	0.81 - 0.95 (0.0319 - 0.0374)	0.98 - 1.12 (0.0386 - 0.0441)
Gap between throttle valve and carburetor body mm (in)	Non-California	0.81 - 0.95 (0.0319 - 0.0374)	1.00 - 1.10 (0.0394 - 0.0433)
Vacuum break adjustment Gap between choke valve and carburetor body mm (in) at 25°C (77°F)	California	3.12 - 3.72 (0.1228 - 0.1465)	
	Non-California	2.62 - 3.22 (0.1031 - 0.1268)	
Choke unloader adjustment Gap between choke valve and carburetor body mm (in)		2.05 - 2.85 (0.0807 - 0.1122)	
Interlock opening of primary and secondary throttle valves mm (in)		7.38 - 8.38 (0.2906 - 0.3299)	
Dash pot adjustment (without loading) rpm		–	1,400 - 1,600

TIGHTENING TORQUE

Unit	N-m	kg-m	ft-lb
Anti-dieseling solenoid valve	18 - 34	1.8 - 3.5	13 - 25
B.C.D.D.	2 - 4	0.2 - 0.4	1.4 - 2.9

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EMISSION CONTROL SYSTEM

SECTION EC

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EMISSION CONTROL DEVICES

Item	Engine model	Z22			
	Destination	U.S.A.			Canada
		California models		Non-California models	
	Transmission	M/T	A/T	M/T	A/T
Air inlet system	Automatic temperature control air cleaner	X	X	X	X
	Fresh air duct	X	X	X	X
	Early fuel evaporative system (Hot water type)	X	X	X	X
	Hot idle compensator	X	X	X	X
Carburetor	P.T.C. auto choke	X	X	X	X
	Altitude compensator	X	X	–	–
	Dash pot	–	X	–	X
Ignition system	IC ignitor (for 2 plugs)	X	X	X	X
	Water temperature control	X	X	X	X
	Idle advance control system	X	X	X	X
Air induction system	Exhaust air induction (E.A.I.) type (type-A)	X	X	–	–
	Exhaust air induction (E.A.I.) type (type-B)	–	–	X	X
E.G.R. system	E.G.R. system with V.V.T. valve	X	X	X	X
Deceleration control system	Fuel shut-off system	X	X	X	X
	Intake manifold vacuum control system	X	X	X	X
Catalyzer	Oxidation catalytic converter	X	X	X	X
Evaporator system	Canister	X	X	X	X
Crankcase ventilation system	P.C.V.	X	X	X	X

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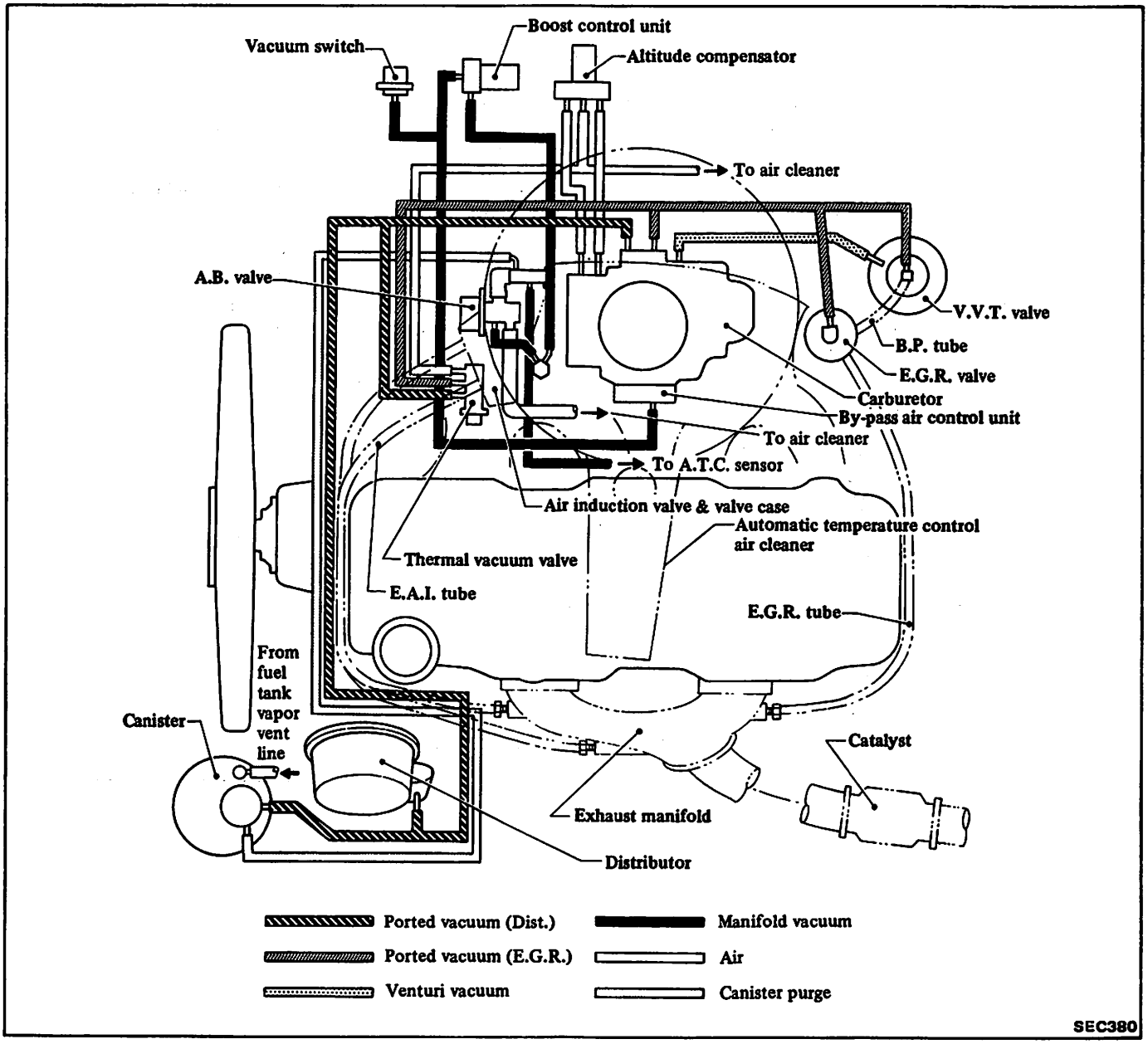
GENERAL DESCRIPTION

There are three types of control systems which are as follows:

1. Closed type crankcase emission control system
2. Exhaust emission control system
3. Evaporative emission control system

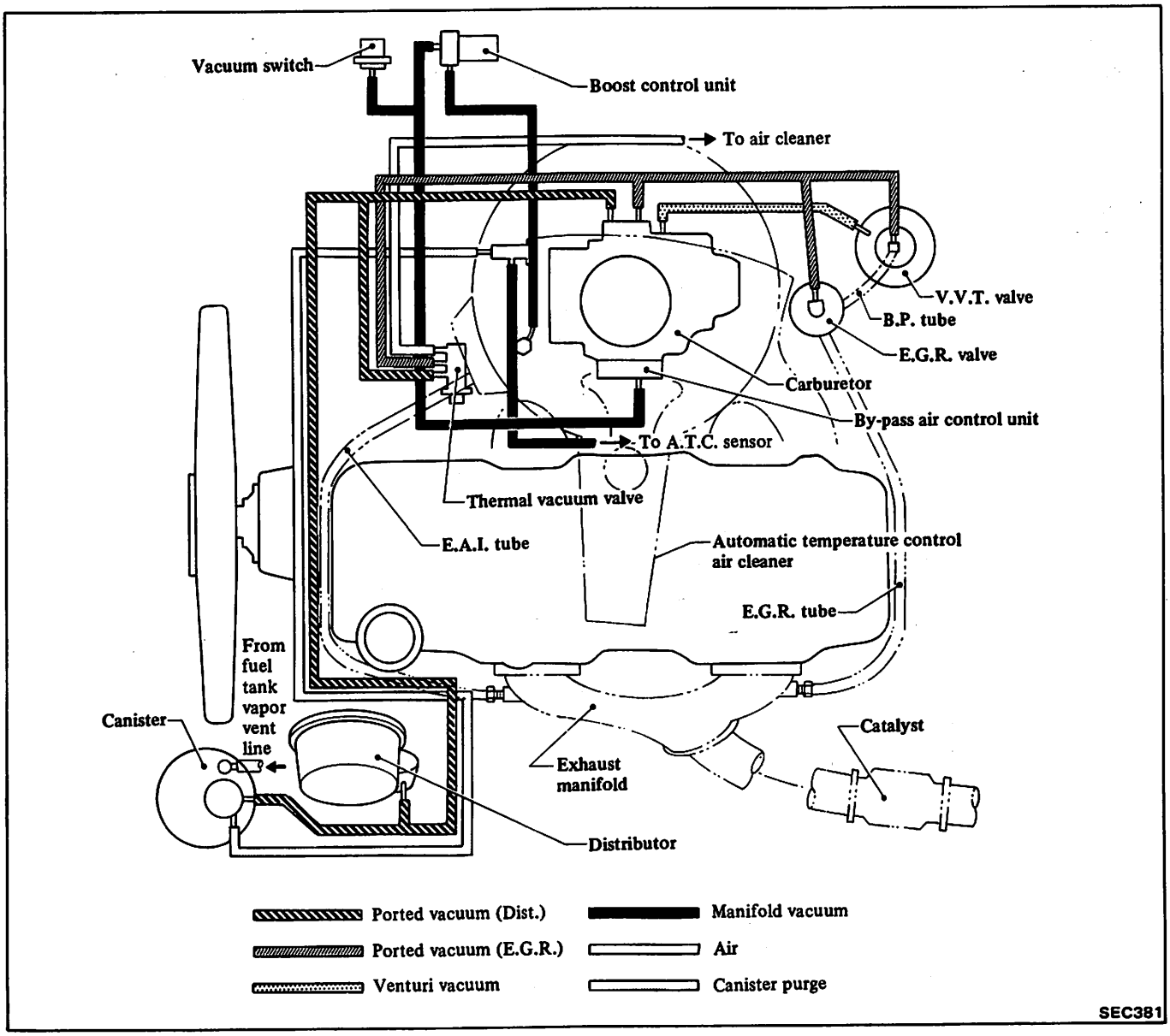
Periodic inspections and necessary servicing of these systems should be performed to keep harmful emissions to a minimum.

CALIFORNIA MODELS



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NON-CALIFORNIA MODELS



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CRANKCASE EMISSION CONTROL SYSTEM

DESCRIPTION

This system returns blow-by gas to both the intake manifold and carburetor air cleaner.

The positive crankcase ventilation (P.C.V.) valve is provided to conduct crankcase blow-by gas to the intake manifold.

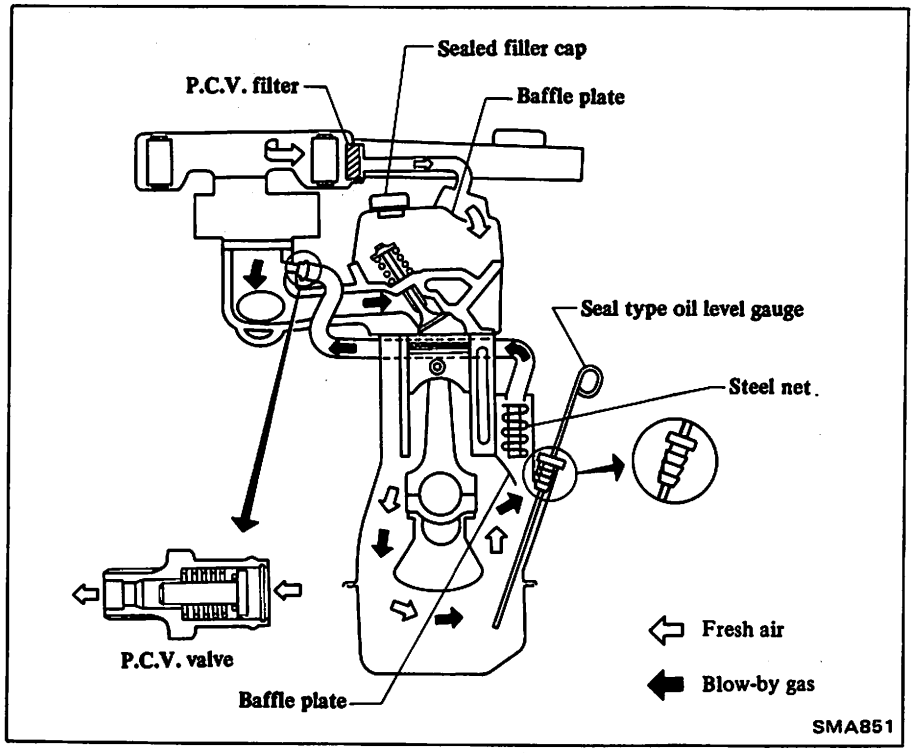
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. valve.

Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.

The ventilating air is then drawn through the tube connecting carburetor air cleaner to rocker cover, into the crankcase.

Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve, and its flow goes through the tube connection in the reverse direction.

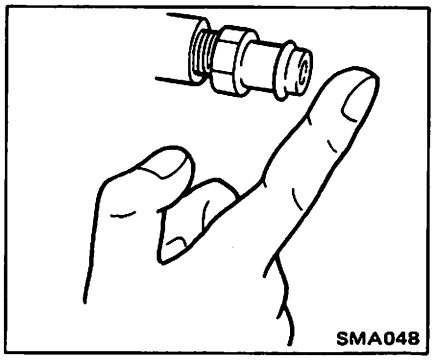
On vehicles with an excessively high blow-by some of the flow will go through the tube connection to carburetor air cleaner under all conditions.



INSPECTION

P.C.V. VALVE AND FILTER

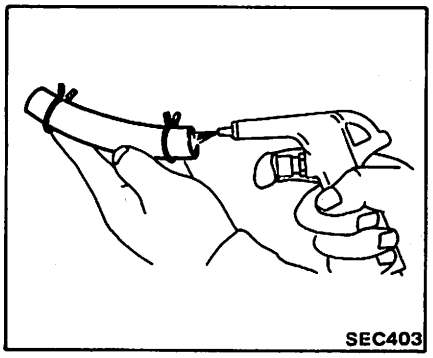
With engine running at idle, remove the ventilator hose from P.C.V. valve, if the valve is working, a hissing noise will be heard as air passes through the valve and a strong vacuum should be felt immediately when a finger is placed over valve inlet.



VENTILATION HOSE

1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air.

If any hose cannot be free of obstructions, replace.



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EXHAUST EMISSION CONTROL SYSTEM

DESCRIPTION

The exhaust emission control system is made up of following:

Destination / Emission control system	U.S.A.	Canada
	California models	Non-California models
Air induction system	(Type A) • Air induction valve • E.A.I. pipe • A.B. valve	(Type B) • Air induction valve • E.A.I. pipe
E.G.R. system	• E.G.R. valve • Thermal vacuum valve (3-port type) • V.V.T. valve	• E.G.R. valve • Thermal vacuum valve (3-port type) • V.V.T. valve
Spark timing control system	• Thermal vacuum valve (3-port type) • Vacuum tank of distributor	• Thermal vacuum valve (3-port type) • Vacuum tank of distributor
Fuel shut-off system	• Vacuum switch • Solenoid valve • Neutral switch (M/T only) • Clutch switch (M/T only) • Inhibitor switch (A/T only)	• Vacuum switch • Solenoid valve • Neutral switch (M/T only) • Clutch switch (M/T only) • Inhibitor switch (A/T only)
Intake manifold vacuum control system	• Boost control unit • By-pass air control unit	• Boost control unit • By-pass air control unit
Catalyst	• Catalytic converter	• Catalytic converter

AIR INDUCTION SYSTEM

DESCRIPTION

The air induction system is designed to send secondary air to the exhaust manifold, utilizing a vacuum caused by exhaust pulsation in the exhaust manifold.

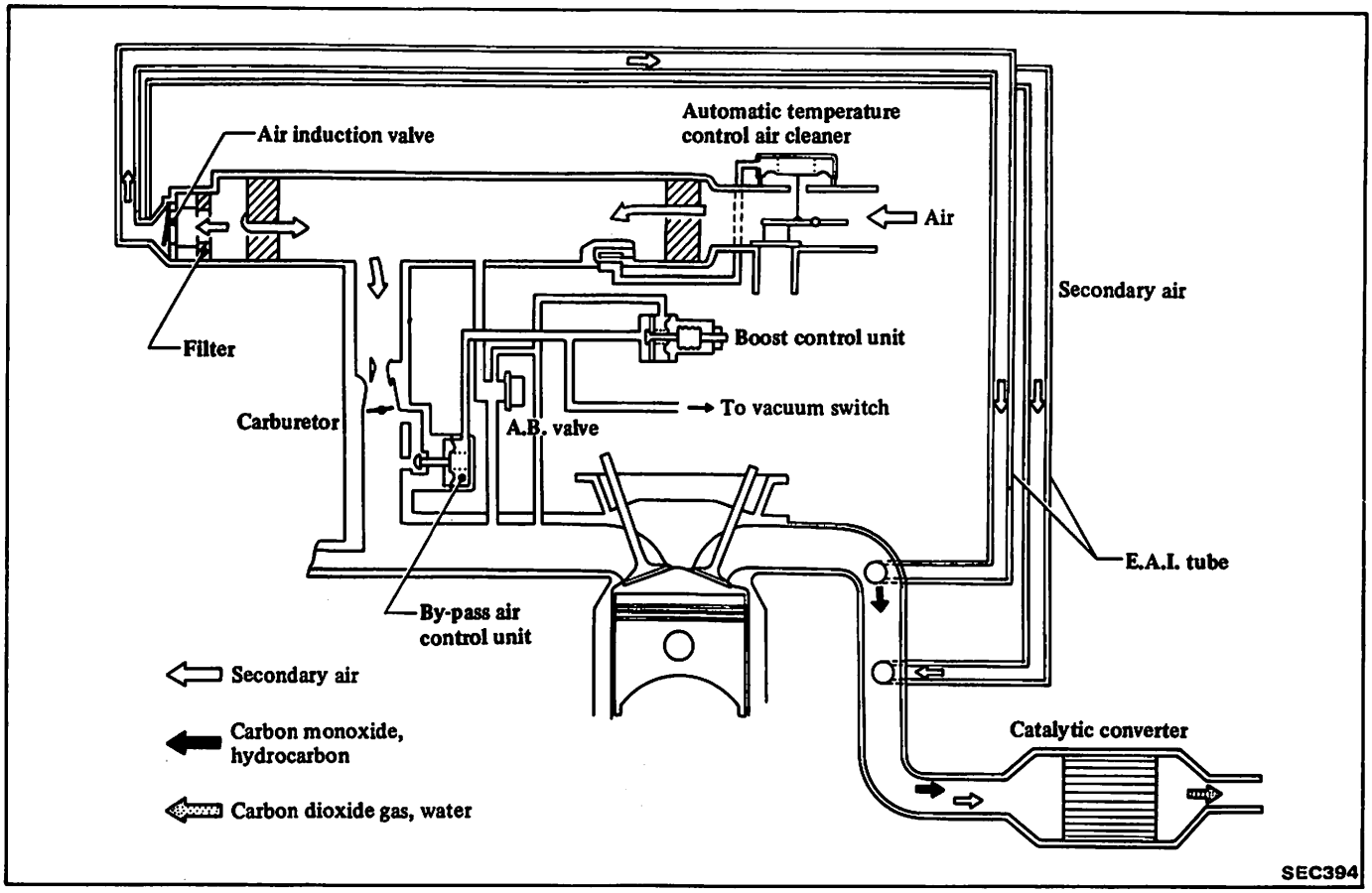
The exhaust pressure in the exhaust manifold usually pulsates in response to the opening and closing of the exhaust valve and it decreases below atmospheric pressure periodically.

If a secondary air intake pipe is opened to the atmosphere under vacuum conditions, secondary air can be drawn into the exhaust manifold in proportion to the vacuum.

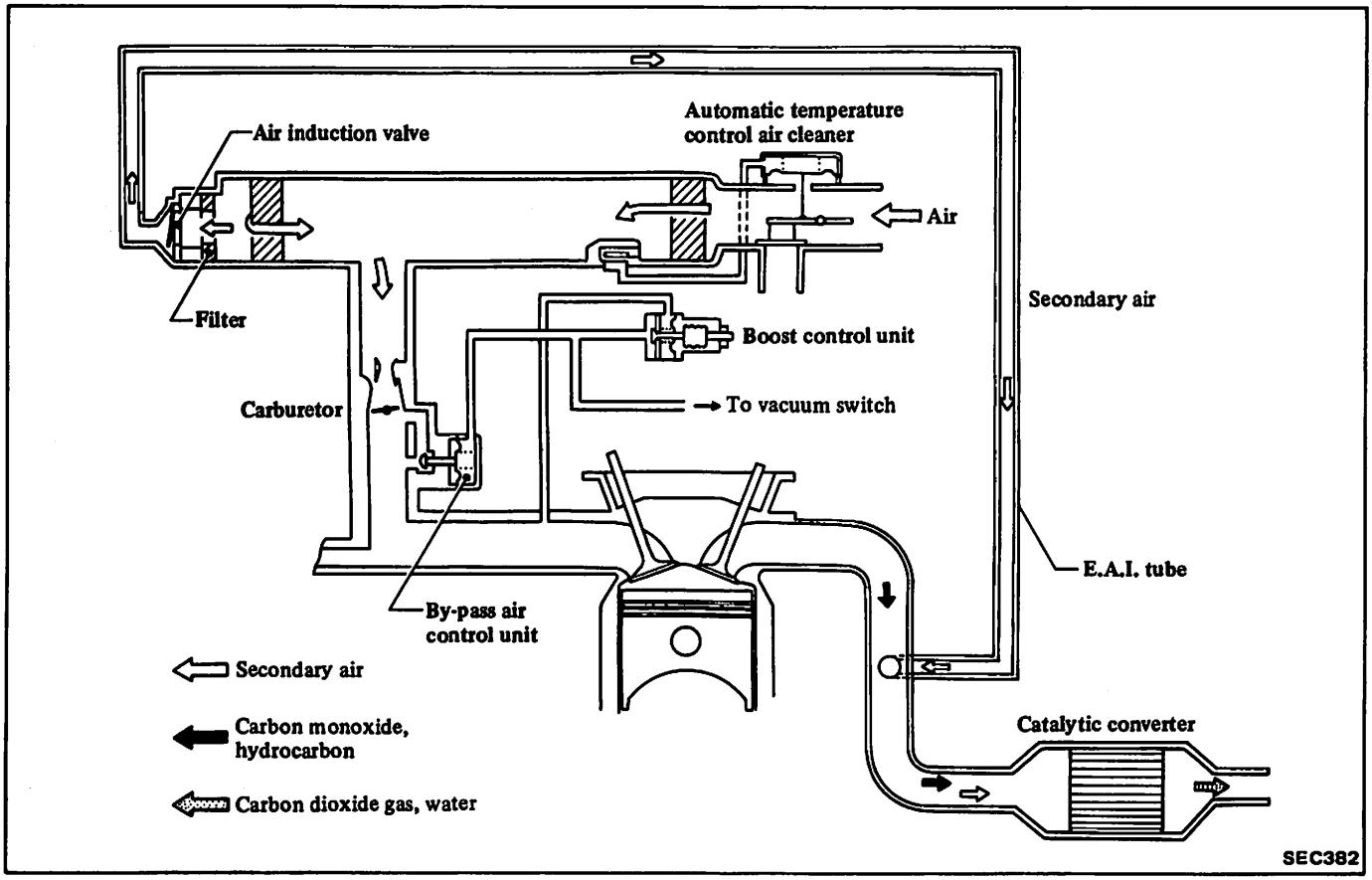
Therefore, the air induction system reduces CO and HC emissions in exhaust gases. The system consists of two air induction valves, a filter, hoses and E.A.I. tube(s).

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Type-A



Type-B

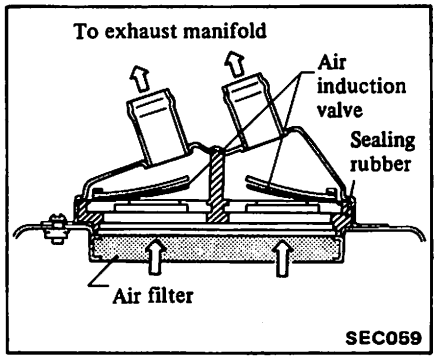


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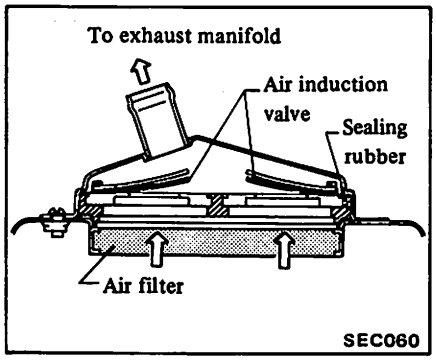
Air induction valve case

The air induction valve case consists of two reed valves, a rubber seal and a filter and is attached to the air cleaner. There are two types of air induction valve cases. Type-A is equipped with two hose connectors and is installed on California models, while Type-B is equipped with one connector and is installed on non-California models.

Type-A



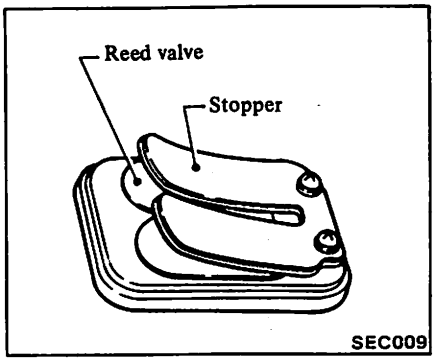
Type-B



Air induction valve

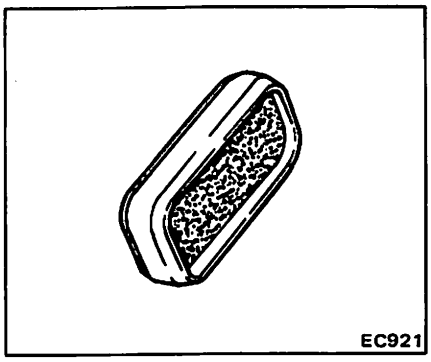
Two reed valve type check valves are installed in the air cleaner. When the exhaust pressure is below atmospheric pressure (negative pressure), secondary air is sent to the exhaust manifold.

When the exhaust pressure is above atmospheric pressure, the reed valves prevent secondary air from being sent back to the air cleaner.



Air induction valve filter

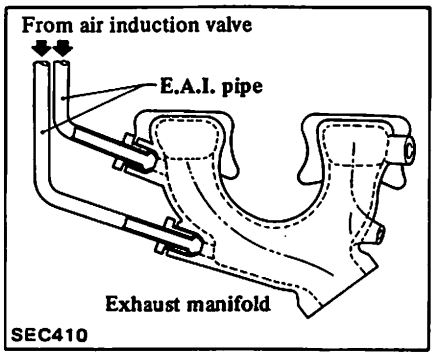
The air induction valve filter is installed at the dust side of the air cleaner. It purifies secondary air to be sent to the exhaust manifold.



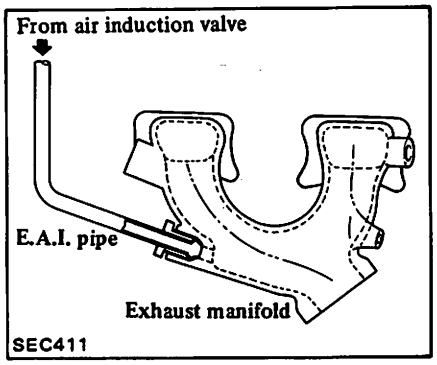
Air induction pipe

The secondary air fed from the air induction valve goes through the E.A.I. pipe to the exhaust manifold.

Type-A



Type-B



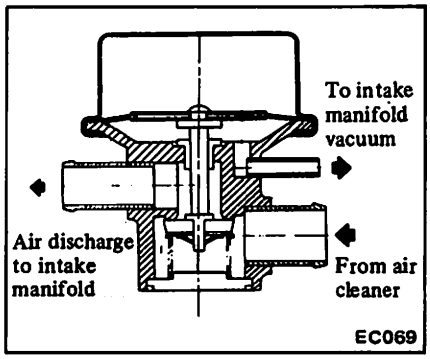
Anti-backfire (A.B.) valve

This valve is actuated by intake manifold vacuum to prevent backfire in the exhaust system at the initial period of deceleration.

At this period, the mixture in the intake manifold becomes too rich to ignite and burn in the combustion chamber and burns easily in the exhaust system with injected air in the exhaust manifold.

The A.B. valve provides air to the intake manifold to make the air-fuel mixture leaner and prevents backfire.

The correct function of this valve reduces hydrocarbon emission during deceleration.

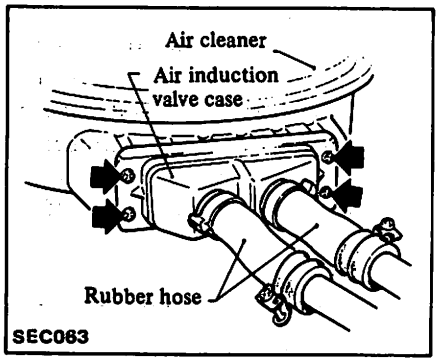


REMOVAL AND INSTALLATION

Air induction valve and filter

Remove the valve and filter on the air cleaner. The air induction valve and valve filter can then be taken out easily. Installation is in the reserve sequence of removal.

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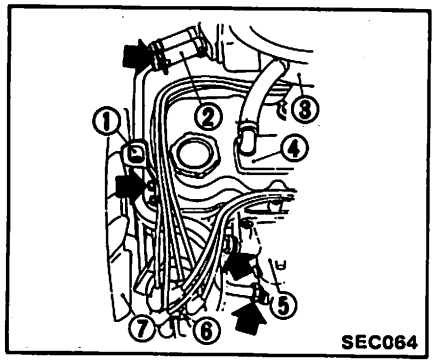


Air induction pipe

Remove nut securing the pipe to the exhaust manifold. At the same time, remove the screws securing the bracket and rubber hose clamp.

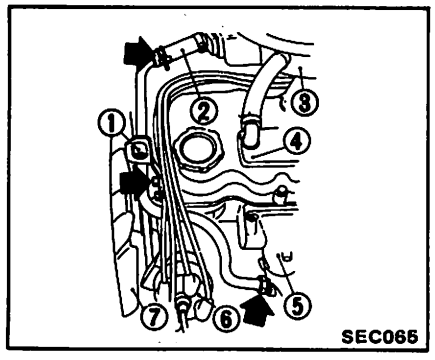
The air induction pipe can then be taken out. Installation is in the reverse sequence of removal.

Type-A



1 Bracket
2 Rubber hose
3 Air cleaner
4 Rocker cover
5 Exhaust manifold
6 Distributor
7 Fan

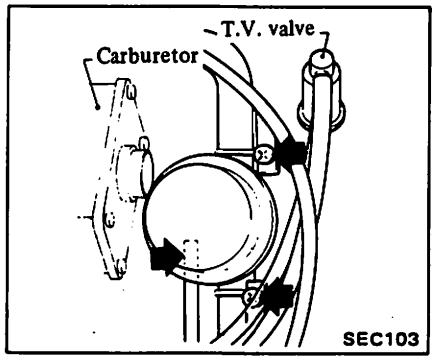
Type-B



1 Bracket
2 Rubber hose
3 Air cleaner
4 Rocker cover
5 Exhaust manifold
6 Distributor
7 Fan

A.B. valve

1. Remove air cleaner.
2. Remove air hoses and vacuum tube. Then the A.B. valve can be taken out.



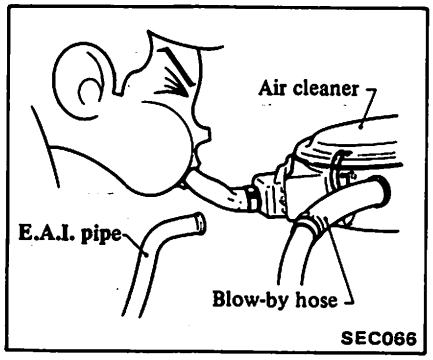
INSPECTION

Preliminary inspection

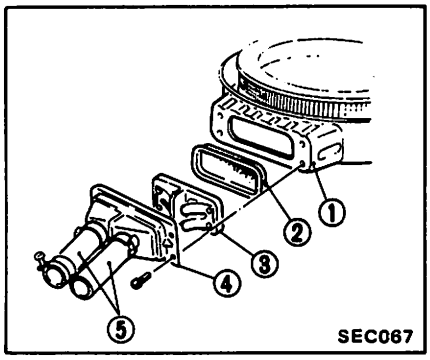
Check hose for looseness, flatting, damage or faulty connections, and each part for proper installation. If necessary, replace.

Air induction valve and filter

1. Disconnect air induction hose at air induction pipe side. Suck or blow hose to make sure that air flows only on the air induction pipe side.



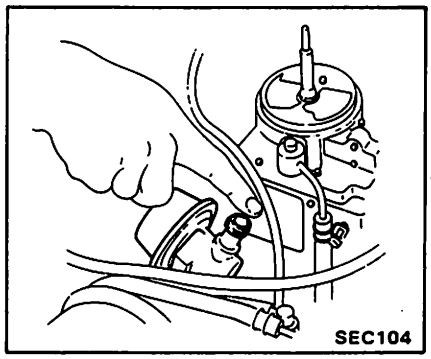
2. Check air induction reed valve for binding or damage. At the same time, check filter for damage or plugging. If necessary, replace. Filter should be replaced periodically in accordance with Maintenance Schedule.



1 Air cleaner
2 Filter
3 Air induction valve
4 Air induction valve case
5 Rubber hose

A.B. valve

1. Warm up engine thoroughly.
2. Remove air cleaner.
3. Disconnect hose from A.B. valve and place a finger near the outlet.
4. Run engine at about 3,000 rpm under no load, then quickly return it to idling. If you feel a pull or suction force on your finger, the anti-backfire valve is functioning normally. If no suction is felt, replace A.B. valve.



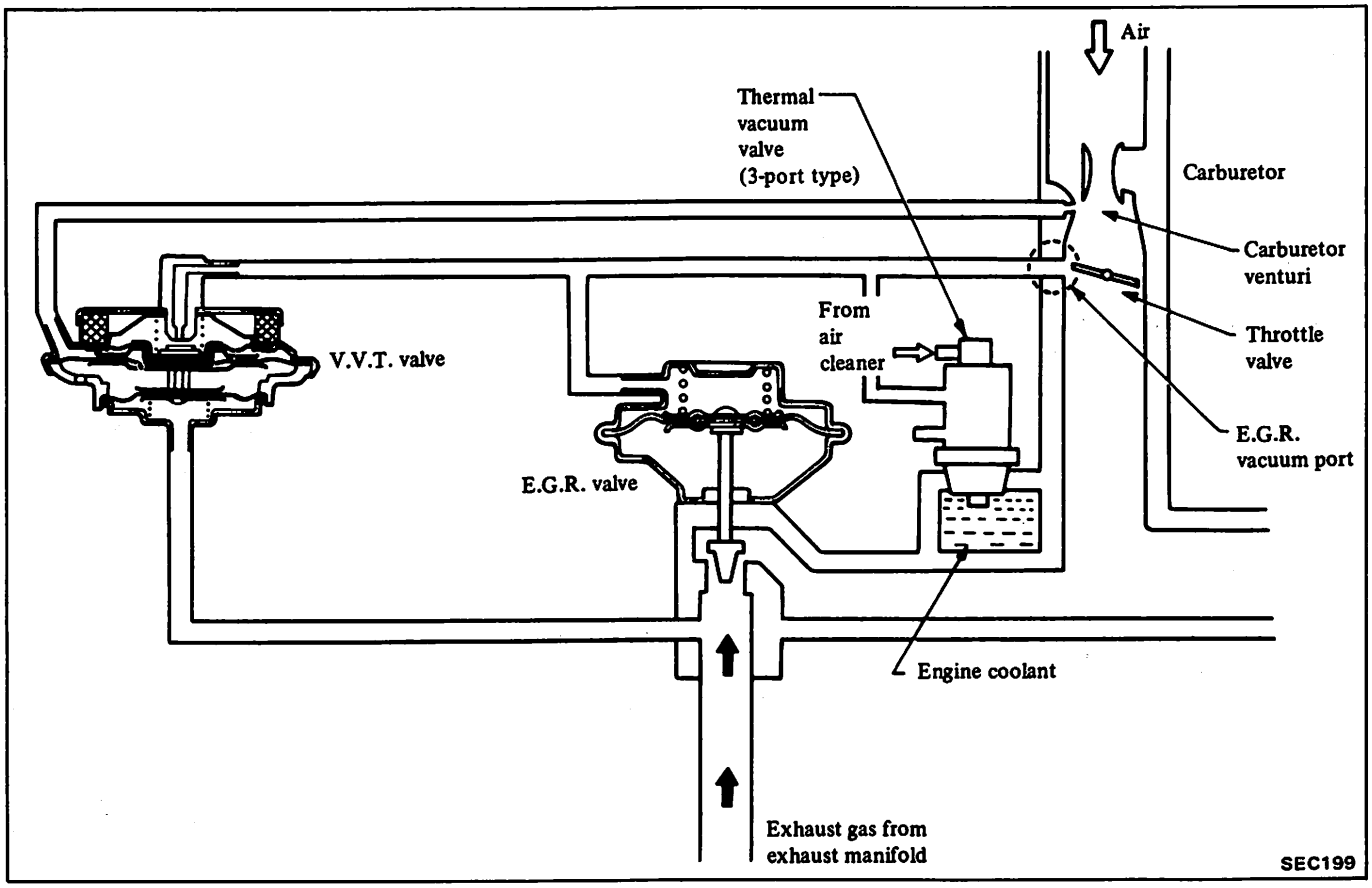
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EXHAUST GAS RECIRCULATION (E.G.R.) CONTROL SYSTEM

DESCRIPTION

In the exhaust gas recirculation system, a part of the exhaust gas is returned to the combustion chamber to lower the spark flame temperature during combustion. This results in a reduction of the nitrogen oxide (NOx) content in the exhaust gas.

When the E.G.R. control valve is open, some of the exhaust gas is led from the exhaust manifold to the E.G.R. chamber or the E.G.R. passage. The exhaust gas is then controlled in quantity by the E.G.R. valve, and is introduced into the intake manifold.



Water temperature °C (°F)	Thermal vacuum valve	V.V.T. valve			E.G.R. control system
		Venturi vacuum	Exhaust gas pressure	Operation	
Below 60 (140)	Open	High	Low	Closed	Not actuated
		↑	High		
		Low	↑		
		↑	Low	Open	
Above 60 (140)	Closed	High	Low	Closed	Actuated
		↑	High		
		Low	↑		
		↑	Low	Open	Not actuated

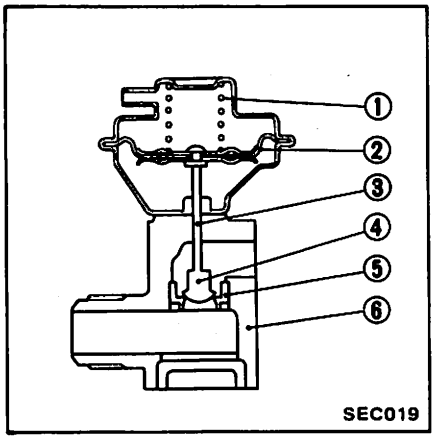
With the engine at idle or at full throttle, the E.G.R. control valve closes to deactivate the E.G.R. system regardless of water temperature (operation of the thermal vacuum valve) and V.V.T. valve.

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E.G.R. control valve

The E.G.R. control valve controls the quantity of exhaust gas to be led to the intake manifold through vertical movement of the valve connected to the diaphragm, to which vacuum is applied in response to the opening of the carburetor throttle valve.

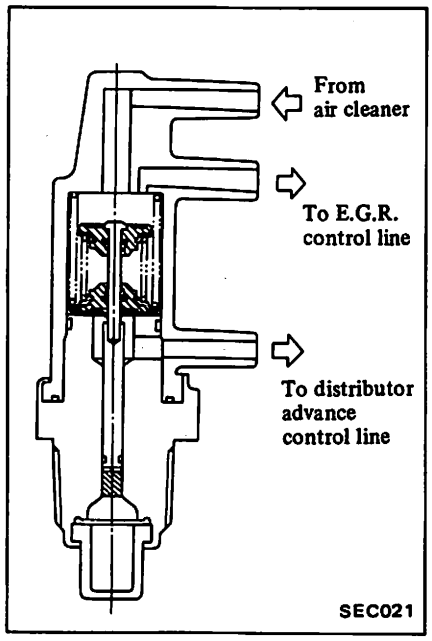
E.G.R. control valve construction and type vary with transmission type and vehicle destination. For identification purposes, the part number is stamped on the recessed portion at the top of the valve.



1 Diaphragm spring
2 Diaphragm
3 Valve shaft
4 Valve
5 Valve seat
6 Valve chamber

Thermal vacuum valve (3-port type)

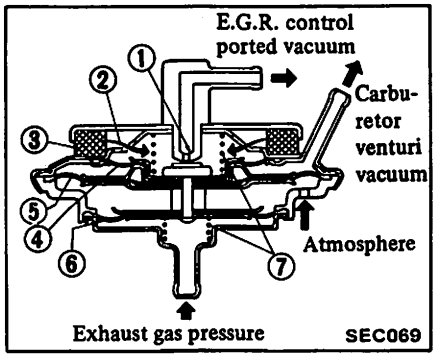
The thermal vacuum valve, which is attached to the thermostat housing, monitors the temperature of the engine cooling water. The valve shaft is propelled by the thermal expansion force of wax which depends on the temperature. This action opens and closes the valve, which causes the E.G.R. control vacuum line to be exposed or closed to the atmosphere. When the valve opens, air from the carburetor vacuum signal line is introduced, and because the venturi vacuum transducer (V.V.T.) valve and E.G.R. valve diaphragm are exposed to the atmosphere the E.G.R. operation will not function.



Venturi vacuum transducer (V.V.T.) valve

The V.V.T. valve monitors the pressure of the exhaust gas which actuates the diaphragm ⑥ and the venturi vacuum which in turn activate the diaphragm ④, ⑤. This valve controls the carburetor throttle vacuum in order to activate the E.G.R. control valve.

In other words, the amount of recirculated exhaust gas varies with the position of the E.G.R. valve regulated by the operating condition of the engine.

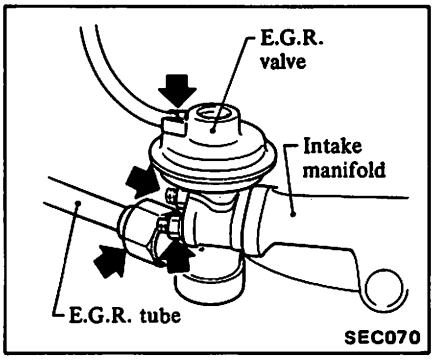


1 Control orifice
2 Air bleed
3 Air filter
4 Diaphragm
5 Diaphragm
6 Diaphragm
7 Spring

REMOVAL AND INSTALLATION

E.G.R. control valve and E.G.R. tube

1. Remove nut which secures E.G.R. tube to E.G.R. valve, and disconnect tube from valve.
2. Disconnect vacuum hose and remove nuts securing E.G.R. control valve to intake manifold. The E.G.R. control valve can then be taken out.



CAUTION:
Pay attention not to give damage to packing of E.G.R. control valve.

3. Installation is in the reverse sequence of removal.

Thermal vacuum valve

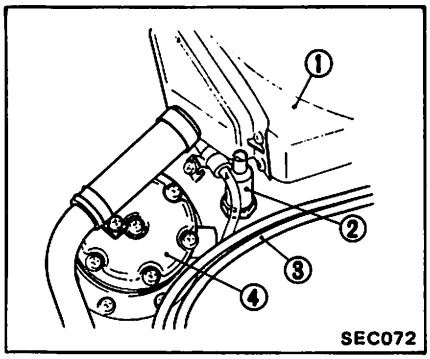
The thermal vacuum valve is made of plastic. Consequently care should be taken to avoid damaging it. This valve is located on the thermostat housing.

1. Drain engine coolant about one liter.
2. Remove air cleaner.
3. Disconnect three vacuum hoses and unscrew the thermal vacuum valve. Then, the valve can be removed.
4. Installation is in the reverse sequence of removal.

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a. Be sure to apply sealer to threads of the valve prior to installing a new valve.

b. When installing a new thermal vacuum valve, be sure that color and shape are correct.

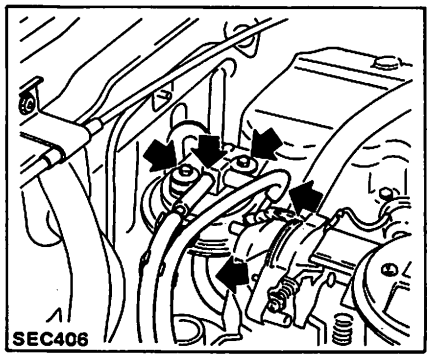


1 Air cleaner
2 T.V. valve
3 High-tention cables
4 Fuel pump

V.V.T. valve

1. Disconnect vacuum tubes on the V.V.T. valve.
2. Disconnect screws which secure V.V.T. valve to bracket.
3. Disconnect back pressure tube from V.V.T. valve.

The V.V.T. valve can then be removed.



4. Installation is in the reverse sequence of removal.

When replacing the V.V.T. valve with a new one, verify that the type number on the new part is the same as that on the former one.

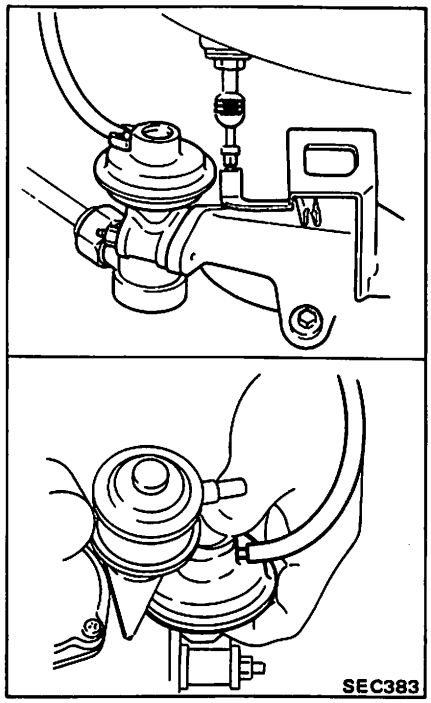
Ⓣ : V.V.T. valve mounting screw
3.7 - 5.0 N·m
(0.38 - 0.51 kg-m,
2.7 - 3.7 ft-lb)

INSPECTION

Entire system

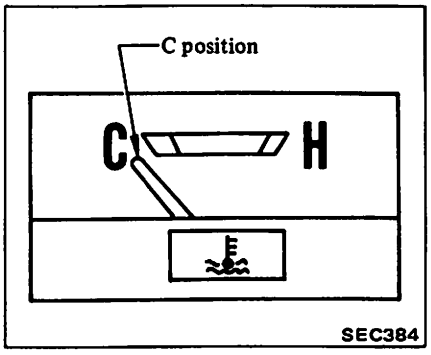
1. Make a thorough visual check of E.G.R. control system. If necessary, wipe away oil to facilitate inspection. If any hoses are cracked or broken, replace.
2. With engine stopped, inspect E.G.R. control valve for any indication of binding or sticking by moving diaphragm of control valve upwards with a finger.
3. With engine running, inspect E.G.R. control valve and thermal vacuum valve for normal operation.

Place your finger on diaphragm of E.G.R. control valve to ensure that the valve functions as described below.



(1) When temperature of the engine coolant is low:

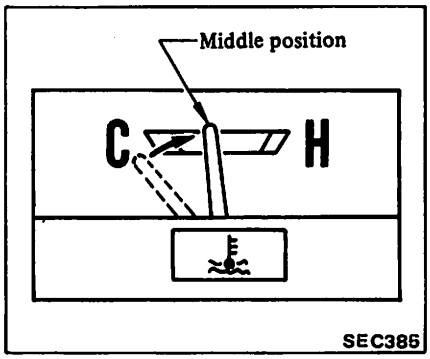
[Below 15°C (59°F)]



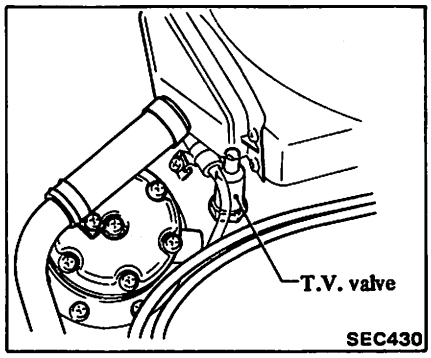
Make sure that E.G.R. control valve does not operate when engine speed is increased from idling to 2,000 - 2,500 rpm.

(2) When temperature of the engine coolant is high:

[Above 60°C (140°F)]



1) Make sure that E.G.R. control valve operates when engine speed is increased from idling to 2,000 - 2,500 rpm.

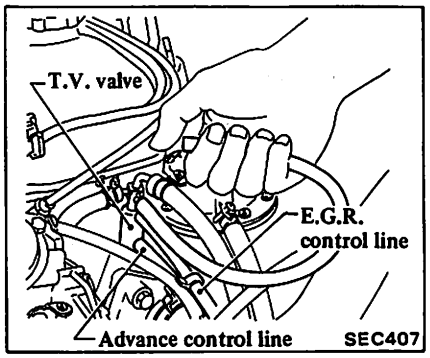


2) If E.G.R. control valve does not operate properly, check it as follows:

- Disconnect one end (E.G.R. control valve side) of vacuum hose which connects 3-way connecter to E.G.R. control valve.
- Increase engine speed from idle to 2,000 - 2,500 rpm.

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- Make sure that thermal vacuum valve is closed, and that throttle vacuum is present at the end (E.G.R. control valve side) of vacuum hose.



If vacuum pressure is either weak or nonexistent, replace thermal vacuum valve. If vacuum pressure is detected, replace E.G.R. valve.

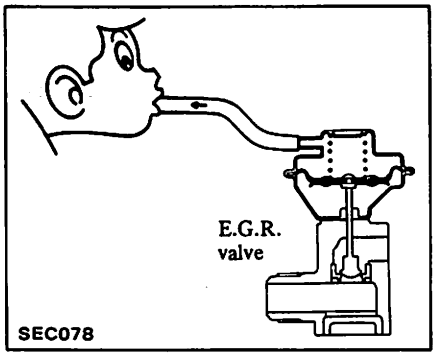
If any difficulty is encountered in judging the condition of any component during above inspection, check the questionable component independently as follows:

E.G.R. control valve

Dismount E.G.R. control valve from engine.

1. Apply vacuum to E.G.R. control valve, referring to the following figure. If the valve moves to full position, it is normal.

E.G.R. control valve will remain open for more than 30 seconds after vacuum has cut off.



2. Visually check E.G.R. control valve for damage, wrinkle or deformation.

Thermal vacuum valve

Dismount thermal vacuum valve from engine.

Before dismounting, drain engine coolant about one liter.

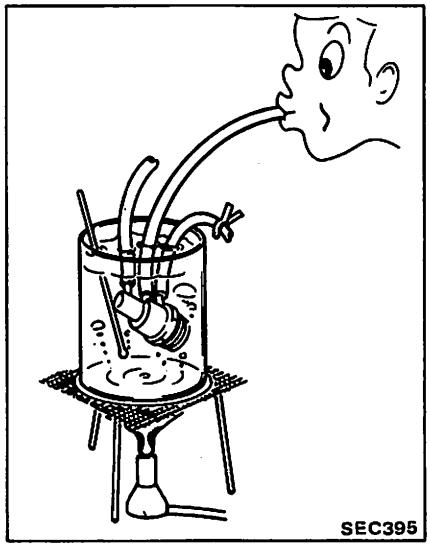
Apply vacuum to thermal vacuum valve and check to be sure that thermal vacuum valve opens or closes in response to engine coolant temperature as specified.

Thermal vacuum valve should open or close at a temperature specified below, completing the vacuum passage.

Thermal vacuum valve operating temperature:

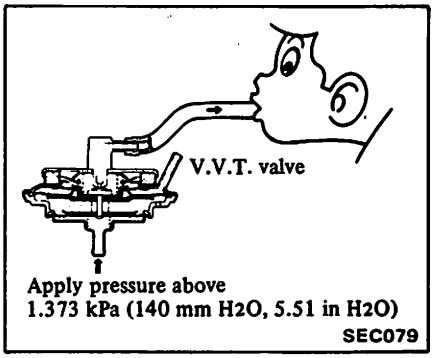
Operating temperature °C (°F)	
Open	Close
Below 60 (140)	Above 60 (140)

CAUTION:
Do not allow water to get inside the thermal vacuum valve.

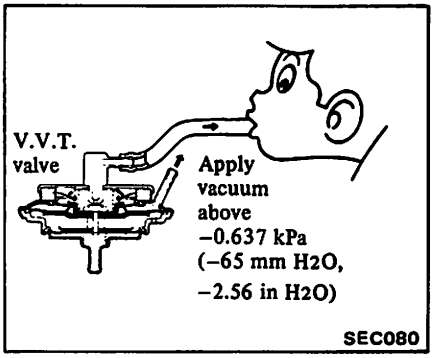


V.V.T. valve

1. Apply a pressure above 1.373 kPa (140 mmH_2O, 5.51 inH_2O) to V.V.T. valve and check it for leakage as shown below. If a leak is discovered, replace valve.



2. Apply vacuum pressure above 0.637 kPa (65 mmH_2O, 2.56 inH_2O) to V.V.T. valve and check it for leakage as shown below. If a leak is discovered, replace valve.



SPARK TIMING CONTROL SYSTEM

DESCRIPTION

The spark timing control system is designed to control the distributor vacuum advance under varying driving conditions so as to reduce HC and NOx emissions.

OPERATION

The operation of the system is as follows.

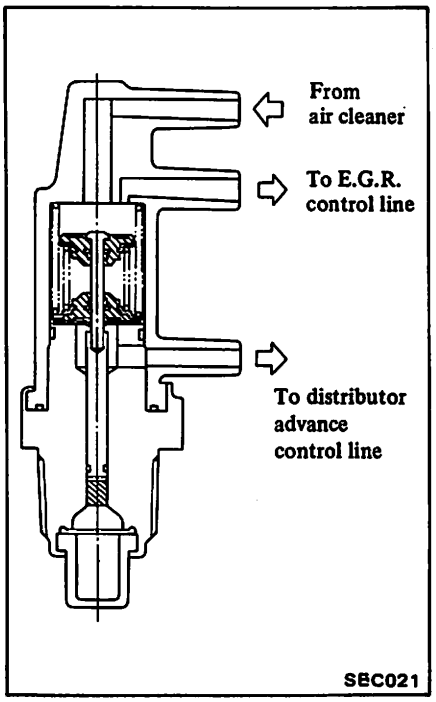
Water temperature °C (°F)	Thermal vacuum valve operation	Spark timing control system
Below 15 (59)	Closed	Actuated
15 - 60 (59 - 140)	Open	Not actuated
Above 60 (140)	Closed	Actuated

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Thermal vacuum valve

The thermal vacuum valve, which is attached to the housing of the thermostat, monitors the temperature of the engine cooling water. The valve shaft is propelled by the thermal expansion force of wax which depends on the temperature. This action opens and closes the valve, which causes the spark timing control vacuum line to be exposed or closed to the atmosphere.

The thermal valve opens and closes to either permit or obstruct external air passing to the distributor vacuum line. When the valve opens, the vacuum signal line will allow external air to enter, thereby stopping the distributor vacuum from advancing.



REMOVAL AND INSTALLATION

Thermal vacuum valve

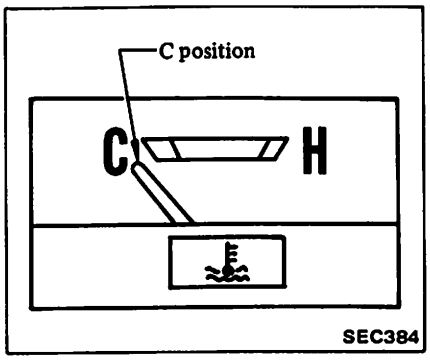
The thermal vacuum valve designs are exactly the same as those used in the E.G.R. control system. Refer to the instructions under the heading "E.G.R. control system".

INSPECTION

Entire system

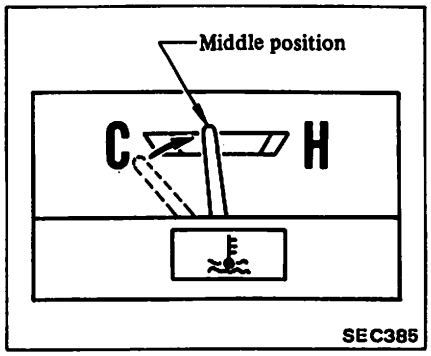
1. Ensure that vacuum hoses are properly connected to their connectors.
2. Make sure that distributor vacuum controller functions properly.
3. Set timing light.
4. Check thermal vacuum valve as follows.

(1) Using a timing light, check the spark timing while temperature gauge is in the C position.



(2) Using a timing light, ensure that spark timing retards from the former condition when temperature gauge changes from the C-position to the middle position.

(3) Warm up the engine until coolant temperature gauge pointer moves to middle position of scale. Ensure that spark timing advances from its previous position.



If spark timing does not change, replace thermal vacuum valve.

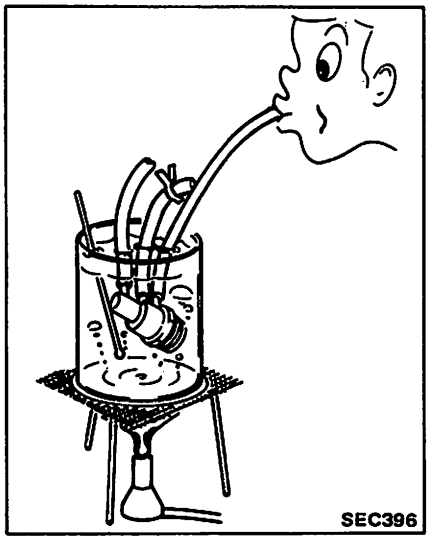
To check operation of thermal vacuum valve, proceed as follows:

Thermal vacuum valve

Remove thermal vacuum valve from engine. Inhale air from port of spark timing control system and check to be sure that thermal vacuum valve opens or closes in response to its temperature.

Thermal vacuum valve operating temperature:

Operating temperature °C (°F)	
Open	Close
15 - 60 (59 - 140)	Below 15 (59) Above 60 (140)



CAUTION:
Do not allow water to enter the thermal vacuum valve.

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FUEL SHUT-OFF SYSTEM

DESCRIPTION

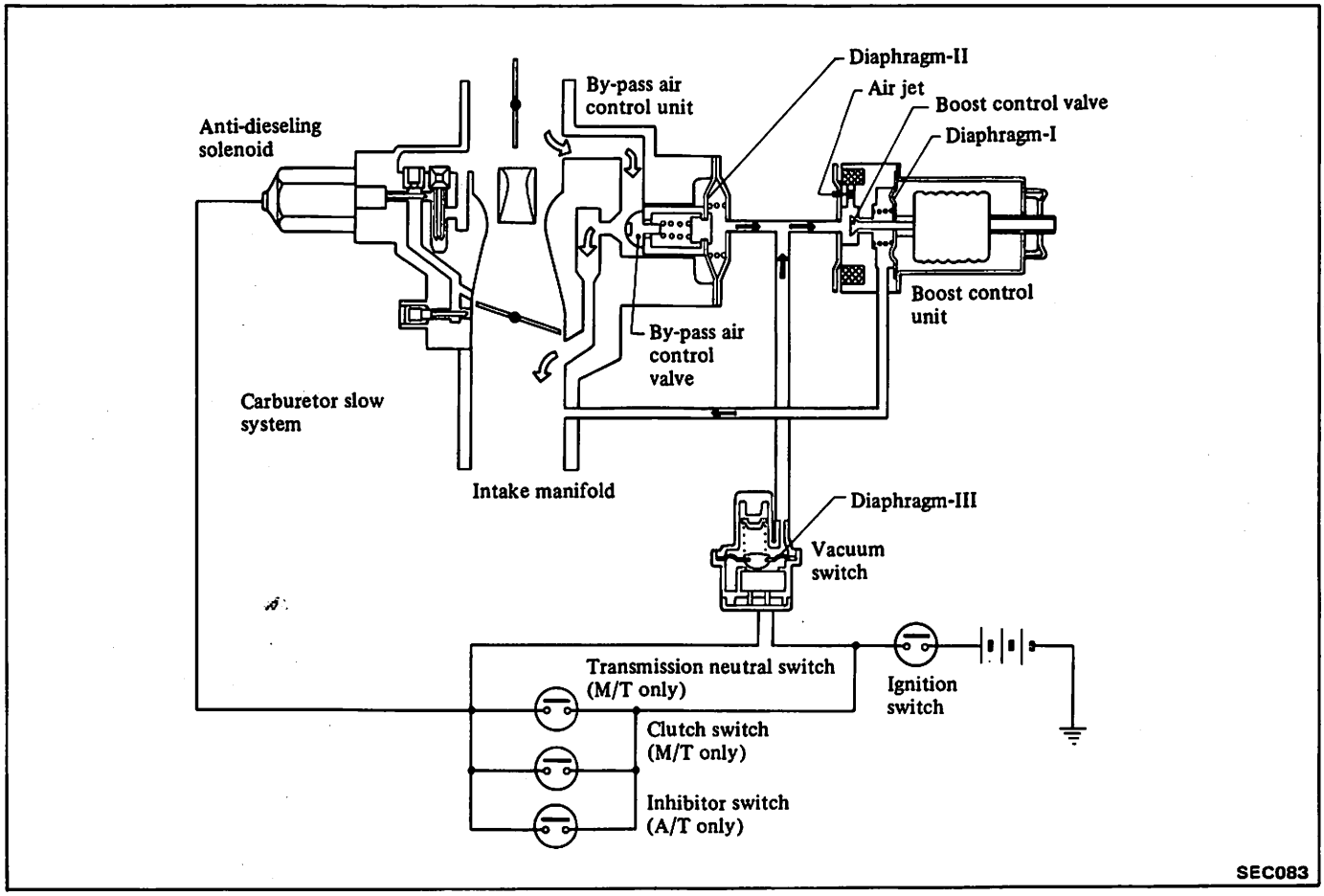
The fuel shut-off system is designed to reduce HC emission and to promote good fuel economy during deceleration.

OPERATION

This system is operated by the anti-dieseling solenoid valve in the carburetor controlled by vacuum switch. When the intake manifold vacuum increases to an extremely high level during deceleration, the fuel of the slow system is shut off by the anti-dieseling solenoid valve. When the intake manifold vacuum drops to a low level, the fuel of the slow system is resupplied.

A subsidiary control system assists in controlling the fuel.

The fuel shut-off system is further gear position switches such as the neutral switch and the inhibitor switch to ensure that fuel cannot be shut-off even if the manifold vacuum is high enough to trigger the fuel shut-off operation.



The operation of this system is as follows:

Condition	Boost control system	Vacuum switch	Switch operation			Fuel shut-off system
			Neutral sw.	Clutch sw.	Inhibitor sw.	
Deceleration	Operate	OFF	OFF	–	–	Actuated
			–	OFF	–	
			–	–	OFF	
			ON	–	–	Not actuated
			–	ON	–	
			–	–	ON	
Others	Not operate	ON	–	–	–	

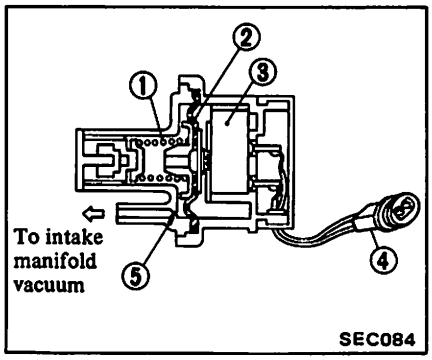
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The operation of the switches is as follows:

Transmission	Condition	Switch operation		
		Neutral sw.	Clutch sw.	Inhibitor sw.
M/T	Neutral position	ON	–	–
	Clutch disengaged	–	ON	–
A/T	"P" & "N" position	–	–	ON

Vacuum switch

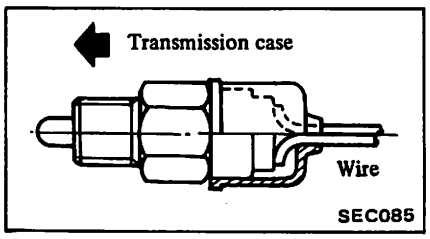
The vacuum switch is inserted into clamp beside the hoodledge. When the intake manifold vacuum increases during deceleration, this switch is activated, thereby interrupting the electrical signal which is sent to the anti-dieseling solenoid valve. This signal interruption causes the anti-dieseling solenoid valve to operate, shutting off the fuel.



1 Spring
2 Diaphragm
3 Micro switch
4 Connector
5 Orifice

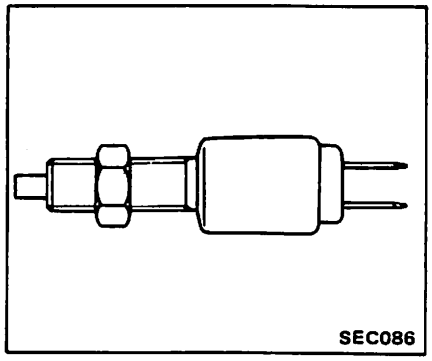
Neutral switch

The neutral switch is located on the transmission case. When the gears are in Neutral, this switch activates, sending an electrical signal to the anti-dieseling solenoid valve. Thus the anti-dieseling solenoid valve cannot operate.



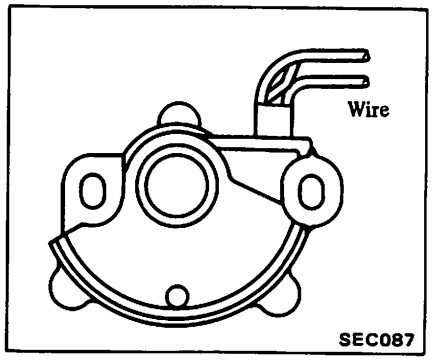
Clutch switch

The clutch switch is attached to the clutch pedal support. When the clutch is disengaged, this switch is activated, sending an electrical signal to the anti-dieseling solenoid valve. At this point, the anti-dieseling solenoid valve will not operate.



Inhibitor switch

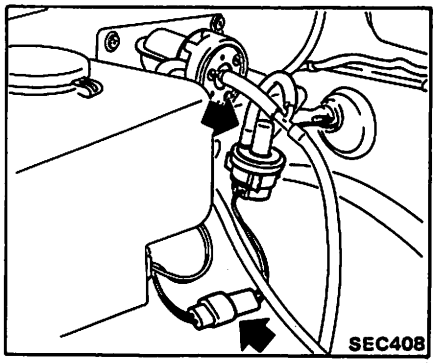
The inhibitor switch is attached to the transmission. When the gears are in Neutral or the "P" position, this switch is activated, transmitting an electrical signal to the anti-dieseling solenoid valve, thereby inactivating the solenoid valve.



REMOVAL AND INSTALLATION

Vacuum switch

1. Disconnect the vacuum hose and a harness connector.
2. Extract vacuum switch from clamp. The vacuum switch can then be removed.

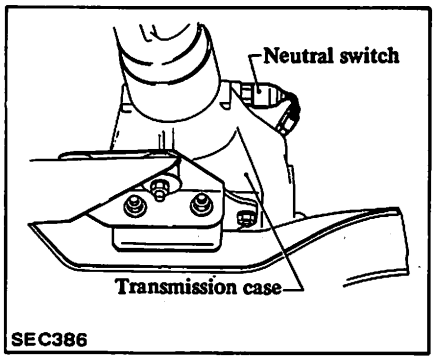


3. Installation is in the reverse sequence of removal.

When installing a new vacuum switch, make sure it is same grade and type as that used previously.

Neutral switch

1. Disconnect two harness connectors and unscrew the neutral switch. The neutral switch can then be removed.

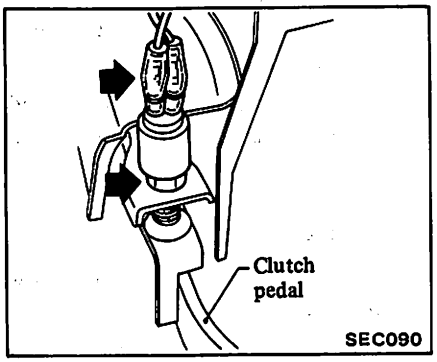


2. Installation is in the reverse sequence of removal.

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Clutch switch

1. Disconnect the harness connector and unscrew clutch switch. The clutch switch can then be removed.

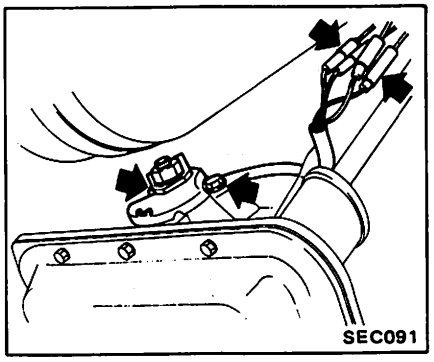


2. Installation is in the reverse sequence of removal.

Inhibitor switch

1. Disconnect four harness connectors and remove screws which secure inhibiter switch to the transmission case.

The inhibitor switch can then be removed.



2. Installation is in the reverse sequence of removal.

INSPECTION

Entire system

1. Make a thorough visual check of fuel shut-off system. If any switches are broken, replace.
2. With engine running between 2,500 and 3,000 rpm, inspect each switch for proper operation using a tester.

Operational modes of each switch should be as follows:

	Condition	
	Switch "ON"	Switch "OFF"
Vacuum switch	Intake manifold vacuum normal level	Intake manifold vacuum high level [above –80.0 kPa (–600 mmHg, –23.62 inHg)]
Neutral switch	Gear position: Neutral position	Other positions
Clutch switch	Clutch disengaged	Clutch engaged
Inhibitor switch	Gear range "N" and "P" range	Other ranges

When checking vacuum switch, run the engine under no load from an idling speed to 3,000 rpm in order that intake manifold vacuum rises to a high level.

INTAKE MANIFOLD VACUUM CONTROL SYSTEM

DESCRIPTION

This system is designed to reduce the engine's lubricating oil consumption when the intake manifold vacuum increases to an extremely high level during deceleration.

This system consists of two units as follows:

1. Boost Control Unit (Boost Control Valve and Diaphragm) as the manifold vacuum sensor.
2. By-pass Air Control Unit (By-pass Air Control Valve and Diaphragm) as actuator.

OPERATION

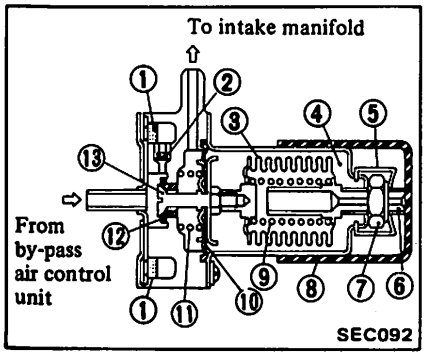
The boost control unit senses the manifold vacuum. When the level of the manifold vacuum increases above the predetermined value, the boost control valve opens and transmits the manifold vacuum to the by-pass air control unit. The manifold vacuum then pulls the diaphragm-II and opens the by-pass air control valve thereby causing the air to be by-passed to the intake manifold. After completion of the air by-pass, the manifold vacuum is lowered. This results in closing of the boost control valve and then closing of the air control valve. This system operates in a tightly controlled circuit so that the manifold vacuum can be kept very close to the predetermined value during the deceleration.

Boost control unit

The boost control unit consists of a vacuum control valve and a diaphragm and it is attached to the bracket beside hoodledge. When the intake manifold vacuum reaches an extremely high

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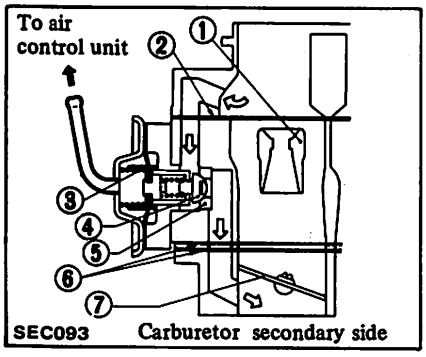
level, the boost control unit activates the air by-pass valve, in order to transmit the vacuum to the air by-pass valve diaphragm.



1 Filter
2 Orifice
3 Bellows
4 Nitrogen gas filled
5 Lock spring
6 Adjusting bolt
7 Adjusting nut
8 Rubber cap
9 Spring
10 Diaphragm
11 Spring
12 Valve seat
13 Valve

By-pass air control unit

The by-pass air control unit is attached to the carburetor and it consists of an air by-pass valve and a diaphragm. The intake manifold vacuum by-passes through the boost control unit and activates the diaphragm. The diaphragm in turn activates the air by-pass valve. This causes the air to by-pass the intake manifold. As a result, the level of the manifold vacuum can be kept below the predetermined value.



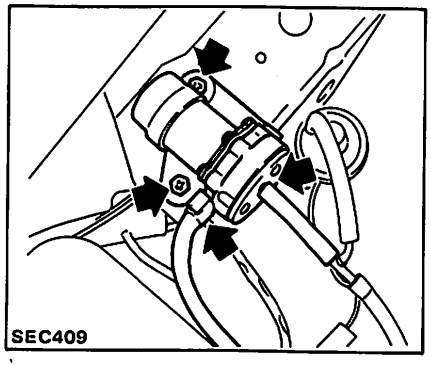
1 Venturi
2 Gasket
3 Spring
4 Valve
5 Valve seat
6 Gasket
7 Throttle valve

REMOVAL AND INSTALLATION

Boost control unit

1. Disconnect vacuum hoses.
2. Remove bolts which secure boost control unit to bracket.

Boost control unit can then be removed.



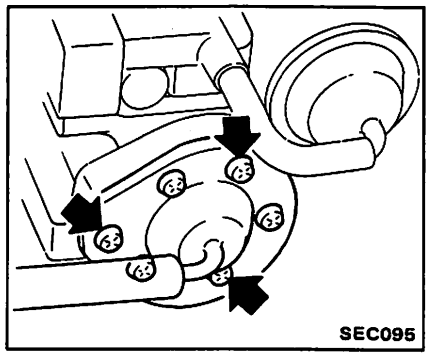
3. Installation is in the reverse sequence of removal.

When installing a new boost control unit, make sure that it has the same model number and identification marks as the previous one.

By-pass air control unit

1. Disconnect a vacuum hose.
2. Remove screws which secure the by-pass air control unit to carburetor.

By-pass air control unit can then be removed.



3. Installation is in the reverse sequence of removal.

INSPECTION

Entire system

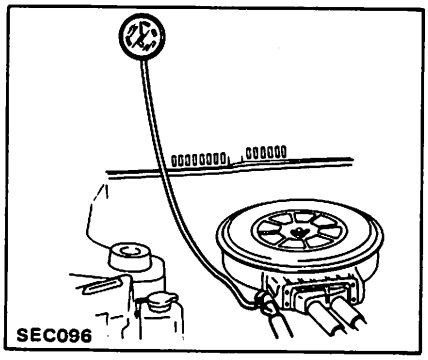
Generally, it is unnecessary to adjust the boost control valve. However, if it becomes necessary to adjust it, proceed as follows:

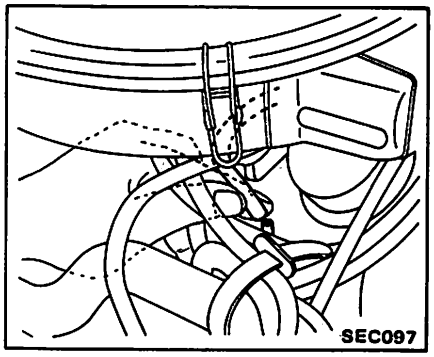
This adjustment should be carried out with the automatic transmission lever in the "N" position.

Prepare the following tools.

(1) A tachometer to measure the engine speed while idling.
(2) A vacuum gauge and connecting pipe.

1. Connect rubber hose between vacuum gauge and intake manifold as shown.



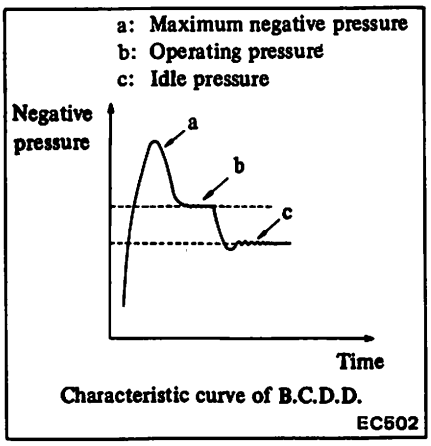


2. Warm up the engine until it reaches its operating temperature.

Then adjust the engine to normal idle setting. (Refer to the item "Idle Adjustment".)

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3. Run the engine under no load. Increase engine speed from 1,500 to 2,000 rpm, then quickly close throttle valve.
4. At that time, the manifold vacuum pressure will change as follows:
1) It will abruptly rise up to –80.0 kPa (–600 mmHg, –23.62 inHg) or above.
2) It will decrease gradually to a certain level and stay there for a while. This is so called operating pressure.
3) In most cases, it will drop to idle pressure.



Characteristic curve of B.C.D.D.
EC502

5. Check that the By-pass air control valve operating pressure is within the specified range.

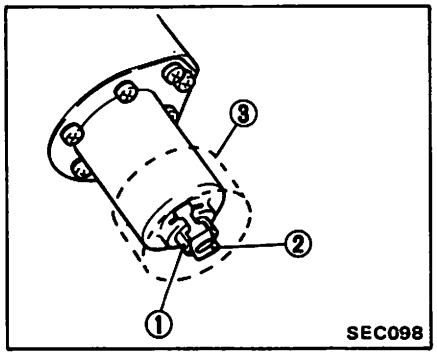
Operating pressure

Unit: kPa (mmHg, inHg)

At atmospheric pressure	Operating pressure
101.3 (760, 29.92)	80.0 ± 2.7 (600 ± 20, 23.62 ± 0.79)
80.0 (600, 23.62)	64.1 ± 3.3 (481 ± 25, 18.94 ± 0.98)

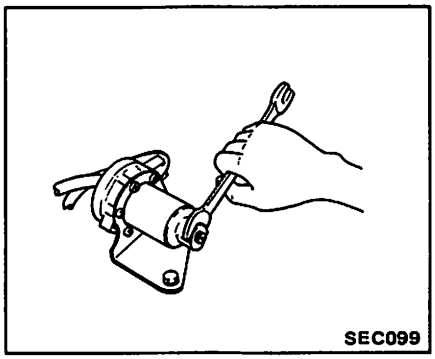
6. If it is lower or higher than the specified level, turn the adjusting screw in the following direction until correct adjustment is made.

Adjusting screw:
Lower condition ..... Counterclockwise
Higher condition ..... Clockwise



SEC098

1 Adjusting nut
2 Lock spring
3 Rubber cap


SEC099

7. Race the engine and check for adjustment.
8. If it is lower than the set level, turn the adjusting screw until correct adjustment is made.
9. Race the engine and check for adjustment.

If engine speed cannot be decreased to idling when checking B.C.D.D. operating pressure, proceed as follows.

10.
(1) Turn adjusting screw counterclockwise so that B.C.D.D. operating pressure is on high vacuum side, 3.3 kPa (25 mmHg, 0.98 inHg) away from the specified value.
(2) Turn adjusting screw 1/4 of a turn clockwise so that B.C.D.D. operating pressure drops by 3.3 kPa (25 mmHg, 0.98 inHg).

If B.C.D.D. operating pressure cannot be observed clearly even in step 9(1), proceed as follows.

11.
(1) Turn adjusting screw counterclockwise so that B.C.D.D. operating pressure is on the high vacuum side, 6.7 kPa (50 mmHg, 1.97 inHg) away from the specified value.
(2) Turn the adjusting screw 1/2 of a turn clockwise.

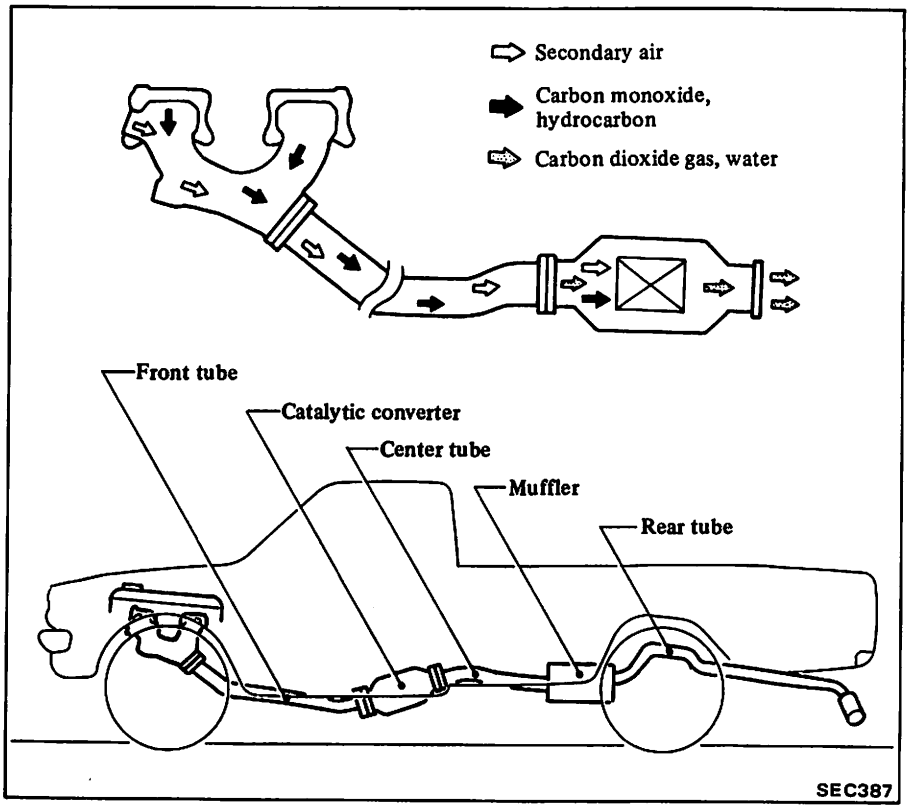
The Boost Control Unit operating pressure should be correctly set within the specified range after the above adjustments, even if the engine speed cannot be decreased to idle.

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CATALYTIC CONVERTER

DESCRIPTION

The catalytic converter accelerates the chemical reaction of hydrocarbons (HC) and carbon monoxide (CO) in the exhaust gas, and changes them into harmless carbon dioxide (CO_2) and water (H_2O). This chemical reaction process requires the proper amount of air, which is induced by the air induction valve (Refer to the item "AIR INDUCTION SYSTEM"). This air is called "secondary air".



OPERATION

Exhaust gas emitted from the engine contains some harmful substances due to incomplete combustion in the combustion chamber. The air induction system is designed to reduce the content of such substances in the exhaust gas. In this system, the secondary air is led from the air induction valve and injected into the exhaust manifold. With this injection of the secondary air, hydrocarbons (HC) and carbon monoxide (CO) in the exhaust gas are gradually oxidized with oxygen (O_2) in the secondary air and converted into harmless carbon dioxide (CO_2) and water (H_2O).

The catalytic converter further cleans engine exhaust gas. Through catalytic action, it changes residual hydrocarbons and carbon monoxide contained in exhaust gas into carbon dioxide and water before exhaust gas is discharged to the atmosphere.

REMOVAL AND INSTALLATION

1. Jack up the vehicle.

Apply parking brake and place wheel chocks.

2. Remove screws securing lower shelter of catalytic converter.

Loosen flange bolts connecting catalytic converter to front and rear exhaust tubes.

Catalytic converter assembly can then be taken out.

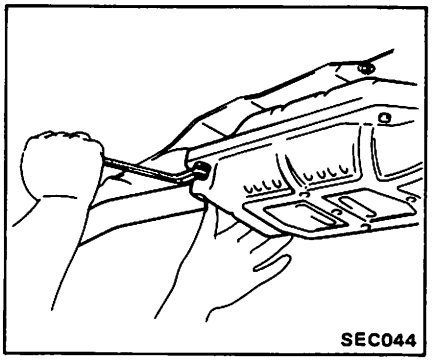
3. Installation is in the reverse sequence of removal.

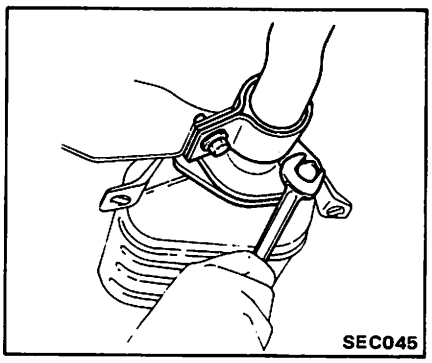
CAUTION:

a. Be careful not to damage catalytic converter when handling.

b. Never wet catalyzer with water, oil, etc.

Ⓣ : Converter lower shelter bolt
6.3 - 8.3 N·m
(0.64 - 0.85 kg-m,
4.6 - 6.1 ft-lb)
Catalytic converter bolt
31 - 42 N·m
(3.2 - 4.3 kg-m,
23 - 31 ft-lb)





INSPECTION

Preliminary Inspection

Visually check condition of all component parts including hoses, tubes, and wires, replace if necessary.

Refer to Air Induction System for inspection.

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Catalytic converter

Whether catalytic converter is normal or not can be checked by observing variation in CO percentage. The checking procedure is as follows:

Apply parking brake. Shift gears into "Neutral" (for manual transmission) and "N" or "P" (for automatic transmission) position.

1. Visually check catalytic converter for damage or cracks.
2. Adjust engine idle speed. Refer to Adjusting Idle RPM for adjustment.
3. Race engine (1,500 to 2,000 rpm) two or three times under no load.
4. If idle speed increases, readjust it to specified speed with throttle adjusting screw.
5. Warm up engine for about four minutes at 2,000 rpm under no load.
6. Measure CO percentage at idle speed. After step 5 has been completed, wait for one minute before making CO percentage measurement.
7. If CO percentage measured in step 6 is less than 0.3%, the catalytic converter is normal.
8. If CO percentage measured in step 6 is over 0.3%, recheck A.I.S. and replace air induction valve. Then, perform inspection steps 5 and 6.
9. If CO percentage is still over 0.3% in step 8, catalytic converter is malfunctioning. Replace catalytic converter.

EVAPORATIVE EMISSION CONTROL SYSTEM

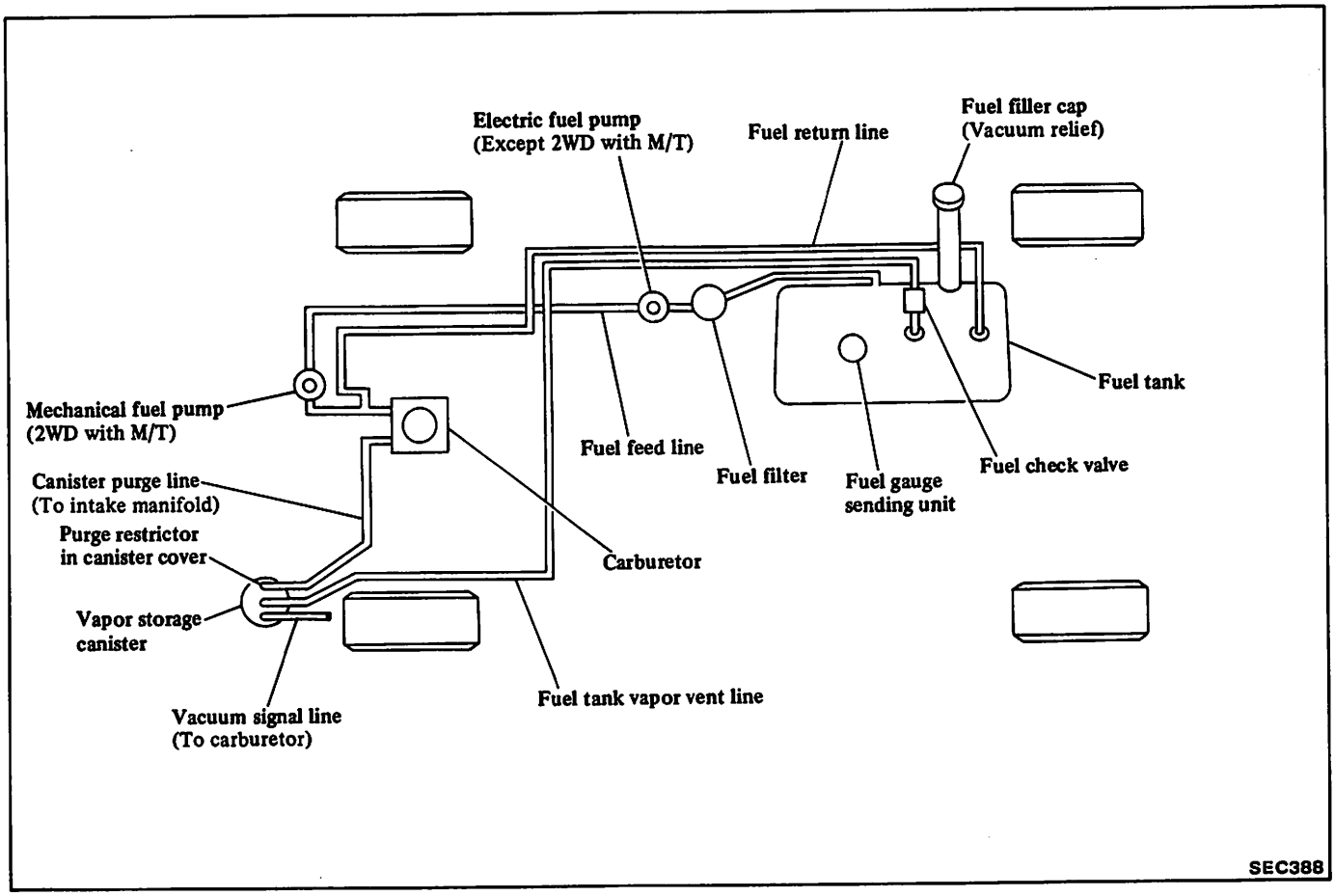
DESCRIPTION

The evaporative emission control system is used to reduce hydrocarbons emitted to the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the carbon canister.

This system is made up of the following:

1. Fuel tank with positive sealing filler cap.
2. Fuel check valve
3. Vapor vent line
4. Carbon canister
5. Vacuum signal line
6. Canister purge line

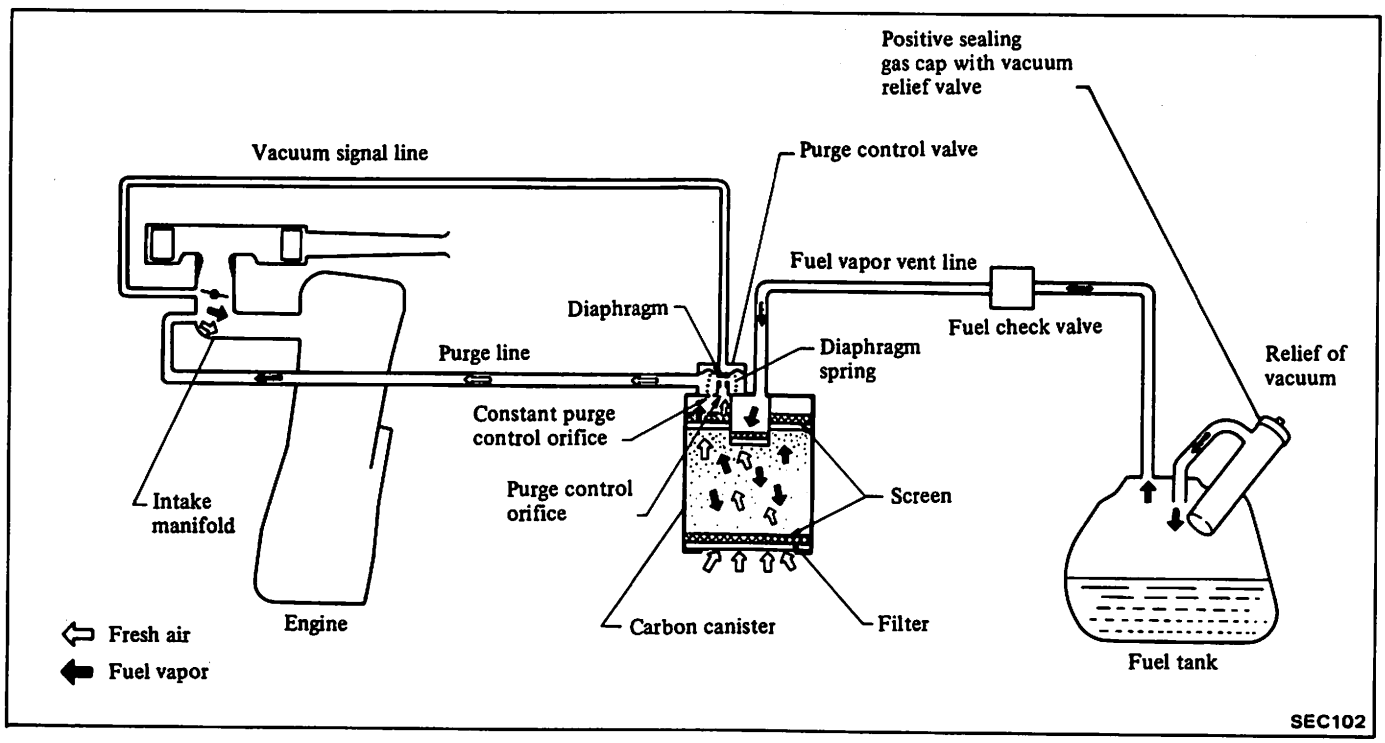
Removal and installation of above components are described in Section FE.



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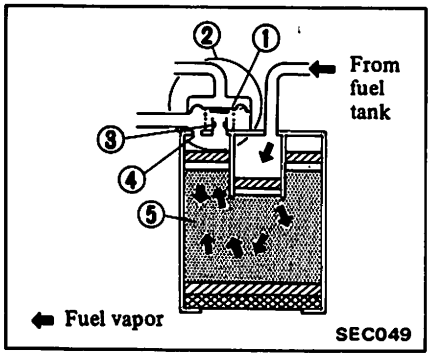
OPERATION

Fuel vapors from the sealed fuel tank are directed to the carbon canister which is filled with activated charcoals and stored there when the engine is not running.



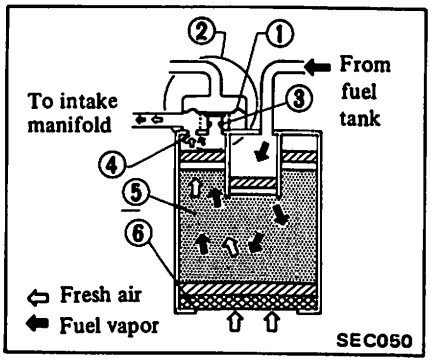
The canister retains the vapor until it is purged by the air drawn through the purge line towards the intake manifold while the engine is operating. When the engine runs at idle, the purge control valve is closed. Only a small amount of purge air flows into the intake manifold through the constant purge orifice. As the engine speed increases, and the ported vacuum rises higher, the purge control valve opens and the vapor is drawn into the intake manifold through both the fixed orifice and the constant purge orifice.

(1) Engine does not operate.



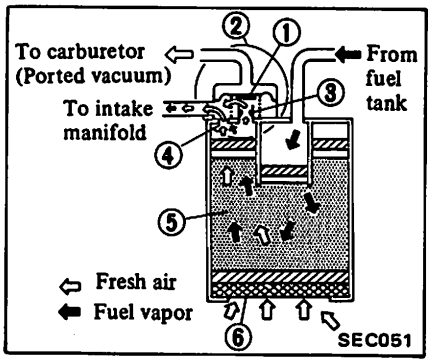
1 Diaphragm
2 Purge control valve
3 Fixed orifice
4 Constant fixed orifice
5 Activated carbon

(2) Engine operates at idle.



1 Diaphragm
2 Purge control valve
3 Fixed orifice
4 Constant fixed orifice
5 Activated carbon
6 Filter

(3) Engine speed increases



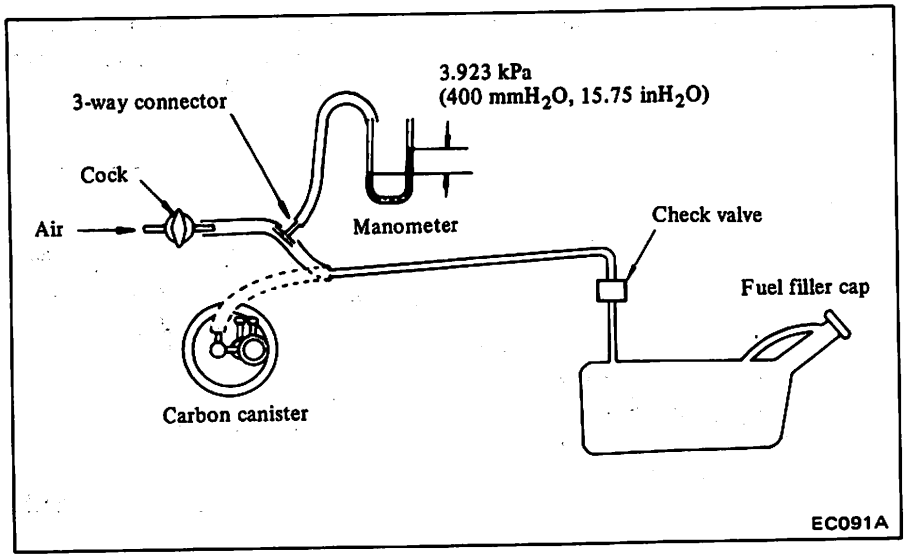
1 Diaphragm
2 Purge control valve
3 Fixed orifice
4 Constant fixed orifice
5 Activated carbon
6 Filter

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INSPECTION

FUEL TANK AND VAPOR VENT LINE

1. Check all hoses and fuel tank filler cap.
2. Disconnect the vapor vent line connecting carbon canister to fuel tank.
3. Connect a 3-way connector, a manometer and a cock (or an equivalent 3-way charge cock) to the end of the vent line.
4. Supply fresh air into the vapor vent line through the cock little by little until pressure becomes 3.923 kPa (400 mmH_2O, 15.75 inH_2O).

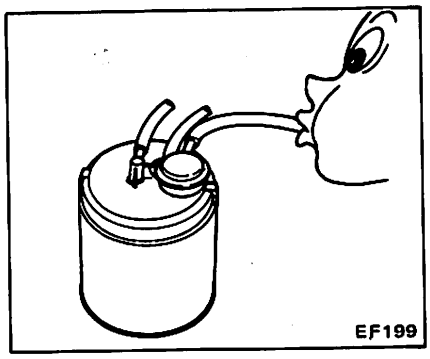


5. Shut the cock completely and leave it unattended.
6. After 2.5 minutes, measure the height of the liquid in the manometer.
7. Variation in height should remain with 0.245 kPa (25 mmH_2O, 0.98 inH_2O).
8. When filler cap does not close completely, the height should drop to zero in a short time.
9. If the height does not drop to zero in a short time when filler cap is removed, it is the cause of a stuffy hose.

In case the vent line is stuffy, the breathing in fuel tank is not thoroughly made, thus causing insufficient delivery of fuel to engine or vapor lock. It must, therefore, be repaired or replaced.

To check for leakage, proceed as follows:

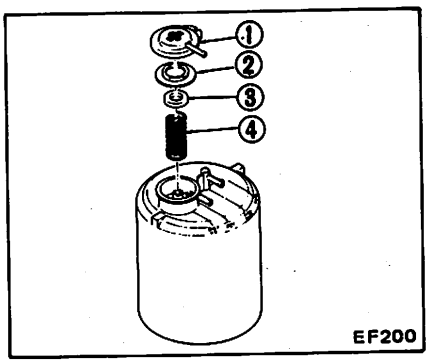
1. Disconnect rubber hose, in the line, between T-connector and carbon canister at T-connector.
2. Inhale air into the opening of rubber hose running to vacuum hole in carbon canister and ensure that there is no leak.



CARBON CANISTER PURGE CONTROL VALVE

Check for fuel vapor leakage, in the distributor vacuum line, at diaphragm of carbon canister purge control valve.

3. If there is a leak, remove top cover from purge control valve and check for dislocated or cracked diaphragm. If necessary, replace diaphragm kit (which is made up of a retainer, diaphragm and spring).



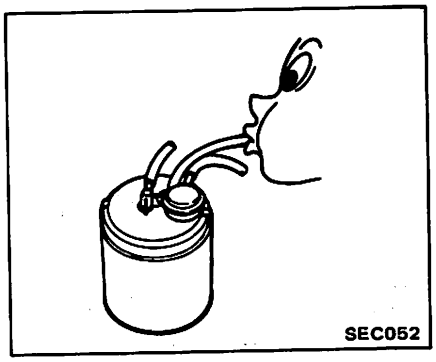
1 Cover
2 Diaphragm
3 Retainer
4 Diaphragm spring

CARBON CANISTER CONSTANT PURGE ORIFICE

Check the constant purge flow in the intake manifold vacuumline, at the constant purge orifice of the carbon canister.

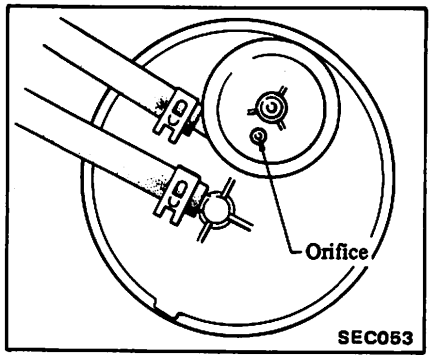
To check the purge flow, proceed as follows:

1. Disconnect the rubber hose on the line between the steel pipe of the engine and the canister.
2. Force air into the opening of the rubber hose which runs to the carbon canister and ensure that there are no leaks.



3. If there are no leaks, remove purge control valve and check the constant purge orifice for leaks. If necessary, clean the constant purge orifice.

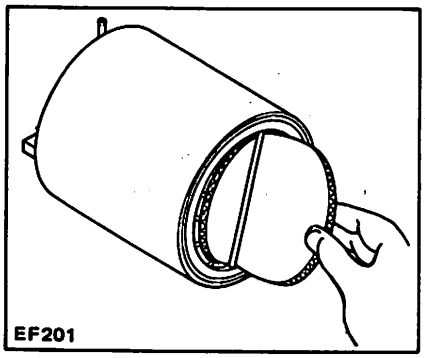
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CARBON CANISTER FILTER

Check for a contaminated element.

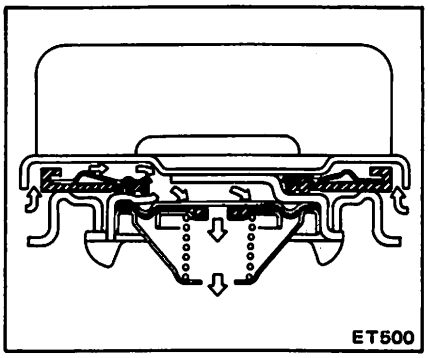
Element can be removed at the bottom of canister installed on vehicle body.



FUEL TANK VACUUM RELIEF VALVE

Remove fuel filler cap and see it functions properly.

1. Wipe clean valve housing and have it in your mouth.
2. Inhale air. A slight resistance accompanied by valve indicates that valve is in good mechanical condition. Note also that, by further inhaling air, the resistance should be disappeared as valve clicks.
3. If valve is clogged, or if no resistance is felt, replace cap as an assembled unit.



FUEL CHECK VALVE

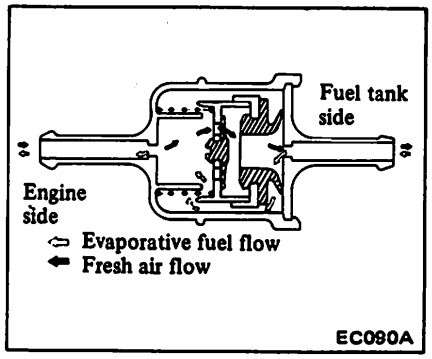
1. Blow air through connector on fuel tank side.

A considerable resistance should be felt at the mouth and a portion of air flow be directed toward the engine.

2. Blow air through connector on engine side.

Air flow should be smoothly directed toward fuel tank.

3. If fuel check valve is suspected of not being properly functioning in steps 1 and 2 above, replace.



SERVICE DATA AND SPECIFICATIONS (S.D.S.)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
E.G.R. tube securing nut	34 - 44	3.5 - 4.5	25 - 33
E.A.I. tube securing nut	34 - 44	3.5 - 4.5	25 - 33
Thermal vacuum valve	Less than 22	Less than 2.2	Less than 16
V.V.T. valve mounting screw	3.7 - 5.0	0.38 - 0.51	2.7 - 3.7
Catalytic converter bolt	31 - 42	3.2 - 4.3	23 - 31

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ENGINE REMOVAL & INSTALLATION

SECTION ER

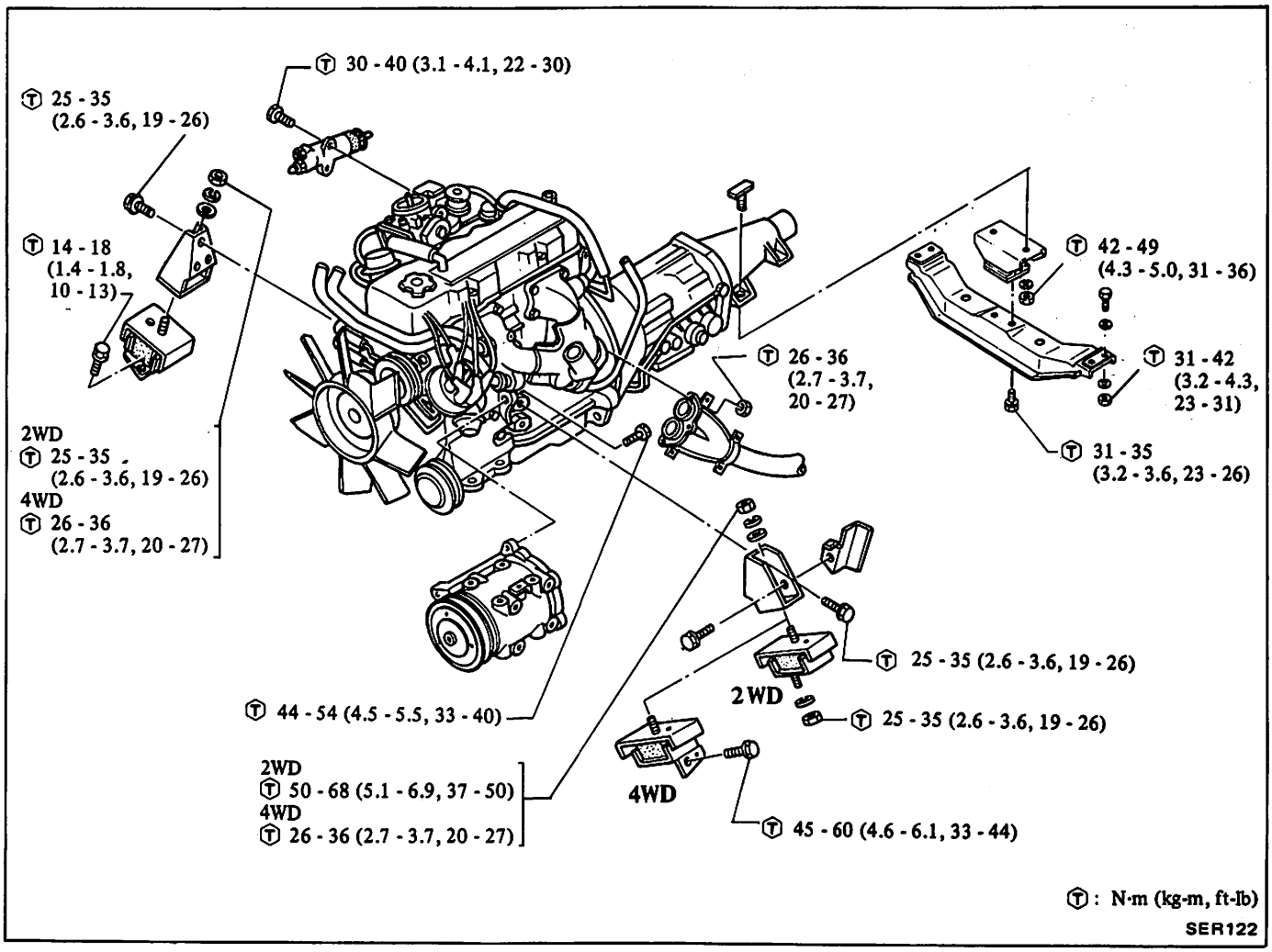
CONTENTS

ENGINE REMOVAL AND INSTALLATION ER-2
CONSTRUCTION ER-2
REMOVAL ER-2
INSTALLATION ER-5
SERVICE DATA AND SPECIFICATIONS (S.D.S.) ER-6
TIGHTENING TORQUE ER-6

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ENGINE REMOVAL AND INSTALLATION

CONSTRUCTION



REMOVAL

It is much easier to remove engine and transmission as a single unit than to remove them separately. After removal, engine can be separated from transmission assembly.

WARNING:
- **a. Place wheel chocks in front of front wheels and in rear of rear wheels.**
- **b. Be sure to hoist engine and jack up transmission in a safe manner.**
- **c. You should not remove the engine until the exhaust system has completely cooled off. Otherwise, you may burn yourself and/or fire may break out in fuel line.**

Fender cover should be used to protect vehicle body.

1. Disconnect the negative battery cable.
2. Drain engine coolant.
3. Remove hood.

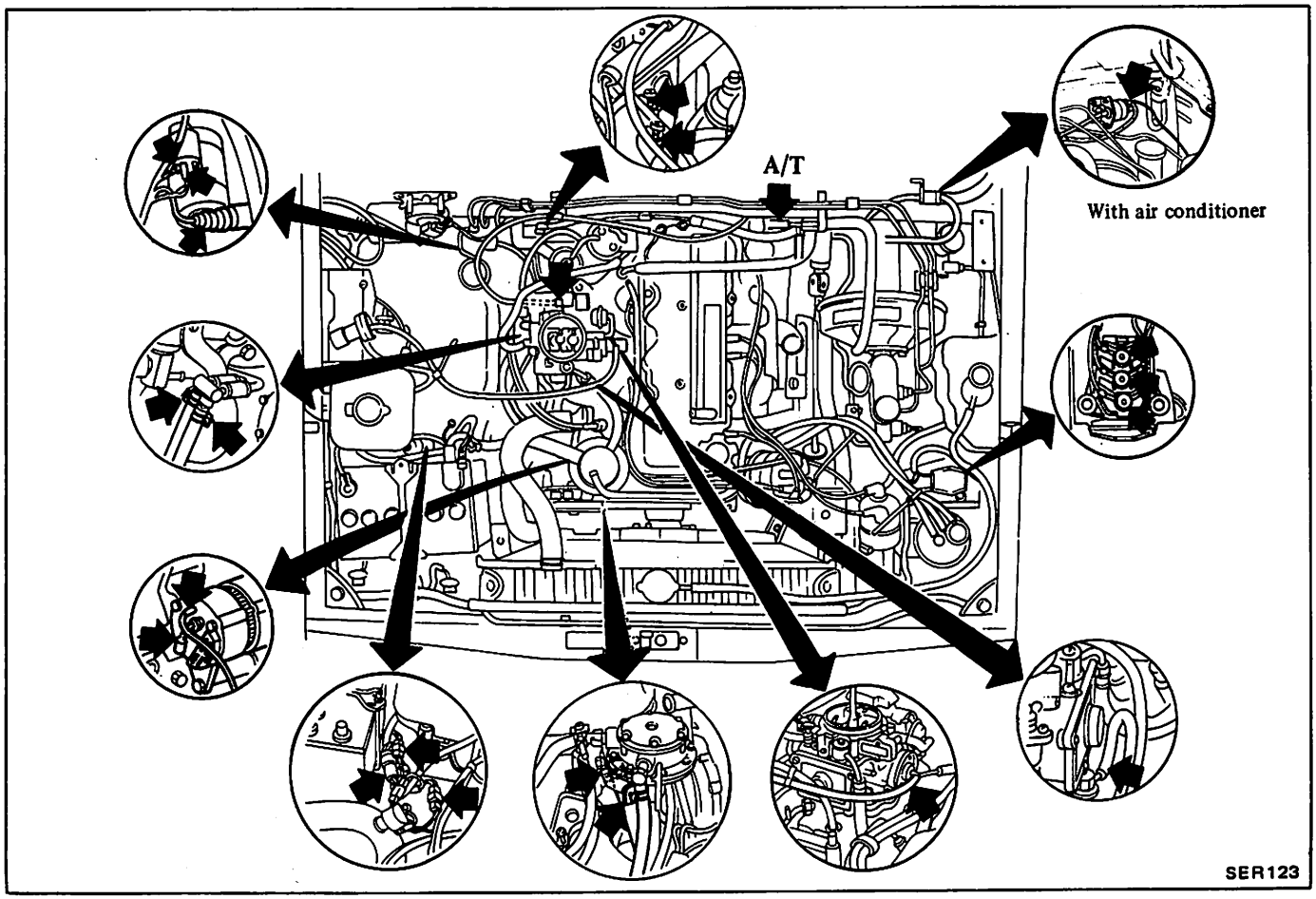
Mark the location of hood hinges on hood to facilitate correct reinstallation.

CAUTION:
Have an assistant help you so as to prevent damage to body.

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4. Remove air cleaner. Refer to Section EF.

5. Remove all wires and hoses indicated by arrows in the figure below.

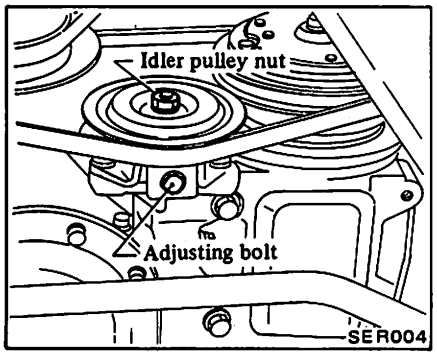


Models equipped with air conditioner

Remove compressor, following the procedures below:

(1) Remove compressor drive belt.

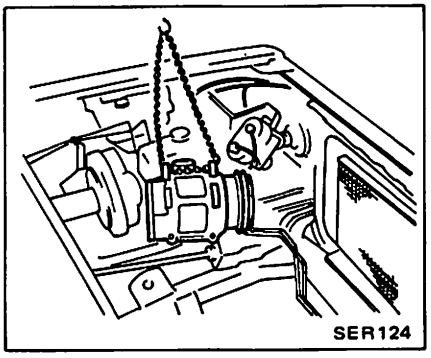
To remove this belt, loosen both idler pulley nut and adjusting bolt.



(2) Remove compressor.

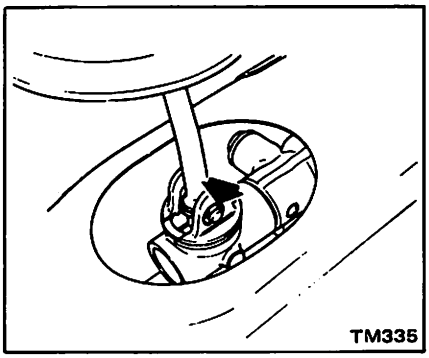
Place the removed compressor as shown.

Never discharge gas from compressor while service/repair work is being performed.

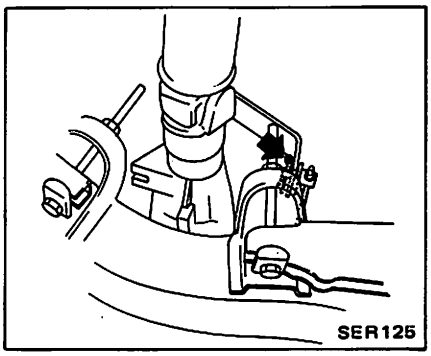


6. Remove transmission control linkage as follows:

(1) Manual transmission



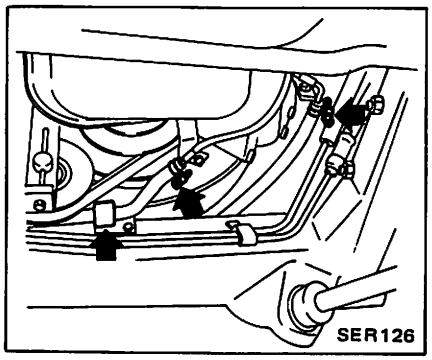
(2) Automatic transmission



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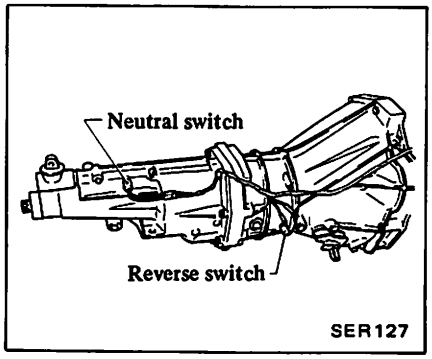
7. Remove upper and lower radiator hoses.
8. Remove radiator and radiator shroud.

On models equipped with automatic transmission, remove oil cooler hoses.

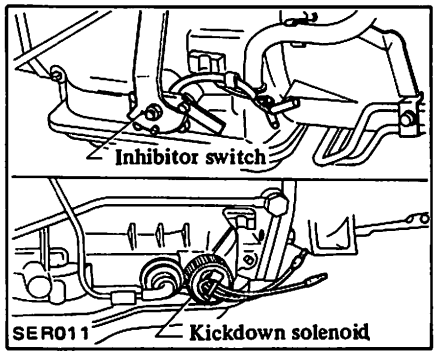


9. Disconnect speedometer cable. (2WD)
10. Disconnect wires from switches located on transmission case.
- Neutral switch (M/T)
- Reverse switch (M/T)
- Inhibitor switch (A/T)
- Kickdown solenoid (A/T)

M/T models



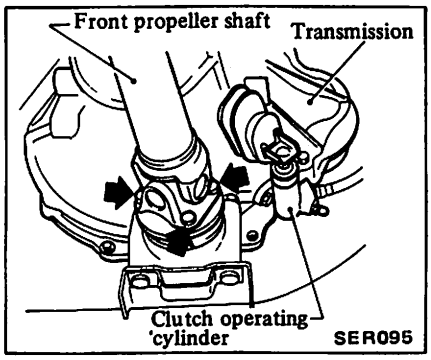
A/T models

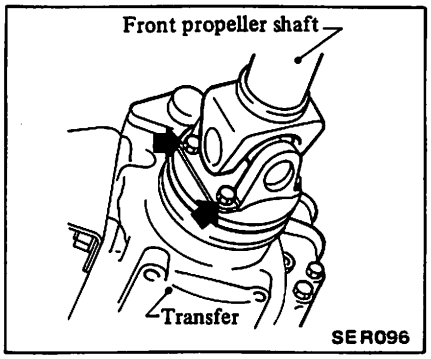


11. Remove parking brake cable from brake lever side.
12. Remove pre-propeller shaft: refer to Transfer (Section TF) for removal. (4WD)

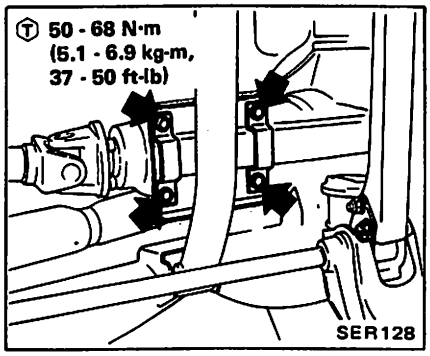
Plug opening in rear extension to prevent oil from flowing out.

13. Remove front propeller shaft. (4WD)

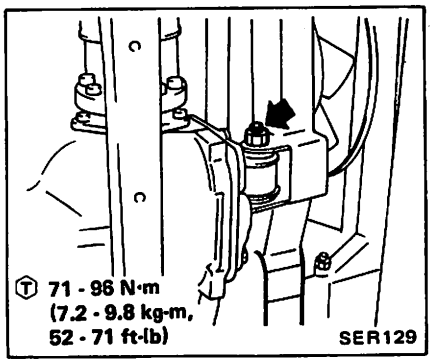




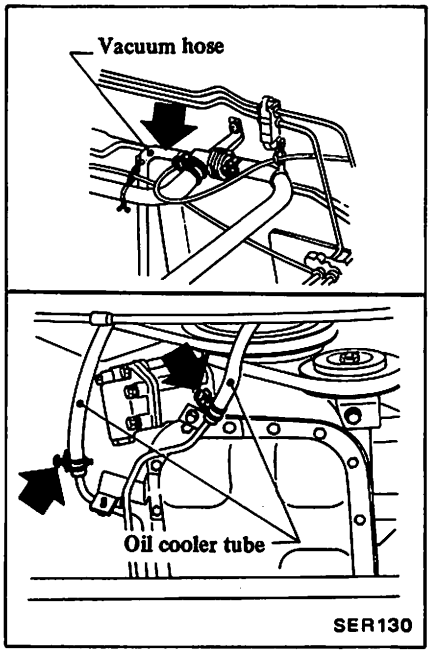
14. Remove differential rear mounting bolts. (4WD)



15. Remove front differential carrier mounting bolt.(4WD)

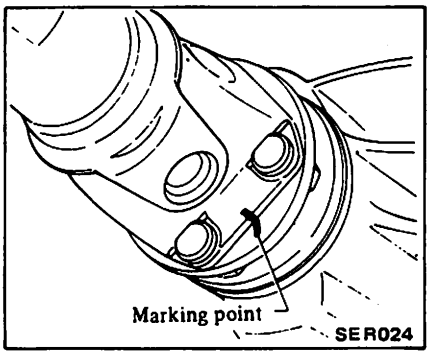


16. Disconnect vacuum hose and oil cooler tubes. (A/T)



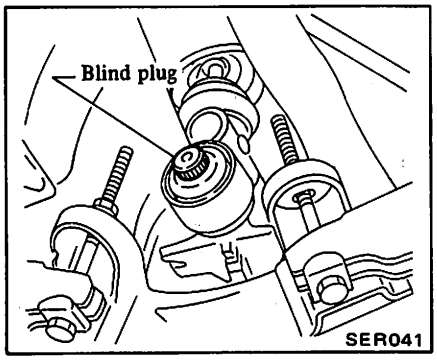
17. Remove propeller shaft. (2WD)

Place marks on propeller shaft before removal to facilitate reinstallation.



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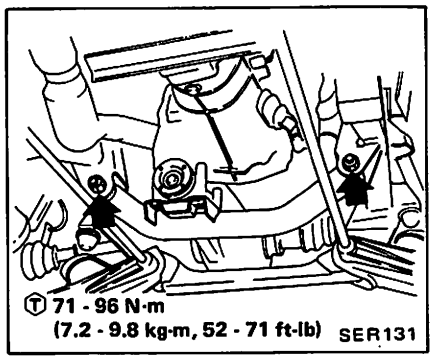
Plug open holes in rear extension housing as shown.



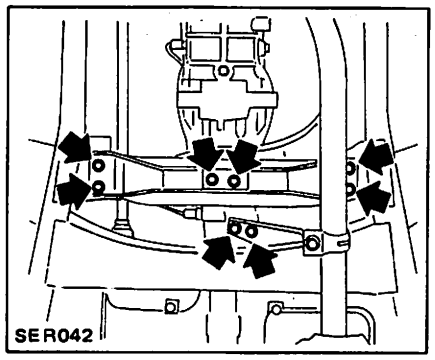
18. Remove clutch operating cylinder and exhaust tube.
19. Attach suitable wires to engine slingers and raise engine using a hoist to take the weight off front and rear mount insulators.

WARNING:
Before raising engine, loosen wires two or three times to make sure it is safe to do so.

20. Remove differential rear mounting member. (4WD)

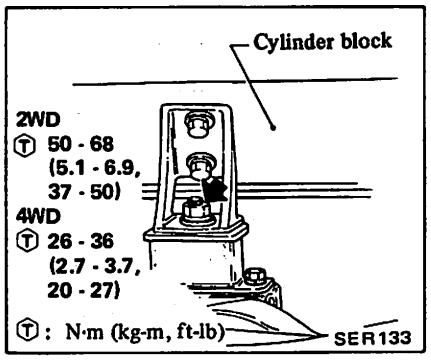


21. Remove bolts which attach rear engine mounting support to the body.

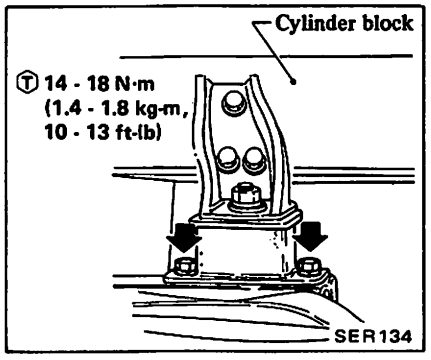


22. Remove front engine mounting bolts.

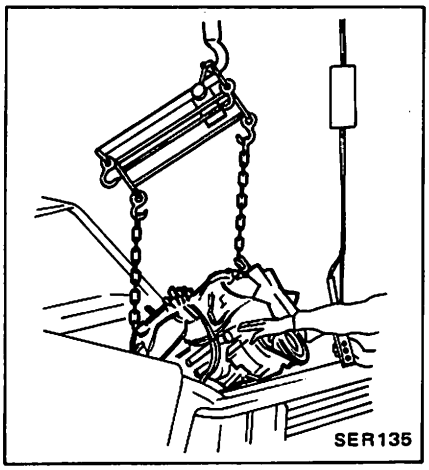
Left side



Right side



23. Raise engine with transmission and remove it from vehicle as a single unit.



WARNING:
When raising engine, be especially careful not to bump it against adjacent parts.

24. Set engine with transmission on an engine stand.

INSTALLATION

Install in the reverse order of removal, observing the following:

When installing, be sure to check that electrical harnesses are correctly connected.

1. When installing, first secure rear engine support bracket to rear mounting insulator.
2. Adjust accelerator control system. Refer to Engine Control System (Section FE) for adjustment.
3. Install air conditioner compressor and adjust belt.

Refer to Engine Maintenance (Section MA) for checking and adjusting drive belts.

4. When reinstalling the hood following engine installation, be sure that it is properly centered and that hood lock operates securely. Refer to Hood (Section BF) for adjustment.
5. Pour the correct amount of engine coolant.

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

TIGHTENING TORQUE

Model		2WD			4WD		
Unit		N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
Fixing bolts and nuts Front mounting bracket to cylinder block		25 - 35	2.6 - 3.6	19 - 26	25 - 35	2.6 - 3.6	19 - 26
Front mounting insulator to bracket	L.H.	50 - 68	5.1 - 6.9	37 - 50	26 - 36	2.7 - 3.7	20 - 27
	R.H.	25 - 35	2.6 - 3.6	19 - 26			
Front mounting insulator to front support	L.H.	25 - 35	2.6 - 3.6	19 - 26	45 - 60	4.6 - 6.1	33 - 44
	R.H.	14 - 18	1.4 - 1.8	10 - 13	14 - 18	1.4 - 1.8	10 - 13
Rear mounting insulator to transmission		42 - 49	4.3 - 5.0	31 - 36	42 - 49	4.3 - 5.0	31 - 36
Rear mounting insulator to rear support		31 - 35	3.2 - 3.6	23 - 26	31 - 35	3.2 - 3.6	23 - 26
Rear support to frame		31 - 42	3.2 - 4.3	23 - 31	31 - 42	3.2 - 4.3	23 - 31
Clutch operating cylinder to transmission		30 - 40	3.1 - 4.1	22 - 30	30 - 40	3.1 - 4.1	22 - 30
Exhaust front tube to exhaust manifold		26 - 36	2.7 - 3.7	20 - 27	26 - 36	2.7 - 3.7	20 - 27
Center bearing bracket to crossmember		16 - 22	1.6 - 2.2	12 - 16	–	–	–
Propeller shaft to companion flange		24 - 32	2.4 - 3.3	17 - 24	34 - 44	3.5 - 4.5	25 - 33
Compressor to bracket		44 - 54	4.5 - 5.5	33 - 40	44 - 54	4.5 - 5.5	33 - 40
Differential mounting insulator to crossmember		–	–	–	71 - 96	7.2 - 9.8	52 - 71
Front differential carrier to differential rear mounting member		–	–	–	50 - 68	5.1 - 6.9	37 - 50
Differential rear mounting member to frame bracket		–	–	–	71 - 96	7.2 - 9.8	52 - 71

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ENGINE CONTROL, FUEL & EXHAUST SYSTEMS

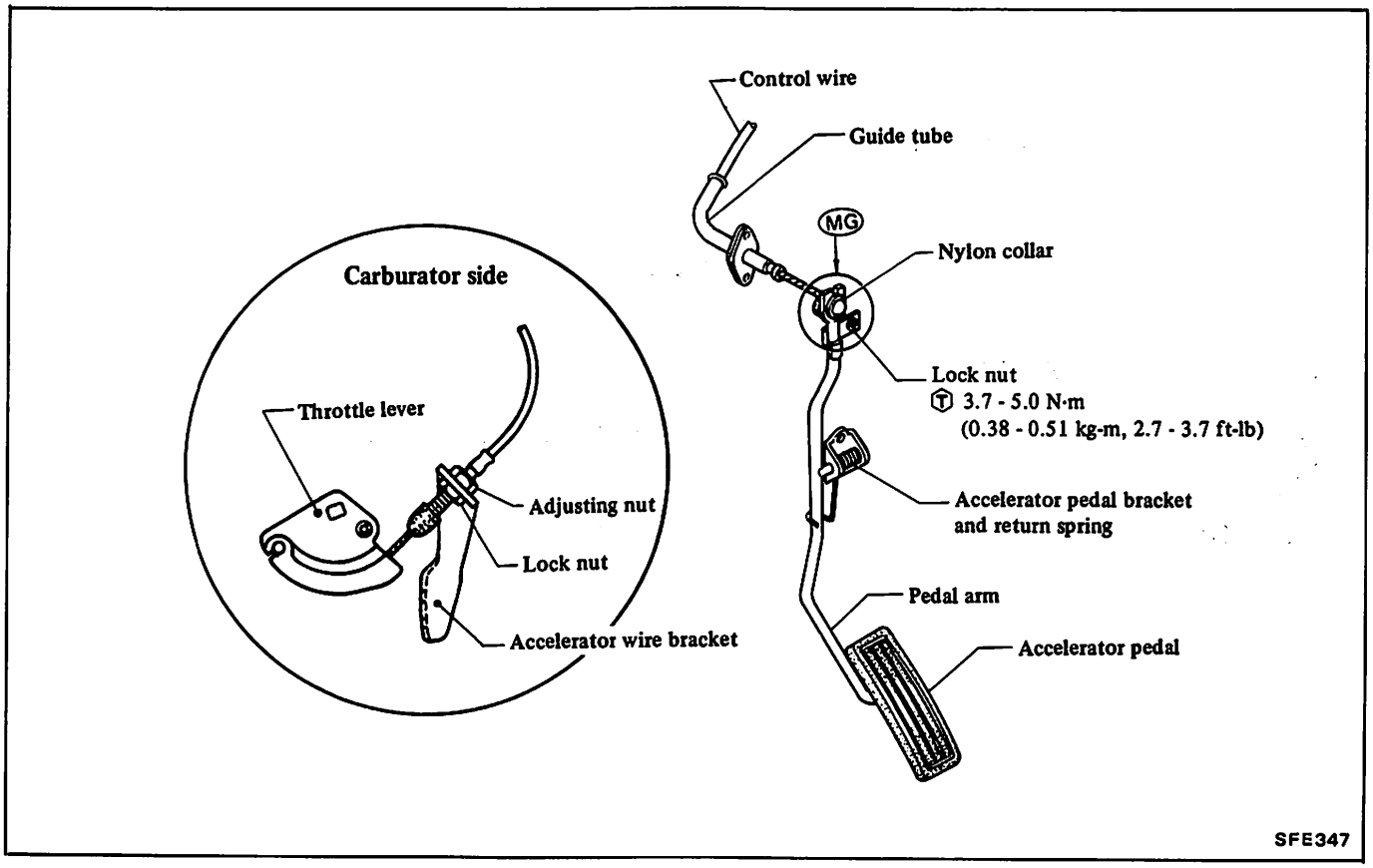
SECTION FE

CONTENTS

ENGINE CONTROL SYSTEM FE-2
ADJUSTMENT FE-2
REMOVAL FE-3
INSPECTION FE-3
INSTALLATION FE-3
FUEL SYSTEM FE-4
REMOVAL FE-5
INSPECTION FE-6
INSTALLATION FE-6
EXHAUST SYSTEM FE-7
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INSPECTION FE-9
INSTALLATION FE-9

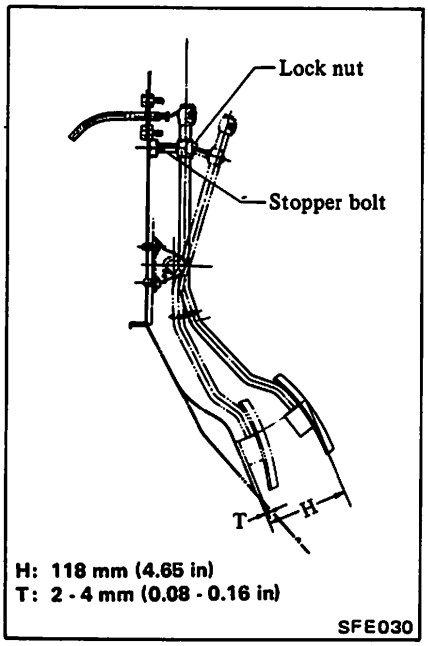
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ENGINE CONTROL SYSTEM



ADJUSTMENT

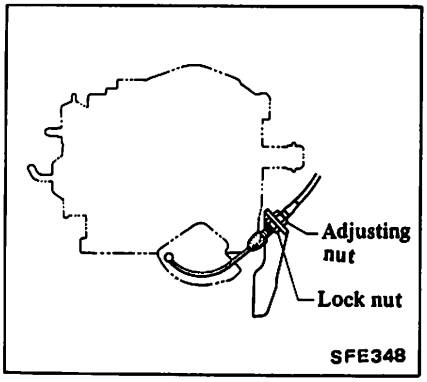
ACCELERATOR PEDAL AND WIRE



1. Adjust accelerator pedal height "H" with pedal stopper bolt. Then tighten lock nut.

Pedal height "H":
118 mm (4.65 in)
Ⓣ : Stopper lock nut
3.7 - 5.0 N·m
(0.38 - 0.51 kg-m,
2.7 - 3.7 ft-lb)

2. Release auto choke effect, since throttle lever is opened by fast idle cam until engine warms up.
(1) Keep choke valve fully open with fingers.
(2) Pull throttle lever up by hand, then automatic choke effect will be released.
3. Set throttle valve to completely closed position and, with wire sufficiently slackened, tighten adjusting nut up to such an extent that throttle lever is about to move. Accelerator pedal play is zero at this time.



4. Unscrew adjusting nut one to two turns so that accelerator wire play is 1.0 to 2.5 mm (0.039 to 0.098 in). Tighten lock nut.
5. After completing the adjustment as previously explained, check the following:

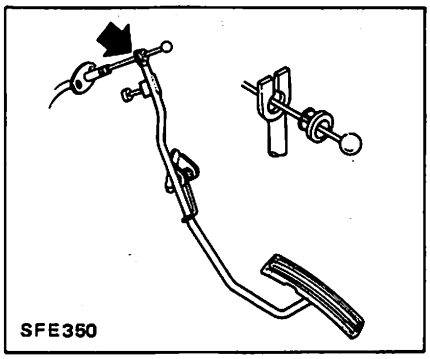
(1) Make sure that accelerator system functions smoothly and quietly without disturbing any adjacent parts.

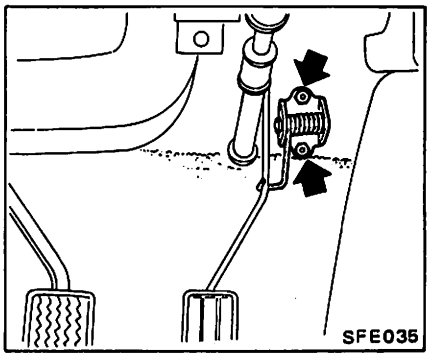
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(2) Depress accelerator pedal down until throttle valve fully opens. Make sure that the clearance "T" between accelerator pedal reverse side and dash floor is 2 to 4 mm (0.08 to 0.16 in) without floor mat. Adjust pedal stopper bolt and lock nut if beyond limit.

(3) Check throttle lever if it returns to the original position as soon as accelerator pedal is released.

(4) Apply recommended multi-purpose grease slightly on the portion as shown on page FE-2. .

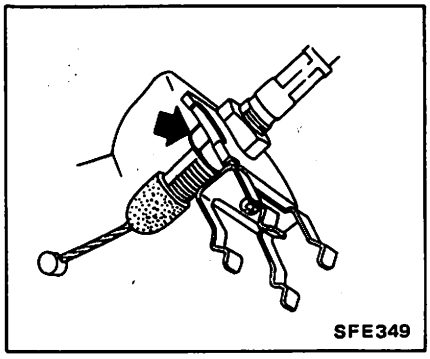




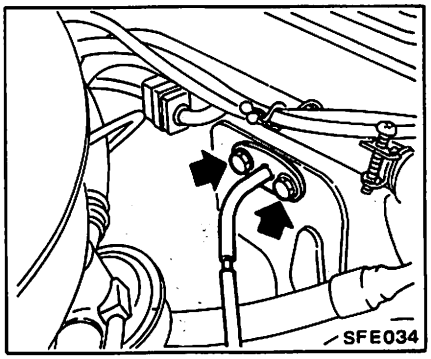
REMOVAL

ACCELERATOR WIRE

1. Remove air cleaner assembly.
2. Disconnect accelerator wire from carburetor.



3. Remove nylon collar by pushing it toward wire end and disconnect accelerator wire from accelerator pedal arm.
4. Remove accelerator wire outer case from body, and detach accelerator wire.



ACCELERATOR PEDAL

1. Remove nylon collar by pushing it toward wire end and disconnect accelerator wire from accelerator pedal arm.
2. Remove pedal with bracket.

INSPECTION

1. Check accelerator pedal return spring for rust, fatigue or damage. Replace if necessary.
2. Check accelerator wire, cases and fastening locations for rust, damage or looseness. Repair or replace if necessary.

INSTALLATION

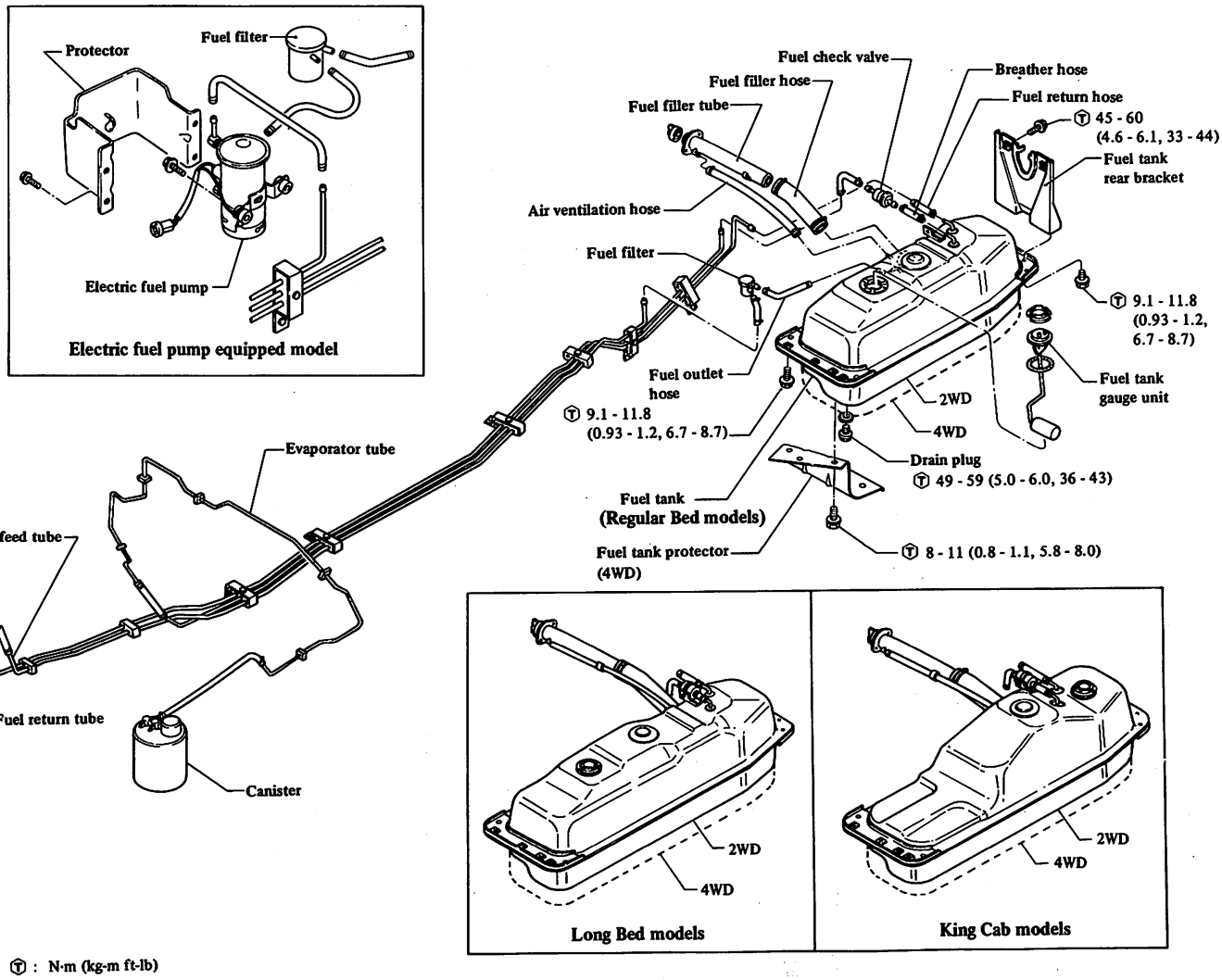
To install, reverse the order of removal.

a. Apply recommended multi-purpose grease slightly to portion (MG) as shown on page FE-2.

b. Ensure that kickdown switch (for automatic transmission models) turns ON when accelerator pedal is fully depressed and throttle valve is fully opened. Also ensure that, at this point, switch's push rod moves properly.

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FUEL SYSTEM



SFE351

Ⓣ : N·m (kg-m ft-lb)

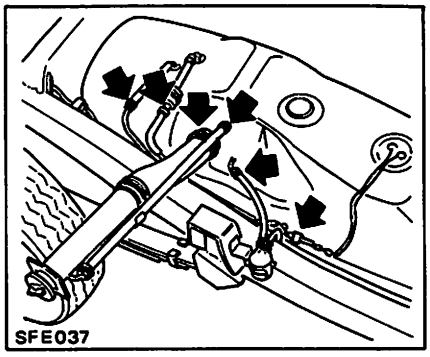
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REMOVAL

WARNING:
When replacing fuel line parts, be sure to observe the following:
a. Put a "CAUTION: INFLAMMABLE" sign in workshop.
b. Be sure to furnish workshop with an asphyxiator.
c. Be sure to disconnect battery ground cable before conducting operations.
d. Put drained fuel in an explosion-proof container and put on lid securely.

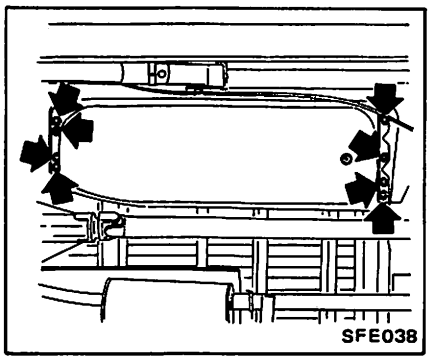
FUEL TANK

1. Disconnect battery ground cable.
2. Drain fuel from fuel tank.
3. Disconnect following parts.
- Fuel filler hose
- Air ventilation hose
- Fuel outlet hose
- Breather hose
- Fuel return hose
- Fuel tank gauge unit wire connector


SFE037

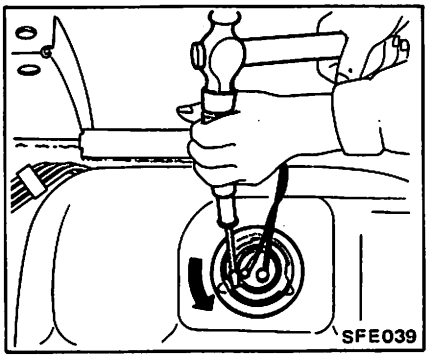
4. Remove fuel tank protector and fuel tank.

Plug hose and pipe opening to prevent entry of dust or dirt during removal.


SFE038

FUEL TANK GAUGE UNIT

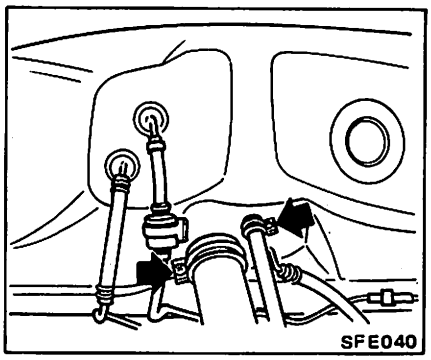
1. Disconnect battery ground cable.
2. Disconnect wires from fuel tank gauge unit.
3. Remove fuel tank. Refer to Fuel Tank for removal.
4. Remove lock plate, turning it counterclockwise with a suitable drift and a hammer.


SFE039

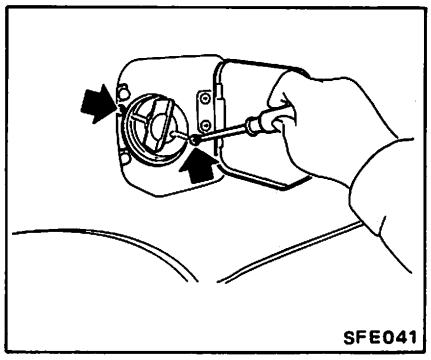
5. Remove fuel tank gauge unit from tank. **Plug tank unit opening to prevent entry of dust or dirt.**

FUEL FILLER TUBE AND HOSE

1. Disconnect battery ground cable.
2. Drain fuel from fuel tank.
3. Disconnect fuel filler hose and air ventilation hose from fuel tank.

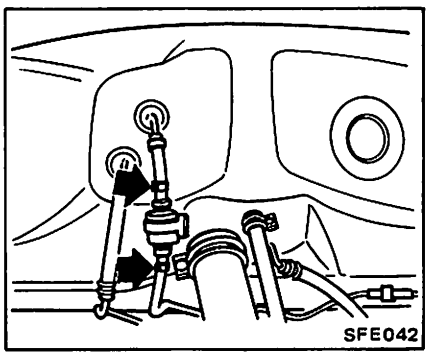

SFE040

4. Remove fuel filler neck attaching bolts and remove fuel filler hose and tube.


SFE041

FUEL CHECK VALVE

1. Disconnect breather hoses from check valve.


SFE042

2. Pull check valve out of its holder.

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FUEL TUBE

Fuel tubes are serviced as an assembly. However, do not disconnect any fuel line unless absolutely necessary.

1. Drain fuel from fuel tank.
2. Loosen fuel hose clamps and disconnect fuel tubes on each end.

Plug hose and tube openings to prevent entry of dust of dirt while removing.

3. Unfasten clips that hold tube on underbody. Do not remove brake tube from clip.
4. Remove tube from the vehicle.

FUEL FILTER

1. Drain fuel from fuel tank.
2. Disconnect fuel hoses from fuel filter by removing clamps.
3. Remove fuel filter.

INSPECTION

FUEL TANK

Check fuel tank for cracks or deformation. If necessary, replace.

FUEL TANK GAUGE UNIT

Refer to Fuel Tank Gauge Unit (Section EL) for inspection.

FUEL HOSE

Inspect all hoses for cracks, fatigue, sweating or deterioration. Replace any hose that is damaged.

FUEL TUBE

Replace any fuel tube that is cracked, rusted, collapsed or deformed.

FUEL CHECK VALVE

Refer to Fuel Check Valve (Section EC) for inspection.

FUEL FILTER

Refer to Fuel Filter (Section EF) for inspection.

INSTALLATION

To install, reverse the order of removal. Observe the following:

a. Install hose clamps securely. Do not tighten excessively to avoid damaging hoses.

b. Fasten fuel tube clamps on underbody securely. Failure to follow this caution could result in damage to the surface of fuel tube.

c. Do not kink or twist hose and tube when they are routed.

d. Install filler hose after fuel tank has been mounted in place. Failure to follow this caution could result in leakage from around hose connections.

e. Always connect the filler hose with the arrow facing the fuel tank and up.

f. When installing fuel tank gauge unit, align the projection of tank gauge unit with the notch in fuel tank and tighten it securely. Be sure to install gauge unit with O-ring in place.

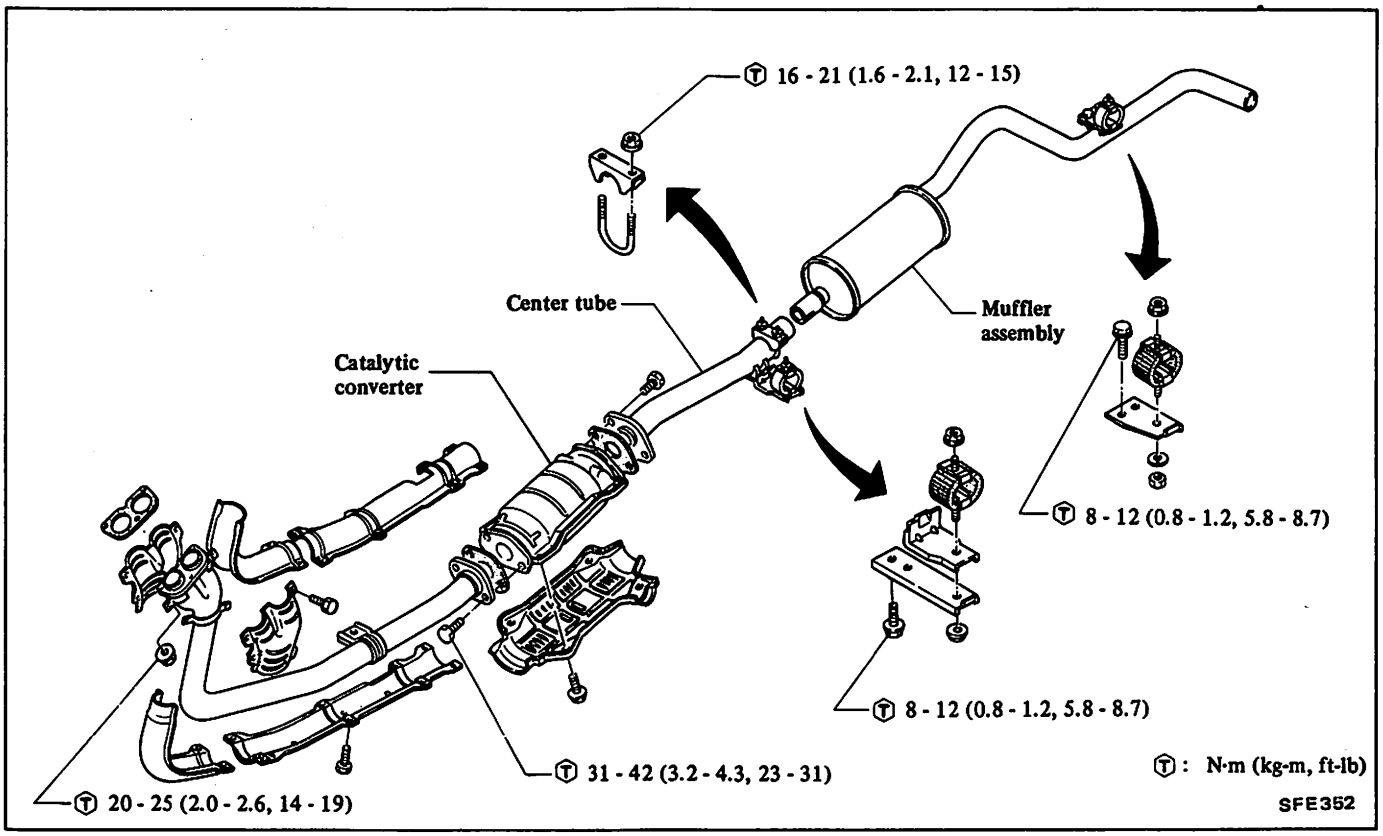
g. Run engine and check for leaks at connections.

Ⓣ : Drain plug:
49 - 59 N·m
(5.0 - 6.0 kg-m,
36 - 43 ft-lb)
Fuel tank securing bolt:
9.1 - 11.8 N·m
(0.93 - 1.2 kg-m,
6.7 - 8.7 ft-lb)
Fuel tank protector securing bolt:
8 - 11 N·m
(0.8 - 1.1 kg-m,
5.8 - 8.0 ft-lb)

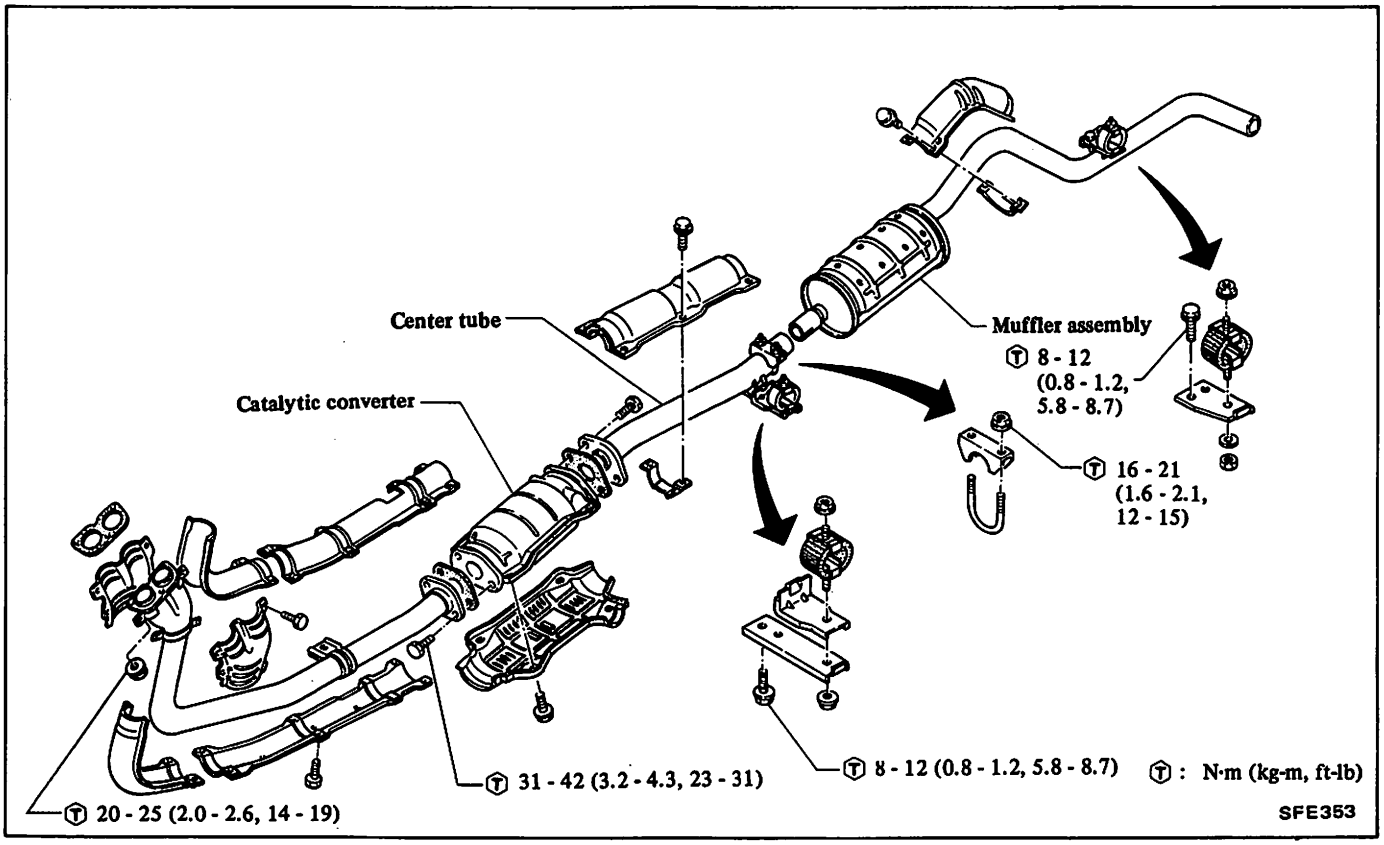
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EXHAUST SYSTEM

2WD (Except Heavy duty models)

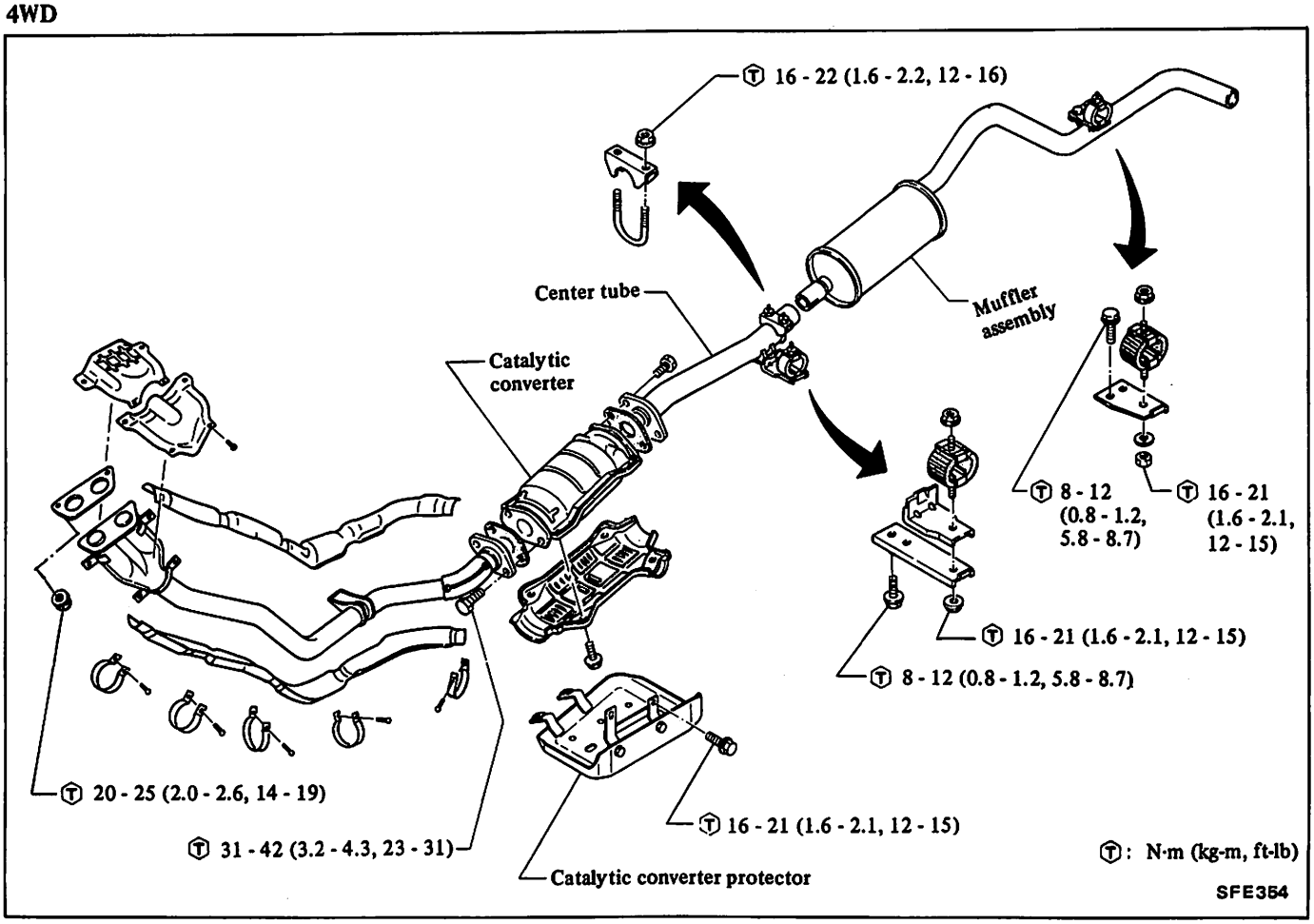


2WD (Heavy duty models)



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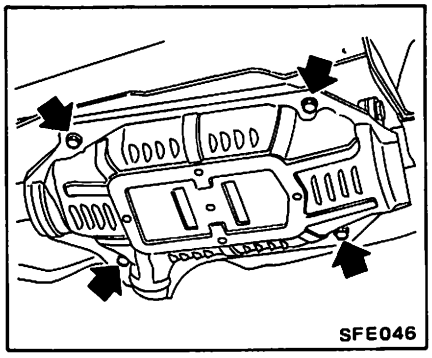
4WD



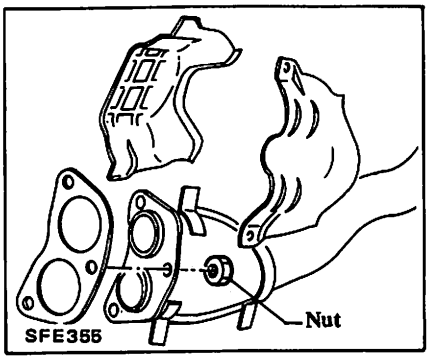
REMOVAL

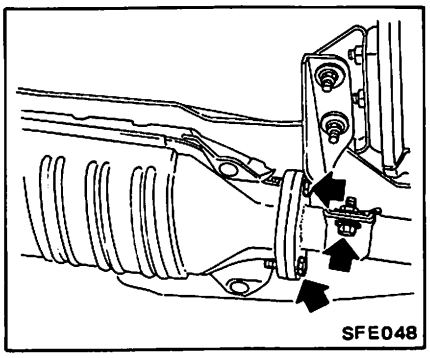
FRONT TUBE

1. Remove catalytic converter lower shelter.

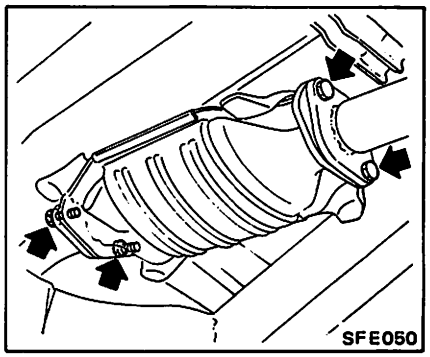


2. Remove bolts and nuts attaching front exhaust tube to exhaust manifold after removing heat insulator, then remove transmission rear extension and catalytic converter. Front exhaust tube can then be taken out.





CATALYTIC CONVERTER



Remove catalytic converter lower shelter and remove catalytic converter.

CAUTION:

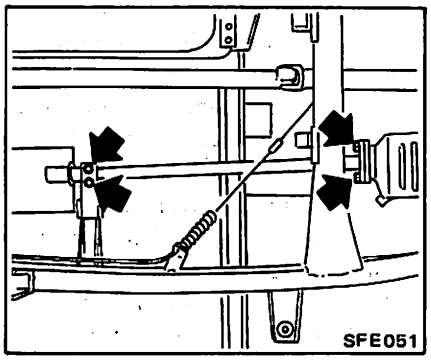
a. Be careful not to damage catalytic converter when handling.

b. Never wet catalytic converter with water, oil, etc.

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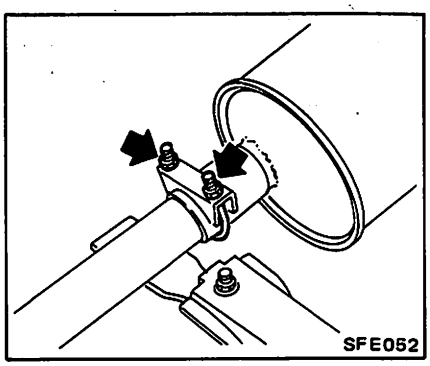
CENTER TUBE

1. Remove muffler assembly. Refer to Main Muffler and Tail Tube.
2. Remove main muffler assembly mounting nuts.
3. Remove bolts attaching center tube to catalytic converter. Center tube can then be taken out.

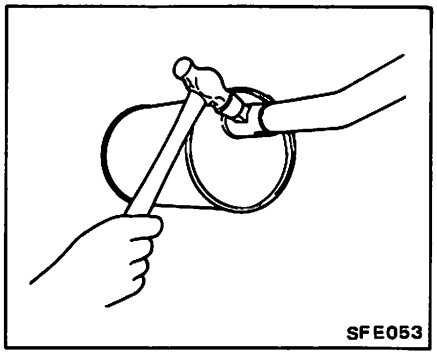

SFE051

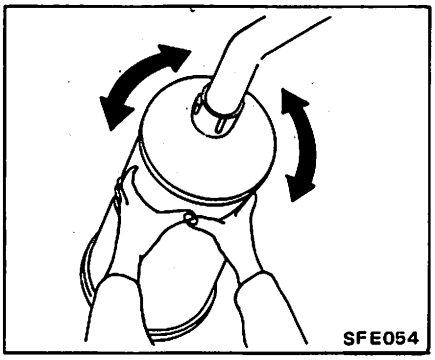
MAIN MUFFLER AND TAIL TUBE

1. Remove exhaust tube U-bolt clamp.

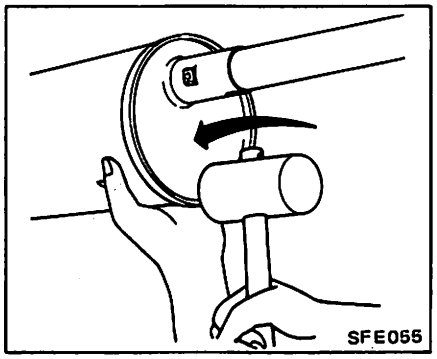

SFE052

2. Break sealant off at front tube to main muffler connection.
(1) Break old sealant off at the connection by lightly tapping around the tube with a hammer and twisting muffler.


SFE053


SFE054

(2) Using a rubber hammer, tap on the front end of muffler while pushing it toward rear. The muffler assembly can then be taken out.


SFE055

3. Remove rear tube mounting bolt, and remove muffler assembly with rear tube.

INSPECTION

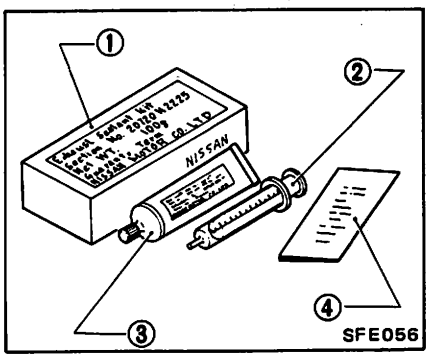
1. Check muffler and tubes for cracks, damage or corrosion.
Replace any part that is damaged beyond limits.
2. Replace bracket and mounting insulator that are cracked, fatigued, or sweated.

INSTALLATION

Install the exhaust system parts in reverse order of removal. Observe the following:

Ⓣ : Exhaust manifold to front tube nut:
20 - 25 N·m
(2.0 - 2.6 kg-m,
14 - 19 ft-lb)
U-bolt securing nut:
16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)
Muffler mounting bracket bolt:
8 - 12 N·m
(0.8 - 1.2 kg-m,
5.8 - 8.7 ft-lb)
Front tube mounting bracket bolt:
16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)
Catalytic converter to front and center tube bolt
31 - 42 N·m
(3.2 - 4.3 kg-m,
23 - 31 ft-lb)
Catalytic converter protector bolt:
16 - 22 N·m
(1.6 - 2.2 kg-m,
12 - 16 ft-lb)

a. Keep a sufficient clearance between exhaust system components and underbody or adjacent parts.
b. After installation, check that mounting brackets and mounting rubbers are free from undue stress. If any of the above parts is not installed properly, excessive noises or vibrations may be transmitted to the vehicle body.
c. Check all tube connections for exhaust gas leaks, and entire system for unusual noises, with engine running.
d. When connecting exhaust tubes, use the Genuine Nissan Sealant "Exhaust Sealant Kit 20720-N2225" to eliminate gas leakage at the joint. Be sure to observe the following procedures.

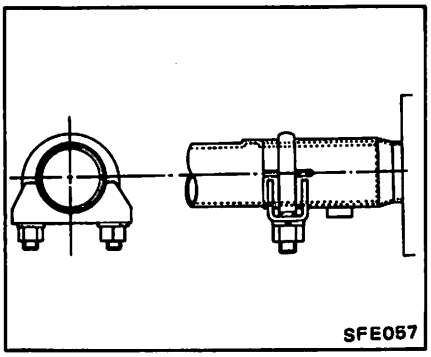


SFE056

1 Case
2 Injector
3 Sealant tube (Polyethylene)
4 Instruction sheet

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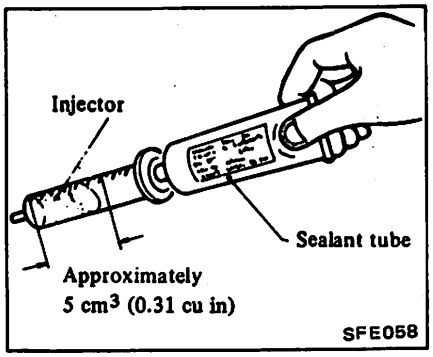
1. Wipe clean all the contact portions of tube joints; allow them to dry thoroughly.
2. Temporarily mount in place exhaust muffler and exhaust tube on the vehicle.
3. Insert front tube until it touches emboss.



4. Tighten following bolts and nuts to specified torque.
- Exhaust manifold securing nut
- Front tube mounting bracket bolt
- U-bolt securing nut
- Muffler mounting bracket bolt

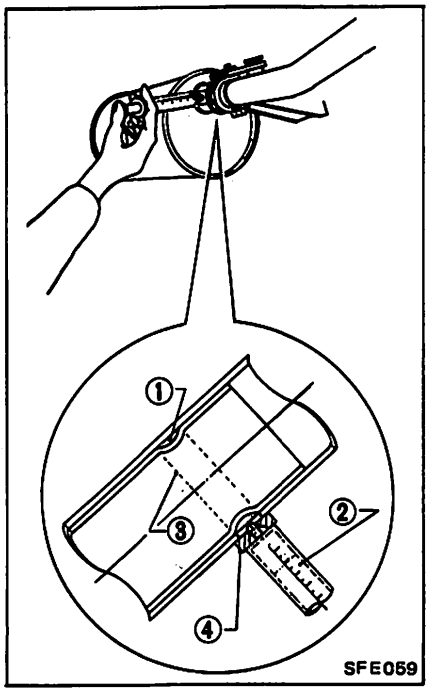
5. Squeeze approximately 5 cm^3 (0.31 cu in) of sealant into injection from sealant tube.

Be sure to place cap back to sealant tube since sealant will dry.



6. Position nozzle of injector to the guide and press it there firmly. Inject sealant slowly until sealant begins to flow out of the slit of tube. This indicates that the bead requires no further sealant. Excessive sealant can cause a clogged tube.

After injecting, wash injector thoroughly in clean water to remove all traces of sealant.



1 Sealant
2 Injector
3 Bead
4 Guide

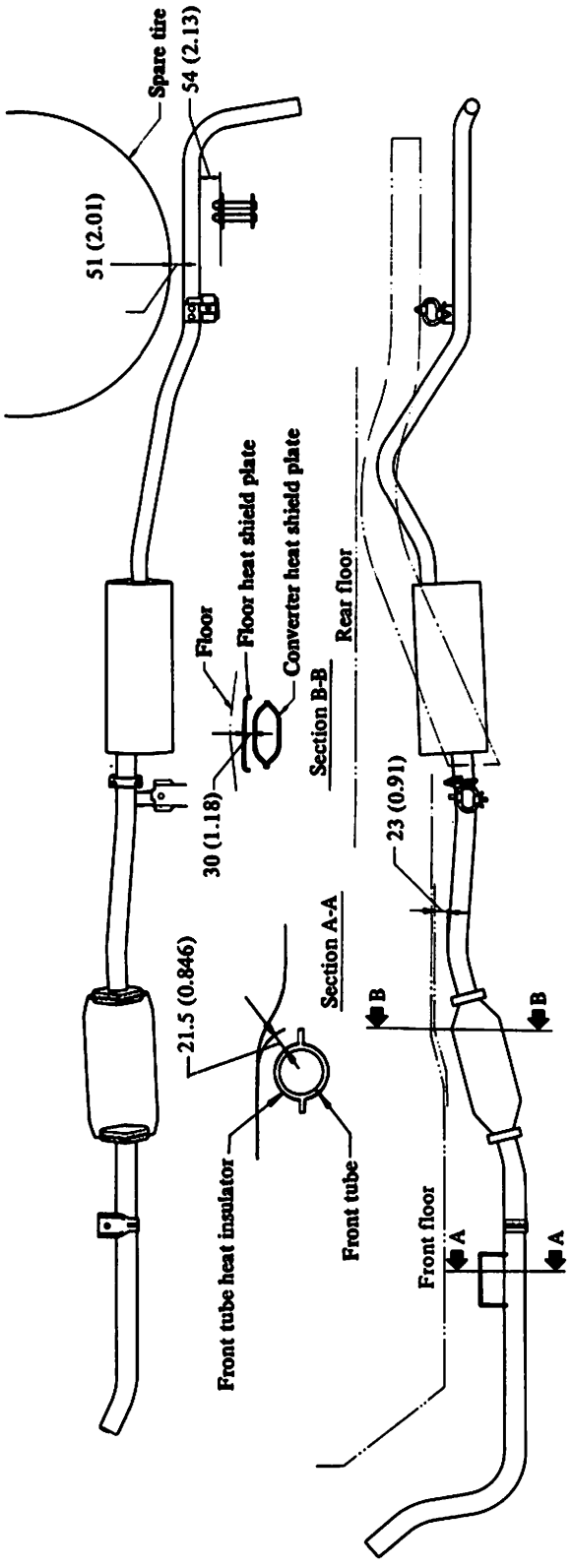
7. Start engine and let it idle slowly for ten minutes (minimum) to harden sealant with the heat of exhaust gas.
8. Check the condition of sealant before driving the vehicle. It is also essential that the vehicle should not be accelerated sharply for 20 to 30 minutes subsequent to this operation.

a. The sealant should be used within guaranty term indicated on the kit case.
b. Exposure of sealant to the skin may cause a rash. Wash sealant off the skin with water.
c. Do not keep the sealant tube in a place where the ambient temperature is above 40°C (104°F). A sealant is hardened above 40°C (104°F) and cannot be used. The most suitable storage temperature is from 15 to 35°C (59 to 95°F). If sealant becomes hardened because of low temperatures, warm the sealant tube with lukewarm water until the sealant is softened. Do not warm tube at a temperature over 40°C (104°F) for a long time.
d. Thoroughly read the instruction sheet furnished with the kit before using the sealant.

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PROPER CLEARANCE FOR EXHAUST SYSTEM

Unit: mm (in)



SFE368

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SECTION CL

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- CLUTCH MASTER CYLINDER ..... CL- 2
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- CLUTCH LINE ..... CL- 5
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- RELEASE BEARING ..... CL- 8
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CL

Refer to Section MA (Clutch) for:

- CHECKING CLUTCH PEDAL HEIGHT AND FREE PLAY

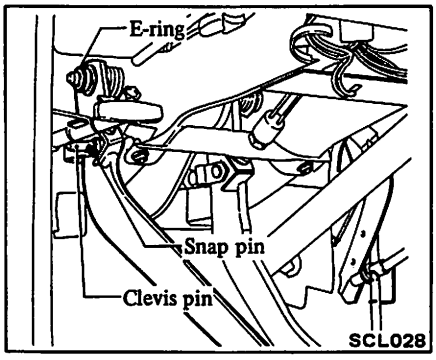
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HYDRAULIC CLUTCH CONTROL

CLUTCH PEDAL

REMOVAL

1. Pry off snap pin and take out clevis pin.



2. Remove clutch switch.
3. Remove E-ring on fulcrum pin, then remove clutch pedal and return spring.

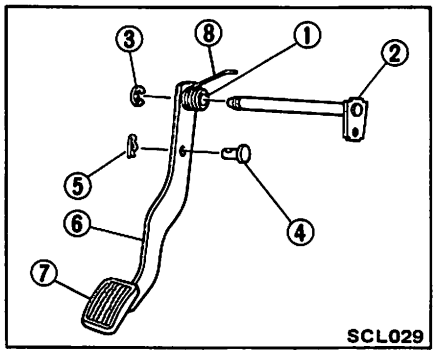
INSPECTION

Inspect the following parts: If abnormalities are found, repair or replace the affected parts.

1. Clutch pedal bushing ① at boss, fulcrum pin ② and E-ring ③ for wear, deformation or damage.

Bushing is press-fitted. If it shows sign of abnormality, replace pedal assembly.

2. Clevis pin ④ for wear or damage, and snap pin ⑤ for any deformation.
3. Pedal ⑥, pedal pad ⑦ and clutch switch for deformation or damage.
4. Return spring ⑧ for fatigue or damage.

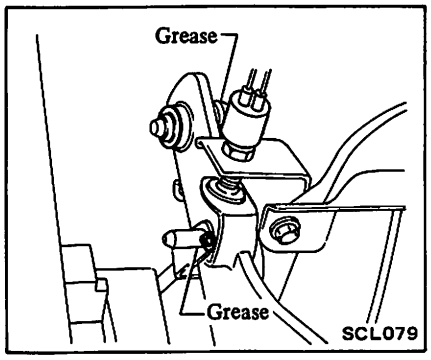


INSTALLATION

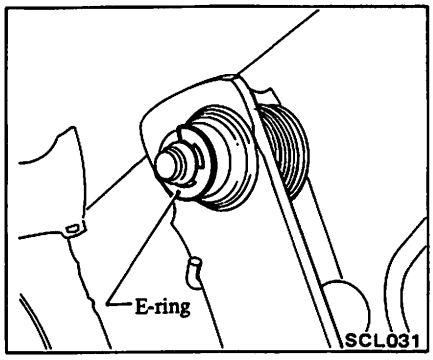
1. Install clutch pedal in reverse order of removal.

Observe following:

a. Apply grease to boss of clutch pedal, return spring and fulcrum pin.

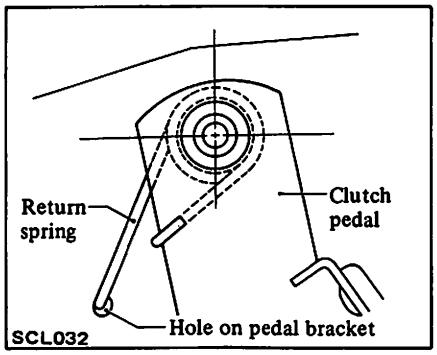


b. Firmly attach E-ring to fulcrum pin.



c. Install clevis pin on the right of fulcrum pin and attach snap pin securely.

d. Install return spring as shown below.



2. After assembly, adjust clutch pedal height and free play.

Refer to Clutch Pedal Height and Free Play (Section MA).

Ⓣ : Clutch switch lock nut
12 - 15 N·m
(1.2 - 1.5 kg-m,
9 - 11 ft-lb)

CLUTCH MASTER CYLINDER

REMOVAL

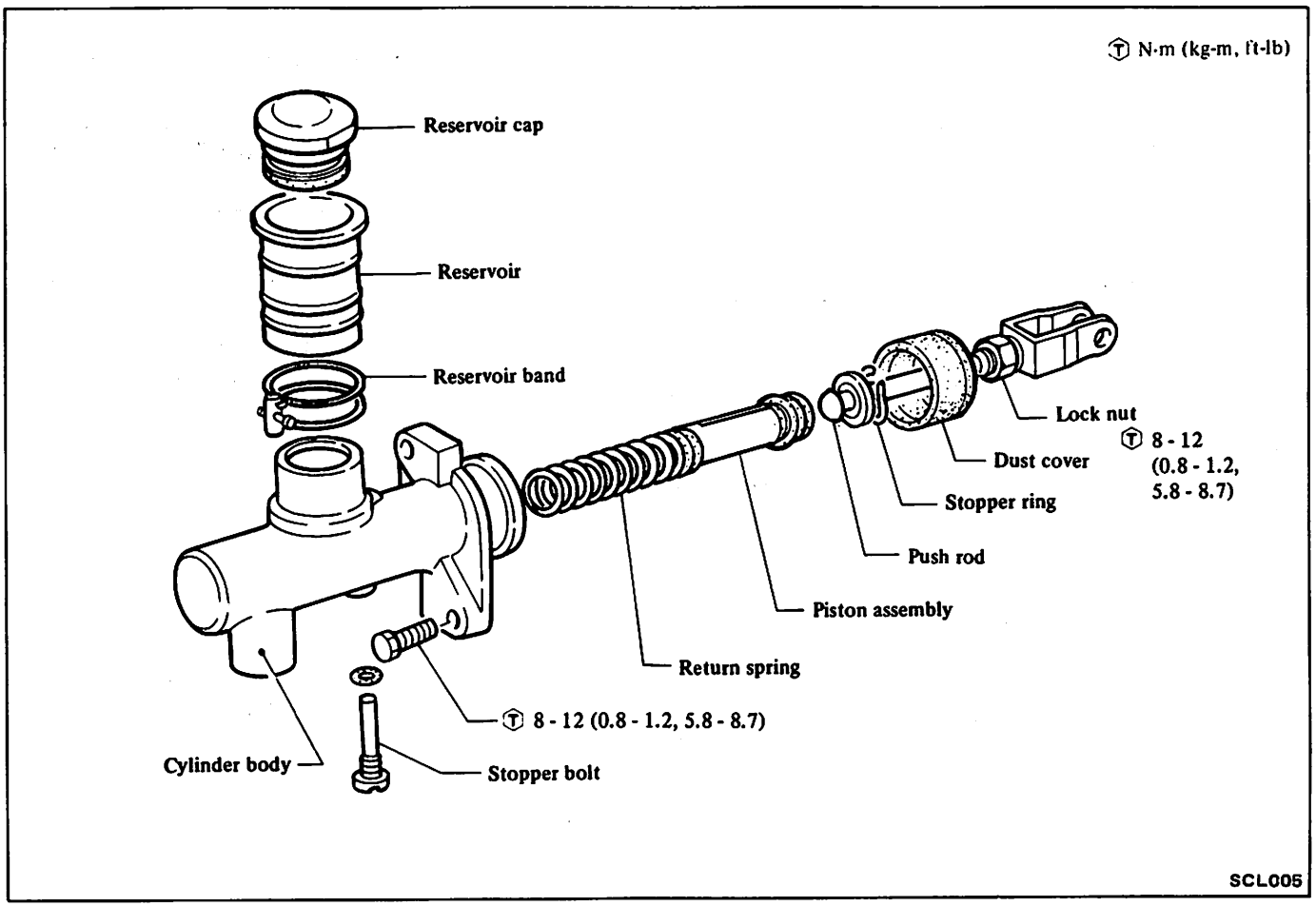
1. Remove snap pin from clevis pin.
2. Pull out clevis pin.
3. Disconnect clutch tube.
4. Remove master cylinder.

When disconnecting clutch tube, be sure to receive draining clutch fluid into a container. Use of rags is also suggested to keep adjacent parts and area clean.

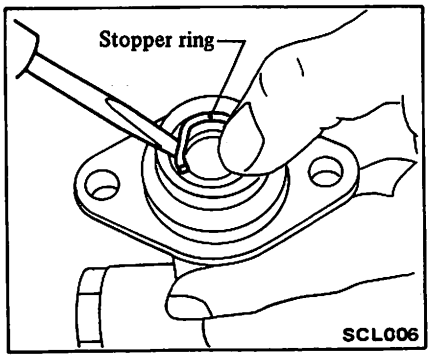
CAUTION:
When disconnecting clutch tube, use suitable flare nut wrench.
Never use an open end wrench or adjustable wrench.

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DISASSEMBLY



1. Remove dust cover and take off stopper ring.



2. Then, the push rod and stopper can be taken out.
3. Loosen stopper bolt and take it out.
4. The piston, spring seat, and return spring can be taken out.

Discard piston cup and dust cover.

CAUTION:
Never detach reservoir. If it is removed for any reason, discard it and install new one.

INSPECTION

CAUTION:
To clean or wash all parts of master cylinder, clean brake fluid must be used. Never use mineral oils such as gasoline and kerosene. It will ruin the rubber parts of the hydraulic system.

1. Check cylinder bore and piston for score or rust and if found, replace.
2. Check cylinder bore and piston for wear. If the clearance between cylinder bore and piston exceeds specified value, replace piston assembly or master cylinder assembly.

Clearance between cylinder bore and piston:
Less than 0.15 mm (0.0059 in)

3. Check condition of piston cup and dust cover. Always replace them after disassembly.
4. Check all recesses, openings and internal passages to ensure that they are clean and free from foreign matter.

ASSEMBLY

1. Apply grease to cylinder body, sliding part and piston cup.

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2. Install piston assembly to cylinder body.

Be careful not to damage piston cup.

3. Make sure that master cylinder operates normally.
4. Make sure that piston can move maximum stroke smoothly.

Ⓣ : Stopper bolt
1.5 - 2.9 N·m
(0.15 - 0.3 kg-m,
1.1 - 2.2 ft-lb)

INSTALLATION

Install clutch master cylinder in reverse order of removal. Observe following:

1. Bleed air out of hydraulic system. Refer to Bleeding Clutch System.
2. Adjust pedal height and pedal free play. Refer to Checking Clutch Pedal Height and Free Play (Section MA).

Ⓣ : Master cylinder to dash panel securing nut
8 - 12 N·m
(0.8 - 1.2 kg-m,
5.8 - 8.7 ft-lb)
Clutch tube flare nut
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)
Push rod lock nut
8 - 12 N·m
(0.8 - 1.2 kg-m,
5.8 - 8.7 ft-lb)

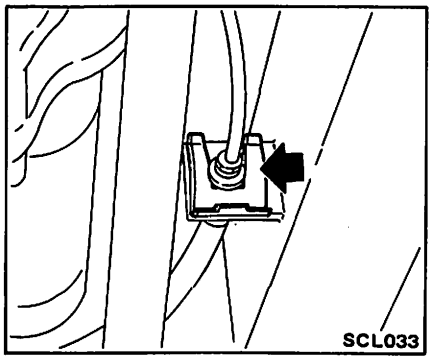
CAUTION:
When connecting clutch tube, use Tool GG94310000.

When tightening flare nut, hold pipe by hand to prevent it from twisting.

OPERATING CYLINDER

REMOVAL

1. Loosen clutch tube flare nut at the bracket on side member.



CAUTION:
When disconnecting clutch tube, use suitable flare nut wrench.
Never use an open end wrench or adjustable wrench.

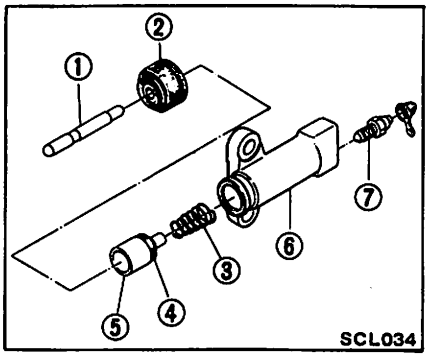
2. Remove lock spring, then disengage hose from bracket.
3. Remove clutch hose from operating cylinder.
4. Remove operating cylinder.

DISASSEMBLY

1. Remove dust cover and push rod.
2. Remove piston and piston cup as an assembly.

Discard piston cup and dust cover.

3. Remove bleeder screw.



1 Push rod
2 Dust cover
3 Piston spring
4 Piston
5 Piston cup
6 Operating cylinder
7 Bleeder screw

INSPECTION

Visually inspect all disassembled parts and replace parts which are worn or damage.

CAUTION:
To clean or wash all parts of operating cylinder, clean brake fluid must be used.
Never use mineral oils such as gasoline and kerosene. It will ruin the rubber parts of the hydraulic system.

1. Check cylinder bore and piston for score or rust and, if found, replace.
2. Check cylinder bore and piston for wear. If clearance between cylinder bore and piston is more than the specified value, replace piston or operating cylinder assembly.

Clearance between cylinder bore and piston:
Less than 0.15 mm
(0.0059 in)

3. Check condition of piston cup and dust cover. Always replace them after disassembly.
4. Check bleeder hole to be sure that it is clean.

ASSEMBLY

Assemble operating cylinder in reverse order of disassembly. Observe following:

1. Prior to assembly, dip a new piston cup in clean brake fluid. To install piston cup on piston, pay particular attention to its direction.
2. Dip cylinder and piston in clean brake fluid before assembly.

INSTALLATION

Install operating cylinder in reverse order of removal. Observe following:

Bleed air thoroughly from clutch hydraulic system. Refer to Bleeding Clutch System.

a. When operating cylinder is removed from, or installed on, clutch housing without disconnecting clutch hose from operating cylinder, loosen bleeder screw so that push rod moves lightly.

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b. Exercise care not to warp or twist clutch hose. Be sure to install clutch hose away from exhaust tube.
c. When tightening flare nut, hold pipe by hand to prevent it from twisting.

CAUTION:
When connecting clutch tube, use Tool GG94310000.

Ⓣ : Bleeder screw
7 - 9 N·m
(0.7 - 0.9 kg-m,
5.1 - 6.5 ft-lb)
Operating cylinder to clutch housing securing bolts
30 - 40 N·m
(3.1 - 4.1 kg-m,
22 - 30 ft-lb)
Clutch hose to operating cylinder
17 - 21 N·m
(1.7 - 2.1 kg-m,
12 - 15 ft-lb)

CLUTCH LINE

INSPECTION

Check clutch lines (tube and hose) for evidence of cracks, deterioration or other damage. Replace if necessary.

If leakage occurs at or around joints, retighten and, if necessary, replace damaged parts.

REMOVAL

CAUTION:
When disconnecting clutch tube, use suitable flare nut wrench.
Never use an open end wrench or adjustable wrench.

1. Disconnect clutch tube from clutch hose at bracket on side member.
2. Remove lock spring, then disengage hose from bracket.
3. Remove clutch hose from operating cylinder.
4. Disconnect clutch tube from master cylinder.
5. Remove clamp fixing clutch tube to dash panel.

INSTALLATION

Wipe the opening ends of hydraulic line to remove any foreign matter before making connections.

1. Install clutch tube.
(1) Connect clutch tube to master cylinder with flare nut.
(2) Fix clutch tube to dash panel with clamp.
(3) Then tighten flare nut.

Ⓣ : Clutch hose to master cylinder
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)

2. Install clutch hose on operating cylinder with a gasket in place.

Use new gasket.

Ⓣ : Clutch hose to operating cylinder
17 - 21 N·m
(1.7 - 2.1 kg-m,
12 - 15 ft-lb)

3. Engage opposite end of hose with bracket. Install lock spring fixing hose to bracket.

a. When tightening flare nut, hold pipe by hand to prevent it from twisting.
b. Exercise care not to warp or twist clutch hose.

4. Connect clutch tube to hose with flare nut and tighten it.

Ⓣ : Flare nut
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)

5. Check distance between clutch line and adjacent parts (especially between hose and exhaust tube).
6. Bleed air out of hydraulic system.

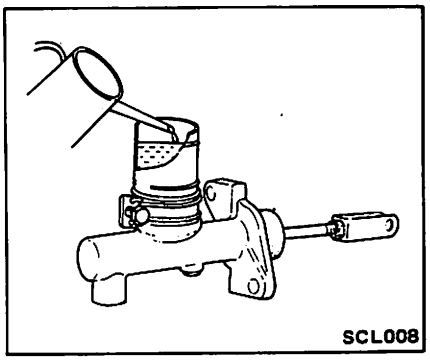
Refer to Bleeding Clutch System for adjustment.

CAUTION:
When tightening flare nut, use Tool GG94310000.

BLEEDING CLUTCH SYSTEM

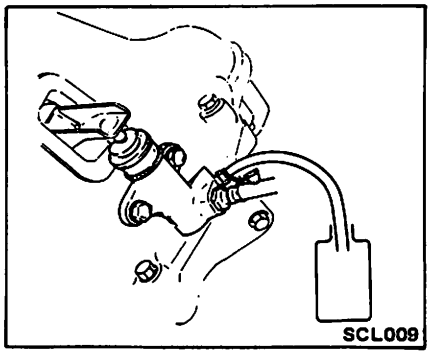
The hydraulic clutch system must be bled whenever clutch line has been disconnected or air has entered it.

1. Remove cap of reservoir and top up with recommended brake fluid.


SCL008

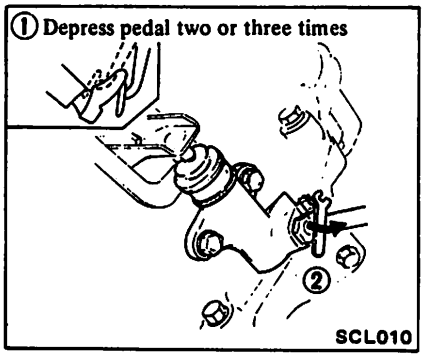
2. Thoroughly clean mud and dust from bleeder screw of operating cylinder so that outlet hole is free from any foreign material. Install bleeder hose (vinyl hose) on bleeder screw.

Place the other end of it in a container filled with brake fluid.


SCL009

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3. Have a co-worker depress clutch pedal two or three times. With clutch pedal depressed fully, loosen bleeder screw to bleed air out of clutch system.



4. Close bleeder screw quickly as clutch pedal is on down stroke.
5. Allow clutch pedal to return slowly with bleeder screw closed.
6. Repeat steps 3 through 5 until no air bubble shows in the vinyl hose.

Ⓣ : **Bleeder screw**
7 - 9 N·m
(0.7 - 0.9 kg-m,
5.1 - 6.5 ft-lb)

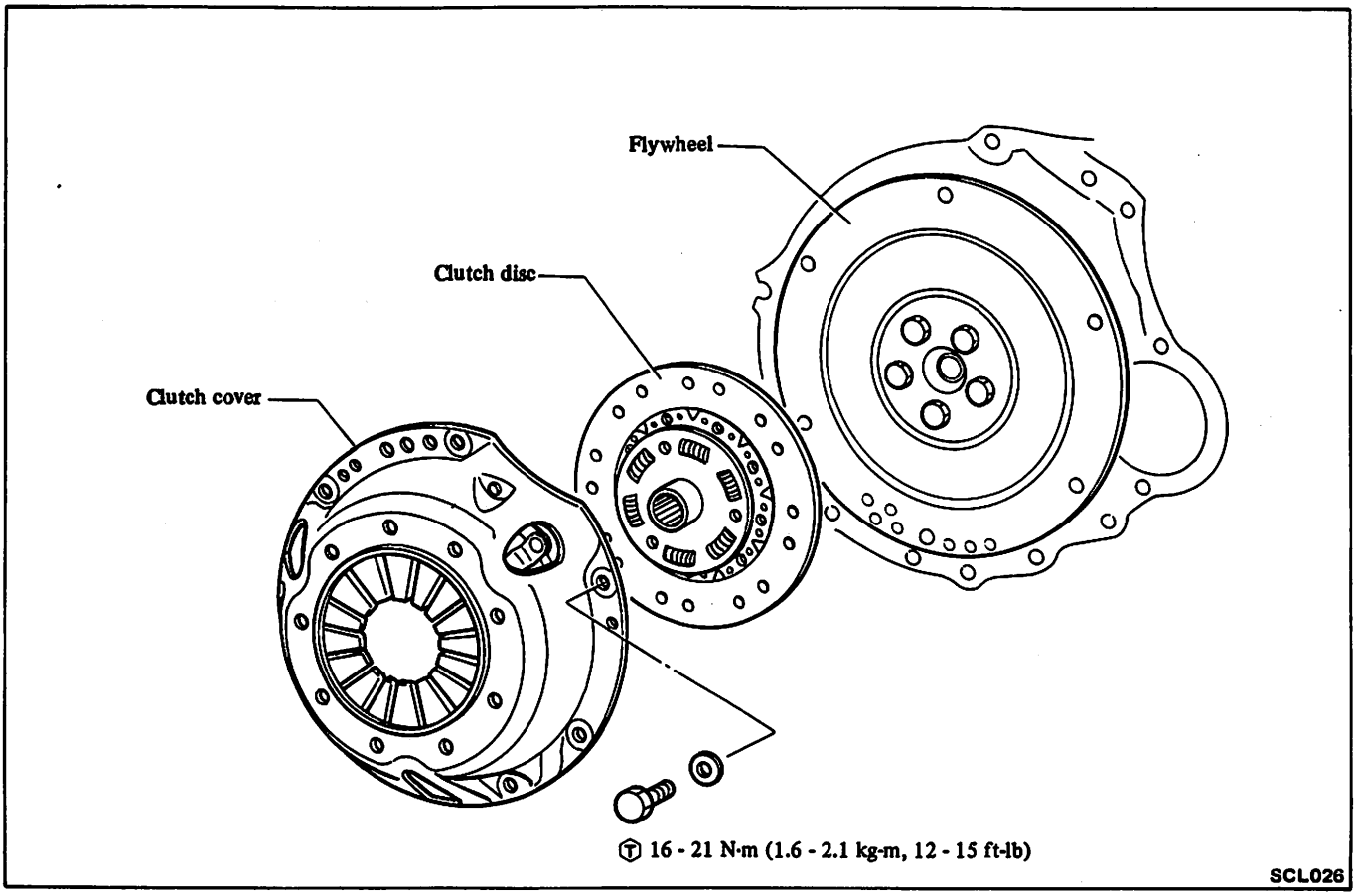
7. Depress and release clutch pedal several times; then, check for external hydraulic leaks at connections.

a. **Brake fluid containing air is white and has visible air bubbles.**
b. **Brake fluid containing no air runs out of bleeder screw in a solid stream without air bubbles.**
c. **Pay close attention to clutch fluid level in reservoir during bleeding operation.**
d. **Add brake fluid to reservoir only up to the specified level. Do not overfill.**

CAUTION:
a. **Do not re-use brake fluid drained during bleeding operation.**
b. **Exercise care not to splash brake fluid on exterior finish as it will damage the paint.**
c. **When tightening flare nut, use Tool GG94310000.**

CLUTCH UNIT

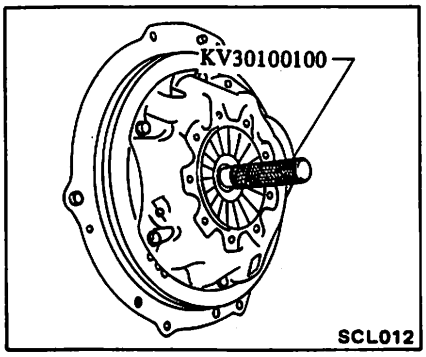
CLUTCH DISC AND COVER



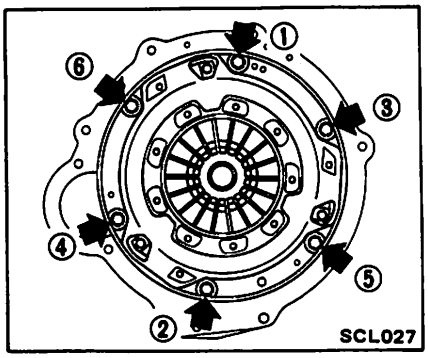
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REMOVAL

1. Remove transmission from engine. Refer to Removal (Section MT).
2. Insert Tool KV30100100 into clutch disc hub.



3. Loosen bolts attaching clutch cover to flywheel, one turn each at a time, until spring pressure is released.
Be sure to turn them out in a crisscross fashion.



4. Remove clutch disc and cover assembly.

INSPECTION

Wash all disassembled parts except disc assembly in suitable cleaning solvent to remove dirt and grease before making inspection and adjustment.

Flywheel and pressure plate

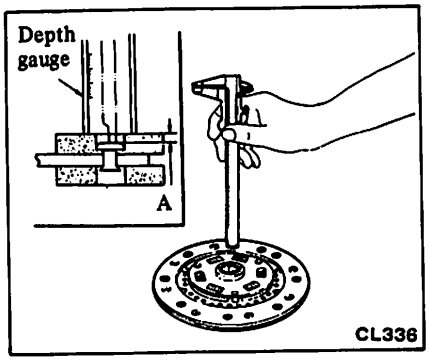
Check friction surface of flywheel and pressure plate for scoring or roughness. Slight roughness may be smoothed by using fine emery cloth. If surface is deeply scored or grooved, the part should be replaced.

Clutch disc assembly

Inspect clutch disc for worn or oily facings, loose rivets and broken or loose torsional springs.

1. If facings are oily, disc should be replaced. In this case, inspect transmission front cover oil seal, pilot bushing, engine rear oil seals and other points for oil leakage.
2. The disc should also be replaced when facings are worn locally or worn down to the specified limit.

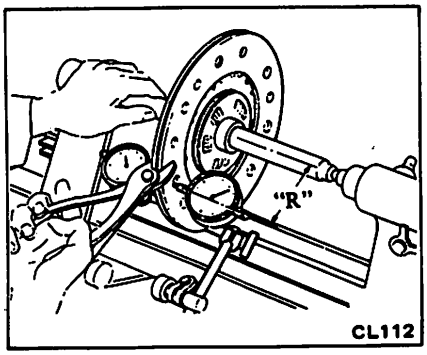
Wear limit of facing "A":
Less than 0.3 mm (0.012 in)



3. Check disc plate for runout whenever the old disc or a new one is installed.
4. If runout exceeds the specified value at outer circumference of facing, replace or repair disc.

Runout limit:
(total indicator reading)
Less than 0.5 mm (0.020 in)
"R" (from hub center):
108 mm (4.25 in)

CAUTION:
When repairing disc plate, never hold it forcibly with pliers or bend it excessively; otherwise facing will be damaged.



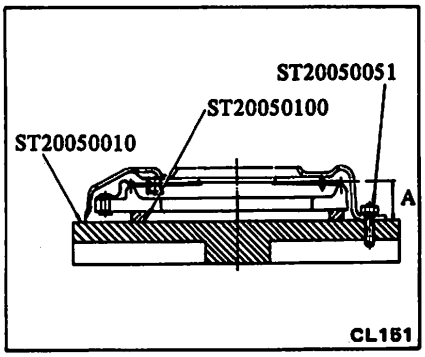
5. Check fit of disc hub on transmission main drive gear splines for smooth sliding. If splines are worn, clutch disc or main drive gear should be replaced; that is, backlash exceeds the specified value at outer edge of clutch disc.

Backlash:
Less than 0.4 mm (0.016 in)

Clutch cover assembly

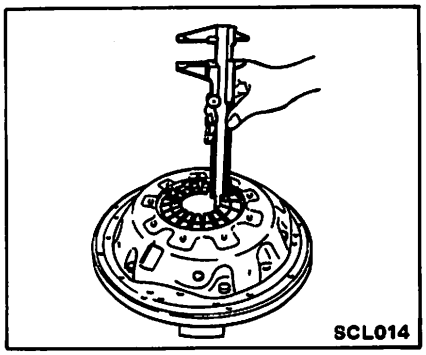
1. Check end surface of diaphragm spring for wear. If excessive wear is found, replace clutch cover assembly.
2. Measure height of diaphragm springs as outlined below:

(1) Place Tool ST20050100 on Tool ST20050010 and then tighten clutch cover assembly on base plate by using Tool ST20050051.



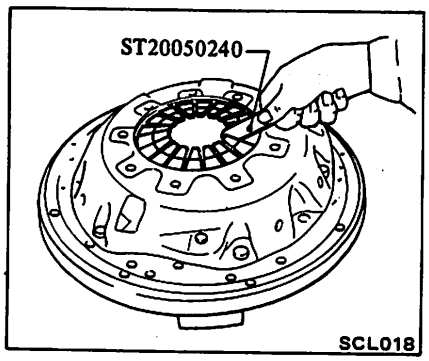
(2) Measure height "A" at several points with a vernier caliper depth gauge.

Diaphragm spring height "A":
33.0 - 35.0 mm
(1.299 - 1.378 in)



If height "A" of spring end is beyond specified value, adjust spring height with Tool ST20050240. If necessary, replace clutch cover assembly.

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Also, unevenness of diaphragm spring toe height should be within the specified limit.

Unevenness of diaphragm spring toe height:
Less than 0.7 mm (0.028 in)

If unevenness of diaphragm spring toe height is beyond specified value, adjust spring height with Tool ST20050240.

3. Inspect thrust rings for wear or damage. As these parts are invisible from outside, shake cover assembly up and down to listen for chattering noise, or lightly hammer on rivets for a slightly cracked noise. Any of these noises indicates need of replacement as a complete assembly.

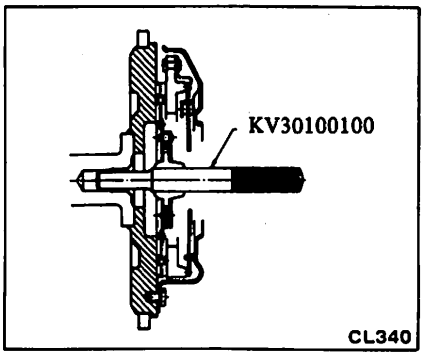
INSTALLATION

1. Apply a light coat of grease (including molybdenum disulphide) to transmission main drive gear splines. Slide clutch disc on main drive gear several times. Remove clutch disc and wipe off excess lubricant pushed off by disc hub.

Take special care to prevent grease or oil from getting on clutch facing.

2. Reinstall clutch disc and clutch cover assembly. Support clutch disc and cover assemblies with Tool KV30100100.

Be sure to keep disc facings, flywheel and pressure plate clean and dry.



3. Install clutch cover assembly. Each bolt should be tightened one turn at a time in a crisscross fashion.

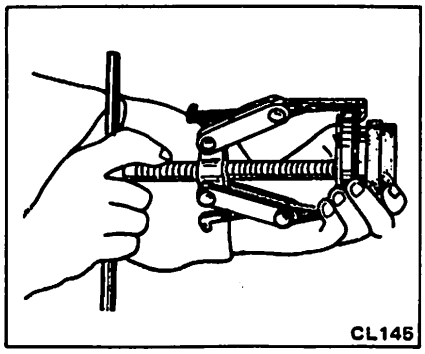
Ⓣ : **Clutch cover bolt**
16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)

4. Remove clutch aligning bar.
5. Reinstall transmission. Refer to Installation (Section MT).

RELEASE BEARING

REMOVAL

1. Remove transmission from engine. Refer to Removal (Section MT).
2. Disconnect holder spring from bearing sleeve.
3. Remove release bearing and sleeve as an assembly from transmission case front cover.
4. Take clutch release bearing out from bearing sleeve, using a universal puller and a suitable adapter.



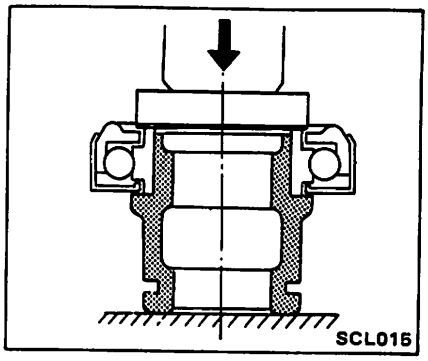
INSPECTION

Check for abnormal wear on contact surface of withdrawal lever, ball pin and bearing sleeve.

Hold bearing inner race and rotate outer race while applying pressure to it. If the bearing rotation is rough or noisy, replace bearing.

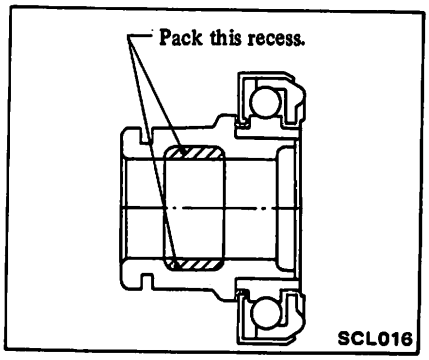
INSTALLATION

1. Assemble release bearing on sleeve, using a press.

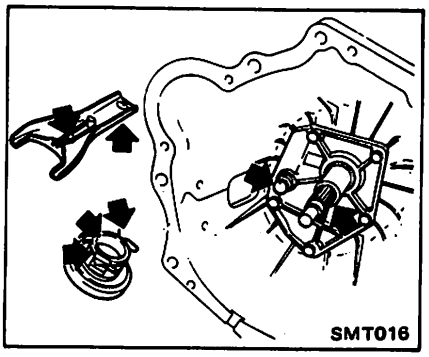


Do not depress outer race.

2. Before or during assembly, lubricate the following points with a light coat of multi-purpose grease.
(1) Inner groove of release bearing sleeve.



(2) Contact surfaces of withdrawal lever, lever ball pin and bearing sleeve.
(3) Bearing sleeve sliding surface of transmission case front cover.

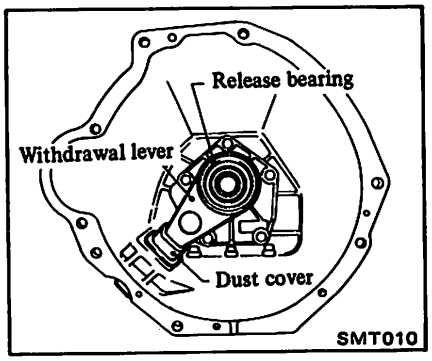


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(4) Transmission main drive gear splines. (Use grease including molybdenum disulphide.)

A small amount of grease should be coated to the above points. If too much lubricant is applied, it will run out on the friction plates when hot, resulting in damaged clutch disc facings.

3. After lubricating, install withdrawal lever, release bearing and sleeve assembly in position. Connect them with holder spring.

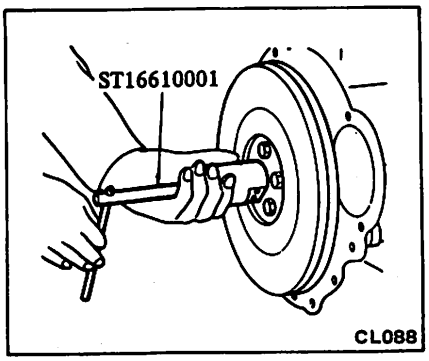


4. Reinstall transmission. Refer to Installation (Section MT).

PILOT BUSHING

REMOVAL

1. Remove transmission from engine. Refer to Removal (Section MT).
2. Remove clutch disc and cover assembly. Refer to Clutch Disc and Cover for removal.
3. Remove pilot bushing in crankshaft with Tool ST16610001.



INSPECTION

Check pilot bushing for fit in bore of crankshaft.

Check inner surface of pilot bushing for wear, roughness or bell-mouthed condition. If pilot bushing is worn or damaged, replace. When bushing is damaged, be sure to check transmission main drive gear at the same time.

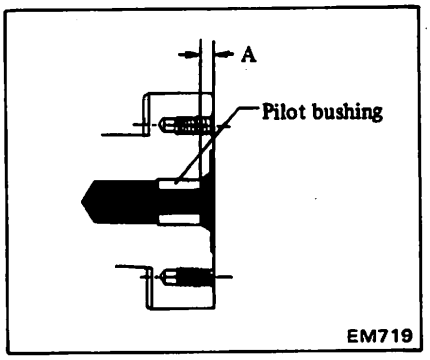
INSTALLATION

1. Before installing a new bushing, thoroughly clean bushing hole.
2. Insert pilot bushing until distance "A" between flange end and pilot bushing is specified distance.

Distance "A":
4.0 mm (0.157 in)

Do not oil bushing.

When inserting pilot bushing, be careful not to damage edge of pilot bushing.



3. Install clutch disc and clutch cover assembly. Refer to Clutch Disc and Cover for installation.
4. Install transmission. Refer to Installation (Section MT).

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

CLUTCH CONTROL SYSTEM

Type of clutch control	Hydraulic

CLUTCH MASTER CYLINDER

Inner diameter mm (in)	15.88 (5/8)

CLUTCH OPERATING CYLINDER

Type	Non-adjustable
Inner diameter mm (in)	19.05 (3/4)

CLUTCH DISC

Type	225CBL
Facing size Outer dia. x Inner dia. x Thickness mm (in)	225 x 150 x 3.5 (8.86 x 5.91 x 0.138)
Thickness of disc assembly Free mm (in)	8.3 - 8.9 (0.327 - 0.350)
Installed mm (in)	7.6 - 8.0 (0.299 - 0.315)
Number of torsion springs	6

CLUTCH COVER

Type	C225S
Full load N (kg, lb)	3,923 (400, 882)

INSPECTION AND ADJUSTMENT

CLUTCH PEDAL

Unit: mm (in)

Pedal height "H"	171 - 177 (6.73 - 6.97)
Pedal free play "A"	1 - 5 (0.04 - 0.20)

CLUTCH MASTER CYLINDER

Clearance between cylinder bore and piston mm (in)	Less than 0.15 (0.0059)

CLUTCH OPERATING CYLINDER

Clearance between cylinder bore and piston mm (in)	Less than 0.15 (0.0059)

CLUTCH DISC

Unit: mm (in)

Model	225CBL
Wear limit of facing surface to rivet head	0.3 (0.012)
Runout limit	0.5 (0.020)
Distance of runout checking point (from the hub center)	108 (4.25)
Maximum backlash of spline (at outer edge of disc)	0.4 (0.016)

CLUTCH COVER

Unit: mm (in)

Model	C255S
Diaphragm spring height	33.0 - 35.0 (1.299 - 1.378)
Unevenness of diaphragm spring toe height	Less than 0.7 (0.028)

PILOT BUSHING

Inserted distance of pilot bushing mm (in)	4.0 (0.157)

TIGHTENING TORQUE

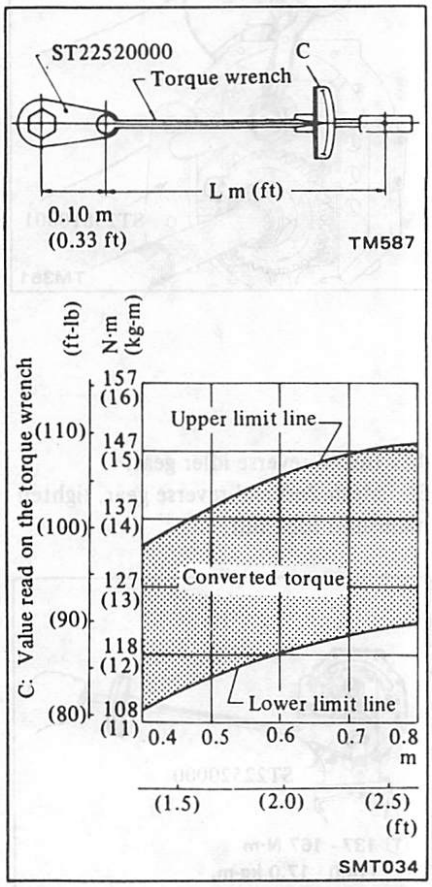
Unit	N·m	kg-m	ft-lb
Clutch switch lock nut	12 - 15	1.2 - 1.5	9 - 11
Master cylinder push rod lock nut	8 - 12	0.8 - 1.2	5.8 - 8.7
Master cylinder stopper bolt	1.5 - 2.9	0.15 - 0.3	1.1 - 2.2
Master cylinder securing nut	8 - 12	0.8 - 1.2	5.8 - 8.7
Clutch tube flare nut	15 - 18	1.5 - 1.8	11 - 13
Push rod lock nut	8 - 12	0.8 - 1.2	5.8 - 8.7
Operating cylinder bleeder screw	7 - 9	0.7 - 0.9	5.1 - 6.5
Operating cylinder securing bolt	30 - 40	3.1 - 4.1	22 - 30
Clutch hose to operating cylinder securing nut	17 - 21	1.7 - 2.1	12 - 15
Clutch cover securing bolt	16 - 21	1.6 - 2.1	12 - 15

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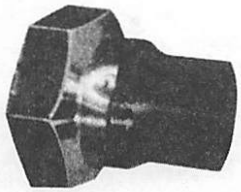
Conversion of torque

Mainshaft nut should be tightened to specified torque with Tool ST22520000. When doing so, the amount of torque to be read on wrench needle should be modified according to the following chart.

Ⓣ : **137 - 167 N·m (14 - 17 kg-m, 101 - 123 ft-lb)**



6. Stake mainshaft lock nut.



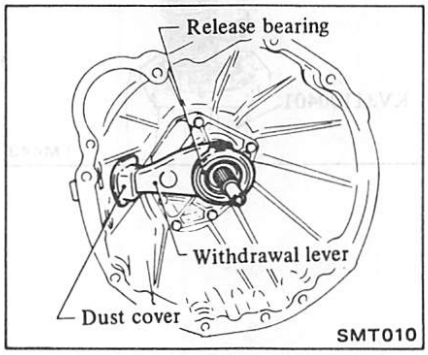
7. **Measure gear end play.** Refer to Gears and Shafts for inspection.
8. Install forks and fork rods. Refer to Forks and Fork rods for assembly.
9. Install transmission case. Refer to Transmission Case for assembly.
10. Install rear extension. Refer to Rear Extension for assembly.

REPLACEMENT OF OIL SEALS

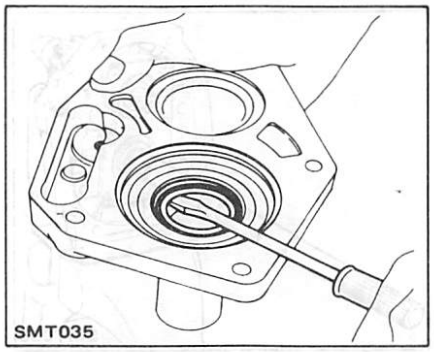
FRONT COVER OIL SEAL

It is necessary to remove transmission unit from car. Replace oil seal as follows:

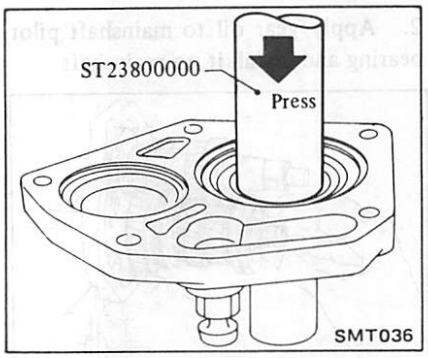
1. Remove transmission. Refer to Removal.
2. Wipe off dirt and grease.
3. Drain oil.
4. Remove dust cover, release bearing and withdrawal lever.



5. Remove front cover.
6. Remove oil seal.



7. Apply coat of gear oil to oil seal surface, then drive new seal into place.

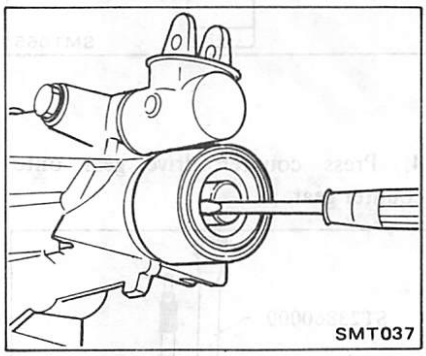


8. Lubricate seal lip and main drive shaft with gear oil.
9. Install front cover in reverse order of removal.

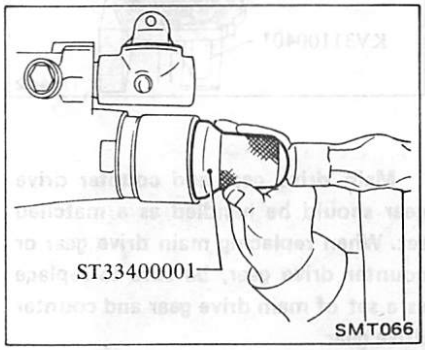
REAR EXTENSION OIL SEAL

Rear extension oil seal can be replaced without removing transmission. Replace oil seal as follows:

1. Remove propeller shaft. Refer to Propeller Shaft (Section PD) for removal.
2. Remove oil seal.



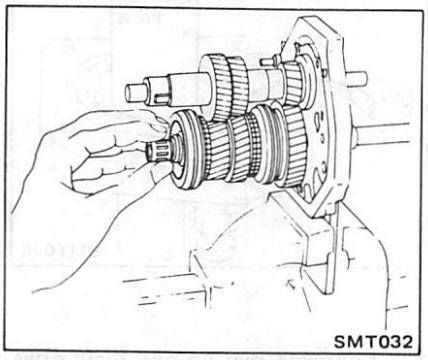
3. Apply coat of gear oil to oil seal surface, then drive new seal into place.



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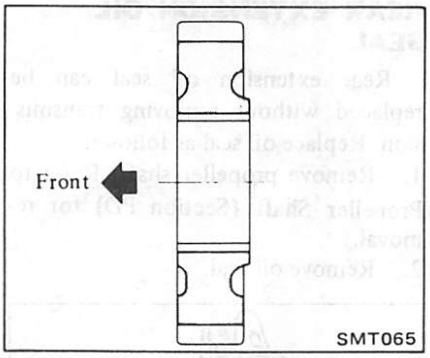
Be sure to align grooves of baulk ring with inserts.

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

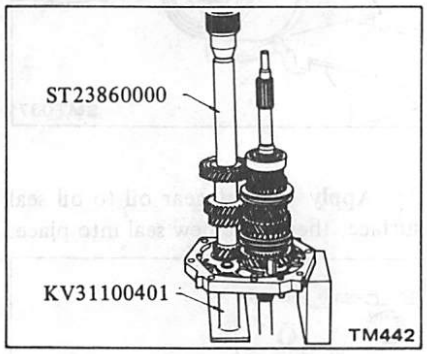


3. Install main drive gear with counter drive gear.

Assemble counter drive gear, paying attention to its direction.



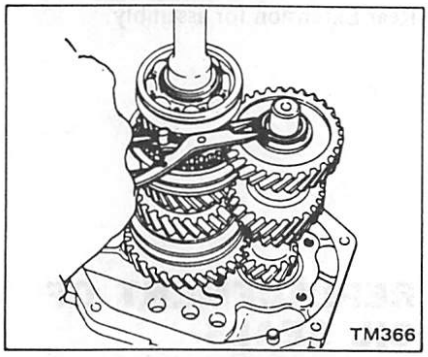
4. Press counter drive gear onto counter gear.



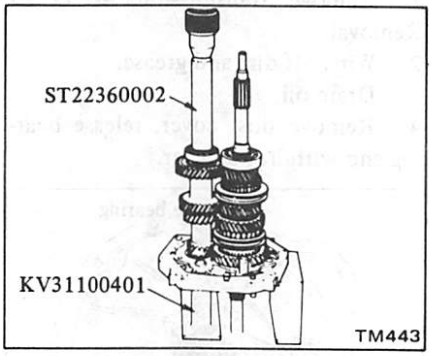
Main drive gear and counter drive gear should be handled as a matched set. When replacing main drive gear or counter drive gear, be sure to replace as a set of main drive gear and counter drive gear.

Counter drive gear snap ring:
Refer to S.D.S.

5. Secure counter drive gear with snap ring that will minimize clearance of groove in countershaft.

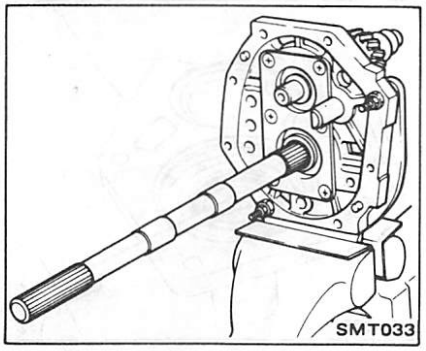


6. Press counter gear front bearing onto counter gear.



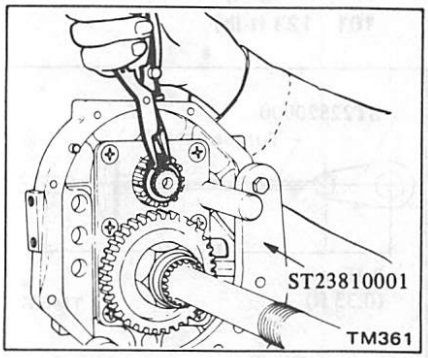
Reverse main gear

1. Support adapter plate in a vise with Tool ST23810001.

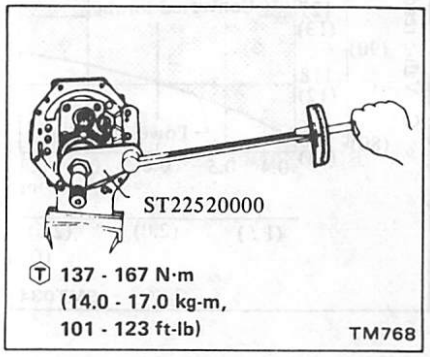


2. Install reverse main gear, plain washer and mainshaft nut. Then tighten mainshaft nut temporarily.
3. Install counter reverse gear and secure with snap ring that will minimize clearance of groove in countershaft.

Counter reverse gear snap ring:
Refer to S.D.S.



4. Install reverse idler gear.
5. Mesh 2nd and reverse gear, tighten mainshaft lock nut.

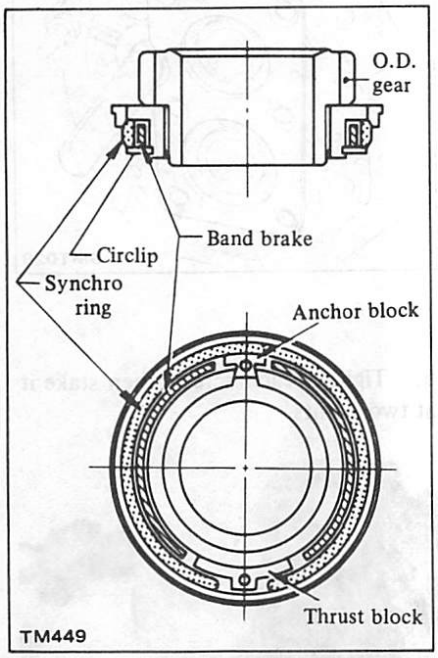


T : Counter gear lock nut (5-speed)
98 - 127 N·m
(10.0 - 13.0 kg-m,
72 - 94 ft-lb)

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Synchronizer (O.D.)

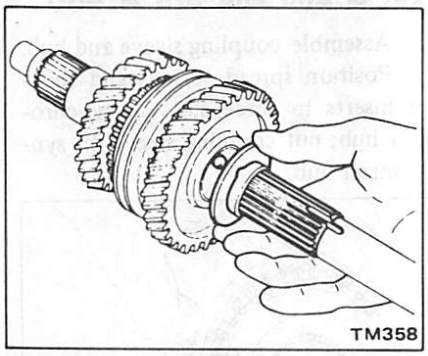
Position synchronizer ring, band brake, thrust block and anchor block on overdrive clutch gear; install circlip.



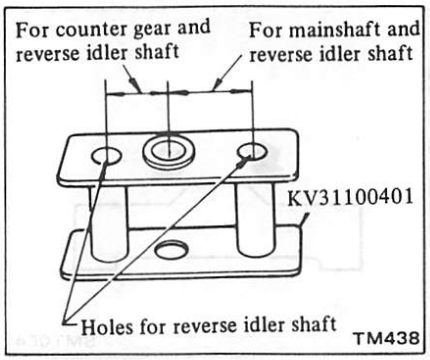
1st and 2nd main gear

1. Assemble 2nd gear needle bearing, 2nd gear, baulk ring, 1st & 2nd synchronizer assembly, 1st gear baulk ring, 1st gear bushing, needle bearing, 1st gear, steel ball, and thrust washer on mainshaft.

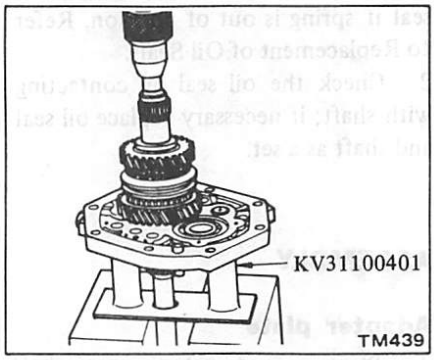
Before installing steel ball and thrust washer, apply grease to them.



2. Set Tool KV31100401 and place adapter plate assembly on it.

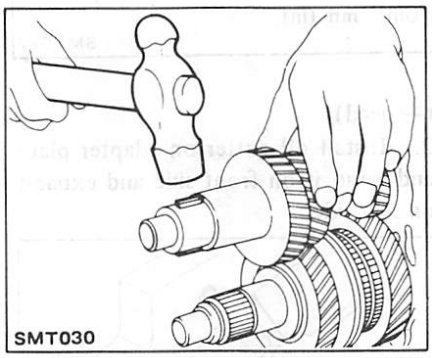


3. Press mainshaft assembly to adapter plate.

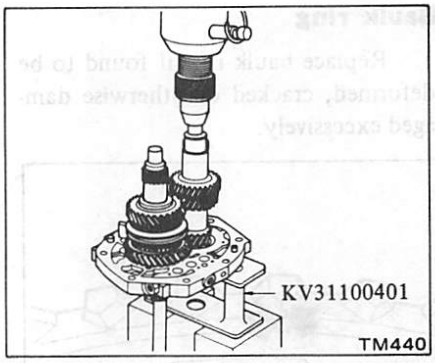


3rd main and counter gear

1. Tap new woodruff keys until they are seated securely.

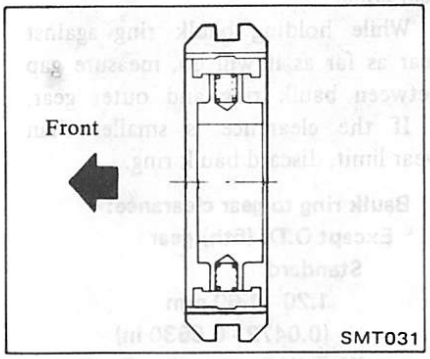


2. Press counter gear into adapter plate.



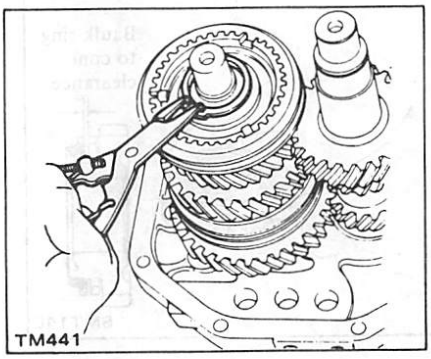
3. Position needle bearing, 3rd main gear, baulk ring and 3rd & 4th synchronizer assembly on the front of mainshaft.

Assemble 3rd-4th synchronizer hub, paying attention to its direction.



4. Install thrust washer on mainshaft and secure it with snap ring of proper thickness that will minimize clearance of groove in mainshaft.

Mainshaft front snap ring:
Refer to S.D.S.



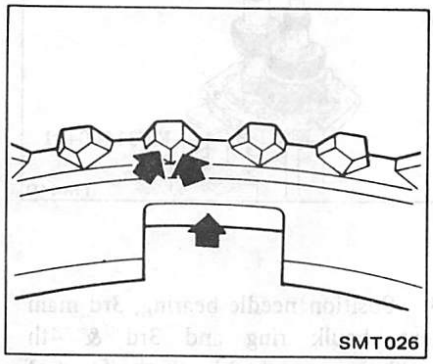
Main drive and counter drive gear

1. Install baulk ring on synchronizer.

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Baulk ring

1. Replace baulk ring if found to be deformed, cracked or otherwise damaged excessively.

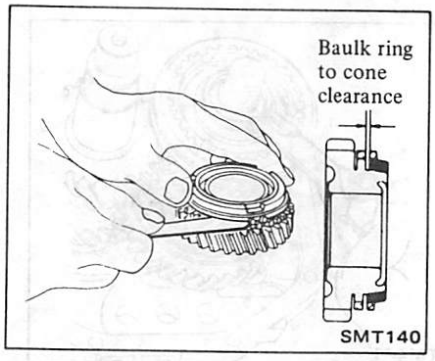


2. Place baulk ring in position on gear cone.

While holding baulk ring against gear as far as it will go, measure gap between baulk ring and outer gear.

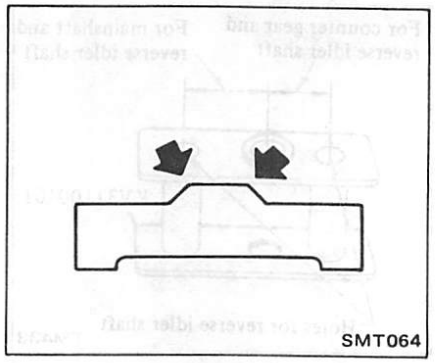
If the clearance is smaller than wear limit, discard baulk ring.

Baulk ring to gear clearance:
Except O.D. (5th) gear
Standard
1.20 - 1.60 mm
(0.0472 - 0.0630 in)
Wear limit
Less than 0.8 mm (0.031 in)
O.D. (5th) gear
Standard
1.00 - 1.40 mm
(0.0394 - 0.0551 in)
Wear limit
Less than 0.5 mm (0.020 in)



Shifting insert

Replace, if worn excessively, worn unevenly, deformed, or damaged.



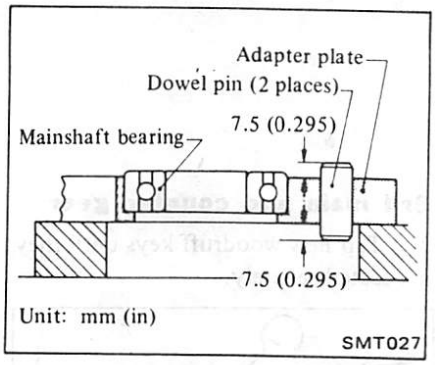
Oil seals

1. Replace oil seal if sealing lip is deformed or cracked. Also discard oil seal if spring is out of position. Refer to Replacement of Oil Seals.
2. Check the oil seal lip contacting with shaft; if necessary replace oil seal and shaft as a set.

ASSEMBLY

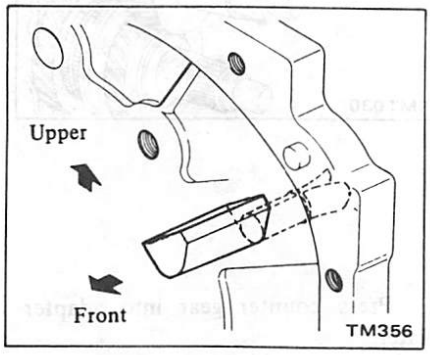
Adapter plate

1. Place new dowel pin, mainshaft bearing on adapter plate and tap them.

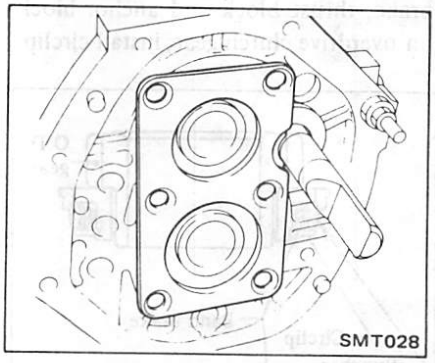


(4-speed)

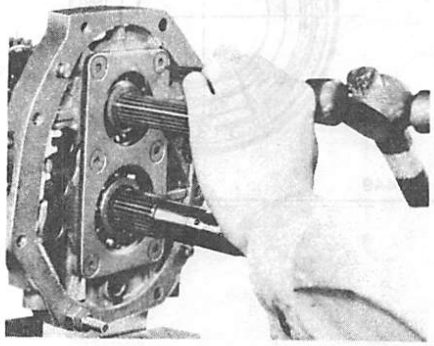
2. Install oil gutter on adapter plate and bend it on front side and expand on rear side.



3. Insert reverse idler shaft.
4. Install bearing retainer.



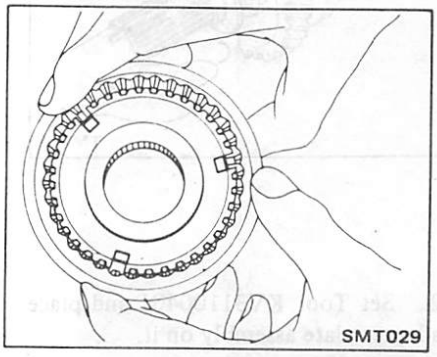
5. Tighten each screw, then stake it at two points.



6. Install counter rear bearing with a soft hammer.

Synchronizer (1st & 2nd and 3rd & 4th)

1. Assemble coupling sleeve and hub.
2. Position spread springs and shifting inserts in three slots in synchronizer hub; put coupling sleeve on synchronizer hub.



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2. Remove mainshaft nut, thrust washer and reverse main gear.

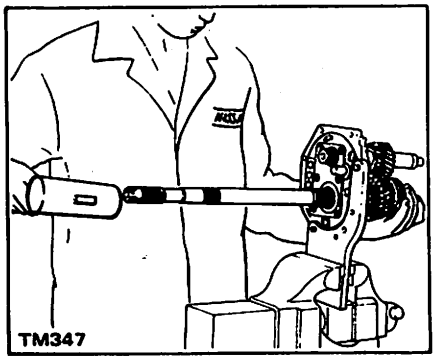
Mainshaft nut should be discarded and should not be reused.

3. Remove snap ring of counter-shaft rear end, and remove reverse counter gear.

1st and 2nd main gear and counter gear

1. Draw out mainshaft assembly together with counter gear, by tapping rear end of mainshaft and counter gear.

Hold front of mainshaft assembly by hand, being careful not to drop counter gear.

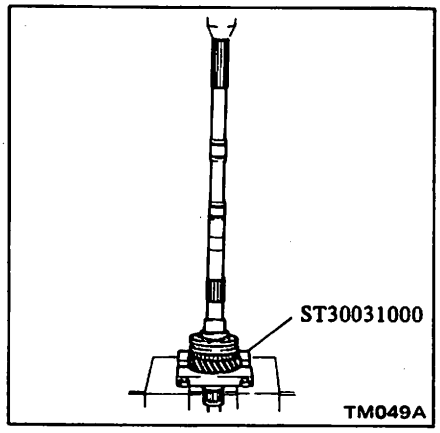


2. Remove thrust washer, steel ball, 1st gear and needle bearing.

Be careful not to lose steel ball retaining thrust washer.

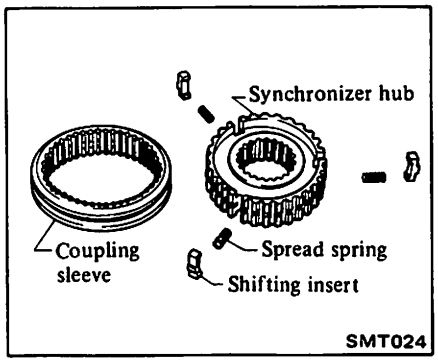
3. Press out 1st gear mainshaft bushing together with 2nd gear and 1st & 2nd synchronizer.

When pressing out bushing, hold mainshaft by hand so as not to drop it.



Synchronizer (1st & 2nd and 3rd & 4th)

Disassemble synchronizer.

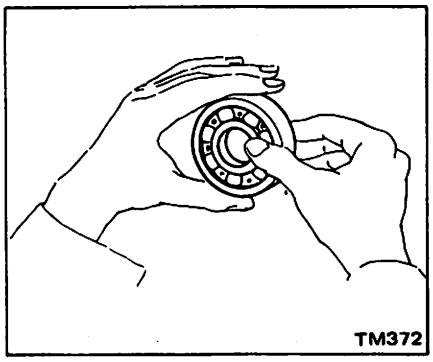


INSPECTION

Bearings

1. Thoroughly clean bearing and dry with compressed air.

CAUTION:
Do not allow the bearings to spin. Because it will damage the race and balls. Turn them slowly by hand.

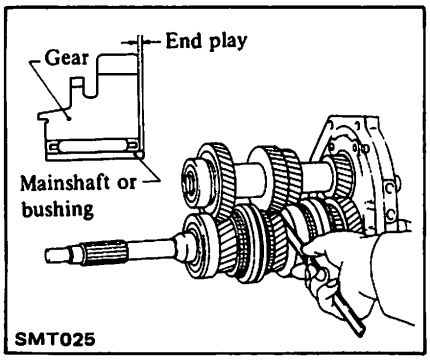


2. When race and ball surfaces are worn or rough, or when balls are out-of-round or rough, replace bearing with a new one.
3. Replace needle bearing if worn or damaged.

Gears and shafts

1. Check all gears for excessive wear, chips or cracks; replace as required.
2. Check shaft for bending, crack, wear, and worn spline; if necessary, replace.
3. **Measure gear end play:**

- It is necessary to measure end play before disassembling mainshaft and after reassembling mainshaft.
- Tighten mainshaft lock nut to specified limit and measure end play to insure that it is within specified limit.
- If end play is not within specified limit, disassemble and check parts for condition.
- Replace any part which is worn or damaged.



Standard end play:

1st gear
0.27 - 0.34 mm
(0.0106 - 0.0134 in)

2nd gear
0.12 - 0.19 mm
(0.0047 - 0.0075 in)

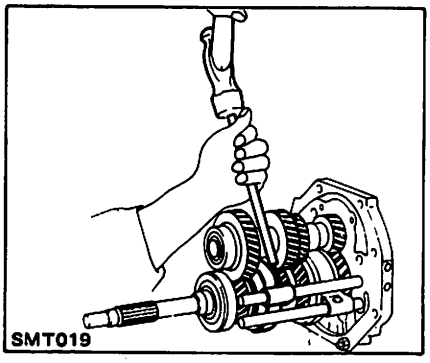
3rd gear
0.13 - 0.37 mm
(0.0051 - 0.0146 in)

O.D. (5th) gear (5-speed)
0.10 - 0.17 mm
(0.0039 - 0.0067 in)

Reverse idler gear (5-speed)
0.05 - 0.50 mm
(0.0020 - 0.0197 in)

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2. Install two (2) interlock balls.
3. Install 3rd & 4th fork rod, then secure with retaining pin.



4. Install two (2) interlock balls.
5.

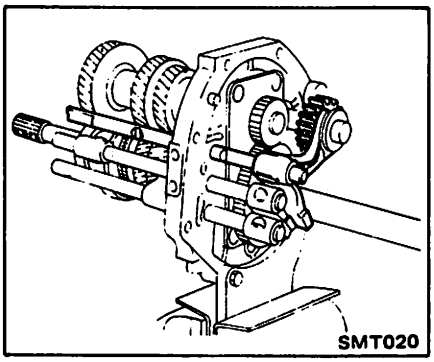
4-speed

Install Rev. fork rod with shift fork and reverse idler gear.

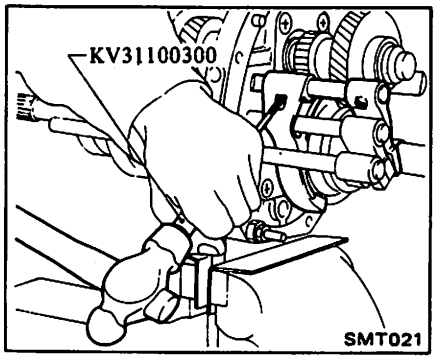
5-speed

Install O.D. & Rev. shift fork and fork rod, then secure with retaining pin.

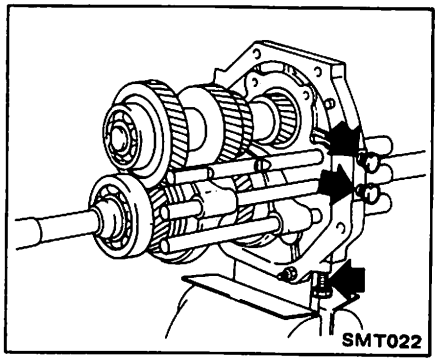
4-speed



5-speed



6. Install check balls and check springs.
7. Apply locking sealer to check ball plugs and install them.



a. Check ball plug for 1st & 2nd fork rod is longer than that for Rev. shift fork rod and 3rd & 4th fork rod.

b. To insure that interlock plunger is installed properly, slide 3rd & 4th fork rod and operate the other fork rod. Make sure that the gear except 3rd or 4th gear does not mesh.

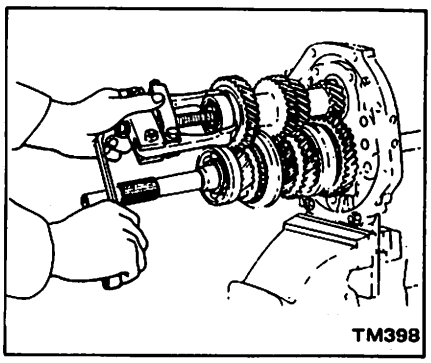
8. Apply gear oil to all sliding surfaces and check to see that shift rods operate correctly and gears are engaged smoothly.
9. Install transmission case. Refer to Transmission Case for assembly.
10. Install rear extension. Refer to Rear Extension for assembly.

GEARS AND SHAFTS

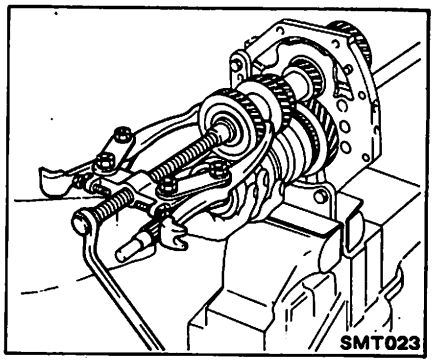
DISASSEMBLY

Main drive and counter drive gear

1. Remove rear extension. Refer to Rear Extension for disassembly.
2. Remove transmission case. Refer to Transmission Case for disassembly.
3. Remove forks and fork rods. Refer to Forks and Fork rods for disassembly.
4. **Measure gear end play.** Refer to Gears and Shafts for inspection.
5. Mesh 2nd and reverse gear, then draw out counter front bearing.



6. Remove counter drive gear snap ring.
7. Draw out counter drive gear with main drive gear.



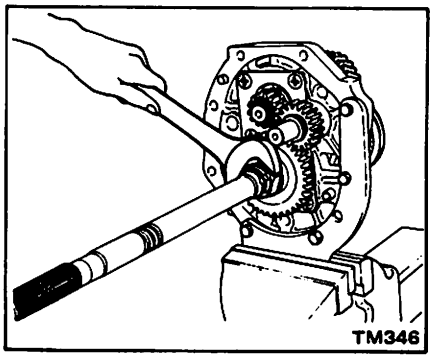
When drawing out main drive gear assembly, be careful not to drop pilot needle bearing and baulk ring.

3rd main gear

1. Remove snap ring and thrust washer.
2. Draw out 3rd & 4th synchronizer and 3rd gear.

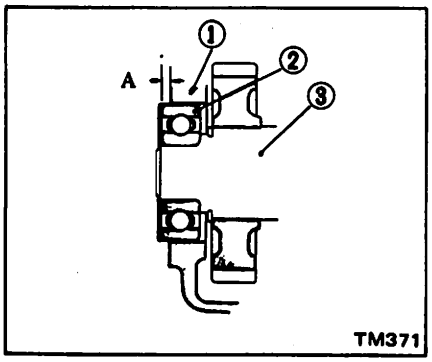
Reverse main gear

1. Release staking on mainshaft nut and loosen it.



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6. Fit main drive bearing snap ring.
7. Select countershaft front bearing shim as follows:
(1) Measure height "A".

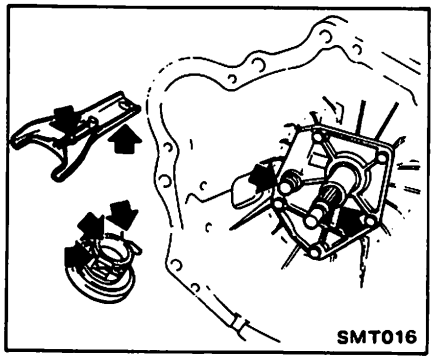


1 Transmission case
2 Counter gear front bearing
3 Counter gear

(2) Select a shim of thickness "A" measured.

Counter gear front bearing shim:
Refer to S.D.S.

8. Clean mating surfaces of front cover and transmission case.
9. Apply grease to shim selected to retain it on front cover.
10. Lubricate seal lip and main drive shaft with gear oil, then install new gasket and front cover.
11. Apply sealant to threads of through-bolts and tighten them to transmission case.
12. Apply a light coat of multi-purpose grease.

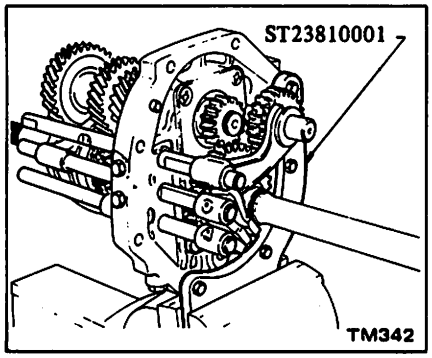


13. Install dust cover, release bearing and withdrawal lever.
14. Assemble Rear Extension. Refer to Rear Extension for assembly.

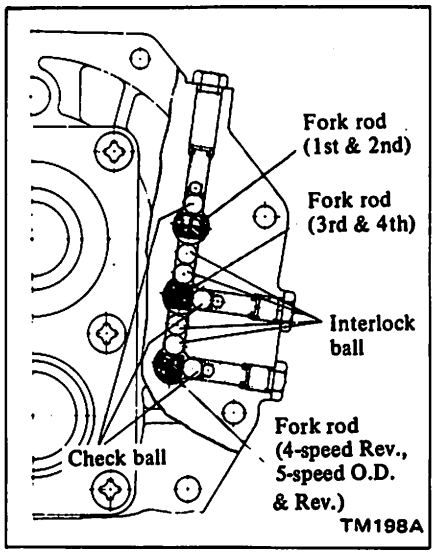
FORKS AND FORK RODS

DISASSEMBLY

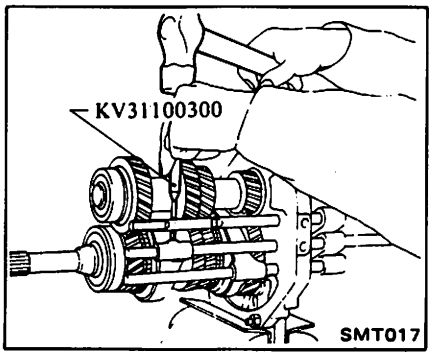
1. Remove rear extension. Refer to Rear Extension for disassembly.
2. Remove transmission case. Refer to Transmission Case for disassembly.
3. Set up Tool on adapter plate.
4. Place above assembly in a vise.



5. Remove check ball plugs and check springs.



6. Drive out retaining pins.

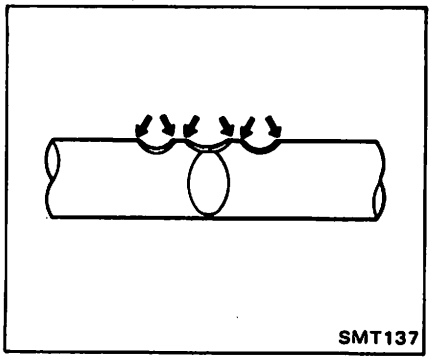


7. Drive out fork rods and remove interlock balls and check balls.

Be careful not to lose three (3) check balls and four (4) interlock balls.

INSPECTION

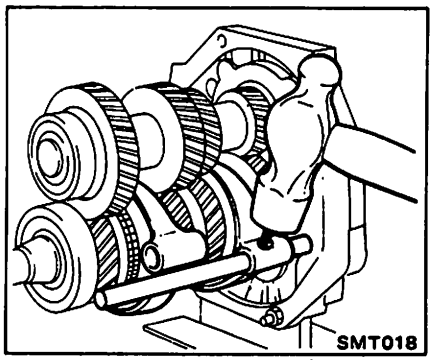
Clean with solvent and check for wear, scratches, projection, damage or other faulty conditions. Replace any part which is worn or damaged.



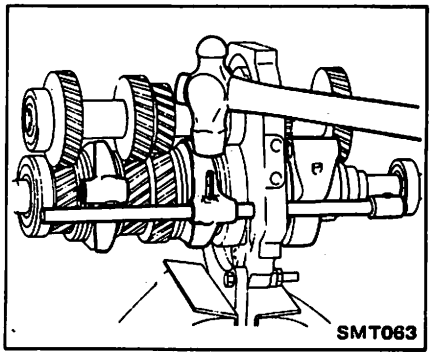
ASSEMBLY

1. Install 1st & 2nd , 3rd & 4th and O.D. & Rev. (5-speed) shift forks and 1st & 2nd fork rod, then secure with retaining pin.

4-speed

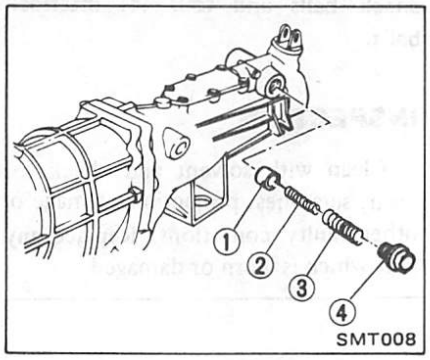


5-speed



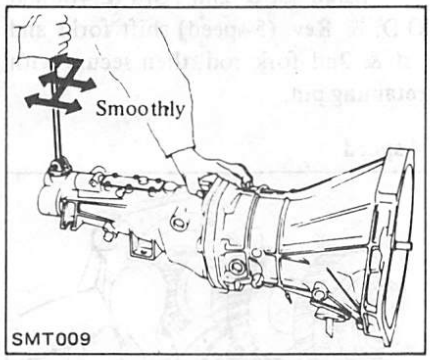
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5. Install plunger, return check spring (4-speed), return spring, and return spring plug.



1 Plunger
2 Return check spring
3 Return spring
4 Return spring plug

6. Apply sealant to stopper guide pin, then install stopper guide pin and E-ring.
7. Install O.D. gear switch (if so equipped).
8. Make sure that gears operate smoothly.



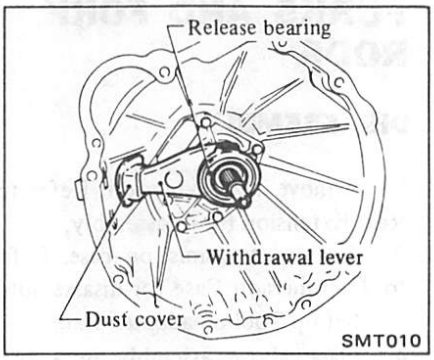
9. Install drain plug.

Ⓣ : **25 - 34 N·m (2.5 - 3.5 kg-m, 18 - 25 ft-lb)**

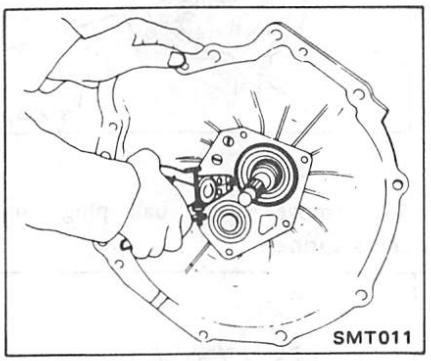
TRANSMISSION CASE

DISASSEMBLY

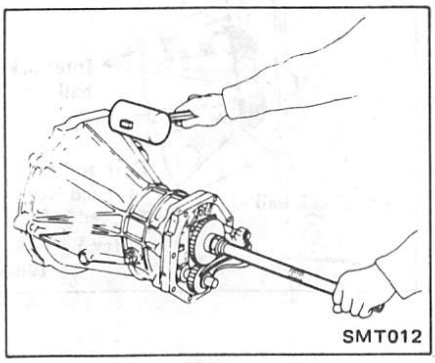
1. Remove rear extension. Refer to Rear Extension for disassembly.
2. Remove dust cover, release bearing and withdrawal lever.



3. Remove front cover and gasket. Detach countershaft front bearing shim.
4. Remove main drive bearing snap ring.



5. Separate transmission case from adapter plate.

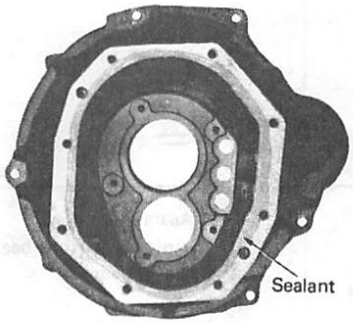


INSPECTION

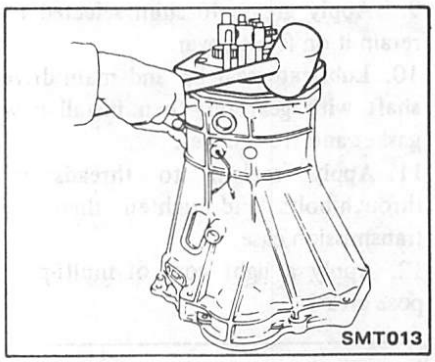
1. Clean with solvent and check for cracks or pits by means of dyeing test.
2. Check mating surface of transmission case for small nicks, projection or sealant.

ASSEMBLY

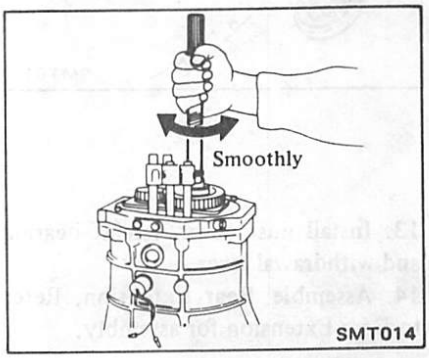
1. Clean mating surfaces of adapter plate and transmission case.
2. Stand transmission case on wooden plates of more than 20 mm (0.79 in) thick.
3. Apply sealant to mating surface of transmission case.



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



5. Make certain that mainshaft rotates smoothly.

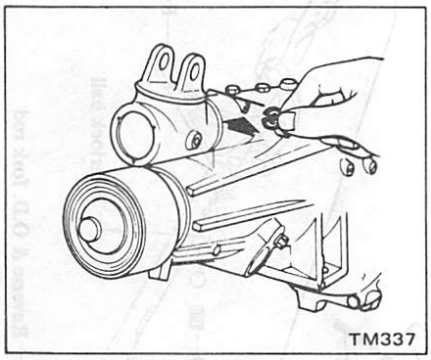


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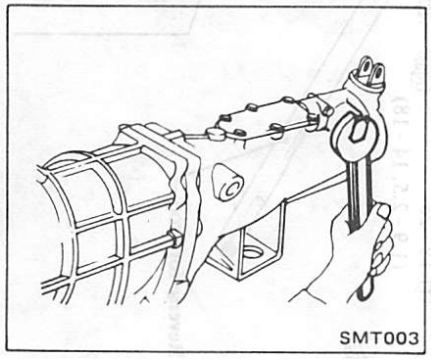
REAR EXTENSION

DISASSEMBLY

1. Wipe off dirt and grease.
2. Drain oil.
3. Remove O.D. gear switch (if so equipped).
4. Remove E-ring and stopper guide pin.

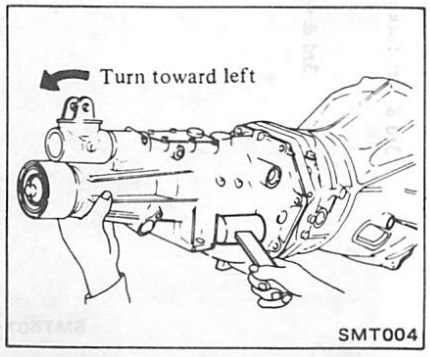


5. Remove return spring plug, return spring, return check spring (4-speed), and plunger from rear extension.

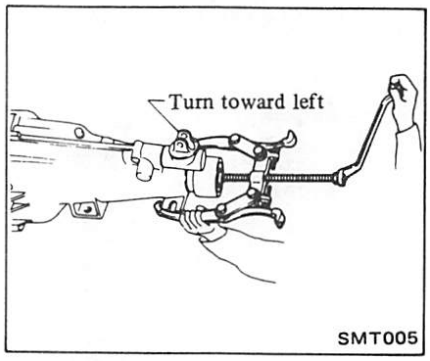


6. Remove rear extension.

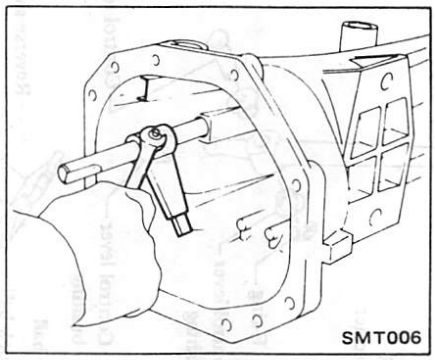
4-speed



5-speed



7. Remove lock pin and then remove striking rod.



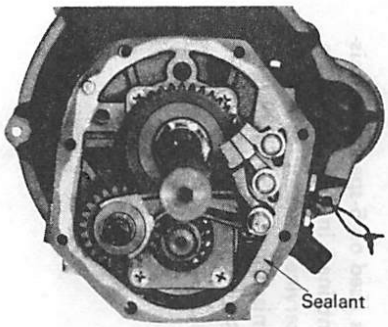
INSPECTION

1. Clean with solvent and check for cracks or cavities by means of dyeing test.
2. Check mating surface of rear extension for small nicks, projection or sealant.

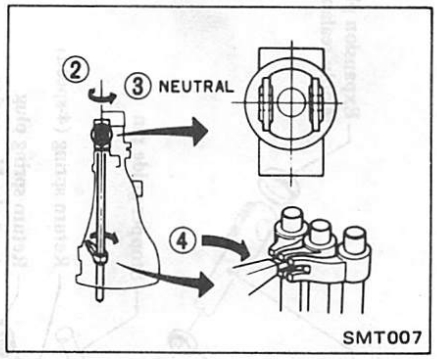
If rear extension bushing is worn or cracked, replace it as an assembly of bushing and rear extension housing.

ASSEMBLY

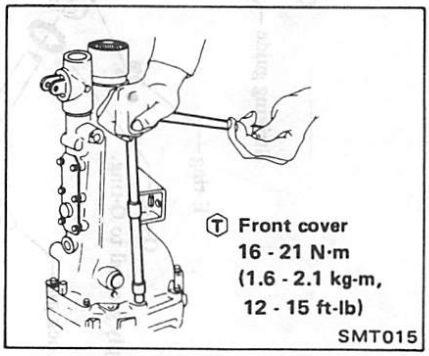
1. Stand transmission case assembly on wooden plates of more than 20 mm (0.79 in) thick.
2. Clean mating surfaces of adapter plate and rear extension.
3. Apply sealant to mating surface of adapter plate.



4. Install rear extension as follows:
(1) Set gears at Neutral.
(2) Turn striking guide counterclockwise.
(3) Set striking guide at Neutral.
(4) Align end of striking lever with cutout portion of fork rod.

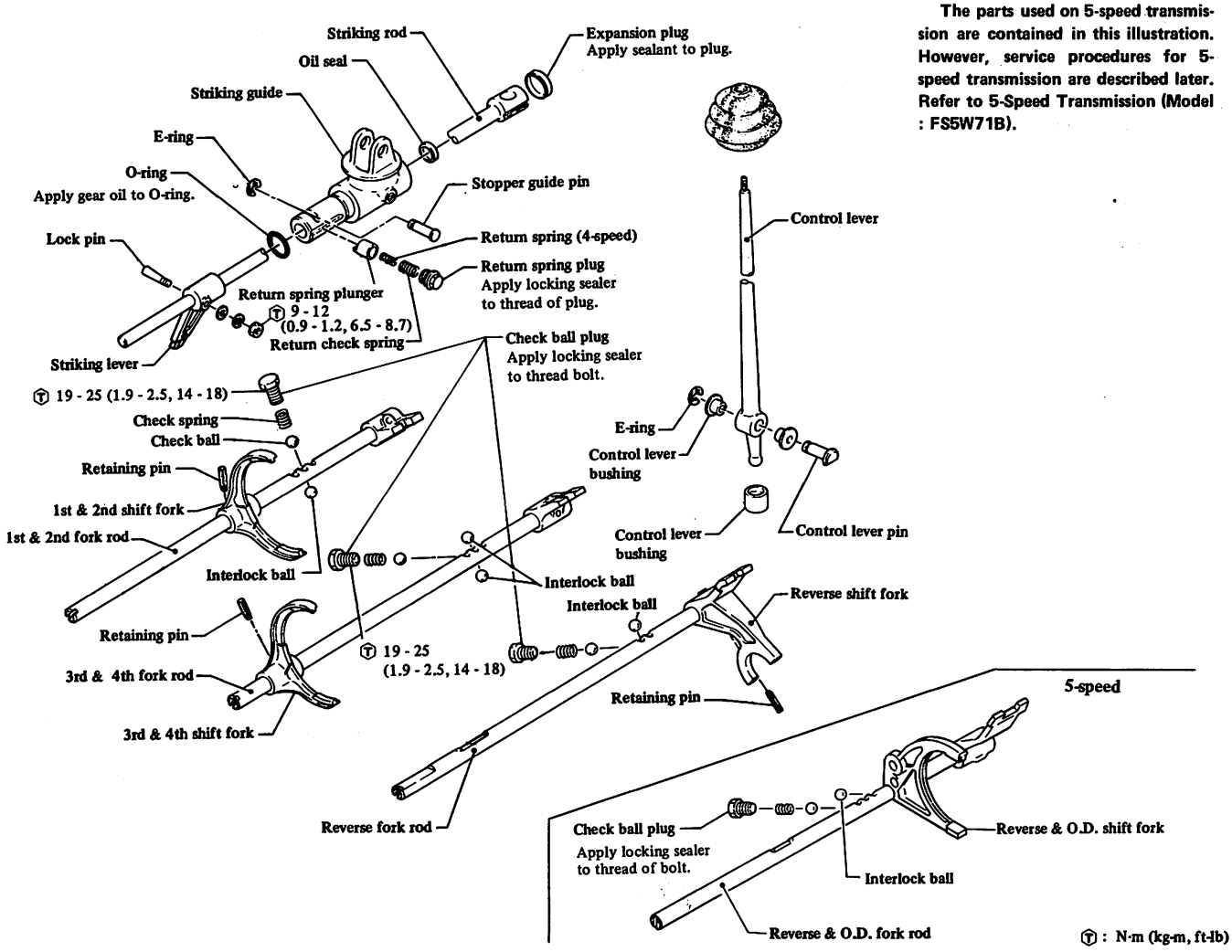


(5) Tighten bolts.



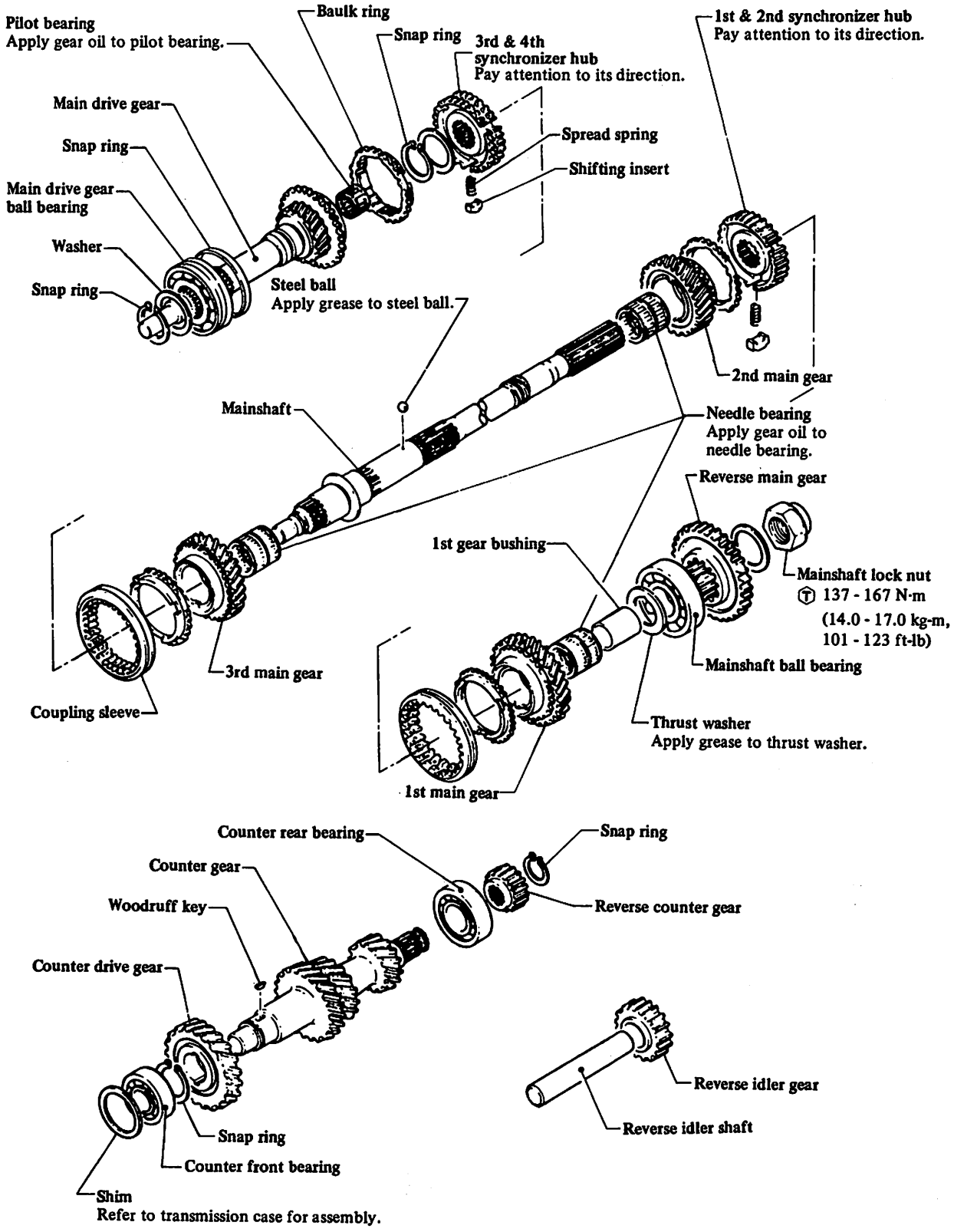
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The parts used on 5-speed transmission are contained in this illustration. However, service procedures for 5-speed transmission are described later. Refer to 5-Speed Transmission (Model : FS5W71B).



SMT507

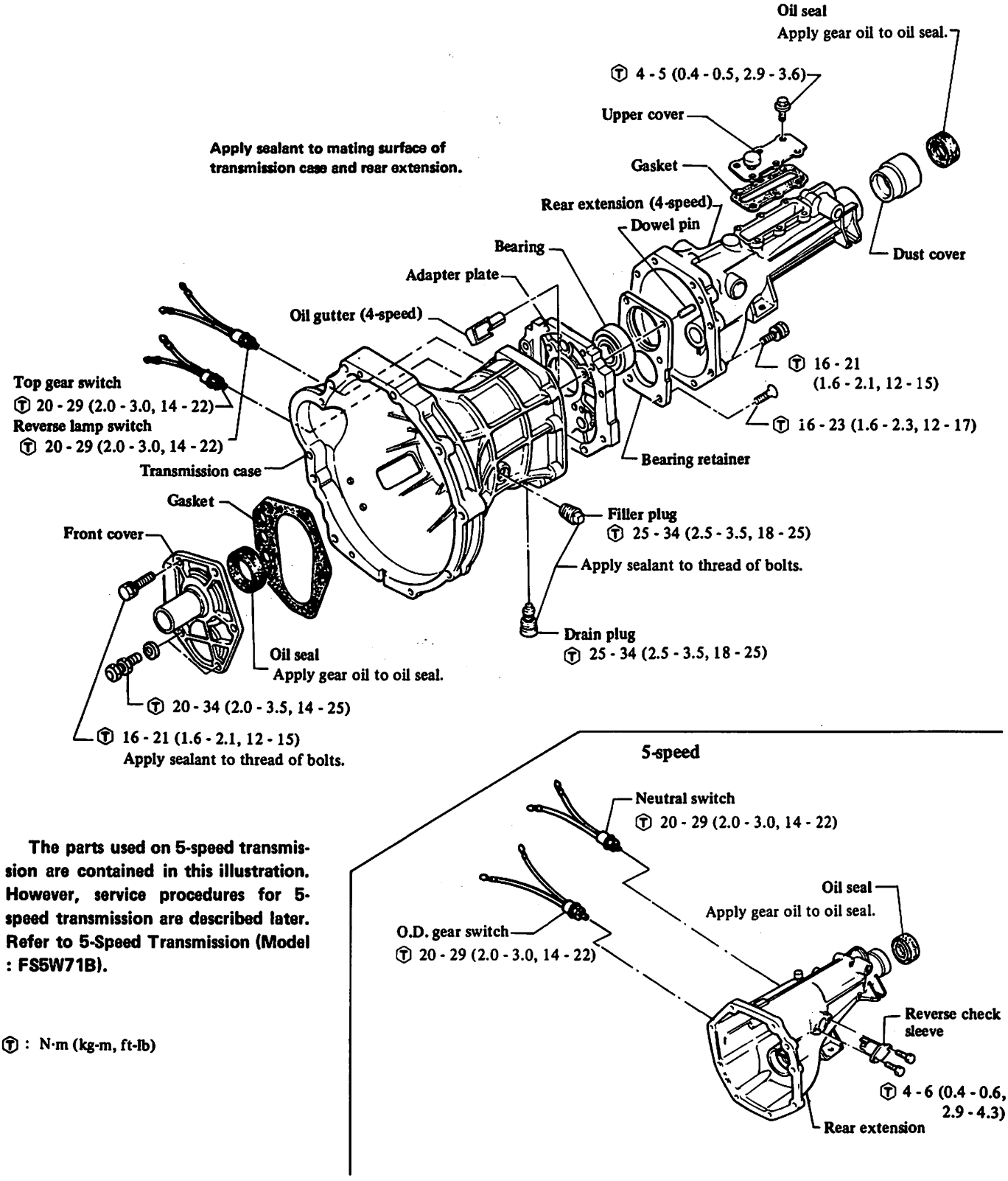
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SMT060

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4-SPEED TRANSMISSION (Model : F4W71B)



The parts used on 5-speed transmission are contained in this illustration. However, service procedures for 5-speed transmission are described later. Refer to 5-Speed Transmission (Model : FS5W71B).

Ⓣ : N·m (kg-m, ft-lb)

SMT506

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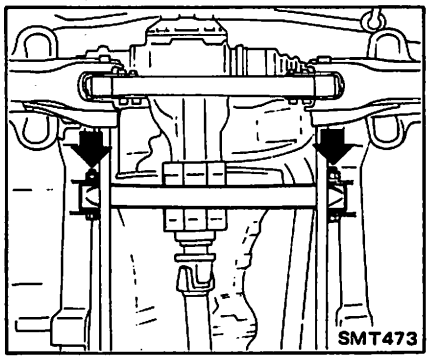
REMOVAL AND INSTALLATION

REMOVAL

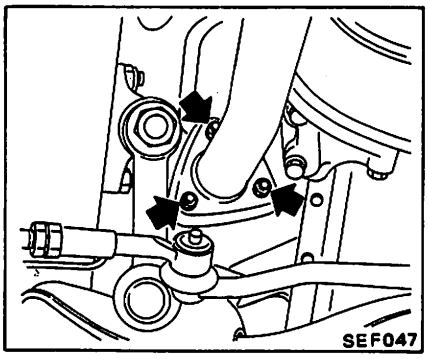
1. Disconnect battery ground cable.
2. Disconnect accelerator wire.
3. Jack up vehicle and support its weight on safety stands. Use a hydraulic hoist or open pit, if available.

   Make sure that safety is insured.
4. Remove primary propeller shaft. Refer to Propeller Shaft (Section PD) for removal (4WD).
5. Remove propeller shaft (2WD)/ front propeller shaft (4WD).

   Refer to Propeller Shaft (Section PD) for removal.
6. Remove front differential carrier crossmember (4WD).

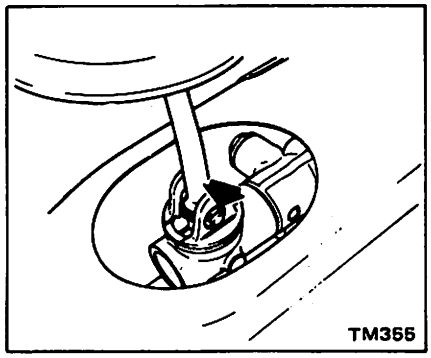


7. Disconnect front exhaust tube.

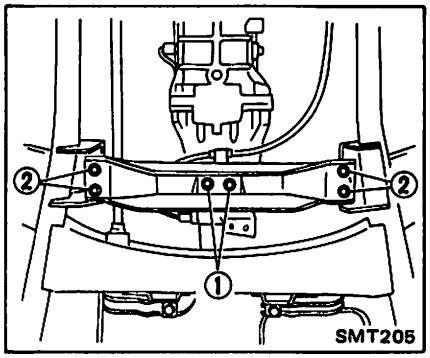


8. Disconnect wires from reverse (back-up) lamp, Neutral, Top and O.D. gear (if so equipped) switches.
9. Disconnect speedometer cable (2WD).
10. Remove clutch operating cylinder.
11. Remove starter motor.
12. Support transmission with a transmission jack.
13.

(1) Remove console box. Refer to Console Box (Section BF) for removal.
(2) Place transmission control lever in neutral position and remove E-ring and control lever.



14. Loosen rear engine mount securing nuts ① and ② and remove crossmember.



15. Remove bolts securing transmission to engine.

    Then support the engine and transmission with jacks, and slide transmission rearward away from engine and remove from the vehicle.

CAUTION:
Take care in dismounting transmission not to strike any adjacent parts and main drive gear.

INSTALLATION

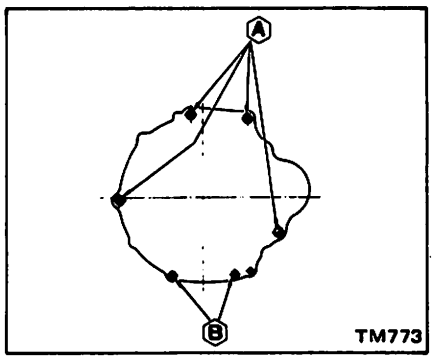
Install the transmission in reverse order of removal, paying attention to the following points.

1. Before installing, clean mating surfaces of engine rear plate and transmission case.
2. Before installing, lightly apply grease to spline parts of clutch disc and main drive gear. And also apply grease to moving surfaces of control lever and striking rod.
3. Remove filler plug and fill transmission with recommended gear oil to the level of the plug hole.

   Oil capacity:
   4-speed
   1.7 liters
   (3-5/8 US pt, 3 Imp pt)
   5-speed
   2.0 liters
   (4-1/4 US pt, 3-1/2 Imp pt)
4. Apply sealant to threads of filler plug, and install filler plug to transmission case.

   Ⓣ : **Filler plug**
   25 - 34 N·m
   (2.5 - 3.5 kg-m,
   18 - 25 ft-lb)
5. Tighten bolts securing transmistion to engine.

   Ⓣ : Ⓐ **43 - 58 N·m**
   (4.4 - 5.9 kg-m,
   32 - 43 ft-lb)
   Ⓑ **9 - 12 N·m**
   (0.9 - 1.2 kg-m,
   6.5 - 8.7 ft-lb)



6. Lubricate oil seal lip and bushing on rear extension with gear oil for initial lubrication.

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MANUAL TRANSMISSION

SECTION MT

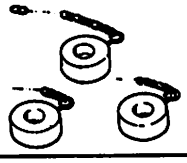
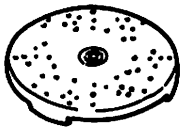
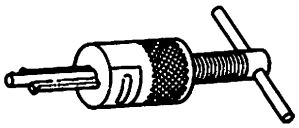
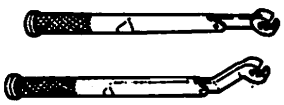
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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name
KV30100100 (–)	Clutch aligning bar 
ST20050100 (–)	Distance piece 
ST20050010 (–)	Base plate 
ST20050051 (–)	Set bolt 
ST20050240 (–)	Diaphragm spring adjusting wrench 
ST16610001 (J23907)	Pilot bushing puller 
GG94310000 (–)	Flare nut torque wrench 

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Probable cause	Corrective action
• Clutch disc hub splines worn or rusted	Replace (or remove rust) and coat with grease
• Oil leakage at master cylinder, operating cylinder, tube or hose	Replace faulty parts
• Air in hydraulic system	Bleed air
• Insufficient pedal stroke	Adjust
• Clutch disc runout or warped	Replace
• Diaphragm spring fatigued	Replace
• Piston cup deformed or damaged	Replace
• Lack of grease on pilot bushing	Coat with grease
• Clutch facing wet with oil	Replace (Replace if engine/ transmission oil seal is faulty)

CLUTCH CHATTERS

Clutch chattering is usually noticeable when car is just rolled off with clutch partially engaged.

Probable cause	Corrective action
• Oil on clutch facing	Replace
• Diaphragm spring fatigued	Replace
• Clutch facing hardened	Replace
• Clutch facing warped	Repair or replace
• Pressure plate worn or warped	Replace
• Engine mounting loose or rubber deteriorated	Tighten or replace
• Clutch facing rivets loose	Replace

NOISY CLUTCH

Probable cause	Corrective action
• Release bearing/sleeve damaged or improperly lubricated	Replace
• Pilot bushing worn, jammed or damaged	Replace
• Clutch facing rivets loose	Replace
• Disc plate cracked	Replace
• Clutch disc torsion springs fatigued	Replace

RABBIT-HOPPING CLUTCH

When "rabbit-hopping" of clutch occurs, vehicle will not roll off smoothly from a standing start or clutch will be engaged before clutch pedal is fully depressed.

Probable cause	Corrective action
• Oil on clutch facing	Replace
• Clutch facing worn or rivets loose	Replace
• Flywheel/pressure plate warped or worn	Replace
• Mounting bolts on engine or power train loose	Tighten
• Diaphragm spring fatigued	Replace

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TROUBLE DIAGNOSES AND CORRECTIONS

CLUTCH SLIP

Slipping of clutch may be noticeable when any of the following symptoms is encountered during operation.
(1) Vehicle will not respond to engine speed during acceleration.
(2) Insufficient vehicle speed.
(3) Lack of power during uphill driving.
(4) Increasing of fuel consumption.

Some of the above conditions may also be attributable to engine problem. First determine whether engine or clutch is causing the problem.

If slipping clutch is left unheeded, wear and/or overheating will occur on clutch facing to such an extent that it is no longer serviceable.

TO TEST FOR SLIPPING CLUTCH, proceed as follows:

Inspection

Insure that parking brake is engaged. Disengage clutch and shift transmission gears into TOP. Gradually increase engine speed while simultaneously engaging clutch. If engine stops while clutch is being engaged, clutch is functioning properly. If vehicle does not move and the engine does not stop, clutch is slipping.

Probable cause	Corrective action
• Clutch facing hardened or wet with oil	Repair or replace
• Clutch facing excessively worn	Replace (Replace if engine/ transmission oil seal is faulty)
• Diaphragm spring weak or damaged	Replace
• Flywheel or pressure plate warped	Repair or replace
• Particles in return port of master cylinder; Piston fails to return to its original position	Clean or replace faulty parts
• Clutch tube deformed or crushed	Replace

CLUTCH DRAGS

Dragging clutch is particularly noticeable when shifting gears, especially into low gear.
TO TEST FOR DRAGGING CLUTCH, proceed to inspection.

Inspection

Disengage clutch and shift gears into Reverse. Shift gears into Neutral, gradually increasing engine speed. After a short intermission, shift gears into Reverse. If noise is heard while gears are being shifted, clutch is dragging.

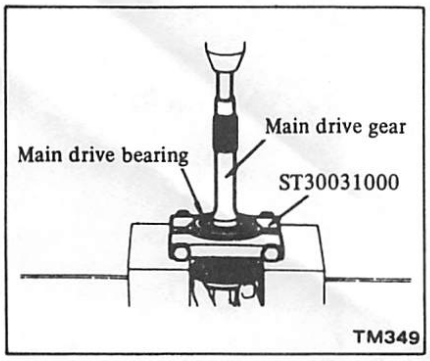
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4. Install propeller shaft. Refer to Propeller Shaft (Section PD) for relation.

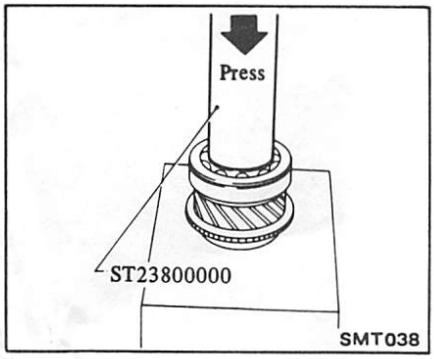
REPLACEMENT OF BEARINGS

MAIN DRIVE AND COUNTER FRONT

1. Remove main drive and counter drive gear. Refer to Gears and Shafts for disassembly.
2. Remove main drive gear snap ring and spacer.
3. Remove main drive bearing.



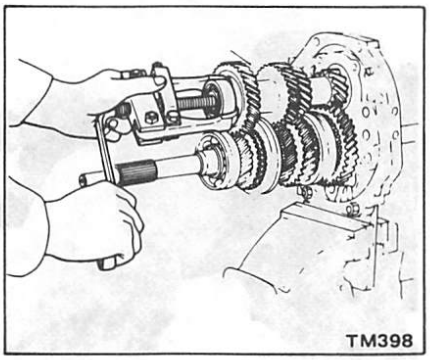
4. Press new main drive bearing.



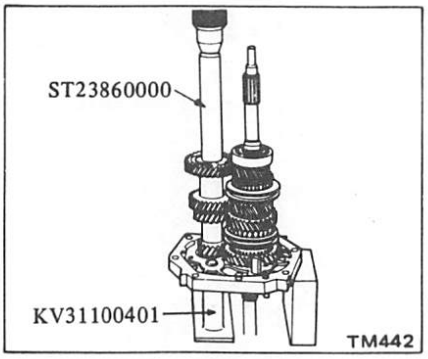
5. Place main drive bearing spacer on main drive bearing and secure main drive bearing with thicker snap ring that will eliminate end play.

Main drive gear snap ring:
Refer to S.D.S.

6. Mesh 2nd and reverse gear, then draw out counter front bearing.



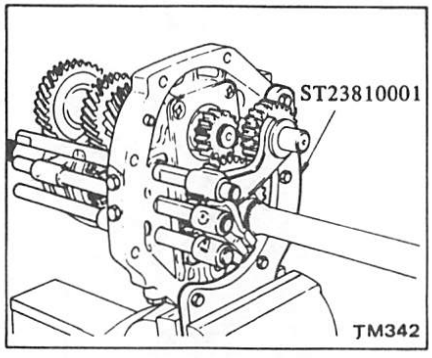
7. Press counter gear front bearing onto counter gear.



8. Install main drive and counter drive gear. Refer to Gears and Shafts for assembly.

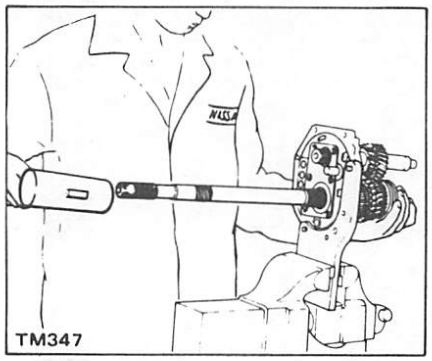
MAINSHAFT AND COUNTER REAR

1. Remove rear extension. Refer to Rear Extension for disassembly.
2. Remove transmission case. Refer to Transmission Case for disassembly.
3. Set up Tool ST23810001 on adapter plate.
4. Place above assembly in a vise.

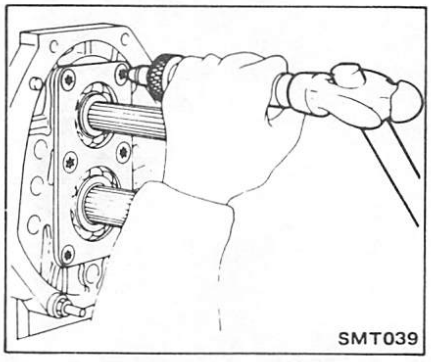


5. Remove main drive and counter drive gear. Refer to Gears and Shafts for disassembly.
6. Remove reverse main gear. Refer to Gears and Shafts for disassembly.
7. Draw out mainshaft assembly together with counter gear, by tapping rear end of mainshaft and counter gear.

Hold front of mainshaft assembly by hand, being careful not to drop counter gear.

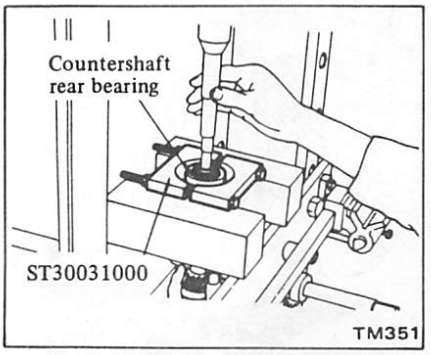


8. Remove bearing retainer.



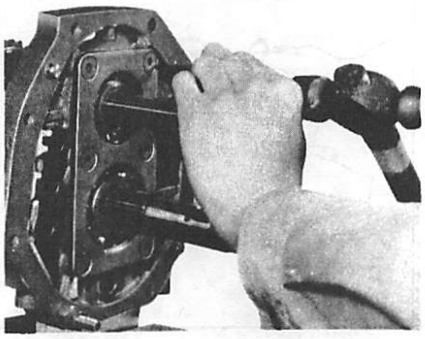
9. Replace mainshaft bearing by new one.
10. Press out countershaft rear bearing.

CAUTION:
When pressing out bearing, hold shaft by hand so as not to drop it.



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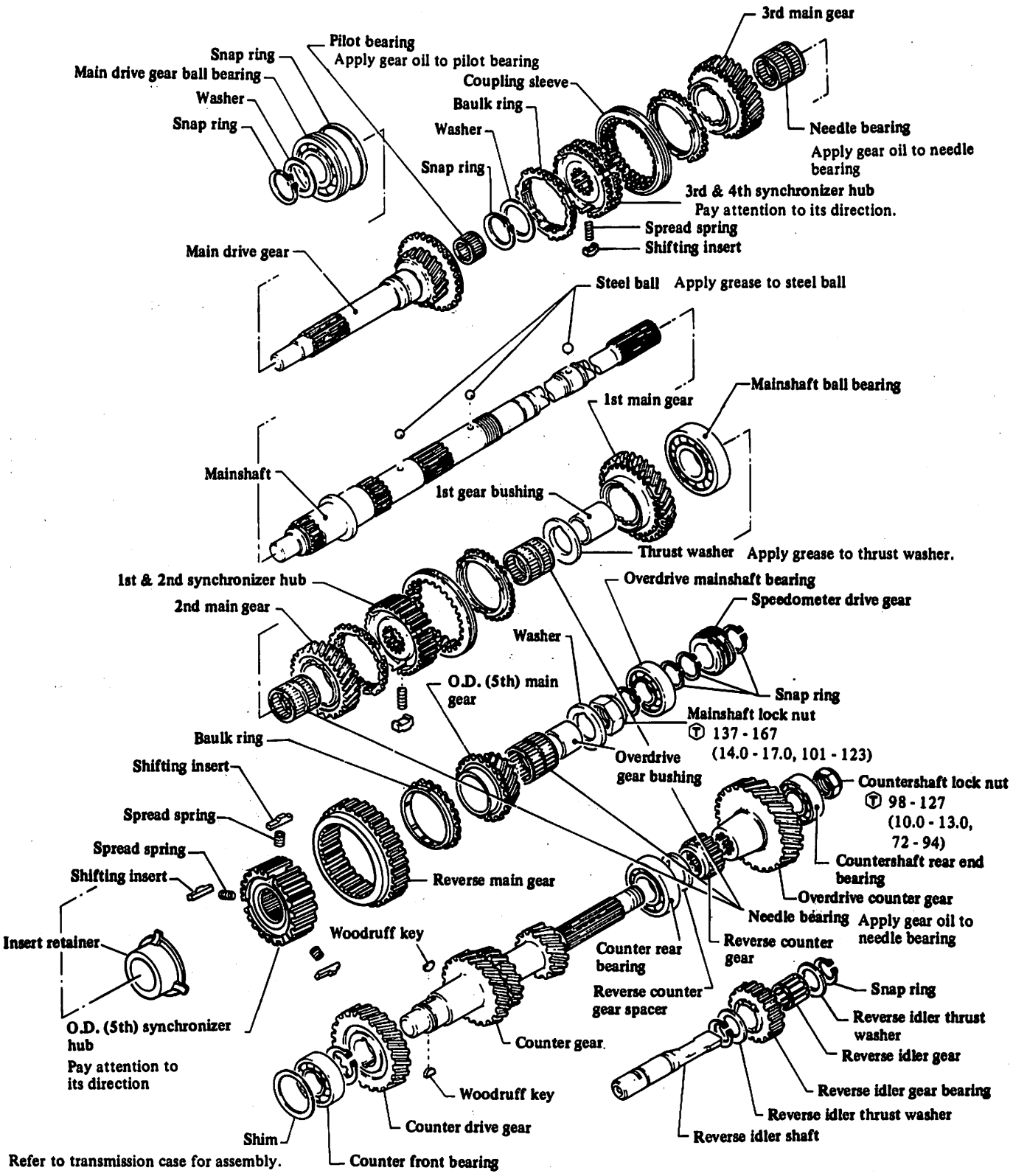
11. Press counter rear bearing onto adapter plate.
12. Install mainshaft bearing onto adapter plate.
13. Install bearing retainer and align bearing retainer with reverse idler shaft at the cut-out portion of the shaft.
14. Tighten and stake each screw at two points.



15. Install main drive and counter drive gear. Refer to Gears and Shafts for assembly.
16. Install reverse main gear. Refer to Gears and Shafts for assembly.
17. Install transmission case. Refer to Transmission Case for assembly.
18. Install rear extension. Refer to Rear Extension for assembly.

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5-SPEED TRANSMISSION (Model : FS5W71B)



The service procedures are almost the same as those for the F4W71B transmission. Unless otherwise noted, refer to F4W71B.

Ⓣ : N·m (kg-m, ft-lb)

SMT359

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GEARS AND SHAFTS

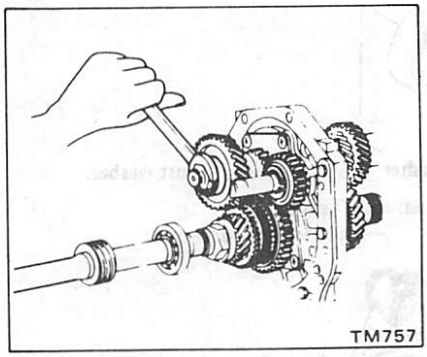
Disassembly and assembly procedures for O.D. gear have been added. For procedures relating to all other parts, refer to Disassembly and Assembly under heading "F4W71B TRANSMISSION"

DISASSEMBLY

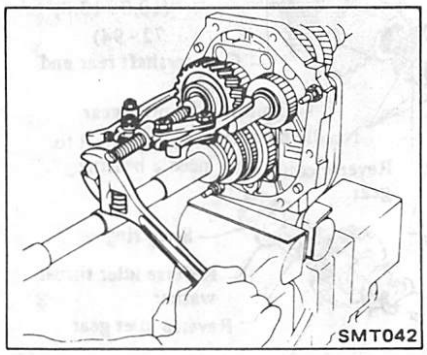
O.D. gear and reverse gear

1. Mesh 2nd and reverse gears. Release staking on counter gear nut and mainshaft nut and loosen these nuts. Remove counter gear nut.

Removed nuts should be discarded and should not be reused.



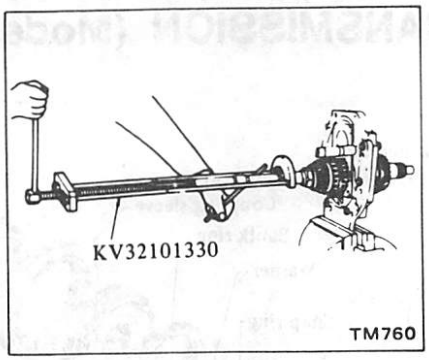
2. Drive out counter O.D. gear and bearing.



3. Remove reverse counter gear and spacer.

Remove snap ring from reverse idler shaft, and remove reverse idler gear.

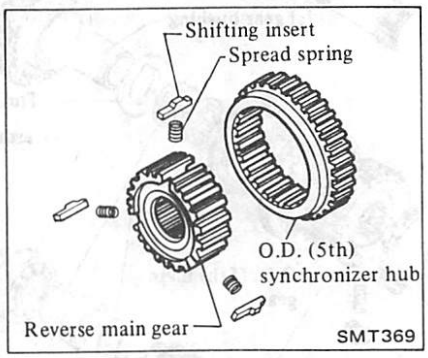
4. Remove snap rings, steel ball, speedometer gear and bearing.



5. Remove mainshaft nut, thrust washer, steel ball, reverse main gear, O.D. synchronizer, O.D. gear and insert retainer together with needle bearing and bushing.

Synchronizer (O.D.)

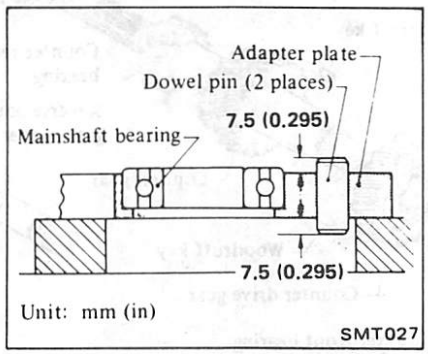
Disassemble synchronizer.



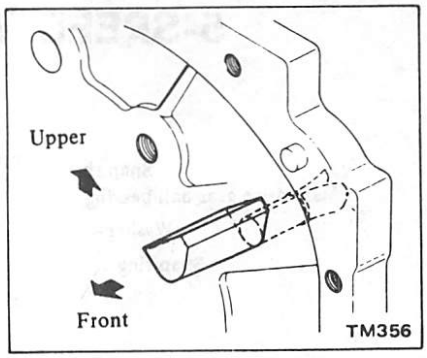
ASSEMBLY

Adapter plate

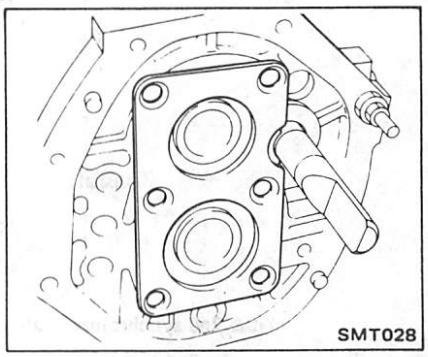
1. Place new dowel pin, mainshaft bearing on adapter plate and tap them.



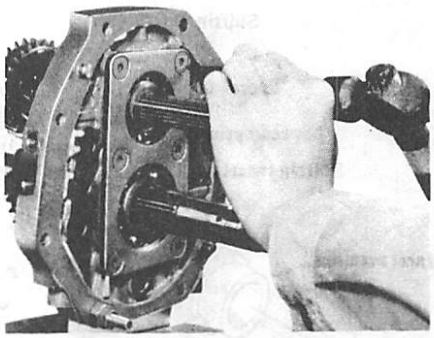
2. Install oil gutter on adapter plate and bend it on front side and expand on rear side.



3. Insert reverse idler shaft.
4. Install bearing retainer.



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



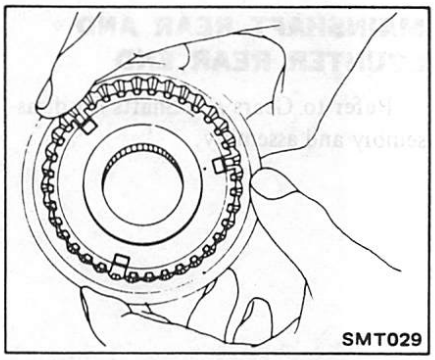
6. Install counter rear bearing with a soft hammer.

Synchronizer

1. Assemble coupling sleeve, and hub.
2. Position spread springs and shifting inserts in three slots in

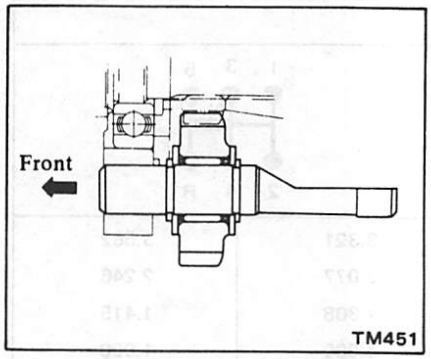
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synchronizer hub; put coupling sleeve (reverse main gear) on synchronizer hub.



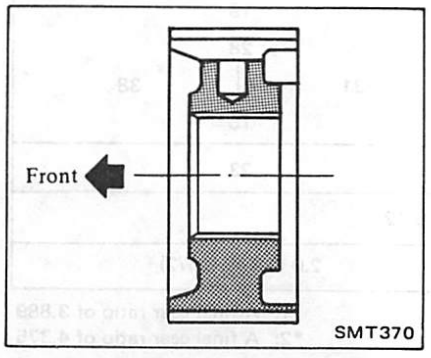
O.D. gear and reverse gear

1. After front side is assembled, assemble reverse counter spacer, snap ring, spacer, needle bearing, reverse idler gear, spacer and snap ring.



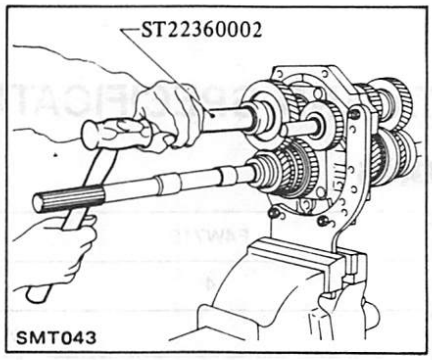
2. Assemble insert retainer, O.D.-reverse synchronizer hub, reverse gear, O.D. gear bushing, needle bearing, O.D. gear assembly, steel ball and thrust washer on mainshaft rear side. Before installing a steel ball, apply grease to it.

a. Assemble O.D.-reverse synchronizer hub, paying attention to its direction.

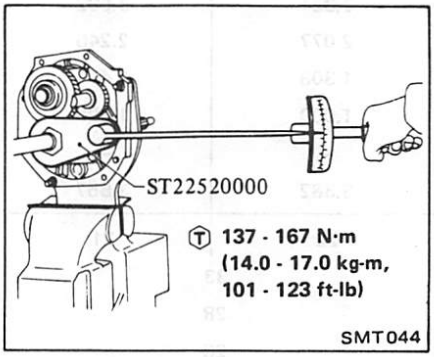


b. Main O.D. gear and counter O.D. gear should be handled as a matched set.
When replacing main O.D. gear and counter O.D. gear, be sure to replace as a set of main O.D. and counter O.D. gears.

3. Assemble reverse counter gear, overdrive counter gear.
4. Assemble new mainshaft nut, and tighten it temporarily.
5. Install bearing.



6. Mesh 2nd and reverse gear and tighten mainshaft lock nut and counter gear lock nut.

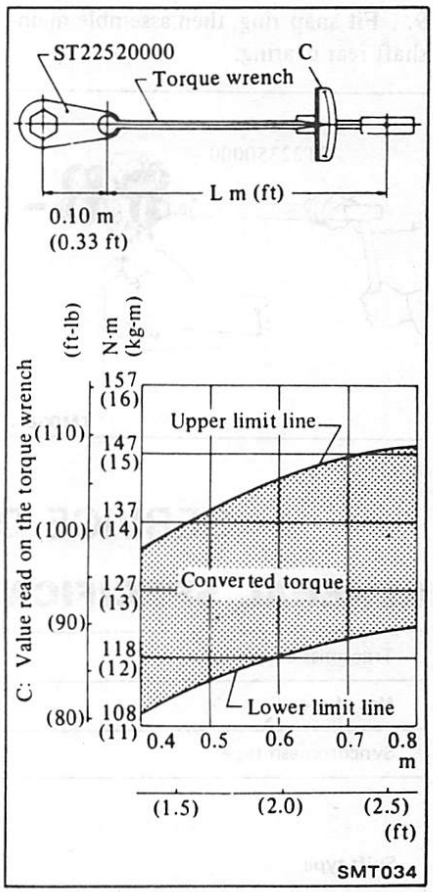


Ⓣ : Counter gear lock nut
98 - 127 N·m
(10.0 - 13.0 kg-m,
72 - 94 ft-lb)

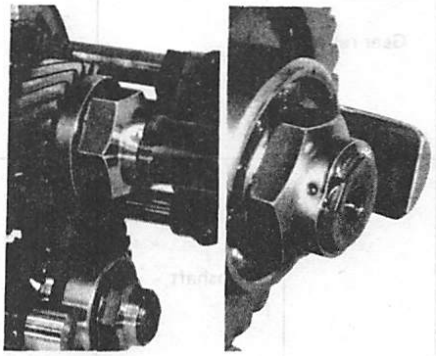
Conversion of torque

Mainshaft nut should be tightened to specified torque with Tool. When doing so, the amount of torque to be read on wrench needle should be modified according to the following chart.

Ⓣ : 137 - 167 N·m
(14 - 17 kg-m,
101 - 123 ft-lb)



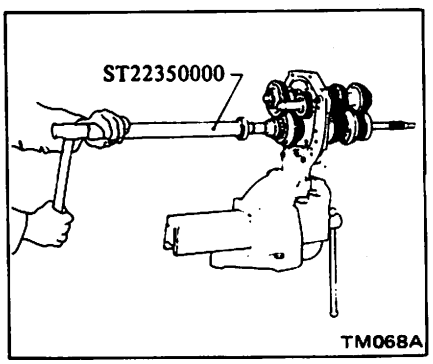
7. Stake mainshaft lock nut and counter gear lock nut with a punch.



8. **Measure gear end play.** Refer to Gears and Shafts for inspection.

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9. Fit snap ring, then assemble mainshaft rear bearing.



10. Fit thick snap ring to mainshaft rear bearing to eliminate end play.

Mainshaft rear bearing snap ring:
Refer to S.D.S.

11. Assemble snap rings, steel ball and speedometer drive gear.
12. Install forks and fork rods. Refer to Forks and Fork Rods for assembly.
13. Install transmission case. Refer to Transmission Case for assembly.
14. Install rear extension. Refer to Rear Extension for assembly.

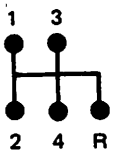
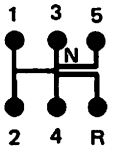
REPLACEMENT OF BEARINGS

MAINSHAFT REAR AND COUNTER REAR END

Refer to Gears and Shafts for disassembly and assembly.

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

Transmission model			F4W71B		FS5W71B	
No. of speed			4		5	
Synchromesh type			Warner			
Shift type						
Gear ratio		1st	3.321	3.592	3.321	3.592
		2nd	2.077	2.246	2.077	2.246
		3rd	1.308	1.415	1.308	1.415
		4th	1.000	1.000	1.000	1.000
		5th	–	–	0.833	0.813
		Rev.	3.382	3.657	3.382	3.657
Number of teeth	Mainshaft	Drive	22	21	22	21
		1st	33		33	
		2nd	28		28	
		3rd	26		26	
		5th	–		19	22
		Rev.	36		36	
	Countershaft	Drive	31	32	31	32
		1st	14		14	
		2nd	19		19	
		3rd	28		28	
		5th	–		31	38
		Rev.	15		15	
	Rev. idler shaft		23		23	
Speedometer gear ratio			18/6 *1, 20/6 *2			
Oil capacity		ℓ (US pt, Imp pt)	1.7 (3-5/8, 3)		2.0 (4-1/4, 3-1/2)	

*1: A final gear ratio of 3.889
*2: A final gear ratio of 4.375

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INSPECTION AND ADJUSTMENT

GEAR END PLAY

Unit: mm (in)

Position \ Model	F4W71B	FS5W71B
1st main gear	0.27 - 0.34 (0.0106 - 0.0134)	0.27 - 0.34 (0.0106 - 0.0134)
2nd main gear	0.12 - 0.19 (0.0047 - 0.0075)	0.12 - 0.19 (0.0047 - 0.0075)
3rd main gear	0.13 - 0.37 (0.0051 - 0.0146)	0.13 - 0.37 (0.0051 - 0.0146)
5th main gear	–	0.10 - 0.17 (0.0039 - 0.0067)
Rev. idler gear	–	0.05 - 0.50 (0.0020 - 0.0197)

CLEARANCE BETWEEN BAULK RING AND GEAR

Unit: mm (in)

Transmission model	F4W71B	FS5W71B	
		Except O.D. (5th) gear	O.D. (5th) gear
Standard	1.20 - 1.60 (0.0472 - 0.0630)	1.20 - 1.60 (0.0472 - 0.0630)	1.00 - 1.40 (0.0394 - 0.0551)
Wear limit	0.8 (0.031)	0.8 (0.031)	0.5 (0.020)

AVAILABLE SNAP RING

Main drive gear bearing

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

Mainshaft front

Thickness mm (in)	Part number
1.4 (0.055)	32263 E9000
1.5 (0.059)	32263 E9001
1.6 (0.063)	32263 E9002

Mainshaft rear end bearing

Model FS5W71B

Thickness mm (in)	Part number
1.1 (0.043)	32228 20100
1.2 (0.047)	32228 20101
1.3 (0.051)	32228 20102
1.4 (0.055)	32228 20103

Counter drive gear

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

Counter reverse gear

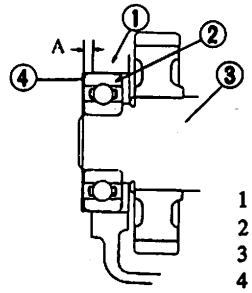
Model F4W71B

Thickness mm (in)	Part number
1.4 (0.055)	32228 E9200
1.5 (0.059)	32228 E9201
1.6 (0.063)	32228 E9202
1.7 (0.067)	32228 E9203

AVAILABLE SHIM

Counter front bearing

Unit: mm (in)



1 Transmission case
2 Counter gear front bearing
3 Counter gear
4 Shim

TM371

"A"	Thickness of shim	Part number
3.42 - 3.51 (0.1346 - 0.1382)	0.1 (0.004)	32218 E9000
3.32 - 3.41 (0.1307 - 0.1343)	0.2 (0.008)	32218 E9001
3.22 - 3.31 (0.1268 - 0.1303)	0.3 (0.012)	32218 E9002
3.12 - 3.21 (0.1228 - 0.1264)	0.4 (0.016)	32218 E9003
3.02 - 3.11 (0.1189 - 0.1224)	0.5 (0.020)	32218 E9004
2.92 - 3.01 (0.1150 - 0.1185)	0.6 (0.024)	32218 E9005

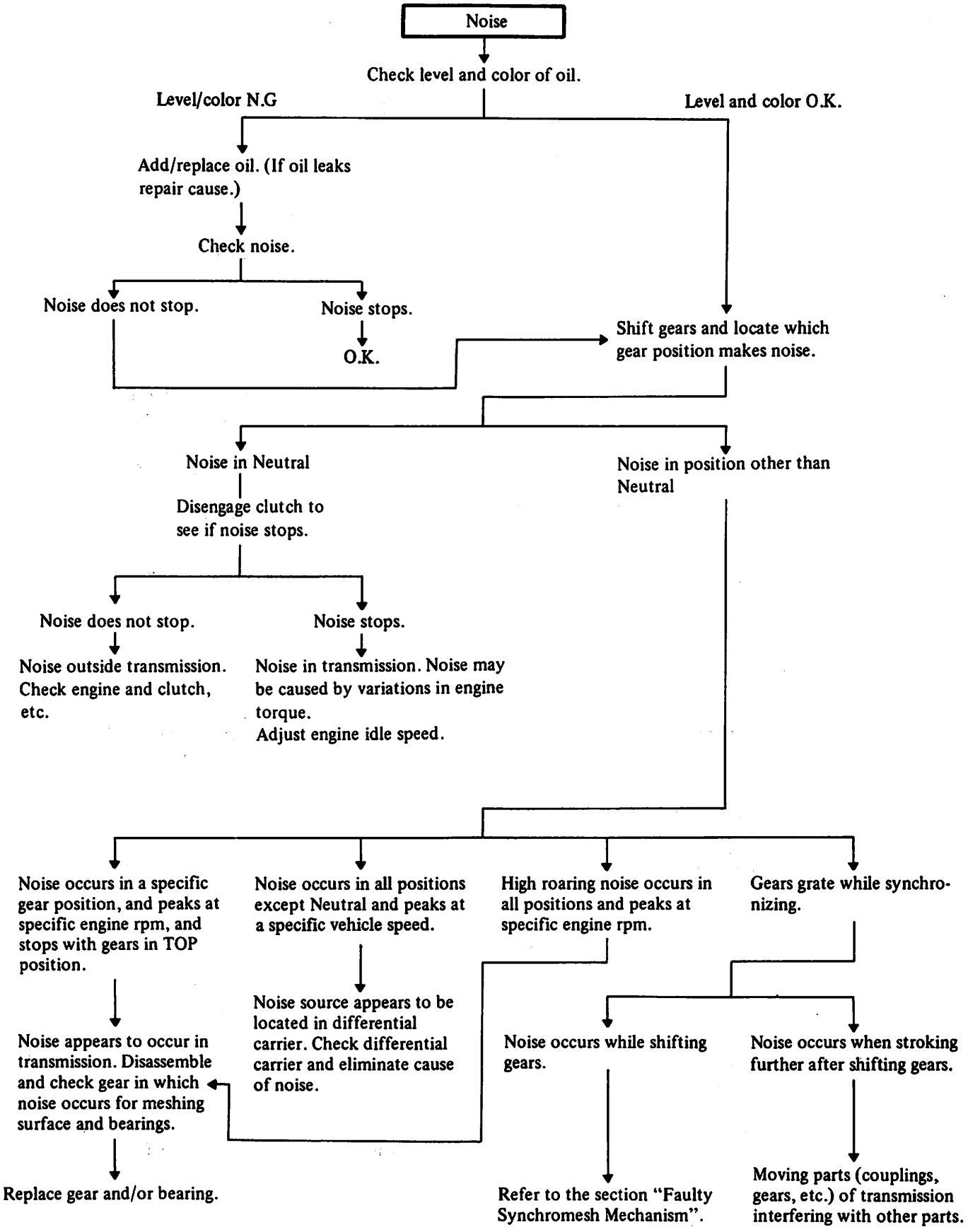
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TIGHTENING TORQUE

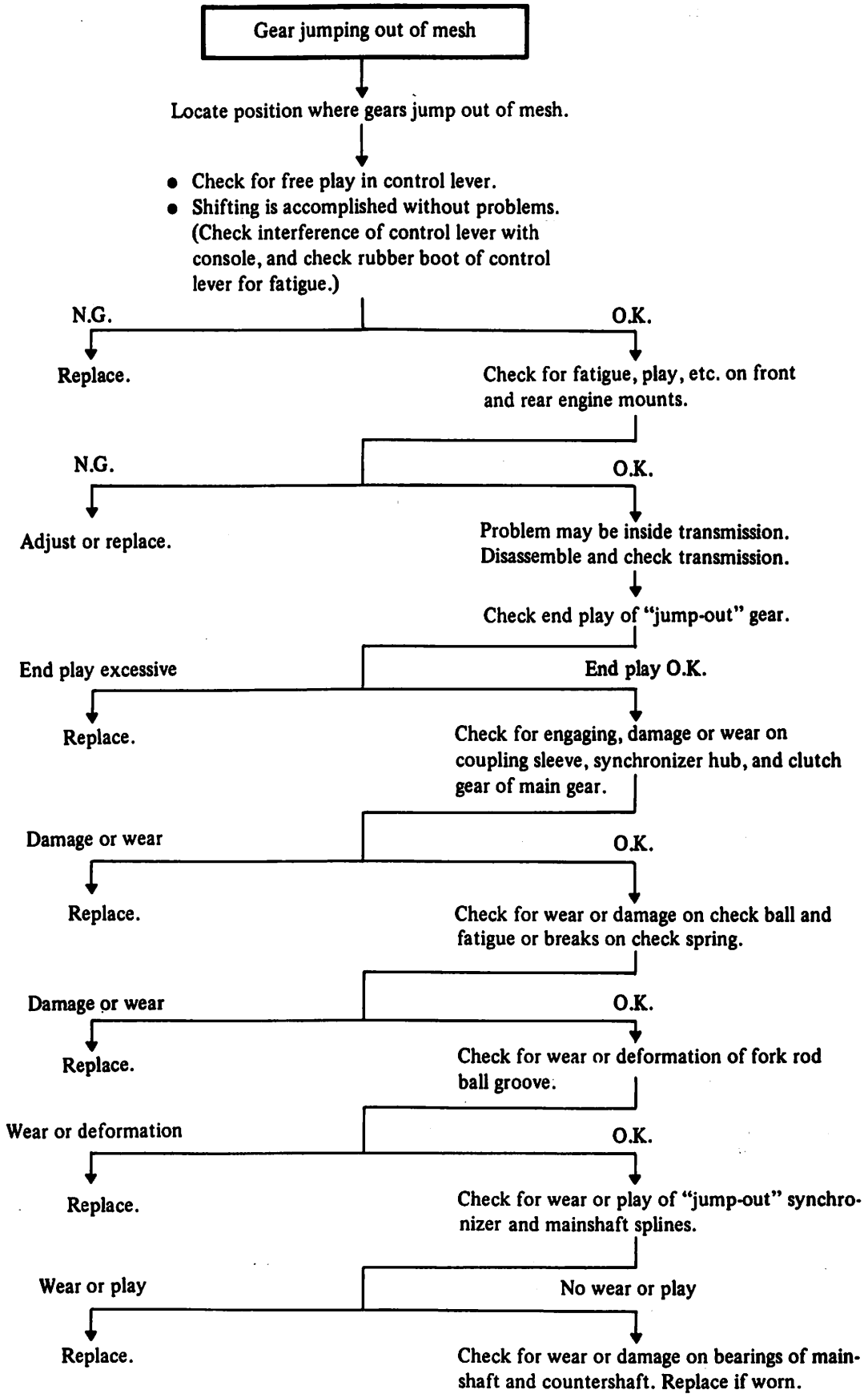
Unit	N·m	kg-m	ft-lb
Transmission installation			
Clutch operating cylinder	30 - 40	3.1 - 4.1	22 - 30
Transmission to engine	43 - 58	4.4 - 5.9	32 - 43
Engine rear plate to transmission	9 - 12	0.9 - 1.2	6.5 - 8.7
Crossmember to body	31 - 42	3.2 - 4.3	23 - 31
Rear mounting insulator to crossmember	31 - 35	3.2 - 3.6	23 - 26
Rear mounting insulator to rear extension	42 - 49	4.3 - 5.0	31 - 36
Starter motor to transmission	29 - 39	3.0 - 4.0	22 - 29
Gear assembly			
Bearing retainer to adapter plate	16 - 23	1.6 - 2.3	12 - 17
Mainshaft lock nut	137 - 167	14.0 - 17.0	101 - 123
Counter gear lock nut (FS5W71B)	98 - 127	10.0 - 13.0	72 - 94
Rear extension to transmission case	16 - 21	1.6 - 2.1	12 - 15
Front cover to transmission case	16 - 21	1.6 - 2.1	12 - 15
Filler plug	25 - 34	2.5 - 3.5	18 - 25
Drain plug	25 - 34	2.5 - 3.5	18 - 25
Ball pin	20 - 34	2.0 - 3.5	14 - 25
Striking lever lock nut	9 - 12	0.9 - 1.2	6.5 - 8.7
Check ball plug	19 - 25	1.9 - 2.5	14 - 18
Speedometer sleeve installation	4 - 5	0.4 - 0.5	2.9 - 3.6
Back-up lamp switch	20 - 29	2.0 - 3.0	14 - 22
Return spring plug	8 - 10	0.8 - 1.0	5.8 - 7.2

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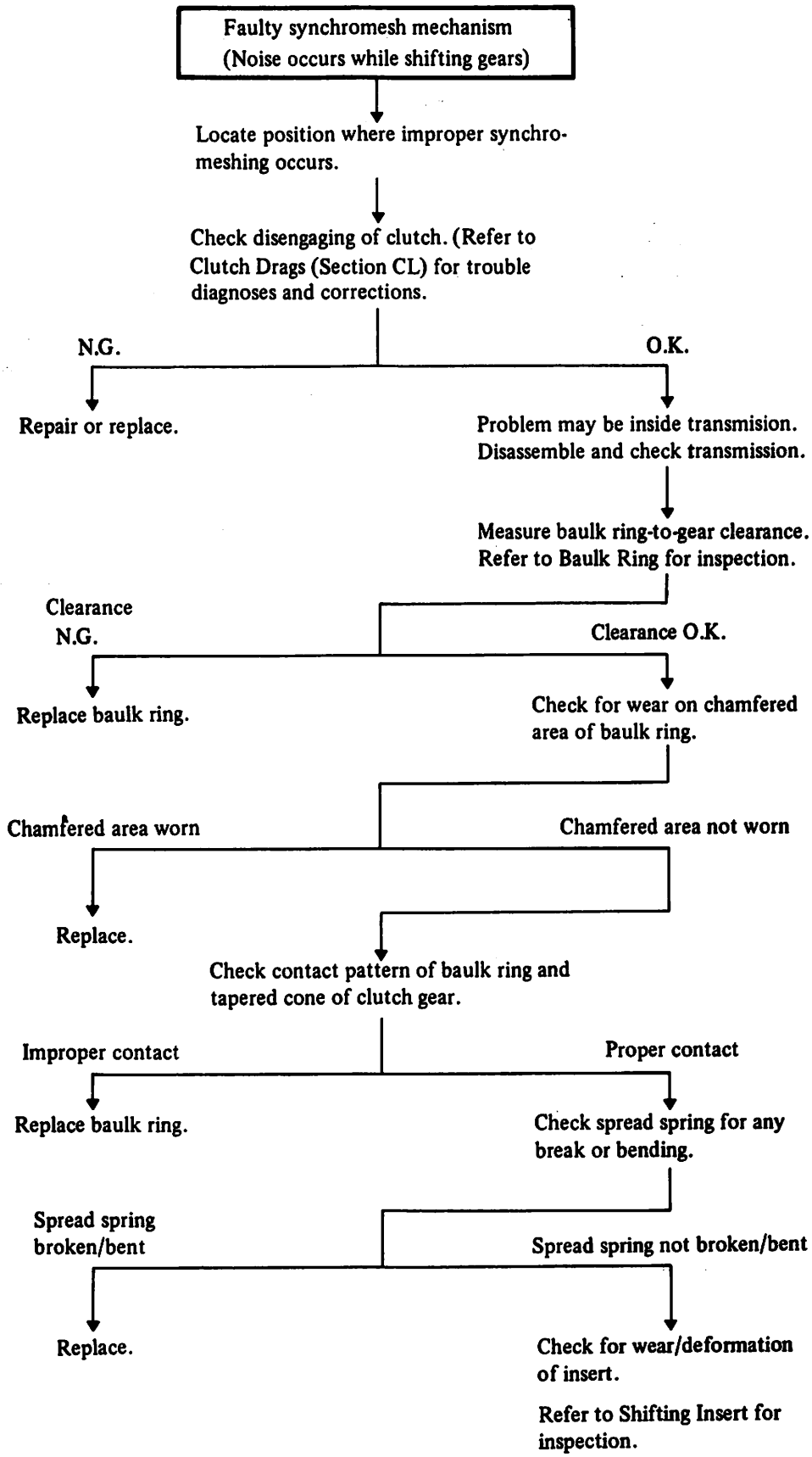
TROUBLE DIAGNOSES AND CORRECTIONS



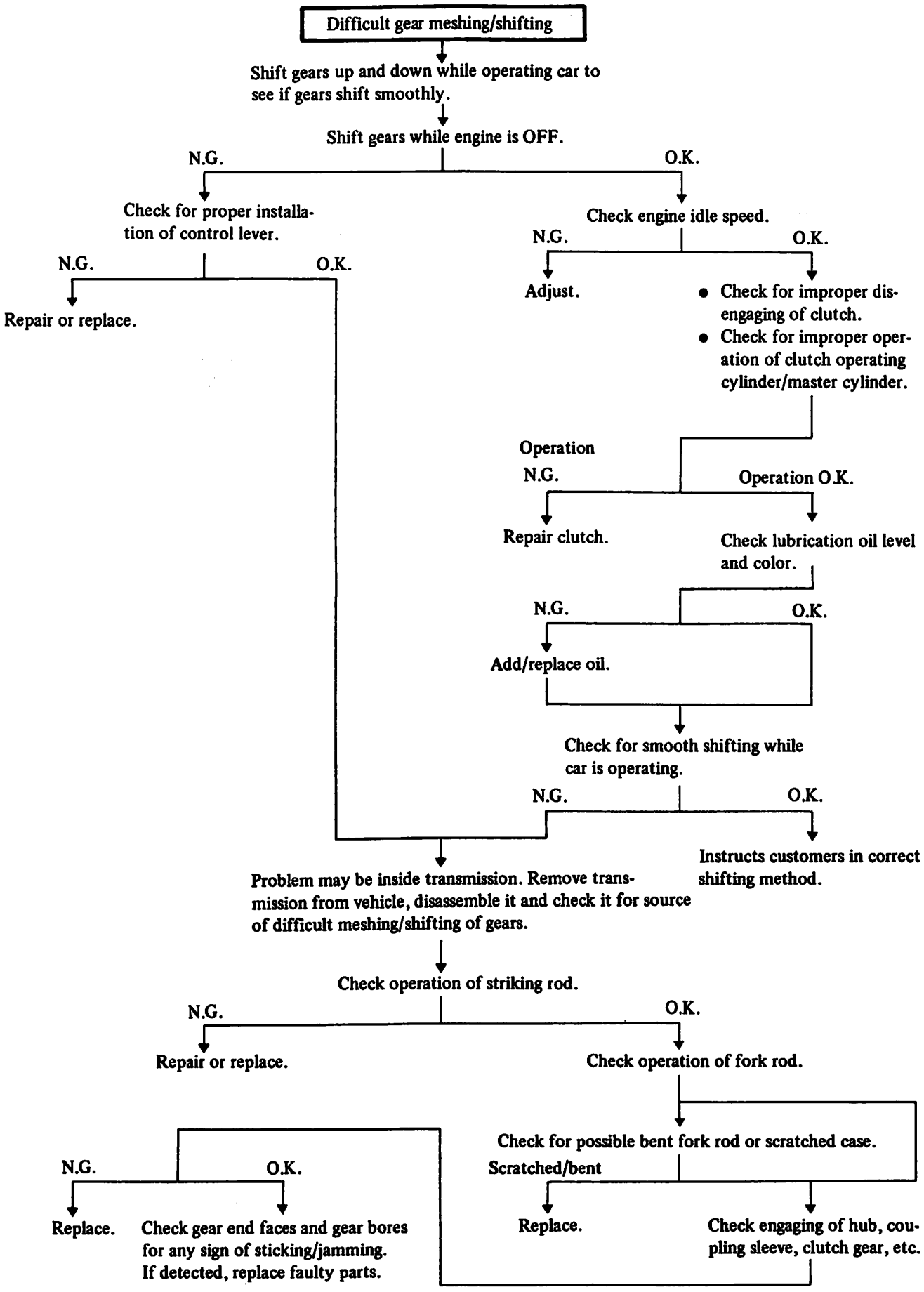
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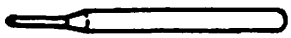
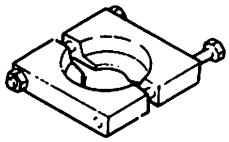
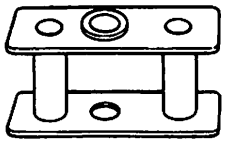
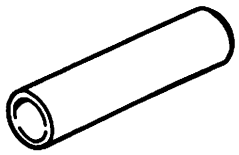
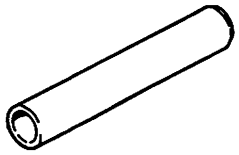
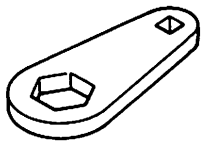
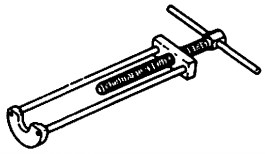
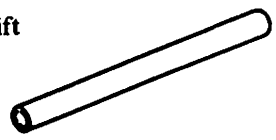


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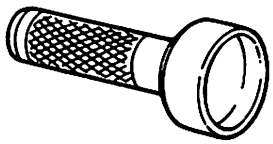


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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name	Unit application	
		F4W71B	FS5W71B
ST23810001 (J25693)	Adapter setting plate 	X	X
KV31100300 (J25689-A)	Fork rod pin punch 	X	X
ST30031000 (J25733-1)	Bearing puller 	X	X
KV31100401 (–)	Transmission press stand 	X	X
ST23860000 (–)	Counter gear drift 	X	X
ST22360002 (J25679-91)	Bearing drift 	X	X
ST22520000 (J26348)	Wrench 	X	X
ST23800000 (J25691-01)	Transmission adapter 	X	X
KV32101330 (See J26349)	Bearing puller 	–	X
ST22350000 (J25678-01)	Mainshaft bearing drift 	–	X

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Tool number (Kent-Moore No.)	Tool name	Unit application	
		F4W71B	FS5W71B
ST33400001 (J26082)	Oil seal drift 	X	X

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AUTOMATIC TRANSMISSION

SECTION AT

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AT

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DESCRIPTION

The 3N71B transmission is a fully automatic unit consisting primarily of a 3 element hydraulic torque converter and two planetary gear sets. Two multiple-disc clutches, a multiple-disc brake, brake band, and one-way clutch provide the friction elements necessary to obtain the desired function of the two planetary gear-sets.

A hydraulic control system is used to operate the friction elements and automatic shift controls.

TORQUE CONVERTER

The torque converter is attached to the crankshaft through a flexible drive plate. Heat generated in the torque converter is dissipated by circulating the transmission fluid through an oil-to-water type cooler in the radiator lower tank.

The welded construction of the torque converter prohibits disassembly or service unless highly specialized equipment is available.

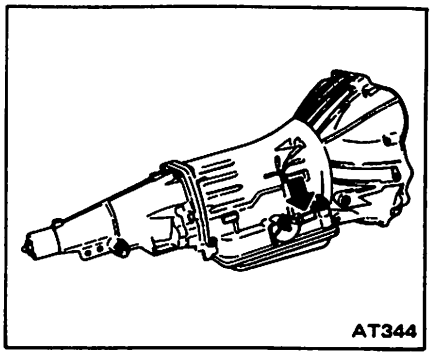
FLUID RECOMMENDATION

Use "DEXRON" type automatic transmission fluid only.

IDENTIFICATION NUMBER

Stamped position:

The plate is attached to the right hand side of transmission case.



AT344

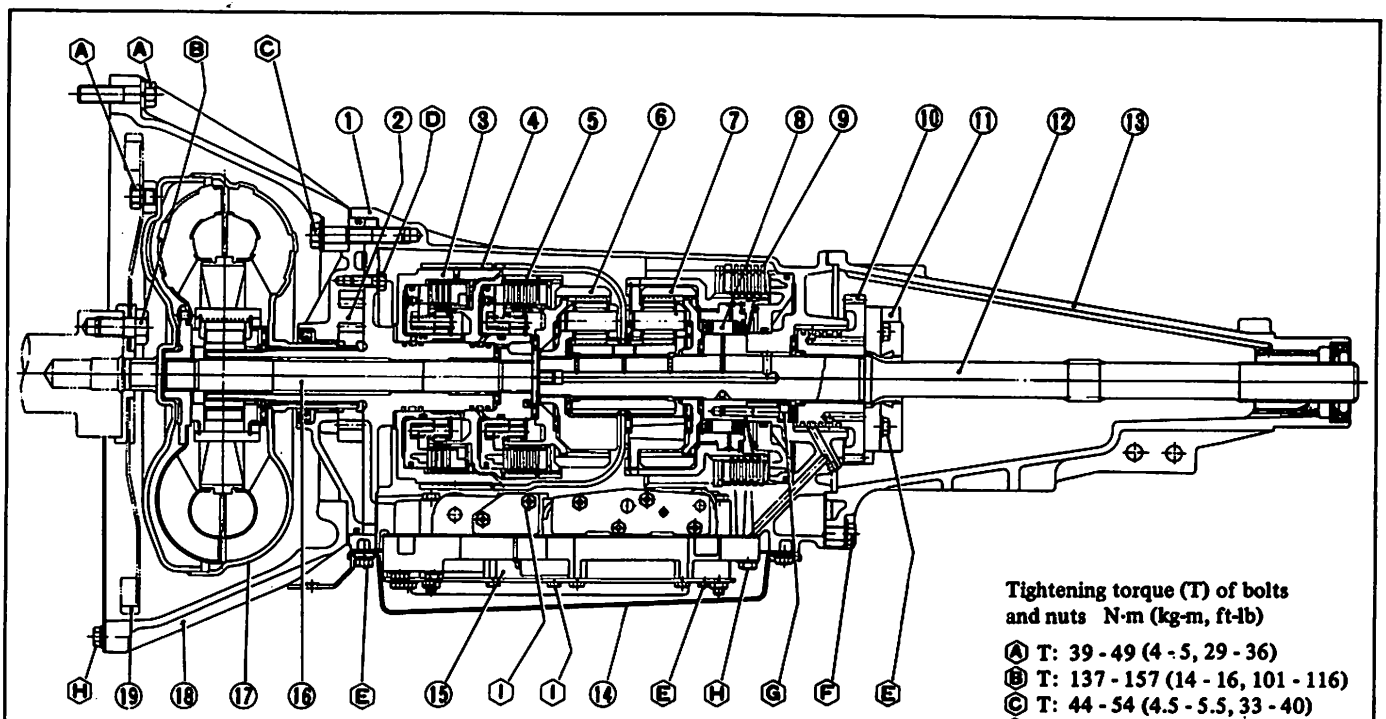
Identification of number arrangements:

JAPAN AUTOMATIC TRANSMISSION CO.,LTD
MODEL X0123
NO. 7601234

Number designation

7 6 0 1 2 3 4

- 4: Serial production number for the month
- 3: Month of production [1: Jan., 2: Feb., ... X: Oct., Y: Nov., Z: Dec.]
- 2: Last figure denoting the year (A.D.)



1 Transmission case
2 Oil pump
3 Front clutch
4 Band brake
5 Rear clutch
6 Front planetary gear
7 Rear planetary gear
8 One-way clutch
9 Low & Reverse brake
10 Oil distributor
11 Governor
12 Output shaft
13 Rear extension
14 Oil pan
15 Control valve
16 Input shaft
17 Torque converter
18 Converter housing
19 Drive plate

Tightening torque (T) of bolts and nuts N·m (kg-m, ft-lb)

- A T: 39 - 49 (4 - 5, 29 - 36)
- B T: 137 - 157 (14 - 16, 101 - 116)
- C T: 44 - 54 (4.5 - 5.5, 33 - 40)
- D T: 6 - 8 (0.6 - 0.8, 4.3 - 5.8)
- E T: 5 - 7 (0.5 - 0.7, 3.6 - 5.1)
- F T: 20 - 25 (2.0 - 2.5, 14 - 18)
- G T: 13 - 18 (1.3 - 1.8, 9 - 13)
- H T: 5.4 - 7.4 (0.55 - 0.75, 4.0 - 5.4)
- I T: 2.5 - 3.4 (0.25 - 0.35, 1.8 - 2.5)

AT312

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HYDRAULIC CONTROL UNIT AND VALVES

The hydraulic, or automatic control system is comprised of four (4) basic groups: the pressure supply system, the pressure regulating system, the flow control valves, and the friction elements.

PRESSURE SUPPLY SYSTEM

The pressure supply system consists of a gear type oil pump driven by the engine through the torque converter. The pump provides pressure for all hydraulic and lubrication needs.

PRESSURE REGULATOR VALVES

The pressure regulating valves control the output pressure of the oil pump.

Pressure regulator valve

The pressure regulator valve controls mainline pressure, based on throttle opening, for the operation of the band, clutches and brake.

Governor valve

The governor valve transmits regulated pressure, based on vehicle speed, to the shift valves to control upshifts and downshifts.

Vacuum throttle valve

The vacuum throttle valve transmits regulated pressure, based on engine load (vacuum). This pressure controls the pressure regulator valve. Also this pressure is applied to one end of the shift valves in opposition to governor pressure, which acts on the other end of the shift valves, controlling upshift and downshift speeds.

FLOW CONTROL VALVES

Manual valve

The manual valve is moved manually by the vehicle operator to select the different drive ranges.

1-2 Shift valve

The 1-2 shift valve automatically shifts the transmission from first to second or from second to first depending upon governor and throttle pressure along with accelerator position (solenoid downshift valve). See Hydraulic Control Circuits, "Drive 2".

2-3 Shift valve

The 2-3 shift valve automatically shifts the transmission from second to top gear or from top to second depending upon governor and throttle pressure, or accelerator position (solenoid downshift valve). See Hydraulic Control Circuits "Drive 3" Range.

Solenoid downshift valve

The solenoid downshift valve is activated electrically when the accelerator is "floored", causing a forced downshift from top to second, top to first, or second to first gear depending upon vehicle speed (governor pressure).

Pressure modified valve

The pressure modifier valve assists the mainline pressure regulator valve in lowering mainline pressure during high speed light load conditions, such as steady speed cruise. Governor pressure, working against a spring, opens the valve which allows modified throttle pressure to work against the pressure regulator valve spring, lowering mainline pressure. Lower operating pressure under light load reduces oil temperature, and increases transmission life.

Throttle back-up valve

The throttle back-up valve assists the vacuum throttle valve to increase line pressure when the manual valve is shifted either to "2" or "1" range.

Second lock valve

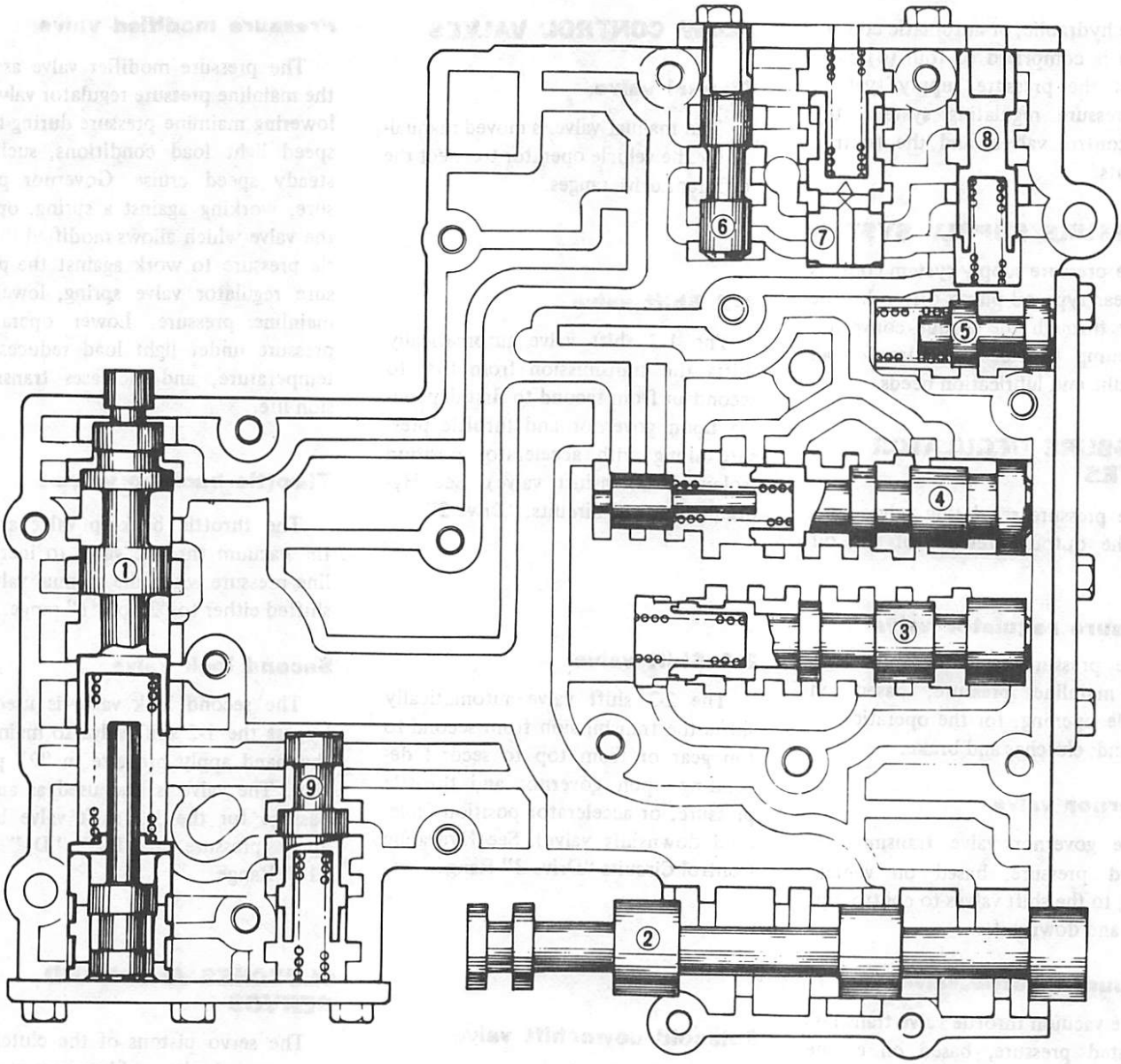
The second lock valve is used to bypass the 1-2 shift valve to maintain the band apply pressure in "2" position. The valve is also used as an oil passage for the 1-2 shift valve band apply pressure in "D_2", "D_3" and "1_2" Range.

CLUTCHES AND BAND SERVOS

The servo pistons of the clutches, low reverse brake, and band are moved hydraulically to engage the clutches, brake, and apply the band. The clutch and brake pistons are released by spring tension, and band piston is released by spring tension and hydraulic pressure.

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Control valve



1 Pressure regulating valve
2 Manual valve
3 1st-2nd shift valve
4 2nd-3rd shift valve
5 Pressure modifier valve
6 Vacuum throttle valve
7 Throttle back-up valve
8 Solenoid down shift valve
9 Second lock valve

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OIL CHANNEL IDENTIFICATION

The circuit numbers shown in each Hydraulic Control Circuit are classified as follows according to the function.

Pressure source of the line: 7

Operating line pressure for friction elements:
1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12.

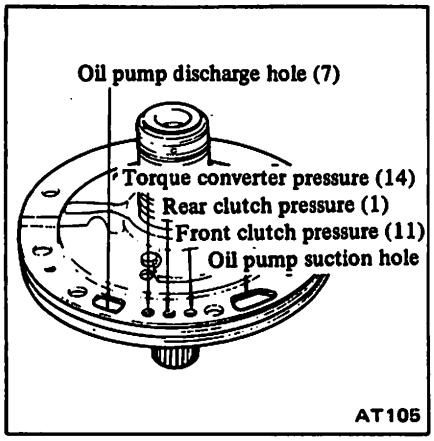
Auxiliary line pressure: 13

Torque converter pressure: 14

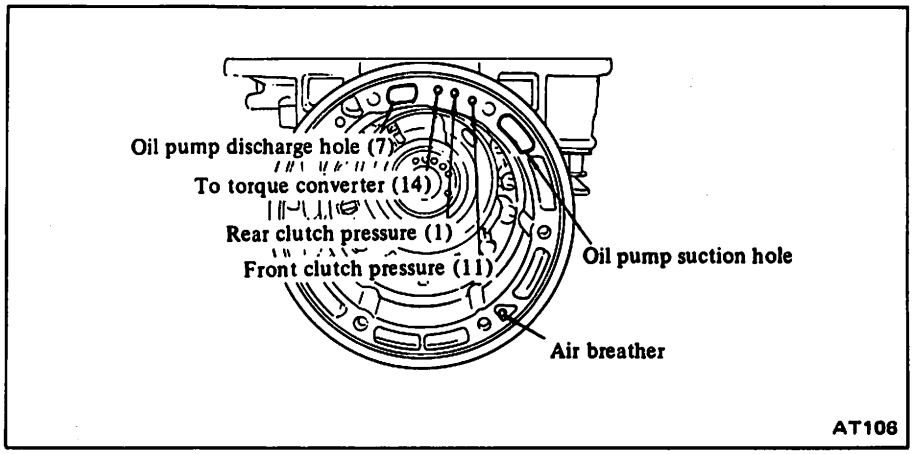
Governor pressure: 15

Throttle system pressure:
16, 17, 18, 19.

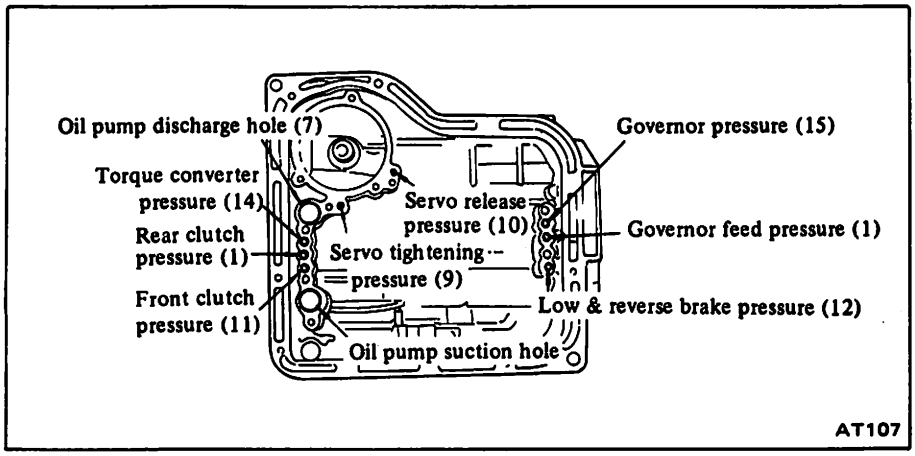
Oil Channels in Oil Pump



Oil Channels in Case Front Face



Oil Channels in Case Face



MECHANICAL OPERATION

In the 3N71B automatic transmission, each part operates as shown in the following table at each gear select position.

Range			Gear ratio	Clutch		Low & reverse brake	Band servo		One way clutch	Parking pawl
				Front	Rear		Operation	Release		
Park						on				on
Reverse			2.182	on		on		on		
Neutral										
Drive	D1	Low	2.458		on				on	
	D2	Second	1.458		on		on			
	D3	Top	1.000	on	on		(on)	on		
2		Second	1.458		on		on			
1	1_2	Second	1.458		on		on			
	1_1	Low	2.458		on	on				

The low & reverse brake is applied in "1_1" range to prevent free wheeling when coasting and allows engine braking.

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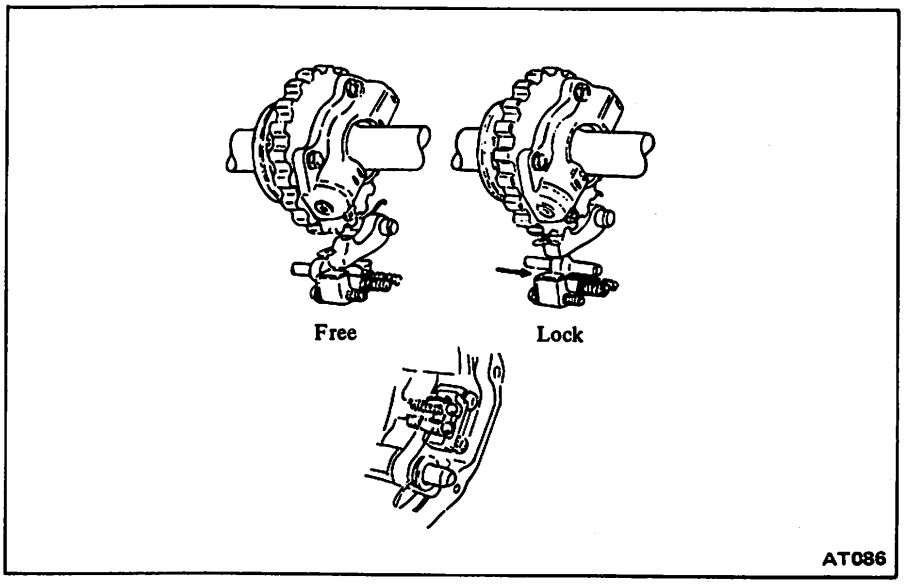
HYDRAULIC CONTROL CIRCUITS

"P" RANGE (PARK)

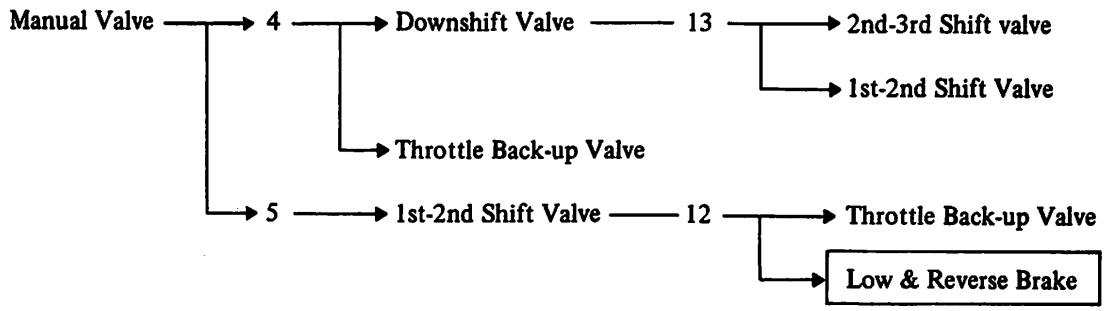
Power flow

In "P" range, the shift linkage actuated parking pawl meshes in a gear splined to the output shaft, preventing movement of the vehicle. When the engine is running, the low and reverse brake is applied by pressure from the manual valve passing through the 1-2 shift valve.

Parking Mechanism



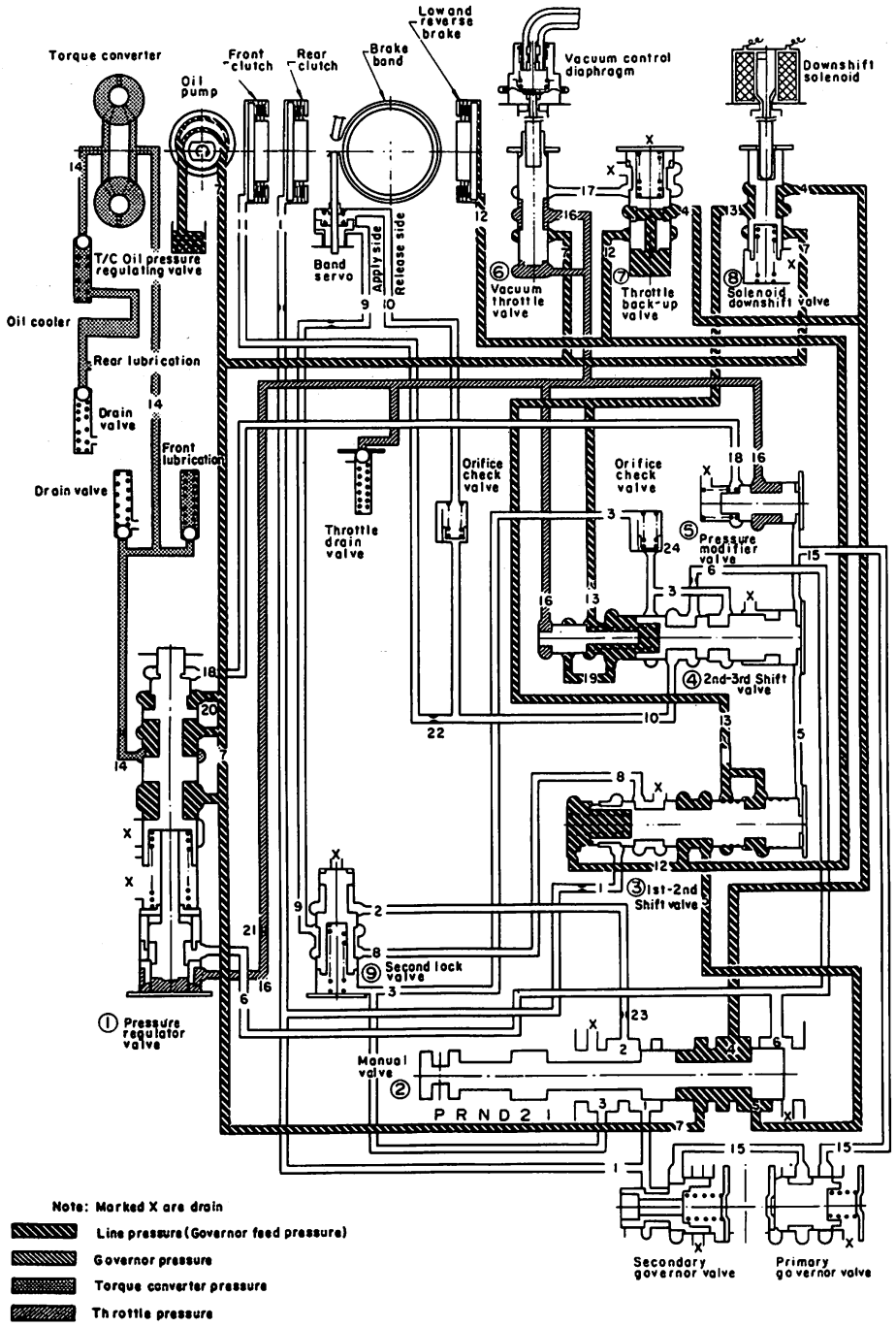
Fluid flow



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Oil Pressure Circuit Diagram – "P" range (Park)



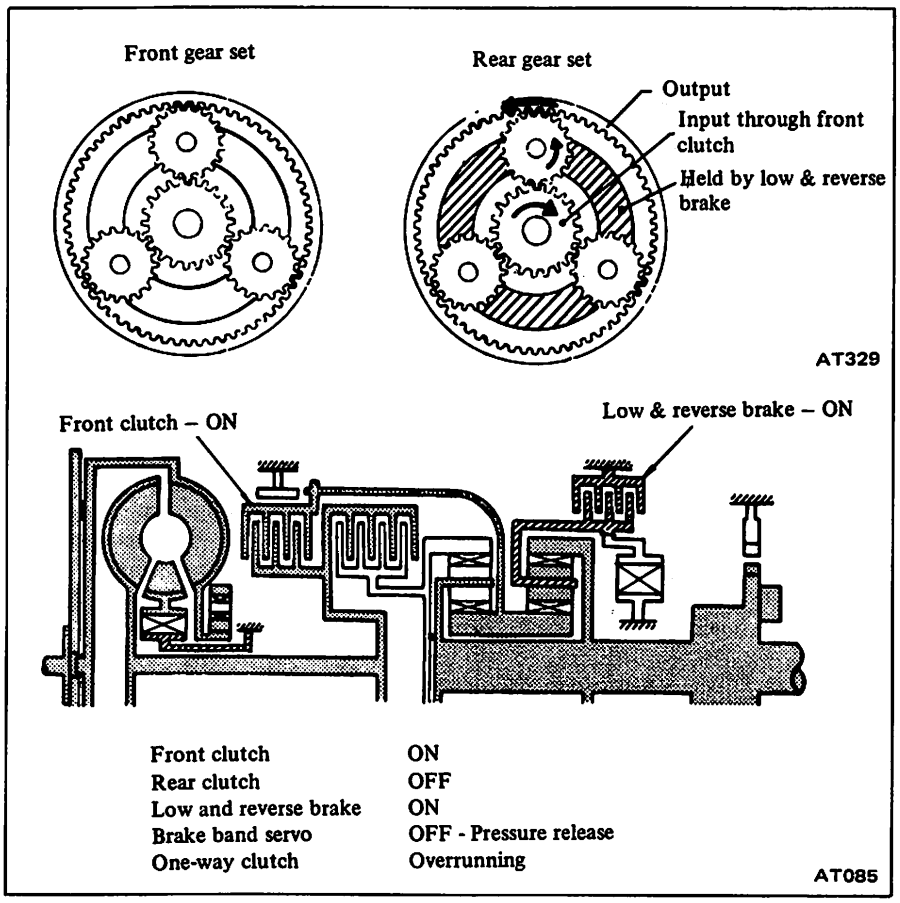
SAT164

"R" RANGE (REVERSE)

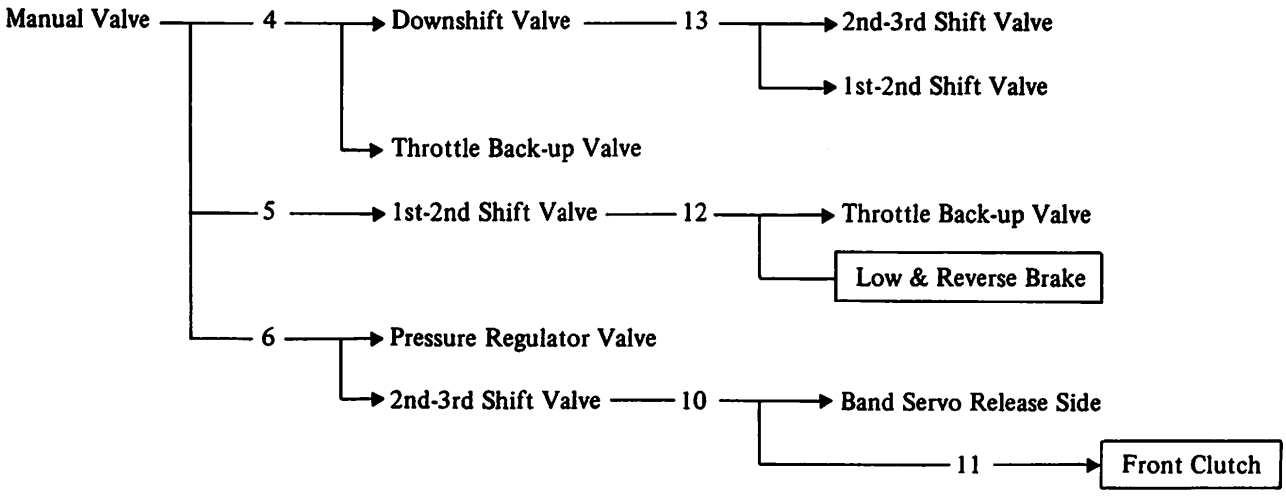
Power flow

With the selector lever in "R" range, the front clutch is applied to transmit clockwise engine torque through the connecting shell to the sun gear. The clockwise rotation of the sun gear causes the planet gears to rotate counterclockwise. With the low and reverse brake holding the rear planet carrier, the rear internal gear, splined to the output shaft, turns counterclockwise in a reduction ratio of approximately 2.18 to 1.

Mechanical Operation during "R" Range

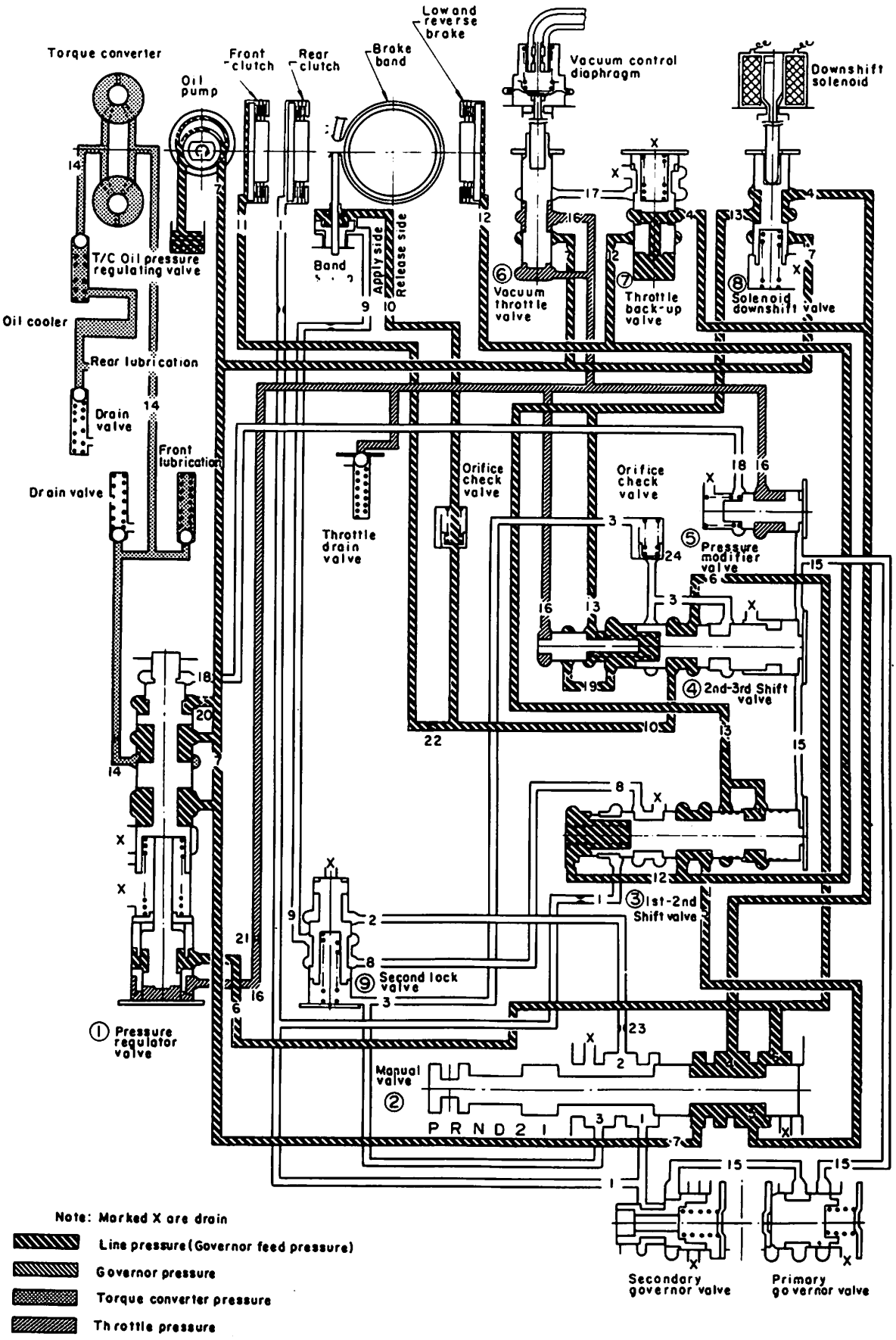


Fluid flow



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Oil Pressure Circuit Diagram – "R" range (Reverse)



SAT165

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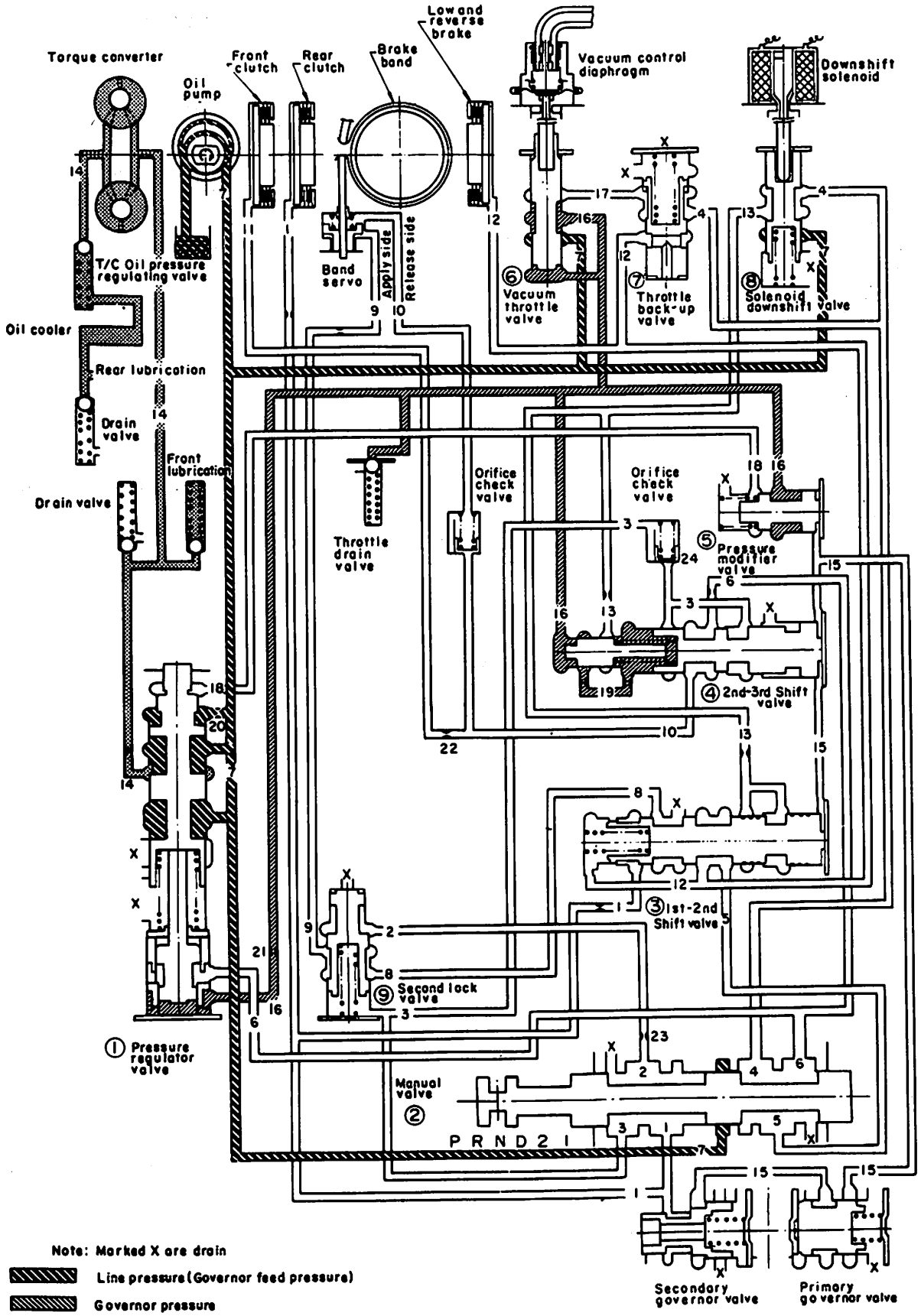
"N" RANGE (NEUTRAL)

Power flow

In "N" range no friction elements are in use, thus no power is transmitted to the output shaft.

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Oil Pressure Circuit Diagram – "N" range (Neutral)



SAT166

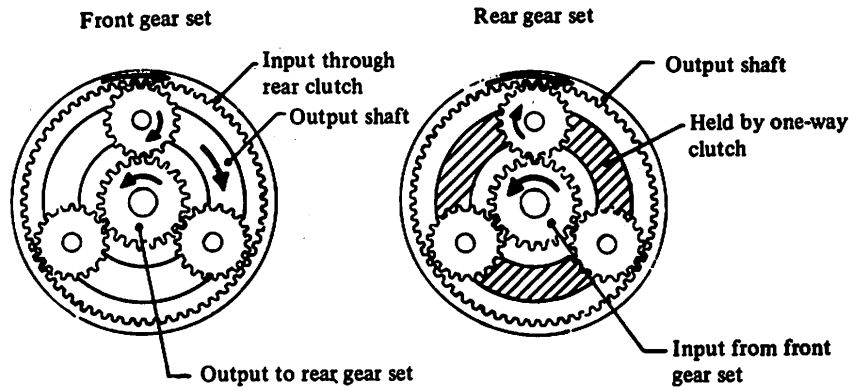
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"D_1" RANGE (LOW GEAR)

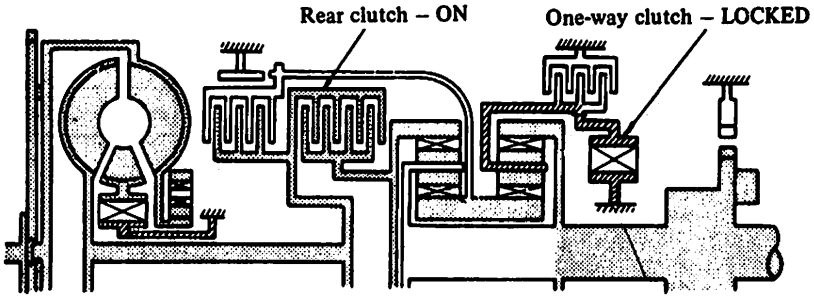
Power flow

With the shift selector in "D" (low gear), engine torque is transmitted, through the applied rear clutch, to the internal gear of the front gear set. The clockwise rotation of the front internal gear causes the front planet gears to rotate clockwise, driving the compound sun gear counterclockwise. The front planetary carrier is splined to the output shaft. This causes the planet gears to drive the sun gear instead of "walking" around the sun gear. This counterclockwise rotation of the sun gear causes the rear planet gears to rotate clockwise. With the one-way clutch holding the rear planet carrier, the rear planetary gears turn the rear internal gear and output shaft clockwise in a reduction ratio of approximately 2.46 to 1.

Mechanical Operation during "D_1" Range



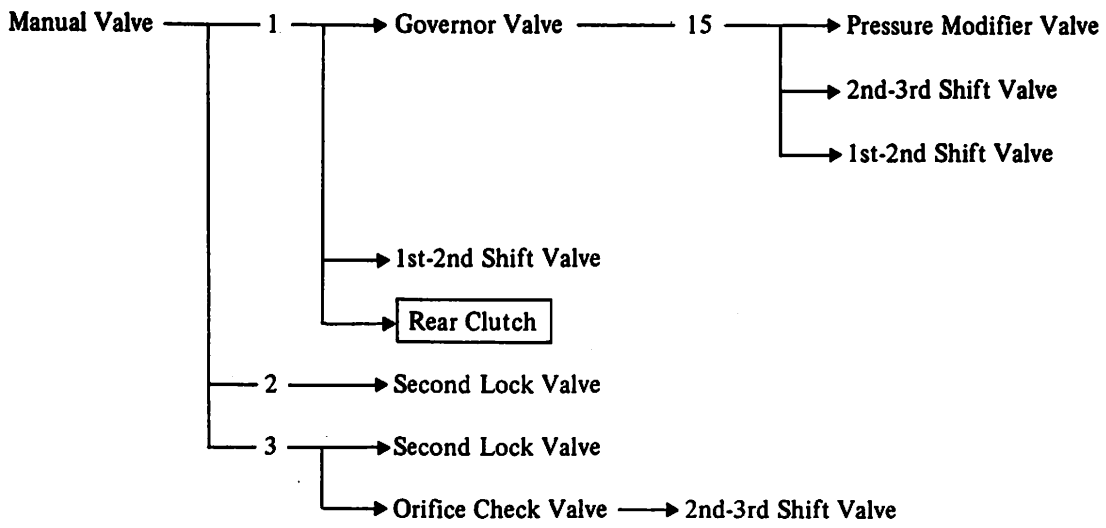
AT330



Front clutch	OFF
Rear clutch	ON
Low and reverse brake	OFF
Brake band servo	OFF
One-way clutch	HOLDING

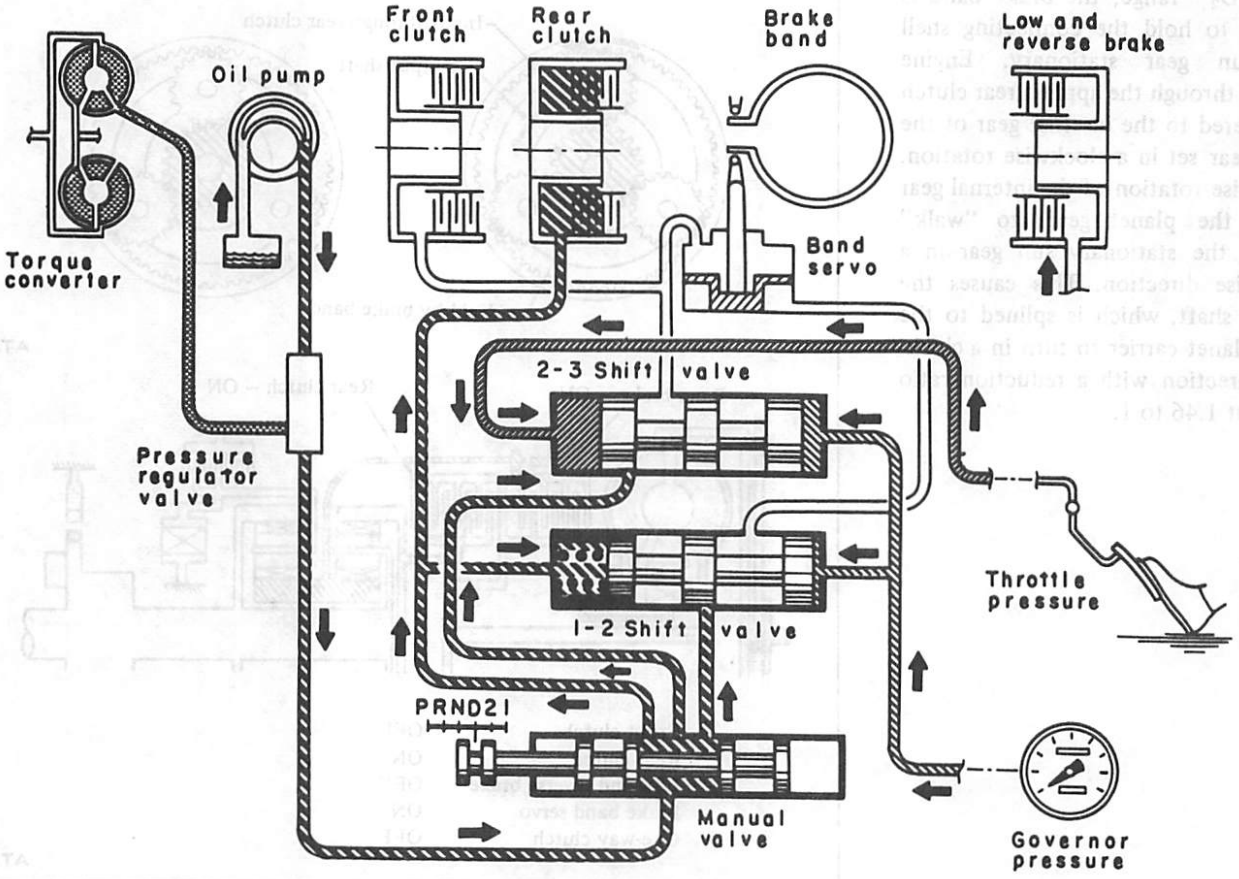
AT081

Fluid flow



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Oil Pressure Circuit Diagram – "D_1" range (Low gear)



Line pressure

Governor pressure

Torque converter pressure

Throttle pressure

AT446

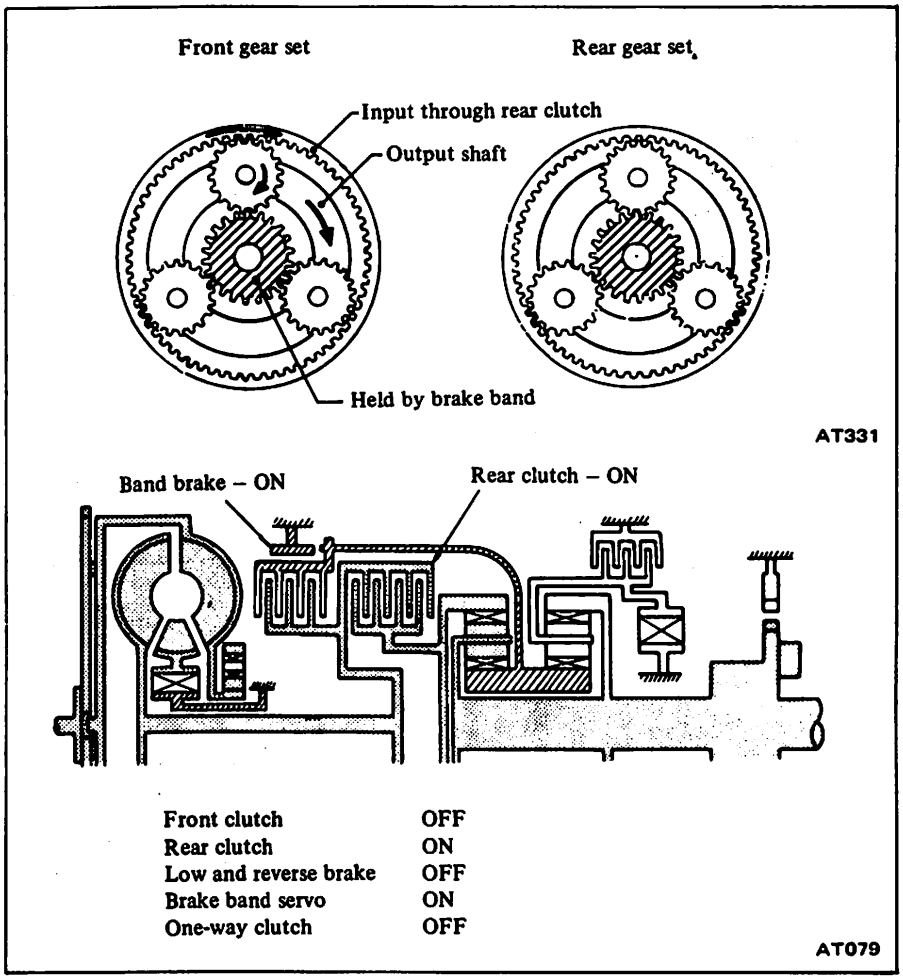
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"D_2" RANGE (2ND GEAR)

Power flow

In "D_2" range, the brake band is applied to hold the connecting shell and sun gear stationary. Engine torque, through the applied rear clutch is delivered to the internal gear of the front gear set in a clockwise rotation. Clockwise rotation of the internal gear causes the planet gears to "walk" around the stationary sun gear in a clockwise direction. This causes the output shaft, which is splined to the front planet carrier to turn in a clockwise direction with a reduction ratio of about 1.46 to 1.

Mechanical Operation during "D_2" Range

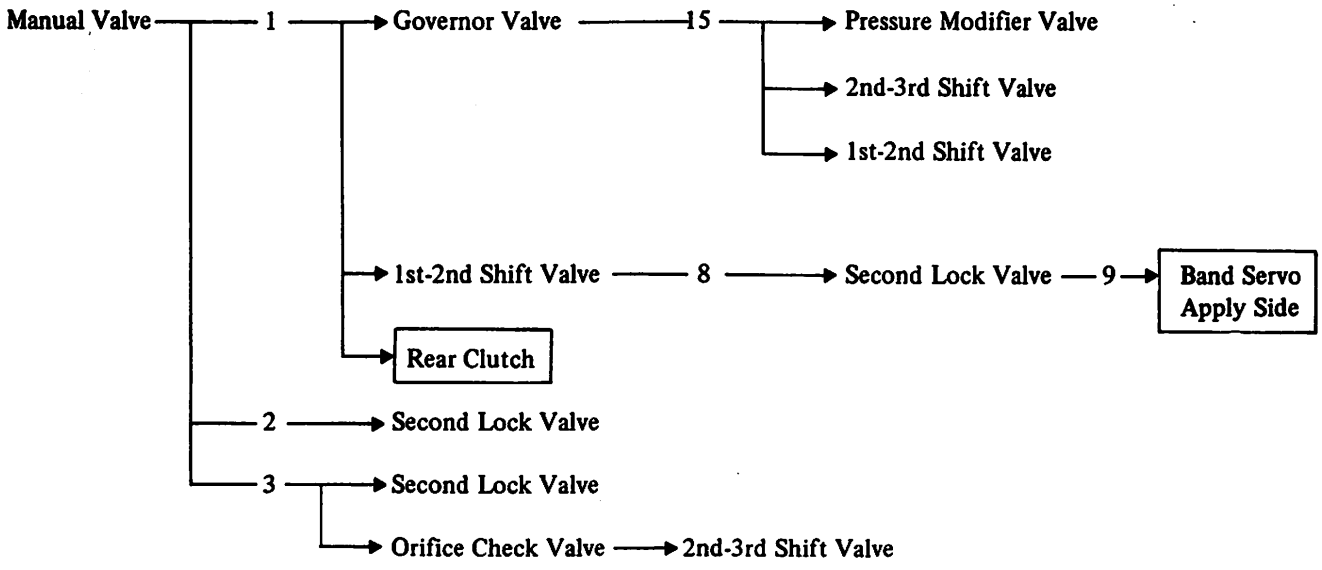


Front clutch	OFF
Rear clutch	ON
Low and reverse brake	OFF
Brake band servo	ON
One-way clutch	OFF

AT079

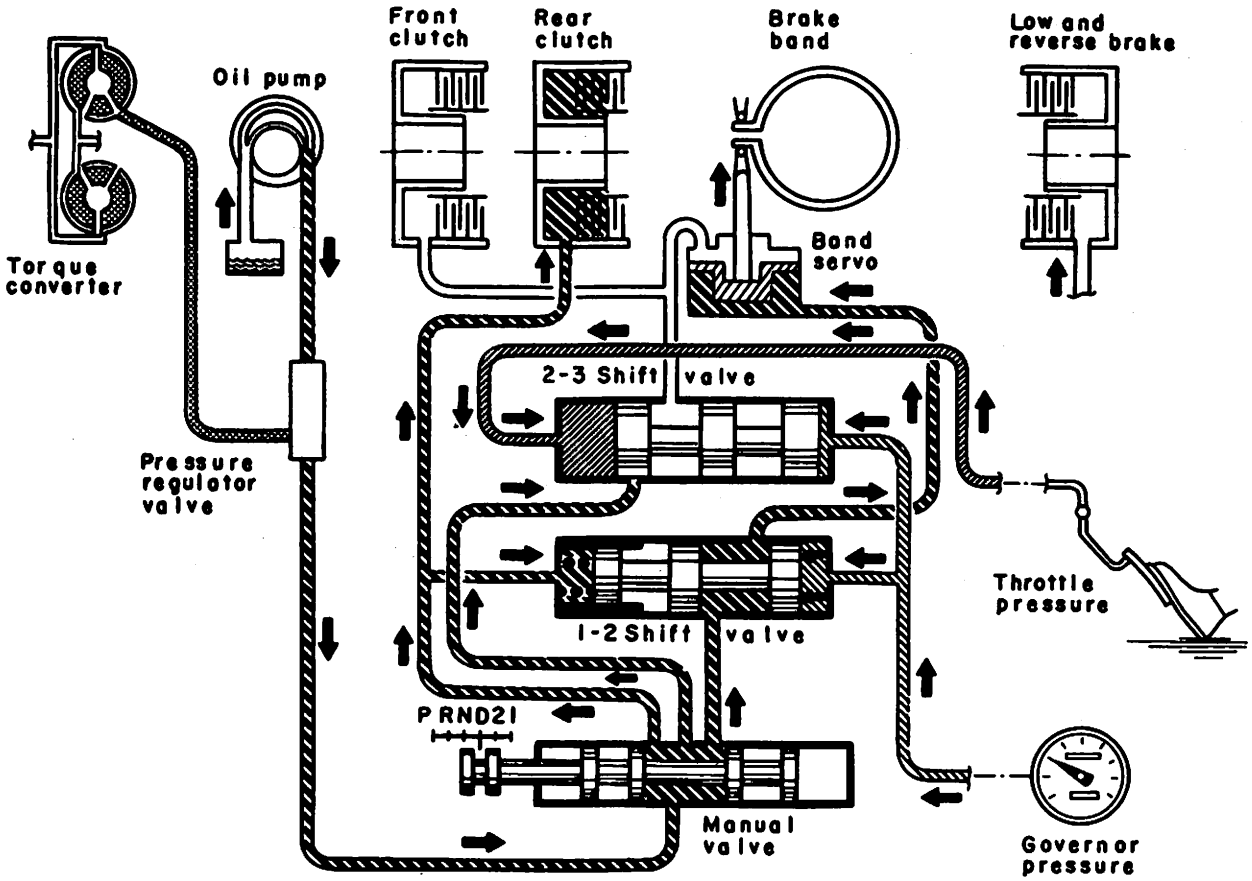
Fluid flow

As vehicle speed and governor pressure increase, the governor pressure acting on the end of the 1-2 shift valve overcomes the force of the 1-2 shift valve spring and line pressure. This allows the 1-2 shift valve to move to the upshift position which directs line pressure through the 2nd lock valve and on to the brake band.



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Oil Pressure Circuit Diagram – "D_2" range (2nd gear)



AT448

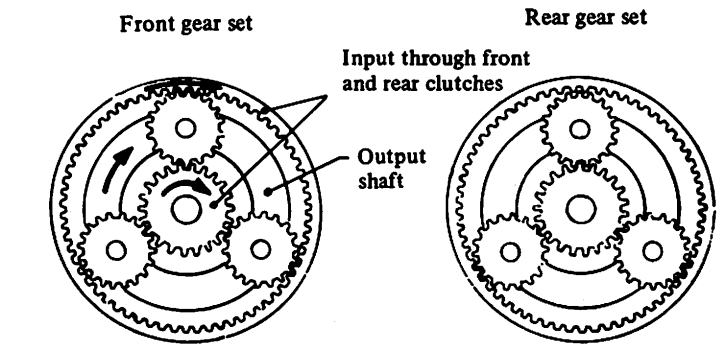
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"D_3" RANGE (3RD GEAR)

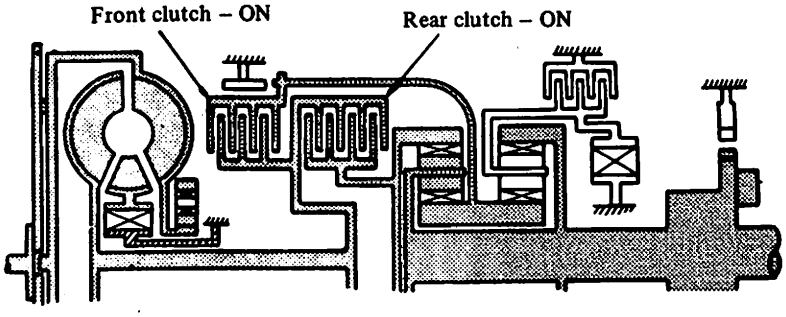
Power flow

In "D_3" range, engine torque is transmitted through both clutches. The front clutch turns the internal gear of the forward gear set clockwise. The rear clutch turns the sun gears in a clockwise direction also. With both the internal gear and the sun gear of the forward gear set turning in the same direction at the same speed, the planet gears are locked in position, and turn as a unit. The output shaft, splined to the forward planet carrier, turns at a ratio of 1 : 1.

Mechanical Operation during "D_3" Range



AT332

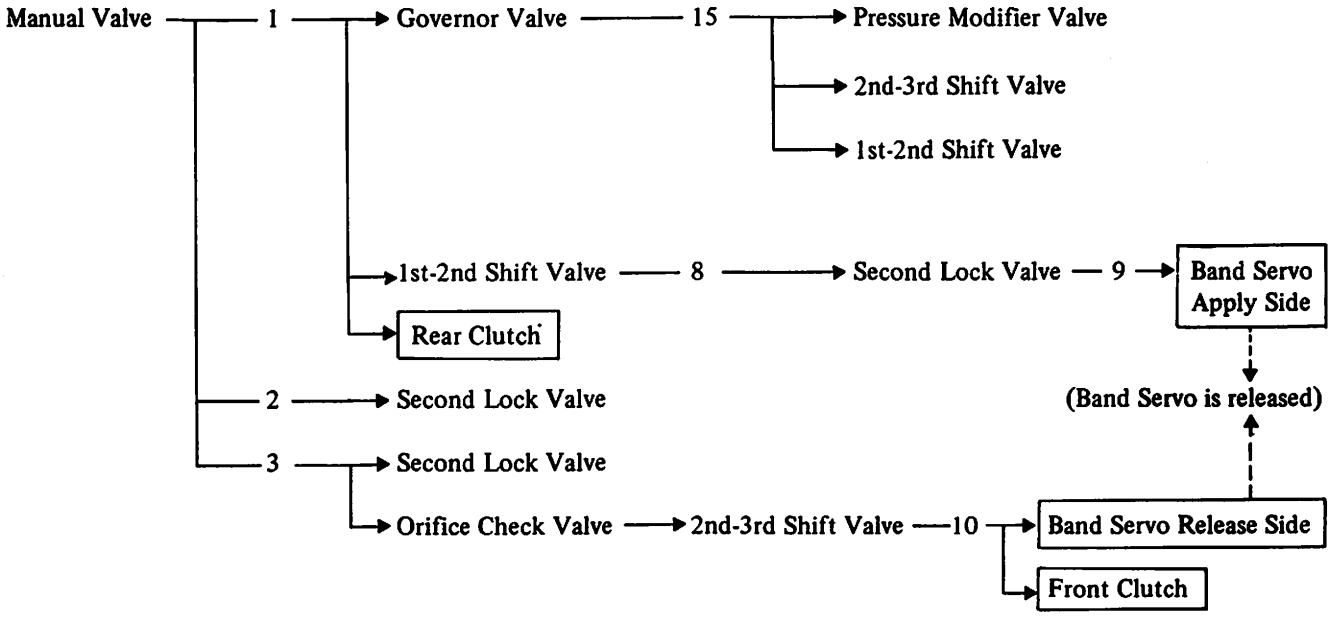


AT083

Front clutch	ON
Rear clutch	ON
Low and reverse brake	OFF
Brake band servo	OFF - Pressure release
One-way clutch	OFF

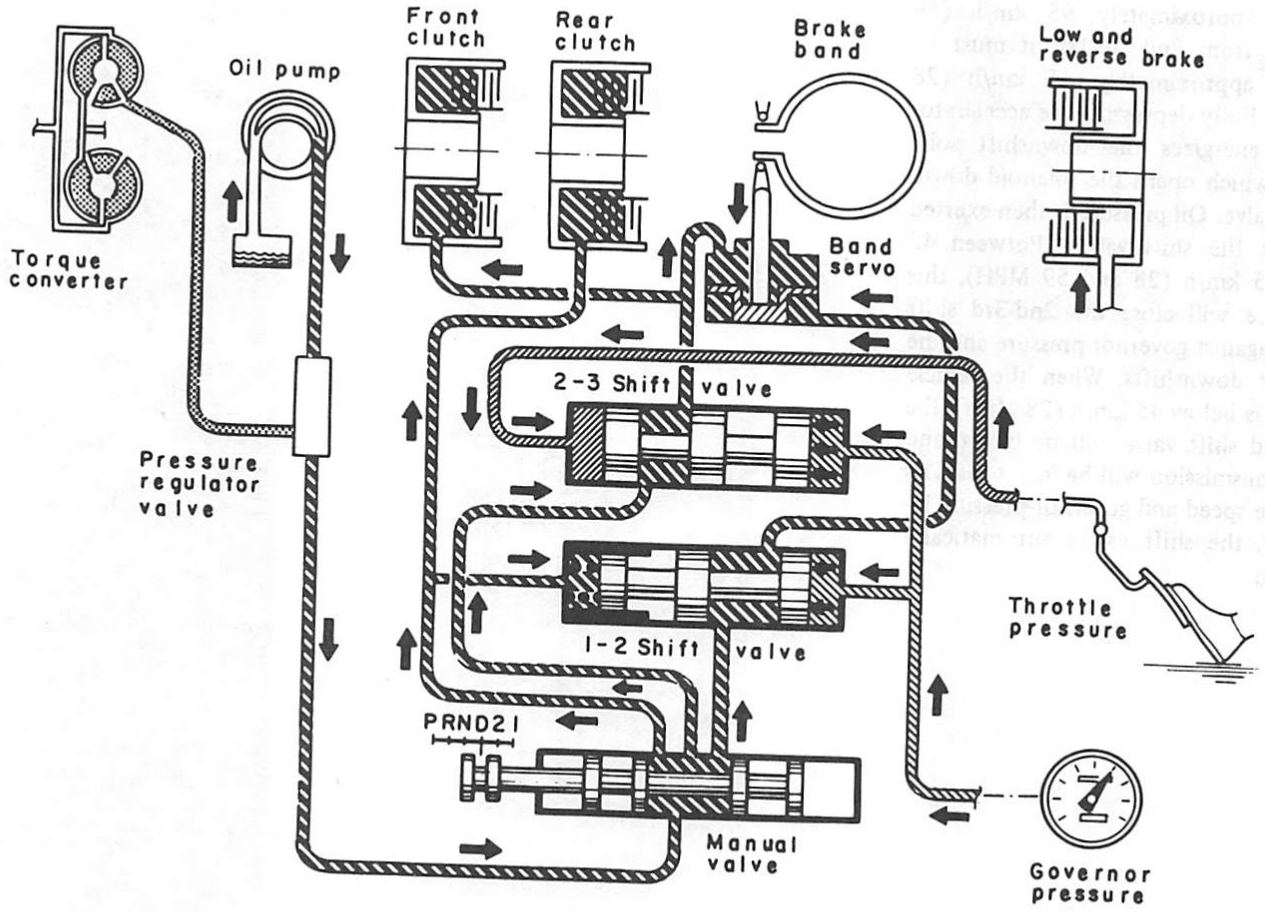
Fluid flow

Governor pressure increases to the point that it can overcome the combined forces of spring and throttle pressure and move the 2nd-3rd shift valve. When the 2nd-3rd shift valve opens, pressure passes through the valve lands on to apply the front clutch and release the brake band. The vehicle is now in D_3 or direct drive (the rear clutch was already applied).



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Oil Pressure Circuit Diagram – "D_3" range (3rd gear)



AT449

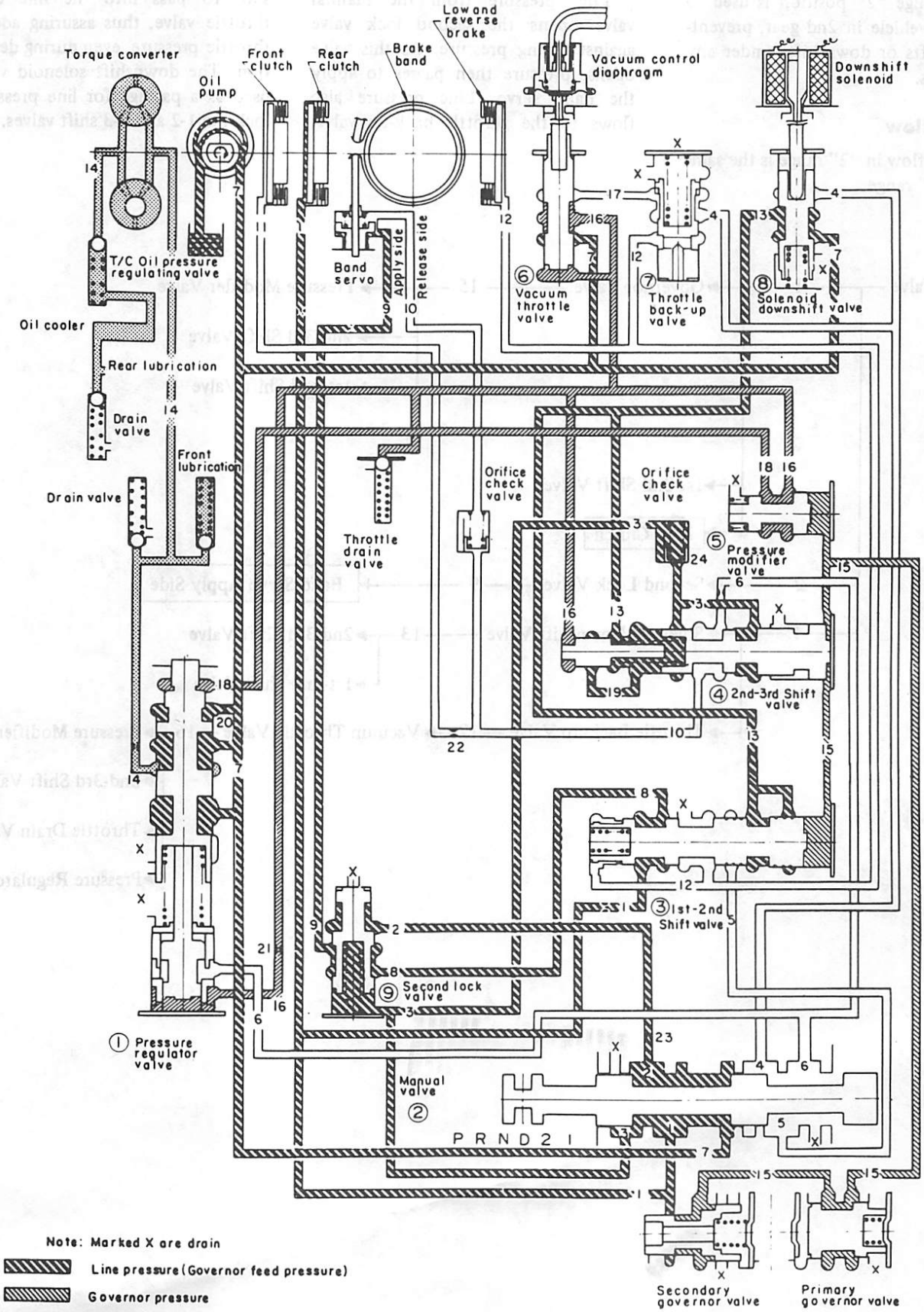
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"D" RANGE KICKDOWN

To achieve a forced downshift from 3rd to 2nd, the vehicle speed must be under approximately 95 km/h (59 MPH); from 2nd to 1st, it must be under approximately 45 km/h (28 MPH). Fully depressing the accelerator pedal energizes the downshift solenoid, which opens the solenoid downshift valve. Oil pressure is then exerted against the shift valves. Between 45 and 95 km/h (28 and 59 MPH), this pressure will close the 2nd-3rd shift valve against governor pressure and the vehicle downshifts. When the vehicle speed is below 45 km/h (28 MPH), the 1st-2nd shift valve will be closed and the transmission will be in 1st gear. As vehicle speed and governor pressure increase, the shift valves automatically reopen.

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Oil Pressure Circuit Diagram – "D" range kickdown (shift valves in 2nd gear position)



SAT167

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"2" RANGE (2ND GEAR)

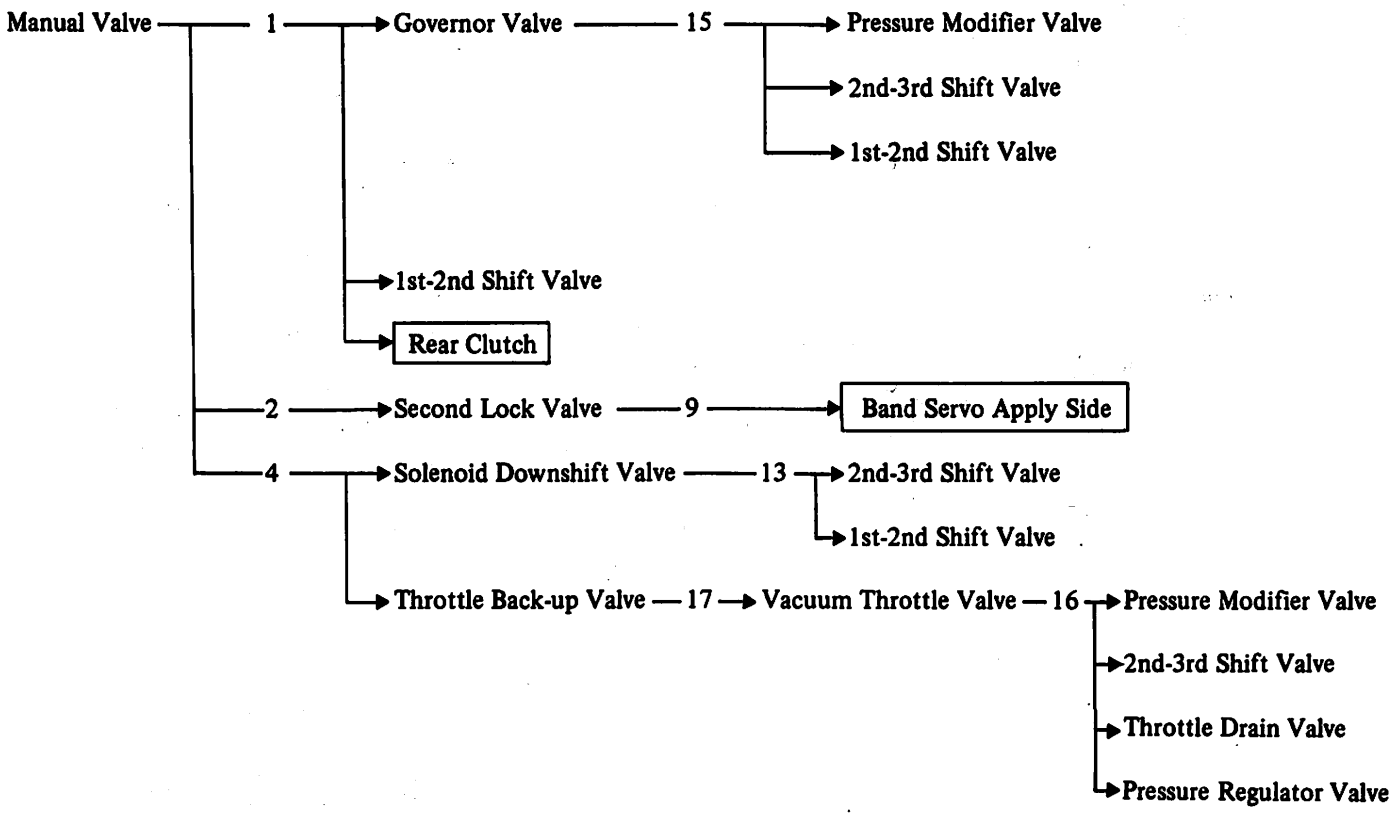
The range "2" position is used to lock the vehicle in 2nd gear, preventing upshifts or downshifts under any conditions.

Power flow

Power flow in "2" range is the same as in "D_2" range.

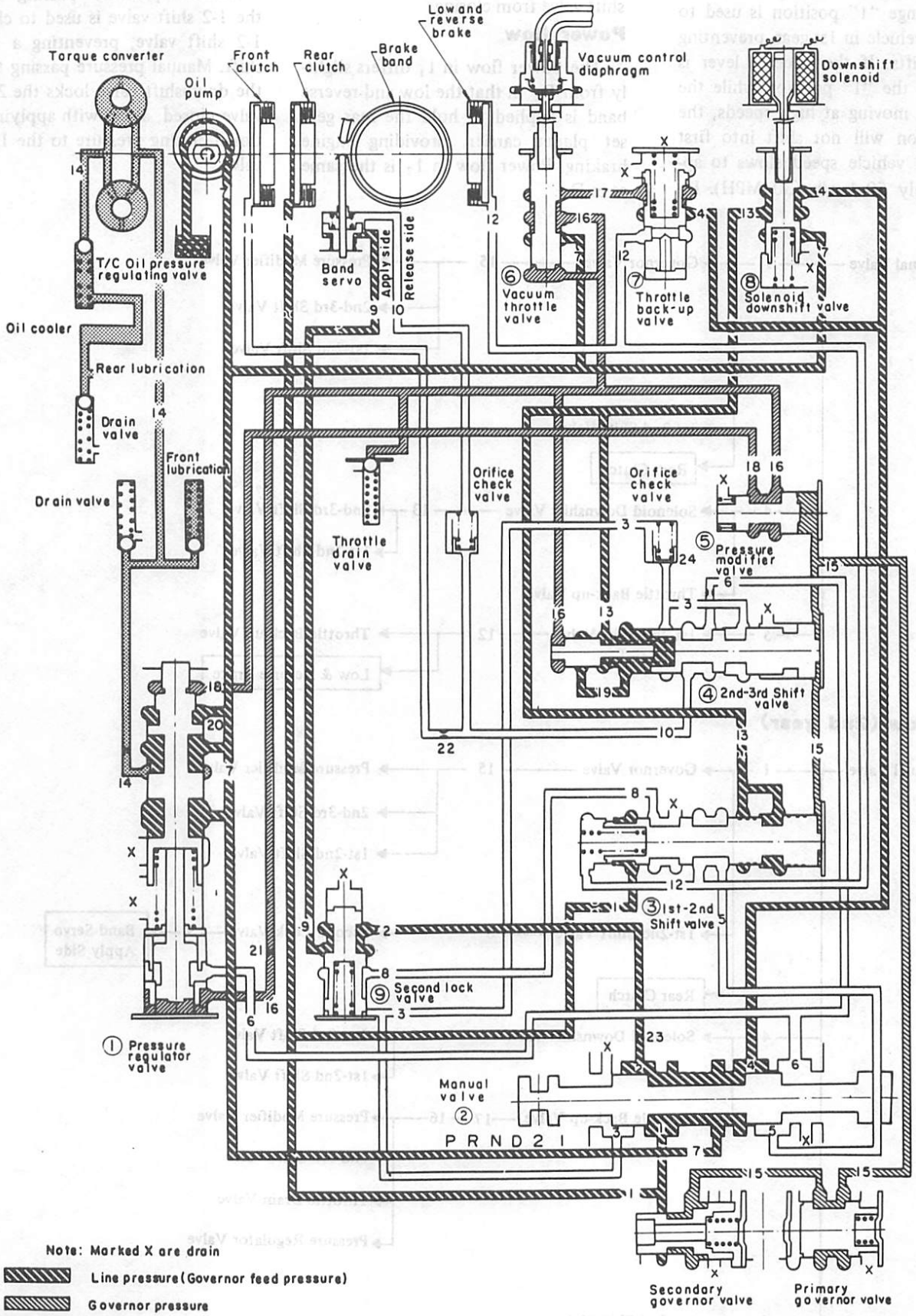
Fluid flow

Line pressure from the manual valve opens the second lock valve against spring pressure. As this valve opens, pressure then passes to apply the band servo. Line pressure also flows to the throttle back-up valve, opening the valve and allowing pressure to pass into the line of the throttle valve, thus assuring adequate throttle pressure, even during deceleration. The downshift solenoid valve is used as a passage for line pressure to lock the 1-2 and 2-3 shift valves.



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Oil Pressure Circuit Diagram – "2" range (2nd gear)



SAT168

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"1" RANGE (LOW AND 2ND GEAR)

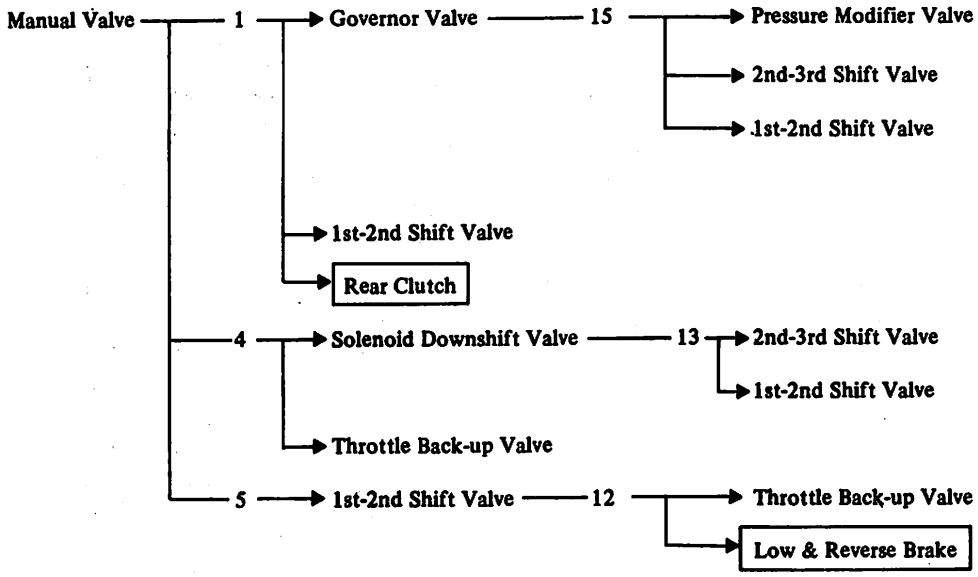
The range "1" position is used to lock the vehicle in 1st gear, preventing any upshifts. If the selector lever is moved to the "1" position while the vehicle is moving at high speeds, the transmission will not shift into first gear until vehicle speed slows to approximately 50 km/h (30 MPH). Instead it will shift to second (1_2), as governor pressure prevents the 1-2 shift valve from closing.

Power flow

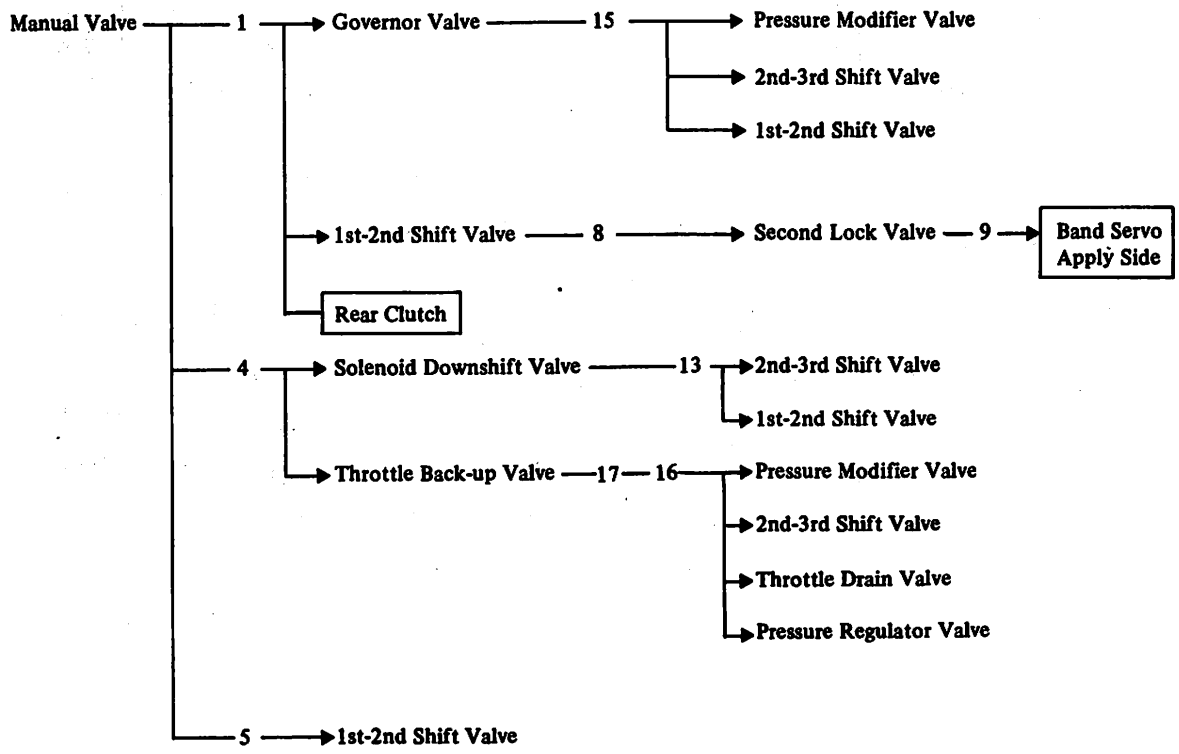
The power flow in 1_1 differs slightly from D_1 in that the low and reverse band is applied to hold the rear gear set planet carrier, providing engine braking. Power flow in 1_2 is the same as in D_2.

Fluid flow (Low gear)

Manual pressure passing through the 1-2 shift valve is used to close the 1-2 shift valve, preventing a 1-2 upshift. Manual pressure passing through the downshift valve locks the 2-3 shift valve closed, along with applying additional closing pressure to the 1-2 shift valve.

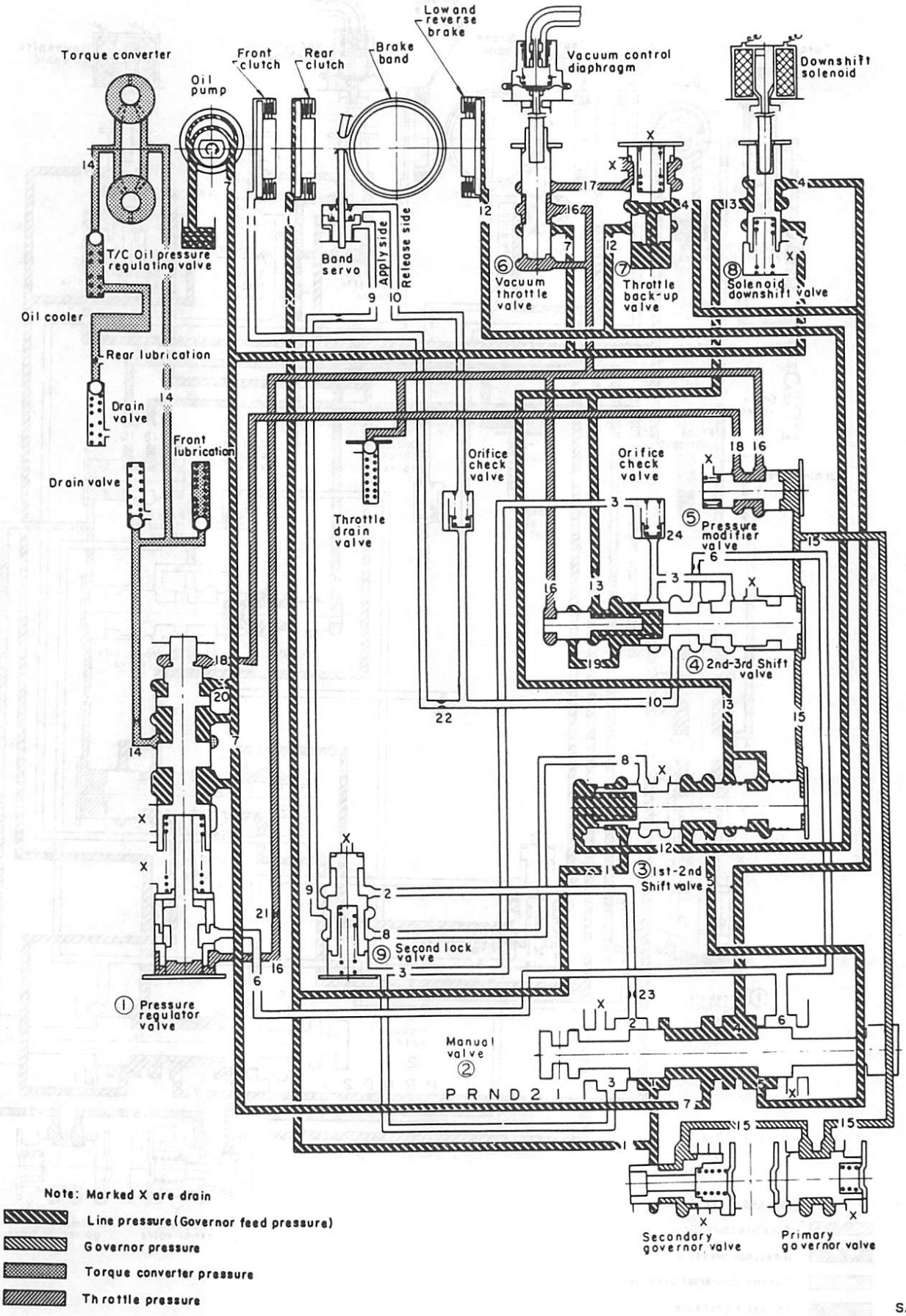


Fluid flow (2nd gear)



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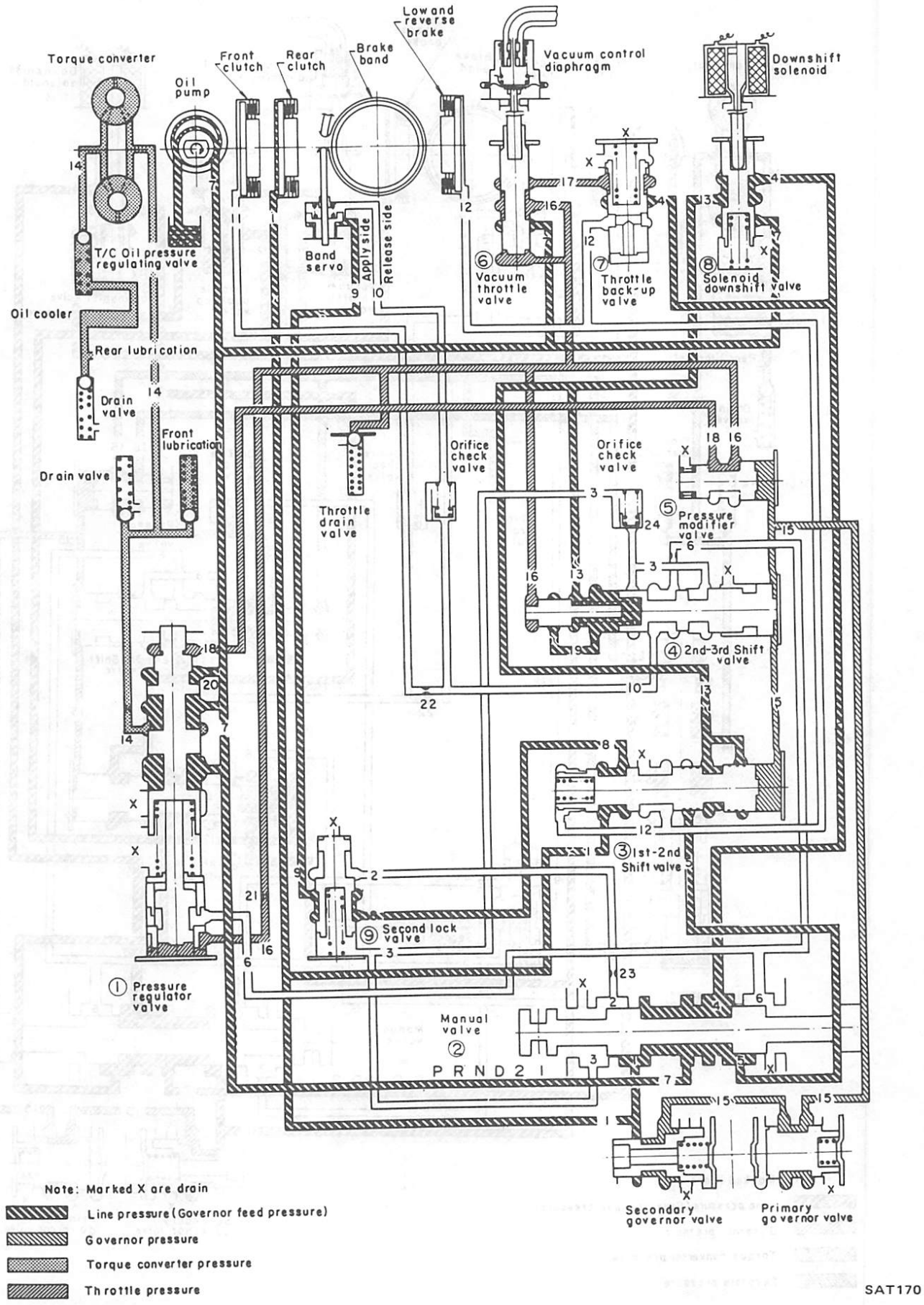
Oil Pressure Circuit Diagram – "1_1" range (Low gear)



SAT169

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Oil Pressure Circuit Diagram – "1_2" range (2nd gear)



SAT170

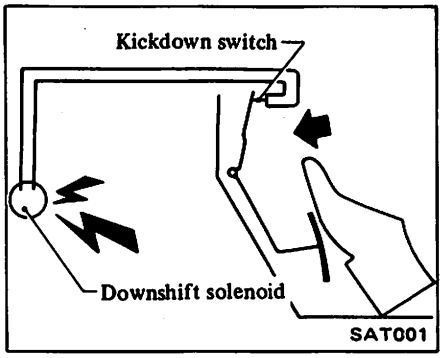
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MINOR ADJUSTMENTS

KICKDOWN SWITCH ADJUSTMENT

The kickdown switch is located at the upper post of the accelerator pedal, inside the vehicle.

When the pedal is fully depressed, a click can be heard just before the pedal bottoms out. If the click is not heard, loosen the locknut and extend the switch until the pedal lever makes contact with the switch and the switch clicks.



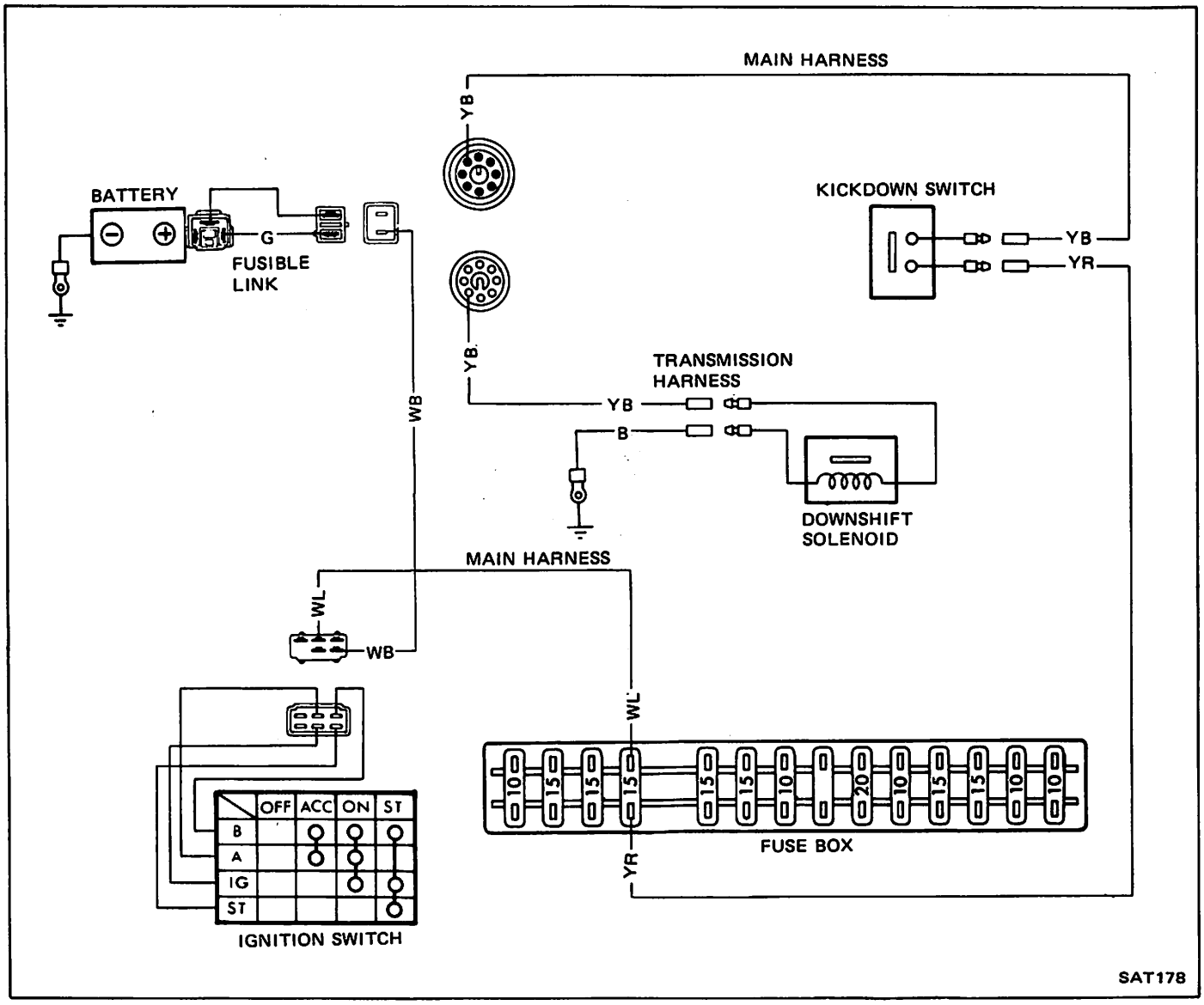
Do not allow the switch to make contact too soon. This would cause the transmission to downshift on part throttle.

DIAGNOSIS:

Switch can be heard clicking, and the transmission still does not kickdown: Check the continuity of the switch using a continuity tester. Also check for available current.

The vehicle upshifts at approximately 60 and 105 km/h (40 and 65 MPH) only: The kick down switch may be internally shorted. (When the switch is shorted, there is continuity through the switch in any position).

Wiring Diagram



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INHIBITOR SWITCH ADJUSTMENT

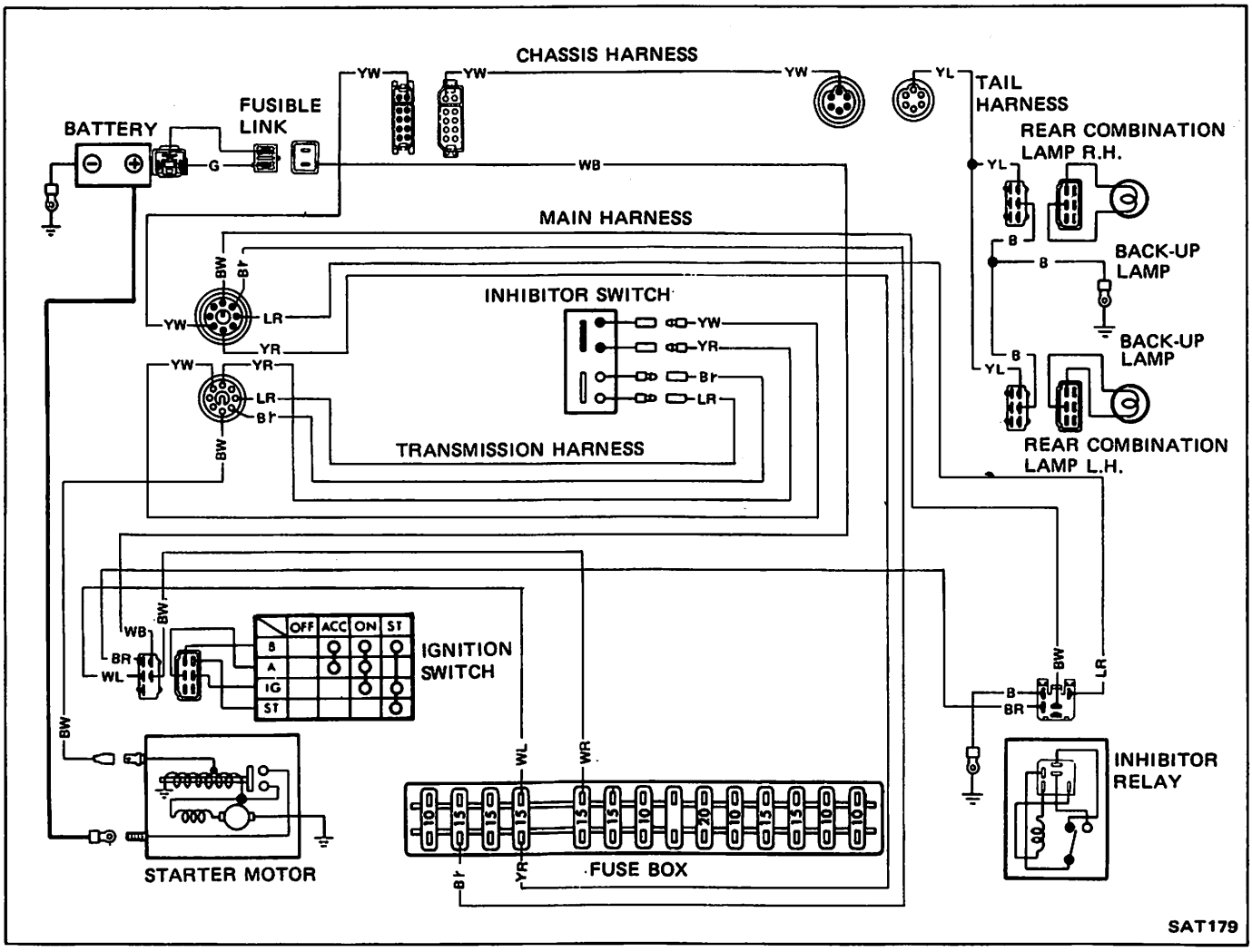
The inhibitor switch has two major functions. It allows the back-up lights to illuminate when the shift lever is placed in the reverse range. It also acts as a neutral safety switch allowing current to pass from the starter only when the lever is placed in the "P" or "N" range.

A continuity tester may be used to check the inhibitor switch for proper operation.

The two black and yellow (B-Y) wires should have continuity when the lever is in the "P" and "N" positions.

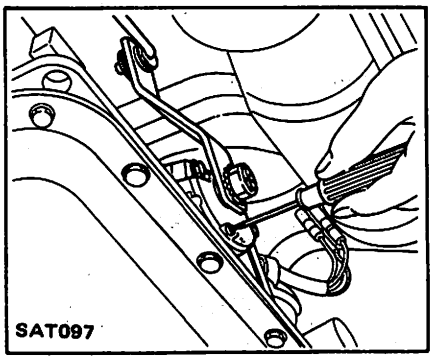
Red and black (R-B) wires should have continuity when the shift lever is moved to "R" range.

Wiring Diagram

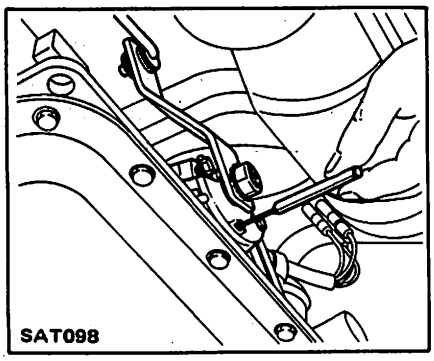


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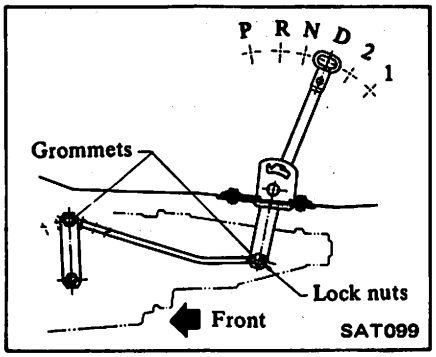
1. Place the manual valve in Neutral (vertical position).
2. Remove the screw as illustrated.



3. Loosen the attaching bolts.
4. Using an aligning pin, move the switch until the pin falls into the hole in the rotor.



5. Tighten the attaching bolts.
6. Recheck for continuity. If faulty, replace the switch.



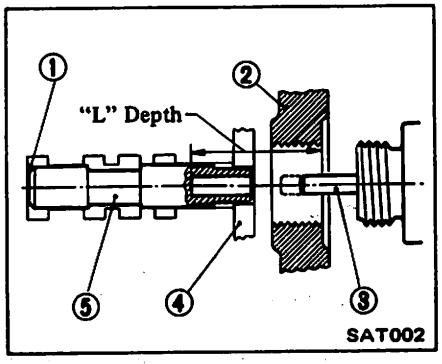
1. Place shift lever in "D" range.
2. Loosen locknuts and move shift lever until "D" is properly aligned and vehicle is in "D" range.
3. Tighten locknut.

Recheck "P" and "Range 1" positions. As a safety measure, be sure you can feel full detent when shift lever is placed in "P". If you are unable to make an adjustment, grommets may be badly worn or damaged and should be replaced.

VACUUM DIAPHRAGM ROD ADJUSTMENT

The vacuum diaphragm and the length of its diaphragm rod help determine the shift patterns of the transmission. It is essential that the correct length rod be installed.

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



1 Note seated valve body
2 Transmission case wall
3 Diaphragm rod
4 Valve body side plate
5 Vacuum throttle valve

Vacuum diaphragm rod selection

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

MANUAL LINKAGE ADJUSTMENT

The adjustment of the manual linkage is an important adjustment of the automatic transmission. Move the shift lever from the "P" range to "Range 1". you should be able to feel the detents in each range.

If the detents cannot be felt or the pointer indicating the range is improperly aligned, the linkage needs adjustment.

BRAKE BAND ADJUSTMENT

Proper brake band adjustment results in smooth shifting between 1st & 2nd and 2nd & 3rd. Although the adjustment is very simple, it is important to use an accurate torque wrench.

1. Loosen locknut.
2. Torque band servo piston stem to 12 to 15 N·m (1.2 to 1.5 kg-m, 9 to 11 ft-lb).
3. Back off band servo piston stem two complete turns.

CAUTION:
Do not back off EXCESSIVELY on adjusting stem as anchor block may fall out of place.

4. Tighten locknut to approximately 20 N·m (2 kg-m, 14 ft-lb) while holding band servo piston stem stationary.

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REMOVAL AND INSTALLATION

TRANSMISSION ASSEMBLY

When dismounting the automatic transmission from a vehicle, pay attention to the following points:

1. Before dismounting the transmission, rigidly inspect it by using the "Trouble-shooting Chart", and dismount it only when it is necessary.
2. Dismount the transmission with utmost care; and when mounting, observing the tightening torque indicated on another table, do not exert excessive force.

REMOVAL

In dismounting the automatic transmission from a vehicle, proceed as follows:

1. Disconnect battery ground cable from terminal.
2. Jack up vehicle and support it on safety stands. We recommend a hydraulic hoist or open pit be utilized, if available.

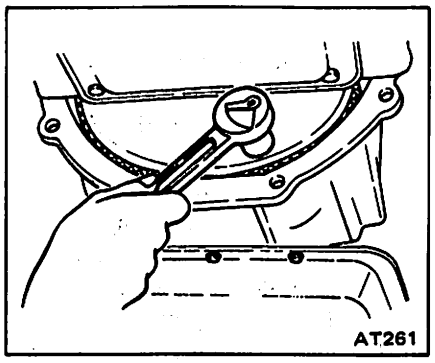
   Observe all safety regulations.
3. Remove propeller shaft.

Plug up the opening in the rear extension to prevent oil from flowing out.

4. Disconnect front exhaust tube.
5. Disconnect selector range lever from manual shaft.
6. Disconnect wire connections at inhibitor switch.
7. Disconnect vacuum tube from vacuum diaphragm, and wire connections at downshift solenoid.
8. Disconnect speedometer cable from rear extension.
9. Disconnect oil charging pipe.
10. Disconnect oil cooler inlet and outlet tubes at transmission case.
11. Support engine by locating a jack under oil pan with a woden block used between oil pan and jack. Support transmission by means of a transmission jack.

CAUTION:
Do not place the jack under the oil pan drain plug.

12. Detach converter housing dust cover. Remove bolts securing torque converter to drive plate.


AT261

Before removing torque converter, inscribe chalk marks on two parts so that they may be replaced in their original positions at assembly.

13. Remove rear engine mount securing bolts and crossmember mounting bolts.
14. Remove starter motor.
15. Remove bolts securing transmission to engine. After removing these bolts, support engine and transmission with jack, and lower the jack gradually until transmission can be removed and take out transmission under the vehicle.

Plug up openings such as oil charging pipe, oil cooler tubes, etc.

CAUTION:
Take care when dismounting transmission not to strike any adjacent parts.

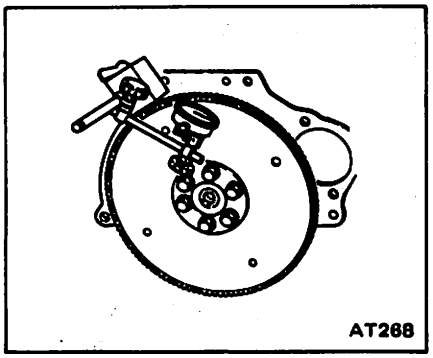
INSTALLATION

Installation of automatic transmission on vehicle is in reverse order of removal. However, observe the following installation notes.

1. Drive plate runout

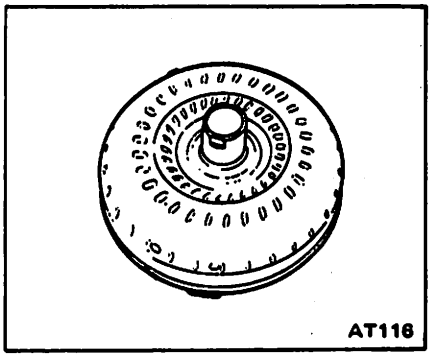
   Turn crankshaft one full turn and measure drive plate runout with indicating finger of a dial gauge rested against plate.

   Maximum allowable runout:
   0.5 mm (0.020 in)


AT268

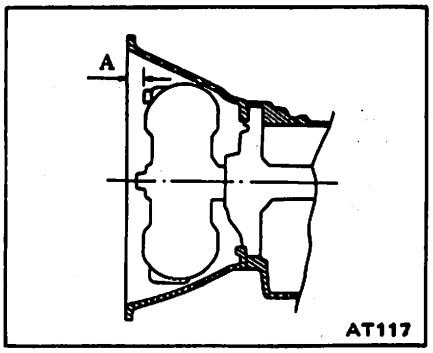
2. Installation of torque converter

   Line up notch in torque converter with that in oil pump. Be extremely careful not to put undue stress on parts when installing torque converter.


AT116

3. When connecting torque converter to transmission, measure distance "A" to be certain that they are correctly assembled.

   Distance "A":
   More than 21.5 mm (0.846 in)



AT117

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4. Bolt converter to drive plate.

Align chalk marks painted across both parts during disassembling processes.

5. After converter is installed, rotate crankshaft several turns and check to be sure that transmission rotates freely without binding.
6. Pour recommended automatic transmission fluid up to correct level through oil charge pipe.
7. Connect manual lever to shift rod. Operation should be carried out with manual and selector levers in "N".
8. Connect inhibitor switch wires.

a. Refer to pages AT-26 and -27 for Inhibitor Switch Adjustment.
b. Inspect and adjust switch as above whenever it has to be removed for service.

9. Check inhibitor switch for operation:

Starter should be brought into operation only when selector lever is in "P" and "N" positions (it should not be started when lever is in "D", "2", "1" and "R" positions).

Back-up lamp should also light when selector lever is placed in "R" position.

10. Check fluid level in transmission. For detailed procedure, see page AT-51.
11. Move selector lever through all positions to be sure that transmission operates correctly.

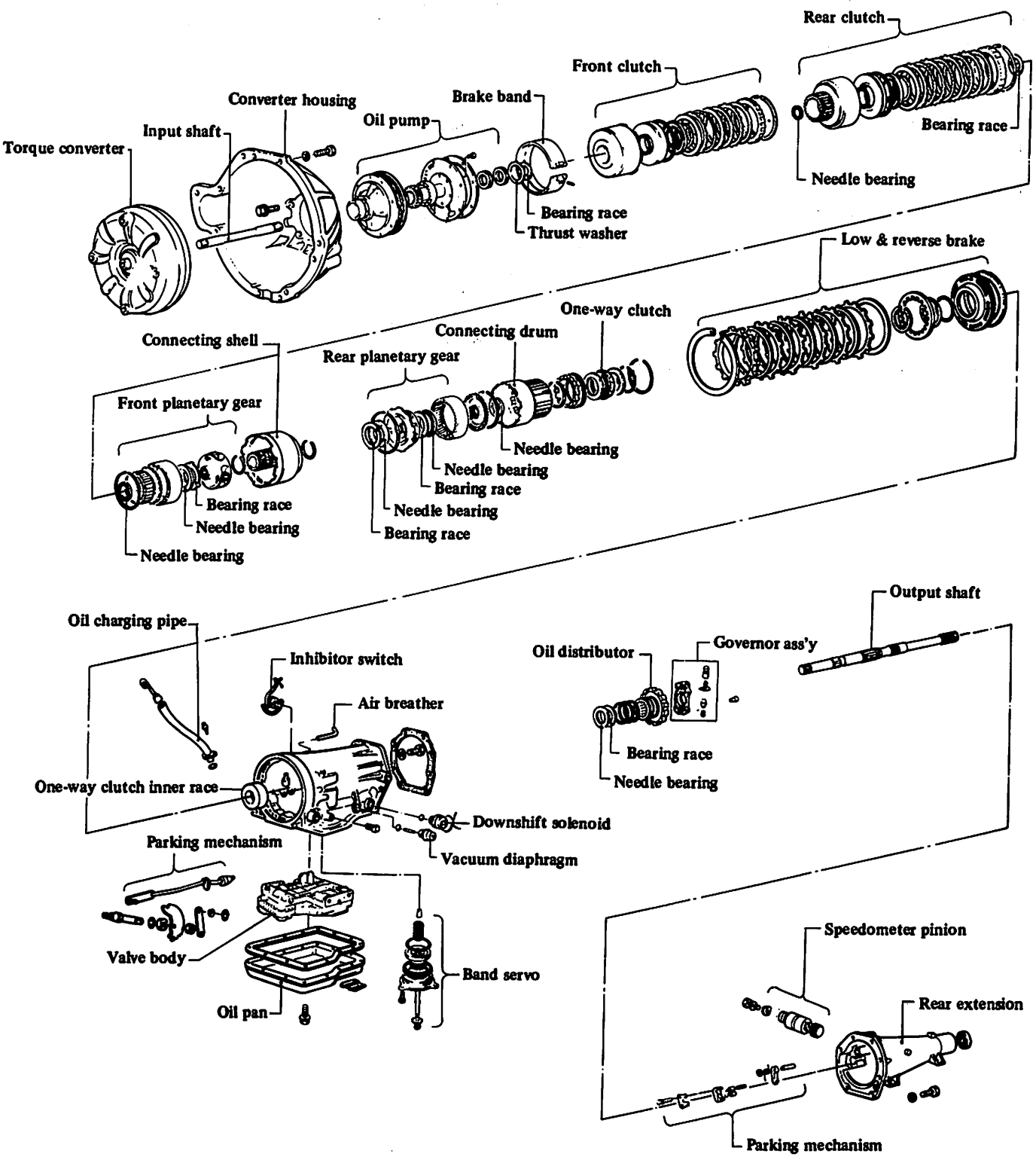
With hand brake applied, rotate engine at idling. Without disturbing the above setting, move selector lever through "N" to "D", to "2", to "1" and to "R". A slight shock should be felt by hand gripping selector each time transmission is shifted.

See page AT-52 for Checking Engine Idle.

12. Check to be sure that line pressure is correct. To do this, refer to page AT-54 for Line Pressure Test.
13. Perform stall test as described in page AT-55.

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MAJOR OVERHAUL OPERATIONS



SAT101

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SERVICE NOTES FOR DISASSEMBLY

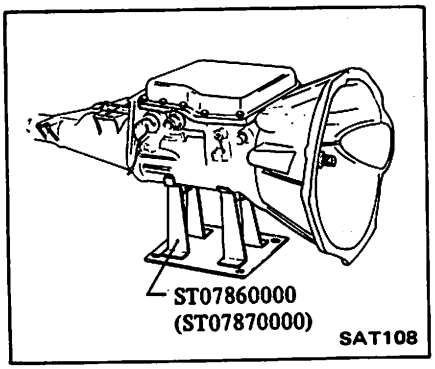
Before proceeding with disassembly, thoroughly clean the outside of the transmission. It is important to prevent the internal parts of the transmission from becoming contaminated by dirt or other foreign matter.

Disassembly should be done in a clean work area.

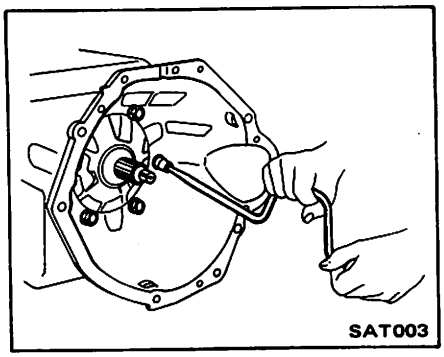
Use a nylon cloth or paper towel for wiping parts clean. Common shop rags can leave lint that might interfere with the transmission's operation.

DISASSEMBLY

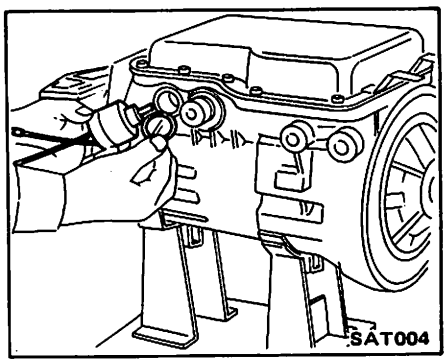
1. Remove torque converter, drain transmission fluid through end of rear extension, and place transmission on Tool.



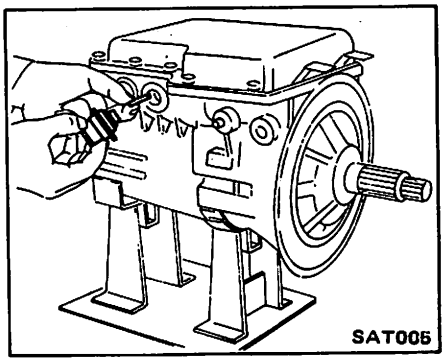
2. Remove converter housing.



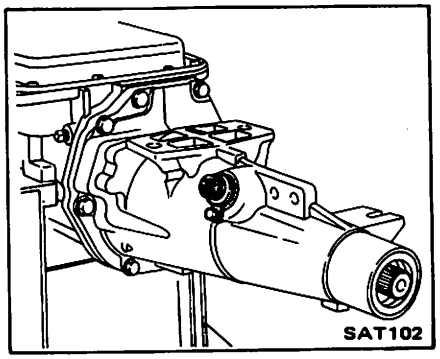
3. Unscrew and remove downshift solenoid and O-ring.



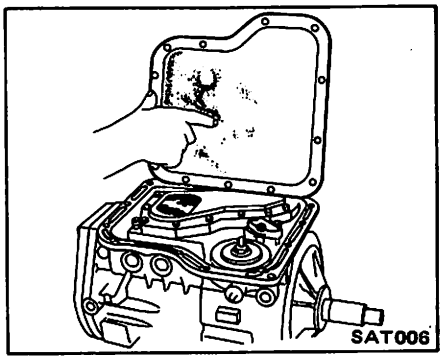
4. Unscrew and remove vacuum diaphragm, diaphragm rod and O-ring.



5. Remove speedometer lock plate retaining bolt. Remove speedometer pinion.



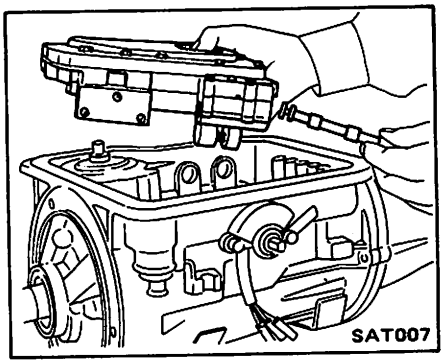
6. Remove oil pan and inspect its contents. An analysis of any foreign matter can indicate the types of problems to look for. If the fluid is very dark, smells burned, or contains foreign particles, the frictional material (clutches, band.) may need replacement. A tacky film that will not wipe clean indicates varnish build up which can cause valves, servo, and clutches to stick and may inhibit pump pressure.



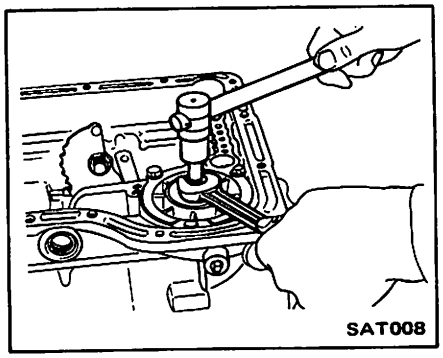
7. Remove control valve body.

Bolts of 3 different lengths are used. Care must be taken to identify individual bolt lengths and locations.

Remove manual valve from valve body as a precaution, to prevent valve from dropping out accidentally.



8. Loosen band servo piston stem locknut and tighten piston stem to prevent front clutch drum from dropping out when removing front pump.



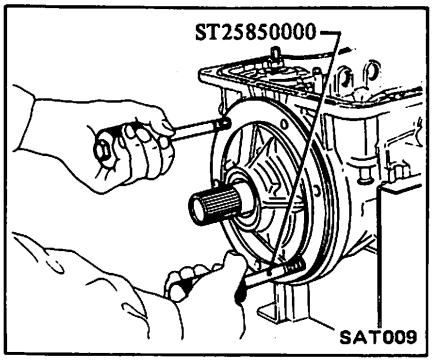
9. Remove input shaft from pump.

Attach Tool to pump and remove pump. Do not allow front clutch to

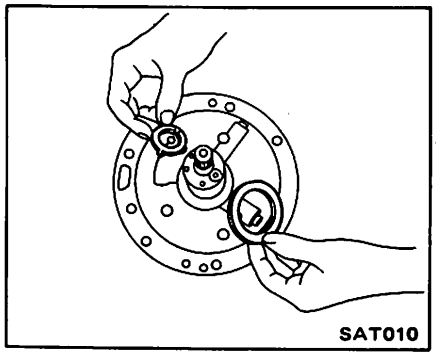
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come out of position and drop onto floor.

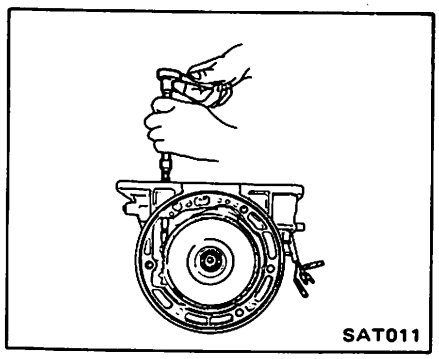
Take care that shaft is not inserted backwards during reassembly.



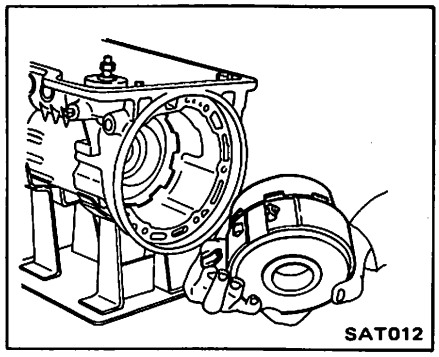
10. Remove front clutch thrust washer and bearing race.



11. Back off band servo piston stem to release band.

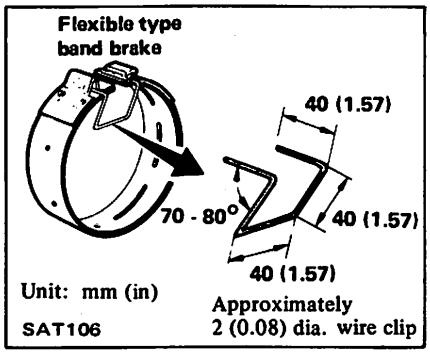


12. Remove brake band strut. Brake band, front and rear clutch assemblies may be removed together.

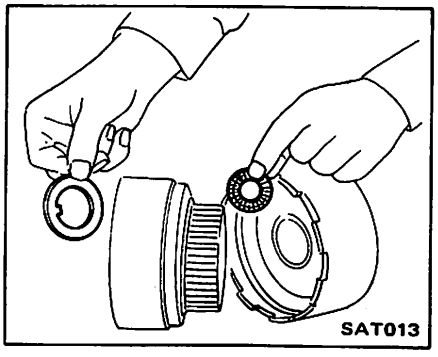


To prevent brake linings from cracking or peeling, do not stretch the flexible band unnecessarily. Before removing the brake band, always secure it with a clip as shown in the figure below.

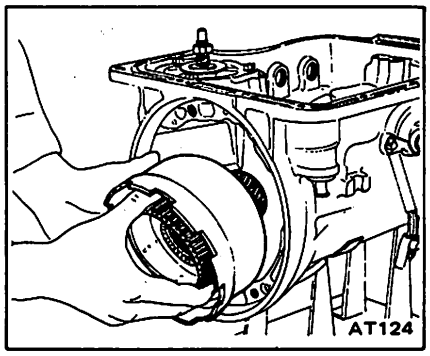
Leave the clip in position after removing the brake band.



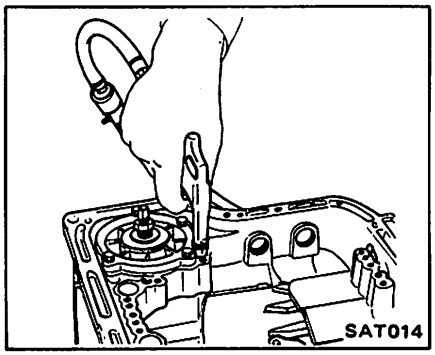
13. Remove pump thrust bearing and rear clutch thrust washer.



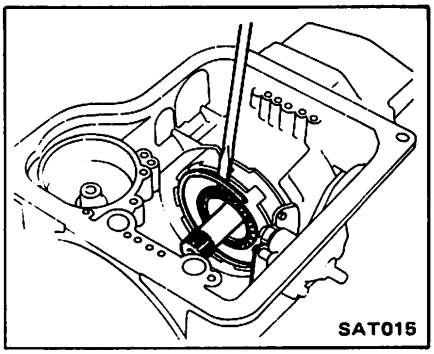
14. Remove rear clutch hub, front planetary carrier and connecting shell, rear clutch thrust bearing, front planetary carrier thrust washer and thrust bearing.



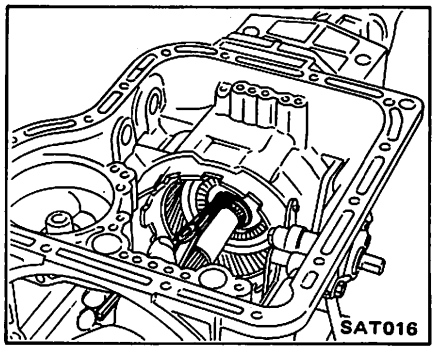
15. Back out, about half-way, band servo attaching bolts. Using an air gun, carefully apply pressure to loosen band servo. Remove band servo retaining bolts and pull band servo.



16. Remove rear planetary carrier snap ring and rear planetary carrier.

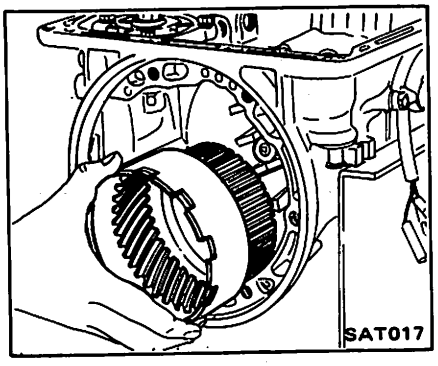


17. Remove output shaft snap ring.

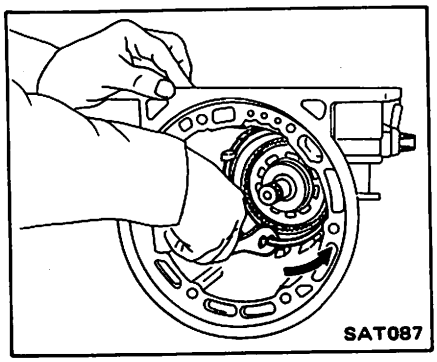


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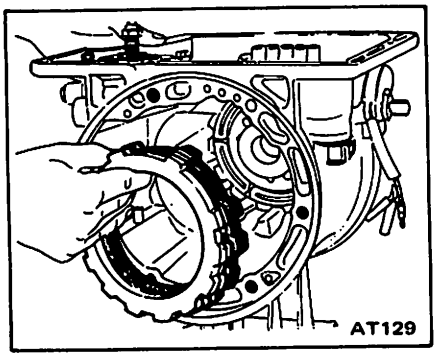
18. Remove rear connecting drum with internal (annulus) gear.



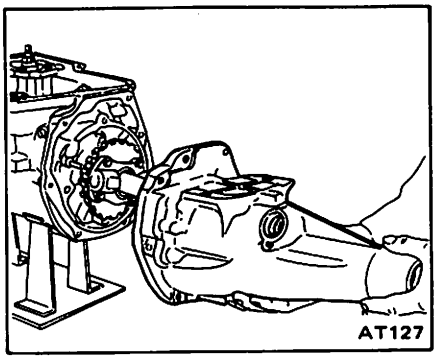
19. Pry off one end of snap ring with a screwdriver. Remove snap ring from low and reverse brake assembly while applying plier force in direction of arrow.



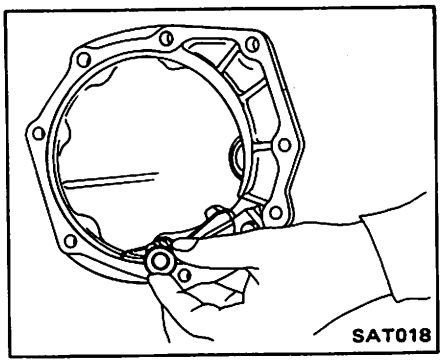
20. Tilt extension housing upward and remove low and reverse brake clutch assembly.



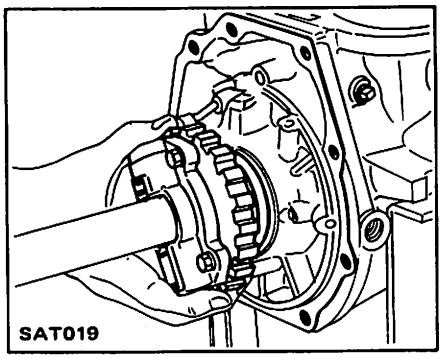
21. Remove rear extension.



22. Be careful not to lose parking pawl, spring and retainer washer.

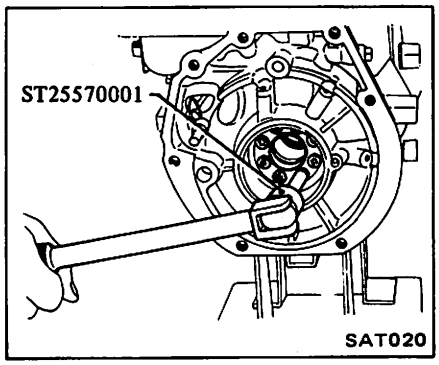


23. Remove output shaft with governor.

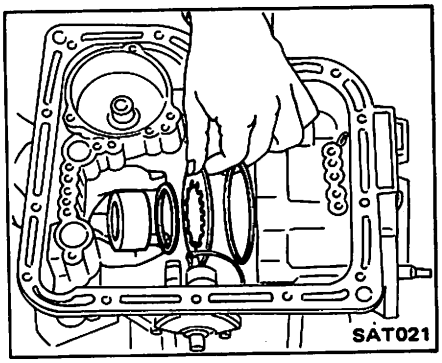


24. Remove governor thrust washer and needle bearing.

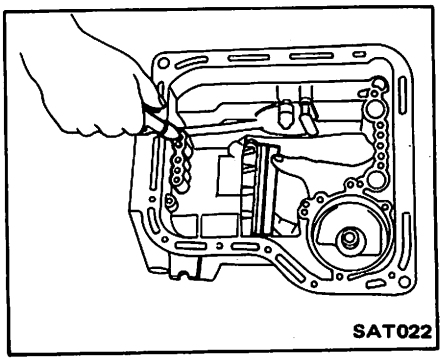
Remove one-way clutch inner race attaching hex-head slotted bolts using Tool.



25. Remove one-way clutch inner race, return thrust washer, low and reverse return spring, and spring thrust ring.

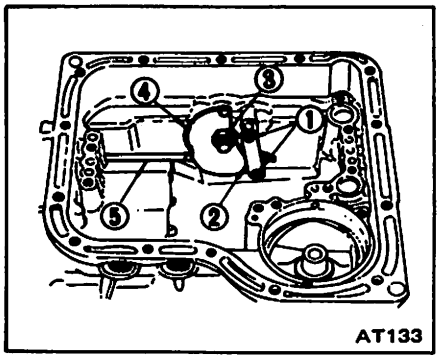


26. Using an air gun with a tapered rubber tip, carefully apply air pressure to remove low and reverse brake piston.



27. Pry off snap rings ① from both ends of parking brake lever ② and remove the lever. Back off manual shaft lock nut ③ and remove manual plate ④ and parking rod ⑤.

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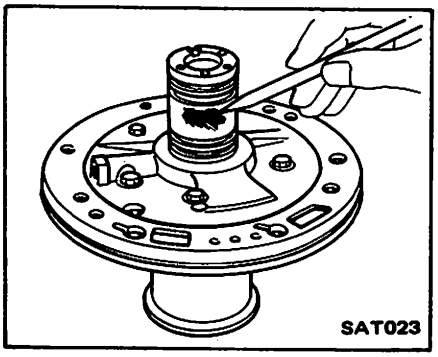
28. Remove inhibitor switch and manual shaft by loosening two securing bolts.

COMPONENT PARTS

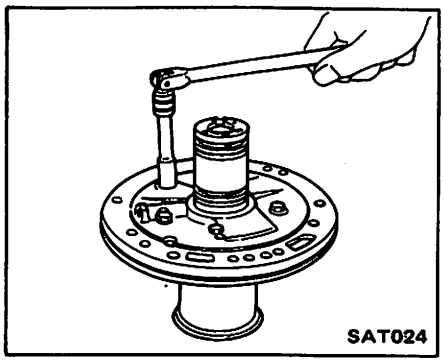
The transmission consists of many small parts that are quite alike in construction yet machined to very close tolerances. When disassembling parts, be sure to place them in order in part rack so they can be put back in the unit in their proper positions. All parts should be carefully cleaned with a general purpose, non-flammable solvent before inspection or reassembly. Gaskets, seals, and similar parts should be replaced. It is also very important to perform functional tests whenever it is designated.

OIL PUMP

1. Remove front pump gasket and O-ring. Inspect pump body, pump shaft and ring groove areas for wear.



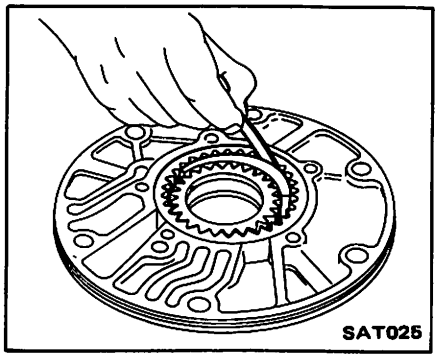
2. Remove pump cover from pump housing.



3. Inspect gears and all internal surfaces for faults and visible wear.
4. Measure clearance between outer gear and crescent.

Standard clearance:
0.14 - 0.21 mm
(0.0055 - 0.0083 in)

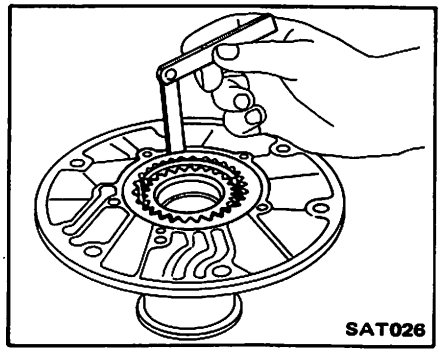
Replace if the clearance exceeds **0.25 mm (0.0098 in).**



5. Measure clearance between outer gear and pump housing.

Standard clearance:
0.05 - 0.20 mm
(0.0020 - 0.0079 in)

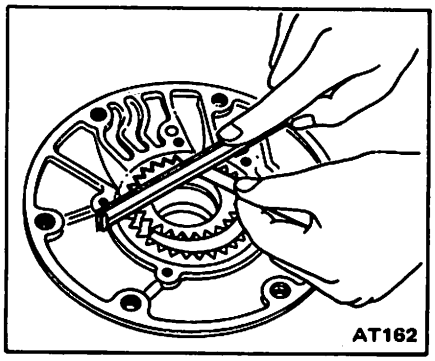
Replace if the clearance exceeds **0.25 mm (0.0098 in).**



6. Using a feeler gauge and straight edge, measure clearance between gears and pump cover.

Standard clearance:
0.02 - 0.04 mm
(0.0008 - 0.0016 in)

Replace if the clearance exceeds **0.08 mm (0.0031 in).**

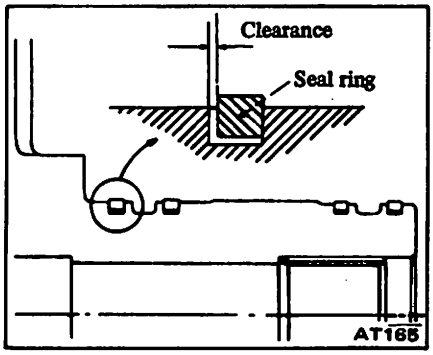


7. Measure clearance between seal ring and ring groove.

Standard clearance:
0.04 - 0.16 mm
(0.0016 - 0.0063 in)

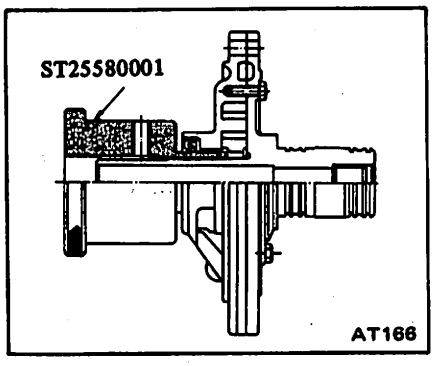
Replace if the clearance exceeds **0.16 mm (0.0063 in).**

Of course, it is good practice to replace all seal rings during an overhaul.



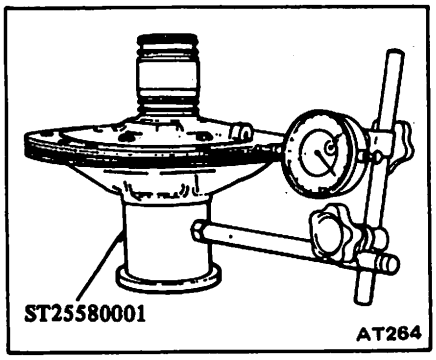
8. Mount pump housing in Tool. Set up pump housing with inner and outer pump gears on it and install pump cover to pump housing. Temporarily assemble oil pump.

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9. Set run-out of the cover to within specified total indicator reading.

Total indicator reading:
Less than 0.07 mm
(0.0028 in)

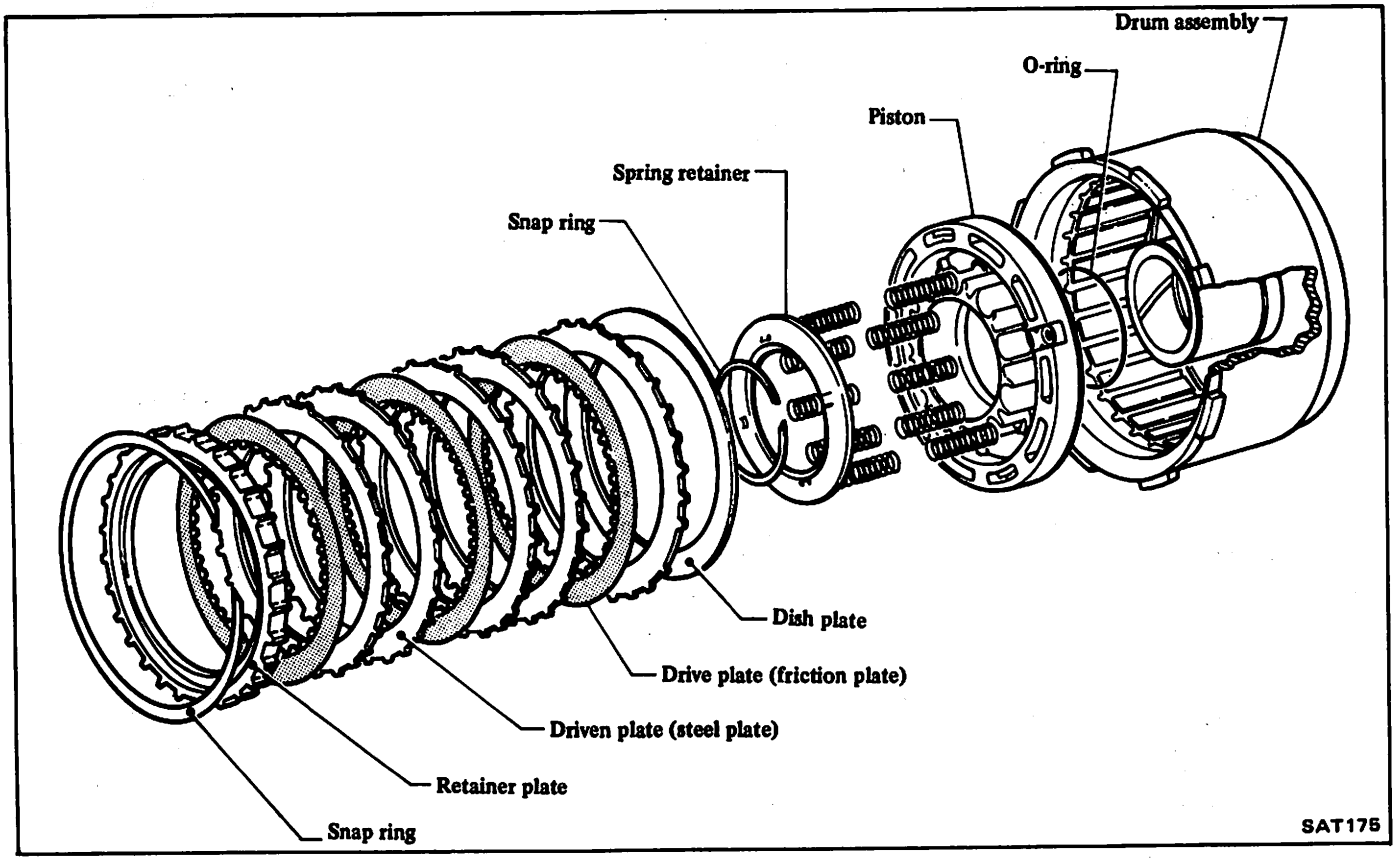


10. Tighten pump securing bolts to specified torque.

Ⓣ : **Oil pump housing to oil pump cover**
6 - 8 N·m
(0.6 - 0.8 kg-m,
4.3 - 6.8 ft-lb)

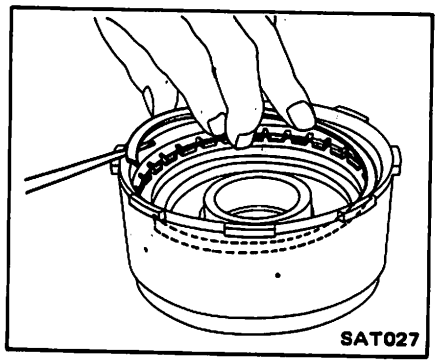
Recheck run-out. Replace O-ring and gasket.

FRONT CLUTCH

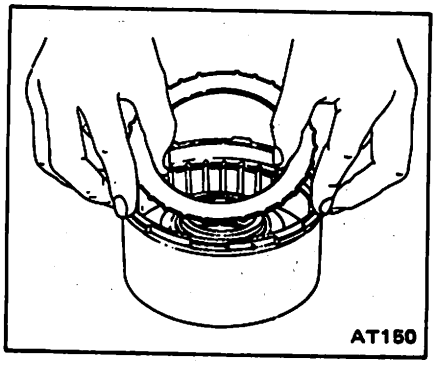


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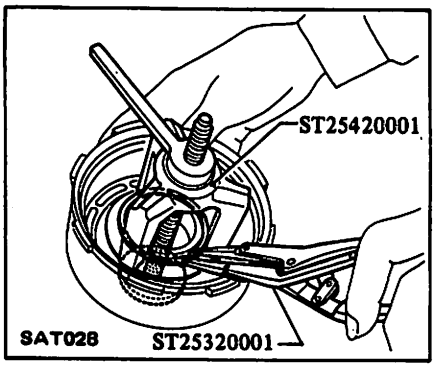
1. Using a screwdriver, remove large clutch retaining plate snap ring.



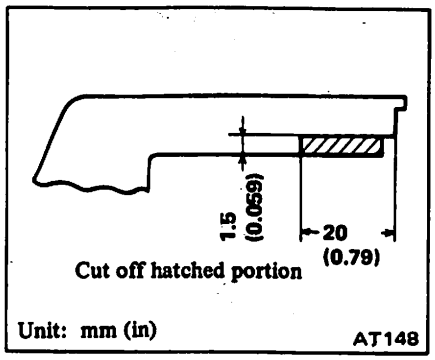
2. Remove clutch plate assembly.



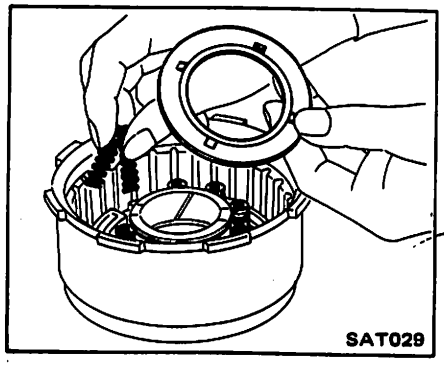
3. Compress clutch springs and remove snap ring from spring retainer.



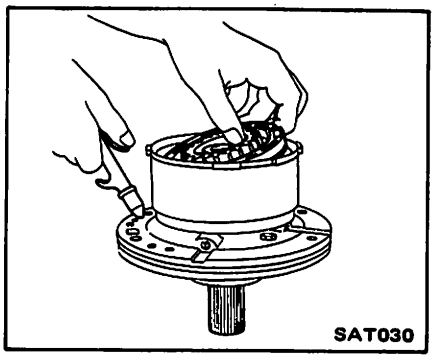
When Tool ST25420000 is to be used, cut toe-tips of three legs with a grinding wheel.



4. Remove spring retainer and springs.



5. For easy removal of piston from drum, mount clutch on pump. Use an air gun with a tapered rubber tip to carefully apply air pressure to loosen piston from drum.



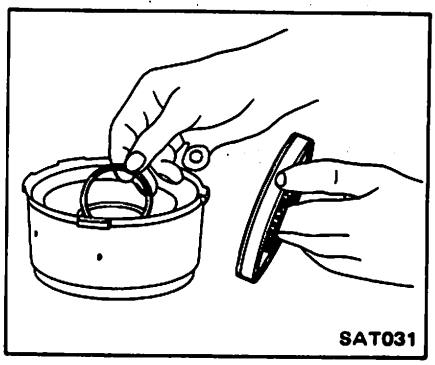
6. Check clutch drive plate facing for wear or damage. Drive plate thickness must not be less than **1.4 mm (0.055 in)**.

Standard drive plate thickness:
1.50 - 1.65 mm
(0.0591 - 0.0650 in)

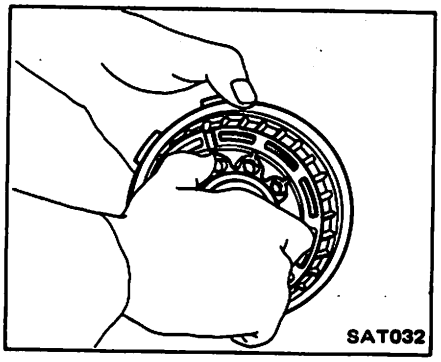
7. Check for wear on snapring, weak or broken coil springs, and warped spring retainer.

8. Lubricate clutch drum hub and seals, and install inner seal and piston seal as illustrated. *Be careful not to stretch seals during installation.*

Never assemble clutch dry; always lubricate its components thoroughly.

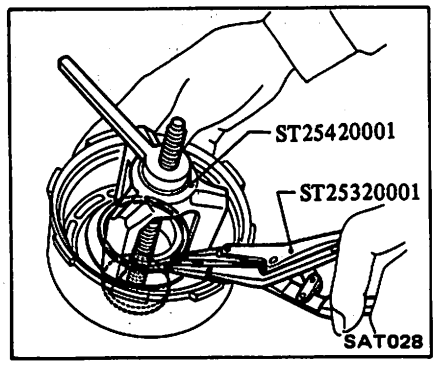


9. Assemble piston, being careful not to allow seal to kink or become damaged during installation. After installing, turn piston by hand to ensure that there is no binding.

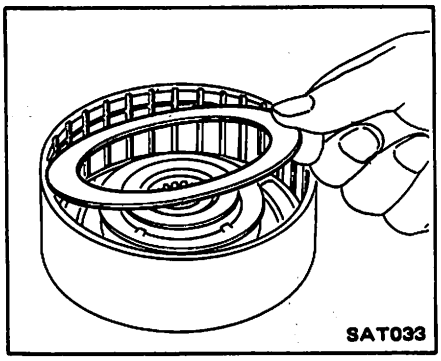


10. Reassemble spring and retainer. Reinstall snap ring. Be sure snap ring is properly seated.

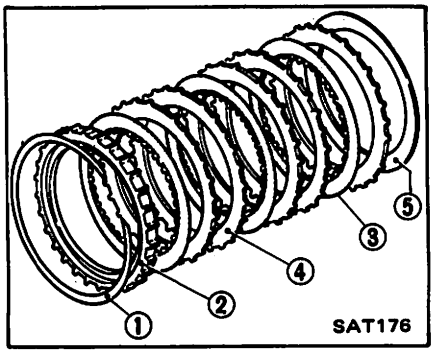
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11. Install dish plate with dish facing outward.



12. Now install driven plate (steel plate), then a drive plate (friction plate) and repeat in this order until correct number of plates has been installed (check Service Data and Specifications for proper quantity of plates). Now install retainer plate and snap ring.



1 Snap ring
2 Retainer plate
3 Drive plate (Friction plate)
4 Driven plate (Steel plate)
5 Dish plate

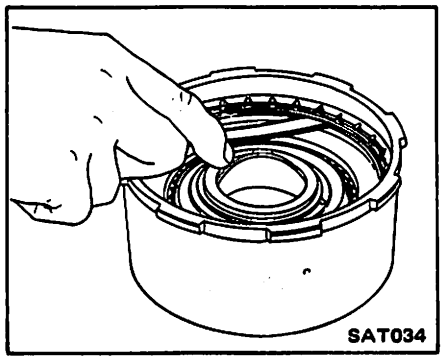
13. Measure clearance between retainer plate and snap ring.

Specified clearance:
1.6 - 2.0 mm (0.063 - 0.079 in)

If necessary, try other retaining plates having different thicknesses until correct clearance is obtained.

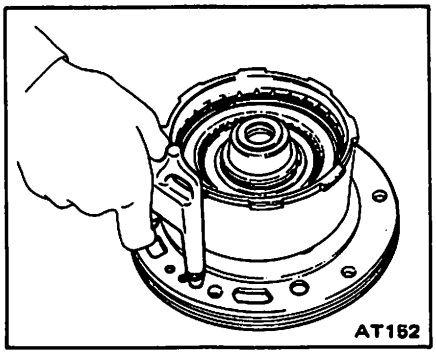
Available retaining plate

Thickness mm (in)	Part number
5.0 (0.197)	31567-X2900
5.2 (0.205)	31567-X2901
5.4 (0.213)	31567-X2902
5.6 (0.220)	31567-X2903
5.8 (0.228)	31567-X2904
6.0 (0.236)	31567-X2905
6.2 (0.244)	31567-X2906

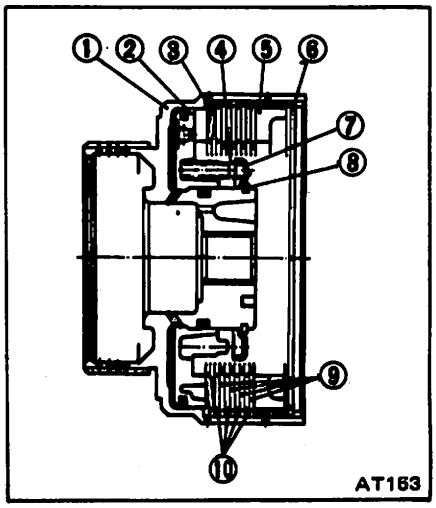


14. Testing front clutch

With front clutch assembled on oil pump cover, direct a jet of air into hole in clutch drum for definite clutch operation.



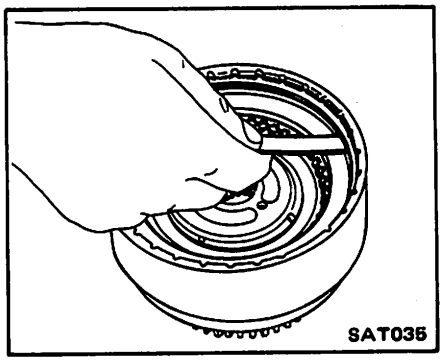
REAR CLUTCH



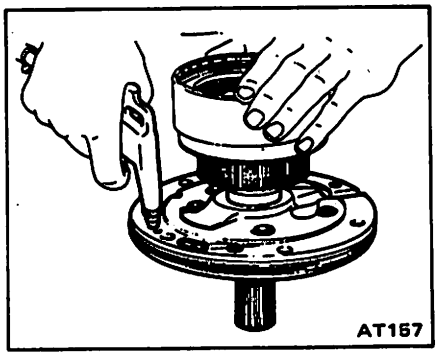
1 Rear clutch drum
2 Piston
3 Dished plate
4 Coil spring
5 Retaining plate
6 Snap ring
7 Spring retainer
8 Snap ring
9 Driven plate
10 Drive plate

Service procedures for rear clutch are essentially the same as those for front clutch, with the following exception:

Specified clearance between retainer plate and snap ring:
0.8 - 1.6 mm
(0.031 - 0.063 in)

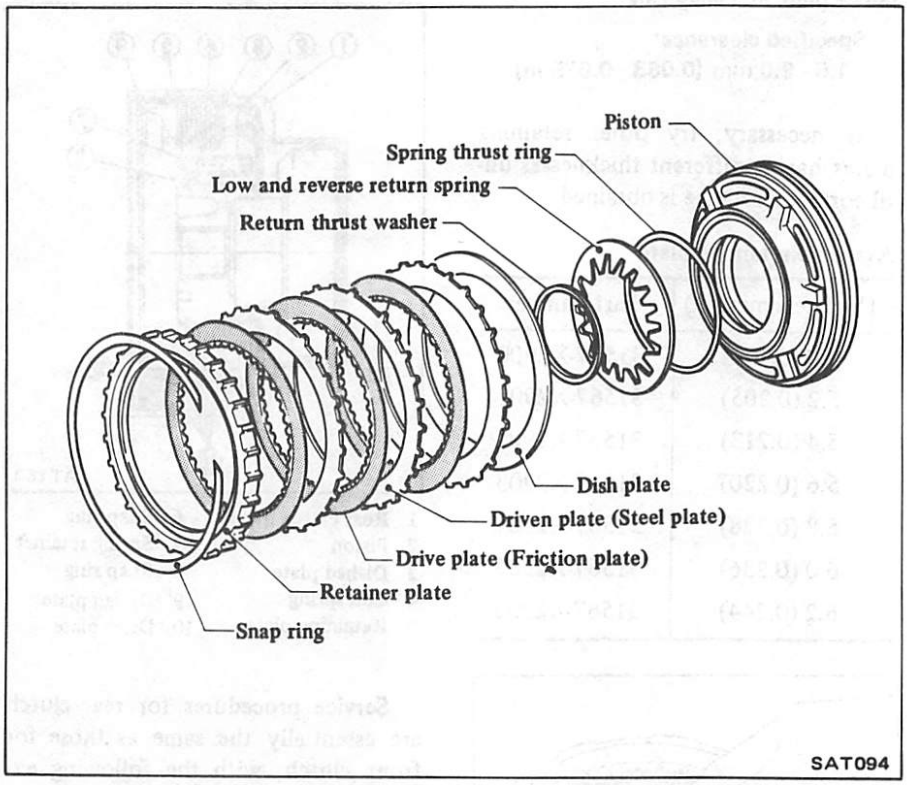


Test rear clutch



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LOW & REVERSE BRAKE

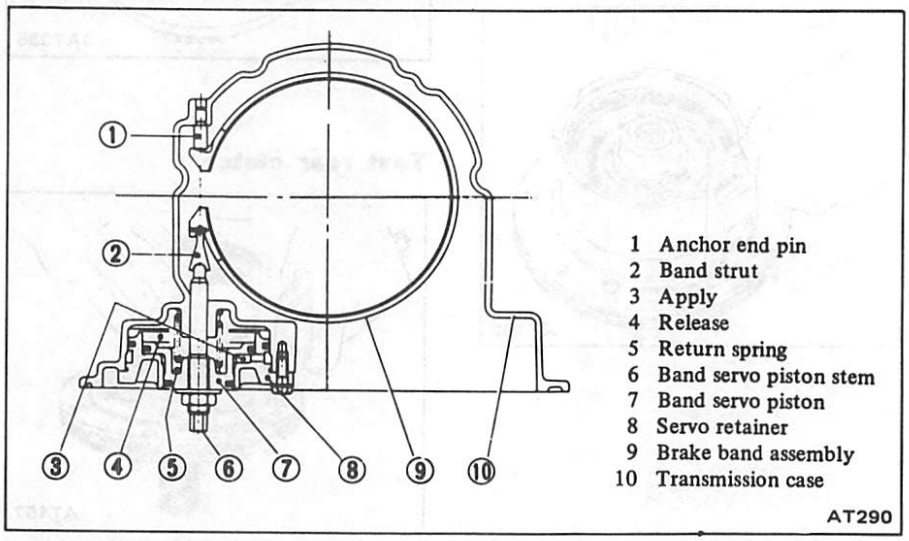


- Examine low and reverse brake for damaged clutch drive plate facing and worn snap ring.
- Check drive plate facing for wear or damage; if necessary, replace.

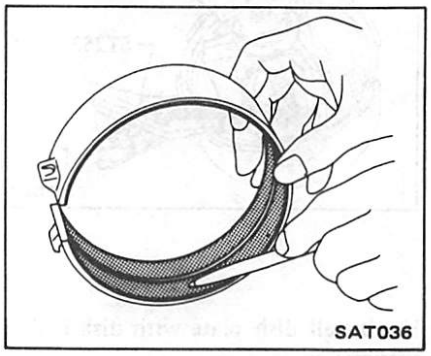
Drive plate thickness:
Standard
1.90 - 2.05 mm
(0.0748 - 0.0807 in)
Allowable limit
1.8 mm (0.071 in)

- Test piston return spring for weakness. Discard if it is too weak.

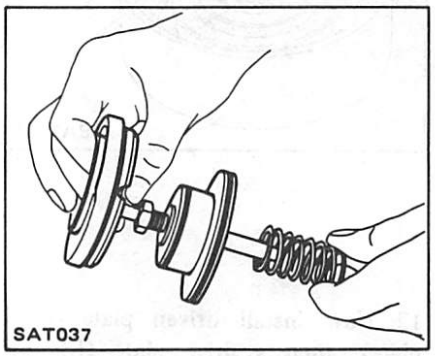
BRAKE BAND AND BAND SERVO



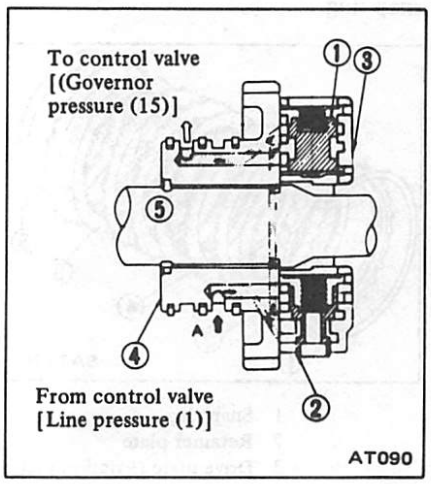
- Inspect band friction material for wear. If cracked, chipped or burnt spots are apparent, replace the band.



- Check band servo components for wear and scoring. Replace piston O-rings and all other components as necessary.



GOVERNOR

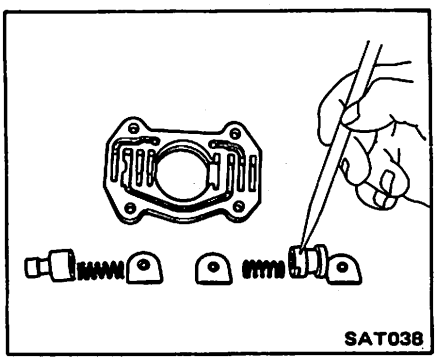


1 Primary governor
2 Secondary governor
3 Governor valve body
4 Oil distributor
5 Output shaft

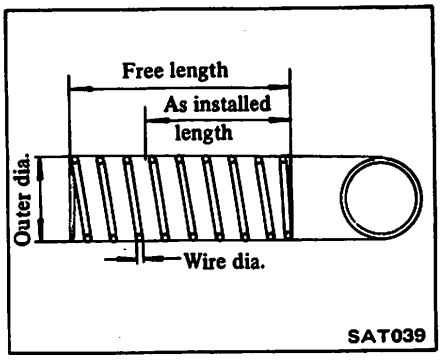
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- Disassemble governor and check valves for indication of burning or scratches. Inspect springs for weakness or burning. Replace parts as necessary and reassemble.

Do not interchange components of primary and secondary governor valves.



Governor valve spring chart



- Assemble governor on oil distributor.

Ⓣ ; **Governor valve body to oil distributor**

Valve spring	Wire dia. mm (in)	Outer coil dia. mm (in)	No. of active coil	Free length mm (in)	Installed	
					Length mm (in)	Load N (kg, lb.)
Primary governor	0.45 (0.0177)	8.75 (0.3445)	5.0	21.8 (0.858)	7.5 (0.295)	2.109 (0.215, 0.474)
Secondary governor	0.70 (0.0276)	9.20 (0.3622)	5.5	25.1 (0.988)	10.5 (0.413)	10.788 (1.100, 2.426)

PLANETARY CARRIER

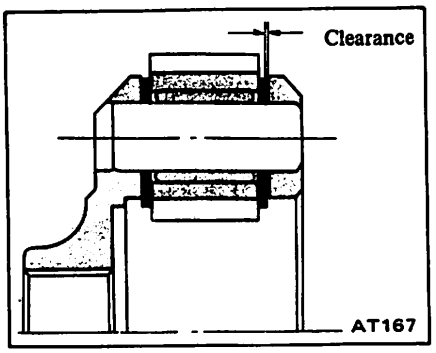
The planetary carrier cannot be divided into its individual components.

If any part of the component is faulty, replace the carrier as a unit.

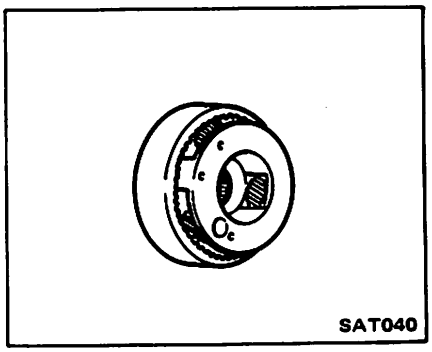
- Check clearance between pinion washer and planetary carrier with a feeler.

Standard clearance:
0.20 - 0.70 mm
(0.0079 - 0.0276 in)

Replace if the clearance exceeds **0.80 mm (0.0315 in).**



- Check planetary gear sets for damaged or worn gears. Gear sets that have been damaged by overheating will have a blue discoloration.

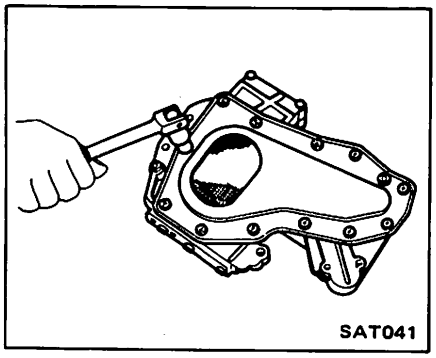


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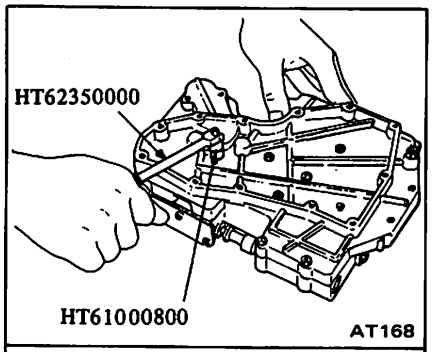
CONTROL VALVE BODY

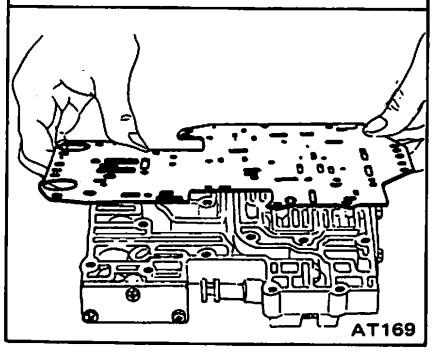
The valve body contains many precision parts and requires extreme care when parts are removed and serviced. Place removed parts on a parts rack so they can be put back in the valve body in the same positions and sequences. Care will also prevent springs and small parts from becoming scattered or lost.

1. Remove oil strainer and its attaching screws, nuts and bolts.



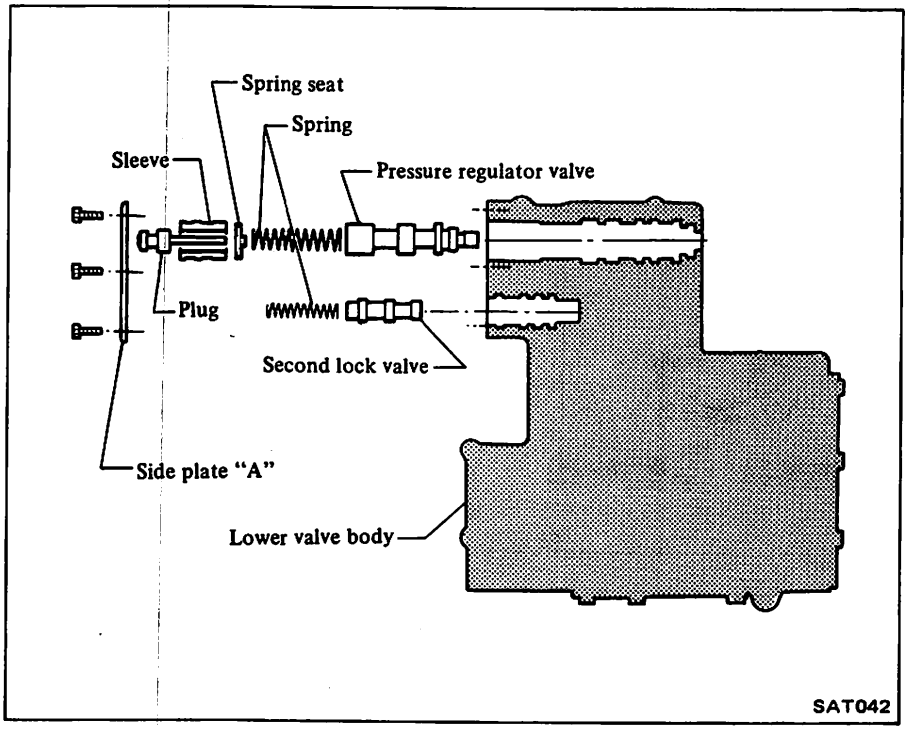
2. Disassemble valve body and its remaining attaching bolts and nuts to carefully separate lower body, separator plate and upper body.



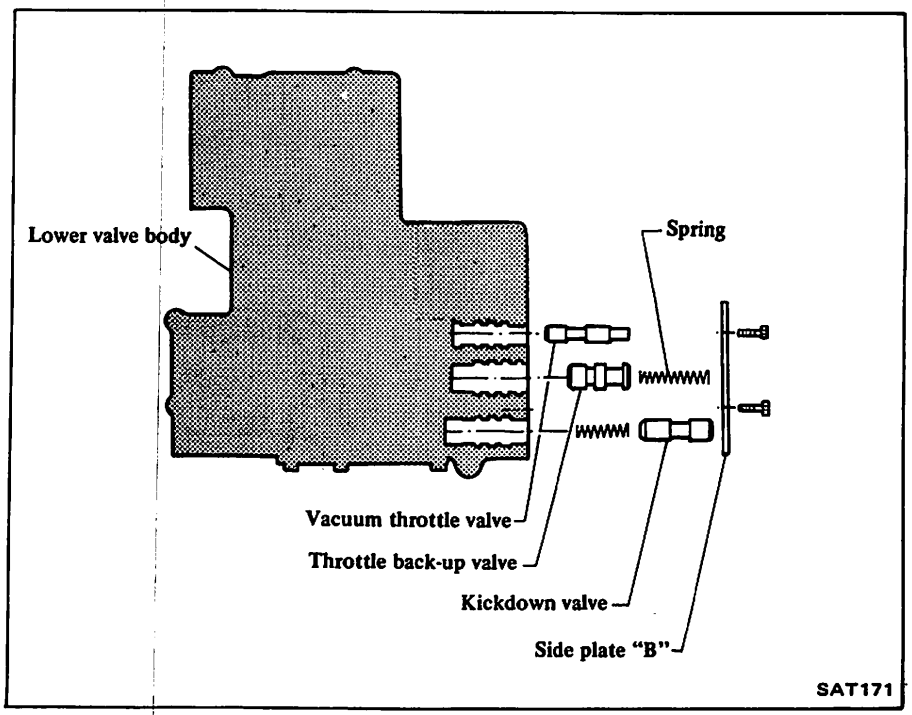


3. During valve body separation, do not scatter or lose orifice check valve, servo orifice check valve, and throttle relief check valve (ball) and related springs.

4. Remove side plate A, pressure regulator valve, spring, spring seat, sleeve, and plug, and second lock valve and spring. Place each loose part on a rack to retain correct sequence of assembly.



5. Remove side plate B, 2nd-3rd timing valve and spring, vacuum throttle valve, throttle back-up valve and spring, and the kickdown valve and spring. Place each loose part on a rack to retain sequence of assembly.

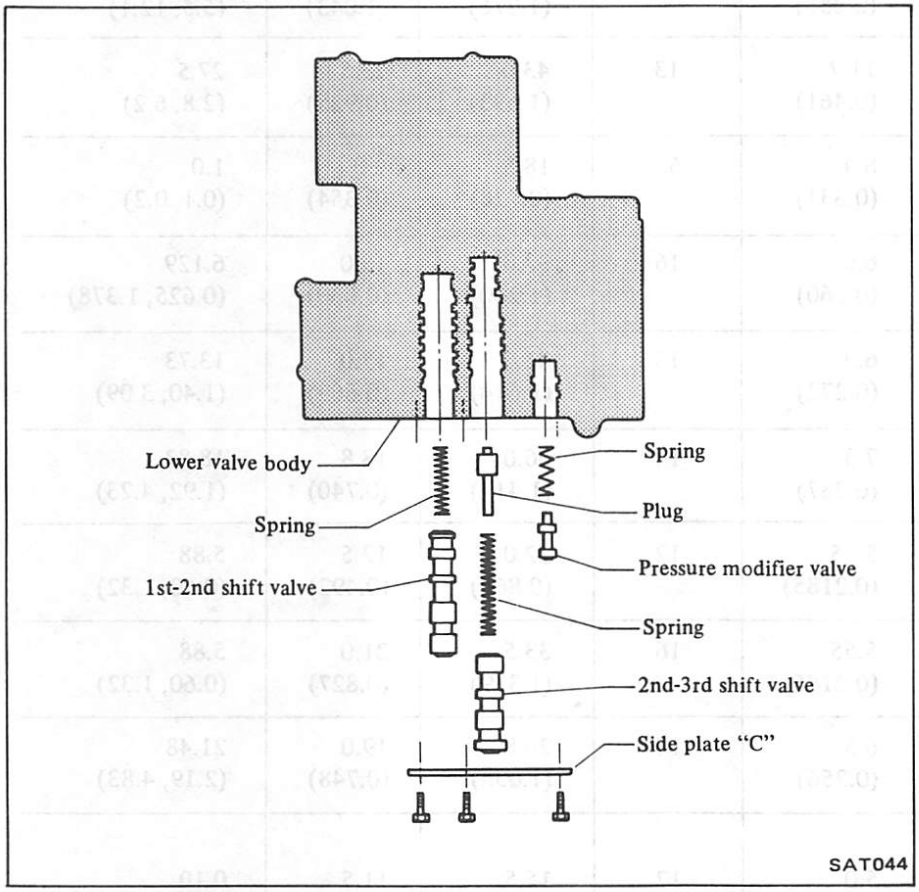


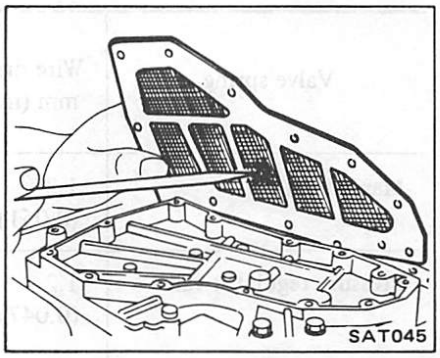
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6. Remove side plate C, pressure modifier valve and spring, 2nd-3rd shift valve, spring and plug, and 1st-2nd shift valve and spring.

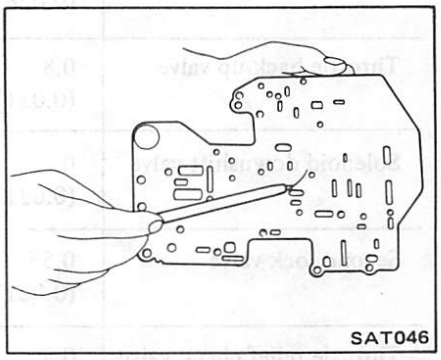
Place each loose part on a rack to retain sequence of assembly.

Manual valve was removed when valve body was removed from transmission. Include valve in subsequent inspection and service sequence.





9. Check separator plate for scratches or damage. Replace if necessary. Scratches or score marks can cause oil to bypass correct oil passages and result in system malfunction.



10. Check oil passages in upper and lower valve bodies for varnish deposits, scratches or other damage that would impair valve movement. Check threaded holes and related bolts and screws for stripped threads; replace as needed.
11. Test valve springs for weakened load condition. Refer to Valve Body Spring Chart for spring specifications.

Precaution for inspection

A newly manufactured valve body represents precision manufactured valves assembled with close tolerances into precision bores of the valve body. If inspection reveals excessive clearances, 0.03mm (0.0012 in) or more, between the valves and the valve body bores, replace the entire valve body rather than attempt rework.

If one or more valves are sticking from varnish deposits or burns resulting from deteriorated oil or overheating, you may be able to clean the valves and valve bodies. **Always use crocus cloth,** which is a very fine type of cutting material. **Never use emery cloth,** as it is too coarse and can scratch the valves or valve bores. Scratches can lead to future deposits of varnish or foreign matter.

During cleaning, do not remove the sharp edges of the valve. When edges are rounded or scratched, entry is provided for dirt or foreign matter to work into the sides of the valves and hinder valve movement.

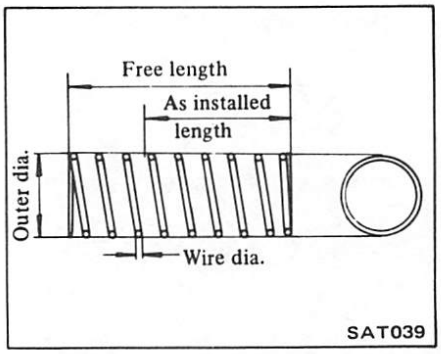
The valves may be cleaned using alcohol or lacquer thinner. The valve bodies can be dip cleaned with a good carburetor cleaner or lacquer thinner. **Do not leave valve bodies submerged in carburetor cleaner longer than five minutes. Rinse parts thoroughly and dry.**

Lubricate all parts in clean automatic transmission fluid before reassembly.

7. Check valves for signs of burning. Replace if beyond clean-up.

8. Check oil strainer for general condition. Replace if necessary.

Valve body spring chart



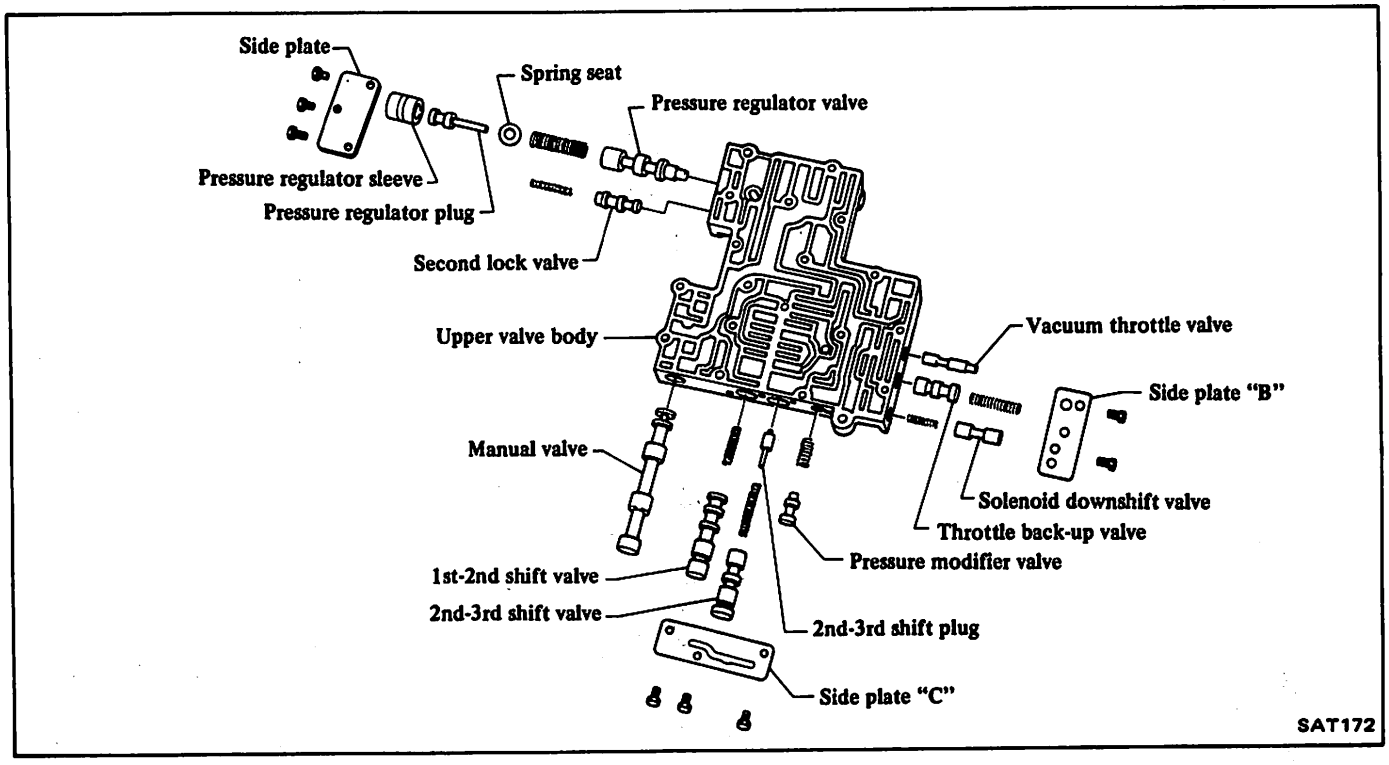
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Valve spring	Wire dia. mm (in)	Outer coil dia. mm (in)	No. of active coil	Free length mm (in)	Installed	
					Length mm (in)	Load N (kg, lb)
Manual detent	1.3 (0.051)	7.3 (0.287)	15	32.4 (1.276)	26.5 (1.043)	53.9 (5.5, 12.1)
Pressure regulator valve	1.2 (0.047)	11.7 (0.461)	13	43.0 (1.693)	23.5 (0.925)	27.5 (2.8, 6.2)
Pressure modifier valve	0.4 (0.016)	8.4 (0.331)	5	18.5 (0.728)	9.0 (0.354)	1.0 (0.1, 0.2)
1st - 2nd shift valve	0.6 (0.024)	6.6 (0.260)	16	32.0 (1.260)	16.0 (0.630)	6.129 (0.625, 1.378)
2nd - 3rd shift valve	0.7 (0.028)	6.9 (0.272)	18	41.0 (1.614)	17.0 (0.669)	13.73 (1.40, 3.09)
Throttle back-up valve	0.8 (0.031)	7.3 (0.287)	14	36.0 (1.417)	18.8 (0.740)	18.83 (1.92, 4.23)
Solenoid downshift valve	0.55 (0.0217)	5.55 (0.2185)	12	22.0 (0.866)	12.5 (0.492)	5.88 (0.60, 1.32)
Second lock valve	0.55 (0.0217)	5.55 (0.2185)	16	33.5 (1.319)	21.0 (0.827)	5.88 (0.60, 1.32)
Throttle relief check valve	0.9 (0.035)	6.5 (0.256)	14	26.8 (1.055)	19.0 (0.748)	21.48 (2.19, 4.83)
Orifice check valve	0.23 (0.0091)	5.0 (0.197)	12	15.5 (0.610)	11.5 (0.453)	0.10 (0.01, 0.02)
Servo orifice check valve						

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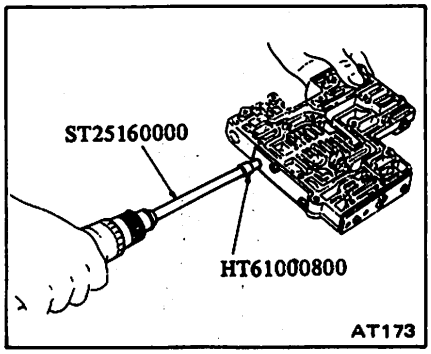
12. Assemble side plate A group of parts into lower valve body. Reinstall side plate and finger tighten screws.

Assemble side plate B group and side plate C group in same manner as A group.

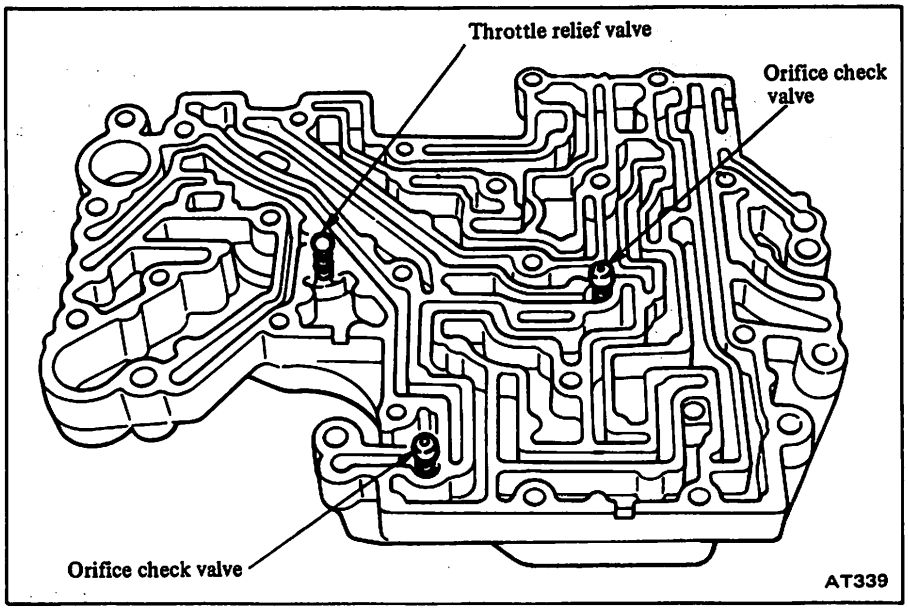


13. Tighten screws.

Ⓣ : **Side plate to valve body**
2.5 - 3.4 N·m
(0.25 - 0.35 kg-m,
1.8 - 2.5 ft-lb)

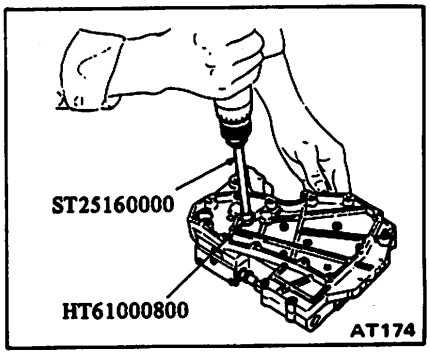


14. Install orifice check valve, valve spring, throttle relief valve spring and steel ball in valve body.



15. Install upper and lower valves.

Ⓣ : **Upper and lower valves:**
2.5 - 3.4 N·m
(0.25 - 0.35 kg-m,
1.8 - 2.5 ft-lb)
Reamer bolt:
5 - 7 N·m
(0.5 - 0.7 kg-m,
3.6 - 5.1 ft-lb)



16. Install oil strainer.

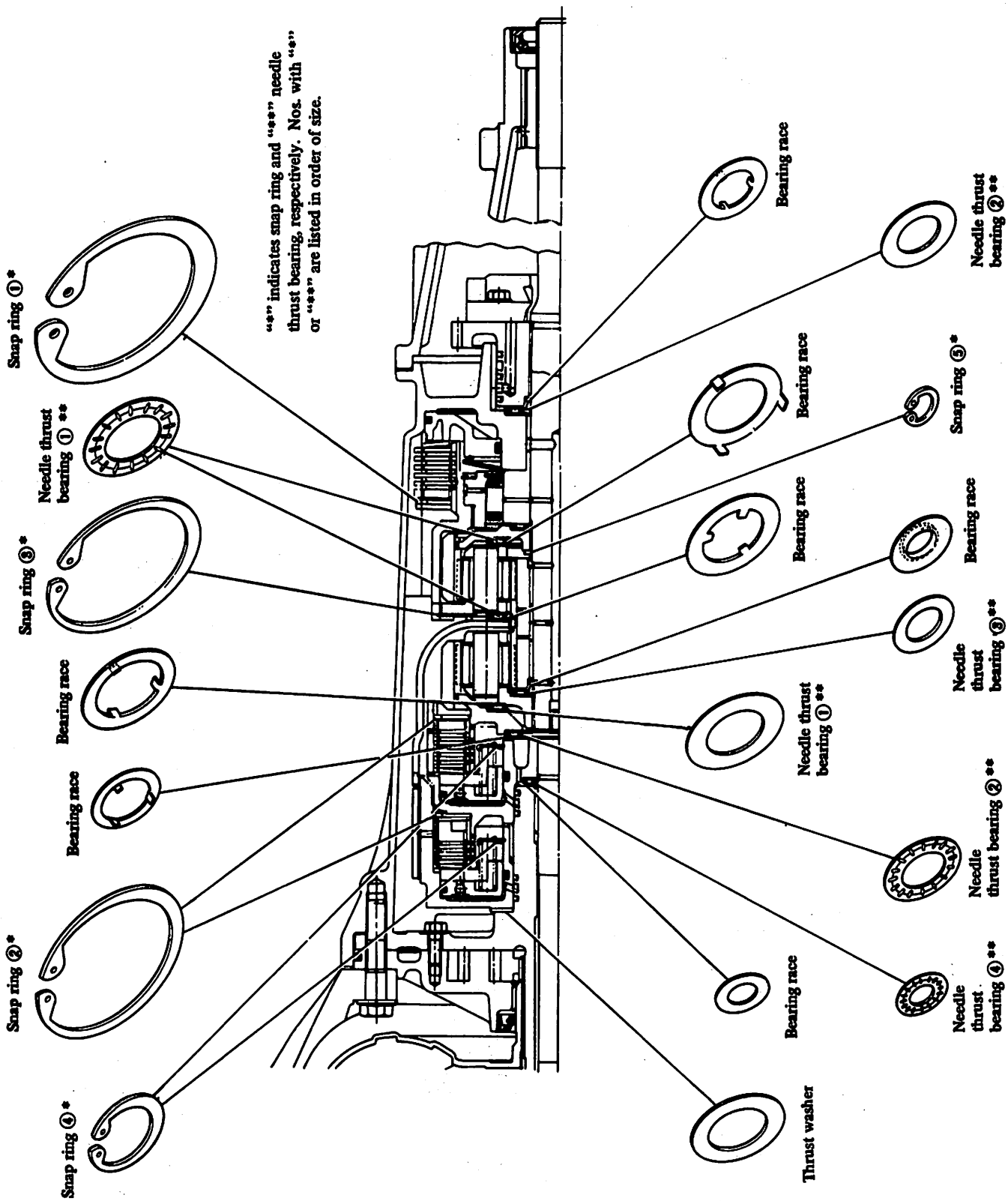
Ⓣ : **Oil strainer to valve body**
2.5 - 3.4 N·m
(0.25 - 0.35 kg-m,
1.8 - 2.5 ft-lb)

The manual valve is inserted into the valve body when the latter is installed in the transmission.

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FINAL ASSEMBLY

When installing/assembling needle bearing, bearing race, snap ring and O-ring (seal ring), use the following illustration as a guide to installation procedures and locations.

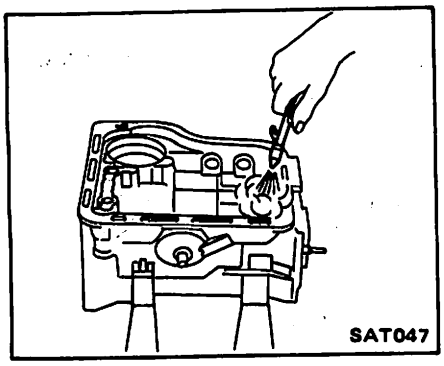


SAT089

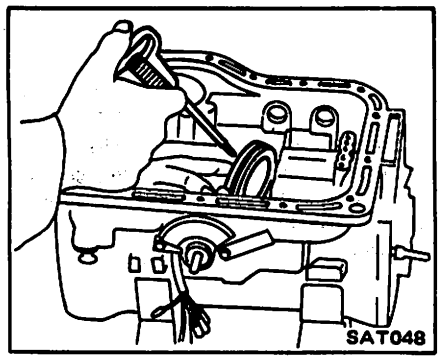
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1. Before proceeding with the final assembly of all components, it is important to verify that the case, housing and parts are clean and free from dust, dirt and foreign matter (use air gun). Have a tray available with clean transmission fluid for lubricating parts.

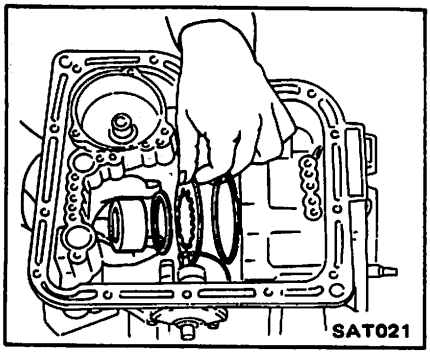
Petroleum jelly can be used to secure washers during installation. All new seals and rings should have been installed before beginning final assembly.



2. Lubricate and install low and reverse piston into the case.



3. Install thrust ring, piston return spring, thrust washer and one-way clutch inner race.



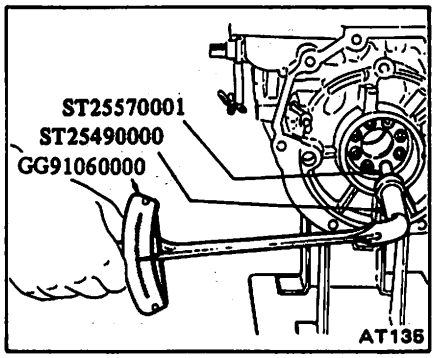
4. Align and start hex-head slotted bolts into inner race from rear of case.

WARNING:
Check that return spring is centered on race before tightening.

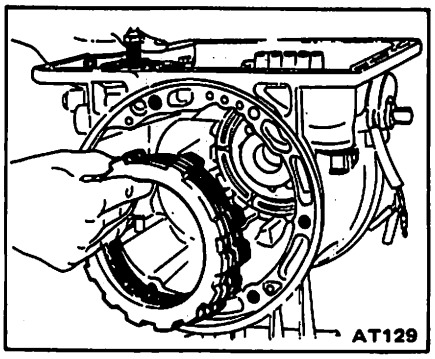
Tighten the bolts

Ⓣ : **One-way clutch inner race to transmission case**

13 - 18 N·m
(1.3 - 1.8 kg-m,
9 - 13 ft-lb)

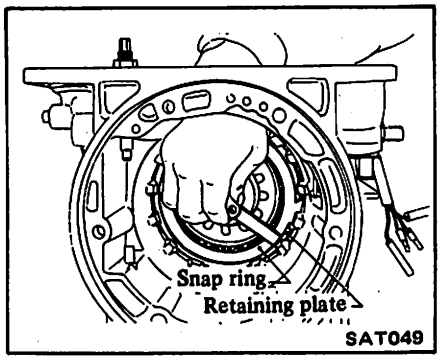


5. Install steel dished plate first, then steel and friction plates, and, finally, retaining plate and snap-ring.

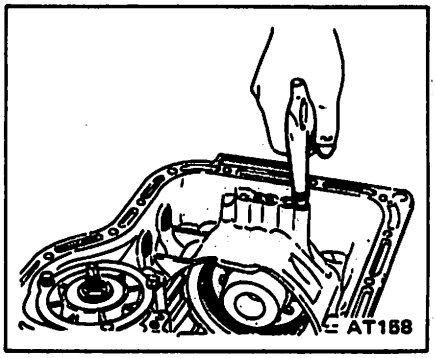


6. After low and reverse brake has been completely assembled, measure clearance between snapring and retainer plate. If measurement exceeds specifications it can be adjusted by replacing retainer plate with one of a different thickness.

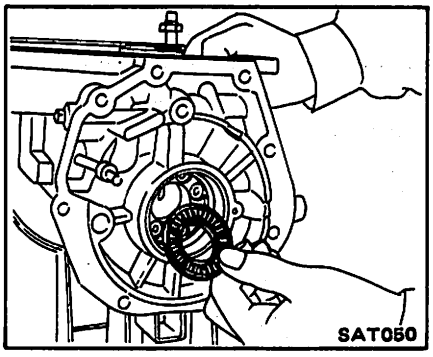
Low and reverse brake clearance:
0.80 - 1.25 mm
(0.0315 - 0.0492 in)



7. Using an air gun with a tapered rubber tip, check low and reverse brake operation.

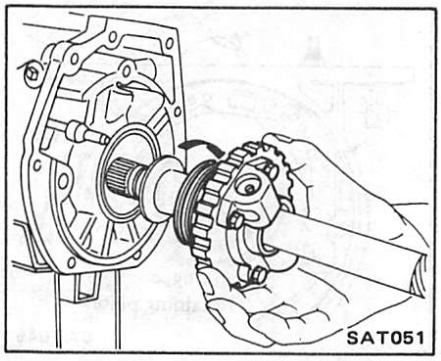


8. Install governor thrust washer and needle bearing.



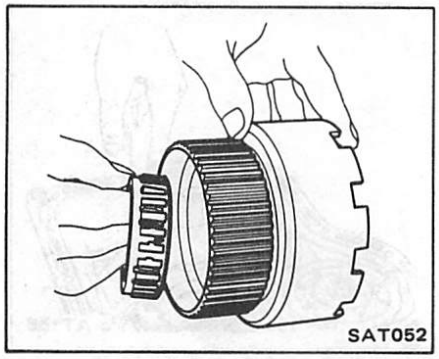
9. Slide governor distributor assembly on output shaft from front of shaft. Install shaft and governor distributor into case, using care not to damage distributor rings.

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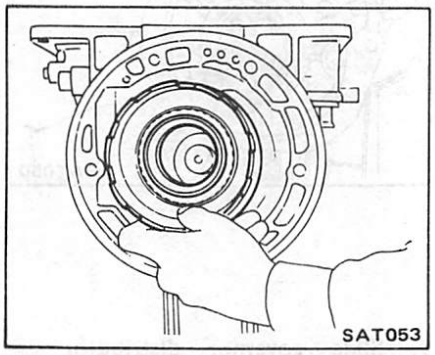

SAT051

10. Install one-way sprag into one-way clutch outer race (attached to connecting drum).

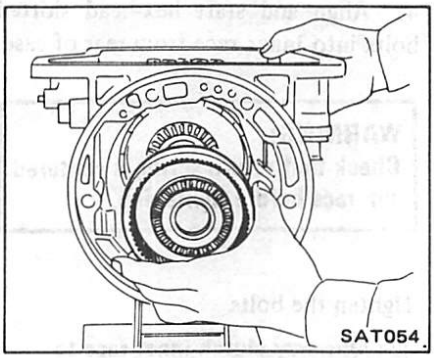
Arrow on sprag must face front of transmission.


SAT052

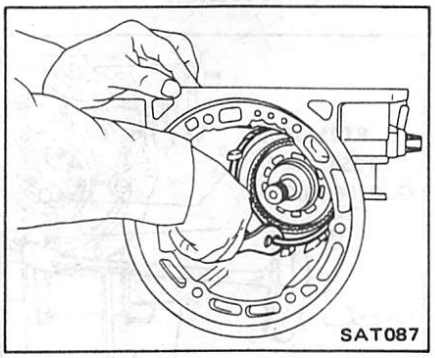
11. Install connecting drum with sprag by rotating drum clockwise using a slight pressure and wobbling to align plates with hub and sprag assembly. Connecting drum should now be free to rotate **clockwise only.** This check will verify that sprag is correctly installed and operative.


SAT053

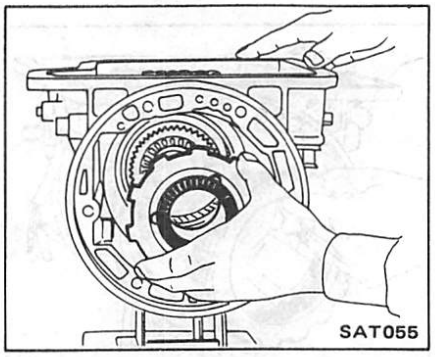
12. Install rear internal gear.


SAT054

13. Install snap-ring on shaft.

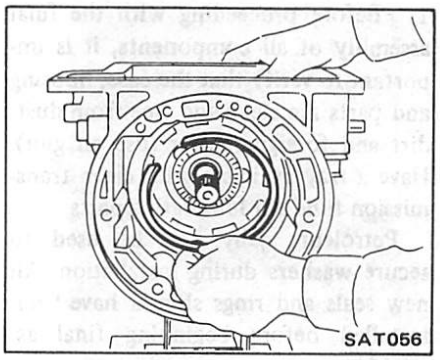

SAT087

14. Secure thrust bearing and thrust washer with petroleum jelly and install rear planetary carrier.

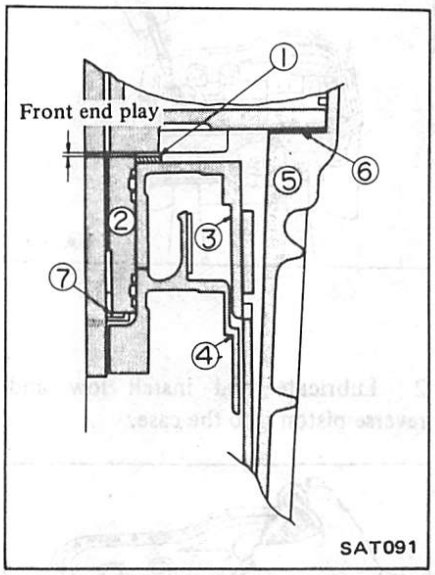

SAT055

15. Install rear planetary carrier snap ring.

This snap ring is thinner than a clutch drum snap ring so be sure you are using correct size. If you have insufficient space to install snap ring into drum groove, pull connecting drum forward as far as possible. This will give you sufficient groove clearance to install drum snap ring.


SAT056

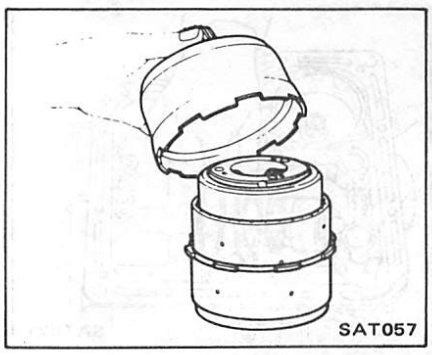
16. Adjust front end play as follows:



SAT091

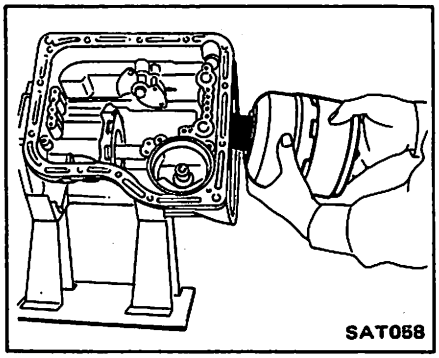
1 Front clutch thrust washer
2 Oil pump cover
3 Front clutch
4 Rear clutch
5 Transmission case
6 Oil pump gasket
7 Oil pump cover bearing race

(1) Assemble front and rear clutches, front internal gear, front planetary carrier and connecting shell. Secure thrust bearings with petroleum jelly.

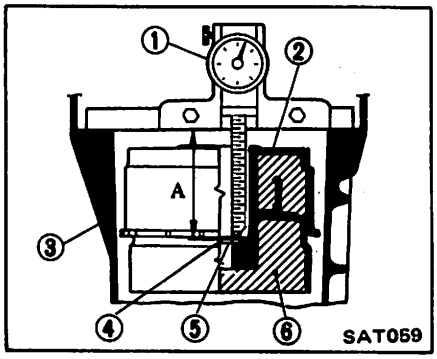

SAT057

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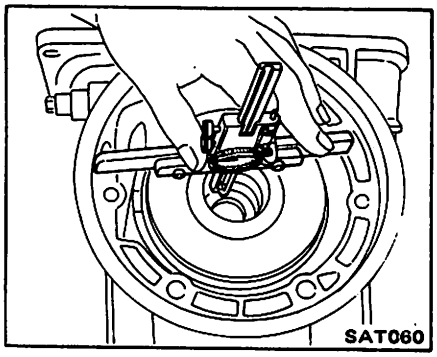
(2) Install assembly into transmission case. Check that parts are properly seated before proceeding with measurements.



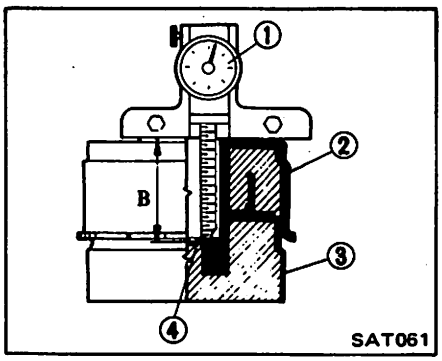
(3) Using a dial gauge or caliper with a seven inch base, measure from rear hub thrust bearing race to case (dimension A).



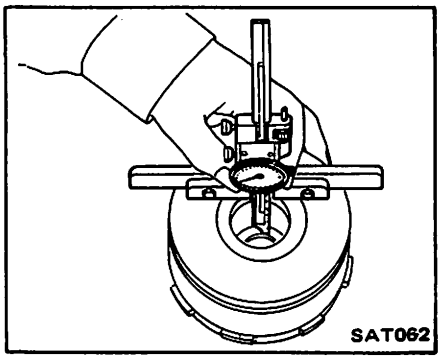
1 Dial gauge
2 Front clutch drum
3 Transmission case
4 Bearing race
5 Thrust bearing
6 Rear clutch drum



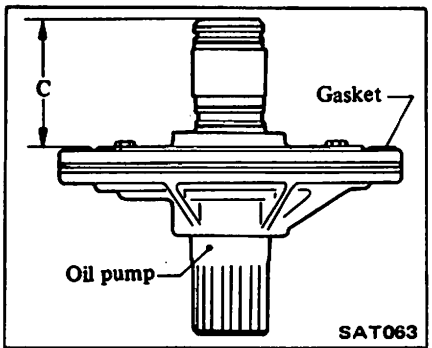
(4) Assemble front and rear clutch drum assemblies together and lay them flat on bench. Be sure rear hub thrust bearing is properly seated. Measure from face of clutch drum to top of thrust bearing race (dimension B).

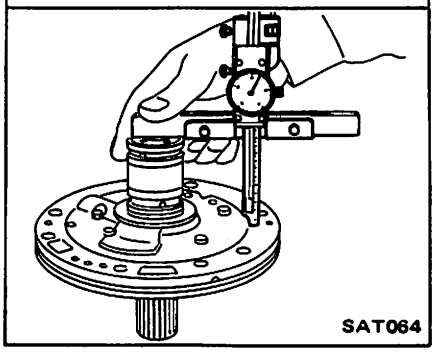


1 Depth gauge
2 Front clutch drum
3 Rear clutch drum
4 Thrust bearing

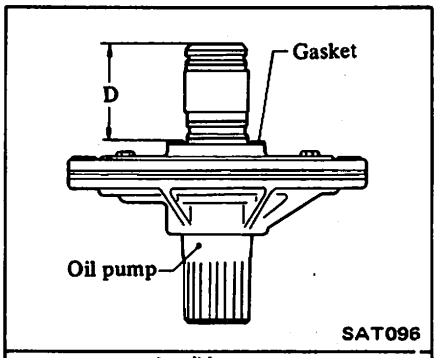


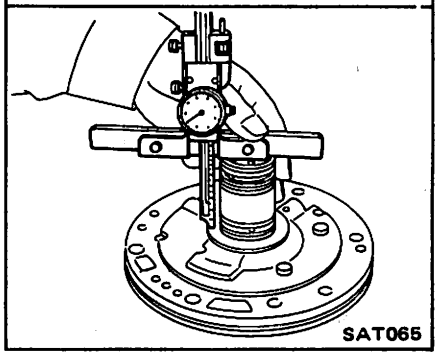
(5) Measure from top of oil pump shaft to gasket installed (dimension C).





(6) Install thrust washer. Measure from top of oil pump shaft to thrust washer (dimension D).





(7) Difference between dimension [A-0.1 mm (0.004 in)-B] and (C-D) is front end play and must be within specified value.

Specified front end play:
0.5 - 0.8 mm
(0.020 - 0.031 in)

Front end play can be adjusted with front clutch thrust washers of different thickness.

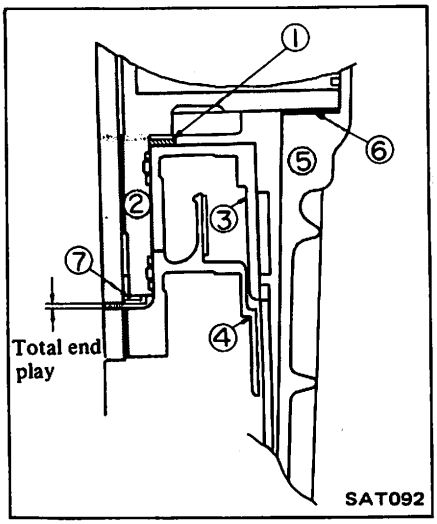
Available front clutch thrust washer

Thickness mm (in)	Part number
1.5 (0.059)	31528 X0106
1.7 (0.067)	31528 X0105
1.9 (0.075)	31528 X0100
2.1 (0.083)	31528 X0101
2.3 (0.091)	31528 X0102
2.5 (0.098)	31528 X0103
2.7 (0.106)	31528 X0104

17. Adjust total end play as follows:
This adjustment is seldom required because this type of thrust bearing and

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race will normally show very little wear. We also have a standard tolerance of 0.25 to 0.50 mm (0.0098 to 0.0197 in). However, we are presenting correct checking procedure.



1 Front clutch thrust washer
2 Oil pump cover
3 Front clutch
4 Rear clutch
5 Transmission case
6 Oil pump gasket
7 Oil pump cover bearing race

(1) Measure dimension A using instructions in steps (1), (2) and (3) under No. 16 above.
(2) Measure dimension C using instructions in step (5) under No. 16 above.
(3) Difference between dimension [A-0.1 mm (0.004 in)] and C is total end play and it must be within specified value.

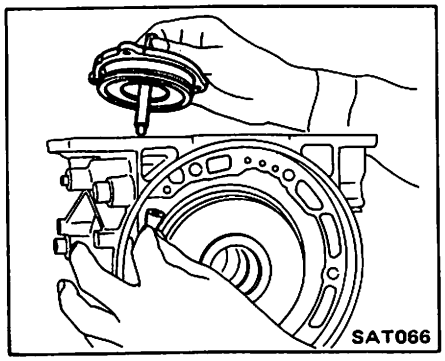
Specified total end play:
0.25 - 0.50 mm
(0.0098 - 0.0197 in)

If difference between [A-0.2 mm (0.008 in)] and C is not within tolerance, select proper size oil pump cover bearing race.

Available oil pump cover bearing race

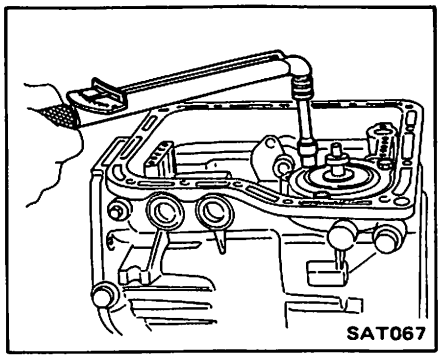
Thickness mm (in)	Part number
1.2 (0.047)	31556 X0100
1.4 (0.055)	31556 X0101
1.6 (0.063)	31556 X0102
1.8 (0.071)	31556 X0103
2.0 (0.079)	31556 X0104
2.2 (0.087)	31556 X0105

18. Install brake band, band strut, and band servo. Lubricate servo O-rings before installing. **Care should be taken to avoid damaging O-rings when reassembling.**

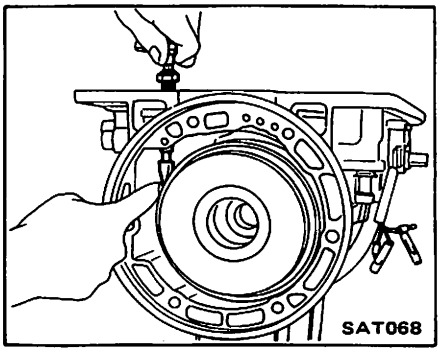


19. Install and torque the retainer bolts. Loosen piston stem.

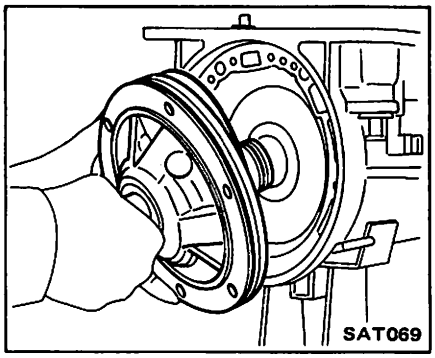
Ⓣ : **Servo piston retainer bolt**
5 - 7 N·m
(0.5 - 0.7 kg-m,
3.6 - 5.1 ft-lb)



20. Finger tighten brake band servo piston stem enough to prevent brake band and strut from falling out. **Do not adjust brake band** at this time.

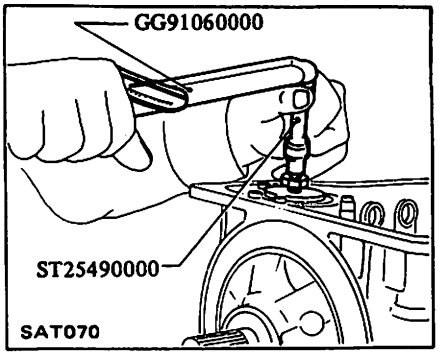


21. Mount oil pump gasket on oil pump with petroleum jelly. Align pump to transmission case and install.



22. Adjust band. Make sure that brake band strut is correctly installed. Torque piston stem to specified value. Back off two full turns and secure with lock nut.

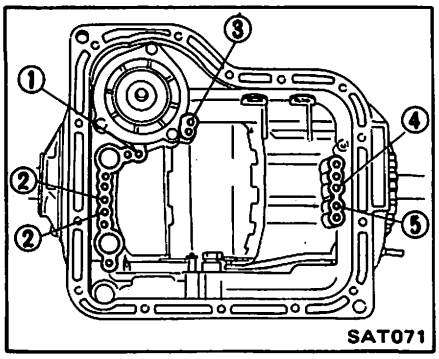
Ⓣ : **Piston stem**
12 - 15 N·m
(1.2 - 1.5 kg-m,
9 - 11 ft-lb)
Piston stem lock nut
15 - 39 N·m
(1.5 - 4.0 kg-m,
11 - 29 ft-lb)



23. Before proceeding with installation of valve body assembly, perform a final air check of all assembled components. This will ensure that you have not overlooked tightening of any bolts or damaged any seals during assembly.

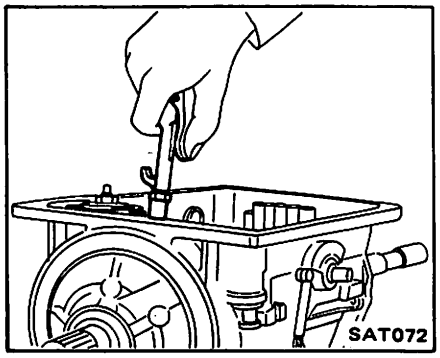
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Air check point

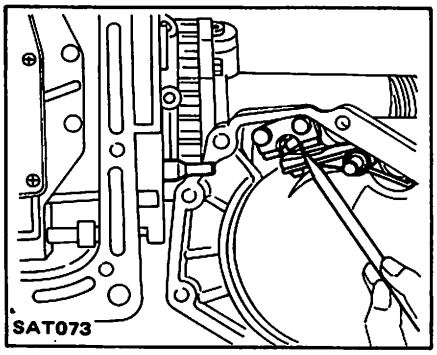


1 Band servo apply (9)
2 Rear clutch (1)
Front clutch (11)
3 Band servo release (10)
4 Governor feed (1)
5 Low & reverse brake (12)

24. Using an air gun with a tapered rubber tip, perform air checks.

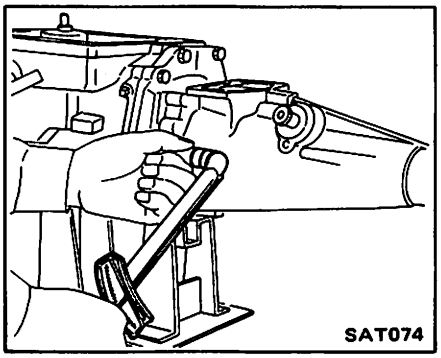


25. Check that parking pawl, pin, spring and washer are assembled correctly.

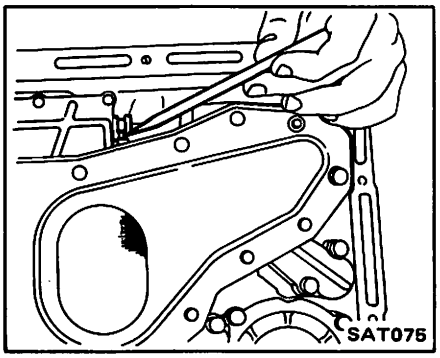


26. Install rear extension.

Ⓣ : **Rear extension to transmission case**
20 - 25 N·m
(2.0 - 2.5 kg-m,
14 - 18 ft-lb)



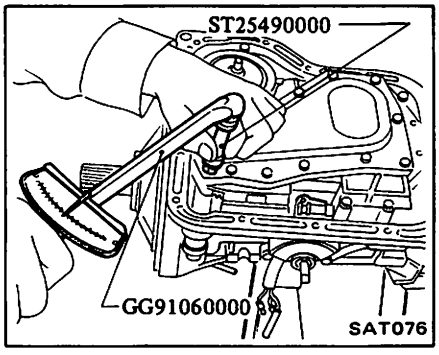
27. Install control valve body. Be sure manual valve is in alignment with selector pin.



28. Tighten control valve body attaching bolts.

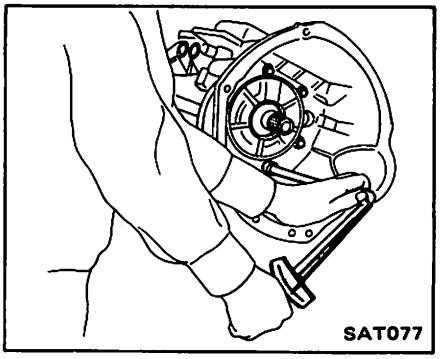
Ⓣ : **5.4 - 7.4 N·m**
(0.55 - 0.75 kg-m,
4.0 - 5.4 ft-lb)

Control valve body attaching bolts vary in length. Care must be taken to ensure that each bolt is returned to correct hole.

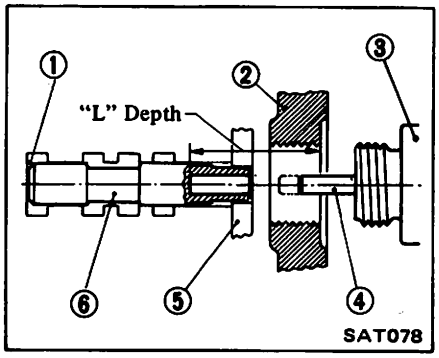


29. Check pump to transmission alignment and install converter housing.

Ⓣ : **44 - 54 N·m**
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)



30. Before installing vacuum diaphragm valve, measure depth of hole in which it is inserted. This measurement determines correct rod length to ensure proper performance.



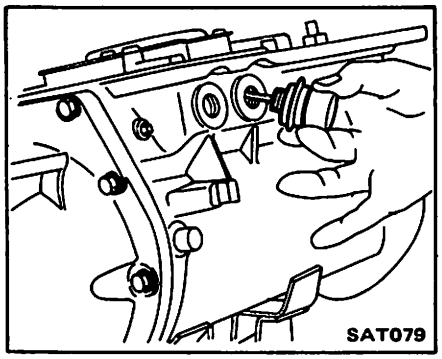
1 Note seated valve body
2 Transmission case wall
3 Vacuum diaphragm
4 Diaphragm rod
5 Valve body side plate
6 Vacuum throttle valve

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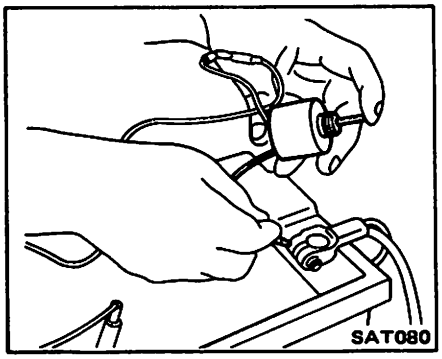
Throttle modulator valve rod selection

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

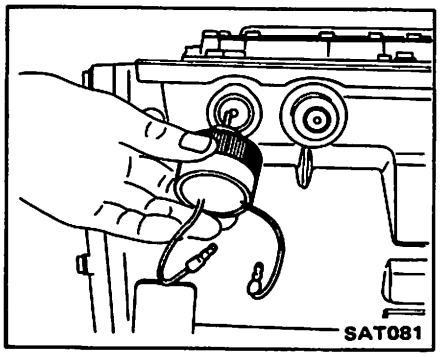
31. Install vacuum diaphragm.



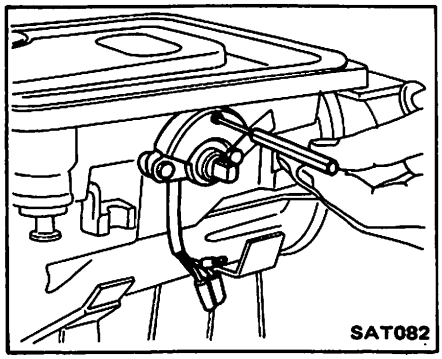
32. Before installing down shift solenoid, check to verify that it is operating properly. Use a hot lead and ground to check solenoid.



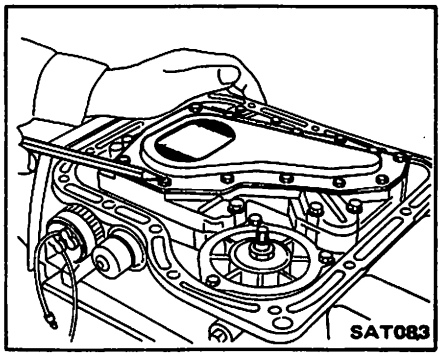
33. Install down shift solenoid.



34. Install inhibitor switch. Check for proper operation in each range using a circuit tester. Refer to Minor Adjustment.

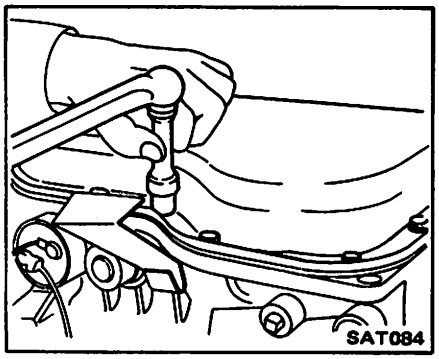


35. Before installing oil pan, check alignment and operation of control lever and parking pawl engagement. Blow mechanism with air to clean. Make final check to be sure all bolts are installed in valve body.

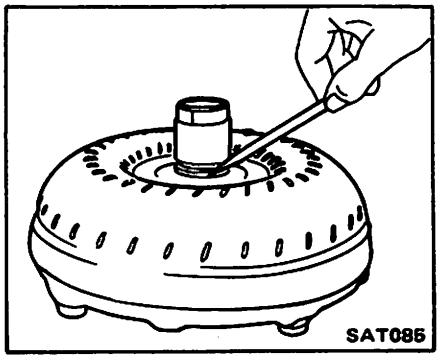


36. Install oil pan with new gasket.

Ⓣ : **Oil pan to transmission case**
5 - 7 N·m
(0.5 - 0.7 kg-m,
3.6 - 5.1 ft-lb)

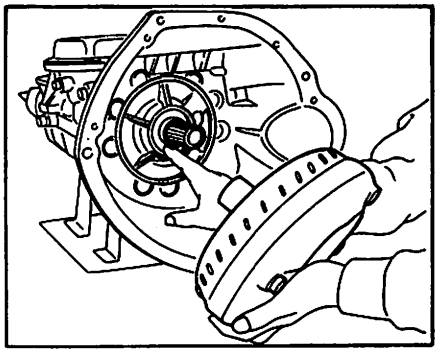


37. Carefully inspect torque converter for damage. Check converter hub for grooves caused by hardened seals. Also check bushing contact area.



38. Lubricate oil pump lip seal and converter neck before installing converter.

Install converter, being sure that converter is properly meshed with oil pump drive gear.



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TROUBLE SHOOTING AND DIAGNOSES

PRELIMINARY CHECKS (Prior to road testing)

Verify customer complaint

The customer should supply as much information as possible, including any unusual characteristics that accompany the complaint.

Fluid level

To properly check fluid level:

1) Place vehicle on a level surface.
2) Put wheel chocks in place and apply parking brake securely.
3) Warm up engine on fast idle.
4) Return engine to curb idling speed.
5) Slowly move the gear selector through the entire shift pattern, and return it to park.
6) Remove the dipstick, clean it, and replace it fully in the filler tube.
7) Quickly remove it again and read the level.

The "L" mark on the dipstick indicates the transmission is approximately 0.4 liter (7/8 US pt, 3/4 Imp pt) low. Add only clean Dexron transmission fluid (or equivalent).

Fluid leakage

To detect a fluid leak:

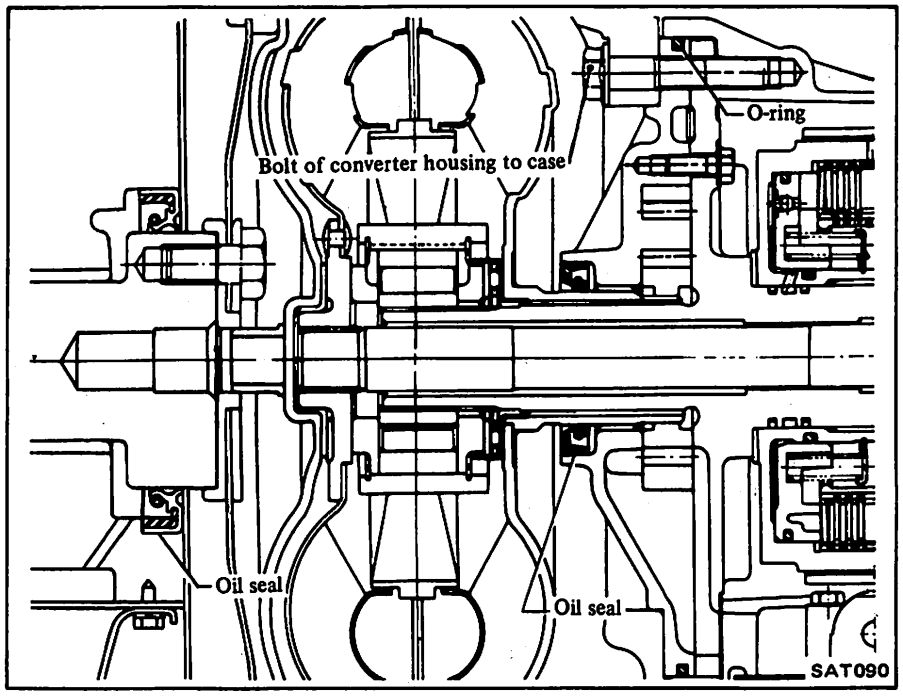
1) Raise vehicle.
2) Clean area suspected of leaking.
3) Start engine, apply foot brake, place gear selector in drive, and wait a few minutes.
4) Stop engine.
5) Check for fresh leakage.

If the transmission breather is suspected:

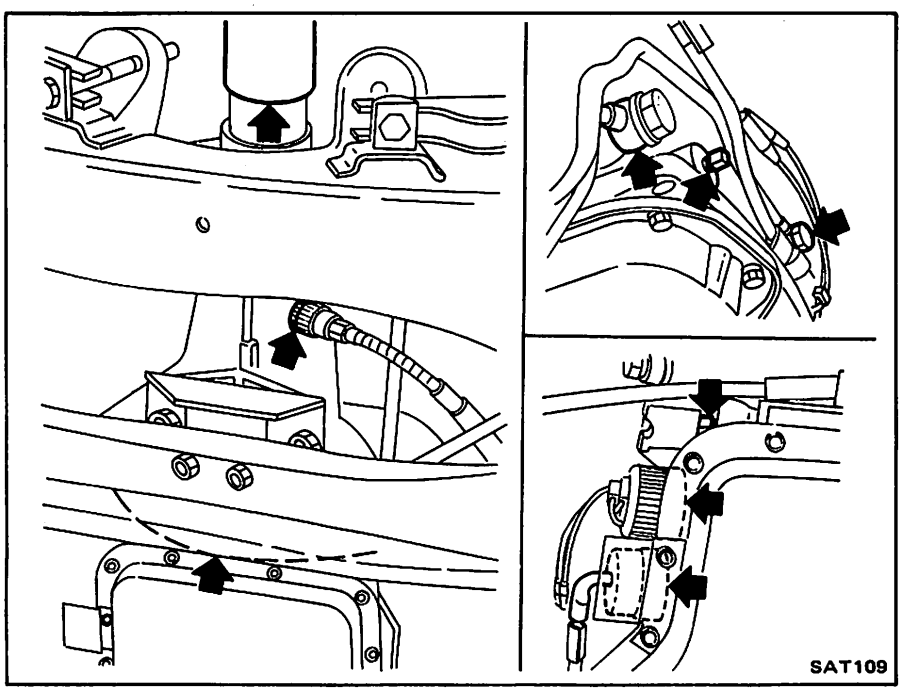
1) Raise vehicle.
2) Clean the area around the breather.
3) Run the vehicle at highway speeds.
4) Check the breather for fresh leakage.

To aid in locating leaks, use the following list of seals and gaskets.

1) Converter housing
- Rubber O-ring of oil pump housing.
- Oil pump housing oil seal (transmission front seal).
- Crankshaft oil seal.
- Bolts of converter housing to case.



2) Transmission and rear extension.
- Junction of transmission and rear extension.
- Oil cooler tube connectors.
- Oil pressure inspection ports.
- Vacuum diaphragm and downshift solenoid.
- Speedometer pinion sleeve.
- Rear extension oil seal.



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Fluid condition

Transmission fluid color and texture can aid greatly in transmission trouble-shooting. When checking fluid level, examine the transmission fluid and note its color, texture, and odor. Some common forms of contamination are listed below:

1) Dark or Black Fluid:
   With a burned odor
   – Worn friction material.
   Without an odor
   – Slight engine coolant leak (in radiator).
2) Milky Pink Fluid: Water Contamination
   – Coolant leak.
   – Road water entering through filler tube or breather.
3) Varnished Fluid, light to dark brown and tacky: Oxidation
   – Over or Underfilling.
   – Overheating.

Engine idle

Check and adjust idle to specifications.

Idling speed (at "D" range)
650 ±100 rpm

Engine oil and coolant levels

Prior to road testing, check engine oil and coolant levels, and fill as necessary.

Shift linkage

Start in park position, depress detent button and slowly move the gear selector through all ranges. The detent "clicks" should correspond with the range indicator.

DIAGNOSTIC ROAD TEST

Prior to road testing, perform the preliminary inspections outlined earlier. If the vehicle is not equipped with a tachometer, install a portable tachometer in the vehicle. And also install a suitable vacuum gauge and pressure gauge. If the customer has a specific complaint, select road conditions similar to those described. (e.g. steep hills, freeways, etc.)

Follow the test sequence as outlined in this section and mark the results on the Symptom Chart on page AT-59. It may be necessary to repeat sections of the test under different throttle conditions. (e.g. light, medium or full throttle.) After completing the road test, compare the test results to the Trouble-shooting Chart on page AT-56.

ROAD TESTING

1. Park Range

Place the gear selector in "P" range and start the engine. Stop the engine and repeat the procedure in all other ranges and neutral. In park, the vehicle should be locked in position, unable to roll or move. Mark all results on the Symptom Chart.

2. Reverse

Manually shift the gear selector from "P" to "R", and note shift quality. Drive the vehicle in reverse long enough to detect slippage or other abnormalities. Note results.

3. Neutral

Manually shift the gear selector from "P" to "N" and note quality. In neutral no clutches or bands are applied, and there should be no movement. Note results.

4. Drive Range

Manually shift the gear selector to range "D", and note shift quality. Drive the vehicle through all automatic shifts and in all gear ranges. Note shift quality and timing [km/h (MPH)], check for slippage, noise, or other abnormal conditions. If necessary, drive the test sequence under different throttle openings (e.g. light, medium or full throttle).

5. Range "2"

Manually shift the gear selector to range "2". Check for slippage, hesitation or abnormal condition. The transmission should remain in 2nd gear regardless of vehicle speed or engine revolutions. Note results.

6. Range "1"

Manually shift the gear selector to range "1". Note shift quality. It should, however, downshift immediately to 2nd gear and downshift again to 1st gear as road speed decreases. Accelerate and decelerate in 1st gear to determine engine braking Note results.

The transmission should not shift into 1st gear from "D" range if the vehicle road speed is above approximately 50 km/h (30 MPH).

7. Record line pressure and governor pressure at each range and at each throttle vacuum in accordance with the pressure testing described below.

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Vehicle speed and line pressure when shifting gears

Intake manifold vacuum –kPa (–mmHg, –inHg)	Gear shift	Vehicle speed* km/h (MPH)			Propeller shaft revolutions rpm	Line pressure kPa (kg/cm², psi)
		7.00-14(B)	185SR14(B)	195SR14(B)		
0 (0, 0) (Kickdown)	$D_1 \rightarrow D_2$	57 - 65 (36 - 40)	56 - 63 (35 - 39)	58 - 65 (36 - 40)	1,970 - 2,220	530 - 686 (5.4 - 7.0, 77 - 100)
	$D_2 \rightarrow D_3$	101 - 109 (63 - 67)	100 - 107 (62 - 66)	102 - 109 (63 - 68)	3,480 - 3,730	
	$D_3 \rightarrow D_2$	99 - 92 (62 - 57)	98 - 90 (61 - 56)	100 - 92 (62 - 57)	3,410 - 3,160	
	$D_2 \rightarrow D_1$	50 - 43 (31 - 27)	49 - 42 (31 - 26)	50 - 43 (31 - 27)	1,720 - 1,470	
13.3 (100, 3.94)	$D_1 \rightarrow D_2$	22 - 29 (14 - 18)	21 - 29 (13 - 18)	22 - 29 (14 - 18)	750 - 1,000	441 - 598 (4.5 - 6.1, 64 - 87)
	$D_2 \rightarrow D_3$	59 - 67 (37 - 41)	58 - 65 (36 - 41)	60 - 67 (37 - 42)	2,040 - 2,290	
	$D_3 \rightarrow D_2$	38 - 31 (23 - 19)	37 - 30 (23 - 19)	38 - 31 (24 - 19)	1,300 - 1,050	
	$D_2 \rightarrow D_1$	10 - 17 (6 - 11)	10 - 17 (6 - 11)	10 - 18 (6 - 11)	350 - 600	
0 (0, 0) (Full throttle)	$2_2 \rightarrow 2_1$	51 - 44 (32 - 27)	50 - 43 (31 - 27)	51 - 44 (32 - 27)	1,750 - 1,500	549 - 706 (5.6 - 7.2, 80 - 102)
40.0 (300, 11.81)	$2_2 \rightarrow 2_1$	51 - 44 (32 - 27)	50 - 43 (31 - 27)	51 - 44 (32 - 27)	1,750 - 1,500	549 - 706 (5.6 - 7.2, 80 - 102)

***Vehicle speed can be calculated by the following formula.**

$$V = \begin{cases} 0.0291 \times Np \text{ [7.00-14(B)]} \\ 0.0286 \times Np \text{ [185SR14(B)]} \\ 0.0292 \times Np \text{ [195SR14(B)]} \end{cases} \left(= \frac{2 \times \pi \times r \times Np \times 60}{R_F \times 1{,}000}\right)$$

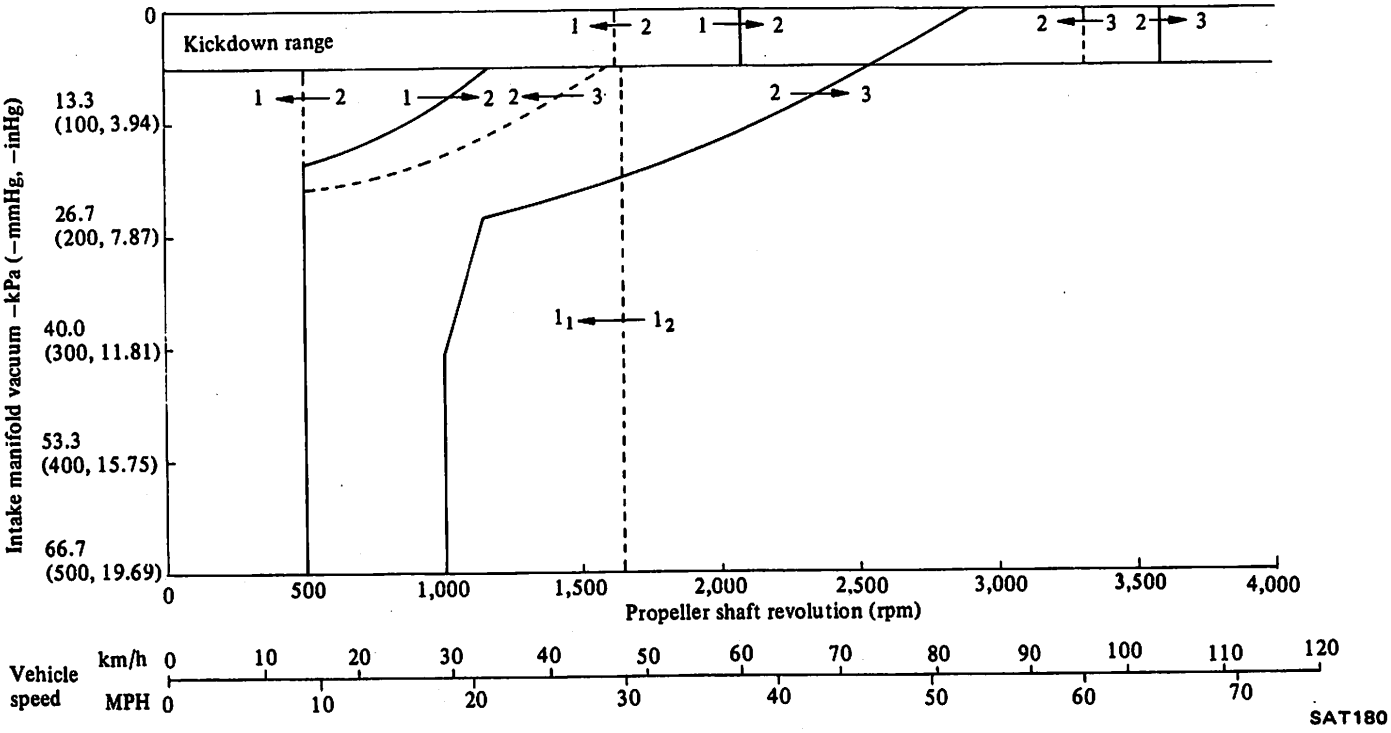
where, V : Vehicle speed (km/h)
Np : Propeller shaft revolution (rpm)
R_F : Final gear ratio (4.111)
r : Tire effective radius (m), 7.00-14(B) (0.317 m), 185SR14(B) (0.312 m), 195SR14(B) (0.319 m)
(π : The ratio of circumference of a circle to its diameter: 3.14)

$$V = \begin{cases} 0.01805 \times Np \text{ [7.00-14(B)]} \\ 0.01776 \times Np \text{ [185SR14(B)]} \\ 0.01817 \times Np \text{ [195SR14(B)]} \end{cases} \left(= \frac{2 \times \pi \times r \times Np \times 60}{R_F \times 63{,}360}\right)$$

where, V : : Vehicle speed (MPH)
Np : Propeller shaft revolution (rpm)
R_F : Final gear ratio (4.111)
r : Tire effective radius (in), 7.00-14(B) (12.48 in), 185SR14(B) (12.28 in), 195SR14(B) (12.56 in)
(π : The ratio of circumference of a circle to its diameter: 3.14)

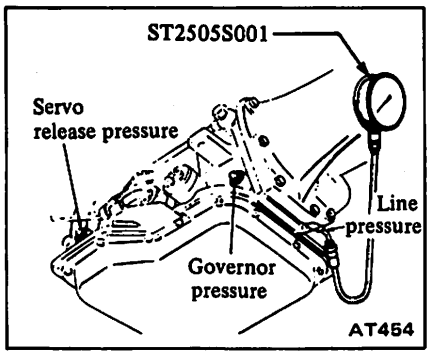
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Shift schedule



PRESSURE TESTING

The 3N71B transmission is provided with three pressure test ports. Only two are useful for transmission trouble-shooting, Line Pressure and Governor Pressure.



LINE PRESSURE

1. Install pressure gauge to line pressure port. (When shift lever is in "D", "2" or "1" range, install pressure gauge to port ① and when in "R" range, install pressure gauge to port ③ shown above.) Locate the gauge so it can be seen by driver. Measure line pressure at idling and at stall test.
2. Road test vehicle and note pressure under different throttle conditions.

At idling

Range	Line pressure kPa (kg/cm², psi)
R	412 - 549 (4.2 - 5.6, 60 - 80)
D	314 - 373 (3.2 - 3.8, 46 - 54)
2	588 - 1,147 (6.0 - 11.7, 85 - 166)
1	314 - 373 (3.2 - 3.8, 46 - 54)

At stall test

Range	Line pressure kPa (kg/cm², psi)
R	1,402 - 1,589 (14.3 - 16.2, 203 - 230)
D	971 - 1,089 (9.9 - 11.1, 141 - 158)
2	1,000 - 1,147 (10.2 - 11.7, 145 - 166)
1	971 - 1,089 (9.9 - 11.1, 141 - 158)

Key points of pressure testing are:

a) Pressure at idle: Look for a steady rise in pressure as vehicle speed increases under light load.

b) Pressure drop between shift points should not exceed 98 kPa (1.0 kg/cm², 14 psi). Excessive pressure drop may indicate an internal leak at a servo or clutch seal.

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Cut-back point

The cut-back point indicates a point where line pressure changes from high to low value as output shaft rotation is gradually increased from "stall" point. The vehicle speed and output shaft rotation at the cut-back point are as indicated in chart below.

Intake manifold vacuum –kPa (–mmHg, –inHg)	Vehicle speed km/h (MPH)			Propeller shaft revolutions rpm
	7.00-14(B)	185SR14(B)	195SR14(B)	
0 (0, 0)	38 - 45 (24 - 28)	37 - 45 (23 - 28)	38 - 46 (24 - 28)	1,310 - 1,560
13.3 (100, 3.94)	19 - 26 (12 - 16)	19 - 26 (12 - 16)	19 - 27 (12 - 17)	660 - 910

Line pressure "after cut-back" means point after the Pressure Modifier Valve has operated.

GOVERNOR PRESSURE

1. Install pressure gauge to governor pressure port. Locate the gauge so it can be seen by driver.
2. Road test car and note pressure at different road speeds. Governor pressure increases directly with road speed, and should always be less than line pressure.

STALL TESTING

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

CAUTION:

a. Transmission and engine fluid levels should always be checked and fluid added as needed.
b. Run engine at 1,200 rpm to attain proper warm-up.
c. During test, never hold throttle wide-open for more than 5 seconds.
d. Do Not test more than two gear ranges without driving vehicle to cool off engine and transmission.

STALL TEST PROCEDURE

1. Install a tachometer where it can be seen by driver during test.
2. Set hand brake and block wheels.
3. Start engine and place shift lever in "D" range.
4. Apply foot brake and accelerate to wide-open throttle. Do **not** hold throttle open longer than five seconds.
5. Quickly note the engine stall speed and immediately release throttle.

Stall revolution:
1,800 - 2,100 rpm

6. Place shift lever in "R" range and repeat above test (same as in "D" range).

If stall test indicates proper stall revolution in "D" range, no further testing is necessary.

STALL TEST ANALYSIS

1. Satisfactory results in "D" range indicates rear clutch, one-way clutch of transmission, and sprag clutch of torque converter, are functioning properly.
2. **Stall revolution in "D" range, 1st gear, is above vehicle specified:**
   The rear clutch is faulty.
3. **Stall revolution in "R" range is above specified revolution (for "D" range);**
   Low and Reverse Brakes are faulty.
4. **Stall revolution in "D" range, 1st gear is below specified revolution:**
   Converter sprag clutch is faulty (slipping), or engine is not performing properly.

If converter sprag clutch is frozen, vehicle will have poor high speed performance. If converter sprag clutch is slipping, vehicle will be sluggish up to 50 or 60 km/h (30 or 40 MPH).

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TROUBLE-SHOOTING CHART

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

	ON VEHICLE										OFF VEHICLE													
	Oil level	Range select linkage	Inhibitor switch and wiring	Vacuum diaphragm and piping	Kickdown solenoid, switch and wiring	Engine idling rpm	Throttle pressure	Manual control valve	Governor	Band servo	Transmission air check	Oil quality	Ignition switch and starter motor	Engine adjustment, brake inspection	Rear clutch	Front clutch	Band brake	Low and reverse brake	Oil pump	Oil passage leak	Transmission one-way clutch	Front clutch check ball	Park linkage
Engine does not start in "N", "P" ranges.	.	2	3	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Engine starts in range other than "N" and "P".	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Transmission noise in "P" and "N" ranges.	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	⑧	.	.	.	.
Vehicle moves when changing into "P" range or parking gear does not disengage when shifted out of "P" range	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	②	
Vehicle runs in "N" range.	.	1	.	.	.	.	.	3	.	.	.	2	.	.	④	.	.	.	.	.	.	.	.
Vehicle will not run in "R" range (but runs in "D", "2" and "1" ranges.) Clutch slips. Very poor acceleration.	1	2	.	.	.	.	3	5	.	.	6	4	.	.	⑨	⑧	.	⑦	.	⑩	.	⑪	.
Vehicle braked when shifting into "R" range.	.	.	.	.	.	.	.	.	.	3	2	1	.	.	④	.	⑤	.	.	.	.	.	⑥
Sharp shock in shifting from "N" to "D" range.	.	.	.	2	.	1	3	4	.	.	.	.	.	.	⑤	.	.	.	.	.	.	.	.
Vehicle will not run in "D" range (but runs in "2", "1" and "R" ranges).	.	1	.	.	.	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	④	.	.
Vehicle will not run in "D", "1", "2" ranges (but runs in "R" range). Clutch slips. Very poor acceleration.	1	2	.	.	.	.	4	5	.	.	6	3	.	7	⑧	.	.	.	.	⑨	.	.	.
Clutches or brakes slip somewhat in starting.	1	2	.	6	.	.	3	5	.	.	7	4	.	.	.	.	.	.	⑧	⑨	.	.	.
Excessive creep.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
No creep at all.	1	2	.	.	.	3	.	5	.	.	.	4	.	.	⑧	⑨	.	.	⑥	⑦	.	.	.
Failure to change gear from "1st" to "2nd".	.	1	.	2	3	.	.	5	6	8	7	4	.	.	.	⑨	.	.	.	⑩	.	⑪	.
Failure to change gear from "2nd" to "3rd".	.	1	.	2	3	.	.	5	6	8	7	4	.	.	.	.	⑨	.	.	⑩	.	.	.
Too high a gear change point from "1st" to "2nd", from "2nd" to "3rd".	.	.	.	1	2	.	3	5	6	.	.	4	.	.	.	.	.	.	.	⑦	.	.	.
Gear change directly from "1st" to "3rd" occurs.	.	.	.	.	.	.	.	2	4	.	3	1	.	.	.	.	⑤	.	.	⑥	.	.	.
	ON VEHICLE														OFF VEHICLE								

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

	ON VEHICLE									OFF VEHICLE				
	Oil level	Range select linkage	Vacuum diaphragm and piping	Kickdown solenoid, switch and wiring	Throttle pressure	Engine stall rpm	Manual control valve	Governor	Band servo	Transmission air check	Oil quality	Engine adjustment, brake inspection	Rear clutch	Front clutch	Band brake	Low and reverse brake	Oil pump	Oil passage leak	Transmission one-way clutch	Front clutch check ball
Too sharp a shock in change from "1st" to "2nd".			1			2		4	5		3				⑥					
Too sharp a shock in change from "2nd" to "3rd".			1	2	3			3	5	4				⑤						
Almost no shock or clutches slipping in change from "1st" to "2nd".	1	2	3		4		6		8	7	5				⑨			⑩		
Almost no shock or slipping in change from "2nd" to "3rd". Engine races extremely.	1	2	3		4		6		8	7	5			⑨				⑩		⑪
Vehicle braked by gear change from "1st" to "2nd".							2				1			④		③			⑤	
Vehicle braked by gear change from "2nd" to "3rd".							3		2		1				④					
Maximum speed not attained. Acceleration poor.	1	2			4	5	7		6		3	8	⑪	⑫	⑨	⑩	⑬			
Failure to change gear from "3rd" to "2nd".			1				3	4	6	5	2			⑦	⑧			⑨		
Failure to change gear from "2nd" to "1st" or from "3rd" to "1st".			1				3	4	6	5	2				⑦				⑧	
Gear change shock felt during deceleration by releasing accelerator pedal.		1	2	3	4		5	6										⑦		
Too high a change point from "3rd" to "2nd", from "2nd" to "1st".		1	2	3	4		5	6										⑦		
Kickdown does not operate when depressing pedal in "3rd" within kickdown vehicle speed.			2	1			4	5		3					⑥			⑦		
Kickdown operates or engine overruns when depressing pedal in "3rd" beyond kickdown vehicle speed limit.		1	2		3		5	6		7	4			⑧				⑨		
Races extremely or slips in changing from "3rd" to "2nd" when depressing pedal.			1		2		4		6	5	3			⑦	⑧			⑨		⑩
	ON VEHICLE									OFF VEHICLE				

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

	ON VEHICLE									OFF VEHICLE					
	Oil level	Range select linkage	Vacuum diaphragm and piping	Engine idling rpm	Throttle pressure	Engine stall rpm	Rear lubrication	Manual control valve	Governor	Band servo	Transmission air check	Oil quality	Rear clutch	Front clutch	Band brake	Low and reverse brake	Oil pump	Oil passage leak	Torque converter, one-way clutch	Transmission one-way clutch	Park linkage	Planetary gear
Vehicle will not run in any range.	1	2	.	.	3	.	.	5	.	.	6	4	.	.	.	.	⑦	⑧	.	.	⑨	.
Transmission noise in "D", "2", "1" and "R" ranges.	1	.	.	.	2	.	.	.	.	.	.	.	③	.	.	.	④	.	.	⑤	.	⑥
Failure to change from "3rd" to "2nd" when changing lever into "2" range.	.	1	.	.	2	.	.	4	.	5	.	3	.	.	⑥	.	.	⑦	.	.	.	.
Gear change from "2nd" to "1st" or from "2nd' " to "3rd" in "2" range.	.	1	.	.	2	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
No shock at change from "1" to "2" range or engine races extremely.	1	2	3	4	.	5	.	7	.	.	8	6	.	.	⑨	.	⑩	.	.	.	.	.
Failure to change from "3rd" to "2nd" when shifting lever into "1" range.	.	1	.	.	2	.	.	4	5	7	6	3	.	⑧	⑨	.	.	⑩	.	.	.	.
Engine brake does not operate in "1" range.	.	1	.	.	2	.	.	4	.	.	5	3	.	.	.	⑥	.	⑦	.	.	.	.
Gear change from "1st" to "2nd" or from "2nd" to "3rd" in "1" range.	.	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	③	.	.	.	.
Does not change from "2nd" to "1st" in "1" range.	1	2	.	.	.	.	.	4	5	6	7	3	.	.	.	⑧	.	⑨	.	.	.	.
Large shock changing from "2nd' " to "1st" in "1" range.	.	.	1	.	.	2	.	4	.	.	.	3	.	.	.	⑤	.	.	.	.	.	.
Transmission overheats.	1	.	.	.	3	4	2	6	.	8	7	5	.	⑨	⑩	⑪	⑫	⑬	⑭	.	.	⑮
Oil shoots out during operation. White smoke emitted from exhaust pipe during operation.	1	.	3	.	5	6	2	7	.	.	8	4	.	⑨	⑩	⑪	⑫	⑬	⑭	.	.	⑮
Offensive smell at oil charging pipe.	1	.	.	.	.	.	.	.	.	.	.	2	③	④	⑤	⑥	⑦	⑧	⑨	.	.	⑩
	ON VEHICLE									OFF VEHICLE					

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ROAD TEST SYMPTOM CHART

		SHIFT QUALITY				VEHICLE WON'T MOVE	CRUISE SLIPPAGE	POOR POWER/ACCELERATION	NOISY	OK	COMMENTS
		ROUGH	SHIFT TIMING [Mark km/h (MPH)]	NO SHIFT	SHIFT SLIPPAGE						
PARK RANGE	ENG. START										
	HOLDING										
"R" RANGE	Man. shift P-R										
	REVERSE										
"N" RANGE	Man. shift R-N										
	ENG. START										
	N										
"D" RANGE	Man. shift N-D										
	1st										
	Auto shift 1-2										
	2nd										
	Auto shift 2-3										
	3rd										
	Decel. 3-2										
	Kickdown 3-2										
	Decel. 2-1										
	Kickdown 2-1										
"2" RANGE	Man. shift D-2										
	2nd										
"1" RANGE	Man. shift 2-1										
	Man. shift D-1										
	Acceleration										
	"1" Engine Braking										

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TROUBLE-SHOOTING GUIDE FOR 3N71B AUTOMATIC TRANSMISSION

Order	Test item	Procedure
Checking	1. Oil level gauge	Check gauge for oil level and leakage before and after each test.
	2. Downshift solenoid	Check for sound of operating solenoid when depressing accelerator pedal fully with ignition key "ON".
	3. Manual linkage	Check by shifting into "P", "R", "N", "D", "2" and "1" ranges with selector lever.
	4. Inhibitor switch	Check whether starter operates in "N" and "P" ranges only and whether reverse lamp operates in "R" range only.
	5. Engine idling rpm.	Check whether idling rpm meet standard.
	6. Vacuum pressure of vacuum pipe.	Check whether vacuum pressure is more than 60.0 kPa (450 mmHg, 17.72 inHg) in idling and whether it decreases with increasing rpm.
	7. Operation in each range.	Check whether transmission engages positively by shifting "N" → "D", "N" → "2", "N" → "1" and "N" → "R" range while idling with brake applied.
	8. Creep of car.	Check whether there is any creep in "D", "2", "1" and "R" ranges.
Stall test	1. Oil pressure before testing.	Measure line pressures in "D", "2", "1" and "R" range while idling.
	2. Stall test.	Measure engine rpm and line pressure in "D", "2", "1" and "R" ranges during full throttle operation. **Temperature of torque converter oil used in test should be from 60 to 100°C (140 to 212°F) i.e., sufficiently warmed up but not overheated.** **CAUTION:** **To cool oil between each stall test for "D", "2", "1" and "R" ranges, idle engine, i.e., rpm at about 1,200 rpm for more than 1 minute in "P" range. Measurement time must not be more than 5 seconds.**
	3. Oil pressure after testing	Same as item 1.
Road test	1. Slow acceleration, 1st → 2nd 2nd → 3rd	Check vehicle speeds and engine rpm in shifting up 1st → 2nd range and 2nd → 3rd range while running with lever in "D" range and engine vacuum pressure of about 13.3 kPa (100 mmHg, 3.94 inHg).
	2. Quick acceleration, 1st → 2nd 2nd → 3rd	Same as item 1 above except with engine vacuum pressure of 0 kPa (0 mmHg, 0 inHg) (i.e., in position just before kickdown).
	3. Kick-down operation, 3rd → 2nd or 2nd → 1st	Check whether the kickdown operates and measure the time delays while running at 30, 40, 50, 60, 70 km/h (19, 25, 31, 37, 43 MPH) in "D_3" range.

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Order	Test item	Procedure
	4. Shift down, $D_3 \rightarrow D_2 \rightarrow D_1$	Check vehicle speeds and engine rpm in shifting down from 3rd → 2nd → 1st (sequentially) while coasting with accelerater pedal released in "D_3" range and engine vacuum pressure of about 60.0 kPa (450 mmHg, 17.72 inHg).
	5. Shift down, $D_3 \rightarrow 1_2 \rightarrow 1_1$	Check for shifting down $D_3 \rightarrow 1_2$ and engine braking, and further for shifting down $1_2 \rightarrow 1_1$ and engine braking after shifting the lever into "1" range with the accelerator pedal released and the engine vacuum pressure of 0 kPa (0 mmHg, 0 inHg) while driving at about 50 km/h (30 MPH) in "D_3" range.
	6. Shift down, $D_3 \rightarrow 2$	Check for quick shifting down $D_3 \rightarrow 2$ and engine braking, after shifting the lever into "2" range while driving at about 50 km/h (30 MPH) in "D_3" range. Also, check for locking of the transmission in 2nd gear ratio regardless of vehicle speed.
	7. Shift up, $1_1 \rightarrow 1_2$	Check for failure of the transmission to shift up during acceleration, when starting in "1" range.
	8. Shift up or down when starting in "2" range.	Check the transmission for not shifting up or down during acceleration or deceleration, when starting in "2" range.
	9. Parking.	Confirm that vehicle will not move on grade when shifting to "P" range.
Others	Abnormal shock, oil leakage.	Enter into record conditions observed during these tests such as gear noise, abnormal clutch noise and acceleration performance.

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

General specifications

Automatic transmission model		3N71B
Stall torque ratio		2.0 : 1
Transmission gear ratio	1st	2.458
	2nd	1.458
	Top	1.000
	Reverse	2.182
Oil		Automatic transmission fluid "Dexron" type
Oil capacity		5.5 liters (5-7/8 US qt, 4-7/8 Imp qt) Approximately 2.7 liters (2-7/8 US qt, 2-3/8 Imp qt) in torque converter

Specifications and adjustment

Automatic transmission assembly Model code number		X2305	
Torque converter assembly Stamped mark on the T/C		G	
Front clutch	Number of drive plates	3	
	Number of driven plates	5	
	Clearance mm (in)	1.6 - 2.0 (0.063 - 0.079)	
	Thickness of retaining plate	Thickness mm (in)	Part number
		5.0 (0.197)	31567-X2900
		5.2 (0.205)	31567-X2901
		5.4 (0.213)	31567-X2902
		5.6 (0.220)	31567-X2903
		5.8 (0.228)	31567-X2904
		6.0 (0.236)	31567-X2905
		6.2 (0.244)	31567-X2906

Rear clutch	Number of drive plates	5	
	Number of driven plates	5	
	Clearance mm (in)	0.8 - 1.6 (0.031 - 0.063)	
	Thickness of retaining plate mm (in)	8.35 (0.3287)	
Low & reverse brake	Number of drive plates	5	
	Number of driven plates	5	
	Clearance mm (in)	0.80 - 1.25 (0.0315 - 0.0492)	
	Thickness of retaining plate	Thickness mm (in)	Part number
		7.8 (0.307)	31667-X0500
		8.0 (0.315)	31667-X0501
		8.2 (0.323)	31667-X0502
		8.4 (0.331)	31667-X0503
		8.6 (0.339)	31667-X0504
		8.8 (0.346)	31667-X0505
Brake band Piston size mm (in)	Big dia.	60 (2.36)	
	Small dia.	36 (1.42)	
Control valve assembly Stamped mark on strainer		LRK	
Governor assembly Stamped mark on governor body		35	

Stall revolution

Stall revolution rpm	1,800 - 2,100

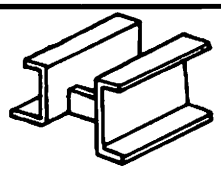
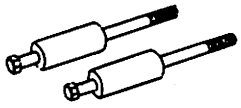
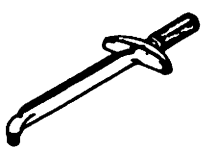
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Tightening torque

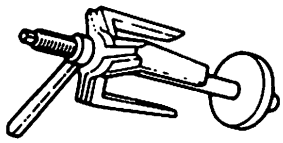
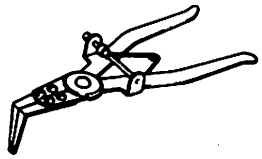
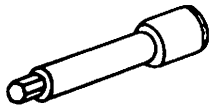
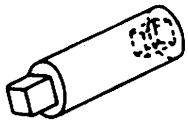
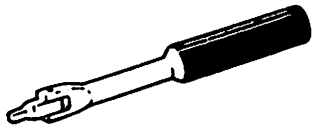
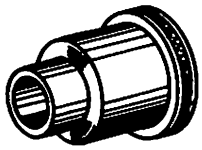
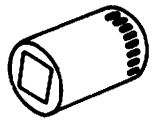
Unit	N·m	kg-m	ft-lb
Drive plate to crankshaft	137 - 157	14.0 - 16.0	101 - 116
Drive plate to torque converter	39 - 49	4.0 - 5.0	29 - 36
Converter housing to engine	39 - 49	4.0 - 5.0	29 - 36
Transmission case to converter housing	44 - 54	4.5 - 5.5	33 - 40
Transmission case to rear extension	20 - 25	2.0 - 2.5	14 - 18
Oil pan to transmission case	5 - 7	0.5 - 0.7	3.6 - 5.1
Servo piston retainer to transmission case	5 - 7	0.5 - 0.7	3.6 - 5.1
Piston stem (when adjusting band brake)	*12 - 15	*1.2 - 1.5	*9 - 11
Piston stem lock nut	15 - 39	1.5 - 4.0	11 - 29
One-way clutch inner race to transmission case	13 - 18	1.3 - 1.8	9 - 13
Control valve body to transmission case	5.4 - 7.4	0.55 - 0.75	4.0 - 5.4
Lower valve body to upper valve body	2.5 - 3.4	0.25 - 0.35	1.8 - 2.5
Side plate to control valve body	2.5 - 3.4	0.25 - 0.35	1.8 - 2.5
Nut for control valve reamer bolt	5 - 7	0.5 - 0.7	3.6 - 5.1
Oil strainer to lower valve body	3 - 4	0.3 - 0.4	2.2 - 2.9
Governor valve body to oil distributor	5 - 7	0.5 - 0.7	3.6 - 5.1
Oil pump housing to oil pump cover	6 - 8	0.6 - 0.8	4.3 - 5.8
Inhibitor switch to transmission case	5 - 7	0.5 - 0.7	3.6 - 5.1
Manual shaft lock nut	29 - 39	3.0 - 4.0	22 - 29
Oil cooler pipe to transmission case	29 - 49	3.0 - 5.0	22 - 36
Test plug (oil pressure inspection hole)	14 - 21	1.4 - 2.1	10 - 15
Support actuator (parking rod inserting position) to rear extension	8 - 11	0.8 - 1.1	5.8 - 8.0

* Turn back two turns after tightening.

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name	
ST07870000 (–) (ST07860000) (J25605)	Transmission case stand	
ST25850000 (J25721)	Sliding hammer	
GG91060000 (–) (GG93010000) (J25703)	Torque wrench	

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Tool number (Kent-Moore No.)	Tool name
ST25420001 (J26063) (ST25420000) (J26063)	Clutch spring compressor 
ST25320001 (J8059)	Snap ring remover 
ST25570001 (J23659) (ST25570000) (J23659)	Hex-head extension 
ST25490000 (–) (ST25512001) (J25713)	Socket extension 
HT62350000 (–)	Spinner handle 
ST25160000 (–)	Torque driver 
ST25580001 (J25719)	Oil pump assembling gauge 
HT61000800 (–)	Hexagon wrench 
ST2505S001 (J25695)	Oil pressure gauge set 

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SECTION TF

CONTENTS

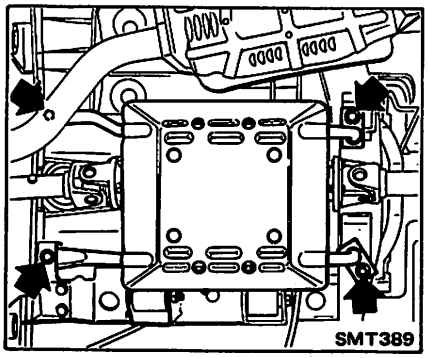
REMOVAL AND INSTALLATION . . . . . TF- 2
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TRANSFER CASE FRONT COVER, TRANSFER FRONT CASE AND TRANSFER REAR CASE (Replacement of oil seals and bearings) TF-11
SERVICE DATA AND SPECIFICATIONS (S.D.S.) TF-13
GENERAL SPECIFICATIONS TF-13
INSPECTION AND ADJUSTMENT TF-13
TIGHTENING TORQUE TF-13
TROUBLE DIAGNOSES AND CORRECTIONS TF-14
SPECIAL SERVICE TOOLS TF-17

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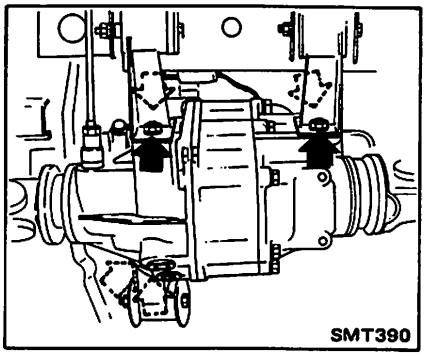
REMOVAL AND INSTALLATION

REMOVAL

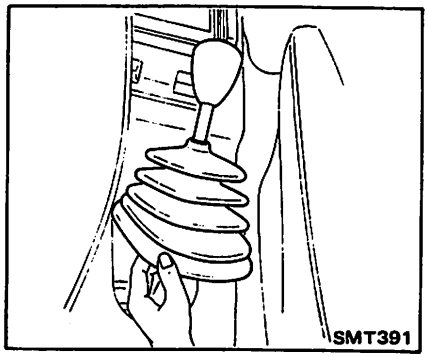
1. Disconnect battery ground cable.
2. Jack up vehicle and support its weight on safety stands. Use a hydraulic hoist or open pit, if available.
   Make sure that safety is insured.
3. Remove transfer protector.


SMT389

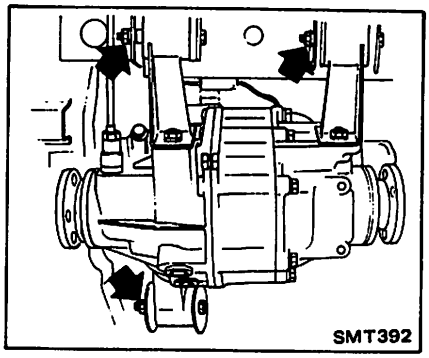
4. Remove pre-propeller shaft securing nuts.
5. Remove front and rear propeller shafts. Refer to Propeller Shaft (Section PD) for removal.
6. Disconnect wire for 4-wheel drive switch.
7. Disconnect speedometer cable.
8. Remove exhaust tube assembly. Refer to Exhaust System (Section FE) for removal.
9. Support transfer with transmission jack.
10. Loosen transfer insulator securing bolt temporarily.


SMT390

11. Remove transfer control lever rubber boot from floor.


SMT391

12. Remove transfer unit with pre-propeller shaft from vehicle.


SMT392

13. Remove insulators from transfer.

INSTALLATION

Install transfer in reverse order of removal, paying attention to the following points.

1. Remove filler plug and fill transfer with recommended gear oil to level of plug hole.

Oil capacity:
1.4 ℓ (3 US pt, 2-1/2 Imp pt)

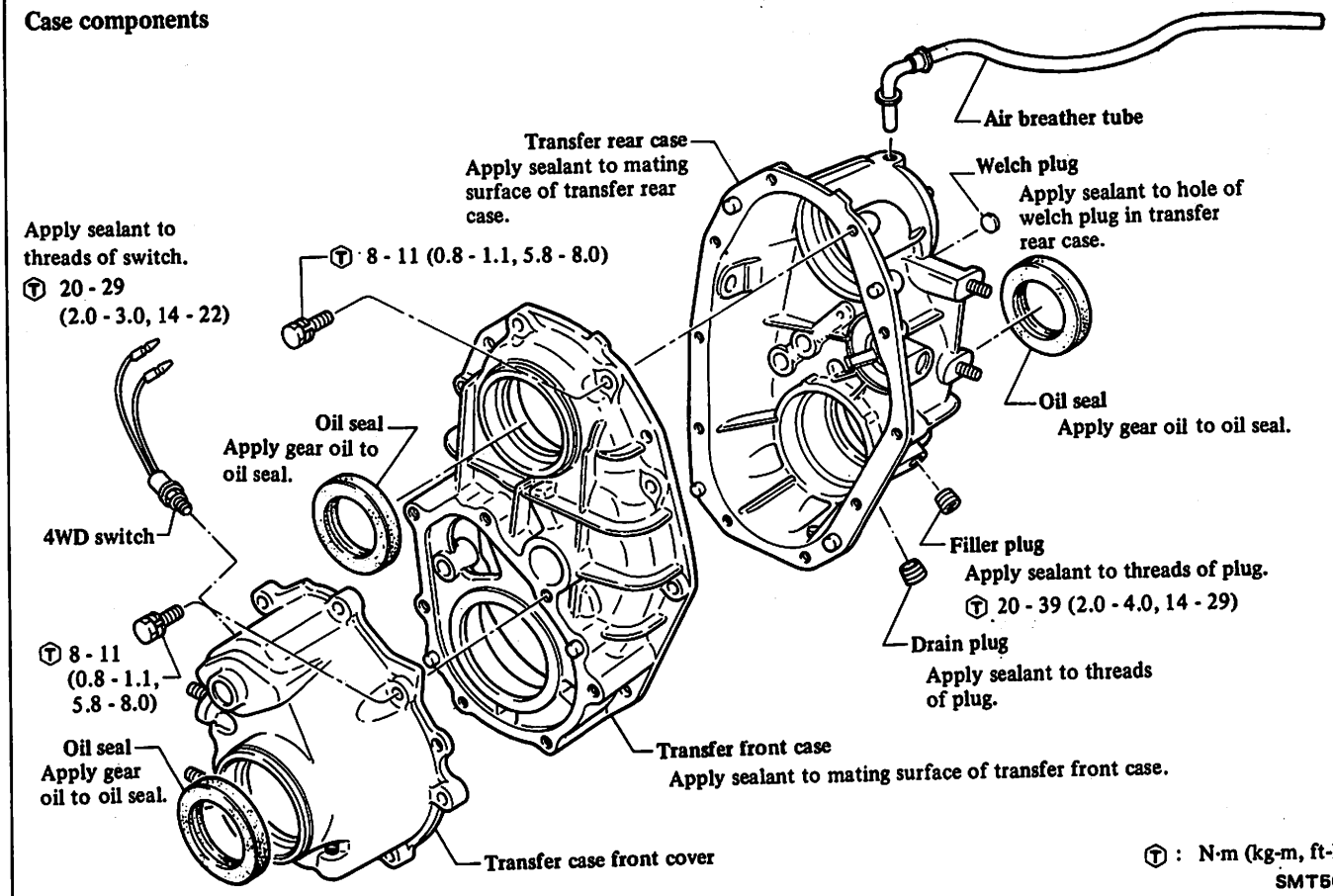
2. Apply sealant to threads of filler plug, and install filler plug to transfer case.

Ⓣ : Filler plug
20 - 39 N·m
(2.0 - 4.0 kg-m,
14 - 29 ft-lb)

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TRANSFER (Model : T100L)

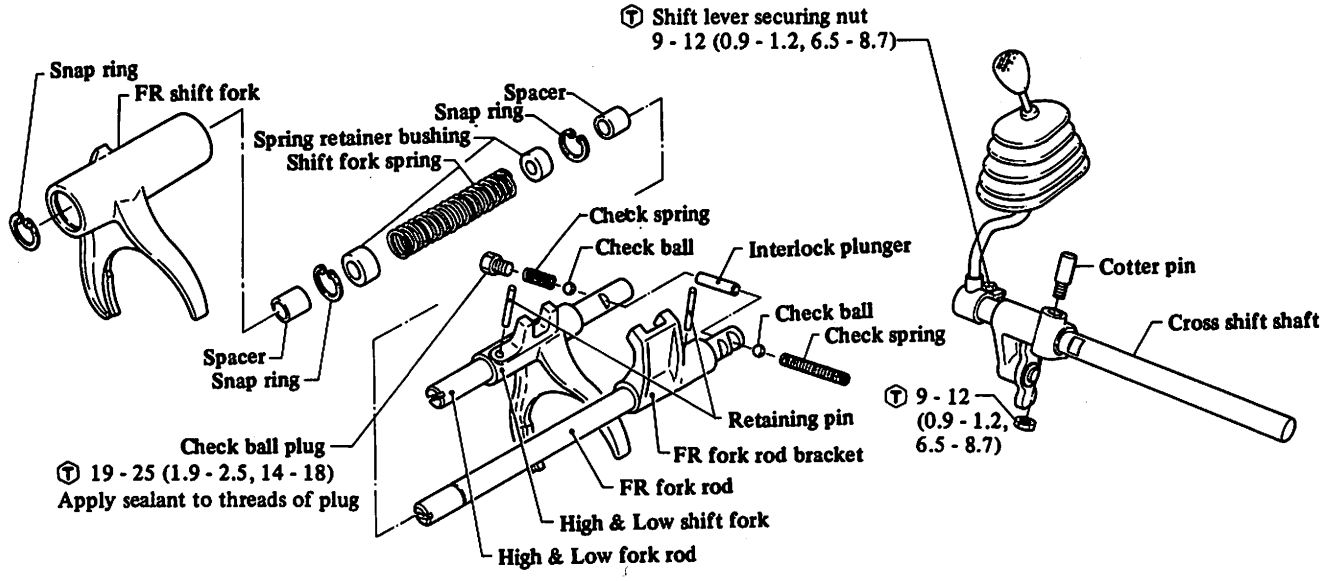
Case components



T : N·m (kg-m, ft-lb)

SMT509

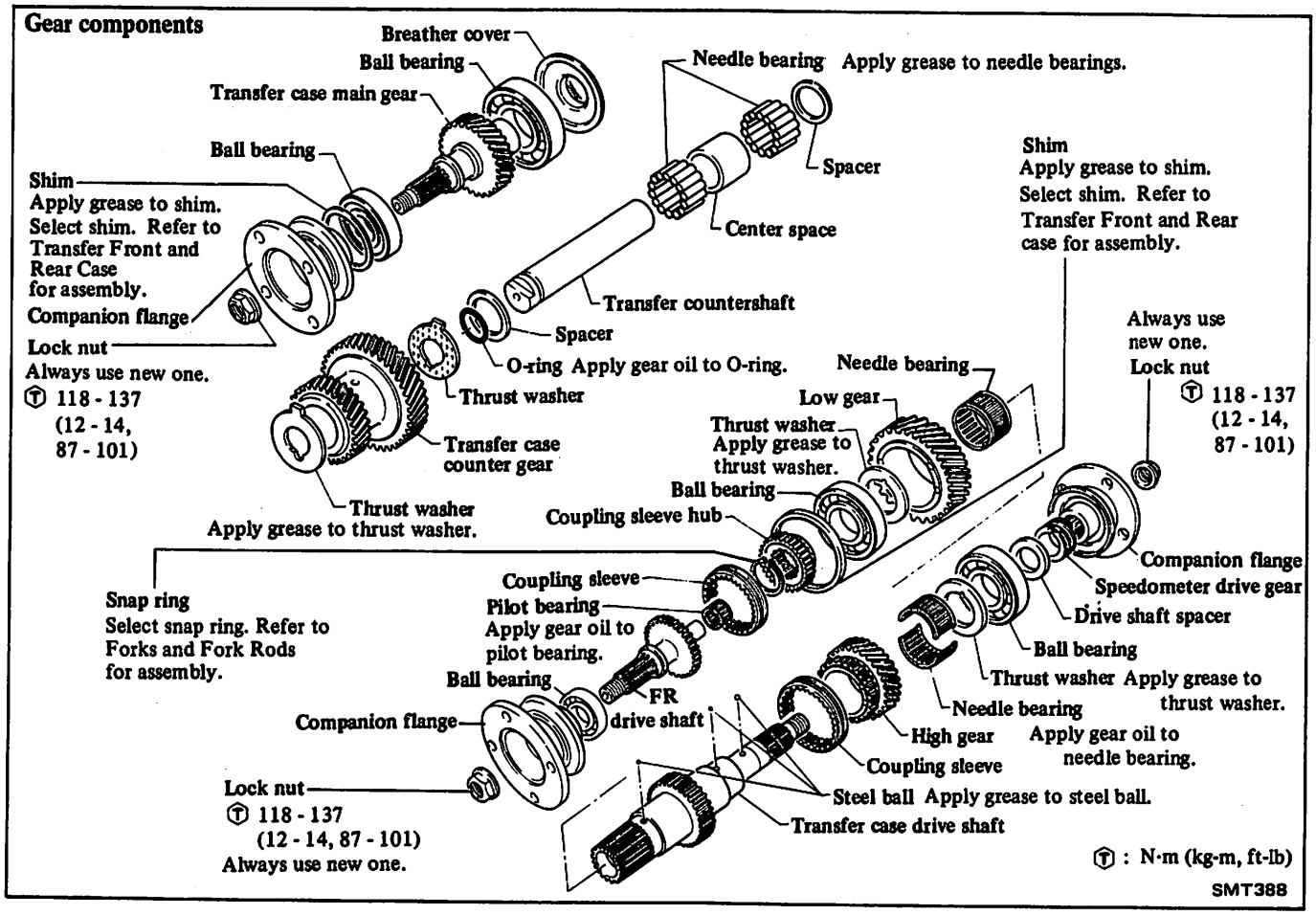
Shift control components



T : N·m (kg-m, ft-lb)

SMT387

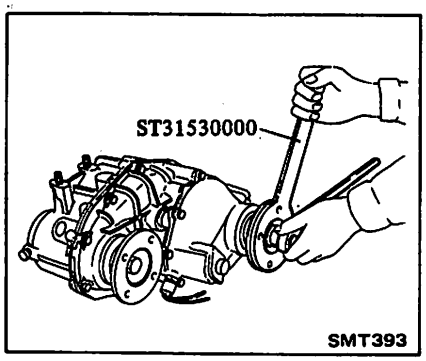
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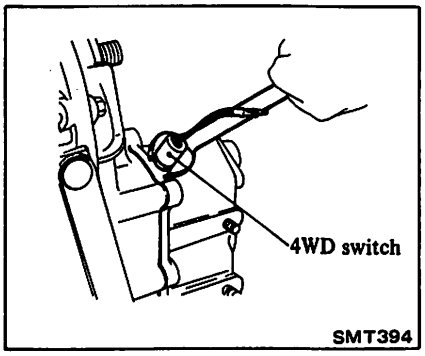
FORKS AND FORK RODS

DISASSEMBLY

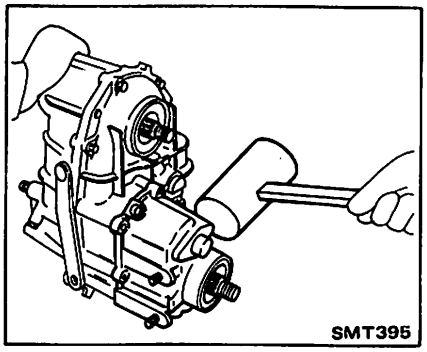
1. Wipe off dirt and grease.
2. Drain oil.
3. Shift control lever to 4L and 2H positions, then remove companion flange lock nuts.



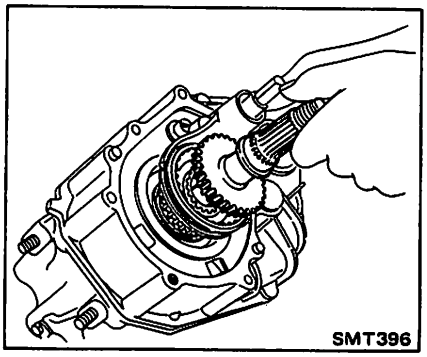
4. Remove three companion flanges.
5. Remove 4WD switch.



6. Remove transfer case front cover by tapping it with soft faced hammer.

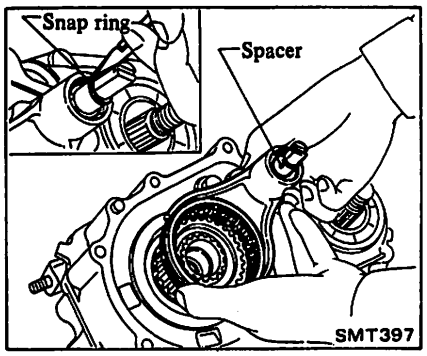


7. Remove FR drive shaft and needle bearing.

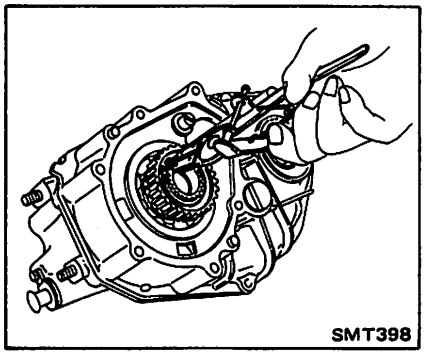


8. Remove snap ring retaining FR shift fork, then remove FR shift fork assembly and spacer together with coupling sleeve.

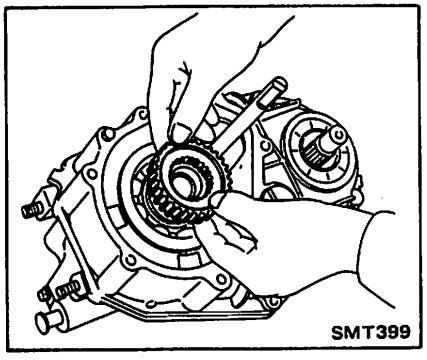
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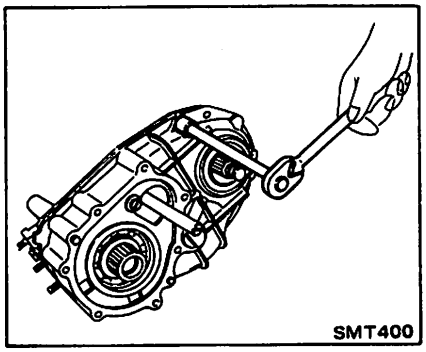
9. Remove snap ring retaining coupling sleeve hub.



10. Remove coupling sleeve hub.

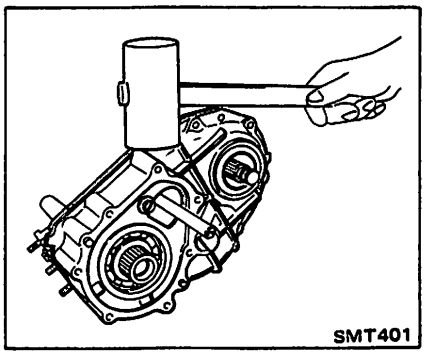


11. Remove transfer front case securing bolts.

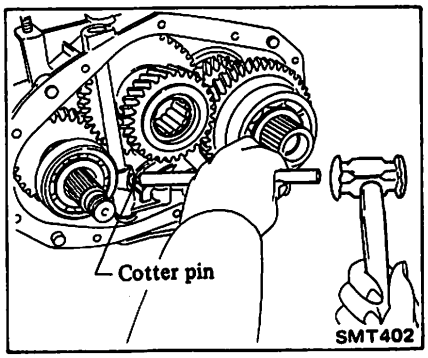


12. Remove transfer front case by tapping it with soft faced hammer.

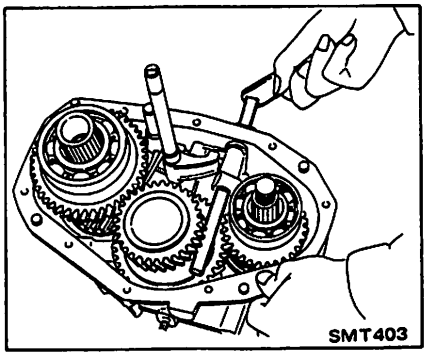
Do not pry transfer front or rear cases with screwdriver.



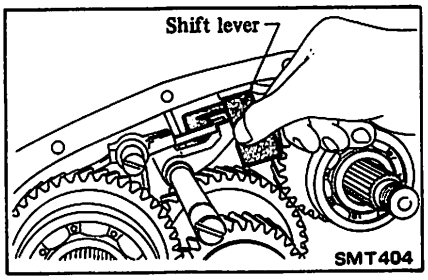
13. Remove cotter pin nut, then remove cotter pin by tapping it with hammer.



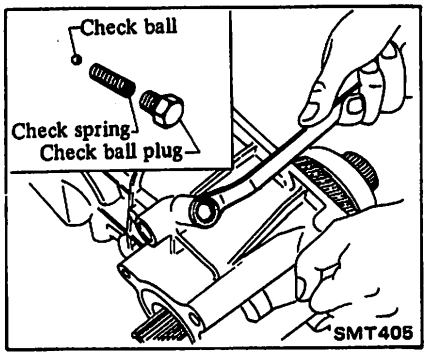
14. Remove cross shift shaft.



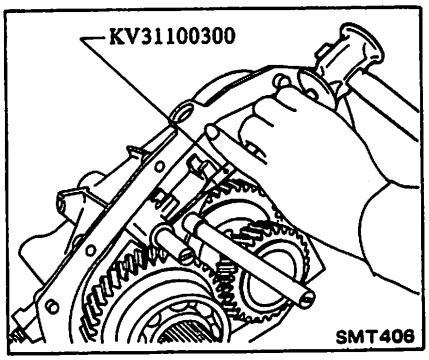
15. Remove shift lever with differential lever.



16. Remove check ball plug, check spring and check ball.



17. Drive out High & Low shift fork retaining pin.

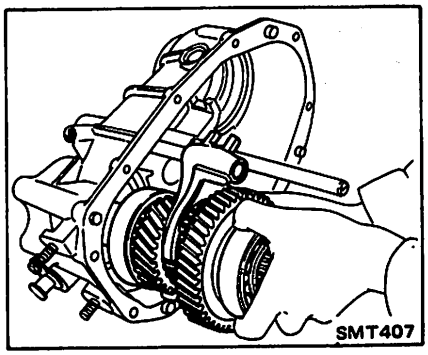


18. Tap rear end of transfer case drive shaft assembly, then remove it with High & Low shift fork and counter gear assembly. Transfer case main gear assembly can be pulled out.

When removing counter gear assembly, be careful not to drop needle bearings.

Remove transfer case front shim.

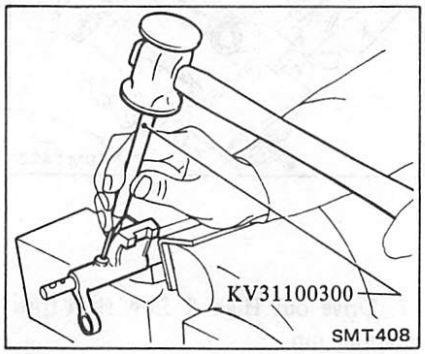
Be careful not to lose shim.



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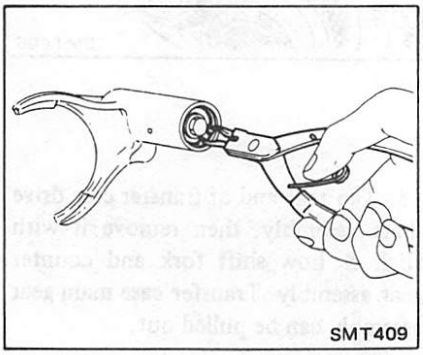
19. Remove High & Low and FR fork rods, interlock plunger, steel ball and check spring.
20. Place FR fork rod in a vise, then drive out retaining pin.

FR fork rod bracket can be removed.

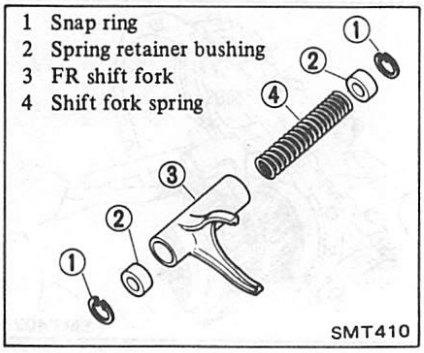


21. Insert M8 bolt into FR shift fork and tighten nut to eliminate shift fork spring tension.

Remove snap ring with snap ring plier.

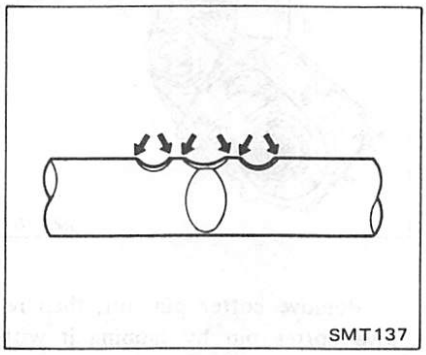


22. Remove spring retainer bushings and shift fork spring. Separate spring retainer bushing and shift fork spring.



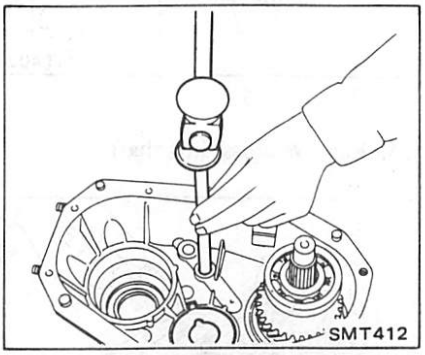
INSPECTION

Clean with solvent and check for wear, scratches, projection, damage or other faulty conditions. Replace any part which is worn or damaged.



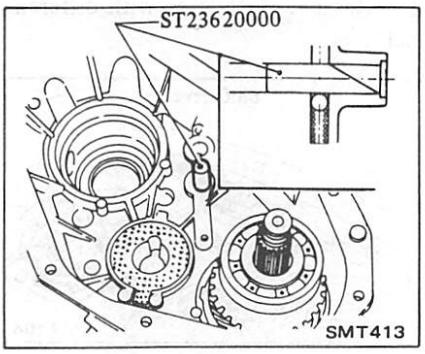
ASSEMBLY

1. Install breather cover, then install transfer main gear assembly by tapping it.
2. Drive out FR shift fork welch plug. This step is necessary for installing FR shift fork.

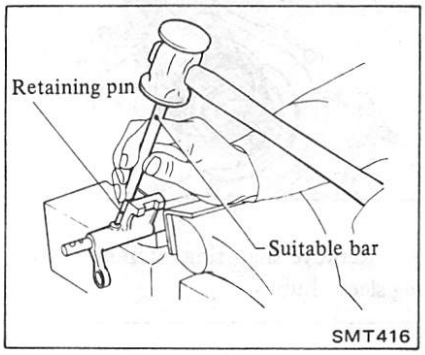


3. Install check spring and steel ball into hole of transfer rear case.
4. Using Tool, retain steel ball.

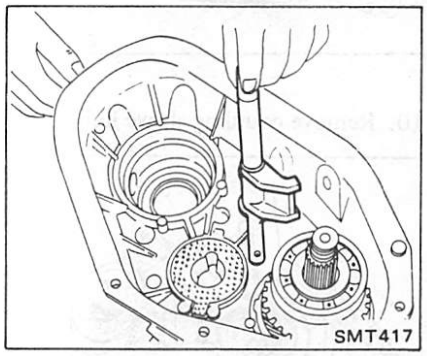
Be careful not to lose check ball and steel ball as the spring force may force them out.



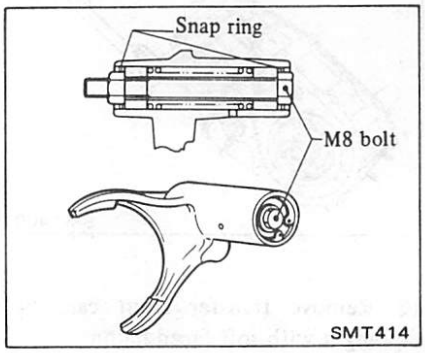
5. Install High & Low shift fork into coupling sleeve.
6. Place FR fork rod in a vise, then install retaining pin.



7. Install FR fork rod pushing Tool ST23620000 out of position. Install interlock pin.



8. Secure FR fork rod bracket to FR fork rod with retaining pin.
9. Assemble snap ring, spring retainer bushings and shift fork spring to FR shift fork. Insert M8 bolt into spring retainer bushing and tighten nut to eliminate spring tension.



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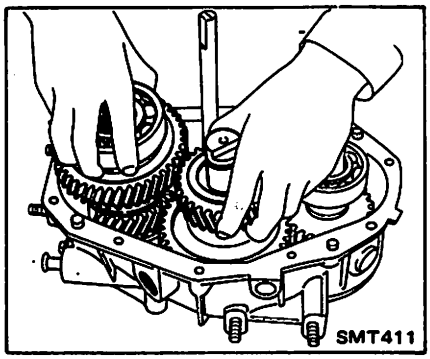
10. Install the other snap ring. Remove bolt and nut.
11. Install new O-ring to countershaft, then install it to transfer rear case.

When installing O-ring, be sure to apply gear oil to it.

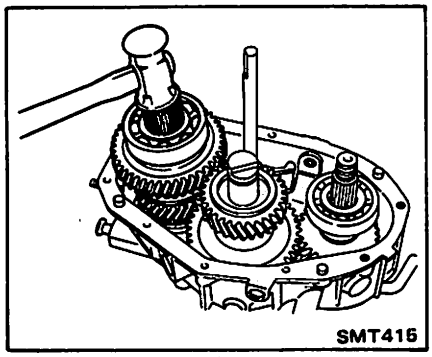
12. Install counter gear assembly.

Make sure that counter gear thrust washer is already installed.

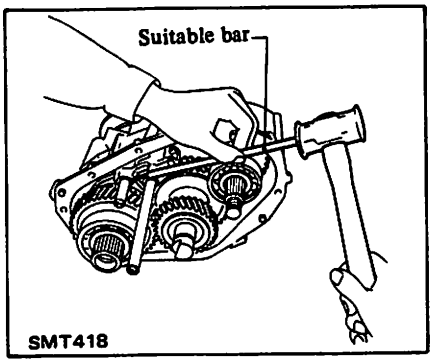
13. While raising counter gear assembly slightly, install transfer case drive shaft assembly and engage each gear.



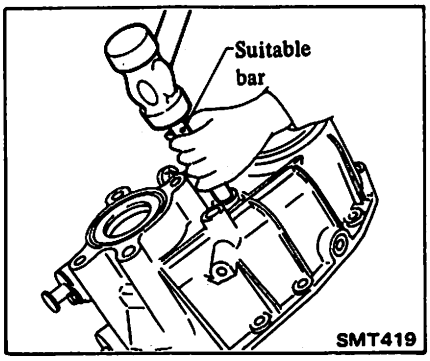
14. Install companion flange at rear side of drive shaft, and tighten finger tight.
15. Tap front end of drive shaft assembly and install it into transfer rear case.



16. Install High & Low fork rod, then secure with retaining pin.

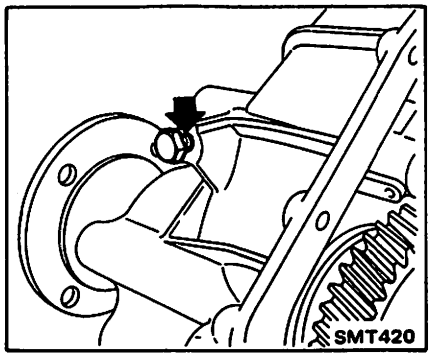


17. Apply sealant to hole of welch plug in transfer rear case and install welch plug in it.



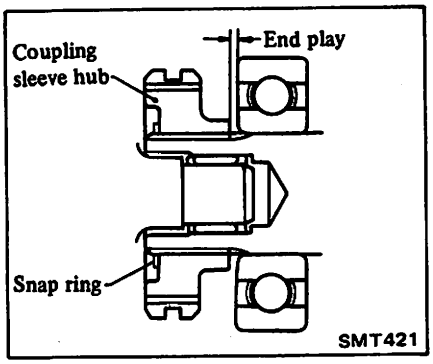
18. Install check ball and check spring.
19. Apply sealant to threads of plug, then tighten it.

Ⓣ: 19 - 25 N·m (1.9 - 2.5 kg-m, 14 - 18 ft-lb)

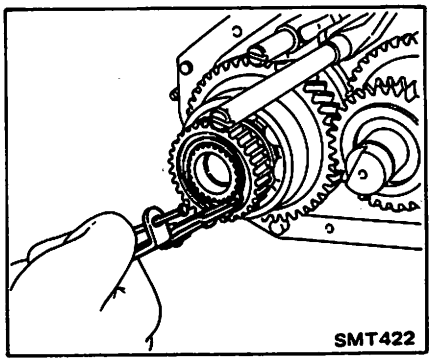


20. Select snap ring so that end play is within specified limit.

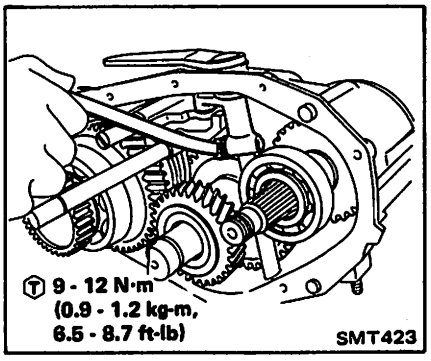
Coupling sleeve hub end play:
0 - 0.20 mm (0 - 0.0079 in)
Coupling sleeve hub snap ring:
Refer to S.D.S.



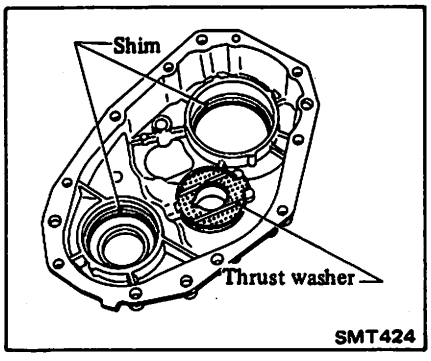
21. Install coupling sleeve hub, then secure with snap ring.



22. Install shift lever with differential lever.
23. Install cross shift shaft.



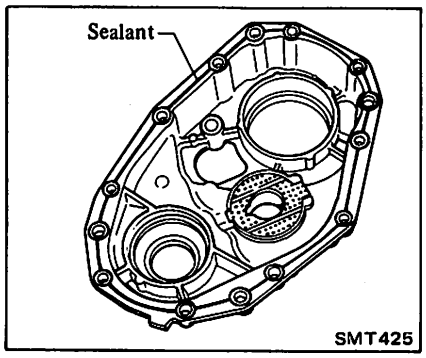
24. Apply grease to thrust washer, main gear front and transfer case front shims selected, then attach them to transfer front case.



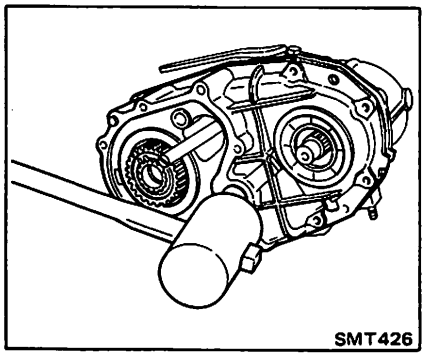
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25. Clean mating surface of transfer front case.
26. Apply sealant to mating surface of transfer front case.

Apply sealant continuously.

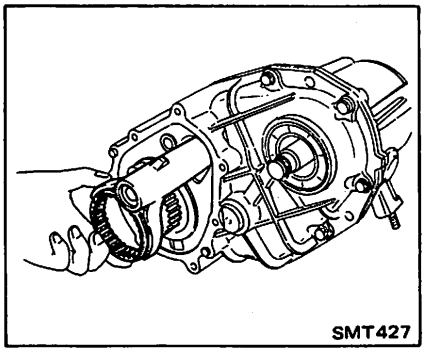


27. Install transfer front case by tapping it with soft faced hammer.

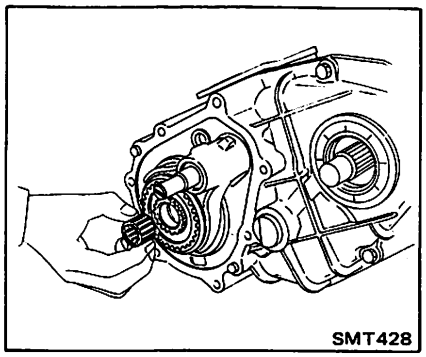


Ⓣ : Transfer front case securing bolt
8 - 11 N·m
(0.8 - 1.1 kg-m,
5.8 - 8.0 ft-lb)

28. Install spacer, FR shift fork assembly with coupling sleeve and spacer, then secure with snap ring.

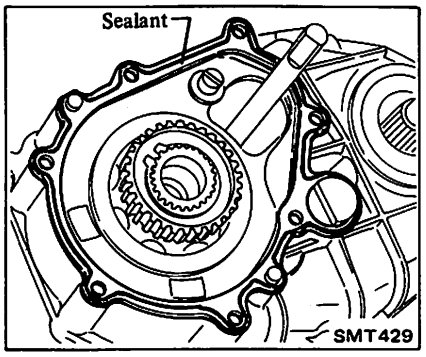


29. Apply gear oil to pilot bearing, then install it in place.

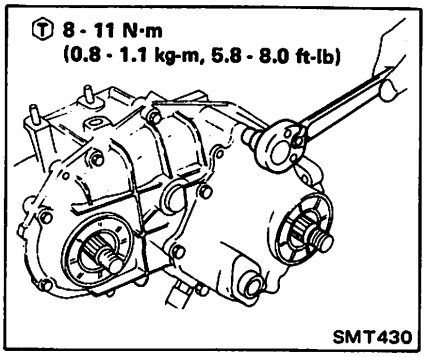


30. Install FR drive shaft to transfer case drive shaft.
31. Clean mating surface of transfer front case, then apply sealant to mating surface of it.

Apply sealant continuously.



32. Install transfer case front cover.



33. Install companion flanges.

Lock nuts are self-lock type so always use new lock nut.

Ⓣ : 118 - 137 N·m
(12 - 14 kg-m,
87 - 101 ft-lb)

34. Install 4WD switch.

Ⓣ : 20 - 29 N·m
(2.0 - 3.0 kg-m,
14 - 22 ft-lb)

GEARS AND SHAFTS

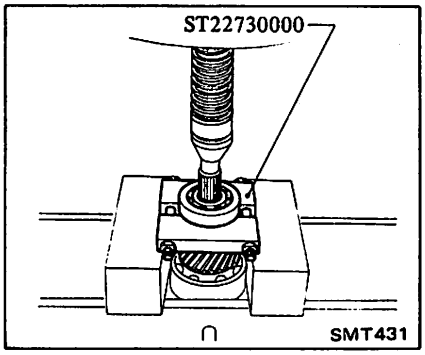
DISASSEMBLY

Counter gear and transfer case main gear

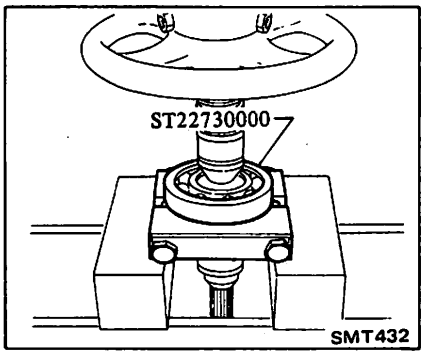
1. Remove transfer case drive shaft assembly, counter gear assembly, forks and fork rods.

Refer to Forks and Fork Rods for disassembly.

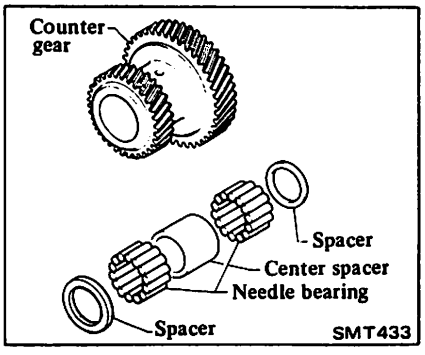
2. Remove transfer main gear and breather cover from transfer rear case.
3. Remove transfer main gear front bearing.



4. Remove transfer main gear rear bearing.



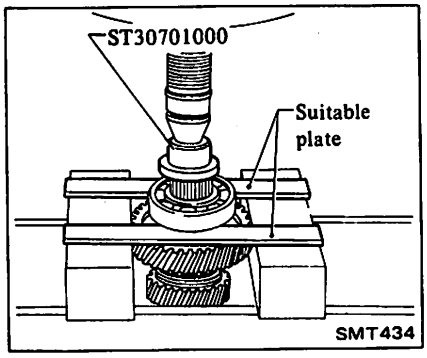
5. Remove needle bearings, center spacer and spacer from counter gear.



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Low gear

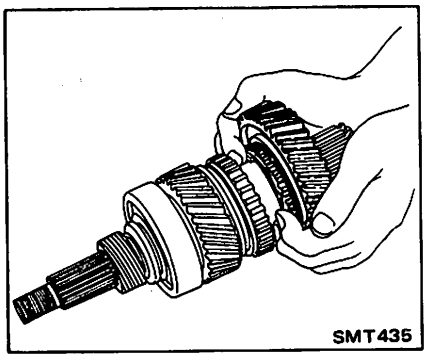
1. Press out drive shaft front ball bearing.



2. Remove thrust washer and steel ball.

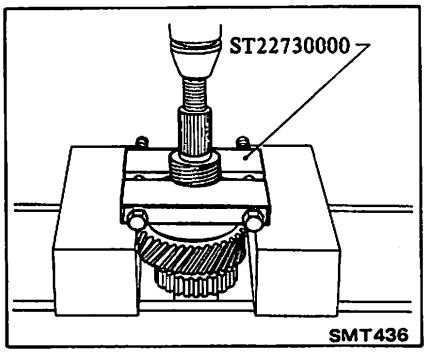
Be careful not to lose steel ball retaining thrust washer.

3. Remove Low gear and needle bearings.



High gear

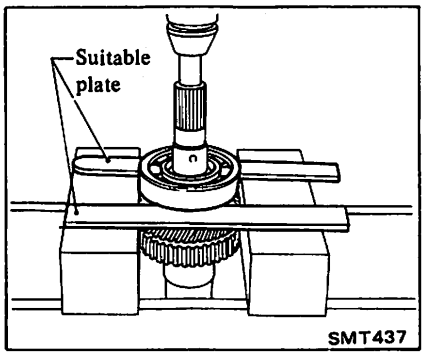
1. Remove speedometer worm gear.



2. Remove spacer and steel ball.

Be careful not to lose steel ball retaining spacer.

3. Press out drive shaft rear ball bearing with suitable plate or puller.



4. Remove thrust washer and steel ball.

Be careful not to lose steel ball retaining thrust washer.

5. Remove High gear, needle bearings and coupling sleeve.

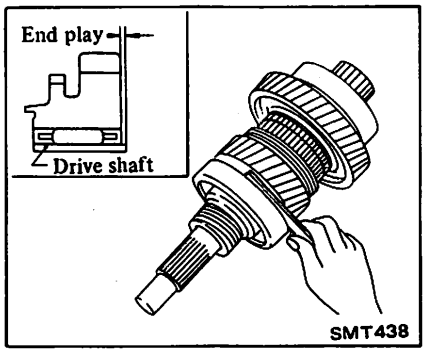
INSPECTION

Gear and shafts

Check all gears for excessive wear, chips or cracks; replace as required.

Measure gear end play:

- It is necessary to measure end play before disassembling transfer case drive shaft and after reassembling transfer case drive shaft.
- If end play is not within specified limit, disassemble and check parts for condition.
- Replace any part which is worn or damaged.



Standard end play:

High gear

0.10 - 0.20 mm

(0.0039 - 0.0079 in)

Low gear

0.10 - 0.20 mm

(0.0039 - 0.0079 in)

Coupling sleeve hub

0 - 0.20 mm

(0 - 0.0079 in)

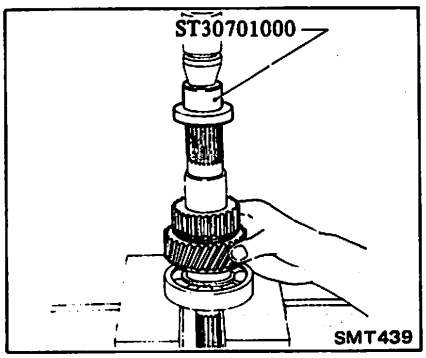
Bearings

Refer to Transfer Front Cover for inspection.

ASSEMBLY

High gear

1. Apply gear oil to needle bearings and install needle bearings and High gear onto transfer case drive shaft.
2. Apply grease to steel ball and thrust washer, then attach them to High gear.
3. Press drive shaft rear ball bearing.



When pressing it, be sure to hold High gear by hand so as not to drop thrust washer.

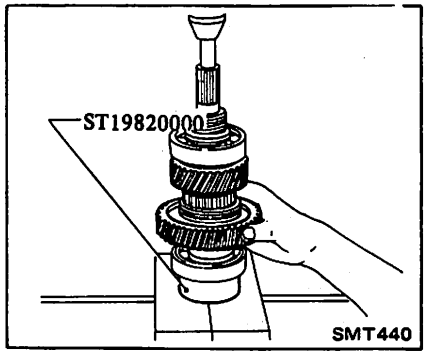
4. Install drive shaft spacer. Apply grease to steel ball, then install steel ball and speedometer worm gear.

Low gear

5. Apply gear oil to needle bearing and install needle bearings, coupling sleeve and Low gear.
6. Apply grease to steel ball and thrust washer, then attach them to Low gear.

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7. Press drive shaft front ball bearing.

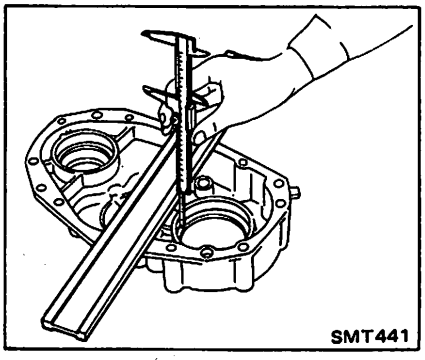


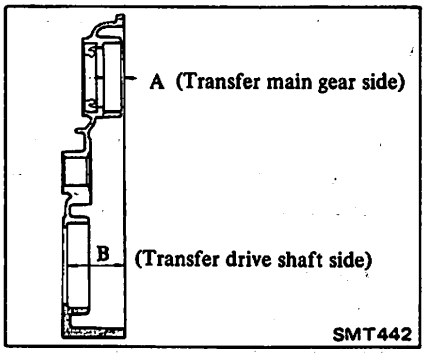
When pressing it, be sure to hold Low gear by hand so as not to drop thrust washer.

Selection of shims

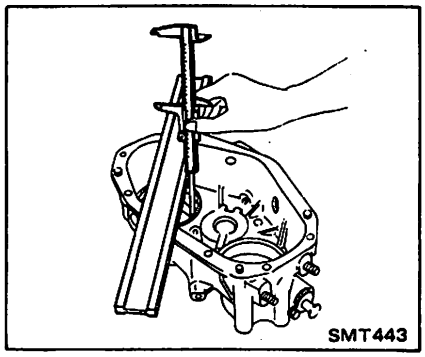
If thrust washer, each ball bearing, drive shaft, transfer front & rear cases or transfer case main gear is replaced, it is necessary to select each shim.

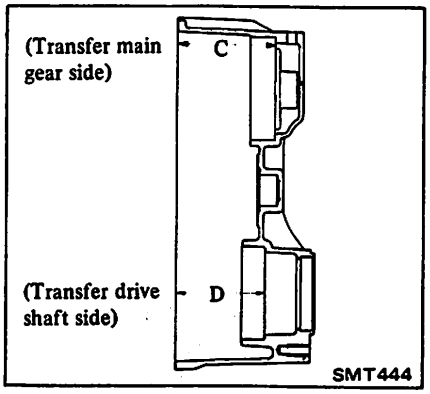
1. Measure bearing insertion lengths A and B for transfer front case.





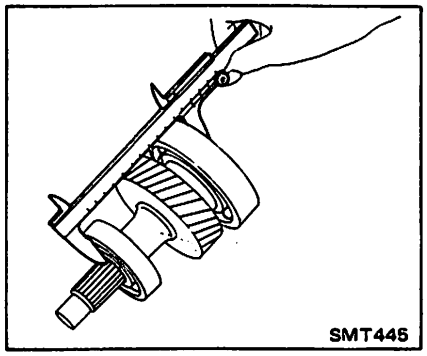
2. Measure bearing insertion lengths C and D for transfer rear case.





When measuring C, be sure to install breather cover in its position.

3. Measure distance E between ball bearing outer races of transfer main gear.

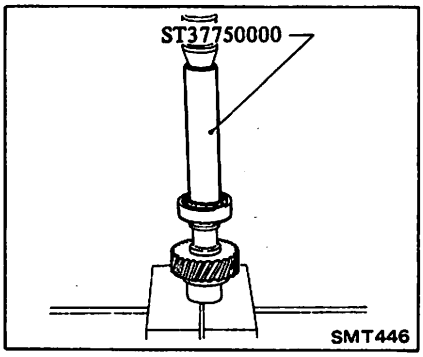


4. Measure distance F between ball bearing outer races of transfer drive shaft.
5. Select shims as follows:
   - 5-1 Calculate L_1 and L_2 by using the following equations:
     $L_1 = A + C - E$
     $L_2 = B + D - F$
   - 5-2 Determine shim thickness by using values L_1 and L_2.

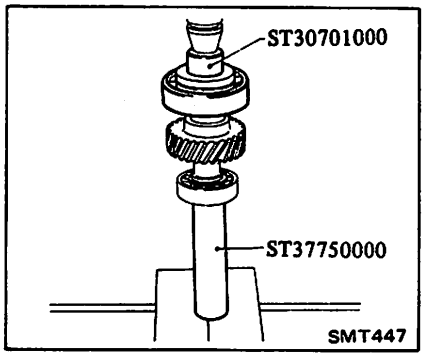
Main gear front and transfer case front shims.
Refer to S.D.S.

Transfer case main gear and counter gear

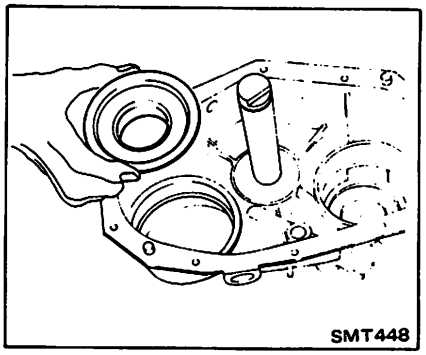
1. Press transfer case main gear front bearing.



2. Press transfer case main gear rear bearing.

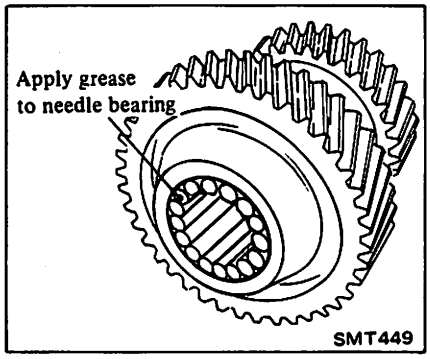


3. Install breather cover and transfer case main gear.



4. Apply grease to all needle bearings and spacers.
5. Install center spacer to counter gear, then assemble needle bearings and spacers in counter gear.

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a. Use 28 needle bearing (14 on each side).
b. After attaching needle bearings in place, apply grease thickly so that bearing does not come off.

6. Install transfer case drive shaft assembly, forks and fork rods.

Refer to Forks and Fork Rods for assembly.

TRANSFER CASE FRONT COVER, TRANSFER FRONT CASE AND TRANSFER REAR CASE (Replacement of oil seals and bearings)

Disassembly and assembly procedures for above cases are the same as those of gears and shafts. Refer to Gears and Shafts for disassembly and assembly.

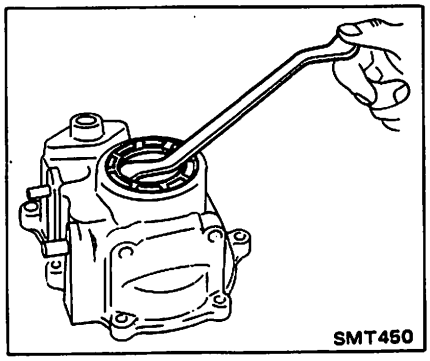
Described below are replacement procedures for oil seal, bearing and cases after disassembling cases.

For replacement of main gear front, rear bearing, drive shaft front and rear bearing, refer to Disassembly and Assembly of Gears and Shafts.

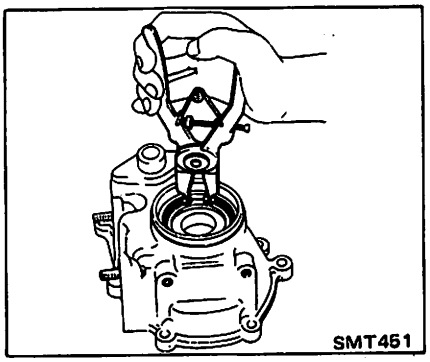
TRANSFER FRONT COVER

Disassembly

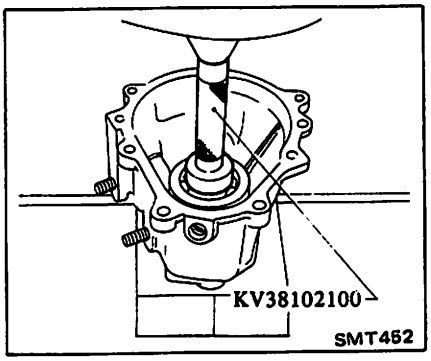
1. Remove oil seal.



2. Remove snap ring.



3. Remove bearing.



Inspection

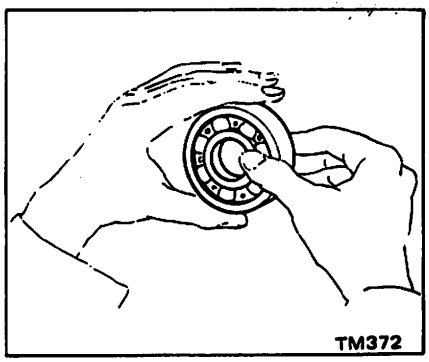
Oil seals

1. Replace oil seal if sealing lip is deformed or cracked. Also discard oil seal if spring is out of position.
2. Check the oil seal lip contacting with shaft; if necessary replace oil seal and shaft as a set.

Bearings

1. Thoroughly clean bearing and dry with compressed air.

CAUTION:
Do not allow the bearings to spin. Because it will damage the race and balls. Turn them slowly by hand.



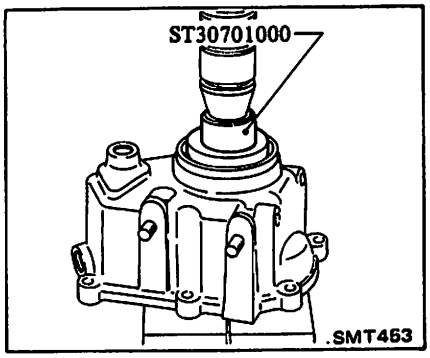
2. When race and ball surfaces are worn or rough, or when balls are out-of-round or rough, replace bearing with a new one.
3. Replace needle bearing if worn or damaged.

Transfer case front cover

1. Clean with solvent and check for cracks or pits by means of dyeing test.
2. Check mating surface of transmission case for small nicks, projection or sealant.

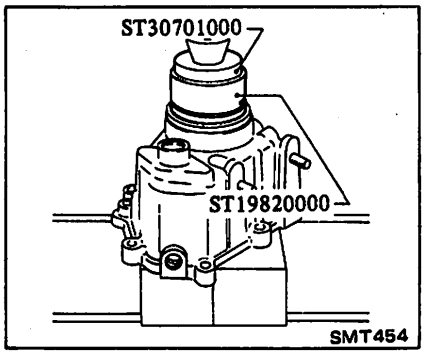
Assembly

1. Press bearing.



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2. Install snap ring with snap ring pliers.
3. Apply coat of gear to oil seal surface, then drive new seal into place.

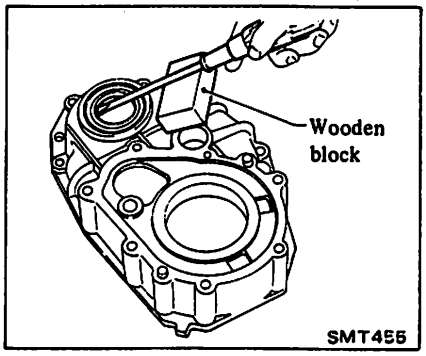


4. Lubricate seal lip with gear oil.

TRANSFER FRONT AND REAR CASE

Disassembly

1. Remove oil seal.

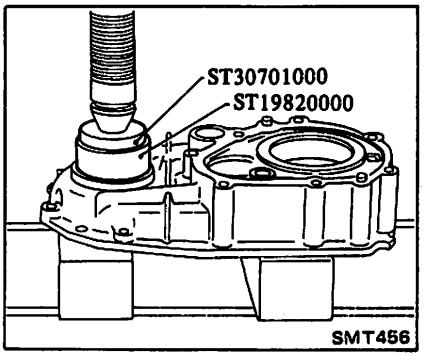


Inspection

Refer to Transfer Front Cover for inspection.

Assembly

1. Apply coat of gear to oil seal surface, then drive new seal into place.



2. Lubricate seal lip with gear oil.

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

Transfer model			T100L
Shift type			2H 4H N 4L
Gear ratio	High		1.000
	Low		2.074
Combined gear ratio with transmission	High	1st 2nd 3rd 4th 5th Rev.	3.592 2.246 1.415 1.000 0.813 3.657
	Low	1st 2nd 3rd 4th 5th Rev.	7.450 4.658 2.935 2.074 1.686 7.585
Number of teeth	Main gear		29
	Counter gear	High	41
		Low	30
	Transfer case	High	29
		Low	44
Speedometer gear ratio			19/6*
Oil capacity ℓ (US pt, Imp pt)			1.4 (3, 2-1/2)

*: For a final gear ratio of 4.375

INSPECTION AND ADJUSTMENT

GEAR END PLAY

Unit: mm (in)

High gear	0.10 - 0.20 (0.0039 - 0.0079)
Low gear	0.10 - 0.20 (0.0039 - 0.0079)
Coupling sleeve hub	0 - 0.20 (0 - 0.0079)

AVAILABLE SNAP RING

Coupling sleeve hub

Thickness mm (in)	Part number
1.3 (0.051)	33145 C6903
1.4 (0.055)	33145 C6904
1.5 (0.059)	33145 C6900
1.6 (0.063)	33145 C6901
1.7 (0.067)	33145 C6902

AVAILABLE SHIM

Main gear front

Unit: mm (in)

"L_1"	Thichness of shim	Part Number
0.06 - 0.15 (0.0024 - 0.0059)	–	–
0.16 - 0.25 (0.0063 - 0.0098)	0.10 (0.0039)	33112 C6900
0.26 - 0.35 (0.0102 - 0.0138)	0.20 (0.0079)	33112 C6901
0.36 - 0.45 (0.0142 - 0.0177)	0.30 (0.0118)	33112 C6902
0.46 - 0.55 (0.0181 - 0.0217)	0.40 (0.0157)	33112 C6903

Transfer case front

Unit: mm (in)

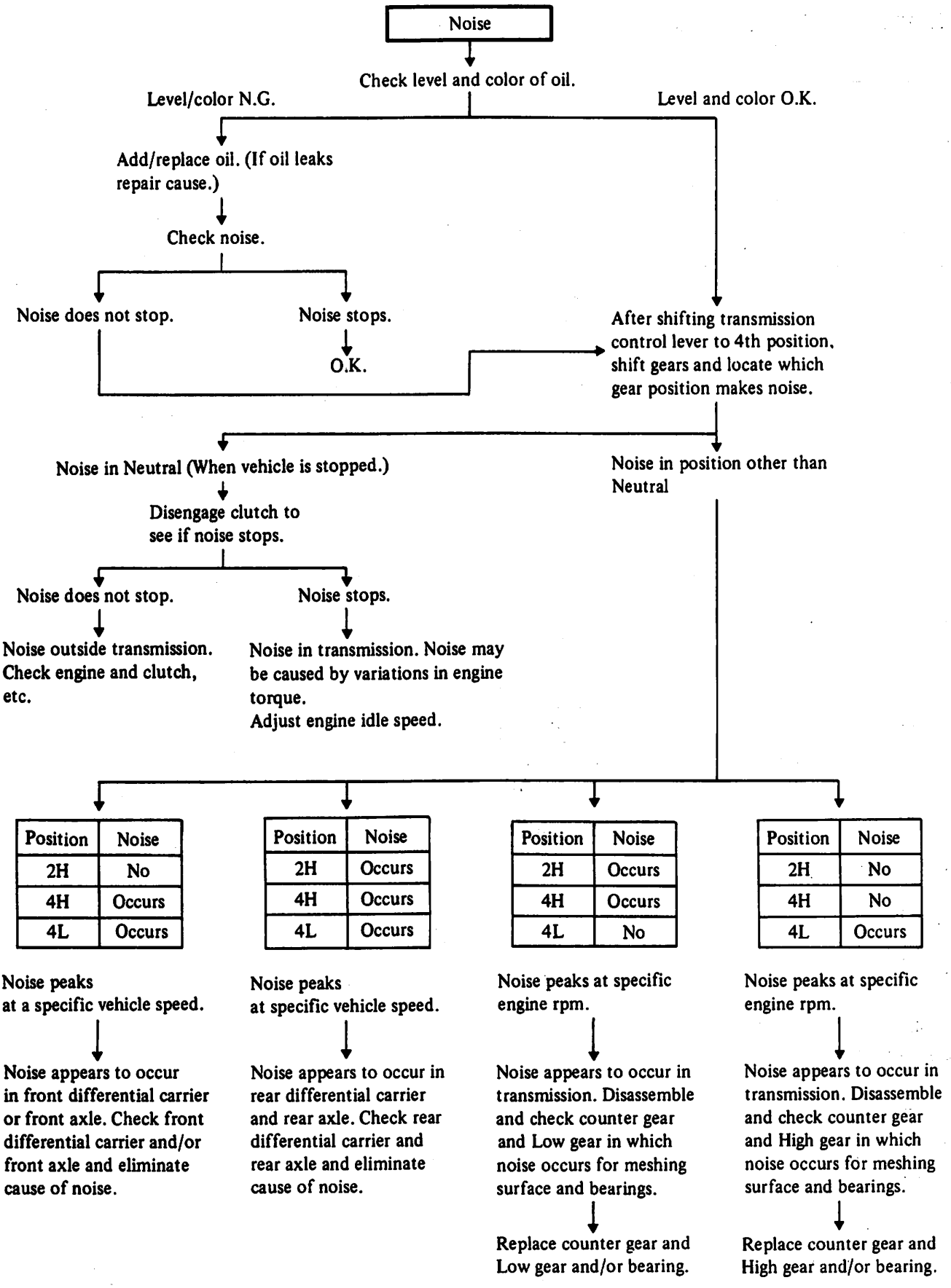
"L_2"	Thickness of shim	Part Number
0 - 0.13 (0 - 0.0051)	–	–
0.14 - 0.23 (0.0055 - 0.0091)	0.10 (0.0039)	33147 C6900
0.24 - 0.33 (0.0094 - 0.0130)	0.20 (0.0079)	33147 C6901
0.34 - 0.43 (0.0134 - 0.0169)	0.30 (0.0118)	33147 C6902
0.44 - 0.53 (0.0173 - 0.0209)	0.40 (0.0157)	33147 C6903
0.54 - 0.63 (0.0213 - 0.0248)	0.50 (0.0197)	33147 C6904

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Transfer installation			
Insulator to transfer	27 - 35	2.8 - 3.6	20 - 26
Insulator to body	27 - 35	2.8 - 3.6	20 - 26
Transfer protector	27 - 35	2.8 - 3.6	20 - 26
Transfer unit			
Check ball plug	19 - 25	1.9 - 2.5	14 - 18
Cotter pin	9 - 12	0.9 - 1.2	6.5 - 8.7
Transfer front case	8 - 11	0.8 - 1.1	5.8 - 8.0
Transfer case front cover	8 - 11	0.8 - 1.1	5.8 - 8.0
4WD switch	20 - 29	2.0 - 3.0	14 - 22
Companion flange	118 - 137	12 - 14	87 - 101
Drain plug	20 - 39	2.0 - 4.0	14 - 29
Filler plug	20 - 39	2.0 - 4.0	14 - 29
Speedometer sleeve	3 - 4	0.3 - 0.4	2.2 - 2.9

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TROUBLE DIAGNOSES AND CORRECTIONS



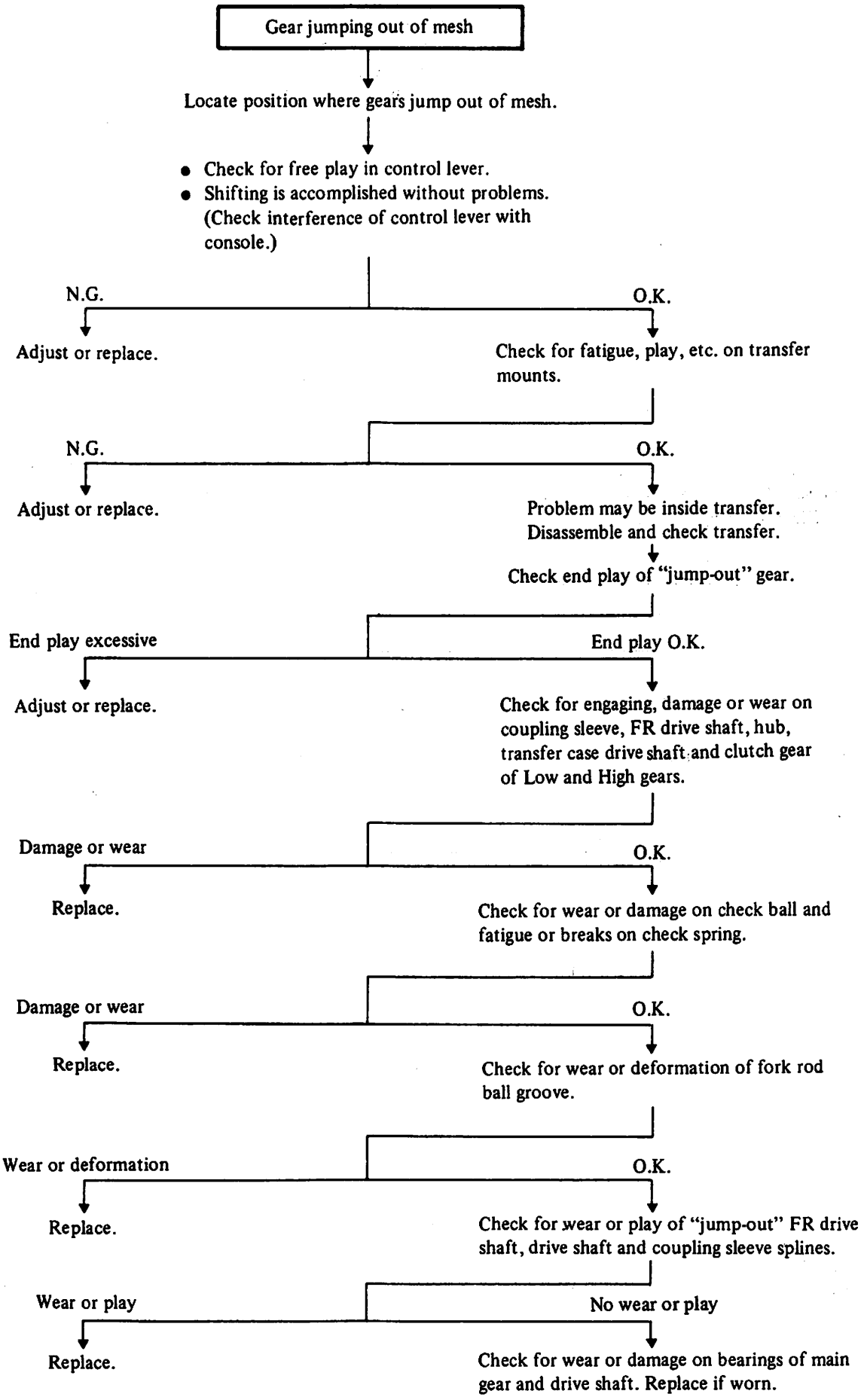
Position	Noise
2H	No
4H	Occurs
4L	Occurs

Position	Noise
2H	Occurs
4H	Occurs
4L	Occurs

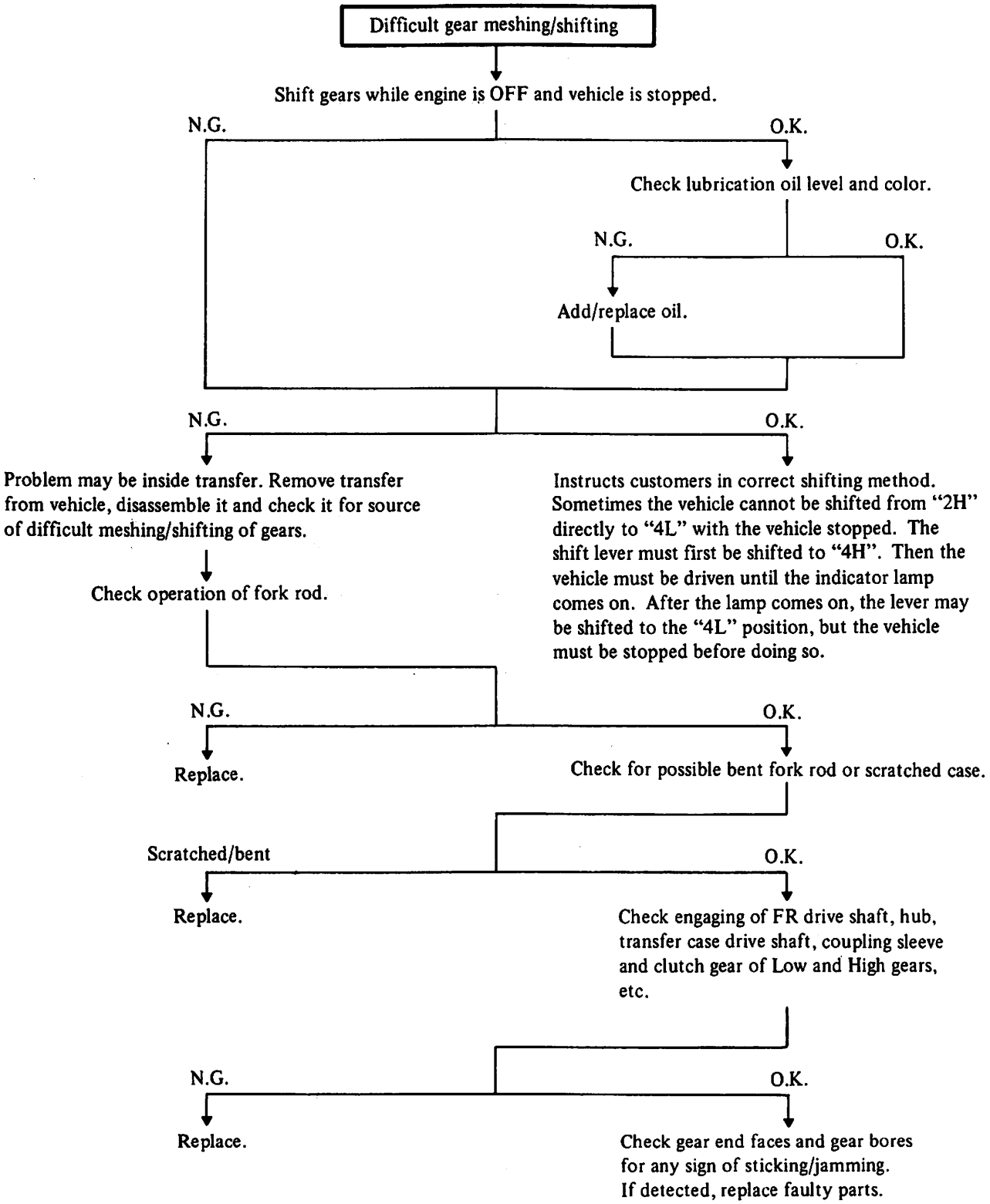
Position	Noise
2H	Occurs
4H	Occurs
4L	No

Position	Noise
2H	No
4H	No
4L	Occurs

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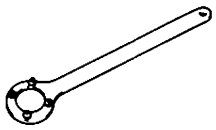
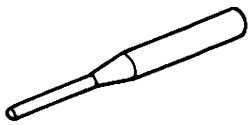
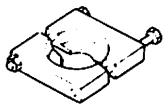
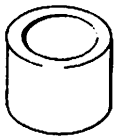
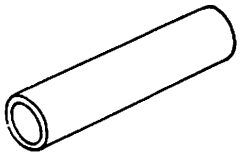
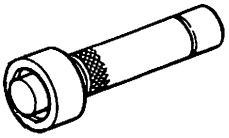


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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name	
ST31530000 (J25774)	Companion flange wrench	
KV31100300 (–)	Fork rod pin punch	
ST23620000 (J25690-01)	Fork rod guide	
ST22730000 (J25681)	Bearing puller	
ST30701000 (J25742-2)	Bearing drift	
ST19820000 (–)	Bearing drift	
ST37750000 (J25862)	Bearing drift	
KV38102100 (J25803)	Oil seal drift	

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PROPELLER SHAFT & DIFFERENTIAL CARRIER

SECTION PD

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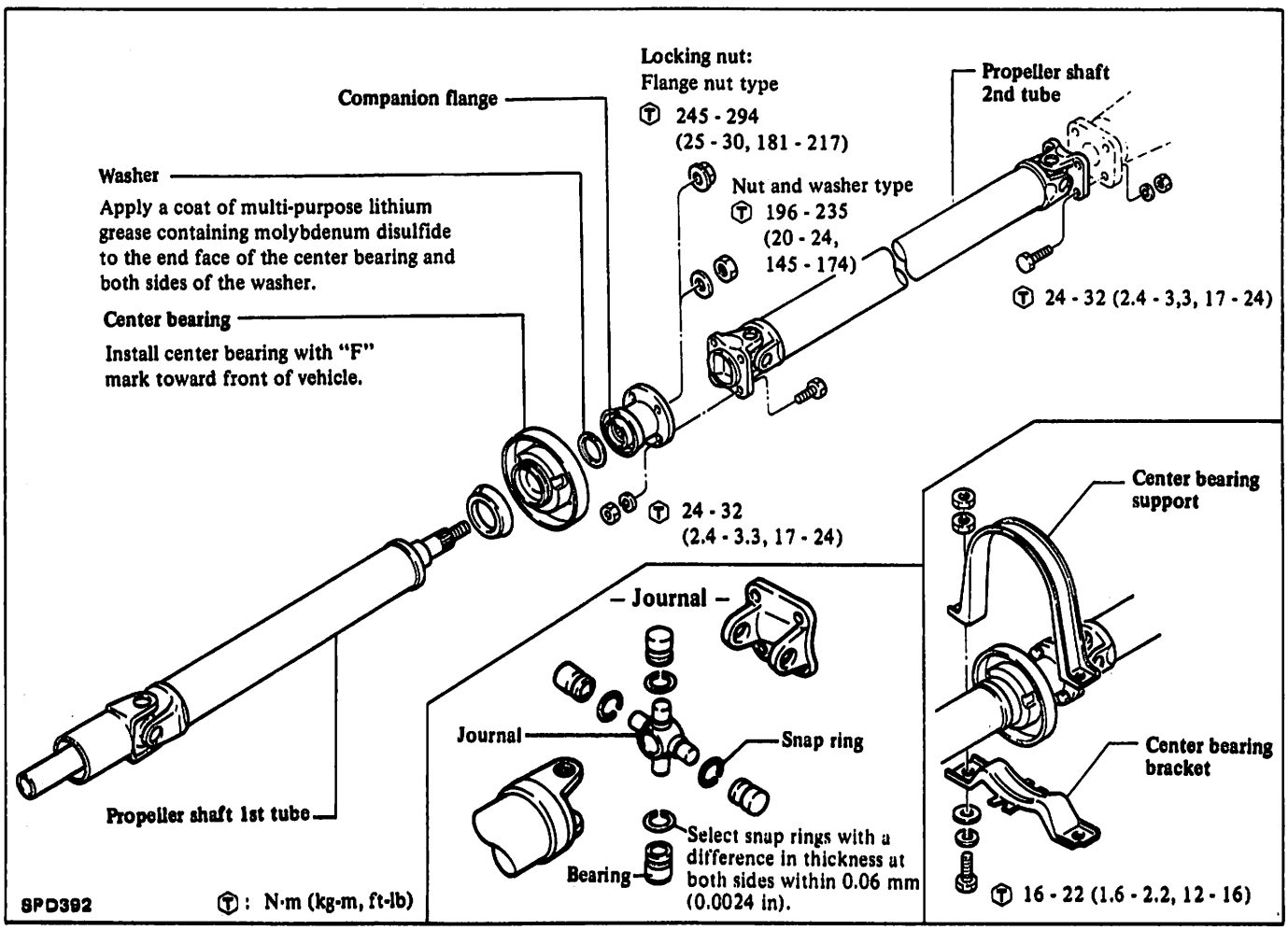
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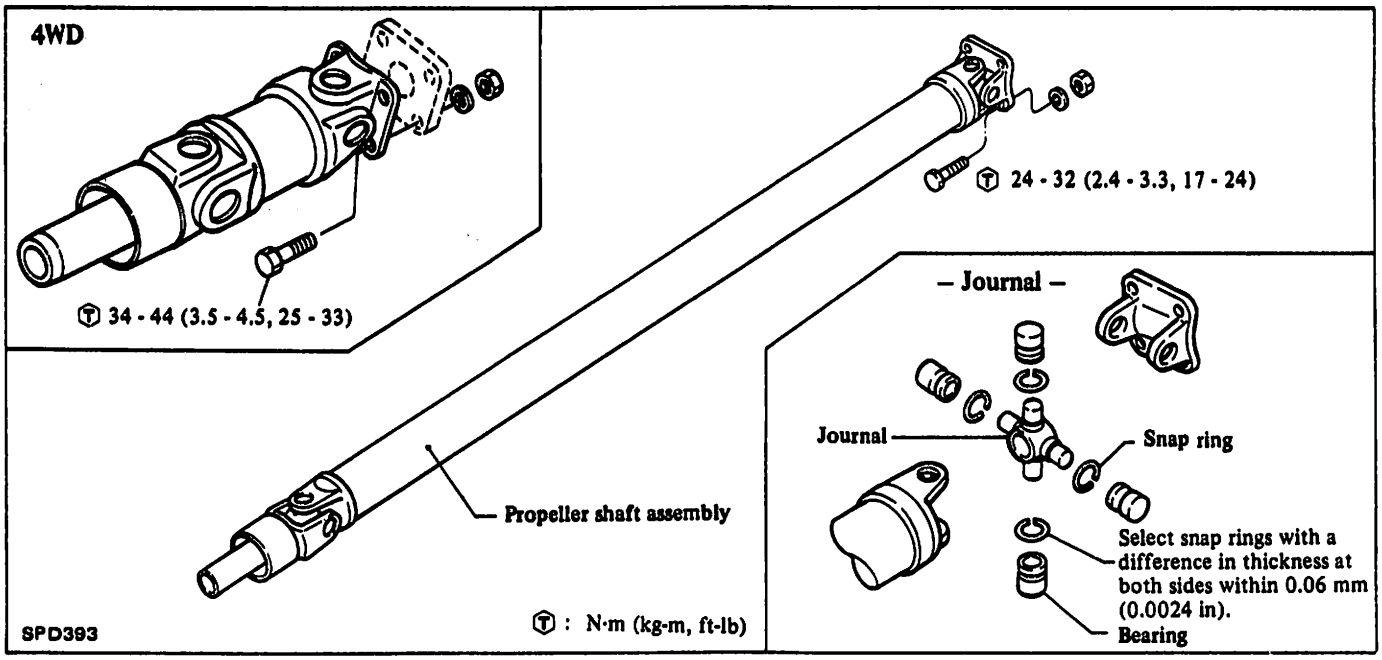
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PROPELLER SHAFT
—Model : 3S63H, 2S63H, 2F63H—

– Model 3S63H –

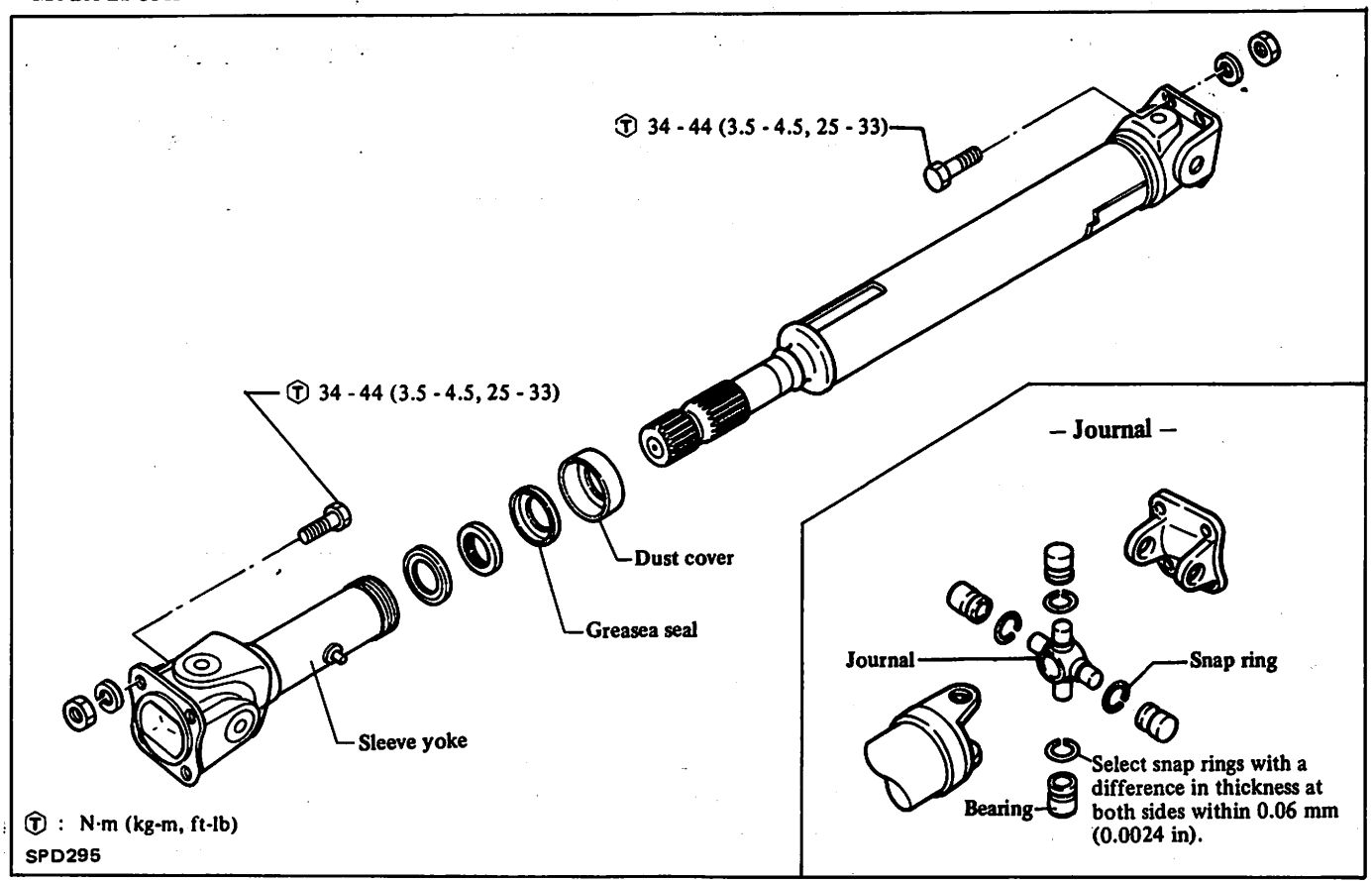


– Model 2S63H –



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– Model 2F63H –



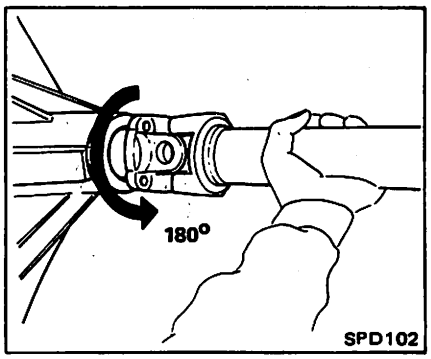
GENERAL INSPECTION

- Inspect propeller shaft tube surface for dents or cracks.
  If damaged, replace propeller shaft assembly.
- If center bearing is noisy or damaged, replace center bearing (3S63H).
- If journal is damaged or worn, replace journal.

PROPELLER SHAFT VIBRATION

To check and correct an unbalanced propeller shaft, proceed as follows:

1. Remove undercoating and other foreign material which could upset shaft balance, and check shaft vibration by road test.
2. If shaft vibration is noted during road test, disconnect propeller shaft at differential carrier companion flange, rotate companion flange **180 degrees** and reconnect propeller shaft.

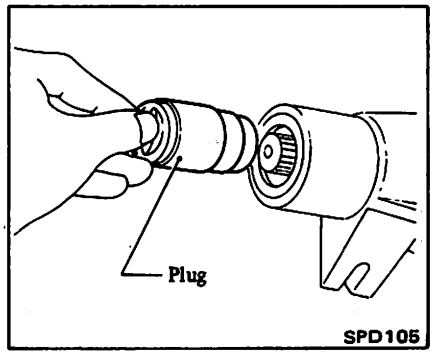


3. Again check shaft vibration. If vibration still persists, replace propeller shaft assembly.

REMOVAL AND INSTALLATION

2S63H(4WD)

1. Put match marks on flanges, and separate propeller shaft from transfer.
2. Remove transfer (Refer to TF section.).
3. Draw out propeller shaft from transmission and **plug up rear end of transmission rear extension housing.**

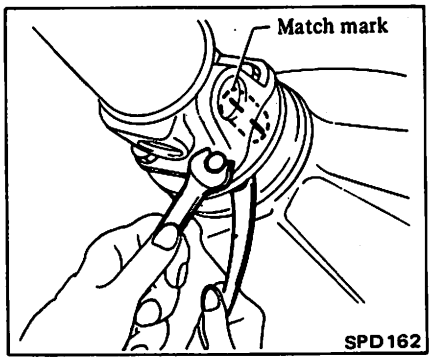


4. To install, reverse the foregoing procedure using reference marks in removal.

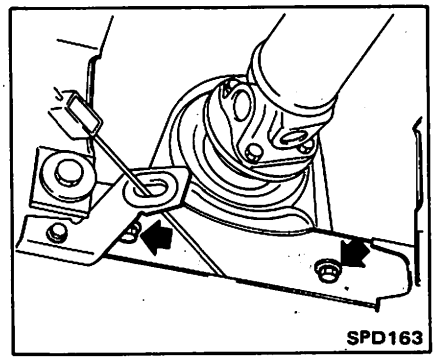
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3S63H, 2S63H, 2F63H

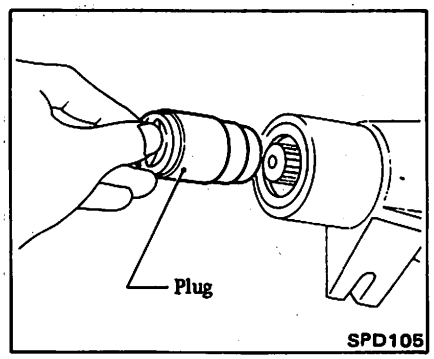
1. **Put match marks** on flanges, and separate propeller shaft from differential carrier and transfer.



2. Remove center bearing bracket (3S63H).



3. Draw out propeller shaft from transmission and **plug up rear end of transmission rear extension housing.**

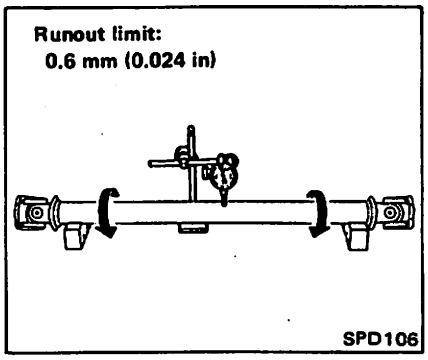


4. To install, reverse the foregoing procedure using reference marks in removal.

INSPECTION

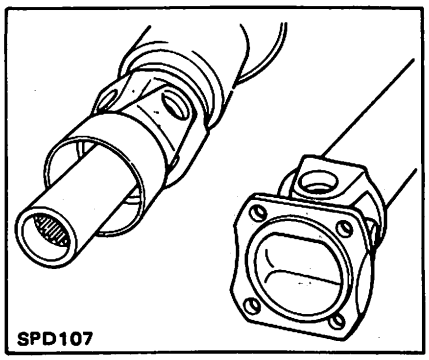
PROPELLER SHAFT RUNOUT

Inspect propeller shaft rounout. If runout exceeds specifications, replace propeller shaft assembly.



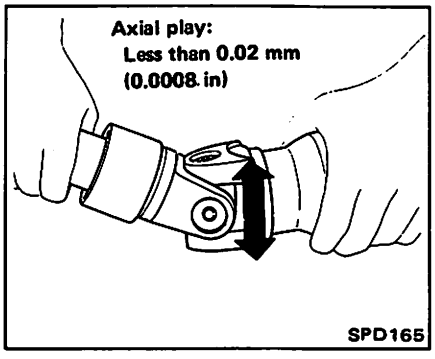
FLANGE YOKE AND SLEEVE YOKE

If flange yoke and sleeve yoke are damaged or worn, replace propeller shaft assembly.



JOURNAL AXIAL PLAY

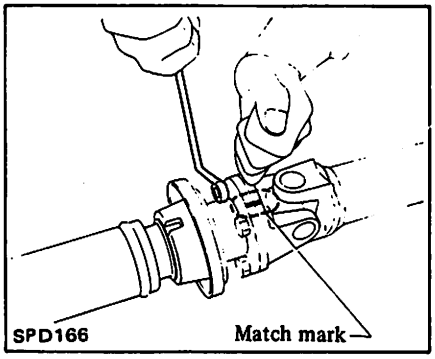
Inspect journal for axial play, if play exceeds specifications, repair journal.



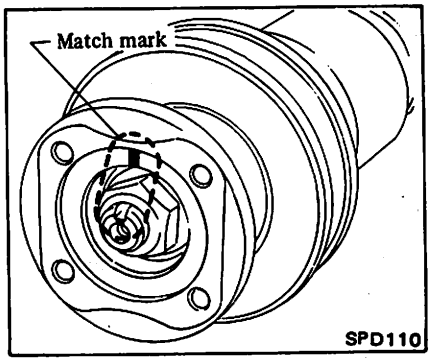
REPAIR

CENTER BEARING (3S63H)

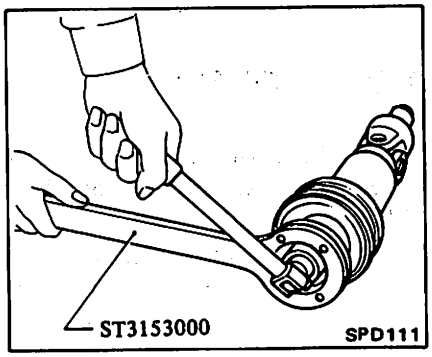
1. **Put match marks on flange,** and separate 2nd tube from 1st tube.



2. Put match marks on the flange and shaft.

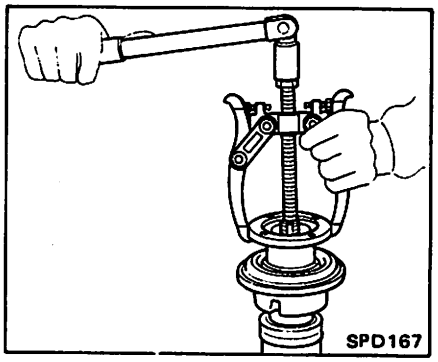


3. Remove lock nut with Tool.

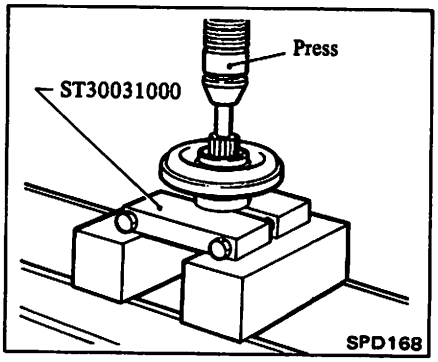


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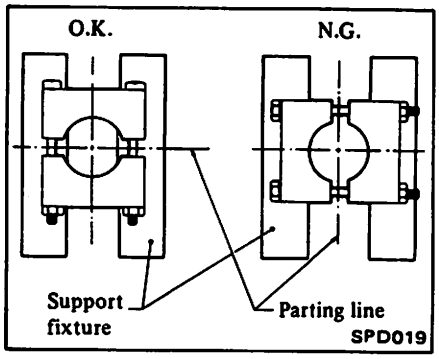
4. Remove companion flange with puller.



5. Remove center bearing with Tool and press.

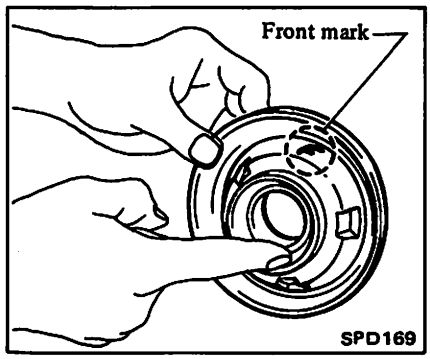


Care should be taken when setting Tool in press to make sure that parting line of Tool is right angle to support fixture of press. This is to prevent Tool from bending.

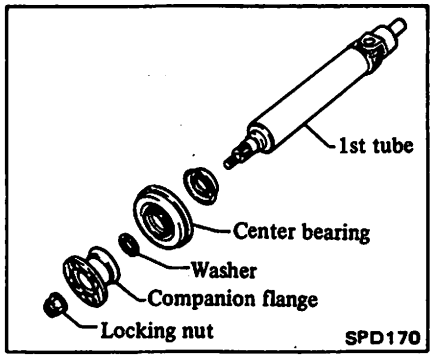


6. Install new center bearing. Be sure to install center bearing with **"F" mark toward front of vehicle.**

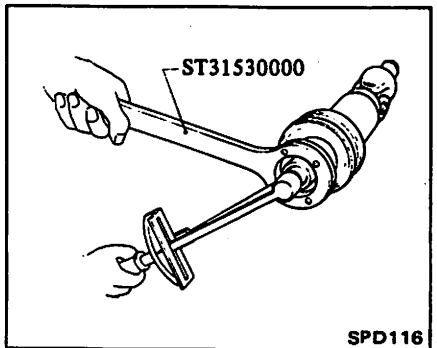
Apply a coat of multi-purpose lithium grease containing molybdenum disulfide to the end face of the center bearing and both sides of the washer.



7. Insert the washer into the end of the center bearing. Align the mark on the companion flange and install the companion flange.

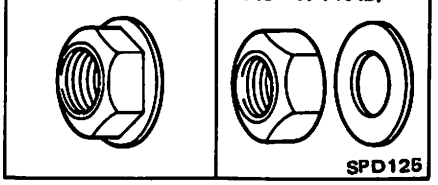


8. Tighten locking nut using Tool.

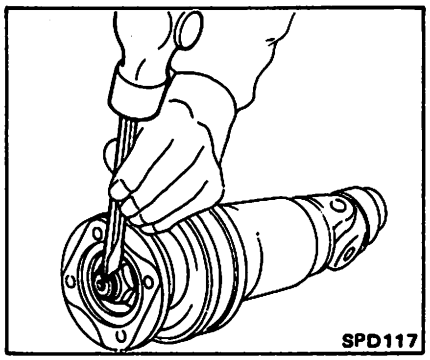


Ⓣ : Center bearing locking nut

Flange nut type	Nut and washer type
245 - 294 N·m (25 - 30 kg-m, 181 - 217 ft-lb)	196 - 235 N·m (20 - 24 kg-m, 145 - 174 ft-lb)



9. Stake the nut.

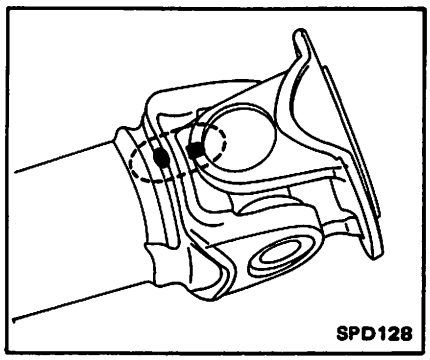


10. Align the mark and connect 1st and 2nd shafts.

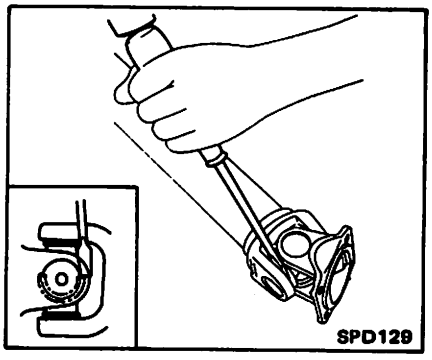
JOURNAL

Disassembly

1. Put match marks on shaft and flange or yoke.

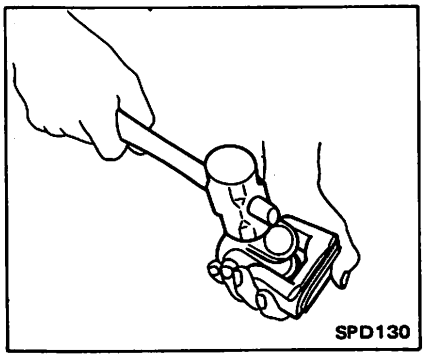


2. Remove snap ring.



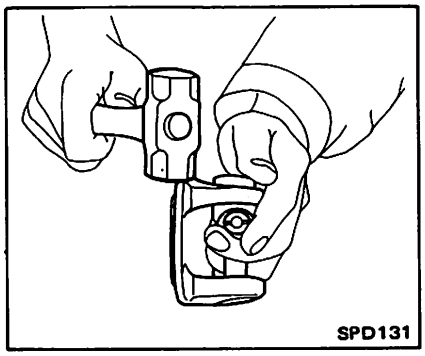
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3. Remove pushed out spider bearing by lightly tapping yoke with a hammer, taking care not to damage journal and yoke hole.



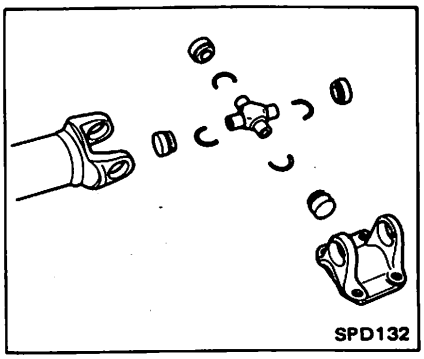
4. Remove bearing at opposite side in above operation.

Put marks on disassembled parts so that they can be reinstalled in their original positions from which they were removed.



Inspection

Inspect disassembled parts, and repair or replace any faulty part.

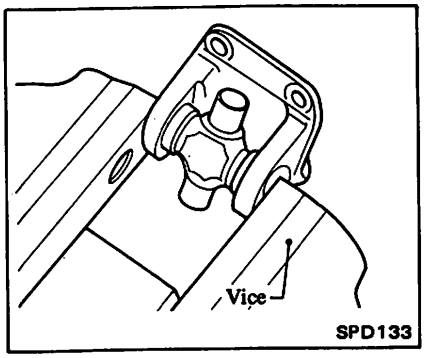


Assembly

To assemble, reverse the foregoing procedure using reference marks in disassembly.

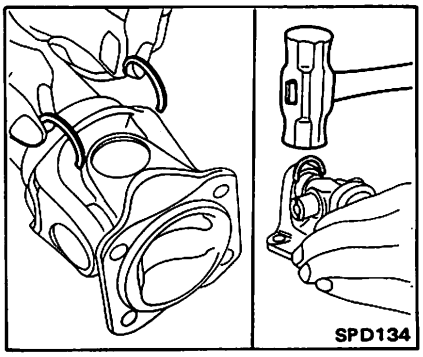
1. Assemble spider bearing. Apply recommended multi-purpose grease on bearing inner surface.

When assembling, be careful that needle bearing does not fall down.

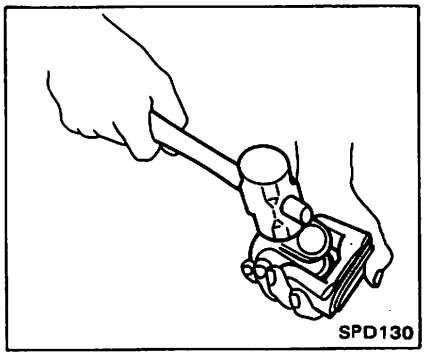


2. Select snap ring that will provide specified play in axial direction of journal, and install them (Refer to S.D.S.).

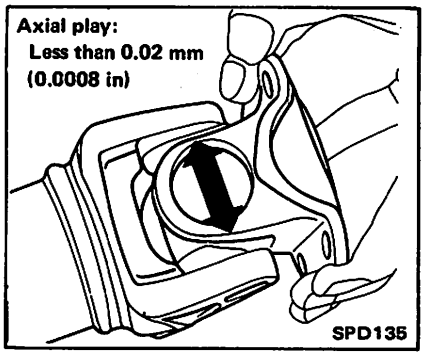
Select snap rings with a difference in thickness at both sides within 0.06 mm (0.0024 in).



3. Adjust thrust clearance between bearing and snap ring to zero by tapping yoke.

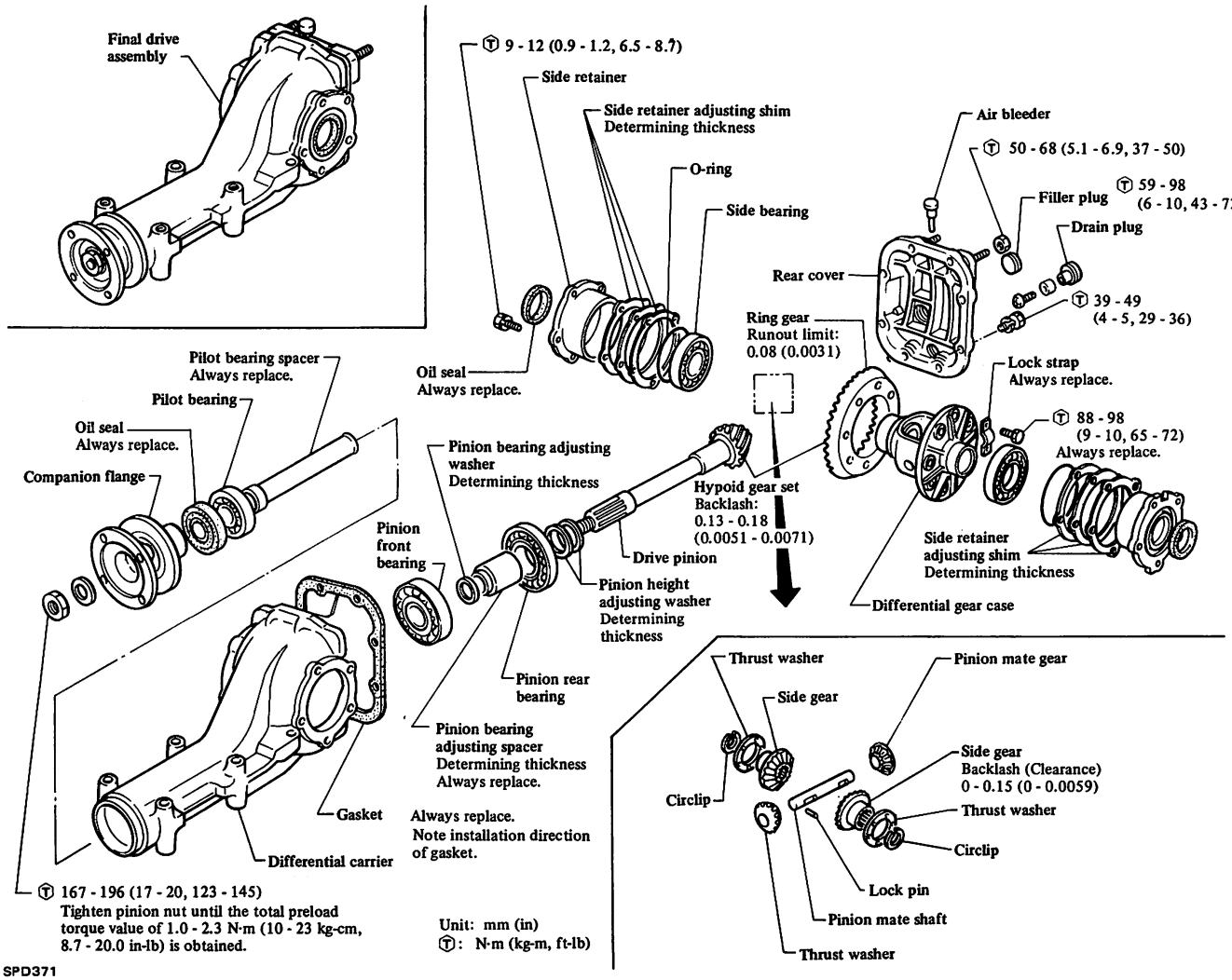


4. Check to see that journal moves smoothly and check for axial play.



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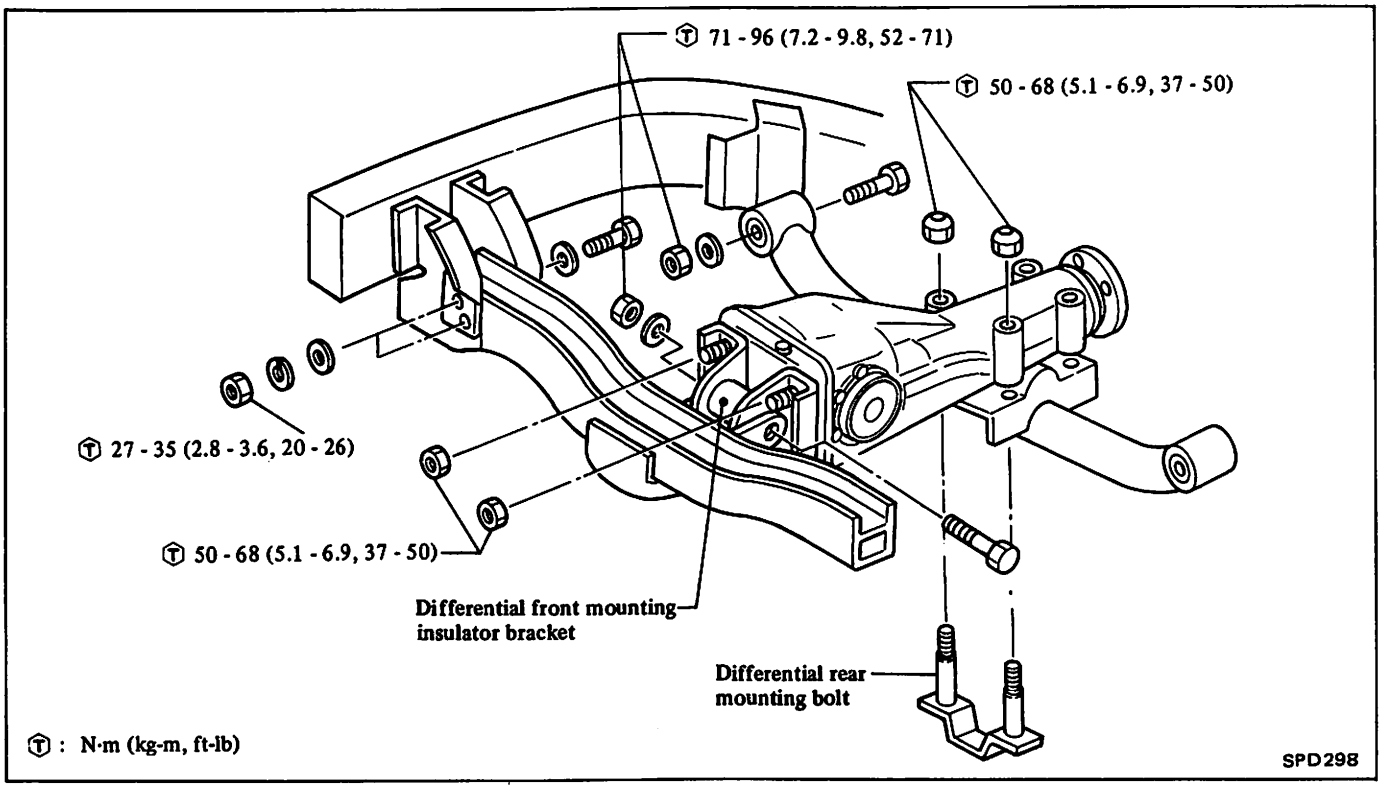
DIFFERENTIAL CARRIER (Final drive)
—Model : R180—



SPD371

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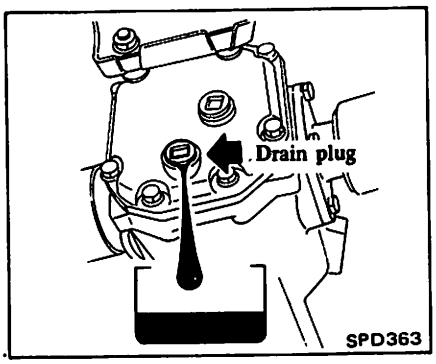
Front differential carrier mounting



PREPARATION FOR DISASSEMBLY

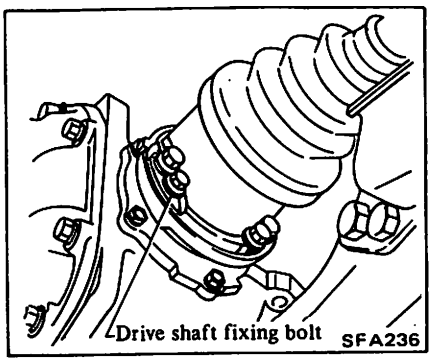
REMOVAL

1. Jack up front of vehicle and support it by placing safety stands, referring to section GI.
2. Remove drain plug and drain gear oil.

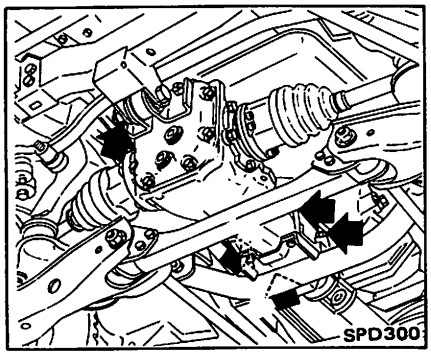


3. Disconnect front propeller shaft. Refer to Propeller Shaft for removal.
4. Remove bolts fixing drive shaft to side flange.

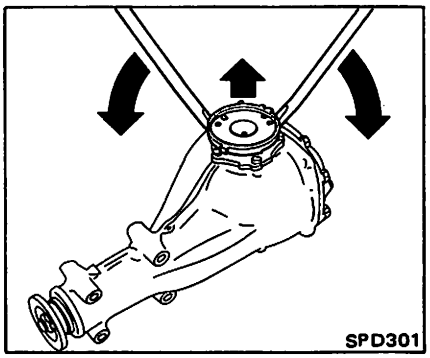
Do not remove boots.



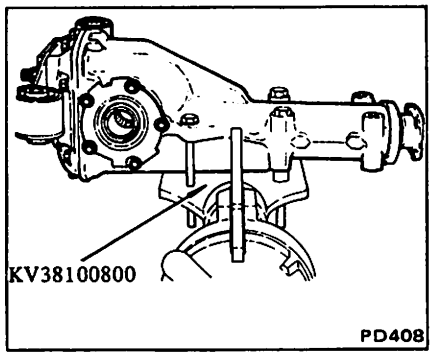
5. Disconnect fixing bolts that hold differential carrier onto crossmember.



6. Remove differential carrier as assembly.
7. Remove side flange by using suitable tools.

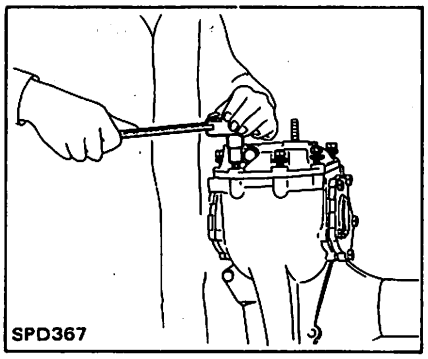


8. Mount differential carrier on Tool.



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9. Remove rear cover.

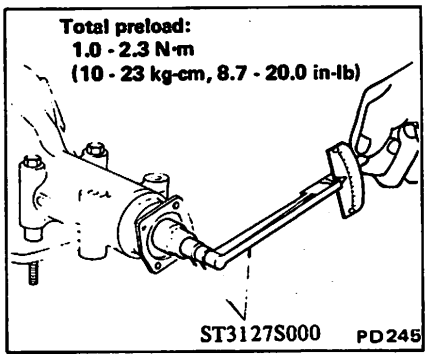


PRE-DISASSEMBLY INSPECTION

1. **Total preload inspection:**

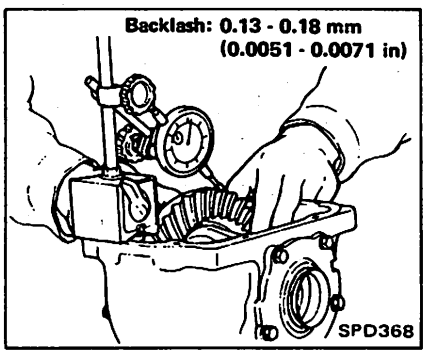
Check total preload with tool. If it is not within specifications, adjust it. Refer to **Drive Pinion Preload Adjustment and Side Retainer Shim Adjustment.**

When checking preload, turn drive pinion in both directions several times to set bearing rollers.



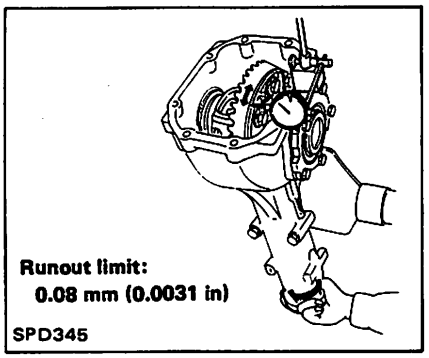
2. **Ring gear backlash inspection:**

Check backlash of ring gear with a dial indicator at several points. If it is not within specification, adjust it referring to **Side Retainer Shim Adjustment.**



3. **Ring gear runout inspection:**

Check runout of ring gear with a dial indicator.



When backlash varies excessively in different places, the variance may have resulted from foreign matter caught between ring gear and differential case.

If the runout is over specifications even after removal of the foreign matter, the hypoid gear set or differential case should be replaced.

If the backlash varies greatly even when the runout of the ring gear is within specified range, the hypoid gear set or differential case should be replaced.

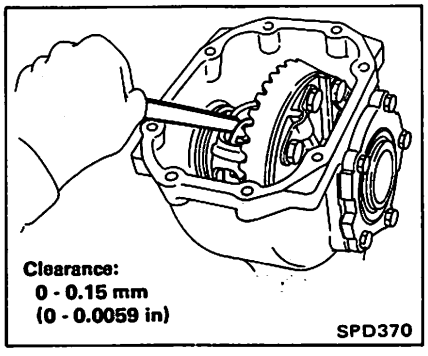
4. **Tooth contact inspection:**

Check tooth contact, referring to **Tooth Contact.**

5. **Side gear backlash inspection:**

Check backlash of side gear. Using a thickness gauge, measure clearance between side gear and differential case.

If it is not within specification, adjust it by selecting side gear thrust washer (Refer to S.D.S.).



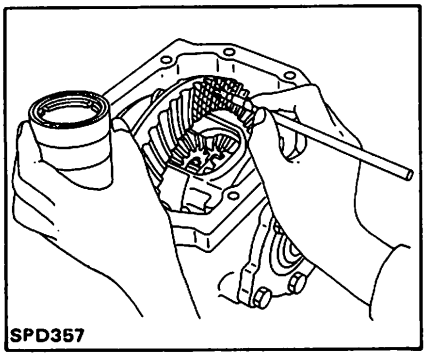
TOOTH CONTACT

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.

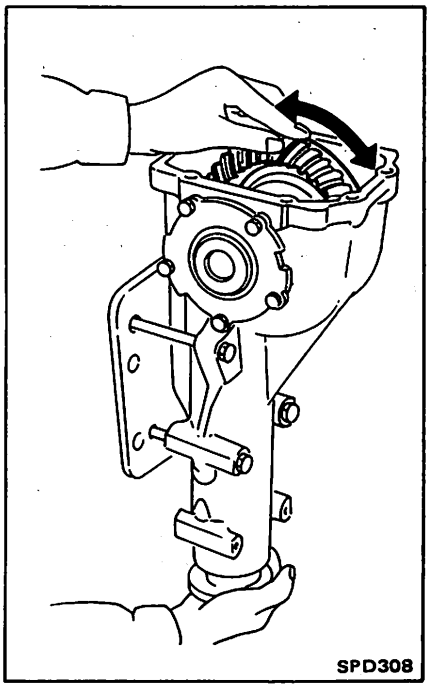
Hypoid gear set which are not positioned properly may be noisy, or have short life or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

Check

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear **drive side.**

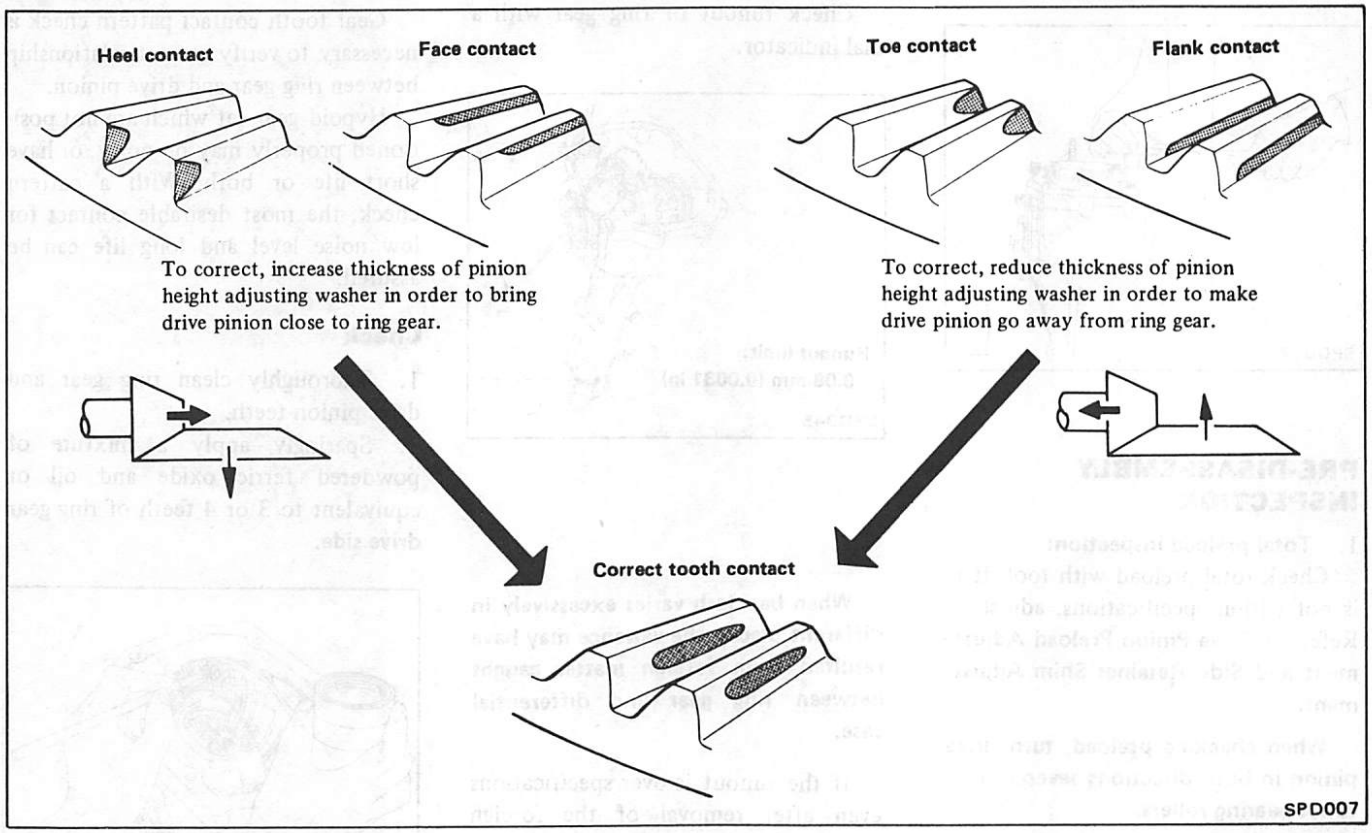


3. Hold companion flange steady by hand and rotate the ring gear in both directions.



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Adjustment



When adjustment is completed, be sure to wipe off completely the ferric oxide and oil or their equivalent.

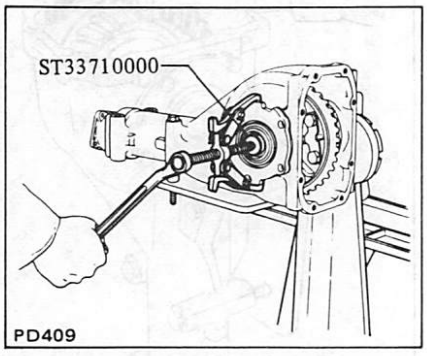
DISASSEMBLY

DIFFERENTIAL CARRIER

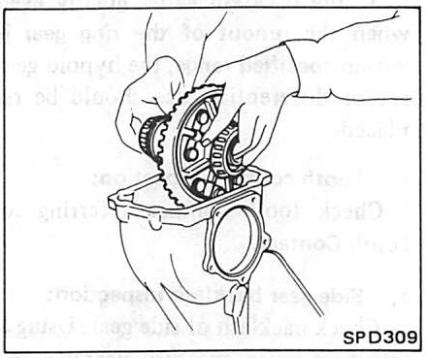
1. Remove side retainers, using Tool.

a. Mark right and left side retainers before removal.

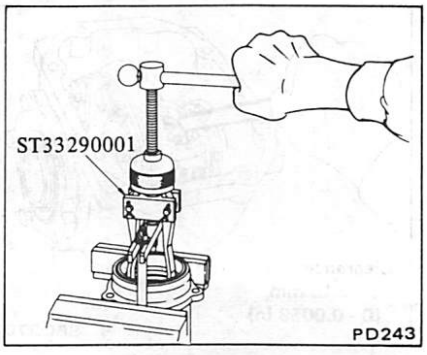
b. Be careful not to confuse right and left hand side retainers and shims when reassembling.



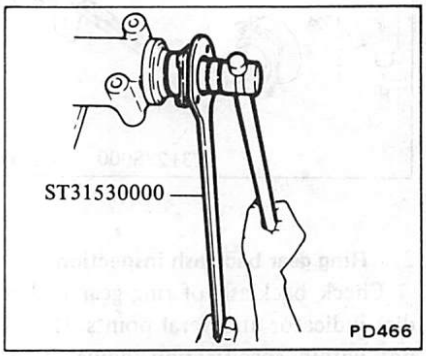
2. Extract differential case from carrier.



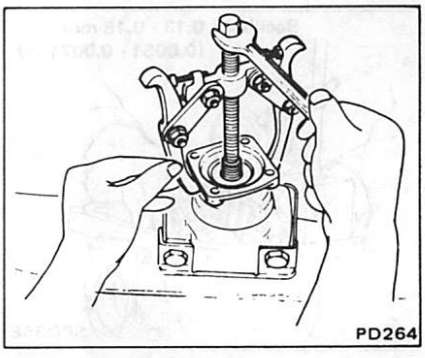
3. When replacing side bearing, extract bearing outer race from side retainer using Tool.



4. Loosen drive pinion nut, holding campanion flange with Tool.

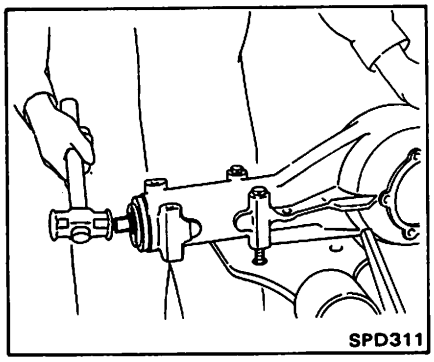


5. Pull off companion flange using a suitable puller.

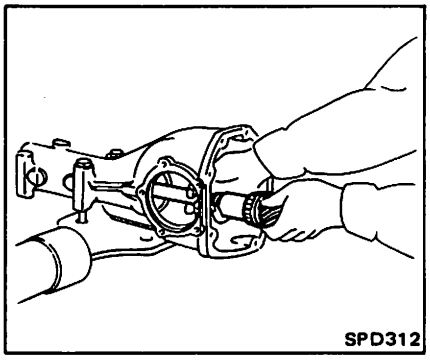


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6. Extract drive pinion from carrier using soft hammer.

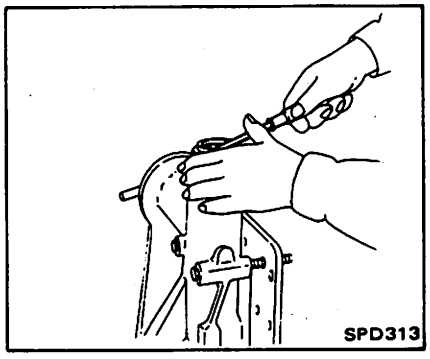


7. Remove drive pinion together with pinion rear bearing inner race, bearing spacer and adjusting washers.

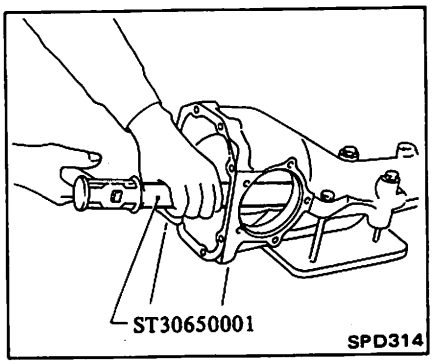


8. Remove oil seal.

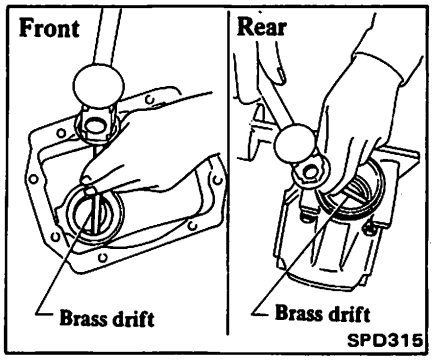
Oil seal must not be reused.



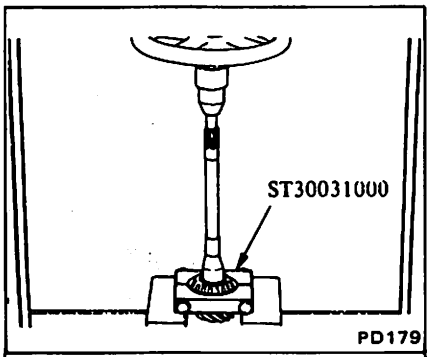
9. Remove pilot bearing together with pilot bearing spacer and pinion front bearing inner race using Tool.

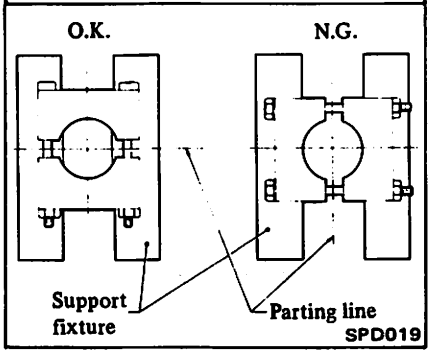


10. Remove pinion bearing outer races using a brass drift.



11. Hold rear bearing inner race with Tool and extract from drive pinion with a press.



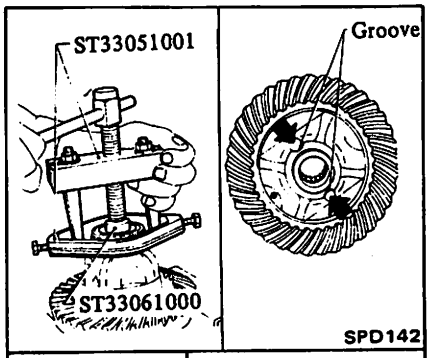


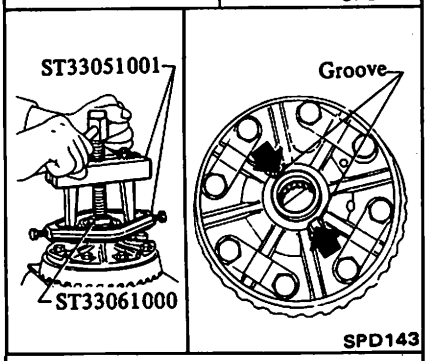
DIFFERENTIAL CASE

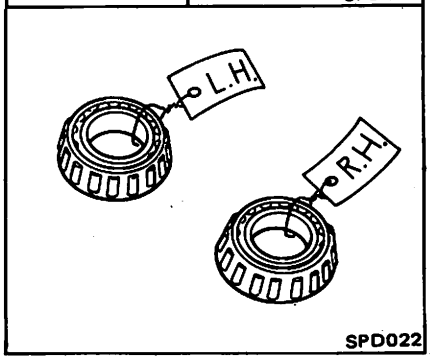
1. Extract bearing using Tool.

a. The puller should be handled with care when catching the edge of bearing inner race.

b. Be careful not to confuse the right and left hand parts.

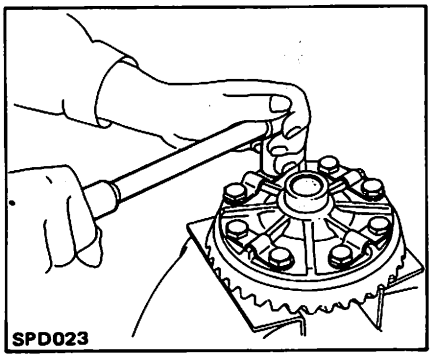






2. Remove ring gear by unfolding lock strap and loosening ring gear bolts.

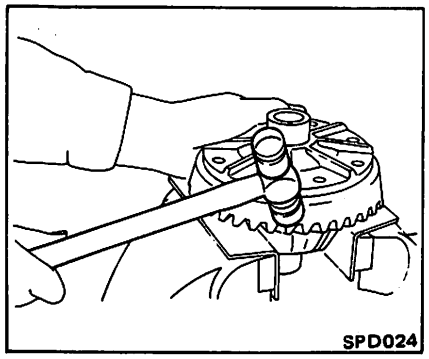
Loosen bolts diagonally.



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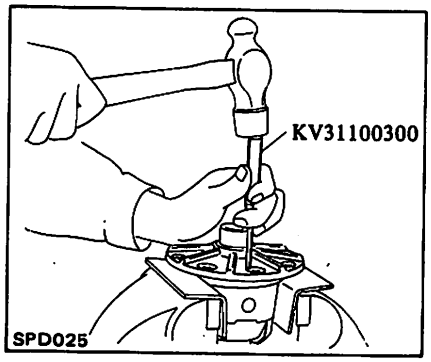
3. Tap ring gear off the gear case using a soft hammer.

Tap evenly all around to keep ring gear from binding.



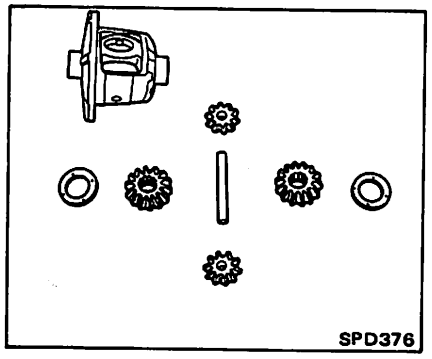
4. Punch off pinion mate shaft lock pin with Tool **from ring gear side.**

Lock pin is calked at pin hole mouth on differential case. Do not force it off without checking how it is calked.



5. Draw out pinion mate shaft and remove pinion mate gears, side gears and thrust washers.

Put marks on gears and thrust washers so that they can be reinstalled in the same position from which they were removed.



INSPECTION

1. Clean disassembled parts completely.

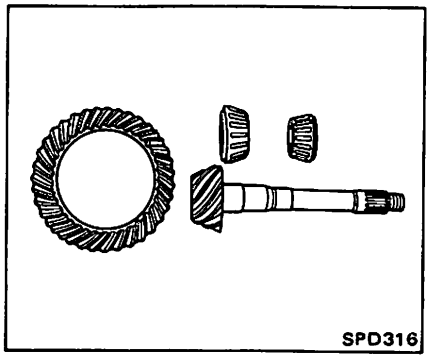
Examine them to see if they are worn, damaged or faulty.

Repair or replace any damaged or faulty parts.

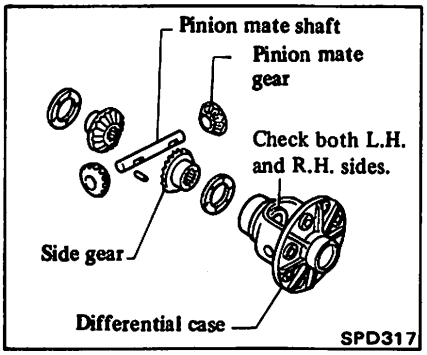
Especially check the following.

(1) Check gear teeth for scoring, cracking or chipping and make sure that tooth contact pattern indicates correct meshing depth. Repair or replace any damaged or faulty parts.

When replacing drive pinion or ring gear, replace with a new hypoid gear set.

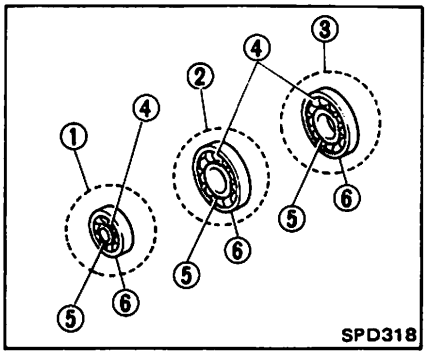


(2) Check pinion gear shaft, pinion gear, side gear and thrust washers on differential case for scores and signs of wear, and replace as required.



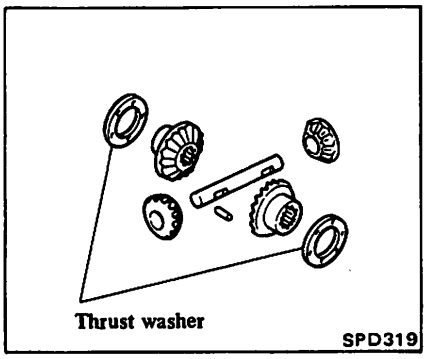
(3) Inspect all bearing races and rollers for scoring, chipping or evidence of excessive wear. They should be in excellent condition with a mirror-like surface and show no signs of wear.

Replace any damaged or faulty parts.

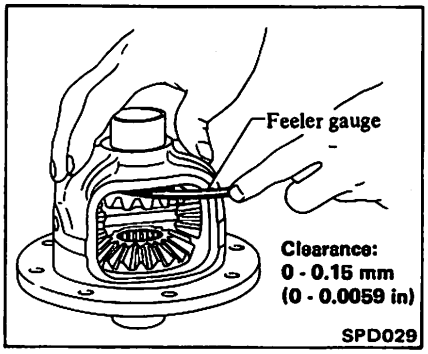


1 Front pilot bearing
2 Pinion front bearing
3 Pinion rear bearing
4 Roller
5 Inner race
6 Outer race

(4) Inspect thrust washer faces. Small faults can be corrected with sandpaper.

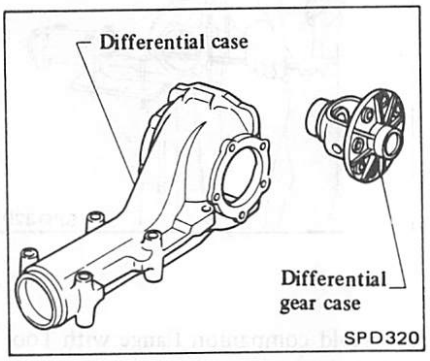


(5) Inspect pinion mate gear to side gear clearance. If clearance between side gear and thrust washer exceeds limits, replace thrust washers.

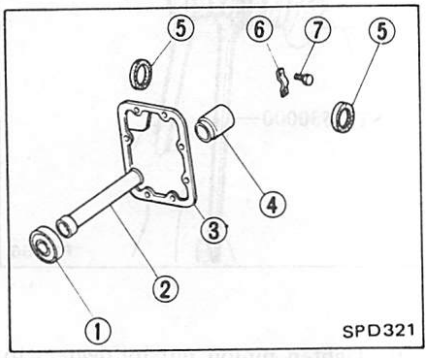


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(6) Inspect differential carrier and differential gear case for cracks or distortion. Replace any faulty parts.



2. The following parts should be replaced each time they are removed.
- Gasket
- Oil seal
- Spacer
- Lock strap
- Ring gear bolt



1 Front oil seal
2 Pilot bearing spacer
3 Gasket
4 Pinion bearing adjusting spacer
5 Side oil seal
6 Ring gear lock strap
7 Ring gear bolt

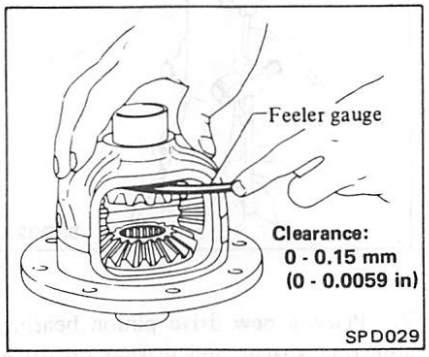
ASSEMBLY

Assembly should be done in the reverse order of disassembly, while making any necessary inspections and adjustments.

CAUTION:
- **a. Arrange shims and washers to install them correctly.**
- **b. Thoroughly clean the surfaces on which shims, washers, bearings and bearing caps are installed.**
- **c. Apply gear oil when installing bearings.**
- **d. Pack recommended multi-purpose grease into cavity between lips when fitting oil seal.**

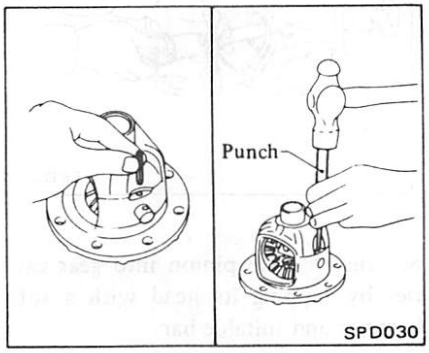
DIFFERENTIAL CASE

1. Install pinion mate gears, side gears and thrust washers into differential case.
2. Fit pinion mate shaft.
3. Adjust clearance between rear face of side gear and thrust washer by selecting side gear thrust washer (Refer to S.D.S.).

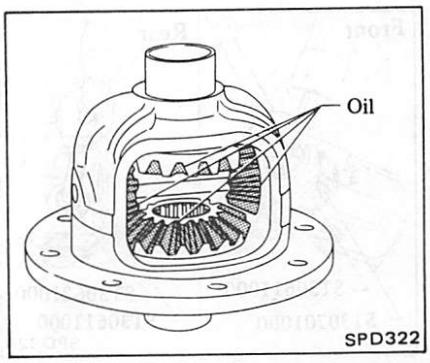


4. Install pinion mate shaft lock pin using a punch.

Make sure lock pin is flush with case.



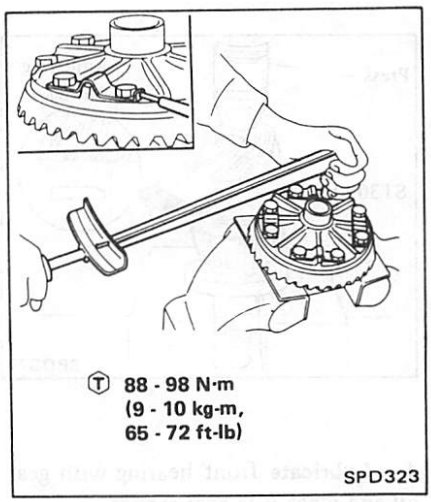
5. Apply oil to gear tooth surfaces and thrust surfaces and check to see they turn properly.



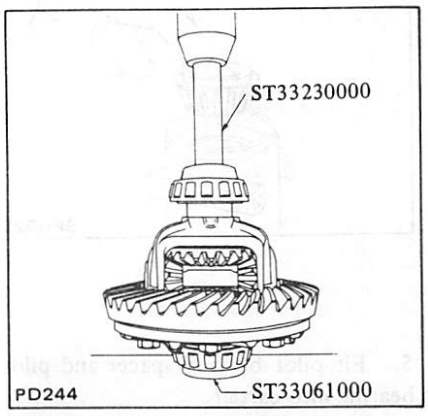
6. Place ring gear on differential case and install **new** lock straps and bolts.

Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

Then bend up lock straps to lock the bolts in place.



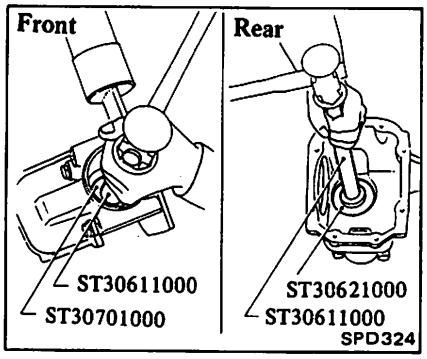
7. Press-fit side bearing cone on differential case with Tools.



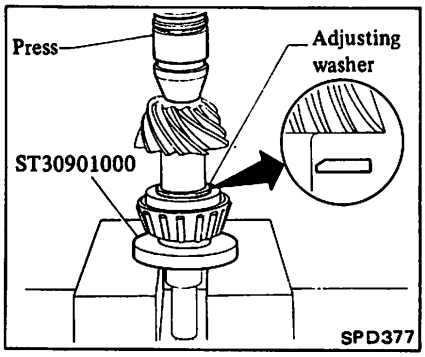
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DIFFERENTIAL CARRIER

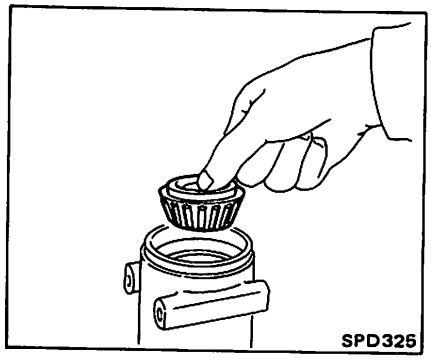
1. Press-fit front and rear bearing outer races using Tools.



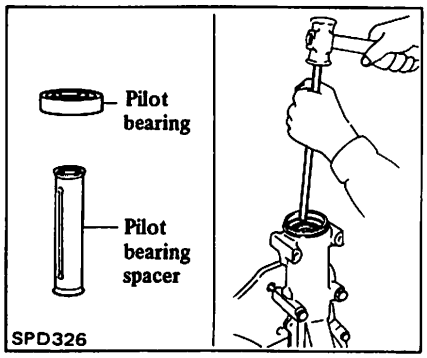
2. Select pinion height adjusting washer, referring to **Pinion Height Adjustment.**
3. Install pinion height adjusting washer in drive pinion, **bevel side toward gear,** and press fit rear bearing inner race in it, using press and Tool.



4. **Lubricate** front bearing with gear oil and place it in gear carrier.

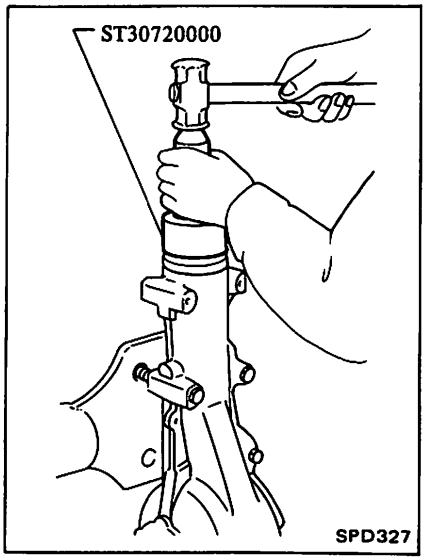


5. Fit pilot bearing spacer and pilot bearing into carrier.

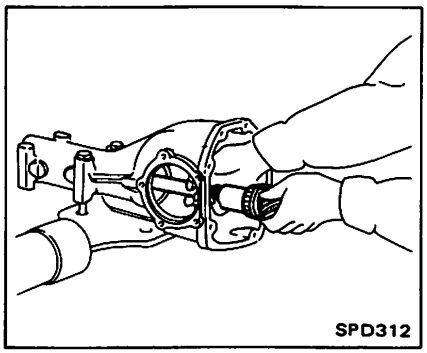


6. Using Tool, carefully fit a **new** oil seal into carrier.

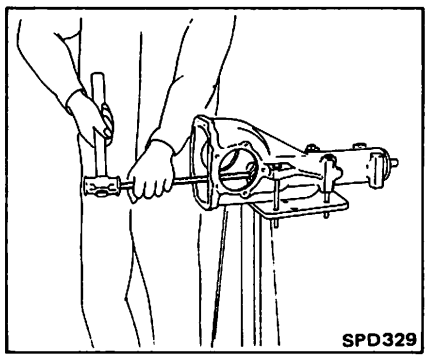
Make sure oil seal is flush with end of carrier and apply multi-purpose grease into cavity between lips.



7. Place a **new** drive pinion bearing adjusting spacer and washer on drive pinion and **lubricate** rear bearing with gear oil, and insert it in gear carrier.

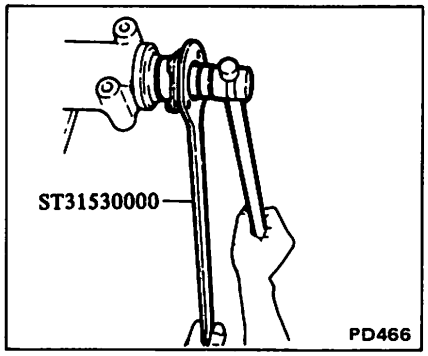


8. Insert drive pinion into gear carrier by tapping its head with a soft hammer and suitable bar.



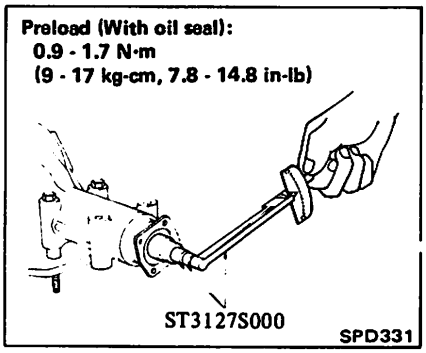
9. Hold companion flange with Tool and temporarily tighten pinion nut, until there is no axial play.

a. If drive pinion lock nut is worn, replace it.
b. Ascertain that threaded portion of drive pinion and pinion nut are free from oil or grease.



10. Tighten pinion nut by degrees to the specified preload while checking the preload with Tools.

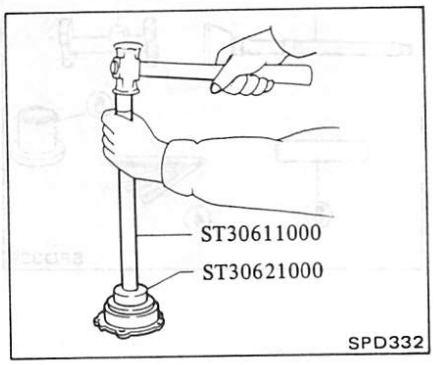
When checking preload, turn drive pinion in both directions several times.



Ⓣ : Drive pinion nut
167 - 196 N·m
(17 - 20 kg-m,
123 - 145 ft-lb)

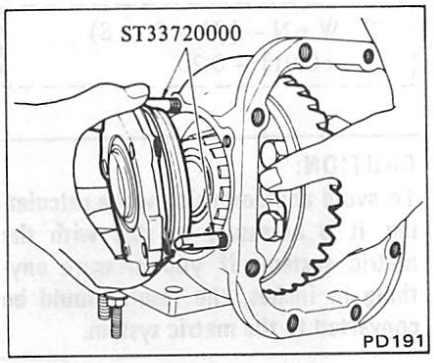
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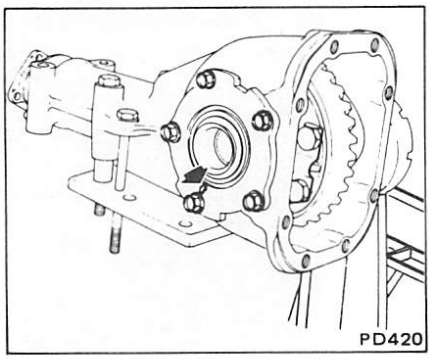
11. Press-fit side bearing outer race into side retainer using Tool.



12. Select side retainer adjusting shim. Refer to **Adjustment of Side Retainer Shims.**

13. Fit side retainer adjusting shims and O-ring in both side retainers, and install retainers in carrier with Tool.





14. Install side flange.

ADJUSTMENT

DRIVE PINION BEARING PRELOAD ADJUSTMENT

Adjust drive pinion bearing preload by placing pinion bearing adjusting washer and pinion bearing adjusting spacer between front and rear bearing cones.

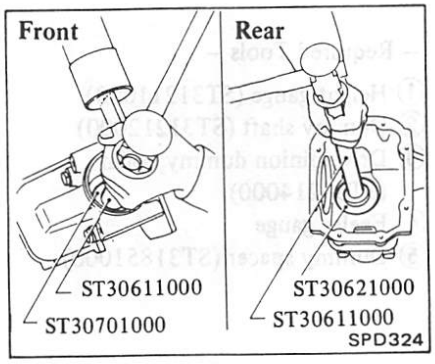
This adjustment is not affected by the thickness of pinion height adjusting washer.

This adjustment must be carried out before inserting oil seal.

– Required Tools –

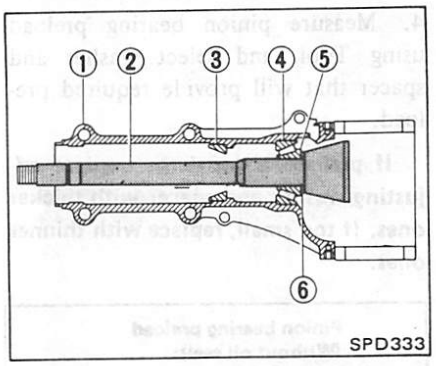
① Dummy shaft (ST31212000)
② Stopper (ST31852000)
③ Drive pinion
Dummy collar (ST31214000)
④ Preload gauge (ST3127S000)

1. Press-fit front and rear bearing outer races into gear carrier using Tools.



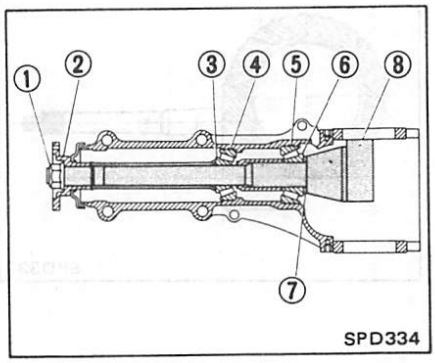
2. Insert pinion height adjusting washer with the specified thickness and rear bearing inner race into Dummy Shaft ST31212000, and install them in gear carrier.

Reuse the old washers if they have normal tooth contact pattern when examined during pre-disassembly check.

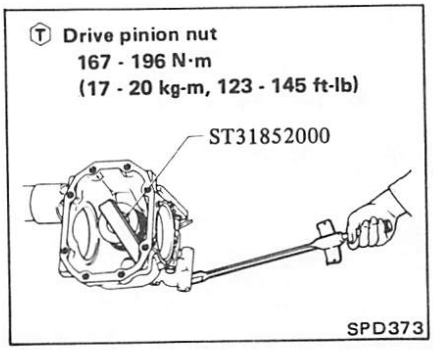


1 Gear carrier
2 ST31212000
3 Front bearing outer race
4 Rear bearing outer race
5 Rear bearing inner race
6 Pinion height adjusting washer

3. Fit drive pinion bearing preload adjusting spacer, washer, pinion front bearing inner race, Drive pinion Dummy Collar ST312140000 and companion flange in this order on dummy shaft and tighten drive pinion nut to the specified torque using Tool.



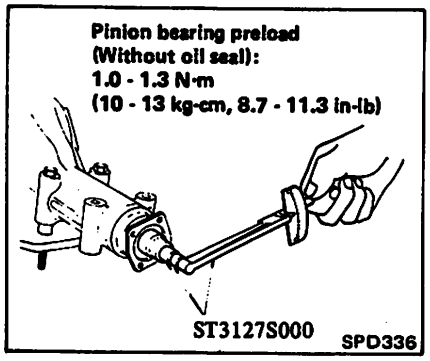
1 Drive pinion nut
2 Companion flange
3 Front bearing inner race
4 Front bearing outer race
5 Rear bearing outer race
6 Rear bearing inner race
7 Pinion height adjusting washer
8 Stopper ST31852000



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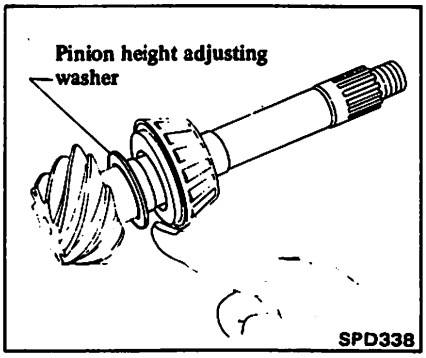
4. Measure pinion bearing preload using Tool, and select washer and spacer that will provide required preload.

If preload is too large, replace adjusting washer and spacer with thicker ones. If too small, replace with thinner ones.

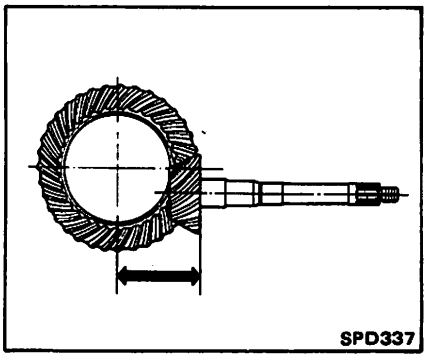


When replacing the hypoid gear set, drive pinion bearing or gear carrier, be sure to adjust the pinion height.

Adjustment of the pinion height can be made by adjusting the washer to be installed between the rear bearing inner race and the drive pinion head.

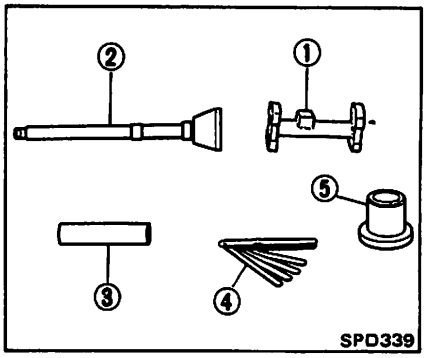


PINION HEIGHT ADJUSTMENT



– Required Tools –

① Height gauge (ST31211000)
② Dummy shaft (ST31212000)
③ Drive pinion dummy collar (ST31214000)
④ Feeler gauge
⑤ Dummy spacer (ST31851000)



⑥ Stopper (ST31852000)
Refer to DRIVE PINION BEARING PRELOAD ADJUSTMENT.
⑦ Preload gauge (ST3127S000)
Refer to DRIVE PINION BEARING PRELOAD ADJUSTMENT.

1. Thickness of drive pinion height adjusting washer can be calculated using the following formula.

$$T = W + N - [(H - D' - S) \times 0.01] - 0.20$$

CAUTION:
To avoid any confusion while calculating, it is necessary to stay with the metric system. If you measure anything in inches, the result should be converted to the metric system.

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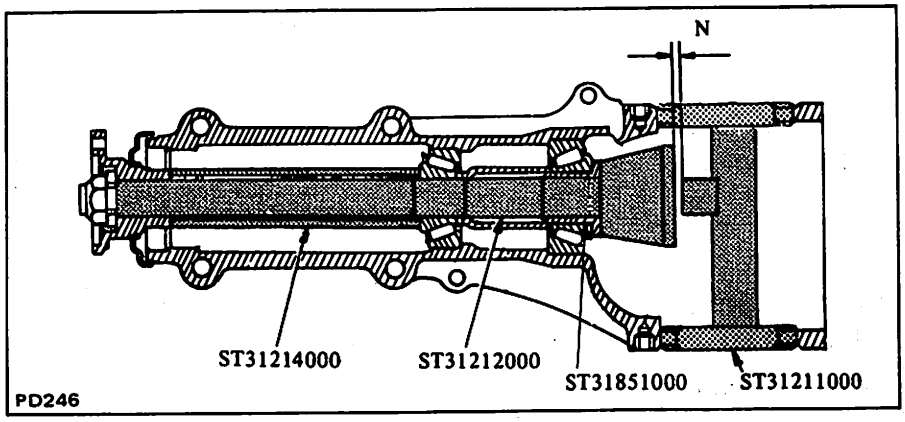
Where:

T = mm	Required thickness of rear bearing adjusting washers	H =	Marked on drive pinion head
W = mm	Thickness of washers temporarily inserted	D' =	Marked on dummy shaft
N = mm	Measured value with thickness gauge	S =	Marked on height gauge

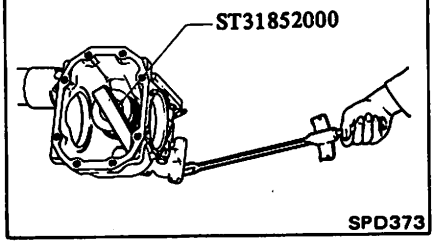
Figures for H, D' and S are dimensional variations in a unit of 1/100 mm against each standard measurement.

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2. Insert pinion height adjusting washer, Dummy Spacer ST31851000, rear bearing inner race into Dummy Shaft ST31212000, and install them in gear carrier. First drive pinion bearing preload adjusting spacer and washer selected in DRIVE PINION BEARING PRELOAD ADJUSTMENT, front bearing inner race, Dummy collar ST31214000, companion flange, companion flange washer and pinion nut in this order.

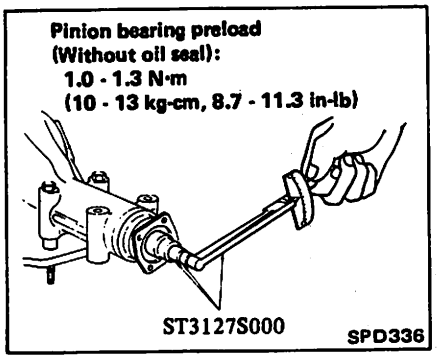


Ⓣ Drive pinion nut
167 - 196 N·m
(17 - 20 kg-m, 123 - 145 ft-lb)



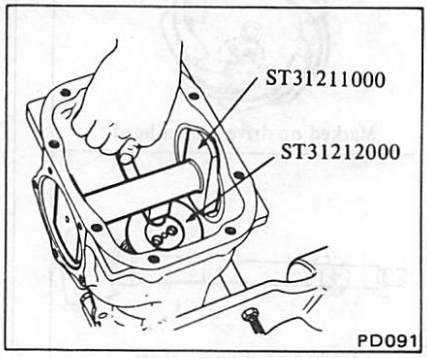
3. Tighten drive pinion nut using Tool, measuring drive pinion bearing preload. Give the specified preload to the drive pinion bearing under the specified torque of the drive pinion nut.

Pinion bearing preload
(Without oil seal):
1.0 - 1.3 N·m
(10 - 13 kg-cm, 8.7 - 11.3 in-lb)



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4. Measure the clearance (N) between the tip end of height gauge and the end surface of dummy shaft, using a feeler gauge.



5. Substitute these values into the equation to calculate the thickness of the washer.

If values signifying H, D′ and S are not given, regard them as zero and calculate.

After assembly, check to see that tooth contact is correct. If not, readjust.

Examples:

Ex. 1 ---

W = 3.09 mm
N = 0.33 mm
H = +2, D′ = –1, S = 0

$T = W + N - [(H - D' - S) \times 0.01] - 0.20$
$= 3.09 + 0.33 - [((+2) - (-1) - (0)) \times 0.01] - 0.20$
$= 3.09 + 0.33 - [(2 + 1 - 0) \times 0.01] - 0.20$
$= 3.09 + 0.33 - [(2 + 1 - 0) \times 0.01] - 0.20$
$= 3.09 + 0.33 - [3 \times 0.01] - 0.20$
$= 3.09 + 0.33 - 0.03 - 0.20$
$= 3.19$ mm

The correct washer is 3.18 mm thick.

Ex. 2 ---

W = 3.09 mm
N = 0.28 mm
H = –2, D′ = +1, S = –1

$T = W + N - [(H - D' - S) \times 0.01] - 0.20$
$= 3.09 + 0.28 - [((-2) - (+1) - (-1)) \times 0.01] - 0.20$
$= 3.09 + 0.28 - [(-2 - 1 + 1) \times 0.01] - 0.20$
$= 3.09 + 0.28 - [-2 \times 0.01] - 0.20$
$= 3.09 + 0.28 + 0.02 - 0.20$
$= 3.19$ mm

The correct washer is 3.18 mm thick.

Ex. 3 ---

W = 3.09 mm
N = 0.45 mm
H = 0, D′ = 0, S = 0

$T = W + N - [(H - D' - S) \times 0.01] - 0.20$
$= 3.09 + 0.45 - [(0 - 0 - 0) \times 0.01] - 0.20$
$= 3.09 + 0.45 - [0 \times 0.01] - 0.20$
$= 3.09 + 0.45 - 0 - 0.20$
$= 3.34$ mm

The correct washer is 3.33 mm thick.

6. Select the proper washer (Refer to S.D.S.).

If you cannot find the desired thickness of washer, use washer so that thickness is the closest to the calculated value.

Example:

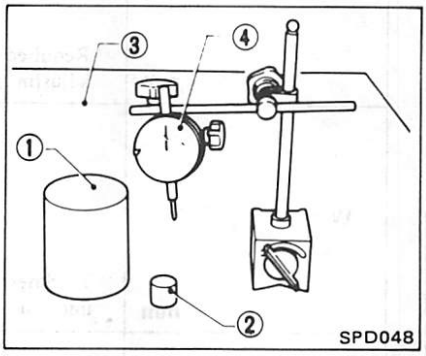
Calculated value.... T = 3.34 mm
Used washer ..... T = 3.33 mm

SIDE RETAINER SHIM ADJUSTMENT

When the hypoid gear set, carrier, differential case, side bearing or side bearing retainer is replaced, or when the ring gear backlash or side bearing preload is out of specifications, side retainer shims of proper thickness should be installed.

– Required Tools –

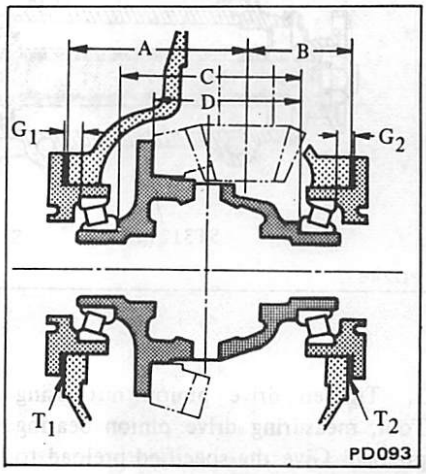
① Weight block (ST32501000)
② Master gauge (KV38101900)
③ Base plate
④ Dial indicator.



1. Thickness of the right and left retainer shims can be calculated using the following equation.

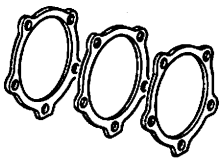
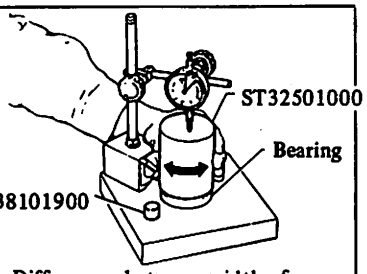
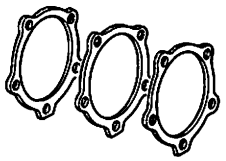
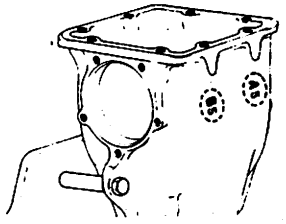
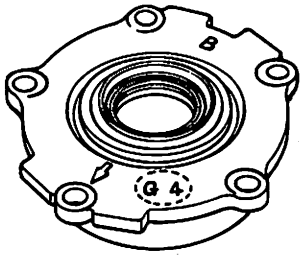
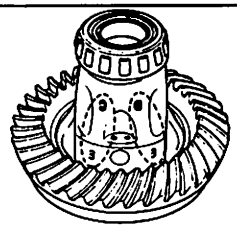
Left side: $T_1 = (A + C + G_1 - D) \times 0.01 + 0.76 - E$
Right side: $T_2 = (B + D + G_2) \times 0.01 + 0.76 - F$

CAUTION:
To avoid any confusion while calculating, it is absolutely necessary to stay with metric system.
If you measure anything in inches, the results should be converted into the metric system.



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Where:

T_1 = mm (Left side retainer shim)		E = mm (Left side bearing)	 Differences between width of left (E) or right (F) side bearing and standard width [20.00 mm (0.7874 in)]
T_2 = mm (Right side retainer shim)		F = mm (Right side bearing)	
A =	 Marked on gear carrier	G_1 = (Left side retainer)	 Marked on side retainer
B =		G_2 = (Right side retainer)	
C =	 Marked on differential case		
D =			

Figures for A, B, C, D, G_1 and G_2 are dimensional variations in a unit of 1/100 mm against each standard measurement.

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2. Substitute these values into the equation to calculate the thickness of the shim.

If values signifying A, B, C, D, G_1 and G_2 are not given, regard them as zero and calculate.

After assembly, check to see that preload and backlash are specifications. If not, readjust.

Examples:

Ex. 1 ---

A = 5, B = 5, C = 3, D = 3, G_1 = 4, G_2 = 1, E = 0.11 mm, F = 0.15 mm

Left side:

T_1 = (A + C + G_1 – D) × 0.01 + 0.76 – E
= (5 + 3 + 4 – 3) × 0.01 + 0.76 – 0.11
= 9 × 0.01 + 0.76 – 0.11
= 0.09 + 0.76 – 0.11
= 0.74 mm

The correct shims are as follows:

Thickness		Quantity	
0.07	×	2	= 0.14
0.10	×	1	= 0.10
0.50	×	1	= 0.50
Total thickness			= 0.74 mm

Right side:

T_2 = (B + D + G_2) × 0.01 + 0.76 – F
= (5 + 3 + 1) × 0.01 + 0.76 – 0.15
= 9 × 0.01 + 0.76 – 0.15
= 0.09 + 0.76 – 0.15
= 0.70 mm

The correct shims are 0.20 plus 0.50 mm thick.

Ex. 2 ---

A = 2, B = 3, G = 0, D = 3
G_1 = 2, G_2 = 3, E = 0.20 mm, F = 0.17 mm

Left side:

T_1 = (A + C + G_1 – D) × 0.01 + 0.76 – E
= (2 + 0 + 2 – 3) × 0.01 + 0.76 – 0.20
= 1 × 0.01 + 0.76 – 0.20
= 0.01 + 0.76 – 0.20
= 0.57 mm

The correct shims are 0.07 plus 0.50 mm thick.

Right side:

T_2 = (B + D + G_2) × 0.01 + 0.76 – F
= (3 + 3 + 3) × 0.01 + 0.76 – 0.17
= 9 × 0.01 + 0.76 – 0.17
= 0.09 + 0.76 – 0.17
= 0.68 mm

The correct shims are as follows:

Thickness		Quantity	
0.07	×	4	= 0.28
0.20	×	2	= 0.40
Total thickness			= 0.68mm

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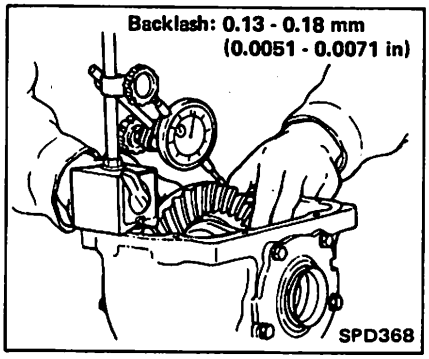
3. Select the proper shims (Refer to S.D.S.).

If you cannot find shims with the desired thickness, use shims so that the total thickness is the closest to the calculated value.

FINAL VERIFICATION

1. Ring gear backlash check and adjustment:

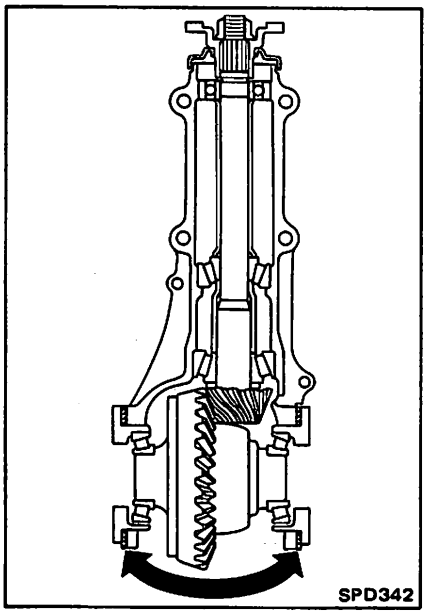
Check backlash of ring gear with a dial indicator.



If backlash is too small, decrease thickness of right shim and increase thickness of left shim by the same amount.

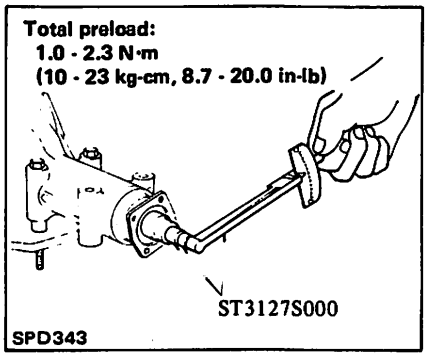
If backlash is too great, reverse the above procedure.

Never change the total amount of shims as it will change the bearing preload.



2. Total preload check and adjustment:

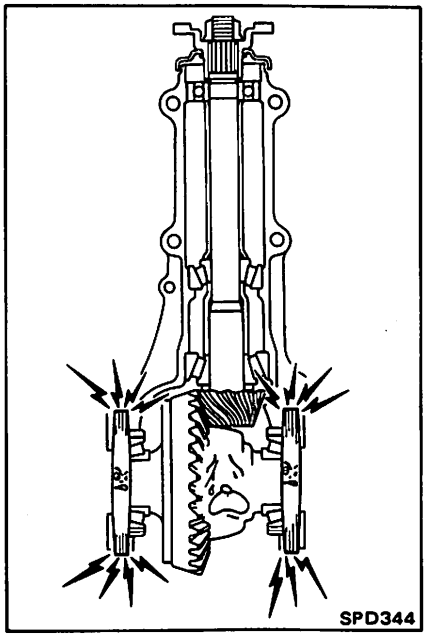
(1) Check total preload with Tools.



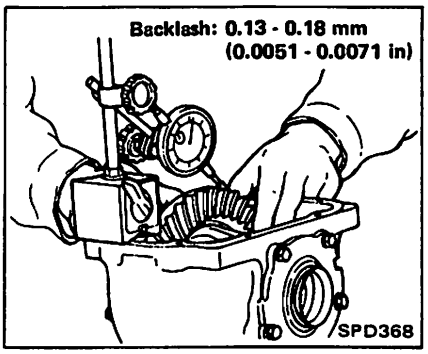
If preload is too great, add the same amount of shim to each side.

If preload is too small, remove the same amount of shim to each side.

Never add or remove different amount of shims to each side, or ring gear backlash will be changed.

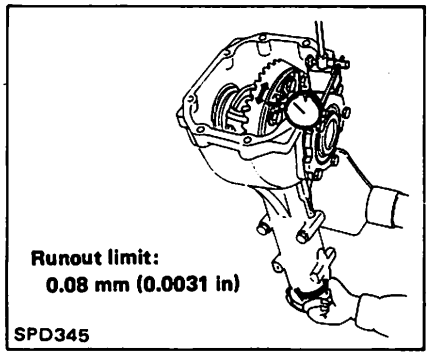


(2) Check ring gear-to-drive pinion backlash because increase or decrease in thickness of shims will cause change of ring gear-to-pinion backlash.



3. Ring gear runout check and adjustment:

Check runout of ring gear with a dial indicator.



If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.

If the runout is over specifications even after removal of the foreign matter, the hypoid gear set or differential case should be replaced.

If the backlash varies greatly even when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

4. Tooth contact check and adjustment:

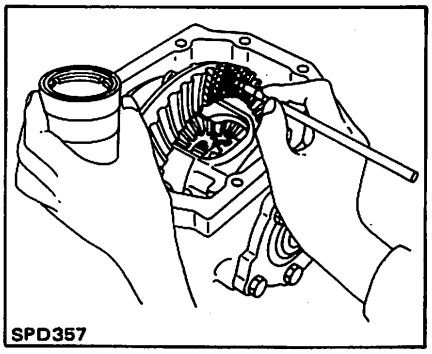
Finally, check for tooth contact pattern.

Refer to **Tooth Contact.**

Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.

However, in extremely rare cases you will have to use trial-and-error processes until you get a good tooth contact pattern.

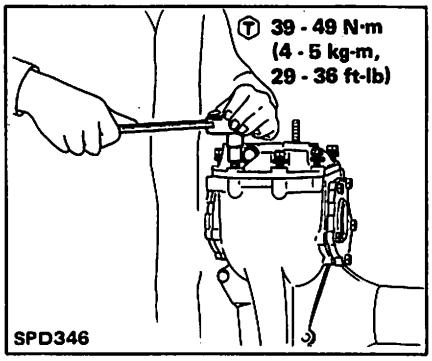
The tooth pattern is the best indication of how well a differential has been set up.



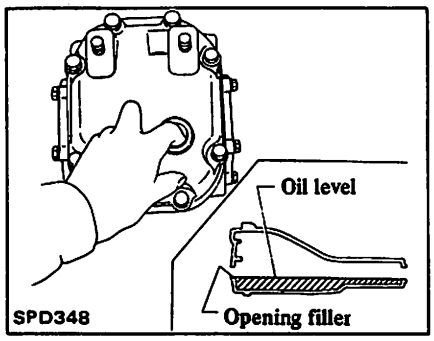
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5. Install rear cover.

Gasket should be replaced by new one each time the differential carrier is removed.



6. Install side flange.
7. Install differential carrier in vehicle and tighten nuts to the specified value.
8. Install drive shaft and front propeller shaft.
9. Then fill with gear oil, referring to Recommended Lubricants (Section MA).



Gear oil capacity:
1.0 liters
(2-1/8 US pt, 1-3/4 Imp pt)

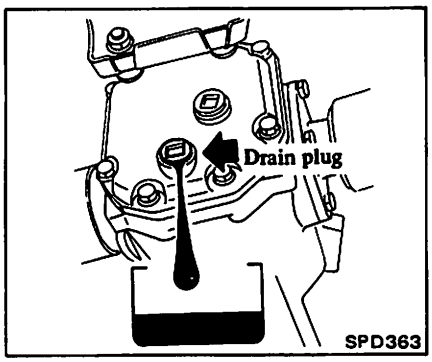
Ⓣ: Differential carrier front mounting
Carrier to bracket
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)
Crossmember to bracket
71 - 96 N·m
(7.2 - 9.8 kg-m,
52 - 71 ft-lb)
Differential carrier rear mounting
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)
Drive shaft to side flange
Use SST to tighten.
27 - 37 N·m
(2.8 - 3.8 kg-m,
20 - 27 ft-lb)
Companion flange to propeller shaft
34 - 44 N·m
(3.5 - 4.5 kg-m,
25 - 33 ft-lb)
Drain and filler plugs
59 - 98 N·m
(6 - 10 kg-m,
43 - 72 ft-lb)

REPLACEMENT OF OIL SEAL

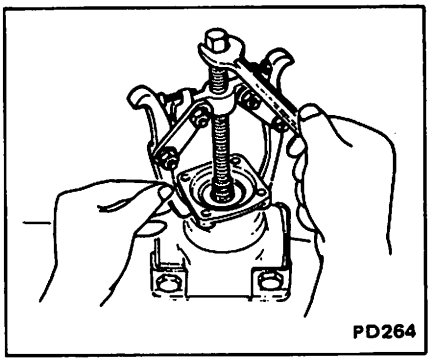
FRONT OIL SEAL

The following is the procedure for replacement of front oil seal with differential gear carrier assembly installed on the vehicle.

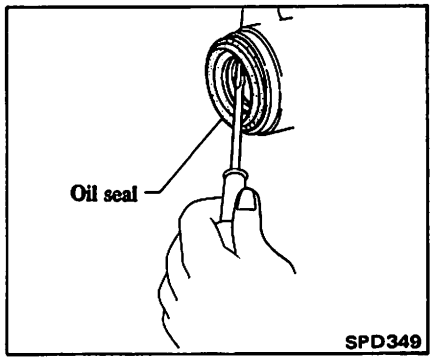
1. Drain gear oil.



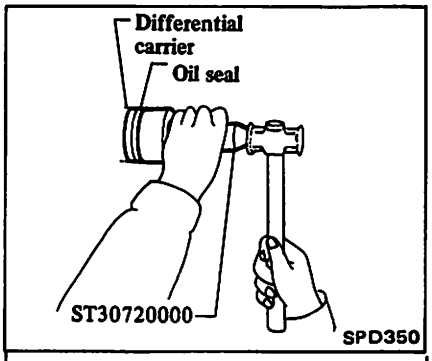
2. Block rear wheels. Raise the front of vehicle with garage jack and position safety stands (Refer to Section GI.).
3. Detach propeller shaft from companion flange of carrier (Refer to Section PD for removal.).
4. Remove drive pinion nut, holding flange with Tool.
5. Extract companion flange using a suitable puller.

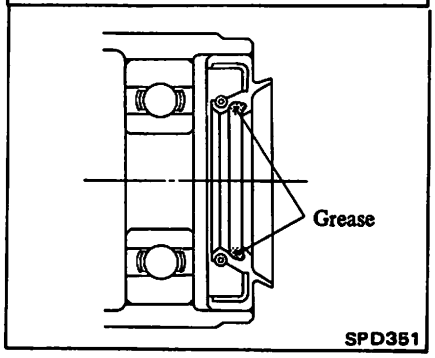


6. Remove oil seal.



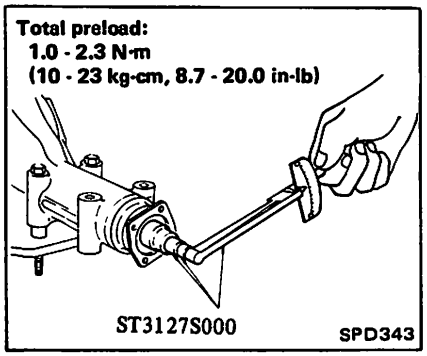
7. Set new oil seal in position using Tool. Apply grease to cavity between oil seal lips.





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8. Fit companion flange on drive pinion, and secure them in position by tightening nut to the specified torque. Confirm the resulting preload, using Tool.

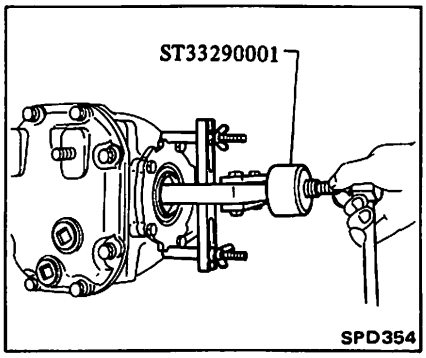


9. Reinstall propeller shaft in the reverse order of removal.
10. Fill with gear oil.

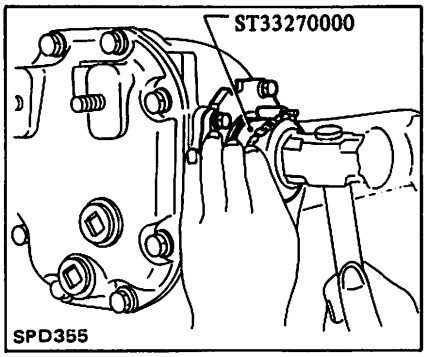
SIDE OIL SEAL

The following is the procedure for replacement of side oil seal with differential gear carrier assembly installed on the vehicle.

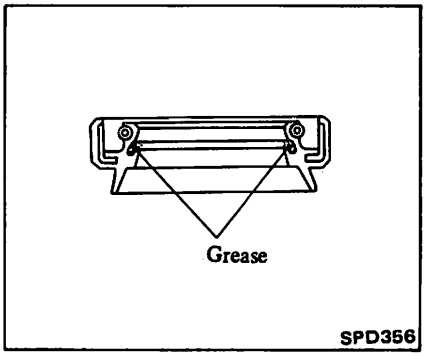
1. Remove side flange.
2. Remove oil seal using Tool.



3. Set in new oil seal using Tool.



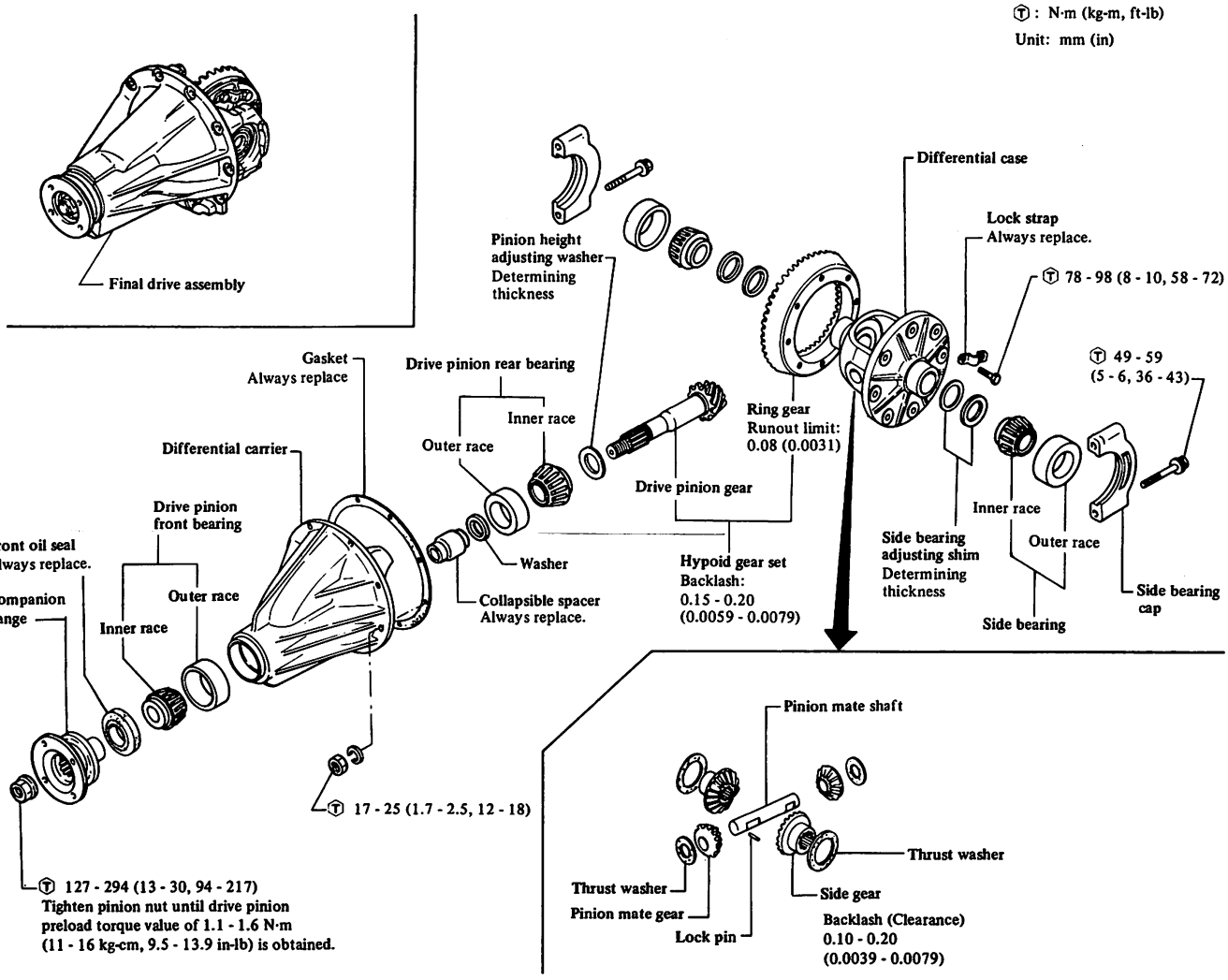
4. Apply grease to cavity between oil seal lips.



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DIFFERENTIAL CARRIER (Final drive)
—Model : H190-ML, H190A—

Ⓣ : N·m (kg-m, ft-lb)
Unit: mm (in)



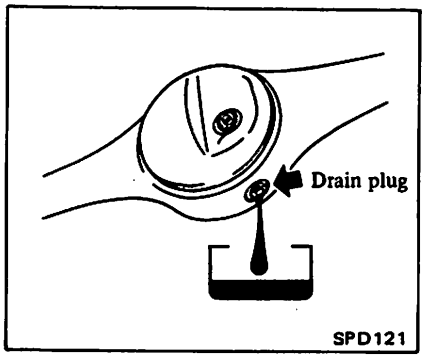
SPD156

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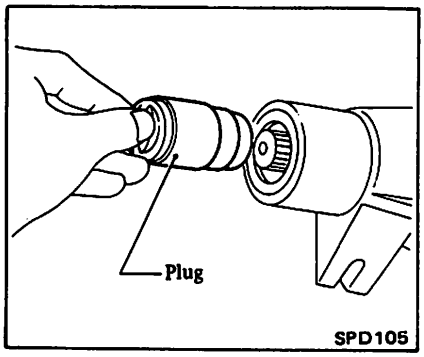
PREPARATION FOR DISASSEMBLY

REMOVAL

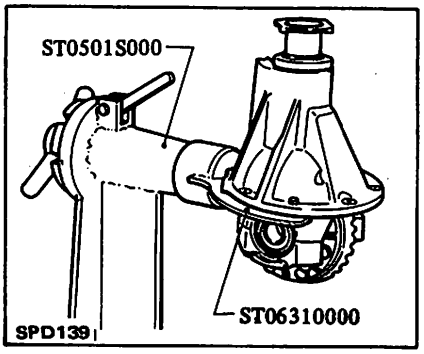
1. Jack up rear of vehicle and support it by placing safety stands under rear axle case, referring to section GI.
2. Remove drain plug and drain gear oil.



3. Remove propeller shaft and rear axle shafts (Refer to Section RA for removal.) and **plug up rear end of transmission rear extension housing.**

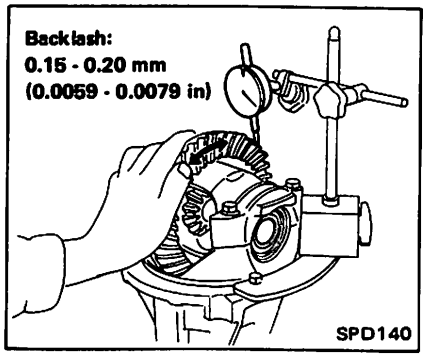


4. Loosen off nuts securing differential carrier to rear axle case, and take out differential carrier.
5. Mount differential carrier on Tool.



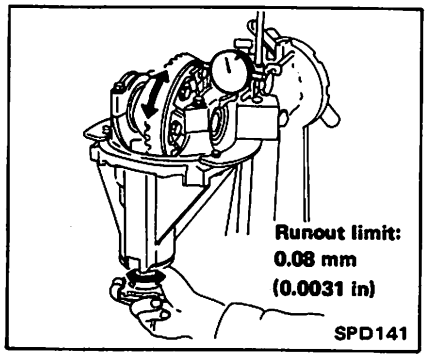
PRE-DISASSEMBLY INSPECTION

1. Check backlash of ring gear with a dial indicator at several points. If it is not within specification, adjust it referring to **SIDE BEARING ADJUSTMENT.**



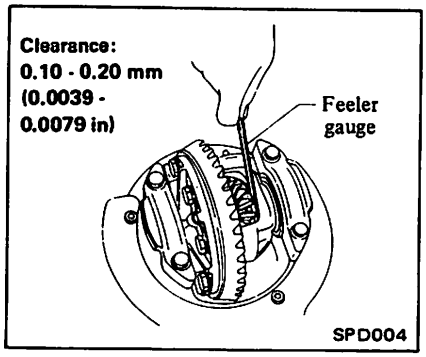
2. Check runout of ring gear with a dial indicator. If it is over specification, hypoid gear set or differential case should be replaced.

When backlash varies excessively in different places, the variance may have resulted from foreign matter caught between ring gear and differential case.



3. Check tooth contact, referring to **TOOTH CONTACT.**
4. Check backlash of side gear. Using a thickness gauge, measure clearance between side gear and differential case.

If it is not within specification, adjust it by selecting side gear thrust washer (Refer to S.D.S.).



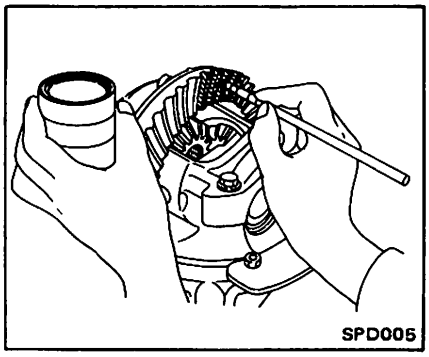
TOOTH CONTACT

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.

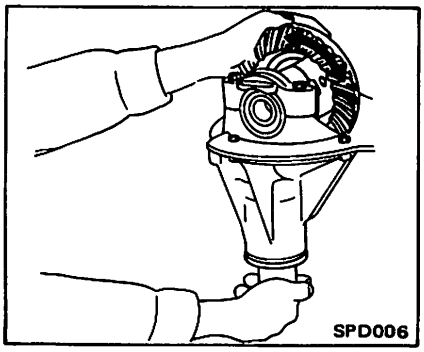
Hypoid gear set which are not positioned properly may be noisy, or have short life or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

Check

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear **drive side.**

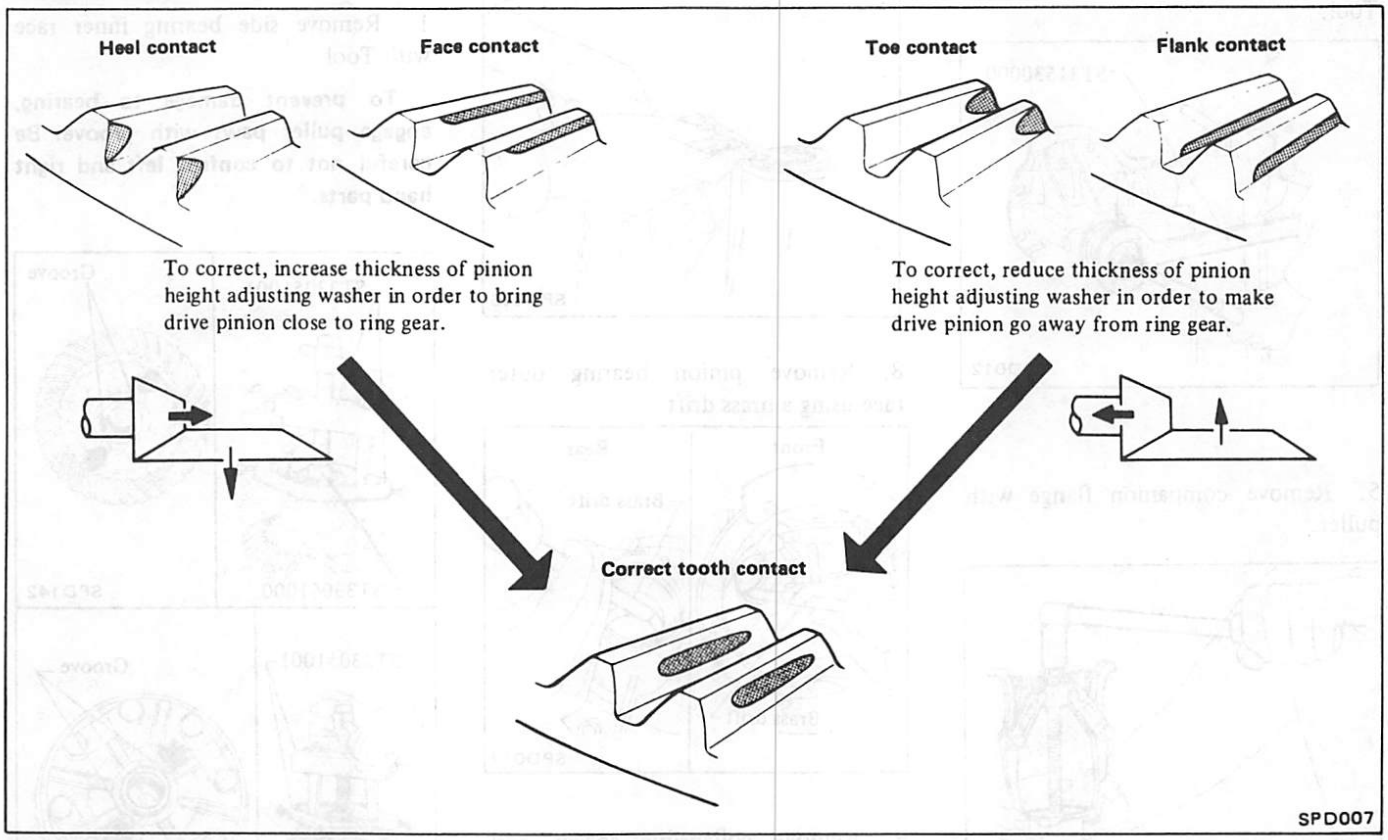


3. Hold companion flange steady by hand and rotate the ring gear in both directions.



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Adjustment

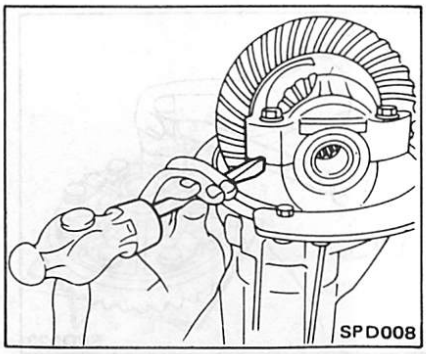


DISASSEMBLY

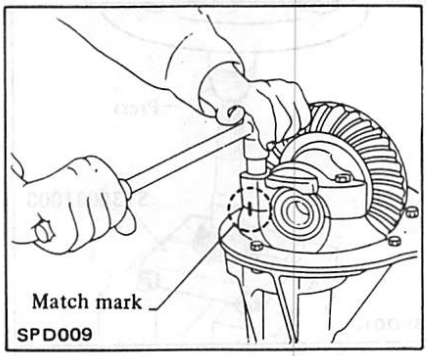
DIFFERENTIAL CARRIER

1. **Put match marks** on one side of side bearing cap with paint or punch to ensure that it is replaced in proper position during reassembly.

Bearing caps are line-board during manufacture and should be put back in their original places.

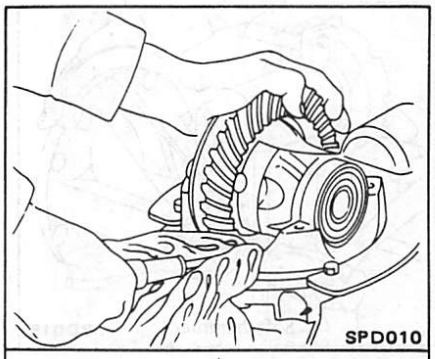


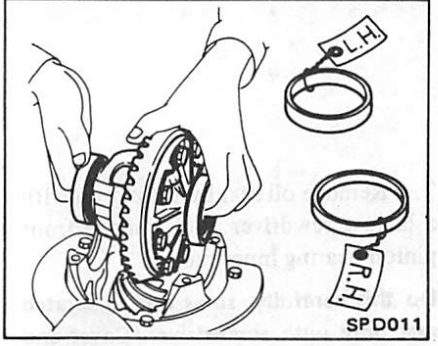
2. Remove side bearing caps.



3. Using a pry bar, remove differential case assembly.

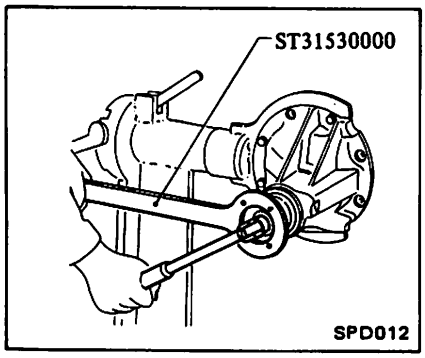
Be careful to keep the side bearing outer races together with inner race – don't mix them up.



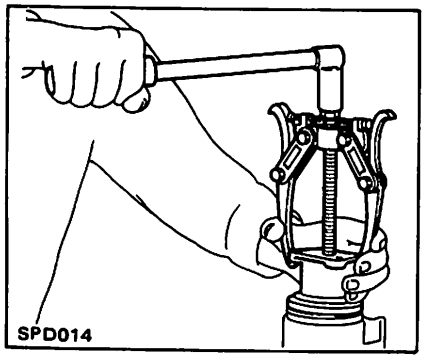


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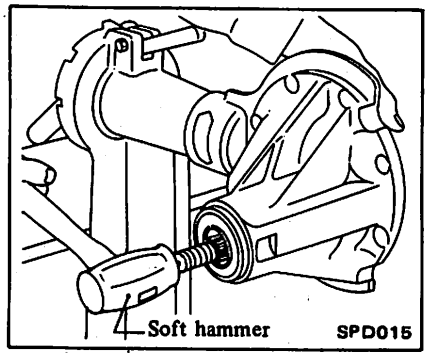
4. Remove drive pinion nut with Tool.



5. Remove companion flange with puller.

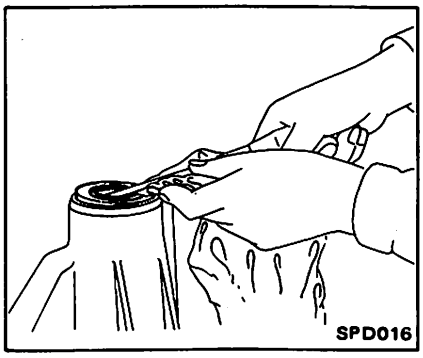


6. Remove drive pinion with soft hammer.

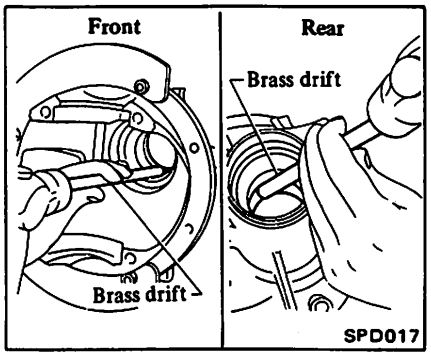


7. Remove oil seal by prying up with a large screwdriver, and remove front pinion bearing inner race.

Do this carefully, so as not to scratch seal bore with screwdriver. Cover end of screwdriver with a rag.

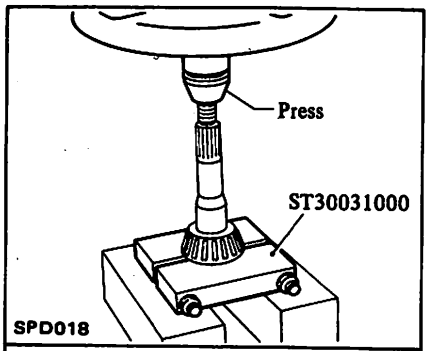


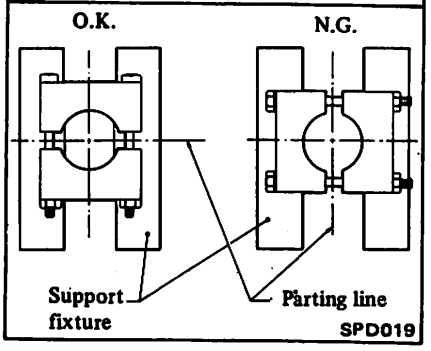
8. Remove pinion bearing outer race using a brass drift



9. Remove collapsible spacer and washer from drive pinion.
10. Pull out rear bearing inner race with a press and Tool.

Care should be taken when setting Tool in press to make sure that parting line of Tool is a right angle to support fixture of press. This is to prevent bending Tool.

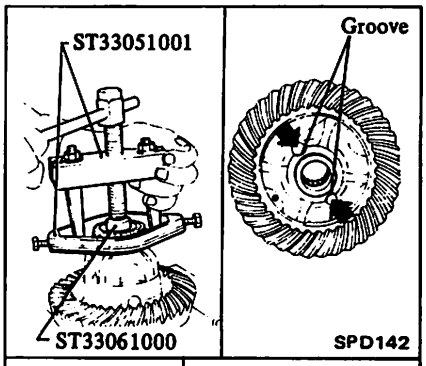


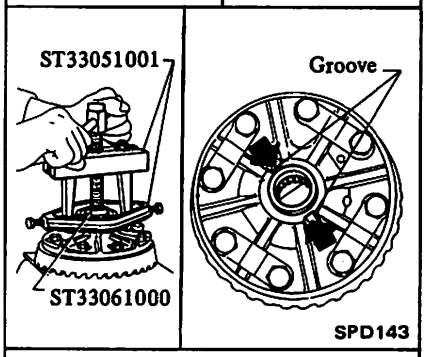


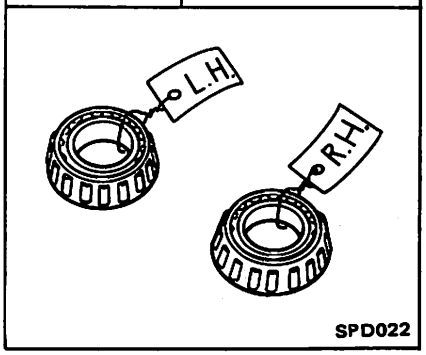
DIFFERENTIAL CASE

1. Remove side bearing inner race with Tool.

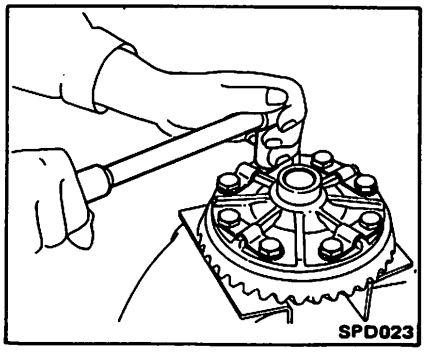
To prevent damage to bearing, engage puller paws with groove. Be careful not to confuse left and right hand parts.







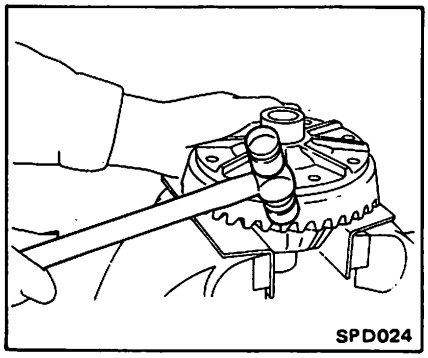
2. Remove ring gear by spreading out lock straps and loosening ring gear bolts in a criss-cross fashion.



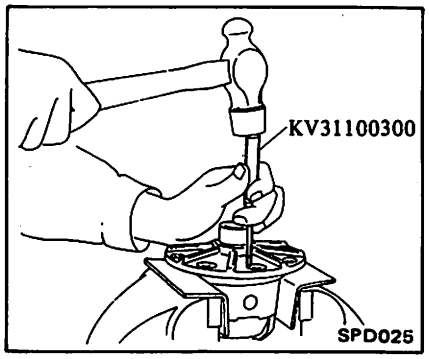
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3. Tap ring gear off gear case using a soft hammer.

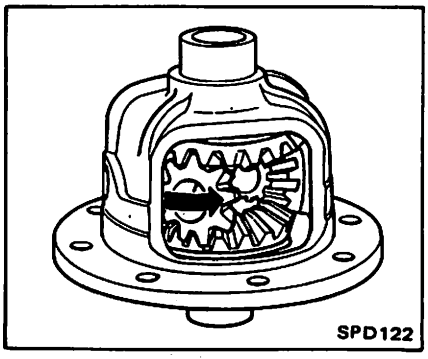
Tap evenly all around to keep ring gear from binding.



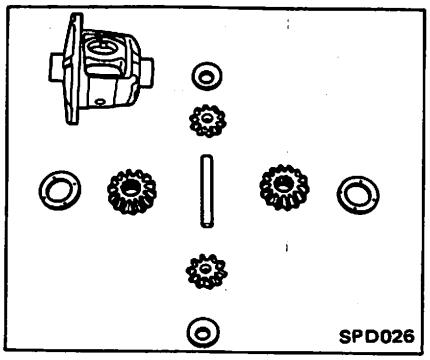
4. Drive out pinion mate shaft lock pin, with Tool **from ring gear side.**



5. Draw out pinion mate shaft, and rotate pinion mate gears out of the case and remove side gears and thrust washers.



Put marks on gears and thrust washers so that they can be reinstalled in their original positions from which they were removed.

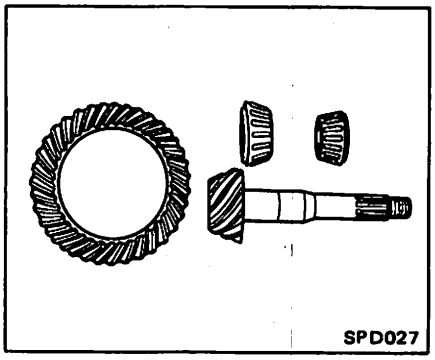


INSPECTION

1. Clean disassembled parts completely.

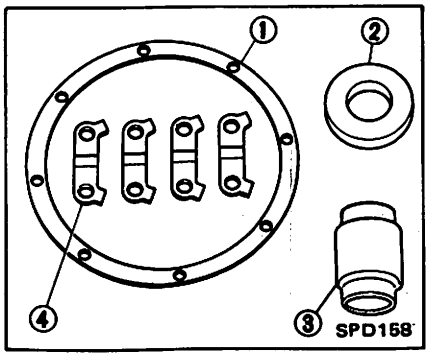
Repair or replace any damaged or faulty parts.

When replacing drive pinion or ring gear, replace with a new hypoid gear set.



2. The following parts should be replaced by new ones each time they are removed.

① Gasket
② Front oil seal
③ Collapsible spacer
④ Lock strap



ASSEMBLY

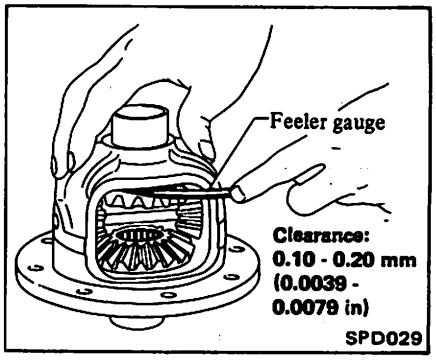
Assembly should be done in the reverse order of disassembly, while making any necessary inspections and adjustments.

PRECAUTION:

a. Arrange shims and washers to install them correctly.
b. Thoroughly clean the surfaces on which shims, washers bearings and bearing caps are installed.
c. Apply gear oil when installing bearings.
d. Pack recommended multi-purpose grease into cavity between lips when fitting oil seal.

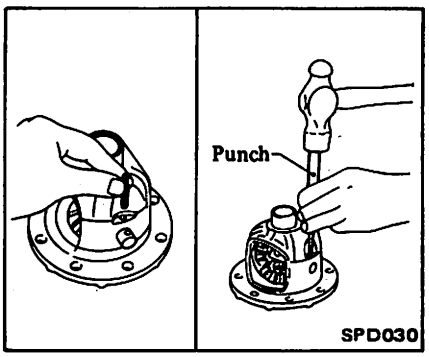
DIFFERENTIAL CASE

1. Install pinion mate gears, side gears and thrust washers into differential case.
2. Fit pinion mate shaft.
3. Adjust clearance between rear face of side gear and thrust washer by selecting side gear thrust washer (Refer to S.D.S.).



4. Install pinion mate shaft lock pin using a punch.

Make sure lock pin is flush with case.

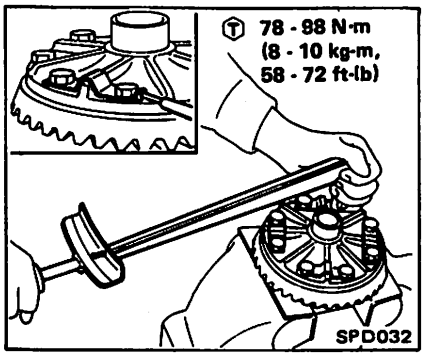


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5. Place ring gear on differential case and install **new** lock straps and bolts.

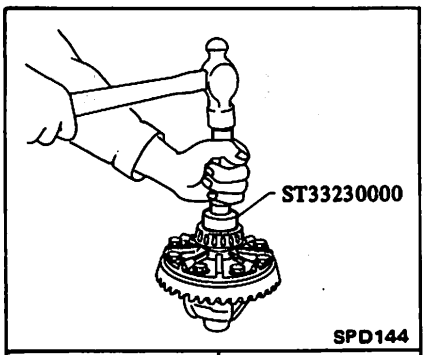
Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

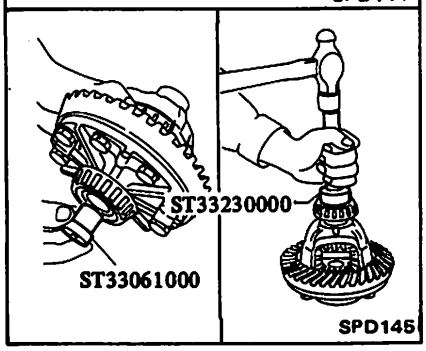
Then bend up lock straps to lock the bolts in place.



6. Select side bearing adjusting shims, referring to **SIDE BEARING ADJUSTMENT.**

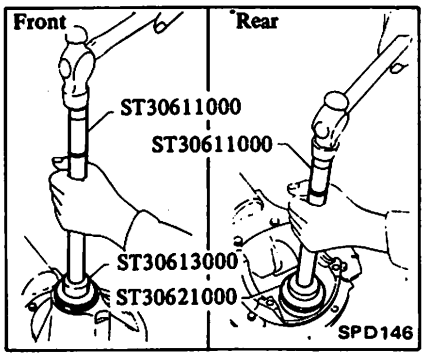
7. Install the shims behind each bearing and press on the bearings, using Tool.





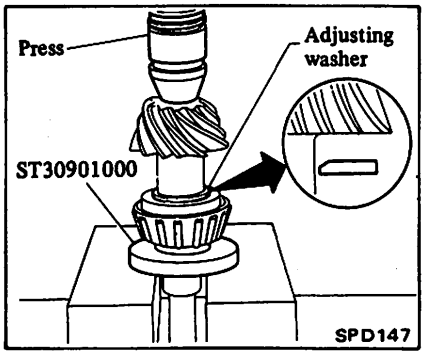
DIFFERENTIAL CARRIER

1. Press fit front and rear bearing outer races using Tools.

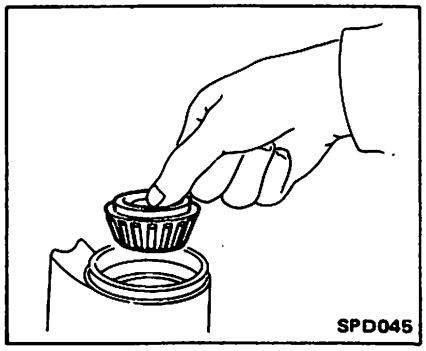


2. Select pinion height adjusting washer, referring to **PINION HEIGHT ADJUSTMENT.**

3. Install pinion height adjusting washer in drive pinion, **bevel side toward gear,** and press fit rear bearing inner race in it, using press and Tool.

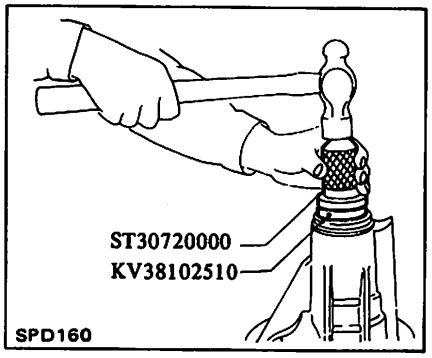


4. **Lubricate** front bearing with gear oil and place it in gear carrier.

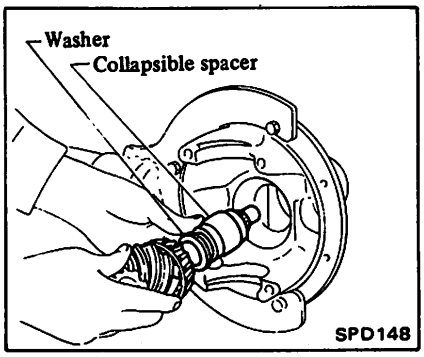


5. Using Tool, carefully fit a **new** oil seal into carrier.

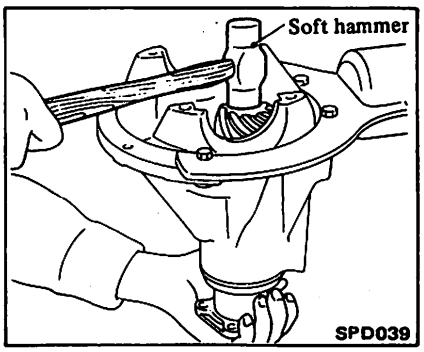
Make sure oil seal is flush with end of carrier and apply multi-purpose grease into cavity between lips.



6. Place a **washer** and a **new** collapsible spacer on drive pinion and **lubricate** rear bearing with gear oil, and insert it in gear carrier.



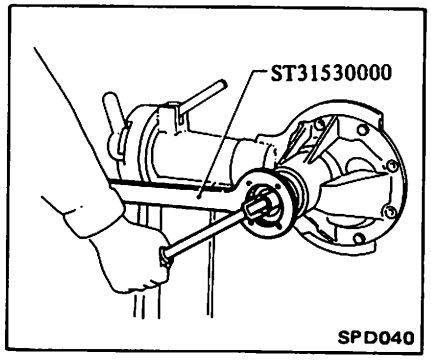
7. Install companion flange and hold it firmly. Insert drive pinion into companion flange by tapping its head with a soft hammer.



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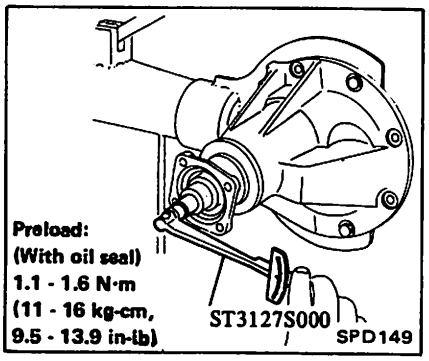
8. Hold companion flange with Tool and temporarily tighten pinion nut, until there is no axial play.

Ascertain that threaded portion of drive pinion and pinion nut are free from oil or grease.



9. Tighten pinion nut by degrees to the specified preload while checking the preload with Tools.

When checking preload, turn drive pinion in both directions several times set bearing rollers.



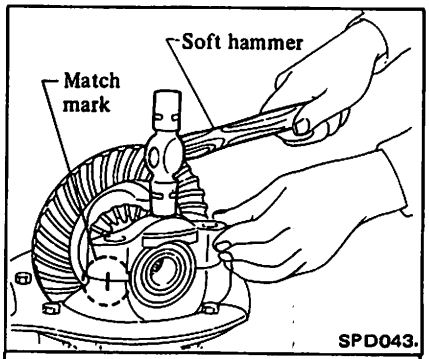
Ⓣ : Drive pinion nut
127 - 294 N·m
(13 - 30 kg-m,
94 - 217 ft-lb)

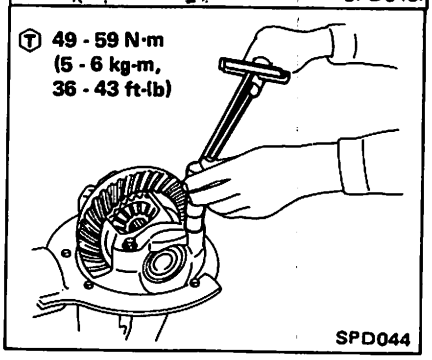
CAUTION:
The preload is achieved by using the permanent set of collapsible spacer. So here, if an over-preload results from excessive turning of the pinion nut, the spacer should be replaced by new one.

10. Install differential case assembly and side bearing outer races into differential carrier, and install side bearing cap.

Tap on the cap with a soft hammer to settle it in the carrier.

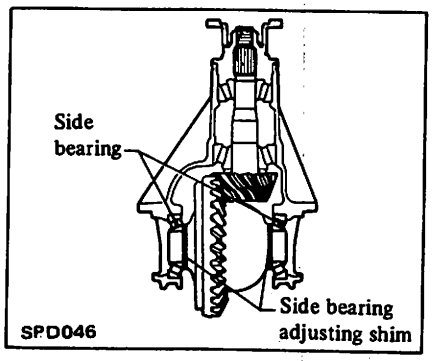
The bearing cap should be installed with the marks put at disassembly aligned.





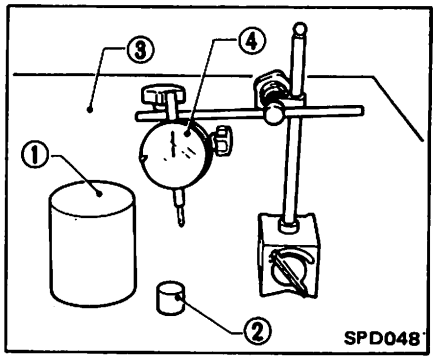
ADJUSTMENT

SIDE BEARING ADJUSTMENT



When the differential case, side bearing, or gear carrier is replaced, or when the ring gear backlash or side bearing preload is out of specifications, side bearing shims of proper thickness should be installed.

– Required Tools –
① Weight Block (ST32501000)
② Master Gauge (KV38101900)
③ Base Plate
④ Dial Indicator.



1. Thickness of shim can be calculated by following equation.

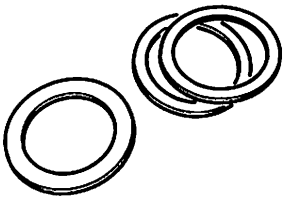
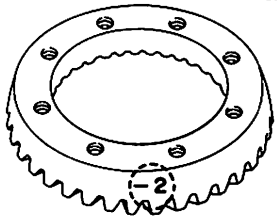
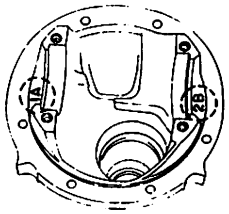
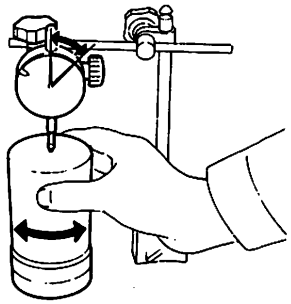
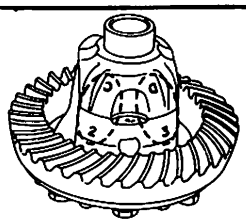
Left side: $T_1 = (A - C + D - H') \times 0.01 + 0.175 + E$

Right side: $T_2 = (B - D + H') \times 0.01 + 0.15 + F$

CAUTION:
To avoid any confusion while calculating, it is absolutely necessary to stay with metric system.
If you measure anything in inches, the results should be converted into the metric system.

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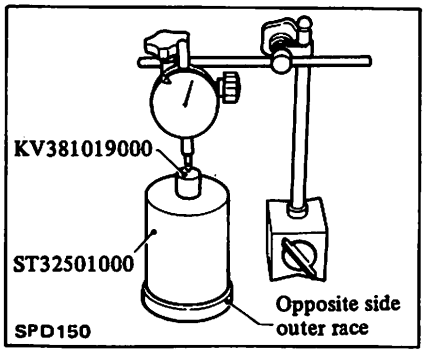
Where:

T_1= (Left side) T_2= (Right side)		H' =	
A =	 Stamped on differential carrier	E = mm (Left Side Bearing)	 Differences between width of left (E) or right (F) side bearing and standard width.
B =			
C =		F = mm (Right Side Bearing)	
D =	Stamped on differential case	A, B, C, D and H are dimensional variations in a unit of 1/100 mm against each standard value.	

SPD126

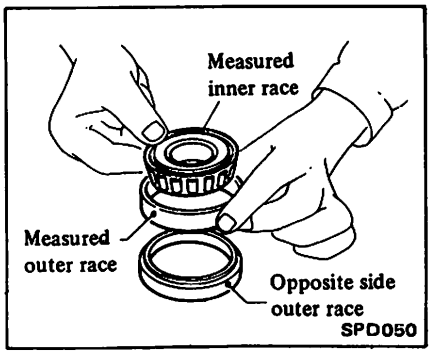
2. Measure values **E** and **F**.
(1) Attach a dial indicator to the base plate.
(2) Place the outer race of the opposite side bearing to be measured.
(3) Place a weight block on that outer race, and a master gauge on that block.

Then adjust the dial indicator scale to zero with its tip on the master gauge.



(4) Remove the master gauge and weight block. Place the bearing outer race and inner race to be measured on the opposite side outer race, and place the weight block on that bearing assembly.

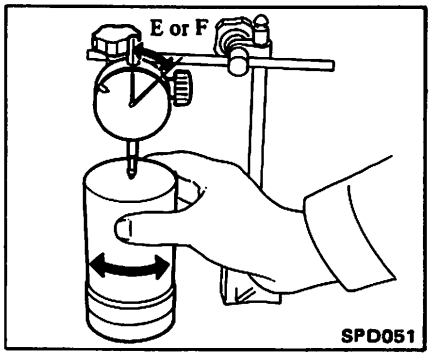
If the bearing assembly is placed on the base plate, the bearing width cannot be accurately determined due to its cage being in contact with the base plate.



(5) Turn the bearing several times to settle it, and then read the indication of the dial indicator.

The indication should be E or F.

Left side bearing . . . . . E
Right side bearing . . . . . F



3. Substitute these values into the equation to calculate the thickness of the shim.

If values signifying A, B, C, D and H' are not given, regard them as zero and calculate.

After assembly, check to see that preload and backlash are specifications. If not, readjust.

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Example:

A = 1 H' = –2
B = 2 E = 0.11
C = 2 F = 0.18
D = 3

Left side:

$T_1 = (A - C + D - H') \times 0.01 + 0.175 + E$
$= [1 - 2 + 3 - (-2)] \times 0.01 + 0.175 + 0.11$

(1)
A 1
–C ..... –2
–1
+D ..... +3
2
–H' ..... –(–2)
4

(2)
4
× 0.01
0.04

(3)
0.04
+ 0.175
0.215

(4)
0.215
+E ..... +0.11
0.325

$\therefore T_1 = 0.325$ mm

Right side:

$T_2 = (B - D + H') \times 0.01 + 0.15 + F$
$= [2 - 3 + (-2)] \times 0.01 + 0.15 + 0.18$

(1)
B 2
–D ..... –3
–1
+H' ..... +(–2)
–3

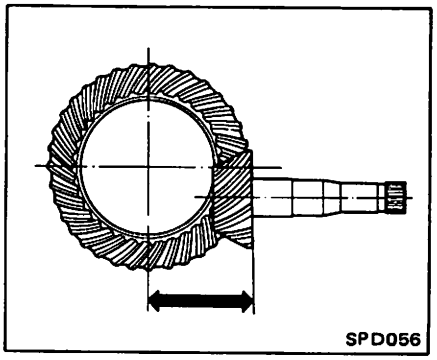
(2)
–3
× 0.01
–0.03

(3)
–0.03
+ 0.15
0.12

(4)
0.12
+F ..... + 0.18
0.30

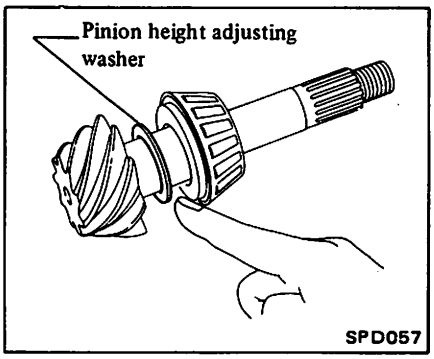
$\therefore T_2 = 0.30$ mm

PINION HEIGHT ADJUSTMENT



When replacing the hypoid gear set, drive pinion bearing or gear carrier, be sure to adjust the pinion height.

Adjustment of the pinion height can be made by adjusting the washer to be installed between the rear bearing inner race and the drive pinion head.



4. Select the proper shims (Refer to S.D.S.).

If you cannot find the desired thickness of shims, use shims so that the total thickness is the closest to the calculated value.

Example:

Left side

Calculated value $T_1 = 0.325$ mm

Used shims

Thickness		Quantity	
0.20	x	1	= 0.20
0.07	x	1	= 0.07
0.05	x	1	= 0.05
Total thickness			0.32 mm

Right side

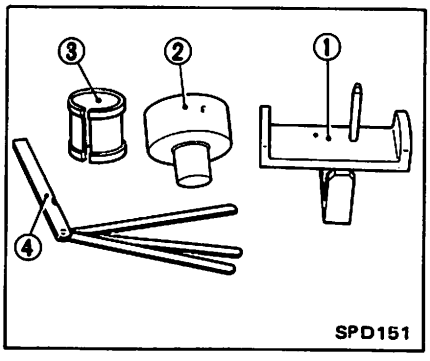
Calculated value ... $T_2 = 0.30$ mm

Used shims

Thickness		Quantity	
0.20	x	1	= 0.20
0.10	x	1	= 0.10
Total thickness			0.30 mm

– Required Tools –

① Height Gauge (ST31941000)
② Dummy Shaft (ST31942000)
③ Collar (ST31970000)
④ Feeler Gauge



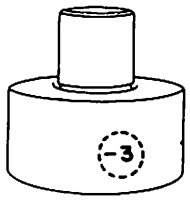
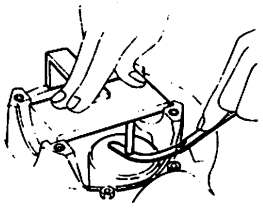
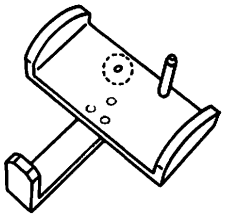
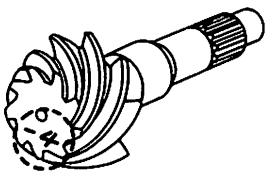
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1. Thickness of washer can be calculated by following equation.

$$T = N - [(H - D' - S) \times 0.01] + 2.18$$

CAUTION:
To avoid any confusion while calculating, it is necessary to stay with the metric system. If you measure anything in inches, the result should be converted to the metric system.

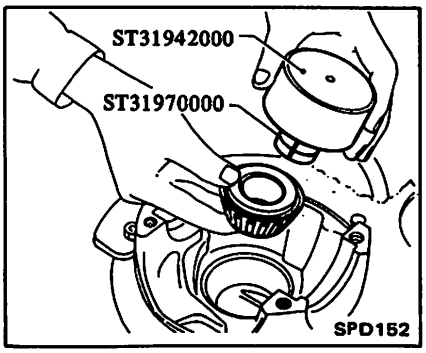
Where:

T = mm		D' =	
N = mm		S =	
H =			

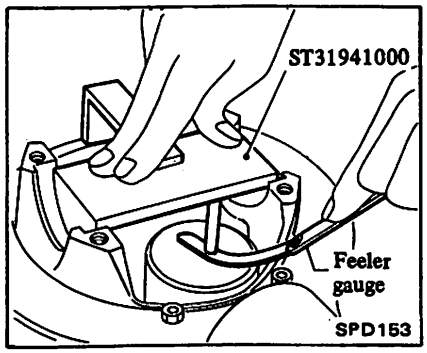
H, D' and S are dimensional variations in a unit of 1/100 mm against each standard value.

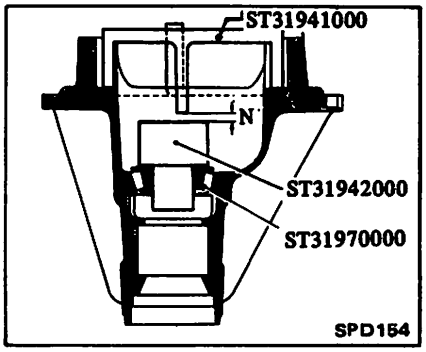
SPD127

2. Assemble Dummy shaft and collar on rear bearing inner race, and fit it into carrier.



3. Attach Height Gauge to carrier.
Using a feeler gauge, measure the clearance between the height gauge tip and the dummy shaft face.





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4. Substitute these values into the equation to calculate the thickness of the washer.

If values signifying H, D' and S are not given, regard them as zero and calculate.

After assembly, check to see that tooth contact is correct. If not, readjust.

Example:

N = 0.46
H = –4
D = –3
S = 0

$T = N - [(H - D' - S) \times 0.01] + 2.18$
$= 0.46 - [\{(-4) - (-3) - 0\} \times 0.01] + 2.18$

(1) H ..... (–4)
–D ..... –(–3)
–1
–S ..... –0
–1

(2) –1 × 0.01 = –0.01

(3) N 0.46
–(–0.01)
0.47

(4) 0.47 + 2.18 = 2.65

∴T = 2.65

5. Select the proper washer (Refer to S.D.S.).

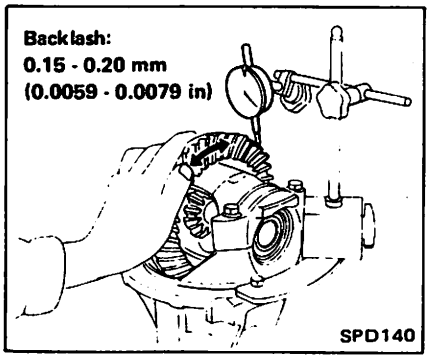
If you cannot find the desired thickness of washer, use washer so that thickness is the closest to the calculate value.

Example:

Calculated value ... T = 2.65 mm
Used washer ... T = 2.64 mm

FINAL VERIFICATION

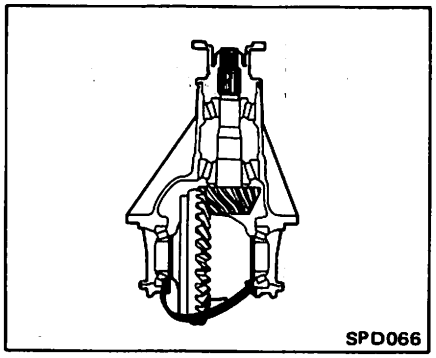
1. Check backlash of ring gear with a dial indicator.



If backlash is too small, decrease thickness of left shim and increase thickness of right shim by the same amount.

If backlash is too great, reverse the above procedure.

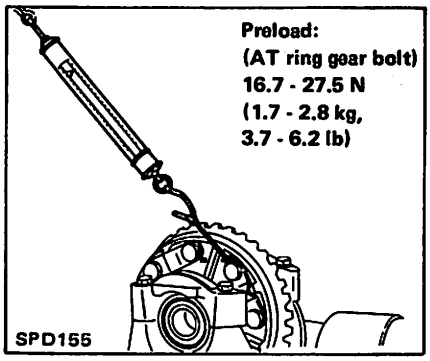
Never add or remove from the total amount of shims or bearing preload will be changed.



2. Check side bearing preload.

Hook the tip of a spring balancer on a ring gear bolt.

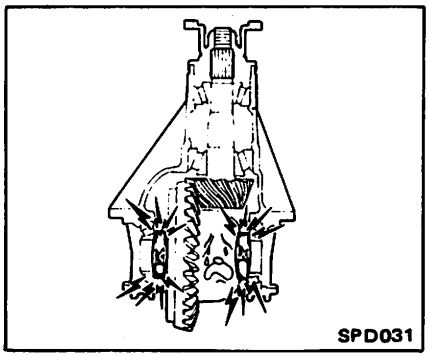
Check the preload by measuring the rotating resistance in a backlash.



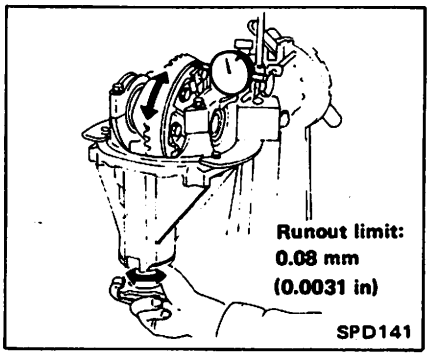
If preload is too great, remove the same amount of shims to each side.

If preload is too small, add the same amount of shims to each side.

Never add or remove different amount of shims to each side or ring gear backlash will be changed.



3. Check runout of ring gear with a dial indicator.



If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.

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If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

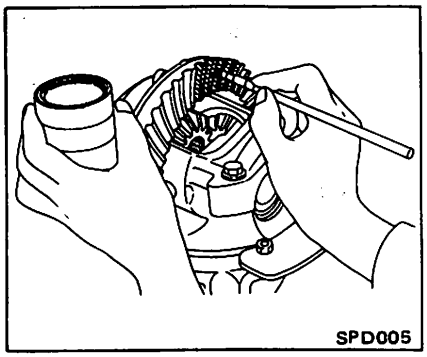
4. Finally, check for tooth contact pattern.

Refer to **TOOTH CONTACT.**

Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.

However, in extremely rare cases you will have to use trial-and-error processes until you get a good tooth contact pattern.

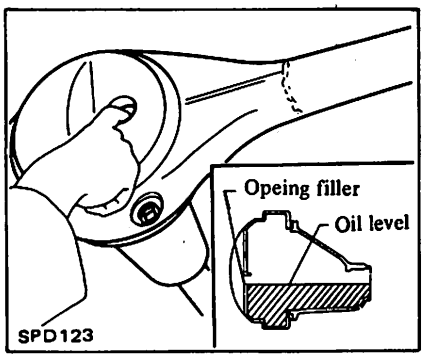
The tooth pattern is the best indication of how well a differential has been set up.



5. Install the differential carrier in the vehicle.

Gasket should be replaced by new one each time the differential carrier is removed.

Then fill with gear oil, referring to Recommended Lubricants (Section MA).



Gear oil capacity:
1.25 liters (2-5/8 US pt, 2-1/4 Imp pt)

Ⓣ : Differential carrier fixing nut
17 - 25 N·m (1.7 - 2.5 kg-m, 12 - 18 ft-lb)

Drain and filler plugs
59 - 98 N·m (6 - 10 kg-m, 43 - 72 ft-lb)

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

PROPELLER SHAFT

GENERAL SPECIFICATIONS

Applied model			2WD			4WD			
			Standard wheelbase		Long wheelbase	Primary	Front	Rear	
			M/T	A/T		Standard and Long wheelbase		Standard wheelbase	Long wheelbase
Model			2S63H	3S63H		2S63H	2F63H	2F63H	
Number of joints			2	3		2			
Coupling method with transmission			Sleeve type						
Distance between yokes		mm (in)	63 (2.48)						
Type of journal bearing			Solid type (Disassembly type)						
Shaft length (Spider to spider)	1st	mm (in)	1,260 (49.61)	515 (20.28)	515 (20.28)	140 (5.51)	650 (25.59)	805 (31.69)	1,045 (41.14)
	2nd	mm (in)		745 (29.33)	983 (38.70)				
Shaft outer diameter	1st	mm (in)	70.0 (2.756)	63.5 (2.500)		50.8 (2.000)			
	2nd	mm (in)				30.0 (1.181)			

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SERVICE DATA

Unit: mm (in)

Propeller shaft runout limit	0.6 (0.024)
Journal axial play	Less than 0.02 (0.0008)

Snap ring

Unit: mm (in)

Thickness	Color	Part No.
2.00 (0.0787)	White	37146-14600
2.02 (0.0795)	Yellow	37147-14600
2.04 (0.0803)	Red	37148-14600
2.06 (0.0811)	Green	37149-14600
2.08 (0.0819)	Blue	37150-14600
2.10 (0.0827)	Light brown	37151-14600
2.12 (0.0835)	No paint	37152-14600

TIGHTENING TORQUE

Unit		N·m	kg-m	ft-lb
Propeller shaft to differential carrier	2WD	24 - 32	2.4 - 3.3	17 - 24
	4WD (both sides)	34 - 44	3.5 - 4.5	25 - 33
Propeller shaft to transfer		34 - 44	3.5 - 4.5	25 - 33
Propeller shaft 1st tube to 2nd tube		24 - 32	2.4 - 3.3	17 - 24
Center bearing locking nut	Flange nut type	245 - 294	25 - 30	181 - 217
	Nut and washer type	196 - 235	20 - 24	145 - 174
Center bearing bracket to frame		16 - 22	1.6 - 2.2	12 - 16

DIFFERENTIAL CARRIER

GENERAL SPECIFICATIONS

Applied model	2WD			4WD	
	Standard model		Heavy duty model	Front	Rear
	M/T	A/T			
Model	H190-ML			R180	H190A
Type	Rigid axle suspension (Banjo type)			Independent suspension	Rigid axle suspension (Banjo type)
Drive pinion preload adjusted by	Collapsible spacer			Solid spacer and washer	Collapsible spacer
Ring gear pitch diameter mm (in)	190 (7.48)			180 (7.09)	190 (7.48)
Gear ratio	3.889	4.111	4.375		
Number of teeth (Ring gear/Drive pinion)	35/9	37/9	35/8		
Oil capacity liter (US pt, Imp pt)	1.25 (2-5/8, 2-1/4)			1.0 (2-1/8, 1-3/4)	1.25 (2-5/8, 2-1/4)

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SERVICE DATA

Model		R180	H190-ML and H190A
Drive pinion preload (With front oil seal) N·m (kg-cm in-lb)		0.9 - 1.7 (9 - 17, 7.8 - 14.8	1.1 - 1.6 (11 - 16, 9.5 - 13.9)
Drive pinion preload (Without front oil seal) N·m (kg-cm, in-lb)		1.0 - 1.3 (10 - 13, 8.7 - 11.3)	1.1 - 1.6 (11 - 16, 9.5 - 13.9)
Side bearing adjusting method		Shim	
Backlash	Drive pinion to ring gear mm (in)	0.13 - 0.18 (0.0051 - 0.0071)	0.15 - 0.20 (0.0059 - 0.0079)
	Side gear to pinion mate gear (Clearance between side gear to differential case) mm (in)	0 - 0.15 (0 - 0.0059)	0.10 - 0.20 (0.0039 - 0.0079)
Ring gear runout limit mm (in)		0.08 (0.0031)	
Side bearing preload (At ring gear bolt) N (kg, lb)		17.7 - 29.4 (1.8 - 3.0, 4.0 - 6.6)	16.7 - 27.5 (1.7 - 2.8, 3.7 - 6.2)
Total preload N·m (kg-cm, in-lb)		1.0 - 2.3 (10 - 23, 8.7 - 20.0)	–

Side gear thrust washer

R180

Thickness mm (in)	Part No.
0.78 (0.0307)	38424-W2000
0.83 (0.0327)	38424-W2001
0.88 (0.0346)	38424-W2002

H190-ML and H190A

Thickness mm (in)	Part No.
0.775 (0.0305)	38424-E3000
0.825 (0.0325)	38424-E3001
0.875 (0.0344)	38424-E3002
0.925 (0.0364)	38424-E3003

Side bearing adjusting shim

H190-ML and H190A

Thickness mm (in)	Part No.
0.05 (0.0020)	38453-61200
0.07 (0.0028)	38454-61200
0.10 (0.0039)	38455-61200
0.20 (0.0079)	38456-61200
0.50 (0.0197)	38457-61200

Side retainer adjusting shim

R180

Thickness mm (in)	Part No.
0.20 (0.0079)	38453-21100
0.25 (0.0098)	38453-21101
0.30 (0.0118)	38453-21102
0.40 (0.0157)	38453-21103
0.50 (0.0197)	38453-21104

Pinion height adjusting washer

R180

Thickness mm (in)	Part No.
3.09 (0.1217)	38154-B4017
3.12 (0.1228)	38154-B4018
3.15 (0.1240)	38154-B4019
3.18 (0.1252)	38154-B4020
3.21 (0.1264)	38154-E4600
3.24 (0.1276)	38154-E4601
3.27 (0.1287)	38154-E4602
3.30 (0.1299)	38154-E4603
3.33 (0.1311)	38154-E4604
3.36 (0.1323)	38154-E4605
3.39 (0.1335)	38154-E4606
3.42 (0.1346)	38154-E4607
3.45 (0.1358)	38154-E4608
3.48 (0.1370)	38154-E4609
3.51 (0.1382)	38154-E4610
3.54 (0.1394)	38154-E4611
3.57 (0.1406)	38154-E4612
3.60 (0.1417)	38154-E4613
3.63 (0.1429)	38154-E4014
3.66 (0.1441)	38154-E4015

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H190-ML and H190A

Thickness mm (in)	Part No.
2.58 (0.1016)	38154-B4000
2.61 (0.1028)	38154-B4001
2.64 (0.1039)	38154-B4002
2.67 (0.1051)	38154-B4003
2.70 (0.1063)	38154-B4004
2.73 (0.1075)	38154-B4005
2.76 (0.1087)	38154-B4006
2.79 (0.1098)	38154-B4007
2.82 (0.1110)	38154-B4008
2.85 (0.1122)	38154-B4009
2.88 (0.1134)	38154-B4010
2.91 (0.1146)	38154-B4011
2.94 (0.1157)	38154-B4012
2.97 (0.1169)	38154-B4013
3.00 (0.1181)	38154-B4014
3.03 (0.1193)	38154-B4015
3.06 (0.1205)	38154-B4016
3.09 (0.1217)	38154-B4017
3.12 (0.1228)	38154-B4018
3.15 (0.1240)	38154-B4019
3.18 (0.1252)	38154-B4020

Pinion bearing adjusting washer

R180

Thickness mm (in)	Part No.
2.31 (0.0909)	38141-09400
2.33 (0.0917)	38140-09400
2.35 (0.0925)	38139-09400
2.37 (0.0933)	38138-09400
2.39 (0.0941)	38137-09400
2.41 (0.0949)	38136-09400
2.43 (0.0957)	38135-09400
2.45 (0.0965)	38134-09400
2.47 (0.0972)	38133-09400
2.49 (0.0980)	38132-09400
2.51 (0.0988)	38131-09400
2.53 (0.0996)	38130-09400
2.55 (0.1004)	38129-09400
2.57 (0.1012)	38128-09400
2.59 (0.1020)	38127-09400

Pinion bearing spacer

R180

Length mm (in)	Part No.
52.20 (2.0551)	38130-78500
52.40 (2.0630)	38131-78500
52.60 (2.0709)	38132-78500
52.80 (2.0787)	38133-78500
53.00 (2.0866)	38134-78500
53.20 (2.0945)	38135-78500

TIGHTENING TORQUE

R180

Unit	N·m	kg-m	ft-lb
Drive pinion nut	167 - 196	17 - 20	123 - 145
Ring gear bolt	88 - 98	9 - 10	65 - 72
Companion flange to propeller shaft bolt	34 - 44	3.5 - 4.5	25 - 33
Drain and filler plugs	59 - 98	6 - 10	43 - 72
Side retainer bolt	9 - 12	0.9 - 1.2	6.5 - 8.7
Rear cover bolt	39 - 49	4 - 5	29 - 36
Differential carrier front mounting			
Carrier to bracket	50 - 68	5.1 - 6.9	37 - 50
Crossmember to bracket	71 - 96	7.2 - 9.8	52 - 71
Differential carrier rear mounting	50 - 68	5.1 - 6.9	37 - 50
Drive shaft to side flange bolts	27 - 37	2.8 - 3.8	20 - 27

H190-ML and H190A

Unit	N·m	kg-m	ft-lb
Drive pinion nut	127 - 294	13 - 30	94 - 217
Ring gear bolt	78 - 98	8 - 10	58 - 72
Side bearing cap bolt	49 - 59	5 - 6	36 - 43
Drain and filler plugs	59 - 98	6 - 10	43 - 72
Companion flange to propeller shaft	24 - 32	2.4 - 3.3	17 - 24
Differential carrier to rear axle case	17 - 25	1.7 - 2.5	12 - 18

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TROUBLE DIAGNOSES AND CORRECTIONS

PROPELLER SHAFT

Condition	Probable cause	Corrective action
Vibration during at medium or high speed.	Worn or damaged journal bearing.	Replace journal assembly.
	Unbalance due to bent or dented propeller shaft.	Replace propeller shaft assembly.
	Loose propeller shaft installation.	Retighten.
	Worn transmission rear extension bushing.	Replace.
	Damaged center bearing. (3S63H)	Replace.
	Undercoating or mud on the shaft causing unbalance.	Clean up shaft.
	Balance weights missing.	Replace propeller shaft assembly
Knocking sound during starting or noise during coasting on propeller shaft.	Worn or damaged journal.	Replace journal assembly.
	Worn sleeve yoke and mainshaft spline.	Replace propeller shaft assembly.
	Loose propeller shaft installation.	Retighten.
	Loose joint installation.	Replace journal assembly or adjust snap ring.
	Damaged center bearing or insulator. (3S63H)	Replace center bearing.
	Loose or missing bolts at center bearing bracket to body. (3S63H)	Replace or tighten bolts.
Scraping noise.	Dust cover on sleeve yoke rubbing on transmission rear extension.	Straighten out dust cover to remove interference.
Whine or whistle.	Damaged center bearing. (3S63H)	Replace center bearing.

DIFFERENTIAL CARRIER

When a differential carrier is suspected of being noisy, it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, exhaust, universal joint, propeller shaft, wheel bearings, engine, transmission, or differential carrier. Noise which originates in other places cannot be corrected by adjustment or replacement of parts in differential carrier.

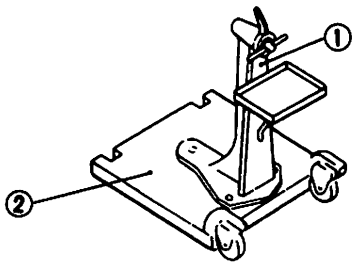
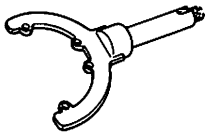
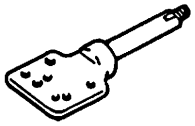
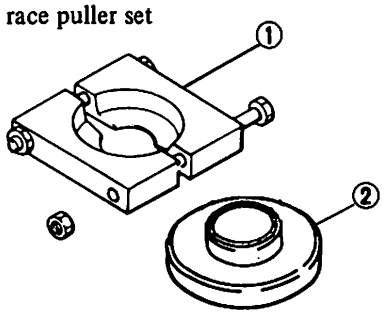
Condition	Probable cause	Corrective action
Noise on drive, coast and float.	Shortage of oil.	Supply gear oil. Rebuild gear carrier if necessary.
	Incorrect tooth contact between ring gear and drive pinion.	Adjust tooth contact or replace the hypoid gear set.
	Incorrect backlash between ring gear and drive pinion.	Adjust backlash or replace the hypoid gear set if necessary.
	Seized up or damaged ring gear and drive pinion.	Replace the hypoid gear set.

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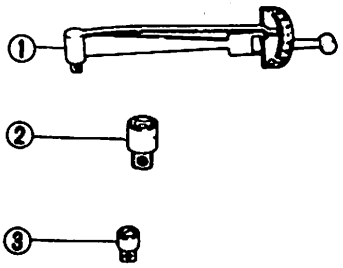
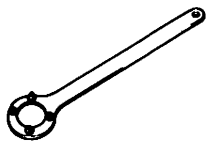
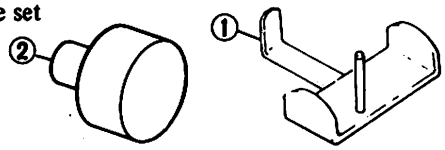
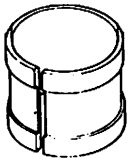
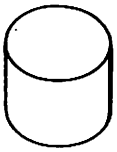
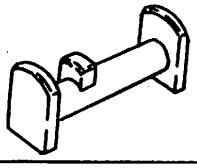
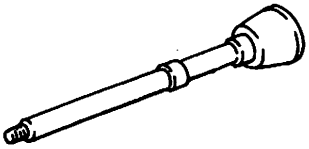
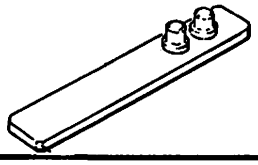
Condition	Probable cause	Corrective action
Noise on drive, coast and float.	Seized up, damaged or broken drive pinion bearing.	Replace the pinion bearing and faulty parts.
	Seized up, damaged or broken side bearing.	Replace the side bearing and faulty parts.
	Loose clamp bolts or nuts holding ring gear, bearing cap, etc.	Clamp them to specified torque, and replace faulty parts.
Noise on turn.	Seized up, damaged or broken side gear and pinion mate gear.	Replace faulty parts.
	Seized up, damaged or broken side gear and pinion mate gear thrust washers.	Replace faulty parts.
	Pinion mate gears too tight on their shaft.	Replace faulty parts.
Knocking sound during starting or gear shifting.	Excessive backlash.	
	Incorrect backlash ring gear-to-drive pinion or side gear-to-pinion mate gear.	Adjust backlash.
	Worn gears or case.	Replace worn parts.
	Worn rear axle shaft and side gear spline.	Replace worn parts.
	Pinion bearing under preload.	Adjust preload.
	Loose drive pinion nut.	Replace or tighten bolt.
	Loose bolts and nuts, such as ring gear bolts.	Replace faulty parts or tighten bolts.
Seizure or breakage.	Shortage of oil or use of unsuitable oil.	Replace faulty parts and use recommended gear oil.
	Excessively small backlash.	Adjust backlash and replace as required.
	Incorrect adjustment of bearings or gears	Replace faulty parts.
	Severe service due to an excessive loading, improper use of clutch	Replace faulty parts.
	Loose bolts and nuts, such as ring gear bolts.	Replace faulty parts or tighten bolts.
Oil leakage.	Worn-out, damaged or improperly driven front oil seal, or bruised, dented or abnormally worn slide face of companion flange.	Replace damaged oil seal. Repair flange with sandpaper or replace if necessary.
	Damaged gasket.	Replace.
	Loose filler or drain plug.	Tighten.
	Clogged or damaged breather.	Repair or replace.

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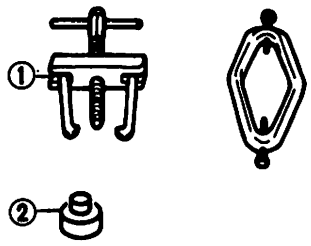
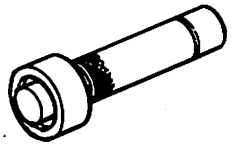
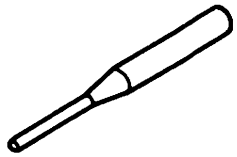
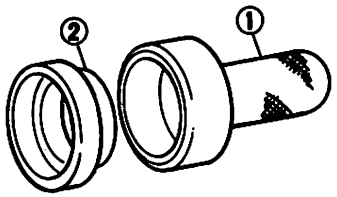
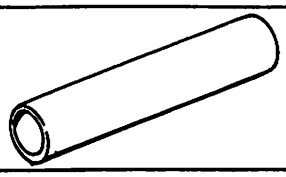
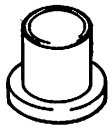
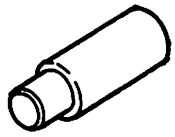
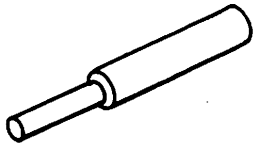
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name	Unit application	
		H190	R180
ST0501S000 (J26023) ① ST05011000 (J26023-2) ② ST05012000 (J26023-1)	Engine stand Engine stand Base 	X	X
ST06310000 (J25603)	Diff. attachment 	X	–
KV38100800 (–)	Diff. attachment 	–	X
ST30611000 (J25742-1)	Drive pinion bearing outer race drift bar 	X	X
ST30613000 (J25742-3)	Drive pinion **front** bearing outer race drift 	X	–
ST30621000 (–)	Drive pinion **rear** bearing outer race drift 	X	X
ST30701000 (J25742-2)	Drift 	–	X
ST3090S000 (–) ① ST30031000 (J25733-1) ② ST30901000 (–)	Drive pinion rear bearing inner race puller set Puller Base 	X	X

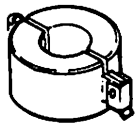
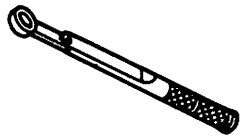
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Tool number (Kent-Moore No.)	Tool name	Unit application	
		H190	R180
ST3127S000 (See J25765) ① GG91030000 (See J25765) ② HT62900000 (–) ③ HT62940000 (–)	Preload gauge Torque wrench Socket adapter (1/2") Socket adapter (3/8") 	X	X
ST31530000 (J25774)	Drive pinion flange wrench 	X	X
ST3194S000 (See J25269-01) ① ST31941000 (–) ② ST31942000 (See J25269-01)	Drive pinion setting gauge set Height gauge Dummy shaft 	X	–
ST31970000 (–)	Collar 	X	–
ST32501000 (J25407-3)	Weight block 	X	X
KV38101900 (–)	Master gauge [20.0 mm (0.787 in)] 	X	X
ST31211000 (See J25269-01)	Height gauge 	–	X
ST31212000 (See J25269-01)	Dummy shaft 	–	X
ST31852000 (See J25269-01)	Stopper 	–	X

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Tool number (Kent-Moore No.)	Tool name	Unit application	
		H190	R180
ST3306S001 (–) ① ST33051001 (–) ② ST33061000 (J25797-2)	Diff. side bearing puller set Puller Adapter 	X	X
ST33230000 (J25805-01)	Diff. side bearing drift 	X	X
KV31100300 (–)	Solid punch 	X	X
KV381025S0 (–) ① ST30720000 (J25751) ② KV38102510 (–)	Oil seal fitting tool Drift bar Drift 	X	X
ST31214000 (See J25269-01)	Collar 	–	X
ST31851000 (See J25269-01)	Spacer 	–	X
ST33710000 (–)	Diff. side retainer attachment 	–	X
ST33290001 (J25810)	Side bearing outer race puller 	–	X
ST30650001 (J25749)	Pilot bearing drift 	–	X

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Tool number (Kent-Moore No.)	Tool name	Unit application	
		H190	R180
ST33720000 (J25817)	Diff. side retainer guide 	–	X
ST33270000 (J25809)	Side oil seal drift 	–	X
KV40102600 (–)	Torque wrench 	–	X

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FRONT AXLE & FRONT SUSPENSION

SECTION FA

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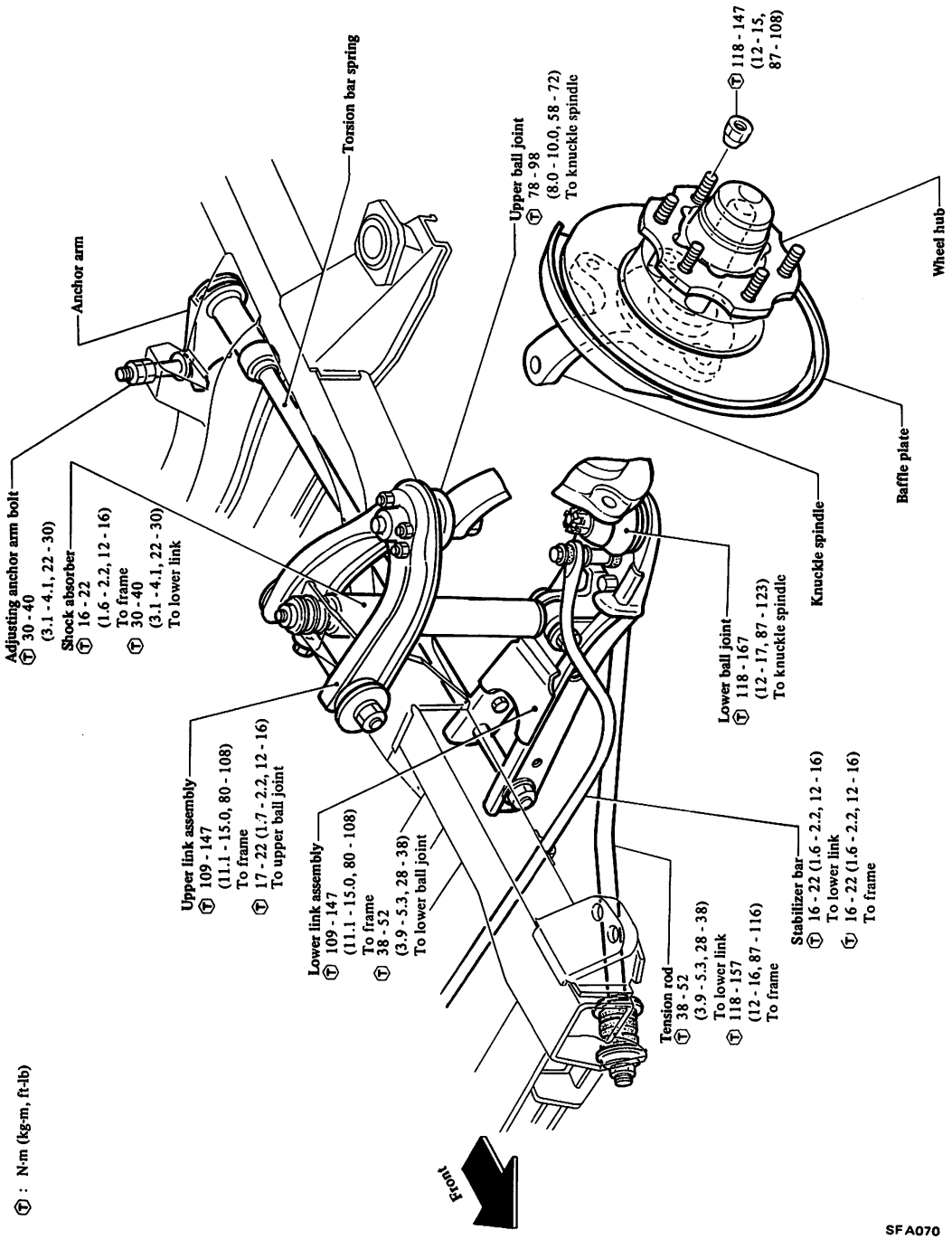
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Refer to Section MA (Front Axle and Front Suspension) for:

- ADJUSTING WHEEL BEARING PRELOAD
- CHECKING WHEEL ALIGNMENT

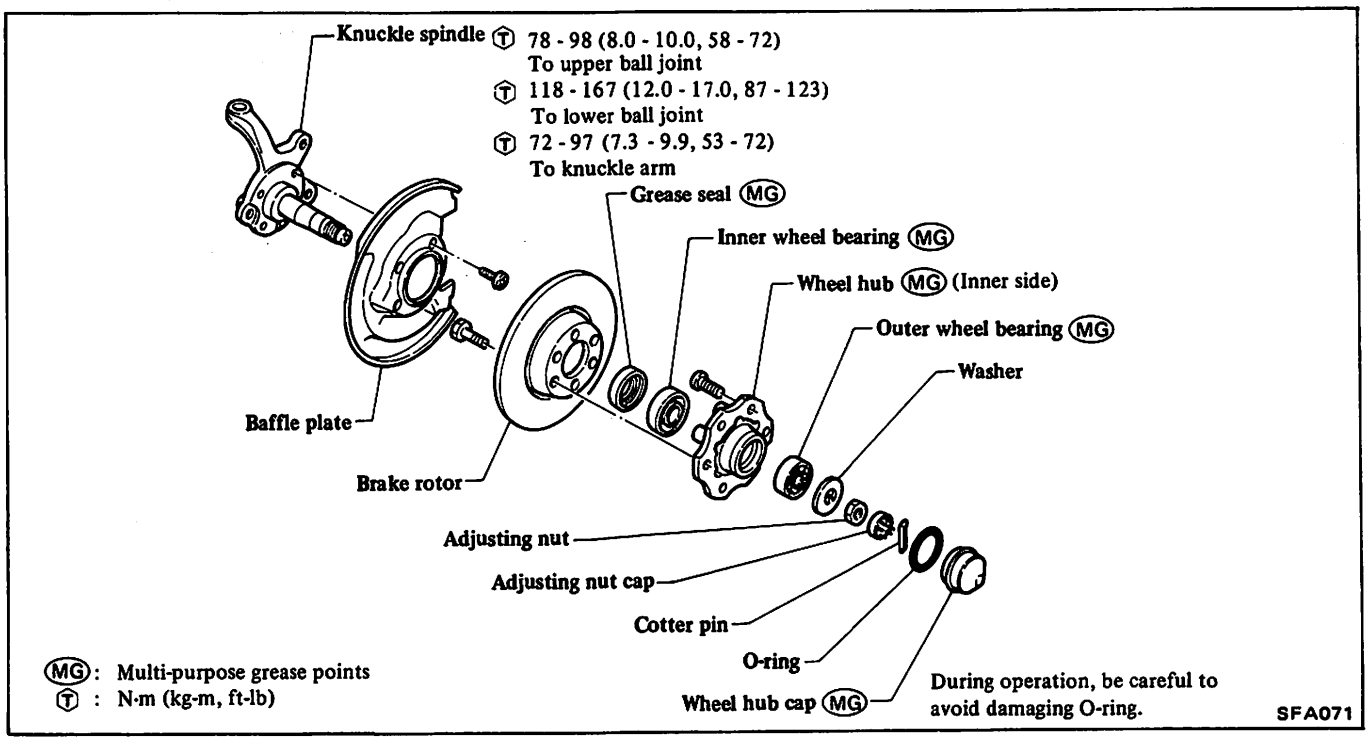
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FRONT AXLE AND FRONT SUSPENSION SYSTEM (2WD)



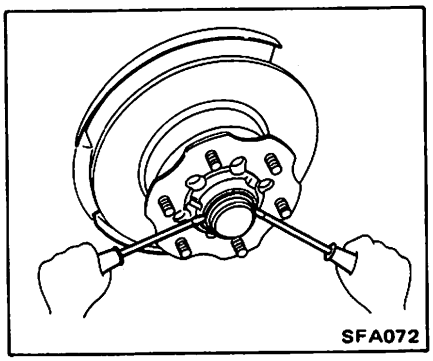
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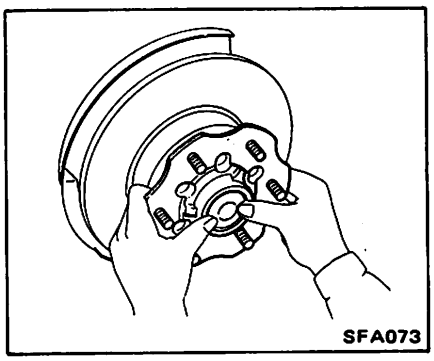
FRONT AXLE

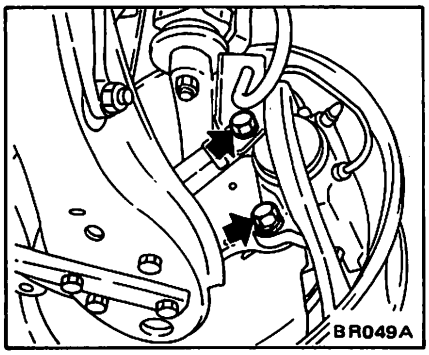


REMOVAL

1. Block rear wheels with chocks and raise front of vehicle, and then **support it with safety stands. Refer to Section GI for lifting points and towing.**
2. Remove wheel and tire assembly.
3. Remove brake caliper assembly **Refer to Service Brake (Section BR) for removal.**







4. Remove wheel hub and wheel bearing.
(1) Work off hub cap.

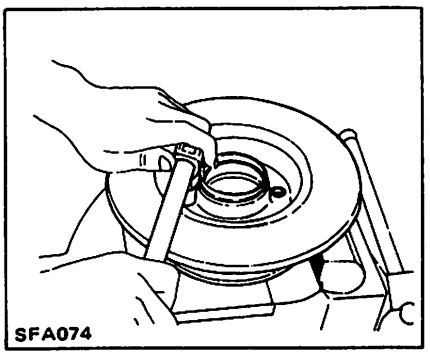
(2) Pry off cotter pin; take out adjusting cap and wheel bearing nut.

Cotter pin must not be reused.

(3) Remove wheel hub with disc brake rotor.

CAUTION:
Be careful not to drop wheel bearing.

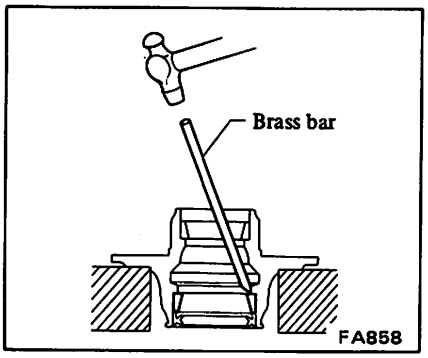
(4) Separate outside wheel bearing inner race and washer.
(5) Separate brake disc to hub.



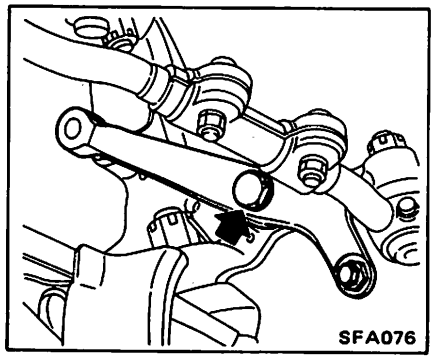
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(6) Remove inside wheel bearing outer race, grease seal and outside wheel bearing outer race.

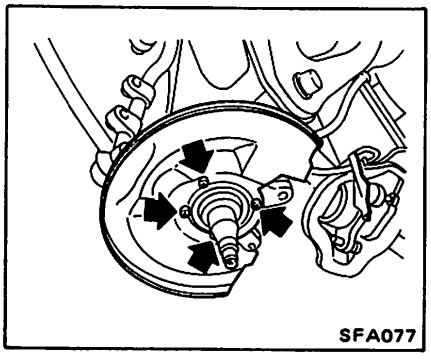
CAUTION:
Be careful not to drop wheel bearing. Grease seal must not be reused.



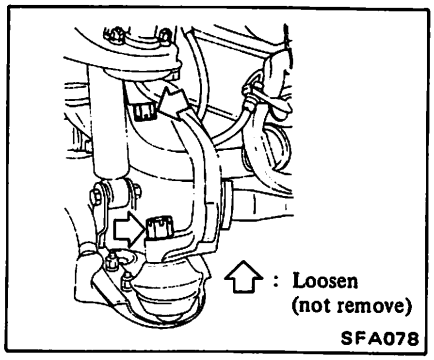
5. Remove knuckle spindle.
(1) Remove knuckle arm.



(2) Remove baffle plate.

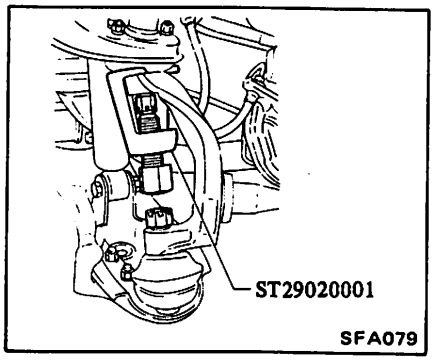


(3) Loosen (**not remove**) upper and lower ball joint tightening nut.

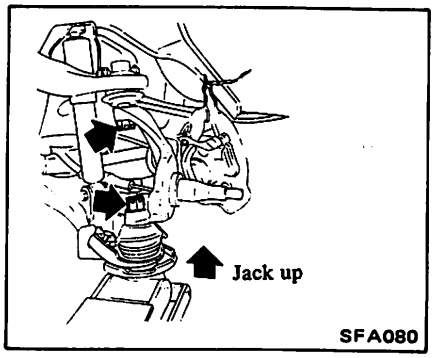


(4) Separate upper and lower ball joint to knuckle spindle using **Tool**.

CAUTION:
During above operation, never remove ball joint nut which is loosened in step (3).



(5) Jack up lower link and then remove ball joint tightening nut.



(6) Separate knuckle spindle from upper and lower links.

INSPECTION

Thoroughly clean bearing and dry with compressed air.

Wheel bearing

When race, cage and roller surfaces make noise or are cracked, pitted, worn, rough, or out-of-round, replace bearing assembly.

Wheel hub

Check wheel hub for cracks by means of a magnetic exploration or dyeing test, replace if necessary.

Knuckle spindle

Also check wheel hub, replace if cracks or damage is found.

Grease seal

If grease leakage is detected during removal, replace grease seal.

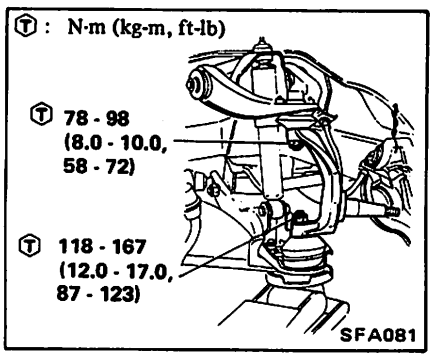
Replace grease seal at every disassembly even if it appears good.

INSTALLATION

Install front axle in the reverse order of removal, noting the following:

1. Install knuckle spindle.
(1) Install knuckle spindle to upper and lower ball joints with jacking up lower link.

CAUTION:
Make sure that oil or grease does not come into contact with tapered areas of ball joint and knuckle spindle and threads of ball joint.



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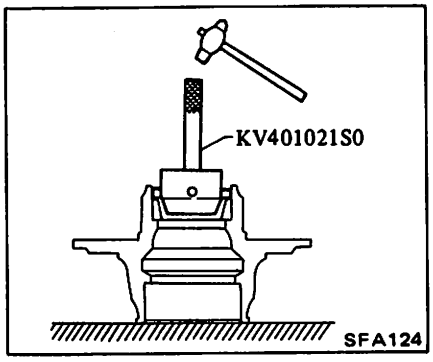
(2) Install knuckle arm.

Ⓣ: **72 - 97 N·m (7.3 - 9.9 kg-m, 53 - 72 ft-lb)**

(3) Install baffle plate.

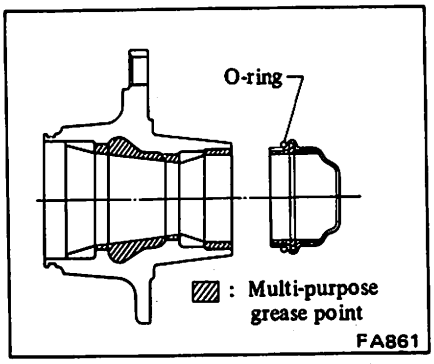
2. Install front wheel hub and wheel bearings.

(1) Install bearing outer race using **Tool.**

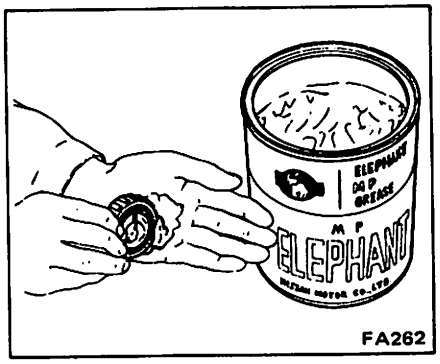


(2) Pack hub and hub cap with recommended multi-purpose grease.

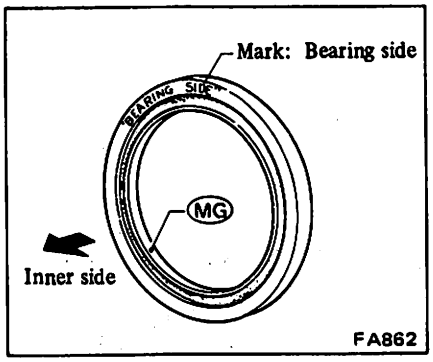
Coat O-ring with recommended multi-purpose grease.



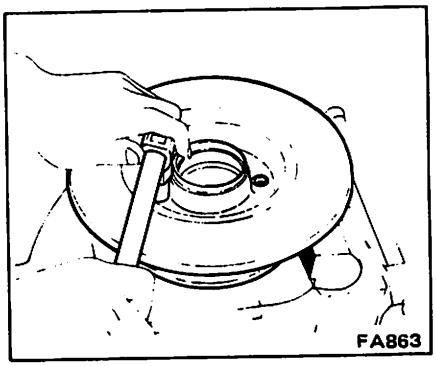
(3) Coat each bearing **with recommended multi-purpose grease.**



(4) Place inner bearing in hub and install a new grease seal, **coating sealing lips with recommended multi-purpose grease.**



(5) Fix brake rotor to hub.



(6) Sparingly apply recommended multi-purpose grease to each part.

- **Threaded portion of spindle.**
- **Bearing washer to bearing contacting face.**

(7) Put hub assembly on spindle and then install washer and wheel bearing nut.

3. Adjust wheel bearing nut.

Refer to Section MA for adjustment.

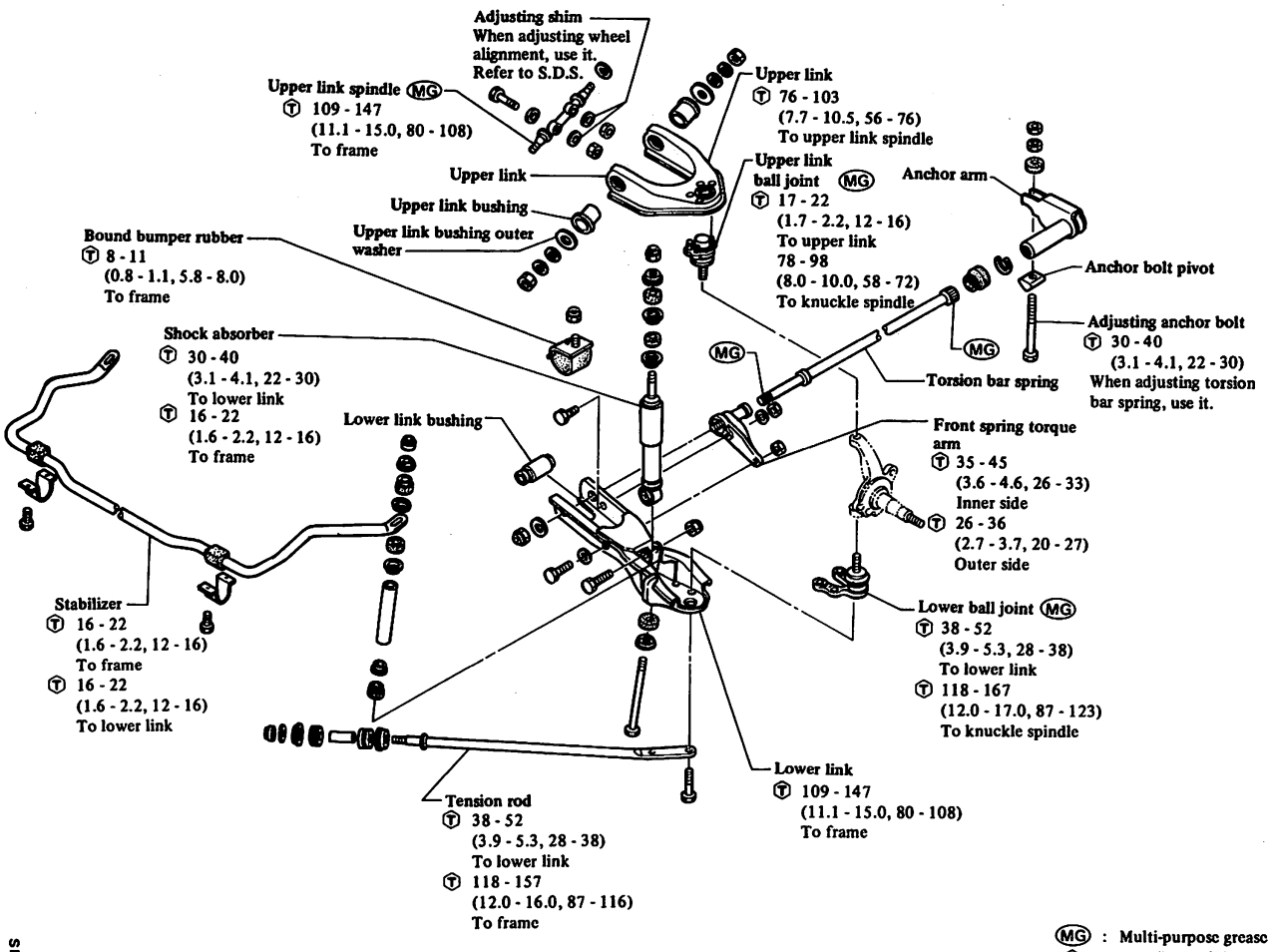
4. Install hub cap with O-ring into hub.

5. Install brake caliper assembly. **Refer to Service Brake (Section BR) for installation.**

6. Install wheel and tire.

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FRONT SUSPENSION



(MG) : Multi-purpose grease points
T : N·m (kg-m, ft-lb)

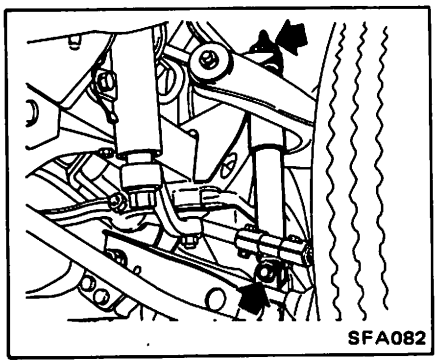
SFA075

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SHOCK ABSORBER

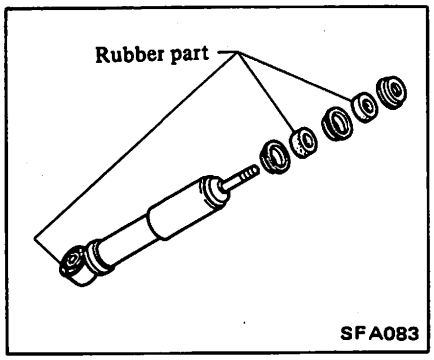
REMOVAL AND INSTALLATION

1. Turn steering wheel to either side.
2. Disconnect upper and lower side fixing nut.


SFA082

3. Remove shock absorber assembly.
4. Install shock absorber in the reverse order of removal.

Do not allow oil or grease to come into contact with rubber parts.



SFA083

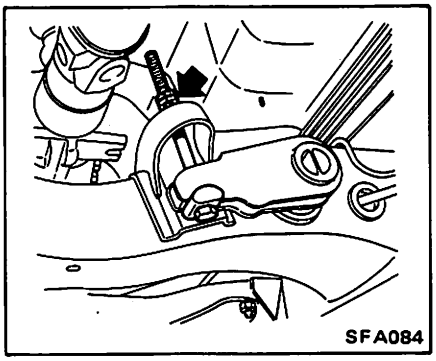
INSPECTION

- Test shock absorber and compare **with specification given in S.D.S. Replace if necessary.**
- Check for oil leakage and cracks. Replace if necessary.
- Check piston rod for smooth operation. Replace if necessary.
- Check all rubber parts for wear, cracks, damage or deformation. Replace if necessary.

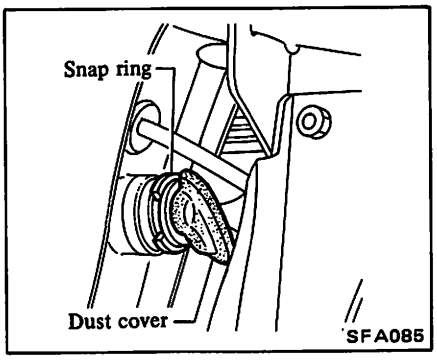
TORSION BAR SPRING

REMOVAL

1. Block rear wheels with chocks and raise front of vehicle, and then support it with safety stands. **Refer to Section GI for lifting points and towing.**
2. Remove torsion bar spring anchor bolt.

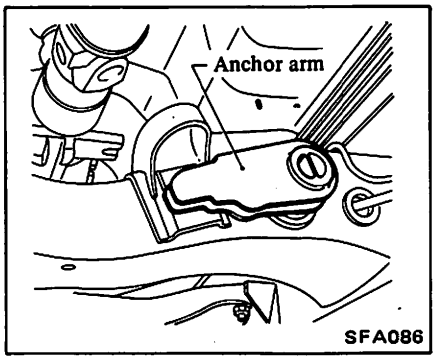

SFA084

3. Remove dust cover and then detach snap ring from anchor arm.



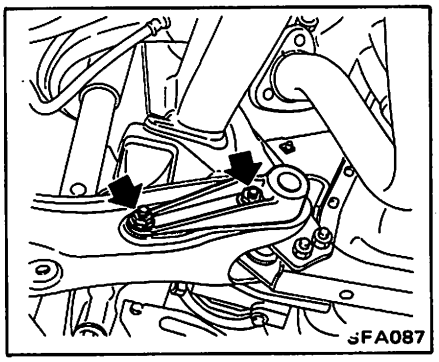
SFA085

4. Pull out anchor arm rearward.



SFA086

5. Withdraw torsion bar spring rearward.
6. Remove torsion bar spring torque arm.


SFA087

INSPECTION

- Check torsion bar spring for wear, twist, bend and other damage. Replace if necessary.
- Check serrations of each part for cracks, wear, twist and other damage. Replace if necessary.

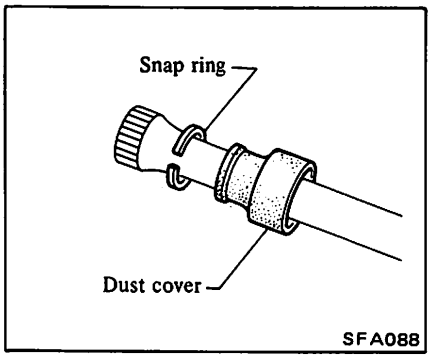
INSTALLATION AND ADJUSTMENT

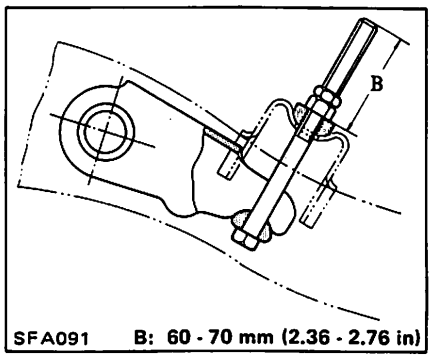
1. Install torque arm to lower link.

Ⓣ : Outer side
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)
Inner side
35 - 45 N·m
(3.6 - 4.6 kg-m,
26 - 33 ft-lb)

2. Set snap ring and dust cover to torsion bar.

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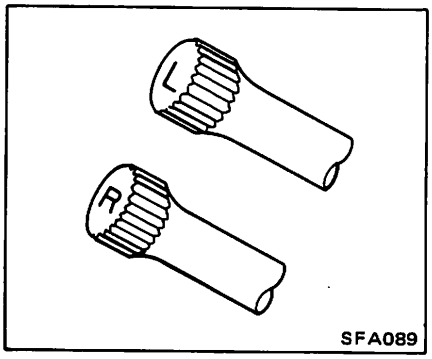


7. Install dust cover.
8. Adjust anchor arm position (vehicle posture).
(1) Lower vehicle.
(2) Turn anchor bolt adjusting nut to obtain the specified "H" dimension.

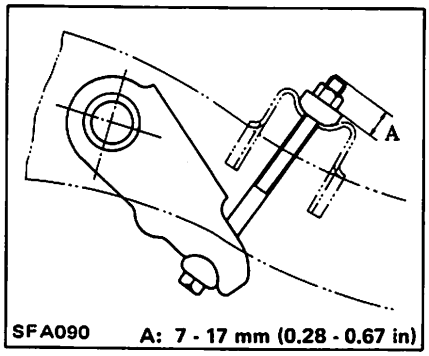
"H" dimension (when vehicle is unladen):
124 - 129 mm
(4.88 - 5.08 in)

3. Coat grease on the serration of torsion bar spring and then install it to torque arm.

Be sure to install right and left torsion bar springs correctly.



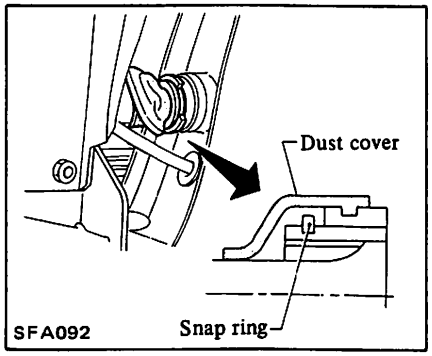
4. Install anchor arm to serration of torsion bar spring and then anchor arm adjusting bolt.

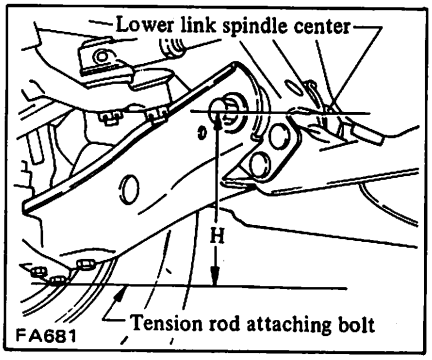


5. Adjust anchor arm adjusting bolt.

6. Install snap ring to anchor arm.

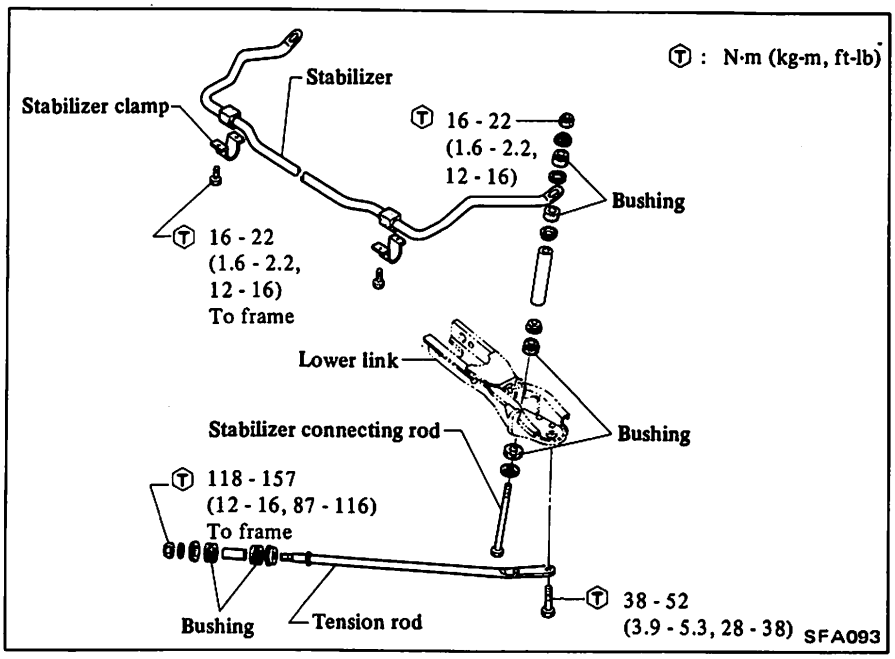
Turn snap ring and make sure that it is completely in groove.





TENSION ROD AND STABILIZER BAR

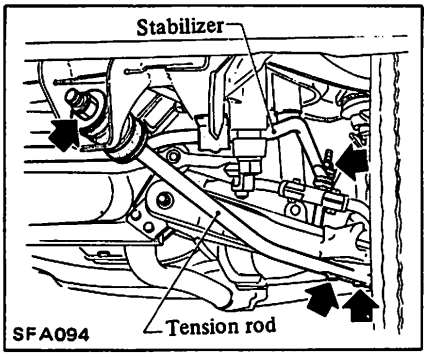
REMOVAL AND INSTALLATION



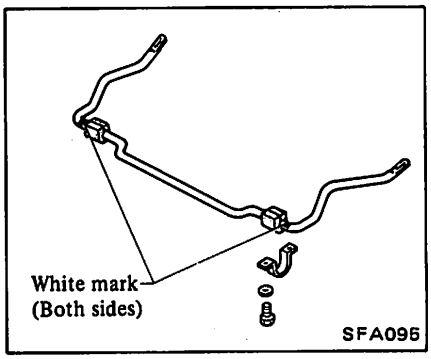
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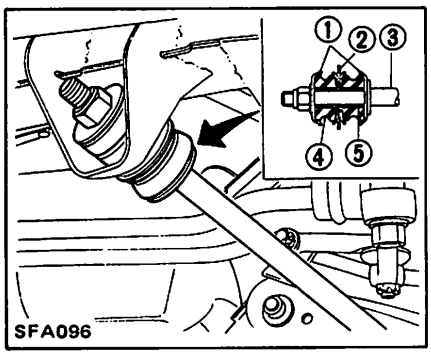
Remove and install as follows:

- Remove under cover.
- Set loaden of vehicle.



- If correctly installed; White mark painted on stabilizer bushing seat can be seen from both sides of vehicle.





1 Thrust washer
2 Frame
3 Tension rod
4 Bushing
5 Collar

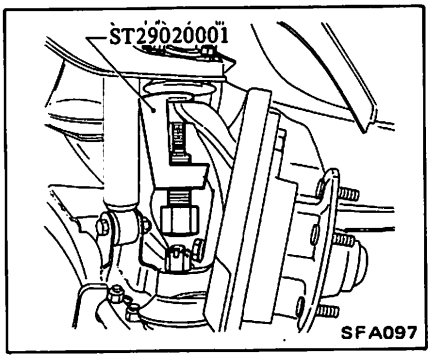
INSPECTION

1. Check tension rod for bend and thread for faulty condition.
   Repair or replace if necessary.
2. Check stabilizer for twist and deformation.
   Replace if necessary.
3. Check each rubber bushing for cracks, wear, and deterioration. Replace if necessary.

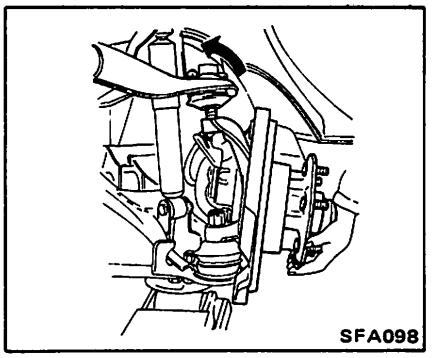
UPPER LINK AND BALL JOINT

REMOVAL

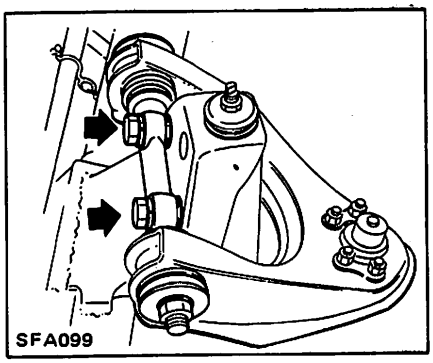
1. Block rear wheels with chocks and raise front of vehicle, and then **support it with safety stands.**
   Refer to Section GI for lifting points and towing.
2. Remove wheel and tire assembly.
3. Jack up lower link and then remove ball joint tightening nut.
4. Separate upper ball joint to knuckle spindle using **Tool.**



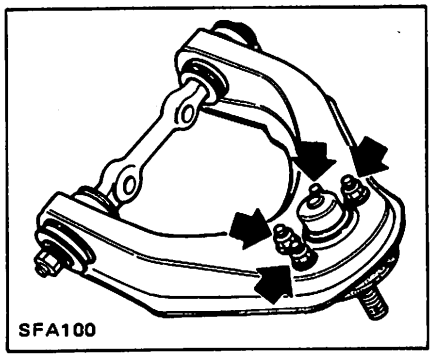
5. Separate upper link ball joint from knuckle spindle.



6. Remove upper link spindle.

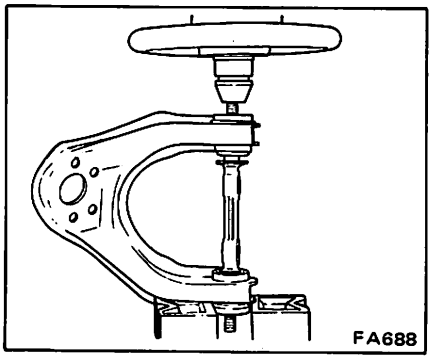


7. Separate ball joint to upper link.



8. Press upper link bushings **in both sides of upper link.**

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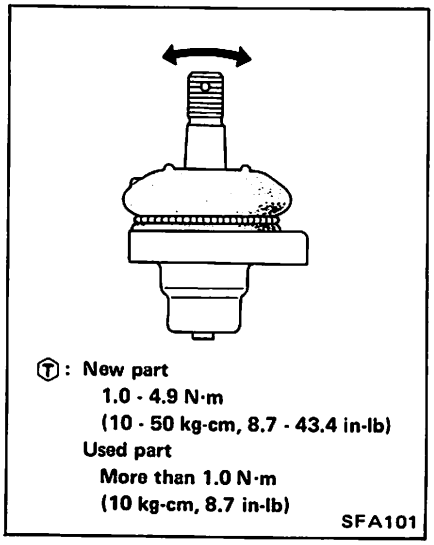


INSPECTION

Upper link ball joint

Ball joint is assembled at the factory and cannot be disassembled.

- Check ball stud turning torque.
  If excessively higher or lower than specifications and ball joint is properly lubricated, replace.



- Check conditional dust cover. If found to be cracked excessively beyond use, replace ball joint with a new one.
- Lubricate ball joint with recommended multi-purpose grease regularly.
  To lubricate, remove plug and install grease nipple in its place.
  Pump grease slowly until old grease is completely forced out. After greasing, reinstall plug.

When a high-pressure grease gun is used, operate the grease gun carefully so that grease is injected slowly and new grease does not come out from the clamp portion.

Upper link spindle and rubber bushing

Check upper link spindle and rubber bushing for damage. Replace if necessary.

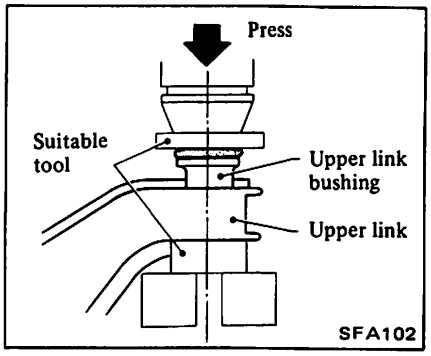
Upper link

Check upper link for deformation or cracks. Replace if necessary.

INSTALLATION

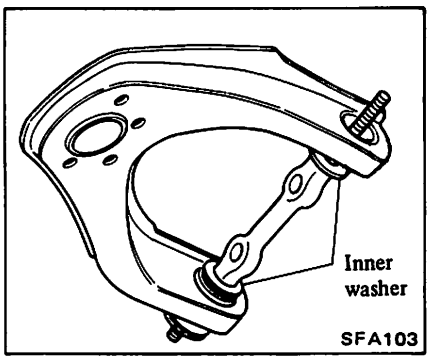
1. Apply ample amount of soapsuds to rubber bushings and force fit it from outside of link.
2. Press upper link bushing.

Press bushing so that flange of bushing securely contacts end surface of upper link collar.



3. Insert upper link spindle and inner washers.

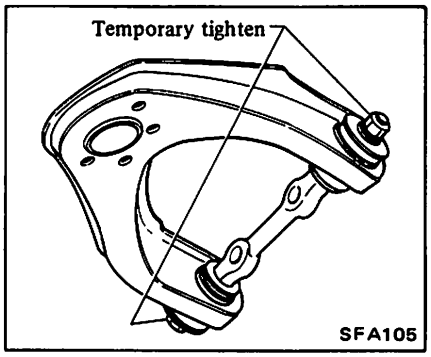
Install inner washers with its rounded edges facing inward.



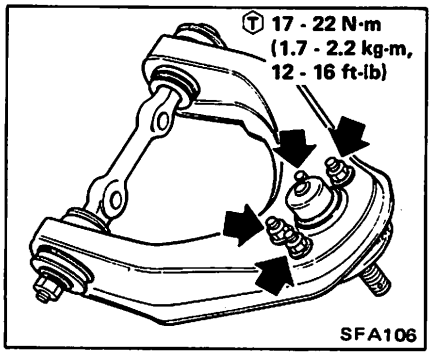
4. Press fit other bushing.

Press bushing so that flange of bushing securely contacts end surface of upper link collar.

5. Temporarily tighten nuts.

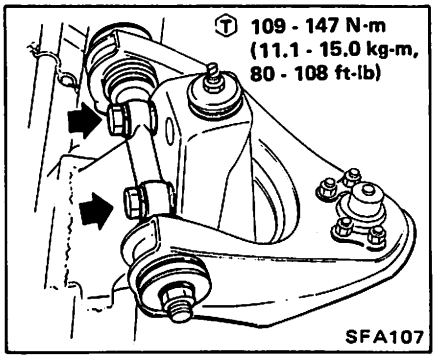


6. Install upper ball joint.

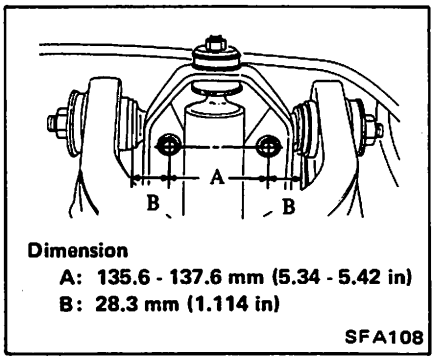


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7. Install upper link assembly to frame.

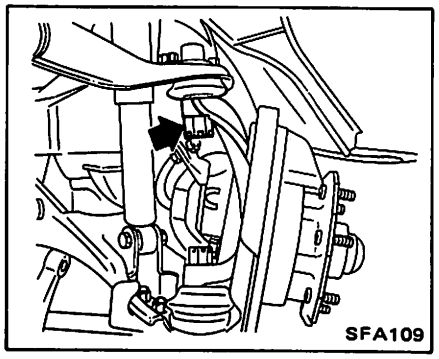


8. Tighten upper link spindle with camber adjusting shims.
9. After fitting, check dimensions "A" and "B" **shown in illustration.**



10. Install upper ball joint to knuckle spindle.

CAUTION:
Make sure that oil or grease does not come into contact with tapered areas of ball joint and knuckle spindle and threads of ball joint..



11. After installing, adjust wheel alignment. **Refer to Section MA for adjustment.**

LOWER LINK AND BALL JOINT

REMOVAL

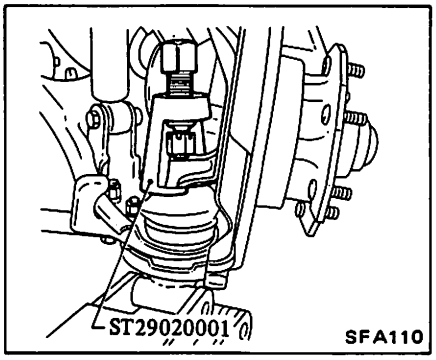
1. Block rear wheels with chocks and raise front of vehicle and then **support it with safety stands.**

Refer to Section GI for lifting points and towing.

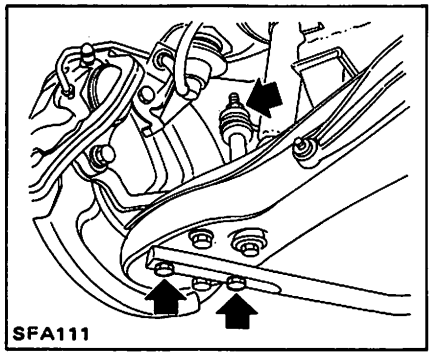
2. Remove wheel and tire assembly
3. Remove torsion bar spring.

Refer to Torsion Bar Spring for removal.

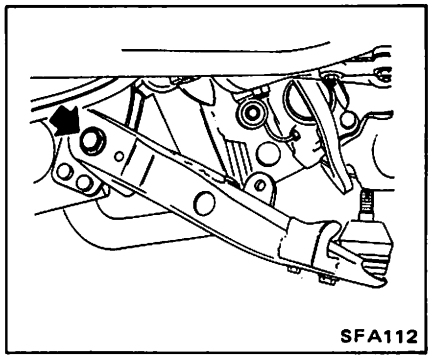
4. Remove shock absorber lower end from lower link.
5. Remove lower link ball joint using **Tool.**



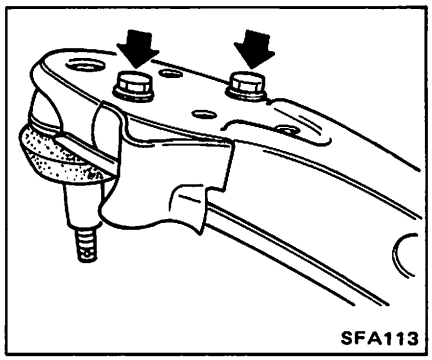
6. Disconnect stabilizer connecting rod and tension rod from lower link.



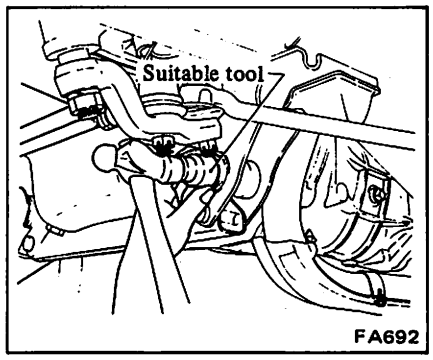
7. Remove torque arm from lower link.
8. Remove lower link from frame.



9. Separate lower link ball joint to lower link.



10. Remove lower link spindle bushing from frame.



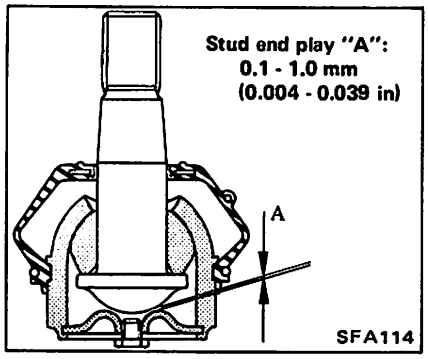
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INSPECTION

Lower ball joint

1. Ball joint is assembled at factory and connot be disassembled.

Check ball stud end play in axial direction. If specified play is exceeded, replace ball joint.



2. Check condition of dust cover.

If found to be cracked excessively beyond use, replace ball joint with new one.

3. Lubricate ball joint with recommended multi-purpose grease regulary.

To lubricate, remove plug and install grease nipple in its place.

Pump grease slowly until old grease is completely forced out. After greasing, reinstall plug.

When a high-pressure grease gun is used, operate grease gun carefully so that grease is injected slowly and new grease does not come out from the clamp portion.

Lower link and lower link spindle

Check lower link and lower link spindle for deformation or cracks. Replace if necessary.

Lower link rubber bushing

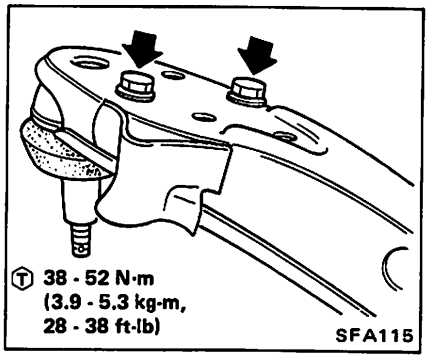
Check lower link rubber bushing for damage or distortion. Replace if necessary.

Torque arm

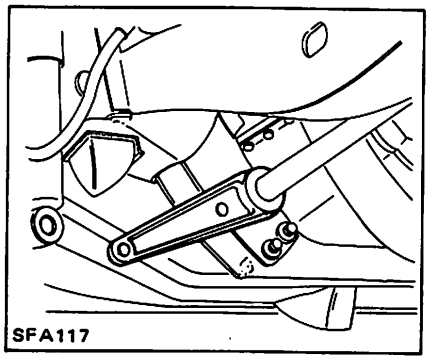
Check torque arm for deformation or cracks. Replace if necessary.

INSTALLATION

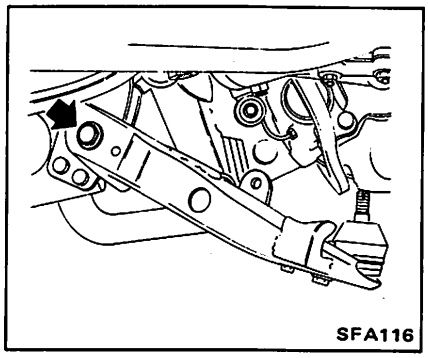
1. Install lower link ball joint.



2. Install lower link spindle bushing to frame using suitable Tool.
3. Set torque arm to torsion bar.



4. Install lower link.



5. Install torque arm to lower link.

Ⓣ : **Inner side**
35 - 45 N·m
(3.6 - 4.6 kg-m,
26 - 33 ft-lb)
Outer side
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)

6. Jack up lower link.
7. Install lower ball joint to knuckle spindle.

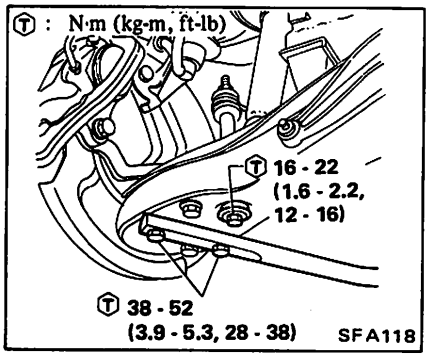
Ⓣ : **118 - 167 N·m**
(12.0 - 17.0 kg-m,
87 - 123 ft-lb)

CAUTION:
Make sure that oil or grease does not come into contact with tapered areas of ball joint and knuckle spindle and threads of ball joint.

8. Install shock absorber lower end to lower link.

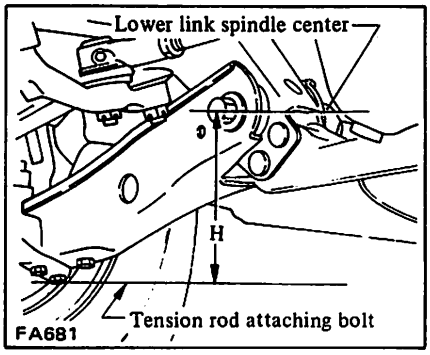
Ⓣ : **30 - 40 N·m**
(3.1 - 4.1 kg-m,
22 - 30 ft-lb)

9. Install tension rod and stabilizer connecting rod to lower link.



10. Lower vehicle.
11. Turn anchor bolt adjusting nut to obtain the specified "H" dimension.

"H" dimension (When vehicle is unladen):
124 - 129 mm
(4.88 - 5.08 in)

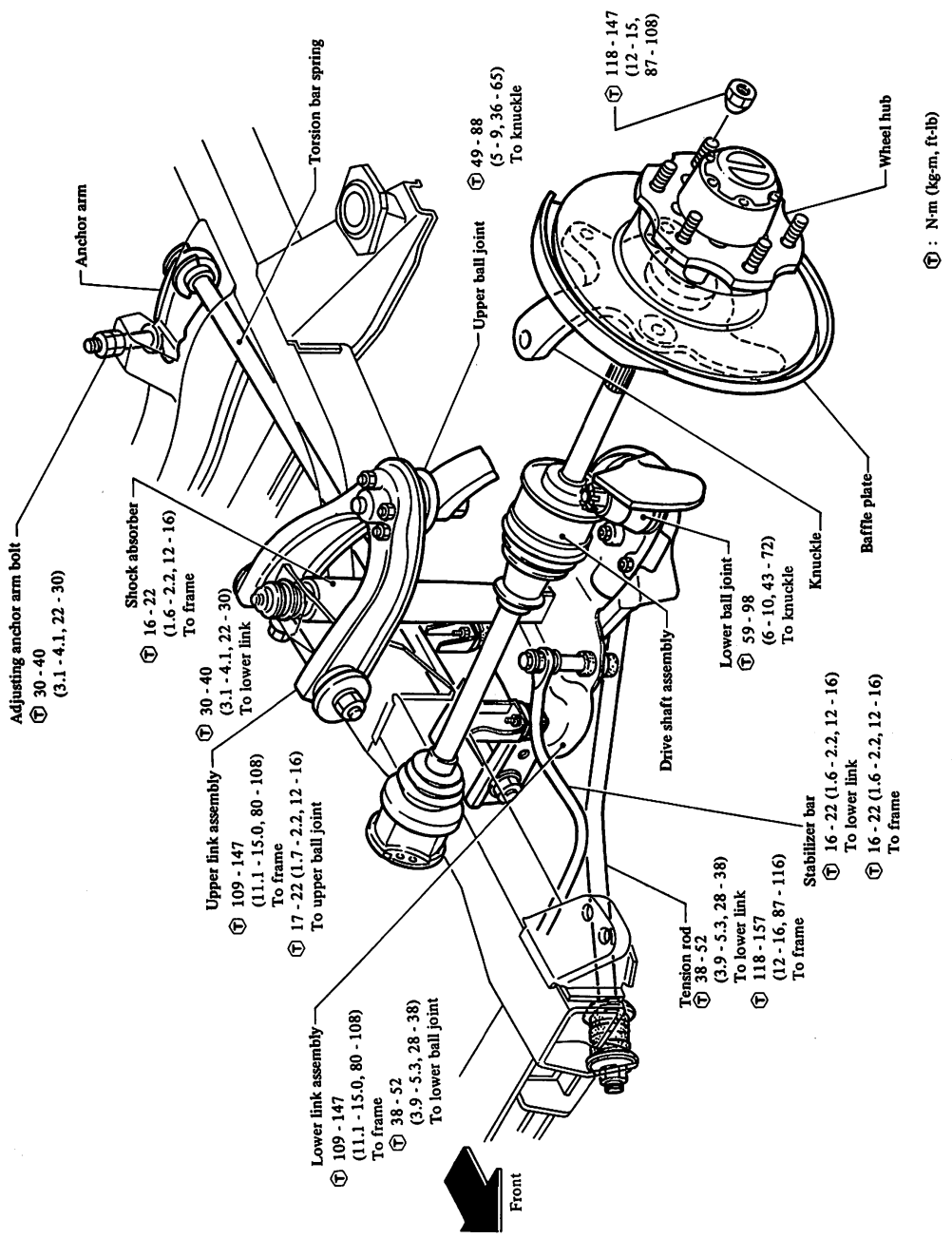


12. After installing, adjust wheel alignment.

Refer to Section MA for adjustment.

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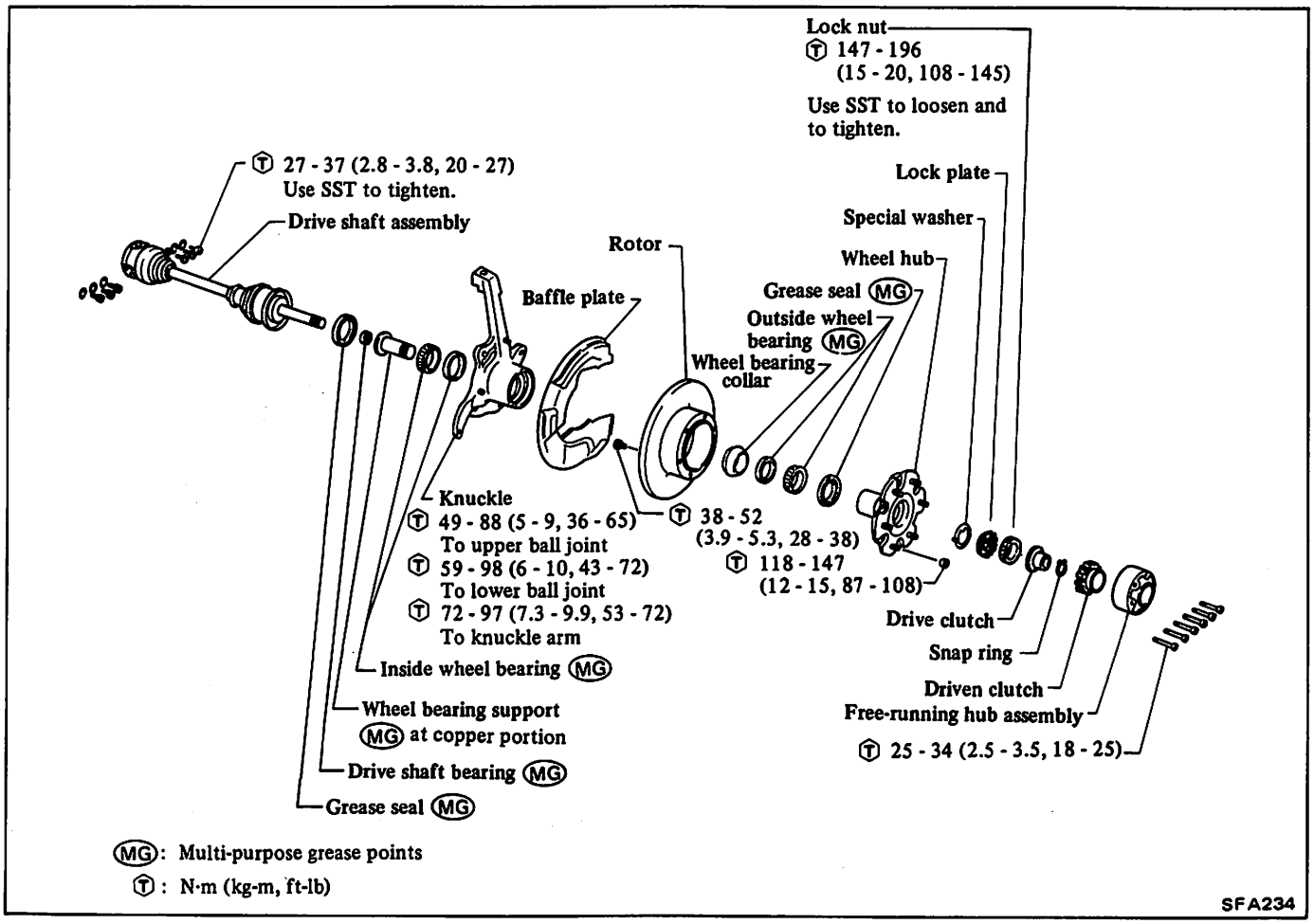
FRONT AXLE AND FRONT SUSPENSION SYSTEM (4WD)



SFA233

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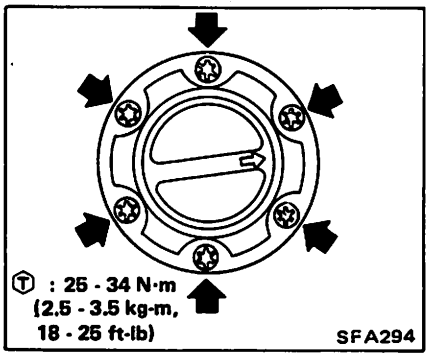
FRONT AXLE



FREE-RUNNING HUB

REMOVAL AND INSTALLATION

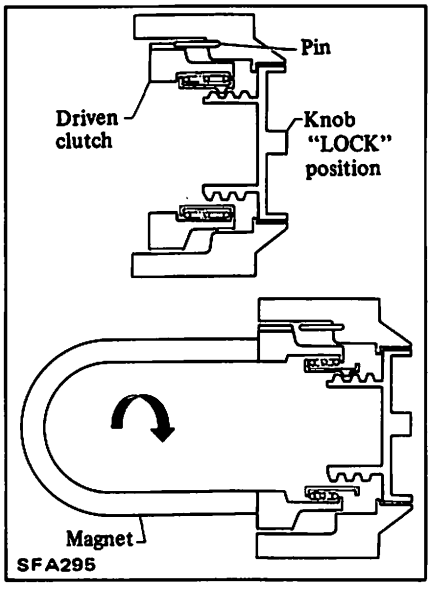
Use torx wrench socket.



DISASSEMBLY

1. **Set free-running hub at "LOCK" position.**
2. Remove driven clutch by turning it clockwise.

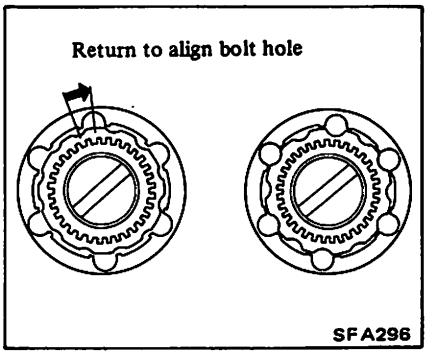
A pin is located inside free-running hub case to lock driven clutch. Pull and turn driven clutch, while attracting lock pin with a magnet, in order to remove it.



3. Remove lock pin.

ASSEMBLY

1. **Set the knob at "FREE" position.**
2. Manually screw driven clutch into place by turning it counterclockwise until it will not go in any further.
3. Then turn it clockwise until it aligns with bolt hole.

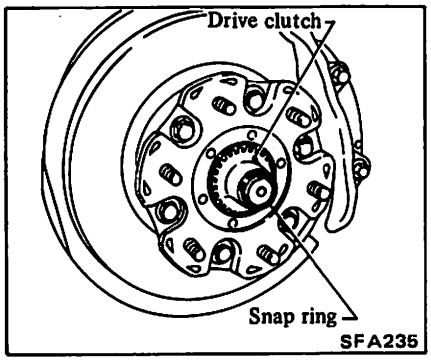


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DRIVE SHAFT

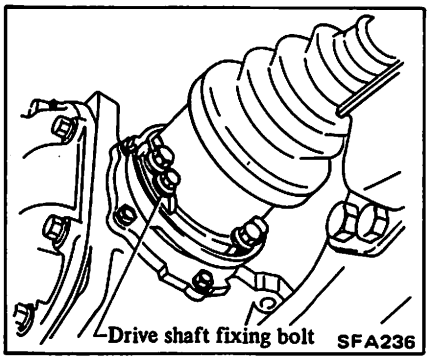
REMOVAL

1. Remove free-running hub assembly.
2. Remove drive clutch after removeing snap ring.



3. Remove rebound bumper.
4. Remove stabilizer bar securing bolt to lower link.
5. Remove bolts fixing drive shaft to differential carrier.

Do not remove boots.



6. Remove drive shaft, drawing its outer end out of front wheel.

Turn steering to the left (right), when removing left (right) drive shaft.

INSPECTION

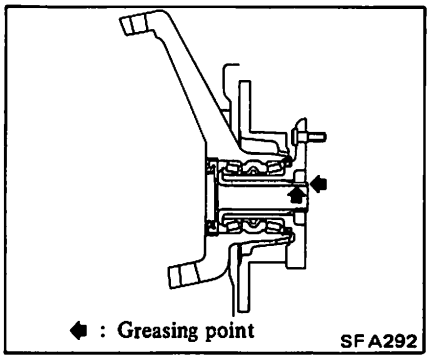
Drive shaft is assembled at the factory and cannot be disassembled.

1. Check shaft and joint portion for deformation, deflection, or other damage.
2. Check boots for fatigue, crack or wear.
3. Replace as an assembly if any fault is detected.

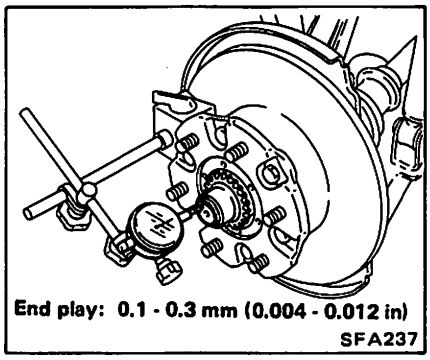
INSTALLATION

Install drive shaft assembly in the reverse order of removal noting the following point.

- Apply recommended multi-purpose grease to the copper portion of wheel bearing support.



- Adjust drive shaft axial end play by installing proper thickness of snap ring to the drive shaft end. Refer to S.D.S.

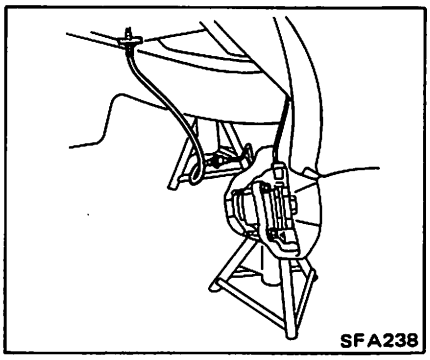


Ⓣ : Drive shaft to differential carrier
Use SST to tighten.
27 - 37 N·m
(2.8 - 3.8 kg-m,
(20 - 27 ft-lb)
Free-running hub
25 - 34 N·m
(2.5 - 3.5 kg-m,
18 - 25 ft-lb)
Stabilizer bar to frame
16 - 22 N·m
(1.6 - 2.2 kg-m,
12 - 16 ft-lb)
Stabilizer bar to lower link
(16 - 22 N·m
1.6 - 2.2 kg-m,
12 - 16 ft-lb)
Wheel nut
118 - 147 N·m
(12 - 15 kg-m,
87 - 108 ft-lb)

WHEEL HUB AND KNUCKLE

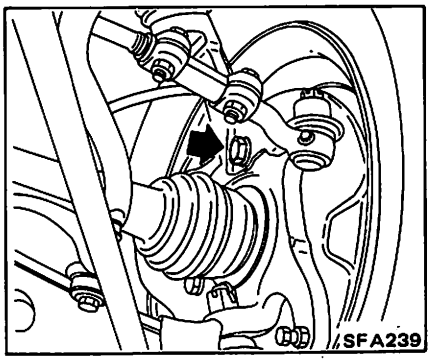
REMOVAL

1. Block rear wheels with chocks and raise front of vehicle, then **support it with safety stands. Refer to Section GI for lifting points and towing.**
2. Remove wheel and tire assembly.
3. Dismount brake caliper assembly.

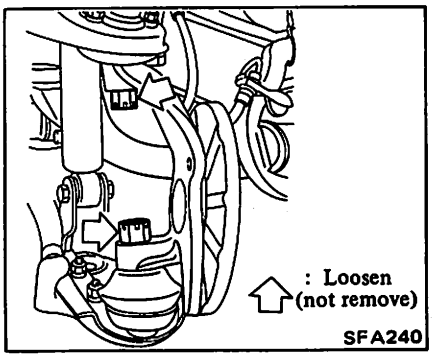


4. Remove drive shaft. Refer to Drive Shaft.
5. Remove wheel hub and knuckle in the following manner.

(1) Remove bolt securing knuckle arm to knuckle.



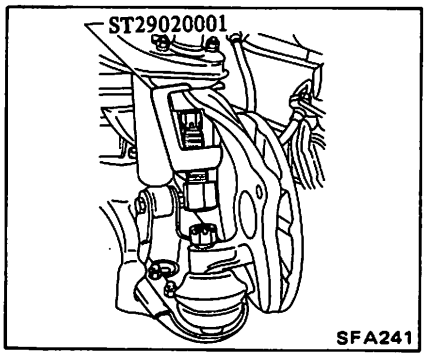
(2) Loosen **(not remove)** upper and lower ball joint tightening nut.



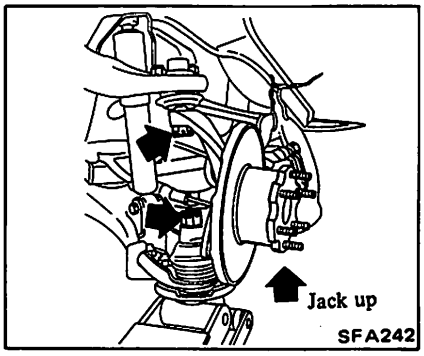
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(3) Separate upper and lower ball joint to knuckle spindle using **Tool.**

CAUTION:
During above operation, never remove ball joint nut which is loosened in step (2).



(4) Jack up lower link and then remove ball joint tightening nut.

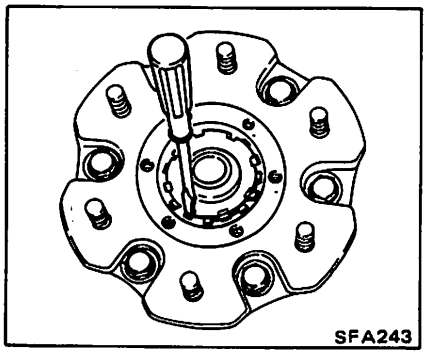


(5) Separate knuckle from upper and lower links.

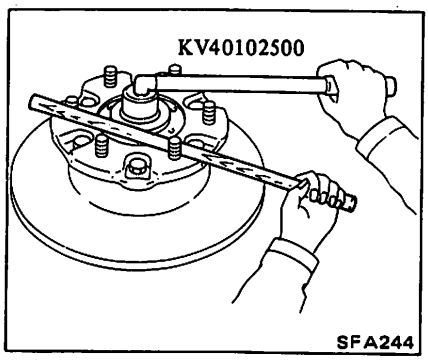
DISASSEMBLY

1. Unbend lock washer with a screwdriver.

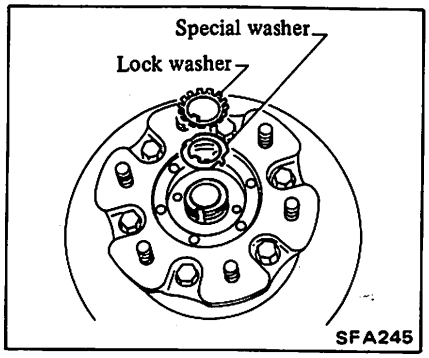
Do not reuse lock washer.



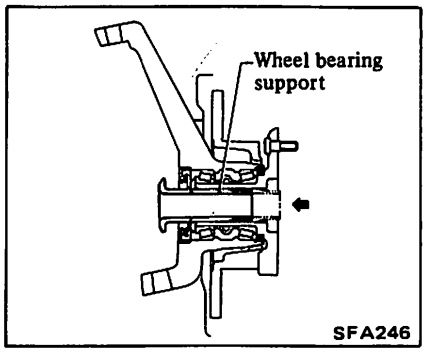
2. Remove front wheel lock nut, using Tool.



3. Remove lock washer and special washer.

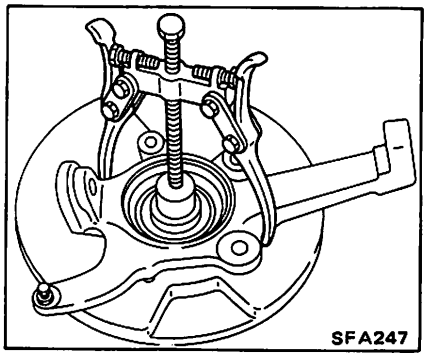


4. Push wheel bearing support out of wheel hub.

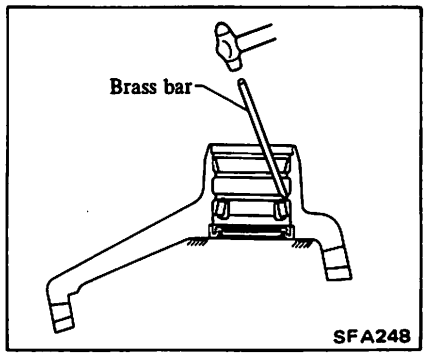


Always replace inside grease seal.

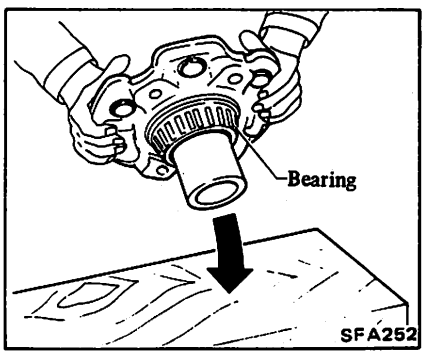
5. Separate knuckle from hub, using suitable puller.



6. Remove wheel bearing collar.
7. Remove inside wheel bearing and inside grease seal by driving bearing outer race with brass bar.

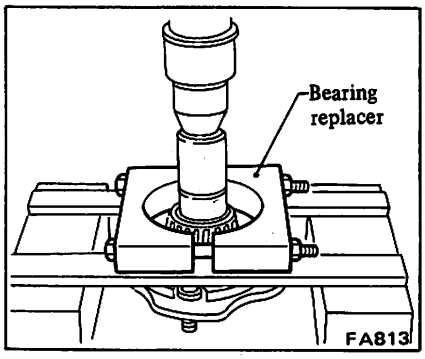


8. Separate wheel hub and rotor.
9. Hit hub assembly on wooden block as shown to shift the position of outside bearing.



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10. Remove outside wheel bearing from wheel hub using suitable bearing replacer, then remove grease seal if necessary.



11. Remove drive shaft bearing from wheel bearing support using suitable drift, as necessary.

INSPECTION

Thoroughly clean bearing and dry with compressed air.

Wheel bearing

When race, cage and roller surfaces make noise or are cracked, pitted, worn, rough, or out-of-round, replace bearing assembly.

Wheel hub

Check wheel hub for cracks by means of a magnetic exploration or dyeing test, replace if necessary.

Knuckle

Also check knuckle, replace if cracks or damage is found.

Grease seal

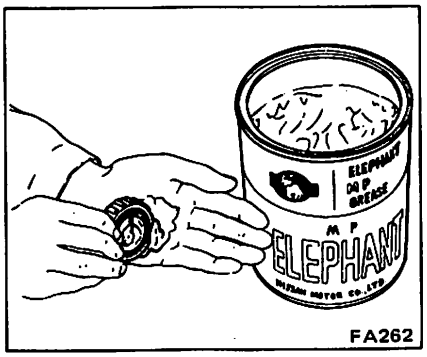
If grease leakage is detected during removal, replace grease seal.

Replace grease seal at every disassembly even if it appears good.

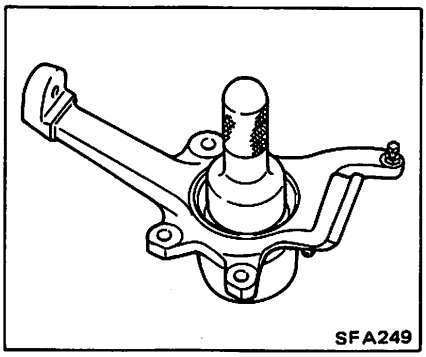
ASSEMBLY

Assemble wheel hub and knuckle in the reverse order of disassembly, noting the following.

- Coat each bearing **with recommended multi-purpose grease.**

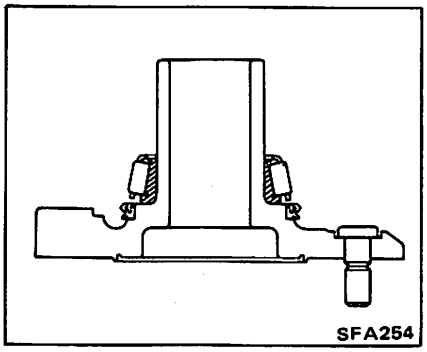


- Install bearing outer race into each side of knuckle using suitable drift or brass bar.



- Install outside grease seal and bearing into wheel hub with suitable drift.

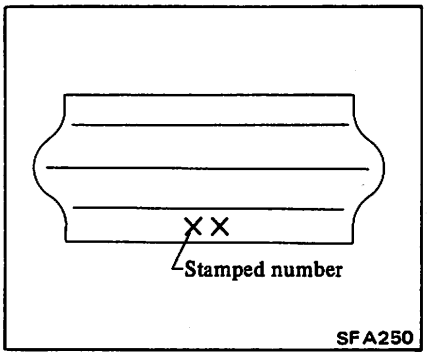
a. Pack seal lip with recommended multi-purpose grease.
b. Be sure that grease seal is facing in proper drection.
c. Press bearing inner race to install, never force to the roller or cage.



- **When replacing wheel bearing or knuckle select wheel bearing collar with the proper thickness so that correct wheel bearing preload is obtained.**

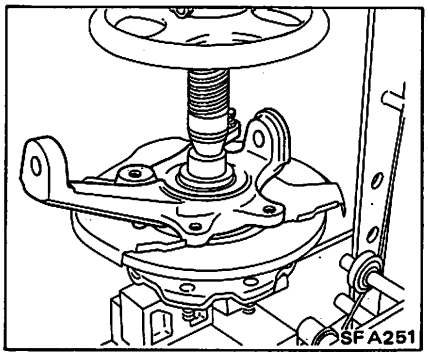
Proceed as follows.

(1) First, install the collar which has been removed, or a new one with the same number.



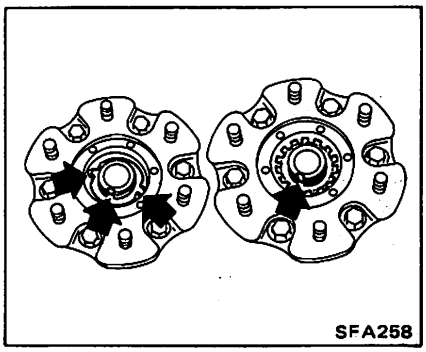
(2) Install inside bearing using press and suitable drift.

Press bearing inner race to install, never force to the roller or cage.



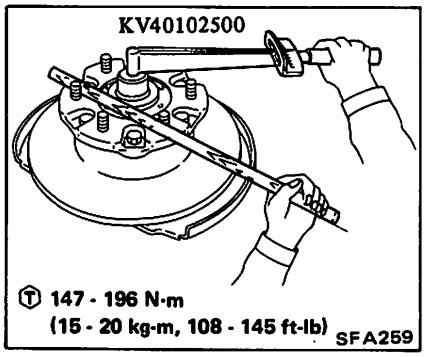
(3) Install special washer and lock washer in proper position.

Use new lock washer.

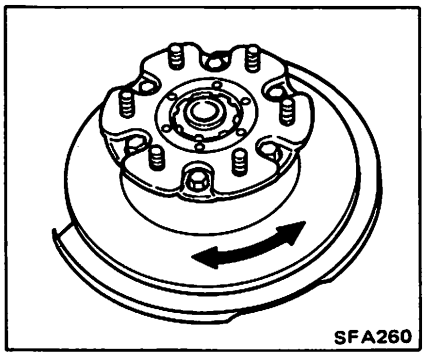


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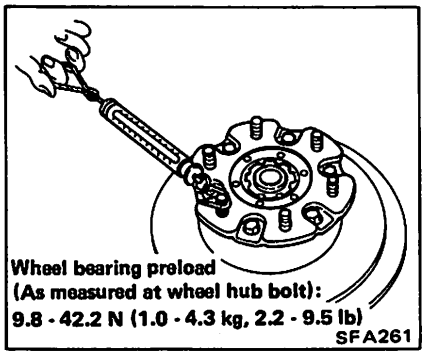
(4) Tighten lock nut to the specified tightening torque using Tool.



(5) Turn wheel hub several times in both directions to seat wheel bearing correctly.



(6) Check wheel bearing preload for specified limit.

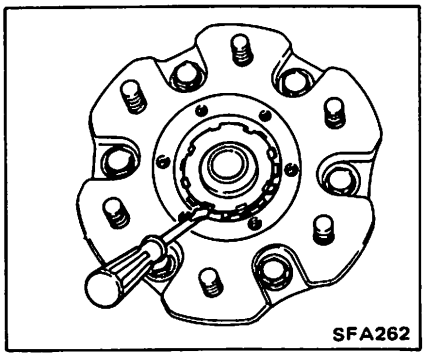


If the preload does not measure to specification, adjust preload by replacing wheel bearing collar.

When the preload is higher than specified, replace collar with thicker one (whose stamped No. is larger by 1). Or when the preload is lower than specified, replace collar with thinner one (whose stamped No. is smaller by 1). Repeat this procedure until specified preload is obtained.

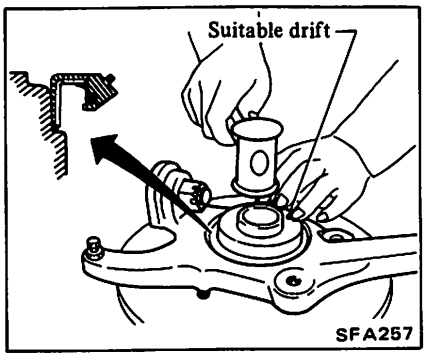
CAUTION:
Never tighten or loosen lock nut beyond specifications, to adjust wheel bearing preload. Doing so will cause bearing damage or loosen the lock nut.

(7) After wheel bearing preload has been adjusted, be sure to bend the lock washer lip up into a nut groove.



(8) Install inside grease seal into knuckle with suitable drift.

a. **Pack seal lip with recommended multi-purpose grease.**
b. **Be sure that grease seal is facing in proper direction.**

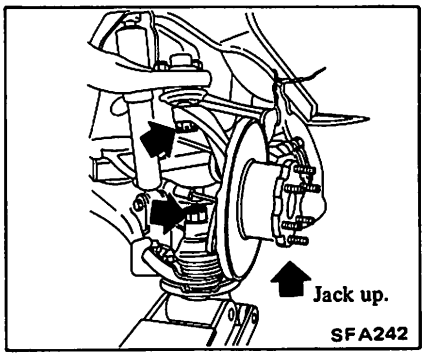


INSTALLATION

Install wheel hub and knuckle assembly in the reverse order of removal, noting the following.

- Install knuckle to upper and lower ball joints with backing up lower link.

CAUTION:
Make sure that oil or grease does not come into contact with tapered areas and threads of ball joint.

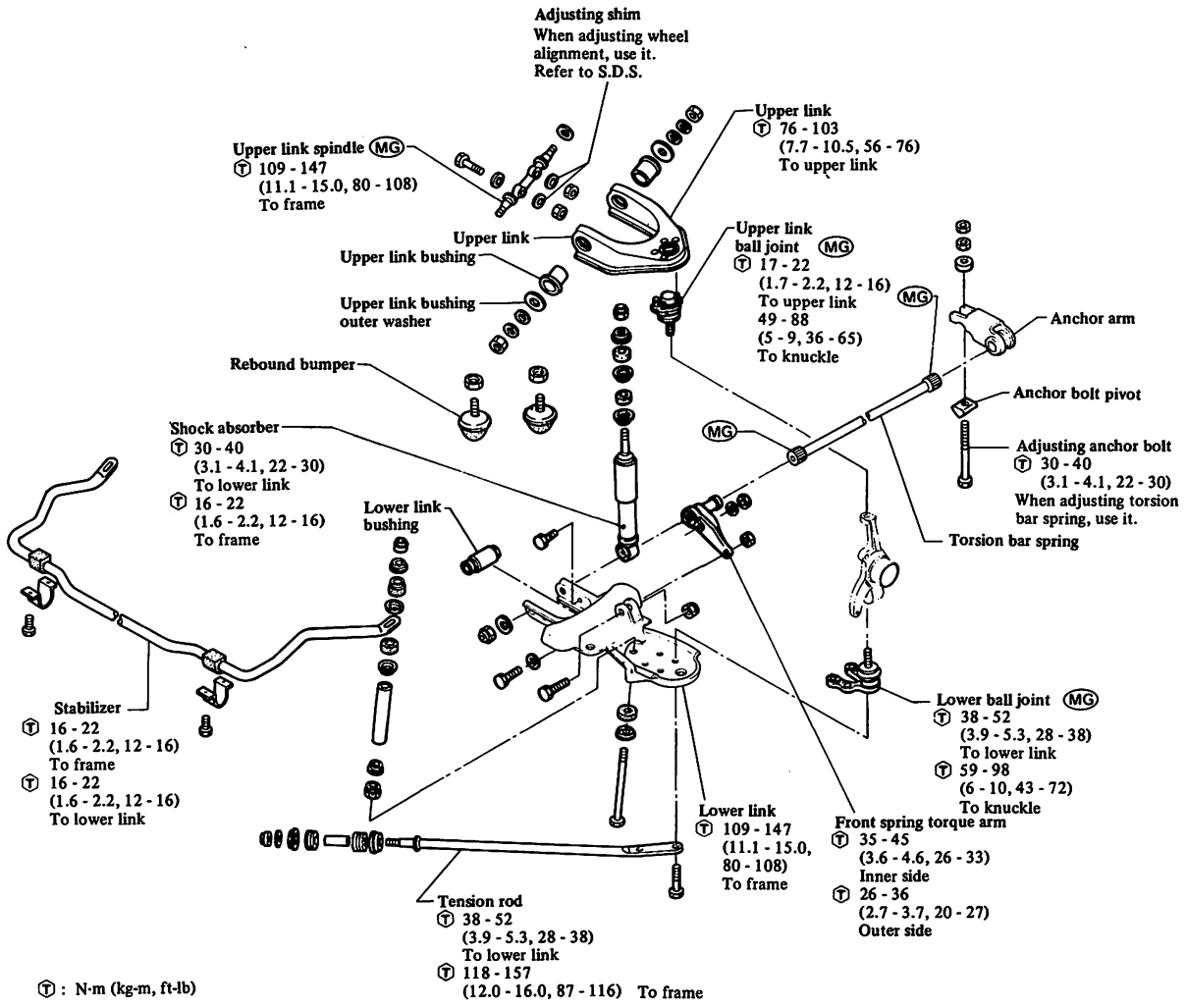


- After installing drive shaft, adjust drive shaft axial end play. Refer to Drive Shaft.

Ⓣ : **Upper ball joint to knuckle**
49 - 88 N·m
(5 - 9 kg-m,
36 - 65 ft-lb)
Lower ball joint to knuckle
59 - 98 N·m
(6 - 10 kg-m,
43 - 72 ft-lb)
Knuckle arm to knuckle
72 - 97 N·m
(7.3 - 9.9 kg-m,
53 - 72 ft-lb)
Brake caliper to knuckle
72 - 97 N·m
(7.3 - 9.9 kg-m,
53 - 72 ft-lb)
Drive shaft to differential carrier
27 - 37 N·m
(2.8 - 3.8 kg-m,
20 - 27 ft-lb)
Free-running hub
25 - 34 N·m
(2.5 - 3.5 kg-m,
18 - 25 ft-lb)
Stabilizer bar to frame
16 - 22 N·m
(1.6 - 2.2 kg-m,
12 - 16 ft-lb)
Stabilizer bar to lower link
16 - 22 N·m
(1.6 - 2.2 kg-m,
12 - 16 ft-lb)
Wheel nut
118 - 147 N·m
(12 - 15 kg-m,
87 - 108 ft-lb)

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FRONT SUSPENSION



Ⓣ : N·m (kg-m, ft-lb)

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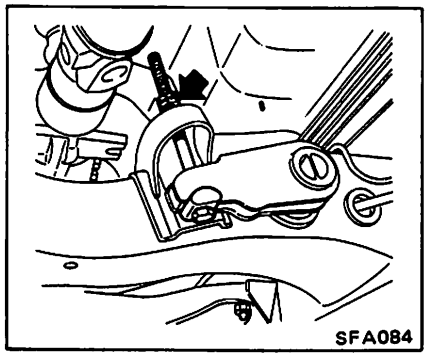
SHOCK ABSORBER

Refer to Front Suspension (2WD) for shock absorber.

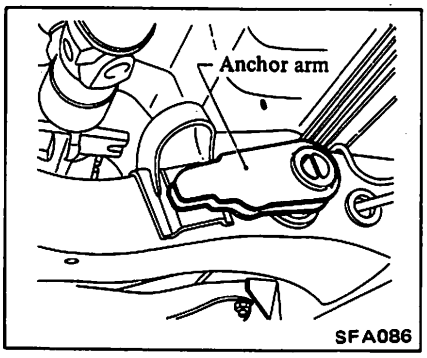
TORSION BAR SPRING

REMOVAL

1. Block rear wheels with chocks and raise front of vehicle, and then support it with safety stands. **Refer to Section GI for lifting points and towing.**
2. Remove torsion bar spring anchor bolt.

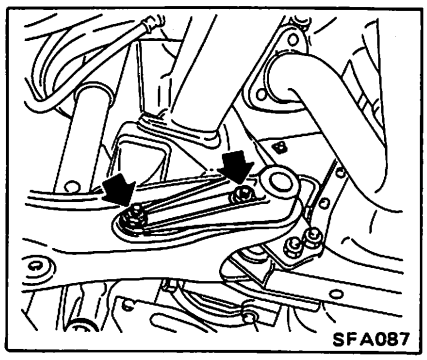

SFA084

3. Pull out anchor arm rearward.



SFA086

4. Withdraw torsion bar spring rearward.
5. Remove torsion bar spring torque arm.


SFA087

INSPECTION

- Check torsion bar spring for wear, twist, bend and other damage. Replace if necessary.
- Check serrations of each part for cracks, wear, twist and other damage. Replace if necessary.

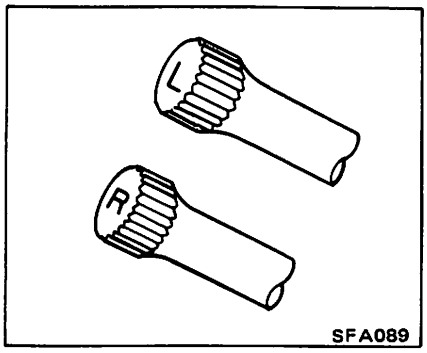
INSTALLATION AND ADJUSTMENT

1. Install torque arm to lower link.

Ⓣ: Outer side
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)
Inner side
35 - 45 N·m
(3.6 - 4.6 kg-m,
26 - 33 ft-lb)

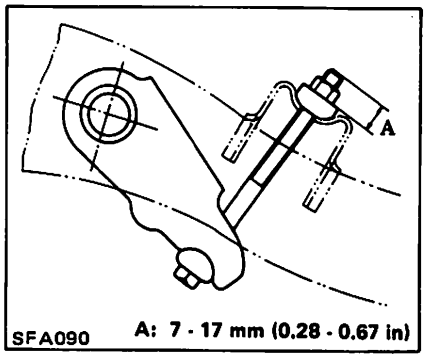
2. Coat grease on the serration of torsion bar spring and then install it to torque arm.

Be sure to install right and left torsion bar springs correctly.



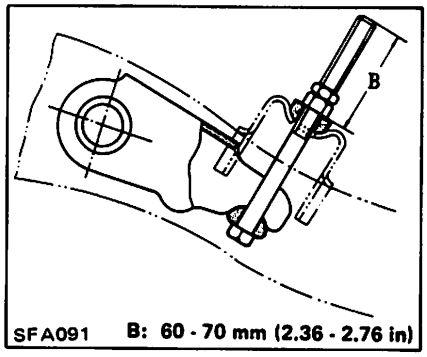
SFA089

3. Install anchor arm to serration of torsion bar spring and then anchor arm adjusting bolt.



SFA090 **A: 7 - 17 mm (0.28 - 0.67 in)**

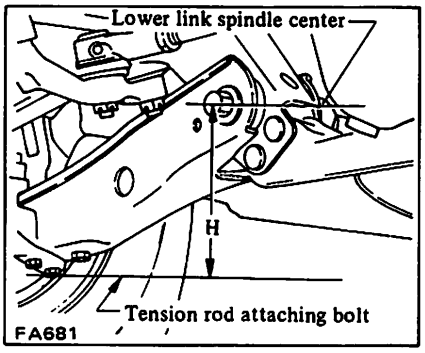
4. Adjust anchor arm adjusting bolt.



SFA091 **B: 60 - 70 mm (2.36 - 2.76 in)**

5. Install dust cover.
6. Adjust anchor arm position (vehicle posture).
(1) Lower vehicle.
(2) Turn anchor bolt adjusting nut to obtain the specified "H" dimension.

"H" dimension (when vehicle is unladen):
134 - 139 mm
(5.28 - 5.47 in)



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TENSION ROD AND STABILIZER BAR

Refer to Front Suspension (2WD) for tension rod and stabilizer bar.

UPPER LINK AND BALL JOINT

Refer to Front Suspension (2WD) for upper link and ball joint.

LOWER LINK AND BALL JOINT

REMOVAL

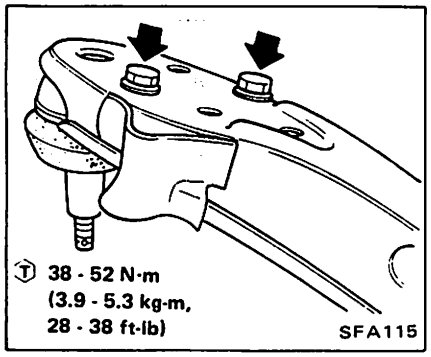
Refer to Front Suspension (2WD) for lower link and ball joint.

INSPECTION

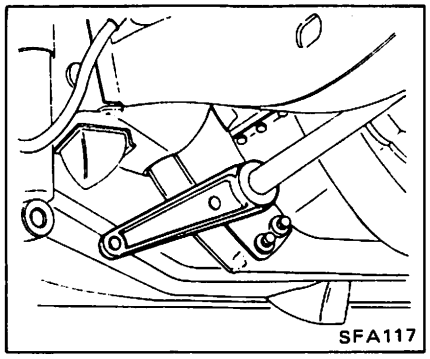
Refer to Front Suspension (2WD) for lower link and ball joint.

INSTALLATION

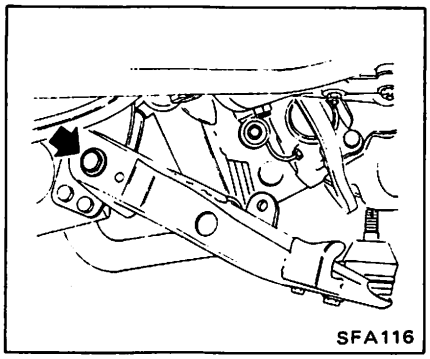
1. Install lower link ball joint.



2. Install lower link spindle bushing to frame using suitable Tool.
3. Set torque arm to torsion bar.



4. Install lower link.



5. Install torque arm to lower link

Ⓣ : **Inner side**
35 - 45 N·m
(3.6 - 4.6 kg-m,
26 - 33 ft-lb)
Outer side
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)

6. Jack up lower link.
7. Install lower ball joint to knuckle spindle.

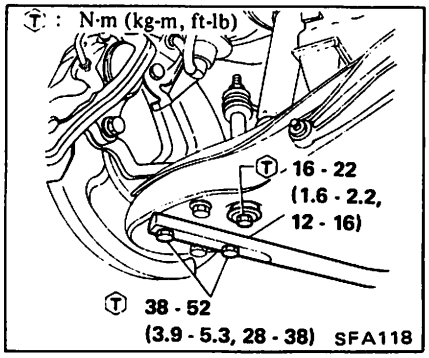
Ⓣ : **59 - 98 N·m**
(6 - 10 kg-m,
43 - 72 ft-lb)

CAUTION:
Make sure that oil or grease does not come into contact with tapered areas of ball joint and knuckle spindle and threads of ball joint.

8. Install shock absorber lower end to lower link.

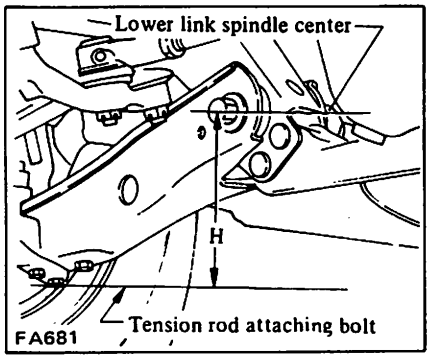
Ⓣ : **30 - 40 N·m**
(3.1 - 4.1 kg-m,
22 - 30 ft-lb)

9. Install tension rod and stabilizer connecting rod to lower link.



10. Lower vehicle.
11. Turn anchor bolt adjusting nut to obtain the specified "H" dimension.

"H" dimension (when vehicle is unladen):
134 - 139 mm
(5.28 - 5.47 in)



12. After installing, adjust wheel alignment.

Refer to Section MA for adjustment.

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

TORSION BAR SPRING

Spring diameter x Length mm (in)	22 (0.87) x 822.5 (32.38)
Torsional rigidity N·m (kg-m, ft-lb)/deg.	37.5 (3.82, 27.6)

SHOCK ABSORBER

Applied model	2WD	4WD
Shock absorber type	Twin tube	
Stroke mm (in)	106 (4.17)	110 (4.33)
Damping force [At 0.3 m (1.0 ft) sec.] Expansion N (kg, lb)	481 (49, 108)	1,079 (110, 243)
Compression N (kg, lb)	235 (24, 53)	539 (55, 121)

STABILIZER BAR

Diameter mm (in)	21 (0.83)

TENSION ROD

Applied model	2WD	4WD
Diameter mm (in)	22 (0.87)	18 (0.71)

DRIVE SHAFT

Type	Tripod constant velocity shaft
Model	TFS50/56A

INSPECTION AND ADJUSTMENT

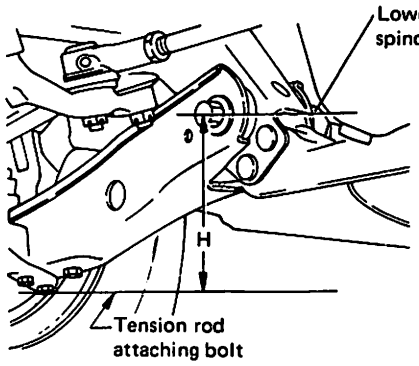
WHEEL ALIGNMENT (Unladen *1)

Applied model		2WD	4WD
Chamber	degree	0° - 1°	
Caster	degree	50' - 1°50'	1°10' - 2°10'
Kingpin inclination	degree	8°30' - 9°30'	10°30' - 11°30'
Toe-in	mm (in)	5 - 7 (0.20 - 0.28)	
	degree*2	14' - 19'	
Front wheel turning angle (Full turn)	Inside	34° - 36°	29° - 33°
	degree Outside	30° - 32°	27° - 29°
Front wheel toe-out turn	Inside	20°	18.5°
	Outside	18°	

*1: Tankful of fuel, radiator coolant and engine oil full.
Spare tire, jack, hand tools, mats in designed position.
*2: On both sides.

VEHICLE POSTURE (Unladen)

"H" dimension mm (in)	2WD	124 - 129 (4.88 - 5.08)
	4WD	134 - 139 (5.28 - 5.47)



FA681

WHEEL BEARING (2WD)

Wheel bearing axial play mm (in)	Less than 0.08 (0.0031)
Wheel bearing nut Tightening torque N·m (kg-m, ft-lb)	34 - 39 (3.5 - 4.0, 25 - 29)
Return angle degree	45°
Wheel bearing starting torque With new grease seal N·m (kg-cm, in-lb)	Less than 2.0 (20, 17)
With used grease seal N·m (kg-cm, in-lb)	Less than 0.7 (7, 6.1)
At wheel hub bolt With new grease seal N (kg, lb)	Less than 28.4 (2.9, 6.4)
With used grease seal N (kg, lb)	Less than 11.8 (1.2, 2.6)

WHEEL BEARING (4WD)

Wheel bearing lock nut Tightening torque	N·m (kg-m, ft-lb)	147 - 196 (15 - 20, 108 - 145)
Wheel bearing preload	N·m (kg-m, ft-lb)	0.7 - 2.9 (0.07 - 0.30, 0.5 - 2.2)
At wheel hub bolt	N (kg, lb)	9.8 - 42.2 (1.0 - 4.3, 2.2 - 9.5)

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Wheel bearing collar

Thickness mm (in)	Number	Thickness mm (in)	Number
27.93 (1.0996)	00	28.28 (1.1134)	07
27.98 (1.1016)	01	28.33 (1.1154)	08
28.03 (1.1035)	02	28.38 (1.1173)	09
28.08 (1.1055)	03	28.43 (1.1193)	10 or A
28.13 (1.1075)	04	28.48 (1.1213)	11 or B
28.18 (1.1094)	05	28.53 (1.1232)	12 or C
28.23 (1.1114)	06	28.58 (1.1252)	13 or D

DRIVE SHAFT

Drive shaft axis end play mm (in)	0.1 - 0.3 (0.004 - 0.012)

Drive shaft end snap ring

Thickness mm (in)	Part No.
1.1 (0.043)	32228 20100
1.3 (0.051)	32228 20102
1.5 (0.059)	32228 20104
1.7 (0.067)	32228 41W00
1.9 (0.075)	32228 41W01

UPPER BALL JOINT

Unit: N·m (kg-cm, in-lb)

Turning torque New part	1.0 - 4.9 (10 - 50, 8.7 - 43.4)
Used part	More than 1.0 (10, 8.7)

LOWER BALL JOINT

Stud axial end play mm (in)	0.1 - 1.0 (0.004 - 0.039)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Wheel hub			
Wheel hub nut	118 - 147	12 - 15	87 - 108
Wheel hub to disc brake rotor	38 - 52	3.9 - 5.3	28 - 38
Shock absorber			
Shock absorber upper end to frame	16 - 22	1.6 - 2.2	12 - 16
Shock absorber lower end to lower link	30 - 40	3.1 - 4.1	22 - 30
Torsion bar spring			
Anchor adjusting bolt lock nut	30 - 40	3.1 - 4.1	22 - 30
Torque arm to lower link Inside	35 - 45	3.6 - 4.6	26 - 33
Torque arm to lower link Outside	26 - 36	2.7 - 3.7	20 - 27
Bound bumper			
Bound bumper to frame	8 - 11	0.8 - 1.1	5.8 - 8.0
Upper link			
Upper link spindle to upper link	76 - 103	7.7 - 10.5	56 - 76
Upper link spindle to frame	109 - 147	11.1 - 15.0	80 - 108
Lower link			
Lower link to frame	109 - 147	11.1 - 15.0	80 - 108
Tension rod			
Tension rod to lower link	38 - 52	3.9 - 5.3	28 - 38
Tension rod to frame	118 - 157	12.0 - 16.0	87 - 116
Stabilizer bar			
Stabilizer bar to frame	16 - 22	1.6 - 2.2	12 - 16
Stabilizer bar to lower link	16 - 22	1.6 - 2.2	12 - 16
Steering stopper bolt			
Steering stopper bolt lock nut	45 - 60	4.6 - 6.1	33 - 44

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(2WD)

Unit	N·m	kg-m	ft-lb
Knuckle arm and knuckle spindle			
Knuckle arm to side rod	54 - 98	5.5 - 10.0	40 - 72
Knuckle arm to knuckle spindle	72 - 97	7.3 - 9.9	53 - 72
Knuckle spindle to caliper	72 - 97	7.3 - 9.9	53 - 72
Ball joint			
Upper ball joint to knuckle spindle	78 - 98	8.0 - 10.0	58 - 72
Upper ball joint to upper link	17 - 22	1.7 - 2.2	12 - 16
Lower ball joint to knuckle spindle	118 - 167	12.0 - 17.0	87 - 123
Lower ball joint to lower link	38 - 52	3.9 - 5.3	28 - 38

(4WD)

Unit	N·m	kg-m	ft-lb
Drive shaft			
Drive shaft to differential carrier	27 - 37	2.8 - 3.8	20 - 27
Free-running hub			
Free-running hub to wheel hub	25 - 34	2.5 - 3.5	18 - 25
Wheel hub			
Wheel bearing lock nut	147 - 196	15 - 20	108 - 145
Knuckle arm and knuckle			
Knuckle arm to side rod	54 - 98	5.5 - 10.0	40 - 72
Knuckle arm to knuckle	72 - 97	7.3 - 9.9	53 - 72
Caliper to knuckle	72 - 97	7.3 - 9.9	53 - 72
Ball joint			
Upper ball joint to knuckle spindle	49 - 88	5 - 9	36 - 65
Upper ball joint to upper link	17 - 22	1.7 - 2.2	12 - 16
Lower ball joint to knuckle spindle	59 - 98	6 - 10	43 - 72
Lower ball joint to lower link	38 - 52	3.9 - 5.3	28 - 38

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TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Vibration, shock and shimmy of steering wheel. **Vibration:** Loose connection and wear of the each part of linkage cause vibration of front wheels and, steering wheel vibration. This is very noticeable when travelling on rough road. **Shock:** When the vehicle is travelling on bumpy roads, the play of the steering linkage is transmitted to the steering wheel. This is especially noticeable when travelling on rough road. **Shimmy:** Abnormal vibration of the front suspension system, the whole steering linkage and road wheel, which occurs at specific speeds.	Improper tire pressure.	Adjust.
	Imbalance and deformation of road wheel.	Correct the imbalance or replace.
	Unevenly worn tire or insufficient tightening of wheel nuts.	Replace or tighten.
	Improperly adjusted or worn front wheel bearing.	Adjust or tighten.
	Faulty wheel alignment.	Adjust.
	Worn upper and lower link bushings.	Replace.
	Insufficiently tightened steering gear housing.	Retighten.
	Wear of steering linkage.	Replace faulty parts.
	Worn suspension ball joint.	Replace.
	Excessive backlash due to improper adjustment of the steering gear box.	Adjust correctly.
	Damaged idler arm.	Replace.
	Worn column bearing, weakened column bearing spring, or loose clamp.	Replace or retighten.
	Malfunction of shock absorber or loose installation bolts.	Replace or retighten.
	Worn or incorrectly adjusted wheel bearing.	Replace or adjust.
	Imbalance of vehicle level.	Adjust.
Vehicle pulls to right or left. When driving with hands off the steering wheel on a flat road, the vehicle gently swerves to right or left. **A faulty rear suspension may also be the cause of this problem and, therefore, see also Section RA.**	Improper tire pressure or insufficient tightening of wheel nuts.	Adjust or tighten.
	Difference in wear and tear of right and left tire treads.	Replace tires.
	Incorrect adjustment or abrasion of front wheel bearing.	Adjust or replace.
	Collapsed or twisted front spring.	Replace.
	Incorrect wheel alignment.	Adjust.
	Brake binding.	Check and correct.
	Worn rubber bushings for upper and lower link, and tension rod.	Replace.
	Deformed steering linkage and upper and lower links and tension rod.	Replace.
	Imbalance of vehicle level.	Adjust.

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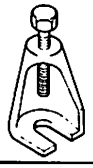
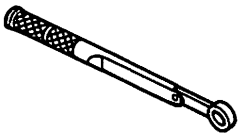
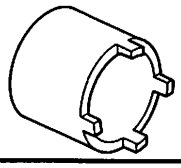
Condition	Probable cause	Corrective action
Instability of vehicle.	Improper tire pressure.	Adjust.
	Worn rubber bushings for upper and lower links, and tension rod.	Replace.
	Incorrect wheel alignment.	Adjust.
	Worn or deformed steering linkage and upper and lower links.	Replace.
	Incorrect adjustment of steering gear. (Backlash and worm bearing preload)	Adjust.
	Deformed or unbalanced road wheel.	Correct or replace.
	Imbalance of vehicle level.	Adjust.
Stiff steering wheel. (Checking up procedure) Jack up front wheels, detach the steering gear arm and operate the steering wheel, and; If it is light, check steering linkage, and suspension parts. If it is heavy, check steering gear, steering linkage and steering column parts.	Improper tire pressure.	Adjust.
	Insufficient lubricants or mixing impurities in steering gear box or excessively worn steering linkage.	Replenish grease or replace the part.
	Stiff or damaged suspension ball joint, or lack of grease.	Replace.
	Worn or damaged steering gear.	Replace.
	Incorrectly adjusted steering gear.	Adjust.
	Deformed steering linkage.	Replace.
	Incorrect wheel alignment.	Adjust.
	Interference of steering column with turn signal switch.	Replace.
Excessive steering wheel play.	Incorrectly adjusted steering gear housing.	Adjust backlash.
	Worn steering linkage.	Replace.
	Improperly fitted gear housing.	Retighten.
	Incorrectly adjusted wheel bearing.	Adjust.
	Worn upper and lower links, and tension rod bushings.	Replace.
Noises.	Improper tire pressure.	Adjust.
	Insufficient lubricating oil and grease for suspension ball joint and steering linkage, or their breakage.	Replenish lubricating oil and grease, or replace.
	Loose steering gear bolts, linkage and suspension parts.	Retighten.
	Faulty shock absorber.	Replace.
	Faulty wheel bearing.	Replace.
	Worn steering linkage and steering gear.	Replace.
	Worn upper and lower links, and tension rod bushings.	Replace.
	Broken tension rod bar spring.	Replace.

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Condition	Probable cause	Corrective action
	Loose stabilizer fixing bolts and nuts.	Retighten.
	Loose shock absorber fixing.	Retighten.
	Worn or damaged drive shaft joints.	Replace.
	Insufficient lubricant for wheel bearing, drive shaft joints or shaft sliding portions (Damaged grease seal or drive shaft boots).	Replenish lubricant, or replace grease seal or drive shaft assembly.
Grating tire noise.	Improper tire pressure.	Adjust.
	Incorrect wheel alignment.	Adjust.
	Deformed knuckle and suspension linkage.	Replace.
Jumping of disc wheel.	Improper tire pressure.	Adjust.
	Imbalanced road wheels.	Adjust.
	Faulty shock absorber.	Replace.
	Faulty tire.	Replace.
	Deformed wheel rim.	Replace.
Excessively or partially worn tire.	Improper tire pressure.	Adjust.
	Incorrect wheel alignment.	Adjust.
	Faulty wheel bearing.	Replace.
	Brake drag.	Check and correct.
	Tire not rotated.	Rotate tires at recommended intervals.
	Rought and improper driving manner.	Drive more gently.

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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name	2WD	4WD
ST29020001 (J25725)	Gear arm puller 	X	X
KV401021S0 (–)	Bearing outer race drift	X	–
① ST35325000 (–)	Drift bar		
② KV40102110 (–)	Drift (A)		
③ KV40102120 (–)	Drift (B)		
④ KV40102130 (–)	Screw (A)		
⑤ KV40102140 (–)	Screw (B)		
⑥ KV40102150 (–)	Screw (C)		
KV40102600 (–)	Torque wrench 	–	X
KV40102500 (–)	Lock nut wrench socket 	–	X

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REAR AXLE & REAR SUSPENSION

SECTION RA

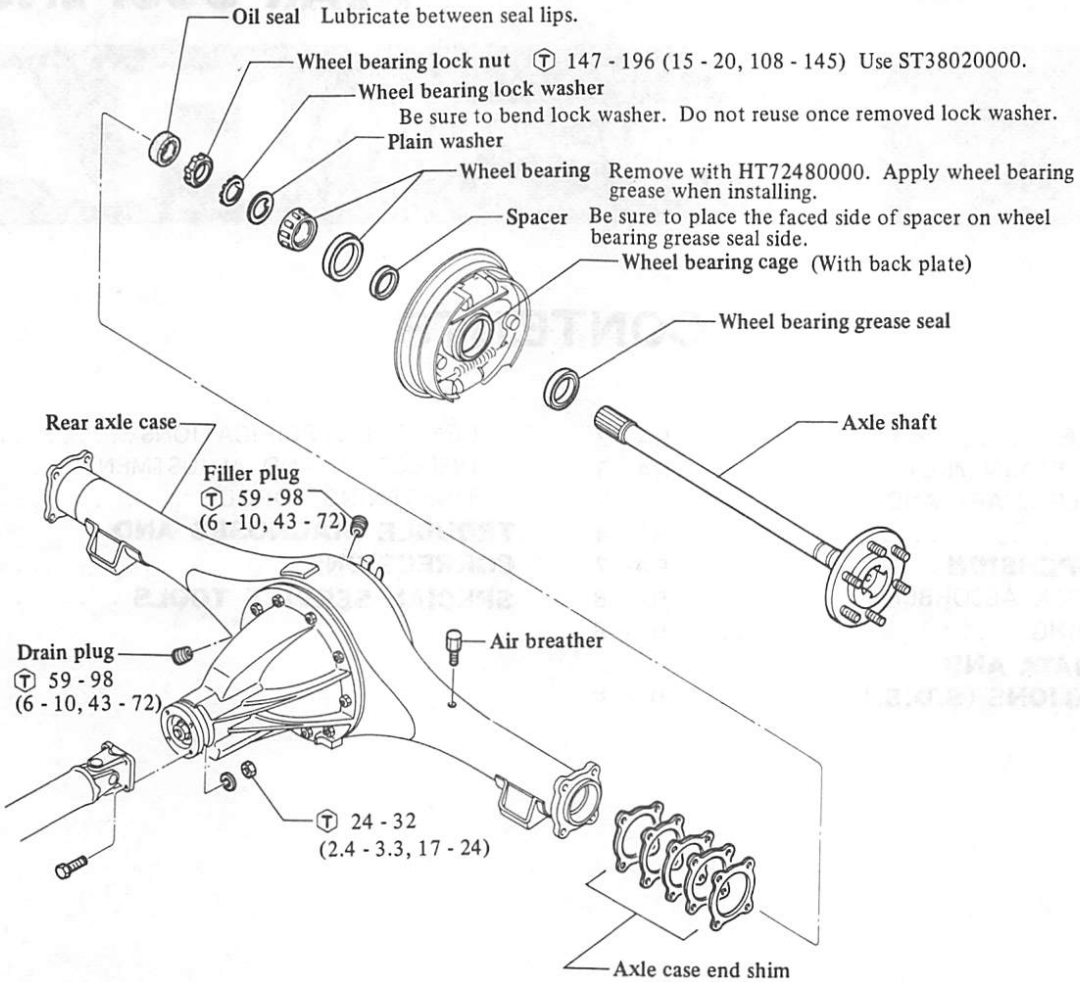
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RA

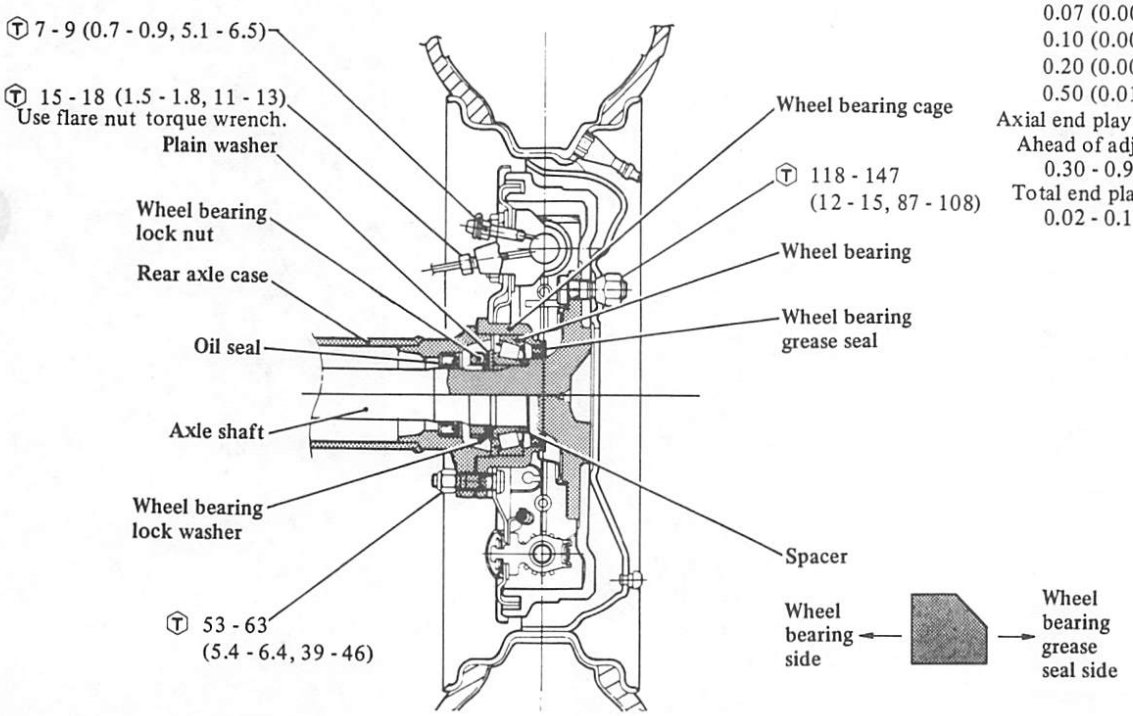
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REAR AXLE



Thickness of shims mm (in)
- 0.05 (0.0020)
- 0.07 (0.0028)
- 0.10 (0.0039)
- 0.20 (0.0079)
- 0.50 (0.0197)

Axial end play
Ahead of adjusting side
0.30 - 0.90 mm (0.0118 - 0.0354 in)
Total end play
0.02 - 0.15 mm (0.0008 - 0.0059 in)



Ⓣ : N·m (kg-m, ft-lb)

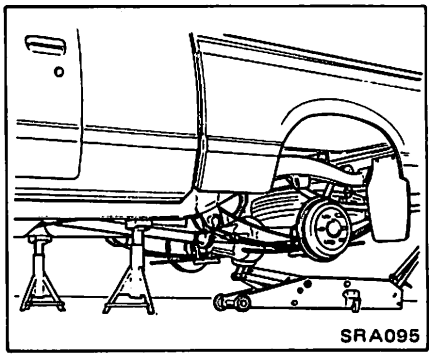
SRA094

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REAR AXLE ASSEMBLY

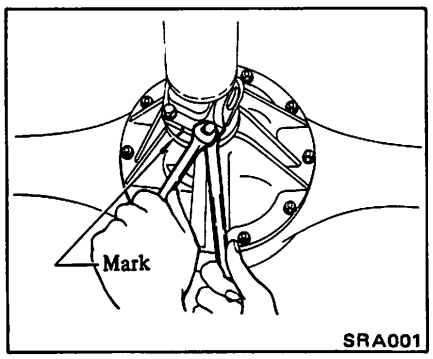
REMOVAL

1. Block front wheels. Support under differential carrier with garage jack. Place stands. Remove rear wheels.

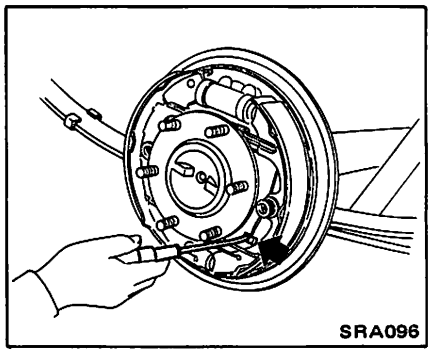


2. Remove propeller shaft.

Mark relationship between propeller shaft flange and companion flange.

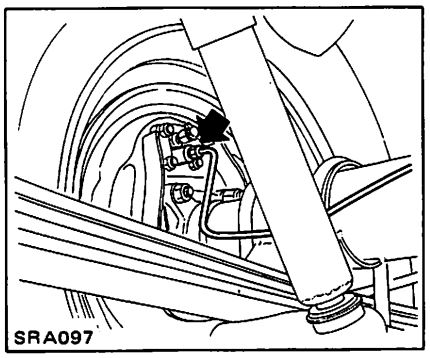


3. Disconnect parking brake cable.

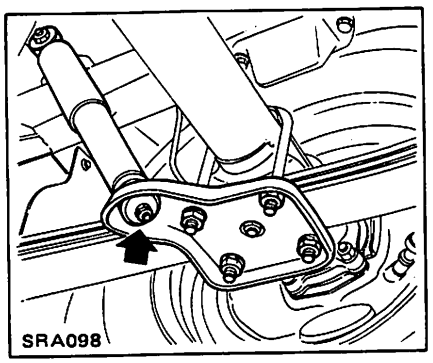


4. Disconnect brake hydraulic line.

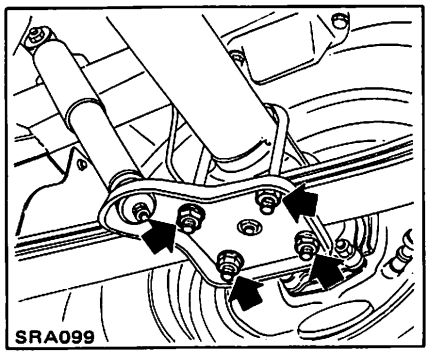
CAUTION:
When removing or installing brake tubes, use Tool GG94310000.



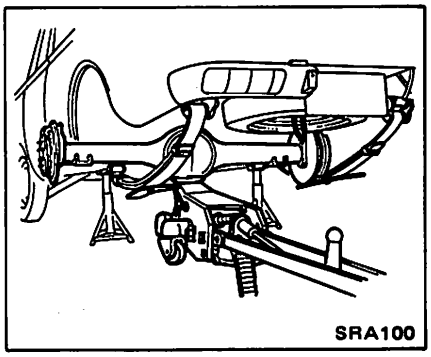
5. Disconnect shock absorber lower end on each side.



6. Remove U-bolts.



7. Pass axle case through space above spring, and take it out.



8. Refer to Rear Axle Shaft and Wheel Bearing for disassembly.

INSPECTION

Check axle case for yield, deformation or cracks and replace if necessary.

INSTALLATION

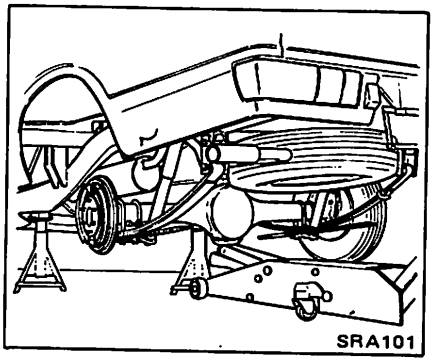
Ⓣ: U-bolt (Spring clip)
88 - 98 N·m
(9.0 - 10.0 kg-m,
65 - 72 ft-lb)
Shock absorber lower end
16 - 22 N·m
(1.6 - 2.2 kg-m,
12 - 16 ft-lb)
Brake tube flare nut
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)
Propeller shaft to companion flange
24 - 32 N·m
(2.4 - 3.3 kg-m,
17 - 24 ft-lb)

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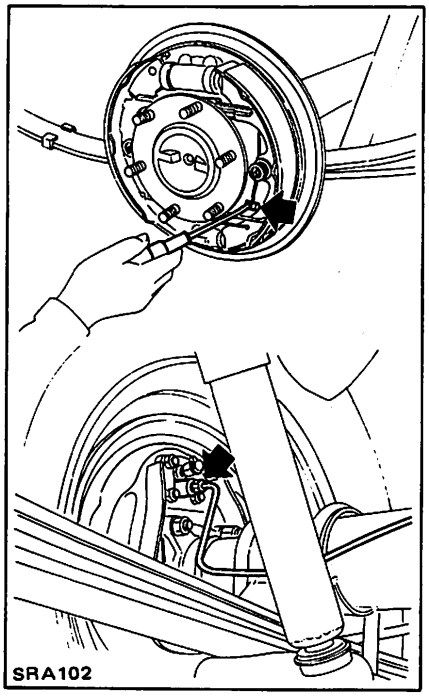
REAR AXLE SHAFT AND WHEEL BEARING

REMOVAL

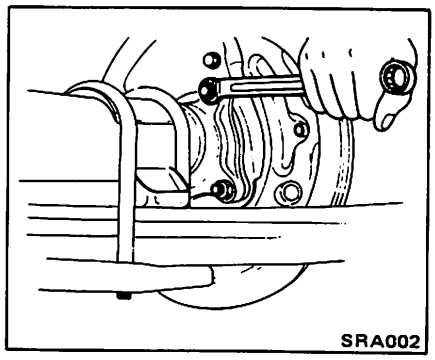
1. Block front wheels. Support under differential carrier with garage jack. Place stands. Remove rear wheel and drum.



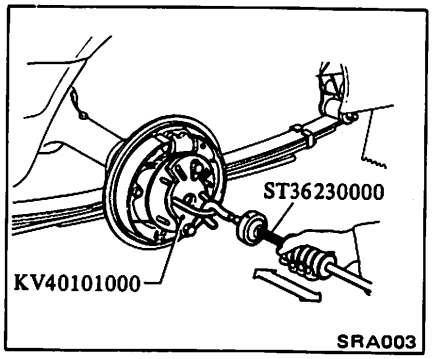
2. Disconnect parking brake cable and brake hydraulic line.



3. Remove nuts fixing brake back plate.

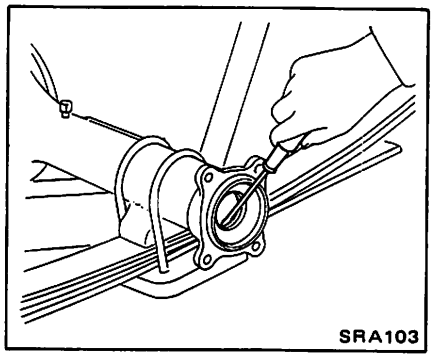


4. Pull out axle shaft assembly together with rear brake.



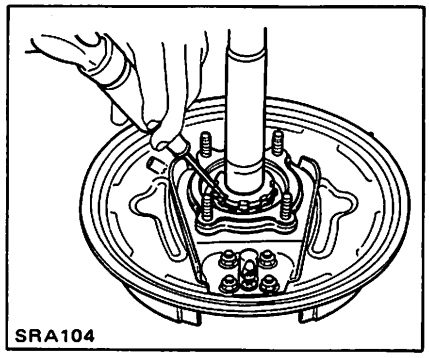
5. Remove oil seal.

Do not reuse once removed oil seal. Always install new one.



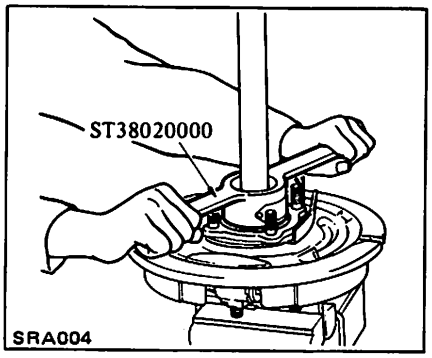
6. Unbend lock washer with a screwdriver.

Do not reuse once removed lock washer. Always install new one.

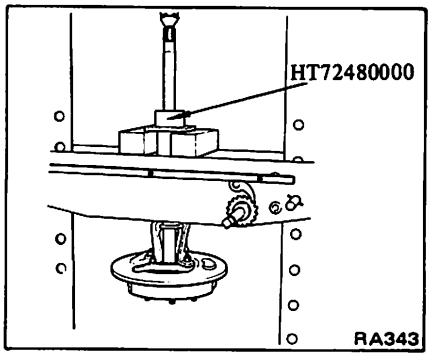


7. Position axle shaft in vise with KV40101000.

Remove bearing lock nut, using tool.



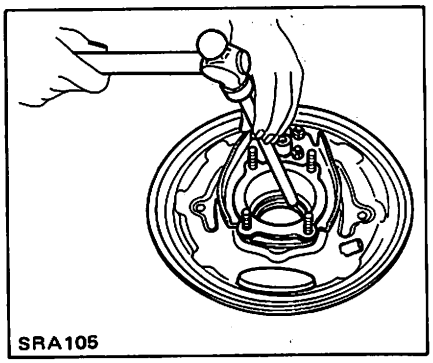
8. Withdraw wheel bearing together with bearing cage and back plate.



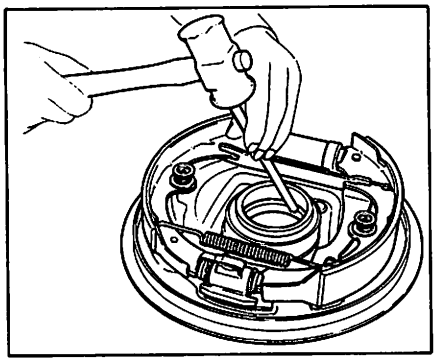
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9. Remove oil seal in bearing cage with suitable bar if necessary.

Do not reuse once removed oil seal. Always install new one.


SRA105

10. To remove wheel bearing outer race, use a brass drift.



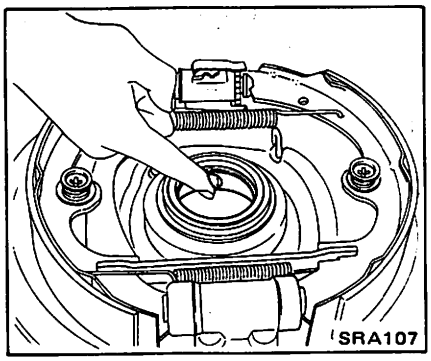
INSPECTION

Inspect the following parts and replace as required.

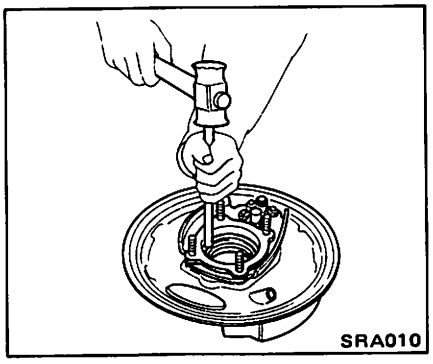
1. Check axle shaft for straightness, cracks, damage, wear or distortion.
2. Check bearing for wear or damage and axial end play.

INSTALLATION

a. Install a new oil seal in bearing cage. Lubricate cavity between seal lips after fitting seal.

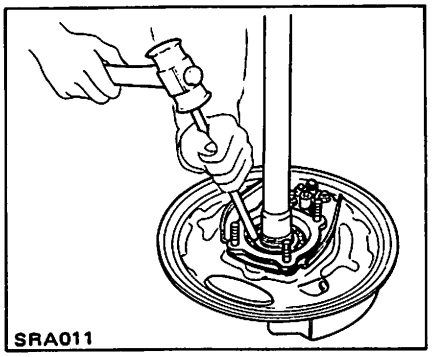

SRA107

b. Install wheel bearing outer race, using a brass drift.


SRA010

c. Be sure to install spacer before installing wheel bearing inner race. Be carefull to place the faced side of spacer on wheel bearing grease seal side.

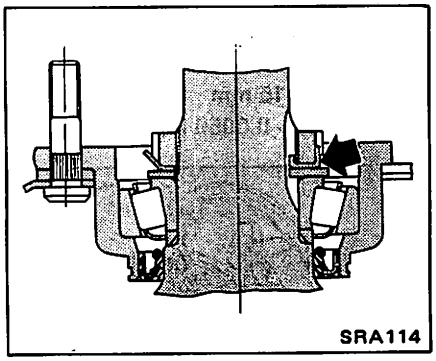
d. Install wheel bearing inner race, using a brass drift.


SRA011

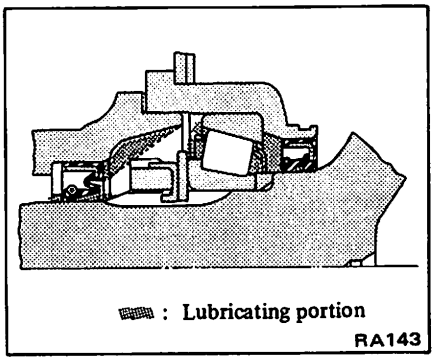
e. Be careful to place the faced side of nut on washer side.

f. Fit washer lip in nut groove correctly by tightening nut.

g. Use a new bearing lock washer. Be sure to bend it up.

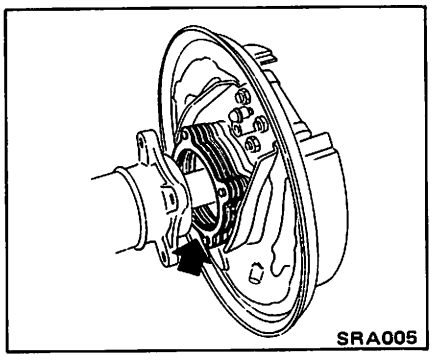

SRA114

h. Apply wheel bearing grease to wheel bearing and recess of axle case end.


: Lubricating portion
RA143

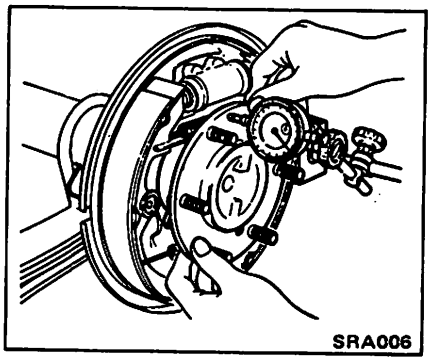
i. Apply gear oil to the spline and apply a coat of wheel bearing grease to seal surface before installing axle shaft.

j. When installing axle shaft, adjust axial end play by applying case end shims.

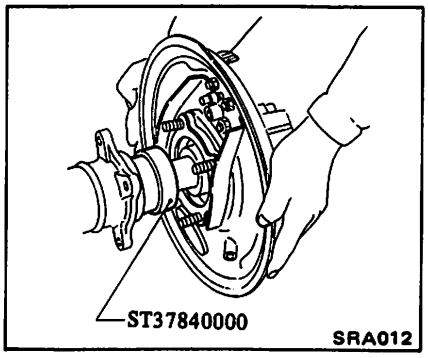

SRA005

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Rear axle case end shim:
Refer to S.D.S.
Axial end play:
Ahead of adjusting side
0.30 - 0.90 mm
(0.0118 - 0.0354 in)
Total end play
0.02 - 0.15 mm
(0.0008 - 0.0059 in)



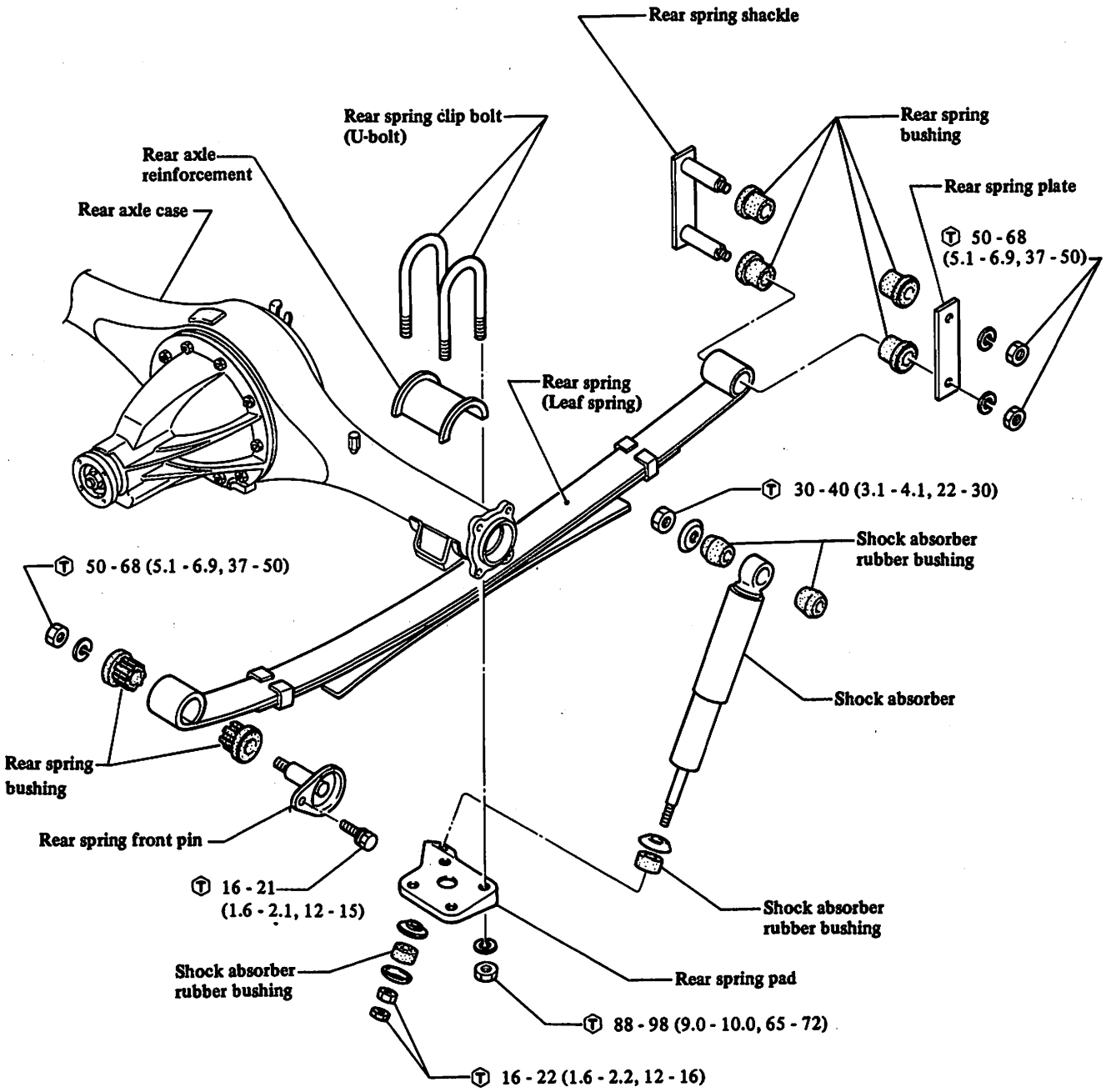
k. When installing axle shaft, use Tool as a guide.



Ⓣ : Wheel bearing lock nut
147 - 196 N·m
(15 - 20 kg-m,
108 - 145 ft-lb)
Back plate fixing nut
53 - 63 N·m
(5.4 - 6.4 kg-m,
39 - 46 ft-lb)
Brake tube flare nut
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)
Wheel nut
118 - 147 N·m
(12 - 15 kg-m,
87 - 108 ft-lb)

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REAR SUSPENSION



Ⓣ : N·m (kg-m, ft-lb)

Vehicle weight must be on rear wheels when tightening front pin, shackle and shock absorber in order to clamp rubber bushings in neutral or unloaded position.

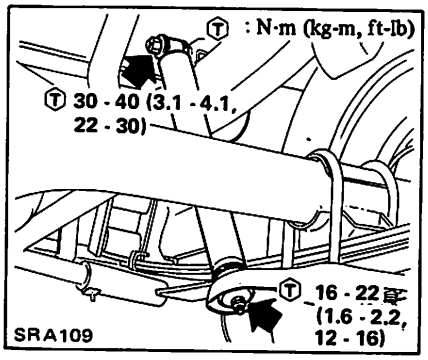
SRA108

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REAR SHOCK ABSORBER

REMOVAL AND INSTALLATION

1. Remove shock absorber by disconnecting upper and lower end.



2. Install shock absorber, observing the following note.

Vehicle weight must be on rear wheels when tightening shock absorber upper and lower ends in order to clamp rubber bushings in neutral or unloaded position.

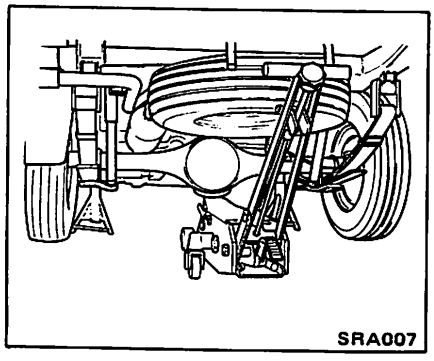
INSPECTION

1. Test shock absorber and compare with specifications given in S.D.S. Replace if necessary.
2. Check for oil leakage and cracks. Also, check shaft for bending.
3. Inspect rubber bushings for damage, cracks and deformation. Replace parts if necessary.

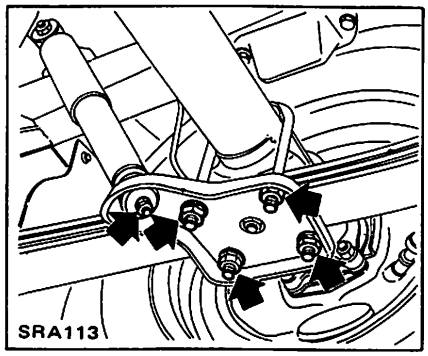
LEAF SPRING

REMOVAL

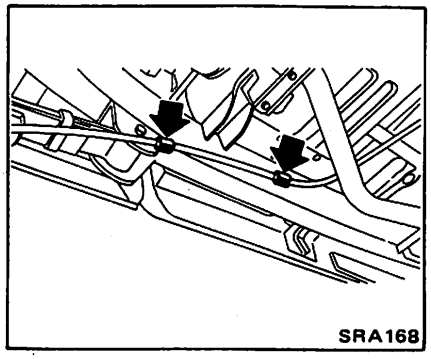
1. Block front wheels. Support under differential carrier with garage jack. Place stands.



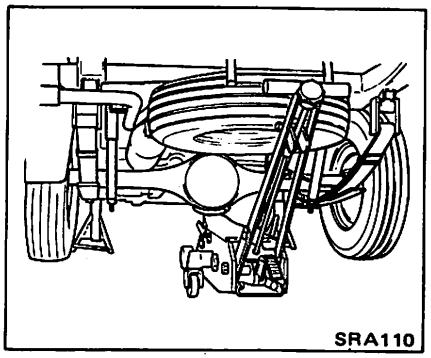
2. Disconnect shock absorber lower end, and remove U-bolts.



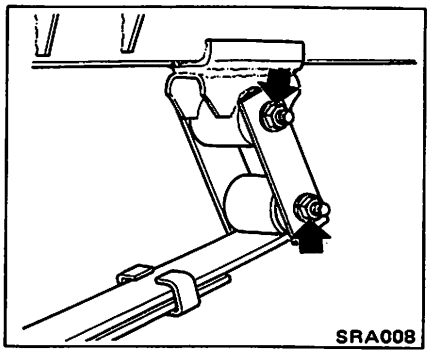
3. Remove one or two parking brake rear cable clamps on the side of leaf spring to be removed. (4WD)

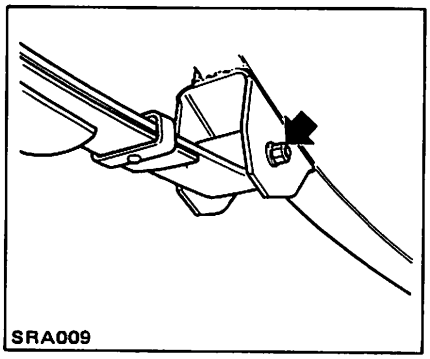


4. Raise (2WD)/Lower (4WD) jack positioned under differential carrier.



5. Disconnect rear spring shackle and front pin.





6. Remove rubber bushing if necessary.

INSPECTION

Clean all rust and dirt from spring leaves, using a wire brush if necessary.
1. Examine spring leaves for fractures or cracks.
2. Check front bracket and pin, shackle, U-bolts and spring seat for wear, cracks, straightness or damaged threads. If faulty parts are found, replace with new ones.
3. Inspect all rubber parts for wear, damage, separation or deformation. Replace them if necessary.

INSTALLATION

Vehicle weight must be on rear wheels when tightening front pin, shackle and shock absorber in order to clamp rubber bushings in neutral or unloaded position.
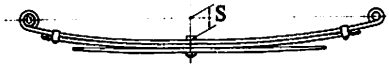
Ⓣ: Spring front pin nut
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)
Spring shackle nut
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)
U-bolt nut
88 - 98 N·m
(9.0 - 10.0 kg-m,
65 - 72 ft-lb)
Wheel nut
118 - 147 N·m
(12 - 15 kg-m,
87 - 108 ft-lb)

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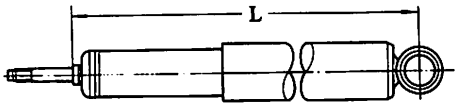
SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

Item \ Model			2WD			4WD
			Standard models		Heavy duty models	
			Standard	Optional		
Suspension type			Semi-elliptic leaf spring			
Leaf spring	Length x width x thickness – number of leaves	mm (in)	1,200 x 60 x 7 – 2, 13 – 1 (47.24 x 2.36 x 0.28 – 2, 0.51 – 1)	1,200 x 60 x 8 – 2, 13 – 2 (47.24 x 2.36 x 0.31 – 2, 0.51 – 2)		1,200 x 60 x 7 – 1, 8 – 1, 12 – 2 (47.24 x 2.36 x 0.28 – 1, 0.31 – 1, 0.47 – 2)
	Free camber "S"	mm (in)	161 (6.34)	114.5 (4.51)		93.6 (3.685)
	Laden camber	mm/N (mm/kg, in/lb)	–7/4,413 (–7/450, –0.28/992)	–7.5/6,816 (–7.5/695, –0.295/1,532)		–31/4,541 (–31/463, –1.22/1,021)
	Spring constant	N/mm (kg/mm, lb/in)	54.43 (5.55, 310.8)	96.60 (9.85, 551.6)		77.48 (7.90, 442.4)
Shock absorber	Maximum length "L"	mm (in)	475 (18.70)	475 (18.70)		475 (18.70)
	Stroke	mm (in)	190 (7.48)	190 (7.48)		190 (7.48)
	Damping force [0.3 m/sec. (1.0 ft/sec.)] N (kg, lb)	Expansion	353 - 510 (36 - 52, 79 - 115)	402 - 579 (41 - 59, 90 - 130)		1,353 - 1,746 (138 - 178, 304 - 392)
		Compression	157 - 275 (16 - 28, 35 - 62)	147 - 245 (15 - 25, 33 - 55)		765 - 1,040 (78 - 106, 172 - 234)



SRA111



SRA112

INSPECTION AND ADJUSTMENT

REAR AXLE

Unit: mm (in)

Total end play	0.02 - 0.15 (0.0008 - 0.0059)	
Rear axle case end shim	Thickness	Part No.
	0.05 (0.0020)	43086 P0110
	0.07 (0.0028)	43087 P0110
	0.10 (0.0039)	43088 P0110
	0.15 (0.0059)	43086 B9500
	0.20 (0.0079)	43089 P0110
	0.50 (0.0197)	43090 P0110

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Shock absorber upper end nut	30 - 40	3.1 - 4.1	22 - 30
Shock absorber lower end nut	16 - 22	1.6 - 2.2	12 - 16
Leaf spring U-bolt nut	88 - 98	9.0 - 10.0	65 - 72
Spring front pin nut	50 - 68	5.1 - 6.9	37 - 50
Spring shackle	50 - 68	5.1 - 6.9	37 - 50
Back plate fixing bolt	53 - 63	5.4 - 6.4	39 - 46
Wheel bearing lock nut	147 - 196	15 - 20	108 - 145
Wheel cylinder air breather	7 - 9	0.7 - 0.9	5.1 - 6.5
Differential gear carrier to axle case nut	17 - 25	1.7 - 2.5	12 - 18

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Unit	N·m	kg-m	ft-lb
Drain plug	59 - 98	6 - 10	43 - 72
Filler plug	59 - 98	6 - 10	43 - 72
Bumper rubber fixing bolt	16 - 22	1.6 - 2.2	12 - 16

Unit	N·m	kg-m	ft-lb
Wheel nut	118 - 147	12 - 15	87 - 108
Propeller shaft to companion flange	24 - 32	2.4 - 3.3	17 - 24
Brake tube flare nut	15 - 18	1.5 - 1.8	11 - 13

TROUBLE DIAGNOSES AND CORRECTIONS

When rear axle and suspension is suspected of being noisy it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, exhaust, propeller shaft, engine, transmission, wheel bearings or suspension.

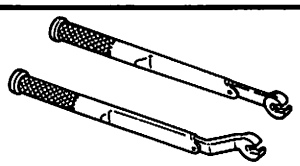
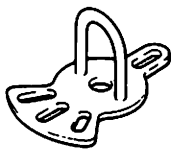
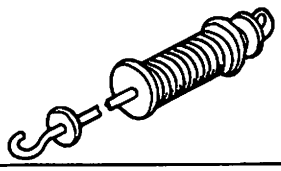
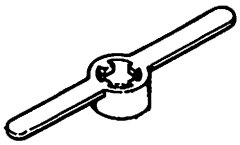
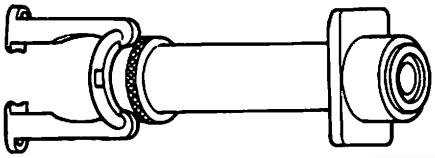
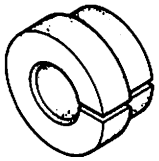
Noise which originates in other places can not be corrected by adjustment or replacement of parts in the rear axle and rear suspension.

In case of oil leak, first check if there is any damage or restriction in breather.

Condition	Probable cause	Corrective action
Noise	Loose wheel nuts.	Tighten the wheel nuts.
	Loose one or more securing bolts.	Tighten the bolts to the specified torque.
	Lack of lubricating oil or grease.	Lubricate as required.
	Faulty shock absorber.	Replace the shock absorber.
	Incorrect adjustment of rear axle shaft end play.	Adjust the rear axle shaft end play.
	Damaged or worn wheel bearing.	Replace wheel bearing.
	Worn spline portion of rear axle shaft.	Replace if necessary.
	Broken leaf spring.	Replace leaf spring.
	Loose journal, connections and so on.	Tighten to the given torque.
	Wheel and tire unbalance.	Balance wheel and tire.
	Damaged rubber parts such as leaf spring bushing and shock absorber mounting bushing.	Replace the required parts.
	Faulty propeller shaft journal.	Correct or replace.
Instability in driving	Loose wheel nuts.	Tighten to the given torque.
	Worn shock absorber.	Replace faulty shock absorber.
	Worn or broken leaf spring.	Replace leaf spring.
Oil leakage	Damaged or restricted air breather.	Clean or replace air breather.
	Damaged oil seal in rear axle case or differential carrier.	Replace the damaged oil seal.
	Oil leakage from between the differential carrier and axle case.	Tighten to the specified torque, or replace gasket.

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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name	
GG94310000 (–)	Flare nut torque wrench	
KV40101000 (J 25604-01)	Rear axle stand	
ST36230000 (J 25840-A)	Sliding hammer	
ST38020000 (J 25864-01)	Bearing lock nut wrench	
HT72480000 (J 25852-B)	Rear axle shaft bearing puller	
ST37840000 (–)	Rear axle shaft guide	

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BRAKE SYSTEM

SECTION BR

CONTENTS

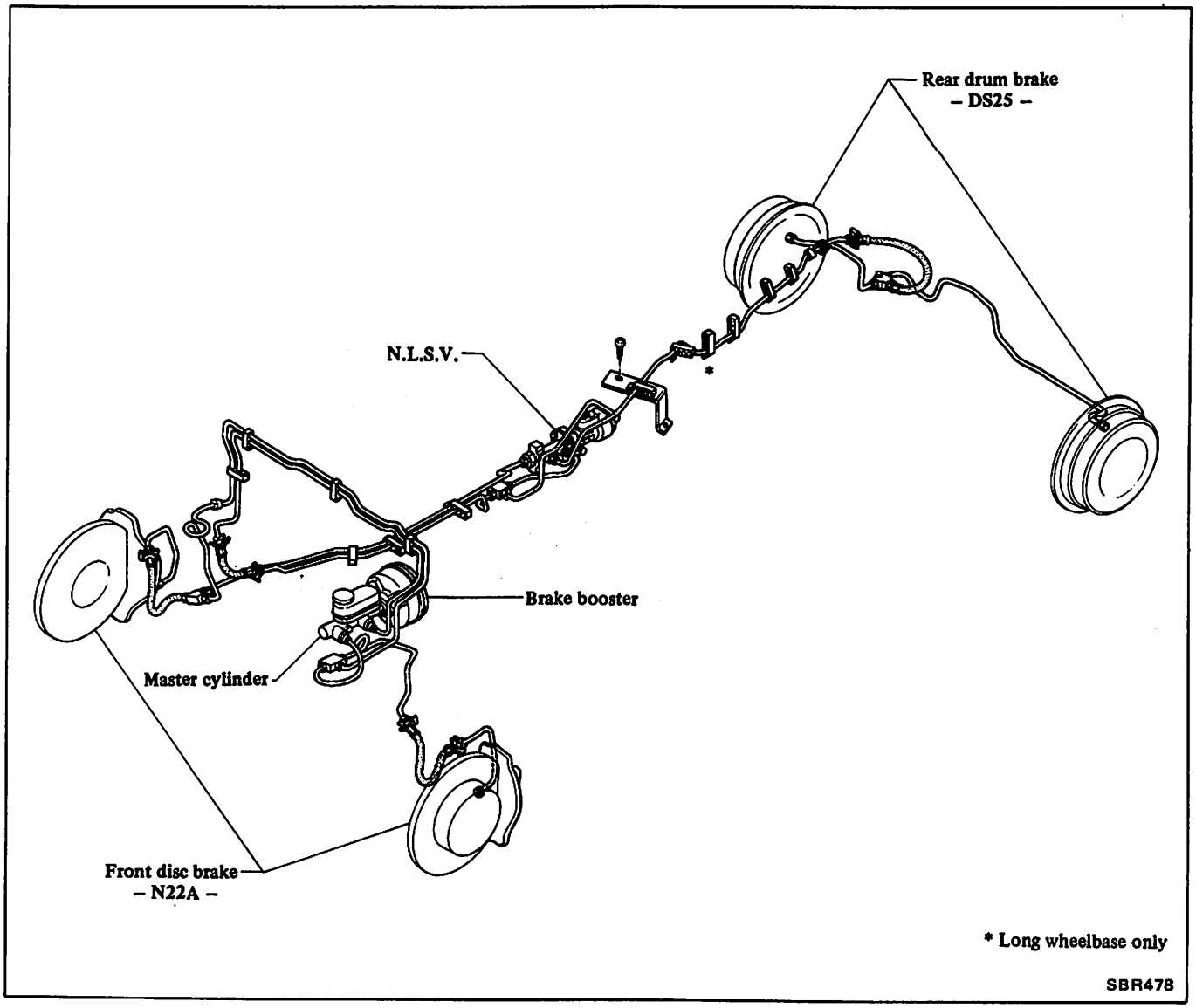
DESCRIPTION . . . . . BR- 2
SERVICE BRAKE . . . . . BR- 3
BRAKE PEDAL . . . . . BR- 3
MASTER CYLINDER . . . . . BR- 4
BRAKE HYDRAULIC LINE . . . . . BR- 5
BLEEDING HYDRAULIC SYSTEM . . . . . BR- 5
NISSAN LOAD SENSING VALVE (N.L.S.V.) . . . . . BR- 5
FRONT DISC BRAKE –N22A– . . . . . BR- 6
FRONT DISC ROTOR . . . . . BR- 9
REAR BRAKE –DS25– BR-10
BRAKE BOOSTER BR-13
PARKING BRAKE BR-15
PARKING BRAKE BR-15
SERVICE DATA AND SPECIFICATIONS (S.D.S.) BR-17
GENERAL SPECIFICATIONS BR-17
INSPECTION AND ADJUSTMENT BR-17
TIGHTENING TORQUE BR-18
TROUBLE DIAGNOSES AND CORRECTIONS BR-18
SPECIAL SERVICE TOOL BR-21

Refer to Section MA (Brake System) for:

- CHECKING FOOT BRAKE
- CHECKING PARKING BRAKE

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DESCRIPTION

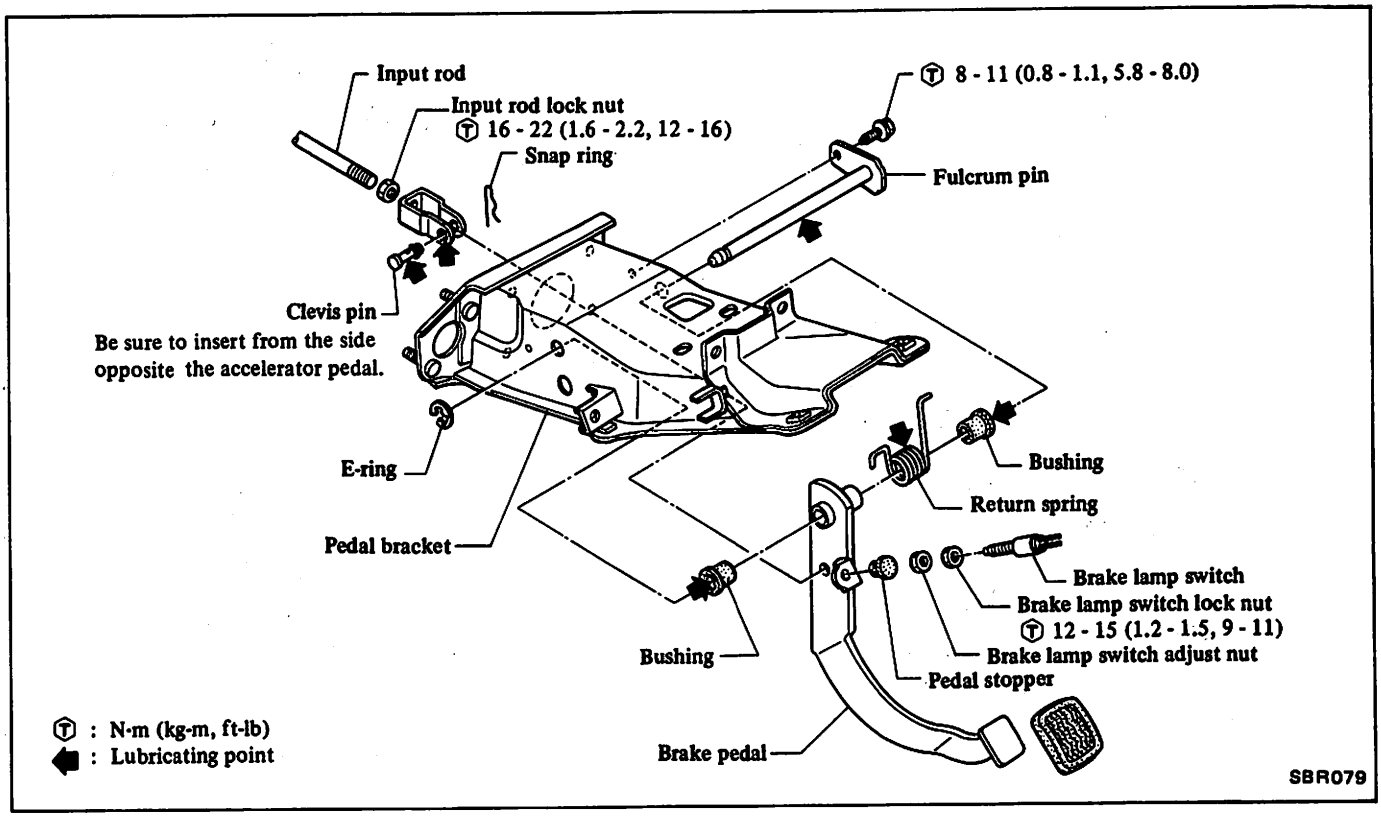


- The brake system is a hydraulically controlled, dual line type which operates independently on the front and rear wheels.
- The brake booster is a power assist device which utilizes the engine intake manifold vacuum.
- The Nissan Load Sensing Valve (N.L.S.V.) responds to deceleration, controlling the rear brake fluid pressure.
- The rear drum brake requires shoe-to-drum clearance adjustment.

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SERVICE BRAKE

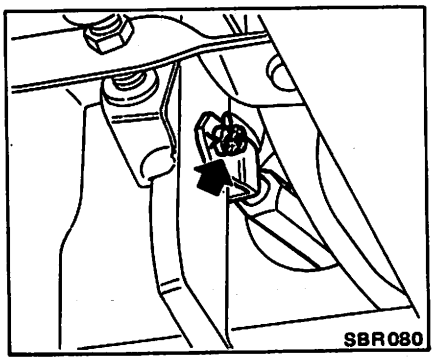
BRAKE PEDAL



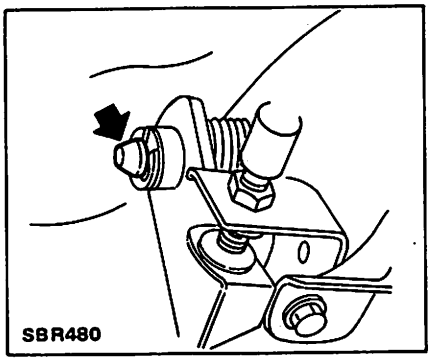
REMOVAL

1. Disconnect clevis.

When removing clevis pin, be careful not to damage clip of the clevis pin.



2. Remove fulcrum pin and pedal.



INSPECTION

Check brake pedal for the following items, servicing as necessary.

1. Check brake pedal for bend.
2. Check return spring for fatigue.
3. Check clevis for deformation and cracks at welded part.

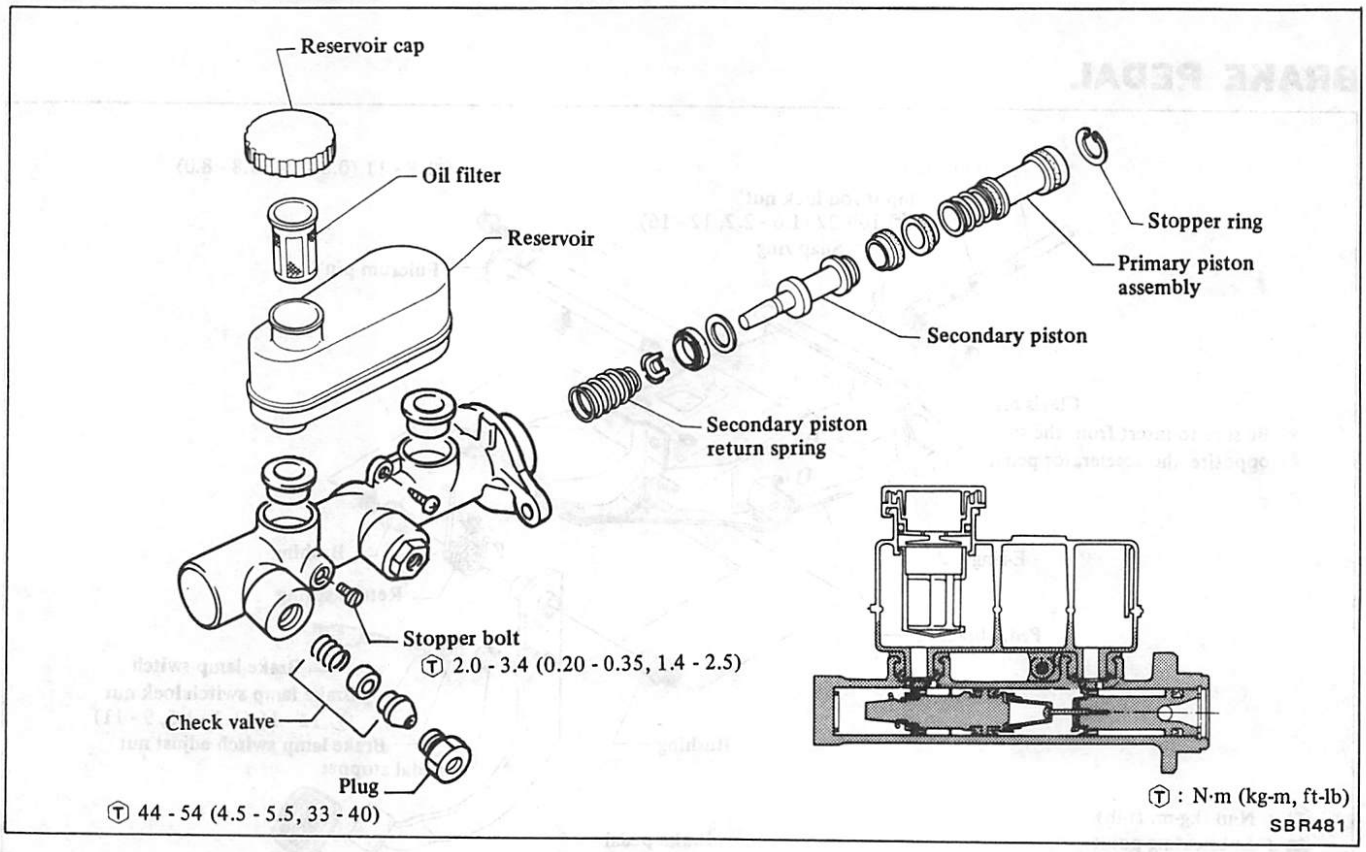
INSTALLATION

1. Apply a coating of recommended multi-purpose grease to sliding portion and return coil spring.
2. Adjust brake pedal after installation is completed. Refer to Section MA for adjustment.

Ⓣ: Fulcrum pin fixing bolt
8 - 11 N·m
(0.8 - 1.1 kg-m, 5.8 - 8.0 ft-lb)
Input rod lock nut
16 - 22 N·m
(1.6 - 2.2 kg-m, 12 - 16 ft-lb)

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MASTER CYLINDER

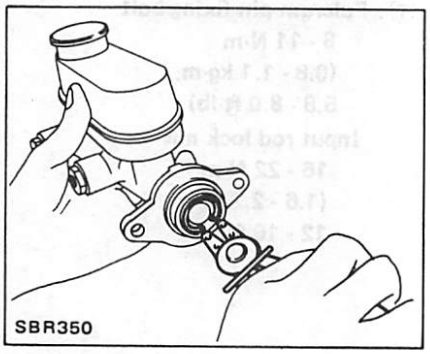


DISASSEMBLY

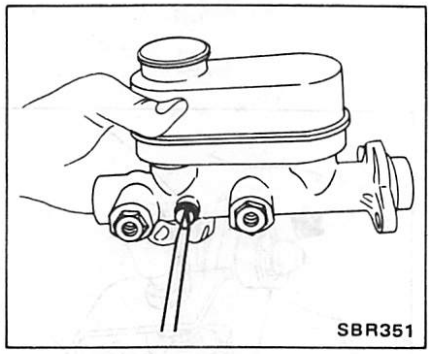
There is no interchangeability of repair kits or component parts between TOKICO and NABCO makes.

When replacing the repair kit or component parts, ascertain the brand of the brake master cylinder body. Be sure to use parts of the same make as the former ones.

1. Pry off stopper ring.

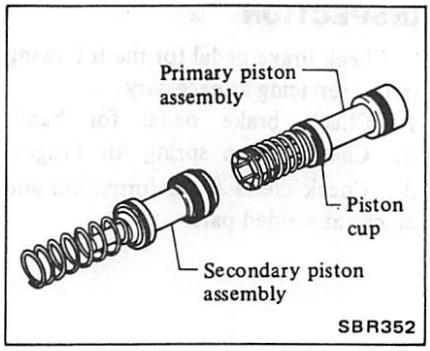


2. Remove stopper screw, then primary and secondary piston assemblies can be taken out.



3. Remove reservoir.
4. Disassemble piston assembly.

Do not disassemble primary piston assembly.



5. Remove piston cups and discard them.

INSPECTION

1. Clean all parts in brake fluid.
2. Check the parts for evidence of abnormal wear or damage.
3. Check piston-to-cylinder clearance.

Piston-to-cylinder clearance:
Less than 0.15 mm (0.0059 in)

ASSEMBLY

a. Replace gaskets and packing with new ones.

b. Apply brake fluid or rubber grease to sliding contact surface of parts to facilitate assembly of master cylinder.

Ⓣ : Check valve plug
44 - 54 N·m
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)

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BRAKE HYDRAULIC LINE

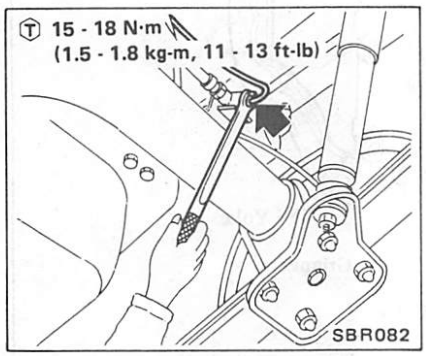
INSPECTION

Check brake lines (tubes and hoses) for evidence of cracks, deterioration or other damage. Replace any faulty parts.

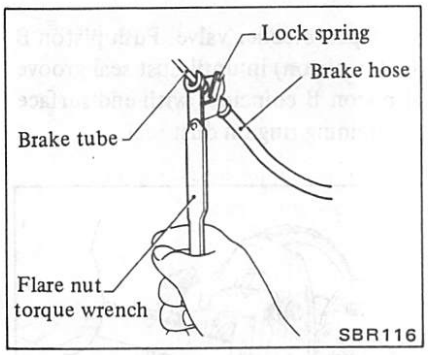
If leakage occurs at end around joints, re-tighten or, if necessary, replace faulty parts.

REMOVAL AND INSTALLATION

- To remove brake tube, disconnect flare nuts on both ends, and remove retainers and clips.



- To remove brake hose, first remove flare nut securing brake tube to hose, then withdraw lock spring. Next disconnect the other side. Do not twist brake hose.



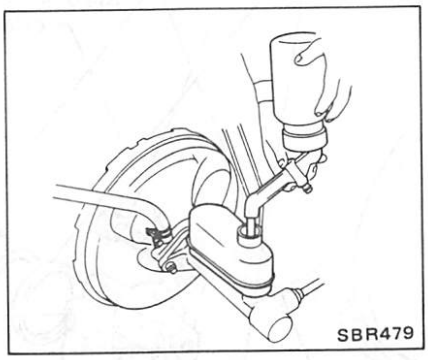
BLEEDING HYDRAULIC SYSTEM

1. Top up reservoir with recommended brake fluid.

a. Do not mix two different brand oils.

b. Carefully monitor brake fluid level at master cylinder during bleeding operation.

c. Do not reuse drained brake fluid.

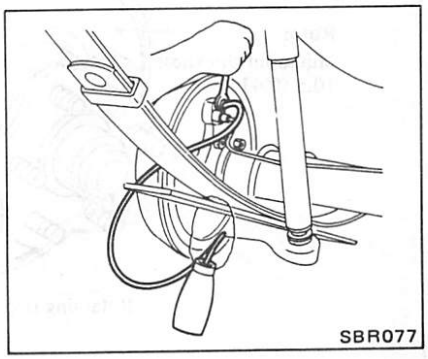


2. Install bleeder hose on bleeder valve. With brake pedal fully depressed, open bleeder valve to exhaust air. Then close bleeder valve and allow brake pedal to return. Repeat bleeding operation until no air bubbles show in hose.

a. Be careful not to splash brake fluid on painted area.

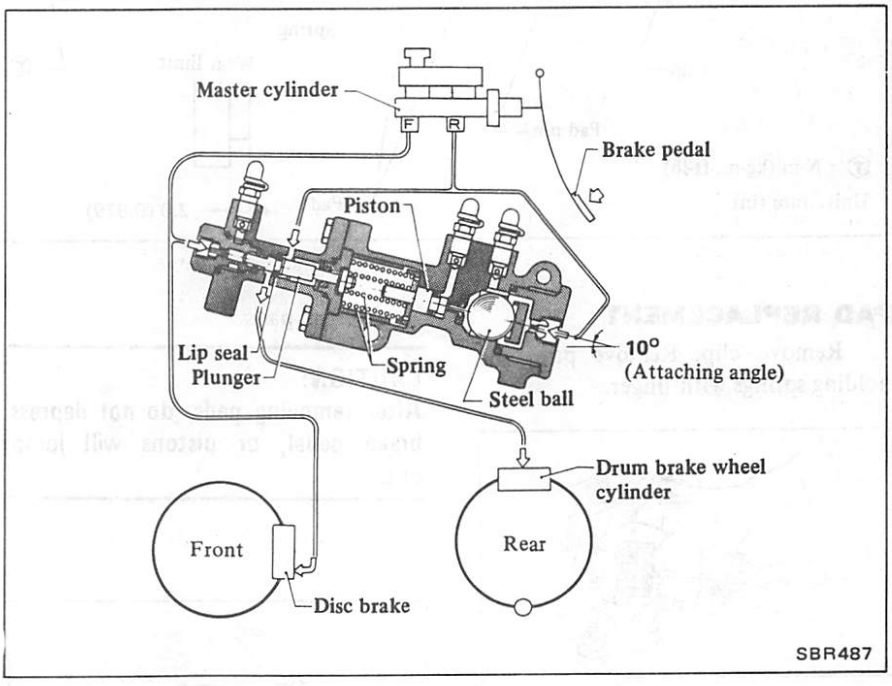
b. Brake fluid containing air is white and contains air bubbles.

c. Brake fluid containing no air runs out of bleeder valve in a solid stream free of air bubbles.



3. Bleed air in the following sequence. **Master cylinder → N.L.S.V. → Rear wheel → Front wheel.**

NISSAN LOAD SENSING VALVE (N.L.S.V.)



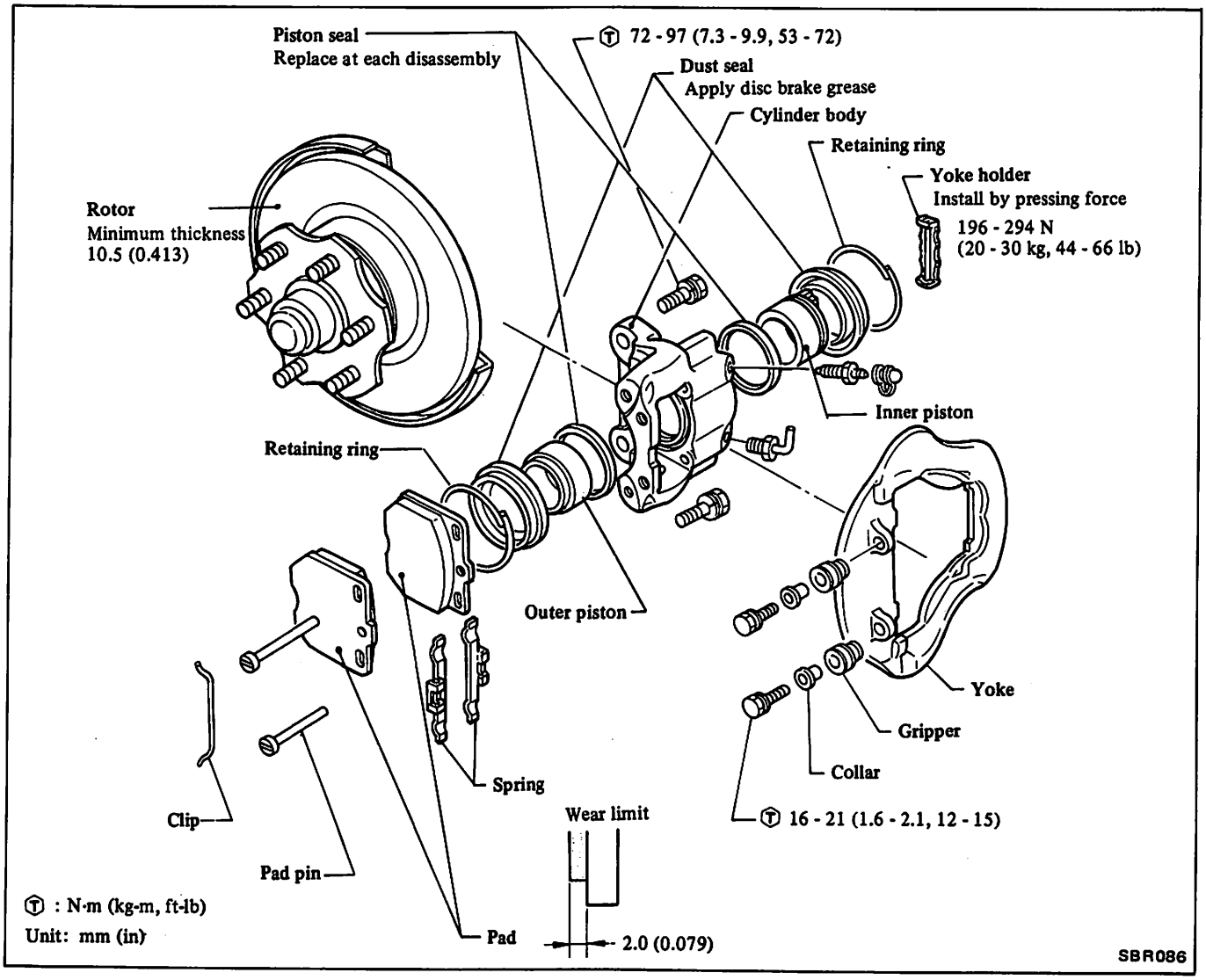
Do not reuse once disassembled N.L.S.V. Replace faulty N.L.S.V. as an assembly.

Ⓣ : Brake tube flare nut
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)

N.L.S.V. mounting bolt
8 - 11 N·m
(0.8 - 1.1 kg-m,
5.8 - 8.0 ft-lb)

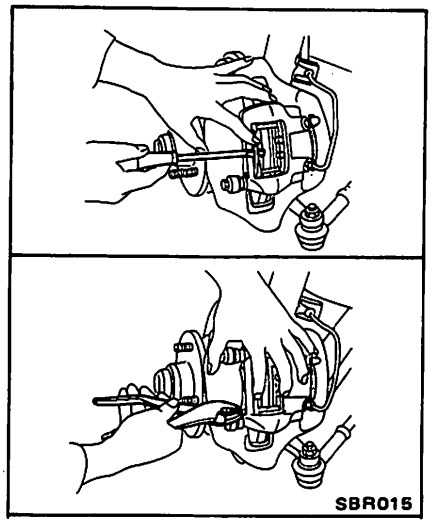
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FRONT DISC BRAKE —N22A—



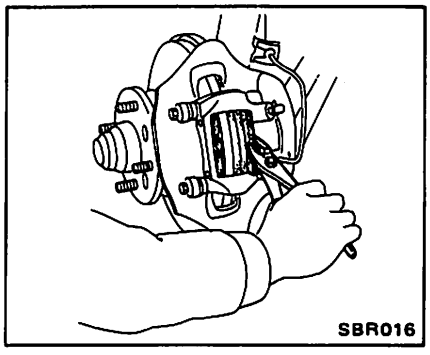
PAD REPLACEMENT

1. Remove clip. Remove pad pins holding springs with finger.

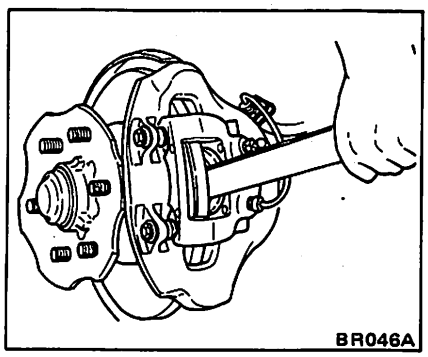


2. Detach pads.

CAUTION:
After removing pads, do not depress brake pedal, or pistons will jump out.

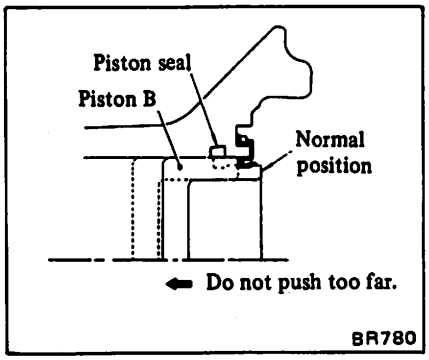


3. Open bleeder valve. Push piston B (Outer piston) in until dust seal groove of piston B coincides with end surface of retaining ring on dust seal.

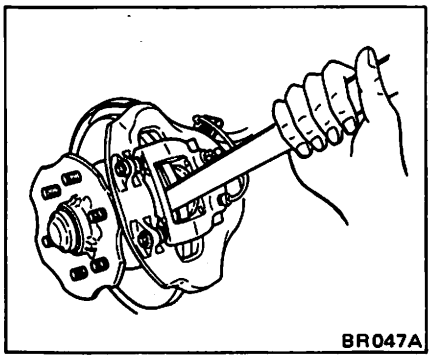


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CAUTION:
Piston can be easily pushed in by hand, but if pushed too far, groove of piston will go inside of piston seal. At this point, if piston is pressured or moved, piston seal will be damaged. If piston has been pushed in too far, remove caliper assembly and disassemble it. Then, push piston out in direction shown by arrow.
Assemble it again, referring to the following.

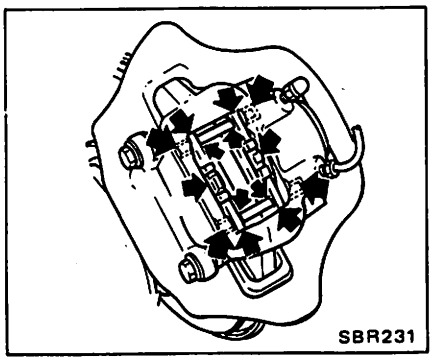


4. Install inner pad. Pull yoke to outer side.



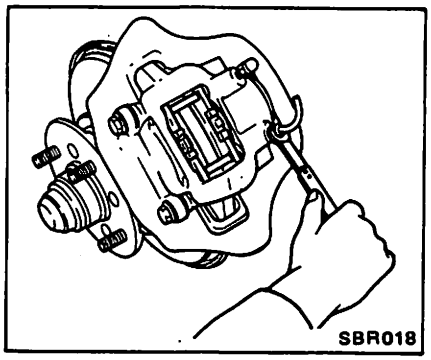
5. Install outer pad.
Coat the following points with recommended brake grease.
- Cylinder body-to-pad clearance.
- Pad pin-to-cylinder body clearance.
- Pad pin holes of cylinder body.

Do not grease friction face of pad.
Then install pad fixing parts previously removed.

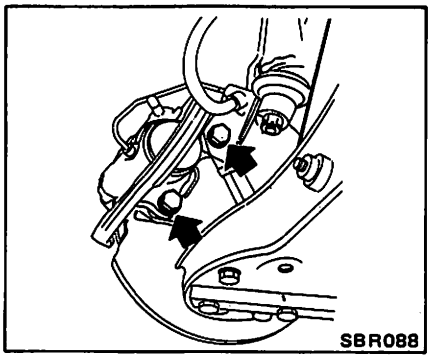


REMOVAL

1. Disconnect brake tube.

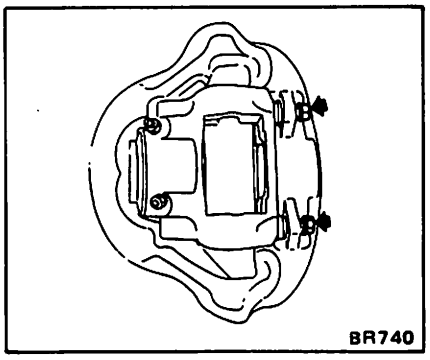


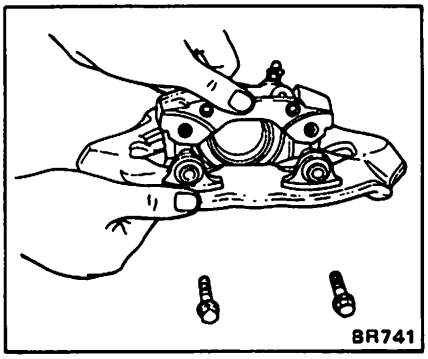
2. Remove caliper assembly.



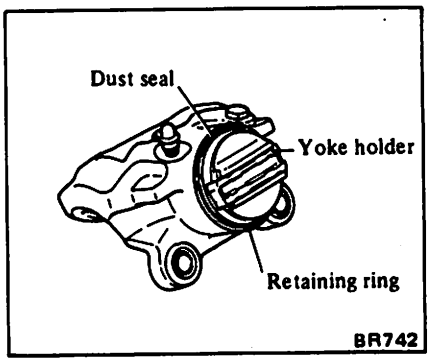
DISASSEMBLY

1. Remove pads. Remove fixing bolt and separate yoke and cylinder body.

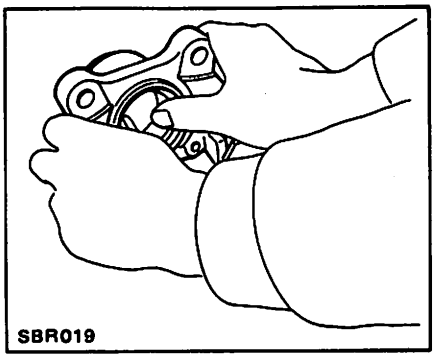




2. Remove yoke holder, retaining rings and dust seals from both pistons.



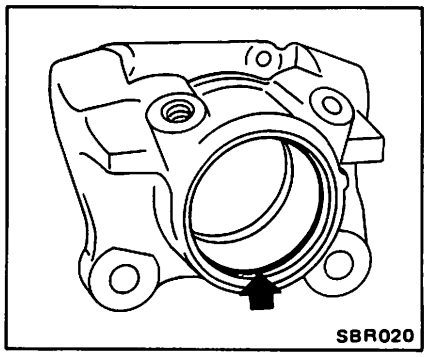
3. Push out pistons from cylinder.



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4. Remove piston seal.

Piston seal must be replaced at each disassembly.



INSPECTION

CAUTION:
Use brake fluid to clean. Never use mineral oil.

Cylinder body

1. Check inside surface of cylinder for score, rust, wear, damage or presence of foreign substances. If any surface fault is detected, replace cylinder body.
2. Minor damage from rust or foreign substances may be eliminated by polishing surface with a fine emery cloth. If damage is major, cylinder assembly must be replaced.

Yoke

Check for wear, cracks or other damage. Replace if any fault is detected.

Piston

Check piston for score, rust, wear, damage or presence of foreign substances. Replace if any fault is detected.

CAUTION:
Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign matter is sticked on sliding surface.

Piston seal and dust seal

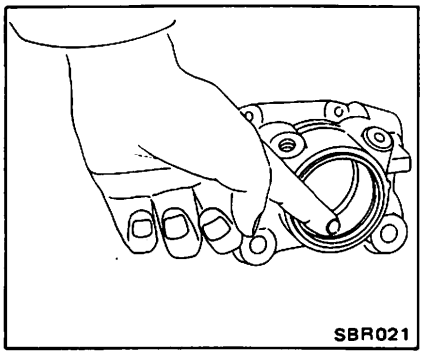
Replace piston seal and dust seal at each disassembly.

Gripper and yoke holder

Check for wear, cracks or other damage. Replace if any fault is detected.

ASSEMBLY

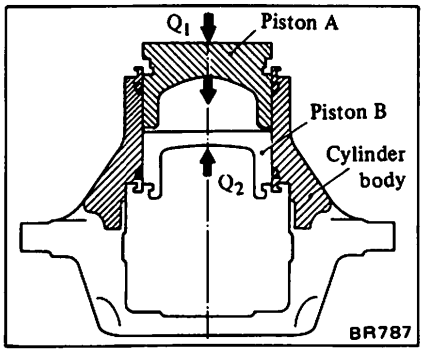
1. Apply rubber grease or brake fluid to seal grooves and seals. Install piston seals, taking care not to damage them.



2. Apply rubber grease or brake fluid to sliding portions. Insert pistons.

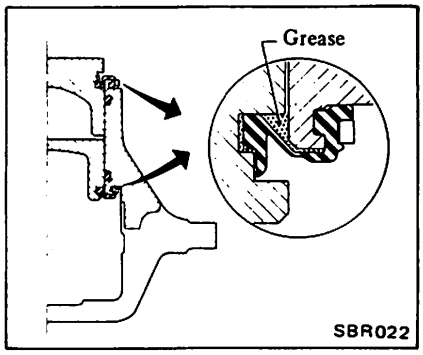
CAUTION:
Insert piston A in direction shown by arrow Q1 and piston B in direction shown by arrow Q2.

a. When inserting pistons, be careful not to insert too far. Refer to Pad Replacement for assembly.
b. Install piston A so that its yoke groove coincides with yoke groove of cylinder.

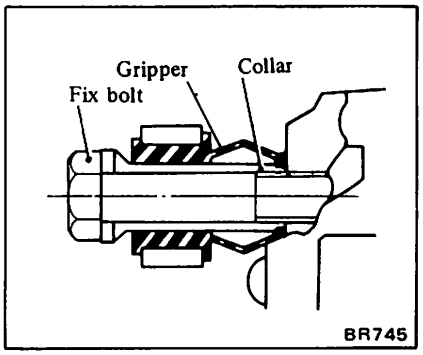


3. Install dust seal and clamp securely with retaining ring.

a. Apply recommended disc brake grease to sealing surface of dust seal.
b. Be careful not to deform dust seal.
c. Wipe off excess grease with alcohol.

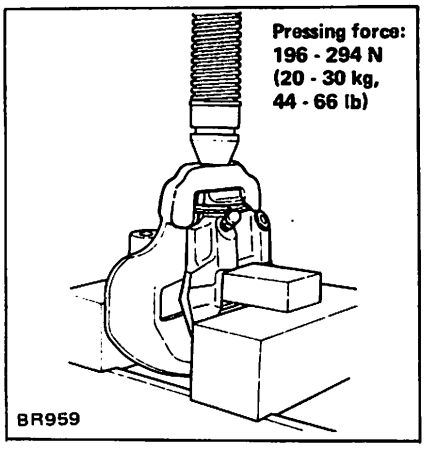


4. Install yoke holder to piston A.
Install gripper to yoke. Apply a coating of 1% soap water to inner wall of gripper, and drive in collar.



5. Install yoke to yoke holder and, supporting end of piston B, press yoke into yoke holder.

CAUTION:
When pressing yoke into yoke holder, be sure to insert yoke vertically so as not to crack or chip yoke holder. If yoke holder is damaged or pressing force is out of specification, replace with a new one.



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FRONT DISC ROTOR

REMOVAL AND INSTALLATION

Refer to Section FA.

INSPECTION

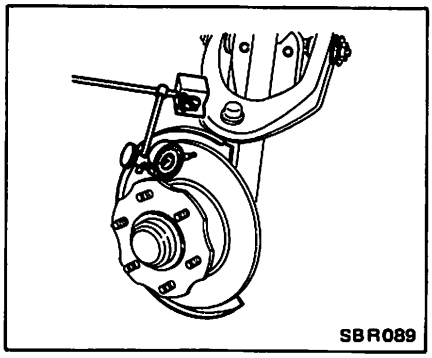
Check the following items and, if necessary, replace.

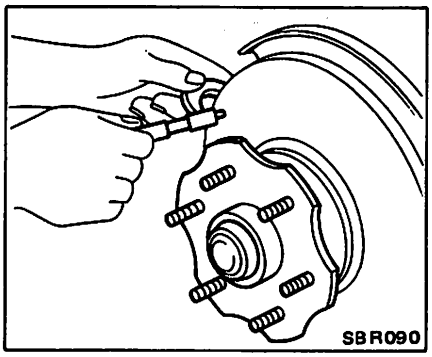
1. Sliding surface.

If there are cracks or considerable chips, replace.

2. Runout.

Rotor repair limit:
Maximum runout
(Total indicator reading at center of rotor pad contact surface)
0.15 mm (0.0059 in)


SBR089


SBR090

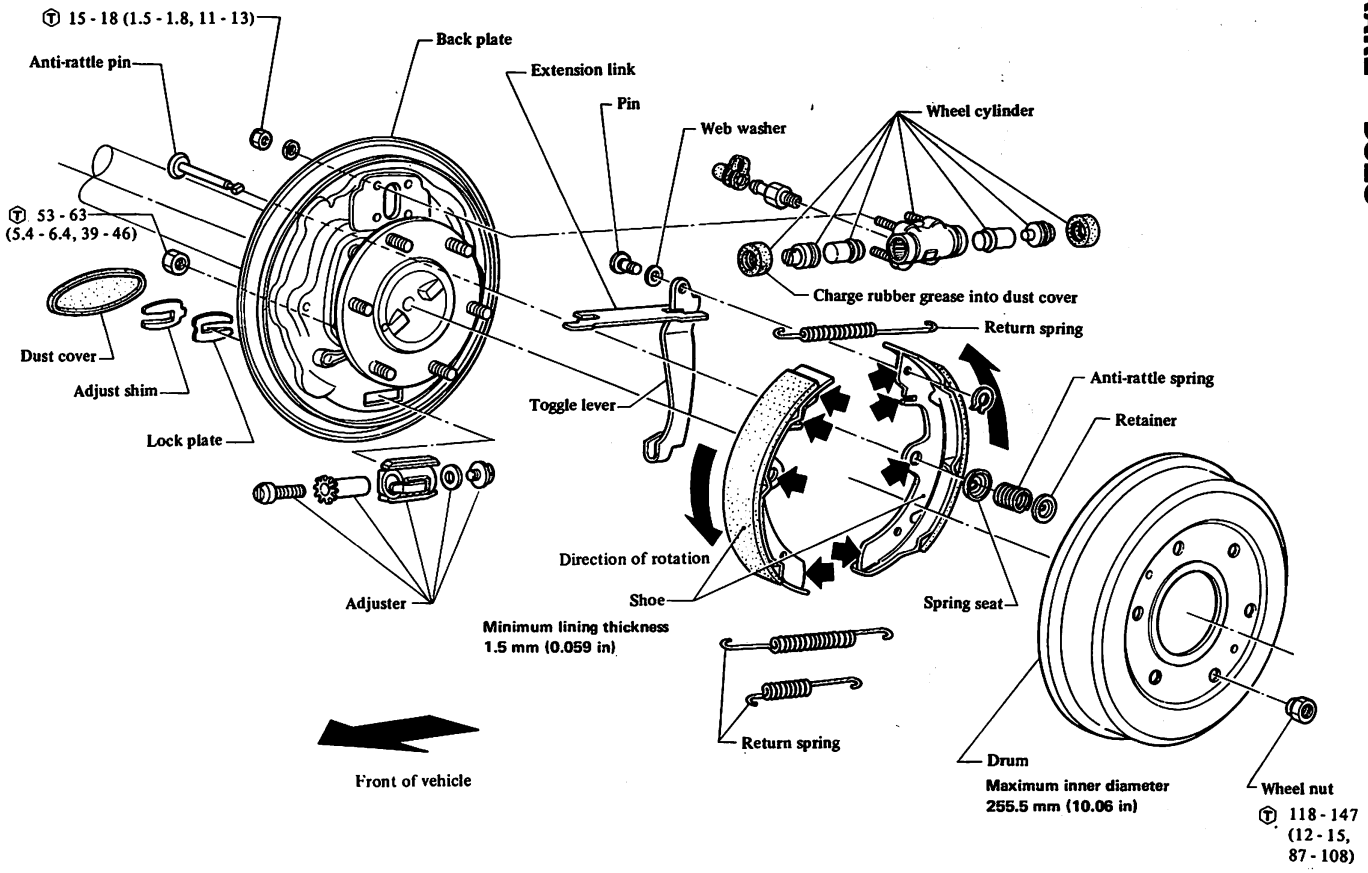
3. Parallelism.

Parallelism (when new):
less than 0.03 mm (0.0012 in)
Rotor repair limit:
Maximum parallelism
(Circumferential direction)
0.07 mm (0.0028 in)

Standard thickness:
12.5 mm (0.492 in)
Rotor repair limit:
Minimum thickness
10.5 mm (0.413 in)

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REAR BRAKE —DS25—



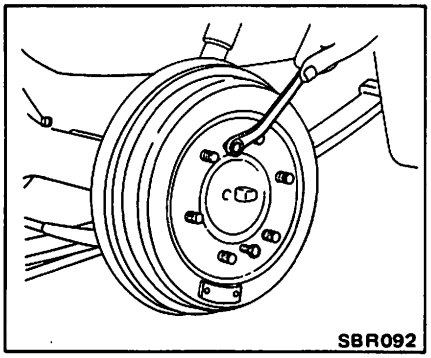
SBR091

Ⓣ : N·m (kg-m, ft-lb)
◀■ : Lubricating point

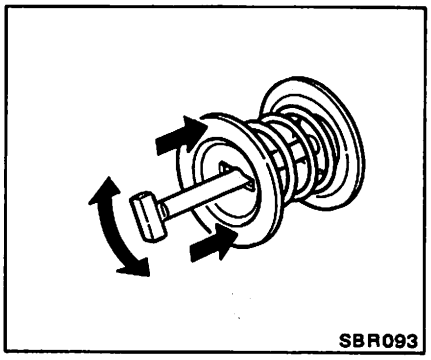
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SHOE REPLACEMENT

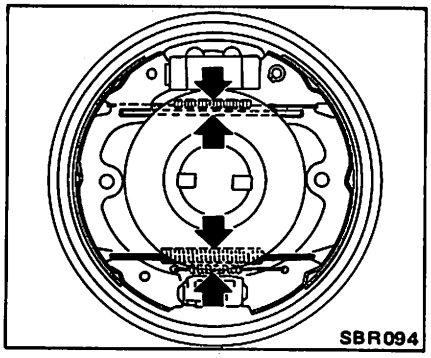
1. Remove wheel and drum. If drum is hard to remove, screw in bolt to drive drum out.



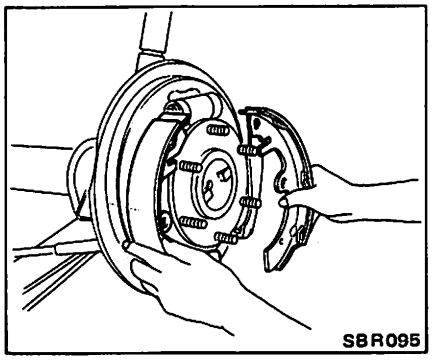
2. Remove anti-rattle spring and pin.



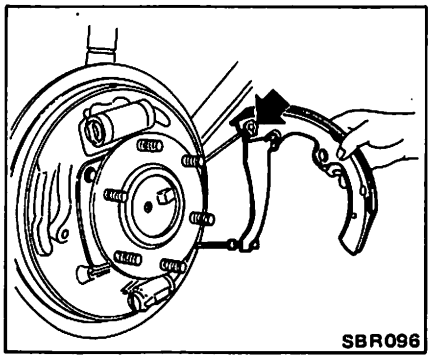
3. Remove two return springs (Lower side), open brake shoe outward, remove a return spring (Higher side), and remove extension link.



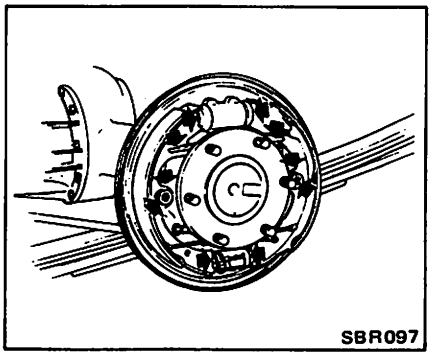
4. Remove shoe assemblies.



5. Separate secondary shoe from toggle lever by removing pin.



6. Apply brake grease to the following points.
- Brake shoe installing grooves of adjuster and wheel cylinder.
- Extension link installing grooves.
- Lower surface of spring seat.
- Contact surfaces between brake disc and brake shoe assembly (six places).

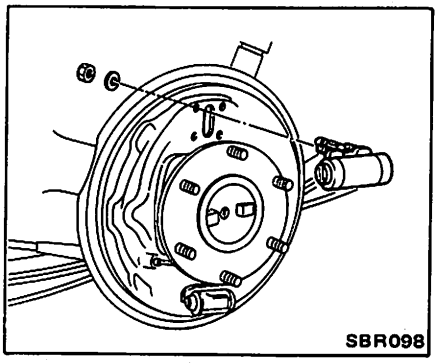


7. After installation is completed, adjust shoe-to-drum clearance. Refer to Section MA for adjustment.

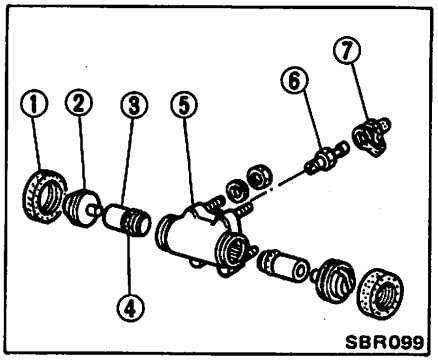
WHEEL CYLINDER

Removal

1. Remove brake shoe.
2. Disconnect brake tube.
3. Then remove wheel cylinder.



Disassembly



1 Dust cover
2 Piston head
3 Piston
4 Piston cup
5 Wheel cylinder housing
6 Bleeder screw
7 Bleeder cap

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Inspection

1. Replace any cylinder to piston which is scratched, scored or worn on its sliding contact surface.
2. Replace worn parts if piston-to-cylinder clearance is beyond specified value.

Piston-to-cylinder clearance:
Less than 0.15 mm (0.0059 in)

3. Replace piston cup which is worn or damaged.
4. Replace if contacting face of cylinder and shoe is worn locally or in step.
5. Replace damaged dust cover, fatigued piston spring or faulty threaded parts.
6. Replace tube connector which is worn on its threaded portion.

Assembly

a. Apply a coating of brake fluid to piston cup at assembly.
b. The brake wheel cylinder is available in both NABCO make and TOKICO make. There is no interchangeability of repair kits or component parts between NABCO and TOKICO makes.
When replacing the repair kit or component parts, ascertain the brand of the brake wheel cylinder body. Be sure to use parts of the same make as the former ones.

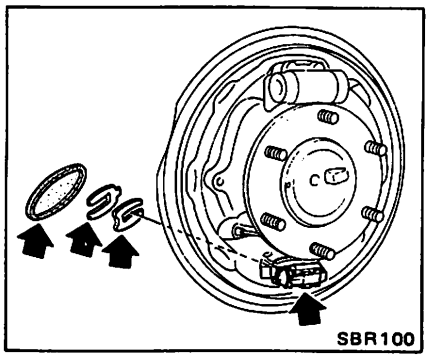
Installation

Ⓣ : Wheel cylinder fixing nut
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)

ADJUSTER

Removal

Remove brake shoe.
Remove rubber boot, adjuster shim, lock plate and adjuster springs, then remove adjuster assembly.

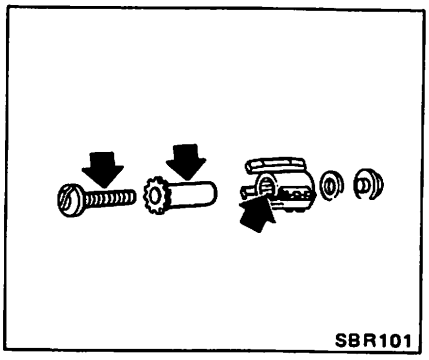

SBR100

Inspection

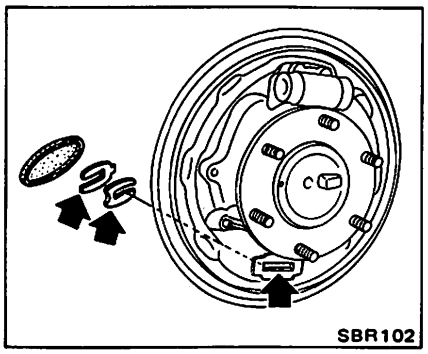
Check adjuster for smooth operation.

Installation

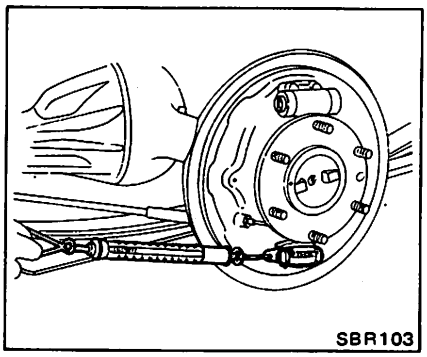
1. Apply brake grease to adjuster housing bore, adjuster wheel and adjuster screw.


SBR101

2. Apply brake grease to sliding surfaces of back plate, adjuster and retaining spring.


SBR102

3. Measure adjuster sliding resistance. Adjust with adjuster shim, if necessary.


SBR103

BRAKE DRUM

Inspection

1. Check inner diameter of brake drum to make sure it is properly round and tapered. If it is not, repair or replace brake drum.

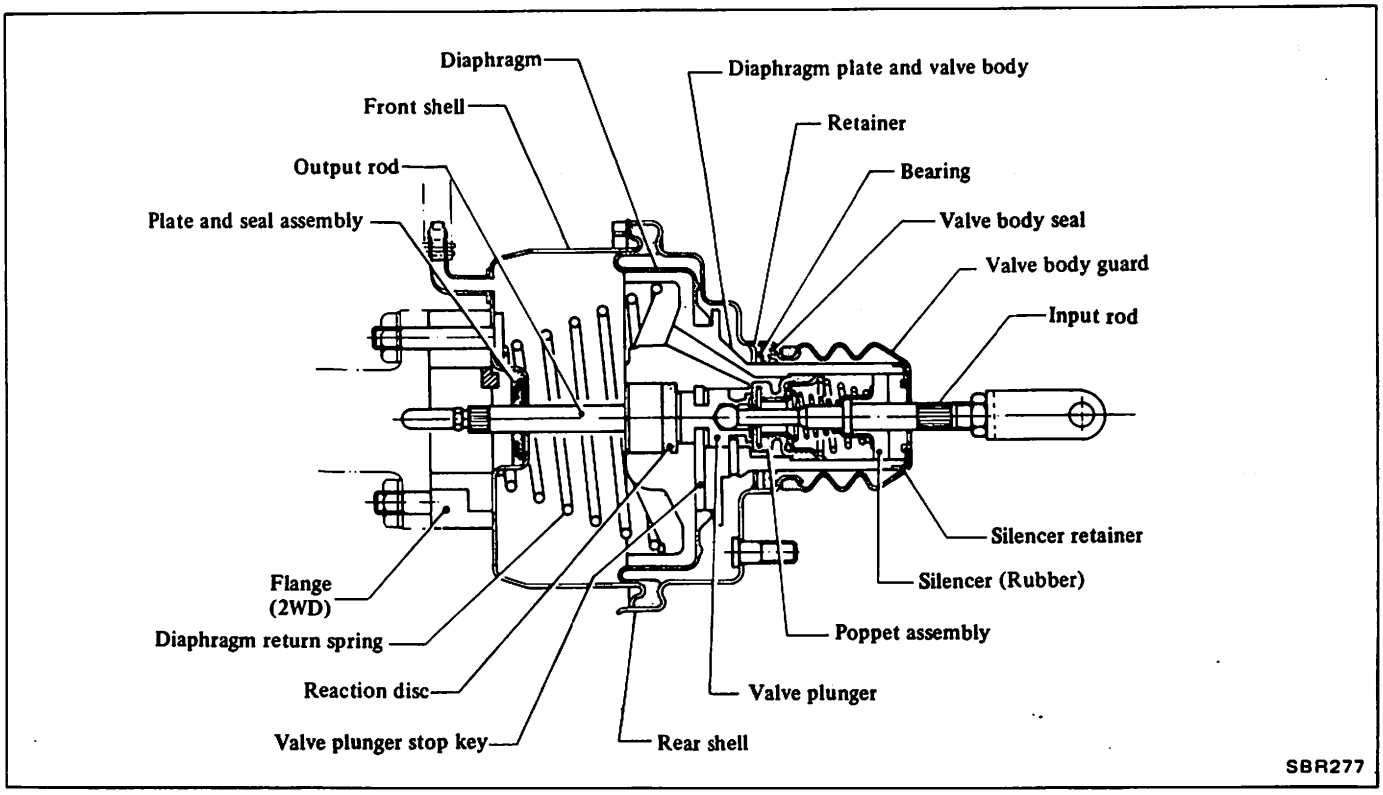
Standard diameter:
254.0 mm (10.00 in)
Maximum inner diameter:
255.5 mm (10.06 in)
Out-of-roundness (ellipticity):
Less than 0.015 mm (0.0006 in)
Radial run-out
(total indicator reading):
Less than 0.12 mm (0.0047 in)
Taper [measured at a point
45 mm (1.77 in) from inlet] :
Less than 0.02 mm (0.0008 in)

2. Contact surface with which linings come into contact should be finished to such an extent that it is ground by a No. 120 to 150 sandpaper.
3. Using a drum racer, finish brake drum by machining if it shows any sign of score marks, partial or stepped wear on its contact surface.

After brake drum is completely reconditioned or replaced, check drum and shoes for proper contact pattern.

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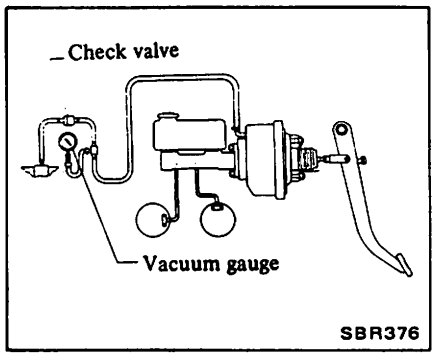
BRAKE BOOSTER



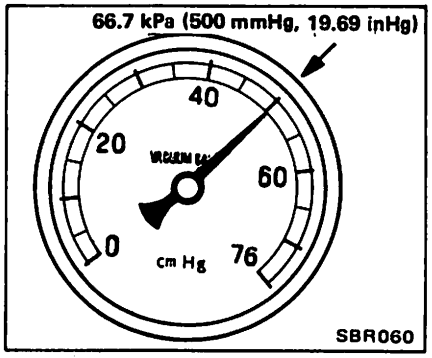
INSPECTION

Airtight test (No load)

1. Connect a vacuum gauge between check valve and brake booster.



2. Start engine and increase engine speed. Stop engine when vacuum is 66.7 kPa (500 mmHg, 19.69 inHg).



3. If vacuum pressure drops more than the specified value, correct the cause in accordance with the following chart.

Maximum vacuum leakage (15 seconds after engine is stopped):
3.3 kPa (25 mmHg, 0.98 inHg)

Probable cause	Corrective action
1. Air leakage at check valve.	Replace check valve.
2. Air leakage at output rod seal.	Replace brake booster as an assembly.
3. Air leakage between valve body and seal.	
4. Air leakage at valve plunger seat.	
5. Damaged piping or joints.	Repair or replace.

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Airtight test (Under load)

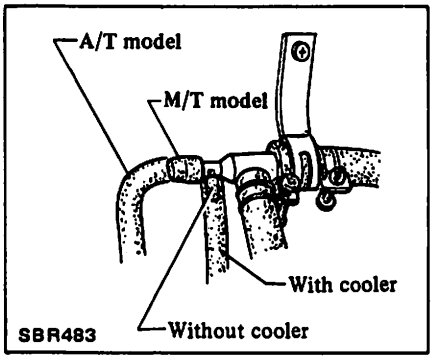
With brake pedal fully depressed, perform an airtight test following the same procedures as used in airtight test under no load.

Maximum vacuum leakage (15 seconds after engine is stopped):
3.3 kPa (25 mmHg, 0.98 inHg)

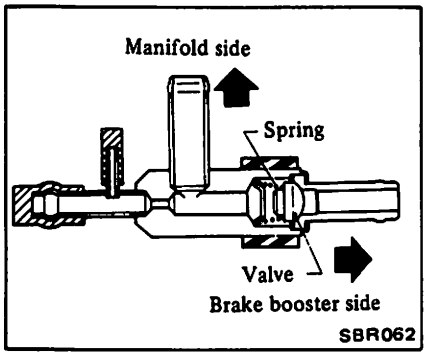
Probable cause	Corrective action
1. Air leakage at check valve.	Replace check valve.
2. Damaged diaphragm.	Replace brake booster as an assembly.
3. Reaction disc dropped off (Brake booster).	
4. Air leakage at poppet assembly seat and valve body.	

Check valve

1. Remove check valve.



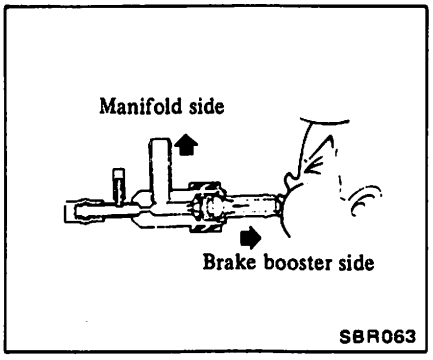
2. Apply a vacuum pressure of 26.7 kPa (200 mmHg, 7.87 inHg) to port of check valve on brake booster side.



3. If vacuum pressure drops below the specified value in 15 seconds, replace check valve with a new one.

Maximum vacuum leakage of check valve:
1.3 kPa
(10 mmHg, 0.39 inHg)

4. When pressure is applied to the brake booster side of check valve and valve does not open, replace check valve with a new one.

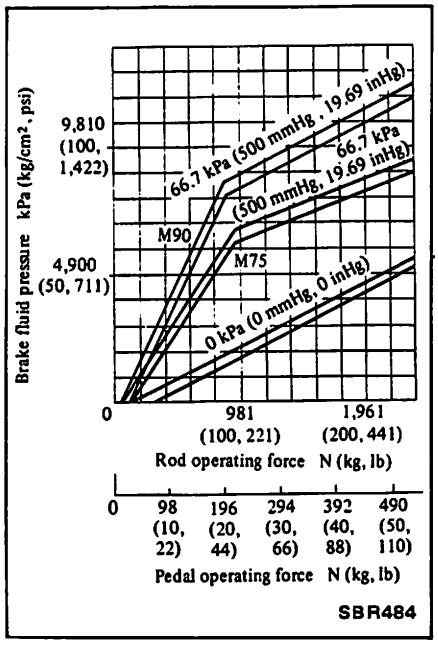


Operating test

1. Connect an oil pressure gauge to brake line, at connection on master cylinder.
2. Install a pedal force gauge on brake pedal.
3. Start engine, and increase engine speed until a vacuum pressure of 66.7 kPa (500 mmHg, 19.69 inHg) is registered on vacuum pressure gauge. With a steady vacuum pressure of 66.7 kPa (500 mmHg, 19.69 inHg), measure oil pressure with respect to each pedal operating force.

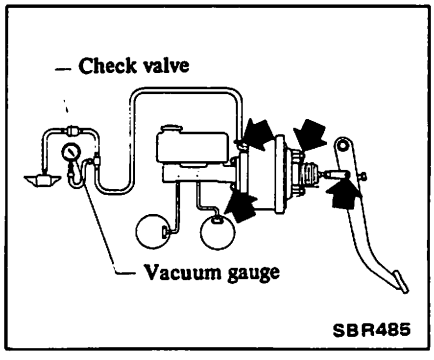
Relationship between oil pressure and pedal operating force is illustrated in Fig. Also check brake line for evidence of fluid leakage.

Determine whether source of problem is in brake booster or check valve. Before you reach a final conclusion, always inspect check valve first.



REMOVAL

To remove brake booster, detach the following points.



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ADJUSTMENT

Output rod length

1. Check length.

Length "A":
9.75 - 10.00 mm
(0.3839 - 0.3937 in)

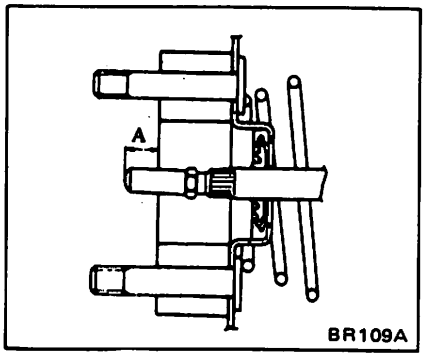
2. Adjust length if necessary.

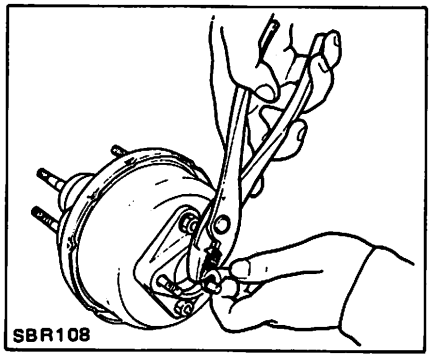
If amount of adjustment required exceeds 0.5 mm (0.020 in), reaction disc may have been either dislocated or fallen off. Replace brake booster assembly.

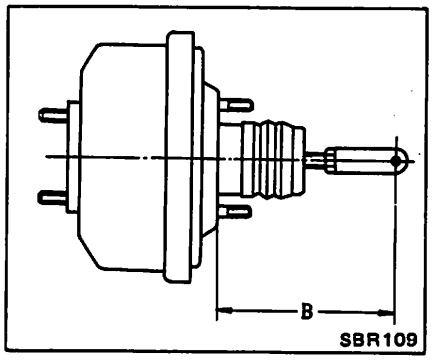
Input rod length

Adjust length by turning clevis.

Length "B":
275 mm (10.83 in)

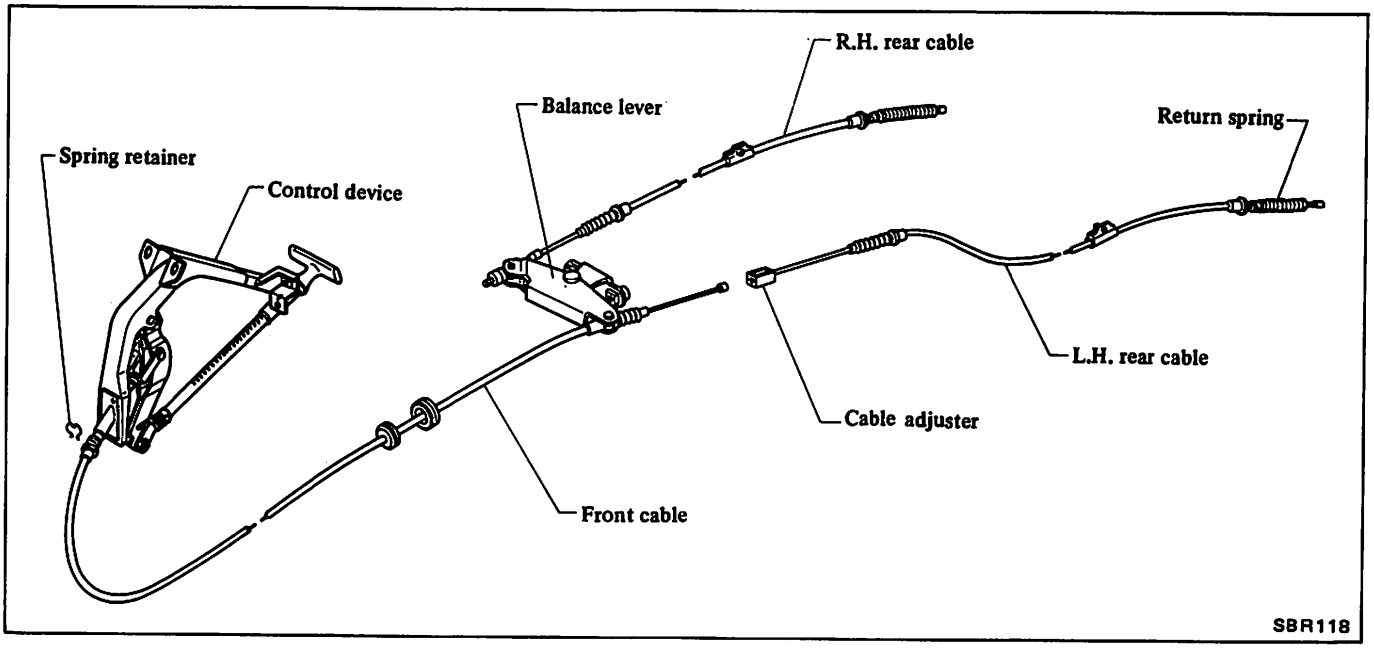






PARKING BRAKE

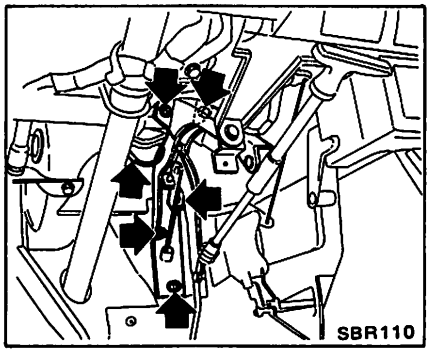
PARKING BRAKE



REMOVAL

Control stem

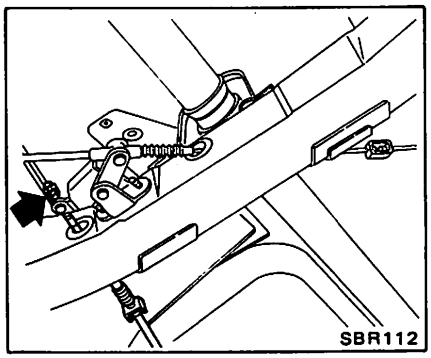
Disconnect harness connector. Disconnect parking brake cable from control lever. Remove bolts and screw securing control bracket. Remove spring retainer in engine compartment. Then remove control stem assembly.



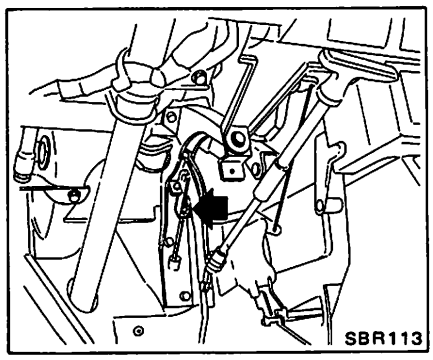
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Front cable

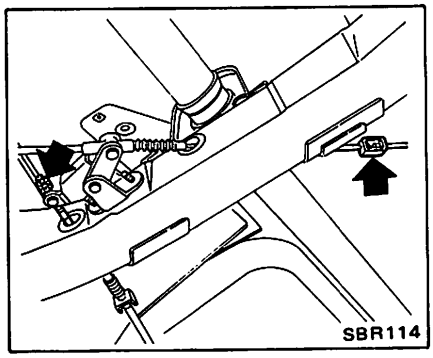
1. Fully release parking brake.
2. Loosen adjuster nut at balance lever.



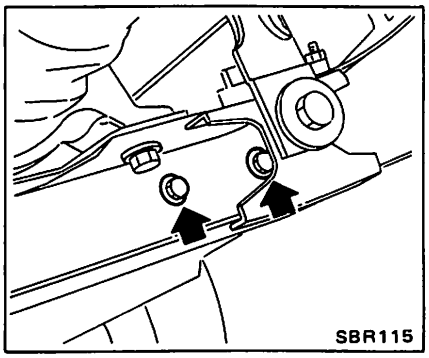
3. Disconnect front cable from control lever.



4. Disconnect R.H. rear cable from balance lever and L.H. rear cable from front cable.



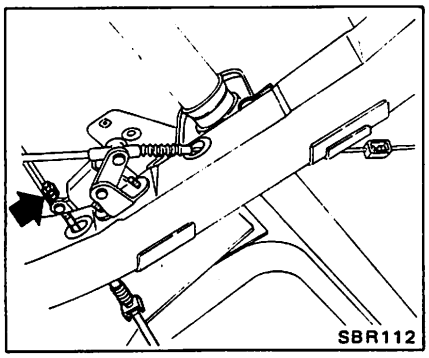
5. Remove bolts securing balance lever.



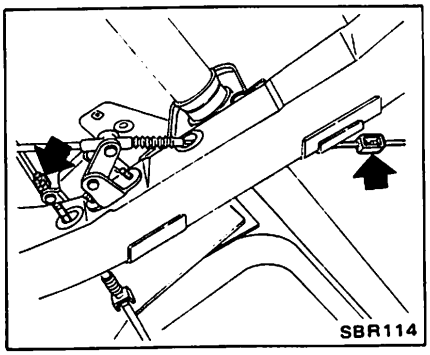
6. Detach clamps and pull out front cable to balance lever.

Rear cable

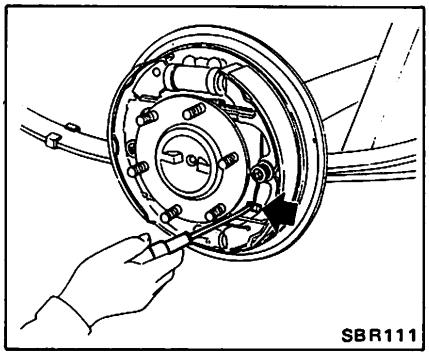
1. Fully release parking brake.
2. Loosen adjusting nut at balance lever.



3. Disconnect R.H. rear cable from balance lever and L.H. rear cable from front cable.



4. Remove both sides rear brake drums, and disconnect rear cable from toggle lever.



5. Detach lock plate and clamps and pull out cable to balance lever.

INSPECTION

1. Check control stem and ratchet for evidence of wear or other damage.
2. Check springs for fatigues.
3. Check wires for evidence of discontinuity or other deterioration.
4. Check parts at each connection for deformation or damage.

INSTALLATION

1. Apply a coating of grease to sliding contact surfaces, especially to those of balance lever.

   Make sure that each sliding part functions smoothly.
2. After installation is completed, adjust entire system. Refer to Section MA for adjustment.

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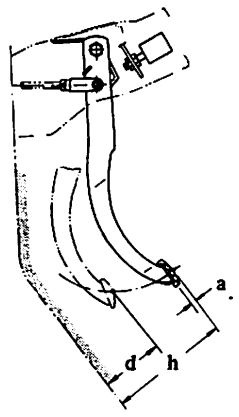
SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

Item \ Model		2WD	4WD
Type	Front	Disc-N22A	
	Rear	Drum-DS25	
Pad or lining dimension Width x thickness x length	Front mm (in)	52.9 x 9.7 x 76.2 (2.083 x 0.382 x 3.000)	
	Rear mm (in)	45 x 4.5 x 244 (1.77 x 0.177 x 9.61)	
Rotor outer diameter or drum inner diameter	Front mm (in)	271 (10.67)	
	Rear mm (in)	254 (10.00)	
Caliper or wheel cylinder inner diameter	Front mm (in)	53.98 (2-1/8)	
	Rear mm (in)	15.88 (5/8)	
Master cylinder inner diameter	mm (in)	22.23 (7/8)	
Brake booster	Type	Master-Vac (M75)	Master-Vac (M90)
	Diaphragm diameter mm (in)	190.5 (7-1/2)	228.6 (9)
Load sensing valve	Reducing ratio	0.2	

INSPECTION AND ADJUSTMENT

BRAKE PEDAL



SBR119

Unit: mm (in)

Free height "h"	168 - 174 (6.61 - 6.85)
Free play at pedal pad "a"	1 - 5 (0.04 - 0.20)
Depressed height "d"	more than 82 (3.23)

PARKING BRAKE

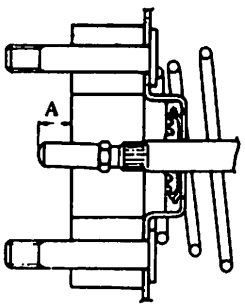
Pulling force	N (kg, lb)	196 (20, 44)
Number of notches		6 - 10

MASTER CYLINDER

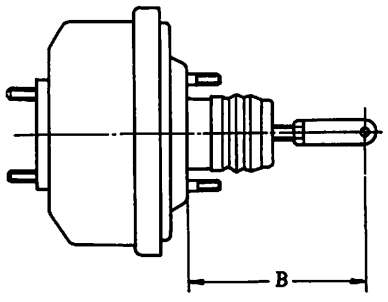
Piston-to-cylinder clearance	mm (in)	less than 0.15 (0.0059)

BRAKE BOOSTER

Maximum vacuum leakage (15 seconds after engine is stopped)	kPa (mmHg, inHg)	3.3 (25, 0.98)
Output rod length "A"	mm (in)	9.75 - 10.00 (0.3839 - 0.3937)
Input rod length "B"	mm (in)	275 (10.83)



BR109A



SBR109

CHECK VALVE

Maximum vacuum leakage [15 seconds after 26.7 kPa (200 mmHg, 7.87 inHg) pressure is applied]	kPa (mmHg, inHg)	1.3 (10, 0.39)

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FRONT DISC BRAKE

Unit: mm (in)

Pad wear limit	Minimum thickness	2.0 (0.079)
Rotor repair limit	Maximum runout	0.15 (0.0059)
	Maximum parallelism	0.07 (0.0028)
	Minimum thickness	10.5 (0.413)

REAR BRAKE

Unit: mm (in)

Lining wear limit (Minimum thickness)	1.5 (0.059)
Drum wear limit	
Maximum inner diameter	255.5 (10.06)
Radial runout	Less than 0.12 (0.0047)
Out-of-roundness	Less than 0.015 (0.0006)
Taper [Measured at a point 45 mm (1.77 in) from inlet]	Less than 0.02 (0.0008)
Wheel cylinder repair limit	
Piston-to-cylinder clearance	Less than 0.15 (0.0059)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Brake tube flare nut	15 - 18	1.5 - 1.8	11 - 13
Brake hose connector	17 - 20	1.7 - 2.0	12 - 14
Wheel cylinder air bleeder	7 - 9	0.7 - 0.9	5.1 - 6.5
Brake lamp switch lock nut	12 - 15	1.2 - 1.5	9 - 11
Input rod lock nut	16 - 22	1.6 - 2.2	12 - 16
Fulcrum pin fixing bolt	8 - 11	0.8 - 1.1	5.8 - 8.0
Brake booster to brake booster spacer	8 - 11	0.8 - 1.1	5.8 - 8.0
Master cylinder to brake booster	8 - 11	0.8 - 1.1	5.8 - 8.0
N.L.S.V. mounting bolt	8 - 11	0.8 - 1.1	5.8 - 8.0
Front disc caliper fixing bolt	72 - 97	7.3 - 9.9	53 - 72
Yoke-to-cylinder body	16 - 21	1.6 - 2.1	12 - 15
Front disc rotor fixing bolt	38 - 52	3.9 - 5.3	28 - 38
3-way connector fixing bolt	17 - 20	1.7 - 2.0	12 - 14
Rear drum brake back plate	53 - 63	5.4 - 6.4	39 - 46
Rear wheel cylinder fixing nut	15 - 18	1.5 - 1.8	11 - 13

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Excessive pedal travel	Low brake fluid level or empty master cylinder reservoir.	Fill and bleed as necessary. Test for source of leakage by examining all lines, connections and wheel cylinder.
	Leakage in master cylinder.	Overhaul master cylinder.
	Deteriorated check valve.	Replace check valve and bleed system.
	Air in system.	Bleed system.
	Faulty brake adjustment.	Adjust shoe-to-drum clearance.
	Excessive lateral play on disc caused by loose or worn wheel bearings or steering parts.	Replace or adjust faulty parts.

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Condition	Probable cause	Corrective action
Spongy pedal	Low fluid level in master cylinder.	Top with fluid and inspect for leakage.
	Air in system.	Correct as necessary.
	Faulty brake adjustment.	Adjust shoe-to-drum clearance.
	Reservoir filler cap vent hole clogged.	Clean and bleed system.
	Swollen hose due to deterioration or use of poor quality hose.	Replace hose and bleed system.
	Distorted brake shoes, or excessively worn or cracked brake drum.	Replace faulty parts.
	Soft or swollen caliper seals.	Drain hydraulic system, flush with alcohol and replace all seals.
	Use of a brake fluid with too low boiling point.	Replace with specified brake fluid and bleed system.
Poor braking effect	Fluid leakage in brake lines.	Check master cylinder, piping and wheel cylinder for leaks, and repair.
	Low brake fluid level or empty master cylinder reservoir.	Fill and bleed as necessary.
	Air in brake lines.	Bleed system.
	Excessive shoe-to-drum clearance.	Adjust.
	Grease, oil, mud or water on linings or pads.	Clean brake mechanism and check for cause of problem. Replace linings or pads.
	Deterioration of linings or pads.	Replace.
	Local fit of linings or pads.	Shave or replace.
	Linings or pads excessively worn.	Replace.
	Master cylinder or wheel cylinders in poor condition.	Repair or replace.
	Frozen or seized caliper pistons on disc brakes.	Disassemble caliper and free up as required.
	Binding mechanical linkage at brake pedal and shoes.	Free up as required.
Unbalanced brakes	Improper tire inflation.	Inflate to correct pressure.
	Improper adjustment of shoe-to-drum clearance.	Readjust.
	Grease, oil, mud or water on linings or pads.	Clean brake mechanism and check for cause of problem. Replace linings or pads.
	Mud in brake drum.	Clean.
	Deterioration of linings or pads.	Replace.
	Excessive wear of linings or pads.	Replace.
	Wheel cylinder in poor condition.	Repair or replace.
	Poor sliding condition of brake shoe.	Adjust.
	Looseness of cylinder body or back plate securing bolts/nuts.	Fasten or replace.

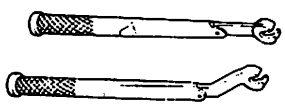
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Condition	Probable cause	Corrective action
(Unbalanced brakes)	Scored or out-of-round drums.	Recondition or replace brake drum as required. Check for improper lining contact with drum and grind lining if necessary.
	Sticking wheel cylinder cups.	Recondition or replace cylinder.
	Deformation of back plate.	Replace.
	Incorrect adjustment of wheel bearings.	Adjust or replace.
	Incorrect adjustment of wheel alignment.	Adjust.
	Looseness of leaf spring securing U-bolts.	Tighten or replace.
Brakes fade	Brake fluid has too low boiling point.	Drain and fill system with approved fluid.
	Use of improper linings or brake linings are contaminated.	Replace linings.
	Brake drums are out-of-round.	Repair or replace as necessary.
	Hydraulic connections, master cylinder and wheel cylinders are corroded or damaged.	Repair as necessary.
	Bleed screw is open.	Close screw and bleed system.
Brakes drag	Pedal linkage is binding or output rod adjustment is too long.	Lubricate linkage, check pedal return spring for condition and adjust output rod as necessary.
	Master cylinder compensator part is obstructed.	Blow out foreign matter with compressed air.
	Seized master cylinder piston.	Disassemble master cylinder and replace piston. Bleed system.
	Poor shoe condition.	Clean and repair.
	Poor wheel cylinder condition.	Repair or replace.
	Deformation of piston cups.	Replace.
	Poor condition of caliper because of faulty piston seals.	Replace piston seals.
	Excessive runout of rotor.	Turn rotor on lathe or replace.
	Parking brake will not return.	Check and repair.
	Clogged master cylinder return port.	Clean.
	Clogged brake lines.	Check and clean.
	Incorrect adjustment of wheel bearings.	Adjust or repair.
	Improper shoe-to-drum clearance.	Adjust.
	Weak shoe return springs.	Replace.
	No free travel in brake shoe return.	Adjust pedal height.
Brake chatters	Groove or out-of-round brake drum or rotor.	Grind or replace as required.
	Loose or bent support plate.	Tighten support plate bolts to specified torque, or replace plate.
	Distorted brake shoes or pads.	Replace as necessary.
	Grease or brake fluid on linings.	Replace linings.

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Condition	Probable cause	Corrective action
Brake squeals	Dirty or scored brake drums.	Blow out assembly with compressed air or refinish drum.
	Distorted brake shoes or bent support plate.	Replace faulty unit.
	Weak or broken brake shoe retaining spring or return spring.	Replace if faulty.
	Glazed or contaminated brake lining.	Cam ground lining to eliminate glaze. If it doesn't, replace linings.
Pedal pulsates	Out-of-round or off-center drum.	Turn drum or replace as necessary.
	On disc brakes, lateral runout of brake rotor is excessive.	Check with dial indicator, turning disc by hand. If runout exceeds specifications, repair or replace disc.
	Excessive variation in thickness of brake rotor surfaces.	Measure around disc face with micrometer. Replace disc as required.
Rear lock (Under light brake pedal force)	Improper tire pressures.	Check and adjust.
	Excessive wear of tires.	Check and replace.
	Faulty N.L.S.V.	Replace.
Rear lock (Under heavy brake pedal force)	Improper tire pressures.	Check and adjust.
	Excessive wear of tires.	Check and replace.
	Poor front braking effect.	
	• Grease, oil, mud or water on linings or pads.	Clean or replace.
	• Excessive wear of linings or pads.	Replace.
	• Local fit of linings or pads.	Shave or replace.
	• Master cylinder or wheel cylinder in poor condition.	Repair or replace.

SPECIAL SERVICE TOOL

Tool number (Kent-Moore No.)	Tool name
GG94310000 (–)	Flare nut torque wrench 

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STEERING SYSTEM

SECTION ST

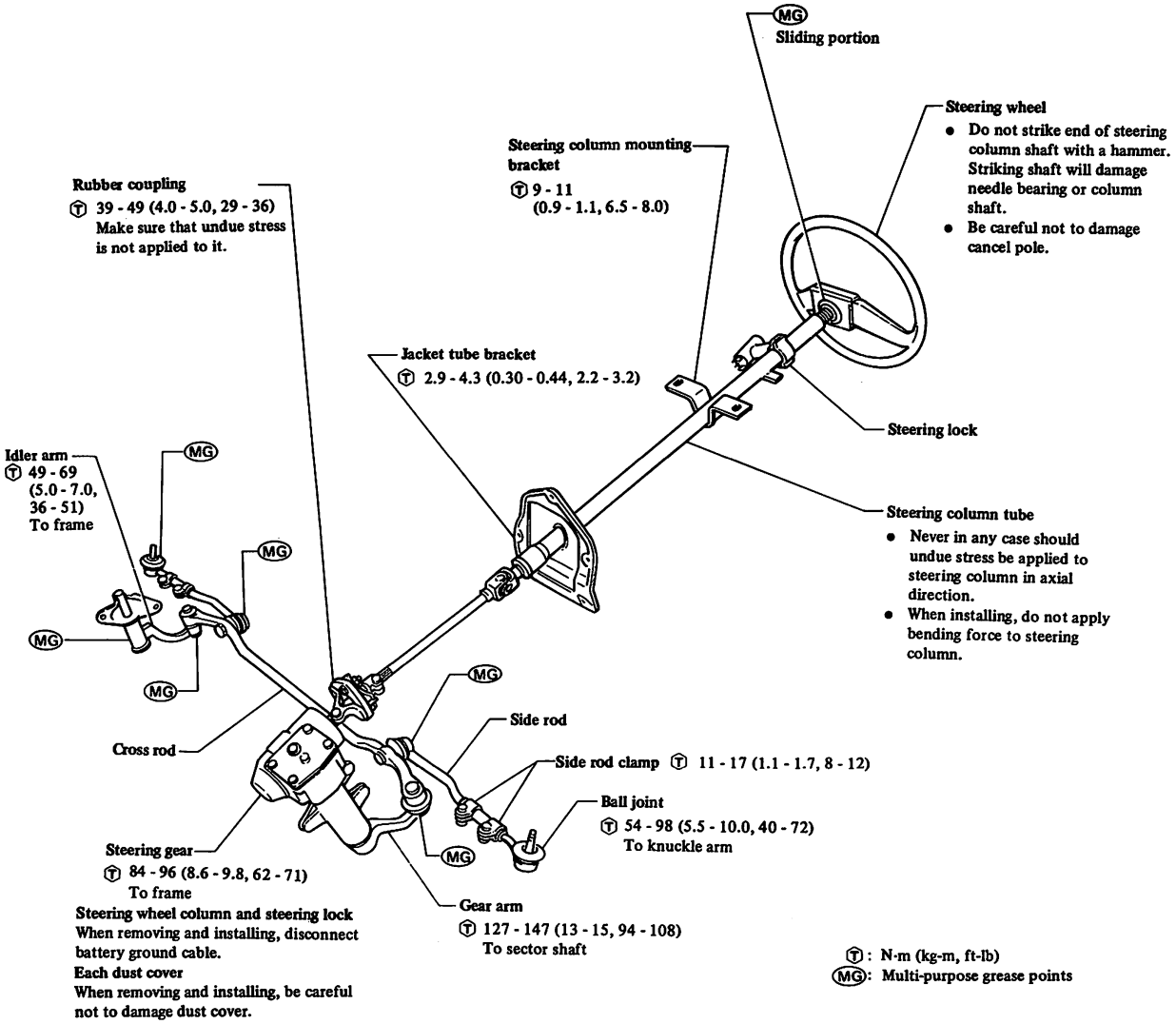
CONTENTS

STEERING SYSTEM . . . . . ST- 2
STEERING WHEEL AND COLUMN . . . . . ST- 3
STEERING WHEEL . . . . . ST- 3
STEERING LOCK . . . . . ST- 3
STEERING COLUMN . . . . . ST- 4
STEERING GEAR (Model : VRB56L) . . . ST- 6
STEERING LINKAGE ST-11
SERVICE DATA AND SPECIFICATIONS (S.D.S.) ST-13
GENERAL SPECIFICATIONS ST-13
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TIGHTENING TORQUE ST-14
TROUBLE DIAGNOSES AND CORRECTIONS ST-15
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STEERING SYSTEM



SST106

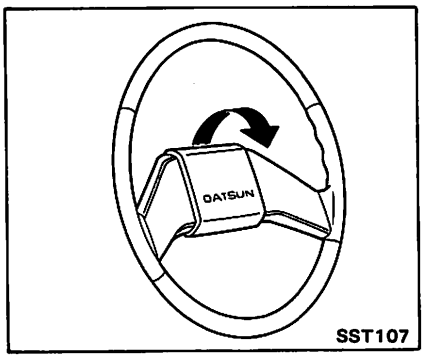
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STEERING WHEEL AND COLUMN

STEERING WHEEL

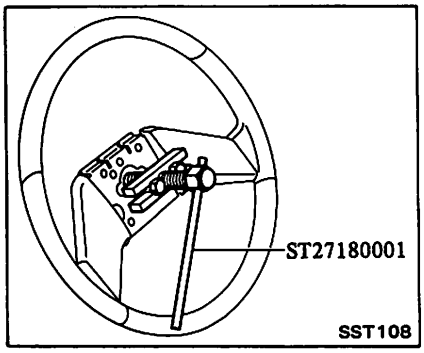
REMOVAL

1. Disconnect battery ground cable.
2. Remove horn pad and steering wheel nut.



3. Remove steering wheel using **Tool.**

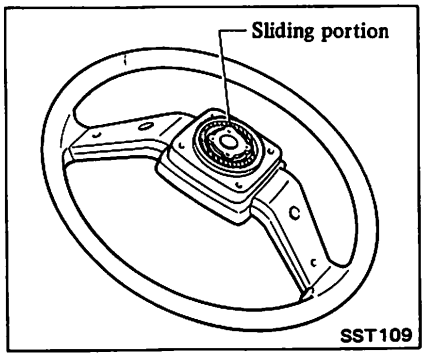
CAUTION:
Do not strike end of steering column shaft with a hammer. Striking shaft will damage bearing or column shaft.



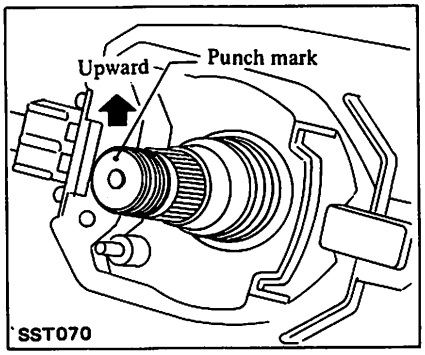
INSTALLATION

Install steering wheel in the reverse order of removal. Observe the following instructions.

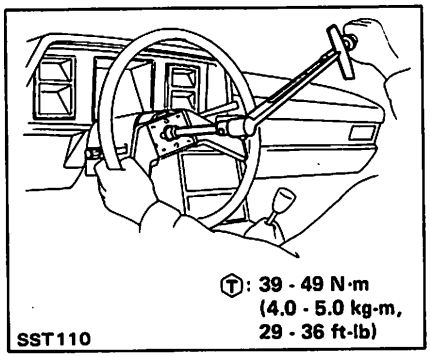
1. Apply grease to sliding portions.



2. Install steering wheel **on column shaft in a straight-ahead position.**



3. Tighten steering wheel nut.



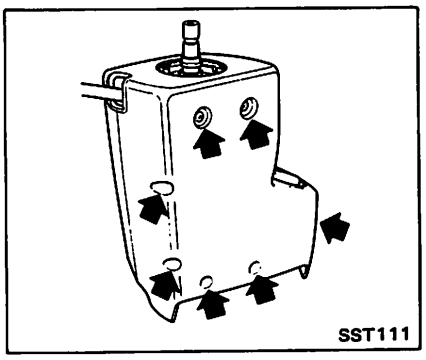
4. After installing steering wheel, turn it clockwise and counterclockwise, checking for catch or drag. Also check horn operation.

STEERING LOCK

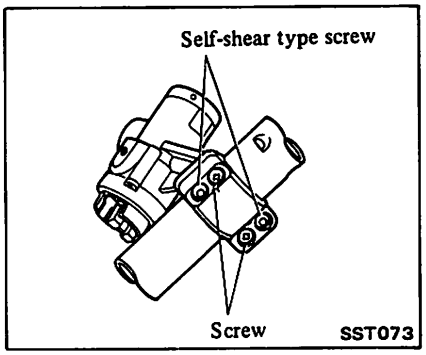
REMOVAL

Before removing steering lock, disconnect battery ground cable.

1. Remove steering column shell cover.

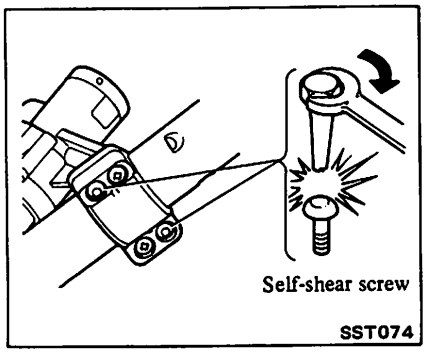


2. Break self-shear type screws with a drill or other appropriate tool.
3. Remove screws and disconnect steering lock.



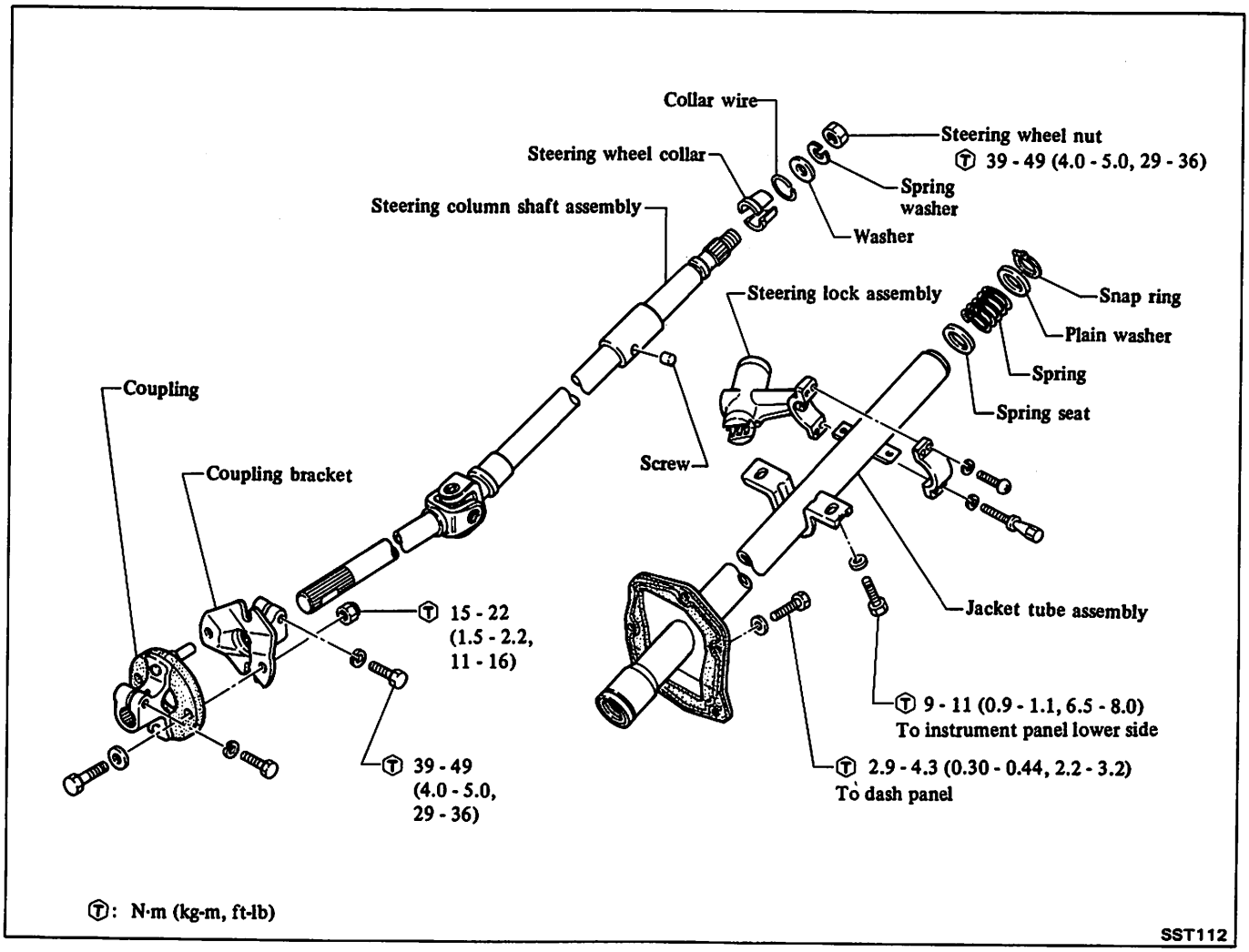
INSTALLATION

1. Align steering lock hole in steering column tube with mating portion of steering lock.
2. Install screws and self-shear type screws and then cut off self-shear type screw heads.



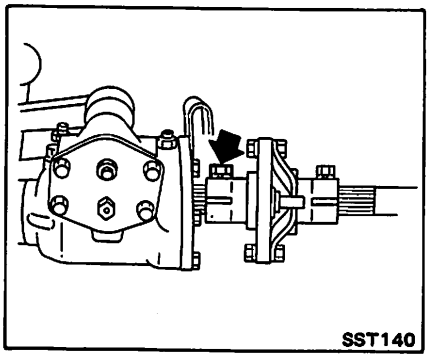
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STEERING COLUMN

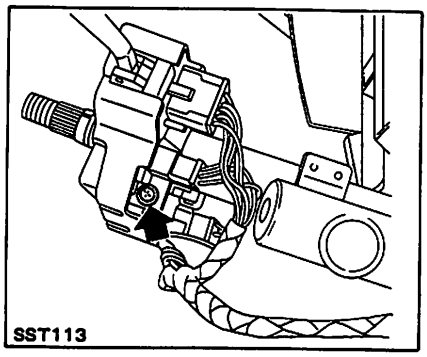


REMOVAL

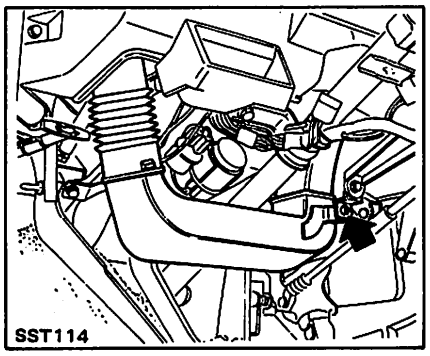
1. Remove bolt securing worm shaft and rubber coupling.



2. Remove steering wheel. **Refer to Steering Wheel.**
3. Remove steering column shell covers.
4. Remove combination switch assembly.

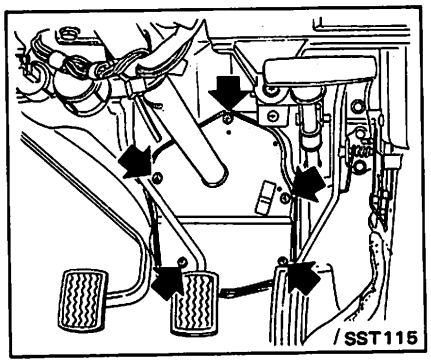


5. Remove heater duct from dash panel side.

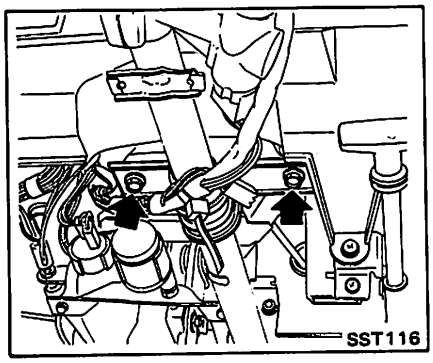


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6. Remove jacket tube bracket from dash panel.



7. Remove column mounting bracket.



8. Draw out steering column assembly from room side.

INSTALLATION

Install steering column in reverse order of removal.

1. Set wheels in a straight-ahead position.
2. Fit steering column assembly on to worm shaft.

Carefully install so that punch mark at top end of column shaft faces upward.

3. After sliding jacket tube bracket to dash panel, tighten nuts to retain it.

Ⓣ : Jacket tube bracket to dash panel
2.9 - 4.3 N·m
(0.30 - 0.44 kg-m,
2.2 - 3.2 ft-lb)

4. Tighten column mounting bracket temporarily.
5. Tighten worm shaft securing bolts temporarily to support upper side of steering column assembly.
6. Tighten worm shaft securing bolts and then tighten column mounting bracket securing bolts.

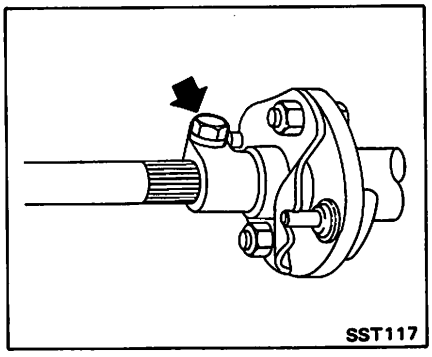
Ⓣ : Rubber coupling to worm shaft
39 - 49 N·m
(4.0 - 5.0 kg-m,
29 - 36 ft-lb)
Column mounting bracket
9 - 11 N·m
(0.9 - 1.1 kg-m,
6.5 - 8.0 ft-lb)

CAUTION:
a. Make sure that any undue stress is not applied to rubber coupling.
b. To avoid damaging bolt or serrations, align groove in worm shaft with bolt hole in rubber coupling.

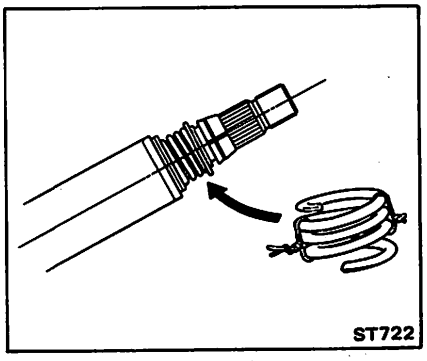
7. Install steering wheel. **Refer to Steering Wheel.**
8. After installation, make sure that steering wheel turns smoothly.

DISASSEMBLY

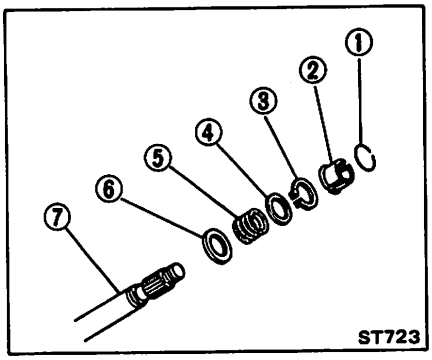
1. Remove rubber coupling assembly.



2. Remove steering lock assembly. **Refer to Steering Lock for removal.**
3. Compress steering column spring with wires.



4. Remove collar fixing wire, steering wheel fixing collar, snap ring, plain washer, steering column spring and spring seat.



1 Collar wire
2 Steering wheel collar
3 Snap ring
4 Plain washer
5 Steering column spring
6 Spring seat
7 Steering column assembly

5. Pull column shaft out.

CAUTION:
Be careful not to damage upper and lower bearings into column tube.

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ASSEMBLY

Assemble steering column in the reverse order of disassembly. Observe the following notes.

Apply recommended multi-purpose grease to column bearings, spring, and other sliding parts.

CAUTION:

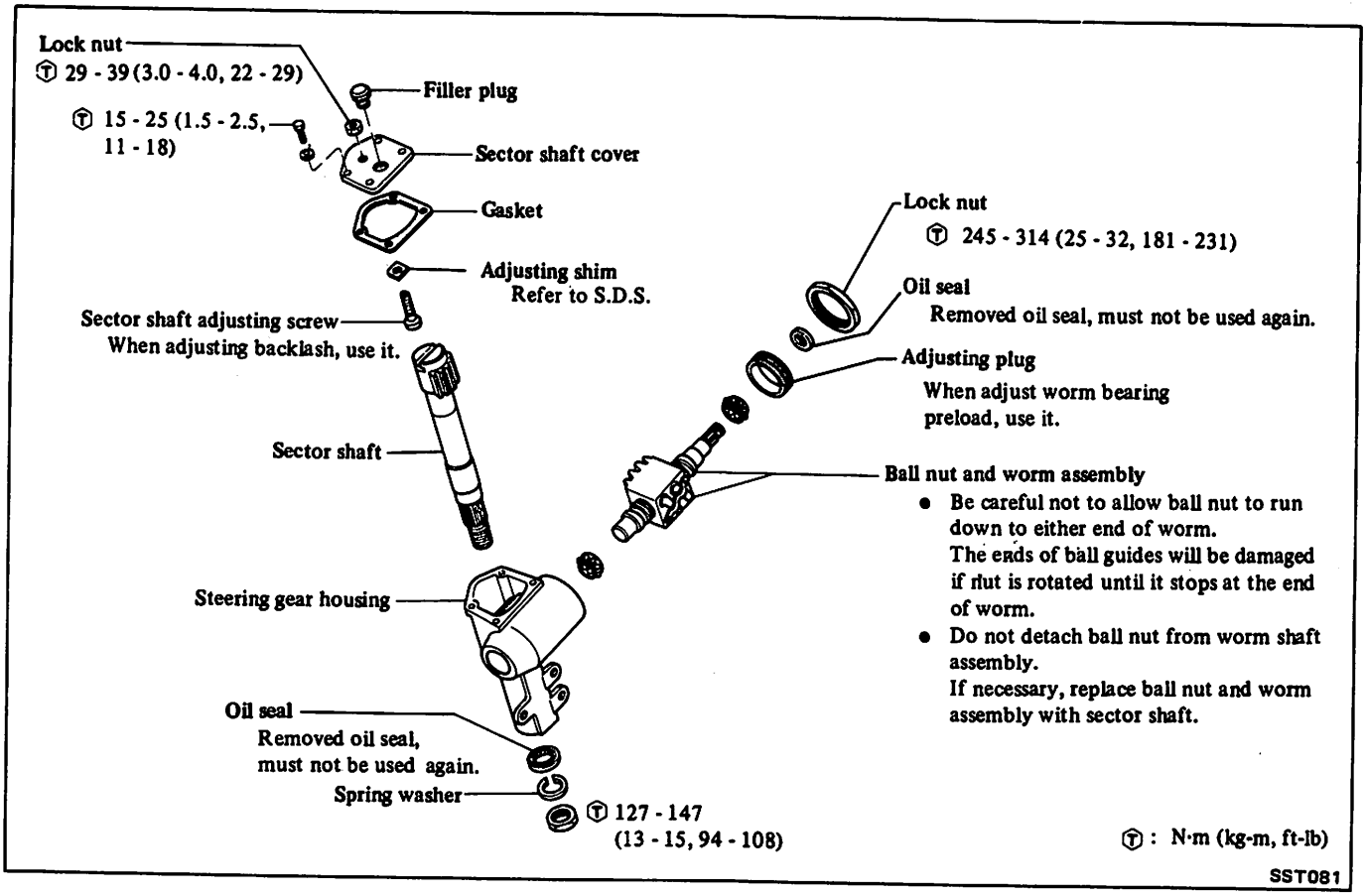
- **Be careful to prevent interference with remote control lever bracket.**
- **Be careful not to give impact force or abnormally strong force in axial direction to steering column shaft.**
- **Snap ring for column shaft should not be reused.**

INSPECTION

When steering wheel will not turn smoothly, check the steering column for the following matters and replace malfunctioning parts.

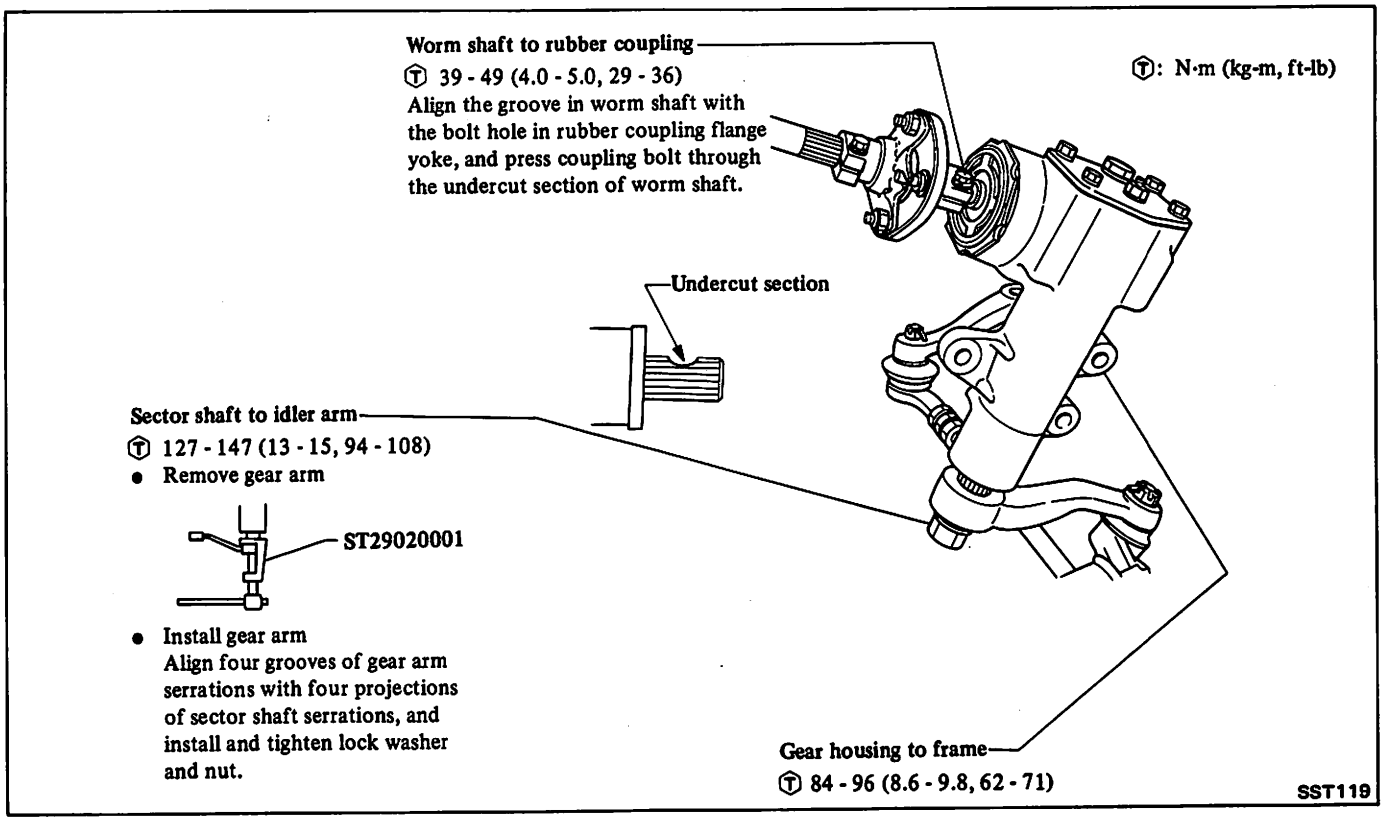
1. Check column bearing for damage or unsmoothness. If so, lubricate with recommended multi-purpose grease or replace with a new one as jacket tube assembly.
2. Check jacket tube for deformation or breakage, and replace if necessary.
3. Check column spring, and replace if damaged or weakened.

STEERING GEAR (Model : VRB56L)



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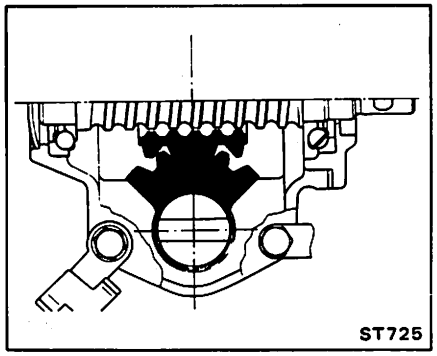
REMOVAL AND INSTALLATION



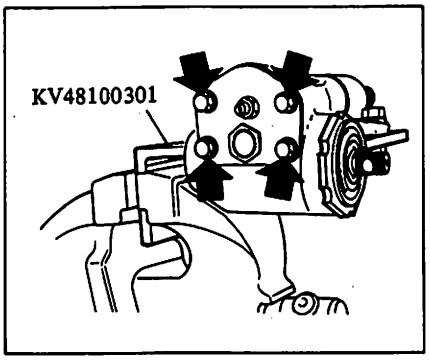
DISASSEMBLY

Before disassembling by hand, make sure external is clean and free from dust and dirt, and thoroughly drain gear fluid by removing filler plug.

1. Place steering gear in a vice using **Tool** KV48100301 in place.
2. Set worm gear in a straight-ahead position.



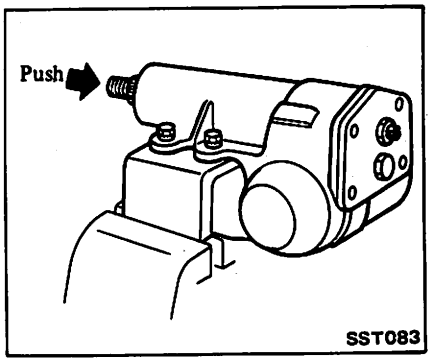
3. Remove sector shaft cover fixing bolts.



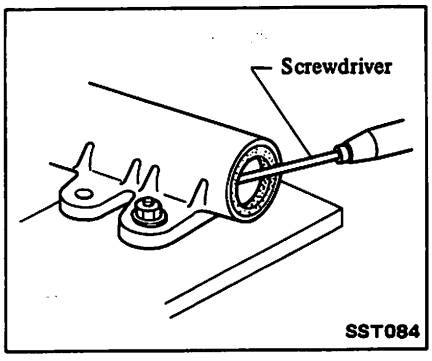
4. Remove sector shaft with sector shaft cover.

CAUTION:

a. When pullling sector shaft out, be careful not to damage oil seal or associated parts.
b. Set worm gear in a straight-ahead position.
c. Do not remove sector shaft needle bearings from steering gear housing. If necessary, replace gear housing assembly.

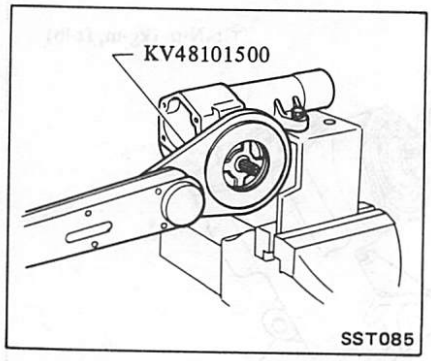


5. Remove sector shaft cover from sector shaft.
6. Remove sector shaft oil seal, **if necessary.**



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7. Loosen adjusting plug lock nut using **Tool.**



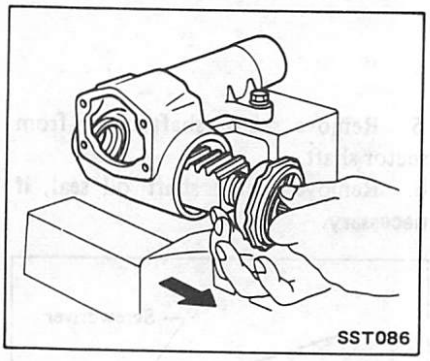
8. Draw out worm gear with worm bearing.

CAUTION:

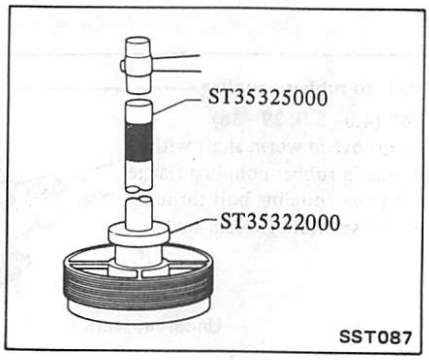
a. Be careful not to allow ball nut to run down to either end of worm. Ends of ball guides will be damaged if nut is rotated until it stops at end of worm.

b. Do not detach ball nut from worm shaft assembly. If necessary, replace entire unit as an assembly.

c. Do not remove sector shaft needle bearings from steering gear housing. If necessary, replace entire gear housing as an assembly.



9. Remove oil seal from adjusting plug using **Tool.**

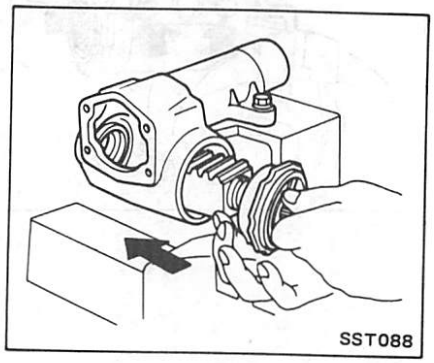


ASSEMBLY AND ADJUSTMENT

- **Before assembling and adjusting by hand, make sure each part is clean and lubricate with gear fluid.**
- **Fill space between sealing lips of new sector shaft and adjusting plug oil seals with recommended multi-purpose grease.**

Worm bearing preload

1. Fit worm gear assembly with worm bearing in gear housing.



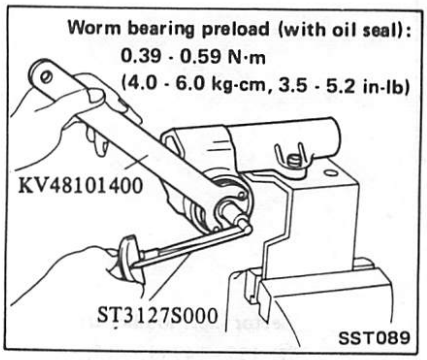
2. Install adjusting plug using **Tool** KV48101400.

3. Adjust worm bearing preload using **Tools.**

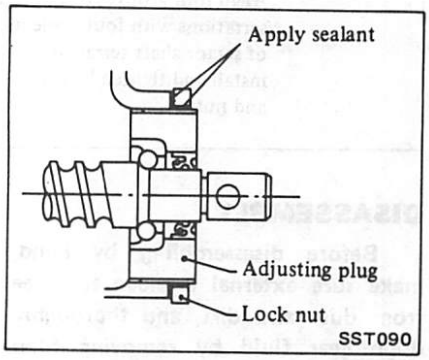
CAUTION:

Always adjust worm bearing preload by turning adjusting plug in "tighten" direction.

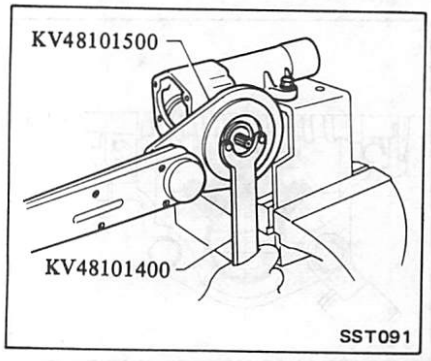
Rotate worm shaft a few turns in both directions to settle down worm bearing and measure preload.



4. Apply suitable liquid sealant around lock nut inner surface.



5. Tighten lock nut using **Tools.**



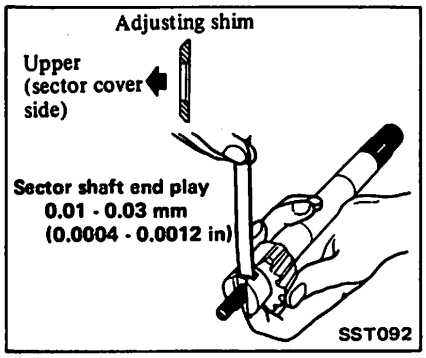
6. After tightening lock nut, check worm bearing preload to make sure it is within specification.

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Sector shaft end play

Select suitable adjusting shim and adjust end play between sector shaft and adjusting screw.

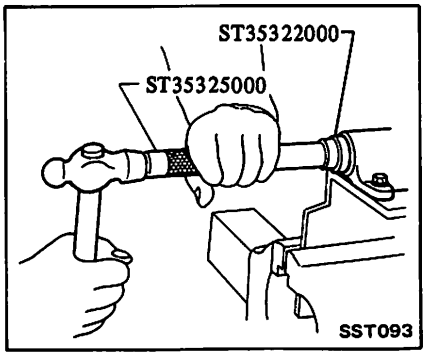
Sector shaft adjusting screw shims:
Refer to S.D.S.



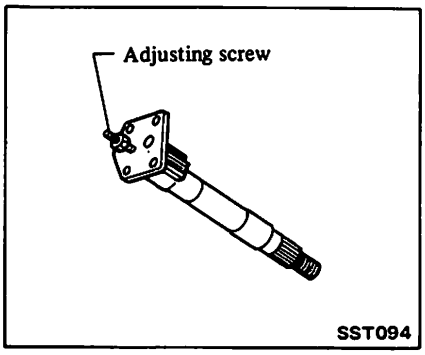
Steering gear preload

1. Press oil seal to steering gear housing using **Tool.**

Before pressing oil seal, coat seal contacting face of oil seal with gear fluid.

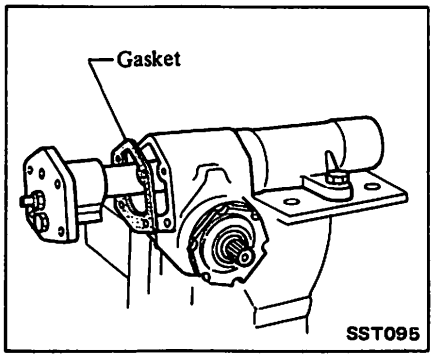


2. Install sector cover on adjusting screw with sector shaft.

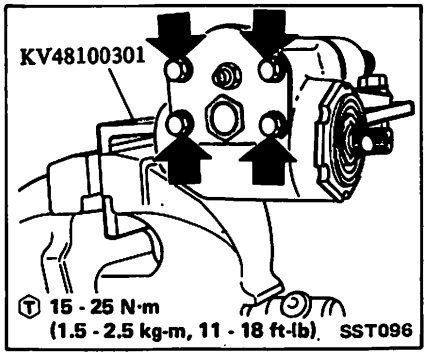


3. Set worm gear in a straight-ahead position.
4. Insert sector shaft and sector cover assembly with gasket into gear housing.

Carefully insert sector shaft in place, using care not to scratch oil seal.



5. Tighten sector cover to gear housing.



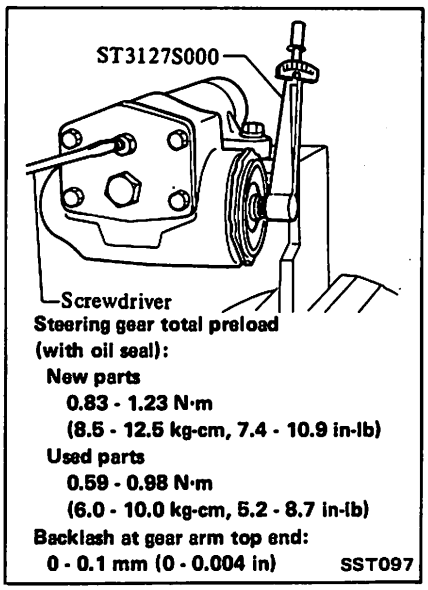
6. Pour recommended gear oil into assembly through filler hole and install filler plug.

Specified refill capacity:
Approximately 0.33 liter
(3/4 US pt, 5/8 Imp pt)

7. Tighten adjusting screw so that gear preload is within specification.

CAUTION:
Always adjust steering gear preload by turning adjusting screw in "tighten" direction.

Rotate worm gear a few turns in both directions to settle down steering gear and then measure steering gear preload in a straight-ahead position.



8. If found to be outside of above steering gear preload specifications, readjust adjusting screw until correct steering gear preload is obtained.

INSPECTION

Wash clean all the disassembled parts in solvent and check for condition.

Sector shaft

1. Check gear tooth surface for pitting, burrs, cracks or any other damage, and replace if necessary.
2. Check sector shaft for distortion on its serration, and replace if necessary. Also check gear housing for deformation.

Steering worm assembly

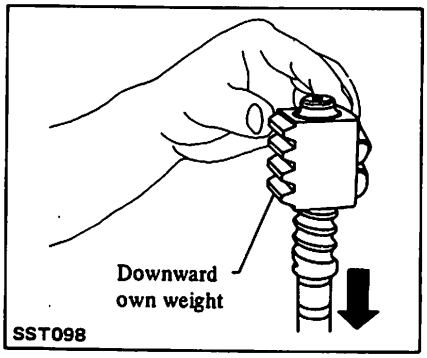
1. Inspect ball nut gear tooth surface, and replace if pitting, burrs, wear or any other damage is found.

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2. Ball nut must rotate smoothly on worm gear. If found too tight, assembly should be replaced.

Check rotation of ball nut as follows:

(1) Move ball nut to either end of worm gear, and gradually stand worm shaft and ball nut assembly until ball nut moves downward on worm gear under its own weight.



(2) If ball nut does not move freely over entire stroke, replace assembly.

Be careful not to damage ball nut guide tube while check is being made.

CAUTION:
Be careful not to allow ball nut to run down to either end of worm.

Bearing

1. Inspect worm bearing for wear, pitting or any other damage. Replace as requried.

When replacing worm bearing, replace it as a set of bearing and outer race.

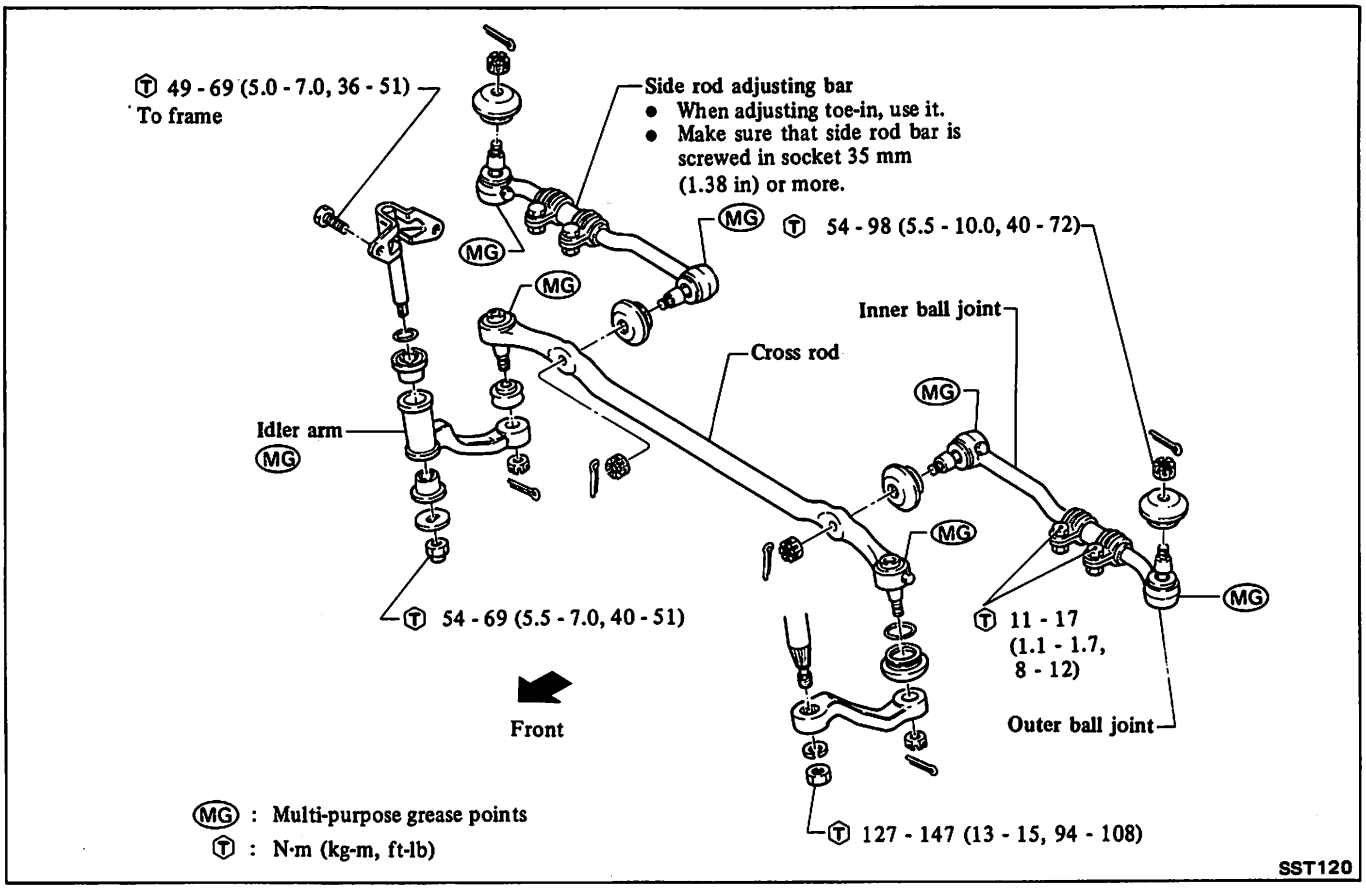
2. If sector shaft needle bearings are worn or damaged, replace as an assembly of gear housing and bearings.

Oil seals

Discard any oil seal which has once been removed. Replace oil seal if sealing lip is deformed or cracked. Also discard oil seal if spring is fatigued or dislocated.

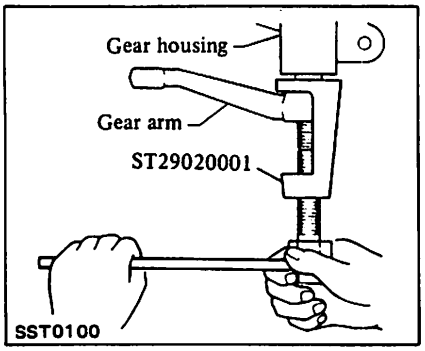
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STEERING LINKAGE

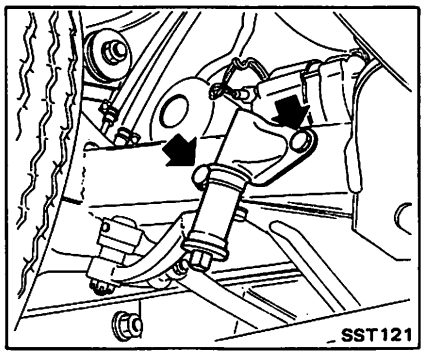


REMOVAL AND INSTALLATION

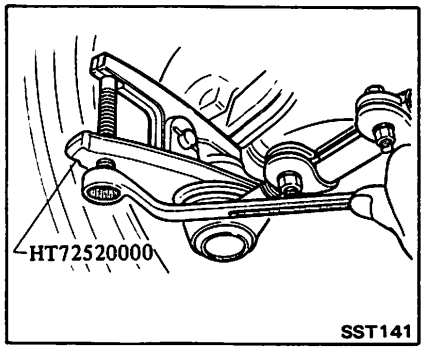
1. Jack up front of vehicle and support it on the safety stands.
2. Block rear wheels with chocks.
3. Remove gear arm using **Tool.**



4. Remove idler arm assembly.



5. Remove side rod from knuckle arm using **Tool.**



6. Install steering linkage in the reverse order of removal.

Ⓣ : Gear arm to sector shaft
127 - 147 N·m
(13 - 15 kg-m,
94 - 108 ft-lb)
Idler arm to body frame
49 - 69 N·m
(5.0 - 7.0 kg-m,
36 - 51 ft-lb)
Side rod to knuckle arm
54 - 98 N·m
(5.5 - 10.0 kg-m,
40 - 72 ft-lb)

7. After installing steering linkage, check wheel alignment, and if necessary, adjust.

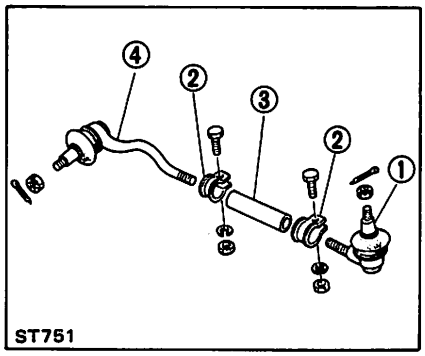
Refer to Section MA for adjustment.

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DISASSEMBLY

Side rod

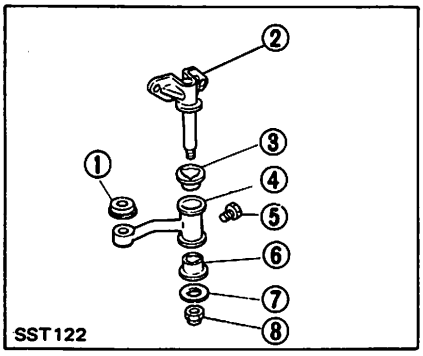
1. Remove both side rods from cross rod using **Tool** HT72520000.
2. Separate outer and inner ball joints from side rod adjusting tube.



1 Outer side rod assembly
2 Side rod clamp
3 Side rod adjusting tube
4 Inner side rod assembly

Idler arm assembly

Loosen nut, and separate each part.



1 Dust cover
2 Idler bracket
3 Idler arm bushing
4 Idler arm
5 Filler plug
6 Idler arm bushing
7 Plain washer
8 Nut

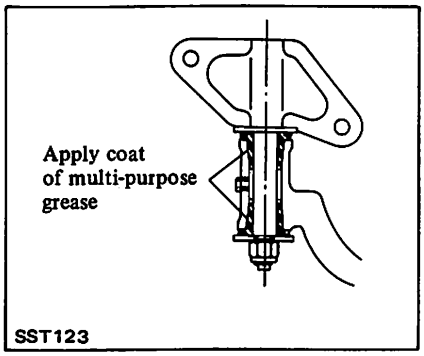
ASSEMBLY

Assemble steering linkage in the reverse order of disassembly, observing the following instructions.

Idler arm assembly

To assemble idler arm, proceed as follows:

1. Apply coat of multi-purpose grease to bushing.



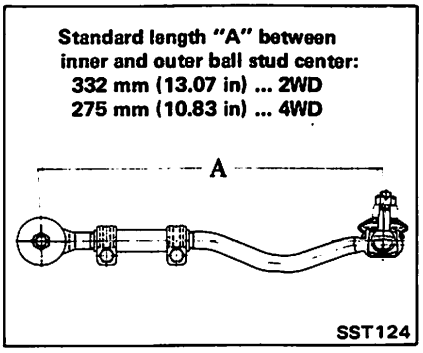
2. Press bushing into idler body, and insert shaft of idler bracket carefully until bushing protrudes.
3. Tighten nut.

Ⓣ : 54 - 69 N·m
(5.5 - 7.0 kg-m,
40 - 51 ft-lb)

Cross rod and side rod

1. When side rod ball joints and side rod bar are separated, adjust side rod length correctly.

Adjustment should be done between ball stud centers.



2. Tighten side rod clamp nut.

Ⓣ : 11 - 17 N·m
(1.1 - 1.7 kg-m,
8 - 12 ft-lb)

Lock side rod clamp nut so that ball joint on outer socket is 90° with respect to that on inner socket.

INSPECTION

Ball joint

1. When ball stud is worn or axial play exists, replace side rod socket with a new one.
2. When dust cover is broken or deformed, be sure to replace with a new one (rod assembly).

Initial turning torque:
Ball joint
1.0 - 4.9 N·m
(10 - 50 kg-cm,
8.7 - 43.4 in-lb)

Idler arm assembly

Check rubber bushing of idler arm for breakage, wear or play, and if necessary replace.

Apply grease to idler arm assembly at recommended intervals.

Cross rod and side rod

Check side rod and cross rod for breakage, bend or crack, and replace with a new one if necessary.

Fixing location

Check fixing location (nuts and cotter pins) for looseness, play or breakage. When looseness or play is found, check for wear on tapered portion of ball stud, gear arm of idler arm.

When reassembling each ball joint, use new cotter pins.

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

Steering column type	Solid
Steering gear type	VRB56L
Turns of steering wheel on the vehicle (Lock-lock)	4.5
Steering gear ratio	19.0 - 22.5

INSPECTION AND ADJUSTMENT

Model	2WD	4WD
Front wheel full turning angle degree Inner wheel	34° - 36°	29° - 33°
Outer wheel	30° - 32°	27° - 29°
Minimum turning radius m (ft) Standard wheelbase model	5.2 (17.1)	5.8 (19.0)
Long wheelbase model	5.6 (18.4)	6.2 (20.3)
Steering wheel axial play mm (in)	0 (0)	
Steering wheel play mm (in)	Less than 35 (1.38)	

STEERING GEAR

Worm bearing preload (With oil seal) N·m (kg-cm, in-lb)	0.39 - 0.59 (4.0 - 6.0, 3.5 - 5.2)	
Steering gear preload (With oil seal) N·m (kg-cm, in-lb)	New parts	0.83 - 1.23 (8.5 - 12.5, 7.4 - 10.9)
	Used parts	0.59 - 0.98 (6.0 - 10.0, 5.2 - 8.7)
Backlash at gear arm top end (In a straight-ahead position) mm (in)	0 - 0.1 (0 - 0.004)	
End play (Between sector shaft and adjusting screw) mm (in)	0.01 - 0.03 (0.0004 - 0.0012)	
Adjusting shim thickness	Thickness mm (in)	Part number
	1.575 - 1.600 (0.0620 - 0.0630)	48213 B0100
	1.550 - 1.575 (0.0610 - 0.0620)	48214 B0100
	1.525 - 1.550 (0.0600 - 0.0610)	48215 B0100
	1.500 - 1.525 (0.0591 - 0.0600)	48216 B0100
	1.475 - 1.500 (0.0581 - 0.0591)	48217 B0100
	1.450 - 1.475 (0.0571 - 0.0581)	48218 B0100
Oil capacity liters (US pt, Imp pt)	Approx. 0.33 (3/4, 5/8)	

STEERING LINKAGE

Model	2WD	4WD
Ball joint initial turning torque N·m (kg-cm, in-lb) New part	1.0 - 4.9 (10 - 50, 8.7 - 43.4)	
Used part	More than 1.0 (10, 8.7)	
Standard side rod length mm (in)	Approx. 332 (13.07)	Approx. 275 (10.83)

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TIGHTENING TORQUE

STEERING COLUMN

Unit	N·m	kg-m	ft-lb
Steering wheel nut	39 - 49	4.0 - 5.0	29 - 36
Jacket tube bracket to dash panel	2.9 - 4.3	0.30 - 0.44	2.2 - 3.2
Steering column mounting bracket	9 - 11	0.9 - 1.1	6.5 - 8.0
Worm shaft to coupling	39 - 49	4.0 - 5.0	29 - 36

STEERING GEAR

Unit	N·m	kg-m	ft-lb
Steering gear housing to body side frame	84 - 96	8.6 - 9.8	62 - 71
Sector shaft to gear arm	127 - 147	13 - 15	94 - 108
Adjusting plug lock nut	245 - 314	25 - 32	181 - 231
Sector shaft cover bolt	15 - 25	1.5 - 2.5	11 - 18
Sector shaft adjusting screw lock nut	29 - 39	3.0 - 4.0	22 - 29

STEERING LINKAGE

Unit	N·m	kg-m	ft-lb
Idle arm to body side frame	49 - 69	5.0 - 7.0	36 - 51
Ball stud nut	54 - 98	5.5 - 10.0	40 - 72
Idle arm nut	54 - 69	5.5 - 7.0	40 - 51
Side rod bar clamp nut	11 - 17	1.1 - 1.7	8 - 12

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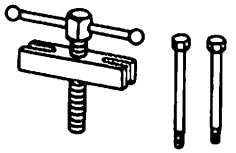
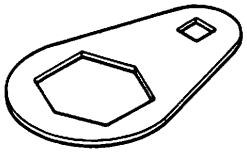
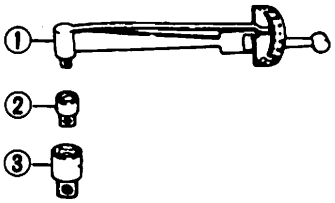
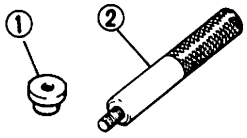
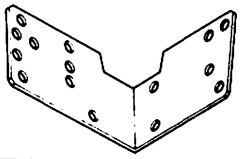
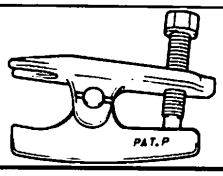
TROUBLE DIAGNOSES AND CORRECTIONS

Except for the following probable causes and corrective actions, refer to Trouble Diagnoses and Corrections in Front Axle and Front Suspension section.

Condition	Probable cause	Corrective action
Excessive wheel play.	Insufficiently tightened or improperly installed steering gear housing.	Retighten.
	Damaged steering linkage or ball joint.	Replace faulty parts.
	Incorrect adjustment of steering gear.	Adjust.
Vibration, shock or shimmying of steering wheel.	Insufficiently tightened or improperly installed steering gear housing.	Retighten.
	Wear of steering linkage.	Replace faulty parts.
	Damaged idler arm.	Replace.
	Worn column bearing, weakened column bearing spring, or loose clamp.	Replace or retighten.
Vehicle pulls to right or left.	Deformed steering linkage and/or suspension link.	Replace.
Stiff or heavy steering wheel.	Insufficient lubricants or mixing impurities in steering linkage or excessively worn steering linkage.	Replenish grease or replace the part.
	Worn or damaged steering gear and bearing.	Replace.
	Incorrectly adjusted steering gear.	Adjust.
	Deformed steering linkage.	Replace.
	Interference of steering column with turn signal switch.	Adjust.

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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name	
ST27180001 (J25726)	Steering wheel puller	
ST29020001 (J25725)	Steering gear arm puller	
KV48101500 (J28802)	Lock nut wrench	
KV48101400 (J28803)	Adjusting plug wrench	
ST3127S000 (See J25765) ① GG91030000 (See J25765) ② HT62940000 (–) ③ HT62900000 (–)	Preload gauge Torque wrench Socket adapter Socket adapter	
① ST35322000 (–) ② ST35325000 (–)	Front wheel bearing drift Drift bar	
KV48100301 (–)	Strut & steering gear box attachment	
HT72520000 (–)	Ball joint remover	

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SECTION BF

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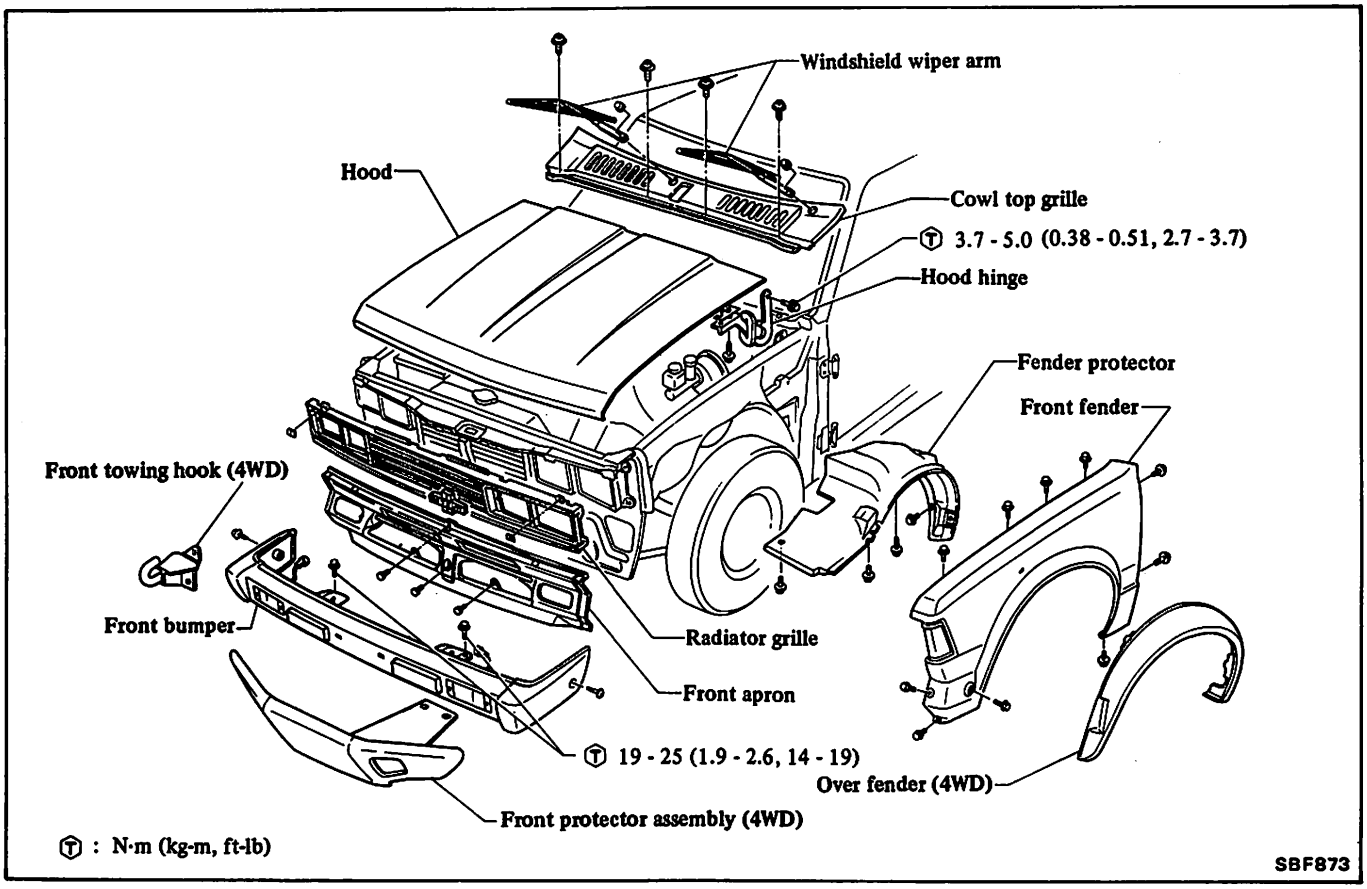
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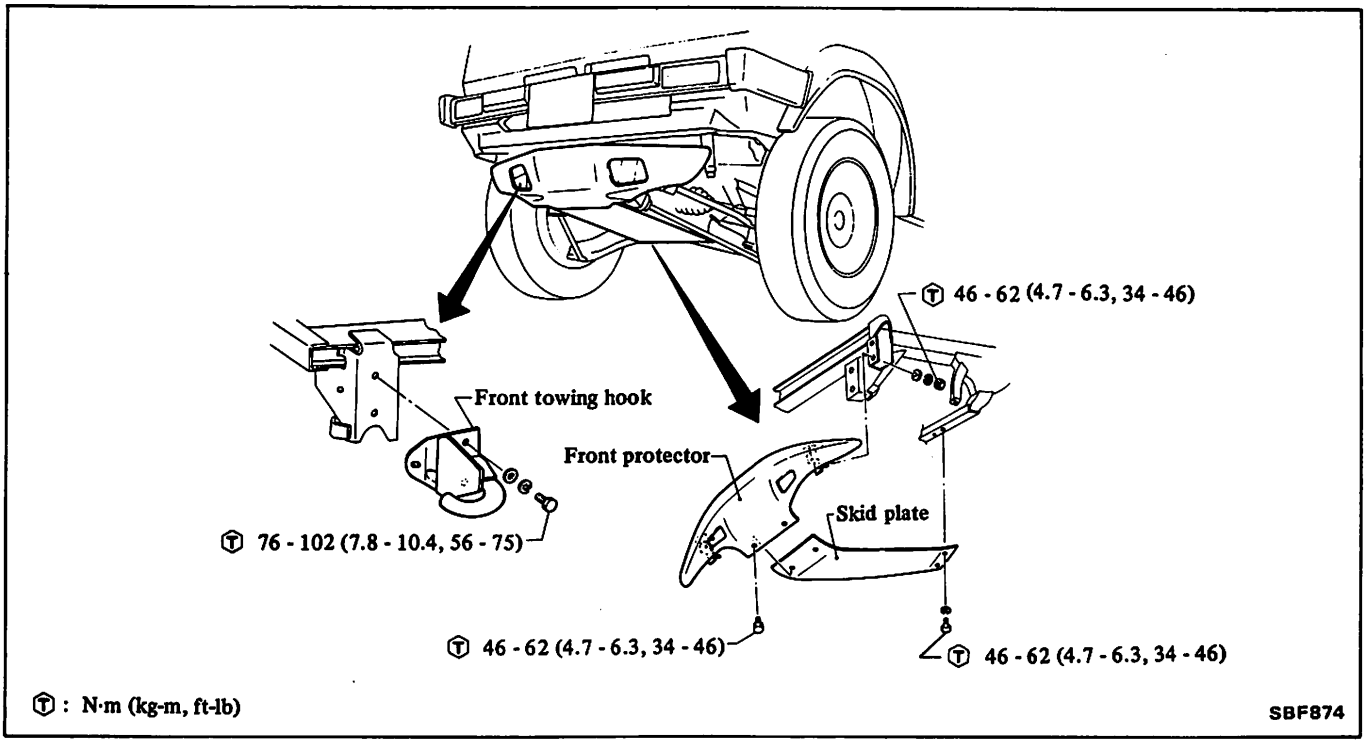
SPECIAL SERVICE TOOLS BF-30

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BODY FRONT END

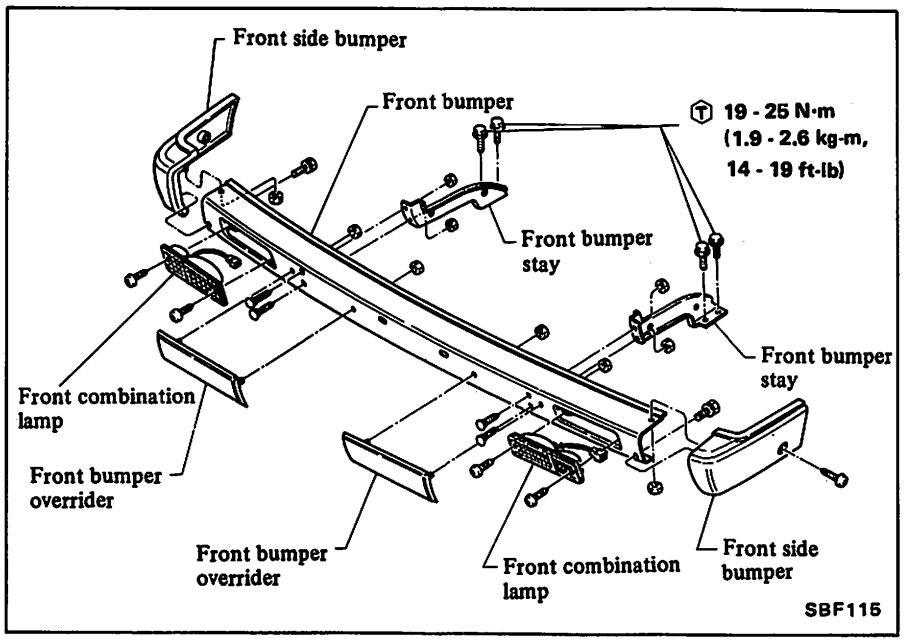


FRONT PROTECTOR ASSEMBLY AND TOWING HOOK (4WD)



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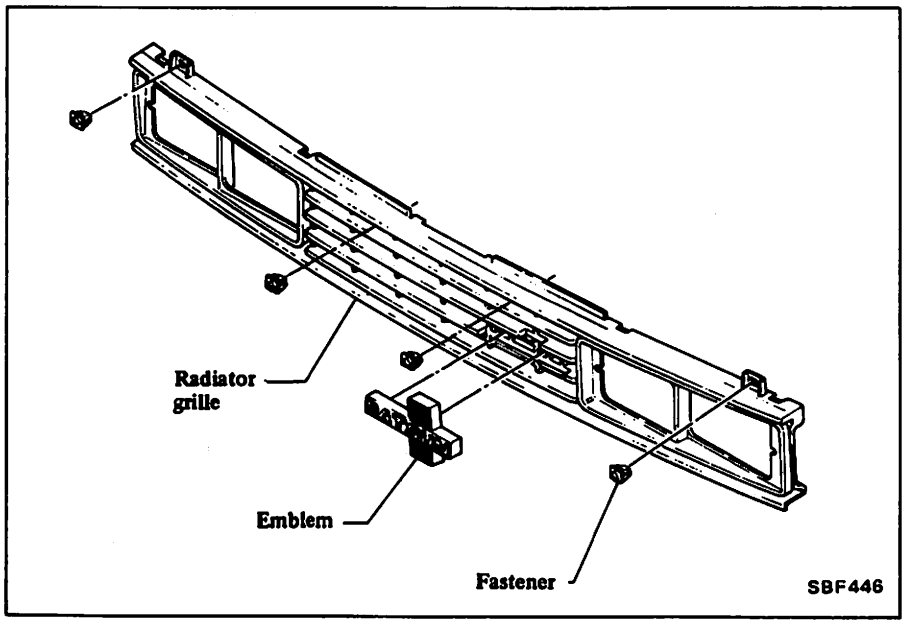
FRONT BUMPER



REMOVAL AND INSTALLATION

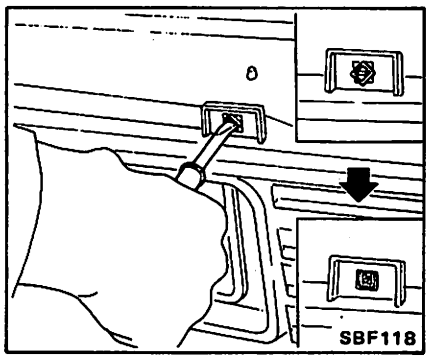
1. Disconnect battery ground cable.
2. Remove front bumper attaching bolts, and disconnect front combination lamp harness, and then remove front bumper assembly.
3. Installation is in reverse order of removal.

RADIATOR GRILLE



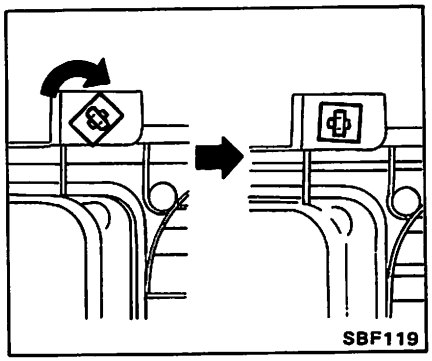
REMOVAL

Turn fasteners a quarter turn with a conventional screwdriver, and then remove radiator grille.



INSTALLATION

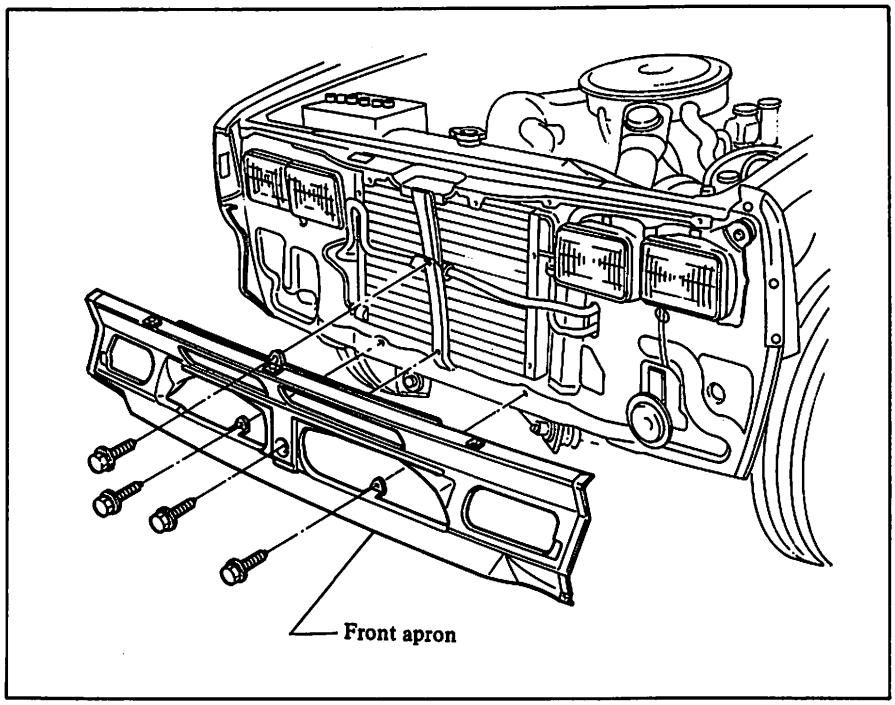
1. Set fasteners in radiator grille from the back, and turn them a quarter turn.



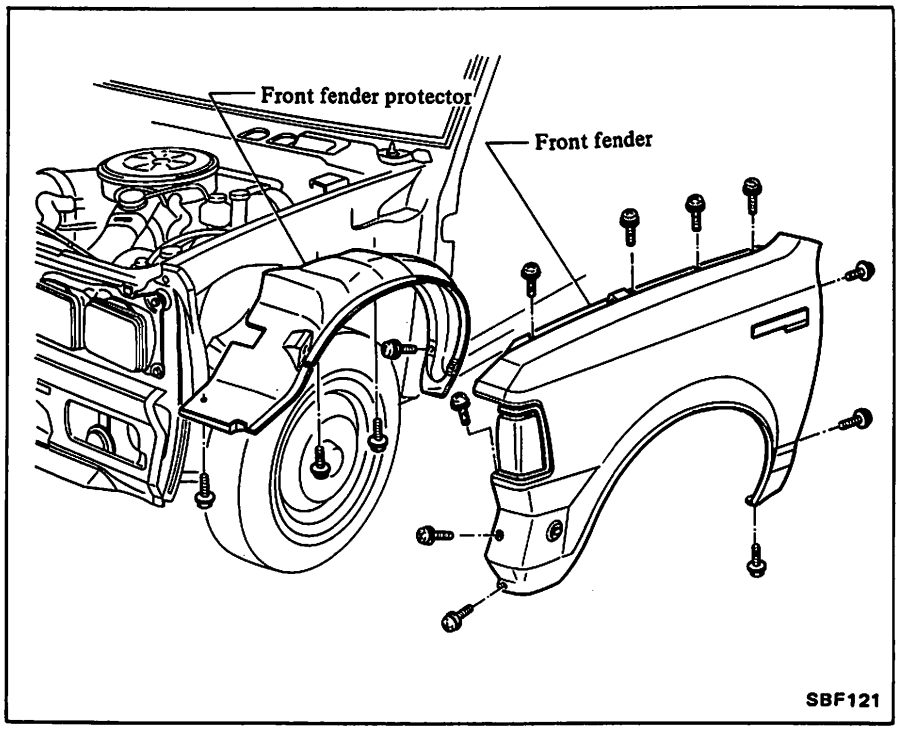
2. Install radiator grille.

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FRONT APRON



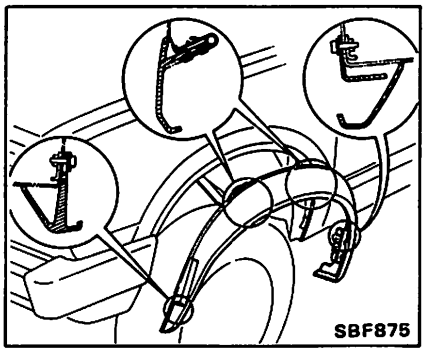
FRONT FENDER



REMOVAL AND INSTALLATION

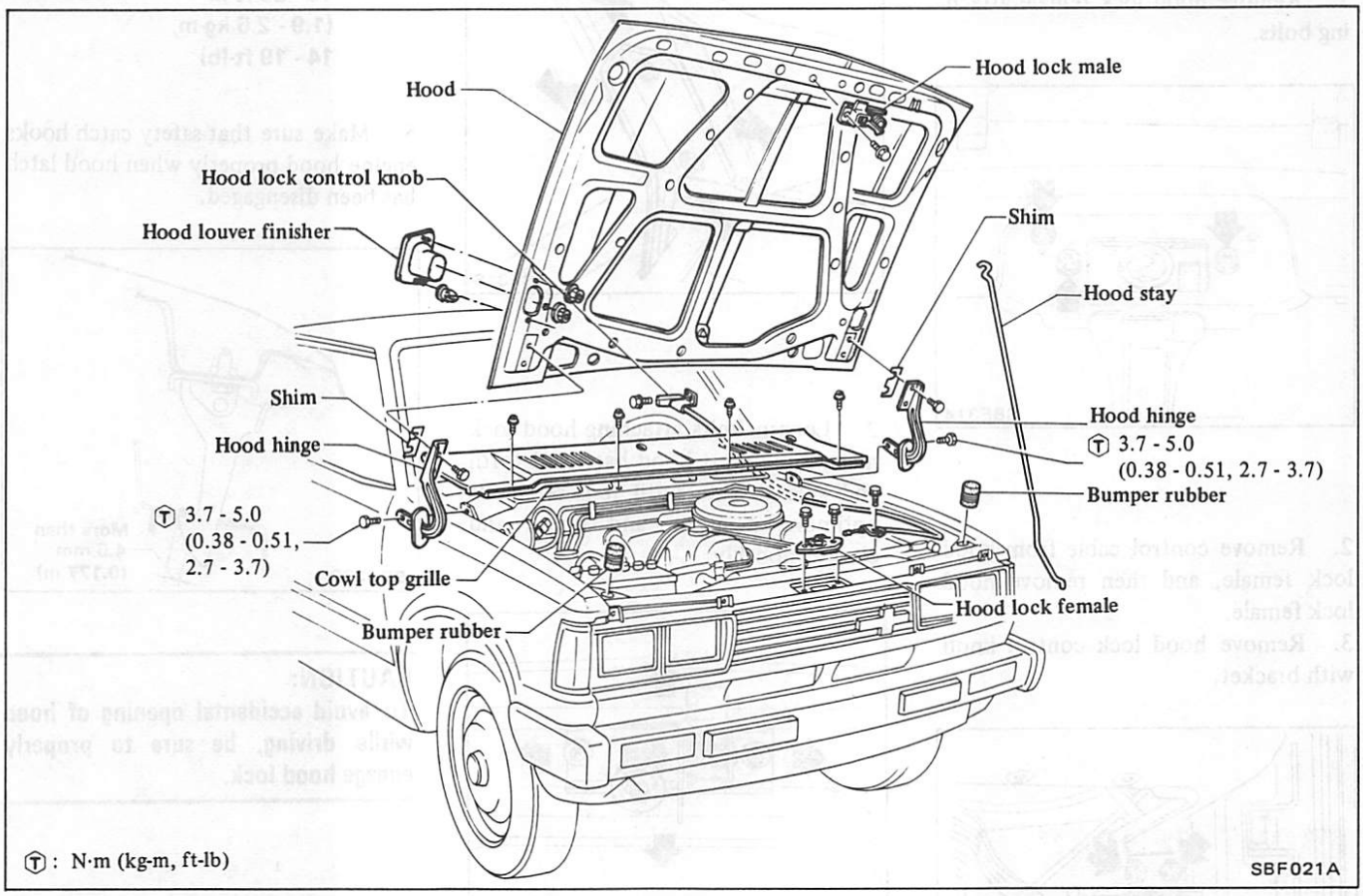
1. Disconnect battery ground cable.
2. Remove front bumper. Refer to Front Bumper.
3. Remove front fender protector.
4. Disconnect side marker lamp harness, and remove front fender.
5. Installation is in reverse order of removal.

OVERFENDER (4WD)



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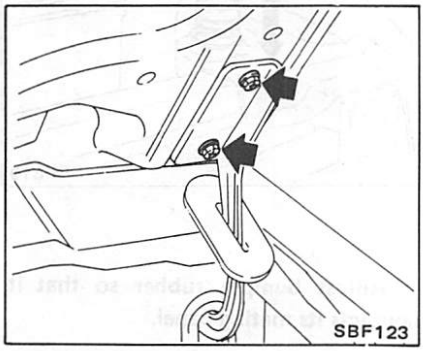
HOOD



REMOVAL AND INSTALLATION

Hood

1. Support hood and remove bolts attaching hood to hinge. Then remove hood.

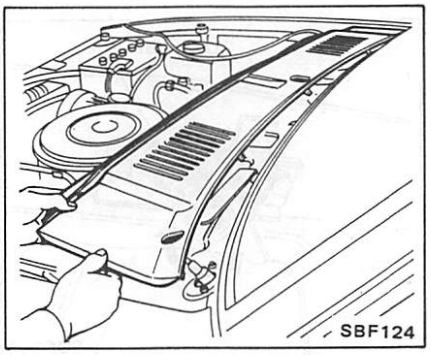


2. Installation is in reverse order of removal.

Adjust hood. Refer to Adjustment.

Cowl top grille

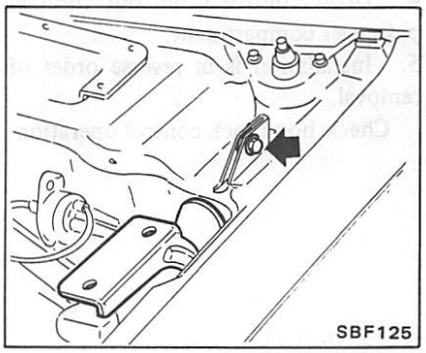
1. Remove hood.
2. Remove windshield wiper arms.
3. Remove cowl top grille fasteners and then remove cowl top grille.



4. Installation is in reverse order of removal.

Hinge

1. Remove hood.
2. Remove windshield wiper arms and cowl top grille.
3. Remove hood hinge pin, and then remove hood hinge.

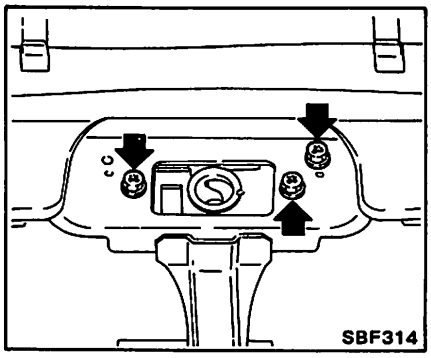


4. Installation is in reverse order of removal.

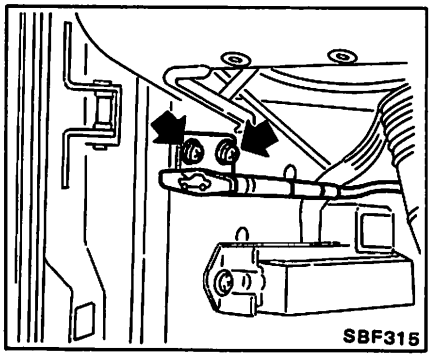
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Lock and lock control

1. Remove hood lock female attaching bolts.



2. Remove control cable from hood lock female, and then remove hood lock female.
3. Remove hood lock control knob with bracket.



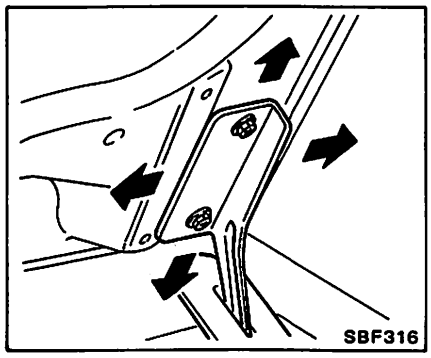
4. Draw control cable out through passenger compartment.
5. Installation is in reverse order of removal.

Check hood lock control operation.

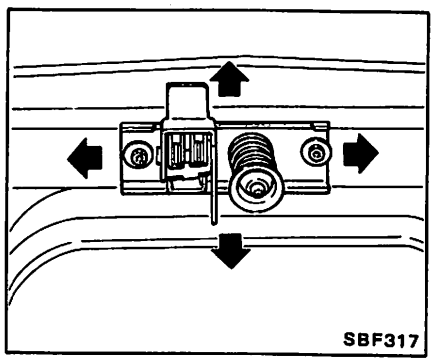
ADJUSTMENT

Hood and lock

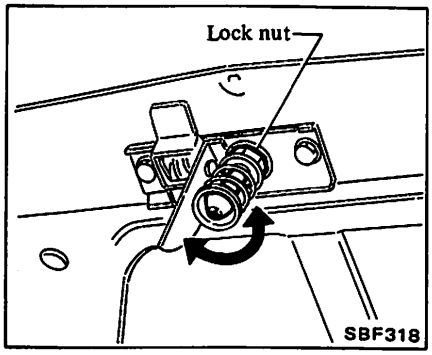
1. Loosen bolts attaching hood hinge. Adjust hood back and forth and side to side until it is set in its optimum position.



2. Loosen bolts attaching hood lock male, and adjust hood back and forth and side to side until it is set in its optimum position, and opens and closes smoothly.



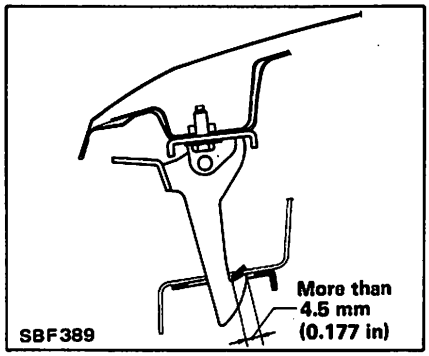
3. Loosen lock nut on dovetail bolt and turn dovetail bolt in or out as necessary to obtain a correct height.



4. Tighten lock nut firmly while holding dovetail bolt with a screwdriver to secure adjustment.

Ⓣ : Dovetail lock nut
19 - 25 N·m
(1.9 - 2.6 kg-m,
14 - 19 ft-lb)

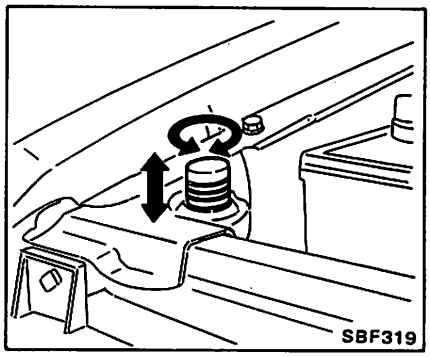
5. Make sure that safety catch hooks engine hood properly when hood latch has been disengaged.



CAUTION:
To avoid accidental opening of hood while driving, be sure to properly engage hood lock.

Bumper rubber

Adjust bumper rubber height so that hood is nearly flush with front fender.

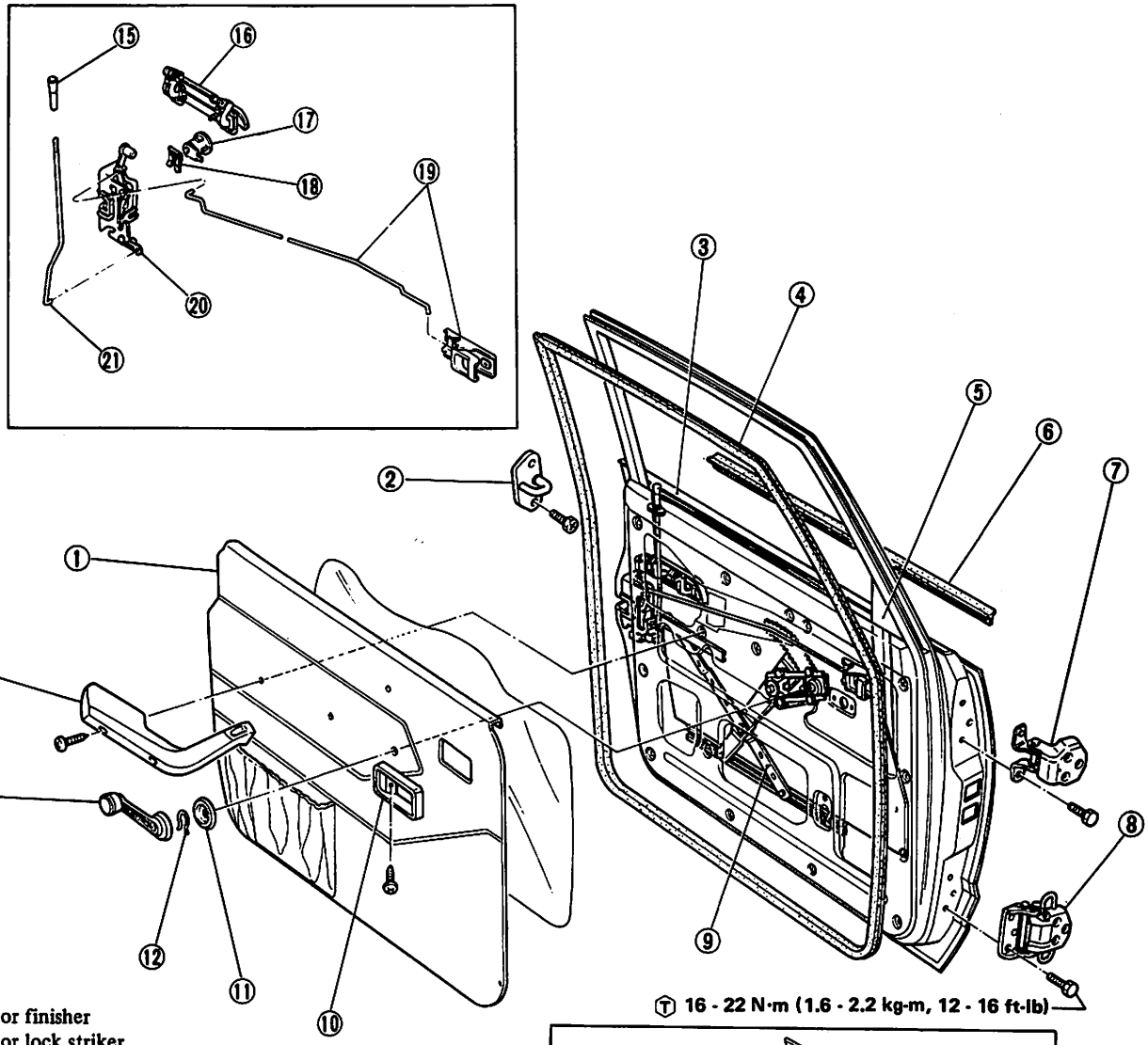


Adjust bumper rubber so that it contacts its mating panel.

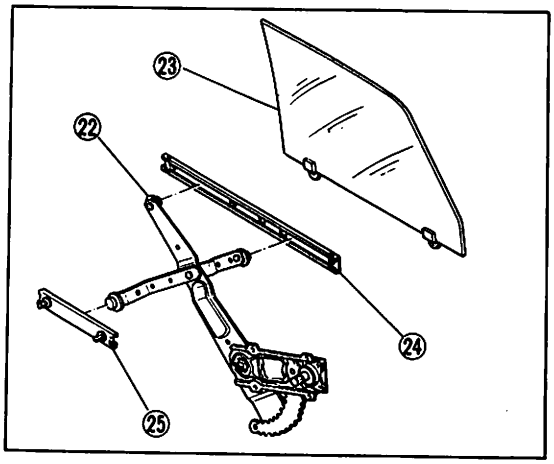
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DOORS

FRONT DOOR



1 Door finisher
2 Door lock striker
3 Door
4 Weatherstrip
5-1 Lower sash
5-2 Ventilator frame (with ventilator model only)
6 Outer side weatherstrip
7 Upper hinge
8 Lower hinge
9 Regulator assembly
10 Remote control escutcheon
11 Regulator seating washer
12 Retaining spring
13 Regulator door handle
14 Arm rest
15 Door lock knob
16 Outside handle
17 Door lock cylinder
18 Retaining clip
19 Remote control assembly
20 Door lock assembly
21 Door lock rod
22 Regulator
23 Door glass
24 Guide channel A
25 Guide channel B



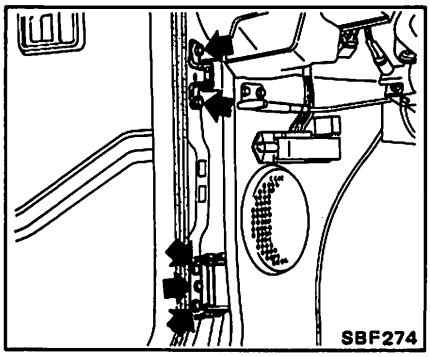
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REMOVAL AND INSTALLATION

Front door assembly

1. Remove front door.

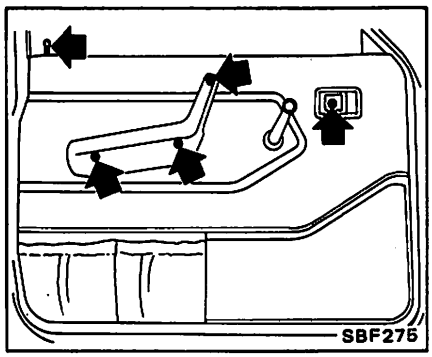


2. Installation is in reverse order of removal.

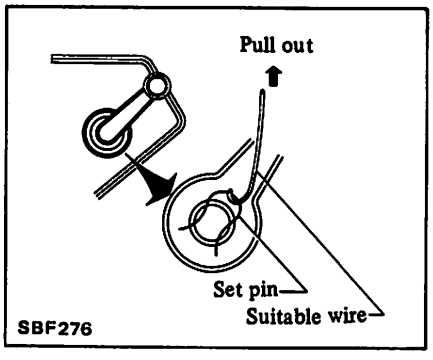
Adjust Door. Refer to Adjustment.

Front door trim

1. Lower door glass fully.
2. Remove arm rest, door lock knob and inside door handle escutcheon.

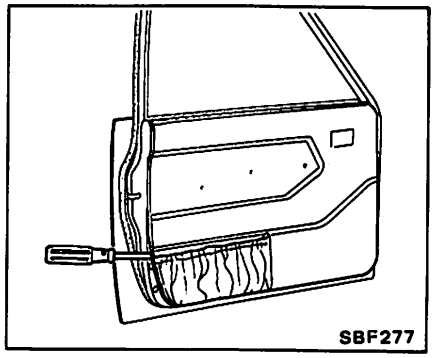


3. Remove regulator handle.



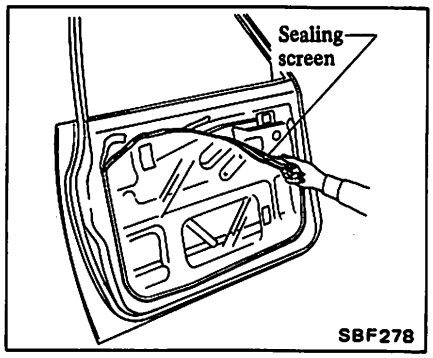
4. Remove door finisher.

When retaining clips from door inner panel, pry door finisher using suitable tool.

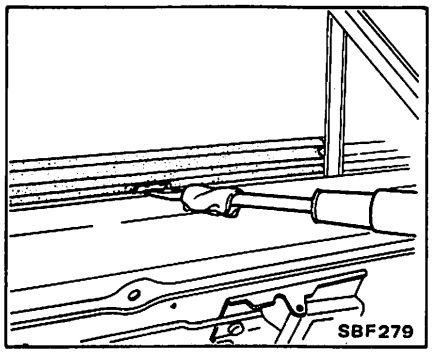


5. Remove sealing screen.

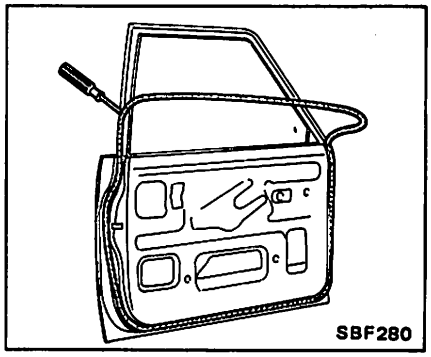
When removing sealing screen, allow bonding agent to contact any adjacent parts.



6. Remove door outer side weatherstrip **using suitable tool.**

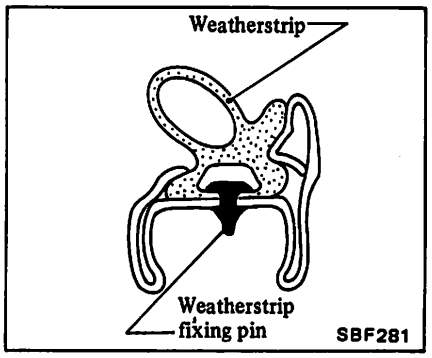


7. Remove door weatherstrip **using suitable tool.**

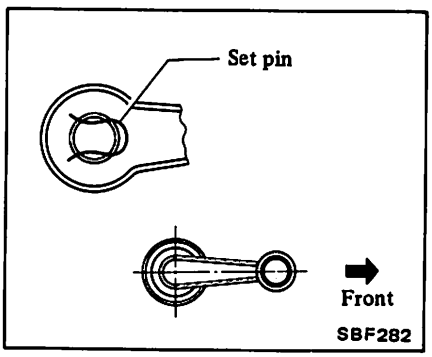


8. Installation is in reverse order of removal.

- When installing weatherstrip pin on door, insert it completely.



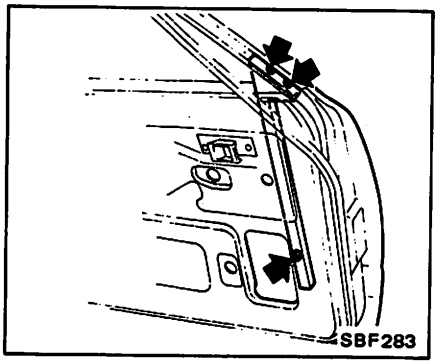
- To avoid water or dust leakage through inner door into passenger compartment, securely attach sealing screen with tape or bonding agent.
- Position regulator handle with door glass closed as shown in figure, securing it with set pin.



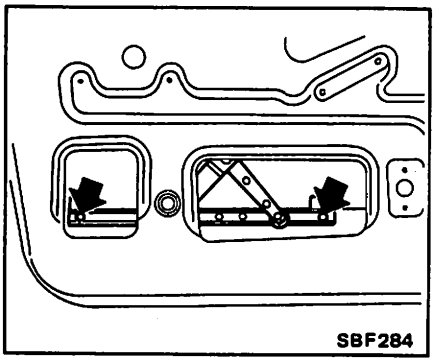
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Door glass and regulator

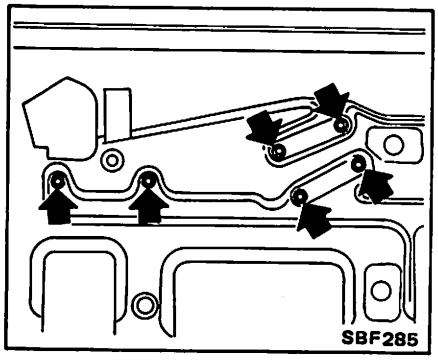
1. Remove front door trim.
2. Remove front door lower sash or front door ventilator frame (Equipped with front door ventilator model).



3. Remove front door glass fixing bolt from regulator assembly.



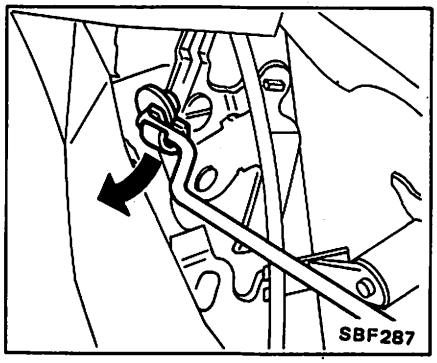
4. Raise door glass and then draw it upwards.
5. Remove regulator assembly fixing bolt from door inner panel.



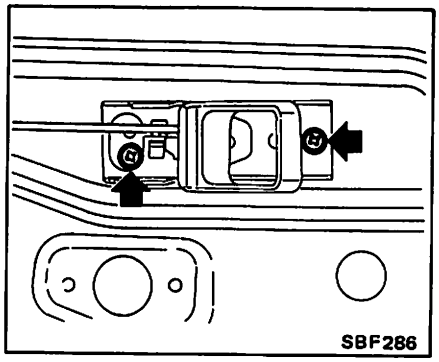
6. Remove regulator assembly through large access hole in door inside panel.
7. Installation is in reverse order of removal.
8. Adjust door glass and regulator. **Refer to Adjustment.**

Door lock and lock control

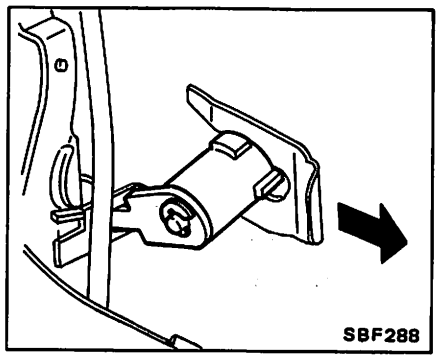
1. Remove front door trim.
2. Disengage rod holder from inside handle unlock rod.



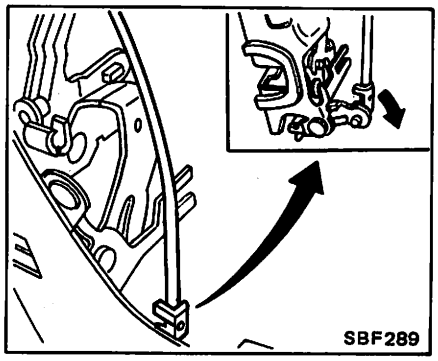
3. Remove door inside handle.



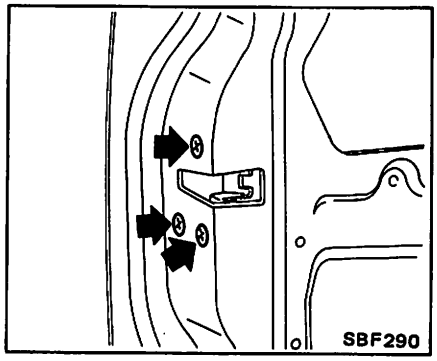
4. Remove door lock cylinder.



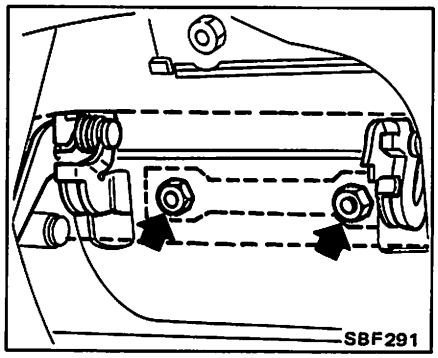
5. Disengage rod holder from door lock rod.



6. Remove door lock assembly.



7. Remove front door outside handle.



8. Installation is in reverse order of removal.

Apply grease to sliding surfaces of levers and springs.

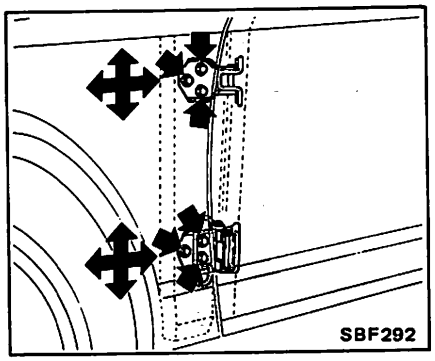
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ADJUSTMENT

Front door assembly

Door should be adjusted for an even and parallel fit with the door opening and surrounding body panel.

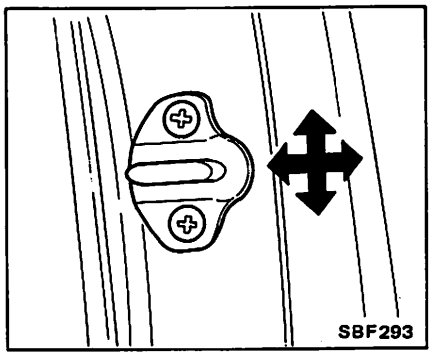
1. Loosen door lock striker fixing screws.
2. Remove front fender protector.
3. Loosen door hinge fixing bolts from front pillar and then adjust door for an even and parallel fit with the door opening and surrounding body panel.


SBF292

4. Tighten door hinge fixing bolts.

Ⓣ : **16 - 22 N·m (1.6 - 2.2 kg-m, 12 - 16 ft-lb)**

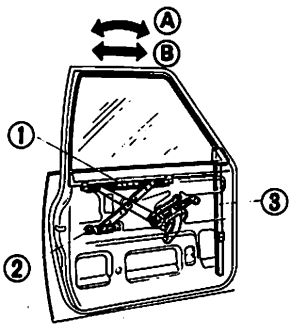
5. Adjust door lock striker on lock position.

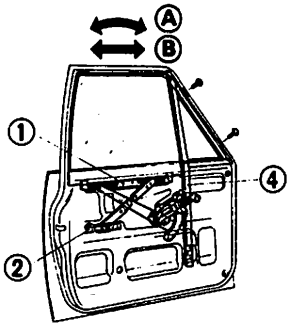

SBF293

Front door glass

Door window glass alignment can be performed by adjusting guide channels A and B, and front door lower sash or front door ventilator frame (Equipped with front door ventilator model).

Partially tighten guide channels A and B and front door lower sash or front door ventilator frame (Equipped with front door ventilator model).


SBF294

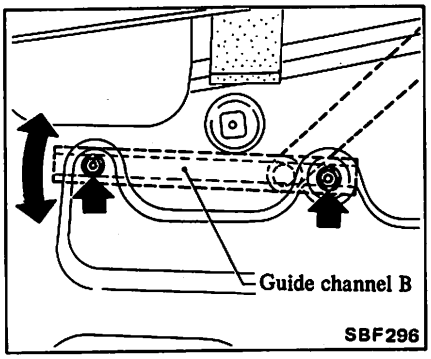

SBF295

1 Guide channel A
2 Guide channel B
3 Front door lower sash
4 Front door ventilator frame

Ⓐ Tilt adjustment
Ⓑ Fore and back adjustment

Ⓐ Tilt adjustment

1. Loosen guide channel B fixing nuts.



SBF296

2. While fully raised, adjust tilt of door window using adjustment portion at channel B.

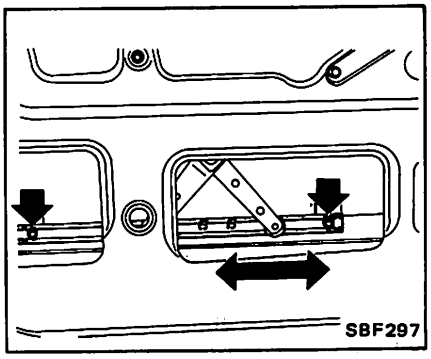
Ensure that upper edge of door glass is parallel to upper sash.

3. After adjusting, tighten guide channel B fixing nuts.

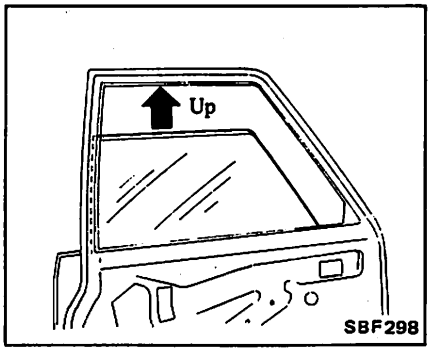
Ⓣ : **3.7 - 5.0 N·m (0.38 - 0.51 kg-m, 2.7 - 3.7 ft-lb)**

Ⓑ Fore-and-aft adjustment

1. Loosen guide channel A and door glass fixing bolts.


SBF297

2. Adjust door glass firmly into the rear edge and upper rear corner of rear glass run rubber.



SBF298

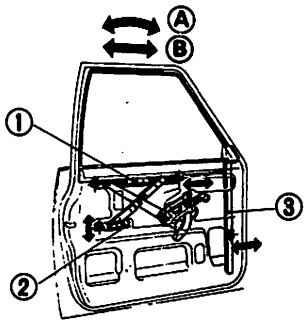
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3. After adjusting, tighten guide channel A and door glass fixing bolts.

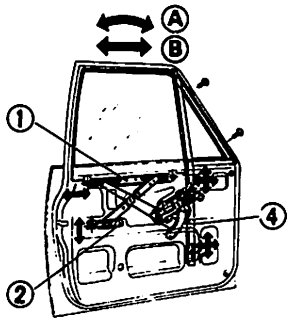
Ⓣ : **3.7 - 5.0 N·m (0.38 - 0.51 kg-m, 2.7 - 3.7 ft-lb)**

Sliding resistance adjustment

1. Loosen front door lower sash or front door ventilator frame (Equipped with front door ventilator model) fixing bolts.



SBF299



SBF300

1 Guide channel A
2 Guide channel B
3 Front door lower sash
4 Front door ventilator frame

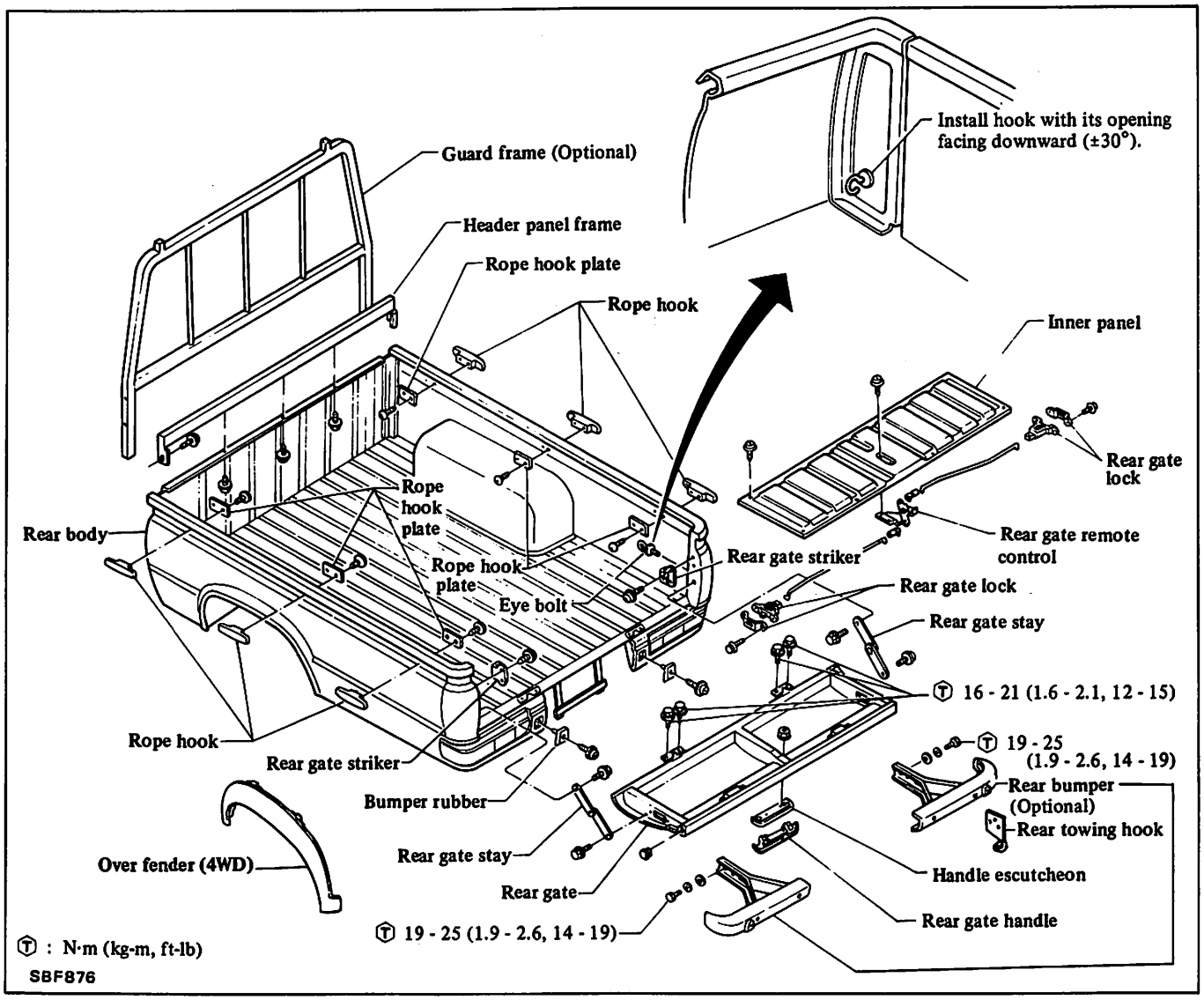
Ⓐ **Tilt adjustment**
Ⓑ **Fore and back adjustment**

2. With cycle door glass up and down, adjust it for smoothly up and down.
3. After adjusting, tighten front door lower sash or front door ventilator frame (Equipped with front door ventilator model) fixing bolts.

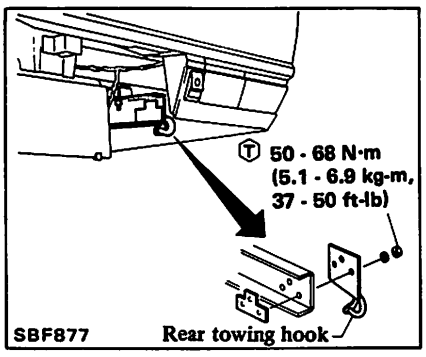
Ⓣ : **3.7 - 5.0 N·m (0.38 - 0.51 kg-m, 2.7 - 3.7 ft-lb)**

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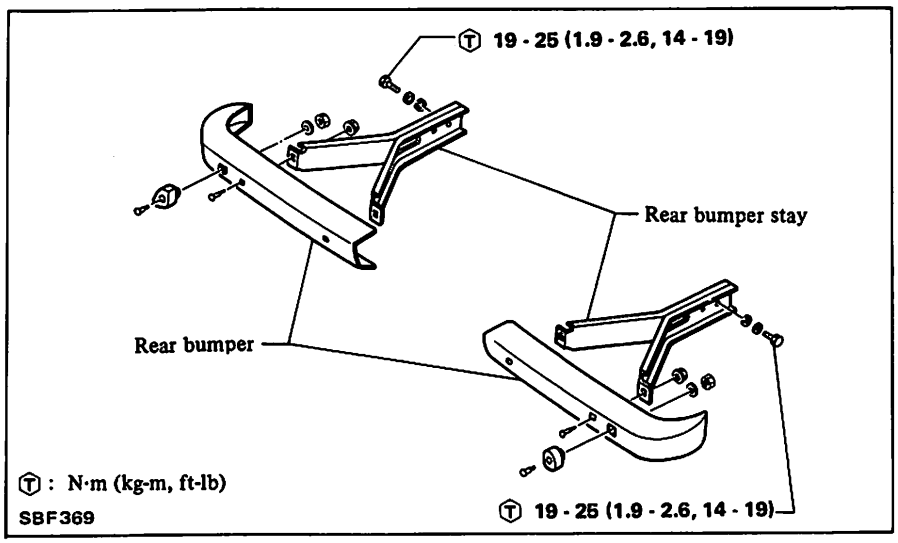
BODY REAR END



TOWING HOOK (4WD)

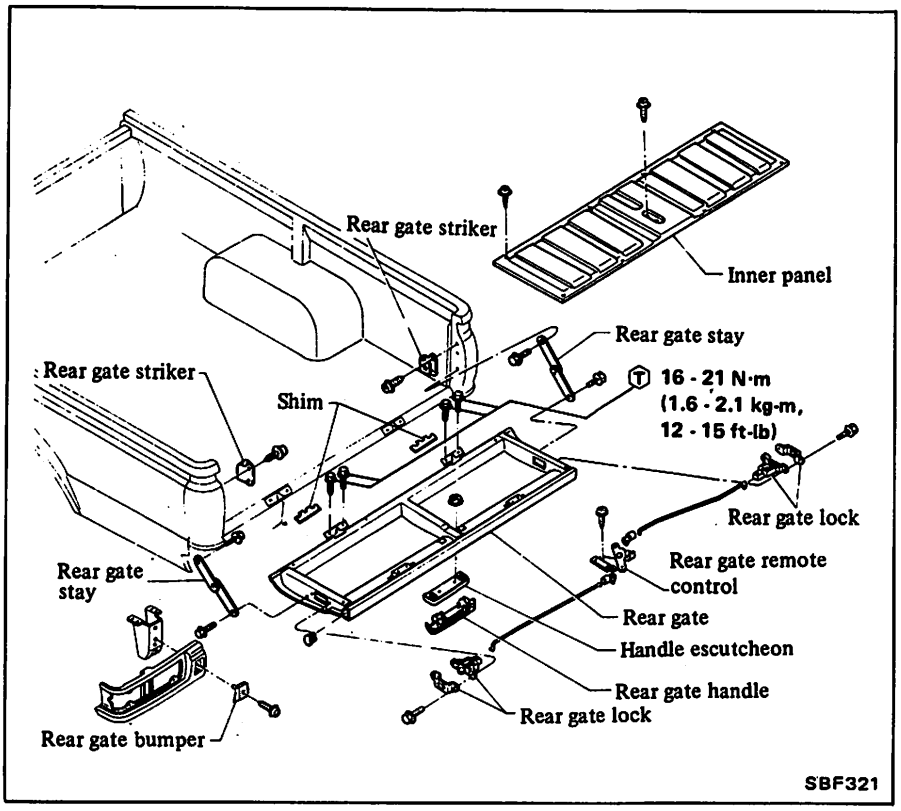


REAR BUMPER (Optional)



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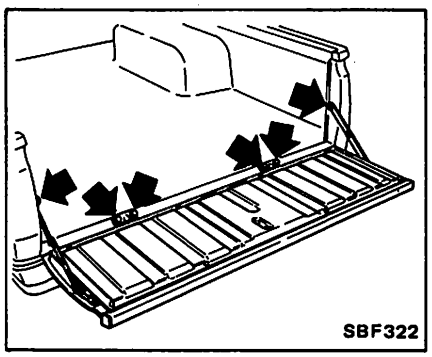
REAR GATE



REMOVAL AND INSTALLATION

Rear gate

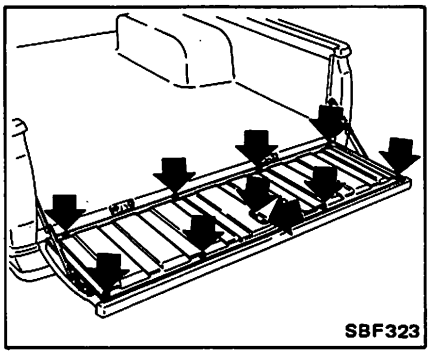
1. Remove rear gate stay and rear gate hinge attaching bolts, and then remove rear gate.



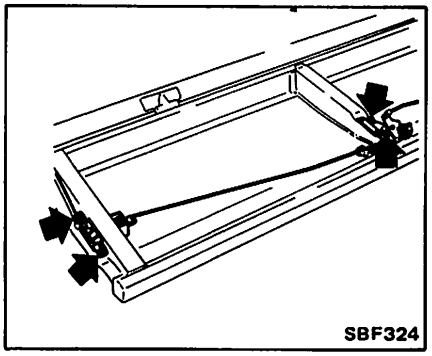
2. Installation is in reverse order of removal.

Lock and lock control

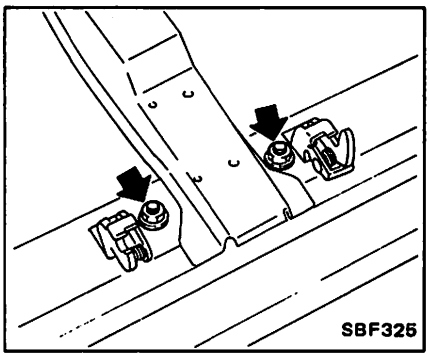
1. Remove inner panel.



2. Remove rear gate lock and remote control.

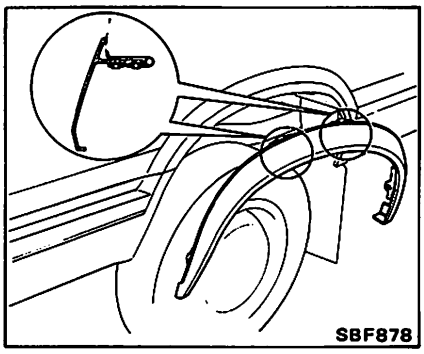


3. Remove rear gate handle and handle escutcheon.



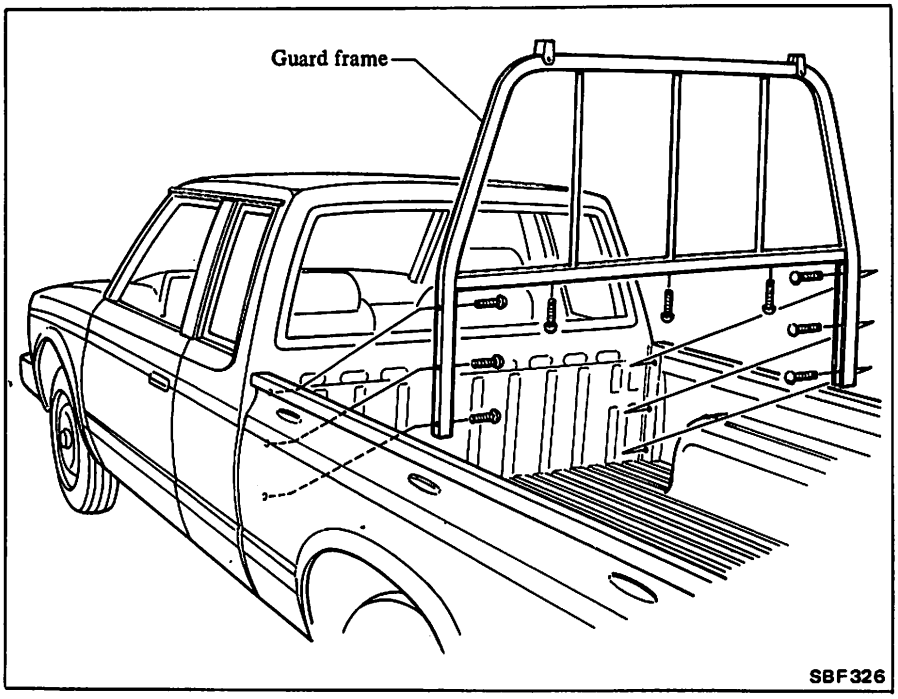
4. Installation is in reverse order of removal.

OVERFENDER (4WD)



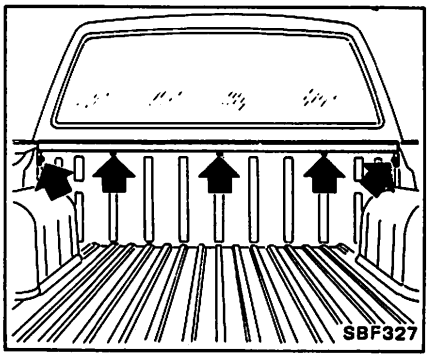
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GUARD FRAME (Optional)

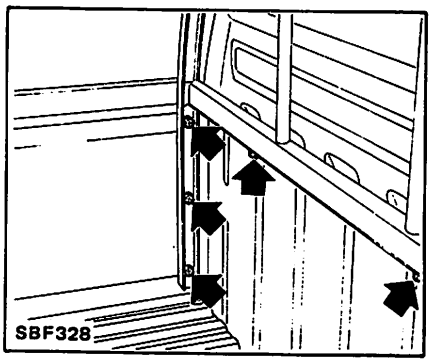


INSTALLATION

1. Remove header panel frame.



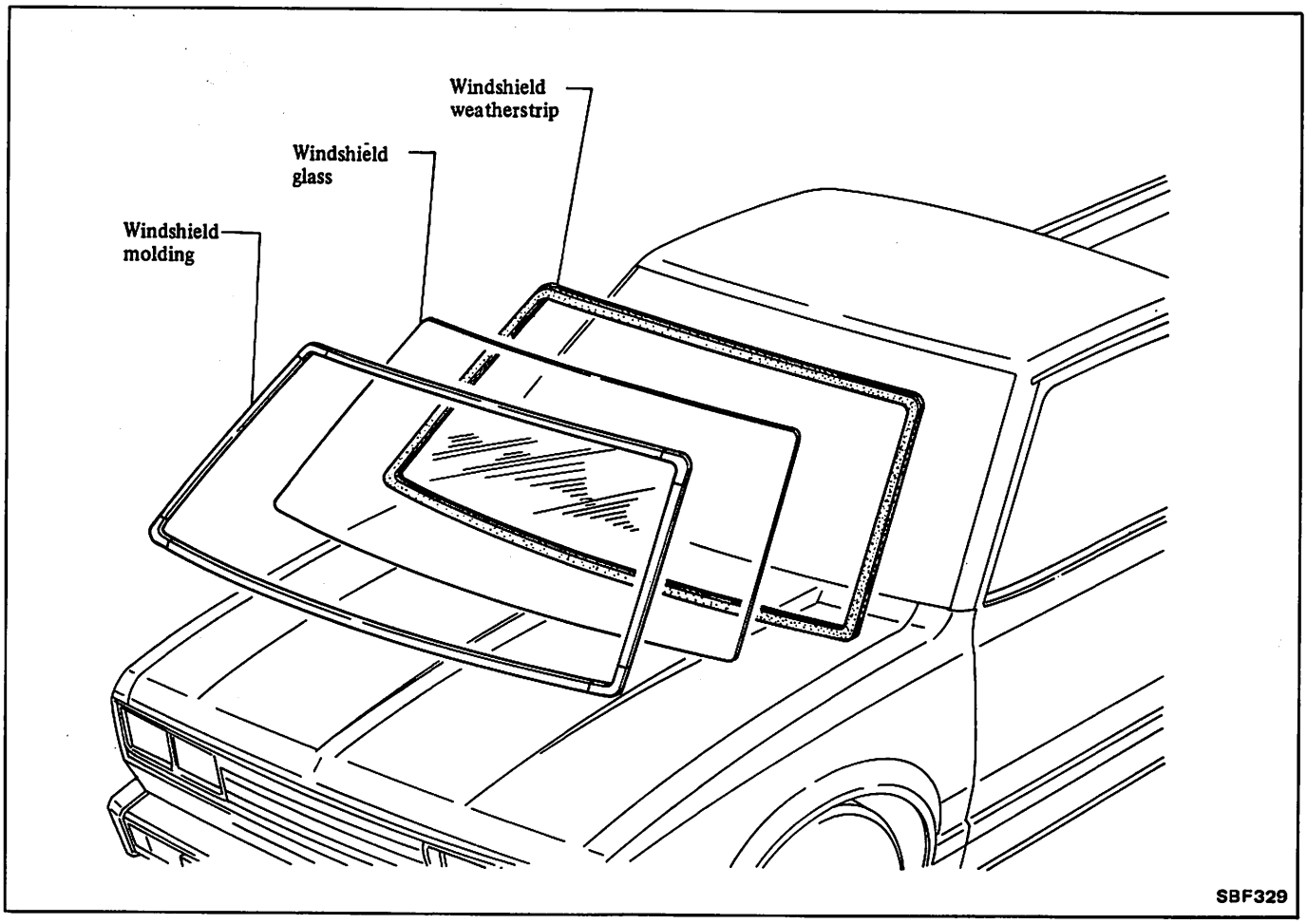
2. Install guard frame.



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WINDSHIELD AND WINDOWS

WINDSHIELD

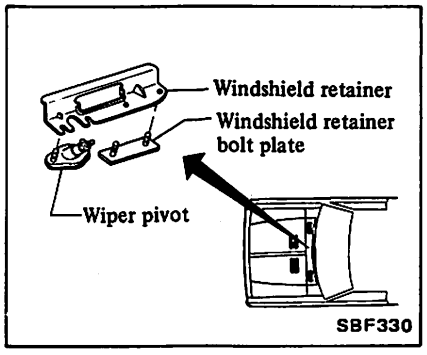


REMOVAL

1. Protect hood, front fenders, instrument panel and front seats with covers.
2. Remove windshield wiper arms.
3. Remove windshield moldings by prying them out.

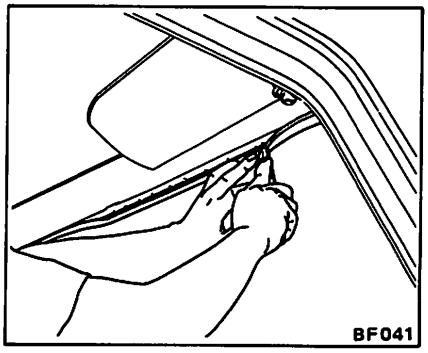
CAUTION:
Be careful not to deform the molding.

4. Remove cowl top grille, and then remove windshield ratainer (if so equipped).



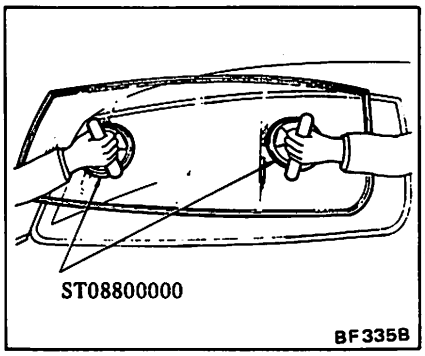
5. Attach Tool ST08800000 on windshield glass.
6. Detach adhesive on the windshield flange side by applying a spatula or conventional screwdriver from the outside.
7. Depressing weatherstrip toward outside, lightly tap and remove windshield glass to the outside.

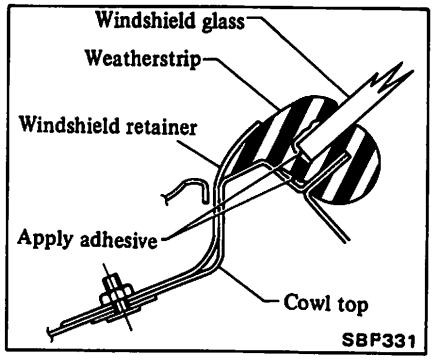
Windshield glass should be removed from the upper side.

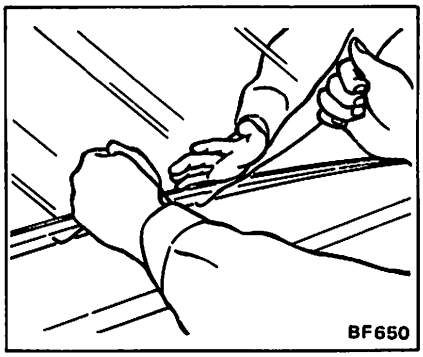


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8. After windshield weatherstrip is free from body flange, with aid of a helper, remove windshield glass.



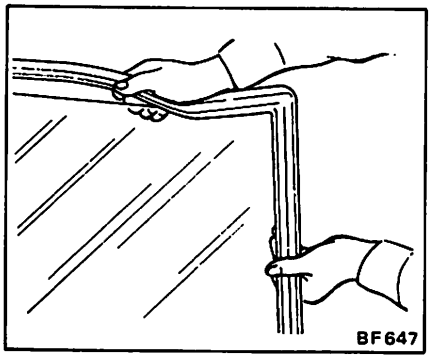




INSTALLATION

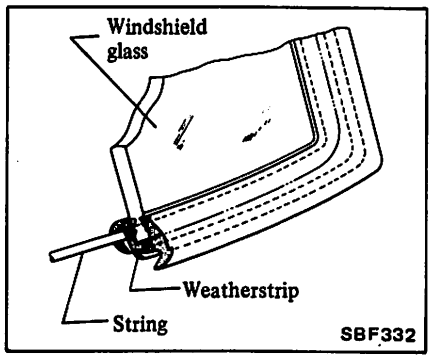
CAUTION:
Care should be exercised to make certain glass does not strike body metal during installation. Edge chips can lead to future breaks.

1. Clean out old adhesive in glass cavity of windshield.
2. Install weatherstrip to glass.



3. Apply adhesive to appropriate portions of weatherstrip as shown below.

4. Insert a strong cord in the groove of weatherstrip where body flange fits.



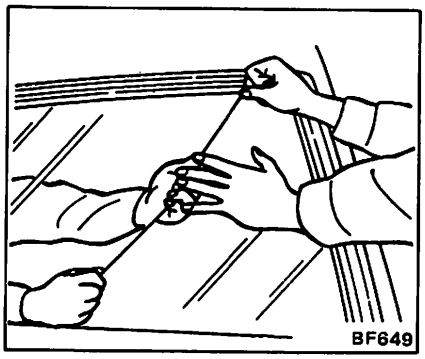
Tie ends of cord and tape to inside surface of glass at bottom center of glass.

5. Position and center windshield glass assembly in body opening.

Do not position glass by tapping or hammering at any time.

6. When glass and weatherstrip are properly positioned in body opening, slowly pull ends of cord, starting at lower center of windshield to seat lip of weatherstrip over body flange.

7. Cord should be pulled first across bottom of windshield, then up each side and finally across windshield top.

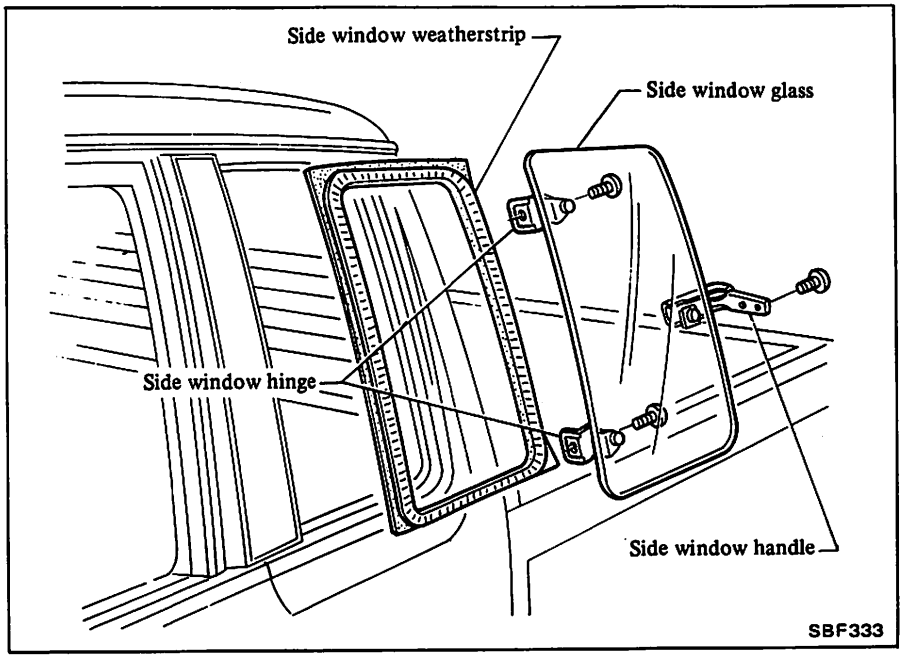


a. **The operation should be carried out by two persons; one works outside and the other inside.**
b. **If the weatherstrip is not fitted into the flange correctly but mounted on the flange, correctly fit the weatherstrip into the flange by the use of a spatula.**

8. Install all previously removed parts.

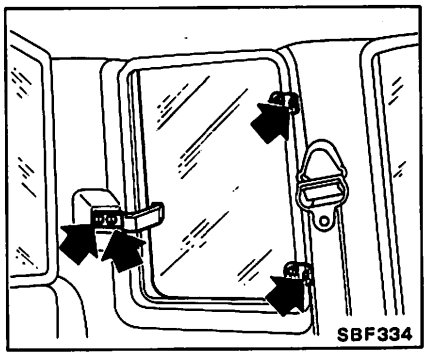
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SIDE WINDOW (King Cab)



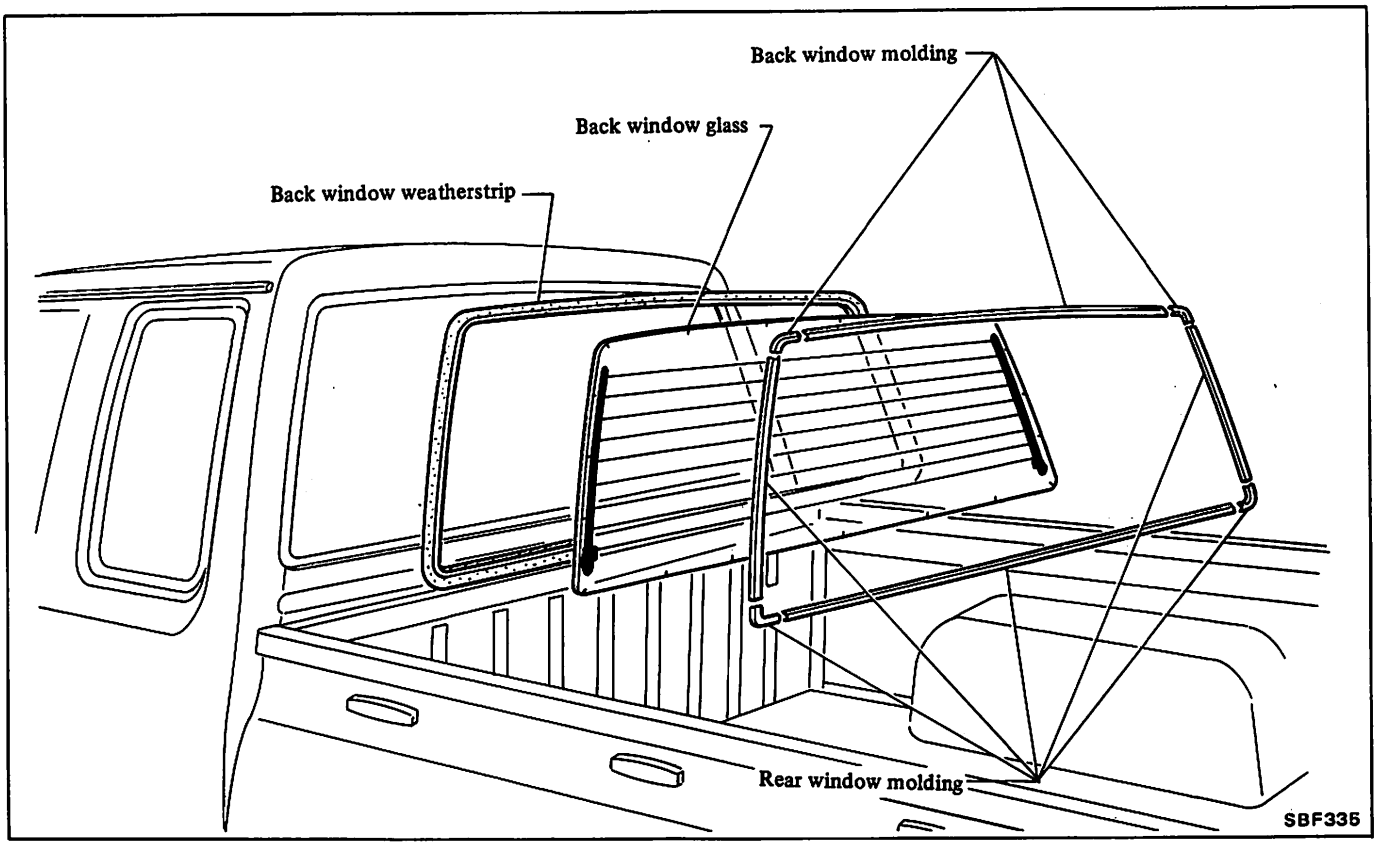
REMOVAL AND INSTALLATION

1. Remove side window assembly attaching screws, and then remove side window assembly.



2. Remove side window weatherstrip.
3. Installation is in reverse order of removal.

BACK WINDOW



REMOVAL AND INSTALLATION

The instructions for windshield glass apply also to back window glass, with the exception that adhesive is not applied for back window weatherstrip.

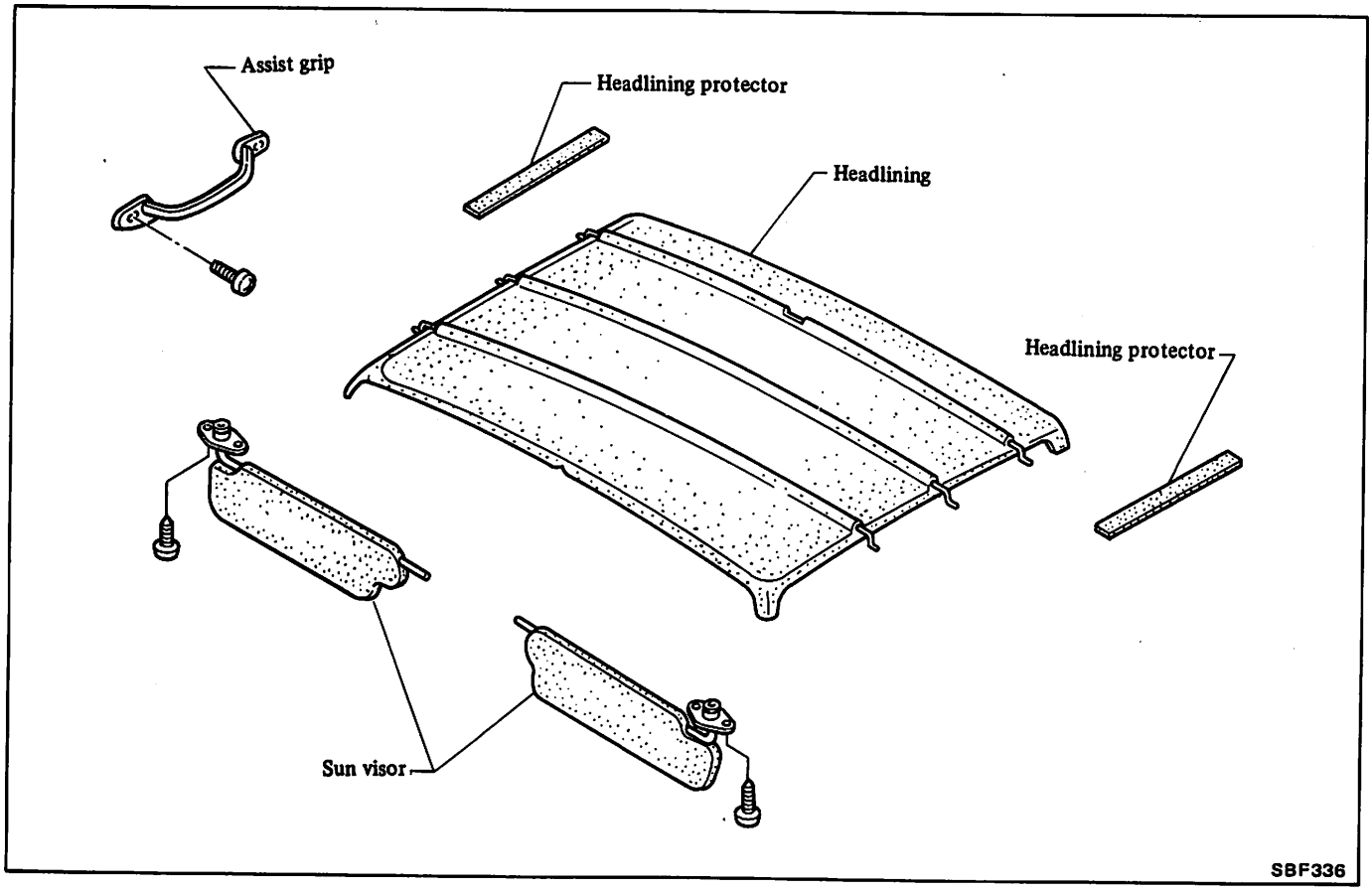
Therefore, refer to Windshield for removal and installation.

Before removing back window glass, disconnect rear window defogger harness.

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TRIM AND MOLDING

ROOF TRIM



REMOVAL AND INSTALLATION

1. Remove room lamp, assist grips, inside rearview mirror and sun visors.
2. Remove rear finisher and rear side finisher.
3. Remove windshield glass, weatherstrip and windshield pillar cloth.
4. Remove back window glass and weatherstrip.
5. Remove headlining from back to front.
6. Installation is in reverse order of removal.

a. Install headlining, from front to rear.

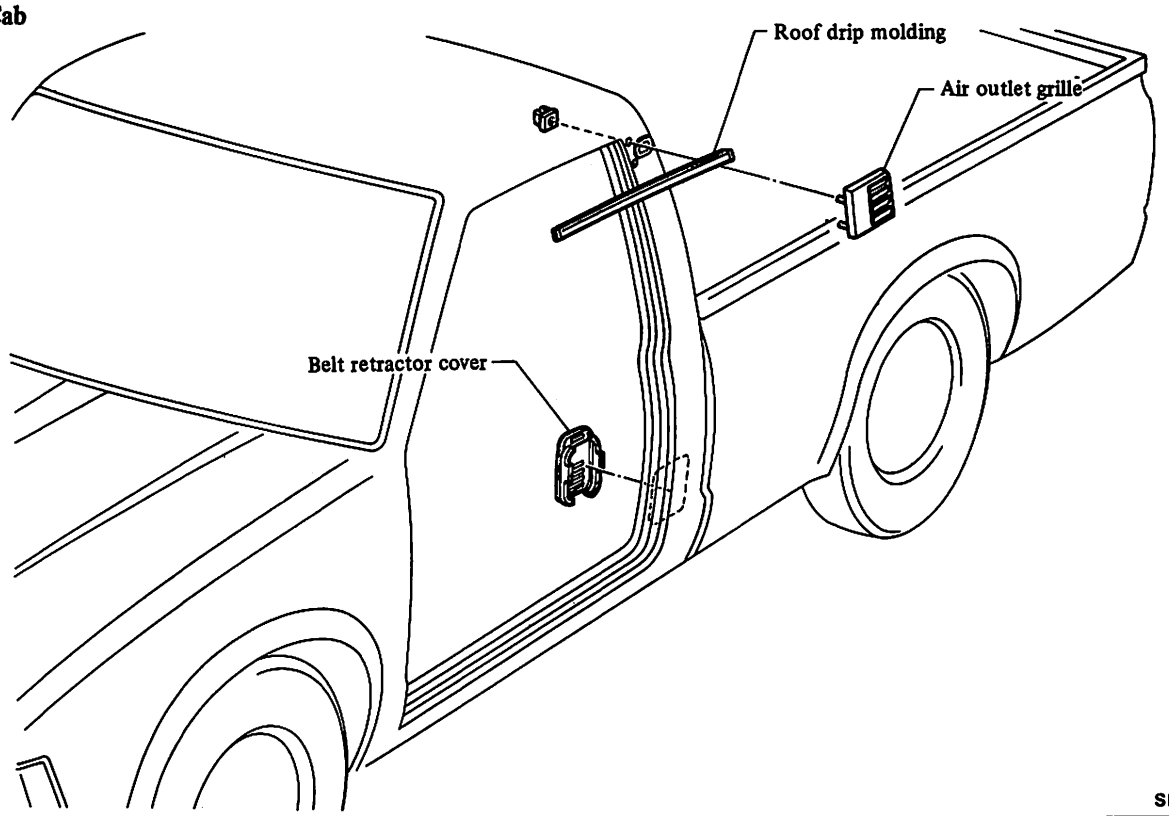
b. When replacing headlining, also replace listing wire if deformed.

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BODY SIDE TRIM AND MOLDING

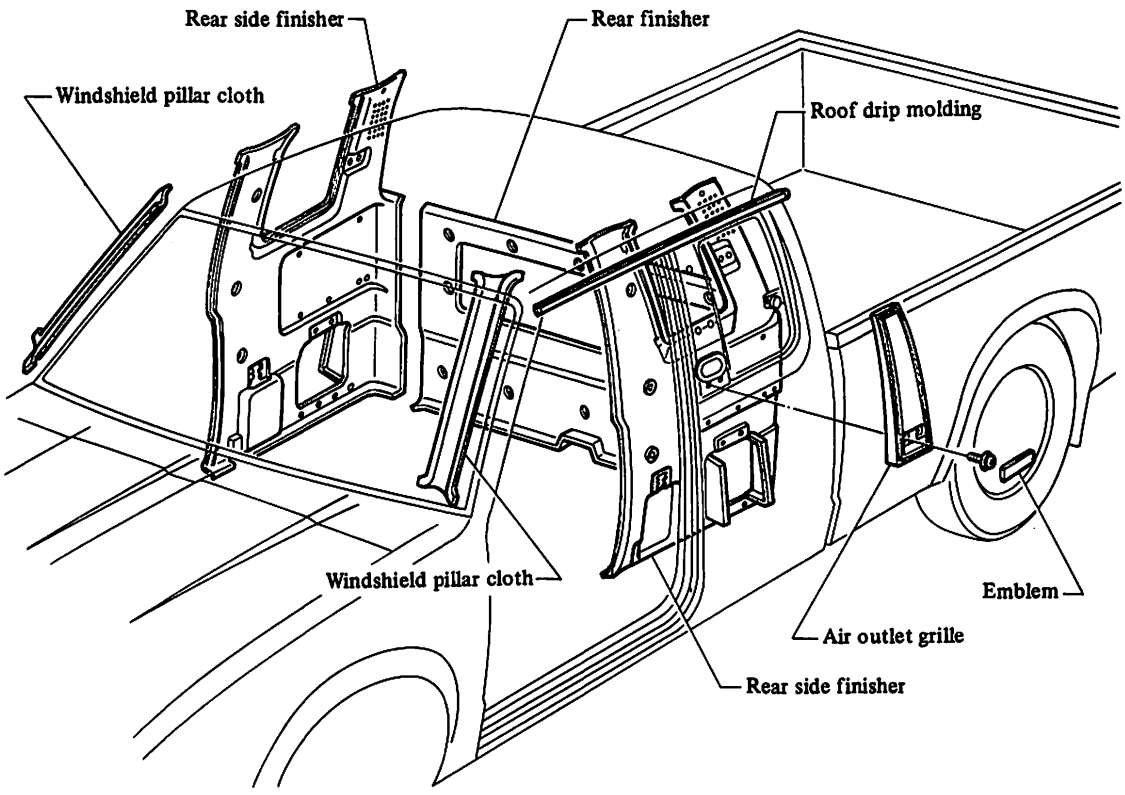
Use care not to damage clip pawls when removing or installing trim and molding.

Regular Cab



SBF337

King Cab

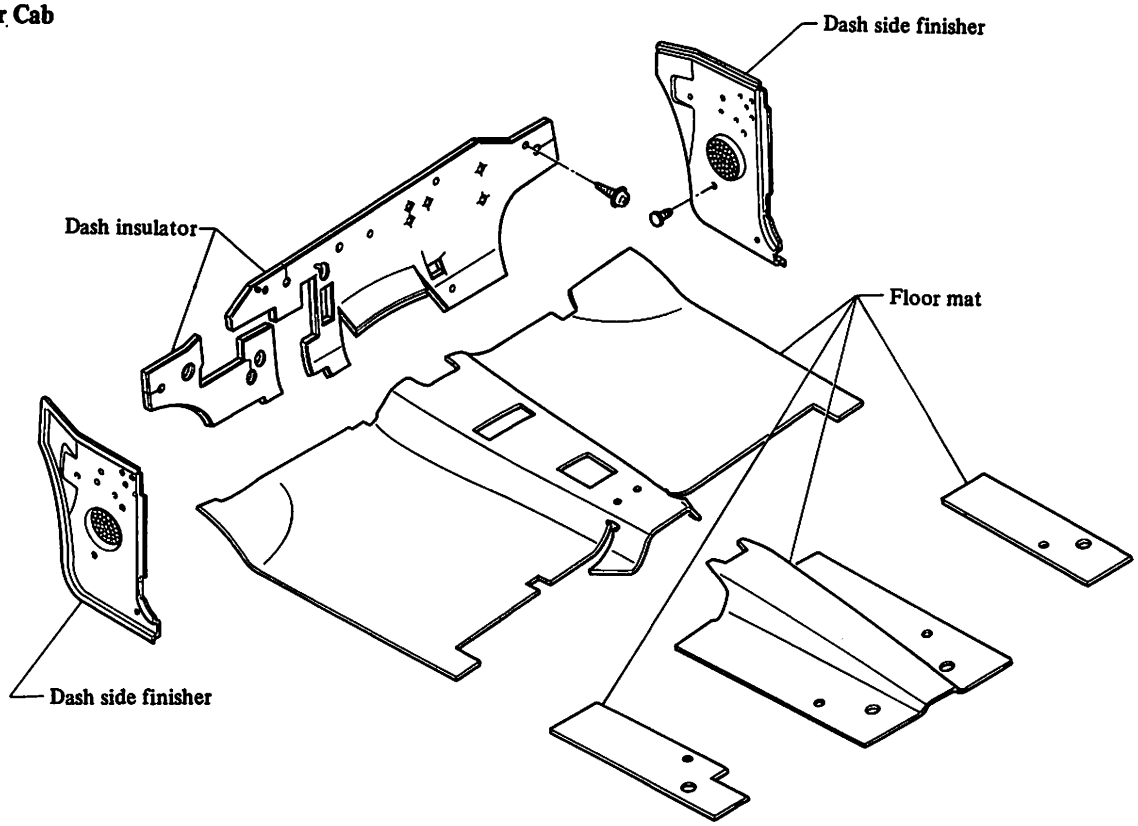


SBF338

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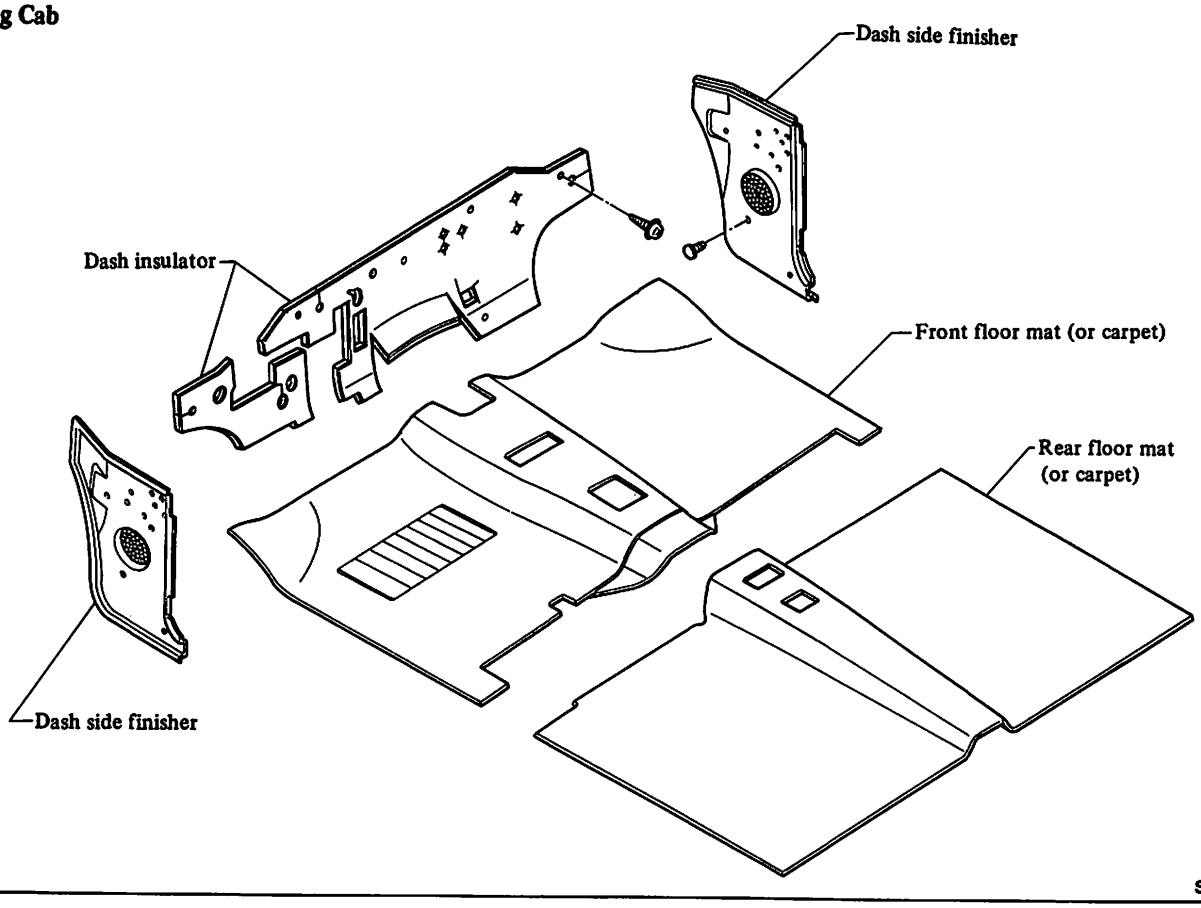
DASH AND FLOOR TRIM

Regular Cab



SBF339

King Cab

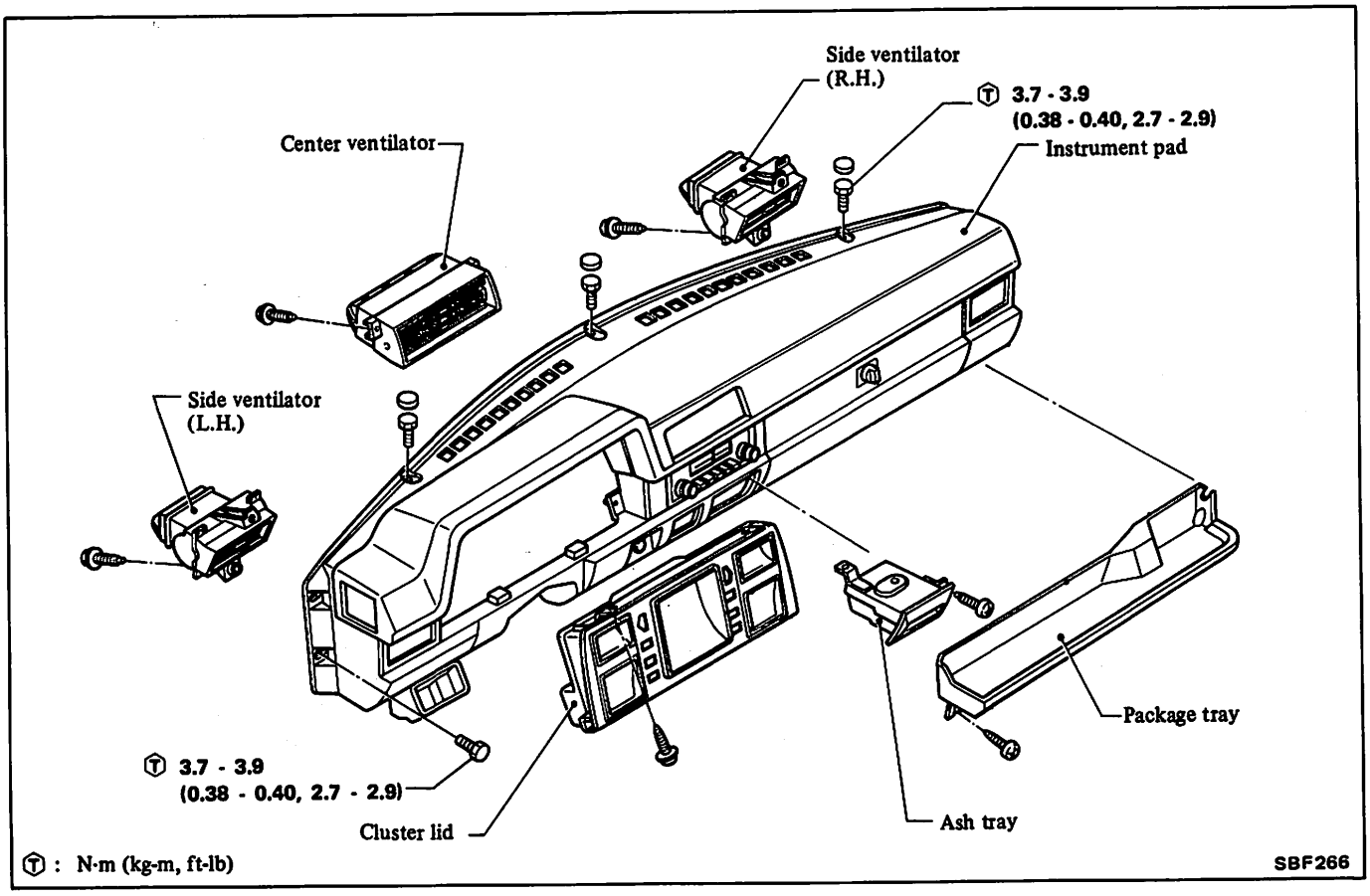


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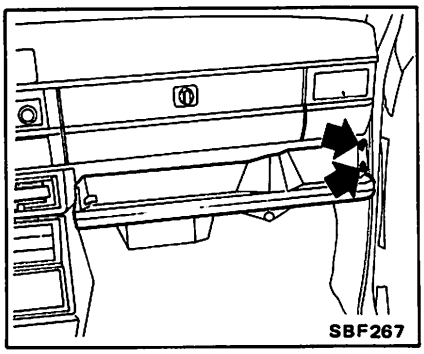
INSTRUMENT PANEL AND SEAT

INSTRUMENT PANEL

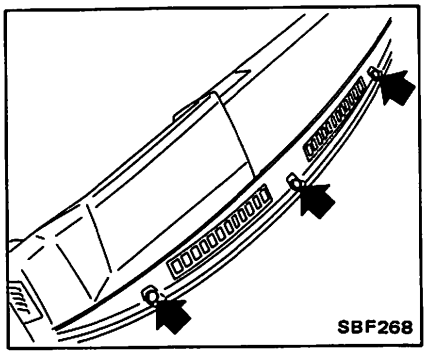


REMOVAL AND INSTALLATION

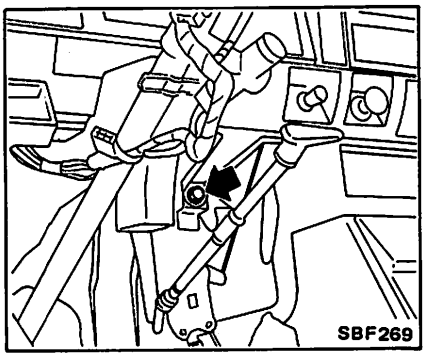
1. Disconnect battery ground cable.
2. Remove steering column shell cover.
3. Remove package tray (if so equipped).



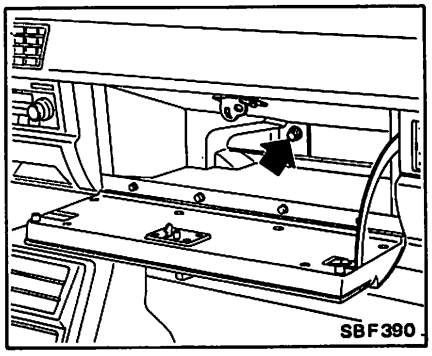
4. Disconnect speedometer cable behind speedometer.
5. Disconnect following wire harness connectors.
   - Center illumination
   - Cigarette lighter
   - Rear defogger switch
   - Clock
   - Turn signal switch
   - Other wire harness connections
6. Remove instrument panel upper side mounting bolts.



7. Remove instrument panel lower side mounting bolt.

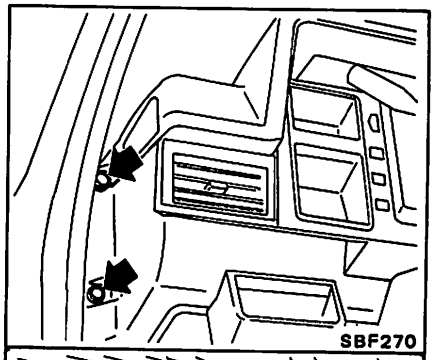


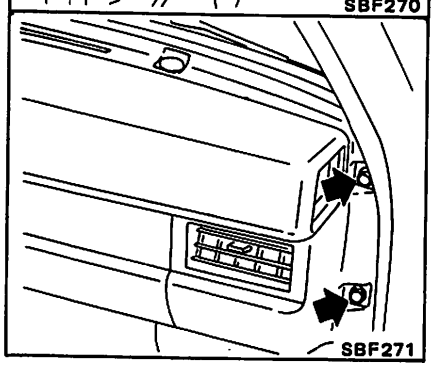
8. Remove instrument panel center mounting bolt (in glove box).



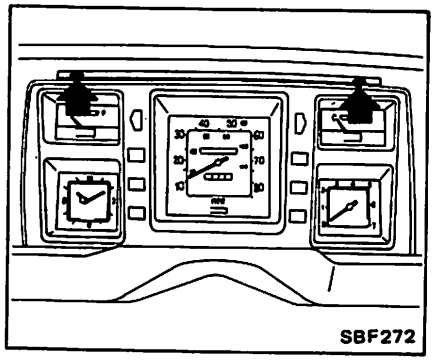
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9. Remove instrument panel both side mounting bolts and then draw out instrument panel assembly.


SBF270

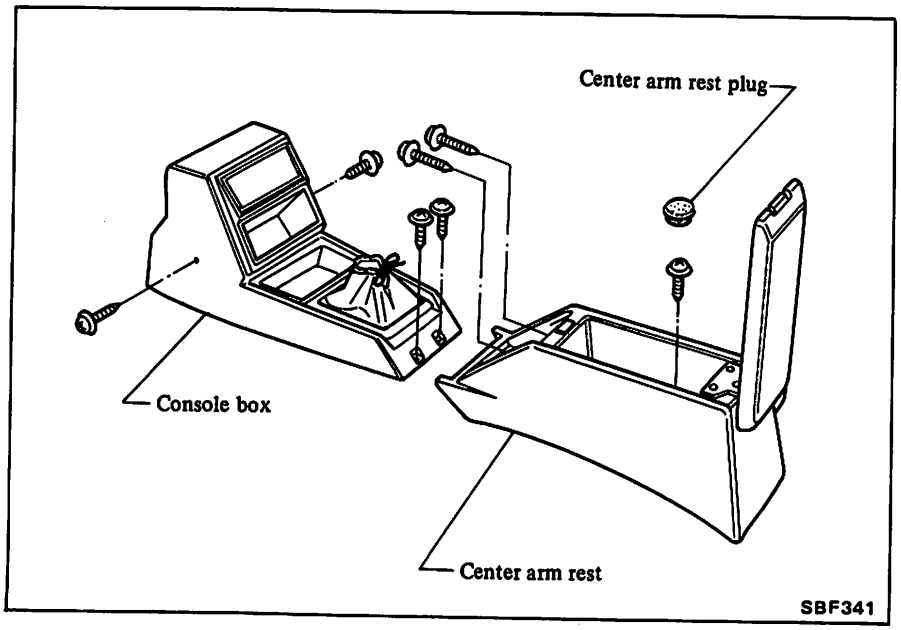

SBF271

10. Remove cluster lid.


SBF272

11. Installation is in reverse order of removal.

CONSOLE BOX



SBF341

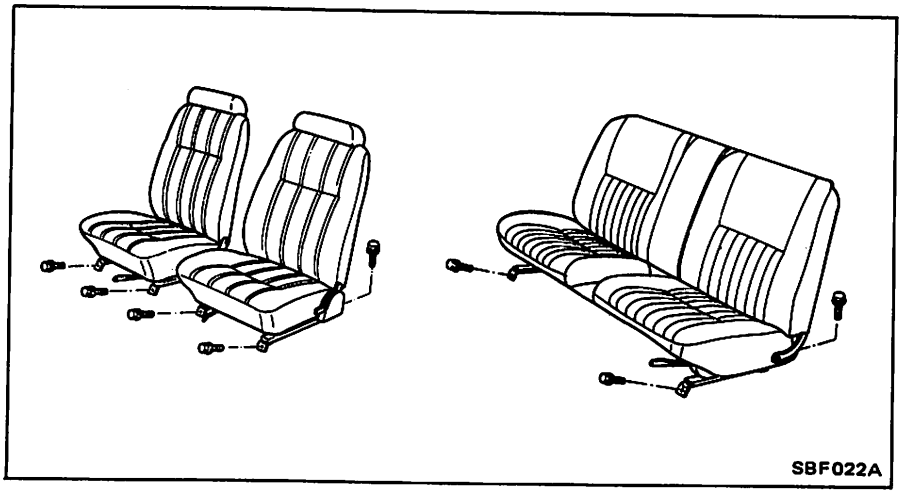
REMOVAL AND INSTALLATION

1. Remove center arm rest plug and center arm rest mounting screws, and then remove center arm rest.
2. Remove console box mounting screws, and then remove console box.
3. Installation is in reverse order of removal.

SEAT

REMOVAL AND INSTALLATION

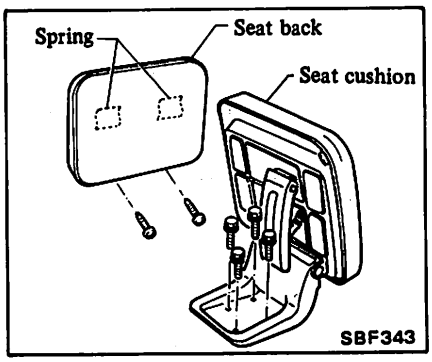
Front seat


SBF022A

1. Remove bolts attaching front of seat bracket to floor.
2. Remove bolts attaching rear of seat bracket to floor.
3. Then remove front seat assembly from vehicle.
4. Installation is in reverse order of removal.

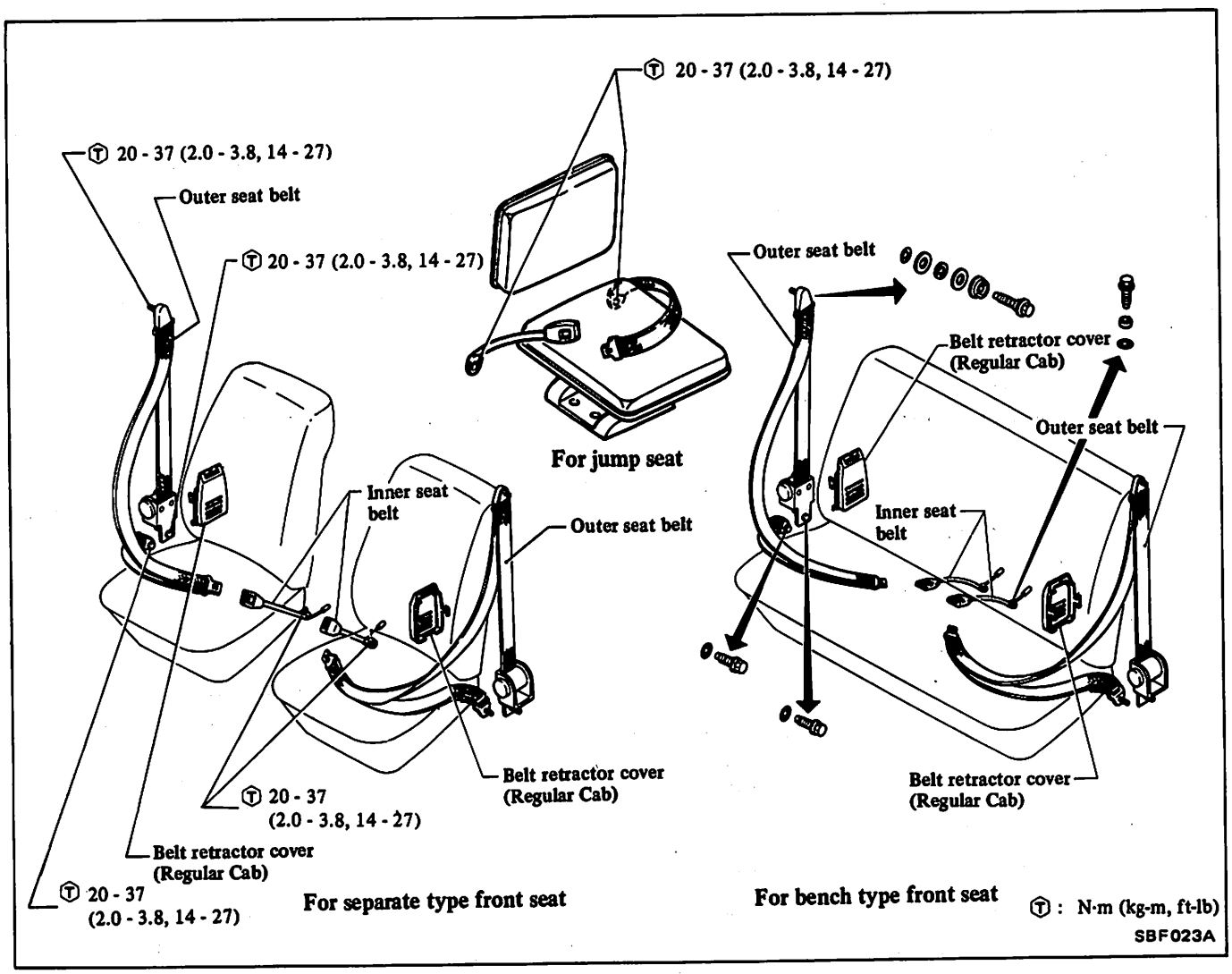
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Jump seat (King Cab)



When removing seat back, remove seat back attaching screws and then lift seat back up.

SEAT BELT



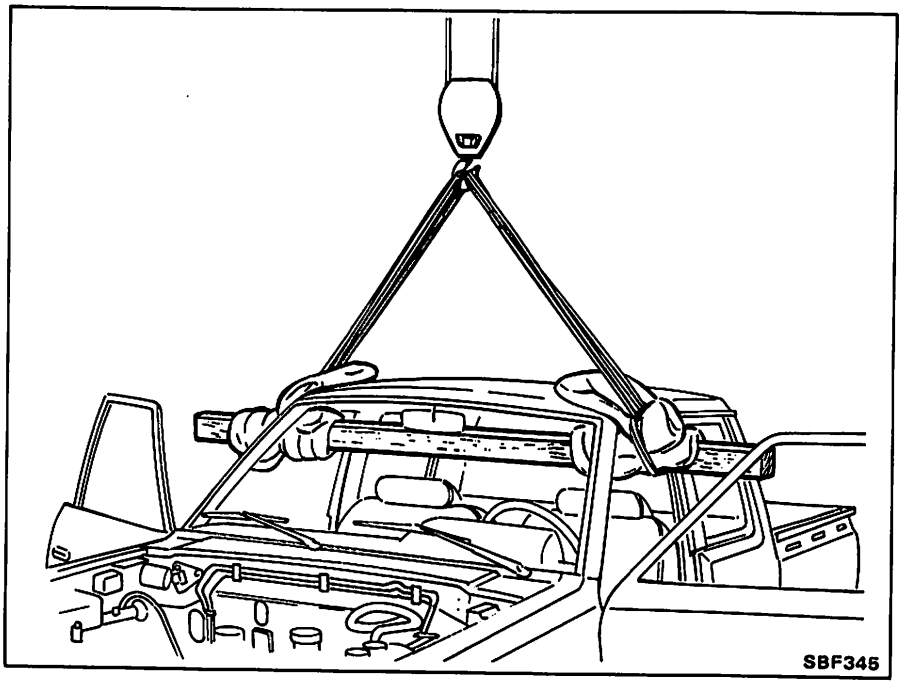
REMOVAL AND INSTALLATION

1. Remove belt retractor cover (Regular Cab).
2. Remove inner and outer seat belt mounting bolts, and then remove inner and outer seat belts.
3. Installation is in reverse order of removal.

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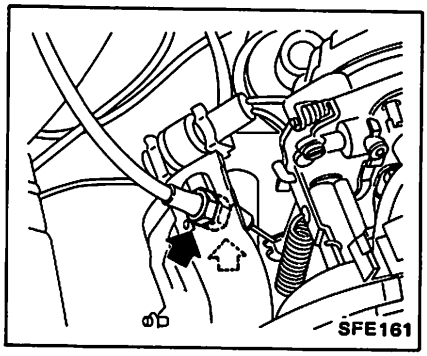
BODY

CAB BODY

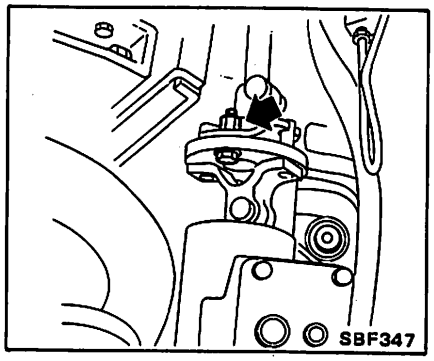


REMOVAL AND INSTALLATION

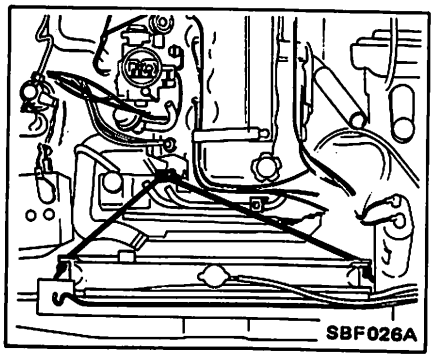
1. Remove hood.
2. Remove front bumper.
3. Remove following parts in engine compartment:
- Battery
- Air cleaner
- Tubes, pipes and hoses for emission control system
- Tubes and pipes for air conditioning system
- Brake booster vacuum hose
- Main harness and other wiring harness
- Accelerator control cable



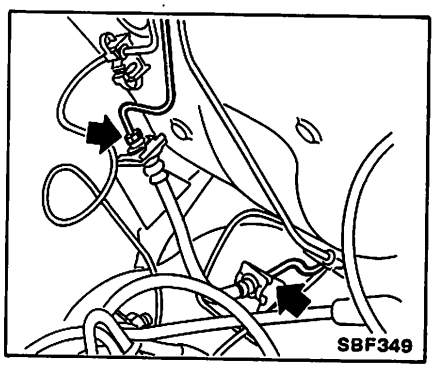
- Steering column from steering gear



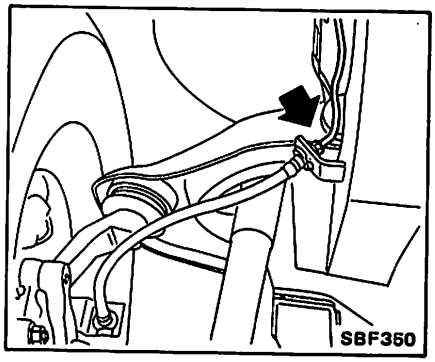
4. Remove radiator fixing bolts, then use ropes to fasten both radiator and radiator shroud to engine.



5. Disconnect brake and clutch line in engine compartment with Tool GG94310000.



6. Disconnect brake line under body with Tool GG94310000.



7. Remove following parts under body:
- Speedometer cable
- Transmission and transfer control levers
- Hand brake control lever and cable
- Main harness and other wiring harness

8. Remove bolts securing cab body to frame.
9. Remove cab body with suitable ropes and an overhead hoist.

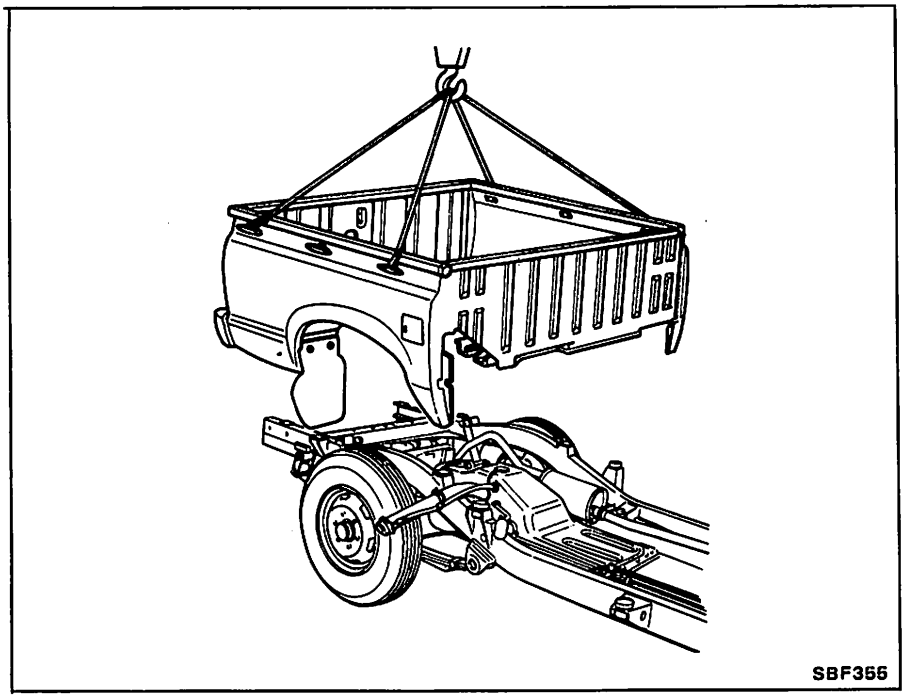
In lifting up cab body, take care not to dash it against engine or rear body.

10. Installation is in reverse order of removal.

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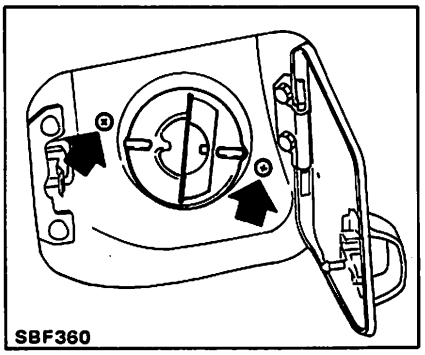
a. Note position and location of insulators and washers used. Refer to Frame for Body Mounting.
b. Adjust hand brake stroke. Refer to Section MA.
c. Air bleed should be performed on brake and clutch lines. Refer to Section CL and Section BR.

REAR BODY


SBF355

REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Disconnect rear combination lamp and license plate lamp harness.
3. Remove fuel filler tube fixing screws.


SBF360

4. Remove bolts securing rear body to frame.
5. Remove rear body with suitable ropes and an overhead hoist.

In lifting up rear body, take care not to dash it against cab body.

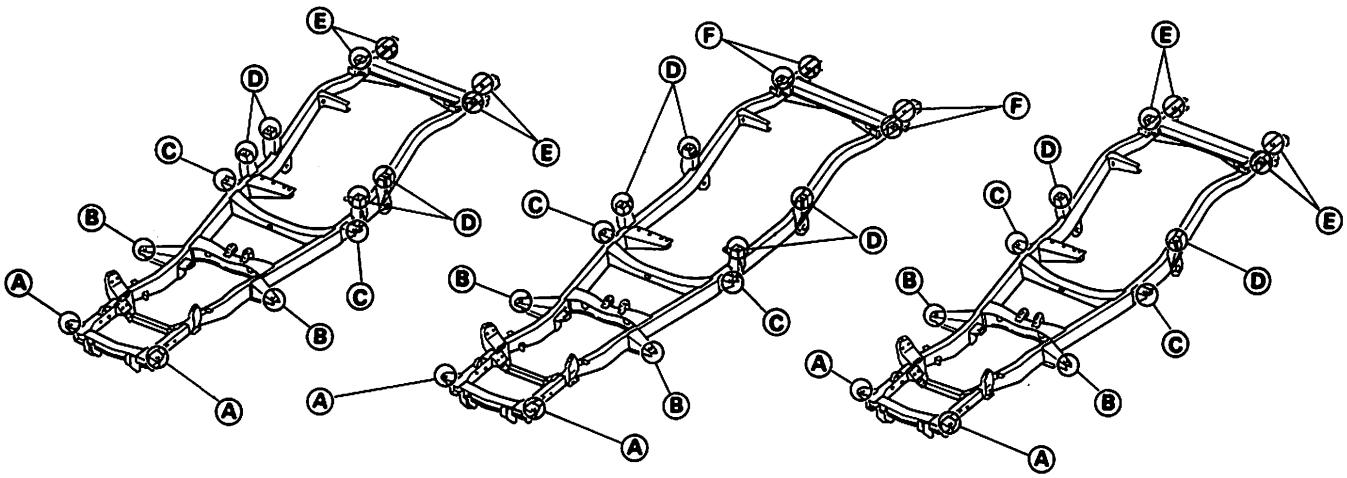
6. Installation is in reverse order of removal.

Note position and location of spacers and shims used. Refer to Frame for Body Mounting.

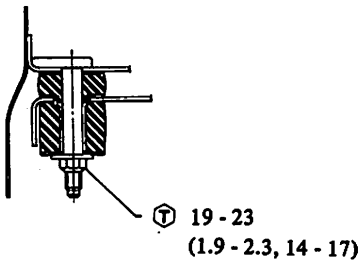
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FRAME

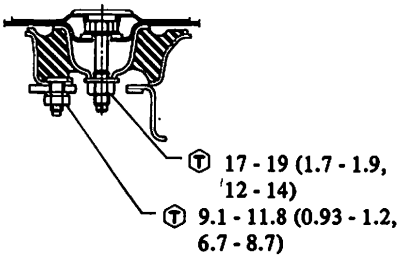
BODY MOUNTING



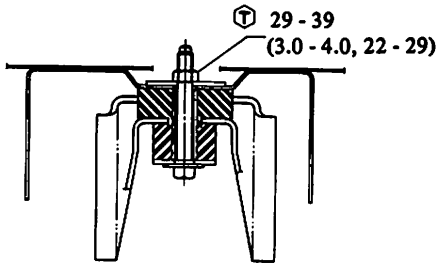
Regular Bed model | Long Bed model | King Cab model



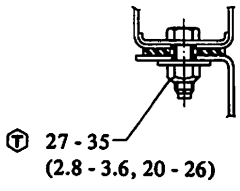
Section Ⓐ



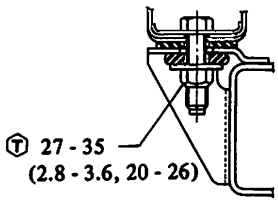
Section Ⓑ



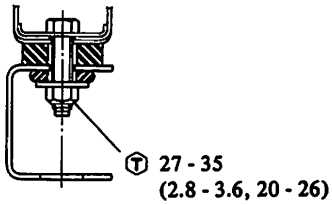
Section Ⓒ



Section Ⓓ



Section Ⓔ



Section Ⓕ

T: N·m (kg-m, ft-lb)

SBF301

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BODY ALIGNMENT

DESCRIPTION

DIMENSION LINES

All dimensions indicated in the drawings/illustrations are the standard design values. These values, along with their dimension lines, are differentiated by thickness for easy identification.

1. Thin dimension line – Indicates a distance from a phantom line of the vehicle body to a point to be measured and cannot be measured with a measuring tape or tram tracking gauge.
2. Thick dimension line – Indicates a direct (or an actual) distance or length between two points and can be measured with a measuring tape or tram tracking gauge.

An asterisk (*) following the value at the measuring point indicates that the measuring point on the other side is symmetrically the same value.

MEASUREMENT OPERATIONS

When vehicle body measurements are taken in accordance with the thick dimension line, careful consideration should be given to the following points.

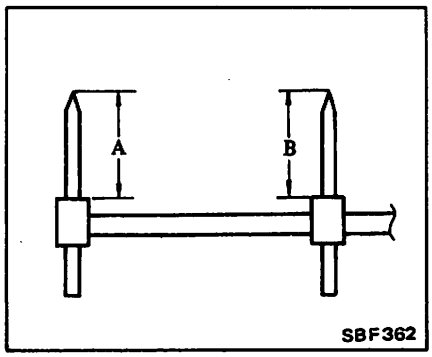
1. Measurement method

- When a tram tracking gauge is used, adjust pointers (A) and (B) to equal lengths as shown in the figure below. Check the pointers and gauge itself to make sure there is no free play.
- When a measuring tape is used, check to be sure there is no elongation, twisting or bending.

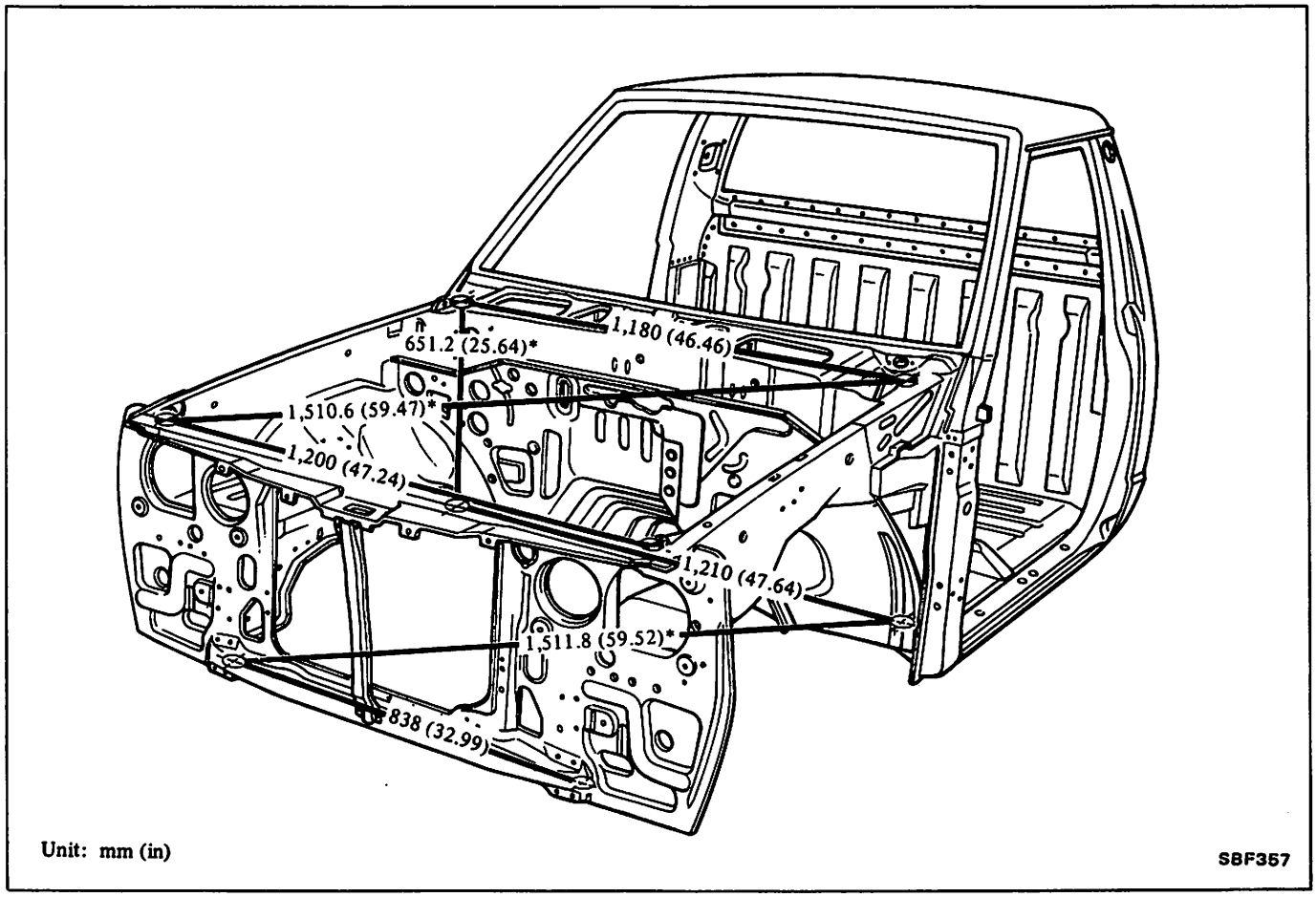
If a part or parts of the vehicle body interferes with measurement when using the measuring tape, you cannot measure the distance or length accurately.

2. Measurement point

Measurements should be taken at the center of mounting holes.



ENGINE COMPARTMENT



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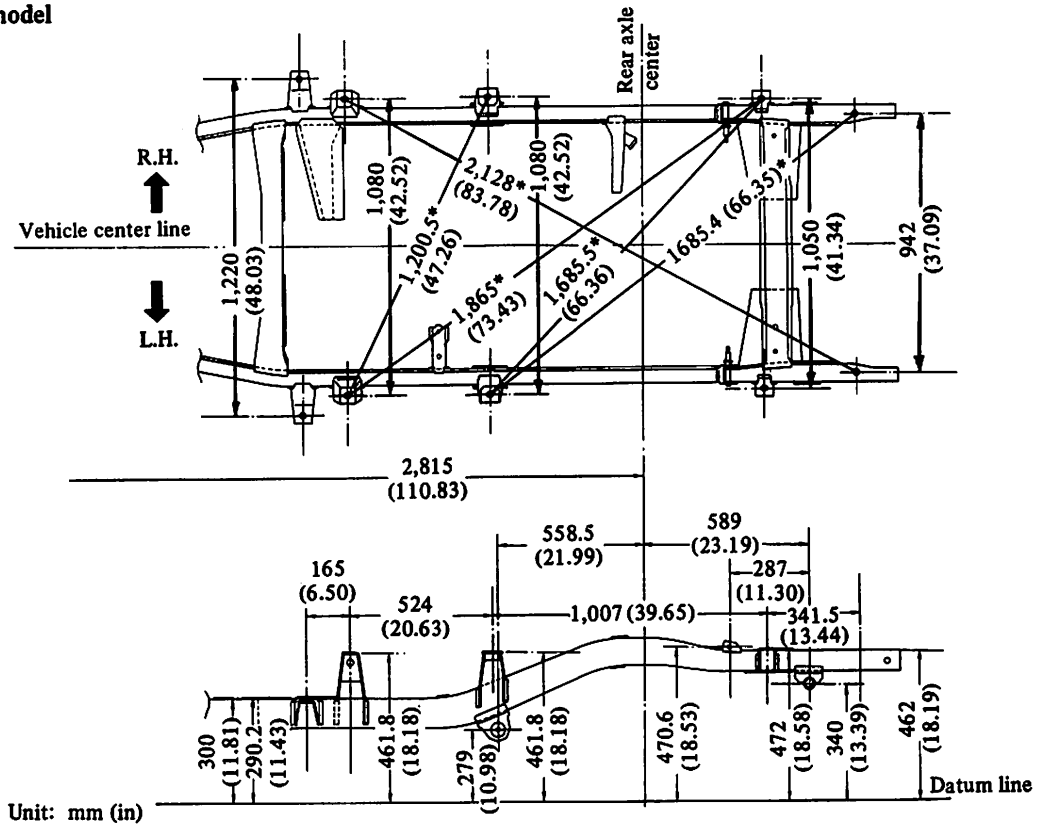
Regular Bed model

Unit: mm (in)

SBF302

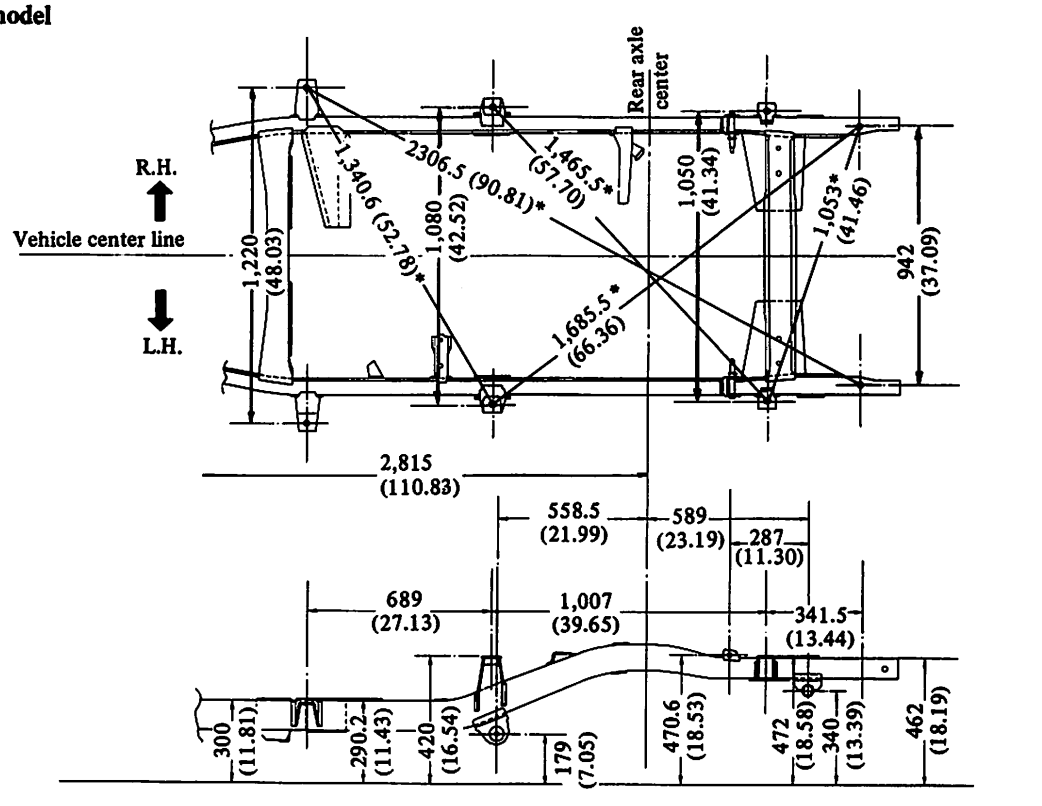
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Long Bed model



SBF303

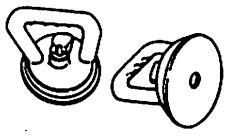
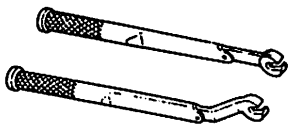
King Cab model



SBF304

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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name
ST08800000 (–)	Sucker 
GG94310000 (–)	Flare nut torque wrench 

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HEATER & AIR CONDITIONER

SECTION HA

CONTENTS

HEATER

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AIR CONDITIONER

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Refer to Section MA (Heater and Air Conditioner) for:

- CHECKING REFRIGERANT LEVEL
- CHECKING REFRIGERANT LEAK

Refer to Section MA (Basic Mechanical System) for:

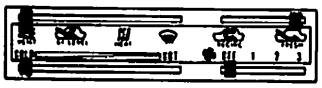
- CHECKING AND ADJUSTING DRIVE BELTS

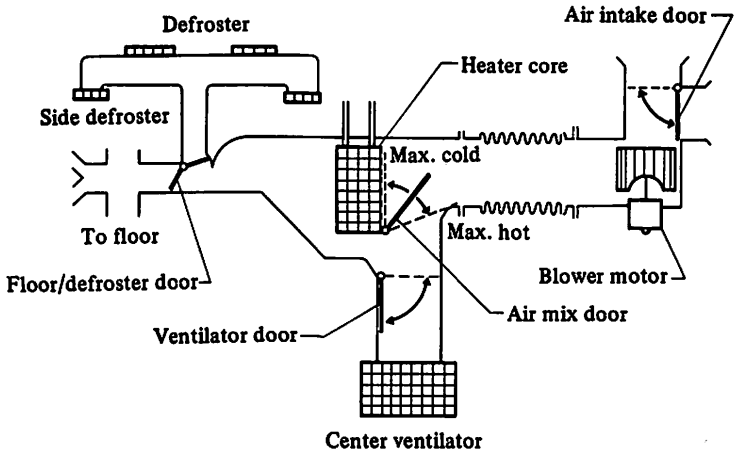
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DESCRIPTION

AIR FLOW

OFF

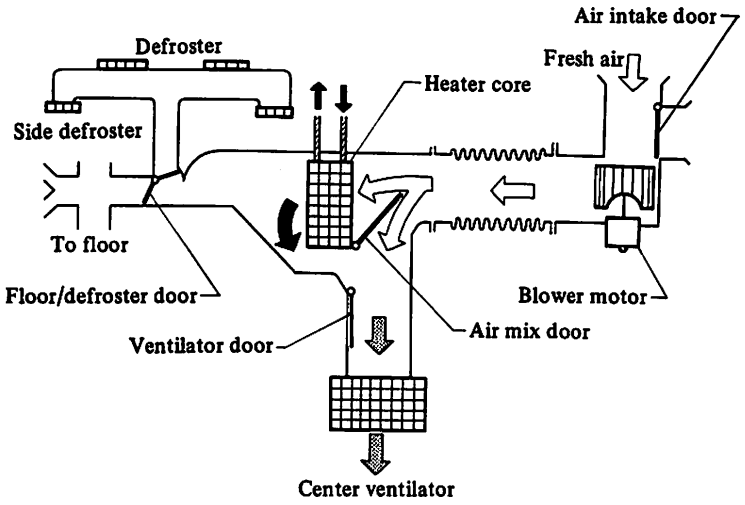




SHA194

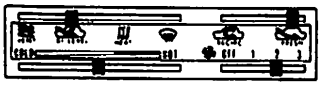
VENT position

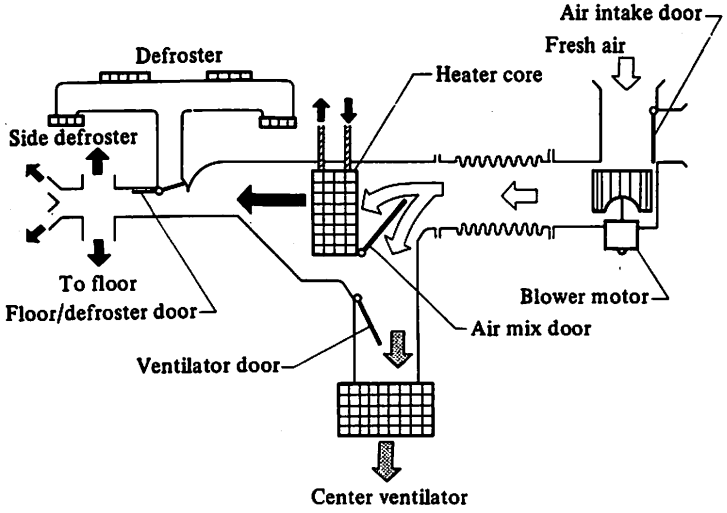




SHA195

B/L (BI-LEVEL) position

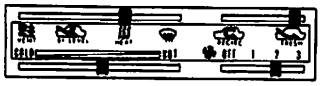


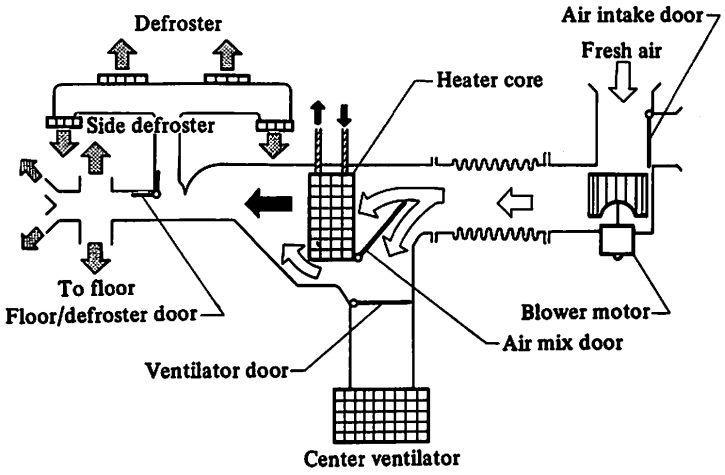


SHA196

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HEAT position

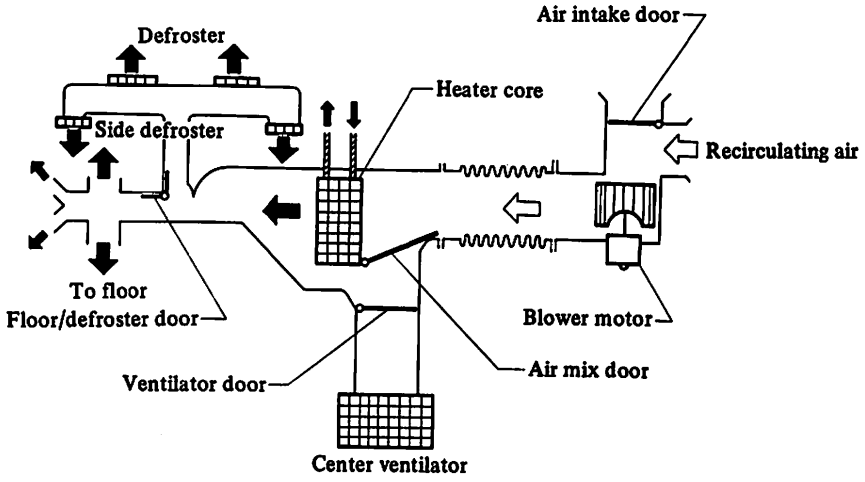




SHA197

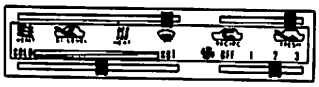
HEAT (Fast heating) position

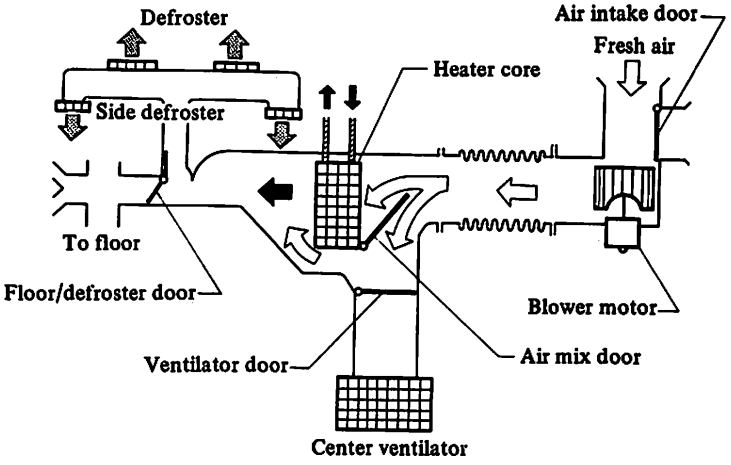




SHA198

position

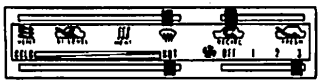


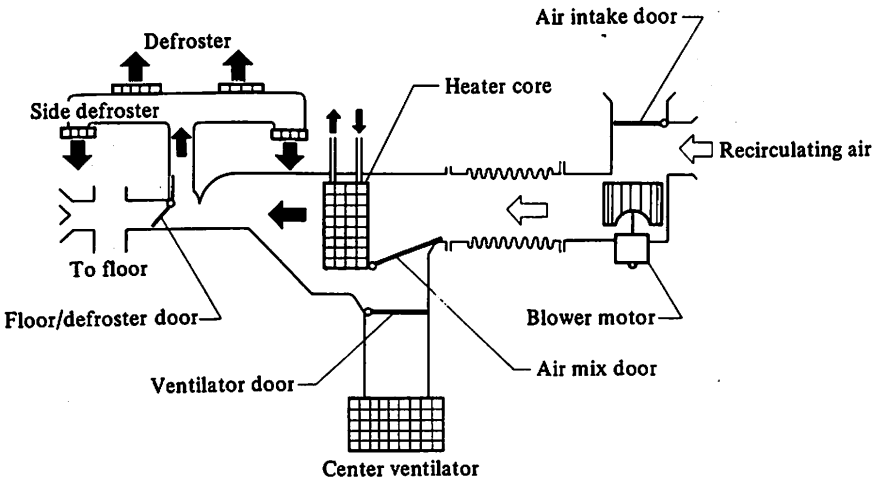


SHA199

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position (Fast defrosting)

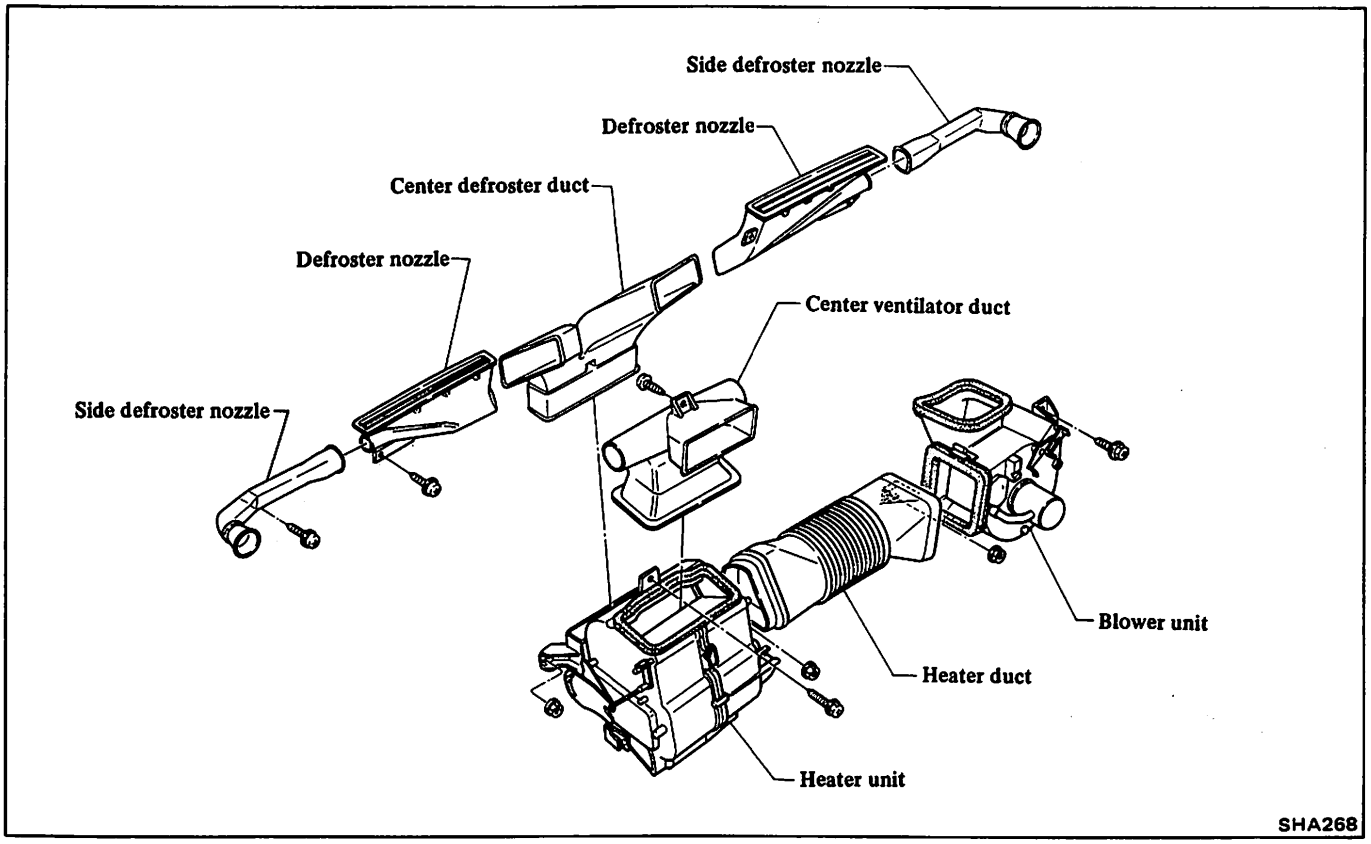




SHA200

SERVICE PROCEDURES

HEATER DUCT AND NOZZLE COMPONENTS



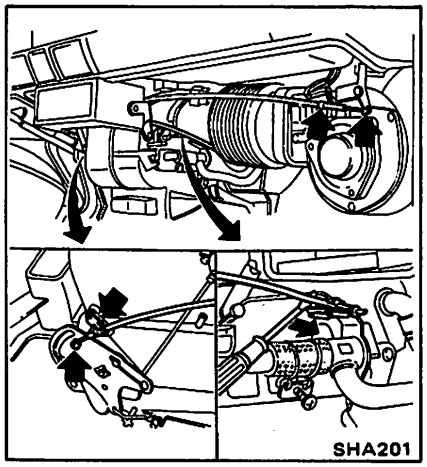
SHA268

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HEATER / AIR CONDITIONER CONTROL

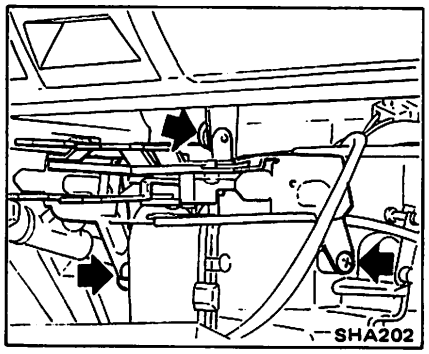
REMOVAL AND INSTALLATION

1. Remove package tray.
2. Disconnect cables from heater unit and blower unit.



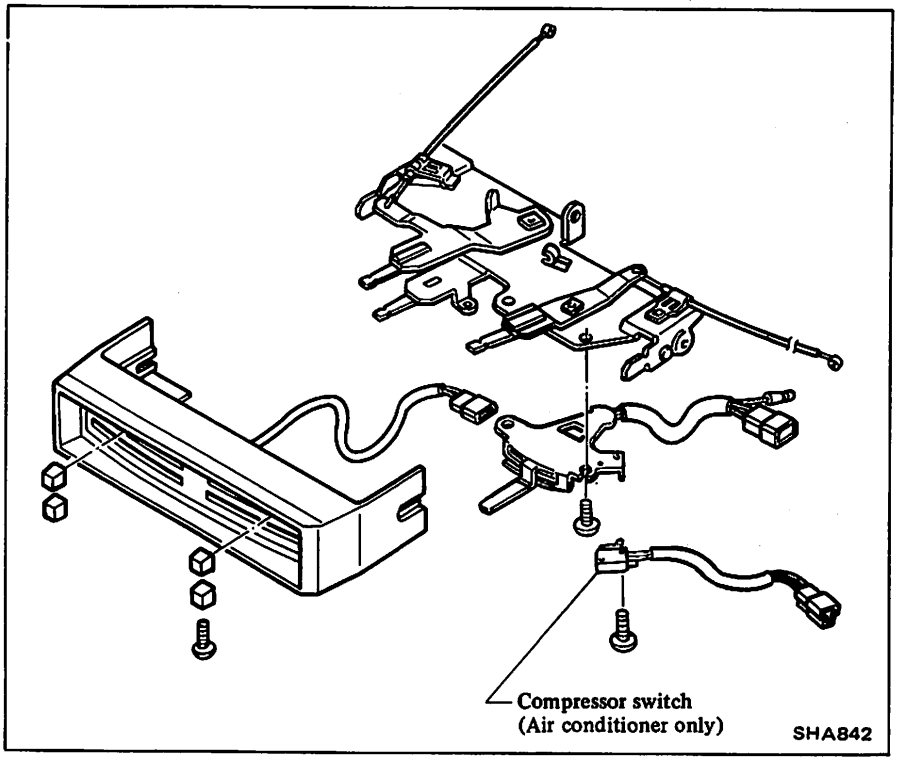
To facilitate disconnection of air mix door/water cock control cable from air conditioner equipped models, set temperature control lever in the "COLD" position.

3. Remove heater/air conditioner control knob and panel and then remove heater/air conditioner control.



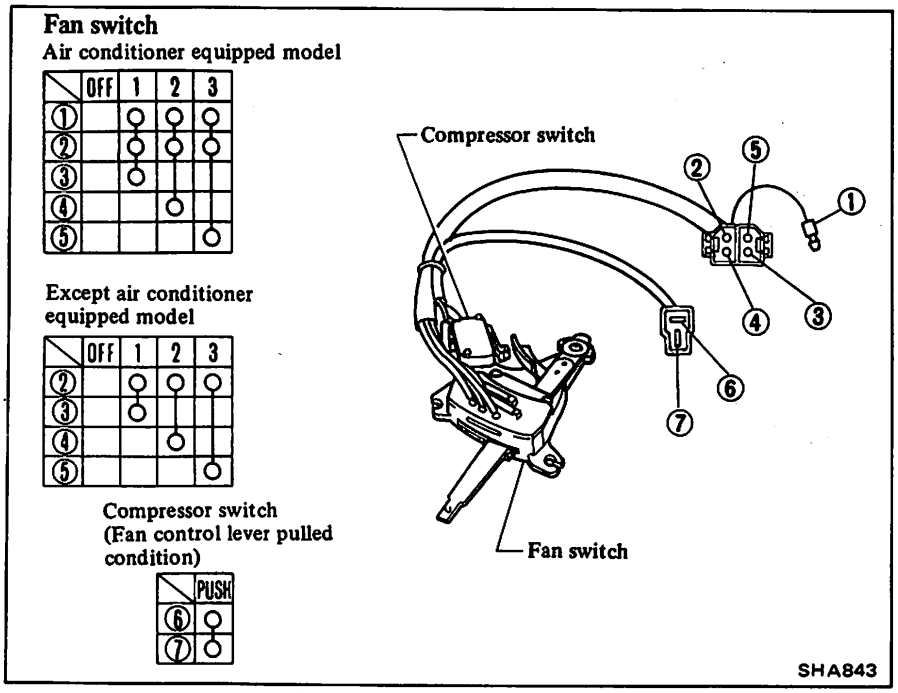
4. Installation is in the reverse order of removal. **Adjust control cables. Refer to Adjusting Heater/Air Conditioner Control.**

DISASSEMBLY AND ASSEMBLY



INSPECTION

Test continuity through switch with a test lamp or ohmmeter.



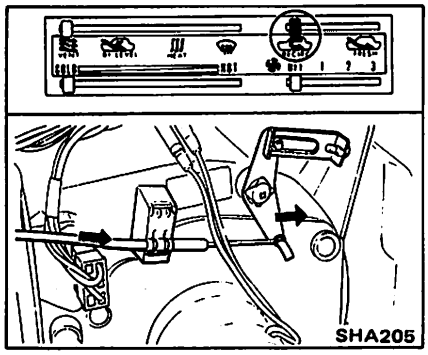
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ADJUSTING HEATER/ AIR CONDITIONER CONTROL

During installation, set the heater control cable outer case and lever in the arrow position as shown in figures, and install clips.

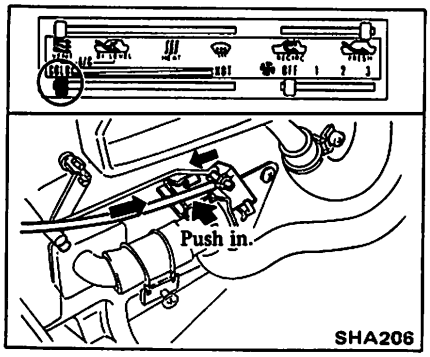
Air intake door control cable

1. Set air intake lever in the "RECIRC" position.
2. Connect control cable to air intake door lever while pushing lever toward the interior air side, and securely clamp control cable.



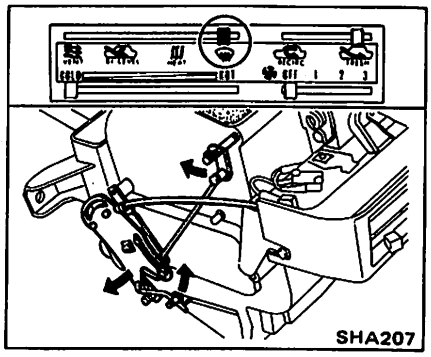
Air mix door/water cock control cable

1. Set temperature control lever in the "COLD" position.
2. Close water cock. With water cock held in that position, connect cable and clamp it securely.



Floor door/ventilator door control cable

1. Set air control lever in "" position.
2. Move side link in the direction which the floor door closes. With side link held in that position, connect cable and clamp it securely.

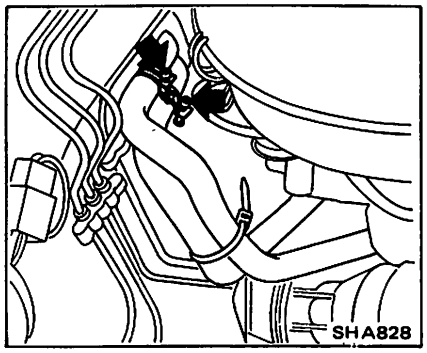


HEATER UNIT

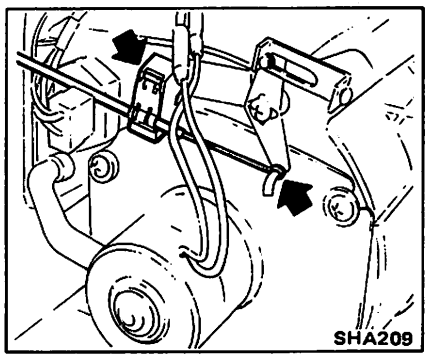
REMOVAL AND INSTALLATION

1. Drain coolant from radiator.
2.
- Air conditioner equipped models
  Disconnect heater hose from engine.
- Except air conditioner equipped models

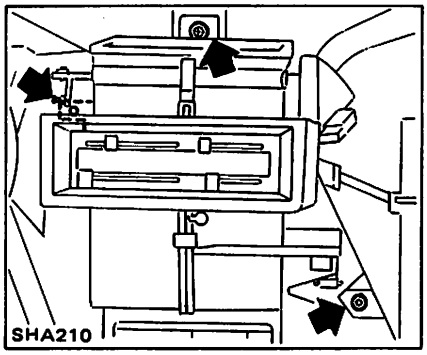
(1) Remove heater duct.
(2) Disconnect heater hose from heater unit.



3. Remove console box and instrument assembly. Refer to BF section.
4. Disconnect air intake control cable from the blower unit.



5. Air conditioner equipped models
(1) Remove blower unit.
(2) **Remove cooling unit mounting nuts and bolts. It is not necessary to remove cooling unit.**
6. Remove heater unit and then separate heater/air conditioner control assembly.

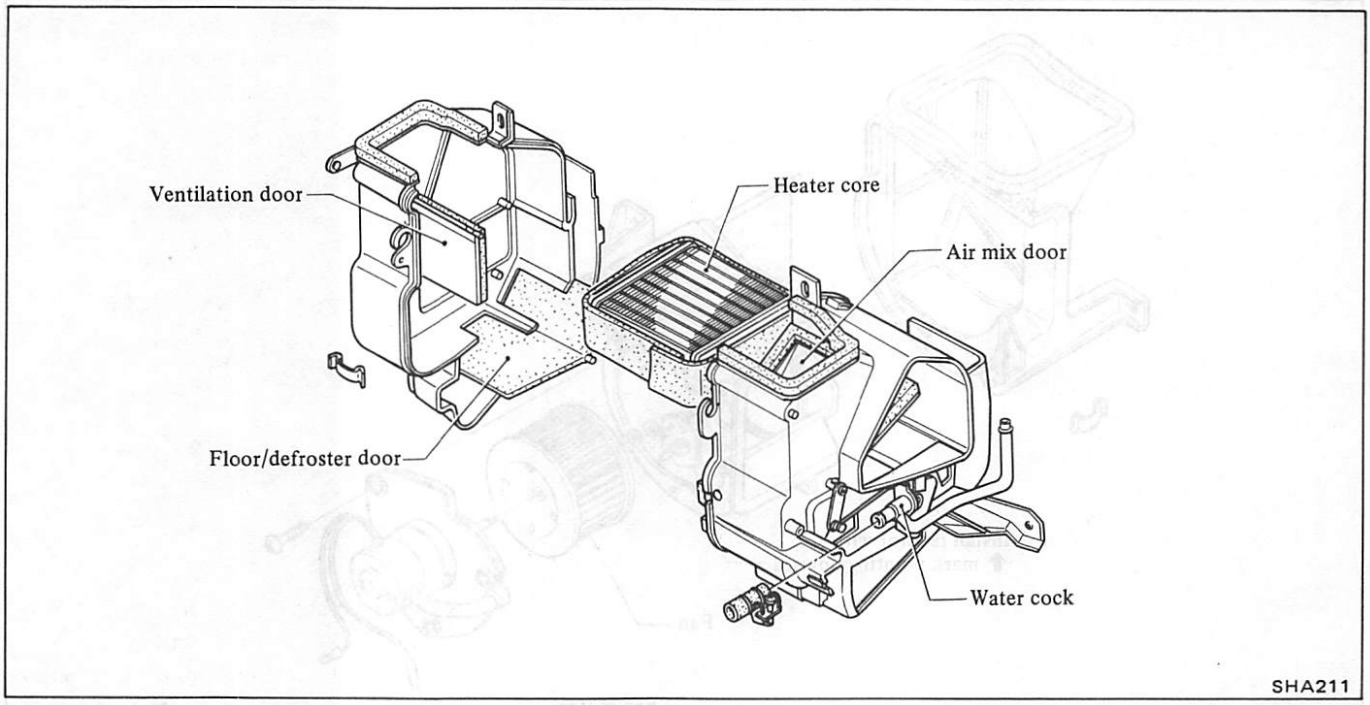


7. Installation is in the reverse order of removal.

Adjust heater control cable. Refer to Adjusting Heater/Air Conditioner Control.

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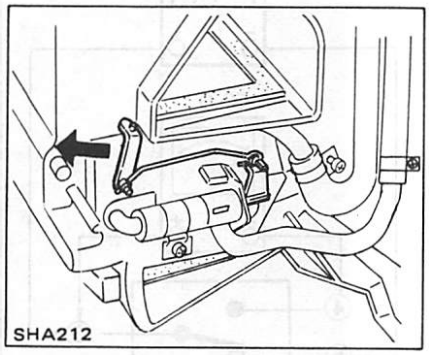
DISASSEMBLY



ASSEMBLY

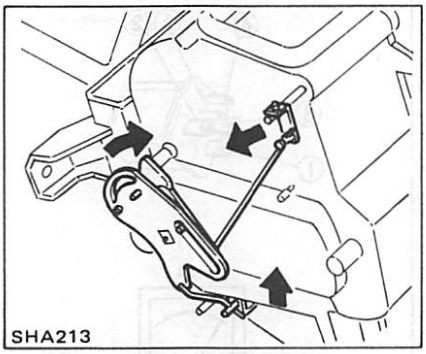
Air mix door rod

Fully tilt air mix door towards heater core by pushing air mix door lever. With lever held in that position, install rod. Water cock should be closed.



Floor door and ventilator door rod

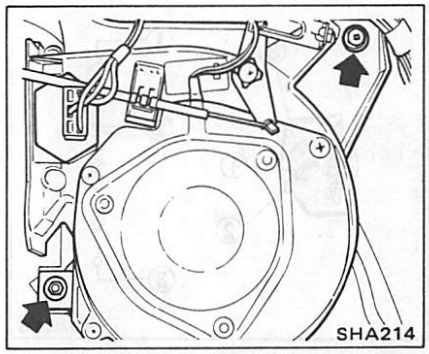
Raise link all the way in the direction indicated by the arrow and close air flow passages with both ventilator door and floor door, and attach rod to lever.



BLOWER UNIT

REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Remove package tray.
3. Remove heater duct (Except air conditioner equipped models)
4. Disconnect resistor connector and air intake door cable.
5. Remove blower unit.

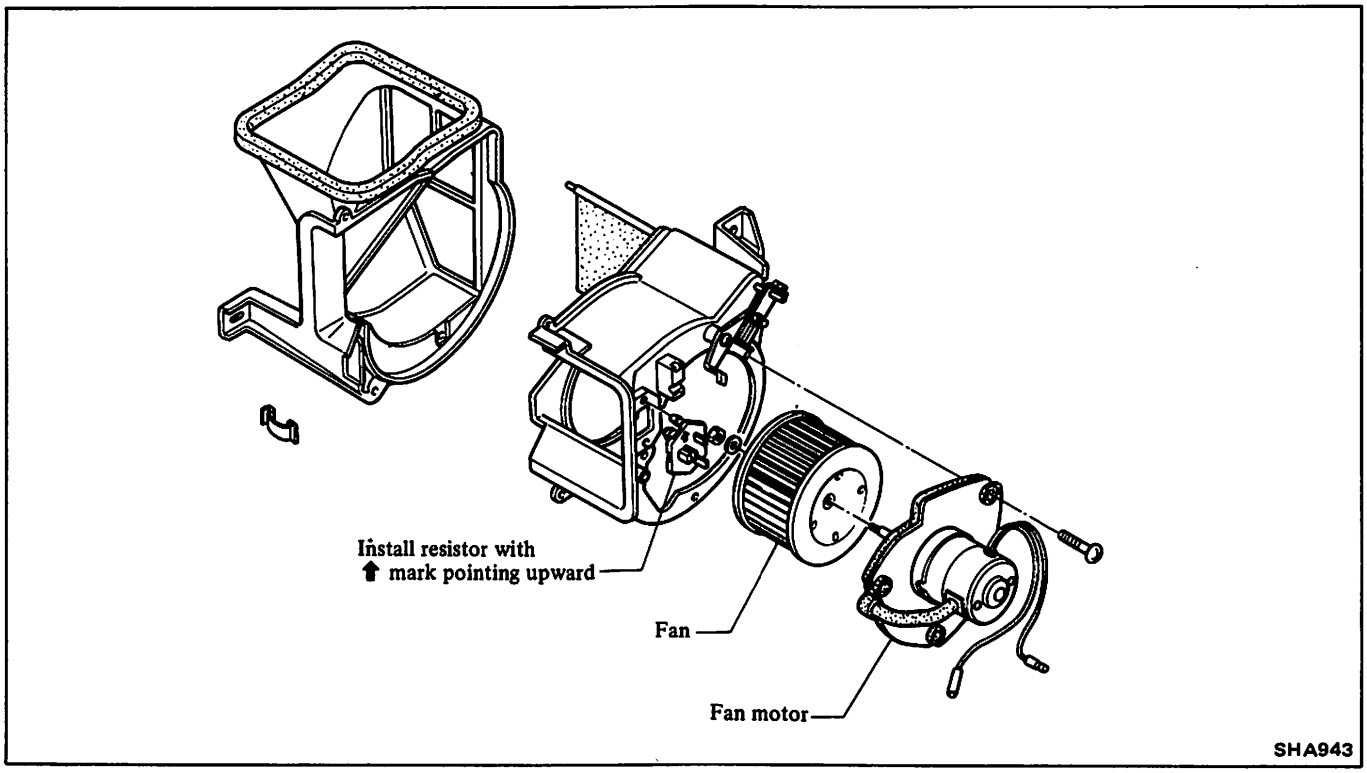


6. Installation is in the reverse order of removal.

Adjust air intake door control cable. Refer to Adjusting Heater/ Air Conditioner Control.

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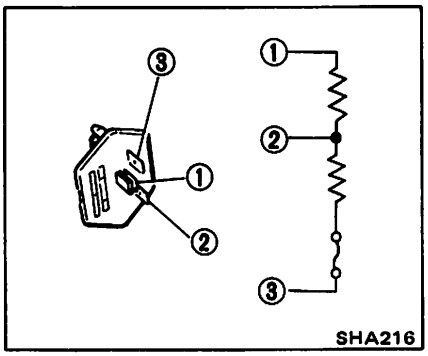
DISASSEMBLY



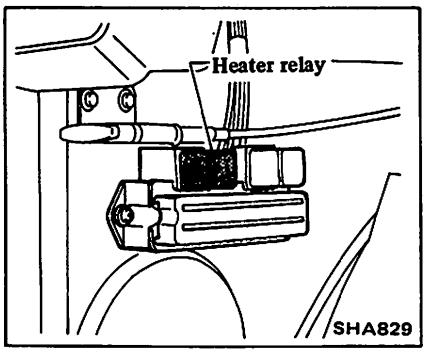
RESISTOR

INSPECTION

Test continuity through resistor with a test lamp or ohmmeter.

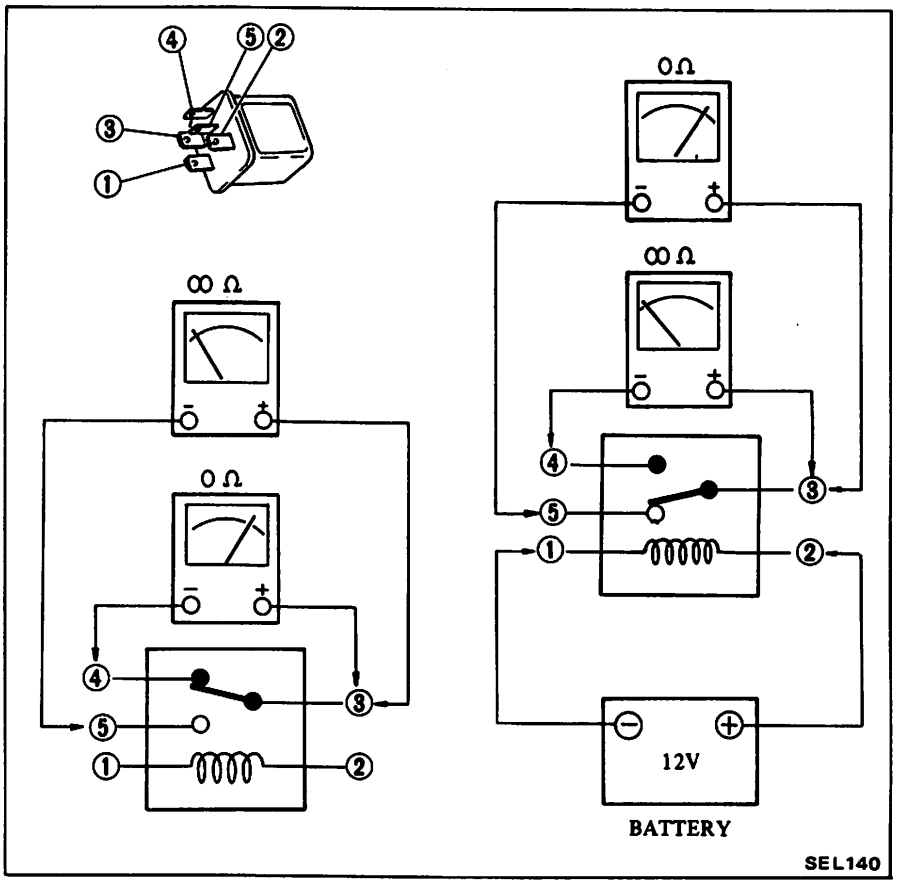


HEATER RELAY



INSPECTION

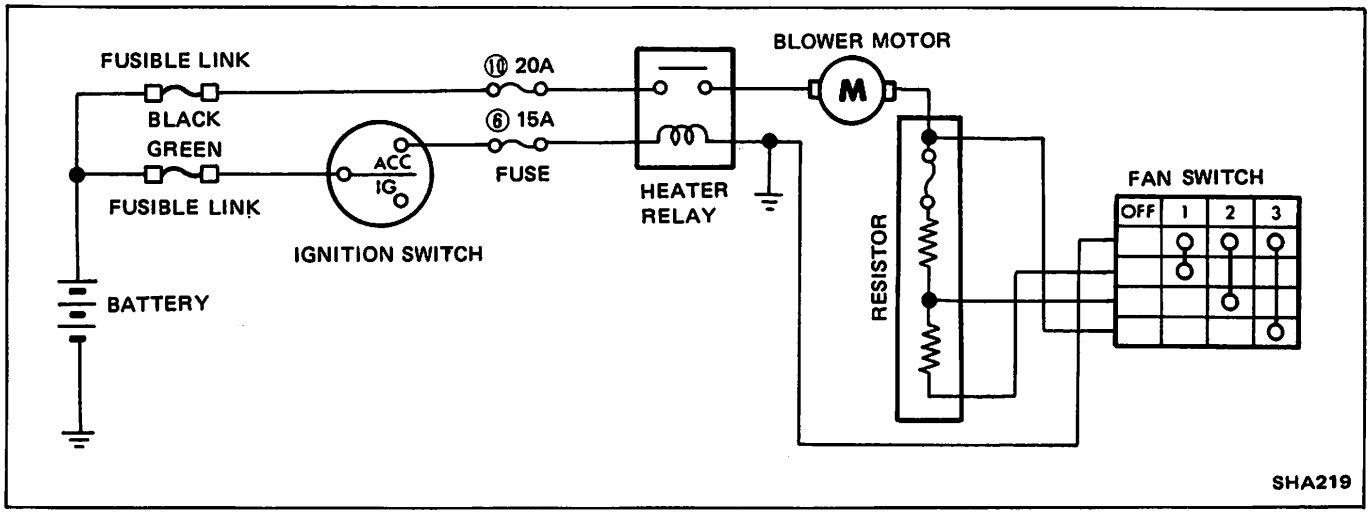
Test continuity through relay with an ohmmeter.



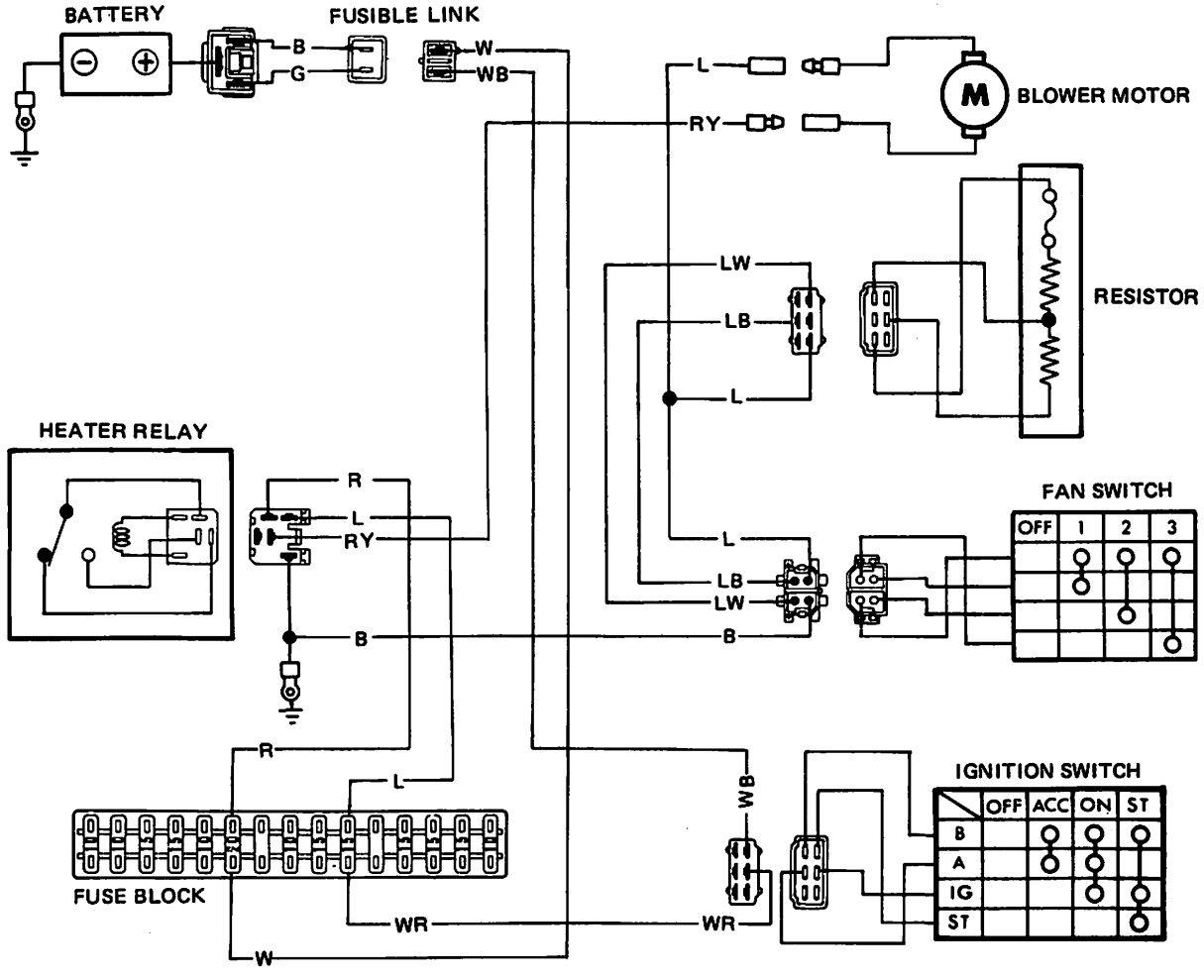
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ELECTRICAL CIRCUIT

SCHEMATIC



WIRING DIAGRAM



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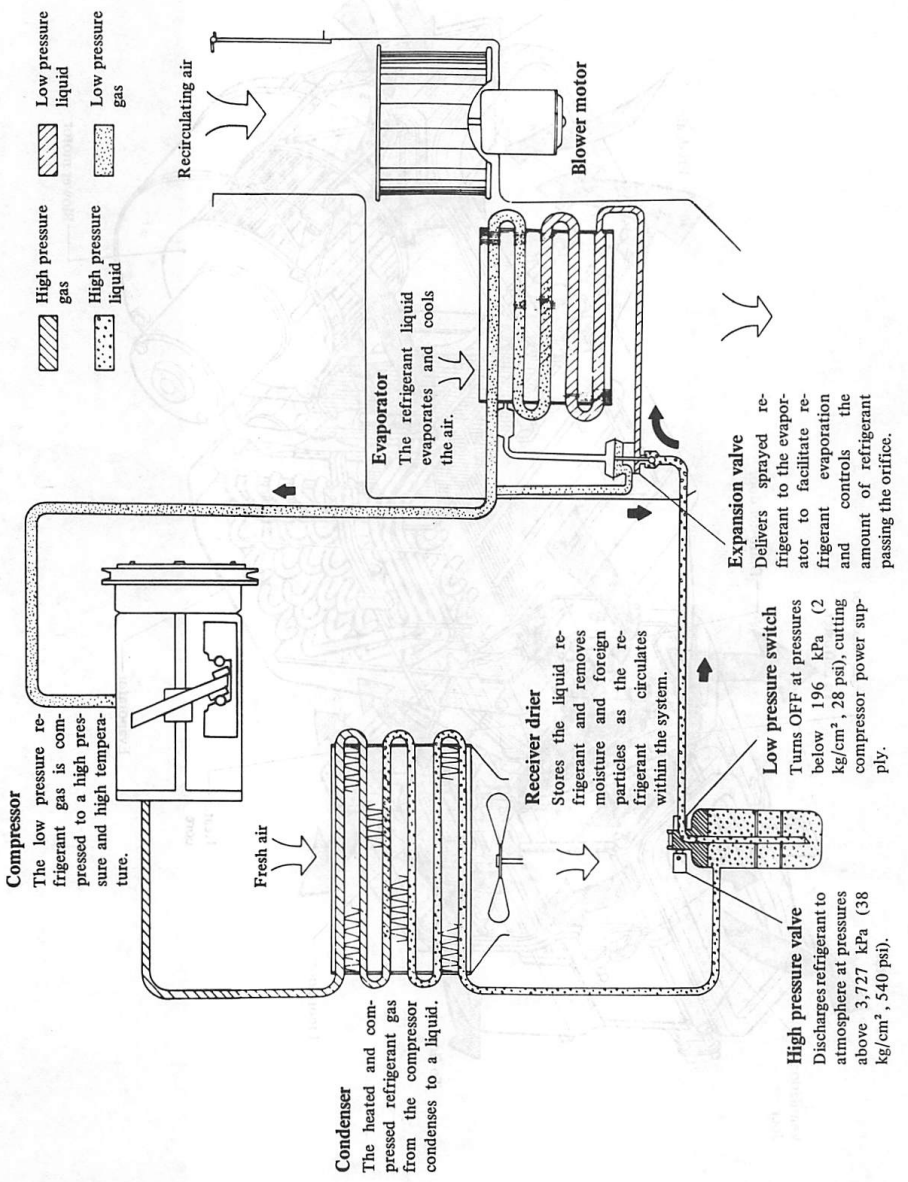
TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Insufficient heating performance. No heated air discharged.	Cooling water temperature too low.	Check thermostat. Replace as necessary.
	Heater core plugged.	Clean.
	Insufficient cooling water level.	Refill.
	Malfunctioning air mix door.	Adjust control cable.
	Malfunctioning water cock.	Check water cock. Replace as necessary. Adjust control cable.
Insufficient air flow to floor.	Blower motor speed too low.	Check motor terminal voltage. Repair poor connection and discontinuity. Replace motor if necessary.
	Malfunctioning floor door.	Adjust control cable.
Insufficient defrosting performance. Cold air discharged.	Refer to "No heated air discharged".	
Insufficient air flow to defroster.	Malfunctioning floor door.	Adjust control cable.
	Defroster nozzle plugged.	Clean.
	Leak at defroster duct-to-nozzle connection.	Correct.
Heated air discharged in VENT position.	Malfunctioning water cock.	Check water cock. Replace as necessary.
	Malfunctioning air mix door.	Adjust control cable. Adjust control cable.
Blower motor does not operate.	Faulty fan switch.	Replace.
	Faulty resistor.	Replace.
	Faulty blower motor.	Replace.
	Faulty heater relay.	Replace.
	Burned fuse.	Replace.
	Loose connector.	Connect securely.
Control lever drags.	Inner wire rubbing against outer case end.	Adjust control cable.
	Control cable bent excessively.	Correct.
	Malfunctioning doors, door levers, etc.	Check and correct.
Recirculating air is not taken in with air intake lever in RECIRC.	Air intake door does not operate properly.	Adjust control cable.
Noise from blower motor.	Loose bolt in blower motor.	Check and tighten loose bolts.

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DESCRIPTION

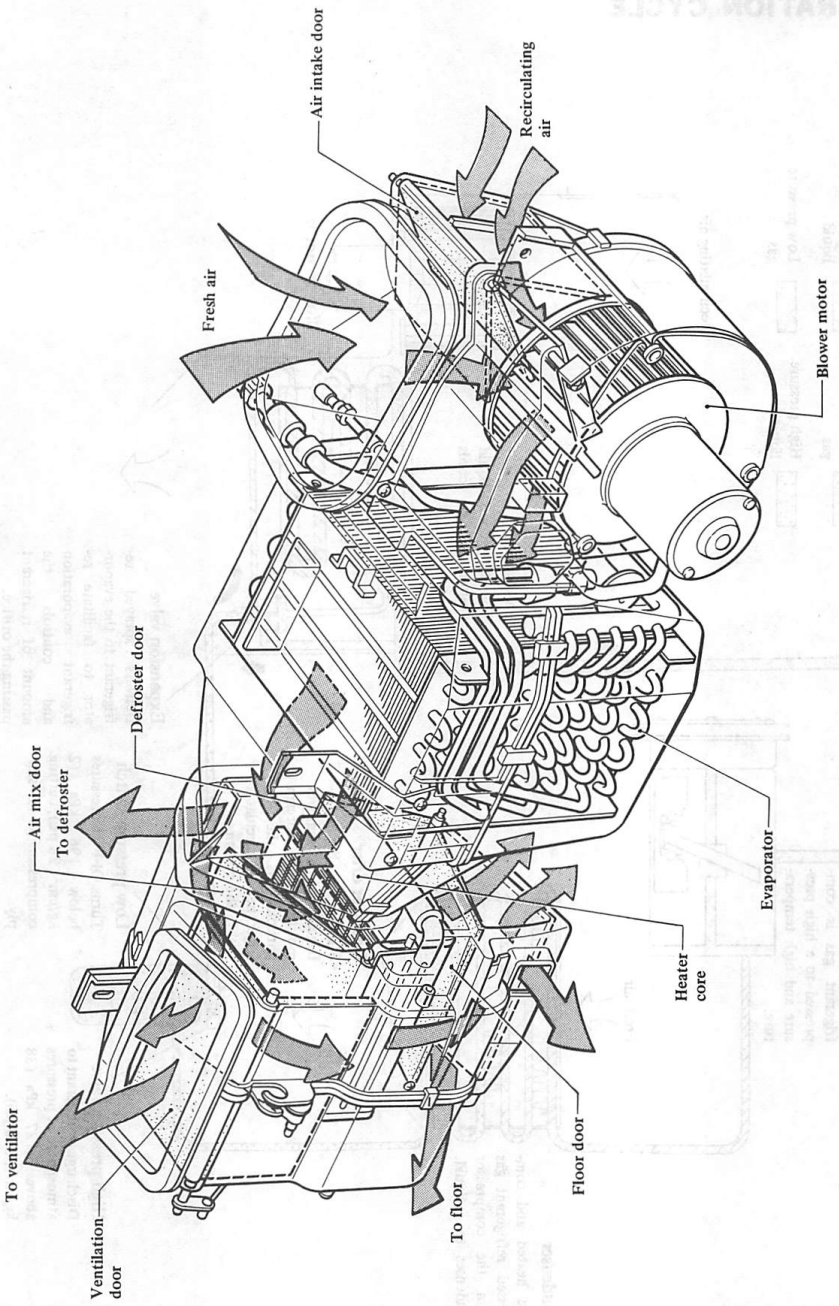
REFRIGERATION CYCLE



SHA220

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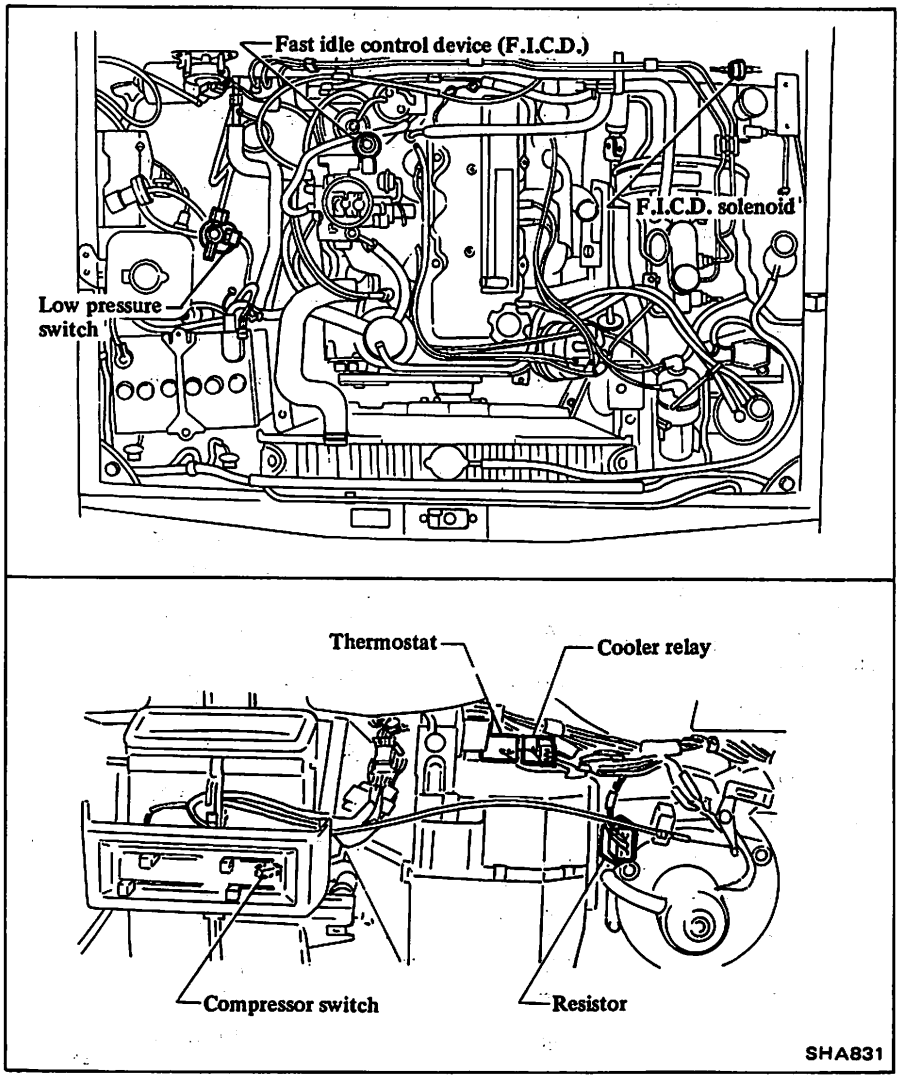
AIR CONDITIONER COMPONENTS



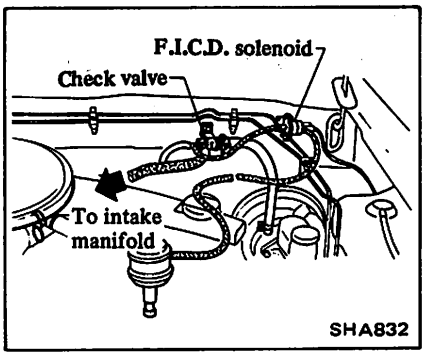
SHA221

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LOCATION OF ELECTRICAL AND VACUUM UNIT



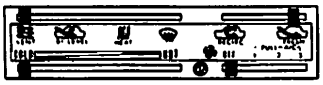
VACUUM LINE

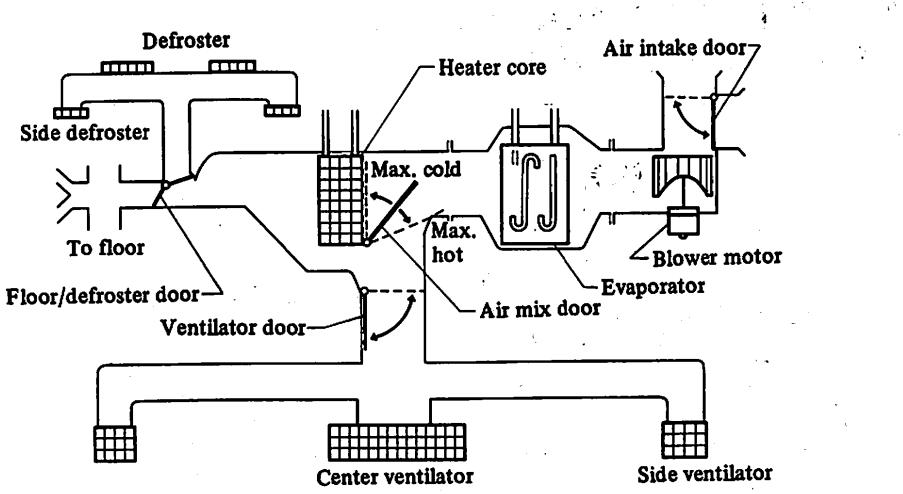


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AIR FLOW

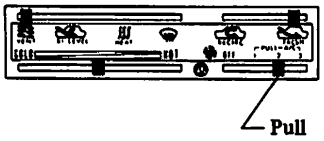
OFF

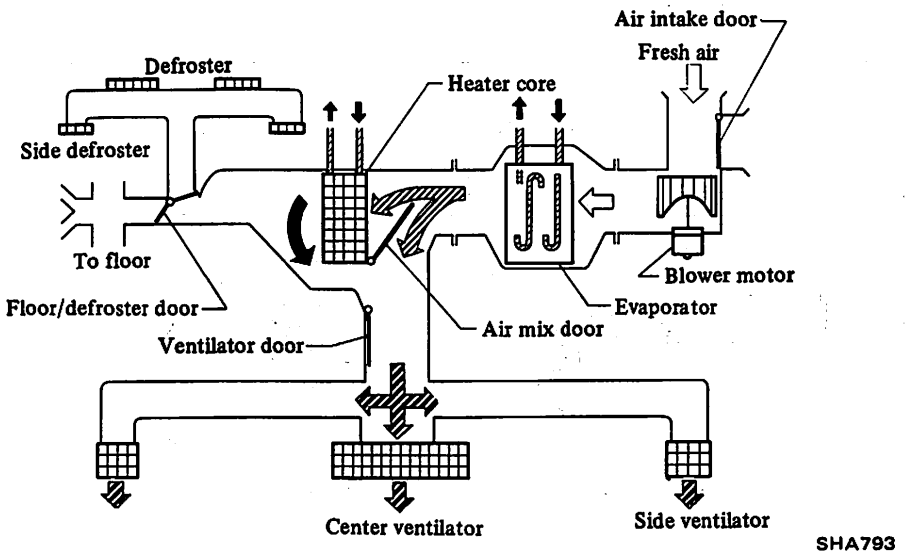




SHA792

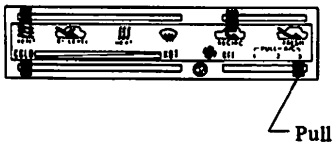
VENT-A/C- position

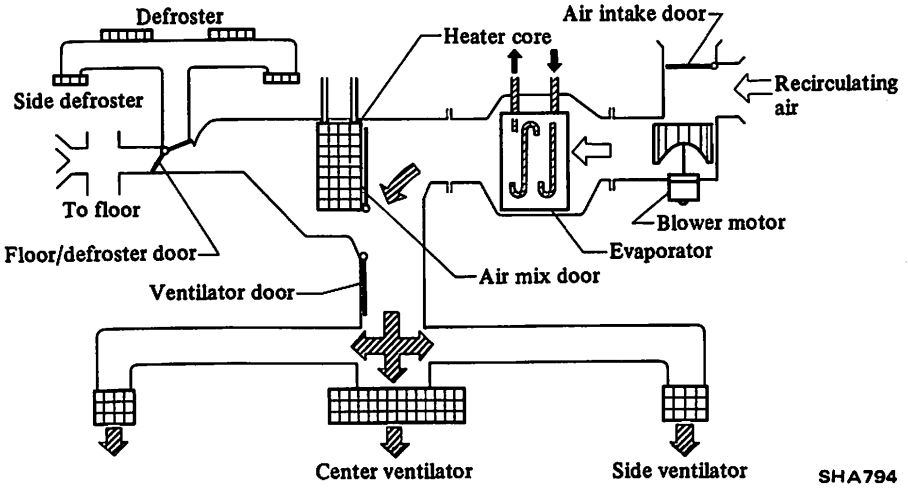




SHA793

VENT-A/C- position (Max. cooling)

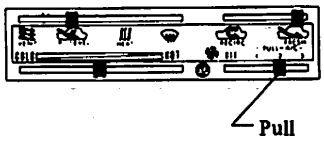


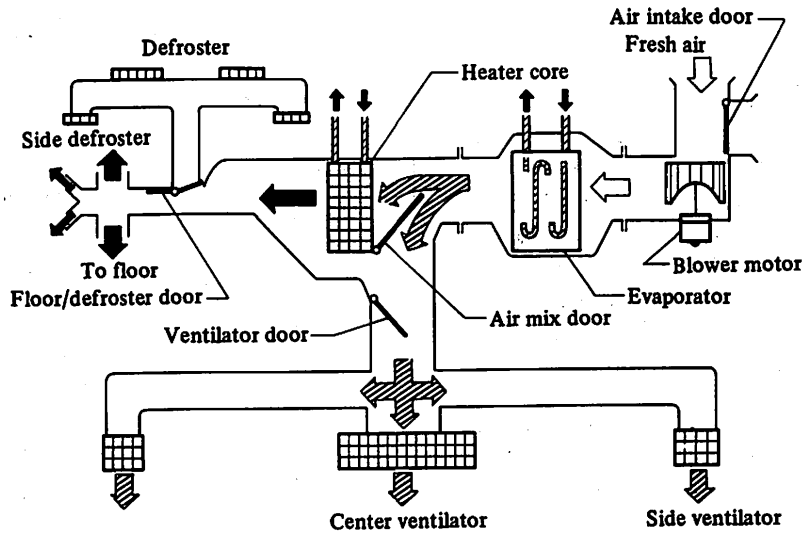


SHA794

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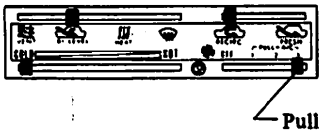
BI-LEVEL-A/C- position

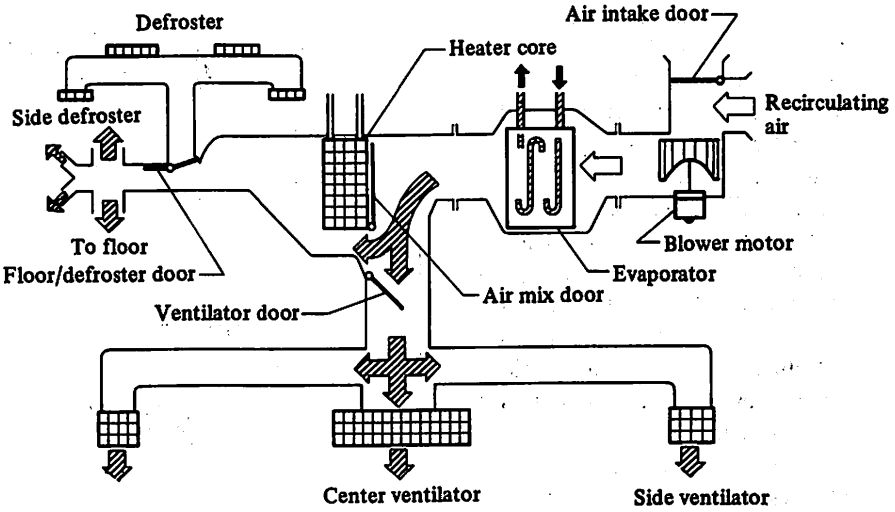




SHA795

BI-LEVEL-A/C- position (Max. cooling)





SHA796

VENT, B/L (BI-LEVEL), HEAT, HEAT (Fast heating), and (Fast defrosting) position

Refer to Description in Heater.

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GENERAL SERVICE

PRECAUTIONS

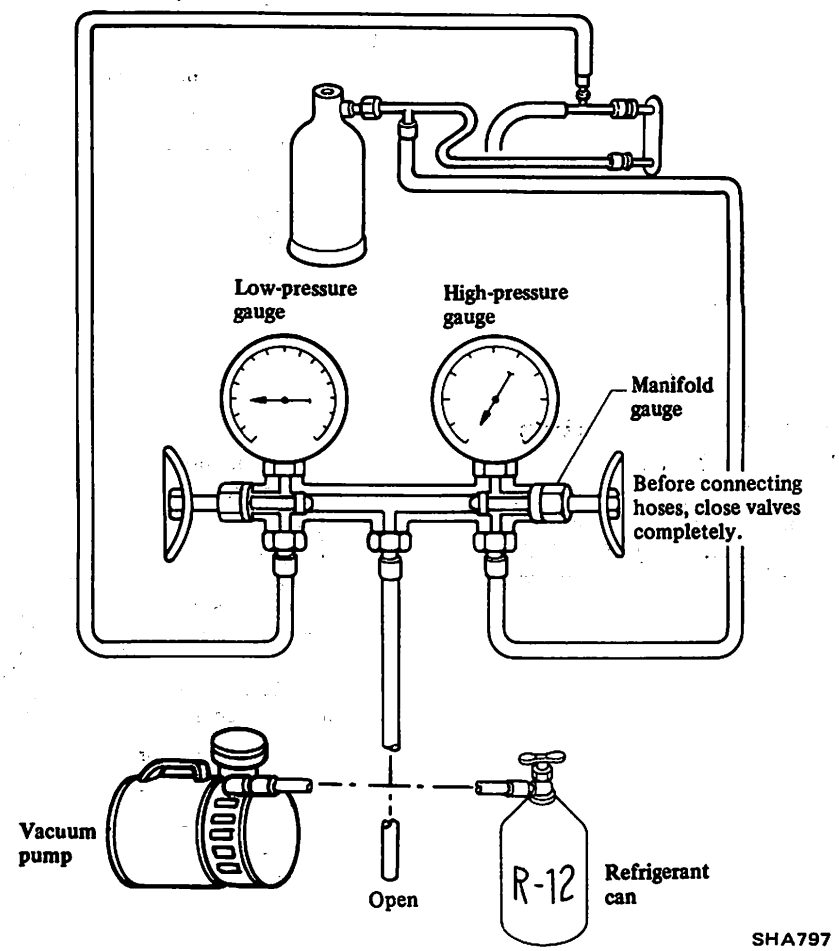
WARNING:

1. Since direct contact of the liquid refrigerant with your skin will cause frostbite, always be careful when handling the refrigerant. Always wear goggles to protect your eyes when working around the system.
2. The refrigerant service container has a safe strength. However, if handled incorrectly, it will explode. Therefore, always follow the instructions on the label. In particular, never store it in a hot location [above 52°C (126°F)] or drop it from a high height.
3. The refrigerant gas is odorless and colorless and breathing may become difficult due to the lack of oxygen. Since the refrigerant gas is heavier than air and will lay close to the floor, be especially careful when handling it in small, confined spaces.
4. The refrigerant itself is nonflammable. However, a toxic gas (phosgene gas) is produced when it contacts fire and special care is therefore required when checking for leaks in the system with a halide torch.
5. Do not steam clean on the system, especially condenser, since excessively high pressure will build up in the system, resulting in explosion of the system.

INSTALLING MANIFOLD GAUGE

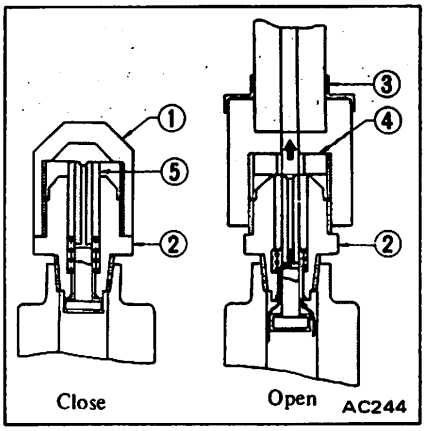
Hoses for the low pressure valve (suction valve) and high pressure valve (discharge valve) should be connected securely to "low" and "high", respectively, on the manifold.

Refer to identification marks (suction side: "S" or "SUCTION", discharge side: "D" or "DISCHARGE").



Connection to service valve

1. Fully close both valves of manifold gauge. Connect high- and low-pressure charging hoses to manifold gauge.
2. Remove caps from service valves. Connect high- and low-pressure charging hoses to service valves in system.



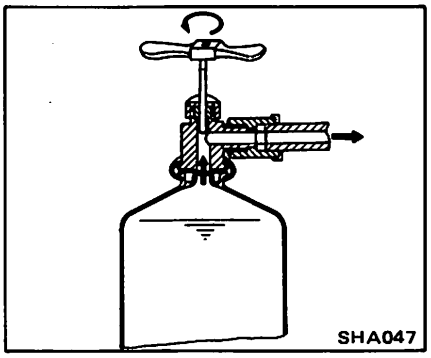
1 Cap
2 Service valve
3 Charging hose
4 Packing
5 Check valve

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Disconnection from service valve

1. Fully close both valves of manifold gauge.
2. Quickly disconnect two charging hoses from service valves and install caps on service valves.

CAUTION:
Do not over-tighten valve cap.


SHA047

WARNING:
Securely connect high pressure (discharge) service valve to that of manifold gauge with a hose; also connect low pressure (suction) service valve to that of manifold gauge.

3. Open both manifold gauge valves **slightly and slowly** discharge refrigerant from system.

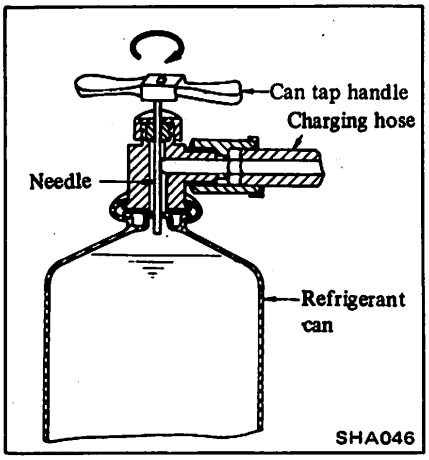
Do not allow refrigerant to rush out. Otherwise, compressor oil will be discharged along with refrigerant.

HANDLING REFRIGERANT SERVICE CAN TAP

The following procedures apply to conventional can taps.

For the correct usage, refer to the manufacturer's instructions.

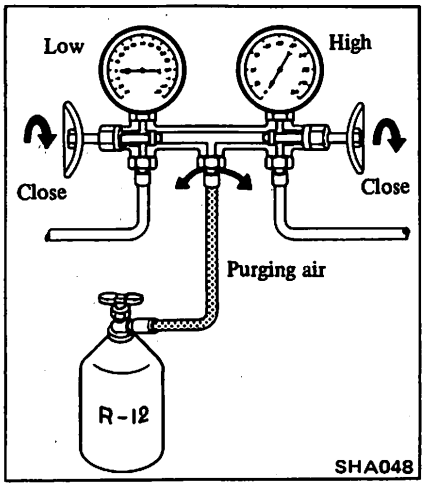
1. Connect charging hose between manifold gauge and can tap.
2. Fully turn in (close) valve stem of manifold gauge.
3. Attach can tap to refrigerant can by turning can tap handle fully counterclockwise.
4. Make a hole in refrigerant can by turning can tap handle clockwise.



SHA046

5. Turn the handle fully counterclockwise to raise the needle. Refrigerant gas will flow up to the manifold gauge.

6. Purge air from charging hose by loosening charging hose nut at manifold gauge.

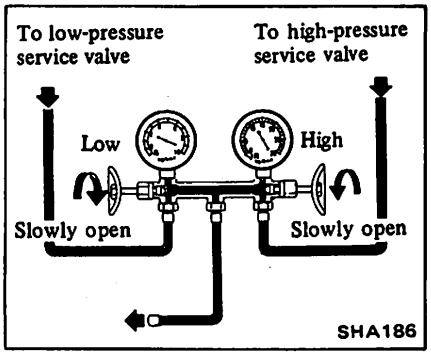


SHA048

DISCHARGING REFRIGERANT

The pressurized refrigerant gas inside the system must be discharged at a pressure approaching atmospheric pressure prior to evacuating refrigerant inside the system.

1. Close high- and low-pressure valves of manifold gauge fully.
2. Connect two charging hoses of manifold gauge to their respective service valves.



SHA186

EVACUATING AND CHARGING REFRIGERANT SYSTEM

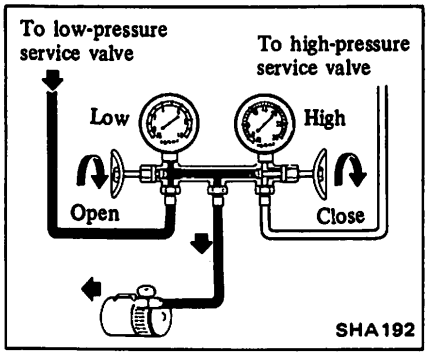
EVACUATING REFRIGERANT SYSTEM

1. Install manifold gauge on system and discharge refrigerant from system until pressure reaches atmospheric pressure.

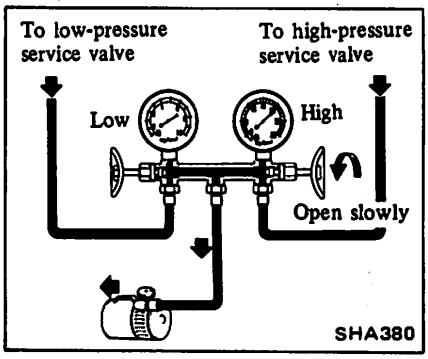
WARNING:
Securely connect high pressure (discharge) service valve to that of manifold gauge with a hose; also connect low pressure (suction) service valve to that of manifold gauge.

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2. Connect center charging hose to vacuum pump.
3. Close both valves of manifold gauge fully. Then start vacuum pump.
4. Open low-pressure valve and suck old refrigerant from system.



5. When low-pressure gauge reading has reached approximately 66.7 kPa 500 mmHg, 19.69 inHg), slowly open high-pressure valve.



6. When pressure inside system has dropped to 94.6 kPa (710 mmHg, 27.95 inHg), fully close both valves of manifold gauge and stop vacuum pump. Let it stand for 5 to 10 minutes in this state and confirm that the reading does not rise.

a. The low-pressure gauge reads lower by 3.3 kPa (25 mmHg, 0.98 inHg) per 300 m (1,000 ft) elevation. Perform evacuation according to the following table.

Elevation m (ft)	Vacuum of system* kPa (mmHg, inHg)
0 (0)	94.6 (710, 27.95)
300 (1,000)	91.3 (685, 26.97)
600 (2,000)	88.0 (660, 25.98)
900 (3,000)	84.6 (635, 25.00)

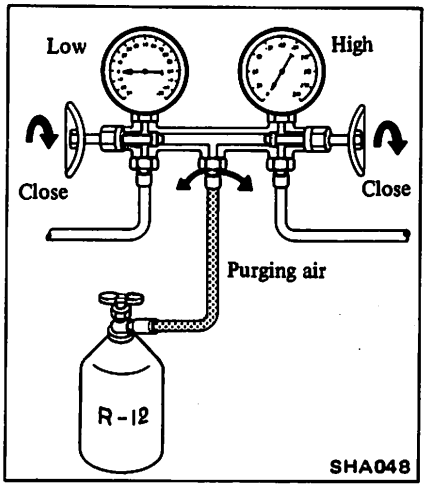
***: Values show reading of the low-pressure gauge.**

b. The rate of ascension of the low-pressure gauge should be less than 3.3 kPa (25 mmHg, 0.98 inHg) in five minutes.

If the pressure rises or the specified negative pressure can not be obtained, there is a leak in the system. In this case, repair the leak described in the following.
(1) Charge system with a can of refrigerant [about 0.4 kg (0.9 lb)]. Refer to Charging Refrigerant.
(2) Check for refrigerant leakage with a leak detector. Repair any leakages found. Refer to Checking for Leaks (MA section).
(3) Discharge refrigerant again, and then evacuate system.

CHARGING REFRIGERANT SYSTEM

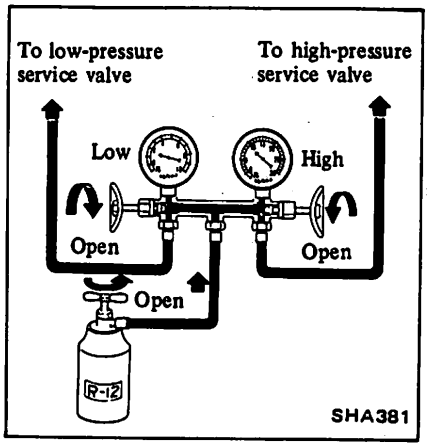
1. Evacuate refrigerant system.
2. Close manifold gauge valves securely and disconnect charging hose from vacuum pump.
3.
(1) Connect center charging hose to refrigerant can through can tap.
(2) Break seal of refrigerant can and purge air from center charging hose.



4. Charge refrigerant into system.

a. In case of charging refrigerant gas.

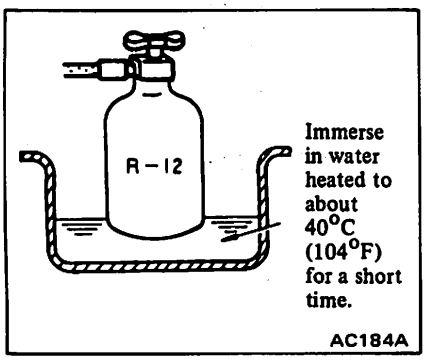
Open high- and low-pressure valves of manifold gauge and charge refrigerant into system.



When refrigerant charging speed is slow, immerse refrigerant can in water, heated to a temperature of about 40°C (104°F) for a short time.

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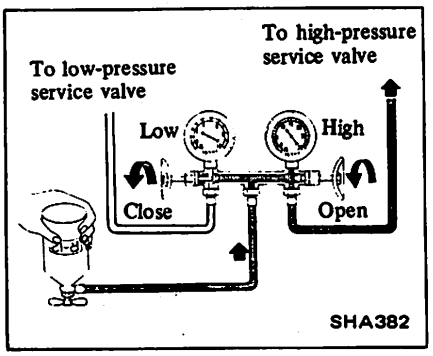
WARNING:
a. Under any circumstances the refrigerant can must not be warmed in water heated to a temperature of over 52°C (126°F).
b. A blow torch or stove must never be used to warm up the can.



b. In case of charging liquefied refrigerant.

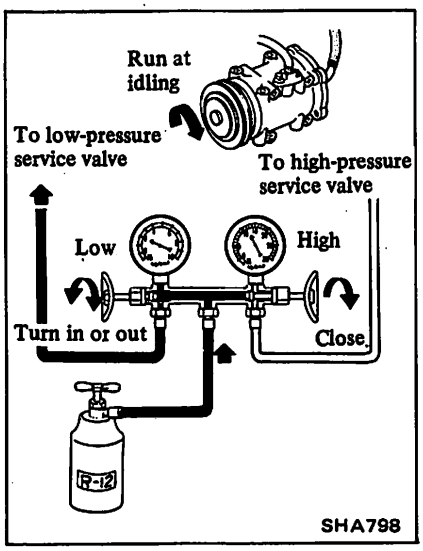
Open high pressure valve of manifold gauge and charge liquefied refrigerant into system with can upside down.

CAUTION:
When charging liquefied refrigerant into the system with the can turned upside down to reduce charging time, charge it only through high pressure (discharge) service valve. After completion of charging, the compressor should always be turned several times manually.



5. **When refrigerant charging speed slows down,** charge it while running the compressor for ease of charging. After having taken the steps up to 4 above, proceed with charging in the following order.
(1) **Shut off high pressure valve of manifold gauge.**
(2) Run the engine **at idling speeds below 1,500 rpm.**
(3) Set mode dial, temperature dial and fan lever at maximum cool and speed respectively.
(4) Charge refrigerant while controlling low-pressure gauge reading at 275 kPa (2.8 kg/cm², 40 psi) or less by turning in or out low-pressure valve of manifold gauge.

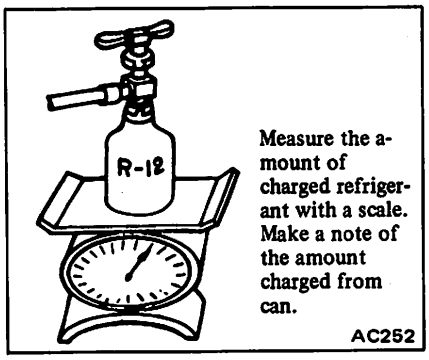
WARNING:
Never charge refrigerant through high pressure side (discharge side) of system since this will force refrigerant back into refrigerant can and can may explode.



6. When refrigerant can is empty, fully close both valves of manifold gauge and replace refrigerant can with a new one. **Before charging refrigerant from new can, purge air from inside charging hose.**

7. Charge the specified amount of refrigerant into system by weighing charged refrigerant with scale.

Refrigerant capacity:
0.75 - 0.95 kg
(1.7 - 2.1 lb)



The state of the bubbles in sight glass should only be used for checking whether the amount of charged refrigerant is small or not. Refer to Refrigerant Level Check (MA section). The amount of charged refrigerant can be correctly judged by means of discharge pressure.

8. Close manifold gauge valves. Then detach charging hoses from service valves of system. Be sure to install valve cap on service valve.
9. Confirm that there are no leaks in system by checking with a leak detector.

Refer to Checking for Leaks (MA section).

Conducting a performance test prior to removing manifold gauge is a good service operation. Refer to Performance Test.

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COMPRESSOR OIL LEVEL CHECK

Almost all compressor oil is circulating in the system together with refrigerant. If an excessive quantity of oil is charged into the system, most of the oil goes around the system and stays in the condenser or in the evaporator, thus causing considerable reduction in the cooling capacity of the system. Insufficient compressor oil leads to poor lubrication of the compressor. Whenever replacing any component of the refrigeration system, the original total oil charge must always be maintained.

Amount of oil in the system:
150 mℓ
(5.1 US fl oz, 5.3 Imp fl oz)

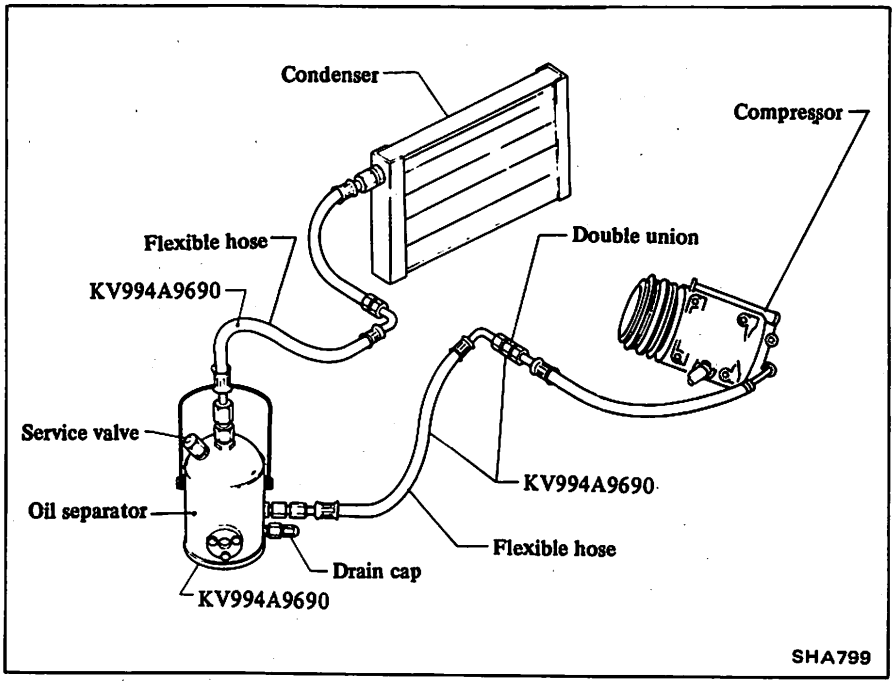
Check and adjust the quantity of oil according to the following procedures.

CAUTION:
- **a. The oil should not be transfused from a container into another, as the failure will possibly cause moisture to mix with the oil.**
- **b. The used oil should not be returned into a container.**
- **c. The oil should not be used if its state of preservation is not clear enough.**

Checking and adjusting (Using oil separator)

The Tool KV994A9690 is used to efficiently withdraw the oil in the refrigeration system (that is, to separate oil and refrigerant). If an excessive quantity of oil is charged in the system, or if the quantity of oil in the system is unknown, adjust the quantity of oil in the system to specification, proceeding as follows:

1. Discharge air conditioning system. Refer to Discharging System.
2. Using two special flexible hoses and double union in Tool KV994A9690, connect oil separator between compressor discharge side and condenser.



3. Evacuate and charge system. Refer to General Service for evacuating and charging system.
4. Fully open all windows or all doors of car.
5. Operate compressor at engine idling with air conditioner set for maximum cooling and high fan speed.

Never allow engine speed to exceed idling speed.

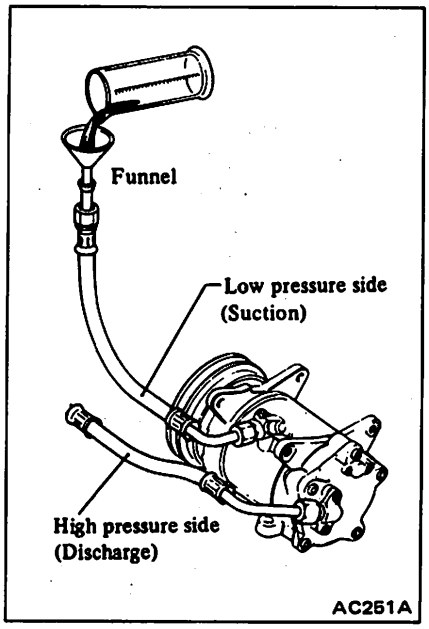
6. Observe oil separator oil level gauge. If rise of oil level has stopped, immediately stop compressor operation. (This indicates that oil has been withdrawn.)

CAUTION:
Do not continue oil withdrawal operation more than 10 minutes.

In some case, fluid refrigerant may be mixed with oil, causing unusual rise of oil level. In such a case, stop compressor operation after ten minutes of withdrawal operation.

7. Discharge system. Refer to General Service for discharging system.
8. Disconnect oil separator, two flexible hoses and double union from system.
9. Connect refrigerant lines to original positions.
10. Disconnect low flexible hose from compressor suction valve.
11. Add oil from compressor suction valve.

Amount of oil to be added:
120 mℓ
(4.1 US fl oz, 4.2 Imp fl oz)



- **a. Oil remains unremoved in the system about 30 mℓ (1.0 US fl oz, 1.1 Imp fl oz)**
- **b. To facilitate replenishment, it is a good practice to disconnect the low-pressure (flexible) hose to the evaporator and add oil to the compressor through the hose.**

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12. After charging, rotate compressor clutch with hand 5 to 10 turns.
13. Connect low flexible hose to compressor suction valve. Evacuate and charge system. Refer to General Service for evacuating system and charging refrigerant.
14. Conduct leak test and performance test.
15. Gradually loosen drain cap of oil separator to release residual pressure. Remove cap and drain oil.
16. To prevent formation of rust and intrusion of moisture or dust, perform the following before placing oil separator kit into storage.
(1) Cap each opening of two flexible hose and double union securely.
(2) Cap oil separator, evacuate it from service valve, and charge refrigerant.

Checking and adjusting (Alternate method)

If the oil Separator is not available, control the quantity of oil in accordance with the table below when charging compressor oil into the system.

When replacing two or more of the parts indicated in the chart below, follow each instruction under the proper charging method column for the correct amount of oil to be added.

OIL CHARGE TABLE

Condition		Proper charging method	Amount of oil to be added mℓ (US fl oz, Imp fl oz)
Replacement of compressor		Remove all oil from new compressor* and charge it with amount of oil shown in right column.	70 (2.4, 2.5)
Replacement of evaporator		Add amount of oil shown in right column.	70 (2.4, 2.5)
Replacement of receiver dryer (liquid tank)		Oil need not be added.	–
Replacement of condenser	There is no sign of oil leakage from condenser.	Oil need not be added.	–
	There are evidences of a large amount of oil leakage from condenser.	Add amount of oil shown in right column.	50 (1.7, 1.8)
Replacement of flexible hose or copper tube	There is no sign of oil leakage.	Oil need not be added.	–
	There are evidences of a large amount of oil leakage.	Add amount of oil shown in right column.	50 (1.7, 1.8)
Gas leakage	There is no sign of oil leakage.	Oil need not be added.	–
	There are evidences of a large amount of oil leakage.	Add amount of oil shown in right column.	50 (1.7, 1.8)

* Remove compressor oil as follows

1. **With the compressor upside down, completely drain the oil through the suction port (from the embossed letter "s" mark side). Be sure to use a clean container to receive the oil.**
2. **When the oil stops flowing out, rotate the clutch hub two or three times to completely drain the oil.**

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PERFORMANCE TEST

PERFORMANCE CHART

TEST CONDITION

Testing must be performed as follows.

Vehicle location:	Indoors or in the shade [Outside wind velocity: Less than 2 m (7 ft)/sec.]
Doors:	Closed
Door windows:	Open
Hood:	Open
Air control lever:	VENT-A/C-position
Temperature control lever:	Max. COLD position
Air intake lever:	RECIRC position
FAN control lever:	3 position
Engine speed:	1,500 rpm (constant)
Manifold gauge:	Connect manifold gauge to high (discharge) and low (suction) service valves.
Measurement of discharge air temperature:	Center outlet grille
Measurement of inside air relative humidity and temperature:	Blower assembly inlet
Measurement of ambient air relative humidity and temperature:	A point 1 m (3.3 ft) in front of condenser

TEST READING

Recirculating-to-discharge air temperature table

Recirculating air at blower assembly inlet		Discharge air temperature at center ventilator °C (°F)
Relative humidity %	Air temperature °C (°F)	
50 - 90	15 (59)	1.0 - 5.0 (34.0 - 41.0)
	20 (68)	3.0 - 8.0 (37.5 - 46.5)
	25 (77)	6.5 - 13.5 (43.5 - 56.5)
	30 (86)	11.5 - 18.5 (52.5 - 65.5)
	35 (95)	17.0 - 24.5 (62.5 - 76.0)

Ambient air temperature-to-compressor pressure table

Ambient air		Pd kPa (kg/cm², psi)	Ps kPa (kg/cm², psi)
Relative humidity %	Temperature °C (°F)	Pressure high (Discharge side)	Pressure low (Suction side)
50 - 90	17 (63)	843 - 1010 (8.6 - 10.3, 122 - 146)	98 - 157 (1.0 - 1.6, 14 - 23)
	20 (68)	902 - 1079 (9.2 - 11.0, 131 - 156)	98 - 167 (1.0 - 1.7, 14 - 24)
	25 (77)	1030 - 1226 (10.5 - 12.5, 149 - 178)	108 - 196 (1.1 - 2.0, 16 - 28)
	30 (86)	1157 - 1393 (11.8 - 14.2, 168 - 202)	127 - 226 (1.3 - 2.3, 18 - 33)
	35 (95)	1304 - 1559 (13.3 - 15.9, 189 - 226)	147 - 265 (1.5 - 2.7, 21 - 38)
	40 (104)	1451 - 1746 (14.8 - 17.8, 210 - 253)	177 - 324 (1.8 - 3.3, 26 - 47)

a. **The pressure will change in the following manner with changes in conditions:**
- **When blower speed is low, discharge pressure will drop.**
- **When the relative humidity of intake air is low, discharge pressure will drop.**

b. **The temperature will change in the following manner with changes in conditions:**
When the ambient air temperature is low, the outlet air temperautre will become low.

If the test reveals that there is any abnormality in system pressure, isolate the cause and repair. Refer to Performance Test Diagnoses.

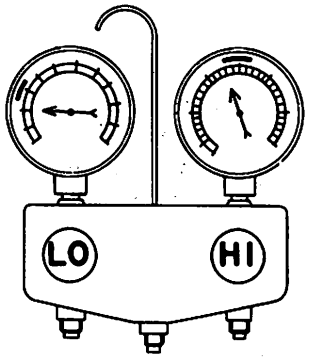
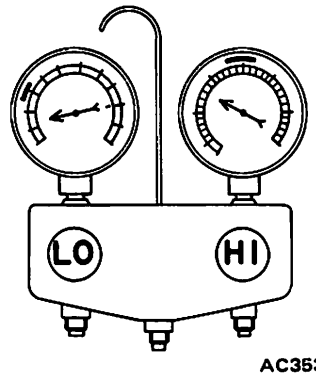
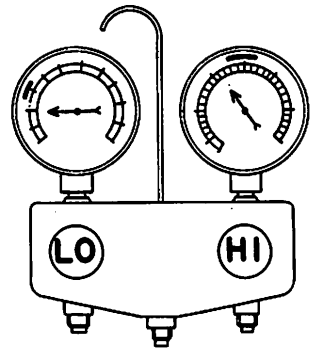
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PERFORMANCE TEST DIAGNOSES

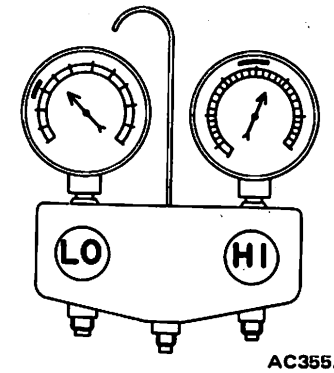
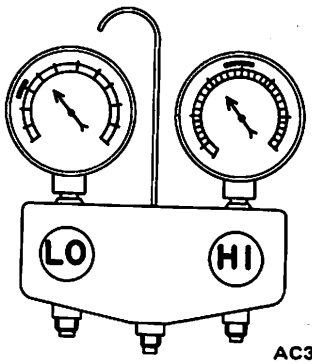
Characteristics revealed on the manifold gauge reading for the air conditioning system are shown in the following.

As to the method of a performance test, refer to the item of "Performance Test".

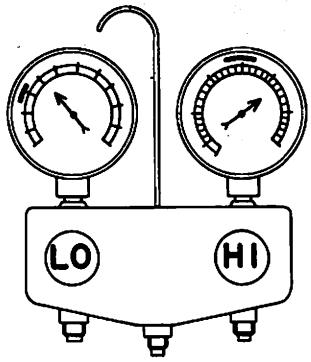
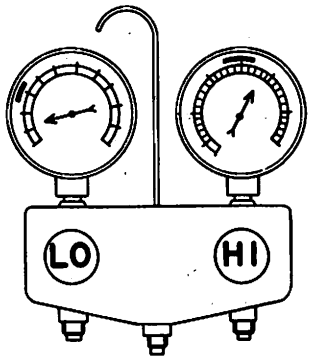
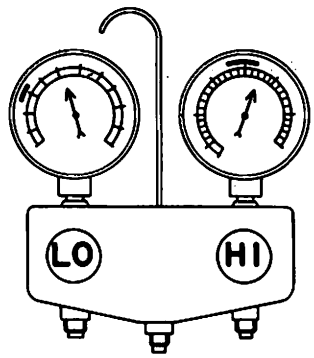
In the following table, the portion smeared with ink on each gauge scale indicates a range based on the assumption that the air conditioning system is in good order. This range is described in PERFORMANCE CHART.

Condition	Probable cause	Corrective action
INSUFFICIENT REFRIGERANT CHARGE  AC352A Insufficient cooling. Bubbles appear in sight glass.	Refrigerant is small, or leaking a little.	1. Leak test. 2. Repair leak. 3. Charge system. **Note: Evacuate, as necessary, and recharge system.**
ALMOST NO REFRIGERANT  AC353A No cooling action. In sight glass appear a lot of bubbles or something like mist.	Serious refrigerant leak.	**Stop compressor immediately.** 1. Leak test. 2. Discharge system. 3. Repair leak(s). 4. Replace receiver drier if necessary. 5. Check oil level. 6. Evacuate and recharge system.
FAULTY EXPANSION VALVE  AC354A Slight cooling. Sweating or frosted expansion valve inlet.	Expansion valve restricts refrigerant flow. ● Expansion valve is clogged. ● Expansion valve is inoperative. Valve stuck closed. Thermal bulb has lost charge.	If valve inlet reveals sweat or frost: 1. Discharge system. 2. Remove valve and clean it. Replace it if necessary. 3. Evacuate system. 4. Charge system. If valve does not operate: 1. Discharge system. 2. Replace valve. 3. Evacuate and charge system.

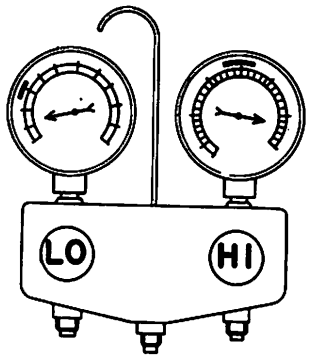
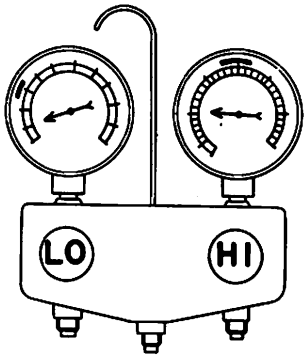
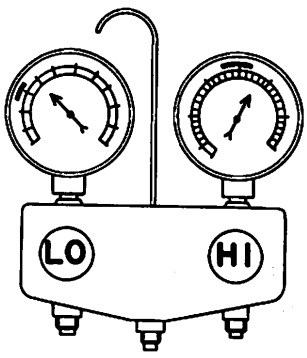
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Condition		Probable cause	Corrective action
 AC355A	Insufficient cooling. Sweated suction line.	Expansion valve allows too much refrigerant through evaporator.	Check valve for operation. If suction side does not show a pressure decrease, replace valve.
 AC356A	No cooling. Sweating or frosted suction line.	Faulty expansion valve.	1. Discharge system. 2. Replace valve. 3. Evacuate and replace system.

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Condition	Probable cause	Corrective action
AIR IN SYSTEM  AC359A Insufficient cooling. Sight glass shows occasional bubbles.	Air mixed with refrigerant in system.	1. Discharge system. 2. Replace receiver drier. 3. Evacuate and charge system.
MOISTURE IN SYSTEM  AC360A After operation for a while, pressure on suction side may show vacuum pressure reading. During this condition, discharge air will be warm. As a warning of this, reading shows 39 kPa (0.4 kg/cm², 6 psi) vibration.	Drier is saturated with moisture. Moisture has frozen at expansion valve. Refrigerant flow is restricted.	1. Discharge system. 2. Replace receiver drier (twice if necessary). 3. Evacuate system completely. (Repeat 30-minute evacuating three times.) 4. Recharge system.
FAULTY CONDENSER  AC361A No cooling action: engine may overheat. Bubbles appear in sight glass of drier. Suction line is very hot.	Usually malfunctioning condenser.	• Check fan belt and fluid coupling. • Check condenser for dirt accumulation. • Check engine cooling system for overheat. • Check for refrigerant overcharge. **If pressure remains high in spite of all above actions taken, remove and inspect the condenser for possible oil clogging.**

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Condition	Probable cause	Corrective action
HIGH PRESSURE LINE BLOCKED  AC362A Insufficient cooling. Frosted high pressure liquid line.	Drier clogged, or restriction in high pressure line	1. Discharge system. 2. Remove receiver drier or strainer and replace it. 3. Evacuate and charge system.
FAULTY COMPRESSOR  AC363A Insufficient cooling.	Internal problem in compressor, or damaged gasket and valve.	1. Discharge system. 2. Remove and check compressor. 3. Repair or replace compressor. 4. Check oil level. 5. Replace receiver drier. 6. Evacuate and charge system.
TOO MUCH OIL IN SYSTEM (Excessive)  AC364A Insufficient cooling.	Too much oil circulates with refrigerant, causing the cooling capacity of the system to be reduced.	Refer to Oil Level Check for correcting oil level.

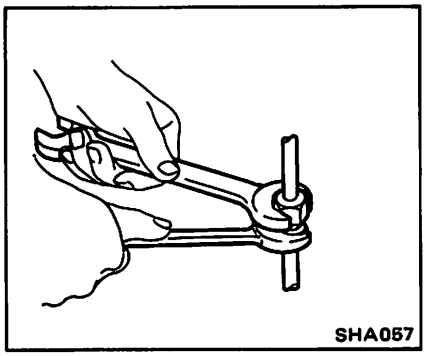
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SERVICE PROCEDURES

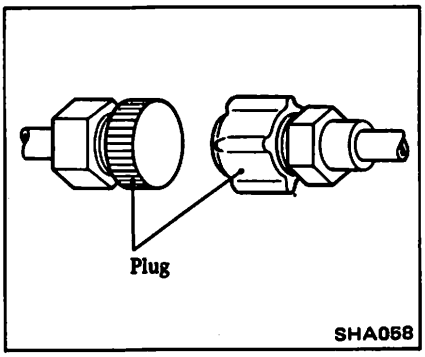
PRECAUTIONS FOR REMOVAL AND INSTALLATION

When replacing refrigerant cycle component, observe the following:

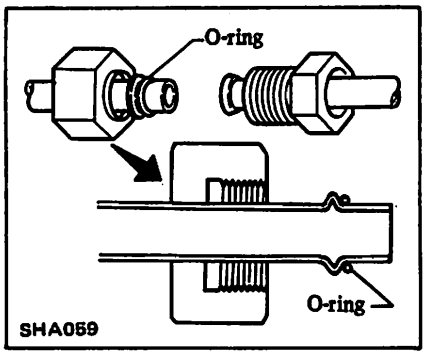
1. Disconnect battery ground cable.
2. Before starting work, be sure to discharge system.
3. When disconnecting or connecting tubes, be sure to use two wrenches on both tubes.



4. After disconnecting tubes, plug all openings immediately to prevent entrance of dirt and moisture.

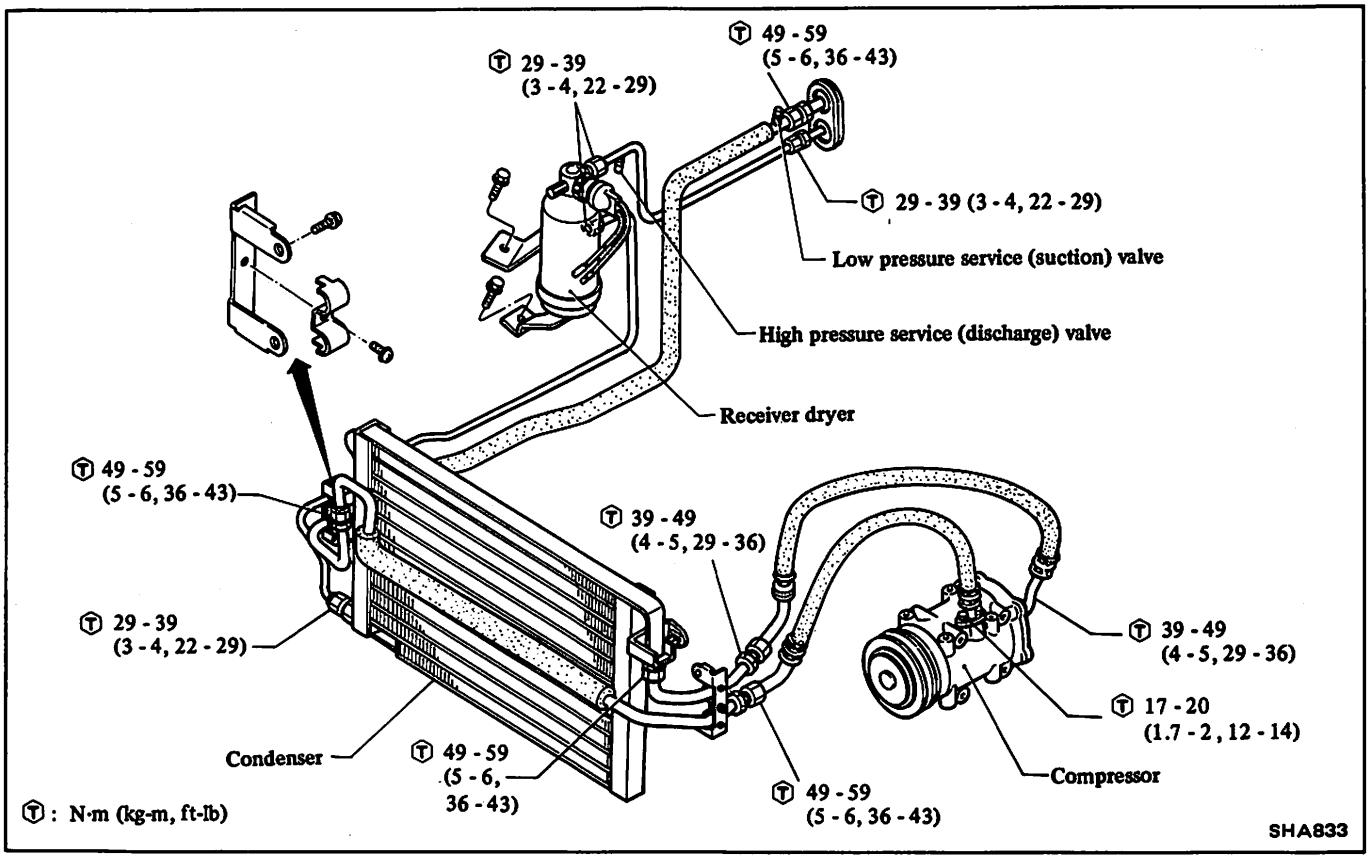


5. Compressed air must never be used to clean dirty line. Clean with refrigerant gas.
6. When connecting tubes, install new O-ring (never reuse used one) into connection and be sure to apply compressor oil to seating surface and O-ring.



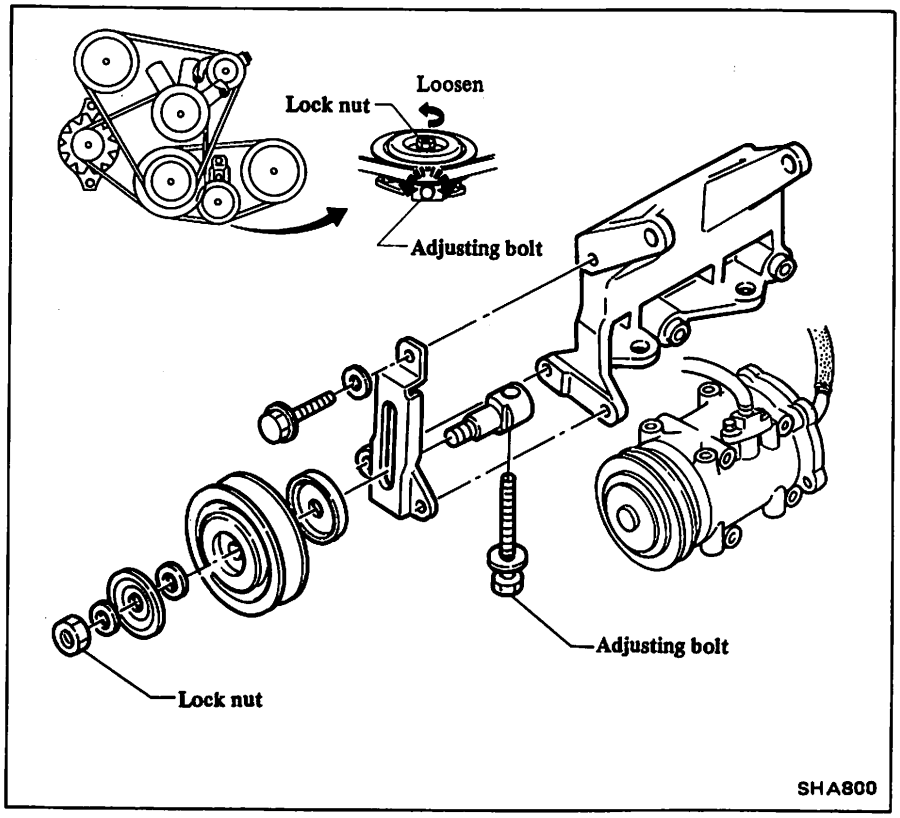
7. Check tightening torque of connections to specification.
8. Check all components to insure they are neither damaged nor interfere with adjacent parts.
9. Conduct leak test and make sure that there is no leak from connections.
10. Determine quantity of oil to be charged into compressor by referring to Compressor Oil Level Check in General Service.

REFRIGERANT LINES



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COMPRESSOR IDLER PULLEY



FAST IDLE CONTROL DEVICE (F.I.C.D.)

ADJUSTMENT OF IDLE SPEED

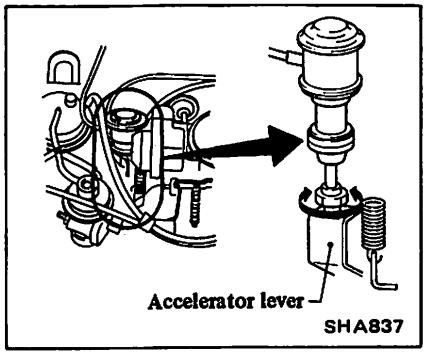
1. Warm up engine.
2. Make sure engine is at correct idle speed with air conditioner in OFF position.

Idling speed:
Refer to S.D.S. (MA section)

3. Set engine speed to the following specifications with air conditioner in ON position (when F.I.C.D. is actuated).

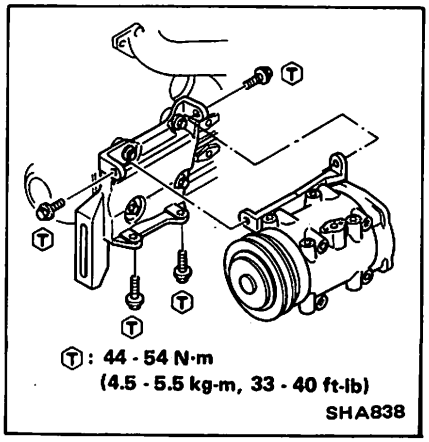
(1) To adjust, rotate adjusting screw located on accelerator lever.

Engine rpm (Air conditioner: ON)
M/T . . . . . 800 rpm
A/T ("N" position) . . . 800 rpm



(2) Depress and release accelerator pedal several times, and make sure that engine speed meets specifications with air conditioner in "OFF" and "ON" position.

COMPRESSOR



REMOVAL AND INSTALLATION

1. Operate compressor, if possible, at engine idling speed, with air conditioner controls set for maximum cooling and high blower speed, for 10 to 15 minutes with all windows open to return oil into compressor.
2. Remove compressor drive belt.
(1) Loosen idler pulley lock nut.
(2) Fully loosen adjusting bolt.
3. Disconnect high (discharge) and low (suction) flexible hoses from compressor.
4. Disconnect compressor clutch harness.
5. Remove compressor.

CAUTION:
Do not attempt to leave the compressor on its side or upside down for more than 10 minutes.

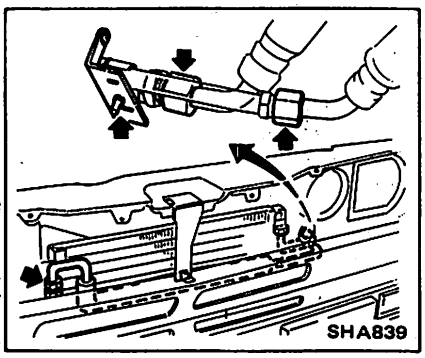
6. Installation is in the reverse order of removal.

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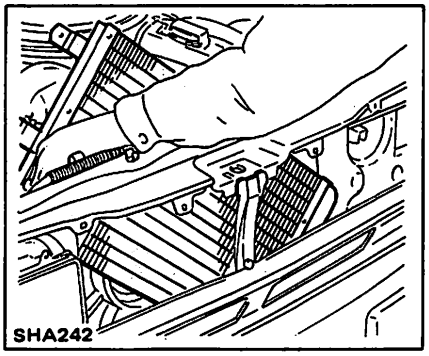
CONDENSER

REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Drain engine coolant.
3. Remove radiator grille and radiator shroud.
4. Remove radiator.
5. Remove L.H. headlamp assembly.
6. Remove refrigerant tubes.



7. Disconnect refrigerant line from condenser.
8. Remove condenser mounting bolts and remove condenser.



9. Installation is in the reverse order of removal.

INSPECTION

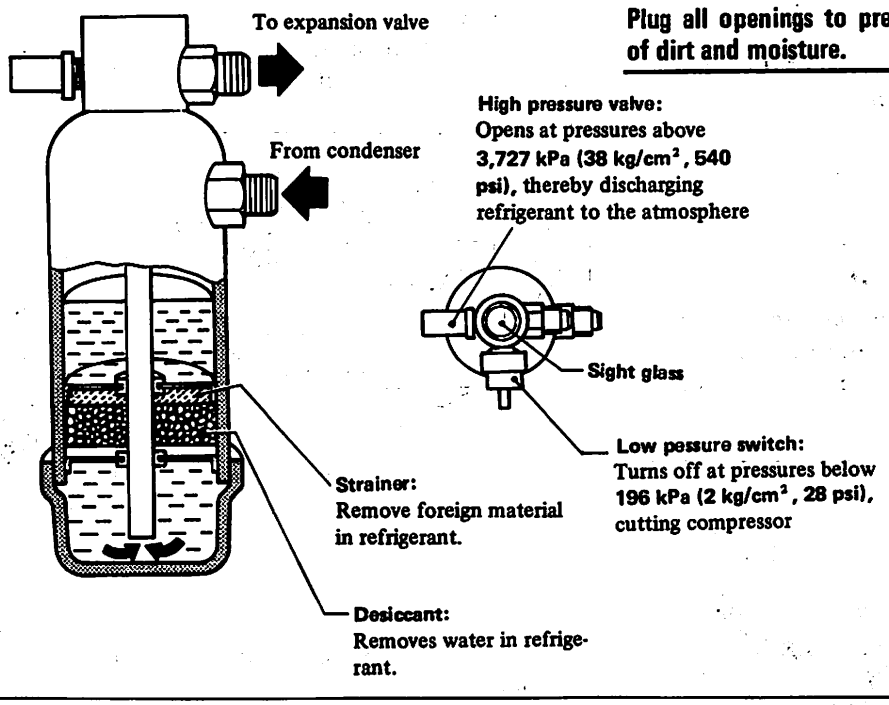
Inspect joints of inlet and outlet pipes for cracks and scratches. Upon finding any problem which may cause gas to leak, repair or replace condenser.

Condenser fins or air passages clogged with dirt, insects or leaves will reduce cooling efficiency of condenser. In such a case, clean fins or air passages with compressed air.

CAUTION:
Do not clean condenser with steam. Be sure to use cold water or compressed air.

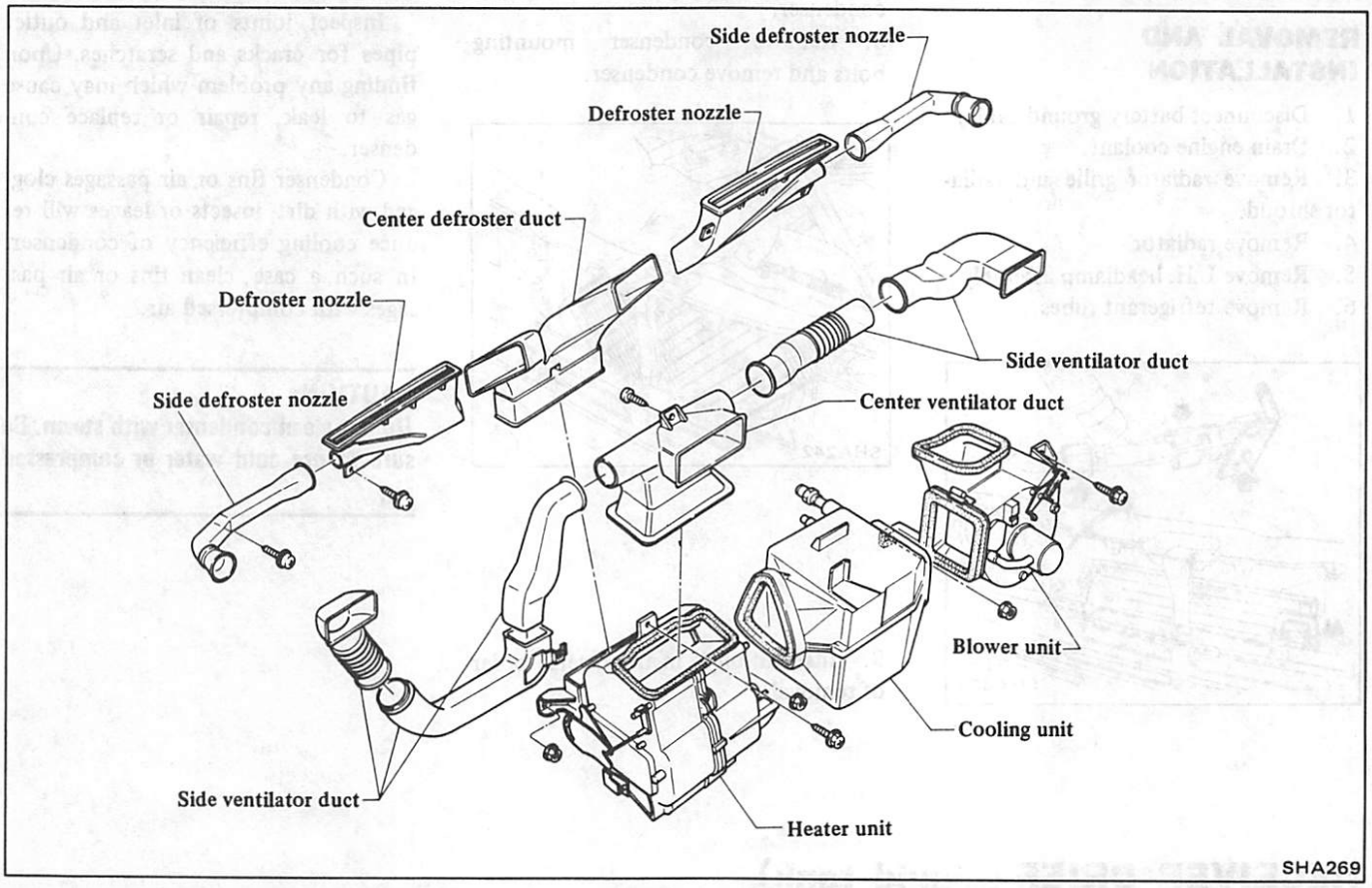
RECEIVER DRIER (Liquid tank)

CAUTION:
Plug all openings to prevent entrance of dirt and moisture.



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AIR CONDITIONER DUCT AND NOZZLE COMPONENT



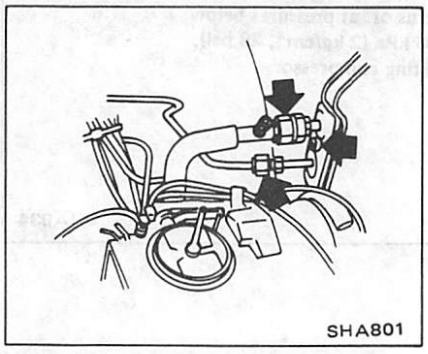
AIR CONDITIONER CONTROL

Refer to Heater/Air Conditioner Control in Heater.

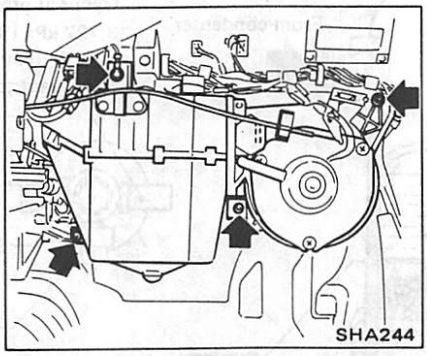
COOLING UNIT

REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Disconnect refrigerant line from cooling unit and remove tube mounting bolt.



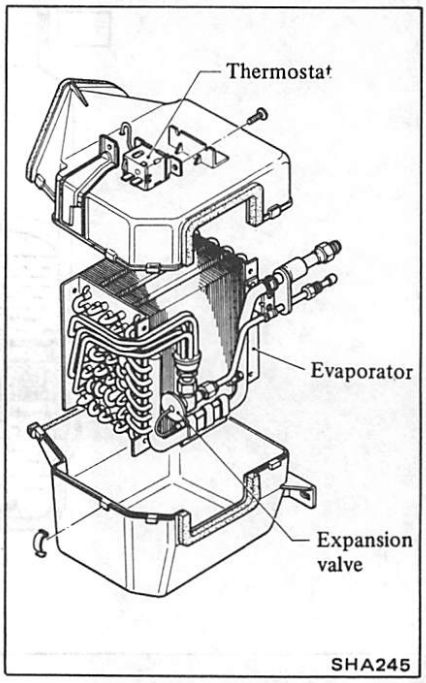
3. Remove instrument panel assembly. Refer to BF section.
4. Remove blower unit.
5. Remove cooling unit.



6. Installation is in the reverse order of removal.

Adjust air intake control cable. Refer to Adjusting Heater Control in Heater.

DISASSEMBLY AND ASSEMBLY



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INSPECTION

Evaporator assembly

1. Clean fins and check for crack or corrosion.

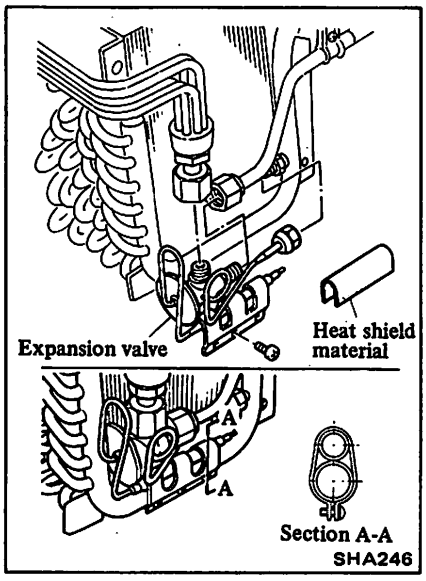
CAUTION:
Do not clean evaporator with steam. Be sure to use cold water or compressed air.

2. Check for gas leaks at the fins and the expansion valves. If there are leaks, retighten or replace them.

Case

Replace case if it is cracked or deformed.

EXPANSION VALVE



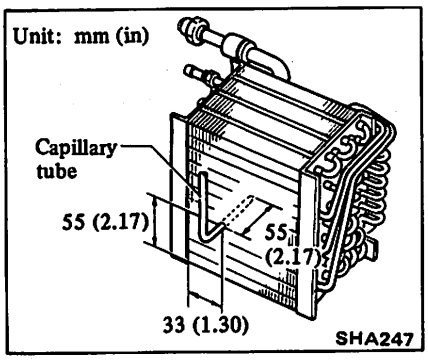
THERMOSTAT

REMOVAL AND INSTALLATION

1. Remove cooling unit.
2. Remove thermostat.

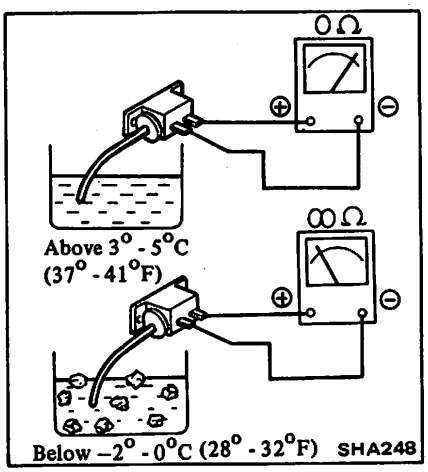
CAUTION:
Capillary tube should not be bent too sharply.

3. Install thermostat as follows.
- Insert capillary tube end between the core fins at 55 mm (2.17 in) from end of the core.



INSPECTION

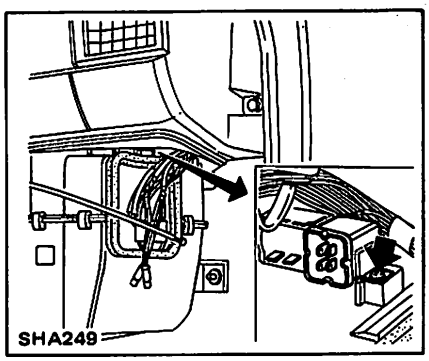
Test continuity through thermostat with a test lamp or ohmmeter.



COMPRESSOR RELAY

REMOVAL AND INSTALLATION

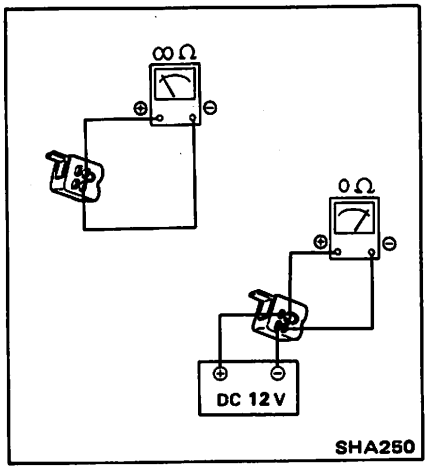
1. Remove blower unit.
2. Disconnect relay connector and then remove relay.



3. Installation is in the reverse order of removal.

INSPECTION

Test continuity through switch with a test lamp or ohmmeter.

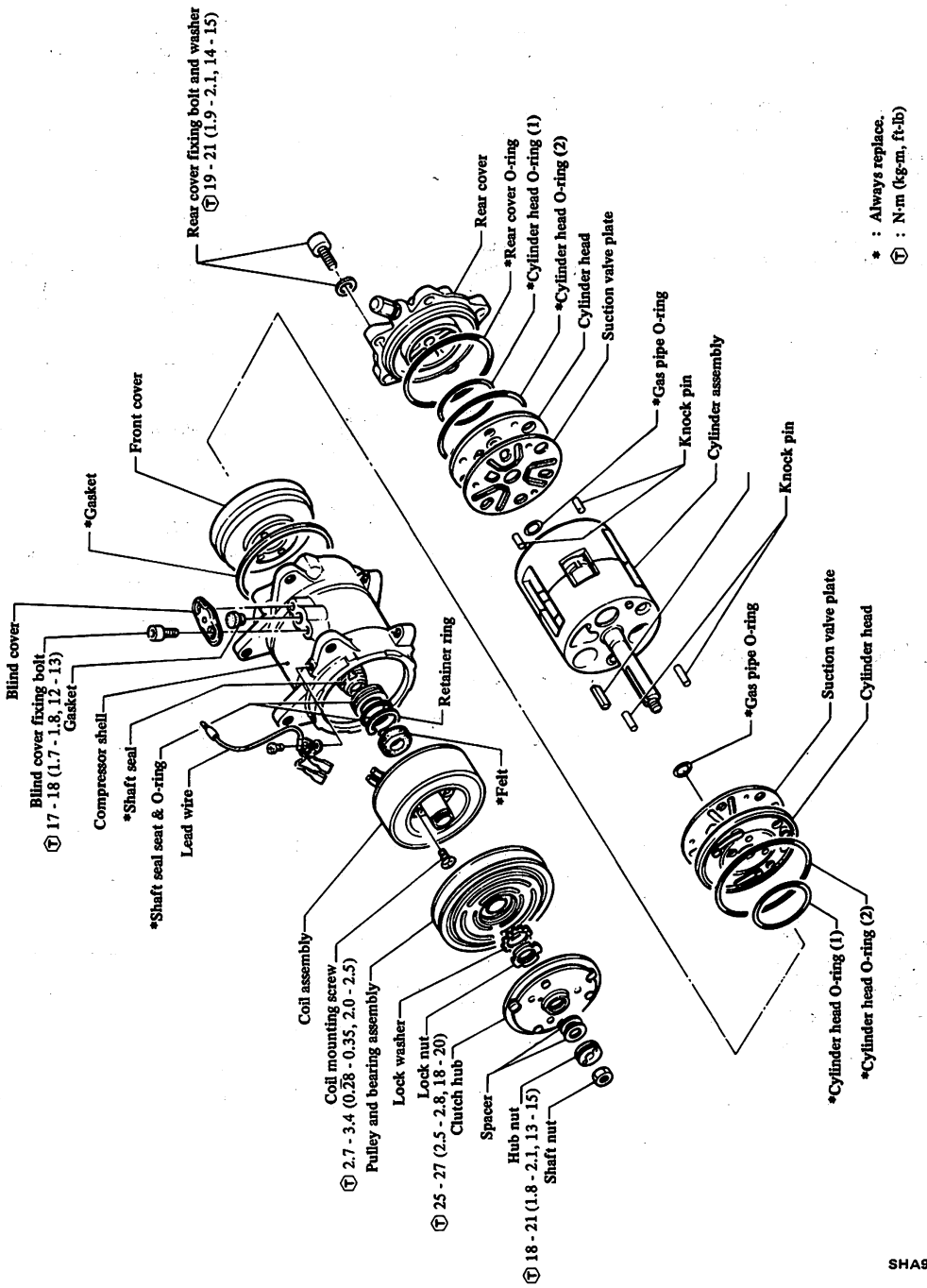


BLOWER UNIT

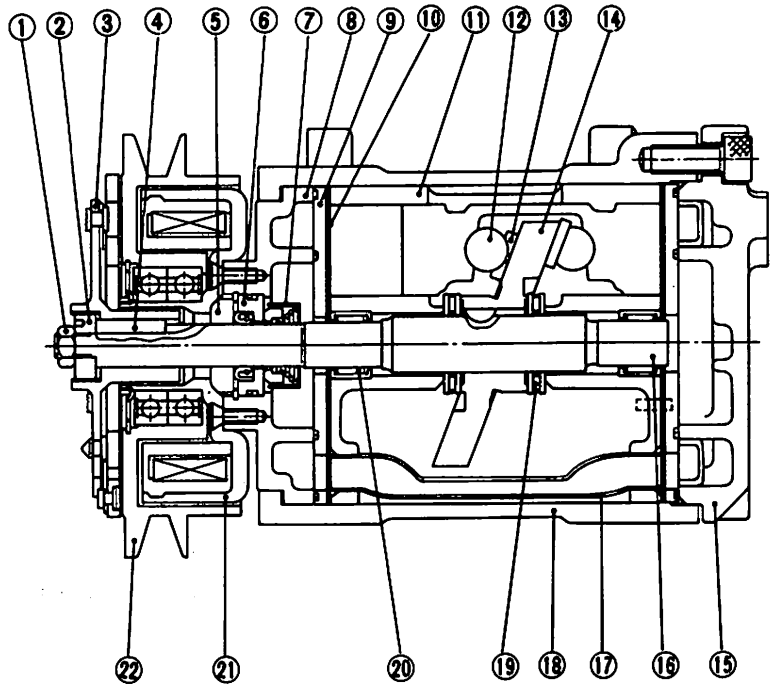
Refer to Blower Unit in Heater.

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COMPRESSOR (Disassembly and assembly)



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1 Shaft nut
2 Hub nut
3 Clutch hub
4 Key
5 Felt
6 Shaft seal seat
7 Shaft seal
8 Front cover
9 Cylinder head
10 Suction valve plate
11 Cylinder
12 Drive ball
13 Shoe disc
14 Swash plate
15 Rear cover
16 Compressor shaft
17 Gas pipe
18 Compressor shell
19 Thrust bearing
20 Needle bearing
21 Coil assembly
22 Pulley and bearing assembly

AC926

PRECAUTIONS

1. **Plug all openings** in the compressor to prevent moisture and foreign matter from entering.
2. **Do not leave compressor on its side or upside down for more than 10 minutes.**
3. **Before replacing with the new compressor, completely drain oil from the new compressor and fill with an amount of oil equaling that remaining in the old compressor.**
4. When replacing parts or oil, **always replace gaskets, O-ring and oil seal.**
5. When storing a compressor, be sure to fill it with refrigerant to prevent rusting. Add refrigerant at the low pressure side and purge air at the high pressure side.

DESCRIPTION

The MJ167 compressor employs an oil-mist jet system in which some lubricant is mixed in the refrigerant and the mixture is sprayed directly to the sliding portions from the compressor suction side.

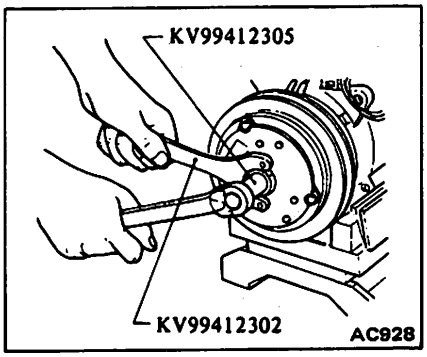
COMPRESSOR CLUTCH

The most likely source of problem is clutch slippage. Factors are listed here. Exercise ample care.

1. Clearance between clutch hub and pulley should be 0.5 to 0.8 mm (0.020 to 0.031 in) at all peripheral points.
2. Make sure that there is no oil or dirt on friction surfaces of clutch disc (clutch hub) and pulley. Remove any oil or dirt with a dry rag.
3. Make sure that terminal voltage at magnetic coil is above 10.5V.

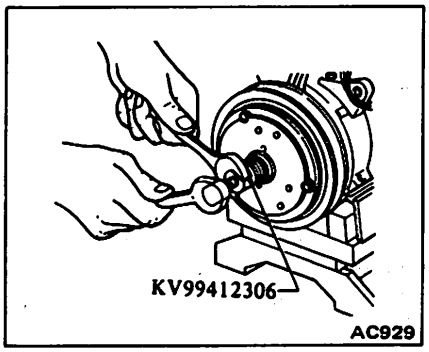
REMOVAL

1. Using Tool KV99412302, hold clutch hub. With suitable socket wrench, remove shaft nut from shaft.
2. Then, using Tool KV99412305, remove clutch hub nut. Remove spacers.



AC928

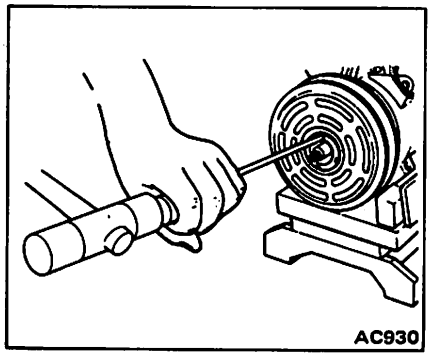
3. Using Tool, remove clutch hub. Thread Tool into the bore of clutch hub, hold Tool with wrench, and then thread in center bolt.



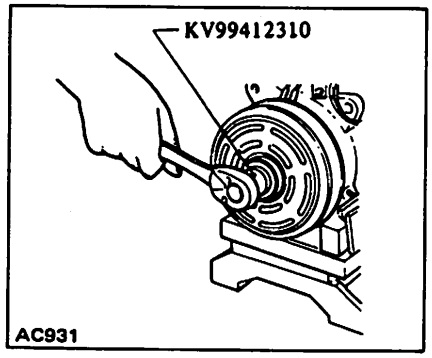
AC929

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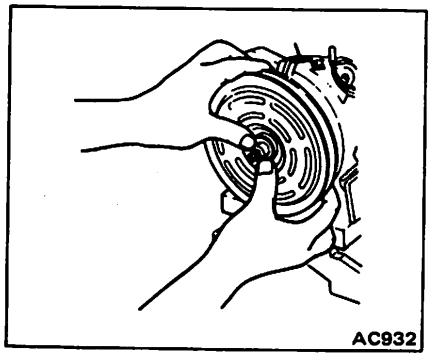
4. With an ordinary screwdriver, flatten lock washer tab.



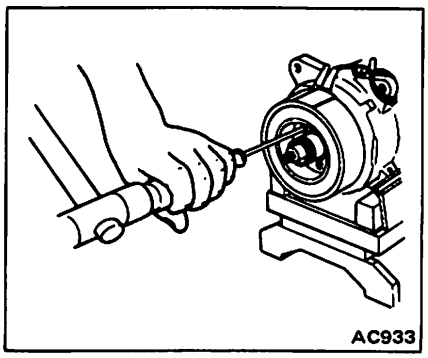
5. Using Tool, loosen lock nut. Remove lock nut and lock washer.



6. Remove pulley and bearing assembly. When the assembly can not be removed by hand, use a puller and Tool KV99412312.



7. Using an impact tool, loosen coil mounting screws. Use of the impact tool is advisable as screws have been calked.



8. Remove coil mounting screws and separate coil assembly.

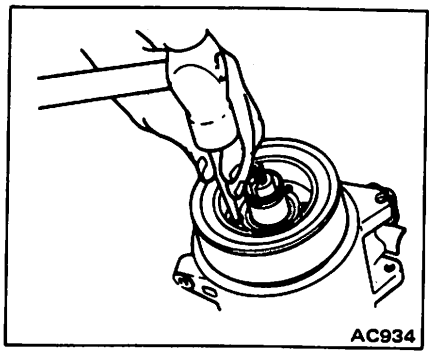
INSPECTION

1. Check the friction surfaces of the clutch for damage due to excessive heat, or excessive grooving due to slippage. If necessary, replace coil, pulley and bearing assembly, and clutch hub as a set.
2. Oil or dirt on the friction surfaces should be cleaned with a suitable solvent and a dry rag.
3. Check coil for shorted or opened binding leads.

INSTALLATION

1. Using a Phillips screwdriver, tighten coil assembly mounting screws in an alternating pattern. After screws have been firmly tightened, punch-lock each at one location to prevent loosening.

Ⓣ : Coil mounting screw
2.7 - 3.4 N·m
(0.28 - 0.35 kg-m,
2.0 - 2.5 ft-lb)



2. Using a plastic mallet, drive pulley and bearing assembly onto the neck of the installed coil assembly. Turn the pulley, making sure that there is no noise and that rotation is free. Also make sure that there is no pulley play.
3. Position lock washer and lock nut in place Using Tool KV99412310, tighten lock nut firmly. With lock washer tab and lock nut cutouts matched, bend the tab with the screwdriver. Proceed carefully to avoid bearing cage damage.

Ⓣ : Lock nut
25 - 27 N·m
(2.5 - 2.8 kg-m,
18 - 20 ft-lb)

4. Fit key and clutch hub to the shaft. Select adjusting spacer which gives the correct clearance between the pulley and clutch hub. Coat hub nut with Locktite (equivalent to HI-LOCK FT-15B).

Ⓣ : Hub nut
18 - 21 N·m
(1.8 - 2.1 kg-m,
13 - 15 ft-lb)

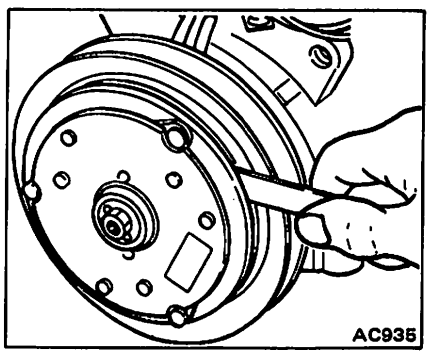
5. Coat shaft nut with Locktite (equivalent to HI-LOCK FT-15B).

Ⓣ : Shaft nut
19 - 21 N·m
(1.9 - 2.1 kg-m,
14 - 15 ft-lb)

6. Using a thickness gauge, measure the clutch hub-to-pulley clearance.

Hub-to-pulley clearance:
0.5 - 0.8 mm
(0.020 - 0.031 in)

If the specified clearance is not obtained, replace adjusting spacer and readjust.



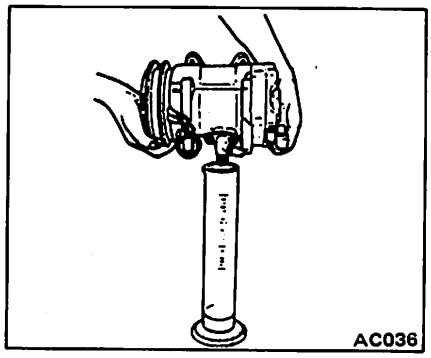
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When replacing compressor clutch assembly, do not forget break-in operation, accomplished by engaging and disengaging the clutch some thirty times. Break-in operation raises the level of transmitted torque.

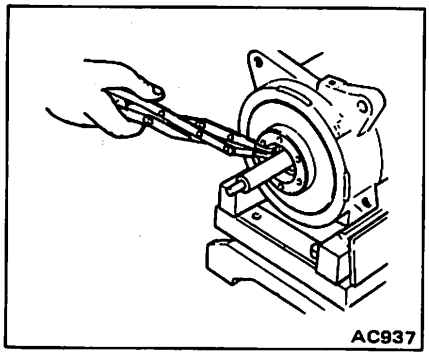
SHAFT SEAL

REMOVAL

1. Turn compressor upside down, and drain oil from suction side.

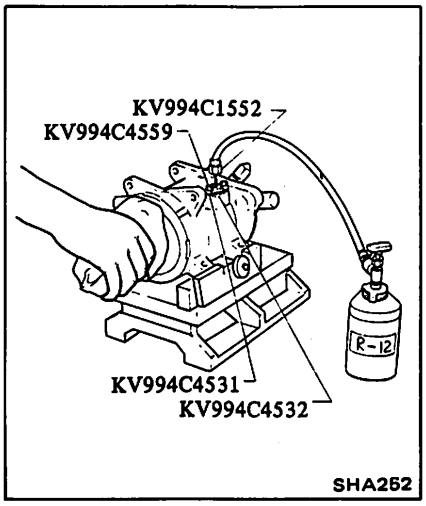


2. Remove clutch hub, pulley and bearing assembly, and coil assembly. Refer to Compressor Clutch for removal.
3. Remove felt.
4. Using snap ring pliers, compress and remove retainer ring.

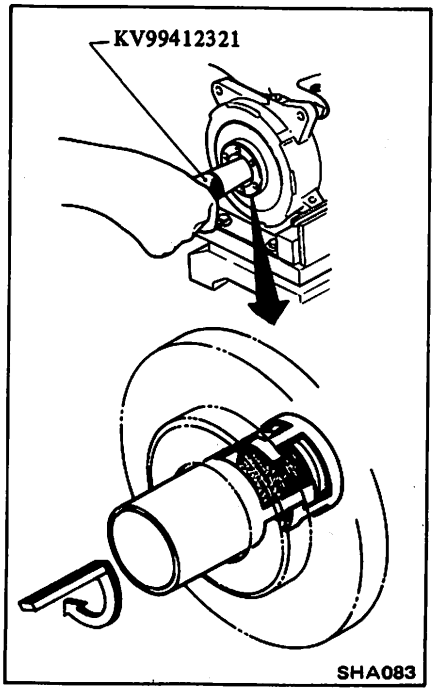


5.
(1) Plug low pressure (suction) opening of compressor with Tool KV994C4531, KV994C4532 and KV994C4559.
(2) Plug high pressure (discharge) vlave opening of compressor with blind cap.
(3) Insert Tool KV994C1552 into hole in middle of blind cover at low pressure side and connect Tool to refrigerant can.
(4) Wrap rag around shaft. Apply pressure 196 to 490 kPa (2 to 5 kg/cm², 28 to 71 psi) from low pressure (suction) service valve of compressor, and receive shaft seal seat in rag.

CAUTION:
Use refrigerant for pressurizing. Do not use compressed air as it involves moisture in the system.

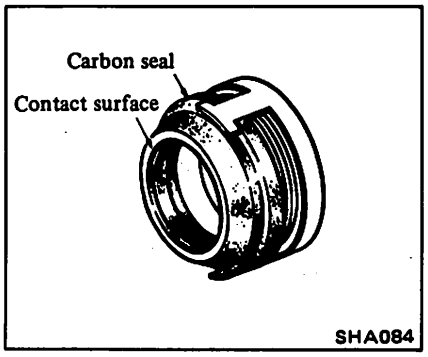


If shaft seal seat cannot be pulled out, reset it to its original position, and again try to pressurize.
6. Insert Tool KV99412321 through the open end of front cover. Depress the carbon seal and hook the Tool at the case projection of shaft seal. Slowly pull out the Tool, thereby removing shaft seal.

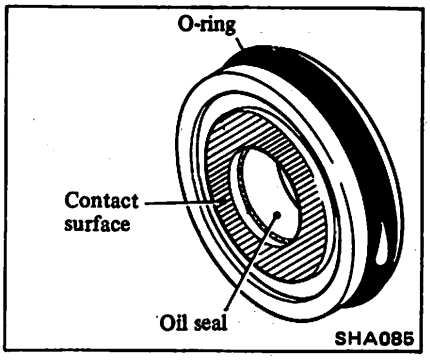


INSPECTION

1. Check the carbon seal surface of shaft seal for damage.



2. Check O-ring and the carbon seal contact surface of shaft seal seat for damage. Make sure that O-ring contact surface at front cover is not damaged. Make sure that grease is applied to oil seal in shaft seal seat.



INSTALLATION

Do not reuse shaft seal and shaft seal seat.

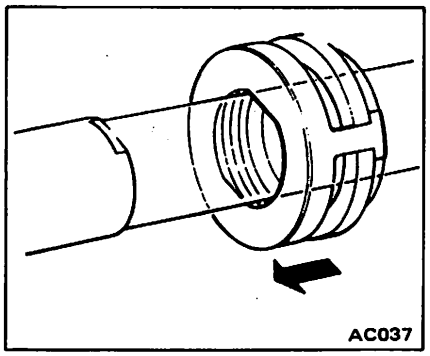
CAUTION:
In placing a new seal kit on the workbench, make sure that the contact surface faces upward. Take necessary steps to avoid damage.

1. Make sure that the shaft seal contact surface is free of dirt and amply lubricated with compressor oil.
2. Cap Tool KV99412322 to the top end of compressor shaft.

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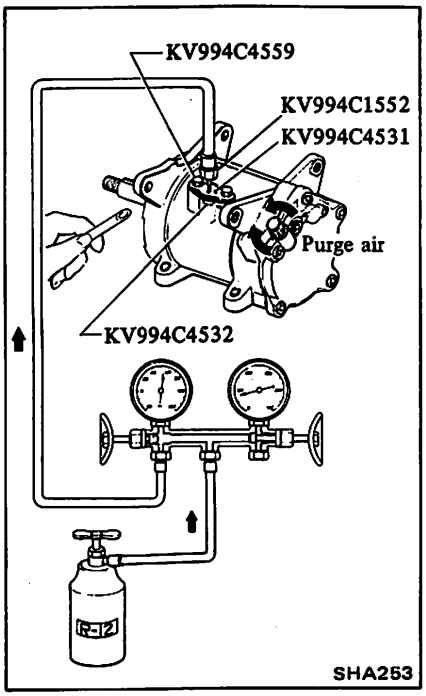
3. Using Tool KV99412321, insert shaft seal with shaft seal case and shaft cutout aligned.

Apply force to turn the seal somewhat to the left and right. Insure that shaft seal seats properly in the shaft cutout.



4. Fit O-ring to the outside groove of shaft seal seat, making sure that it seats properly.
5. Apply quite a bit of compressor oil on contact surface and around shaft seal seat so that it can slide easily in front cover. Lightly coat surface of shaft with recommended multi-purpose grease (or compressor oil). Following this, push in shaft seal seat so that it seats properly at the land of front cover.
6. Using snap ring pliers, compress retainer ring and fit it into front cover. Seat retainer ring firmly in the groove. Thoroughly wipe grease or oil from shaft surface.
7. Install felt.
8. Install clutch hub and key to the shaft of compressor, and turn the shaft 5 to 6 turns in the clockwise direction.
9. Then, check for gas leakage as follows.
(1) Plug low pressure (suction) opening of compressor with Tool KV994C4531, KV994C4532 and KV994C4559.
(2) Plug high pressure (discharge) valve opening of compressor with a blind cap.
(3) Install Tool KV994C1552, changing hose and refrigerant can to manifold gauge and insert Tool KV994C1552 into hole in middle of blind cover at low pressure side.

Connect refrigerant can to the middle hose of manifold gauge.
(4) Open valve of can tap, charge refrigerant through low pressure (suction) service side and purge air from high pressure (discharge) valve by loosening blind cap.
(5) Conduct a leak test. If there is a leak, remove and then install parts again.



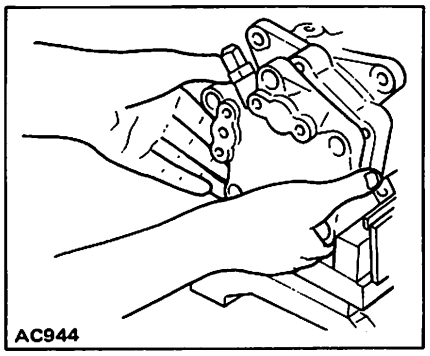
10. Install compressor clutch assembly. Refer to Compressor Clutch for installation.
11. From suction side, charge compressor with same amount of new oil as was drained before. Refer to Oil Level Check for required amount of oil.

REAR COVER AND REAR CYLINDER HEAD

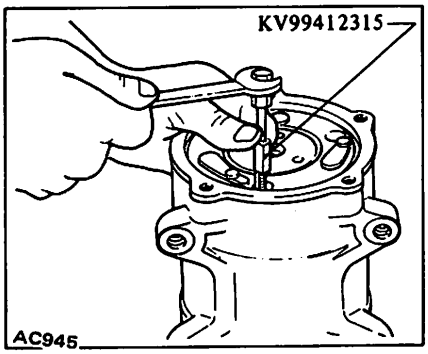
REMOVAL

1. Turn compressor upside down, and drain oil from suction side.
2. Using Tool (KV99412330), remove rear cover mounting bolts. Loosen all bolts one turn in an alternating pattern. Then remove bolts in turn.
3. Grasp rear cover and carefully separate it from compressor. Tap the flange lightly and alternately as required with a plastic mallet.

CAUTION:
Do not tap on the compressor shaft.



4. Remove three O-rings. Discard used O-rings.
5. Remove rear cylinder head, suction valve plate, two pins and O-ring. Carefully remove suction valve plate, avoiding deformation.
6. When removal proves difficult, use Tool. Insert this tool into hole in cylinder head. With the nut in firm contact with the back side of cylinder head, tighten the bolt slowly to break loose the head.



INSPECTION

Check suction valve plate and cylinder head for broken valves.

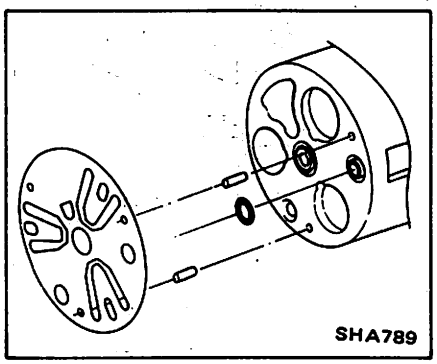
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INSTALLATION

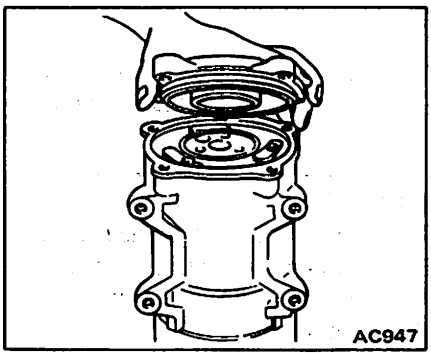
Do not reuse old O-ring.

Using clean compressor oil, remove dirt and other matter from rear cover, cylinder head and suction valve plate. Clean the workbench.

1. Using suitable blocks, position compressor with the front face downward and the rear upward.
2. Install two pins and gas pipe O-ring in the rear of cylinder. Coat O-ring beforehand with an ample amount of oil.
3. Install suction valve plate, making sure that the three valves properly align with cylinder cutouts.


SHA789

4. Assemble cylinder head and install three O-rings in their respective positions. Coat O-rings with ample amount of oil before installation.
5. Carefully fit rear cover to the rear of compressor.


AC947

6. Using Tool KV99412330, tighten up bolts in an alternating pattern, starting at the top. Do not forget lock washers.

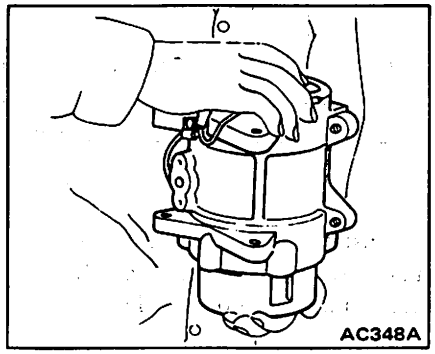
Ⓣ : Rear cover fixing bolt
19 - 21 N·m
(1.9 - 2.1 kg-m,
14 - 15 ft-lb)

7. Upon completion of the above operation, conduct a leak test. Refer to Shaft Seal for gas leak test.
8. From suction side, charge compressor with same amount of new oil as was drained before. Refer to Oil Level Check for required amount of oil.

FRONT COVER, FRONT CYLINDER HEAD AND CYLINDER

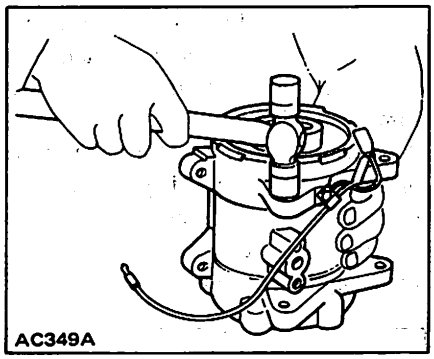
REMOVAL

1. Turn compressor upside down, and drain oil from suction side.
2. Remove compressor clutch assembly. Refer to Compressor Clutch.
3. Using snap ring pliers, remove shaft seal retainer ring. Then remove shaft seal seat. Refer to Shaft Seal. Removal of shaft seal is not absolutely necessary. It may be removed when cylinder assembly is removed from front cover. In fact, this approach facilitates work.
4. Remove discharge valve. Refer to Discharge Valve for removal.
5. Remove rear cover, three O-rings, cylinder head, suction valve plate, two pins and O-ring in that order. Refer to Rear Cover and Rear Cylinder Head. This exposes the rear part of cylinder.
6. Remove cylinder assembly from compressor shell.

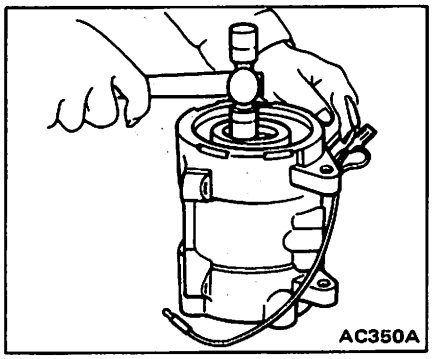

AC348A

Do not drop cylinder assembly and scratch.

When cylinder does not drop from shell, tap shell lightly with plastic mallet. Do not tap compressor shaft.


AC349A

7. Detach front cover from shell.


AC350A

8. Remove shaft seal from the shaft.
9. Remove two O-rings, cylinder head, suction valve plate, two pins and O-ring. In removing two pins, proceed carefully to avoid cylinder head damage. Discard old O-rings.

CAUTION:
Do not deform suction valve plate when removing it.

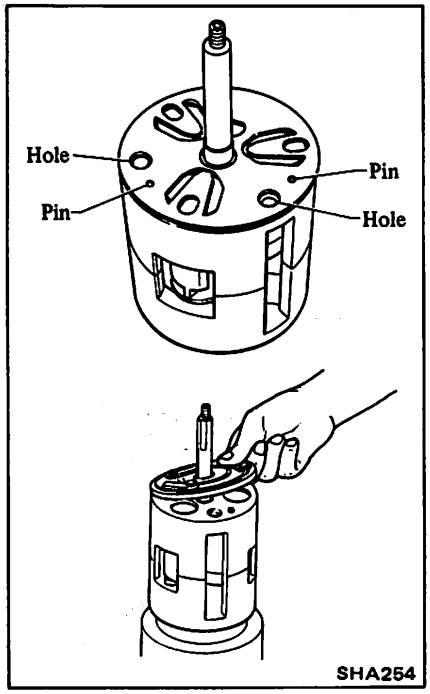
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INSTALLATION

Suction valve plates and cylinder heads are the same as those of front and rear.

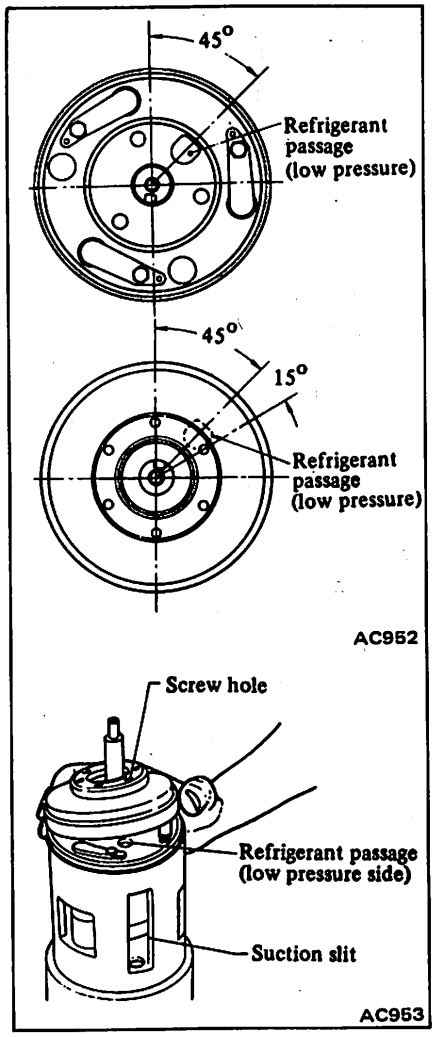
Do not reuse old gasket and O-ring.

1. Using suitable blocks, face cylinder assembly upward. Install two pins and O-ring. Lubricate O-ring before assembly.
2. Position suction valve plate in the order listed while making sure that the three valves of suction valve plate are aligned with the cylinder cutouts. Install cylinder head.

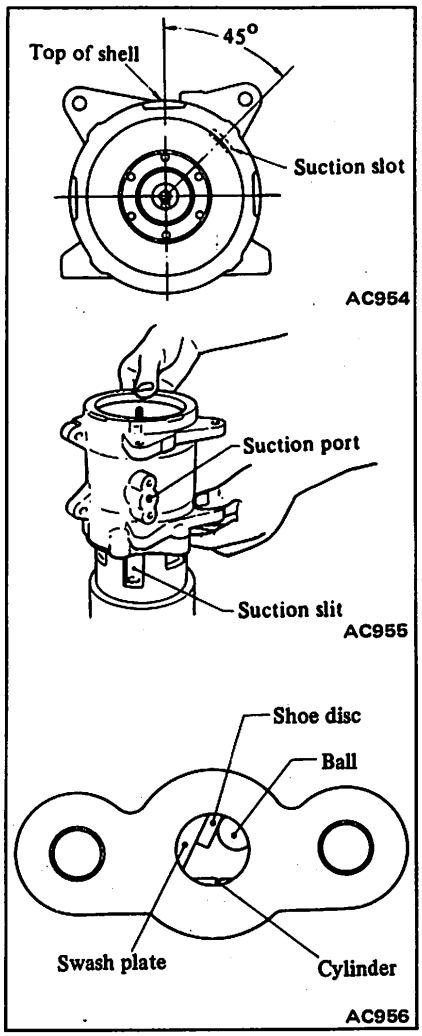


3. Align shaft seal with the shaft cutaway. Firmly seat shaft seal at the shaft land. Attempt to turn shaft seal to clockwise and counterclockwise, confirming that it is seated properly.
4. Install two O-rings on cylinder head. Coat O-rings with ample amount of oil before installation.
5. Install front cover as follows:

Front cover must be installed in such a manner that clutch terminal can be positioned in cut portion of shell when these three parts are assembled. For this purpose, install front cover on cylinder head so that angle between 5 mm (0.20 in) threaded hole in front cover and low pressure side refrigerant passage in cylinder head is about 45°.



6. Install gasket on front cover. Install shell on cylinder head. In this case, adjust position of shell so that suction inlet of shell opens in the same direction as suction slot of cylinder assembly. Then, make sure swash plate is visible in suction inlet.

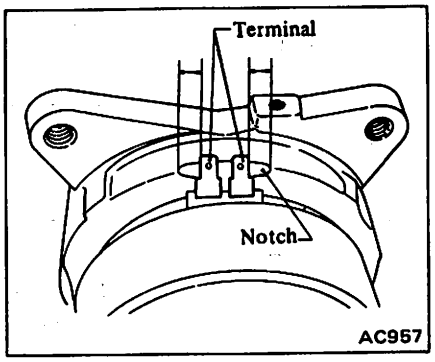


7. Turn over the assembled shell and cylinder, that is, with the front downward.

CAUTION:
Hold securely with hand shell and cylinder assembly to prevent possible mismatching. Otherwise, O-ring will be deflected or moved.

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8. Continue with work up to installation of rear cover. Refer to Rear Cover and Rear Cylinder Head for installation.
9. Continue with work up to installation of discharge valve. Refer to Discharge Valve for installation.
10. Install shaft seal seat. Refer to Shaft Seal for installation.
11. Install and adjust compressor clutch. Refer to Compressor Clutch for installation.
12. Make sure that clutch terminal is in cut portion provided on top of shell. If no coincidence is observed, repeat installation procedure starting from step 3.



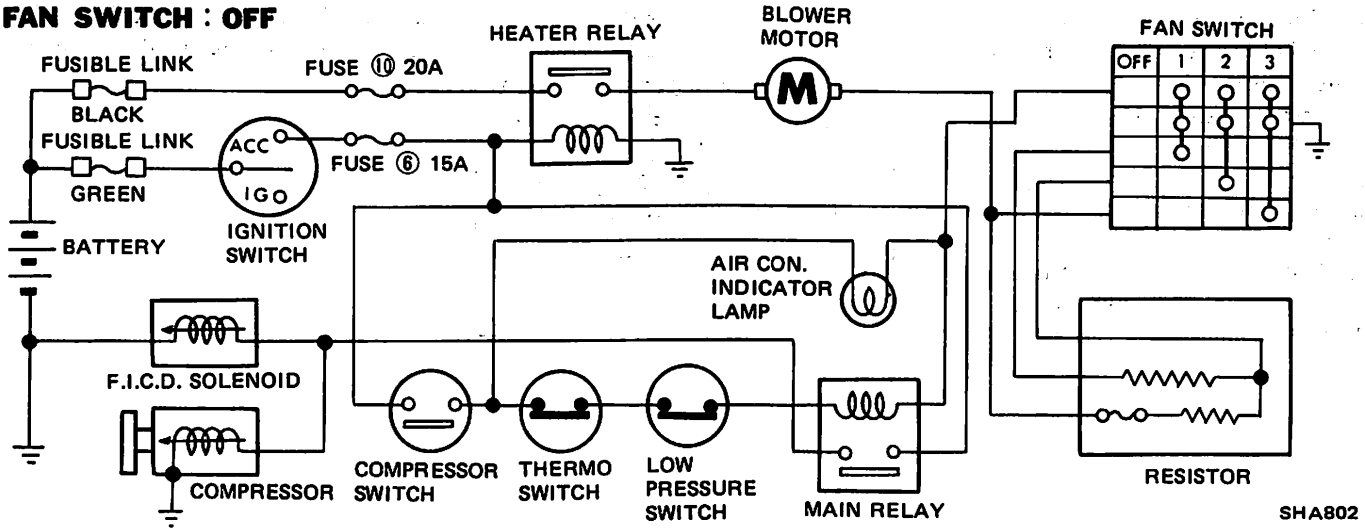
13. Conduct a leak test. Refer to Shaft Seal for gas leak test.
14. From suction side, charge compressor with same amount of new oil as was drained before. Refer to Oil Level Check for required amount of oil.

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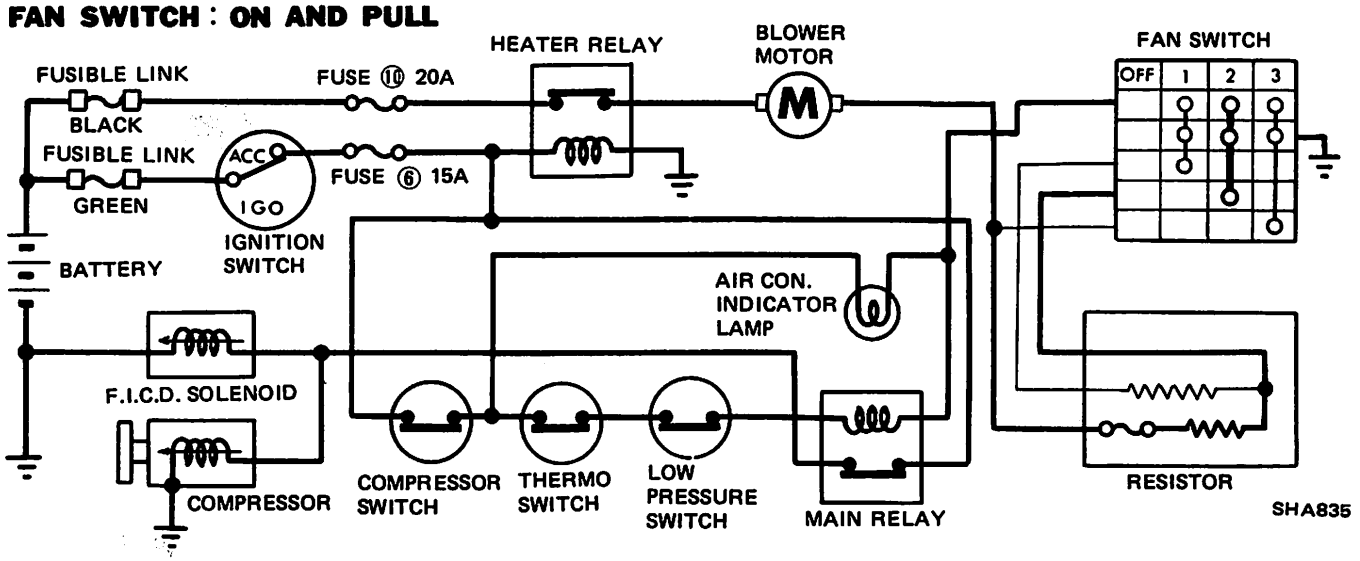
ELECTRICAL CIRCUIT

SCHEMATIC

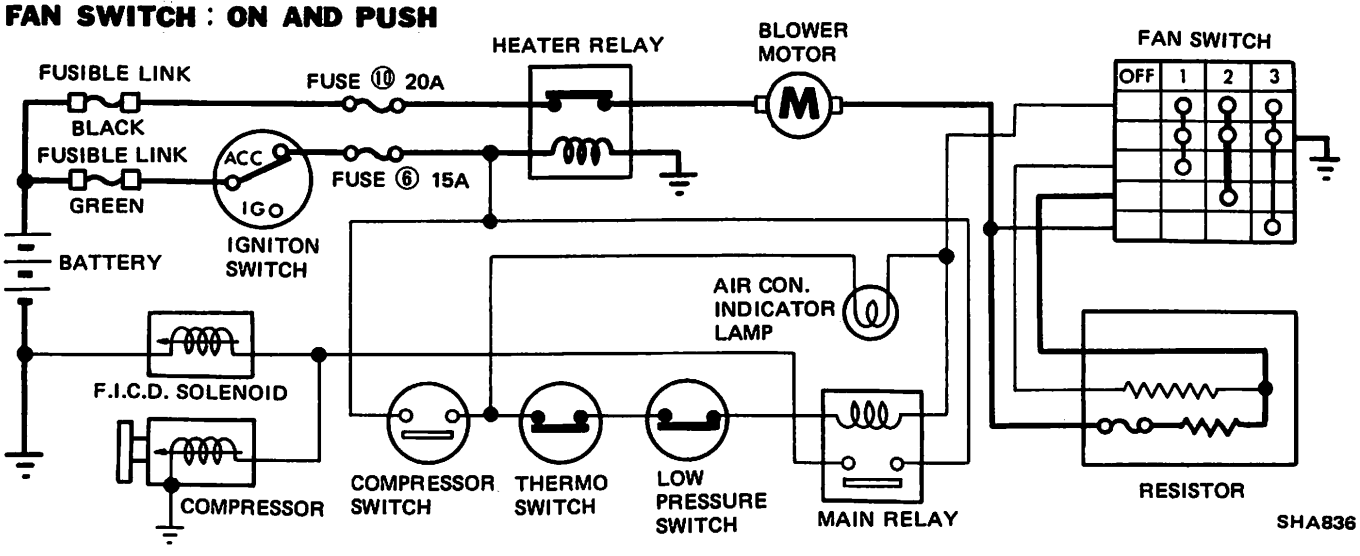
FAN SWITCH : OFF



FAN SWITCH : ON AND PULL

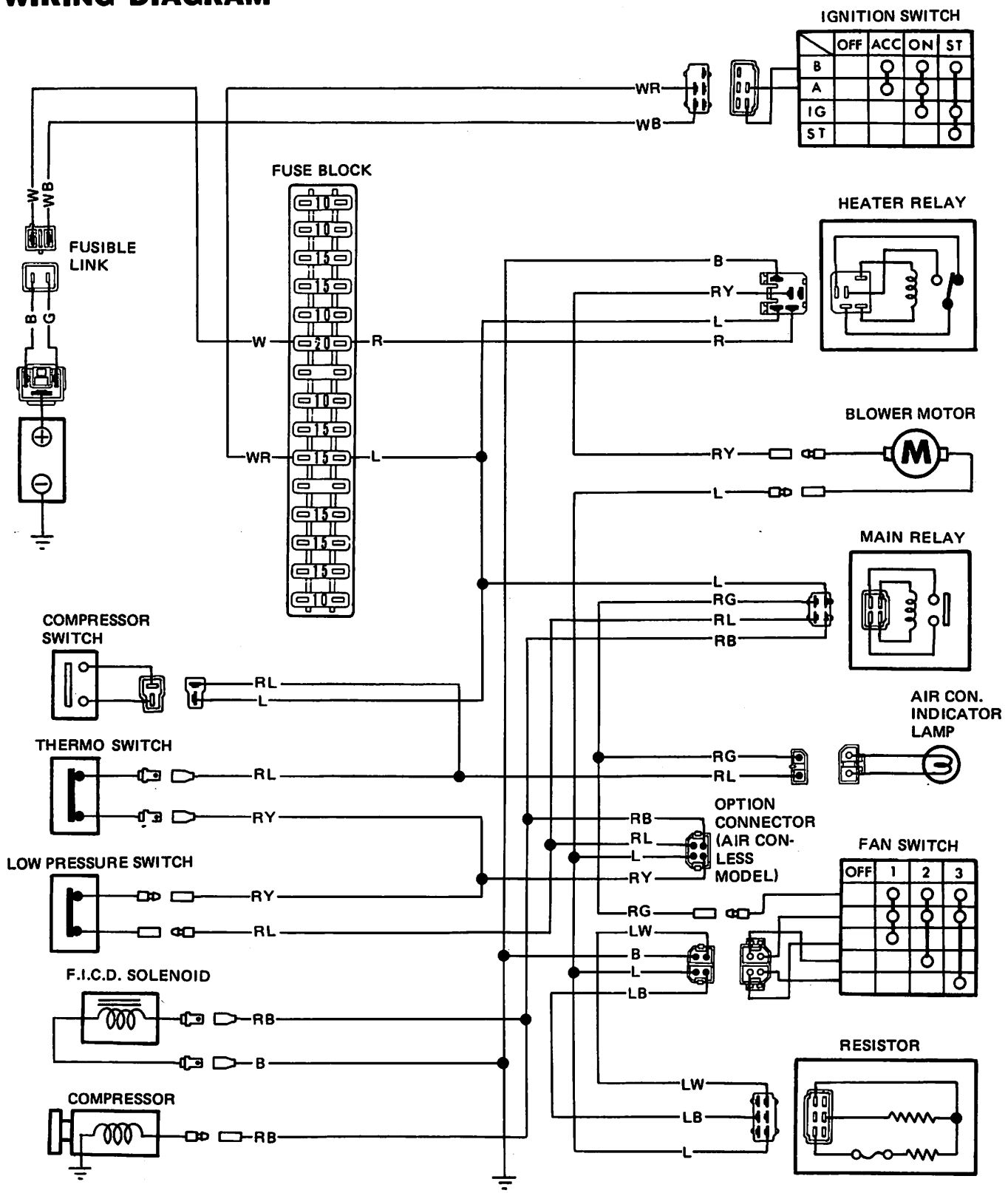


FAN SWITCH : ON AND PUSH



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WIRING DIAGRAM

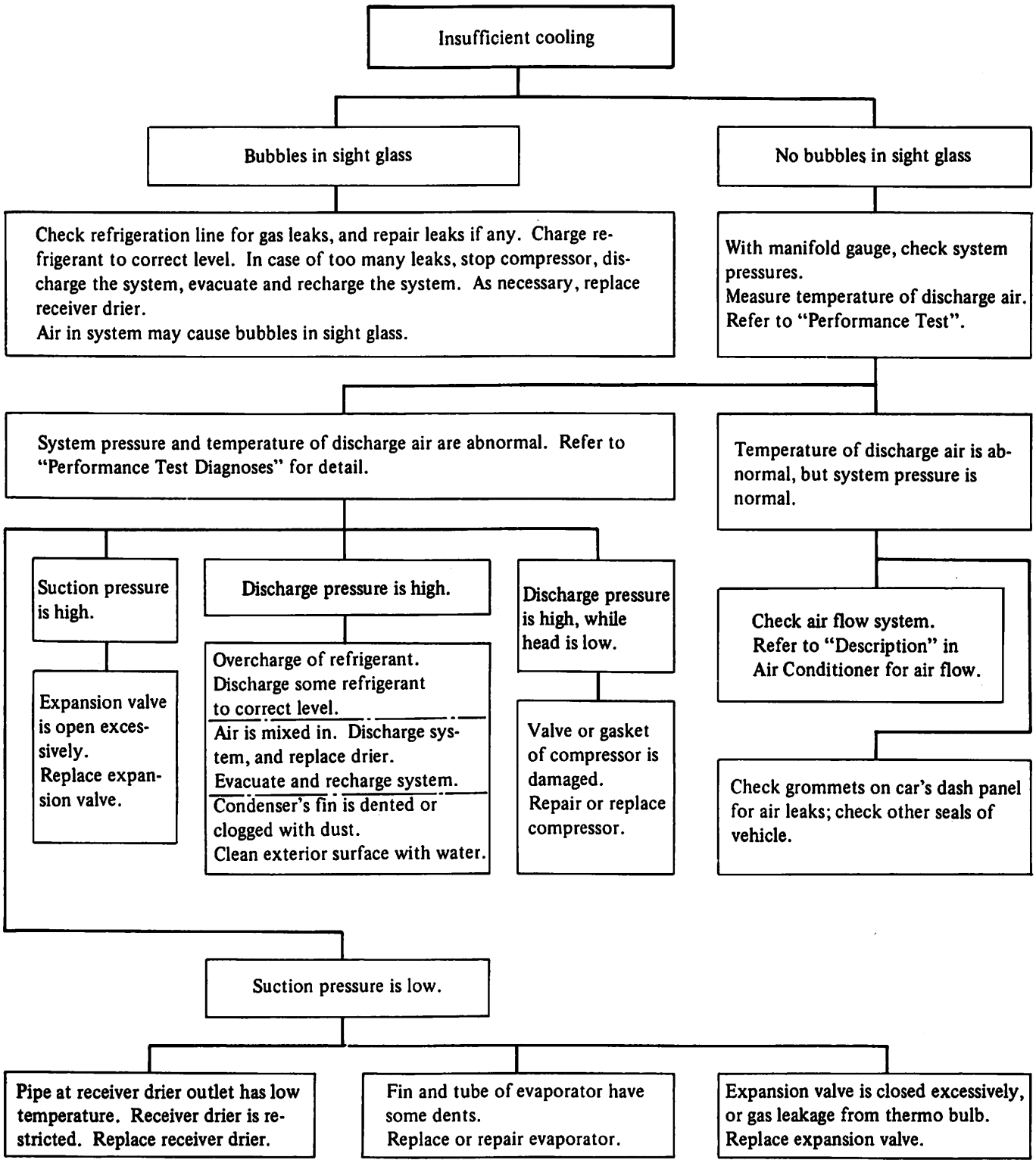


SHA805

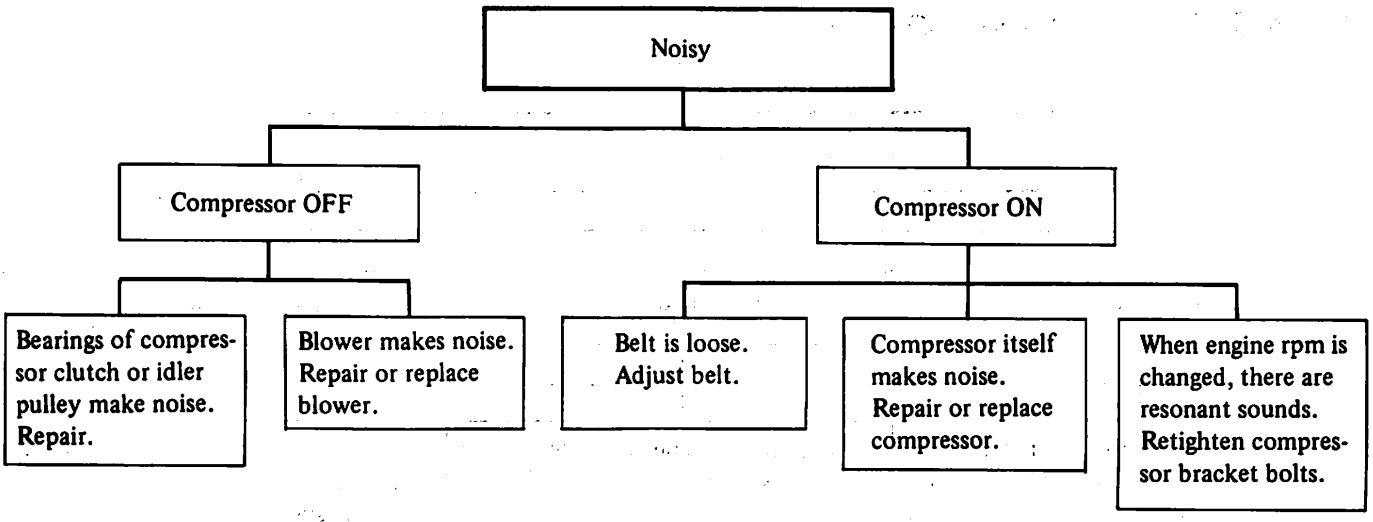
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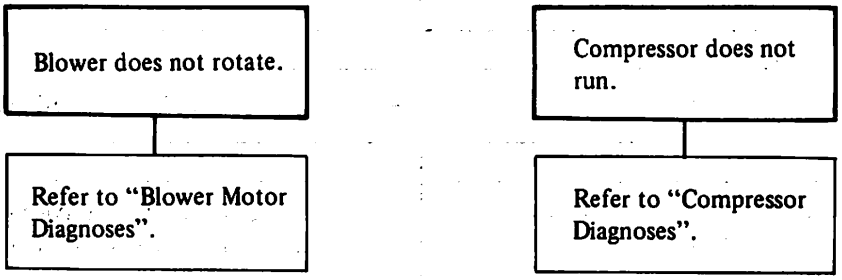
TROUBLE DIAGNOSES AND CORRECTIONS

AIR CONDITIONER DIAGNOSES



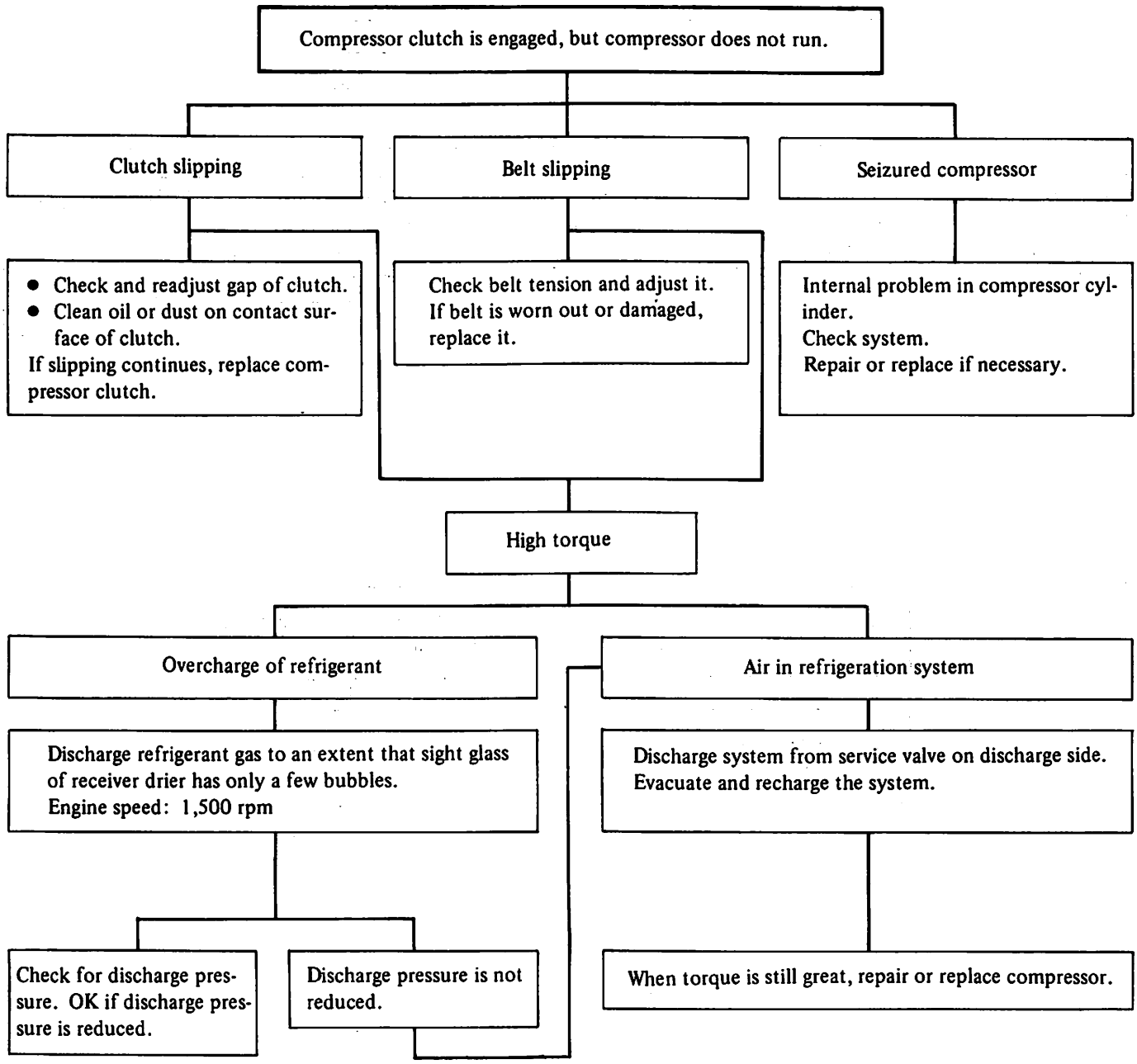
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COMPRESSOR DIAGNOSES



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Compressor oil leaking

Air-blow on spot where oil leak evidence is found. Then check for refrigerant leaks using leak detector.

- Refrigerant leaking. → Repair or replace compressor.
- No refrigerant leaking. → Wipe - clean oil with rag.

Compressor is noisy.

- Noisy only when clutch is engaged.
  - Check for loose compressor mounting bolts. Retighten bolts.
  - Compressor drive belt is loose. Adjust belt tension.
  - If compressor is still noisy, repair or replace compressor.
- Noisy when clutch is not engaged. → Remove compressor belt. Turn pulley of compressor clutch by hand, and check for noise. If noise is heard, repair compressor clutch.

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FAST IDLE CONTROL DEVICE (F.I.C.D.) DIAGNOSES

Test condition

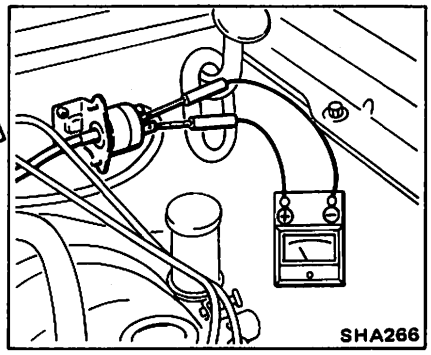
Compressor clutch is engaged.

Position of ignition switch : ON (With engine running)
Position of fan switch : ON AND PULL

: Condition
: Check
: Probable cause

F.I.C.D. is not engaged.

Disconnect F.I.C.D. solenoid harness connectors. Check continuity of F.I.C.D. solenoid.


SHA266

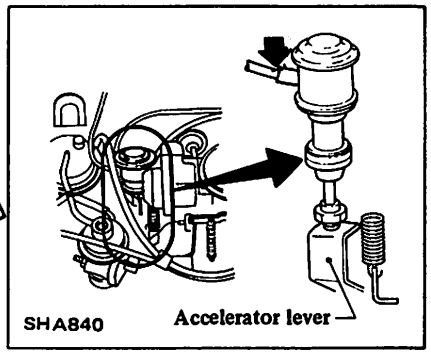
∞Ω

Needle deflects.

Faulty F.I.C.D. solenoid.

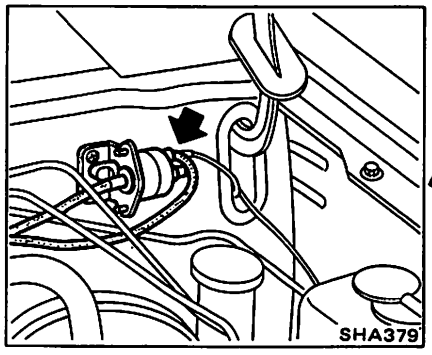
Replace.

Disconnect F.I.C.D. device-to F.I.C.D. solenoid vacuum hose at F.I.C.D. device and check vacuum.


SHA840 Accelerator lever

Vacuum N.G.

Vacuum O.K.


SHA379

Disconnect intake manifold-to-F.I.C.D. solenoid vacuum hose at F.I.C.D. solenoid, and check vacuum.

Faulty F.I.C.D. device

Incorrect adjustment

Vacuum O.K.

Vacuum N.G.

Replace.

Readjust.

Clogged or loose vacuum connector

Broken vacuum hose

Repair.

Replace.

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BLOWER MOTOR DIAGNOSES

Test condition

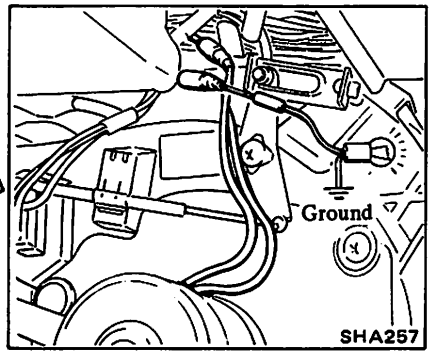
Battery : O.K.
Fusible link (Red) : O.K.
Fusible link (Green) : O.K.
Ignition switch : O.K.
Fuse 15A, 20A : O.K.
Position of ignition switch : ACC.
Position of fan switch : ON

Quick check: Check that wipers operate.

: Condition
: Check
: Probable cause

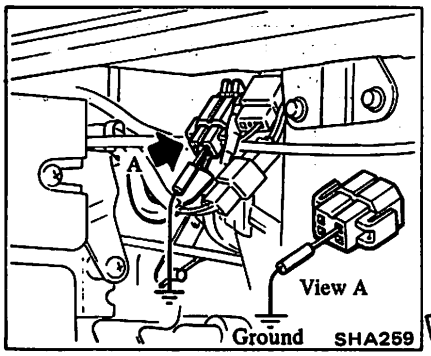
Blower motor does not run.

Connect test light to red-yellow wire leading to fan motor.



Light OFF

Light ON



With test lamp attached, connect one of the lead wires to fan switch connector and ground the other, as shown in illustration.

Light ON

Light OFF

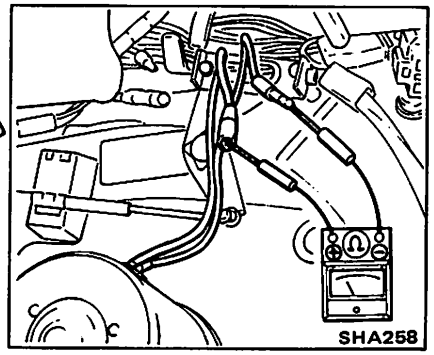
Faulty fan switch without problem in lead wire connection or poor grounding

Replace or repair.

Faulty heater relay without problem in lead wire connection.

Replace.

Check continuity of blower motor.



∞Ω

0Ω

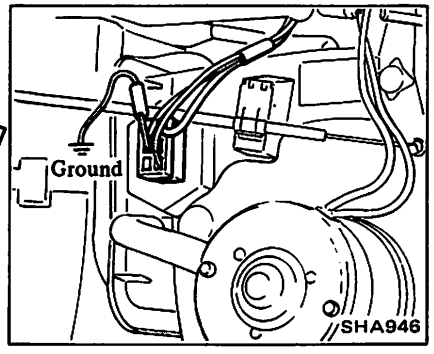
Faulty blower motor without problem in lead wire connection.

Replace.

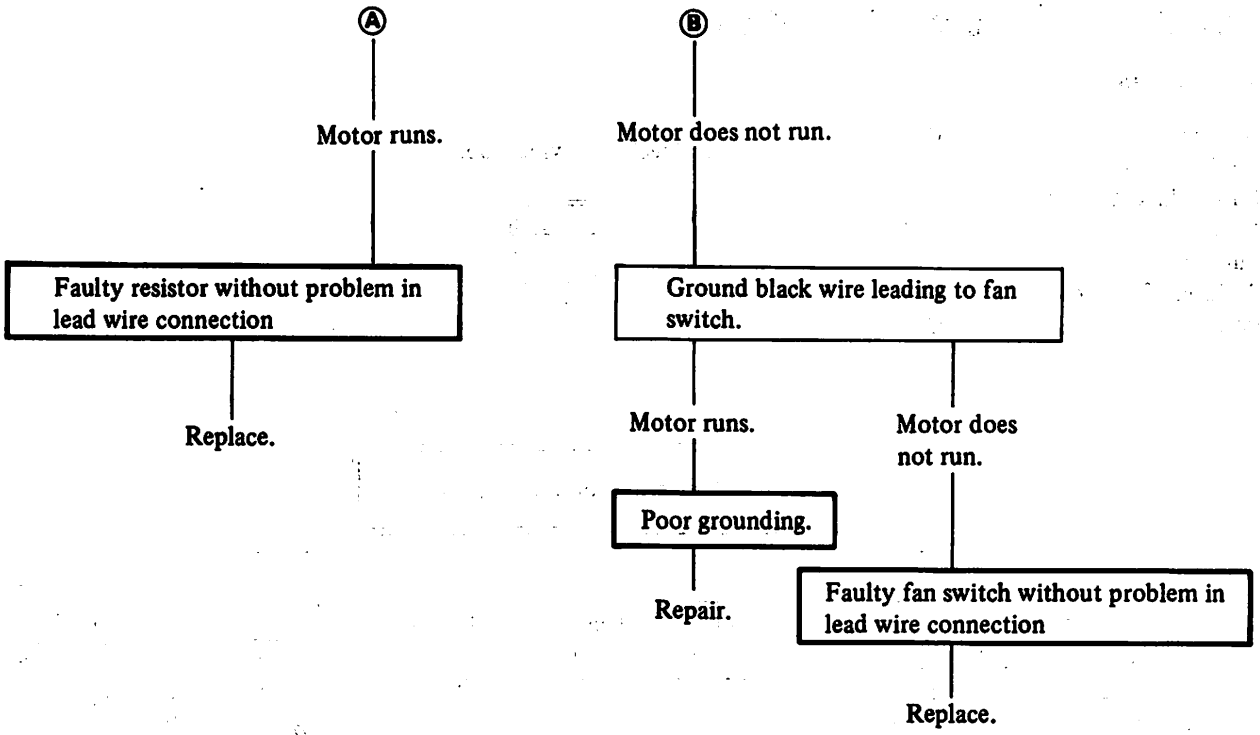
Ground blue-black or blue-white wire leading to resistor.

Ⓐ

Ⓑ



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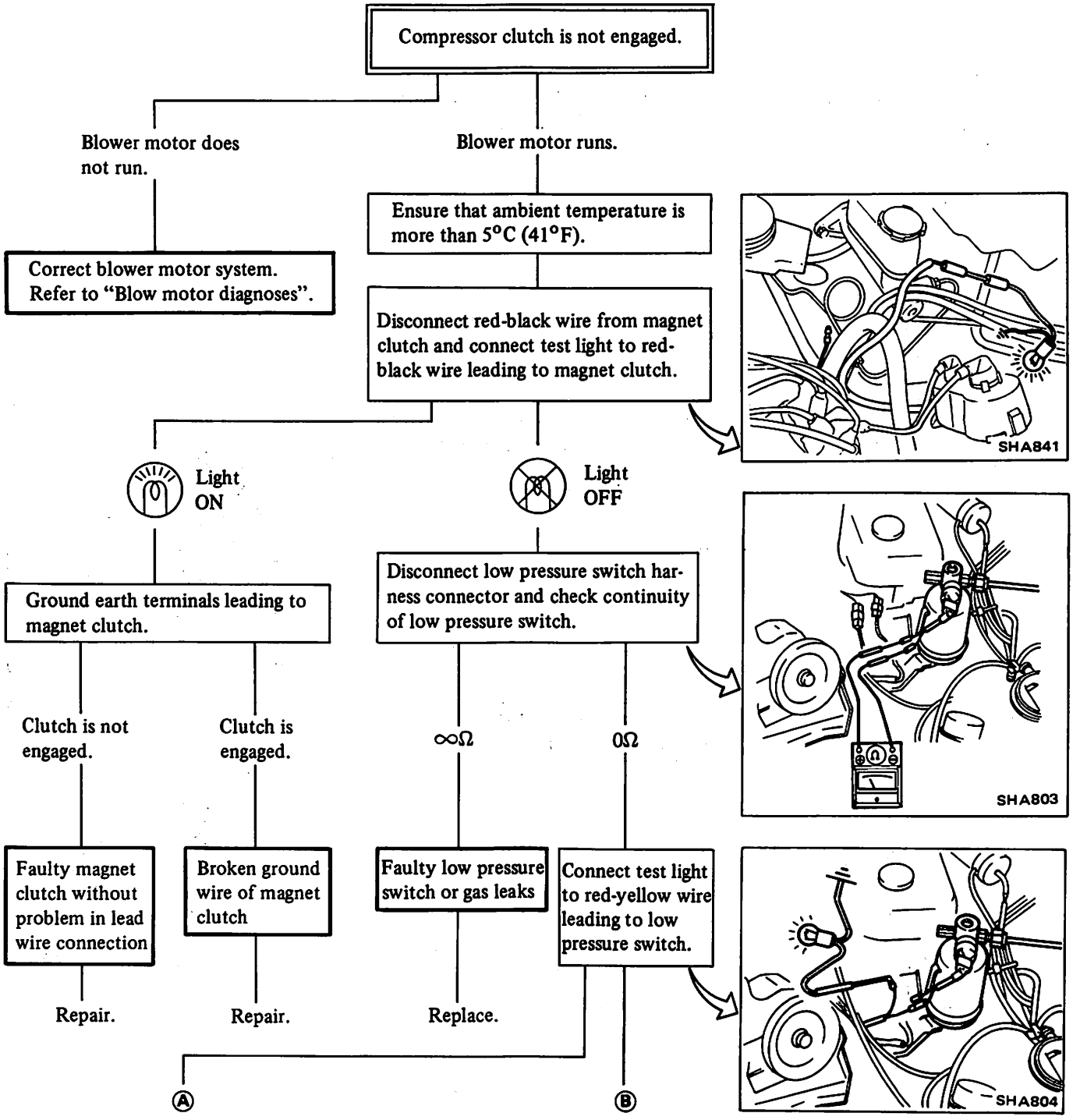
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COMPRESSOR CLUTCH DIAGNOSES

Test condition

Battery	: O.K.	Quick check: Check that radio and wiper operate.
Fusible link (Red)	: O.K.	
Fusible link (Green)	: O.K.	
Ignition switch	: O.K.	
Fuse 15A	: O.K.	
Position of ignition switch	: ACC.	
Position of fan switch	: ON AND PULL	

: Condition
: Check
: Probable cause



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Ⓐ

Light ON

Loose connection.

Repair.

Ⓑ

Light OFF

Disconnect thermo switch harness connector and check continuity of thermo switch.

∞Ω

Faulty thermo switch

Replace.

0Ω

Connect test light to red-blue wire leading to thermo switch.

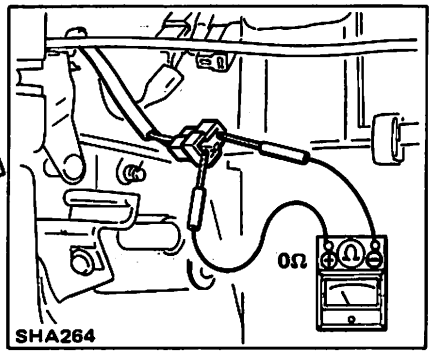
Light ON

Loose connection.

Repair.

Light OFF

Disconnect compressor switch harness connector and check continuity of compressor switch.



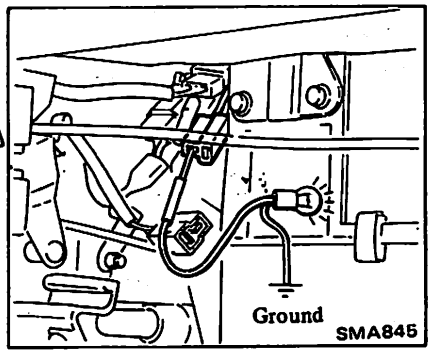
∞Ω

Faulty compressor switch.

Replace.

0Ω

Connect test light to blue wire leading to compressor switch.



Light ON

Loose connection.

Repair.

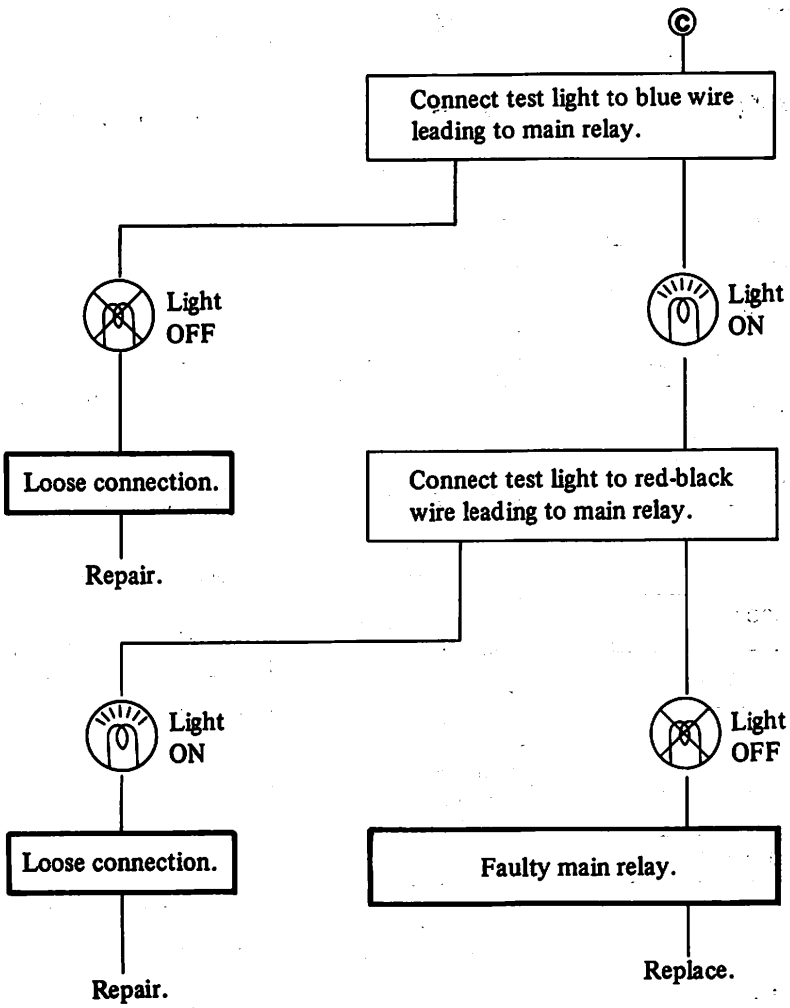
Light OFF

Broken blue wire leading to compressor switch.

Repair

Ⓒ

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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

GENERAL SPECIFICATIONS

COMPRESSOR

Model	MJ167
Type	Swash plate
Displacement cm^3 (cu in)/Rev.	167 (10.19)
Cylinder bore x stroke mm (in)	37.2 x 25.7 (1.465 x 1.012)
Direction of rotation	Clockwise (Viewed from drive end)
Drive belt	B type

LUBRICATION OIL

Type	SUNISO 5GS
Capacity mℓ (US fl oz, Imp fl oz)	150 (5.1, 5.3)

REFRIGERANT

Type	R-12
Capacity kg (lb)	0.7 - 0.9 (1.5 - 2.0)

ENGINE IDLING SPEED

Transmission	When A/C is ON (F.I.C.D. is actuated)
Manual	800 rpm
Automatic	800 rpm at "N" range

INSPECTION AND ADJUSTMENT

BELT TENSION

Fan belt/Applied pressure mm (in)/ N (kg, lb)	8 - 12 (0.31 - 0.47)/ 98 (10, 22)

COMPRESSOR

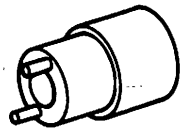
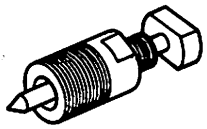
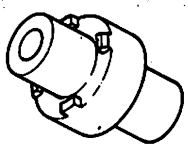
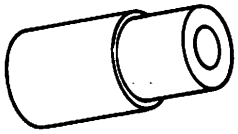
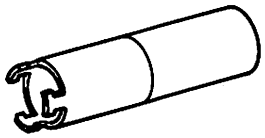
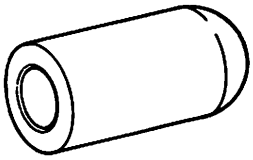
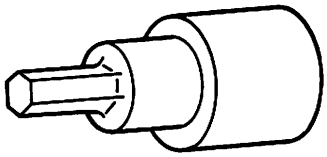
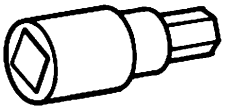
Clutch hub to pulley clearance mm (in)	0.5 - 0.8 (0.020 - 0.031)

TIGHTENING TORQUE

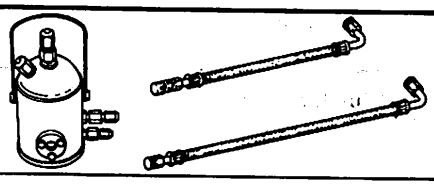
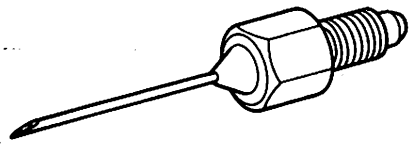
Unit	N·m	kg-m	ft-lb
Compressor bracket to cylinder block	44 - 54	4.5 - 5.5	33 - 40
Compressor to compressor bracket	44 - 54	4.5 - 5.5	33 - 40
Refrigerant line connection			
High pressure line Compressor to condenser	39 - 49	4 - 5	29 - 36
Condenser to cooling unit line	29 - 39	3 - 4	22 - 29
Low pressure line	49 - 59	5 - 6	36 - 43
Compressor			
Shaft nut	19 - 21	1.9 - 2.1	14 - 15
Lock nut	25 - 27	2.5 - 2.8	18 - 20
Clutch hub nut	18 - 21	1.8 - 2.1	13 - 15
Clutch coil screw	2.7 - 3.4	0.28 - 0.35	2.0 - 2.5
Rear cover bolt	19 - 21	1.9 - 2.1	14 - 15

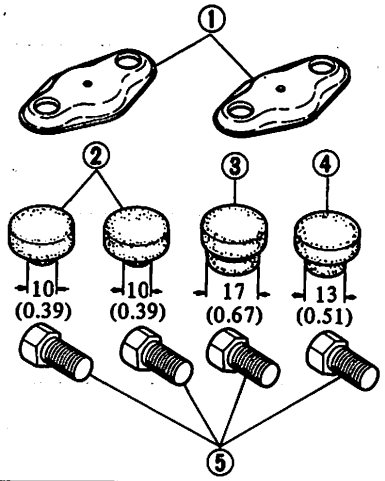
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SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.)	Tool name	
KV99412302 (J24878-1)	Clutch hub wrench	
KV99412305 (J24878-2)	Hub nut socket	
KV99412306 (J24878-3)	Clutch hub puller	
KV99412310 (J24878-4)	Lock nut socket	
KV99412312 (J25472)	Puller pilot	
KV99412321 (J26067)	Shaft seal remover and installer	
KV99412322 (J25473)	Shaft seal pilot	
KV99412324 (–)	Allen socket	
KV99412330 (–)	Allen socket	
KV99412315 (–)	Cylinder head remover	

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Tool number (Kent-Moore No.)	Tool name
KV994A9690 (–)	Oil separator kit 
KV994C1552 (–)	Charge nozzle 
KV994C4548 (–)	Blind cover set
① KV994C4531 (–)	Blind cover
② KV994C4532 (–)	Gasket
③ KV994C4533 (–)	Gasket (Useless)
④ KV994C4534 (–)	Gasket (Useless)
⑤ KV994C4559 (–)	Bolt



Unit: mm (in)

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ELECTRICAL SYSTEM

SECTION EL

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Refer to Section EC (Emission Control System) for:
- **EMISSION CONTROL SYSTEM**

Refer to Section HA (Heater & Air Conditioner) for:
- **HEATER**
- **AIR CONDITIONER**

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ELECTRICAL DIAGNOSIS INTRODUCTION

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

The key to timely and accurate diagnosis of electrical problems is to:
1. Have a basic understanding of electrical principles and electrical component operation.
2. Be able to interpret wiring diagrams and schematics.
3. Know the various test methods and when to use each.
4. Have a systematic approach to identify the specific cause of an electrical problem.

BASIC RULE OF ELECTRICITY

A complete electrical circuit must have:
1. A Source (battery, alternator)
2. A Load (lights, coil, amplifiers, motor, etc.)
3. Electrical Pathway (connecting from the source to the load and back to the source); (wires, switches, body of vehicle (ground)).

Remembering this basic rule will make it a lot easier to troubleshoot electrical problems.

WIRING DIAGRAMS

There are several wiring diagrams and schematics illustrating each electrical circuit. Accurate diagnosis of electrical problems requires that you effectively use and interpret these diagrams. Since they have a special language, i.e., symbols, codes and abbreviations, let's review the following chart.

ELECTRICAL SYMBOLS AND ABBREVIATIONS

SYMBOLS

- Single filament bulb
- Dual filament bulb
- Fuse
- Fusible link
- Diode
- Motor
- Transistor
- Resistor
- Coil
- Variable resistor
- Thermistor
- Reed switch
- Circuit breaker
- Condenser
- Switch (Normally open)
- Switch (Normally closed)
- Ground
- No connection between wires
- Connection between wires

CONNECTORS

- Pin-type connector (Male)
- Pin-type connector (Female)
- Plain-type connector (Male)
- Plain-type connector (Female)
- Bullet connector (Female and male)
- Plain connector (Female and male)

WIRE COLOR CODING

B = Black	Y = Yellow
W = White	Lg = Light Green
R = Red	Br = Brown
G = Green	Gr = Gray
L = Blue	

In case of color coding with Tracers, Base Color is given first, followed by the Tracer Color:

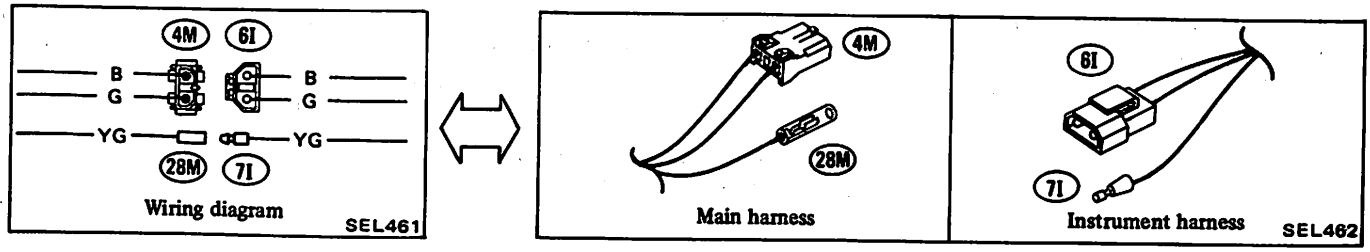
Example: LW = Blue w/White Tracers

ABBREVIATIONS

- (A) Automatic transmission models
- (M) Manual transmission models

HARNESS LAYOUT

For easy identification, connectors indicated in the system wiring diagram have the same numbers as those used in the harness layout schematic. (Refer to page EL-70)



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To trace a problem in any electrical circuit, several types of diagrams can be used.

1. **Power Supply Routing** (Refer to page EL-4). This diagram is helpful in identifying specific problems in the power supply portion of the electrical circuits. For example, let's say a vehicle has inoperative instrument meter lights. A quick check proves that all other lights in the vehicle are operative. The power supply diagram shows that there cannot be a problem between the battery, ignition relay, ignition switch or fuse since the power supply circuit for the instrument meter lights is common with the clearance, tail, side marker, and license plate lights. Therefore, the cause of this specific problem must lie past the fuse, such as in the wiring, meter lights, or ground.
2. **Schematic** (Refer to Headlamp Circuit page EL-36). A schematic is a very simplified wiring diagram useful for tracing electrical current flow and studying the operation of an electrical circuit.
3. **Circuit Wiring Diagram** (Refer to Headlamp Circuit page EL-36). This diagram is a more "true to life" layout of a complete circuit than the schematic. It identifies types and number of connectors, electrical terminal positions in the connector, color coding of wires, and connector codes. In order to quickly find the exact location of a connector, the connector codes can be cross-referenced to the harness layout illustrations in the back of this section.
4. **Complete Wiring Diagram** (Fold-out page). The complete wiring diagram will assist in locating interrelated circuits i.e., circuits which share common ground circuits, power circuits, etc.

TESTING

Many people think of electrical testing as connecting electrical test instruments into a circuit and measuring amps, volts and ohms. But there is really a lot more. In fact using test instruments should be one of the last steps in correcting an electrical problem.

SIGHT AND SOUND play an important role in electrical testing. Relays click, blowers spin, air condition clutches engage, lights illuminate, etc. Even though we cannot observe current flowing through a wire or a component, we can observe the effect it has on an electrical component. Sight and sound testing methods should be thoroughly exhausted before hooking-up any test instrument.

SUBSTITUTION is another test method. For example, you suspect a bad ground at the tail lamp. Try a jumper wire from ground to the lamp. What about a questionable fuse? Simply replace it with another. In several instances substitution may turn out to be the most effective method of correcting an electrical problem.

TEST INSTRUMENTS

Problems that cannot be solved through sight, sound, or substitution can be solved by using the appropriate test instrument. The charts on the back of the vehicle wiring diagram, illustrates how and when these instruments should be used.

A general rule to follow while trouble-shooting is to perform the easiest and least expensive checks first. This often means giving some careful thought to a trouble-shooting plan. Some of the most frustrating and confusing electrical problems begin with a haphazard and planless start. Make sure the checks you have selected are going to give the answers you need. If you test the wrong circuit, use the wrong meter, or forget to check the meter scale and calibration, you just can't diagnose the problem.

TROUBLE-SHOOTING APPROACH

You should have a routine procedure or approach when trouble-shooting a problem, a method you are familiar with which gives you the maximum amount of information at minimum expense and effort. Sometimes it is helpful to ask yourself some questions first. For example:

WHAT IS THE PROBLEM? While this may seem a foolish question at first glance, the problem involved may not be the same as stated on the repair order or even as observed by the customer. Sometimes, other problems or symptoms have been overlooked. Do not forget to identify the problem and controls involved. Check to see what electrical components work and what components do not work. This is an opportune time to use sight and sound testing methods.

HOW DOES THE CIRCUIT WORK? Once the electrical problem has been identified, consult the various wiring diagrams in the service manual.

Study the simplified schematic to develop an understanding of how the circuit is supposed to work. Then use the circuit wiring diagram, harness layout illustration, power supply routing diagram, and vehicle wiring diagram. Get an idea of how the circuit is laid out in the car and how it interrelates with other circuits.

WHICH TEST IS BEST? Stop and think of exactly what information you need to reach a proper solution. Decide which test will give you the most information. Do not forget to think of where you are going to make your test connections. Make sure you are performing your test at the most advantageous point. You do not want to dismantle a dash assembly to check a component which could be tested at a more accessible location. For instance, it is much easier to check terminal connectors and plugs than to break into a harness.

Once the tests have been performed, you should have the information you need to reach a logical conclusion and solve the problem but, if not, then review your testing procedure. Be certain that you are performing the test correctly and your procedure is valid.

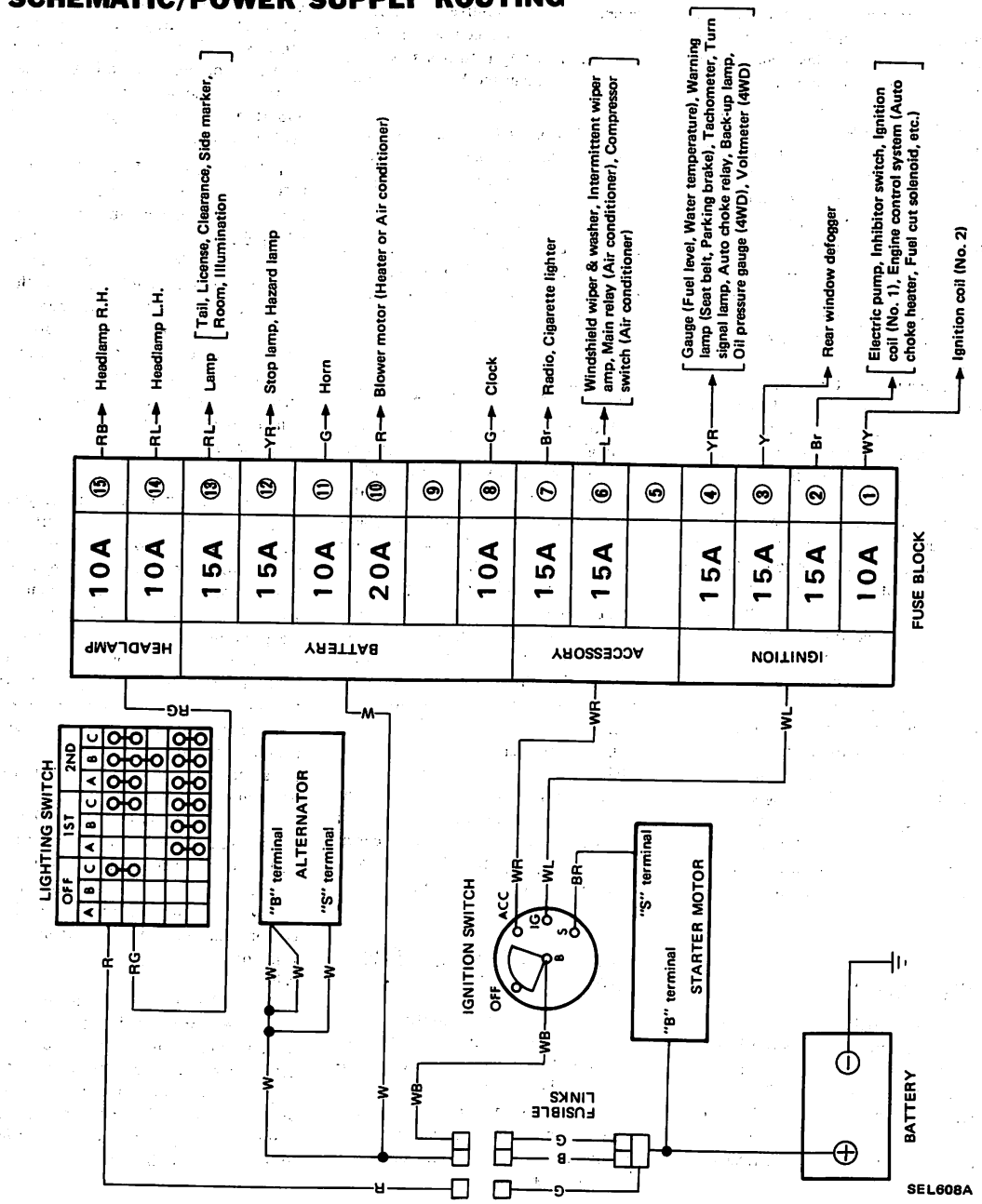
Remember the most complex circuits are constructed from combinations and/or variations of the basic circuit: Source, Conductors, and Load. If you keep this in mind, use the service manual, and follow a logical trouble-shooting sequence, you can effectively troubleshoot electrical problems.

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POWER SUPPLY ROUTING

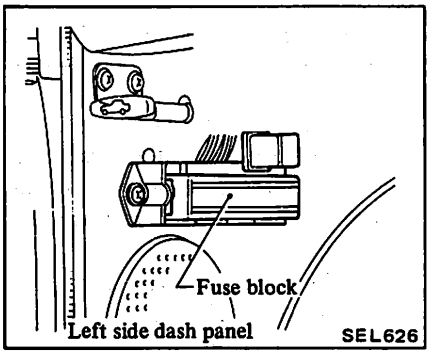
CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

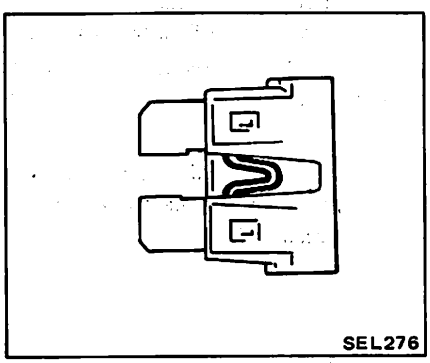
SCHEMATIC/POWER SUPPLY ROUTING



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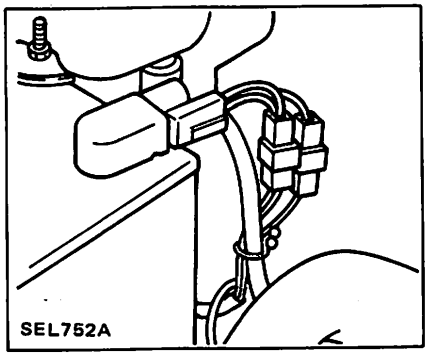
FUSE





a. If fuse is blown, be sure to eliminate the cause of the problem before installing new fuse.
b. Never use fuse of more than specified rating.
c. Check condition of fuse holders. If much rust or dirt is found, clean metal parts with fine-grained sandpaper until proper metal-to-metal contact is made.
   Poor contact in any fuse holder will often lead to voltage drop or heating in the circuit and could result in improper circuit operation.
d. Do not install fuse in oblique direction, always snap it into fuse holder properly.

FUSIBLE LINK



CAUTION:

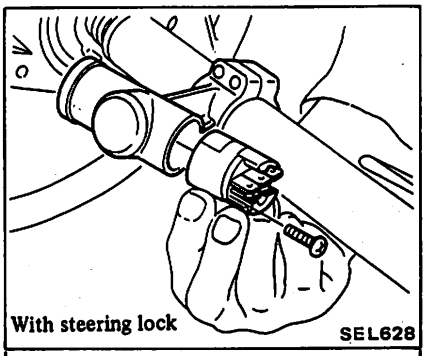
a. If fusible link should melt, it is possible that a critical circuit (power supply or large current carrying circuit) is shorted. In such a case, carefully check and eliminate the cause of the problem.
b. Never wrap periphery of fusible link with vinyl tape. Extreme care should be taken with this link to ensure that it does not come into contact with any other wiring harness or vinyl or rubber parts.

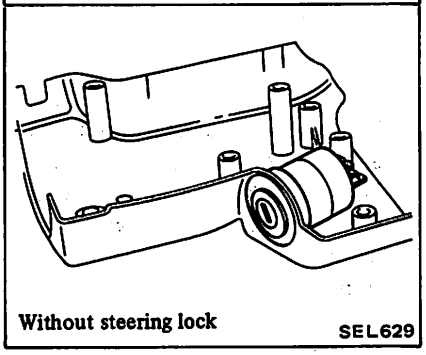
A melted fusible link can be detected either by visual inspection or by feeling with finger-tip. If its condition is questionable, use circuit tester or test lamp, as required, to conduct continuity test. This continuity test can be performed in the same manner as for any conventional fuse.

IGNITION SWITCH

REMOVAL AND INSTALLATION

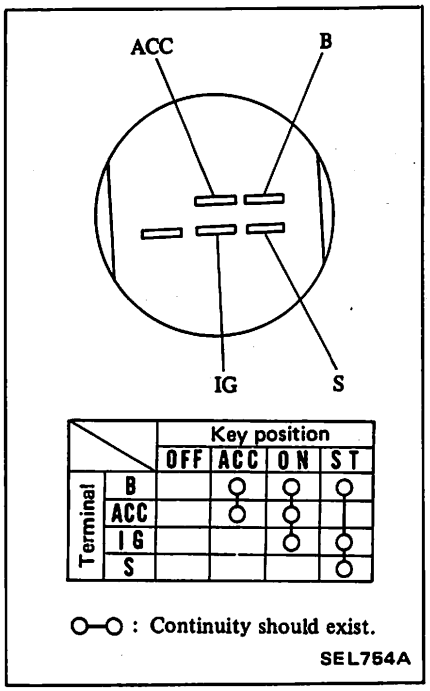
1. Disconnect battery ground cable.
2. Remove steering column cover.
3. Disconnect ignition switch harness connector.
4. Remove ignition switch.
5. Installation is in the reverse order of removal.





INSPECTION

Test continuity through switch with an ohmmeter.



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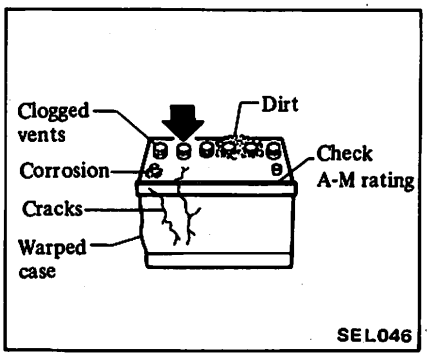
BATTERY

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

WARNING:
Never touch positive and negative terminals at the same time with bare hands. This could result in injury.

CAUTION:
a. If it becomes necessary to start the engine with a booster battery and jumper cables, the booster battery voltage must not exceed 12 volts, or the control unit of the fuel injection system and other electric components will be damaged.
b. If the battery cables are disconnected, they should be tightly clamped to the battery terminals to secure a good contact.

VISUAL INSPECTION



1. Check battery rating against that of original factory equipment.
2. Check for cracks and warpage of the case.
3. Make sure cables are clean and tight.
4. Check acid level.
5. Make sure vents are not cloggged.
6. Make sure top of battery is clean.

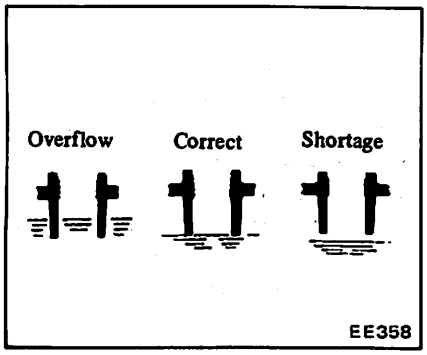
CLEANING

Use a stiff brush and a common baking soda and water solution to clean the battery surface, terminals and cable ends.

CAUTION:
Never allow the solution to enter individual cells. The baking soda will react with the battery acid. Also remember that battery acid is harmful to the eyes, skin and clothing.

CHECKING ELECTROLYTE LEVEL

Check for electrolyte level in each cell.



If the level is low, fill with distilled water.

TESTING SEQUENCE

1. Determine battery's state of charge by using the following tests:
   (1) Specific Gravity Test
   (2) Battery Capacity Test

Do not perform battery capacity test unless specific gravity is more than 1.220.

Otherwise faulty reading will be obtained.

2. If battery passes both tests, it is O.K. If battery fails either test, connect a battery charger with a variable amperage control and perform the following tests:
   (1) Three-minute charge test
   (2) Cell test under charge test
   (3) Visual check
3. If there is still a discharging problem and condition of battery has been determined to be satisfactory, perform a battery leakage test and a battery draw test.

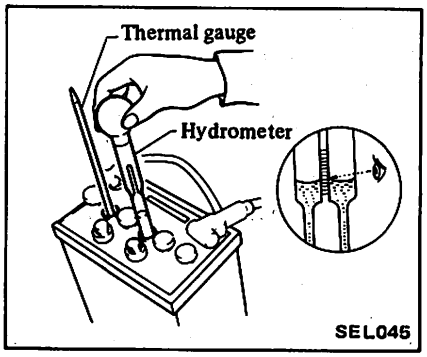
Always thoroughly test battery's ability to accept and maintain a charge before replacing it.

TESTS

Specific gravity test

1. Read hydrometer and thermal gauge indications at eye level.

Read top level with scale.



2. Correct specific gravity at 27°C (80°F). (Refer to chart.)
3. Determine charging state of battery.

Fully Charged	1.260 - 1.280
75% Charged	1.215 - 1.230
50% Charged	1.170 - 1.180
25% Charged	1.120 - 1.130
Discharged	1.070 - 1.080

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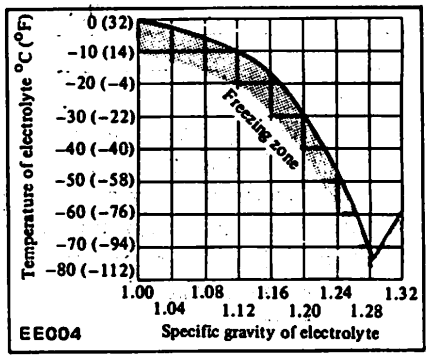
Specific gravity temperature correction chart

Indicated specific gravity	Actual specific gravity										
1.300	1.280	1.284	1.288	1.292	1.296	1.300	1.304	1.308	1.312	1.316	1.320
1.280	1.260	1.254	1.268	1.272	1.276	1.280	1.284	1.288	1.292	1.296	1.300
1.260	1.240	1.244	1.248	1.252	1.256	1.250	1.264	1.268	1.272	1.276	1.280
1.240	1.220	1.224	1.228	1.232	1.236	1.240	1.244	1.248	1.252	1.256	1.250
1.240	1.200	1.204	1.208	1.212	1.216	1.220	1.224	1.288	1.232	1.236	1.240
1.200	1.180	1.184	1.188	1.192	1.196	1.200	1.204	1.208	1.212	1.216	1.220
1.180	1.160	1.164	1.168	1.172	1.176	1.180	1.184	1.188	1.192	1.196	1.200
1.150	1.140	1.144	1.148	1.152	1.156	1.160	1.164	1.168	1.172	1.176	1.180
1.140	1.120	1.124	1.128	1.132	1.136	1.140	1.144	1.148	1.152	1.156	1.160
1.120	1.100	1.104	1.108	1.112	1.116	1.120	1.124	1.128	1.132	1.136	1.140
1.100	1.080	1.084	1.088	1.092	1.096	1.100	1.104	1.108	1.112	1.116	1.120
	−1°C	4°C	10°C	16°C	21°C	27°C	32°C	38°C	43°C	49°C	54°C
	30°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F	110°F	120°F	130°F

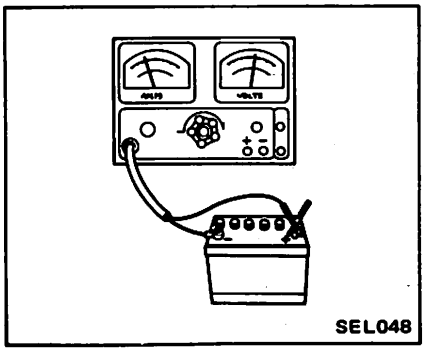
Electrolyte temperature

Battery Freezing

CAUTION:
A battery can freeze if the specific gravity drops to a low level.

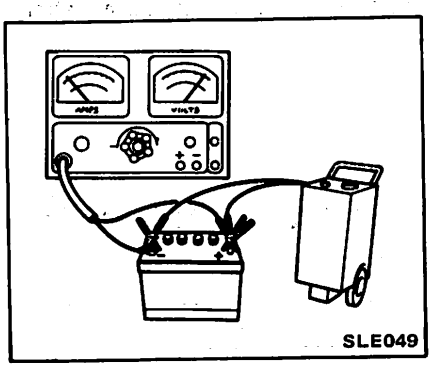


Battery capacity test

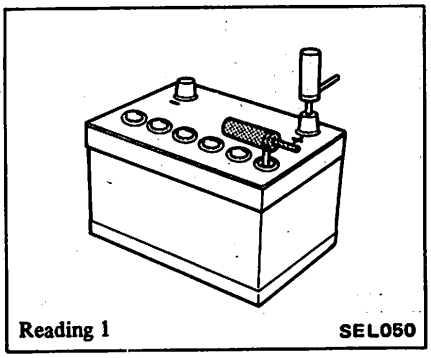


1. Check battery rating against that of original factory equipment.
2. With battery connected to tester as shown, turn load knob until a draw of 3 times the battery rating is shown. (Example: Battery rating 60AH Turn load to 180A draw.)
3. Hold this draw for 15 seconds, then look at voltage. If voltage remains at 9.6 volts or above, THE BATTERY IS GOOD. You need not perform any further tests. If voltage drops below 9.6 volts, then proceed to next test.

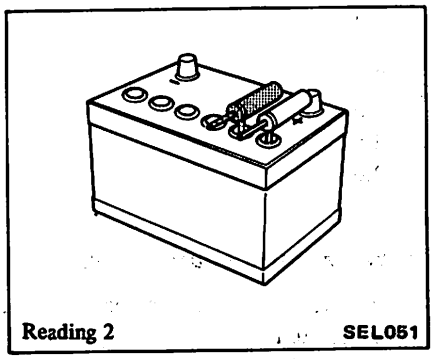
Cell test under charge



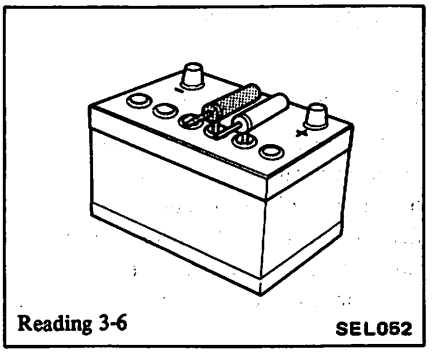
Connect tester and battery charger. Set to fast charge rate (35 to 40A).
1. Turn to low range voltmeter.
2. Attach special cell probes to voltmeter leads.
3. Touch positive probe to battery positive (+) terminal.
4. Stick black probe in battery cell nearest the battery positive post. WRITE DOWN voltmeter reading.



5. Now put positive probe in cell nearest the positive post. Put negative probe in next cell down. Record reading.

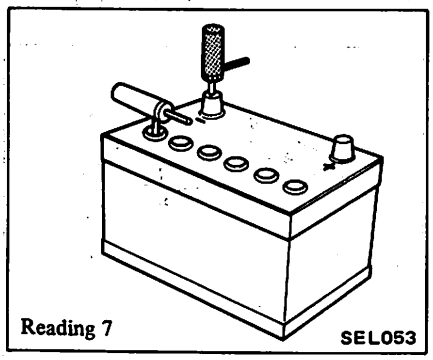


6. Continue on down the battery, recording reading each time.



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7. When you get to point where positive probe is in last cell of battery, touch negative probe to negative post. Record this reading.


Reading 7 SEL053

8. You should now have seven readings. Now add the first reading to the last; this will give you six readings. They should all be within 0.2 (two-tenths) volt of each other. If one cell varies more than this amount from any other, then battery is bad and must be replaced.

2.4*
2.6
2.6 2.4
2.6 0.2
2.6 = 2.6*
2.6
0.2*

Three-minute charge test

This test identifies a battery as being sulfated and should only be performed if the battery has failed the capacity test.

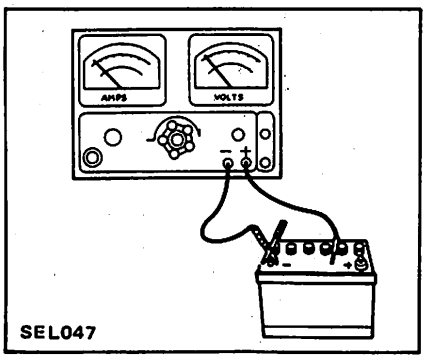
1. Connect a good quality battery charger. Remove cell caps.
2. Turn charger to a fast rate not over 40A.
3. After three minutes, check voltmeter reading. If it is over 15.5 volts (16.5 for maintenance free batteries) battery should be replaced.

Visual check under charge

This test can be performed in conjunction with "Cell test under charge" or "Three-minute charge test". While fast charging simply inspect each cell for signs of bubbling. A cell in which no bubbling action occurs is an indication of a weak cell.

Battery leakage test

Check to make sure battery is not discharging across top, between two posts.



1. Set voltmeter to low range.
2. Touch negative lead of voltmeter to negative battery post.
3. Touch positive lead of voltmeter to top of battery, and move it around.

If reading goes over 0.5 volts, then clean off top of battery and retest.

Battery draw test

For discharging problems after other battery tests show that the battery is good and capable of holding a charge perform the battery draw test.

1. Disconnect battery ground cable.
2. Insert test light in series between cable end and the negative battery post.
3. With all switches and systems off the test light should not be lit.
4. If the light is lit begin disconnecting fuses and units until the light goes out. **The clock is designed to run at all times. Be sure it is not the cause of the light being on.**
5. Repair the circuit causing the draw.

CHARGING

CAUTION:
a. Carry out charging with negative cable removed.
b. Do not allow electrolyte temperature to go over 45°C (113°F).

Approximate charging rates

Specific Gravity at 27°C (80°F)
Charging Rate/Time

1.150 or less	40 amps/45 minutes
1.150 to 1.175	40 amps/30 minutes
1.175 to 1.200	40 amps/20 minutes
1.200 to 1.225	40 amps/10 minutes
above 1.225	slow charge

WARNING:
a. Keep battery away from open flame while it is being charged.
b. When connecting charger, connect leads first, then turn on charger. Do not turn on charger first, as this may cause a spark.

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

BATTERY

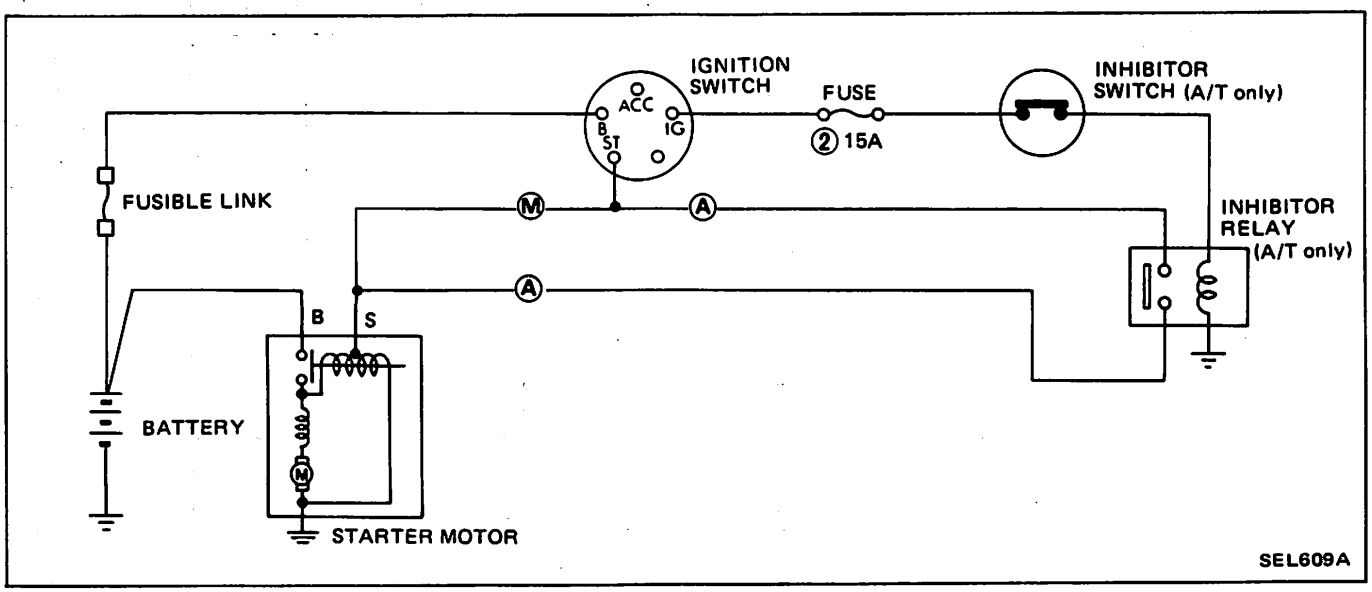
	N50Z	NS70
Applied model	U.S.A.	Canada
Capacity V-AH	12-60	12-65
Full charging specific gravity at 20°C (68°F)	1.26	1.28

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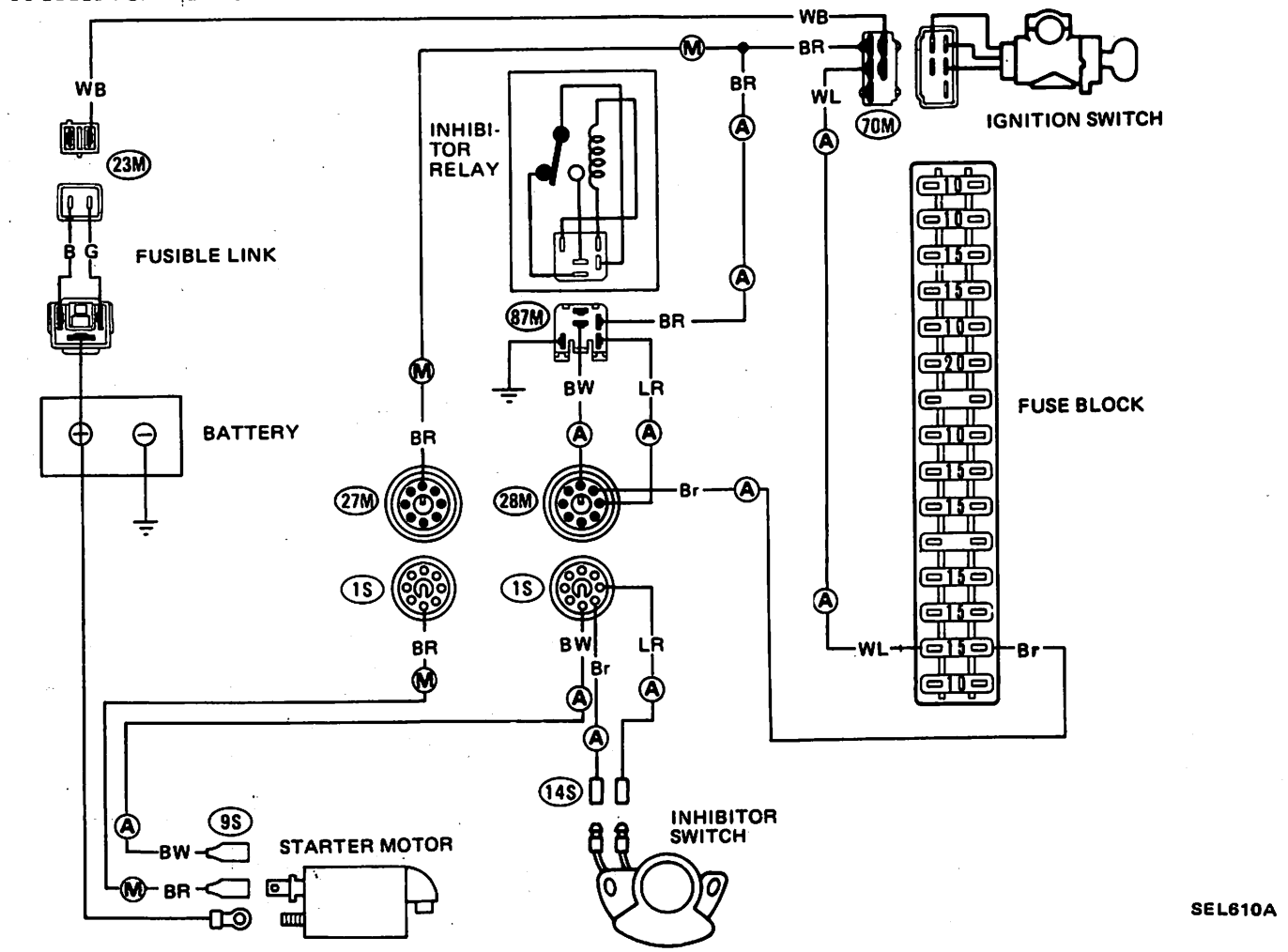
STARTING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

SCHEMATIC

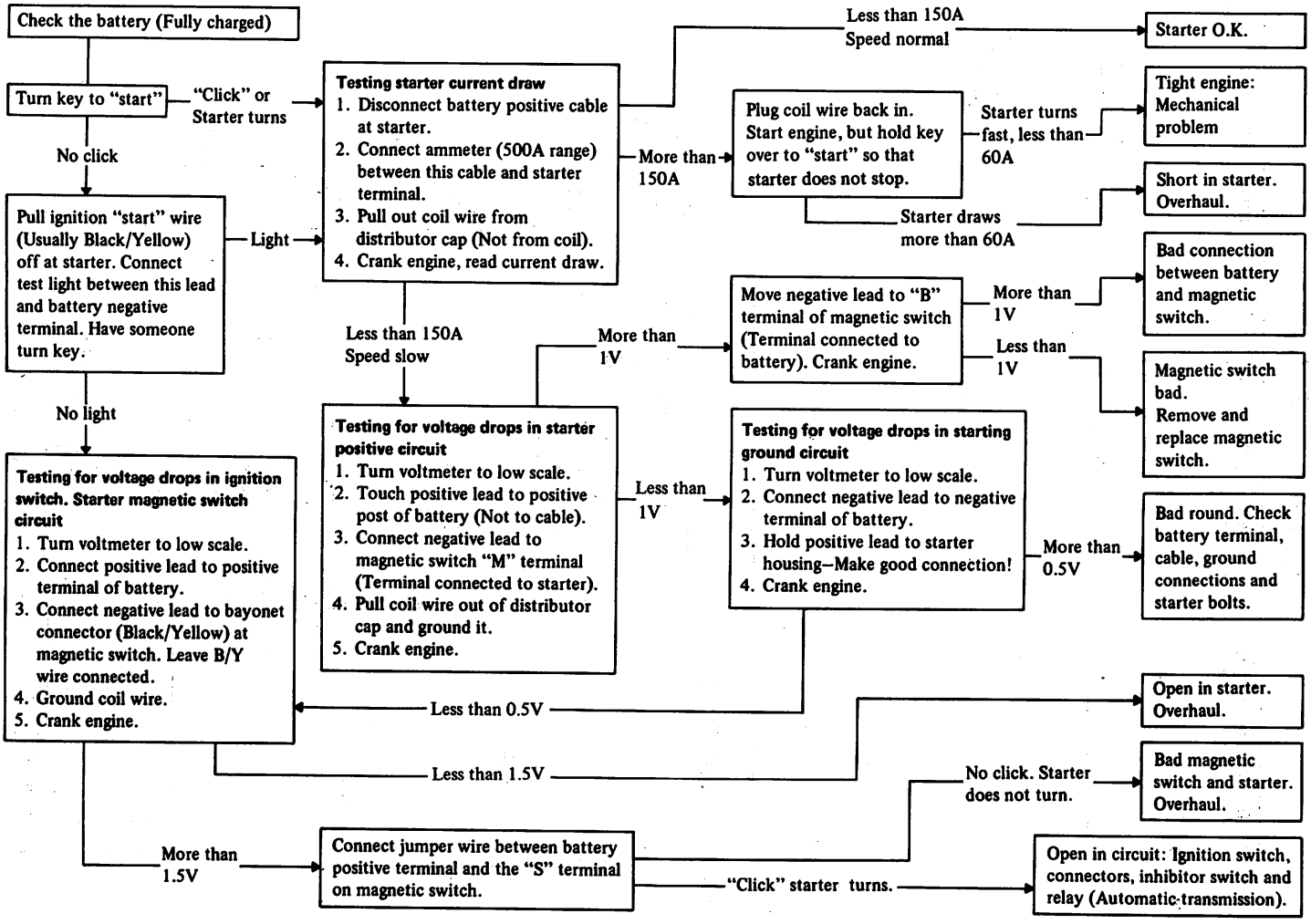


WIRING DIAGRAM



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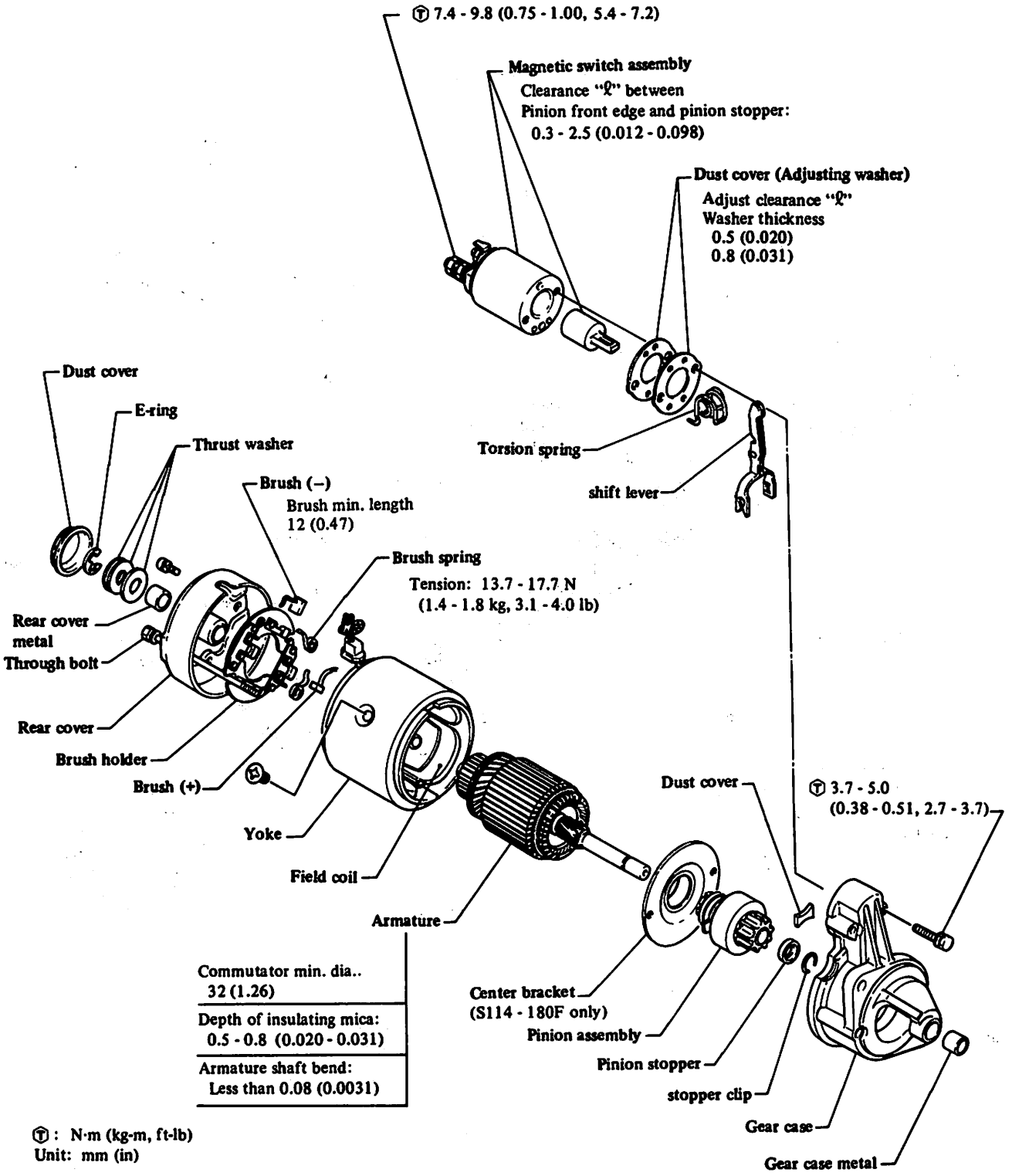
STARTING SYSTEM TROUBLE-SHOOTING



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STARTER MOTOR

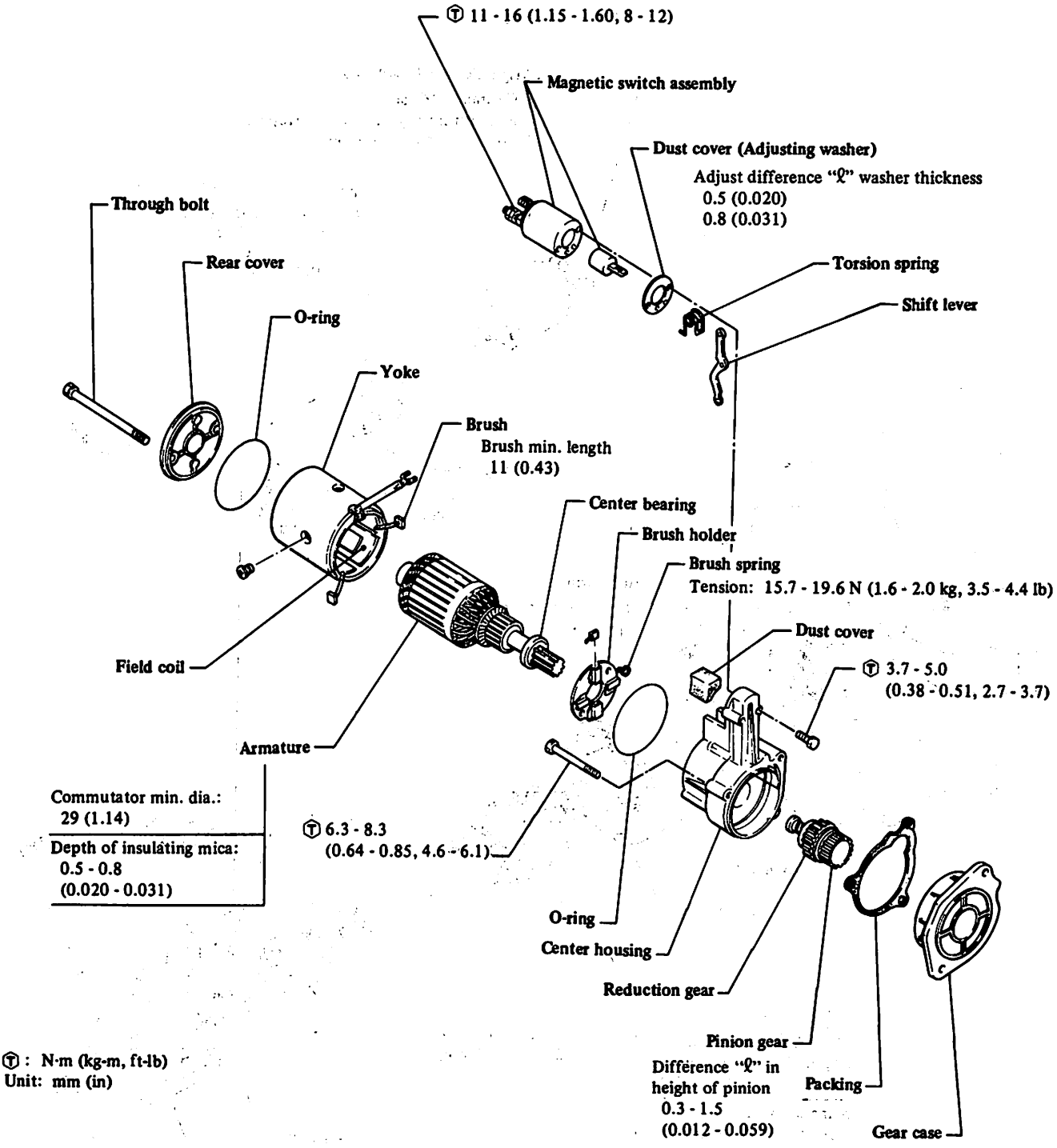
Non-reduction gear type



SEL007

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Reduction gear type



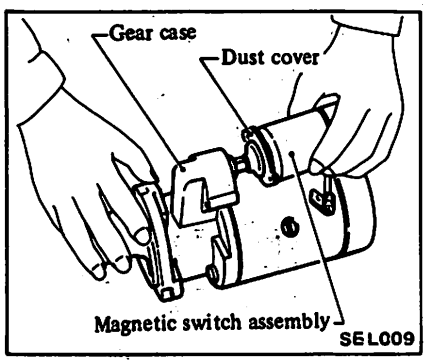
SEL008

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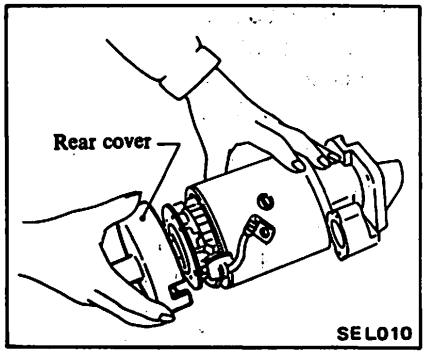
DISASSEMBLY

Non-reduction gear type

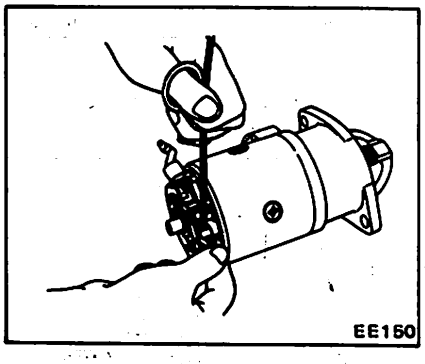
1. Remove magnetic switch.



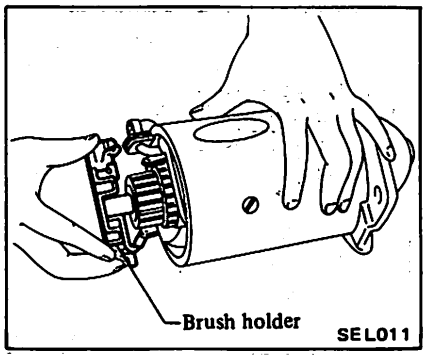
2. Remove rear cover.
(1) Remove dust cover, E-ring and thrust washer(s).
(2) Remove brush holder setscrews.
(3) Remove through bolts.



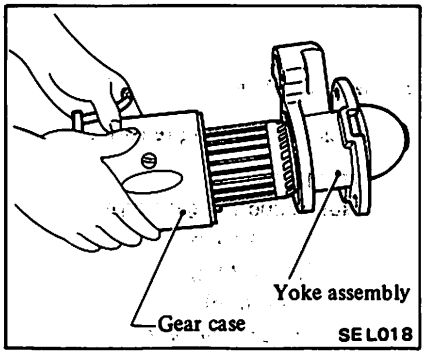
3. Lift up brush springs.



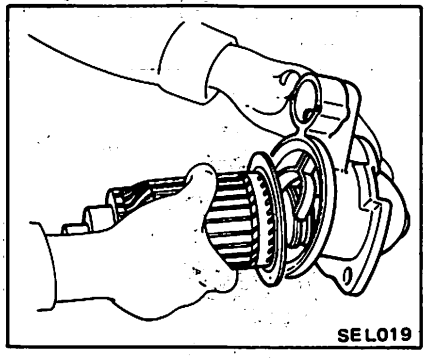
4. Remove brush holder



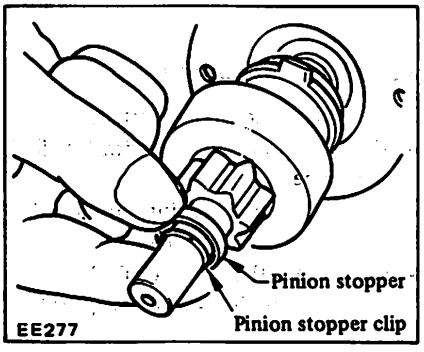
5. Remove yoke.



6. Withdraw armature and shift lever.



7. Remove overrunning clutch.
- Remove pinion stopper clip, pushing pinion stopper toward clutch side.



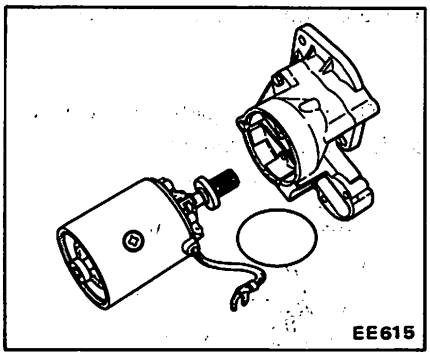
Reduction gear type

1. Remove magnetic switch assembly.
2. Remove torsion spring.
3. Remove through bolts and rear cover.

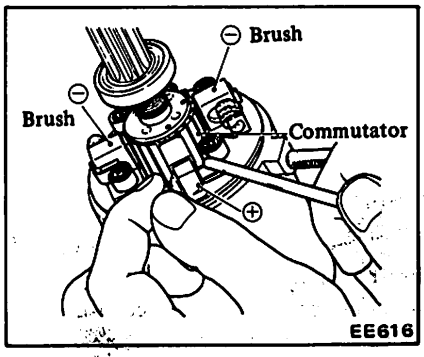
CAUTION:
Be careful not to damage O-ring.

4. Remove yoke, armature and brush holder as an assembly from center housing.

CAUTION:
Be careful not to knock brush, commutator or coil against any adjacent part.



5. Remove center housing.
6. Remove pinion gear.
7. Lift up brush springs.
8. Remove brushes from brush holder.



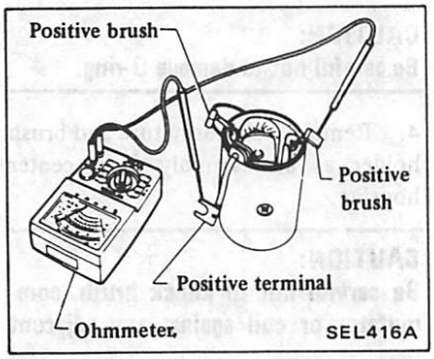
9. Remove brush holder.
10. Remove yoke.

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INSPECTION

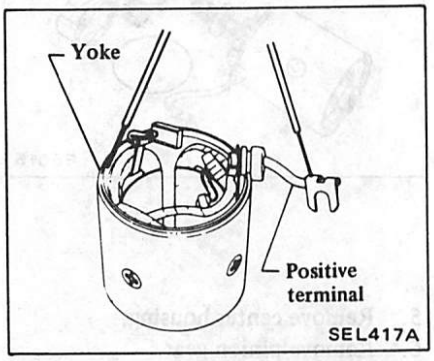
Field coil

1. Continuity test (between field coil positive terminal and positive brushes).



- No continuity ... Replace field coil.

2. Ground test. (between field coil positive terminal and yoke).



- Continuity exists ... Replace field coil.

Brush

Check the surface condition of brush contact.

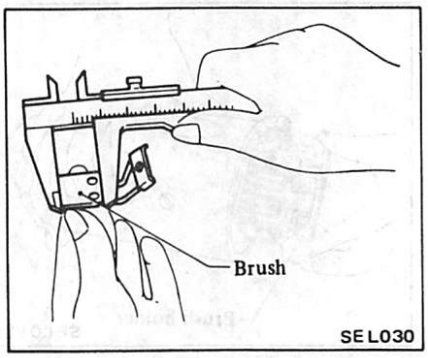
- Loose contact ... Replace.

Check wear of brush.

Minimum length of brush:

Non-reduction gear type:
12 mm (0.47 in)
Reduction gear type:
11 mm (0.43 in)

- Excessive wear ... Replace.

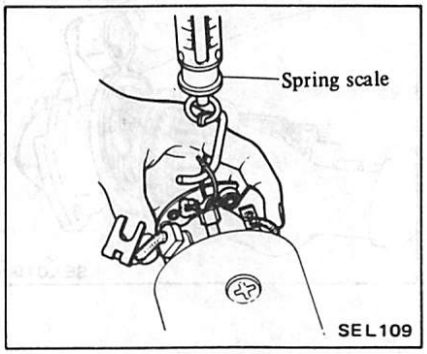


Brush spring

Check brush spring tension.

Spring tension:
Non-reduction gear type
13.7 - 17.7 N
(1.4 - 1.8 kg,
3.1 - 4.0 lb)
Reduction gear type
15.7 - 19.6 N
(1.6 - 2.0 kg,
3.5 - 4.4 lb)

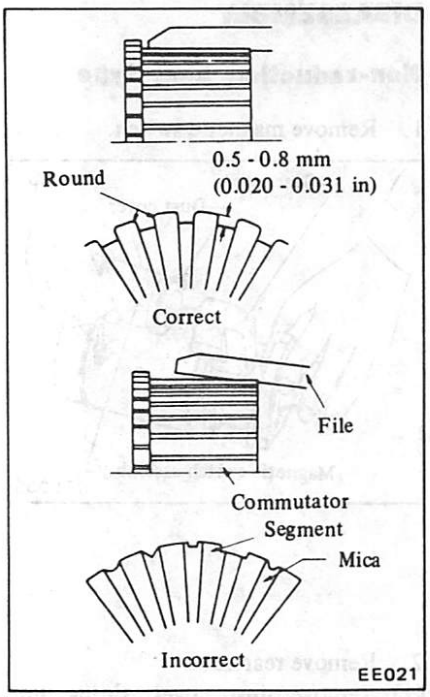
- Not in the specified value. ... Repair or replace.



Armature assembly

1. Check commutator surface.
- Rough ... Sand lightly with No. 500 sandpaper.

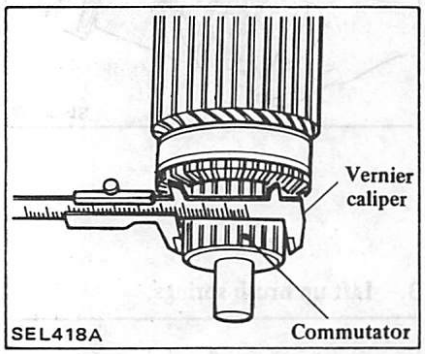
2. Check depth of insulating mica from commutator surface.
- Less than 0.2 mm (0.008 in) ... Undercut to 0.5 - 0.8 mm (0.020 - 0.031 in)



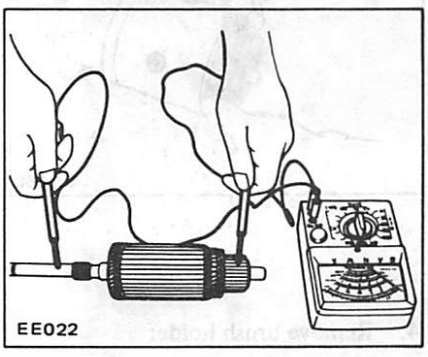
3. Check diameter of commutator.
Commutator minimum diameter:

Non reduction gear type:
32 mm (1.26 in)
Reduction gear type:
29 mm (1.14 in)

- Less than specified value ... Replace.



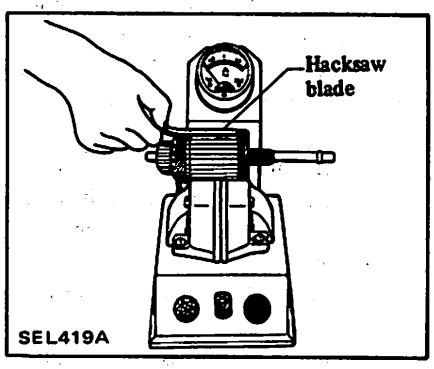
4. Ground test (between each commutator bar and shaft).



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• Continuity exists ... Replace.

5. Short test with armature tester (growler) and a piece of iron over armature core.



• Plate vibrates ... Replace.

6. Continuity test (between two segments side by side).

• No continuity ... Replace.

Over-running clutch assembly

1. Inspect smooth sliding of pinion gear.

• Abnormal resistance ... Repair.

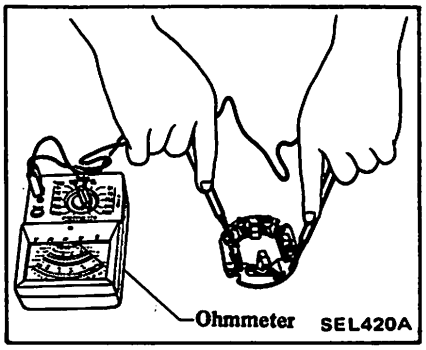
2. Inspect pinion teeth.

• Excessive rubbing ... Replace.

CAUTION:
Flywheel ring gear also must be inspected.

Brush holder

Ground test (between negative side of brush holder and another positive side).



• Continuity exists ... Replace.

Pinion case bearing metal (Non-reduction gear type)

Check clearance between bearing metal and armature shaft.

Bearing metal to armature shaft clearance:
Less than 0.2 mm (0.008 in)

• More than specified value ... Replace.

Ball bearing (Reduction gear type)

Holding outer race with finger, rotate bearing.

• Any play or bind ... Replace.

Magnetic switch assembly

1. Continuity test (between "S" terminal and switch body).

• No continuity ... Replace.

2. Continuity test (between terminals "S" and "M").

• No continuity ... Replace.

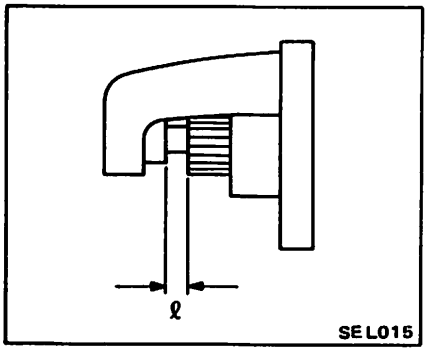
ASSEMBLY

• Apply grease to gear case and rear cover bearing metal, and apply oil to pinion slightly.

(Non-reduction gear type)

With the switch on, push pinion back to remove all slack and measure the clearance "ℓ" between pinion front edge and pinion stopper.

Clearance "ℓ":
0.3 - 2.5 mm
(0.012 - 0.098 in)



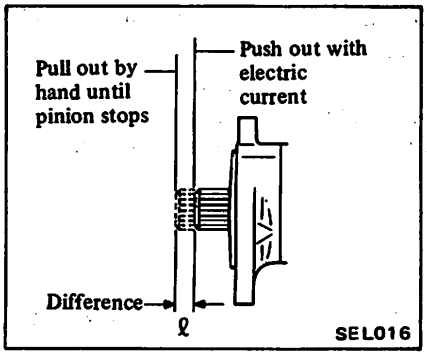
• Not in the specified value ... Adjust by adjusting washer(s).

Adjusting washer thickness
0.5 mm (0.020 in)
0.8 mm (0.031 in)

(Reduction gear type)

Compare difference "ℓ" in height of pinion when it is pushed out with magnetic switch energized and when it is pulled out by hand until it touches stopper.

Difference "ℓ":
0.3 - 1.5 mm
(0.012 - 0.059 in)



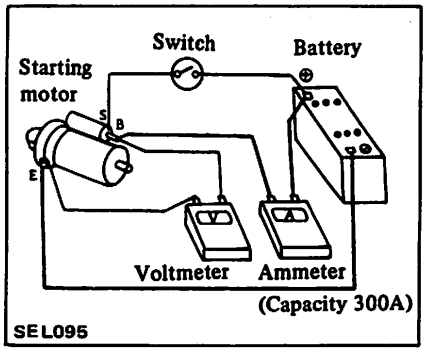
• Not in the specified value ... Adjust by adjusting washer(s).

Adjusting washer thickness:
0.5 mm (0.020 in)
0.8 mm (0.031 in)

TESTING

Performance test

No-load test



Specifications

Refer to S.D.S.

Diagnosis of test

1. Low speed with no-load and high current draw.

(1) Tight, dirty or worn bearings.
(2) Bent armature shaft or loosened field probe.

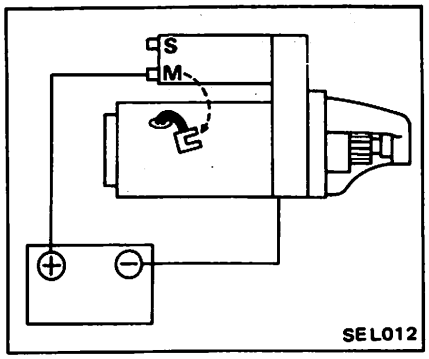
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(3) Shorted armature coil.
(4) A grounded armature of field coil.
2. Failure to operate with high current draw.
(1) A grounded or open field coil.
(2) Burned out commutator bar.
- Weak brush spring tension
- Thrust out of mica in commutator
- Loose contact between brush and commutator.

3. Low current draw and low no-load speed.
(1) Loose connections.
(2) Dirty commutator.
(3) Burned out commutator bar.

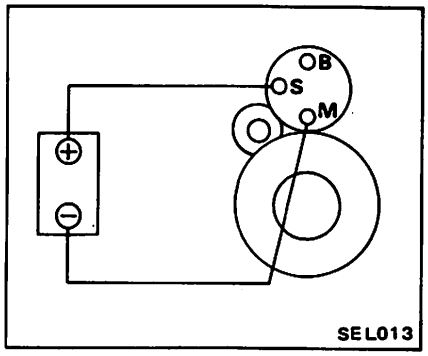
Magnetic switch returnability

1. Disconnect lead wire from terminal "M" of magnetic switch.
2. Connect terminal "M" and positive ⊕ terminal of battery with a jumper lead wire.
3. Connect starter motor body and negative ⊖ terminal of battery with a jumper lead wire.
4. Pull pinion gear all the way out with your hands.
5. Release your hands from pinion gear.
6. If pinion gear returns to its original position, magnetic switch is properly functioning.



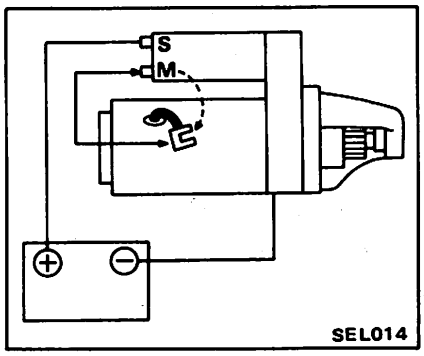
Series coil

1. Connect terminal "M" of magnetic switch and negative ⊖ terminal of battery with a jumper lead wire.
2. Connect terminal "S" of magnetic switch and positive ⊕ terminal of battery with a jumper wire.
3. With these connections having been made, if plunger is pulled in by force, series coil is properly functioning.



Shunt coil

1. Disconnect lead wire which connects terminal "M" of magnetic switch and starting motor terminal, and connect a jumper wire in its place.
2. Connect terminal "S" of magnetic switch and positive ⊕ terminal of battery with a jumper wire.
3. Connect negative ⊖ terminal of battery and starting motor body with a jumper wire. Plunger should be pulled in by force.
4. Disconnect jumper wire from terminal "M".
5. If plunger continues to be pulled in with jumper wire disconnected from terminal "M", shunt coil is properly functioning.



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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

STARTER MOTOR

Type			S114-180F	S114-229F	S114-304
Applied model			Non-reduction gear type		Reduction gear type
			U.S.A. A/T	U.S.A. M/T	Canada
System voltage		V	12		
No load	Terminal voltage	V	11.5		11
	Current	A	Less than 60		Less than 100
	Revolution	rpm	More than 6,000	More than 7,000	More than 3,900
Outer diameter of commutator		mm (in)	More than 32 (1.26)		More than 29 (1.14)
Minimum length of brush		mm (in)	12 (0.47)		11 (0.43)
Brush spring tension		N (kg, lb)	13.7 - 17.7 (1.4 - 1.8, 3.1 - 4.0)		15.7 - 19.6 (1.6 - 2.0, 3.5 - 4.4)
Clearance between bearing metal and armature shaft		mm (in)	Less than 0.2 (0.008)		–
Clearance "ℓ" between pinion front edge and pinion stopper		mm (in)	0.3 - 2.5 (0.012 - 0.098)		–
Difference "ℓ" in height of pinion		mm (in)	–		0.3 - 1.5 (0.012 - 0.059)

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CHARGING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

DESCRIPTION

The charging circuit consists of a battery, an alternator incorporating an IC voltage regulator and wiring that connects these parts.

With the ignition switch in ON, the circuit between transistor "Tr_1" of the IC voltage regulator and ground is closed. Current from the battery then flows along the route shown by the arrow in Figure, turning on the charge warning lamp and flowing on through terminal "L" to excite the rotor.

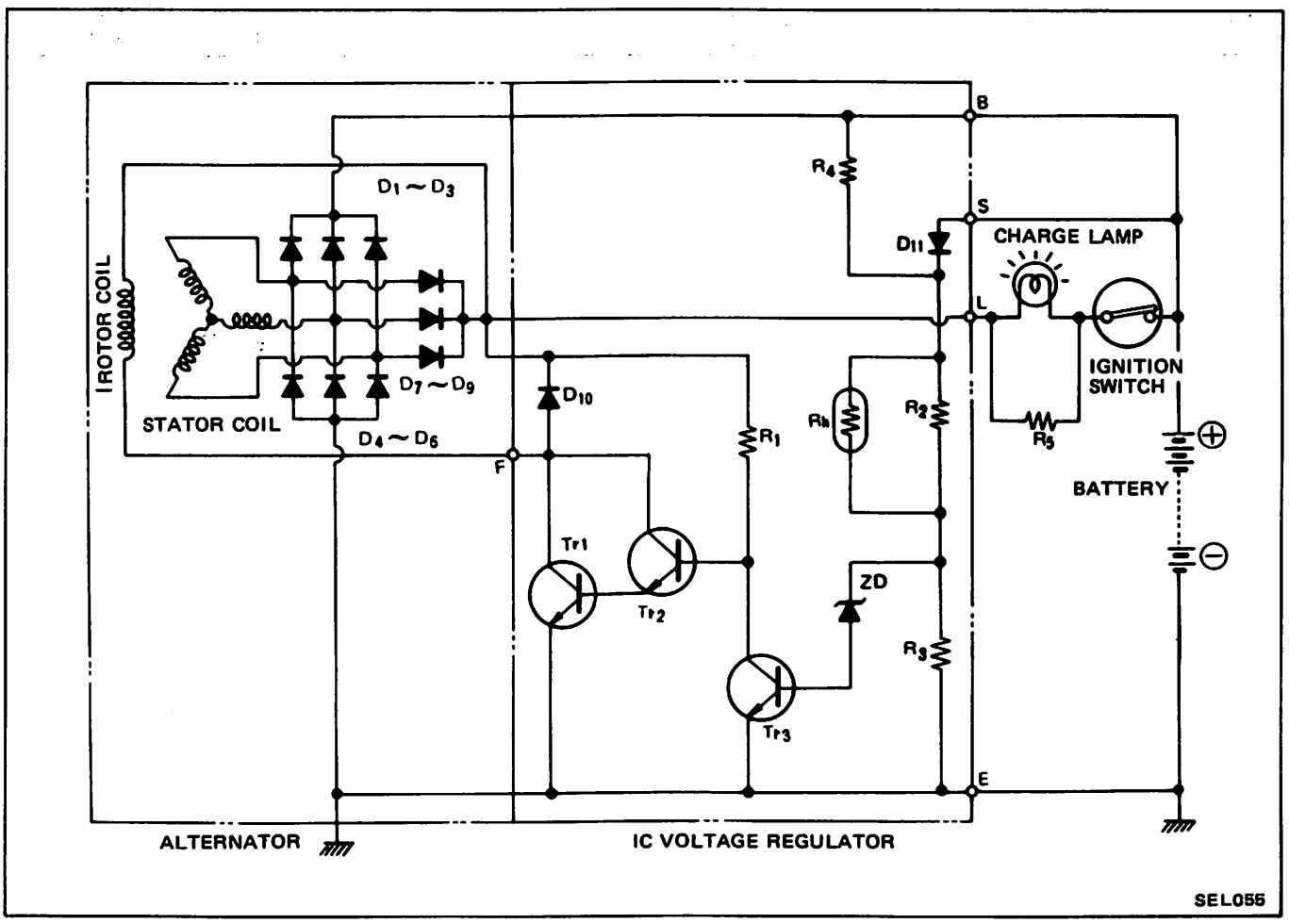
When the alternator begins to operate, three-phase alternating current is produced in the stator coil. This alternating current is rectified by the positive and negative silicon diodes.

When the voltage at terminal "B" is higher than battery voltage, current produced at the stator flows to recharge the battery. While the battery is being re-charged, the voltage at terminal "L" is equal to that of terminal "B". At this point, there is no voltage differential on either side of the charge warning lamp, which causes the charge warning lamp to turn off. In other words, current does not flow from the battery to terminal "L". Accordingly, current flow through the rotor is taken over by current produced at the stator. The circuit between terminal "F" and "Tr_1" is then closed:

The IC voltage regulator monitors generating voltage to be applied to the battery at terminal "S". When current exceeds the specified value, it then flows through the zener diode (ZD), closing the circuit consisting of transistor "Tr_3" and resistor "R1". At this point, current neither flows through transistor "Tr_1" to ground nor to the rotor, thereby reducing the voltage generated at the stator.

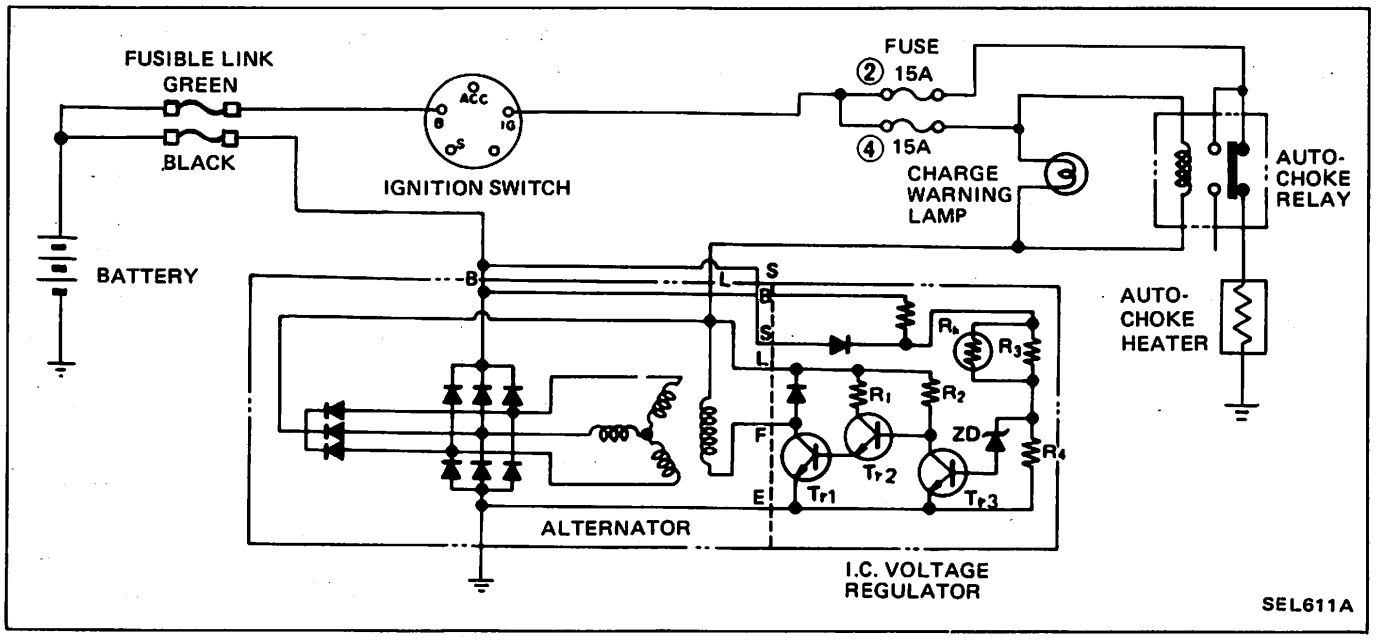
When voltage generated at terminal "S" is reduced to the specified value, transistor allows current to flow through the rotor, increasing the generating voltage.

In this manner, output voltage from the alternator does not rise above the specified value by the ON-OFF operation of the rotor coil through the IC voltage regulator.

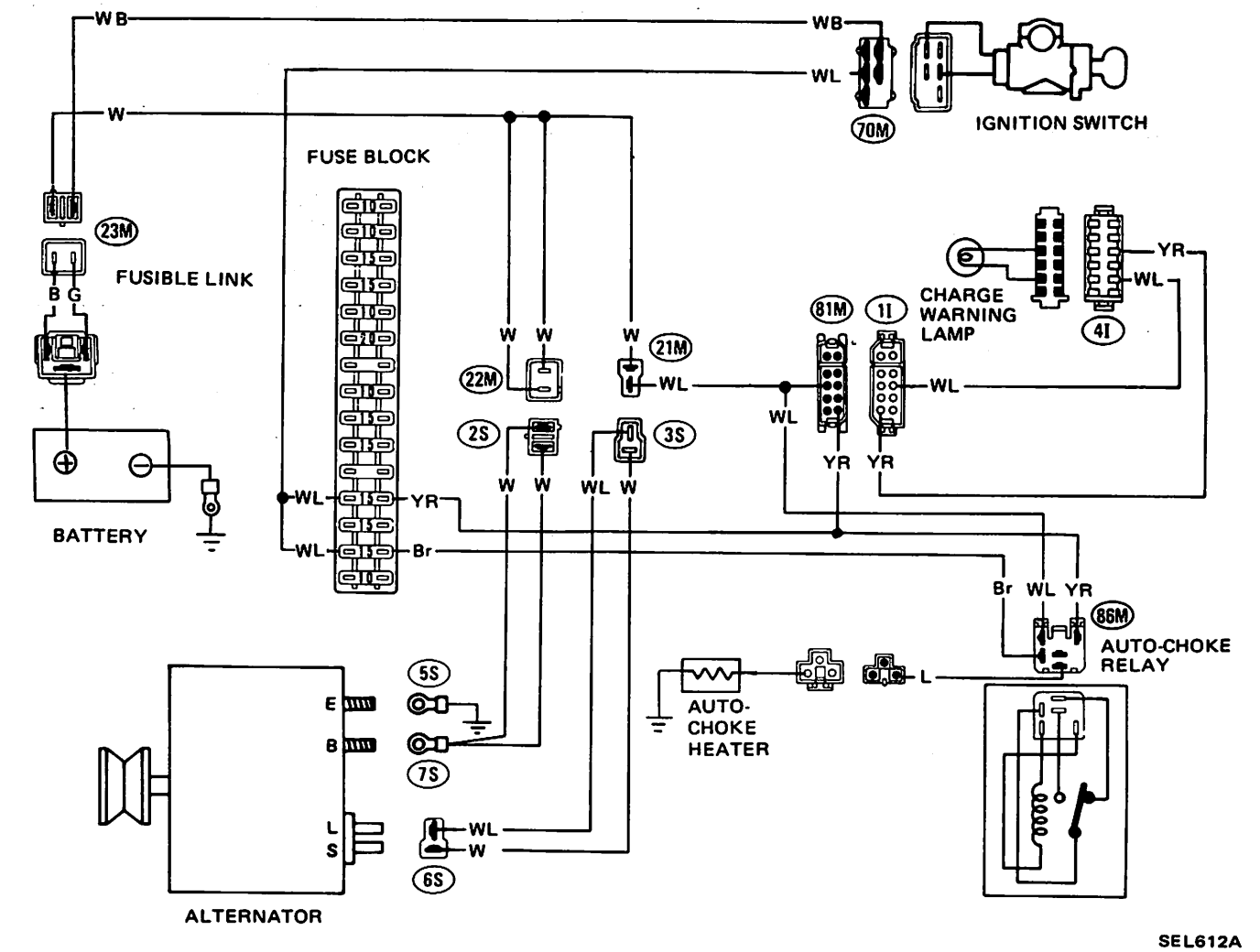


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SCHEMATIC



WIRING DIAGRAM



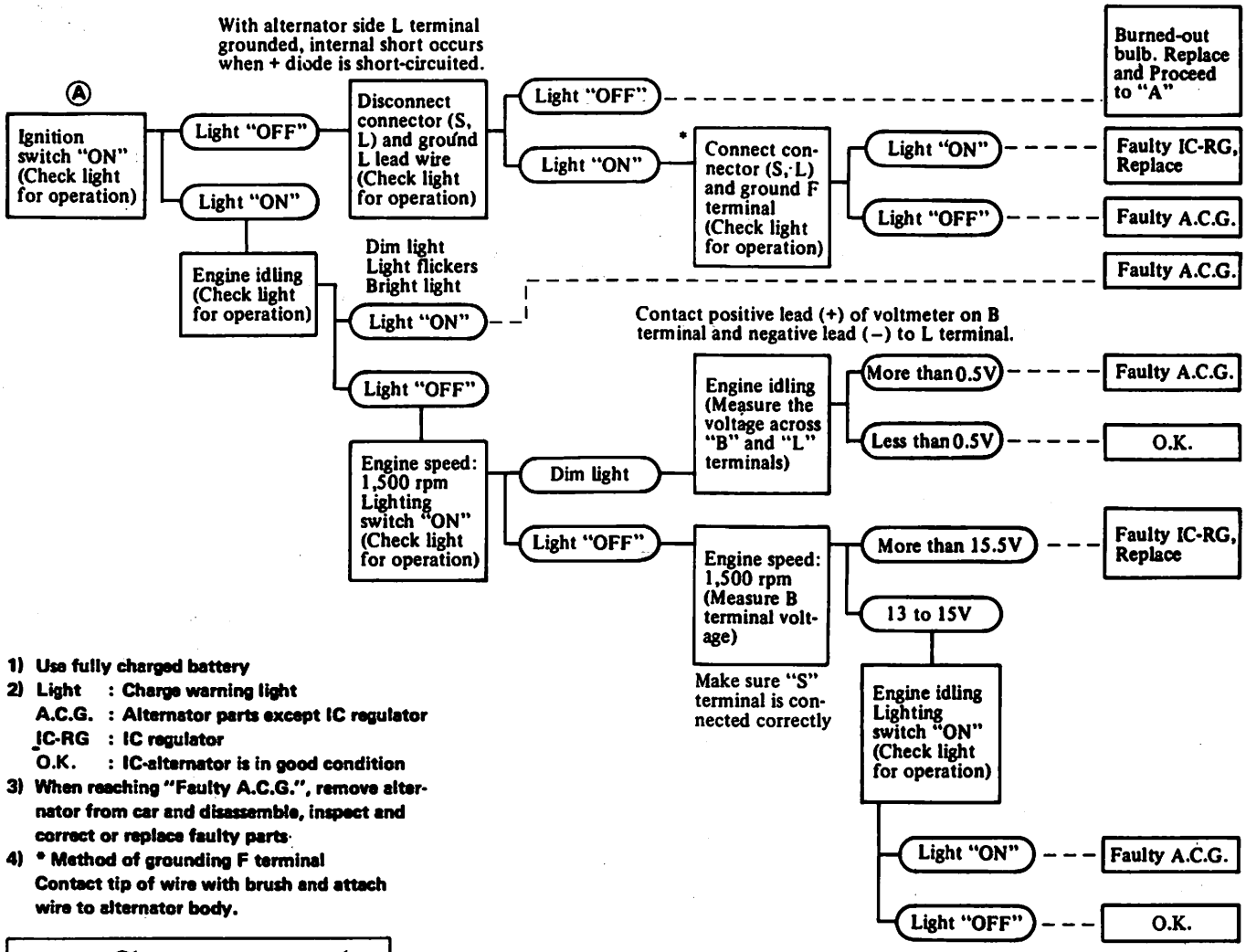
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CHARGING SYSTEM TROUBLE-SHOOTING

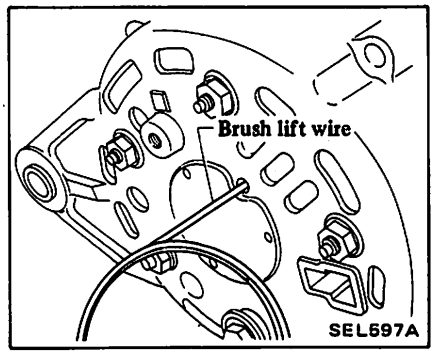
Before conducting an alternator test, make sure that the battery is fully charged.

A 30-Volt voltmeter and suitable test probes are necessary for the test.

The alternator can be checked easily by referring to the Inspection Table.



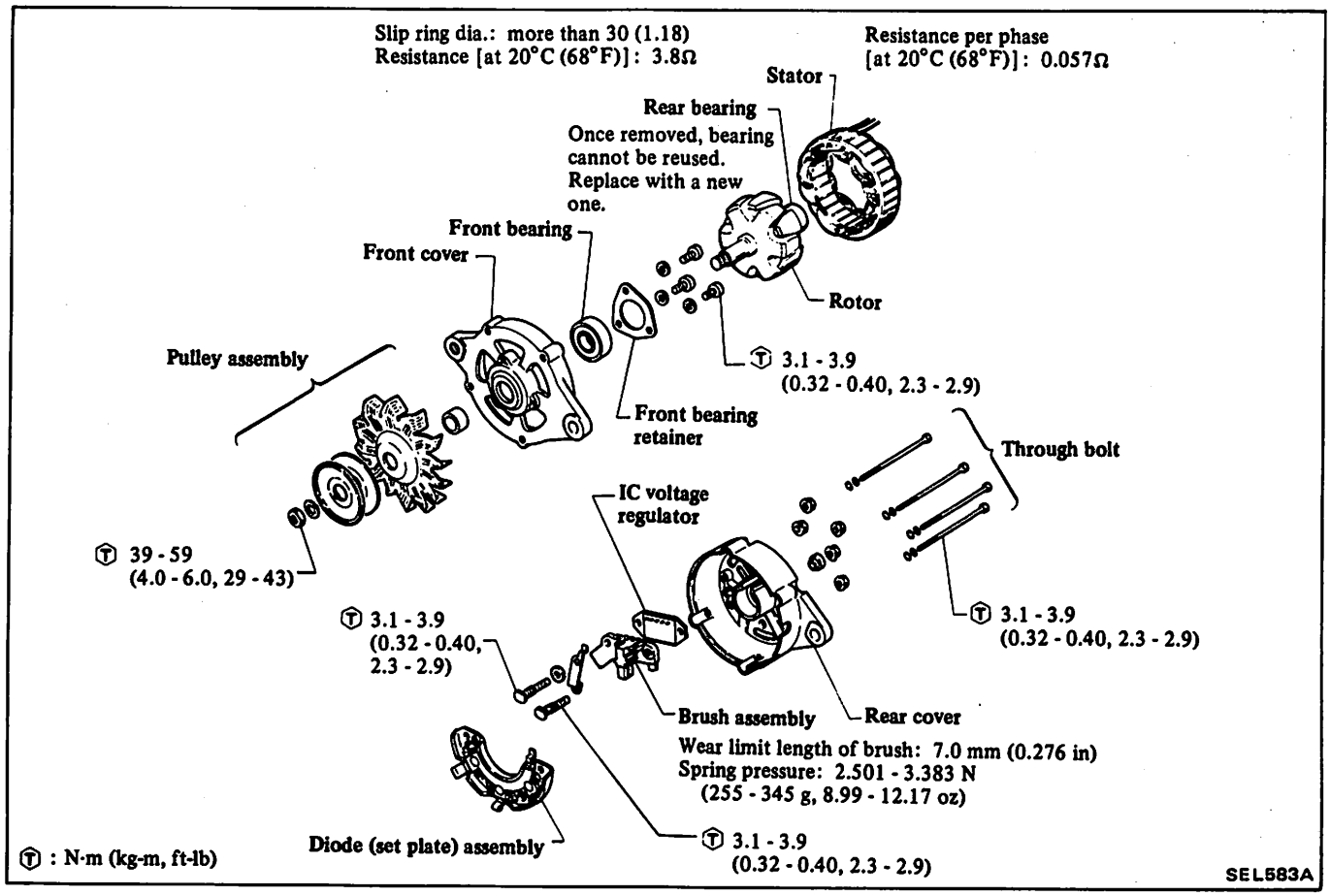
1) Use fully charged battery
2) Light : Charge warning light
   A.C.G. : Alternator parts except IC regulator
   IC-RG : IC regulator
   O.K. : IC-alternator is in good condition
3) When reaching "Faulty A.C.G.", remove alternator from car and disassemble, inspect and correct or replace faulty parts.
4) * Method of grounding F terminal
   Contact tip of wire with brush and attach wire to alternator body.



5) Terminals "S", "L", "BAT" and "E" are marked on rear cover of alternator.

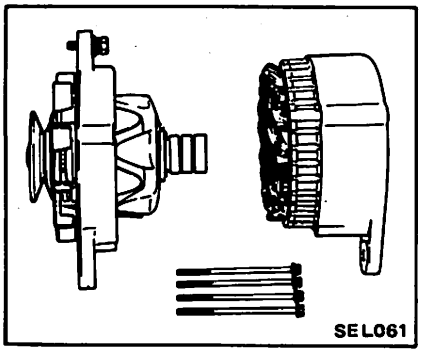
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ALTERNATOR

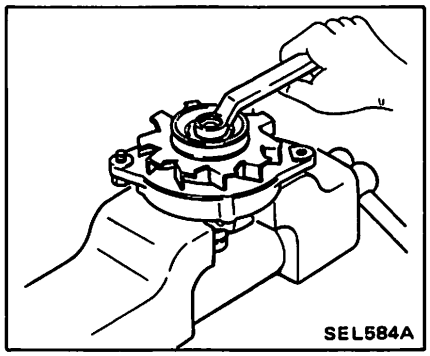


DISASSEMBLY

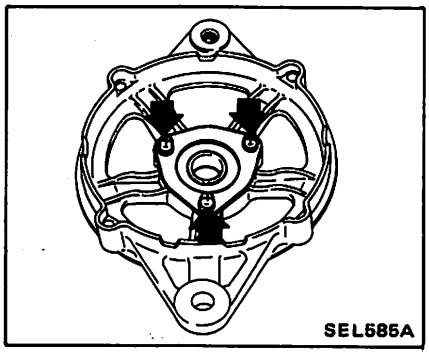
1. Remove through bolts.
2. Separate front cover from rear cover.



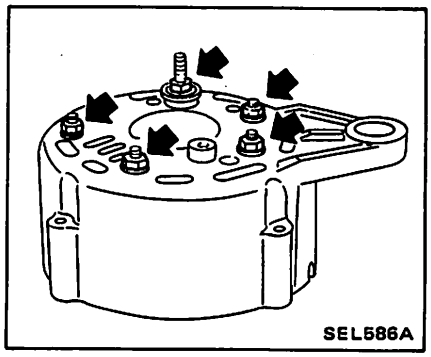
3. Remove pulley and fan.
(1) Place rear cover side of rotor in a vice.
(2) Remove pulley nut.



4. Remove setscrews from bearing retainer.



5. Remove attaching nuts and take out stator assembly.

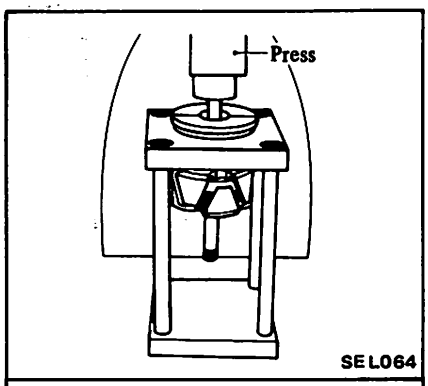


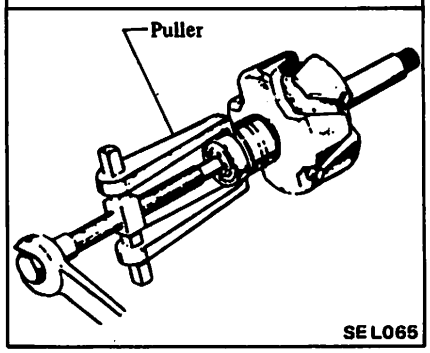
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Potor

Pull rear bearing off from rotor assembly with a press or bearing puller.

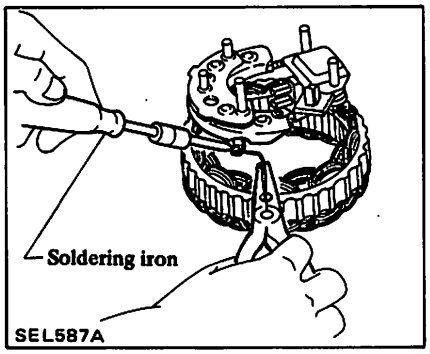
Once removed, bearing cannot be reused. Replace with a new one.





Stator

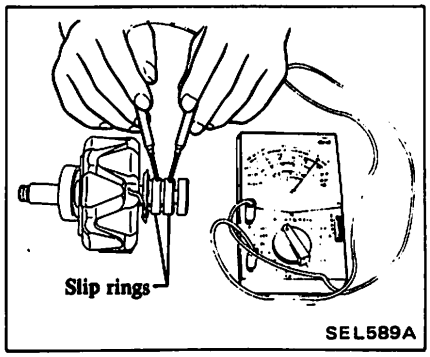
Disconnect stator coil lead wires from diode terminals.



INSPECTION

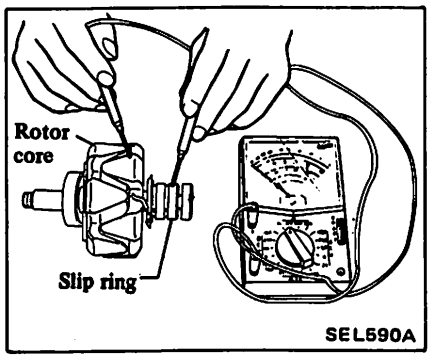
Rotor

1. Continuity test.



- No continuity ... Replace rotor.

2. Ground test



- Continuity exists ... Replace rotor.

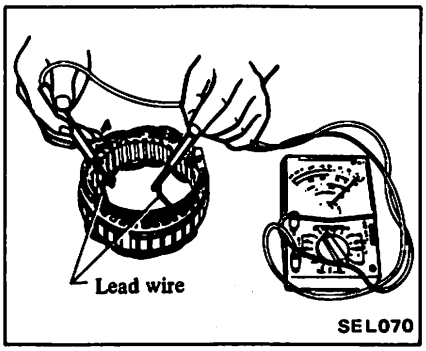
3. Check slip ring for wear.

Slip ring outer diameter
More than 30 mm (1.18 in)

If necessary, replace rotor assembly.

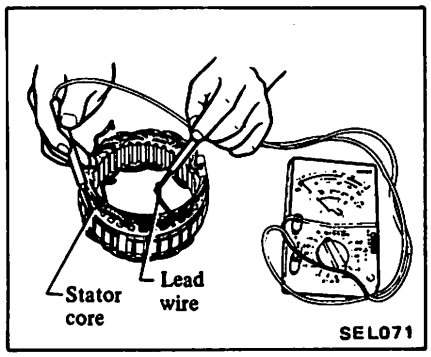
Stator

1. Continuity test



- No continuity ... Replace stator.

2. Ground test



- Continuity exists ... Replace stator.

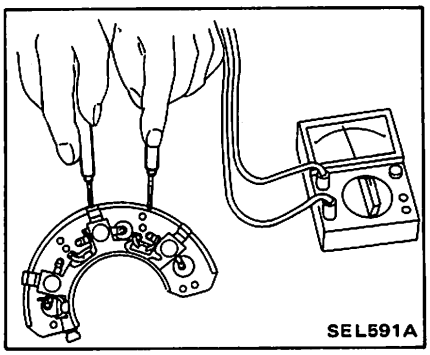
Diode

Perform a continuity test on diodes in both directions, using an ohmmeter.

Circuit tester terminal		Conduction
Positive	Negative	
(+) plate Holder plate	Diode terminal	Yes
Diode terminal	(+) plate Holder plate	No
(–) plate Rear cover	Diode terminal	No
Diode terminal	(–) plate Rear cover	Yes

Some ohmmeters use a reverse polarity, in which case continuity will be exactly opposite from the chart above.

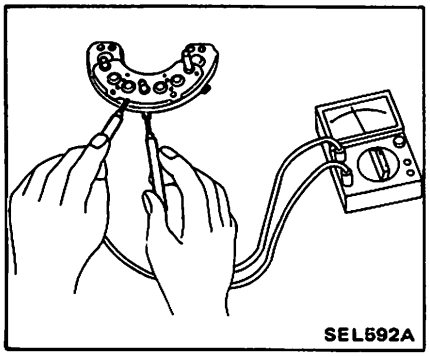
Positive diode



- Conduction test is N.G. ... Replace diode assembly.

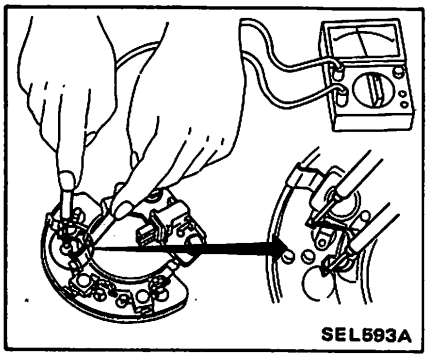
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Negative diode



- Conduction test is N.G. ... Replace diode assembly.

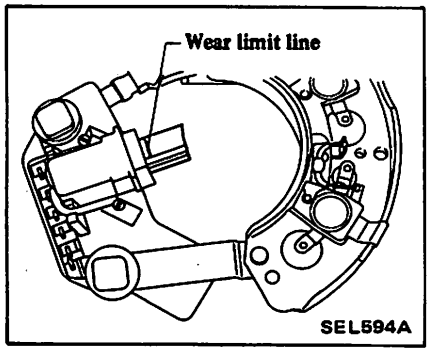
Sub-diode



- Conduction test is N.G. ... Replace diode assembly.

Brush

1. Check smooth movement of brush.
- Not smooth ... Check brush holder and clean.
2. Check brush for wear.

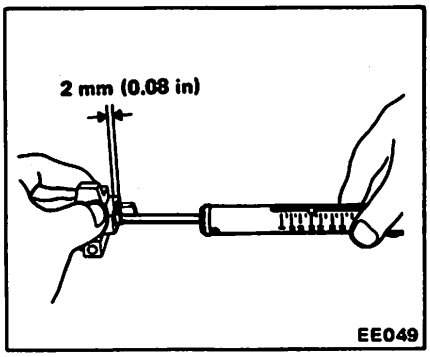


3. Check brush pig tail for damage.
- Damaged ... Replace.
4. Check brush spring pressure.

Measure brush spring pressure with brush projected approximately 2 mm (0.08 in) from brush holder.

Spring pressure:
2.501 - 3.383 N
(255 - 345 g,
8.99 - 12.17 oz)

When brush is worn, pressure decreases approximately 0.196 N (20 g, 0.71 oz) per 1 mm (0.04 in) wear.



- Not in the specified value ... Replace brush assembly.

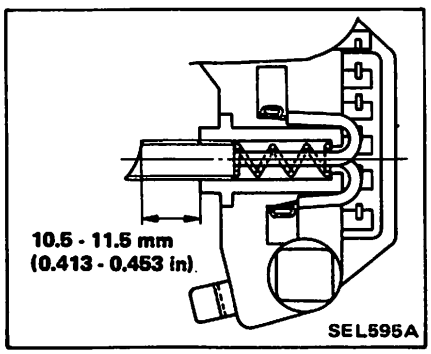
ASSEMBLY

Assemble alternator in the reverse order of disassembly, noting the following:

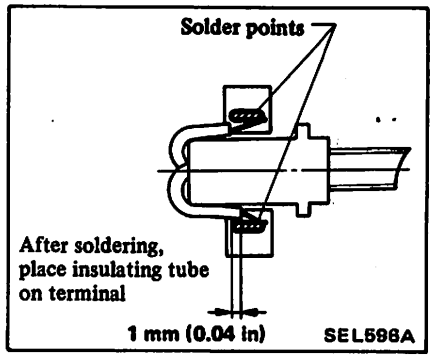
1. When soldering each stator coil lead wire to diode assembly terminal, carry out the operation as fast as possible.

2. When soldering brush lead wire, observe the following.

(1) Position brush so that it extends 11 mm (0.43 in) from brush holder.



(2) Coil lead wire 1.5 times around terminal groove. Solder outside of terminal.



Ⓣ : **Brush holder**
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m,
2.3 - 2.9 ft-lb)
Diode and IC regulator
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m,
2.3 - 2.9 ft-lb)
Bearing retainer
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m,
2.3 - 2.9 ft-lb)

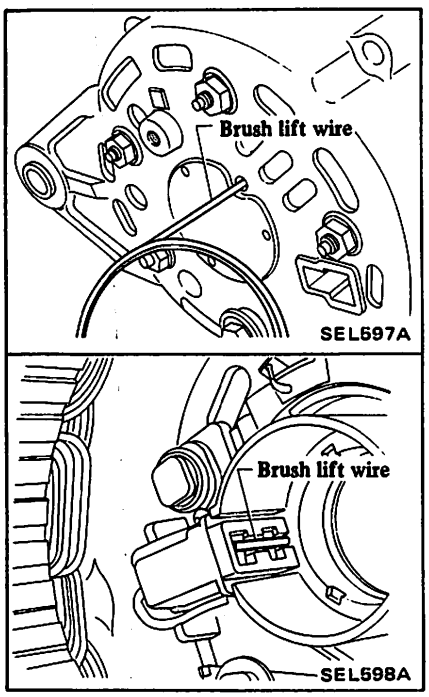
3. Tighten pulley nut and make sure that deflection of V-groove is proper.

Ⓣ : **Pulley nut**
39 - 59 N·m
(4.0 - 6.0 kg-m,
29 - 43 ft-lb)

V-groove deflection:
0.3 mm (0.012 in)

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4. Before installing front and rear sides of alternator, push brush up with fingers and retain brush, by inserting brush lift wire into brush lift hole from outside.



5. After installing front and rear sides of alternator, pull brush lift by pushing toward center.

Do not pull brush lift by pushing toward outside of cover as it will damage slip ring sliding surface.

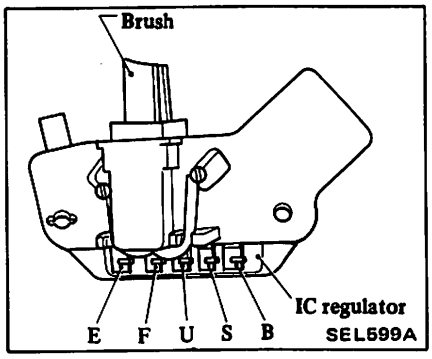
6. Tighten through bolts.

Ⓣ : Through bolts
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m,
2.3 - 2.9 ft-lb)

IC VOLTAGE REGULATOR

DESCRIPTION

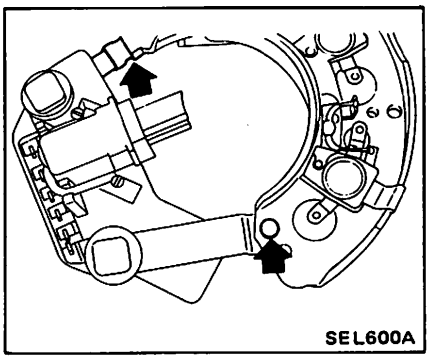
The regulator consists essentially of integrated circuits incorporating transistors. These transistors interrupt and admit current flow to the alternator rotor coil, thus maintaining its output voltage at a constant value. Unlike in a mechanical type regulator, an electronic relay employing transistors is utilized. These transistors are enclosed in a very compact, sealed case. On the charge warning lamp circuit, a diode monitors generating voltage at the stator so that when the monitored voltage and charging voltage are equal during re-charging, the charge warning lamp is turned off, Accordingly, a charge warning relay is not employed in this circuit.



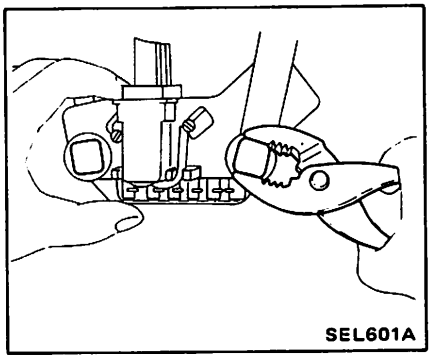
REPLACEMENT

Removal should be done only when IC regulator is being replaced.

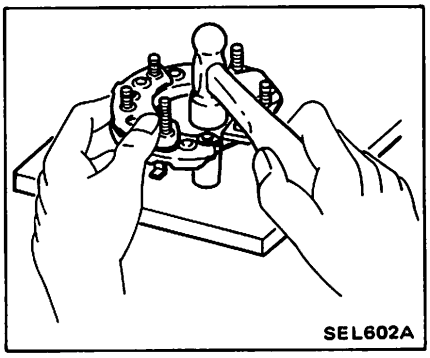
1. Remove rivet and solder.



2. Remove the terminal's solder and take out bolts.



3. When installing the regulator, reverse order of removal, noting the following.
(1) Put IC regulator on brush holder and press-fit bolts using hand press.
(2) Stake rivets using Tool.



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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

ALTERNATOR

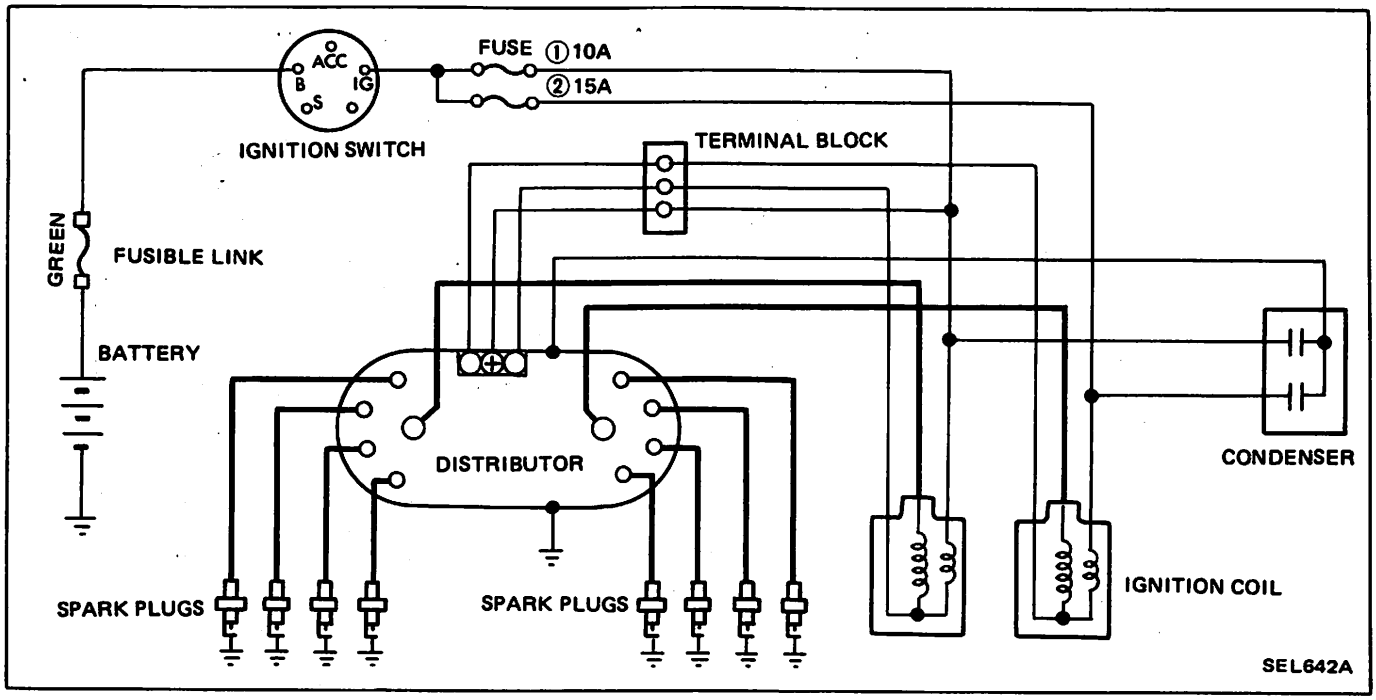
Type		LR150-98	LR160-78	LR150-52	LR160-78
Applied model		2WD		4WD	
		Standard model	Heavy duty model	Standard model for Canada	Option for U.S.A.
Nominal rating	V-A	12-50	12-60	12-50	12-60
Ground polarity		Negative		Negative	
Minimum revolution under no-load (When 14 volts is applied)	rpm	Less than 1,000		Less than 1,000	
Hot output current	A/rpm	More than 40/2,500 More than 50/5,000	More than 50/2,500 More than 60/5,000	More than 40/2,500 More than 50/5,000	More than 50/2,500 More than 60/5,000
Pulley ratio		2.20		2.20	
Regulated output voltage	V	14.4 - 15.0		14.4 - 15.0	
Brush wear limit	mm (in)	More than 7 (0.28)		More than 7 (0.28)	
Brush spring pressure	N (g, oz)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)		2.501 - 3.383 (255 - 345, 8.99 - 12.17)	
Slip ring outer diameter	mm (in)	More than 30 (1.18)		More than 30 (1.18)	

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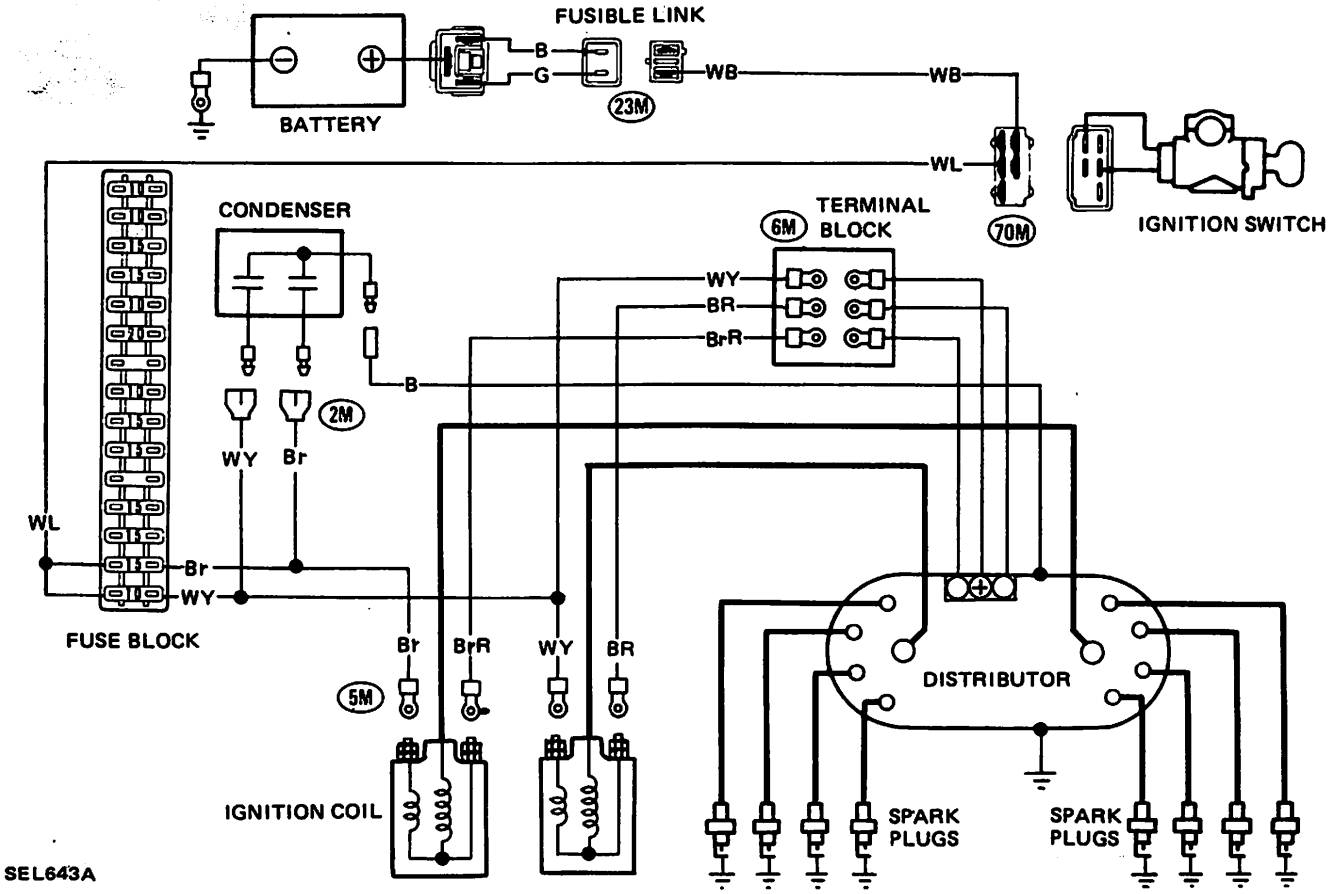
IGNITION SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

SCHEMATIC



WIRING DIAGRAM



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CHECKING PROCEDURE

WARNING:
When current is flowing, never touch with bare hand high tension cables or any other parts with high voltage. If parts are moist, touching them could cause an electric shock, even if they are insulated. Always wear dry, well-insulated gloves or wrap affected parts with dry cloth before handling.

"No-start" condition

Sparking performance check

1. Turn ignition switch to "OFF" position.
2. Disconnect EFI fusible link connector.

CAUTION:
Before disconnecting EFI fusible link connector, ensure that ignition switch is in "OFF" position.

3. Disconnect cold start valve harness connector.
4. Disconnect high tension cable from distributor.
5. Keeping high tension cable end 4 to 5 mm (0.16 to 0.20 in) away from engine block, rotate starter motor and check whether sparks occur across the clearance.

≪ JUDGMENT ≫

- Sparks occur.
  IC ignition system . . . . . O.K.

In this case, IC ignition system and component parts need not be checked beyond this.

- No spark occurs on sparks are intermittent
  IC ignition system . . . . . N.G.

Proceed with tests below.

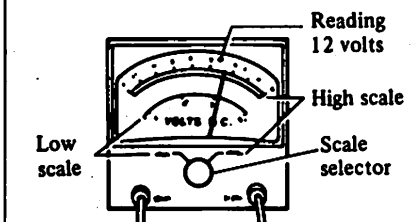
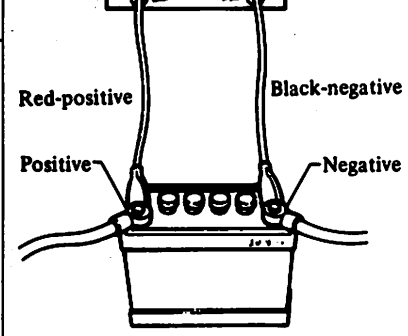
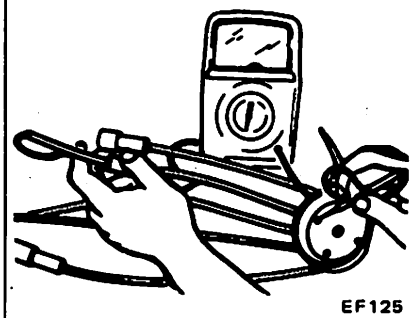
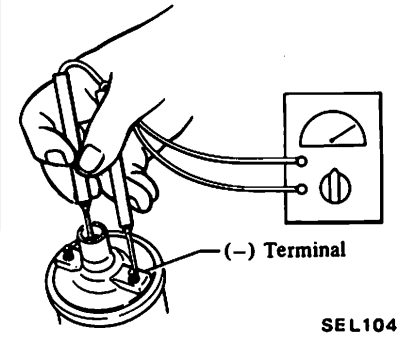
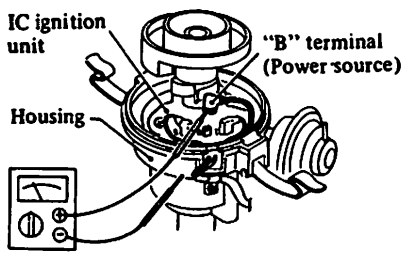
Manual testing of IC ignition system using a voltmeter

IC Ignition System is best checked using J-26350 Transistor Ignition Analyzer. However, if an analyzer is not available, a volt-ohm-milliammeter (V.O.M.) may be used to diagnose transistor ignition malfunctions.While this method requires more time, it can nevertheless provide accurate results. Follow the steps in the sequence indicated. If a fault is found, correct the problem before continuing. If all tests indicate "O.K." replace the IC Ignition Unit. DO NOT REPLACE THE UNIT UNTIL ALL TESTS HAVE BEEN COMPLETED AND INDICATE "O.K.".

1. When performing the following tests, use a multitester which can measure accurately in the following ranges; 0 to 20V. D.C.; 0 to 1,000Ω; 0 to 10V A.C.; 0 to 50,000Ω.
2. If possible, start the vehicles and let it run for 5 to 15 minutes with the hood closed. This will bring all components to normal operating temperature, and will make it easier to diagnose intermittent problems.
3. It is not necessary to disconnect the harness connectors when performing the tests which follow. Simply insert the meter probes into the back of appropriate connector cavity.

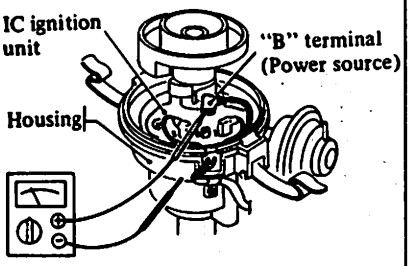
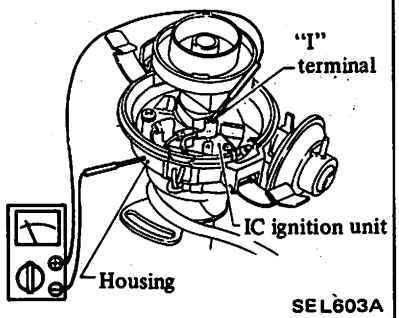
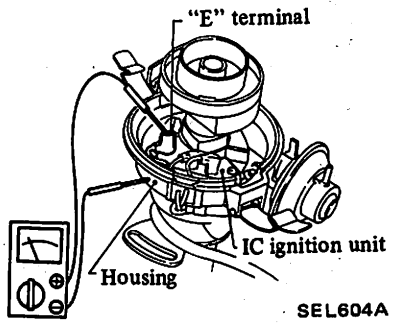
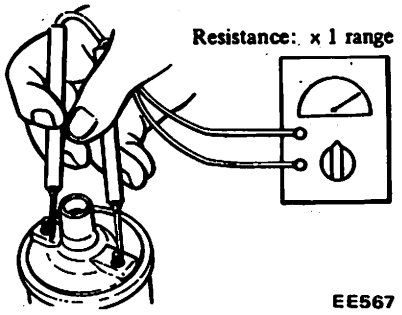
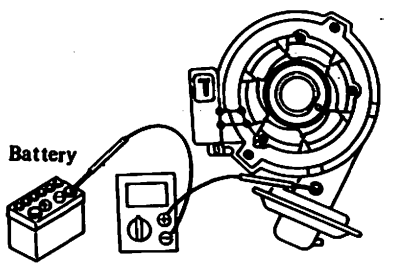
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IC IGNITION SYSTEM TROUBLE-SHOOTING

TEST	TEST METHOD	CONDITIONS	RESULT	ACTION
1. Battery Voltage (no load)		1. Ignition key in "OFF" position. 2. Connect voltmeter as illustrated and set to appropriate scale. 3. Read and record battery voltage reading. Battery voltage ☐	11.5 - 12.5 volts	Proceed to Step 2.
			Below 11.5 volts	Battery, charging system or starting system – Faulty. Refer to applicable sections in Service Manual to correct the situation.
2. Battery Cranking Voltage	 SEL103	1. Connect voltmeter as illustrated and set to appropriate scale. 2. Remove coil wire from distributor cap and ground it. 3. Read voltmeter while cranking engine for approximately 15 seconds. 4. Record voltage reading. Battery cranking voltage ☐	Voltage reading greater than 9.6 volts	Battery O.K. Proceed to Step 3.
			Voltage reading less than 9.6 volts	Battery, charging system or starting system – Faulty. Refer to applicable sections in Service Manual to correct the situation.
3. Secondary Wiring	 EF125	1. Connect ohmmeter as illustrated and measure the resistance of each high tension cable.	Resistance readings less than 30,000 ohms	Distributor cap and high tension cables – O.K. Proceed to Step 4.
			Resistance readings greater than 30,000 ohms	Replace high tension cable(s) and/or distributor cap as required.
4. Ignition Coil Secondary Circuit	 SEL104	1. Ignition key in "OFF" position. 2. Coil wire removed from coil. 3. Connect ohmmeter as illustrated Check both coils.	7,300 - 11,000 ohms	Ignition coil secondary windings – O.K. Proceed to Step 5.
			Resistance reading not between 7,300 - 11,000 ohms	Faulty ignition coil – replace
5. Power Supply Circuit	 SEL084	1. Connect voltmeter as illustrated and set to appropriate scale. 2. Turn ignition key to "ON" position.	11.5 - 12.5 volts	Proceed to Step 6.
			Below 11.5 volts Below 11.5 volts	Check wiring from ignition switch to I.C. unit.

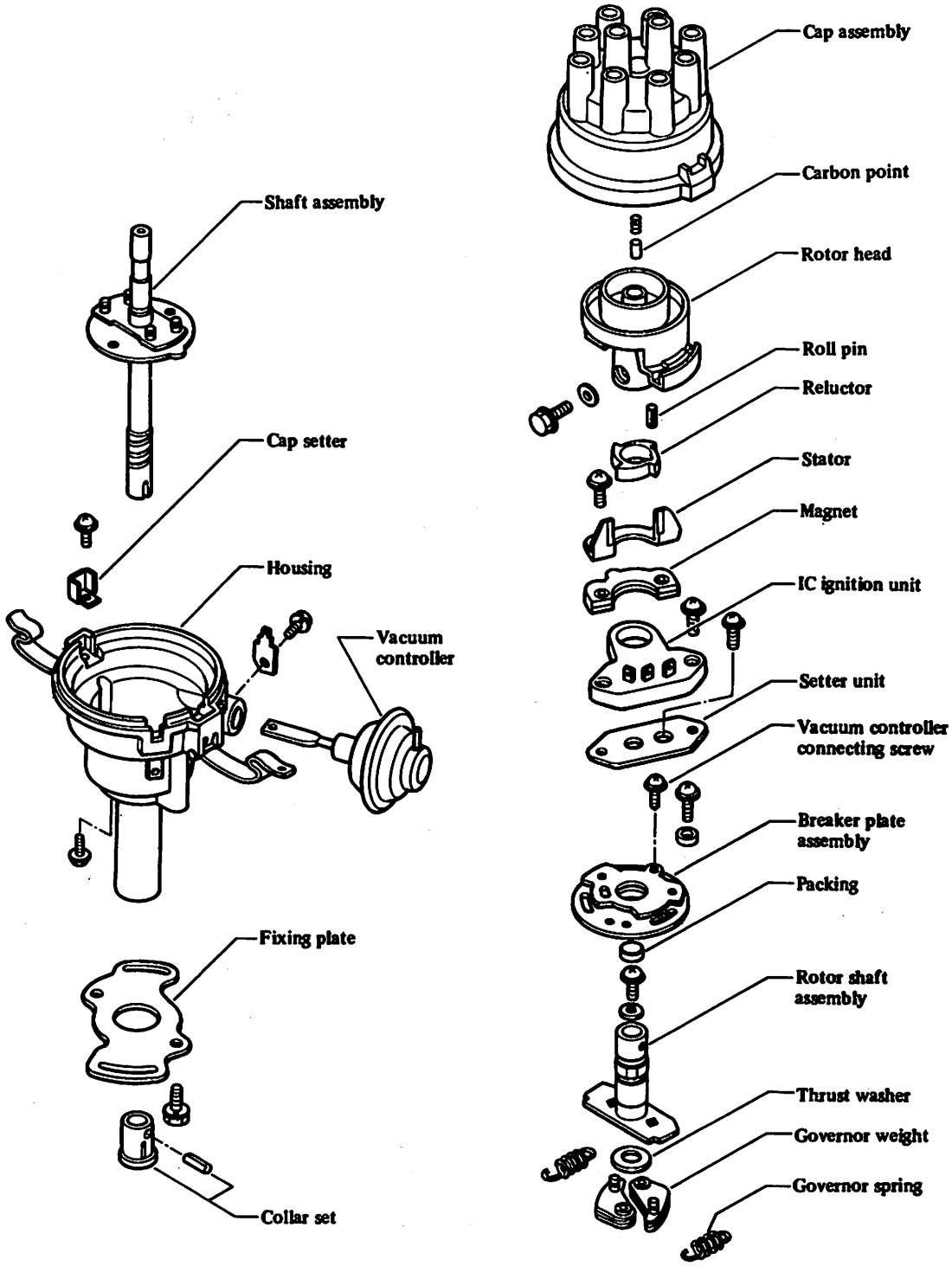
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TEST	TEST METHOD	CONDITIONS	RESULT	ACTION
6. Power Supply Circuit (Cranking)	 SEL084	1. Connect voltmeter as illustrated and set to appropriate scale. 2. Pull out coil wire from distributor cap and ground it. 3. Turn key to "START" position and observe voltmeter while engine is cranking.	Voltage reading is less than 1 volt below battery cranking voltage and is greater than 8.6 volts.	Proceed to Step 7-A.
			Voltage reading is more than 1 volt below battery cranking voltage and/or is below 8.6 volts.	Check ignition switch and wiring from switch to I.C. unit.
7-A. Ignition Primary Circuit	 SEL603A	1. Connect voltmeter as illustrated and set to appropriate scale. 2. Ignition key in "ON" position.	11.5 - 12.5 volts	Proceed to Step 7-B.
			Below 11.5 volts	Proceed to Step 8.
7-B. Ignition Primary Circuit	 SEL604A	1. Connect voltmeter as illustrated and set to appropriate scale. 2. Ignition key in "ON" position.	11.5 - 12.5 volts	Proceed to Step 9.
			Below 11.5 volts	Proceed to Step 8.
8. Ignition Coil Primary Circuit	 EE567	1. Ignition key in "OFF" position. 2. Coil wire removed from coil. 3. Connect ohmmeter as illustrated. Check both coils.	1.04 - 1.27 ohms	Ignition coil primary winding O.K. Check ignition switch and wiring from ignition switch to coil and IC unit.
			Resistance reading not between 1.04 - 1.27 ohms	Faulty ignition coil – replace.
9. I.C. Unit Ground Circuit	 SEL081	1. Connect voltmeter as illustrated and set to appropriate scale. 2. Pull out coil wire from distributor cap and ground it. 3. Turn key to "START" position and observe voltmeter while engine is cranking.	0.5 volts or less	Replace IC ignition unit assembly.
			More than 0.5 volts	Check distributor ground, wiring from chassis ground to battery including battery cable connections.

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DISTRIBUTOR (IC type)



SEL001

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CHECKING AND ADJUSTMENT

Cap and rotor head

Check cap and rotor head for dust, carbon deposits and cracks.

Advance mechanisms

Specifications

Refer to S.D.S.

Vacuum advance mechanism mechanical parts

1. Check vacuum inlet for signs of leakages at its connection.
2. Check vacuum diaphragm for air leak.

If leak is found, replace vacuum controller assembly.

3. Inspect breaker plate for smooth moving.

If plate does not move smoothly, this condition could be due to sticky steel balls or pivot. Apply grease to steel balls or, if necessary, replace breaker plate as an assembly.

Centrifugal advance mechanical parts

When cause of engine malfunction is traced to centrifugal advance mechanical parts, use distributor tester to check its characteristics.

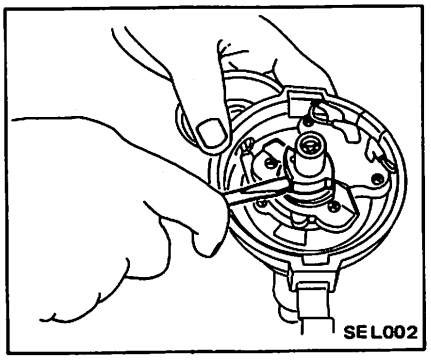
If nothing is wrong with its characteristics, conceivable causes are faulty or abnormal wear of driving part or others. So do not disassemble it.

In the event of improper characteristics, check closely rotor shaft assembly, governor weight and shaft.

If any of the above parts are malfunctioning, replace the parts.

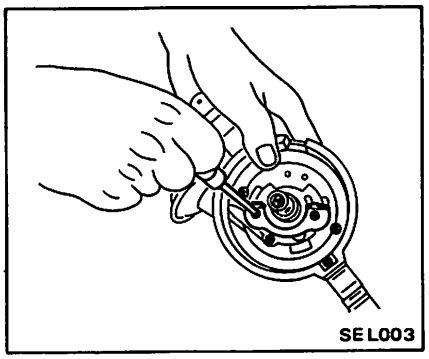
DISASSEMBLY

1. Take off cap and remove rotor head.
2. Pry reluctor from shaft.



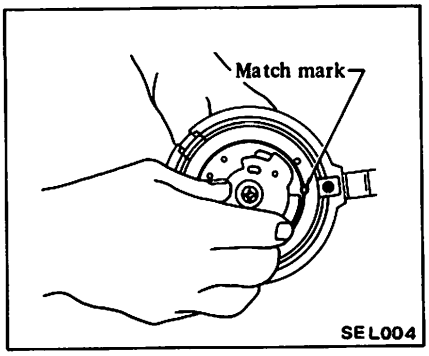
CAUTION:
When removing reluctor, be careful not to distort or damage the teeth.

3. Remove IC ignition unit and unit setter.
4. Remove stator and magnet.



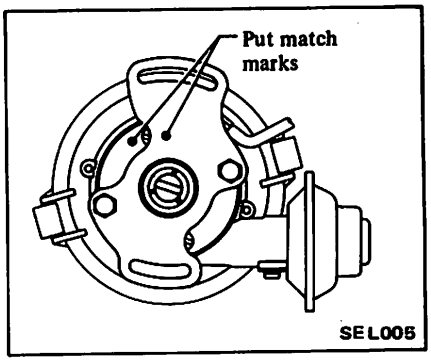
5. Remove vacuum control assembly.
6. Remove breaker plate.

Before disassembling, be sure to mark housing and fixing plate.

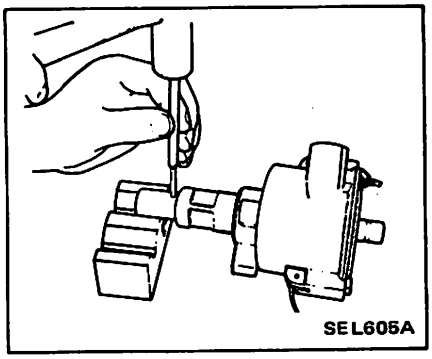


7. Remove fixing plate.

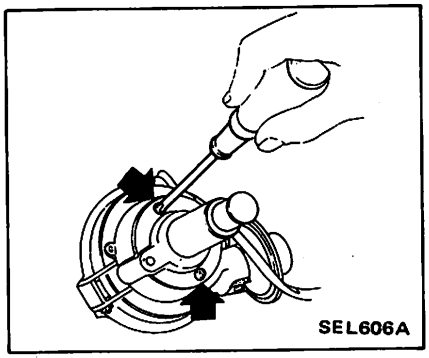
Mark housing and fixing plate.



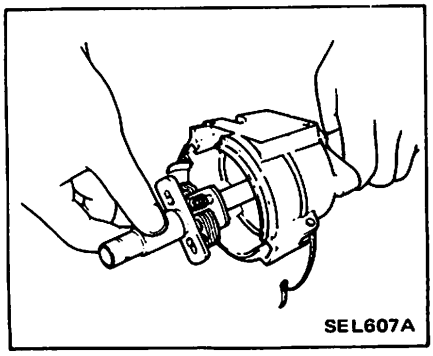
8. Remove collar.



9. Remove bearing retainer attaching bolts.

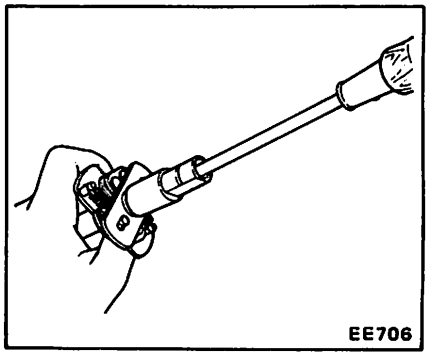


10. Remove rotor shaft and drive shaft.



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11. Mark rotor shaft and drive shaft. Remove packing from the top of rotor shaft and remove rotor shaft.



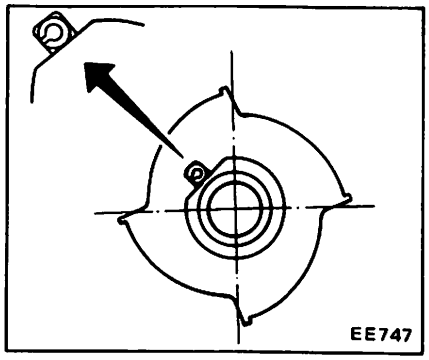
12. Mark one of the governor springs and its bracket. Also mark one of the governor weights and its pivot pins.
13. Carefully unhook and remove governor springs.
14. Remove governor weights. Apply grease to governor weights, after disassembling.

ASSEMBLY

To assembly, reverse the order of disassembly. Carefully observe the following instruction.

CAUTION:
Before installing IC ignition unit, make sure mating surfaces of IC ignition unit and distributor are clean and free from dust, sand and moisture.

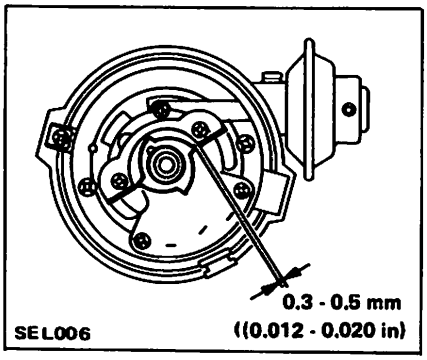
1. Align match marks so that parts are assembled to their original positions.
2. Ensure that reluctor is properly oriented when installing on shaft. Always drive in new roll pin as shown in Figure.



3. Apply grease to the top of rotor shaft as required.

4. Check the operation of governor before installing distributor on engine.
5. Properly center stator and reluctor before tightening.

Standard air gap:
0.3 - 0.5 mm
(0.012 - 0.020 in)



6. Adjust ignition timing after distributor is installed on engine.

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IC IGNITION UNIT

DESCRIPTION

In the conventional distributor the ignition timing is detected by the cam and breaker arm, while in this distributor it is detected by the reluctor on the shaft and the pick-up coil provided in place of the breaker. The amount of magnetic flux passing through the pick-up coil is changed when the reluctor rotates, and then the electrical signal is generated in the pick-up coil.

This electric signal is conducted into the IC ignition unit, which makes and breaks the primary current running through the ignition coil and generates high voltage in the secondary winding.

The centrifugal and vacuum advance mechanisms employ the conventional mechanical type.

The IC ignition unit utilizes a semiconductor IC device, and is mounted in the distributor.

The IC ignition unit has the following circuits:

1. Spark timing signal monitoring circuit

This circuit detects the ignition signal sent from the distributor pick-up coil, and amplifies the signal.

2. Lock-preventing circuit

This circuit cuts off the ignition coil primary current when the ignition switch is ON and the engine is stationary.

If the ignition coil primary current is allowed to flow under such conditions, excessive current will be drawn because of low internal resistance of the ignition coil.

This can result in an abnormal temperature rise in the ignition coil or discharged battery. These malfunctions can be prevented by this lock-preventing circuit.

3. Duty control circuit

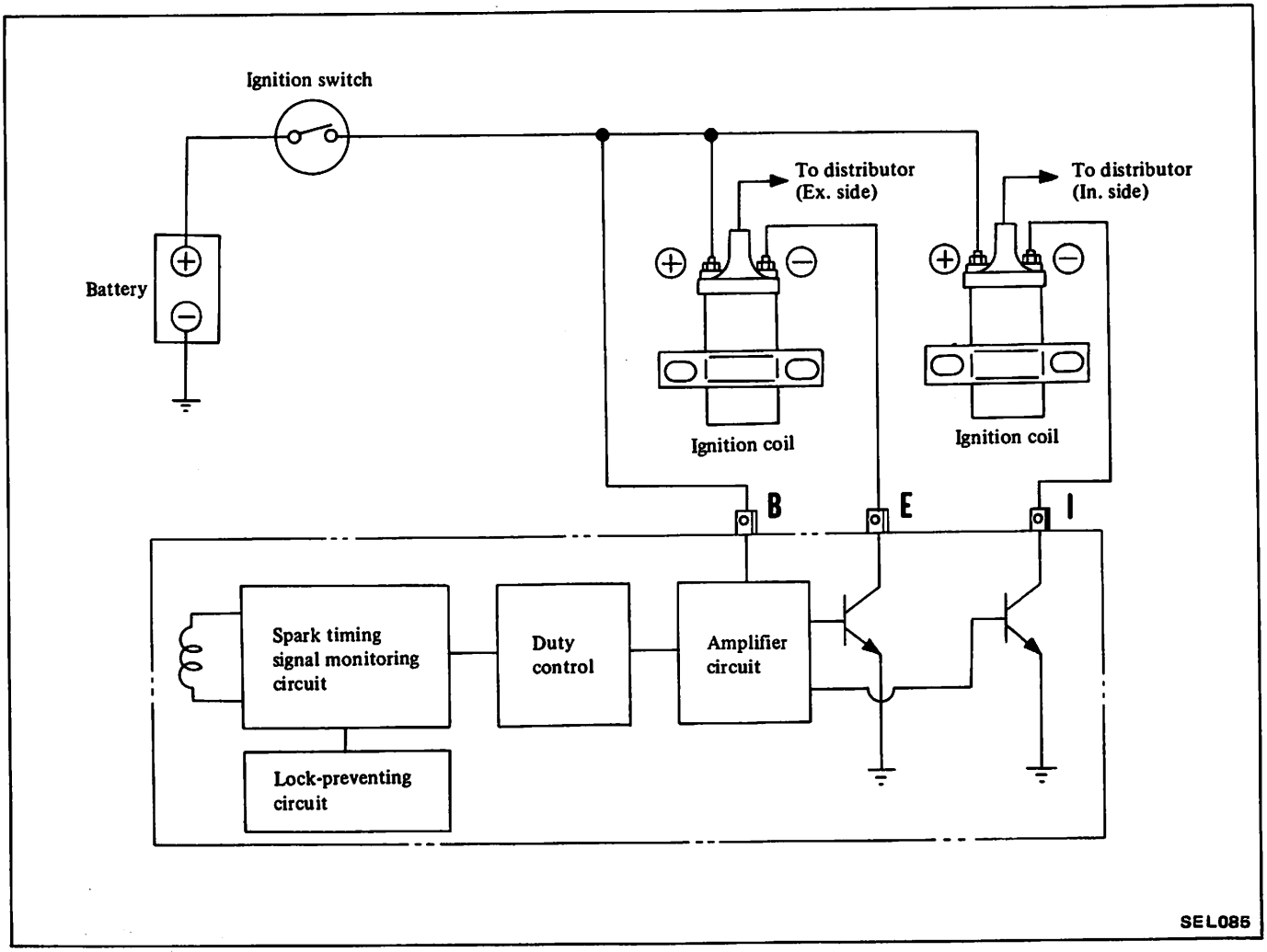
This circuit controls the ratio of the ignition coil primary current ON-OFF time periods, in one cycle of ignition operation.

This is equivalent to the dwell angle of the conventional point type distributor. In order to provide high-performance spark firing over a wide-range of driving speeds, this duty can be controlled by the source voltage and the ambient temperature, as well as by the engine rpm.

4. Power switching circuit

This circuit is used to make or break directly the primary circuit current of the ignition coil.

To ensure efficient operation of the IC ignition unit, these four circuits are manufactured in one assembly.



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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

DISTRIBUTOR

Type	D4N80-14	D4N80-15	D4N80-16	D4N80-17	D4N80-14	D4N80-15	D4N80-16	D4N80-18	D4N80-19	D4N80-20
Applied model	California model				Non-California model			Canada model		
	M/T except heavy duty and 4WD	A/T	Heavy duty	4WD	Except heavy duty and 4WD	4WD	Heavy duty	Except cab & chassis and 4WD	4WD	Cab & chassis
Rotor head type	Without resistor						Without resistor	With resistor		
Firing order	1-3-4-2									
Rotating direction	Counterclockwise									
Air gap mm (in)	0.3 - 0.5 (0.012 - 0.020)									
Cap insulation resistance MΩ	More than 50									
Rotor head insulation resistance MΩ	More than 50									
Cap carbon point length mm (in)	10 (0.39)			12 (0.47)	10 (0.39)	12 (0.47)	10 (0.39)		12 (0.47)	10 (0.39)
Vacuum advance [Distributor degree/distributor kPa (mmHg, inHg)]	0°/10.7 (80, 3.15) 4°/ 16.0 - 20.0 (120 - 150, 4.72 - 5.91) 17.5°/53.3 (400, 15.75)	0°/10.7 (80, 3.15) 4°/ 16.0 - 20.0 (120 - 150, 4.72 - 5.91) 15°/46.7 (350, 13.78)	0°/13.3 (100, 3.94) 1.5°/ 16.0 - 20.0 (120 - 150, 4.72 - 5.91) 5°/33.3 (250, 9.84)	0°/10.7 (80, 3.15) 4°/ 16.0 - 20.0 (120 - 150, 4.72 - 5.91) 10°/34.7 (260, 10.24)	0°/10.7 (80, 3.15) 4°/ 16.0 - 20.0 (120 - 150, 4.72 - 5.91) 17.5°/53.3 (400, 15.75)	0°/10.7 (80, 3.15) 4°/ 16.0 - 20.0 (120 - 150, 4.72 - 5.91) 15°/46.7 (350, 13.78)	0°/13.3 (100, 3.94) 1.5°/ 16.0 - 20.0 (120 - 150, 4.72 - 5.91) 5°/33.3 (250, 9.84)	0°/10.7 (80, 3.15) 4°/ 16.0 - 20.0 (120 - 150 4.72 - 5.91) 17.5°/53.3 (400, 15.75)	0°/10.7 (80, 3.15) 4°/ 16.0 - 20.0 (120 - 150 4.72 - 5.91) 15°/46.7 (350, 13.78)	0°/13.3 (100, 3.94) 1.5°/ 16.0 - 20.0 (120 - 150, 4.72 - 5.91) 5°/33.3 (250, 9.84)
Centrifugal advance [Distributor degree/distributor rpm]	0°/750 6°/2,000									

IGNITION COIL

Type	CIT-45
Applied model	All
Primary voltage V	12
Spark gap mm (in)	More than 7 (0.28)
Primary resistance [at 20°C (68°F)] Ω	1.04 - 1.27
Secondary resistance [at 20°C (68°F)] kΩ	7.3 - 11.0

SPARK PLUG

Applied model		U.S.A.	Canada
Type	Standard	BP6ES BPR6ES*	BPR6ES
	Hot	BP5ES BPR5ES*	BPR5ES
	Cold	BP7ES BPR7ES*	BPR7ES
Size (Screw dia. x reach) mm (in)	14 x 19 (0.55 x 0.75)		
Plug gap mm (in)	0.8 - 0.9 (0.031 - 0.035)		

*: Optional

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LIGHTING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

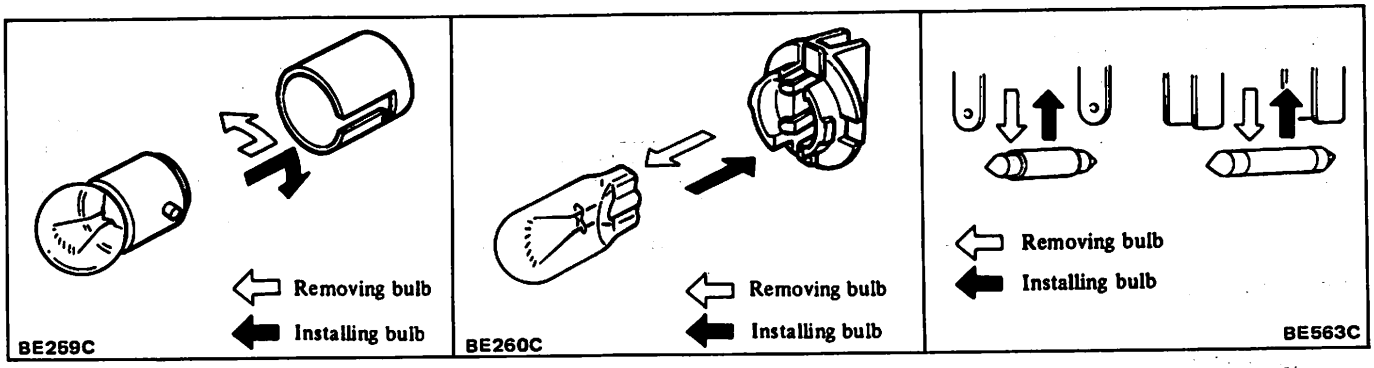
BULBS

BULB SPECIFICATION

Item	Wattage (W)	SAE trade number
Headlamp (Sealed beam)		
Inner–High	50	4651
Outer–High/Low	40/60	4652
Front combination lamp		
Turn signal	27	1156
Clearance	5	–
Side marker lamp		
Front	5	–
Rear	3.8	–
Rear combination lamp		
Stop/Tail	27/8	1157
Turn signal	27	1156
Back-up	27	1156
License plate lamp	10	–
Room lamp		
Except King Cab	5	–
King Cab	10	–
Combination meter		
Illumination lamp	1.7	–
Warning lamp	3.4	158

Item	Wattage (W)	SAE trade number
Cigarette lighter illumination lamp	1.4	–
4WD oil pressure gauge illumination lamp	3.4	158
4WD voltmeter illumination lamp	3.4	158
4WD indicator lamp	3.4	158
Heater (Air-con.) control panel illumination lamp	3.4	158
Radio illumination lamp	3.4	158
Selector lever illumination lamp (A/T models)	3.4	158
Rear window defogger switch indicator lamp	1.4	–
Rear window defogger switch illumination lamp	3.4	158

REPLACING BULB



COMBINATION SWITCH

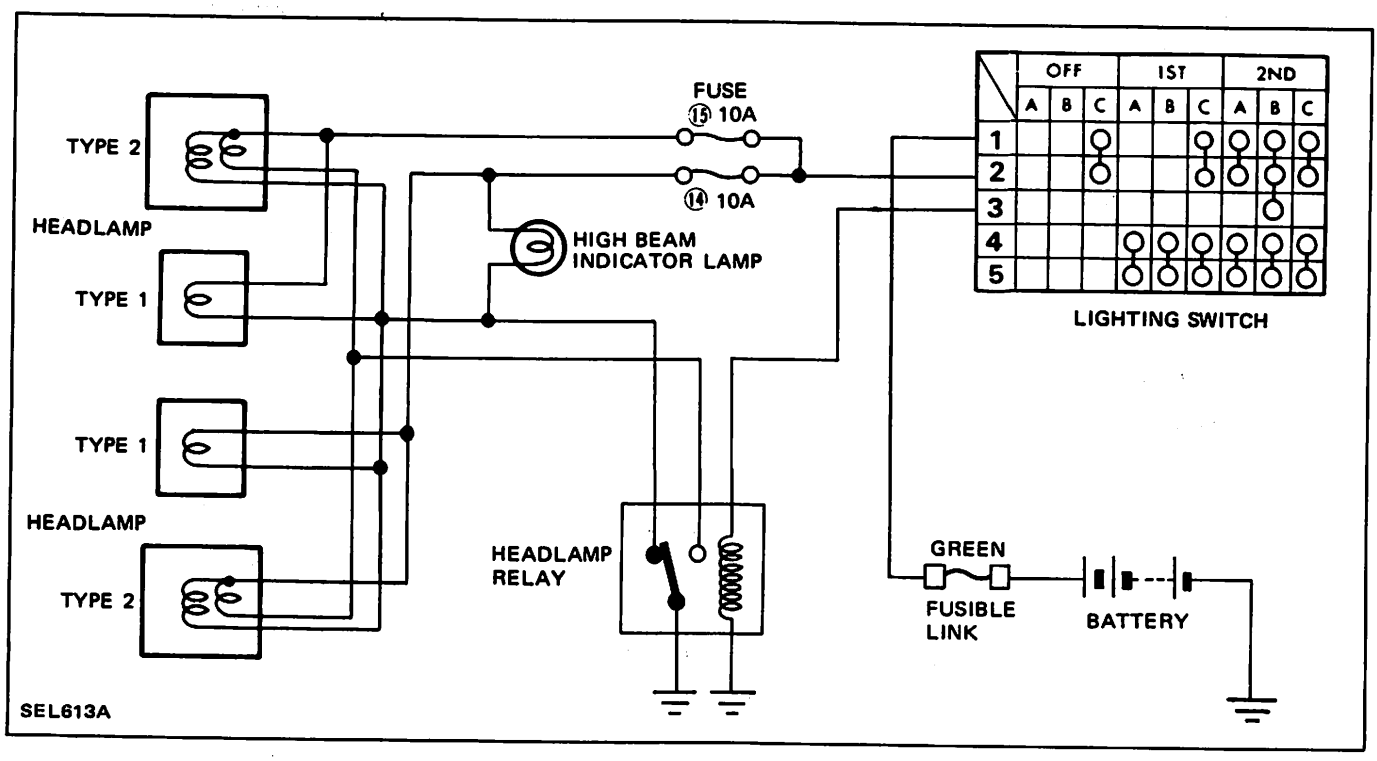
REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Remove horn pad.
3. Remove steering wheel.
4. Remove steering column cover.
5. Disconnect combination switch wires at connector.
6. Loosen retaining screw and remove combination switch assembly.
7. Install combination switch in the reverse order of removal.

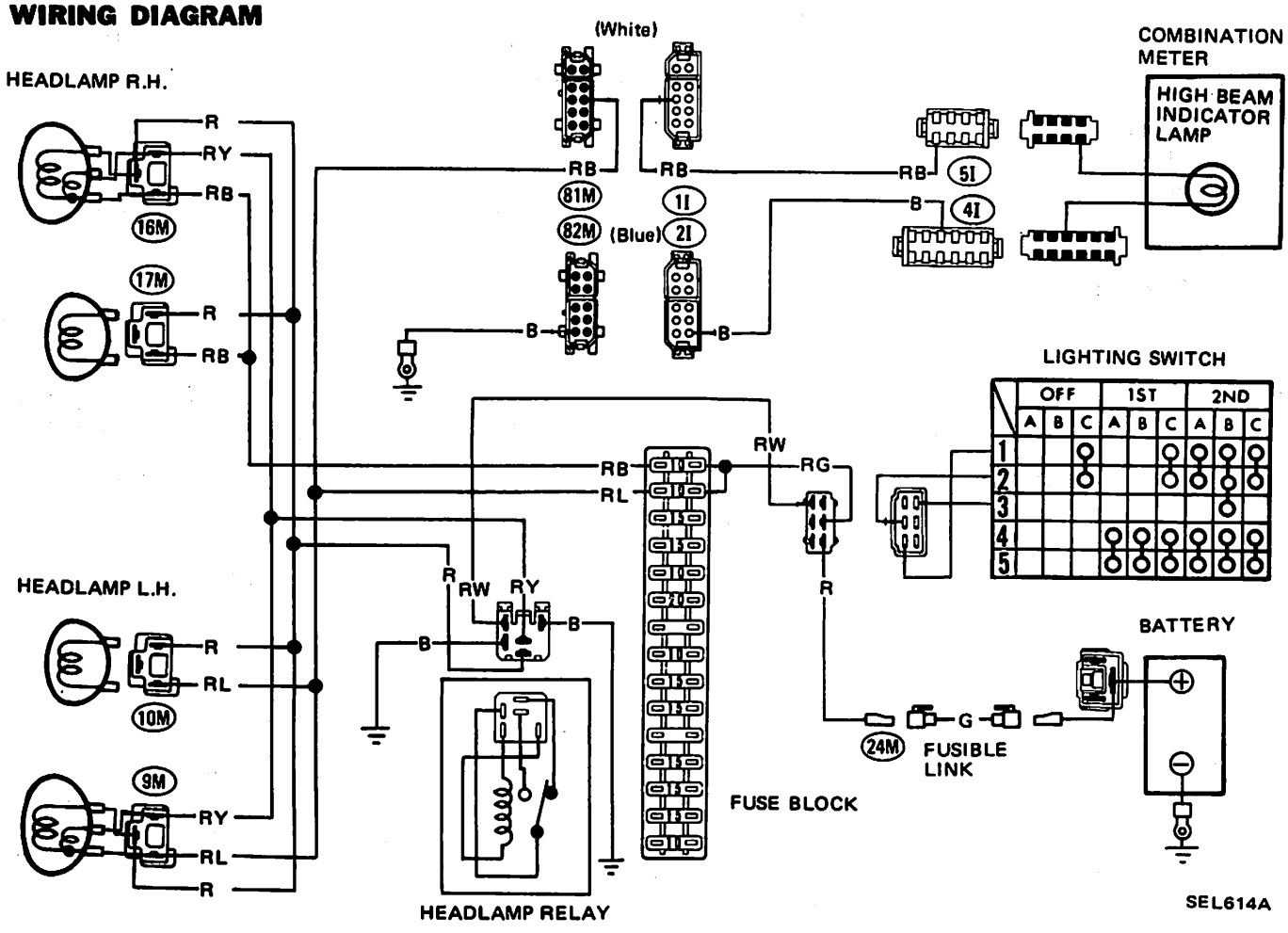
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HEADLAMP

SCHEMATIC



WIRING DIAGRAM



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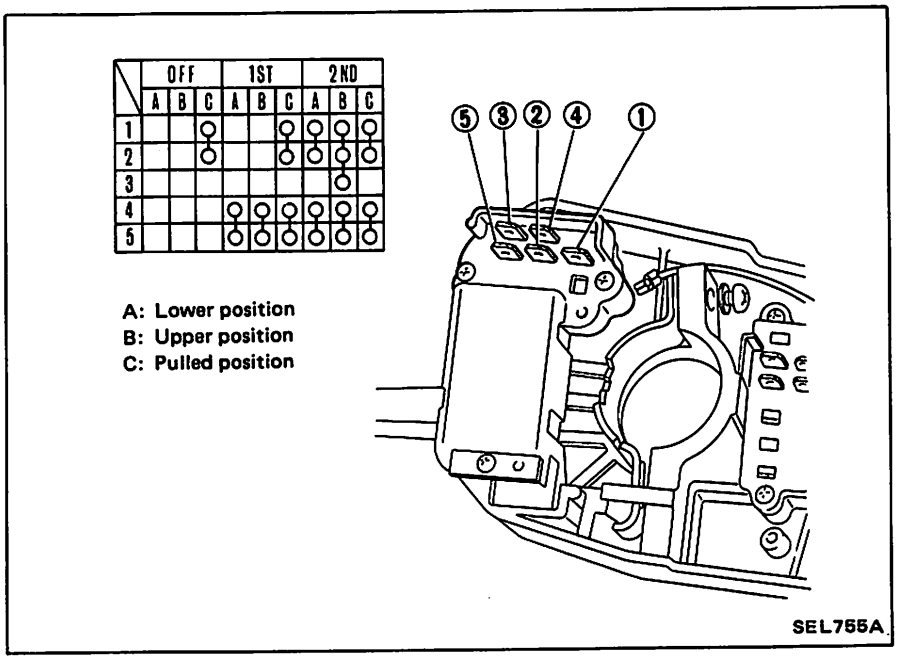
TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Headlamps do not come on, either high or low beams.	Blown out fusible link (Green) or fuse (⑭ 10A or ⑮ 10A). Loose connection or open circuit. Faulty lighting switch. [High (low) beam comes on when ① and ② (①, ② and ③) terminals of harness connector to combination switch are connected with test lead including (⑭ 10A and ⑮ 10A fuse] .	Correct cause and replace fusible link or fuse. Check wiring and/or repair connection. Replace if necessary.
High beam cannot be switched to low beam or vice versa.	Faulty lighting switch. [High (low) beam comes on when ① and ② (①, ② and ③) terminals of harness connector to combination switch are connected with test lead including ⑭ 10A and ⑮ 10A fuse] .	Replace if necessary.
Headlamps dim.	Partly discharged or run-down battery. Inoperative charging system. Poor ground or loose connection.	Measure specific gravity of electrolyte and recharge or replace battery if necessary. Measure voltage at headlamp terminals with engine running. If it is less than 12.8V, check charging system for proper operation. Clean and/or tighten.
Headlamp lights on only one side.	Loose headlamp connection. Faulty headlamp beam.	Repair. Replace.

LIGHTING SWITCH

Inspection

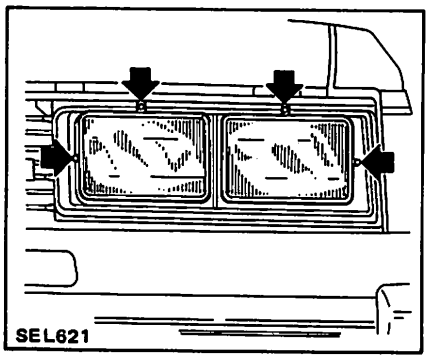
Test continuity through switch with an ohmmeter.



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AIMING ADJUSTMENT

To adjust vertical aim, use adjusting screw on upper side of headlamp; and to adjust horizontal aim, use adjusting screw on side of headlamp.



Before making headlamp aiming adjustment, observe the following instructions.

a. Keep all tires inflated to correct pressures.

b. Place vehicle and tester on one and same flat surface.

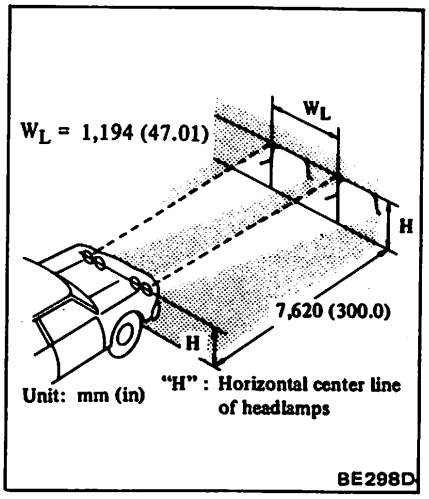
c. See that there is no load in vehicle (coolant, engine oil filled up to correct level and full fuel tank) other than the driver (or equivalent weight placed in driver's position).

When performing headlamp aiming adjustment, use an aiming machine, aiming wall screen or headlamp tester. For operating instructions of any aimer, it should be in good repair, calibrated and used according to respective operation manuals supplied with the unit.

If any aimer is not available, aiming adjustment can be done as follows:

Low beam

Turn headlamp low beam on.



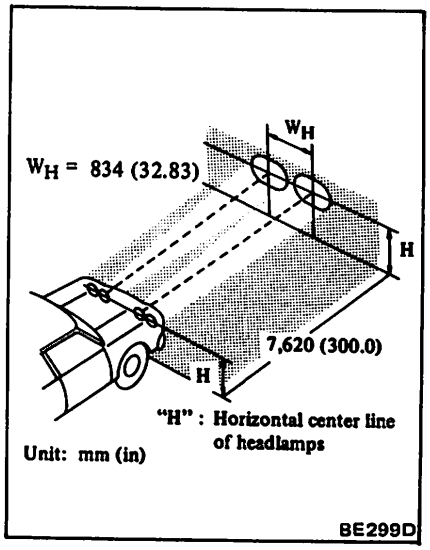
a. Adjust headlamps so that upper edge of hot spot is equal in height to headlamp height.

b. The illustration, below center, shows headlamp aiming pattern for driving on right side of road; for driving on left side of road, aiming pattern is reversed.

c. Dotted lines in illustration show center of headlamp.

High beam

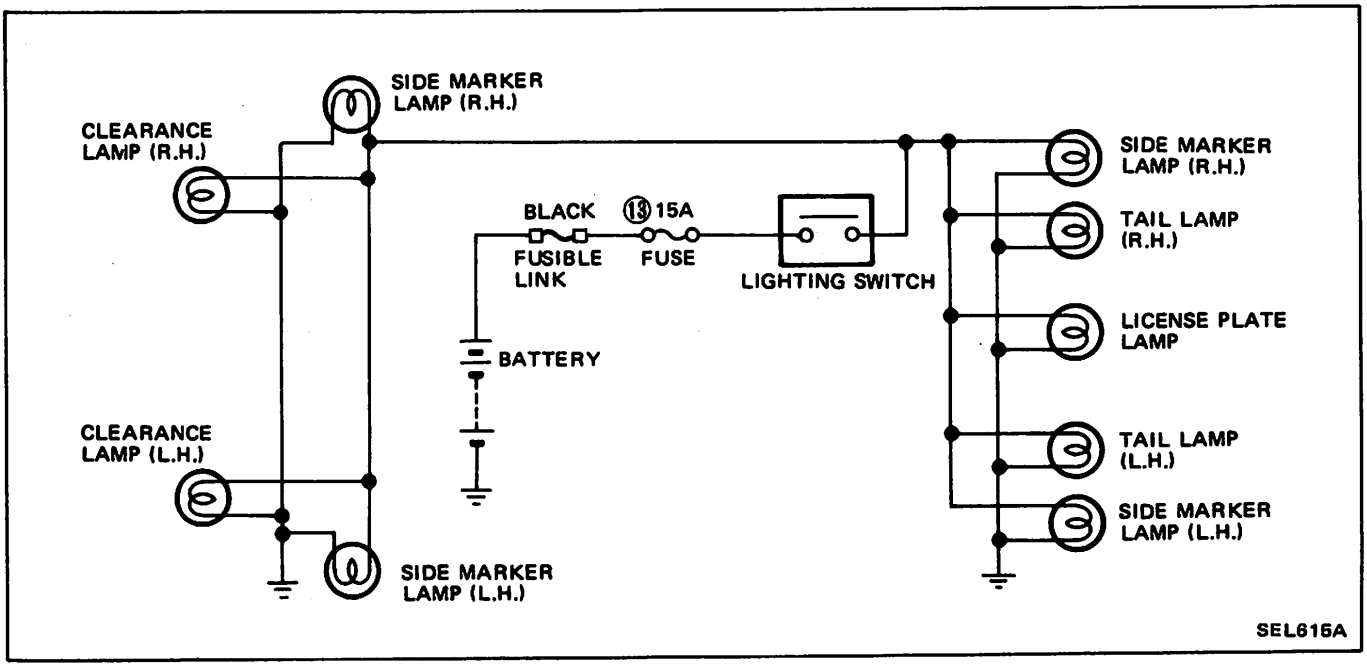
With type II unit lamps (outer lamps) covered, turn headlamps to high beam.



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TAIL, CLEARANCE, SIDE MARKER AND LICENSE PLATE LAMPS

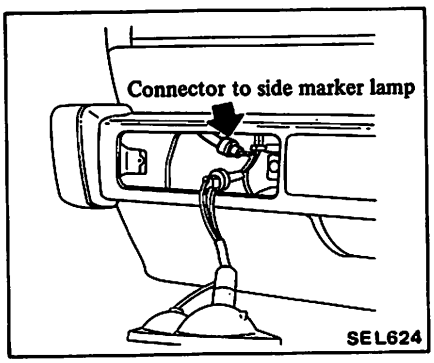
SCHEMATIC



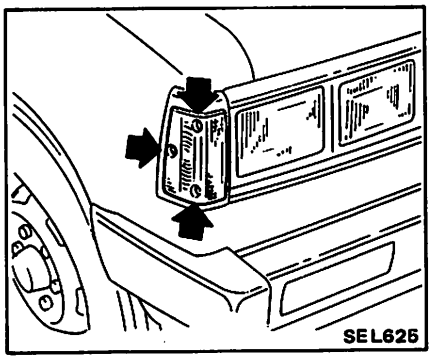
FRONT SIDE MARKER LAMP

Removal and Installation

1. Disconnect battery ground cable.
2. Remove front combination lamp.



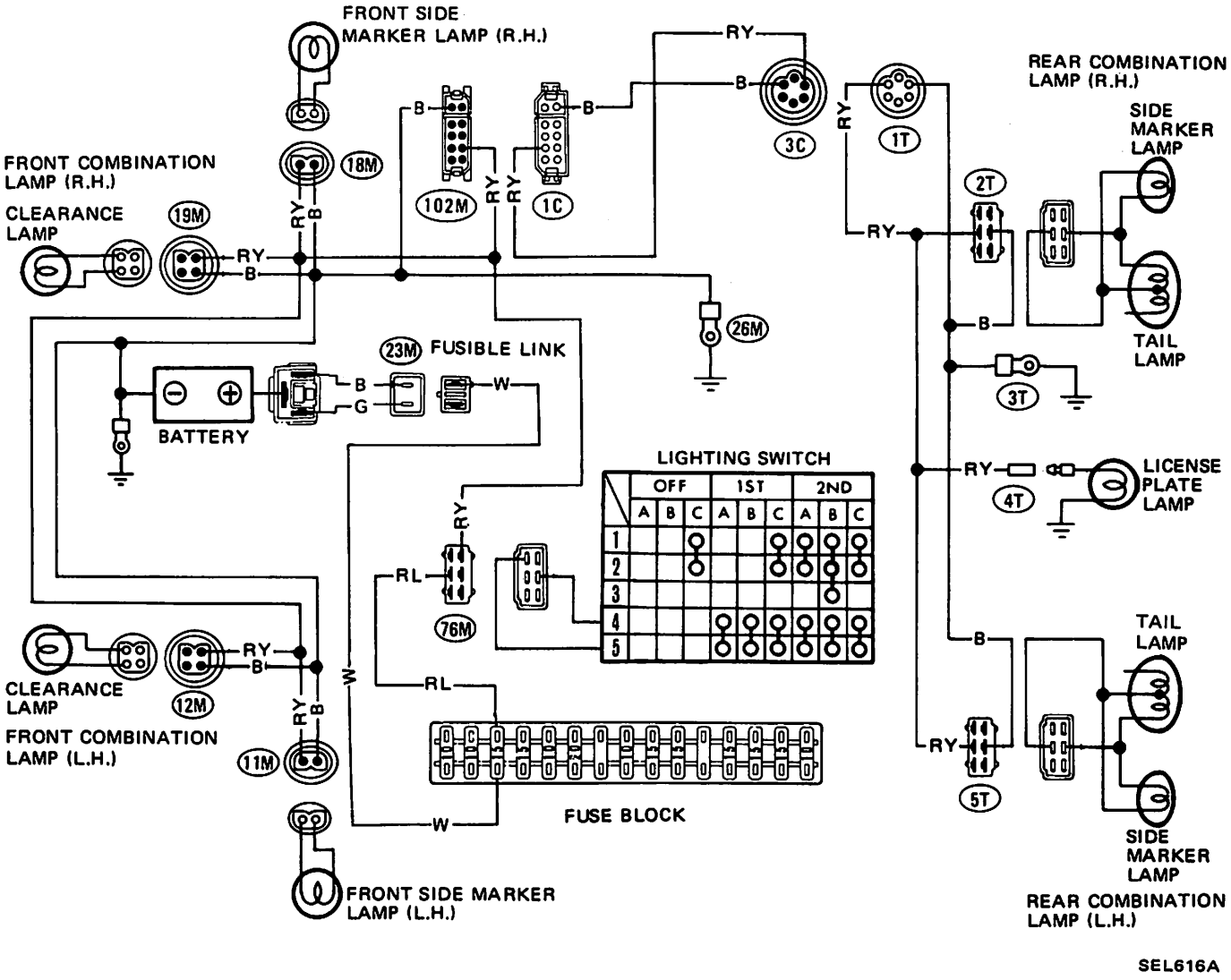
3. Disconnect harness connector to side marker lamp.



4. Remove front side marker lamp.
5. Installation is in the reverse order of removal.

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WIRING DIAGRAM



SEL616A

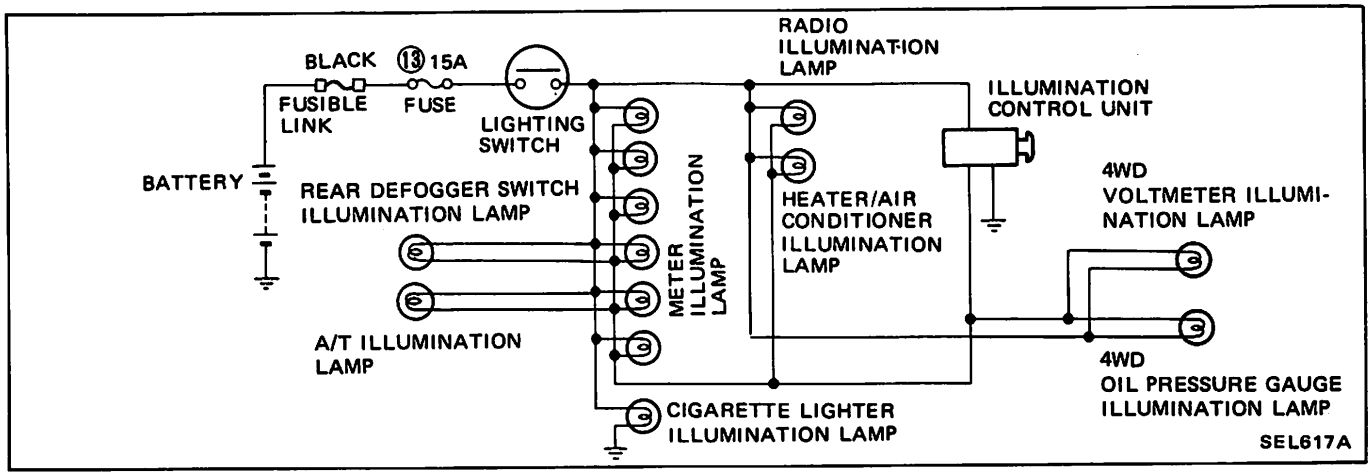
TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Neither left nor right lamp lights.	Blown out fusible link (Black) or fuse (⑬ 15A).	Correct cause and replace.
	Loose connection or open circuit.	Check wiring and/or repair connection.
	Faulty lighting switch. [Lamps light when ④ and ⑤ terminals of harness connector to combination switch are connected with test lead including ⑬ 15A fuse].	Replace if necessary.
Lamp on only one side lights.	Burned out bulb.	Replace.
	Loose bulb.	Correct.
	Loose-connection to lamp.	Correct.

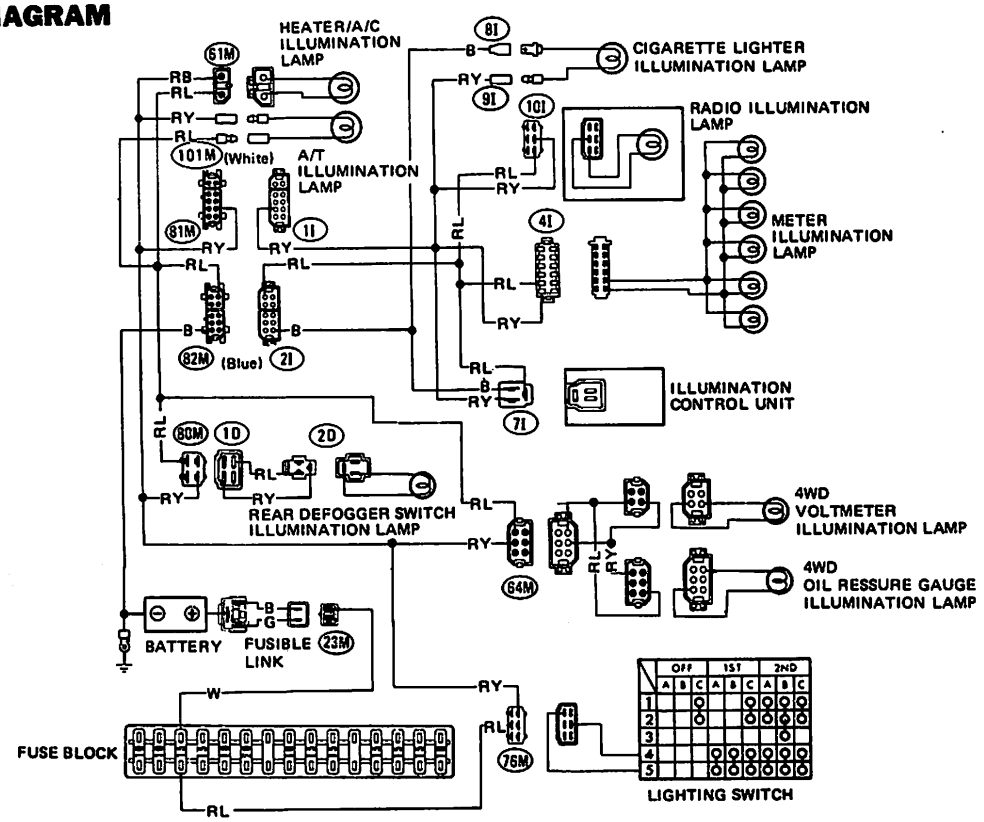
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ILLUMINATION LAMPS

SCHEMATIC



WIRING DIAGRAM



ILLUMINATION CONTROL UNIT

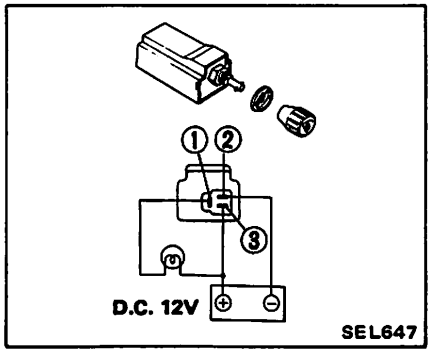
Removal and Installation

1. Disconnect battery ground cable.
2. Pull out knob of switch.
3. Remove ring nut and disconnect harness connector.
4. Switch body can be taken out from behind instrument panel.
5. Installation is in the reverse order of removal.

Inspection

1. Connect test lamp between terminal ① and positive (+) terminal.
2. Connect terminal ③ to positive (+) terminal, and terminal ② to negative (–) terminal.
3. Turn control knob right or left, and brightness of test lamp will vary.

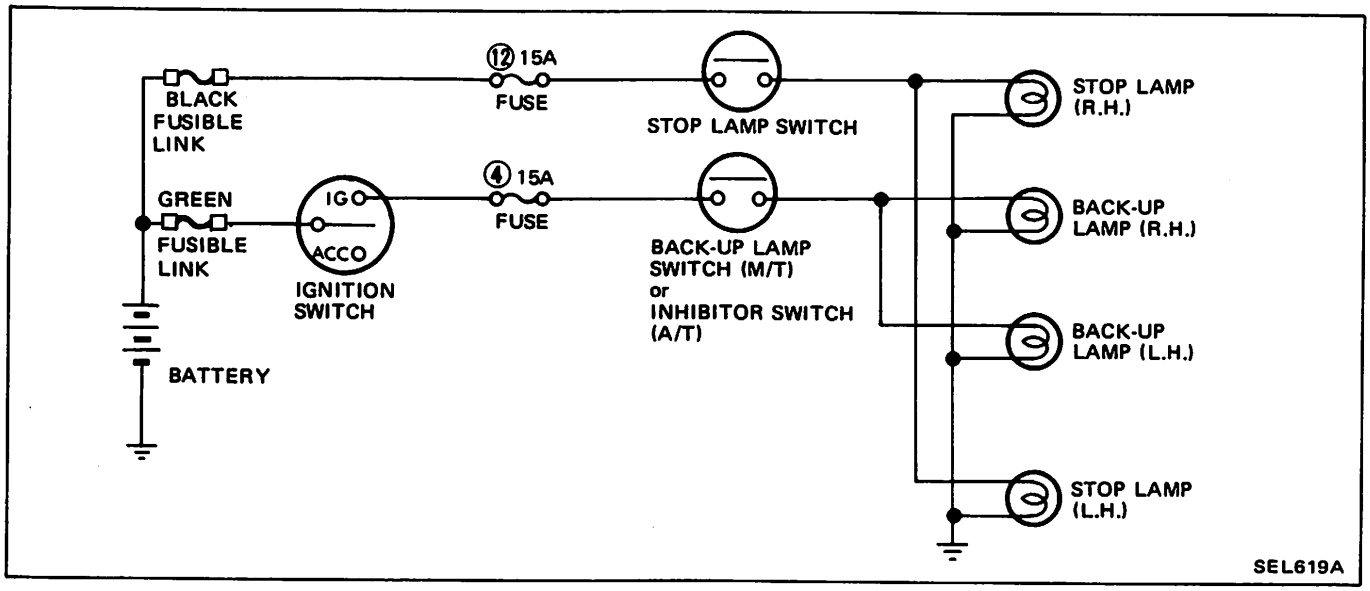
Be careful not to connect lead wires to incorrect terminals as this will damage the unit.



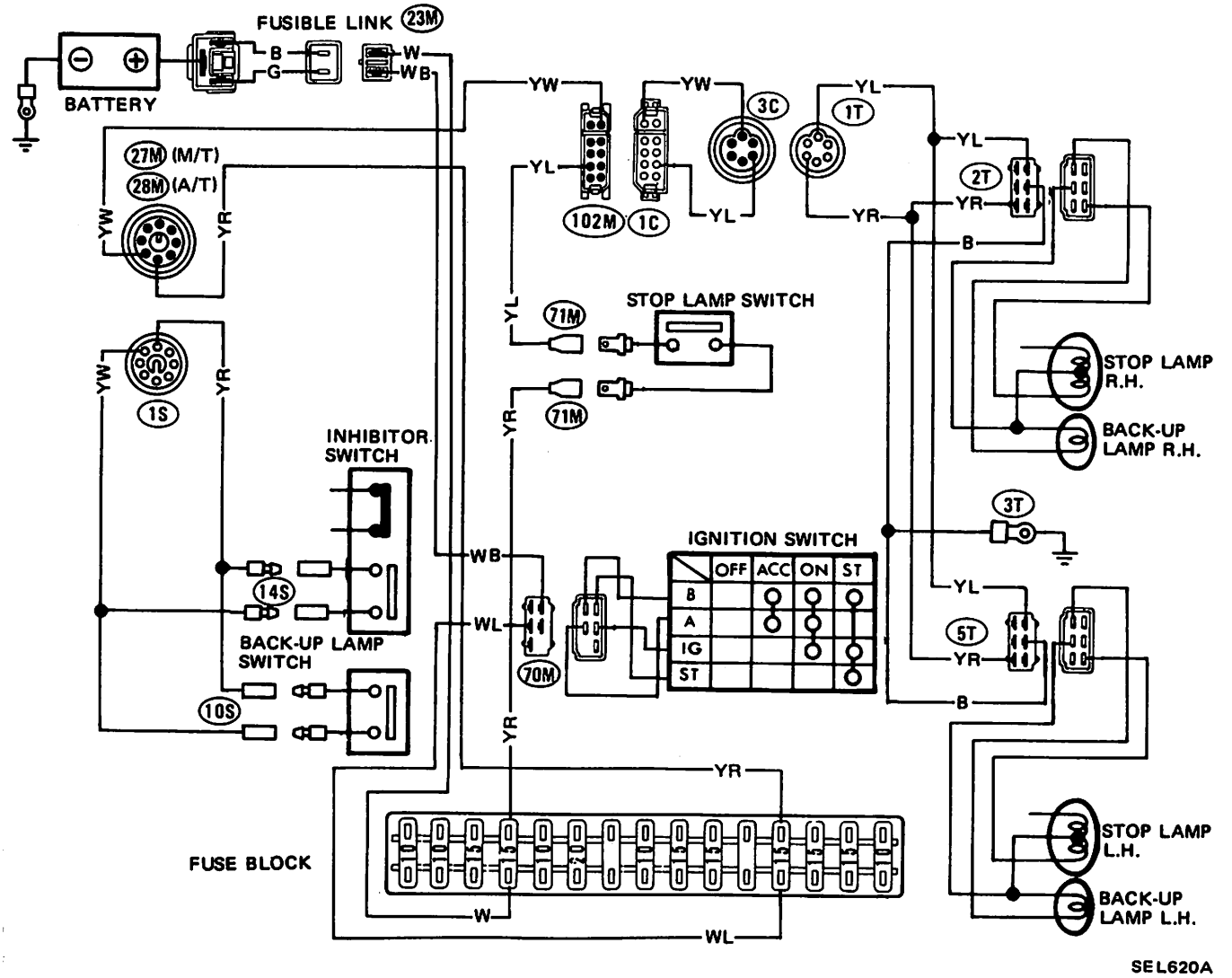
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STOP AND BACK-UP LAMPS

SCHEMATIC



WIRING DIAGRAM



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TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Stop lamp		
Neither left nor right lamp lights.	Blown out fusible link (Black or fuse (⑫ 15A).	Correct cause and replace.
	Faulty stop lamp switch.	Conduct continuity test and replace if necessary.
	Loose connection or open circuit.	Check wiring and/or repair connection.
Lamp on only one side lights.	Burned out bulb.	Replace.
	Loose bulb.	Repair lamp socket.
	Loose connection or open circuit.	Check wiring and/or repair connection.
Back-up lamp		
Neither left nor right lamp lights.	Faulty back-up lamp switch (M/T) or inhibitor switch (A/T).	Conduct continuity test and replace if necessary.
	Blown out fusible link (Green) or fuse (④ 15A).	Correct cause and replace.
	Loose connection or open circuit.	Check wiring and/or repair connection.
Lamp on only one side lights.	Burned out bulb.	Replace.
	Loose bulb.	Repair lamp socket.
	Loose connection or open circuit.	Check wiring and/or repair connection.

STOP LAMP SWITCH

Inspection

Test continuity through stop lamp switch with a test lamp or ohmmeter.

When plunger is pressed into switch assembly, stop lamp switch contacts are open. Contacts are closed when plunger is projected.

BACK-UP LAMP SWITCH (M/T)

Back-up lamp switch is installed on transmission.

Inspection

When transmission lever is in "R" position, there should be continuity between two teminals.

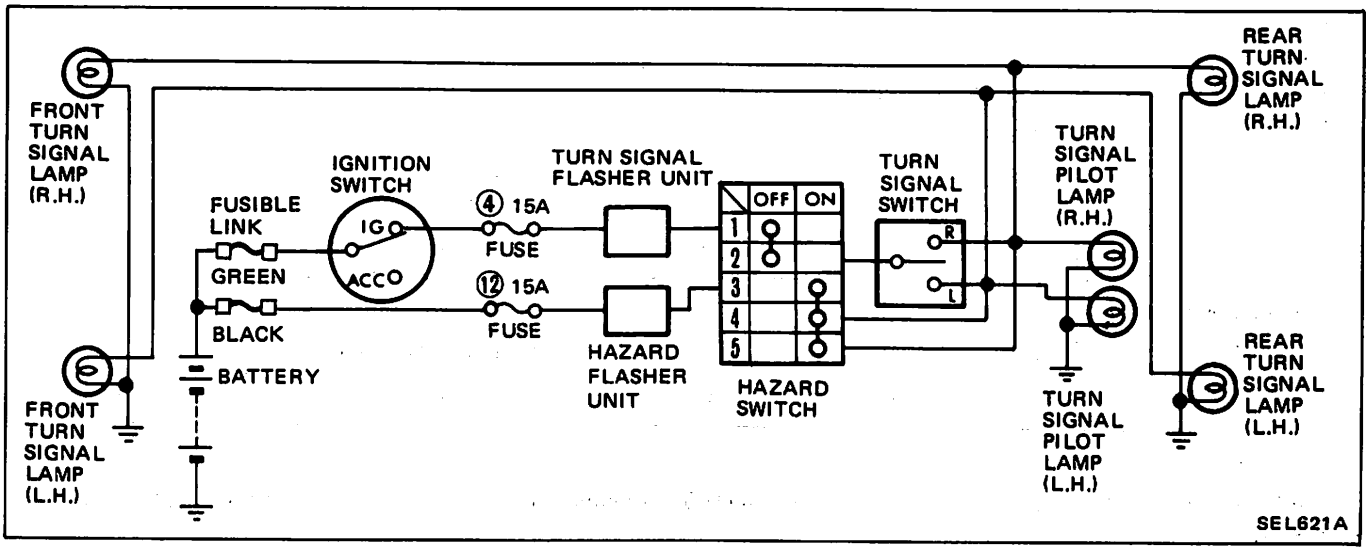
INHIBITOR SWITCH (A/T)

Refer to A/T section.

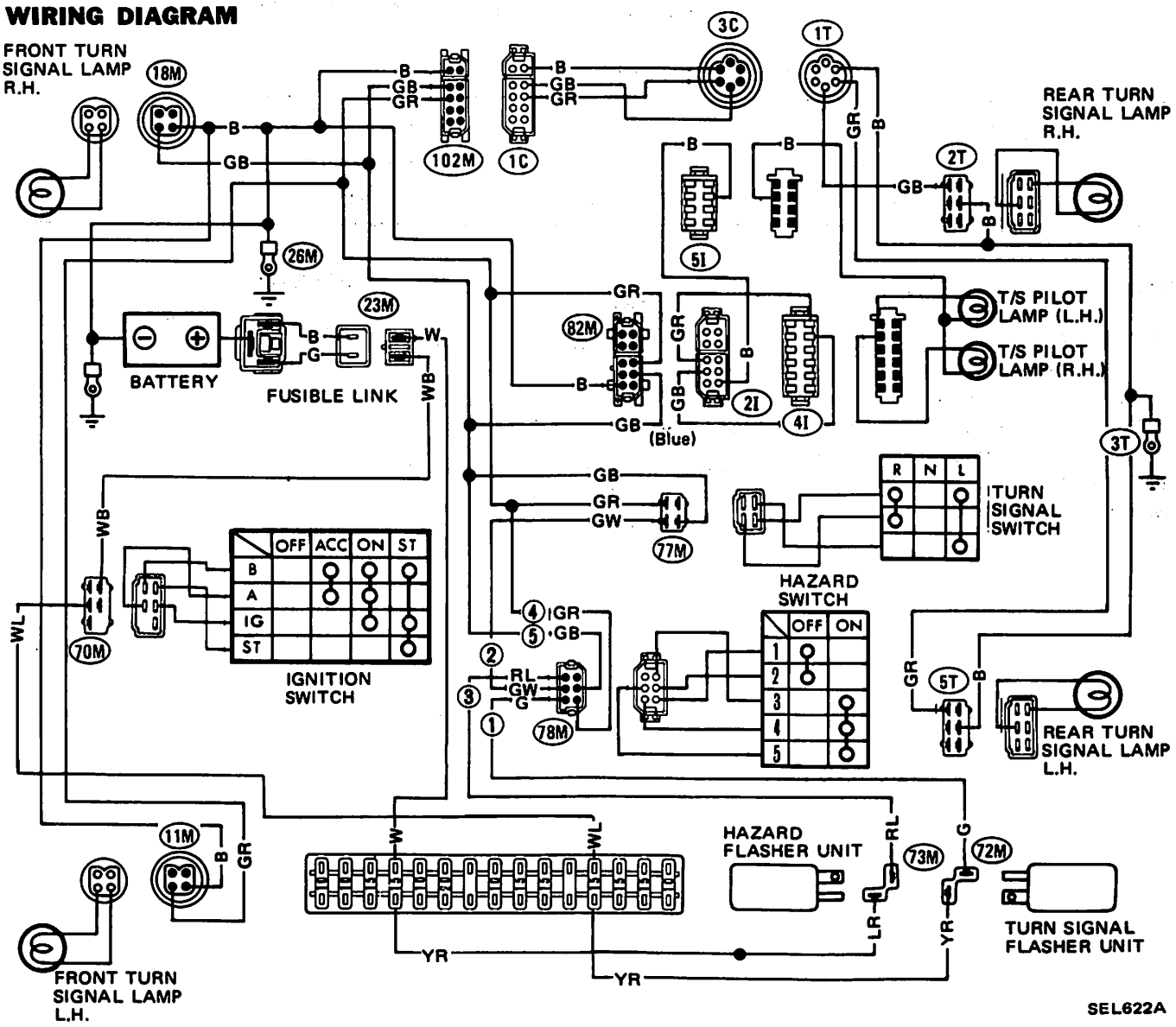
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TURN SIGNAL AND HAZARD WARNING

SCHEMATIC



WIRING DIAGRAM



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TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Turn signals do not operate. (Hazard warning lamps operate).	Blown out fusible link (Green) or fuse (④ 15A).	Correct cause and replace.
	Loose connection or open circuit.	Check wiring and/or repair connection.
	Faulty flasher unit.	Replace.
	Faulty turn signal switch.	Conduct continuity test and replace if necessary.
	Faulty hazard switch. [Turn signals operate when ① and ② terminals of harness connector to hazard switch are connected with test lead including ④ 15A fuse].	Replace if necessary.
Hazard warning lamps do not operate. (Turn signals operate).	Blown out fusible link (Black) or fuse (⑫ 15A).	Correct cause and replace.
	Faulty hazard warning flasher unit.	Replace.
	Faulty hazard switch. [Left (Right) side lamps operate when ③ and ④ (③ and ⑤) terminals of harness connector to hazard switch are connected with test lead including ⑫ 15A fuse].	Replace if necessary.
No flasher click is heard.	Burned out bulb.	Replace.
	Loose connection.	Reconnect firmly.
Flasher cycle is too slow (Pilot lamp does not go out.), or too fast.	Bulb other than specified wattage being used.	Replace with one specified.
	Burned out bulbs.	Replace.
	Loose connections.	Repair.
	Faulty flasher unit.	Replace.
Flashing cycle is irregular.	Burned out bulb.	Replace.
	Loose connection.	Repair.
	Bulbs other than specified wattage being used.	Replace with one specified.

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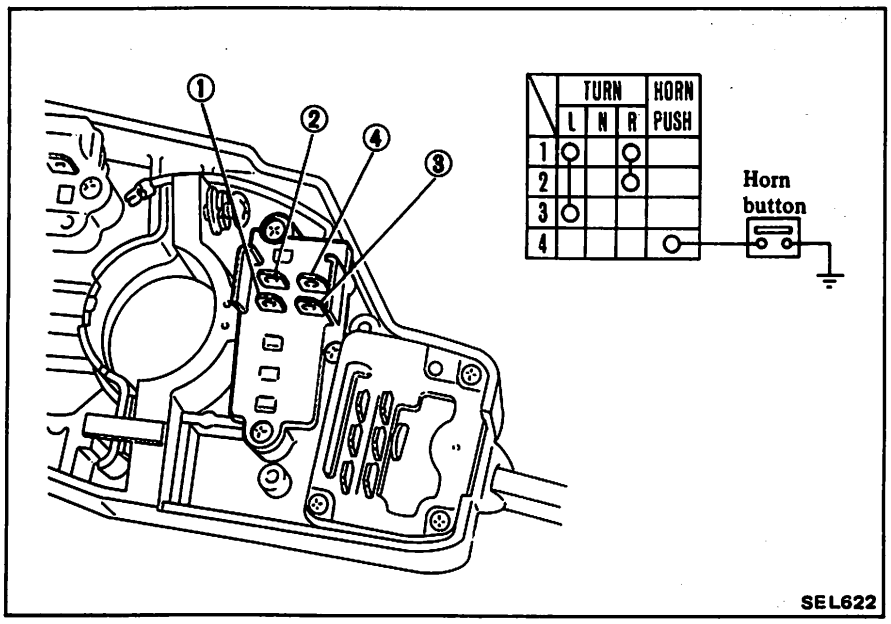
TURN SIGNAL SWITCH

Removal and Installation

Refer to Combination Switch.

Inspection

Test continuity through switch with a test lamp or ohmmeter.



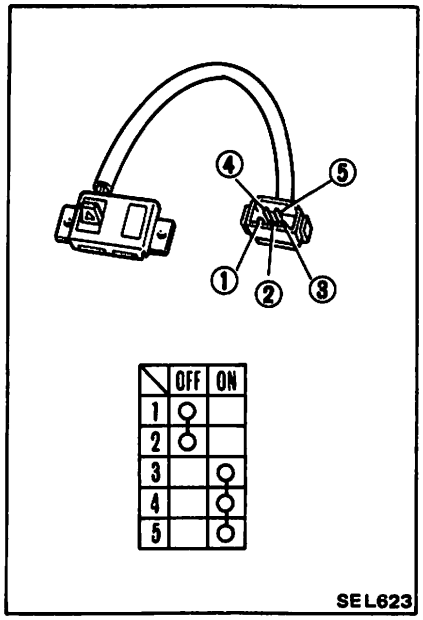
HAZARD WARNING SWITCH

Removal and Installation

1. Disconnect battery ground cable.
2. Remove steering column cover.
3. Remove hazard warning switch.
4. Installation is in the reverse order of removal.

Inspection

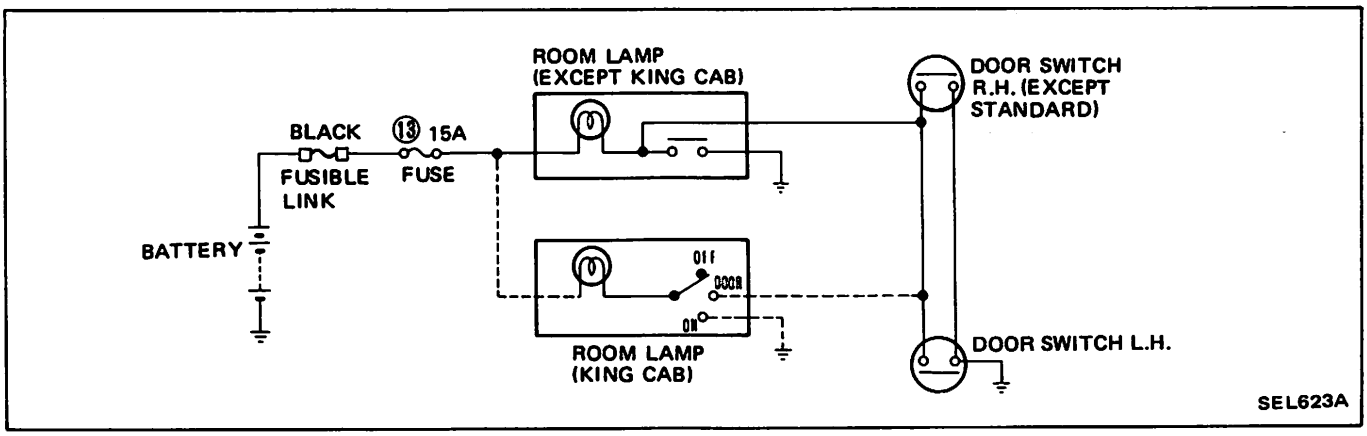
Test continuity through switch with an ohmmeter.



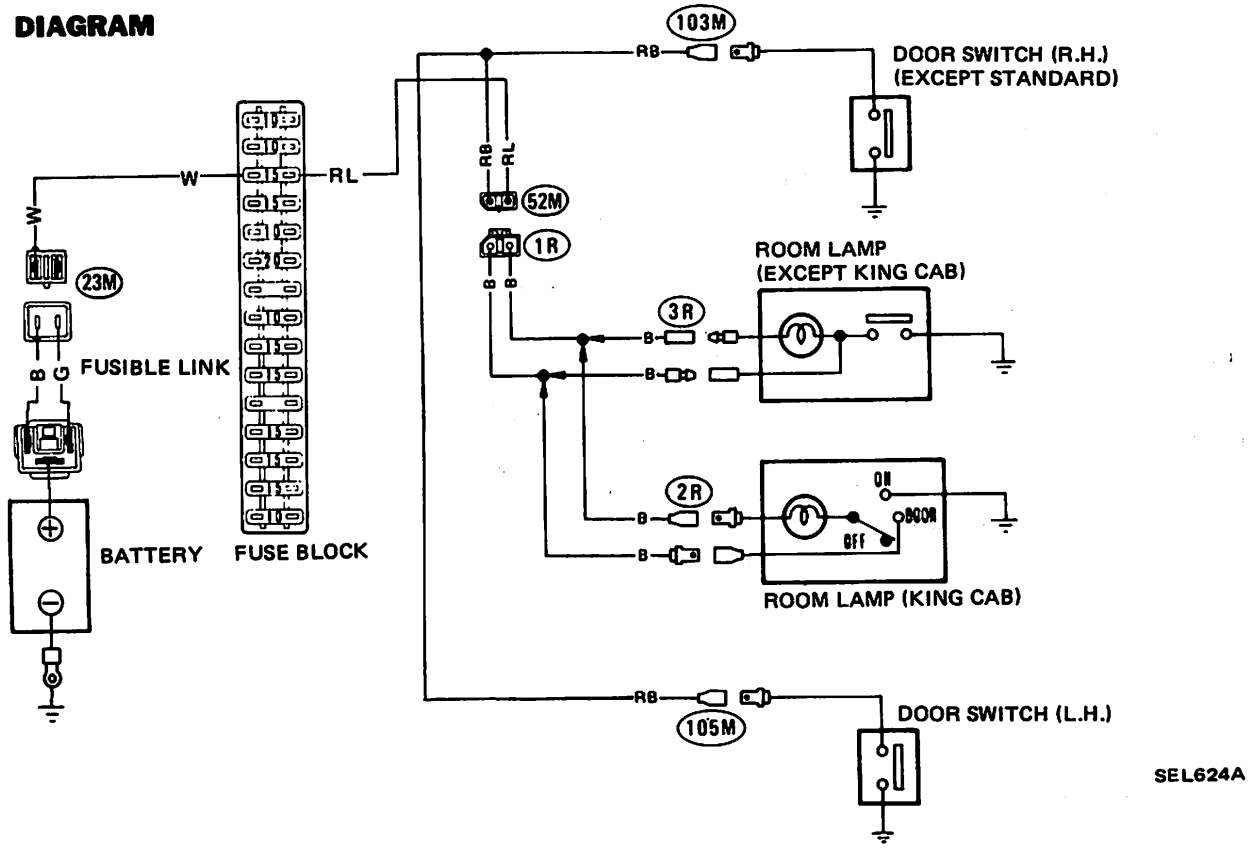
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ROOM LAMP

SCHEMATIC



WIRING DIAGRAM



TROUBLE DIAGNOSES AND CORRECTIONS

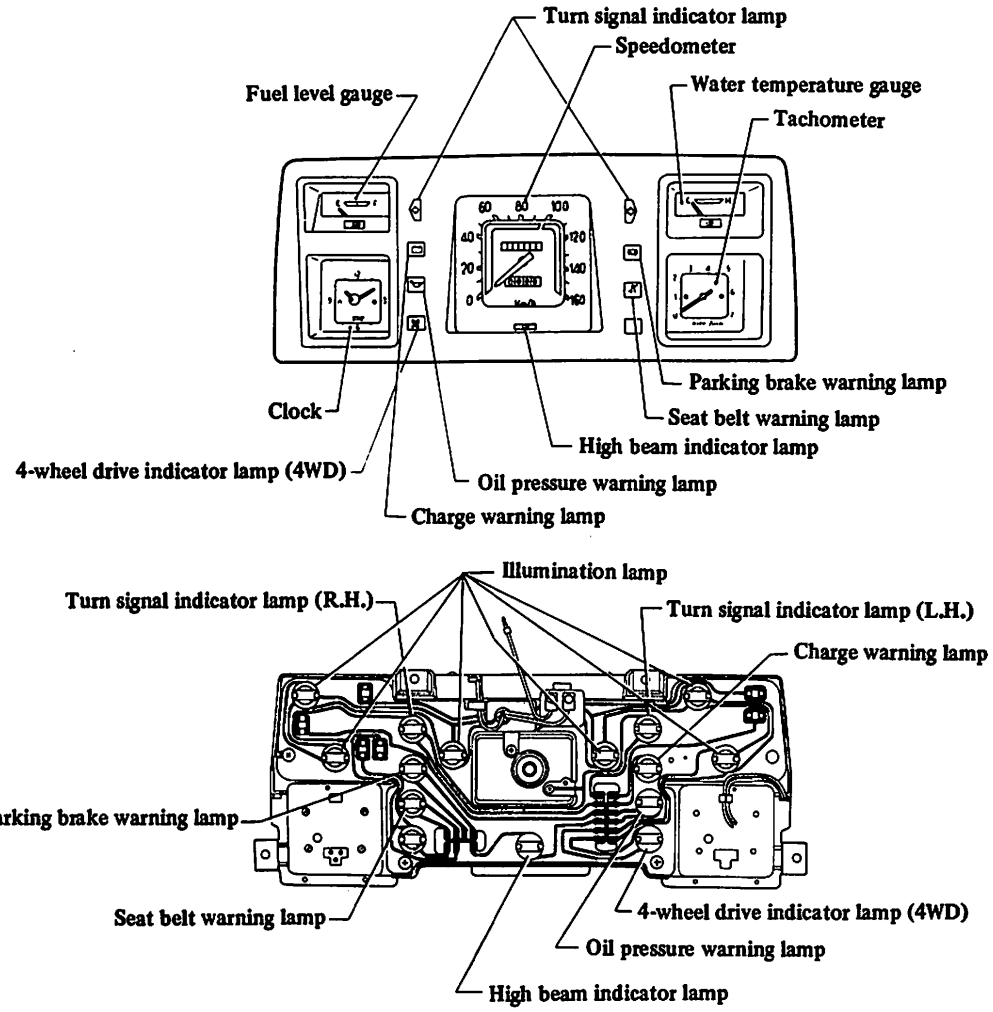
Condition	Probable cause	Correction action
Lamp does not light when door is opened.	Blown out fusible link (Black) or fuse (⑬ 15A).	Correct cause and replace.
	Burned out bulb.	Repalce.
	Loose bulb.	Correct.
	Loose connection to lamp.	Correct.
	Faulty door switch.	Replace if necessary.
	Faulty room lamp switch.	Replace if necessary.

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METERS, GAUGES AND WARNING SYSTEM

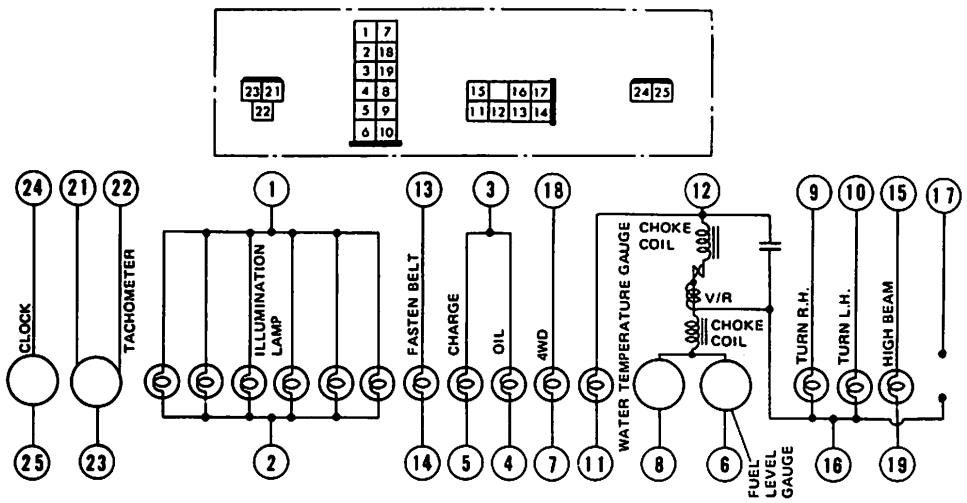
CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

COMBINATION METER



SEL849A

SCHEMATIC

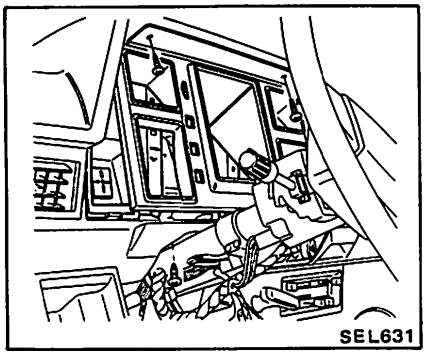


SEL625A

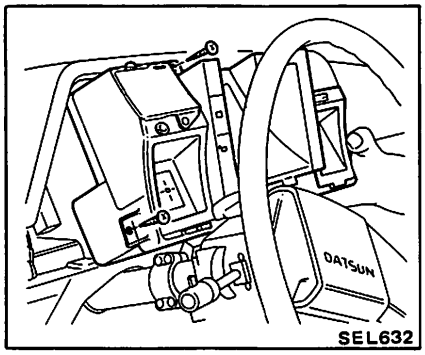
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REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Remove cluster lid.



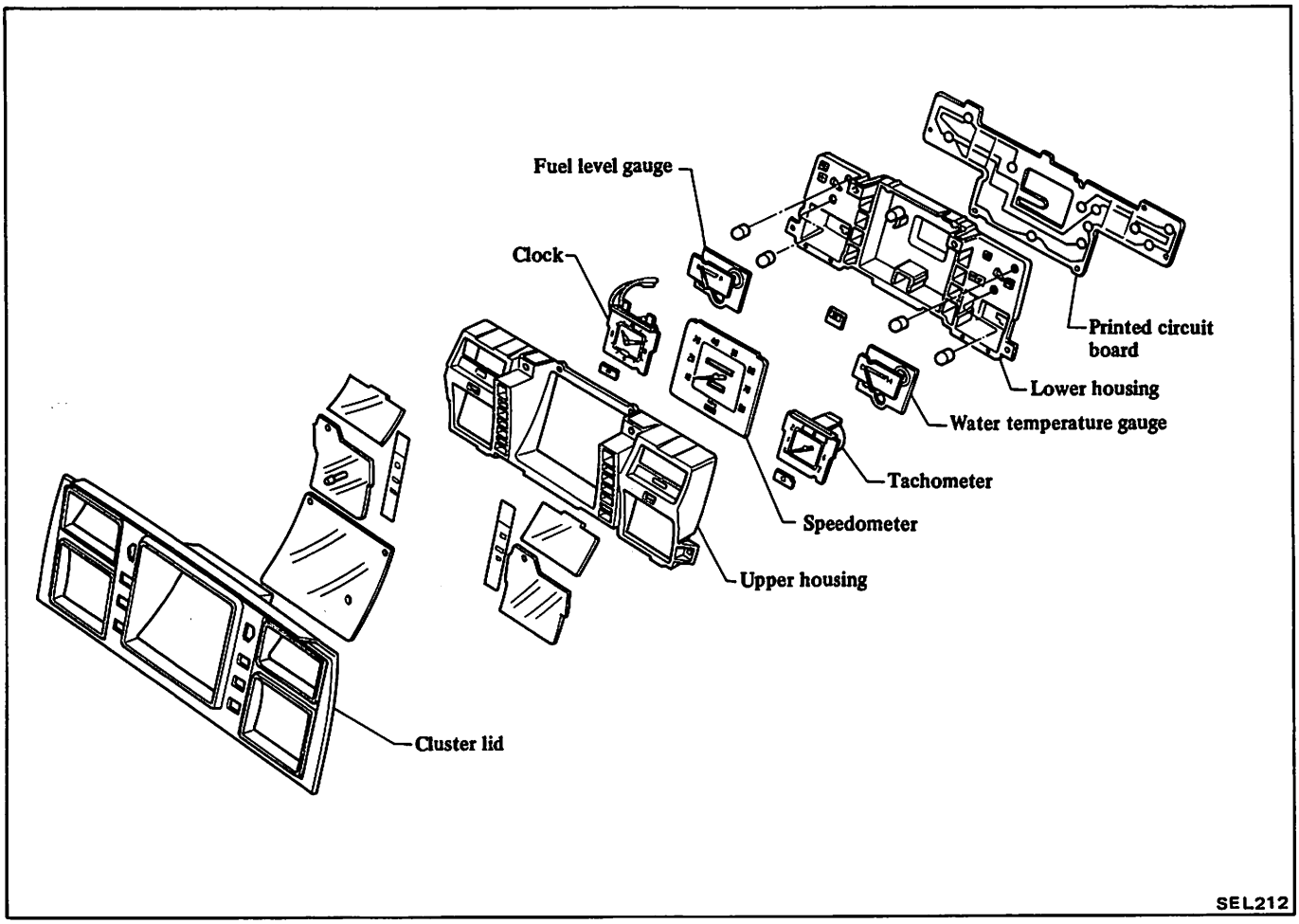
3. Remove combination meter assembly.



Carefully pull out combination meter and disconnect connectors.

4. Install combination meter in the reverse order of removal.

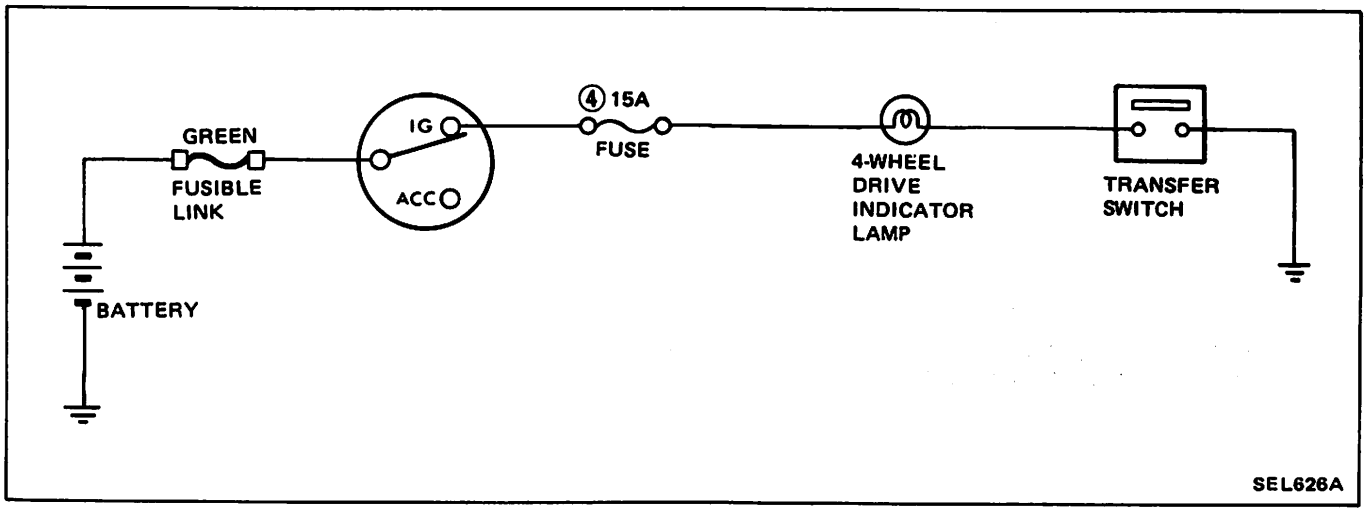
DISASSEMBLY AND ASSEMBLY



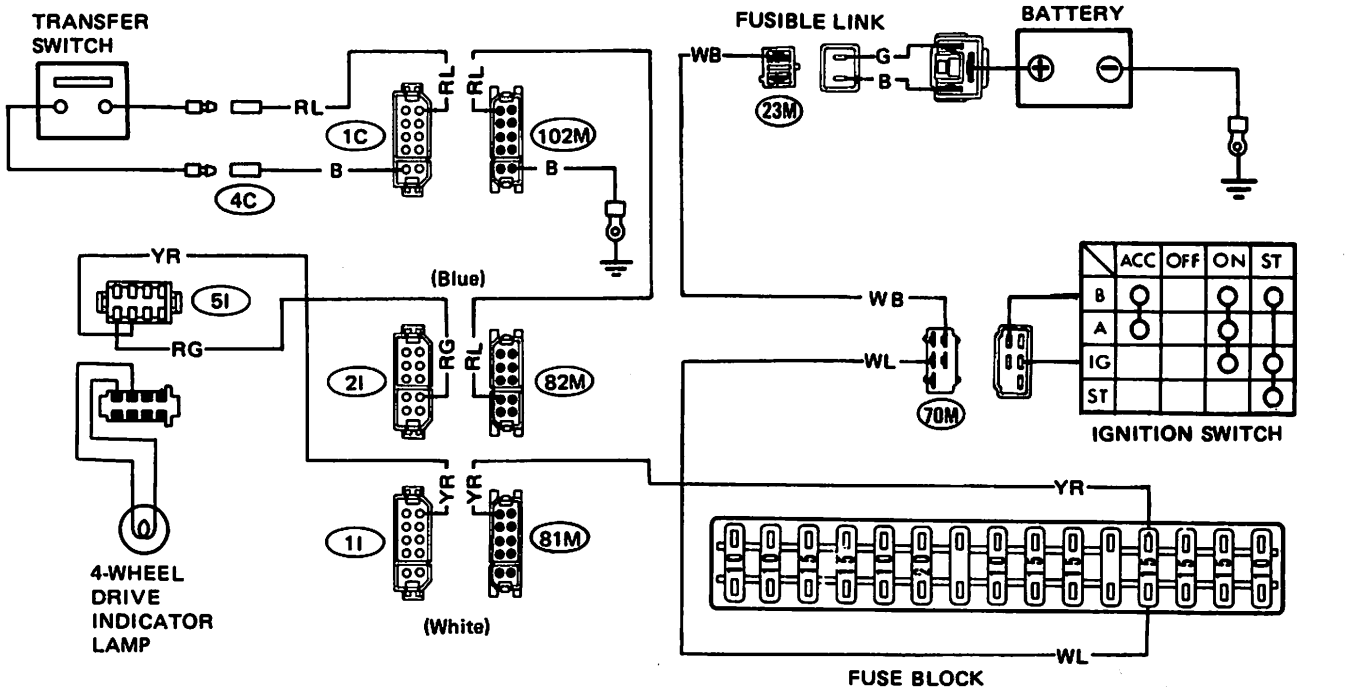
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4-WHEEL DRIVE INDICATOR LAMP

SCHEMATIC



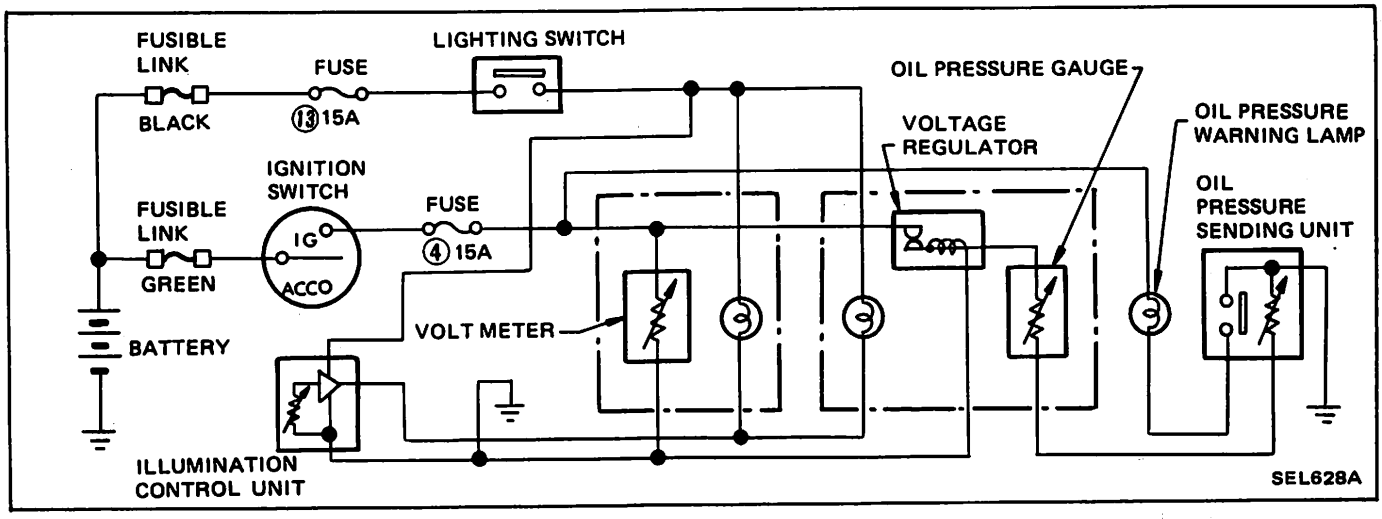
WIRING DIAGRAM



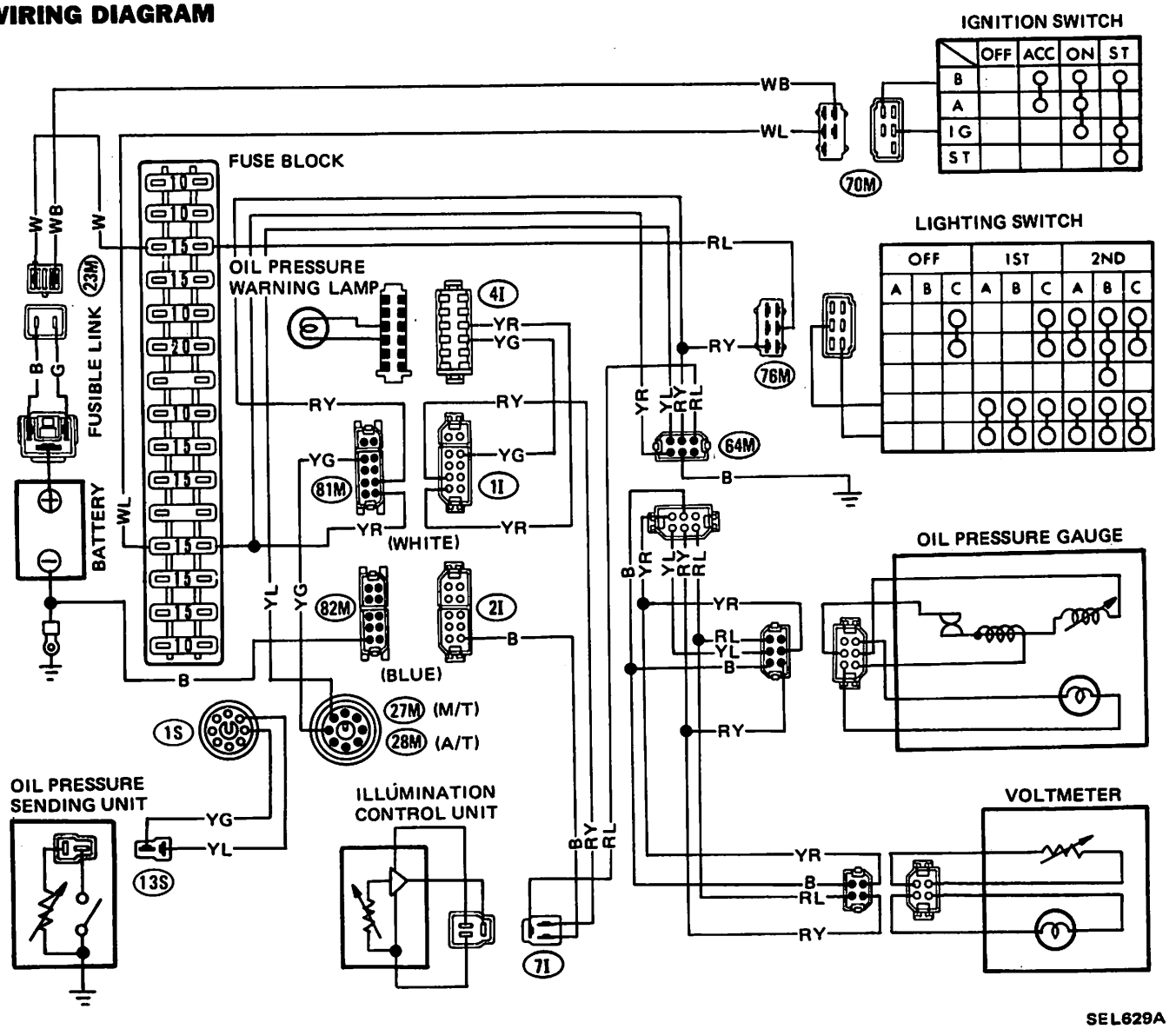
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VOLTMETER AND OIL PRESSURE GAUGE

SCHEMATIC



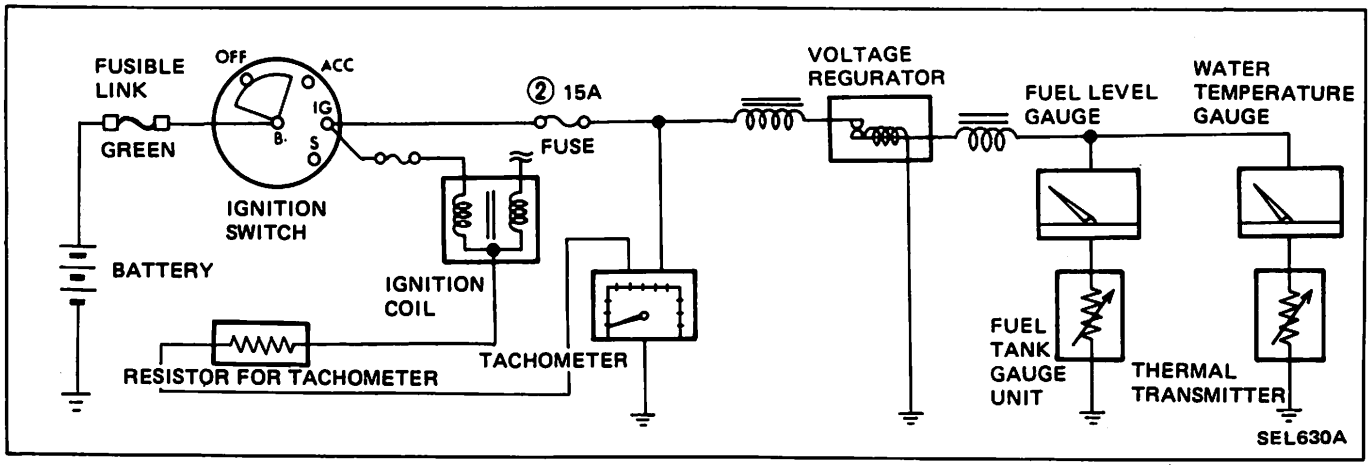
WIRING DIAGRAM



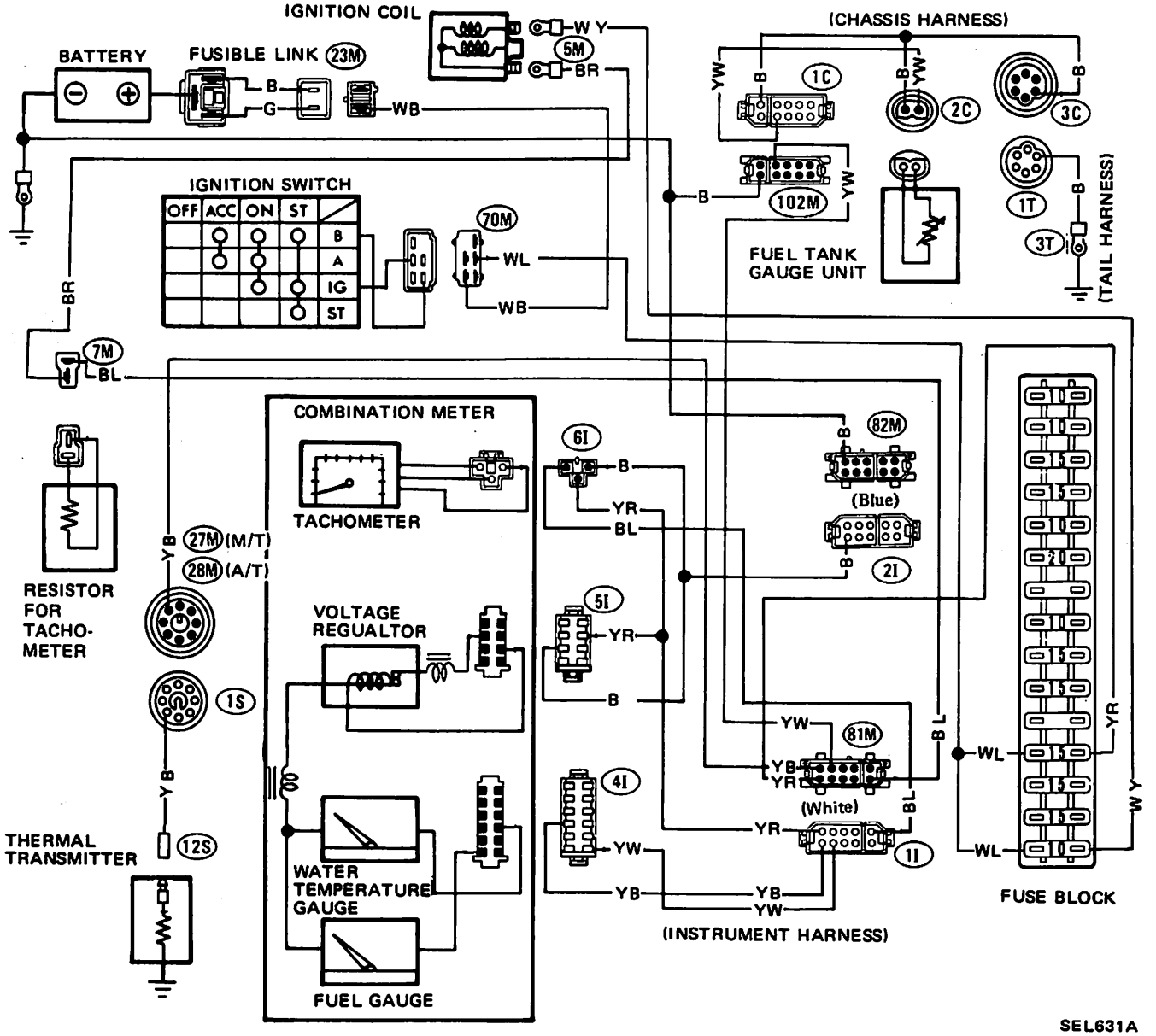
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GAUGES AND METERS

SCHEMATIC



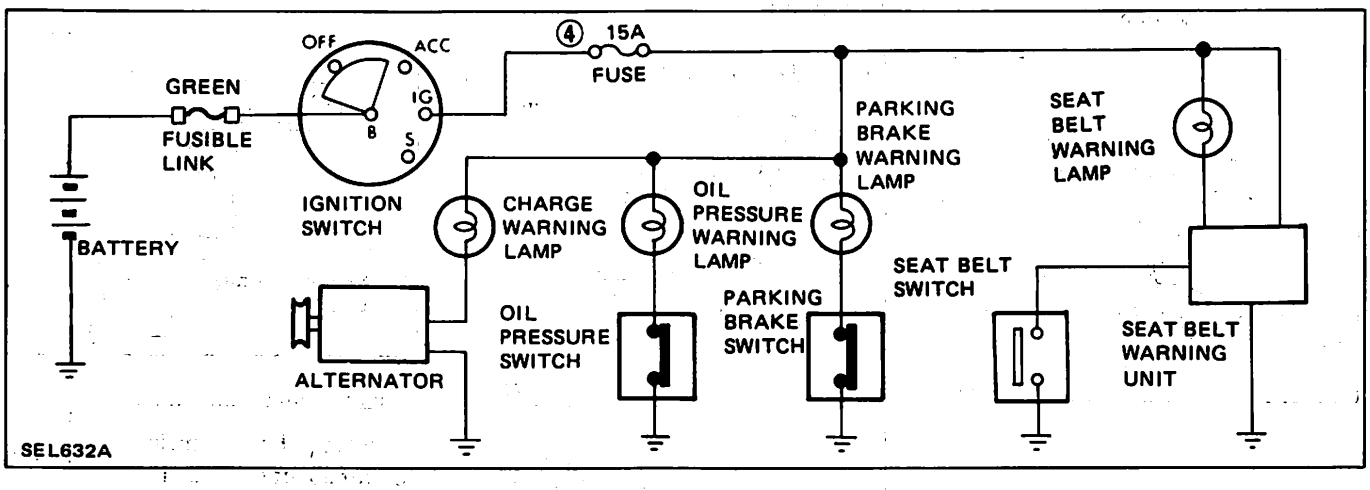
WIRING DIAGRAM



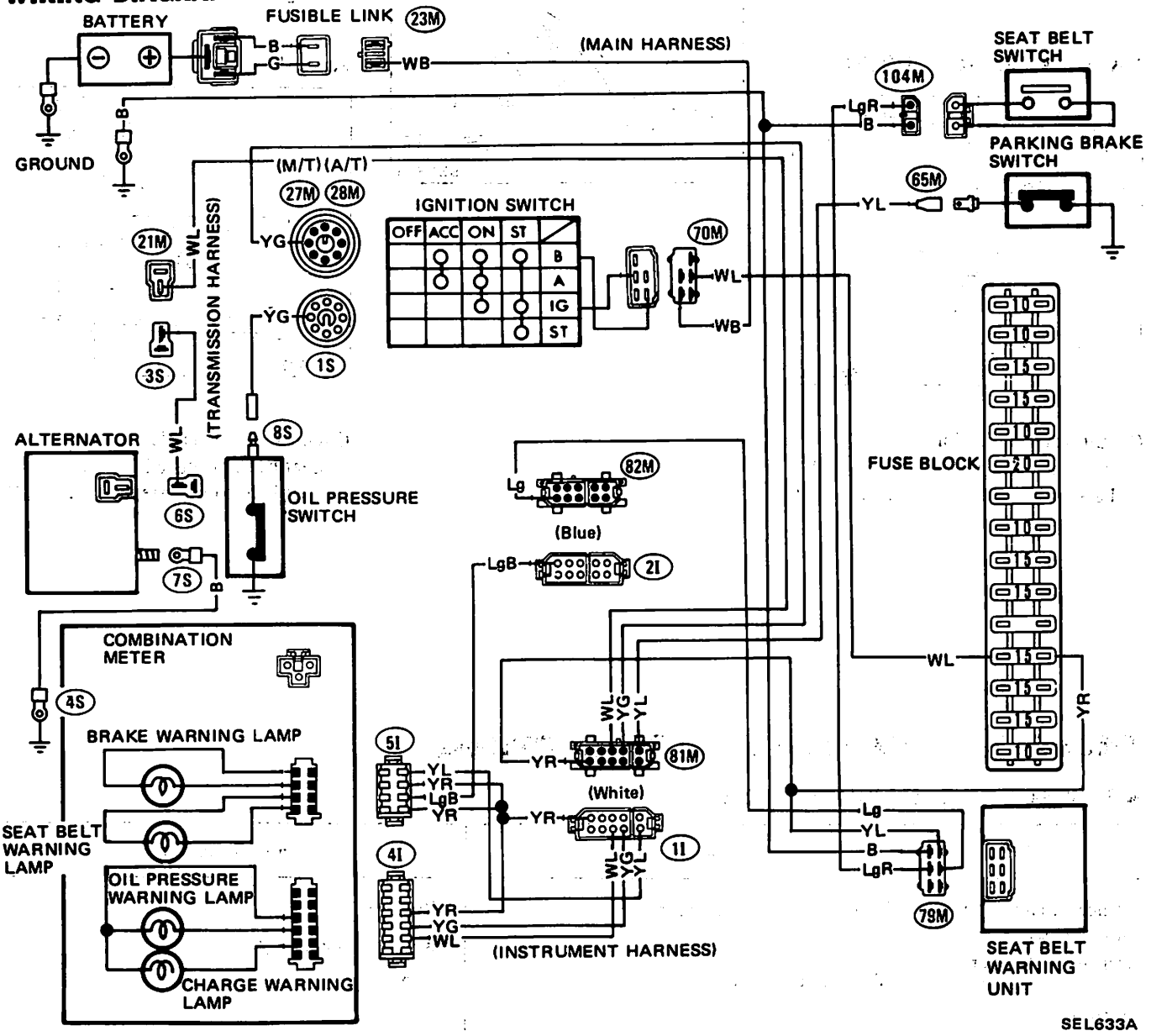
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WARNING SYSTEM

SCHEMATIC



WIRING DIAGRAM

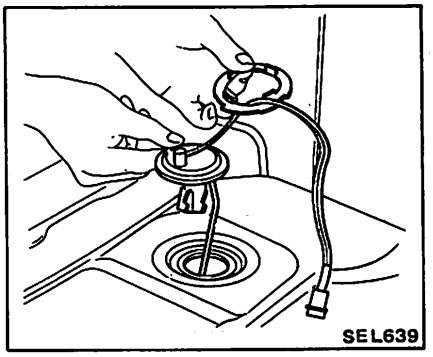


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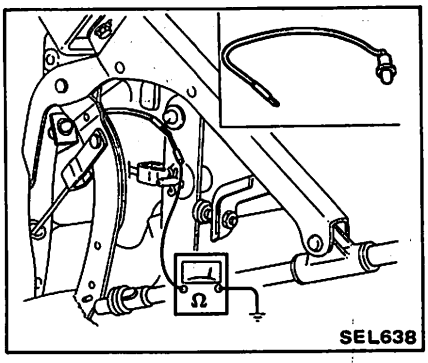
FUEL TANK GAUGE UNIT

Removal and installation

Refer to FE section



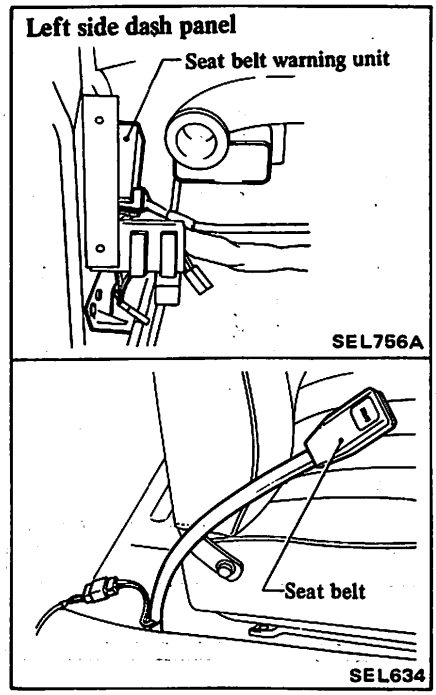
PARKING BRAKE SWITCH



Circuit tester indication:
Parking brake pulled 0Ω
Parking brake released . . . . . ∞Ω

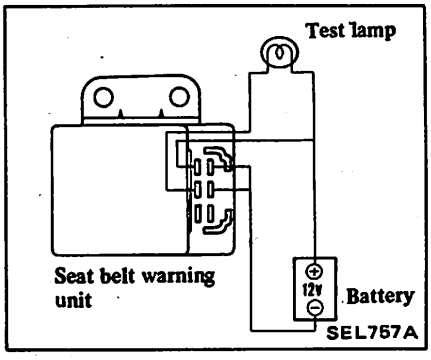
SEAT BELT WARNING SYSTEM

Location



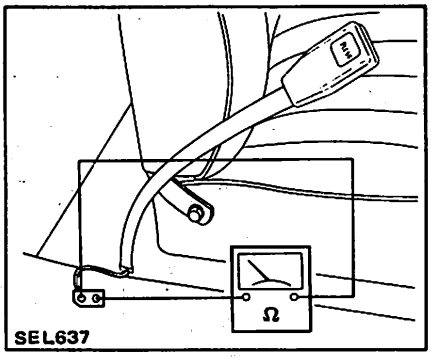
Inspection

Seat belt warning unit



Buzzer sounds ..... O.K.
Test lamp should remain on for about 6 sec. and then go out .....

Seat belt switch



Circuit tester indication
Seat belt is fastened . . . . . ∞Ω
Seat belt is not fastened 0Ω

TROUBLE DIAGNOSES AND CORRECTIONS

4-WHEEL DRIVE INDICATOR LAMP

Condition	Probable cause	Corrective action
Indicator lamp does not glow when transfer shift lever is set in 4-wheel drive position.	Burned out indicator lamp bulb. Faulty transfer switch. Blown out fuse (④ 15A).	Replace. Replace if necessary. Replace.

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VOLTMETER AND OIL PRESSURE GAUGE

Condition	Probable cause	Corrective action
Oil pressure gauge Oil pressure gauge does not operate.	Faulty oil pressure sending unit or loose terminal connection.	Replace oil pressure sending unit or correct terminal connection.
Gauge indicates only maximum pressure.	Faulty oil pressure gauge unit. (Gauge pointer returns to original position when ignition switch is turned off.)	Replace.
	Faulty oil pressure gauge. (Gauge pointer indicates maximum pressure even after ignition switch is turned off.)	Replace.
Voltmeter Voltmeter does not operate, or abnormally indicates.	Faulty voltmeter.	Replace.
	Loose or poor connection.	Check wiring and/or repair connection.

SPEEDOMETER

Condition	Probable cause	Corrective action
Neither speedometer pointer nor odometer operates.	Loose speedometer cable connector.	Regithten.
	Broken speedometer cable.	Replace.
	Damaged speedometer drive pinion gear (Transmission side).	Replace.
	Faulty speedometer.	Replace.
Unstable speedometer pointer.	Loose speedometer cable connector.	Retighten.
	Damaged speedometer cable.	Replace.
	Faulty speedometer.	Replace.
Unusual sound occurs in response to increase in driving speed.	Excessively bent or twisted speedometer cable inner wire or lack of lubrication.	Replace or lubricate.
	Faulty speedometer.	Replace.
Inaccurate speedometer indication.	Faulty speedometer.	Replace.
Inaccurate odometer operation.	Improperly meshed second and third gear or worn gears.	Replace speedometer.
	Faulty feeding due to deformed odometer and pinion carrier.	Replace speedometer.

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FUEL LEVEL GAUGE

Condition	Probable cause	Corrective action
Fuel level gauge does not operate.	Faulty fuel tank gauge unit. (Pointer deflects when fuel tank gauge unit YW wire is grounded.)	Replace fuel tank gauge unit.
	Faulty fuel level gauge.	Replace.
	Loose connection or open circuit.	Check wiring and/or repair connection.
	Faulty voltage regulator built into water temperature gauge.	Replace water temperature gauge.
Pointer indicates only "F" position.	Faulty fuel tank gauge unit. (Gauge pointer returns to original position when ignition switch is turned off.)	Replace.
	Faulty fuel level gauge. (Gauge pointer indicates "F" position even after ignition switch has been turned off.)	Replace.
Fuel level gauge does not operate accurately.	Faulty fuel tank gague unit.	Replace.
	Faulty fuel level gauge.	Replace fuel level gauge.
	Poor or loose connection.	Correct connector terminal contact.

WATER TEMPERATURE GAUGE

Condition	Probable cause	Corrective action
Gauge does not operate.	Faulty thermal transmitter or loose terminal connection. (When wire to thermal transmitter is grounded, gauge pointer fluctuates.)	Replace thermal transmitter or correct terminal connection.
	Faulty water temperature gauge.	Replace water temperature gauge.
	Faulty voltage regulator built into water temperature gauge.	Replace water temperature gauge.
Gauge indicates only maximum temperature.	Faulty thermal transmitter. (Gauge pointer returns to original position when ignition switch is turned off.)	Replace thermal transmitter.
	Faulty water temperature gauge. (Gauge pointer indicates maximum temperature even after ignition switch is turned off.)	Replace water temperature gauge.
Gauge does not operate accurately.	Faulty water temperature gauge.	Replace water temperature gauge.
	Loose or poor connection.	Correct connector terminal contact.

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WARNING LAMPS

Condition	Probable cause	Corrective action
Change warning lamp Lamp does not go out when engine is started.	Faulty charging system.	Inspect charging system.
Oil pressure warning lamp Lamp does not lgiht when ignition switch is set to "ON".	Faulty oil pressure switch or loose switch termianl connection. (When lead wire connected to switch is grounded, warning lamp lights.)	Replace or correct connection.
Lamp does not go out while engine is being operated.	Lack of engine oil. Oil pressure too low. Faulty oil pressure switch.	Check oil level and add oil as required. Inspect engine oil pressure system. Replace.
Parking brake warning lamp Lamp does not go out.	Faulty parking brake switch (When parking brake lever is released).	Replace.

TACHOMETER

Condition	Probable cause	Corrective action
Tachometer pointer deflects.	Loose or poor connection. Faulty resistor. Faulty tachometer.	Repair. Replace resistor. Repair or replace tachometer.
Tachometer pointer will not move.	Loose or poor connection. Faulty tachometer.	Repair. Repair or replace tachometer.

SEAT BELT WARNING SYSTEM

Condition	Probable cause	Corrective action
Buzzer does not sound and warning lamp does not glow with ignition switch on.	Faulty seat belt switch. Faulty seat belt warning unit. Loose connection or open circuit.	Repair or replace Replace. Correct connector terminal contacts.
Either buzzer or warning lamp does not operate with proper condition.	Loose connection or open circuit. Burnt bulb. Faulty seat belt warning unit (Built-in buzzer).	Correct connector terminal contacts. Replace. Replace.

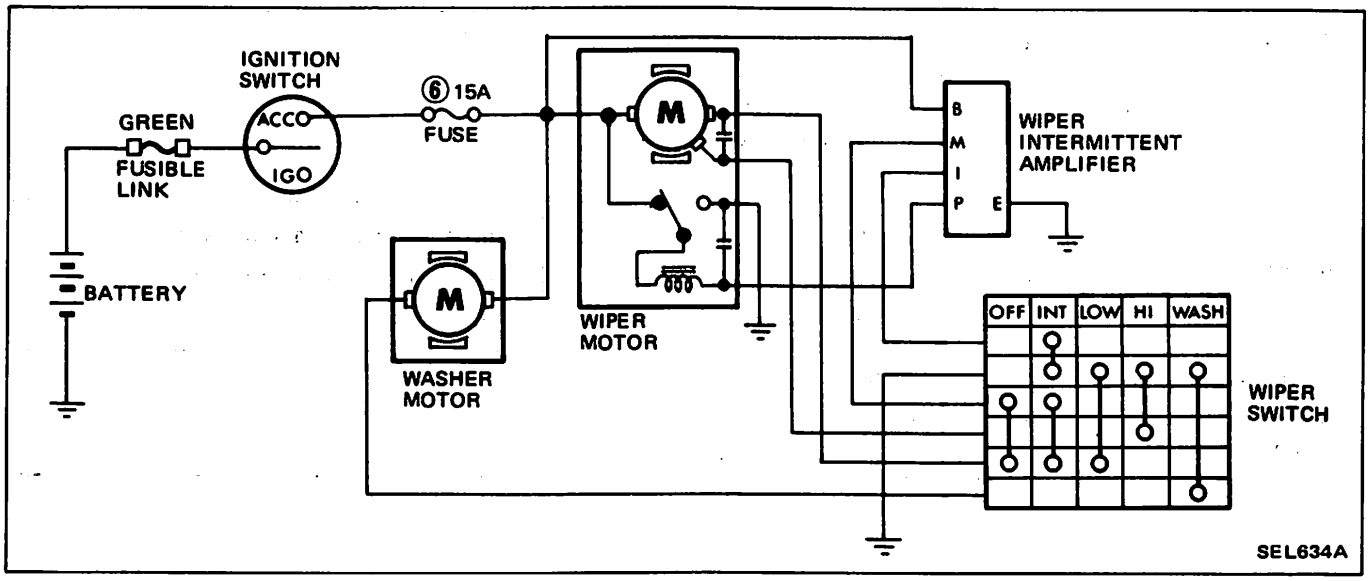
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WIPER AND WASHER

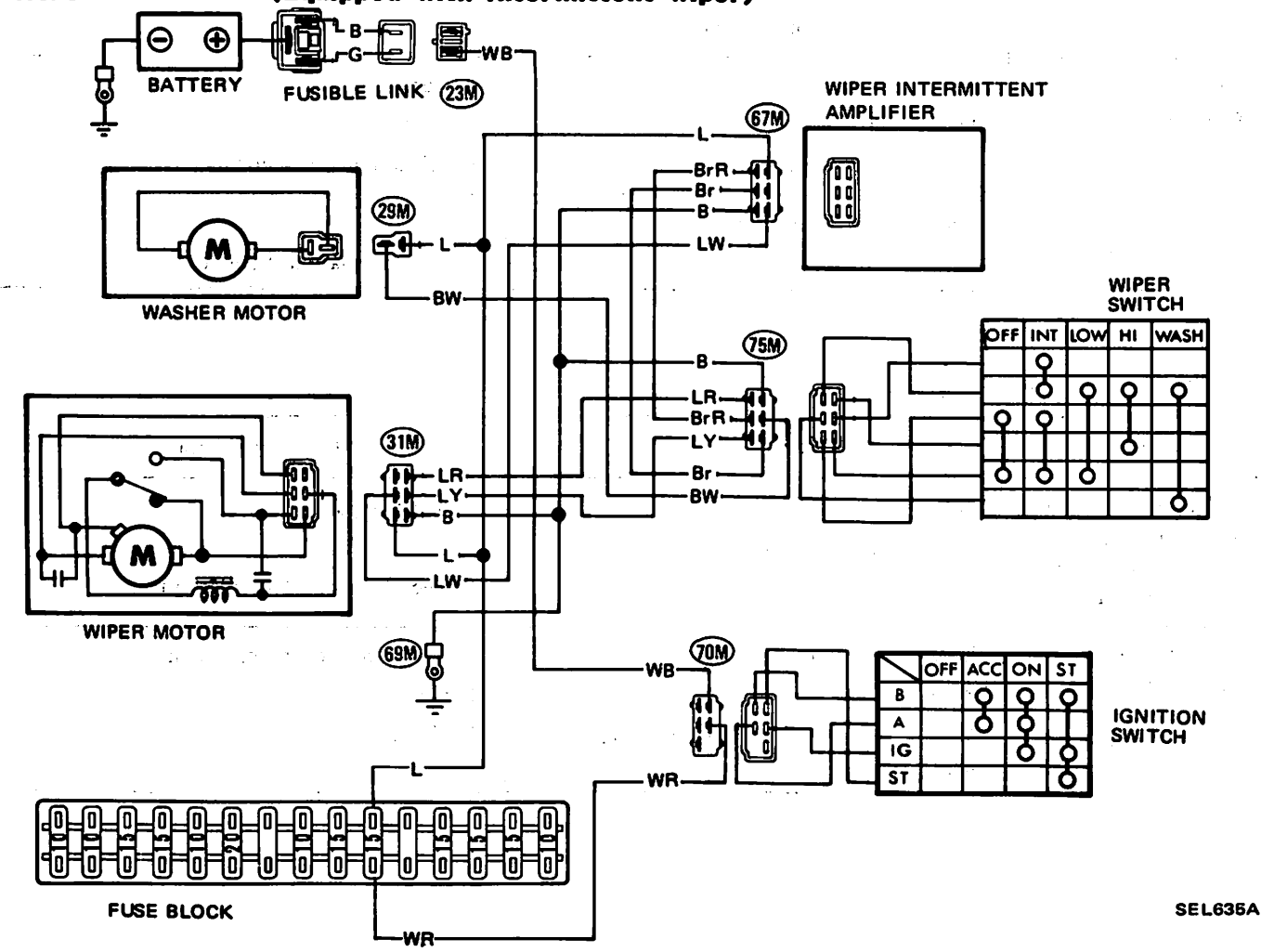
CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

WINDSHIELD WIPER AND WASHER

SCHEMATIC (Equipped with intermittent wiper)

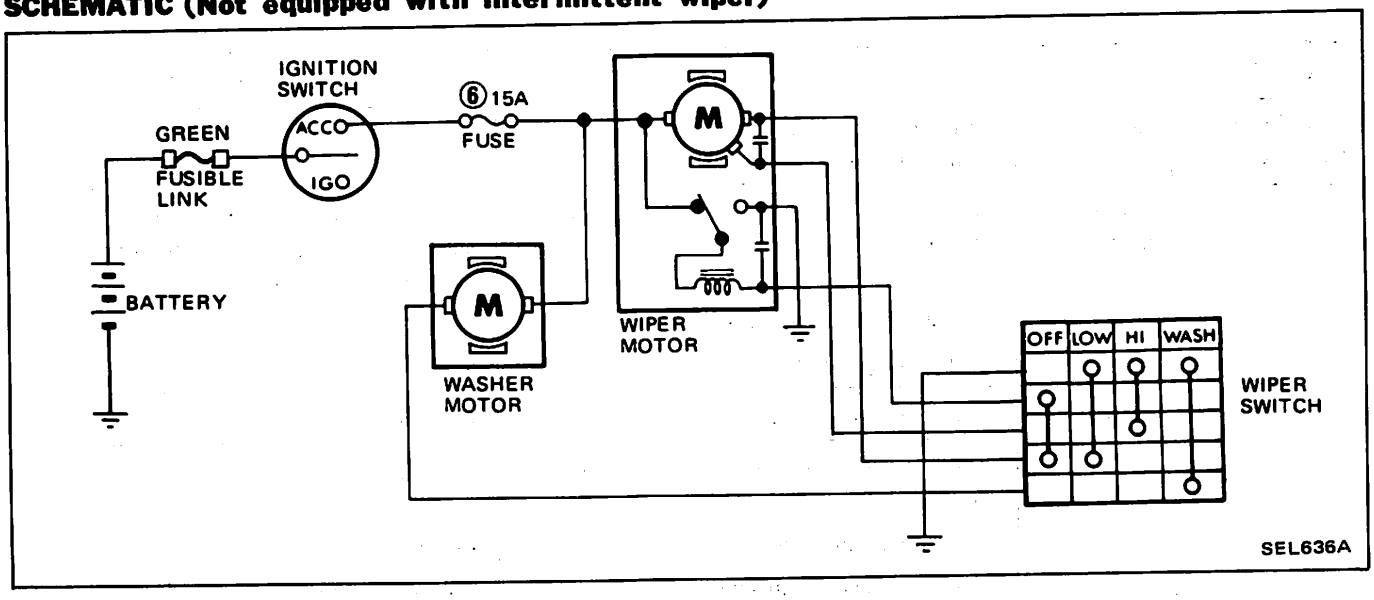


WIRING DIAGRAM (Equipped with intermittent wiper)

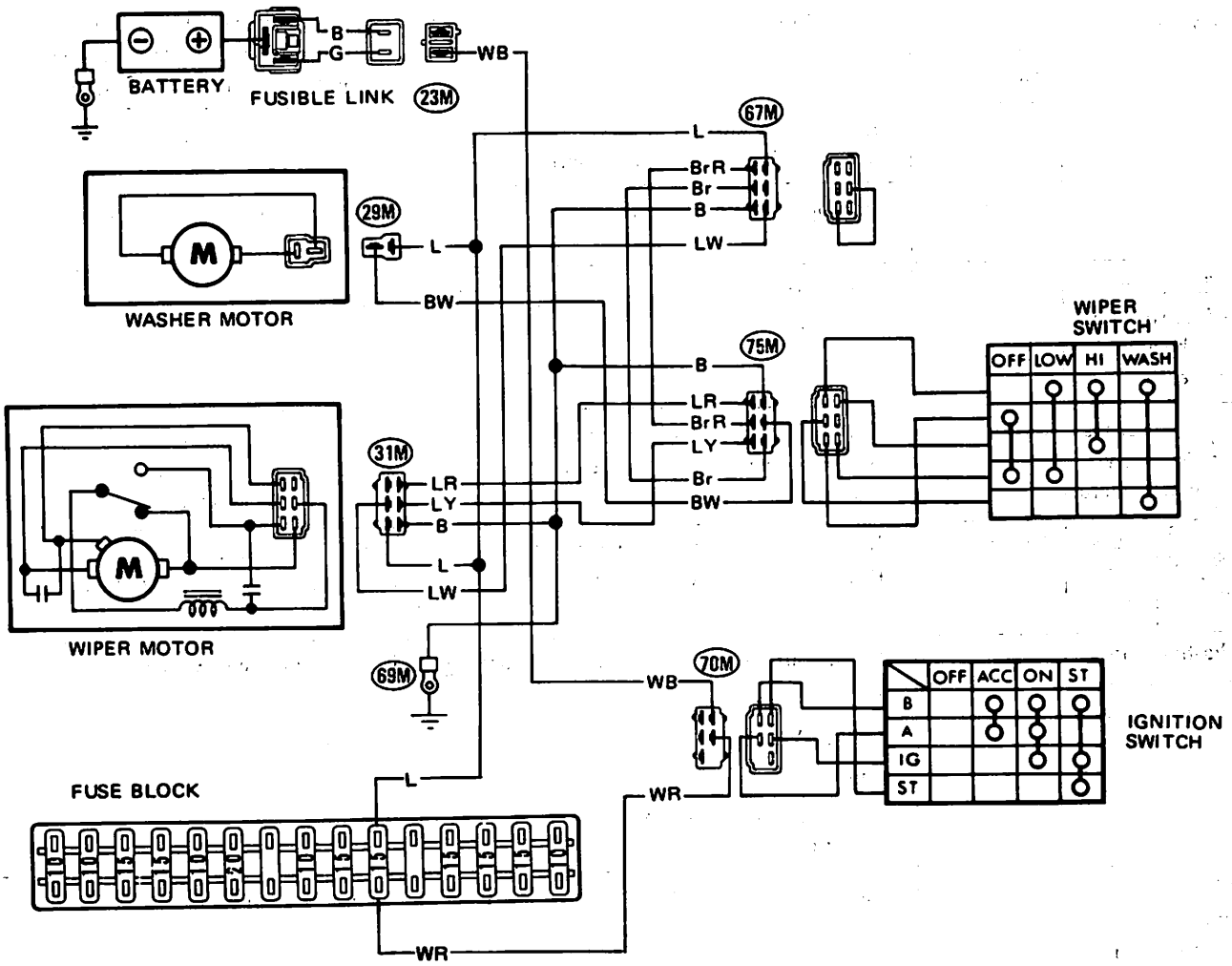


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SCHEMATIC (Not equipped with intermittent wiper)



WIRING DIAGRAM (Not equipped with intermittent wiper)



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TROUBLE DIAGNOSES AND CORRECTIONS

Condition		Probable cause	Corrective action
Windshield wiper does not operate.	Motor	Broken armature, worn motor brush or seized motor shaft.	Replace motor.
	Power supply and cable	Blown out fusible link (Green) or fuse (⑥ 15A). Loose, open or broken wiring. Improper grounding.	Check short-circuit, burnt component inside motor or other part for operation, and correct problem. Correct. Correct.
	Switch	Improper switch contact.	Correct.
	Link	Foreign material interrupts movement of link mechanism. Disconnect link rod. Seized or rusted arm shaft.	Correct. Correct. Lubricate or replace arm shaft.
Windshield wiper operating speed is too slow.	Motor	Short-circuit of motor armature, worn motor brush or seized motor shaft.	Replace motor or lubricate bearing with engine oil.
	Power supply and cable	Low source voltage.	Measure voltage, check other electrical parts for operation, and take corrective action for power supply if necessary.
	Link	Humming occurs on motor in arm operating cycle due to seized arm shaft.	Lubricate or replace.
	Switch	Improper switch contact.	Conduct continuity test, and replace if necessary.
Windshield wiper speed can not be adjusted correctly.	Motor	Motor brush for either low or high speed is worn.	Replace motor.
Windshield wiper does not stop correctly. Stops anywhere.	Motor	Contaminated auto-return device contacts or improper contact due to foreign matter.	Remove auto-return device cover, and clean contacts carefully so as not to deform contacts plate.
Windshield wiper does not stop correctly. Does not stop.	Motor	Incomplete auto-return device operation (Contact is not interrupted.)	Remove auto-return device cover, and correct contacts plate bending.
Washer motor does not operate when pushing washer switch on.		Blown out fusible link (Green) or fuse (⑥ 15A). Faulty switch. Faulty washer motor. Loose or poor connection contact at motor or switch.	Correct cause and replace fuse. Replace. Replace. Repair.
Washer motor operate but washer fluid is not ejected.		Clogged washer nozzle.	Clean nozzle or replace.

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Intermittent windshield wiper

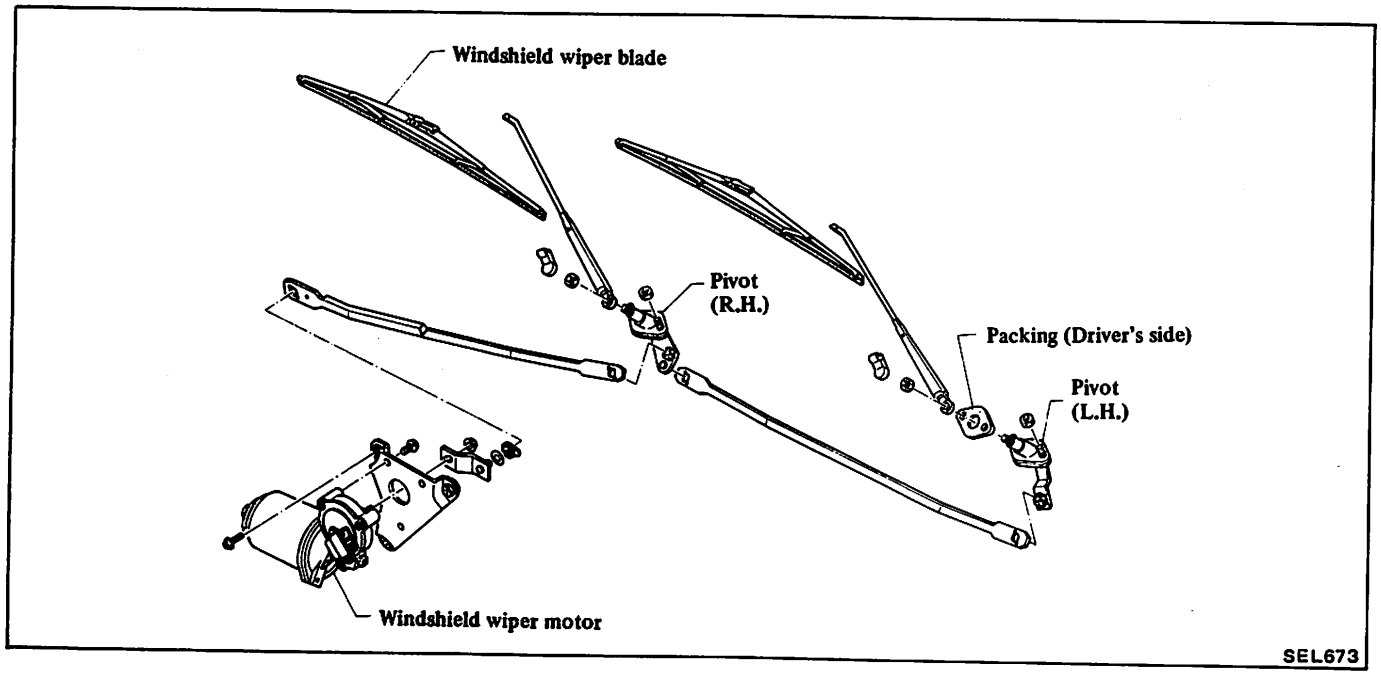
The sign for corrective action

A. Measure voltage across positive (+) and negative (–) terminals of intermittent amplifier with a circuit tester.
B. Check continuity of all wiper switch positions.
C. Check continuity of terminals of wiper motor, wiper switch and intermittent amplifier.
D. Check continuity in wiper motor circuit.
E. Alternator or battery is faulty.

Condition	Probable cause	Corrective action
Wipers do not operate intermittently but operates at Low and High speeds.	• Line voltage below 10 volts • Wiper switch faulty • Wiring faulty • Intermittent amplifier faulty	A: Replace if necessary. B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Intermittent speed is too short for proper wiping.	• Line voltage too high • Wiper motor (auto-return device) faulty • Intermittent amplifier faulty	A: Replace if necessary. D: Replace if necessary. Replace.
Intermittent speed is too long for proper wiping.	• Line voltage below 10 volts • Wiper switch faulty • Wiring faulty • Intermittent amplifier faulty	A: Replace if necessary. B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Wipers do not shut off.	• Wiper motor faulty • Intermittent amplifier faulty	D: Replace if necessary. Replace.
Wipers operate intermittently with wiper switch OFF.	• Wiper switch faulty • Wiring faulty • Intermittent amplifier faulty	B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Intermittent speed is erratic.	• Line voltage fluctuation excessive • Wiper switch faulty • Wiring faulty • Wiper motor faulty • Intermittent amplifier faulty	E: Correct or replace if necessary. B: Correct or replace if necessary. A,C: Repair or replace if necessary. D: Replace if necessary. Replace.
Wipers make a complete wiping stroke only one time with wiper switch ON but do not continue operation.	• Line voltage below 10 volts • Intermittent amplifier faulty	A: Replace if necessary. Replace.
Wiper motor is not interconnected when washer switch is depressed, but intermittent operation is normal.	• Connections poor • Intermittent amplifier faulty	C: Repair or replace if necessary. Replace.
Wiper motor simultaneously operates (or: does not delay) when washer switch is depressed.	• Intermittent amplifier faulty	Replace.
Wipers do not make a complete wiping stroke when washer switch is first turned on and is quickly turned off.	• Intermittent amplifier faulty	Replace.

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WINDSHIELD WIPER



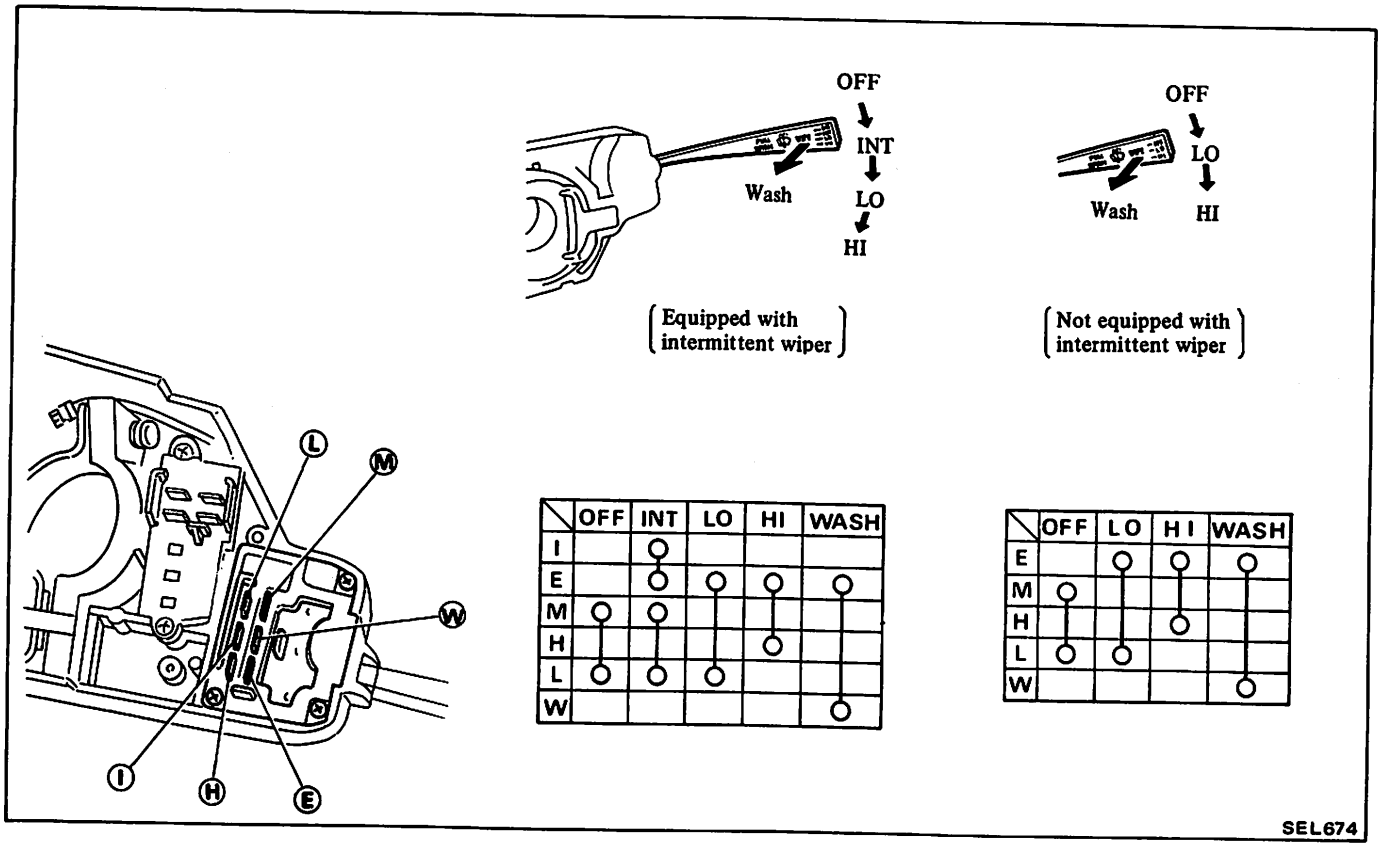
WIPER AND WASHER SWITCH

Removal and Installation

Refer to Combination Switch.

Inspection

Test continuity through switch with a test lamp or ohmmeter.

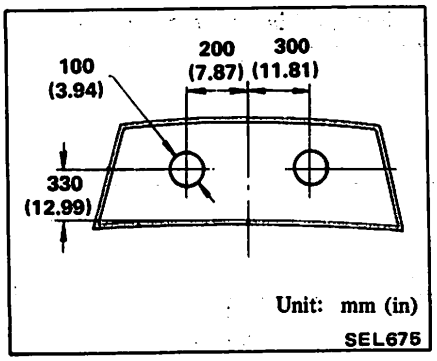


	OFF	INT	LO	HI	WASH
I		○			
E		○	○	○	○
M	○	○			
H				○	
L	○	○	○		
W					○

	OFF	LO	HI	WASH
E		○	○	○
M	○			
H			○	
L	○	○		
W				○

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WASHER NOZZLE ADJUSTMENT



CAUTION:

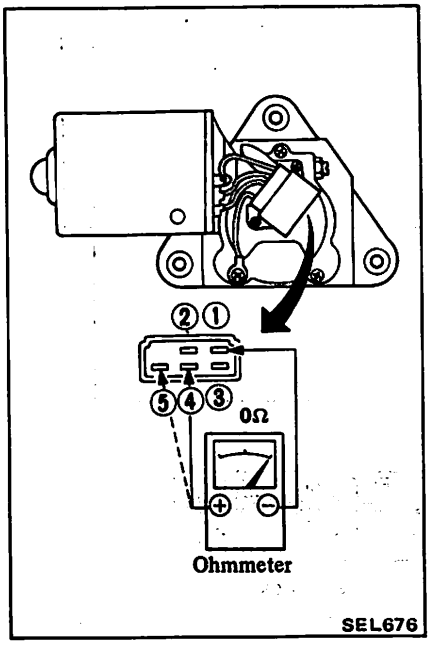
a. Be sure to use only windshield washing solution.
Never mix soap powder or detergent with solution.

b. To avoid improper windshield washer operation, do not operate windshield washer continuously for more than 30 seconds or without washer fluid. Normally, windshield washer should be operated for 10 seconds or less at one time.

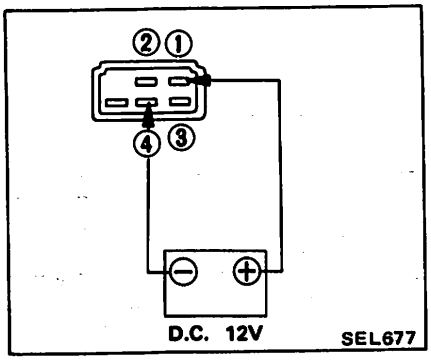
WINDSHIELD WIPER MOTOR

Inspection

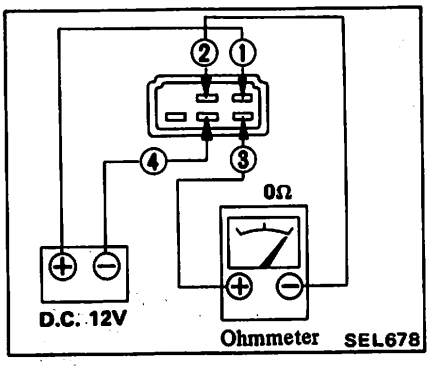
1. There should be continuity between terminals ① and ④, and ① and ⑤.



2. Connect positive lead wire to terminal ①, and ground lead wire to terminal ④. The motor should be run at low speed.



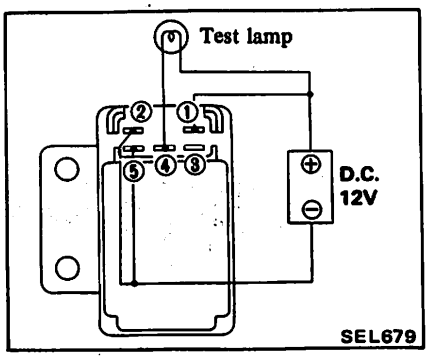
3. Keep the motor running.
Check continuity between terminals ② and ③.
Continuity should repeat "ON" and "OFF" periodically.



INTERMITTENT AMPLIFIER

Inspection

To check intermittent amplifier for proper operation, fabricate adapters shown in the following illustration, and utilize the following procedures in the order enumerated.

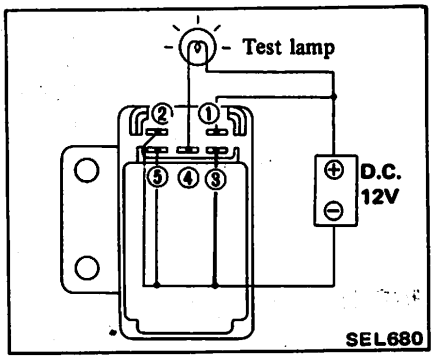


Failure to observe the order of these test procedures may lead to improper test results.

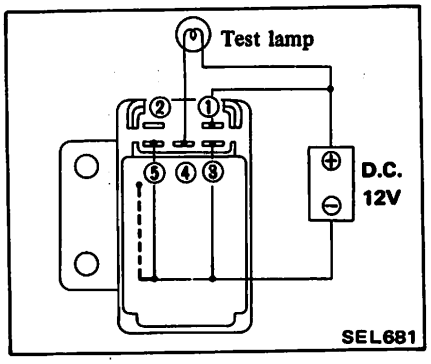
If results of following tests are satisfactory as indicated below, intermittent amplifier is functioning properly.

Be careful not to connect lead wires to incorrect terminals as this will damage intermittent amplifier.

1. Make sure that test lamp comes on when negative lead wire is connected to terminal ③.



2. Disconnect lead wire from terminal ②. Test lamp should go out and comes on in about 6 seconds.



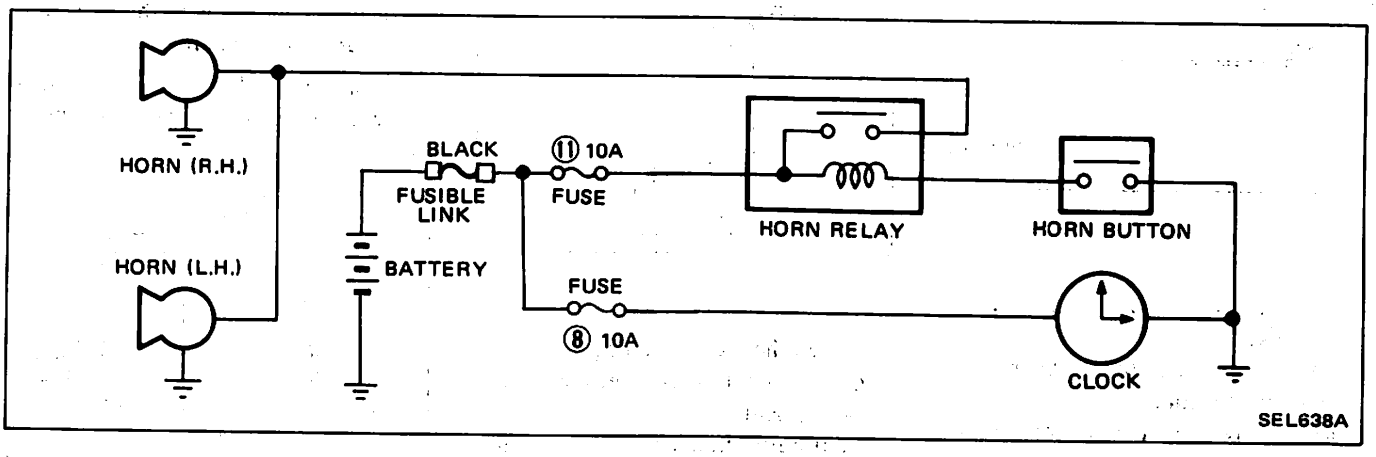
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ELECTRICAL ACCESSORIES

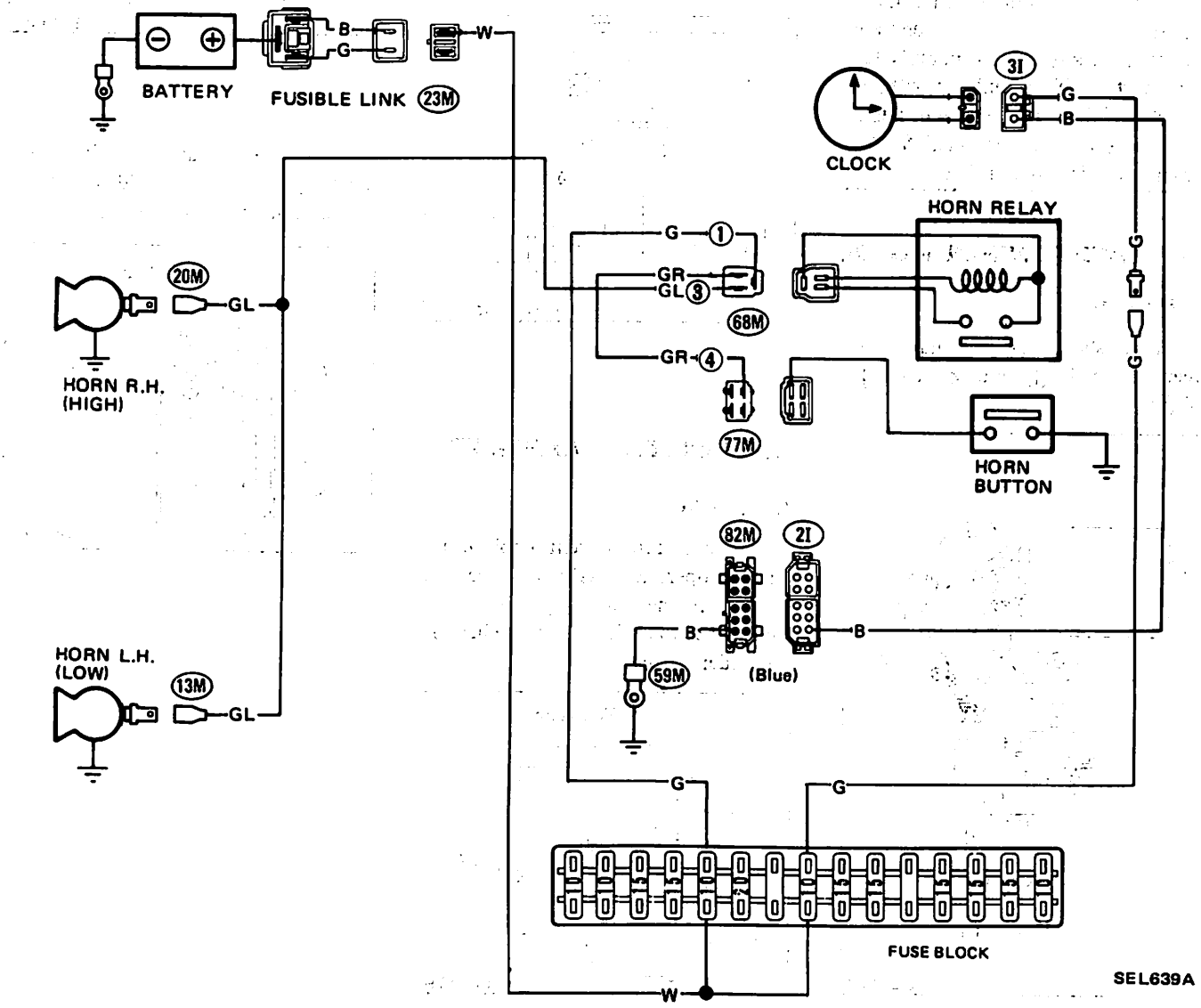
CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

HORN AND CLOCK

SCHEMATIC



WIRING DIAGRAM



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TROUBLE DIAGNOSES AND CORRECTIONS

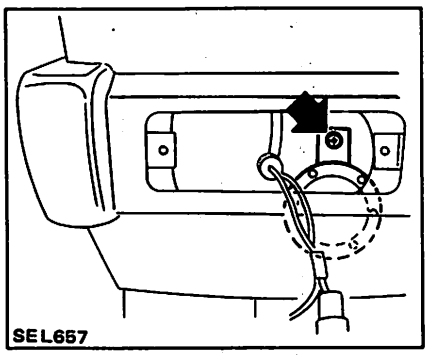
Horn

Condition	Probable cause	Corrective action
Neither high nor low horn operates.	Burnt fuse. (⑪ 10A)	Correct cause and replace fuse.
	Faulty horn button contact. [Horn sounds when ④ terminal of harness connector to combination switch is grounded.]	Repair horn button.
	Faulty horn relay. [Horn sounds when ① and ③ terminals of main harness to horn relay are connected with a test lead including 10A fuse.]	Replace.
	Loose connection or open circuit.	Check wiring and/or repair connection.
High (Low) horn does not operate.	Faulty horn or loose horn terminal connection.	Correct horn terminal connection or replace horn.
	Break in wire to horn.	Repair.
Horn does not stop to sound.	Short-circuited horn button and/or horn button lead wire. [When harness connector is disconnected from combination switch, horn stops sounding.]	Repair horn button or its wiring.
	Faulty horn relay.	Replace.
Reduce volume and/ or tone quality.	Loose or poor connector contact. (Fuse, relay, horn and/or horn button.)	Repair.
	Faulty horn.	Replace.

HORN

Removal and Installation

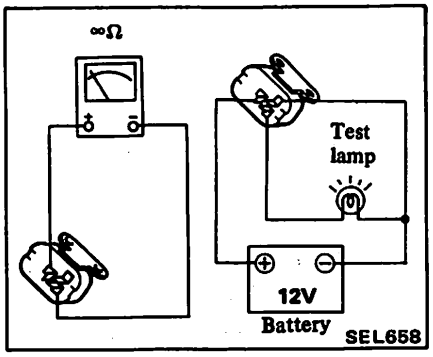
1. Disconnect battery ground cable.
2. Remove front combination light.
3. Remove horn.



4. Installation is in the reverse order of removal.

HORN RELAY

Inspection



CLOCK

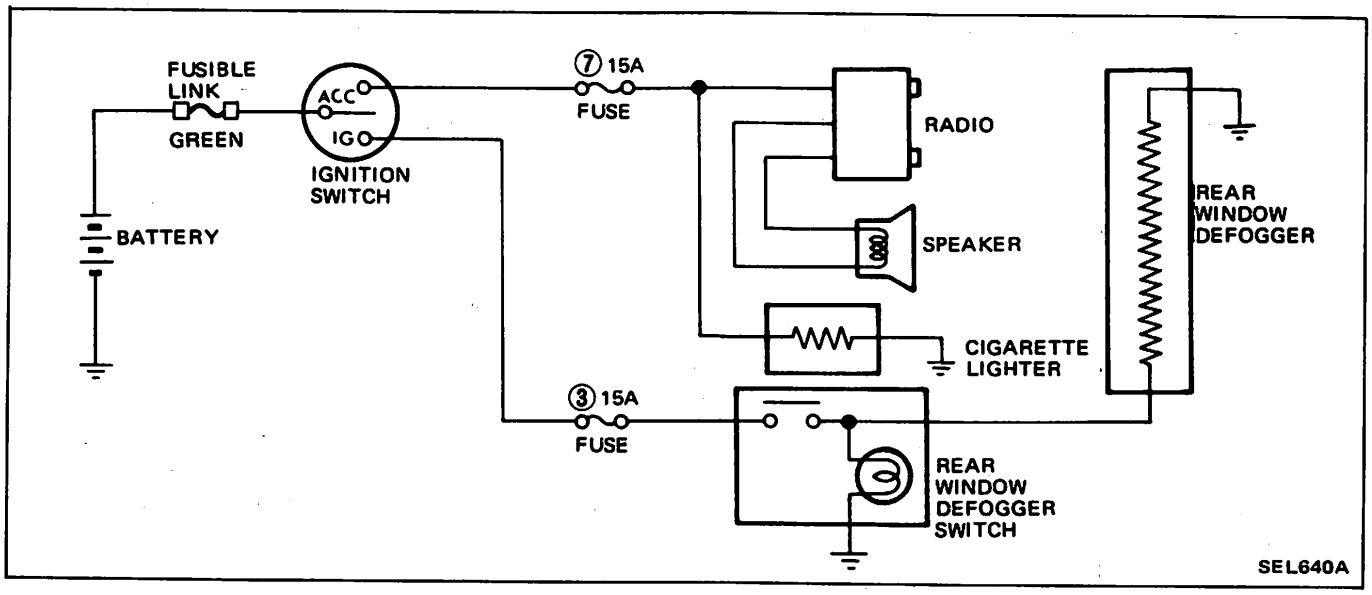
Removal and Installation

1. Disconnect battery ground cable.
2. Remove cluster lid and combination meter. Refer to Combination Meter.
3. Disassemble combination meter and then remove clock. Refer to Combination meter.
4. Installation is in the reverse order of removal.

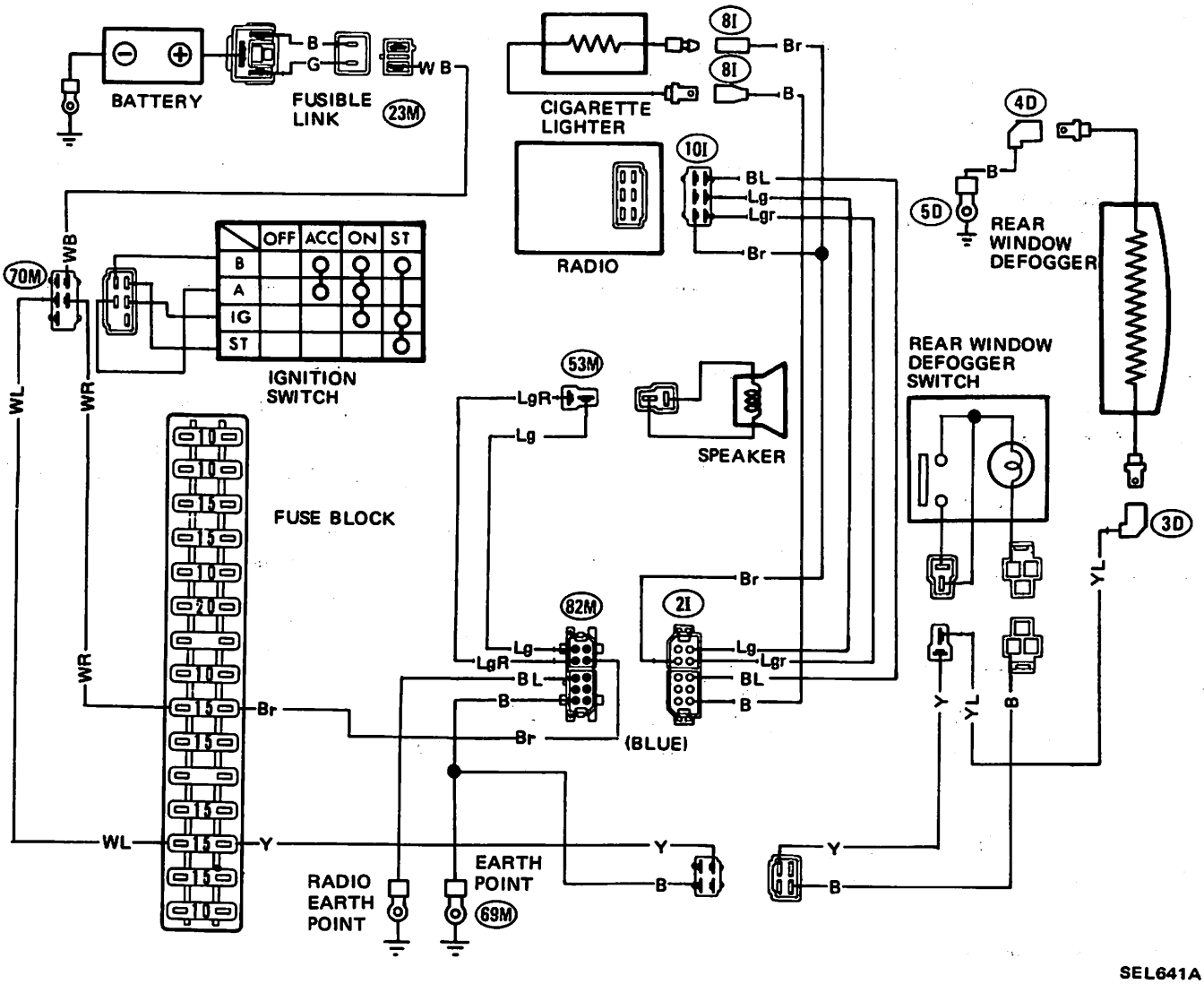
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REAR WINDOW DEFOGGER, CIGARETTE LIGHTER AND RADIO

SCHEMATIC



WIRING DIAGRAM



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TROUBLE DIAGNOSES AND CORRECTIONS (Radio)

Noise prevention chart

Position vehicle in an open area away from steel buildings, run engine, extend antenna to its maximum length, set volume control to maximum and set dial at a median point where no broadcasting wave is received.

Condition	Probable cause	Corrective action
Ignition system Noise occurs when engine is operated.	High tension cable. Ignition coil.	Install new high tension cable. Replace 0.5μF capacitor installed to primary side ⊕ terminal of ignition coil with new ones. **Be careful not to install capacitor to secondary or primary ⊖ terminal side. This will result in improper engine operation.**
Charging system Sound of alternating current present.	Alternator.	Replace 0.5μF capacitor installed to charging terminal B. **Do not use a larger capacitor.**

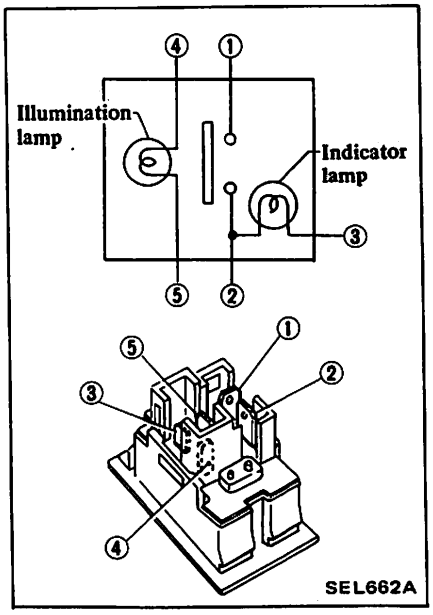
REAR WINDOW DEFOGGER SWITCH

Removal and installation

1. Disconnect battery ground cable.
2. Remove defogger switch by prying it off with a screwdriver and pull it out.
3. Disconnect harness connector.
4. Install defogger switch in the reverse order of removal.

Inspection

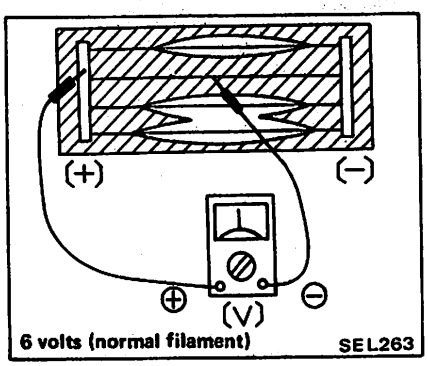
Test continuity through switch with ohmmeter or test lamp.



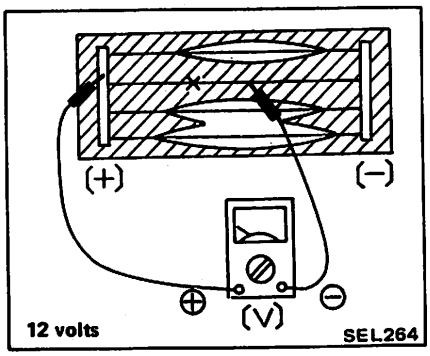
REAR WINDOW DEFOGGER FILAMENTS

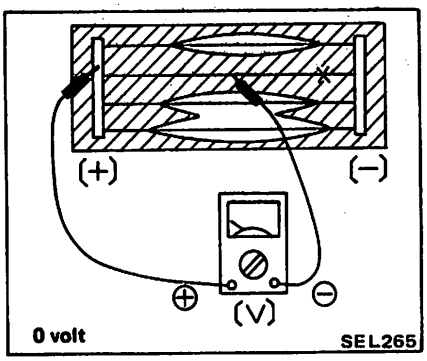
Inspection

1. Connect probe of circuit tester (in Volt range) to middle portion of each filament. Engine should run.

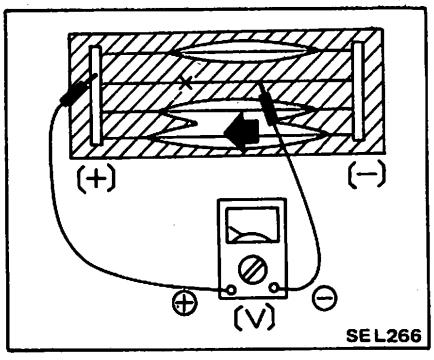


2. Tester indicates 0 or 12 volts if a filament is burned out.





3. Burned out point can be detected by an abrupt deflection of tester pointer while moving probe to left and right along filament.



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FILAMENT MAINTENANCE

Repair equipment

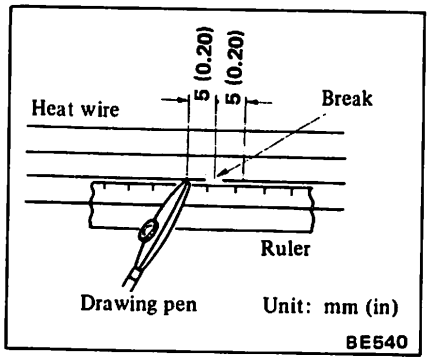
1. Conductive silver composition (Dupont No. 4817) or equivalent
2. Ruler, 30 cm (12 in) long
3. Drawing pen
4. Heat gun
5. Alcohol
6. Cloth

Repair procedure

1. Wipe broken heat wire and its surrounding area clean with a cloth dampended in alcohol.
2. Apply a small amount of conductive silver composition to tip of drawing pen.

Shake silver composition container before use.

3. Place ruler on glass along broken line. Deposit conductive silver composition on break with drawing pen. Slightly overlap existing heat wire on both sides [preferably 5 mm (0.20 in)] of the break.



4. Wipe clean silver composition from tip of drawing pen.
5. After repair has been completed, check repaired wire for continuity. **This check should be conducted 10 minutes after silver composition is deposited.**

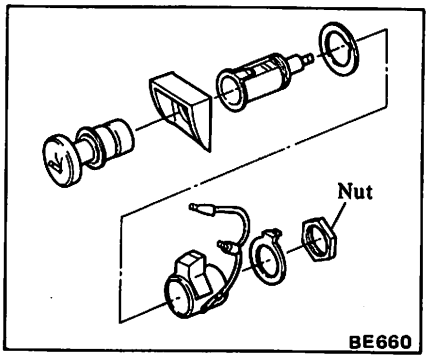
Do not touch repaired area while test is being conducted.

6. Apply a constant stream of hot air directly to the repaired area for approximately 20 minutes with a heat gun. **A minimum distance of 3 cm (1.2 in) should be kept between repaired area and hot air outlet.** If a heat gun is not available, let the repaired area dry for 24 hours.

CIGARETTE LIGHTER

Removal and installation

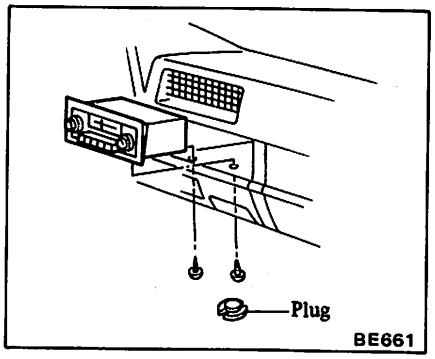
1. Disconnect battery ground cable.
2. Disconnect cigarette lighter connectors.
3. Remove lighter mounting nut and then remove cigarette lighter assembly.
4. Installation is in the reverse order of removal.



RADIO

Removal and installation

1. Disconnect battery gound cable.
2. Remove ash tray and heater/air conditioner control panel.
3. Remove plug and then remove radio mounting screws.



4. Draw out radio and disconnect radio harness connector and antenna cable.
5. Installation is in the reverse order of removal.

Install plug securely.

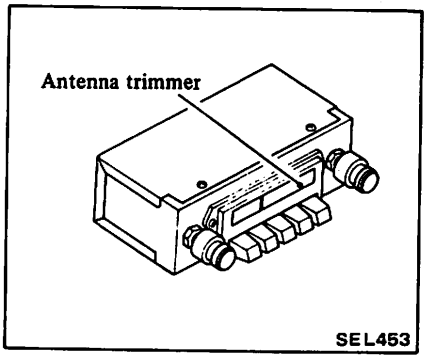
Antenna trimmer adjustment

The antenna trimmrer should be adjusted in the following cases:

- Fading and weak AM reception.
- After installation of new antenna, feeder cable or radio receiver.

Before adjusting, be sure to check harness and antenna feeder cable connectors for proper connection.

1. Extend antenna completely.
2. Turn radio on, and turn volume control to increase speaker volume.
3. Push the AM selector button.
4. Tune in the weakest station (barely audible) on dial at the range around 14 (1,400 kHz).
5. Turn antenna trimmer to left or right slowly, and set it in the position where reception is strongest.

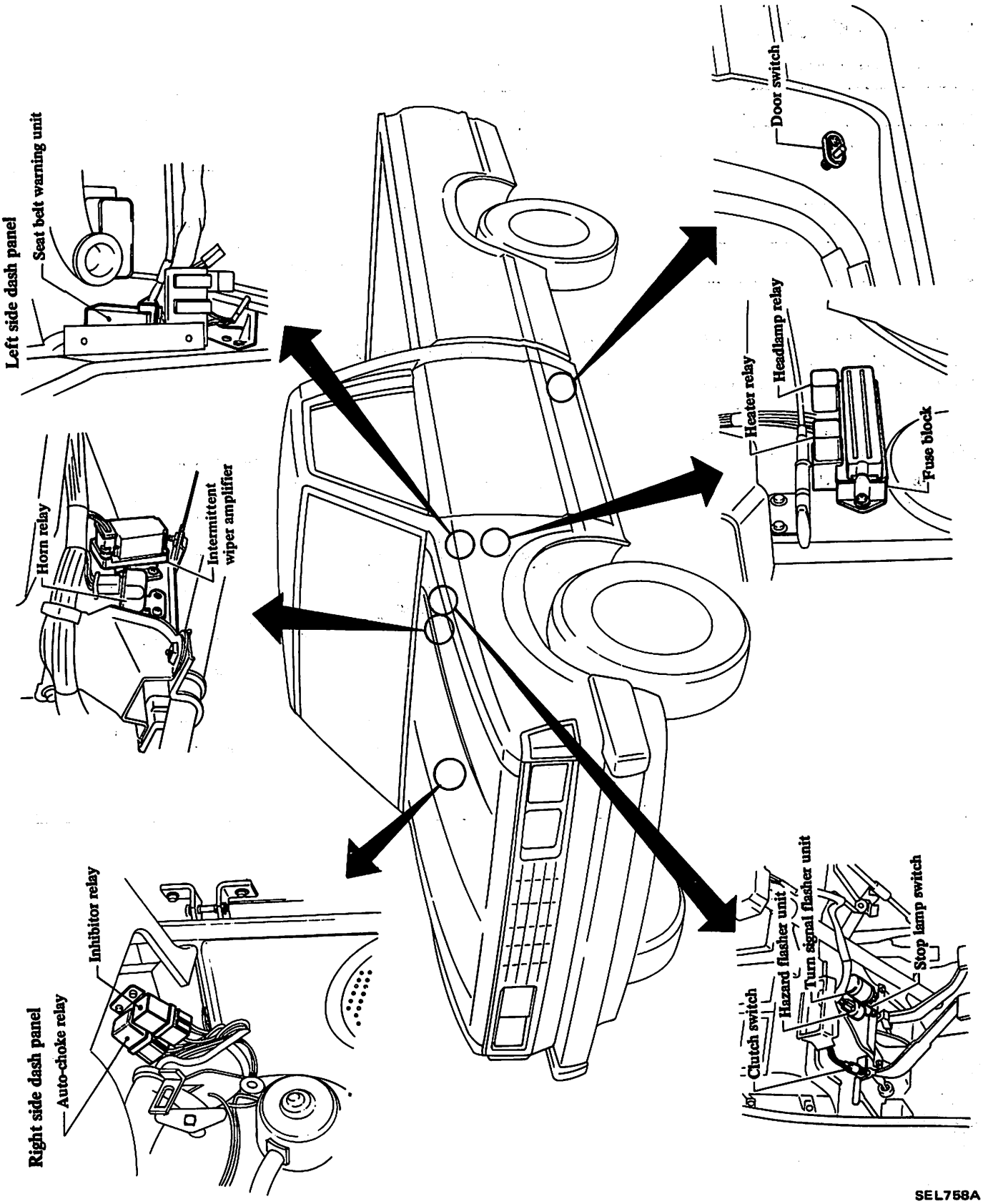


CAUTION:
Do not turn antenna trimmer more than one-half turn.

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LOCATION OF ELECTRICAL UNITS

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.



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WIRING HARNESS

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

CABLE COLORS

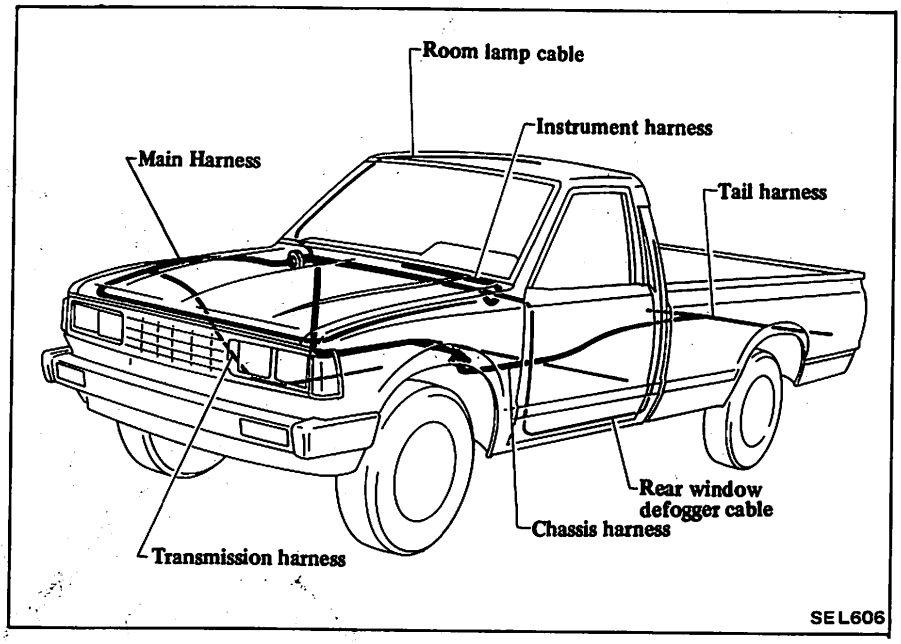
Cable colors are generally used as shown in the following table.

Circuit system	Base color	Circuit system	Base color
Starting and ignition system	B (Black)	Instrument system	Y (Yellow)
Changing system	W (White)	Others	L (Blue) Br (Brown) Lg (Light green)
Lighting system	R (Red)		
Signal system	G (Green)	Grounding circuit	B (Black)

The main cable of each system is generally coded with a single color. These colors are represented by such letters as G, W, or Br. Minor items of each circuit's terminal are coded with a two-tone color as follows:

BW : Black with white stripe
LgR: Light green with red stripe

WIRING HARNESS LAYOUT



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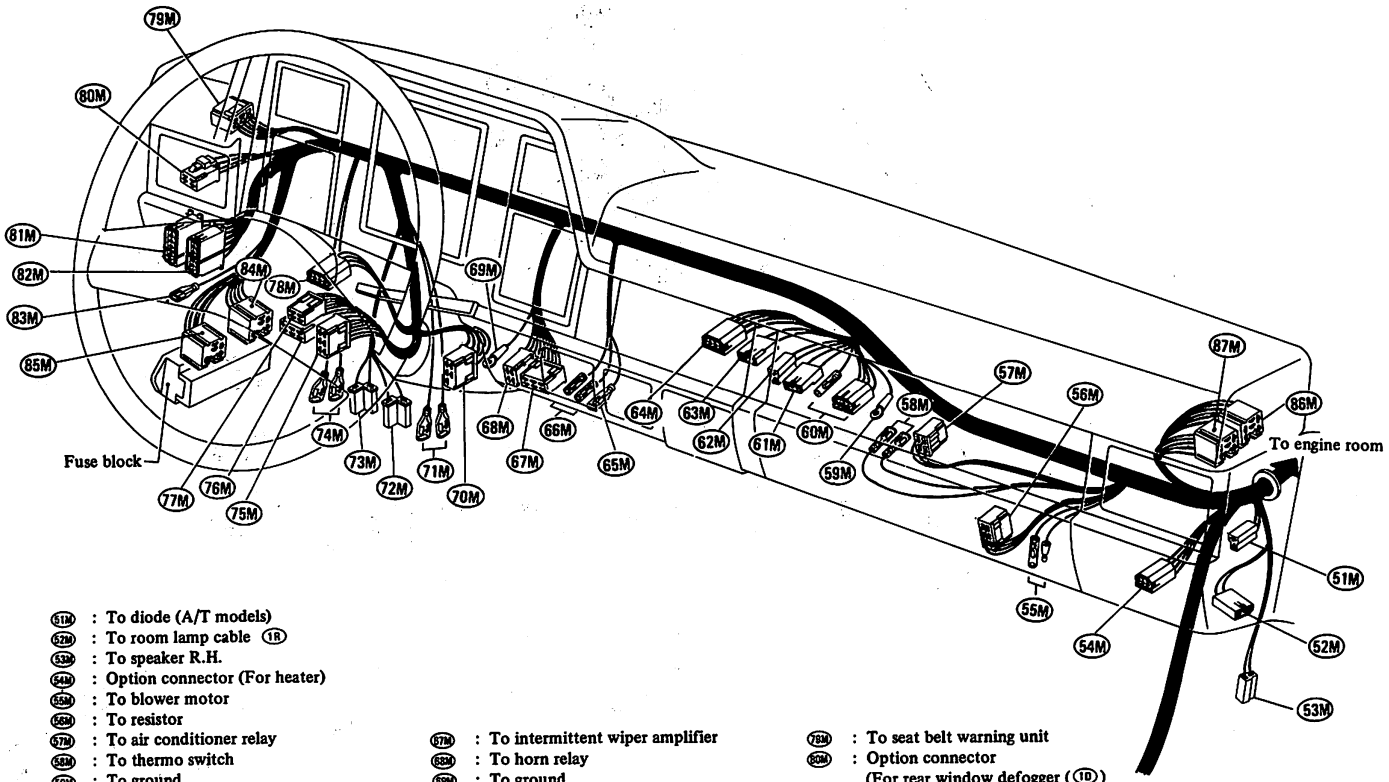
MAIN HARNESS (Engine room side)

(1M) : To F.I.C.D. solenoid
(2M) : To condenser
(3M) : To air conditioner compressor
(4M) : To distributor earth point (California models)
(5M) : To ignition coil
(6M) : To terminal block
(7M) : To resistor (Tachometer)
(8M) : To check connector
(9M) : To headlamp L.H. Type-2
(10M) : To headlamp L.H. Type-1
(11M) : To side marker lamp L.H.
(12M) : To front combination lamp L.H.
(13M) : To horn "Low"
(14M) : To distributor
(15M) : To distributor earth point (Non-California models)
(16M) : To headlamp R.H. Type-2
(17M) : To headlamp R.H. Type-1
(18M) : To side marker lamp R.H.
(19M) : To front combination lamp R.H.
(20M) : To horn "High"
(21M) : To transmission harness (3S)
(22M) : To transmission harness (2S)
(23M) : To fusible link
(24M) : To fusible link
(25M) : To low pressure switch
(26M) : To ground
(27M) : To transmission harness (M/T models) (1S)
(28M) : To transmission harness (A/T models) (1S)
(29M) : To windshield washer motor
(30M) : To vacuum switch
(31M) : To wiper motor
(32M) : To fuel cut solenoid and auto-choke heater

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MAIN HARNESS (Passenger compartment side-A)



51M : To diode (A/T models)
52M : To room lamp cable (1R)
53M : To speaker R.H.
54M : Option connector (For heater)
55M : To blower motor
56M : To resistor
57M : To air conditioner relay
58M : To thermo switch
59M : To ground
60M : To fan switch
61M : To heater and air conditioner control panel illumination lamp
62M : To compressor switch
63M : To air conditioner warning lamp
64M : To console harness (For voltmeter and oil pressure gauge) (4WD)
65M : To parking brake switch
66M : To kickdown switch (A/T models)

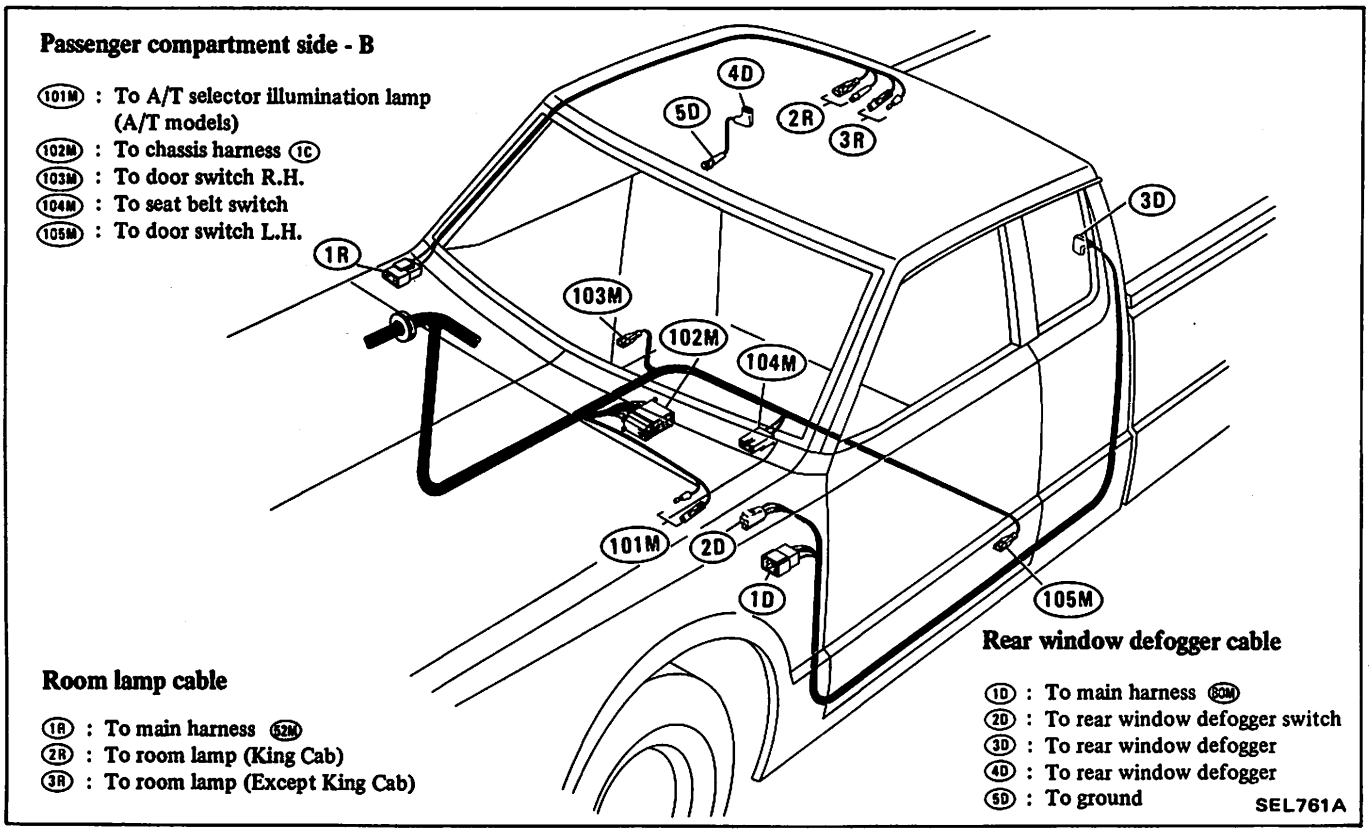
67M : To intermittent wiper amplifier
68M : To horn relay
69M : To ground
70M : To ignition switch
71M : To stop lamp switch
72M : To turn signal flasher unit
73M : To hazard flasher unit
74M : To clutch switch
75M : To wiper and washer switch
76M : To lighting switch
77M : To turn signal switch
78M : To hazard switch

78M : To seat belt warning unit
80M : Option connector (For rear window defogger (1D))
81M : To instrument harness (1I) (Connector color: White)
82M : To instrument harness (2I) (Connector color: Blue)
83M : To lock
84M : To headlamp relay
85M : To heater relay
86M : To auto-choke relay
87M : To inhibitor relay (A/T models)

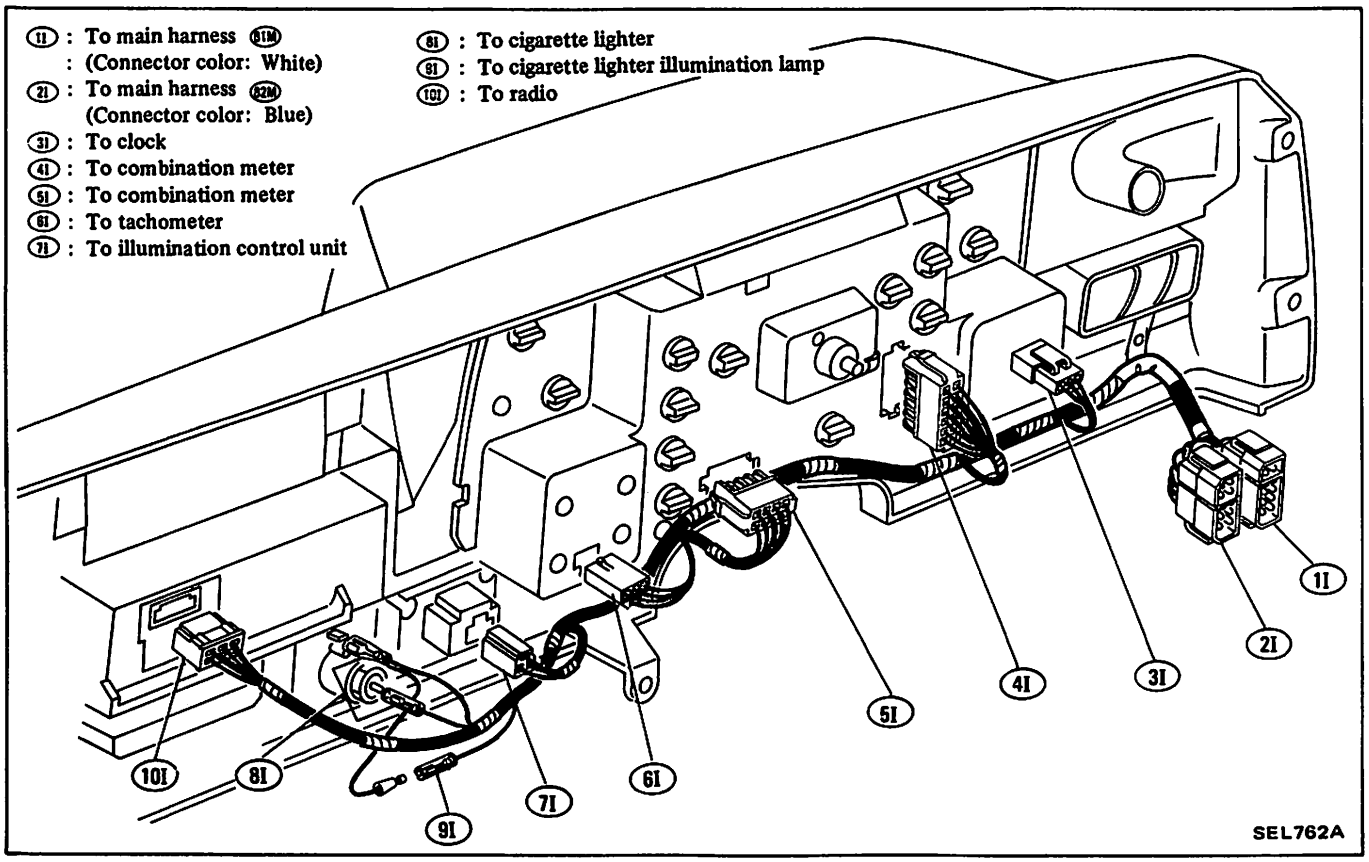
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MAIN HARNESS (Passenger compartment side-B), ROOM LAMP CABLE AND REAR WINDOW DEFOGGER CABLE



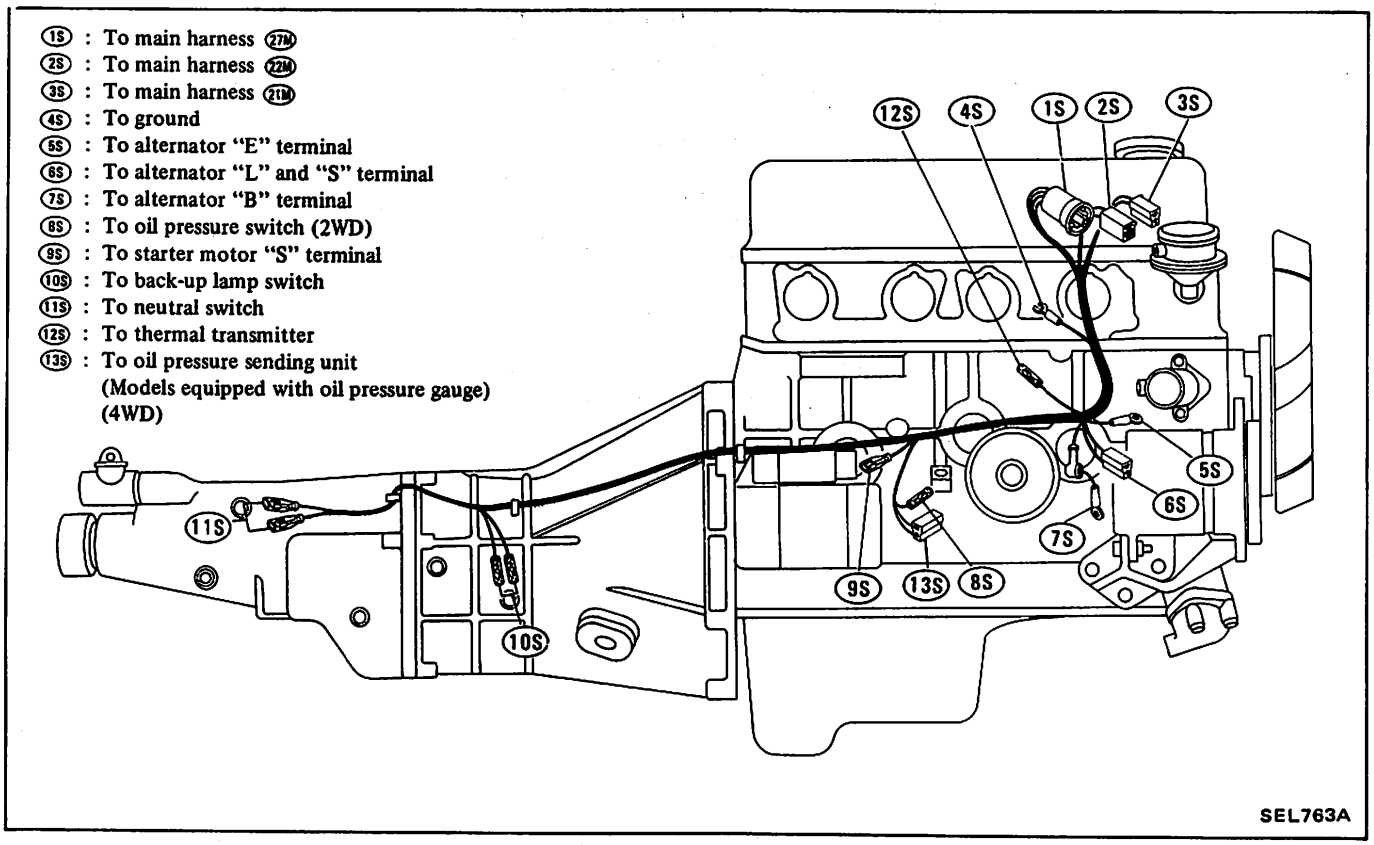
INSTRUMENT HARNESS



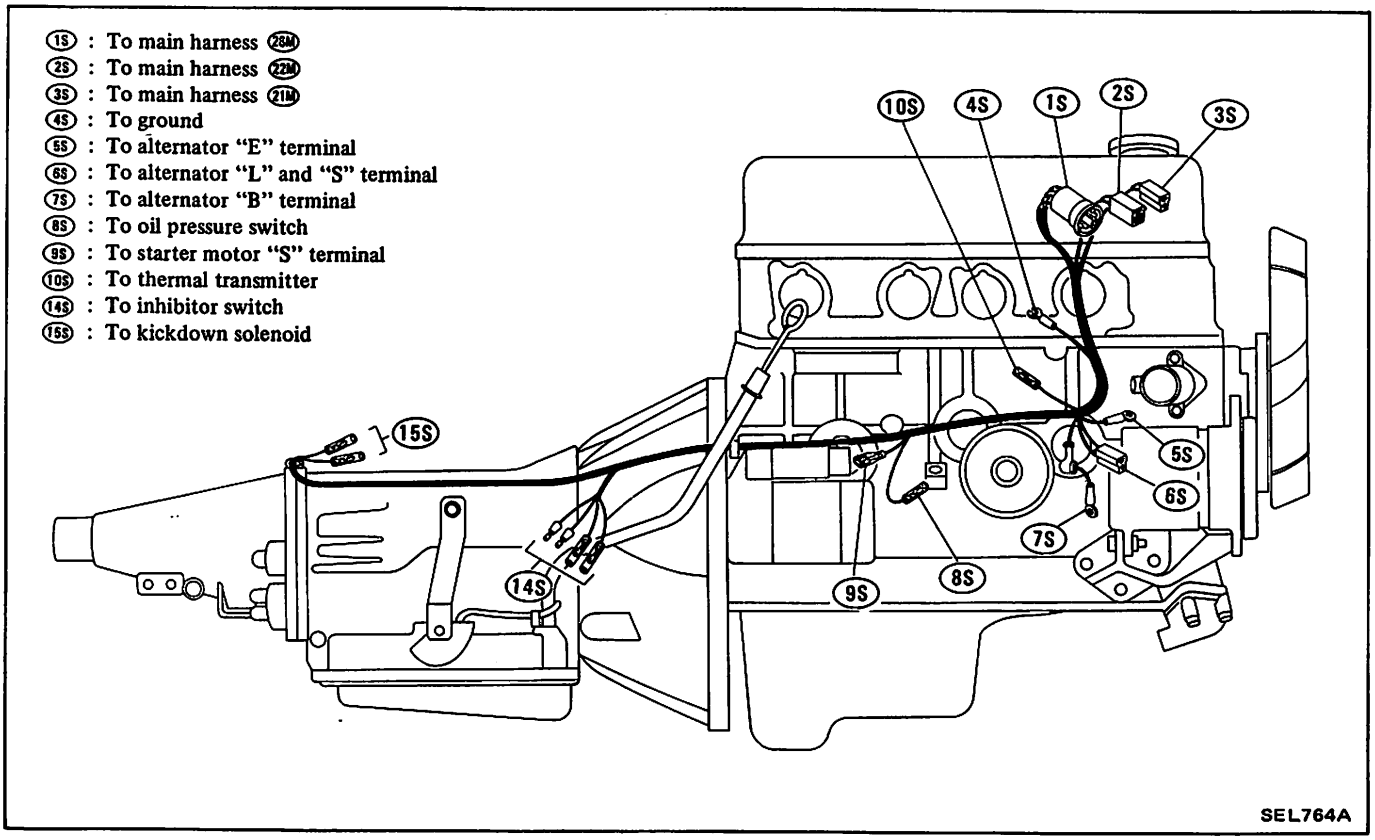
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TRANSMISSION HARNESS

Manual transmission models



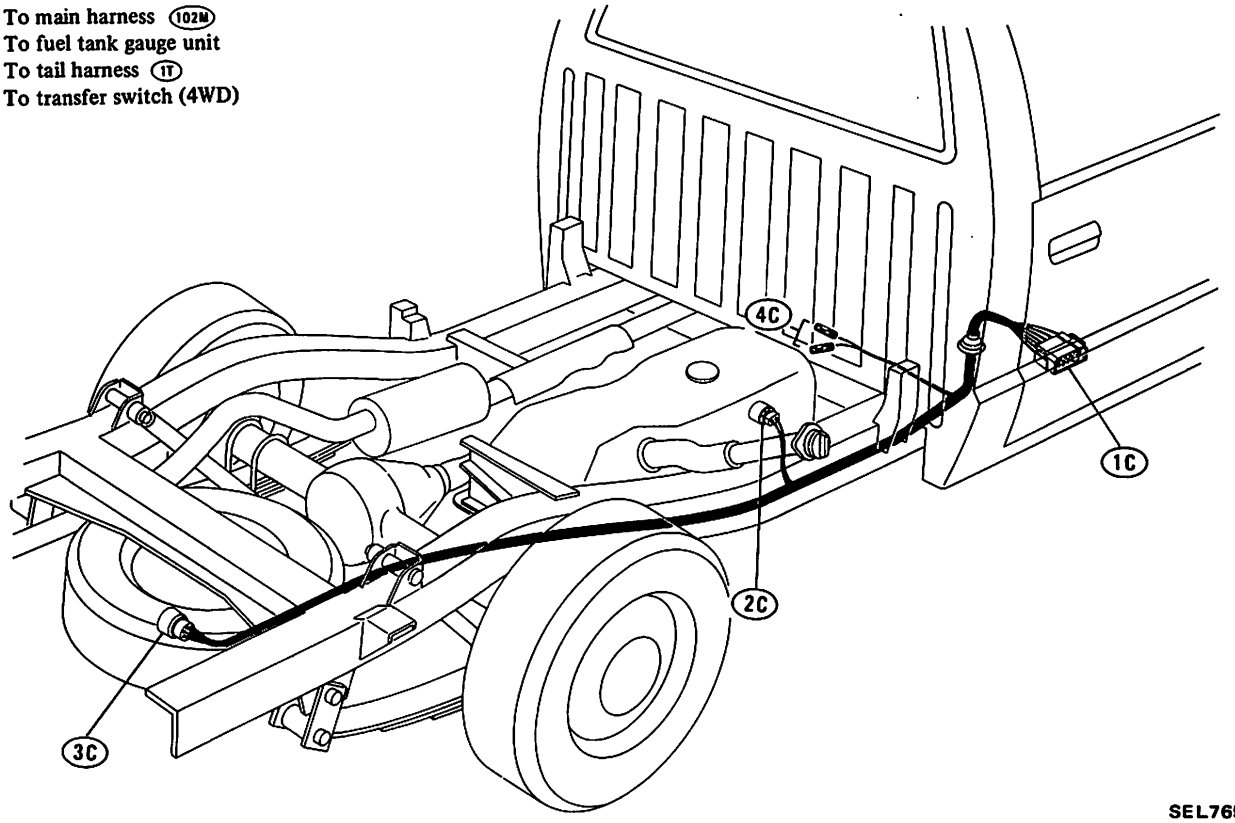
Automatic transmission models



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CHASSIS HARNESS

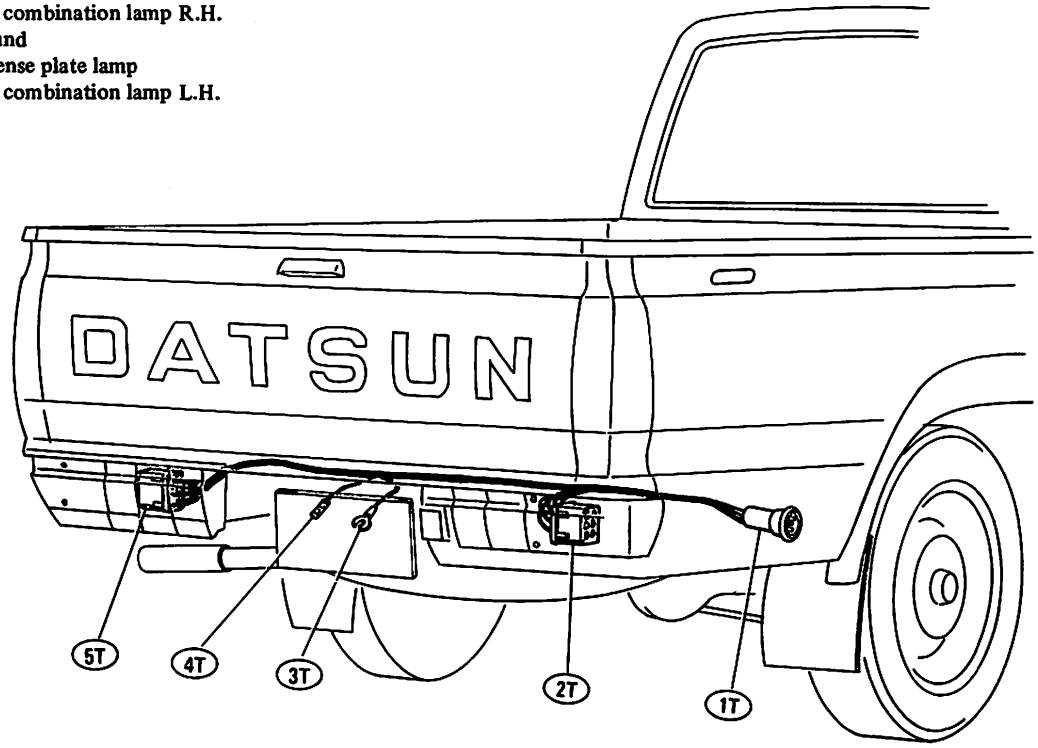
(1C) : To main harness (102M)
(2C) : To fuel tank gauge unit
(3C) : To tail harness (1T)
(4C) : To transfer switch (4WD)



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TAIL HARNESS

(1T) : To chassis harness (3C)
(2T) : To rear combination lamp R.H.
(3T) : To ground
(4T) : To lincense plate lamp
(5T) : To rear combination lamp L.H.



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INCH TO METRIC CONVERSION TABLE

(Rounded-off for automotive use)

inches	mm	inches	mm
.100	2.54	.610	15.49
.110	2.79	.620	15.75
.120	3.05	.630	16.00
.130	3.30	.640	16.26
.140	3.56	.650	16.51
.150	3.81	.660	16.76
.160	4.06	.670	17.02
.170	4.32	.680	17.27
.180	4.57	.690	17.53
.190	4.83	.700	17.78
.200	5.08	.710	18.03
.210	5.33	.720	18.29
.220	5.59	.730	18.54
.230	5.84	.740	18.80
.240	6.10	.750	19.05
.250	6.35	.760	19.30
.260	6.60	.770	19.56
.270	6.86	.780	19.81
.280	7.11	.790	20.07
.290	7.37	.800	20.32
.300	7.62	.810	20.57
.310	7.87	.820	20.83
.320	8.13	.830	21.08
.330	8.38	.840	21.34
.340	8.64	.850	21.59
.350	8.89	.860	21.84
.360	9.14	.870	22.10
.370	9.40	.880	22.35
.380	9.65	.890	22.61
.390	9.91	.900	22.86
.400	10.16	.910	23.11
.410	10.41	.920	23.37
.420	10.67	.930	23.62
.430	10.92	.940	23.88
.440	11.18	.950	24.11
.450	11.43	.960	24.38
.460	11.68	.970	24.64
.470	11.94	.980	24.89
.480	12.19	.990	25.15
.490	12.45	1.000	25.40
.500	12.70	2.000	50.80
.510	12.95	3.000	76.20
.520	13.21	4.000	101.60
.530	13.46	5.000	127.00
.540	13.72	6.000	152.40
.550	13.97	7.000	177.80
.560	14.22	8.000	203.20
.570	14.48	9.000	228.60
.580	14.73	10.000	254.00
.590	14.99	20.000	508.00
.600	15.24		

METRIC TO INCH CONVERSION TABLE

(Rounded-off for automotive use)

mm	inches	mm	inches
1	.0394	51	2.008
2	.079	52	2.047
3	.118	53	2.087
4	.157	54	2.126
5	.197	55	2.165
6	.236	56	2.205
7	.276	57	2.244
8	.315	58	2.283
9	.354	59	2.323
10	.394	60	2.362
11	.433	61	2.402
12	472	62	2.441
13	.512	63	2.480
14	.551	64	2.520
15	.591	65	2.559
16	.630	66	2.598
17	.669	67	2.638
18	.709	68	2.677
19	.748	69	2.717
20	.787	70	2.756
21	.827	71	2.795
22	.866	72	2.835
23	.906	73	2.874
24	.945	74	2.913
25	.984	75	2.953
26	1.024	76	2.992
27	1.063	77	3.031
28	1.102	78	3.071
29	1.142	79	3.110
30	1.181	80	3.150
31	1.220	81	3.189
32	1.260	82	3.228
33	1.299	83	3.268
34	1.339	84	3.307
35	1.378	85	3.346
36	1.417	86	3.386
37	1.457	87	3.425
38	1.496	88	3.465
39	1.535	89	3.504
40	1.575	90	3.543
41	1.614	91	3.583
42	1.654	92	3.622
43	1.693	93	3.661
44	1.732	94	3.701
45	1.772	95	3.740
46	1.811	96	3.780
47	1.850	97	3.819
48	1.890	98	3.858
49	1.929	99	3.898
50	1.969	100	3.937

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QUICK REFERENCE CHART: PICK-UP [ ] 1981

ENGINE TUNE-UP DATA

Item	Model	California 2WD	California 4WD	Non-California 2WD	Non-California 4WD	Canada 2WD	Canada 4WD
Engine model		Z22					
Firing order		1-3-4-2					
Idle speed rpm	M/T	650 ±100	800 ±100	650 ±100	800 ±100	650 ±100	800 ±100
	A/T	650 ±100 (in "D" position)					
Ignition timing * (degree B.T.D.C. at idle speed)		5 ±2°					
"CO" % at idle speed		Idle mixture screw is preset and sealed at factory.					
Fast idle adjustment (At 2nd cam step) mm (in)	M/T	0.81 - 0.95 (0.0319 - 0.0374)					
	A/T	0.98 - 1.12 (0.0386 - 0.0441)		1.00 - 1.10 (0.0394 - 0.0433)			
B.C.D.D. operating pressure [At sea level] kPa (mmHg, inHg)		−80.0 ±2.7 (−600 ±20, −23.62 ±0.79)					
Dash pot Touch speed rpm	M/T	–					
	A/T	1,400 - 1,600					
Vacuum break mm (in)		3.12 - 3.72 (0.1228 - 0.1465)		2.62 - 3.22 (0.1031 - 0.1268)			
Valve clearance (Hot) mm (in)	Intake	0.30 (0.012)					
	Exhaust	0.30 (0.012)					
Drive belt deflection [Applied pressed force 98 N (10 kg, 22 lb)] mm (in)		8 - 12 (0.31 - 0.47)					
Radiator cap relief pressure kPa (kg/cm², psi)		88 (0.9, 13)					
Cooling system leakage testing pressure kPa (kg/cm², psi)		157 (1.6, 23)					
Compression pressure kPa (kg/cm², psi)/rpm	Standard	1,177 (12.0, 171)/350					
	Minimum	883 (9.0, 128)/350					
High tension cable resistance kΩ		Less than 30					
Spark plug Type		BP6ES				BPR6ES	
Gap mm (in)		0.8 - 0.9 (0.031 - 0.035)					
Battery Type		N50Z				NS70	
Capacity V-AH		12 - 60				12 - 65	
Full charging specific gravity		1.26				1.28	
Distributor Vacuum advance [Maximum distributor degree/distributor kPa (mmHg, inHg)]	M/T Standard	17.5°/53.3 (400, 15.75)	10°/34.7 (260, 10.24)	17.5°/53.3 (400, 15.75)	15°/46.7 (350, 13.78)	17.5°/53.3 (400, 15.75)	15°/46.7 (350, 13.78)
	M/T Heavy duty	5°/33.3 (250, 9.84)	–	5°/33.3 (250, 9.84)	–	5°/33.3 (250, 9.84)	–
	A/T Standard	15°/46.7 (350, 13.78)	–	17.5°/53.3 (400, 15.75)	–	17.5°/53.3 (400, 15.75)	–
Centrifugal advance [Maximum distributor degree/distributor rpm]		6°/2,000					

Tightening torque	N-m	kg-m	ft-lb
Cylinder head	69 - 78	7.0 - 8.0	51 - 58
Rocker cover bolt	8 - 10	0.8 - 1.0	5.8 - 7.2
Manifold bolt and nut	16 - 21	1.6 - 2.1	12 - 15

* Ignition timing should be checked with distributor vacuum hose disconnected and plugged up.

BRAKE

Unit: mm (in)

Disc brake Pad minimum thickness	2.0 (0.079)
Rotor repair limit Runout	Less than 0.15 (0.0059)
Parallelism circumferential direction	Less than 0.07 (0.0028)
Minimum thickness	10.5 (0.413)
Drum brake Lining minimum thickness	1.5 (0.059)
Drum repair limit Maximum inner diameter	255.5 (10.06)
Radial runout	Less than 0.12 (0.0047)
Out-of-roundness	Less than 0.015 (0.0006)
Taper	Less than 0.02 (0.0008)

CLUTCH PEDAL

Unit: mm (in)

Height	171 - 177 (6.73 - 6.97)
Free play	1 - 5 (0.04 - 0.20)

WHEEL ALIGNMENT (Unladen*)

Item	Model	2WD	4WD
Camber	degree	0° - 1°	
Caster	degree	50' - 1°50'	1°10' - 2°10'
Toe-in	mm (in)	5 - 7 (0.20 - 0.28)	
	degree	14' - 19' (On both sides)	
Turning angle	degree		
Toe-out-turns (Inside/Outside)		20°/18°	18.5°/18°
Inside		34° - 36°	29° - 33°
Outside		30° - 32°	27° - 29°

*: Tankful of fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools, mats in designed position.

FRONT WHEEL BEARING

Item	Model	2WD	4WD
Tightening torque	N-m (kg-m, ft-lb)	34 - 39 (3.5 - 4.0, 25 - 29)	147 - 196 (15 - 20, 108 - 145)
Return angle	degree	45°	–
Preload (At hub bolt)	N (kg, lb) New seal	Less than 28.4 (2.9, 6.4)	9.8 - 42.2 (1.0 - 4.3, 2.2 - 9.5)
	N (kg, lb) Used seal	Less than 11.8 (1.2, 2.6)	

WHEEL AND TIRE

Item	Model	2WD			4WD	
Applied Model		Regular Bed & Long Bed	King Cab	Heavy duty	Regular Bed & Long Bed	King Cab
Tire size		7.00-14(B)	185SR14(B)	195SR14(B)	E78-14LT(D)	G78-15(B)	GR78-15(B)
Inflation pressure* psi (kPa, kg/cm²) Moderate Load	Front	22 (152, 1.55)	24 (165, 1.7)	24 (165, 1.7)	26 (179, 1.8)	28 (193, 2.0)	
	Rear				40 (275, 2.8)		
Heavy Load	Front	22 (152, 1.55)	24 (165, 1.7)	24 (165, 1.7)	26 (179, 1.8)	28 (193, 2.0)	
	Rear	32 (221, 2.25)	32 (221, 2.25)	28 (193, 2.0)	60 (414, 4.25)		
Wheel nut tightening torque N-m (kg-m, ft-lb)		118 - 147 (12 - 15, 87 - 108)					

*: Tire pressure should be checked when tires are COLD.

REFILL CAPACITIES

				Liter	US measure
Fuel tank		Standard wheelbase (including King Cab)	2WD	50	13-1/4 gal
			4WD	60	15-7/8 gal
		Long wheelbase	2WD	64	16-7/8 gal
			4WD	75	19-7/8 gal
Coolant	M/T	With heater		10.2	10-3/4 qt
		Without heater		9.5	10 qt
	A/T	With heater		10.1	10-5/8 qt
		Without heater		9.4	10 qt
Engine oil		With oil filter	2WD	4.4	4-5/8 qt
			4WD	4.2	4-1/2 qt
		Without oil filter	2WD	3.9	4-1/8 qt
			4WD	3.7	3-7/8 qt
Transmission		M/T	4-speed	1.7	3-5/8 pt
			5-speed	2.0	4-1/4 pt
		A/T		5.5	5-7/8 qt
Transfer unit				1.4	3 pt
Differential carrier		Front	R180	1.0	2-1/8 pt
		Rear	H190	1.25	2-5/8 pt
Steering gear				0.33	3/4 pt
Windshield washer tank				1.85	2 qt
Air conditioning system		Compressor oil		0.15 139 g	5.1 fl oz 4.9 oz
		Refrigerant		0.7 - 0.9 kg	1.5 - 2.0 lb

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