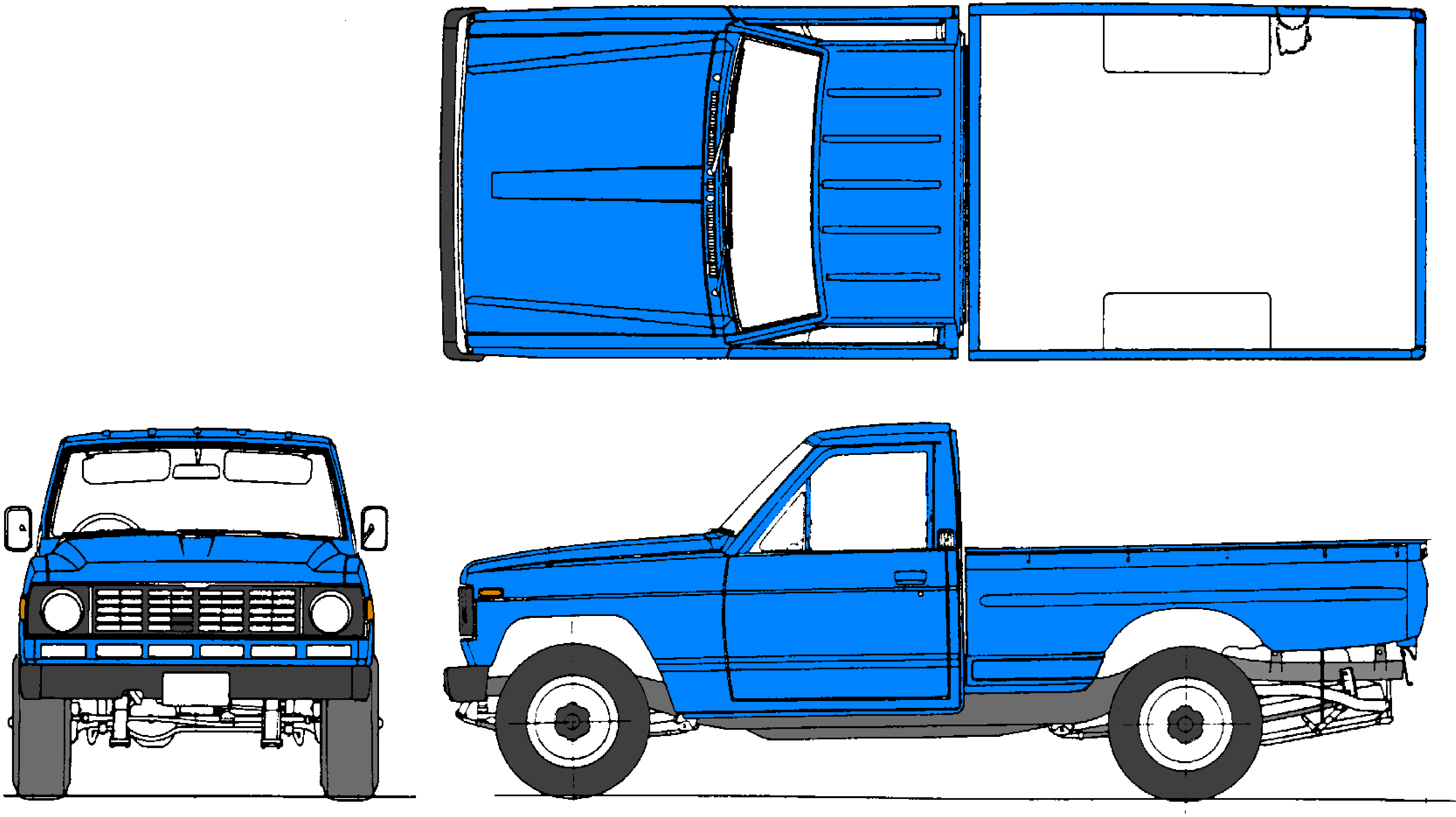

NISSAN/DATSUN

SERVICE MANUAL

MODEL 160 & 61 SERIES

THE NAME OF QUALITY

NISSAN

NISSAN MOTOR CO.,LTD

NISSAN

DATSUN

英

EXPORT SERVICE DEPARTMENT
NISSAN MOTOR CO., LTD.
17-1, Ginza 6-Chome, Chuo-ku, Tokyo 104, Japan

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英

NISSAN

Model
160 & 61 Series

FOREWORD

This service manual has been prepared primarily for the purpose of assisting service personnel in providing effective service and maintenance of the model 160 & 61 series.

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 vehicle 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.

QUICK REFERENCE INDEX

HOW TO USE THIS MANUAL

- This Service Manual is designed as a guide for servicing vehicles.

- This manual is divided into 21 sections and deals with the engine, chassis, body and the electric system.

- This manual does not include material on the diesel engine. For information concerning the diesel engine, please refer to the following manual.
  - NISSAN/DATSUN SERVICE MANUAL MODEL SD22 & SD33 DIESEL ENGINE

- 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.

- 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.

- In the text, the following abbreviations are used:

S.D.S.:	Service Data and Specifications	L.H., R.H.:	Left Hand, Right Hand
Ⓣ:	Tightening Torque	M/T, A/T :	Manual Transmission, Automatic Transmission

- 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.

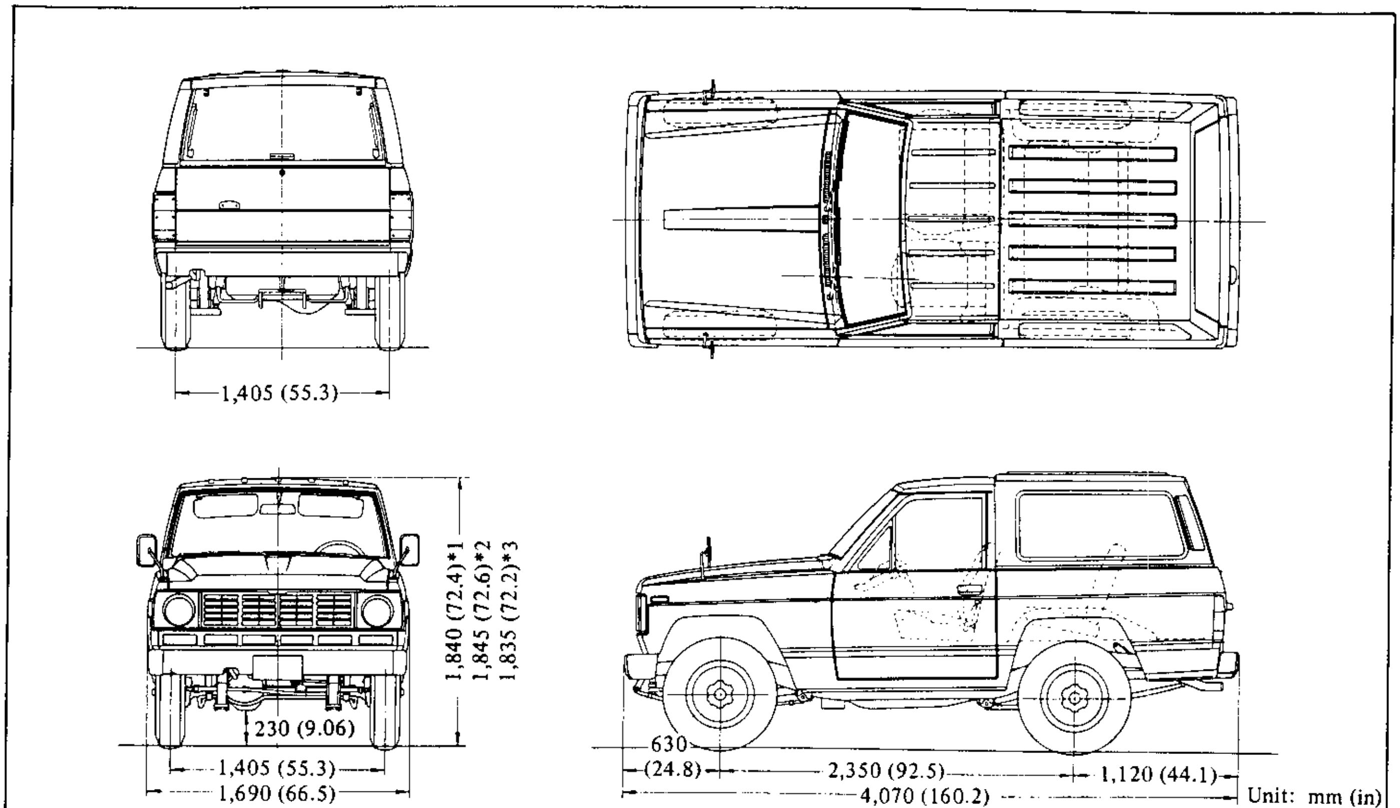
GENERAL INFORMATION

SECTION GI

CONTENTS

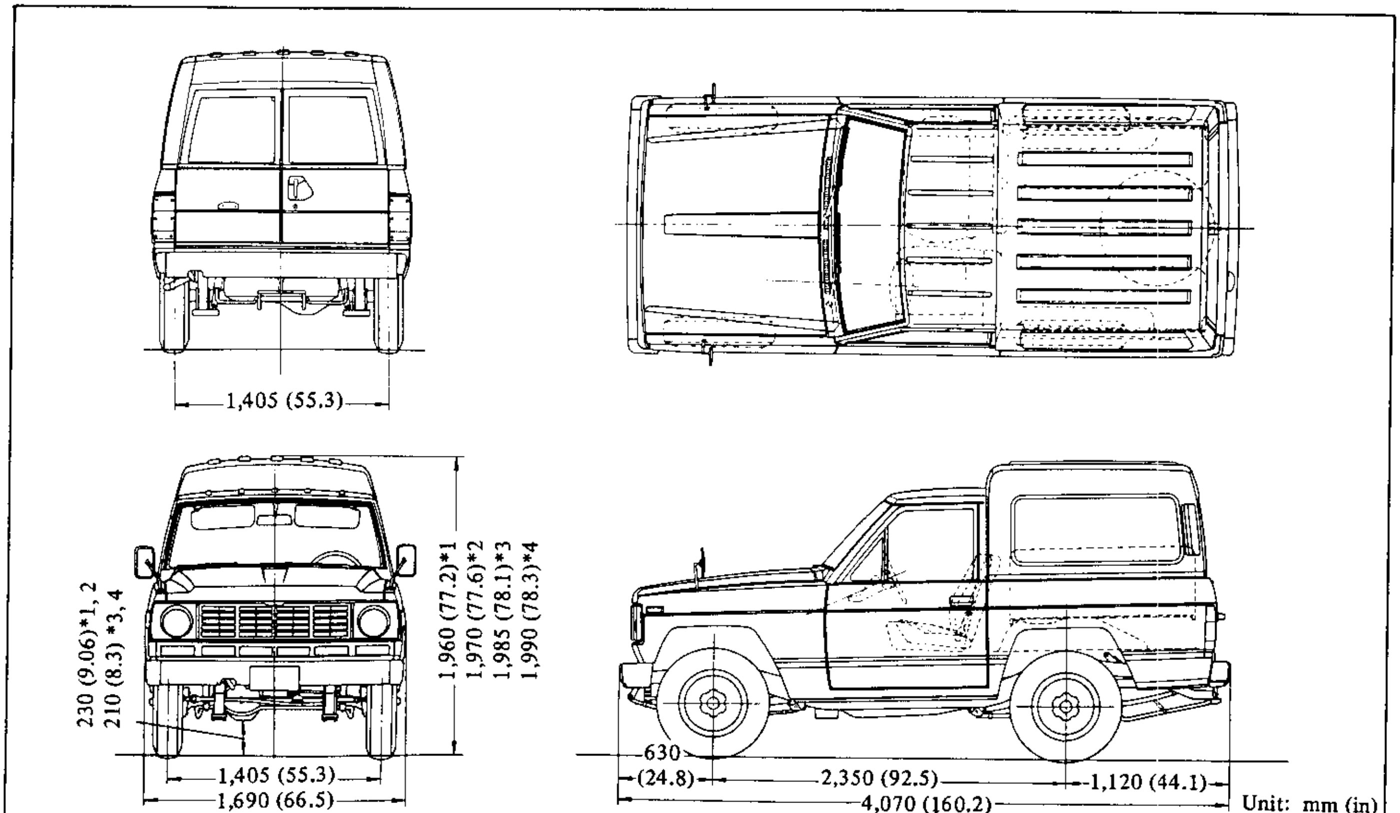
GENERAL VIEWS

Hardtop



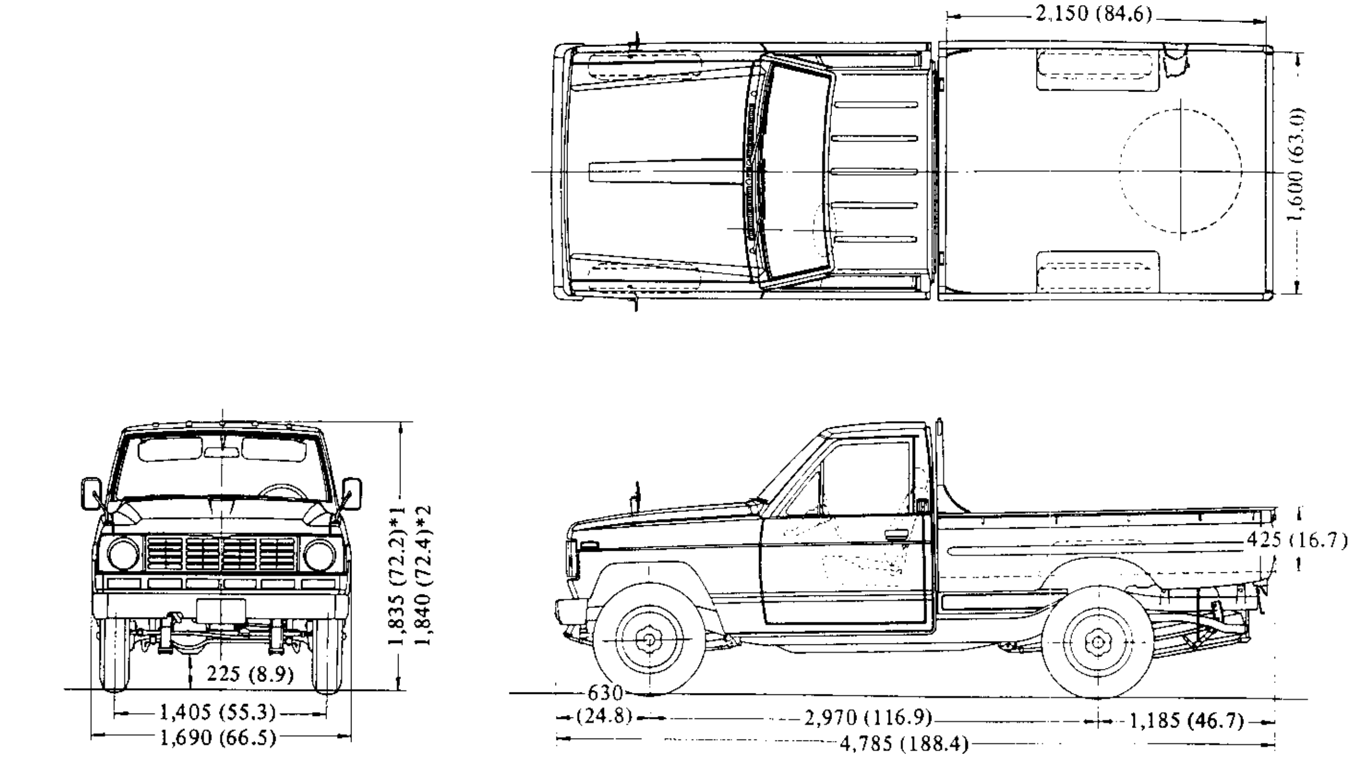
*1 All area P40 engine *2 General area SD33 and L28 engine, Europe SD33 engine *3 Europe L28 engine SGI053

High-roof Hardtop



*1 P40 engine-Light duty *2 SD33, L28 engine-Light duty *3 P40 engine-Heavy duty *4 SD33, L28 engine-Heavy duty SGI054

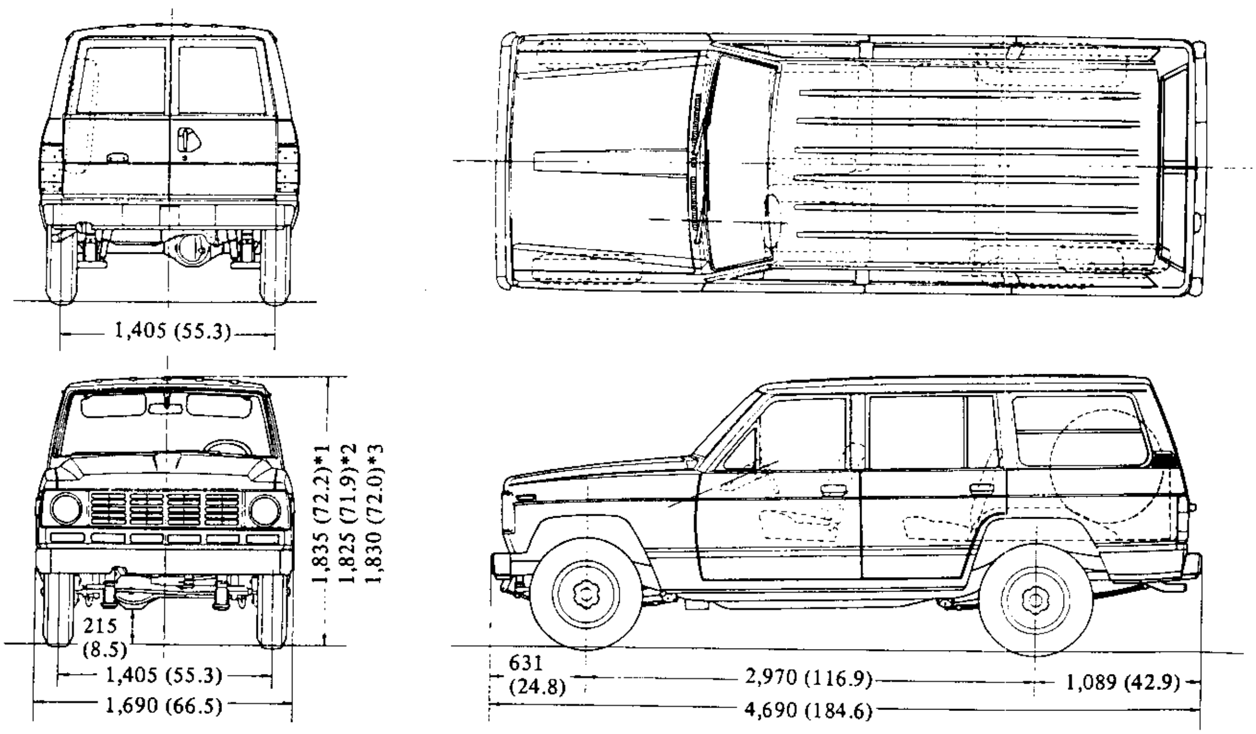
Pick-up



*1 P40 and SD33 engine *2 L28 engine

Unit: mm (in)
SG1055

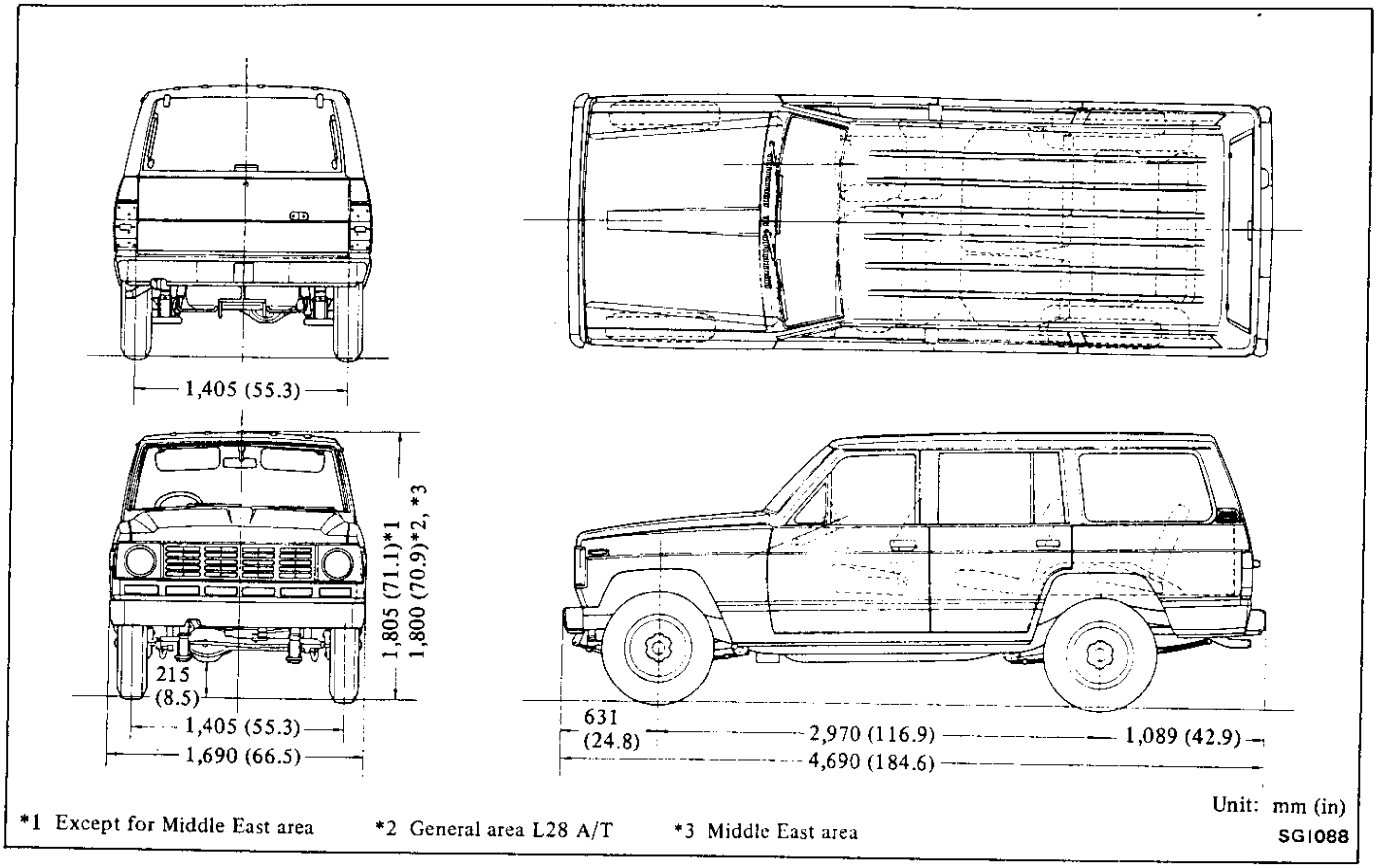
Van



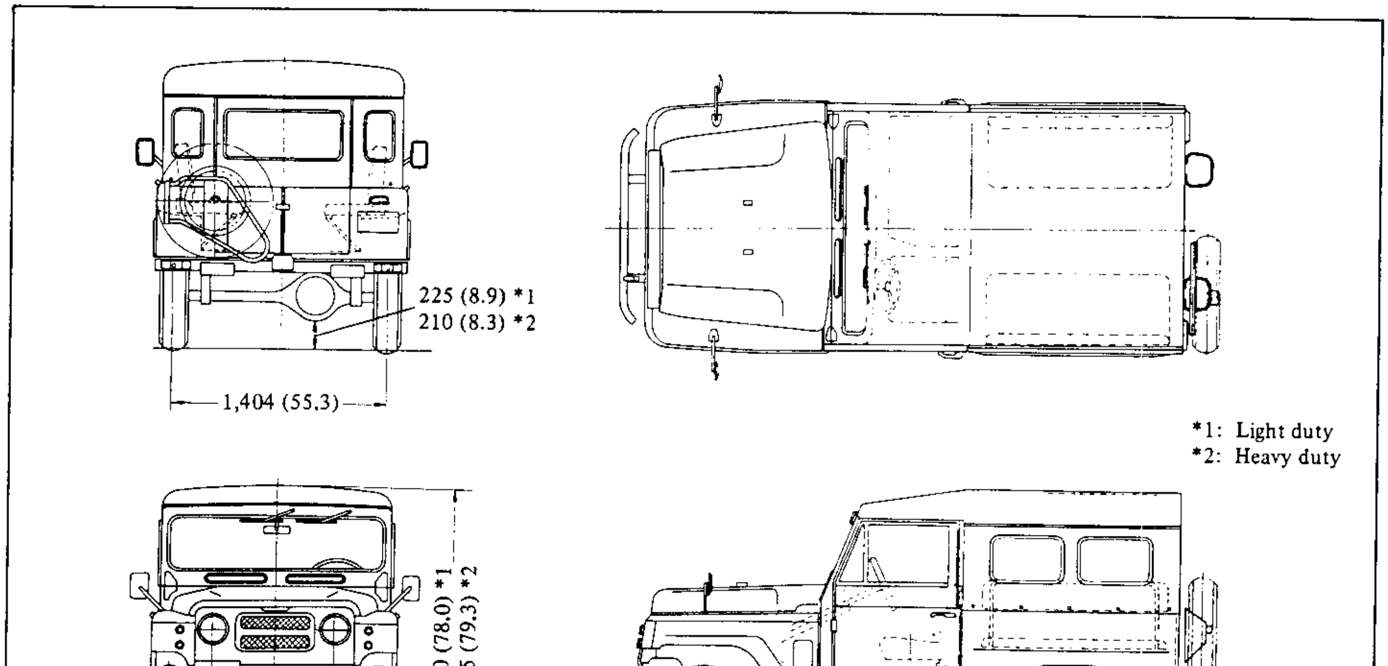
*1 General area *2 General area L28 A/T *3 Middle East area

Unit: mm (in)
SG1087

Station wagon



Canvas Top



MODEL VARIATION

Prefix and suffix designations

160 Series

X X X X 160 X X X X X

K : Hardtop
T : Hardtop*
U : Pick-up
J : High-roof Hardtop
V : Van
W : Station Wagon

□ : P40 Engine
L : L28 Engine
R : SD33 Engine

□ : R.H. drive model
L : L.H. drive model

□ : W.B. 2,350 mm (92.5 in)
G : W.B. 2,970 mm (116.9 in)

* : without rear seat (For Europe)

□ : Light duty model
G : Heavy duty model

□ : Deluxe
S : Standard

□ : M/T
K : A/T

A : Chassis "A"

□ : L.H. drive model
U : R.H. drive model
R : For Middle East
Q : For Europe

61 Series

X X 61 X X

□ : R.H. drive model
L : L.H. drive model

G : W.B. 2,500 mm (98.4 in)

□ : Light duty model
H : Heavy duty model

U : R.H. drive model

□ : means no indication.
W.B. : Wheelbase

		Model: L.H. drive	Model: R.H. drive	Wheelbase mm (in)	Engine	Trans-mission	Transfer	Differential carrier (Front/Rear): Model	Differential carrier (Front/Rear): Gear ratio	Road wheel: Size	Road wheel: Offset mm (in)
General area	Hardtop	KL160S	K160SU	2,350 (92.5)	P40	F4W81A	T130A	C200/ C200	3.364	STD: 4.50Ex16 5.50Fx16SDC (opt) DX: 5.50Fx16SDC	30 (1.18)
		KL160	K160U								
		KRL160S	KR160SU		SD33				4.111		
		KRL160	KR160U								
		KML160S	KM160SU		L28				4.375		
		KML160	KM160U								
	High-roof Hardtop	JL160S	J160SU		P40			C200/ C200	3.364	Light duty model: 4.50Ex16 5.50Fx16SDC (opt) Heavy duty model: Front: 4.50Ex16 5.50Fx16SDC (opt) Rear: 5.50Fx16SDC	
		JL160GS	J160GSU					C200/ H233B	4.111		
		JRL160S	JR160SU		SD33			C200/ C200	4.111		
		JRL160GS	JR160GSU					C200/ H233B	4.625		
		JML160S	JM160SU		L28			C200/ C200			
		JML160GS	JM160GSU					C200/ H233B			
	Pick-up	ULG160GS	UG160GSU	2,970 (116.9)	P40				4.111	5.50Fx16SDC	
		ULG160GSA	UG160GSAU								
		URLG160GS	URG160GSU		SD33				4.625		
		URLG160GSA	URG160GSAU								
		UMLG160GS	UMG160GSU		L28		T100L		4.625		
		UMLG160GSA	UMG160GSAU								
	Van	VLG160GS	VG160GSU		P40		T130A		3.900	STD: Front 4.50Ex16 5.50Fx16SDC (opt) Rear 5.50Fx16SDC DX: 5.50Fx16SDC	
		VRLG160GS	–		SD33				4.625		
		VMLG160GS	VMG160GSU		L28		T100L				
		VMLG160GK	VMG160GKU			3N71B					
	Station Wagon	WLG160G	WG160GU		P40	F4W81A	T130A		3.900	4.50Ex16 5.50Fx16SDC (opt)	
		WMLG160G	WMG160GU		L28		T100L		4.625		
		WMLG160GK	WMG160GKU			3N71B				5.50Fx16SDC	
	Canvas Top	LG61	G61U	2,500 (98.4)	P40	F4W81A	T130A	C200/ C200	3.364	4.50Ex16 5.00Ex16 (opt) 5.50Fx16SDC (opt)	
		LG61H	G61H					C200/ H233B	4.111		
Middle East area	Hardtop	KL160R	–	2,350 (92.5)	P40	F4W81A	T130A	C200/ C200	3.364	4.50Ex16 5.50Fx16SDC (opt)	
		KML160R			L28				4.375		
	High-roof Hardtop	JL160GR			P40			C200/ H233B	3.900	Front: 4.50Ex16 5.50Fx16SDC (opt) Rear: 5.50Fx16SDC	
		JML160GR			L28				4.625		
	Pick-up	ULG160GR		2,970 (116.9)	P40				3.900	5.50Fx16SDC	
		UMLG160GR			L28		T100L		4.875		
	Van	VLG160GR			P40		T130A		3.900		
		VMLG160GR			L28		T100L		4.625		
	Station Wagon	WLG160GR			P40		T130A		3.900		
		WMLG160GR			L28		T100L		4.625		
	Canvas Top	LG61		2,500 (98.4)	P40		T130A	C200/ C200	3.364	4.50Ex16 5.00Ex16 5.50Fx16SDC } opt	
		LG61H						C200/ H233B	4.111		
Europe	Hardtop	KL160Q	–	2,350 (92.5)	P40	F4W81A	T130A	C200/ C200	3.364	5.50Fx16SDC	
		KRL160Q	KR160Q		SD33				4.111		
		TRL160LQ	–								
		KML160Q	KM160Q		L28				4.375		
	Pick-up	URLG160GQ	URG160GQ	2,970 (116.9)	SD33			C200/ H233B	4.625		
	Station Wagon	WRLG160GQ	WRG160GQ								
		WMLG160GQ	WMG160GQ		L28		T100L				

Tire size, pattern, valve size																										
6.50-16-6PRLT L TR15	6.50-16-6PRLT L TR15	6.50-16-6PRLT R&L JS75	6.50-16-6PRLT R&L JS75		6.50-16-10PRLT R&L JS75	6.50-16-6PRLT R&L TR15		6.50-16-6PRLT G JS75	6.50-16-6PRLT G JS75		6.50-16-6PRLT G TR15	6.50-16-6PRLT G TR15		7.00-16-6PRLT L TR15	7.00-16-6PRLT R TR15	7.00-16-6PRLT R&L TR15	7.00-16-6PRLT G TR15	7.00-16-6PRLT R&L JS75	7.00-16-6PRLT SN TR15	7.50-16-6PRLT R&L JS75	7.50-16-6PRLT R&L JS75		7.50R16C-8PRLT M&S JS75	7.50R16C-8PRLT SA JS75	205R16C-8PRLT M&S JS75	Front
	6.50-16-8PRLT L TR15		6.50-16-8PRLT R&L JS75	6.50-16-10PRLT R&L JS75		6.50-16-8PRLT R&L TR15	6.50-16-10PRLT R&L TR15		6.50-16-8PRLT G JS75	6.50-16-10PRLT G JS75		6.50-16-8PRLT G TR15	6.50-16-10PRLT G TR15					7.00-16-10PRLT R&L JS75			7.50-16-8PRLT R&L JS75	7.50-16-10PRLT R&L JS75				Rear
			*2			*1			*2			•									*2		*2	*2		
			*1						•												*1		*1	*1		
			*2			*1			*2			•									*2		*2	*2		
			*1						•												*1		*1	*1		
			*2			*1			*2			•									*2		*2	*2		
			*1						•												*1		*1	*1		
			*2			*1			*2			•									*2		*2	*2		
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			*2			*1			*2			•									*2		*2	*2		
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		*2			•			*2			*1												*2	*2		
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*1											•			*3	*3	*3	*3		*3	*2						
	•													*3	*3	*3	*3		*3	*2						
			*2			•			*2			*1									*2		*2	*2		
				*2			•			*2			*1									*2	*2	*2		
																		•				*1	*1	*1		
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*1											•			*3	*3	*3	*3		*3	*2						
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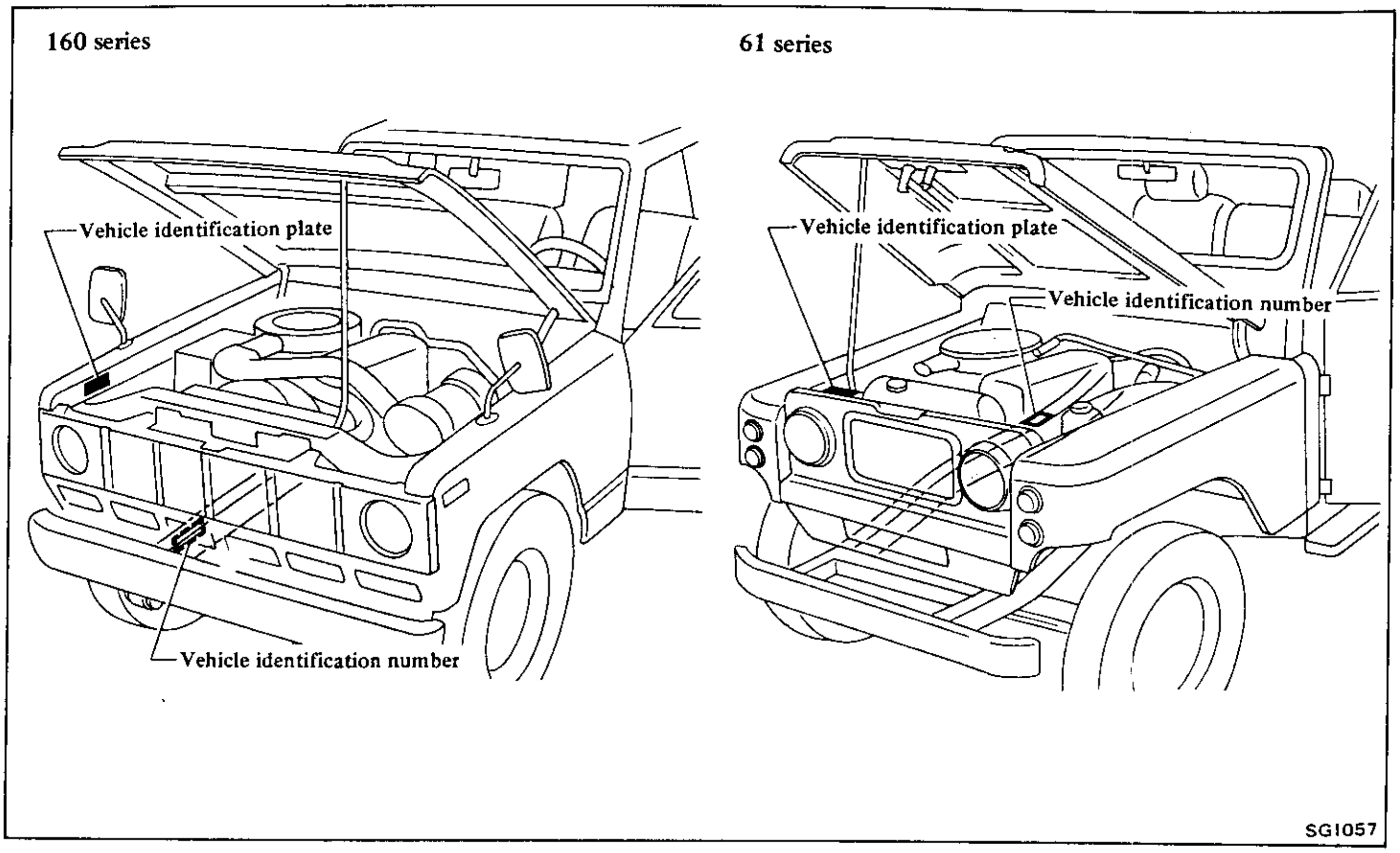
			•																						*1	
			•																						*1	
			*1																						•	
																		•							*1	
		•																							*1	
		•																							*1 *4	

L: Lug
R: Rib
G: Grip
SA: Sand
SN: Snow
R&L: Rib & lug
M&S: Mud & snow
•: Standard equipment
Opt: Option
*1: Option (With standard road wheel)
*2: Option (With road wheel size 5.50F×16SDC as a set)
*3: Option (With road wheel size 5.00E×16SDC as a set)
*4: For West Germany, Standard equipment

IDENTIFICATION NUMBER



VEHICLE IDENTIFICATION NUMBER (Chassis number)

Prefix and suffix designations

URG160 – XXXXXX

G61 – XXXXX

- K : Hardtop
- J : High-roof Hardtop
- U : Pick-up
- V : Van
- W : Station Wagon
- □ : P40 engine
- R : SD33 engine
- M : L28 engine
- □ : W.B. 2,350 mm (92.5 in)
- G : W.B. 2,970 mm (116.9 in)
  W.B. 2,500 mm (98.4 in)

Model

Vehicle identification number (Chassis number)

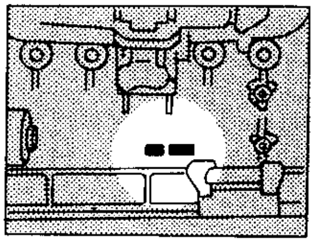
□ : means no indication

W.B. : Wheelbase

ENGINE SERIAL NUMBER

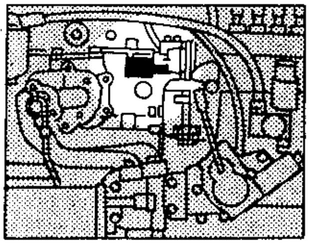
The engine serial number is stamped on the right side of the cylinder block for gasoline engine and on the left side for diesel engine.

Gasoline engine



SG1059

Diesel engine

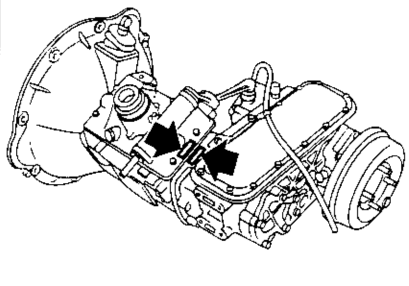


SG1060

MANUAL TRANSMISSION AND TRANSFER NUMBER

The transmission serial number is stamped on the upper face of the transmission gear cover.

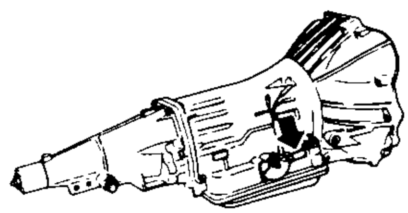
The transfer serial number is stamped on the upper face of the transfer case.



SG1061

AUTOMATIC TRANSMISSION NUMBER

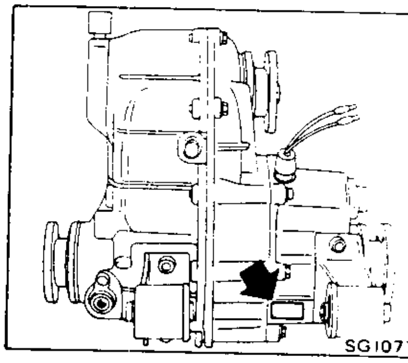
The transmission serial number plate is attached on the right-hand side of the transmission case.



AT344

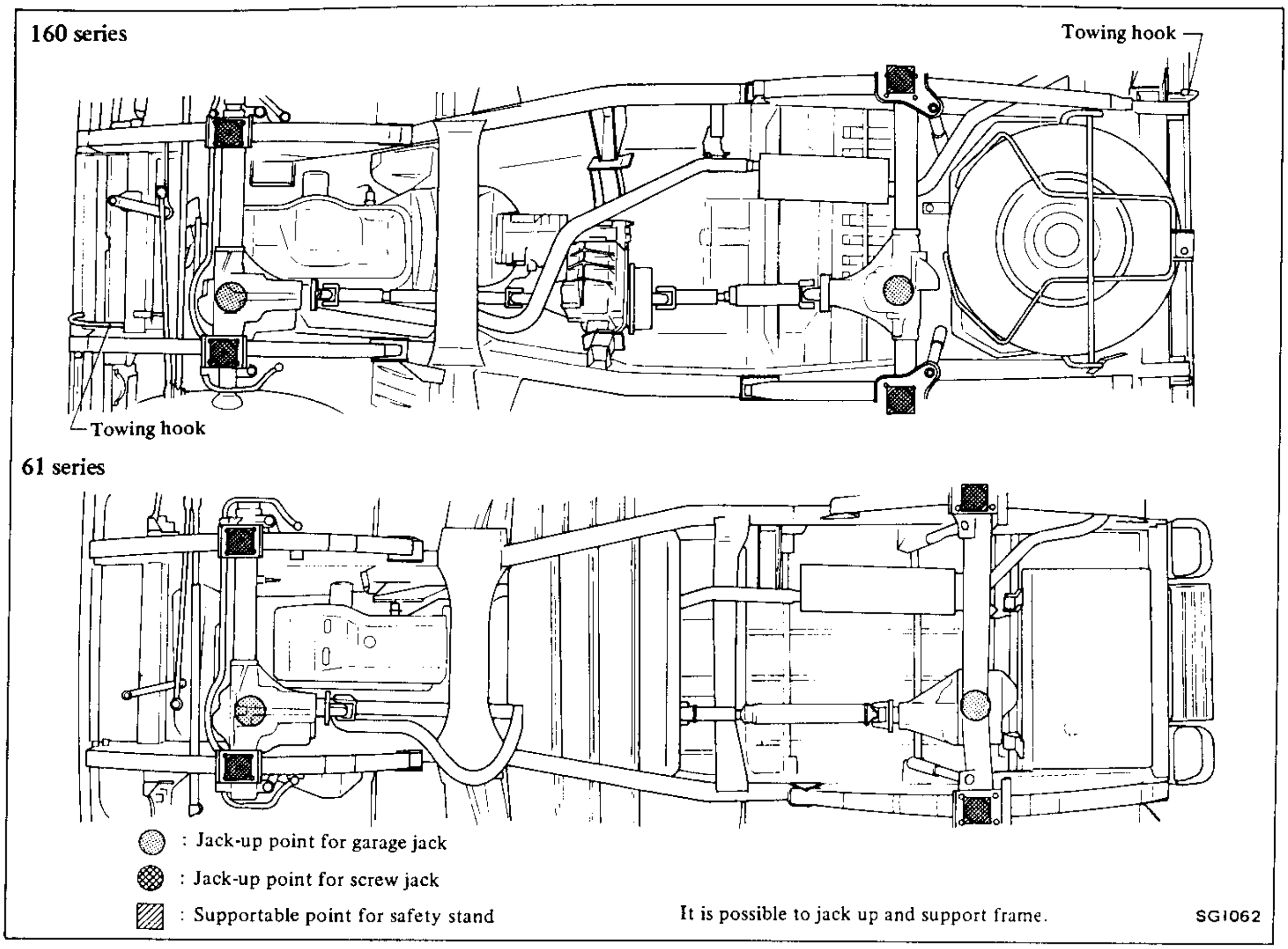
T100L TRANSFER NUMBER

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



SG1077

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, spring seat 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 above 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 above in a safe manner.

TIE-DOWN

FRONT SIDE

Use front spring shackle for tie-down.

REAR SIDE

Use rear spring shackle for tie-down.

TOWING

CAUTION:

a. The leaf spring should not be used for towing.
b. Before towing, make sure that the transfer, axles, steering system and power train are in good order. If any unit is damaged, a dolly must be used.
c. If the transfer is inoperative, two the vehicle with the rear wheels off the ground, or with the propeller shaft removed.
d. 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.
e. Release the parking brake and set the gearshift and transfer control levers in "Neutral" position before starting to tow the vehicle.
f. Set the free-running hubs at the "FREE" position if equipped.

SPECIAL SERVICE TOOLS

Special Tools play very important role in the maintenance 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	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

SECTION MA

CONTENTS

PRE-DELIVERY INSPECTION ITEMS

Shown below are Pre-delivery Inspection Items required for the new vehicle. It is recommended that necessary items other than those listed here be added, paying due regard to the conditions in each country.

UNDERHOOD -engine off

- Radiator coolant level and coolant hose connections for leaks
- Battery fluid level, specific gravity and conditions of battery terminals
- Drive belts tension
- Fuel filter for water or dusts, and fuel lines and connections for leaks
- Engine oil level and oil leaks
- Clutch and brake reservoir fluid level and fluid lines for leaks
- Windshield and rear window washer reservoir fluid level

ON INSIDE AND OUTSIDE

- Operation of all instruments, gauges, lights and accessories
- Operation of horn(s), wiper and washer
- Steering lock for operation
- Check air conditioner for gas leaks
- Front and rear seats and seat belts for operation
- All moldings, trims and fittings for fit and alignment
- All windows for operation and alignment
- Hood, door panels for fit and alignment
- Latches, keys and locks for operation
- Weatherstrips for installation and fit
- Headlight aiming
- Tighten wheel nuts
- Tire pressures
- Check front wheels for side slip
- Check position of free-running hubs

UNDERBODY

- Manual transmission, transfer and differential gear oil level
- Brake and fuel lines for leaks
- Tighten bolts and nuts of steering linkage and gear box
- Tighten suspension bolts and nuts

ROAD TEST

- Clutch operation
- Parking brake operation
- Service brake operation
- Steering control and returnability
- Engine performance
- Squeaks and rattles

ENGINE OPERATING AND HOT

- Engine idling
- Adjust idle mixture, speed and ignition timing (Gasoline engine)
- Power steering reservoir fluid level and hose connections for leaks
- Automatic transmission fluid level and hose connections for leaks

FINAL INSPECTION

- Install necessary parts (outside mirror, wheel covers, seat belts, mat or carpet)
- Inspect for interior and exterior metal and paint damage
- Check for spare tire, jack, tools and literature
- Wash, clean interior and exterior

MAINTENANCE SCHEDULE

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

The first 1,000 km (600 miles) of service is one of the most important service periods and is vital to ensure the optimum condition.

MAINTENANCE OPERATION Periodic maintenance should be performed either at number of kilometers (miles) or months, whichever comes first		MAINTENANCE INTERVAL									Reference page
	Number of kilometers in thousands	1	10	20	30	40	50	60	70	80	
	(Number of miles in thousands)	(0.6)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)	
	Number of months	–	6	12	18	24	30	36	42	48	
UNDERHOOD MAINTENANCE											
Torque check cylinder head bolts, manifolds & exhaust tube nuts & carburetor attaching nuts		X									MA-7
Adjust intake & exhaust valve clearance		X		X		X		X		X	MA-7
Check drive belts for cracks, fraying, wear & tension		X		X		X		X		X	MA-8
Change engine anti-freeze coolant (Ethylene glycol base)						X				X	MA-10
Change engine coolant (Soft water)			X	X	X	X	X	X	X	X	MA-10
Check cooling system hoses & connections				X		X		X		X	MA-10
Check fuel lines (Hoses, piping, connections, etc.)						X				X	MA-17, 24
Clean & replace air cleaner filter (Dry paper type)	Clean (1)		X	X	X		X	X	X		MA-17
	Replace (1)					X				X	MA-17
Replace air cleaner filter (Viscous paper type)	(1)					X				X	MA-17
Check cyclone pre-air cleaner						X				X	MA-17
GASOLINE ENGINE: Change engine oil (Use API SE oil)	(2)		X	X	X	X	X	X	X	X	MA-9
GASOLINE ENGINE: Change engine oil filter	(2)		X	X	X	X	X	X	X	X	MA-9
GASOLINE ENGINE: Check & adjust idle rpm & mixture ratio (Check mixture ratio only on models bound for areas affected by emission regulations)		X	X	X	X	X	X	X	X	X	MA-14
GASOLINE ENGINE: Replace fuel filter						X				X	MA-17
GASOLINE ENGINE: Check & replace distributor breaker point	Check		X		X		X		X		MA-12
	Replace			X		X		X		X	MA-13
GASOLINE ENGINE: Adjust ignition timing			X	X	X	X	X	X	X	X	MA-14
GASOLINE ENGINE: Check & replace spark plugs	Check		X		X		X		X		MA-11
	Replace			X		X		X		X	MA-11
GASOLINE ENGINE: Check ignition wiring						X				X	MA-12
GASOLINE ENGINE: Check positive crankcase ventilation (P.C.V.) system (L28 engine)				X		X		X		X	MA-17
DIESEL ENGINE*: Replace fuel filter	(1)					X				X	Refer to Service Manual for SD22 & SD33 diesel engine.
DIESEL ENGINE*: Change engine oil (Use API CC or CD oil)		X	Change every 5,000 km (3,000 miles) or 3 months								
DIESEL ENGINE*: Change oil filter	(2)	X	X	X	X	X	X	X	X	X	
DIESEL ENGINE*: Check nozzles	(3)										
DIESEL ENGINE*: Check idling speed		X		X		X		X		X	
DIESEL ENGINE*: Drain fuel & lubricate diaphragm (Injection pump governor chamber)			X	X	X	X	X	X	X	X	
Check brake, clutch, automatic transmission & steering gear fluid or oil level & leaks			X	X	X	X	X	X	X	X	MA-24, 25, 30, 36
Change brake fluid				X		X		X		X	MA-30

*: For the maintenance of diesel engine, refer to Service Manual for SD22 & SD33 diesel engine.

MAINTENANCE OPERATION Periodic maintenance should be performed either at number of kilometers (miles) or months, whichever comes first	MAINTENANCE INTERVAL									Reference page
Number of kilometers in thousands	1	10	20	30	40	50	60	70	80	
(Number of miles in thousands)	(0.6)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)	
Number of months	–	6	12	18	24	30	36	42	48	
UNDERHOOD MAINTENANCE (Continued)										
Check brake booster vacuum hoses, connections & check valve					X				X	MA-30
Check air conditioning system hoses, connections & refrigerant leaks			X		X		X		X	MA-42
Check power steering fluid & lines		X	X	X	X	X	X	X	X	MA-36
UNDER VEHICLE MAINTENANCE										
Check brake, clutch, fuel & exhaust systems for proper attachment, leaks, cracks, chafing, abrasion, deterioration, etc.		X	X	X	X	X	X	X	X	MA-24, 30
Check electric fuel pump filter					X				X	MA-17
Check level & change oil in manual transmission, transfer & differential gear — Check		X	X	X		X	X	X		MA-25, 26
Check level & change oil in manual transmission, transfer & differential gear — Change					X				X	MA-25, 26
Grease nipples of front suspension (5)		X	X	X	X	X	X	X	X	MA-27
Grease front axle joints & knuckle flange bearing		X	X	X	X	X	X	X	X	MA-27
Check hydraulic steering damper			X		X		X		X	MA-37
Check steering gear box & linkage, suspension parts, propeller shafts & front drive shafts for damaged, loose & missing parts (4)	X	X	X	X	X	X	X	X	X	MA-26, 27, 29, 36, 37
Retighten body mountings	X		X		X		X		X	MA-39, 40
OUTSIDE AND INSIDE MAINTENANCE										
Check tire condition	X									MA-32
Check wheel alignment. If necessary, rotate & balance wheels			X		X		X		X	MA-28,32,33,34,35,36
Check disc brake pads & other brake components for wear, deterioration & leaks (5)		X	X	X	X	X	X	X	X	MA-30, 31
Check brake drums, lining & other brake components for wear, deterioration & leaks (6)			X		X		X		X	MA-30, 31
Repack front wheel bearing grease			X		X		X		X	MA-28
Lubricate locks, hinges & hood latch (5)		X	X	X	X	X	X	X	X	MA-38
Check seat belts, buckles, retractors, anchors & adjuster			X		X		X		X	MA-38
Check foot brake & clutch for free play & operation		X	X	X	X	X	X	X	X	MA-24, 31
Check parking brake for stroke & operation	X	X	X	X	X	X	X	X	X	MA-32

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.

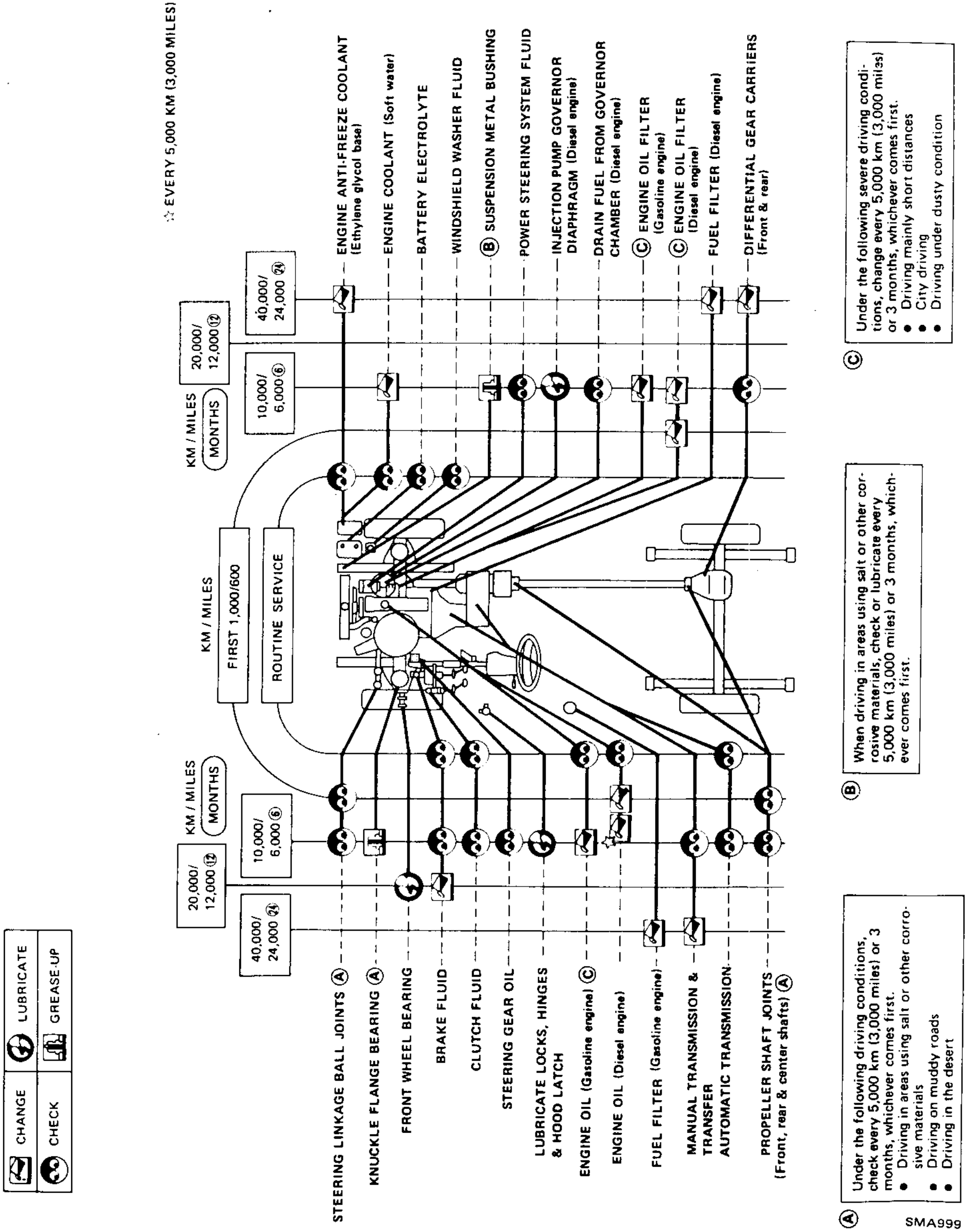
Check: Check, correct and replace if necessary.

NOTE:
(1) Under dusty driving conditions, more frequent maintenance should be necessary.
(2) Under the following severe driving conditions, change every 5,000 km (3,000 miles) or 3 months, whichever comes first.
- Driving mainly short distances
- City driving
- Driving under dusty conditions

(3) If engine power is decreased or black exhaust smoke is emitted, check and, if necessary, adjust the fuel injection nozzle's starting pressure and the fuel spray pattern.
(4) Under the following driving conditions, check every 5,000 km (3,000 miles) or 3 months, whichever comes first.
- Driving in areas using salt or other corrosive materials
- Driving on muddy roads
- Driving in the desert

(5) When driving in areas using salt or other corrosive materials, check or lubricate every 5,000 km (3,000 miles) or 3 months, whichever comes first.
(6) When driving in areas using salt or other corrosive materials, check every 10,000 km (6,000 miles) or 6 months, whichever comes first.

LUBRICATION CHART



RECOMMENDED FUEL AND LUBRICANTS

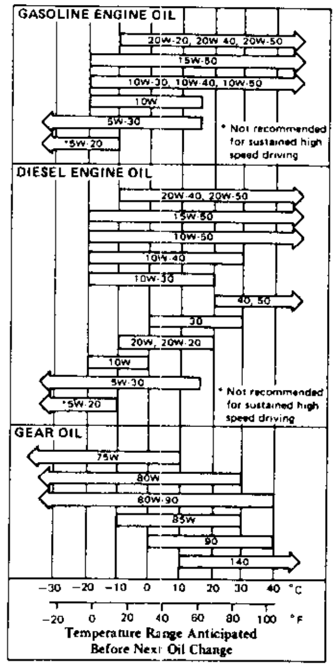
FUEL

Gasoline engine	Use a proper grade gasoline of above 88 octane number (RON).
Diesel engine	Use a diesel fuel of above 45 cetane

LUBRICANTS

Lubricant		Specifications	Remarks
Engine oil	Gasoline	API SE	Further details, refer to recommended SAE viscosity chart.
	Diesel	API CC or CD	
Gear oil	Manual transmission, transfer, manual steering gear and winch	API GL-4	
	Differential	API GL-5	–
	Limited slip differential	Gear Oil Hypoid L.S.D. (Service part number: KL430-14002-03)	–
Power steering and automatic transmission fluid		Type DEXRON	–
Multi-purpose grease		NLGI No. 2	Lithium soap base
Brake and clutch fluid		DOT 3	US FMVSS No. 116
Anti-freeze (L.L.C.)		–	Ethylene glycol base

SAE VISCOSITY NUMBER



APPROXIMATE REFILL CAPACITIES

			Liter	Imp measure
Fuel tank			82, 70 *1	18 gal, 15-3/8 gal *1
Coolant	With heater	L28	10.8	9-1/2 qt
		P40	14.8, 16.2 *1	13 qt, 14-1/4 qt *1
		SD33	12.9	11-3/8 qt
	Without heater	L28	9.9	8-3/4 qt
		P40	13.9, 15.3 *1	12-1/4 qt, 13-1/2 qt *1
		SD33	12.0	10-5/8 qt
Engine	With oil filter change	L28	4.4	3-7/8 qt
		P40	5.5, 6.5 *2	4-7/8 qt, 5-3/4 qt *2
		SD33	9.0	7-7/8 qt
	Without oil filter change	L28	3.9	3-3/8 qt
		P40	5.1	4-1/2 qt
		SD33	7.5	6-5/8 qt
Manual transmission		F4W81A	2.7	4-3/4 pt
Automatic transmission		3N71B	5.5	4-7/8 qt
Transfer		T130A	1.8	3-1/8 pt
		T100L	1.4	2-1/2 pt
Differential carrier		C200	FR 1.5, RR 1.0	FR 2-5/8 pt, RR 1-3/4 pt
		H233B	2.0	3-1/2 pt
Steering gear		VRB70	0.4	3/4 pt
		IPS56L *3	1.1	2 pt
Air conditioning system	Compressor oil		270 mℓ	9.5 fl oz
	Refrigerant		0.8 - 1.0 kg	1.8 - 2.2 lb
Winch *4			0.4	3/4 pt

*1 Model 61 series only *2 With oil cooler unit (For Middle East area only) *3 With oil pump and hoses
*4 Except for Europe

ENGINE MAINTENANCE —Gasoline Engine—

BASIC MECHANICAL SYSTEM

RETIGHTENING CYLINDER HEAD BOLTS, MANIFOLD AND EXHAUST TUBE NUTS

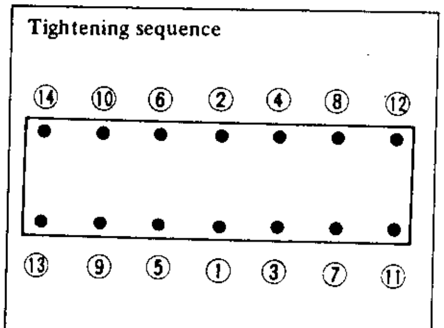
Cylinder head bolt

1. Start engine and warm up engine until water temperature indicator points to the middle of gauge, then stop engine.
2. Remove valve rocker cover.
3. Retighten cylinder head bolts according to the order shown in figure.

L28 engine

T : 69 - 83 N·m (7.0 - 8.5 kg-m, 51 - 61 ft-lb)

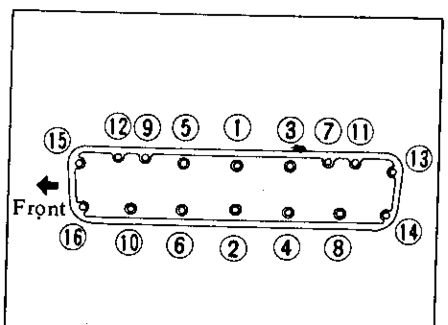
- **Tighten by using Tool ST10120000.**



EM727

P40 engine

T : 69 - 88 N·m (7.0 - 9.0 kg-m, 51 - 65 ft-lb)



SMA539

4. Install valve rocker cover.

Manifold, exhaust tube, carburetor and P.C.V. valve attaching nuts

> **WARNING:**
> **You should not check the exhaust system until it has been cooled off. Otherwise, you may burn yourself.**

Tightening torque

L28 engine

Unit		N·m	kg-m	ft-lb
Manifold	Bolt	15 - 25	1.5 - 2.5	11 - 18
	Nut	12 - 16	1.2 - 1.6	9 - 12
Front exhaust tube		26 - 36	2.7 - 3.7	20 - 27
Carburetor		12 - 18	1.2 - 1.8	9 - 13
P.C.V. Valve		15 - 20	1.5 - 2.0	11 - 14

P40 engine

Unit	N·m	kg-m	ft-lb
Manifold	25 - 34	2.5 - 3.5	18 - 25
Front exhaust tube	26 - 36	2.7 - 3.7	20 - 27
Carburetor	14 - 18	1.4 - 1.8	10 - 13

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.

Adjustment cannot be made while engine is in operation.

2. Remove valve rocker cover.
3. Adjust valve clearance as follows:

L28 engine

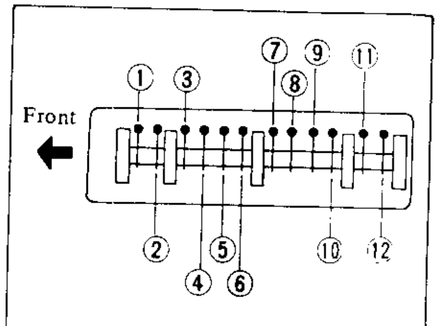
(1) Set so that high point of No. 1 cam lobe points above.

(2) Check valve clearances of 1, 3, 7, 8, 9 and 11.

Valve clearance (Hot)

Intake . . . 3 8 11 : 0.25 mm (0.010 in)

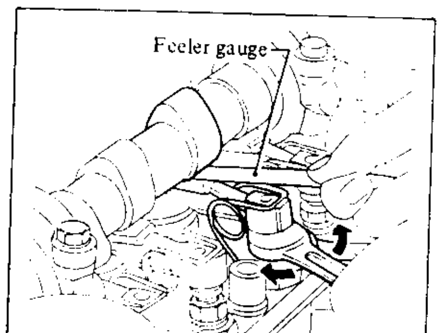
Exhaust. . 1 7 9 : 0.30 mm (0.012 in)



SMA540

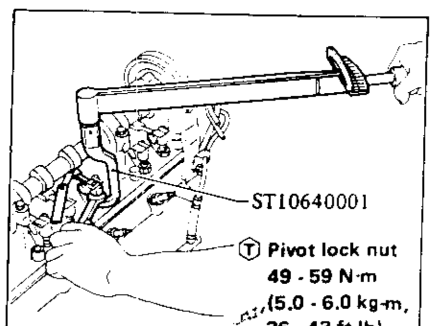
(3) If the clearance is not specified value, loosen pivot lock nut and turn valve rocker pivot to provide proper clearance.

Feeler gauge should move with a very slight drag.



SMA541

(4) Hold valve rocker pivot and tighten pivot lock nut **using Tool.**



SMA004

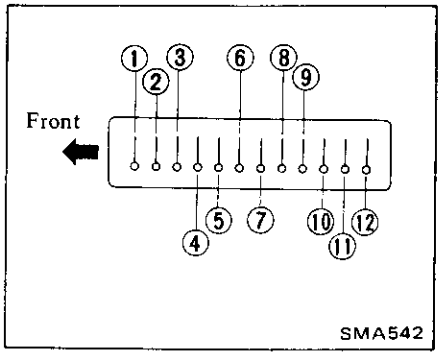
(5) Turn crankshaft and set so that high point of No. 1 cam lobe points down.
(6) Check and adjust valve clearances of ②, ④, ⑤, ⑥, ⑩ and ⑫, following same procedure as for steps (2), (3) and (4).

Valve clearance (Hot)
Intake . . . ② ⑤ ⑩ : 0.25 mm (0.010 in)
Exhaust. . ④ ⑥ ⑫ : 0.30 mm (0.012 in)

P40 engine

(1) Set No. 1 cylinder in top dead center on its compression stroke.
(2) Check valve clearances of ①, ②, ③, ⑥, ⑧ and ⑨.

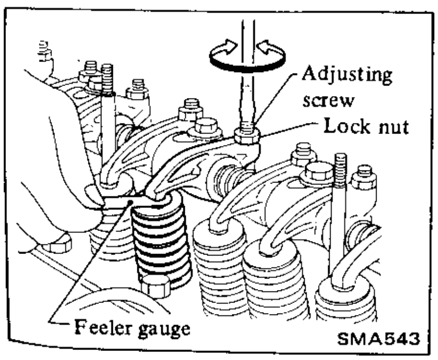
Valve clearance (Hot):
0.38 mm (0.015 in)



SMA542

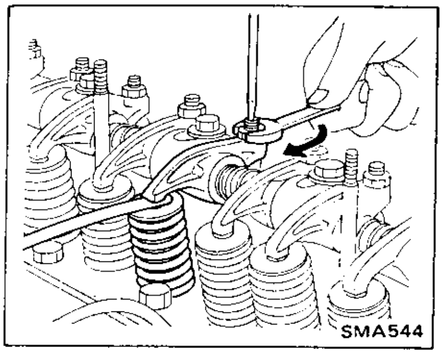
(3) If the clearance is not specified value, loosen valve rocker adjusting screw lock nut and turn adjusting screw to provide proper clearance.

Feeler gauge should move with a very slight drag.



SMA543

(4) Lock adjusting screw and tighten lock nut.


SMA544

(5) Turn crankshaft and set No. 6 cylinder in top dead center on its compression stroke.
(6) Check and adjust valve clearances of ④, ⑤, ⑦, ⑩, ⑪, and ⑫, following same procedure as for steps (2), (3) and (4).
4. Install valve rocker cover.

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)

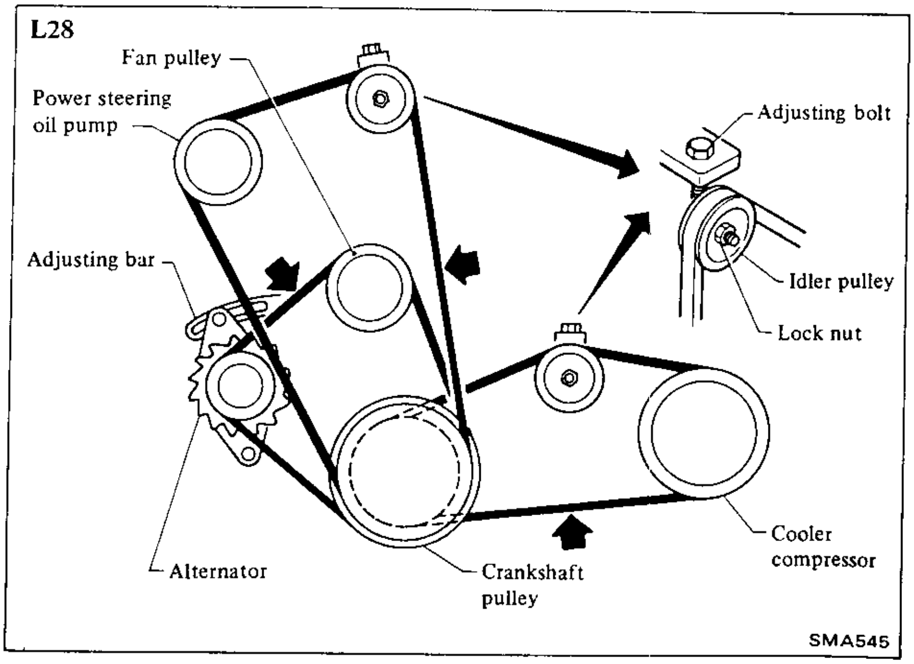
3. Adjust belt tension as follows:

Fan and alternator belt

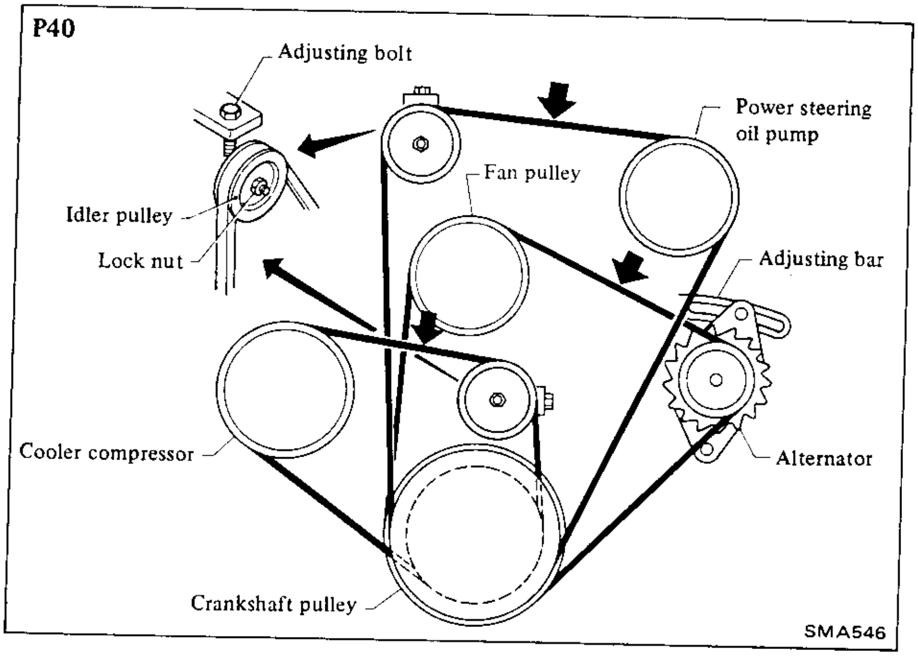
1. Loosen the upper and lower alternator securing bolts until the alternator can be moved slightly.
2. Move the alternator with a prying bar until the belt tension is within the specified amount. Then tighten the bolts securely.

Air conditioner compressor and power steering oil pump belts

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



SMA545

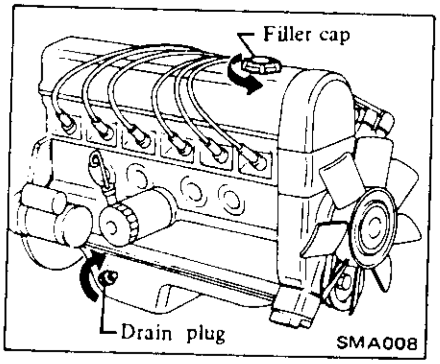


SMA546

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.

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



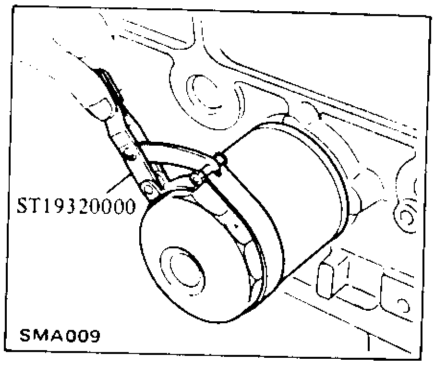
SMA008

- **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.

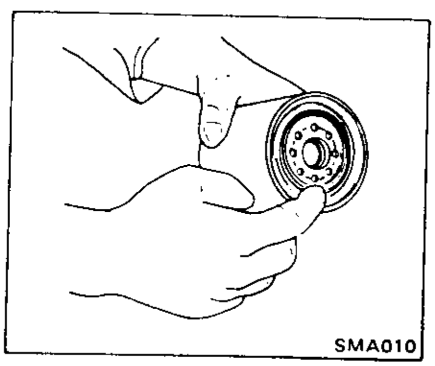
Ⓣ : **Oil pan drain plug**
L28 engine
20 - 29 N·m
(2.0 - 3.0 kg-m, 14 - 22 ft-lb)
P40 engine
20 - 39 N·m
(2.0 - 4.0 kg-m, 14 - 29 ft-lb)

4. Using **Tool**, remove oil filter.



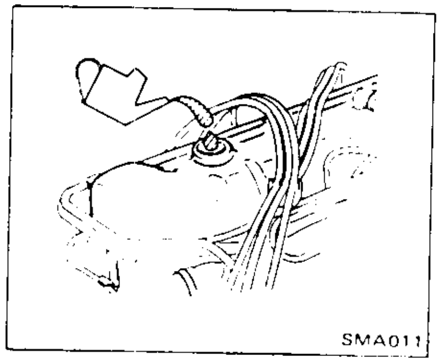
SMA009

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


SMA010

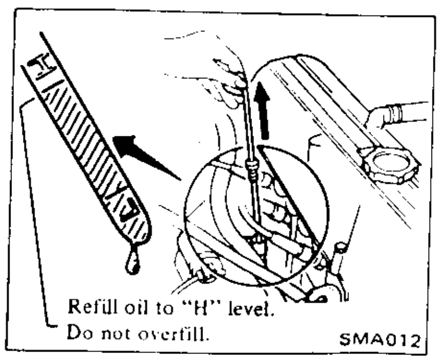
7. Install new oil filter. **Hand-tighten ONLY. DO NOT use a wrench to tighten the filter.**
8. Refill engine with new engine oil, referring to RECOMMENDED LUBRICANTS.
   Check oil level with dipstick.

Oil capacity:
L28 engine
With oil filter
4.4ℓ (3-7/8 Imp qt)
Without oil filter
3.9ℓ (3-3/8 Imp qt)
P40 engine
With oil filter
5.5ℓ (4-7/8 Imp qt)
With oil cooler unit
6.5ℓ (5-3/4 Imp qt)
Without oil filter
5.1ℓ (4-1/2 Imp qt)


SMA011

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 water temperature indicator points to the middle of gauge. Then stop engine and wait several minutes. Check oil level with dipstick. If necessary, add engine oil.

When checking oil level, park the vehicle on a level surface.



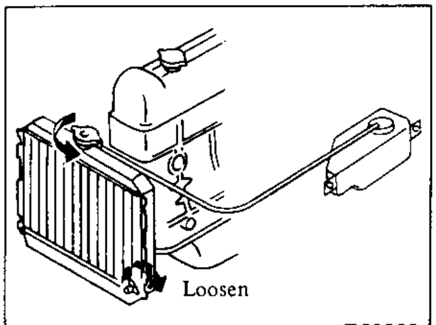
SMA012

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 drain cock at bottom of radiator, and remove radiator cap.



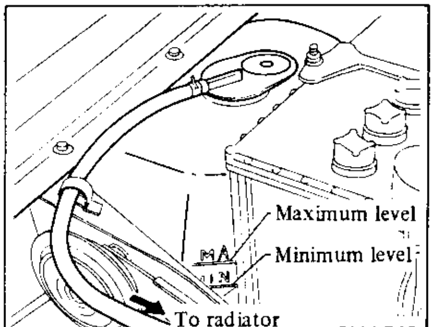
TCS009

2. Remove cylinder block drain plug located at side of cylinder block.
3. Drain coolant completely. Then flush cooling system.
4. Close drain cock and plug.
5. Fill radiator with coolant up to filter opening. When using anti-freeze coolant, mix the anti-freeze coolant with water, observing instructions attached to anti-freeze continer.

Cooling water capacity:
- **With heater**
  - **P40**
    - **14.8 ℓ (13 Imp qt),**
    - **16.2 ℓ (14-1/4 Imp qt)***
  - **L28**
    - **10.8 ℓ (9-1/2 Imp qt)**
- **Without heater**
  - **P40**
    - **13.9 ℓ (12-1/4 Imp qt),**
    - **15.3 ℓ (13-1/2 Imp qt)***
  - **L28**
    - **9.9 ℓ (8-3/4 Imp qt)**

***Canvas Top model**

6. Run engine for a few minutes. Then stop engine, and check coolant level. If necessary, add coolant.
7. Fill reservoir tank with coolant up to "MAX" level.



SMA549

8. Check drain cock and plug for any sign of leakage.

CHECKING COOLING SYSTEM, HOSES AND CONNECTIONS

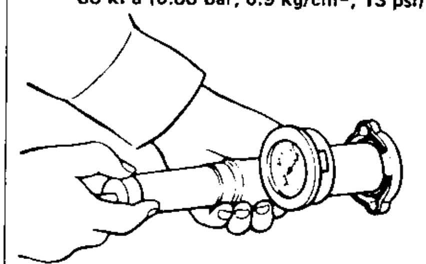
Check hoses and fittings for loose connections or deterioration. Retighten or replace if necessary.

Checking radiator cap

Using cap tester, check the radiator cap relief pressure.

If the pressure gauge drops rapidly and excessively, replace the radiator cap.

Cap relief pressure:
88 kPa (0.88 bar, 0.9 kg/cm², 13 psi)


SLC081

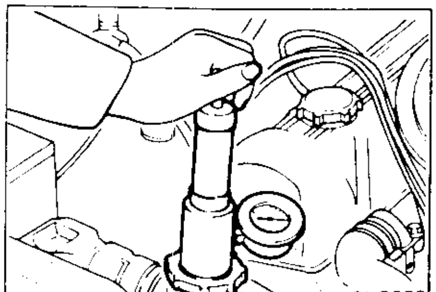
Checking cooling system for leaks

Attach pressure tester and pump tester to the specified pressure.

Check for drop in pressure.

If the pressure drops, check for leaks from hoses, radiator, or water pump.

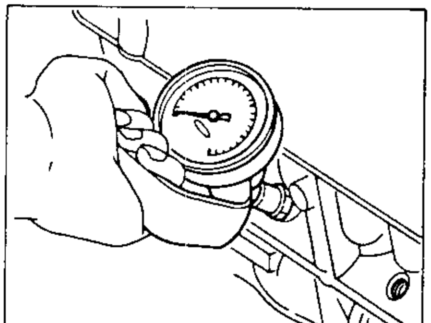
If no external leaks are found, check heater core, block and head.


SLC082

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

CHECKING ENGINE COMPRESSION PRESSURE

1. Warm up engine until water temperature indicator points to the middle of gauge, then stop engine.
2. Disconnect all spark plugs.
3. Properly attach a compression tester to spark plug hole in cylinder being tested.


SMA042

4. Fully open choke valve.
5. Depress accelerator pedal to open throttle valve.
   Do not "pump" pedal.
6. Crank engine and read gauge indication.

- Engine compression measurement should be made as quickly as possible.

Compression pressure:

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

	Standard	Minimum
L28 engine	1,177 (11.77, 12.0, 171)/350	883 (8.83, 9.0, 128)/350
P40 engine	1,128 (11.28, 11.5 164)/250	1,030 (10.30, 10.5, 149)/250

7. 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.

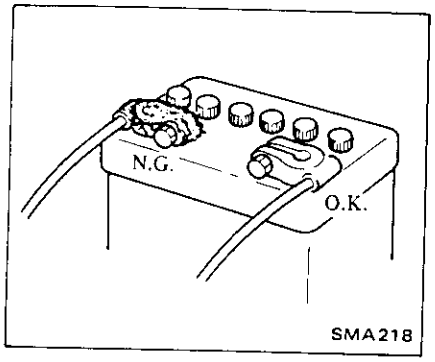
IGNITION AND FUEL SYSTEMS

CHECKING BATTERY

WARNING:
Do not expose the battery to flames or electrical sparks. Hydrogen gas generated by battery action is explosive. Do not allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces. If the acid contacts the eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention. In freezing weather, run the engine for a while after adding distilled water, to make sure that the water mixes properly with the fluid. Otherwise the water may freeze and damage the battery.

Visual check

1. Rusted battery support.
2. Loose terminal connections.
3. Rusted or deteriorated terminals.
4. Damaged or leaking battery.

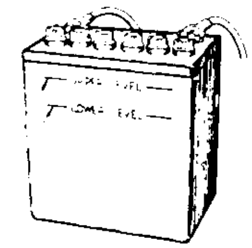


SMA218

Checking electrolyte level

Check the fluid level in each filler. If necessary, add only distilled water. Do not overfill.

Translucent battery

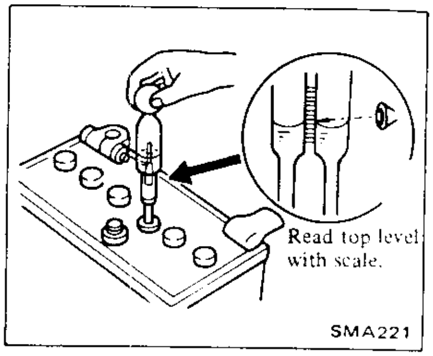


Fluid level should be between upper and lower levels. SMA219

Checking electrolyte gravity

1. Place the hydrometer in the cell. Be sure the float is not in contact with the cylinder wall.
2. Take in enough electrolyte into the hydrometer to allow the float to suspend freely between the top and bottom of the cylinder.
3. Read indication.

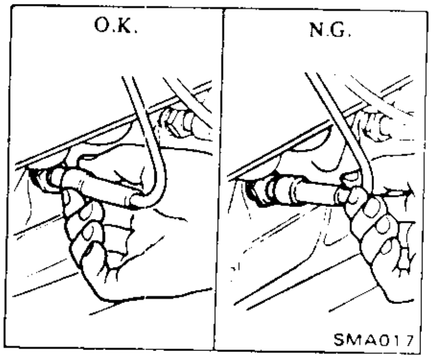
	Permissible valve	Fully charged value [at 20°C (68°F)]
Other climates	Over 1.20	1.26
Frigid climate	Over 1.22	1.28
Tropical climate	Over 1.18	1.24



SMA221

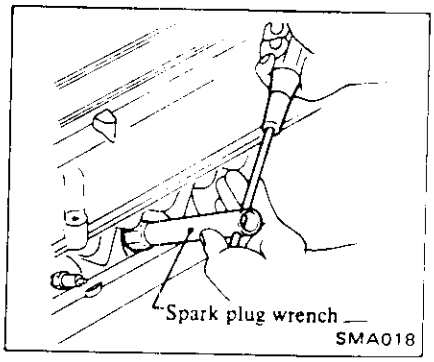
CHECKING AND REPLACING SPARK PLUGS

1. Disconnect spark plug wire at boot. Do not pull on the wires.



SMA017

2. Remove spark plugs with spark plug wrench.

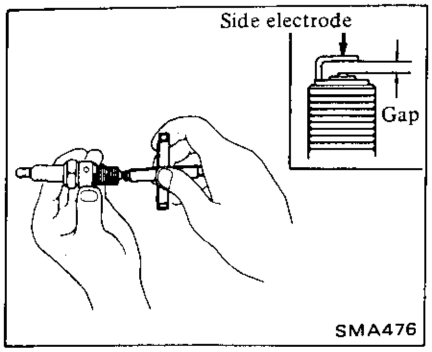


SMA018

3. Clean plugs in sand blast cleaner. And inspect insulation for cracks or chips. If they are excessively worn, replace with new spark plugs.

The spark plugs should be replaced in accordance with the periodic maintenance schedule.

4. Check spark plug gap.
If it is not within specified range, set gap by bending side electrode.



Spark plug gap:
L28 engine
0.8 - 0.9 mm
(0.031 - 0.035 in)
P40 engine
0.7 - 0.8 mm
(0.028 - 0.031 in)
Spark plug type:
Refer to S.D.S.

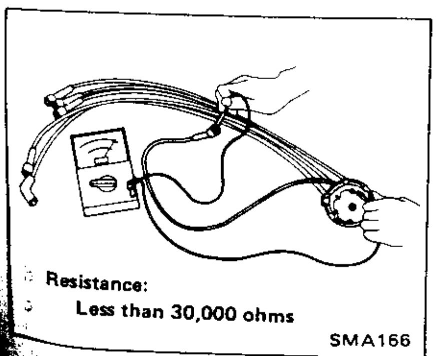
5. Install spark plugs. **Reconnect high tension cables according to Nos. indicated on them.**

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

CHECKING IGNITION WIRING

1. Visually check wiring for cracks, and damaged and burned terminals.
2. Using an ohmmeter, measure the resistance between cable terminal on the spark plug side and corresponding electrode inside cap.

Shake the wire while measuring resistance to check for intermittent brakes.



CHECKING AND REPLACING DISTRIBUTOR BREAKER POINTS

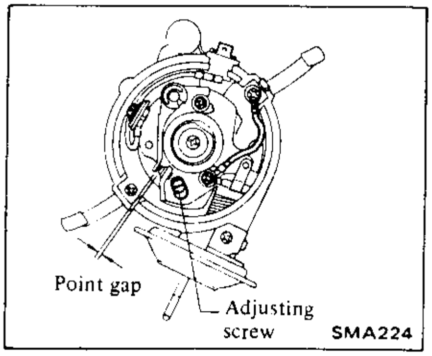
Visual check

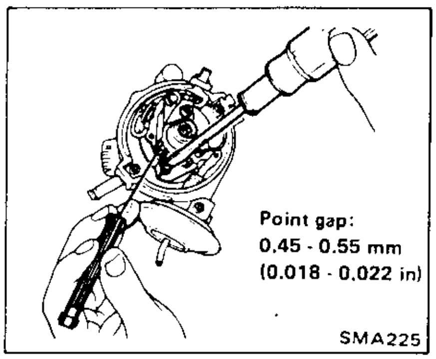
1. Inspect points for excessive burning or pitting. Replace points if necessary.
2. Use a point file to clean contact area and remove scale from points. Filing is done for cleaning purposes only.

Do not attempt to remove all roughness.

Checking point gap

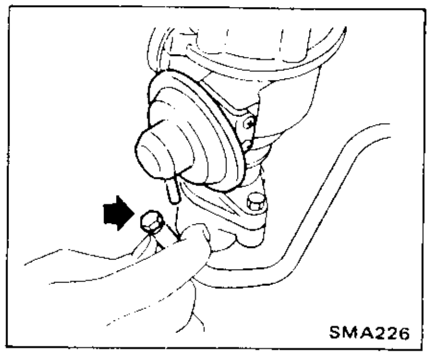
Check point gap with a feeler gauge. If necessary, adjust gap.





Checking dwell angle

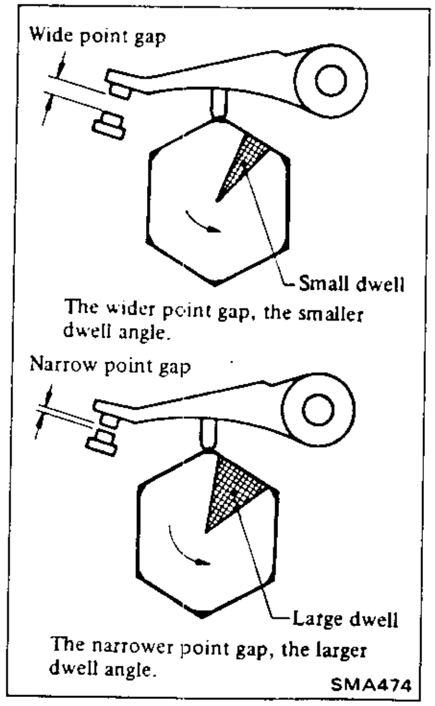
1. Connect dwell meter.
2. Disconnect distributor vacuum hose from distributor vacuum controller, and plug hose with proper plug.



3. Start engine and warm up engine until water temperature indicator points to the middle of gauge.
4. Run engine at idle speed and measure dwell angle.

Dwell angle:
35° - 41°

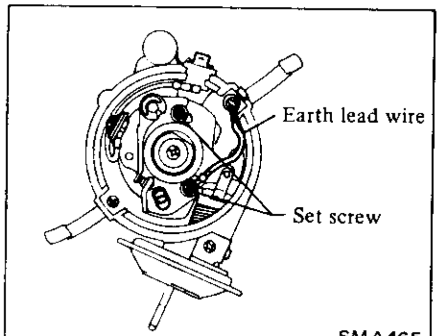
5. If dwell angle is not within the specified value turn off engine and adjust point gap.



6. Recheck dwell angle.
7. Repeat this procedure until specified point gap and dwell angle are obtained. If dwell angle is not within the specified valve when point gap is correct, cam lobe is worn. Replace cam.

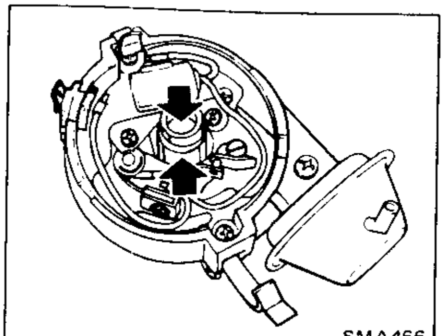
Replacing distributor breaker point

1. Remove earth lead wire and set screws and then remove breaker point.



SMA465

2. Install new breaker point. Apply grease to distributor cam and head.


SMA466

3. Adjust point gap and dwell angle.

CHECKING AND ADJUSTING IDLE RPM AND IGNITION TIMING

Preparation

1. On air conditioner equipped models, inspections should be carried out while the air conditioner is "OFF".
2. Inspection should be carried out while shift lever is in "Neutral" position. Be sure to engage parking brake and to lock both front and rear wheels with wheel chocks.

Maintenance procedure

START

↓

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

SMA020

↓

Race engine two or three times under noload, then run engine for one minute at idle speed.

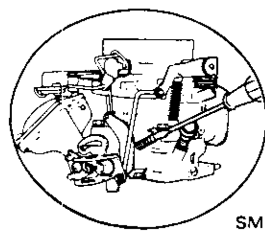
↓

Check idle speed.

IDLE SPEED:
- L28 engine
  - M/T ... 650 rpm
  - A/T ... 650 rpm (in "N" position)
- P40 engine
  - 500 rpm (Except for Europe and Hong Kong)
  - 650 rpm (For Europe and Hong Kong)

O.K. → Check ignition timing with timing light.

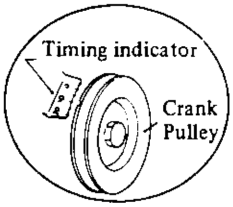
N.G. → Adjust idle speed by turning **throttle adjusting screw.** → (return to "Race engine two or three times under noload, then run engine for one minute at idle speed.")



SMA355

Check ignition timing with timing light.

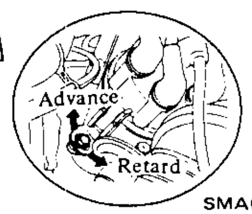
Ignition timing:
- L28 engine
  - 10° B.T.D.C.
- P40 engine
  - 10° B.T.D.C. (Except for Europe and Hong Kong)
  - 5° B.T.D.C. (For Europe and Hong Kong)



SMA028

O.K. → END

N.G. → Adjust ignition timing by turning distributor after loosening bolt which secures distributor. → (return to "Race engine two or three times under noload, then run engine for one minute at idle speed.")



SMA029

END

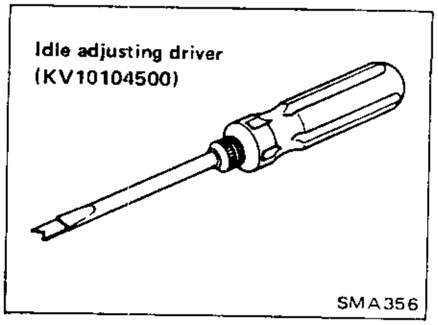
CHECKING AND ADJUSTING MIXTURE RATIO

CAUTION:

a. Idle mixture ratio is adjusted at factory and requires no further adjustment. If it becomes necessary to adjust it, proceed with the following steps.
b. Do not attempt to screw the idle adjusting screw down completely. Doing so could cause damage to tip, which in turn will tend to cause malfunctions.
c. Idle limiter cap equipped with idle adjusting screw should not be removed.

Preparation

1. Inspection should be carried out while shift lever is in "Neutral" position. Be sure to engage parking brake and to lock both front and rear wheels with wheel chocks.
2. On air conditioner equipped modeles, checks should be carried out while the air conditioner is "OFF".
3. When checking mixture ratio, make sure that float level is correct at idling speed and choke knob is pushed all the way in.
4. Use "CO"-meter after it is fully warmed up.
5. When measuring "CO"%, insert probe into tail pipe more than 0.4 m (16 in).
6. Measure "CO"% with air cleaner installed.
7. On carburetor with metal idle limiter cap (For Europe and Hong Kong), adjust idle adjusting screw with idle adjusting driver.



SMA356

Maintenance procedure (with "CO"-meter (For Europe and Hong Kong))

START

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

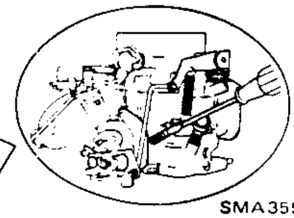
SMA020

Race engine two or three times under no-load, then run engine for one minute at idle speed.

Check idle speed.

IDLE SPEED:
L28 engine
M/T ... 650 rpm
A/T ... 650 rpm (in "N" position)
P40 engine 650 rpm

N.G. → Adjust idle speed by turning throttle adjusting screw.

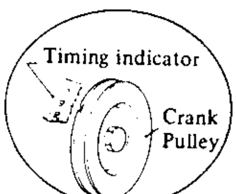


SMA355

O.K.

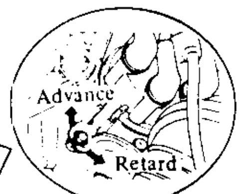
Check ignition timing with timing light.

Ignition timing:
L28 engine 10° B.T.D.C.
P40 engine 5° B.T.D.C.



SMA028

N.G. → Adjust ignition timing by turning distributor after loosening bolt which secures distributor.



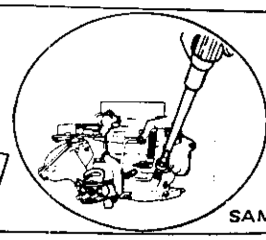
SMA029

O.K.

Check "CO"% with "CO"-meter.

Idle "CO"%
L28 engine: 2%
P40 engine: 1.5%

N.G. → Adjust idle "CO"% by turning idle adjusting screw.



SAM357

O.K.

END

Maintenance procedure (without "CO"-meter)

START

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

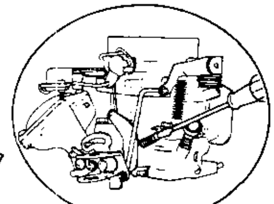
SMA020

Race engine two or three times under no-load, then run engine for one minute at idle speed.

Check idle speed.

IDLE SPEED:
L28 engine
M/T ... 650 rpm
A/T ... 650 rpm (in "N" position)
P40 engine *1

N.G. → Adjust idle speed by turning **throttle adjusting screw.**

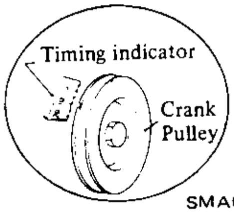


SMA355

O.K.

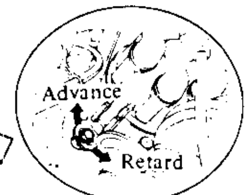
Check ignition timing with timing light.

Ignition timing (B.T.D.C.)
***2**



SMA028

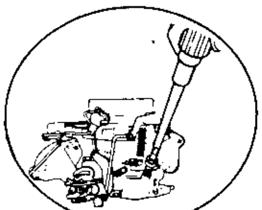
N.G. → Adjust ignition timing by turning distributor after loosening bolt which secures distributor.



SMA029

O.K.

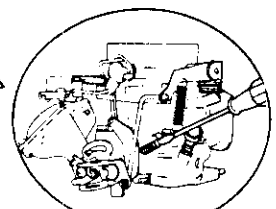
Turn out **idle adjusting screw** approximately two turns, starting from fully closed position.



SMA357

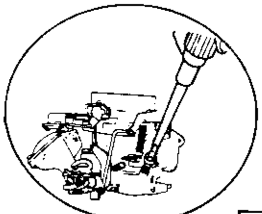
Adjust engine speed by turning **throttle adjusting screw.**

Engine Speed:
Except Europe and Hong Kong
L28 engine
M/T ... 650 rpm
A/T ... 650 rpm (in "N" position)
P40 engine
500 rpm
Europe and Hong Kong
L28 engine
M/T ... 680 rpm
P40 engine
680 rpm



SMA355

Turn the **idle adjusting screw** until engine runs smoothly at highest speed.



SMA357

Does engine speed not raise in spite of turning **idle adjusting screw.**

Yes → (return to "Adjust engine speed by turning throttle adjusting screw")

No: Europe and Hong Kong models

Adjust engine speed by turning in **idle adjusting screw.**

IDLE SPEED:
L28 engine
M/T ... 650 rpm
A/T ... 650 rpm (in "N" position)
P40 engine
***3**

No: Except Europe and Hong Kong models

END

***1 P40 engine**
500 rpm (Except for Europe and Hong Kong)
650 rpm (For Europe and Hong Kong)

***2 Ignition timing (B.T.D.C.):**
L28 engine 10°
P40 engine 10° (Except for Europe and Hong Kong)
5° (For Europe and Hong Kong)

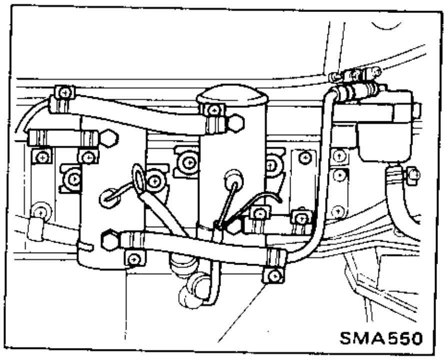
***3 P40 engine**
500 rpm (Except for Europe and Hong Kong)
650 rpm (For Europe and Hong Kong)

CHECKING ELECTRIC FUEL PUMP FILTER

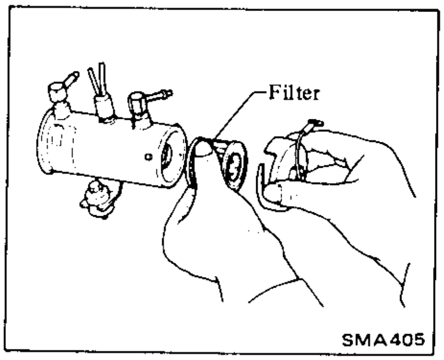
1. Disconnect battery ground cable.
2. Temporarily clamp hose between fuel tank and fuel filter, and disconnect inlet hose from fuel pump.

Be careful not to spill fuel. Place a rag to absorb fuel.

3. Disconnect outlet hose from fuel tube, **put fuel tube and hose into a suitable container, and plug the openings with a clean rag.**


SMA550

4. Remove fuel pump.
5. Remove cover, check filter and if necessary, replace filter with new one.

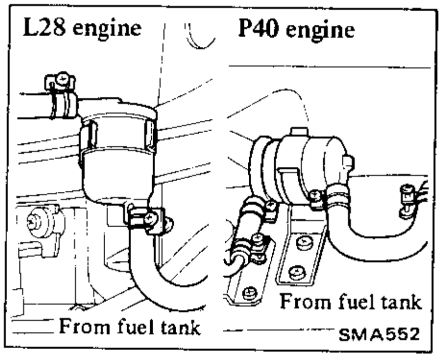


SMA405

6. To install fuel pump and fuel filter, reverse the order of removal.

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

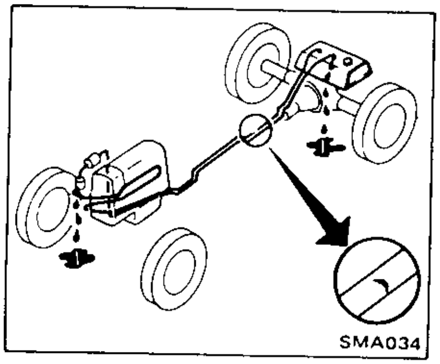
And plug open of fuel hose immediately.

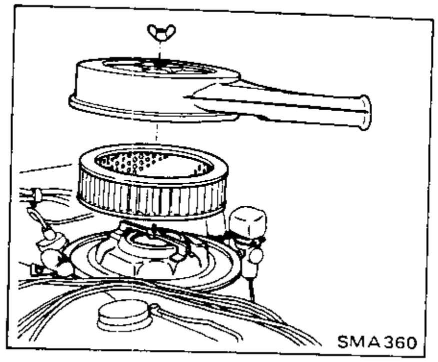


SMA552

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

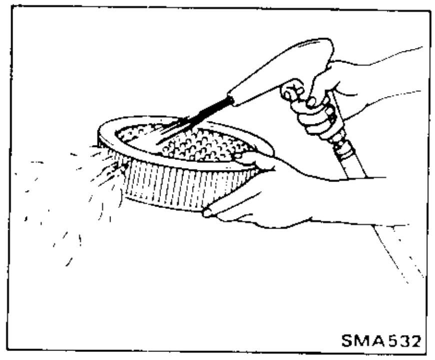
1. Check fuel line for leaks, particularly around connection of fuel pipe and fuel hose.
2. Retighten loose connections and replace any damage or deformed parts.


SMA034


SMA360

CLEANING OR REPLACING AIR CLEANER FILTER (Dry paper type)

It is necessary to clean the element or replace it at the recommended interval, more often under dusty driving conditions.


SMA532

Cyclone pre-air cleaner

The pre-air cleaner is a cyclone type.

It should be checked periodically as recommended in **"Periodic Maintenance and Lubrication Schedule in Section GI.**

REPLACING FUEL FILTER

Fuel filter is a replaceable cartridge type.

Unfasten clamps securing fuel hoses to the outlet and inlet sides of fuel filter, and disconnect fuel hoses. And replace it.

REPLACING AIR CLEANER FILTER (Viscous paper type)

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

Remove air cleaner cover and remove air cleaner filter.

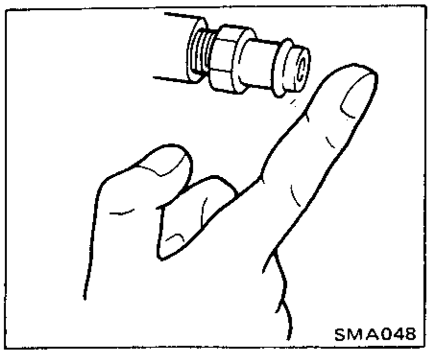
CHECKING POSITIVE CRANKCASE VENTILATION (P.C.V.) SYSTEM (L28 engine models)

Checking P.C.V. valve

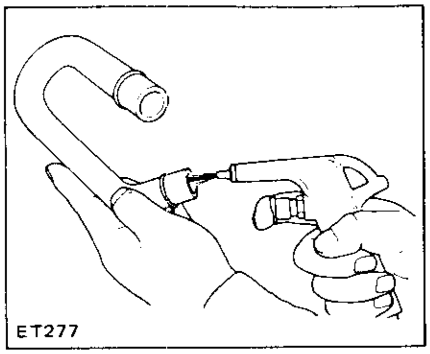
Check positive crankcase ventilation (P.C.V.) valve as follows.

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 passed through the valve and a strong vacuum should be felt immediately when a finger is placed over the valve inlet.


SMA048

If the valve is plugged or broken, replace with a new one.


ET277

Checking ventilation hoses

1. Check hoses and hose connections for leaks.
2. Check each hose for cracks or distortion.
3. Disconnect all hoses and blow them out with compressed air.

If any hose cannot be made free of obstructions, replace with a new one.

4. Insure that the flame arrester is surely inserted in the hose, between the air cleaner and rocker cover.

MINOR TROUBLE DIAGNOSES AND CORRECTIONS —Gasoline Engine—

Condition	Probable cause	Corrective action
CANNOT CRANK ENGINE OR SLOW CRANKING	Improper grade oil.	Replace with proper grade oil.
	Discharged battery.	Charge battery.
	Faulty battery.	Replace.
	Loose fan belt.	Adjust.
	Malfunction in charging system.	Inspect.
	Wiring connection loose in starting circuit.	Correct.
	Faulty ignition switch.	Repair or replace.
	Faulty starter motor.	Repair or replace.

(Trouble-shooting procedure on starting circuit)
Switch on the starter motor with light "ON".

When light goes off or dims considerably,

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

When light stays bright,

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

Condition	Probable cause	Corrective action

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 cylinder compression.

No spark occurs. — Check the current flow in primary circuit.

Very high current. — Inspect primary circuit for short.

Low or no current. — Check for loose terminal disconnection in primary circuit.

Condition	Probable cause	Corrective action
Ignition system out of order	Burned distributor point.	Repair or replace.
	Improper point gap.	Adjust.
	Faulty condenser.	Replace.
	Leak at rotor cap and rotor.	Clean or replace.
	Faulty spark plug.	Clean, adjust plug gap or replace.
	Improper ignition timing.	Adjust.
	Faulty ignition coil.	Replace.
	Disconnection of high tension cable.	Replace.
	Loose connection or disconnection in primary circuit.	Repair or replace.
Fuel system out of order	Lack of fuel.	Supply.
	Dirty fuel filter.	Replace.
	Dirty or clogged fuel pipe.	Clean.
	Fuel pump will not work properly.	Repair or replace.
	Carburetor choke will not work properly.	Check and adjust.
	Improper adjustment of float level.	Correct.
	Improper idling.	Adjust.
	Dirty or clogged carburetor.	Disassemble and clean.
	Clogged breather pipe of fuel tank.	Repair and clean.
	Malfunctioning anti-dieseling solenoid valve.	Check for loose terminal or wire harness.

Condition	Probable cause	Corrective action
Low compression	Incorrect spark plug tightening or faulty 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.	Remove cylinder head and lap valves.
	Sticky valve stem.	Correct or replace valve and valve guide.
	Weak or damaged valve springs.	Replace.
	Compression leak at cylinder head gasket.	Replace gasket.
	Sticking or damaged piston ring.	Replace piston rings.
	Worn piston ring or cylinder.	Overhaul engine.

(Trouble-shooting procedure)
Inject a small quantity of engine oil in spark plug hole, and then measure cylinder compression.

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

IMPROPER ENGINE IDLING (Low engine idle speed)		
Fuel system out of order	Clogged or damaged carburetor jets.	Clean or replace.
	Incorrect idle adjustment.	Adjust.
	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.
	Malfunctioning carburetor choke.	Check and adjust.
Low compression		Previously mentioned.
Others	Incorrect valve clearance.	Adjust.
	Extremely low revolution.	Adjust.
	Malfunction of the ignition system (spark plug, high tension cable, ignition coil, etc.)	Replace.
	Incorrect basic ignition timing.	Adjust.
	Faulty P.C.V. valve.	Replace.
	Loose manifold and cylinder head bolts.	Retighten bolts.
IMPROPER ENGINE IDLING (High engine idle speed)	Binding accelerator linkage.	Check and correct accelerator linkage.
	Incorrect idle adjustment.	Adjust.
	Malfunctioning carburetor choke.	Check and adjust.
	Improper dashpot adjustment.	Check and adjust.

Condition	Probable cause	Corrective action
ENGINE POWER NOT UP TO NORMAL		
Low compression		Previously mentioned.
Ignition system out of order	Incorrect ignition timing.	Adjust.
	Damaged spark plugs.	Clean, adjust or replace plugs.
Fuel system out of order	Malfunction of choke system.	Adjust.
	Clogged fuel pipe or needle valve.	Clean.
	Dirty or clogged fuel filter.	Replace.
	Fuel pump will not work properly.	Repair or replace.
	Clogged carburetor jets.	Disassemble and clean.
	Throttle valve does not open fully.	Readjust.
Air intake system out of order	Clogged air cleaner.	Replace filter.
	Air inhaling from manifold gasket or carburetor gasket.	Replace gasket.
	Faulty P.C.V. valve.	Replace.
Overheating	Insufficient coolant.	Replenish.
	Loose fan belt.	Adjust fan belt.
	Worn or oiled fan belt.	Replace.
	Inoperative thermostat.	Replace.
	Worn water pump.	Replace.
	Clogged or leaky radiator.	Flush, repair or replace.
	Faulty 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.
	Clogged carburetor (lean mixture).	Overhaul carburetor.
Overcooling	Inoperative thermostat.	Replace.
Others	Improper octane fuel.	Replace with specified octane fuel.
	Improper tire pressure.	Inflate to specified pressure.
	Dragging brake.	Adjust.
	Clutch slipping.	Adjust.
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.

Condition	Probable cause	Corrective action
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 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. **This noise will be heard when clutch is disengaged.**	Renew bushing and adjust drive shaft.
ABNORMAL COMBUSTION (Backfire, afterfire, run-on, etc.)		
Improper ignition timing	Improper ignition timing.	Adjust.
	Improper heat range of spark plugs.	Use specified spark plugs.
Fuel system out of order	Improper idle adjustment.	Adjust.
	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.
	Malfunction of anti-dieseling solenoid valve.	Check or replace.
	Uneven idling. (Run-on)	Adjust.

Condition	Probable cause	Corrective action
Faulty cylinder head, etc.	Improperly adjusted valve clearance.	Adjust.
	Excess carbon in combustion chamber.	Remove head and get rid of carbon.
	Damaged valve spring (backfire, afterfire).	Replace it with a new one.
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.
	Worn oil seal in front and rear of crankshaft.	Renew oil seal.
	Loose 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.
	Loose or damaged oil pressure switch.	Renew oil pressure switch or tighten it.
Excessive oil consumption	Cylinder and piston wear.	Overhaul cylinder and renew piston.
	Improper location of piston ring gap or reversely assembled piston ring.	Remount piston rings.
	Damaged piston rings.	Renew rings. Repair or renew piston and cylinder.
	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	Inadequate quality of engine oil.	Use the designated oil.
	Engine overheat.	Previously mentioned.
	Malfunction of P.C.V. system.	Check or replace.
POOR FUEL ECONOMY		
See the explanation of the power decrease		
Others	Exceeding idling revolution.	Adjust it to the designated rpm.
	Faulty acceleration recovery.	Adjust it.
	Fuel leakage.	Repair or tighten the connection of fuel pipes.

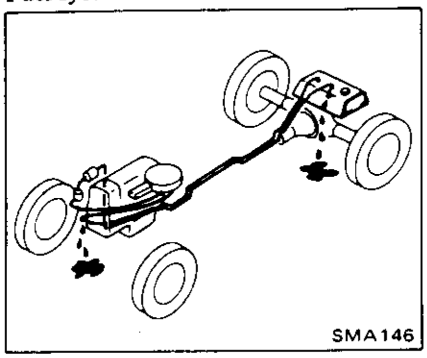
CHASSIS AND BODY MAINTENANCE

ENGINE CONTROL, FUEL AND EXHAUST SYSTEMS

CHECKING FUEL AND EXHAUST SYSTEMS

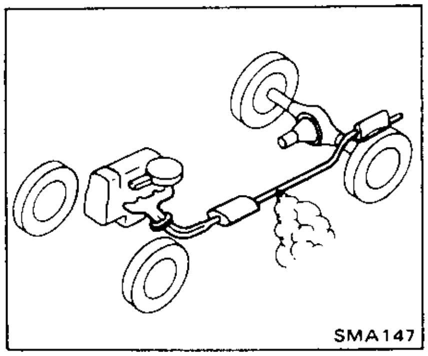
Check fuel and exhaust systems for condition, connections and leaks.

Fuel system



SMA146

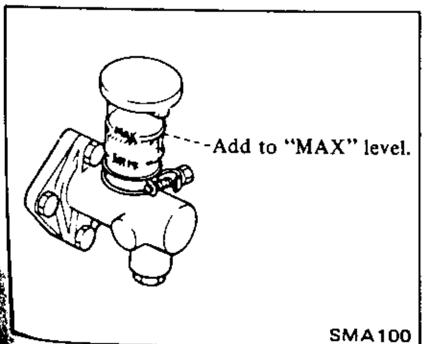
Exhaust system



SMA147

CLUTCH

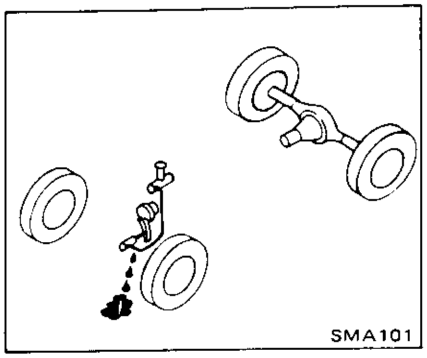
CHECKING CLUTCH FLUID LEVEL AND LEAKS



SMA100

CHECKING CLUTCH SYSTEM

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

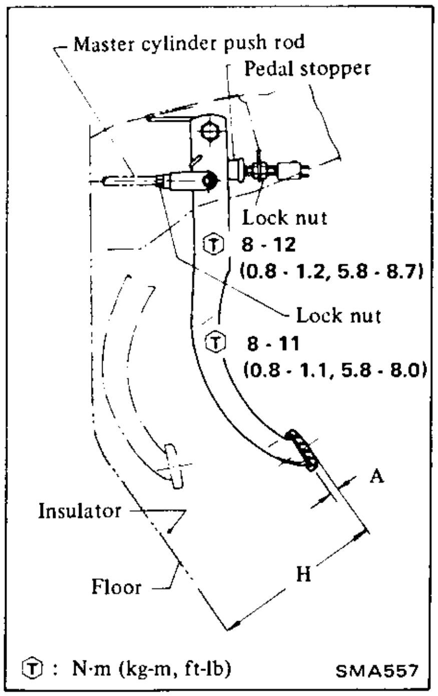


SMA101

CHECKING CLUTCH PEDAL HEIGHT AND FREE PLAY OR FREE TRAVEL

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

Model 160 series



Ⓣ : N·m (kg-m, ft-lb) SMA557

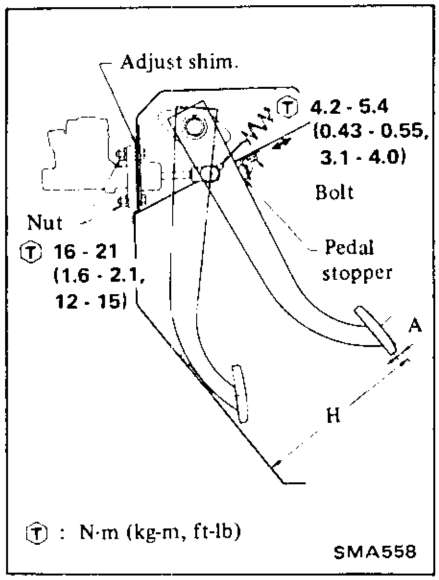
Pedal height "H":
190 - 196 mm
(7.48 - 7.72 in)
Pedal free play "A":
1 - 5 mm (0.04 - 0.20 in)

1. Adjust pedal height with pedal stopper. 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.

Model 61 series



Ⓣ : N·m (kg-m, ft-lb) SMA558

Pedal height "H":
181 - 187 mm (7.13 - 7.36 in)
Pedal free play "A":
1 - 5 mm (0.04 - 0.20 in)

1. Adjust clutch pedal height by sliding pedal stopper bracket back or forth.
2. After installing master cylinder, adjust pedal free play by increasing or decreasing number of shims.

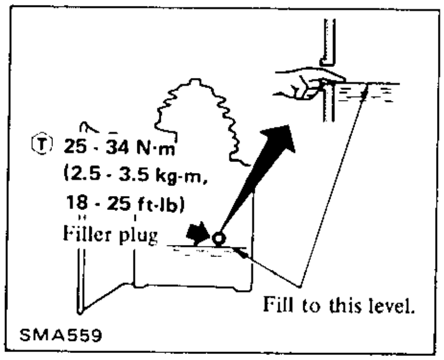
a. Pedal free play means the following total measured at position of pedal pad.
- Play due to clevis pin and clevis pin hole in pedal lever.
- Play due to piston and piston rod.

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

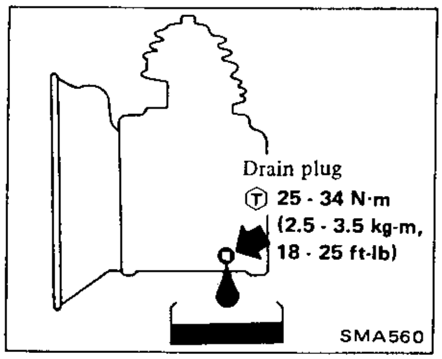
CHECKING MANUAL TRANSMISSION OIL LEVEL

Never start engine while checking oil level.

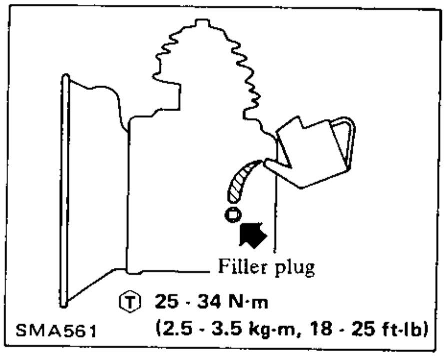


CHANGING MANUAL TRANSMISSION OIL

1. Drain oil completely.



2. Refill transmission and check oil level.



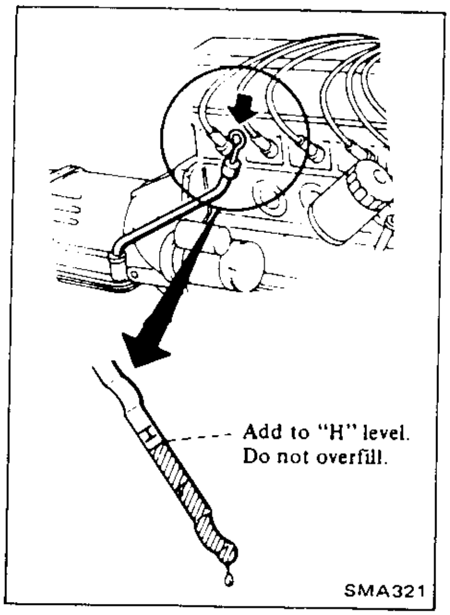
Oil capacity:
2.7 ℓ (4-3/4 Imp pt)

AUTOMATIC TRANSMISSION

CHECKING AUTOMATIC TRANSMISSION FLUID LEVEL

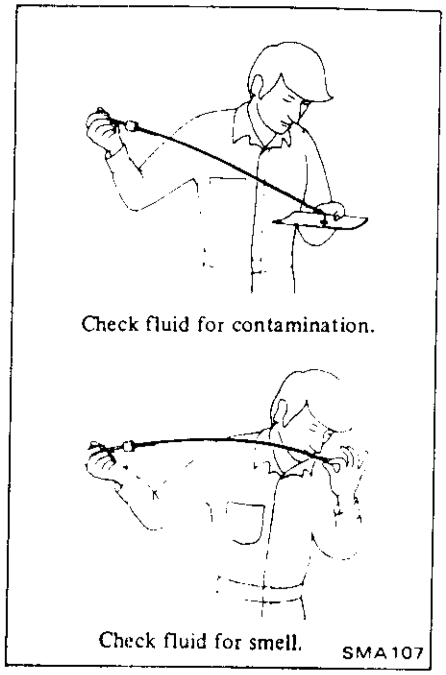
1. Check under following conditions.
(1) Place selector lever in "P" (PARK) position and idle engine.
(2) Maintain fluid temperature at 50 to 80°C (122 to 176°F).
2. Add oil, if necessary.

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



CHECKING AUTOMATIC TRANSMISSION FLUID CONDITION

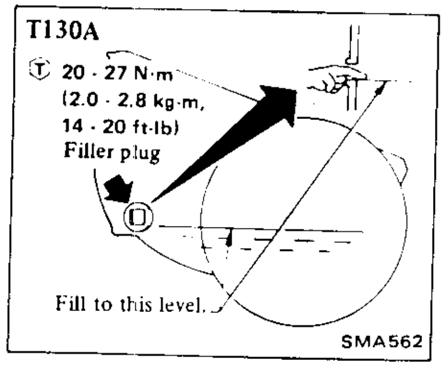
Check fluid for contamination to determine condition of automatic transmission. If fluid is very dark or smells burned, the frictional material (clutches, band, etc.) may need replacement.

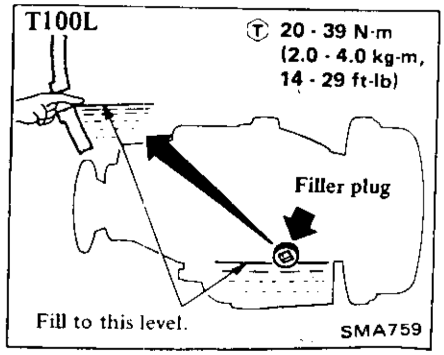


TRANSFER

CHECKING TRANSFER OIL LEVEL

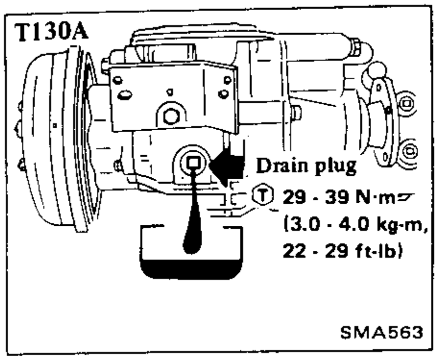
Never start engine while checking oil level.

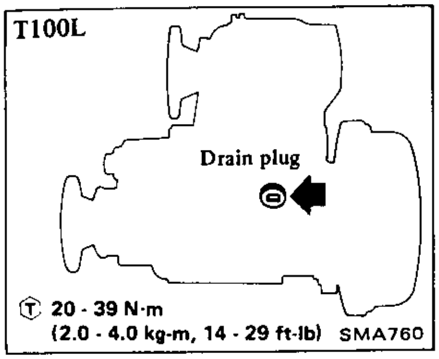




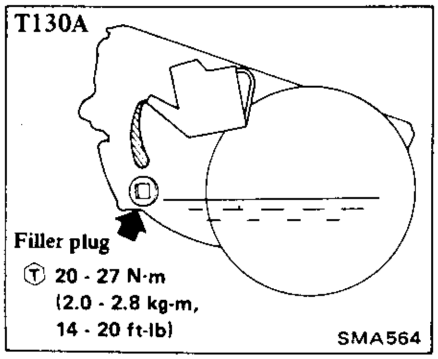
CHANGING TRANSFER OIL

1. Drain oil completely.

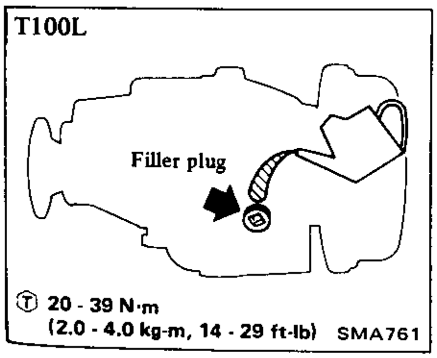




2. Refill oil and check oil level.



Oil capacity:
1.8 ℓ (3-1/8 Imp pt)

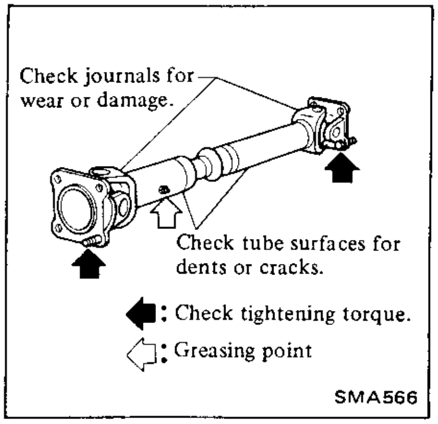


Oil capacity:
1.4 ℓ (2-1/2 Imp pt)

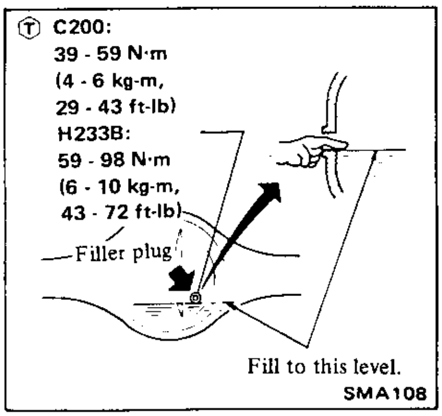
PROPELLER SHAFT AND DIFFERENTIAL CARRIER

CHECKING PROPELLER SHAFT

Check propeller shaft, replace if necessary.

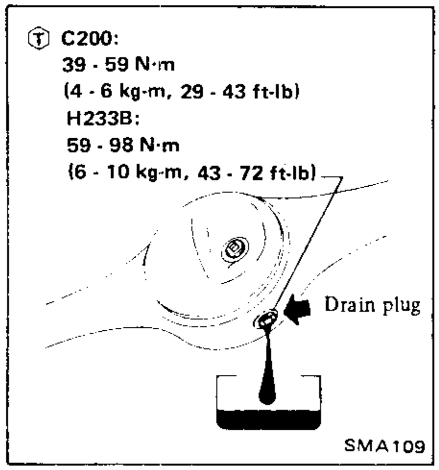


CHECKING DIFFERENTIAL CARRIER OIL LEVEL

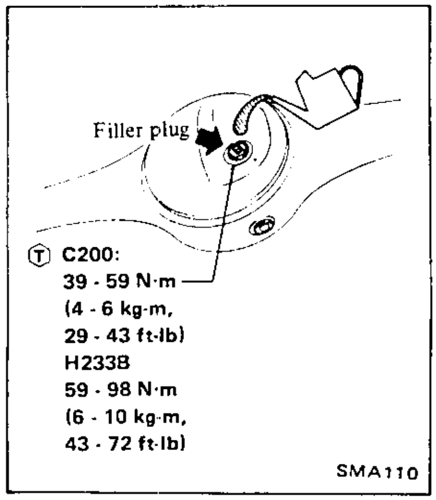


CHANGING DIFFERENTIAL CARRIER OIL

1. Drain oil completely.



2. Refill differential carrier and check oil level.



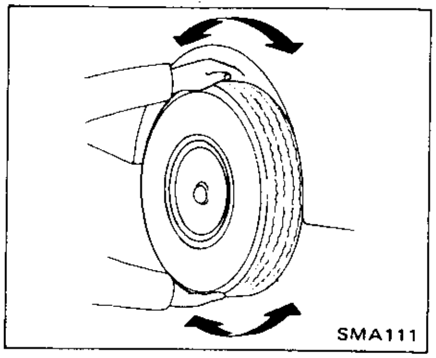
Oil capacity:

Model		Liter	Imp measure
H233B		2.0	3-1/2 pt
C200	FR	1.5	2-5/8 pt
	RR	1.0	1-3/4 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.

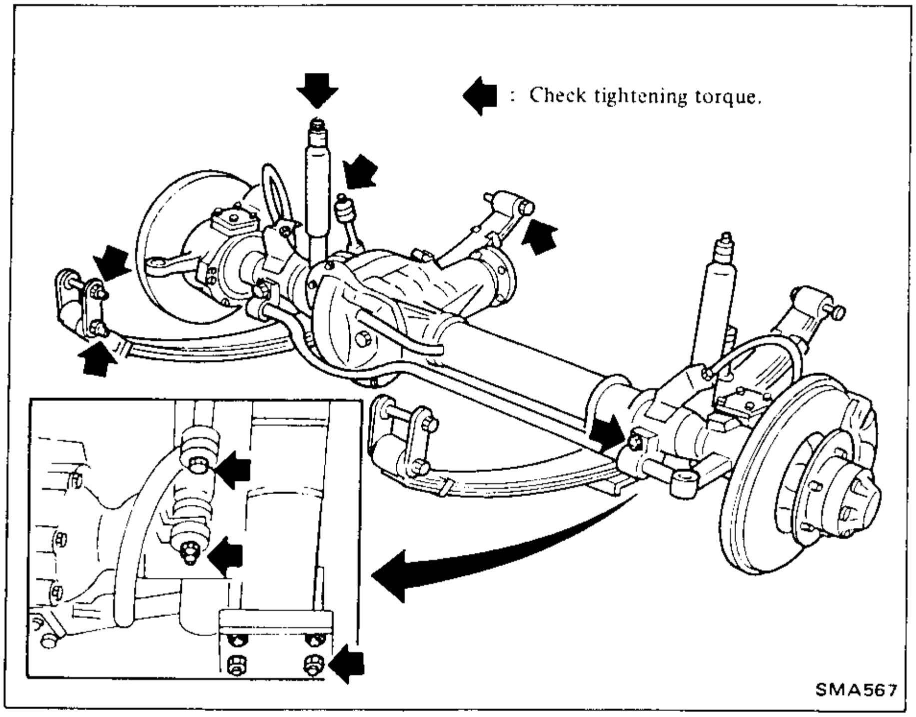


SMA111

Check suspension parts for looseness, wear, or damage.

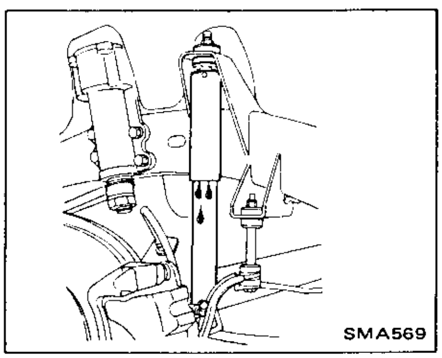
Retighten all loose nuts and bolts to the specified torque. Refer to Section FA for tightening torque.

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



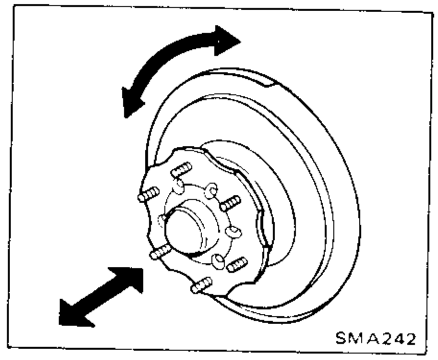
SMA567

3. Check shock absorber for oil leakage or damage.



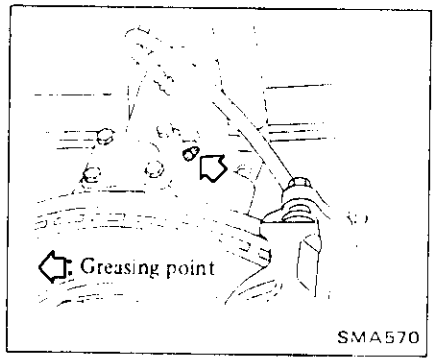
SMA569

4. Remove wheel and tire assembly.
5. Check front axle parts for crack or damage.
   Replace worn parts.
   Refer to Front Axle (Section FA).
6. Remove brake pads (Models equipped with front disc brake).
   Refer to section BR.
7. 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).

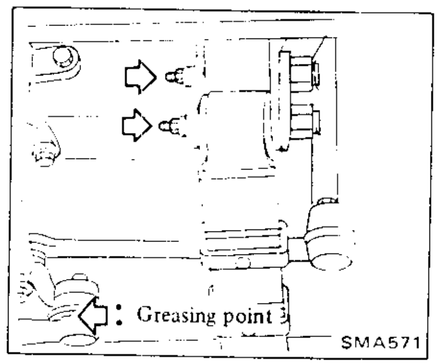


SMA242

GREASING SUSPENSION AND AXLE PARTS



SMA570



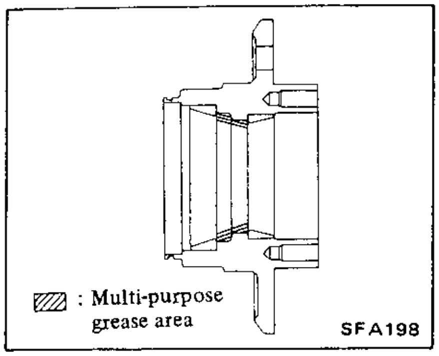
SMA571

ADJUSTING WHEEL BEARING PRELOAD

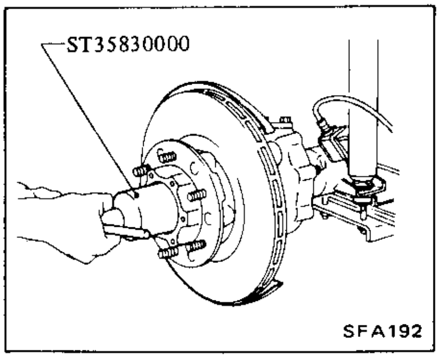
After wheel bearing has been replaced or front axle has been reassembled be sure to adjust wheel bearing preload as described below.

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.

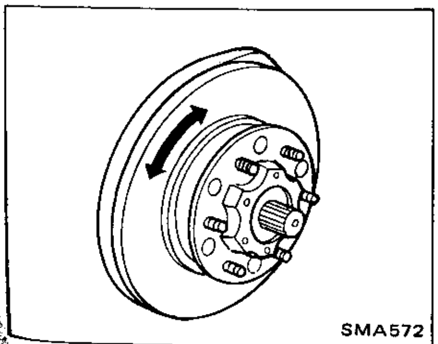


3. Install washer to knuckle spindle.
Apply grease to wheel bearing inner lock nut and tighten it to specified torque using **Tool.**



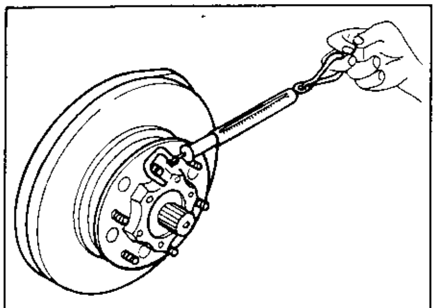
Ⓣ : Wheel bearing lock nut
167 - 196 N·m
(17 - 20 kg-m,
123 - 145 ft-lb)

4. Turn hub two or three times to nestle bearing and again tighten wheel bearing inner lock nut to specified torque.



Ⓣ : Wheel bearing lock nut
167 - 196 N·m
(17 - 20 kg-m,
123 - 145 ft-lb)

5. Adjust wheel bearing preload and axial play to the specified values by loosening inner lock nut.



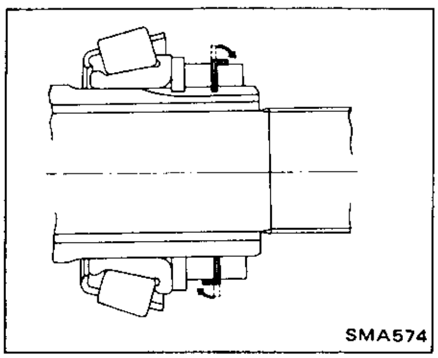
Axial play:
Less than 0.08 mm (0.0031 in)
Wheel bearing preload (As measured at wheel hub bolt):
With new parts
29 - 49 N (3 - 5 kg, 7 - 11 lb)
With used parts
20 - 39 N (2 - 4 kg, 4 - 9 lb)

SMA573

6. When wheel bearing preload and axial play are to the specified values, tighten outer lock nut to specified torque.

Ⓣ : Wheel bearing lock nut
167 - 196 N·m
(17 - 20 kg-m,
123 - 145 ft-lb)

7. Firmly bend wheel bearing lock washer at 2 positions approximately 180 degrees apart.



8. Install free-running hub or drive flange, snap ring and cap. **Refer to Section FA for axle shaft installation.**

CHECKING WHEEL ALIGNMENT

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

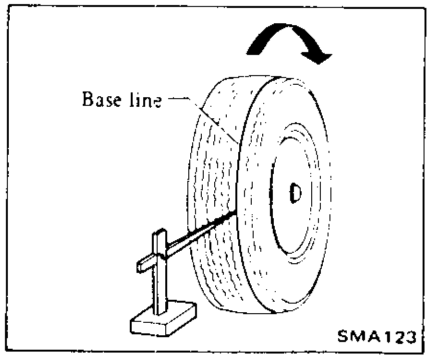
- **Tire pressure**
- **Wheel bearing axial play**
- **Steering gear housing looseness at frame**
- **Steering linkage and connections**
- **Shock absorber operation**
- **Tighten each front axle and suspension parts.**
- **Measure vehicle height (Unladen).**
- **Repair or replace the damaged portion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

Toe-in

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

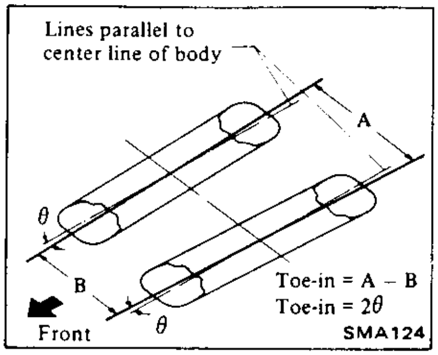
1. Raise front of vehicle and mark a base line across the tread of left and right wheels.



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

Lower front of vehicle and move vehicle back and forth.

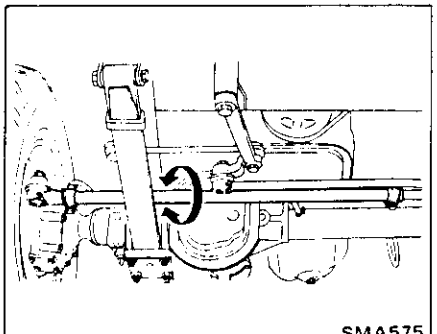
3. Measure toe-in and make necessary adjustments.



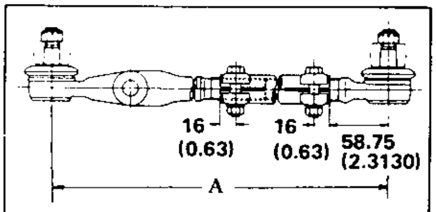
SMA124

Toe-in (Unladen):
3 - 4 mm (0.12 - 0.16 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 tie rod.


SMA575

If tie rod has been disassembled, set the distance between left and right ball stud centers to the specified value "A" prior to reassembling.



Standard length "A" between ball stud centers: 1,219 (47.99)

Unit: mm (in)

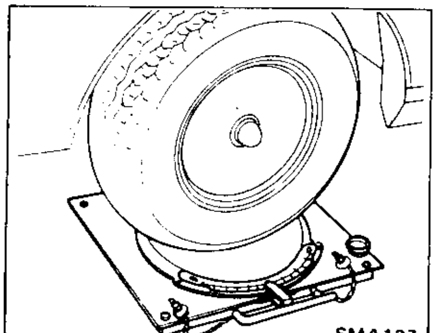
SST314

4. After correct toe-in has been obtained, tighten tie rod tube clamps.

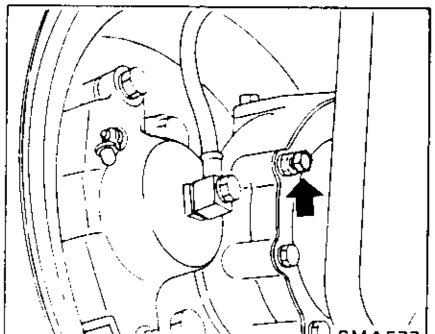
Ⓣ : **Tie rod tube clamps**
25 - 28 N·m
(2.5 - 2.9 kg-m,
18 - 21 ft-lb)

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.


SMA127

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


SMA577

Front wheel turning angle:
Toe-out turns (When inner wheel 20°)
Outer wheel 19.5°
Full turns
Inner wheel 28° - 32°
Outer wheel 27.5° - 31.5°

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.

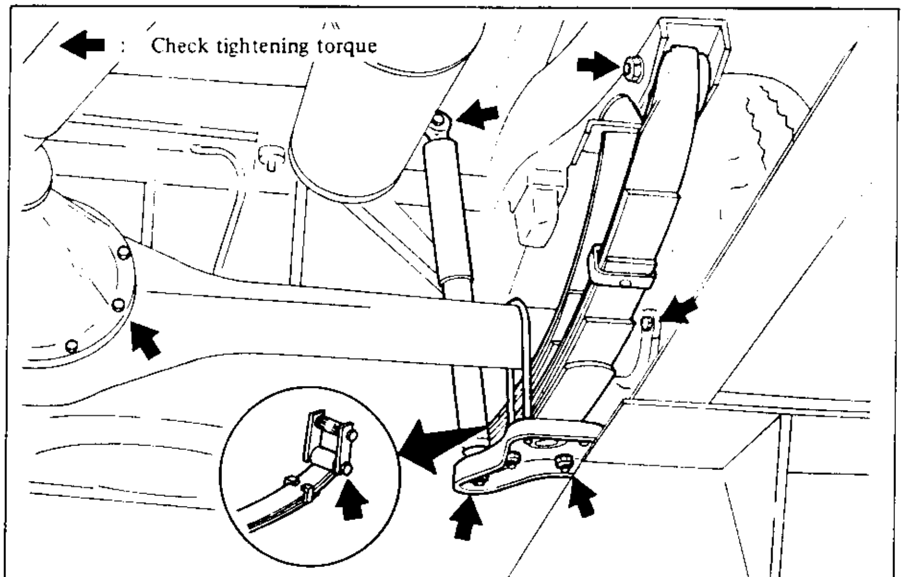
REAR AXLE AND REAR SUSPENSION

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.**

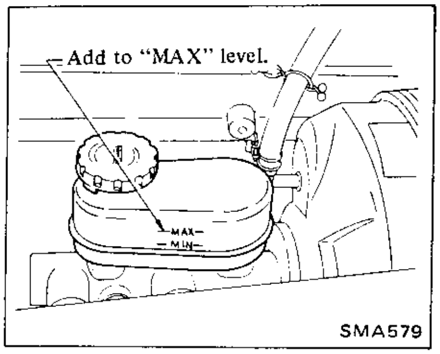
Replace all worn parts as instructed **under Rear Suspension (Section RA).**



SMA578

BRAKE SYSTEM

CHECKING BRAKE FLUID LEVEL AND LEAKS



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

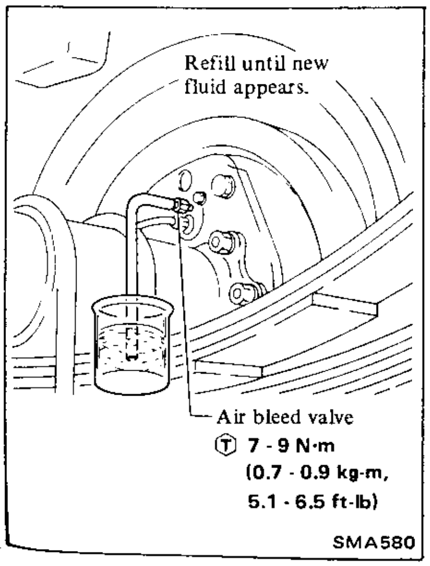
CHANGING BRAKE FLUID

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.

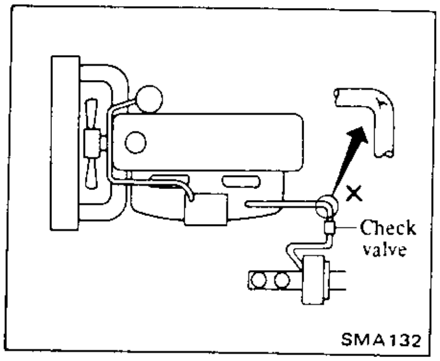
Recommended brake fluid specification:
DOT 3 (F.M.V.S.S. No. 116)

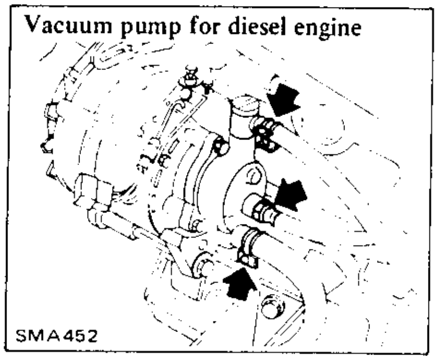


2. Check brake fluid level.
3. Check for leaks.

CHECKING BRAKE BOOSTER VACUUM HOSES, CONNECTIONS AND CHECK VALVE

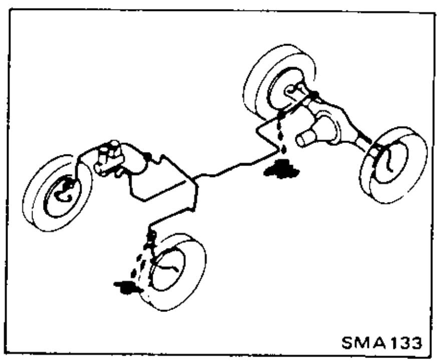
1. Check condition of vacuum hoses and connections.
2. Check vacuum hoses, check valve and vacuum pump (for diesel engine) for air tightness.





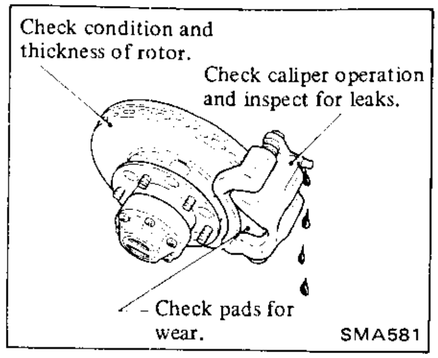
CHECKING BRAKE SYSTEM

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

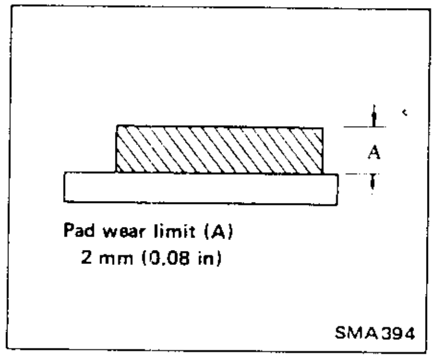


CHECKING DISC BRAKE

Check condition of disc brake components.

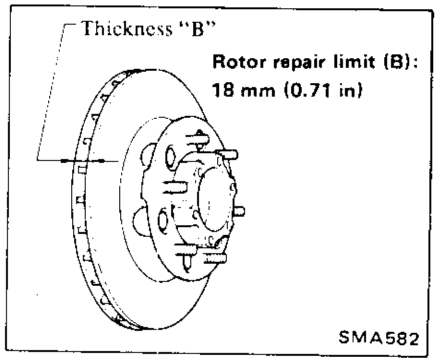


Pad wear limit



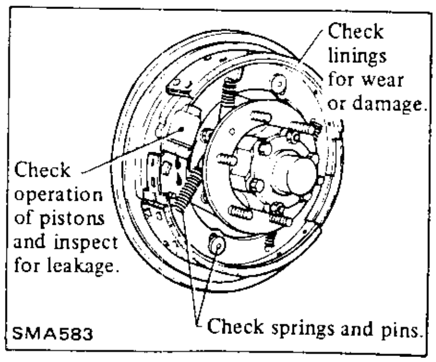
Refer to Section BR for pad replacement.

Rotor repair limit

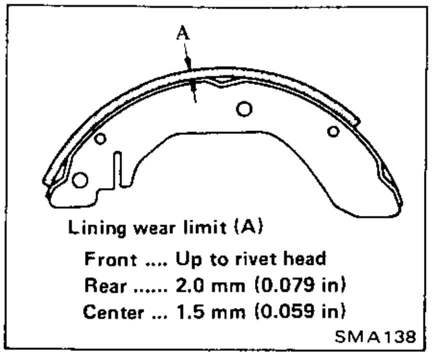


CHECKING DRUM BRAKE

Check condition of drum brake components.

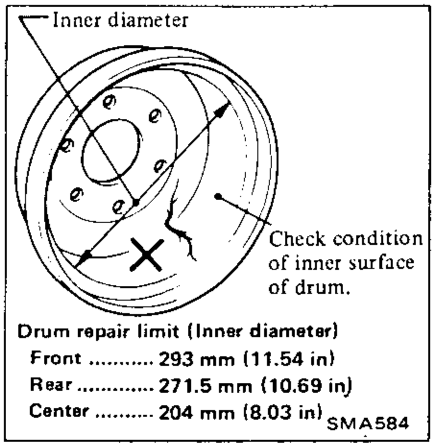


Lining wear limit



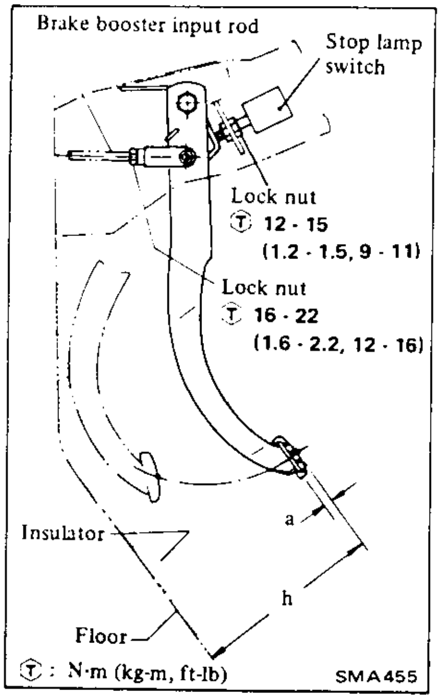
Refer to Section BR for shoe replacement.

Drum repair limit



CHECKING FOOT BRAKE

1. Check brake pedal free height and free play.
   Adjust if necessary.



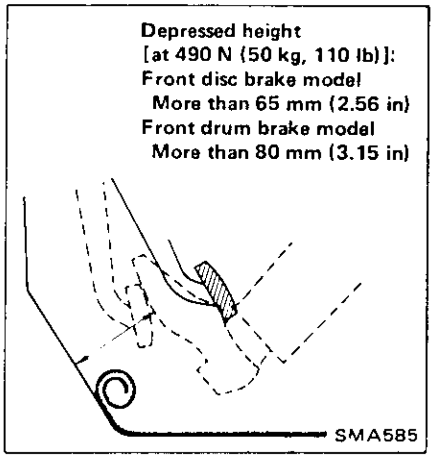
Pedal free height "h":
Model 160 series
190 - 196 mm (7.48 - 7.72 in)
Model 61 series
181 - 187 mm (7.13 - 7.36 in)
Pedal free play "a":
1 - 5 mm (0.04 - 0.20 in)

(1) Adjust pedal free height with stop 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 and adjust shoe-to-drum clearance, 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

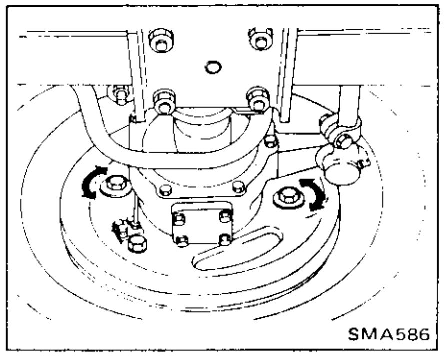
Front disc brake

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.

Front drum brake

1. Before adjustment of lining to drum clearance, pump brake pedal several times to settle brake shoes in correct position.
2. Raise vehicle until front wheels clear floor.
3. Turn a cam clockwise for left drum (counterclockwise for right drum) until shoe drags against brake drum.

Shoes expand and brake is locked when cam is turned in the direction of vehicle forward movement.

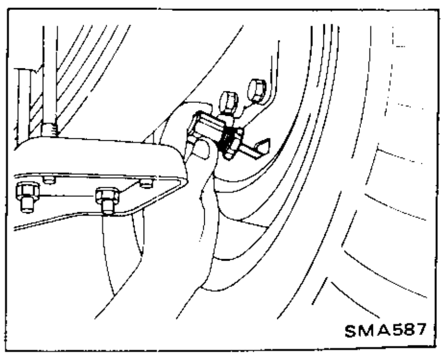


4. Turn out the adjusting cam a little at a time until brake shoe is not in contact with brake drum.
5. Follow steps 3 and 4 on remaining cam.

Rear brake

1. Make sure parking brake lever returns to its original position.
2. Raise vehicle until rear wheels clear floor.
3. Remove rubber cap from brake disc.
4. Turn down adjuster wheel with a screwdriver until shoe drags against brake drum.

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



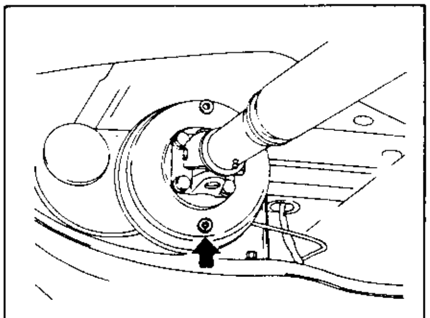
5. Return adjuster wheel until brake shoe is not in contact with brake drum.

Standard returning latches: 8 - 10

6. Install rubber cap.

ADJUSTING PARKING BRAKE

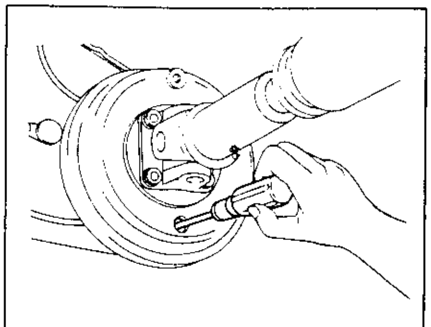
1. Set transmission and transfer control lever in neutral position.
2. Remove rubber cap from center brake drum.



SMA588

3. Turn down adjuster wheel with a screwdriver until shoe drags against brake drum.

Brake shoes spread when adjuster wheel is turned downward.



SMA589

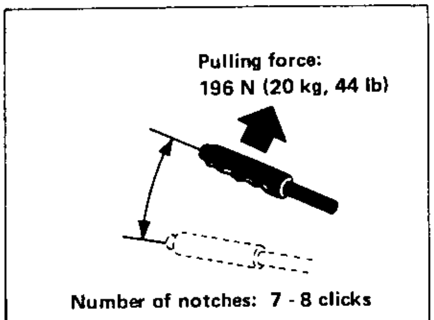
4. Return adjuster wheel standard latches to obtain correct clearance between brake drum and brake shoes.

Standard returning latches: 8 - 10

Turn brake drum, and make sure that brake drum turns without dragging. When brake shoes interfere with brake drum, return adjuster wheel one by one until brake shoe is not in contact with brake drum.

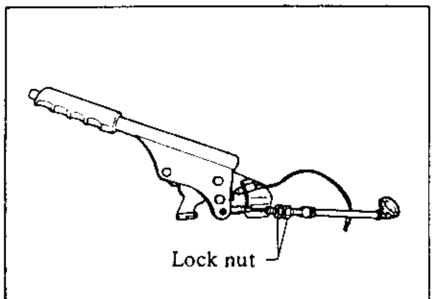
5. Pull lever with specified amount of force.

Measure lever stroke with number of notches.



SMA590

6. Adjust lever stroke.



SMA591

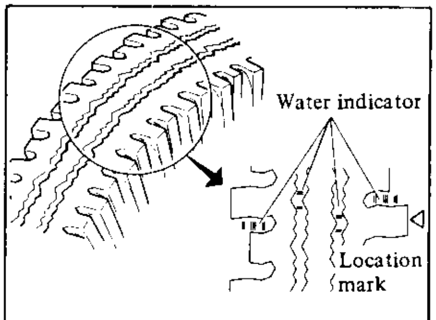
7. Bend parking brake warning lamp switch plate down so that brake warning light comes on when ratchet at parking brake lever is moved back one notch and goes out when returned to its original position.

WHEEL AND TIRE

CHECKING TIRE CONDITION

Tire condition

1. Tires are provided with "tread wear indicator", indicating 1.6 mm (1/16 in) tread depth. When tires wear and then marks appear, replace them with new ones.



SMA904

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

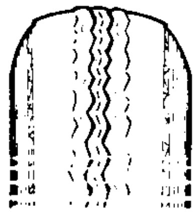
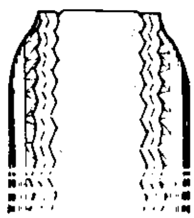
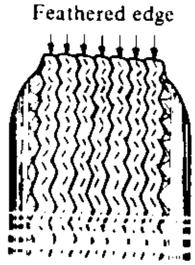
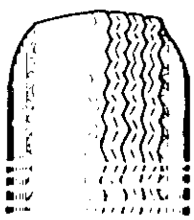
1. Check tire pressure. If necessary, adjust it to the specified value. **Refer to S.D.S.**

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.

Abnormal tire wear

Correct abnormal tire wear according to the chart shown below.

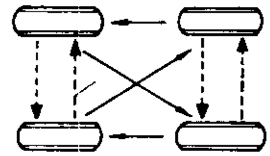
Condition	Probable cause	Corrective action
 Shoulder wear	• Underinflation (both sides wear) • Incorrect wheel camber (one side wear) • Hard cornering • Lack of rotation	• Measure and adjust pressure. • Adjust camber. • Reduce speed. • Rotate tires.
 Center wear	• Overinflation • Lack of rotation	• Measure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

SMA592

Bias and Bias Belted Tires

If the number of plies differs between front and rear tires, rotate according to the dotted lines.

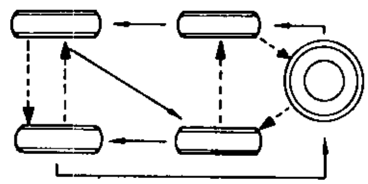
Right front Right rear



Left front Left rear

4 WHEELS

Right front Right rear

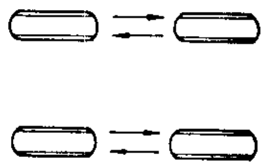


Left front Left rear

5 WHEELS

Radial Tire

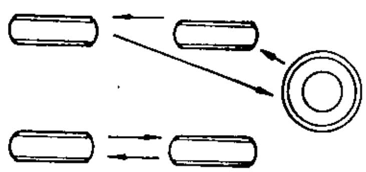
Right front Right rear



Left front Left rear

4 WHEELS

Right front Right rear



Left front Left rear

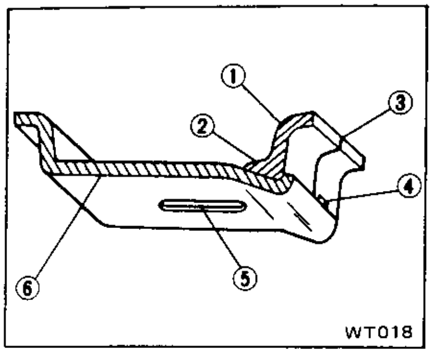
5 WHEELS

SMA637

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.**

5.50F X16SDC WHEEL AND TIRE



1	Side ring	4	Lever groove
2	Side ring bead seat	5	Valve hole
3	Side ring gap	6	Rim base

Removal

1. Fully deflate tire.
2. Insert tire lever between tire and side ring, and pry off tire over entire bead periphery.
3. Attach tire lever to side ring gap and flip toward lever groove in side ring.
4. Insert tip of side ring lever into its groove and flip side ring lever toward middle of wheel. Side ring gap end will then be separated from rim groove.

WARNING:
Always insert side ring lever far enough into groove, or it may slip out of place, resulting in accident or injury.

5. Starting with ring gap end, gradually pry side ring until it removed.

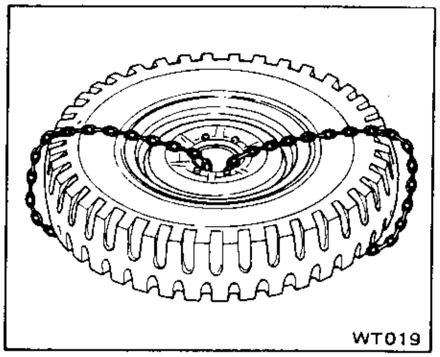
Installation

Before installing tire, carefully check side ring and rim, especially rim groove which comes in contact with side ring. Remove rust and dirt with a wire brush. If possible, coat these parts with rust-preventing paint.

1. Attach tire to rim.

Make sure air valve is facing in correct direction.

2. Place side ring onto rim, and **step on areas around side ring gap end until it catches in rim groove.**
3. Attach lever to a position 100 mm (3.94 in) away from the other end gap. Pulling side ring outwards, step on it starting with position where ring has already caught in groove, until entire side ring fits in rim groove.
4. Check side ring to make sure it is securely caught in groove all around and side ring gaps are positioned properly.
5. Attach chain or wire to wheel and tire.



6. Inflate tire to approx. 98 kPa (1.0 bar, 1 kg/cm^2, 14 psi). Lightly tap tire with a mallet so that it is well seated on side ring.
7. Inflate tire to the specified pressure.

TIRE REPLACEMENT

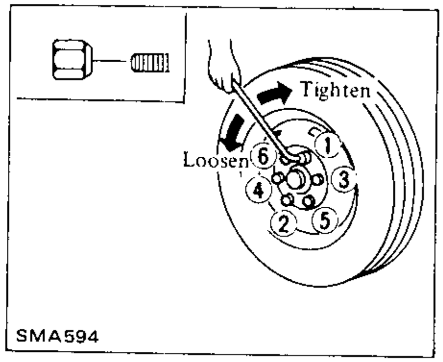
CAUTION:
Different types of tires, such as bias, bias belted and radial tires, must not be mixed under any circumstances. Mixed use of different types of tires can adversely affect vehicle handling and may cause driver to lose control.

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, tubes 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.



Ⓣ : **118 - 147 N·m**
(12 - 15 kg-m,
87 - 108 ft-lb)

TIRE AND/OR TUBE 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.
- 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.

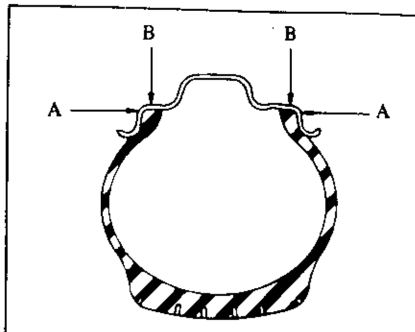
WHEEL INSPECTION

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.
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 2.0 mm (0.079 in)
SMA595

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

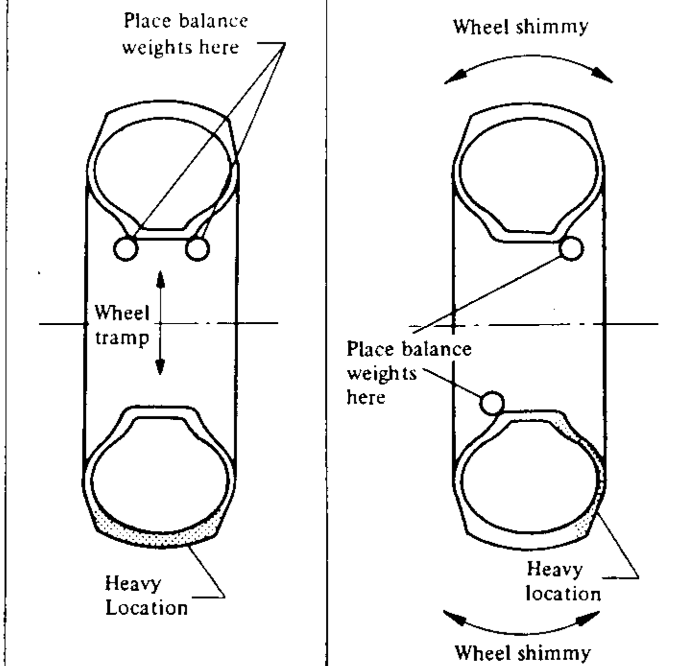
Inspect wheel and tire for wheel balance and correct it if unbalance is present, taking the following points into consideration.

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

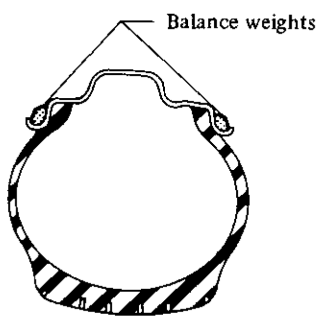
Balancing wheels

> **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



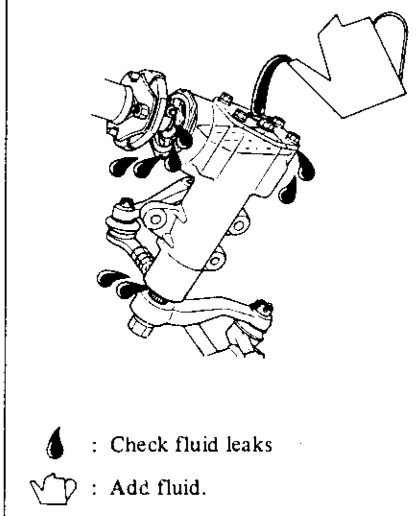
Maximum allowable unbalance at rim flange:
30 g (1.06 oz)
Balance weight:
Ⓐ Road wheel size 4.50Ex16 & 5.00Ex16
10 - 60 g (0.35 - 2.12 oz) at 10 g (0.35 oz) interval
Ⓑ Road wheel size 5.50Fx16SDC
20 - 100 g (0.71 - 3.53 oz) at 20 g (0.71 oz) interval

SMA596

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



: Check fluid leaks
: Add fluid.

SMA604

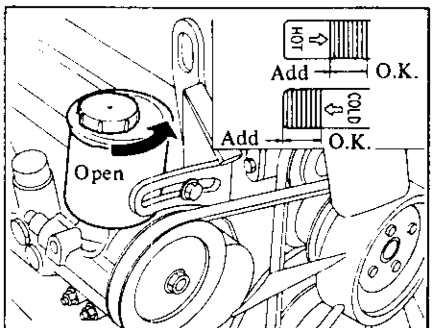
CHECKING ZF POWER STEERING SYSTEM FLUID AND LINES

1. After stopping the engine, check fluid level in reservoir.

Check dipstick on "HOT" side at normal operating temperature, or "COLD" side when fluid is cold.

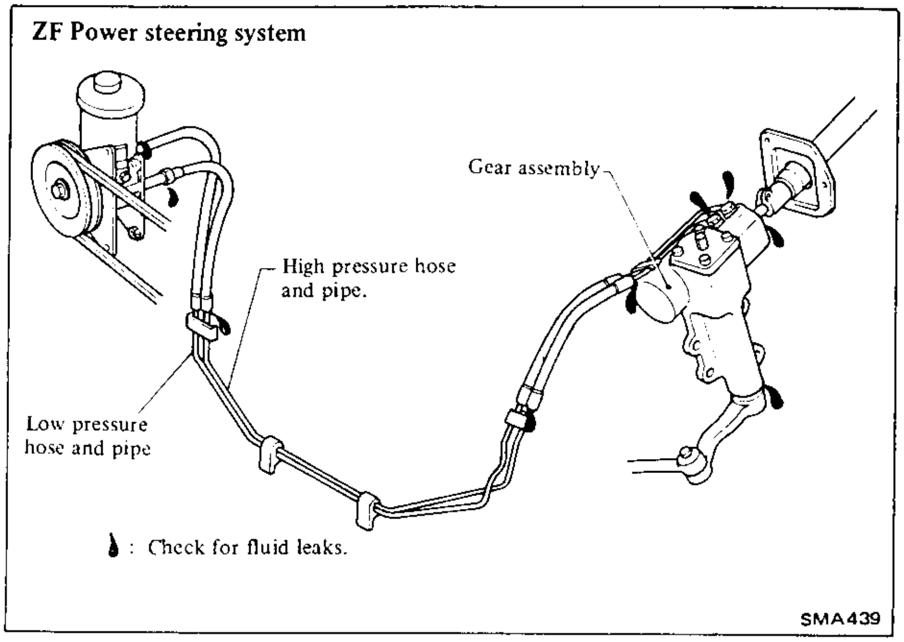
Add recommended fluid if necessary.

> **CAUTION:**
> **Do not overfill.**



TPF001

2. Inspect line condition and check for leaks.



CHECKING STEERING GEAR BOX AND LINKAGE

Steering gear box

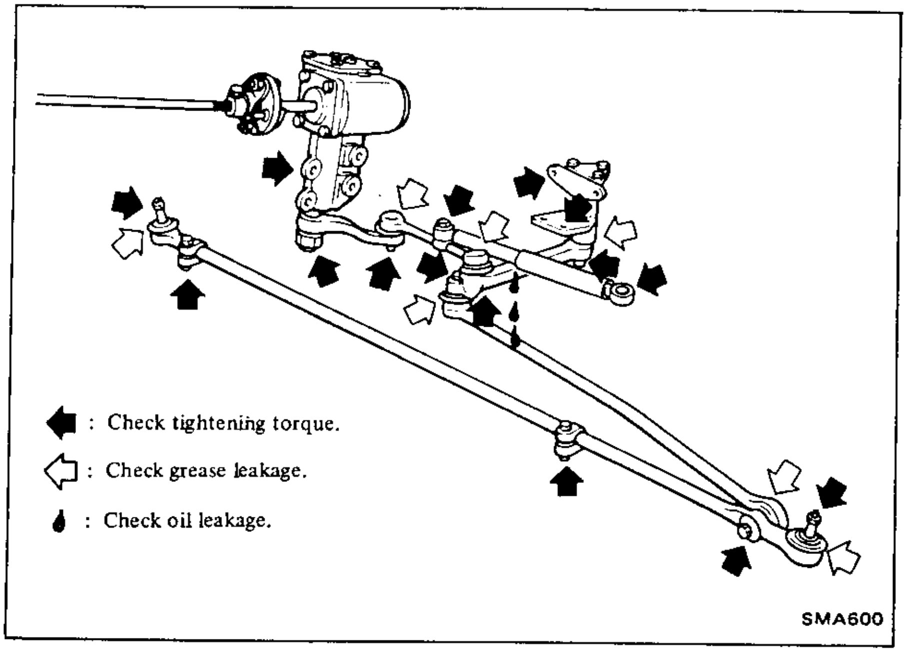
- Check parts for looseness, wear or damage. Retighten if neccessary. **Refer to Section ST for tightening torque.**

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.).

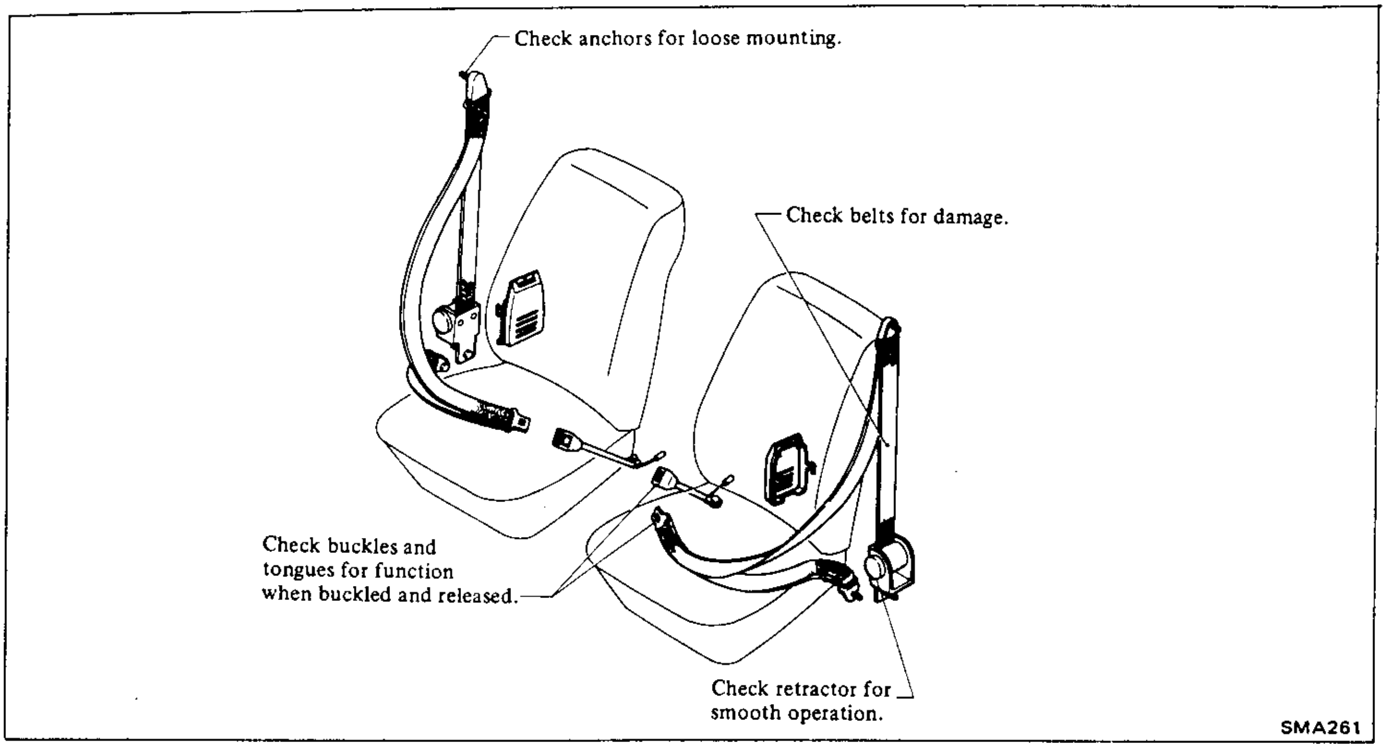
Steering damper

- Check shock absorber for oil leakage, damage or looseness.

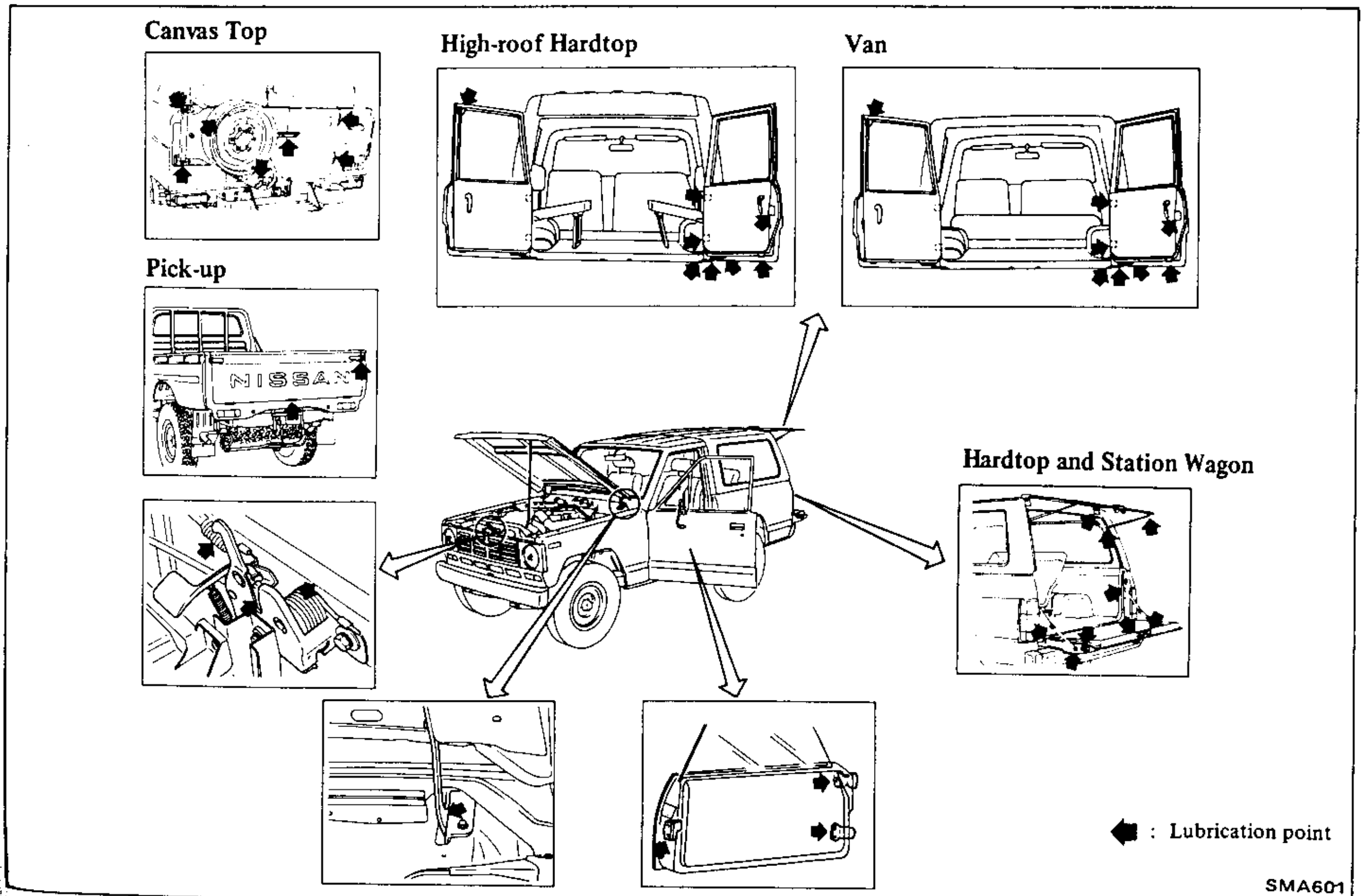


BODY

CHECKING SEAT BELTS, BUCKLES, RETRACTORS, ANCHORS AND ADJUSTER

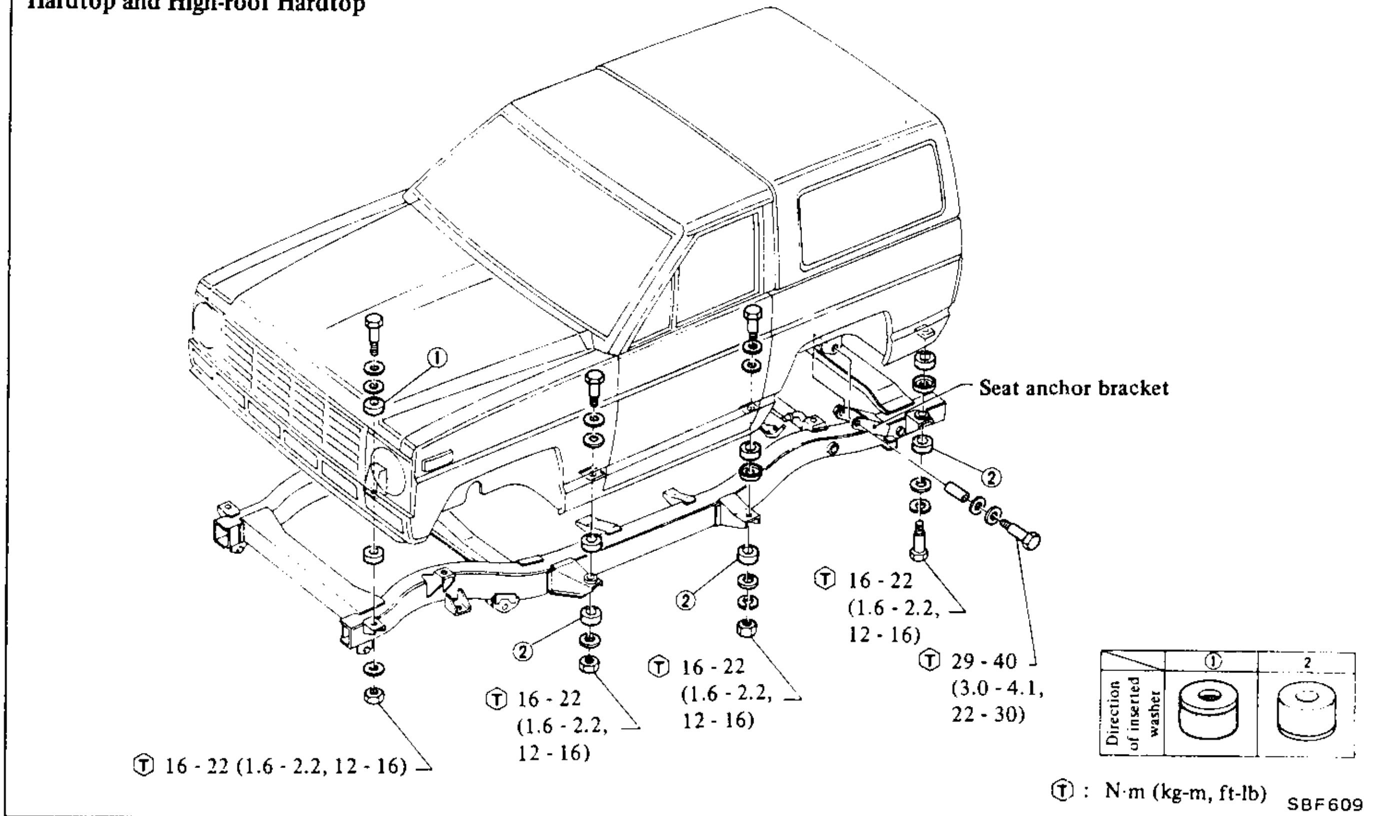


LUBRICATING LOCKS, HINGES AND HOOD LATCH

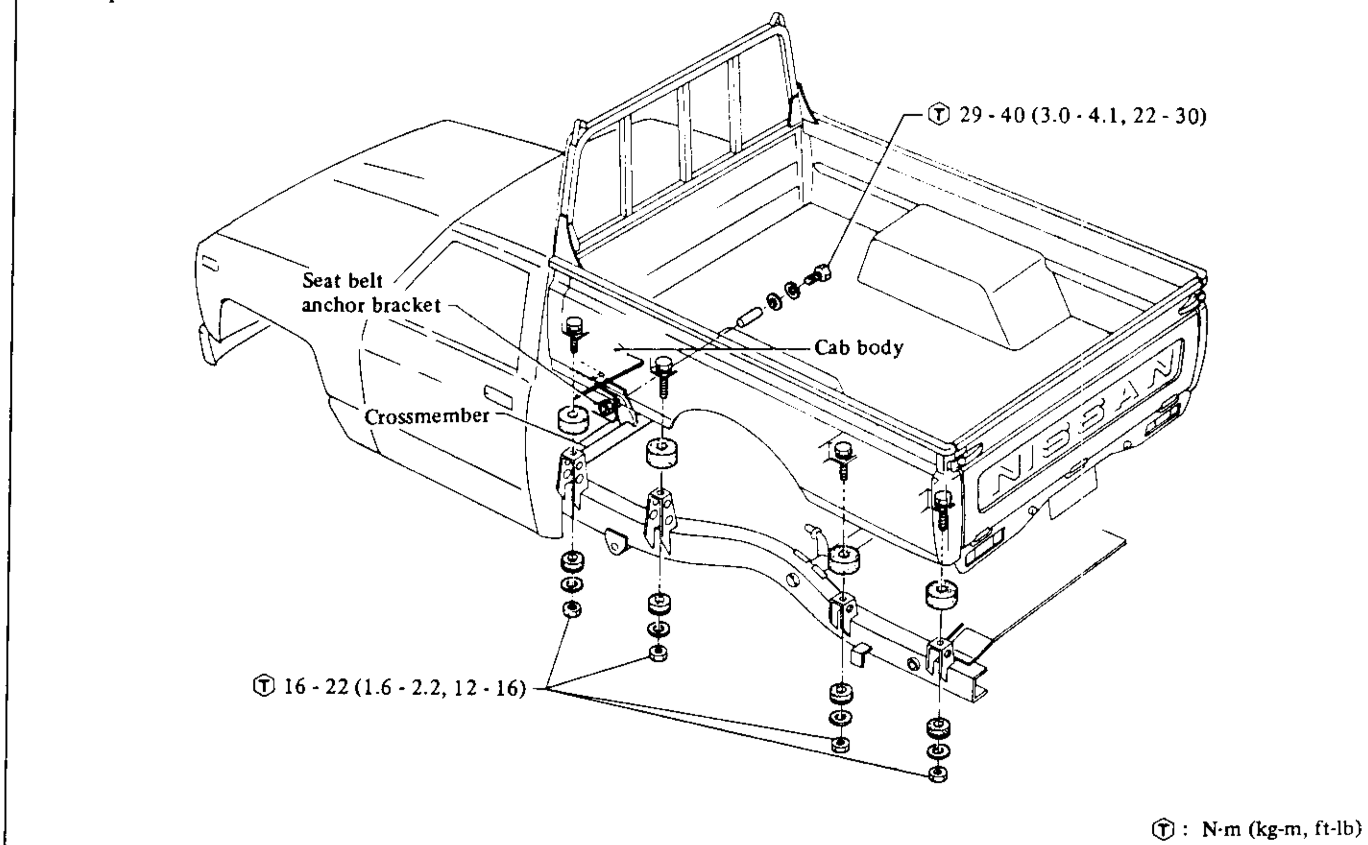


RETIGHTEN BODY MOUNTINGS

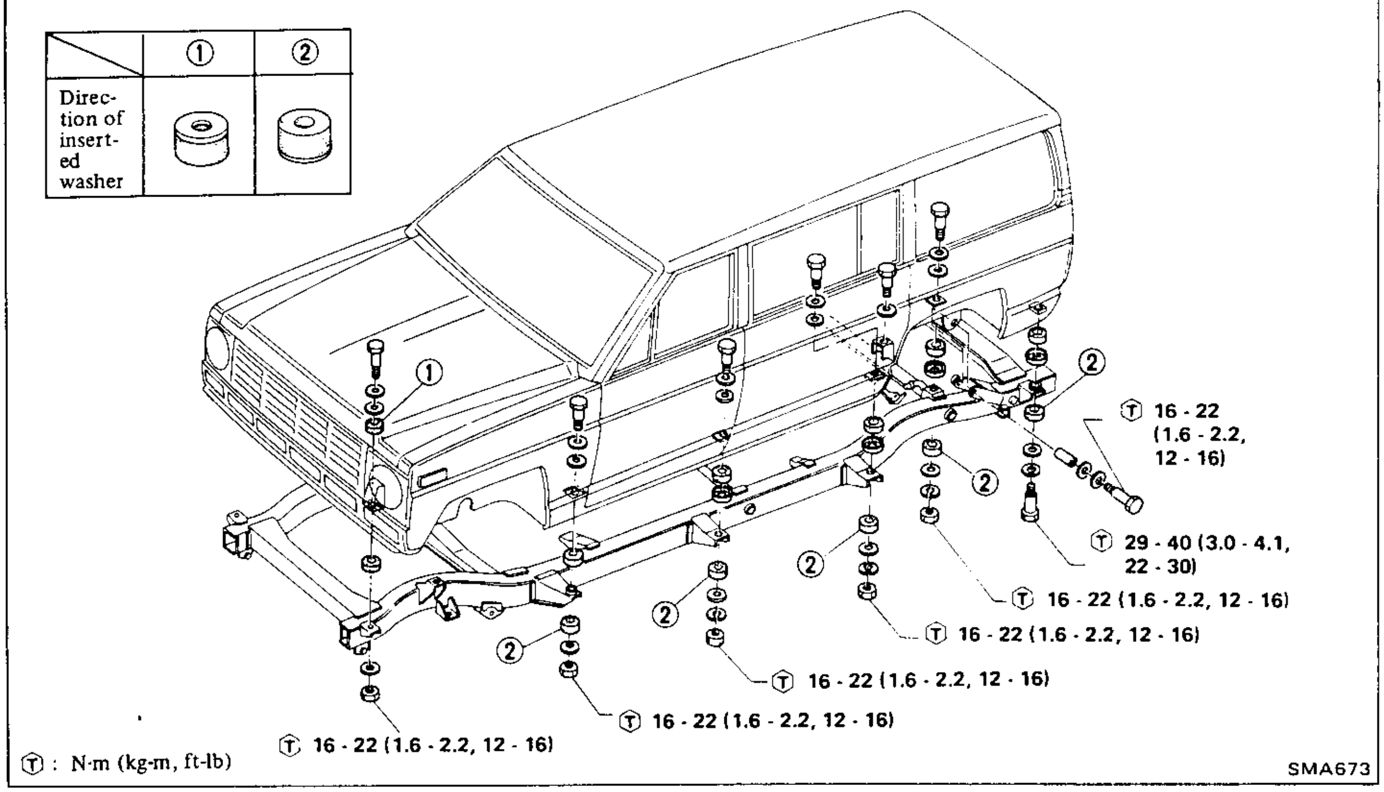
Hardtop and High-roof Hardtop



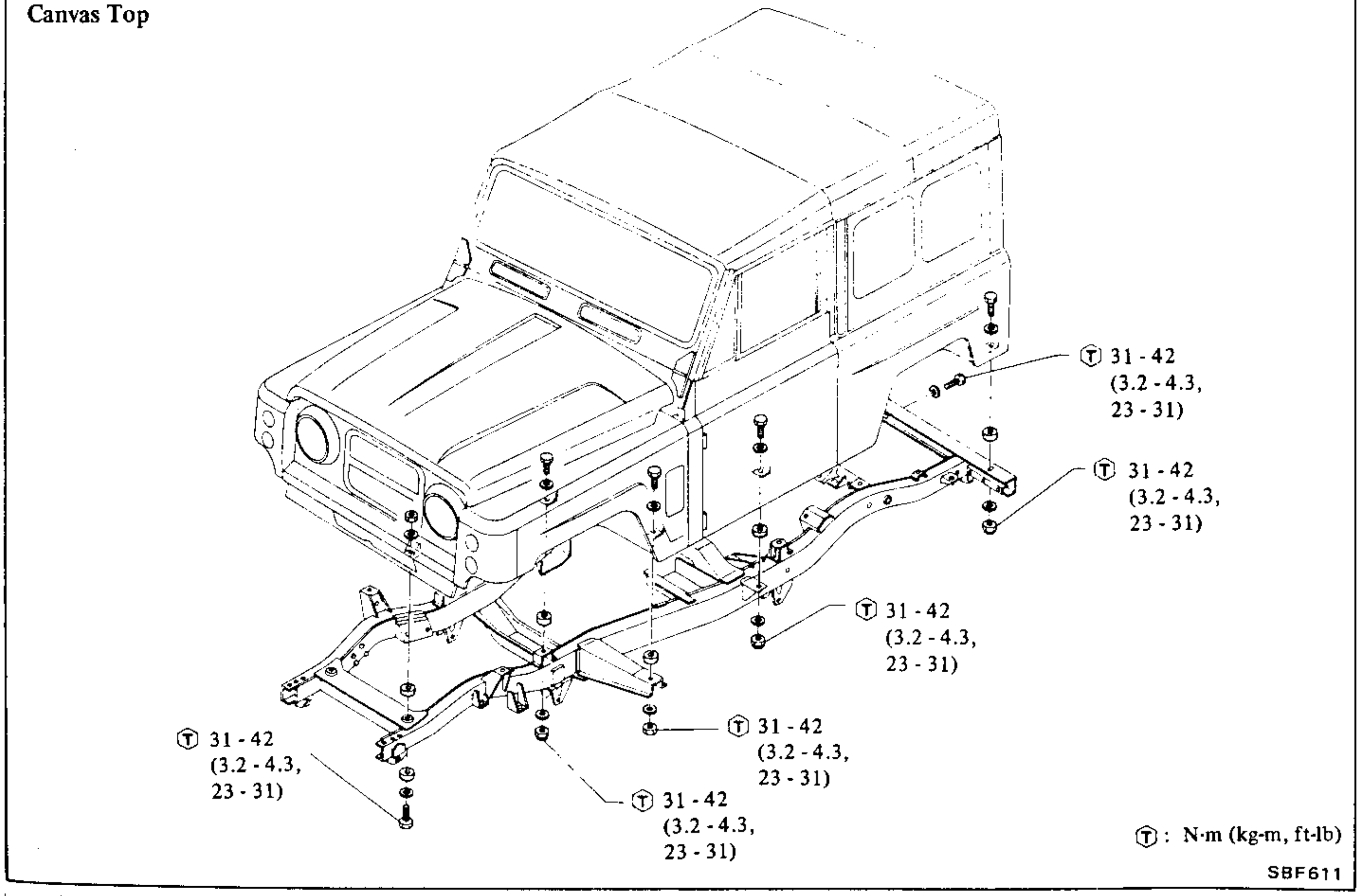
Pick-up



Van and Station Wagon



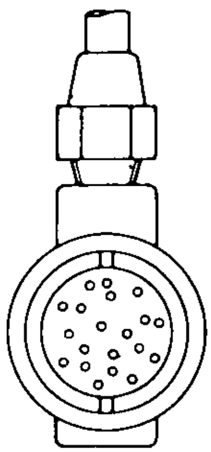
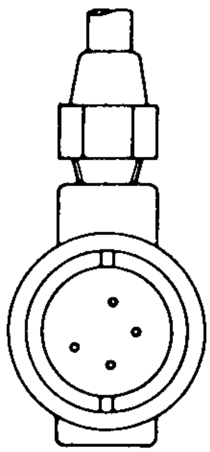
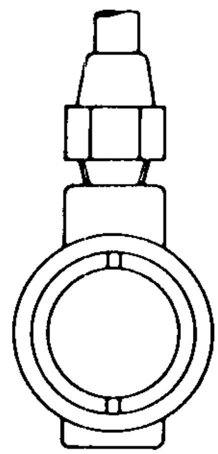
Canvas Top



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.

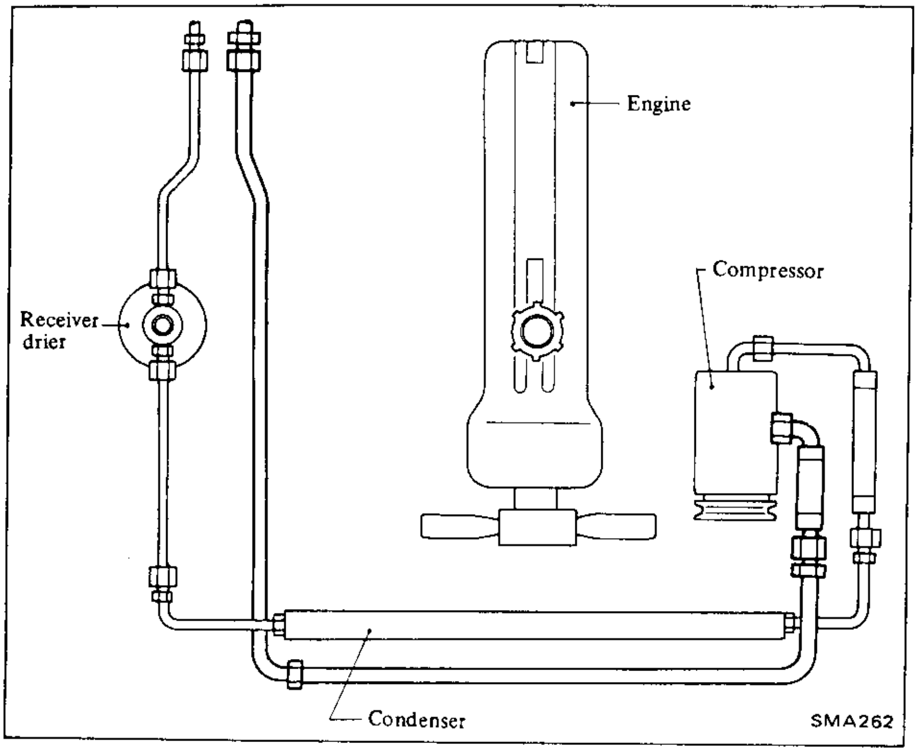
CHECKING COMPRESSOR DRIVE BELT

Refer to Engine Maintenance for inspection and adjustment.

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.

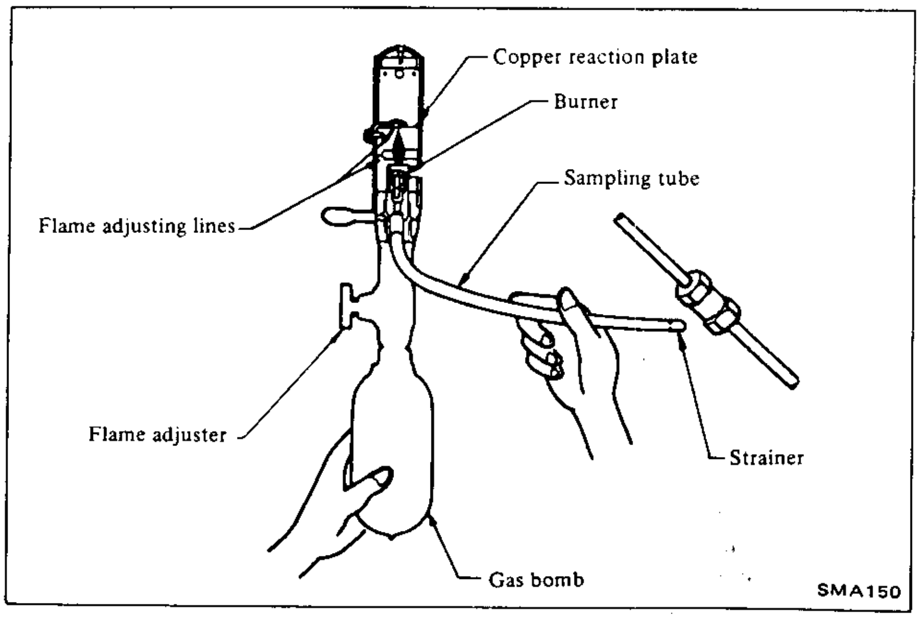
Major check points

(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



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.

SERVICE DATA AND SPECIFICATIONS

ENGINE MAINTENANCE —Gasoline Engine—

INSPECTION AND ADJUSTMENT

Basic mechanical system

Engine		L28	P40
Valve clearance (Hot) mm (in)	Intake	0.25 (0.010)	0.38 (0.015)
	Exhaust	0.30 (0.012)	
Drive belt deflection [Applied force 98 N (10 kg, 22 lb)] mm (in)		8 - 12 (0.31 - 0.47)	
Engine oil capacity liter (Imp qt)	with oil filter	4.4 (3-7/8)	5.5 (4-7/8)
	without oil filter	3.9 (3-3/8)	4.8 (4-1/4)
Water capacity liter (Imp qt)	with heater	10.8 (9-1/2)	14.8 (13) *16.2 (14-1/4)
	without heater	9.9 (8-3/4)	13.9 (12-1/4) *15.3 (13-1/2)

*Canvas Top model

Engine		L28	P40
Radiator cap relief pressure kPa (bar, kg/cm², psi)		88 (0.88, 0.9, 13)	
Cooling system leakage testing pressure kPa (bar, kg/cm², psi)		157 (1.57, 1.6, 23)	
Compression pressure kPa (bar, kg/cm², psi) at rpm	Standard	1,177 (11.77, 12.0, 171)/350	1,128 (11.28, 11.5, 164)/250
	Minimum	883 (8.83, 9.0, 128)/350	1,030 (10.30, 10.5, 149)/250

Ignition and fuel system

Ignition timing, engine idle speed and idle "CO"%

Engine	L28	P40
Ignition timing/Idle speed (B.T.D.C. degree/rpm)	10°/650 *1	10°/550 *2 5°/650 *3
Idle "CO" %	2.0	3.0 *2 1.5 *3

*1: For A/T models, values are measured in "N" position.
*2: Except for Europe and Hong Kong
*3: For Europe and Hong Kong

Distributor

Engine	L28	P40
Point gap mm (in)	0.45 - 0.55 (0.018 - 0.022)	
Dwell angle degree	35° - 41°	

Spark plug

	Engine	L28	P40
Type	Cold	BP7ES, L44PW BPR7ES*	B7ES, L44W BPR7ES*
	Standard	BP6ES, L45PW BPR6ES*	B6ES, L45W BPR6ES*
	Hot	BP5ES, L46PW BP4E, L47PW BPR5ES*, BPR4E*	B5ES, L46W B4E, L47W BPR5ES*, BPR4E*
Plug gap mm (in)		0.8 - 0.9 (0.031 - 0.035)	0.7 - 0.8 (0.028 - 0.031)

*: Resistor built-in type spark plug for Europe.

High tension cable

Resistance (Ohm)	Less than 30,000

Battery

Type		N50Z		
Voltage/Capacity (V/A–Hr)		12/60		
Electrolyte gravity [At 20°C (68°F)]		Frigid climate	Tropical climate	Other climates
	Permissive valve	Over 1.22	Over 1.18	Over 1.20
	Fully charged valve	1.28	1.24	1.26

TIGHTENING TORQUE

Unit: N·m (kg-m, ft-lb)

Engine		L28	P40
Cylinder head bolt		69 - 83 (7.0 - 8.5, 51 - 61)	69 - 88 (7.0 - 9.0, 51 - 65)
Pivot lock nut		49 - 59 (5.0 - 6.0, 36 - 43)	–
Manifold bolt and nut	Bolt	15 - 25 (1.5 - 2.5, 11 - 18)	25 - 34 (2.5 - 3.5, 18 - 25)
	Nut	12 - 16 (1.2 - 1.6, 9 - 12)	
Carburetor		12 - 18 (1.2 - 1.8, 9 - 13)	
Exhaust tube		26 - 36 (2.7 - 3.7, 20 - 27)	
Spark plug		15 - 20 (1.5 - 2.0, 11 - 14)	
Oil pan drain plug		20 - 29 (2.0 - 3.0, 14 - 22)	

CHASSIS AND BODY MAINTENANCE

INSPECTION AND ADJUSTMENT

Clutch

Unit: mm (in)

	Model 160 series	Model 61 series
Pedal height	190 - 196 (7.48 - 7.72)	181 - 187 (7.13 - 7.36)
Pedal free play	1 - 5 (0.04 - 0.20)	

Front axle and suspension

Axial play mm (in)	Less than 0.08 (0.0031)
Wheel bearing preload As measured at wheel hub bolt With new parts N (kg, lb)	29 - 49 (3 - 5, 7 - 11)
With used parts N (kg, lb)	20 - 39 (2 - 4, 4 - 9)
Wheel alignment (Unladen) Toe-in mm (in)	3 - 4 (0.12 - 0.16) 14' - 19' (On both sides)
Side slip (Reference data)	Out 3 mm - In 3 mm/m (Out 0.036 - In 0.036 in/ft)
Standard tie rod length between left and right ball stud center mm (in)	1,219 (47.99)
Front wheel turning angle Toe-out turns (When inner wheel is 20°) Outer wheel	19.5°
Full turns Inner wheel	28° - 32°
Outer wheel	27.5° - 31.5°

Brake system

Unit: mm (in)

Pad wear limit		2 (0.08)
Rotor repair limit		18 (0.71)
Lining wear limit	Front	Up to rivet head
	Rear	2.0 (0.079)
	Center	1.5 (0.059)
Drum repair limit	Front	293 (11.54)
	Rear	271.5 (10.69)
	Center	204 (8.03)
Pedal height	Model 160 series	190 - 196 (7.48 - 7.72)
	Model 61 series	181 - 187 (7.13 - 7.36)
Pedal free play		1 - 5 (0.04 - 0.20)
Pedal depressed height	Front disc	More than 65 (2.56)
	Front drum	More than 80 (3.15)
Parking brake [At pulling force: 196 N (20 kg, 44 lb)] Number of notches		7 - 8

Wheel and tire

Unit: kg/cm² (kPa, bar, psi)

Model			Tire (Load →)	Light	Heavy
Hardtop	Light duty	Front Rear	6.50-16-6PRLT 6.50-16-8PRLT	1.8 (177, 1.77, 26) 2.4 (235, 2.35, 34)	1.8 (177, 1.77, 26) 3.5 (343, 3.43, 50)
		Front Rear	7.50-16-6PRLT 7.50-16-8PRLT	1.8 (177, 1.77, 26) 2.4 (235, 2.35, 34)	1.8 (177, 1.77, 26) 3.5 (343, 3.43, 50)
		Front Rear	7.50R16-8PRLT 7.50R16-8PRLT	2.0 (196, 1.96, 28) 2.0 (196, 1.96, 28)	2.0 (196, 1.96, 28) 3.5 (343, 3.43, 50)
	Heavy duty	Front Rear	6.50-16-6PRLT 6.50-16-10PRLT	1.8 (177, 1.77, 26) 2.6 (255, 2.55, 37)	1.8 (177, 1.77, 26) 5.0 (490, 4.90, 71)
		Front Rear	7.50-16-6PRLT 7.50-16-10PRLT	1.8 (177, 1.77, 26) 2.6 (255, 2.55, 37)	1.8 (177, 1.77, 26) 5.0 (490, 4.90, 71)
		Front Rear	7.50R16-8PRLT 7.50R16-8PRLT	2.0 (196, 1.96, 28) 2.4 (235, 2.35, 34)	2.0 (196, 1.96, 28) 4.6 (451, 4.51, 65)
Pick-up	Except SD33 Engine	Front Rear	7.00-16-6PRLT 7.00-16-10PRLT	2.4 (235, 2.35, 34) 2.4 (235, 2.35, 34)	2.4 (235, 2.35, 34) 5.0 (490, 4.90, 71)
		Front Rear	7.50-16-6PRLT 7.50-16-10PRLT	2.4 (235, 2.35, 34) 2.4 (235, 2.35, 34)	2.4 (235, 2.35, 34) 5.0 (490, 4.90, 71)
		Front Rear	7.50R16-8PRLT 7.50R16-8PRLT	2.0 (196, 1.96, 28) 2.4 (235, 2.35, 34)	2.0 (196, 1.96, 28) 4.6 (451, 4.51, 65)
	SD33 Engine	Front Rear	7.00-16-6PRLT 7.00-16-10PRLT	1.8 (177, 1.77, 26) 5.0 (490, 4.90, 71)	1.8 (177, 1.77, 26) 5.0 (490, 4.90, 71)
		Front Rear	7.50-16-6PRLT 7.50-16-10PRLT	1.8 (177, 1.77, 26) 5.0 (490, 4.90, 71)	1.8 (177, 1.77, 26) 5.0 (490, 4.90, 71)
		Front Rear	7.50R16-8PRLT 7.50R16-8PRLT	2.0 (196, 1.96, 28) 4.6 (451, 4.51, 65)	2.0 (196, 1.96, 28) 4.6 (451, 4.51, 65)
Van		Front Rear	6.50-16-6PRLT 6.50-16-10PRLT	1.8 (177, 1.77, 26) 2.4 (235, 2.35, 34)	2.4 (235, 2.35, 34) 4.8 (471, 4.71, 68)
		Front Rear	7.50-16-6PRLT 7.50-16-8PRLT	1.8 (177, 1.77, 26) 2.4 (235, 2.35, 34)	2.4 (235, 2.35, 34) 4.8 (471, 4.71, 68)
		Front Rear	7.50R16-8PRLT 7.50R16-8PRLT	2.2 (216, 2.16, 31) 2.8 (275, 2.75, 40)	2.2 (216, 2.16, 31) 4.2 (412, 4.12, 60)
Station Wagon		Front Rear	6.50-16-6PRLT 6.50-16-6PRLT	2.0 (196, 1.96, 28) 2.0 (196, 1.96, 28)	2.4 (235, 2.35, 34) 3.25 (319, 3.19, 46)
		Front Rear	7.50-16-6PRLT 7.50-16-6PRLT	2.0 (196, 1.96, 28) 2.0 (196, 1.96, 28)	2.2 (216, 2.16, 31) 2.6 (255, 2.55, 37)
		Front Rear	7.50R16-8PRLT 7.50R16-8PRLT	2.0 (196, 1.96, 28) 2.0 (196, 1.96, 28)	2.2 (216, 2.16, 31) 2.6 (255, 2.55, 37)

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

Model		Tire	Load	Light	Heavy
Canvas Top	(L)G61(Y)	Front Rear	6.50-16-6PRLT 6.50-16-6PRLT	1.5 (147, 1.47, 21) 2.2 (216, 2.16, 31)	1.8 (177, 1.77, 26) 2.6 (256, 2.55, 37)
		Front Rear	7.00-16-6PRLT 7.00-16-6PRLT	1.5 (147, 1.47, 21) 2.2 (216, 2.16, 31)	1.8 (177, 1.77, 26) 2.6 (255, 2.55, 37)
		Front Rear	7.50-16-6PRLT 7.50-16-6PRLT	1.6 (157, 1.57, 23) 2.0 (196, 1.96, 28)	1.8 (177, 1.77, 26) 2.8 (275, 2.75, 40)
	(L)G61H(Y)	Front Rear	6.50-16-6PRLT 6.50-16-6PRLT	1.5 (147, 1.47, 21) 2.6 (255, 2.55, 37)	1.8 (177, 1.77, 26) 4.0 (392, 3.92, 57)
		Front Rear	7.00-16-6PRLT 7.00-16-6PRLT	1.8 (177, 1.77, 26) 2.6 (255, 2.55, 37)	1.8 (177, 1.77, 26) 3.25 (319, 3.19, 46)
		Front Rear	7.50-16-6PRLT 7.50-16-6PRLT	1.8 (177, 1.77, 26) 2.6 (255, 2.55, 37)	1.8 (177, 1.77, 26) 3.25 (319, 3.19, 46)

Tire pressure should be checked when tires are COLD.

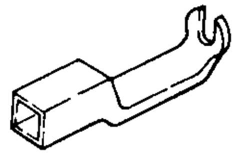
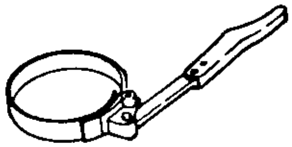
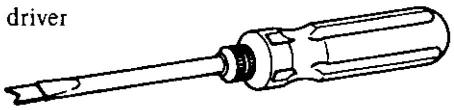
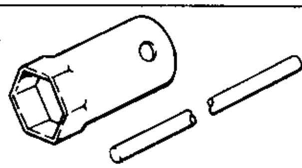
Wheel rim lateral and radial runout	mm (in)	Less than 2.0 (0.079)
Wheel balance (Maximum allowable unbalance at rim flange)	g (oz)	30 (1.06)
Tire balancing weight	g (oz)	Wheel disc size 4.50E x 16, 5.00E x 16: 10 - 60 (0.35 - 2.12) Spacing 10 (0.35) 5.50F x 16SDC: 20 - 100 (0.71 - 3.53) Spacing 20 (0.71)

TIGHTENING TORQUE

Unit	N·m	kg·m	ft-lb
Clutch Model 160 series Pedal stopper lock nut	8 - 12	0.8 - 1.2	5.8 - 8.7
Master cylinder push rod lock nut	8 - 11	0.8 - 1.1	5.8 - 8.0
Model 61 series Pedal stopper fixing bolt	4.2 - 5.4	0.43 - 0.55	3.1 - 4.0
Master cylinder fixing nut	16 - 21	1.6 - 2.1	12 - 15

Unit	N·m	kg·m	ft-lb
Manual transmission Drain and filler plugs	25 - 34	2.5 - 3.5	18 - 25
Transfer Filler plug T130A	20 - 27	2.0 - 2.8	14 - 20
T100L	20 - 39	2.0 - 4.0	14 - 29
Drain plug T130A	29 - 39	3.0 - 4.0	22 - 29
T100L	20 - 39	2.0 - 4.0	14 - 29
Differential carrier Drain and filler plugs C200	39 - 59	4.0 - 6.0	29 - 43
H233B	59 - 98	6.0 - 10.0	43 - 72
Front axle and front suspension Wheel bearing lock nut	167 - 196	17 - 20	123 - 145
Tie rod clamp nut	25 - 28	2.5 - 2.9	18 - 21
Brake Air bleed valve	7 - 9	0.7 - 0.9	5.1 - 6.5
Stop lamp switch lock nut	12 - 15	1.2 - 1.5	9 - 11
Brake booster input rod lock nut	16 - 22	1.6 - 2.2	12 - 16
Wheel and tire Wheel nut	118 - 147	12 - 15	87 - 108

SPECIAL SERVICE TOOLS

Tool number	Tool name	Engine application	
		L28	P40
ST10120000	Cylinder head bolt wrench 	X	–
ST10640001	Pivot adjuster 	X	–
ST19320000	Oil filter wrench 	X	X
KV10104500	Idle adjusting driver 	X	X
ST35830000	Wheel bearing lock nut wrench 	X	X

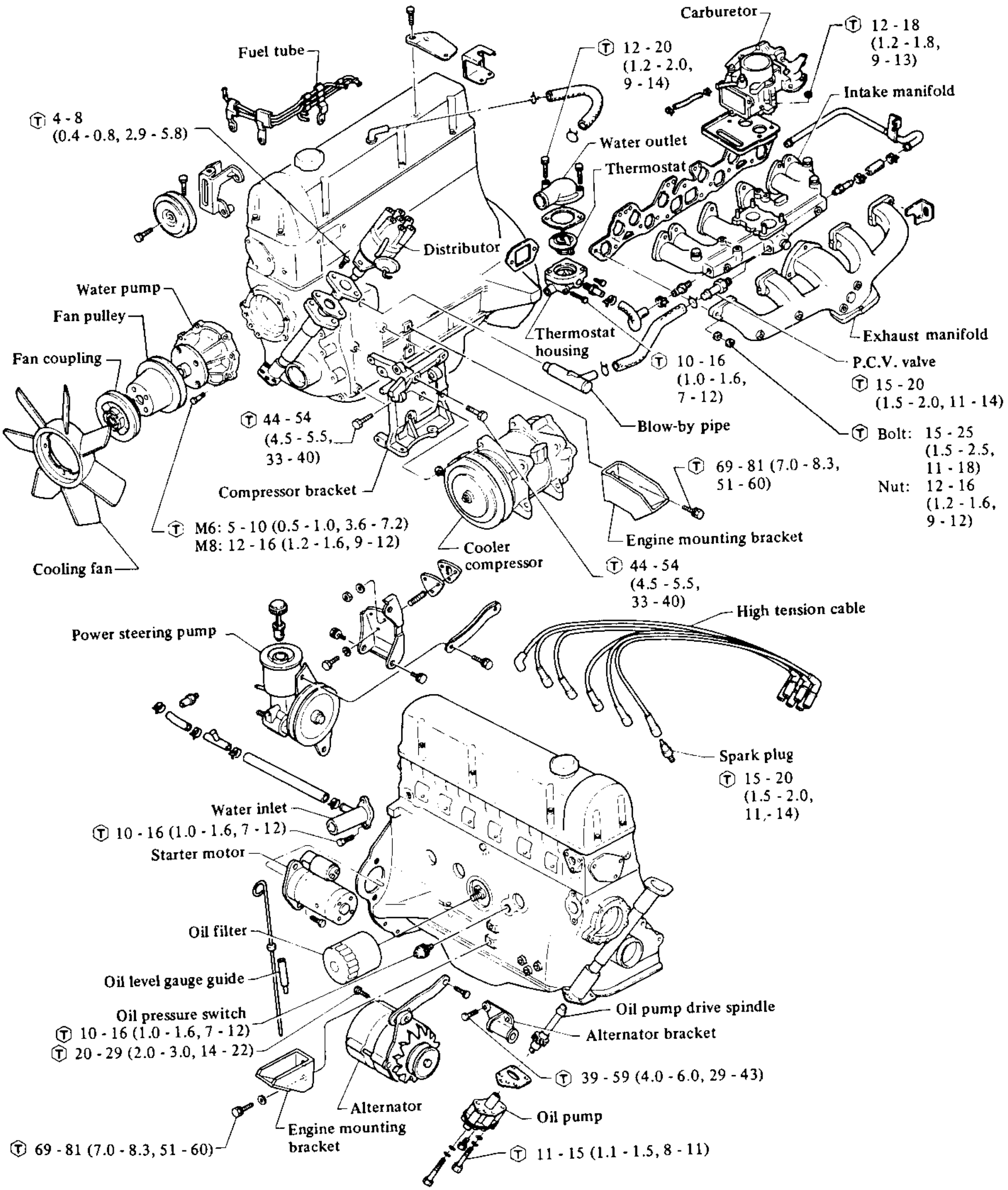
ENGINE MECHANICAL

SECTION EM

EM

CONTENTS

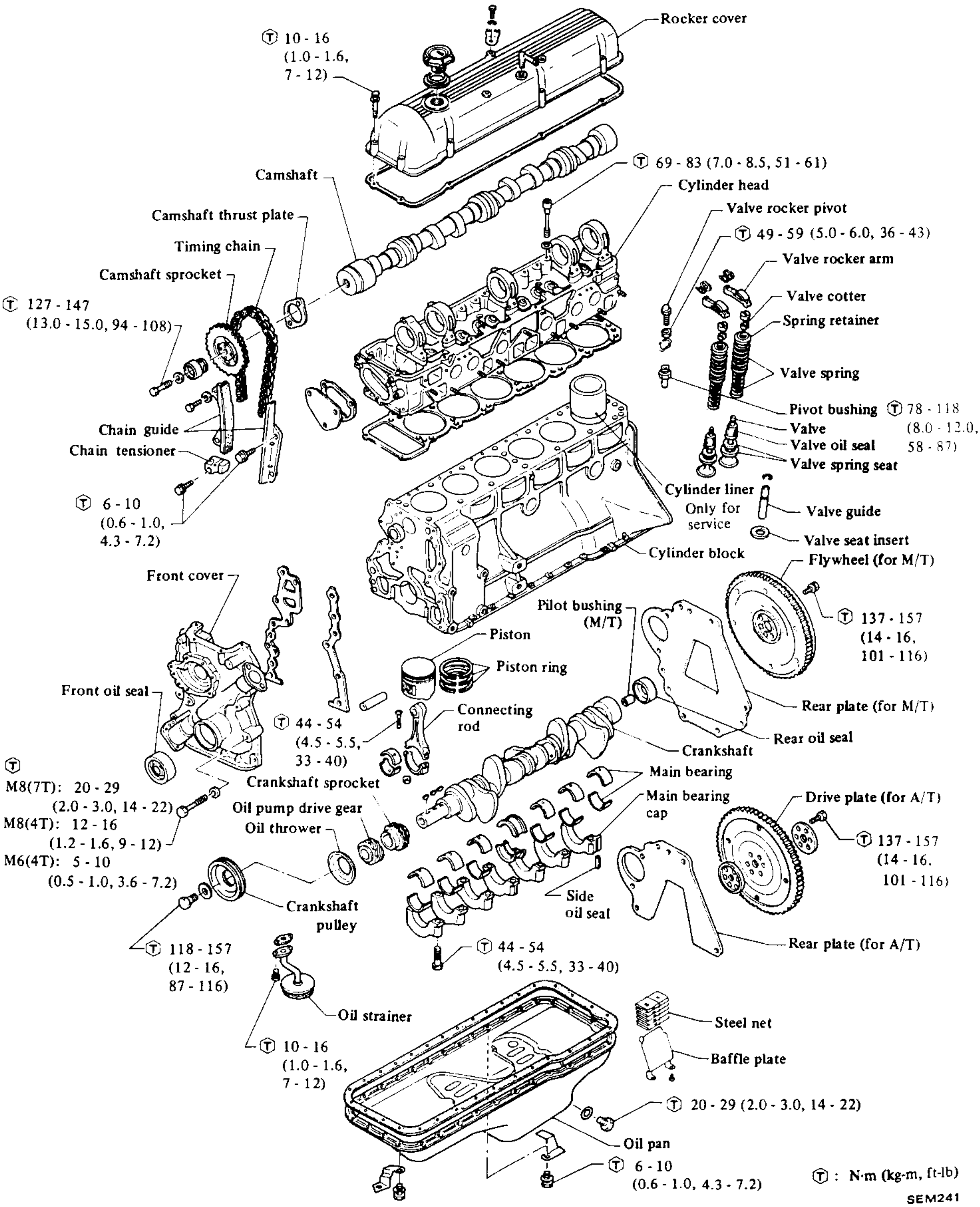
ENGINE COMPONENTS (L28 engine outer parts)



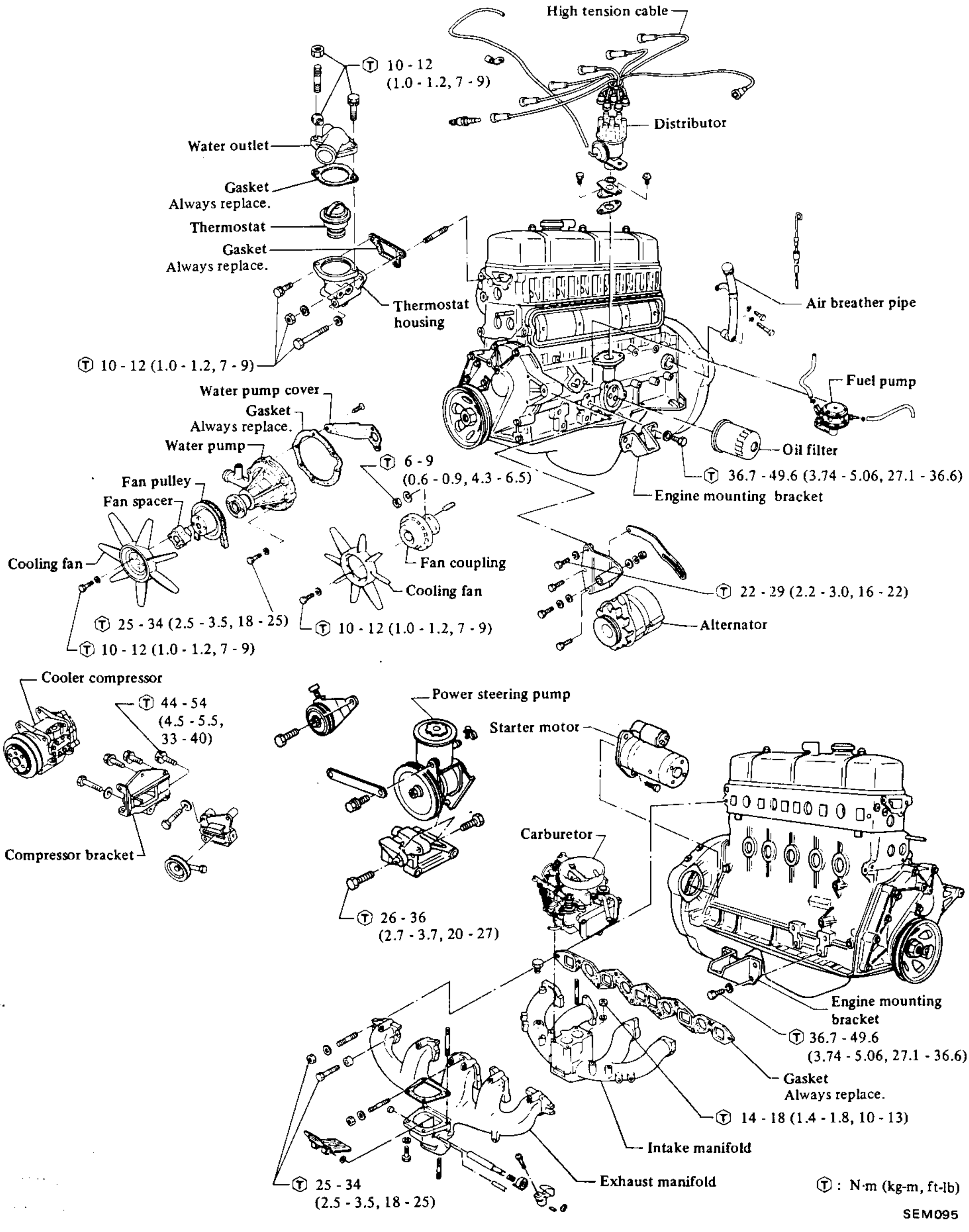
Ⓣ : N·m (kg-m, ft-lb)

SEM093

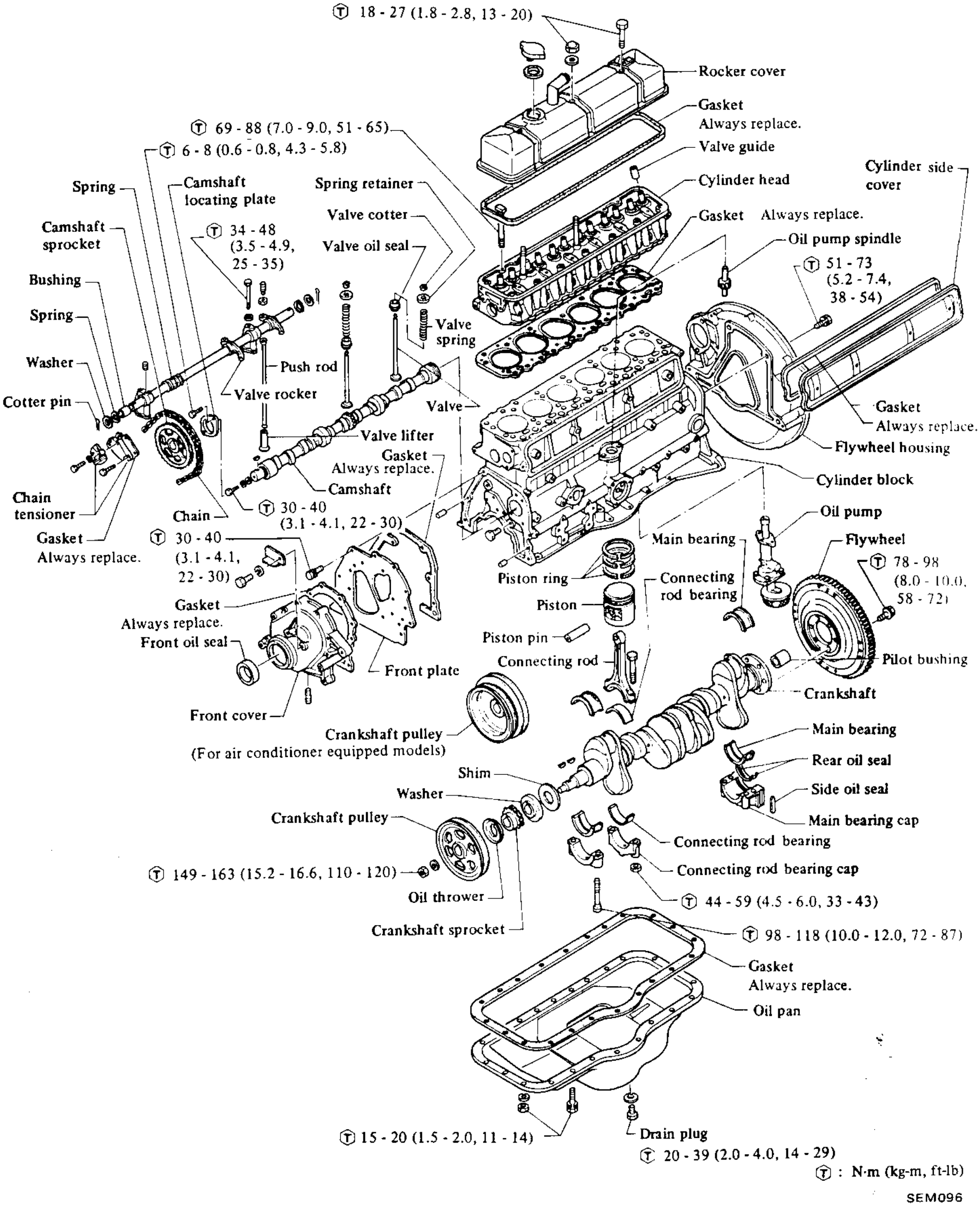
ENGINE COMPONENTS (L28 engine body parts)



ENGINE COMPONENTS (P40 engine outer parts)



ENGINE COMPONENTS (P40 engine body parts)



ENGINE DISASSEMBLY

PRECAUTIONS

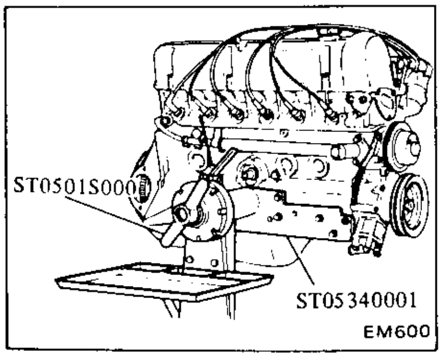
Arrange the disassembled parts on the parts stand in accordance with their assembled locations, sequence, etc., so that the parts will be reassembled to their original locations. Place mating marks on the parts if necessary.

DISASSEMBLING L28 ENGINE OVERALL

MOUNTING ENGINE ON ENGINE STAND

1. Remove following parts located at rear and right side of engine.
- Starter motor
- Clutch cover assembly (M/T)
- Converter housing (A/T)
- Alternator, alternator drive belt and alternator bracket
- Engine mounting bracket R.H.
- Oil filter **using Tool ST19320000**

2. Install engine attachment to cylinder block. Then, mount the engine on the engine stand.

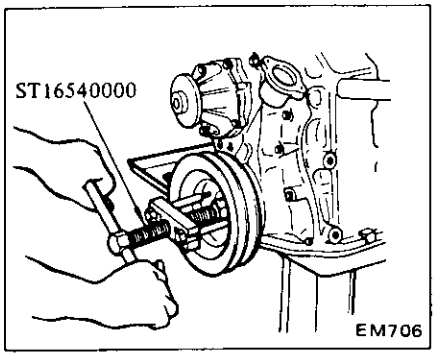


EM600

3. Drain engine oil and coolant.

REMOVING OUTER PARTS

Remove following parts:
1. Engine front side parts
- Fan, fan coupling and fan pulley
- Alternator adjusting bar
- Crank pulley **using Tool**



EM706

2. Engine left side parts.
- Distributor cap and high tension cable
- Distributor
- Hoses connected to engine
- Fuel line
- Carburetor from intake manifold
- Intake and exhaust manifold as an assembly with gaskets.
- Thermostat housing
- Air conditioner compressor bracket
- Engine mounting bracket L.H.

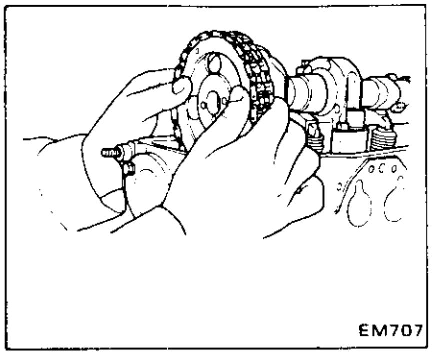
3. Engine right side parts
- Water inlet
- Water hoses and pipes
- Power steering oil pump bracket
- Oil pressure switch
- Oil level gauge
- Spark plugs

4. Engine bottom side parts
- Oil pump and oil pump drive spindle

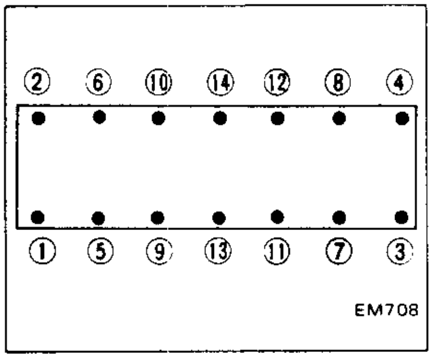
REMOVING BODY PARTS

Remove following parts:
1. Oil pan and oil strainer
2. Valve rocker cover
3. Cylinder head assembly

(1) Remove camshaft bolt by locking camshaft.
(2) Remove fuel pump cam and camshaft sprocket, and slowly lower timing chain.


EM707

(3) Remove bolts securing cylinder head to front cover.
(4) Loosen cylinder head bolts in the sequence as shown **using Tool ST10120000.**



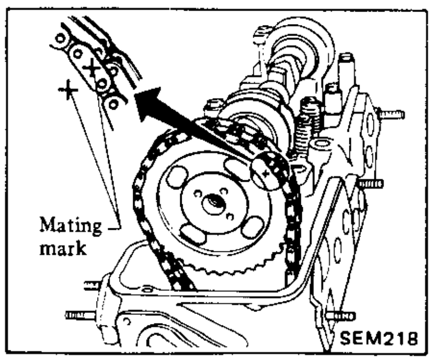
EM708

Gradually loosen cylinder head bolts in two or three stages.

(5) Remove cylinder head.

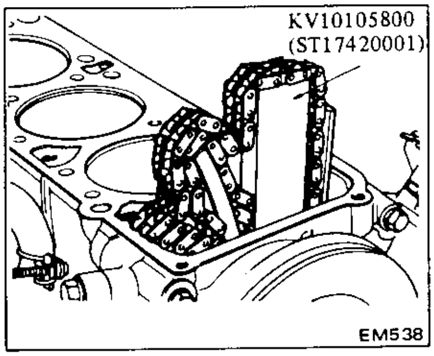
When removing cylinder head from engine installed on car, follow the instructions below.

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.



SEM218

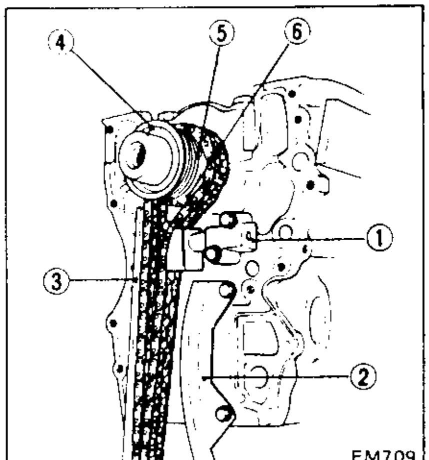
c. Support timing chain by utilizing Tool between timing chains.



EM538

d. Install cylinder head, and then install camshaft sprocket by aligning marks on it and timing chain.

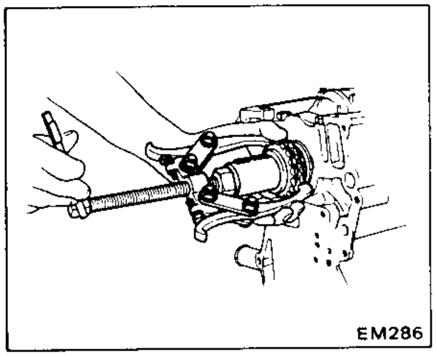
4. Front side parts
- Water pump
- Front cover
- Timing chain
- Chain tensioner and chain guides
- Oil thrower, oil pump drive gear and crankshaft sprocket from crankshaft.



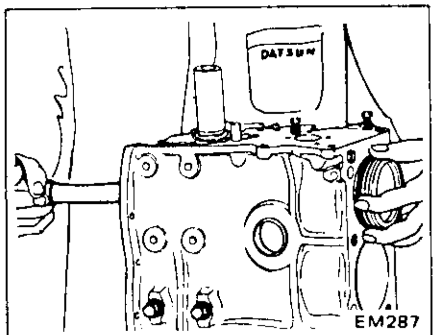
EM709

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 sproket, use a suitable puller.


EM286

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



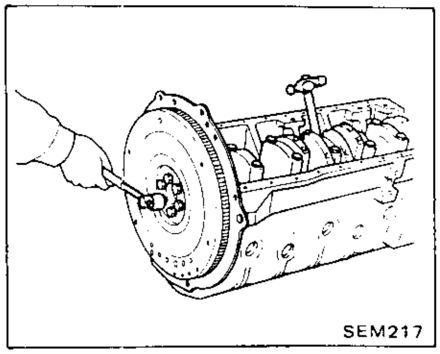
EM287

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.

6. Flywheel (M/T) or drive plate (A/T) and rear plate. Remove while crankshaft is locked using hammer handle.

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

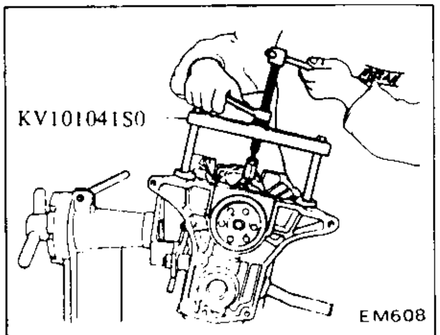

SEM217

7. Crankshaft.
(1) Remove main bearing cap with bearing.

a. When loosening main bearing cap bolts, loosen from outside in sequence.
Do not completely loosen bolts in one step. Instead use two or three steps for this procedure.

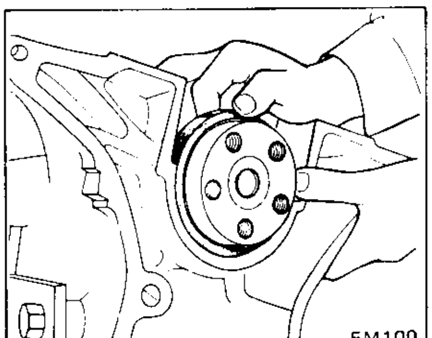
b. Remove center and rear main bearing caps using Tool.

c. Keep them in order.



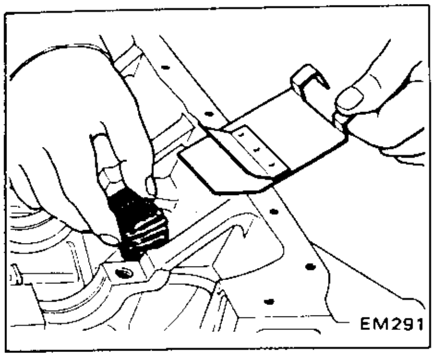
EM608

(2) Remove rear oil seal.


EM100

When removing rear oil seal without removing main bearing cap, pry it off with a screwdriver so as not to damage crankshaft.

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

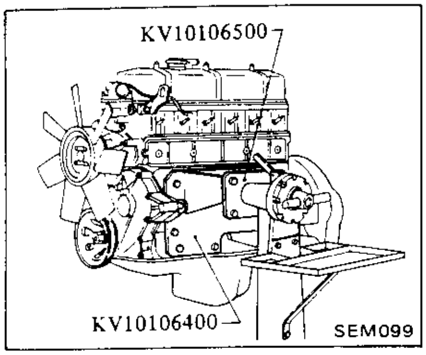


DISASSEMBLING P40 ENGINE OVERALL

MOUNTING ENGINE ON ENGINE STAND

1. Remove following parts located at rear and left side of engine.
- Transmission
- Clutch cover assembly
- Alternator, alternator drive belt and alternator bracket
- Alternator adjusting bar
- Engine mounting bracket L.H.
- Oil filter **using Tool ST19320000**
- Oil level gauge
- Oil pressure switch
- Fuel pump
- Distributor cap and high tension cable
- Distributor
- Oil pump spindle
- Cylinder side cover
- Oil filter stud
- Oil level gauge guide
- Distributor support
- Air breather pipe
- Coolant temperature sensor

2. Drain engine oil and coolant.
3. Oil cooler unit **(Refer to Section LC)**.
4. Install engine attachment to cylinder block. Then, mount the engine on the engine stand.

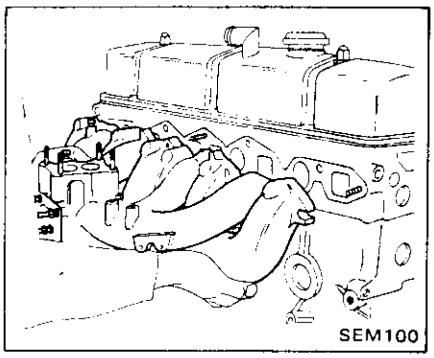


REMOVING OUTER PARTS

Remove following parts:
1. Engine front side parts
- Cooling fan, fan coupling and fan pulley
- Thermostat housing
- Water pump
- Fuel line and front engine slinger
- Crank pulley

2. Engine left side parts
- Spark plugs

3. Engine right side parts
- Carburetor from intake manifold
- Intake and exhaust manifold as an assembly with gaskets

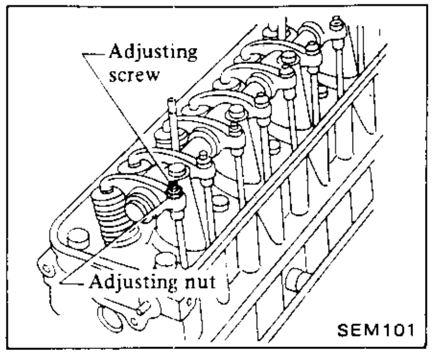


- Rear engine slinger
- Starter motor
- Engine mounting bracket R.H.

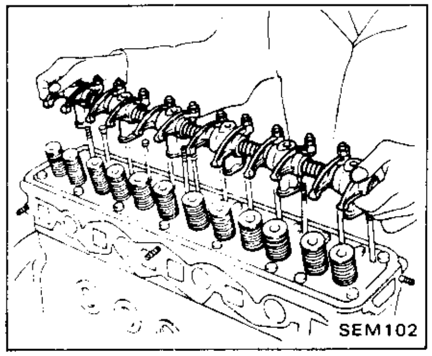
REMOVING BODY PARTS

Remove following parts:
1. Valve rocker cover.
2. Valve rocker shaft assembly.

(1) Loosen valve rocker adjusting nuts and turn adjusting screws out to disengage push rods.



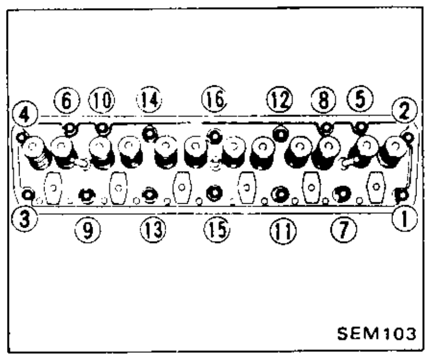
(2) Remove rocker shaft assembly.



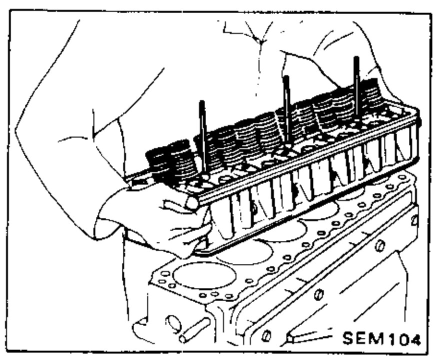
(3) Withdraw push rods, and keep them in correct order.

3. Cylinder head assembly

(1) Loosen cylinder head bolts in the sequence as shown.



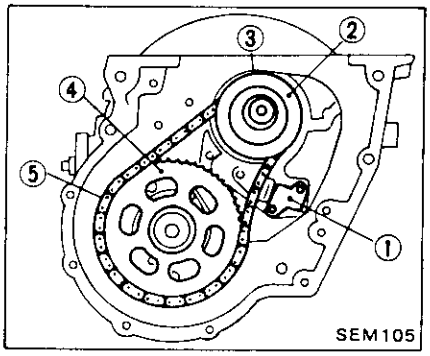
(2) Remove cylinder head.



4. Oil pan and oil pump
5. Front side parts

- Front cover
- Chain tensioner, chain guide and oil thrower
- Camshaft sprocket, crankshaft sprocket and timing chain

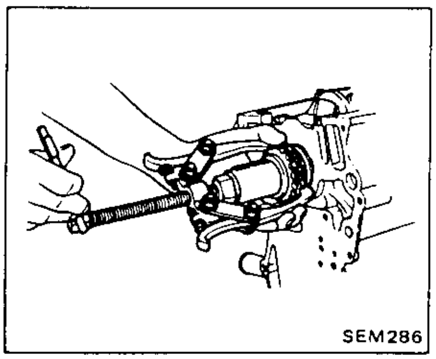
To facilitate assembling operation, scribe a mark on timing chain and camshaft sprocket with paint before removal.



SEM105

1 Chain tensioner
2 Oil thrower
3 Crankshaft sprocket
4 Camshaft sprocket
5 Timing chain

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

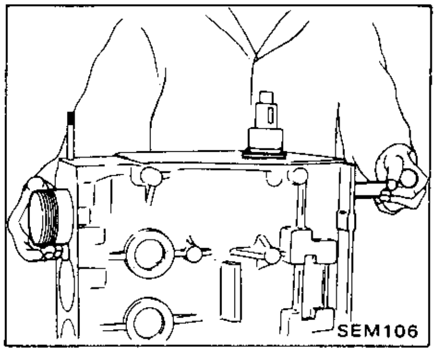

SEM286

- Front plate and gasket

6. Camshaft locating plate, camshaft and valve lifters, and keep then in correct order.
7. Piston and connecting rod assembly

(1) Remove connecting rod bearing cap with bearing.

(2) Push out piston with connecting rod toward cylinder head side.


SEM106

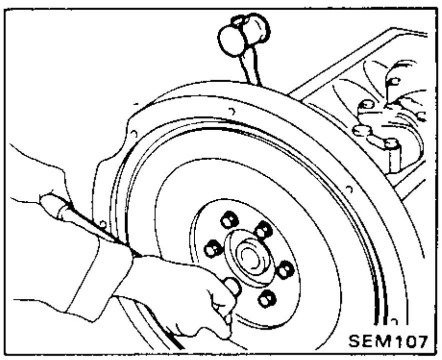
a. Piston can be easily removed by scraping carbon off top face of cylinder with a scraper.

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

8. Flywheel and flywheel housing.

- Remove flywheel while crankshaft is locked, using hammer handle.

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


SEM107

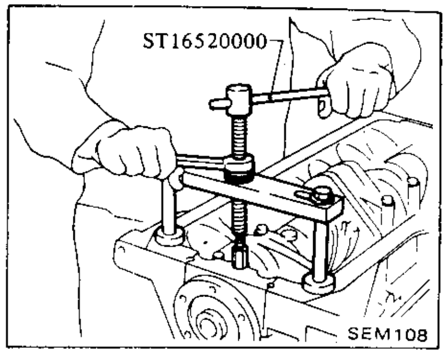
9. Crankshaft

(1) Remove main bearing cap with bearing.

a. When loosening main bearing cap bolt, loosen from outside in sequence.
Do not completely loosen bolts in one step. Instead use two or three steps for this procedure.

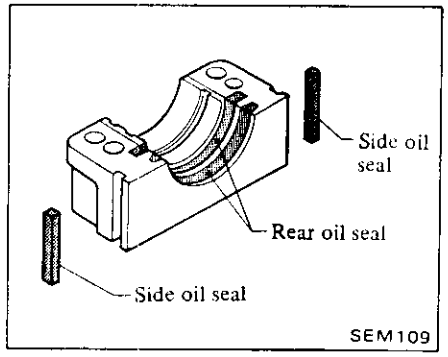
b. Remove rear main bearing cap using Tool.

c. Keep them in order.



SEM108

(2) Remove rear and side oil seal.



SEM109

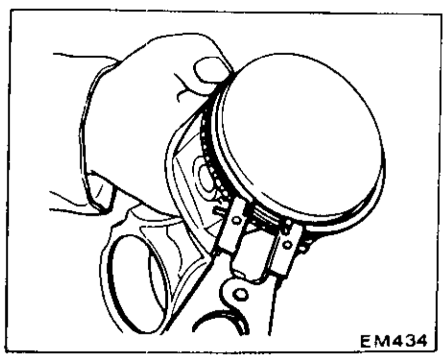
(3) Remove crankshaft.

(4) Remove main bearing and rear oil seal at block side.

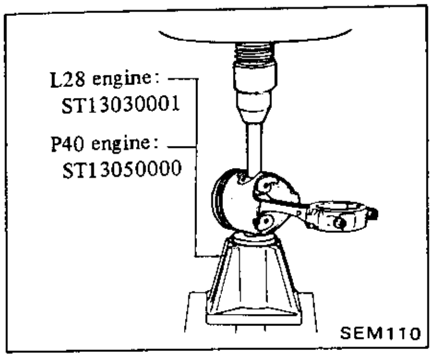
DISASSEMBLING PISTON AND CONNECTING ROD

1. Remove top & second piston rings with a ring remover and remove oil ring expander & rails by hand.

When removing piston rings, be careful not to scratch piston.


EM434

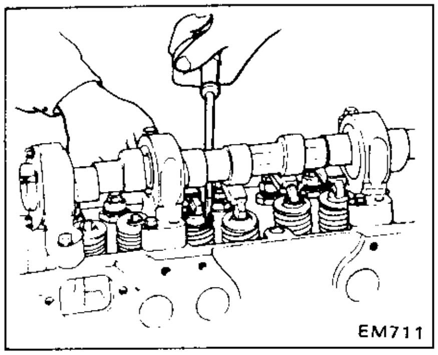
2. Press piston pin out, **using press and Tool.**



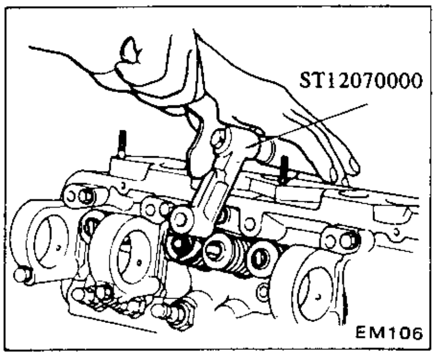
DISASSEMBLING CYLINDER HEAD

L28 ENGINE

1. Remove valve rocker spring.
2. Loosen valve rocker pivot lock nut and set cam nose to upper position, then remove rocker arm by pressing down on valve spring.



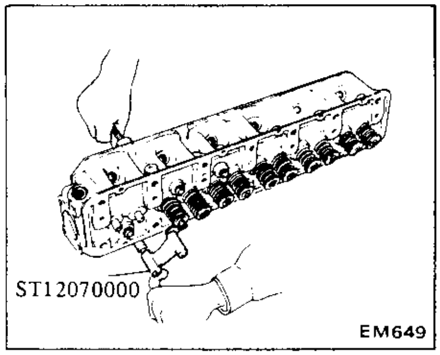
3. Remove camshaft.
4. Remove valves, valve springs and relating parts **using Tool.**



- **Keep the disassembled parts in order.**
- **Do not remove rocker pivot bushing from cylinder head.**

P40 ENGINE

Remove valves, valve springs and relating parts **using Tool.**



Keep the disassembled parts in order.

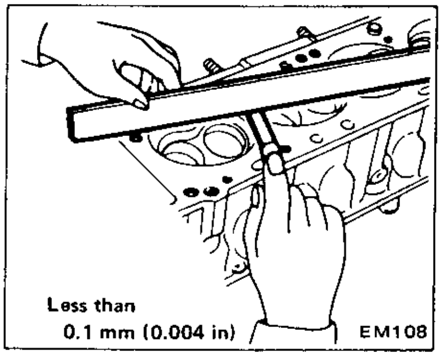
INSPECTION AND REPAIR

CYLINDER HEAD

CHECKING 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.



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"

The limit is as follows:

A + B = 0.2 mm (0.008 in)

VALVE GUIDE

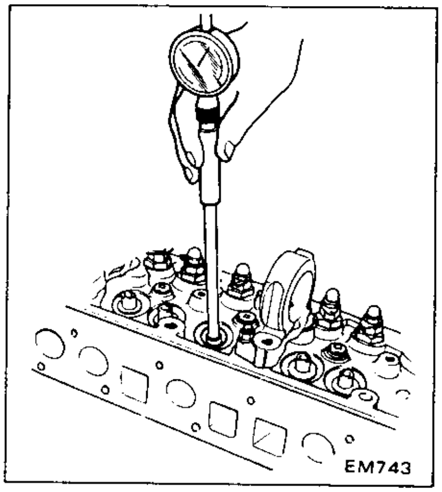
Measure the clearance between valve guide and valve stem. If the clearance exceeds the specified limit, replace the worn parts or both valve and valve guide. In this case, it is essential to determine if such a clearance has been caused by a worn or bent valve stem or by a worn valve guide.

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:

Maximum limit

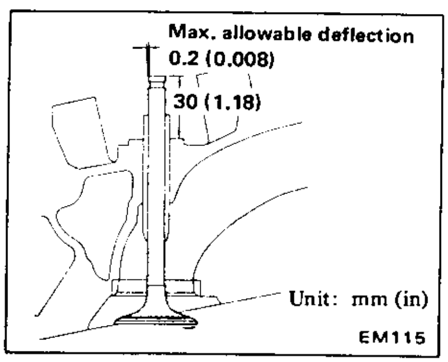
0.1 mm (0.004 in)

2. Expedient method

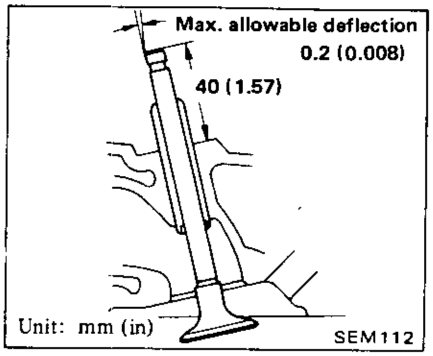
Pry the valve in lateral direction, and measure the deflection at stem tip with dial gauge.

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

L28 engine



P40 engine

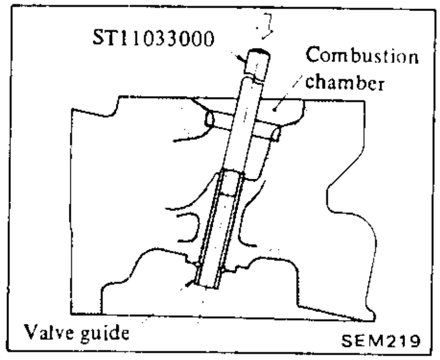


Replacement of valve guide

To remove old guides, use a press **[under a 20 kN (2t, 2.2 US ton, 2.0 Imp ton) pressure]or a hammer, and Tool.**

L28 engine

1. Drive them out toward rocker cover side **using Tool.** Heating the cylinder head will facilitate the operation.

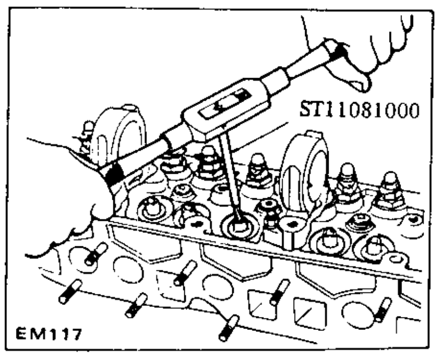


2. Ream cylinder head valve guide hole **using Tool at room temperature.**

Reaming bore:

12.185 - 12.196 mm

(0.4797 - 0.4802 in)



3. Fit snap ring on new valve guide. **Heat cylinder head to 150 to 200°C (302 to 392°F),** and press the guide onto cylinder haed until the snap ring comes in contact with cylinder head surface.

Valve guide with 0.2 mm (0.008 in) oversize diameter is available for service.
Refer to S.D.S.

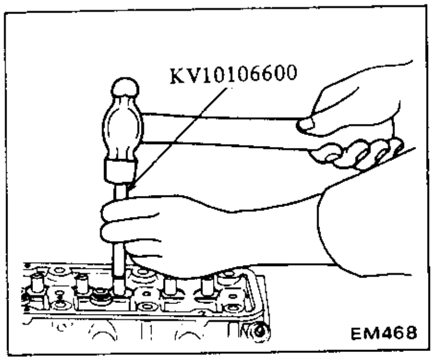
4. Ream the bore **using Tool ST11032000.**

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

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

P40 engine

1. **Using Tool**, drive them out opposite to rocker cover. Heated cylinder head will facilitate the operation.

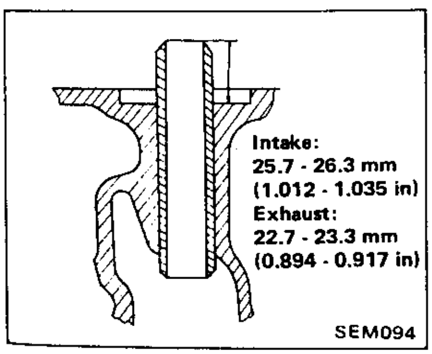


EM468

2. Make sure that interference between valve guide and guide hole is within the specified value.

Interference between valve guide and guide hole:
0.013 - 0.045 mm
(0.0005 - 0.0018 in)

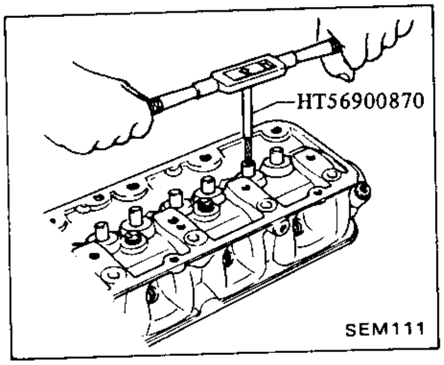
3. Insert and press new valve guide into cylinder head, **using Tool KV10106600, after heating cylinder head to 150 to 200°C (302 to 392°F).**



SEM094

4. Ream bore using a suitable reamer.

Reaming bore:
8.685 - 8.700 mm
(0.3419 - 0.3425 in)



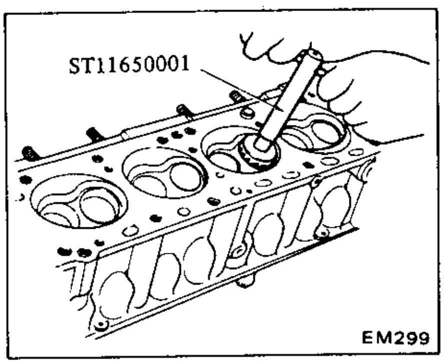
SEM111

VALVE SEAT

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

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

Valve seat insert of 0.5 mm (0.020 in) oversize is available for service (L28 engine).
Refer to S.D.S.



EM299

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

Replacement of valve seat insert (L28 engine)

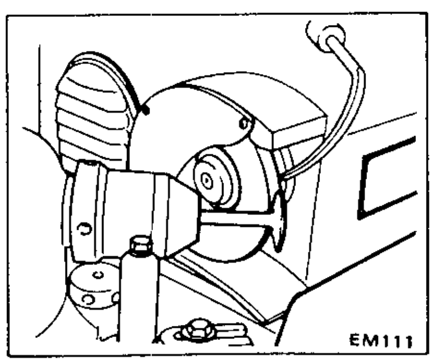
1. Old insert can be removed by boring out until it collapses. The machine stop depth should be set so that boring cannot continue beyond the bottom face of the insert recess in cylinder head.
2. Select a suitable valve seat insert and check its outside diameter.
3. Machine the cylinder head recess in the concentric circles which center on the valve guide.
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 bends on the bottom face of its recess, and caulk more than 4 points.
7. Newly-fitted valve seats 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 valves for worn, damaged or deformed valve head or stem. Correct or replace the valve that is faulty.
2. Valve face or valve stem end surface should be refaced by using a valve grinder.

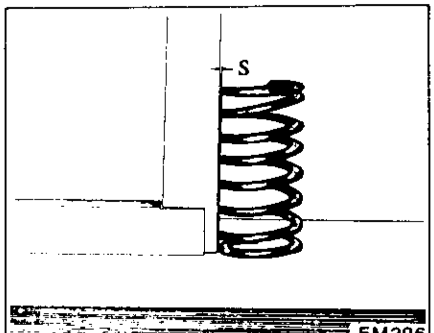
When valve head has been worn down to 0.5 mm (0.020 in) in thickness, replace the valve.

Grinding allowance for valve stem end surface is 0.5 mm (0.020 in) or less.


EM111

VALVE SPRING

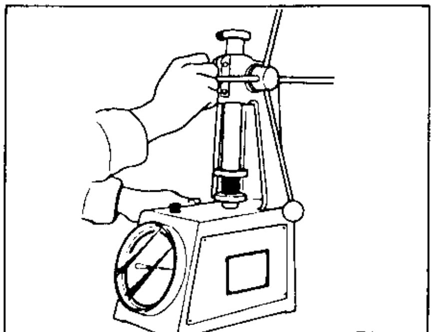
1. Check valve spring for squareness using a steel square and surface plate. If spring is out of square "S" more than specified limit, replace with new ones. **Refer to S.D.S.**



EM296

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.



EM113

ROCKER ARM AND VALVE ROCKER PIVOT OF L28 ENGINE

Check pivot head and cam contact and pivot contact surfaces of rocker arm for damage or wear. If faults are found, replace them. A faulty pivot necessitates its replacement together with the corresponding rocker arm.

ROCKER ARM AND ROCKER SHAFT OF P40 ENGINE

1. Check rocker arms and shaft for sign of wear or damage, and if worn excessively, replace the rocker arm or shaft.

2. Check clearance between each rocker arm and shaft by measuring inner diameter of rocker arm bore and outer diameter of shaft.

If either clearance is not within specification, replace bushing in rocker arm **using Tool ST1130S000. Refer to S.D.S.**

VALVE LIFTER AND PUSH ROD OF P40 ENGINE

1. Check valve lifter for sign of wear or damage, and if worn excessively, replace it.

2. Check clearance between valve lifter guide on cylinder block and valve lifter. If the clearance exceeds the specified limit, replace valve lifter.

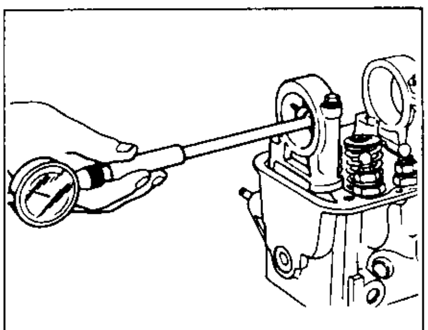
Clearance between valve lifter guide and valve lifter:
Limit 0.15 mm (0.0059 in)

CAMSHAFT AND CAMSHAFT BEARING

CAMSHAFT BEARING CLEARANCE OF L28 ENGINE

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.

Max. tolerance of camshaft bearing clearance:
0.1 mm (0.004 in)

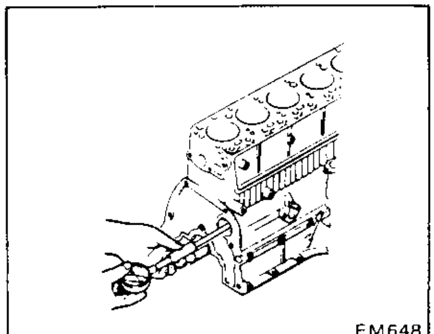


EM119

Do not remove camshaft brackets. If camshaft bracket were removed, install them by checking for a smooth rotation with the camshaft.

CAMSHAFT BEARING CLEARANCE OF P40 ENGINE

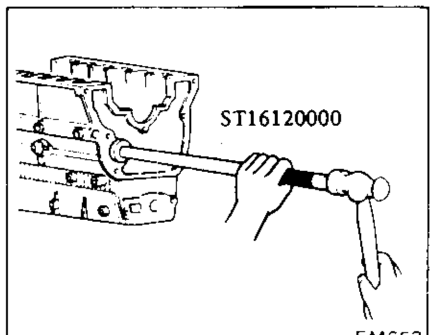
Check the inside diameter of camshaft bearing with an inside dial gauge and the outside diameter of camshaft journal with a micrometer.



EM648

Measurements should then be compared to determine whether bearings are worn. If the wear exceeds the specified limit, replace camshaft bearing **using Tool.**

Max. tolerance of camshaft bearing clearance:
0.1 mm (0.004 in)



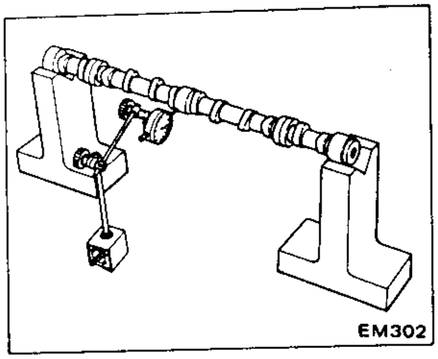
EM653

CAMSHAFT ALIGNMENT

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

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

Camshaft bend (Total indicator reading):
Limit 0.10 mm (0.0039 in)



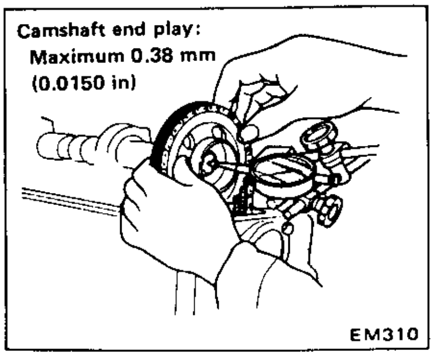
3. Measure camshaft cam height. If beyond the specified limit, replace camshaft.

Wear limit of cam height:
0.15 mm (0.0059 in)

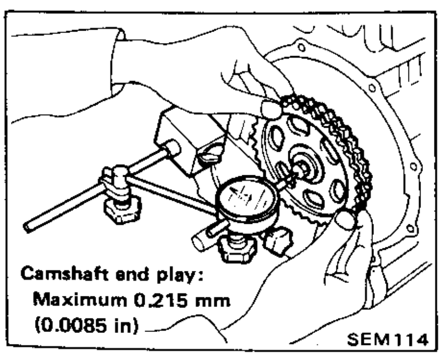
4. Measure camshaft end play. If beyond the specified limit, replace thrust/locating plate.

Camshaft end play:
L28 engine
Limit 0.38 mm (0.0150 in)
P40 engine
Limit 0.215 mm (0.0085 in)

L28 engine

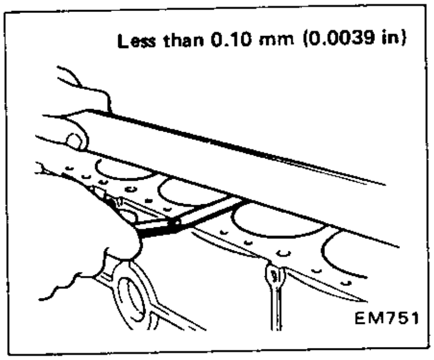


P40 engine



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 warpage exceeds the specified limit, correct with a grinder.

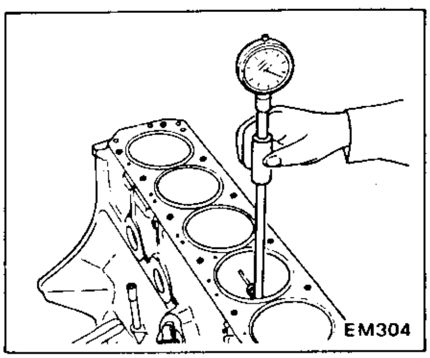


Surface grinding limit;
The grinding limit of cylinder block is determined by the cylinder head grinding in an engine.
Depth of cylinder head grinding is "A"
Depth of cylinder block grinding is "B"
The limit is as follows:
A + B = 0.2 mm (0.008 in)

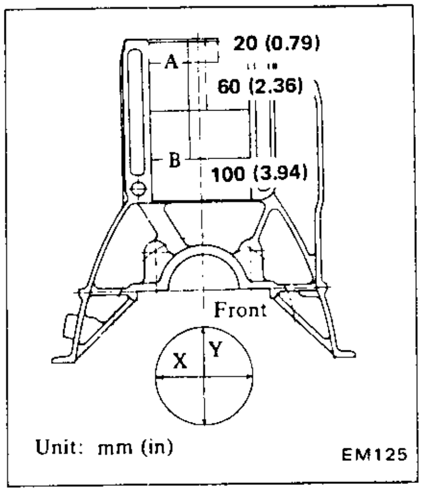
3. Using a bore gauge, measure cylinder bore for wear, out-of-round or taper. If they are excessive, rebore the cylinder walls with a boring machine. Measurement should be taken along bores for taper and around bores for out-of-round.

Refer to S.D.S.

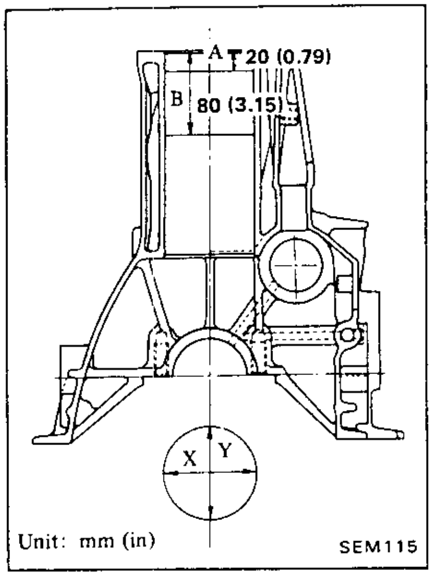
Out-of-round . . . . X-Y
Taper . . . . A-B



L28 engine



P40 engine



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.

As for L28 engine, if cylinder bore has worn beyond the wear limit, use cylinder liner.

Undersize cylinder liners are available for service. Refer to S. D. S.

Interference fit of cylinder liner in cylinder block should be 0.075 to 0.085 mm (0.0030 to 0.0033 in).

CYLINDER BORING

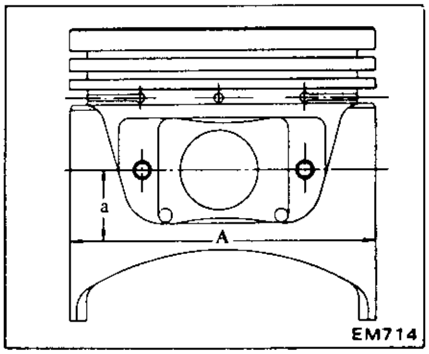
When any cylinder needs boring, all other cylinders must also be bored at the same time.

Determining bore size

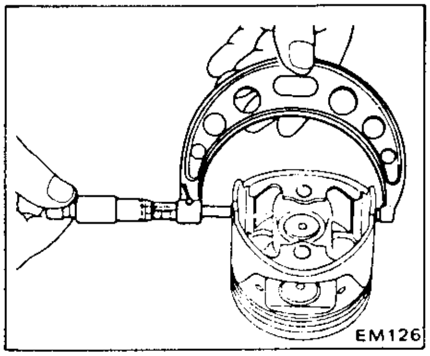
1. Determine piston oversize according to amount of cylinder wear.

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".



EM714


EM126

Dimension "a"
(distance from center of pin):
L28 engine
Approximately
20 mm (0.79 in)
P40 engine
Approximately
40 mm (1.57 in)
Rebored size calculation
L28 engine
D = A + B – C = A + [0.005 to 0.025 mm (0.0002 to 0.0010 in)]
P40 engine
D = A + B – C = A + [0.003 to 0.023 mm (0.0001 to 0.0009 in)]
Where,
D : Honed diameter
A : Skirt diameter as measured
B : Piston-to-wall clearance
C : Machining allowance
0.02 mm (0.0008 in)

Boring

1. Install main bearing caps in place, and tighten to the specified torque to prevent distortion of the cylinder bores in final assembly.
2. Cut cylinder bores.

- **Do not cut too much out of the cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.**
- **Bore the cylinders in the order of 1-5-3-6-2-4 to prevent heat strain due to cutting.**

3. Hone the cylinders to the required size **referring to S.D.S.**

- **Use clean sharp stones of proper grade.**
- **Cross-hatch pattern should be approximately 45°.**

4. Measure the finished cylinder bore for out-of-round and taper.

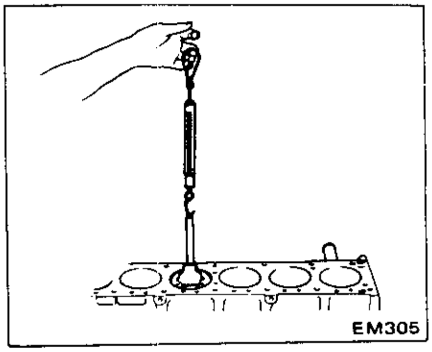
Measurement of a just machined cylinder bore requires utmost care since it is expanded by cutting heat.

Measuring piston-to-cylinder clearance

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

Feeler gauge thickness:
L28 engine
0.04 mm (0.0016 in)
P40 engine
0.063 mm (0.0025 in)
Extracting force:
L28 engine
2.0 - 14.7 N
(0.2 - 1.5 kg, 0.4 - 3.3 lb)
P40 engine
10 - 29 N
(1 - 3 kg, 2 - 7 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).

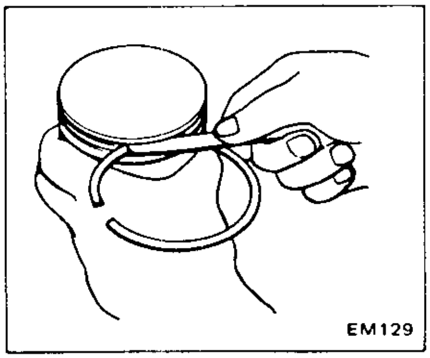

EM305

PISTON, PISTON PIN AND PISTON RING

PISTON

1. Scrape carbon off piston and ring grooves with a carbon scraper and a curved steel wire. 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.
3. Measure the side clearance of rings in ring grooves as each ring is installed.

Max. tolerance of side clearance:
0.1 mm (0.004 in)


EM129

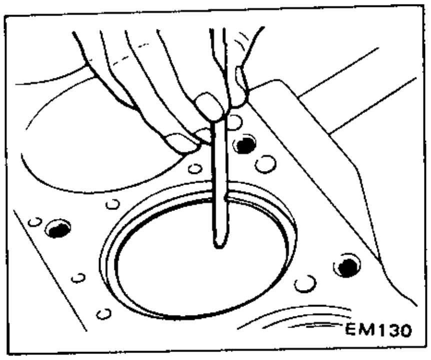
If side clearance exceeds the specified limit, replace piston together with piston ring.

PISTON RING

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.

Max. tolerance of ring gap:
1.0 mm (0.039 in)



EM130

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.

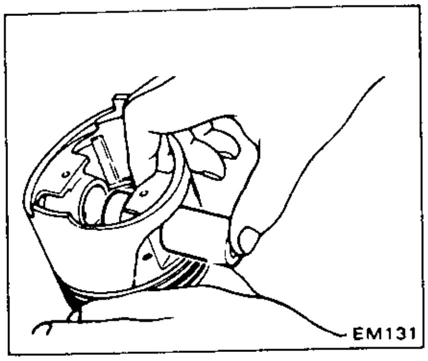
L28 engine:
0.5 mm (0.020 in), 1.0 mm (0.039 in) oversize.
P40 engine:
0.5 mm (0.020 in), 1.0 mm (0.039 in), 1.5 mm (0.059 in) oversize.

PISTON PIN

1. Check piston pin and piston pin hole for signs of sticking and other abnormalities.
2. Measure piston pin hole in relation to the outer diameter of pin. If wear exceeds the limit, replace such piston pin together with piston on which it is installed.

Piston pin to piston clearance:
L28 engine
0.006 - 0.013 mm
(0.0002 - 0.0005 in)
P40 engine
0.004 - 0.006 mm
(0.00016 - 0.00024 in)

Determine the fitting of piston pin into piston pin hole to such an extent that it can be pressed smoothly by finger at room temperature.

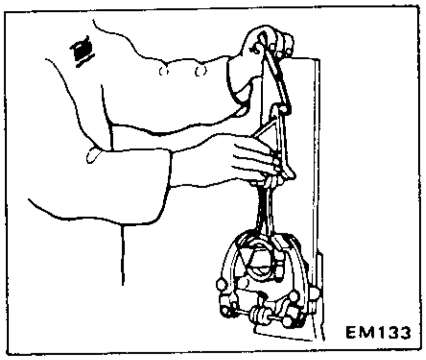


EM131

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.

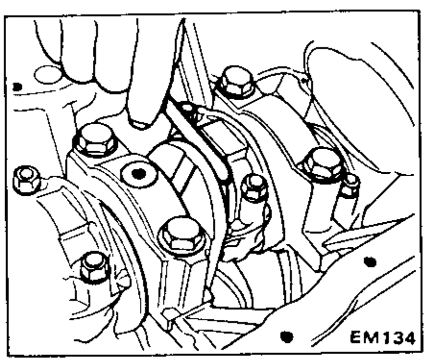
Bend and torsion
[per 100 mm (3.94 in) length] :
Less than
0.05 mm (0.0020 in)



EM133

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.

Max. tolerance of big end play:
0.6 mm (0.024 in)



EM134

When replacing connecting rod, select so that weight difference between each cylinder is within the specified limit in the condition of piston and connecting rod assembly.

Connecting rod weight difference:
L28 engine
Limit 7 g (0.25 oz)
P40 engine
Limit 5 g (0.18 oz)

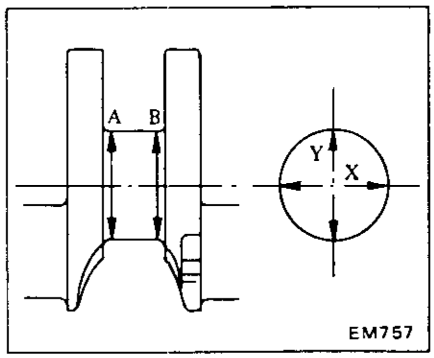
CRANKSHAFT

CRANK JOURNAL AND PIN

1. Repair or replace as required. If faults are minor, correct with fine crocus cloth.
2. Check journals and crank pins with a micrometer 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):
Less than 0.03 mm (0.0012 in)
Taper (A-B):
Less than 0.03 mm (0.0012 in)



EM757

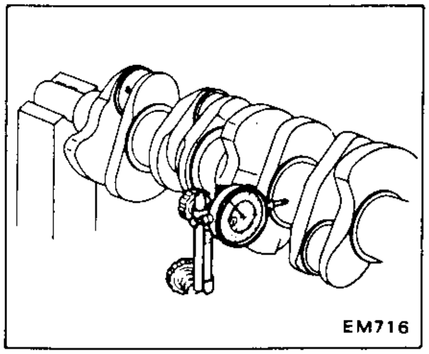
3. After regrinding crankshaft, finish it to the necessary size indicated in the chart under S. D. S. by using an adequate undersize bearing according to the extent of required repair.

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.

If bend exceeds the specified limit, replace or repair.

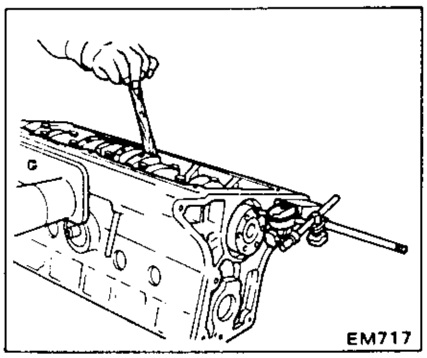
Bend:
Less than
0.10 mm (0.0039 in)



EM716

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

Max. tolerance of end play:
0.30 mm (0.0118 in)



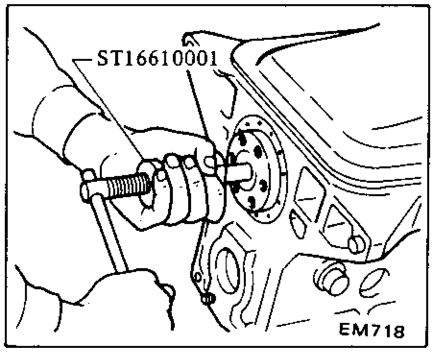
EM717

REPLACING PILOT BUSHING

To replace crankshaft rear pilot bushing, proceed as follows:

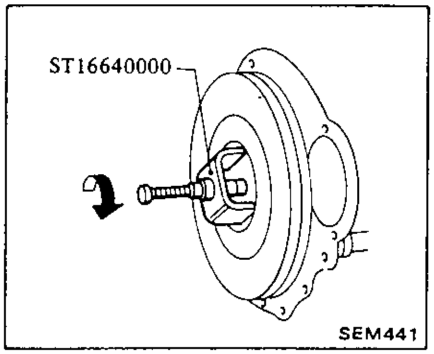
1. Pull out bushing **using Tool.**

L28 engine



EM718

P40 engine

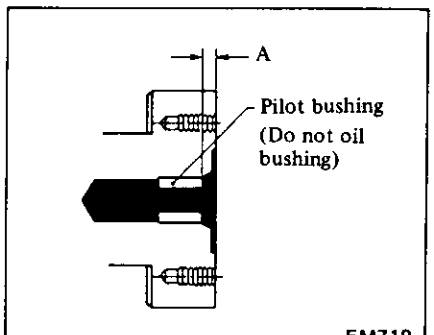


SEM441

2. Before installing a new bushing, thoroughly clean bushing hole.
3. Install a new bushing as follows:

Insert pilot bushing until distance between flange end and pilot bushing is the specified distance "A".

Distance "A":
L28 engine
Approximately
4.0 mm (0.157 in)
P40 engine
Approximately
0.6 mm (0.024 in)



EM719

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

MAIN BEARING AND CONNECTING ROD BEARING

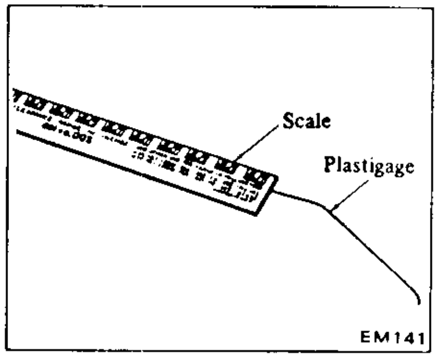
MAIN BEARING

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, getting clear of the oil hole.



EM141

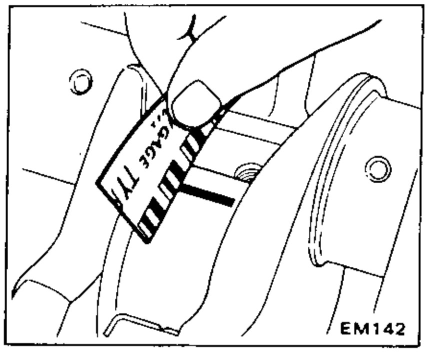
(2) Install crankshaft, bearings and bearing cap, with the bolts tightened to the specified torque.

Ⓣ: **Main bearing cap**
L28 engine
44 - 54 N·m
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)
P40 engine
98 - 118 N·m
(10.0 - 12.0 kg-m,
72 - 87 ft-lb)

Do not turn crankshaft while the plastigage is being inserted.

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

Max. tolerance of main bearing clearance:
0.12 mm (0.0047 in)



EM142

3. If clerance 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
L28 engine
44 - 54 N·m
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)
P40 engine
44 - 59 N·m
(4.5 - 6.0 kg-m,
33 - 43 ft-lb)
Max. tolerance of connecting rod bearing clearance:
0.12 mm (0.0047 in)

2. If clearance exceeds the specified value, replace bearing with an undersize bearing and grind the crankshaft journal adequately. **Refer to S.D.S.**

MISCELLANEOUS COMPONENTS

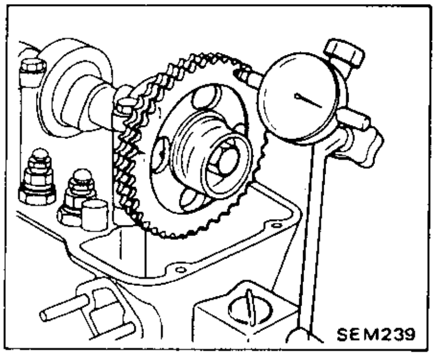
CAMSHAFT SPROCKET

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

If runout exceeds the specified limit, replace camshaft sprocket.

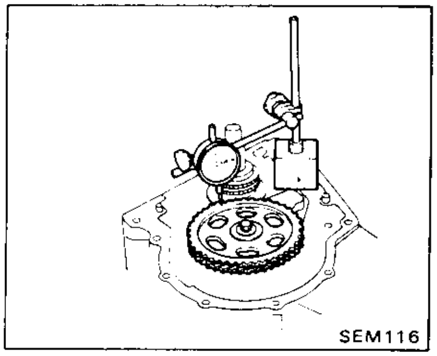
Runout (Total indicator reading):
L28 engine
Less than 0.1 mm (0.004 in)
P40 engine
Less than 0.08 mm (0.0031 in)

L28 engine



SEM239

P40 engine



SEM116

CHAIN

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

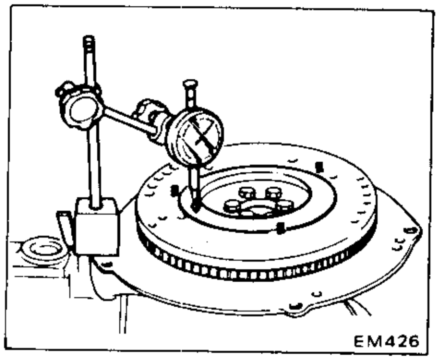
CHAIN TENSIONER AND CHAIN GUIDE

Check for wear and breakage. Replace if necessary.

FLYWHEEL (M/T models)

1. Check the clutch disc contact surface on flywheel 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):
L28 engine
Less than 0.15 mm (0.0059 in)
P40 engine
Less than 0.35 mm (0.0138 in)



EM426

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

Replace if necessary.

Install ring gear on fly wheel, heating ring gear to about 180 to 220°C (356 to 428°F)

DRIVE PLATE (A/T models)

1. Check drive plate for cracks or distorsion.
2. Check tooth surfaces of ring gear for flaws or wear.

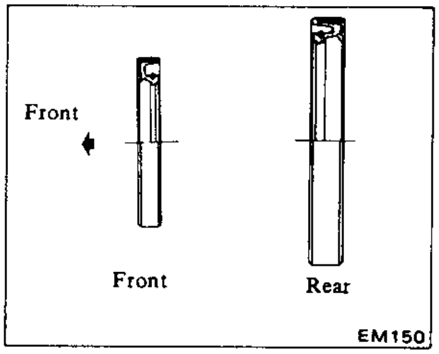
Replace drive plate assembly if necessary.

FRONT AND REAR OIL SEALS

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

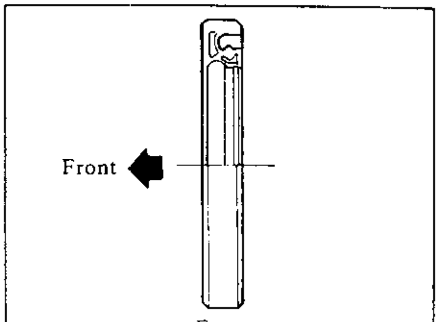
It is good practice to renew oil seal whenever engine is overhauled.

L28 engine



EM150

P40 engine



SEM117

ENGINE ASSEMBLY

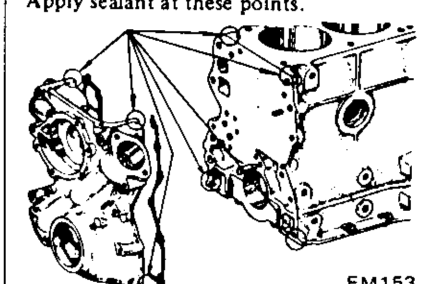
PRECAUTIONS

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 the specified order and tightening torque.
4. Applying sealant

Use sealant to eliminate water and oil leaks. **Do not apply too much sealant.** Parts requiring sealant are as follows.

L28 engine

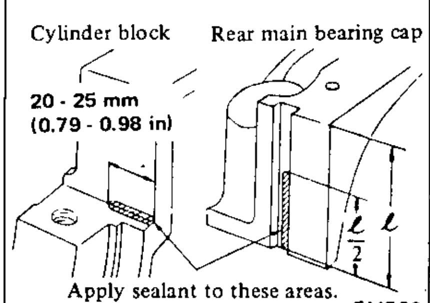
(1) Front cover gasket.
(2) Front cover.



EM153

(3) Main bearing cap and cylinder block:

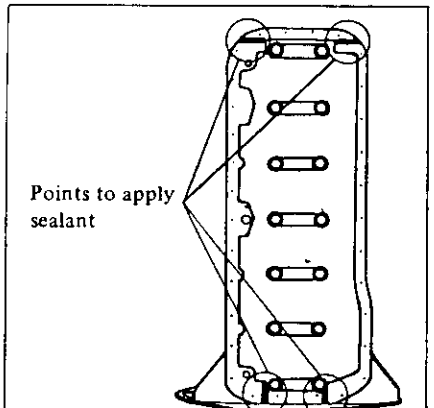
Each side of rear main bearing cap and each corner of cylinder block.



EM720

(4) Cylinder block:

Step portions on the bottom and at four mating surfaces (cylinder block to front cover and cylinder block to rear main bearing cap).

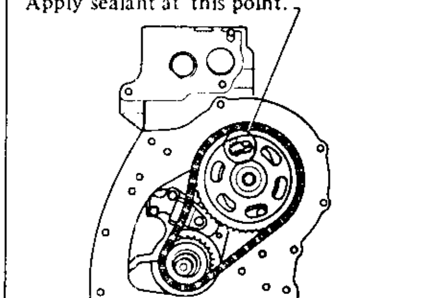


EM315

After inserting rear bearing cap side seals, apply sealant to rear main bearing cap.

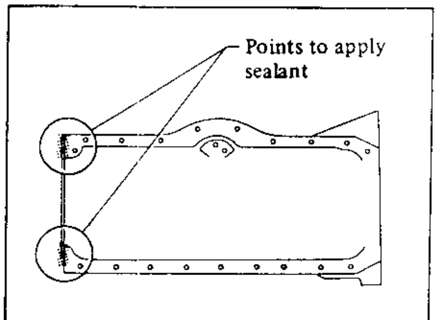
P40 engine

(1) Cylinder block.



SEM329

(2) Front plate.

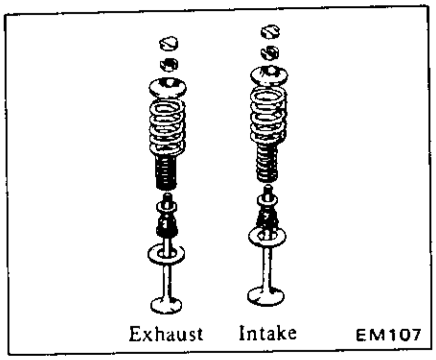


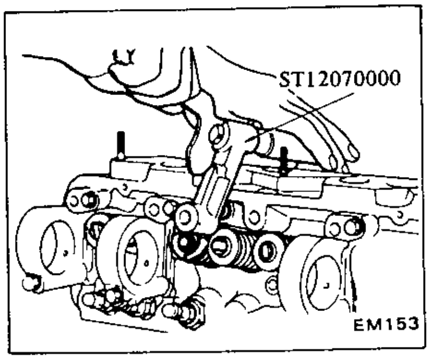
SEM098

(3) Cylinder side cover and gasket.

ASSEMBLING CYLINDER HEAD OF L28 ENGINE

1. Install valve and valve spring.
(1) Set valve spring inner and outer seat and install valve oil seal to valve guide.
(2) Install valve, inner and outer valve spring, valve spring retainer and valve spring collet 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. Outer valve spring is of an uneven pitch type. Install valve spring with its narrow pitch side (painted) at cylinder head side.

2. Install valve rocker pivot assembly. Screw valve rocker pivots joined with lock nuts into pivot bushing. Install valve rocker spring retainer.

Fully screw in valve rocker pivot.

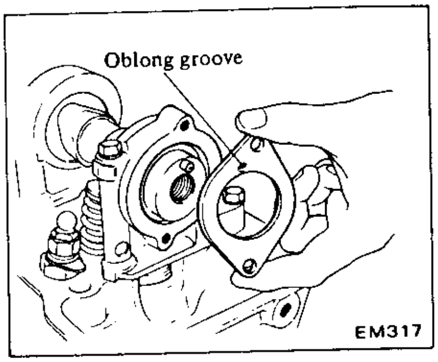
3. Install camshaft assembly in cylinder head carefully.

Do not damage the bearing inside.

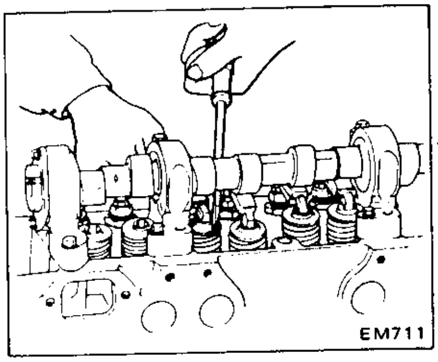
4. Set thrust plate.

Ⓣ : Camshaft thrust plate
6 - 10 N·m
(0.6 - 1.0 kg-m,
4.3 - 7.2 ft-lb)

The oblong groove must be directed toward the front side of engine.



5. Install valve rocker guides.
6. Install rocker arms by pressing down valve springs with a screwdriver, etc.

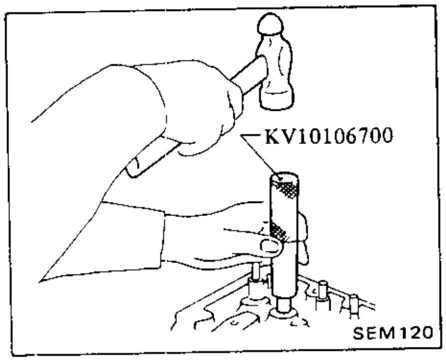


7. Install valve rocker springs.
8. After assembling cylinder head, turn camshaft until No. 1 piston is at T.D.C. on its compression stroke.

ASSEMBLING CYLINDER HEAD OF P40 ENGINE

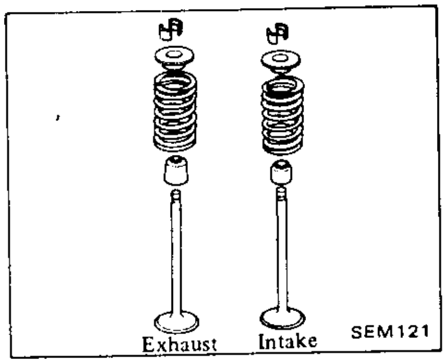
1. Install valve and valve spring.
(1) Install valve and valve oil seal.

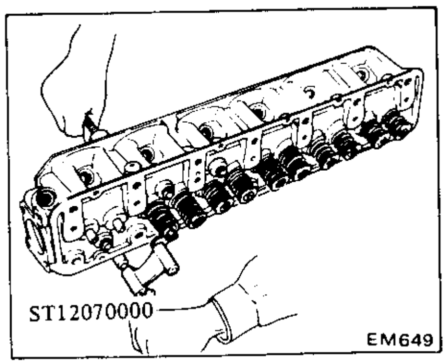
a. Apply engine oil on the valve stem and lip of valve oil seal.
b. Valve oil seals are different for intake and exhaust valves.
When installing valve oil seal on intake valve, tap valve oil seal with a plastic hammer on valve guide through Tool.



When installing valve oil seal on exhaust valve, set valve oil seal on valve stem.

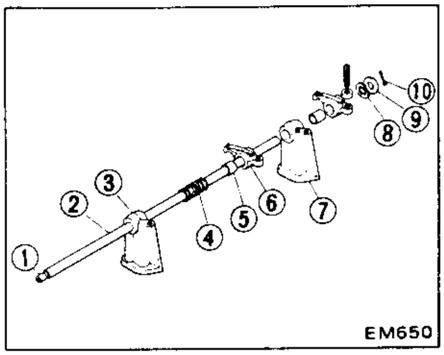
(2) Install valve spring, valve spring retainer and valve spring collet by **using Tool.**





a. Check whether the valve face is free from foreign matter.
b. Valve spring is of an uneven pitch type. Install valve spring with its narrow pitch side (painted) at cylinder head side.

2. If replacement of bushing in rocker arm is performed, assemble rocker arms, rocker shaft and relating parts.



1 Plug
2 Rocker shaft
3 Rocker shaft bracket–B
4 Spring
5 Bushing
6 Valve rocker arm
7 Rocker shaft bracket–A
8 Spring
9 Washer
10 Cotter pin

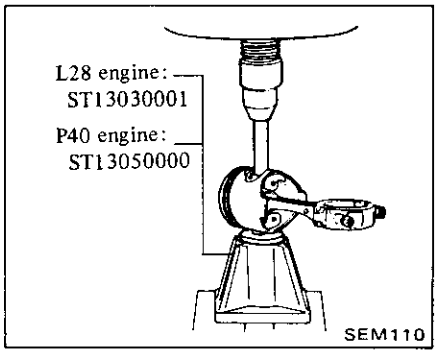
ASSEMBLING PISTON AND CONNECTING ROD

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

a. Piston pin is pressed into connecting rod, and fitting force should be within the specified limit and the aid of the following Tool is necessary.

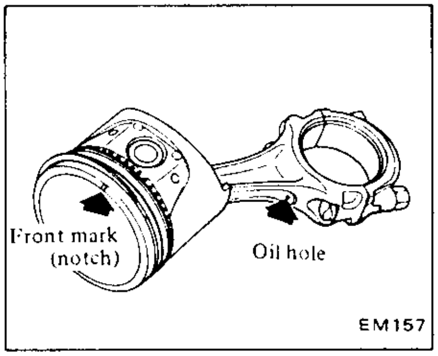
Piston pin fitting force:
L28 engine
4.9 - 14.7 kN
(0.5 - 1.5 t,
0.6 - 1.7 US ton,
0.49 - 1.48 Imp ton)
P40 engine
14.7 - 34.3 kN
(1.5 - 3.5 t,
1.7 - 3.9 US ton,
1.48 - 3.44 Imp ton)

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

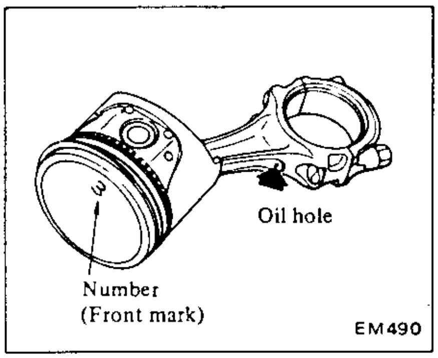


b. Arrange so that oil jet of connecting rod big end is directed toward the right side of cylinder block.

L28 engine



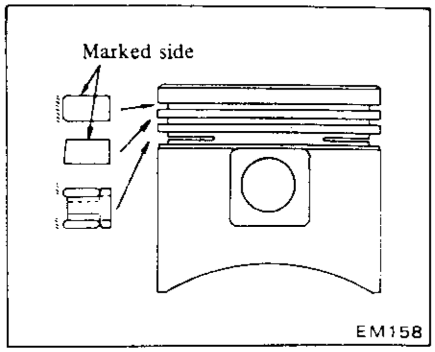
P40 engine



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 chromium-plated on liner contacting face.
b. Second ring has larger taper surface than top ring.
c. In the combined oil ring, upper rail is the same as lower one.



ASSEMBLING ENGINE OVERALL

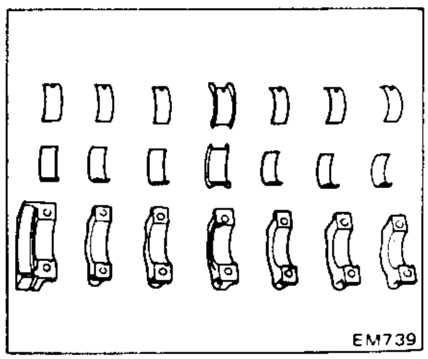
INSTALLING BODY PARTS OF L28 ENGINE

First, mount cylinder block on engine stand (**refer to Engine Disassembly**).
Then install following parts:

1. Baffle plate and steel net.
Install them into crankcase and tighten the screws applying Locktite.
2. Crankshaft.

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

a. Upper bearings have oil hole and oil groove, however lower bearings do not.
b. Only center bearing (No. 4) is a flange type.
c. Front bearing (No. 1) is also the same type as rear bearing (No. 7).
d. Other inter bearings, except center bearing, are the same type.

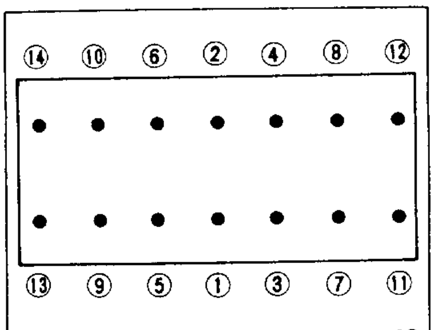


(2) Apply engine oil to main bearing surfaces on both sides of cylinder block and cap.
(3) Install crankshaft.

(4) Install main bearing cap and tighten bolts to specified torque.

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

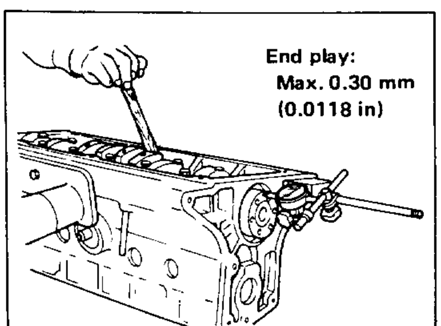
a. Apply sealant to each side of rear main bearing cap and each corner of cylinder block. Refer to Precautions.
b. Arrange the parts so that the arrow mark on bearing cap faces toward the front of engine.
c. Prior to tightening bearing cap bolts, place bearing cap in proper position by shifting crankshaft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



EM723

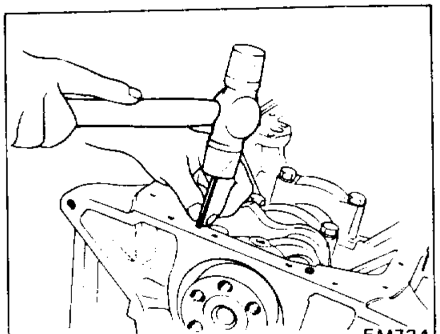
e. After securing bearing cap bolts, ascertain that crankshaft turns smoothly.

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



EM717

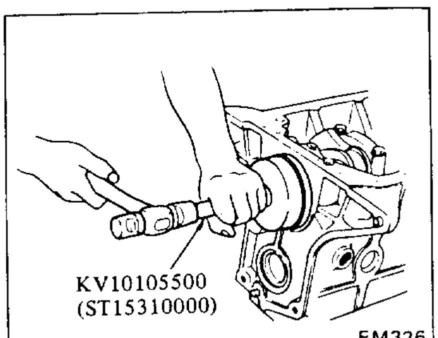
3. Side oil seals. Apply sealant to these seals. Then install them into main bearing cap.


EM724

Cut off projecting portion of seals with a putty knife, and apply sealer to cut edges of seals.

CAUTION:
Be careful not to apply an excessive amount of sealer to cut edges.

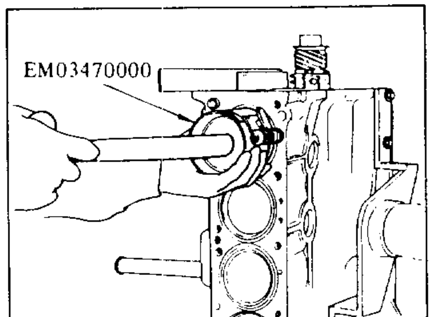
4. Rear oil seal. Install rear oil seal by using **Tool.**



EM326

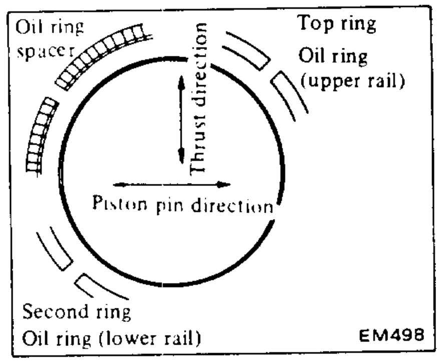
a. When installing oil seal, give coating of engine oil to mating shaft to prevent scratches and folded lip. Also apply coating of oil to periphery of oil seal.
b. Install oil seal in the direction that dust seal lip faces to the outside of crankcase.

5. Piston with connecting rod.
(1) Install them into corresponding cylinder **using Tool.**



EM328

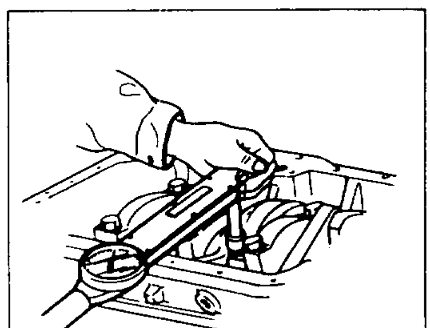
a. Apply engine oil to sliding parts.
b. Arrange so that the front mark on piston head faces to the front of engine.
c. Set piston rings as shown below.



EM498

(2) Install connecting rod caps.

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

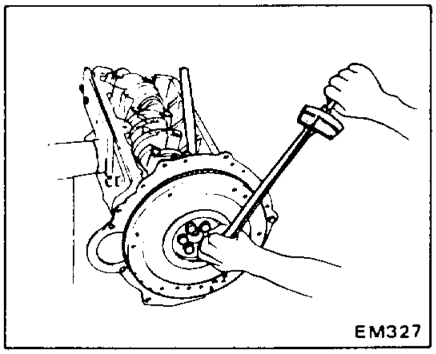

EM329

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.**

6. Rear plate and flywheel or drive plate.

Ⓣ : **Flywheel or drive plate fixing bolts**
137 - 157 N·m
(14.0 - 16.0 kg-m,
101 - 116 ft-lb)



Do not lock at ring gear.

7. Cylinder head assembly. Install it through gasket by accommodating knock pin of cylinder block as follows:

(1) Thoroughly clean cylinder block and head surface.

Do not apply sealant to any other part of cylinder block and head surface.

(2) Turn crankshaft until No. 1 piston is at T.D.C. on its compression stroke.

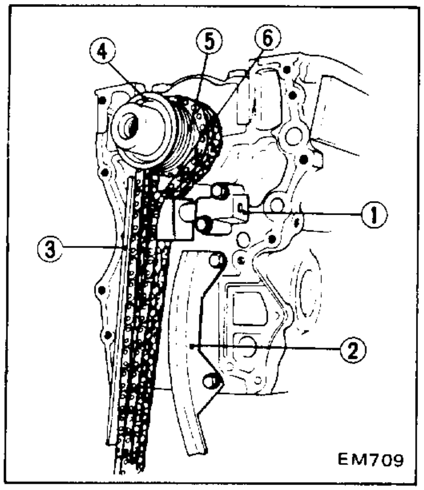
(3) When installing cylinder head, make sure that all valves are apart from head of pistons. If necessary, loosen adjusting screws of rocker arm to draw valves in.

(4) Temporarily tighten two center bolts.

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

a. **Final tightening operation should be carried out after installing chain and front cover.**
b. **Do not rotate crankshaft and camshaft separately, because valves will hit piston heads.**
c. **Always use new cylinder head gasket.**
d. **There are two kinds of cylinder head bolts with different lengths.**

8. 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

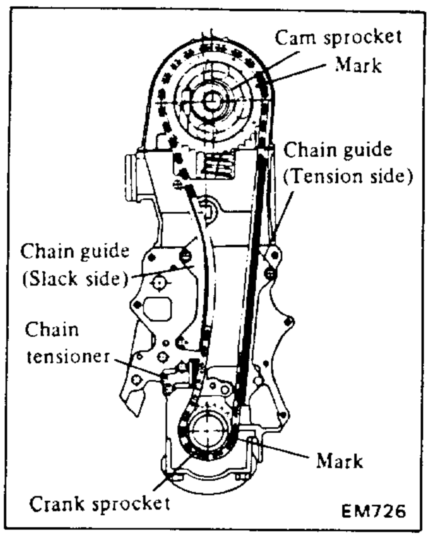
(1) Install crankshaft sprocket, oil pump drive gear and oil thrower.

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 side faces rearward.**

(2) Install chain guide to cylinder block.

(3) Set chain by aligning mating mark on camshaft sprocket with that of crankshaft sprocket and install camshaft sprocket to camshaft.

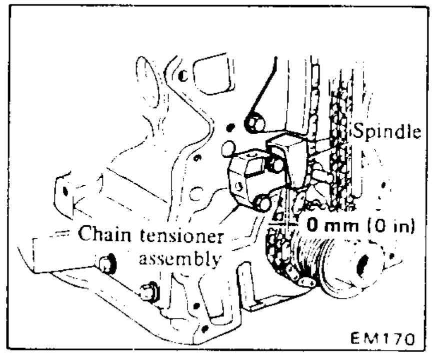
Ⓣ : **Camshaft sprocket bolt**
127 - 147 N·m
(13.0 - 15.0 kg-m,
94 - 108 ft-lb)



a. **Set timing chain by making its mating marks align with those of crankshaft sprocket and camshaft sprocket the right hand side.**
b. **Camshaft sprocket should be installed by accommodating its No. 1 hole to knock pin of camshaft.**

(4) Install chain guide and chain tensioner. Then tighten slack side chain guide mounting bolt so that protrusion of chain tensioner spindle is 0 mm (0 in).

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



(5) Install front cover with gasket in place observing the following:

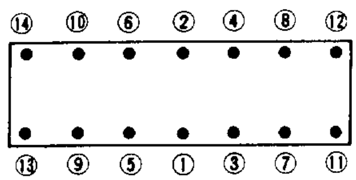
a. **Before installing front cover, press new oil seal in front cover in the direction that dust seal lip faces to the outside of front cover.**
b. **Apply sealant to gaskets and sealing portions designated. Refer to Precautions.**
c. **Apply coating of engine oil to periphery of oil seal.**

9. Tighten temporarily front cover to cylinder block bolts and cylinder head to front cover bolts.

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).

10. Tighten cylinder head bolts to the specified torque in several steps in the sequence as follows **using Tool ST10120000.**

Ⓣ : Cylinder head bolt
69 - 83 N·m
(7.0 - 8.5 kg-m,
51 - 61 ft-lb)



EM727

After engine has been operated for several minutes; if necessary, re-tighten.

11. Finally tighten front cover to cylinder block bolts and cylinder head to front cover bolts.

Ⓣ : Front cover bolts

	N·m	kg-m	ft-lb
M8 (7T)	20 - 29	2.0 - 3.0	14 - 22
M8 (4T)	12 - 16	1.2 - 1.6	9 - 12
M6 (4T)	5 - 10	0.5 - 1.0	3.6 - 7.2

Ⓣ : Cylinder head to front cover bolts
8 - 14 N·m
(0.8 - 1.4 kg-m,
5.8 - 10.1 ft-lb)

12. Install water pump assembly.

Ⓣ : Water pump fixing bolt
Same as the front cover bolts [M8 (4T), M6 (4T)].

13. Install crankshaft pulley and washer and tighten pulley bolt by locking crankshaft.

Ⓣ : Crankshaft pulley bolt
118 - 157 N·m
(12.0 - 16.0 kg-m,
87 - 116 ft-lb)

14. Install oil strainer and oil pan with new gasket.

Ⓣ : Oil strainer bolts
10 - 16 N·m
(1.0 - 1.6 kg-m,
7 - 12 ft-lb)
Oil pan bolts
6 - 10 N·m
(0.6 - 1.0 kg-m,
4.3 - 7.2 ft-lb)

a. Apply sealant to the designated portions. Refer to Precautions.
b. Oil pan should be tightened in a criss-cross pattern. Do not over-tighten.
c. Always use new oil pan gasket.

INSTALLING BODY PARTS OF P40 ENGINE

First, mount cylinder block on engine stand (**refer to Engine Disassembly**).
Then install following parts:
1. Camshaft
(1) Insert valve lifters.
(2) Insert camshaft in cylinder block from front side of engine.

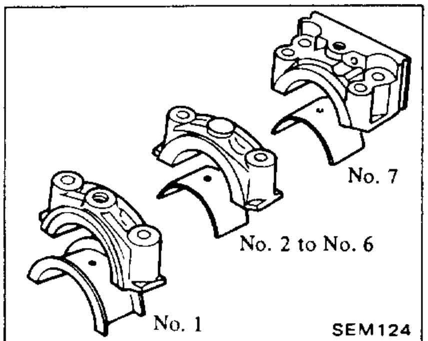
Do not damage camshaft bushings.

(3) Install camshaft locating plate.

Ⓣ : Camshaft locating plate bolts
6 - 8 N·m
(0.6 - 0.8 kg-m,
4.3 - 5.8 ft-lb)

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

a. Only front bearing (No. 1) is a flange type.
b. All inter-bearings are the same type.
c. All upper and lower bearings are interchangeable.

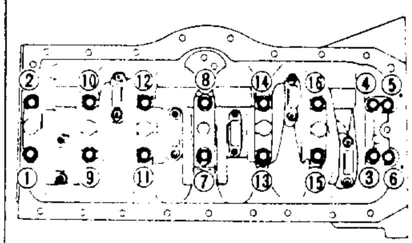


SEM124

(2) Apply engine oil to main bearing surfaces on both sides of cylinder block and cap.
(3) Install rear oil seal at block side.
(4) Install crankshaft.
(5) Install rear oil seal and main bearing cap and tighten bolts to specified torque.

Ⓣ : Main bearing cap bolts
98 - 118 N·m
(10.0 - 12.0 kg-m,
72 - 87 ft-lb)

a. Arrange the parts so that the "⇦" mark on bearing cap faces to camshaft.
b. Prior to tightening bearing cap bolts, place bearing cap in proper position by shifting crankshaft in the axial direction.
c. Tighten bearing cap bolts gradually in separating two to three stages, and outwardly from center bearing in sequence.

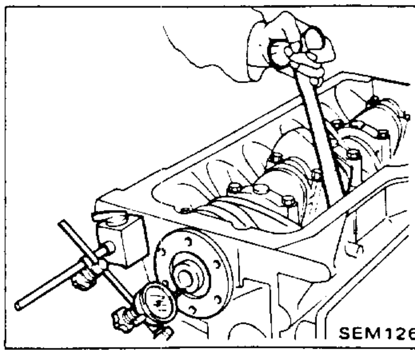


SEM125

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

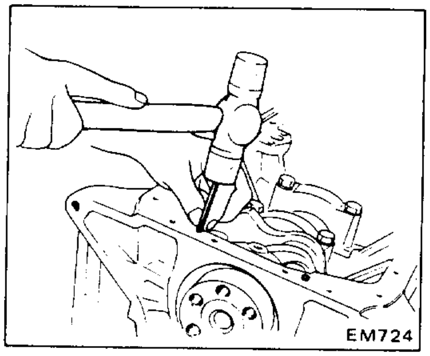
(6) Make sure that there exists proper end play at crankshaft.

Crankshaft end play:
Max. 0.30 mm (0.0118 in)



SEM126

3. Side oil seals. Apply sealant to these seals. Then install them into rear main bearing cap.

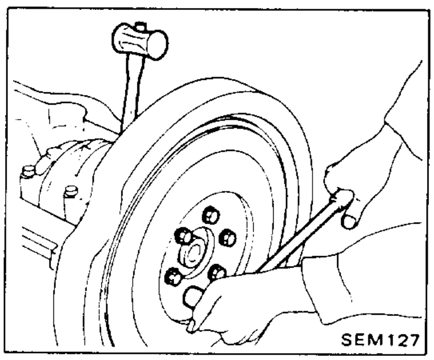


Cut off projecting portion of seals with a putty knife, and apply sealer to cut edges of seals.

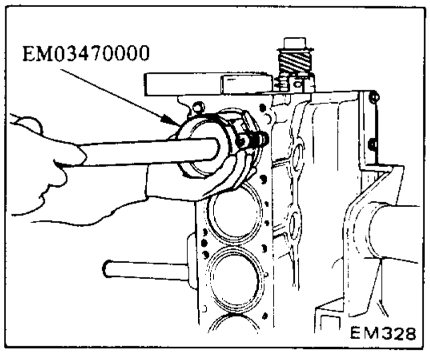
CAUTION:
Be careful not to apply an excessive amount of sealer to cut edges.

4. Flywheel housing and flywheel.

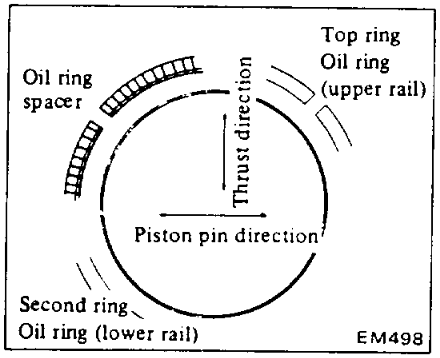
Ⓣ : **Flywheel fixing bolts**
78 - 98 N·m
(8.0 - 10.0 kg-m,
58 - 72 ft-lb)



5. Piston with connecting rod.
(1) Install them into corresponding cylinder **using Tool.**

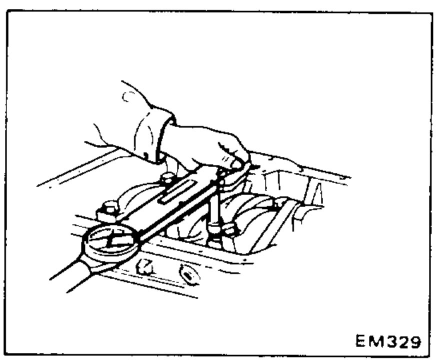


a. Apply engine oil to sliding parts.
b. Arrange so that the grade mark on piston head faces to the front of engine.
c. Install piston ring as shown below.



(2) Install connecting rod caps.

Ⓣ : **Connecting rod cap nuts**
44 - 59 N·m
(4.5 - 6.0 kg-m,
33 - 43 ft-lb)

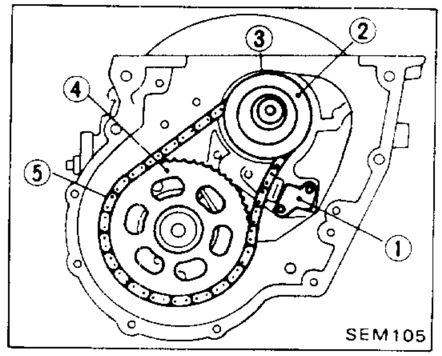


Arrange connecting rods and connecting rod caps so that the cylinder numbers face in the same direction.

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

Apply sealant on the bottom of front plate. Refer to Precautions.

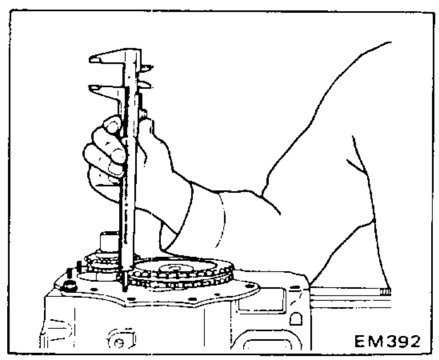
6. Front side parts.



1 Chain tensioner
2 Oil thrower
3 Crankshaft sprocket
4 Camshaft sprocket
5 Timing chain

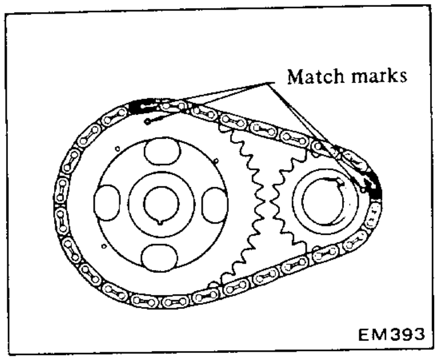
Turn crankshaft until No. 1 piston is at T.D.C. on its compression stroke.

Install crankshaft sprocket, camshaft sprocket and chain in the following manner:
(1) Insert keys in keyways. Temporarily install both crankshaft and camshaft sprockets and check to see that they are flush with each other. If difference in height falls below 0.5 mm (0.020 in), place a 0.15 mm (0.0059 in) washer under crankshaft sprocket.



(2) After above step has been completed, install crankshaft sprocket, chain and camshaft sprocket with their markings properly aligned. Oil sprocket teeth and chain with light engine oil.

Ⓣ : Camshaft sprocket bolt
30 - 40 N·m
(3.1 - 4.1 kg-m,
22 - 30 ft-lb)

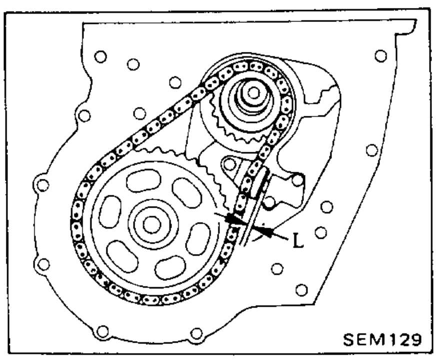


EM393

(3) Install chain tensioner. If projection "L" of spindle is below the specified limit, replace spindle.

Projection "L" of spindle:
Limit 2 mm (0.08 in)

Ⓣ : Chain tensioner mounting bolt
7 - 9 N·m
(0.7 - 0.9 kg-m,
5.1 - 6.5 ft-lb)



SEM129

(4) Install oil thrower.
(5) Install front cover with gasket in place observing the followings:

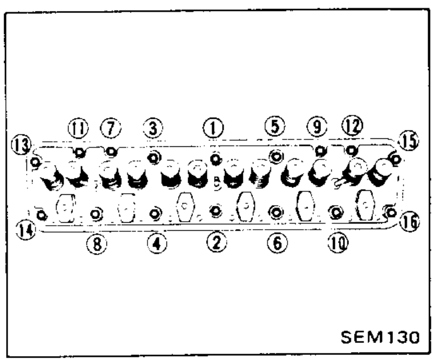
a. Before installing front cover, press new oil seal in front cover in the direction that dust seal lip faces to the outside of timing chain case.
b. Apply sealant to sealing portion designated. Refer to Precautions.
c. Apply a lithium grease to sealing lip of oil seal.
d. Note that different lengths of bolts are used.

Ⓣ : Front cover bolts
Size M10
30 - 40 N·m
(3.1 - 4.1 kg-m,
22 - 30 ft-lb)
Size M8
11 - 21 N·m
(1.1 - 2.1 kg-m,
8 - 15 ft-lb)

7. Cylinder head assembly. Install it through gasket as follows:
(1) Thoroughly clean cylinder block and head surface.
Do not apply sealant to any other part of cylinder block and head surface.
(2) When installing cylinder head, make sure that all valves are apart from piston heads. If necessary loosen adjusting screws of rocker arm to draw valves in.

Always use new cylinder head gasket.

(3) Tighten head bolts to the specified torque in several steps in the sequence shown below.



SEM130

Ⓣ : Cylinder head bolts
69 - 88 N·m
(7.0 - 9.0 kg-m,
51 - 65 ft-lb)

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

8. Valve lifters and push rods. Install them in original position.
9. Oil pump and oil pan with new gasket.

Ⓣ : Oil pump bolts
25 - 34 N·m
(2.5 - 3.5 kg-m,
18 - 25 ft-lb)
Oil pan bolts
15 - 20 N·m
(1.5 - 2.0 kg-m,
11 - 14 ft-lb)

a. Oil pan should be tightened in criss-cross pattern.
b. Always use new oil pan gasket.

DISMOUNTING ENGINE FROM ENGINE STAND

Dismount engine in reverse order of mounting and install engine right (or left) side and rear side parts.
Refer to Mounting Engine on Engine Stand.

a. When installing clutch assembly (or torque converter) and transmission, refer to sections CL and MT (or AT).
b. When installing oil cooler unit (for Middle East area) or oil filter, refer to section LC.
c. Fill engine oil and coolant to the specified level, after engine has been installed on vehicle. Refer to section MA.

ENGINE TUNE-UP

Referring to Section MA, adjust following items:
1. Fan belt deflection.
2. Idle adjustment.
3. Valve clearance.

(1) First, set clearance to the cold specifications.
(2) After engine has run for at least several minutes, finally adjust the clearance to the hot specifications.
When installing valve rocker cover, use new gasket and tighten bolts (or nuts) in a criss-cross pattern.
When adjusting valve clearance for L28 engine, use Tool ST10640001.

L28 engine
Ⓣ : Valve rocker cover bolts
10 - 16 N·m
(1.0 - 1.6 kg-m,
7 - 12 ft-lb)

P40 engine
Ⓣ : Valve rocker cover nuts
18 - 27 N·m
(1.8 - 2.8 kg-m,
13 - 20 ft-lb)

INSTALLING OUTER PARTS

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

Refer to Removing Outer Parts and S.D.S.

a. When installing oil pump (L28 engine) and distributor driving spindle, refer to section LC.

b. When connecting fuel pipes, refer to section EF.

c. When installing water outlet and thermostat, refer to section LC.

1. Engine bottom side parts (L28 engine).
2. Engine right side parts.
3. Engine left side parts.
4. Engine front side parts.

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Engine model		L28	P40
Cylinder arrangement		6, in-line	6, in-line
Displacement cm^3 (cu in)		2,753 (167.99)	3,956 (241.40)
Bore and stroke mm (in)		86.0 x 79.0 (3.386 x 3.110)	85.7 x 114.3 (3.374 x 4.500)
Valve arrangement		O.H.C.	O.H.V.
Firing order		1-5-3-6-2-4	1-5-3-6-2-4
Number of piston rings	Compression	2	2
	Oil	1	1
Number of main bearings		7	7
Compression ratio		8.6	7.8

INSPECTION AND ADJUSTMENT

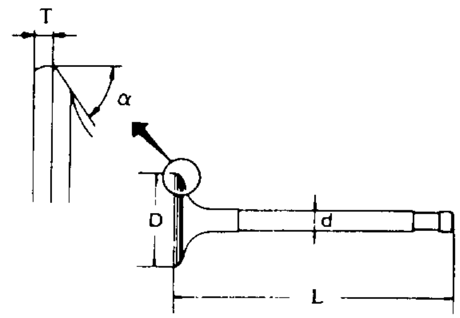
CYLINDER HEAD

Unit: mm (in)

	Standard	Limit
Head surface flatness	Less than 0.05 (0.0020)	0.1 (0.004)

VALVE

Unit: mm (in)



SEM188

Engine model		L28	P40
Valve head diameter "D"	Intake	44.0 (1.732)	43.0 (1.693)
	Exhaust	35.0 (1.378)	36.2 (1.425)
Valve length "L"	Intake	116.15 - 116.55 (4.5728 - 4.5886)	130.05 - 130.35 (5.1201 - 5.1319)
	Exhaust	117.15 - 117.55 (4.6122 - 4.6279)	131.35 - 131.65 (5.1712 - 5.1831)
Valve stem diameter "d"	Intake	7.965 - 7.980 (0.3136 - 0.3142)	8.637 - 8.650 (0.3400 - 0.3406)
	Exhaust	7.945 - 7.960 (0.3128 - 0.3134)	8.627 - 8.640 (0.3396 - 0.3402)
Valve seat angle "α"		45°30'	45°
Valve margin "T" limit		0.5 (0.020)	0.5 (0.020)
Valve stem end surface grinding limit		0.5 (0.020)	0.5 (0.020)
Valve clearance Hot [*Cold]	Intake	0.25 (0.010) [0.17 (0.007)]	0.38 - 0.40 (0.015 - 0.016)
	Exhaust	0.30 (0.012) [0.24 (0.009)]	0.38 - 0.40) (0.015 - 0.016)

*Cold: Used as approximate values during engine assembly, clearances should ultimately be adjusted to the above hot values; refer to Section MA for procedures.

Valve spring

L28 engine

Free height mm (in)	Outer		49.98 (1.9677)
	Inner		44.85 (1.7657)
Pressure height mm/N (mm/kg, in/lb)	Outer	Intake	30.0/467.8 (30.0/47.7, 1.181/105.2)
		Exhaust	29.5/480.5 (29.5/49.0, 1.161/108.0)
	Inner	Intake	25.0/244.2 (25.0/24.9, 0.984/54.9)
		Exhaust	24.5/250.1 (24.5/25.5, 0.965/56.2)
Assembled height mm/N (mm/kg, in/lb)	Outer		40.0/208.9 (40.0/21.3, 1.575/47.0)
	Inner		35.0/120.6 (35.0/12.3, 1.378/27.1)
Out of square "S" mm (in)	Outer		2.2 (0.087)
	Inner		1.2 (0.047)

P40 engine

Free height mm (in)	57.5 (2.264)
Pressure height mm/N (mm/kg, in/lb)	40/588 (40/60, 1.57/132)
Out of square "S" mm (in)	1.6 (0.063)

Valve guide

L28 engine

Unit: mm (in)

		Standard	Service
Valve guide Outer diameter		12.023 - 12.034 (0.4733 - 0.4738)	12.223 - 12.234 (0.4812 - 0.4817)
Valve guide Inner diameter [Finished size]		8.000 - 8.018 (0.3150 - 0.3157)	
Cylinder head valve guide hole diameter		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	Max. tolerance
Stem to guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.1 (0.004)
	Exhaust	0.040 - 0.073 (0.0016 - 0.0029)	
Valve deflection limit		0.2 (0.008)	

P40 engine

Unit: mm (in)

Valve guide Outer diameter		14.313 - 14.326 (0.5635 - 0.5640)	
Valve guide Inner diameter [Finished size]		8.685 - 8.700 (0.3419 - 0.3425)	
Cylinder head valve guide hole diameter		14.281 - 14.300 (0.5622 - 0.5630)	
Interference fit of valve guide		0.013 - 0.045 (0.0005 - 0.0018)	
		Standard	Max. tolerance
Stem to guide clearance	Intake	0.035 - 0.063 (0.0014 - 0.0025)	0.1 (0.004)
	Exhaust	0.045 - 0.073 (0.0018 - 0.0029)	
Valve deflection limit		0.2 (0.008)	

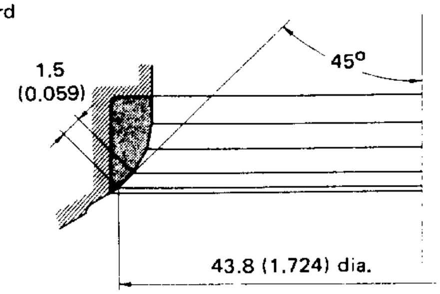
Valve seat

L28 engine

Unit: mm (in)

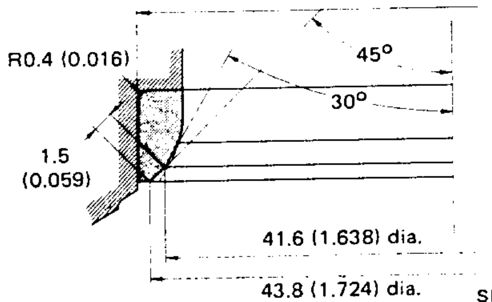
INTAKE

Standard



SEM224

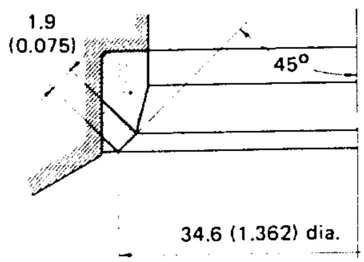
Oversize [0.5 (0.020)]: 45.500 - 45.516 (1.7913 - 1.7920) dia. [Cylinder head]



SEM225

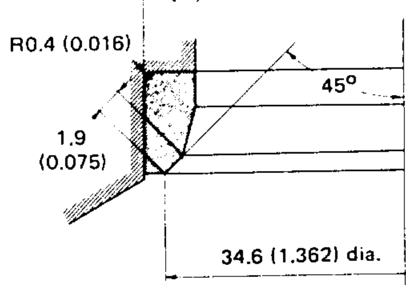
EXHAUST

Standard



SEM226

Oversize [0.5 (0.020)]: 37.500 - 37.516 (1.4764 - 1.4770) dia. [Cylinder head]



SEM227

P40 engine

Contacting face angle		44.5°
Contacting face width mm (in)	Intake	1.5 - 1.7 (0.059 - 0.067)
	Exhaust	1.7 - 1.9 (0.067 - 0.075)

ROCKER ARM AND ROCKER SHAFT (P40 engine)

Unit: mm (in)

Rocker shaft outer diameter	19.975 - 20.000 (0.7864 - 0.7874)
Rocker arm bushing bore diameter [Finished size]	20.020 - 20.033 (0.7882 - 0.7887)
Rocker arm to rocker shaft clearance	0.020 - 0.063 (0.0008 - 0.0025)

VALVE LIFTER (P40 engine)

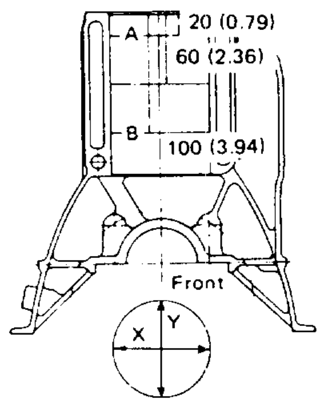
Unit: mm (in)

Valve lifter to guide clearance	Standard	0.02 - 0.05 (0.0008 - 0.0020)
	Limit	0.15 (0.0059)

CYLINDER BLOCK

L28 engine

Unit: mm (in)

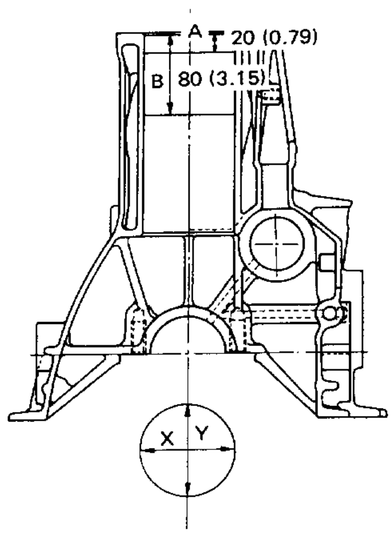


EM125

		Standard	Wear limit
Surface flatness		Less than 0.05 (0.0020)	0.10 (0.0039)
Cylinder bore	Inner diameter	86.000 - 86.050 (3.3858 - 3.3878)	–
	Out-of-round (X-Y)	Less than 0.02 (0.0008)	–
	Taper (A-B)	Less than 0.02 (0.0008)	–
Difference in inner diameter between cylinders		Less than 0.05 (0.0020)	–
Piston to cylinder clearance		0.025 - 0.045 (0.0010 - 0.0018)	–
		Outer diameter	**Remarks**
Outer diameter of cylinder liner for service	4.0 (0.157) Undersize	90.00 - 90.05 (3.5433 - 3.5453)	Interference fit cylinder liner to cylinder block 0.075 - 0.085 (0.0030 - 0.0033)
	4.5 (0.177) Undersize	90.50 - 90.55 (3.5630 - 3.5650)	
	5.0 (0.197) Undersize	91.00 - 91.05 (3.5827 - 3.5846)	

P40 engine

Unit: mm (in)



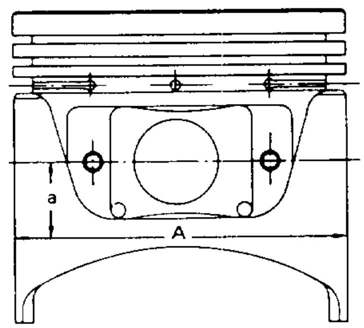
SEM115

		Standard	Wear limit
Surface flatness		Less than 0.07 (0.0028)	0.10 (0.0039)
Cylinder bore	Inner diameter	85.690 - 85.740 (3.3736 - 3.3756)	–
	Out-of-round (X-Y)	Less than 0.025 (0.0010)	–
	Taper (A-B)	Less than 0.025 (0.0010)	–
Difference in inner diameter between cylinders		Less than 0.05 (0.0020)	–
Piston to cylinder clearance		0.031 - 0.049 (0.0012 - 0.0019)	–

PISTON, PISTON RING AND PISTON PIN

Piston

Unit: mm (in)



EM714

Engine model			L28	P40
Piston skirt diameter "A"	Standard		85.965 - 86.015 (3.3844 - 3.3864)	85.650 - 85.699 (3.3720 - 3.3740)
	Oversize	0.02 (0.0008)	85.985 - 86.035 (3.3852 - 3.3872)	–
		0.5 (0.020)	86.465 - 86.515 (3.4041 - 3.4061)	86.150 - 86.199 (3.3917 - 3.3937)
		1.0 (0.039)	86.965 - 87.015 (3.4238 - 3.4258)	86.650 - 86.699 (3.4114 - 3.4133)
		1.5 (0.059)	–	87.150 - 87.199 (3.4311 - 3.4330)
"a" dimension			Approximately 20 (0.79)	Approximately 40 (1.57)
Piston pin hole diameter			21.001 - 21.008 (0.8268 - 0.8271)	20.652 - 20.659 (0.8131 - 0.8133)
Piston clearance to cylinder block			0.025 - 0.045 (0.0010 - 0.0018)	0.031 - 0.049 (0.0012 - 0.0019)

Piston ring

Unit: mm (in)

Engine model			L28	P40
Side clearance	Top	Standard	0.040 - 0.073 (0.0016 - 0.0029)	0.031 - 0.078 (0.0012 - 0.0031)
		Limit	0.1 (0.004)	0.1 (0.004)
	2nd	Standard	0.030 - 0.063 (0.0012 - 0.0025)	0.031 - 0.078 (0.0012 - 0.0031)
		Limit	0.1 (0.004)	0.1 (0.004)
	Oil		Combined	Combined
Ring gap	Top	Standard	0.25 - 0.40 (0.0098 - 0.0157)	0.25 - 0.40 (0.0098 - 0.0157)
		Limit	1.0 (0.039)	1.0 (0.039)
	2nd	Standard	0.15 - 0.30 (0.0059 - 0.0118)	0.15 - 0.30 (0.0059 - 0.0118)
		Limit	1.0 (0.039)	1.0 (0.039)
	Oil (Rail ring)	Standard	0.3 - 0.9 (0.012 - 0.035)	0.2 - 0.9 (0.008 - 0.035)
		Limit	1.0 (0.039)	1.0 (0.039)

Piston pin

Unit: mm (in)

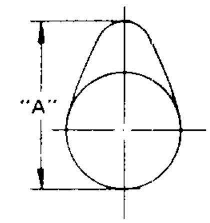
Engine model	L28	P40
Piston pin outer diameter	20.993 - 20.998 (0.8265 - 0.8267)	20.648 - 20.653 (0.8129 - 0.8131)
Piston pin to piston clearance	0.006 - 0.013 (0.0002 - 0.0005)	0.004 - 0.006 (0.00016 - 0.00024)
Interference fit of piston pin to connecting rod	0.015 - 0.033 (0.0006 - 0.0013)	0.018 - 0.035 (0.0007 - 0.0014)

CAMSHAFT AND CAMSHAFT BEARING

L28 engine

Unit: mm (in)

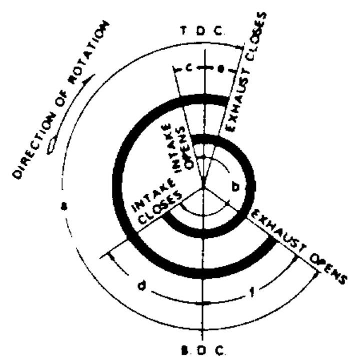
	Standard	Max. tolerance
Camshaft journal to bearing clearance	0.038 - 0.067 (0.0015 - 0.0026)	0.1 (0.004)
Inner diameter of camshaft bearing	48.000 - 48.016 (1.8898 - 1.8904)	–
Outer diameter of camshaft journal	47.949 - 47.962 (1.8878 - 1.8883)	–
Camshaft bend [T.I.R.]	Less than 0.04 (0.0016)	0.10 (0.0039)
Camshaft end play	0.08 - 0.38 (0.0031 - 0.0150)	



EM671

Cam height "A"	Intake	39.95 - 40.00 (1.5728 - 1.5748)
	Exhaust	40.30 - 40.35 (1.5866 - 1.5886)
Wear limit of cam height		0.15 (0.0059)

Valve timing



EM120

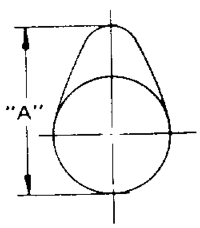
Unit: degree

a	b	c	d	e	f
248	240	16	44	10	58

P40 engine

Unit: mm (in)

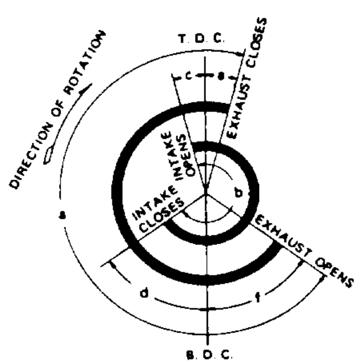
		Standard	Max. tolerance
Camshaft journal to bearing clearance		0.030 - 0.075 (0.0012 - 0.0030)	0.1 (0.004)
Inner diameter of camshaft bearing	1st	49.154 - 49.224 (1.9352 - 1.9379)	–
	2nd	48.950 - 49.020 (1.9272 - 1.9299)	–
	3rd	48.646 - 48.716 (1.9152 - 1.9179)	–
	4th	48.341 - 48.411 (1.9032 - 1.9059)	–
Outer diameter of camshaft journal	1st	49.124 - 49.149 (1.9340 - 1.9350)	–
	2nd	48.920 - 48.945 (1.9260 - 1.9270)	–
	3rd	48.616 - 48.641 (1.9140 - 1.9150)	–
	4th	48.311 - 48.336 (1.9020 - 1.9030)	–
Camshaft bend [T.I.R.]		Less than 0.025 (0.0010)	0.10 (0.0039)
Camshaft end play		0.045 - 0.215 (0.0018 - 0.0085)	



EM671

Cam height "A"	Intake	41.246 (1.6239)
	Exhaust	41.246 (1.6239)
Wear limit of cam height		0.15 (0.0059)

Valve timing



EM120

Unit: degree

a	b	c	d	e	f
244	244	14	50	12	52

CONNECTING ROD

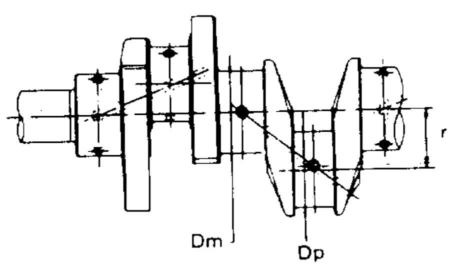
Unit: mm (in)

Engine model		L28	P40
Center distance		130.35 (5.13)	200 (7.87)
Bend, torsion [per 100 mm (3.94 in)]	Standard	Less than 0.025 (0.0010)	Less than 0.025 (0.0010)
	Limit	0.05 (0.0020)	0.05 (0.0020)
Piston pin bore dia.		20.965 - 20.978 (0.8254 - 0.8259)	20.618 - 20.630 (0.8117 - 0.8122)
Big end play	Standard	0.2 - 0.3 (0.008 - 0.012)	0.15 - 0.28 (0.0059 - 0.0110)
	Limit	0.6 (0.024)	0.6 (0.024)

CRANKSHAFT

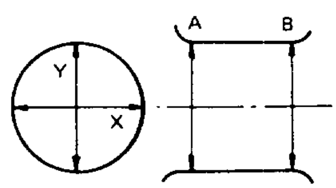
Unit: mm (in)

Engine model		L28	P40
Main journal dia. "Dm"		54.942 - 54.955 (2.1631 - 2.1636)	69.275 - 69.300 (2.7274 - 2.7283)
Pin journal dia. "Dp"		49.961 - 49.974 (1.9670 - 1.9675)	57.131 - 57.150 (2.2492 - 2.2500)
Center distance "r"		39.50 (1.5551)	57.150 (2.2500)
Out-of-round (X-Y) and taper (A-B)	Standard	Less than 0.01 (0.0004)	Less than 0.01 (0.0004)
	Limit	0.03 (0.0012)	0.03 (0.0012)
Bend [T.I.R.]	Standard	Less than 0.05 (0.0020)	Less than 0.075 (0.0030)
	Limit	0.10 (0.0039)	0.10 (0.0039)
Free end play	Standard	0.05 - 0.18 (0.0020 - 0.0071)	0.08 - 0.20 (0.0031 - 0.0079)
	Limit	0.30 (0.0118)	0.30 (0.0118)
Pilot bushing insert distance		Approximately 4.0 (0.157)	Approximately 0.6 (0.024)



EM737

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



EM715

BEARING

Bearing clearance

Unit: mm (in)

Engine model		L28	P40
Main bearing clearance	Standard	0.020 - 0.072 (0.0008 - 0.0028)	0.030 - 0.106 (0.0012 - 0.0042)
	Limit	0.12 (0.0047)	0.12 (0.0047)
Connecting rod bearing clearance	Standard	0.014 - 0.066 (0.0006 - 0.0026)	0.014 - 0.068 (0.0006 - 0.0027)
	Limit	0.12 (0.0047)	0.12 (0.0047)

Main bearing undersize

L28 engine

Unit: mm (in)

	Crank journal diameter
Standard	54.942 - 54.955 (2.1631 - 2.1636)
0.25 (0.0098) Undersize	54.692 - 54.705 (2.1532 - 2.1537)
0.50 (0.0197) Undersize	54.442 - 54.455 (2.1434 - 2.1439)
0.75 (0.0295) Undersize	54.192 - 54.205 (2.1335 - 2.1341)

P40 engine

Unit: mm (in)

	Crank journal diameter
Standard	69.275 - 69.300 (2.7274 - 2.7283)
0.12 (0.0047) Undersize	69.155 - 69.180 (2.7226 - 2.7236)
0.25 (0.0098) Undersize	69.025 - 69.050 (2.7175 - 2.7185)
0.50 (0.0197) Undersize	68.775 - 68.800 (2.7077 - 2.7087)
0.75 (0.0295) Undersize	68.525 - 68.550 (2.6978 - 2.6988)
1.00 (0.0394) Undersize	68.275 - 68.300 (2.6880 - 2.6890)
1.25 (0.0492) Undersize	68.025 - 68.050 (2.6781 - 2.6791)
1.50 (0.0591) Undersize	67.775 - 67.800 (2.6683 - 2.6693)

Connecting rod bearing undersize

L28 engine

Unit: mm (in)

	Crank journal diameter
Standard	49.961 - 49.974 (1.9670 - 1.9675)
0.25 (0.0098) Undersize	49.711 - 49.724 (1.9571 - 1.9576)
0.50 (0.0197) Undersize	49.461 - 49.474 (1.9473 - 1.9478)
0.75 (0.0295) Undersize	49.211 - 49.224 (1.9374 - 1.9379)

P40 engine

Unit: mm (in)

	Crank journal diameter
Standard	57.131 - 57.150 (2.2492 - 2.2500)
0.25 (0.0098) Undersize	56.881 - 56.900 (2.2394 - 2.2402)
0.50 (0.0197) Undersize	56.631 - 56.650 (2.2296 - 2.2303)
0.75 (0.0295) Undersize	56.381 - 56.400 (2.2197 - 2.2205)
1.00 (0.0394) Undersize	56.131 - 56.150 (2.2099 - 2.2106)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Engine model	L28	P40
Camshaft sprocket Runout [T.I.R.]	Less than 0.1 (0.004)	Less than 0.08 (0.0031)
Flywheel Runout [T.I.R.]	Less than 0.15 (0.0059)	Less than 0.35 (0.0138)

TIGHTENING TORQUE

L28 engine

Unit		N·m	kg-m	ft-lb
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
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
Front cover bolt	M8 (7T)	20 - 29	2.0 - 3.0	14 - 22
	M8 (4T)	12 - 16	1.2 - 1.6	9 - 12
	M6 (4T)	5 - 10	0.5 - 1.0	3.6 - 7.2
Cylinder head		69 - 83	7.0 - 8.5	51 - 61
Cylinder head to front cover bolt		8 - 14	0.8 - 1.4	5.8 - 10.1
Camshaft thrust plate bolt		6 - 10	0.6 - 1.0	4.3 - 7.2
Pivot bushing bolt		78 - 118	8.0 - 12.0	58 - 87
Pivot lock nut		49 - 59	5.0 - 6.0	36 - 43
Camshaft sprocket bolt		127 - 147	13.0 - 15.0	94 - 108
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
Oil pump bolt		11 - 15	1.1 - 1.5	8 - 11

Unit		N·m	kg-m	ft-lb
Water pump bolt	M8	12 - 16	1.2 - 1.6	9 - 12
	M6	5 - 10	0.5 - 1.0	3.6 - 7.2
Water pump pulley stud		6 - 10	0.6 - 1.0	4.3 - 7.2
Water inlet bolt		10 - 16	1.0 - 1.6	7 - 12
Crank pulley bolt		118 - 157	12.0 - 16.0	87 - 116
Oil strainer bolt		10 - 16	1.0 - 1.6	7 - 12
Oil pan bolt		6 - 10	0.6 - 1.0	4.3 - 7.2
Oil pan drain plug		20 - 29	2.0 - 3.0	14 - 22
Clutch cover bolt		20 - 29	2.0 - 3.0	14 - 22
Rocker cover bolt		10 - 16	1.0 - 1.6	7 - 12
Spark plug		15 - 20	1.5 - 2.0	11 - 14
Manifold Bolt and Nut	M8 Bolt	15 - 25	1.5 - 2.5	11 - 18
	M8 Nut	12 - 16	1.2 - 1.6	9 - 12
Water outlet bolt		12 - 20	1.2 - 2.0	9 - 14
Thermostat housing		10 - 16	1.0 - 1.6	7 - 12
Distributor support bolt		4 - 8	0.4 - 0.8	2.9 - 5.8
Oil pressure sending unit		10 - 16	1.0 - 1.6	7 - 12
Alternator bracket		39 - 59	4.0 - 6.0	29 - 43
Alternator to adjusting bar bolt		20 - 29	2.0 - 3.0	14 - 22
Engine mounting bracket		69 - 81	7.0 - 8.3	51 - 60
Carburetor nut		12 - 18	1.2 - 1.8	9 - 13
Fuel pump nut		12 - 18	1.2 - 1.8	9 - 13

P40 engine

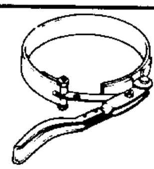
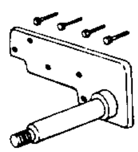
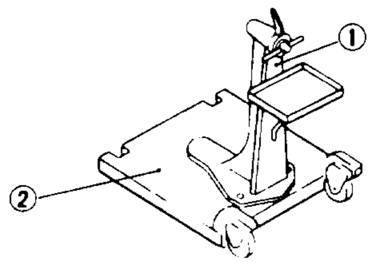
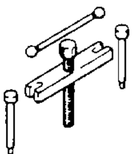
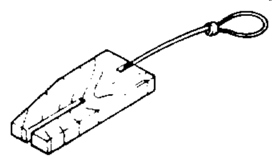
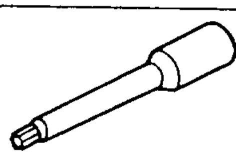
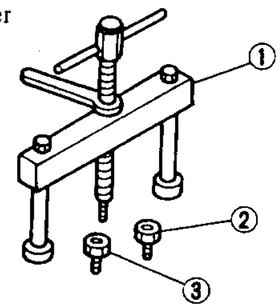
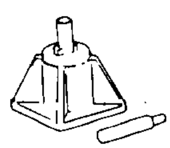
Unit		N·m	kg-m	ft-lb
Main bearing cap bolt		98 - 118	10.0 - 12.0	72 - 87
Connecting rod big end nut		44 - 59	4.5 - 6.0	33 - 43
Flywheel bolt		78 - 98	8.0 - 10.0	58 - 72
Front cover bolt	M10 (7T)	30 - 40	3.1 - 4.1	22 - 30
	M8 (4T)	11 - 21	1.1 - 2.1	8 - 15
Front plate bolt		30 - 40	3.1 - 4.1	22 - 30
Flywheel housing bolt		51 - 73	5.2 - 7.4	38 - 54
Cylinder head bolt		69 - 88	7.0 - 9.0	51 - 65
Rocker shaft bracket bolt		34 - 48	3.5 - 4.9	25 - 35
Valve rocker adjusting screw		30 - 38	3.1 - 3.9	22 - 28
Camshaft sprocket bolt		30 - 40	3.1 - 4.1	22 - 30
Camshaft locating plate bolt		6 - 8	0.6 - 0.8	4.3 - 5.8
Oil pump bolt		25 - 34	2.5 - 3.5	18 - 25
Water pump bolt and nut		25 - 34	2.5 - 3.5	18 - 25
Crank pulley nut		149 - 163	15.2 - 16.6	110 - 120
Oil pan bolt and nut		15 - 20	1.5 - 2.0	11 - 14
Oil pan drain plug		20 - 39	2.0 - 4.0	14 - 29
Rocker cover nut		18 - 27	1.8 - 2.8	13 - 20
Spark plug		18 - 24	1.8 - 2.4	13 - 17
Manifold bolt and nut		25 - 34	2.5 - 3.5	18 - 25
Water outlet bolt		10 - 12	1.0 - 1.2	7 - 9
Thermostat housing		10 - 12	1.0 - 1.2	7 - 9
Distributor support bolt		10 - 12	1.0 - 1.2	7 - 9
Alternator bracket		22 - 29	2.2 - 3.0	16 - 22
Alternator to adjusting bar bolt		14 - 21	1.4 - 2.1	10 - 15
Engine mounting bracket		36.7 - 49.6	3.74 - 5.06	27.1 - 36.6
Carburetor nut		14 - 18	1.4 - 1.8	10 - 13
Fuel pump nut		11 - 21	1.1 - 2.1	8 - 15

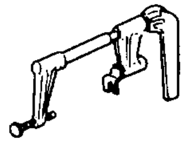
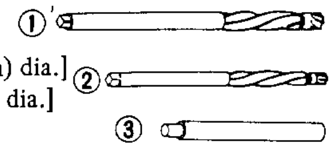
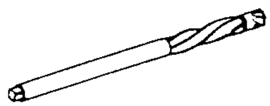
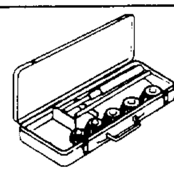
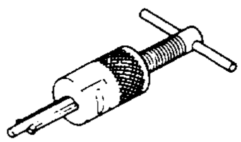
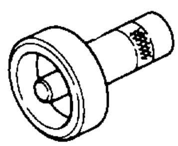
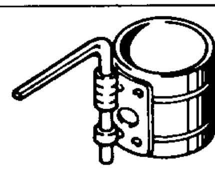
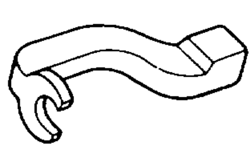
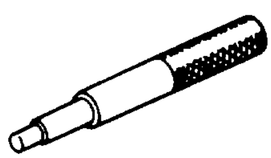
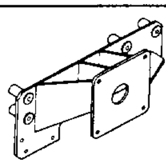
TROUBLE DIAGNOSES AND CORRECTIONS

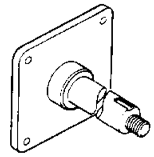
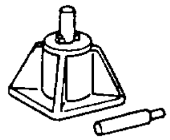
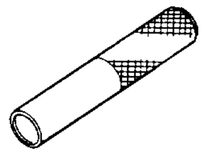
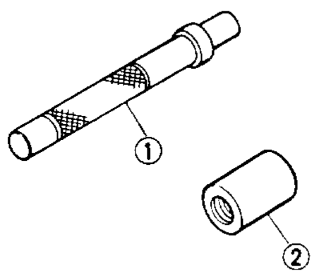
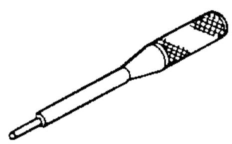
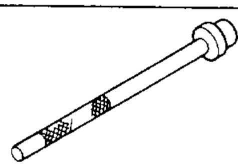
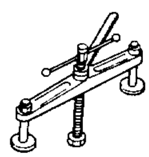
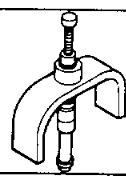
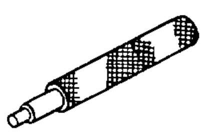
Condition	Probable cause	Corrective action
I. Noisy engine		
Piston and connecting rod knocking.	Seized piston pin.	Replace piston with pin.
	Seized piston in cylinder.	Recondition cylinder and replace piston with pin.
	Broken piston ring.	Replace ring and/or recondition cylinder.
	Improper connecting rod alignment.	Realign or replace connecting rod.
	Seized or loose connecting rod bearing.	Replace.
Knocking of crank-shaft 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.
	Excessive camshaft clearance.	Replace.
Camshaft and valve mechanism knocking.	Improper valve clearance.	Adjust.
	Worn adjusting screw.	Replace.
	Worn rocker face.	Replace.
	Loose valve stem in guide.	Replace guide.
	Weakened valve spring.	Replace.
	Seized valve.	Replace.
Camshaft knocking.	Excessive camshaft 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.

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 or replace.
Excessively worn cylinder and piston.	Shortage of engine oil.	Add or replace oil.
	Dirty engine oil.	Clean crankcase, replace oil and oil filter.
	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.	Replace.
	Mixture too lean.	Adjust carburetor mixture ratio and check intake air leakage.
	Engine over run.	Drive at proper speeds.
Faulty connecting rod.	Shortage of engine oil.	Add oil.
	Low oil pressure.	Correct.
	Poor quality engine oil.	Use proper oil.
	Rough surface of crankshaft.	Repair crankshaft 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.

SPECIAL SERVICE TOOLS

Tool number	Tool name	Unit application	
		L28	P40
ST19320000	Oil filter wrench 	X	X
ST05340001	Engine attachment 	X	–
ST0501S000 ① ST05011000 ② ST05012000	Engine stand assembly Engine stand Base 	X	X
ST16540000	Puller crank pulley 	X	–
KV10105800 (ST17420001)	Chain stopper 	X	–
ST10120000	Cylinder head bolt wrench 	X	–
KV101041S0 ① ST16511000 ② ST16512001 ③ ST16701001	Crankshaft main bearing cap puller Crankshaft main bearing puller Adapter Adapter 	X	–
ST13030001	Piston pin press stand 	X	–

Tool number	Tool name	Unit application	
		L28	P40
ST12070000	Valve lifter 	X	X
KV101039S0 ① ST11081000 ② ST11032000 ③ ST11320000	Valve guide reamer set Reamer [12.2 mm (0.480 in) dia.] Reamer [8.0 mm (0.315 in) dia.] Drift 	X	–
HT56900870	Valve guide reamer 	–	X
ST11650001	Valve seat cutter set 	X	X
ST16610001	Pilot bushing puller 	X	–
KV10105500 (ST15310000)	Crankshaft rear oil seal drift 	X	–
EM03470000	Piston ring compressor 	X	X
ST10640001	Pivot adjuster 	X	–
KV30100100	Clutch aligning bar 	X	–
KV10106400	Engine attachment 	–	X

Tool number	Tool name	Unit application	
		L28	P40
KV10106500	Engine stand shaft 	–	X
ST13050000	Piston pin press stand 	–	X
KV10106700	Valve oil seal drift 	–	X
ST1130S000 ① ST11301000 ② ST11302000	Valve rocker bushing drift Drift Bushing support ring 	–	X
KV10106600	Valve guide drift 	–	X
ST16120000	Camshaft bearing drift 	–	X
ST16520000	Crankshaft main bearing cap puller 	–	X
ST16640000	Pilot bushing puller 	–	X
KV30100600	Clutch aligning bar 	–	X

ENGINE LUBRICATION & COOLING SYSTEMS

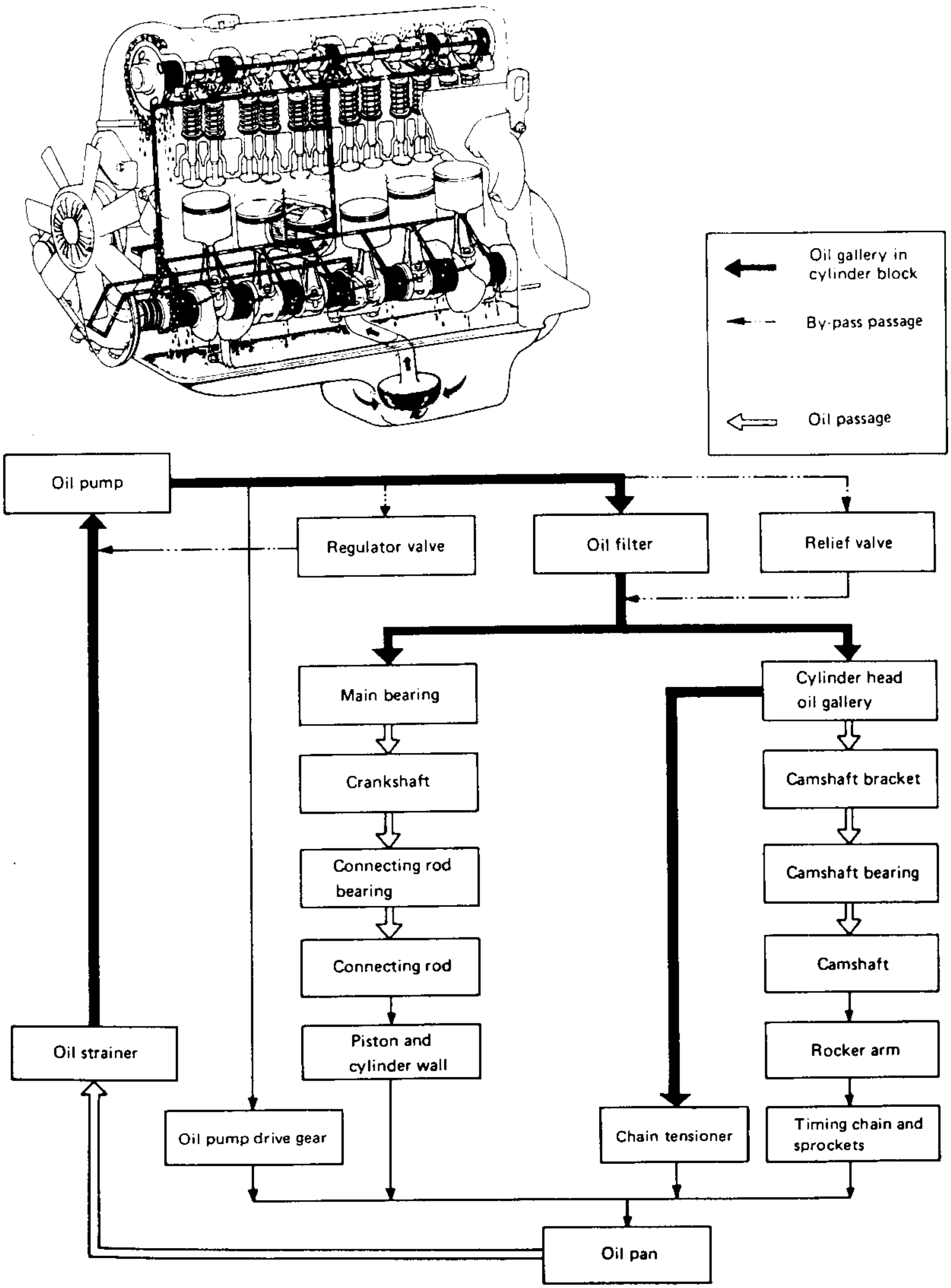
LC

CONTENTS

ENGINE LUBRICATION SYSTEM

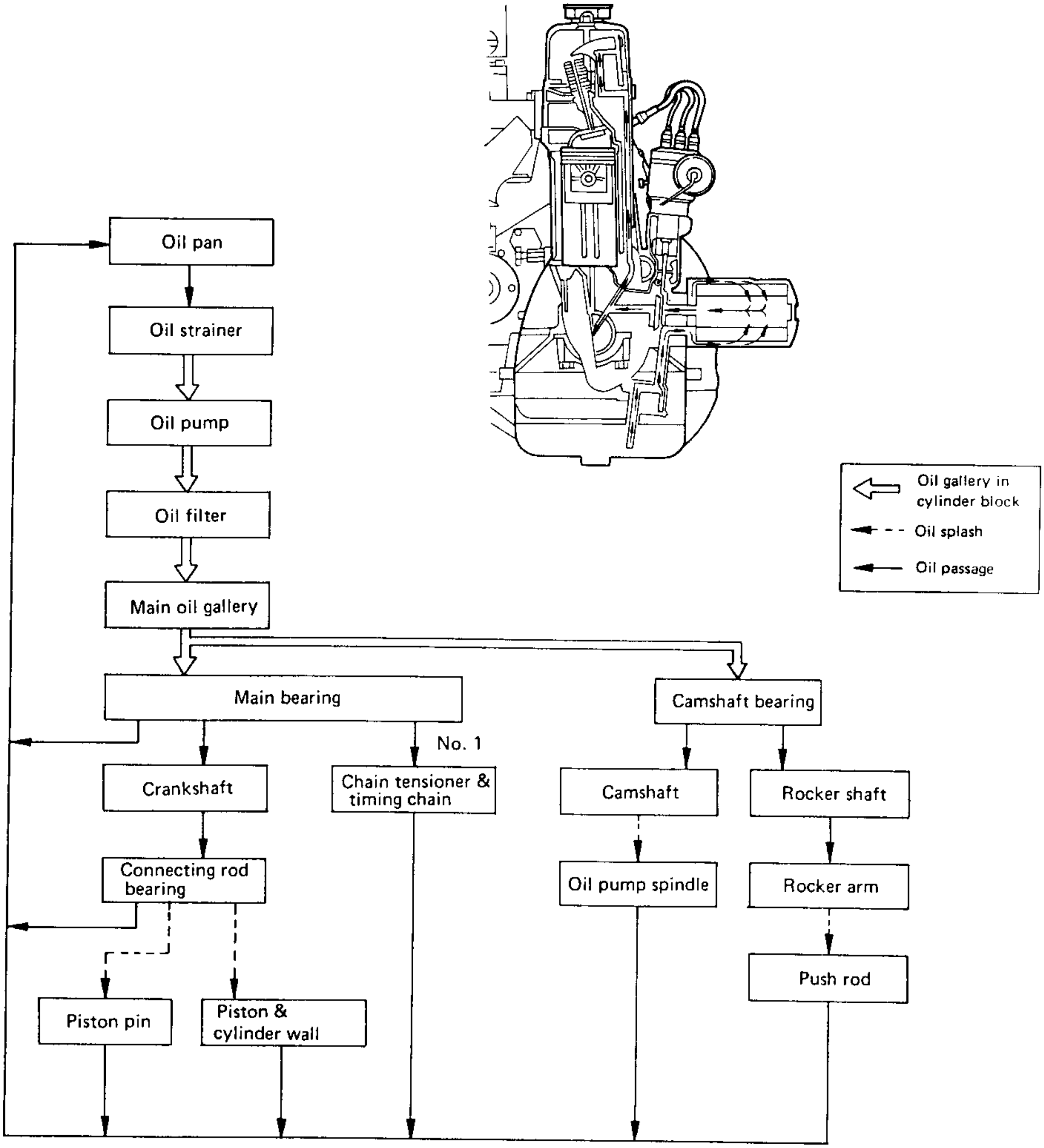
LUBRICATION CIRCUIT

L28 engine



SLC062

P40 engine

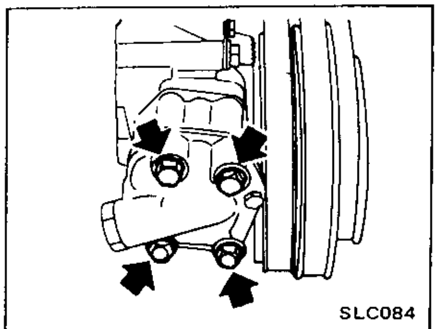


SLC132

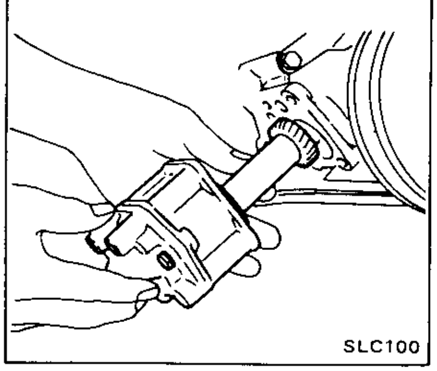
OIL PUMP

REMOVAL (L28 engine)

1. Remove oil pan drain plug, and allow oil to drain.
2. Remove distributor.
3. Remove oil pump and drive spindle as an assembly.



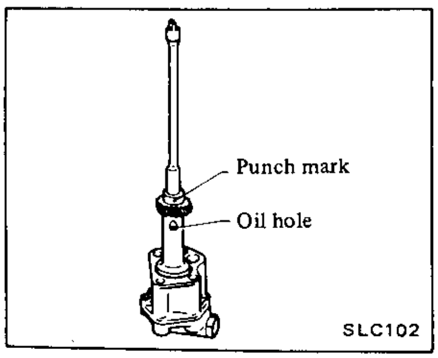
SLC084



SLC100

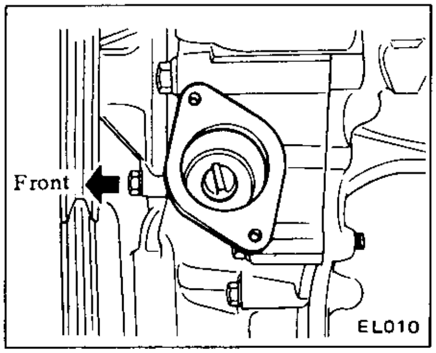
INSTALLATION (L28 engine)

1. Before installing oil pump in engine, turn crankshaft so that **No. 1 piston is at T.D.C. on its compression stroke.**
2. Fill pump housing with engine oil, then align punch mark of drive spindle with hole in oil pump.



SLC102

3. Using a new gasket, install oil pump and drive spindle assembly so that the projection on its top is located in an 11 : 25 position. At this time, the smaller bow-shape will be placed toward the front.



EL010

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

4. Install distributor.
   Make sure that tip of drive spindle assembly fits distributor fitting hole securely.
5. Refill engine with oil.

Oil capacity

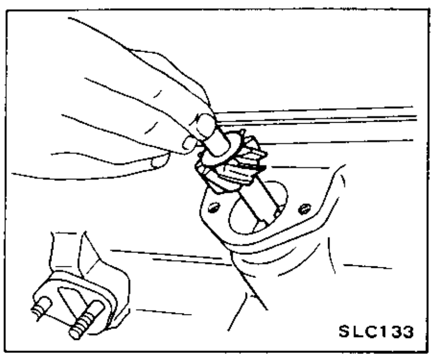
Unit: ℓ (Imp qt)

With oil filter	4.5 (4)
Without oil filter	4.0 (3-1/2)

6. Run engine for a few minutes, and check for leaks.

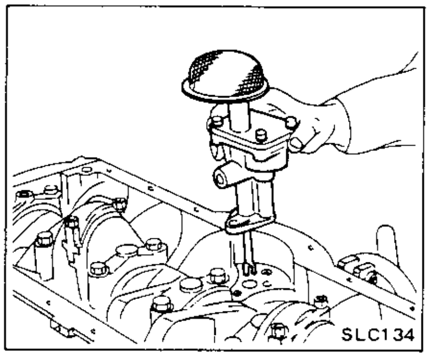
REMOVAL (P40 engine)

1. Remove oil pan drain plug, and allow oil to drain.
2. Remove distributor and oil pump spindle.



SLC133

3. Remove oil pan.
4. Remove oil pump body.



SLC134

INSTALLATION (P40 engine)

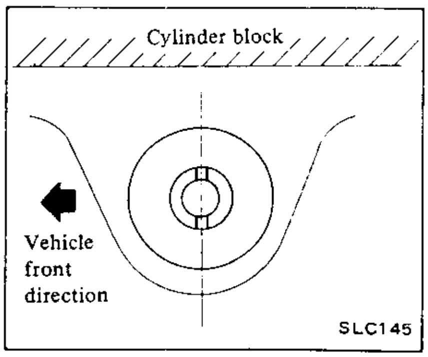
1. Before installing oil pump in engine, turn crankshaft so that **No. 1 piston is at T.D.C. on its compression stroke.**
2. Install oil pump on cylinder block.

Ⓣ : **Oil pump mounting bolts**
25 - 34 N·m
(2.5 - 3.5 kg-m,
18 - 25 ft-lb)

3. Install oil pan.

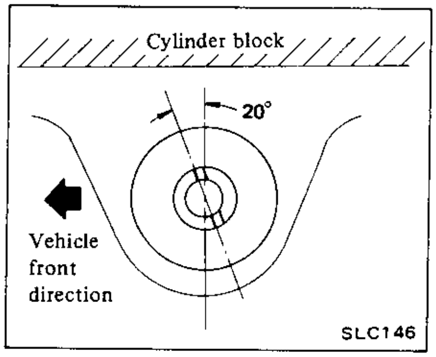
Ⓣ : **Oil pan bolt**
15 - 20 N·m
(1.5 - 2.0 kg-m,
11 - 14 ft-lb)

4. Rotate oil pump shaft with a conventional screwdriver as shown.

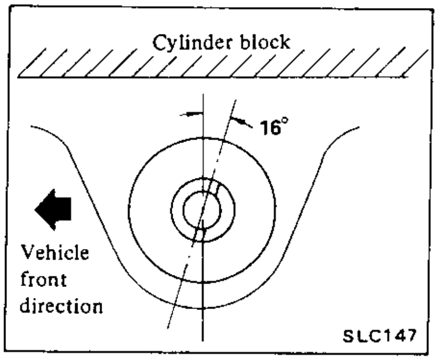


SLC145

5. Install oil pump spindle as follows:
(1) Set oil pump spindle as shown.



(2) Insert and turn oil pump spindle clockwise.
(3) Confirm that slit on oil pump spindle deflects as shown.



6. Insert distributor, meshing distributor drive slit and driven slit.
7. Refill engine with oil.

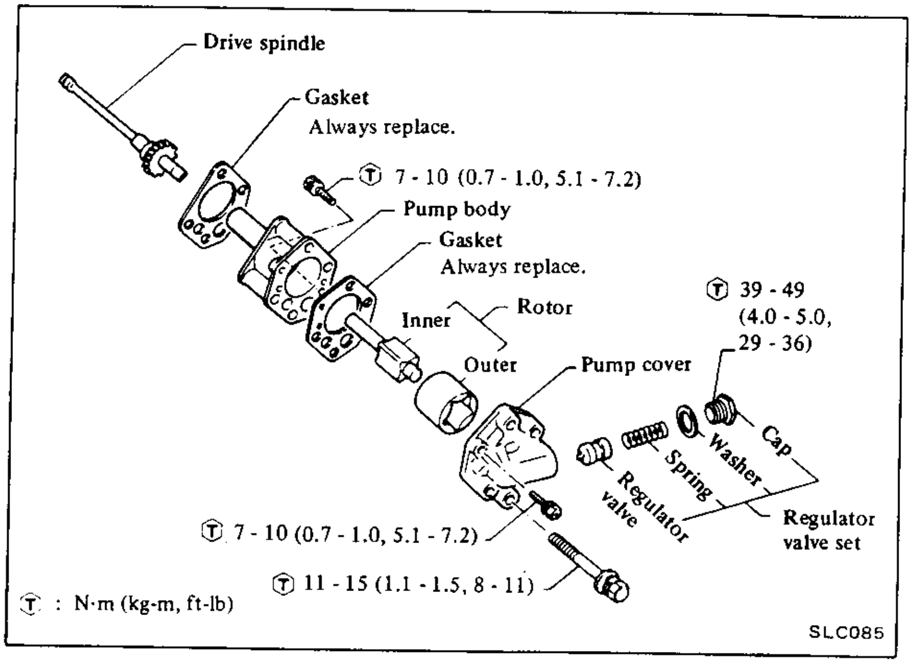
Oil capacity

Unit: ℓ (Imp qt)

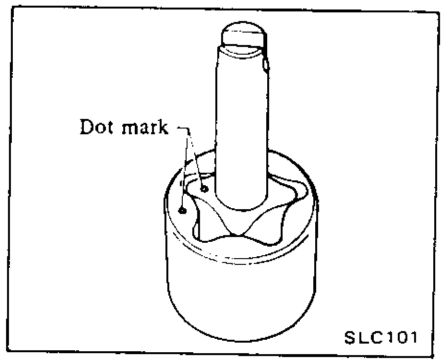
With oil filter	5.5 (4-7/8)
Without oil filter	4.8 (4-1/4)

DISASSEMBLY AND ASSEMBLY

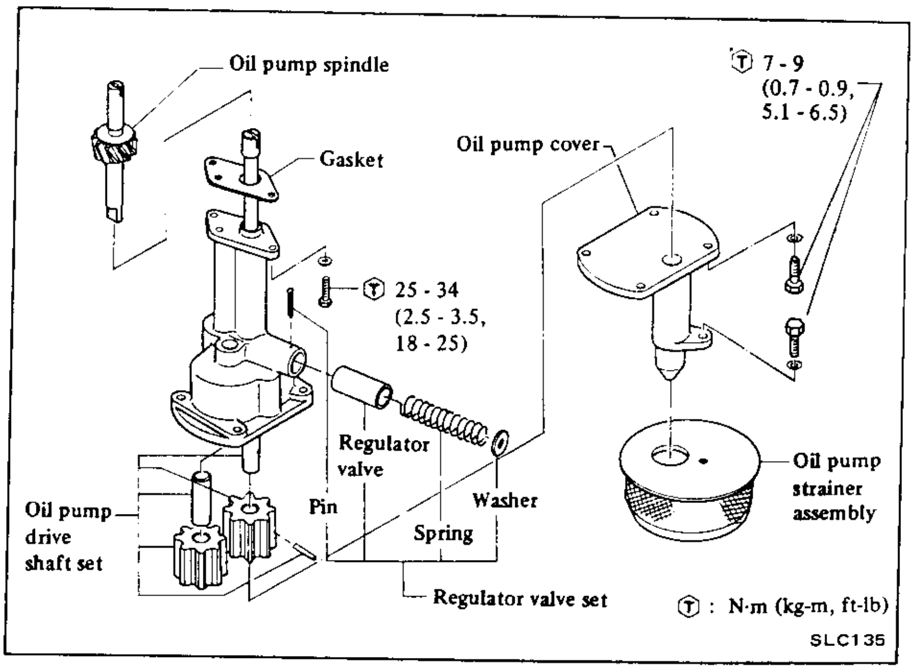
L28 engine



a. The dot on outer and inner rotor should face toward oil pump body.
b. Always replace with a new gasket.



P40 engine



INSPECTION

L28 engine

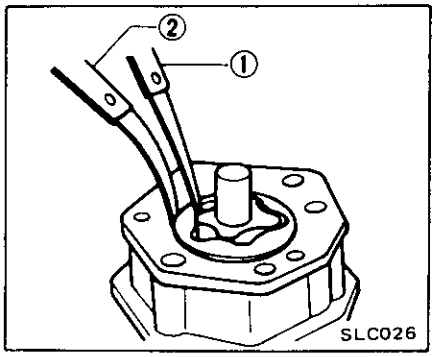
1. Inspect the following for wear or damage.
- Pump body and cover
- Pump rotors
- Drive spindle

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.

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

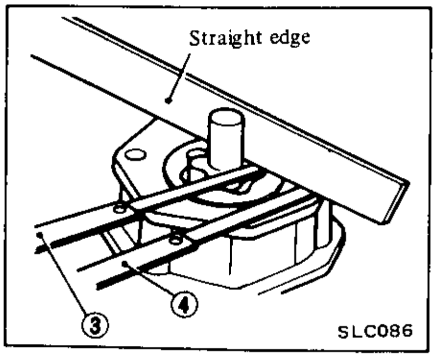
If it exceeds the limit, replace rotor set or entire oil pump assembly.

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



SLC026

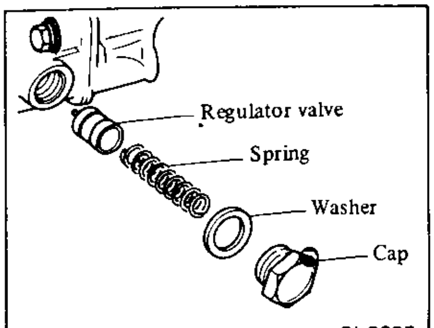
Rotor to straight edge ③:
Less than 0.06 mm (0.0024 in)
Oil pump body to straight edge ④:
Less than 0.03 mm (0.0012 in)



SLC086

3. Check oil pressure regulator valve sliding surface and valve spring.

If damaged, replace valve set or pump assembly.



SLC087

P40 engine

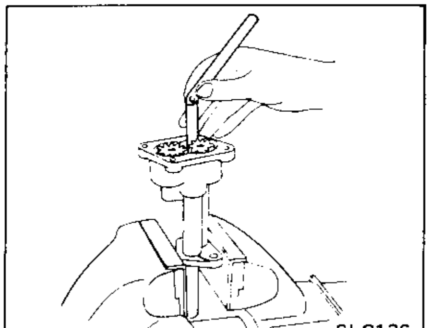
1. Inspect the following for wear or damage.
- Pump body and cover
- Pump gears
- Drive spindle

Pump gears and body are not serviced separately. If pump gears or body are damaged or worn, replace drive shaft set or entire oil pump assembly.

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

If it exceeds the limit, replace drive shaft set or entire oil pump assembly.

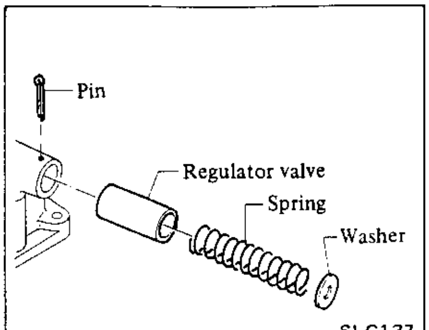
Pump gear to pump body:
Less than 0.26 mm (0.0102 in)


SLC136

Pump gear backlash
Less than 0.51 mm (0.0201 in)
Pump gear vertical clearance
Less than 0.115 mm (0.0045 in)

3. Check oil pressure regulator valve sliding surface and valve spring.

If damaged, replace valve set or pump assembly.

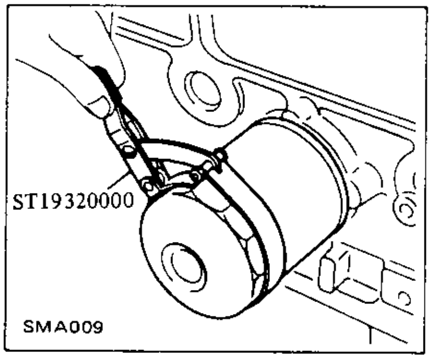


SLC137

OIL FILTER

REPLACEMENT

1. Remove oil pan drain plug, and allow oil to drain.
2. Using **Tool**, remove oil filter.

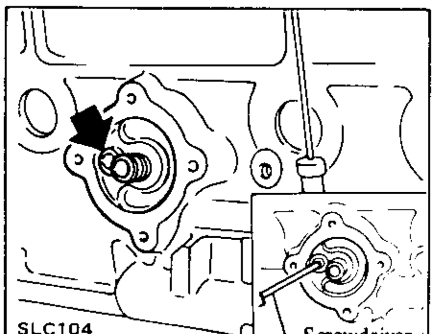


SMA009

3. Wipe oil filter mounting surface with clean rag.
4. Check oil pressure relief valve for cracks or breaks.

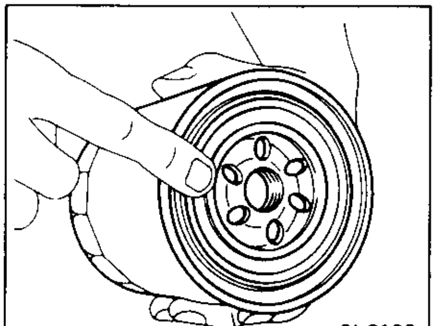
If necessary, remove valve by prying it out with a screwdriver.

Install a new valve by tapping it in place.



SLC104

5. Smear a little engine oil on rubber gasket of oil filter.


SLC103

6. Install oil filter.

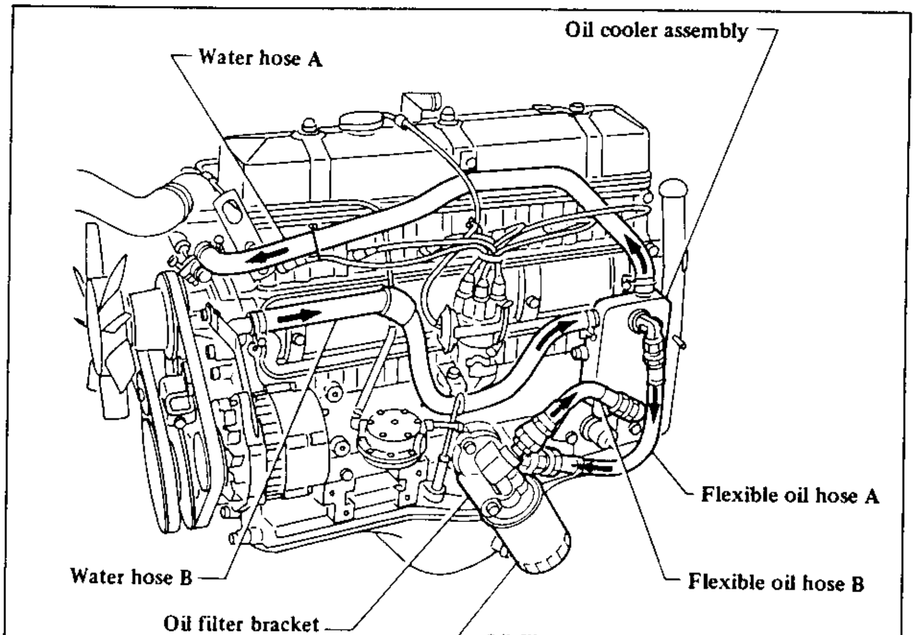
Hand-tighten ONLY.
DO NOT use a wrench to tighten the filter.

7. Refill engine with oil.

Oil capacity:
L28 engine
4.5 liters (4 Imp qt)
P40 engine
5.5 liters (4-7/8 Imp qt)

8. Run engine for a few minutes, and check for leaks.

OIL COOLER UNIT (Equipped on P40 engine for Middle East area)



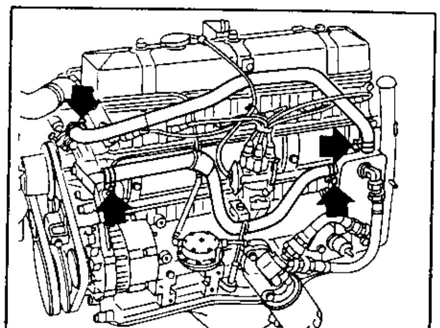
SLC228

REMOVAL

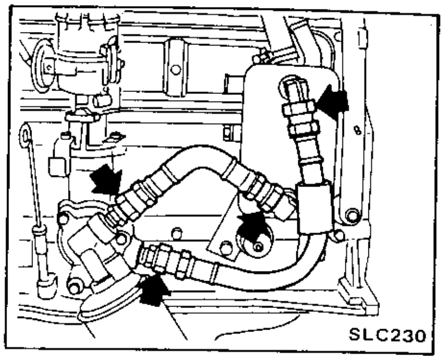
1. Remove oil pan drain plug and allow oil to drain.
2. Remove radiator cap.
3. Open radiator drain cock and allow coolant to drain into a suitable container.

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

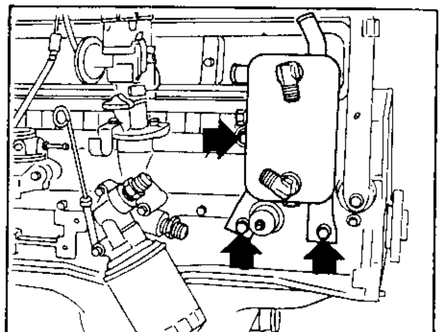
4. Disconnect water hoses A and B.


SLC229

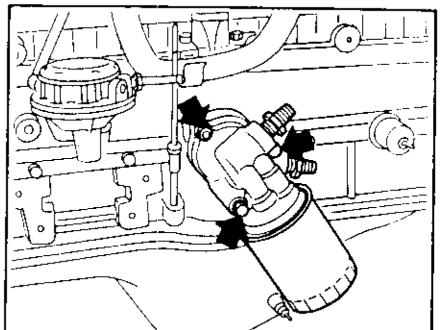
5. Disconnect flexible oil hoses A and B.


SLC230

6. Remove oil cooler assembly.

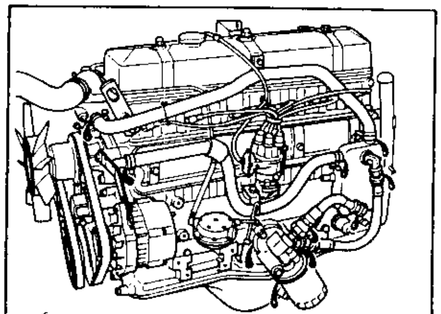

SLC231

7. Remove oil filter bracket with oil filter.

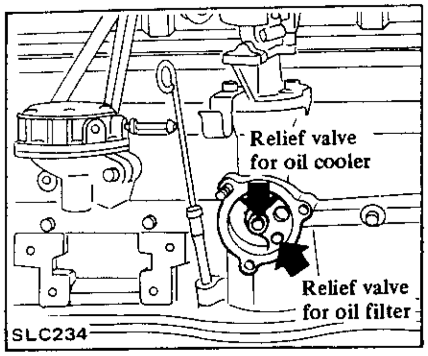

SLC232

INSPECTION

- Check oil cooler system for leaks.


mark: Check points SLC233

- Check oil pressure relief valves for cracks or breaks.



If necessary, remove valve by prying it out with a screwdriver.

Install a new valve by tapping it in place.

INSTALLATION

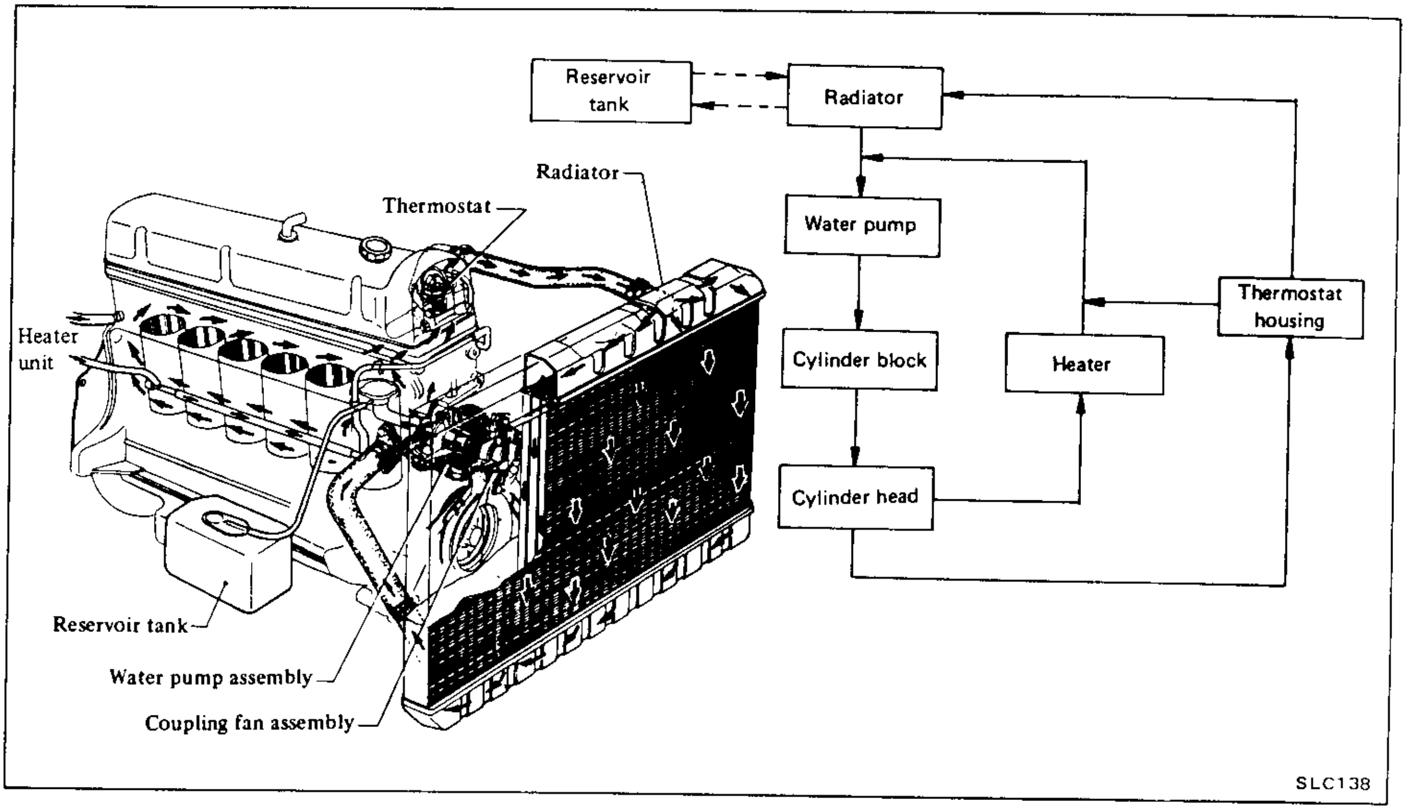
Install oil cooler unit in reverse order of removal.

Ⓣ: Flexible oil hose A and B
59 - 78 N·m
(6 - 8 kg-m,
43 - 58 ft-lb)
Oil cooler assembly to cylinder body
29 - 39 N·m
(3 - 4 kg-m,
22 - 29 ft-lb)
Oil filter bracket to cylinder body
16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)

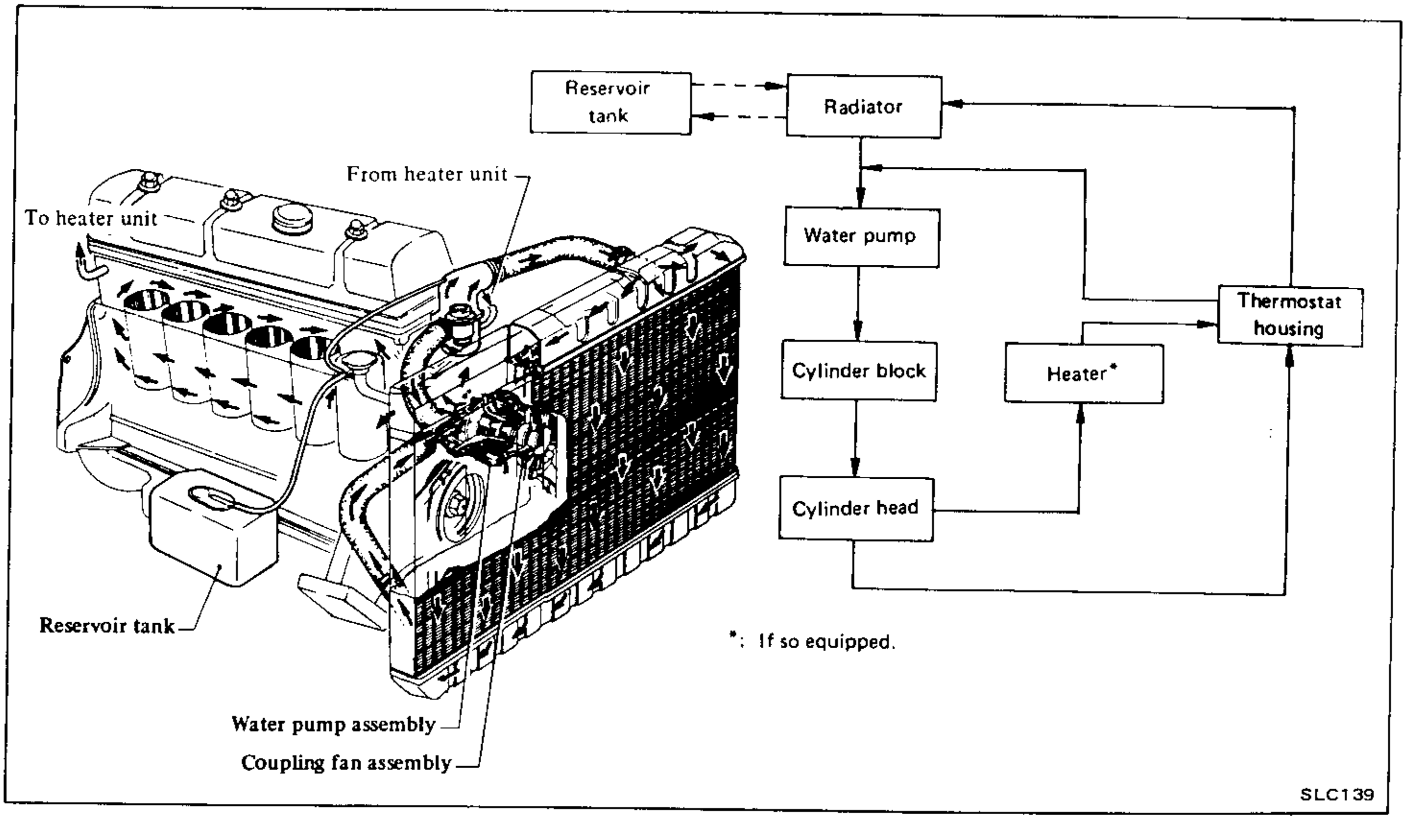
ENGINE COOLING SYSTEM

COOLING CIRCUIT

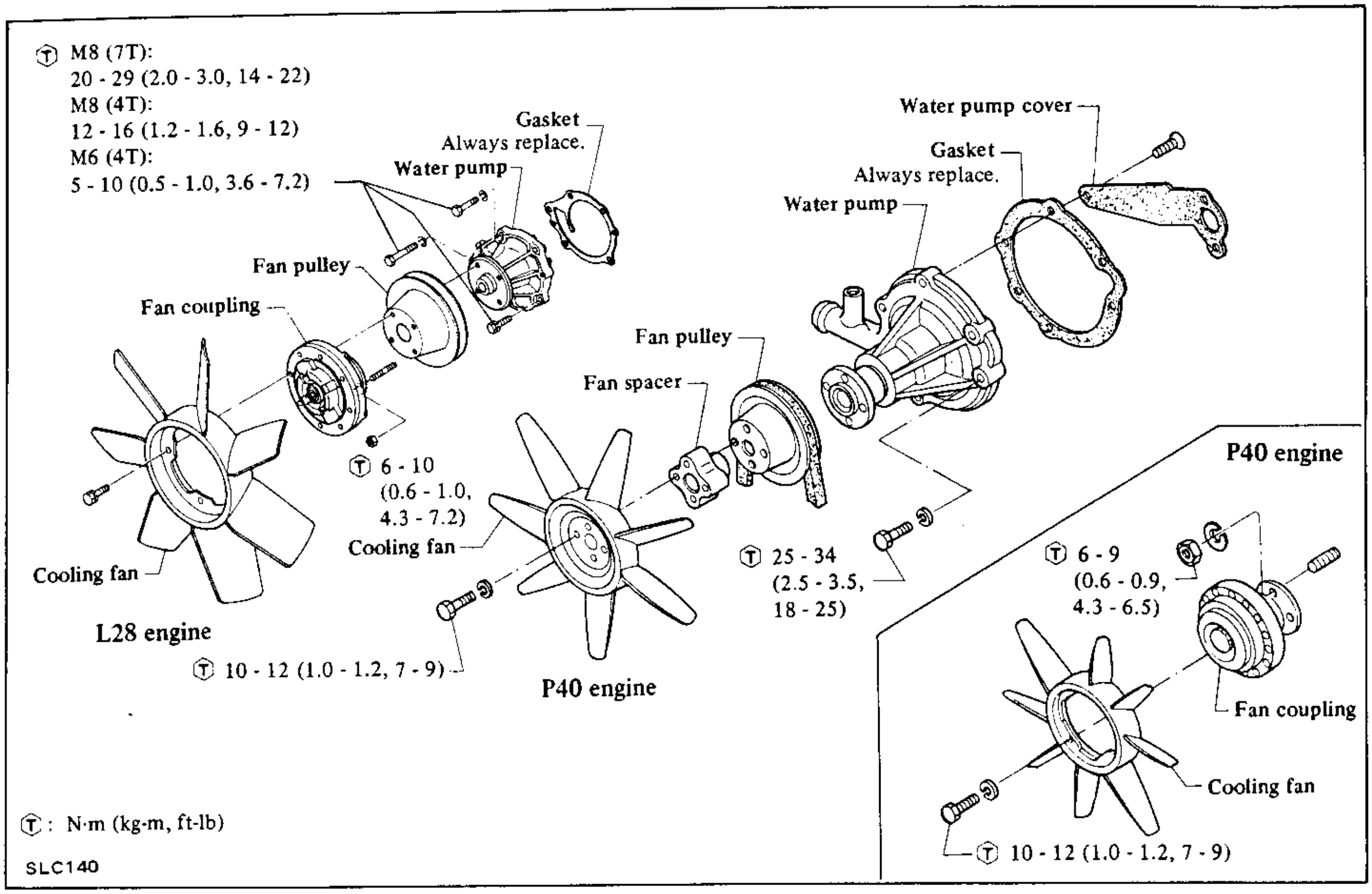
L28 engine



P40 engine



WATER PUMP

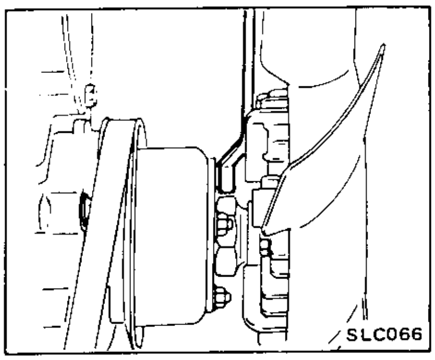


REMOVAL

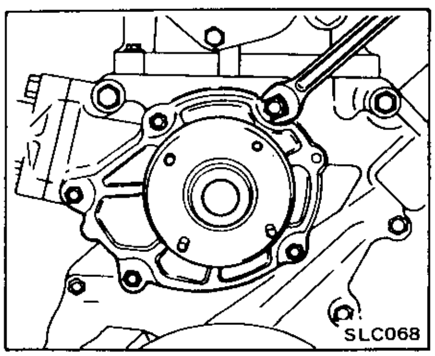
1. Open radiator drain cock and allow coolant to drain into a suitable container.

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

2. Remove radiator shroud.
3. Loosen fan belt.
(1) Loosen alternator securing bolts.
(2) Move the alternator toward the engine.
4. Remove fan, fan coupling and fan pulley.



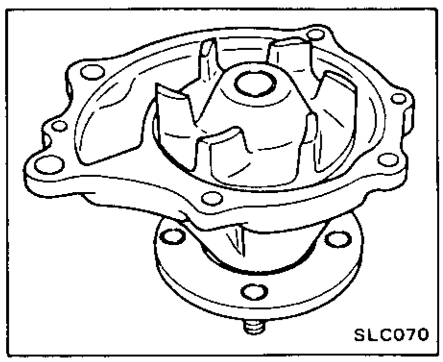
5. Remove water pump with gasket.



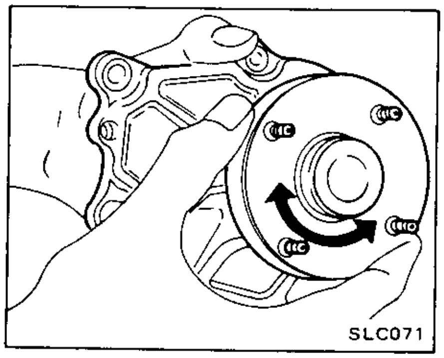
INSPECTION

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

1. Inspect water pump body and vane for rust or corrosion.

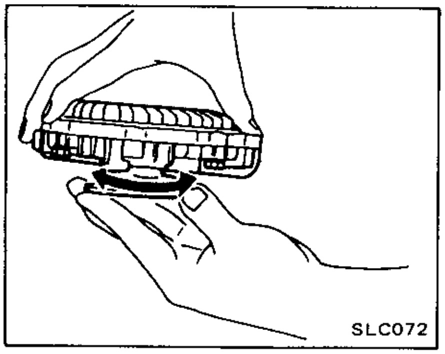


2. Check water pump bearing for excessive and play or rough operation.



SLC071

3. Check the fan coupling for oil leakage or bent bimetal.



SLC072

INSTALLATION

1. Install water pump in the reverse order of removal.

Always use new gasket.

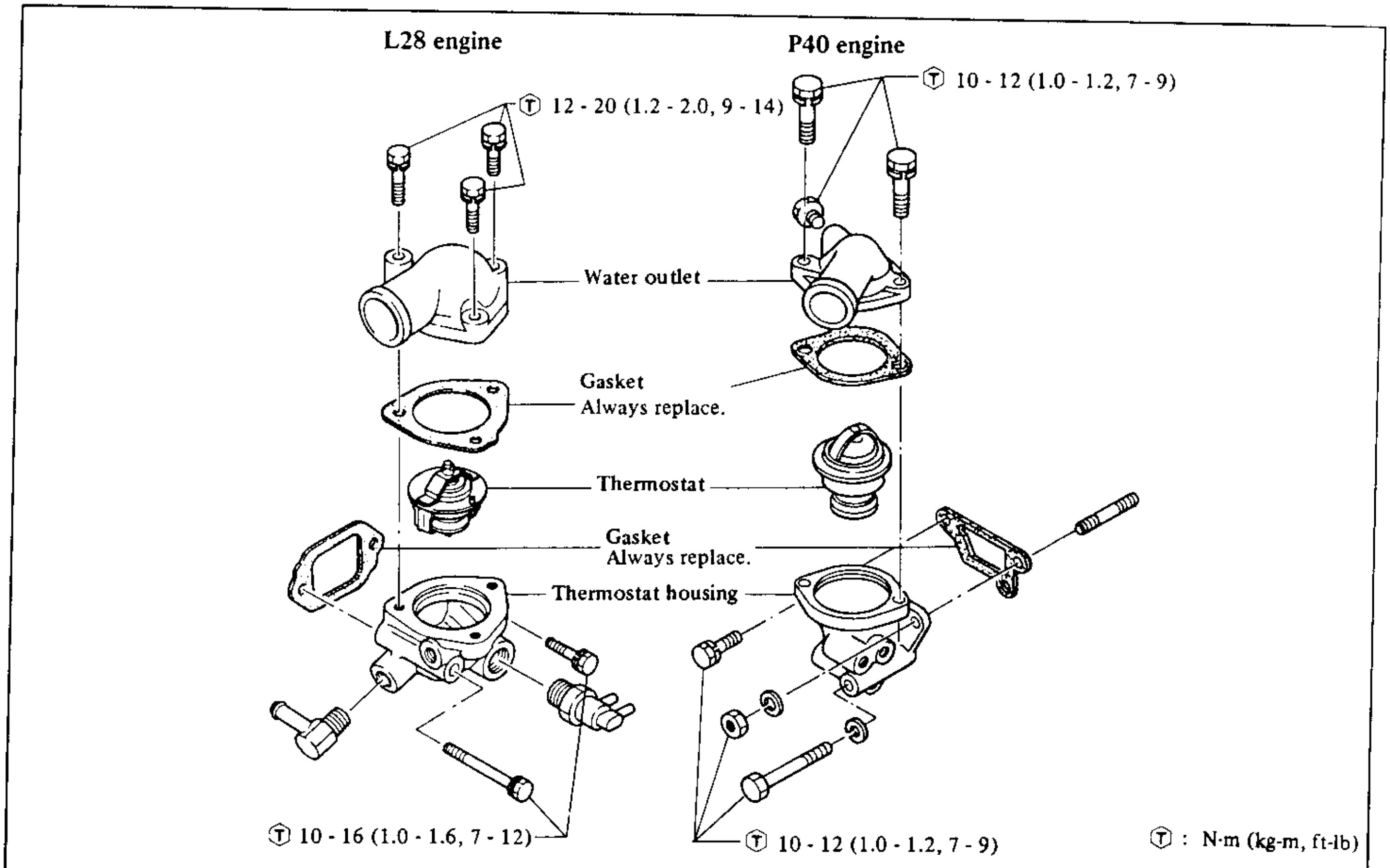
2. Adjust fan belt tension.

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

3. Fill radiator with coolant.
For details, **refer to Changing Engine Coolant in Section MA.**

Coolant capacity with reservoir tank:
L28 engine
10.8 liters (9-1/2 Imp qt)
P40 engine (Except Canvas Top)
14.8 liters (13 Imp qt)
P40 engine (Canvas Top)
19.0 liters (16-3/4 Imp qt)

THERMOSTAT



SLC141

REMOVAL

1. Drain a small amount of coolant partially and disconnect radiator upper hose at water outlet.

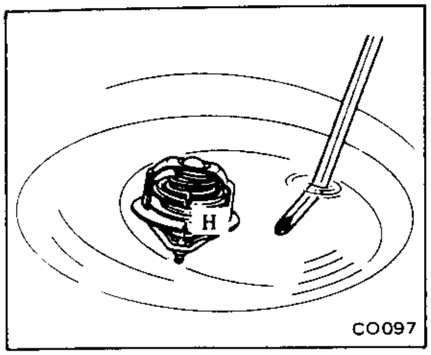
WARNING:
To avoid the danger of being scalded, never attempt to drain the coolant when the engine is hot.

2. Remove water outlet and then remove thermostat.

INSPECTION

Inspect thermostat for the following and replace if necessary.

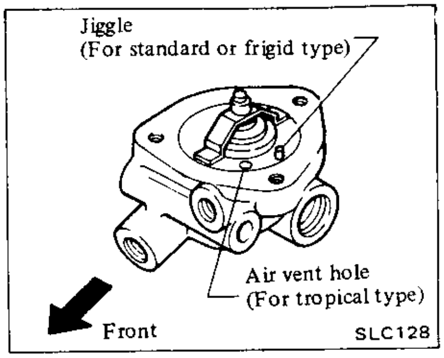
1. Valve seating condition at ordinary temperature. It should seat tightly.
2. Valve opening temperature and maximum valve lift **(Refer to S.D.S.)**.



C0097

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.



SLC128

INSTALLATION

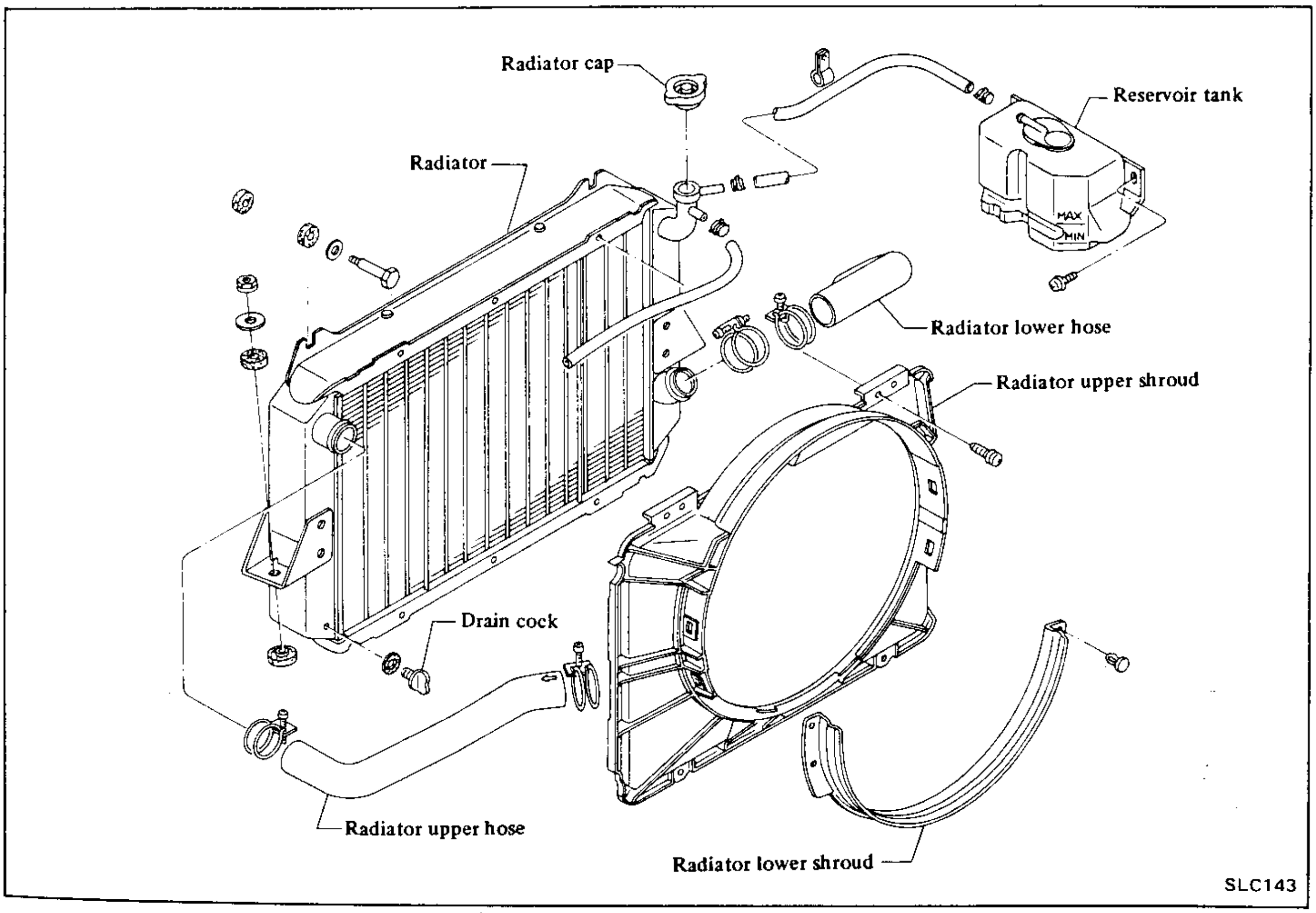
1. Position thermostat on thermostat housing.

When installing thermostat on models equipped with L28 engine, be sure it is positioned in the proper direction.

2. Install water outlet with new gasket.
3. Connect radiator upper hose and fill radiator with coolant.
4. Run engine for a few minutes, and check for leaks.

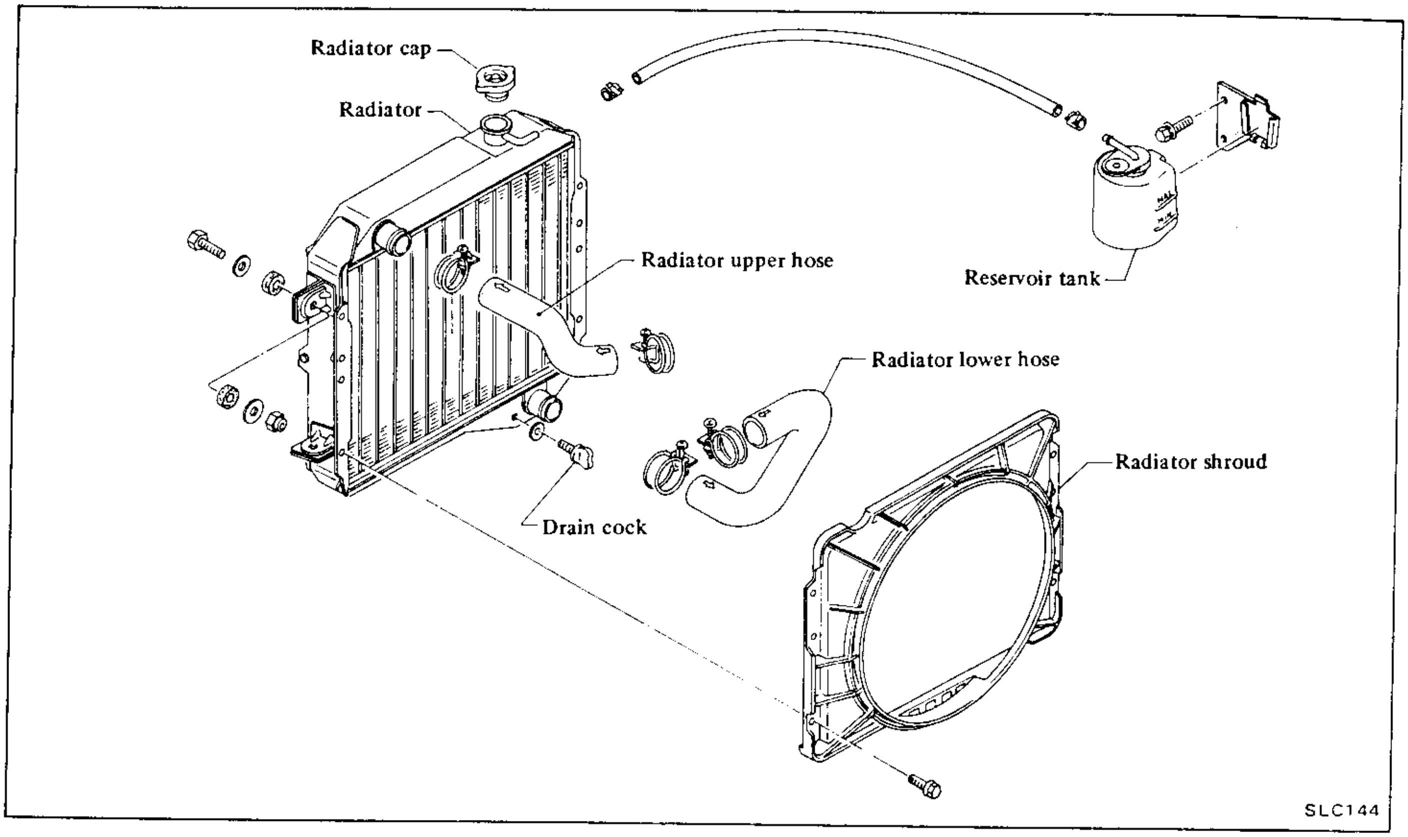
RADIATOR

Except Canvas Top



SLC143

Canvas Top

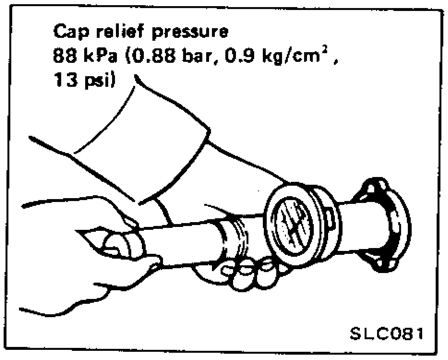


INSPECTION

Checking radiator cap

Using cap tester, check the radiator cap relief pressure.

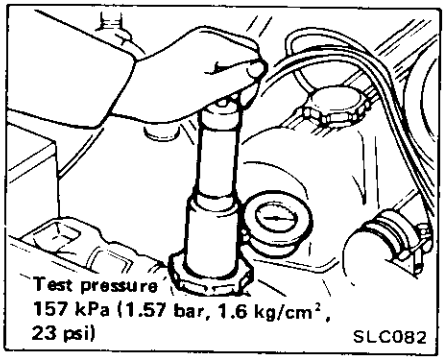
If the pressure gauge drops rapidly and excessively, replace the radiator cap.



Checking cooling system for leaks

Attach pressure tester, pump tester to the specified pressure.

Check for drop in pressure



If the pressure drops, check for leaks from hoses, radiator, or water pump.

If no external leaks are found, check heater core, block and head.

REMOVAL AND INSTALLATION

1. Open radiator drain cock and allow to drain coolant into a suitable container.

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

2. Remove radiator shroud attaching screws and place radiator shroud close to engine.
(Radiator shroud can be removed after removing radiator.)
3. Disconnect radiator upper and lower hoses, and reservoir tank hose.
4. On a vehicle with automatic transmission, disconnect cooler inlet and outlet lines from radiator.
5. Remove radiator.
6. Installation is in reverse order of removal.
7. Fill radiator with coolant.

Coolant capacity with reservoir tank:
L28 engine
10.8 liters (9-1/2 Imp qt)
P40 engine (Except Canvas Top)
14.8 liters (13 Imp qt)
P40 engine (Canvas Top)
19.0 liters (16-3/4 Imp qt)

8. Run engine for a few minutes, and check for leaks.

Refer to Changing Engine Coolant in Section MA.

SERVICE DATA AND SPECIFICATIONS

ENGINE LUBRICATION SYSTEM

GENERAL SPECIFICATIONS

Engine model	L28	P40
Lubrication method	Pressed feed flow	
Oil pump type	Trochoid type	Spur gear type
Oil filter type	Full flow and cartridge type	
Oil capacity With oil filter	4.5 ℓ (4 Imp qt)	5.5 ℓ (4-7/8 Imp qt)
Without oil filter	4.0 ℓ (3-1/2 Imp qt)	4.8 ℓ (4-1/4 Imp qt)

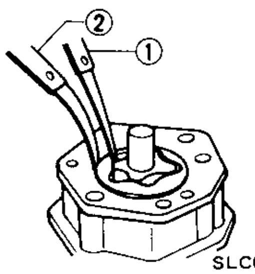
INSPECTION AND ADJUSTMENT

Oil pump

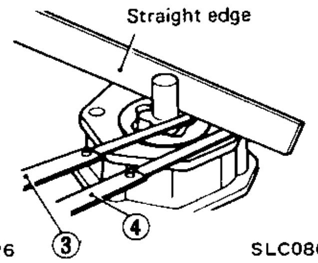
L28 engine

Unit: mm (in)

Rotor tip clearance ①	Less than 0.20 (0.0079)
Outer rotor to body clearance ②	Less than 0.50 (0.0197)
Rotor to straight edge ③	Less than 0.06 (0.0024)
Oil pump body to straight edge ④	Less than 0.03 (0.0012)



SLC026

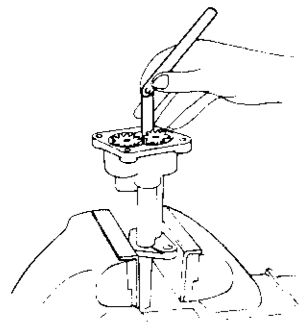


SLC086

P40 engine

Unit: mm (in)

Pump gear to pump body clearance	Less than 0.26 (0.0102)
Pump gear backlash	Less than 0.51 (0.0201)
Pump gear vertical clearance	Less than 0.115 (0.0045)



SLC136

TIGHTENING TORQUE

Engine model	L28			P40		
Unit	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
Oil pump mounting bolts	11 - 15	1.1 - 1.5	8 - 11	25 - 34	2.5 - 3.5	18 - 25
Oil pump cover bolt	7 - 10	0.7 - 1.0	5.1 - 7.2	7 - 9	0.7 - 0.9	5.1 - 6.5
Regulator valve cap	39 - 49	4.0 - 5.0	29 - 36	–	–	–
Oil pan drain plug	20 - 29	2.0 - 3.0	14 - 22	20 - 39	2.0 - 4.0	14 - 29
Oil pan bolt				15 - 20	1.5 - 2.0	11 - 14
Flexible oil hose				59 - 78	6 - 8	43 - 58
Oil cooler assembly to cylinder bracket				29 - 39	3 - 4	22 - 29
Oil filter bracket to cylinder bracket				16 - 21	1.6 - 2.1	12 - 15

ENGINE COOLING SYSTEM

GENERAL SPECIFICATIONS

Engine model	L28	P40
Cooling method	Water cooling, forced circulation	
Water pump type	Centrifugal	
Thermostat type	Wax-pellet	
Radiator type	Corrugated fin and tube	
Cooling fan Fan dia. x No. of blades mm (in)	430 (16.93) x 8 450 (17.72) x 8 *1	430 (16.93) x 7 450 (17.72) x 8 *1
Fan coupling method	Temperature coupling	
Coolant capacity with reservoir tank	10.8 ℓ (9-1/2 Imp qt)	14.8 ℓ (13 Imp qt) 19.0 ℓ (16-3/4 Imp qt) *2

*1: Optional
*2: Canvas Top

INSPECTION AND ADJUSTMENT

Water pump

Fan belt deflection [Applied force 98 N (10 kg, 22 lb)] mm (in)	8 - 12 (0.31 - 0.47)

Thermostat

		Standard type	Frigid type	Tropical type
Valve opening temperature °C (°F)		82 (180)	88 (190)	76.5 (170)
Max. valve lift mm/°C (in/°F)	L28 engine	8/95 (0.31/203)	8/100 (0.31/212)	8/90 (0.31/194)
	P40 engine	10/95 (0.39/203)	10/100 (0.39/212)	10/90 (0.39/194)

Radiator

Unit: kPa (bar, kg/cm², psi)

Cap relief pressure	88 (0.88, 0.9, 13)
Leakage test pressure	157 (1.57, 1.6, 23)

TIGHTENING TORQUE

L28 engine

Unit		N·m	kg-m	ft-lb
Water pump bolt	M8 (7T)	20 - 29	2.0 - 3.0	14 - 22
	M8 (4T)	12 - 16	1.2 - 1.6	9 - 12
	M6 (4T)	5 - 10	0.5 - 1.0	3.6 - 7.2
Water pump pulley stud		6 - 10	0.6 - 1.0	4.3 - 7.2
Thermostat housing		10 - 16	1.0 - 1.6	7 - 12
Water outlet bolt		12 - 20	1.2 - 2.0	9 - 14

P40 engine

Unit	N·m	kg-m	ft-lb
Water pump bolt and nut	25 - 34	2.5 - 3.5	18 - 25
Water pump pulley stud	6 - 9	0.6 - 0.9	4.3 - 6.5
Fan pulley bolt	10 - 12	1.0 - 1.2	7 - 9
Thermostat housing	10 - 12	1.0 - 1.2	7 - 9
Water outlet bolt	10 - 12	1.0 - 1.2	7 - 9

TROUBLE DIAGNOSES AND CORRECTIONS

ENGINE LUBRICATION SYSTEM

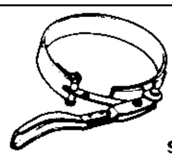
Condition	Probable cause	Corrective action
Oil leakage	Damaged or cracked pump body cover.	Replace.
	Oil leakage from gasket and oil seal.	Replace.
	Oil leakage from regulator valve.	Tighten or replace.
	Oil leakage from blind plug.	Replace.
Decreased oil pressure	Lack of oil in engine oil pan.	Correct.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

ENGINE 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.
	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.	Replace cylinder head gasket.

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 impurity 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 antifreeze (Ethylene glycol base) can be used throughout the seasons of a year.
Overheating	Malfunctioning thermostat, radiator cap and fan 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.
	Impurity in water.	Use soft, clean water.
Overcooling	Malfunctioning thermostat.	Replace.
	Inaccurate temperature gauge.	Replace.
Noise	Squeak at water pump mechanical seal.	Replace pump assembly.
	Damaged or worn water pump bearing.	Replace pump assembly.

SPECIAL SERVICE TOOL

Tool number	Tool name
ST19320000	Oil filter wrench  SLC036

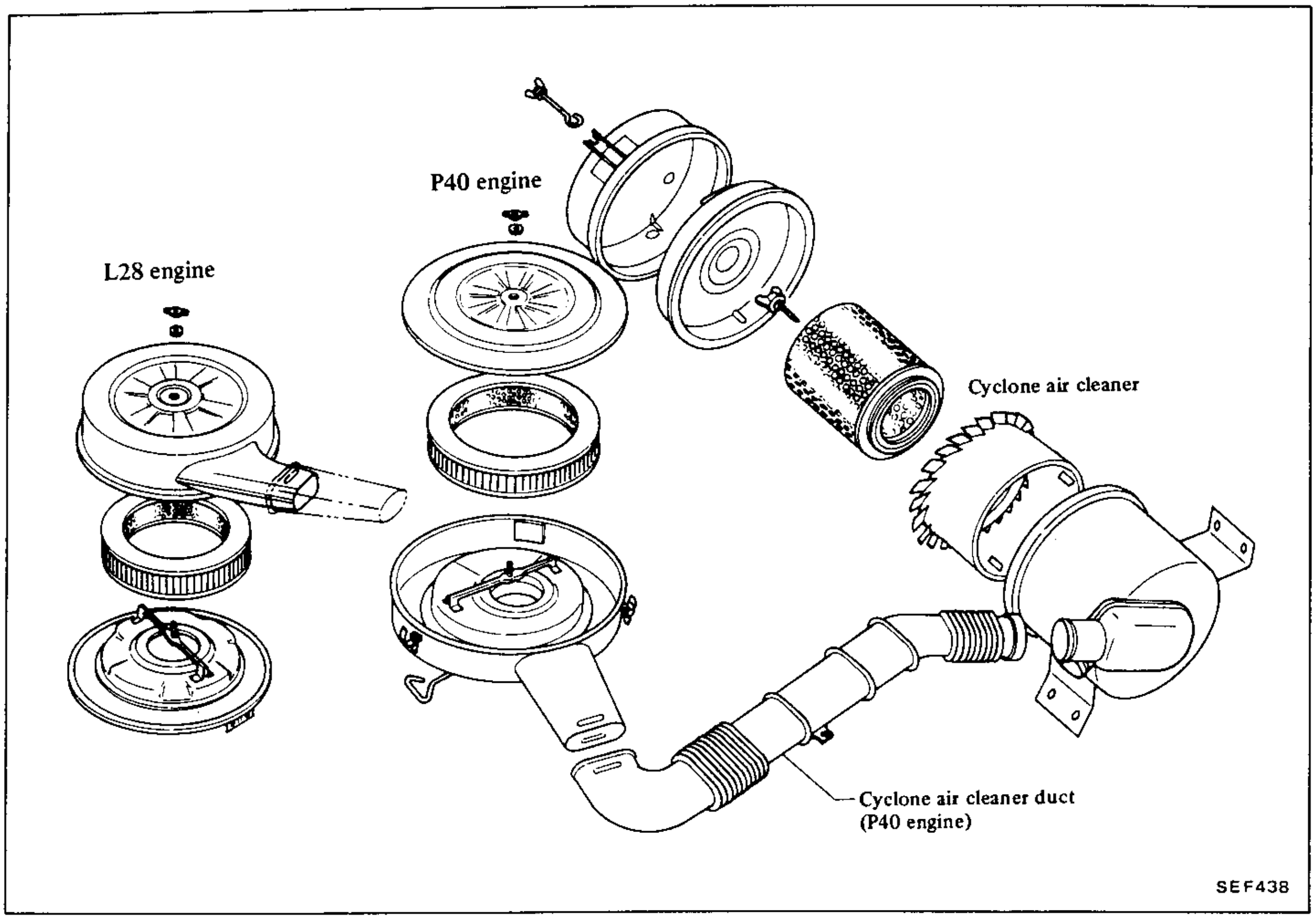
ENGINE FUEL

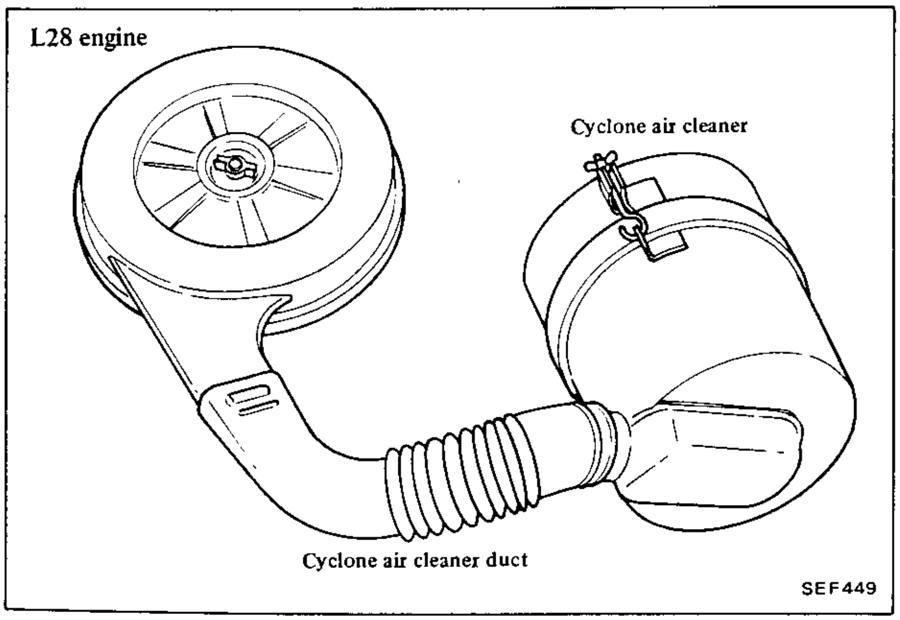
SECTION EF

EF

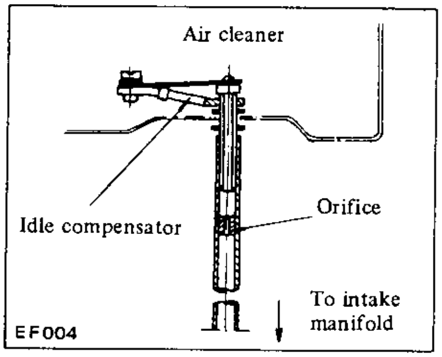
CONTENTS

AIR CLEANER


P40 engine
L28 engine
Cyclone air cleaner
Cyclone air cleaner duct
(P40 engine)
SEF438


L28 engine
Cyclone air cleaner
Cyclone air cleaner duct
SEF449

IDLE COMPENSATOR



EF004

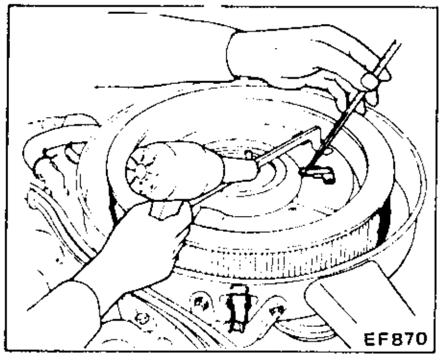
Intake air temperature	Bimetal function
Below 60°C (140°F)	Fully closed
60 to 70°C (140 to 158°F)	Closed or open
Above 70°C (158°F)	Fully open

When idle compensator is opened, "hissing" sound is heard.

INSPECTION

1. Warm up engine completely.
2. Open engine hood and remove air cleaner cover.
3. Direct warm air to idle compensator with a heat gun.

   And measure operating temperature of idle compensator.

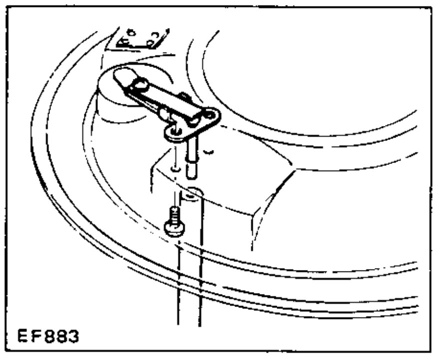

EF870

a. Engine operation is not stabilized due to warm air flow before idle compensator reaches 60 to 70°C (140 to 158°F).
As idle compensator reaches its operating temperature, secondary air is introduced into intake manifold and engine operation becomes stabilized.
b. Locate stick temperature gauge as close to sensor as possible so that warm air from dryer is directed to these parts evenly.

REMOVAL AND INSTALLATION

1. Remove air cleaner.
2. Disconnect hose from idle compensator.
3. Remove two setscrews from back of air cleaner lower cover.

   Idle compensator can then be taken out easily.

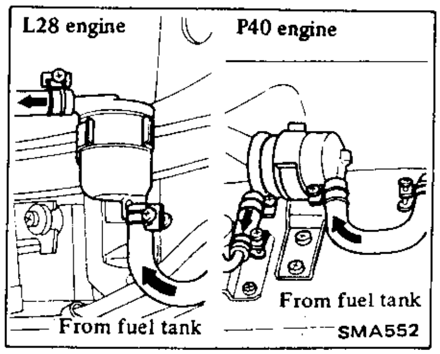

EF883

4. To install, reverse the removal procedure.

FUEL FILTER

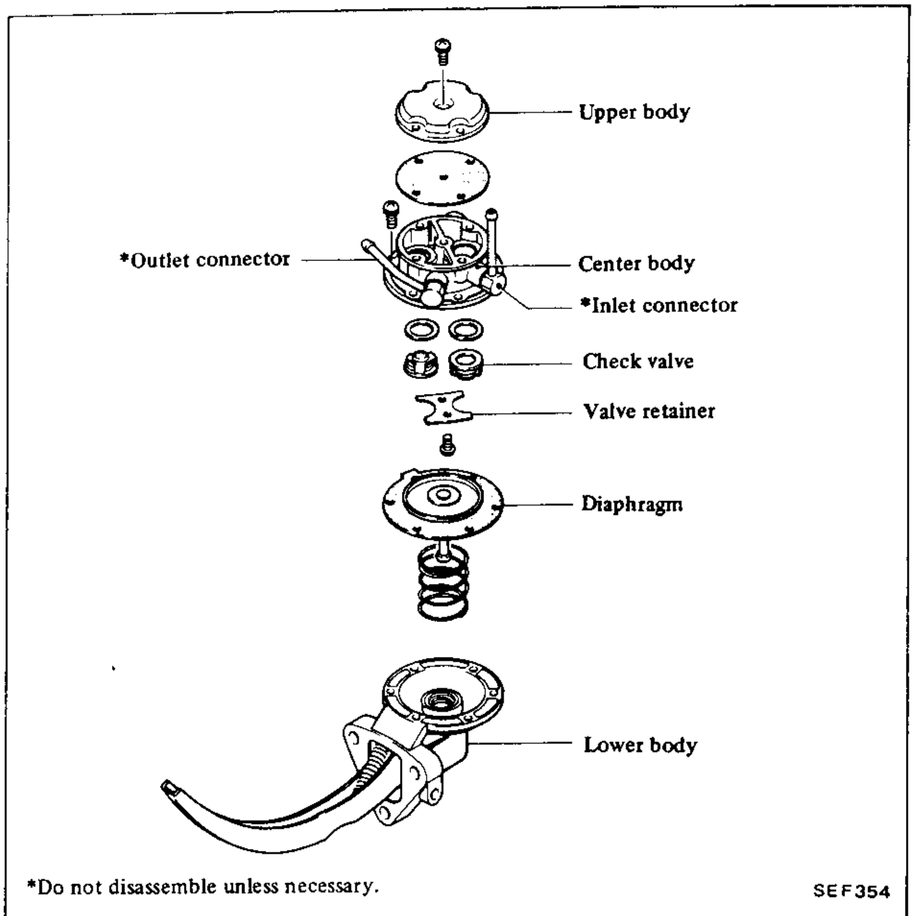
The fuel filter is a cartridge type, and should be replaced periodically as an assembly.

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



SMA552

MECHANICAL FUEL PUMP



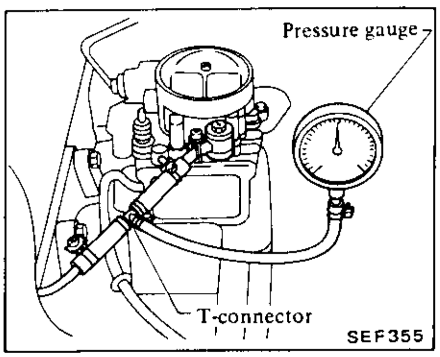
OPERATING TEST

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

STATIC PRESSURE TEST

1. Connect a T-connector and a suitable pressure gauge.
2. Check static fuel pressure with engine running at various speeds.

Fuel pump static pressure:
L28
22.7 - 29.3 kPa
(227 - 293 mbar,
170 - 220 mmHg,
6.69 - 8.66 inHg)
P40
160 Series
21.2 - 28.0 kPa
(212 - 280 mbar,
159 - 210 mmHg,
6.26 - 8.27 inHg)
61 Series
16.7 - 23.6 kPa
(167 - 236 mbar,
125 - 177 mmHg,
4.92 - 6.97 inHg)



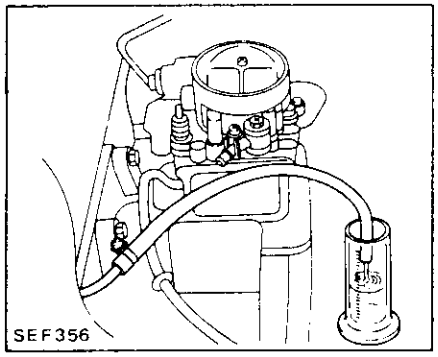
If out of specification, replace fuel pump.

CAPACITY TEST

The capacity test is conducted only when static pressure is within the specification.

1. Install a suitable container.
2. Check fuel pump capacity with engine running at 1,000 rpm.

Fuel pump capacity:
L28
1,300 mℓ
(45.8 Imp. fl oz)/min.
P40
2,500 mℓ
(88.0 Imp. fl oz)/min.
Canvas Top
2,400 mℓ (84.5 Imp. fl oz)/min.



If 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.

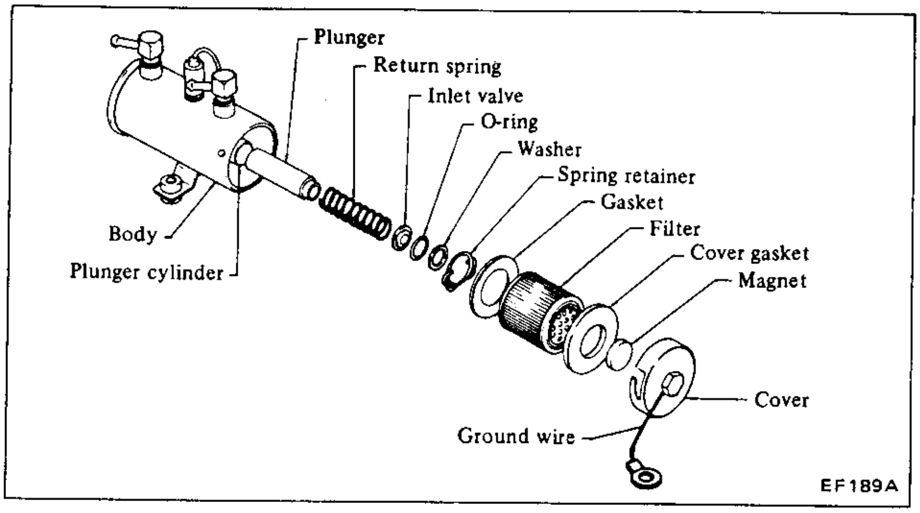
If little or no fuel flows from open end of pipe, it is an indication that fuel line is clogged or pump is malfunctioning.

INSPECTION

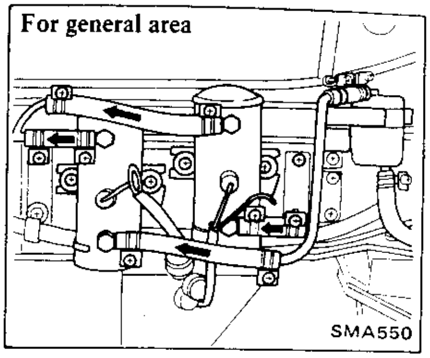
After assembly, test the function as follows:

1. Position fuel pump assembly about 1.0 meter (3.3 ft) above fuel level of fuel filter and connect a pipe from filter to fuel pump.
2. Operate rocker arm by hand. If fuel is drawn up soon after rocker arm is released, fuel pump is functioning properly.

ELECTRIC FUEL PUMP



EF189A



SMA550

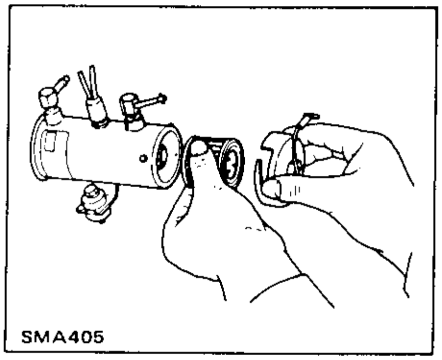
The electric fuel pump is located on the right side frame near the fuel tank.

Before removing fuel pump, disconnect battery ground cable.

INSPECTION OF FUEL PUMP FILTER

Be careful not to allow dirt to enter fuel pump during inspection.

Remove cover and check fuel filter.



SMA405

OPERATING TEST

Before disconnecting fuel hose, place a container below hose connection to catch excess fuel.

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

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.

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.

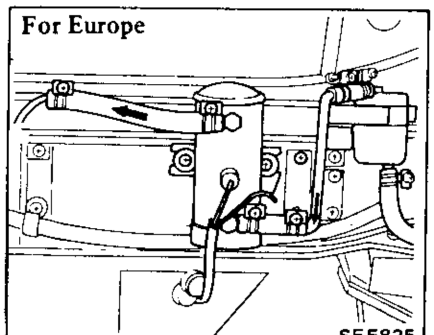
CAUTION:

a. **Do not connect battery in reverse polarity. If this is done and left for a long time, circuits will sustain damage, the fuel pump will be disabled.**

b. **Do not apply overvoltage (max. 18V). Overvoltage starting by quick charge or overvoltage running would deteriorate or damage electric components.**

c. **Do not operate engine under no-load conditions for an extended period of time. This can overheat fuel pump, resulting in premature wear of working parts.**

REMOVAL AND INSTALLATION



SEF825

1. Disconnect inlet and outlet hoses from fuel pump and disconnect harness at connector and ground wire.

After disconnecting each hose, plug blind plug so that fuel will not leak out.

2. Remove bolts securing fuel pump to body.

CAUTION:

Do not let fall pump, as it may damage electric components.

DISASSEMBLY

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

Do not disassemble electric components. If necessary, replace with new ones as electric fuel pump assembly.

INSPECTION

Check all components for any abnormalities and, if necessary, replace with new ones as electric fue pump assembly.

ASSEMBLY

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

Take care not to deform plunger cylinder.

2. Insert plunger assembly into body and apply electric current to it.

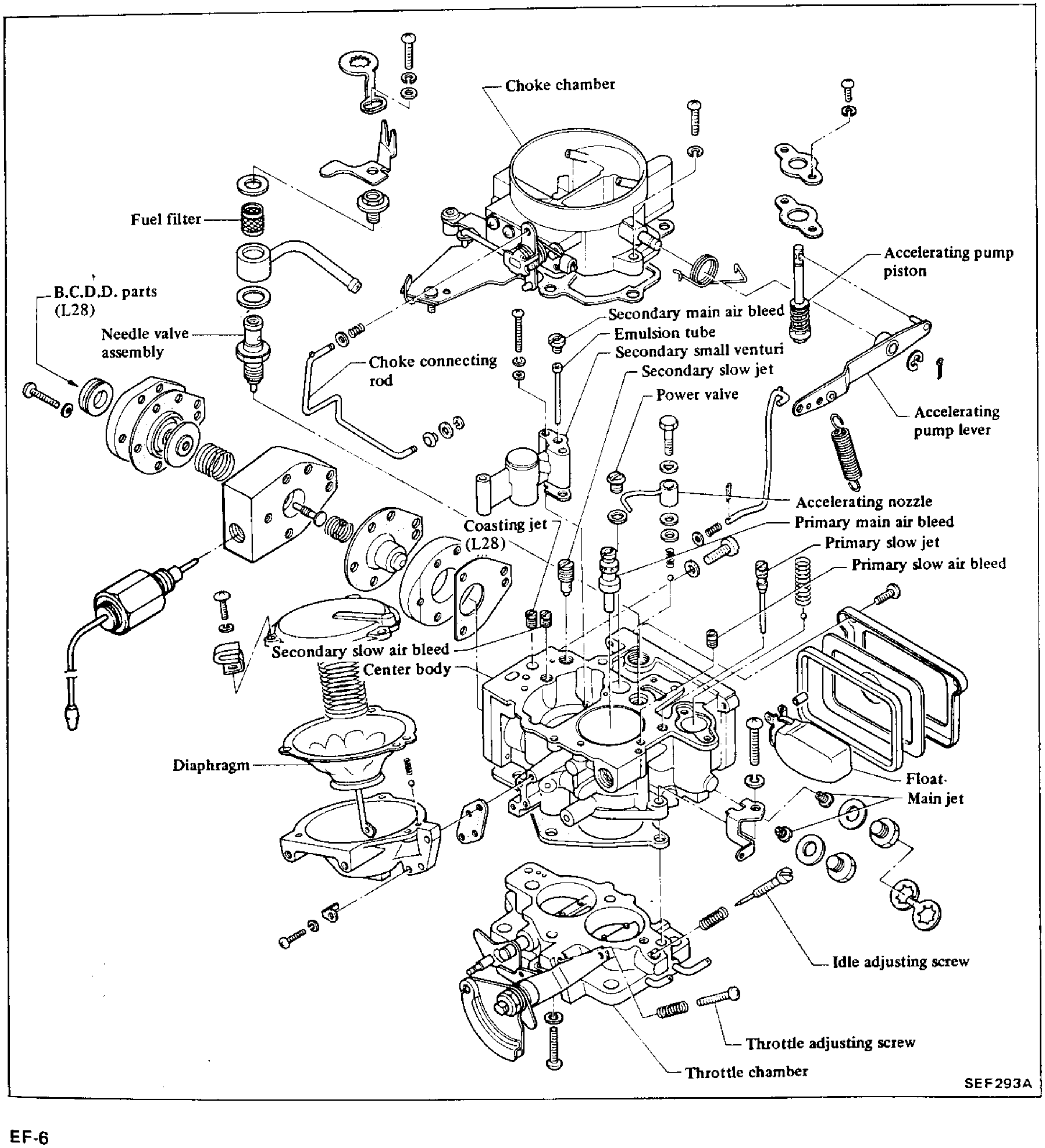
Move the assembly up and down.

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

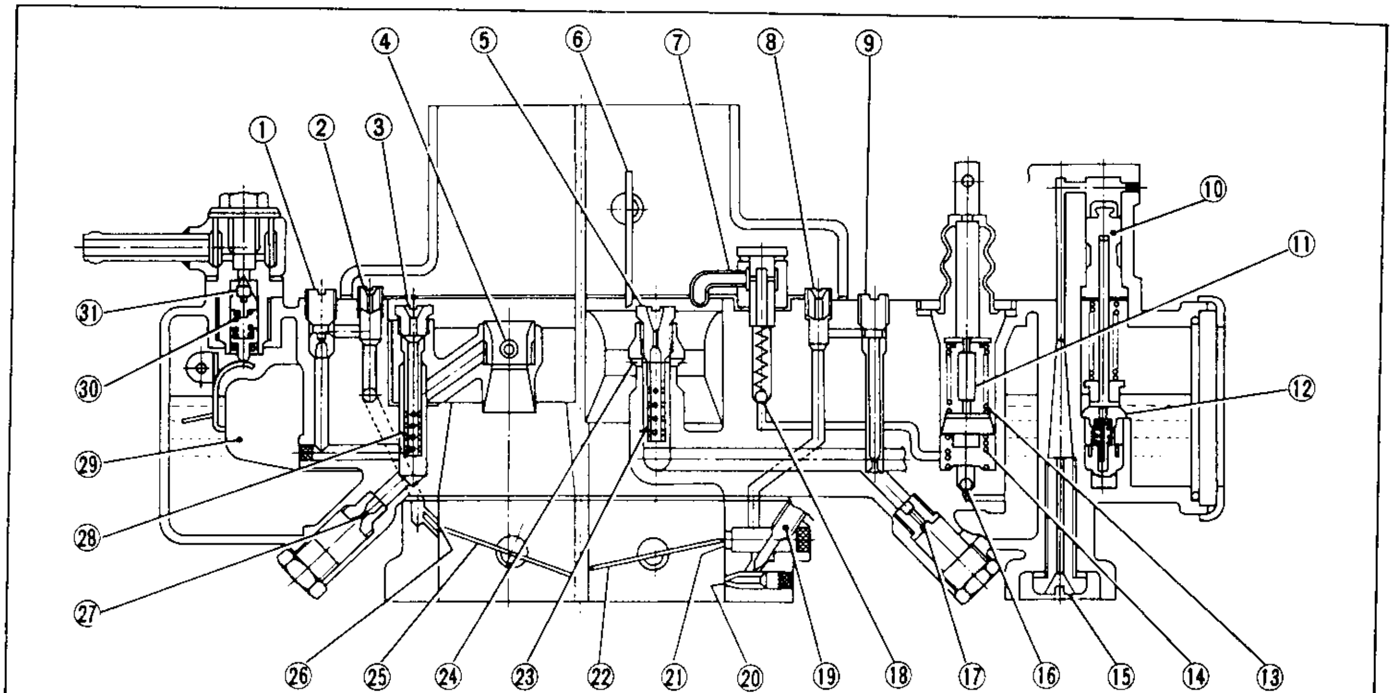
3. Assembly is in the reverse order of disassembly.

Be careful not to allow dirt to enter fuel pump during assembly.

CARBURETOR



STRUCTURE AND OPERATION



1 Secondary slow jet
2 Secondary slow air bleed
3 Secondary main air bleed
4 Secondary main nozzle
5 Primary main air bleed
6 Choke valve
7 Pump injector
8 Primary slow air bleed
9 Primary slow jet
10 Vacuum piston
11 Piston
12 Power jet
13 Damper spring
14 Piston return spring
15 Vacuum port
16 Inlet valve
17 Primary main jet
18 Outlet valve
19 Idle adjusting screw
20 Idle hole
21 By-pass hole
22 Primary throttle valve
23 Primary emulsion tube
24 Primary main nozzle
25 Secondary throttle valve
26 Secondary slow hole
27 Secondary main jet
28 Secondary emulsion tube
29 Float
30 Needle valve spring
31 Needle valve

SEF440

Carburetors basically consist of a primary system for normal running, a secondary system for high speed, heavy load running and a float system.

A starting mechanism, an accelerating mechanism, a power valve mechanism, a secondary switchover mechanism, etc. are also attached.

PRIMARY SYSTEM

Primary main system

The primary main system is of Solex type. Fuel flows 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.

Idling and slow system

During low engine speed, fuel flows through the slow jet, mixing with air coming from the air bleed, and then is pulled out into the engine through the idle hole and by-pass hole.

Accelerating mechanism

When the primary throttle valve is opened, the piston goes down, opening the outlet valve, and the fuel which is stored in the piston chamber is forced out through the pump injector. When the throttle valve is closed, the piston goes up, and the fuel flows from the float chamber through the inlet valve into the piston chamber and is stored again.

Power valve mechanism

When the throttle valve is slightly opened during light load running, a 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 heavy load running, the spring pushes the vacuum piston downward, opening the power valve to furnish fuel.

Starting mechanism

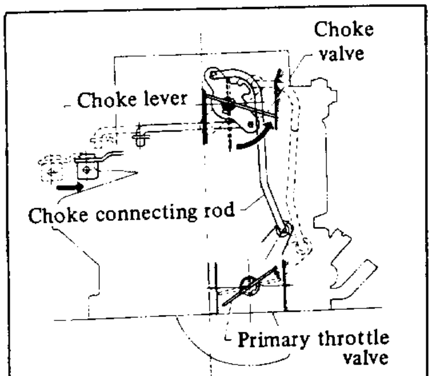
This mechanism consists of:

1. Choke valve

When the choke knob is pulled out, the choke valve linked to it is closed, developing a fairly high vacuum in the primary nozzle. This vacuum causes the primary nozzle to deliver a heavy stream of fuel, sufficient to produce the rich mixture necessary for starting the engine.

2. Fast idle mechanism

The fast idle mechanism linked to the choke valve determines the opening of the primary throttle valve so as to obtain the proper amount of mixture for starting and warming-up.



SEF027

SECONDARY SYSTEM

Secondary main system

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 small venturi.

Secondary slow system

This system functions to fill the gap properly when the fuel supply is transferred from the primary system to the secondary system. The construction of this system may correspond to the idling and slow system of the primary system.

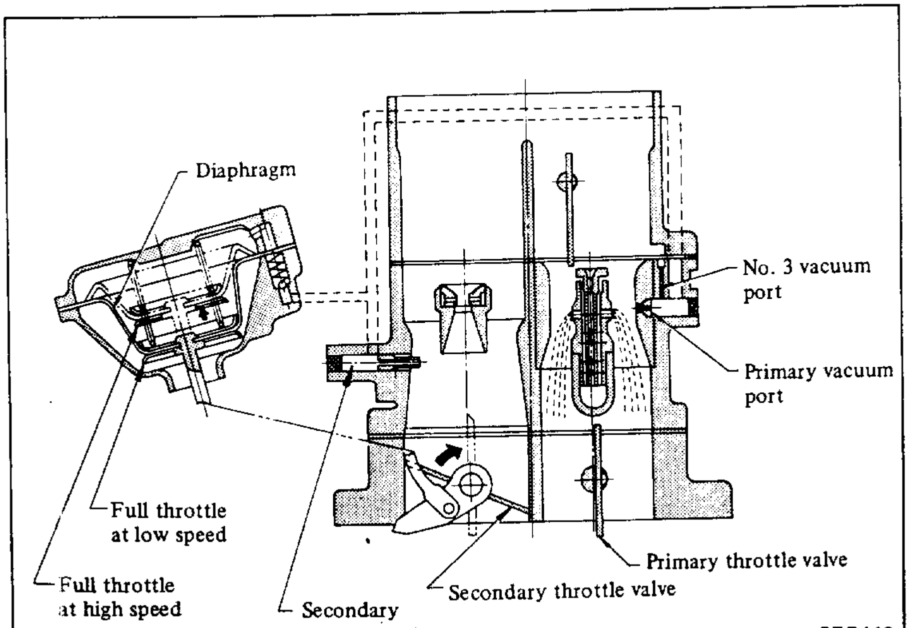
Secondary switchover mechanism

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

During high speed, heavy load 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 the predetermined value), 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 position wider than the predetermined value, the secondary throttle valve is ready to open, because the locking arm rotates and leaves from the secondary throttle arm.

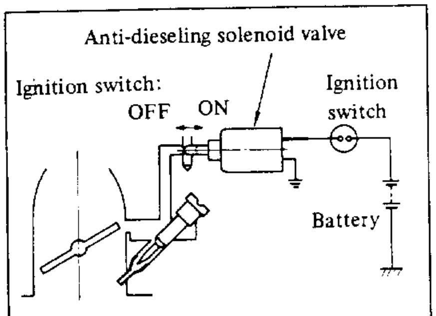


SEF443

ANTI-DIESELING SYSTEM (Europe)

The carburetor destined for Europe is equipped with an anti-dieseling solenoid.

As the ignition switch is turned off, the valve is brought into operation, shutting off the supply of fuel to the slow circuit.



SEF444

INSPECTION AND ADJUSTMENT

IDLE RPM AND MIXTURE RATIO

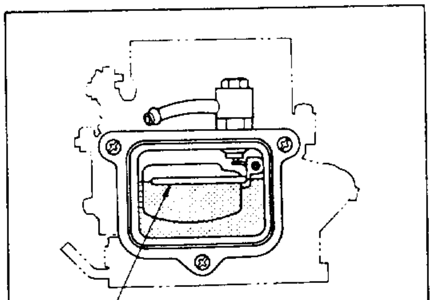
Refer to Section MA for Inspection and Adjustment of idle rpm and mixture ratio.

Idle limiter cap

Refer to Idle Limiter Cap (Section MA) for checking and adjustment.

FUEL LEVEL

1. With engine idle, check fuel level.

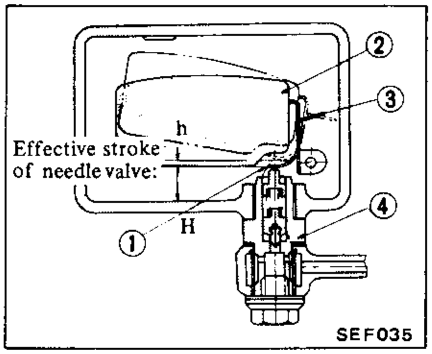


SEF435

To adjust fuel level, proceed as follows:

1. Remove carburetor from engine and remove level gauge cover.
2. Turn down carburetor and check float position "H".

Top float position "H":
8.5 mm (0.335 in)



SEF035

1 Float seat
2 Float
3 Float stopper
4 Needle valve

If out of specification, adjust it by bending float seat.
3. Check clearance "h" (bottom float position between float seat and needle valve stem).

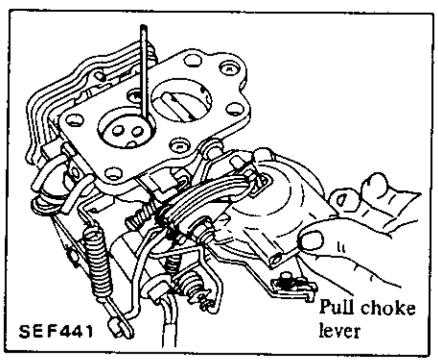
Clearance "h":
1.3 - 1.7 mm (0.051 - 0.067 in)

If out of specification, adjust it by bending float stopper.

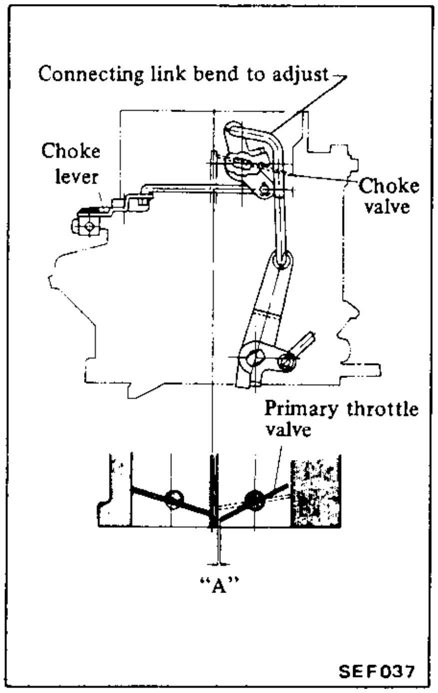
FAST IDLE

Pull choke lever and close choke valve completely and then check clearance "A" between primary throttle valve and inner wall.

Clearance "A":
L28
1.80 - 1.94 mm
(0.0709 - 0.0764 in)
P40
2.08 - 2.22 mm
(0.0819 - 0.0874 in)



SEF441

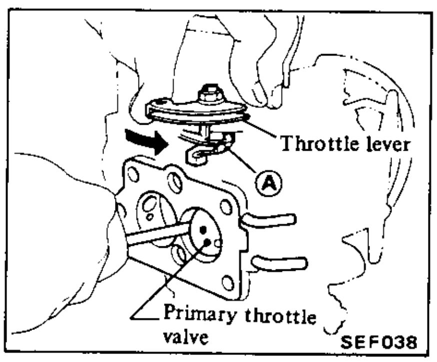


SEF037

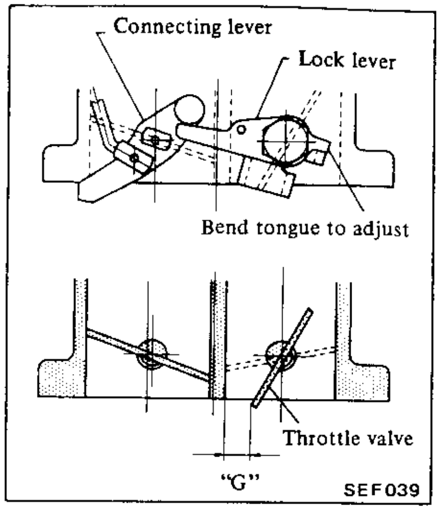
INTERLOCK OPENING OF PRIMARY AND SECONDARY THROTTLE VALVES

When adjusting plate comes in contact with lock lever at point Ⓐ by turning throttle lever, check clearance "G" between primary throttle valve and inner wall.

Clearance "G":
L28
7.2 - 8.2 mm
(0.283 - 0.323 in)
P40
8.2 - 9.2 mm
(0.323 - 0.362 in)



SEF038

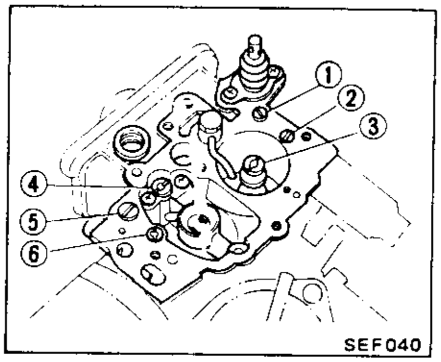


SEF039

JET AND AIR BLEED

CAUTION:
a. Be sure to use a screwdriver of proper size.
b. Be careful not to scratch or nick jet and air bleed.
c. To clean jet and air bleed, use solvent and compressed air.

1. Remove upper body of carburetor and check jets and air bleeds for stamped number, looseness and clogging.
If any abnormality is found, correct.



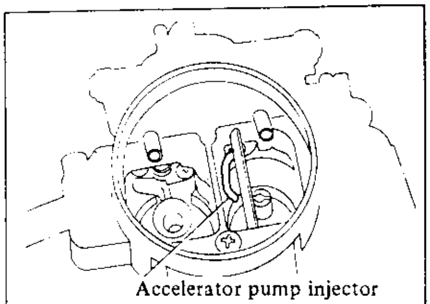
SEF040

1 Primary slow jet
2 Primary slow air bleed
3 Primary main air bleed
4 Secondary main air bleed
5 Secondary slow jet
6 Secondary slow air bleed

2. Check power valve for looseness and clogging.
3. Remove main jet cap from lower portion of float chamber and check main jet.

ACCELERATOR PUMP

When accelerator pump is operated by opening throttle lever by hand with engine stopped, remove air cleaner and check pump injector located at primary port if it injects fuel smoothly without delay.



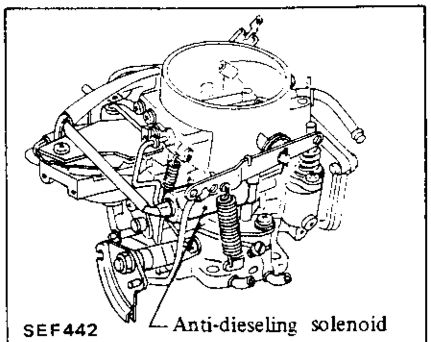
SEF043

ANTI-DIESELING SOLENOID VALVE (Europe)

1. If engine does not stop when solenoid connector is disconnected, replace solenoid valve.
2. If click sound is not heard from solenoid valve when ignition switch is turned on-off, replace it.

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

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



SEF442

DISASSEMBLY

WARNING:
Before disassembly, be sure to drain fuel from carburetor to eliminate possibility of fire.

CAUTION:
a. Properly use wrenches and screwdrivers to remove nozzles and jets as well as screws and nuts, exercising care not to damage any part.
b. Be careful not to bend or scratch any part.

- Clean carburetor thoroughly before disassembly.
- Be careful not to lose any parts. Some carburetor parts can be removed without detaching the choke chamber or throttle chamber, while other parts cannot. Prior to removing any parts, carefully read and follow the instructions and removal procedures so as to save time and labor.

DISASSEMBLY FROM OUTSIDE

Parts which can be removed without removing the throttle chamber of choke chamber are as follows:

- Main jets
- Slow jets
- Float chamber parts
- Fuel nipple
- Needle valve parts
- Accelerating mechanism parts
- Diaphragm chamber parts
- Adjusting screws
- Throttle and choke linkage parts

INSPECTION AND CLEANING

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

Be careful not to lose any parts.

1. Clean and check parts for clogged passages. Remove any obstacles from passages.
2. Check all parts for scratches or deformation. If necessary, replace them.
3. Check gaskets, diaphragm and sealing rubber parts for scratches or breakage. If necessary, replace.

ASSEMBLY

CAUTION:
a. Properly use wrenches and screwdrivers to install nozzles and jets as well as screws and nuts, exercising care not to damage any part.
b. Be careful not to bend or scratch any part.

Be sure to install each part correctly.

1. Assemble in the reverse order of removal.
2. After assembling, check each rotating portion or sliding portion for smooth operation.

SERVICE DATA AND SPECIFICATIONS

CARBURETOR

*1: Includes Hong Kong
*2: For Canvas Top

Engine			L28		P40	
			Except Europe	Europe *1	Except Europe	Europe *1
Carburetor model			DAF342 –44	DAF342 –45	DAF342 –52 –51 *2	DAF342 –56
Outer dia. mm (in)		P.	32 (1.26)			
		S.	34 (1.34)			
Large venturi dia. mm (in)		P.	26 (1.02)			
		S.	32 (1.26)			
Main jet		P.	#132		#134	#130
		S.	#200		#210	
Main air bleed		P.	#240		#230	
		S.	#50			
Slow jet		P.	#50		#46	#52
		S.	#100			
Slow air bleed		P.	#230		#210	
		S.	#50			
Power jet			#80			
Fast idle opening Clearance "A" mm (in)			1.80 - 1.94 (0.0709 - 0.0764)		2.08 - 2.22 (0.0819 - 0.0874)	
Interlock opening of primary and secondary throttle valve Clearance "G" mm (in)			7.2 - 8.2 (0.283 - 0.323)		8.2 - 9.2 (0.323 - 0.362)	
Fuel level adjustment Gap between float and carburetor body "H" mm (in)			8.5 (0.335)			
Gap between valve stem and float seat "h" mm (in)			1.3 - 1.7 (0.051 - 0.067)			
Main jet variation for altitude	1,000 m (3,300 ft)	P.	#128	–	#130	–
		S.	#195	–	#204	–
	2,000 m (6,600 ft)	P.	#125	–	#127	–
		S.	#190	–	#198	–
	3,000 m (9,900 ft)	P.	#121	–	#123	–
		S.	#185	–	#192	–
	4,000 m (13,000 ft)	P.	#117	–	#119	–
		S.	#180	–	#186	–

FUEL PUMP

Engine		L28	P40
Mechanical fuel pump Fuel pump pressure	kPa (mbar, mmHg, inHg)	22.7 - 29.3 (227 - 293, 170 - 220 6.69 - 8.66)	21.2 - 28.0 (212 - 280, 159 - 210, 6.26 - 8.27) 16.7 - 23.6 (167 - 236) 125 - 177, 4.92 - 6.97)*
Fuel pump capacity	mℓ (Imp. fl oz)/minute at 1,000 rpm	More than 1,300 (45.8)	More than 2,500 (88.0) 2,400 (84.5)*
Electric fuel pump Fuel pump capacity	mℓ (Imp. fl oz)/minute at 1,000 rpm	More than 1,600 (56,3)	–

*Canvas Top

TROUBLE DIAGNOSES AND CORRECTIONS

In the following table, the symptoms and causes of carburetor problems 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 seems apparently to have some problems, when in fact the electrical system is faulty. Therefore, whenever the engine has problems, electrical system must be checked first before making carburetor adjustment.

Condition	Probable cause	Corrective action
Overflow	Float damaged.	Replace.
	Dirt accumulated on needle valve.	Clean needle valve.
	Fuel pump pressure too high.	Repair pump.
	Needle valve seat improper.	Repair or replace.
Excessive fuel consumption	Fuel level improper.	Adjust, or repair float system parts.
	Main jet or slow jet size too large.	Replace with the specified one.
	Main air bleed or slow air bleed clogged.	Clean.
	Main jet or slow jet damaged.	Replace.
	Choke valve does not fully open.	Adjust.
	Outlet valve seat of accelerator pump improper.	Lap.
	Linked opening of secondary throttle valve too early.	Adjust.
	Idle adjustment incorrect.	Adjust.
Power shortage	Main jet clogged or damaged.	Clean or replace.
	Each throttle valve does not open fully.	Adjust.
	Fuel filter clogged.	Replace.
	Air cleaner filter clogged.	Replace.
	Vacuum jet or passage clogged.	Clean.
	Secondary diaphragm damaged.	Replace.
	Power valve operating improperly.	Adjust.
	Malfunctioning fuel pump.	Repair or replace.

Condition	Probable cause	Corrective action
Improper idling	Idle adjustment incorrect.	Adjust.
	Slow jet or slow air bleed clogged.	Clean.
	Throttle valve does not close.	Adjust.
	Secondary throttle valve operated improperly.	Overhaul and clean.
	Throttle valve shaft worn.	Replace.
	Manifold/carburetor tightening improper.	Correct.
	Packing between manifold/carburetor faulty.	Replace gasket.
	Fuel overflow.	See above item.
Engine hesitation	Main jet or slow jet clogged.	Clean.
	By-pass hole, idle passage clogged.	Clean tube.
	Emulsion tube clogged.	Clean.
	Idling adjustment incorrect.	Correct adjustment.
	Accelerating mechanism does not operate properly.	Repair.
Engine does not start.	Fuel overflow.	See above item.
	No fuel fed to engine.	Check pump, fuel pipe and needle valve.
	Idle adjustment incorrect.	Adjust.
	Fast idle adjustment incorrect.	Adjust.

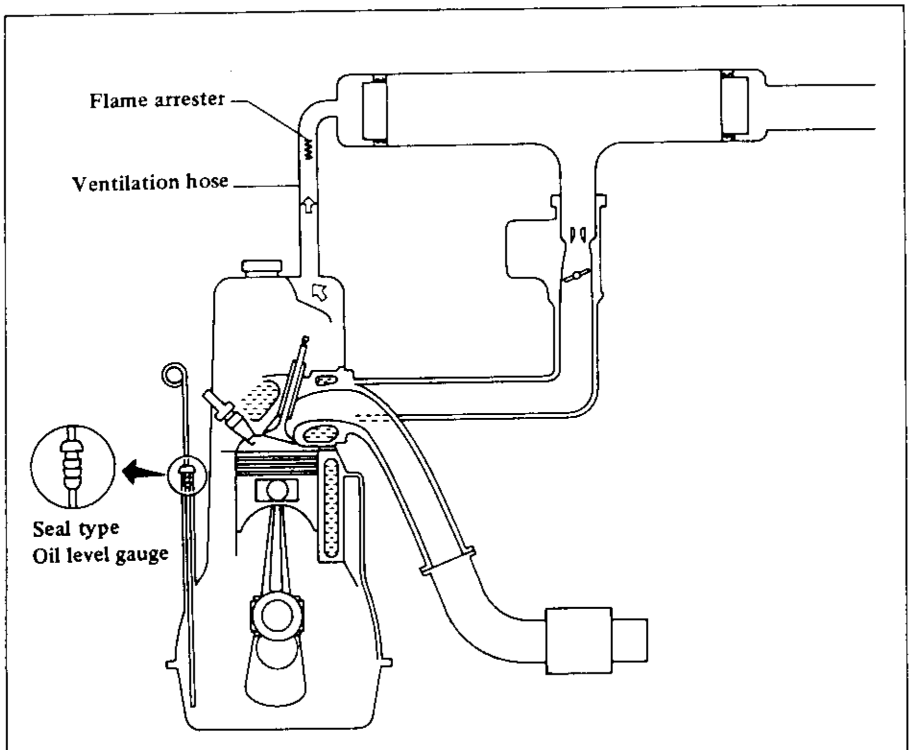
EMISSION CONTROL SYSTEM

CONTENTS

CRANKCASE EMISSION CONTROL SYSTEM (P40 engine)

DESCRIPTION

This system is designed to send blow-by gases back to the combustion chamber through the air cleaner for reburning, and prevents blow-by gases from being emitted into the atmosphere.



SEC837

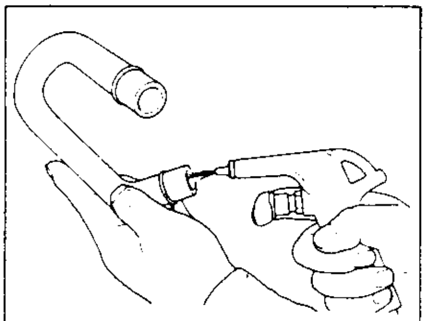
INSPECTION

VENTILATION HOSE

1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air.

If any hose cannot be freed of obstructions, replace.

Ensure that flame arrester is securely inserted in hose between air cleaner and rocker cover.



ET277

CRANKCASE EMISSION CONTROL SYSTEM (L28 engine)

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.

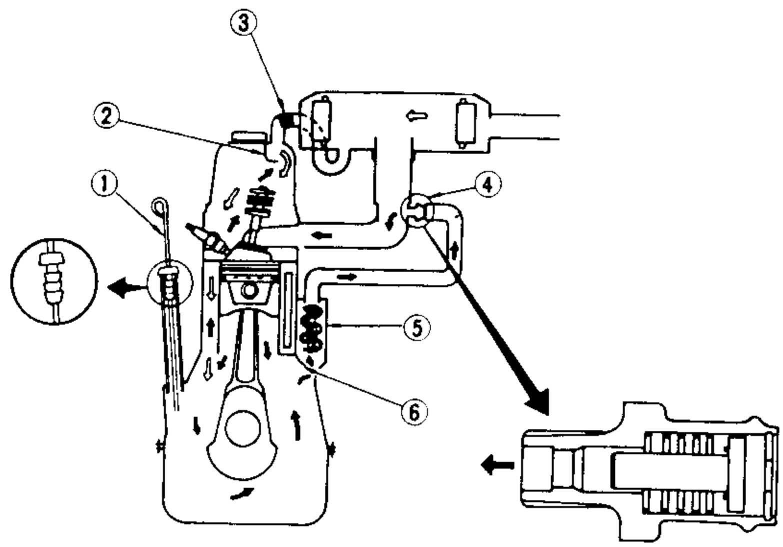
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. valve.

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 from the clean side of the carburetor air cleaner, through the tube connecting the carburetor air cleaner to the 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 the carburetor air cleaner under all conditions.



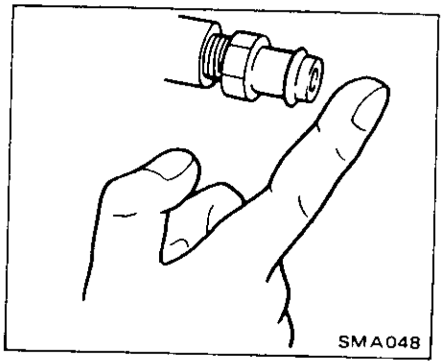
EC282A

INSPECTION

P.C.V. VALVE

Check P.C.V. valve in accordance with the following method:

With engine running at idle, remove ventilation hose from P.C.V. valve; if valve is working properly, a hissing noise will be heard as air passes through it and a strong vacuum should be felt immediately when a finger is placed over valve inlet. Replace P.C.V. valve in accordance with the Maintenance Schedule.

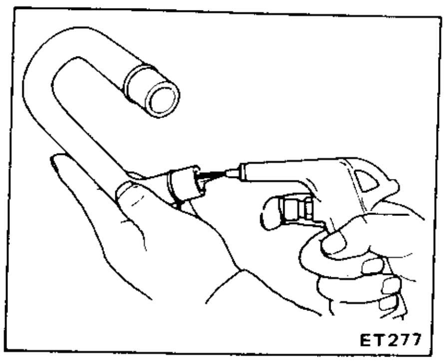


SMA048

Ⓣ : P.C.V. valve
15 - 20 N·m
(1.5 - 2.0 kg-m,
11 - 14 ft-lb)

VENTILATION HOSE

1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.



ET277

EXHAUST EMISSION CONTROL SYSTEM (L28 engine)

BOOST CONTROLLED DECELERATION DEVICE (B.C.D.D.)

DESCRIPTION

The B.C.D.D. serves to reduce HC emissions during coasting.

The high manifold vacuum during coasting prevents the complete combustion of the mixture gas due to the reduced amount of mixture gas available.

As a result, an excess amount of HC is emitted into the atmosphere.

When manifold vacuum exceeds the set value, this B.C.D.D. operates to supply additional mixture gas of optimum mixture ratio.

Complete combustion of fuel is assisted by this additional mixture, and HC emissions are thereby reduced.

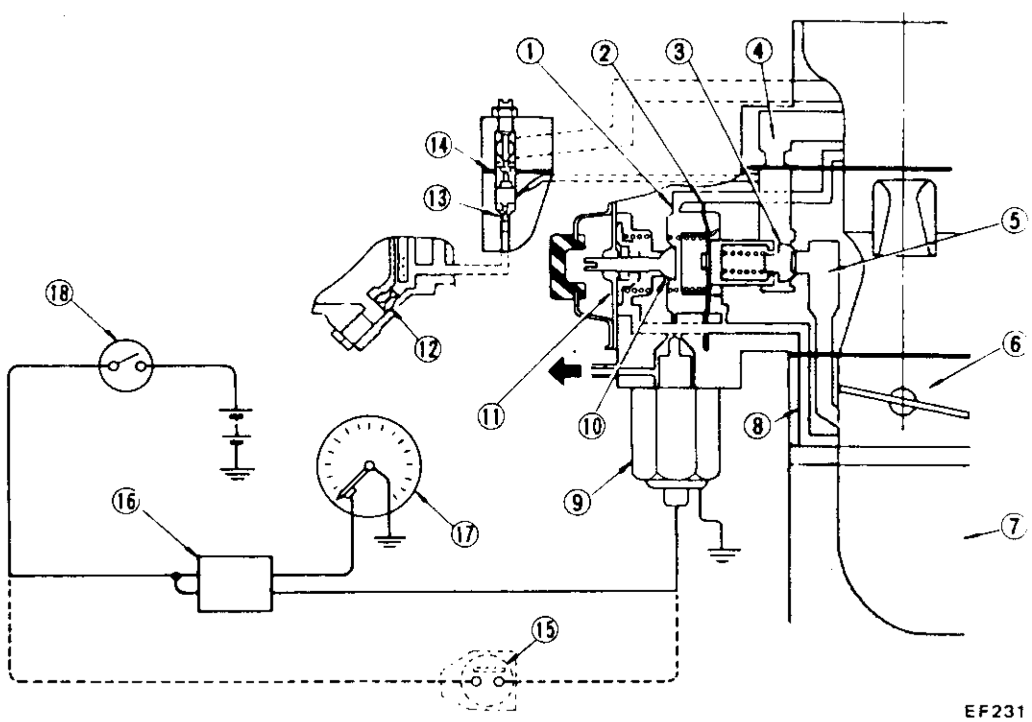
A B.C.D.D. cut solenoid serves to inactivate B.C.D.D. at idling.

A speed switch monitors the vehicle speed of below 10 km/h (5 MPH) for manual transmission models. It actuates the cut solenoid to inactivate the B.C.D.D.

On automatic transmission models, an inhibitor switch monitors the "N" or "P" position, and inactive the B.C.D.D.

1 Air jet
2 Diaphragm II
3 Mixture control valve
4 Coasting air bleed II
5 Mixture air passage
6 Secondary barrel
7 Intake manifold
8 Boost passage
9 B.C.D.D. cut solenoid
10 Vacuum control valve
11 Diaphragm I
12 Secondary main jet
13 Coasting jet
14 Coasting air bleed I
15 Inhibitor switch "N", "P": ON (for automatic transmission)
16 Amplifier
17 Speed detecting switch below 10 km/h (5 MPH): ON (for manual transmission)
18 Ignition switch

Note: Broken line applies only to Automatic Transmission



EF231

INSPECTION AND ADJUSTMENT

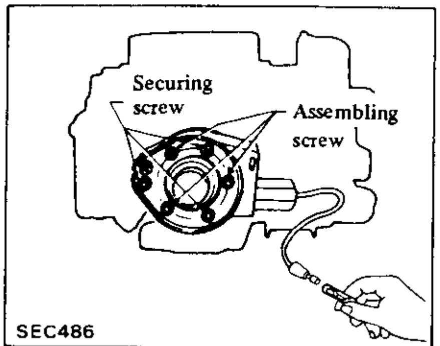
Generally, it is unnecessary to inspect and adjust B.C.D.D., however, if it should become necessary to do so, proceed as follows:

Prepare the following tools.

(1) Tachometer to measure the engine speed, and a screwdriver.
(2) A vacuum gauge and rubber hose.

A quick-response type boost gauge such as Bourdon's type is recommended: a mercury-type manometer should not be used.

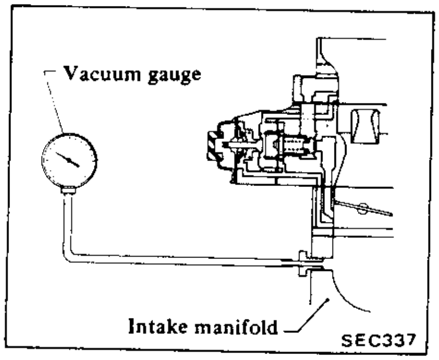
1. Disconnect lead wire of B.C.D.D. cut solenoid.



SEC486

Be sure to reconnect harness of solenoid after inspection or adjustment is completed.

2. Connect vacuum gauge to intake manifold.



A service plug is installed on intake manifold. Remove this plug and install an attachment which is equipped with a vacuum gauge.

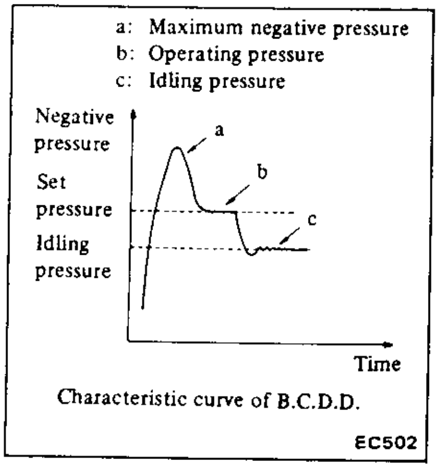
3. Fully loosen dash pot adjusting screw. (A/T model only)

After adjustment has been made, readjust dash pot touch point.

4. Warm up engine until it is heated to operating temperature.
Then adjust engine at normal idle setting. (Refer to MA section.)
5. Run engine under no load. Increase engine speed to 3,000 to 3,500 rpm, then quickly close throttle valve.

This operation simulates the engine coasting condition.

6. At that time, the manifold vacuum pressure will charge as follows:



Characteristic curve of B.C.D.D.

a. It will suddenly rise up to about –80.0 kPa (–800 mbar, –600 mmHg, –23.62 inHg).
b. It will decrease gradually to –74.6 kPa (–746 mbar, –560 mmHg, –22.05 inHg) and stay there for a while. This is so called operating pressure.
c. In most cases, it will drop to idling pressure.

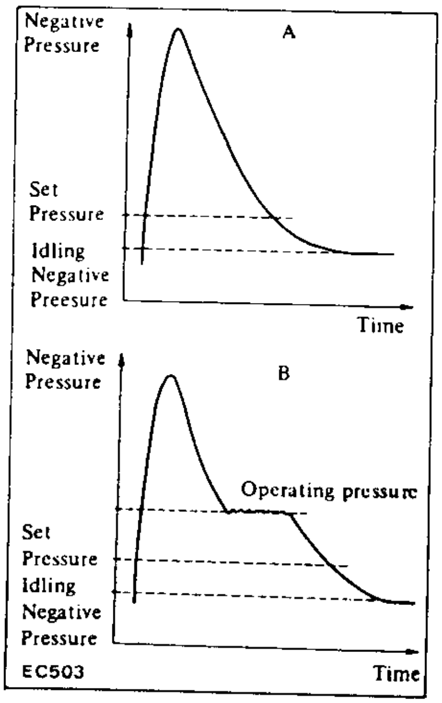
The operating pressure should be within the specified range: namely set pressure.

B.C.D.D. set pressure
–74.6±2.7 kPa
(–746±27 mbar,
–560±20 mmHg,
–22.05±0.79 inHg)

There are two types of manifold vacuum operation as shown in following figures when B.C.D.D. operating pressure is not correct. In such a case, adjust it as follows.

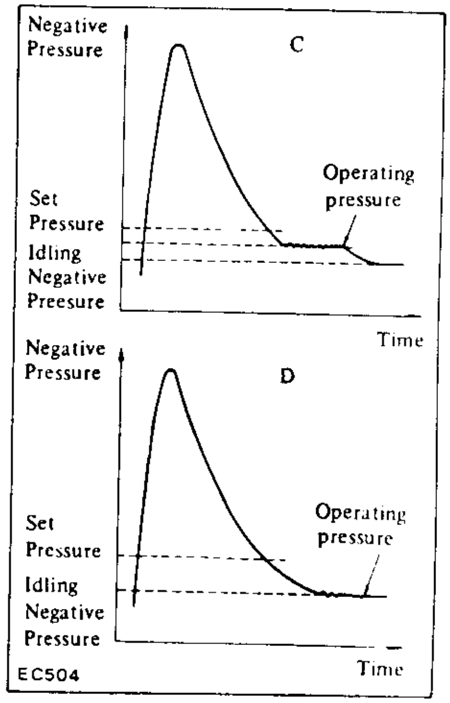
≪ High operating pressure ≫

When operating pressure is too high,
A. B.C.D.D. remains inoperative and negative pressure decreases with no sustained plateaus while it is falling.
B. B.C.D.D. operates, but the operating pressure is higher than the specified level (such as set pressure).



≪ Low operating pressure ≫

When operating pressure is too low,
C. Engine rpm will not fall to idling speed. (Even in this case, it is normal if the result of road test described below is correct.)
D. Engine falls to idling speed, but the operating pressure is lower than the specified level (such as set pressure).

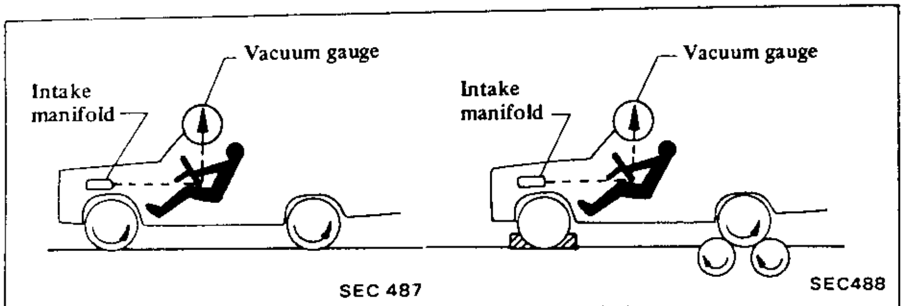


If engine speed cannot be decreased to idling when checking B.C.D.D. operating pressure, proceed as follows.

When the engine speed does not fall to idling speed, it is necessary to reduce the negative idling pressure of the manifold to lower than the set pressure of the B.C.D.D. (The engine speed will not drop to idling speed when the negative idling pressure is higher than the set pressure of the B.C.D.D.)

In this case, the engine must be labored by (1) road test (2) chassis dynamometer, accelerating the vehicle to 60 to 80 km/h (37 to 50 MPH) in top gear (manual transmission) or in "D" position (automatic transmission), and then releasing the accelerator pedal and letting the vehicle decelerate. After doing this, check whether the B.C.D.D. set pressure is at the predetermined value or not.

7. Connect leat wire of B.C.D.D. cut solenoid, and make sure engine falls to idling speed.



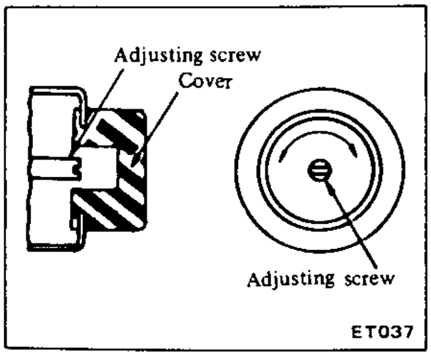
(1) Road test (2) Chassis dynamometer

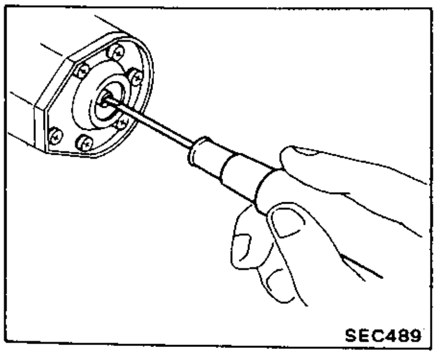
Adjustment

1. Remove rubber cap at bottom of B.C.D.D.
2. Turn adjusting screw slightly. Then, race engine and confirm that operating pressure is at the specified value.

If it is higher than the set level, turn adjusting screw clockwise until correct adjustment is made; if it is lower than that, turn screw counter-clockwise.

a. Turning adjusting screw one quarter rotation will cause a change in operation pressure of about 2.7 kPa (27 mbar, 20 mmHg, 0.79 inHg).
b. Do not fit tip of screwdriver tightly into screw slot.





3. Race the engine and check for adjustment.

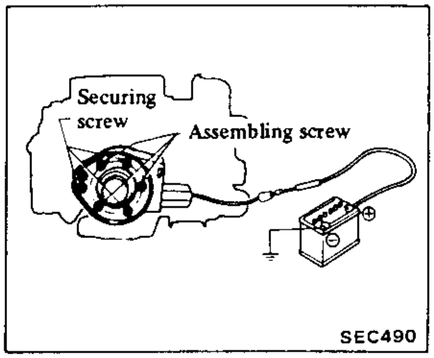
INSPECTION

Cut solenoid

Check function of cut solenoid as follows:

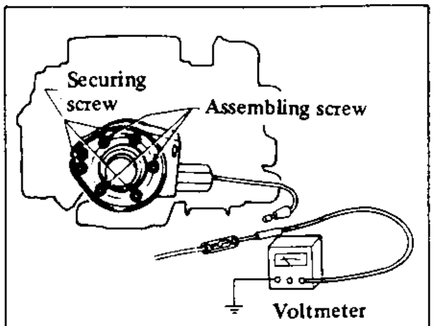
Apply 12 volts to B.C.D.D. cut solenoid lead wire and check for movement of needle valve in solenoid. When needle valve does not move, replace solenoid.

If solenoid is in good condition, check control circuit.



Control circuit

1. Confirm that each wire connector of control circuit is fitted tightly. Also check fuse.
2. Turn on ignition switch and check voltage between harness side connector for solenoid and body ground with test lamp or voltmeter.



a. Never use ammeter or amplifier may be damaged.
b. On automatic transmission models, shift in "N" position while check is being made.

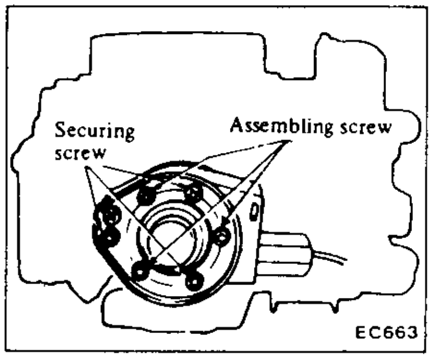
3. When a voltage of approx. 12 volts is indicated, control circuit is in good condition.

If not, the amplfier (M/T model) or inhibitor switch (A/T model) may be damaged.

REPLACEMENT

B.C.D.D. assembly

1. Remove three B.C.D.D. retaining screws, B.C.D.D. assembly can then be taken out from carburetor.



There are seven screws at the bottom of B.C.D.D. Three of them are B.C.D.D. securing screws and others are B.C.D.D. assembly screws.

2. Remove B.C.D.D. cut solenoid from B.C.D.D. assembly. B.C.D.D. can then be taken out easily.
3. New B.C.D.D. assembly can be installed in the reverse sequence of removal.

After securing three securing screws, rescrew other three B.C.D.D. assembly screws in order to avoid warping B.C.D.D. body.

Ⓣ : B.C.D.D. securing screws assembly screws
2 - 4 N·m
(0.2 - 0.4 kg-m,
1.4 - 2.9 ft-lb)

Cut solenoid

1. Disconnect lead wire at connector.
2. Remove cut solenoid by unscrewing it.
3. Install new solenoid in the reverse seuqence of removal.

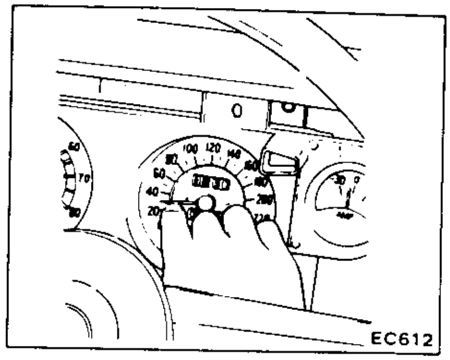
Amplifier, speed switch (M/T only)

The speed switch is part of the speedometer. The amplifier is installed on the back of the speedometer. After replacing amplifier, check its function.

1. Remove combination meter. Refer to Section EL.
2. Disconnect lead wires from amplifier. Remove setscrew, and remove amplifier.
3. Install new amplifier on combination meter.
4. Install combination meter into dash panel, then remove meter cover by unscrewing setscrews.

Connect all wires for combination meter at this point.

5. Turn ignition switch ON, and move speedometer pointer to ensure that cut solenoid moves.



EC612

6. Then, install combination meter with amplifier in the reverse sequence of removal.

Inhibitor switch (A/T only)

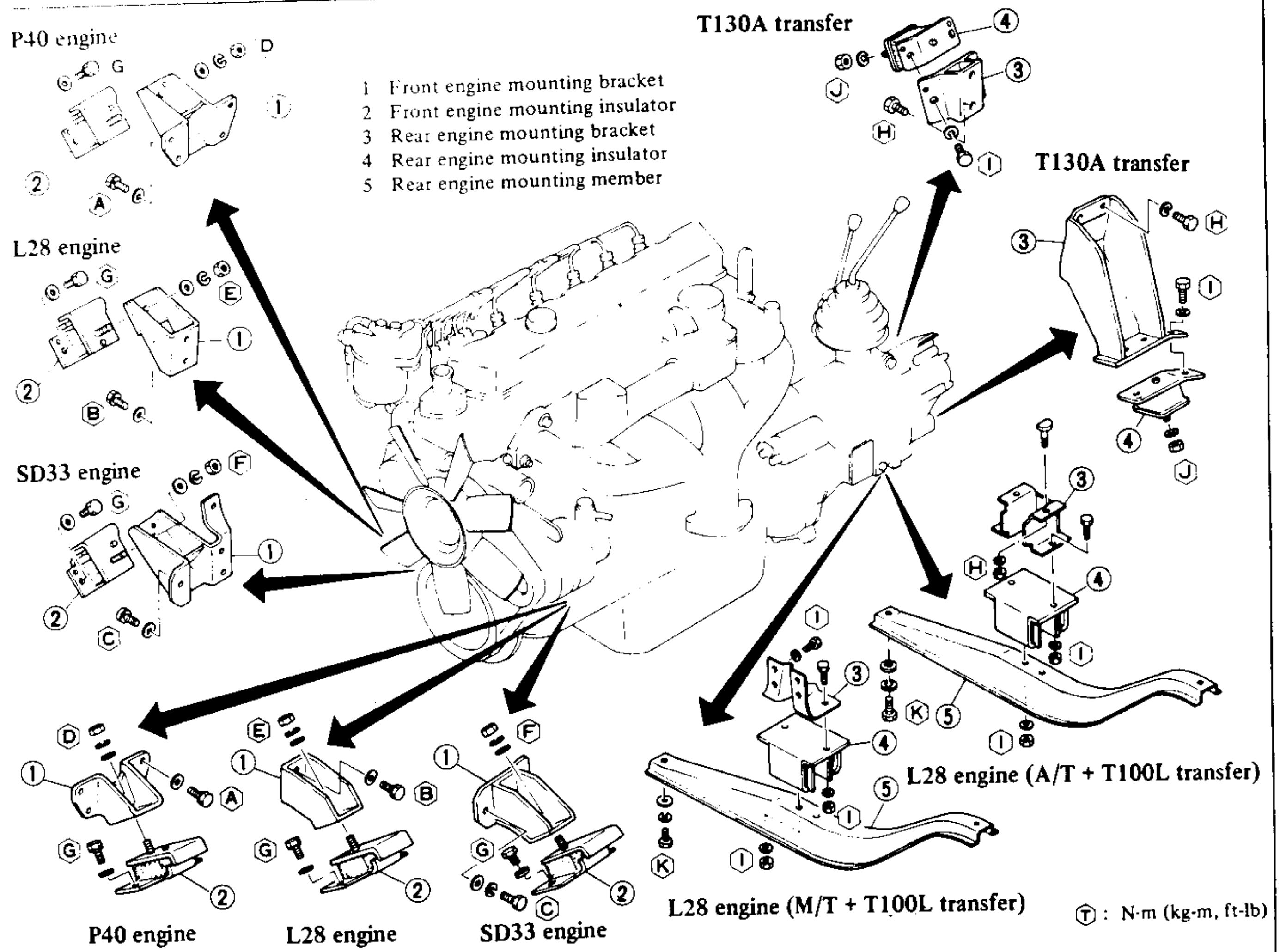
The inhibitor switch is located on the automatic transmission.

ENGINE REMOVAL & INSTALLATION

CONTENTS

ENGINE REMOVAL AND INSTALLATION (Except Canvas Top)

CONSTRUCTION



Ⓣ : N·m (kg-m, ft-lb)

Ⓐ 36.7 - 49.6 (3.74 - 5.06, 27.1 - 36.6)
Ⓑ 69 - 81 (7.0 - 8.3, 51 - 60)
Ⓒ 65.0 - 88.0 (6.63 - 8.97, 48.0 - 64.9)
Ⓓ 76 - 101 (7.7 - 10.3, 56 - 74)
Ⓔ 35 - 47 (3.6 - 4.8, 26 - 35)
Ⓕ 91 - 108 (9.3 - 11.0, 67 - 80)
Ⓖ 35 - 47 (3.6 - 4.8, 26 - 35)
Ⓗ 27 - 36 (2.8 - 3.7, 20 - 27)
Ⓘ 17 - 22 (1.7 - 2.2, 12 - 16)
Ⓙ 30 - 41 (3.1 - 4.2, 22 - 30)
Ⓚ 50 - 69 (5.1 - 7.0, 37 - 51)

SER063

REMOVAL

With T130A transfer

It is much easier to remove engine with clutch housing, transmission and transfer as a single unit than to remove them separately. After removal, separate engine and transmission.

With T100L transfer

It is much easier to remove engine with transmission and clutch housing or converter housing as a single unit.

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.

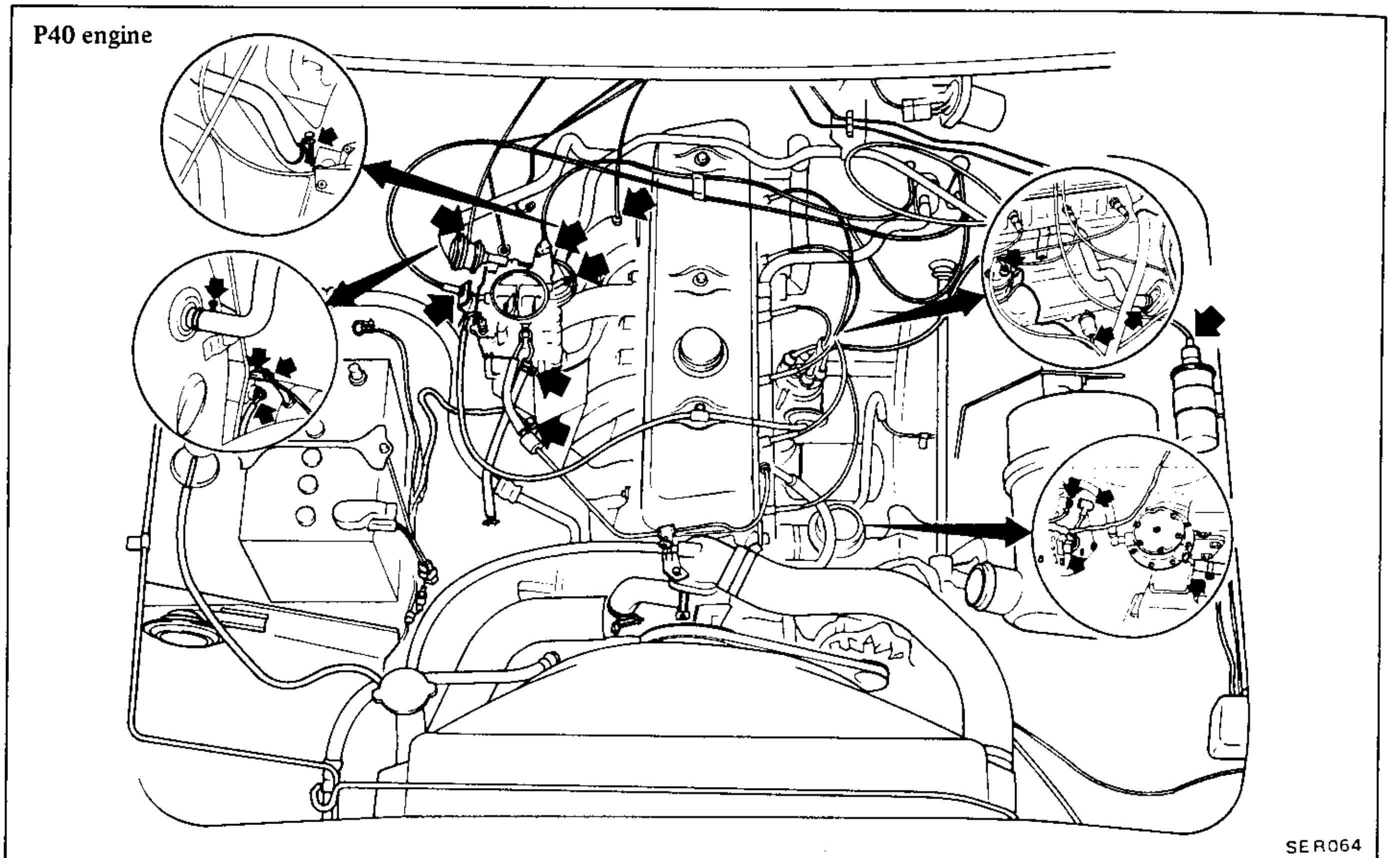
1. Disconnect battery around cable.
2. Drain engine coolant and then disconnect radiator hoses.
3. Remove hood.

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.

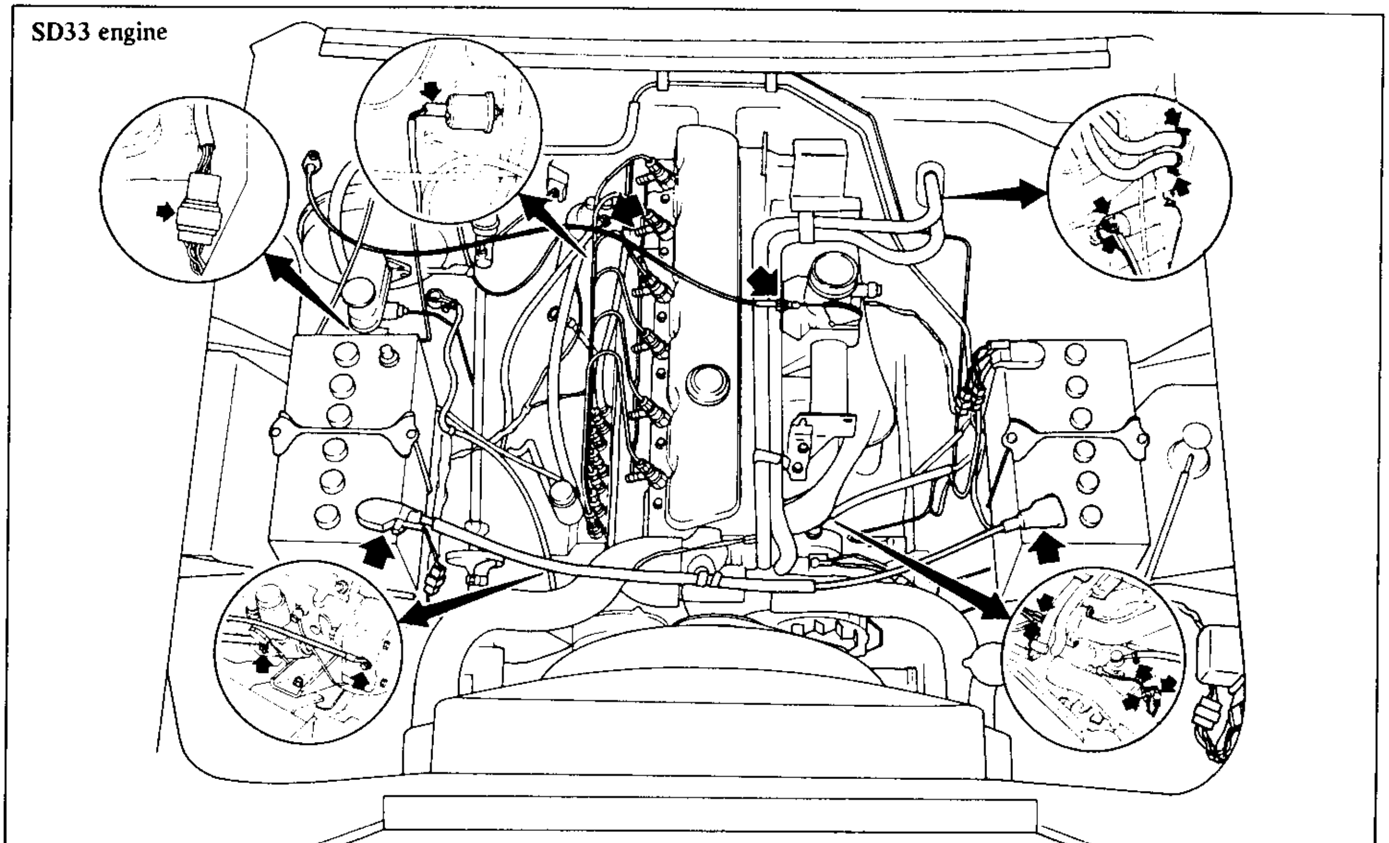
4. Remove air cleaner.
5. Remove all wires and hoses indicated by arrows in the following figures.

P40 engine



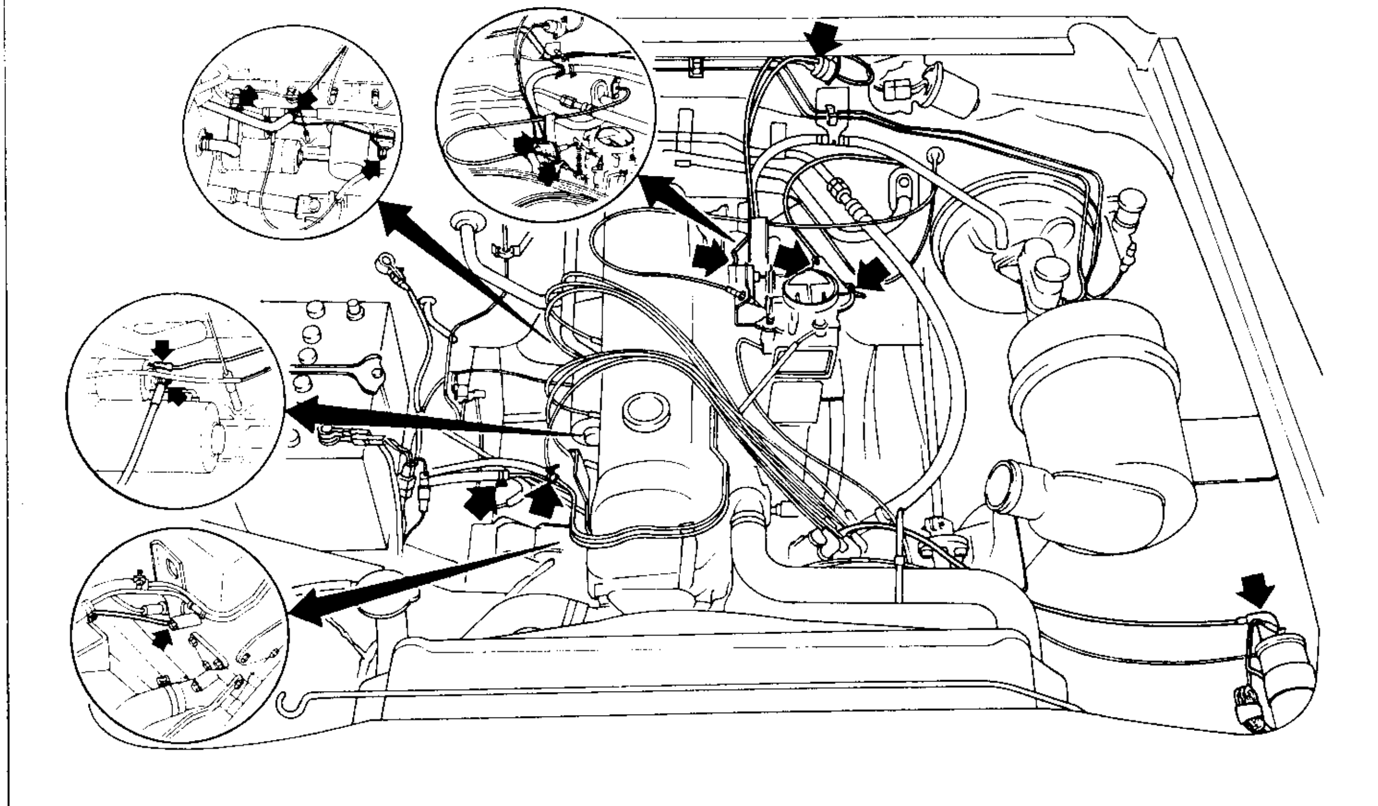
SER064

SD33 engine



SER066

L28 engine



SER065

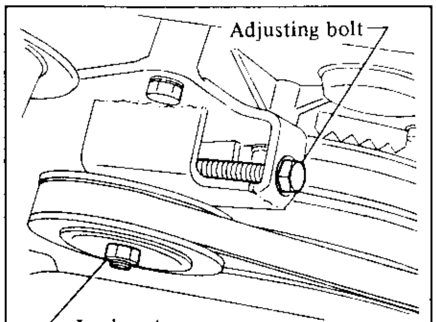
6. Models equipped with air conditioner:

Remove compressor, following the procedures below.

(1) Remove battery or cyclone pre-air cleaner at compressor side.

(2) Remove compressor drive belt.

To remove this belt, loosen both idler pulley nut and adjusting bolt.

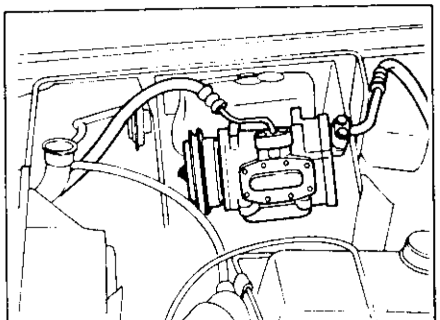


SHA662

(3) Disconnect harness connector and remove compressor.

Place the removed compressor as shown below.

Never discharge gas from compressor while service/repair work is being performed.

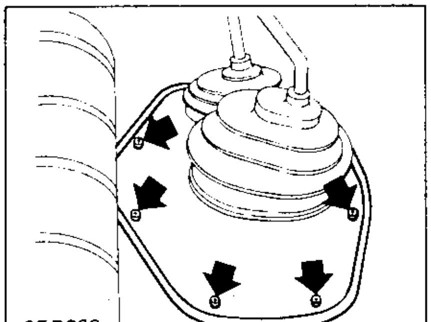


SER068

7. Remove power steering oil pump. **Refer to Section ST.**

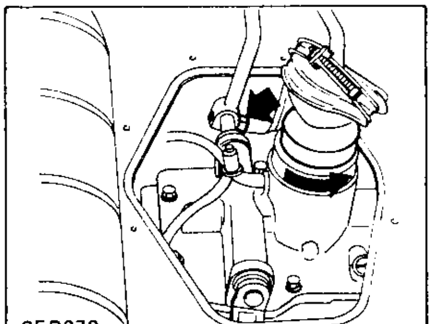
8. Remove transmission and transfer control levers as follows:

(1) Remove floor mat and floor hole cover.



SER069

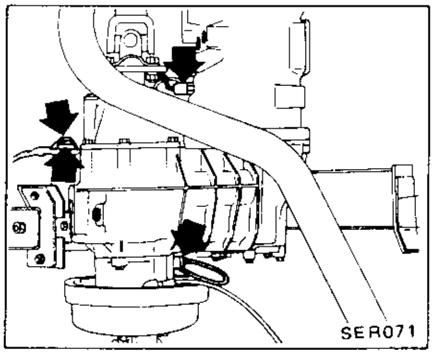
(2) Remove transmission (and transfer) control levers.



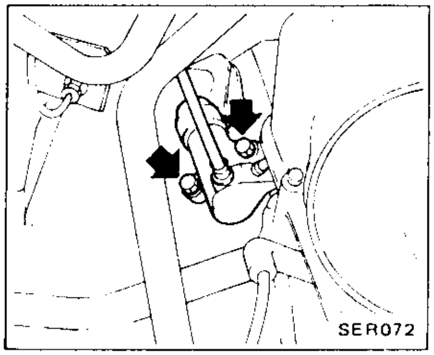
SER070

Refer to Section MT or AT.

9. Remove radiator upper and lower hoses, then remove radiator and radiator shroud.
10. Disconnect speedometer cable, reverse lamp switch harness connector on transmission case (and 4WD switch harness connector on transfer case).



11. Remove hand brake cable.
12. Remove clutch operating cylinder.



13.

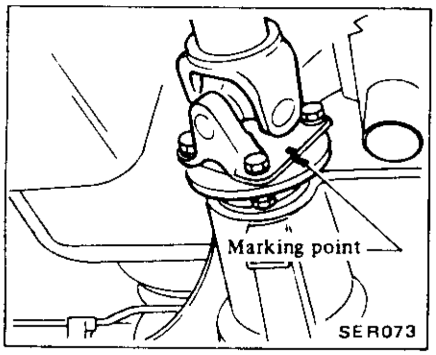
T130A transfer models

Remove front exhaust tube and front and rear propeller shafts.

T100L transfer models

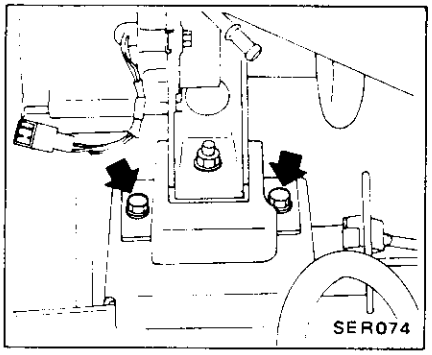
Remove front exhaust tube and pre-propeller shaft. **Refer to Section TF.**

Place marks on propeller shaft before removal to facilitate reinstallation.

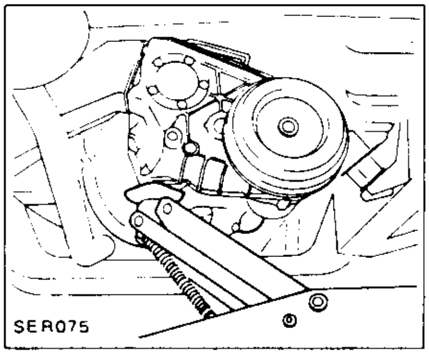


14. Disconnect winch drive shaft from P.T.O. (Models equipped with winch).

15. Remove front engine mounting bracket bolts.



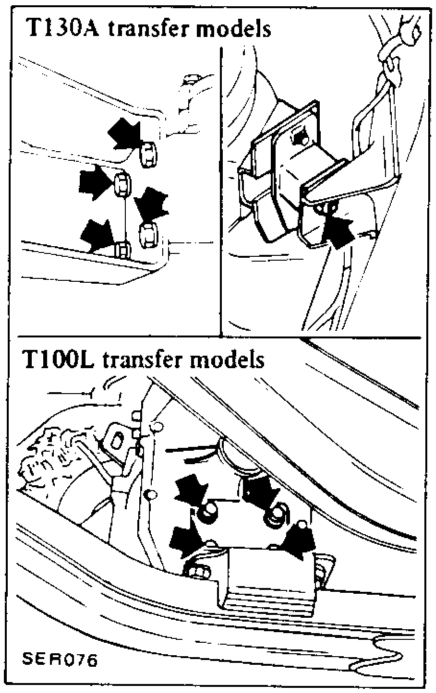
16. Support transmission with garage jack.



17. Attach suitable chains to engine slingers and **support engine using a hoist.**

Do not put tension on the chains.

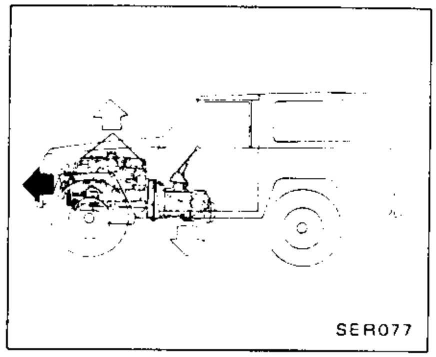
18. Remove rear engine mounting bracket bolts.



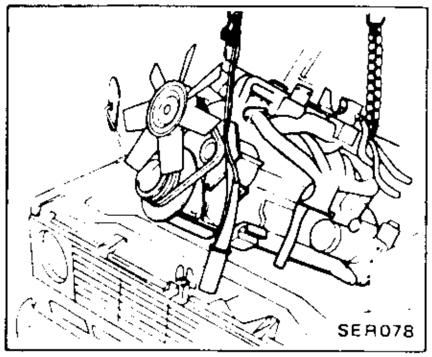
19. While lowering the transmission support, raise engine slightly with a hoist.

> **WARNING:**
> **Before raising engine, make sure it is safe to do so.**

20. Move engine with transmission (and transfer) toward front of vehicle.



21. Raise engine with transmission (and transfer), and remove it from vehicle as a single unit.



> **WARNING:**
> **When raising engine, be especially careful not to bump it against adjacent parts.**

22. Set engine with transmission (and transfer) on an engine stand.

INSTALLATION

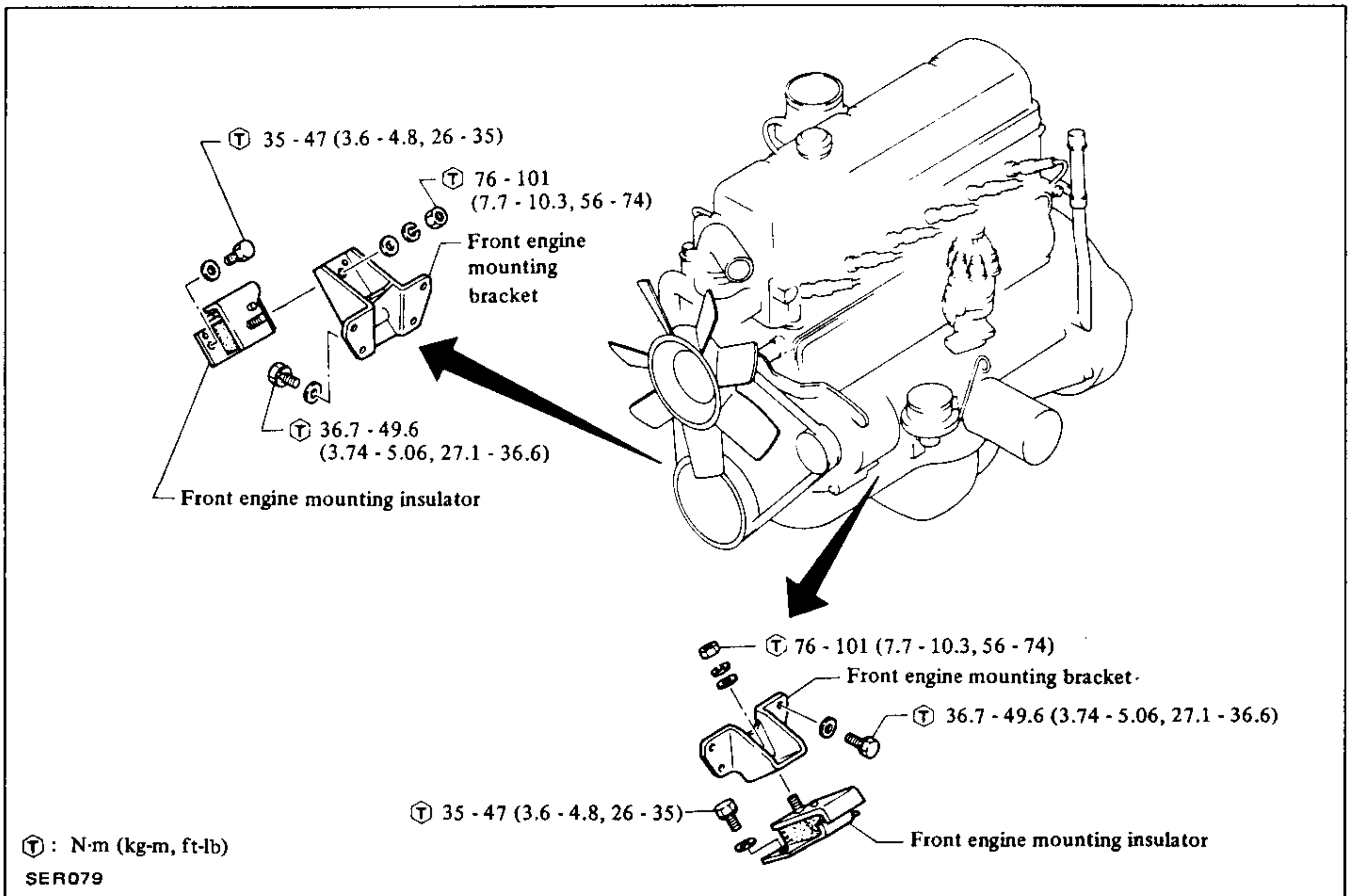
Installation is in reverse order of removal, observing the following:

When installing, be sure to check that electrical harnesses are correctly connected.

1. Adjust hand brake control lever stroke. **Refer to Section BR for adjustment.**
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. Adjust power steering pump belt.
   Refer to Engine Maintenance (Section MA) for checking and adjusting drive belts.
5. 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.**
6. Fill the cooling system with the correct amount of engine coolant.

ENGINE REMOVAL AND INSTALLATION (Canvas Top)

CONSTRUCTION



REMOVAL

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.

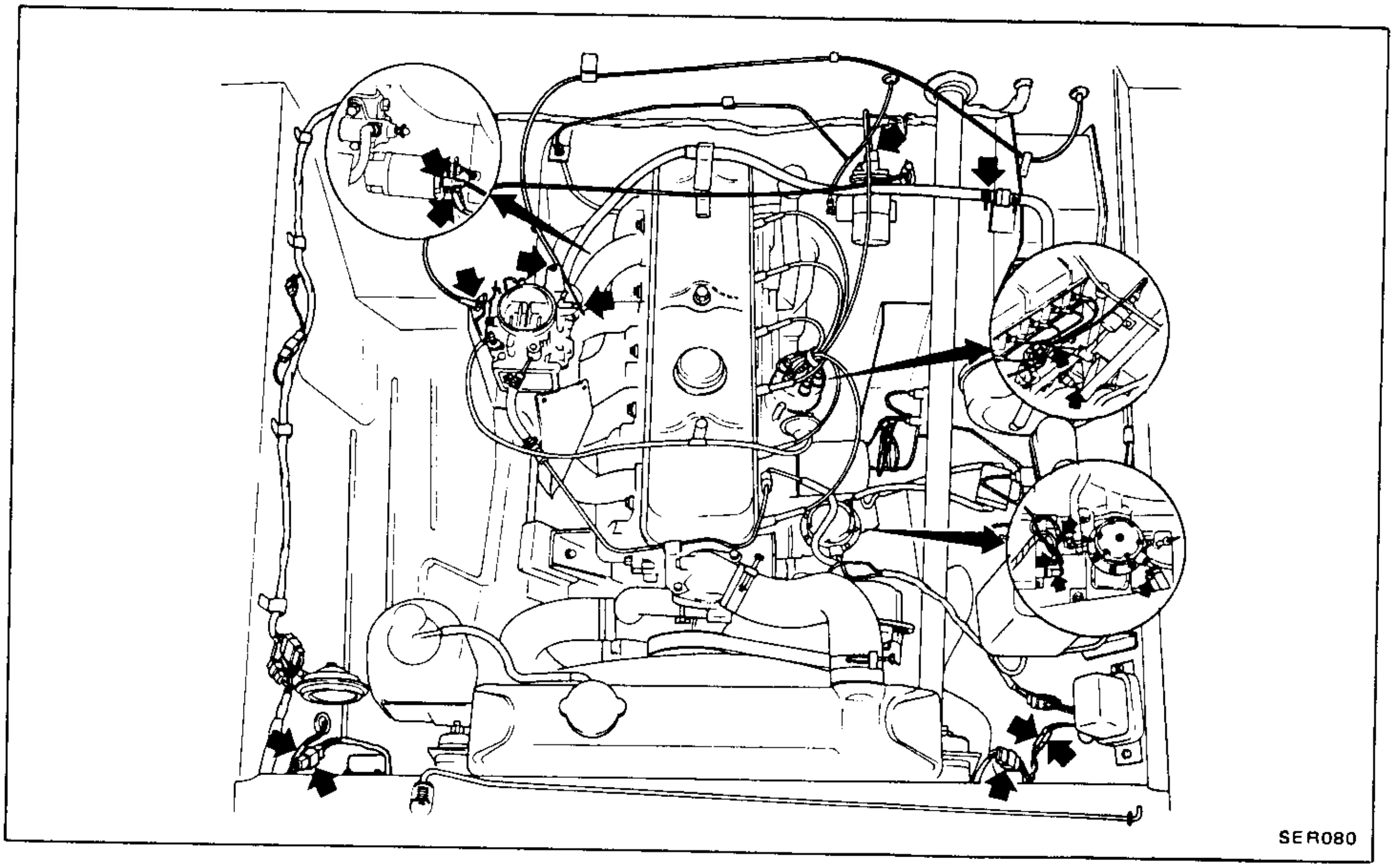
Fender cover should be used to protect vehicle body.

1. Disconnect battery ground cable.
2. Drain engine coolant.
3. Remove hood.

Mark the location of hood hinges on hood to facilitate correct reinstallation.

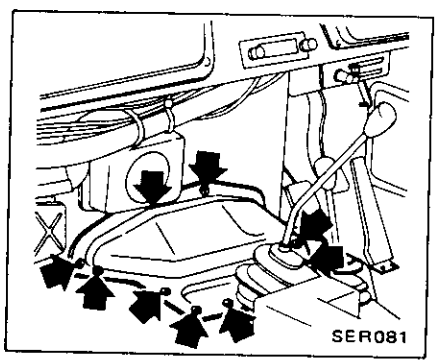
CAUTION:
Have an assistant help you so as to prevent damage to body.

4. Remove air cleaner.
5. Remove all wires and hoses indicated by arrows in the figure below.



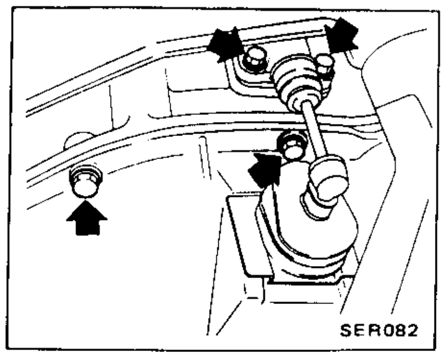
SER080

6. Remove floor hole cover.



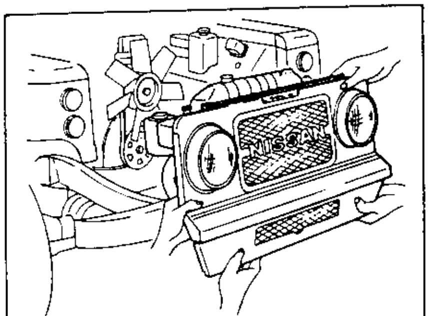
SER081

7. Remove clutch operating cylinder. Then remove bolts which hold the clutch housing to upper side of engine.



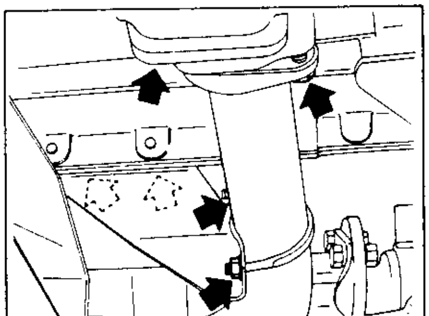
SER082

8. Remove radiator upper and lower hoses, and then remove radiator core support together with radiator.



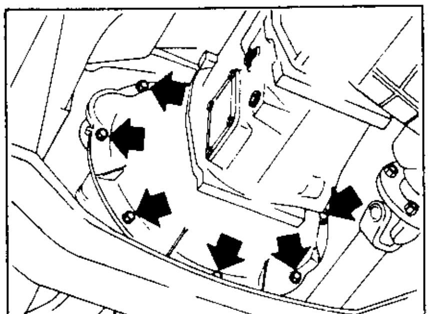
SER083

9. Remove front exhaust tube from exhaust manifold.



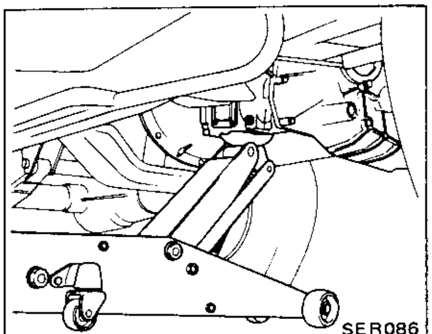
SER084

10. Remove bolts which hold clutch housing to lower side of engine.



SER085

11. Support transmission with garage jack.

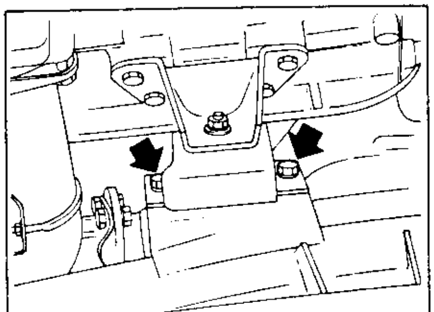


SER086

12. Attach suitable chains to engine slingers and support engine using a hoist.

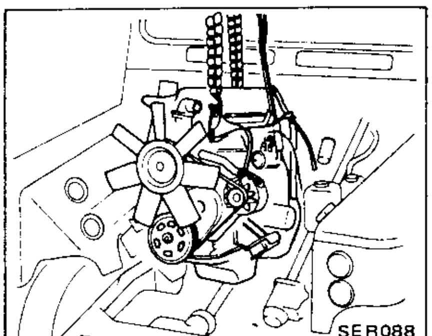
Do not put tension on the chains.

13. Remove front engine mounting bolts.



SER087

14. Slide out engine and remove it from vehicle.



SER088

WARNING:
When raising engine, be especially careful not to bump it against adjacent parts.

15. Set engine on an engine stand.

INSTALLATION

Installation is in reverse order of removal, observing the following:

When installing, be sure to check that electrical harnesses are correctly connected.

1. Adjust accelerator control system. Refer to Engine Control System (Section FE) for adjustment.
2. When reinstalling the hood following engine installation, be sure that it is properly centered and that hood lock operates properly. Refer to Hood (Section BF) for adjustment.
3. Fill the cooling system with the correct amount of engine coolant.

SERVICE DATA AND SPECIFICATIONS

TIGHTENING TORQUE

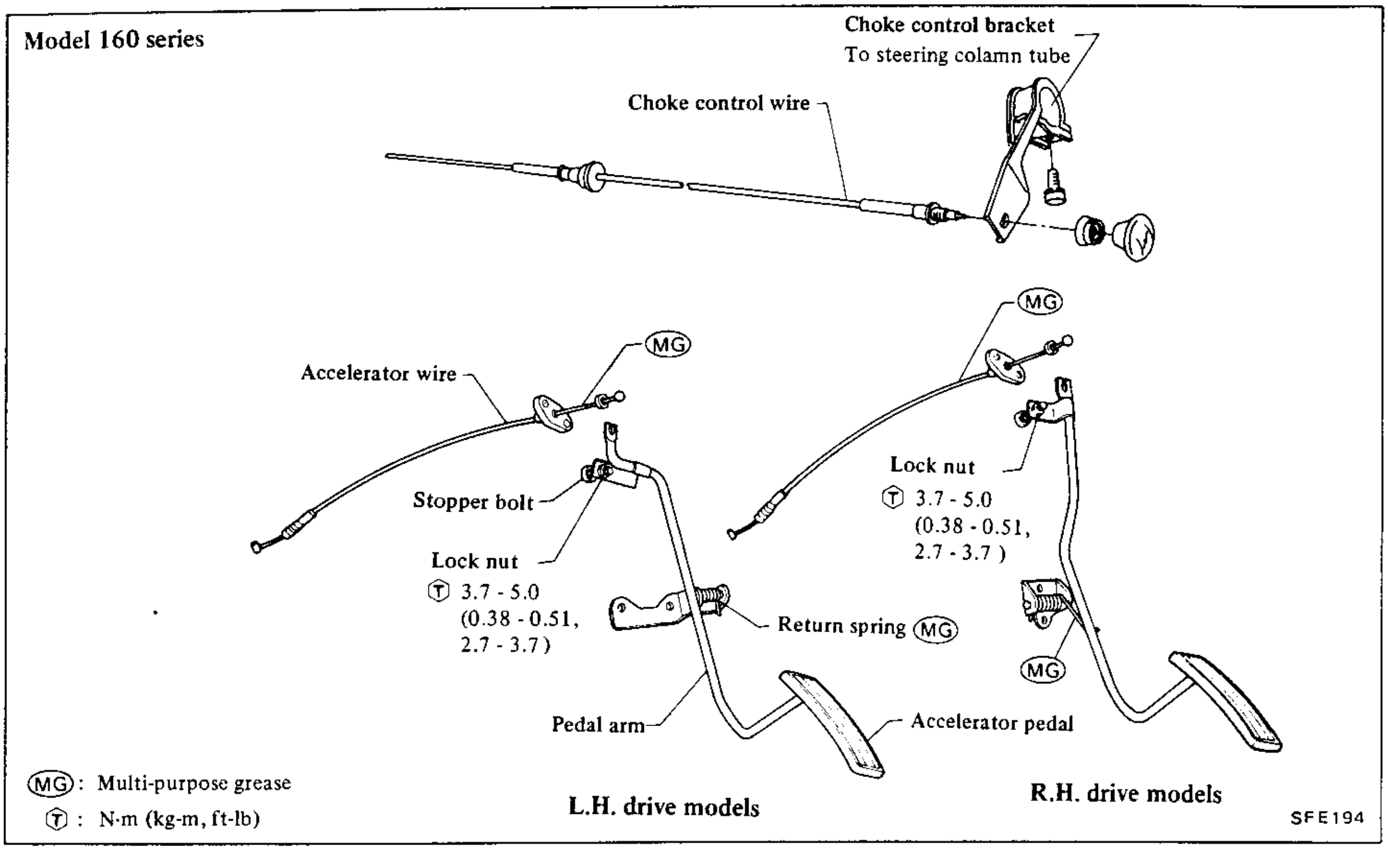
Unit		N·m	kg-m	ft-lb
Front engine mounting bracket to cylinder block	P40	36.7 - 49.6	3.74 - 5.06	27.1 - 36.6
	L28	69 - 81	7.0 - 8.3	51 - 60
	SD33	65.0 - 88.0	6.63 - 8.97	48.0 - 64.9
Front engine mounting insulator to bracket	P40	76 - 101	7.7 - 10.3	56 - 74
	L28	35 - 47	3.6 - 4.8	26 - 35
	SD33	91 - 108	9.3 - 11.0	67 - 80
Front engine mounting insulator to frame		35 - 47	3.6 - 4.8	26 - 35
Rear engine mounting bracket to transfer (or transmission)	P40, SD33, L28 A/T	27 - 36	2.8 - 3.7	20 - 27
	L28 M/T	17 - 22	1.7 - 2.2	12 - 16
Rear engine mounting insulator to bracket		17 - 22	1.7 - 2.2	12 - 16
Rear engine mounting insulator to frame (or member)	P40, SD33	30 - 41	3.1 - 4.2	22 - 30
	L28	17 - 22	1.7 - 2.2	12 - 16
Rear engine mounting member to frame (L28 engine)		50 - 69	5.1 - 7.0	37 - 51
Clutch operating cylinder to engine		30 - 40	3.1 - 4.1	22 - 30
Front exhaust tube to exhaust manifold		26 - 36	2.7 - 3.7	20 - 27
Front exhaust tube to bracket		20 - 22	2.0 - 2.2	14 - 16
Front exhaust tube bracket to oil pan (Canvas Top)		8 - 14	0.8 - 1.4	5.8 - 10.1
Propeller shaft to companion flange		78 - 88	8.0 - 9.0	58 - 65
Compressor to bracket		44 - 54	4.5 - 5.5	33 - 40
Oil pump to bracket		26 - 36	2.7 - 3.7	20 - 27
Clutch housing to engine	P40, SD33	38 - 49	3.9 - 5.0	28 - 36
	L28 "A" Bolt	43 - 58	4.4 - 5.9	32 - 43
	"B" Bolt	25 - 35	2.6 - 3.6	19 - 26

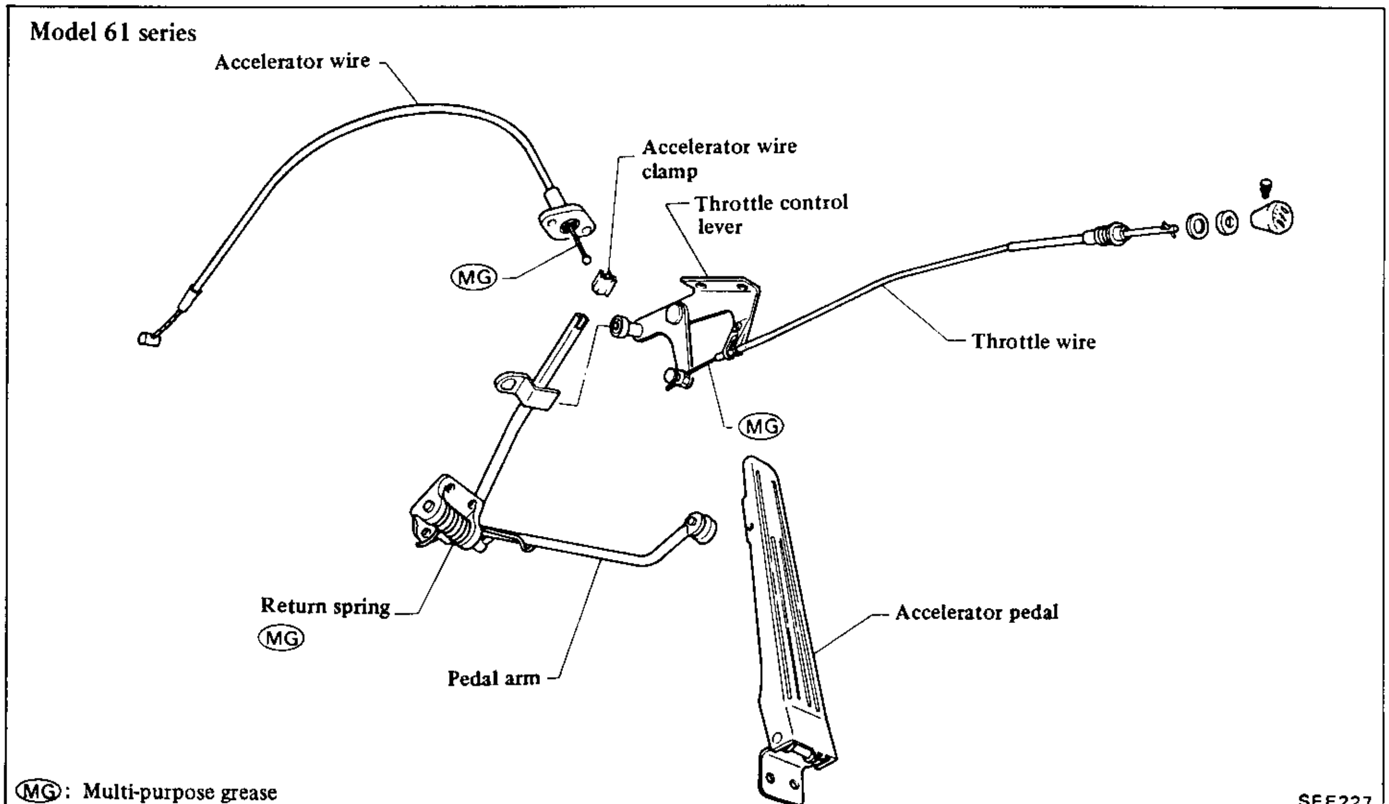
ENGINE CONTROL, FUEL & EXHAUST SYSTEMS

CONTENTS

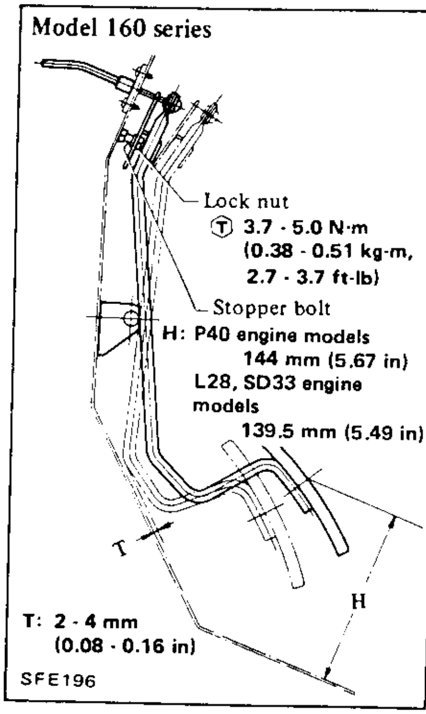
ENGINE CONTROL SYSTEM

ACCELERATOR AND WIRE

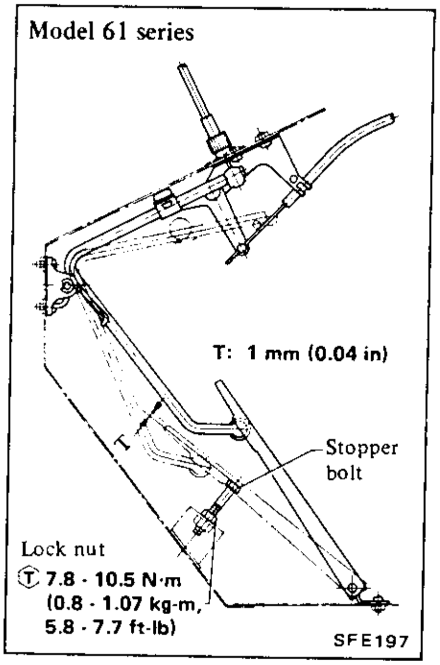




ADJUSTMENT



SFE196



SFE197

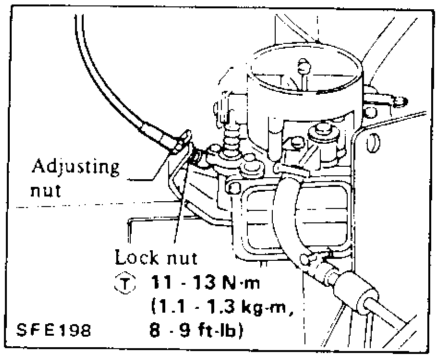
1. Adjust accelerator pedal height "H" with pedal stopper bolt. Then tighten lock nut (Model 160 series).

Pedal height "H":
Except Canvas Top
P40 engine models
144 mm (5.67 in)
L28, SD33 engine models
139.5 mm (5.49 in)

Ⓣ : Stopper lock nut
Model 160 series
3.7 - 5.0 N·m
(0.38 - 0.51 kg-m,
2.7 - 3.7 ft-lb)
Model 61 series
7.8 - 10.5 N·m
(0.8 - 1.07 kg-m,
5.8 - 7.7 ft-lb)

2. Adjust accelerator wire play as follows:

(1) Set throttle valve to completely closed position, with wire sufficiently slackened.
(2) Tighten adjusting nut up to such an extent that throttle lever is about to move (play is zero at the time).
(3) 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.



SFE198

3. After completing the adjustment as previously explained, check the following:

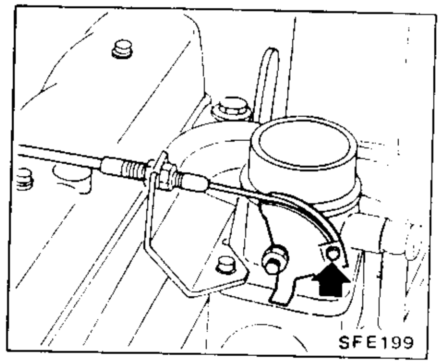
(1) Make sure the accelerator system functions smoothly and quietly without disturbing any adjacent parts.
(2) Model 160 series:
Depress accelerator pedal down until throttle valve fully opens. Make sure that the clearance "T" between accelerator pedal reverse side and dash floor is 2 to 4 mm (0.08 to 0.16 in) without floor mat. Adjust pedal stopper bolt and lock nut if beyound limits.

Model 61 series:
Depress accelerator pedal down until throttle valve fully opens. Make sure that the clearance "T" between accelerator pedal and pedal stopper bolt is 1 mm (0.04 in). Adjust pedal stopper bolt and lock nut if beyond limits.
(3) Check throttle lever if it returns to the original position as soon as accelerator pedal is released.
(4) Apply a small amount of recommended multi-purpose grease as shown on page FE-2.

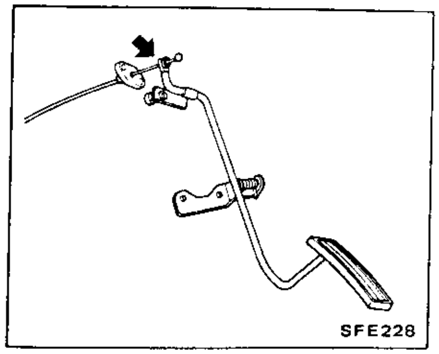
REMOVAL

Accelerator wire

1. Remove air cleaner assembly.
2. Disconnect accelerator wire from carburetor.

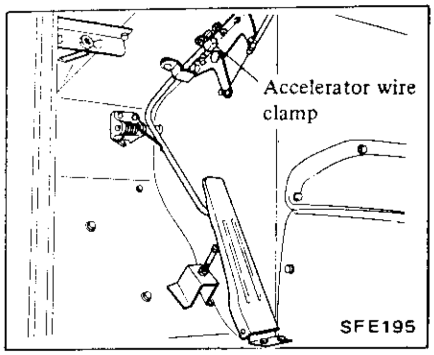

SFE199

3. **Model 160 series:**
Remove nylon collar by pushing it toward the wire end and disconnect accelerator wire from accelerator pedal arm.

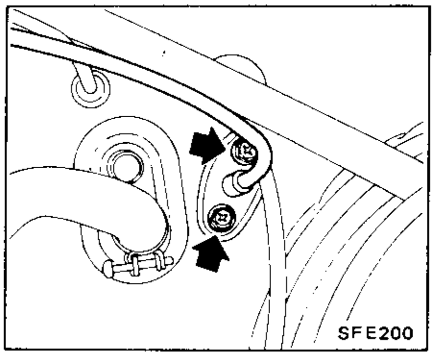

SFE228

Model 61 series:

Remove accelerator wire clamp by pulling it and disconnect accelerator wire from accelerator pedal arm.



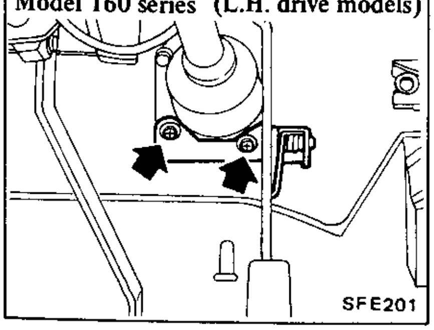
4. Remove outer case of the accelerator wire from the body, and detach accelerator wire.



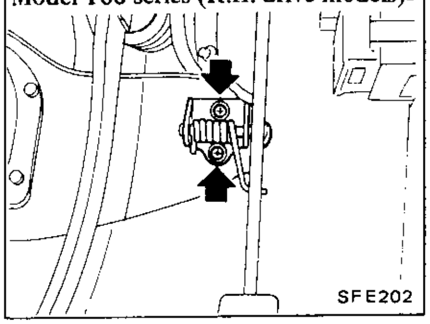
Accelerator pedal

1. Remove nylon collar by pushing it toward the wire end and disconnect accelerator wire from accelerator pedal arm.
2. Remove pedal with bracket.

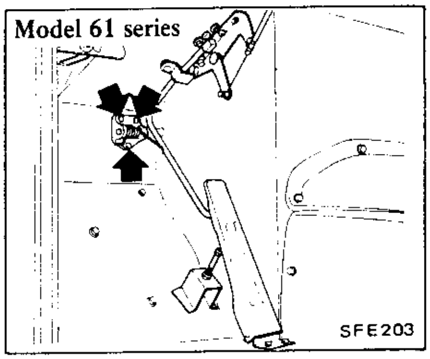
Model 160 series (L.H. drive models)



Model 160 series (R.H. drive models)



Model 61 series



INSPECTION

Accelerator pedal and wire

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

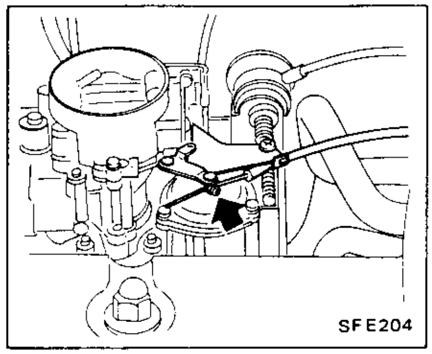
To install, reverse the order of removal.

Apply a small amount of recommended multi-purpose grease to portion (MG) as shown on page FE-2.

CHOKE CONTROL WIRE (Gasoline engine)

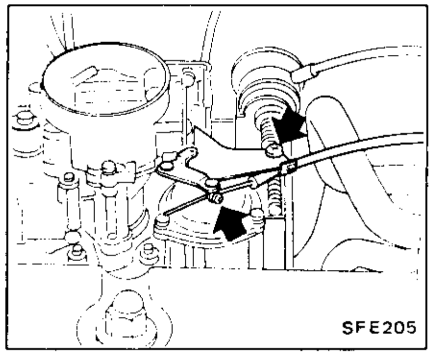
ADJUSTMENT

The choke control adjustment is accomplished when carburetor choke valve returns to its original position as choke knob is fully pushed in. The wire should be slack when it is securely connected to carburetor.

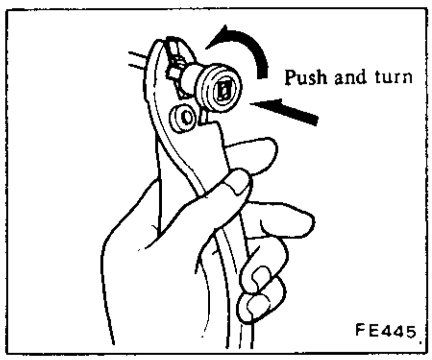


REMOVAL

1. Remove air cleaner assembly.
2. Disconnect choke wire from choke control lever of carburetor.



3. Remove choke knob. Pull out knob, hold wire with pliers, and then rotate knob 90° counterclockwise while pushing on knob. Wrap wire with rags to avoid damaging wire.

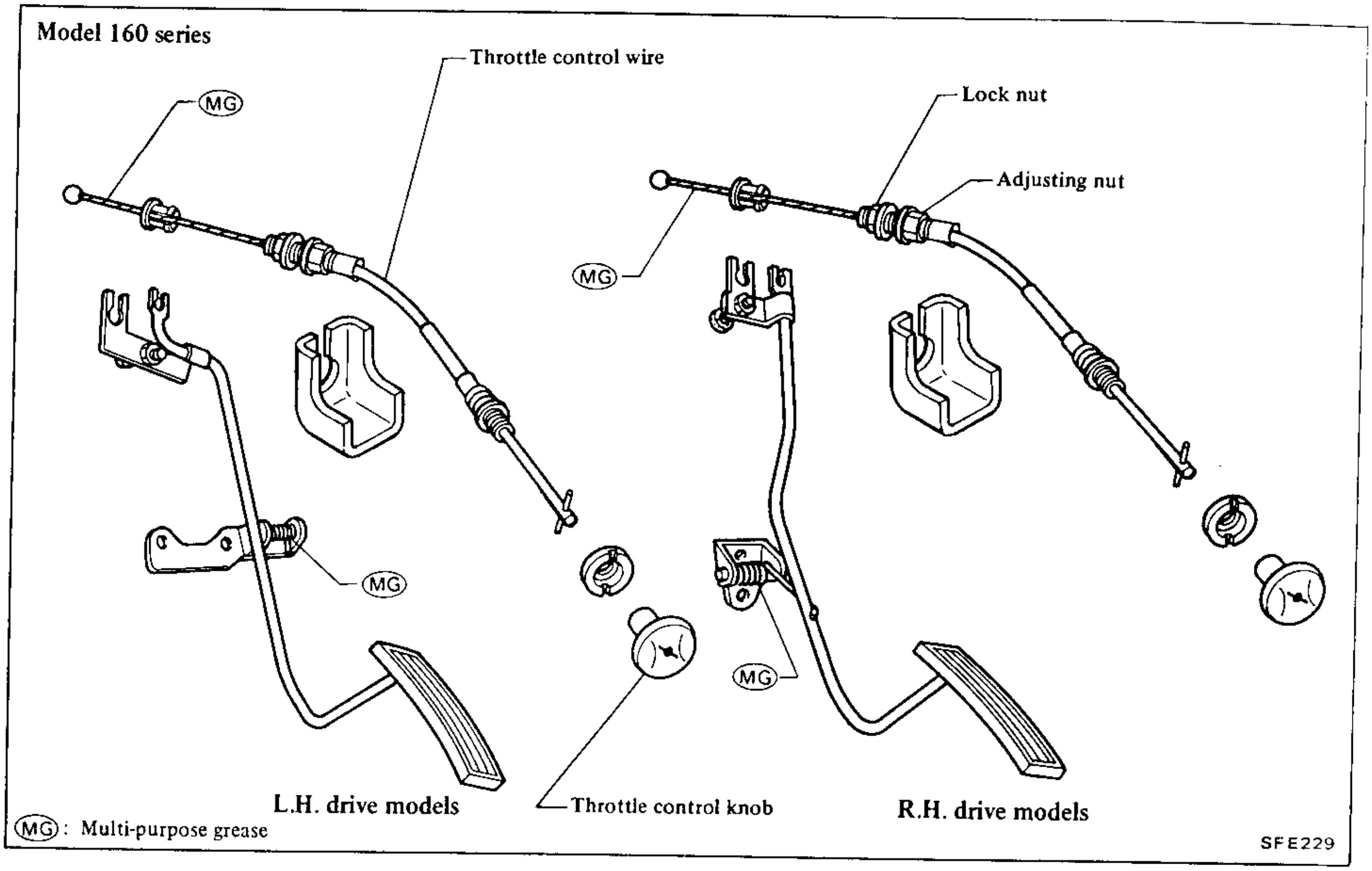


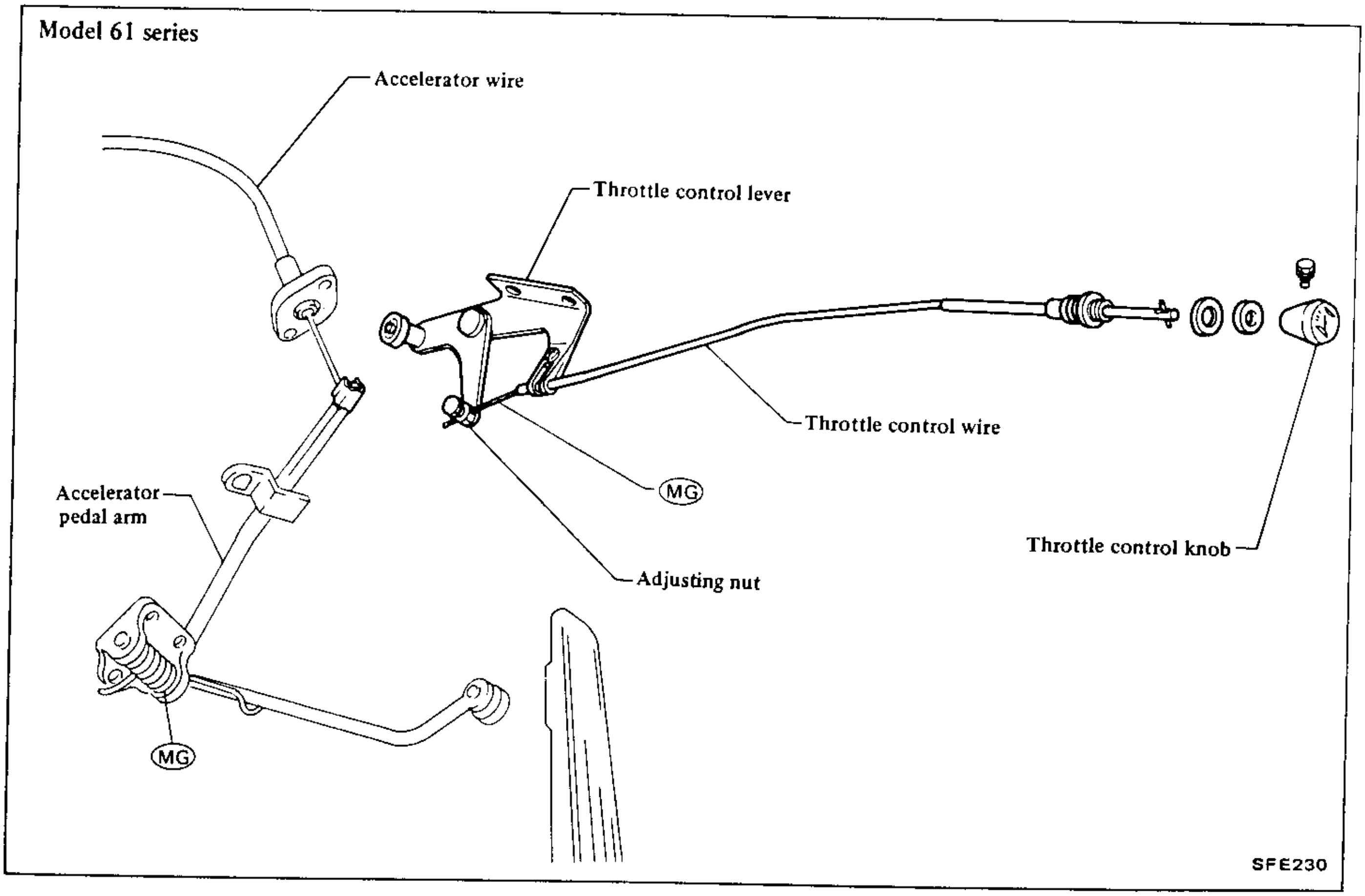
4. Remove lock nut securing wire to instrument panel and take out choke control wire as an assembly.

INSTALLATION

To install, reverse the order of removal.

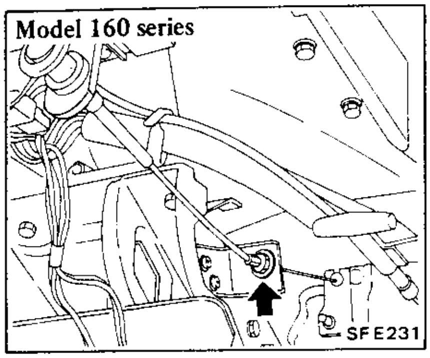
THROTTLE CONTROL WIRE

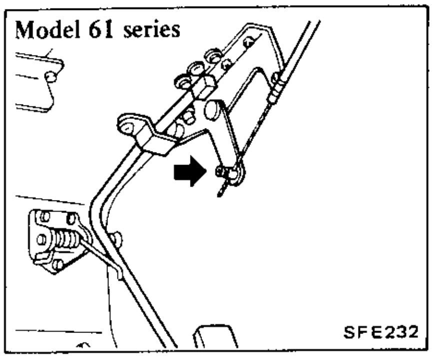




ADJUSTMENT

After adjusting accelerator wire length and accelerator pedal height, adjust throttle control wire length with adjusting nut at bracket so that accelerator pedal keeps its original position when pushing in throttle control knob completely.

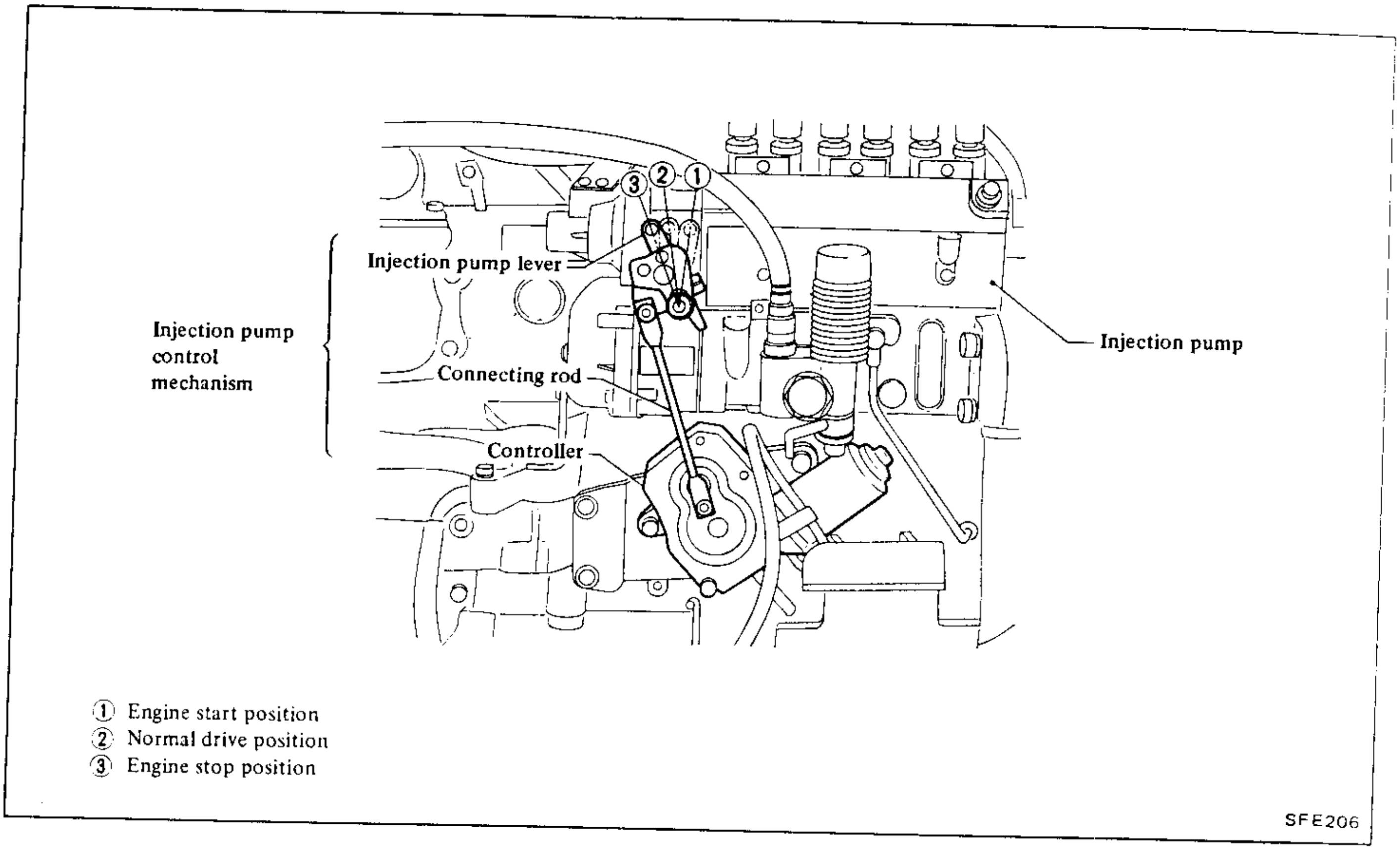




REMOVAL AND INSTALLATION

1. Disconnect throttle control wire from pedal arm.
2. Disconnect throttle control wire from throttle control wire bracket.
3. Pull out throttle control knob.
4. To install, reverse the order of removal.

INJECTION PUMP CONTROL MECHANISM (Diesel engine)



DESCRIPTION

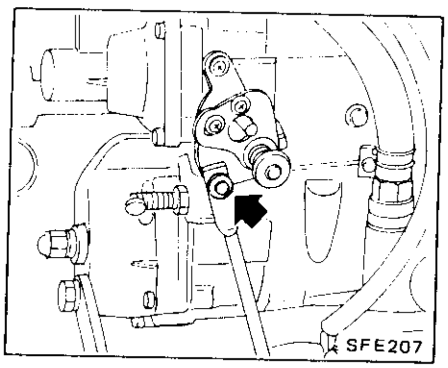
The injection pump control system is controlled by the ignition key in order to start, operate or stop the fuel injection pump.

The injection pump control mechanism is controlled by the injection pump control unit (D.P.C. module), thereby controlling the amount of fuel injection by operating the injection pump lever.

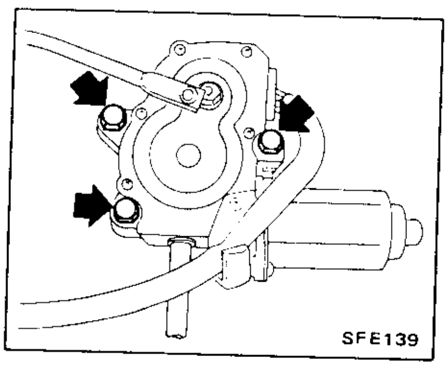
When the ignition key is in the "START" position, the injection pump lever is set at position ①, thereby increasing the fuel causing the engine to start. After starting the engine (with the ignition key in the "ON" position), the injection pump lever moves to position ②. When the ignition key is in the "OFF" position, the injection pump lever moves to position ③, thereby cutting off the fuel injection causing the engine to stop.

REMOVAL

1. Remove connecting rod.



2. Remove controller.



INSTALLATION

To install, reverse the order of removal.

Prior to assembling, ensure that controller and injection pump lever are positioned at STOP.

INSPECTION

Refer to Injection Pump Control System (Section EL).

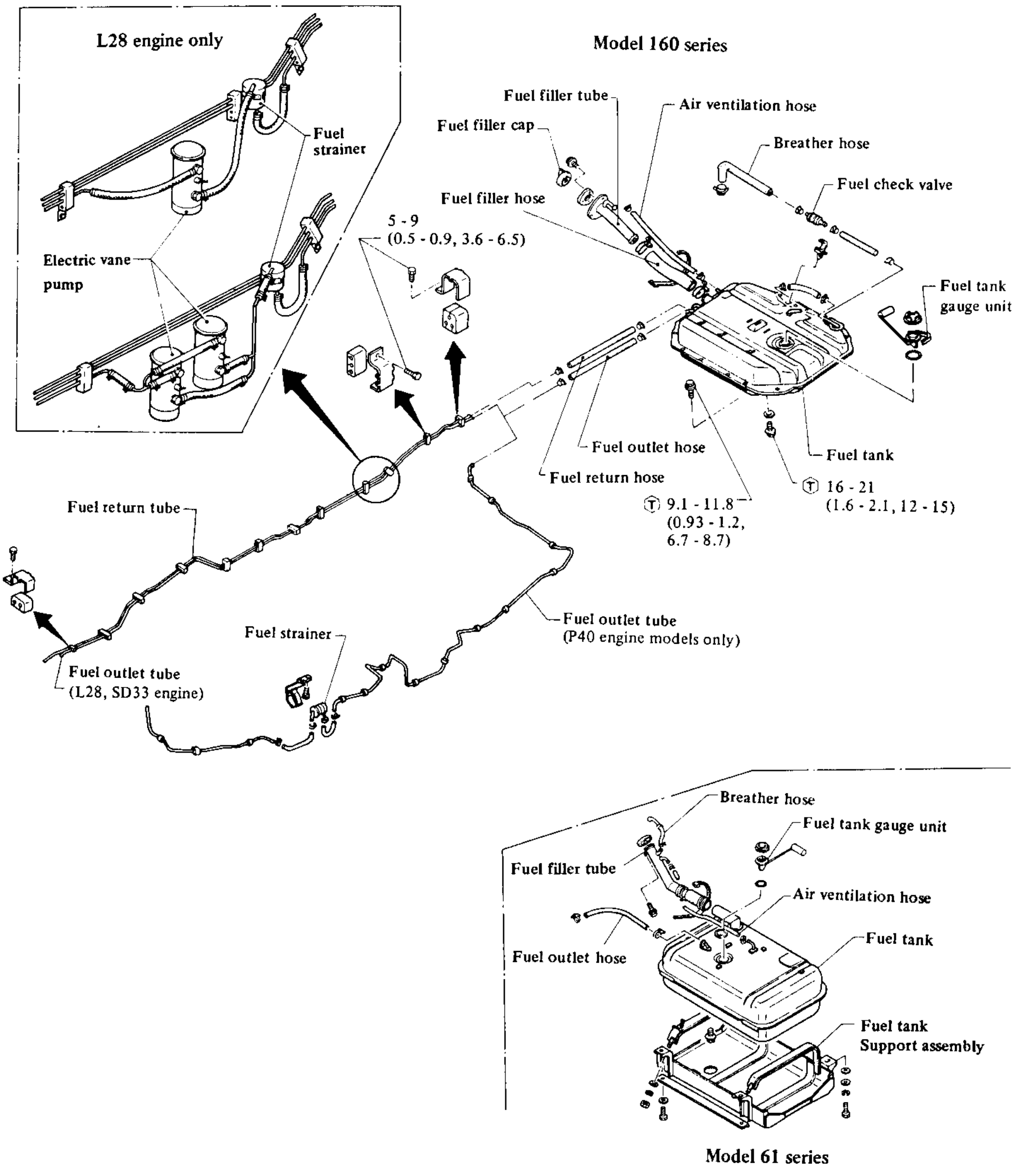
TROUBLE-SHOOTING

Refer to Injection Pump Control System (Section EL).

INJECTION PUMP CONTROL UNIT (D.P.C. module)

Refer to Injection Pump Control Unit (Section EL).

FUEL SYSTEM



Ⓣ : N·m (kg-m, ft-lb)

SFE241

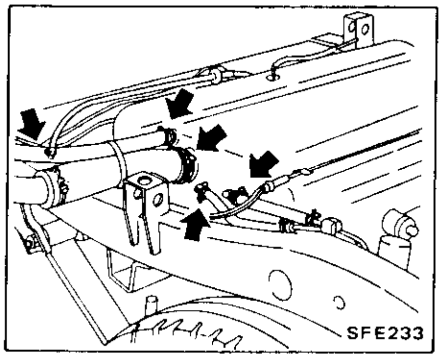
REMOVAL

> **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

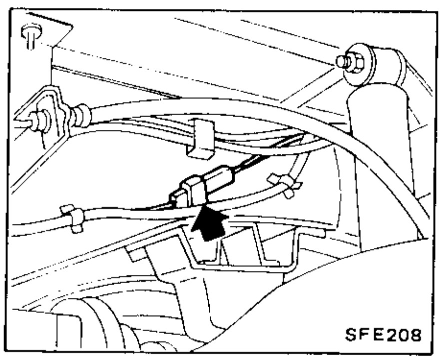
1. Disconnect battery ground cable.
2. Drain fuel from fuel tank.
3. Disconnect following parts.

- Fuel filler hose
- Air ventilation hose
- Fuel outlet hose
- Fuel return hose
- Breather hose



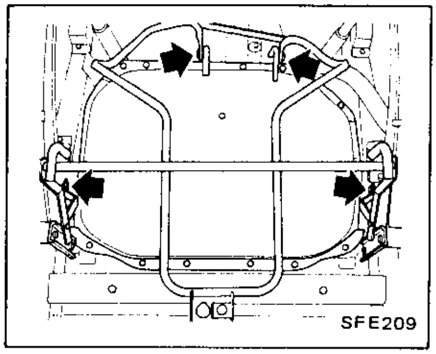
SFE233

- Fuel tank gauge unit wire connector



SFE208

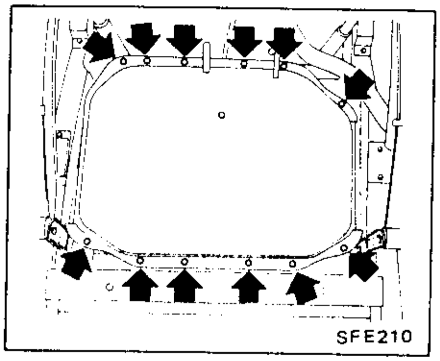
4. Remove spare tire and spare tire carrier.



SFE209

5. Remove fuel tank.

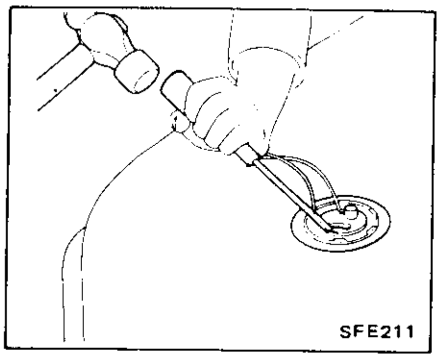
Plug hose and pipe opening to prevent entry of dust or dirt during removal.



SFE210

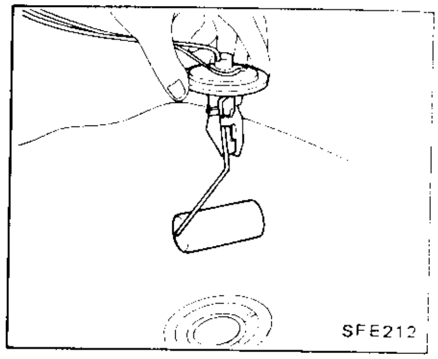
FUEL TANK GAUGE UNIT

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.



SFE211

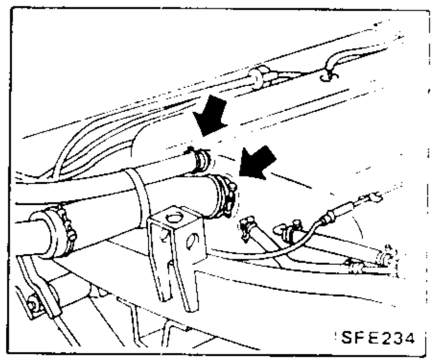
5. Remove fuel tank gauge unit from tank. **Plug tank unit opening to prevent entry of dust or dirt.**



SFE212

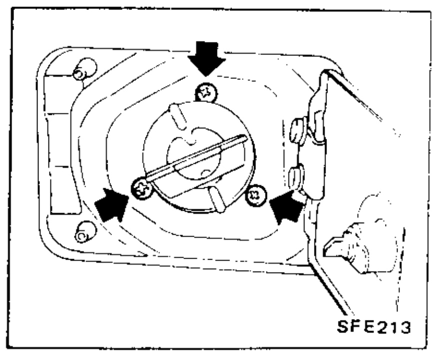
FUEL FILLER TUBE AND HOSE

1. Disconnect battery ground cable.
2. Drain fuel from fuel tank.
3. Disconnect fuel filler hose and air ventilation hose from fuel tank.



SFE234

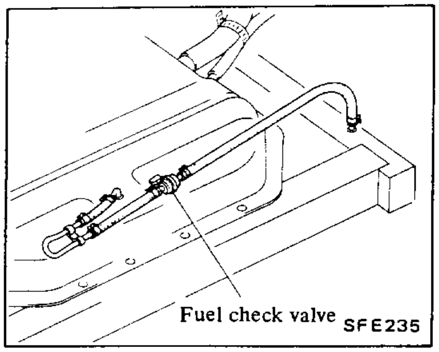
4. Remove fuel filler neck attaching bolts and remove fuel filler hose and tube.



SFE213

FUEL CHECK VALVE

1. Remove fuel tank.
2. Remove fuel check valve.



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 or 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 PUMP AND FUEL FILTER

Refer to Section EF.

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

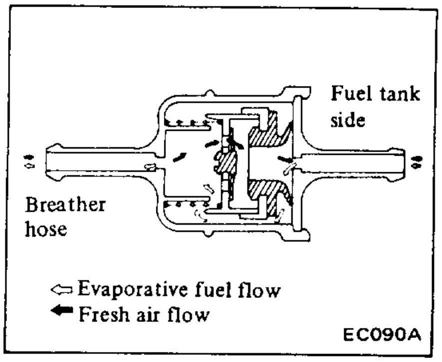
1. Blow air through connector on fuel tank side.

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 breather hose.

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.



FUEL FILTER

Refer to Fuel Filter (Section EF) for inspection.

INSTALLATION

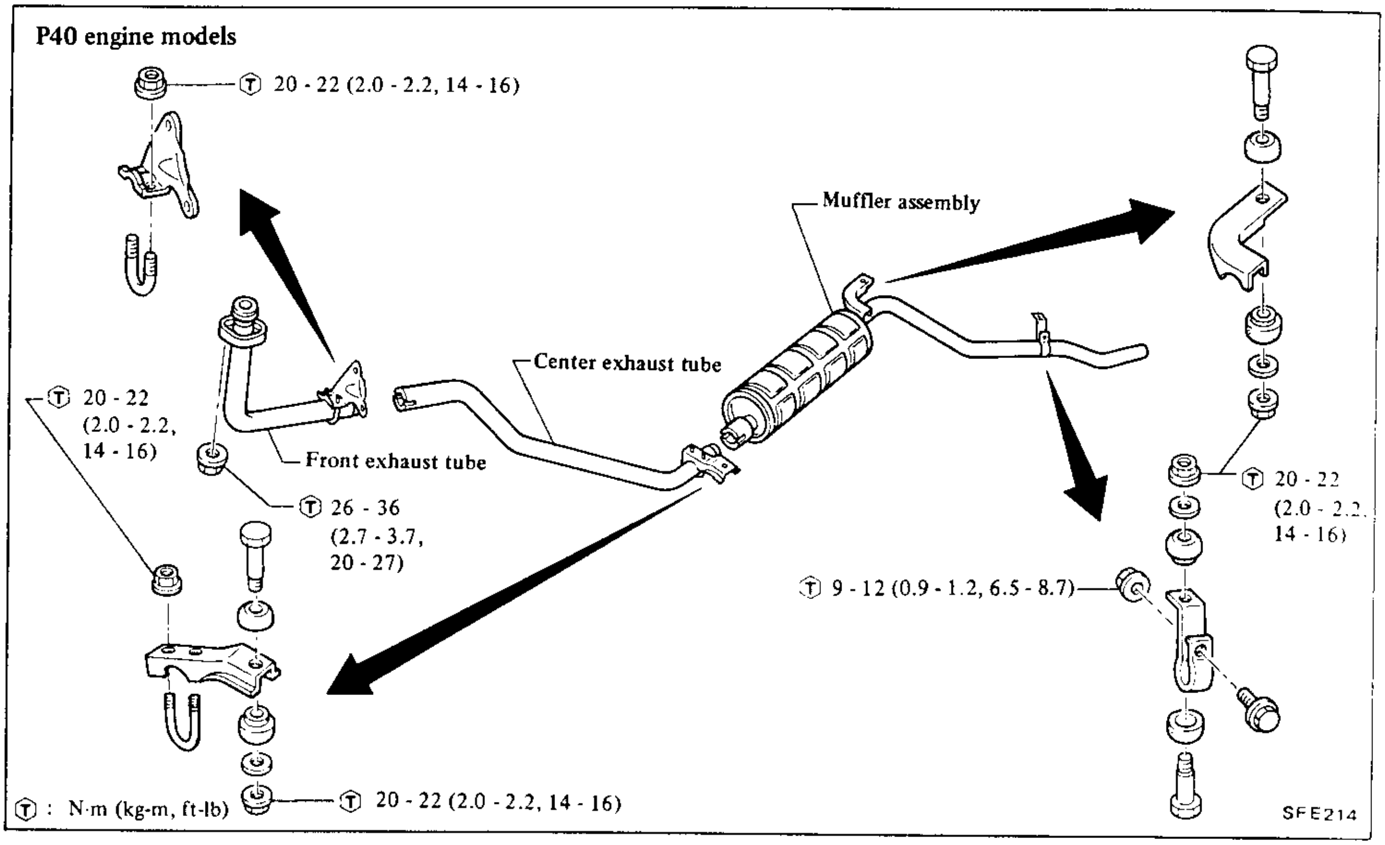
To install, reverse the order of removal. Observe the following:

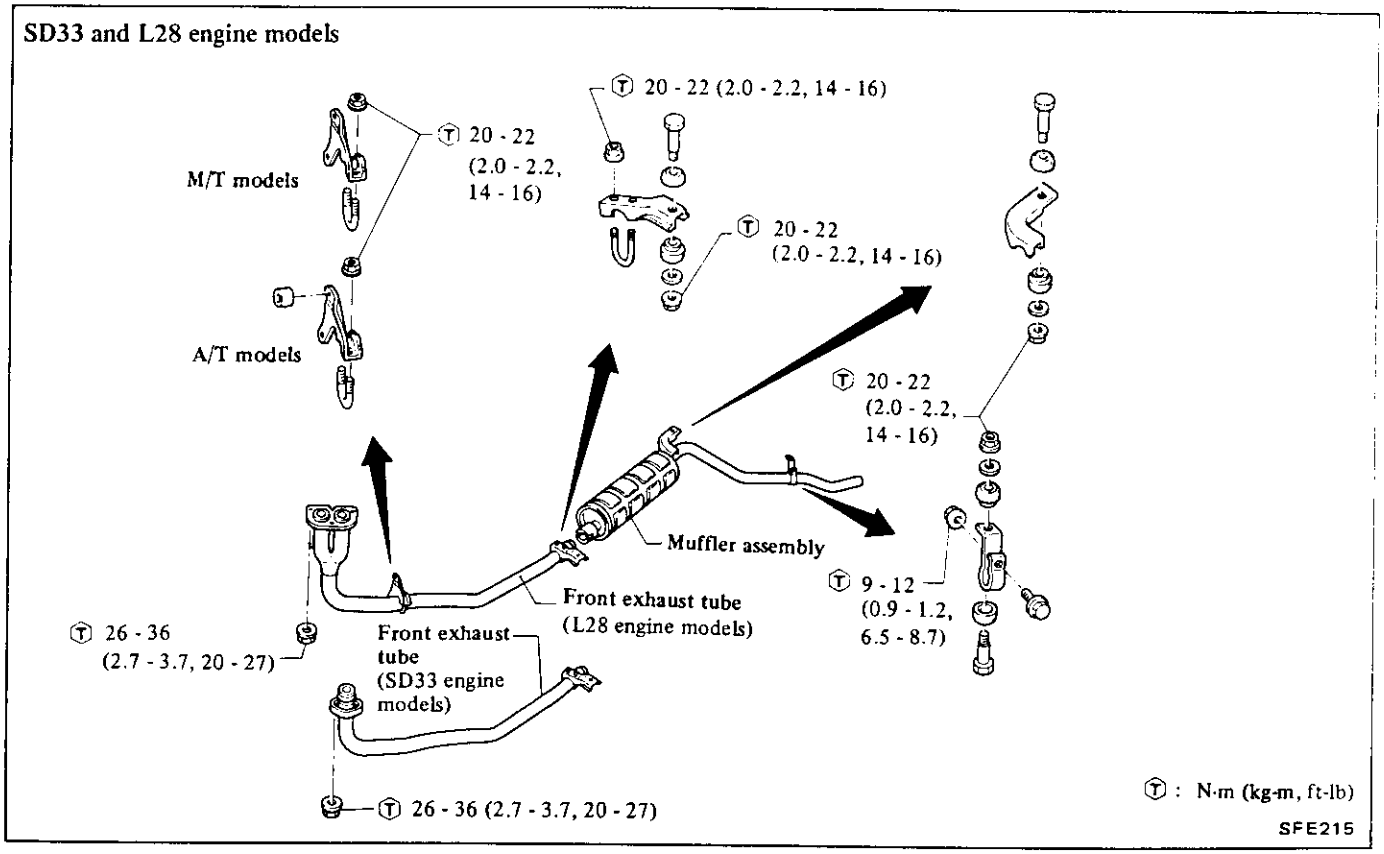
a. Install hose clamps securely. Do not tighten excessively to avoid damaging hoses.
b. Fasten fuel tube clamps on underbody securely. Failure to follow this caution could result in damage to the surface of fuel tube.
c. Do not kink or twist hose and tube when they are routed.
d. Install fuel filler 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 fuel 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
16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)
Fuel tank securing bolt
9.1 - 11.8 N·m
(0.93 - 1.20 kg-m,
6.7 - 8.7 ft-lb)

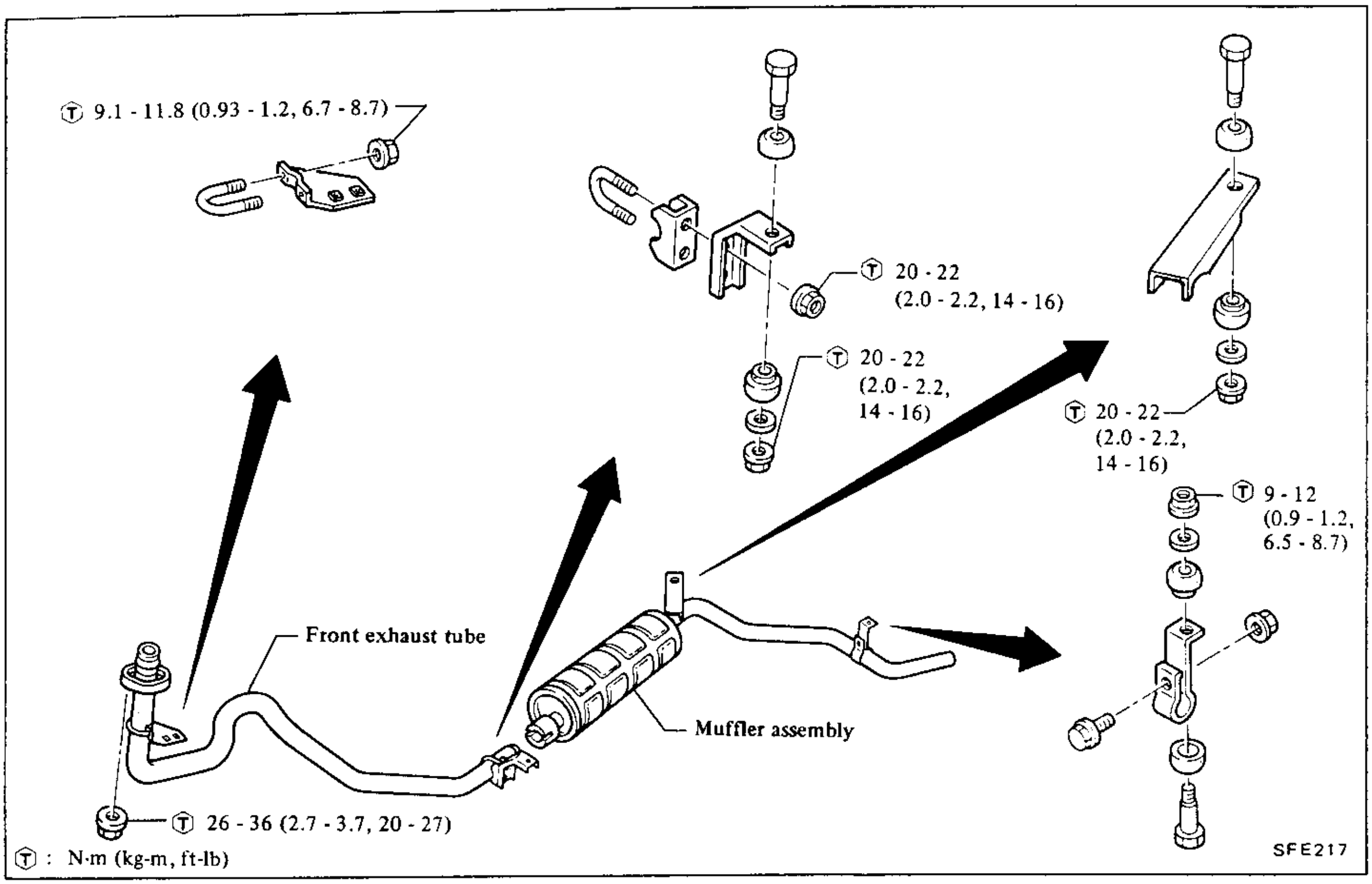
EXHAUST SYSTEM

Model 160 series





Model 61 series

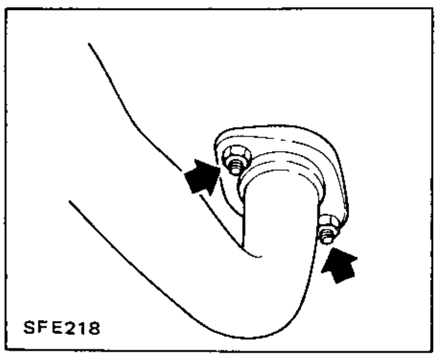


REMOVAL

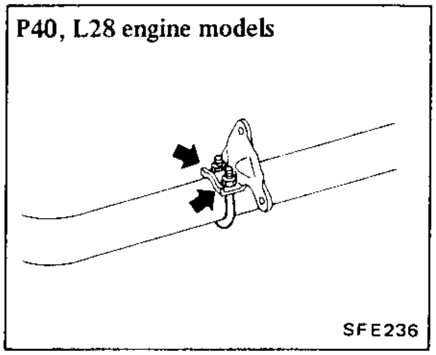
FRONT TUBE

Model 160 series

1. Remove muffler assembly. **Refer to Muffler and Tail Tube for removal.**
2. Remove nuts attaching front exhaust tube to exhaust manifold.



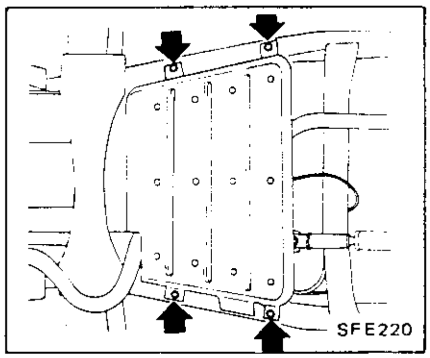
3. Remove exhaust mounting bracket to clutch housing (P40, L28 engine models).



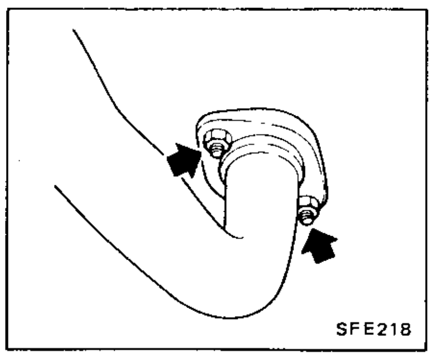
4. Front exhaust tube can then be taken out.

Model 61 series

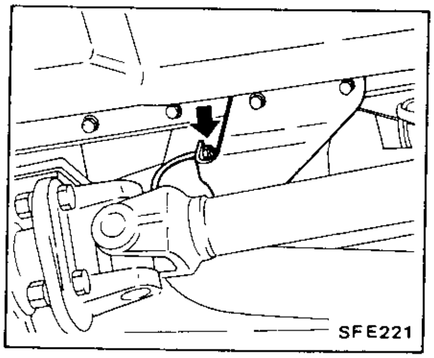
1. Remove gear box protector.



2. Remove muffler assembly. Refer to Muffler and Tail Tube for removal.
3. Remove nuts attaching front exhaust tube to exhaust manifold.



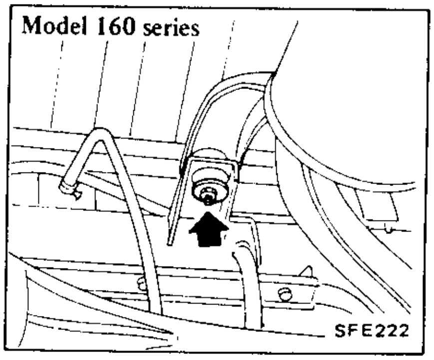
4. Remove front exhaust tube bracket.

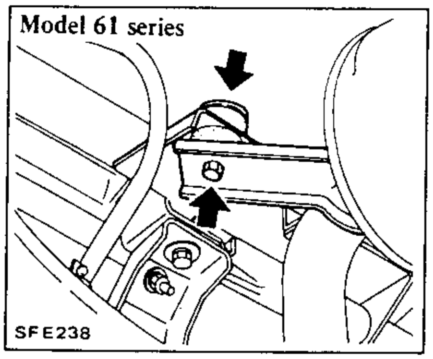


5. Front exhaust tube can then be taken out.

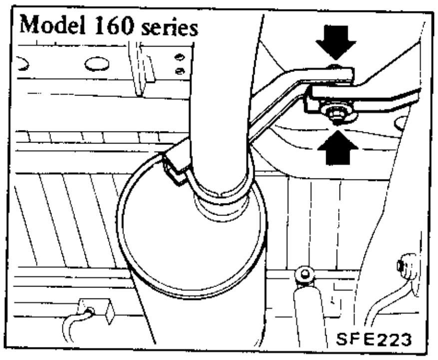
MUFFLER AND TAIL TUBE

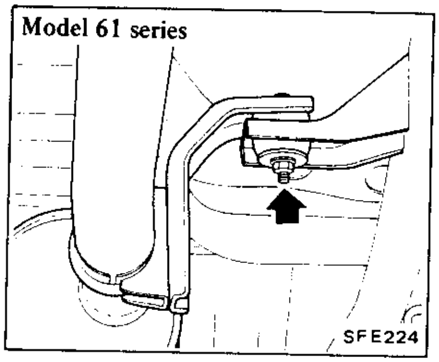
1. Remove muffler rear mounting bracket.



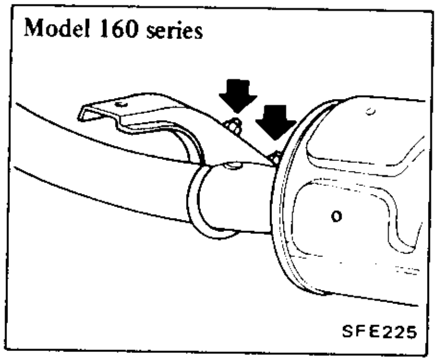


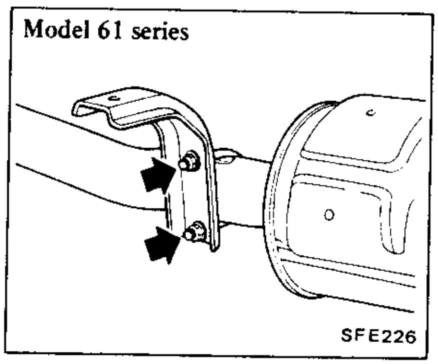
2. Remove muffler front mounting bracket.





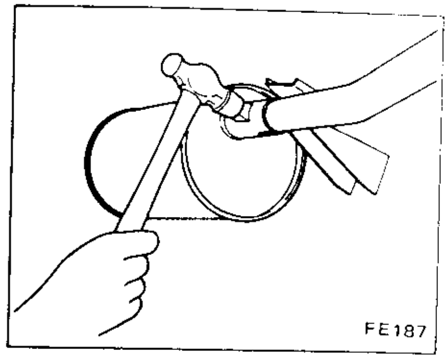
3. Remove exhaust tube U-bolt clamp.

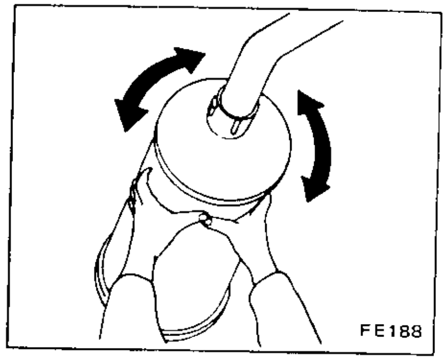




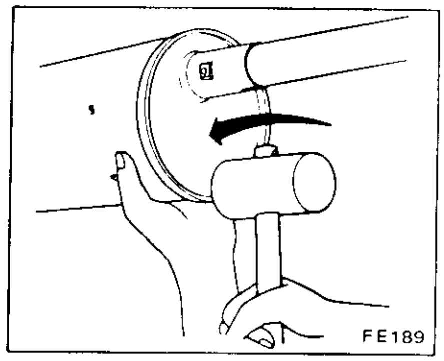
4. Break sealant off at front tube to main muffler connection.

(1) Break old sealant off at the connection by lightly tapping around the tube with a hammer and twisting muffler.





(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.



5. 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:

T : Exhaust manifold to front tube nut:
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)

U-bolt securing nut:
20 - 22 N·m
(2.0 - 2.2 kg-m,
14 - 16 ft-lb)

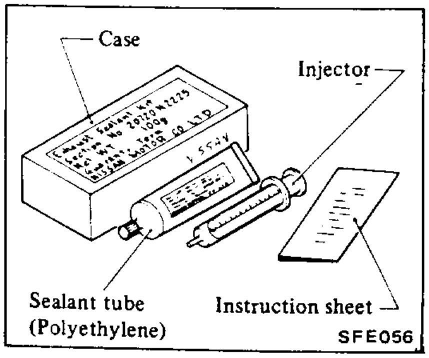
Muffler mounting bracket bolt:
20 - 22 N·m
(2.0 - 2.2 kg-m,
14 - 16 ft-lb)

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.

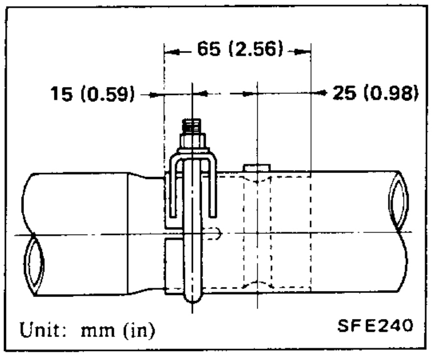
c. Check all tube connections for exhaust gas leaks, and entire system for unusual noises, with engine running.

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. 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. Connect front tube, center tube and tail tube referring to illustration below.

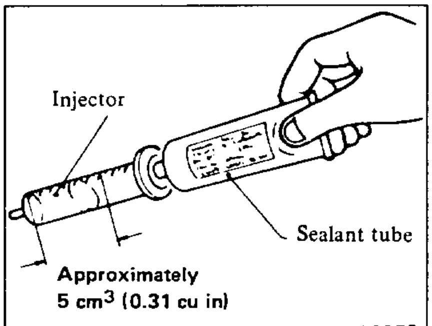


SFE240

4. Tighten following bolts and nuts to specified torque.
- Exhaust manifold securing nut
- Muffler mounting bracket bolt
- Rear tube mounting bolt

5. Squeeze approximately 5 cm^3 (0.31 cu in) of sealant into injection from sealant tube.

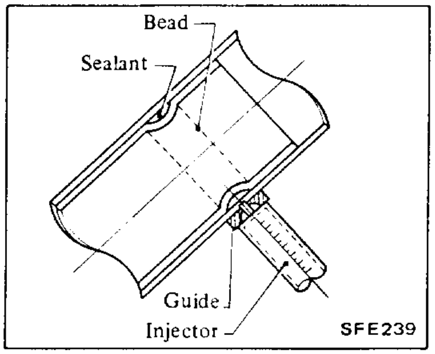
Be sure to place cap back to sealant tube since sealant will dry.



SFE058

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.



SFE239

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. Thoroghly read the instruction sheet furnished with the kit before using the sealant.

CLUTCH

CONTENTS

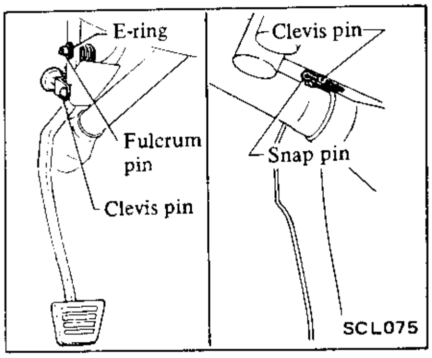
Refer to Section MA (Clutch) for:
- CHECKING CLUTCH PEDAL HEIGHT AND FREE PLAY OR FREE TRAVEL

HYDRAULIC CLUTCH CONTROL

CLUTCH PEDAL

REMOVAL

1. Pry off snap pin and take out clevis pin.



2. After removing E-ring (160 series) or bolts and pedal shaft plates (61 series), remove or pull out fulcrum pin, then remove clutch pedal and return spring.

INSPECTION

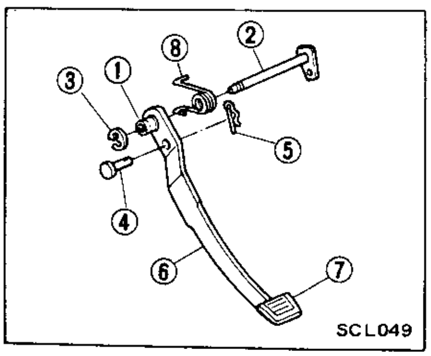
Inspect the following parts: If abnormalities are found, repair or replace the affected parts.

1. Clutch pedal bushing ① at boss, fulcrum pin ② and E-ring ③ (160 series)/pedal shaft plate ⑨ (61 series) for wear, deformation or damage.

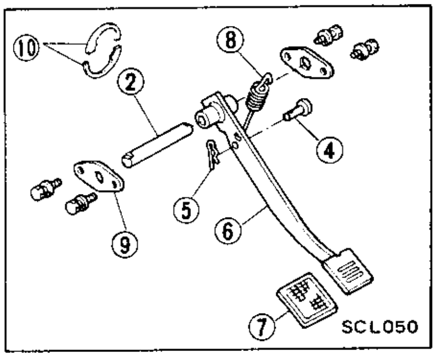
Bushing is press-fitted. If it shows sign of abnormality, replace pedal assembly.

2. Clevis pin ④ for wear or damage, and snap pin ⑤ for any deformation.
3. Pedal ⑥, pedal pad ⑦ and pedal stopper for deformation or damage.
4. Return spring ⑧ for fatigue or damage.

160 series



61 series



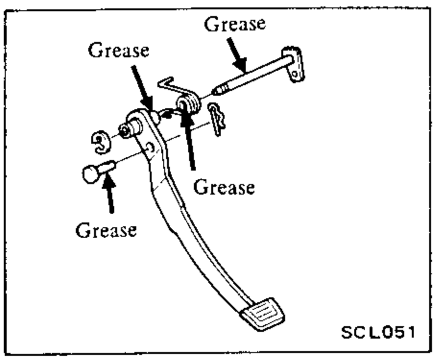
1 Clutch pedal bushing
2 Fulcrum pin
3 E-ring
4 Clevis pin
5 Snap pin
6 Clutch pedal
7 Pedal pad
8 Return spring
9 Pedal shaft plate
10 Master cylinder shim

INSTALLATION

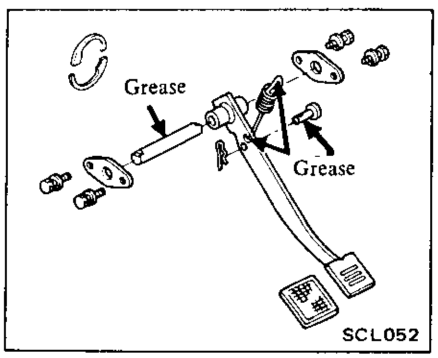
1. Install clutch pedal in reverse order of removal.
   Observe the following:

a. **Apply grease to boss of clutch pedal (160 series), return spring, clevis pin and fulcrum pin.**

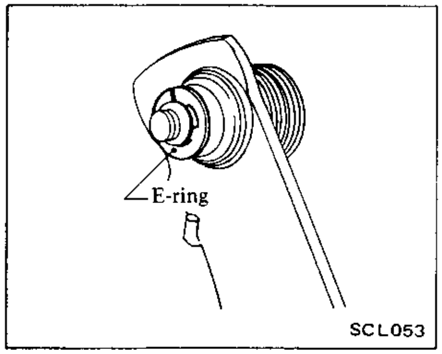
160 series



61 series



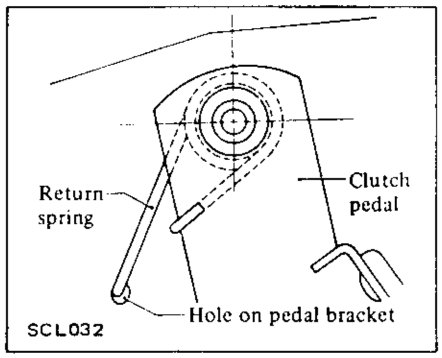
b. **Firmly attach E-ring to fulcrum pin (160 series).**



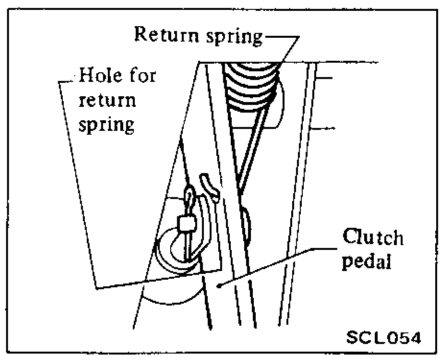
c. **Be sure to insert clevis pin from the opposite side of accelerator pedal (160 series)/the side of accelerator pedal (61 series) and attach snap pin securely.**

d. **Install return spring as shown below.**

160 series



61 series



2. After assembly, adjust clutch pedal height and free play.

Refer to Clutch Pedal Height and Free play (Section MA):

Ⓣ : **160 series**

Pedal stopper bolt lock nut
8 - 11 N·m
(0.8 - 1.1 kg-m,
5.8 - 8.0 ft-lb)

Master cylinder push rod lock nut
8 - 12 N·m
(0.8 - 1.2 kg-m,
5.8 - 8.7 ft-lb)

61 series

Pedal stopper bracket fixing bolt
3.1 - 4.3 N·m
(0.32 - 0.44 kg-m,
2.3 - 3.2 ft-lb)

Master cylinder securing nut
8 - 12 N·m
(0.8 - 1.2 kg-m,
5.8 - 8.7 ft-lb)

CLUTCH MASTER CYLINDER

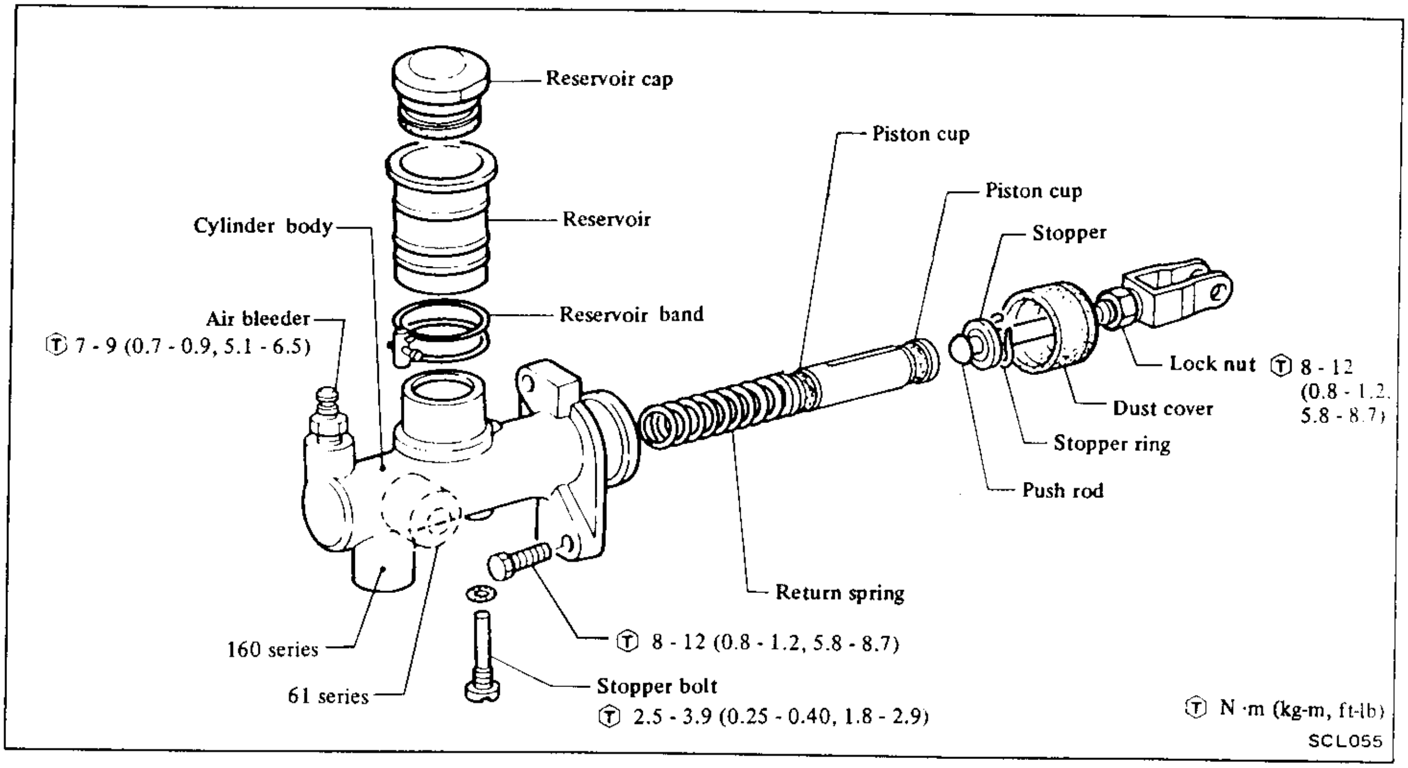
REMOVAL

1. Remove snap pin from clevis pin.
2. Pull out clevis pin.
3. Disconnect clutch tube.
4. Remove master cylinder.

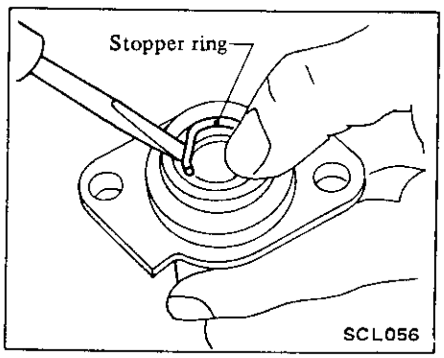
When disconnecting clutch tube, be sure to receive drained clutch fluid into a container. Use of rags is also suggested to keep adjacent parts and area clean.

CAUTION:
When disconnecting clutch tube, use Tool GG94310000.
Never use an open end wrench or adjustable wrench.

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 rubber grease to cylinder body, sliding part and piston cup.
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
2.5 - 3.9 N·m
(0.25 - 0.40 kg-m,
1.8 - 2.9 ft-lb)

INSTALLATION

Install clutch master cylinder in reverse order of removal. Observe the 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.

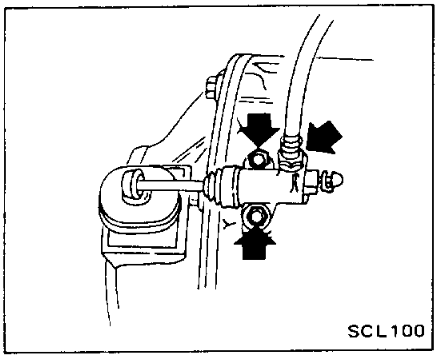
OPERATING CYLINDER

REMOVAL

1. Disconnect clutch hose from operating cylinder.

When disconnecting clutch hose, be sure to receive drained clutch fluid into a container. Use of rags is also suggested to keep adjacent parts and area clean.

2. Remove operating cylinder.

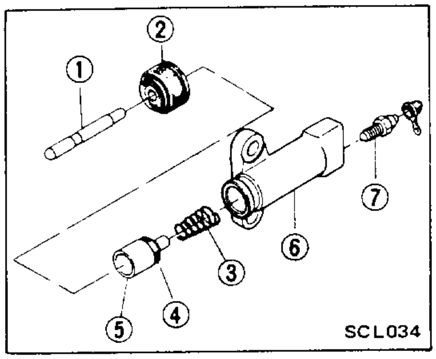


DISASSEMBLY

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 cup
5 Piston
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 the 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 the following:

Bleed air thoroughly from clutch hydraulic system. **Refer to Bleeding Clutch system.**

a. When operating cylinder is installed on clutch housing without disconnecting clutch hose from operating cylinder, loosen bleeder screw so that push rod moves lightly.

b. Exercise care not to warp or twist clutch hose. Be sure to install clutch hose away from exhaust tube.

Ⓣ : **Bleeder screw**
6 - 10 N·m
(0.6 - 1.0 kg-m,
4.3 - 7.2 ft-lb)
Operating cylinder securing bolts
30 - 40 N·m
(3.1 - 4.1 kg-m,
22 - 30 ft-lb)
Clutch hose to operating cylinder
17 - 20 N·m
(1.7 - 2.0 kg-m,
12 - 14 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 Tool GG94310000.
Never use an open end wrench or adjustable wrench.

When disconnecting clutch hose/tube, be sure to receive drained clutch fluid into a container. Use of rags is also suggested to keep adjacent parts and area clean.

1. Disconnect clutch tube from clutch hose at clutch hose bracket.
2. Remove lock spring, then disengage hose from bracket.
3. Disconnect clutch hose from operating cylinder.
4. Disconnect clutch tube from master cylinder.

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) Then tighten flare nut.

When tightening flare nut, hold pipe by hand to prevent it from twisting.

Ⓣ : **Clutch tube to master cylinder**
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)

2. Install clutch hose on operating cylinder in place.

Ⓣ : **Clutch hose to operating cylinder**
17 - 20 N·m
(1.7 - 2.0 kg-m,
12 - 14 ft-lb)

3. Engage opposite end of hose with clutch hose bracket. Install lock spring fixing hose to bracket.

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)

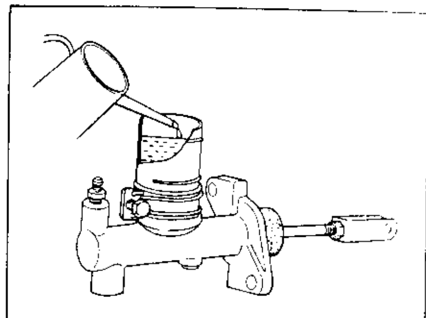
5. Check distance between clutch line and adjacent parts (especially between hose and exhaust tube).
6. Bleed air out of hydraulic system.
Refer to Bleeding Clutch System.

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.

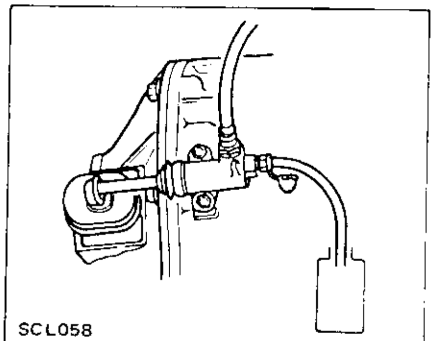
1. Remove reservoir cap and top up with recommended brake fluid.



SCL076

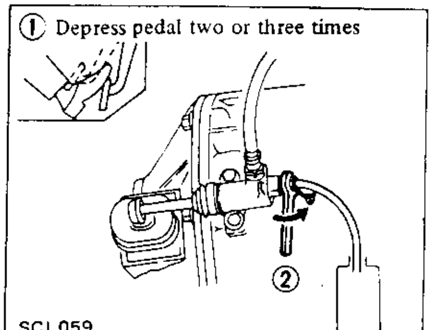
2. First bleed clutch master cylinder by following procedures 3 to 8 for operating cylinder.
3. Thoroughly clean mud and dust from bleeder screw of operating cylinder so that outlet hole is free from any foreign material. Install bleeder hose (vinyl hose) on bleeder screw.

Place the other end of it in a container filled with brake fluid.



SCL058

4. 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.



SCL059

5. Close bleeder screw quickly as clutch pedal is on down stroke.

6. Allow clutch pedal to return slowly with bleeder screw closed.
7. Repeat steps 4 through 6 until no air bubble shows in the vinyl hose.
8. 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.

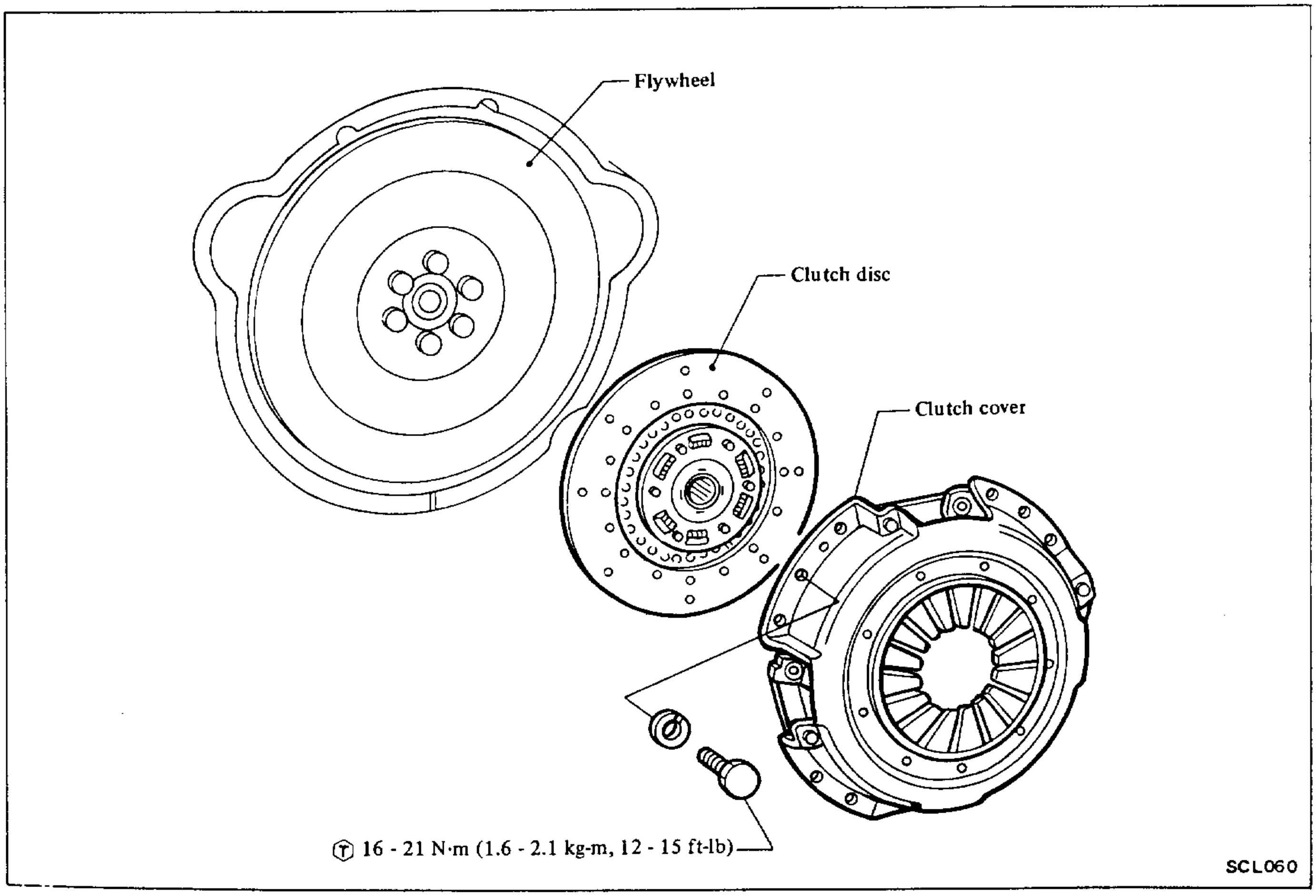
CAUTION:

a. Do not reuse 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.

(T) : Bleeder screw
Master cylinder
7 - 9 N·m
(0.7 - 0.9 kg-m,
5.1 - 6.5 ft-lb)
Operating cylinder
6 - 10 N·m
(0.6 - 1.0 kg-m,
4.3 - 7.2 ft-lb)

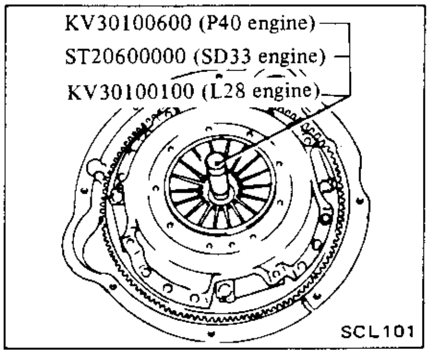
CLUTCH UNIT

CLUTCH DISC AND COVER



REMOVAL

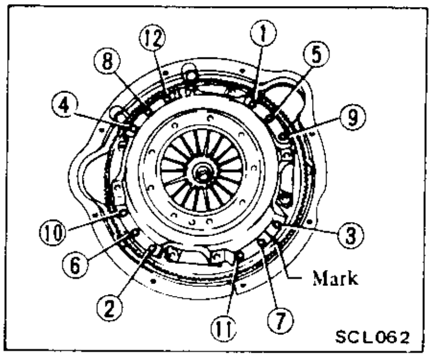
1. Remove transmission from engine. **Refer to Removal (Section MT).**
2. Insert **Tool** into clutch disc hub.



SCL101

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.

Mark relationship between clutch cover and flywheel before loosening bolts.



SCL062

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

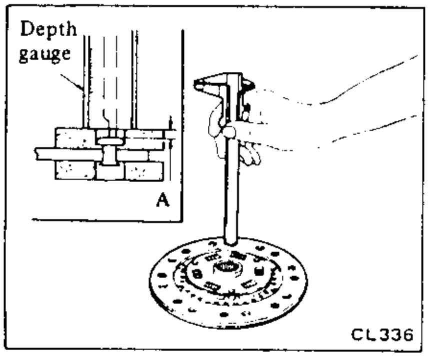
Check friction surface of flywheel and pressure plate for scoring or roughness. Slight roughness may be smoothed by using fine emery cloth. If surface is deeply scored or grooved, the part should be replaced.

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)

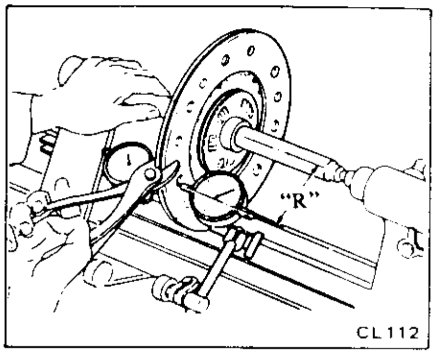


CL336

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.

Maximum runout (Total indicator reading):
275 TBL:
1.3 mm (0.051 in)
240 TBL:
0.7 mm (0.028 in)
"R" (from hub center):
275 TBL:
132.5 mm (5.22 in)
240 TBL:
115.0 mm (4.53 in)

CAUTION:
When repairing disc plate, never hold it forcibly with pliers or bend it excessively; otherwise facing will be damaged.



CL112

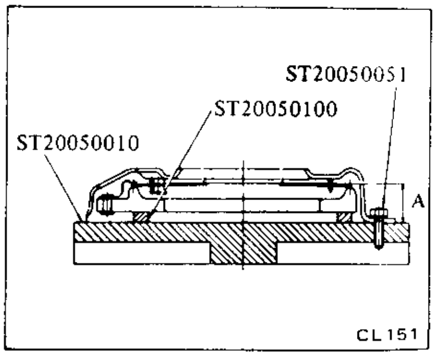
5. Check fit of disc hub on transmission main drive gear splines for smooth sliding. If splines are worn, clutch disc or main drive gear should be replaced; that is, backlash exceeds the specified value at outer edge of clutch disc.

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:

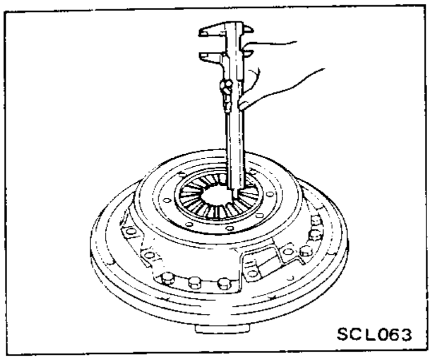
(1) Place **Tool ST20050100 on Tool ST20050010** and then tighten clutch cover assembly on base plate by using **Tool ST20050051.**



CL151

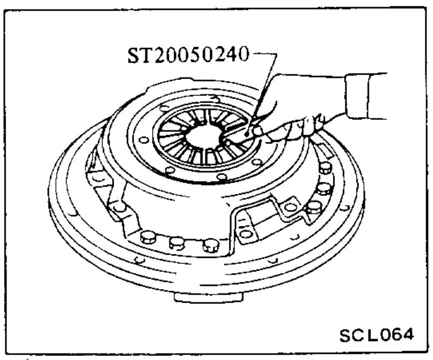
(2) Measure height "A" at several points with a vernier caliper depth gauge.

Diaphragm spring height "A":
D275K models:
44.0 - 46.0
(1.732 - 1.811 in)
D240K models:
37.5 - 39.5 mm
(1.476 - 1.555 in)



SCL063

If height "A" of spring end is beyond specified value, adjust spring height **with Tool ST20050240.** If necessary, replace clutch cover assembly.



SCL064

Also, unevenness of diaphragm spring toe height should be within the specified limit.

Maximum unevenness of diaphragm spring toe height:
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.

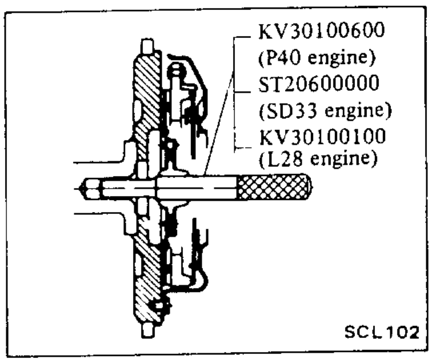
INSTALLATION

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 KV30100600 (P40 engine), ST20600000 (SD33 engine) or KV30100100 (L28 engine).**

Be sure to keep disc facings, flywheel and pressure plate clean and dry.



SCL102

3. Install clutch cover assembly. Each bolt should be tightened one turn at a time in a crisscross fashion.

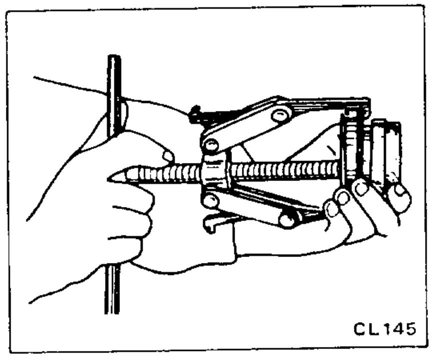
Ⓣ : Clutch cover bolt
16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)

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. Remove withdrawal lever, release bearing and sleeve as an assembly from transmission case front cover.
3. Disconnect holder spring from bearing sleeve.
4. Take clutch release bearing out from bearing sleeve, using a universal puller and a suitable adapter.



CL145

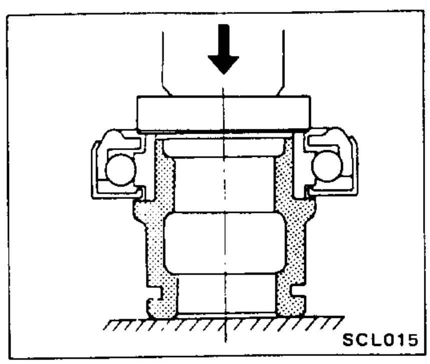
INSPECTION

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

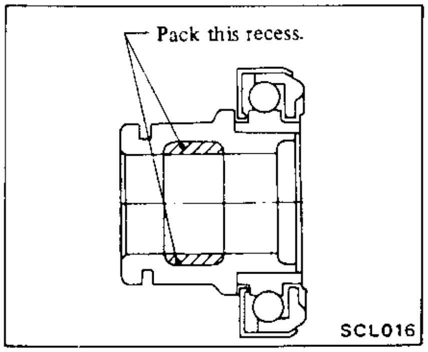
1. Assemble release bearing on sleeve, using a press.



SCL015

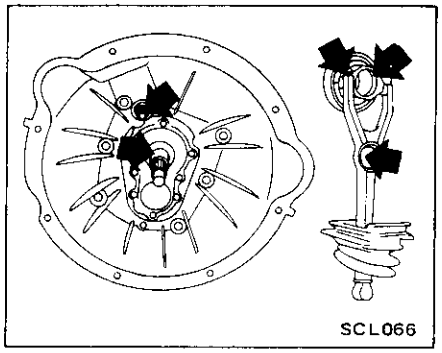
Do not depress outer race.

2. Before or during assembly, lubricate the following points with a light coat of multi-purpose grease.
(1) Inner groove of release bearing sleeve.



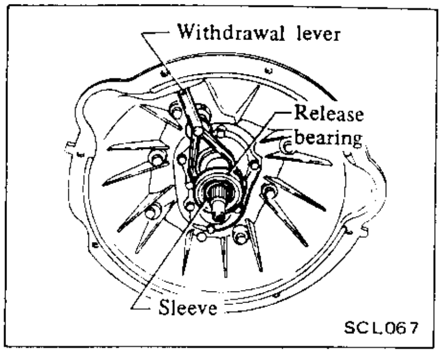
SCL016

(2) Contact surfaces of withdrawal lever, lever ball pin and bearing sleeve.
(3) Bearing sleeve sliding surface of transmission case front cover.
(4) Transmission main drive gear splines. (Use grease including molybdenum disulphide.)


SCL066

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. Install withdrawal lever, release bearing and sleeve as an assembly in position, after connecting them with holder spring.



SCL067

4. Reinstall transmission. **Refer to Installation (Section MT).**

PILOT BUSHING

Refer to Crankshaft (Section EM) for replacing pilot bushing.

SERVICE DATA AND SPECIFICATIONS

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

Item \ Model	P40 engine equipped models	SD33 and L28 engine equipped models
Type	275TBL	240TBL
Facing size mm (in) Outer dia. x Inner dia. x Thickness	275 x 180 x 3.5 (10.83 x 7.09 x 0.138)	240 x 150 x 3.5 (9.45 x 5.91 x 0.138)
Thickness of disc assembly Free mm (in)	8.15 - 8.85 (0.3209 - 0.3484)	8.6 - 9.2 (0.339 - 0.362)
Installed mm (in)/N (kg, lb)	7.6 - 8.0 (0.299 - 0.315)/ 5,394 (550, 1,213)	7.7 - 8.3 (0.303 - 0.327)/ 4,904 (500, 1,103)
Number of torsion springs	6	

CLUTCH COVER

Item \ Model	P40 engine equipped models	SD33 and L28 engine equipped models
Type	D275K	D240K
Installed load N (kg, lb)	5,394 (550, 1,213)	4,904 (500, 1,103)

INSPECTION AND ADJUSTMENT

CLUTCH PEDAL

Unit: mm (in)

Item \ Model	160 series	61 series
Pedal height "H"	190 - 196 (7.48 - 7.72)	181 - 187 (7.13 - 7.36)
Pedal free play "A"	1 - 5 (0.04 - 0.20)	
Withdrawal lever play "C"	0 (0) [Non-adjustable]	

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	275TBL	240TBL
Wear limit of facing surface to rivet head	0.3 (0.012)	
Runout limit	1.3 (0.051)	0.7 (0.028)
Distance of runout checking point (From the hub center)	132.5 (5.22)	115.0 (4.53)
Maximum backlash of spline (At outer edge of disc)	0.4 (0.016)	

CLUTCH COVER

Model	D275K	D240K
Diaphragm spring height mm (in)	44.0 - 46.0 (1.732 - 1.811)	37.5 - 39.5 (1.476 - 1.555)
Maximum unevenness of diaphragm spring toe height mm (in)	0.7 (0.028)	

PILOT BUSHING

Item \ Model	P40 engine equipped models	SD33 and L28 engine equipped models
Inserted distance of pilot bushing mm (in)	0.6 (0.024)	2.8 (0.110)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Pedal stopper bolt lock nut (160 series)	8 - 11	0.8 - 1.1	5.8 - 8.0
Pedal stopper bracket fixing bolt (61 series)	3.1 - 4.3	0.32 - 0.44	2.3 - 3.2
Master cylinder push rod lock nut	8 - 12	0.8 - 1.2	5.8 - 8.7
Master cylinder stopper bolt	2.5 - 3.9	0.25 - 0.40	1.8 - 2.9
Master cylinder securing nut	8 - 12	0.8 - 1.2	5.8 - 8.7
Master cylinder bleeder screw	7 - 9	0.7 - 0.9	5.1 - 6.5
Clutch tube flare nut	15 - 18	1.5 - 1.8	11 - 13
Operating cylinder bleeder screw	6 - 10	0.6 - 1.0	4.3 - 7.2
Operating cylinder securing bolt	30 - 40	3.1 - 4.1	22 - 30
Clutch hose to operating cylinder securing nut	17 - 20	1.7 - 2.0	12 - 14
Clutch cover securing bolt	16 - 21	1.6 - 2.1	12 - 15

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.

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 vehicle 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

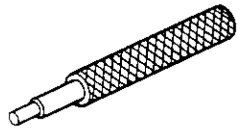
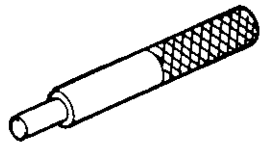
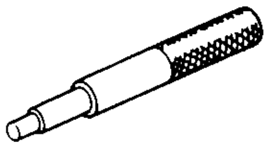
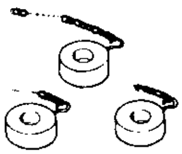
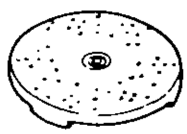
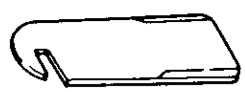
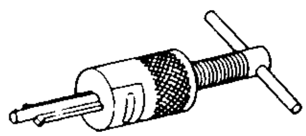
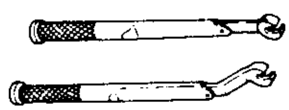
Probable cause	Corrective action
• Release bearing/sleeve damaged or improperly lubricated	Replace.
• Pilot bushing worn, jammed or damaged	Replace.
• Clutch facing rivets loose	Replace.
• Disc plate cracked	Replace.
• Clutch disc torsion springs fatigues	Replace.

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.

SPECIAL SERVICE TOOLS

Tool number	Tool name	Engine application		
		P40	SD33	L28
KV30100600	Clutch aligning bar 	X	–	–
ST20600000	Clutch aligning bar 	–	X	–
KV30100100	Clutch aligning bar 	–	–	X
ST20050100	Distance piece 	X	X	X
ST20050010	Base plate 	X	X	X
ST20050051	Set bolt 	X	X	X
ST20050240	Diaphragm spring adjusting wrench 	X	X	X
ST16610001	Pilot bushing puller 	X	X	X
GG94310000	Flare nut torque wrench 	X	X	X

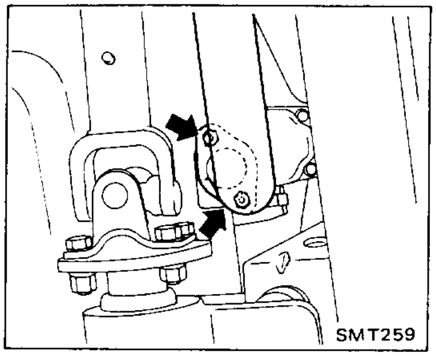
MANUAL TRANSMISSION

CONTENTS

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. Drain gear oil.
4. Disconnect front exhaust tube (models equipped with P40 engine and T130A transfer).


SMT259

5. Disconnect wires from reverse (back-up) lamp switch.
6. Disconnect 4WD lamp switch.
7. Disconnect speedometer cable.
8. Remove front and rear propeller shafts.
   Refer to Propeller Shaft (Section PD) for removal.

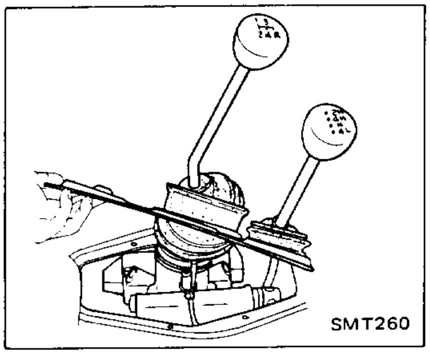
- Disconnect center brake cable.

With T100L transfer
- Remove transfer unit.
  Refer to Section TF for removal.
- Remove pre-propeller shaft.

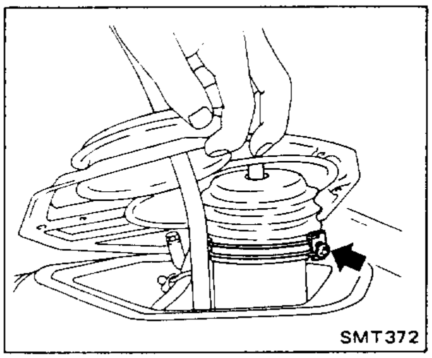
9. Remove floor carpet.
10. **With T100L transfer**

- Remove transmission control lever boot.

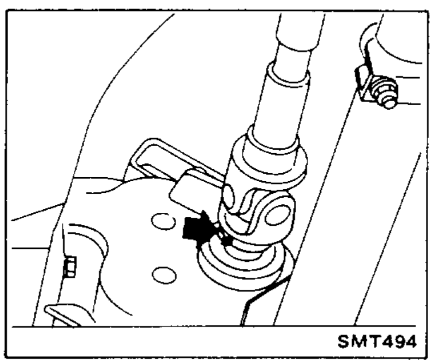
With T130A transfer
- Place transmission control lever in neutral position and remove transmission cover panel.


SMT260

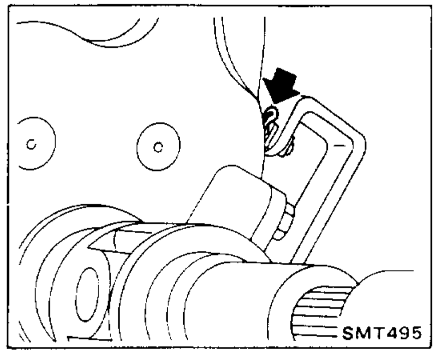
11. Loosen rubber boot retaining screw.


SMT372

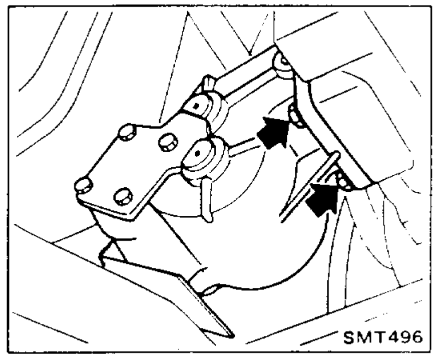
12. Remove control lever.
13. Remove clutch operating cylinder.
14. If winch is equipped, remove P.T.O. as follows:
1) Remove pin from drive shaft.


SMT494

2) Slide rear joint of drive shaft forward.
3) Remove P.T.O. control lever cotter pin.


SMT495

4) Remove P.T.O. unit.

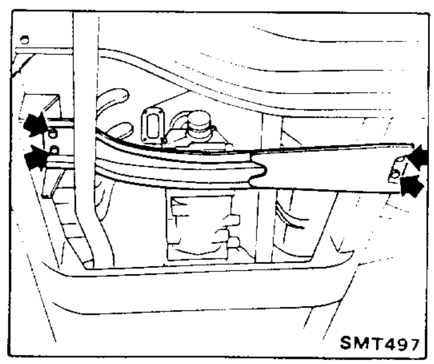

SMT496

15. Remove clutch operating cylinder.
16. Support engine by placing a jack under oil pan with a wooden block used between oil pan and jack.

CAUTION:
Do not place jack under oil pan drain plug.

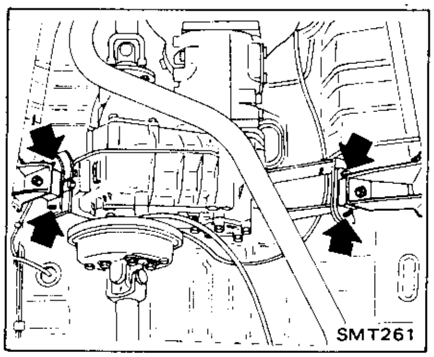
17. Support transmission with a transmission jack.
18.
With T100L transfer

Loosen rear crossmember securing nuts.


SMT497

With T130L transfer

Loosen rear engine mount securing nuts temporarily.


SMT261

19. Remove starter motor.
20. Support engine and transmission with jacks.
21. Remove bolts securing clutch housing to engine.
22. Remove rear engine mounting brackets.
23. Slide transmission rearward away from engine.

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.

- Before installing, clean mating surfaces of engine rear plate and transmission case.
- 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.
- Remove filler plug and fill transmission with recommended gear oil to the level of the plug hole.

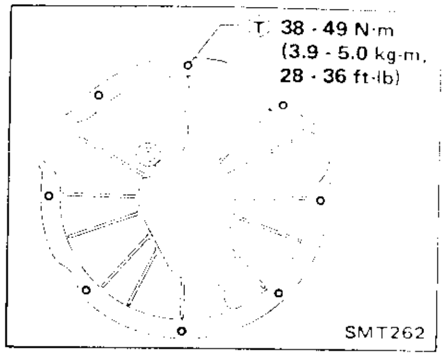
Oil capacity:
2.7 liters
(4-3/4 Imp pt)

- 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)

- Tighten bolts securing transmission to engine.

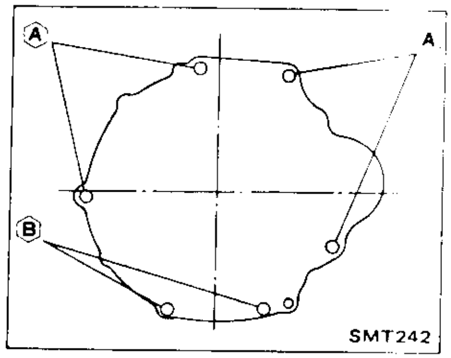
Models equipped with P40 and SD33 engines



SMT262

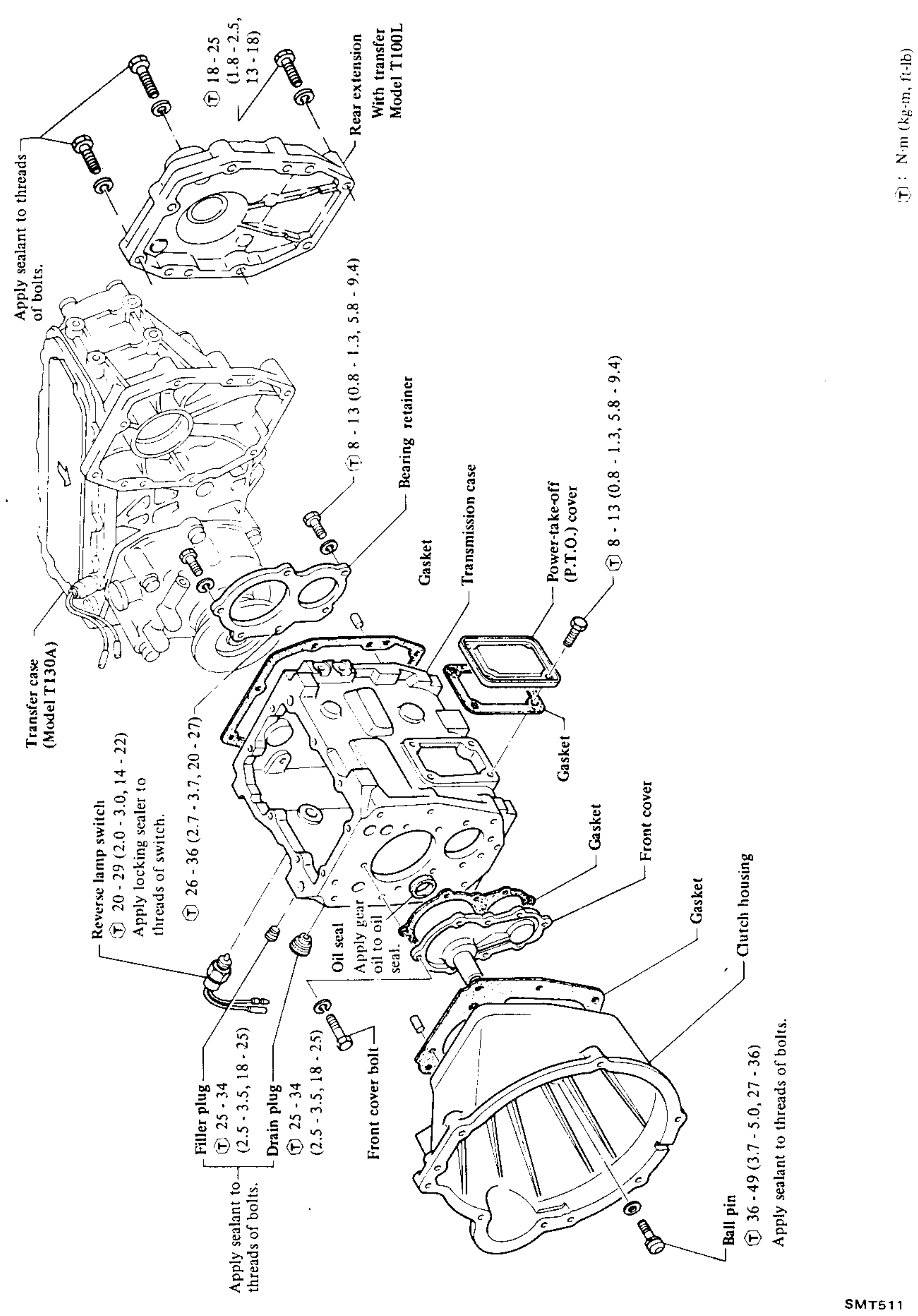
Models equipped with L28 engine

Ⓣ : Ⓐ **43 - 58 N·m**
(4.4 - 5.9 kg-m, 32 - 43 ft-lb)
Ⓑ **25 - 35 N·m**
(2.6 - 3.6 kg-m, 19 - 26 ft-lb)

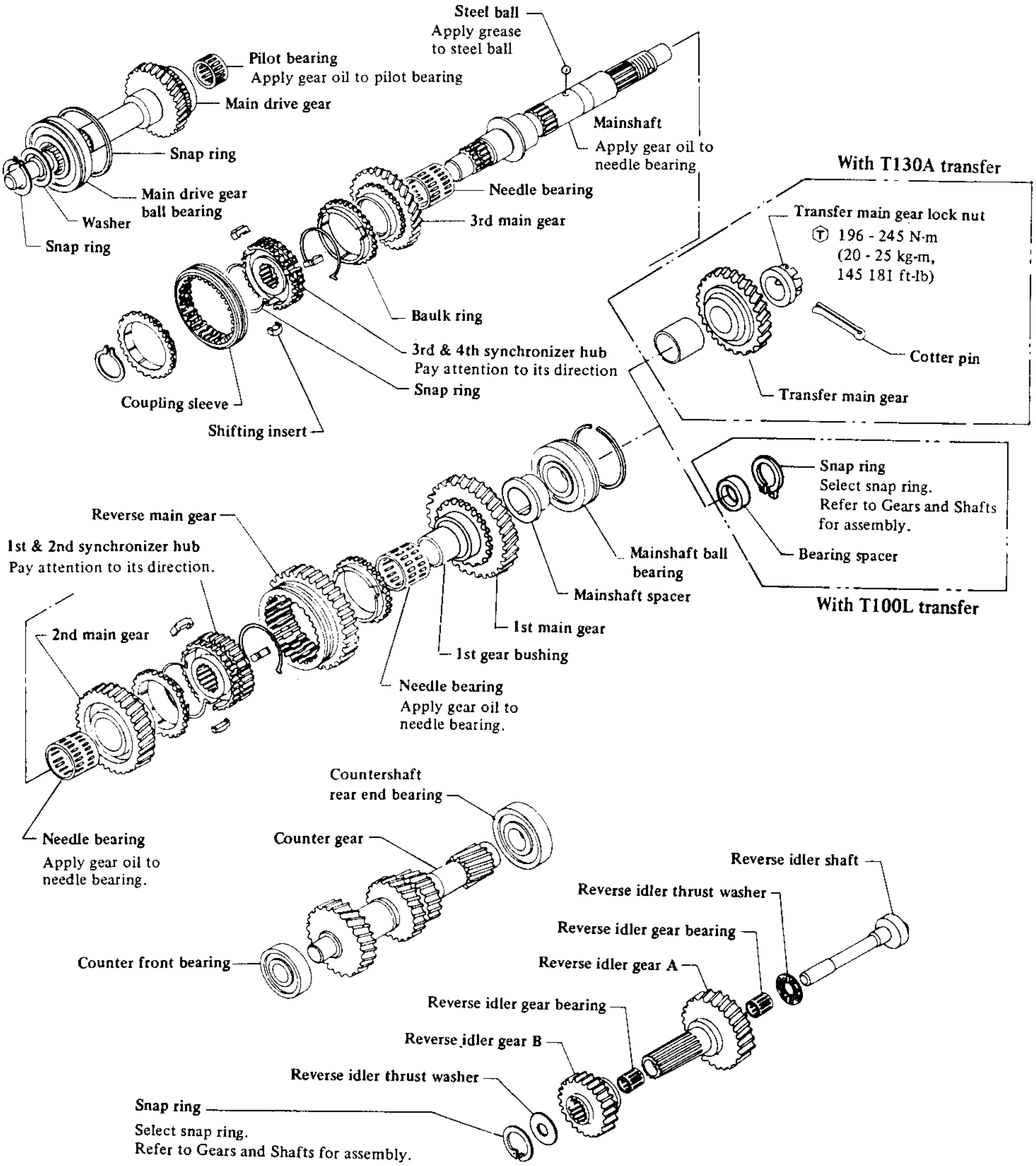


SMT242

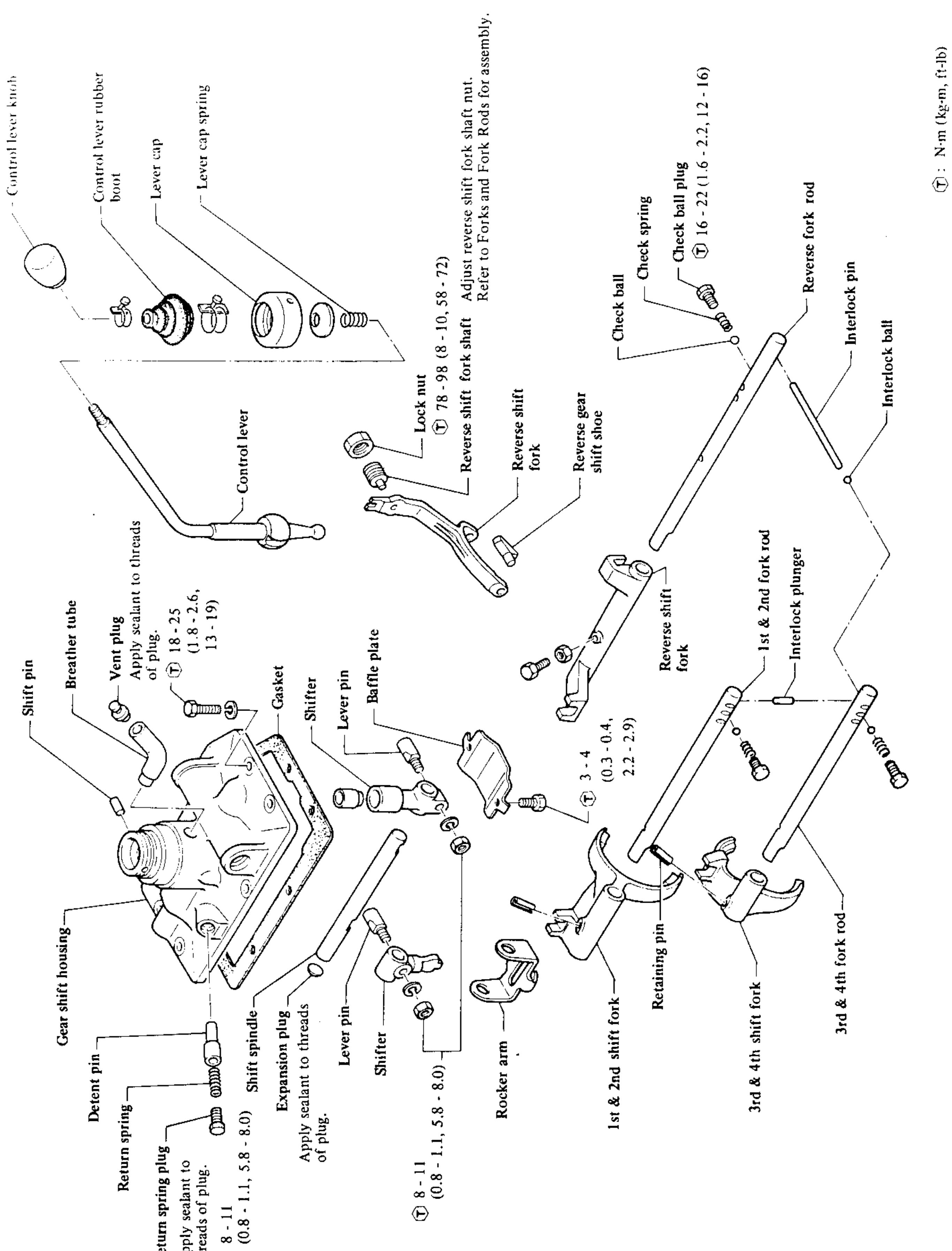
4-SPEED TRANSMISSION (Model : F4W81A)



SMT511


Steel ball
Apply grease
to steel ball
Pilot bearing
Apply gear oil to pilot bearing
Main drive gear
Mainshaft
Apply gear oil to
needle bearing
Snap ring
Main drive gear
ball bearing
Washer
Snap ring
Needle bearing
3rd main gear
With T130A transfer
Transfer main gear lock nut
Ⓣ 196 - 245 N·m
(20 - 25 kg-m,
145 181 ft-lb)
Cotter pin
Transfer main gear
Baulk ring
3rd & 4th synchronizer hub
Pay attention to its direction
Snap ring
Coupling sleeve
Shifting insert
Snap ring
Select snap ring.
Refer to Gears and Shafts
for assembly.
Bearing spacer
With T100L transfer
Reverse main gear
1st & 2nd synchronizer hub
Pay attention to its direction.
Mainshaft ball
bearing
Mainshaft spacer
2nd main gear
1st main gear
1st gear bushing
Needle bearing
Apply gear oil to
needle bearing.
Countershaft
rear end bearing
Needle bearing
Apply gear oil to
needle bearing.
Counter gear
Reverse idler shaft
Reverse idler thrust washer
Reverse idler gear bearing
Counter front bearing
Reverse idler gear A
Reverse idler gear bearing
Reverse idler gear B
Reverse idler thrust washer
Snap ring
Select snap ring.
Refer to Gears and Shafts for assembly.

SMT512



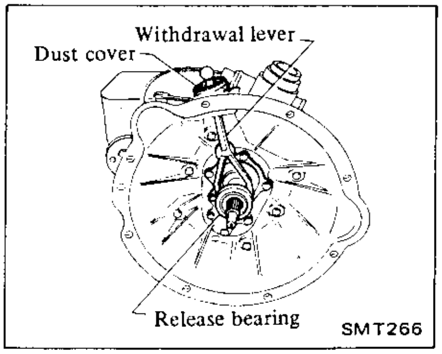
Control lever knob
Control lever rubber boot
Lever cap
Lever cap spring
Control lever
Lock nut
Ⓣ 78 - 98 (8 - 10, 58 - 72)
Reverse shift fork shaft
Adjust reverse shift fork shaft nut.
Refer to Forks and Fork Rods for assembly.
Reverse shift fork
Reverse gear shift shoe
Check ball
Check spring
Check ball plug
Ⓣ 16 - 22 (1.6 - 2.2, 12 - 16)
Reverse fork rod
Interlock pin
Interlock ball
Ⓣ : N·m (kg-m, ft-lb)
Shift pin
Breather tube
Vent plug
Apply sealant to threads of plug.
Ⓣ 18 - 25 (1.8 - 2.6, 13 - 19)
Gasket
Shifter
Lever pin
Baffle plate
Ⓣ 3 - 4 (0.3 - 0.4, 2.2 - 2.9)
Reverse shift fork
1st & 2nd fork rod
Interlock plunger
Gear shift housing
Detent pin
Return spring
Return spring plug
Apply sealant to threads of plug.
Ⓣ 8 - 11 (0.8 - 1.1, 5.8 - 8.0)
Shift spindle
Expansion plug
Apply sealant to threads of plug.
Lever pin
Shifter
Ⓣ 8 - 11 (0.8 - 1.1, 5.8 - 8.0)
Rocker arm
1st & 2nd shift fork
Retaining pin
3rd & 4th shift fork
3rd & 4th fork rod

SMT265

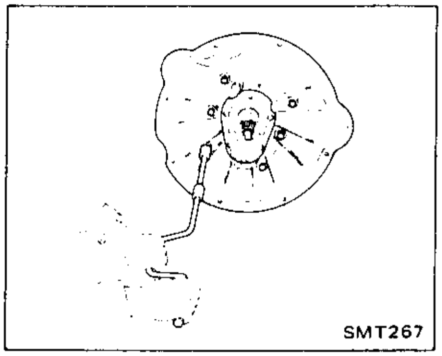
CLUTCH HOUSING

DISASSEMBLY

1. Wipe off dirt and grease.
2. Remove dust cover, release bearing and withdrawal lever.



3. Remove clutch housing.

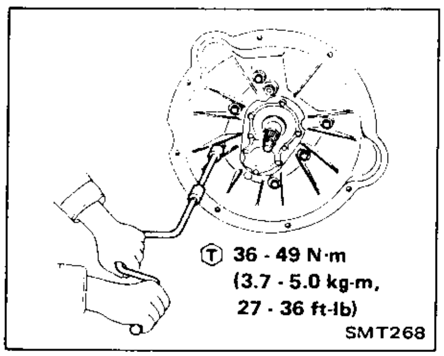


INSPECTION

1. Clean with solvent and check for cracks or pits.
2. Check mating surface of clutch housing for small nicks or projections.

ASSEMBLY

1. Install clutch housing and **new gasket.**



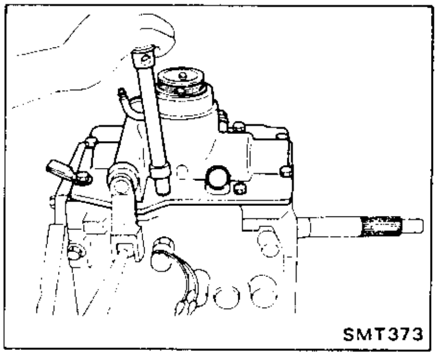
2. Install dust cover, release bearing and withdrawal lever.

Refer to Release Bearing (Section CL) for installation.

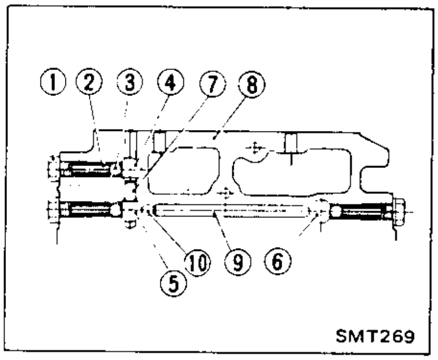
FORKS AND FORK RODS

DISASSEMBLY

1. Remove clutch housing.
   Refer to Clutch Housing for disassembly.
2. Remove gear shift housing.

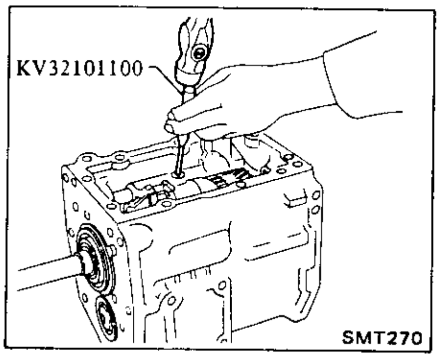


3. Remove check ball plugs and check springs.



1	Check ball plug	6	Reverse fork rod
2	Check spring	7	Interlock plunger
3	Check ball	8	Transmission case
4	1st & 2nd fork rod	9	Interlock pin
5	3rd & 4th fork rod	10	Interlock ball

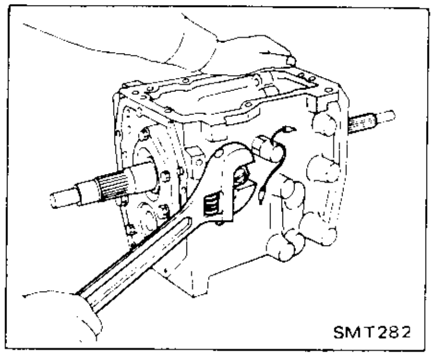
4. Drive out retaining pins.



5. Drive out fork rods and remove interlock plunger, interlock pin, check balls and interlock ball.

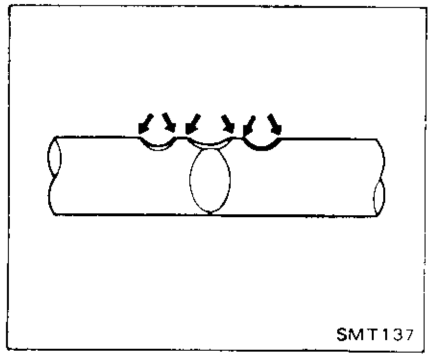
Be careful not to lose the three (3) check balls, interlock plunger and interlock ball.

6. Draw out shift forks.
7. Remove reverse shift fork shaft.



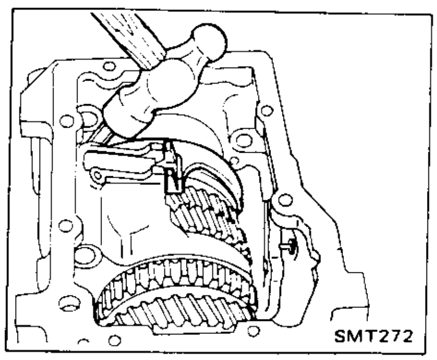
INSPECTION

Clean with solvent and check for wear, scratches, projection, damage or other faulty conditions. Replace any part which is worn or damaged.

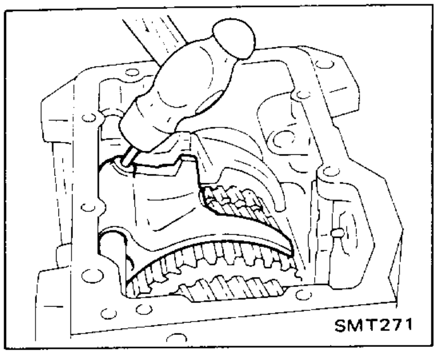


ASSEMBLY

1. Install 1st & 2nd and 3rd & 4th shift forks and 3rd & 4th fork rod, then secure with retaining pin.



2. Install interlock plunger and check balls.
3. Install 1st & 2nd fork rod, then secure with retaining pin.



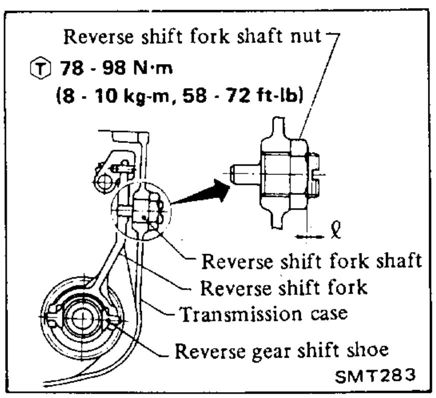
SMT271

4. Install interlock pin and interlock ball.
5. Install reverse check ball and check spring. Then install reverse shift fork shaft.

Note that check springs for 1st & 2nd fork rod and 3rd & 4th fork rod differ from that for Rev. fork rod side.

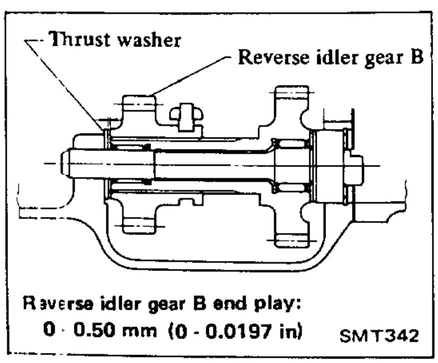
6. Adjust end play of reverse idler gear.

(1) Set dimension ℓ to +0.5 mm (+0.020 in).



SMT283

(2) Adjust end play of reverse idler gear B to 0 - 0.50 mm (0 - 0.197 in) by tightening reverse shift fork shaft.

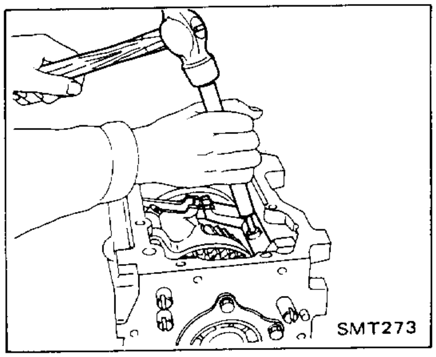


Reverse idler gear B end play:
0 - 0.50 mm (0 - 0.0197 in)

SMT342

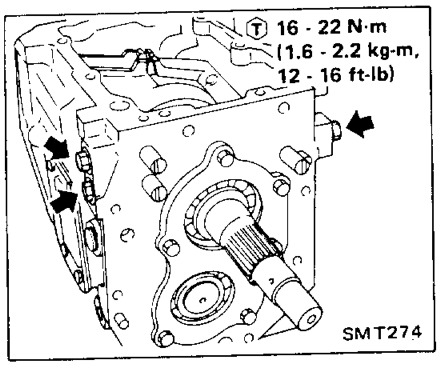
(3) Make sure that difference ℓ is $\pm$0.5 mm ($\pm$0.020 in).

7. Install Rev. fork and fork rod, then secure with retaining pin.



SMT273

8. Install check balls and check springs for 1st & 2nd fork rod and 3rd & 4th fork rod.
9. Apply locking sealer to check ball plugs and install them.



SMT274

10. Apply gear oil to all sliding surfaces.
11. Install gear shift housing.

After installing forks and fork rods, tap 1st & 2nd and Rev. fork rods when 3rd & 4th fork rod is shifted into 4th position to make sure that they do not move.

12. Check to see that shift rods operate correctly and gears are engaged smoothly.
13. Install clutch housing.

Refer to Clutch Housing for assembly.

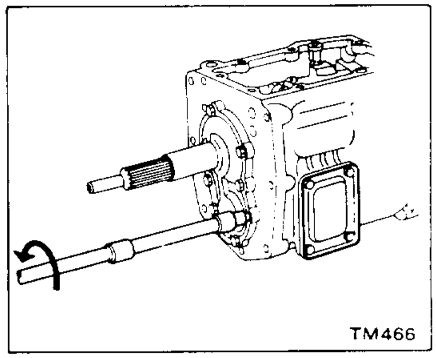
TRANSMISSION CASE AND REAR EXTENSION

DISASSEMBLY

1. Remove clutch housing.

Refer to Clutch Housing for disassembly.

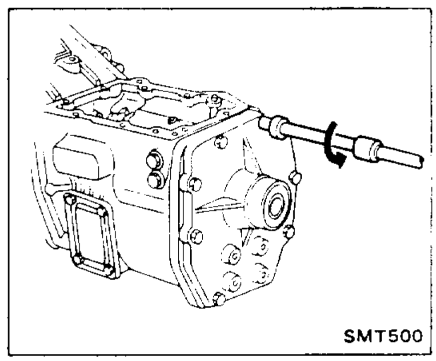
2. Remove drain plug and drain oil from transmission case.
3. Remove front cover and gasket.



TM466

4. With T100L transfer

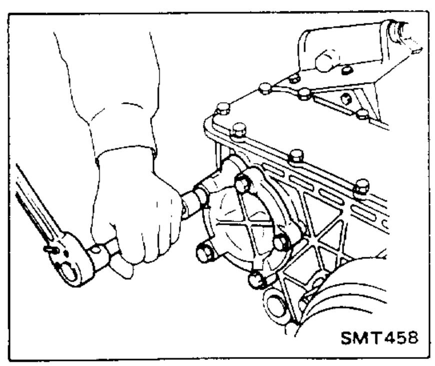
Remove rear extension and gasket.



SMT500

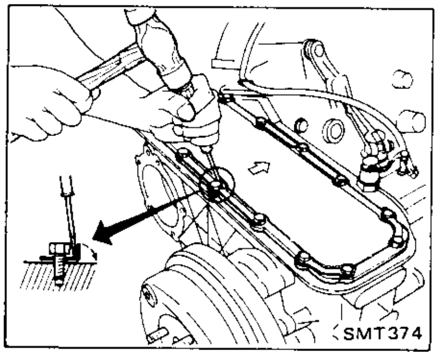
With T130A transfer

(1) Remove mainshaft cover and needle bearing.

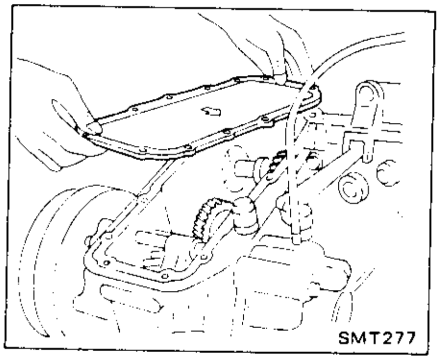


SMT458

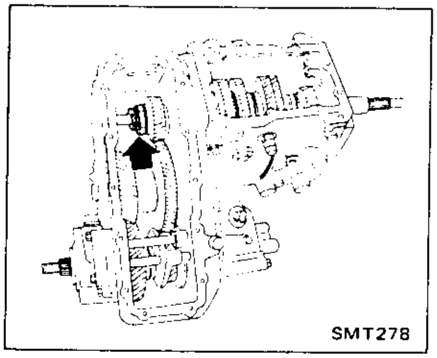
(2) Flatten lock plate.


SMT374

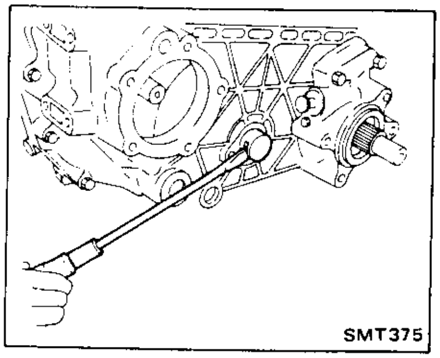
(3) Remove transfer case cover and lock plates.


SMT277

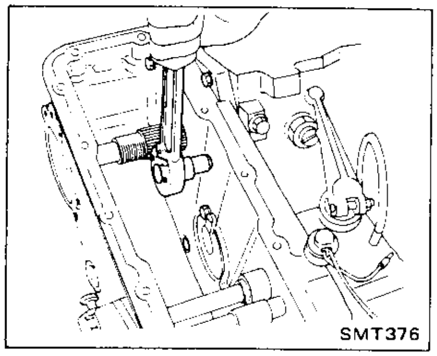
(4) Remove cotter pin.
(5) Mesh second and reverse gears.
Remove mainshaft rear end lock nut with **Tool KV32101600.**


SMT278

(6) Remove transfer main gear and spacer.
(7) Remove transfer counter gear.

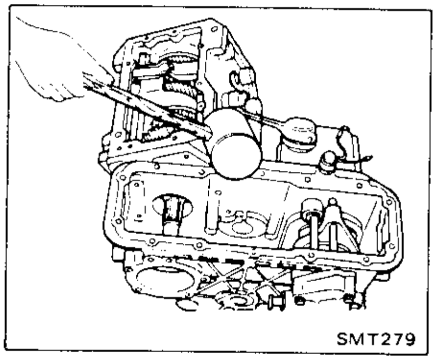

SMT375

(8) Remove bolts securing transfer case to transmission case.

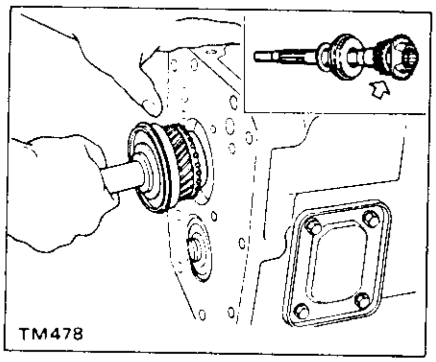

SMT376

(9) Remove transfer unit from transmission case.

Be careful not to damage oil seal when removing transfer case and transmission case.


SMT279

5. Remove main drive gear, main drive gear ball bearing and baulk ring, **placing the cutout portion facing downward on main drive gear.**


TM478

6. Remove forks and fork rods.
Refer to Forks and Fork Rods for disassembly.
7. Remove bearing retainer.
Refer to Main Drive Gear in Gears And Shafts for disassembly.

8. Remove countershaft and mainshaft.
Refer to Counter Gear in Gears and Shafts for disassembly.
9. Remove reverse idler gear.
Refer to Reverse Idler Gear in Gears And Shafts for disassembly.

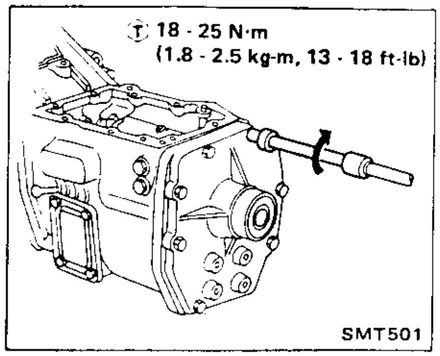
INSPECTION

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 or projections.

ASSEMBLY

1. Clean mating surfaces of transmission case and clutch housing.
2. Install reverse idler gear and shaft, thrust washers and needle bearings.
Refer to Transmission Case for assembly.
3. Install counter gear and mainshaft.
Refer to Counter Gear and Mainshaft in Gears and Shafts for assembly.
4. Install bearing retainer.
Refer to Counter Gear and Mainshaft in Gears and Shafts for assembly.
5. Install forks and fork rods.
Refer to Forks and Fork Rods for assembly.
6. Install main drive gear and pilot bearing.
Refer to Main Drive Gear for assembly.
7.
With T100L transfer

Install rear extension and new gasket to transmission case.



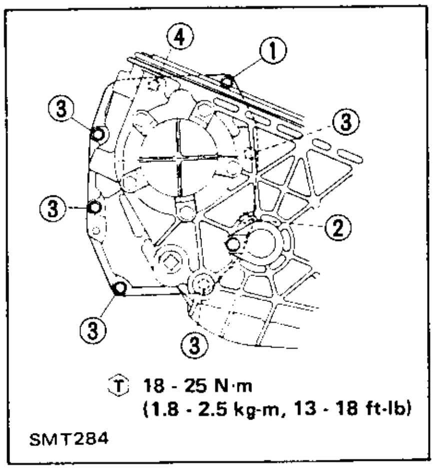
SMT501

With T130A transfer

(1) Install transfer unit and new gasket to transmission case.

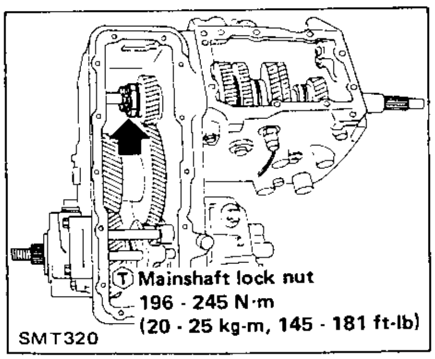
Be careful when installing bolts as they differ in length according to their installing position.

① 30 mm (1.18 in) Apply sealant to threads of bolt.
② 50 mm (1.97 in) Apply sealant to threads of bolt.
③ 50 mm (1.97 in)
④ 65 mm (2.56 in)



SMT284

(2) Install spacer, transfer main gear and mainshaft lock nut.
(3) Mesh to 2nd and reverse gear, then tighten mainshaft lock nut to specified torque.

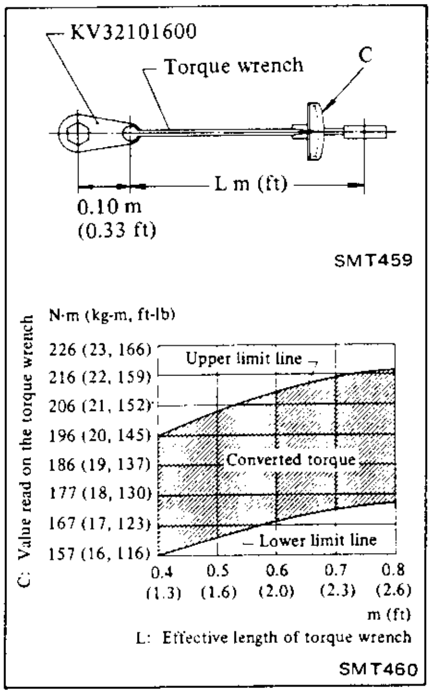


SMT320

Conversion of torque

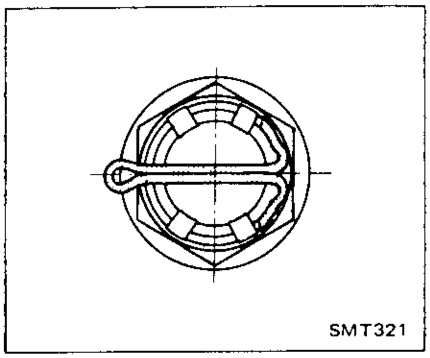
Mainshaft nut should be tightened to specified torque with **Tool KV32101600.** When doing so, the amount of torque to be read on wrench needle should be modified according to the following chart.

Ⓣ : **196 - 245 N·m (20 - 25 kg-m, 145 - 181 ft-lb)**

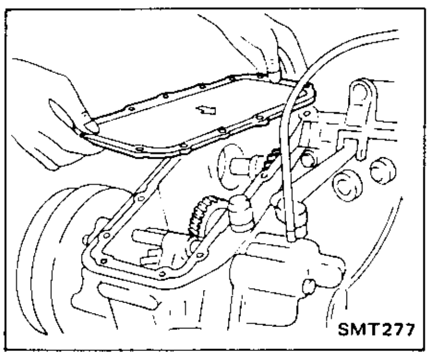


SMT460

(4) Install cotter pin and bend it.

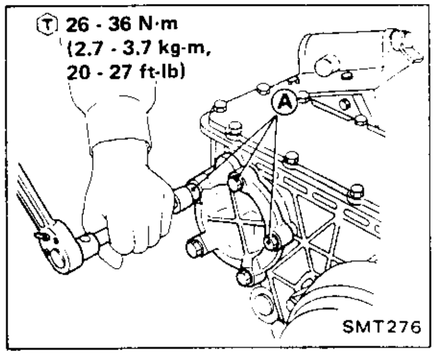

SMT321

(5) Install transfer case cover, gasket and lock plates.


SMT277

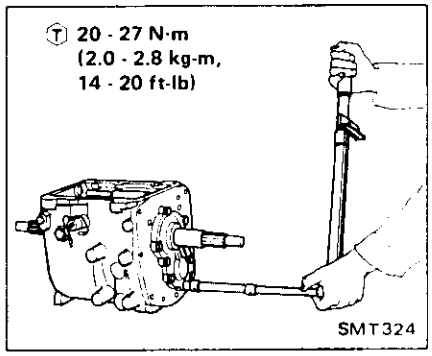
(6) Install mainshaft cover and needle bearing.

Ⓐ : Apply sealant to threads of bolts.



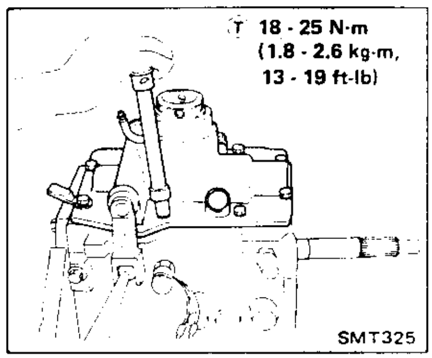
SMT276

8. Install front cover and **new gasket.**



SMT324

9. Install gear shift housing.



SMT325

10. Apply sealant to threads of drain plug.
11. Install drain plug.

Ⓣ : **25 - 34 N·m (2.5 - 3.5 kg-m, 18 - 25 ft-lb)**

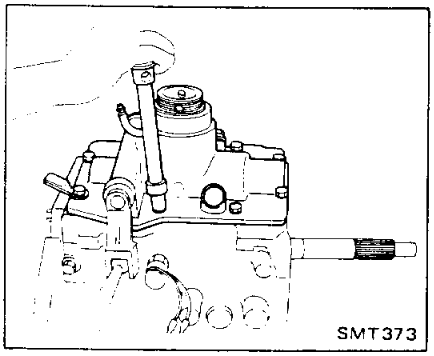
12. Install clutch housing.

Refer to Clutch Housing for assembly.

GEAR SHIFT HOUSING

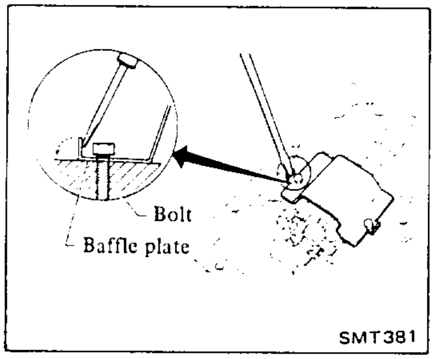
DISASSEMBLY

1. Remove gear shift housing from transmission case.



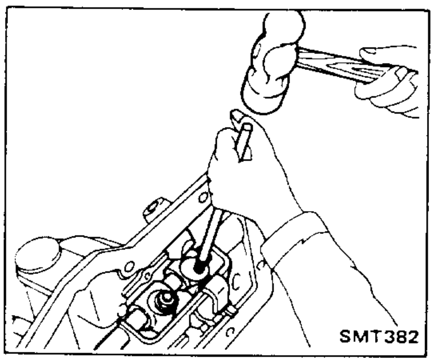
SMT373

2. Remove return springs and detent pins.
3. Flatten baffle plate.



SMT381

4. Remove baffle plate.
5. Remove expansion plug.
6. Slide shifter spindle by tapping shifter.
7. Remove lever pin nuts.
8. Remove lever pins by tapping them.



SMT382

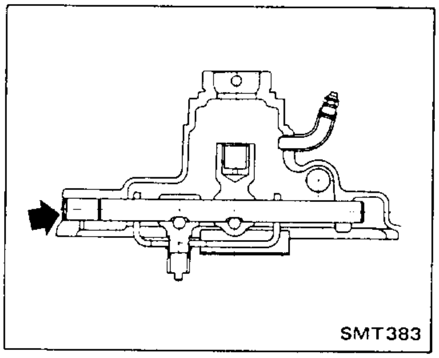
9. Remove shifters, shifter spindle and rocker arm.

INSPECTION

1. Clean with solvent and check for cracks or pits.
2. Check mating surface of gear shift housing for small nicks or projections.

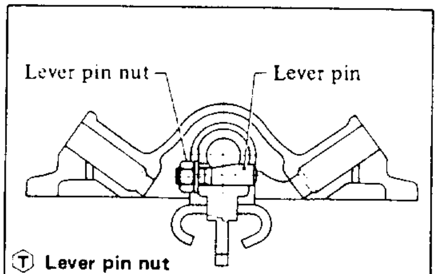
ASSEMBLY

1. Install shifter spindle, rocker arm and shifters.
2. Apply sealant to expansion plug, then install it.



SMT383

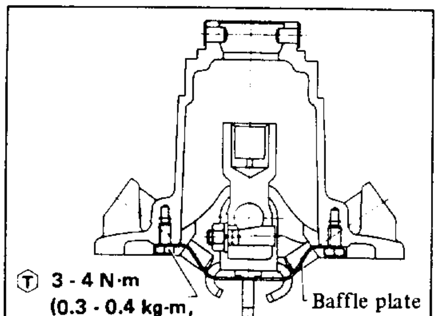
3. Install lever pins and nuts.



Ⓣ **Lever pin nut**
8 - 11 N·m
(0.8 - 1.1 kg-m,
5.8 - 8.0 ft-lb)

SMT384

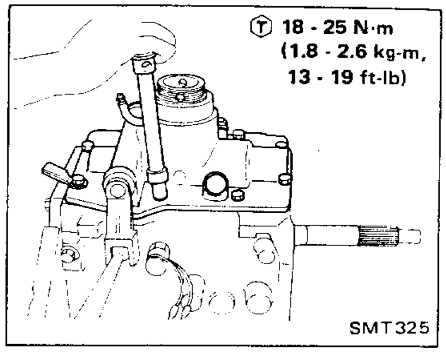
4. Install baffle plate.



Ⓣ **3 - 4 N·m**
(0.3 - 0.4 kg-m,
2.2 - 2.9 ft-lb)

SMT385

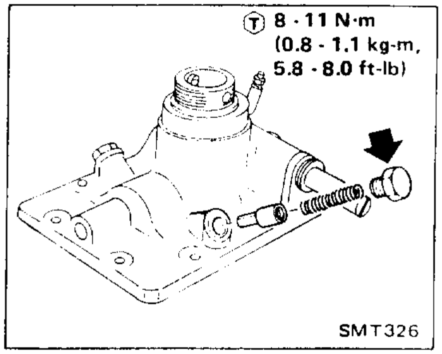
5. Install gear shift housing to transmission case.



Ⓣ **18 - 25 N·m**
(1.8 - 2.6 kg-m,
13 - 19 ft-lb)

SMT325

6. Assemble locking springs and detent pins.
7. Apply sealant to threads of plug, then tighten it.



Ⓣ **8 - 11 N·m**
(0.8 - 1.1 kg-m,
5.8 - 8.0 ft-lb)

SMT326

GEARS AND SHAFTS

DISASSEMBLY

Main drive gear

1. Remove gear shift housing.
Refer to Gear Shift Housing for disassembly.
2. **Measure gear end play. Refer to Gears and Shafts for inspection.**
3.
With T100L transfer

Remove rear extension. **Refer to Rear Extension for disassembly.**

With T130A transfer

Remove transfer unit. **Refer to Transmission Case for disassembly.**
4. Remove forks and fork rods. **Refer to Forks and Fork Rods for disassembly.**

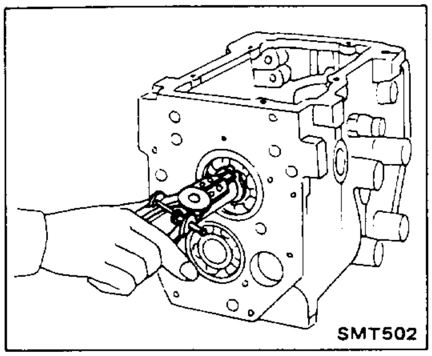
5. Remove front cover **Refer to Transmission Case for disassembly.**

6. Remove main drive gear assembly and main drive gear ball bearing. **Refer to Transmission Case for disassembly.**

Counter gear and reverse idler gear A and B

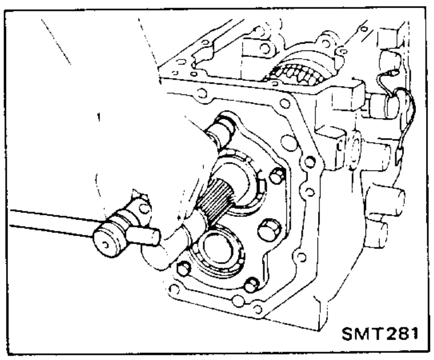
1. **With T100L transfer**

Remove snap ring and bearing spacer.

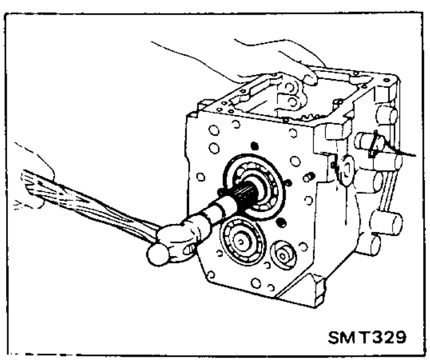

SMT502

With T130A transfer

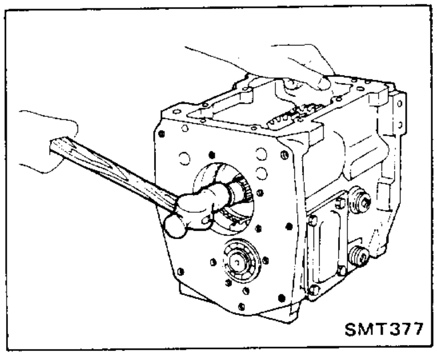
Remove bearing retainer.


SMT281

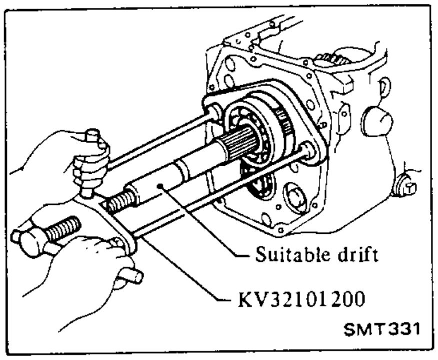
2. Tap mainshaft from rear side. When doing this, **keep snap ring attached to bearing.**


SMT329

3. Then tap mainshaft and counter gear from front side evenly.

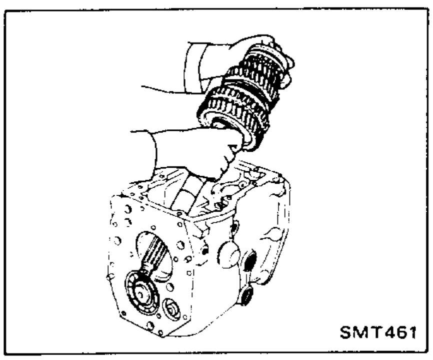

SMT377

4. Remove mainshaft bearing **using Tool.**

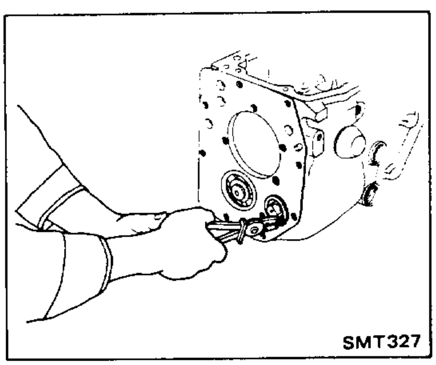


SMT331

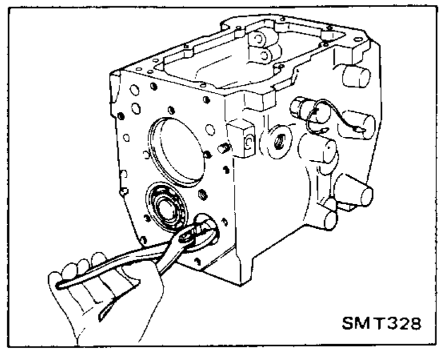
5. Take out mainshaft assembly.


SMT461

6. Remove snap ring at the rear end of reverse idler shaft.

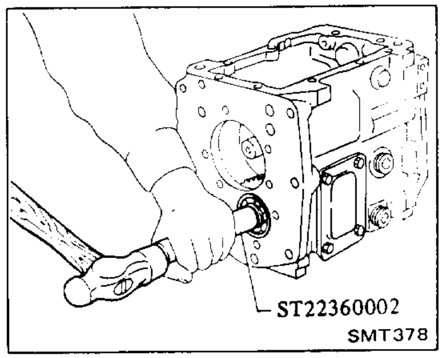

SMT327

7. Remove reverse idler shaft.


SMT328

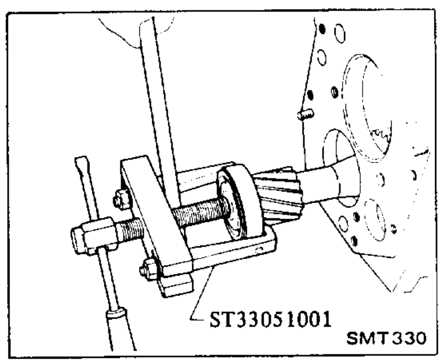
8. Remove reverse idler gear A and B, needle bearings and thrust washers.

9. Tap countershaft from front side.



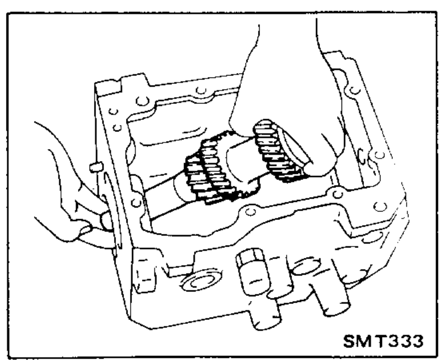
SMT378

10. Remove countershaft rear bearing.



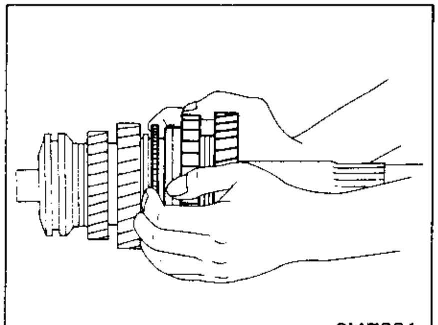
SMT330

11. Take out countershaft assembly.


SMT333

1st and 2nd main gear and reverse main gear

1. Remove mainshaft spacer and steel ball, and then remove 1st & 2nd synchronizer hub and reverse main gear together with 1st main gear, needle bearing and 1st gear bushing.



SMT334

Be careful not to lose steel ball retaining mainshaft spacer.

2. Remove 2nd gear and needle bearing.

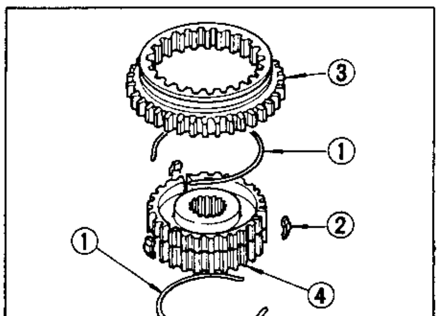
3rd main gear

1. Remove snap ring.
2. Draw out 3rd & 4th synchronizer, 3rd gear and needle bearing.

Synchronizer

Disassemble synchronizer.

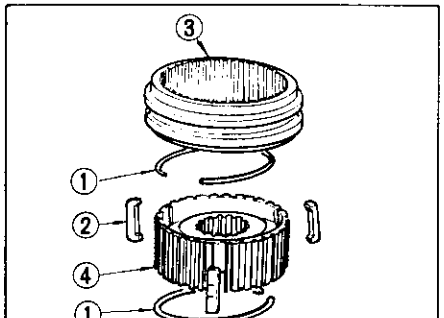
(1st & 2nd)



SMT335

1 Spread spring
2. Shifting insert
3 Reverse main gear (Coupling sleeve)
4 Synchronizer hub

(3rd & 4th)



SMT336

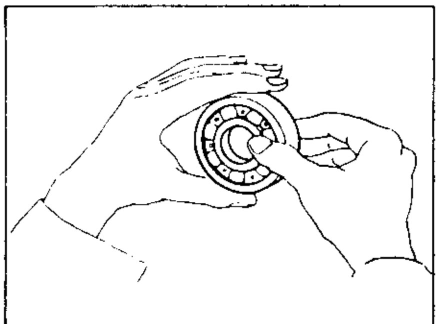
1 Spread spring
2 Shifting insert
3 Coupling sleeve
4 Synchronizer hub

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.



TM372

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 it.

With T100L transfer

- Select mainshaft snap ring and measure end play to insure that it is within specified limit.

Mainshaft snap ring:
Refer to S.D.S.

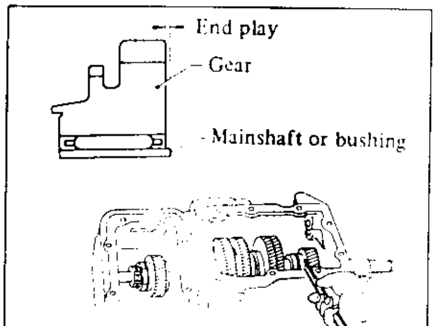
With T130A transfer

- Tighten mainshaft lock nut to specified limit and measure end play to insure that it is within specified limit.

Ⓣ : **Mainshaft lock nut:**
196 - 245 N·m
(20 - 25 kg-m,
145 - 181 ft-lb)

With T100L or T130A transfer

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

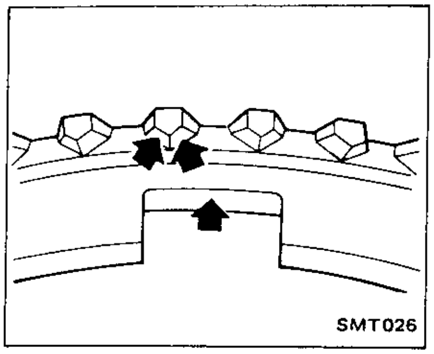


SMT337

Standard end play:
1st gear
0.15 - 0.30 mm
(0.0059 - 0.0118 in)
2nd gear
0.20 - 0.36 mm
(0.0079 - 0.0142 in)
3rd gear
0.10 - 0.26 mm
(0.0039 - 0.0102 in)
Reverse idler gear A
0.05 - 0.45 mm
(0.0020 - 0.0177 in)
Reverse idler gear B
0 - 0.50 mm
(0 - 0.0197 in)

Baulk ring

1. Replace baulk ring if found to be deformed, cracked or otherwise damaged excessively.



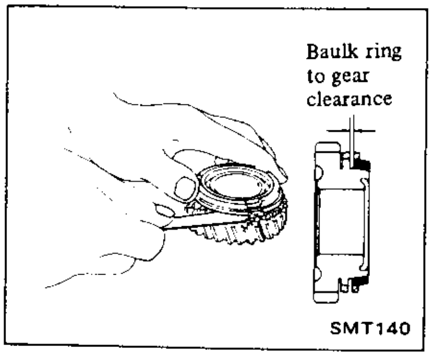
SMT026

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.

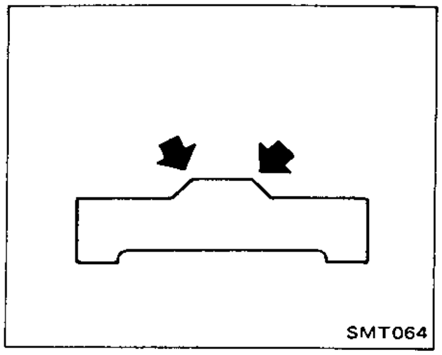
Baulk ring to gear clearance:
- **Standard**
  - **1st & 2nd**
    - **1.25 - 1.80 mm (0.0492 - 0.0709 in)**
  - **3rd & 4th**
    - **0.90 - 1.80 mm (0.0354 - 0.0709 in)**
- **Wear limit**
  - **1st & 2nd**
    - **Less than 0.8 mm (0.031 in)**
  - **3rd & 4th**
    - **Less than 0.5 mm (0.020 in)**



SMT140

Shifting insert

Replace, if worn excessively, worn unevenly, deformed, or damaged.



SMT064

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

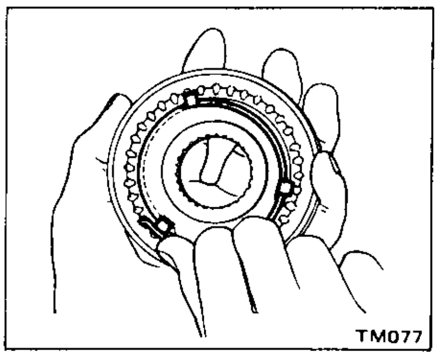
Synchronizer

1. Place synchro-hub into coupling sleeve.

Be sure that hub and sleeve operates smoothly and correctly by hand.

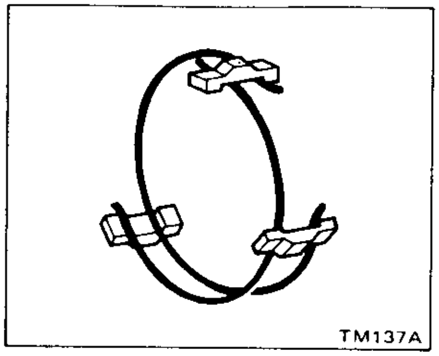
2. Fit shifting insert in three (3) grooves in synchro-hub.
3. Install spread spring to inserts so that insert is securely attached to inner side of coupling sleeve.

Install the other spread spring on the opposite side of synchro-hub.



TM077

Be careful not to hook front and rear ends of spread spring to the same insert.

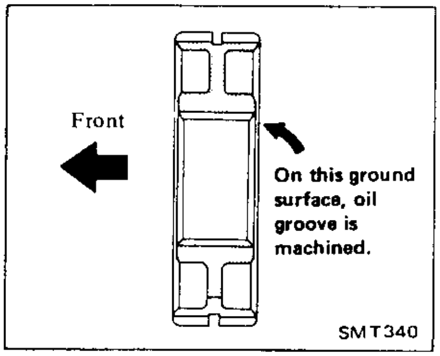


TM137A

3rd main gear

1. Assemble 3rd & 4th synchronizer, needle bearing and 3rd gear.

Assemble 3rd & 4th synchronizer, paying attention to its direction.



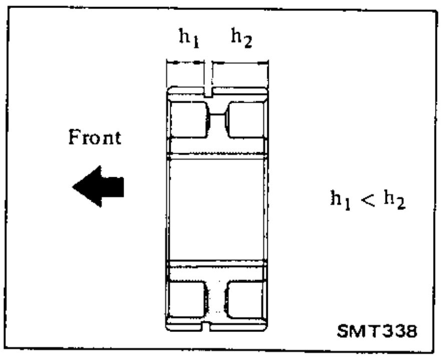
SMT340

2. Install snap ring.

1st and 2nd main gear and reverse main gear

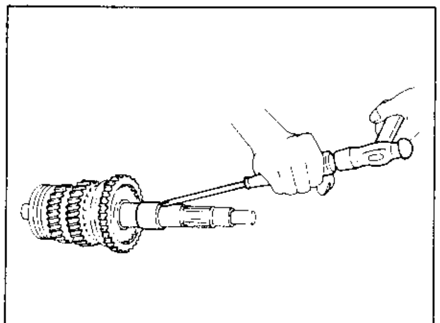
1. Assemble 2nd gear needle bearing, 2nd gear, baulk ring and 1st & 2nd synchronizer assembly.

Assemble 1st & 2nd synchronizer, paying attention to its direction.



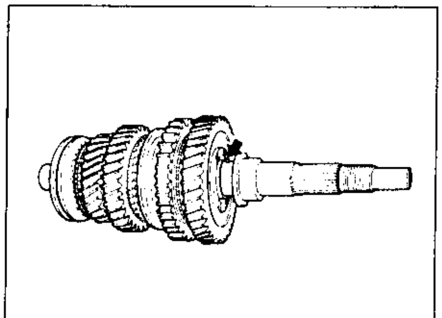
SMT338

2. Assemble 1st gear bushing, needle bearing, 1st gear, steel ball, and mainshaft spacer on mainshaft.



SMT379

Before installing steel ball, apply grease to it.

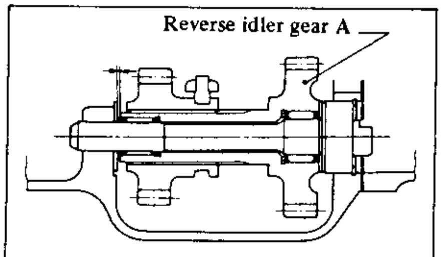


SMT339

Reverse idler gear A and B

1. Apply grease to thrust washers, then attach them to transmission case.
2. Install reverse idler gear A and B.
3. Install reverse idler shaft. Select a reverse idler shaft snap ring of suitable thickness so that end play of reverse idler gear A is within specified limit.

Reverse idler shaft snap ring:
Refer to S.D.S.

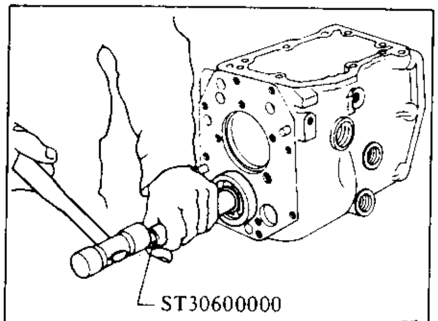


Reverse idler gear A end play:
0.05 - 0.45 mm (0.0020 - 0.0177 in)

SMT462

Counter gear and mainshaft

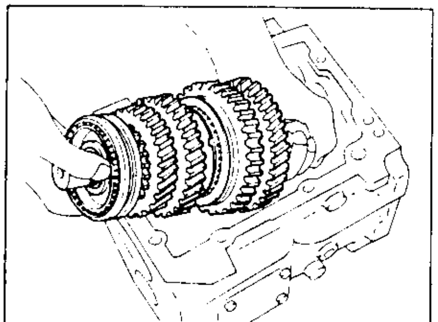
1. Install countershaft together with countershaft front bearing.
2. Press countershaft rear bearing.



TM967

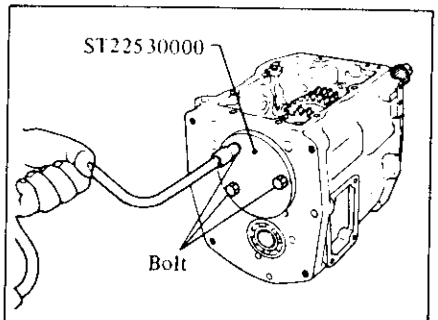
3. Install mainshaft assembly.

Be careful not to drop steel ball.



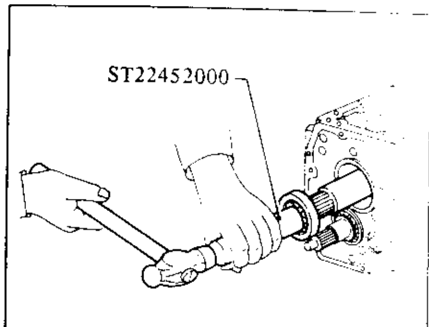
SMT343

4. Install **Tool ST22530000** on the front side of transmission case to support the front end of mainshaft. Use front cover securing bolts.



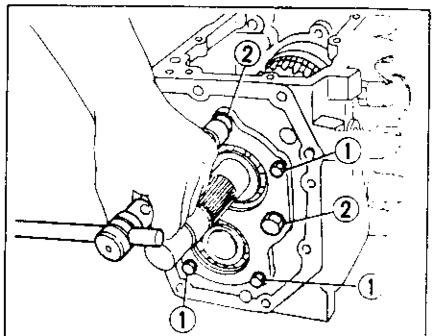
TM515

5. Press mainshaft bearing.



SMT345

6. Install bearing retainer.



SMT380

Ⓣ : ① 8 - 13 N·m (0.8 - 1.3 kg-m, 5.8 - 9.4 ft-lb)
② 26 - 36 N·m (2.7 - 3.7 kg-m, 20 - 27 ft-lb)

7. **With T100L transfer**

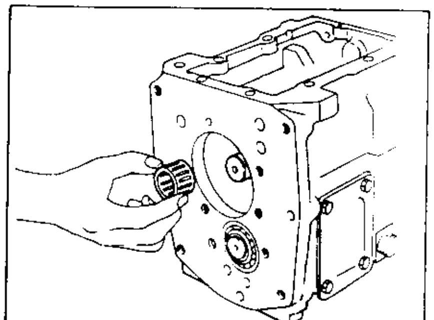
(1) Install bearing spacer, then select snap ring so that the play on mainshaft is minimum.

Mainshaft snap ring:
Refer to S.D.S.

(2) Install bearing spacer and secure it with snap ring.

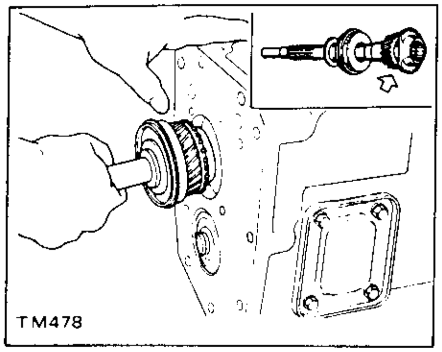
Main drive gear

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



SMT346

2. Install main drive gear assembly with baulk ring, placing the cut-out portion facing downward on main drive gear.



TM478

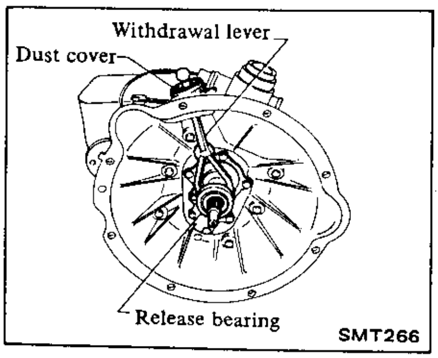
3. Install front cover. **Refer to Transmission Case for assembly.**
4. Install forks and fork rods. **Refer to Forks and Fork Rods for assembly.**
5. Install transfer unit (with T130 transfer). **Refer to Transmission Case for assembly.**

REPLACEMENT OF OIL SEAL

FRONT COVER OIL SEAL

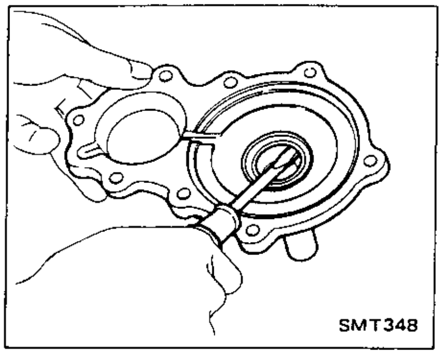
It is necessary to remove transmission unit from vehicle. Replace oil seal as follows:

1. Remove transmission. Refer to Removal.
2. Wipe off dirt and grease.
3. Drain oil.
4. Remove dust cover, release bearing and withdrawal lever.



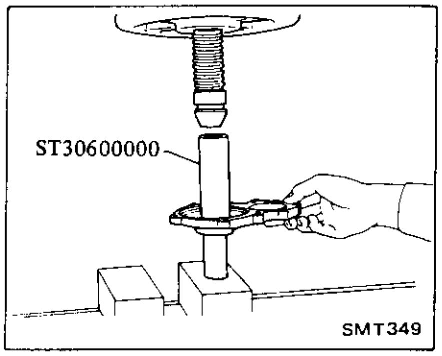
SMT266

5. Remove front cover.
6. Remove oil seal.



SMT348

7. Apply coat of gear oil to oil seal surface, then drive new seal into place.



SMT349

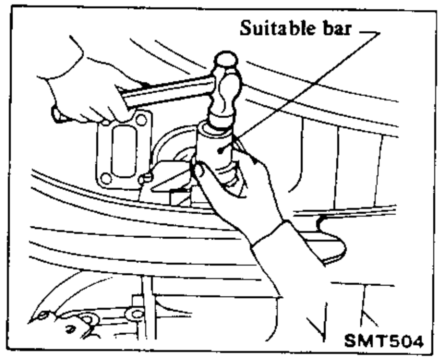
8. Lubricate seal lip and main drive shaft with gear oil.
9. Install front cover in reverse order of removal.

REAR EXTENSION OIL SEAL

(With T100L transfer)

It is necessary to remove transfer unit from vehicle. Replace oil seal as follows:

1. Remove transfer. **Refer to Transfer for removal.**
2. Remove primary propeller shaft. **Refer to Propeller Shaft for removal.**
3. Wipe off dirt and grease.
4. Remove oil seal.
5. Apply coat of gear oil to oil seal surface, then drive new seal into place.



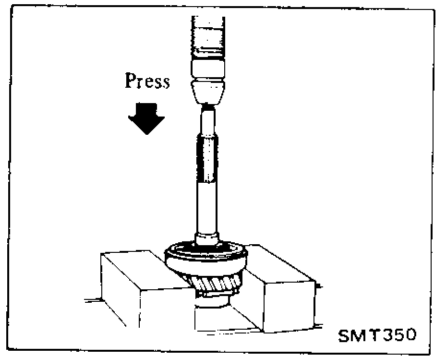
SMT504

6. Lubricate seal lip and primary propeller shaft with gear oil.
7. Install transfer in reverse order of removal.

REPLACEMENT OF BEARINGS

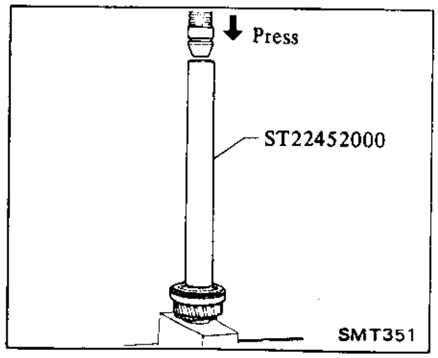
MAIN DRIVE GEAR

1. Remove main drive gear together with main drive gear ball bearing. **Refer to Gears and Shafts for disassembly.**
2. Remove main drive gear snap ring and spacer.
3. Remove main drive bearing.



SMT350

4. Press new main drive bearing.



SMT351

5. Place main drive bearing spacer on main drive bearing and secure main drive bearing with snap ring.
6. Install main drive gear into transmission case. **Refer to Main drive gear for assembly.**

MAINSHAFT AND COUNTER GEAR

Rear side

1. **With T100L transfer**

   Remove rear extension.

   Refer to Transmission Case for disassembly.

   With T130A transfer

   Remove transfer unit from transmission case. **Refer to Transmission Case for disassembly.**
2. Measure gear end play.

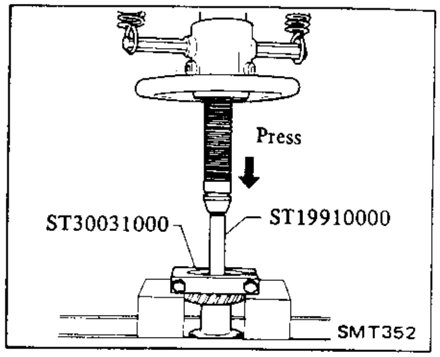
   Refer to Gear and shaft for inspection.
3. Remove forks and fork rods. **Refer to Forks and Fork Rods for disassembly.**
4. Remove bearing retainer.
5. Remove snap ring at the rear end of countershaft.
6. Slide counter shaft and mainshaft backward to remove countershaft rear and mainshaft bearings evenly by tapping them.
7. Remove countershaft rear bearing.
8. Remove mainshaft bearing.
9. Press new counter gear rear bearing.
10. Press new mainshaft bearing.
11. Install mainshaft and counter gear into transmission.
12. Measure gear end play.

    Refer to Gear and Shaft for inspection.

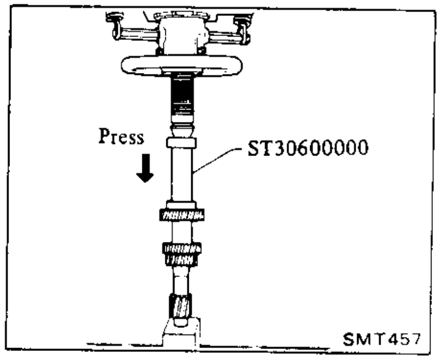
Front side

1. Remove counter gear. **Refer to Counter Gear for disassembly.**
2. Press out countershaft front bearing.

CAUTION:
When pressing out bearing, hold shaft by hand so as not to drop it.



3. Press new countershaft front bearing.

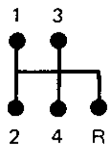


4. Install counter gear into transmission.

   Refer to Counter Gear and Mainshaft for assembly.

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Transmission model			F4W81A
No. of speed			4
Synchromesh type			Warner
Shift type			
Gear ratio		1st	3.519
		2nd	2.157
		3rd	1.449
		4th	1.000
		Rev.	4.181
Number of teeth	Mainshaft	Drive	27
		1st	38
		2nd	33
		3rd	30
		Rev.	33
	Countershaft	Drive	30
		1st	12
		2nd	17
		3rd	23
		Rev.	12
	Rev. idler gear	Mainshaft (*1)	19
		Countershaft (*2)	26
Oil capacity ℓ (Imp pt)			2.7 (4-3/4)

(*1) Mesh to main reverse gear.
(*2) Mesh to counter reverse gear.

INSPECTION AND ADJUSTMENT

GEAR END PLAY

Unit: mm (in)

Position \ Model	All models
1st main gear	0.15 - 0.30 (0.0059 - 0.0118)
2nd main gear	0.20 - 0.36 (0.0079 - 0.0142)
3rd main gear	0.10 - 0.26 (0.0039 - 0.0102)
Rev. idler gear A	0.05 - 0.45 (0.0020 - 0.0177)
Rev. idler gear B	0 - 0.50 (0 - 0.0197)

CLEARANCE BETWEEN BAULK RING AND GEAR

Unit: mm (in)

		All models
Standard	1st & 2nd	1.25 - 1.80 (0.0492 - 0.0709)
	3rd & 4th	0.90 - 1.80 (0.0354 - 0.0709)
Wear limit	1st & 2nd	0.8 (0.031)
	3rd & 4th	0.5 (0.020)

AVAILABLE SNAP RING

Mainshaft (With T100L transfer)

Unit: mm (in)

Thickness	Part number
2.4 (0.094)	32311 78000
2.5 (0.098)	32311 78001
2.6 (0.102)	32311 78002
2.7 (0.106)	32311 78003
2.8 (0.110)	32311 78004
2.9 (0.114)	32311 78005

Reverse idler shaft

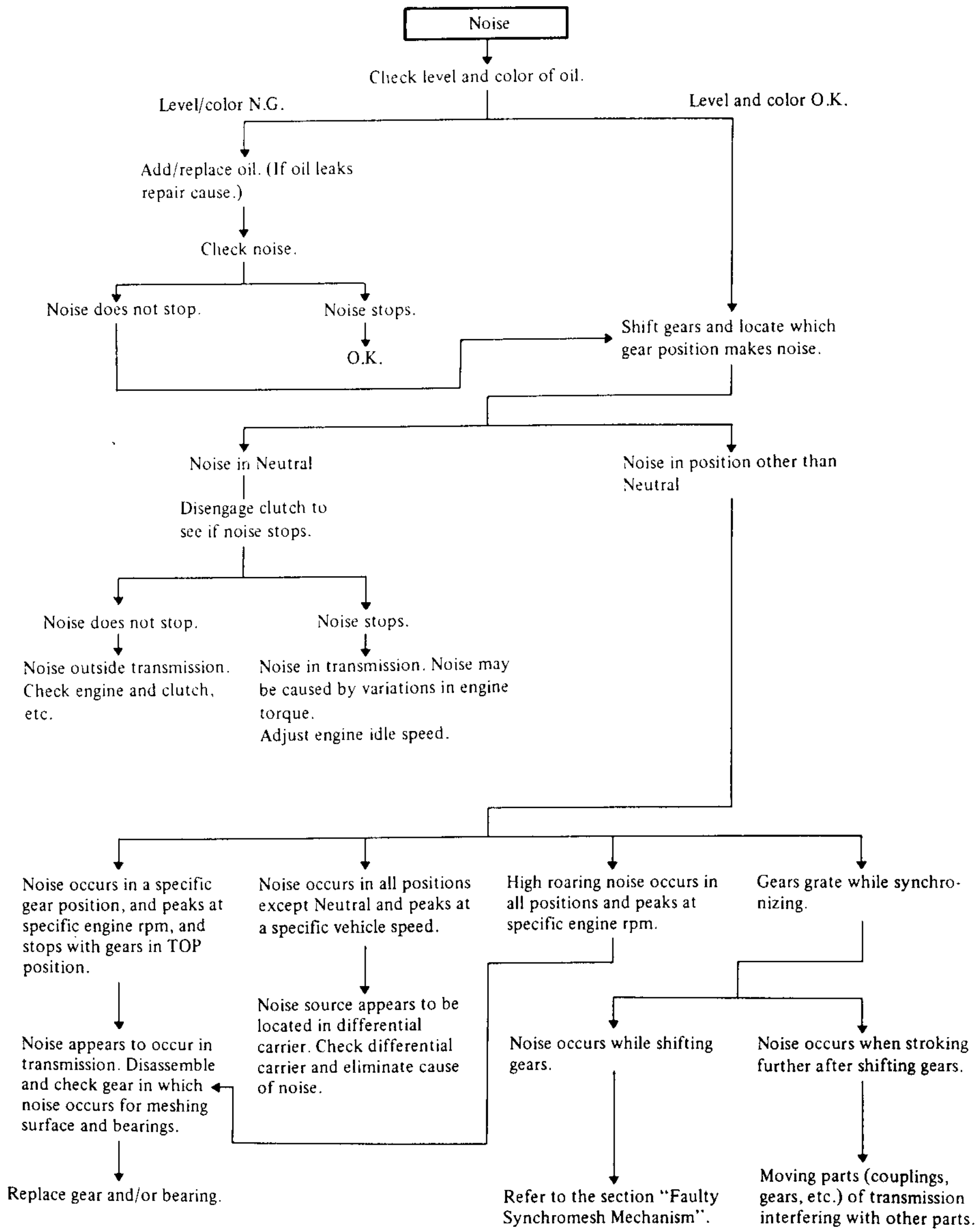
Unit: mm (in)

Thickness	Part number
1.55 (0.0610)	32285 86401
1.90 (0.0748)	32285 86402
1.30 (0.0512)	32285 86403

TIGHTENING TORQUE

Unit		N·m	kg-m	ft-lb
Gear oil filler plug		25 - 34	2.5 - 3.5	18 - 25
Transmission to engine installation bolt	P40, SD33	38 - 49	3.9 - 5.0	28 - 36
	L28 "A" bolt	43 - 58	4.4 - 5.9	32 - 43
	L28 "B" bolt	25 - 35	2.6 - 3.6	19 - 26
Clutch housing installation bolt		36 - 49	3.7 - 5.0	27 - 36
Reverse shift fork shaft nut		78 - 98	8 - 10	58 - 72
Check ball plug		16 - 22	1.6 - 2.2	12 - 16
Transmission to transfer installation bolt		20 - 27 18 - 25	2.0 - 2.8 1.8 - 2.5	14 - 20 13 - 18
Mainshaft lock nut		196 - 245	20 - 25	145 - 181
Mainshaft cover bolt		26 - 36	2.7 - 3.7	20 - 27
Front cover bolt		20 - 27	2.0 - 2.8	14 - 20
Gear shift housing bolt		18 - 25	1.8 - 2.6	13 - 19
Gear oil drain plug		25 - 34	2.5 - 3.5	18 - 25
Bearing retainer bolt		26 - 36 8 - 13	2.7 - 3.7 0.8 - 1.3	20 - 27 5.8 - 9.4
Reverse lamp switch		20 - 29	2.0 - 3.0	14 - 22
Lever pin nut		8 - 11	0.8 - 1.1	5.8 - 8.0
Baffle plate installation bolt		3 - 4	0.3 - 0.4	2.2 - 2.9
P.T.O. cover bolt		8 - 13	0.8 - 1.3	5.8 - 9.4

TROUBLE DIAGNOSES AND CORRECTIONS



Gear jumping out of mesh

↓

Locate position where gears jump out of mesh.

↓

- Check for free play in control lever.
- Shifting is accomplished without problems. (Check interference of control lever with console, and check rubber boot of control lever for fatigue.)

  - N.G. → Adjust or replace.
  - O.K. → Check for fatigue, play, etc. on front and rear engine mounts.
    - N.G. → Adjust or replace.
    - O.K. → Problem may be inside transmission. Disassemble and check transmission.

      ↓

      Check end play of "jump-out" gear.
      - End play excessive → Replace.
      - End play O.K. → Check for engaging, damage or wear on coupling sleeve, synchronizer hub, and clutch gear of main gear.
        - Damage or wear → Replace.
        - O.K. → Check for wear or damage on check ball and fatigue or breaks on check spring.
          - Damage or wear → Replace.
          - O.K. → Check for wear or deformation of fork rod ball groove.
            - Wear or deformation → Replace.
            - O.K. → Check for wear or play of "jump-out" synchronizer and mainshaft splines.
              - Wear or play → Replace.
              - No wear or play → Check for wear or damage on bearings of mainshaft and countershaft. Replace if worn.

Faulty synchromesh mechanism (Noise occurs while shifting gears)

↓

Locate position where improper synchromeshing occurs.

↓

Check disengaging of clutch. (Refer to Clutch Drags (Section CL) for trouble diagnoses and corrections.

- N.G. → Repair or replace.
- O.K. → Problem may be inside transmision. Disassemble and check transmission.

↓

Measure baulk ring-to-gear clearance. Refer to Baulk Ring for inspection.

- Clearance N.G. → Replace baulk ring.
- Clearance O.K. → Check for wear on chamfered area of baulk ring.

Check for wear on chamfered area of baulk ring.

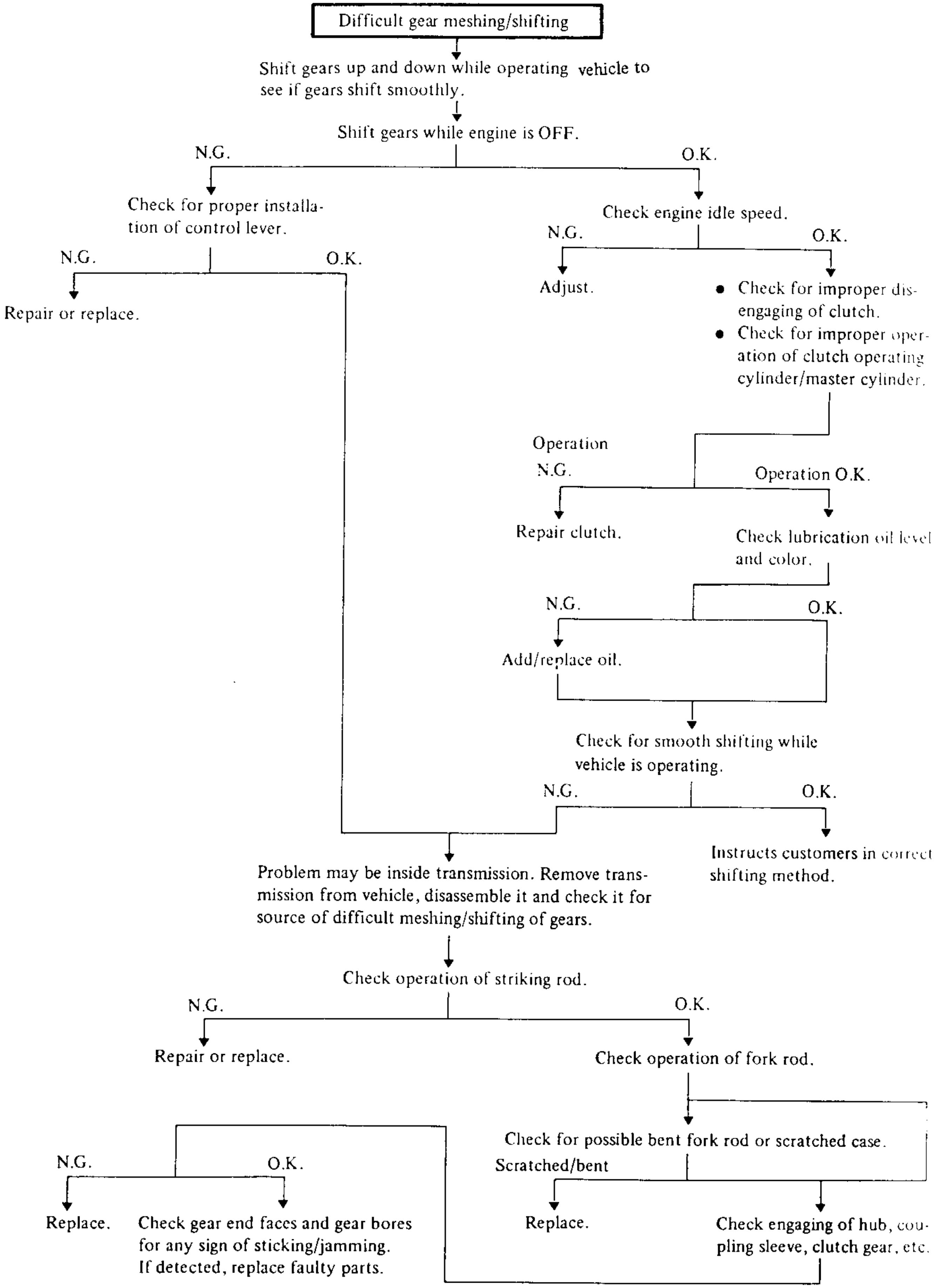
- Chamfered area worn → Replace.
- Chamfered area not worn → Check contact pattern of baulk ring and tapered cone of clutch gear.

Check contact pattern of baulk ring and tapered cone of clutch gear.

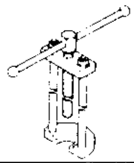
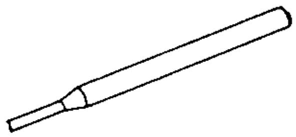
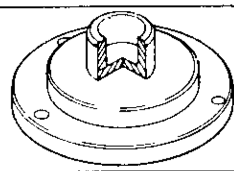
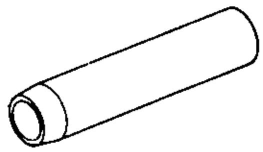
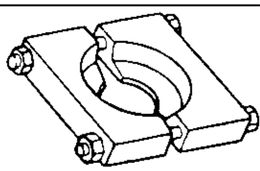
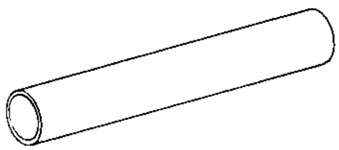
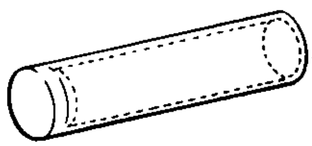
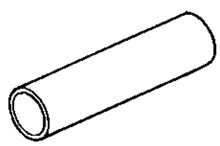
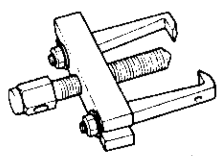
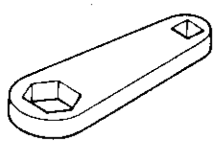
- Improper contact → Replace baulk ring.
- Proper contact → Check spread spring for any break or bending.

Check spread spring for any break or bending.

- Spread spring broken/bent → Replace.
- Spread spring not broken/bent → Check for wear/deformation of insert. Refer to Shifting Insert for inspection.


Difficult gear meshing/shifting
Shift gears up and down while operating vehicle to see if gears shift smoothly.
Shift gears while engine is OFF.
N.G.
O.K.
Check for proper installation of control lever.
N.G.
O.K.
Repair or replace.
Check engine idle speed.
N.G.
O.K.
Adjust.
• Check for improper disengaging of clutch.
• Check for improper operation of clutch operating cylinder/master cylinder.
Operation N.G.
Operation O.K.
Repair clutch.
Check lubrication oil level and color.
N.G.
O.K.
Add/replace oil.
Check for smooth shifting while vehicle is operating.
N.G.
O.K.
Instructs customers in correct shifting method.
Problem may be inside transmission. Remove transmission from vehicle, disassemble it and check it for source of difficult meshing/shifting of gears.
Check operation of striking rod.
N.G.
O.K.
Repair or replace.
Check operation of fork rod.
Check for possible bent fork rod or scratched case.
Scratched/bent
Replace.
Check engaging of hub, coupling sleeve, clutch gear, etc.
N.G.
O.K.
Replace.
Check gear end faces and gear bores for any sign of sticking/jamming. If detected, replace faulty parts.

SPECIAL SERVICE TOOLS

Tool number	Tool name
KV32101200	Mainshaft bearing puller 
KV32101100	Fork rod pin punch 
ST22530000	Adapter 
ST22360002	Bearing drift 
ST30031000	Bearing puller 
ST22452000	Mainshaft bearing drift 
ST19910000	Bearing drift 
ST30600000	Bearing drift 
ST33051001	Bearing puller 
KV32101600	Wrench 

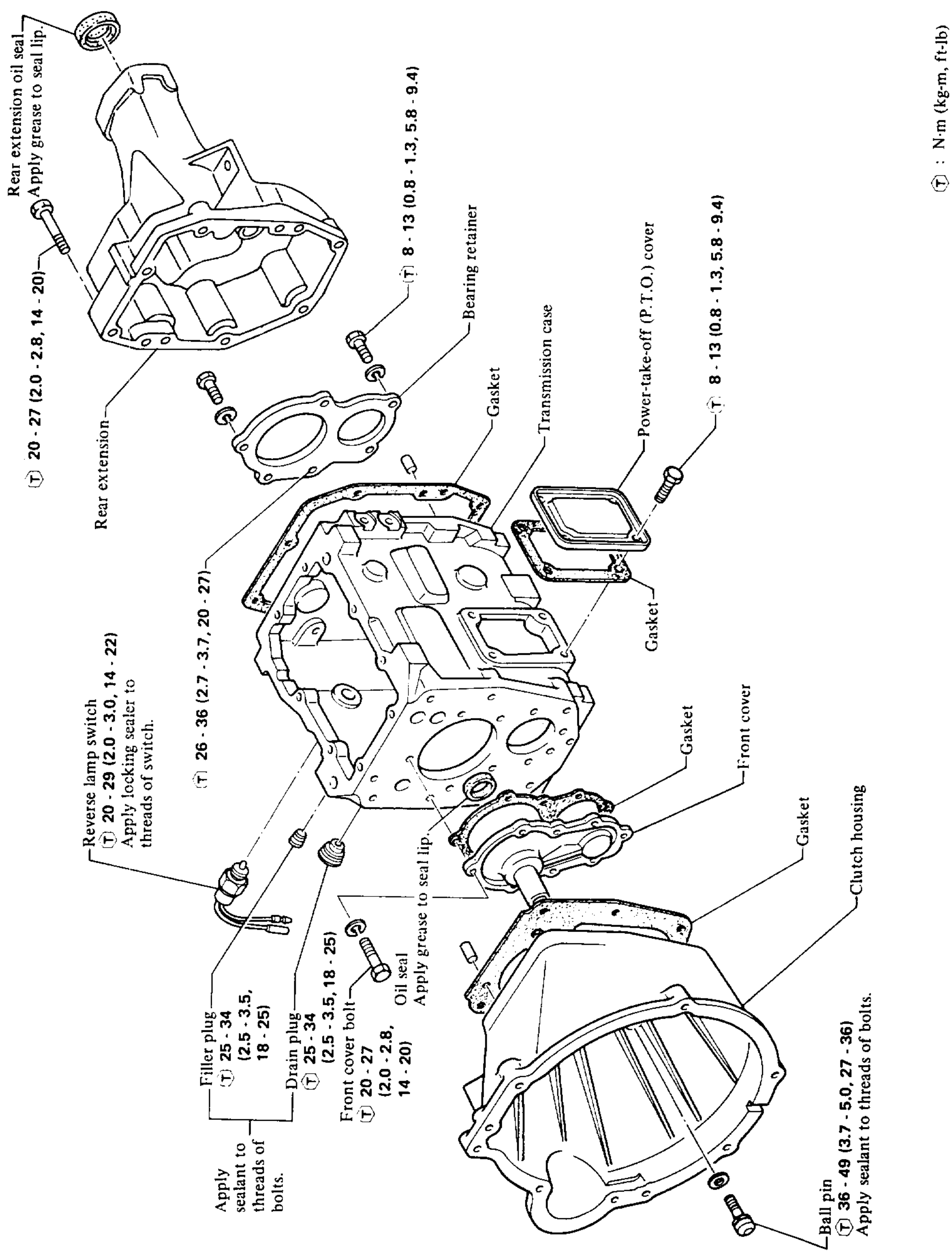
MANUAL TRANSMISSION

SECTION MT

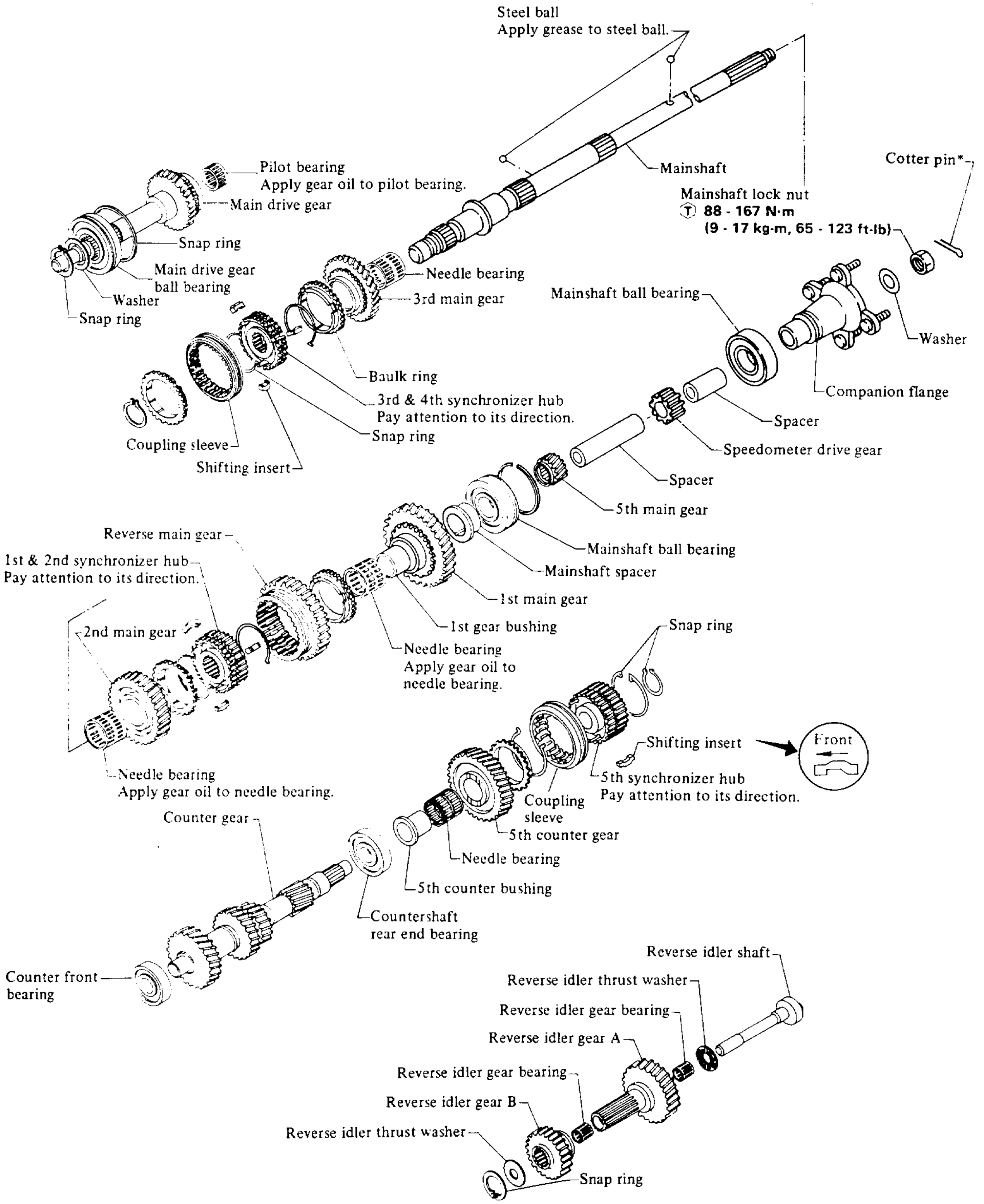
MT

MANUAL TRANSMISSION — 5-speed transmission (Model: FS5W81A)

5-SPEED TRANSMISSION (Model: FS5W81A) – 2WD model



SMT501A

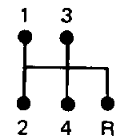
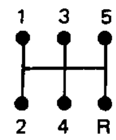
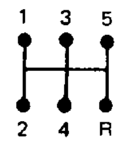


*Do not reuse pin after removal.

SMT502A

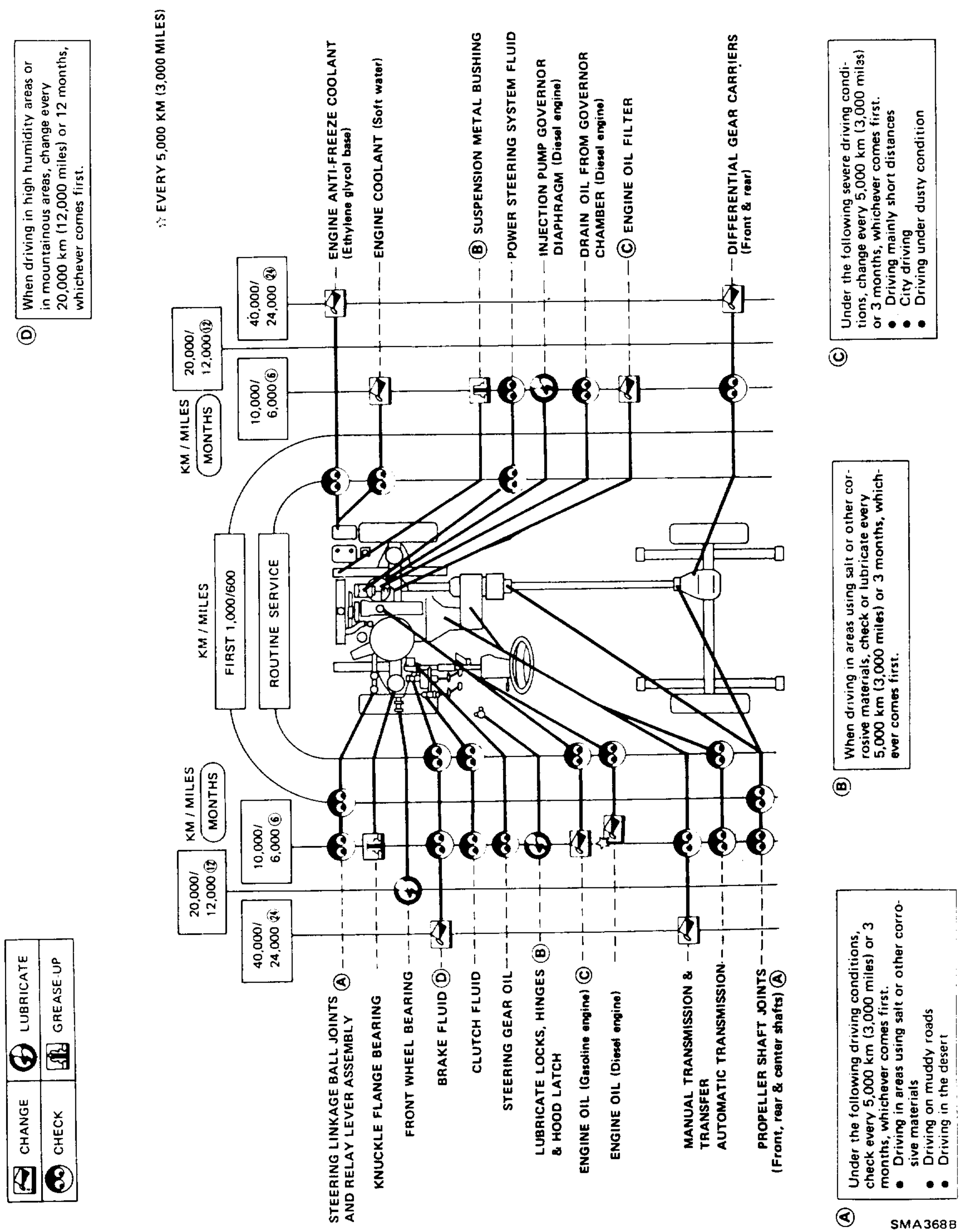
SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Vehicle model	4WD model				2WD model
Transmission model	F4W81A		FS5W81A		FS5W81A
Engine	L28	P40	L28, SD33	SD33T, P40	L28
No. of speed	4		5		5
Synchromesh type	Warner				Warner
Shift type					
Gear ratio					
1st	4.222	3.897	4.222	3.897	4.222
2nd	2.370	2.370	2.370	2.370	2.370
3rd	1.440	1.440	1.440	1.440	1.440
4th	1.000	1.000	1.000	1.000	1.000
O.D.	–	–	0.825	0.825	0.825
Rev.	4.622	4.267	4.622	4.267	4.622
Number of teech					
Mainshaft					
Drive	24	24	24	24	24
1st	38	38	38	38	38
2nd	32	32	32	32	32
3rd	27	27	27	27	27
O.D.	–	–	26	26	26
Rev.	32	32	32	32	32
Countershaft					
Drive	32	32	32	32	32
1st	12	13	12	13	12
2nd	18	18	18	18	18
3rd	25	25	25	25	25
O.D.	–	–	42	42	42
Rev.	12	13	12	13	12
Rev. idler gear					
Countershaft (*A)	26	26	26	26	26
Mainshaft (*B)	20	20	20	20	20
Oil capacity ℓ (Imp pt)	2.7 (4-3/4)	2.7 (4-3/4)	2.7 (4-3/4)	2.7 (4-3/4)	2.7 (4-3/4)

(*A) Mesh to counter reverse gear.
(*B) Mesh to reverse main gear.

LUBRICATION CHART



AUTOMATIC TRANSMISSION

CONTENTS

AT

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.

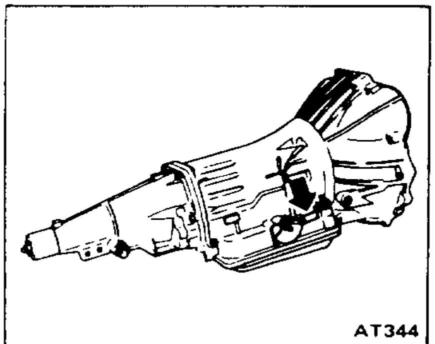
FLUID RECOMMENDATION

Use "DEXRON" type automatic transmission fluid only.

IDENTIFICATION NUMBER

Stamped position:

The plate is attached to the right hand side of transmission case.



AT344

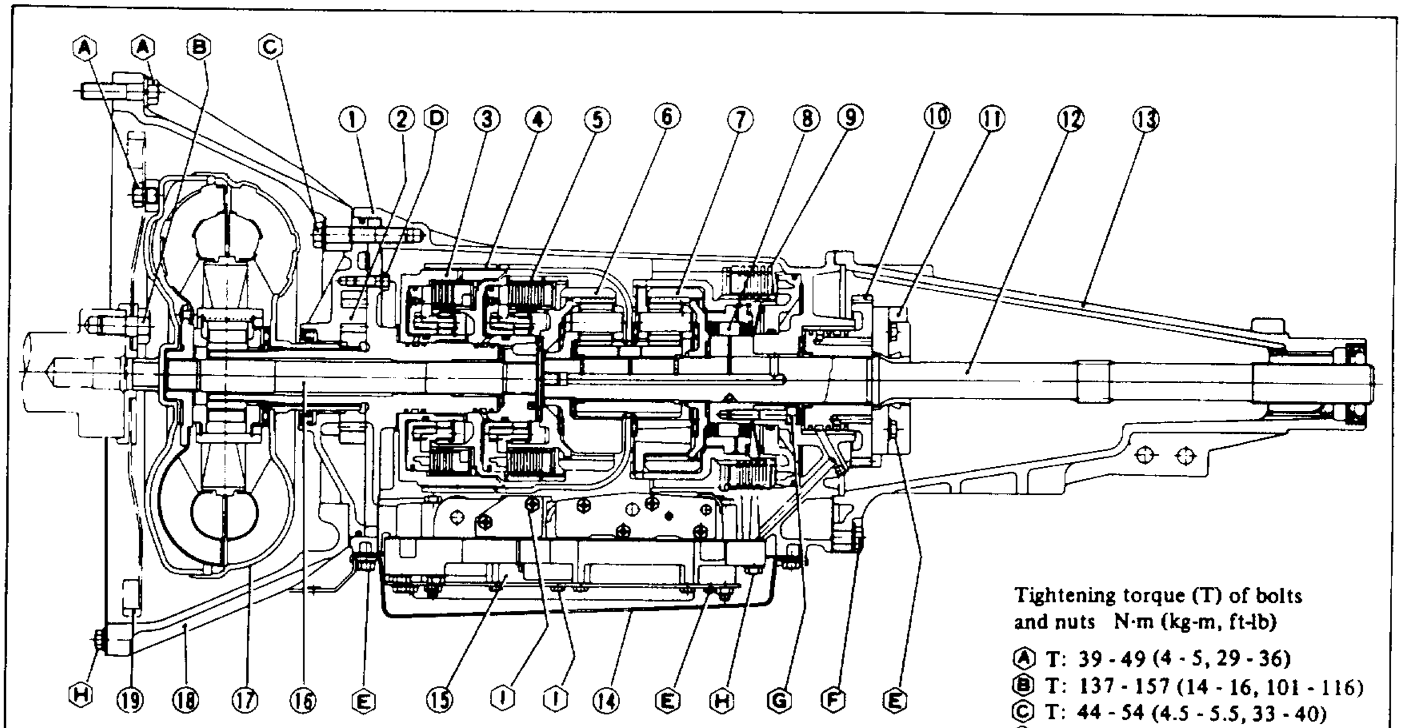
Identification of number arrangements:

JAPAN AUTOMATIC TRANSMISSION CO., LTD
MODEL X0123
NO. 7601234

Number designation

7 6 0 1 2 3 4

- 7: Last figure denoting the year (A.D.)
- 6: Month of production [1: Jan., 2: Feb., ... X: Oct., Y: Nov., Z: Dec.]
- 01234: Serial production number for the month



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)

- Ⓐ T: 39 - 49 (4 - 5, 29 - 36)
- Ⓑ T: 137 - 157 (14 - 16, 101 - 116)
- Ⓒ T: 44 - 54 (4.5 - 5.5, 33 - 40)
- Ⓓ T: 6 - 8 (0.6 - 0.8, 4.3 - 5.8)
- Ⓔ T: 5 - 7 (0.5 - 0.7, 3.6 - 5.1)
- Ⓕ T: 20 - 25 (2.0 - 2.5, 14 - 18)
- Ⓖ T: 13 - 18 (1.3 - 1.8, 9 - 13)
- Ⓗ T: 5.4 - 7.4 (0.55 - 0.75, 4.0 - 5.4)
- Ⓘ T: 2.5 - 3.4 (0.25 - 0.35, 1.8 - 2.5)

AT312

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.

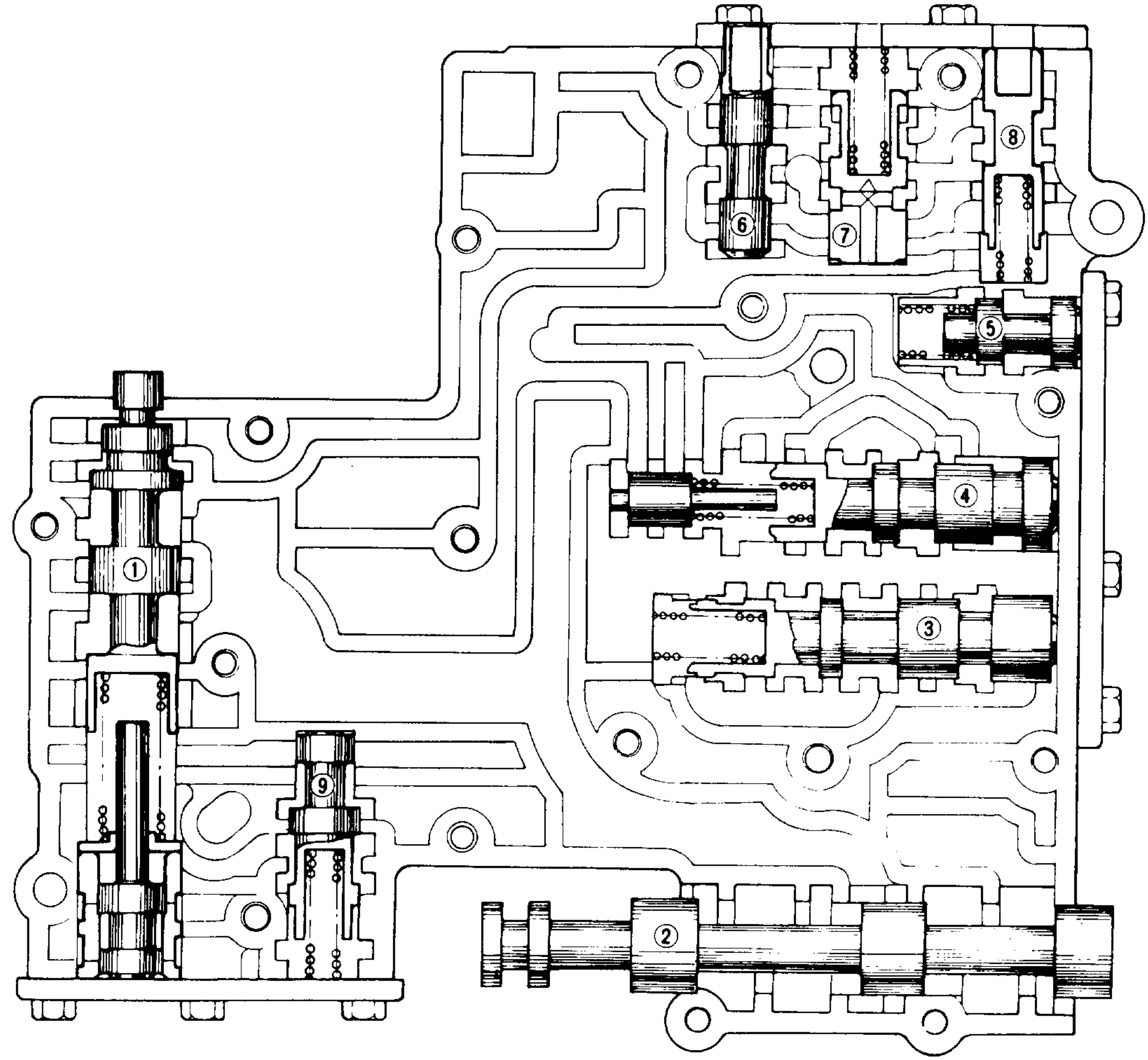
Second lock valve

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.

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

SAT163

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.

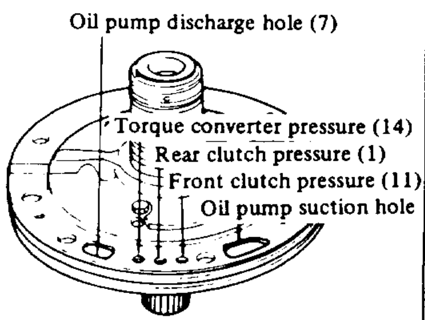
Auxiliary line pressure: 13

Torque converter pressure: 14

Governor pressure: 15

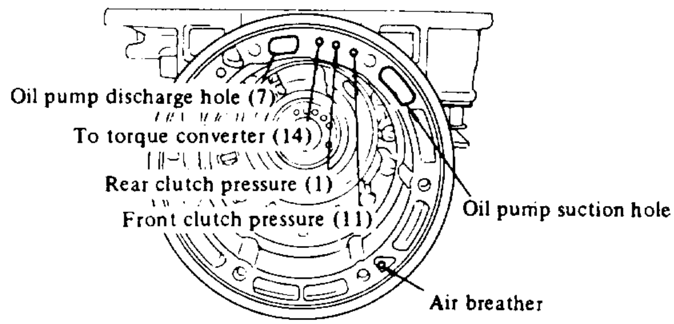
Throttle system pressure:
16, 17, 18, 19.

Oil Channels in Oil Pump



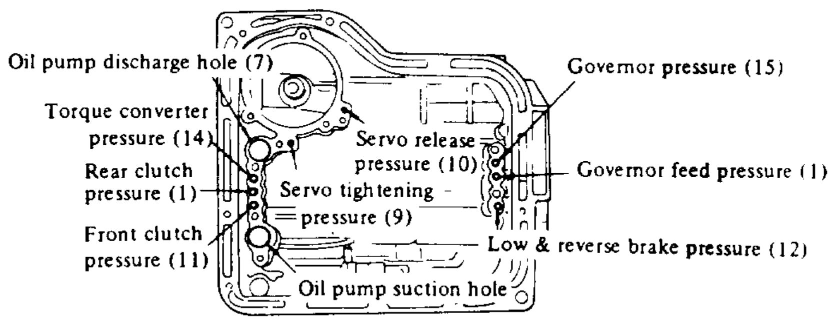
AT105

Oil Channels in Case Front Face



AT106

Oil Channels in Case Face



AT107

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.

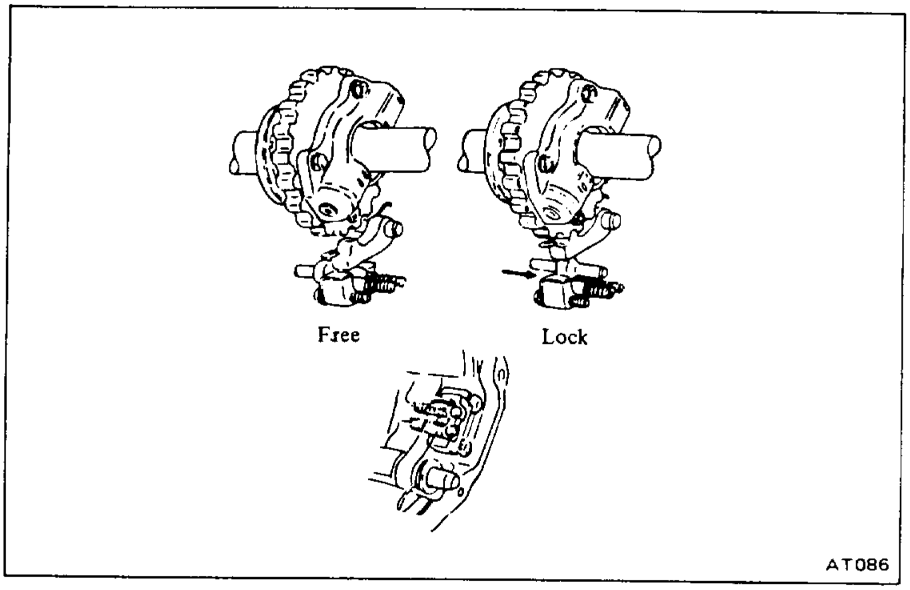
HYDRAULIC CONTROL CIRCUITS

"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

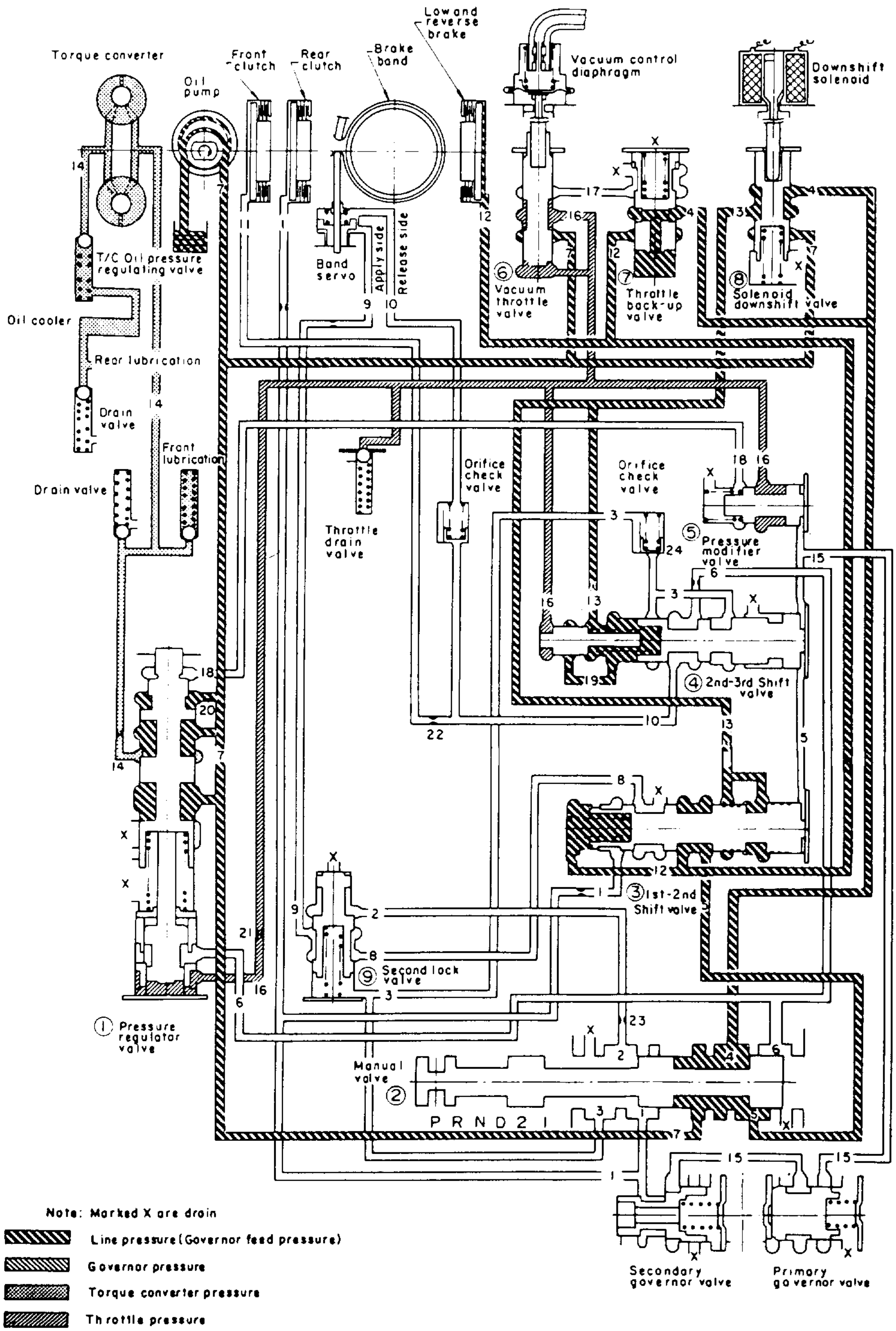


Fluid flow

Manual Valve → 4 → Downshift Valve — 13 → 2nd-3rd Shift valve
→ 1st-2nd Shift Valve
4 → Throttle Back-up Valve

Manual Valve → 5 → 1st-2nd Shift Valve — 12 → Throttle Back-up Valve
→ $\boxed{\text{Low \& Reverse Brake}}$

Oil Pressure Circuit Diagram – "P" range (Park)



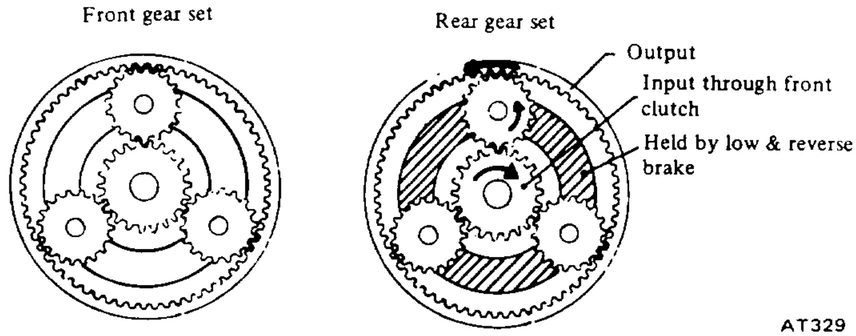
SAT164

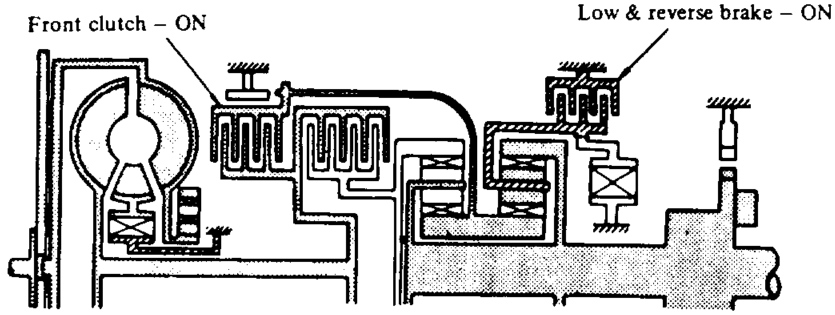
"R" RANGE (REVERSE)

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





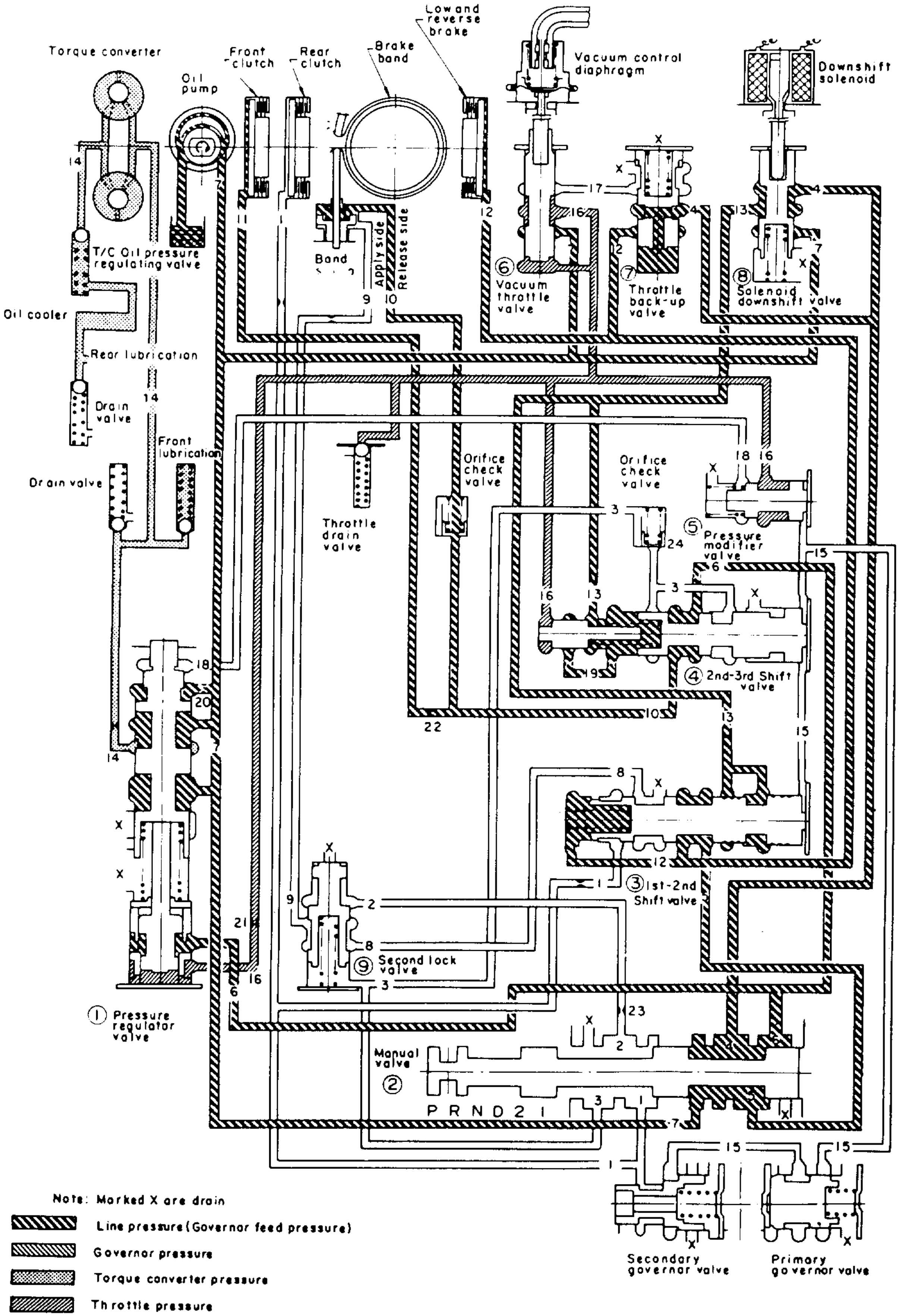
Front clutch	ON
Rear clutch	OFF
Low and reverse brake	ON
Brake band servo	OFF - Pressure release
One-way clutch	Overrunning

AT085

Fluid flow

- Manual Valve
  - 4 → Downshift Valve — 13
    - → 2nd-3rd Shift Valve
    - → 1st-2nd Shift Valve
  - 4 → Throttle Back-up Valve
  - 5 → 1st-2nd Shift Valve — 12
    - → Throttle Back-up Valve
    - → Low & Reverse Brake
  - 6 → Pressure Regulator Valve
  - 6 → 2nd-3rd Shift Valve — 10
    - → Band Servo Release Side
    - — 11 → Front Clutch

Oil Pressure Circuit Diagram – "R" range (Reverse)



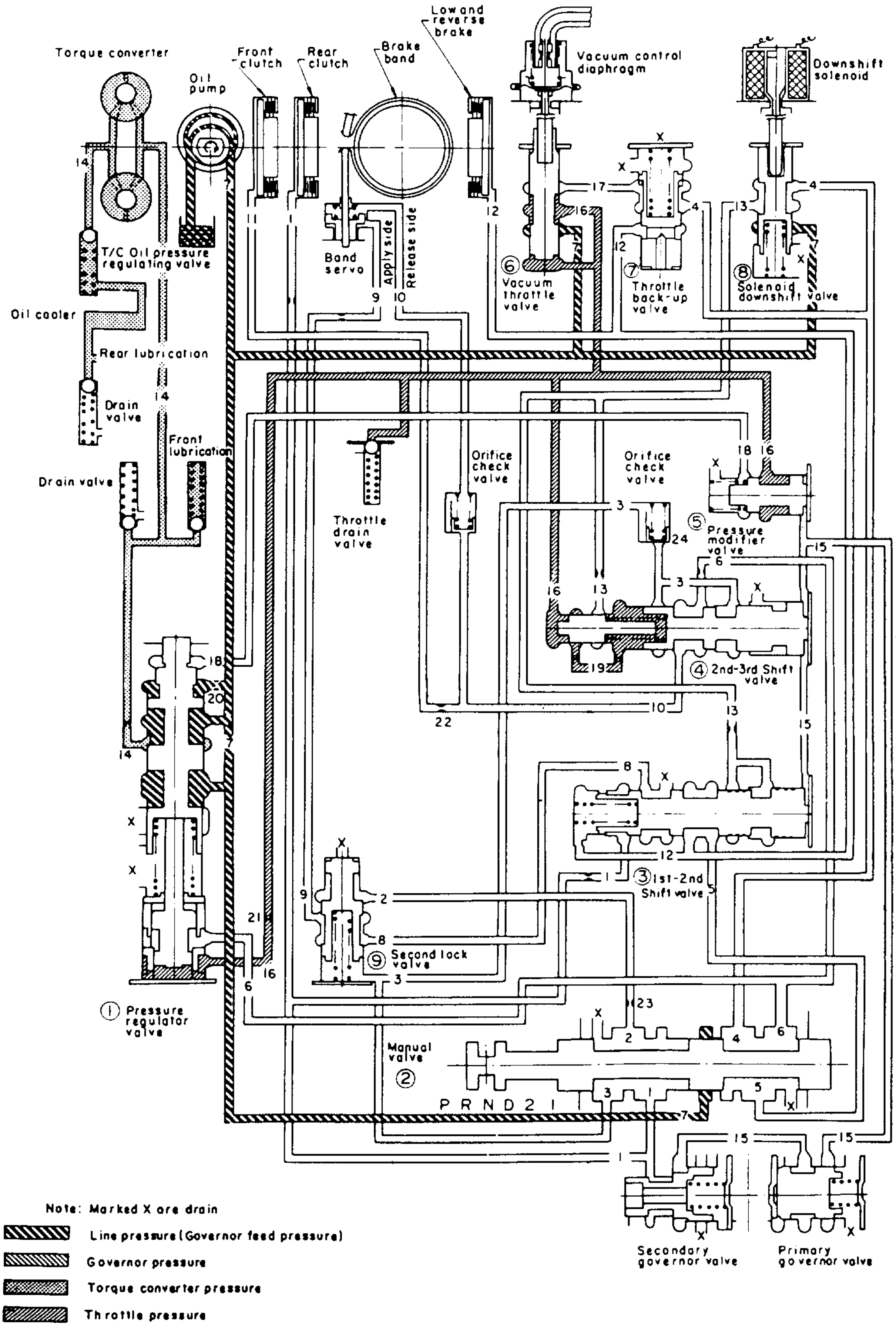
SAT165

"N" RANGE (NEUTRAL)

Power flow

In "N" range no friction elements are in use, thus no power is transmitted to the output shaft.

Oil Pressure Circuit Diagram – "N" range (Neutral)



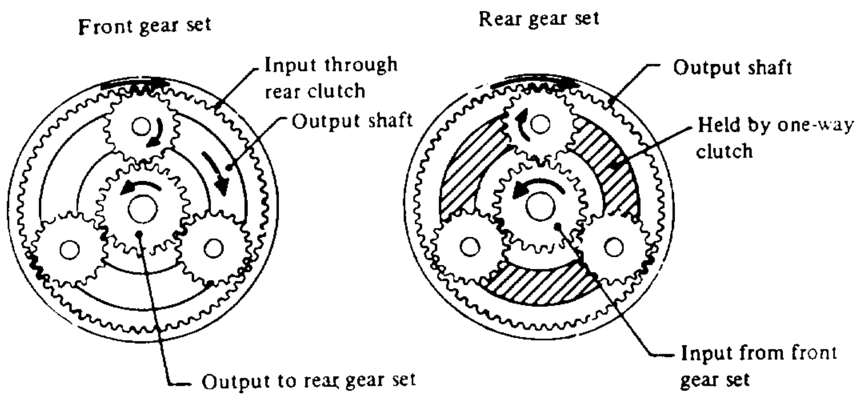
SAT166

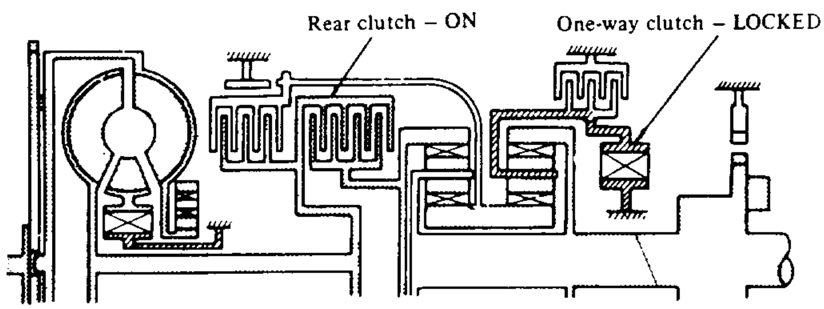
"D₁" RANGE (LOW GEAR)

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 "D₁" Range





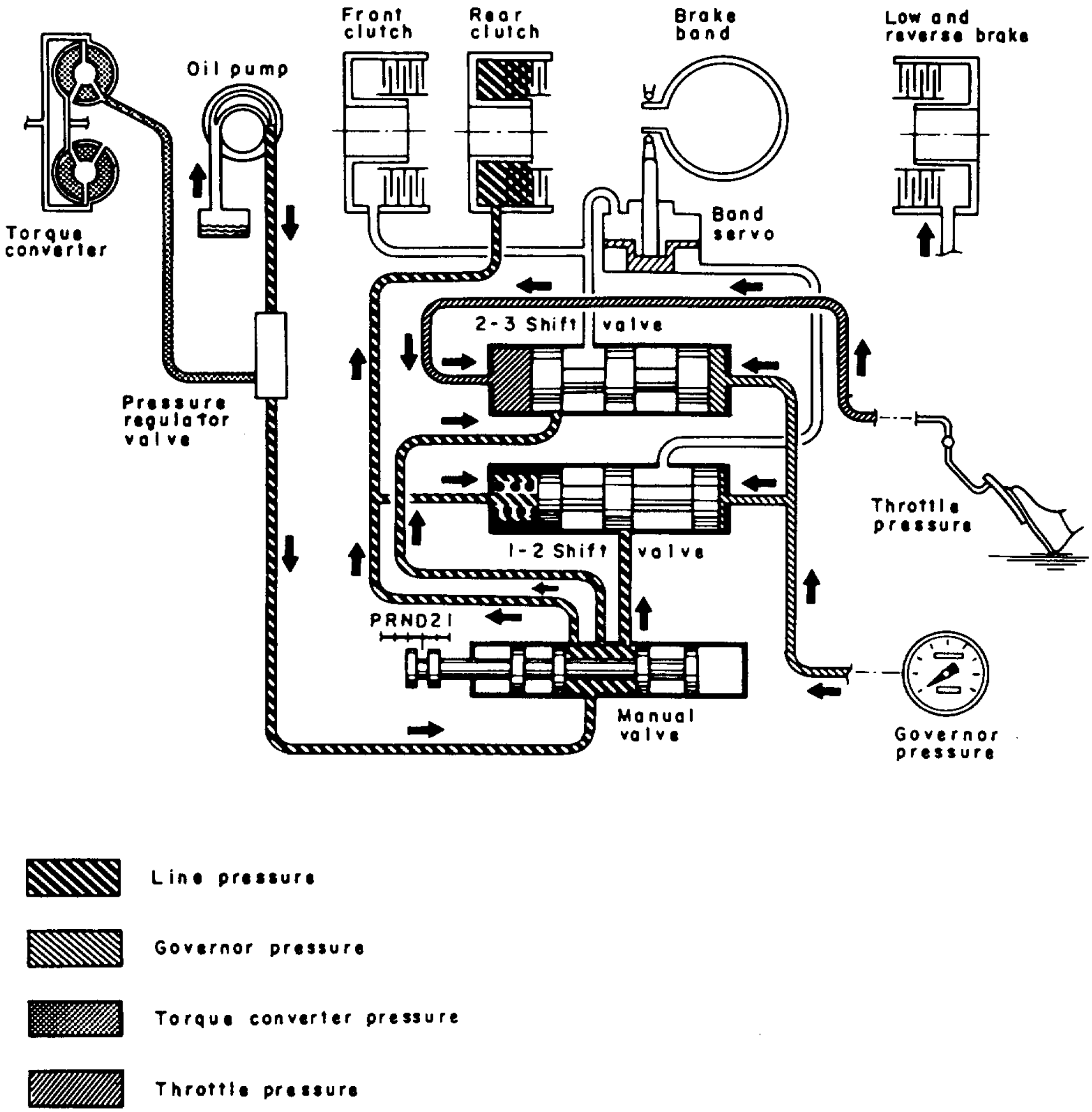
Front clutch	OFF
Rear clutch	ON
Low and reverse brake	OFF
Brake band servo	OFF
One-way clutch	HOLDING

AT081

Fluid flow

Manual Valve
- 1
  - → Governor Valve — 15
    - → Pressure Modifier Valve
    - → 2nd-3rd Shift Valve
    - → 1st-2nd Shift Valve
  - → 1st-2nd Shift Valve
  - → **Rear Clutch**
- 2 → Second Lock Valve
- 3
  - → Second Lock Valve
  - → Orifice Check Valve → 2nd-3rd Shift Valve

Oil Pressure Circuit Diagram – "D_1" range (Low gear)



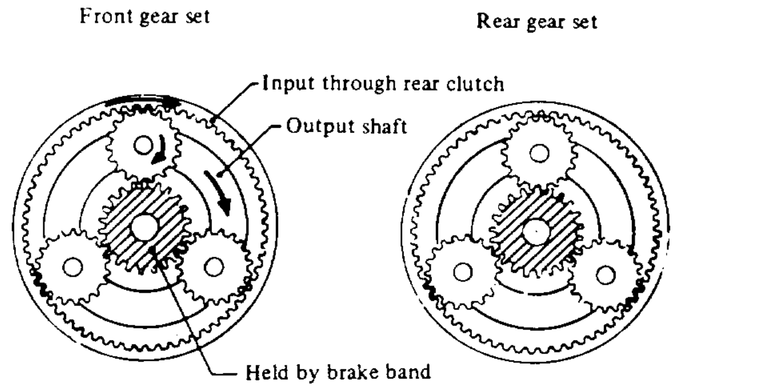
AT446

"D_2" RANGE (2ND GEAR)

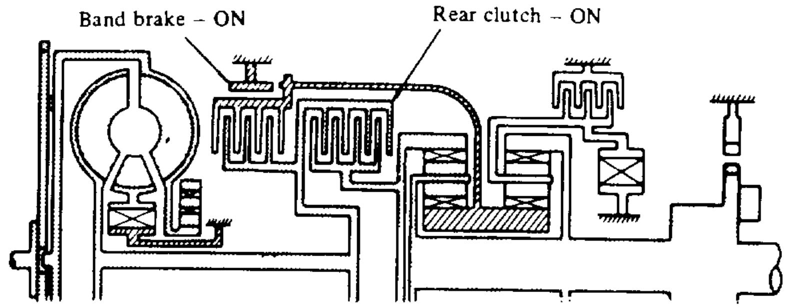
Power flow

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



AT331



Front clutch	OFF
Rear clutch	ON
Low and reverse brake	OFF
Brake band servo	ON
One-way clutch	OFF

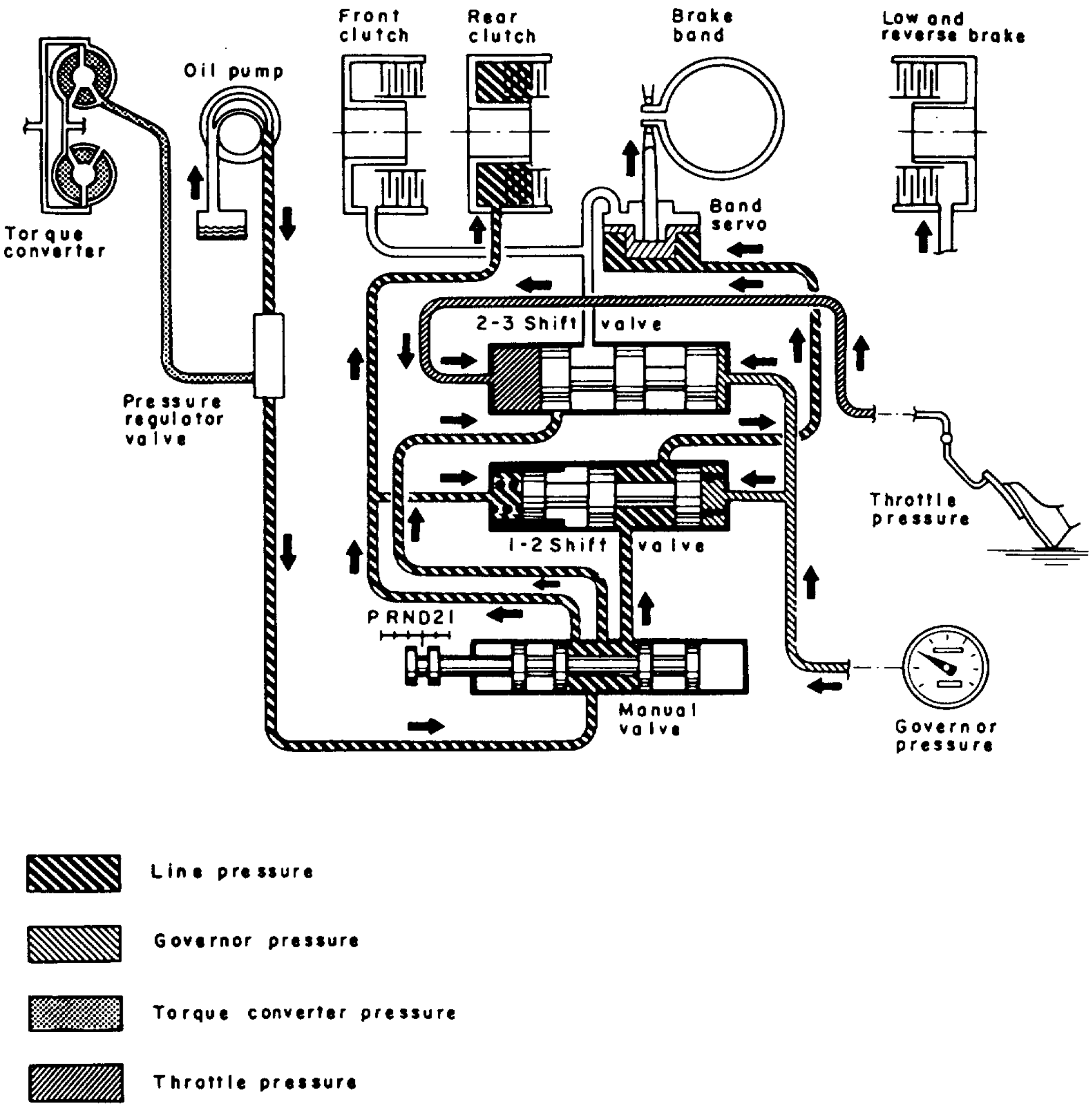
AT079

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.

- Manual Valve
  - 1 → Governor Valve — 15
    - → Pressure Modifier Valve
    - → 2nd-3rd Shift Valve
    - → 1st-2nd Shift Valve
  - 1 → 1st-2nd Shift Valve — 8 → Second Lock Valve — 9 → **Band Servo Apply Side**
  - 1 → **Rear Clutch**
  - 2 → Second Lock Valve
  - 3 → Second Lock Valve
  - 3 → Orifice Check Valve → 2nd-3rd Shift Valve

Oil Pressure Circuit Diagram – "D_2" range (2nd gear)



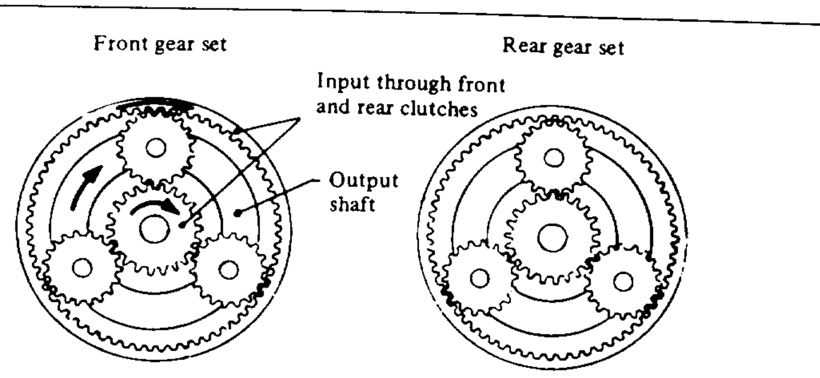
AT448

"D_3" RANGE (3RD GEAR)

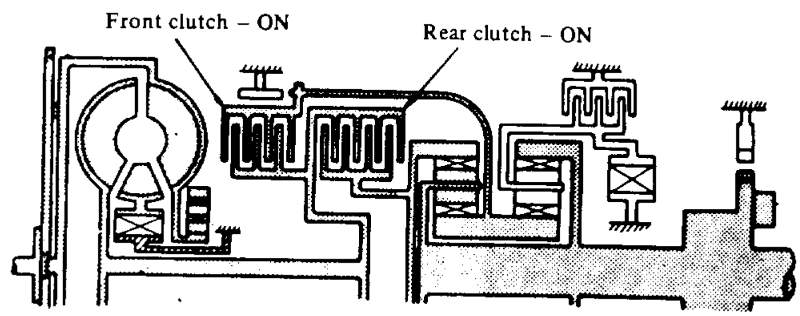
Power flow

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

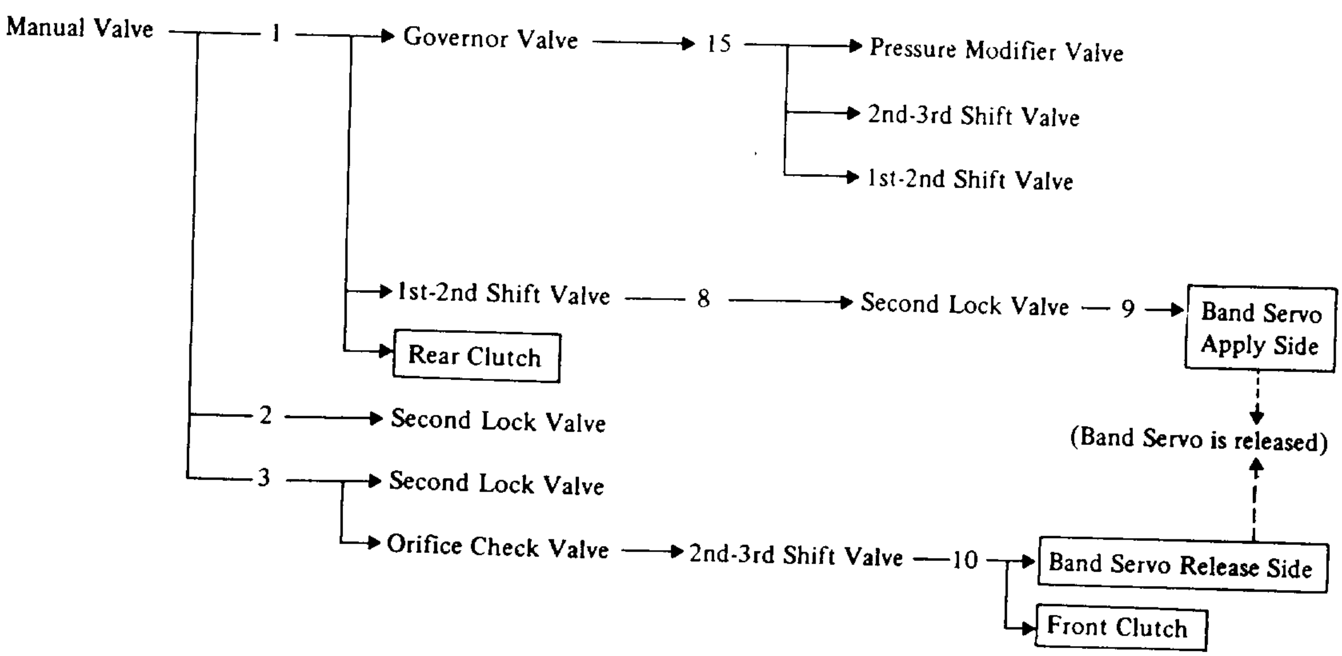


AT083

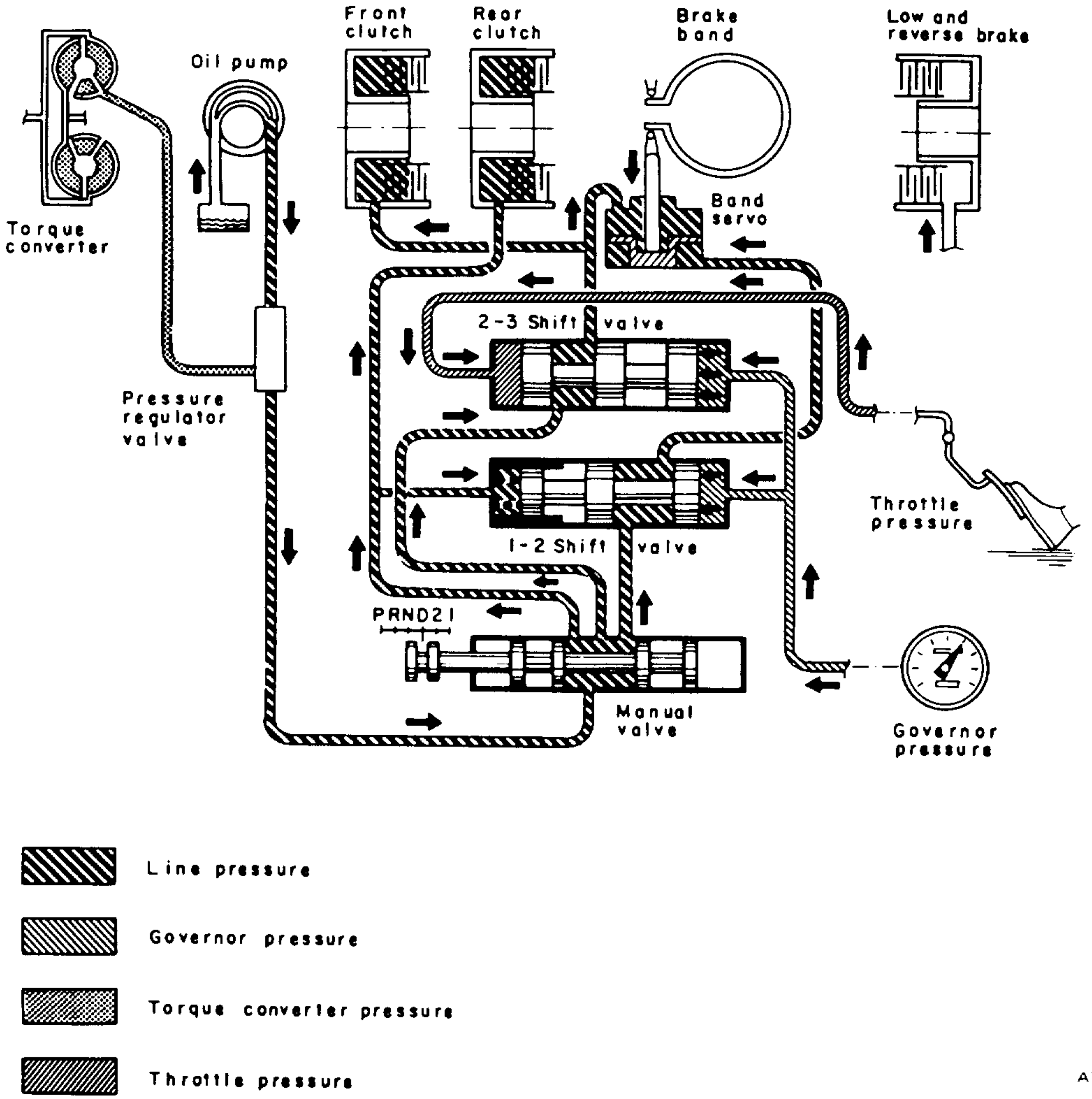
Front clutch	ON
Rear clutch	ON
Low and reverse brake	OFF
Brake band servo	OFF - Pressure release
One-way clutch	OFF

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).



Oil Pressure Circuit Diagram – "D3" range (3rd gear)



AT449

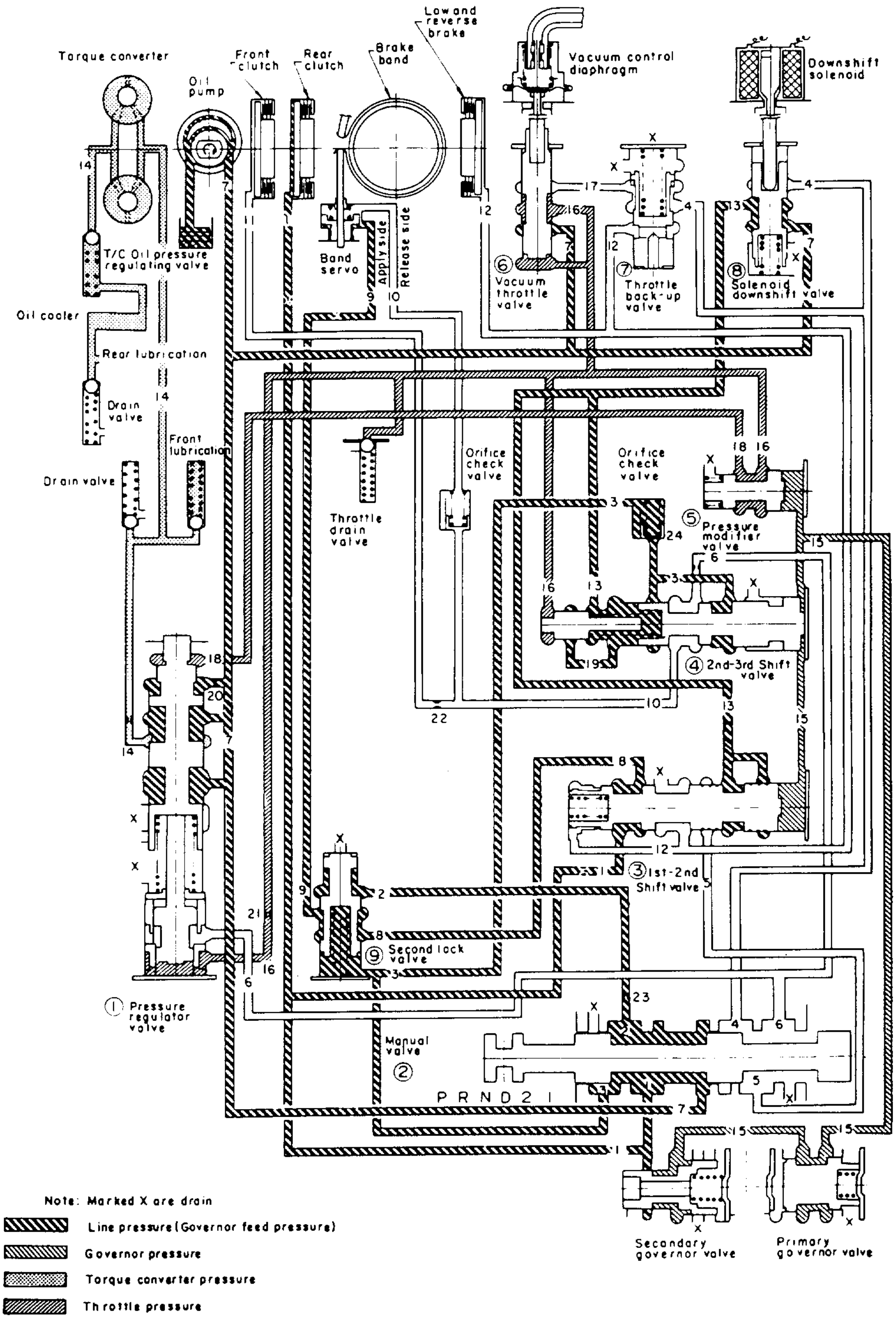
"D" RANGE KICKDOWN

To achieve a forced downshift from 3rd to 2nd, the vehicle speed must be under approximately X_1 km/h (Y_1 MPH); from 2nd to 1st, it must be under approximately X_2 km/h (Y_2 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 X_2 and X_1 km/h (Y_2 and Y_1 MPH), this pressure will close the 2nd-3rd shift valve against governor pressure and the vehicle downshifts. When the vehicle speed is below X_2 km/h (Y_2 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.

Tire size		205R16C-8PRLT 6.50-16-10PRLT	7.50-16-10PRLT 7.50R16-8PRLT
X_1	km/h	90	95
X_2	km/h	45	50
Y_1	MPH	55	60
Y_2	MPH	28	30

Vehicle speed indicated when driving vehicle with transfer control lever shifted into "2H" or "4H" position.

Oil Pressure Circuit Diagram – "D" range kickdown (shift valves in 2nd gear position)



SAT167

"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

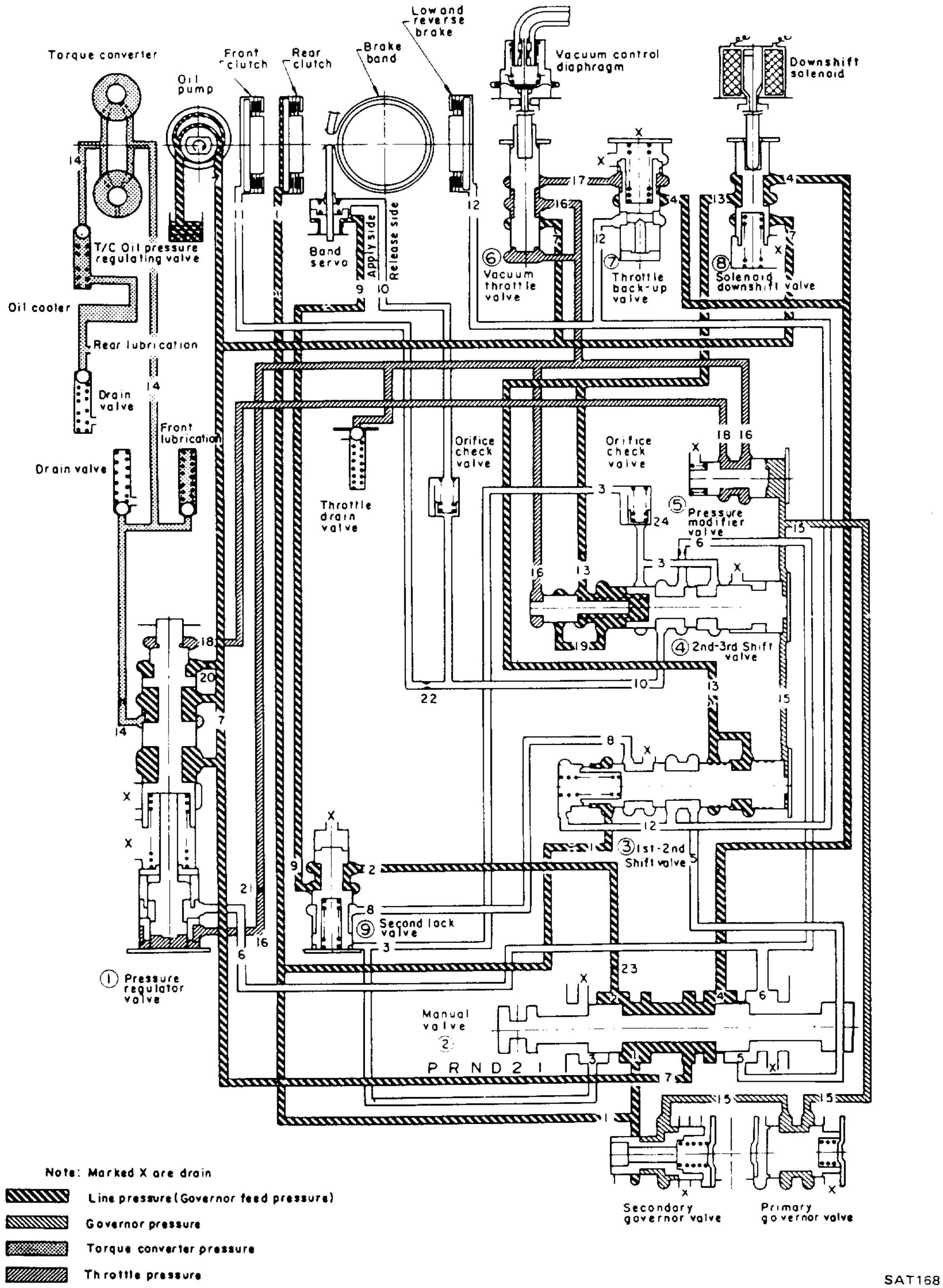
Power flow in "2" range is the same as in "D_2" range.

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.

- Manual Valve
  - 1 → Governor Valve — 15
    - → Pressure Modifier Valve
    - → 2nd-3rd Shift Valve
    - → 1st-2nd Shift Valve
  - 1 → 1st-2nd Shift Valve
  - 1 → Rear Clutch
  - 2 → Second Lock Valve — 9 → Band Servo Apply Side
  - 4 → Solenoid Downshift Valve — 13
    - → 2nd-3rd Shift Valve
    - → 1st-2nd Shift Valve
  - 4 → Throttle Back-up Valve — 17 → Vacuum Throttle Valve — 16
    - → Pressure Modifier Valve
    - → 2nd-3rd Shift Valve
    - → Throttle Drain Valve
    - → Pressure Regulator Valve

Oil Pressure Circuit Diagram – "2" range (2nd gear)



"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 70 km/h (40 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)

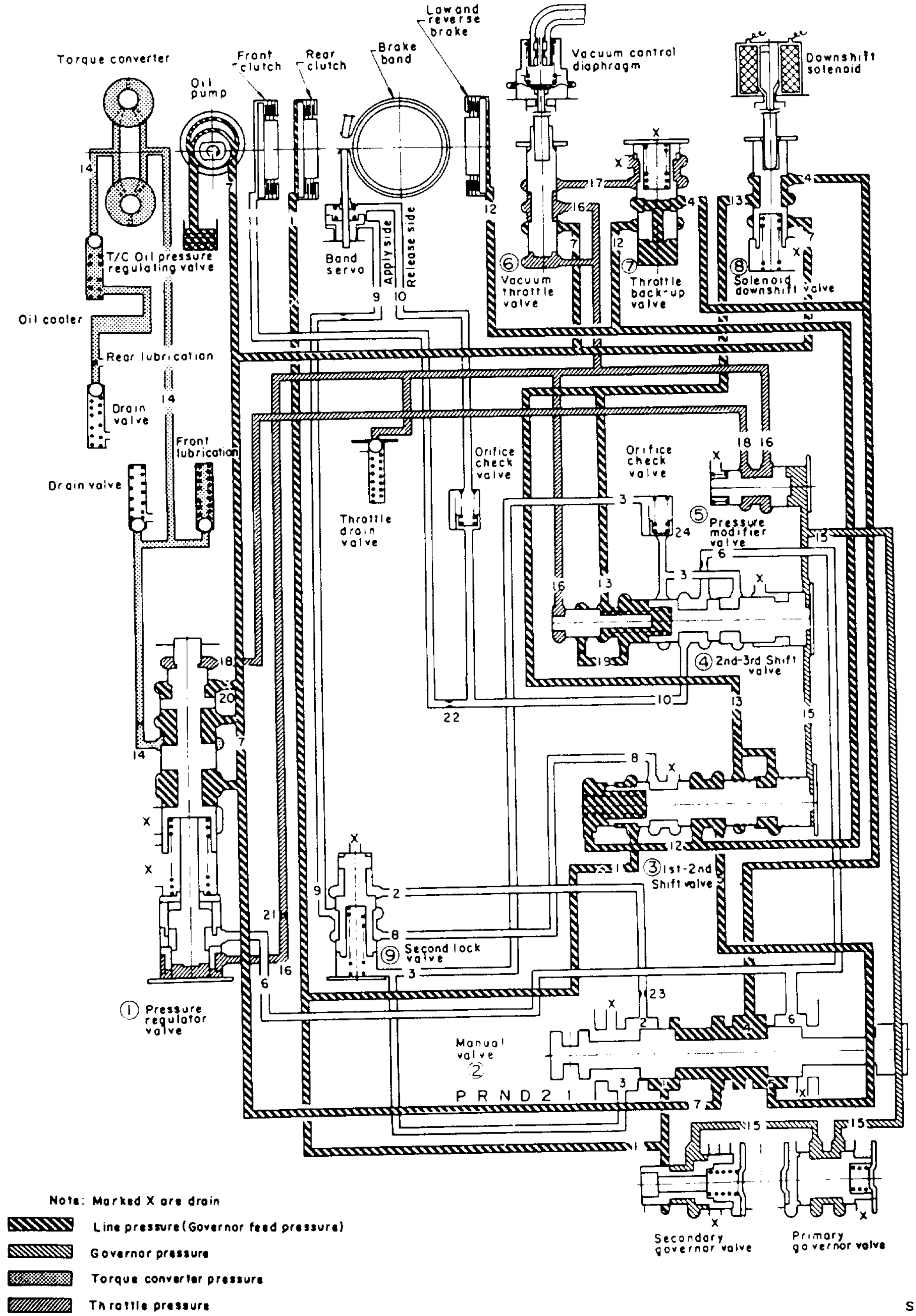
Manual pressure passing through the 1-2 shift valve is used to close the 1-2 shift valve, preventing a 1-2 upshift. Manual pressure passing through the downshift valve locks the 2-3 shift valve closed, along with applying additional closing pressure to the 1-2 shift valve.

- Manual Valve
  - 1
    - → Governor Valve — 15
      - → Pressure Modifier Valve
      - → 2nd-3rd Shift Valve
      - → 1st-2nd Shift Valve
    - → 1st-2nd Shift Valve
    - → Rear Clutch
  - 4
    - → Solenoid Downshift Valve — 13
      - → 2nd-3rd Shift Valve
      - → 1st-2nd Shift Valve
    - → Throttle Back-up Valve
  - 5
    - → 1st-2nd Shift Valve — 12
      - → Throttle Back-up Valve
      - → Low & Reverse Brake

Fluid flow (2nd gear)

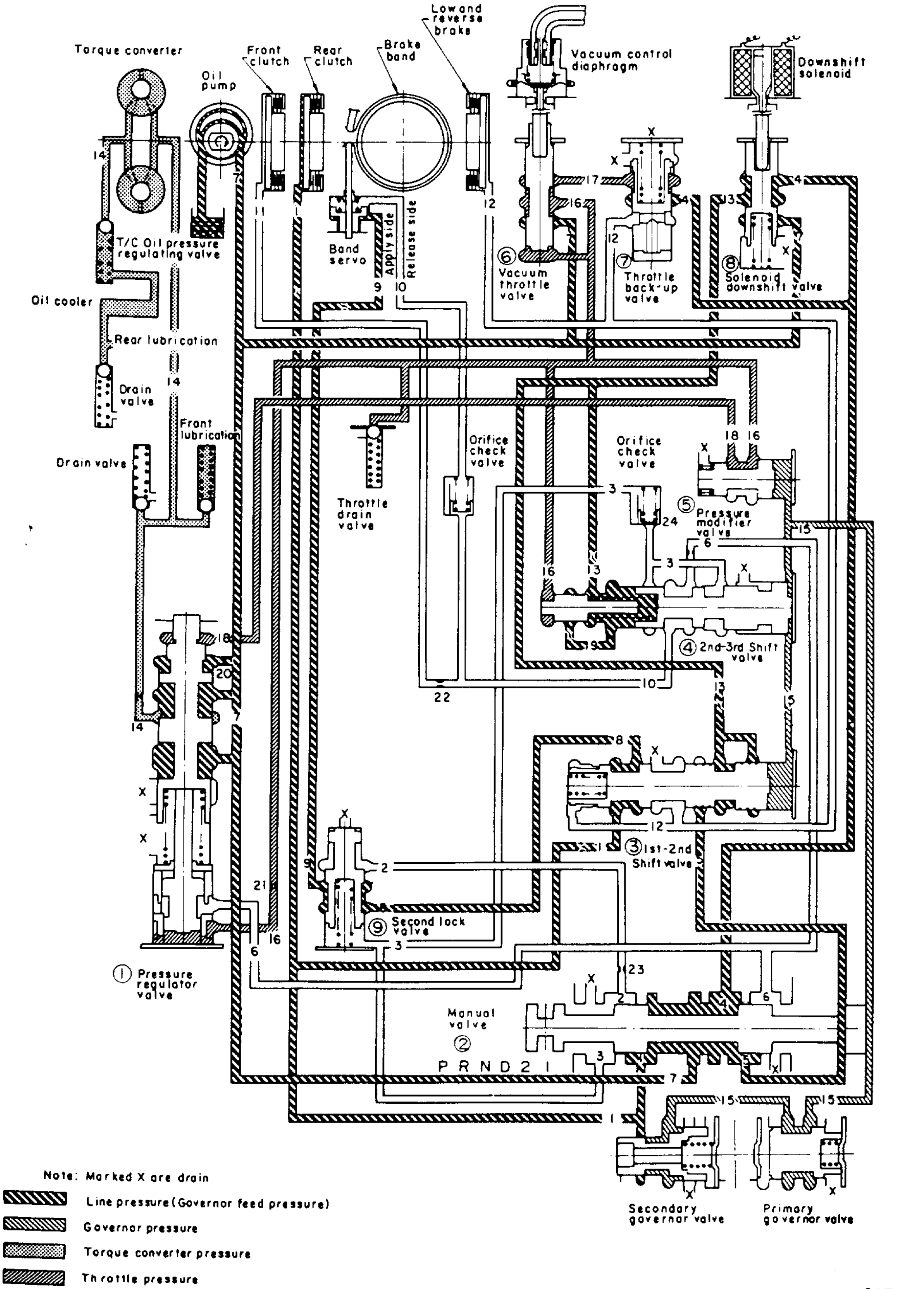
- Manual Valve
  - 1
    - → Governor Valve — 15
      - → Pressure Modifier Valve
      - → 2nd-3rd Shift Valve
      - → 1st-2nd Shift Valve
    - → 1st-2nd Shift Valve — 8 → Second Lock Valve — 9 → Band Servo Apply Side
    - Rear Clutch
  - 4
    - → Solenoid Downshift Valve — 13
      - → 2nd-3rd Shift Valve
      - → 1st-2nd Shift Valve
    - → Throttle Back-up Valve — 17 — 16
      - → Pressure Modifier Valve
      - → 2nd-3rd Shift Valve
      - → Throttle Drain Valve
      - → Pressure Regulator Valve
  - 5
    - → 1st-2nd Shift Valve

Oil Pressure Circuit Diagram – "1_1" range (Low gear)



SAT169

Oil Pressure Circuit Diagram – "1_2" range (2nd gear)



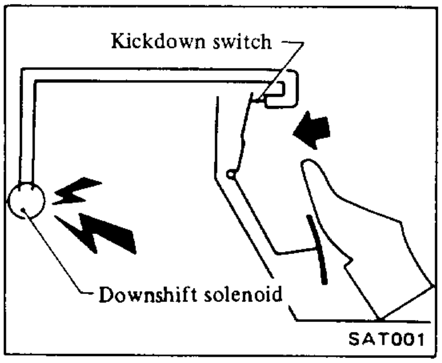
SAT170

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.



SAT001

Do not allow the switch to make contact too soon. This would cause the transmission to downshift on part throttle.

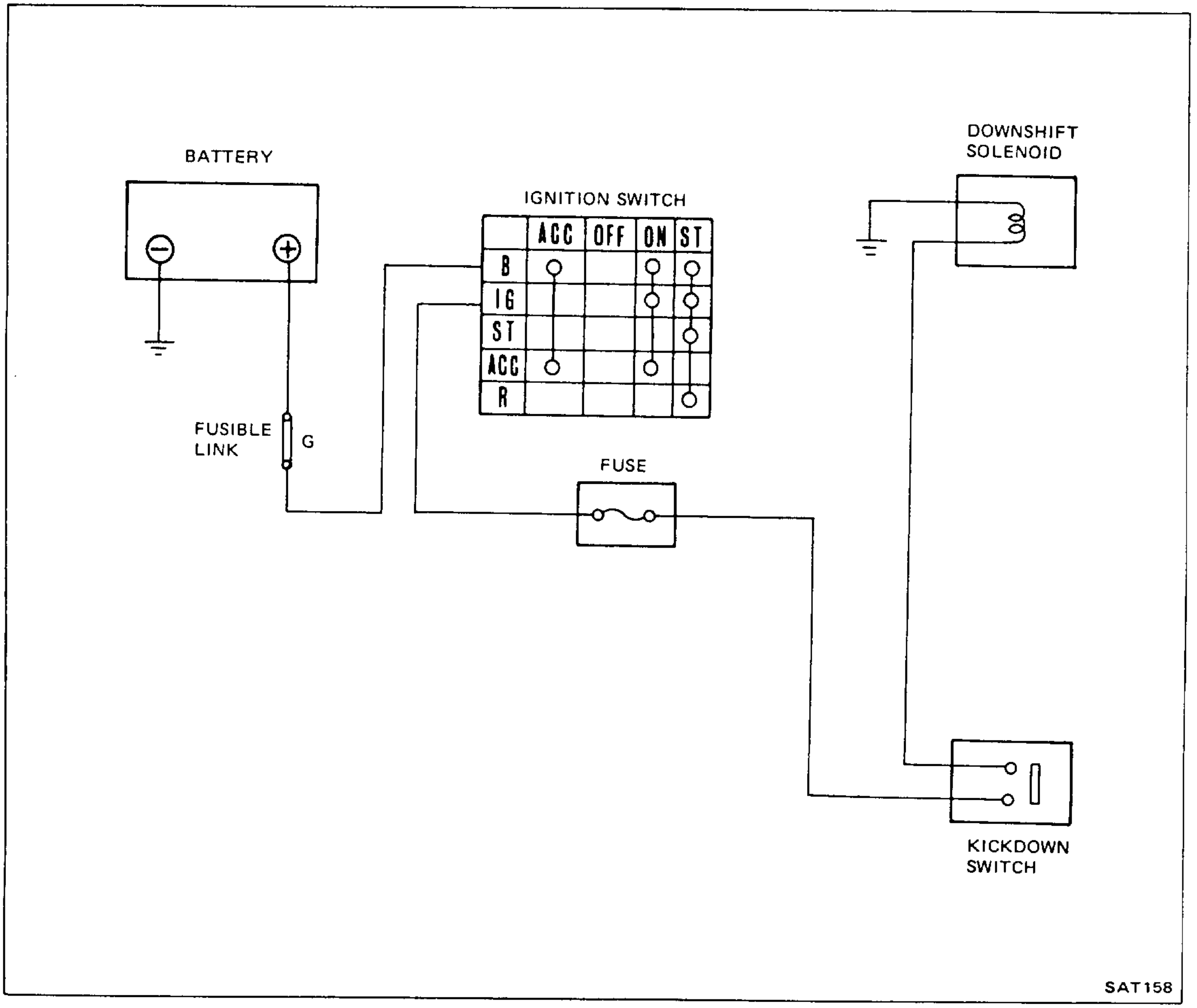
DIAGNOSIS:

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 100 km/h (38 and 63 MPH) only: The kick down switch may be internally shorted. (When the switch is shorted, there is continuity through the switch in any position).

* **Vehicle speed indicated when driving vehicle with transfer control lever shifted into "2H" or "4H" position.**

Wiring Diagram



SAT158

INHIBITOR SWITCH ADJUSTMENT

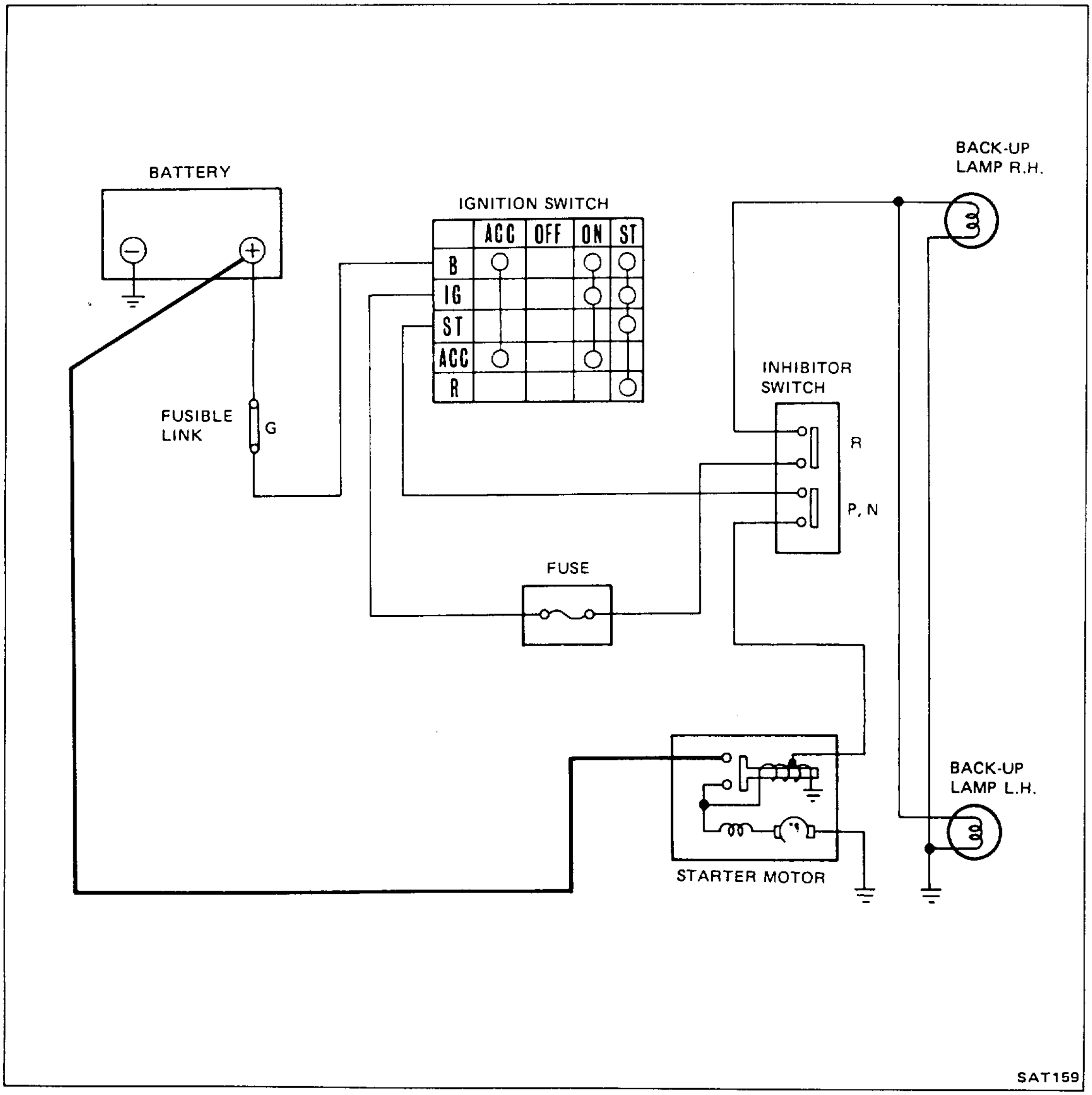
The inhibitor switch has two major functions. It allows the back-up lights to illuminate when the shift lever is placed in the reverse range. It also acts as a neutral safety switch allowing current to pass from the starter only when the lever is placed in the "P" or "N" range.

A continuity tester may be used to check the inhibitor switch for proper operation.

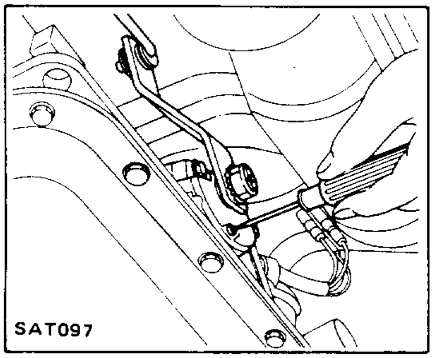
The two black and yellow (B-Y) wires should have continuity when the lever is in the "P" and "N" positions.

Red and black (R-B) wires should have continuity when the shift lever is moved to "R" range.

Wiring Diagram

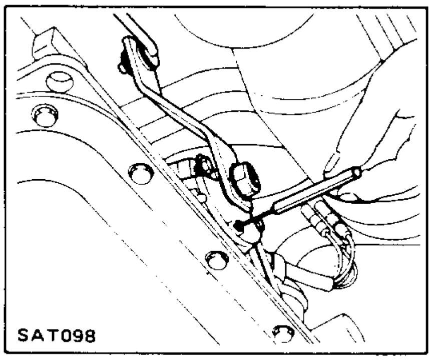


1. Place the manual valve in Neutral (vertical position).
2. Remove the screw as illustrated.



SAT097

3. Loosen the attaching bolts.
4. Using an aligning pin, move the switch until the pin falls into the hole in the rotor.



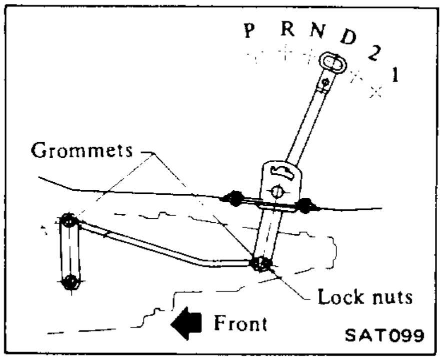
SAT098

5. Tighten the attaching bolts.
6. Recheck for continuity. If faulty, replace the switch.

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.



SAT099

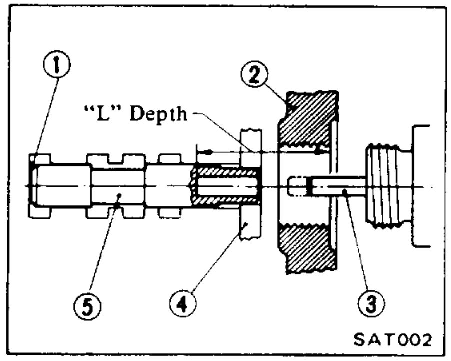
1. Place shift lever in "D" range.
2. Loosen locknuts and move shift lever until "D" is properly aligned and vehicle is in "D" range.
3. Tighten locknut.

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.



SAT002

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

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.

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.

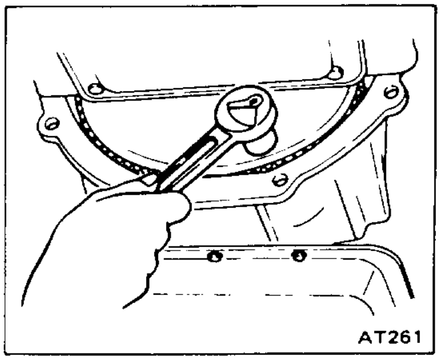
REMOVAL

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 recommended a hydraulic hoist or open pit be utilized, if available.
   Observe all safety regulations.
3. Remove transfer with pre-propeller shaft from the vehicle. Refer to Section TF for removal.

Plug up the opening in the rear extension to prevent oil from flowing out.

4. Disconnect selector range lever from manual shaft.
5. Disconnect wire connections at inhibitor switch.
6. Disconnect vacuum tube from vacuum diaphragm, and wire connections at downshift solenoid.
7. Disconnect oil charging pipe.
8. Disconnect oil cooler inlet and outlet tubes at transmission case.
   Plug up openings such as oil charging pipe, oil cooler tubes, etc.
9. Support engine by locating a jack under oil pan with a wooden block used between oil pan and jack. Support transmission by means of a transmission jack.
10. 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.

11. Remove rear engine mount securing bolts and crossmember mounting bolts.
12. Remove starter motor.
13. Remove bolts securing transmission to engine. After removing these bolts, support engine and transmission with jack, pull transmission backward until transmission can be removed, lower the jack gradually and take out transmission under the vehicle.

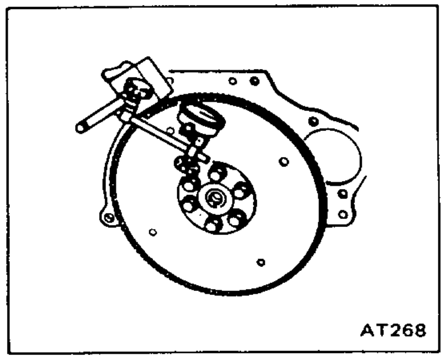
CAUTION:
Do not drop torque converter from transmission. Take care when dismounting transmission not to strike any adjacent parts.

INSTALLATION

Installation of automatic transmission on vehicle is in reverse order of removal. However, observe the following installation notes.

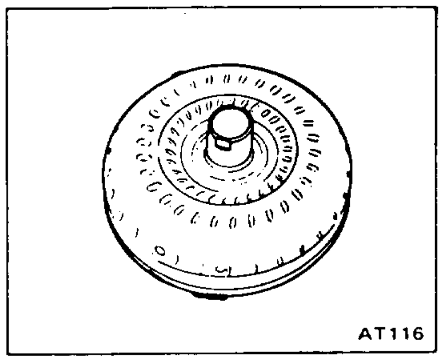
1. Drive plate runout
   Turn crankshaft one full turn and measure drive plate runout with indicating finger of a dial gauge rested against plate.

   Maximum allowable runout:
   0.5 mm (0.020 in)



AT268

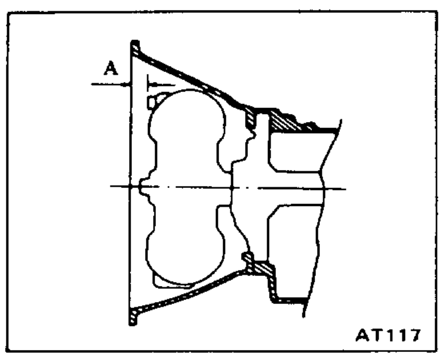
2. Installation of torque converter
   Line up notch in torque converter with that in oil pump. Be extremely careful not to put undue stress on parts when installing torque converter.



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

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.

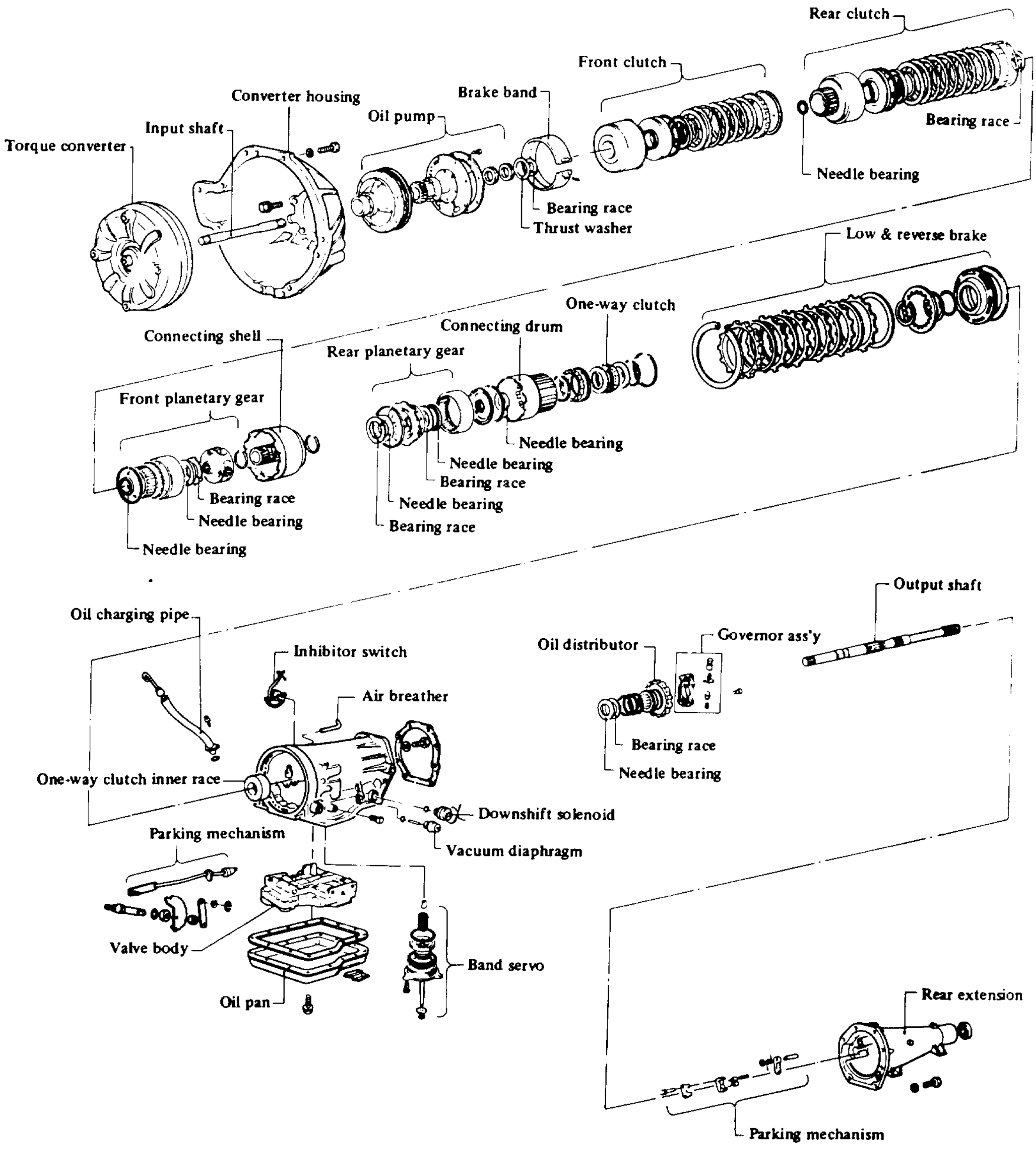
a. Refer to pages AT-26 and -27 for Inhibitor Switch Adjustment.
b. Inspect and adjust switch as above whenever it has to be removed for service.

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.

MAJOR OVERHAUL OPERATIONS



SAT160

SERVICE NOTES FOR DISASSEMBLY

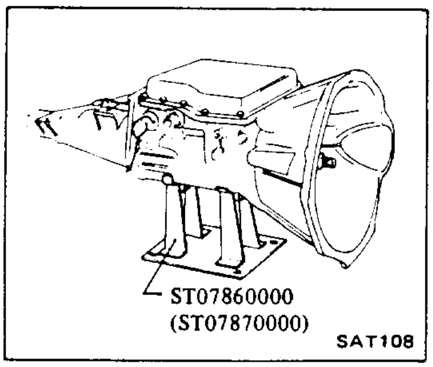
Before proceeding with disassembly, thoroughly clean the outside of the transmission. It is important to prevent the internal parts of the transmission from becoming contaminated by dirt or other foreign matter.

Disassembly should be done in a clean work area.

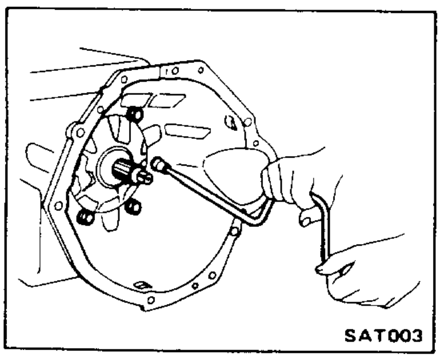
Use a nylon cloth or paper towel for wiping parts clean. Common shop rags can leave lint that might interfere with the transmission's operation.

DISASSEMBLY

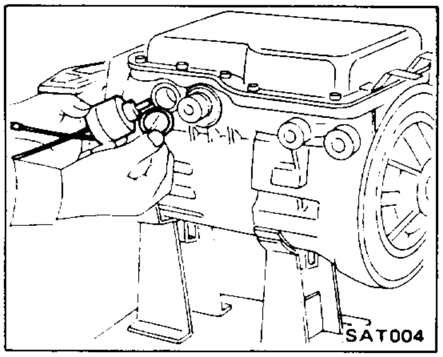
1. Remove torque converter, drain transmission fluid through end of rear extension, and place transmission on Tool.



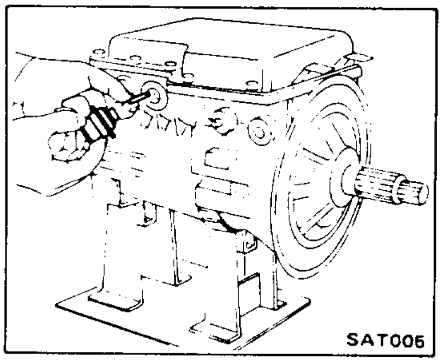
2. Remove converter housing.



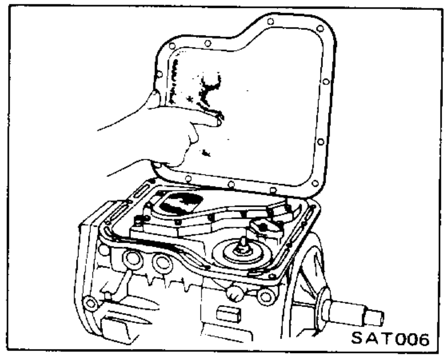
3. Unscrew and remove downshift solenoid and O-ring.



4. Unscrew and remove vacuum diaphragm, diaphragm rod and O-ring.



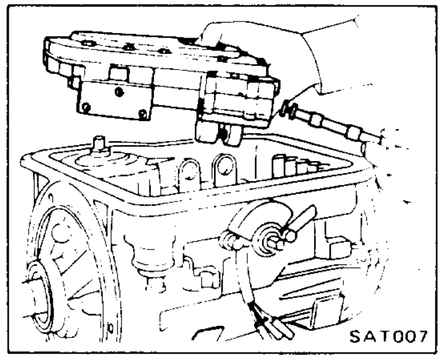
5. Remove oil pan and inspect its contents. An analysis of any foreign matter can indicate the types of problems to look for. If the fluid is very dark, smells burned, or contains foreign particles, the frictional material (clutches, band.) may need replacement. A tacky film that will not wipe clean indicates varnish build up which can cause valves, servo, and clutches to stick and may inhibit pump pressure.



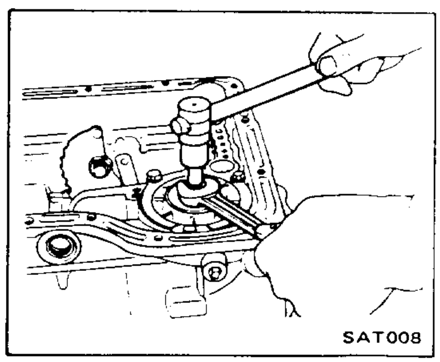
6. Remove control valve body.

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.



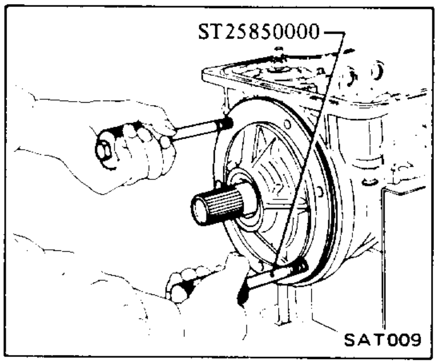
7. Loosen band servo piston stem locknut and tighten piston stem to prevent front clutch drum from dropping out when removing front pump.



8. Remove input shaft from pump.

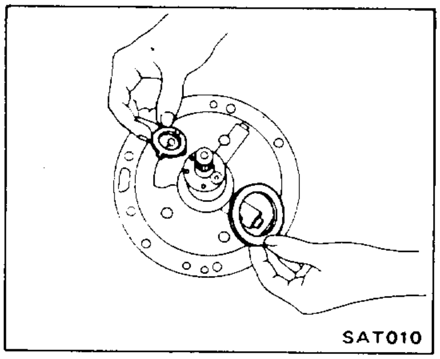
Attach Tool to pump and remove pump. Do not allow front clutch to come out of position and drop onto floor.

Take care that shaft is not inserted backwards during reassembly.

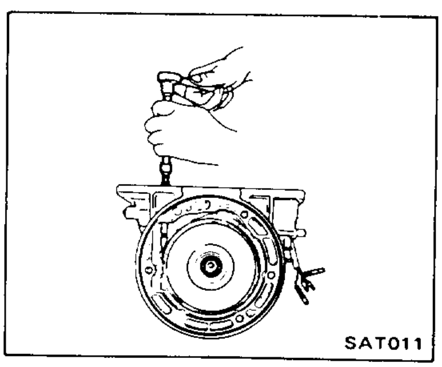


SAT009

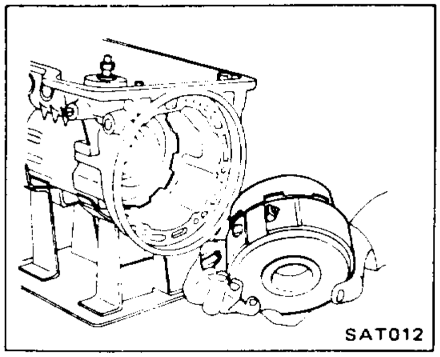
9. Remove front clutch thrust washer and bearing race.


SAT010

10. Back off band servo piston stem to release band.

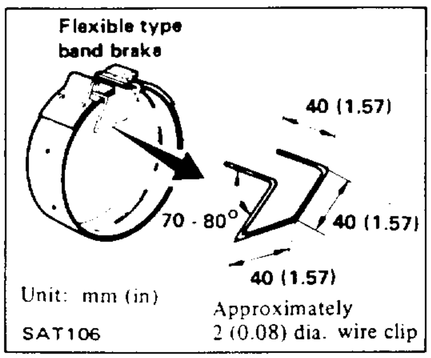

SAT011

11. Remove brake band strut. Brake band, front and rear clutch assemblies may be removed together.


SAT012

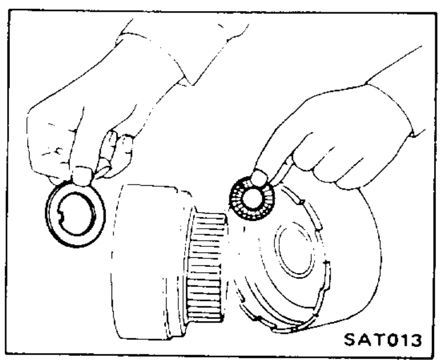
To prevent brake linings from cracking or peeling, do not stretch the flexible band unnecessarily. Before removing the brake band, always secure it with a clip as shown in the figure below.

Leave the clip in position after removing the brake band.

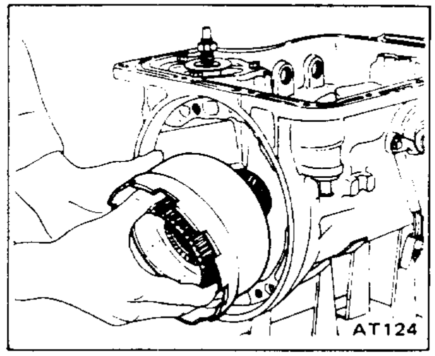


SAT106

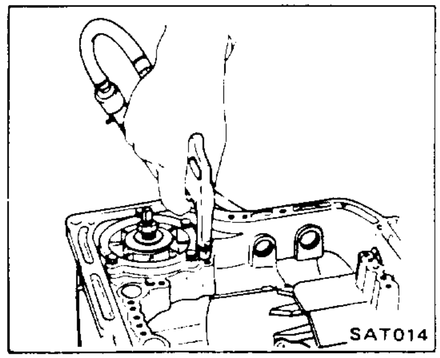
12. Remove pump thrust bearing and rear clutch thrust washer.


SAT013

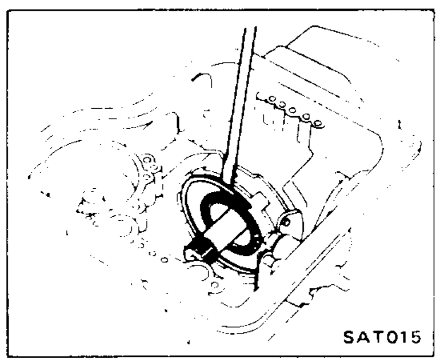
13. Remove rear clutch hub, front planetary carrier and connecting shell, rear clutch thrust bearing, front planetary carrier thrust washer and thrust bearing.


AT124

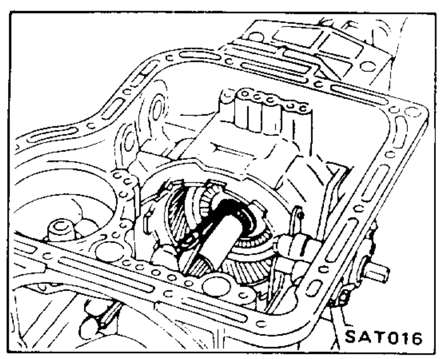
14. Back out, about half-way, band servo attaching bolts. Using an air gun, carefully apply pressure to loosen band servo. Remove band servo retaining bolts and pull band servo.


SAT014

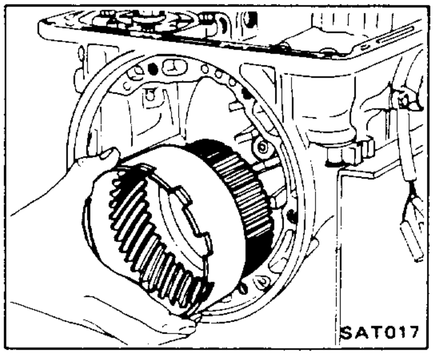
15. Remove rear planetary carrier snap ring and rear planetary carrier.


SAT015

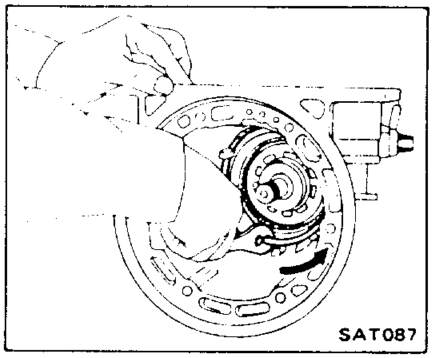
16. Remove output shaft snap ring.


SAT016

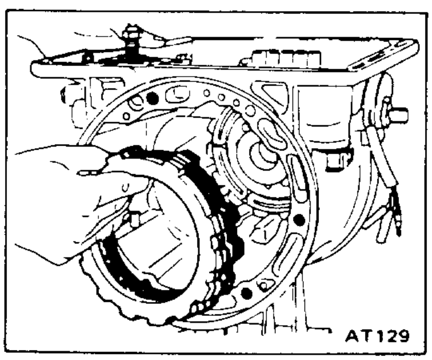
17. Remove rear connecting drum with internal (annulus) gear.



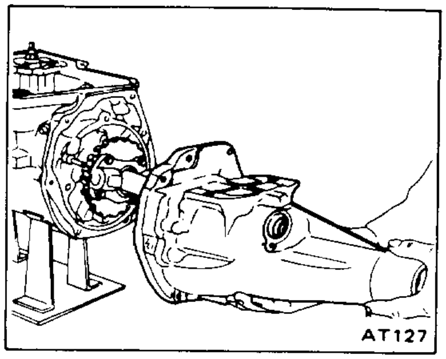
18. Pry off one end of snap ring with a screwdriver. Remove snap ring from low and reverse brake assembly while applying plier force in direction of arrow.



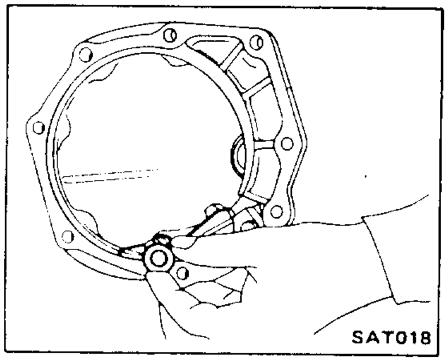
19. Tilt extension housing upward and remove low and reverse brake clutch assembly.



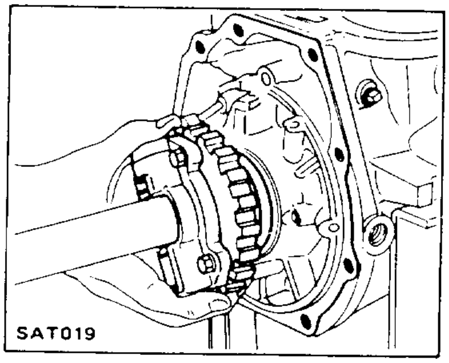
20. Remove rear extension.



21. Be careful not to lose parking pawl, spring and retainer washer.

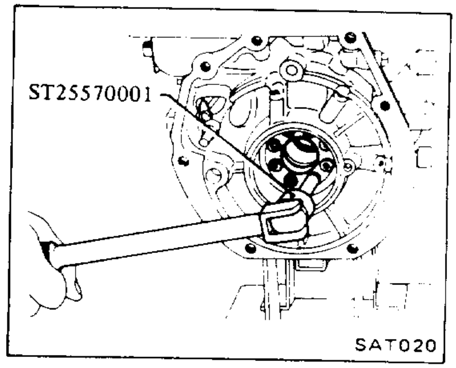


22. Remove output shaft with governor.

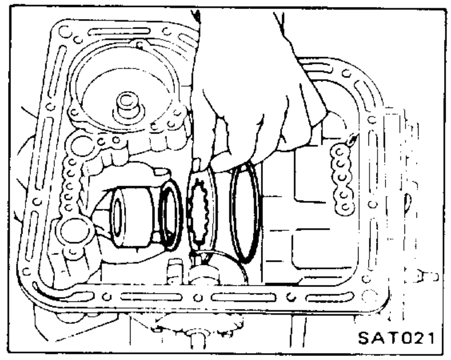


23. Remove governor thrust washer and needle bearing.

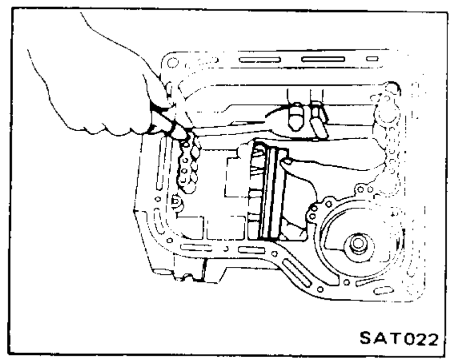
Remove one-way clutch inner race attaching hex-head slotted bolts using Tool.



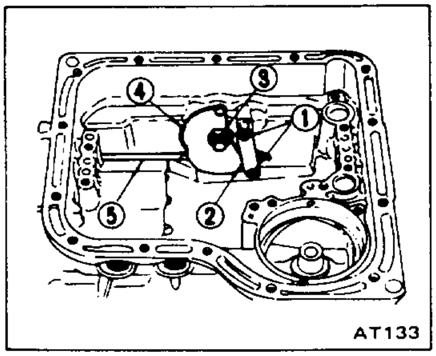
24. Remove one-way clutch inner race, return thrust washer, low and reverse return spring, and spring thrust ring.



25. Using an air gun with a tapered rubber tip, carefully apply air pressure to remove low and reverse brake piston.



26. 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.



AT133

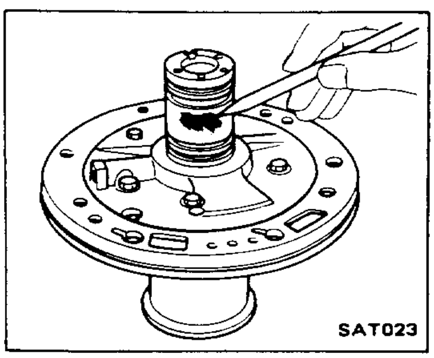
27. Remove inhibitor switch and manual shaft by loosening two securing bolts.

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.

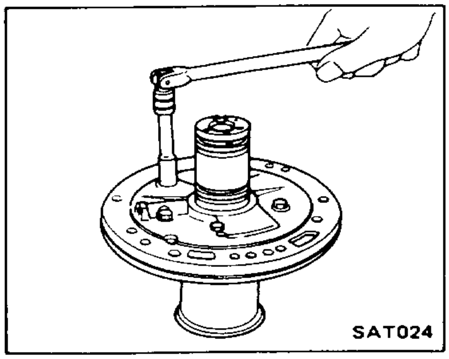
OIL PUMP

1. Remove front pump gasket and O-ring. Inspect pump body, pump shaft and ring groove areas for wear.



SAT023

2. Remove pump cover from pump housing.

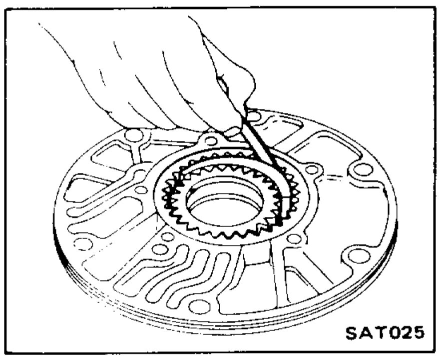


SAT024

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).**

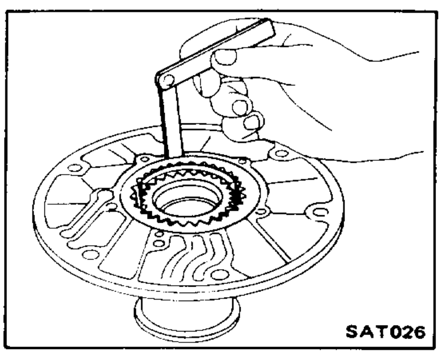


SAT025

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).**

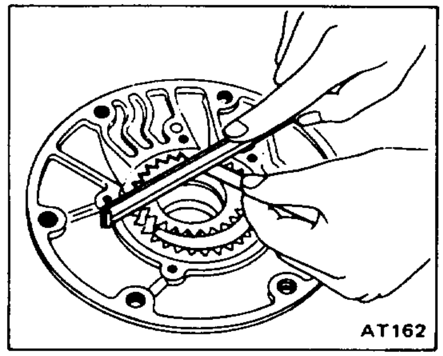


SAT026

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).**



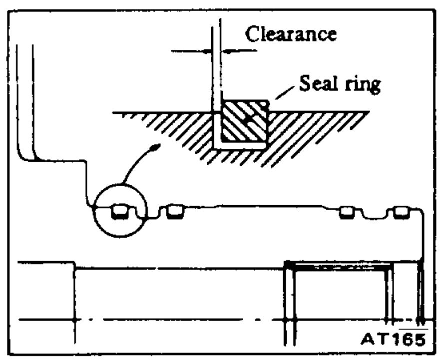
AT162

7. Measure clearance between seal ring and ring groove.

Standard clearance:
0.04 - 0.16 mm
(0.0016 - 0.0063 in)

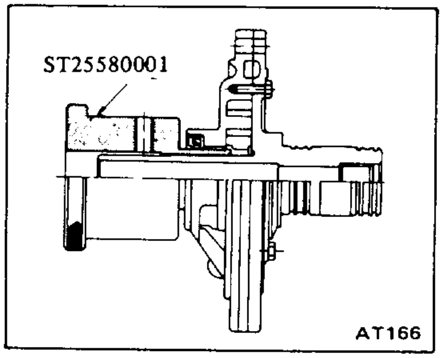
Replace if the clearance exceeds **0.16 mm (0.0063 in).**

Of course, it is good practice to replace all seal rings during an overhaul.



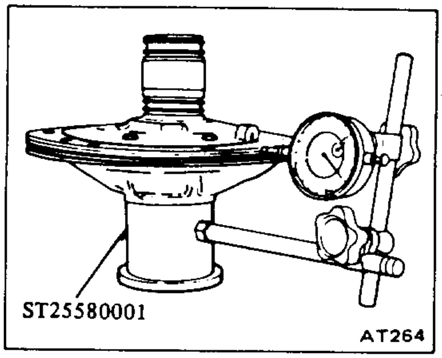
AT165

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.



9. Set run-out of the cover to within specified total indicator reading.

Total indicator reading:
Less than 0.07 mm
(0.0028 in)

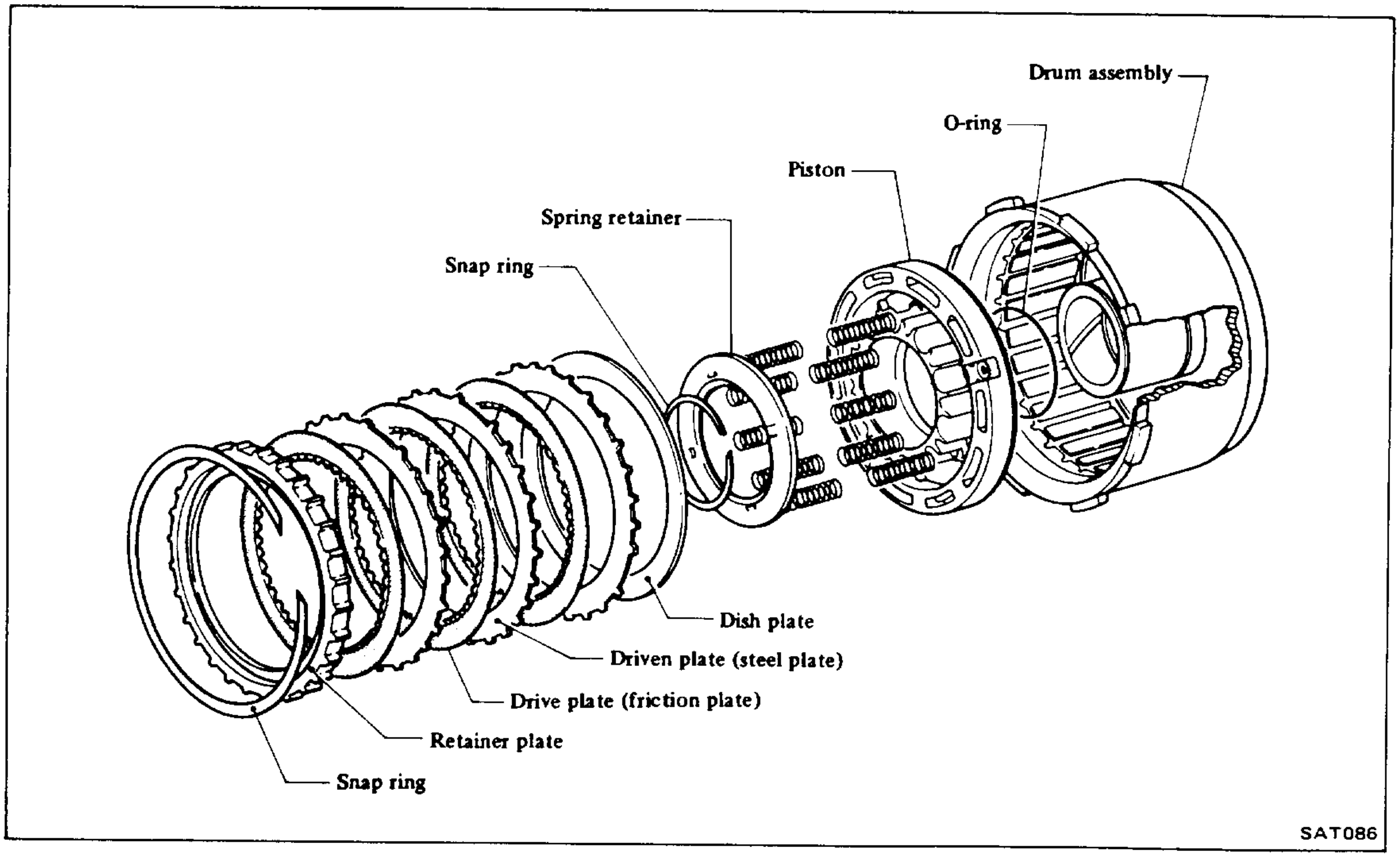


10. Tighten pump securing bolts to specified torque.

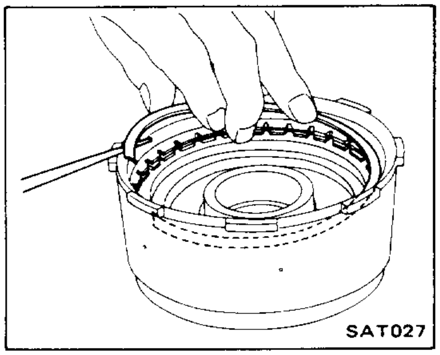
Ⓣ : **Oil pump housing to oil pump cover**
6 - 8 N·m
(0.6 - 0.8 kg-m,
4.3 - 5.8 ft-lb)

Recheck run-out. Replace O-ring and gasket.

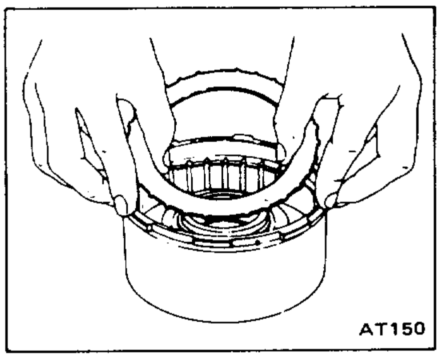
FRONT CLUTCH



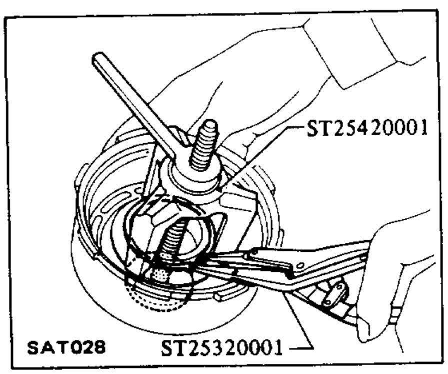
1. Using a screwdriver, remove large clutch retaining plate snap ring.


SAT027

2. Remove clutch plate assembly.

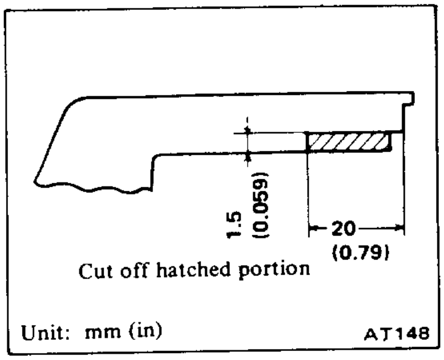

AT150

3. Compress clutch springs and remove snap ring from spring retainer.



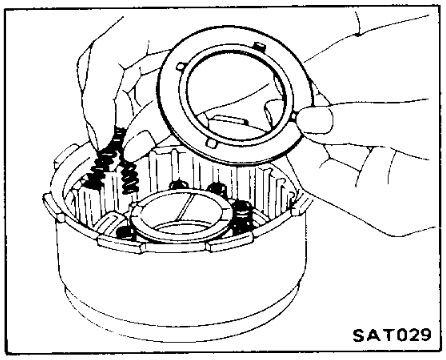
SAT028

When Tool ST25420000 is to be used, cut toe-tips of three legs with a grinding wheel.

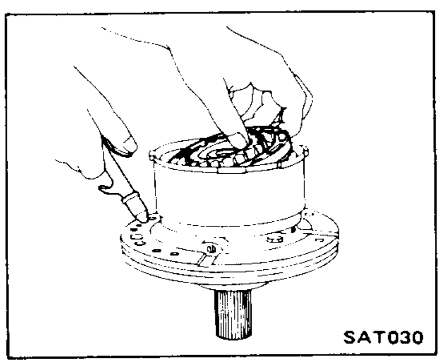


AT148

4. Remove spring retainer and springs.


SAT029

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.


SAT030

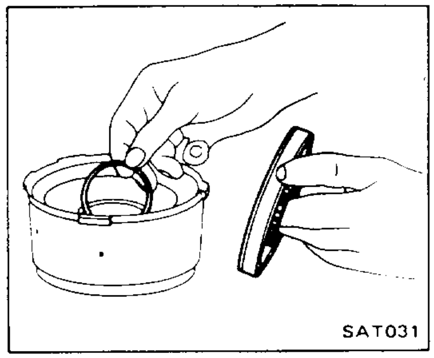
6. Check clutch drive plate facing for wear or damage. Drive plate thickness must not be less than **1.4 mm (0.055 in)**.

Standard drive plate thickness:
1.50 - 1.65 mm
(0.0591 - 0.0650 in)

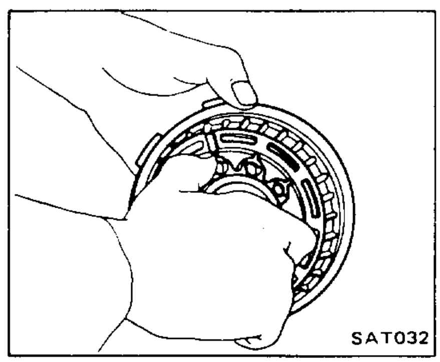
7. Check for wear on snapring, weak or broken coil springs, and warped spring retainer.

8. Lubricate clutch drum hub and seals, and install inner seal and piston seal as illustrated. *Be careful not to stretch seals during installation.*

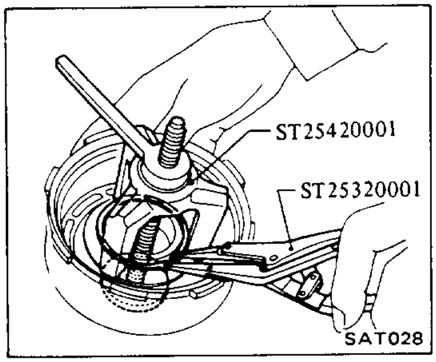
Never assemble clutch dry; always lubricate its components thoroughly.


SAT031

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.

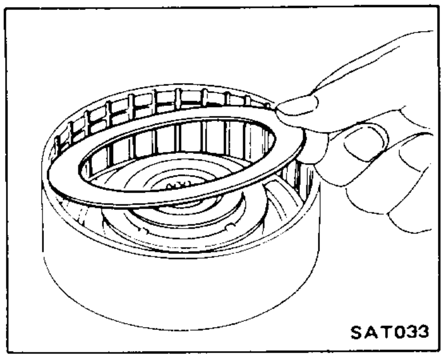

SAT032

10. Reassemble spring and retainer. Reinstall snap ring. Be sure snap ring is properly seated.

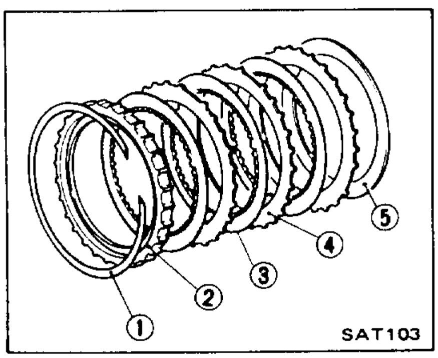


SAT028

11. Install dish plate with dish facing outward.


SAT033

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.



SAT103

1 Snap ring
2 Retainer plate
3 Drive plate (Friction plate)
4 Driven plate (Steel plate)
5 Dish plate

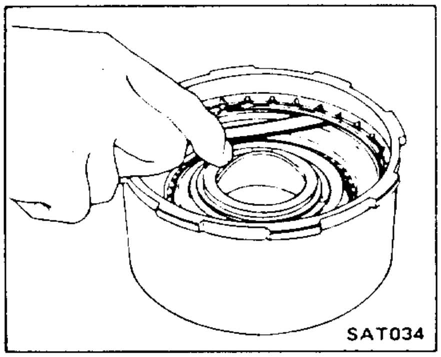
13. Measure clearance between retainer plate and snap ring.

Specified clearance:
1.6 - 2.0 mm (0.063 - 0.079 in)

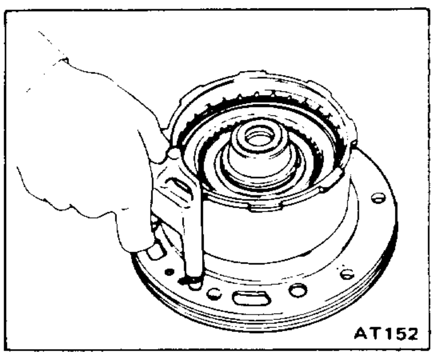
If necessary, try other retaining plates having different thicknesses until correct clearance is obtained.

Available retaining plate

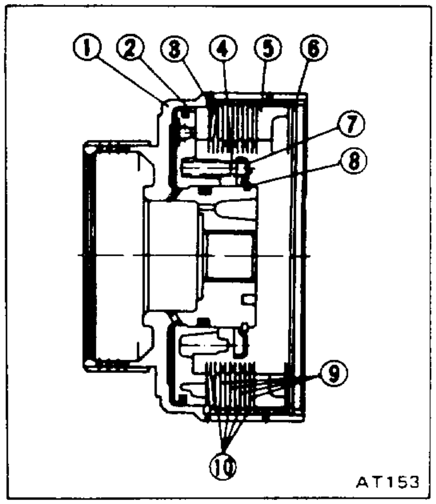
Thickness mm (in)	Part number
5.0 (0.197)	31567-X2900
5.2 (0.205)	31567-X2901
5.4 (0.213)	31567-X2902
5.6 (0.220)	31567-X2903
5.8 (0.228)	31567-X2904
6.0 (0.236)	31567-X2905
6.2 (0.244)	31567-X2906


SAT034

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.


AT152

REAR CLUTCH

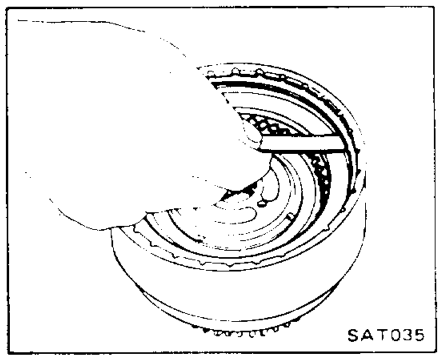


AT153

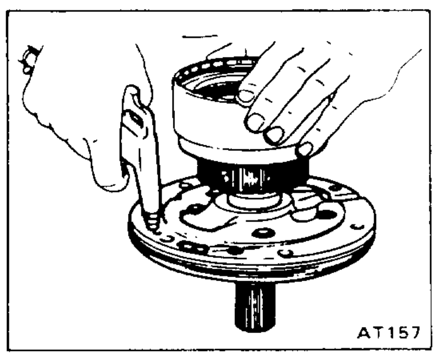
1	Rear clutch drum	6	Snap ring
2	Piston	7	Spring retainer
3	Dished plate	8	Snap ring
4	Coil spring	9	Driven plate
5	Retaining plate	10	Drive plate

Service procedures for rear clutch are essentially the same as those for front clutch, with the following exception:

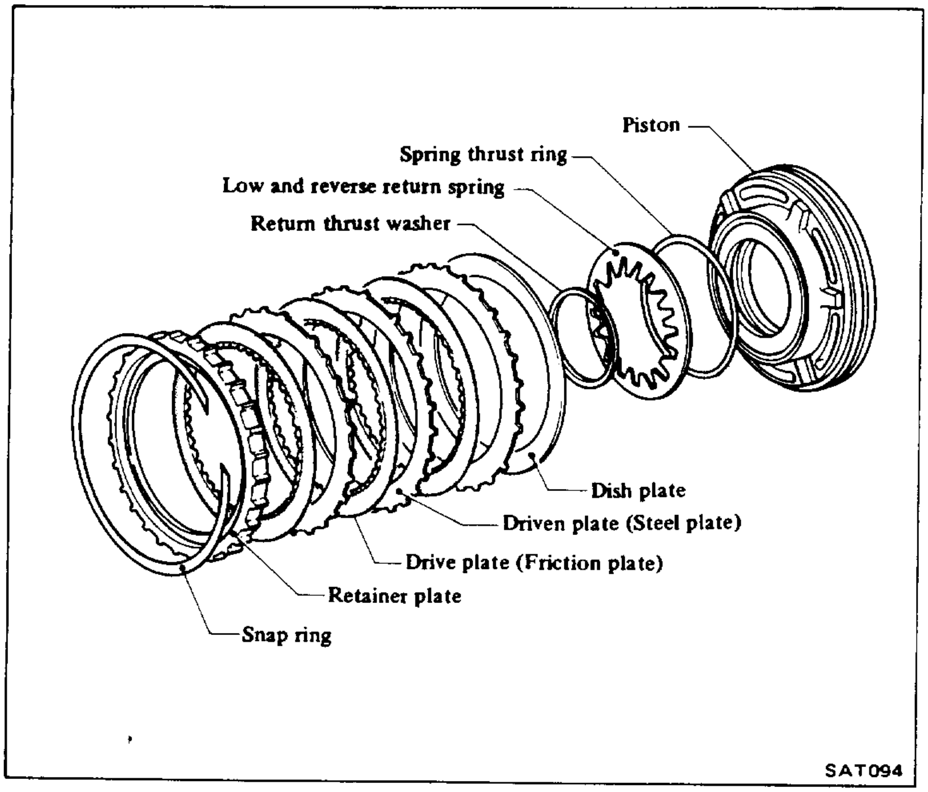
Specified clearance between retainer plate and snap ring:
0.8 - 1.6 mm
(0.031 - 0.063 in)


SAT035

Test rear clutch


AT157

LOW & REVERSE BRAKE



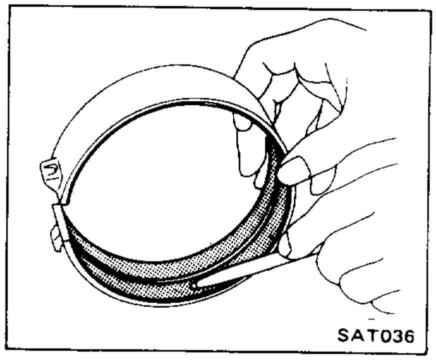
SAT094

- 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)

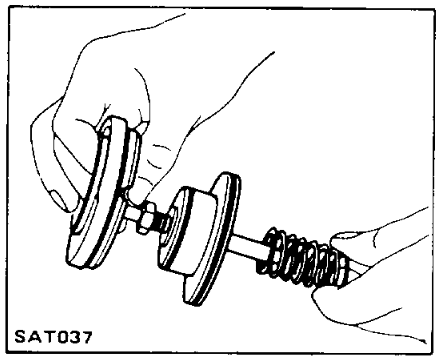
- Test piston return spring for weakness. Discard if it is too weak.

- Inspect band friction material for wear. If cracked, chipped or burnt spots are apparent, replace the band.



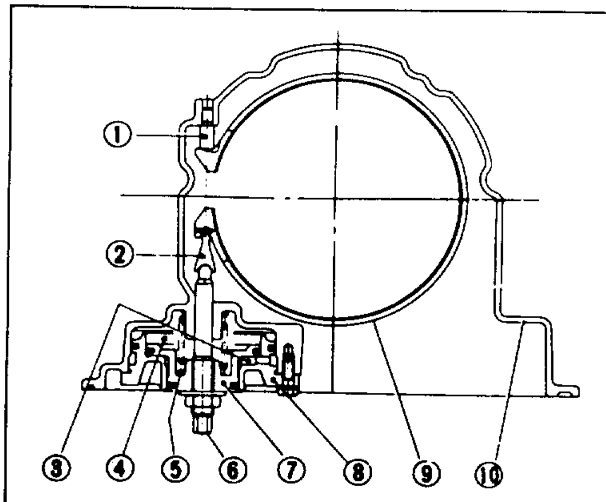
SAT036

- Check band servo components for wear and scoring. Replace piston O-rings and all other components as necessary.



SAT037

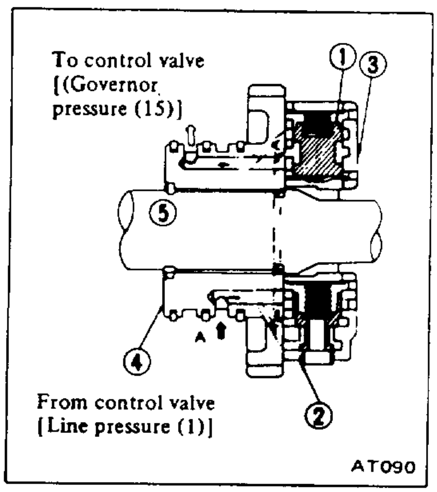
BRAKE BAND AND BAND SERVO



1 Anchor end pin
2 Band strut
3 Apply
4 Release
5 Return spring
6 Band servo piston stem
7 Band servo piston
8 Servo retainer
9 Brake band assembly
10 Transmission case

AT290

GOVERNOR

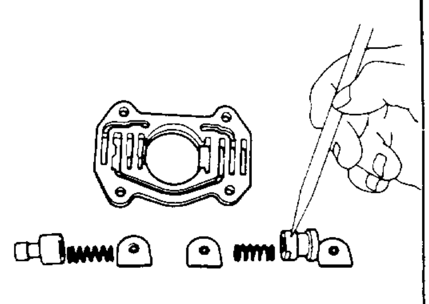


AT090

1 Primary governor
2 Secondary governor
3 Governor valve body
4 Oil distributor
5 Output shaft

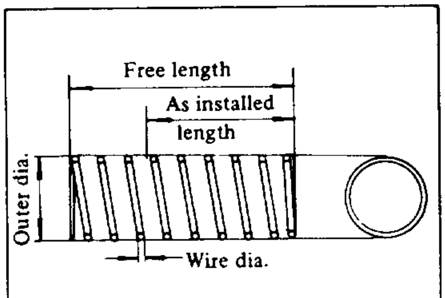
- Disassemble governor and check valves for indication of burning or scratches. Inspect springs for weakness or burning. Replace parts as necessary and reassemble.

Do not interchange components of primary and secondary governor valves.



SAT038

Governor valve spring chart



SAT039

- 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

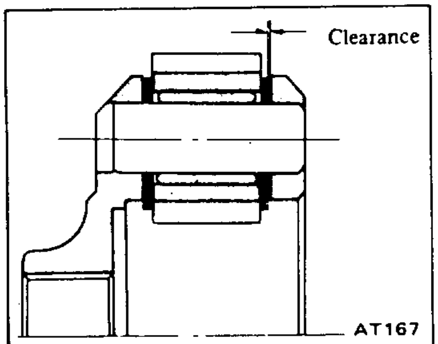
The planetary carrier cannot be divided into its individual components.

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.

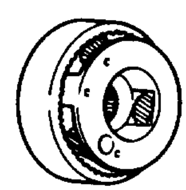
Standard clearance:
0.20 - 0.70 mm
(0.0079 - 0.0276 in)

Replace if the clearance exceeds **0.80 mm (0.0315 in).**



AT167

- Check planetary gear sets for damaged or worn gears. Gear sets that have been damaged by overheating will have a blue discoloration.

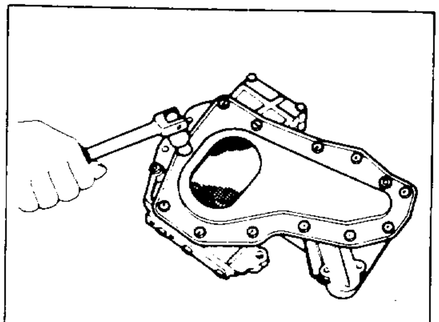


SAT040

CONTROL VALVE BODY

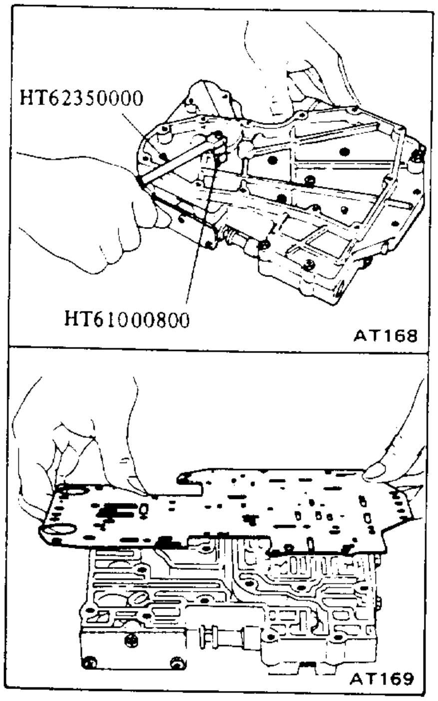
The valve body contains many precision parts and requires extreme care when parts are removed and serviced. Place removed parts on a parts rack so they can be put back in the valve body in the same positions and sequences. Care will also prevent springs and small parts from becoming scattered or lost.

1. Remove oil strainer and its attaching screws, nuts and bolts.



SAT041

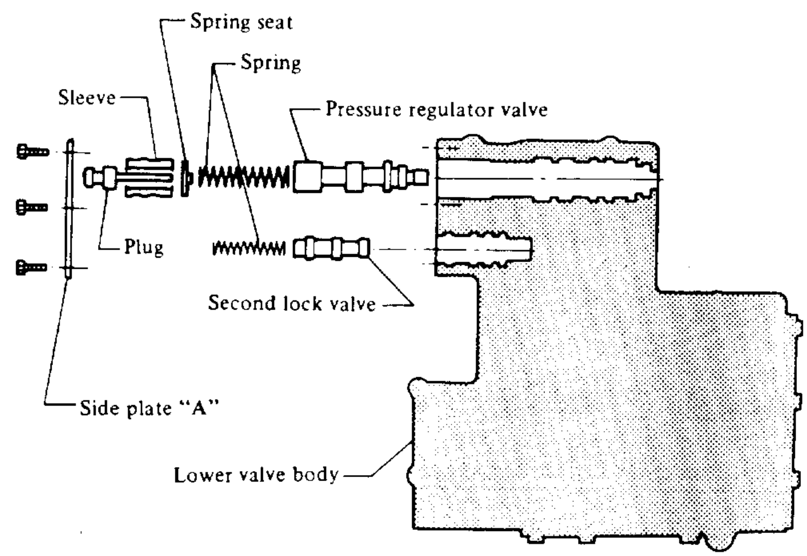
2. Disassemble valve body and its remaining attaching bolts and nuts to carefully separate lower body, separator plate and upper body.



AT168

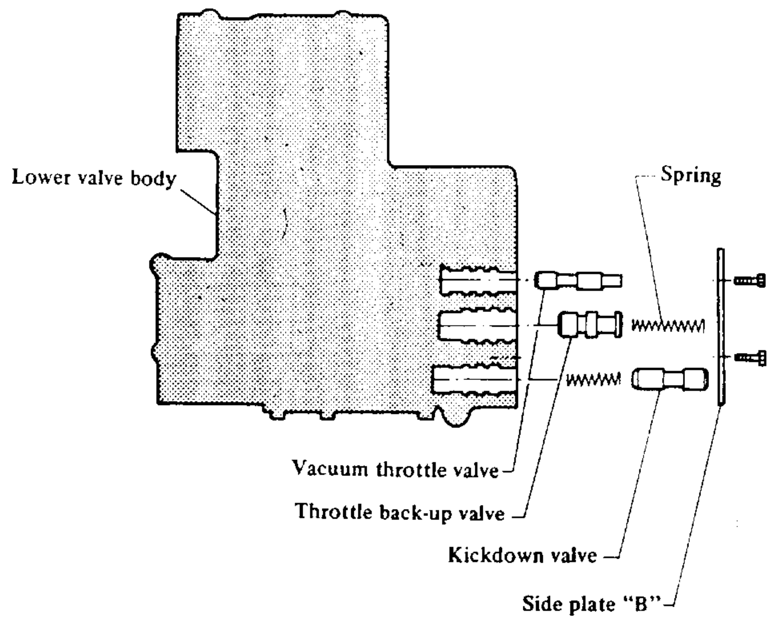
AT169

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.



SAT042

5. Remove side plate B, 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.

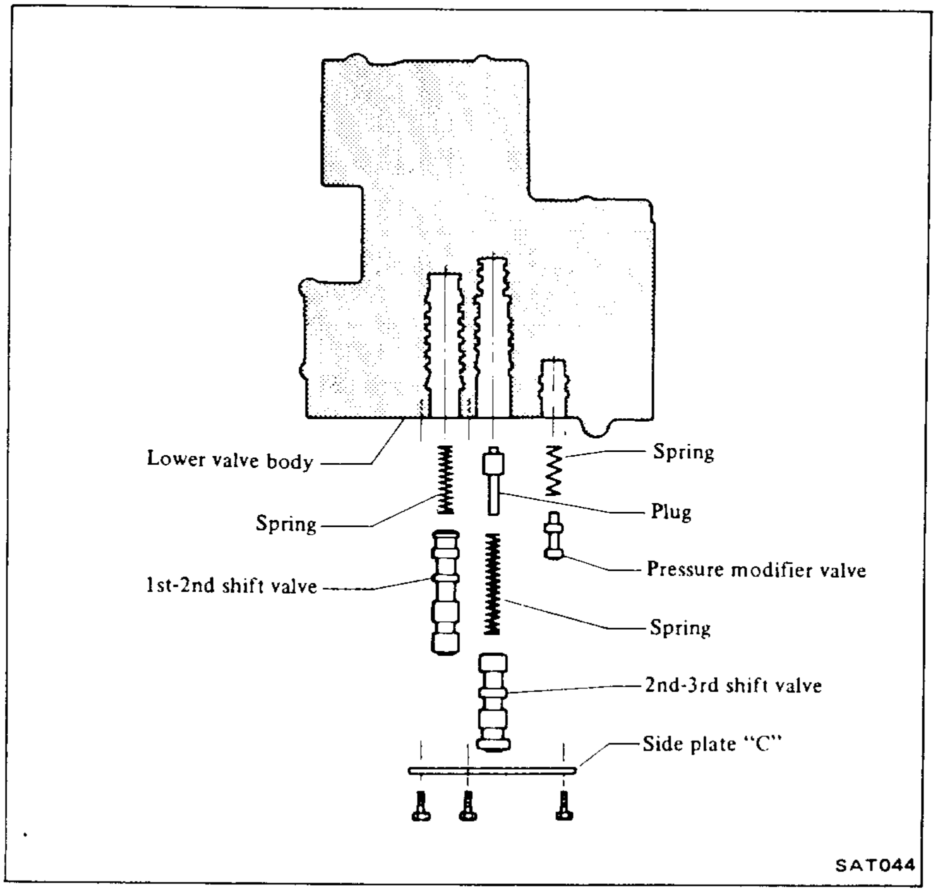


SAT171

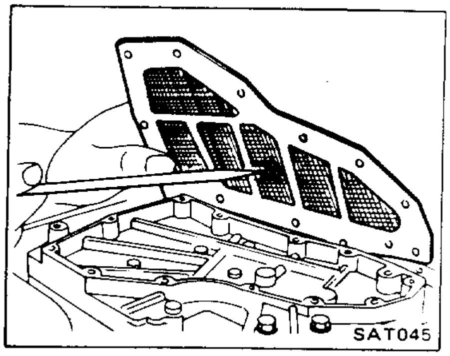
6. Remove side plate C, pressure modifier valve and spring, 2nd-3rd shift valve, spring and plug, and 1st-2nd shift valve and spring.

Place each loose part on a rack to retain sequence of assembly.

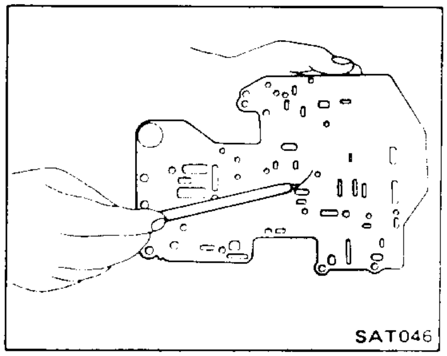
Manual valve was removed when valve body was removed from transmission. Include valve in subsequent inspection and service sequence.



SAT044


SAT045

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.


SAT046

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.

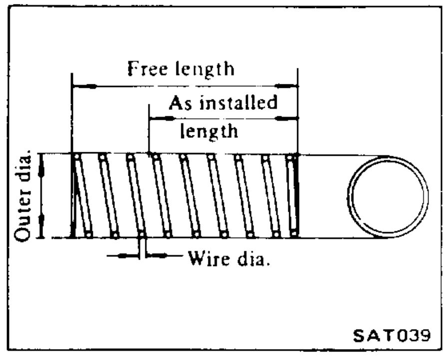
The valves may be cleaned using alcohol or lacquer thinner. The valve bodies can be dip cleaned with a good carburetor cleaner or lacquer thinner. **Do not leave valve bodies submerged in carburetor cleaner longer than five minutes. Rinse parts thoroughly and dry.**

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

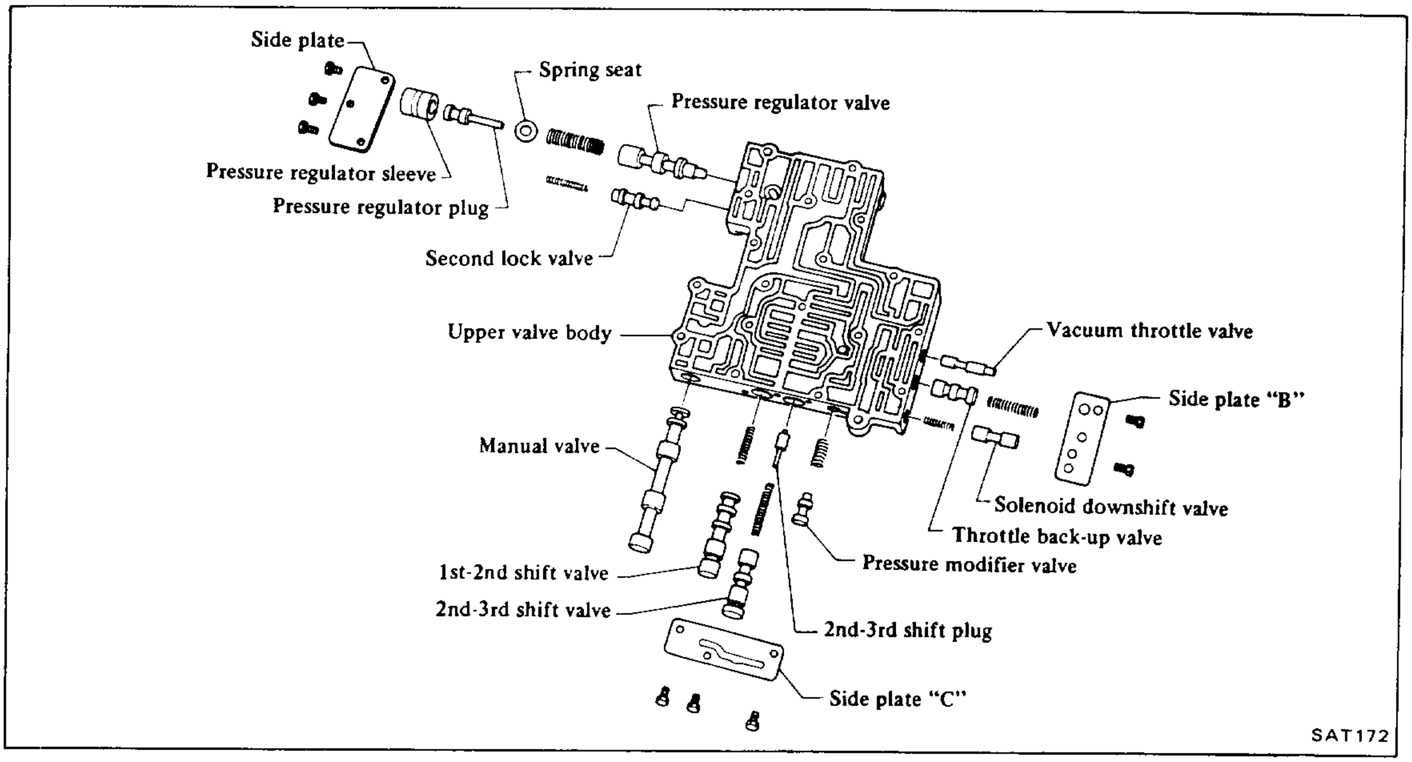


SAT039

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 Servo 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)

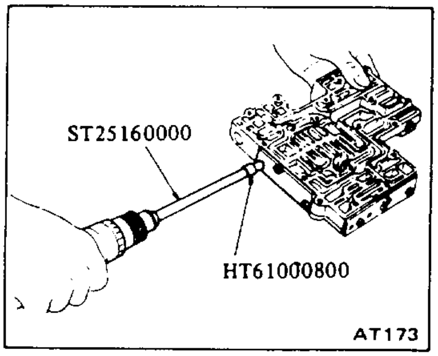
12. Assemble side plate A group of parts into lower valve body. Reinstall side plate and finger tighten screws.

Assemble side plate B group and side plate C group in same manner as A group.

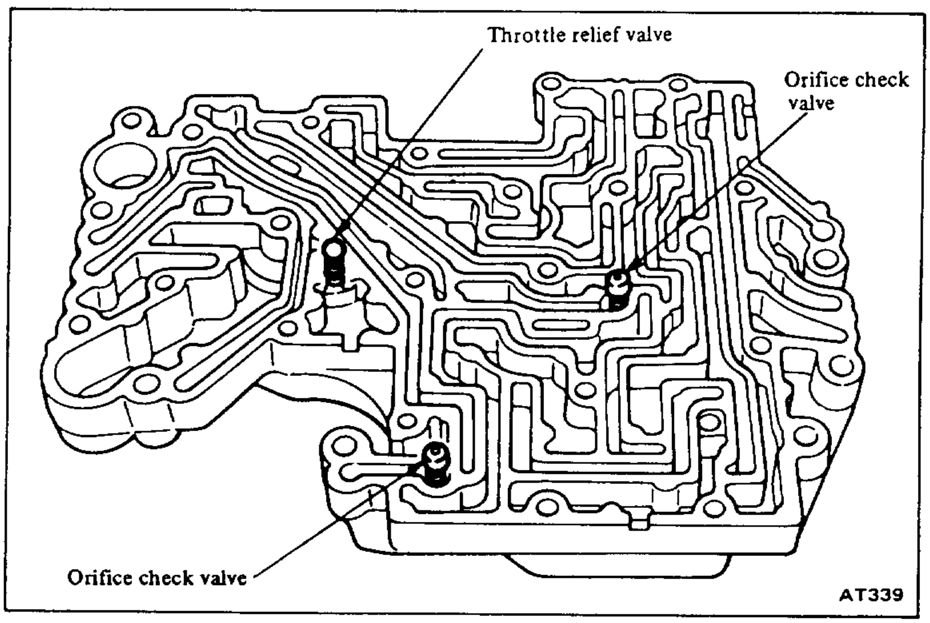


13. Tighten screws.

Ⓣ : **Side plate to valve body**
2.5 - 3.4 N·m
(0.25 - 0.35 kg-m,
1.8 - 2.5 ft-lb)

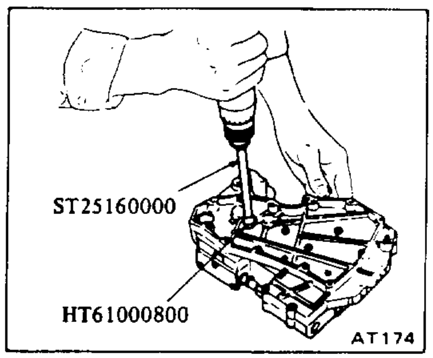


14. Install orifice check valve, valve spring, throttle relief valve spring and steel ball in valve body.



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)



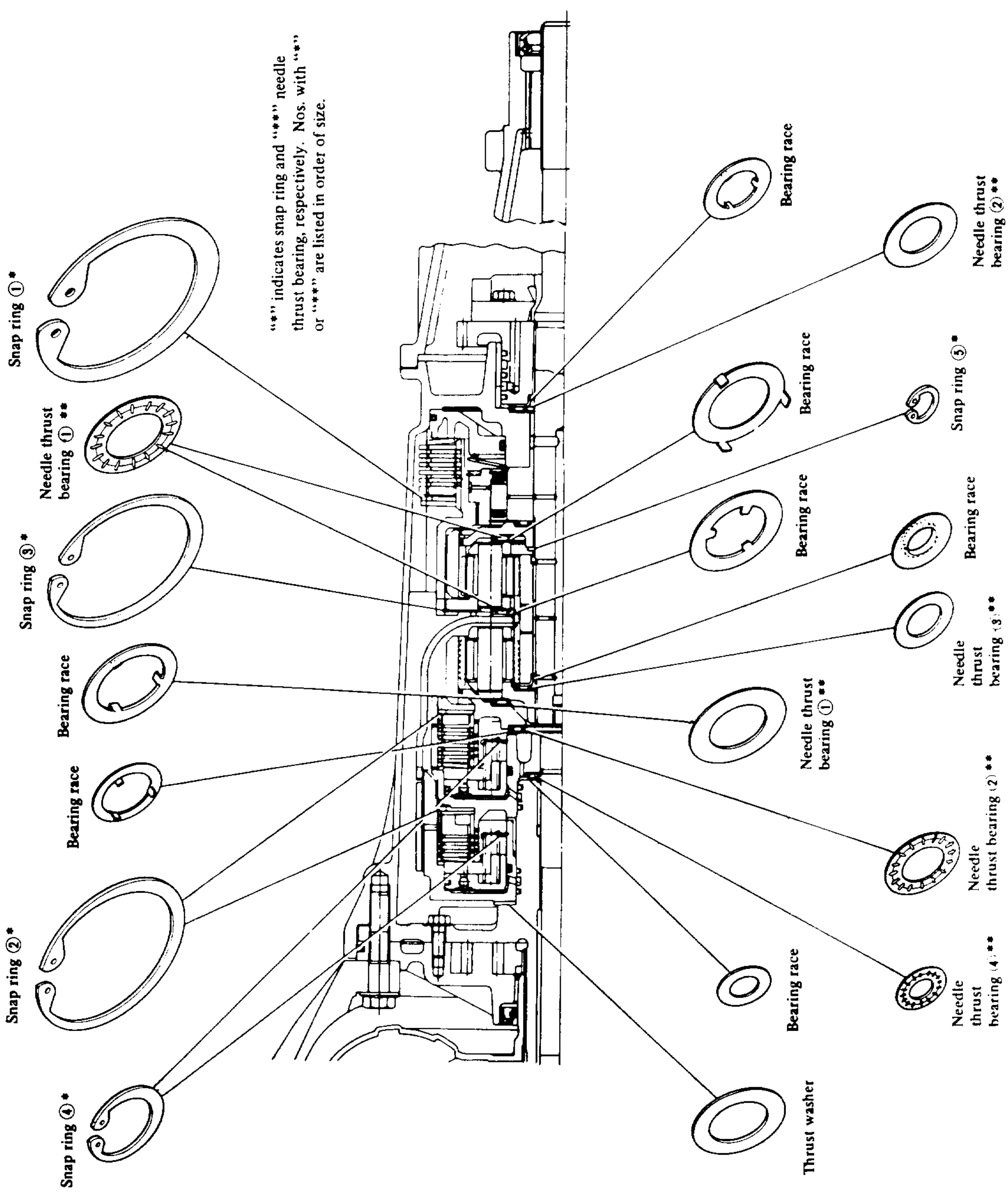
16. Install oil strainer.

Ⓣ : **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.

FINAL ASSEMBLY

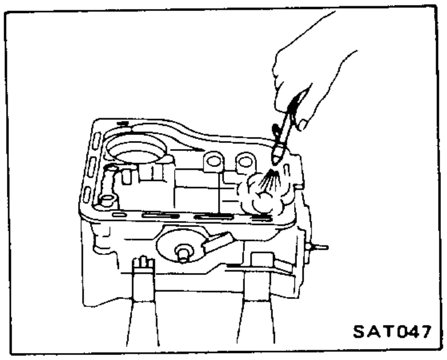
When installing/assembling needle bearing, bearing race, snap ring and O-ring (seal ring), use the following illustration as a guide to installation procedures and locations.



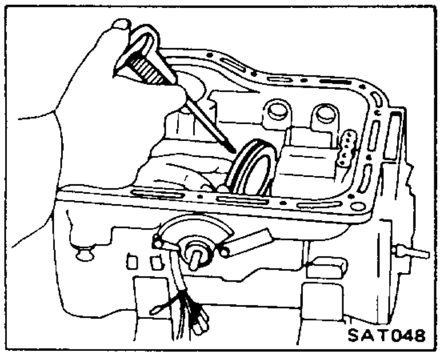
SAT089

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.

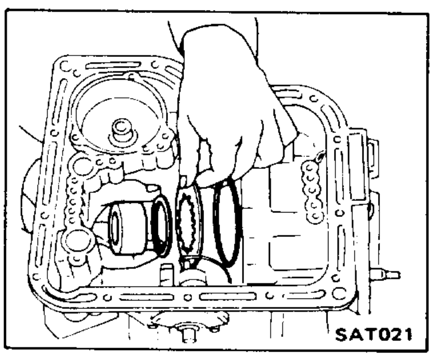
Petroleum jelly can be used to secure washers during installation. All new seals and rings should have been installed before beginning final assembly.


SAT047

2. Lubricate and install low and reverse piston into the case.


SAT048

3. Install thrust ring, piston return spring, thrust washer and one-way clutch inner race.


SAT021

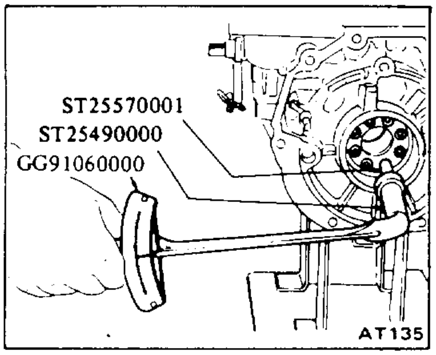
4. Align and start hex-head slotted bolts into inner race from rear of case.

> **WARNING:**
> **Check that return spring is centered on race before tightening.**

Tighten the bolts

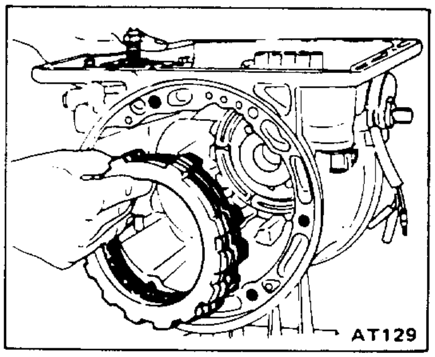
Ⓣ : **One-way clutch inner race to transmission case**

13 - 18 N·m
(1.3 - 1.8 kg-m,
9 - 13 ft-lb)



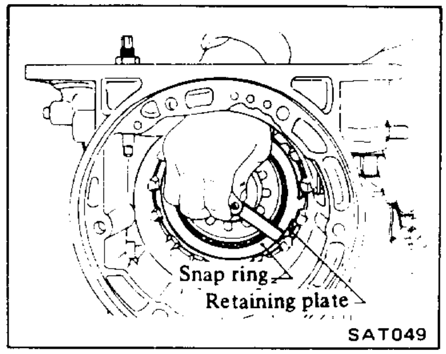
AT135

5. Install steel dished plate first, then steel and friction plates, and, finally, retaining plate and snap-ring.


AT129

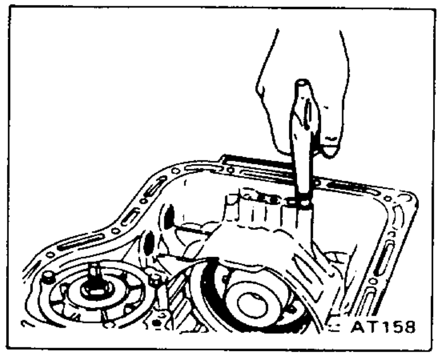
6. After low and reverse brake has been completely assembled, measure clearance between snapring and retainer plate. If measurement exceeds specifications it can be adjusted by replacing retainer plate with one of a different thickness.

Low and reverse brake clearance:
0.80 - 1.25 mm
(0.0315 - 0.0492 in)

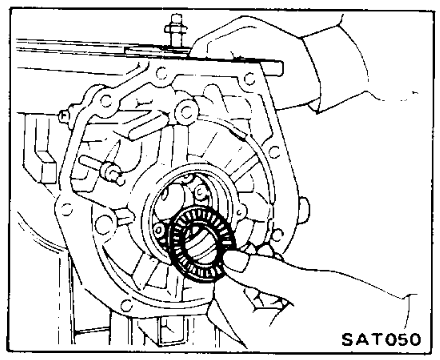


SAT049

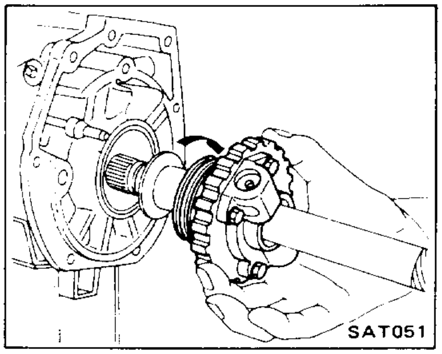
7. Using an air gun with a tapered rubber tip, check low and reverse brake operation.


AT158

8. Install governor thrust washer and needle bearing.

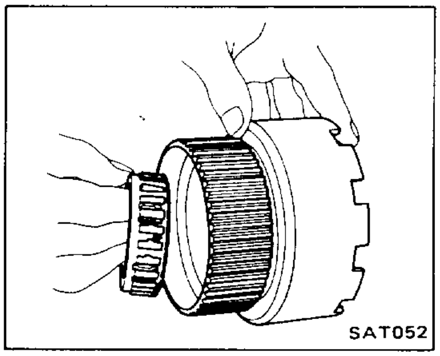

SAT050

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.

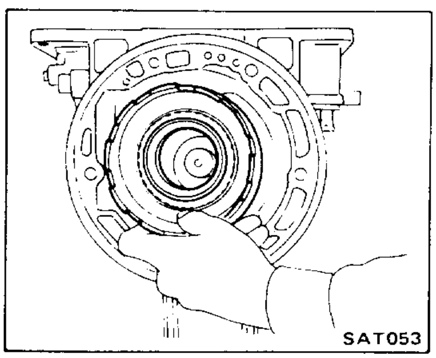

SAT051

10. Install one-way sprag into one-way clutch outer race (attached to connecting drum).

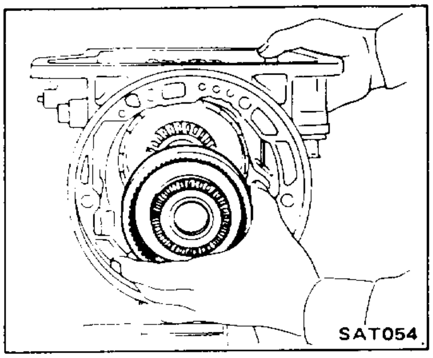
Arrow on sprag must face front of transmission.


SAT052

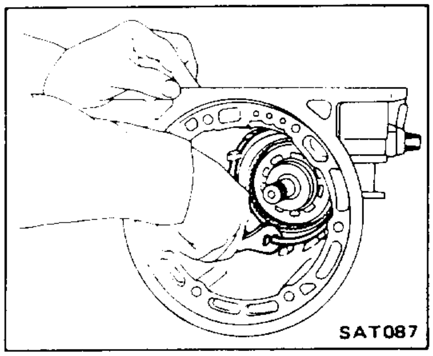
11. Install connecting drum with sprag by rotating drum clockwise using a slight pressure and wobbling to align plates with hub and sprag assembly. Connecting drum should now be free to rotate **clockwise only.** This check will verify that sprag is correctly installed and operative.


SAT053

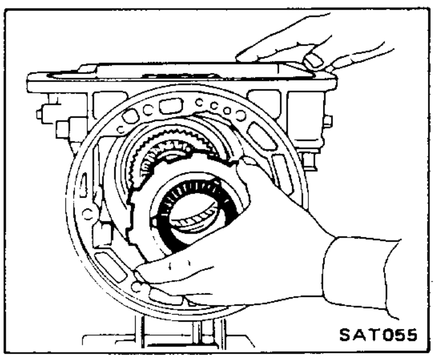
12. Install rear internal gear.


SAT054

13. Install snap-ring on shaft.

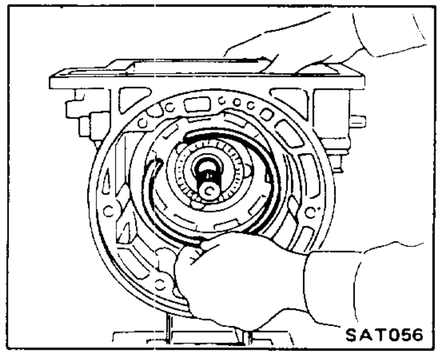

SAT087

14. Secure thrust bearing and thrust washer with petroleum jelly and install rear planetary carrier.

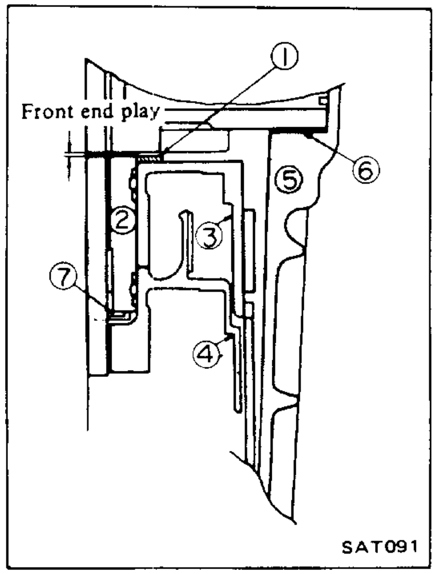

SAT055

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

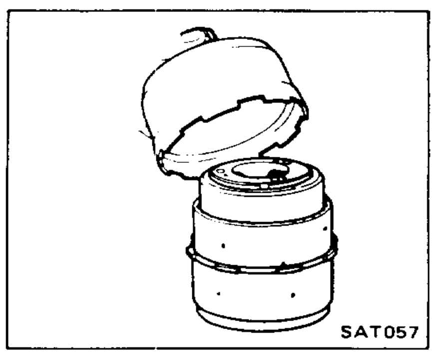
16. Adjust front end play as follows:



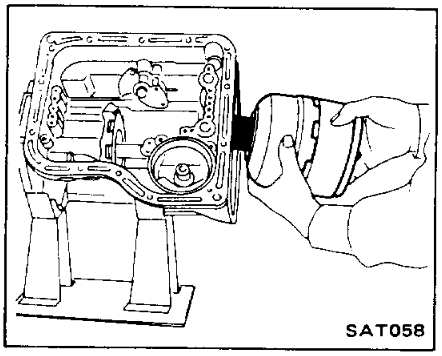
SAT091

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

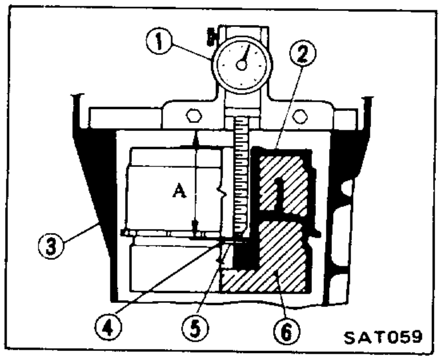
(1) Assemble front and rear clutches, front internal gear, front planetary carrier and connecting shell. Secure thrust bearings with petroleum jelly.


SAT057

(2) Install assembly into transmission case. Check that parts are properly seated before proceeding with measurements.

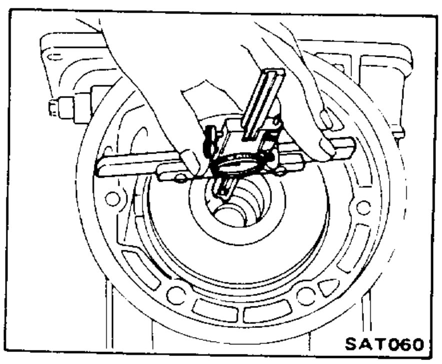

SAT058

(3) Using a dial gauge or caliper with a seven inch base, measure from rear hub thrust bearing race to case (dimension A).

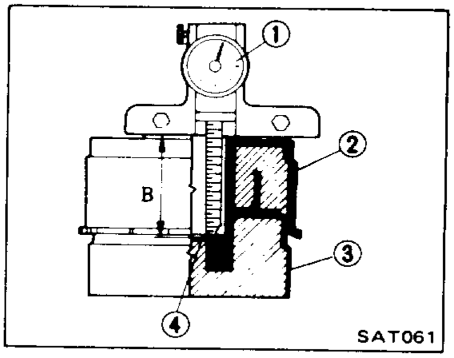


SAT059

1 Dial gauge
2 Front clutch drum
3 Transmission case
4 Bearing race
5 Thrust bearing
6 Rear clutch drum

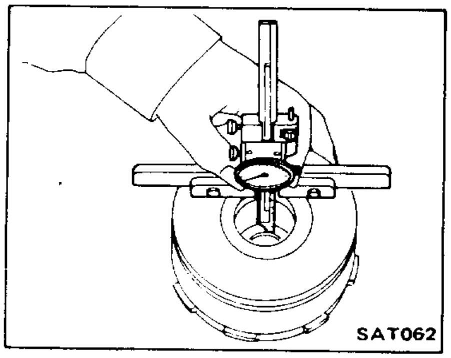

SAT060

(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).

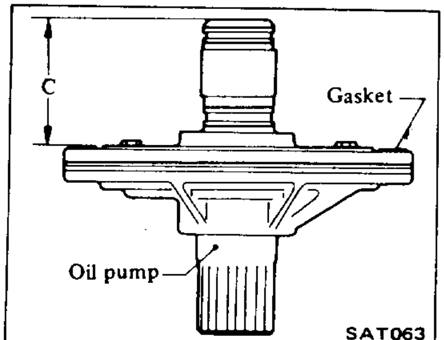


SAT061

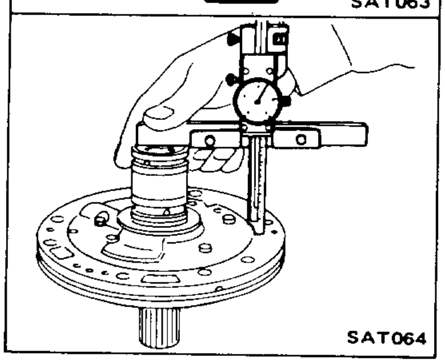
1 Depth gauge
2 Front clutch drum
3 Rear clutch drum
4 Thrust bearing


SAT062

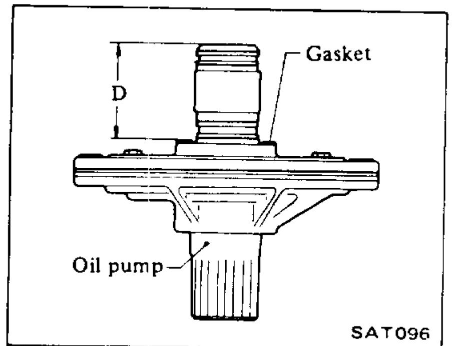
(5) Measure from top of oil pump shaft to gasket installed (dimension C).



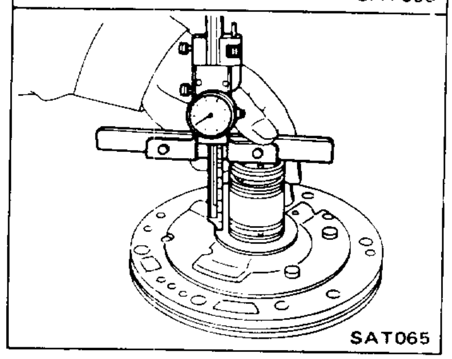
SAT063


SAT064

(6) Install thrust washer. Measure from top of oil pump shaft to thrust washer (dimension D).



SAT096


SAT065

(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)

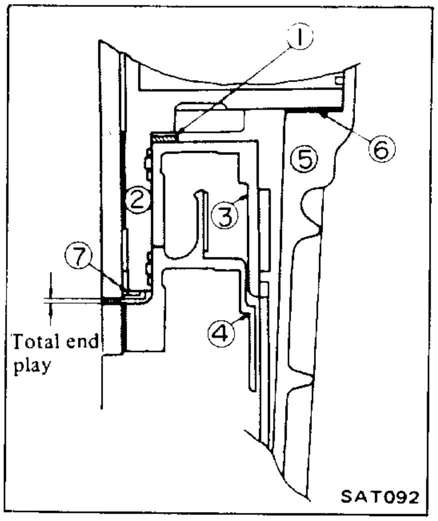
Front end play can be adjusted with front clutch thrust washers of different thickness.

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

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.



SAT092

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.

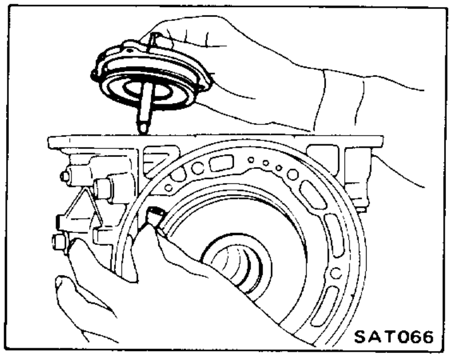
Specified total end play:
0.25 - 0.50 mm
(0.0098 - 0.0197 in)

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

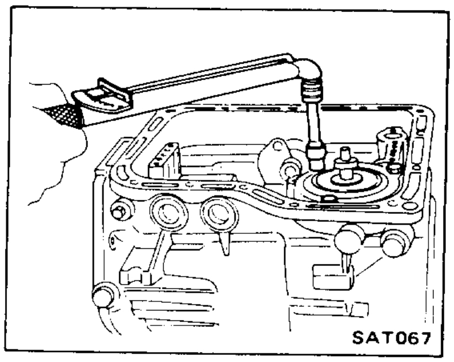
Thickness mm (in)	Part number
1.2 (0.047)	31556 X0100
1.4 (0.055)	31556 X0101
1.6 (0.063)	31556 X0102
1.8 (0.071)	31556 X0103
2.0 (0.079)	31556 X0104
2.2 (0.087)	31556 X0105

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.**

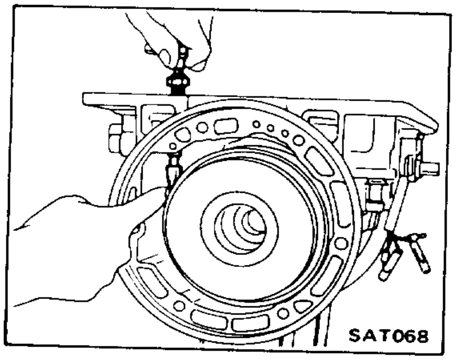

SAT066

19. Install and torque the retainer bolts. Loosen piston stem.

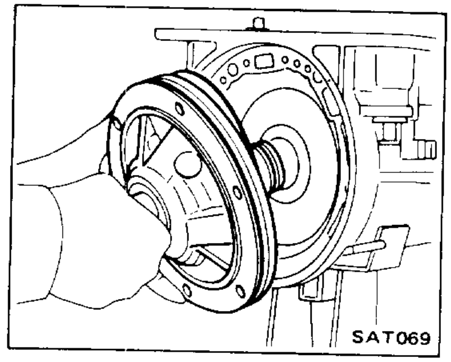
Ⓣ : **Servo piston retainer bolt**
5 - 7 N·m
(0.5 - 0.7 kg-m,
3.6 - 5.1 ft-lb)


SAT067

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.

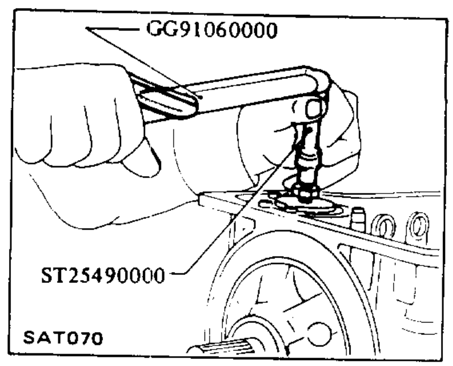

SAT068

21. Mount oil pump gasket on oil pump with petroleum jelly. Align pump to transmission case and install.


SAT069

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.

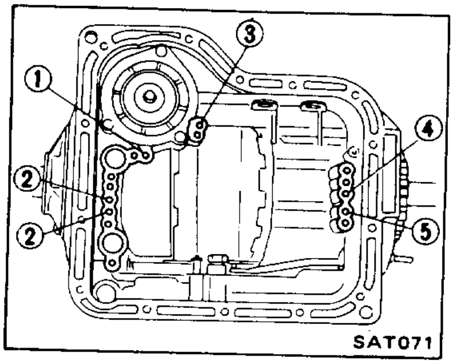
Ⓣ : **Piston stem**
12 - 15 N·m
(1.2 - 1.5 kg-m,
9 - 11 ft-lb)
Piston stem lock nut
15 - 39 N·m
(1.5 - 4.0 kg-m,
11 - 29 ft-lb)



SAT070

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.

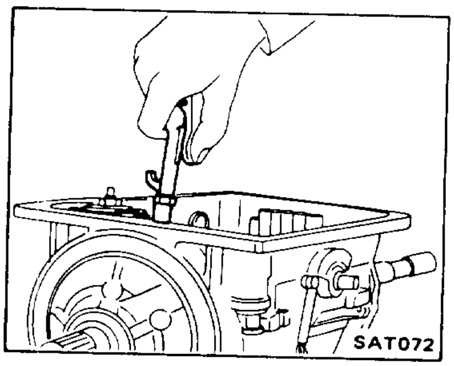
Air check point



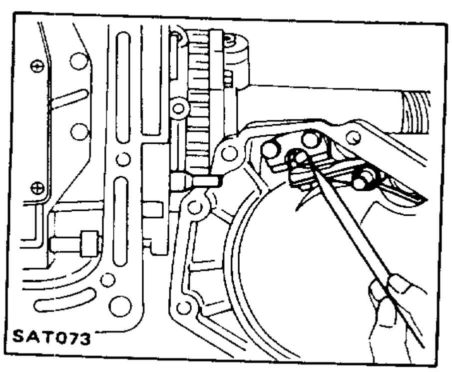
SAT071

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.

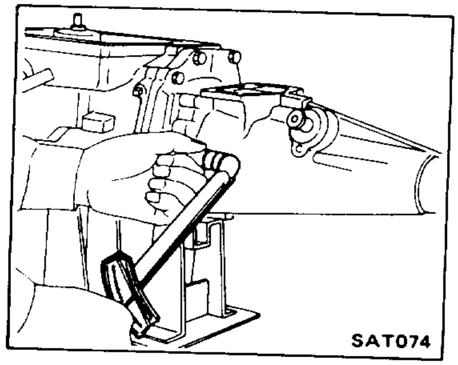

SAT072

25. Check that parking pawl, pin, spring and washer are assembled correctly.

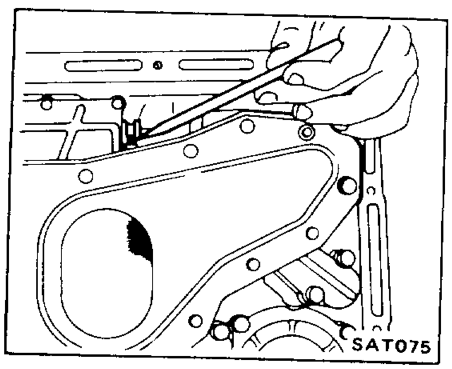

SAT073

26. Install rear extension.

Ⓣ : **Rear extension to transmission case**
20 - 25 N·m
(2.0 - 2.5 kg-m,
14 - 18 ft-lb)


SAT074

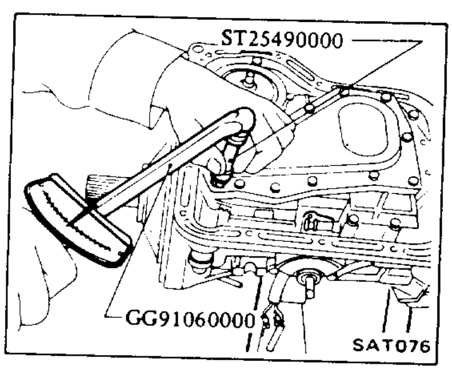
27. Install control valve body. Be sure manual valve is in alignment with selector pin.


SAT075

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)

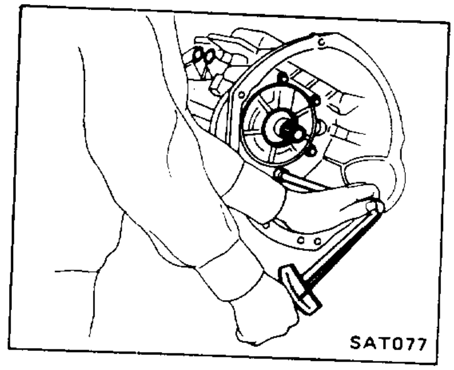
Control valve body attaching bolts vary in length. Care must be taken to ensure that each bolt is returned to correct hole.



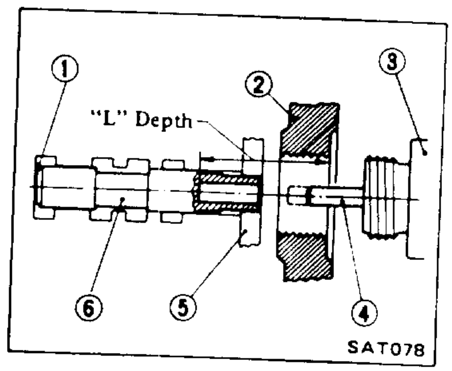
SAT076

29. Check pump to transmission alignment and install converter housing.

Ⓣ : **44 - 54 N·m**
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)


SAT077

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.



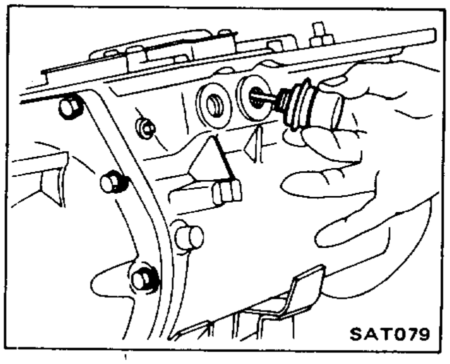
SAT078

1 Note seated valve body
2 Transmission case wall
3 Vacuum diaphragm
4 Diaphragm rod
5 Valve body side plate
6 Vacuum throttle valve

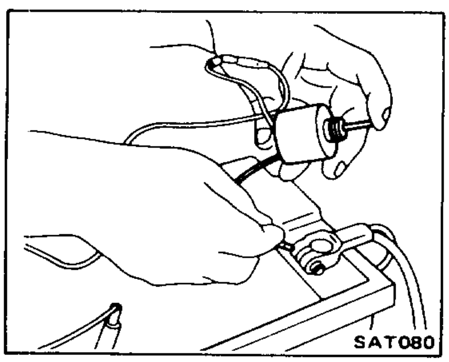
Throttle modulator valve rod selection

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

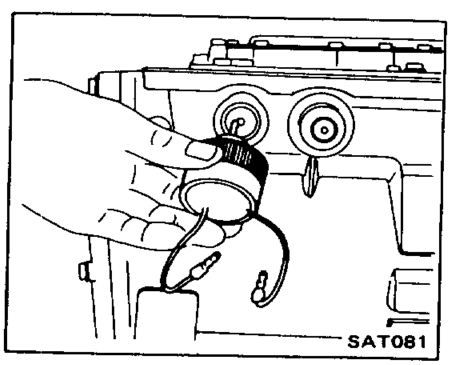
31. Install vacuum diaphragm.



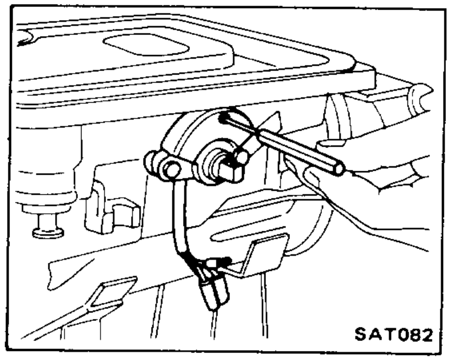
32. Before installing down shift solenoid, check to verify that it is operating properly. Use a hot lead and ground to check solenoid.



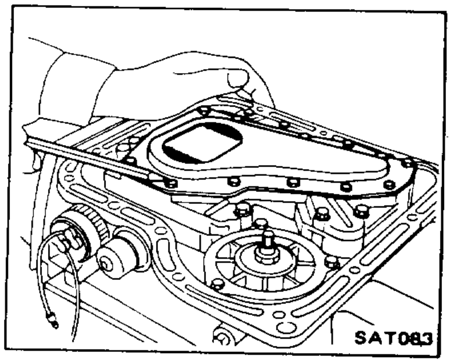
33. Install down shift solenoid.



34. Install inhibitor switch. Check for proper operation in each range using a circuit tester. Refer to Minor Adjustment.

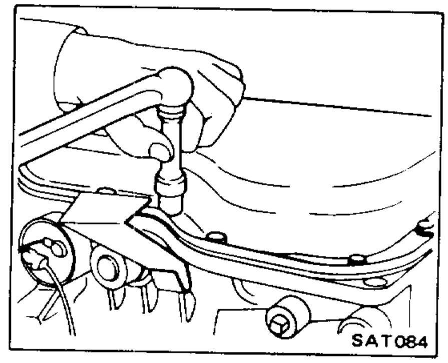


35. Before installing oil pan, check alignment and operation of control lever and parking pawl engagement. Blow mechanism with air to clean. Make final check to be sure all bolts are installed in valve body.

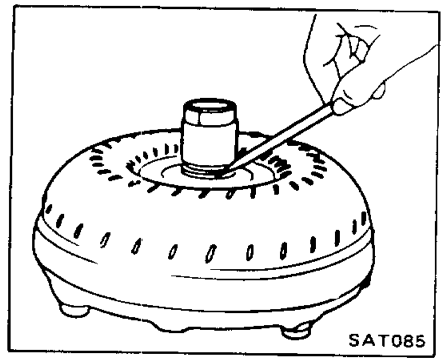


36. Install oil pan with new gasket.

Ⓣ : Oil pan to transmission case
5 - 7 N·m
(0.5 - 0.7 kg-m,
3.6 - 5.1 ft-lb)

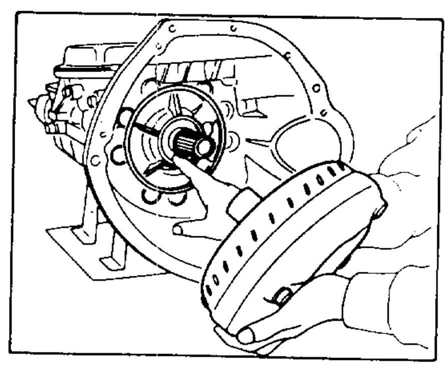


37. Carefully inspect torque converter for damage. Check converter hub for grooves caused by hardened seals. Also check bushing contact area.



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.



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 (3/4 Imp pt) low. Add only clean Dexron transmission fluid (or equivalent).

Fluid leakage

To detect a fluid leak:

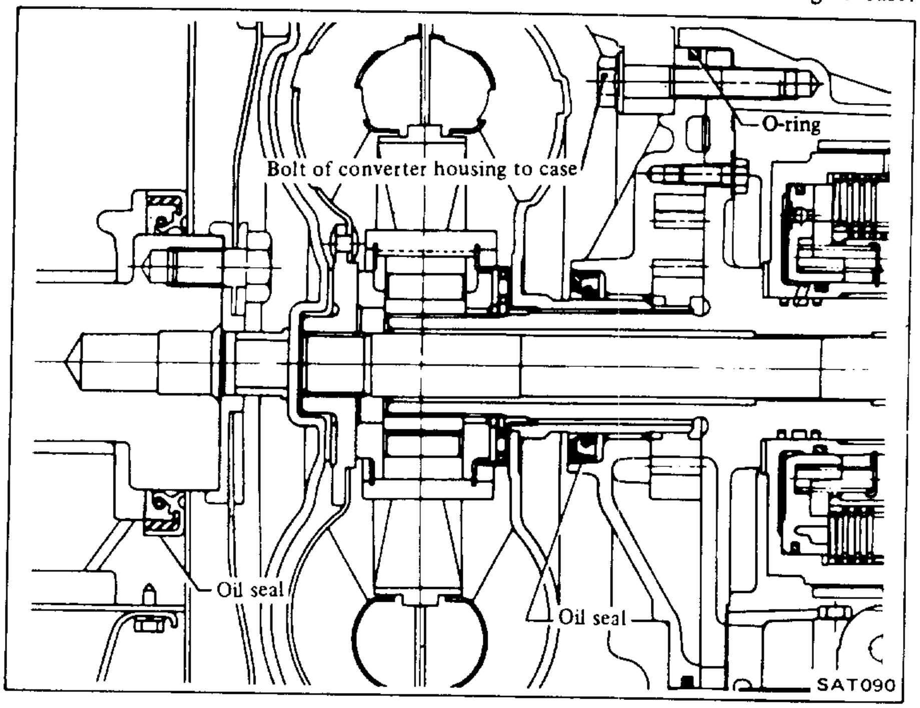
1) Raise vehicle.
2) Clean area suspected of leaking.
3) Start engine, apply foot brake, place gear selector in drive, and wait a few minutes.
4) Stop engine.
5) Check for fresh leakage.

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.

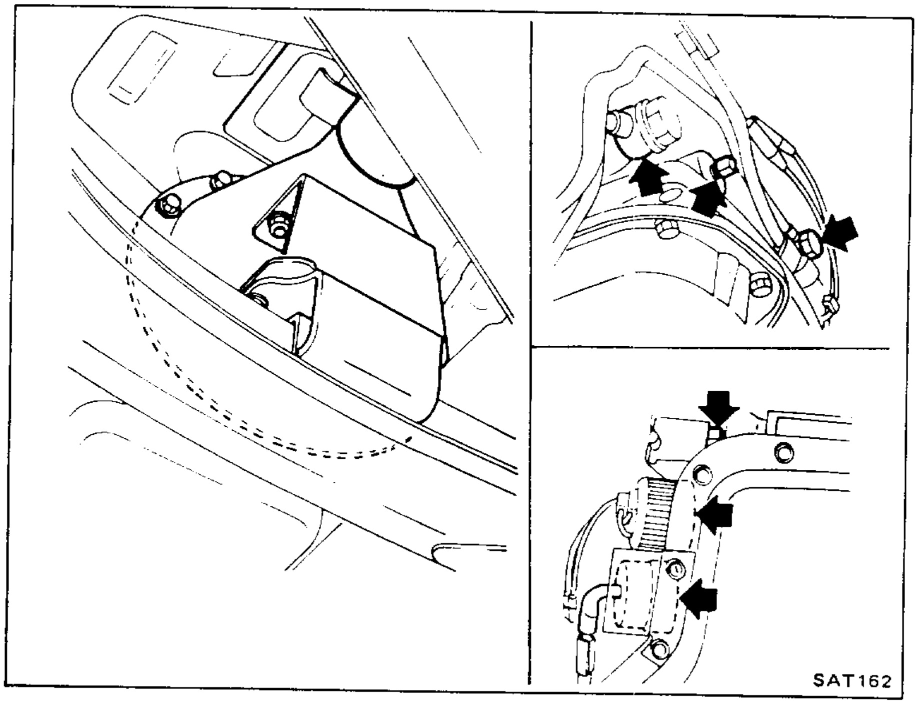
To aid in locating leaks, use the following list of seals and gaskets.

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.



SAT090

2) Transmission and rear extension.
- Junction of transmission and rear extension.
- Oil cooler tube connectors.
- Oil pressure inspection ports.
- Vacuum diaphragm and downshift solenoid.
- Rear extension oil seal.



SAT162

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 "N" range): 650 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.

Vehicle speed and line pressure when shifting gears

Intake manifold vacuum –kPa (–mbar, –mmHg, –inHg)	Gearshift	Vehicle speed* km/h (MPH)		Propeller shaft revolutions rpm	Line pressure kPa (bar, kg/cm², psi)
		205R16C-8PRLT 6.50-16-10PRLT	7.50-16-10PRLT 7.50R16-8PRLT		
0 (0, 0, 0) (Kickdown)	$D_1 \rightarrow D_2$	50 - 64 (31 - 40)	54 - 69 (33 - 43)	1,720 - 2,220	686 - 863 (6.86 - 8.63, 7.0 - 8.8, 100 - 125)
	$D_2 \rightarrow D_3$	89 - 103 (55 - 64)	95 - 111 (59 - 69)	3,060 - 3,560	
	$D_3 \rightarrow D_2$	93 - 79 (58 - 49)	100 - 85 (63 - 53)	3,220 - 2,720	
	$D_2 \rightarrow D_1$	50 - 36 (31 - 22)	54 - 38 (34 - 24)	1,730 - 1,230	
26.7 (267, 200, 7.87)	$D_1 \rightarrow D_2$	12 - 26 (7 - 16)	12 - 28 (8 - 17)	400 - 900	530 - 628 (5.30 - 6.28, 5.4 - 6.4, 77 - 91)
	$D_2 \rightarrow D_3$	41 - 55 (25 - 34)	44 - 60 (27 - 37)	1,410 - 1,910	
	$D_3 \rightarrow D_2$	34 - 19 (21 - 12)	36 - 21 (23 - 13)	1,160 - 660	
	$D_2 \rightarrow D_1$	20 MAX. (13 MAX.)	22 MAX. (14 MAX.)	700 MAX.	530 - 883 (5.30 - 8.83, 5.4 - 9.0, 77 - 128)
0 (0, 0, 0) (Full throttle)	$1_2 \rightarrow 1_1$	52 - 35 (32 - 22)	56 - 37 (35 - 23)	1,800 - 1,200	745 - 922 (7.45 - 9.22, 7.6 - 9.4, 108 - 134)
60.0 (600, 450, 17.72)	$1_2 \rightarrow 1_1$	52 - 35 (32 - 22)	56 - 37 (35 - 23)	1,800 - 1,200	745 - 922 (7.45 - 9.22, 7.6 - 9.4, 108 - 134)

*Vehicle speed can be calculated by the following formula if vehicle is driven with transfer control lever shifted into "2H" or "4H" position.

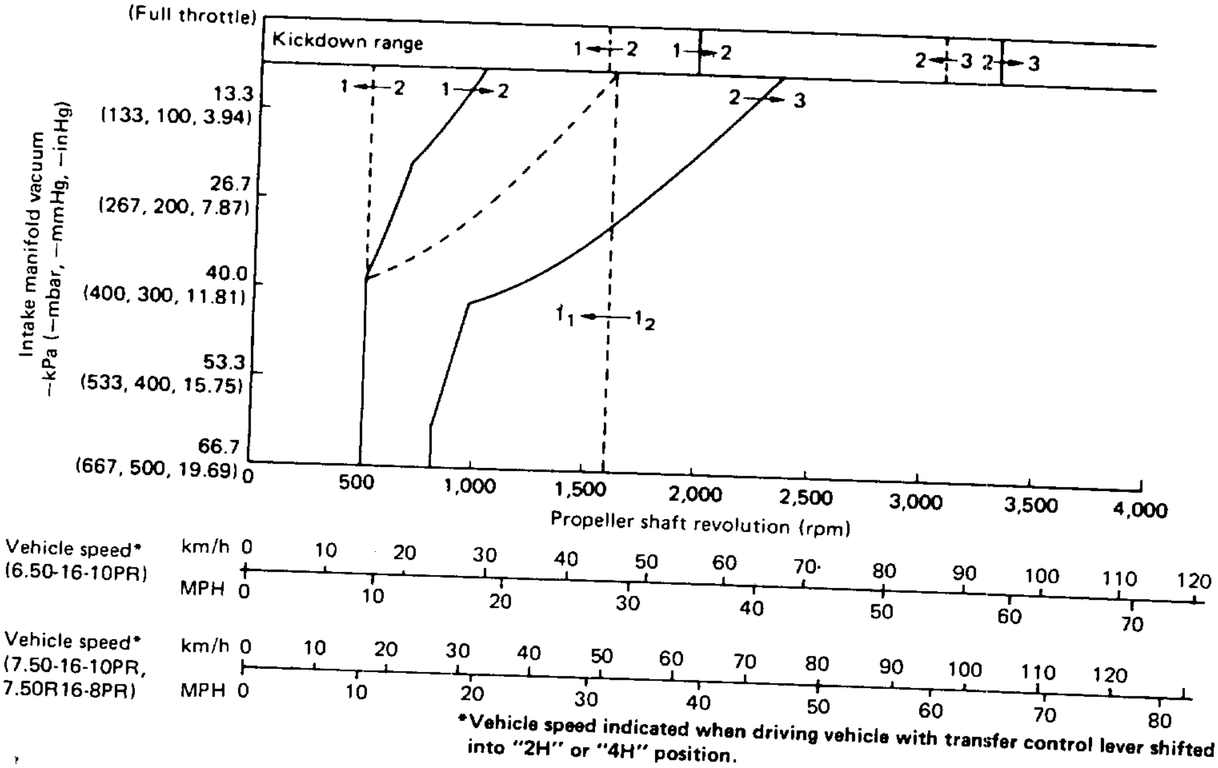
$$V = \frac{0.0290 \times Np\ (205R16C\text{-}8PRLT,\ 6.50\text{-}16\text{-}10PRLT)}{0.0312 \times Np\ (7.50\text{-}16\text{-}10PRLT,\ 7.50R16\text{-}8PRLT)} \quad \left(= \frac{2 \times \pi \times r \times Np \times 60}{R_F \times 1{,}000}\right)$$

where, V : Vehicle speed (km/h)
NP : Propeller shaft revolution (rpm)
R_F : Final gear ratio (4.625)
r : Tire effective radius (m), 205R16C-8PRLT and 6.50-16-10PRLT (0.356 m), 7.50-16-10PRLT (0.382 m), 7.50R16-8PRLT (0.386 m)
π : The ratio of circumference of a circle to its diameter: 3.14

$$V = \frac{0.01803 \times Np\ (205R16C\text{-}8PRLT,\ 6.50\text{-}16\text{-}10PRLT)}{0.01944 \times Np\ (7.50\text{-}16\text{-}10PRLT,\ 7.50R16\text{-}10PRLT)} \left(= \frac{2 \times \pi \times r \times Np \times 60}{R_F \times 63{,}360}\right)$$

where, V : Vehicle speed (MPH)
Np : Propeller shaft revolution (rpm)
R_F : Final gear ratio (4.625)
r : Tire effective radius (in), 205R16C-8PRLT and 6.50-16-10PRLT (14.02 in), 7.50-16-10PRLT (15.04 in), 7.50R16-8PRLT (15.20 in)
π : The ratio of circumference of a circle to its diameter: 3.14

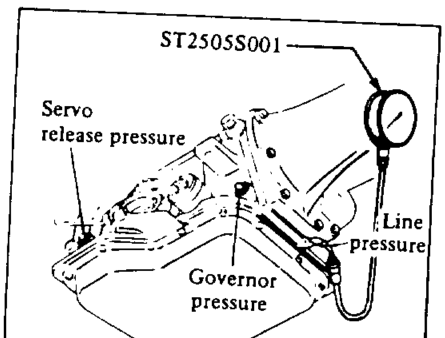
Shift schedule



SAT161

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.



AT454

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 (bar, kg/cm², psi)
R	294 - 736 (2.94 - 7.36, 3.0 - 7.5, 43 - 107)
D	294 - 392 (2.94 - 3.92, 3.0 - 4.0, 43 - 57)
2	736 - 1,373 (7.36 - 13.73, 7.5 - 14.0, 107 - 199)
1	294 - 392 (2.94 - 3.92, 3.0 - 4.0, 43 - 57)

At stall test

Range	Line pressure kPa (bar, kg/cm², psi)
R	2,059 - 2,354 (20.59 - 23.54, 21.0 - 24.0, 299 - 341)
D	1,079 - 1,275 (10.79 - 12.75, 11.0 - 13.0, 156 - 185)
2	1,177 - 1,373 (11.77 - 13.73, 12.0 - 14.0, 171 - 199)
1	1,079 - 1,275 (10.79 - 12.75, 11.0 - 13.0, 156 - 185)

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 (0.98 bar, 1.0 kg/cm², 14 psi). Excessive pressure drop may indicate an internal leak at a servo or clutch seal.

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 (–mbar, –mmHg, –inHg)	Vehicle speed* km/h (MPH)		Propeller shaft revolutions rpm
	205RC16-8PRLT 6.50-16-10PRLT	7.50-16-10PRLT 7.50R16-8PRLT	
0 (0, 0)	27 - 36 (17 - 22)	29 - 38 (18 - 24)	930 - 1,230
26.7 (267, 200, 7.87)	12 - 17 (7 - 11)	12 - 19 (8 - 12)	400 - 600

***Vehicle speed indicated when driving vehicle with transfer control lever shifted into "2H" or "4H" position.**

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:
1,950 - 2,250 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).

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	Line 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	.	.	.	.	.	.	.	.	.	.	.	③	.	.	.	.
Vehicle moves when changing into "P" range or parking gear does not disengage when shifted out of "P" range	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	②
Vehicle runs in "N" range.	.	1	.	.	.	.	.	3	.	.	.	2	.	.	④	.	.	.	.	.	.	.	.
Vehicle will not run in "R" range (but runs in "D", "2" and "1" ranges.) Clutch slips. Very poor acceleration.	1	2	.	.	.	.	3	5	.	.	6	4	.	.	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								

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	Line 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	.	.	.	⑥	.	.	.	.	.	.
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							

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	Line 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

ROAD TEST SYMPTOM CHART

		SHIFT QUALITY									
		ROUGH	SHIFT TIMING [Mark km/h (MPH)]	NO SHIFT	SHIFT SLIPPAGE	VEHICLE WON'T MOVE	CRUISE SLIPPAGE	POOR POWER/ACCELERATION	NOISY	OK	COMMENTS
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										

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 (600 mbar, 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 26.7 kPa (267 mbar, 200 mmHg, 7.87 inHg).
	2. Quick acceleration, 1st → 2nd 2nd → 3rd	Same as item 1 above except with engine vacuum pressure of 0 kPa (0 mbar, 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.

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 (600 mbar, 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 mbar, 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.

SERVICE DATA AND SPECIFICATIONS

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 (4-7/8 Imp qt) Approximately 2.7 liters (2-3/8 Imp qt) in torque converter

Specifications and adjustment

Automatic transmission assembly Model code number		X2764	
Torque converter assembly Stamped mark on the T/C		G	
Front clutch	Number of drive plates	3	
	Number of driven plates	3	
	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.	64 (2.52)	
	Small dia.	40 (1.57)	
Control valve assembly Stamped mark on strainer		MEK	
Governor assembly Stamped mark on governor body		M33	

Stall revolution

Stall revolution rpm	1,950 - 2,250

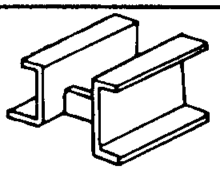
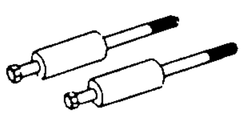
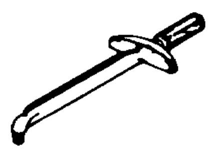
Tightening torque

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

Unit	N·m	kg-m	ft-lb
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

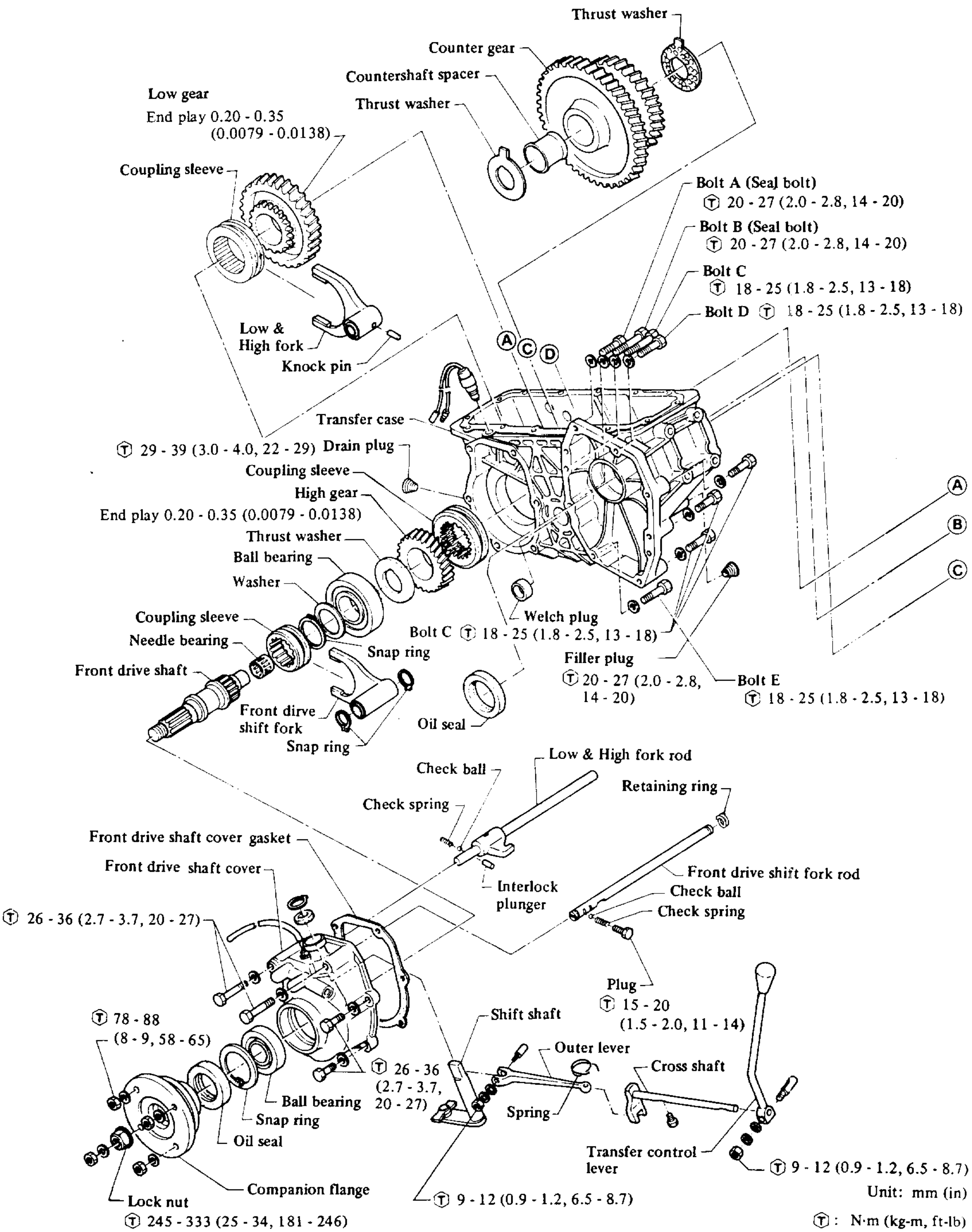
* Turn back two turns after tightening.

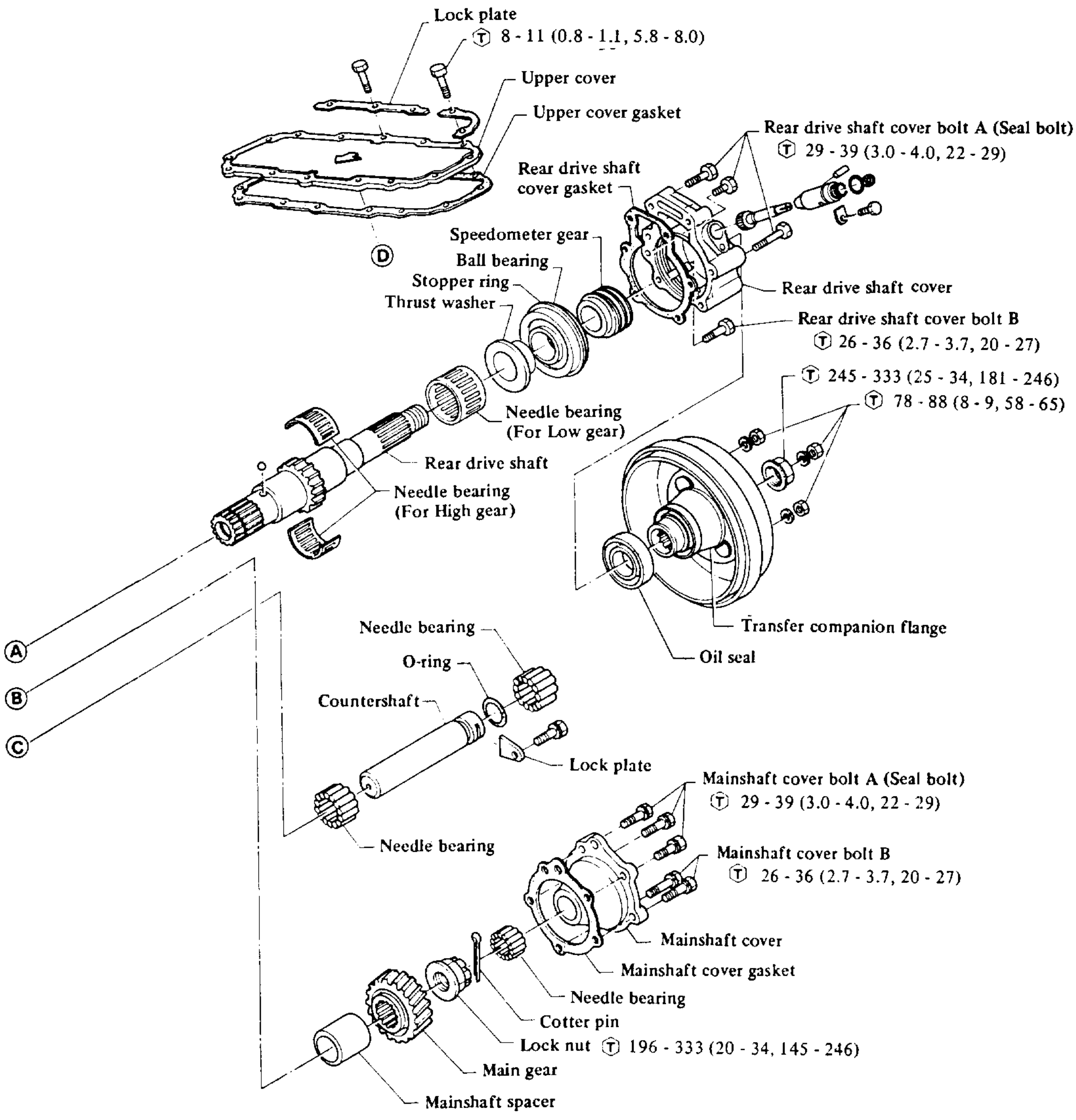
SPECIAL SERVICE TOOLS

Tool number	Tool name
ST07870000 (ST07860000)	Transmission case stand 
ST25850000	Sliding hammer 
GG91060000 (GG93010000)	Torque wrench 

CONTENTS

TRANSFER (Model : T130A)





Note: a. Apply sealant when reinstalling seal bolt.
b. The following parts should be replaced with new one at every disassembly.
- Oil seal
- O-ring
- Gasket
- Companion flange lock nut
- Snap ring

Ⓣ : N·m (kg-m, ft-lb)

SMT257

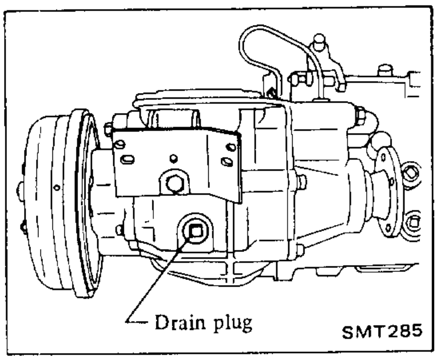
REMOVAL AND INSTALLATION

Refer to Section MT.

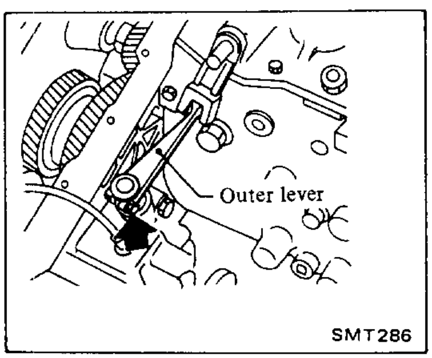
FORKS AND FORK RODS

DISASSEMBLY

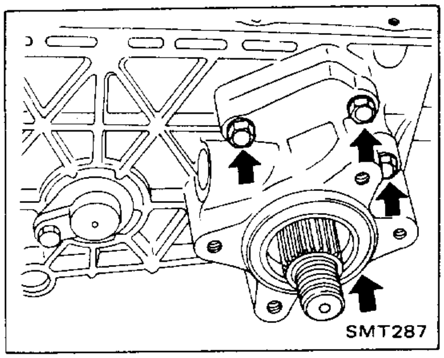
1. Remove transfer with transmission from vehicle. **Refer to Section MT for removal.**
2. Drain transfer oil prior to disassembly.



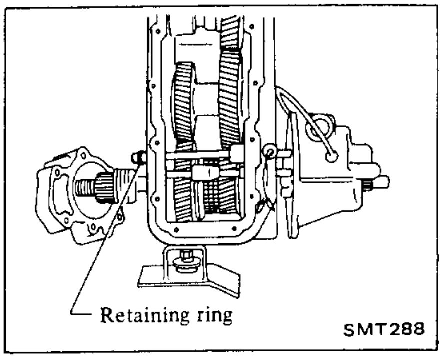
3. Remove center brake assembly and each companion flange.
4. Remove upper cover from transfer.
5. Remove transfer outer lever.



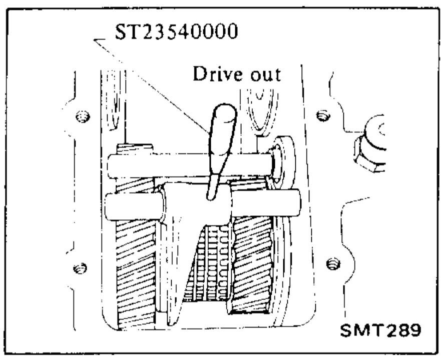
6. Remove rear drive shaft cover.



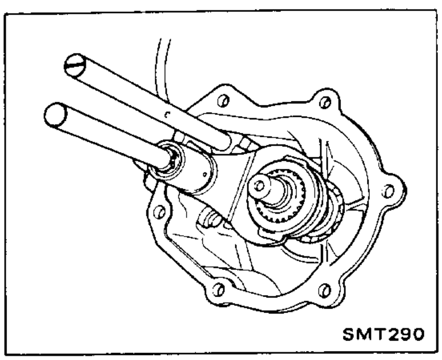
7. Remove retaining ring from front drive fork rod.



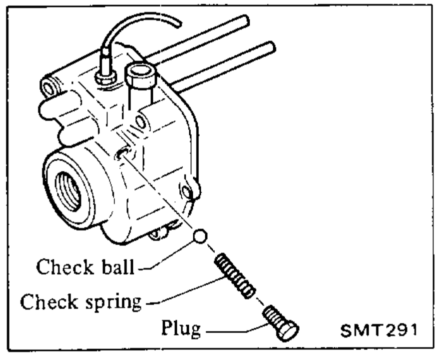
8. Remove dowel pin from Low & High shift fork **using Tool.**



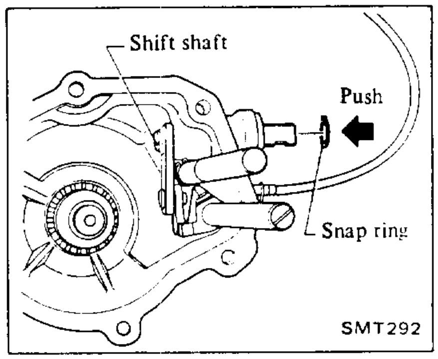
9. Remove front drive shaft cover assembly.



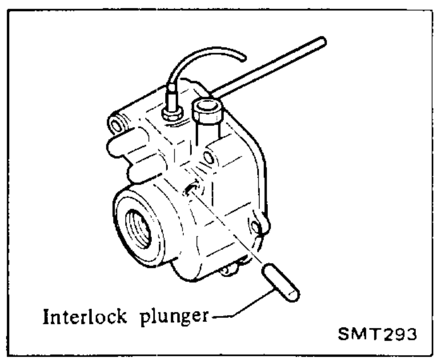
10. Remove snap ring and front drive shift fork.
11. Remove check ball plug, check spring and check ball for front drive fork rod.



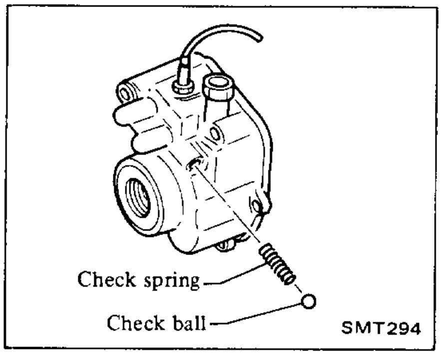
12. Remove snap ring and shift shaft assembly.



13. Pull front drive fork rod out, then remove interlock plunger.

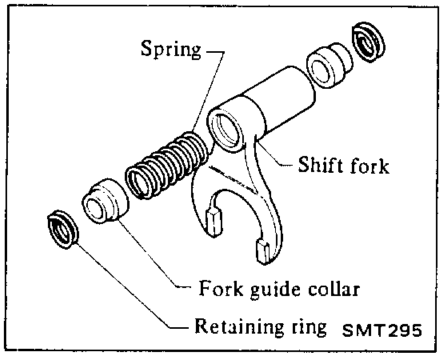


14. Pull Low & High fork rod out, then remove check ball and check spring for Low & High fork rod.



SMT294

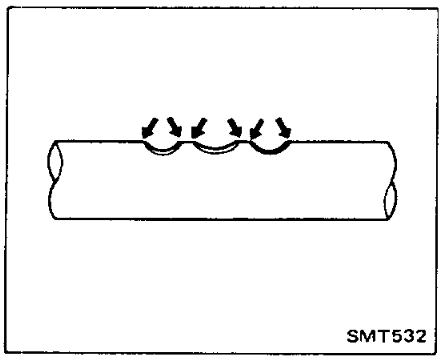
15. Disassemble front drive shift fork.
16. Fork guide collar and spring can be removed by removing retaining ring.



SMT295

INSPECTION

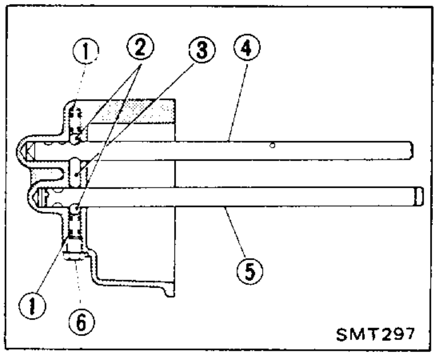
1. Clean with solvent, and check forks for wear, scratches, projection, damage or other defects. Replace any part which is worn or damaged.
2. Check fork rods for bend, scratches, and check groove of check ball for wear as illustrated.


SMT532

ASSEMBLY

Assemble fork and fork rods in the reverse order of disassembly, noting following points.

- Install check ball, check sping and interlock plunger to their original positions.
- When installing fork rods, pay attention to the direction of their grooves.
- Push Low & High fork rod until check ball fits securely into 3rd groove.



SMT297

1 Check spring
2 Check ball
3 Interlock plunger
4 Low & High fork rod
5 Front drive fork rod
6 Plug

- Always install new gasket on front cover and rear drive shaft cover.
- Apply sealant to check ball hole plug.
- Apply sealant to three rear drive shaft cover mounting bolts for through holes.

T : Check ball hole plug
15 - 20 N·m
(1.5 - 2.0 kg-m,
11 - 14 ft-lb)
Front drive shaft cover bolt
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)
Rear drive shaft cover bolt A
(Seal bolt)
29 - 39 N·m
(3 - 4 kg-m,
22 - 29 ft-lb)
Rear drive shaft cover bolt B
26 - 36 N·m
(2.7 - 3.7 kg-m
20 - 27 ft-lb)
Upper cover bolt
8 - 11 N·m
(0.8 - 1.1 kg-m,
5.8 - 8.0 ft-lb)
Shift rod lock pin nut
9 - 12 N·m
(0.9 - 1.2 kg-m,
6.5 - 8.7 ft-lb)
Filler plug
20 - 27 N·m
(2.0 - 2.8 kg-m,
14 - 20 ft-lb)
Drain plug
29 - 39 N·m
(3 - 4 kg-m,
22 - 29 ft-lb)
Transfer oil capacity:
1.8ℓ (3-1/8 Imp pt)

GEARS AND SHAFTS

DISASSEMBLY AND ASSEMBLY

Transfer main gear, counter gear and countershaft

Refer to Section MT for disassembly.

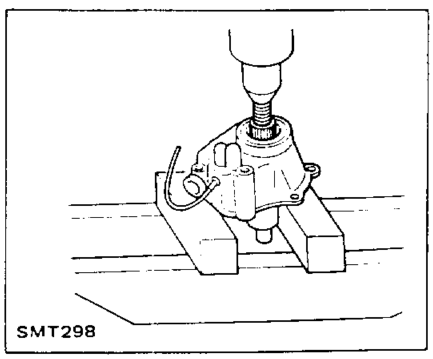
When assembling gears and shafts, observe following points.

- Apply a coat of grease to counter gear thrust washer, and countershaft and mainshaft needle bearings.
- Always install new O-rings and gaskets.
- Apply sealant to three mainshaft cover mounting bolts for through holes.

Front drive shaft

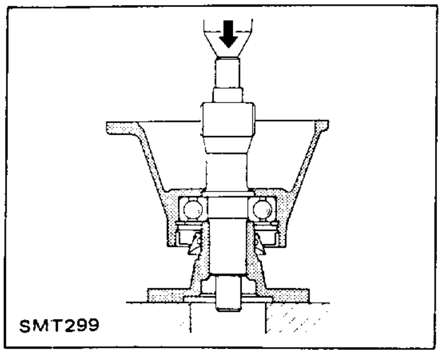
First remove front companion flange before disassembling.

1. Remove front drive shaft cover. Refer to Fork and Fork Rods for disassembly.
2. Remove front drive shaft from front drive shaft cover.


SMT298

3. Install front drive shaft.

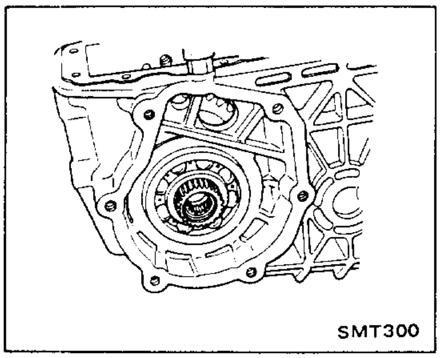
When pressing front drive shaft, ball bearing inner race should receive pressing force.


SMT299

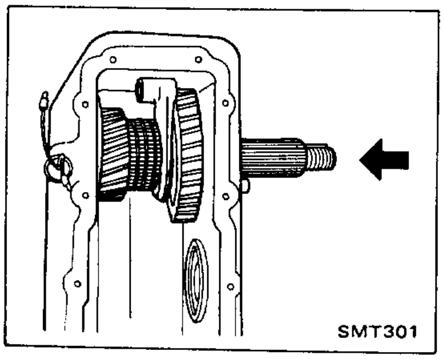
4. Install front drive shaft cover. **Refer to Forks and Fork Rods.**

Rear drive shaft and transfer High/Low gear

1. Remove front cover with fork, fork rods and front drive shaft. **Refer to Forks and Fork Rods for removal.**

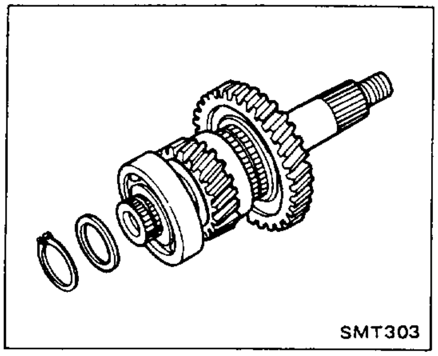

SMT300

2. Drive rear end of rear drive shafts until front bearing is driven out of transfer case.

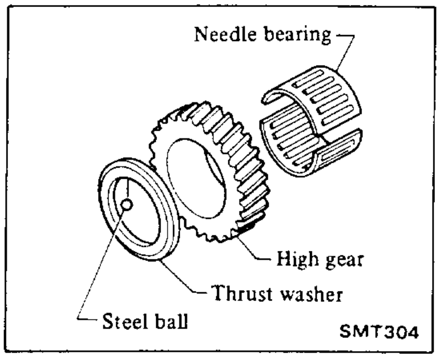

SMT301

Use a copper hammer for driving.

3. Remove snap ring, and front ball bearing as necessary using a suitable puller.


SMT303

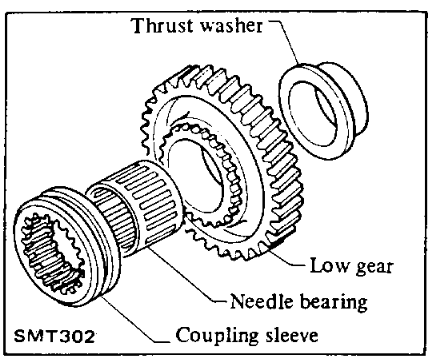
4. Separate the following parts from rear drive shaft.



SMT304

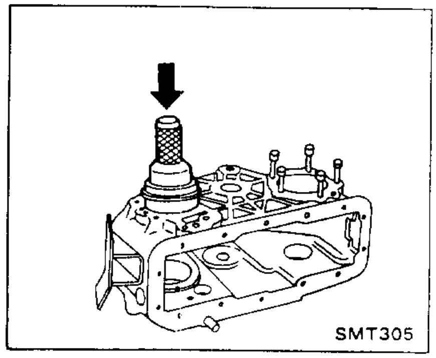
Be careful not to lose steel ball (used on inner side of thrust washer).

5. Separate the following parts from rear drive shaft.



SMT302

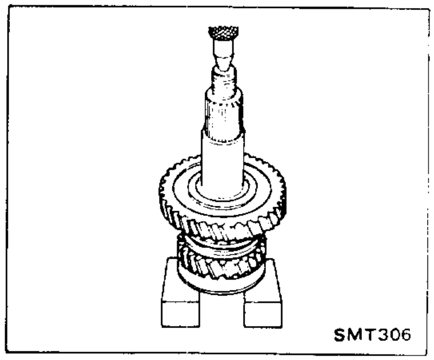
6. Remove rear ball bearing from transfer case as necessary and install new bearing using suitable drift.


SMT305

Press rear bearing until it butts against bearing retainer.

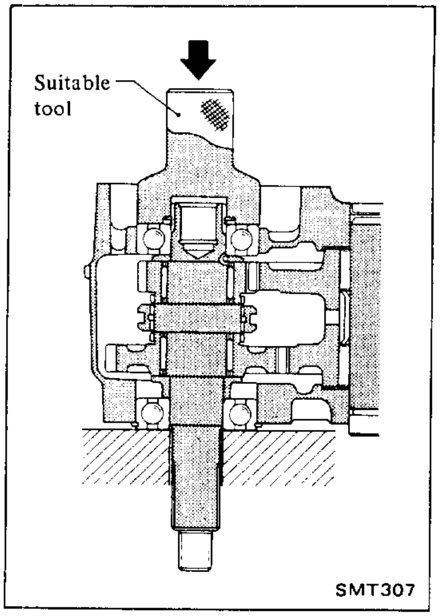
7. Install gears and shaft in the reverse order of removal, noting the following.

- **When installing front ball bearing onto shaft, always receive inner race until bearing butts against thrust washer.**


SMT306

- **When assembling rear drive shaft to transfer case, press both inner and outer front bearings with a press and drifts so that pressing forces are always imposed upon rear outer and inner ball bearings.**

CAUTION:
Engage coupling sleeve to match serration of High/Low gear and press fit them.



SMT307

- **After assembly, make sure that gears and coupling sleeves move smoothly without any binding.**

INSPECTION

1. Check gears for excessive wear, chips or cracks; replace as required.
2. Check shaft for bend, crack, wear, and worn spline; if necessary, replace.

OIL SEALS

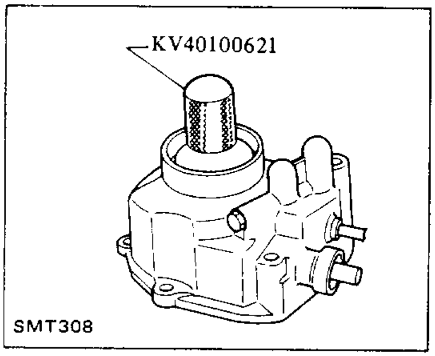
INSPECTION

1. Check seal portions of front drive shaft, shift shaft and rear drive shaft for oil leaks. Replace oil seal as necessary.
2. Check countershaft O-ring and speedometer driven gear O-ring for leaks. Replace O-rings as necessary.
3. Check gaskets of upper cover, mainshaft cover, rear cover, front drive shaft cover and transfer case for oil leaks. Replace gaskets as necessary.

REPLACEMENT

Front drive shaft oil seal

1. Remove front drive shaft cover, and remove front drive shaft from cover. **Refer to Front Drive Shaft for removal.**
2. Remove oil seal.
3. Apply grease to cavity between seal lips and install oil seal **using Tool.**



SMT308

Be careful not to scratch sealing lips or damage oil seals.

Ⓣ : Front drive shaft nut
245 - 333 N·m
(25 - 34 kg-m,
181 - 246 ft-lb)
Front propeller shaft to companion flange
78 - 88 N·m
(8 - 9 kg-m,
58 - 65 ft-lb)

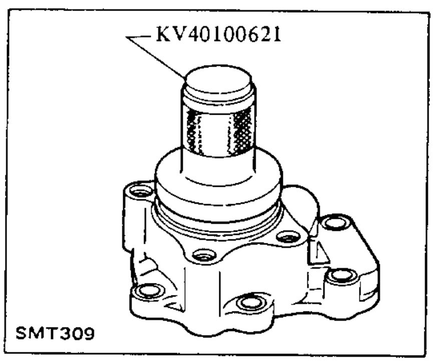
Rear drive shaft oil seal and rear drive shaft cover gasket

Rear drive shaft oil seal and rear cover gasket can be replaced without removing transfer from vehicle.

1. Drain transfer oil.
2. Disconnect rear propeller shaft.
3. Remove center brake.
4. Remove rear drive shaft cover to replace gasket.
5. Remove oil seal as necessary.

Oil seal once removed should not be used again.

6. Apply grease to cavity between seal lips and install oil seal **using Tool.**



SMT309

Be careful not to scratch sealing lips or damage oil seals.

7. Install in the reverse order of removal.

Apply sealant to three rear drive shaft cover mounting bolts for through holes.

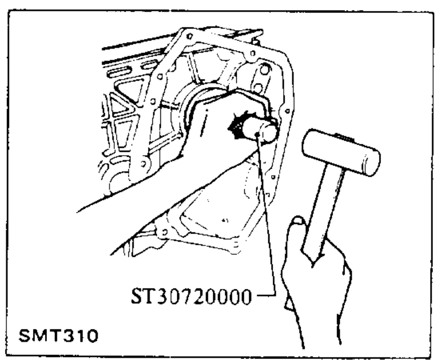
Ⓣ : Rear drive shaft cover mounting bolt
29 - 39 N·m
(3 - 4 kg-m,
22 - 29 ft-lb)
Center brake securing bolt
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)
Rear drive shaft nut
245 - 333 N·m
(25 - 34 kg-m,
181 - 246 ft-lb)
Rear propeller shaft to brake drum
78 - 88 N·m
(8 - 9 kg-m,
58 - 65 ft-lb)

Main drive shaft oil seal and transfer case gasket

1. Remove transfer with transmission, and separate transfer from transmission. **Refer to Section MT for removal.**
2. Remove oil seal as necessary using suitable drift.

Oil seal once removed should not be used again.

3. Apply a coat of gear oil to new oil seal surface, and install it **using Tool.**



SMT310

Be careful not to scratch sealing lips or damage oil seals.

4. Apply a coat of grease to sealing lips.

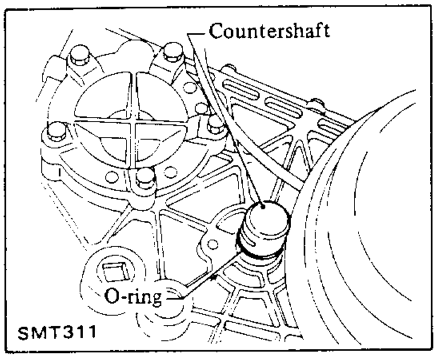
5. Replace transfer case gasket.

Install in the reverse order of removal noting the following.

When installing transfer unit on transmission, be careful not to damage or fold oil seal lips with main drive shaft.

Countershaft O-ring

1. Remove countershaft lock plate.
2. Drive countershaft out until O-ring is visible.



SMT311

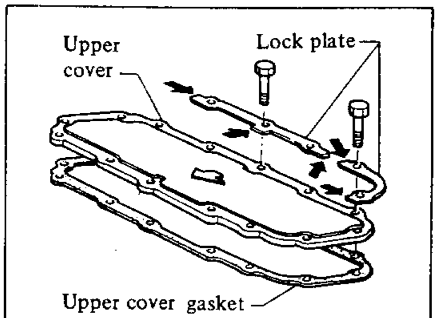
Do not drive out countershaft more than 30 mm (1.18 in). Doing so can cause needle bearing to drop, resulting in assembly difficulties.

3. Replace O-ring.

Apply a coat of grease to new O-ring and O-ring groove.

Upper cover gasket

1. Straighten straps. Remove bolts and upper cover.



SMT313

2. Replace gasket.

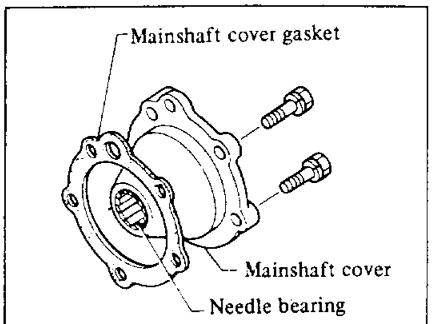
After assembly, be sure to bend straps securely.

Ⓣ : Upper cover securing bolt
8 - 11 N·m
(0.8 - 1.1 kg-m,
5.8 - 8.0 ft-lb)

Mainshaft cover gasket

1. Remove mainshaft cover.

Be careful not to drop needle bearings (used on inner side of cover).



SMT312

2. Replace gasket

Ⓣ : Mainshaft cover securing bolt A (Seal bolt)
29 - 39 N·m
(3 - 4 kg-m,
22 - 29 ft-lb)
Mainshaft cover securing bolt B
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)

Apply sealant to three mainshaft cover securing bolts for through holes.

Front drive shaft cover gasket

In replacing front cover gasket it is necessary to remove transfer from vehicle as a unit with transmission.

1. Remove front cover with front drive shaft and fork rods, referring to Forks and Fork Rods for removal.
2. Replace gasket.
3. Install in the reverse order of removal.

BEARINGS

REPLACEMENT

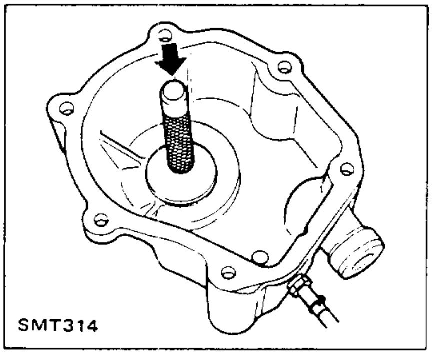
Front drive shaft bearing

1. Remove front drive shaft oil seal.

Refer to Oil Seals for removal.

Oil seal once removed should not be used again.

2. Remove snap ring.
3. Remove front drive shaft bearing using suitable drift.

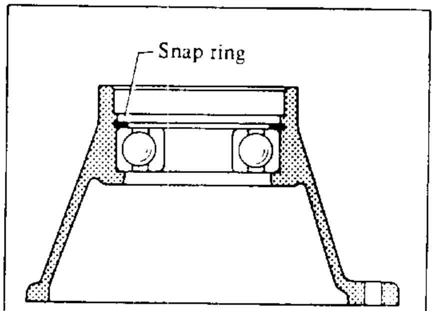


SMT314

4. Install new bearing.

Always press bearing outer race.

5. Install snap ring.



SMT315

6. Install new oil seal.

Rear drive shaft bearings

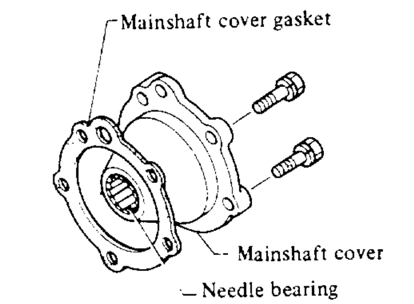
Refer to Rear Drive Shaft and Transfer High/Low Gear for replacement.

Countershaft bearings

Refer to Counter Gear and Countershaft for replacement.

Mainshaft needle bearing

Remove mainshaft cover, and remove needle bearing.



SMT312

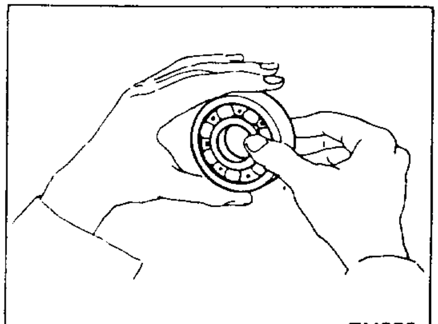
- **Affix needle bearings to their original positions, applying grease.**
- **Always install new gaskets.**
- **Apply sealant to three mainshaft cover securing bolts for through holes.**

Ⓣ : Mainshaft cover securing bolt A (Seal bolt)
29 - 39 N·m
(3 - 4 kg-m,
22 - 29 ft-lb)
Mainshaft cover securing bolt B
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)

INSPECTION

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.


TM372

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 AND COVERS

INSPECTION

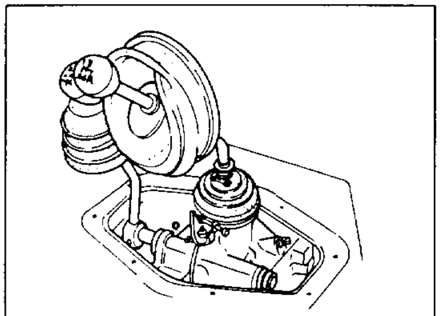
1. Clean with solvent and check for cracks or pits by means of dyeing test.
2. Check mating surface of transmission case for small nicks, projection or sealant.

TRANSFER CONTROL

REMOVAL AND INSTALLATION

Transfer control lever

1. Remove control lever boots.
2. Remove floor hole cover.
3. Remove nut and control lever pin.

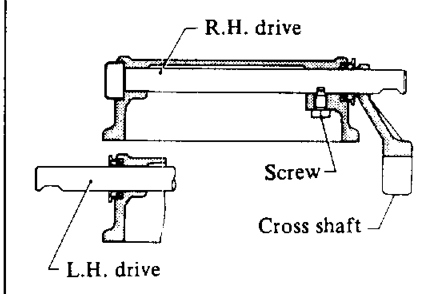

SMT317

Cross shaft

It is required to remove transfer with transmission from vehicle.

Refer to Section MT for removal.

1. Remove transmission shift cover.
2. Remove screw, then draw cross shaft out.

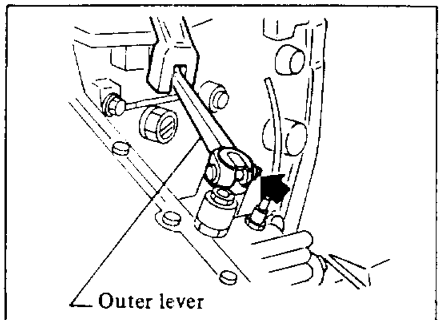


SMT318

3. Replace cross shaft seals as necessary.

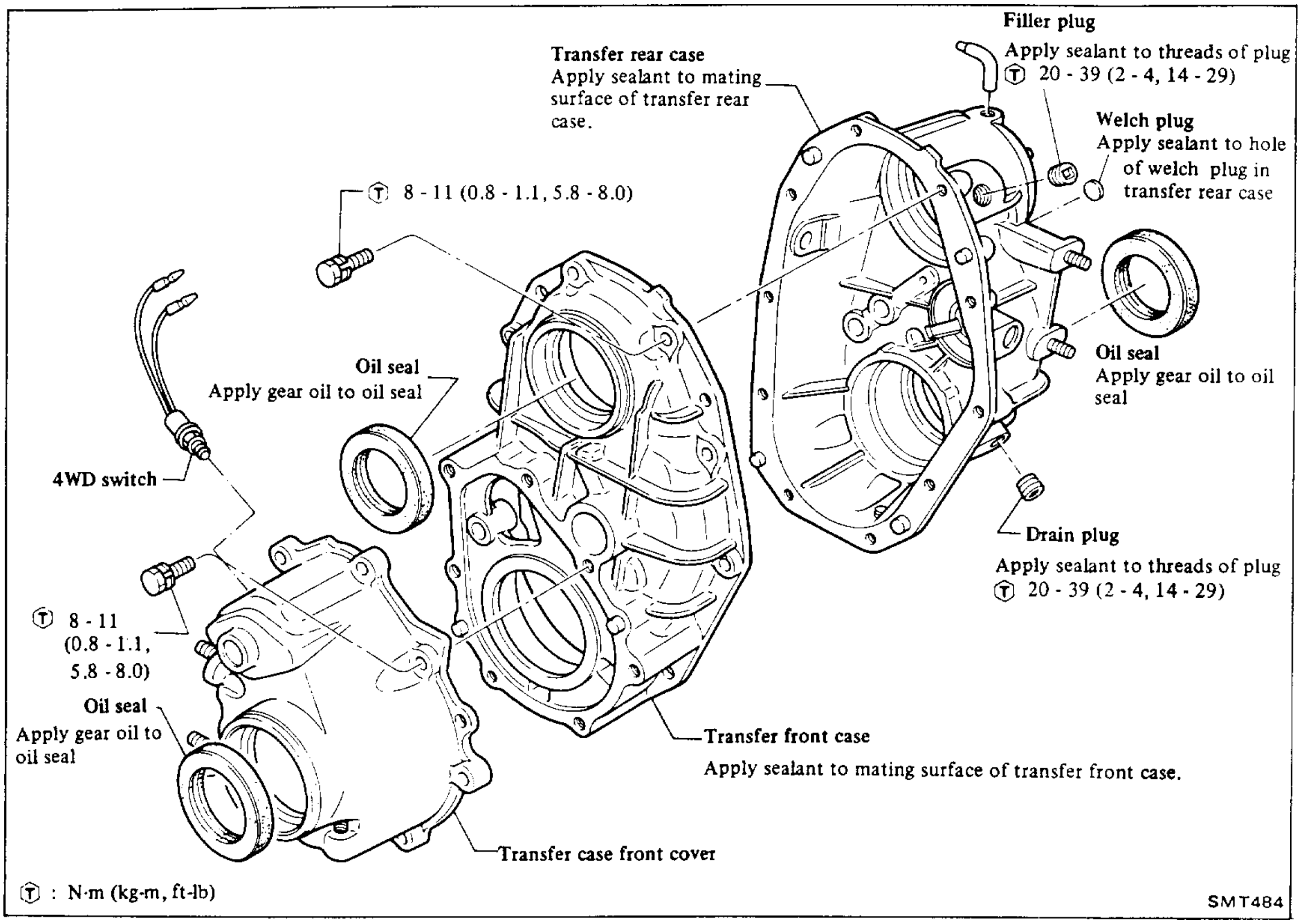
Outer lever

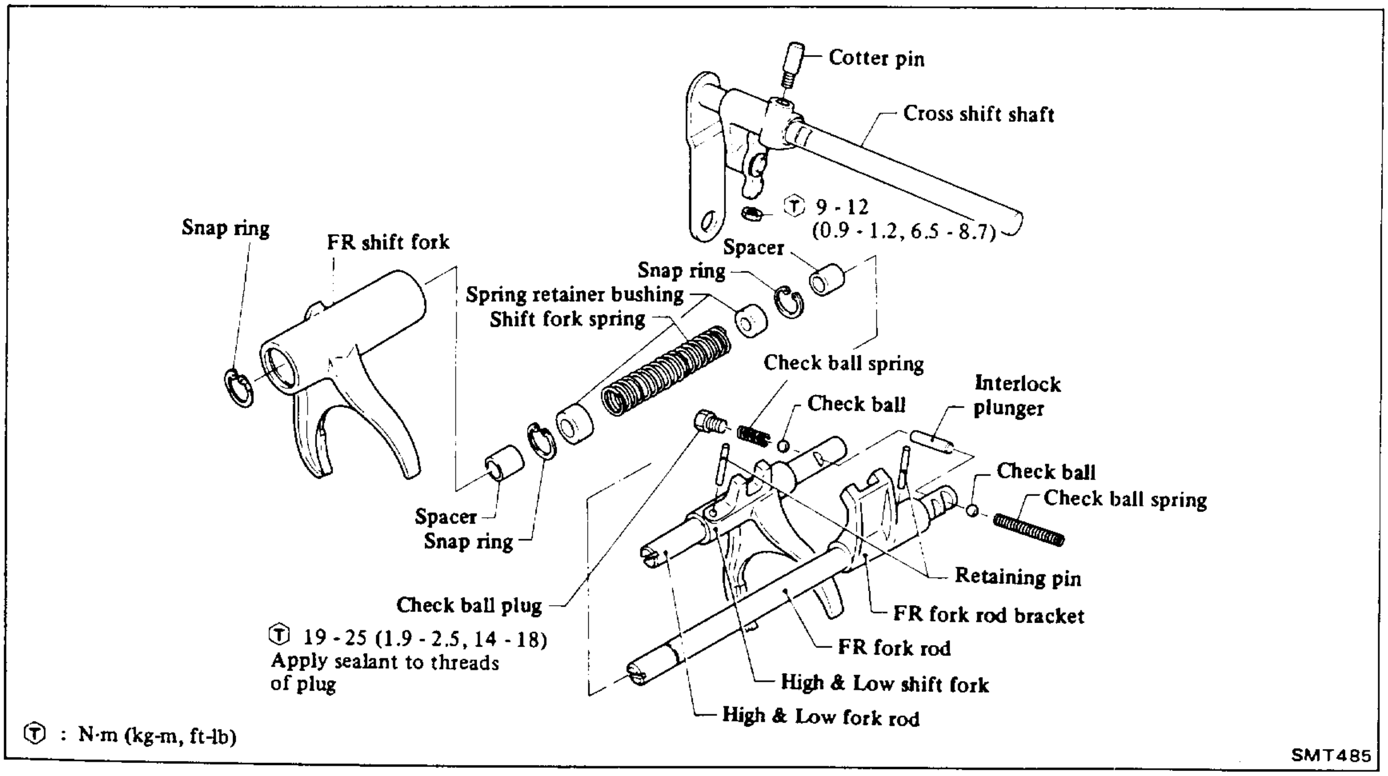
Remove nut and outer lever pin.

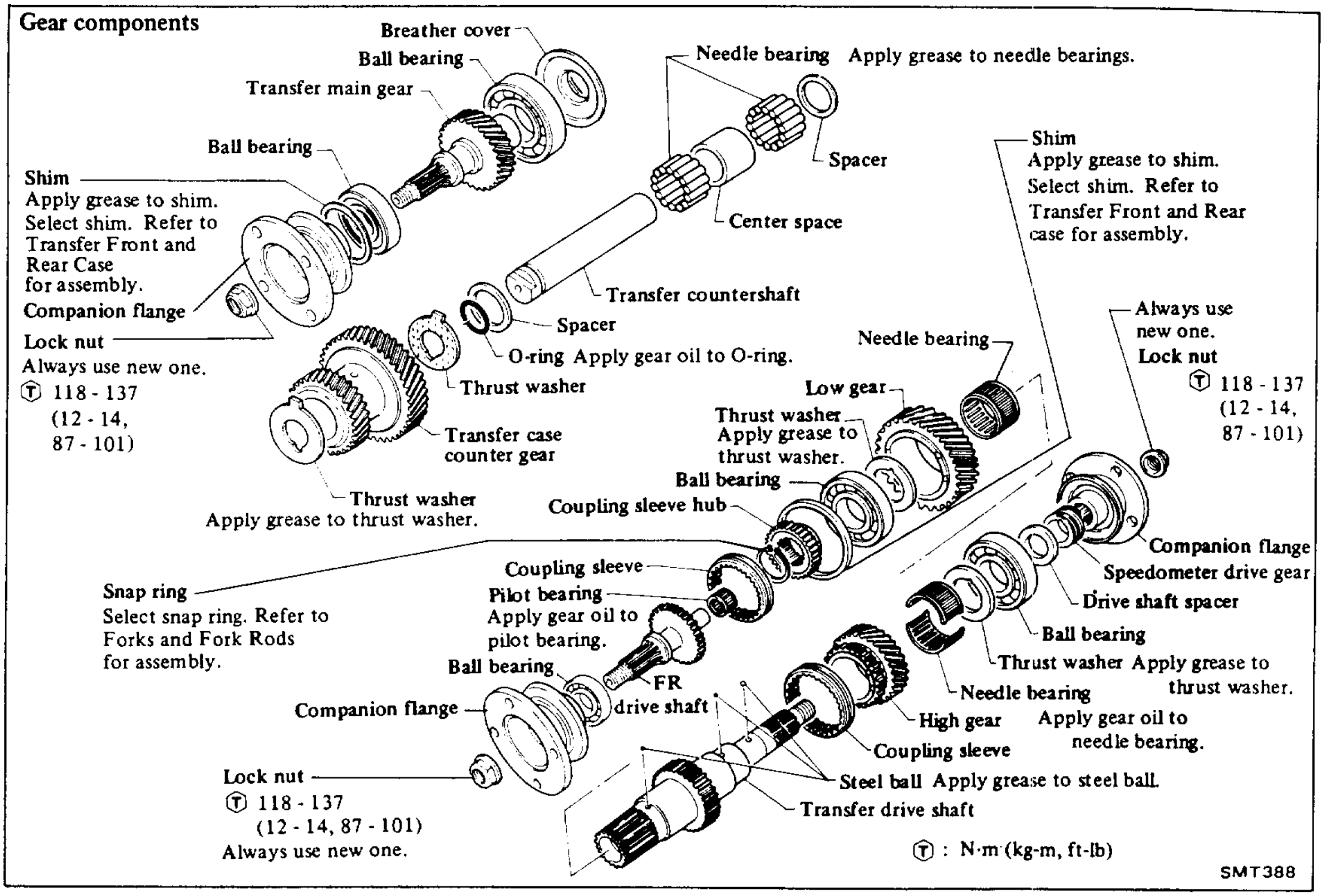


SMT319

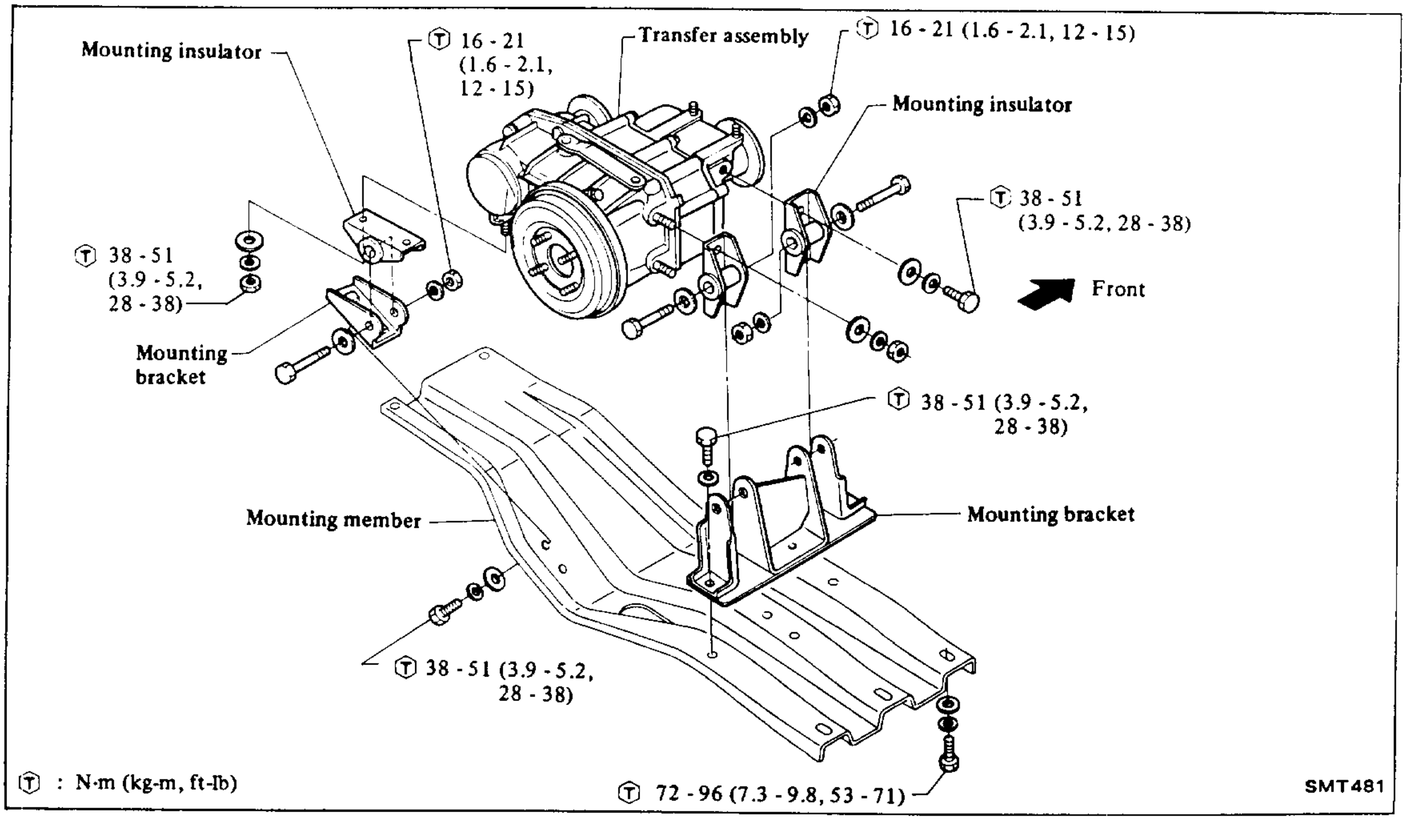
TRANSFER (Model : T100L)





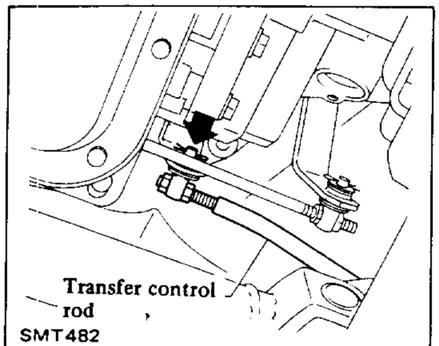


REMOVAL AND INSTALLATION



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.**
3. Disconnect propeller shafts. **Refer to Propeller Shaft (Section PD) for removal.**
4. Disconnect wire for 4-wheel drive switch.
5. Disconnect speedometer cable.
6. Support transfer with a jack.
7. Disconnect transfer control rod.



SMT482

8. Disconnect brake cable from control lever and pull the wire to transfer side. **Refer to Center Brake (Section BR).**
9. Remove transfer mounting member attaching bolts, and remove transfer unit with mounting member.
10. Remove mounting brackets and mounting insulator.

INSTALLATION

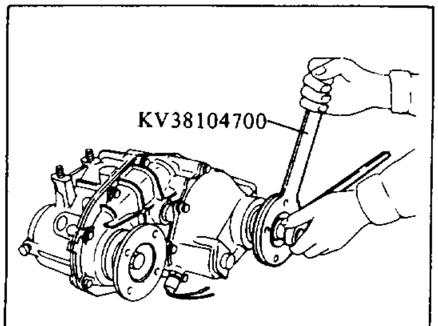
Install transfer in reverse order of removal, observing the following.

Ⓣ : **Mounting member to side member**
72 - 96 N·m
(7.3 - 9.8 kg-m,
53 - 71 ft-lb)
Mounting insulator to mounting bracket
16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)
Mounting bracket to mounting member
38 - 51 N·m
(3.9 - 5.2 kg-m,
28 - 38 ft-lb)
Mounting insulator to transfer
38 - 51 N·m
(3.9 - 5.2 kg-m,
28 - 38 ft-lb)
Oil capacity:
1.4ℓ (2-1/2 Imp pt)

FORKS AND FORK RODS

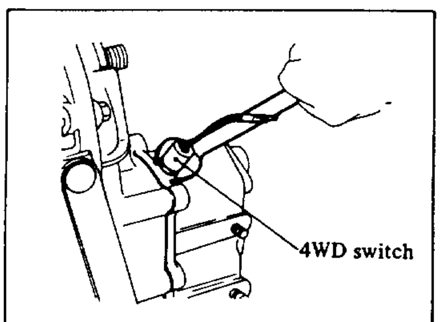
DISASSEMBLY

1. Wipe off dirt and grease.
2. Drain oil.
3. Remove companion flange lock nuts.



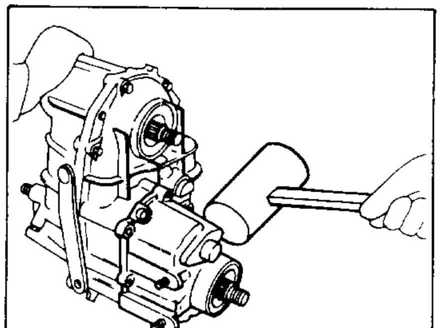
SMT393

4. Remove companion flanges.
5. Remove 4WD switch.

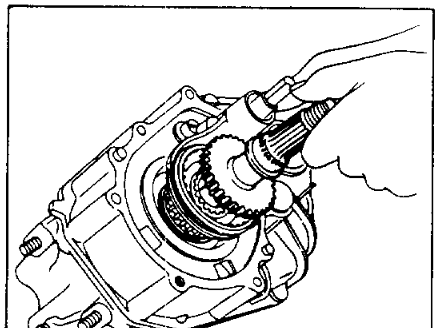


SMT394

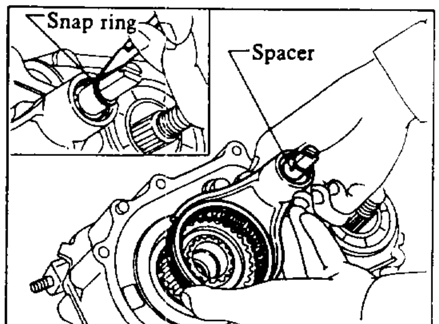
6. Remove transfer case front cover by tapping it with soft faced hammer.


SMT395

7. Remove FR drive shaft and needle bearing.

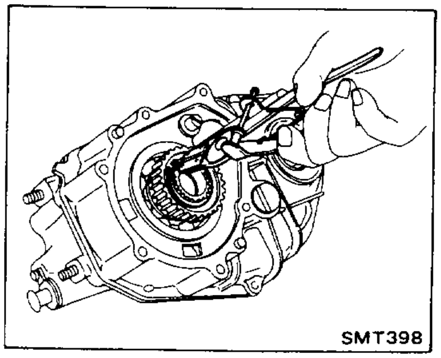

SMT396

8. Remove snap ring retaining FR shift fork, then remove FR shift fork assembly and spacer together with coupling sleeve.



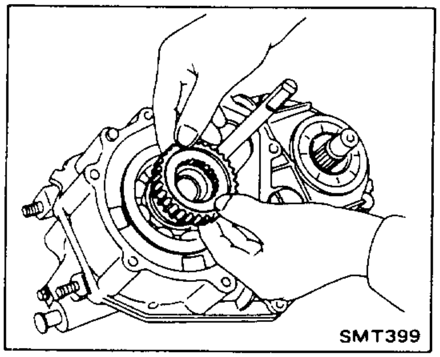
SMT397

9. Remove snap ring retaining coupling sleeve hub.



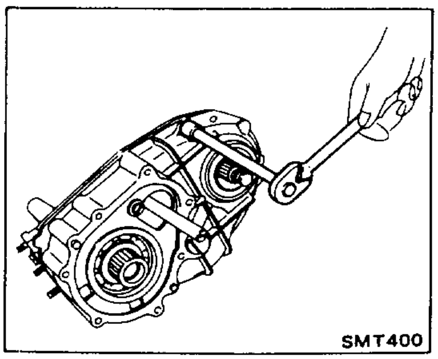
SMT398

10. Remove coupling sleeve hub.



SMT399

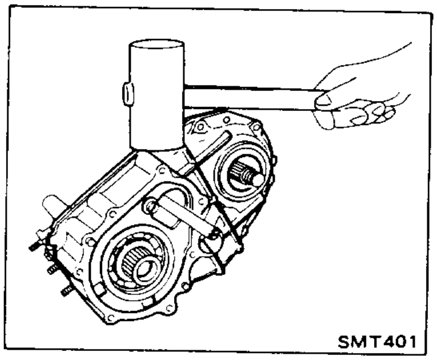
11. Remove transfer front case securing bolts.



SMT400

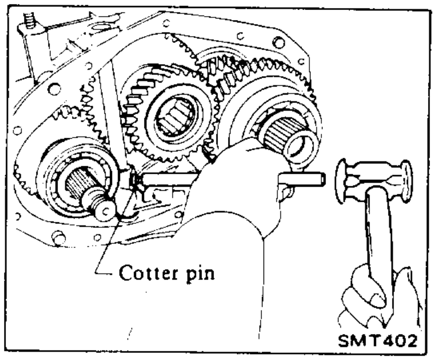
12. Remove transfer front case by tapping it with soft faced hammer.

Do not pry transfer front or rear cases with screwdriver.



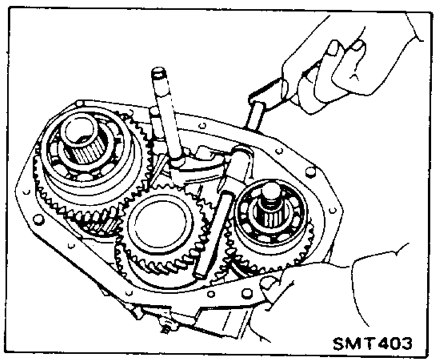
SMT401

13. Remove cotter pin nut, then remove cotter pin by tapping it with hammer.



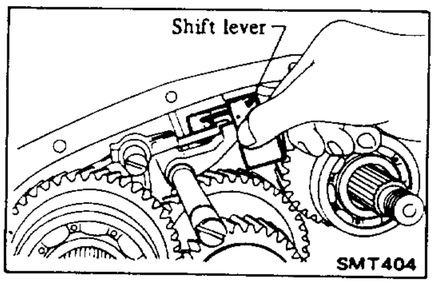
SMT402

14. Remove cross shift shaft.



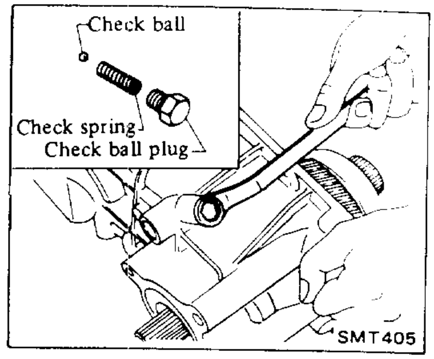
SMT403

15. Remove shift lever with differential lever.



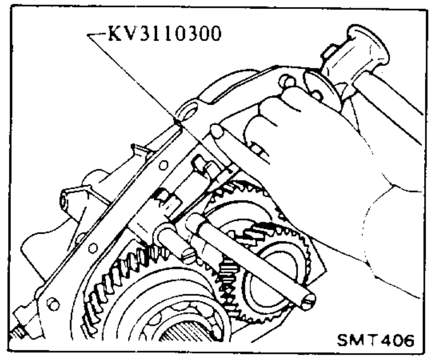
SMT404

16. Remove check ball plug, check spring and check ball.



SMT405

17. Drive out High & Low shift fork retaining pin.



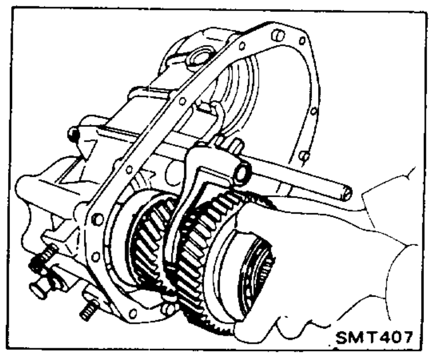
SMT406

18. Tap rear end of transter 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.

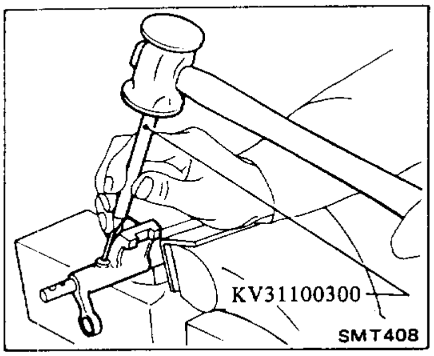
Remove transfer case front shim.

Be careful not to lose shim.



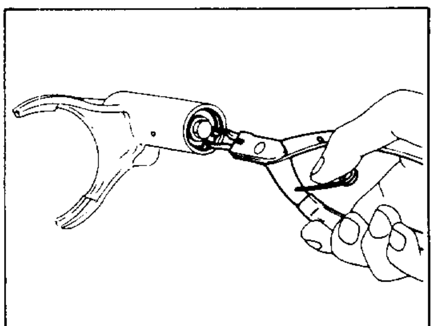
SMT407

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.

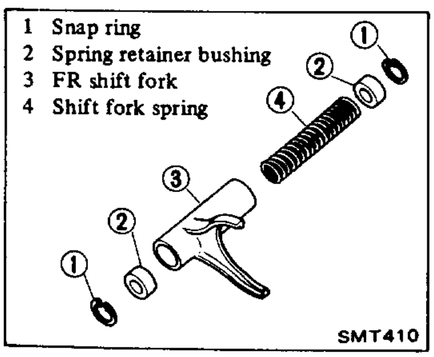


SMT408

21. Insert M8 bolt into FR shift fork and tighten nut to eliminate shift fork spring tension.
Remove snap ring with snap ring plier.


SMT409

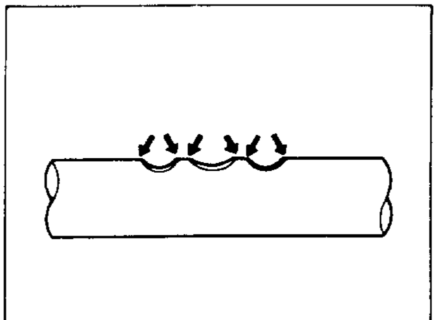
22. Remove spring retainer bushings and shift fork spring. Separate spring retainer bushing and shift fork spring.



SMT410

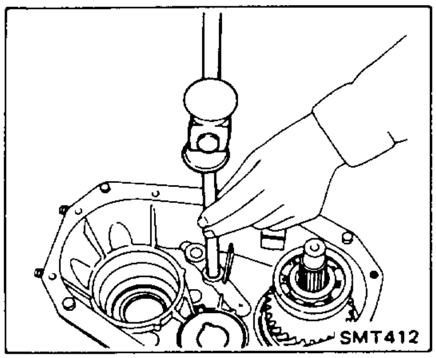
INSPECTION

Clean with solvent and check for wear, scratches, projection, damage or other faulty conditions. Replace any part which is worn or damaged.


SMT532

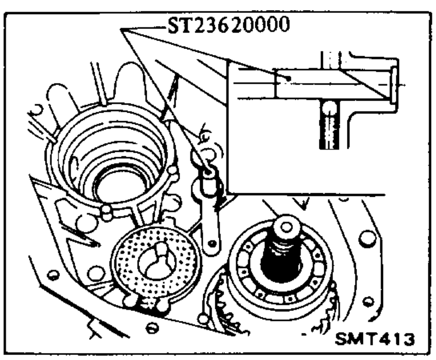
ASSEMBLY

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.


SMT412

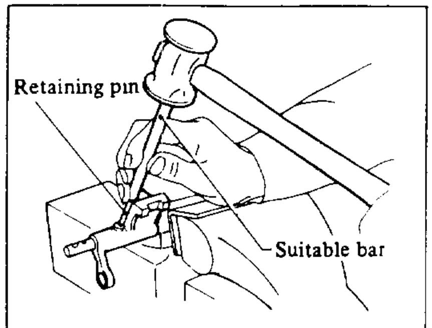
3. Install check spring and steel ball into hole of transfer rear case.
4. Using Tool, retain steel ball.

Be careful not to lose check ball and steel ball as the spring force may force them out.



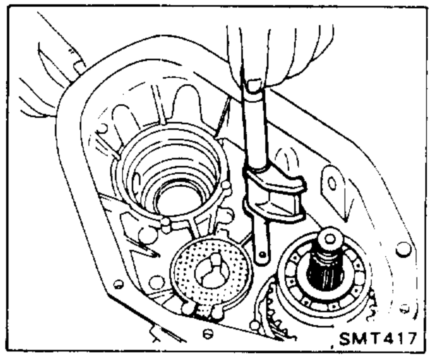
SMT413

5. Install High & Low shift fork into coupling sleeve.
6. Place FR fork rod in a vise, then install retaining pin.

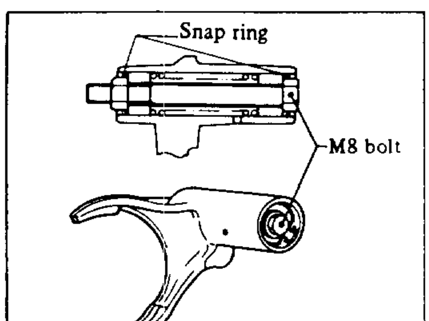


SMT416

7. Install FR fork rod pushing Tool **ST23620000** out of position. Install interlock pin.


SMT417

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.



SMT414

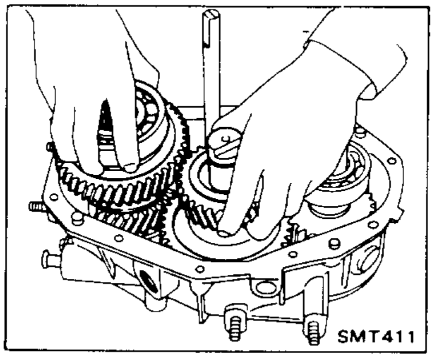
10. Install the other snap ring. Remove bolt and nut.
11. Install **new O-ring** to countershaft, then install it to transfer rear case.

When installing O-ring, be sure to apply gear oil to it.

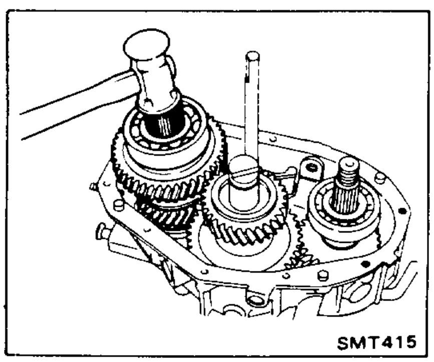
12. Install counter gear assembly.

Make sure that counter gear thrust washer is already installed.

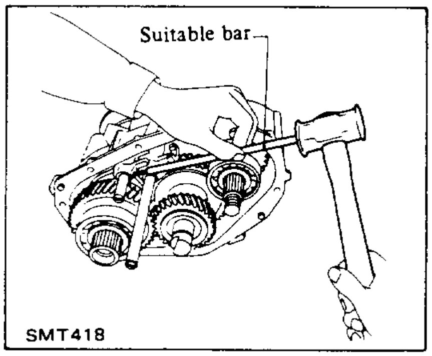
13. While raising counter gear assembly slightly, install transfer case drive shaft assembly and engage each gear.


SMT411

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.

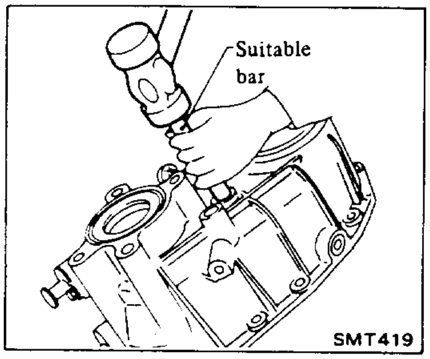

SMT415

16. Install High & Low fork rod, then secure with retaining pin.



SMT418

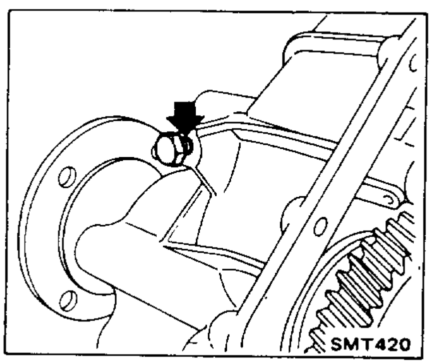
17. Apply sealant to hole of welch plug in transfer rear case and install welch plug in it.



SMT419

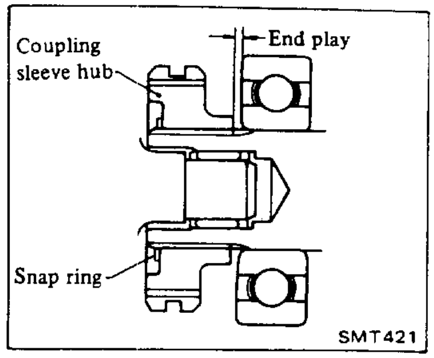
18. Install check ball and check spring.
19. Apply sealant to threads of plug, then tighten it.

Ⓣ: **19 - 25 N·m**
(1.9 - 2.5 kg-m,
14 - 18 ft-lb)


SMT420

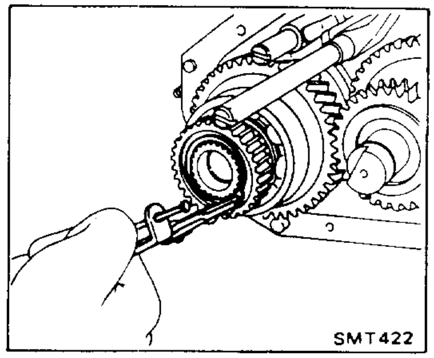
20. Select snap ring so that end play is within specified limit.

Coupling sleeve hub end play:
0 - 0.20 mm (0 - 0.0079 in)
Coupling sleeve hub snap ring:
Refer to S.D.S.

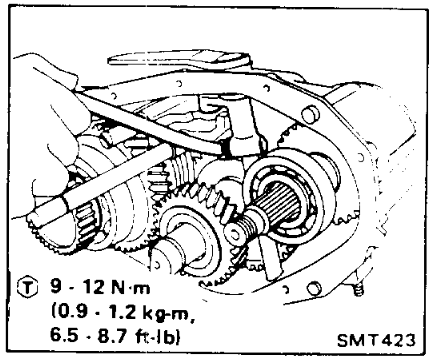


SMT421

21. Install coupling sleeve hub, then secure with snap ring.

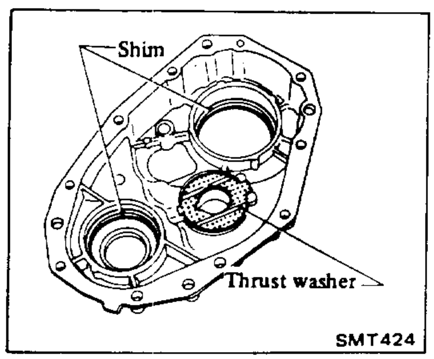

SMT422

22. Install shift lever with differential lever.
23. Install cross shift shaft.



SMT423

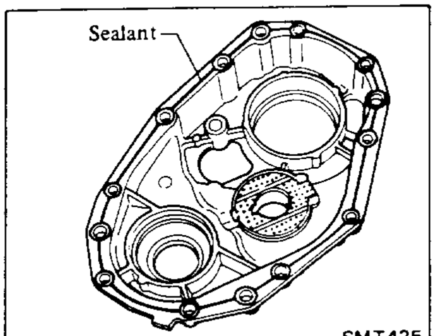
24. Apply grease to thrust washer, main gear front and transfer case front shims selected, then attach them to transfer front case.



SMT424

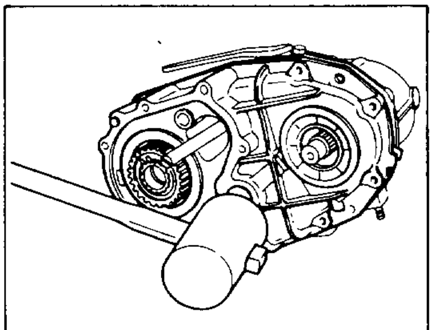
25. Clean mating surface of transfer front case.
26. Apply sealant to mating surface of transfer front case.

Apply sealant continuously.



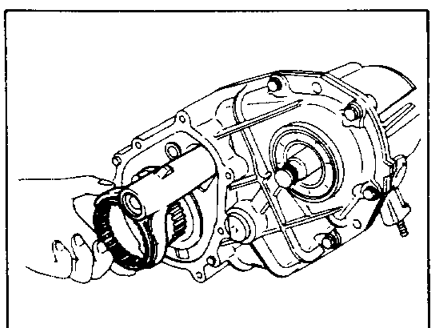
SMT425

27. Install transfer front case by tapping it with soft faced hammer.

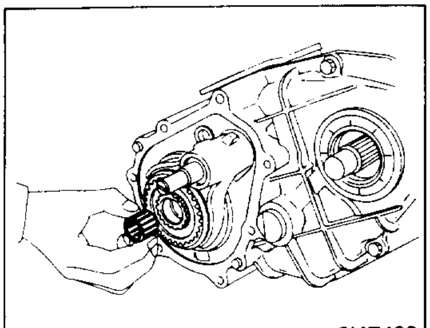

SMT426

Ⓣ : **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.

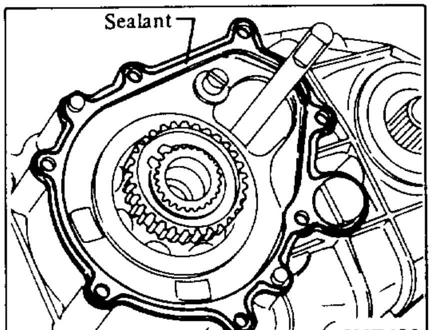

SMT427

29. Apply gear oil to pilot bearing, then install it in place.


SMT428

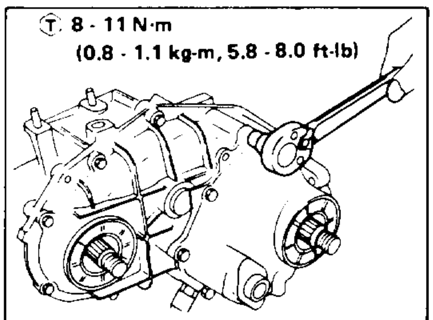
30. Install FR drive shaft to transfer case drive shaft.
31. Clean mating surface of transfer front case, then apply sealant to mating surface of it.

Apply sealant continuously.



SMT429

32. Install transfer case front cover.



SMT430

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.

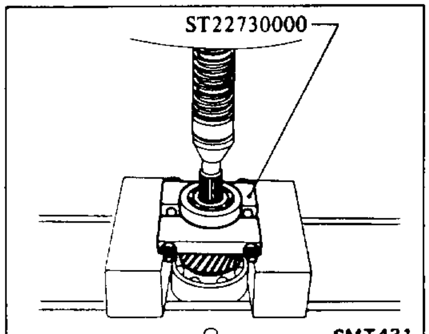
Ⓣ : **20 - 29 N·m**
(2 - 3 kg-m,
14 - 22 ft-lb)

GEARS AND SHAFTS

DISASSEMBLY

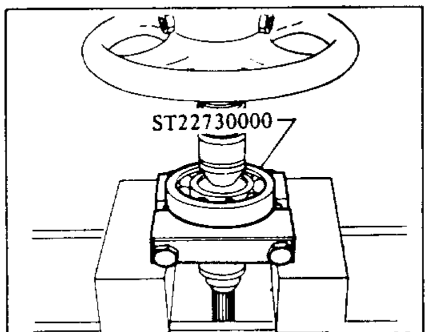
Counter gear and transfer case main gear

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.



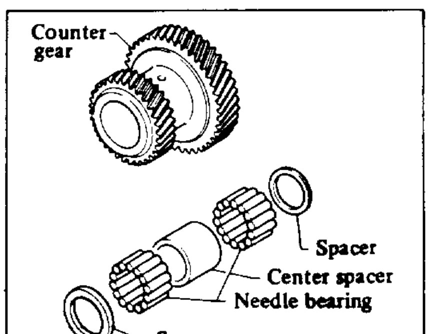
SMT431

4. Remove transfer main gear rear bearing.



SMT432

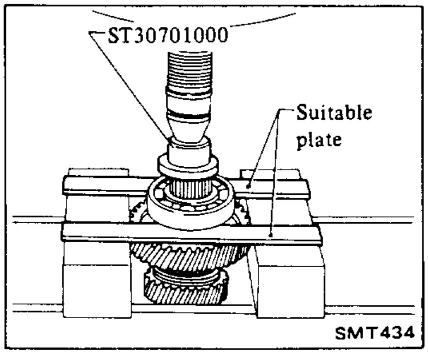
5. Remove needle bearings, center spacer and spacer from counter gear.



SMT433

Low gear

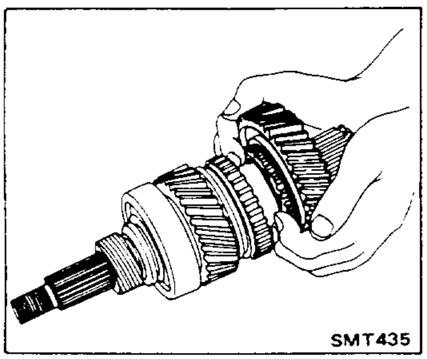
1. Press out drive shaft front ball bearing.



2. Remove thrust washer and steel ball.

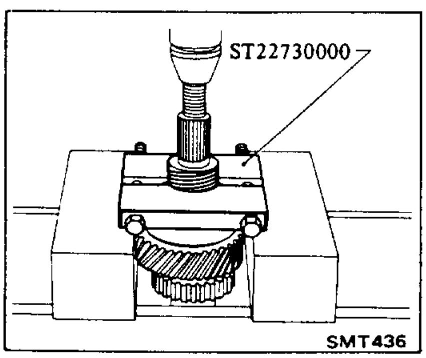
Be careful not to lose steel ball retaining thrust washer.

3. Remove Low gear and needle bearings.



High gear

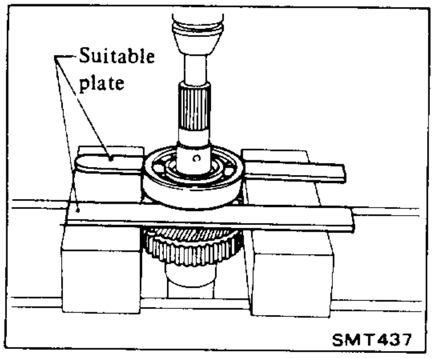
1. Remove speedometer worm gear.



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.

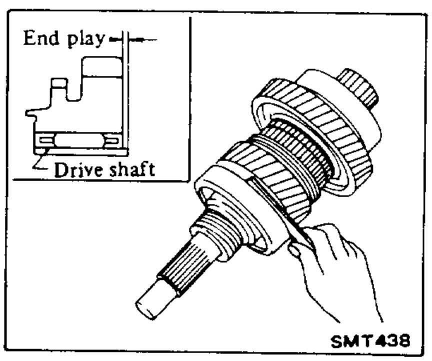
INSPECTION

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)

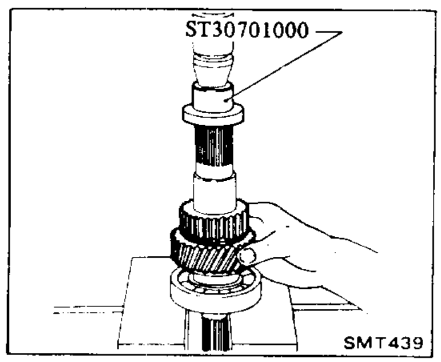
Bearings

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.



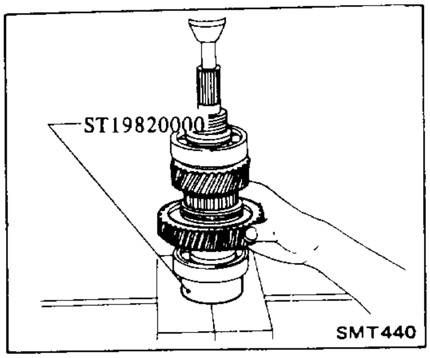
When pressing it, be sure to hold High gear by hand so as not to drop thrust washer.

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.

7. Press drive shaft front ball bearing.

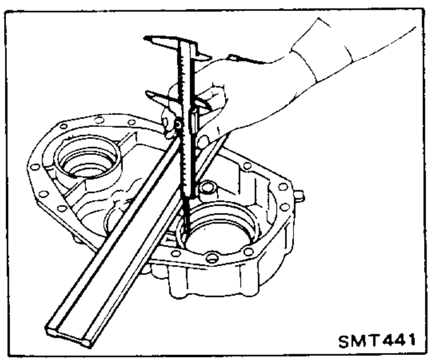


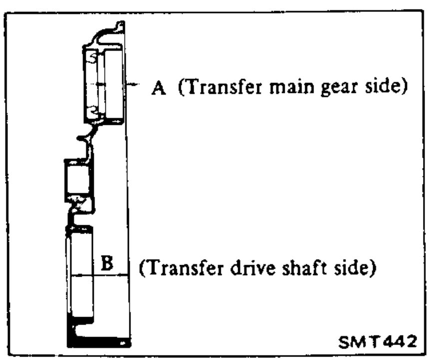
When pressing it, be sure to hold Low gear by hand so as not to drop thrust washer.

Selection of shims

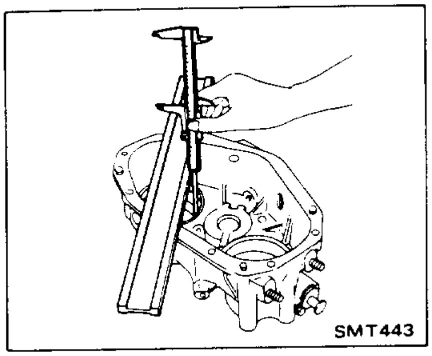
If thrust washer, each ball bearing, drive shaft, transfer front & rear cases or transfer case main gear is replaced, it is necessary to select each shim.

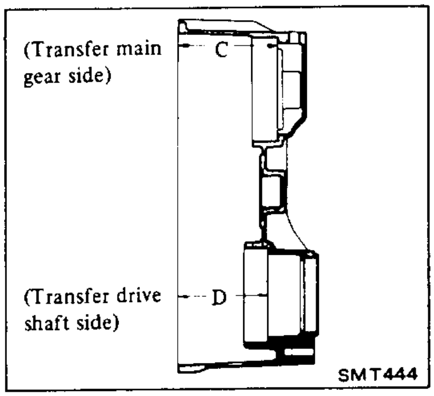
1. Measure bearing insertion lengths A and B for transfer front case.





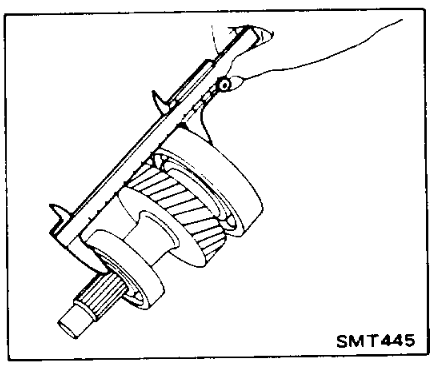
2. Measure bearing insertion lengths C and D for transfer rear case.





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.

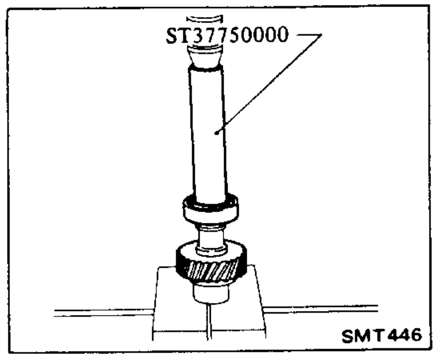


4. Measure distance F between ball bearing outer races of transfer drive shaft.
5. Select shims as follows:
   5-1 Calculate L_1 and L_2 by using the following equations:
   $L_1 = A + C - E$
   $L_2 = B + D - F$
   5-2 Determine shim thickness by using values L_1 and L_2.

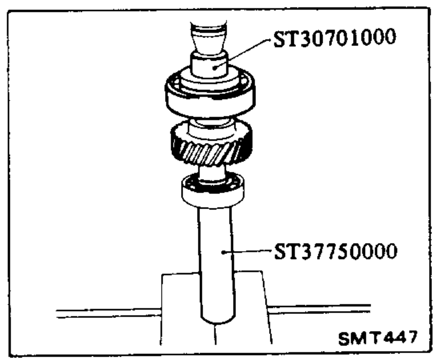
Main gear front and transfer case front shims.
Refer to S.D.S.

Transfer case main gear and counter gear

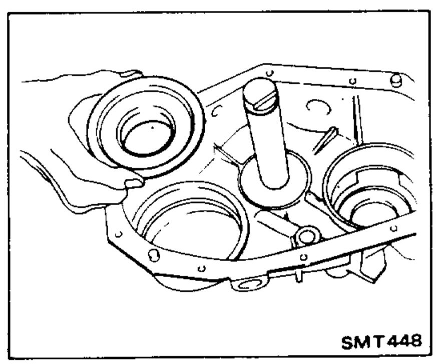
1. Press transfer case main gear front bearing.



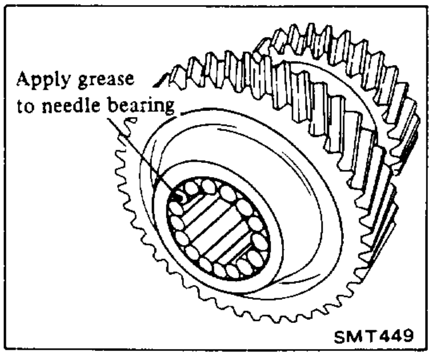
2. Press transfer case main gear rear bearing.



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.



SMT449

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.

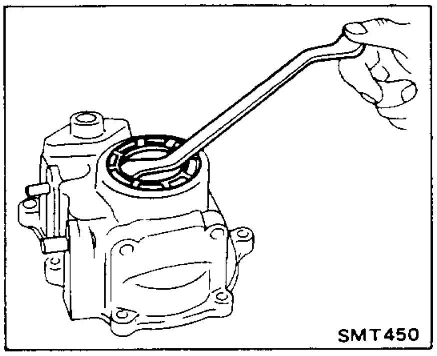
Described below are replacement procedures for oil seal, bearing and cases after disassembling cases.

For replacement of main gear front, rear bearing, drive shaft front and rear bearing, refer to Disassembly and Assembly of Gears and Shafts.

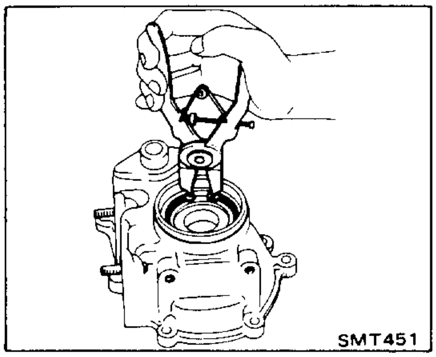
TRANSFER FRONT COVER

Disassembly

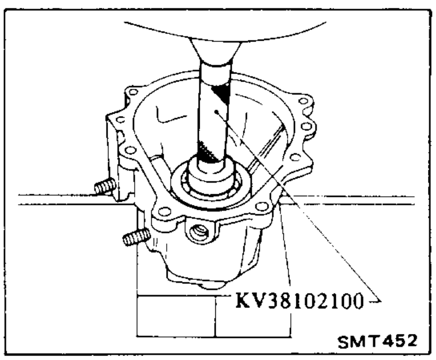
1. Remove oil seal.


SMT450

2. Remove snap ring.


SMT451

3. Remove bearing.



SMT452

Inspection

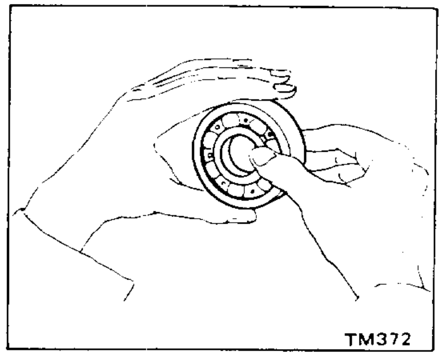
Oil seals

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.


TM372

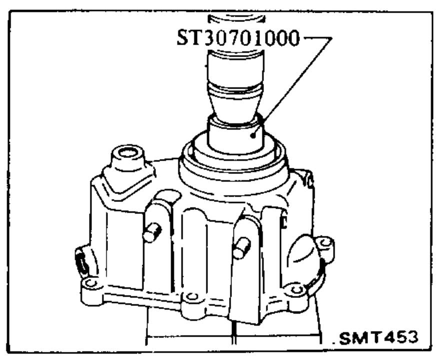
2. When race and ball surfaces are worn or rough, or when balls are out-of-round or rough, replace bearing with a new one.
3. Replace needle bearing if worn or damaged.

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.

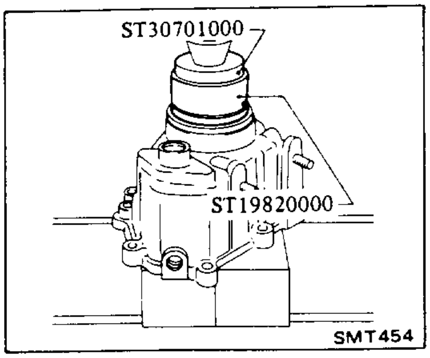
Assembly

1. Press bearing.



SMT453

2. Install snap ring with snap ring pliers.
3. Apply coat of gear oil to oil seal surface, then drive new seal into place.

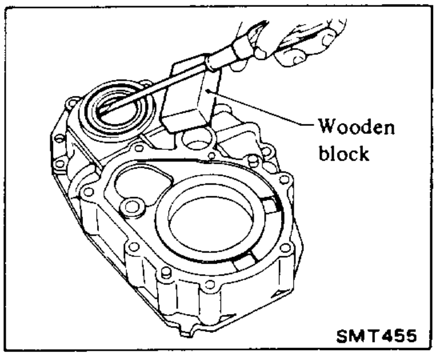


4. Lubricate seal lip with gear oil.

TRANSFER FRONT AND REAR CASE

Disassembly

Remove oil seal.

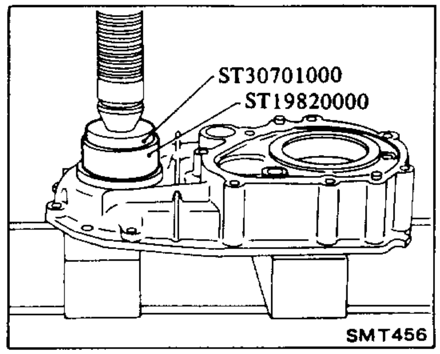


Inspection

Refer to Transfer Front Cover for inspection.

Assembly

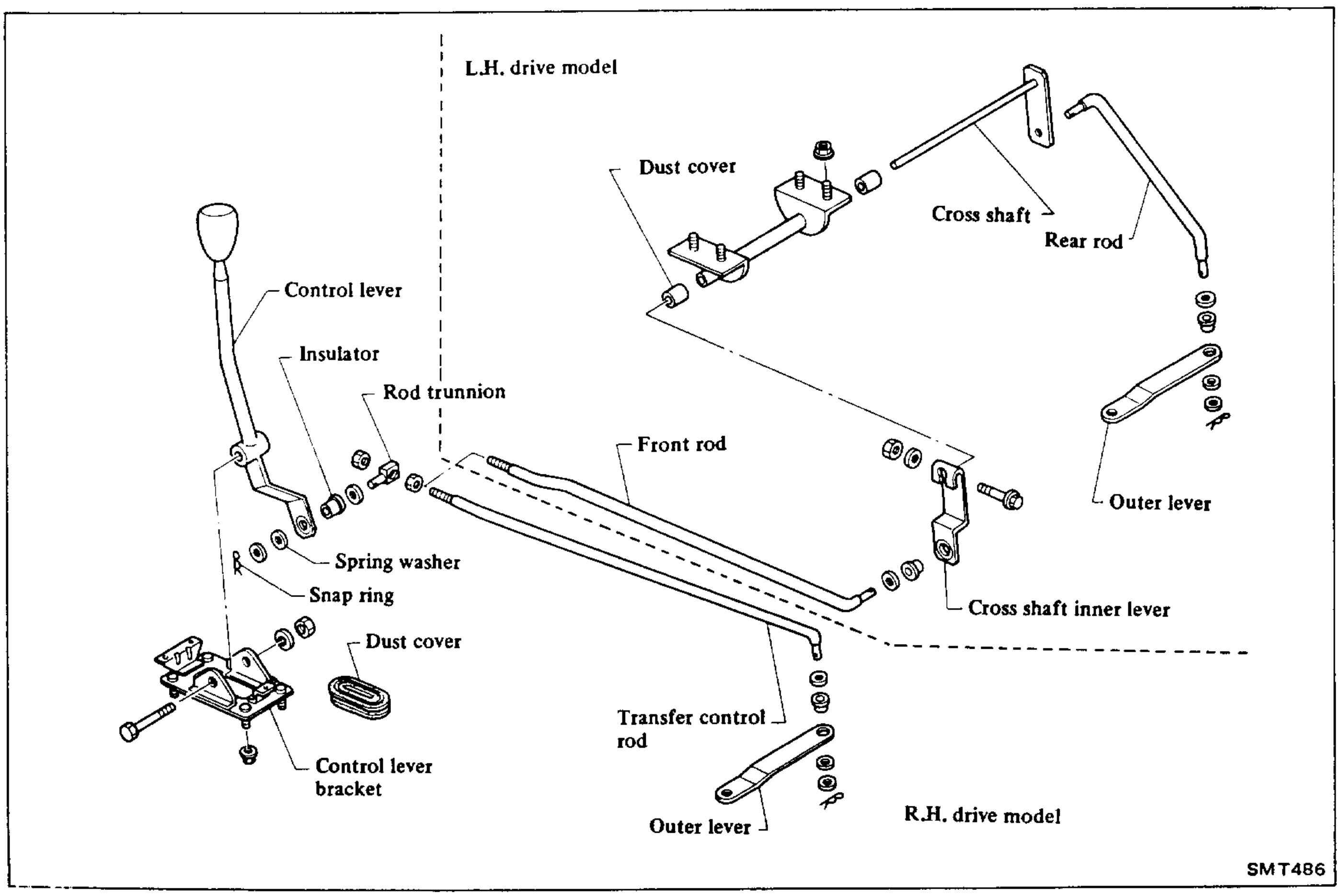
1. Apply coat of gear oil to oil seal surface, then drive new seal into place.



2. Lubricate seal lip with gear oil.

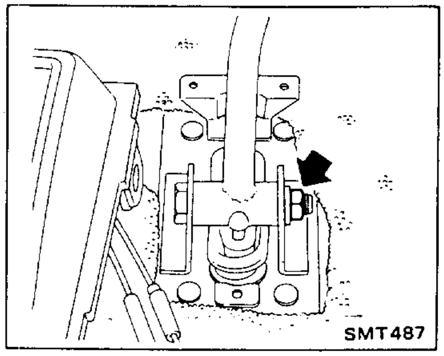
TRANSFER CONTROL

REMOVAL AND INSTALLATION



Transfer control lever

1. Disconnect control rod from control lever.
2. Remove control lever cover.
3. Remove nut and control lever pin, and remove control lever.

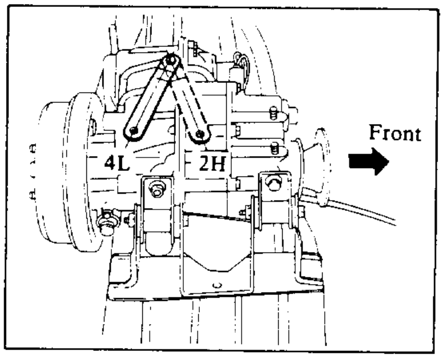


Control rod

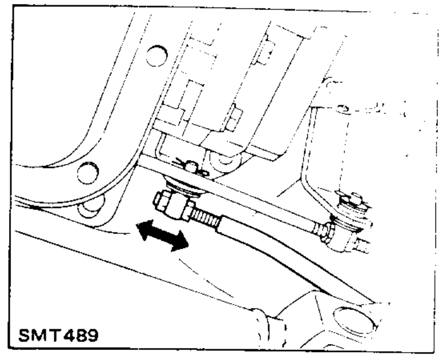
Remove snap pins from both ends of control rod and remove it.

ADJUSTMENT

1. Set lever on transfer side in "2H" position.



2. Provide a clearance of more than 48 mm (1.89 in) between control lever and heater unit. Then connect rod to control lever.



3. Set control lever in "4L" position and make sure there is a clearance of more than 50 mm (1.97 in) between control lever and hand brake.
4. Make sure that the force required for operating control lever is within 39 to 78 N (4 to 8 kg, 9 to 18 lb).

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Transfer model			T130A		T100L	
Shift type			2H 4H N 4L			
Gear ratio	High		1.000			
	Low		2.220		2.074	
Combined gear ratio with F4W81A transmission	High	1st	3.519			
		2nd	2.157			
		3rd	1.449			
		4th	1.000			
		Rev.	4.181			
	Low	1st	7.812		7.298	
		2nd	4.789		4.474	
		3rd	3.217		3.005	
		4th	2.220		2.074	
		Rev.	9.282		8.671	
Combined gear ratio with 3N71B transmission	High	1st	–		2.458	
		2nd			1.458	
		Top			1.000	
		Rev.			2.182	
	Low	1st	–		5.098	
		2nd			3.024	
		Top			2.074	
		Rev.			4.525	
Number of teeth	Main gear		30		29	
	Counter gear	High	48		41	
		Low	35		30	
	Transfer case	High	30		29	
		Low	34		44	
Speedometer gear ratio	Final ratio \ Tire size		6.50-16	205R16C 7.00-16 7.50-16	6.50-16	205R16C 7.50-16
	3.364		6/16	6/13	–	–
	4.111		6/17	6/16	–	–
	4.375		6/18	6/17	6/18	6/17
	4.625		6/19	6/18	6/19	6/18
Oil capacity ℓ (Imp pt)			1.8 (3-1/8)		1.4 (2-1/2)	

INSPECTION AND ADJUSTMENT (Model : T130A)

High gear end play mm (in)	0.20 - 0.35 (0.0079 - 0.0138)
Low gear end play mm (in)	0.20 - 0.35 (0.0079 - 0.0138)

INSPECTION AND ADJUSTMENT (Model : T100L)

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

TIGHTENING TORQUE

MODEL T130A

Unit	N·m	kg-m	ft-lb
Transfer installation			
Front and rear propeller shaft	78 - 88	8 - 9	58 - 65
Transfer mounting bracket to transfer	27 - 36	2.8 - 3.7	20 - 27
Insulator to transfer mounting bracket	17 - 22	1.7 - 2.2	12 - 16
Insulator to frame	30 - 41	3.1 - 4.2	22 - 30
Rear companion flange	245 - 333	25 - 34	181 - 246
Transfer unit			
Drain plug	29 - 39	3 - 4	22 - 29
Filler plug	20 - 27	2.0 - 2.8	14 - 20
Transfer upper cover	8 - 11	0.8 - 1.1	5.8 - 8.0
Mainshaft cover A (Seal bolt)	29 - 39	3 - 4	22 - 29
Mainshaft cover B	26 - 36	2.7 - 3.7	20 - 27
Main gear lock nut	196 - 333	20 - 34	145 - 246
Countershaft lock bolt	14 - 18	1.4 - 1.8	10 - 13
Transfer to transmission A (Seal bolt)	20 - 27	2.0 - 2.8	14 - 20
Transfer to transmission B (Seal bolt)	20 - 27	2.0 - 2.8	14 - 20
Transfer to transmission C	18 - 25	1.8 - 2.5	13 - 18
Transfer to transmission D	18 - 25	1.8 - 2.5	13 - 18
Transfer to transmission E	18 - 25	1.8 - 2.5	13 - 18
Shift lever lock nut	9 - 12	0.9 - 1.2	6.5 - 8.7
Front companion flange	245 - 333	25 - 34	181 - 246
Front cover	26 - 36	2.7 - 3.7	20 - 27
Check ball hole plug	15 - 20	1.5 - 2.0	11 - 14
Center brake drum	78 - 88	8 - 9	58 - 65
Center brake assembly	26 - 36	2.7 - 3.7	20 - 27
Rear drive shaft cover A (Seal bolt)	29 - 39	3 - 4	22 - 29
Rear drive shaft cover B	26 - 36	2.7 - 3.7	20 - 27
Speedometer sleeve lock bolt	3 - 4	0.3 - 0.4	2.2 - 2.9
Breather	10 - 13	1.0 - 1.3	7 - 9

MODEL T100L

Unit	N·m	kg-m	ft-lb
Transfer installation			
Mounting member to side member	72 - 96	7.3 - 9.8	53 - 71
Mounting insulator to mounting bracket	16 - 21	1.6 - 2.1	12 - 15
Mounting bracket to mounting member	38 - 51	3.9 - 5.2	28 - 38
Mounting insulator to transfer	38 - 51	3.9 - 5.2	28 - 38
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 - 3	14 - 22
Companion flange	118 - 137	12 - 14	87 - 101
Drain plug	20 - 39	2 - 4	14 - 29
Filler plug	20 - 39	2 - 4	14 - 29
Speedometer sleeve	3 - 4	0.3 - 0.4	2.2 - 2.9

TROUBLE DIAGNOSES AND CORRECTIONS

Noise

↓

Check level and color of oil.

- Level/color N.G.
  - ↓ Add/replace oil. (If oil leaks repair cause.)
  - ↓ Check noise.
    - Noise does not stop. → After shifting transmission control lever to 4th position, shift gears and locate which gear position makes noise.
    - Noise stops. ↓ O.K.
- Level and color O.K.
  - ↓ After shifting transmission control lever to 4th position, shift gears and locate which gear position makes noise.

After shifting transmission control lever to 4th position, shift gears and locate which gear position makes noise.

- Noise in Neutral (When vehicle is stopped.)
  - ↓ Disengage clutch to see if noise stops.
    - Noise does not stop. ↓ Noise outside transmission. Check engine and clutch, etc.
    - Noise stops. ↓ Noise in transmission. Noise may be caused by variations in engine torque. Adjust engine idle speed.
- Noise in position other than Neutral

Position	Noise
2H	No
4H	Occurs
4L	Occurs

Noise peaks at a specific vehicle speed.

↓

Noise appears to occur in front differential carrier or front axle. Check front differential carrier and/or front axle and eliminate cause of noise.

Position	Noise
2H	Occurs
4H	Occurs
4L	Occurs

Noise peaks at specific vehicle speed.

↓

Noise appears to occur in rear differential carrier and rear axle. Check rear differential carrier and rear axle and eliminate cause of noise.

Position	Noise
2H	Occurs
4H	Occurs
4L	No

Noise peaks at specific engine rpm.

↓

Noise appears to occur in transmission. Disassemble and check counter gear and Low gear in which noise occurs for meshing surface and bearings.

↓

Replace counter gear and Low gear and/or bearing.

Position	Noise
2H	No
4H	No
4L	Occurs

Noise peaks at specific engine rpm.

↓

Noise appears to occur in transmission. Disassemble and check counter gear and High gear in which noise occurs for meshing surface and bearings.

↓

Replace counter gear and High gear and/or bearing.

Gear jumping out of mesh

↓

Locate position where gears jump out of mesh.

↓

- Check for free play in control lever.
- Shifting is accomplished without problems. (Check interference of control lever with console.)

N.G. → Adjust or replace.

O.K. → Check for fatigue, play, etc. on transfer mounts.

N.G. → Adjust or replace.

O.K. → Problem may be inside transfer. Disassemble and check transfer.

↓

Check end play of "jump-out" gear.

End play excessive → Adjust or replace.

End play O.K. → Check for engaging, damage or wear on coupling sleeve, FR drive shaft, hub, transfer case drive shaft and clutch gear of Low and High gears.

Damage or wear → Replace.

O.K. → Check for wear or damage on check ball and fatigue or breaks on check spring.

Damage or wear → Replace.

O.K. → Check for wear or deformation of fork rod ball groove.

Wear or deformation → Replace.

→ Check for wear or play of "jump-out" FR drive shaft, drive shaft and coupling sleeve splines.

Wear or play → Replace.

→ Check for wear or damage on bearings of main gear and drive shaft. Replace if worn.

Difficult gear meshing/shifting

Shift gears while engine is OFF and vehicle is stopped.

- N.G. → (go to next check below)
- O.K. → Check lubrication oil level and color.
  - N.G. → Add/replace oil.
  - O.K.

N.G. → Problem may be inside transfer. Remove transfer from vehicle, disassemble it and check it for source of difficult meshing/shifting of gears.

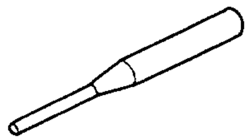
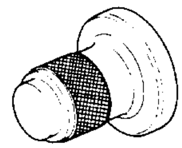
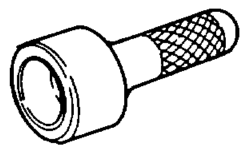
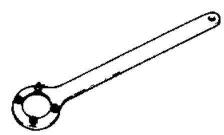
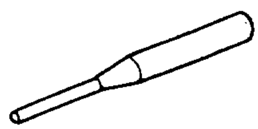
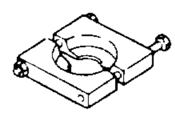
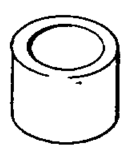
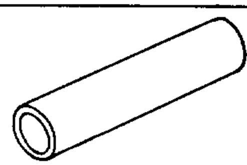
O.K. → Instructs customers in correct shifting method.

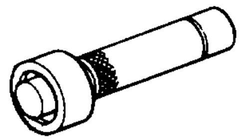
↓

Check operation of fork rod.

- N.G. → Replace.
- O.K. → Check for possible bent fork rod or scratched case.
  - Scratched/bent → Replace.
  - O.K. → Check engaging of FR drive shaft, hub, transfer case drive shaft, coupling sleeve and clutch gear of Low and High gears, etc.
    - N.G. → Replace.
    - O.K. → Check gear end faces and gear bores for any sign of sticking/jamming. If detected, replace faulty parts.

SPECIAL SERVICE TOOLS

Tool number	Tool name	T130A	T100L
ST23540000	Fork rod pin punch 	X	–
KV40100621	Oil seal drift 	X	–
ST30720000	Oil seal drift 	X	–
KV38104700	Companion flange wrench 	–	X
KV31100300	Fork rod pin punch 	–	X
ST23620000	Fork rod guide 	–	X
ST22730000	Bearing puller 	–	X
ST30701000	Bearing drift 	–	X
ST19820000	Bearing drift 	–	X
ST37750000	Bearing drift 	–	X

Tool number	Tool name	T130A	T100L
KV38102100	Oil seal drift 	–	X

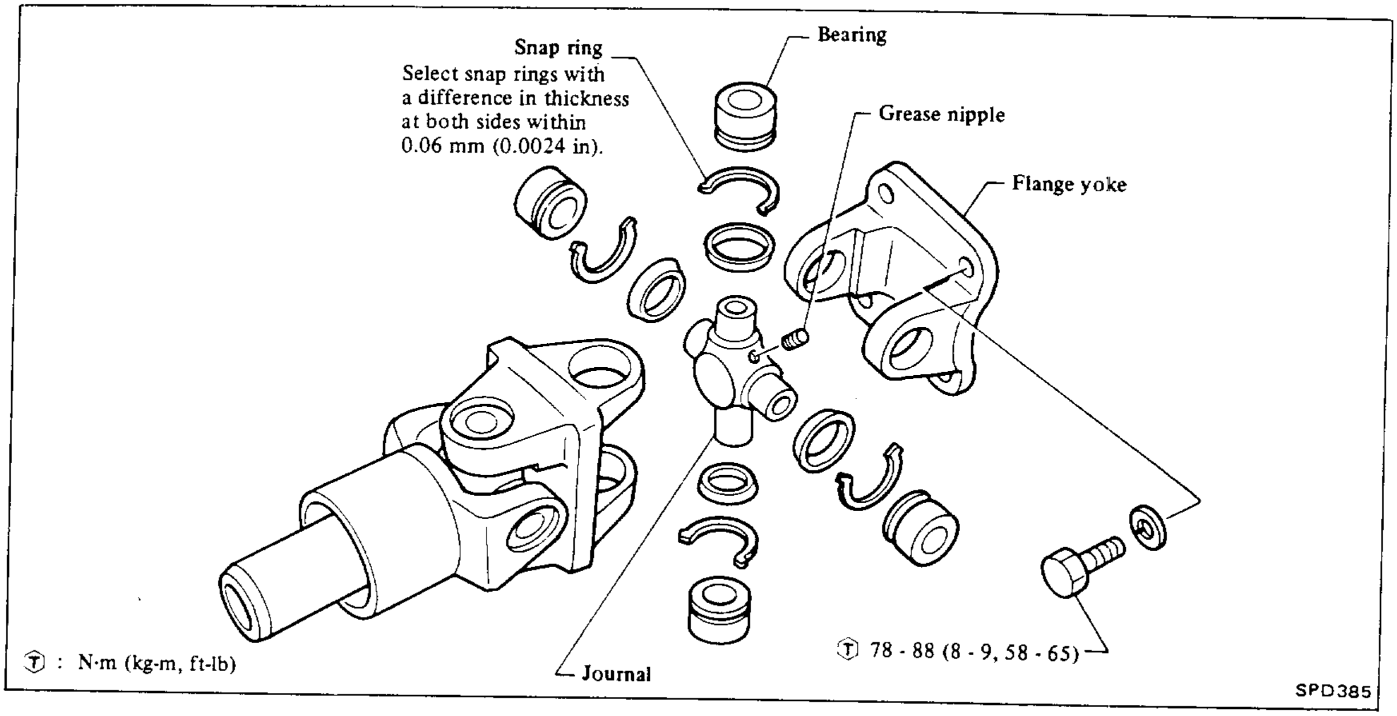
PROPELLER SHAFT & DIFFERENTIAL CARRIER

CONTENTS

PROPELLER SHAFT —Model : 2S80B, 2F80B, 2F80B-D—

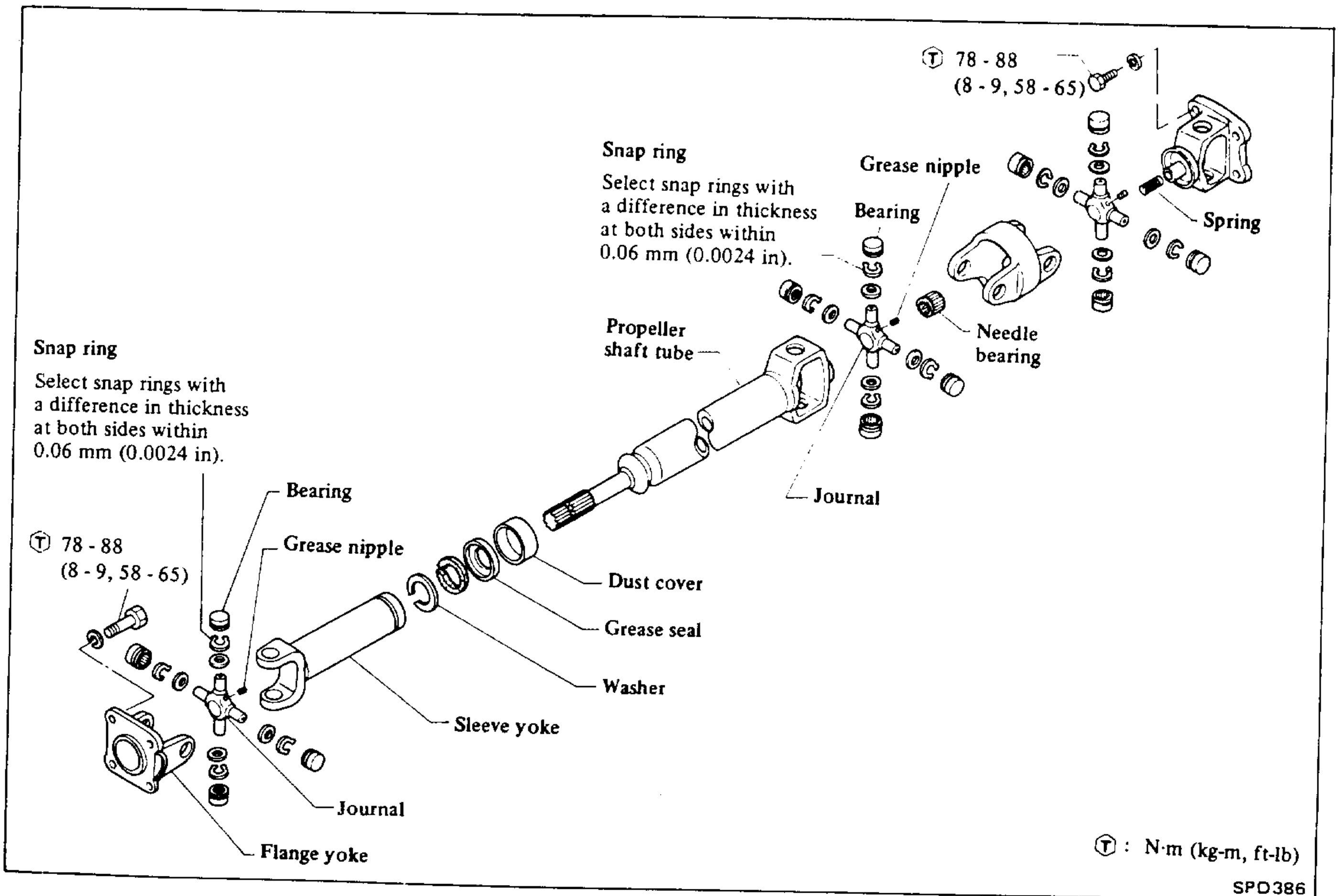
Primary propeller shaft

– Model 2S80B –



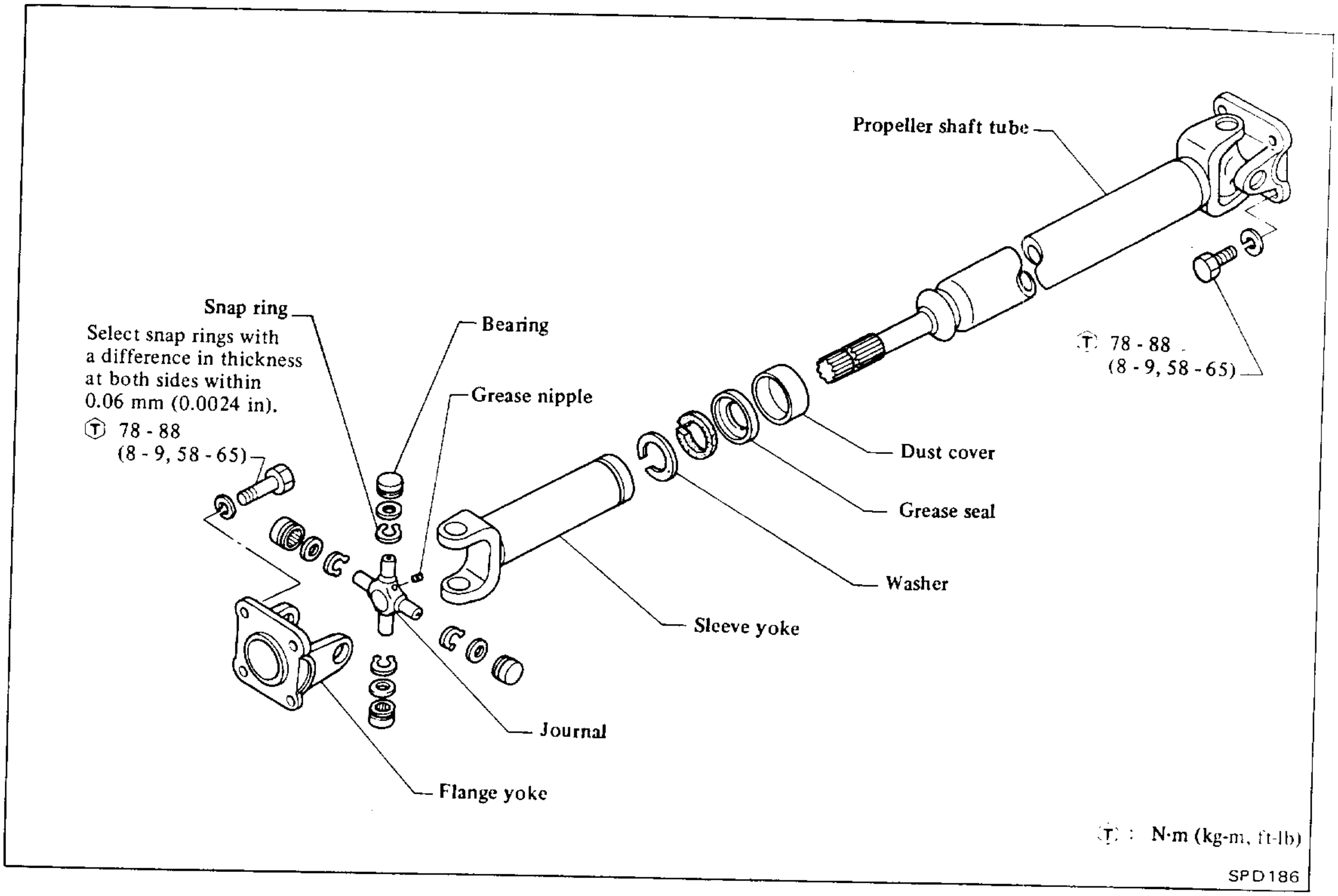
Front propeller shaft

– Model 2F80B-D –



Front and rear propeller shaft

– Model 2F80B –



SPD186

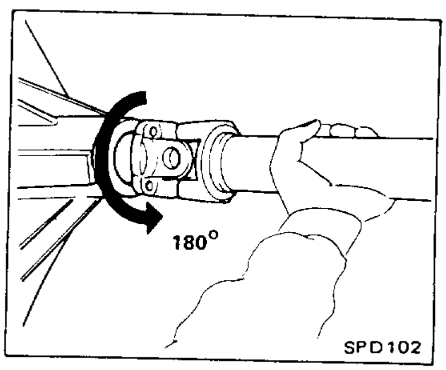
GENERAL INSPECTION

- Inspect propeller shaft tube surface for dents or cracks. If damaged, replace propeller shaft assembly.
- 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.



SPD102

3. Again check shaft vibration. If vibration still persists, replace propeller shaft assembly.

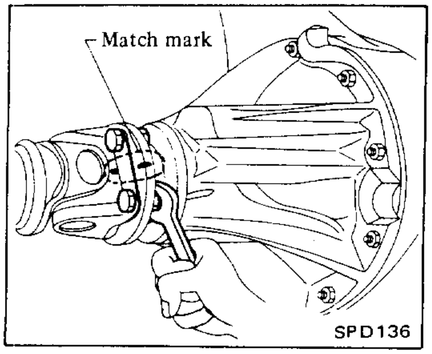
REMOVAL AND INSTALLATION

PRIMARY PROPELLER SHAFT

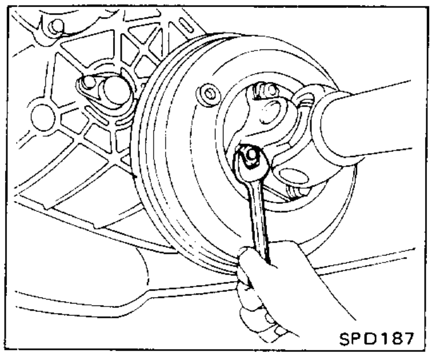
1. Separate propeller shaft from transfer assembly.
2. Remove transfer assembly.
   Refer to Section TF (T100L).
3. Draw out primary propeller shaft from transmission.
4. Installation is in reverse order of removal.

FRONT AND REAR PROPELLER SHAFT

1. **Put match marks** on flanges and separate propeller shaft from transfer and differential carrier.



SPD136


SPD187

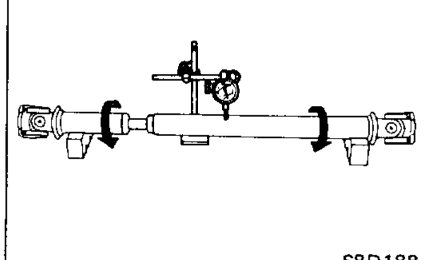
2. To install, reverse the foregoing procedure using reference marks in removal.

INSPECTION

PROPELLER SHAFT RUNOUT

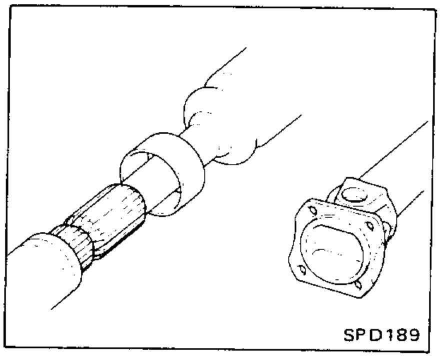
Inspect propeller shaft runout. If runout exceeds specifications, replace propeller shaft assembly.

Runout limit:
0.6 mm (0.024 in)


SPD188

FLANGE YOKE AND SLEEVE YOKE

Check flange yoke and sleeve yoke for damage or wear. Replace if necessary.

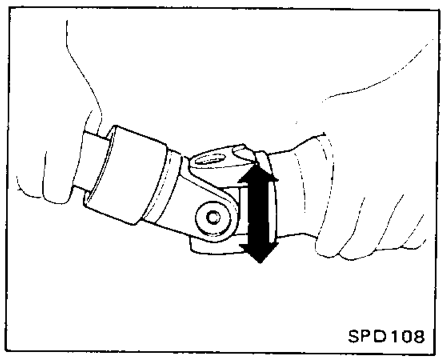

SPD189

JOURNAL AXIAL PLAY

Inspect journal for axial play.

If play exceeds specifications, repair journal.

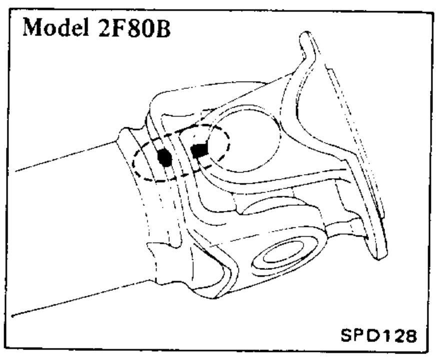
Axial play:
Less than 0.02 mm (0.0008 in)


SPD108

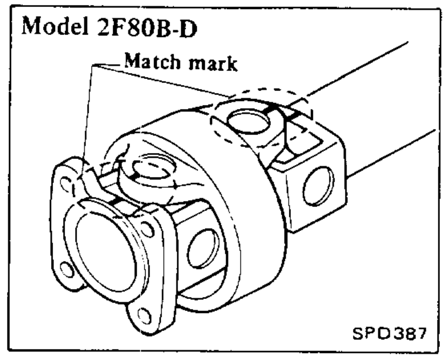
REPAIR

DISASSEMBLY

1. Put match marks on shaft and flange or yoke.

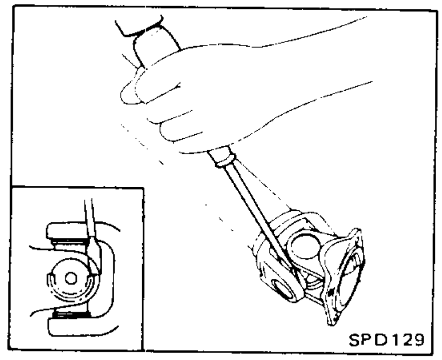


SPD128

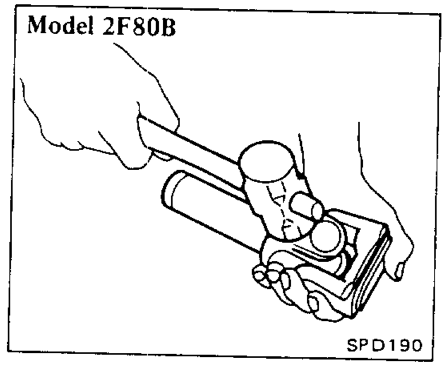


SPD387

2. Remove snap ring.

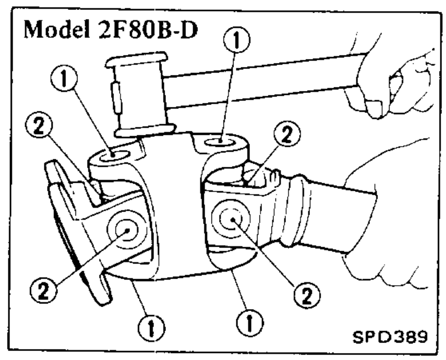

SPD129

3. Remove pushed out spider bearing by lightly tapping yoke with a hammer, taking care not to damage journal and yoke hole.



SPD190

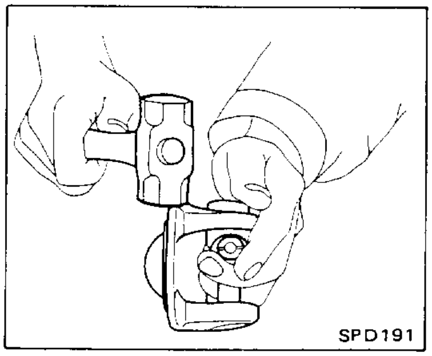
Remove spider bearing in the order of ① and ② as in Figure below.



SPD389

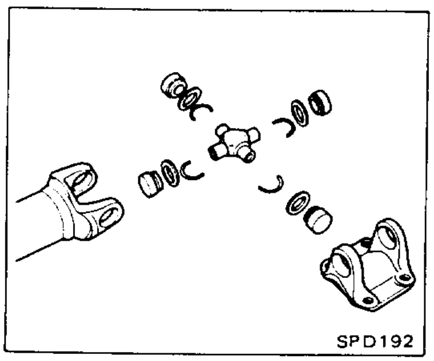
4. Remove bearing at opposite side in above operation.

Put marks on disassembled parts so that they can be reinstalled in their original positions from which they were removed.


SPD191

INSPECTION

Inspect disassembled parts, and repair or replace any faulty part.

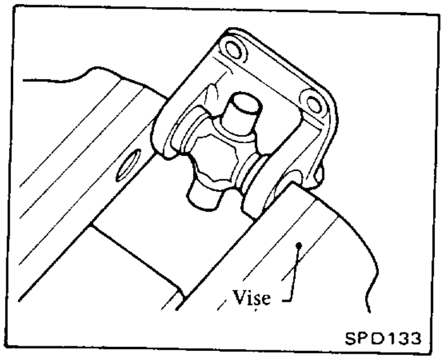

SPD192

ASSEMBLY

To assemble, reverse the foregoing procedure using reference marks in disassembly.

1. Assemble spider bearing. Apply grease to the bearing inner surface and needle bearings.

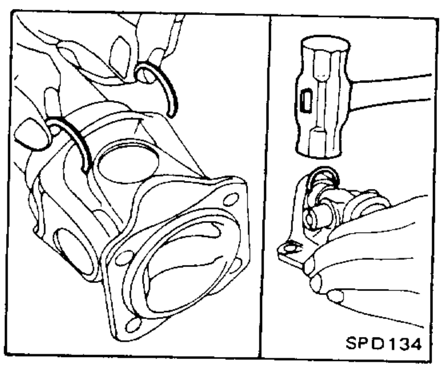
When assembling, be careful that needle bearing does not fall down.



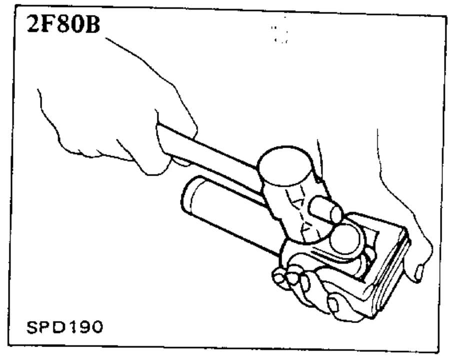
SPD133

2. Select snap ring that will provide specified play in axial direction of journal, and install them **(Refer to S.D.S.).**

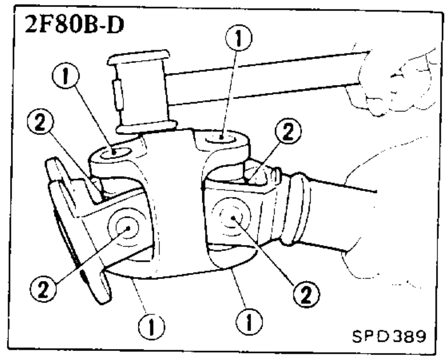
Select snap rings with a difference in thickness at both sides within 0.06 mm (0.0024 in).


SPD134

3. Adjust thrust clearance between bearing and snap ring to zero by tapping yoke.

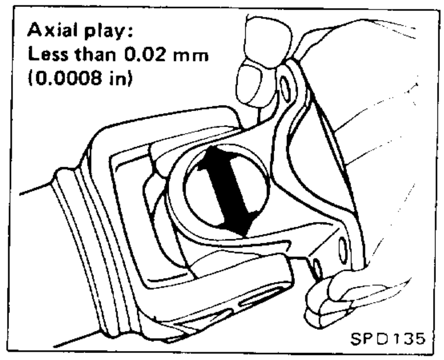


SPD190



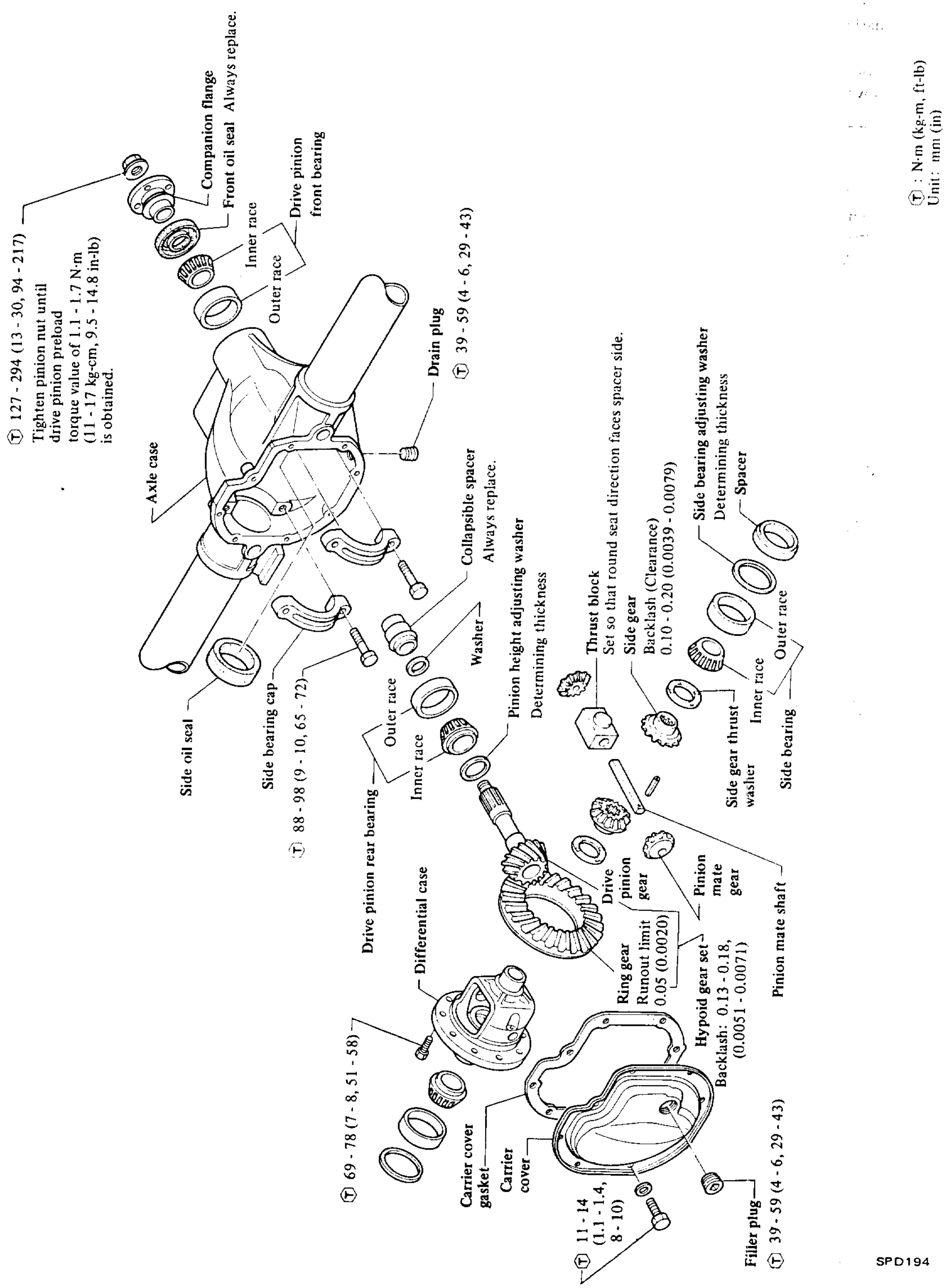
SPD389

4. Check to see that journal moves smoothly and check for axial play.



SPD135

DIFFERENTIAL CARRIER (Final drive) —Model : C200—

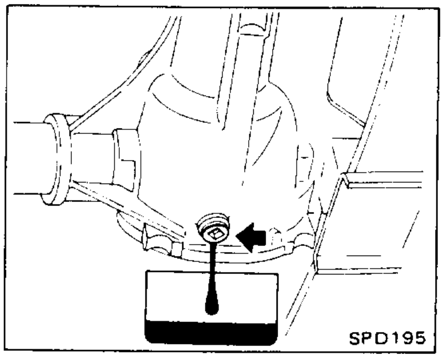


SPD194

PREPARATION FOR DISASSEMBLY

REMOVAL

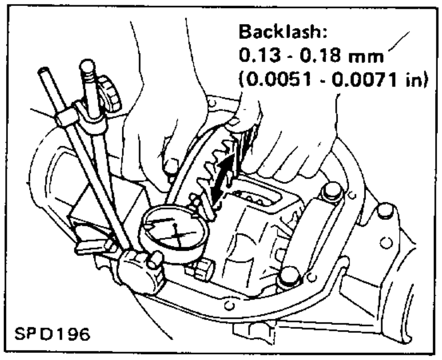
1. Remove front or rear axle assembly. **Refer to Front Axle (Section FA) or Rear Axle (Section RA) for removal.**
2. Remove drain plug and drain gear oil.


SPD195

3. Remove front or rear axle shafts. **Refer to Front Axle (Section FA) or Rear Axle (Section RA) for removal.**

PRE-DISASSEMBLY INSPECTION

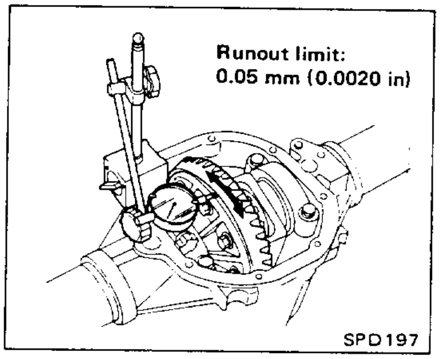
1. Check backlash of ring gear with a dial indicator at several points. If it is not within specification, **refer to Side Bearing Adjustment.**



SPD196

2. Check runout of ring gear with a dial indicator. If it is over specification, hypoid gear set or differential case should be replaced.

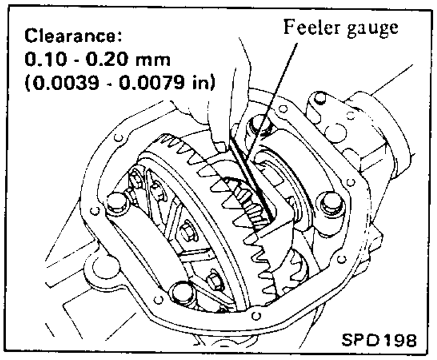
When backlash varies excessively in different places, the variance may have resulted from foreign matter caught between ring gear and differential case.



SPD197

3. Check tooth contact. **Refer 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.).**



SPD198

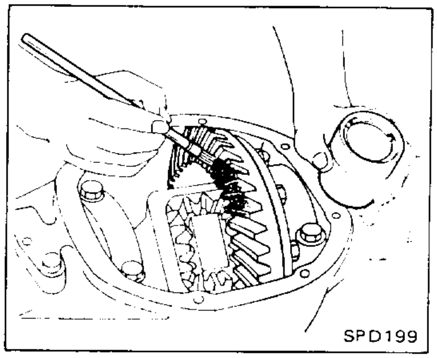
TOOTH CONTACT

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.

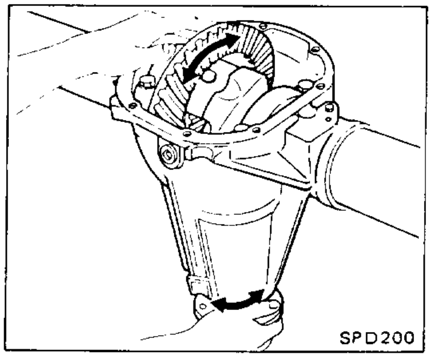
Hypoid gear set which are not positioned properly may be noisy, or have short life or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

Check

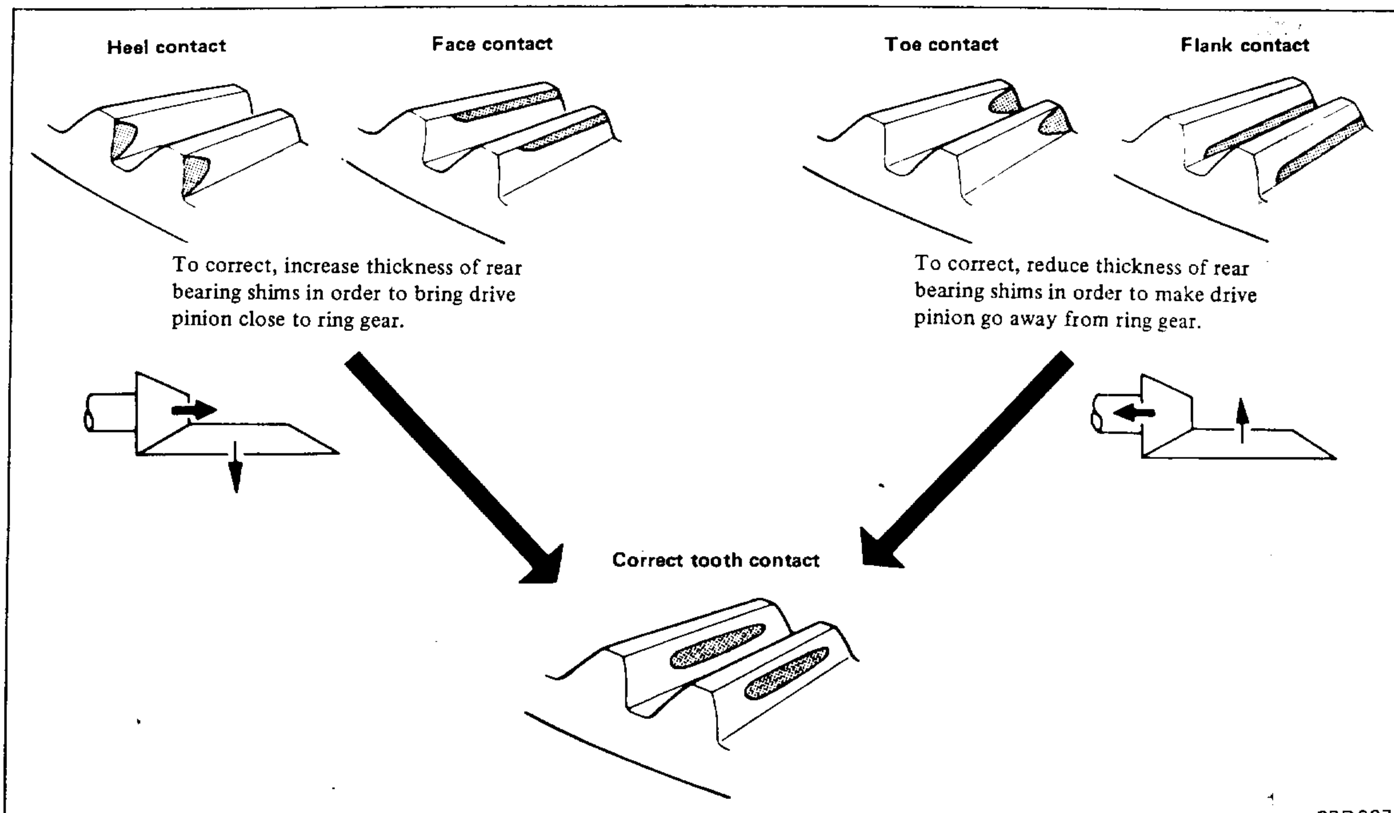
1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear **drive side.**


SPD199

3. Hold companion flange steady by hand and rotate the ring gear in both directions.


SPD200

Adjustment

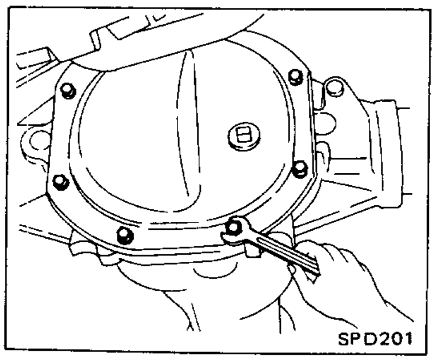


SPD007

DISASSEMBLY

DIFFERENTIAL CARRIER

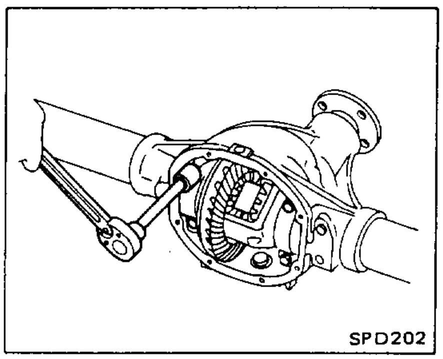
1. Remove rear cover and rear cover gasket.



SPD201

2. Remove side bearing caps.

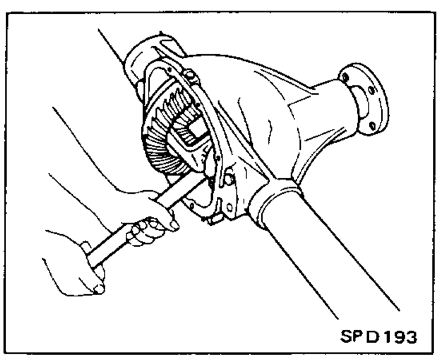
Bearing caps are line-board during manufacture and should be put back in their original places.



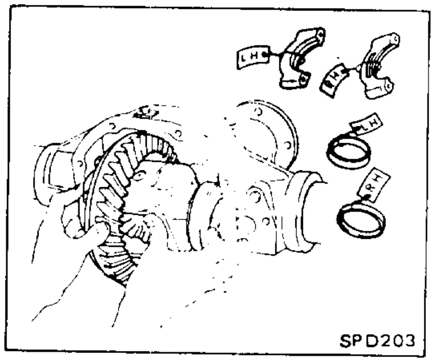
SPD202

3. Using a pry bar, remove differential case assembly.

Be careful to keep the side bearing outer races together with inner race – do not mix them up.

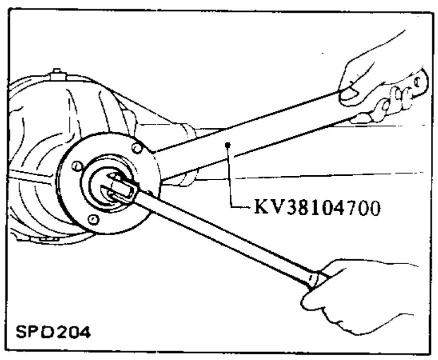


SPD193



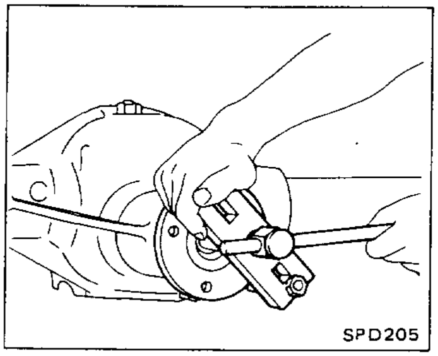
SPD203

4. Remove drive pinion nut using **Tool.**

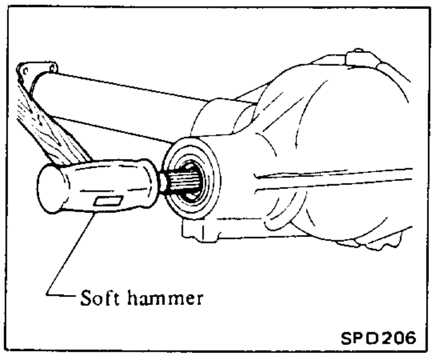


SPD204

5. Remove companion flange using puller.


SPD205

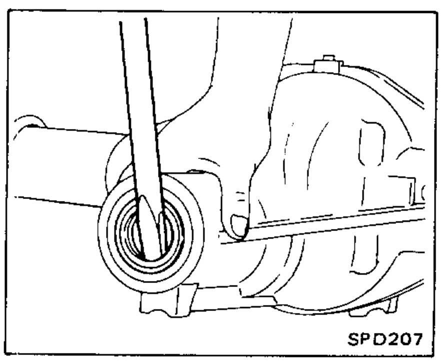
6. Remove drive pinion using soft hammer.



SPD206

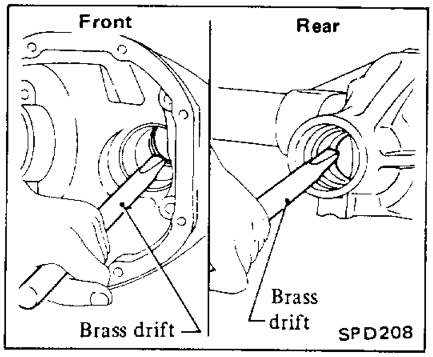
7. Remove oil seal by prying up using a large screwdriver, and remove front pinion bearing inner race.

Do this carefully, so as not to scratch seal bore with screwdriver. Cover end of screwdriver with a rag.


SPD207

Do not reuse oil seal once removed. Always install new one.

8. Remove pinion bearing outer race using brass drift.

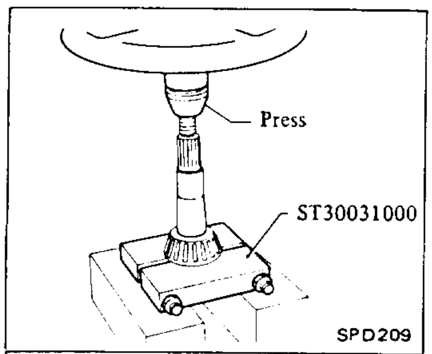


SPD208

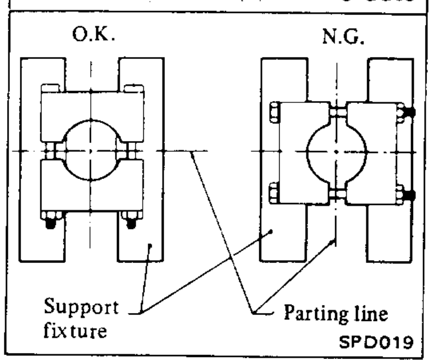
9. Remove collapsible spacer and washer from drive pinion.

10. Pull out rear bearing inner race **using 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.



SPD209

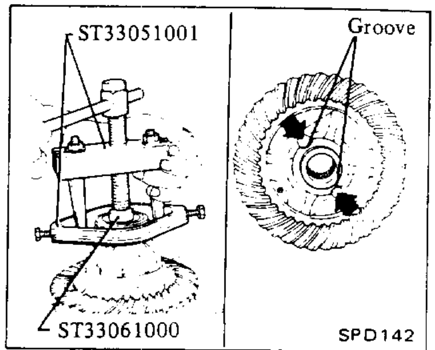


SPD019

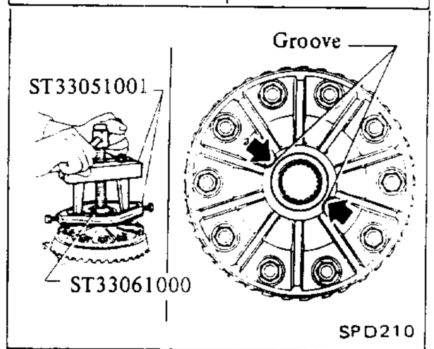
DIFFERENTIAL CASE

1. Remove side bearing inner race **using Tool.**

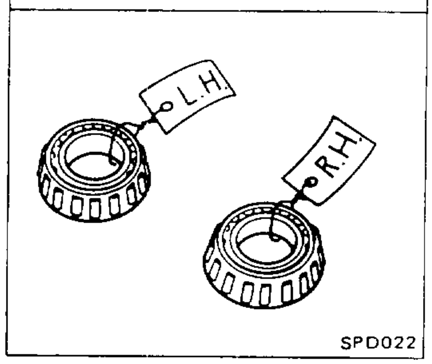
To prevent damage to bearing, engage puller paws with groove. Be careful not to confuse left and right hand parts.



SPD142

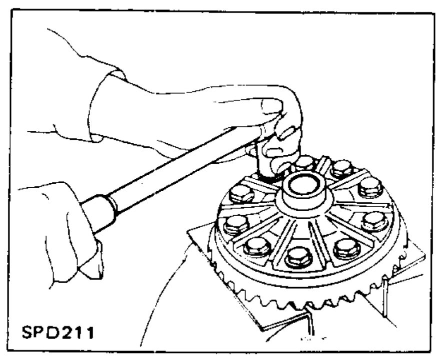


SPD210



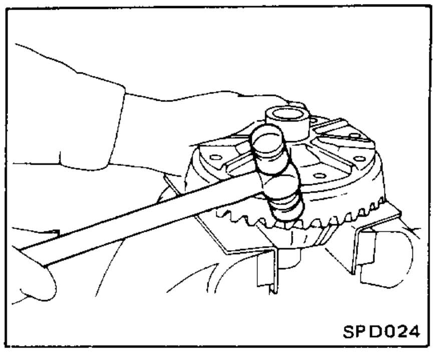
SPD022

2. Remove ring gear by loosening ring gear bolts **in a criss-cross fashion.**

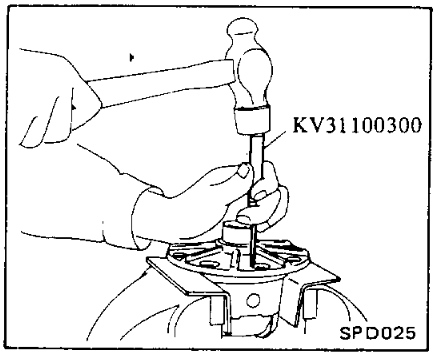

SPD211

3. Tap ring gear off gear case using soft hammer.

Tap evenly all around to keep ring gear from binding.

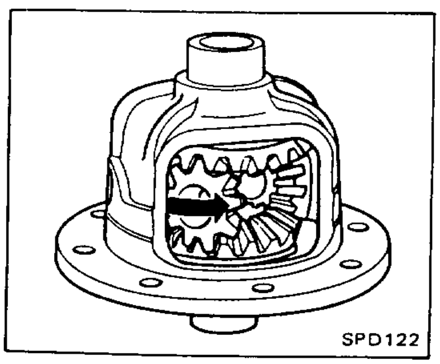

SPD024

4. Drive out pinion mate shaft lock pin **using Tool from ring gear side.**



SPD025

5. Draw out pinion mate shaft, and rotate pinion mate gears out of the case and remove side gears and thrust washers.


SPD122

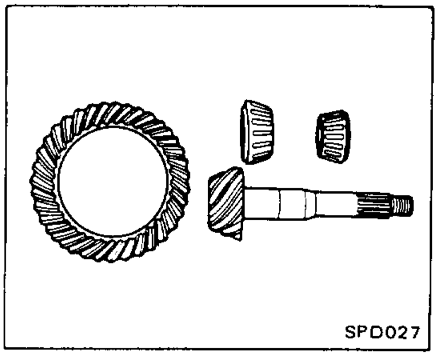
Put marks on gears and thrust washers so that they can be reinstalled in their original positions from which they were removed.

INSPECTION

1. Clean disassembled parts completely.

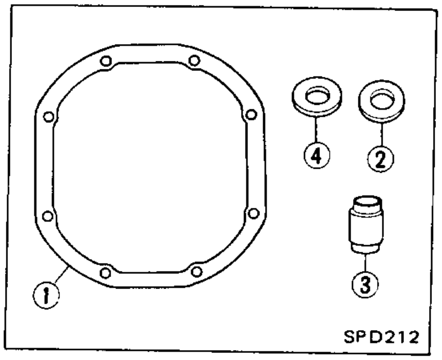
Repair or replace any damaged or faulty parts.

When replacing drive pinion or ring gear, replace with a new hypoid gear set.


SPD027

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 Side oil seal



SPD212

ASSEMBLY

Assembly should be done in the reverse order of disassembly, while marking any necessary inspections and adjustments.

PRECAUTION:

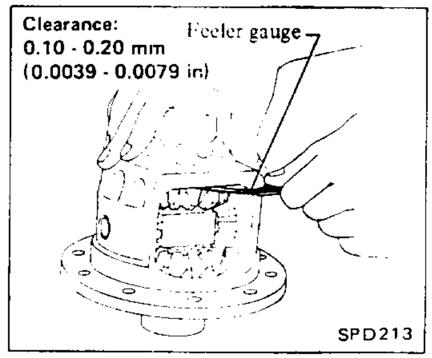
a. Arrange washers to install them correctly.
b. Thoroughly clean the surfaces on which spacer, washers, bearings and bearing caps are installed.
c. Apply gear oil when installing bearings.
d. Pack recommended multi-purpose grease into cavity between lips when fitting oil seal.

DIFFERENTIAL CASE

1. Install pinion mate gears, side gears, thrust washers and thrust block into differential case.

Be sure round seat of thrust block faces spacer.

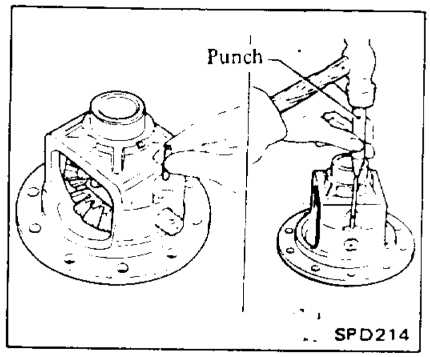
2. Fit pinion mate shaft.
3. Adjust clearance between rear face of side gear and thrust washer by selecting side gear thrust washer **(Refer to S.D.S.).**



SPD213

4. Install pinion mate shaft lock pin using a punch.

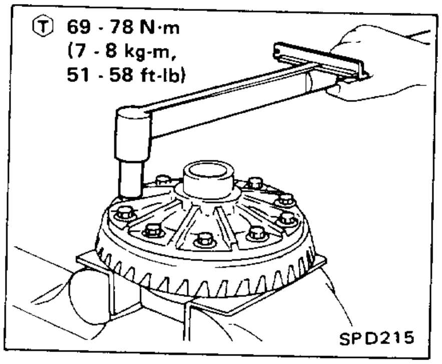
Make sure lock pin is flush with case.



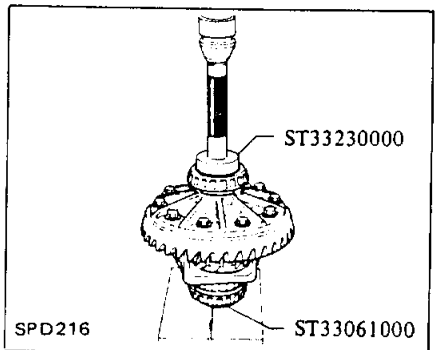
SPD214

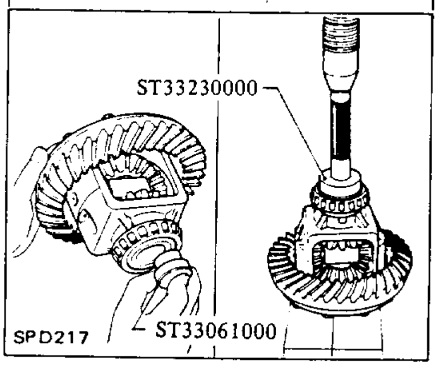
5. Place ring gear on differential case and install bolts.

Tighten bolt in a criss-cross fashion, lightly tapping bolt head with a hammer.



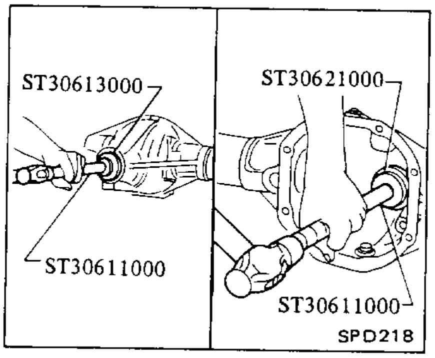
6. Press on the bearings **using Tool.**





DIFFERENTIAL CARRIER

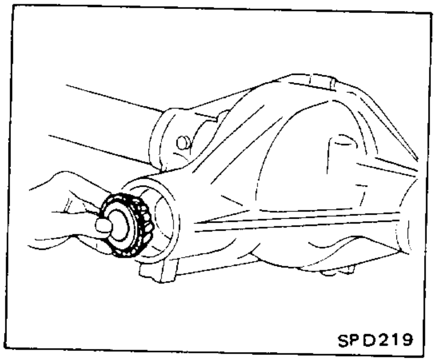
1. Press fit front and rear bearing outer races **using Tools.**



2. Adjust pinion height.

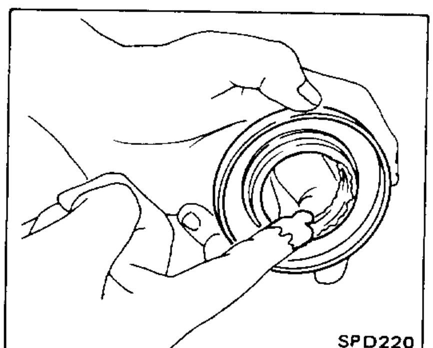
Refer to Pinion Height Adjustment.

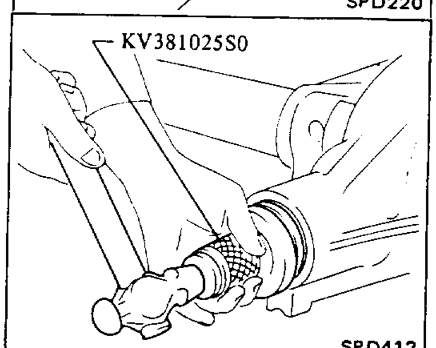
3. **Lubricate** front bearing with gear oil and place it in gear carrier.



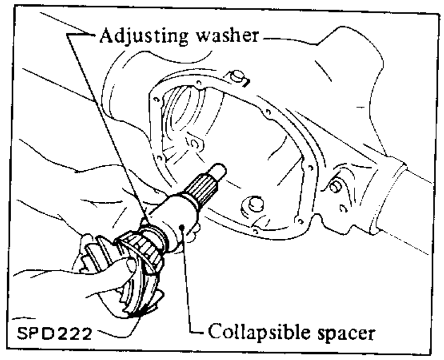
4. **Using Tool,** carefully fit a **new** oil seal into carrier.

Make sure oil seal is flush with end of carrier and apply multi-purpose grease into cavity between lips.

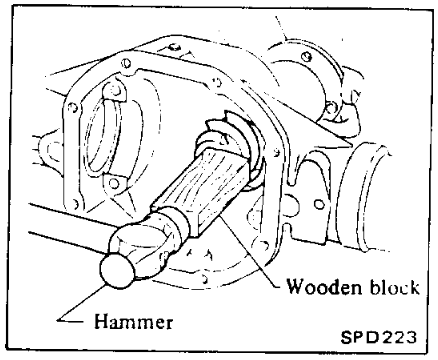




5. Place a **washer** and a **new** collapsible spacer on drive pinion and **lubricate** rear bearing with **gear** oil, and insert it in gear carrier.

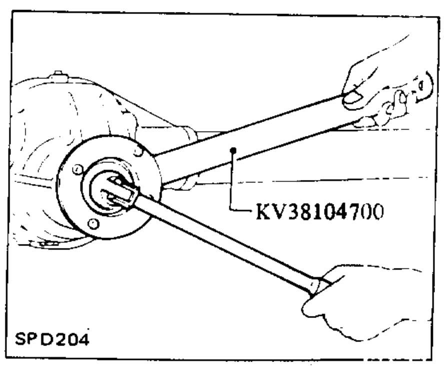


6. Install companion flange and hold it firmly. Insert drive pinion into companion flange by tapping its head with a soft hammer.



7. Hold companion flange **with Tool** and temporarily tighten pinion nut, until there is no axial play.

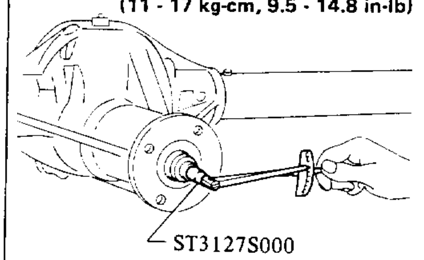
Ascertain that threaded portion of drive pinion and pinion nut are free from oil or grease.



8. 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 to set bearing rollers.

Preload (With oil seal):
1.1 - 1.7 N·m
(11 - 17 kg-cm, 9.5 - 14.8 in-lb)



SPD225

Ⓣ : **Drive pinion nut**
127 - 294 N·m
(13 - 30 kg-m,
94 - 217 ft-lb)

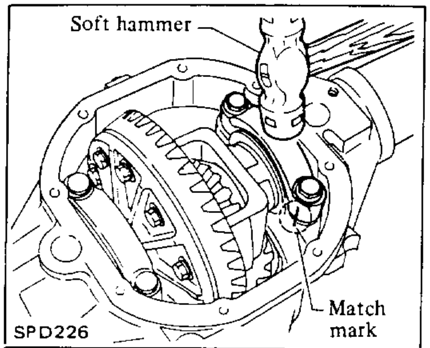
CAUTION:
The preload is achieved by using the permanent set of collapsible spacer. So here, if an over-preload results from excessive turning of the pinion nut, the spacer should be replaced by new one.

---

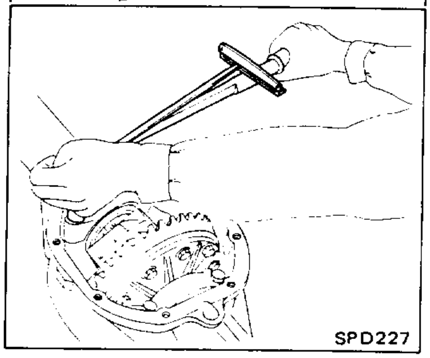
9. Install differential case assembly, side bearing outer races and side bearing adjust washer, spacer into differential carrier, and then install side bearing caps.

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.

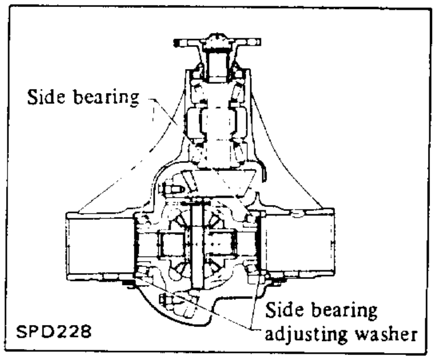


SPD226


SPD227

ADJUSTMENT

SIDE BEARING ADJUSTMENT

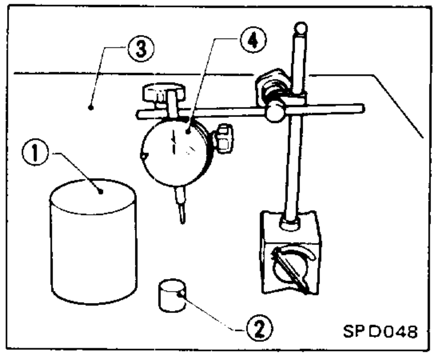


SPD228

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 adjusting washers of proper thickness should be installed.

– Required Tools –

① Weight Block (ST32501000)
② Master Gauge (KV38102000)
③ Base Plate
④ Dial Indicator



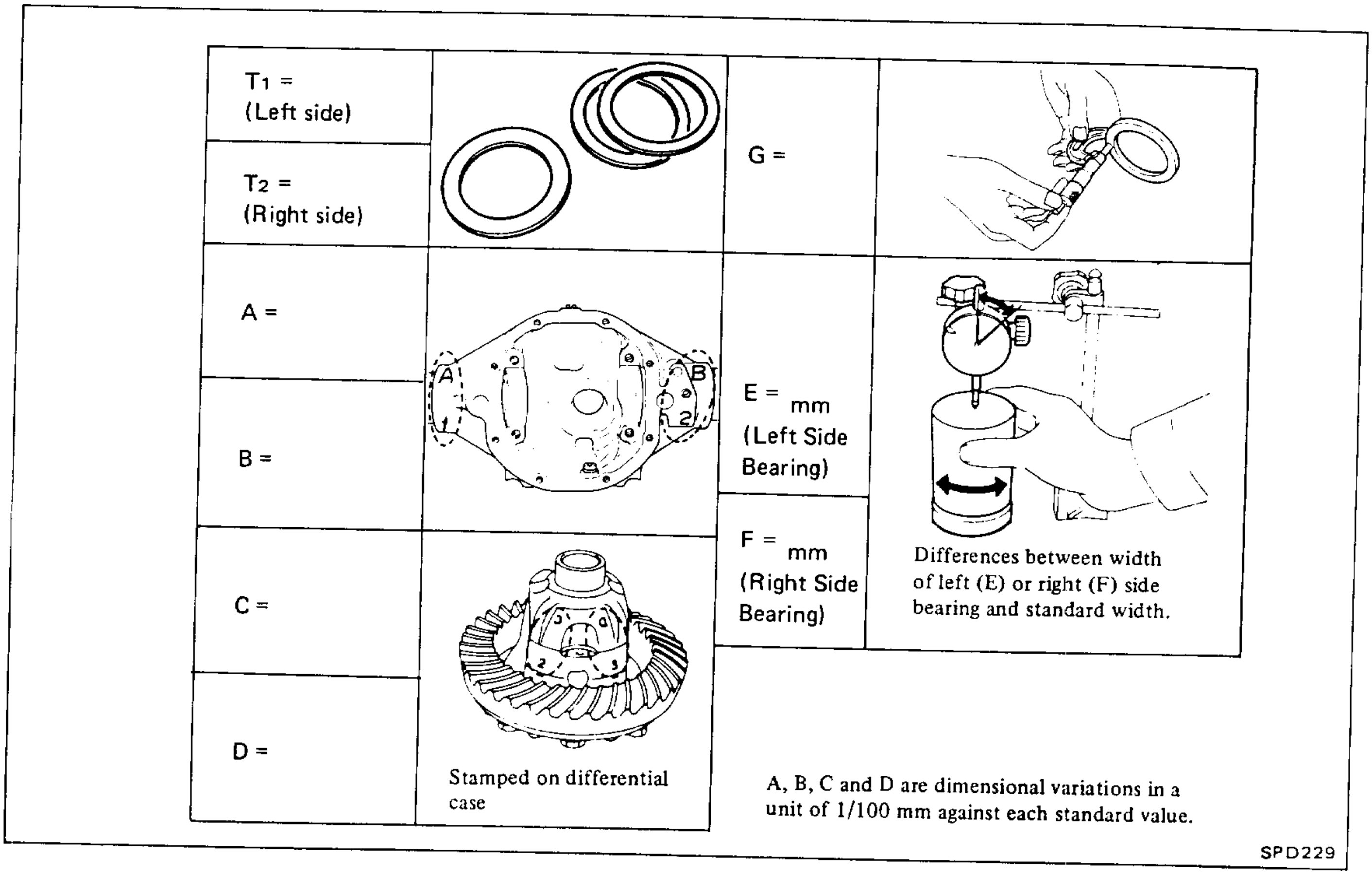
SPD048

1. Thickness of side bearing adjusting washer can be calculated by following equation.

- **When spacer is located on ring gear side**
  Left side: $T_1 = (A - C + D) \times 0.01 + E - G + 10.03$
  Right side: $T_2 = (B - D) \times 0.01 + F + 2.03$
- **When spacer is located opposite ring gear**
  Left side: $T_1 = (A - C + D) \times 0.01 + E + 2.03$
  Right side: $T_2 = (B - D) \times 0.01 + F - G + 10.03$

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.

Where:

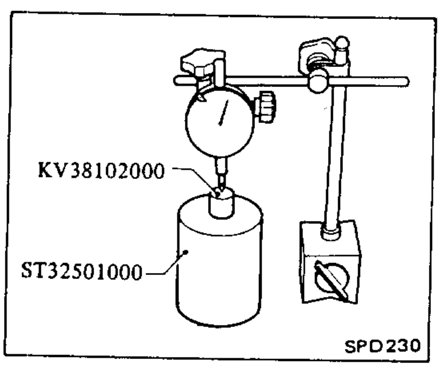


2. Measure values **E** and **F**.

(1) Attach a dial indicator to the base plate.

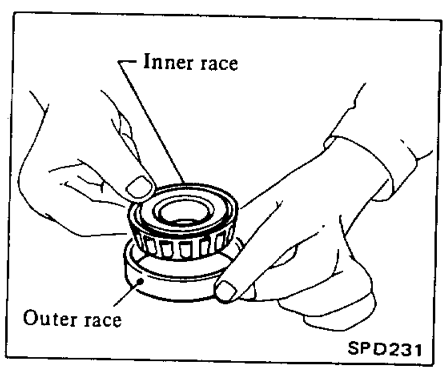
(2) Place a weight block on the base plate, and a master gauge on that block.

Then adjust the dial indicator scale to zero with its tip on the master gauge.



(3) Remove the master gauge and weight block.

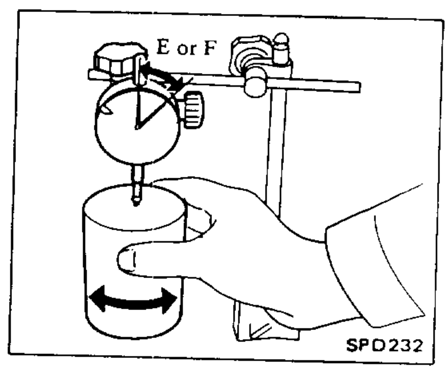
Place the bearing outer race and inner race to be measured on the base plate, and place the weight block on that bearing assembly.



(4) 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. Measure thickness **G** of spacer with micrometer.

4. Substitute these values into the equation to calculate the thickness of the side bearing adjusting washer.

If values signifying A, B, C and D are not given, regard them as zero and calculate.

After assembly, check to see that preload and backlash are within specifications. If not, readjust.

Example:

A = 1 G = 8.09
B = 2 E = 0.15
C = 2 F = 0.17
D = 3

- When spacer is located opposite ring gear

Left side:

$T_1 = (A - C + D) \times 0.01 + E + 2.03$
$= (1 - 2 + 3) \times 0.01 + 0.15 + 2.03$

(1) A 1
−C .... −2
= −1
+D .... +3
= 2

(2) 2
× 0.01
= 0.02

(3) 0.02
+E .... +0.15
= 0.17

(4) 0.17
+2.03
= 2.20

$\therefore T_1 = 2.20$

Right side:

$T_2 = (B - D) \times 0.01 + F - G + 10.03$
$= (2 - 3) \times 0.01 + 0.17 - 8.09 + 10.03$

(1) B 2
−D .... −3
= −1

(2) −1
× 0.01
= −0.01

(3) −0.01
+F .... +0.17
= 0.16

(4) 0.16
− G .... −8.09
= −7.93

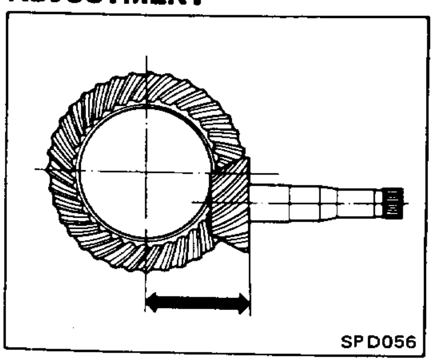
(5) 10.03
−7.93
= 2.10

$\therefore T_2 = 2.10$

5. Select the proper washer (**Refer to S.D.S.**).

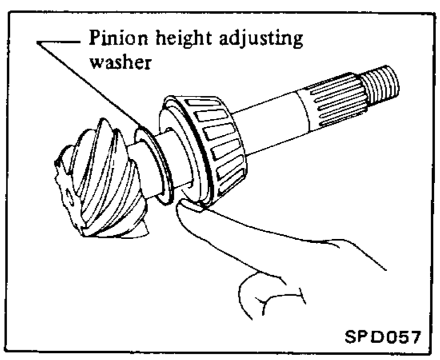
If you cannot find a washer with the desired thickness, use a washer with the thickness closest to the calculated value.

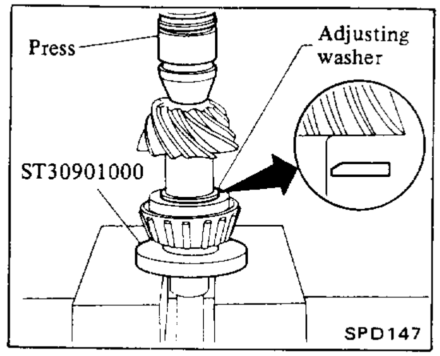
PINION HEIGHT ADJUSTMENT



When replacing the hypoid gear set, drive pinion bearing or gear carrier, be sure to adjust the pinion height.

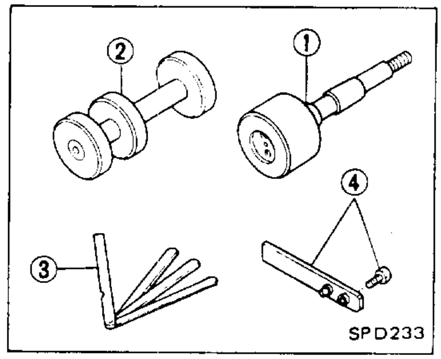
Adjustment of the pinion height can be made by adjusting the washer to be installed between the rear bearing inner race and the drive pinion head.





— Required Tools —

① Dummy Shaft (KV38103910)
② Height Gauge (KV38100120)
③ Feeler Gauge
④ Stopper (KV38100140)

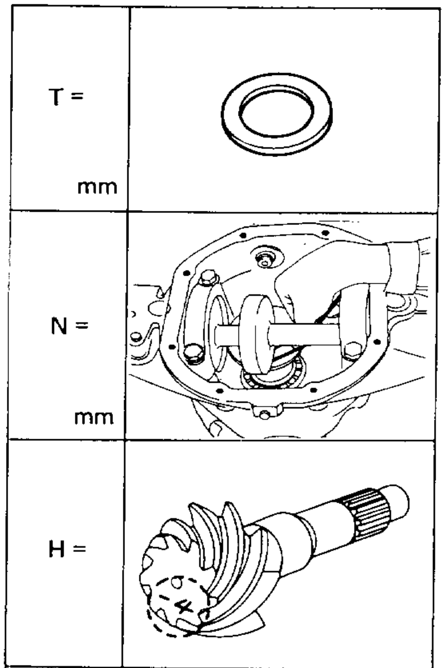


1. Thickness of washer can be calculated by following equation.

$\boxed{T = N - (H \times 0.01) + 3.00}$

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.

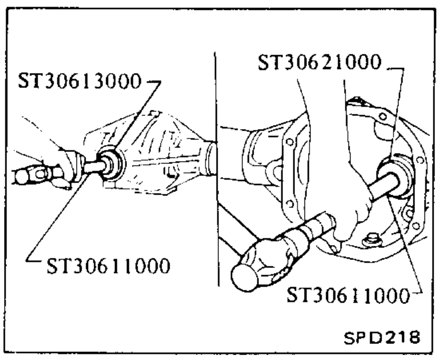
Where:



H are dimensional variations in a unit of 1/100 mm against each standard value.

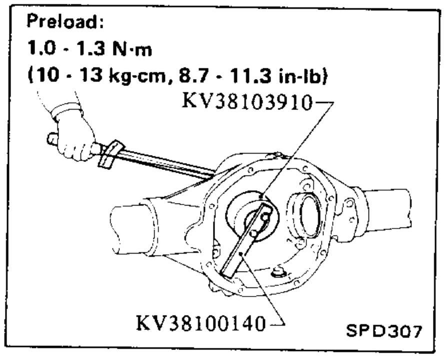
SPD234

2. Press fit front and rear bearing outer races **using Tools.**

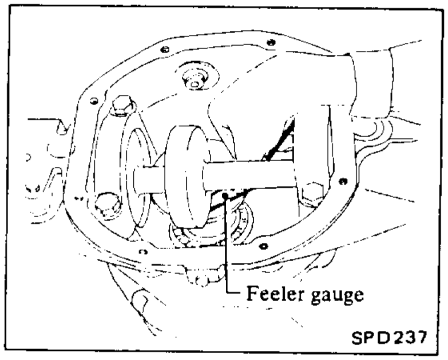


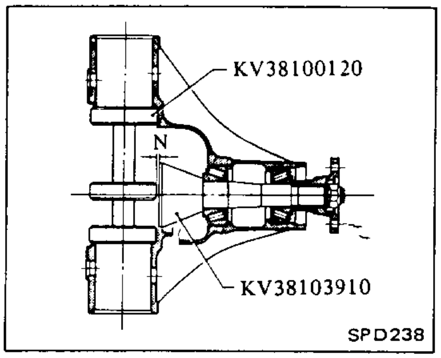
3. Fit rear bearing inner race on dummy shaft and install them on carrier.
4. Install front bearing and companion flange, and tighten drive pinion nut so that drive pinion bearing preload is within the specified value.

Do not overtighten as there is no collapsible spacer. Tighten gradually.



5. Install height gauge on carrier.
Using a feeler gauge, measure the clearance between the height gauge tip and the dummy shaft face.





6. Substitute these values into the equation to calculate the thickness of the washer.

If values signifying H are not given, regard them as zero and calculate.

After assembly, check to see that tooth contact is correct. If not, readjust.

N = 0.23
H = 1

$$T = N - (H \times 0.01) + 3.00$$
$$= 0.23 - (1 \times 0.01) + 3.00$$

(1) H 1
× 0.01
0.01

(2) N 0.23
− 0.01
0.22

(3) 0.22
+ 3.00
3.22

∴ T = 3.22

7. Select the proper washer (**Refer to S.D.S.**).

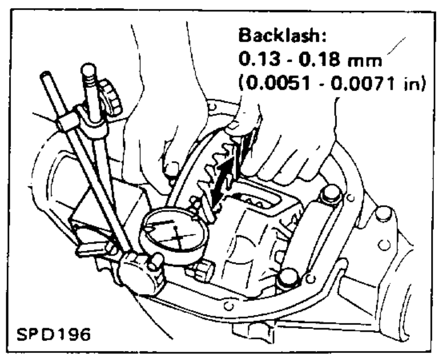
If you cannot find the desired thickness of washer, use washer so that thickness is the closest to the calculated value.

Example:

Calculated value	**T = 3.22 mm**
Used washer	**T = 3.21 mm**

FINAL VERIFICATION

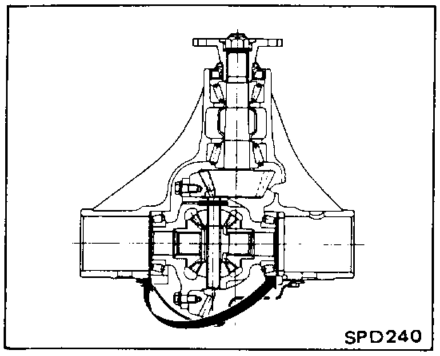
1. Check backlash of ring gear with a dial indicator.



If backlash is too small, decrease thickness of left side bearing adjusting washer and increase thickness of right side bearing adjusting washer by the same amount.

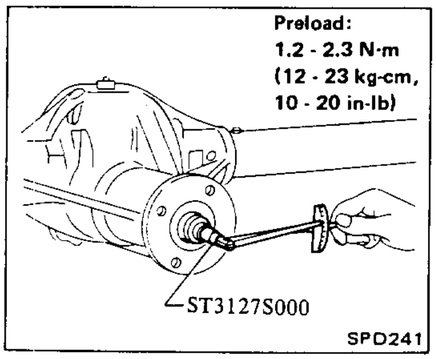
If backlash if too great, reverse the above procedure.

Never add or remove from the total amount of side bearing adjusting washer or bearing preload will be changed.



SPD240

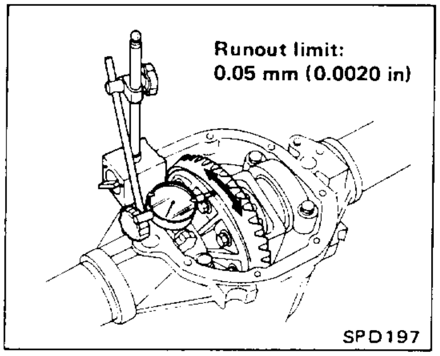
2. Check total preload.



SPD241

If preload is too great, replace side bearing adjusting washers with thinner ones of the same thickness on each side. If preload is too small, replace side bearing adjusting washers with thicker ones of the same thickness on each side. If done incorrectly, ring gear backlash will change.

3. Check runout of ring gear with a dial indicator.



SPD197

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 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.

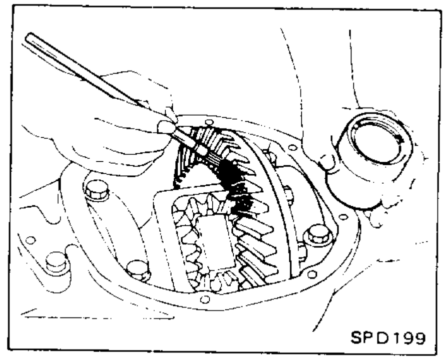
4. Finally, check for tooth contact pattern.

Refer to Tooth Contact.

Usually the pattern will be correct if you have calculated the washers 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.



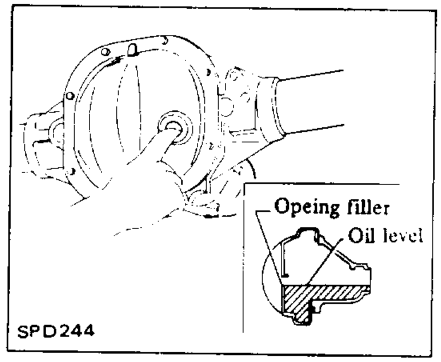
SPD199

5. Install the differential carrier in the vehicle **(Refer to Section FA or RA for installation).**

Gasket should be replaced by new one each time the differential carrier is removed.

Then fill with gear oil.

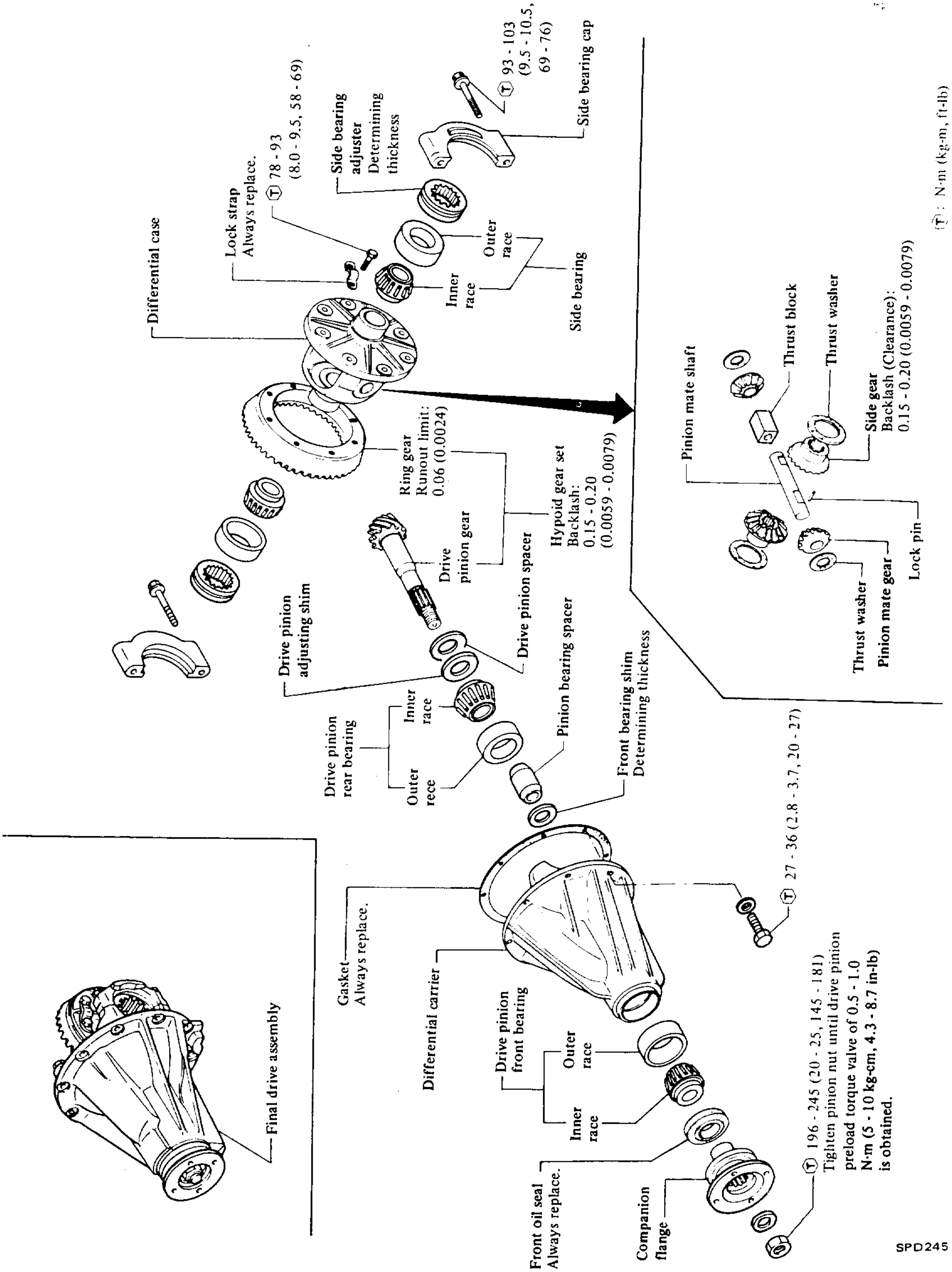
With limited slip differentials, use Gear Oil Hypoid L.S.D. (Service part **number: KL430-14002-03).**



SPD244

Ⓣ : **Drain and filler plugs**
39 - 59 N·m
(4 - 6 kg-m,
29 - 43 ft-lb)
Gear oil capacity:
1.3 liters
(2-1/4 Imp pt)

DIFFERENTIAL CARRIER (Final drive) —Model : H233B—

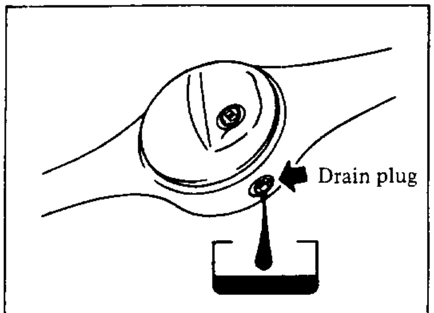


SPD245

PREPARATION FOR DISASSEMBLY

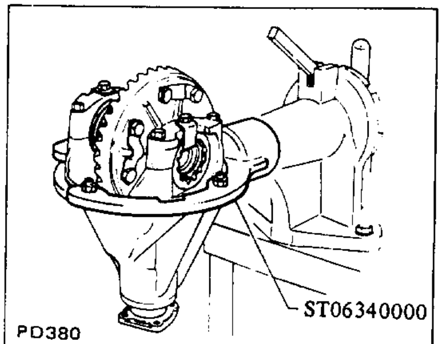
REMOVAL

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.



SPD121

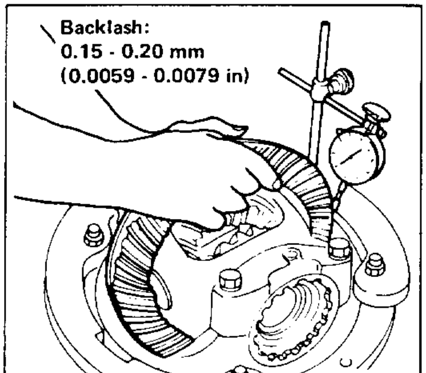
3. Separate propeller shaft and differential carrier.
4. Remove rear axle shaft. **Refer to Section RA for removal.**
5. Loosen off nuts securing differential carrier to rear axle case, and take out differential carrier.
6. Mount differential carrier on **Tool.**



PD380

PRE-DISASSEMBLY INSPECTION

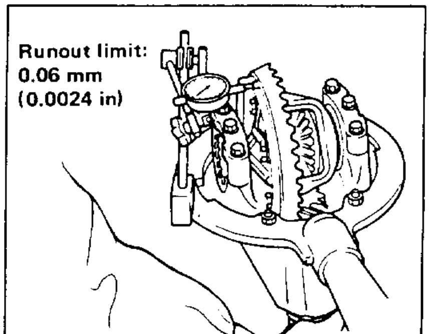
1. Check backlash of ring gear with a dial indicator at several points. If it is not within specification, adjust it referring to **Side Bearing Adjustment.**



SPD246

2. Check runout of ring gear with a dial indicator. If it is over specification, hypoid gear set or differential case should be replaced.

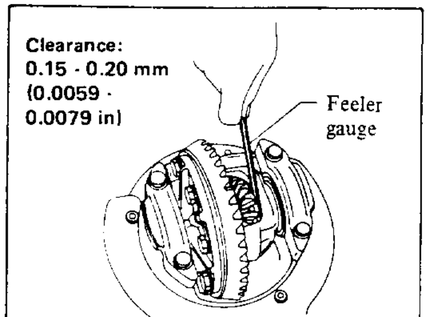
When backlash varies excessively in different places, the variance may have resulted from foreign matter caught between ring gear and differential case.



SPD247

3. Check tooth contact. **Refer 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.).**



SPD004

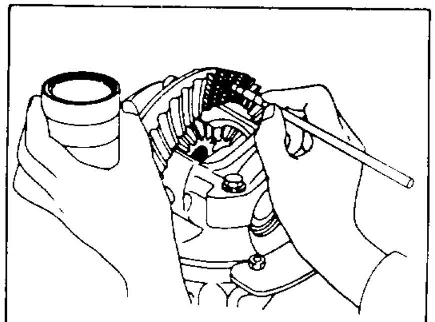
TOOTH CONTACT

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.

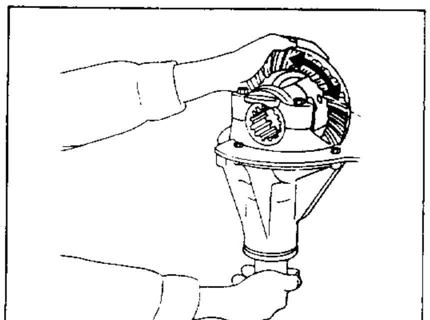
Hypoid gear set which are not positioned properly may be noisy, or have short life or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

Check

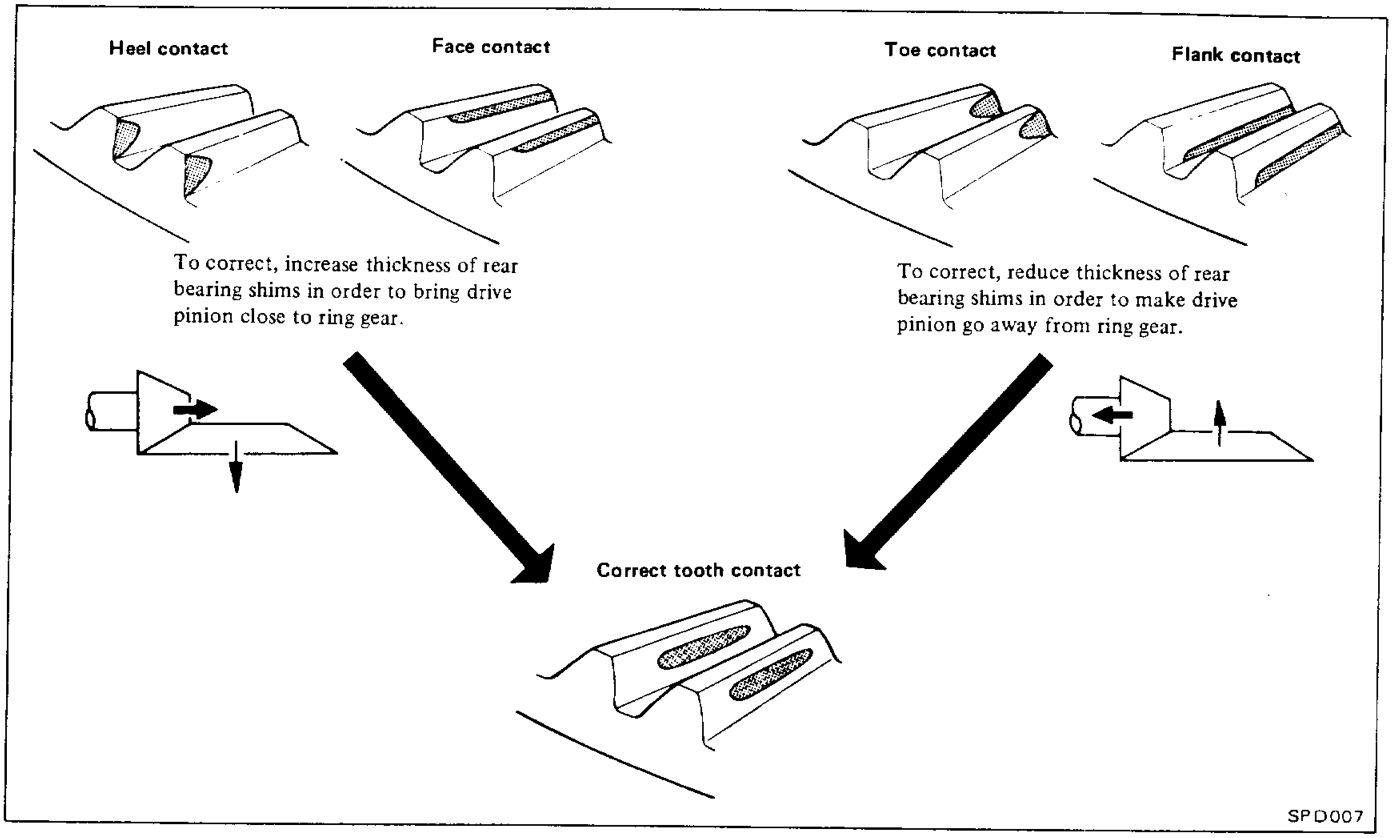
1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.


SPD005

3. Hold companion flange steady by hand and rotate the ring gear in both directions.


SPD248

Adjustment



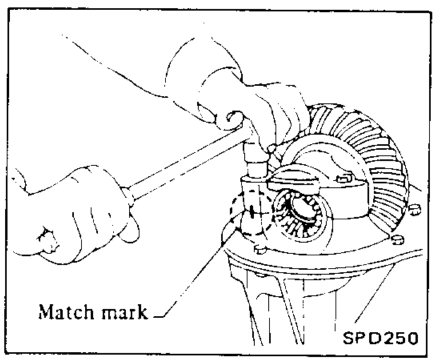
SPD007

DISASSEMBLY

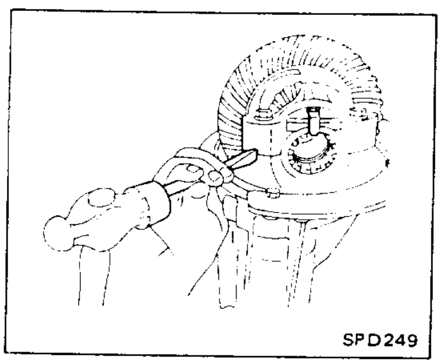
DIFFERENTIAL CARRIER

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.

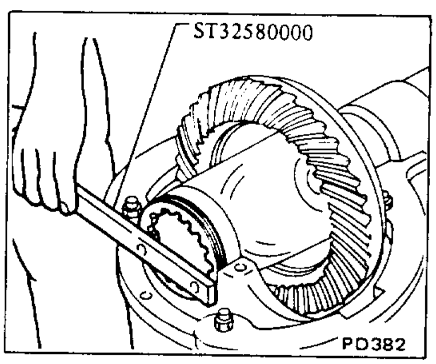


SPD250


SPD249

2. Remove side lock fingers and side bearing caps.

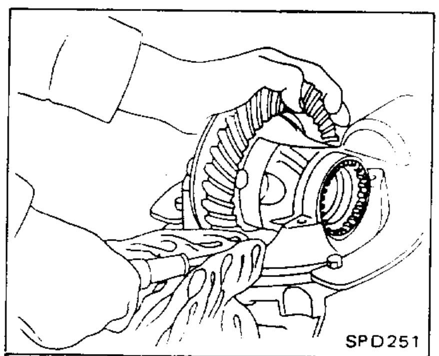
3. **Using Tool,** remove side bearing adjuster.

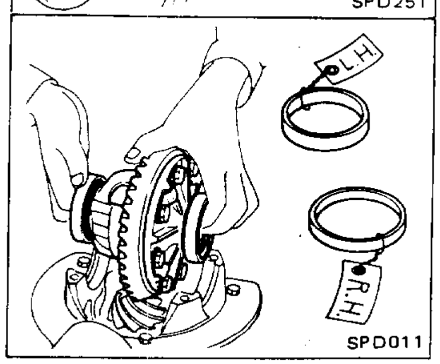


PD382

4. Using a pry bar, remove differential case assembly.

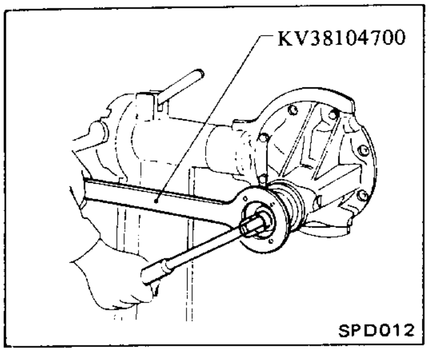
Be careful to keep the side bearing outer races together with inner race – do not mix them up.


SPD251



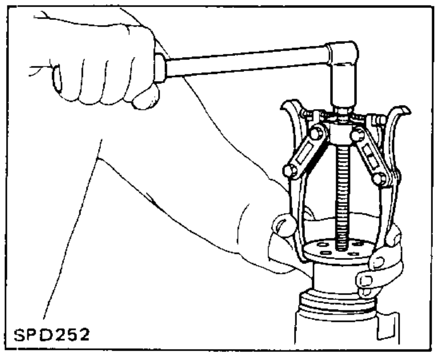
SPD011

5. Remove drive pinion nut **using Tool.**

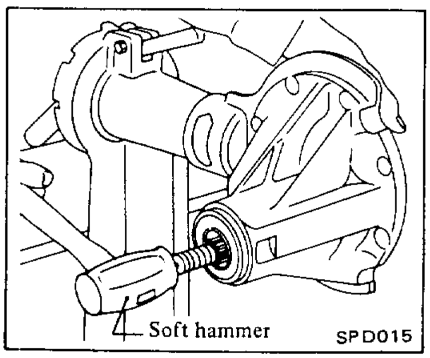


SPD012

6. Remove companion flange with puller.


SPD252

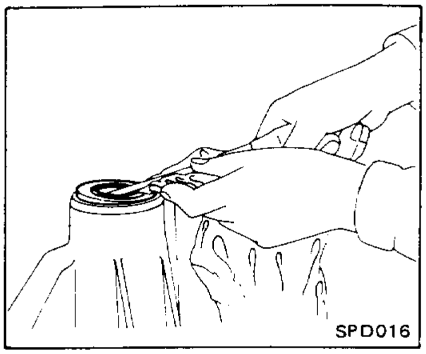
7. Remove drive pinion with soft hammer.



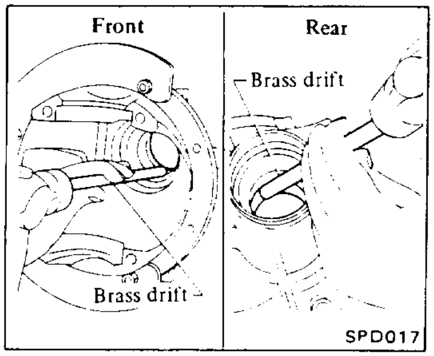
SPD015

8. 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.


SPD016

9. Remove pinion bearing outer race using a brass drift.

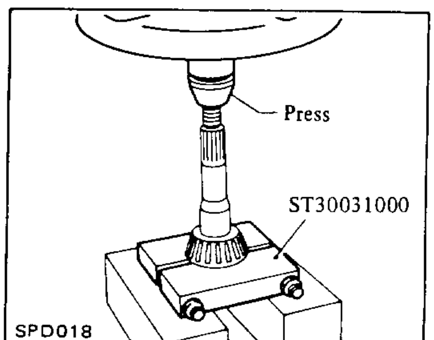


SPD017

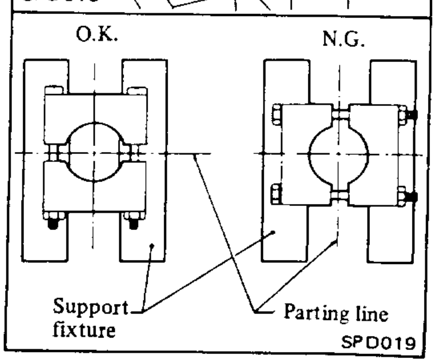
10. Remove collapsible spacer and washer from drive pinion.

11. Pull out rear bearing inner race **using 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.



SPD018

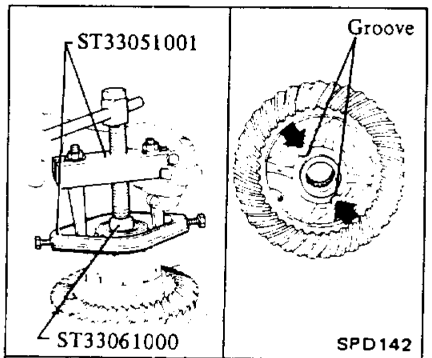


SPD019

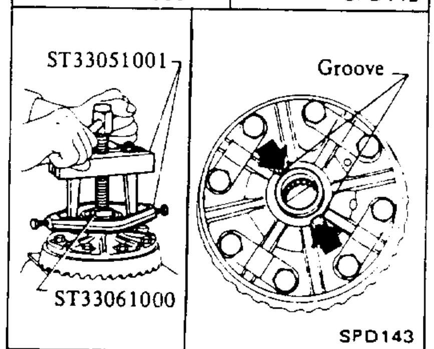
DIFFERENTIAL CASE

1. Remove side bearing inner race **using Tool.**

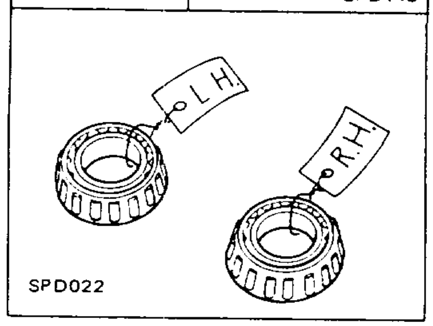
To prevent damage to bearing, engage puller paws with groove. Be careful not to confuse left and right hand parts.



SPD142

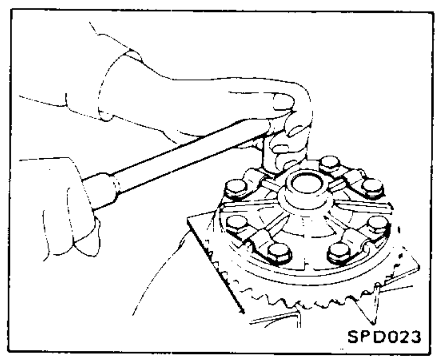


SPD143



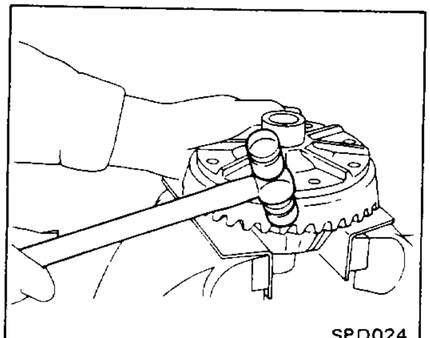
SPD022

2. Remove ring gear by spreading out lock straps and loosening ring gear bolts in a criss-cross fashion.


SPD023

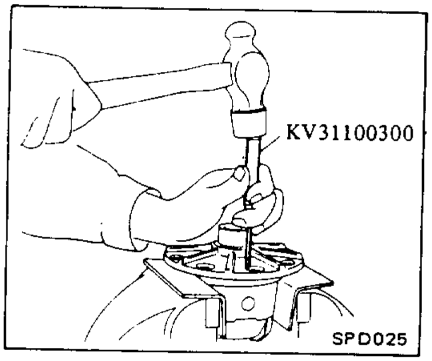
3. Tap ring gear off gear case using a soft hammer.

Tap evenly all around to keep ring gear from binding.



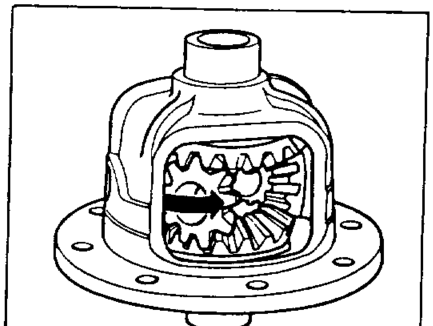
SPD024

4. Drive out pinion mate shaft lock pin, **using Tool from ring gear side.**



SPD025

5. Draw out pinion mate shaft, and rotate pinion mate gears out of the case and remove side gears and thrust washers.



SPD122

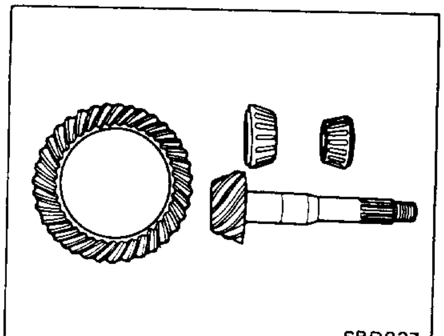
Put marks on gears and thrust washers so that they can be reinstalled in their original positions from which they were removed.

INSPECTION

1. Clean disassembled parts completely.

Repair or replace any damaged or faulty parts.

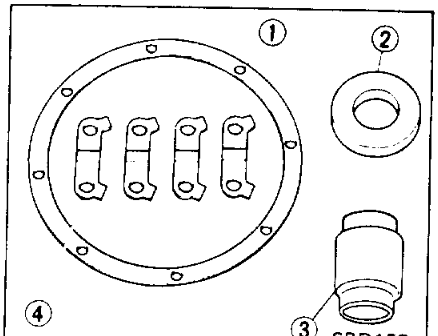
When replacing drive pinion or ring gear, replace with a new hypoid gear set.



SPD027

2. The following parts should be replaced by new ones each time they are removed.

① Gasket
② Front oil seal
③ Pinion bearing spacer
④ Lock strap



SPD158

ASSEMBLY

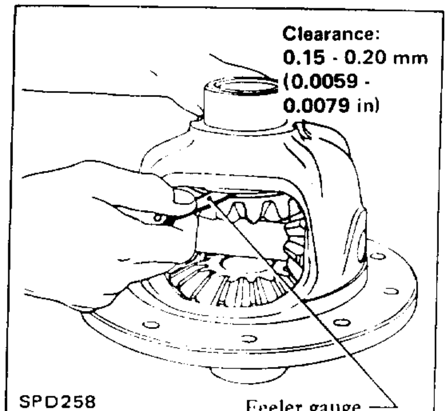
Assembly should be done in the reverse order of disassembly, while making any necessary inspections and adjustments.

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

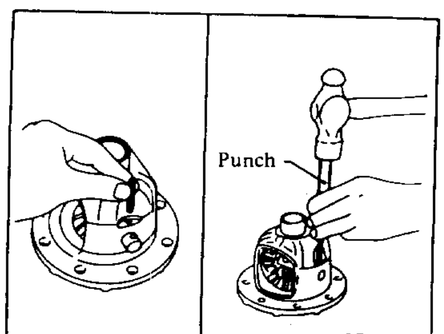
1. Install pinion mate gears, side gears, thrust washers and thrust block into differential case.
2. Fit pinion mate shaft.
3. Adjust clearance between rear face of side gear and thrust washer by selecting side gear thrust washer **(Refer to S.D.S.).**



SPD258

4. Install pinion mate shaft lock pin using a punch.

Make sure lock pin is flush with case.

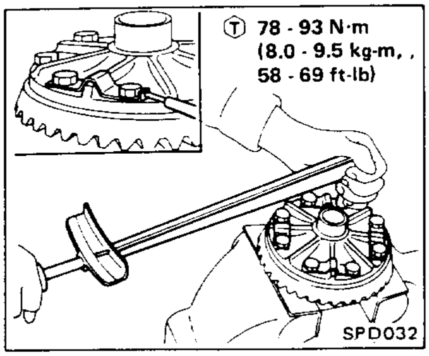


SPD030

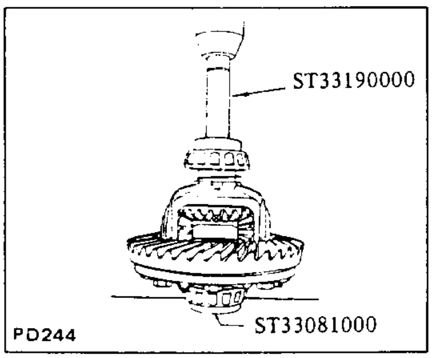
5. Place ring gear on differential case and install **new lock straps** and bolts.

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.

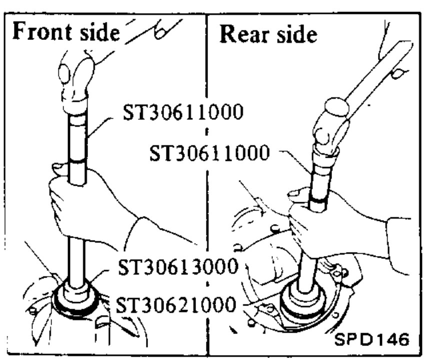


6. Press fit side bearing inner race into differential case, **using Tool.**



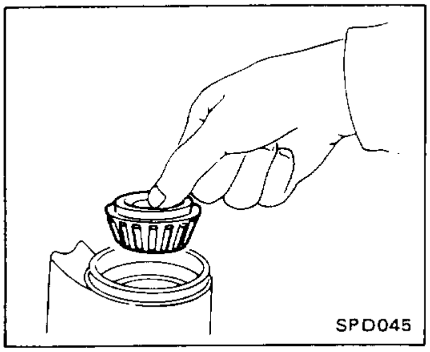
DIFFERENTIAL CARRIER

1. Press fit front and rear bearing outer races **using Tools.**



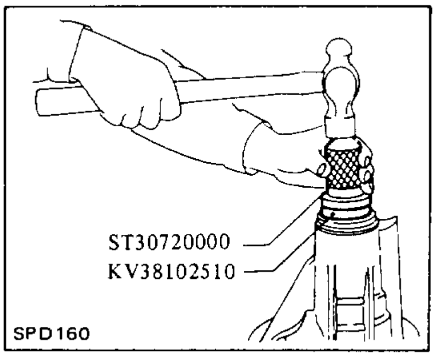
2. Adjust pinion height.
Refer to Pinion Height Adjustment.

3. **Lubricate** front bearing with gear oil and place it in gear carrier.

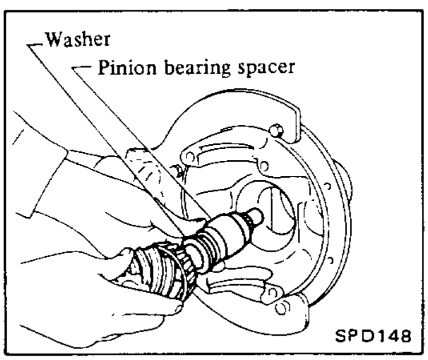


4. **Using Tool,** carefully fit a **new** oil seal into carrier.

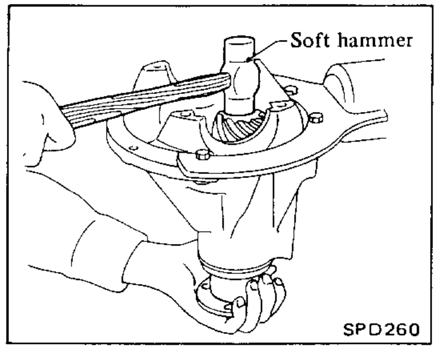
Make sure oil seal is flush with end of carrier and apply multi-purpose grease into cavity between lips.



5. Place a washer and a pinion bearing spacer on drive pinion and **lubricate** rear bearing with gear oil, and insert it in gear carrier.

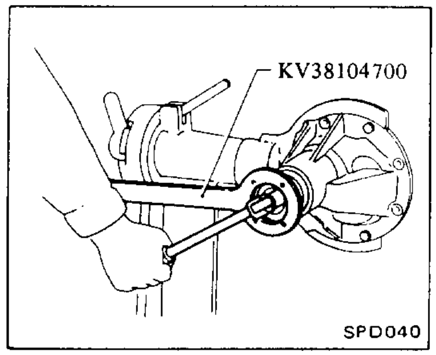


6. Install companion flange and hold it firmly. Insert drive pinion into companion flange by tapping its head with a soft hammer.



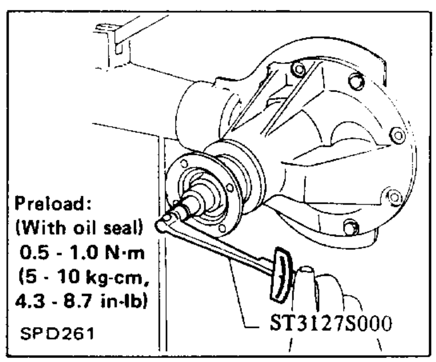
7. Hold companion flange with Tool and temporarily tighten pinion nut, until there is no axial play.

Ascertain that threaded nut is free from oil or grease.



8. 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 to set bearing rollers.

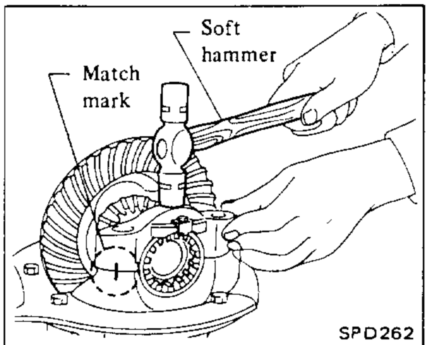


Ⓣ : Drive pinion nut
196 - 245 N·m
(20 - 25 kg-m,
145 - 181 ft-lb)

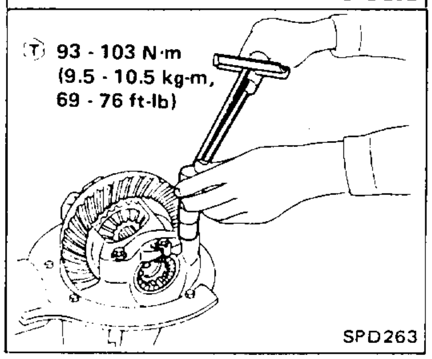
9. Install differential case assembly and side bearing outer races into differential carrier, and install side bearing cap and side bearing adjusters. **Refer to Side Bearing Adjustment.**

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.



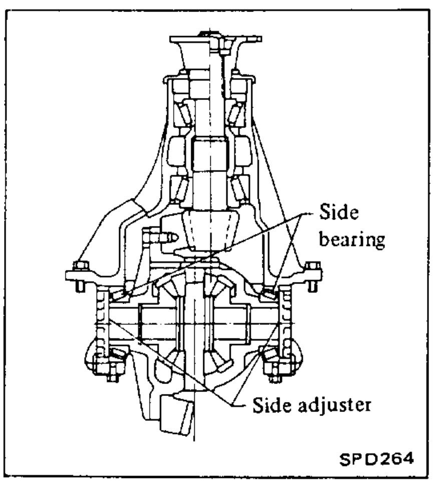
SPD262



SPD263

ADJUSTMENT

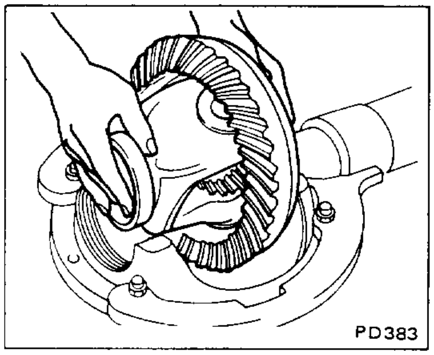
SIDE BEARING ADJUSTMENT



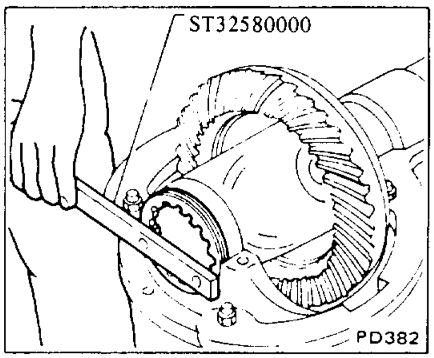
SPD264

1. Install differential case to gear carrier together with side bearing outer races.

Care should be taken not to confuse the right and left sides of side bearing outer races.

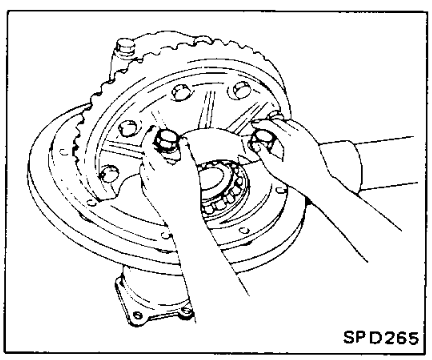

PD383

2. Position side bearing adjusters on gear carrier with threads properly engaged; screw in adjusters lightly at this stage of assembly.

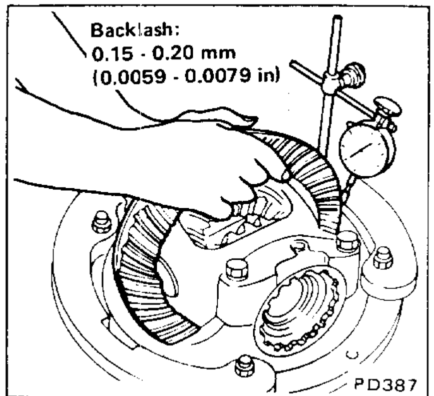


PD382

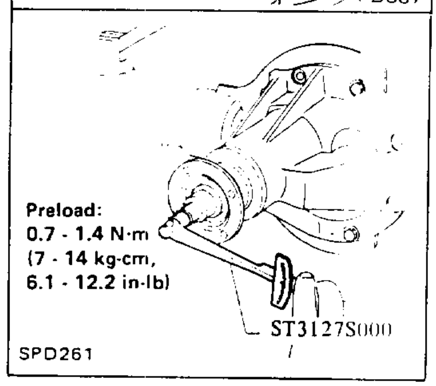
3. Align the marks on side bearing cap with these on gear carrier, and install side bearing cap on carrier. Screw in side bearing cap bolt, **but do not tighten at this point to allow further tightening of side bearing adjusters.**


SPD265

4. Tighten both right and left side bearing adjusters alternately and measure ring gear backlash and total preload at the same time. Adjust right and left side bearing adjusters by tightening them alternately so that proper ring gear backlash and total preload can be obtained.



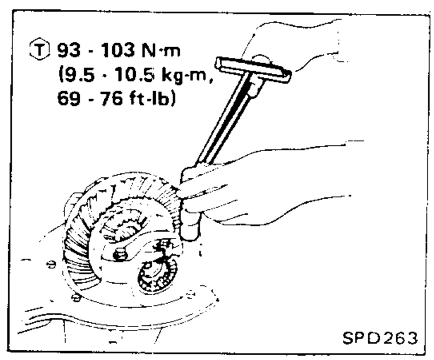
PD387



SPD261

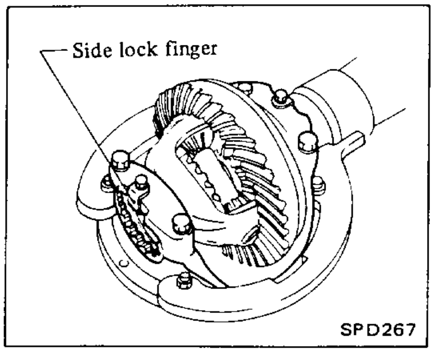
Prior to measuring preload, lightly tap around housing to locate bearings correctly.

5. Tighten side bearing cap bolts.



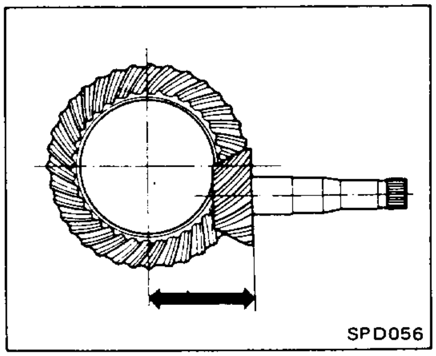
SPD263

6. Install side lock finger in place and bend down its locking tab against the groove in side bearing adjuster to prevent rotation during operation.



SPD267

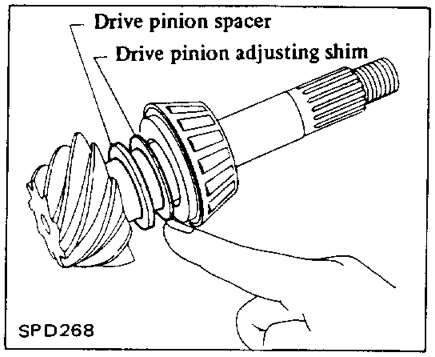
PINION HEIGHT ADJUSTMENT



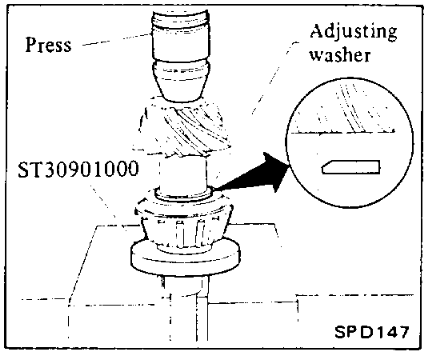
SPD056

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 shim and spacer to be installed between the rear bearing inner race and the drive pinion head.



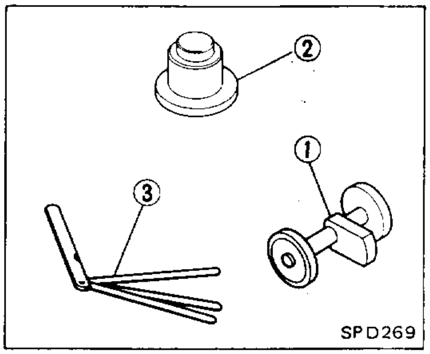
SPD268



SPD147

– Required Tools –

① Height Gauge (ST31251000)
② Dummy Shaft (ST31181001)
③ Feeler Gauge



SPD269

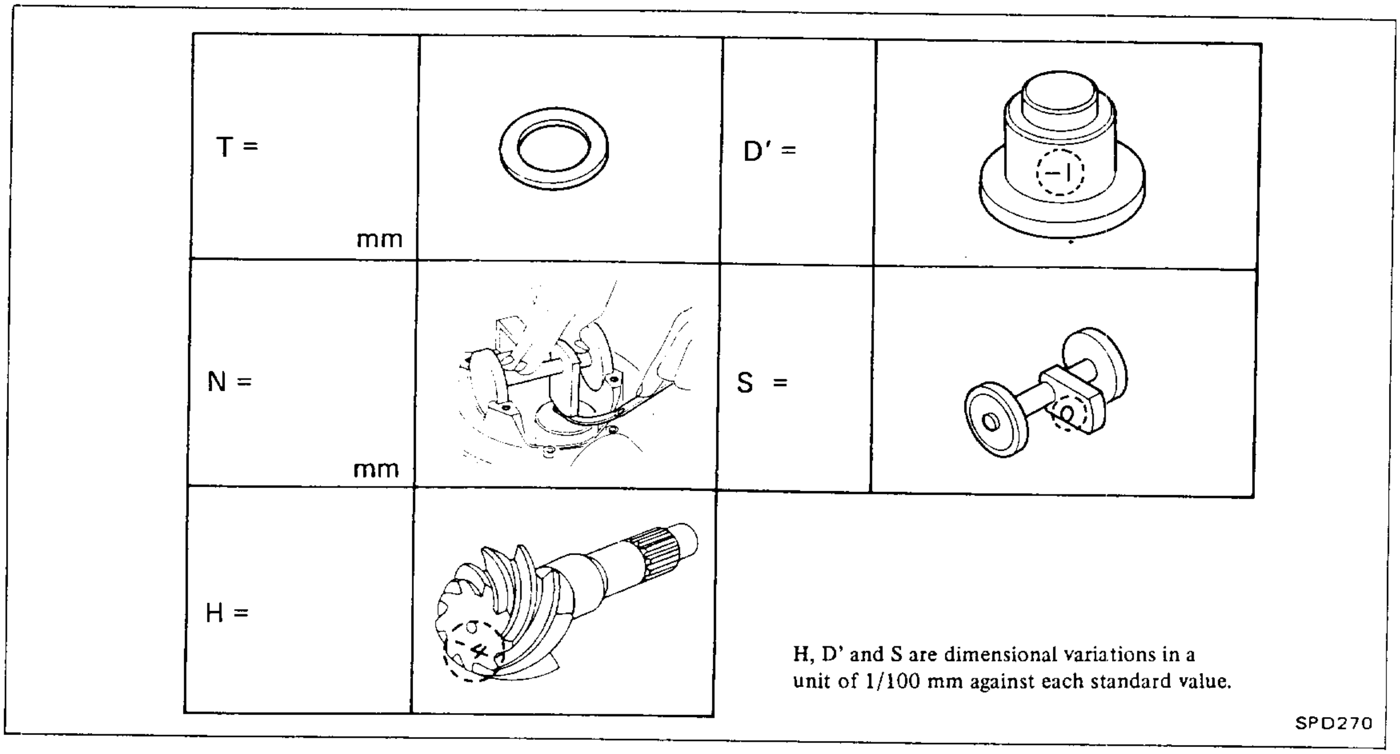
1. Thickness of washer can be calculated by following equation.

$$T = N - [(H - D' - S) \times 0.01] + 0.55$$

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.

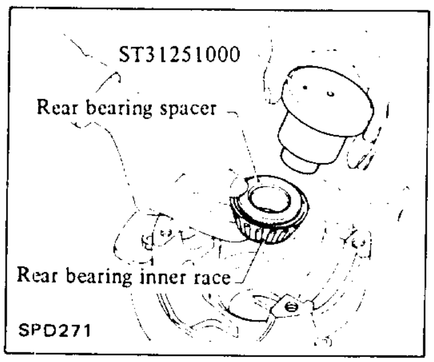
Where:



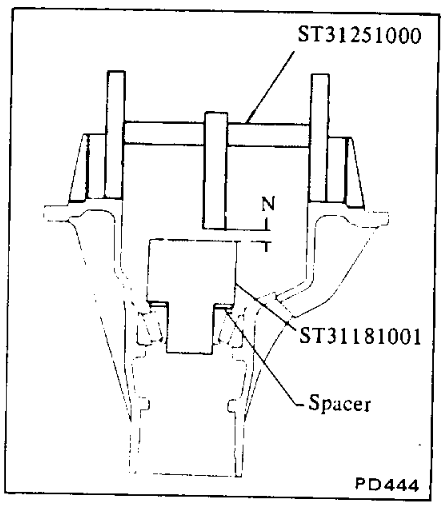
H, D' and S are dimensional variations in a unit of 1/100 mm against each standard value.

SPD270

2. Assemble dummy shaft and rear bearing spacer on rear bearing inner race, and fit it into carrier.

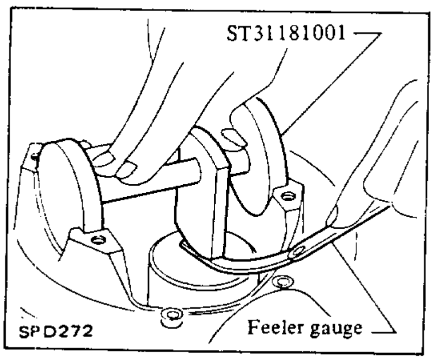


SPD271



PD444

3. Attach Height Gauge to carrier.
Using a feeler gauge, measure the clearance between the height gauge tip and the dummy shaft face.



SPD272

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, re-adjust.

Example:

N = 0.31
H = 2
D' = −1
S = 0

T = N − [(H − D' − S) × 0.01] + 0.55
= 0.31 − [(2 − (−1) −0) × 0.01] + 0.55

(1) H 2
−D' .... − (−1)
3
−S .... −0
3

(2) 3
× 0.01
0.03

(3) N 0.31
−0.03
0.28

(4) 0.28
+0.55
0.83

∴ T = 0.83

5. Select the proper shims **(Refer to S.D.S.)**.

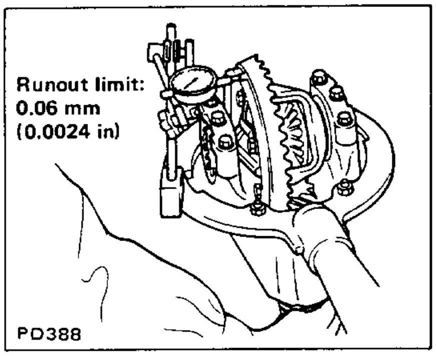
If you cannot find the desired thickness of shims, use shims so that the total thickness is the closest to the calculated value.

Example:

Calculated value T = 0.83 mm		
Used shims		
Thickness	Quantity	
0.40 ×	1	= 0.40
0.45 ×	1	= 0.45
Total thickness		0.85 mm

FINAL VERIFICATION

1. 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.

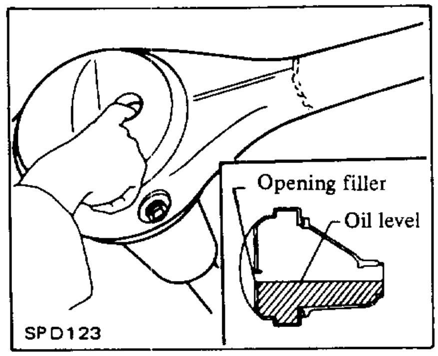
If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

2. Install the differential carrier in the vehicle **(Refer to Section RA for installation).**

Gasket should be replaced by new one each time the differential carrier is removed.

Then fill with gear oil.

With limited slip differentials, use Gear Oil Hypoid L.S.D. (Service part number: KL430-14002-03).

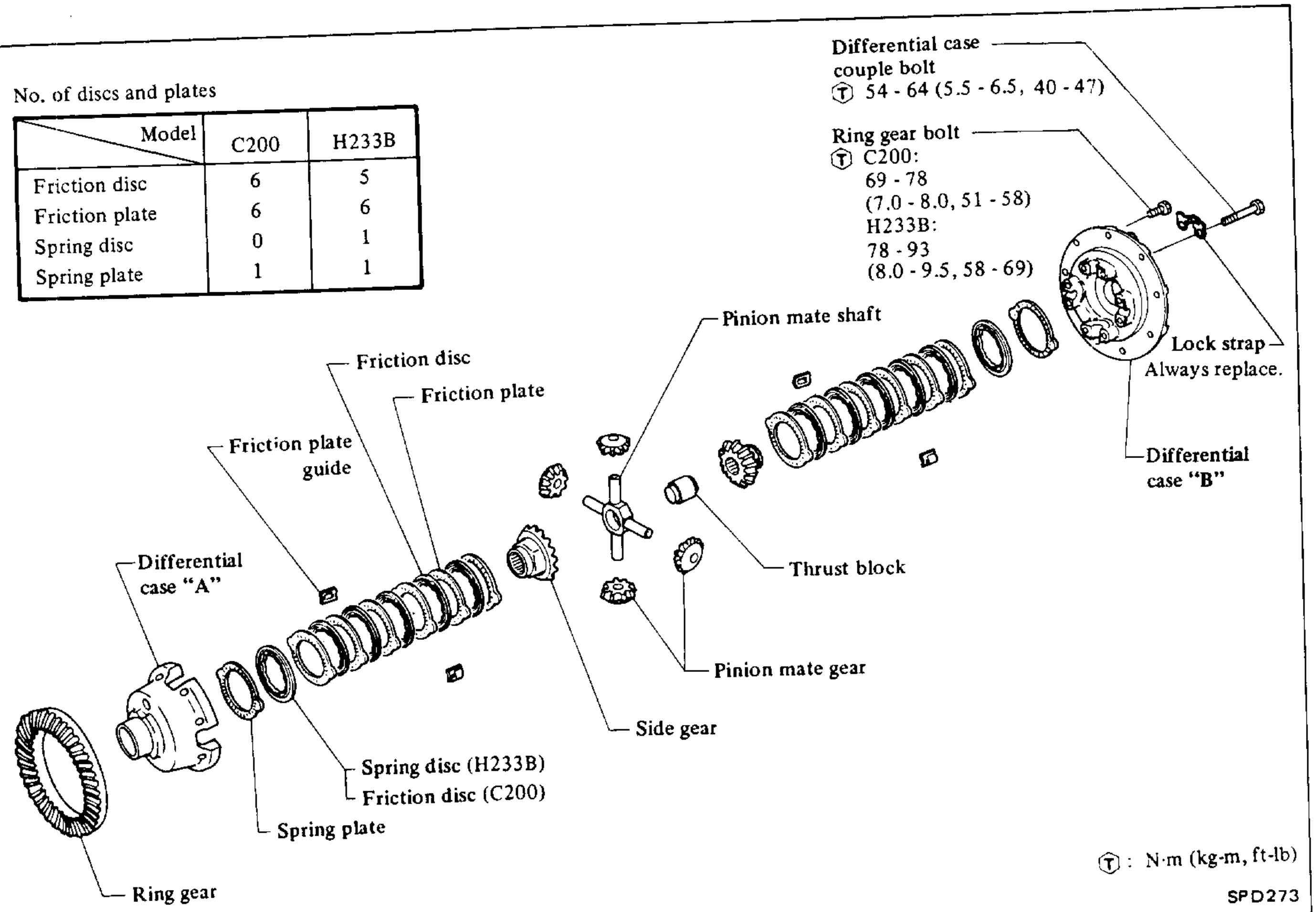


Ⓣ : Differential carrier fixing nut
27 - 36 N·m
(2.8 - 3.7 kg-m,
20 - 27 ft-lb)
Drain and filler plugs
59 - 98 N·m
(6 - 10 kg-m,
43 - 72 ft-lb)
Gear oil capacity
2.0 liters
(3-1/2 Imp pt)

LIMITED SLIP DIFFERENTIAL

No. of discs and plates

Model	C200	H233B
Friction disc	6	5
Friction plate	6	6
Spring disc	0	1
Spring plate	1	1



SPD273

CAUTION:
When jacking up vehicle equipped with this unit, be sure to jack up both rear wheels before starting engine.

PREPARATION FOR DISASSEMBLY

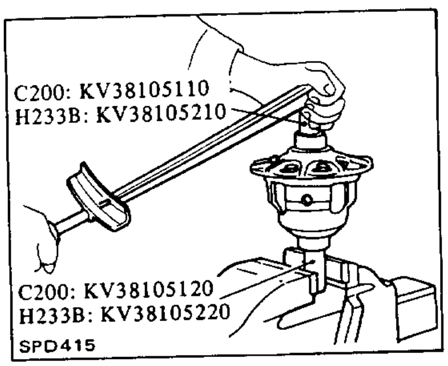
REMOVAL, PRE-DISASSEMBLY INSPECTION AND TOOTH CONTACT

Refer to Differential Carrier (Final drive).

CHECKING PRELOAD

Check the limited slip differential for preload using **Tool**.

Preload:
- C200
  - 147 - 216 N·m (15 - 22 kg-m, 108 - 159 ft-lb)
- H233B
  - 294 - 392 N·m (30 - 40 kg-m, 217 - 289 ft-lb)



SPD415

DISASSEMBLY

DIFFERENTIAL CARRIER

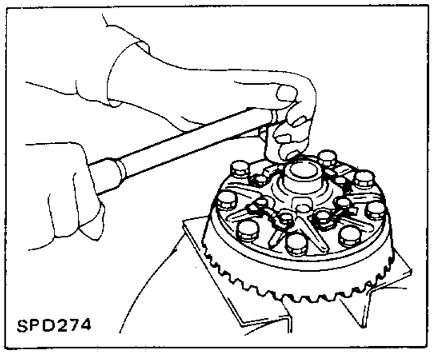
Refer to Differential Carrier (Final drive).

DIFFERENTIAL CASE

1. Remove side bearing inner race using Tool.

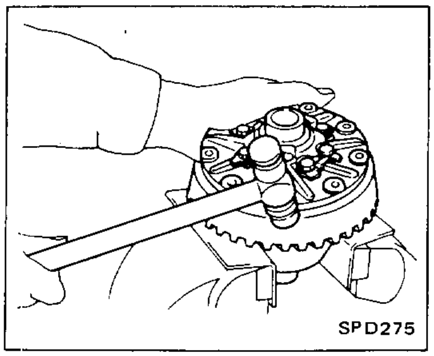
   Refer to Differential Carrier (Final drive) for disassembly.

2. Remove ring gear by spreading out lock straps (H233B only) and loosening ring gear bolts in a criss-cross fashion.

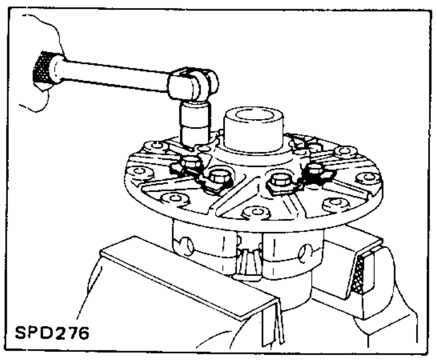

SPD274

3. Tap ring gear off gear case using a soft hammer.

Tap evenly all around to keep ring gear from binding.

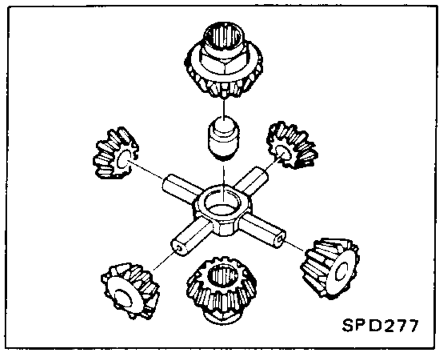

SPD275

4. Spread out lock straps. Then loosen differential case couple bolts and remove differential case "B" on ring gear side.


SPD276

5. Separate each part.

Put marks on gears so that they can be reinstalled in their original positions from which they were removed.


SPD277

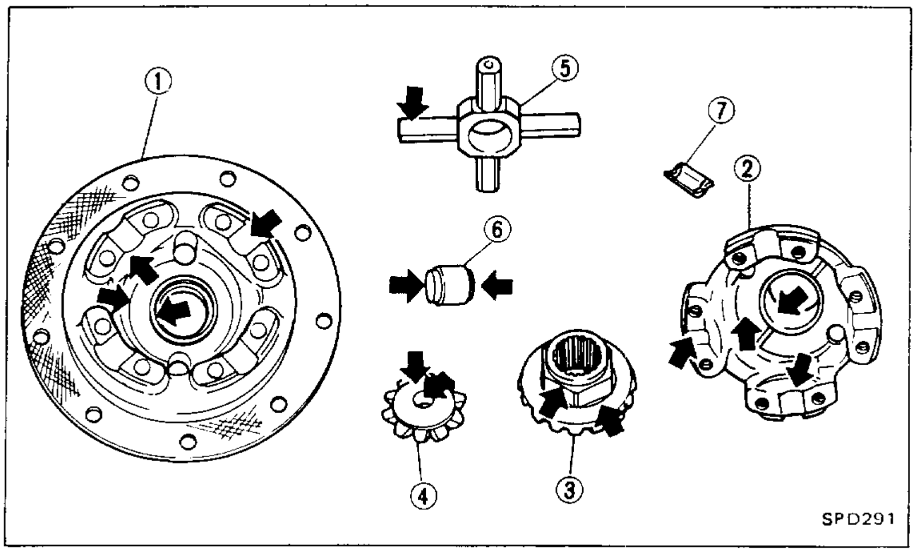
INSPECTION

CONTACT SURFACES

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found with burrs or scratches, smooth with oil stone.

① Differential case "A" (Ring gear side)
② Differential case "B" (Opposite side of ring gear)
③ Side gear
④ Pinion mate gear
⑤ Pinion mate shaft
⑥ Thrust block
⑦ Friction plate guide

Repair or replace damaged or faulty parts.

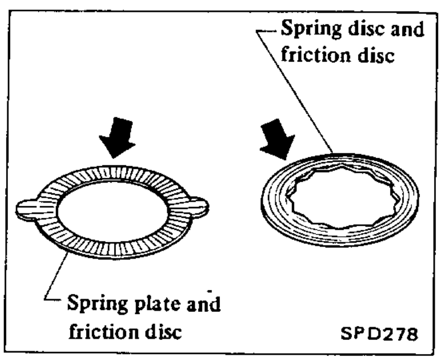


SPD291

DISC AND PLATE

1. Clean the discs and plates in suitable solvent and blow dry with compressed air.
2. Inspect each disc and plate for wear, nicks or burrs.

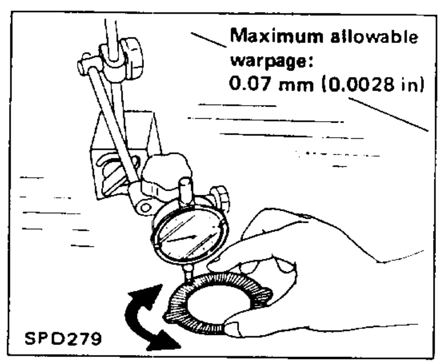
Replace with new parts if worn or damaged.



SPD278

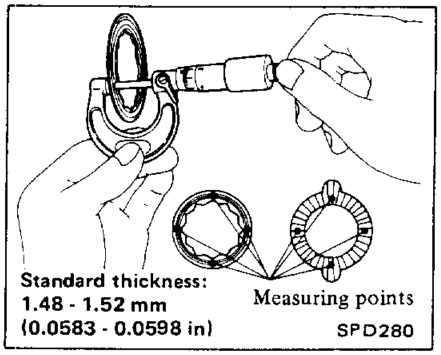
3. Inspect each disc and plate for distortion.

If it exceeds above limits, replace with a new disc or plate to eliminate possibility of clutch slippage or sticking.



SPD279

4. Measure thickness of friction disc, friction plate, spring disc and spring plate in 4 places as shown in the figure and compute mean value. If excessively worn, replace.



SPD280

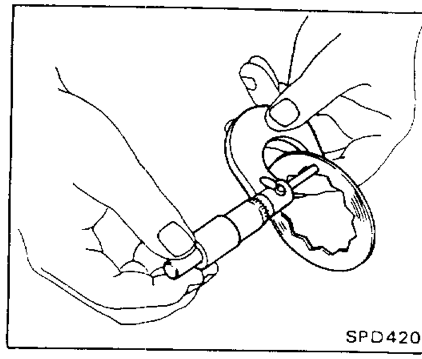
ADJUSTMENT

FRICTION DISC AND FRICTION PLATE END PLAY

End play of friction disc and friction plate can be calculated by using following equation and should be adjusted within following range.

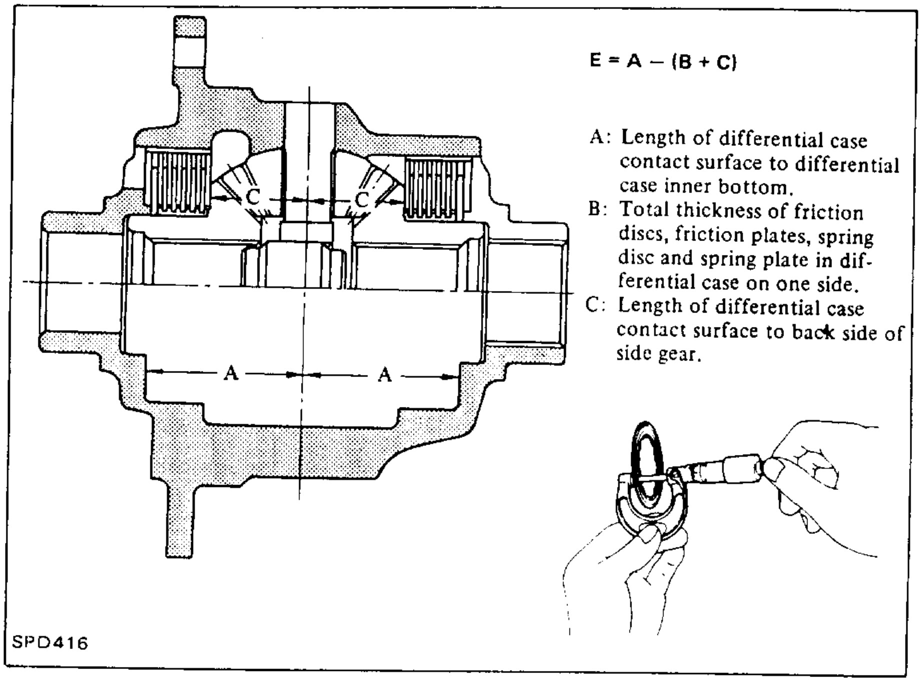
Adjustment can be made by selecting friction disc having two different thicknesses.

End play E:
0.10 - 0.30 mm
(0.0039 - 0.0118 in)


SPD420

No. of discs and plates

Model	C200	H233B
Friction disc	6	5
Friction plate	6	6
Spring disc	0	1
Spring plate	1	1



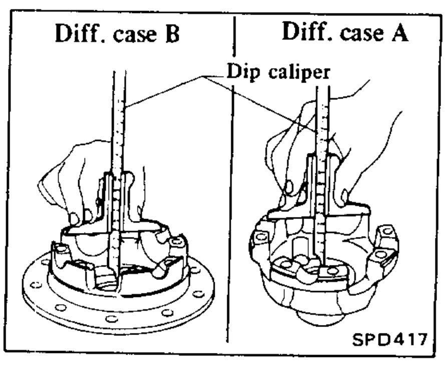
E = A − (B + C)

A: Length of differential case contact surface to differential case inner bottom.
B: Total thickness of friction discs, friction plates, spring disc and spring plate in differential case on one side.
C: Length of differential case contact surface to back side of side gear.

SPD416

1. Measure values of "A".

Standard length A:
49.50 - 49.55 mm
(1.9488 - 1.9508 in)



SPD417

2. Measure thickness of each disc and plate.

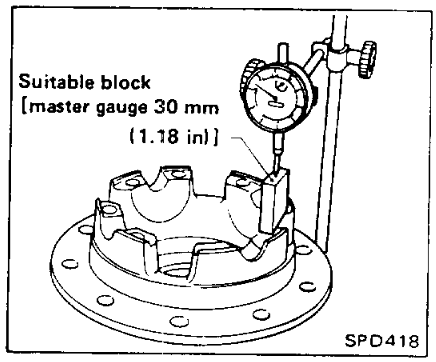
Total thickness "B":
H233B
19.24 - 20.26 mm
(0.7575 - 0.7976 in)
C200
19.24 - 20.36 mm
(0.7575 - 0.8016 in)

3. Measure values of "C".

(1) Attach a dial indicator to the base plate.

(2) Place differential case B on the base plate, and install a master gauge on case B.

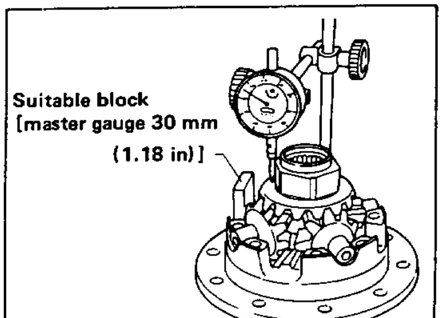
Then adjust the dial indicator scale to zero with its tip on the master gauge.



SPD418

(3) Install pinion mate gears, side gears and pinion mate shaft in differential case B.

(4) Set dial indicator's tip on the side gear, and read the indication.



SPD419

Example:

$$
\begin{aligned}
E &= A - D \\
&= A - (B + C) \\
&= 0.1 \text{ to } 0.3 \text{ mm} \\
&\quad (0.004 \text{ to } 0.012 \text{ in}) \\
A &= 49.52 \text{ mm } (1.9496 \text{ in}) \\
B &= 19.45 \text{ mm } (0.7657 \text{ in}) \\
C &= 29.7 \text{ mm } (1.169 \text{ in}) \\
D &= B + C
\end{aligned}
$$

$$
\begin{array}{rl}
B \ldots & 19.45\ (0.7657) \\
+\ C \ldots & 29.7\ (1.169) \\
\hline
& 49.15\ (1.9347)
\end{array}
$$

$$E = A - D$$

$$
\begin{array}{rl}
A \ldots & 49.52\ (1.9496) \\
-\ D \ldots & 49.15\ (1.9347) \\
\hline
& 0.37\ (0.0149)
\end{array}
$$

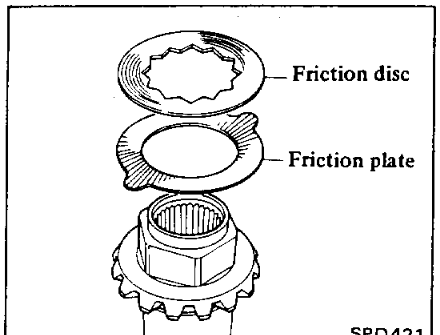
From the above equation, end play of 0.37 mm (0.0149 in) exceeds the specified range of 0.1 to 0.3 mm (0.004 to 0.012 in). Select suitable discs and plates to adjust correctly.

ASSEMBLY

Prior to assembling discs and plates, properly lubricate them by dipping them **in limited slip differential oil.**

1. Alternately position specified number of friction plates and friction discs on rear of side gear.

Always position a friction plate first on rear of side gear.



SPD421

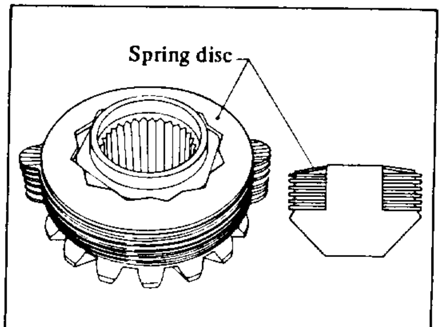
No. of friction plates and friction discs

Model	C200	H233B
Friction plates	6	6
Friction discs	6	5

2. Install spring disc. (Model H233B differential only)

a. Align the twelve angular holes in spring disc with the hexagonal area of the side gear.

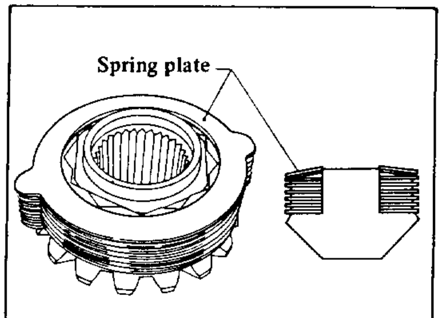
b. Always position side gear correctly (See Figure).



SPD422

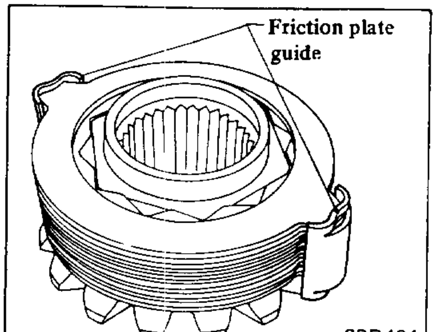
3. Install spring plate.

Always position side gear correctly (See Figure).



SPD423

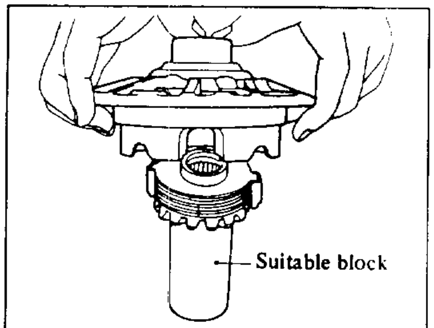
4. Install friction plate guides.



SPD424

Correctly align the raised portions of friction plates, and apply grease to inner surfaces of friction plate guides to prevent them from falling.

5. Install differential case B over side gear, discs, plates and friction plate guide assembly.

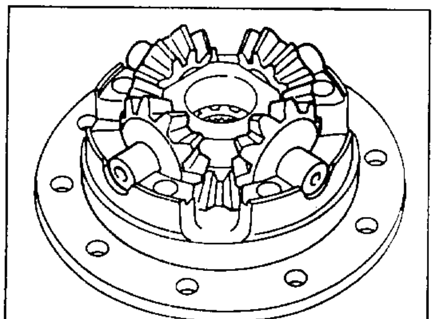


SPD425

a. Install differential case B while supporting friction plate guides with your middle finger inserted through oil hole in differential case.

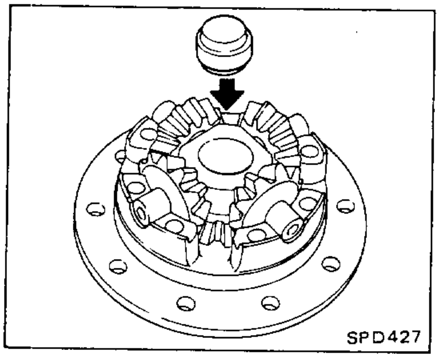
b. Be careful not to detach spring disc from the hexagonal part of the side gear.

6. Install pinion mate gears and pinion shaft to differential case B.

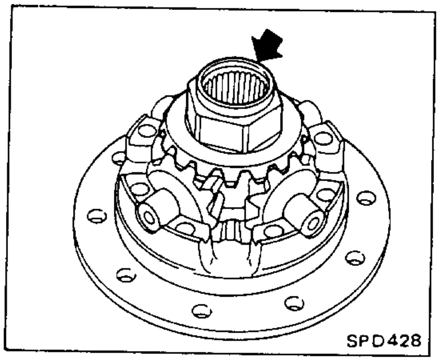


SPD426

7. Install thrust block.

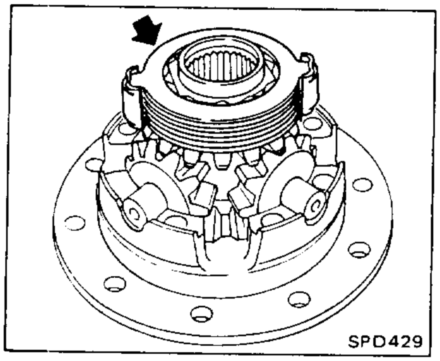


8. Install side gear to pinion mate gears.



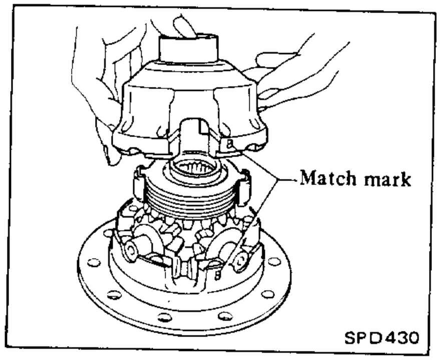
9. Install each disc and plate.

Use same procedures as outlined in steps 1. through 4. above.

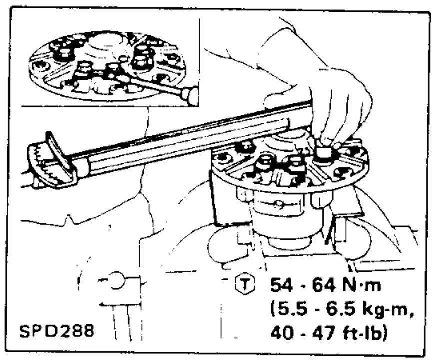


10. Install differential case A.

Position differential cases A and B by correctly aligning marks stamped on cases.



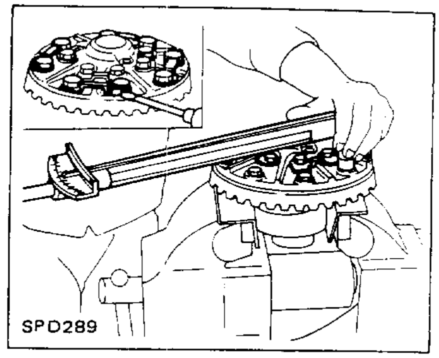
11. Tighten differential case bolts.



12. 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.



Ⓣ : Ring gear bolt
C200
69 - 78 N·m
(7 - 8 kg-m,
51 - 58 ft-lb)
H233B
78 - 93 N·m
(8.0 - 9.5 kg-m,
58 - 69 ft-lb)

13. Install the shims behind each bearing and press on the bearings, using **Tool. Refer to Differential Carrier (Final drive) for assembly.**

14. Check preload of differential case clutch mechanism.

Refer to Checking Preload (Preparation for disassembly).

SERVICE DATA AND SPECIFICATIONS

PROPELLER SHAFT

GENERAL SPECIFICATIONS

Primary propeller shaft and front propeller shaft

Applied model	Primary propeller shaft (L28 engine, long wheelbase)		Front propeller shaft		
			P40 and SD33 engine	L28 engine	
	M/T	A/T		Short wheelbase	Long wheelbase
Model	2S80B		2F80B	2F80B-D	
Number of joints	2			3	
Coupling method with transmission or transfer	Transmission side: Sleeve type Transfer side: Flange type		Flange type		
Distance between yokes mm (in)	80 (3.15)				
Type of journal bearing	Solid type (Disassembly type)				
Shaft length (Spider to spider) mm (in)	158 (6.22)	68 (2.68)	600 (23.62) *1 650 (25.59) *2	510 (20.08)	895 (35.24)
Shaft outer diameter mm (in)	45 (1.77)				

*1: Model 160
*2: Model 61

Rear propeller shaft

Applied model	Hardtop		High-roof Hardtop				Pick-up, Van, Station Wagon		Canvas Top	
			Light duty model		Heavy duty model					
	P40 and SD33 engine	L28 engine	P40 and SD33 engine	L28 engine	P40 and SD33 engine	L28 engine	P40 and SD33 engine	L28 engine	Light duty model	Heavy duty model
Model	2F80B									
Number of joints	2									
Coupling method with transfer	Flange type									
Distance between yokes mm (in)	80 (3.15)									
Type of journal	Solid type (Disassembly type)									
Shaft length [Spider to spider] mm (in)	616 (24.25)	690 (27.17)	616 (24.25)	690 (27.17)	590 (23.23)	665 (26.18)	1,210 (47.64)	910 (35.83)	710 (27.95)	690 (27.17)
Shaft outer diameter mm (in)	75 (2.95)									

SERVICE DATA

Unit: mm (in)

Propeller shaft runout limit	0.6 (0.024)
Journal axial play	Less than 0.02 (0.0008)

Snap ring (2F80B)

Unit: mm (in)

Tickness	Color	Part number
1.49 (0.0587)	White	39646 - 21001
1.52 (0.0598)	Yellow	39647 - 21001
1.55 (0.0610)	Red	39648 - 21001
1.58 (0.0622)	Green	39649 - 21001
1.61 (0.0634)	Blue	39646 - 21002
1.64 (0.0646)	Light brown	39647 - 21002
1.67 (0.0657)	Black	39648 - 21002

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Propeller shaft to differential carrier or transfer	78 - 88	8 - 9	58 - 65

DIFFERENTIAL CARRIER

GENERAL SPECIFICATIONS

Front differential carrier

*1: Middle East *2: High-roof Hardtop

Applied model	Hardtop and High-roof Hardtop						Pick-up			Van and Station Wagon		Canvas Top	
	Light duty model			Heavy duty model									
	P40 engine	SD33 engine	L28 engine	P40 engine	SD33 engine	L28 engine	P40 engine	SD33 engine	L28 engine	P40 engine	SD33 and L28 engine	Light duty model	Heavy duty model
Model	C200												
Type	Cast center												
Ring gear pitch diameter mm (in)	200 (7.87)												
Gear ratio	3.364	4.111	4.375 4.625*2	4.111 3.900*1	4.625		4.111 3.900*1	4.625	4.625 4.875*1	3.900	4.625	3.364	4.111
Number of teeth (Ring gear/Drive gear)	37/11	37/9	35/8 37/8*2	37/9 39/10*1	37/8		37/9 39/10*1	37/8	37/8 39/8*1	39/10	37/8	37/11	37/9
Oil capacity liter (Imp. pt)	1.3 (2-1/4)												

Rear differential carrier

*1: Middle East *2: High-roof Hardtop

Applied model	Hardtop and High-roof Hardtop						Pick-up			Van and Station Wagon		Canvas Top	
	Light duty model			Heavy duty model									
	P40 engine	SD33 engine	L28 engine	P40 engine	SD33 engine	L28 engine	P40 engine	SD33 engine	L28 engine	P40 engine	SD33 and L28 engine	Light duty model	Heavy duty model
Model	C200			H233B								C200	H233B
Type	Cast center			Rigid axle suspension								Cast center	Rigid axle suspension
Ring gear pitch diameter mm (in)	200 (7.87)			233 (9.17)								200 (7.87)	233 (9.17)
Gear ratio	3.364	4.111	4.375 4.625*2	4.111 3.900*1	4.625		4.111 3.900*1	4.625	4.625 4.875*1	3.900	4.625	3.364	4.111
Number of teeth (Ring gear/Drive gear)	37/11	37/9	35/8 37/8*2	37/9 39/10*1	37/8		37/9 39/10*1	37/8	37/8 39/8*1	39/10	37/8	37/11	37/9
Oil capacity liter (Imp. pt)	1.3 (2-1/4)			2.0 (3-1/2)								1.3 (2-1/4)	2.0 (3-1/2)

SERVICE DATA

Model			C200	H233B
Drive pinion bearing adjusting method			Collapsible spacer	Solid spacer
Drive pinion preload (With front oil seal)		N·m (kg-cm, in-lb)	1.1 - 1.7 (11 - 17, 9.5 - 14.8)	0.5 - 1.0 (5 - 10, 4.3 - 8.7)
Side bearing adjusting method			Shim	Side adjuster
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)	0.10 - 0.20 (0.0039 - 0.0079)	0.15 - 0.20 (0.0059 - 0.0079)
Ring gear runout limit		mm (in)	0.05 (0.0020)	0.06 (0.0024)
Total preload		N·m (kg-cm, in-lb)	1.2 - 2.3 (12 - 23, 10 - 20)	0.7 - 1.4 (7 - 14, 6.1 - 12.2)

Side gear thrust washer

Unit: mm (in)

Model	Thickness	Part number
C200	0.775 (0.0305)	38424 - N3100
	0.825 (0.0325)	38424 - N3101
	0.875 (0.0344)	38424 - N3102
H233B	1.60 (0.0630)	38424 - T4000
	1.80 (0.0709)	38424 - T4001

Side bearing adjusting shim (C200)

Unit: mm (in)

Thickness	Part number
2.00 (0.0787)	38453 - N3100
2.05 (0.0807)	38453 - N3101
2.10 (0.0827)	38453 - N3102
2.15 (0.0846)	38453 - N3103
2.20 (0.0866)	38453 - N3104
2.25 (0.0886)	38453 - N3105
2.30 (0.0906)	38453 - N3106
2.35 (0.0925)	38453 - N3107
2.40 (0.0945)	38453 - N3108
2.45 (0.0965)	38453 - N3109
2.50 (0.0984)	38953 - N3110
2.55 (0.1004)	38453 - N3111
2.60 (0.1024)	38453 - N3112

Pinion height adjusting washer (C200)

Unit: mm (in)

Thickness	Part number
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 - E4614
3.66 (0.1441)	38154 - E4615

Front bearing shim (H233B)

Unit: mm (in)

Thickness	Part number
0.40 (0.0157)	24127 - 4301P
0.45 (0.0177)	24127 - 4302P
0.50 (0.0197)	24127 - 4303P
0.55 (0.0217)	24127 - 4304P
0.60 (0.0236)	24127 - 4305P
0.65 (0.0256)	24127 - 4306P
0.70 (0.0276)	24127 - 4307P
0.75 (0.0295)	24127 - 4308P

Rear bearing shim (H233B)

Unit: mm (in)

Thickness	Part number
0.40 (0.0157)	24128 - 6401P
0.45 (0.0177)	24128 - 6402P
0.50 (0.0197)	24128 - 6403P
0.55 (0.0217)	24128 - 6404P
0.60 (0.0236)	24128 - 6405P
0.65 (0.0256)	24128 - 6406P
0.70 (0.0276)	24128 - 6407P
0.75 (0.0295)	24128 - 6408P

DISCS AND PLATES (Limited slip differential)

Unit: mm (in)

Part name	Thickness	Part number
Friction plate	1.48 - 1.52 (0.0583 - 0.0598)	38432 - C6000
Friction disc	1.48 - 1.52 (0.0583 - 0.0598)	38433 - C6000 (Standard type)
	1.58 - 1.62 (0.0622 - 0.0638)	38433 - C6001 (Adjusting type)
Spring disc	1.48 - 1.52 (0.0583 - 0.0598)	38436 - C6000
Spring plate	1.48 - 1.52 (0.0583 - 0.0598)	38435 - C6000

TIGHTENING TORQUE

Model	C200			H233B		
Unit	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
Drive pinion nut	127 - 294	13 - 30	94 - 217	196 - 245	20 - 25	145 - 181
Ring gear bolt	69 - 78	7 - 8	51 - 58	78 - 93	8.0 - 9.5	58 - 69
Side bearing cap bolt	88 - 98	9 - 10	65 - 72	93 - 103	9.5 - 10.5	69 - 76
Drain and filler plugs	39 - 59	4 - 6	29 - 43	59 - 98	6 - 10	43 - 72
Differential carrier to propeller shaft	78 - 88	8 - 9	58 - 65	78 - 88	8 - 9	58 - 65
Differential carrier to rear axle case (H233B)	–	–	–	27 - 36	2.8 - 3.7	20 - 27
Differential carrier rear cover bolt (C200)	11 - 14	1.1 - 1.4	8 - 10	–	–	–
Differential case couple bolt (Limited slip differential)	54 - 64	5.5 - 6.5	40 - 47	54 - 64	5.5 - 6.5	40 - 47

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.
	Tight journal.	Tap yokes with hammer to free journal. Replace joint if unable to free or if journal feels rough when rotated by hand.
	Undercoating or mud on the shaft causing unbalance.	Clean up shaft.
	Tire unbalance.	Balance wheel and tire assembly or replace with correctly balanced tire.
	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.
	Loosen propeller shaft installation.	Retighten.
	Loose joint installation.	Replace journal assembly or adjust snap ring.

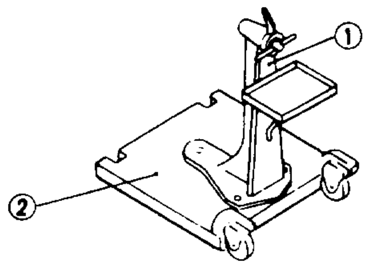
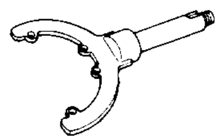
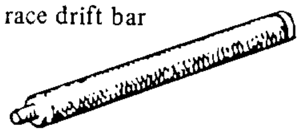
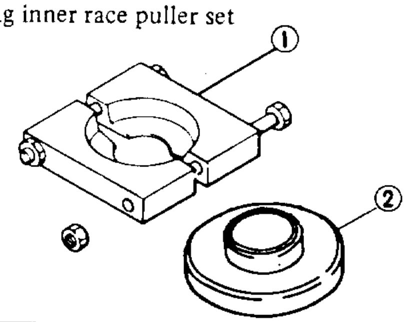
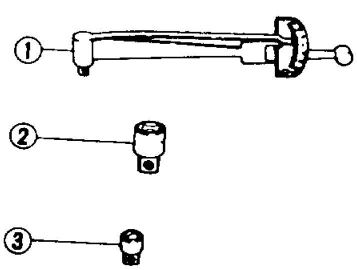
DIFFERENTIAL CARRIER

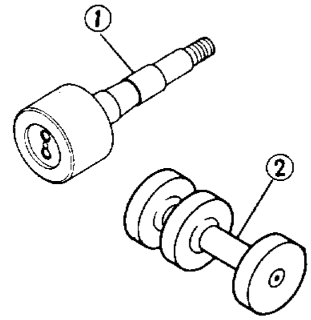
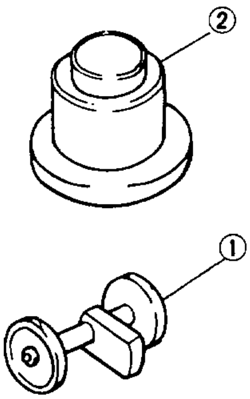
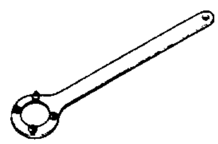
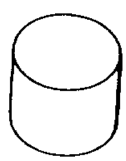
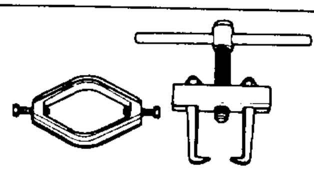
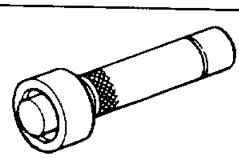
When a differential carrier is suspected of being noisy, it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, exhaust, universal joint, propeller shaft, wheel bearings, engine, transmission, transfer, or differential carrier. Noise which originates in other places cannot be corrected by adjustment or replacement of parts in differential carrier.

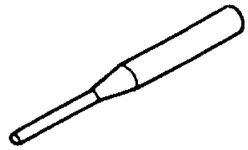
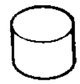
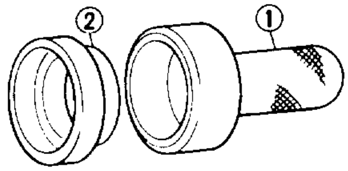
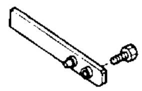
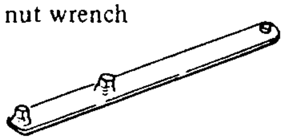
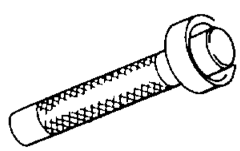
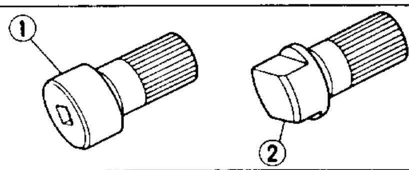
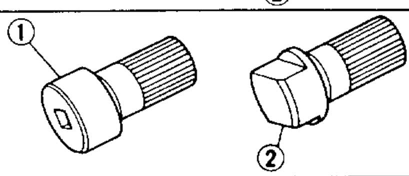
Condition	Probable cause	Corrective action
Noise on drive, coast and float.	Shortage of oil.	Supply gear oil. Rebuild gear carrier if necessary.
	Incorrect tooth contact between ring gear and drive pinion.	Adjust tooth contact or replace the hypoid gear set.
	Incorrect backlash between ring gear and 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.
	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.

Condition	Probable cause	Corrective action
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 or thrust block.	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 of 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, side oil seal, or bruised, dented or abnormally worn slide face or companion flange.	Replace damaged oil seal. Repair flange with sandpaper or replace if necessary.
	Loose bolts holding gear carrier.	Tighten the bolts to specified torque.
	Damaged gasket.	Replace.
	Loose filler or drain plug.	Tighten.
	Clogged or damaged breather.	Repair or replace.

SPECIAL SERVICE TOOLS

Tool number	Tool name	Unit application	
		C200	H233B
ST0501S000 ① ST05011000 ② ST05012000	Engine stand Engine stand Base 	–	X
ST06340000	Diff. attachment 	–	X
ST30611000	Drive pinion bearing outer race drift bar 	X	X
ST30613000	Drive pinion **front** bearing outer race drift 	X	X
ST30621000	Drive pinion **rear** bearing outer race drift 	X	X
ST3090S000 ① ST30031000 ② ST30901000	Drive pinion rear bearing inner race puller set Puller Base 	X	X
ST3127S000 ① GG91030000 ② HT62900000 ③ HT62940000	Preload gauge Torque wrench Socket adapter (1/2") Socket adapter (3/8") 	X	X

Tool number	Tool name	Unit application	
		C200	H233B
KV381039S0 ① KV38103910 ② KV38100120	Drive pinion setting gauge Dummy shaft Height gauge 	X	–
ST3125S000 ① ST31251000 ② ST31181001	Drive pinion setting gauge set Drive pinion height gauge Dummy shaft 	–	X
KV38104700	Drive pinion flange wrench 	X	X
ST32501000	Weight block 	X	X
ST33051001	Diff. side bearing puller 	X	X
ST33061000	Adapter 	X	X
ST33230000	Diff. side bearing drift 	X	X

Tool number	Tool name	Unit application	
		C200	H233B
KV31100300	Fork rod pin punch 	X	X
KV38102000	Master gauge [21.0 mm (0.827 in)] 	X	–
KV381025S0 ① ST30720000 ② KV38102510	Oil seal fitting tool Drift bar Drift 	X	X
KV38100140	Stopper 	X	–
ST32580000	Diff. side bearing adjusting nut wrench 	–	X
ST33190000	Diff. side bearing drift 	–	X
ST33081000	Side bearing puller adapter 	–	X
KV381051S0 ① KV38105110 ② KV38105120	Rear axle shaft dummy Torque wrench side Vice side 	X	–
KV381052S0 ① KV38105210 ② KV38105220	Rear axle shaft dummy Torque wrench side Vice side 	–	X

FRONT AXLE & FRONT SUSPENSION

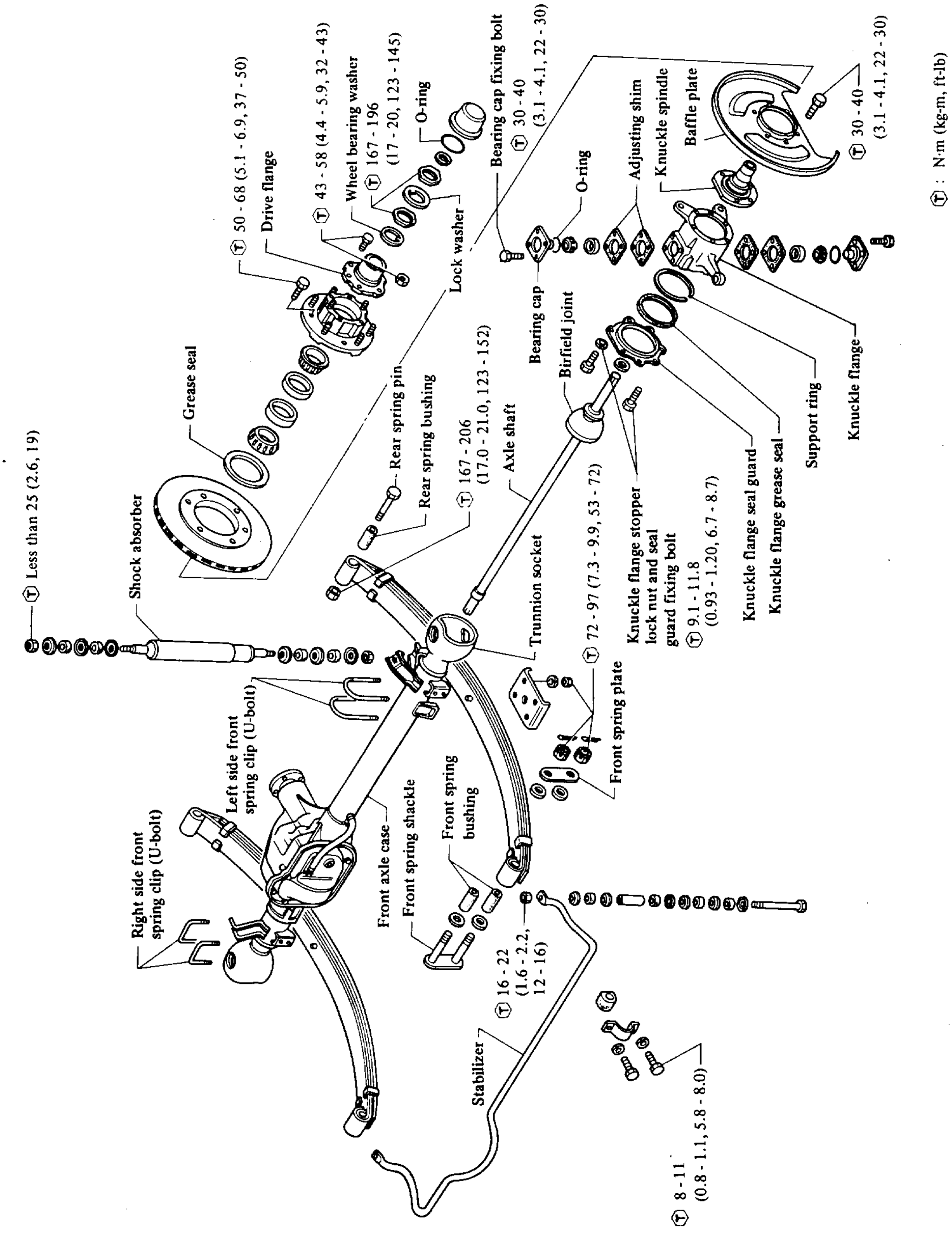
SECTION FA

CONTENTS

Refer to Section MA (Front Axle and Front Suspension) for:

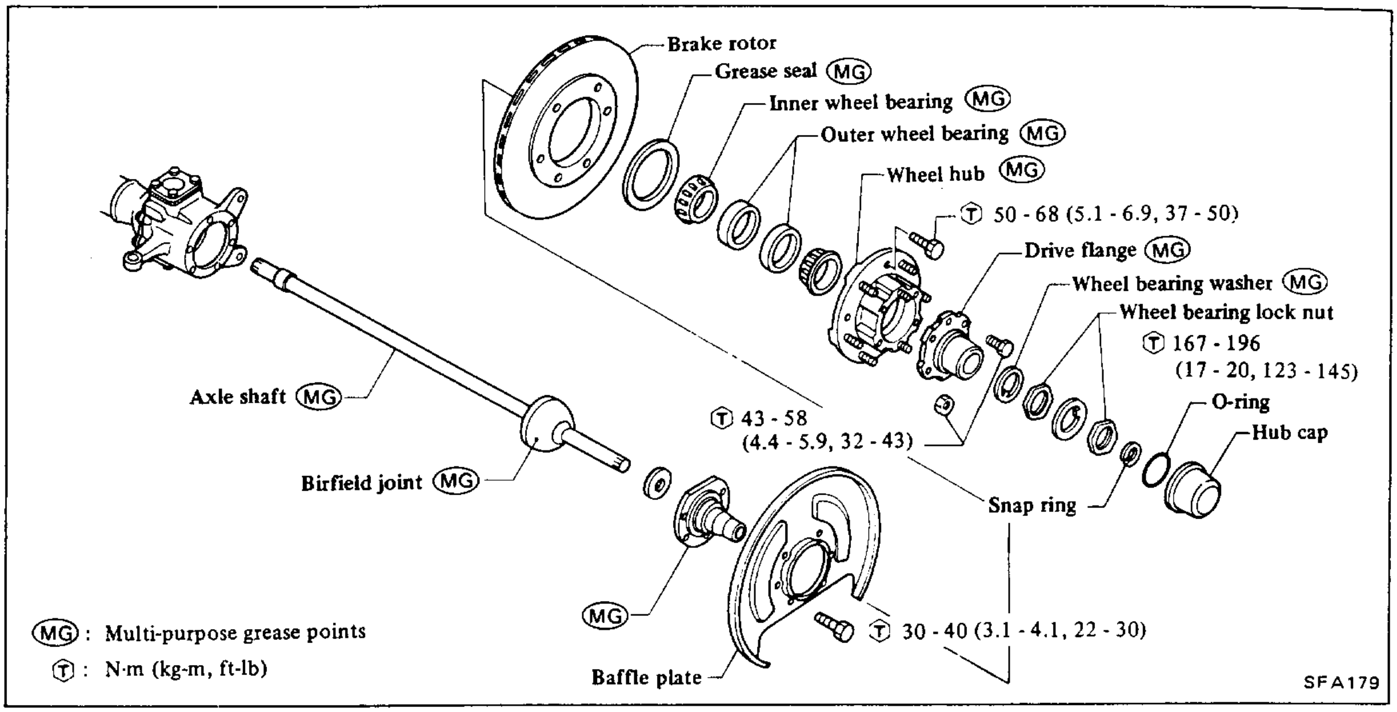
- ADJUSTING WHEEL BEARING PRELOAD
- CHECKING WHEEL ALIGNMENT

FRONT AXLE AND FRONT SUSPENSION SYSTEM



SFA178

FRONT AXLE

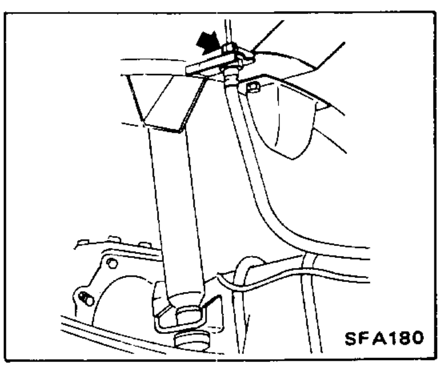


FRONT AXLE ASSEMBLY

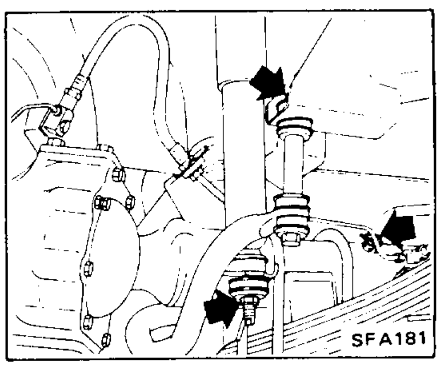
REMOVAL

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. Disconnect propeller shaft.
   Refer to Section PD for disconnecting propeller shaft.
4. Disconnect brake tube.

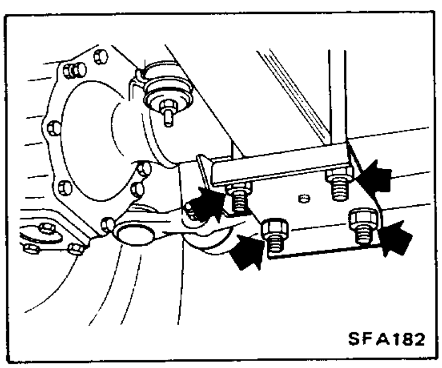
CATUION:
When removing or installing brake tubes, use Tool GG94310000.



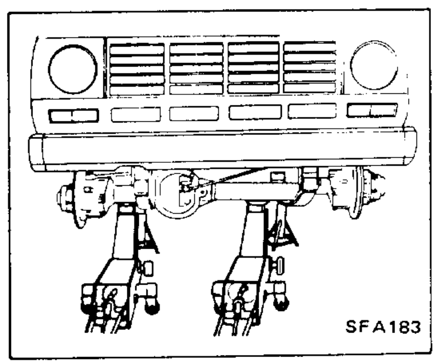
5. Jack up front suspension.
   Do not raise differential carrier.
6. Disconnect shock absorber lower ends and remove the stablizer bar connecting bolts. Remove air breather tube from engine compartment.



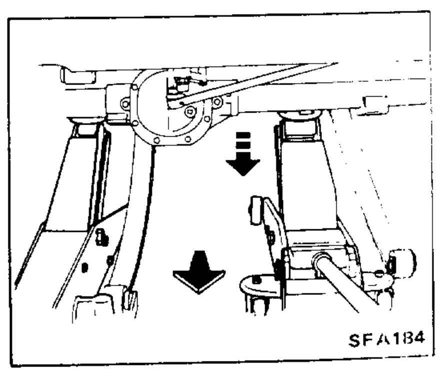
7. Disconnect tie rod ends.
   Refer to Section ST for disconnecting tie rod ends.
8. Remove U-bolts.



9. Support axle case with two jacks and remove front shackle pins, then lower leaf springs.



10. Slowly lower jacks, then pull axle case with jacks towards front of the vehicle.



INSPECTION

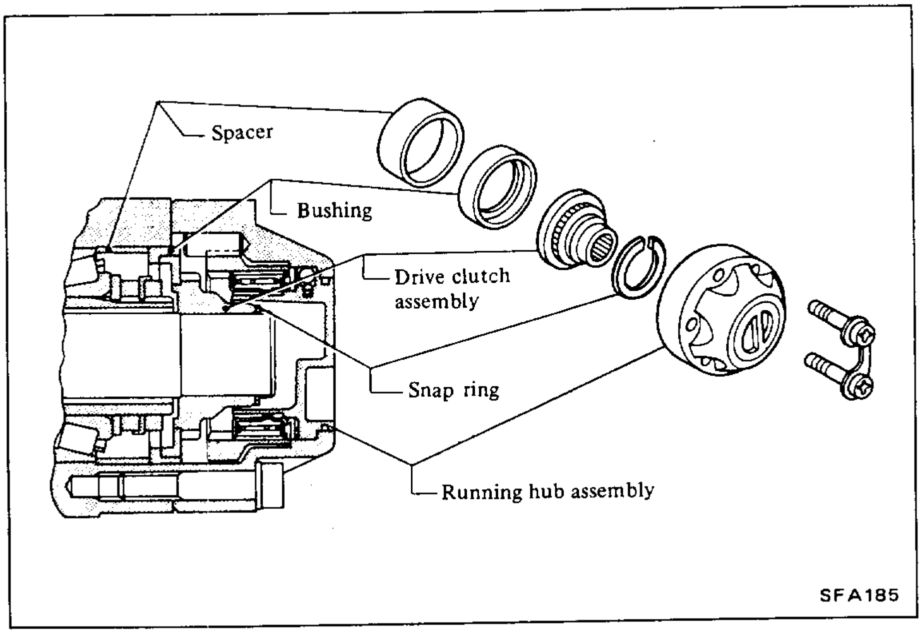
Check axle case for yield, deformation or cracks and replace if necessary.

INSTALLATION

Install front axle assembly in the reverse order of removal.

Ⓣ : **U-bolt**
72 - 97 N·m
(7.3 - 9.9 kg-m, 53 - 72 ft-lb)
Shock absorber lower end
Less than 25 N·m
(2.6 kg-m, 19 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
78 - 88 N·m
(8 - 9 kg-m, 58 - 65 ft-lb)
Spring shackle
72 - 97 N·m
(7.3 - 9.9 kg-m, 53 - 72 ft-lb)

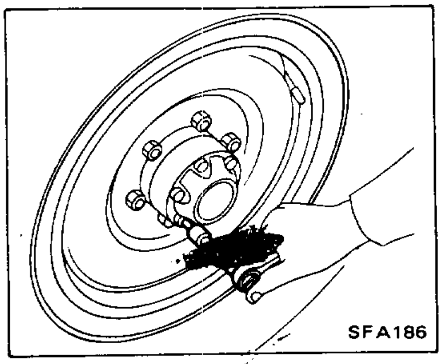
FREE-RUNNING HUB



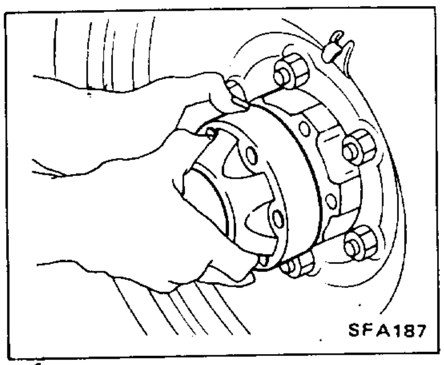
SFA185

REMOVAL

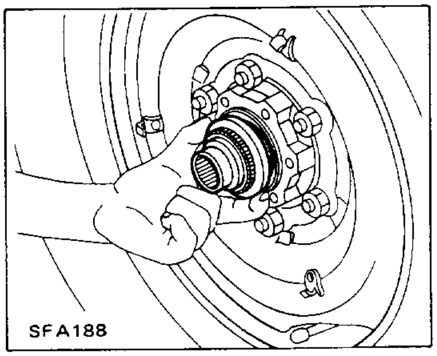
1. **Using torx wrench socket**, remove free-running hub fixing bolts.


SFA186

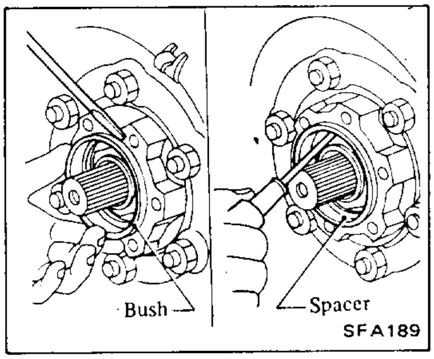
2. Remove free-running hub assembly.


SFA187

3. Remove snap ring and take off drive clutch.


SFA188

4. Take out bushing and spacer from wheel hub.



SFA189

INSTALLATION

Install free-running hub in the reverse order of removal.

When installing snap ring, refer to Axle Shaft for installing snap ring.

Ⓣ : **Free-running hub fixing bolt**
54 - 59 N·m
(5.5 - 6.0 kg-m, 40 - 43 ft-lb)

AXLE SHAFT AND WHEEL HUB

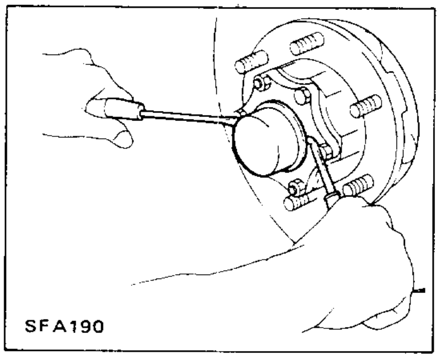
REMOVAL

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.
With free-running hub model:
Remove free-running hub assembly. Refer to Free-running Hub for removal.
3. Remove brake caliper assembly (Disc brake model) or brake drum (Drum brake model).

Refer to Service Brake (Section BR) for removal.

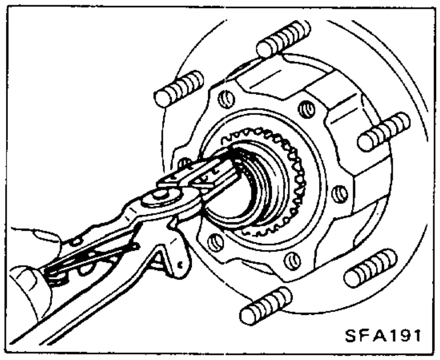
4. Remove wheel hub and wheel bearing.

(1) Work off hub cap with O-ring.



SFA190

(2) Remove snap ring and drive flange.



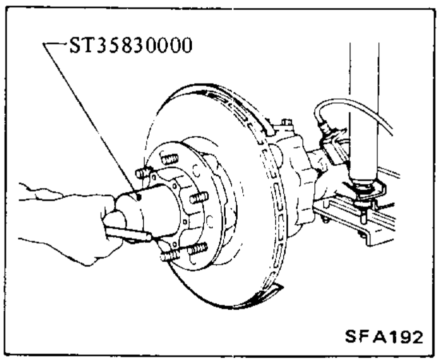
SFA191

With free-running hub model:

After removing snap ring, remove drive clutch, bushing and spacer.

Refer to Free-running Hub for removal.

(3) Straighten lock washer and then, **using Tool**, remove wheel bearing lock nut and wheel bearing washer.

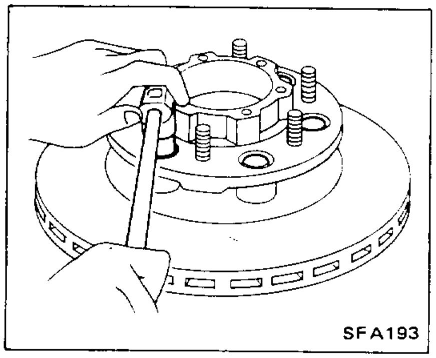


SFA192

(4) Remove wheel hub with disc brake rotor (Disc brake model) or front wheel hub assembly (Drum brake model).

(5) Separate outside wheel bearing inner race.

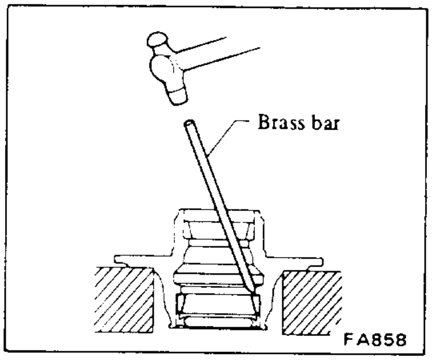
(6) Separate brake disc to hub (Disc brake model only).



SFA193

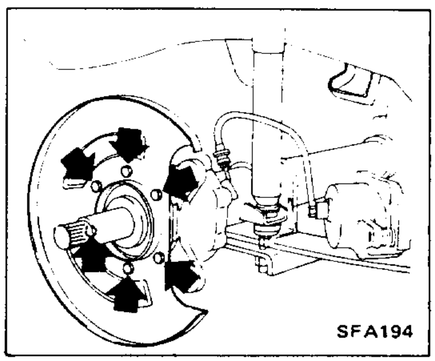
(7) Remove inside wheel bearing outer race, grease seal and outside wheel bearing outer race.

CAUTION:
Be careful not to drop wheel bearing. Grease seal must not be reused.



FA858

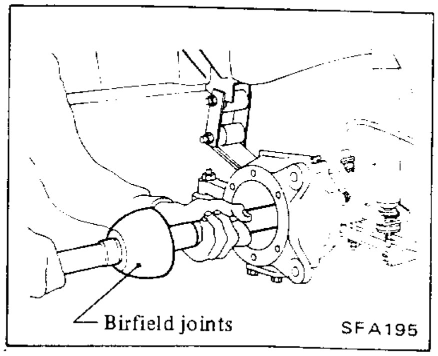
5. Remove baffle plate and draw out knuckle spindle.



SFA194

Drum brake model:
Remove baffle plate with wheel cylinder and shoes.

6. Draw out axle shaft.



SFA195

CAUTION:
Birfield joints can not be disassembled.

INSPECTION

Thoroughly clean parts 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.

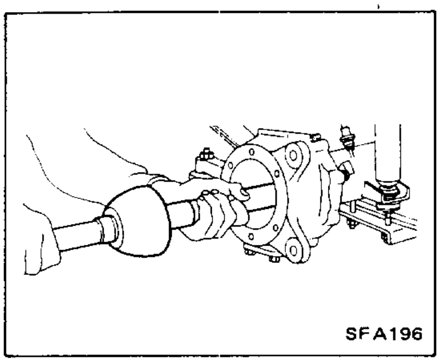
Birfield joints and shaft

Replace Birfield joint assembly if its outer or inner shaft is bent or has worn splines; if assembly is cracked or excessively worn; if joint is clattering or chattering or noisy. Small nicks or scratches can be removed with a fine stone.

INSTALLATION

Install front axle in the reverse order of removal, noting the following:

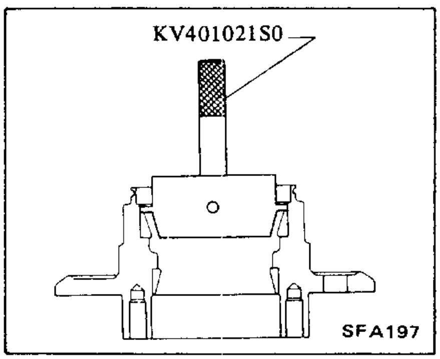
1. Install axle shaft. Apply grease to joints and seal surface and line up spline of differential gear and axle shaft, then assemble.



SFA196

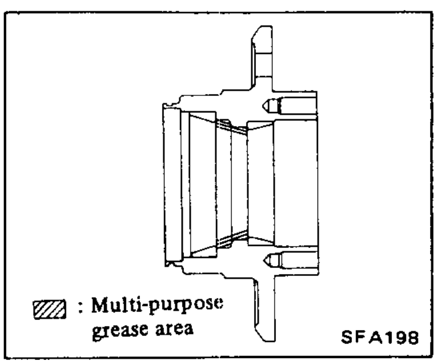
2. Pack knuckle spindle groove with grease, then install it with baffle plate.
3. Install front wheel hub and wheel bearings.

(1) Install bearing outer race **using Tool.**



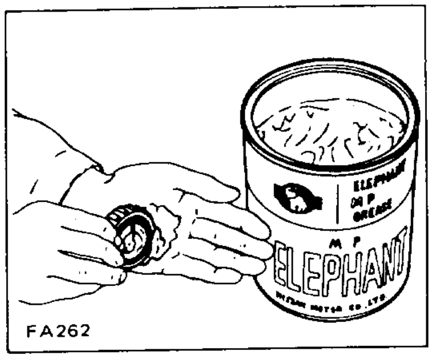
SFA197

(2) Pack hub with recommended multi-purpose grease.



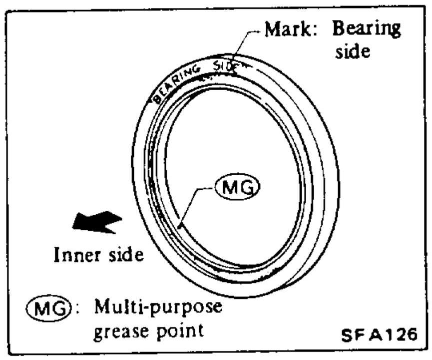
SFA198

(3) Coat each bearing **with recommended multi-purpose grease.**



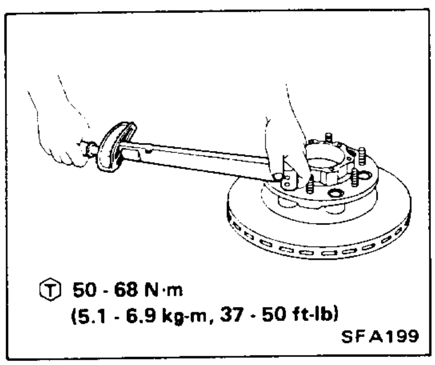
FA262

(4) Place inner bearing in hub and install a new grease seal, **coating sealing lips with recommended multi-purpose grease.**



SFA126

(5) Fix brake rotor to hub (Disc brake model only).



SFA199

(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 lock nut.

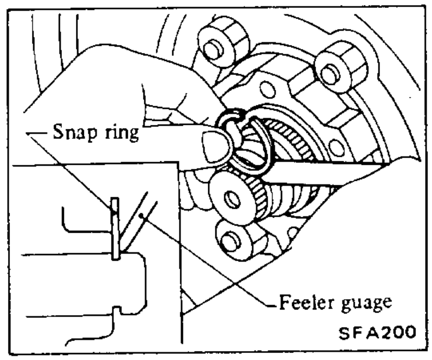
(8) Install wheel bearing lock washer and other wheel bearing lock nut.

Refer to Section MA for adjustment of wheel bearing pre-load.

Ⓣ : Wheel bearing lock nut
167 - 196 N·m
(17 - 20 kg-m, 123 - 145 ft-lb)

4. Pack drive flange groove with grease, apply grease to drive flange hub cap surface, then install flange. Place snap ring in axle shaft groove. Choose snap ring so that the gap between groove and snap ring is 0.1 to 0.2 mm (0.004 to 0.008 in).

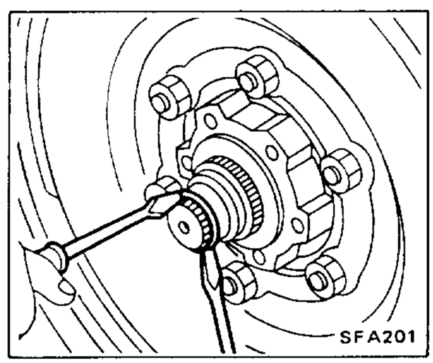
Refer to S.D.S. for selection of snap ring.



SFA200

Ⓣ : Drive flange fixing bolt
43 - 58 N·m
(4.4 - 5.9 kg-m, 32 - 43 ft-lb)

CAUTION:
When placing snap ring in groove, support groove with screwdriver so that axle shaft will not slide.



SFA201

5. Install brake caliper assembly (Disc brake model) or brake drum (Drum brake model).

Refer to Service Brake (Section BR) for installation.

With free-running hub model:

(1) After installation of spacer and bushing to hub, place drive clutch in position and install snap ring.

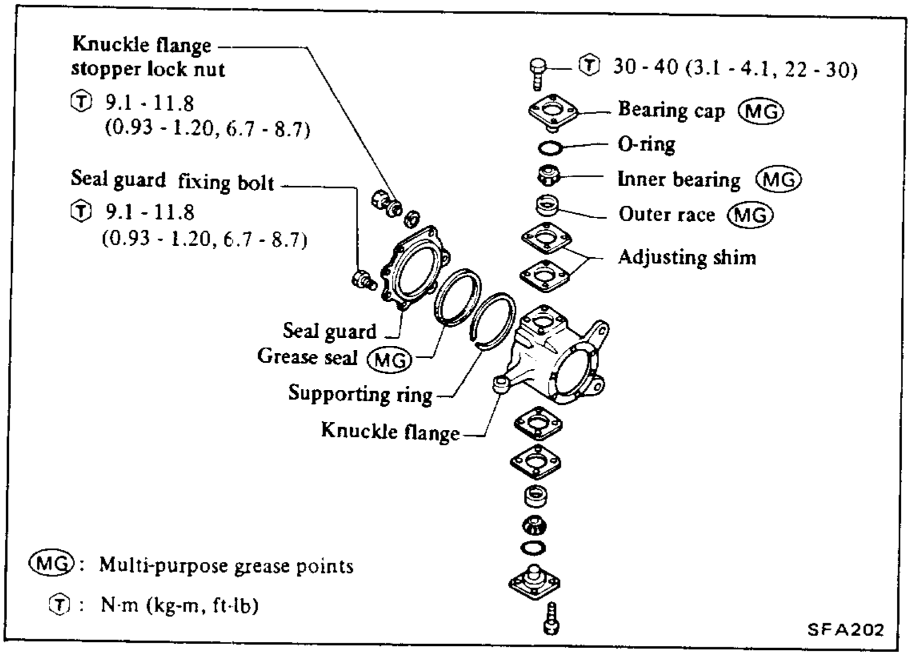
Refer to Axle Shaft for installing snap ring.

(2) Install free-running hub assembly.

Ⓣ : Free-running hub fixing bolt
54 - 59 N·m
(5.5 - 6.0 kg-m, 40 - 43 ft-lb)

6. Install wheel and tire.

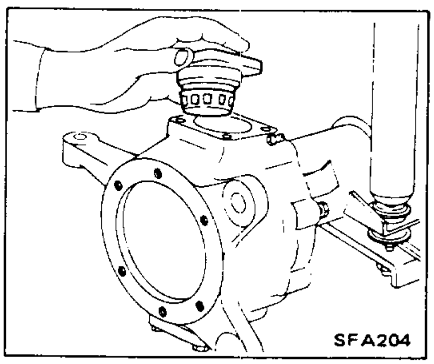
KNUCKLE FLANGE



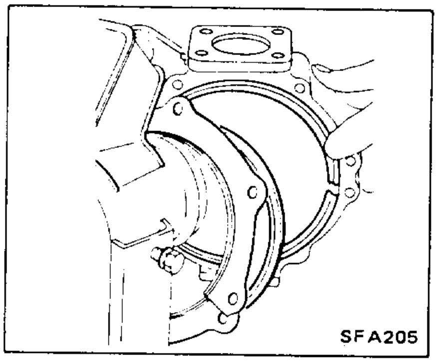
SFA202

REMOVAL

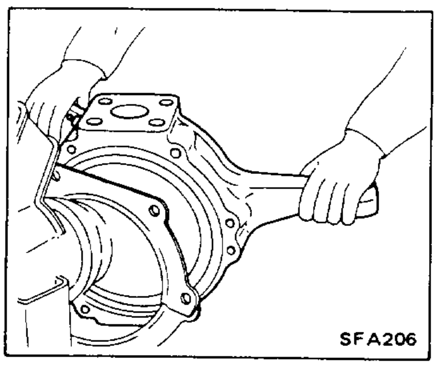
1. Draw out axle shaft.
Refer to Axle Shaft for removal.
2. Disconnect tie rod ends.
Refer to Section ST for disconnecting tie rod ends.
3. Remove upper and lower bearing caps with inner bearing and O-ring.


SFA204

4. Remove seal guard fixing bolts, then separate seal guard and grease seals from knuckle flange.


SFA205

5. Remove knuckle flange, grease seal guard and grease seals from axle case.


SFA206

6. Remove bearing outer race from trunnion socket.

INSPECTION

Knuckle flange bearing cap

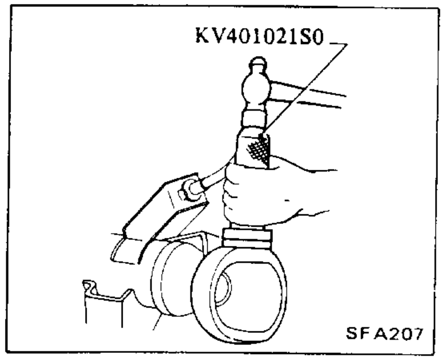
Replace knuckle flange bearing if it is worn, pitted or corroded.

Knuckle flange

Replace knuckle flange if it is cracked. If studs on knuckle flange are bent, broken or damaged, replace them.

INSTALLATION

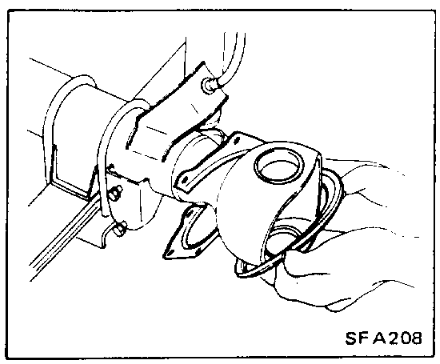
1. **Using Tool**, place bearing outer race in trunnion socket.



SFA207

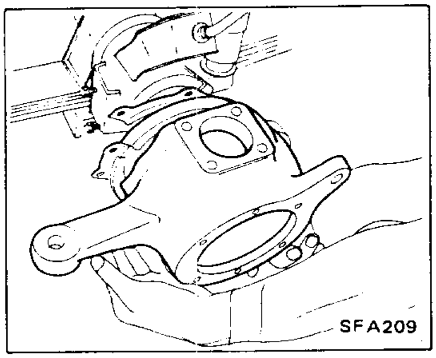
2. Place grease seal guard and grease seal in axle case.

Grease lip area and circumference seals in axle case.


SFA208

3. Apply recommended grease around trunnion socket spherical area, then place knuckle flange in trunnion socket.

Renew grease compounded with molybdenum disulfide, exercising care not to allow dirt and dust to get inside.


SFA209

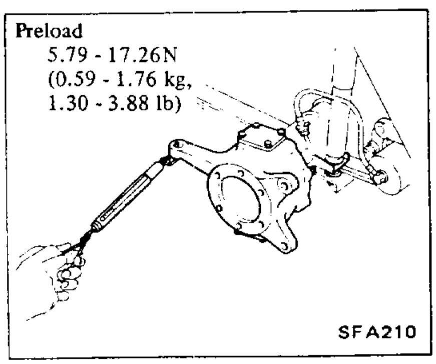
4. Pack bearing cap groove with recommended grease, and install bearing cap with inner race and O-ring.

Ⓣ : **Bearing cap bolt**
30 - 40 N·m
(3.1 - 4.1 kg-m, 22 - 30 ft-lb)

5. Install grease seal guard and grease seals.
6. Measure knuckle flange bearing preload.

Adjust bearing cap shim so that knuckle flange can rotate smoothly with a spring balancer.

CAUTION:
Use same thickness of shims at upper and lower portions of bearing cap.

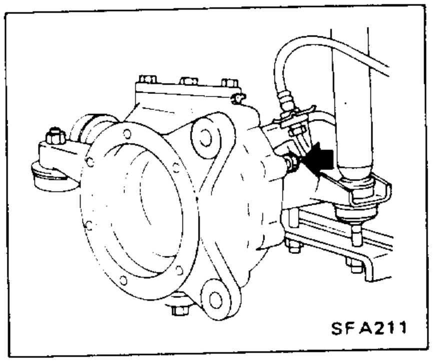


SFA210

Ⓣ : **Seal guard fixing bolt**
9.1 - 11.8 N·m
(0.93 - 1.2 kg-m, 6.7 - 8.7 ft-lb)

Knuckle flange stopper bolt
9.1 - 11.8 N·m
(0.93 - 1.2 kg-m, 6.7 - 8.7 ft-lb)

CAUTION:
Install knuckle flange stopper bolt and nut on stopper side of axle case.
After installing tie rod, adjust it to specified steering angle using turning radius gauge, then tighten with lock nut.

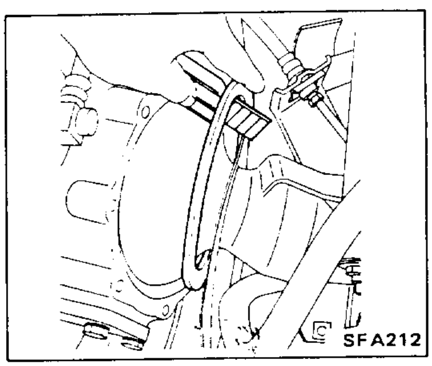

SFA211

KNUCKLE FLANGE GREASE SEAL

To replace only knuckle flange grease seal, proceed as follows:

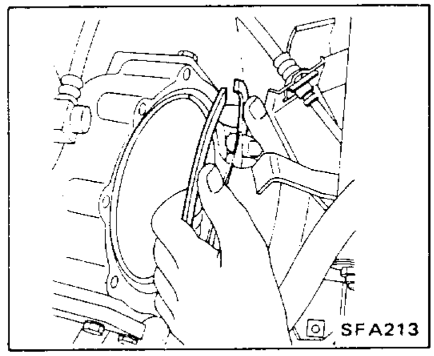
REMOVAL

1. Turn steering wheel to both the extreme right and left, and remove grease seal guard from knuckle flange.
2. Extract grease seal and remove it by cutting it from axle case.


SFA212

INSTALLATION

1. Cut off a part of new grease seal and fill lip portion with grease. Then insert grease seal into axle case.


SFA213

CAUTION:
Cut grease seal so that cut surface is straight.

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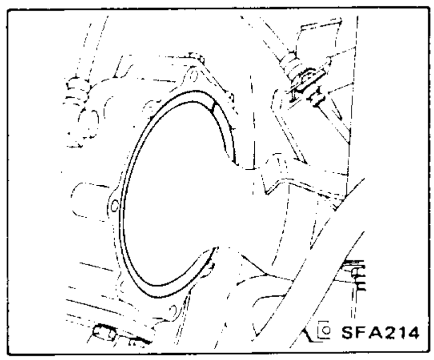
2. Apply adhesive to cut surface of grease seal.

Install grease seal so that its cut surface is above knuckle flange.


SFA214

CAUTION:
Be sure not to allow adhesive to protrude beyond cut surface of grease seal.

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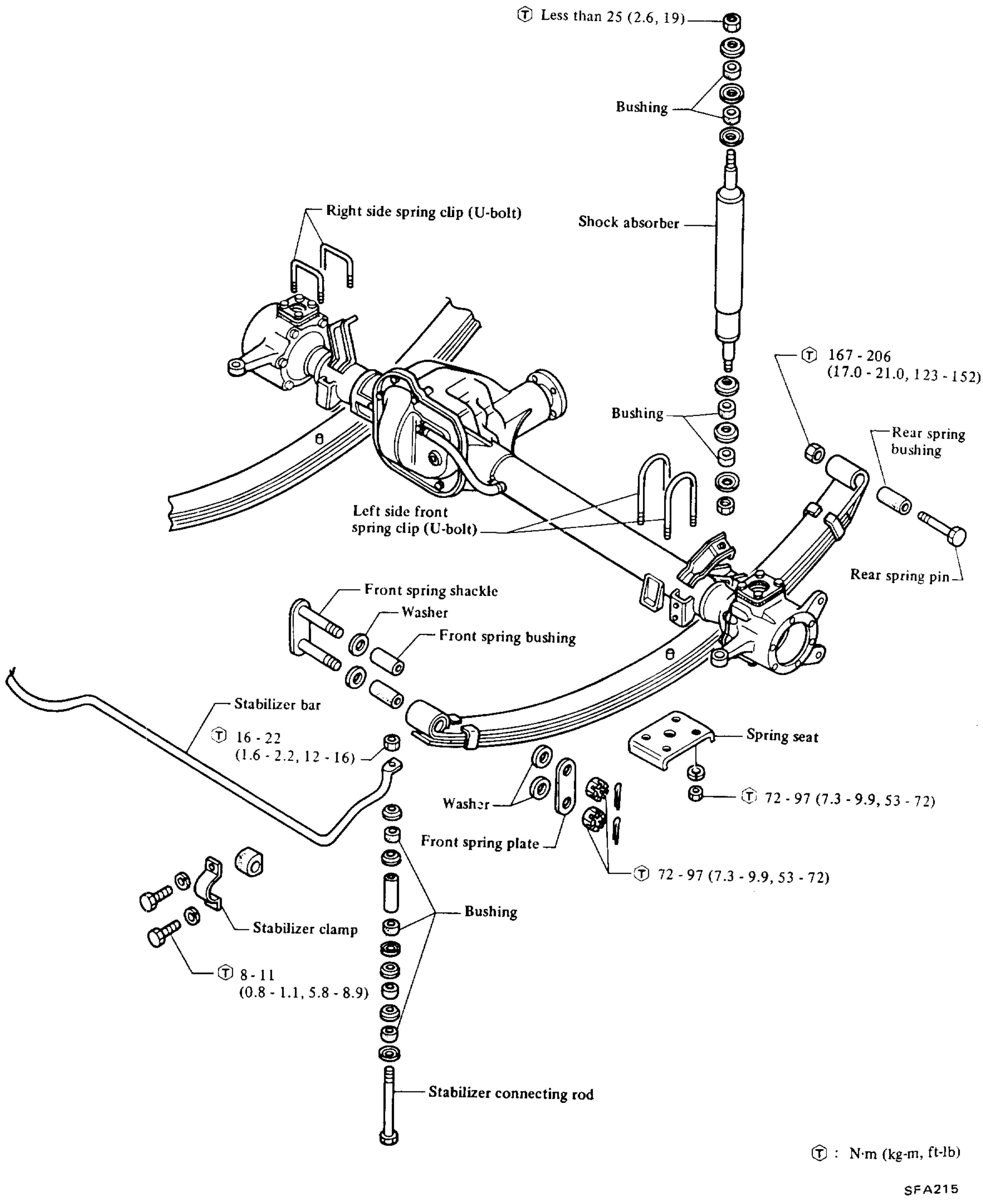
3. Install grease seal guard on knuckle flange.

CAUTION:
After replacing grease seal, adjust steering wheel to specified turning angle with a turning radius gauge. Then tighten lock nut.

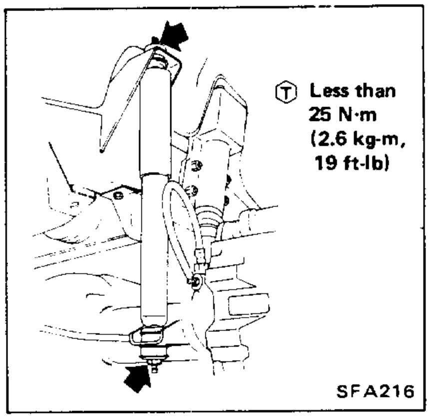
FRONT SUSPENSION



SHOCK ABSORBER

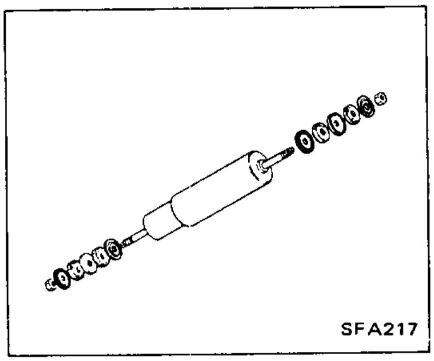
REMOVAL AND INSTALLATION

1. Disconnect both upper and lower sides fixing nuts.



2. Install shock absorber, observing the following note.

Do not allow oil or grease to come into contact with rubber parts.



INSPECTION

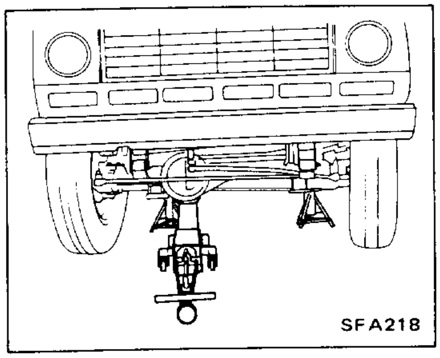
- Test shock absorber and compare **with specification given in S.D.S. Replace if necessary.**
- Check for oil leakage and cracks. Replace if necessary.
- Check piston rod for smooth operation. Replace if necessary.
- Check all rubber parts for wear, cracks, damage or deformation. Replace if necessary.

LEAF SPRING

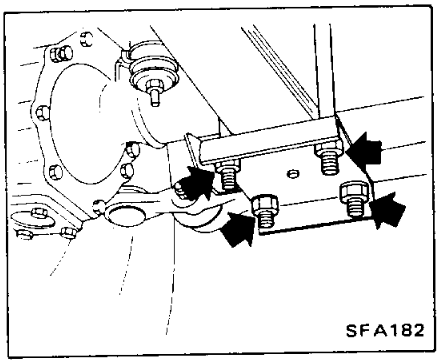
REMOVAL

1. Block rear wheels. Support under differential carrier with garage jack. Place stands.

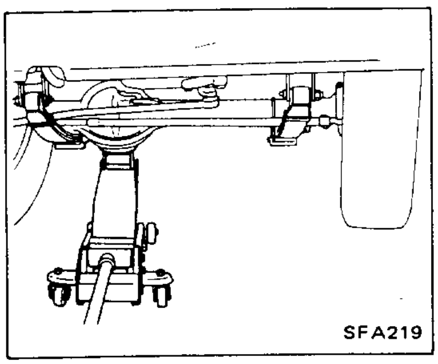
Do not raise differential carrier.



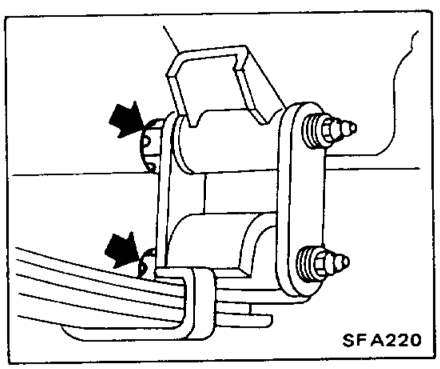
2. Remove U-bolts.

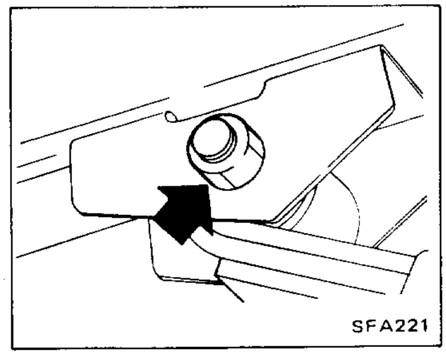


3. Raise jack positioned under differential carrier and front axle case from spring.

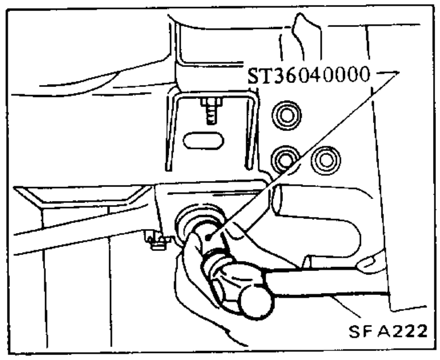


4. Disconnect front spring shackle and rear pin.

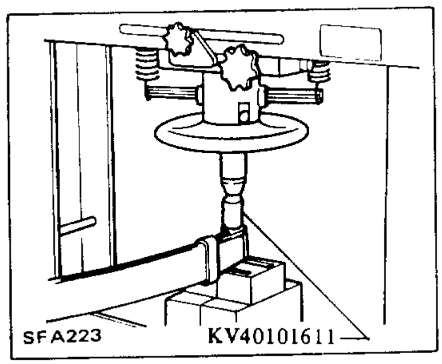


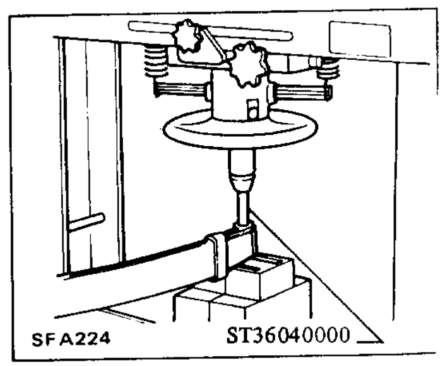


5. Extract metal bushing from frame by **using Tool.**



6. Extract metal bushing and rubber bushing from eyeend of leaf spring by **using Tool.**





CAUTION:
Be sure to install bushing straight.

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 rear 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

Install leaf spring in the reverse order of removal.

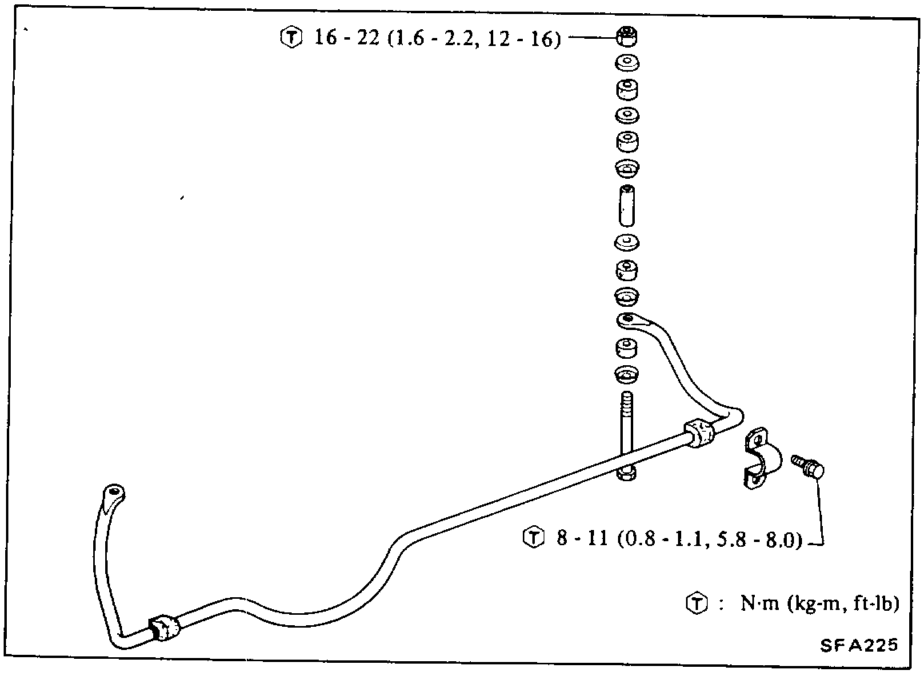
a. **Using press, be sure to install bushing straight.**

b. **Vehicle weight must be on front wheels when tightening rear pin, shackle and shock absorber in order to clamp rubber bushings in neutral or unloaded position.**

c. **After tightening spring shackle nut to specified torque, turn shackle nut back 45 to 90 degrees. Align shackle bolt hole and insert pin.**

Ⓣ : Spring rear pin nut
167 - 206 N·m
(17.0 - 21.0 kg-m,
123 - 152 ft-lb)
Spring shackle nut
72 - 97 N·m
(7.3 - 9.9 kg-m,
53 - 72 ft-lb)
U-bolt nut
72 - 97 N·m
(7.3 - 9.9 kg-m,
53 - 72 ft-lb)

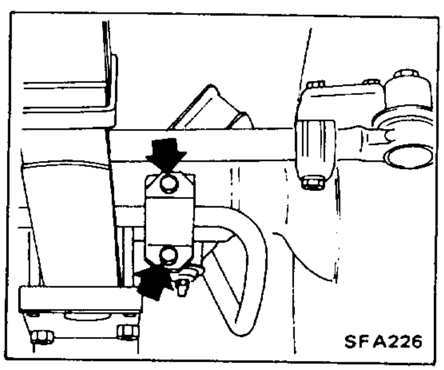
STABILIZER BAR

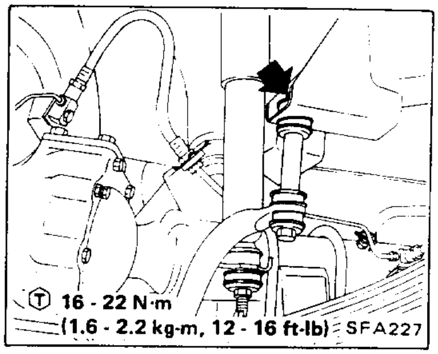


SFA225

REMOVAL

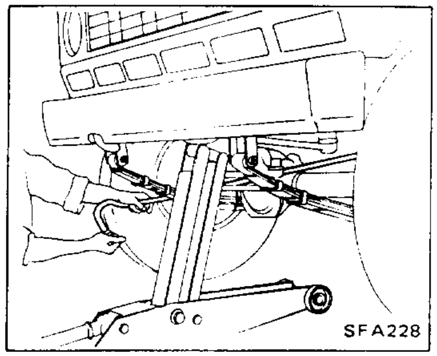
1. Turn steering wheel to either side.
2. Remove stabilizer bar fixing bolts.


SFA226



SFA227

3. Jack up front body frame and take out stabilizer bar.


SFA228

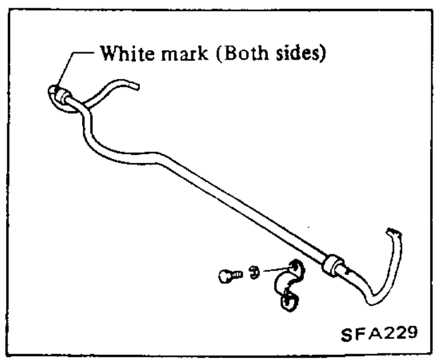
INSPECTION

1. Check stabilizer for twist and deformation.
   Replace if necessary.
2. Check each rubber bushing for cracks, wear, and deterioration. Replace if necessary.

INSTALLATION

Install stabilizer bar in the reverse order of removal, noting the following:

If correctly installed: white mark painted on stabilizer bushing seat can be seen from both sides of vehicle.



SFA229

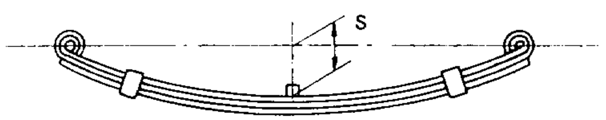
SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

LEAF SPRING

Item \ Model		160 series				61 series
		Light duty model		Heavy duty model		
Suspension type		Parallel semi-elliptic leaf spring				
Axle type		Full floating Birfield joint type				
Leaf spring	Part No.	54010-C6001*	54010-C6060 (For Middle East)	54010-C6200*	54010-C6260 (For Middle East)	54010-C6260 (All areas)
	Length x width x thickness - number of leaves mm (in)	1,100 x 60 x 9 - 3 (43.31 x 2.36 x 0.35 - 3)	1,100 x 60 x 6 - 6 (43.31 x 2.36 x 0.24 - 6)	1,100 x 60 x 9 - 3 (43.31 x 2.36 x 0.35 - 3)	1,100 x 60 x 6 - 7 (43.31 x 2.36 x 0.24 - 7)	
	Free camber "S" mm (in)	136 (5.35)	138.5 (5.45)	125.5 (4.94)	128.5 (5.06)	
	Laden camber mm/N (mm/kg, in/lb)	72/2,942 (72/300, 2.83/662)				
	Spring constant N/mm (kg/mm, lb/in)	45.80 (4.67, 261.5)	44.13 (4.50, 252.0)	55.02 (5.61, 314.2)	52.17 (5.32, 297.9)	

* Except Middle East: Standard
For Middle East: Option



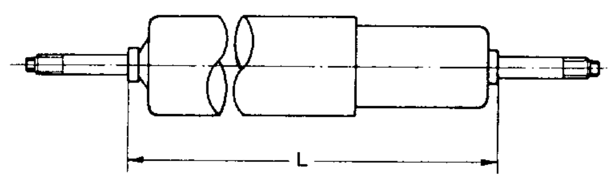
SFA230

STABILIZER BAR

Stabilizer bar Diameter mm (in)	23 (0.91)

SHOCK ABSORBER

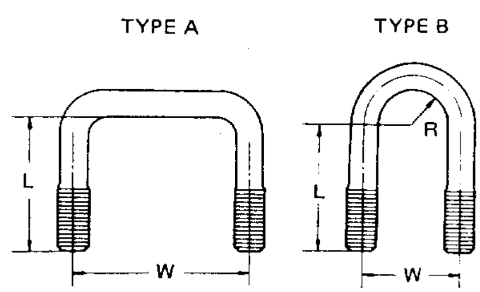
Shock absorber Maximum length "L" mm (in)		405 (15.94)
Stroke mm (in)		160 (6.30)
Damping force [0.3 m/sec. (1.0 ft/sec.)] N (kg, lb)	Expansion	2,158 (220, 485)
	Compression	834 (85, 187)



SFA231

U-BOLT

Item \ Model	160 series		61 series
	*	For Middle East	All areas
Type A R.H. Length(L) x width(W) mm (in) (Part No.)	73 x 73.5 (2.87 x 2.894) (54219-C6001)	84 x 73.5 (3.31 x 2.894) (54219-C6060)	
Type B L.H. Length(L) x width(W) mm (in) (Part No.)	120 x 89 (4.72 x 3.50) (55247-G7100)	125 x 85 (4.92 x 3.35) (55247-B9500)	



SFA232

* Except Middle East: Standard For Middle East: Option

INSPECTION AND ADJUSTMENT

WHEEL ALIGNMENT (Unladen *1)

Camber	degree	1°30′
Caster	degree	1°30′
Kingpin inclination	degree	7°30′
Toe-in	mm (in)	3 - 4 (0.12 - 0.16)
	degree *2	14′ - 19′
Front wheel turning angle (Full turn) degree	Inside	30°
	Outside	29°30′
Front wheel toe-out turn degree	Inside	20°
	Outside	19°50′

*1: Tankful of fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools, mats in designed position.
*2: On both sides

BEARING CAP SHIM

Thickness mm (in)	Part no.
0.075 (0.0030)	40606 44000
0.127 (0.0050)	40605 44000
0.254 (0.0100)	40604 44000
0.762 (0.0300)	40603 44000

FLANGE FREE PLAY SNAP RING

Thickness mm (in)	Part no.
1.1 (0.043)	39253 C6000
1.3 (0.051)	39253 C6001
1.5 (0.059)	39253 C6002
1.7 (0.067)	39253 C6003
1.9 (0.075)	39253 C6004
2.1 (0.083)	39253 C6005

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Shock absorber lower end nut	Less than 25	Less than 2.6	Less than 19
Shock absorber upper end nut	Less than 25	Less than 2.6	Less than 19
Leaf spring U-bolt nut	72 - 97	7.3 - 9.9	53 - 72
Spring rear pin nut	167 - 206	17.0 - 21.0	123 - 152
Spring shackle	72 - 97	7.3 - 9.9	53 - 72
Back plate and knuckle spindle fixing bolt	30 - 40	3.1 - 4.1	22 - 30
Baffle plate and knuckle spindle fixing bolt	30 - 40	3.1 - 4.1	22 - 30
Wheel bearing lock nut	167 - 196	17 - 20	123 - 145
Wheel cylinder air breather	7 - 9	0.7 - 0.9	5.1 - 6.5
Free-running hub fixing bolt	54 - 59	5.5 - 6.0	40 - 43
Drain plug	39 - 59	4.0 - 6.0	29 - 43
Filler plug	39 - 59	4.0 - 6.0	29 - 43
Bumper rubber fixing bolt	16 - 22	1.6 - 2.2	12 - 16
Wheel nut	118 - 147	12 - 15	87 - 108
Propeller shaft to companion flange	78 - 88	8 - 9	58 - 65
Brake tube flare nut	15 - 18	1.5 - 1.8	11 - 13
Brake connector	8 - 11	0.8 - 1.1	5.8 - 8.0
Stabilizer bar to frame	16 - 22	1.6 - 2.2	12 - 16
Stabilizer bar to axle case	8 - 11	0.8 - 1.1	5.8 - 8.0
Wheel hub to disc brake rotor	50 - 68	5.1 - 6.9	37 - 50
Drive flange fixing bolt	43 - 58	4.4 - 5.9	32 - 43
Flange drive stud nut	43 - 58	4.4 - 5.9	32 - 43
Bearing cap bolt	30 - 40	3.1 - 4.1	22 - 30
Caliper bolt	108 - 147	11 - 15	80 - 108
Knuckle spindle fixing bolt	30 - 40	3.1 - 4.1	22 - 30
Seal guard fixing bolt	9.1 - 11.8	0.93 - 1.2	6.7 - 8.7
Knuckle flange stopper bolt nut	9.1 - 11.8	0.93 - 1.2	6.7 - 8.7
Tie rod slotted nut	46 - 54	4.7 - 5.5	34 - 40
Tie rod clip nut	25 - 28	2.5 - 2.9	18 - 21
Torque arrester fixing nut	16 - 22	1.6 - 2.2	12 - 16

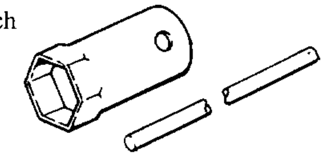
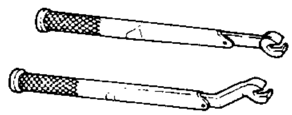
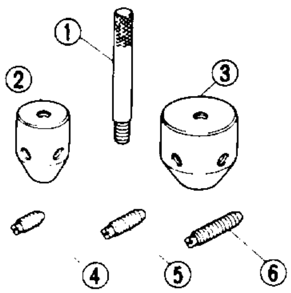
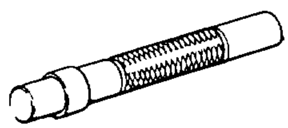
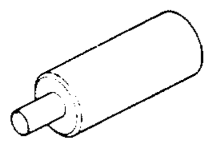
TROUBLE DIAGNOSES AND CORRECTIONS

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.
	Insufficiently tightened steering gear housing.	Retighten.
	Wear of steering linkage.	Replace faulty parts.
	Worn suspension bushing.	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.
	Incorrect brake adjustment (binding).	Adjust.
	Deformed steering linkage and stabilizer bar.	Replace.
	Imbalance of vehicle level.	Adjust.
Instability of vehicle.	Improper tire pressure.	Adjust.
	Broken stabilizer bar.	Replace.
	Incorrect wheel alignment.	Adjust.
	Worn or deformed steering linkage.	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.

Condition	Probable cause	Corrective action
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, or lack of grease.	Replace or repair.
	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.
Noises.	Improper tire pressure.	Adjust.
	Insufficient lubricating oil and grease for suspension bushings 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 stabilizer bushings.	Replace.
	Broken stabilizer bar.	Replace.
	Loose stabilizer bar fixing bolts and nuts.	Retighten.
	Loose shock abosrber fixing.	Retighten.
Grating tire noise.	Improper tire pressure.	Adjust.
	Incorrect wheel alignment.	Adjust.
	Deformed 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.

Condition	Probable cause	Corrective action
Excessively or partially worn tire.	Improper tire pressure.	Adjust.
	Incorrect wheel alignment.	Adjust.
	Faulty wheel bearing.	Replace.
	Incorrect brake adjustment.	Adjust.
	Tires not rotated.	Rotate tires at recommended intervals.
	Rough and improper driving manner.	Drive more gently.
Oil leakage (includes grease)	Damaged or restricted air breather.	Clean or replace air breather.
	Damaged oil seal in front 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.

SPECIAL SERVICE TOOLS

Tool number	Tool name
ST35830000	Wheel bearing lock nut wrench 
GG94310000	Flare nut torque wrench 
KV401021S0 ① ST35325000 ② KV40102110 ③ KV40102120 ④ KV40102130 ⑤ KV40102140 ⑥ KV40102150	Bearing race drift Drift bar Drift (A) Drift (B) Screw (A) Screw (B) Screw (C) 
ST36040000	Spring pin bush replacer 
KV40101611	Adapter 

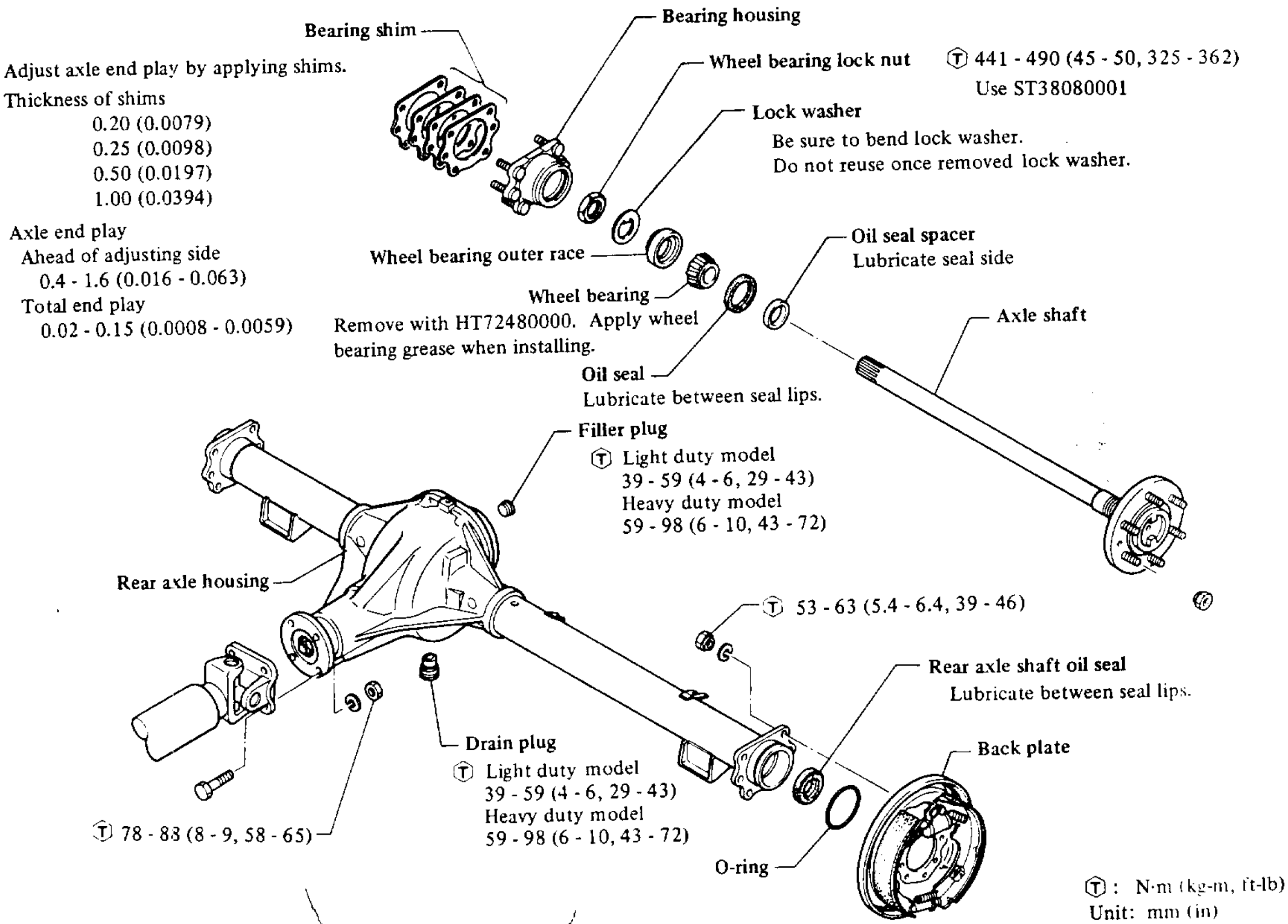
REAR AXLE &
REAR SUSPENSION

SECTION RA

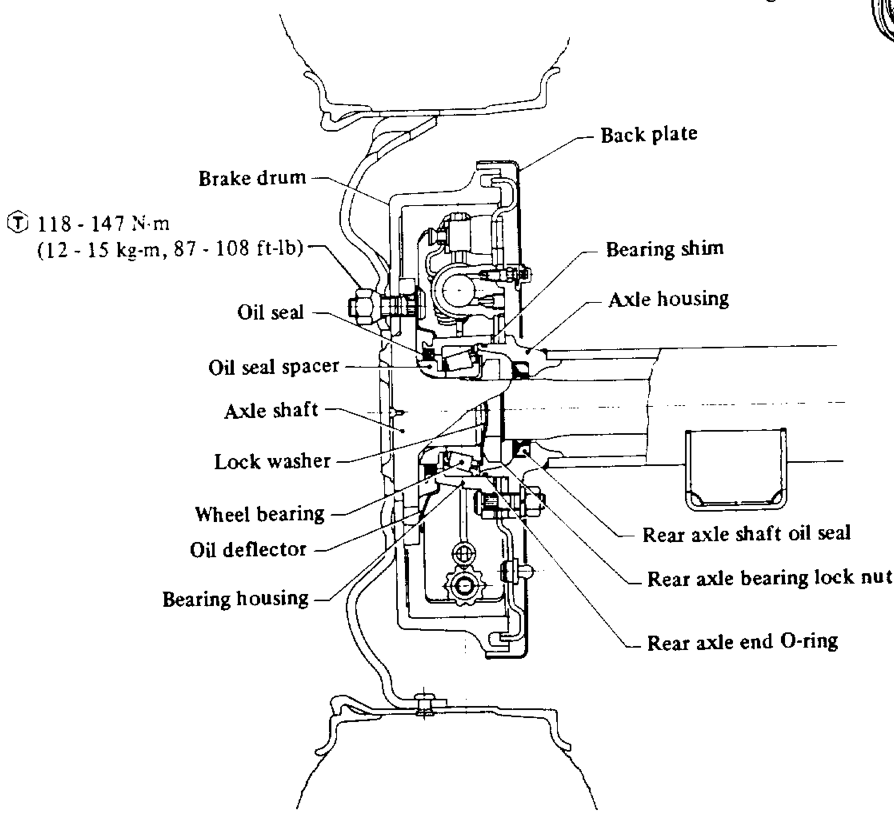
CONTENTS

RA

REAR AXLE



SRA133

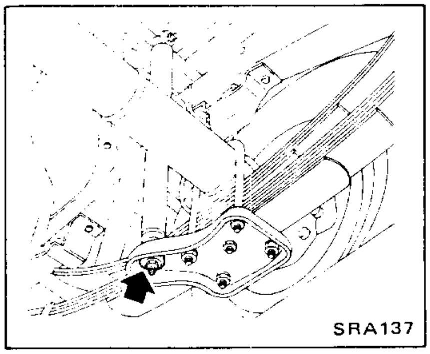


SRA134

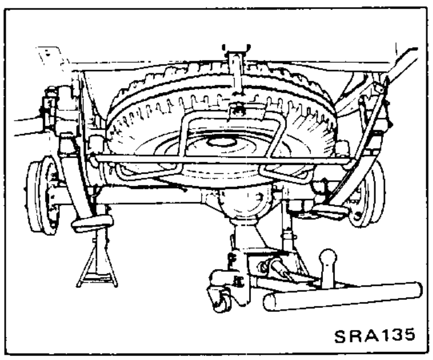
REAR AXLE ASSEMBLY

REMOVAL AND INSTALLATION

1. Disconnect shock absorber lower end on each side.

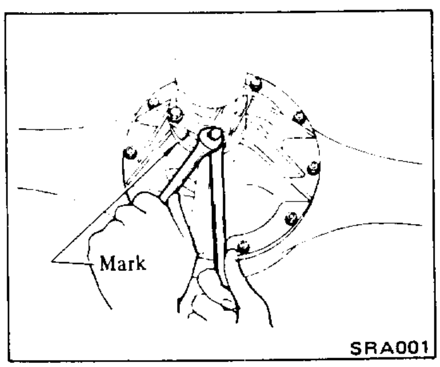

SRA137

2. Block front wheels with chocks and raise rear of vehicle, then **support it with safety stands. Refer to Section GI for lifting points and towing.**


SRA135

3. Remove wheel and tire assembly.
4. Separate propeller shaft and rear axle housing.

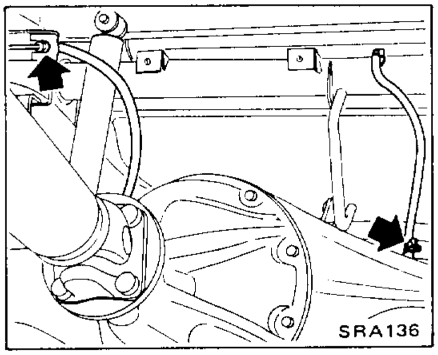
Mark relationship between propeller shaft flange and companion flange.



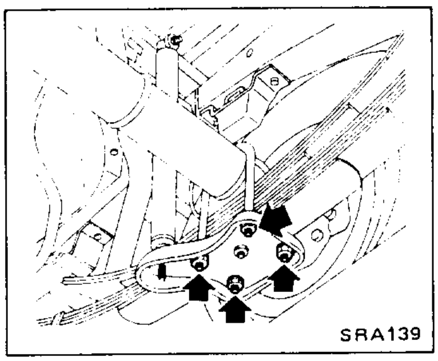
SRA001

5. Disconnect brake tube and breather hose.

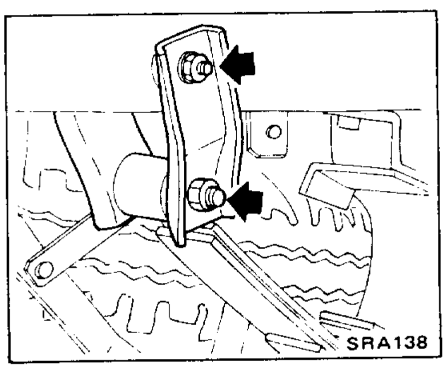
CAUTION:
When removing or installing brake tubes, use Tool GG94310000.


SRA136

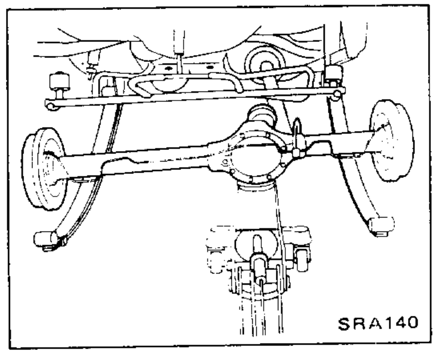
6. Loosen U-bolt.


SRA139

7. Support rear axle by the jack.
8. Disconnect rear spring shackle on each side.


SRA138

9. Lower the jack and remove U-bolts, and take out rear axle case.


SRA140

INSPECTION

Check axle case for yield, deformation or cracks and replace if necessary.

INSTALLATION

Ⓣ : U-bolt (Spring clip)
Light duty models
72 - 97 N·m
(7.3 - 9.9 kg-m,
53 - 72 ft-lb)
Heavy duty models
147 - 177 N·m
(15.0 - 18.0 kg-m,
108 - 130 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
78 - 88 N·m
(8 - 9 kg-m,
58 - 65 ft-lb)

REAR AXLE SHAFT AND WHEEL BEARING

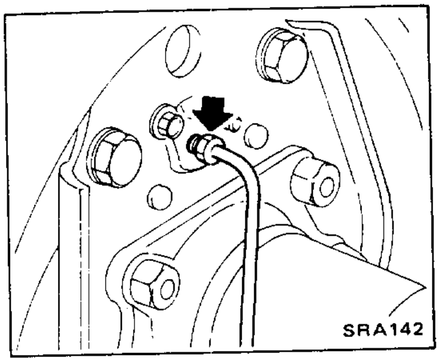
REMOVAL

1. Block front wheels with chocks and raise rear of vehicle, then **support**

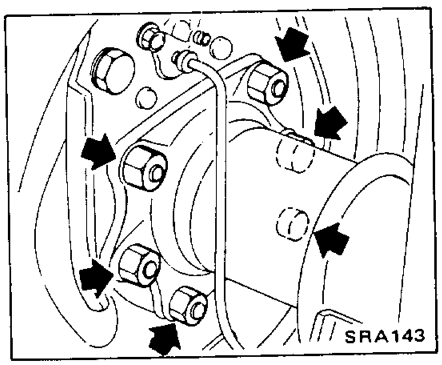
it with safety stands. Refer to Section GI for lifting points and towing.

2. Remove rear wheels and brake drums.
3. Disconnect brake tube.

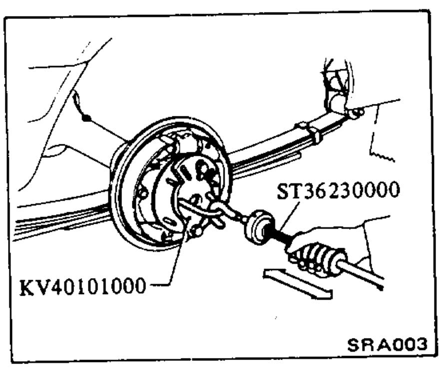
Cover brake tube and back plate openings to prevent entrance of dirt.



4. Remove nuts retaining bearing housing and back plate to rear axle housing.

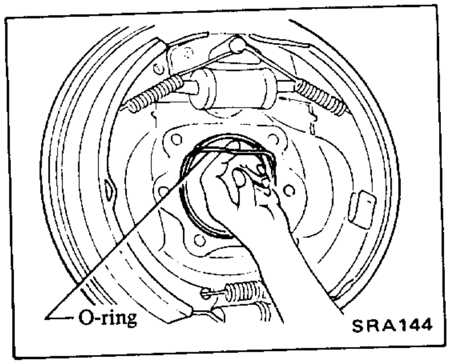


5. Pull out axle shaft assembly together with bearing housing.



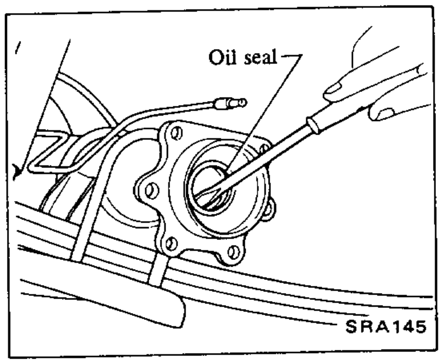
6. Remove O-ring and back plate with brake assembly.

Do not reuse once removed O-ring. Always install new one.



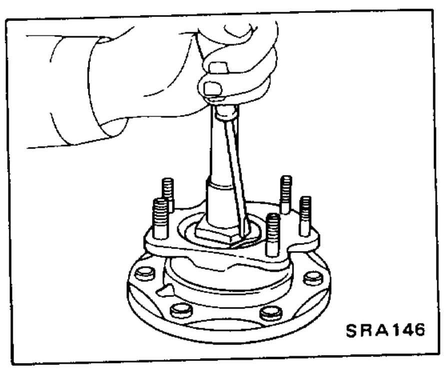
7. Remove oil seal.

Do not reuse once removed oil seal. Always install new one.



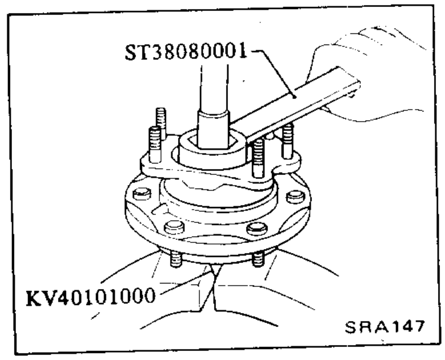
8. Unbend lock washer with a screwdriver.

Do not reuse once removed lock washer. Always install new one.

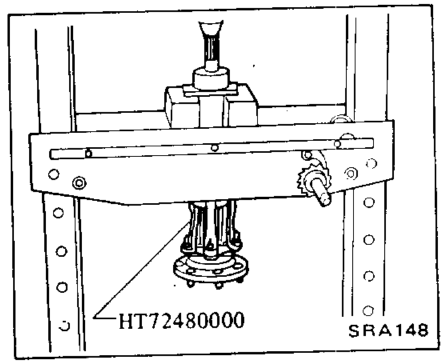


9. Position axle shaft in vise **with KV40101000.**

Remove bearing lock nut, **using Tool.**

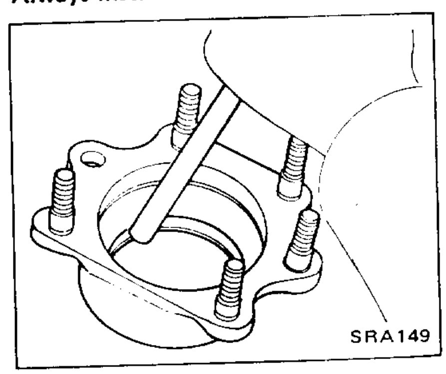


10. Withdraw wheel bearing together with bearing cage.

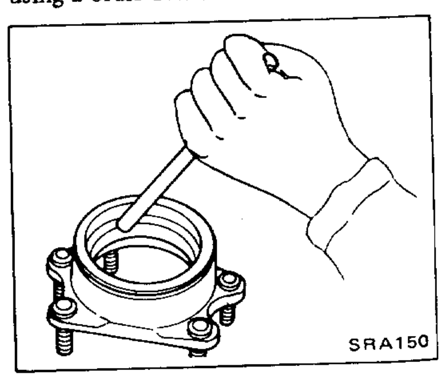


11. Remove oil seal in bearing cage with suitable bar if necessary.

Do not reuse once removed oil seal. Always install new one.



12. Remove wheel bearing outer race using a brass drift.



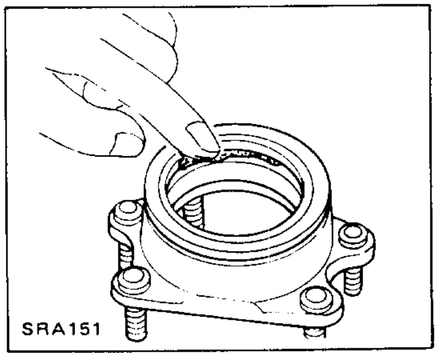
INSPECTION

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.

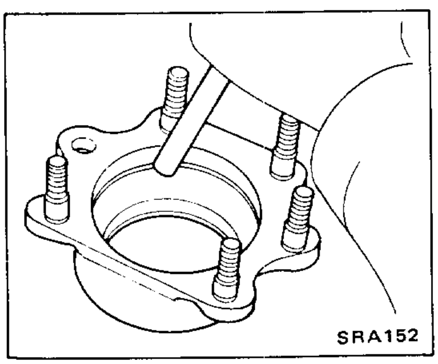
INSTALLATION

a. Install a new oil seal in bearing cage. Lubricate cavity between seal lips after fitting seal.



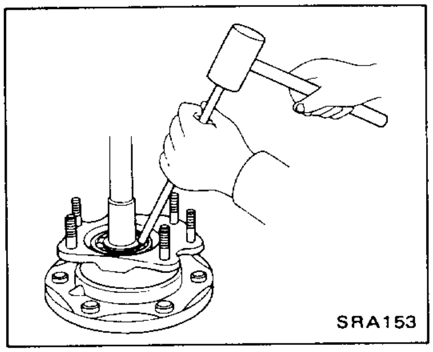
SRA151

b. Install wheel bearing outer race, using a brass drift.



SRA152

c. Install wheel bearing inner race, using a brass drift.



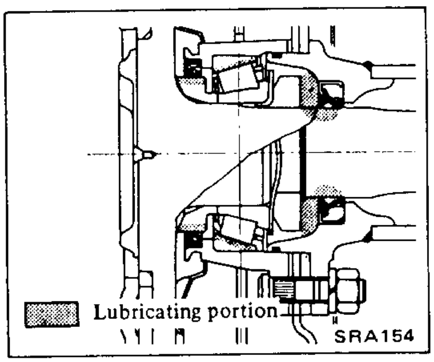
SRA153

d. Be careful to place the faced side of nut on washer side.

e. Fit washer lip in axle shaft groove correctly.

f. Use a new bearing lock washer. Be sure to bend it up.

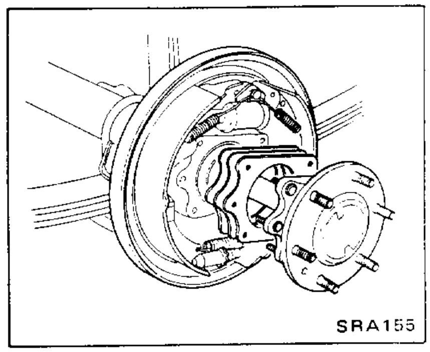
g. Apply wheel bearing grease to wheel bearing and recess of axle case end.



SRA154

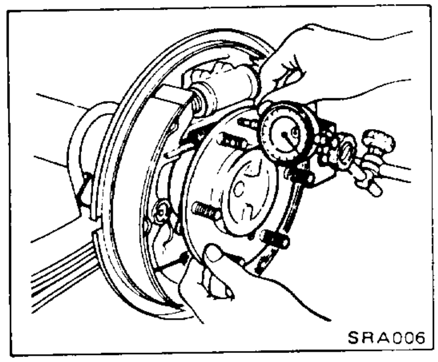
h. Apply gear oil to the spline and apply a coat of wheel bearing grease to seal surface before installing axle shaft.

i. When installing axle shaft, adjust axial end play by applying case end shims.



SRA155

Rear axle case end shim:
Rear to S.D.S.
Axial end play:
Total end play
0.02 - 0.15 mm
(0.0008 - 0.0059 in)

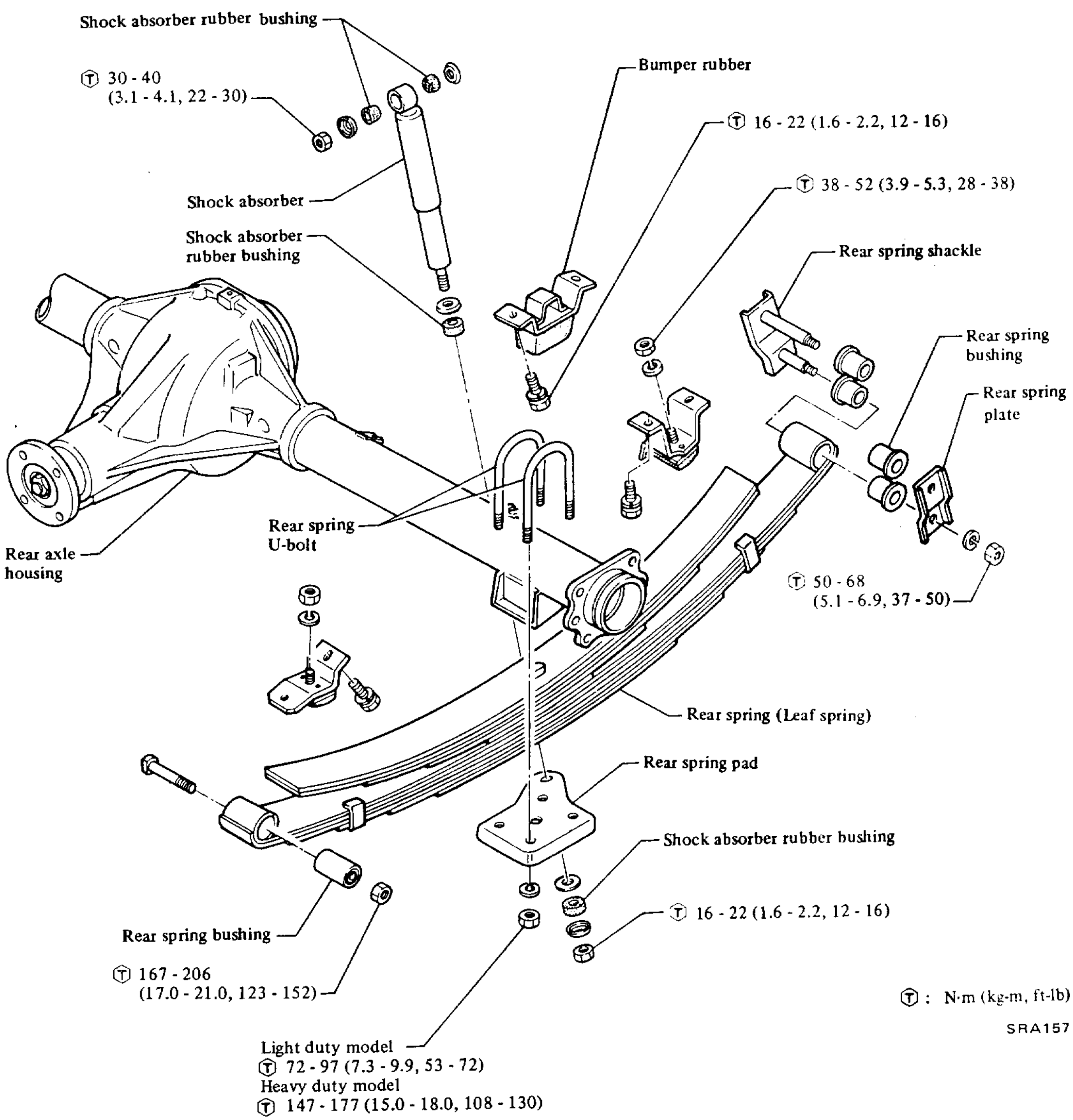


SRA006

j. When installing axle shaft, be careful not to damage oil seal in axle housing.

Ⓣ: Wheel bearing lock nut
441 - 490 N·m
(45 - 50 kg-m,
325 - 362 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)

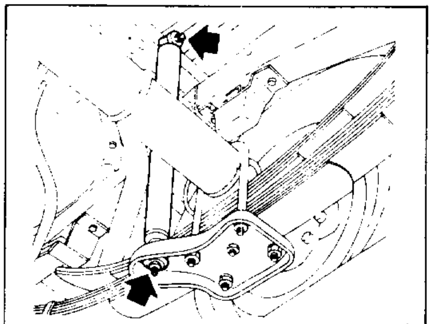
REAR SUSPENSION



REAR SHOCK ABSORBER

REMOVAL AND INSTALLATION

1. Remove shock absorber by disconnecting upper and lower ends.



SRA158

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.

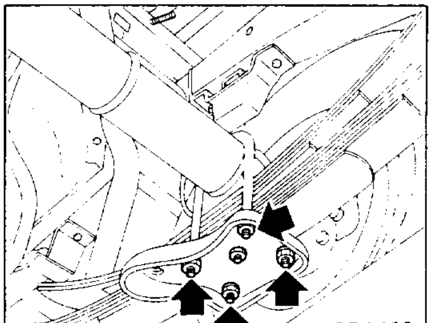
INSPECTION

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

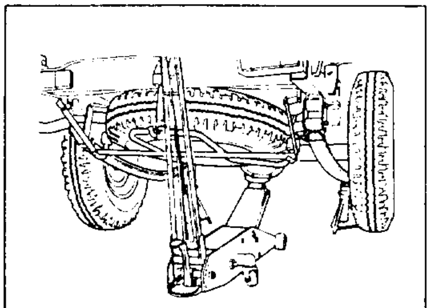
REMOVAL

1. Disconnect shock absorber lower end.
2. Block front wheels with chocks and raise rear of vehicle, then **support it with safety stands. Refer to Section GI for lifting points and towing.**
3. Remove U-bolts.



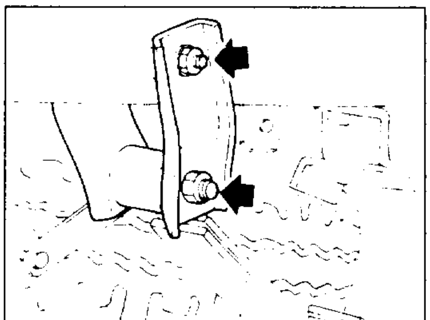
SRA160

4. Raise jack positioned under differential carrier and float axle case from spring.

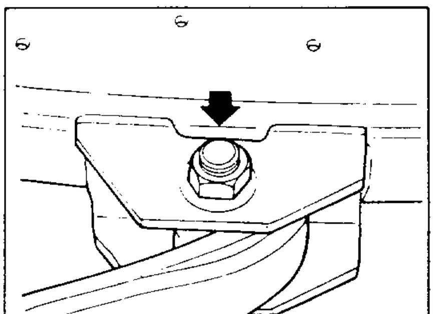


SRA161

5. Disconnect rear spring shackle and front pin.



SRA138



SRA162

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.

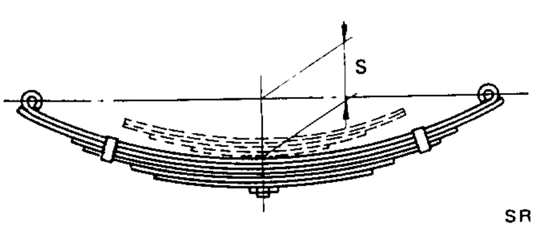
Ⓣ : Spring front pin nut
167 - 206 N·m
(17.0 - 21.0 kg-m,
123 - 152 ft-lb)
Spring shackle nut
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)
U-bolt nut
Light duty models
72 - 97 N·m
(7.3 - 9.9 kg-m,
53 - 72 ft-lb)
Heavy duty models
147 - 177 N·m
(15.0 - 18.0 kg-m,
108 - 130)
Wheel nut
118 - 147 N·m
(12 - 15 kg-m,
87 - 108 ft-lb)

SERVICE DATA AND SPECIFICATIONS

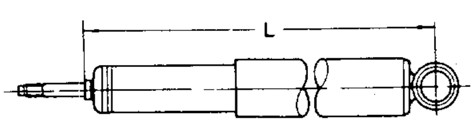
GENERAL SPECIFICATIONS

Item \ Model			Model 160 series				Model 61 series	
			Light duty model		Heavy duty model		Light duty model	Heavy duty model
			*	For Middle East	*	For Middle East		
Suspension type			Semi-elliptic leaf spring					
Leaf spring	Length x width x thickness — number of leaves mm (in)		1,420 x 60 x 11 - 3 (55.91 x 2.36 x 0.43 - 3)	1,420 x 60 x 8 - 6 (55.91 x 2.36 x 0.31 - 6)	(Main) 1,435 x 60 x 11 - 3 (56.50 x 2.36 x 0.43 - 3) (Helper) 1,051 x 60 x 10 - 2 (41.38 x 2.36 x 0.39 - 2)	(Main) 1,435 x 60 x 8 - 6 (56.50 x 2.36 x 0.31 - 6) (Helper) 1,051 x 60 x 7 - 4 (41.38 x 2.36 x 0.28 - 4)	1,300 x 70 x 7.5 - 5 (51.18 x 2.76 x 0.295 - 5)	1,300 x 70 x 8 - 1 7 - 7 (51.18 x 2.76 x 0.31 - 1, 0.28 - 8)
	Free camber "S" mm (in)		173.3 (6.82)	165 (6.50)	206 (8.11)	215.7 (8.49)	145 (5.71)	168 (6.61)
	Laden camber "S" mm/N (mm/kg, in/lb)		40.5 - 52.5/ 5,982 (40.5 - 52.5/ 610, 1.594 - 2.067/ 1,345)	30.5 - 42.5/ 5,982 (30.5 - 42.5/ 610, 1.201 - 1.673/ 1,345)	64 - 76/ 8,238 (64 - 76/ 840, 2.52 - 2.99/ 1,852)	80 - 92/ 8,238 (80 - 92/ 840, 3.15 - 3.62/ 1,852)	17 - 27/ 5,247 (17 - 27/ 535, 0.67 - 1.06/ 1,180)	45.5 - 56.5/ 7,257 (45.5 - 56.5/740, 1.791 - 2.224/ 1,632)
	Spring constant N/mm (kg/mm, lb/in)		47.17 (4.81, 269.4)	46.58 (4.75, 266.0)	46.88 - 115.53 (4.78 - 11.78, 267.7 - 659.7)	46.39 - 118.86 (4.73 - 12.12, 264.9 - 678.7)	39.571 - 45.652 (4.035 - 4.655, 225.96 - 260.68)	66.30 - 76.30 (6.76 - 7.78, 378.6 - 435.7)
Shock absorber	Maximum length "L" mm (in)		458 (18.03)	498 (19.61)	518 (20.39)	538 (21.18)	482 (18.98)	
	Stroke mm (in)		180 (7.09)	200 (7.87)	210 (8.27)	220 (8.66)	200 (7.87)	
	Damping force [0.3 m/sec (1.0 ft/sec)] N (kg, lb)	Expansion	1,128 (115,254)				1,863 (190, 419)	
		Compression	451 (46,101)				785 (80, 176)	

* Except Middle East: Standard
For Middle East: Option



SRA163



SRA112

INSPECTION AND ADJUSTMENT

REAR AXLE

Unit: mm (in)

Total end play	0.02 - 0.15 (0.0008 - 0.0059)	
Bearing housing shim	Thickness	Part No.
	1.00 (0.0394)	43086 T0400
	0.50 (0.0197)	43087 T0400
	0.25 (0.0098)	43088 T0400
	0.20 (0.0079)	43089 T0400

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	72 - 97 147 - 177*	7.3 - 9.9 15.0 - 18.0*	53 - 72 108 - 130*
Spring front pin nut	167 - 206	17.0 - 21.0	123 - 152
Spring shackle	50 - 68	5.1 - 6.9	37 - 50
Back plate and bearing housing fixing nut	53 - 63	5.4 - 6.4	39 - 46
Wheel bearing lock nut	441 - 490	45 - 50	325 - 362
Differential gear carrier to axle case nut	11 - 14 27 - 36*	1.1 - 1.4 2.8 - 3.7*	8 - 10 20 - 27*
Drain plug	39 - 59 59 - 98*	4 - 6 6 - 10*	29 - 43 43 - 72*
Filler plug	39 - 59 59 - 98*	4 - 6 6 - 10*	29 - 43 43 - 72*
Bumper rubber fixing bolt	16 - 22	1.6 - 2.2	12 - 16
Wheel nut	118 - 147	12 - 15	87 - 108
Propeller shaft to companion flange	78 - 88	8 - 9	58 - 65
Brake tube flare nut	15 - 18	1.5 - 1.8	11 - 13
Bumper rubber fixing nut	38 - 52*	3.9 - 5.3*	28 - 38*

* Heavy duty models

TROUBLE DIAGNOSES AND CORRECTIONS

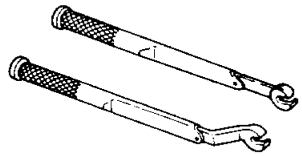
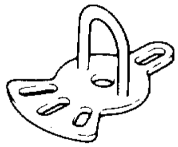
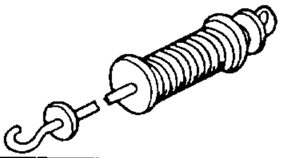
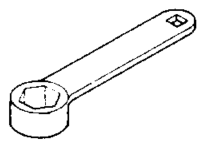
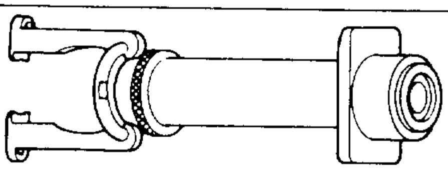
When rear axle and suspension is suspected of being noisy it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, exhaust, propeller shaft, engine, transmission, wheel bearings or suspension.

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.

SPECIAL SERVICE TOOLS

Tool number	Tool name
GG94310000	Flare nut torque wrench 
KV40101000	Rear axle stand 
ST36230000	Sliding hammer 
ST38080001	Bearing lock nut wrench 
HT72480000	Rear axle shaft bearing puller 

BRAKE SYSTEM

SECTION BR

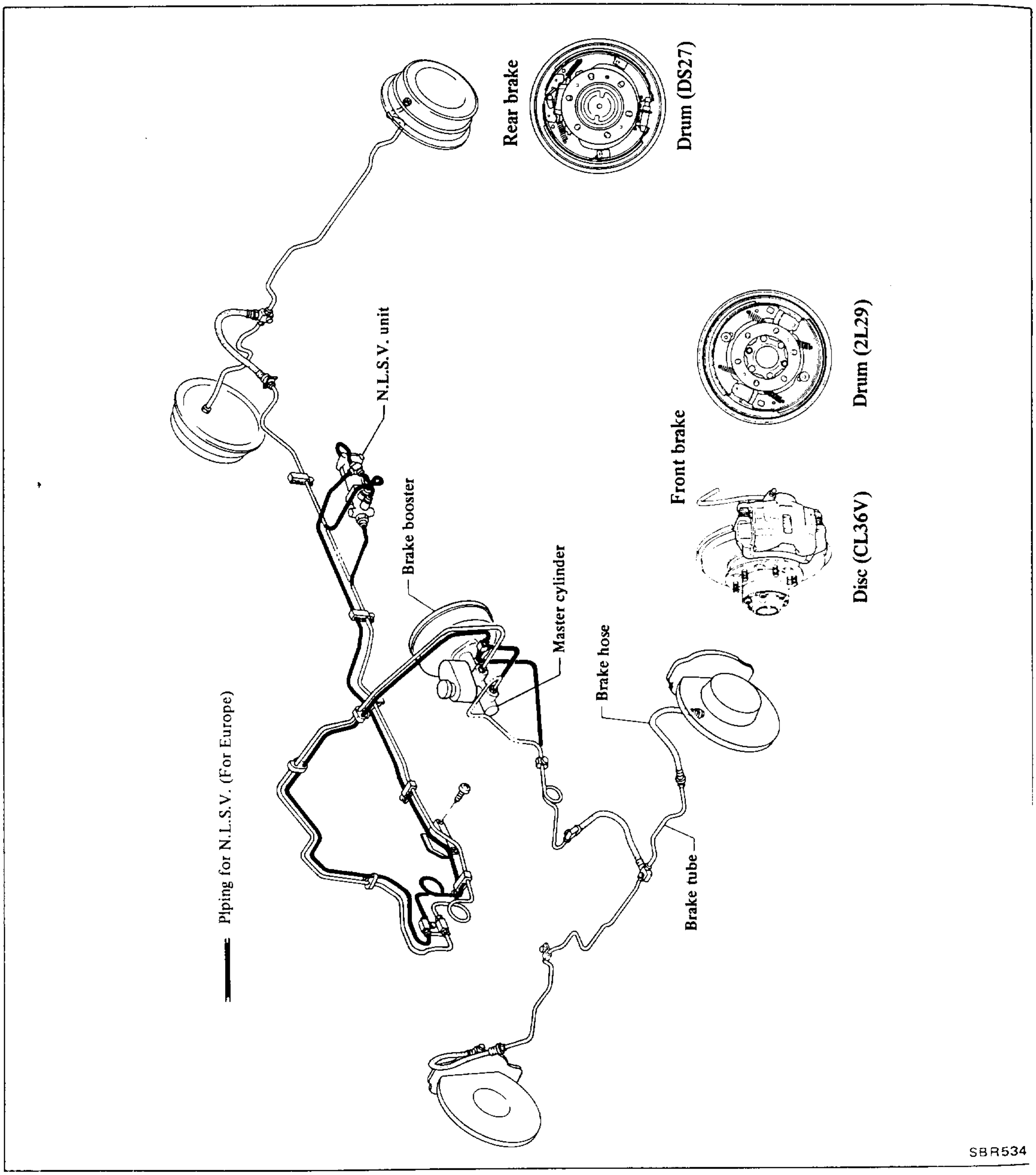
CONTENTS

Refer to section MA (Brake System) for:

- CHECKING FOOT BRAKE
- CHECKING PARKING BRAKE

BR

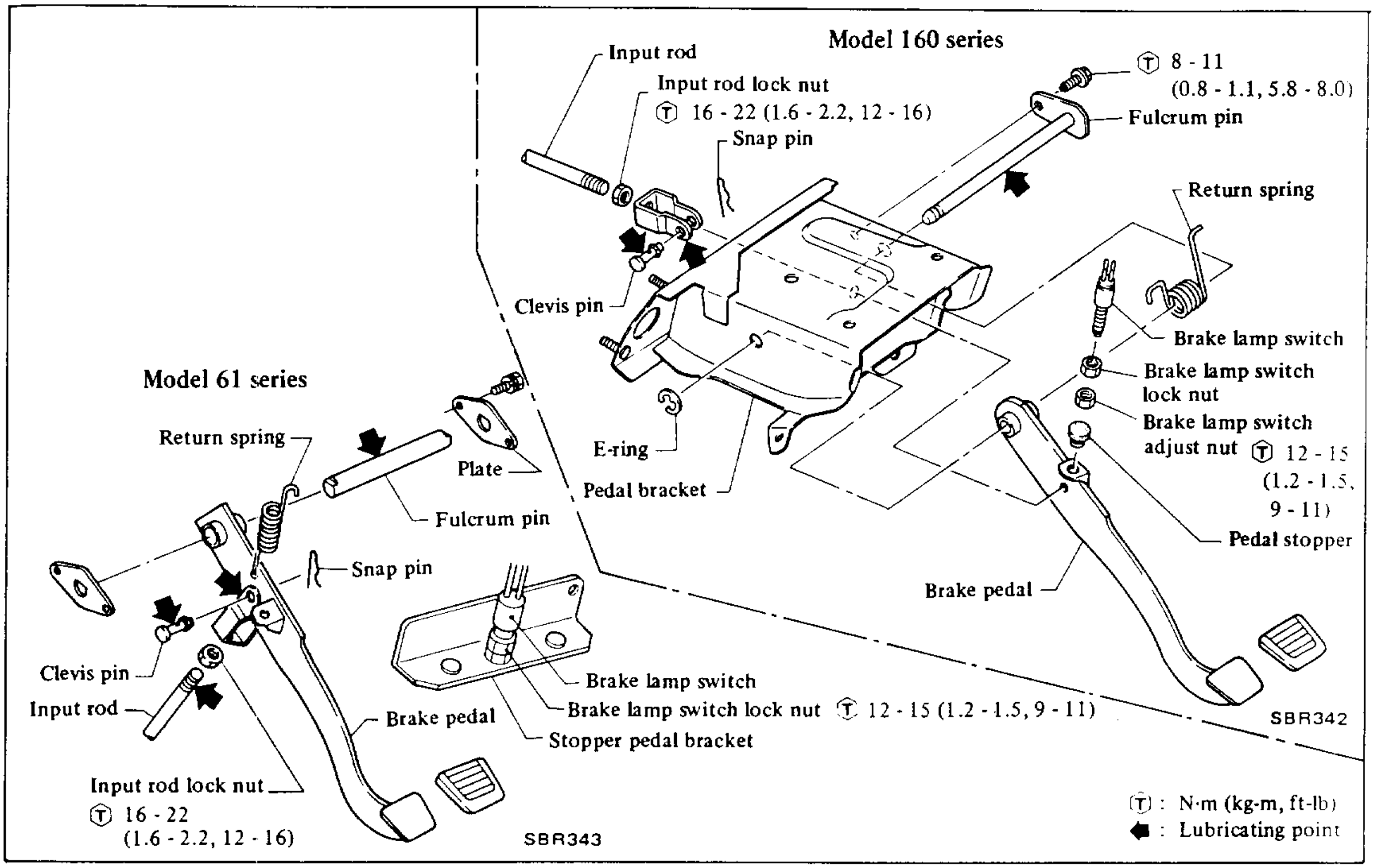
DESCRIPTION



- 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 (For Europe).
- The drum brake requires shoe-to-drum clearance adjustment.

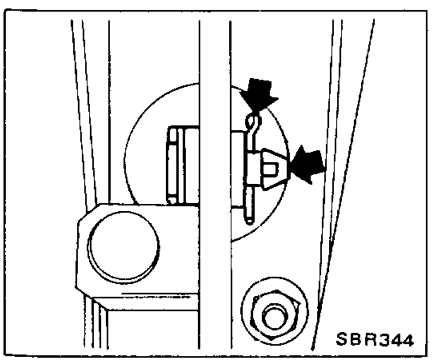
SERVICE BRAKE

BRAKE PEDAL

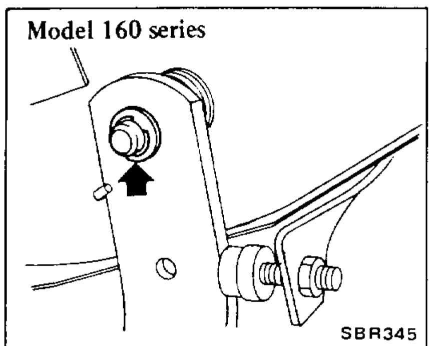


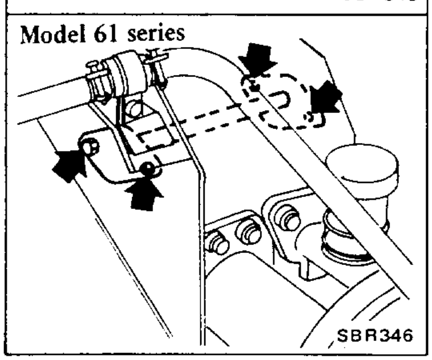
REMOVAL

1. Disconnect clevis pin.
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.

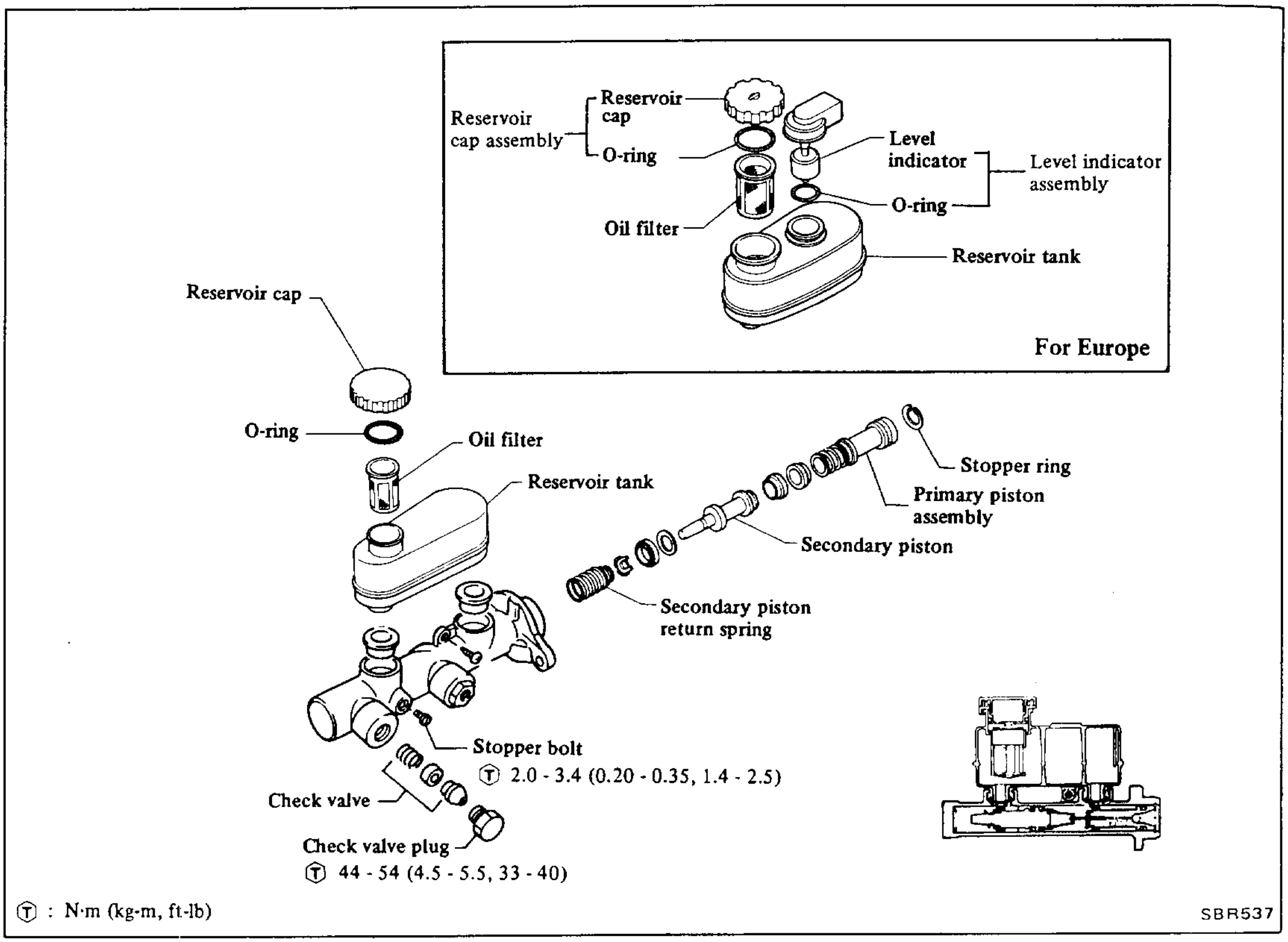
1. Check brake pedal for bend.
2. Check return spring for fatigue.
3. Check clevis for deformation and cracks at welded part.

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)

MASTER CYLINDER

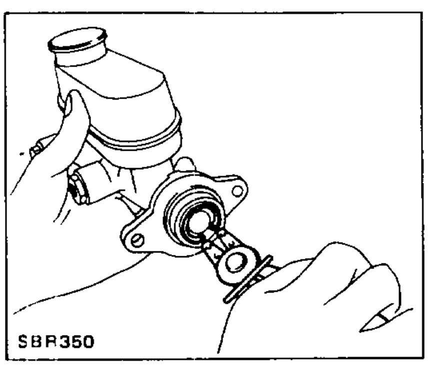


DISASSEMBLY

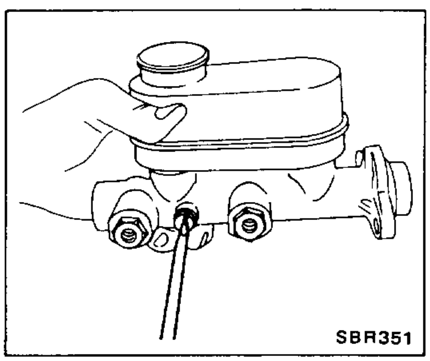
There is no interchangeability of repair kits or component parts between TOKICO and NABCO makes.

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.

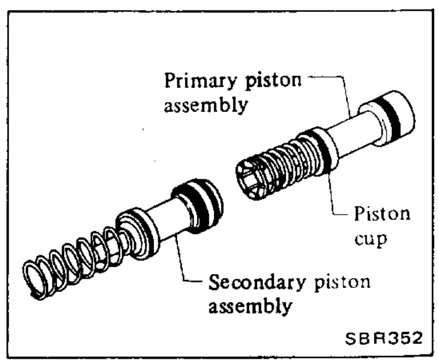


2. Remove stopper bolt, then primary and secondary piston assemblies can be taken out.



3. Remove reservoir.
4. Disassemble piston assembly.

Do not disassemble primary piston assembly.



5. Remove piston cups.

Do not reuse piston cups once removed. Always install new one.

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, packing and piston cups with new ones.
b. Apply brake fluid or rubber grease to sliding contact surface of parts to facilitate assembly of master cylinder.

(T) : Check valve plug
44 - 54 N·m
(4.5 - 5.5 kg-m,
33 - 40 ft-lb)

BRAKE HYDRAULIC LINE

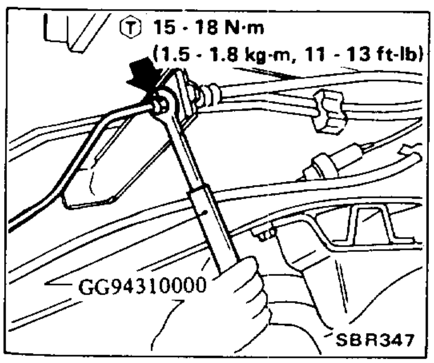
INSPECTION

Check brake lines (tubes and hoses) for evidence of cracks, deterioration or other damage. Replace any faulty parts.

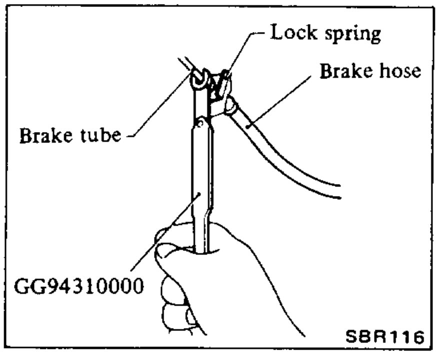
If leakage occurs at end around joints, re-tighten or, if necessary, replace faulty parts.

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.



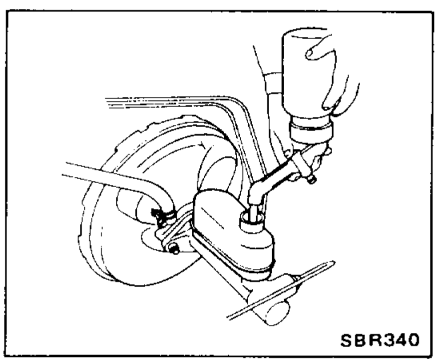
- Installation is in the reverse order of removal.

(T) : Brake tube flare nut
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)

BLEEDING HYDRAULIC SYSTEM

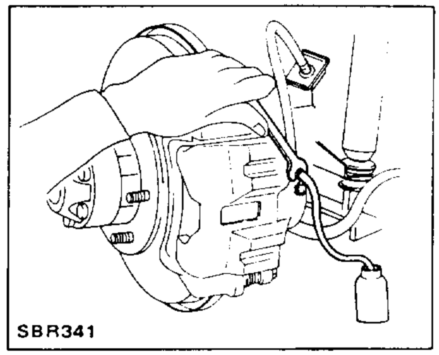
1. Top up reservoir with recommended brake fluid.

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.

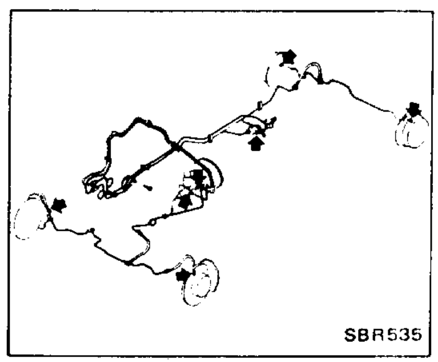


2. Install bleeder hose on bleeder valve. With brake pedal fully depressed, open bleeder valve to exhaust air. Then close bleeder valve and allow brake pedal to return. Repeat bleeding operation until no air bubbles show in hose.

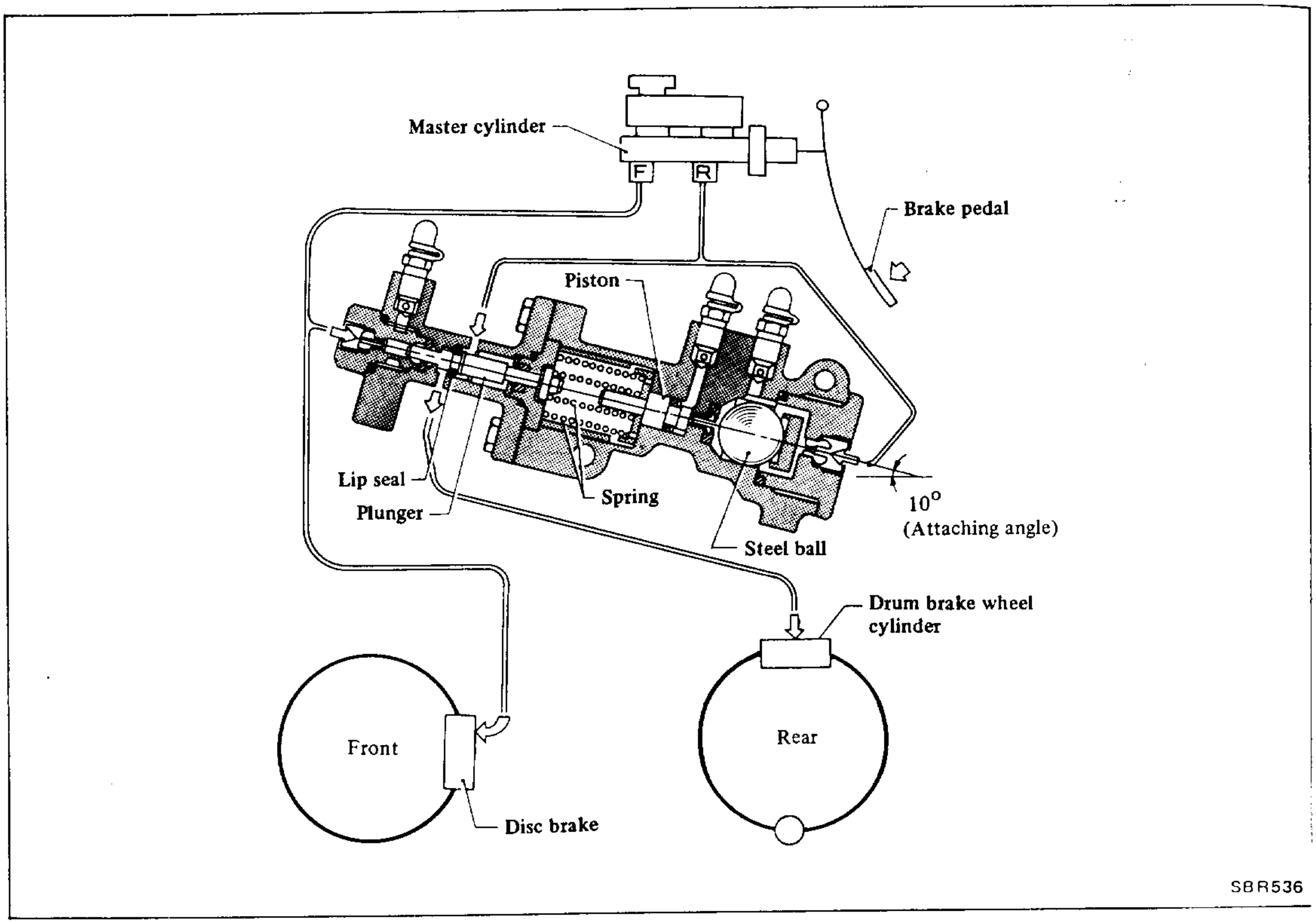
a. Be careful not to splash brake fluid on painted area.
b. Brake fluid containing air is white and contains air bubbles.
c. Brake fluid containing no air runs out of bleeder valve in a solid stream free of air bubbles.



3. Bleed air in the following sequence. **Master cylinder → N.L.S.V. (For Europe) → Rear wheel → Front wheel.**



NISSAN LOAD SENSING VALVE (N.L.S.V.) —For Europe—

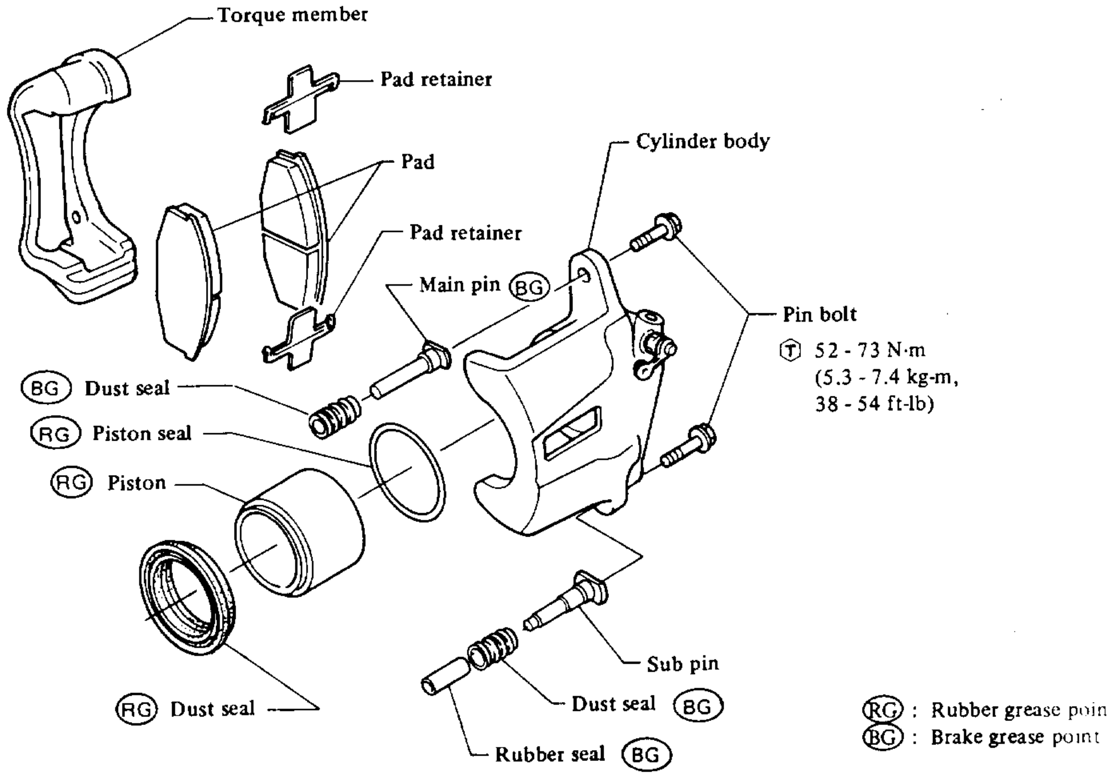


Do not reuse once disassembled N.L.S.V. Replace faulty N.L.S.V. as an assembly.

Ⓣ : 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)

FRONT DISC BRAKE —CL36V—

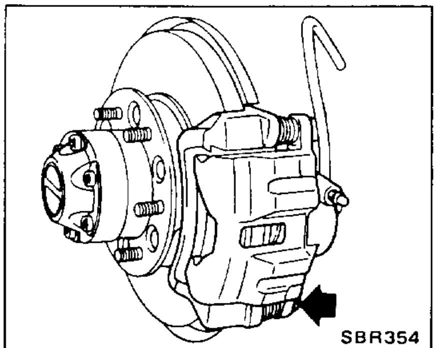


SBR353

PAD REPLACEMENT

Removal

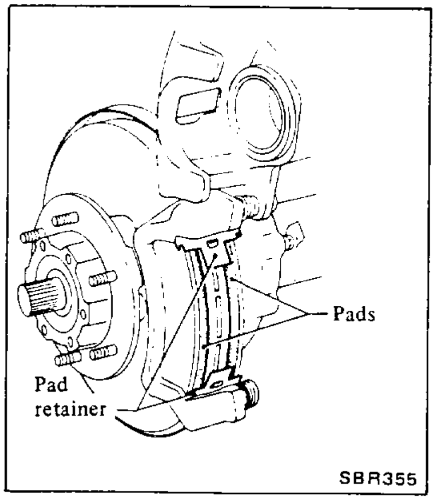
1. Jack up front of vehicle, and **support it on safety stands.** Remove wheel.
2. Remove lower pin bolt.


SBR354

3. Open cylinder body upward and remove pad retainer.

Do not pull out cylinder body in axial direction (direction of pin guide).

4. Detach pads.



SBR355

CAUTION:
After removing pads, do not depress brake pedal, or pistons will jump out.

Inspection

1. When pads are heavily fouled with oil or grease or when pad is deteriorated or deformed, replace it.
2. If pad is worn to less than the specified value, replace.

Pad wear limit
(Minimum thickness):
2 mm (0.08 in)

Always replace pads in pad kit (four pads).

3. Check rotor, **referring to** Rotor **for inspection.**

Installation

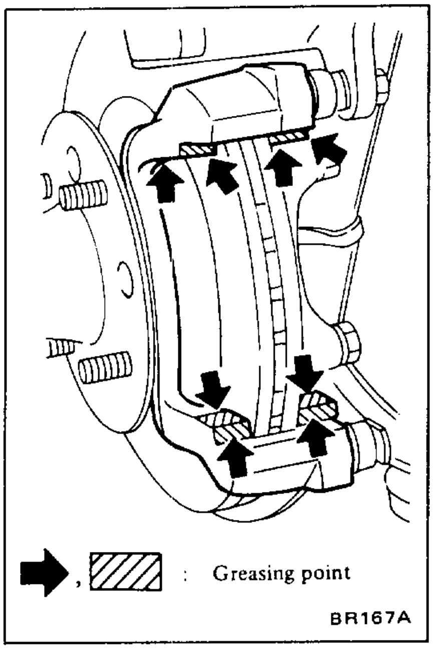
1. Clean piston end and surroundings of pin bolts.

CAUTION:
Use brake fluid to clean. Never use mineral oil.

Be careful not to get oil on rotor.

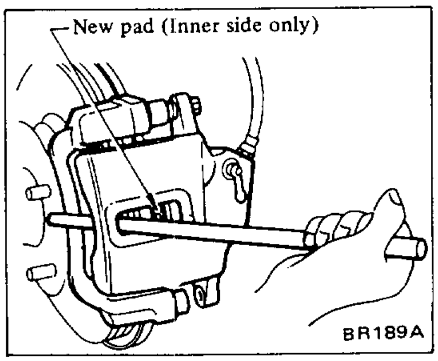
2. Coat the following point with recommended brake grease.
- Torque member-to-pad clearance

Do not grease friction face of pad.



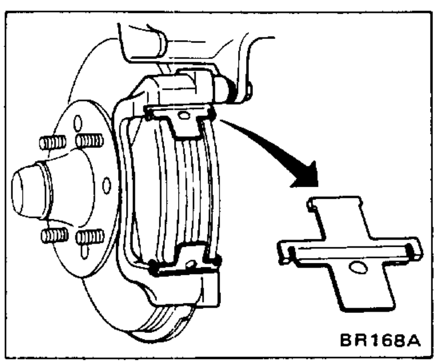
BR167A

3. Install new pad (inner side).
Insert lever into opening in cylinder body as shown below and push piston by catching torque member.



BR189A

4. Install new pad (outer side).
5. After installing pads, install pad retainer, being careful not to fit it upside down.


BR168A

6. Install cylinder body and then tighten lower pin bolt.

Ⓣ : **Pin bolt**
52 - 73 N·m
(5.3 - 7.4 kg-m,
38 - 54 ft-lb)

7. Depress brake pedal several times, and pads will settle into proper position.
8. Install wheels and lower vehicle to ground.

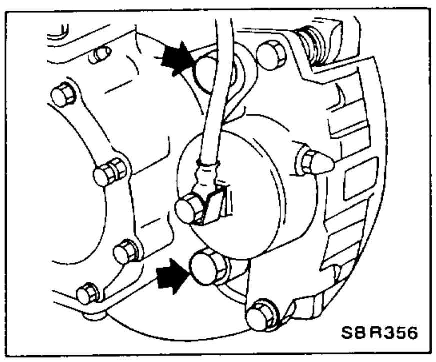
REMOVAL

1. Jack up front of vehicle, and **support it on safety stands.** Remove wheel.
2. Remove front brake hose.

CAUTION:
When removing brake tube, use Tool GG94310000. Never use open-end or adjustable wrench.

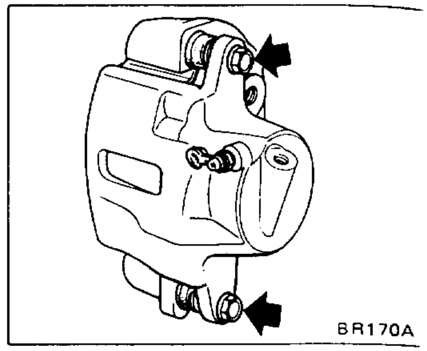
Plug up hole in caliper and brake tube so that brake fluid does not flow out.

3. Remove caliper assembly from knuckle spindle.


SBR356

DISASSEMBLY

1. Drain brake fluid from cylinder body.
2. Wipe off dust and mud from caliper assembly.
3. Remove pin bolts.


BR170A

4. Separate cylinder body and torqu member.
5. Remove pad retainers and pads
6. Force out pistons with dust sea from cylinder by feeding compresse air gradually.

WARNING:
Gradually increase air pressure so that piston does not pop out.

7. Remove piston seals.

CAUTION:
Be careful not to damage seals an cylinder body.

8. If necessary, remove sub pin main pin and dust seals.

INSPECTION

Clean all parts and check as fo lows:

CAUTION:
Use brake fluid to clean. Never u mineral oil.

Cylinder body

1. Check inside surface of cylind for score, rust, wear, damage or pre ence of foreign substances. If ar surface fault is detected, replace c inder body.
2. Minor damage from rust foreign substances may be eliminat by polishing surface with a fine eme cloth. If damage is major, cylind assembly must be replaced.

Torque member

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.

Main pin, sub pin and rubber bushing

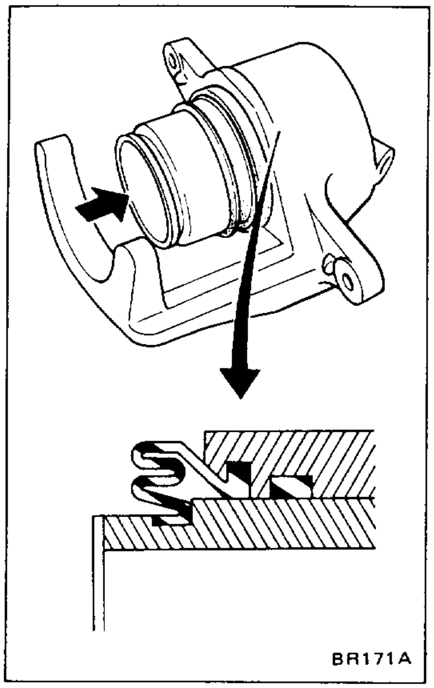
Check for wear, cracks or other damage. Replace if any fault is detected.

ASSEMBLY

Assemble front brake in reverse order of disassembly, closely observing the following:

1. Install piston seals, taking care not to damage them.
2. Apply brake fluid to sliding portions of piston, inside of cylinder body.
3. With dust seal fitted to piston, insert dust seal into groove in cylinder body and install piston. Then securely fit dust seal.

Apply rubber grease to inside of dust seal.



BR171A

4. Coat the following part with recommended brake grease.
• Torque member-to-pad clearance.
5. Apply a coat of recommended multi-purpose grease to main pin rubber bushing and to sub pin.
6. Tighten pin bolts.

Ⓣ : **Pin bolts**
52 - 73 N·m
(5.3 - 7.4 kg-m,
38 - 54 ft-lb)

INSTALLATION

1. Install caliper assembly without pads and pad retainer to knuckle flange.

Ⓣ : **Caliper mounting bolt**
108 - 147 N·m
(11 - 15 kg-m,
80 - 108 ft-lb)

2. Install pads and pad retainer.
Refer to Pad Replacement.
3. Install front brake hose and bleed brake system.

CAUTION:
When installing brake tubes, use Tool GG94310000.

Ⓣ : **Brake tube flare nut**
15 - 18 N·m
(1.5 - 1.8 kg-m,
11 - 13 ft-lb)
Air bleeder
7 - 9 N·m
(0.7 - 0.9 kg-m,
5.1 - 6.5 ft-lb)

4. After installing, see if there is no leak by depressing brake pedal several times.

Turn rotor to make sure it does not drag excessively.

FRONT DISC ROTOR

REMOVAL

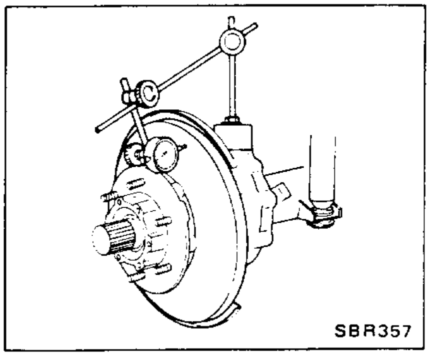
Refer to Removal (Section FA).

INSPECTION

Check the following items and, if necessary, replace. Checks can be made by removing only wheel.

1. Sliding surface
If there are cracks or considerable chips, replace.
2. Runout
Adjust wheel bearing correctly.
Using a dial gauge, measure runout.

Runout limit
(Total indicator reading):
Less than 0.07 mm (0.0028 in) at center of rotor pad contact surface

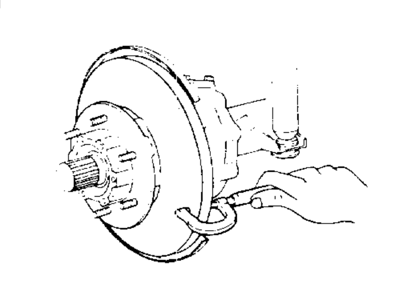


SBR357

3. Parallelism
Measure thickness of rotor in circumferential direction, using a micrometer.

Parallelism:
Circumferential direction
Less than
0.03 mm (0.0012 in)

As this value increases (wear occurs progressively), vibration corresponding to revolution of tire may often be transmitted to interior of vehicle.



SBR358

4. Thickness

If rotor thickness is beyond wear limit, replace rotor. When correcting thickness, be sure that the thickness after correction does not exceed the limit.

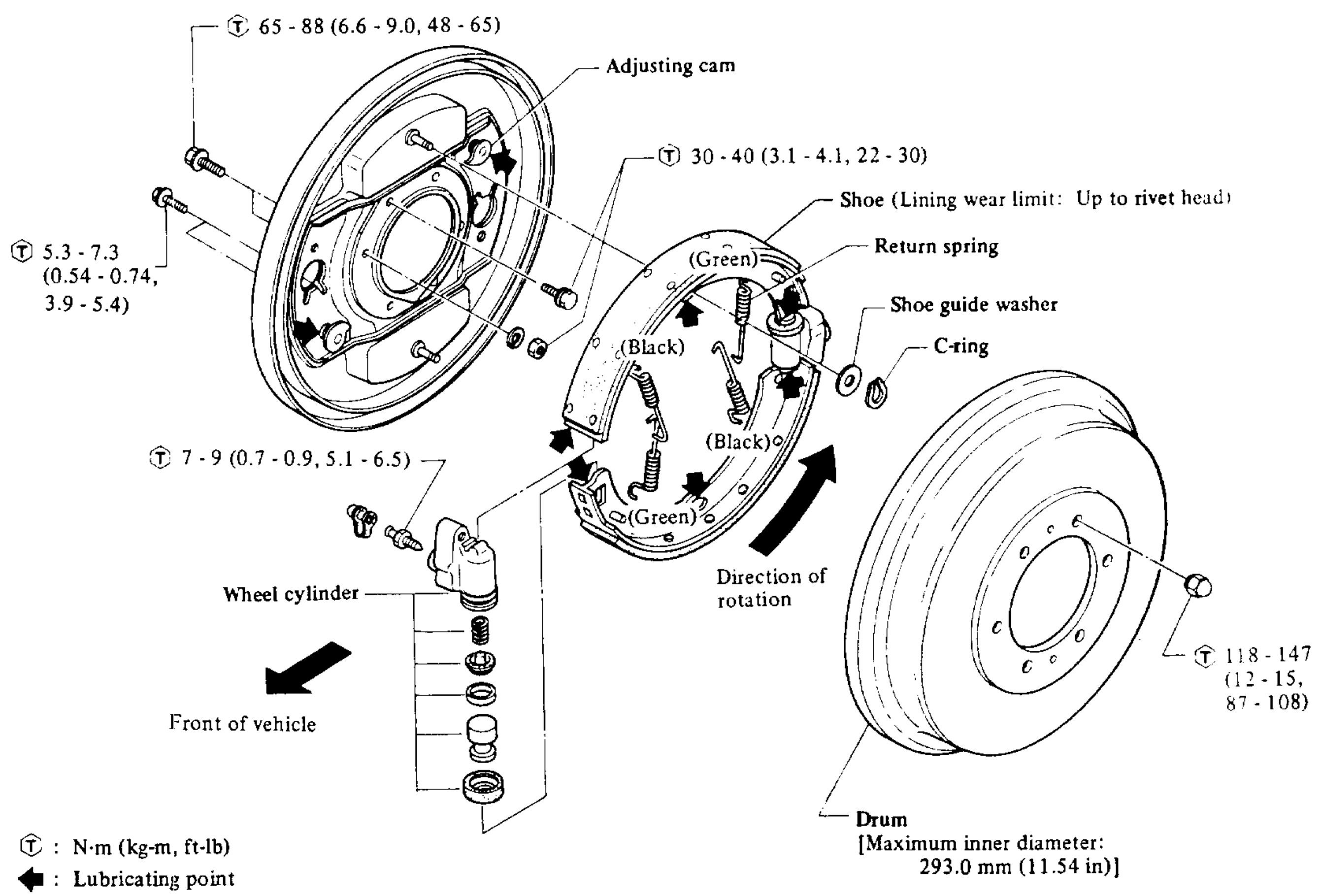
Standard thickness:
20.0 mm (0.787 in)
Wear limit (Minimum thickness):
18 mm (0.71 in)

INSTALLATION

Install rotor in reverse order of removal. Adjust wheel bearing preload correctly. **Refer to Adjustment (Section MA).**

Ⓣ : Rotor to wheel hub
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)

FRONT DRUM BRAKE —2L29—

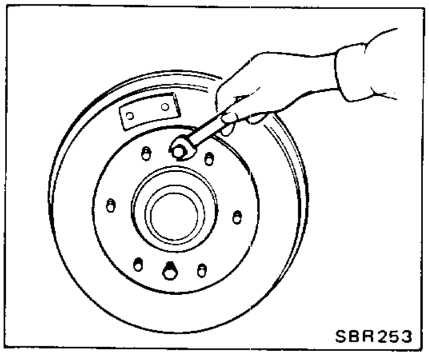


SBR359

SHOE REPLACEMENT

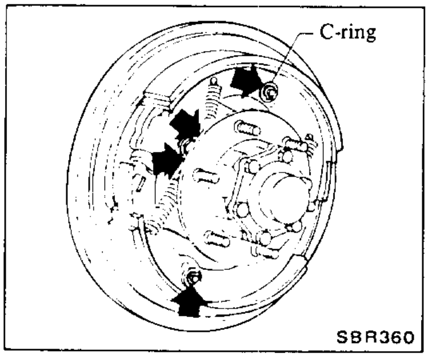
Removal

1. Remove wheel and drum. **If drum is hard to remove, screw in bolt to drive drum out.**



SBR253

2. Remove C-ring and return springs.



SBR360

3. Remove brake shoes.

Installation

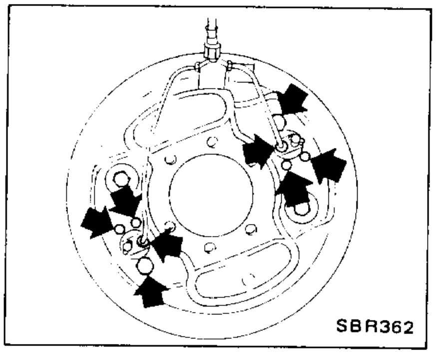
1. Apply brake grease to the following contact areas.
- Shoe to wheel cylinder piston and anchor.
- Adjuster cam to shoe.
- Shoe guide washer to shoe.

2. After installation is completed, adjust shoe-to-drum clearance. **Refer to Section MA for adjustment.**

WHEEL CYLINDER

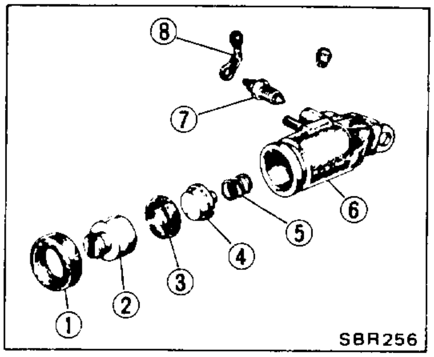
Removal

1. Remove brake shoe.
2. Disconnect brake tube.
3. Then remove wheel cylinder.



SBR362

Disassembly



SBR256

1	Dust cover	5	Spring
2	Piston	6	Cylinder
3	Piston cup	7	Bleeder
4	Spring retainer	8	Bleeder cap

Inspection

1. Replace any cylinder or piston which is scratched, scored or worn on its sliding contact surface.
2. Replace worn parts if piston-to-cylinder clearance is beyond limit.

Piston-to-cylinder clearance:
Less than 0.15 mm (0.0059 in)

3. Replace any piston cup which is worn or otherwise damaged.
4. Replace if contacting face of cylinder and shoe is worn locally or in step.
5. Replace any damaged dust cover, fatigued piston spring or faulty threaded parts.
6. Replace any 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.

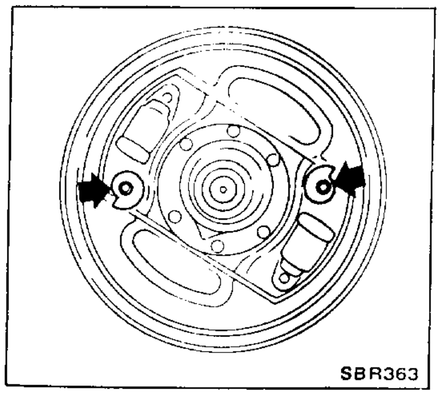
Installation

Ⓣ : Wheel cylinder fixing nut
Small bolt
5.3 - 7.3 N·m
(0.54 - 0.74 kg-m,
3.9 - 5.4 ft-lb)
Large bolt
65 - 88 N·m
(6.6 - 9.0 kg-m,
48 - 65 ft-lb)

Refer to Shoe Replacement for installation.

ADJUSTER CAM

The adjuster cam can not be removed from the back plate. It should always be replaced along with the back plate assembly.



SBR363

BRAKE DRUM

Inspection

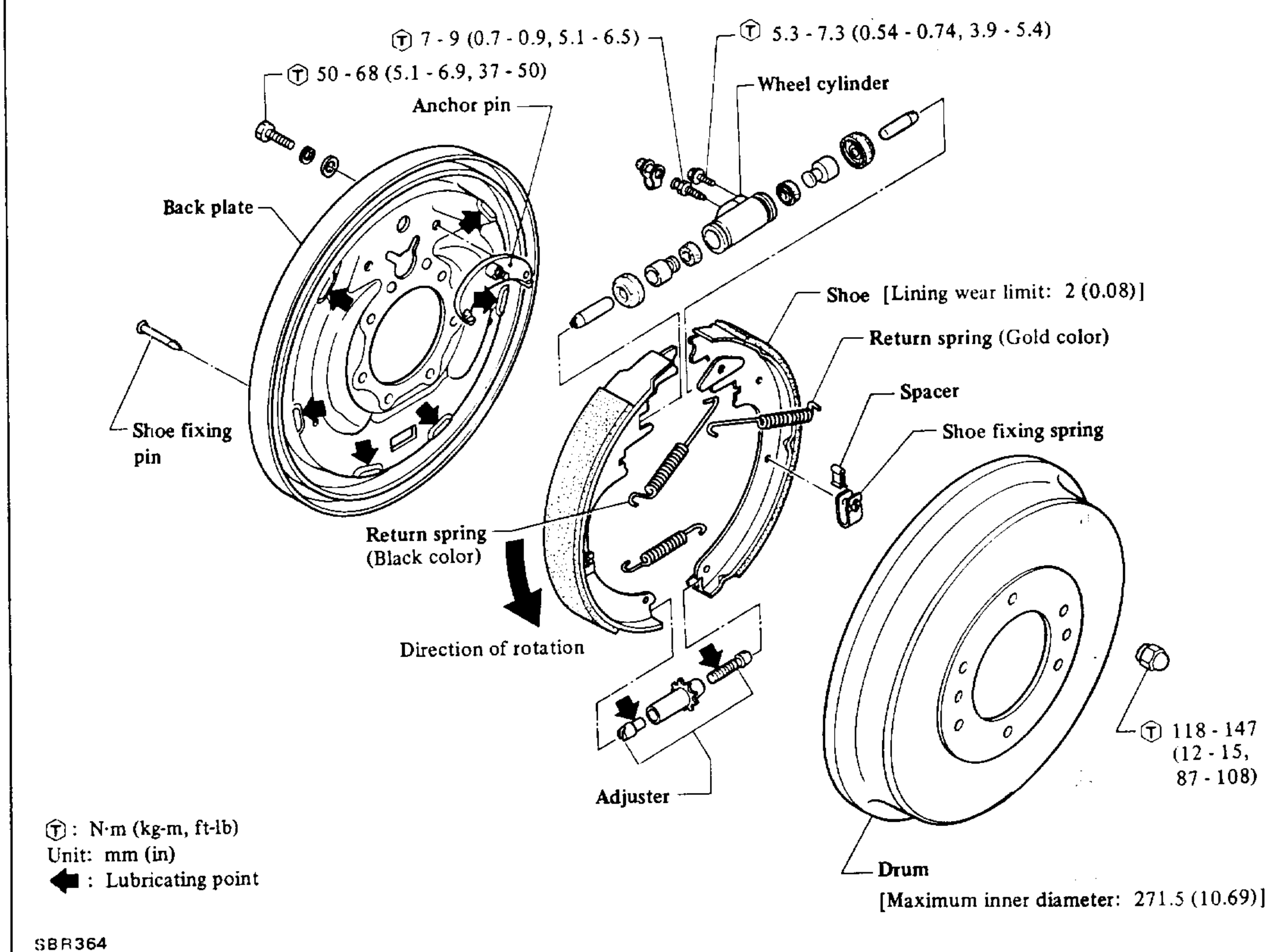
1. Check inner diameter of brake drum to make sure it is properly round and tapered. If it is not, repair or replace brake drum.

Standard inner diameter:
292.1 mm (11.50 in)
Maximum inner diameter:
293.0 mm (11.54 in)
Out-of-roundness (ellipticity):
Less than 0.05 mm (0.0020 in)
Radial runout
(Total indicator reading):
Less than 0.15 mm (0.0059 in)

2. Contact surface with which linings come into contact should be fine-finished with No. 120 to 150 sandpaper.
3. Using a drum racer, finish brake drum by machining if it shows any sign of score marks, partial wear or stepped wear on its contact surface.

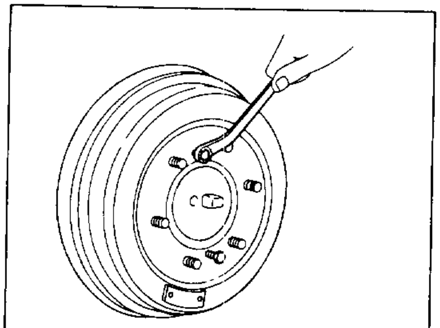
After brake drum has been completely re-conditioned or replaced, check drum and shoes for proper contact pattern.

REAR BRAKE —DS27—



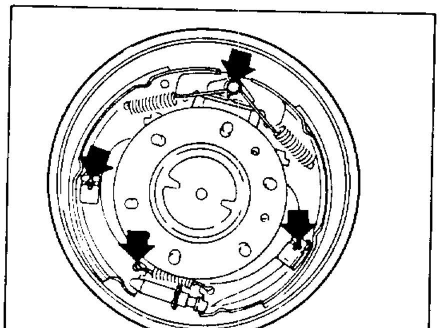
SHOE REPLACEMENT

1. Remove wheel and drum. **If drum is hard to remove, screw in bolt to drive drum out.**



SBR365

2. Remove shoe fixing springs and return springs.



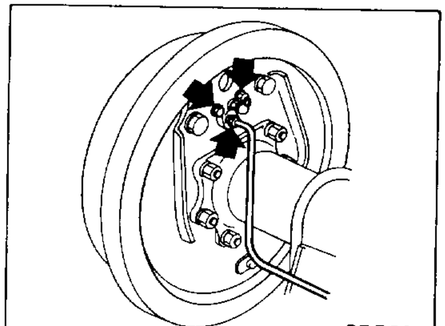
SBR366

3. Remove shoe assemblies.
4. Apply brake grease to the following points.
   - Brake shoe installing grooves of adjuster and wheel cylinder.
   - Contact surfaces between brake disc and brake shoe assembly (six places).
5. After installation is completed, adjust shoe-to-drum clearance. **Refer to Section MA for adjustment.**

WHEEL CYLINDER

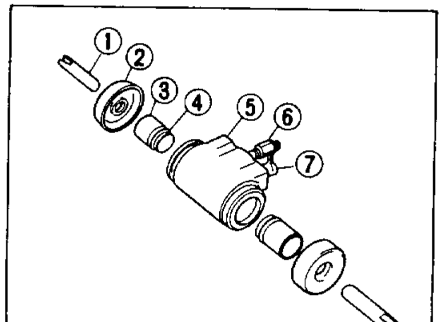
Removal

1. Remove brake shoe.
2. Disconnect brake tube.
3. Then remove wheel cylinder.



SBR368

Disassembly



SBR369

1 Piston head
2 Dust cover
3 Piston
4 Piston cup
5 Wheel cylinder housing
6 Bleeder screw
7 Bleeder cap

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 bolt
5.3 - 7.3 N·m
(0.54 - 0.74 kg-m,
3.9 - 5.4 ft-lb)

BRAKE DRUM

Inspection

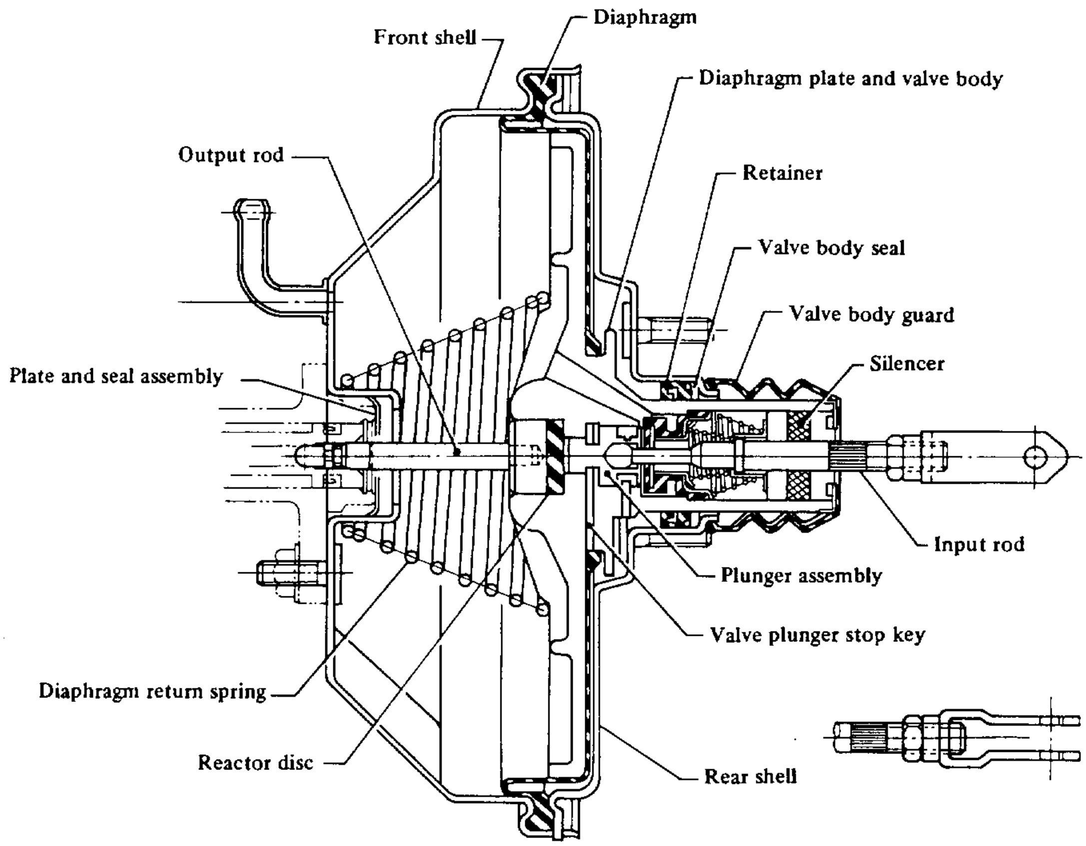
1. Check inner diameter of brake drum to make sure it is properly round and tapered. If it is not, repair or replace brake drum.

Standard diameter:
270 mm (10.63 in)
Maximum inner diameter:
271.5 mm (10.69 in)
Out-of-roundness (ellipticity):
Less than 0.05 mm (0.0020 in)
Radial run-out
(total indicator reading):
Less than 0.12 mm (0.0047 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.

BRAKE BOOSTER

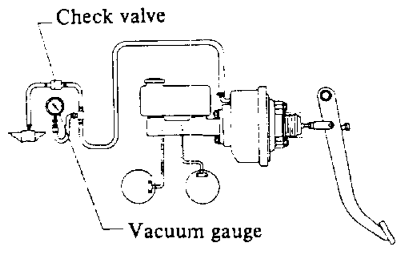


SBR375

INSPECTION

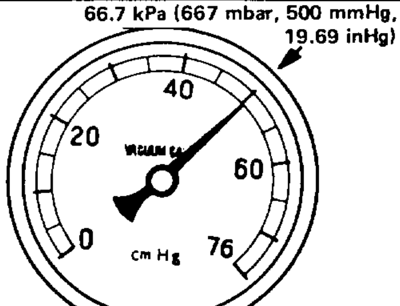
Airtight test (No load)

1. Connect a vacuum gauge between check valve and brake booster.



SBR376

2. Start engine and increase engine speed. Stop engine when vacuum is 66.7 kPa (667 mbar, 500 mmHg, 19.69 inHg).



SBR060

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
(33 mbar, 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.

Airtight test (Under load)

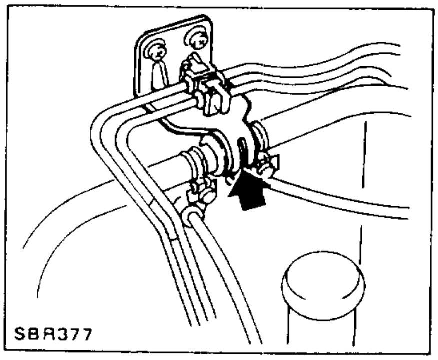
With brake pedal fully depressed, perform an airtight test following the same procedures as used in airtight test under no load.

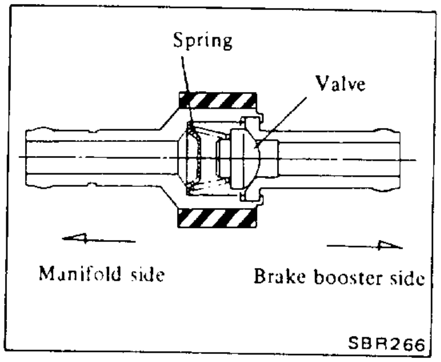
Maximum vacuum leakage (15 seconds after engine is stopped):
3.3 kPa (33 mbar, 25 mmHg, 0.98 inHg)

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.


SBR377



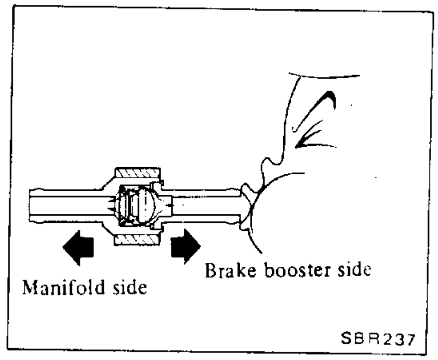
SBR266

2. Apply a vacuum pressure of 66.7 kPa (667 mbar, 500 mmHg, 19.69 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 (13 mbar, 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.



SBR237

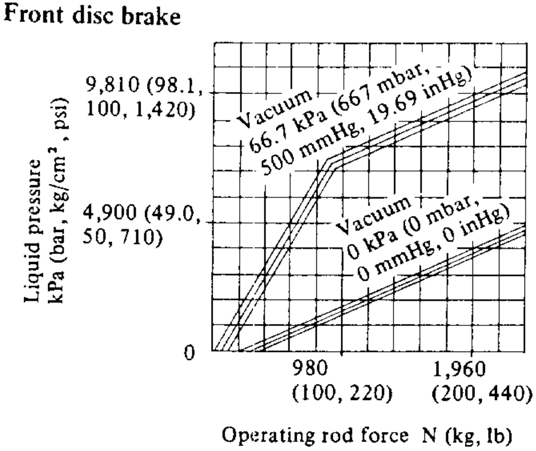
Operating test

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 (667 mbar, 500 mmHg, 19.69 inHg) is registered on vacuum pressure gauge. With a steady vacuum pressure of 66.7 kPa (667 mbar, 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 the following figures. Also check brake line for evidence of fluid leakage.

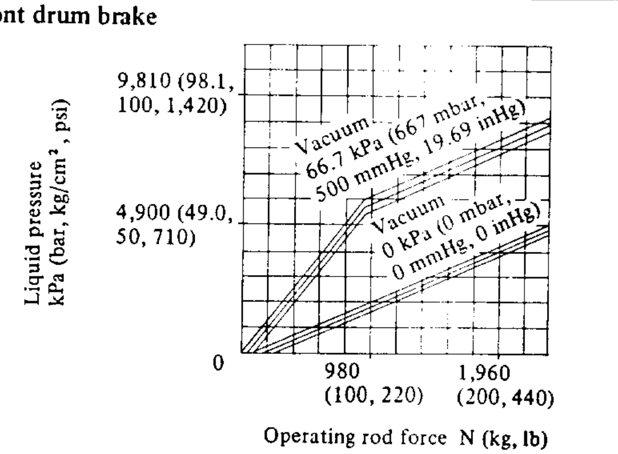
Determine whether source of problem is in brake booster or check valve. Before you reach a final conclusion, always inspect check valve first.

Front disc brake



SBR378

Front drum brake

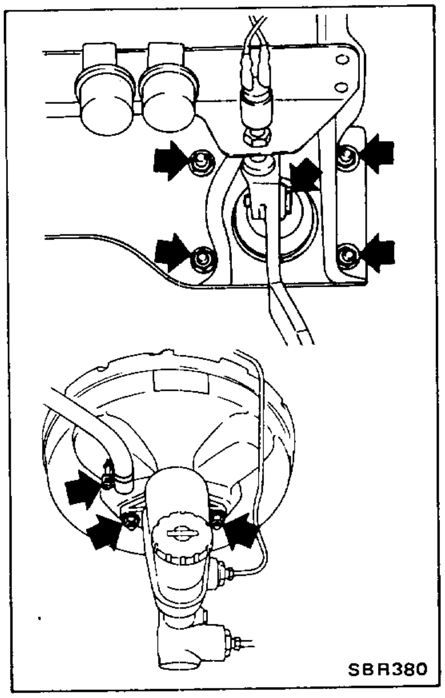


SBR379

The values for pedal operating force are 1/4 those of rod operating force.

REMOVAL

To remove brake booster, detach the following points.



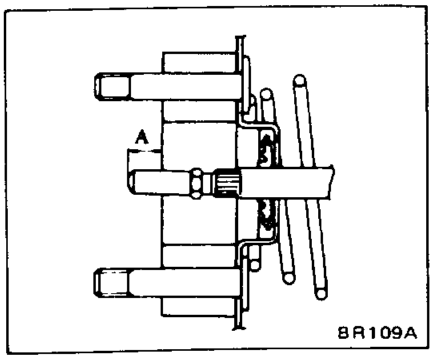
SBR380

ADJUSTMENT

Output rod length

1. Check length.

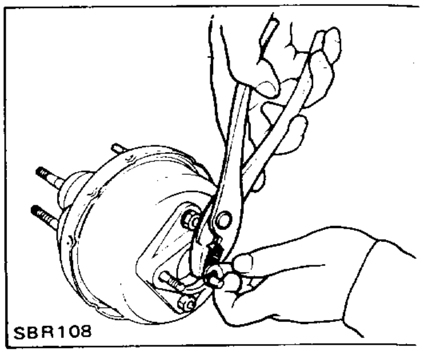
   Length "A":
   9.75 - 10.00 mm
   (0.3839 - 0.3937 in)



BR109A

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.

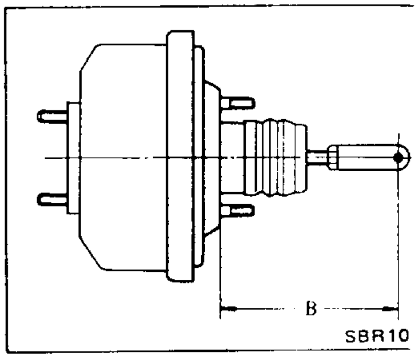


SBR108

Input rod length

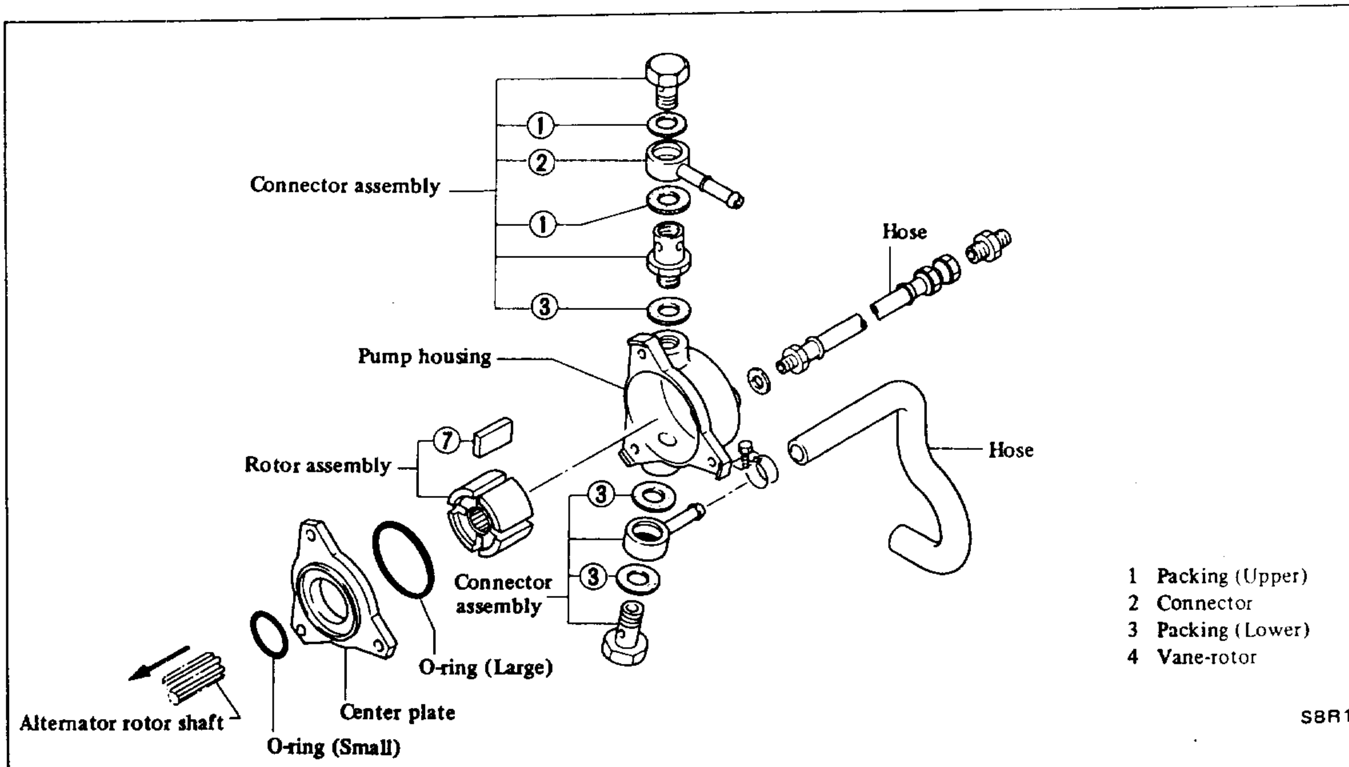
Adjust length by turning adjustin nut.

Length "B":
128 mm (5.04 in)



SBR10

VACUUM PUMP (Equipped with SD33 engine only)



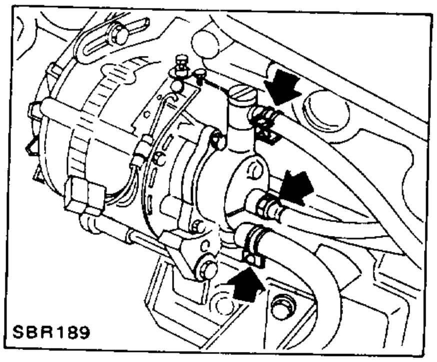
SBR1

Removal and installation

1. Drain oil from vacuum pump.

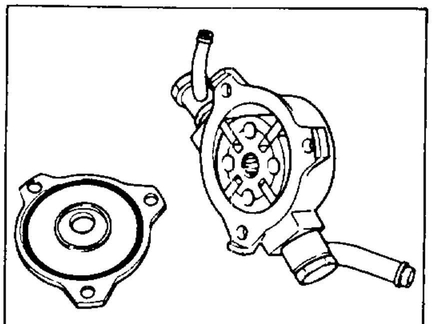
Manually rotate fan belt clockwise to discharge any oil which may have accumulated in vacuum pump.

2. Remove vacuum pump assembly from AC alternator.



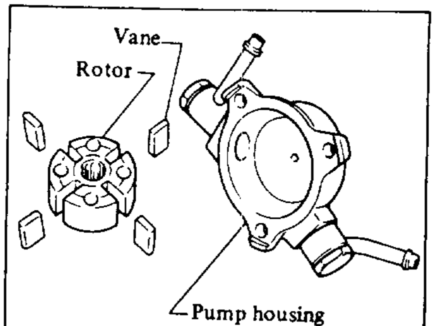
SBR189

3. Separate center plate and vacuum pump housing.



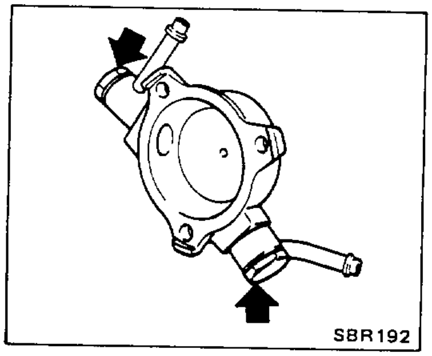
SBR190

4. Disassemble rotor, vane and vacuum pump housing.



SBR191

5. Disconnect valve assembly.



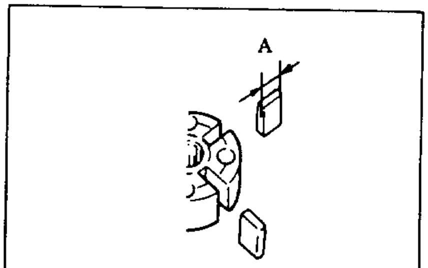
SBR192

6. Install vacuum pump in the reverse order of removal.

INSPECTION

Clean all parts and check them as follows:

- Check for wear or scratches on mating surfaces of rotor and vacuum pump housing and of rotor and center plate. If any wear or scratches are noted, replace those parts.
- Check for wear or scratches on vanes. If necessary, replace.



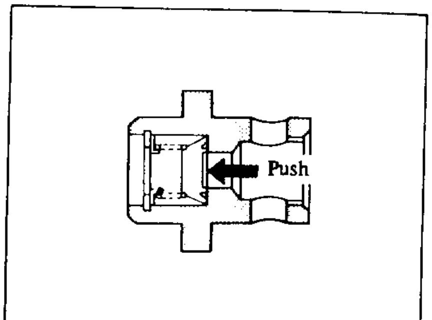
Vane length "A" : 11.6 - 12.6 mm (0.457 - 0.496 in)

SBR193

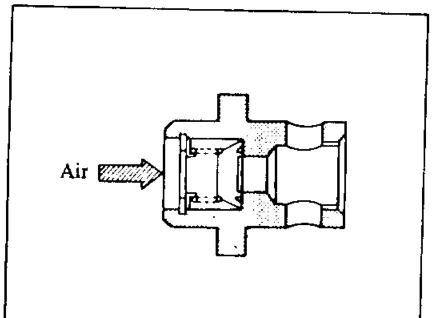
- Check inner wall of vacuum pump housing for wear. If necessary, replace.

Vacuum pump housing inner diameter:
53.7 - 53.8 mm
(2.114 - 2.118 in)

- Check rotor shaft opening and serrates end of rotor shaft for wear. If necessary, replace.
- Check valve locations and copper washers for bending or deformity. If necessary, replace.
- Check operation of valves. If necessary, replace.



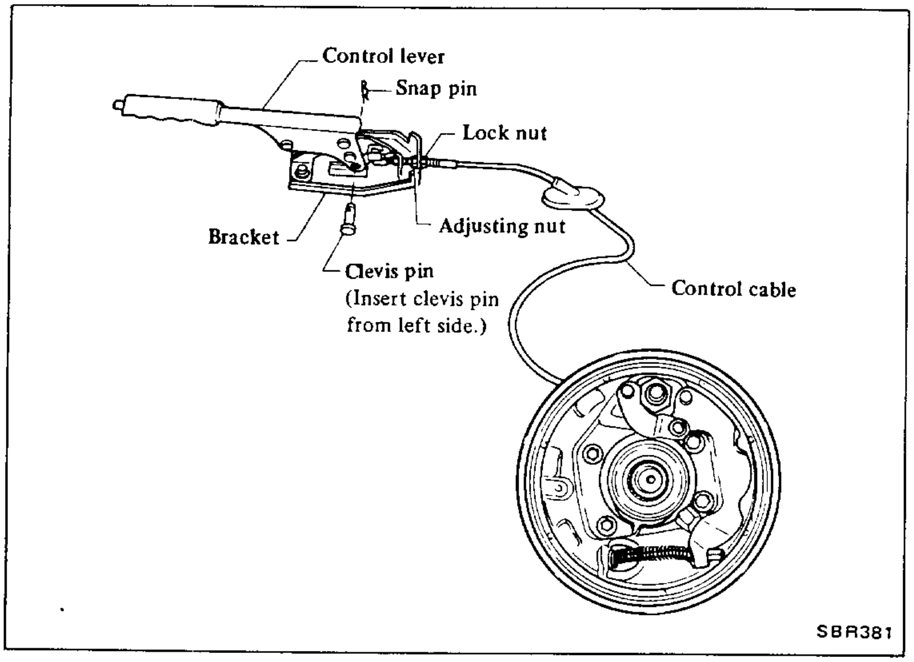
Checking operate valve SBR194



Checking air leakage of valve SBR195

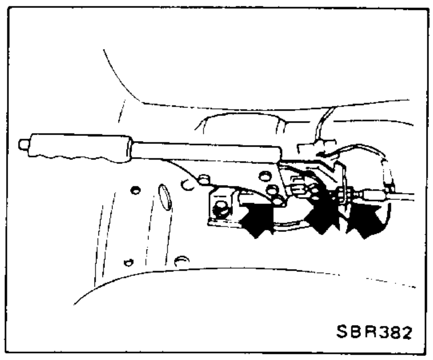
PARKING BRAKE

PARKING BRAKE CONTROL



REMOVAL

1. Disconnect harness connector.
2. Disconnect control cable from control lever and bracket.



3. Remove control lever and bracket.
4. Disconnect control cable from center brake and remove control cable. Refer to Center Brake.

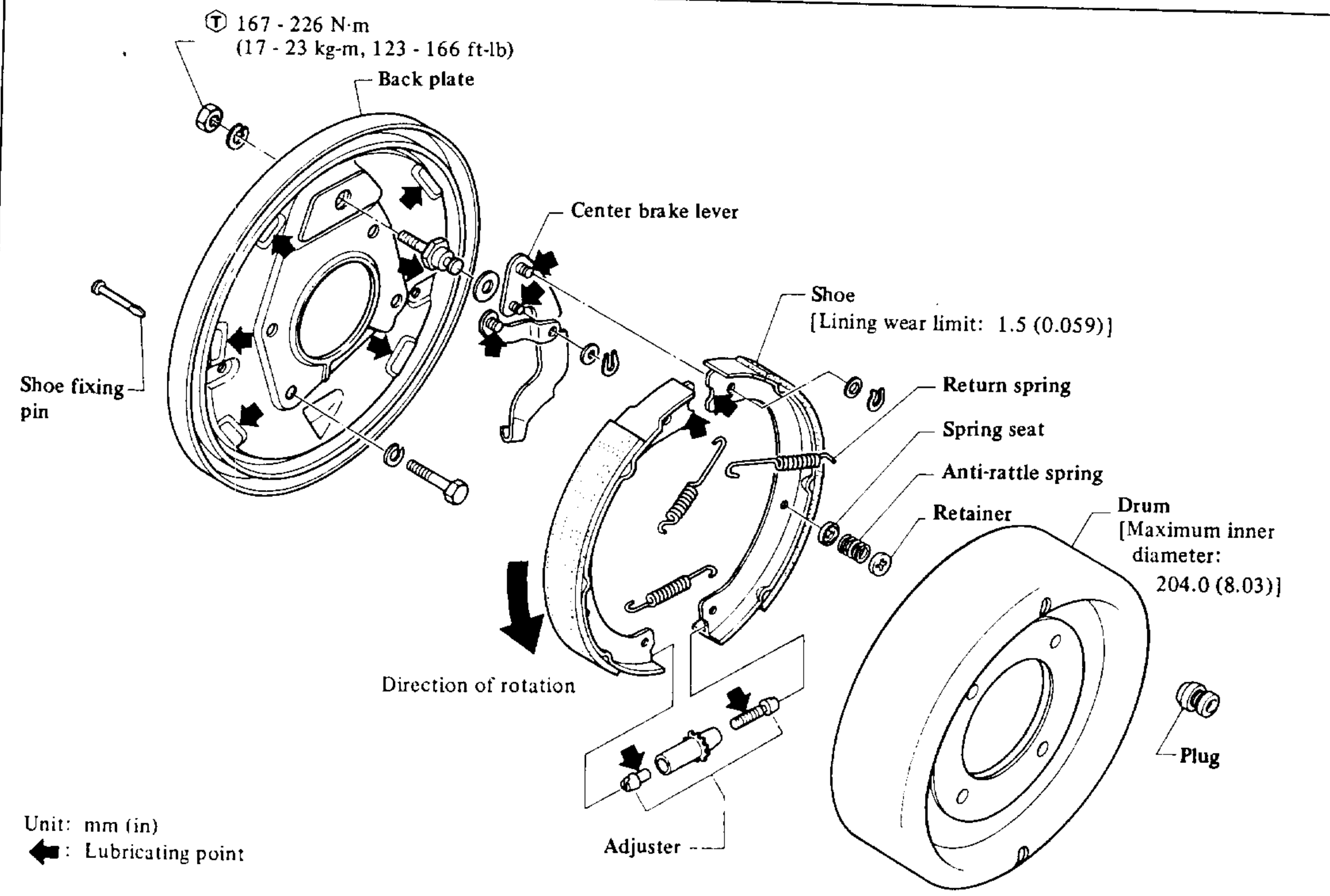
INSPECTION

1. Check control lever and ratchet for evidence of wear or other damage.
2. Check wires for evidence of discontinuity or other deterioration.
3. Check parts at each connection for deformation or damage.

INSTALLATION

1. Apply a coating of grease to sliding contact surfaces.
2. Insert clevis pin from left side.
3. After installation is completed, adjust entire system. Refer to Section MA for adjustment.

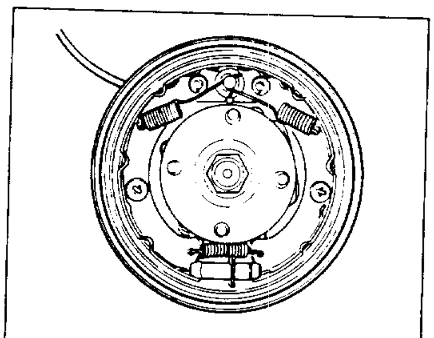
CENTER BRAKE



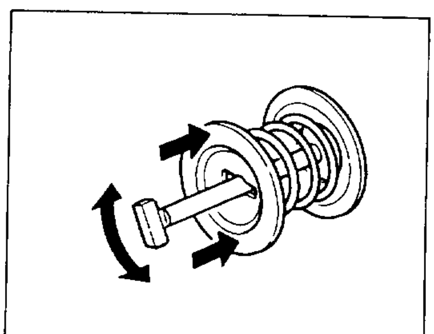
SBR370

SHOE REPLACEMENT

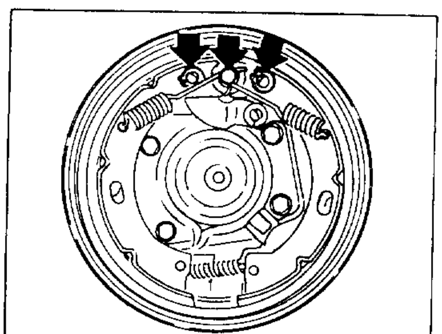
1. Remove propeller shaft and drum.


SBR371

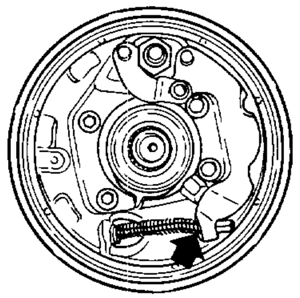
2. Remove anti-rattle spring and pin.


SBR093

3. Remove C-ring, return springs and adjuster.


SBR372

4. Remove shoe assemblies.
5. Disconnect hand brake cable from center brake lever and remove center brake lever.


SBR373

6. Apply brake grease to the following points.
- Contact surfaces between brake shoe and anchor pin.
- Bolt of adjuster and nut sleeve.
- Contact surfaces between brake back plate and brake shoe assembly (six places).

7. After installation is completed, adjust shoe-to-drum clearance. Refer to Section MA for adjustment.

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:
203.2 mm (8.00 in)
Maximum inner diameter:
204.0 mm (8.03 in)
Out-of-roundness (ellipticity):
Less than 0.02 mm (0.0008 in)
Radial run-out
(total indicator reading):
Less than 0.10 mm (0.0034 in)
Taper [measured at a point 35 mm (1.38 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.

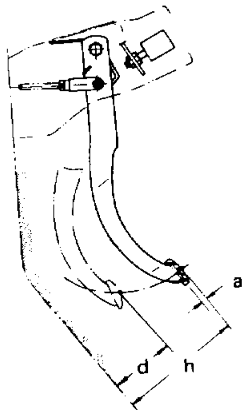
SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Item		Model: 160 series	Model: 61 series
Type	Front	CL36V	2L29
	Rear	DS27	DS27
Pad or lining dimension Width x thickness x length mm (in)	Front	Pad: 52 x 11.5 x 130 (2.05 x 0.453 x 5.12)	Lining: 55 x 6.9 x 305 (2.17 x 0.272 x 12.01)
	Rear	Lining: 50 x 6 x 283 (1.97 x 0.24 x 11.14)	Lining: 50 x 6 x 283 (1.97 x 0.24 x 11.14)
Rotor outer diameter or drum inner diameter mm (in)	Front	Rotor: 295 (11.61)	Drum: 292.1 (11.50)
	Rear	Drum: 270 (10.63)	Drum: 270 (10.63)
Caliper or wheel cylinder inner diameter mm (in)	Front	Caliper: 68.1 (2.681)	Wheel cylinder: 25.4 (1)
	Rear	Wheel cylinder: 19.05 (3/4)	Wheel cylinder: 19.05 (3/4)
Master cylinder inner diameter mm (in)		23.81 (15/16)	22.23 (7/8)
Brake booster	Type	Master-Vac (M90)	Mater-Vac (M75)
	Diaphragm diameter mm (in)	234 (9.21)	195 (7.68)
Vacuum pump (SD33)	Discharge amount mℓ (Imp fl oz)	30 (1.1)	30 (1.1)
	No. of revolutions in use rpm	1,000 - 11,500	1,000 - 11,500
Center brake drum inner diameter mm (in)		203.2 (8.00)	203.2 (8.00)
Center brake lining dimension Width x thickness x length mm (in)		45 x 5.1 x 195 (1.77 x 0.201 x 7.68)	45 x 5.1 x 195 (1.77 x 0.201 x 7.68)

INSPECTION AND ADJUSTMENT

BRAKE PEDAL



Unit: mm (in)

SBR119

Model	160 series	61 series
Free height "h"	190 - 196 (7.48 - 7.72)	181 - 187 (7.13 - 7.36)
Free play at pedal pad "a"	1 - 5 (0.04 - 0.20)	1 - 5 (0.04 - 0.20)
Depressed height "d" [Under force of 490 N (50 kg, 110 lb)]	65 (2.56)*1 80 (3.15)*2	80 (3.15)*2

*1: Front disc brake *2: Front drum brake

PARKING BRAKE

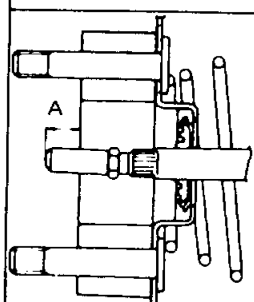
Pulling force N (kg, lb)	196 (20, 44)
Number of notches	7 - 8

MASTER CYLINDER

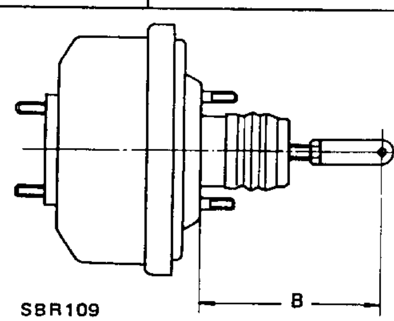
Piston to cylinder clearance mm (in)	Less than 0.15 (0.0059)

BRAKE BOOSTER

Maximum vacuum leakage (15 seconds after engine is stopped) kPa (mbar, mmHg, inHg)	3.3 (33, 25, 0.98)
Output rod length "A" mm (in)	9.75 - 10.00 (0.3839 - 0.3937)
Input rod length "B" mm (in)	128 (5.04)



BR109A



SBR109

CHECK VALVE

Maximum vacuum leakage [15 seconds after 66.7 kPa (667 mbar, 500 mmHg, 19.69 inHg) pressure is applied] kPa (mbar, mmHg, inHg)	1.3 (13, 10, 0.39)

FRONT DISC BRAKE

Unit: mm (in)

Pad wear limit	Minimum thickness	2 (0.08)
Rotor repair limit	Maximum runout	0.07 (0.0028)
	Maximum parallelism	0.03 (0.0012)
	Minimum thickness	18 (0.71)

FRONT DRUM BRAKE

Unit: mm (in)

Lining wear limit (Minimum thickness)	Up to rivet head
Drum wear limit Maximum inner diameter	293.0 (11.54)
Radial rounout	Less than 0.15 (0.0059)
Out-of-roundness	Less than 0.05 (0.0020)
Wheel cylinder repair limit: Piston-to-cylinder clearance	Less than 0.15 (0.0059)

REAR BRAKE

Unit: mm (in)

Lining wear limit (Minimum thickness)	2 (0.08)
Drum wear lim t Maximum inner diameter	271.5 (10.69)
Radial runout	Less than 0.12 (0.0047)
Out-of-roundness	Less than 0.05 (0.0020)
Wheel cylinder repair limit: Piston-to-cylinder clearance	Less than 0.15 (0.0059)

CENTER BRAKE

Unit: mm (in)

Lining wear limit (Minimum thickness)	1.5 (0.059)
Drum wear limit Maximum inner diameter	204.0 (8.03)
Radial runout	Less than 0.10 (0.0039)
Out-of-roundness	Less than 0.02 (0.0008)
Taper [Measured at a point 35 mm (1.38 in) from inlet]	Less than 0.02 (0.0008)

TIGHTENING TORQUE

Item \ 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
Stop 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 pedal bracket	8 - 11	0.8 - 1.1	5.8 - 8.0
Pedal bracket attaching bolt	8 - 11	0.8 - 1.1	5.8 - 8.0
Master cylinder to brake booster	8 - 11	0.8 - 1.1	5.8 - 8.
Master cylinder check valve plug	44 - 54	4.5 - 5.5	33 - 40
N.L.S.V. mounting bolt	8 - 11	0.8 - 1.1	5.8 - 8.
Vacuum pump to alternator	6 - 7	0.6 - 0.7	4.3 - 5
Front disc brake back plate	30 - 40	3.1 - 4.1	22 - 3
Front disc caliper fixing bolt	108 - 147	11 - 15	80 - 1
Pin bolt	52 - 73	5.3 - 7.4	38 - 5
Front disc rotor fixing bolt	50 - 68	5.1 - 6.9	37 - 50
Front drum brake back plate	30 - 40	3.1 - 4.1	22 - 30
Front wheel cylinder to back plate Large	65 - 88	6.6 - 9.0	48 - 65
Small	5.3 - 7.3	0.54 - 0.74	3.9 - 5.
Rear drum brake back plate	53 - 63	5.4 - 6.4	39 - 4
Rear wheel cylinder	5.3 - 7.3	0.54 - 0.74	3.9 - 5
Rear anchor bolt	50 - 68	5.1 - 6.9	37 - 5

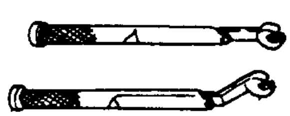
TROUBLE DIAGNOSES AND CORRECTIONS

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.
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.

Condition	Probable cause	Corrective action
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.
	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.
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.
Brake squeals	Dirty or scored brake drums.	Blow out assembly with compressed air o 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 i does not, replace linings.
Brakes drag	Pedal linkage is binding or output rod adjustment is too long.	Lubricate linkage, check pedal return sprin for condition and adjust output rod as necessary.

Condition	Probable cause	Corrective action
(Brakes drag)	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.
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.

SPECIAL SERVICE TOOL

Tool number	Tool name
GG94310000	Flare nut torque wrench 

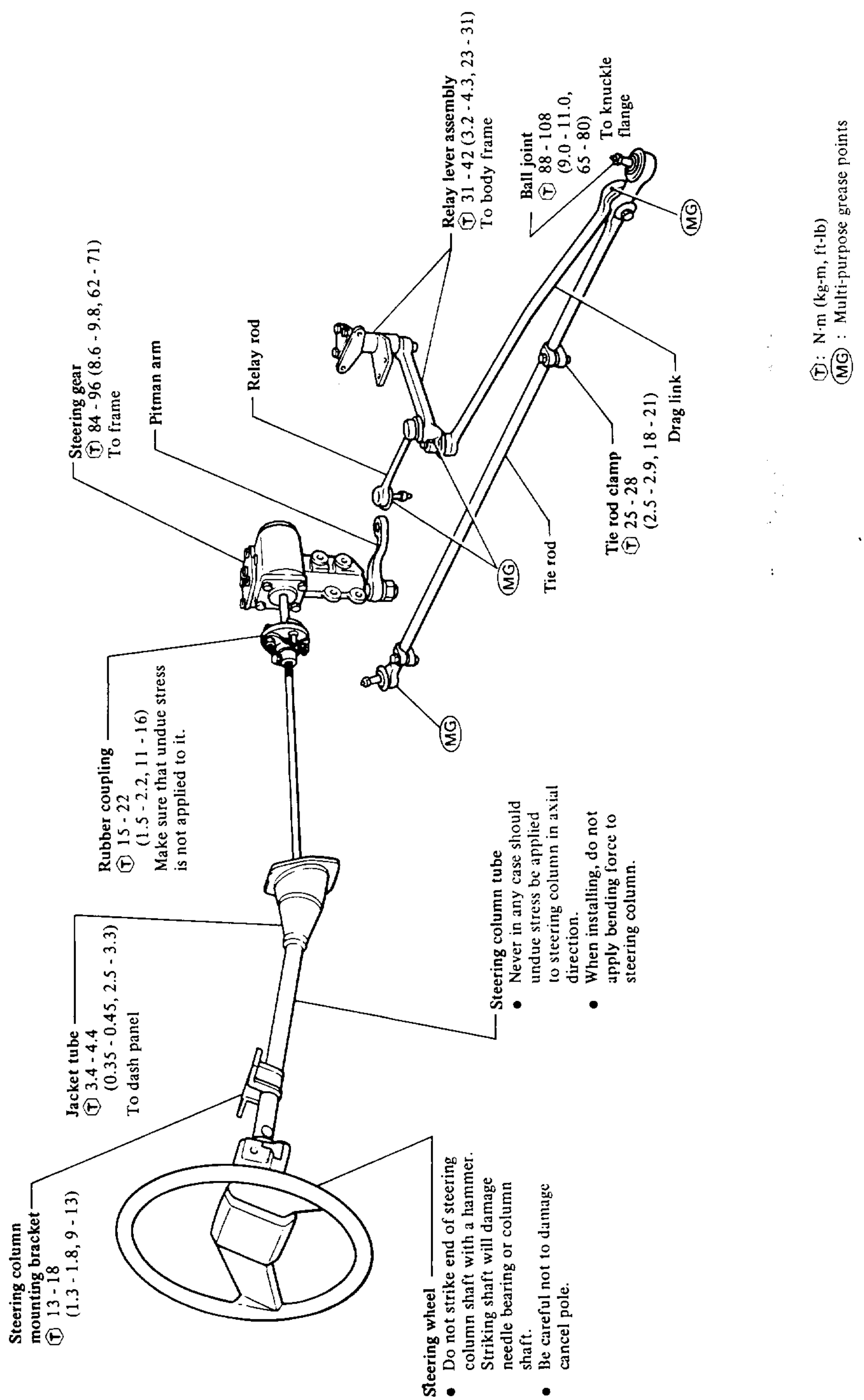
STEERING SYSTEM

SECTION ST

CONTENTS

ST

STEERING SYSTEM



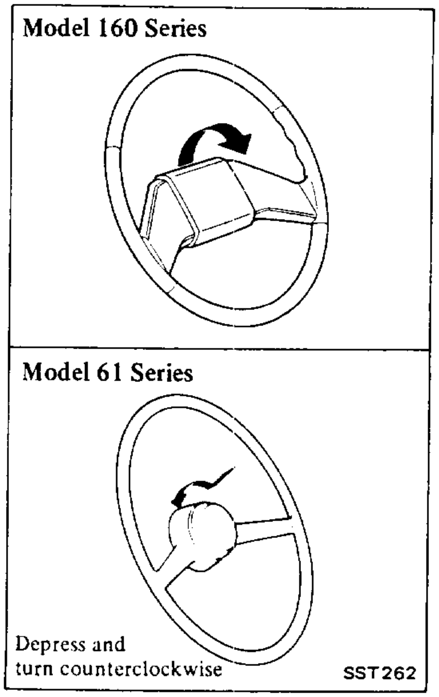
SST28

STEERING WHEEL AND COLUMN

STEERING WHEEL

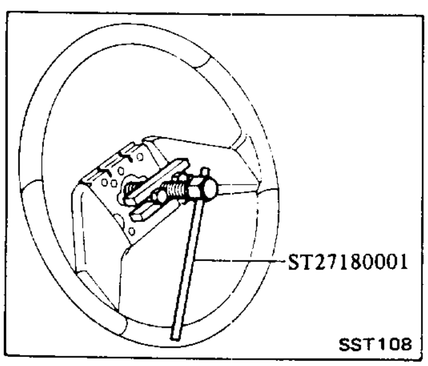
REMOVAL

1. Disconnect battery ground cable.
2. Remove horn pad and steering wheel nut.



3. Remove steering wheel using **Tool.**

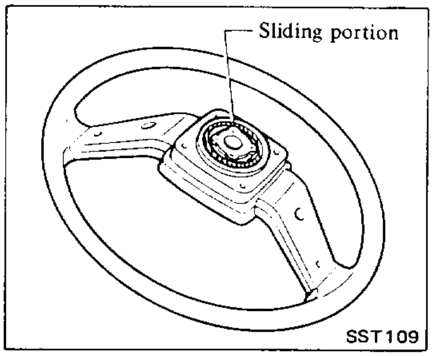
CAUTION:
Do not strike end of steering column shaft with a hammer. Striking shaft will damage bearing or column shaft.



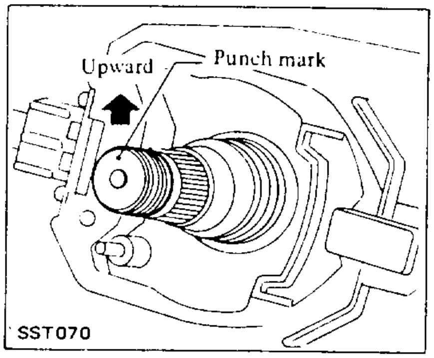
INSTALLATION

Install steering wheel in the reverse order of removal. Observe the following instructions.

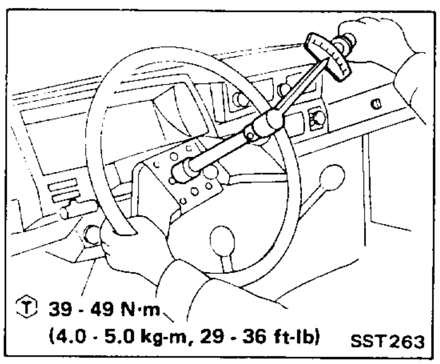
1. Apply grease to sliding portions.



2. Install steering wheel **on column shaft in a straight-ahead position.**



3. Tighten steering wheel nut.



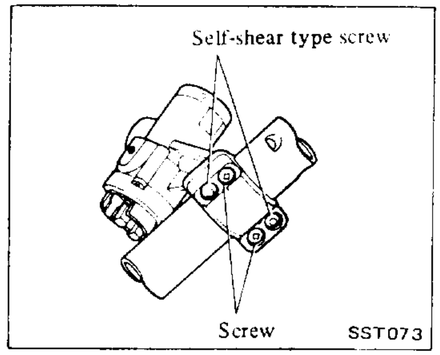
4. After installing steering wheel, turn it clockwise and counterclockwise, checking for catch or drag. Also check horn operation.

STEERING LOCK

REMOVAL

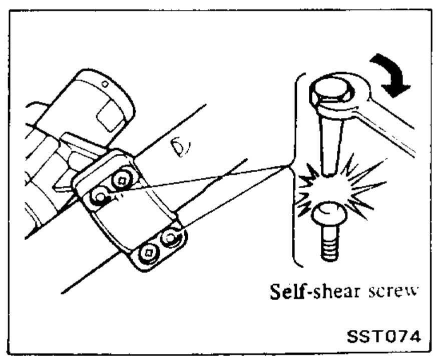
Before removing steering lock, disconnect battery ground cable.

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.

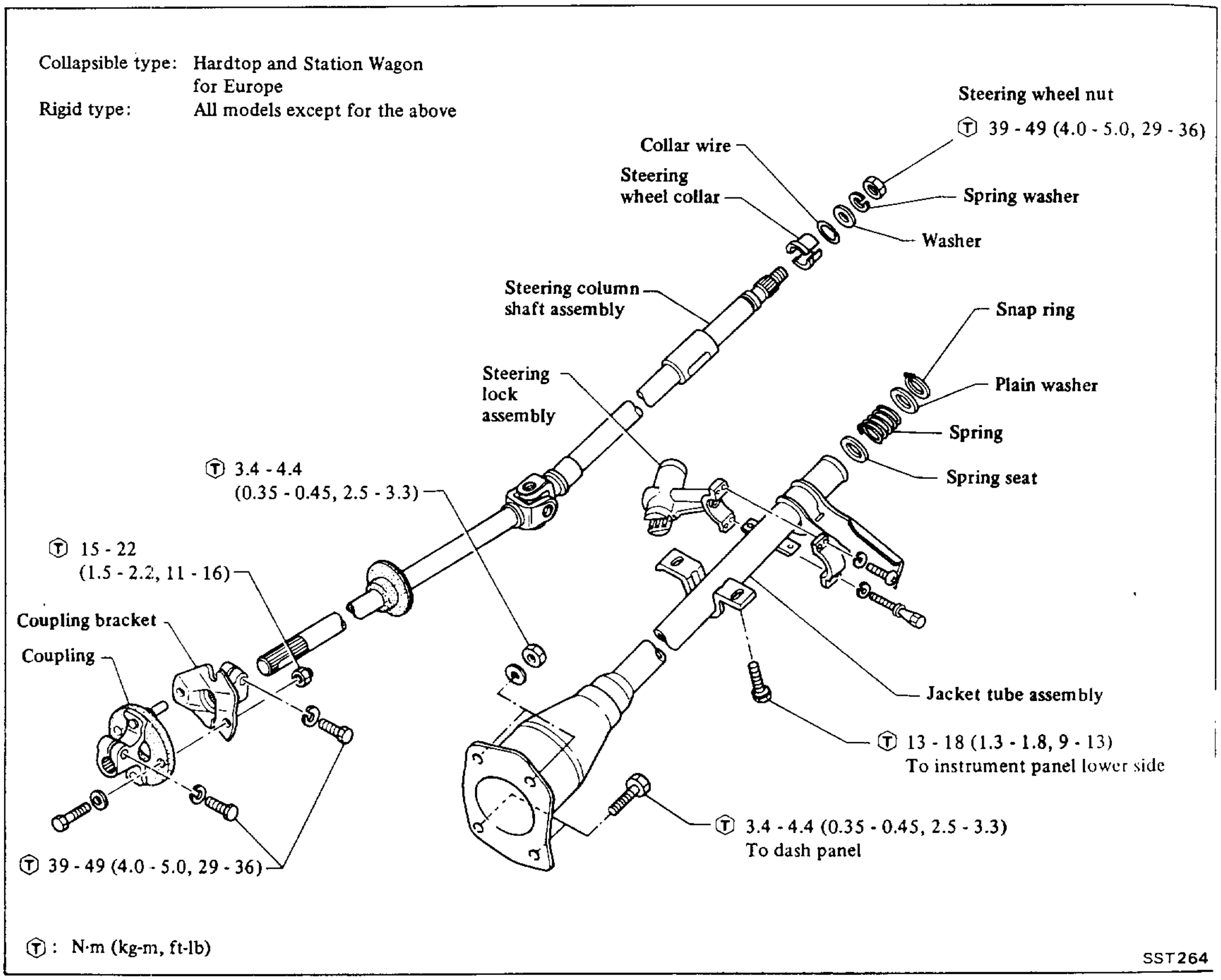


INSTALLATION

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.

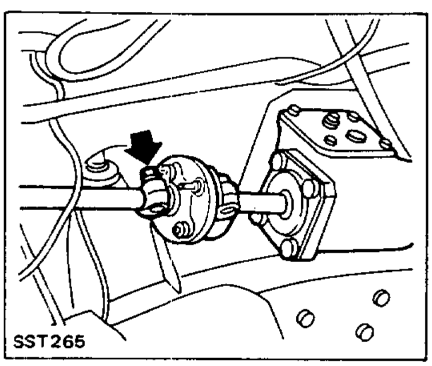


STEERING COLUMN (Model 160 series)



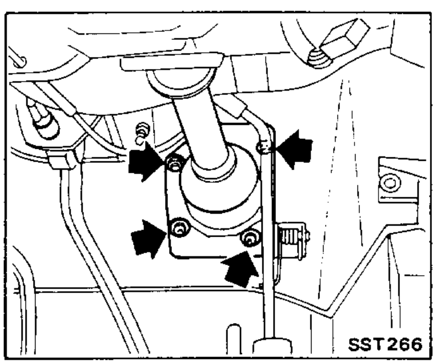
REMOVAL

1. Remove bolt securing column shaft and rubber coupling.

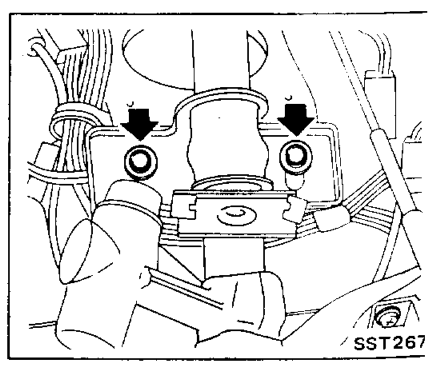


2. Remove steering wheel. **Refer to Steering Wheel.**

3. Remove steering column shell covers.
4. Remove combination switch assembly.
   Refer to Section EL.
5. Remove jacket tube bracket from dash panel.



6. Remove column mounting bracket.



7. 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
3.4 - 4.4 N·m
(0.35 - 0.45 kg-m,
2.5 - 3.3 ft-lb)

4. Tighten column mounting bracket temporarily.
5. Tighten column shaft securing bolts temporarily to support upper side of steering column assembly.
6. Tighten column shaft securing bolts and then tighten column mounting bracket securing bolts.

Ⓣ : Rubber coupling to column shaft
39 - 49 N·m
(4.0 - 5.0 kg-m,
29 - 36 ft-lb)
Column mounting bracket
13 - 18 N·m
(1.3 - 1.8 kg-m,
9 - 13 ft-lb)

CAUTION:

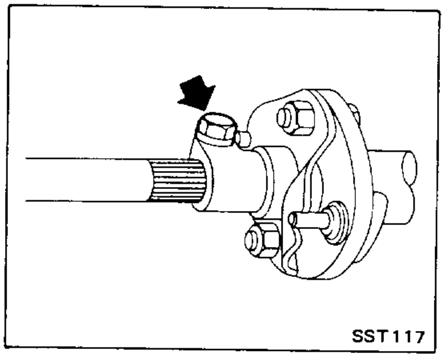
a. Make sure that any undue stress is not applied to rubber coupling.
b. To avoid damaging bolt or serrations, align groove in worm shaft with bolt hole in rubber coupling.

---

7. Install steering wheel. **Refer to Steering Wheel.**
8. After installation, make sure that steering wheel turns smoothly.

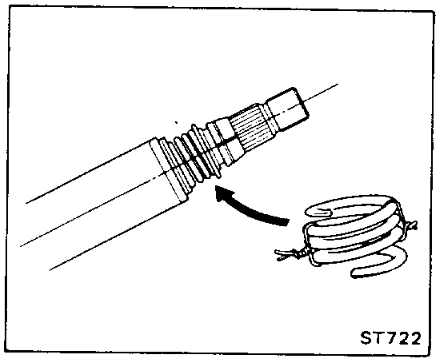
DISASSEMBLY

1. Remove rubber coupling assembly.



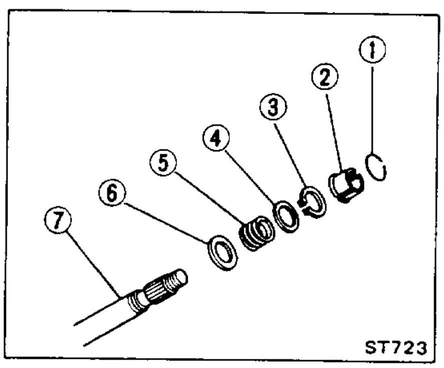
SST117

2. Remove steering lock assembly. **Refer to Steering Lock for removal.**
3. Compress steering column spring with wires.



ST722

4. Remove collar fixing wire, steering wheel fixing collar, snap ring, plain washer, steering column spring and spring seat.



ST723

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.

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:

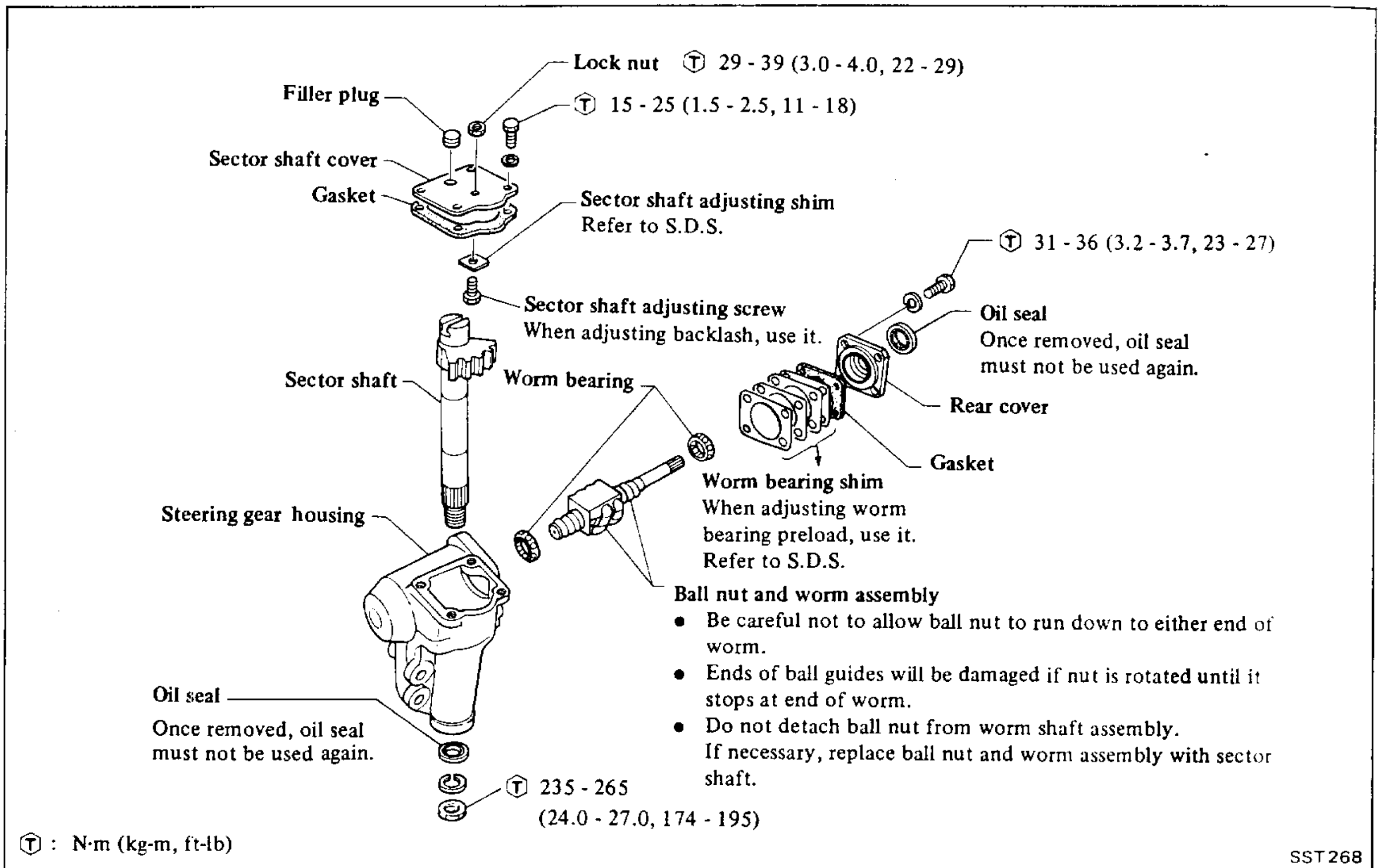
- **Be careful to prevent interference with remote control lever bracket.**
- **Be careful not to give impact force or abnormally strong force in axial direction to steering column shaft.**
- **Snap ring for column shaft should not be reused.**

INSPECTION

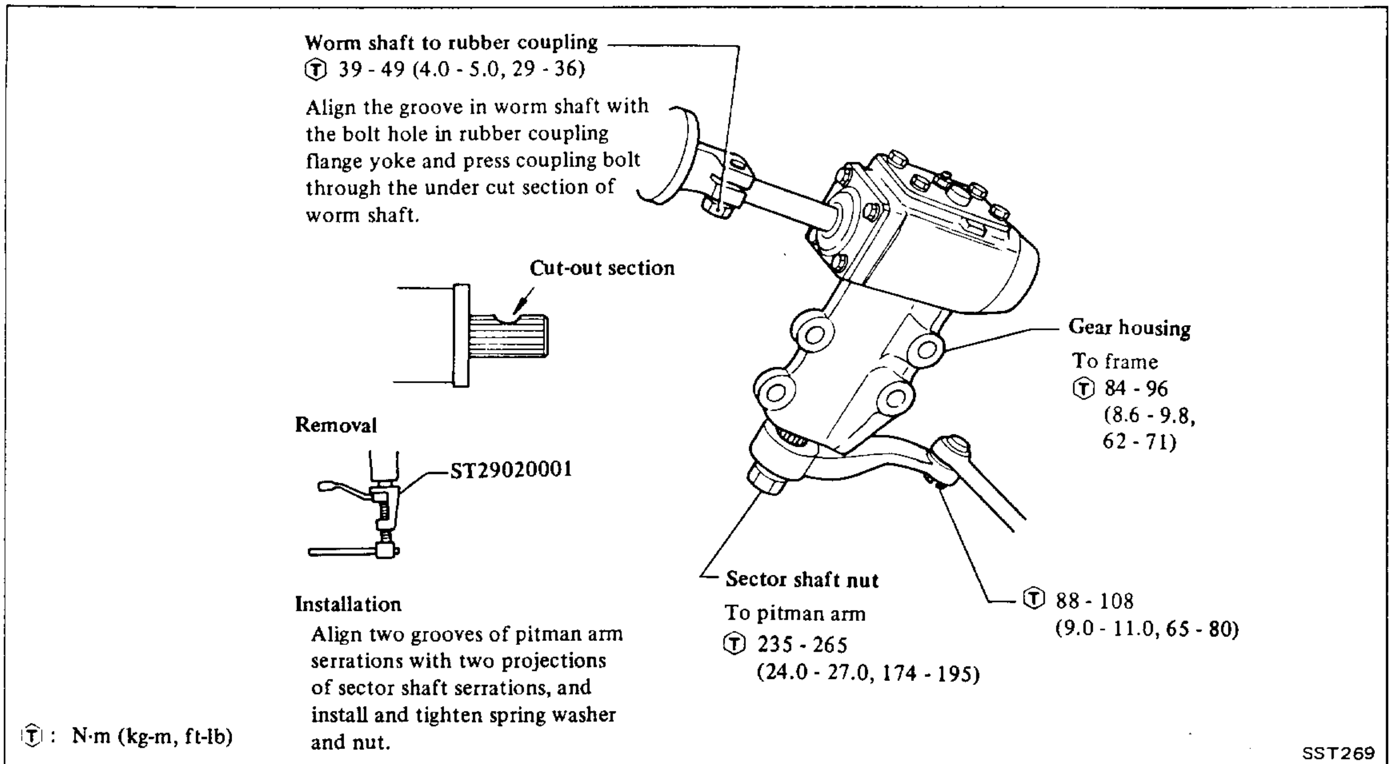
When steering wheel will not turn smoothly, check the steering column for the following matters and replace malfunctioning parts.

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.

MANUAL STEERING GEAR (Model : VRB70L) —Model 160 series—



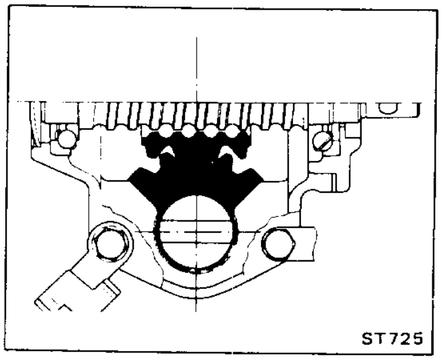
REMOVAL AND INSTALLATION



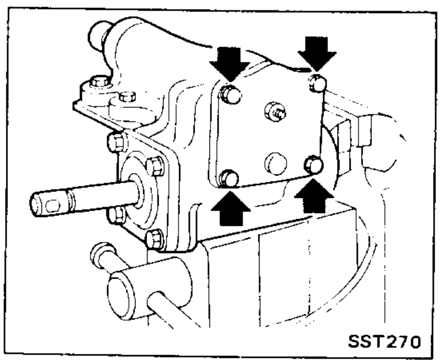
DISASSEMBLY

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 vise using **Tool KV48100301** in place.
2. Set worm gear in a straight-ahead position.



3. Remove sector shaft cover fixing bolts.



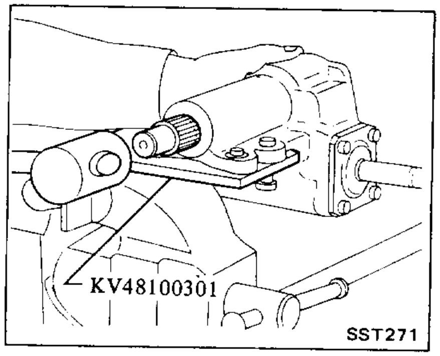
4. Remove sector shaft with sector shaft cover.

CAUTION:

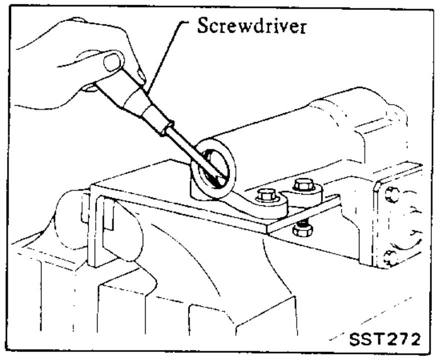
a. When pullling sector shaft out, be careful not to damage oil seal or associated parts.

b. Set worm gear in a straight-ahead position.

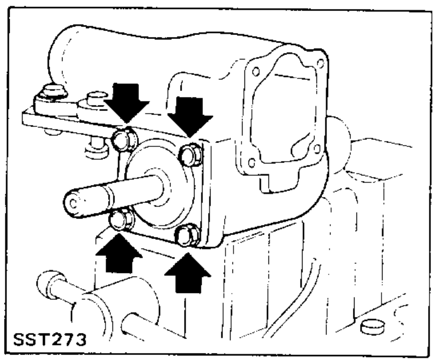
c. Do not remove sector shaft bearing from steering gear housing. If necessary, replace gear housing assembly.



5. Remove sector shaft cover from sector shaft.
6. Remove sector shaft oil seal, if **necessary.**



7. Remove rear cover.

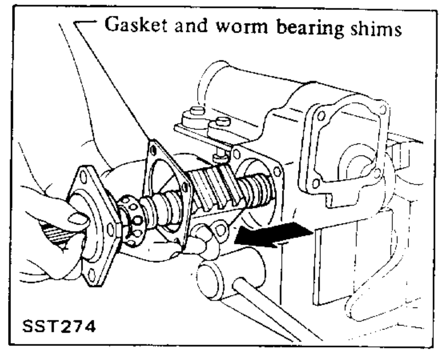


8. Draw out worm gear with worm bearing.

CAUTION:

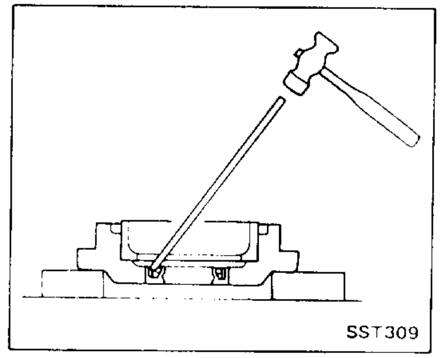
a. Be careful not to allow ball nut to run down to either end of worm. Ends of ball guides will be damaged if nut is rotated until it stops at end of worm.

b. Do not detach ball nut from worm shaft assembly.
If necessary, replace entire unit as an assembly.



9. Remove oil seal from rear cover.

Once removed, oil seal must not be used again.



ASSEMBLY AND ADJUSTMENT

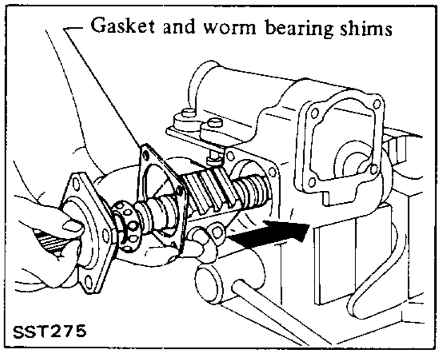
- **Before assembling and adjusting by hand, make sure each part is clean and lubricate with gear fluid.**
- **Fill space between sealing lips of new sector shaft and adjusting plug oil seals with recommended multi-purpose grease.**

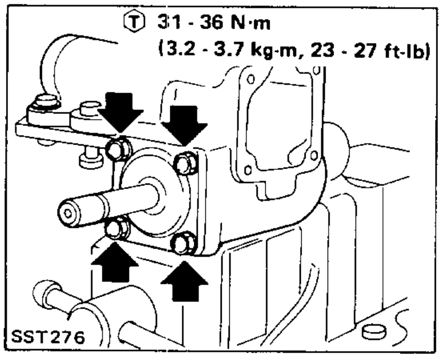
Worm bearing preload

1. Fit worm gear assembly with worm bearing in gear housing.

2. Install rear cover on gear housing with gasket and worm bearing shims.

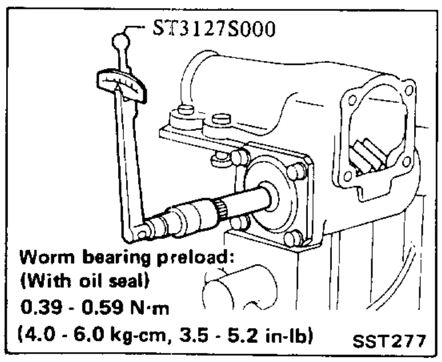
Standard shim thickness:
1.0 mm (0.039 in)
Available worm bearing shims:
Refer to S.D.S.





3. Adjust worm bearing preload using **Tools.**

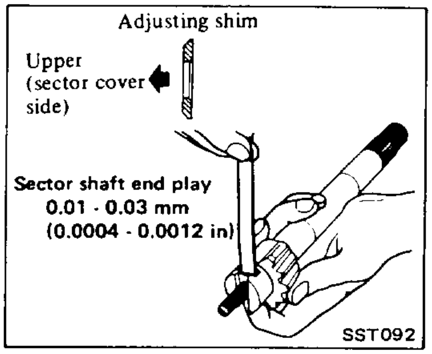
- Rotate worm shaft a few turns in both directions to correctly settle worm bearing and measure preload.
- When adjusting worm bearing preload, add or remove shims until correct adjustment is achieved.



Sector shaft end play

Select suitable adjusting shim and adjust end play between sector shaft and adjusting screw.

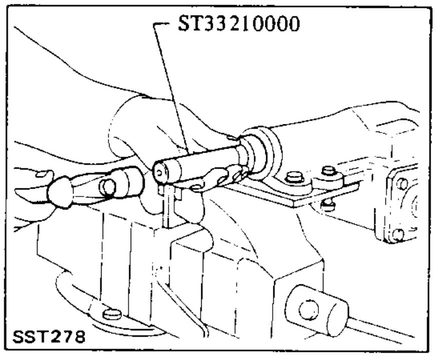
Sector shaft adjusting screw shims:
Refer to S.D.S.



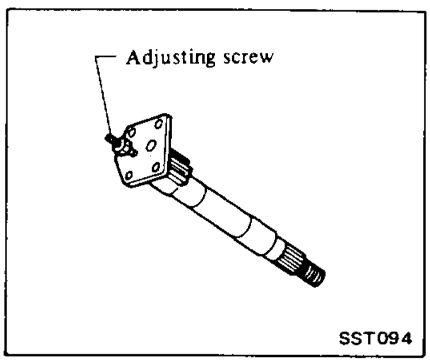
Steering gear preload

1. Press oil seal to steering gear housing using **Tool.**

Before pressing oil seal, coat seal contacting face of oil seal with gear fluid.

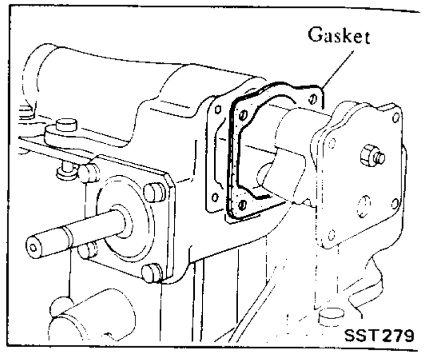


2. Install sector cover on adjusting screw with sector shaft.

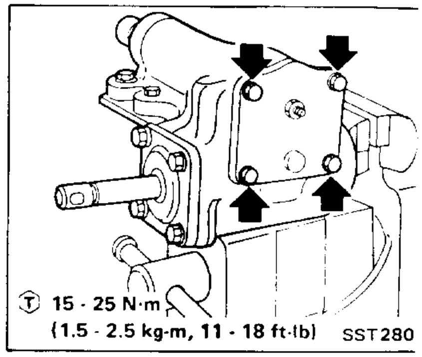


3. Set worm gear in a straight-ahead position.
4. Insert sector shaft and sector cover assembly with gasket into gear housing.

Carefully insert sector shaft in place, using care not to scratch oil seal

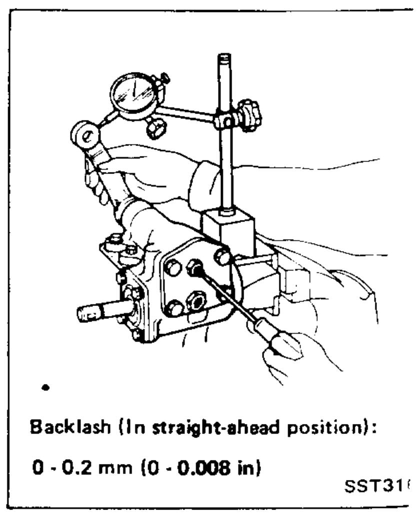


5. Tighten sector cover to gear housing.

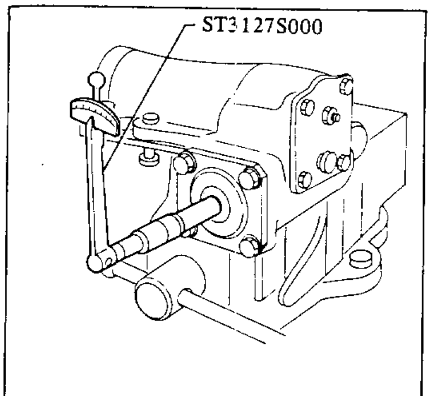


6. Adjust backlash as shown in illustration.

Rotate worm gear a few turns in both directions to settle down steering gear and in straight-ahead position and then measure backlash at gear arm top end.



7. Measure total gear preload in straight-ahead position.



Total gear preload:
(With oil seal)
Less than 1.23 N·m
(12.5 kg-cm, 10.9 in-lb)

SST281

INSPECTION

Wash clean all the disassembled parts in solvent and check for condition.

Sector shaft

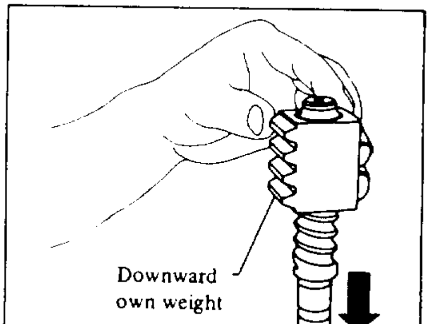
1. Check gear tooth surface for pitting, burrs, cracks or any other damage, and replace if necessary.
2. Check sector shaft for distortion on its serration, and replace if necessary. Also check gear housing for deformation.

Steering worm assembly

1. Inspect ball nut gear tooth surface, and replace if pitting, burrs, wear or any other damage is found.
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.



SST098

(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.

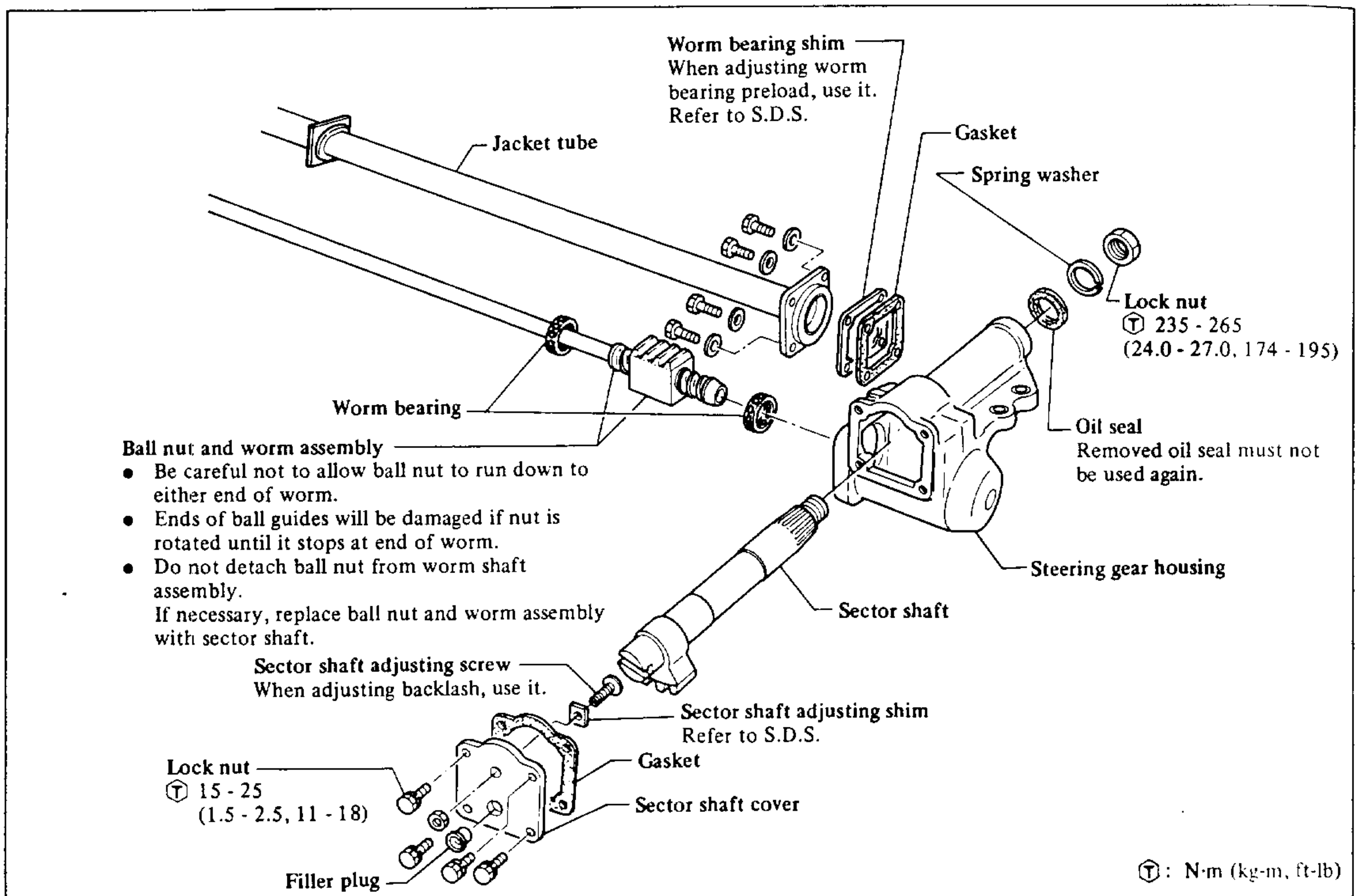
When replacing worm bearing, replace it as a set of bearing and outer race.

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.

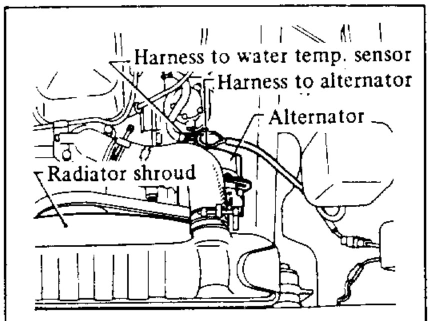
MANUAL STEERING GEAR (Model : VRB70L) —Model 61 series—



SST310

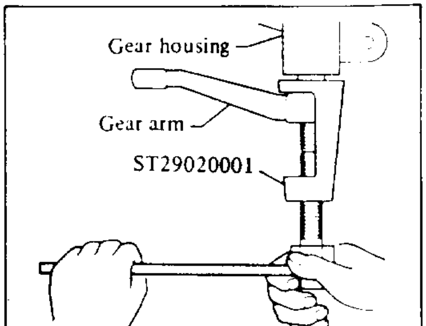
REMOVAL AND INSTALLATION

1. Remove following parts.
- Steering wheel
- Steering shell cover
- Combination switch
- Steering column mounting bracket
2. Loosen combination meter cover.
3. Jack up front of vehicle and support it on safety stands.
4. Block rear wheels with chocks.
5. Remove following parts.
- Harness connectors at alternator and water temperature sensor
- Alternator
- Radiator shroud attaching bolts



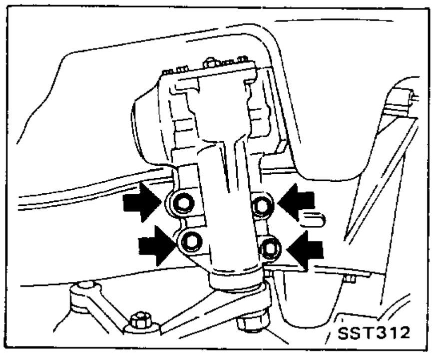
SST311

6. Remove pitman arm.



SST100

7. Remove bolts securing gear box.



SST312

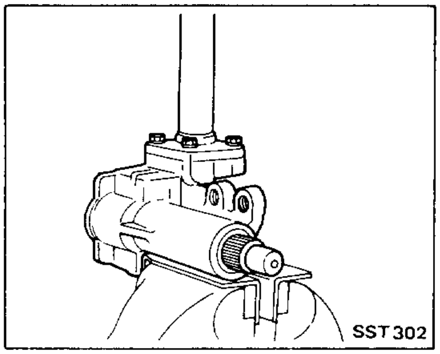
8. After removing steering lock, extract steering gear from under vehicle body.

DISASSEMBLY

Before disassembling steering gear, **make sure external is clean and free from dust and dirt, and thoroughly drain gear fluid by removing filler plug.**

For disassembly, **refer to Manual Steering Gear (Model: VRB70L) –Model 160 Series–.** However, note the following additional instruction.

- Placing steering gear in a vise.



SST302

ASSEMBLY AND ADJUSTMENT

- **Before assembling and adjusting, make sure each part is clean and lubricate with gear fluid.**
- **Fill space between sealing lips of new sector shaft and rear cover oil seals with recommended multi-purpose grease.**

Refer to Manual Steering Gear (Model: VRB70L) –Model 160 Series–.

INSPECTION

Refer to Manual Steering Gear (Model: VRB70L) –Model 160 Series–.

POWER STEERING GEAR (Model : I.P.S. 56L) AND OIL PUMP

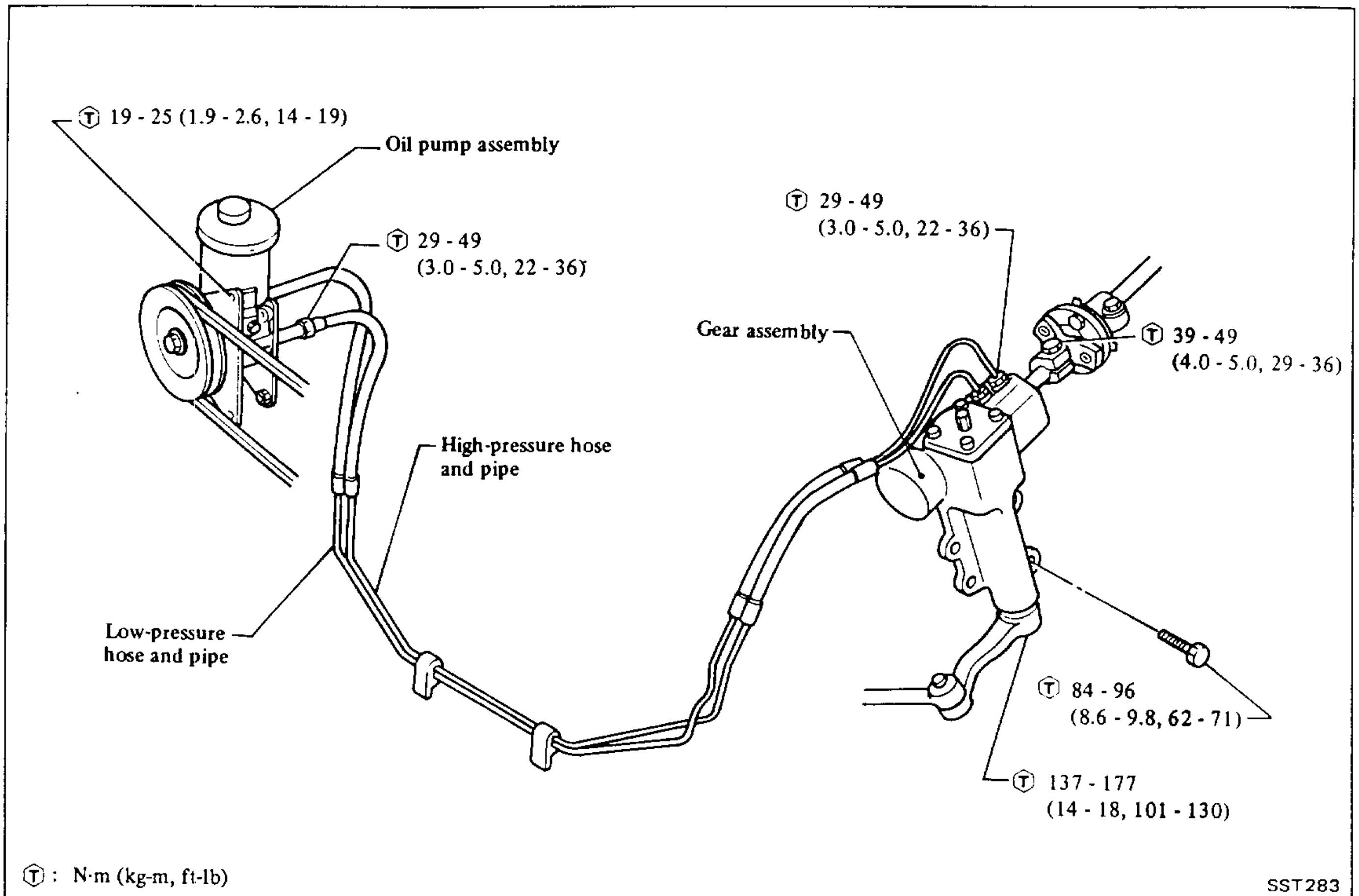
DESCRIPTION

Power steering system

The power steering gear is licensed by ZF company in West Germany.

The integral power steering unit is a gear housing into which a control valve (2-spool valve type) and power cylinder are built compactly. The major components are as follows:

- Oil pump
- Power steering gear
- Oil piping



Power steering gear

The integral power steering gear is an accurate oil pressure mechanism. In disassembling it, be careful to keep dust, iron powder and other foreign particles out of the gear housing.

Only the sealing parts of the gear assembly can be replaced. The remaining parts must be replaced as an gear assembly.

CAUTION:

a. The parts which can be disassembled are strongly restricted, and never disassemble other parts than the specified ones. If parts not indicated in the manual are also disassembled, replace the assembly instead of reassembling those parts.

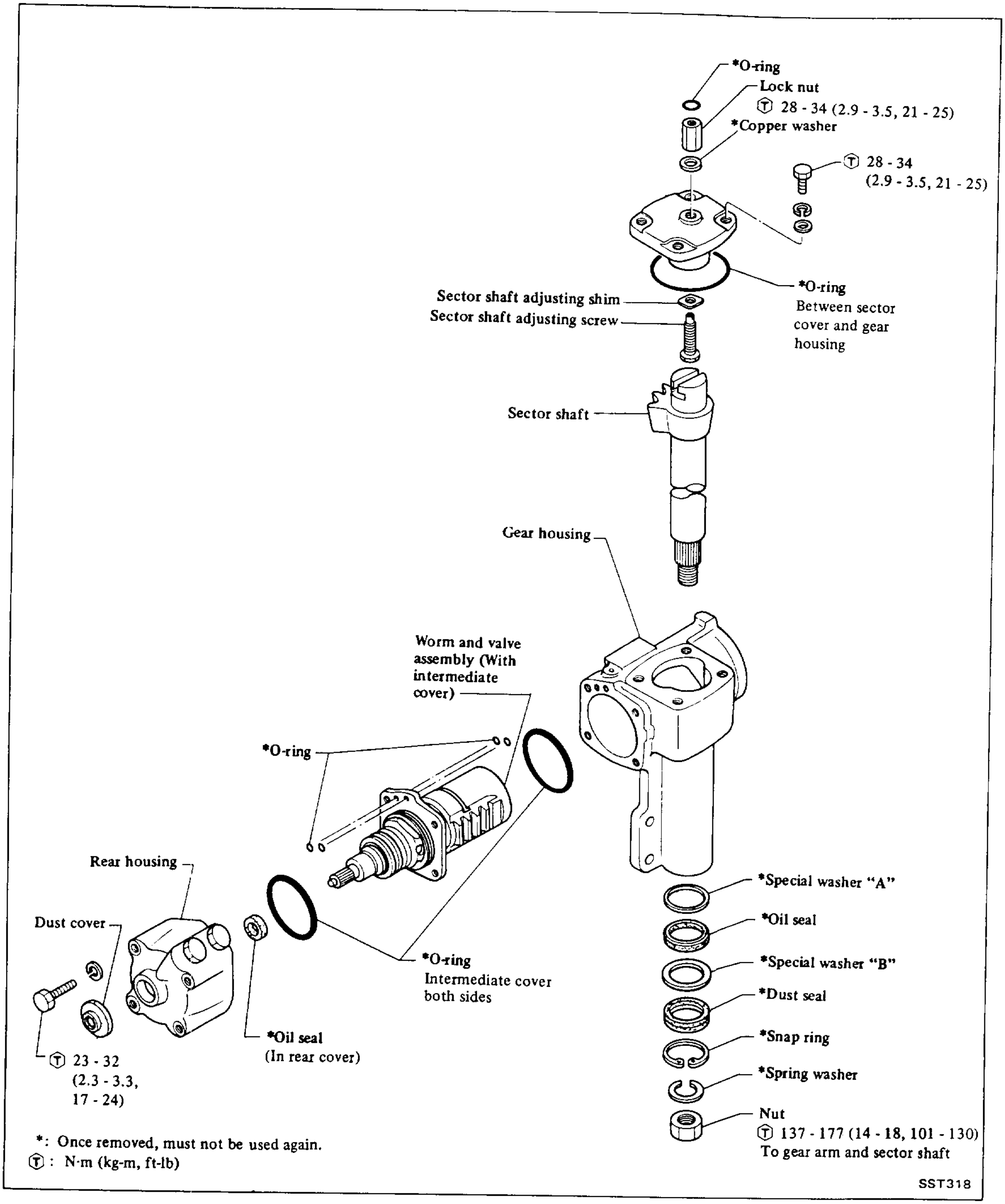
b. Disassembly of integral power steering gear should be performed in a place as clean as possible, although a dust preventing device is not required.

c. Should disassembly of integral power steering gear remain unfinished for any reason, indicate it as "Half Disassembled" and cover parts with a clean cover.

d. Hands should be cleaned immediately before disassembly.

e. Do not use a rag. Be sure to use nylon or paper cloth.

f. Be sure to follow procedures and cautions indicated in the Service Manual.



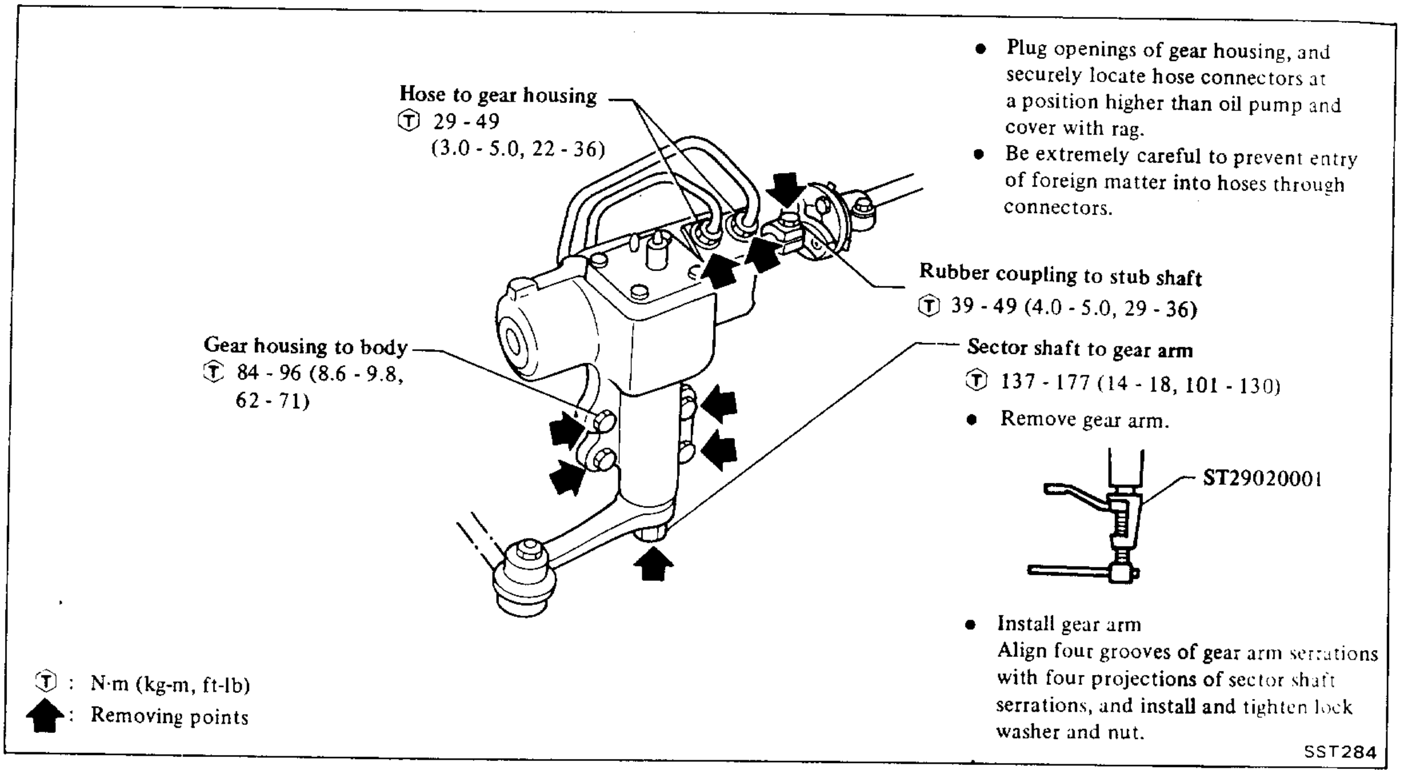
Oil pump

Malfunctioning (Replace as an oil pump assembly).

REMOVAL

Before removing, clean exteriors of gear housing and oil pump with steam and dry with compressed air.

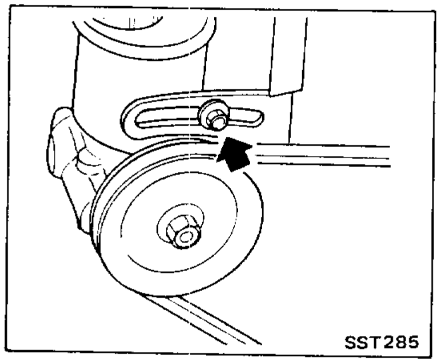
Steering gear



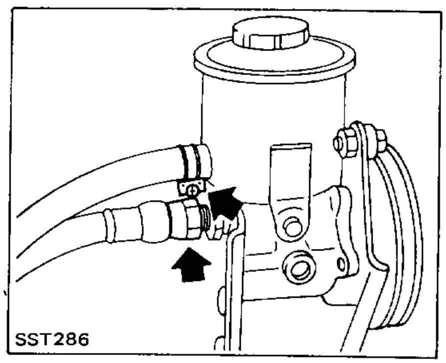
SST284

Oil pump and each hose

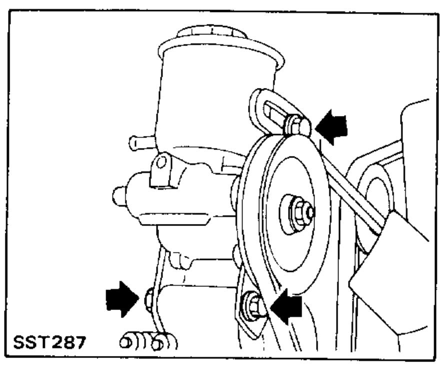
1. Turn belt adjusting bolt counter-clockwise.


SST285

2. Remove oil pump belt.
3. Loosen (not remove) hoses at pump.


SST286

4. Remove oil pump.


SST287

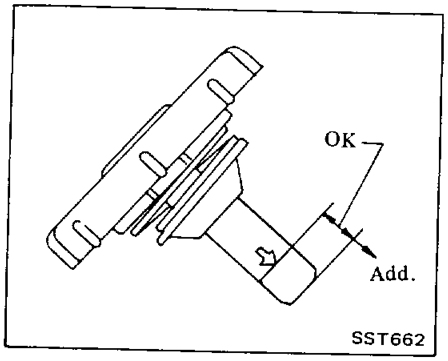
5. Disconnect hoses from pump.
6. Remove oil pump brackets and other brackets from engine.
7. Unfasten hose clamps, and remove hoses from suspension crossmember.

INSTALLATION AND ADJUSTMENT

Install steering gear in the reverse order of removal.

Fluid level

1. Check fluid level in reservoir, observing dipstick when fluid is cold.



SST662

- **Do not overfill with fluid.**
- **Normal operating temperature is 60 to 80°C (140 to 176°F).**
- **When running engine, make sure fluid level variations in opening oil pump are less than 2 mm (0.08 in).**

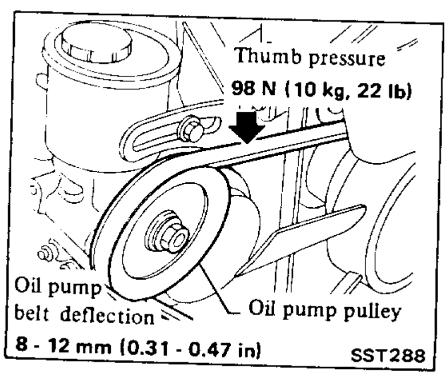
2. Check fluid level and leakage.

Recommended fluid is Automatic Transmission Fluid "Dexron Type". Refer to Section MA for "Recommended Lubricant".

Fluid capacity (With oil pump, each hose and steering gear assembly):
Approximately
750 - 950 mℓ
(26.4 - 33.4 Imp fl oz)

Pump belt adjustment

Adjust oil pump belt tension.



SST288

Check fluid leakage

1. Run engine at idle speed or 1,000 rpm.

Make sure temperature of fluid in pump rises to 60 to 80°C (140 to 176°F) with a temperature indicator.

2. Turn steering wheel to right-to-left several times.
3. Hold steering wheel at each "lock" position for five seconds and carefully check the following points for fluid leakage.

- Oil seal at rear cover
- Intermediate cover
- Adjusting screw lock nut
- Sector shaft oil seal
- Sector cover O-ring
- Oil pressure line connectors

CAUTION:
Do not hold steering wheel at lock position for more than fifteen seconds at a time.

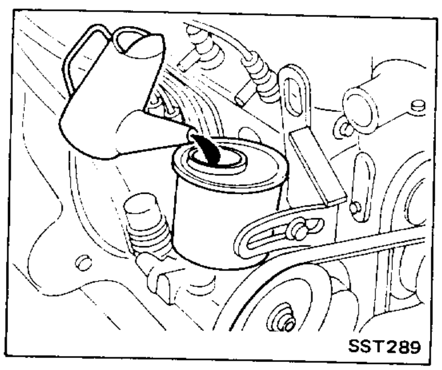
Hydraulic system check

To determine whether problem is in steering gear or oil pump, measure operating pressure.

Before conducting hydraulic system test, carefully check belt tension and condition of driving pulley.

Tires must be inflated to normal pressure.

1. Check fluid level and fluid leakage, **adding oil if necessary.**

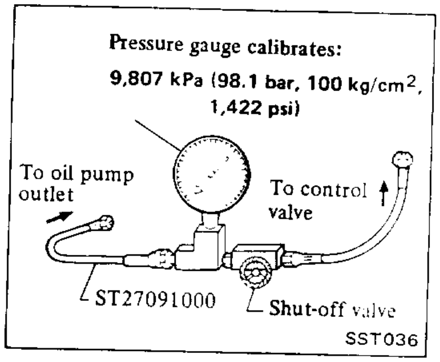

SST289

2. Run engine.

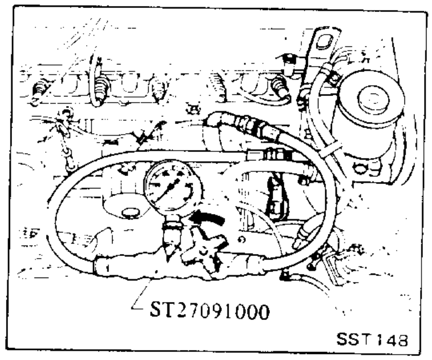
Make sure temperature of fluid in pump rises to 60 to 80°C (140 to 176°F) with a temperature indicator.

3. Stop engine.
4. Set **Tool.**

- **Gauge must be between shut-off valve and oil pump.**



SST036



SST148

5. Open shut-off valve at **Tool.**
6. Check fluid level, **adding fluid if necessary.**
7. Run engine at idle **for 3 to 5 seconds.**
8. Stop engine and check fluid level, **adding fluid if necessary.**
9. Run engine and **check fluid level again, adding oil if necessary.**
10. Turn steering wheel fully in left or right until fluid reaches operating temperature.

- **Be sure that all connections are tight.**
- **Expel any air from system.**

11. Slowly close shut-off valve with **steering wheel fully turned in left or right and lightly touch wheel stopper.**

CAUTION:
Do not close shut-off valve for more than fifteen seconds, as this would abnormally increase lubricant temperature and cause undue pump wear.

With valve fully closed, pump pressure should be at maximum.

Normal pressure:
6,865 kPa (68.6 bar, 70 kg/cm², 995 psi) at idling

12. If pressure increases beyond upper limit, pressure relief valve in oil pump is not functioning properly. Replace as oil pump assembly.

13. If, with shut-off valve fully closed, pressure drops below lower limit, the problem is in pump. Replace as oil pump assembly.

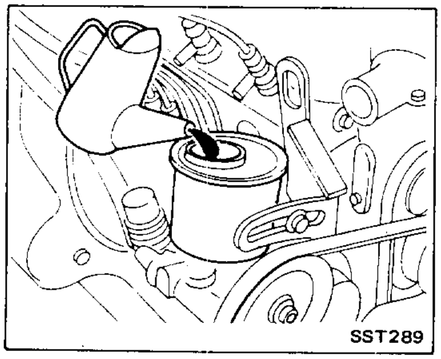
After checking hydraulic system, add fluid as necessary, then completely bleed air out of system.

Bleeding hydraulic system

1. Raise front end of vehicle until wheels clear ground.
2. Run engine.

Make sure temperature of fluid in pump rises to 60 to 80°C (140 to 176°F) with a temperature indicator.

3. Check fluid level, **adding fluid if necessary.**



SST289

4. Run engine for 3 to 5 seconds.
5. Stop engine, **adding fluid if necessary.**
6. Quickly turn steering wheel **all the way to right and left ten times and lightly touch wheel stoppers.**
7. Check fluid level, **adding fluid if necessary.**
8. Start engine at idle.

Repeat steps 4 through 8 until air will be bled from pump.

9. Stop engine and cool fluid. Check fluid level, adding fluid if necessary.

- **Operation should be performed, making sure that fluid level is kept within specified limit.**
- **Repeat this operation until air bleeding is completed.**

10. If air cannot be bled completely in steps 1 through 9, proceed as follows:

(1) With engine runing at 1,000 to 1,500 rpm, repeat step 9.

(2) Turn steering wheel to right and left from lock to lock five to ten times. Carefully check fluid leakage with steering wheel held at each lock position for five seconds.

CAUTION:
Do not hold steering wheel at lock position for more than fifteen seconds at a time.

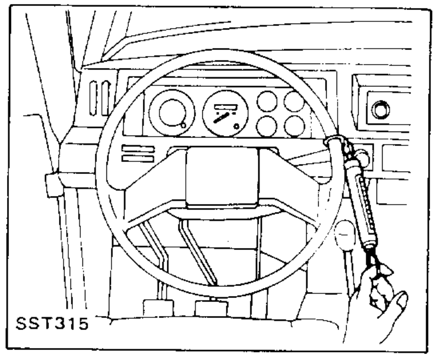
Steering wheel turning torque check

1. Park vehicle on a level, dry surface and set parking brake firmly.
2. Bring power steering fluid up to adequate operating temperature. **[Approximately 60 to 80°C (140 to 176°F)].**

- **It is easy to bring power steering fluid up to adequate operating temperature by idling engine and at the same time turning steering wheel from left to right for about two minutes. Alternatively, drive vehicle several miles.**
- **Tires must be inflated to normal pressure.**

3. Check steering wheel turning torque when steering wheel has been turned 360° from straight-ahead position.

Steering wheel turning force:
Less than 34.3 N (3.5 kg, 7.7 lb) at circumference of steering wheel



SST315

INSPECTION AND ADJUSTMENT

Wash clean all disassembled parts in suitable cleaning solvent and check their condition.

Check sealing portion.

- O-ring at adjusting screw nut
- O-ring at sector shaft cover
- Sector shaft oil seals
- Rear housing oil seal
- O-rings at intermediate cover

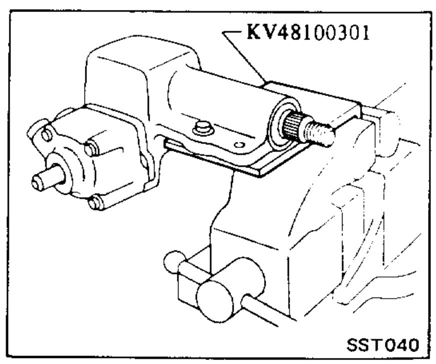
Discard any oil seals and O-rings which have once been removed.

Replace oil seal and O-ring if sealing surface is deformed or cracked.

Steering gear turning torque measurement

1. Measure turning torque at 360° position.

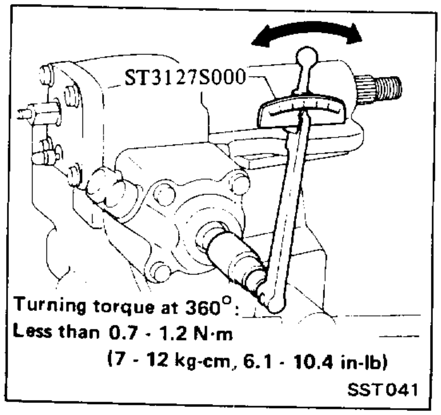
(1) Install steering gear on **Tool.**



SST040

(2) Turn stub shaft all the way to right and left several times.

(3) Measure turning torque at 360° position from straight-ahead position using **Tool.**



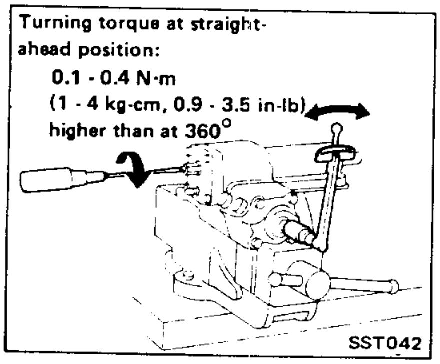
- **Stub shaft can be turned by wrapping vinyl tape around serration area of stub shaft and fitting wrench socket.**
- **If it is beyond specification, gear must be replaced as an assembly.**

2. Measure turning torque at straight-ahead position.

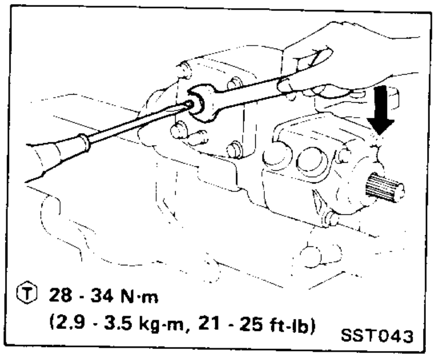
(1) Set worm gear in a straight-ahead position.

Straight-ahead position is a position where stub shaft is turned two turns by 45° from lock position.

(2) Measure turning torque using **Tool.**



3. After adjustment is completed, tighten lock nut.



Measure turning torque. If they are not within specifications, replace gear assembly.

DISASSEMBLY

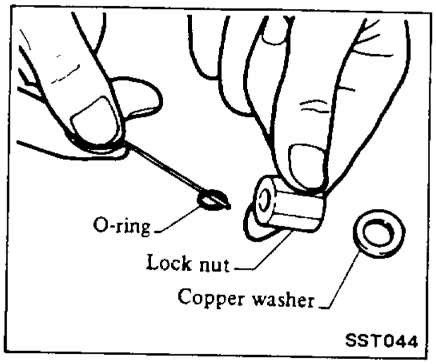
Before disassembly, measure turning torque.

If they are not within specifications, replace steering gear assembly.

CAUTION:
Each oil sealing parts and dust cover once removed must not be used again.

Adjusting screw lock nut seal

Remove adjusting screw lock nut, and replace O-ring.



Sector shaft oil seal

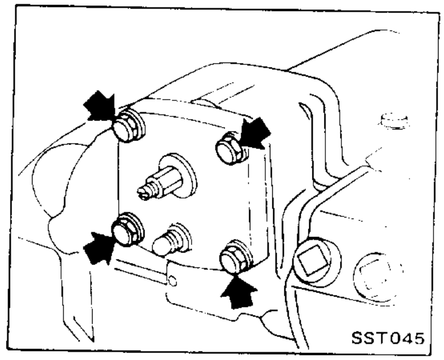
1. Install steering gear on Tool **KV48100301.**
2. Set stub shaft in a straight-ahead position.

Straight-ahead position is a position where stub shaft is turned two turns by 45° from lock position.

3. Disconnect sector shaft cover bolt.

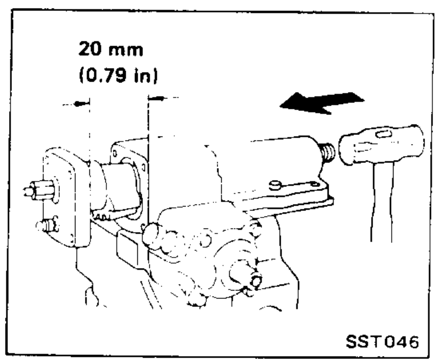
Do not loosen adjusting screw lock nut.

Do not turn lock nut unless necessary; otherwise it will damage O-ring, resulting in an oil leak.



4. Draw out sector shaft.

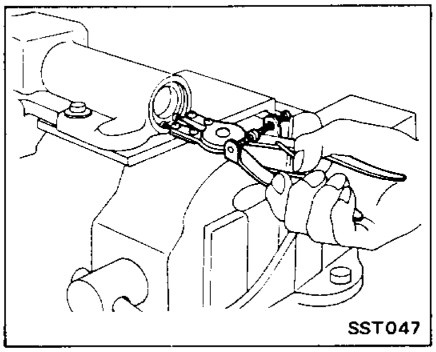
Knock out end of sector shaft approximately 20 mm (0.79 in).



5. Pull out sector shaft by hand.

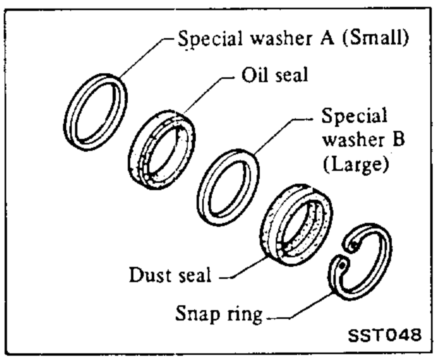
Attach plastic film to two bearings located inside gear housing while simultaneously pulling out sector shaft so that bearings will not drop into housing.

6. Remove snap ring.


SST047

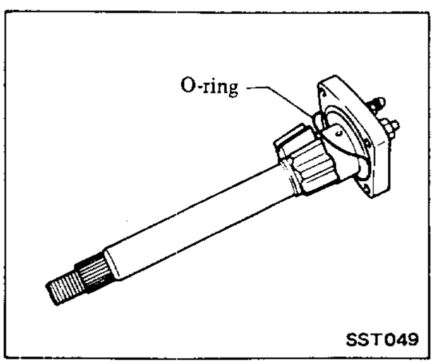
7. Remove dust cover, special washers and oil seal.

Apply blade of screwdriver to oil seal lightly so that it will not damage inner side of gear housing.



SST048

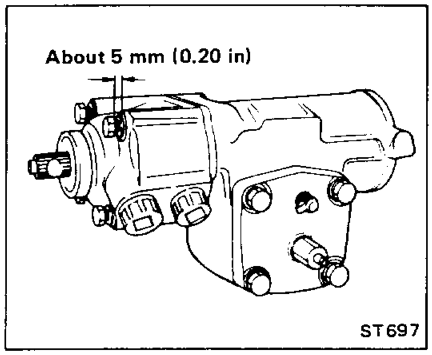
8. Remove O-ring.



SST049

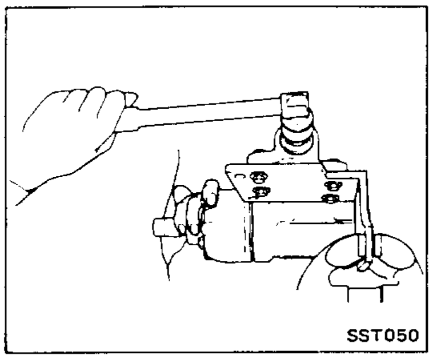
Rear housing seal

1. Install gear on **Tool KV48100301** in a vise.
2. Loosen (not remove) rear housing bolts.



ST697

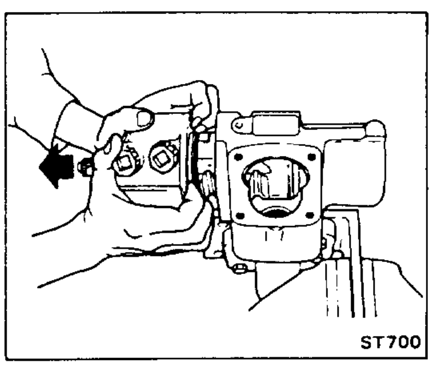
3. Turn sector shaft clockwise slightly to raise intermediate cover through piston.


SST050

4. Turn stub shaft counterclockwise and place piston (worm gear) in its straight-ahead position.
5. Remove sector shaft.

Refer to Sector Shaft Seal for disassembly.

6. Remove rear housing bolts.
7. Pull out rear housing, intermediate cover with worm gear assembly.


ST700

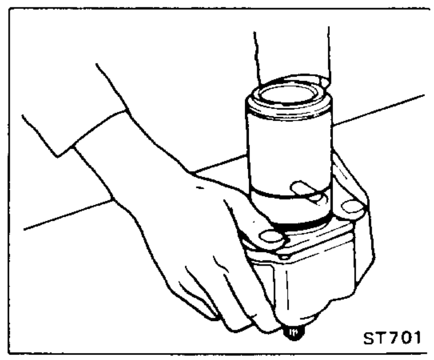
CAUTION:

a. When worm assembly is removed, piston may turn and come off under its own weight. Hold piston to prevent it from turning.
If piston-to-intermediate cover clearance exceeds 45 mm (1.77 in) by loosening, recirculating ball will be out of groove of worm; do not reinstall piston but replace the entire assembly.

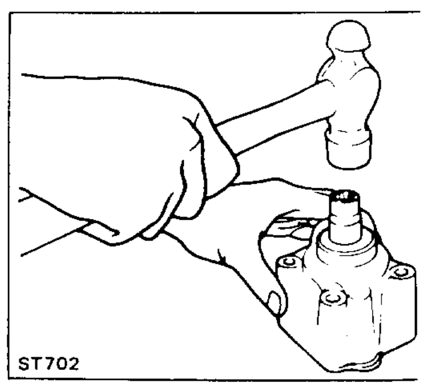
b. Take care not to damage teflon ring at piston end when removing.

8. Remove rear housing, **turn worm assembly upside down, and lightly tap stub shaft end on top of workbench.**

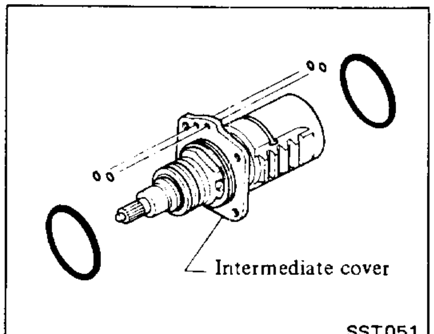
CAUTION:
Do not strike shaft with a hammer or pry it with a screwdriver.


ST701

9. Remove rear housing oil seal.


ST702

10. Remove O-ring on both sides of intermediate cover.



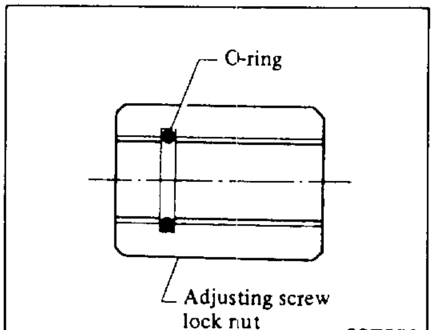
SST051

ASSEMBLY

Adjusting screw lock nut seal

Insert new O-ring into adjusting screw lock nut.

- Before inserting, apply a thin coat of vaseline to O-ring.
- Insert O-ring to make sure it fits into groove.

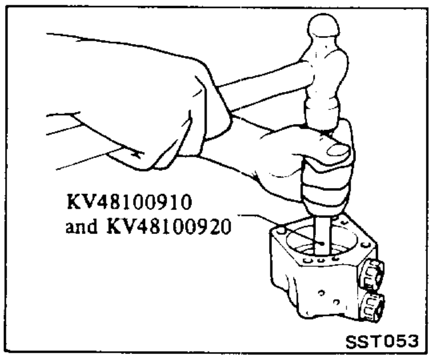


SST052

Rear housing seal

1. Install rear housing oil seal using Tool.

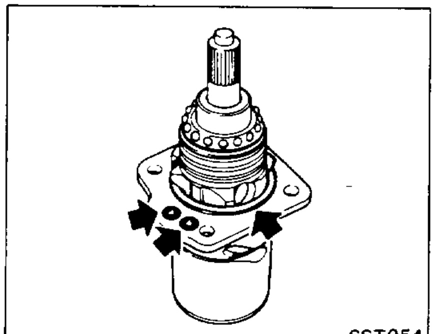
Before installing oil seal, apply recommended multi-purpose grease to lips.



SST053

2. Install O-rings on both sides of intermediate cover with new ones.

- Apply a thin coat of vaseline to new O-rings prior to their installation.
- Be careful not to install wrong O-rings as some of them resemble in size.

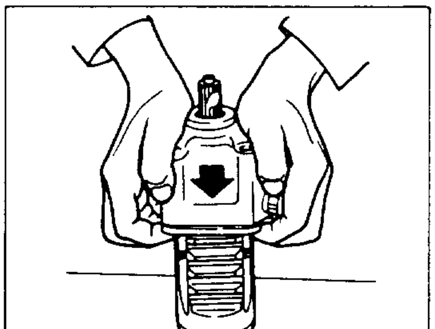

SST054

3. Fit rear housing onto intermediate cover with worm gear assembly.

CAUTION:

a. Do not tilt ball bearing.

b. Make sure that O-rings are not protruding or extruding.

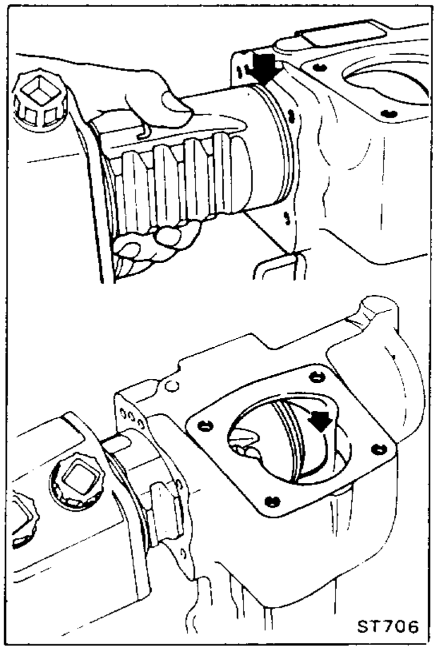

ST705

4. Insert worm gear assembly with rear housing and intermediate cover into gear housing

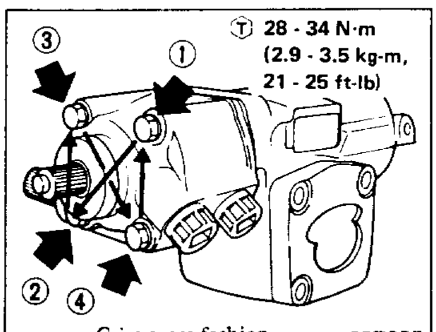
CAUTION:

a. Be careful that teflon ring at piston end is not damaged during insertion of gear housing.

b. When worm assembly is halfway inserted, teflon ring is deflected. Insert remaining part of worm assembly paying particular attention. Take care not to damage teflon ring on corner of sector hole. Be sure that teflon ring settles in its correct position.


ST706

5. Gradually tighten rear housing bolts in a criss-cross fashion.



SST055

CAUTION:

a. If bolts are tightened while worm assembly is tilted, inner seals will be damaged. Tighten bolts while assembly is level.
If worm assembly is tilted, stub shaft's turning torque will be increased.

b. Check O-rings to ensure that they do not protrude or extrude.

6. Install sector shaft into gear housing.

Refer to Sector Shaft Oil Seal for assembly.

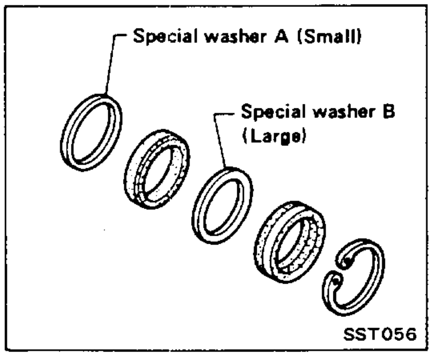
7. Check turning torque.

Refer to Inspection and Adjustment.

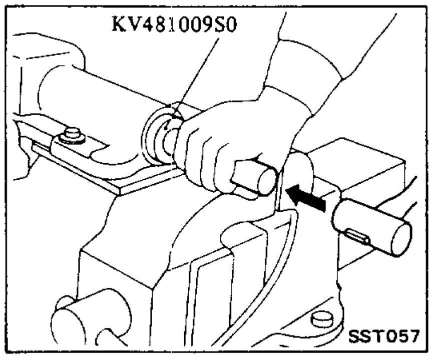
Sector shaft oil seal

1. Press new oil seal and dust cover using **Tool KV481009S0.**

- **When installing, be sure to use new oil seal, dust cover and special washers.**
- **Before installing, apply a thin coat of vaseline to new oil seal and dust cover.**



SST056



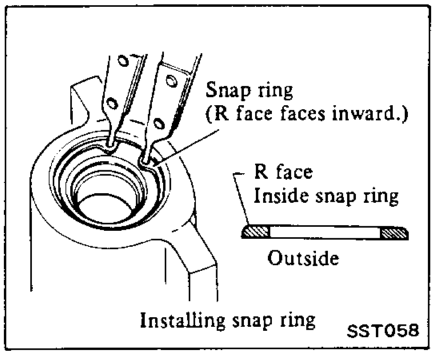
SST057

2. Install a new snap ring into gear housing.

CAUTION:

a. Turn snap ring to make sure it fits into groove.

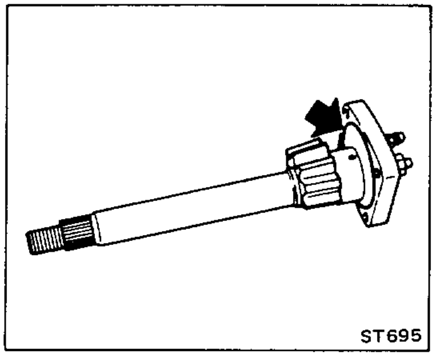
b. Always install snap ring with its rounded edges facing oil seal.



Installing snap ring SST058

3. Fit new O-ring into sector shaft cover.

- **Before installing, apply a thin coat of vaseline to O-ring.**
- **Make certain that O-ring is installed properly, and not damaged by sector shaft.**

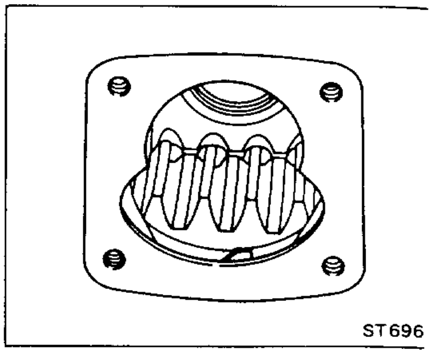


ST695

4. Set piston rack at straight-ahead position.

Turn piston rack about 10° to 15° toward yourself with your finger.

This is for smooth insertion of sector gear.



ST696

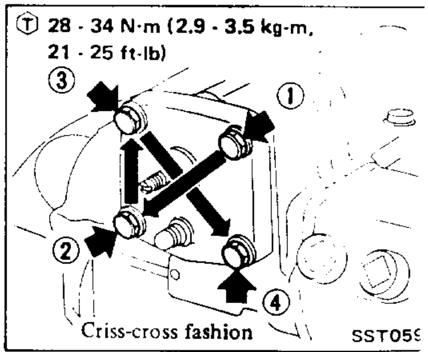
5. Wrap vinyl tape around serration area of sector shaft.

The reason is that vinyl tape prevents oil seal lip from being damaged during insertion.

6. Gradually insert sector shaft into gear housing, being careful not to damage oil seal.

When inserting sector shaft into gear housing, remove plastic film. Be careful not to drop bearings into gear housing.

7. Tighten sector shaft cover bolts.



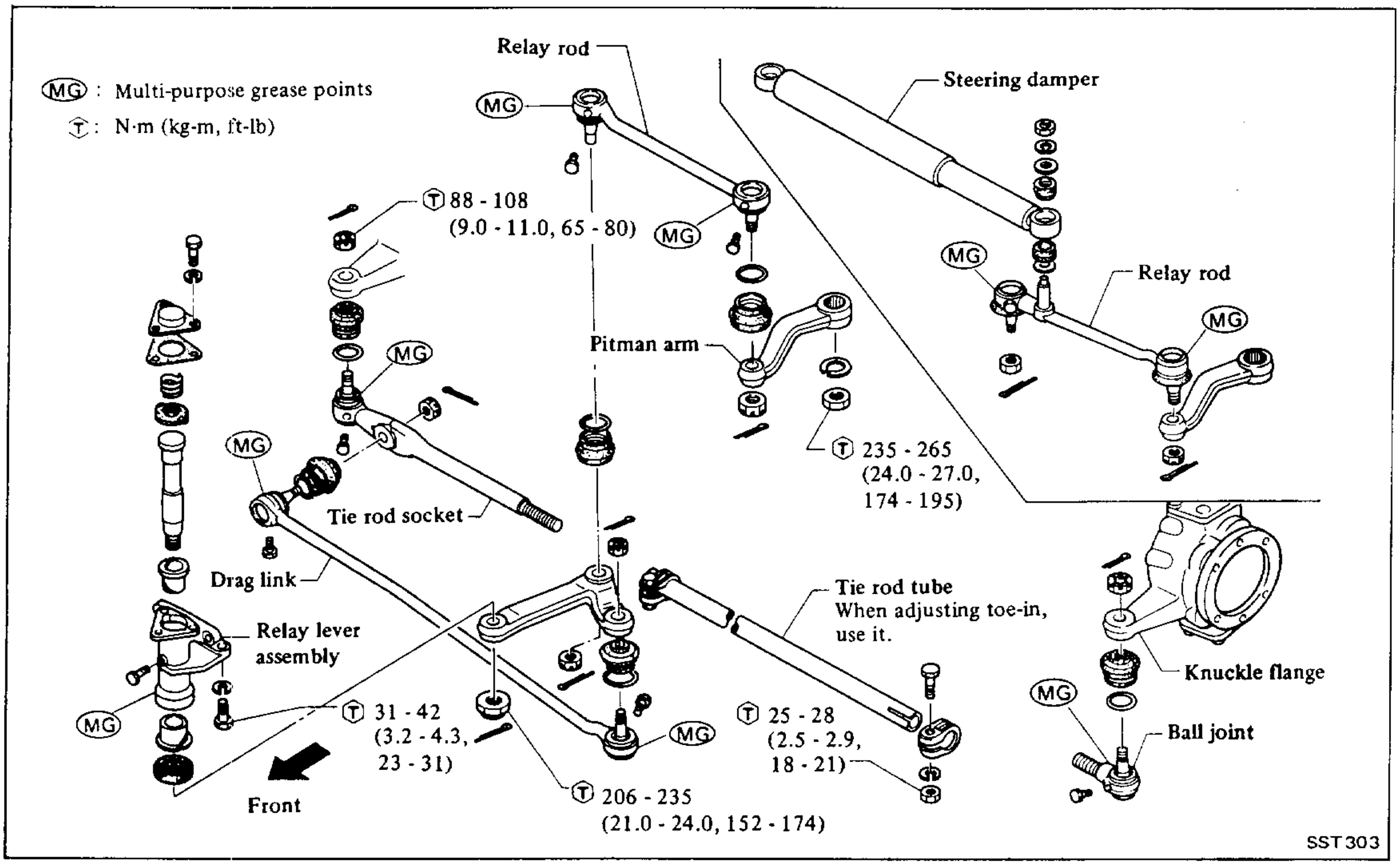
SST05?

8. Check steering gear turnin torque.

Refer to Inspection and Adjust ment.

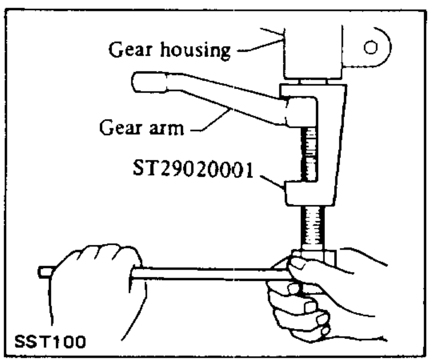
- **If there is a great difference be tween values of turning torque be fore and after disassembly, it mus be assumed that some new problen has occurred. It will be necessary t replace the entire assembly.**

STEERING LINKAGE

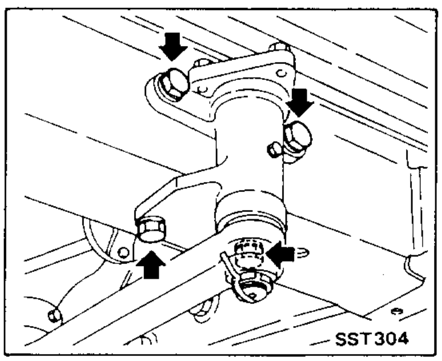


REMOVAL AND INSTALLATION

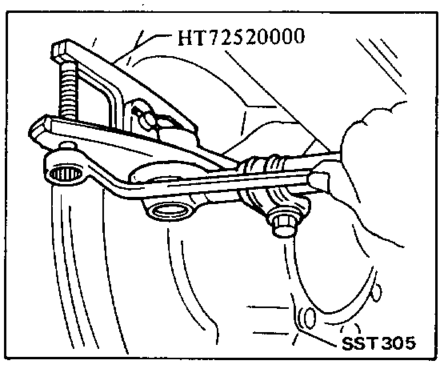
1. Jack up front of vehicle and support it on the safety stands.
2. Block rear wheels with chocks.
3. Remove pitman arm using **Tool.**



4. Remove relay lever assembly.



5. Remove tie rod from knuckle flange using **Tool.**



6. Install steering linkage in the reverse order of removal.

T : Pitman arm to sector shaft

VRB70L models
235 - 265 N·m
(24.0 - 27.0 kg-m,
174 - 195 ft-lb)

I.P.S. 56L models
137 - 177 N·m
(14 - 18 kg-m,
101 - 130 ft-lb)

Relay rod assembly to body frame
31 - 42 N·m
(3.2 - 4.3 kg-m,
23 - 31 ft-lb)

Tie rod to knuckle flange
88 - 108 N·m
(9.0 - 11.0 kg-m,
65 - 80 ft-lb)

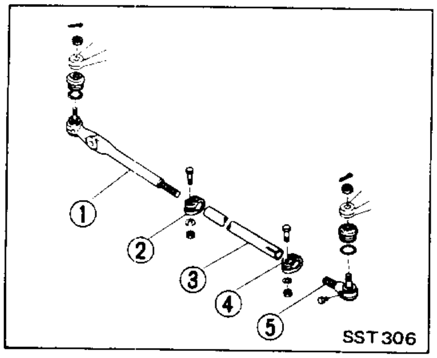
7. After installing steering linkage, check wheel alignment, and if necessary, adjust.

Refer to Section MA for adjustment.

DISASSEMBLY

Tie rod assembly

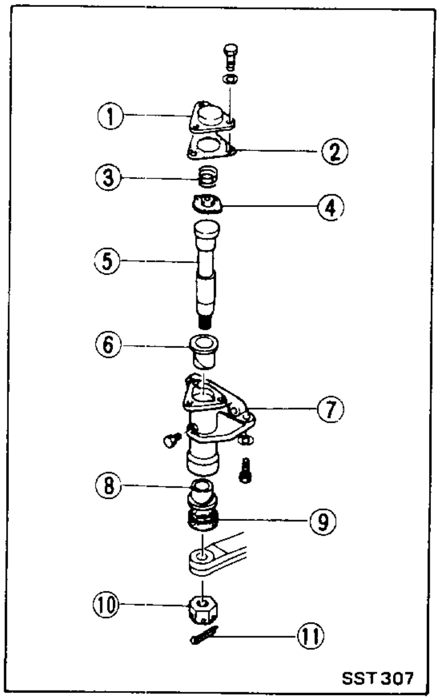
1. Remove tie rod assembly from knuckle flange **using Tool HT72520000.**
2. Separate tie rod socket assembly from tie rod tube.



1 Tie rod socket assembly
2 Tie rod clamp
3 Tie rod tube
4 Tie rod clamp
5 Tie rod socket assembly

Relay lever assembly

Loosen nut, and separate each part.



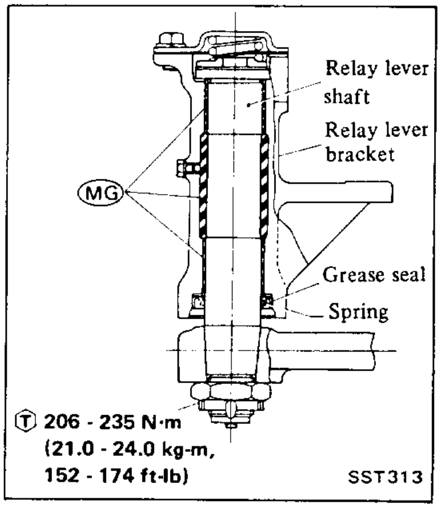
1 Relay lever bracket cover
2 Gasket
3 Spring
4 Spring seat
5 Relay lever shaft
6 Bushing
7 Relay lever bracket
8 Bushing
9 Grease seal
10 Nut
11 Cotter pin

ASSEMBLY

Assemble steering linkage in the reverse order of disassembly, observing the following instructions.

Relay lever assembly

a. Apply multi-purpose grease to clearance between shaft and bracket, and to each sliding portion.



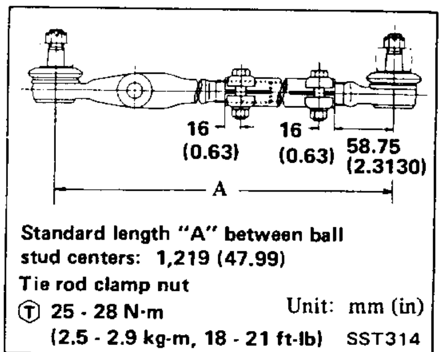
b. Press relay lever bushing and grease seal into bracket.
Apply multi-purpose grease between lips of grease seal.

c. Apply liquid packing to both sides of gasket, and install relay lever bracket cover.

Ⓣ : Relay lever starting torque
Less than 4.9 N·m
(50 kg-cm, 43 in-lb)

Tie rod assembly

When tie rod socket assembly and tie rod tube are separated, correctly adjust tie rod length.



INSPECTION

Ball joint

1. When ball stud is worn or a play exists, replace side rod so with a new one.
2. When dust cover is broken deformed, be sure to replace wi 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)

Relay lever assembly

Check grease seal for break wear or play, and if necessary repl

Apply grease to relay lever ass bly at recommended intervals.

Initial turning torque:
Less than 4.9 N·m
(50 kg-cm, 43 in-lb)

Tie rod assembly

Check tie rod socket assembly tie rod tube for breakage, bend crack, and replace with a new on necessary.

Steering damper

Check oil leakage or damping fo of damper, and replace if necessary

Damping force:
147 N (15 kg, 33 lb)
at 0.3 m (1.0 ft)/sec.

Fixing location

Check fixing location (nuts cotter pins) for looseness, play breakage. When looseness or pla found, check for wear on tap portion of ball stud, pitman arn relay lever assembly.

When reassembling each ball jo use new cotter pins.

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Steering column type	Solid	
Steering gear model	VRB70L	I.P.S. 56L
Turns of steering wheel on the vehicle (Lock-lock)	4.5	3.6
Steering gear ratio	24.4 - 26.84	17.0
Steering damper N (kg, lb)	147 (15, 33)	

INSPECTION AND ADJUSTMENT

Front wheel full turning angle Inner wheel degree		28° - 30°
Outer wheel degree		27.5° - 29.5°
Minimum turning radius (Wall to wall) m (ft)	Hardtop	5.5 (18.0)
	Pick-up	6.7 (22.0)
	Canvas Top	5.8 (19.0)
Steering wheel axial play mm (in)		0 (0)
Steering wheel play mm (in)		Less than 35 (1.38)

STEERING GEAR

Model VRB70L

Worm bearing preload (With oil seal) N·m (kg-cm, in-lb)	0.39 - 0.59 (4.0 - 6.0, 3.5 - 5.2)	
Worm bearing preload adjusting shims Standard shim thickness mm (in)	1.0 (0.039)	
Adjusting shim thickness	Thickness mm (in)	Unit number
	0.500 (0.0197)	48273 82100
	0.200 (0.0079)	48274 82100
	0.100 (0.0039)	48275 82100
	0.075 (0.0030)	48276 82100
	0.050 (0.0020)	48277 82100
Steering gear total preload (With oil seal) N·m (kg-cm, in-lb)	Less than 1.23 N·m (12.5 kg-cm, 10.9 in-lb)	

Backlash at gear arm top end (In straight-ahead position) mm (in)		0 - 0.2 (0 - 0.008)	
End play (Between sector shaft and adjusting screw) Standard shim thickness 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 (Imp pt)	Model 160 series	Approximately 0.40 (3/4)	
	Model 61 series	Approximately 0.45 (3/4)	

Model I.P.S. 56L

Oil pump belt deflection mm (in)	8 - 12 (0.31 - 0.47) at 98N (10 kg, 22 lb)
Steering wheel turning force (At circumference of steering wheel) N (kg, lb)	Less than 34.3 (3.5, 7.7)
Oil pump maximum pressure kPa (bar, kg/cm², psi)	6,865 (68.6, 70, 995) at idling
Normal operating temperature at fluid °C (°F)	60 - 80 (140 - 176)
Fluid capacity mℓ (Imp fl oz)	Approximately 750 - 950 (26.4 - 33.4)
Steering gear turning torque N·m (kg-cm, in-lb) 360° position from straight-ahead position	0.7 - 1.2 (7 - 12, 6.1 - 10.4)
Straight-ahead position (As compared with steering wheel turned 360°)	0.1 - 0.4 (1 - 4, 0.9 - 3.5) higher than at 360°

STEERING LINKAGE

	N·m	kg-cm	in-lb
Initial turning torque Ball joint	1.0 - 4.9	10 - 50	8.7 - 43.4
Relay lever	Less than 4.9	Less than 50	Less than 43

TIGHTENING TORQUE

STEERING COLUMN (Model 160 series)

	N·m	kg-m	ft-lb
Steering wheel nut	39 - 49	4.0 - 5.0	29 - 36
Jacket tube bracket to dash panel	3.4 - 4.4	0.35 - 0.45	2.5 - 3.3
Steering column mounting bracket	13 - 18	1.3 - 1.8	9 - 13
Stub shaft or worm shaft to coupling	39 - 49	4.0 - 5.0	29 - 36

STEERING GEAR

	VRB70L			I.P.S. 56L		
	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
Pitman arm nut	235 - 265	24.0 - 27.0	174 - 195	137 - 177	14 - 18	101 - 130
Steering gear housing to body frame	84 - 96	8.6 - 9.8	62 - 71	84 - 96	8.6 - 9.8	62 - 71
Sector shaft cover to gear housing	15 - 25	1.5 - 2.5	11 - 18	28 - 34	2.9 - 3.5	21 - 25
Rear cover to gear housing	31 - 36	3.2 - 3.7	23 - 27	23 - 32	2.3 - 3.3	17 - 24
Sector shaft adjusting screw lock nut	29 - 39	3.0 - 4.0	22 - 29	28 - 34	2.9 - 3.5	21 - 25
Oil pump to bracket	–	–	–	26 - 36	2.7 - 3.7	20 - 27
Hose to oil pump	–	–	–	29 - 49	3.0 - 5.0	22 - 36
Steering gear to hoses	–	–	–	29 - 49	3.0 - 5.0	22 - 36

STEERING LINKAGE

	N·m	kg-m	ft-lb
Ball stud nuts	88 - 108	9.0 - 11.0	65 - 80
Tie rod adjusting tube clamp nuts	25 - 28	2.5 - 2.9	18 - 21
Relay lever nut	206 - 235	21.0 - 24.0	152 - 174
Relay lever assembly to body frame	31 - 42	3.2 - 4.3	23 - 31

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.

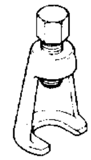
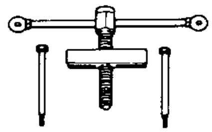
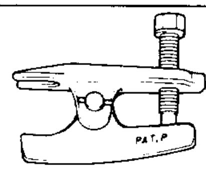
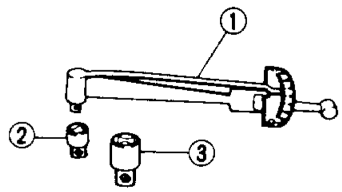
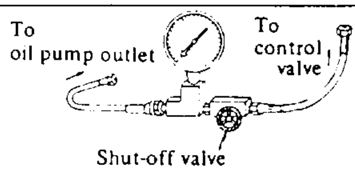
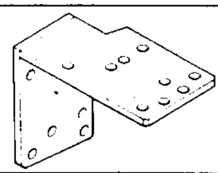
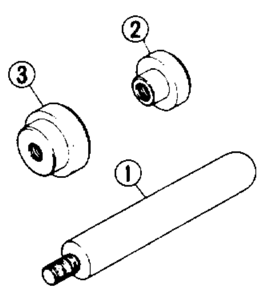
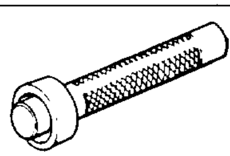
MANUAL STEERING

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 relay lever assembly.	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.

POWER STEERING

Condition	Probable cause	Corrective action
Oil pressure does not build up.	Pump drive belt slipping on pulley.	Readjust belt tension.
	Pump malfunctioning.	Replace.
	Oil leaking through hose joints.	Replace or retighten copper washer.
	Oil leaking through power steering.	Replace sealing parts at steering gear.
Steering wheel moves heavily.	Lack of oil in oil pump.*	Refill.
	Air present in oil.	Bleed air.
	Oil pressure too low.	See "Hydraulic system check".
	Wheel alignment out of specifications or air pressure in tires too low.*	Re-align or inflate tires to correct pressure.
	Steering gears improperly engaged.*	Replace gear assembly.
	Steering column out of alignment.*	Repair or replace.
	Worn or damaged ball joint at suspension and steering linkage.*	Replace.
	Relay lever dragging.*	Repair or replace.
Steering wheel fails to return.	Refer to items marked "*" above.	
	Front wheel caster improperly adjusted.	Readjust.
	Internal gears dragged or gouged.	Replace gear assembly.
Steering effort is not the same in both directions.	Oil leakage in steering gear.	Replace sealing parts.
	Stuffy oil passage in steering gear.	Replace gear assembly.
Unstable running.	Wheel bearing not properly adjusted.	Readjust.
	Stuck or damaged control valve in steering gear.	Replace gear assembly.
	Front wheel alignment not properly.	Readjust.
	Excessive steering gear play.	Readjust backlash or replace gear assembly.
	Play at suspension and linkage ball joint.	Replace.
Noisy pump.	Lack of oil in oil pump.	Refill.
	Hoses or oil filter clogged.	Clean or, if necessary, replace.
	Loose pulley.	Repair.
	Belt noisy or slapping.	Readjust tension.
	Broken pump part.	Replace.

SPECIAL SERVICE TOOLS

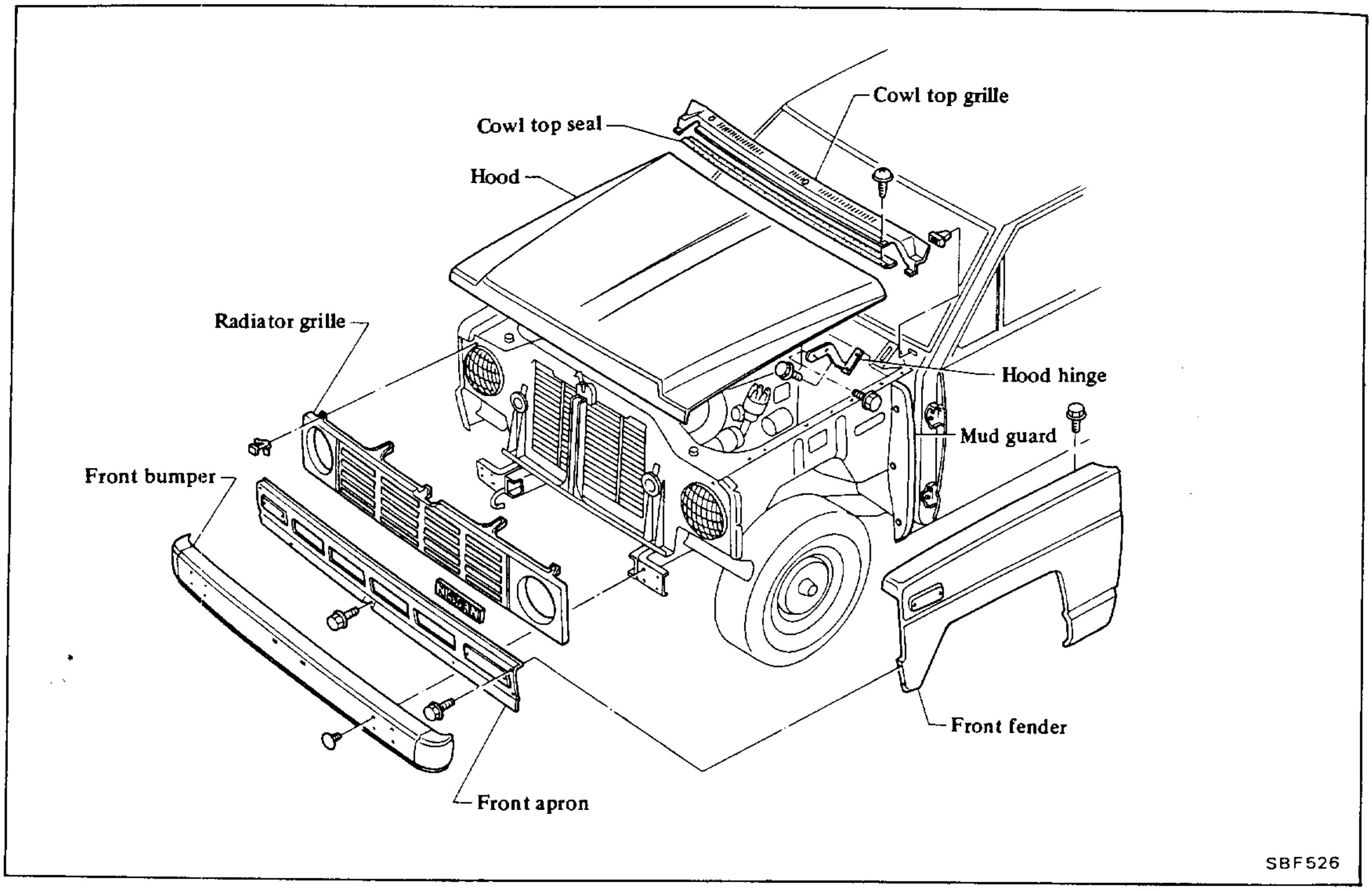
Tool number	Tool name	Unit application	
		Model VRB70L	Model I.P.S. 56L
ST29020001	Steering gear arm puller 	X	X
ST27180001	Steering wheel puller 	X	X
HT72520000	Steering ball joint remover 	X	X
ST3127S000 ① GG91030000 ② HT62900000 ③ HT62940000	Preload gauge Torque wrench Socket adapter Socket adapter 	X	X
ST27091000	Pressure gauge 		X
KV48100301	Steering gear housing attachment 	X	X
KV481009S0 ① KV48100910 ② KV48100920 ③ KV48100930	Oil seal drift set Drift Adapter Adapter 		X
ST33210000	Gear carrier side bearing drift 	X	

BODY & FRAME

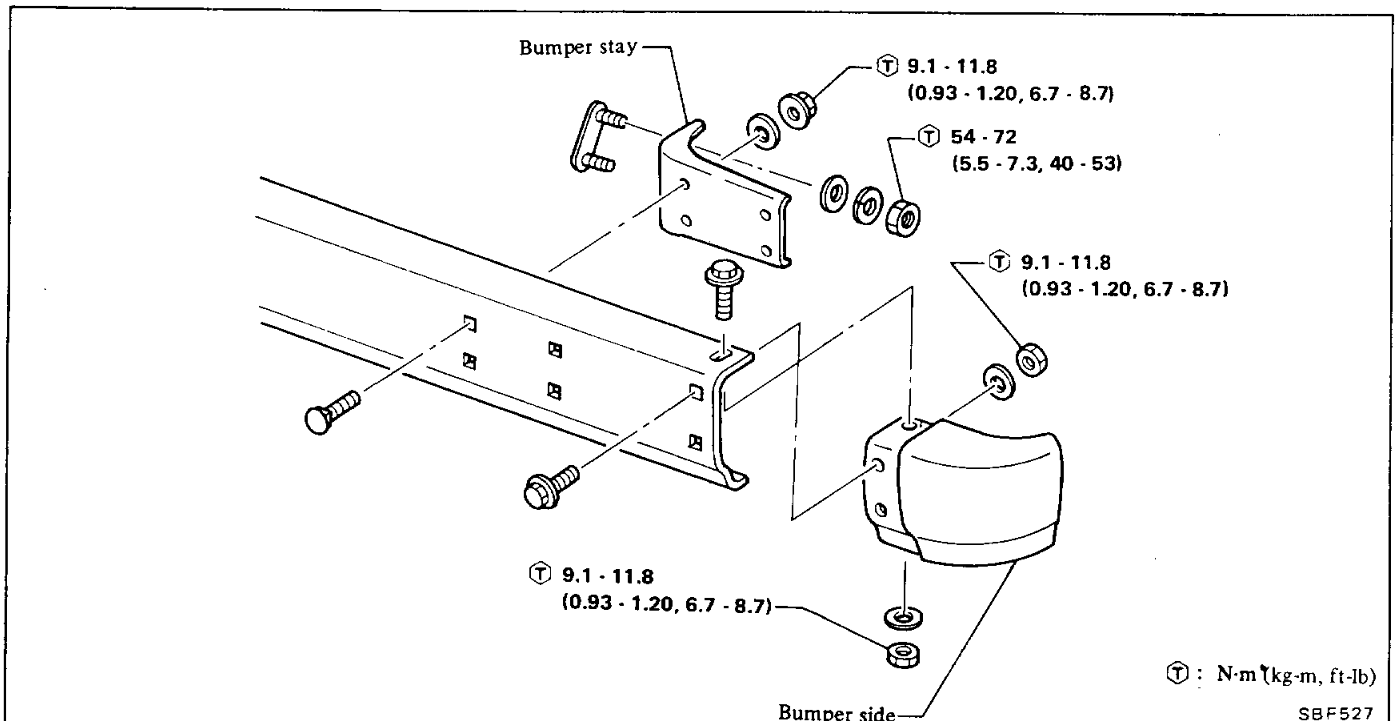
BF

CONTENTS

BODY FRONT END (Except Canvas Top)



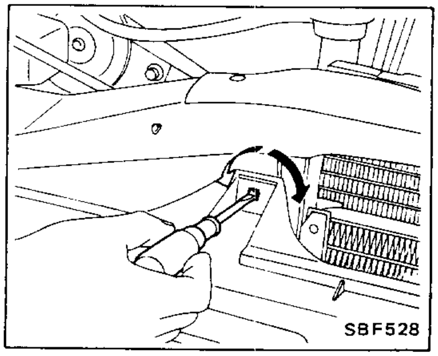
FRONT BUMPER



RADIATOR GRILLE

REMOVAL

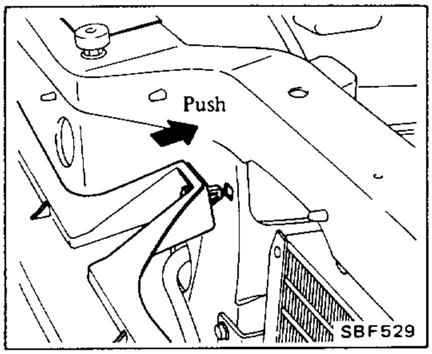
Turn fasteners a quarter turn with a conventional screwdriver, and then remove radiator grille.



SBF528

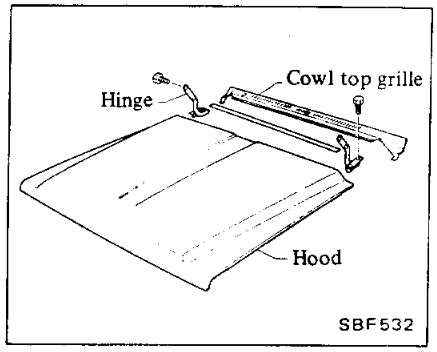
INSTALLATION

1. Set fasteners in radiator grille from the back, and turn them a quarter turn.
2. Install radiator grille.



SBF529

HOOD

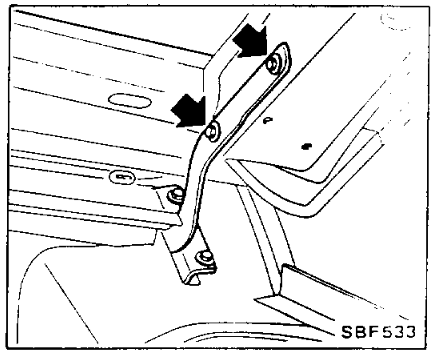


SBF532

REMOVAL AND INSTALLATION

Hood

1. Support hood and remove bolts attaching hood to hinge. Then remove hood.



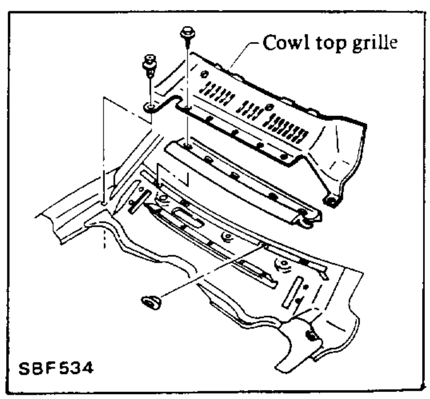
SBF533

2. Installation is in reverse order of removal.

Adjust hood. Refer to Adjustment.

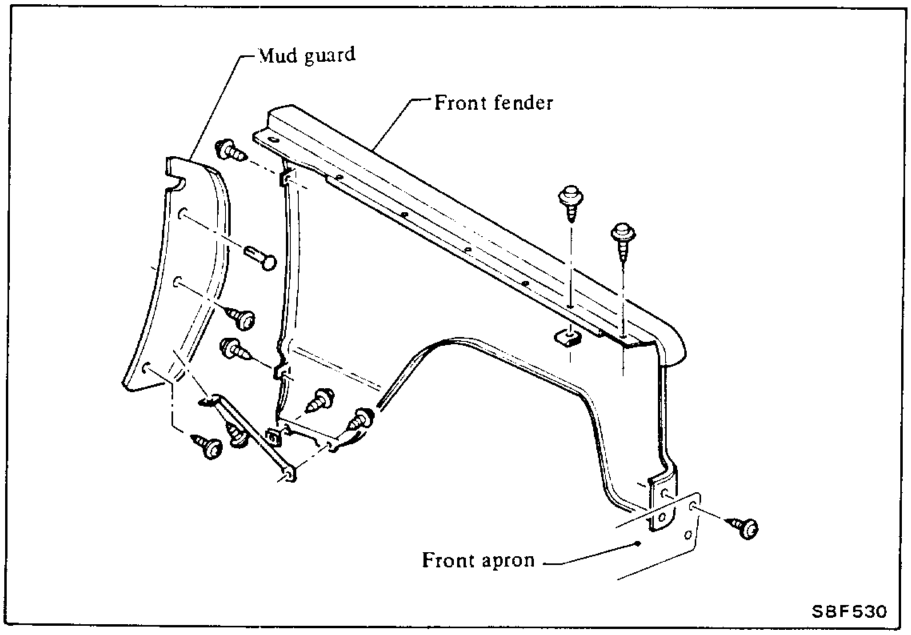
Cowl top grille

1. Remove hood.
2. Remove windshield wiper arms.
3. Remove cowl top grille fasteners, then remove cowl top grille.



SBF534

FRONT FENDER

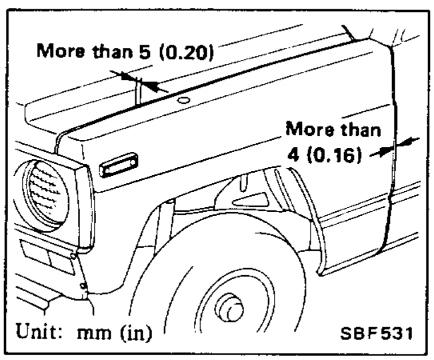


SBF530

REMOVAL AND INSTALLATION

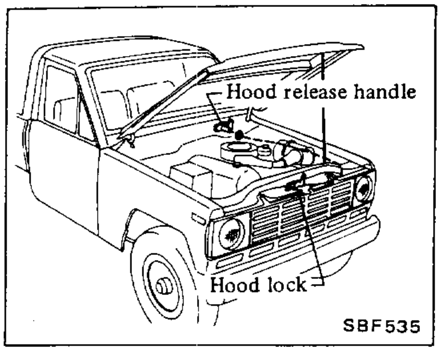
1. Disconnect battery ground cable.
2. Remove mud guard.
3. Disconnect side marker lamp harness, and remove front fender.
4. Installation is in reverse order of removal.

ADJUSTMENT



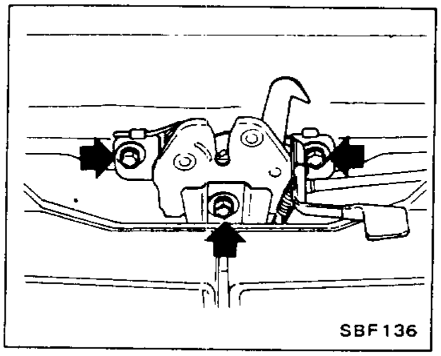
SBF531

Lock and lock control

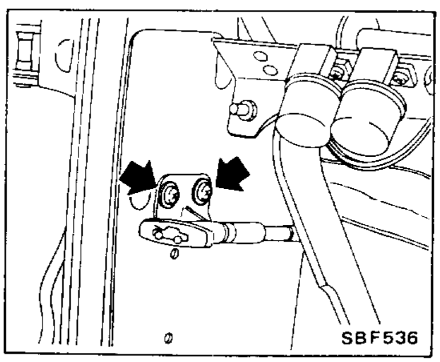


SBF535

1. Remove hood lock female attaching bolts.


SBF136

2. Remove control cable from hood lock female, then remove hood lock female.
3. Remove hood release handle with bracket.


SBF536

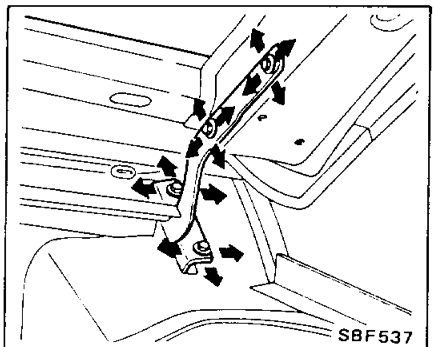
4. Draw control cable out through passenger compartment.
5. Installation is in reverse order of removal.

Check hood lock control operation.

ADJUSTMENT

Hood

Loosen bolts attaching hood hinge. Adjust hood back and forth and side to side until it is set in its optimum position.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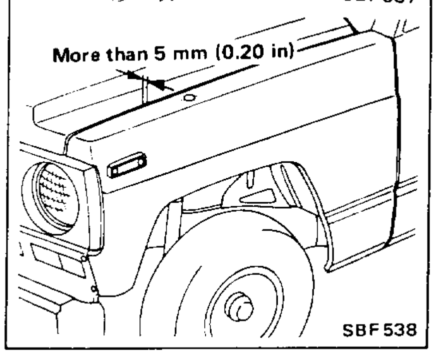
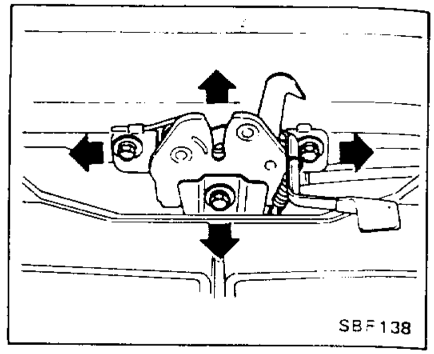


SBF538

Hood lock

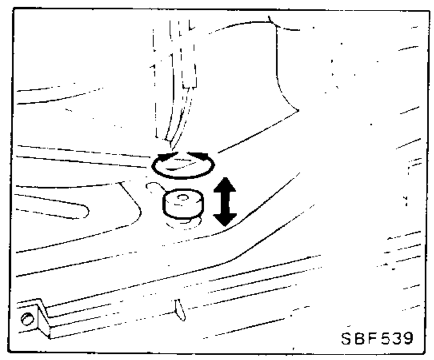
Loosen bolts attaching hood lock female, and adjust hood back and forth and side to side until it is set in its optimum position, and opens and closes smoothly.


SBF138

CAUTION:
To avoid accidental opening of hood while driving, be sure to properly engage hood lock.

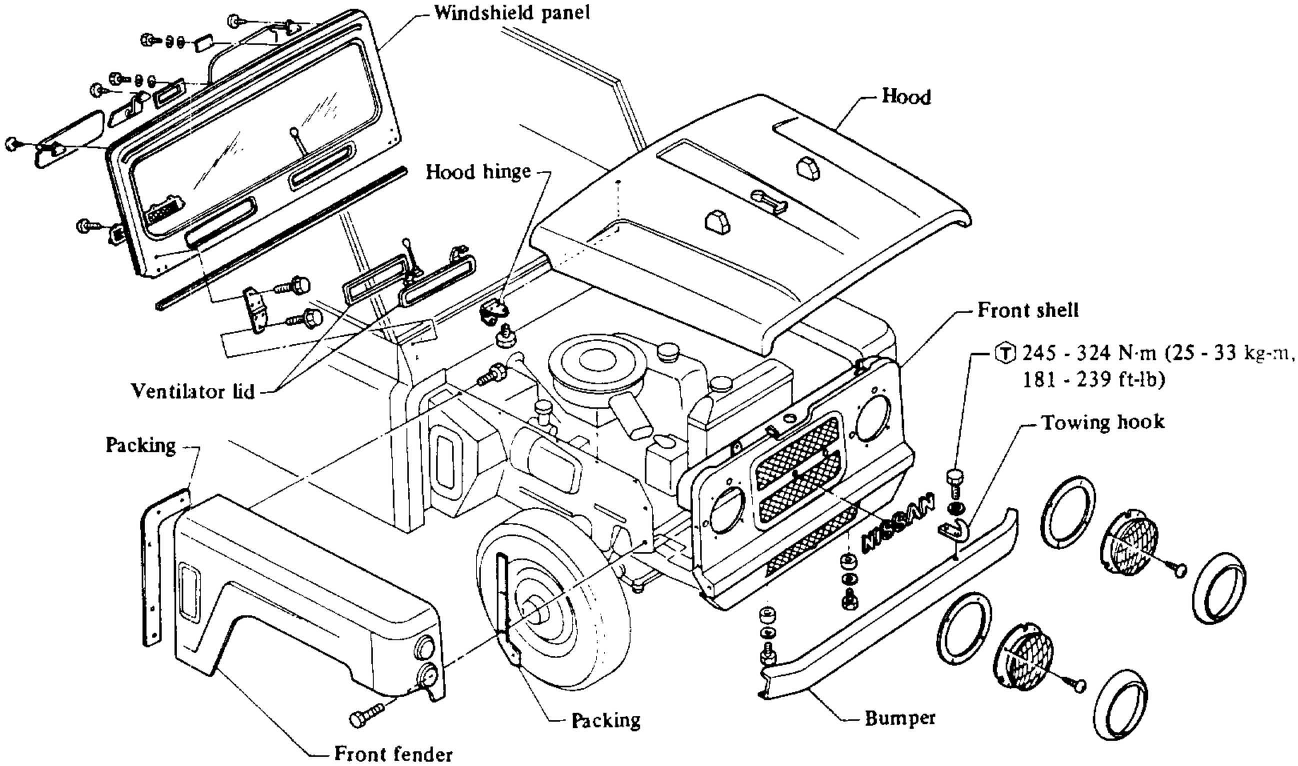
Bumper rubber

Adjust bumper rubber height so that hood is nearly flush with front fender.


SBF539

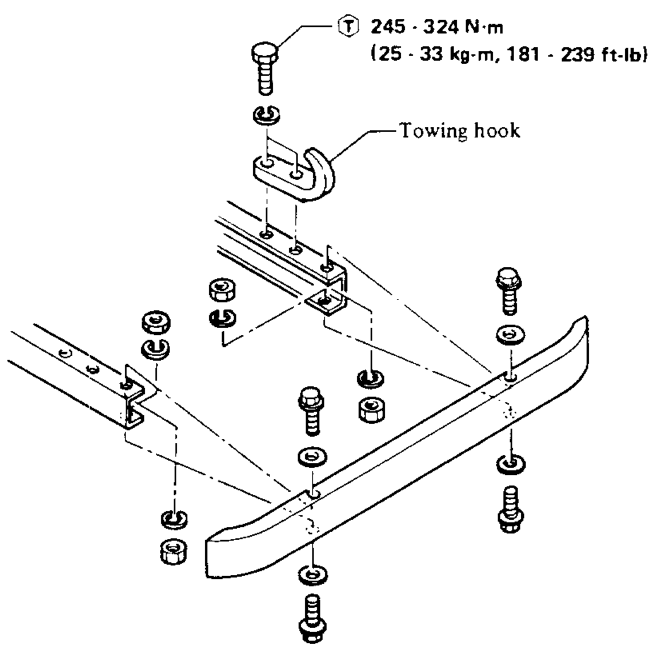
Adjust bumper rubber so that it contacts its mating panel.

BODY FRONT END (Canvas Top)



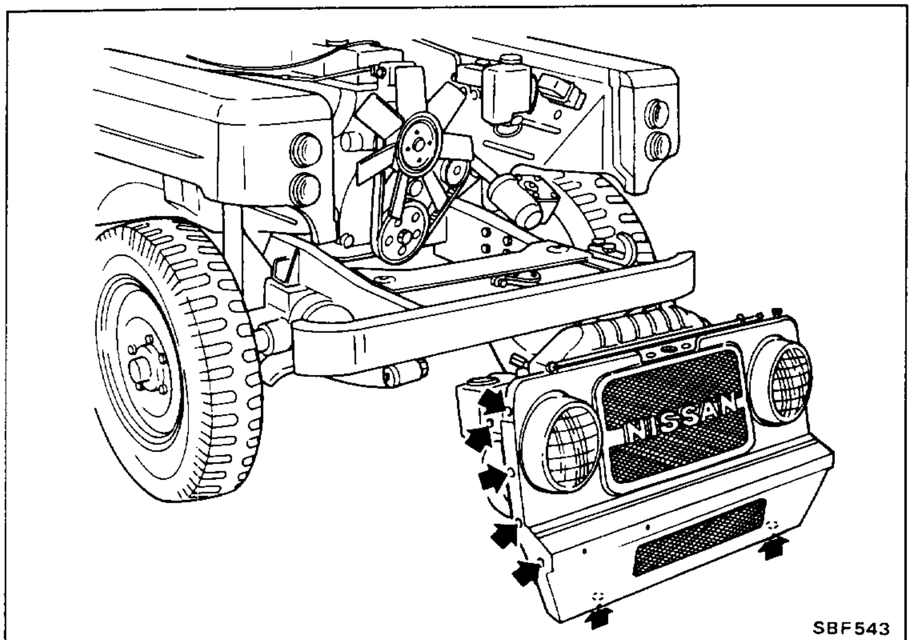
SBF541

FRONT BUMPER AND TOWING HOOK



SBF542

RADIATOR SHELL

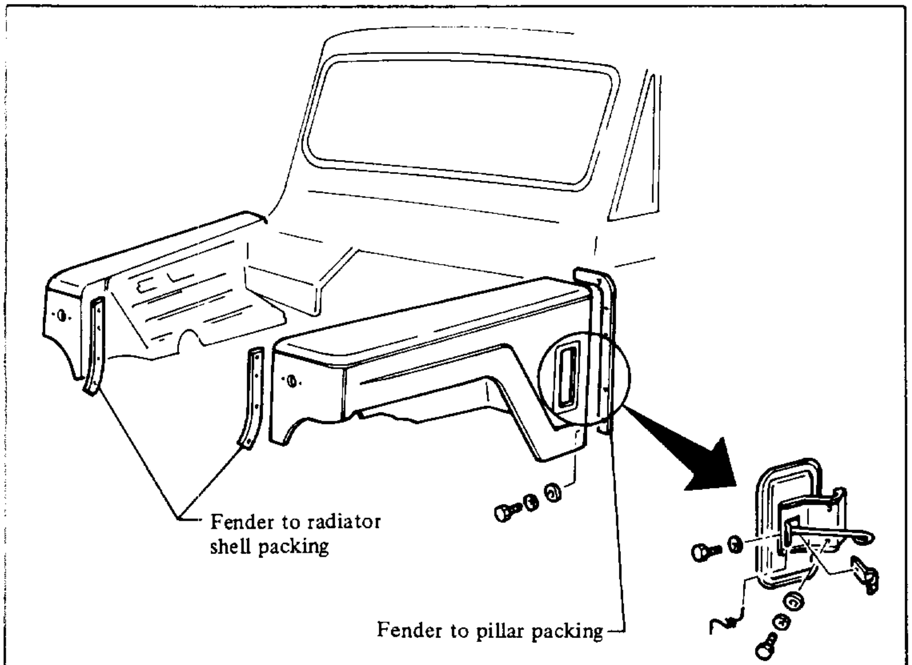


SBF543

REMOVAL AND INSTALLATION

1. Remove hood.
2. Drain engine coolant.
3. Disconnect upper and lower radiator hoses.
4. Disconnect all engine compartment harness connectors.
5. Remove radiator shell securing bolts.
6. Remove radiator shell, engine compartment harness and radiator assembly as a unit.
7. Installation is in reverse order of removal.

FRONT FENDER



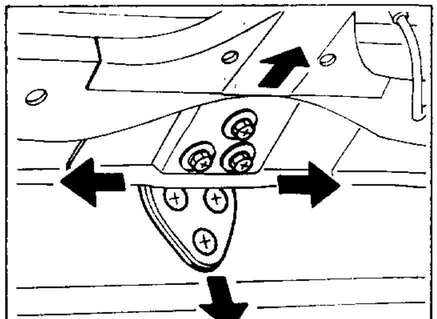
SBF544

HOOD

ADJUSTMENT

Hood

Loosen bolts attaching hood hinge. Adjust hood back and forth and side to side until it is set in its optimum position.

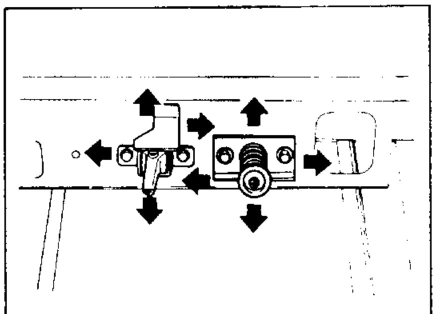


SBF545

Hood lock

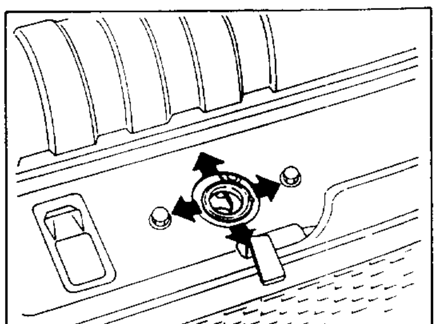
Loosen bolts attaching hood locks. Adjust hood locks back and forth and side to side until they are set in their optimum position.

Male side



SBF546

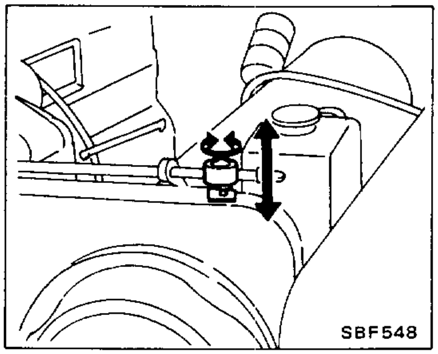
Female side



SBF547

Bumper rubber

Adjust bumper rubber height so that hood does not interfere with front fender.

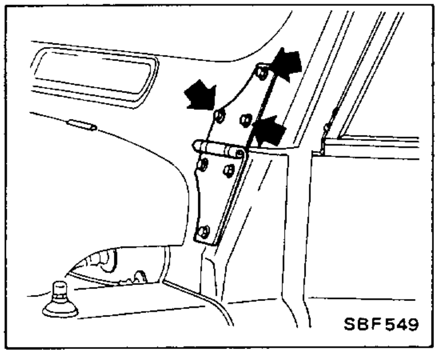


Adjust bumper rubber so that it contacts its mating panel.

WINDSHIELD PANEL

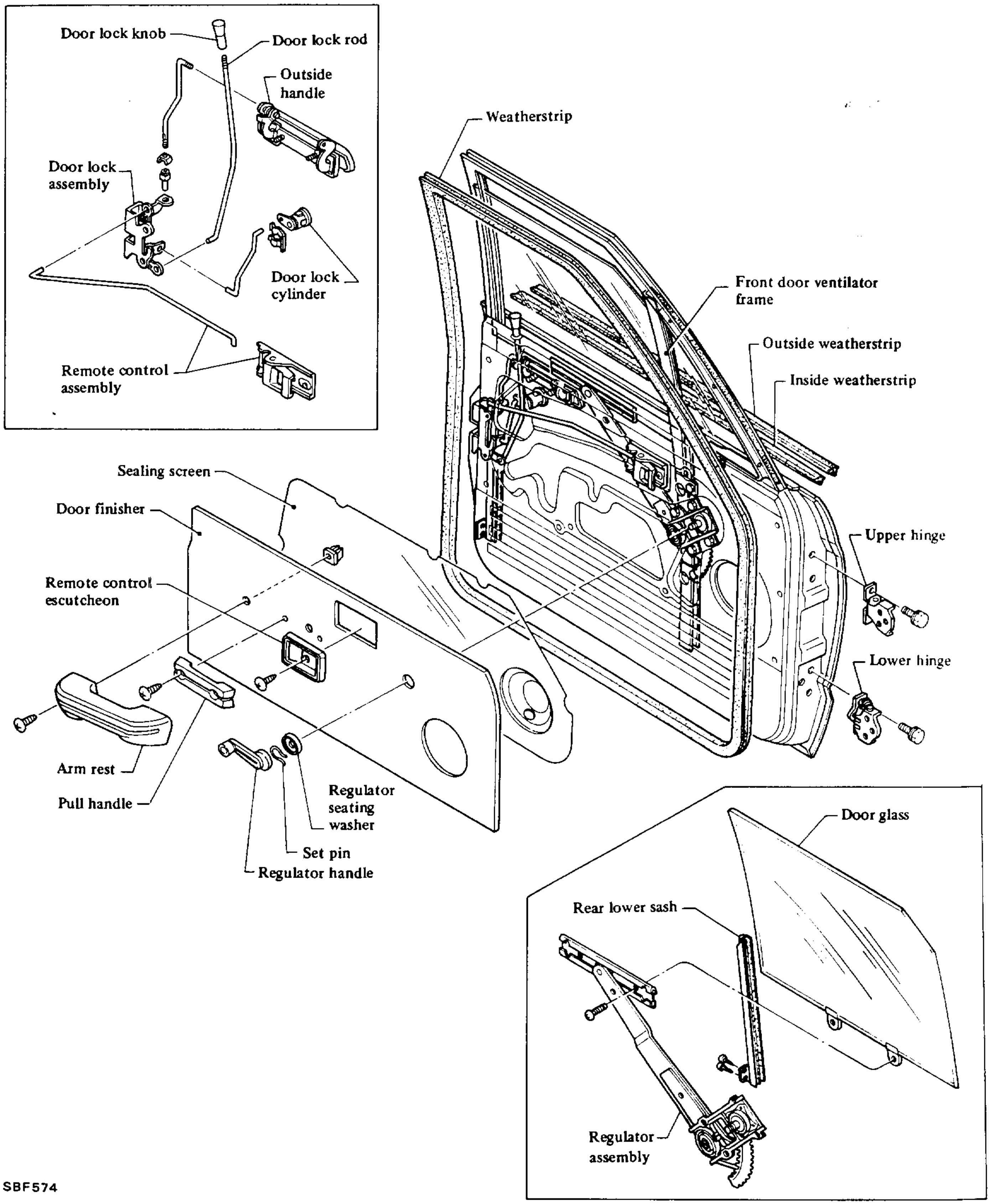
REMOVAL AND INSTALLATION

1. Disconnect wiper motor harness connector.
2. Remove bolts securing windshield panel hinge.



DOORS (Except Canvas Top)

FRONT DOOR

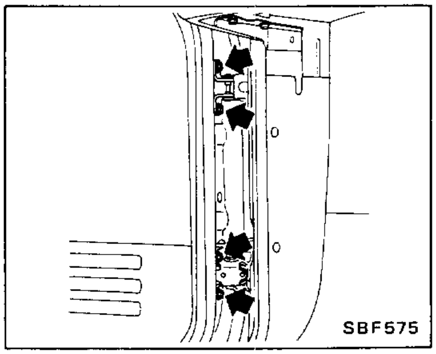


SBF574

REMOVAL AND INSTALLATION

Front door assembly

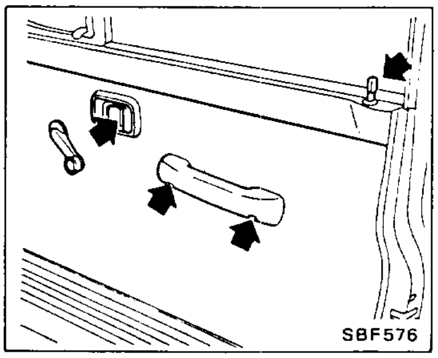
1. Remove front door.


SBF575

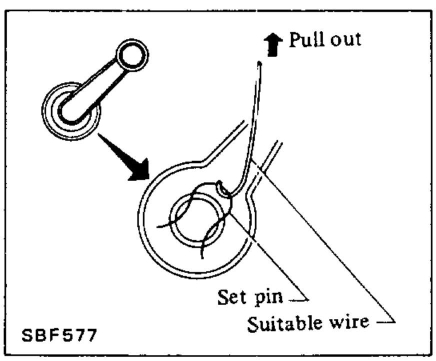
2. Installation is in reverse order of removal.
Adjust door. **Refer to Adjustment.**

Front door trim

1. Remove arm rest, door lock knob and remote control escutcheon.


SBF576

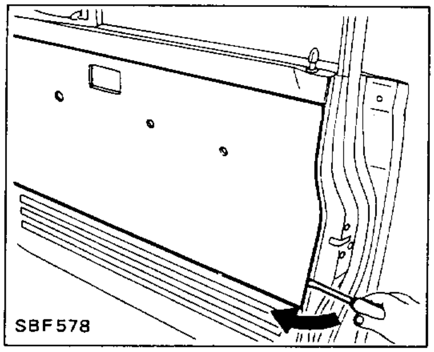
2. Remove regulator handle.



SBF577

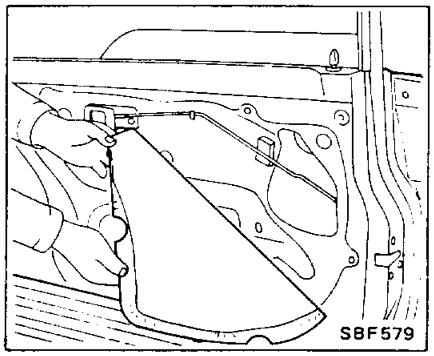
3. Remove door finisher.

When retaining clips from door inner panel, pry door finisher using suitable tool.

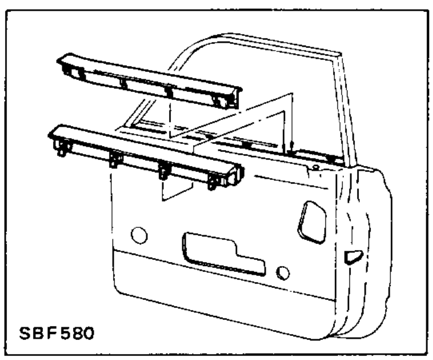

SBF578

4. Remove sealing screen.

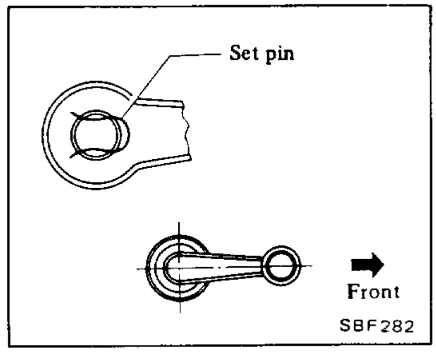
When removing sealing screen, allow bonding agent to contact any adjacent parts.


SBF579

5. Remove door weatherstrip using suitable tools.


SBF580

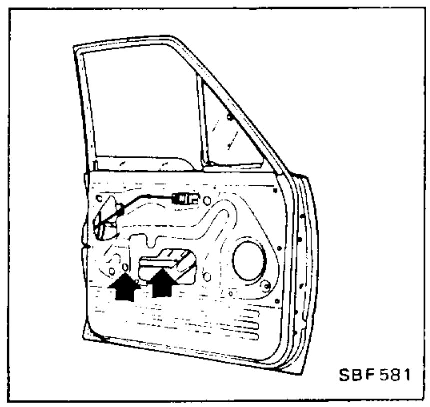
- To avoid water or dust leakage through inner door into passneger compartment, securely attach sealing screen with tape or bonding agent.
- Position regulator handle with door glass closed as shown in figure, securing it with set pin.



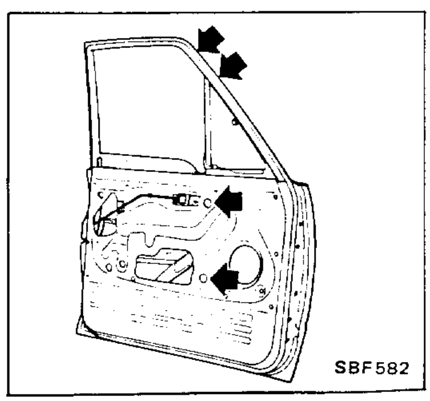
SBF282

Door glass and regulator

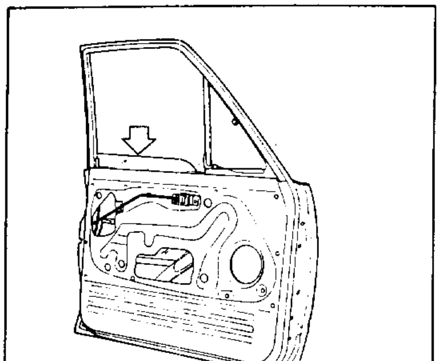
1. Remove front door trim.
2. Remove front door glass fixing bolt from regulator arm.


SBF581

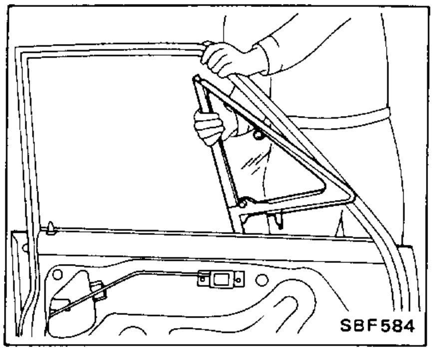
3. Remove bolts securing front door ventilator frame.


SBF582

4. Remove door glass from regulator, and lower it completely.



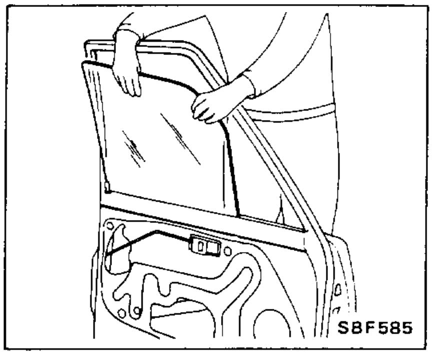
SBF583



SBF584

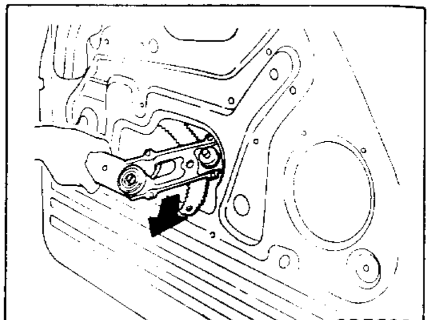
5. Withdraw front door ventilator frame.

6. Remove front door glass.



SBF585

7. Remove door glass regulator attaching bolts, and withdraw door glass regulator.

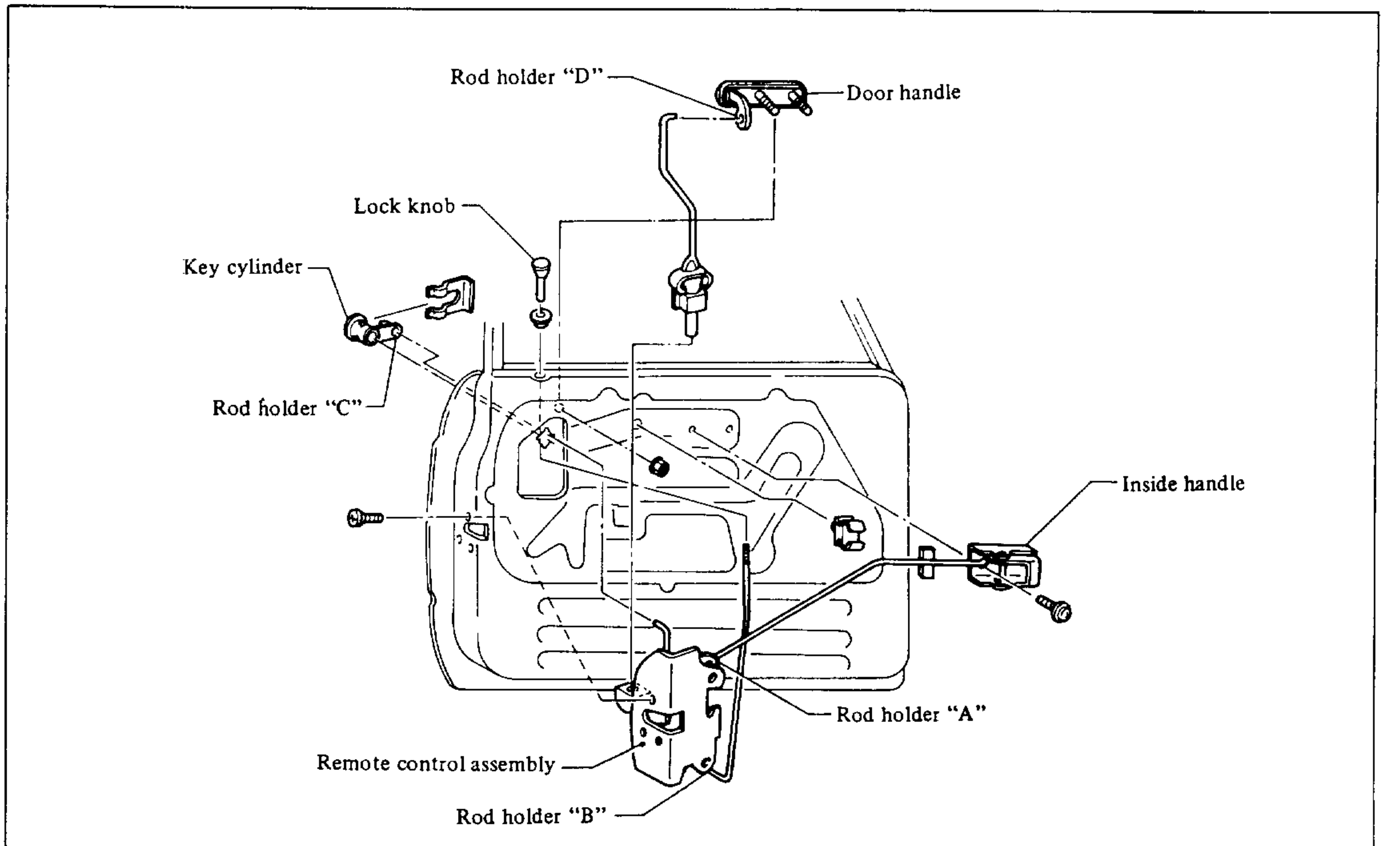


SBF586

8. Installation is in reverse order of removal.

Adjust door glass and regulator. **Refer to Adjustment.**

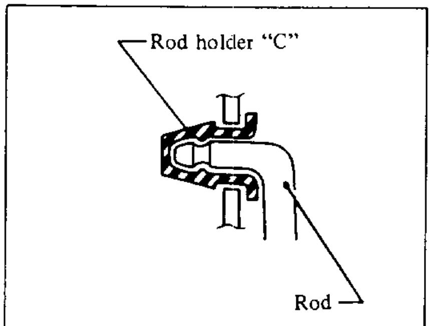
Door lock and lock control



SBF587

1. Remove front door trim and door lock knob.
2. Disengage rod holder "A" and remove inside door handle.
3. Disengage rod holder "C".
4. Disconnect door lock assembly retaining screws, and remove door lock assembly.
5. Remove outside front door handle.

Discard rod holder "C" after removal, and install new one.



SBF588

6. Remove key cylinder.
7. Installation is in reverse order of removal.

Adjust door lock. **Refer to Adjustment.**

ADJUSTMENT

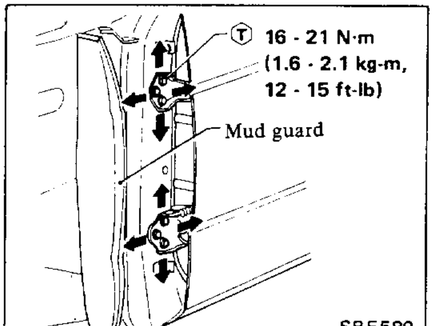
Front door assembly

Door should be adjusted for an even and parallel fit with the door opening and surrounding body panel.

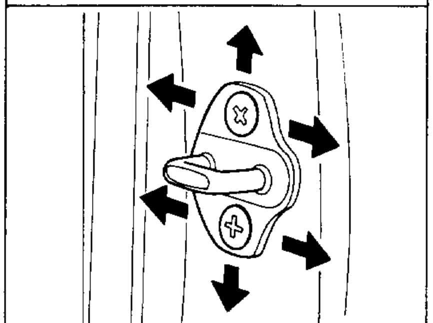
1. Loosen door lock striker fixing screws.
2. Remove mud guard.
3. Loosen door hinge fixing bolts from front pillar and then adjust door for an even and parallel fit with the door opening and surrounding body panel.
4. Tighten door hinge fixing bolts.

Ⓣ : 16 - 21 N·m
(1.6 - 2.1 kg-m,
12 - 15 ft-lb)

5. Adjust door lock striker on lock position.



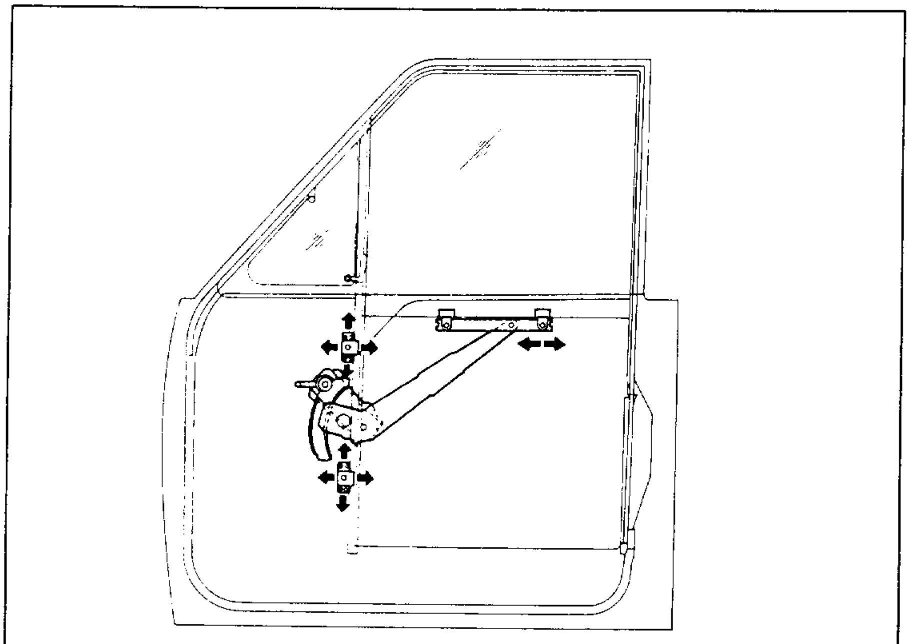
SBF589


SBF590

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.

Partially tighten guide channels A and B and front door lower sash or front door ventilator frame.


SBF591

Fore-and-aft adjustment

1. Loosen bolts attaching door window glass.
2. Adjust door window glass firmly into the rear edge and upper rear corner of rear glass run rubber.
3. After adjusting, tighten bolts attaching door window glass.

Ⓣ : 3.7 - 5.0 N·m
(0.38 - 0.51 kg-m,
2.7 - 3.7 ft-lb)

Sliding resistance adjustment

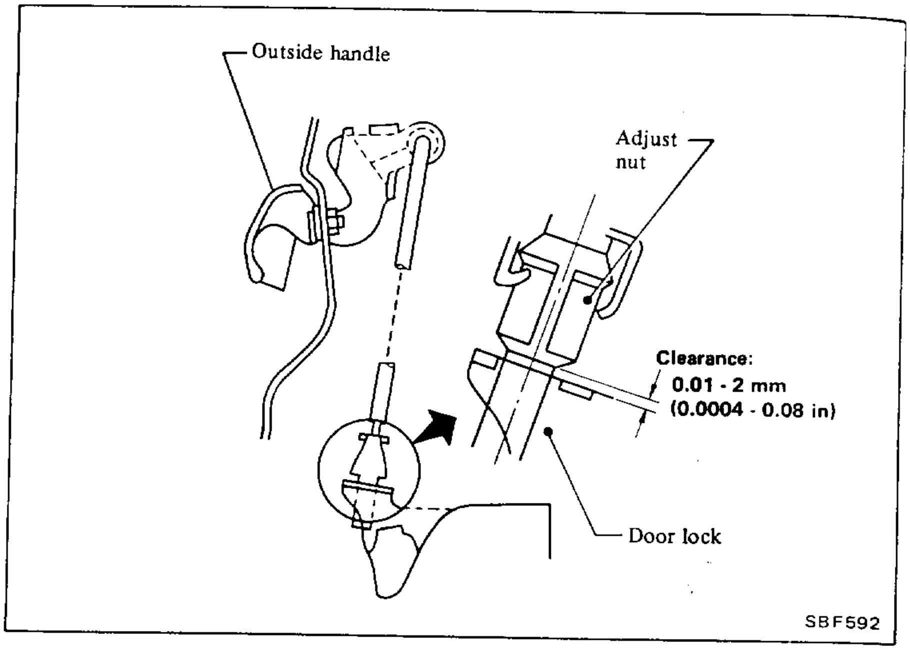
1. Loosen front door ventilator frame fixing bolts.
2. With cycle door glass up and down, adjust it for smoothly up and down.
3. After adjusting, tighten front door ventilator frame fixing bolts.

Ⓣ : 3.7 - 5.0 N·m
(0.38 - 0.51 kg-m,
2.7 - 3.7 ft-lb)

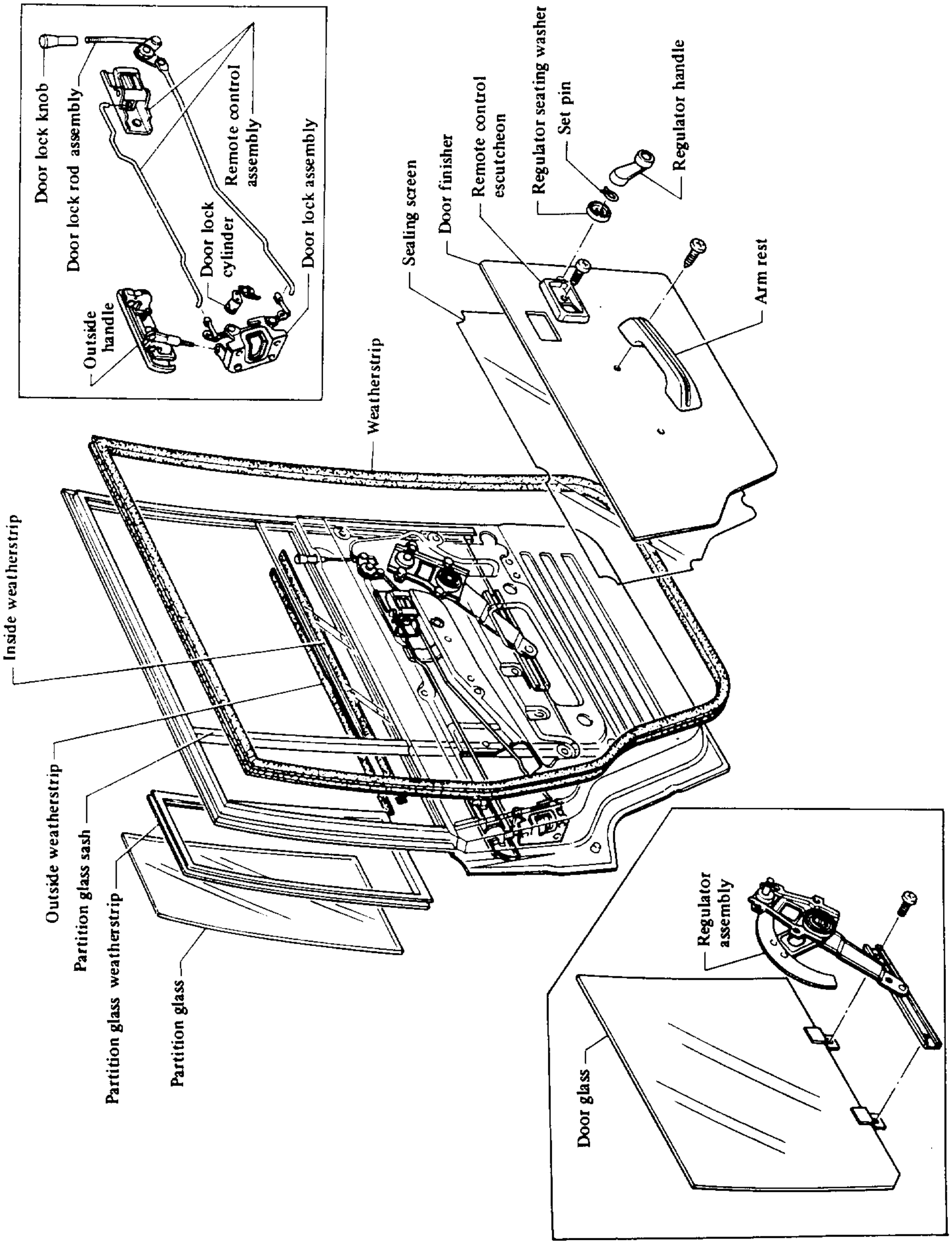
Outside handle

Adjust clearance between outside handle and adjusting nut.

Clearance:
0.01 - 2 mm (0.0004 - 0.08 in)



REAR DOOR



SBF932

REMOVAL AND INSTALLATION

Rear door assembly

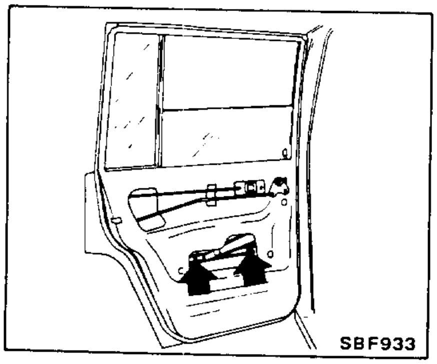
1. Remove seat belt fixing bolt on lock pillar side.
2. Remove seat belt lock pillar reinforcement.
3. Remove rear door.
4. Installation is in reverse order of removal.

Rear door trim

Follow the same procedures as for Front Door.

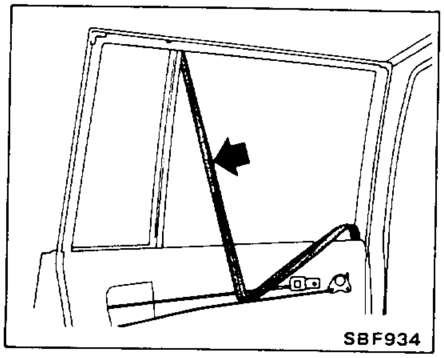
Door glass and regulator

1. Remove rear door trim.
2. Remove rear door glass fixing bolts.



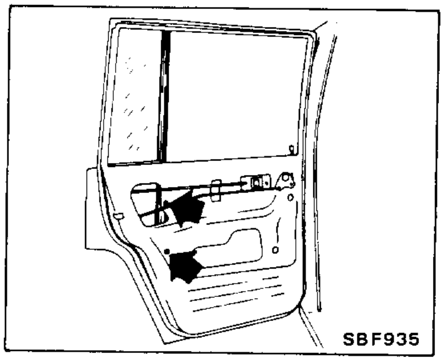
SBF933

3. Remove rear door glass run.



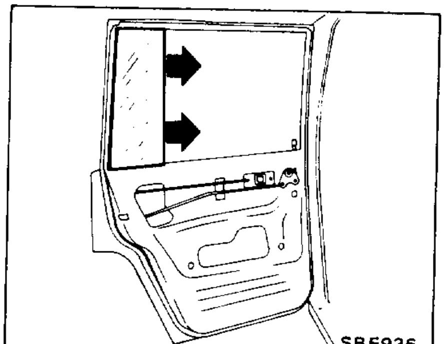
SBF934

4. Remove rear door partition sash.



SBF935

5. Remove rear door partition glass.



SBF936

6. Remove rear door glass.
7. Remove door glass regulator.
8. Installation is in reverse order (removal.

Adjust door glass. **Refer to Adjus ment.**

Door lock and lock control

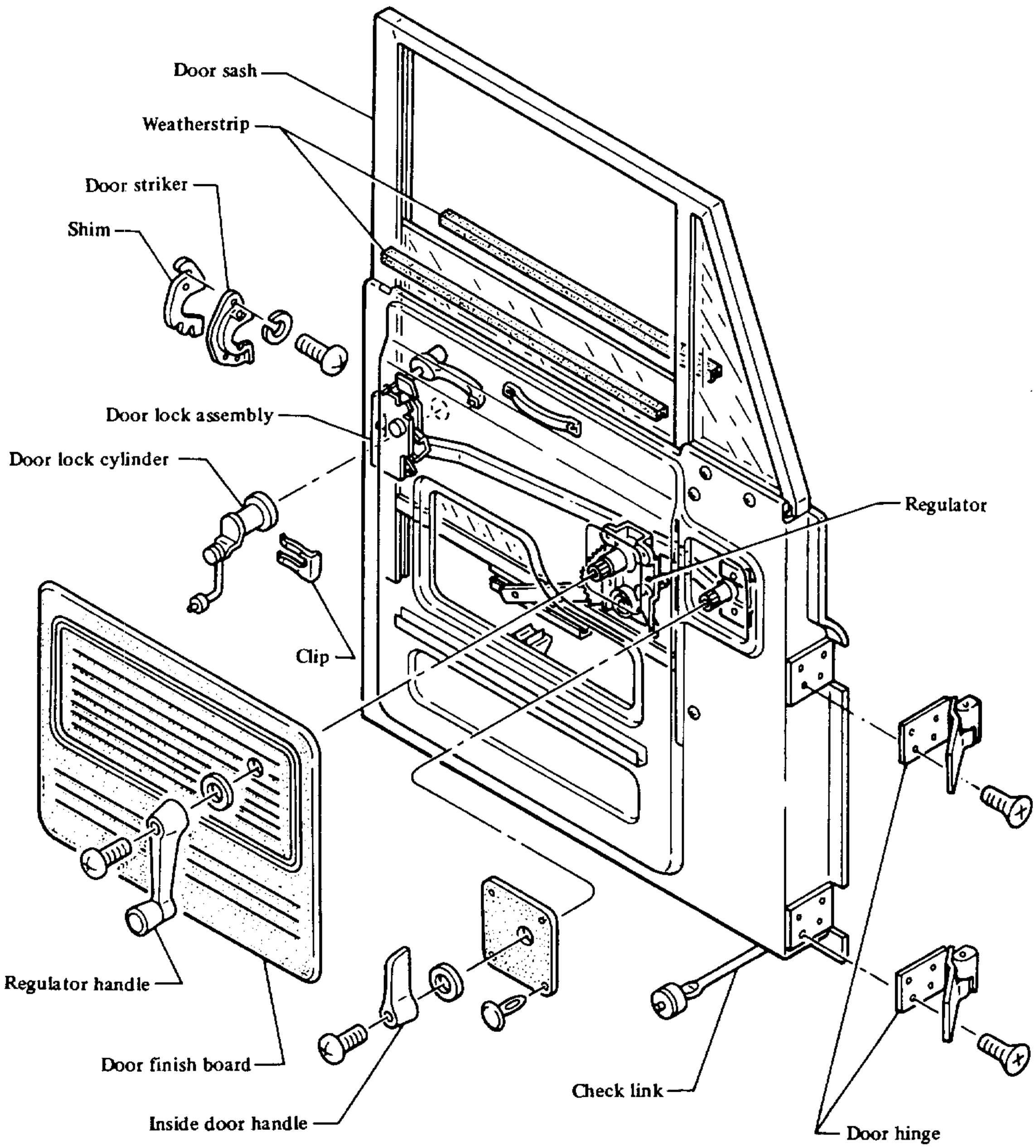
Follow the same procedures as fc Front Door.

ADJUSTMENT

Follow the same procedures as fc Front Door.

DOORS (Canvas Top)

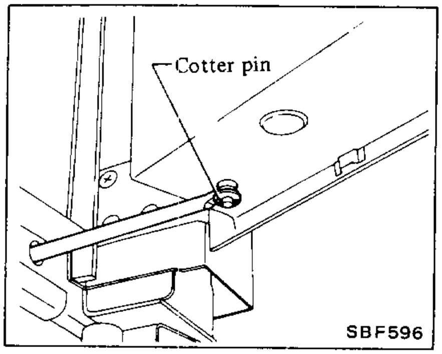
FRONT DOOR



REMOVAL AND INSTALLATION

Front door assembly

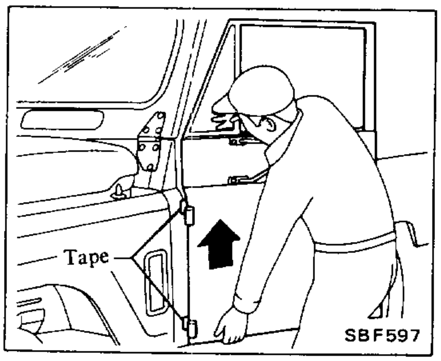
1. Remove cotter pin at door check link and disconnect check link from front door.



SBF596

2. Open door completely, and carefully lift it up and away from vehicle body.

Use tapes when removing or installing door to avoid scratching vehicle body.



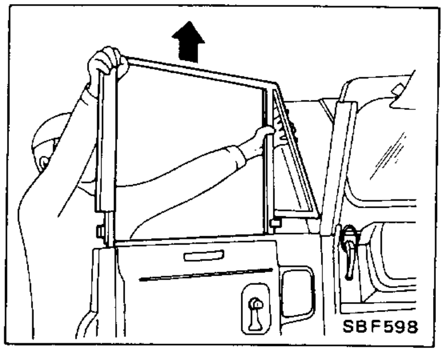
SBF597

3. Installation is in reverse order of removal.

Door window glass

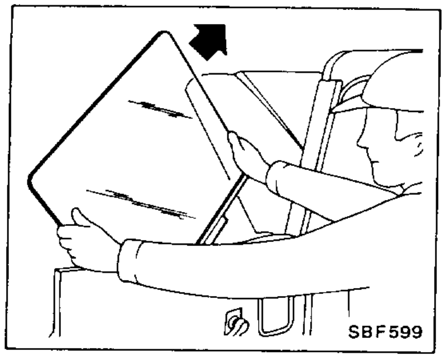
1. Remove door finish boards, regulator handle, inside lock handle, and door finisher.

2. Remove front door sash fixing bolt and detach sash.



SBF598

3. Tilt and remove front door window glass.

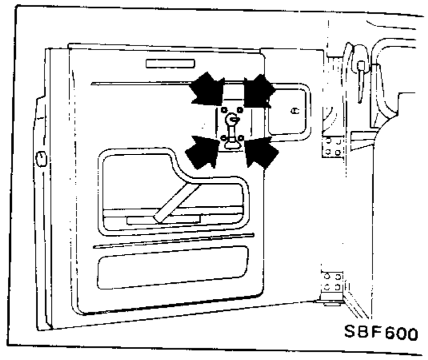


SBF599

4. Installation is in reverse order of removal.

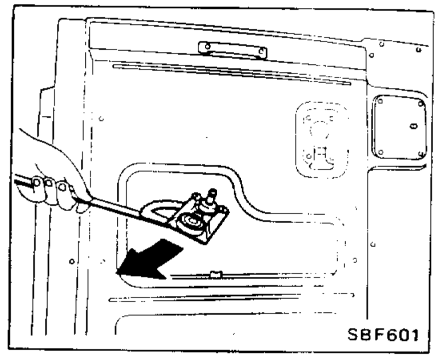
Window regulator

1. Remove window regulator fixing bolts.



SBF600

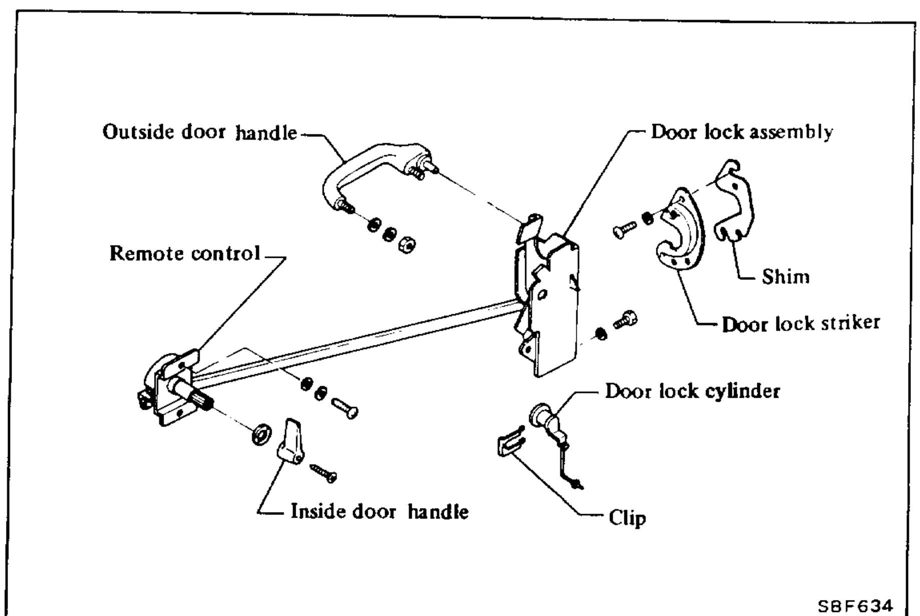
2. Remove window regulator through large access hole in door panel.



SBF601

3. Installation is in reverse order of removal.

Door lock



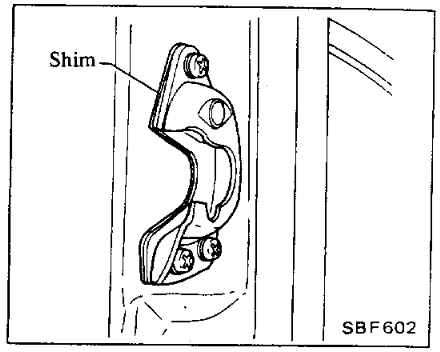
SBF634

1. Remove inside door handle and door lock assembly.
2. Remove outside door handle.
3. Remove door lock cylinder.
4. Installation is in reverse order of removal.

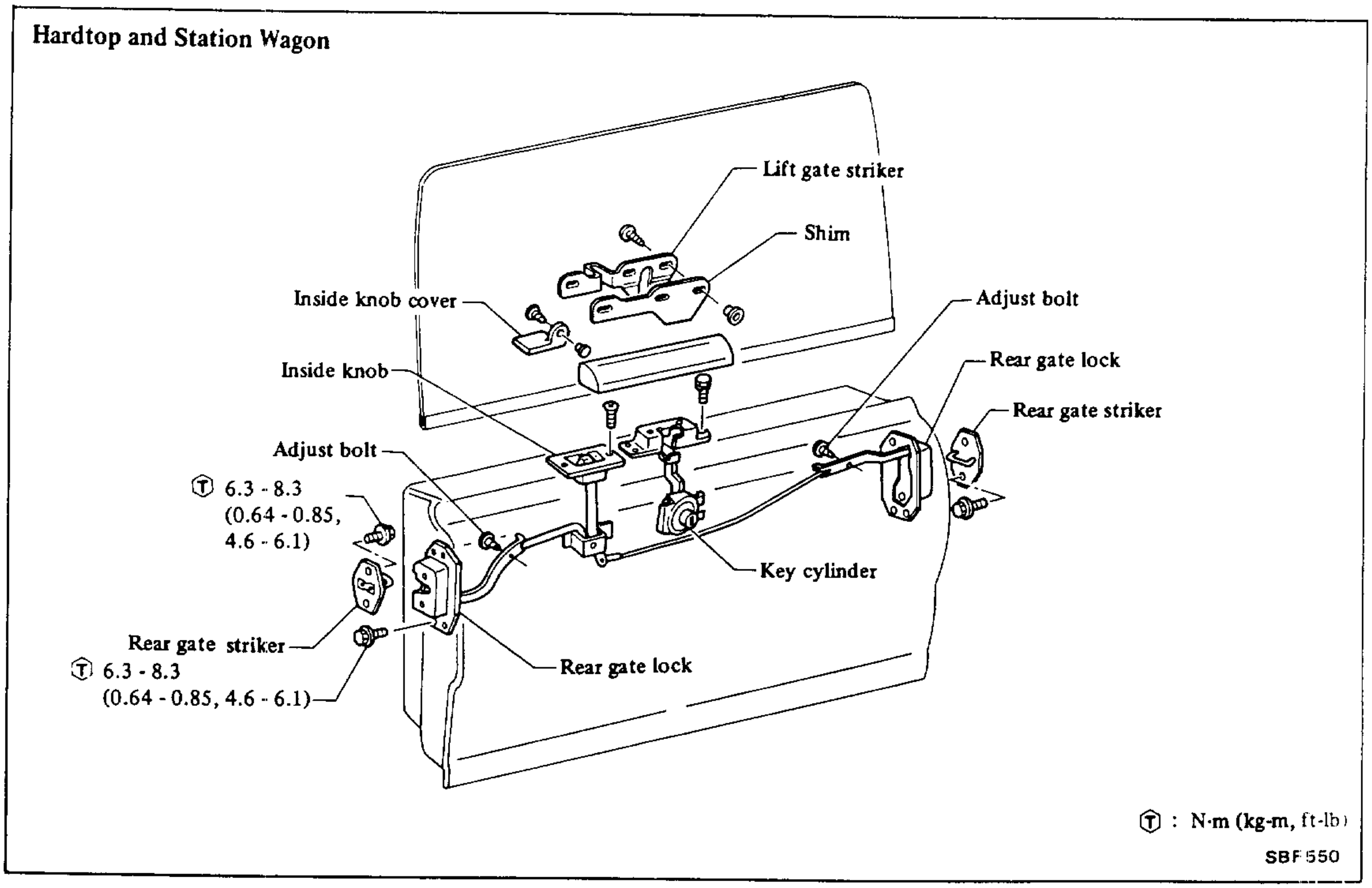
ADJUSTMENT

Front door assembly

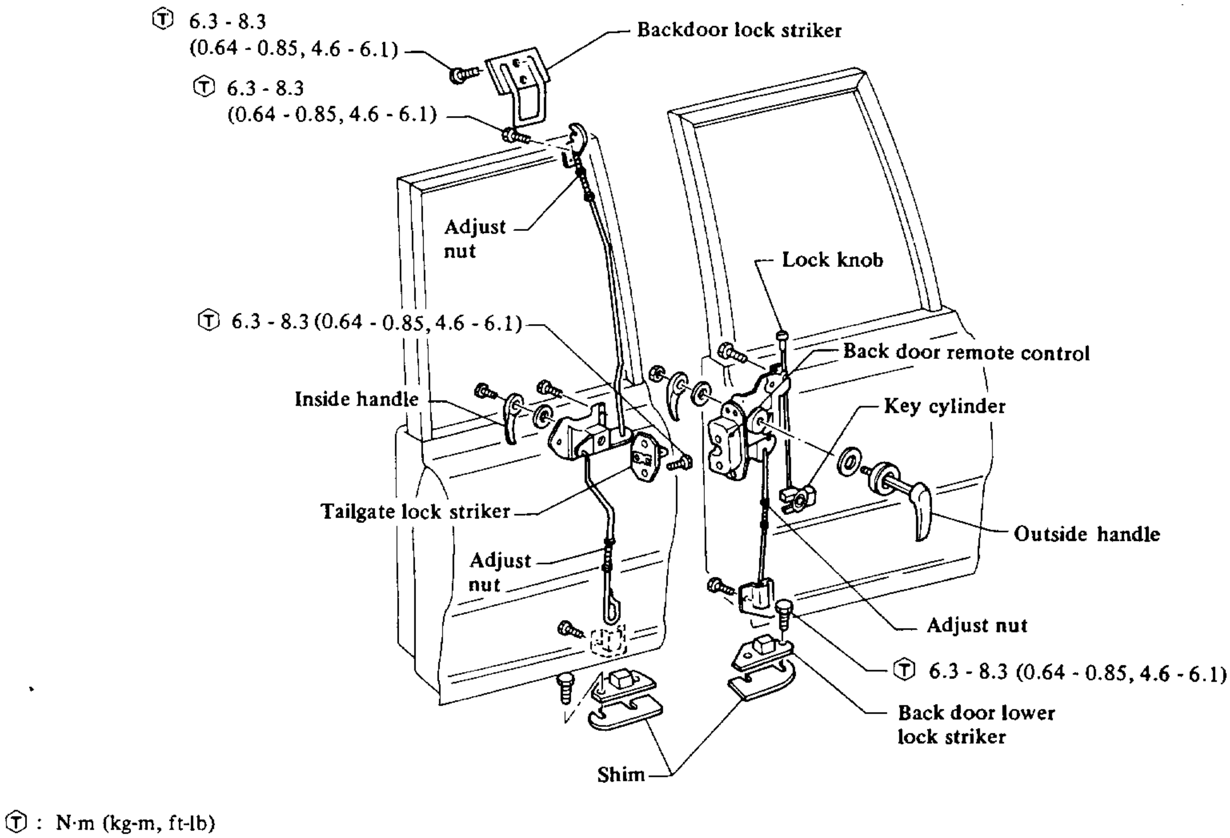
Adjust door lock striker by adding or removing shims.



BODY REAR END (Except Canvas Top)

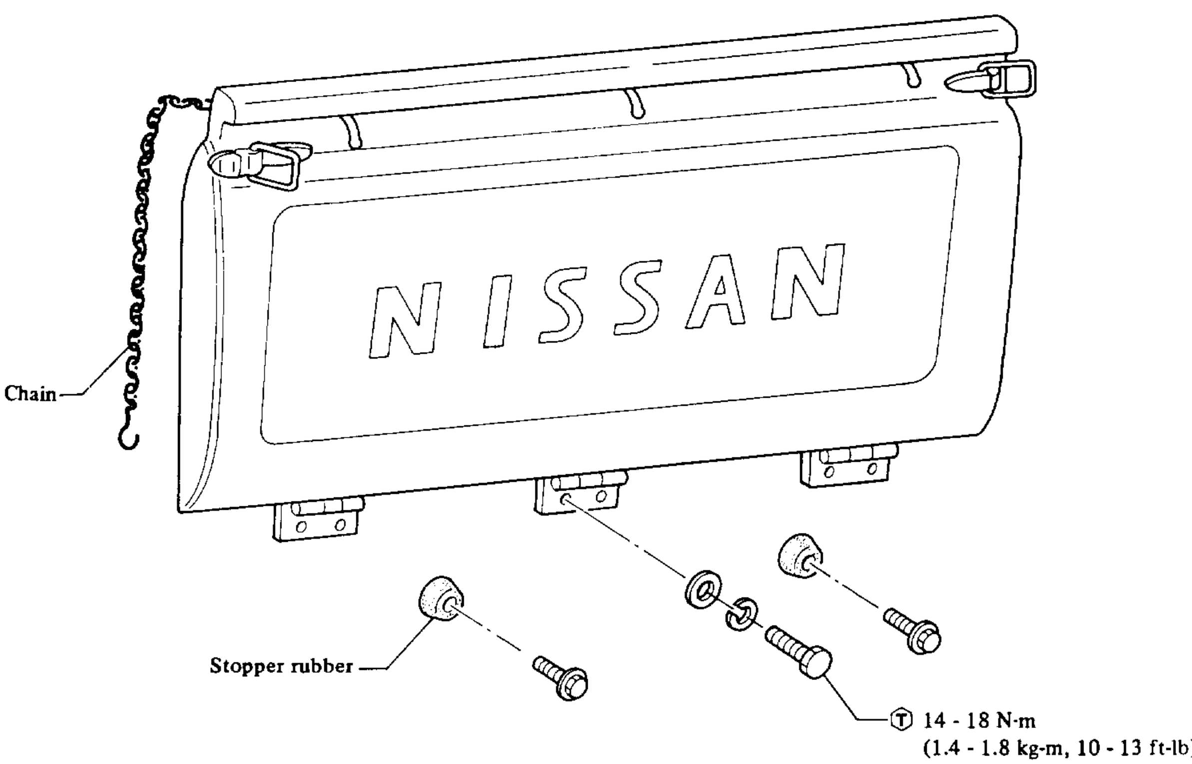


High-roof Hardtop and Van



SBF551

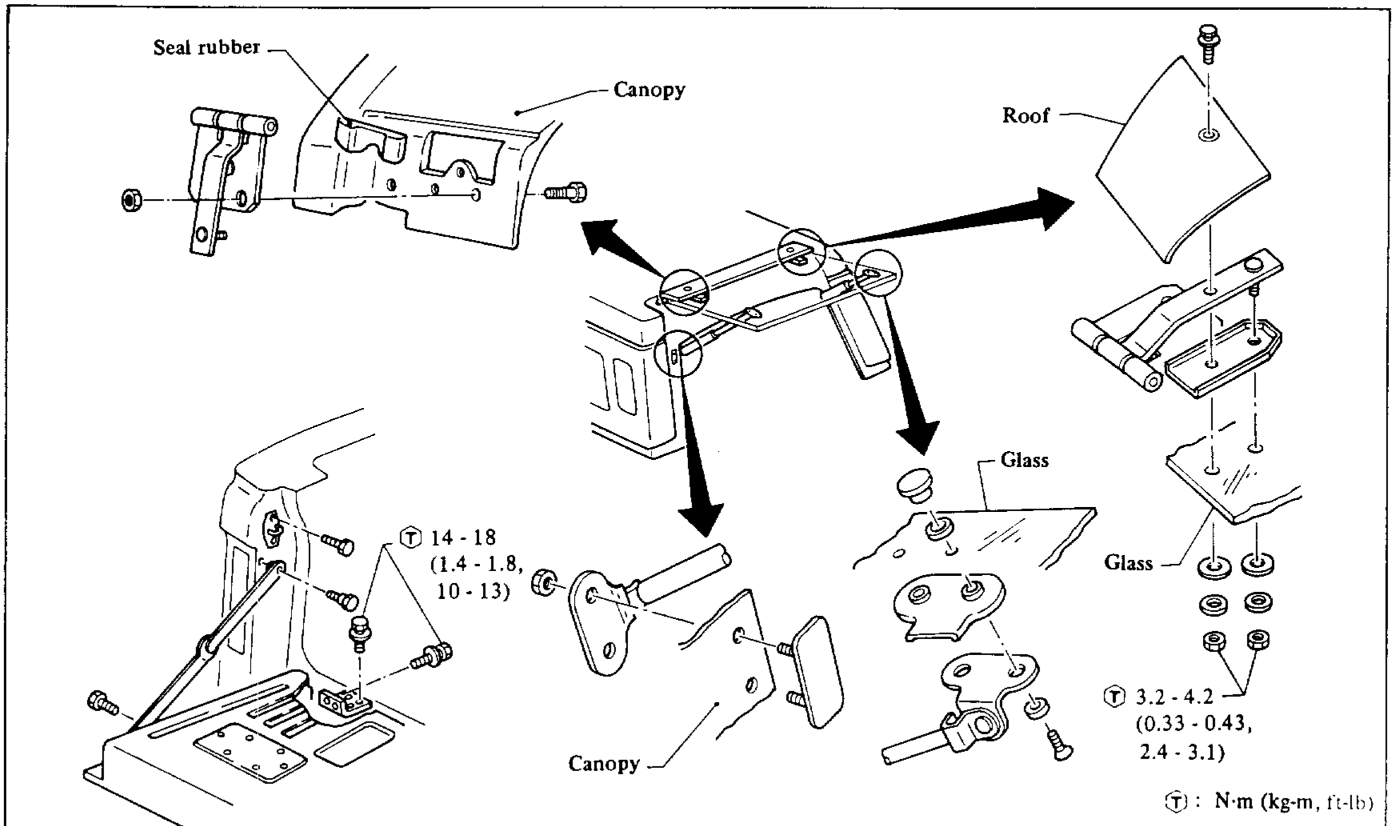
Pick-up



SBF552

REAR GATE (Hardtop and Station Wagon)

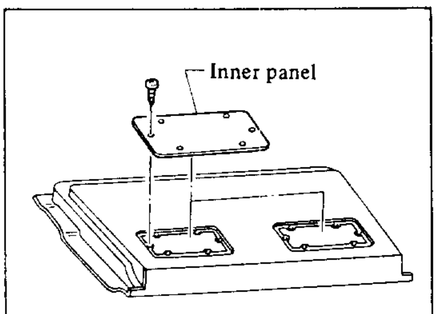
REMOVAL AND INSTALLATION



SBF553

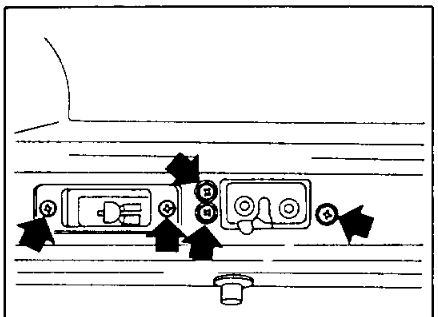
DISASSEMBLY AND ASSEMBLY

1. Remove inner panel.



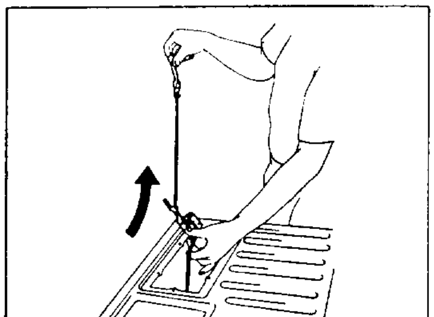
SBF558

2. Remove lower gate control escutchen and upper gate lock.



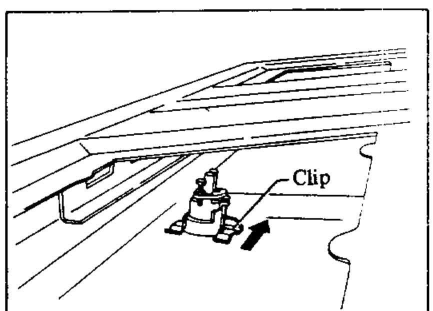
SBF559

3. Disconnect lower gate locks securing bolts and remove lower gate lock control rod.



SBF560

4. Remove key cylinder.

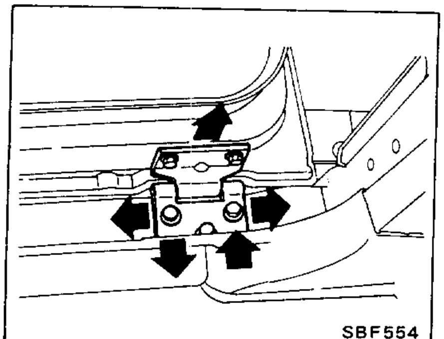


SBF561

5. Assembly is in reverse order of disassembly.

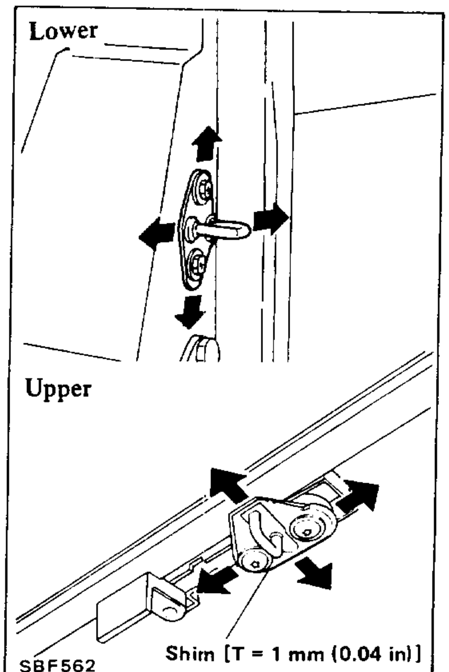
ADJUSTMENT

Lower gate adjustment



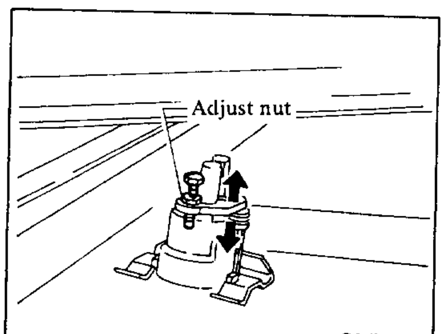
SBF554

Striker adjustment



SBF562

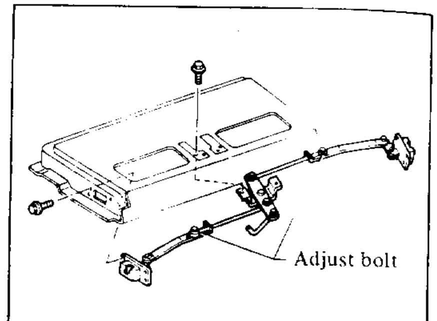
Lift gate lock adjustment



SBF563

Position adjusting nut height so that lift gate lock cylinder unlocks properly.

Tailgate lock adjustment

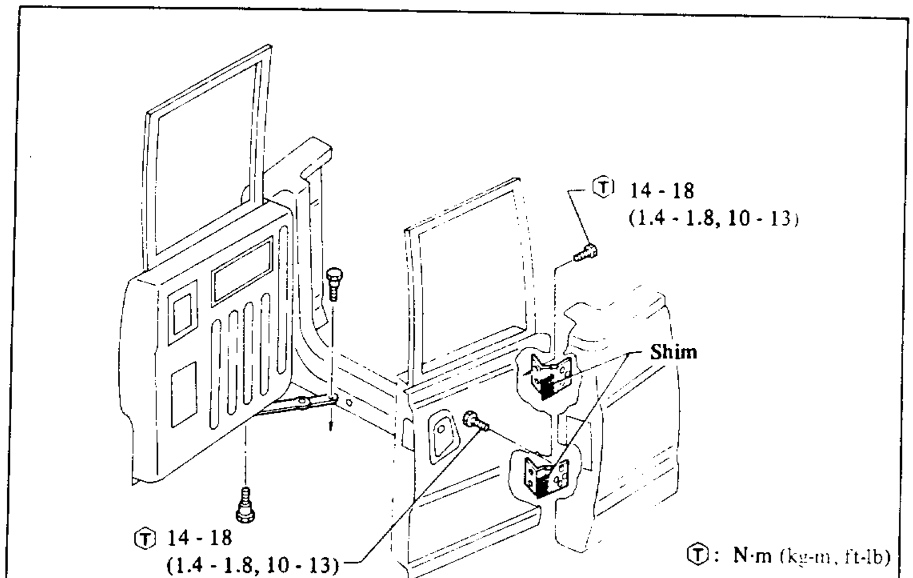


SBF564

Adjust rod length with adjusting nut so that tailgate unlocks properly.

REAR GATE (High-roof Hardtop and Van)

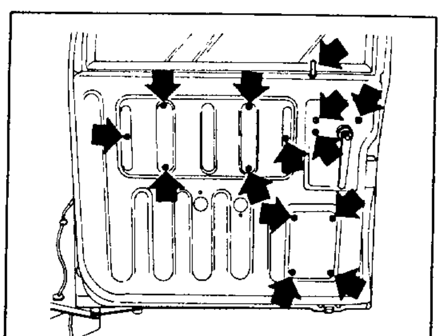
REMOVAL AND INSTALLATION



SBF555

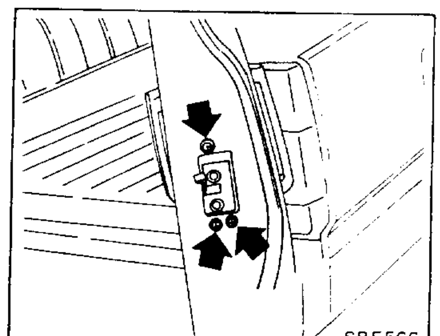
DISASSEMBLY AND ASSEMBLY

1. Remove inner panel and lock knob.



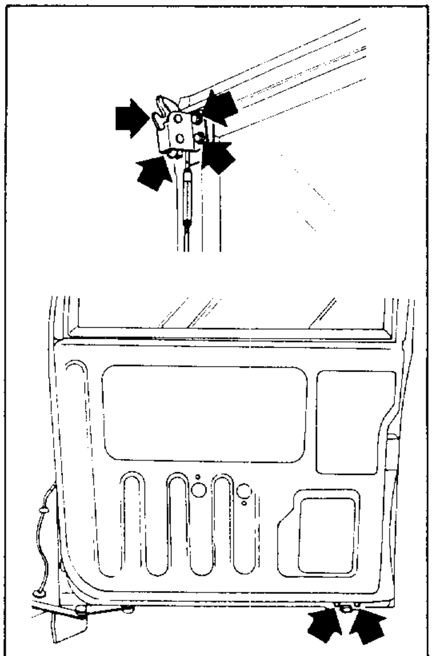
SBF565

2. Remove inside and outside handle.
3. Disengage rod holder at back door remote control and remove back door remote control.



SBF566

4. Remove back door lower and upper lock.

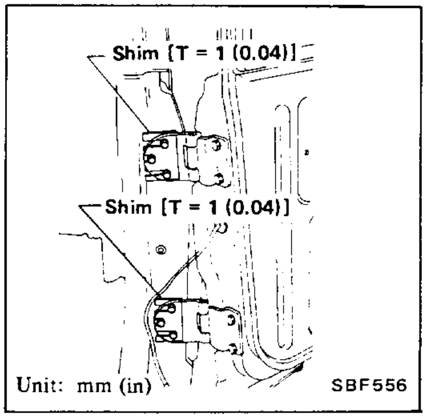


SBF567

5. Remove key cylinder.
6. Disassembly is in reverse order of assembly.

ADJUSTMENT

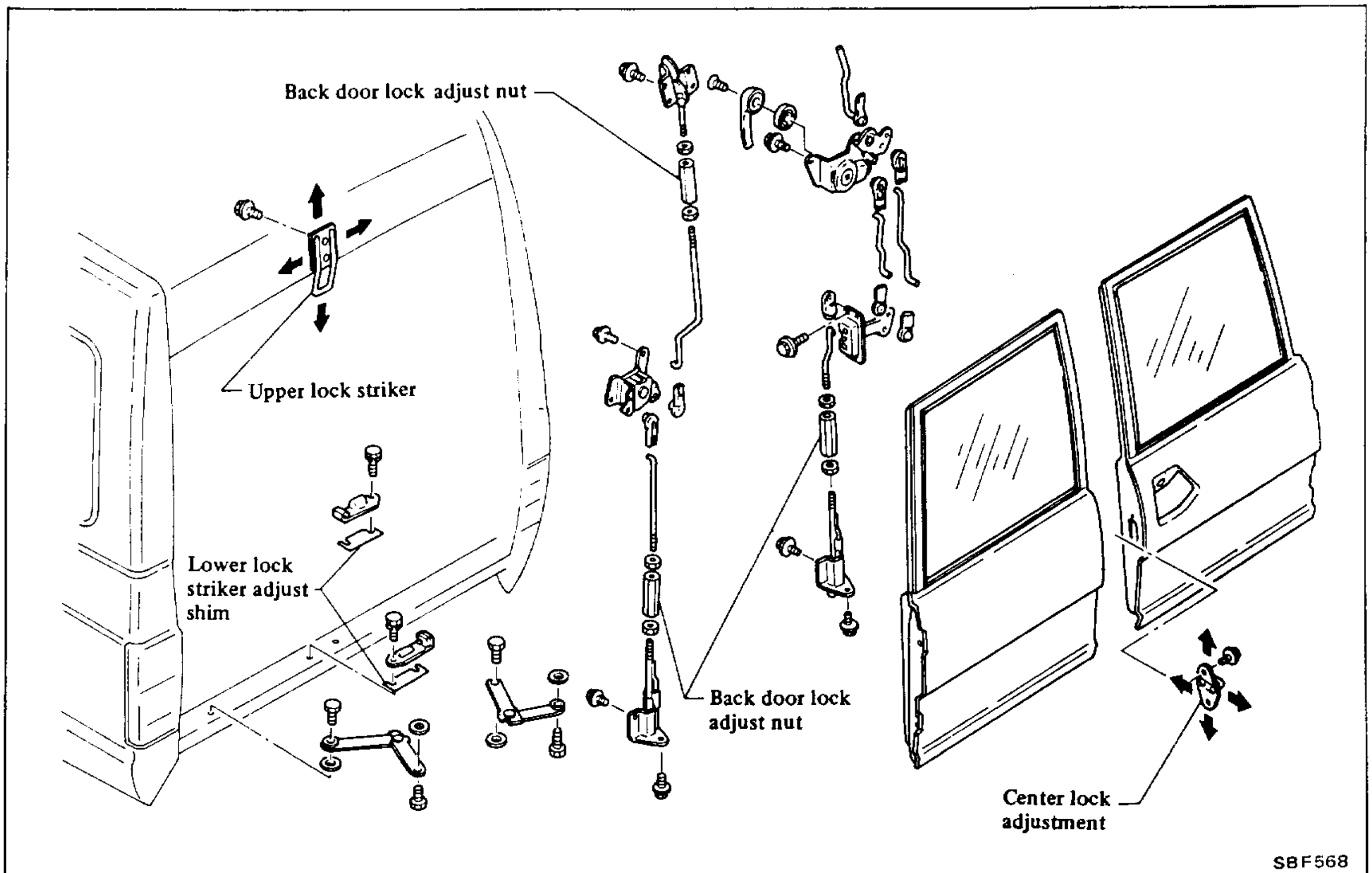
Gate adjustment



SBF556

Adjust rear gate by adding or removing shims.

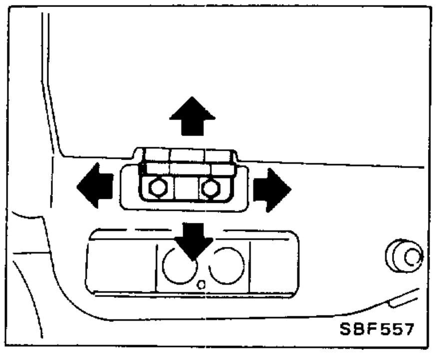
Striker and lock adjustment



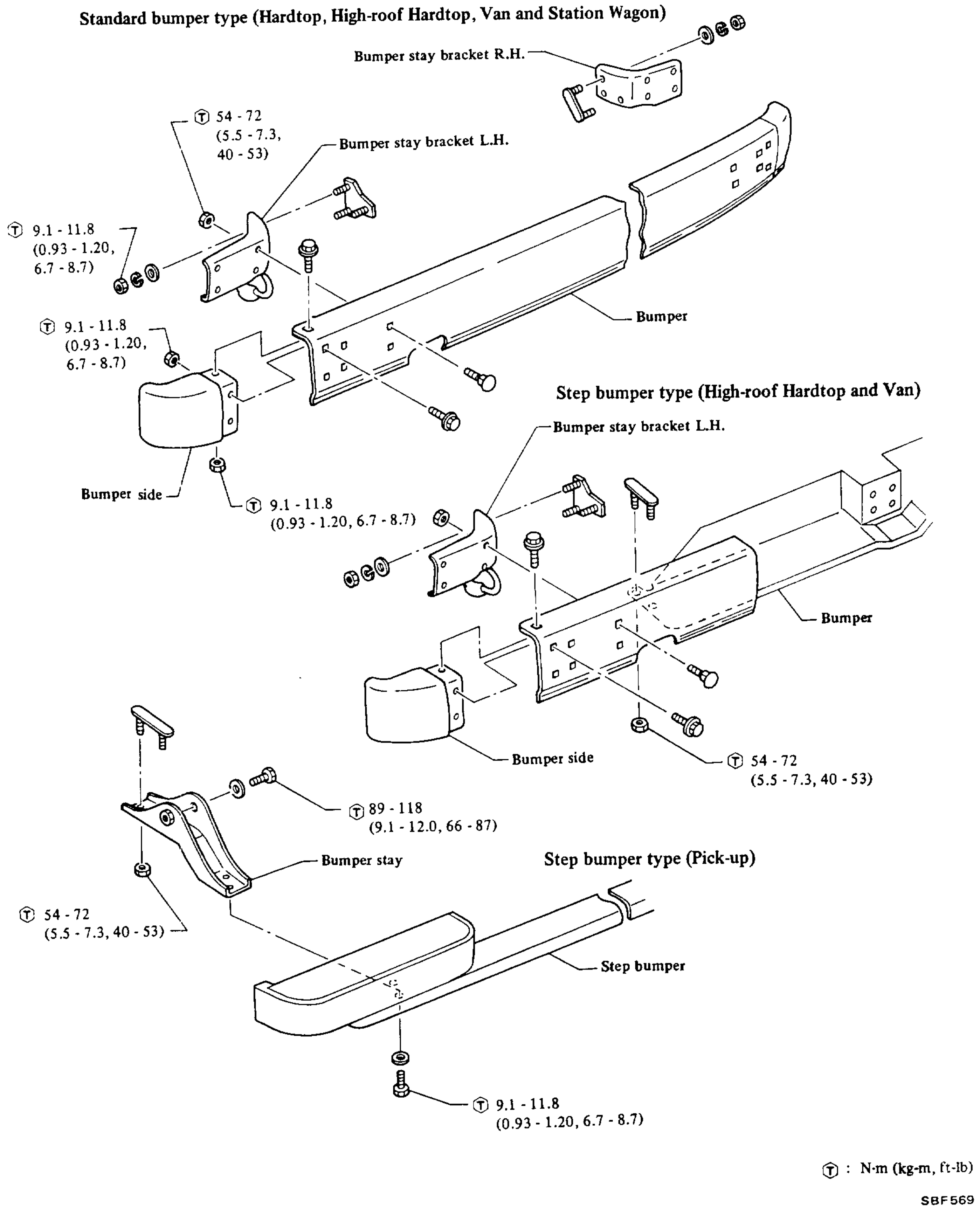
SBF568

REAR GATE (Pick-up)

ADJUSTMENT

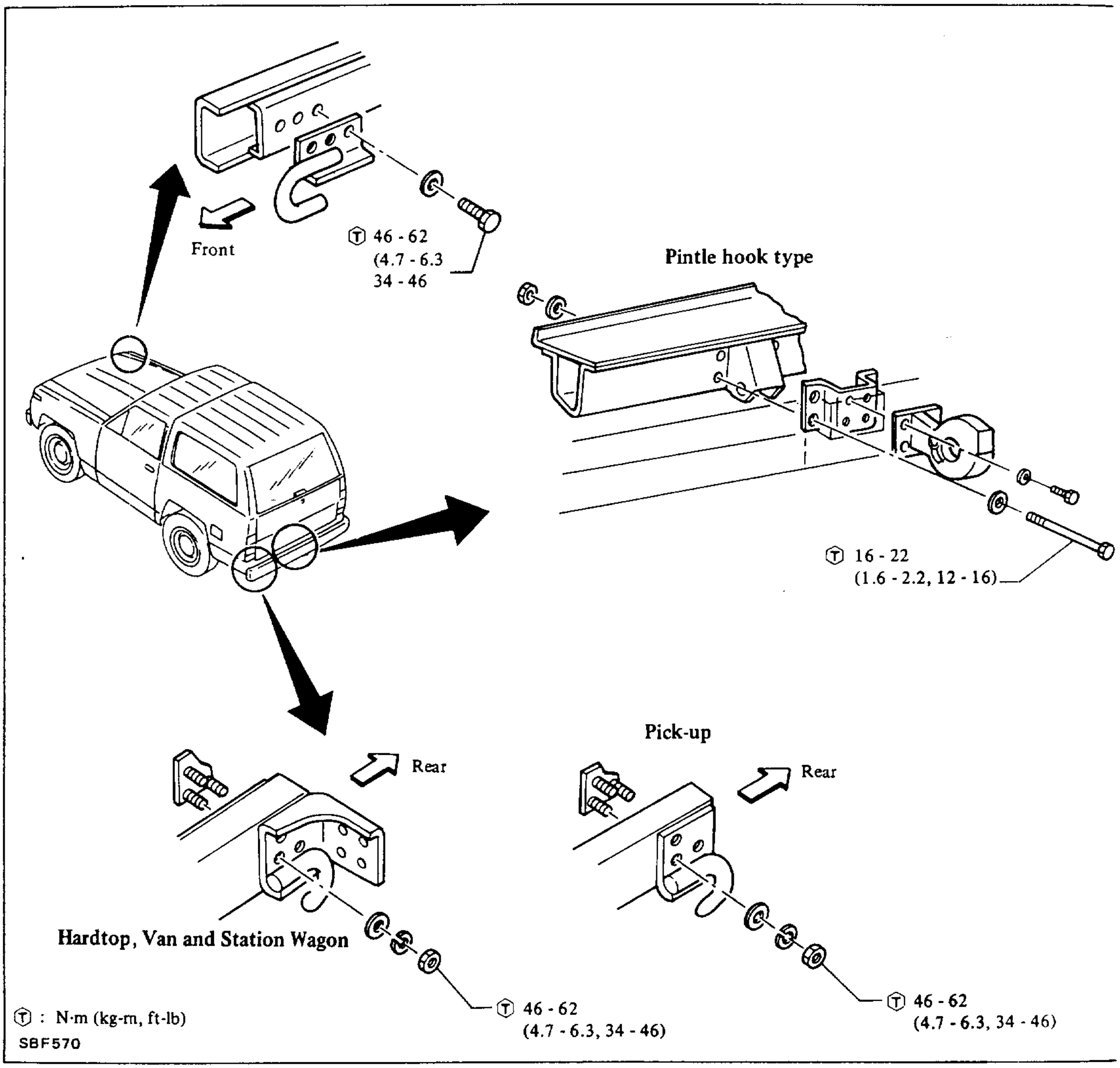


REAR BUMPER

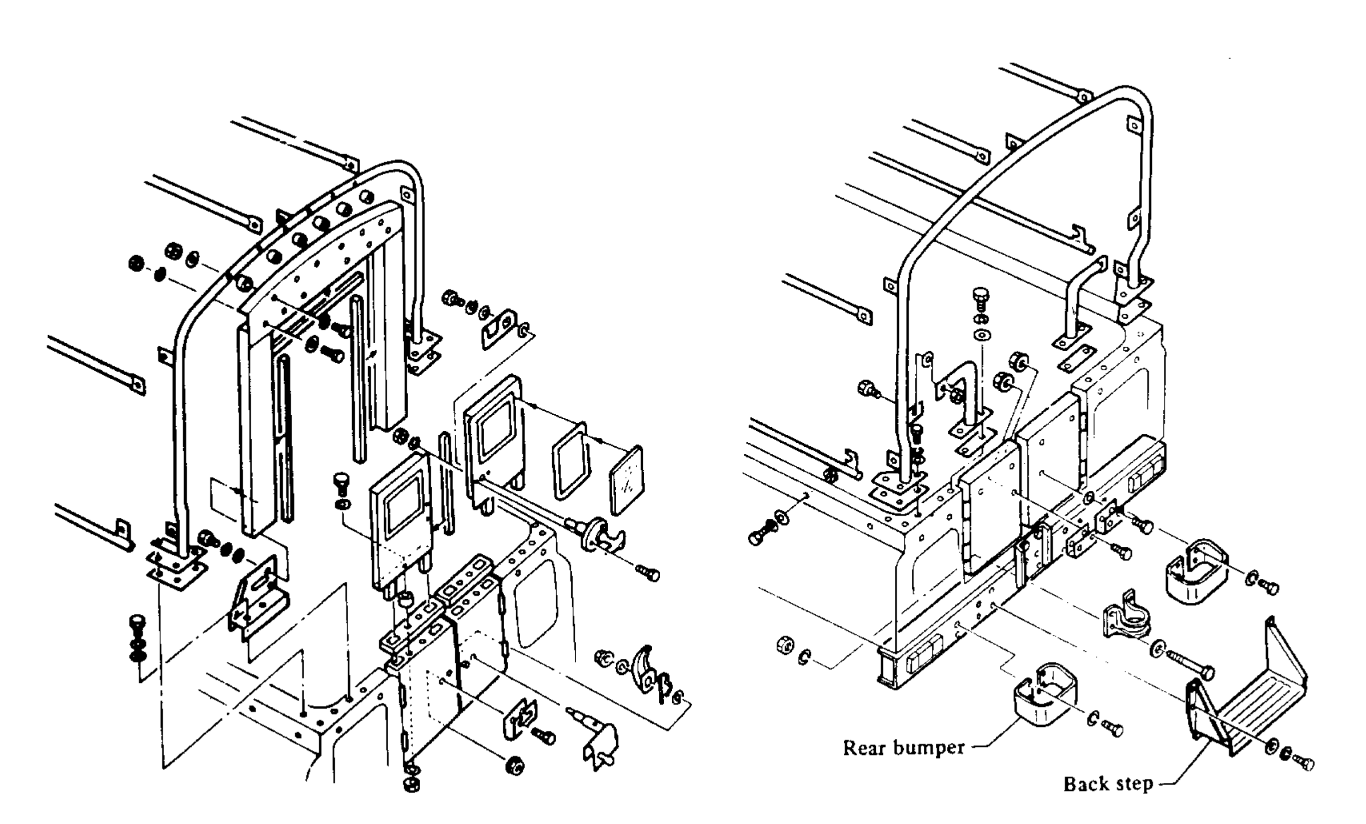


Standard bumper type (Hardtop, High-roof Hardtop, Van and Station Wagon)
Bumper stay bracket R.H.
54 - 72 (5.5 - 7.3, 40 - 53)
Bumper stay bracket L.H.
9.1 - 11.8 (0.93 - 1.20, 6.7 - 8.7)
9.1 - 11.8 (0.93 - 1.20, 6.7 - 8.7)
Bumper
Bumper side
9.1 - 11.8 (0.93 - 1.20, 6.7 - 8.7)
Step bumper type (High-roof Hardtop and Van)
Bumper stay bracket L.H.
Bumper
Bumper side
54 - 72 (5.5 - 7.3, 40 - 53)
89 - 118 (9.1 - 12.0, 66 - 87)
Bumper stay
Step bumper type (Pick-up)
54 - 72 (5.5 - 7.3, 40 - 53)
Step bumper
9.1 - 11.8 (0.93 - 1.20, 6.7 - 8.7)
: N·m (kg-m, ft-lb)
SBF569

TOWING HOOK

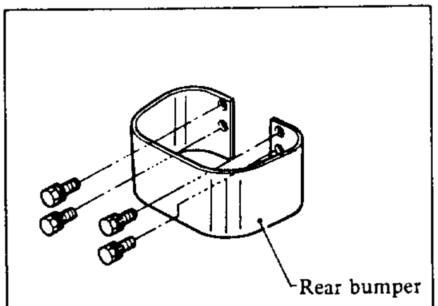

Front
Ⓣ 46 - 62
(4.7 - 6.3
34 - 46
Pintle hook type
Ⓣ 16 - 22
(1.6 - 2.2, 12 - 16)
Rear
Pick-up
Rear
Hardtop, Van and Station Wagon
Ⓣ 46 - 62
(4.7 - 6.3, 34 - 46)
Ⓣ 46 - 62
(4.7 - 6.3, 34 - 46)
Ⓣ : N·m (kg-m, ft-lb)
SBF570

BODY REAR END (Canvas Top)



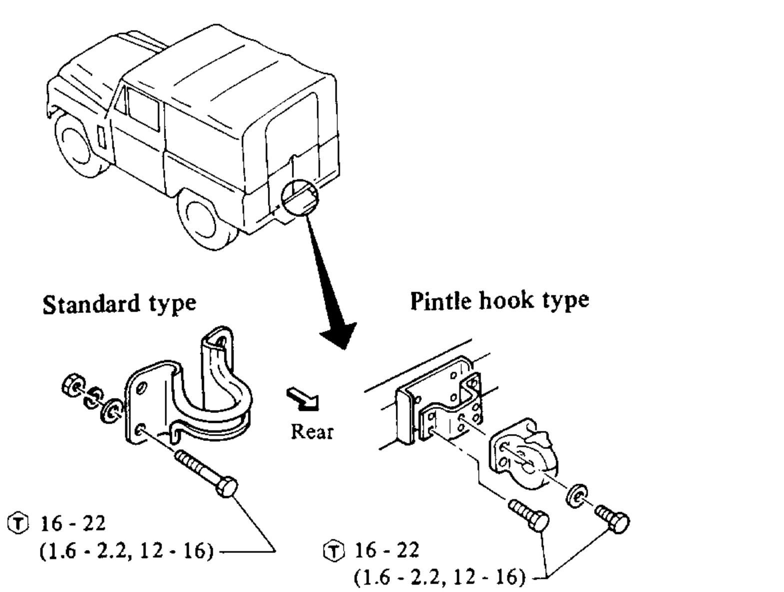
SBF571

REAR BUMPER



SBF572

TOWING HOOK

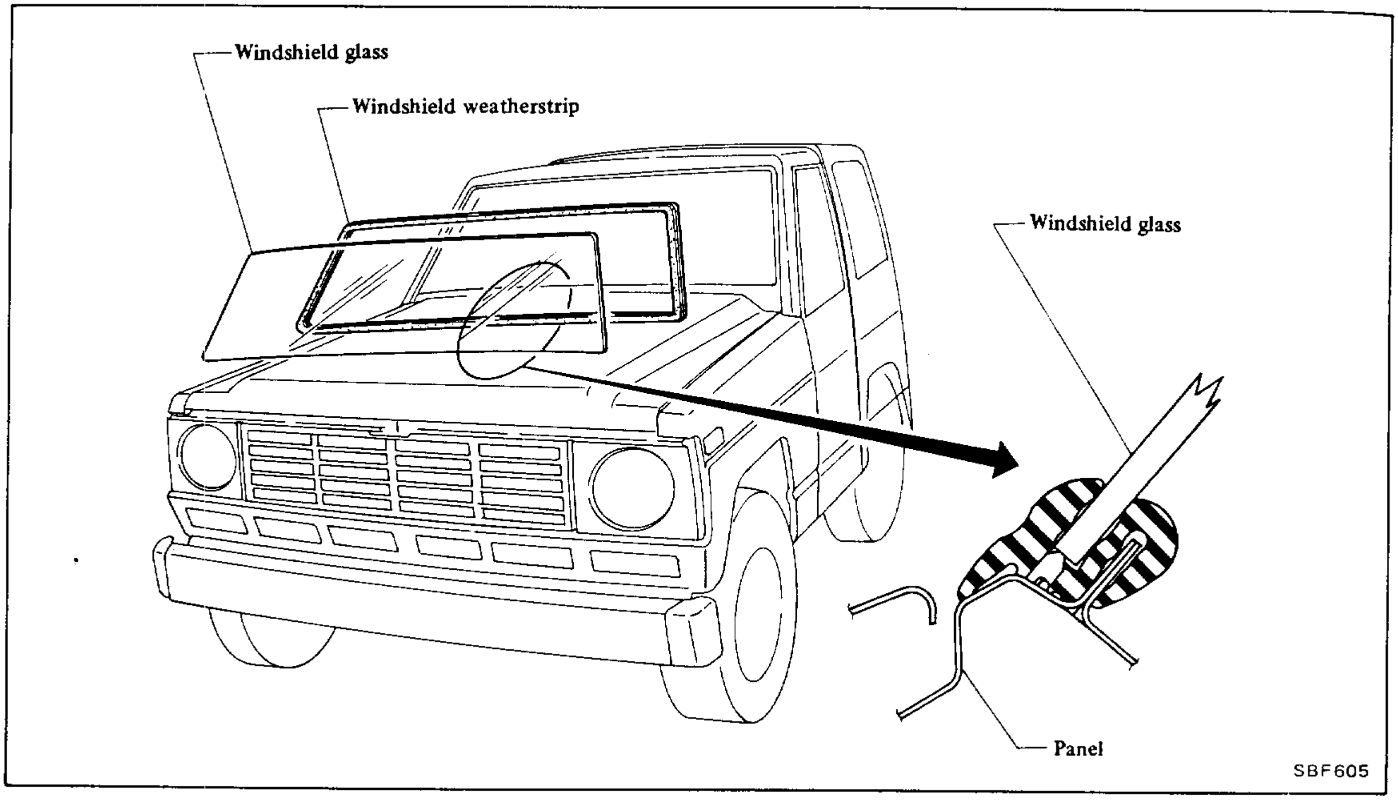


SBF573

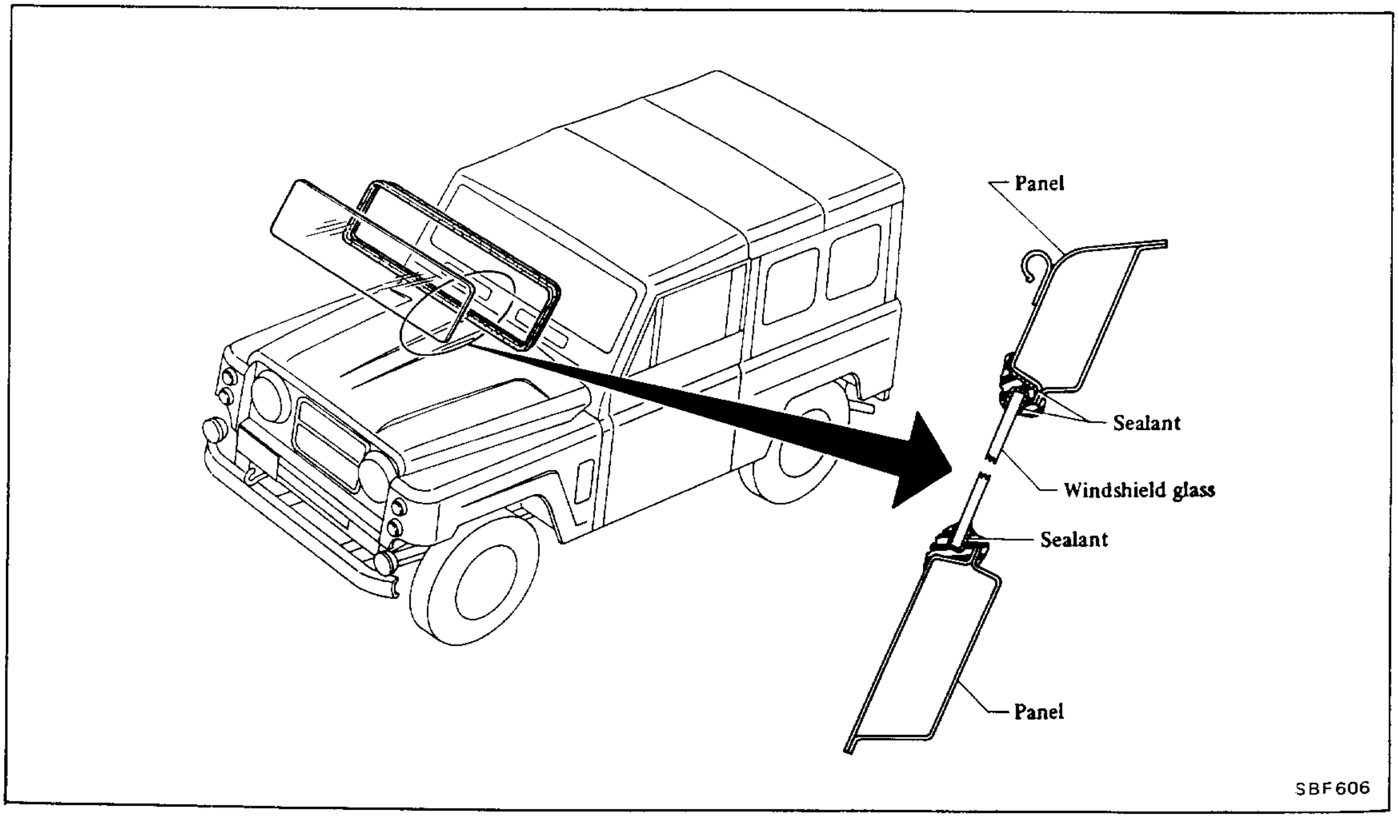
WINDSHIELD AND WINDOWS

WINDSHIELD

EXCEPT CANVAS TOP



CANVAS TOP



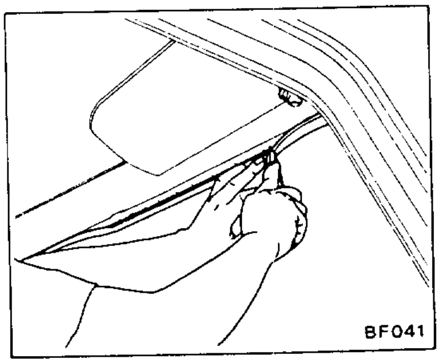
REMOVAL

1. Protect hood, front fenders, instrument panel and front seats with covers.
2. Remove windshield wiper arms.

CAUTION:
Be careful not to deform the molding.

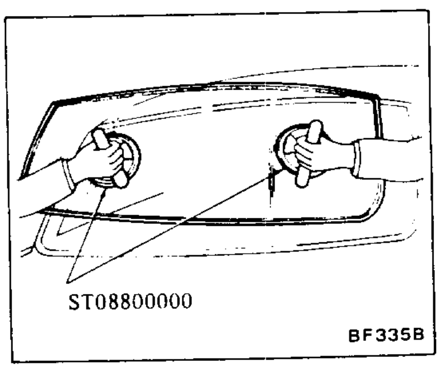
3. Attach **Tool ST08800000** on windshield glass.
4. Depressing weatherstrip toward outside, lightly tap and remove windshield glass to the outside.

Windshield glass should be removed from the upper side.



BF041

5. After windshield weatherstrip is free from body flange, with aid of a helper, remove windshield glass.

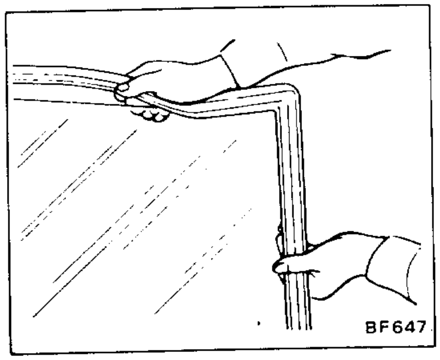


BF335B

INSTALLATION

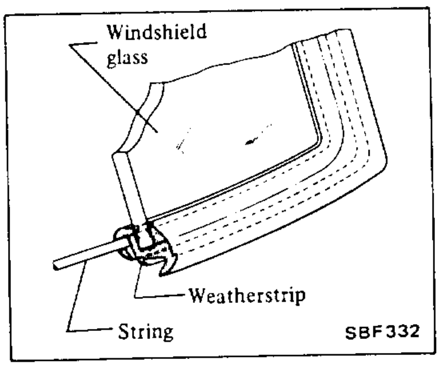
CAUTION:
Care should be exercised to make certain glass does not strike body metal during installation. Edge chips can lead to future breaks.

1. Attach weatherstrip to glass.



BF647

2. Insert a strong cord in the groove of weatherstrip where body flange fits.

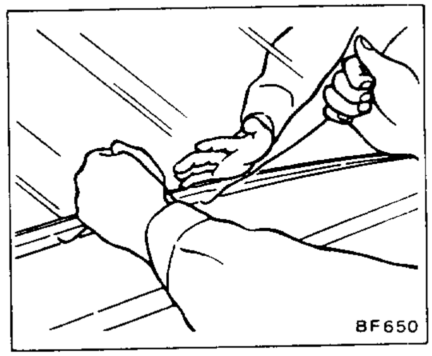


SBF332

3. Tie ends of cord and tape to inside surface of glass at bottom center of glass.
4. Position and center windshield glass assembly in body opening.

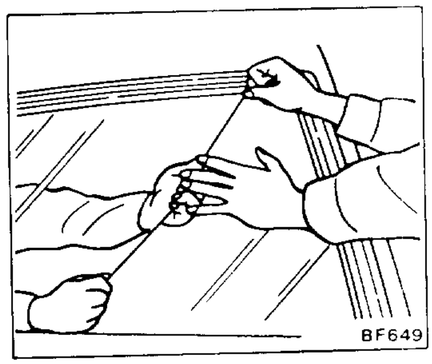
Do not position glass by tapping or hammering at any time.

5. 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.



BF650

6. Cord should be pulled first across bottom of windshield, then up each side and finally across windshield top.



BF649

Exercise care not to wrinkle headlining (except Canvas Top).

7. Seal weatherstrip with sealer as shown on page BF-26 (Canvas Top only).

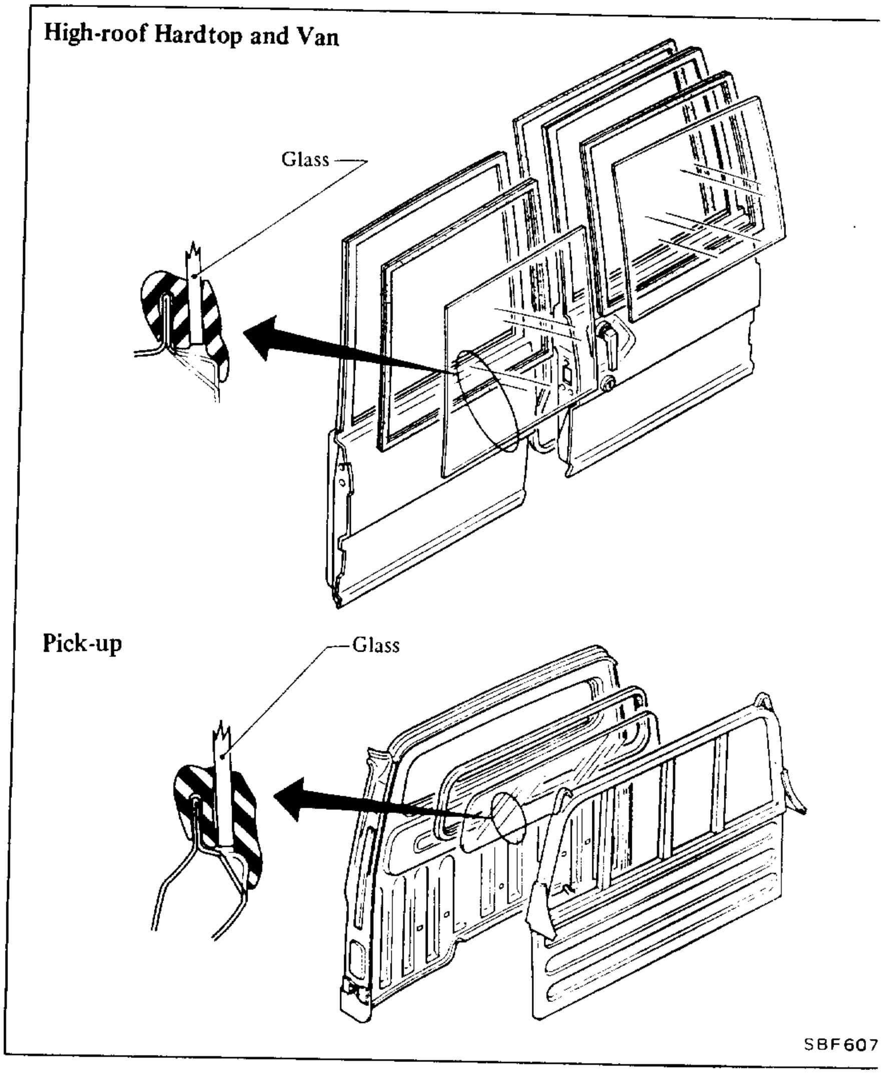
BACK WINDOW

REMOVAL AND INSTALLATION

The instructions for windshield glass apply also to back window glass.

Therefore, refer to Windshield for removal and installation.

When installing back window glass, always start by pulling string cord beginning at bottom of glass. Use care not to scratch vehicle body.



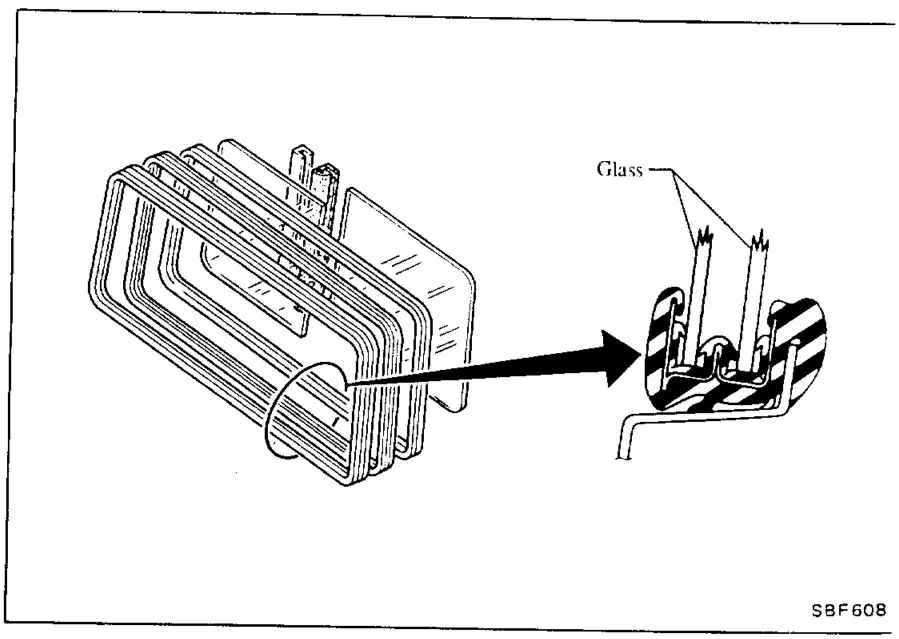
SIDE WINDOW (Hardtop, High-roof Hardtop, Van and Station Wagon)

REMOVAL AND INSTALLATION

The instructions for windshield glass apply also to side window glass.

Therefore, refer to Windshield for removal and installation.

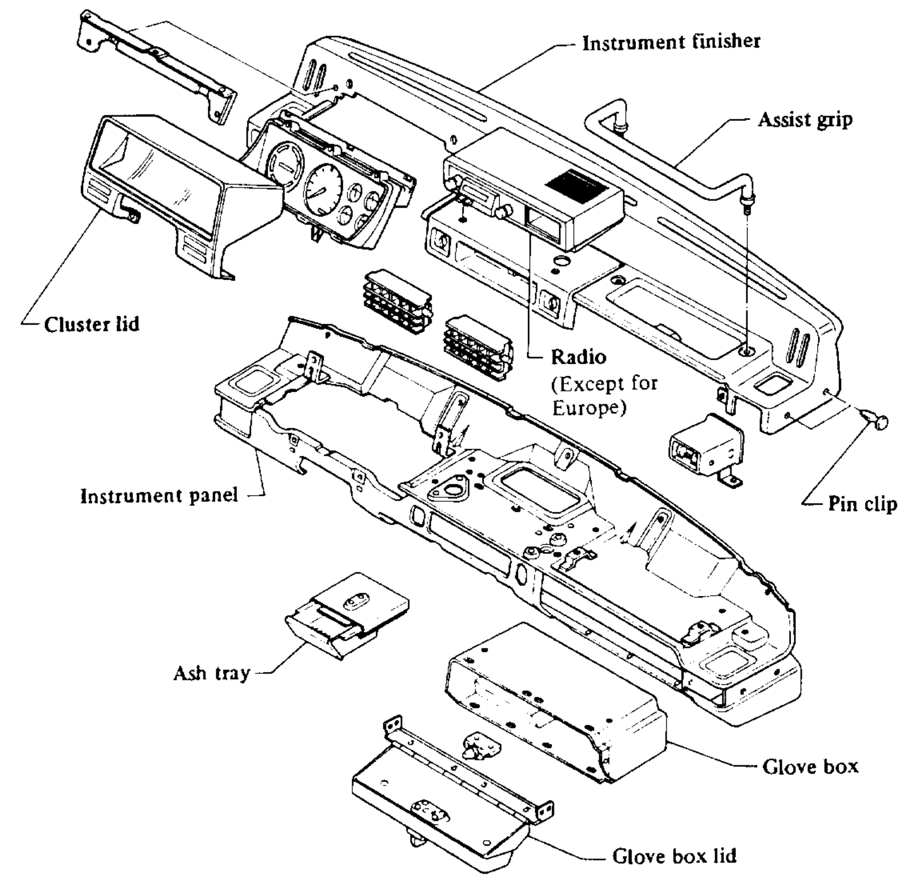
When installing side window, always start by pulling string cord beginning at bottom of glass. Use care not to scratch vehicle body.



INSTRUMENT PANEL AND SEAT

INSTRUMENT PANEL

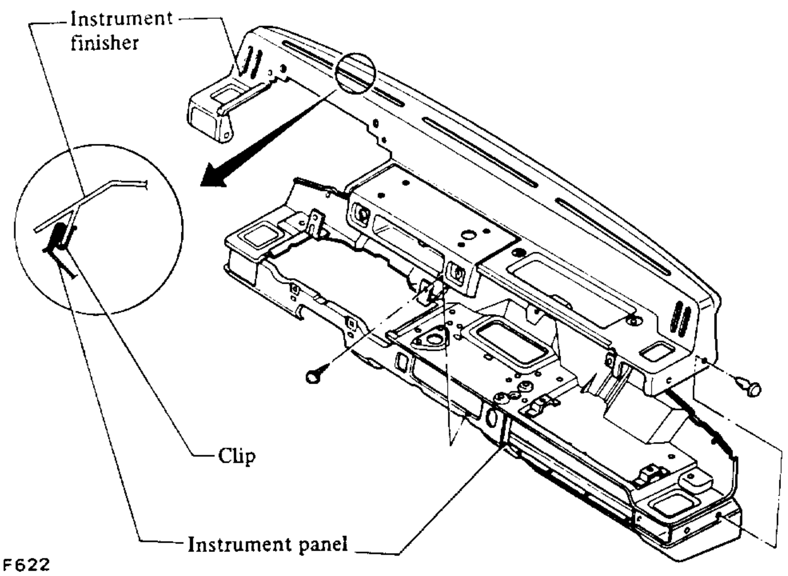
EXCEPT CANVAS TOP



SBF621

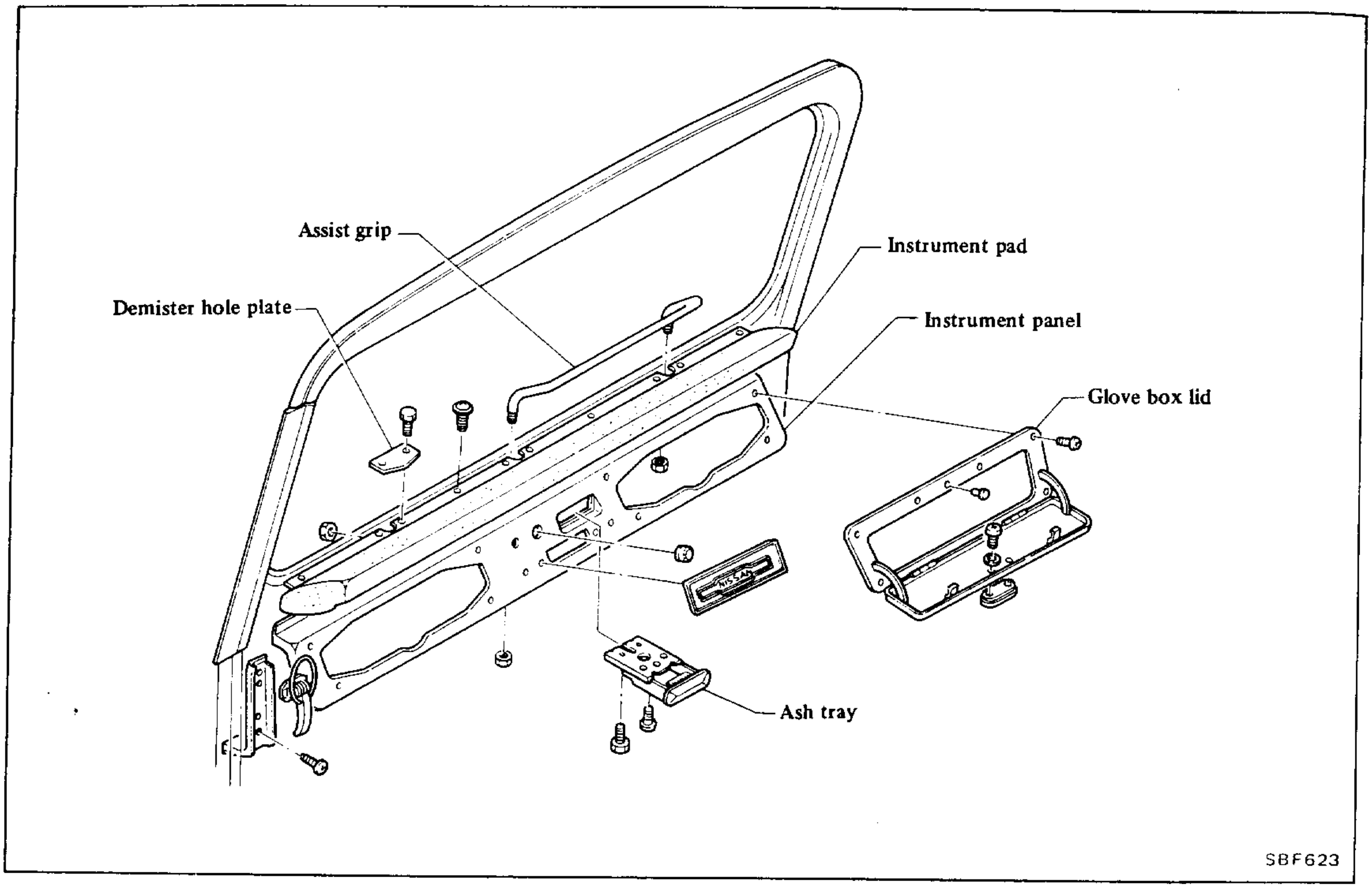
Removal and installation (Instrument finisher)

1. Disconnect harness connectors and remove radio box.
2. Remove assist grip.
3. Remove cluster lid.
4. Disconnect speedometer cable and remove combination meter.
5. Withdraw instrument finisher securing pin clip.
6. Remove clip from instrument finisher, then remove instrument finisher.
7. Installation is in reverse order of removal.



SBF622

CANVAS TOP



Removal and Installation

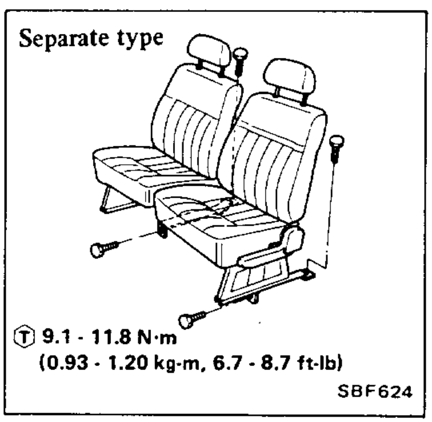
1. Remove glove box lid.
2. Remove demister hole plate and instrument pad.
3. Disconnect speedometer cable and harness connectors.
4. Remove combination meter.
5. Remove instrument panel fixing bolts and instrument panel.
6. Installation is in reverse order of removal.

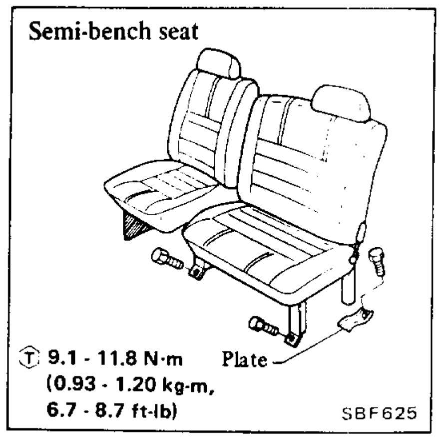
SEAT

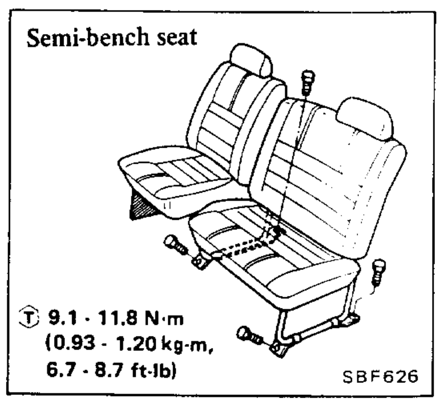
REMOVAL AND INSTALLATION

Front seat

Except Canvas Top

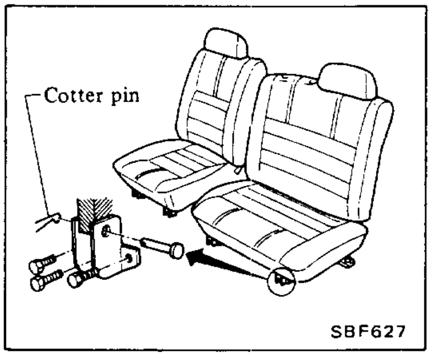






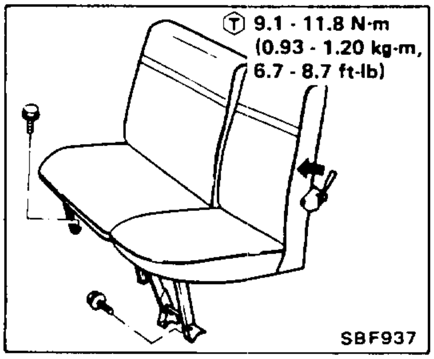
1. Remove bolts attaching front of seat bracket to floor.
2. Remove bolts attaching rear of seat bracket to floor.
3. Then remove front seat assembly from vehicle.
4. Installation is in reverse order of removal.

Canvas Top



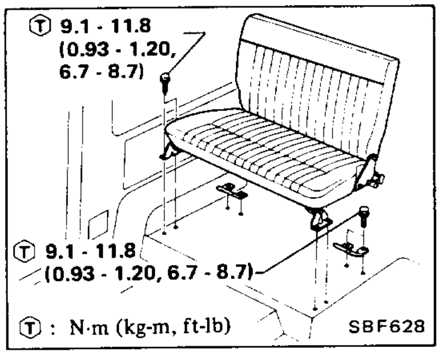
1. Remove cotter pin and rod.
2. Remove front seat assembly.

2nd seat (Station Wagon only)

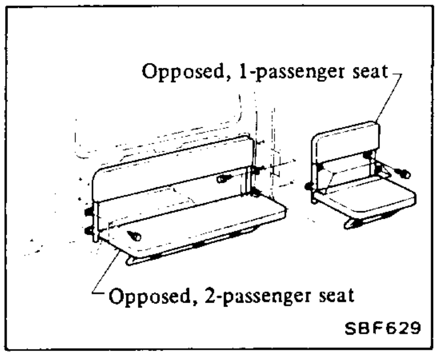


Rear seat

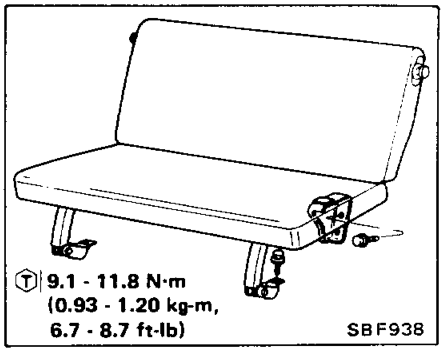
Hardtop and Station Wagon



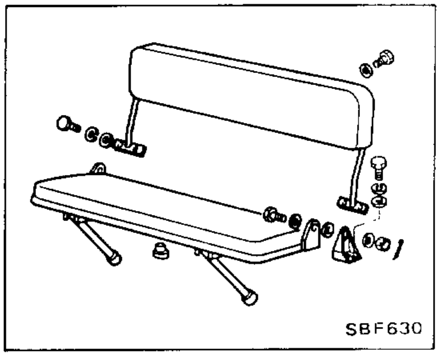
High-roof Hardtop



Van



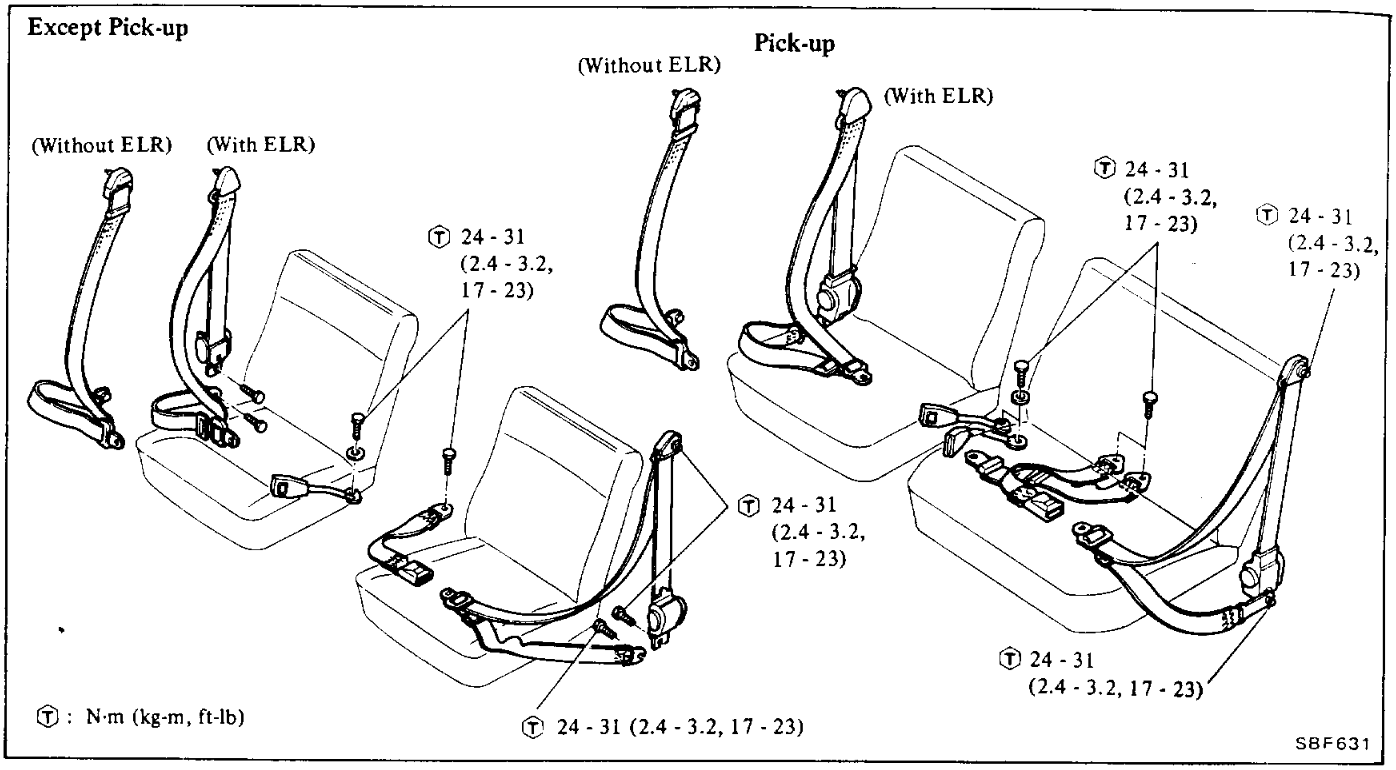
Canvas Top



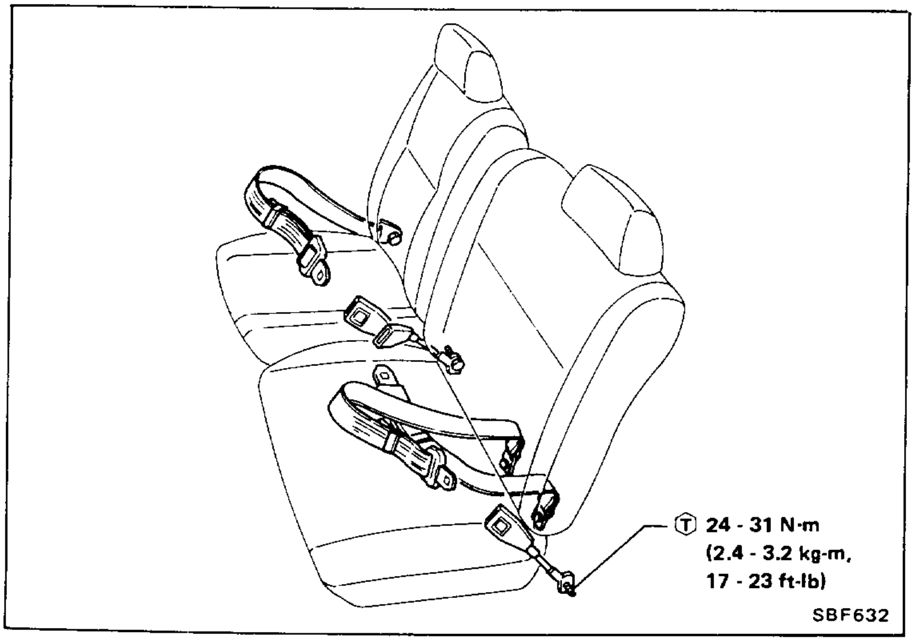
SEAT BELT

FRONT SEAT BELT

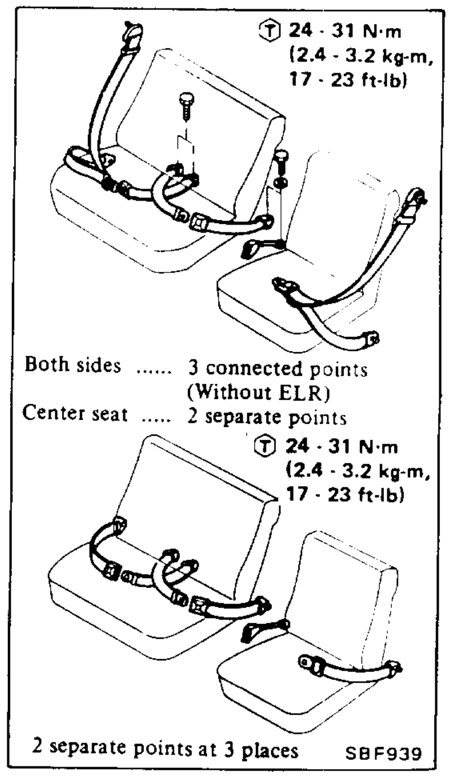
Except Canvas Top



Canvas Top

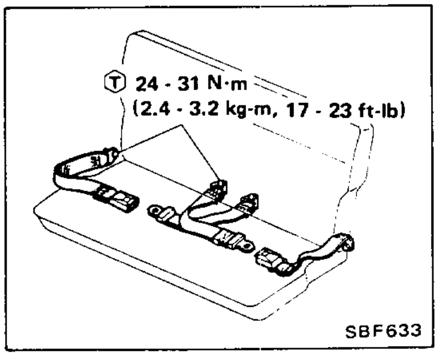


2nd seat (Station Wagon only)



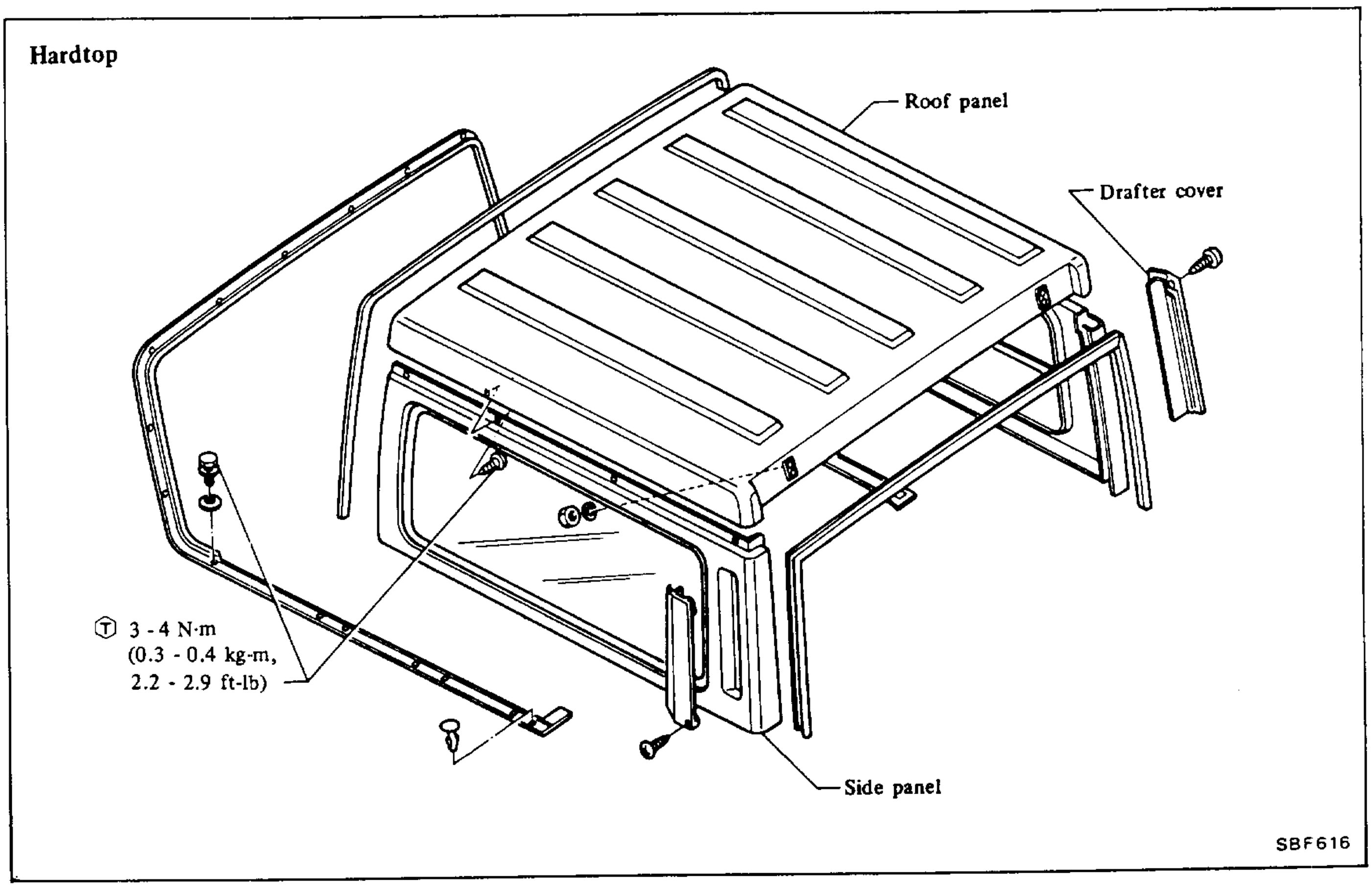
REAR SEAT BELT

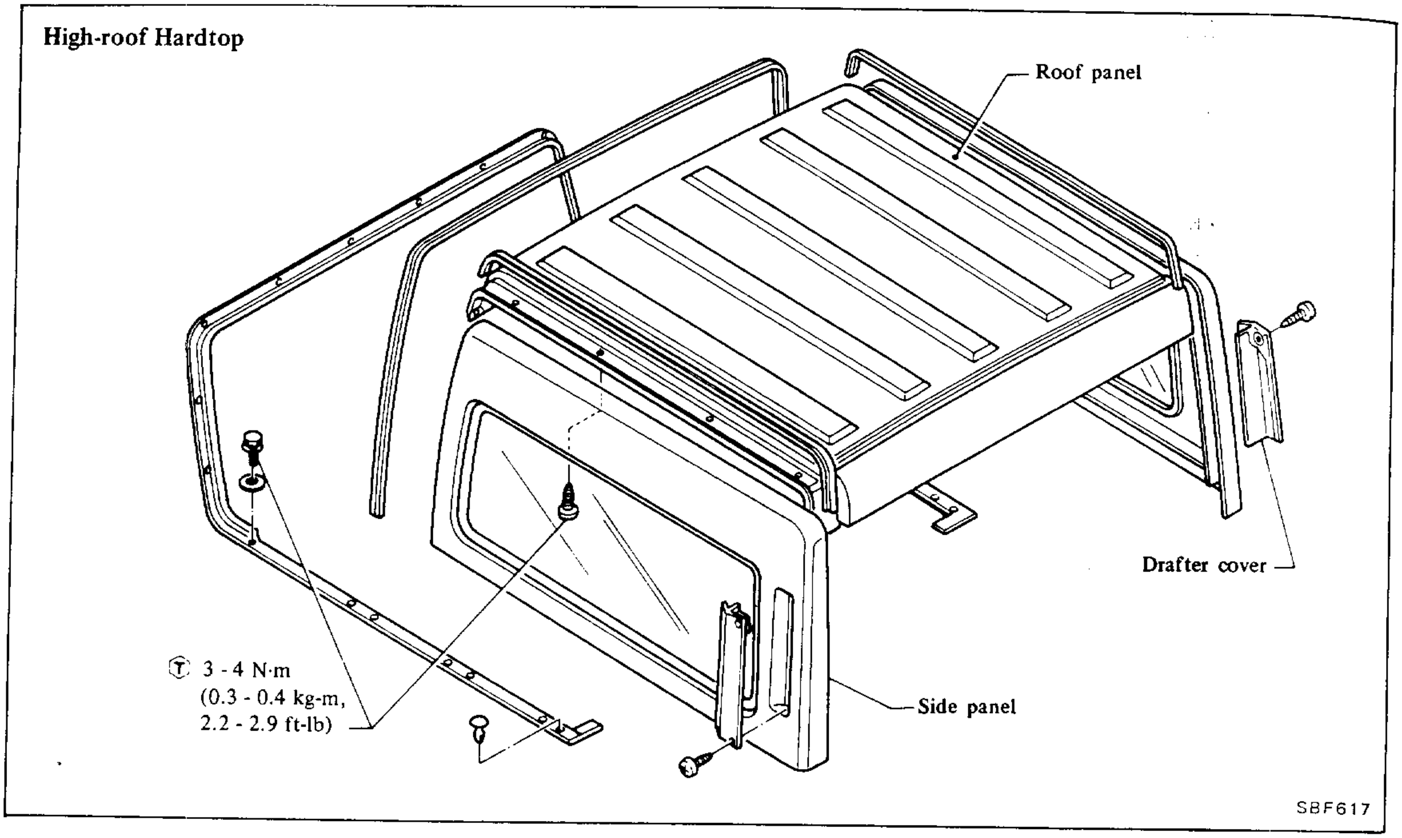
Hardtop, Van and Station Wagon



ROOF

CANOPY





REMOVAL AND INSTALLATION

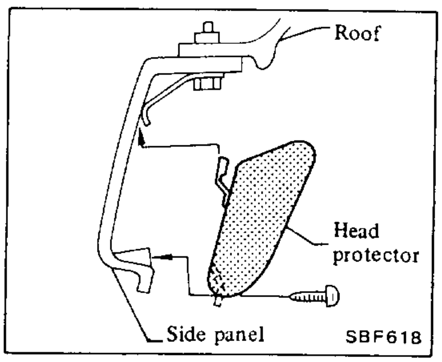
- Canopy consists of roof and both side panels. When replacing roof or side panel, remove it as a canopy assembly.
- TORX wrench is necessary to remove bolts as they are TORX bolts.

1. Disconnect canopy retaining bolts (TORX bolts).
2. Remove canopy as an assembly.
3. Installation is in reverse order of removal.

Ⓣ : **Canopy retaining bolts**
3 - 4 N·m
(0.3 - 0.4 kg-m,
2.2 - 2.9 ft-lb)

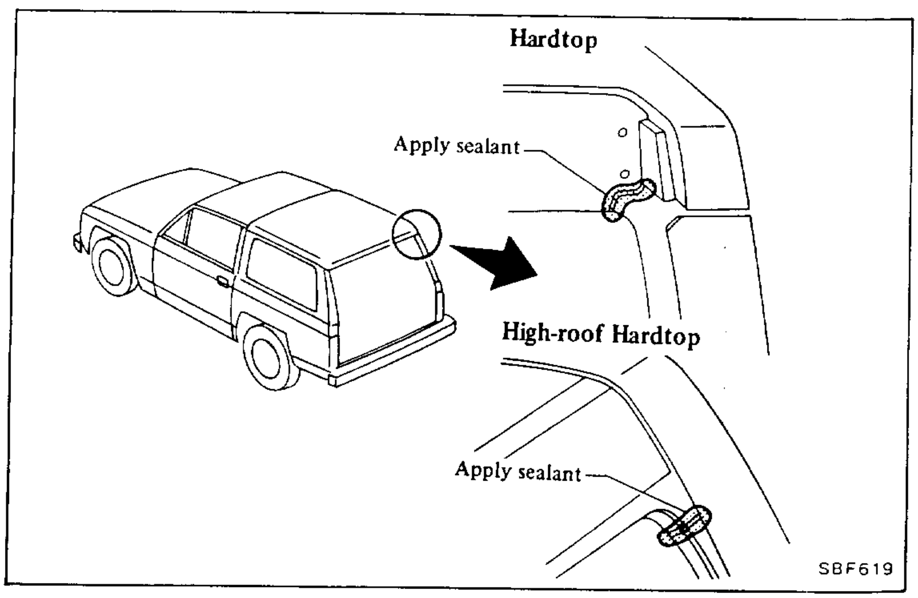
DISASSEMBLY AND ASSEMBLY

1. Remove weatherstrip from canopy.
2. On High-roof Hardtop models, remove head protector.



3. Remove bolts securing side panel to roof.
4. Installation is in reverse order of removal. Apply sealant to mating surface of side panel and as shown in following figure.

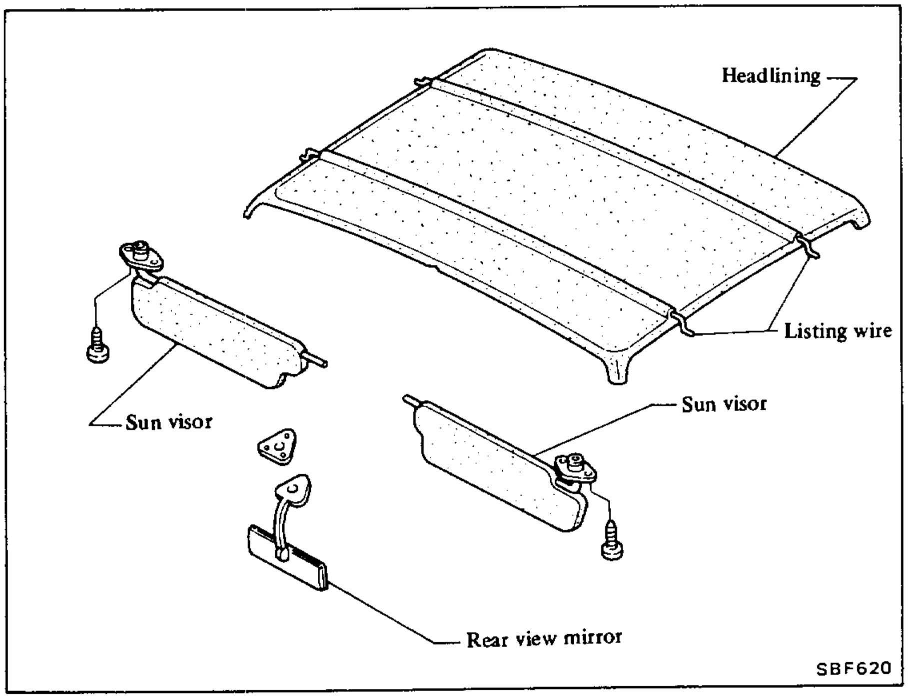
Ⓣ : **Bolts securing side panel to roof**
3 - 4 N·m
(0.3 - 0.4 kg-m,
2.2 - 2.9 ft-lb)



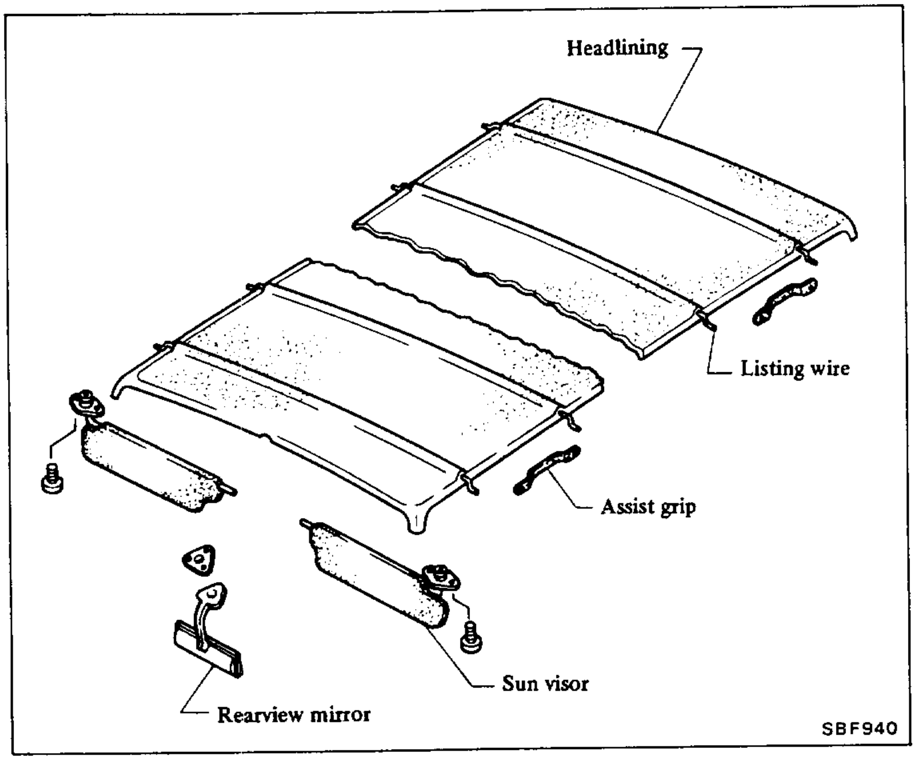
ROOF TRIM

REMOVAL AND INSTALLATION

Hardtop, High-roof Hardtop and Pick-up



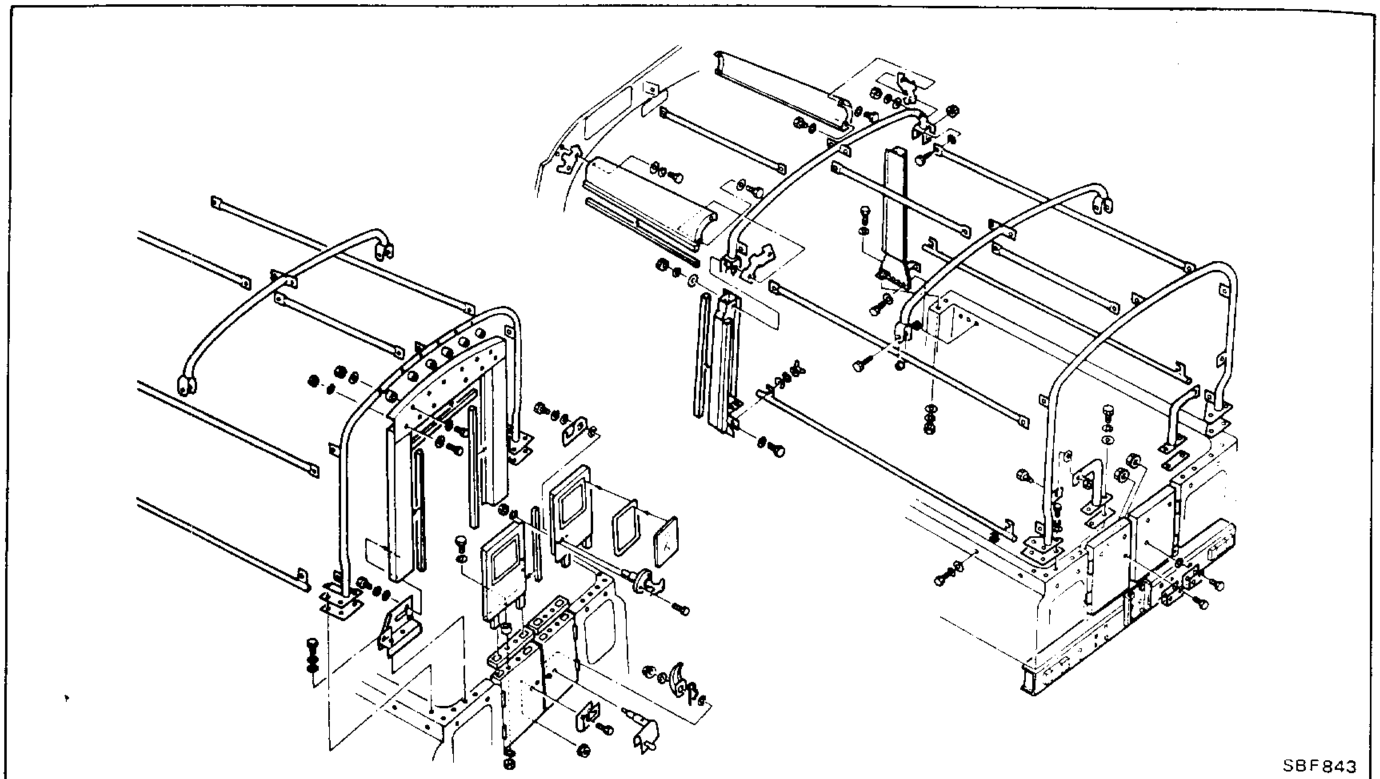
Van and Station Wagon



1. Remove interior lamp, inside rear-view mirror, sun visors and assist grips.
2. Remove canopy (Hardtop and High-roof Hardtop).
   Remove rear window glass (Pick-up).
3. Remove roof rear side garnish (Van and Station Wagon).
4. Remove windshield glass.
5. Remove headlining.
6. Installation is in reverse order of removal.

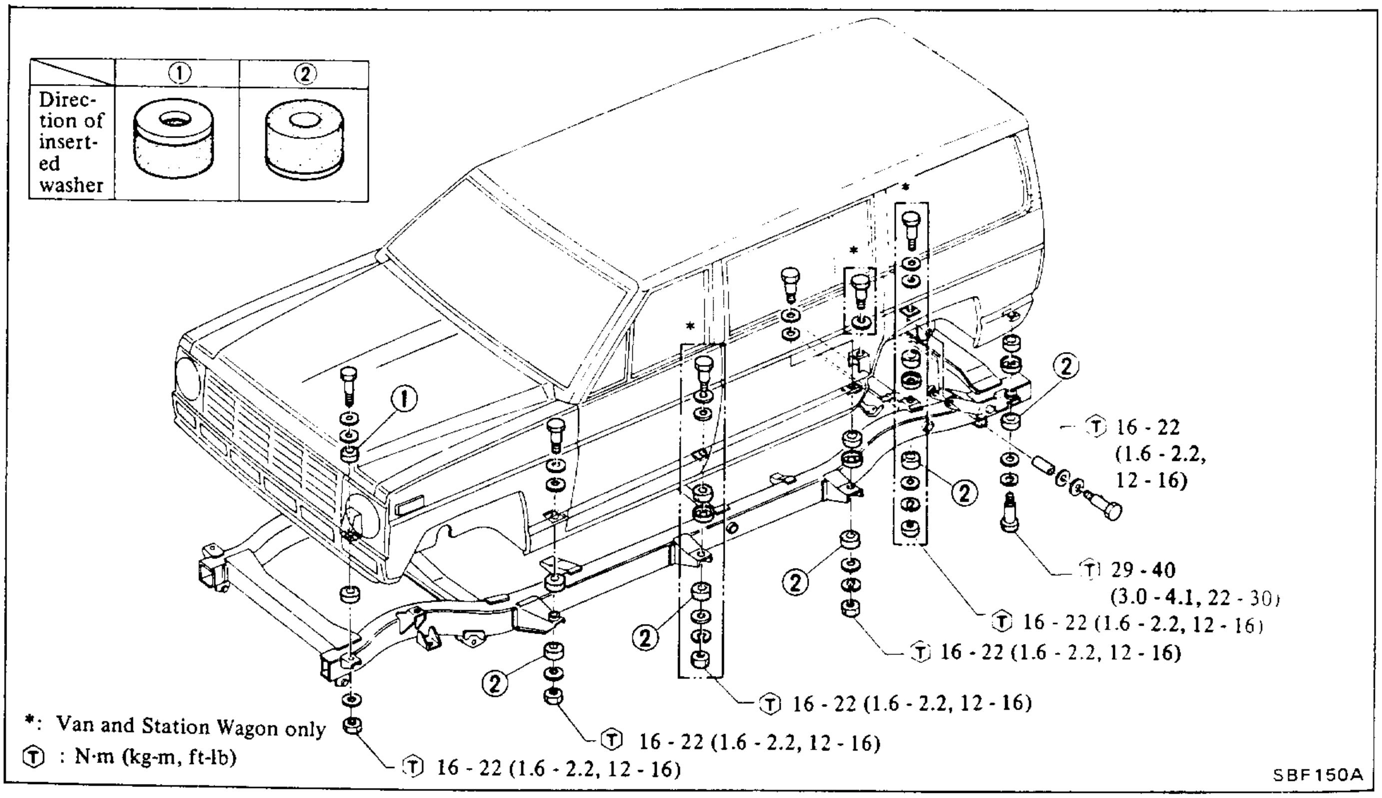
When replacing headlining, also replace listing wire if deformed.

CANVAS



BODY MOUNTING

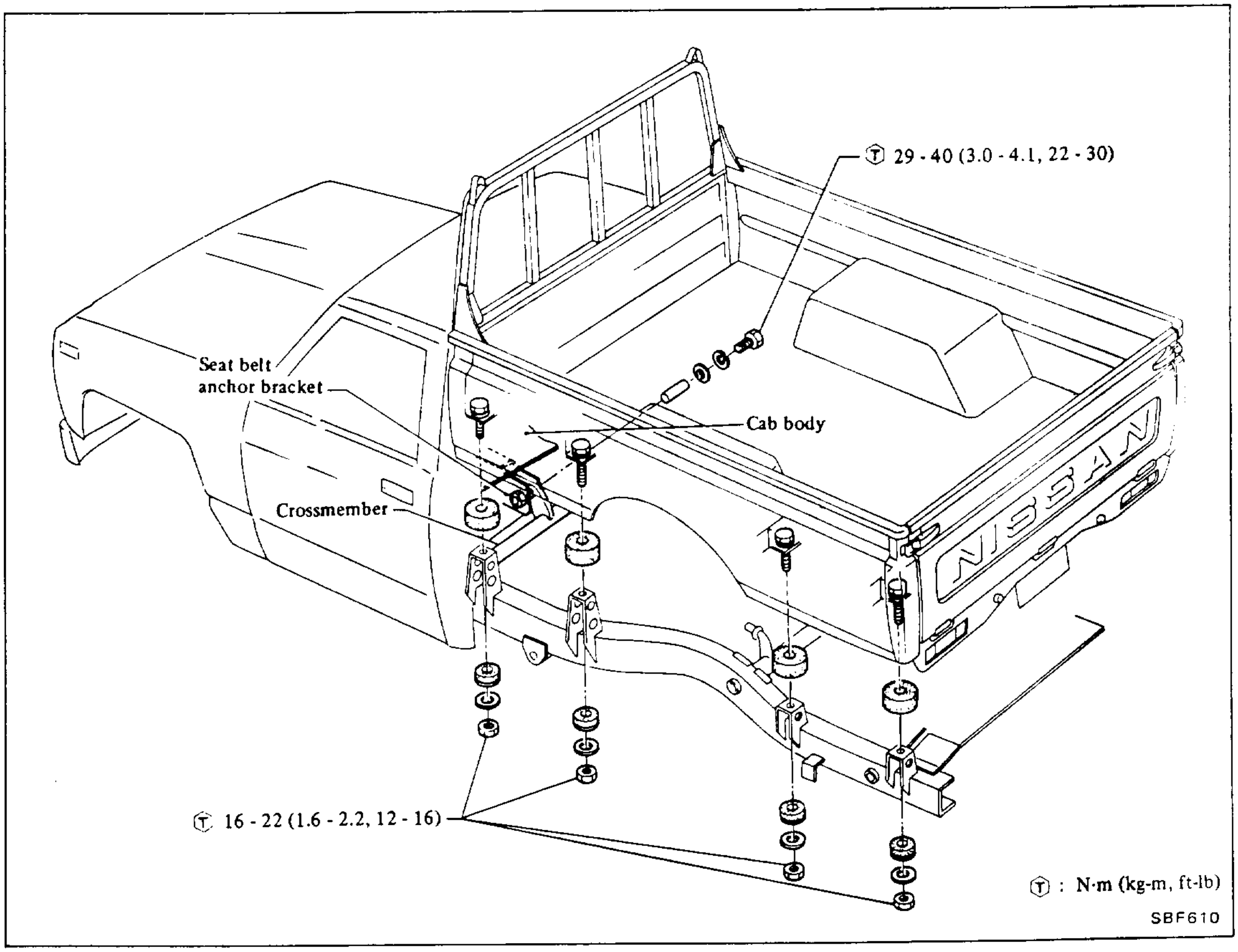
HARDTOP, HIGH-ROOF HARDTOP, VAN AND STATION WAGON



Before removing cab body, remove or disconnect the following parts:

- Wiring harness
- Steering column rubber coupling
- Brake booster vacuum hose
- Accelerator cable and Choke control cable
- Battery
- Clutch tube line
- Brake tube line
- Parking brake wire
- Radiator shroud fixing bolt
- Engine coolant inlet and outlet hoses
- Heater hose
- Speedometer cable
- Transmission and Transfer lever
- Fuel filler hose
- Seat belt anchor bracket

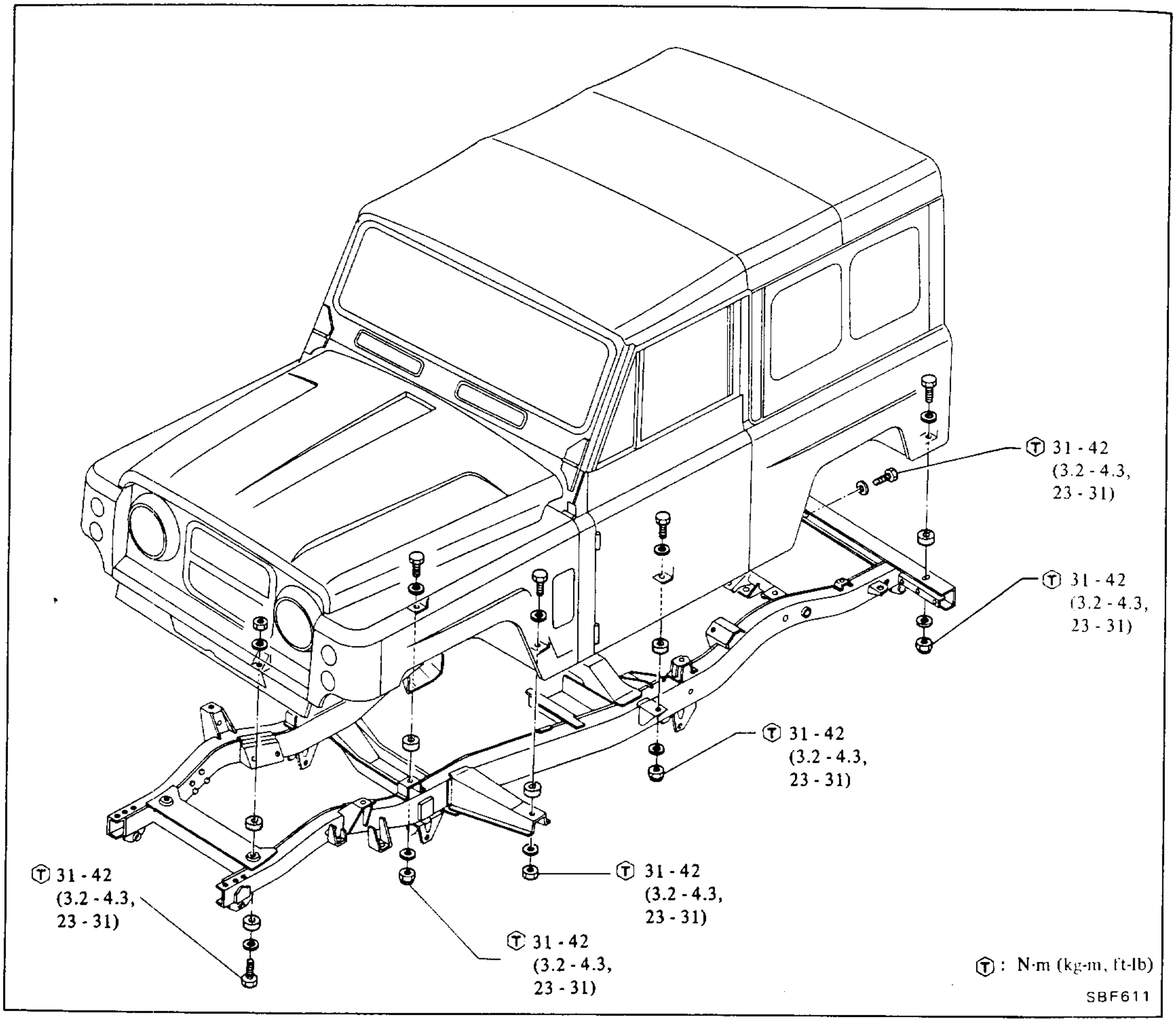
PICK-UP (Rear body)



Before removing rear body, remove or disconnect the following parts:

- Wiring harness
- Fuel filler hose

CANVAS TOP



Before removing cab body, remove or disconnect the following parts:

- Radiator shell
- Front fender
- Wiring harness
- Steering gear arm
- Brake booster vacuum hose
- Accelerator cable and choke control cable
- Battery
- Clutch tube line
- Brake tube line
- Parking brake wire
- Heater hose
- Speedometer cable
- Transmission and Transfer lever
- Fuel filler hose

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.

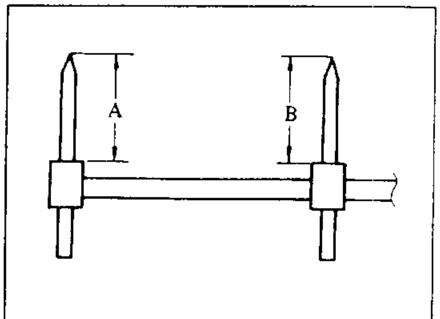
1. Measurement method

- 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.

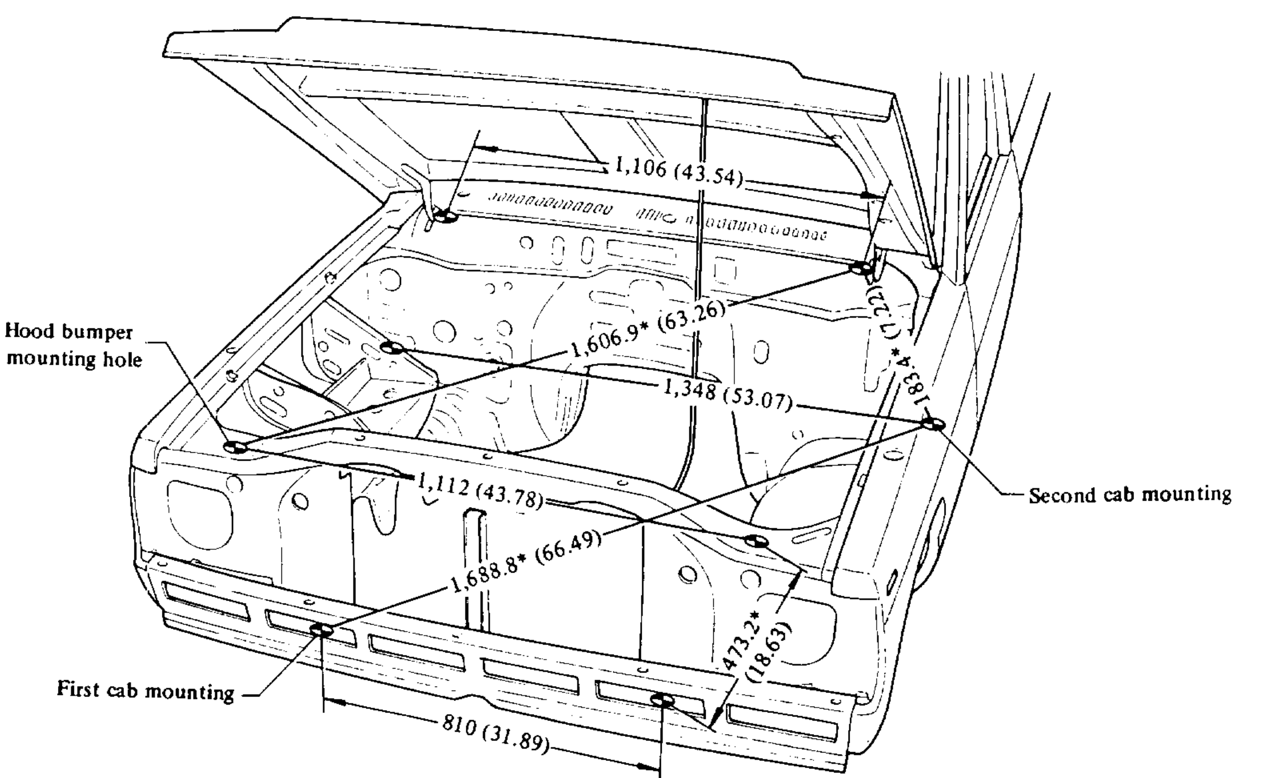
2. Measurement point

Measurements should be taken at the center of mounting holes.



SBF362

ENGINE COMPARTMENT (Except Canvas Top)

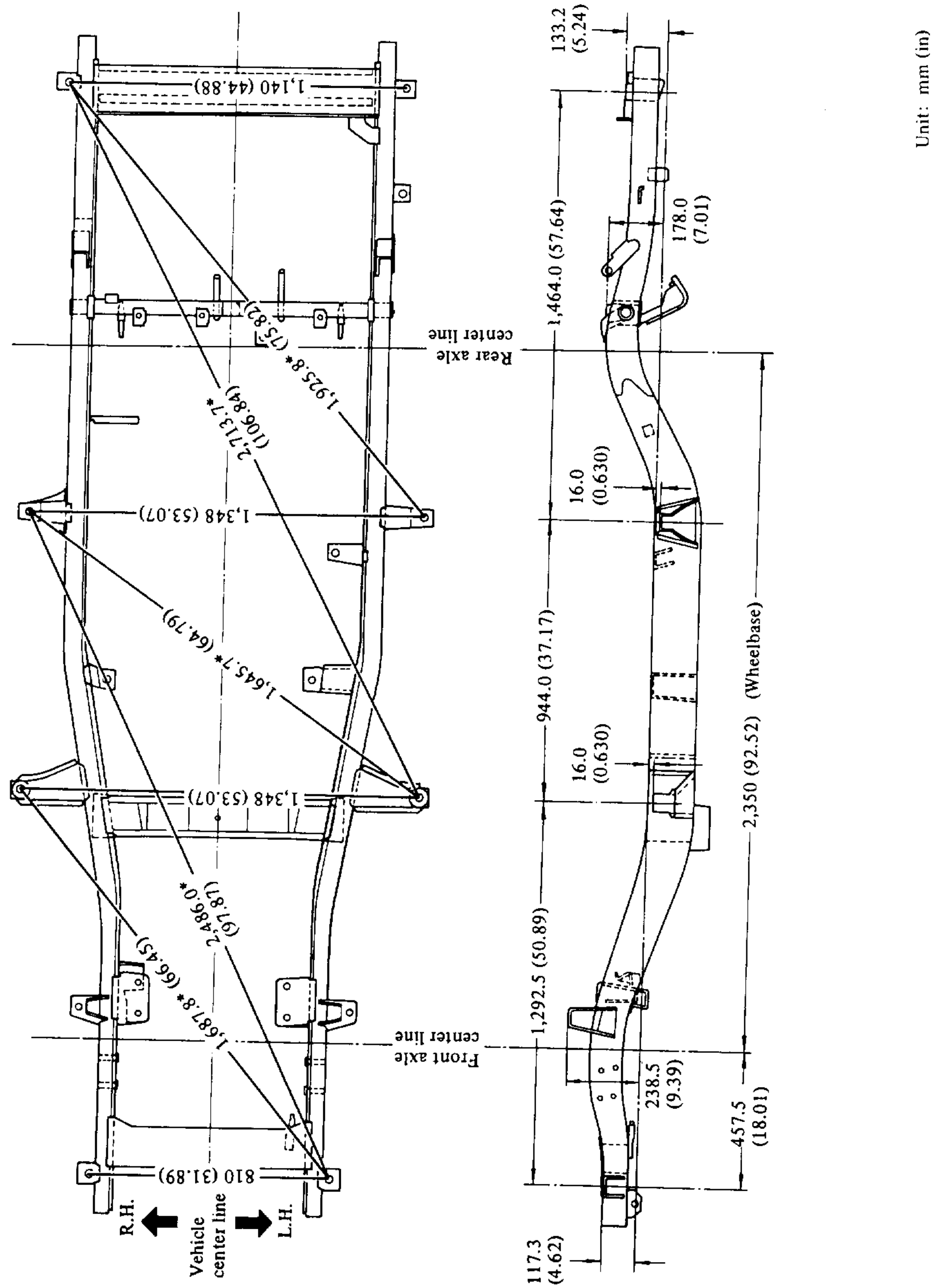


Unit: mm (in)

SBF612

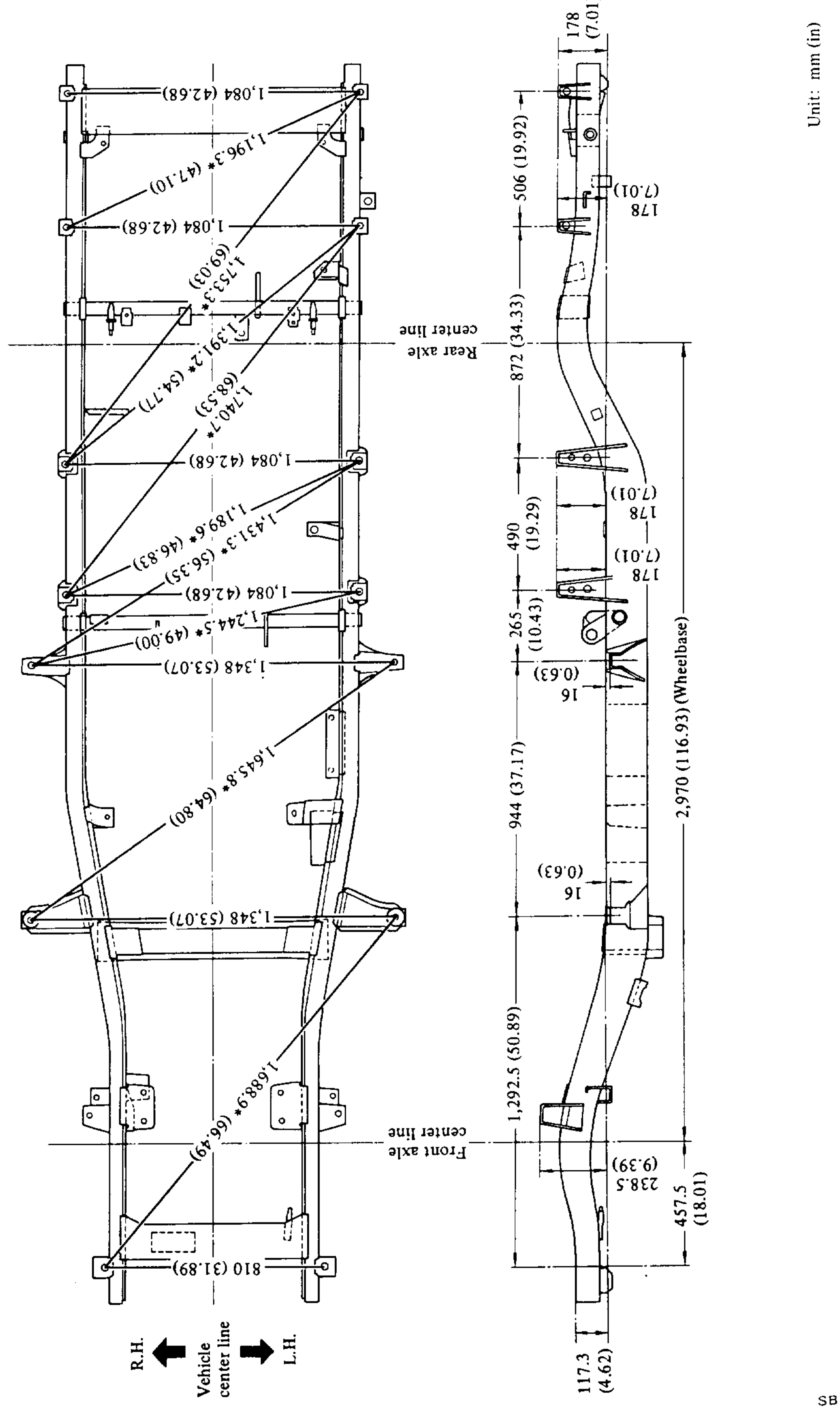
FRAME

HARDTOP AND HIGH-ROOF HARDTOP



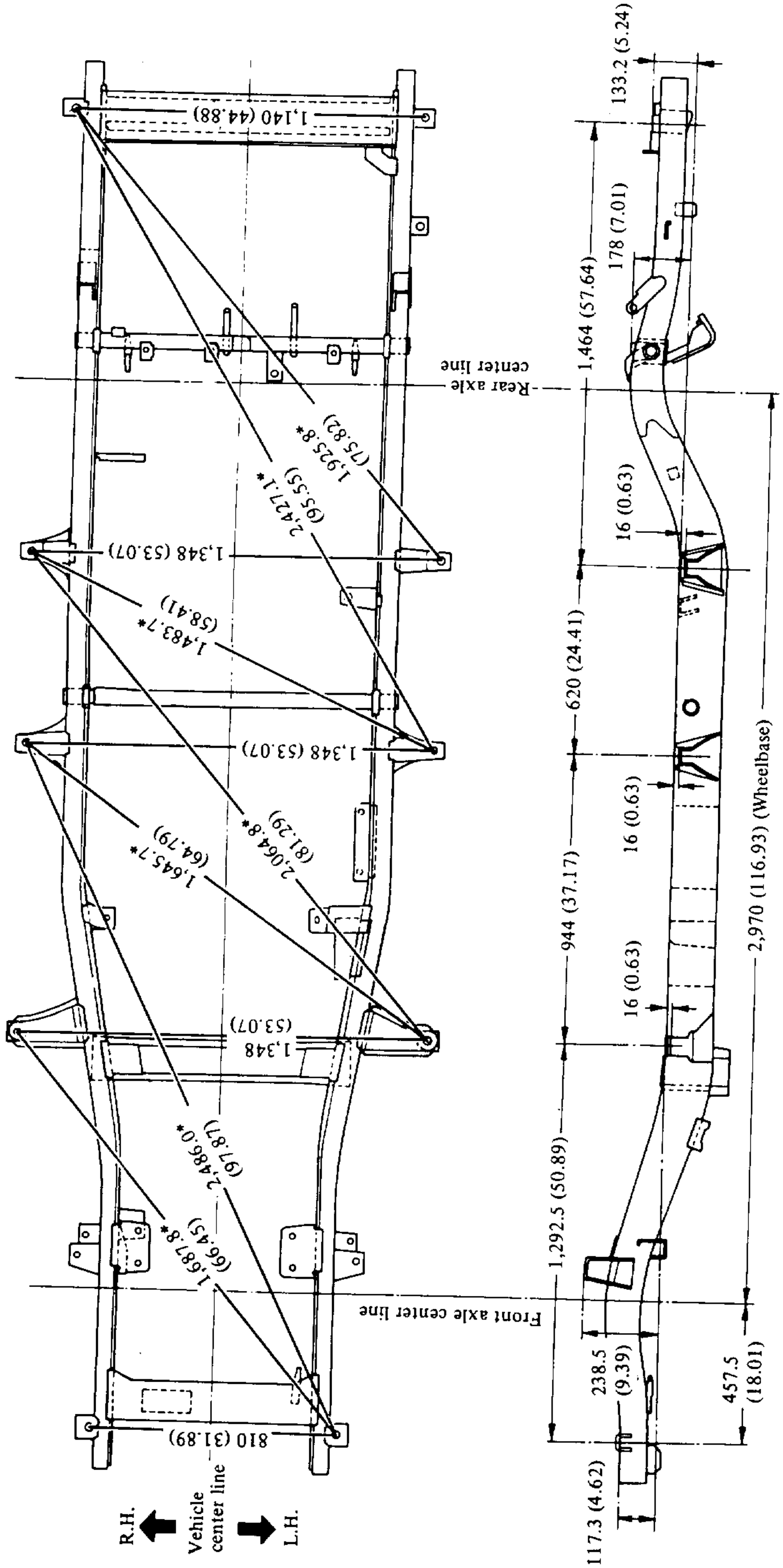
SBF613

PICK-UP



SBF614

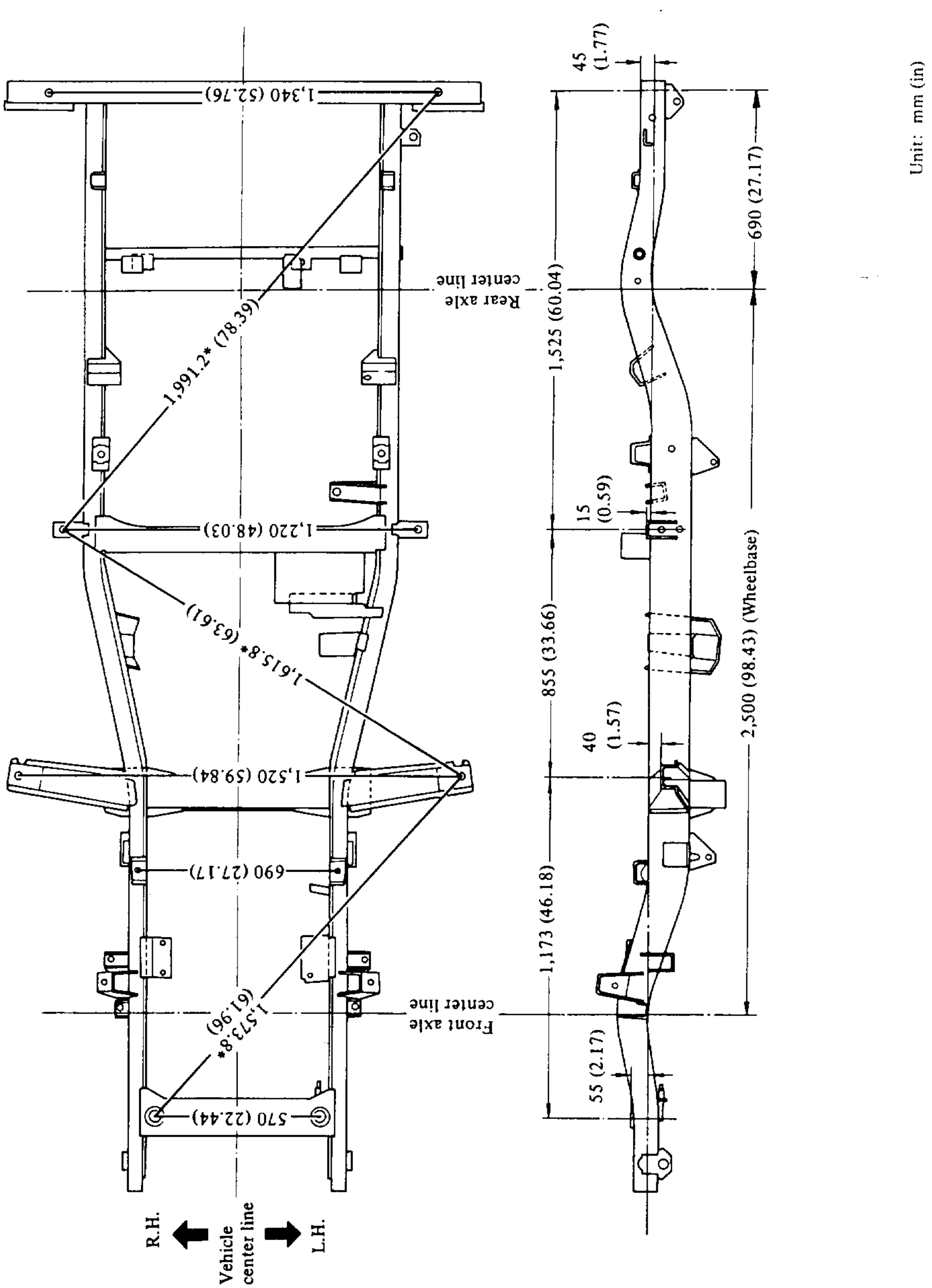
VAN AND STATION WAGON



Unit: mm (in)

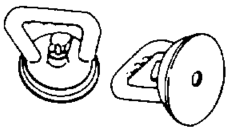
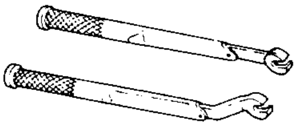
SBF942

CANVAS TOP



SBF615

SPECIAL SERVICE TOOLS

Tool number	Tool name
ST08800000	Sucker 
GG94310000	Flare nut torque wrench 

HEATER & AIR CONDITIONER

CONTENTS

HEATER

AIR CONDITIONER

Refer to Section MA (Heater and Air Conditioner) for:

- CHECKING REFRIGERANT LEVEL
- CHECKING REFRIGERANT LEAKS

Refer to Section MA (Basic Mechanical System) for:

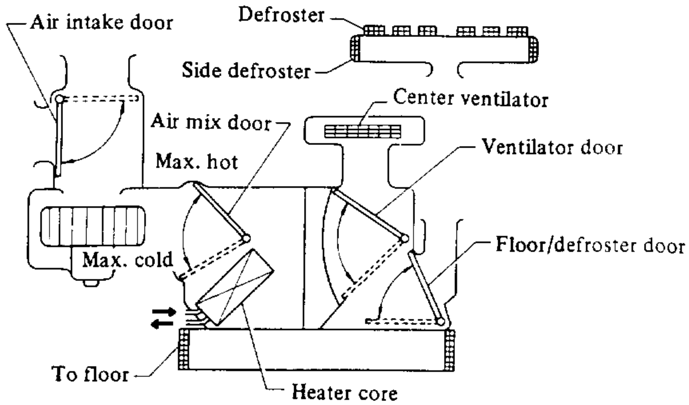
- CHECKING AND ADJUSTING DRIVE BELTS

DESCRIPTION

AIR FLOW

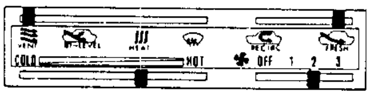
MODEL 160 SERIES

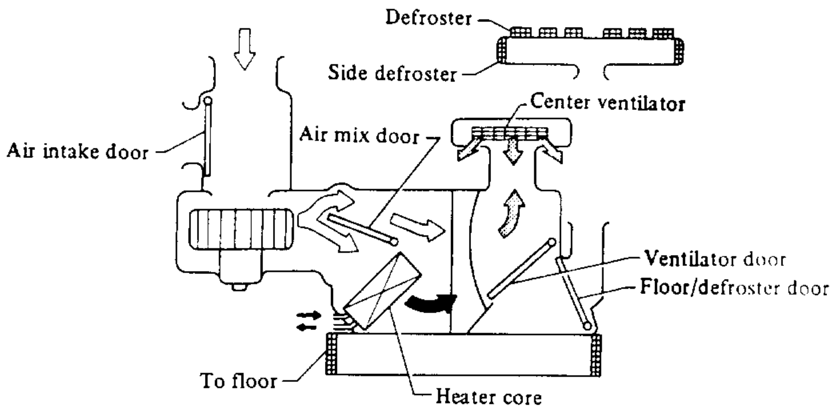
OFF



SHA606

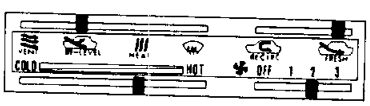
VENT position

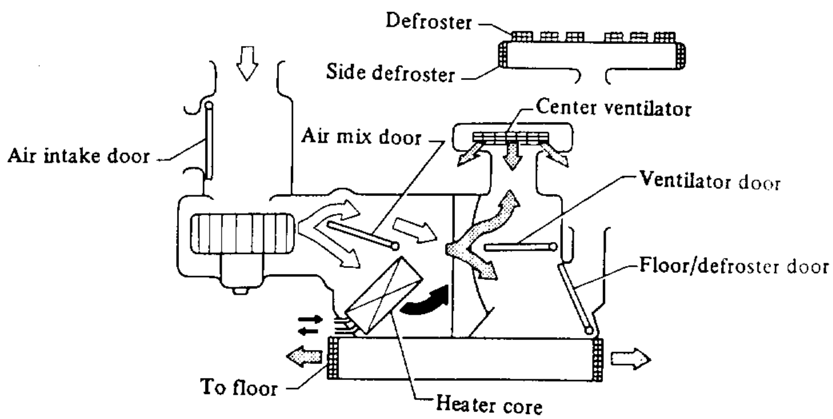




SHA609

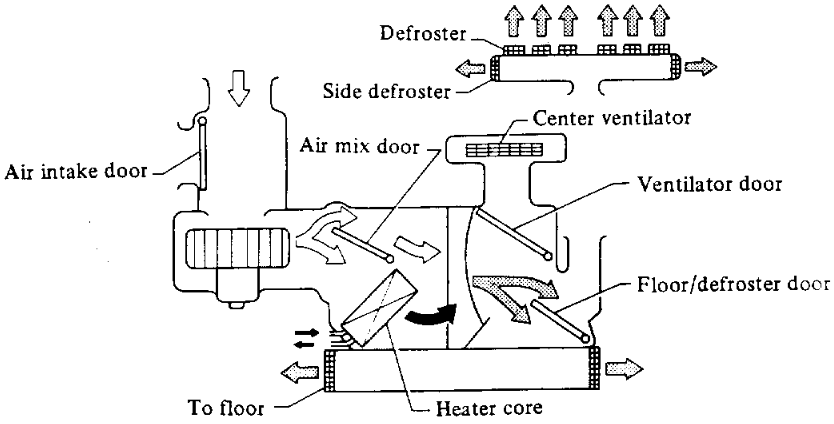
B/L (BI-LEVEL) position





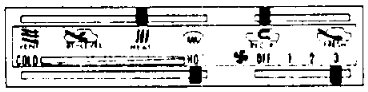
SHA610

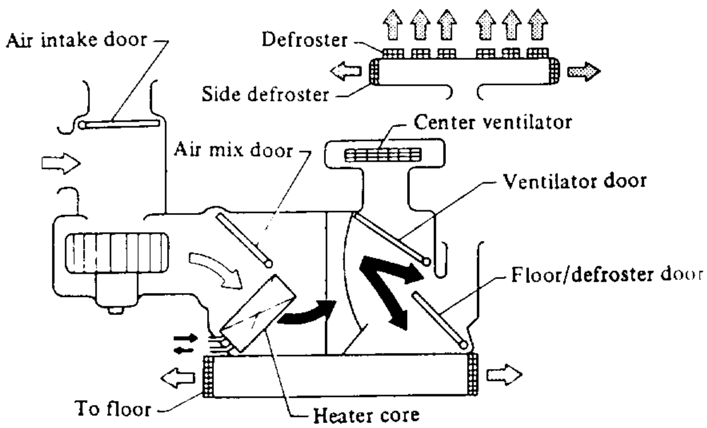
HEAT position



SHA608

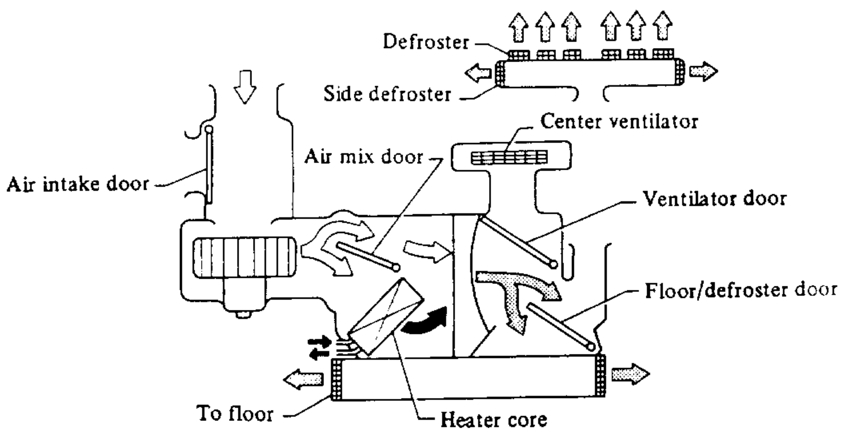
HEAT (Fast heating) position





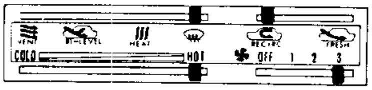
SHA607

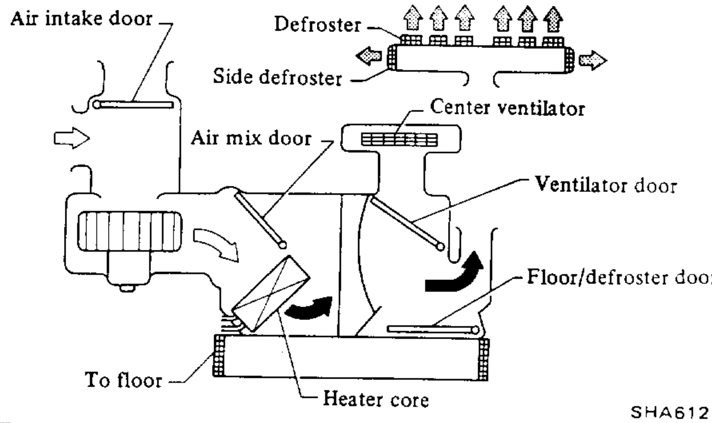
position



SHA611

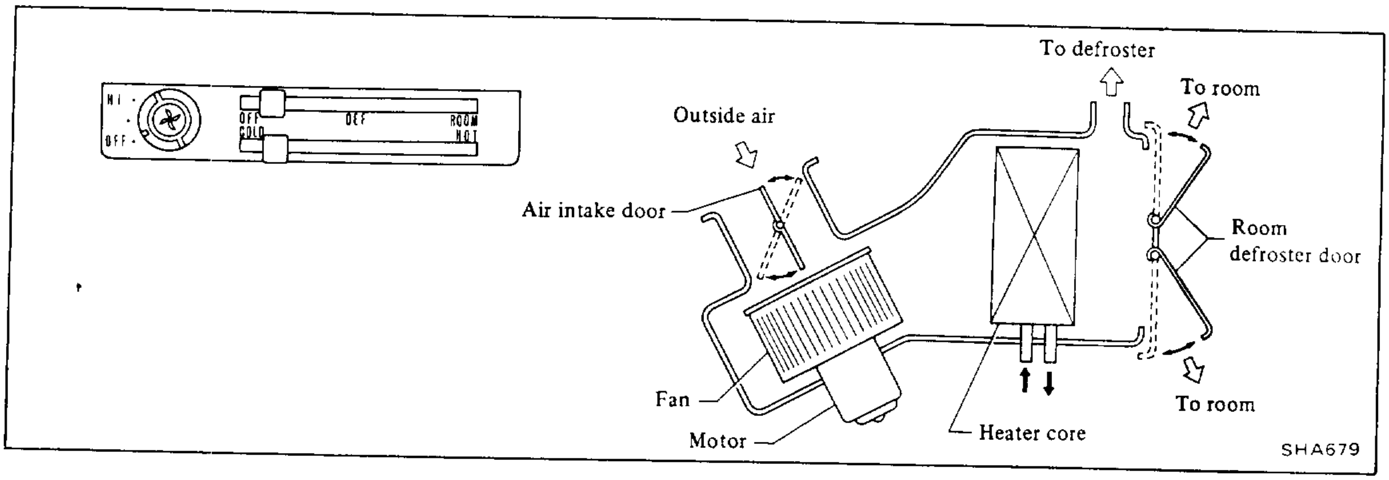
position (Fast defrosting)





SHA612

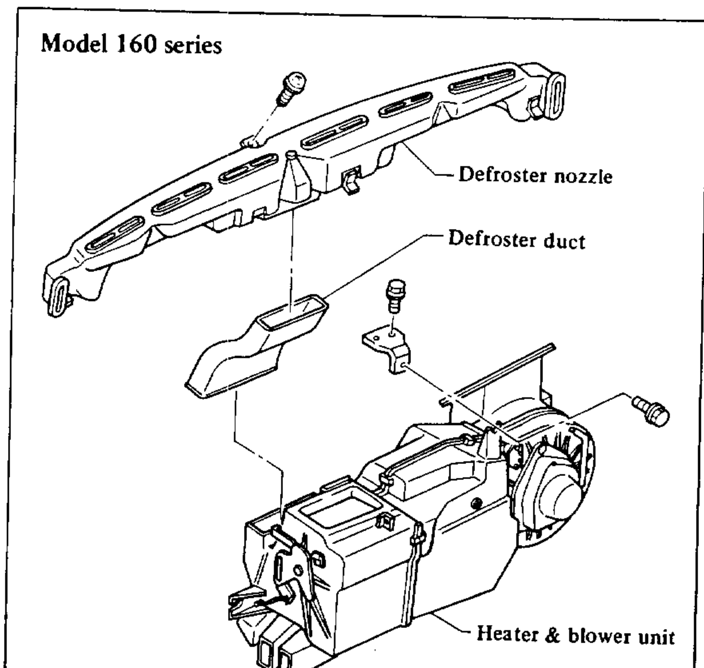
MODEL 61 SERIES



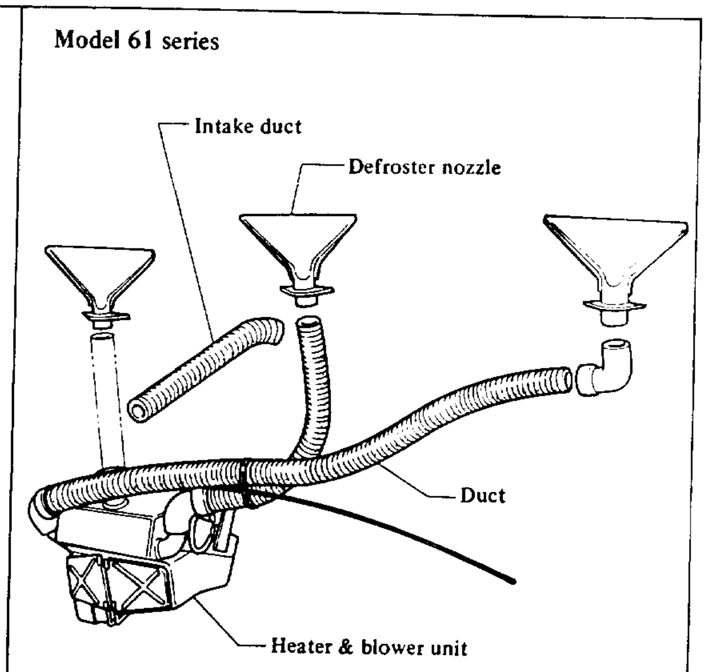
SHA679

SERVICE PROCEDURES

HEATER COMPONENTS

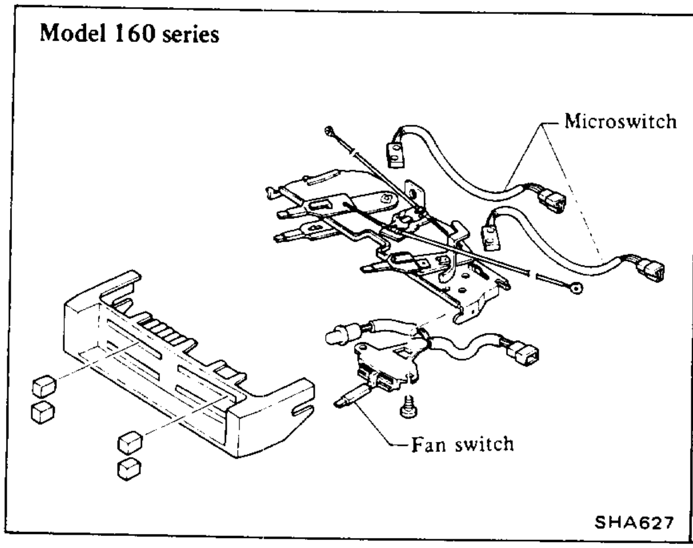


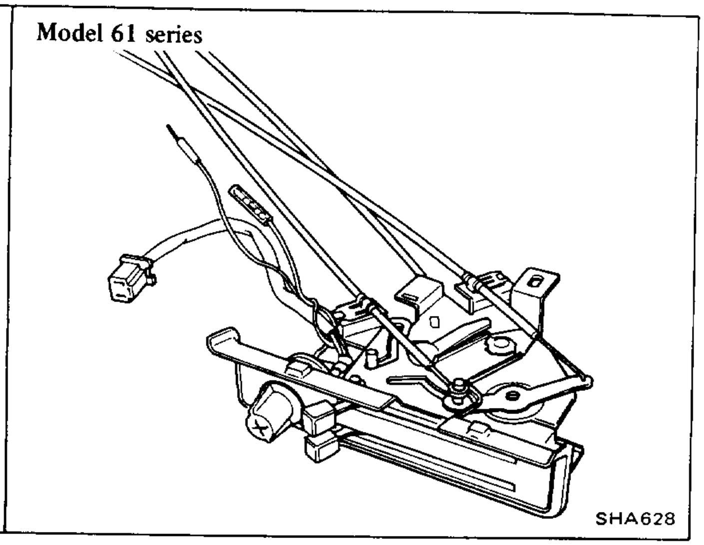
SHA632



SHA633

HEATER/AIR CONDITIONER CONTROL ASSEMBLY

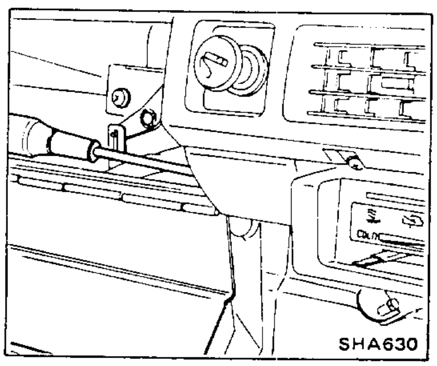




REMOVAL AND INSTALLATION

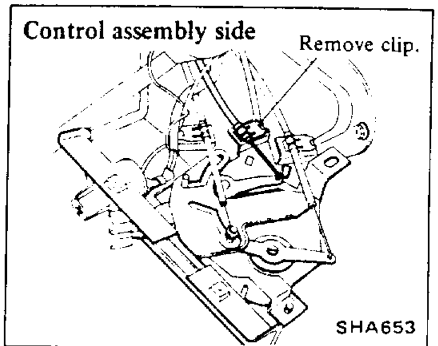
Model 160 series

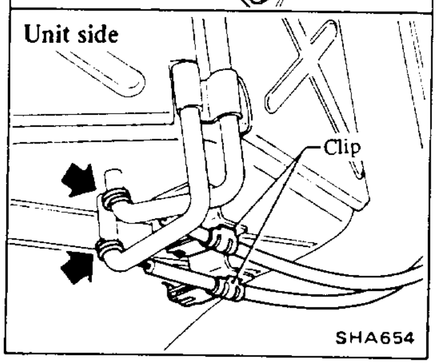
1. Disconnect battery ground cable.
2. Remove glove box.
3. Remove ash tray.
4. Remove control cable ratainging clips.
5. Remove control knob.
6. Remove screw and then remove control assembly.



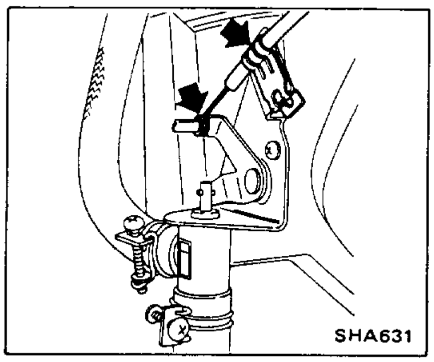
Model 61 series

1. Disconnect battery ground cable.
2. Disconnect "DEF" "ROOM" control cable.





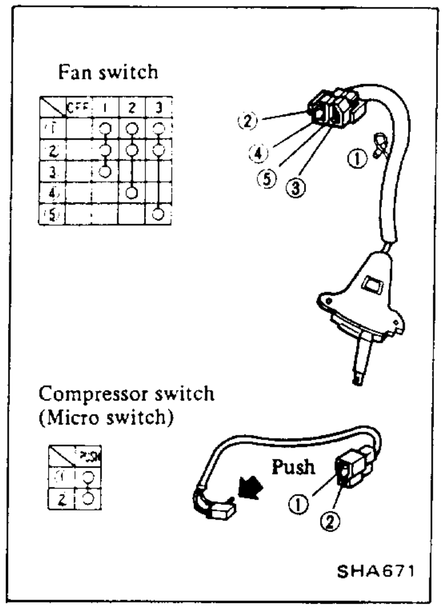
3. Disconnect water control cable.



4. Remove control assembly.

INSPECTION

Test continuity through switch with a test lamp or ohmmeter.



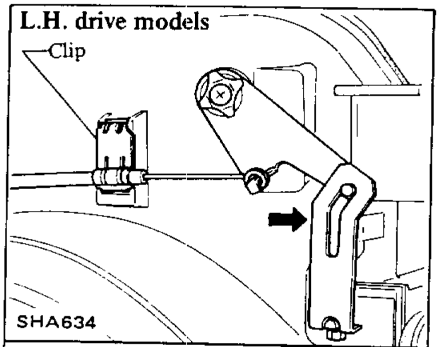
ADJUSTING HEATER CONTROL CABLE

Model 160 series

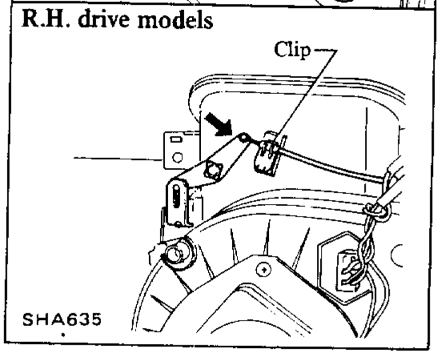
Air intake door control cable

1. Move control lever to "RECIRC".

2. With lever pushed in direction of arrow, fasten control cable with clip.



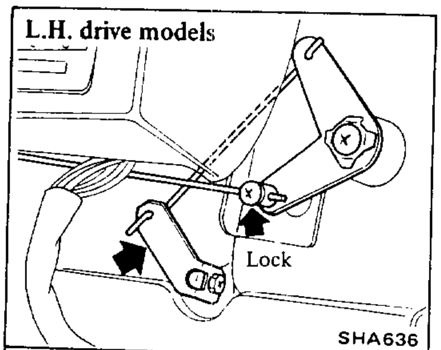
SHA634



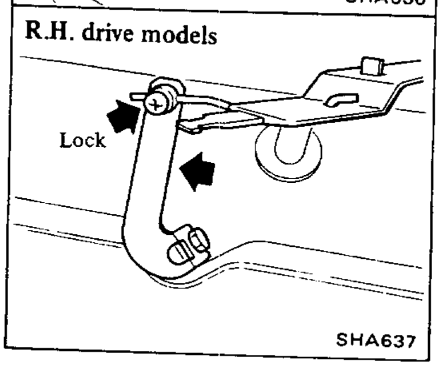
SHA635

Air mix door/water cock control cable

1. Move control lever to "COLD".
2. With link pushed in direction of arrow, lock control cable with screw.



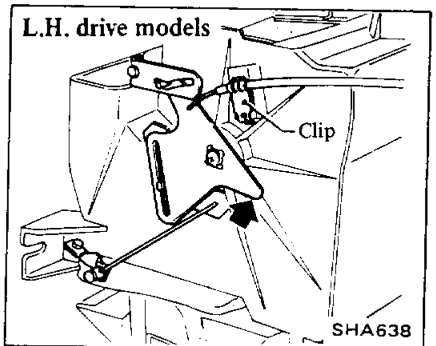
SHA636



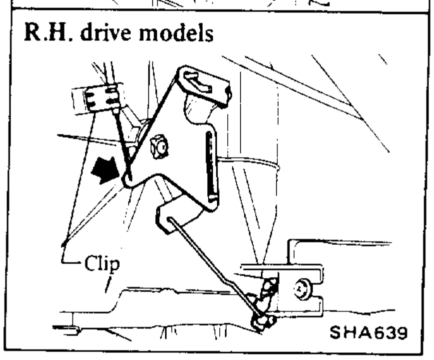
SHA637

Floor door/ventilator door control cable

1. Move control lever to (defroster symbol).
2. With lever pushed in direction of arrow, fasten control lever with clip.



SHA638



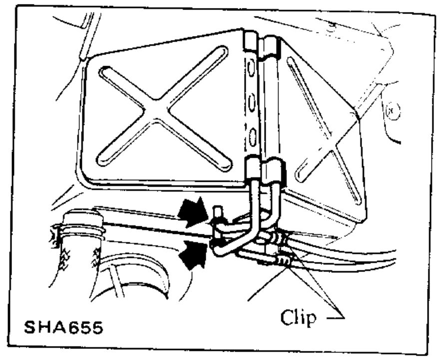
SHA639

Model 61 series

Room/defroster control cable

1. Move control lever to "OFF".

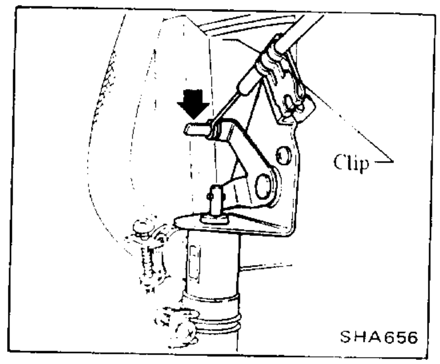
2. With heater door closed, connect cable and fasten it with clips.



SHA655

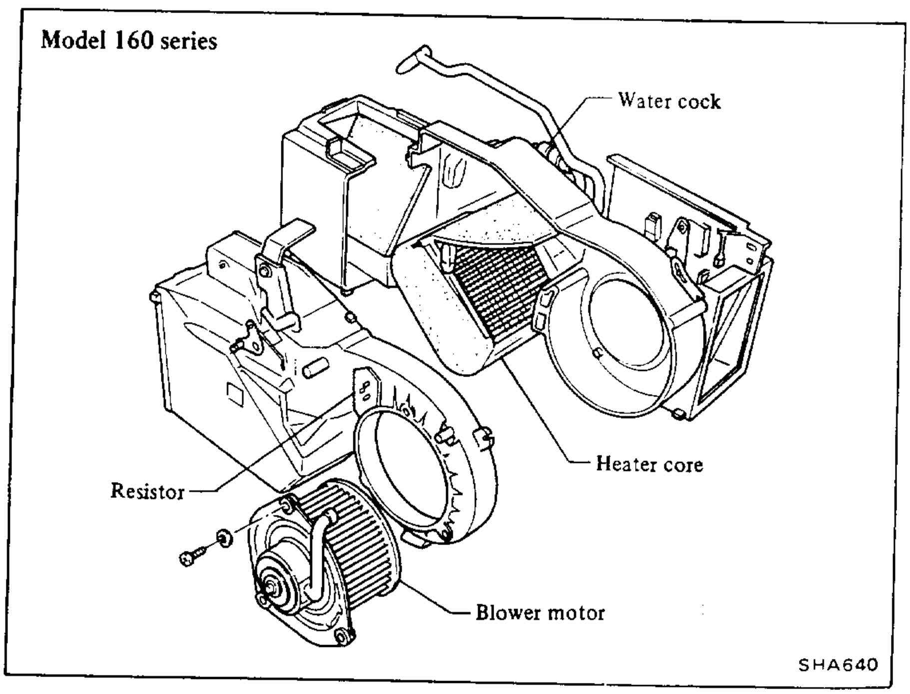
Water cock control cable

1. Move control lever to "COLD".
2. With water cock set at position shown by arrow, connect cable and fasten it with clips.

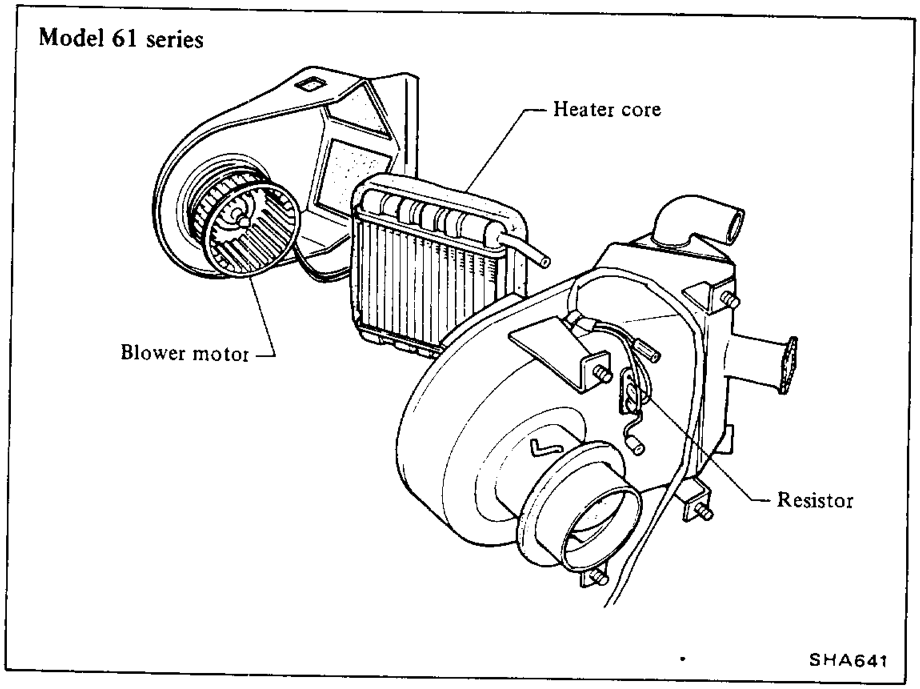


SHA656

HEATER/BLOWER UNIT



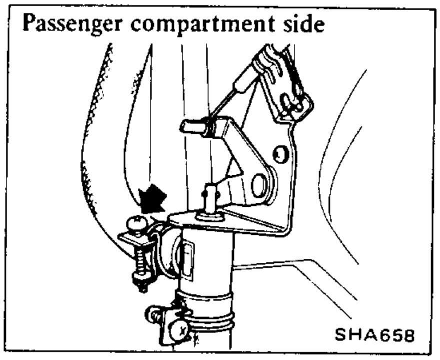
SHA640



REMOVAL AND INSTALLATION

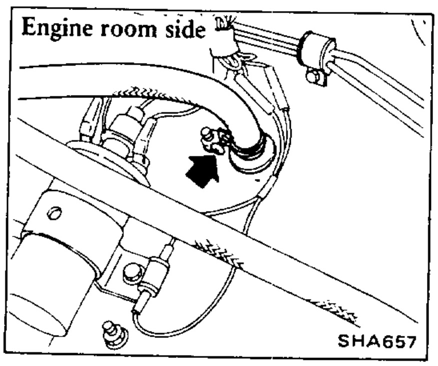
Model 160 series

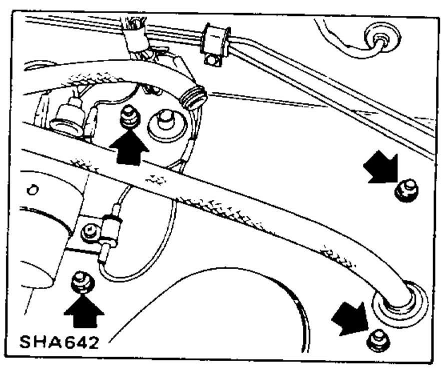
1. Disconnect battery ground cable.
2. Drain coolant.
3. Remove instrument upper finisher.
- Remove assistant strap.
- Remove radio, if so equipped.
- Remove meter cover and then remove meter assembly.
4. Remove glove box.
5. Disconnect heater hose.
6. Remove heater control unit.
7. Remove heater/blower unit assembly.



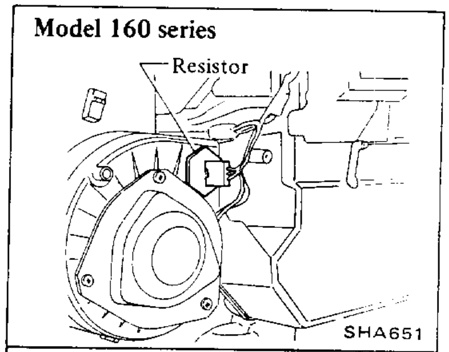
Model 61 series

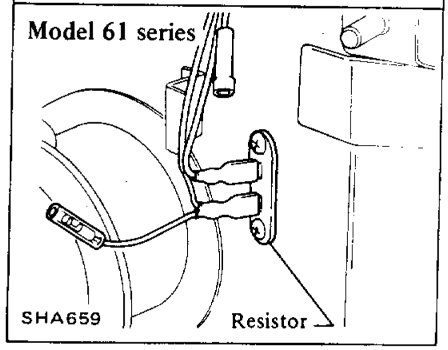
1. Disconnect battery ground cable.
2. Drain coolant.
3. Disconnect heater hose.
4. Remove control cable.
5. Remove duct.
6. Remove bolt and then remove heater/blower unit assembly.





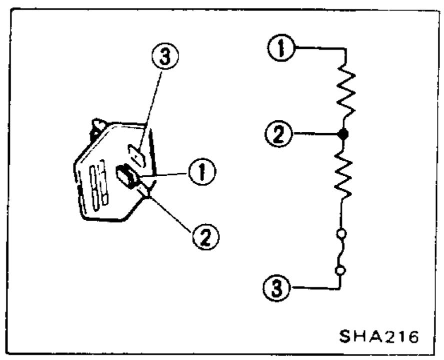
RESISTOR



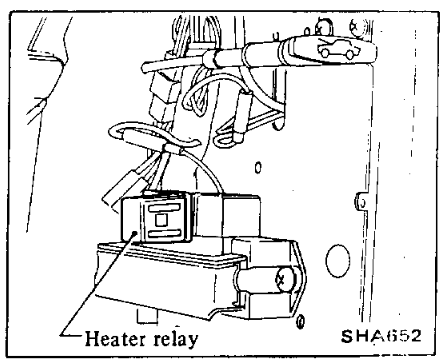


INSPECTION

Test continuity through resistor with a test lamp or ohmmeter.

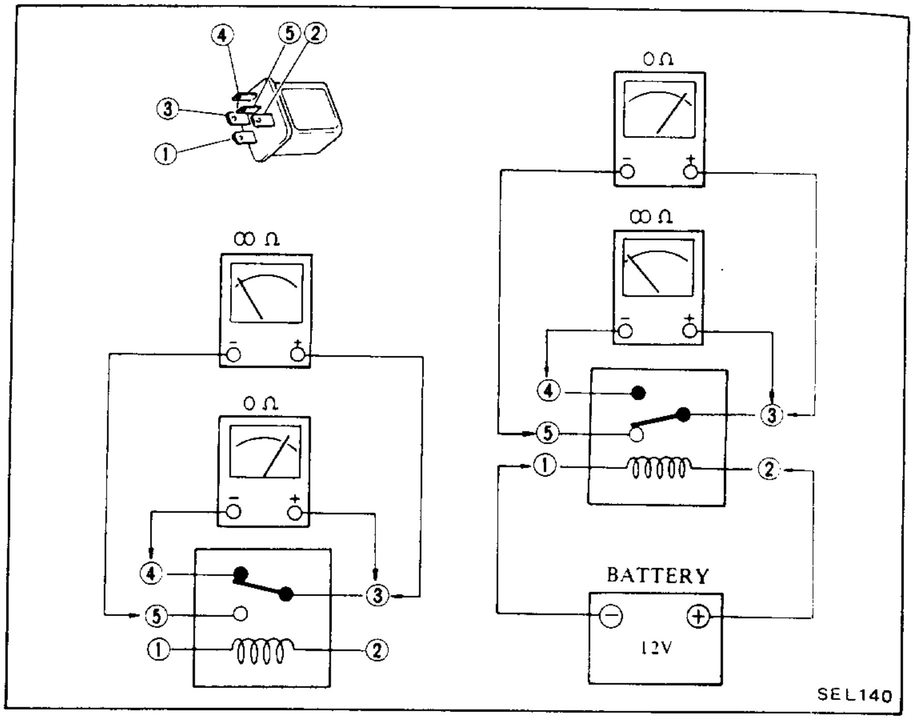


HEATER RELAY



INSPECTION

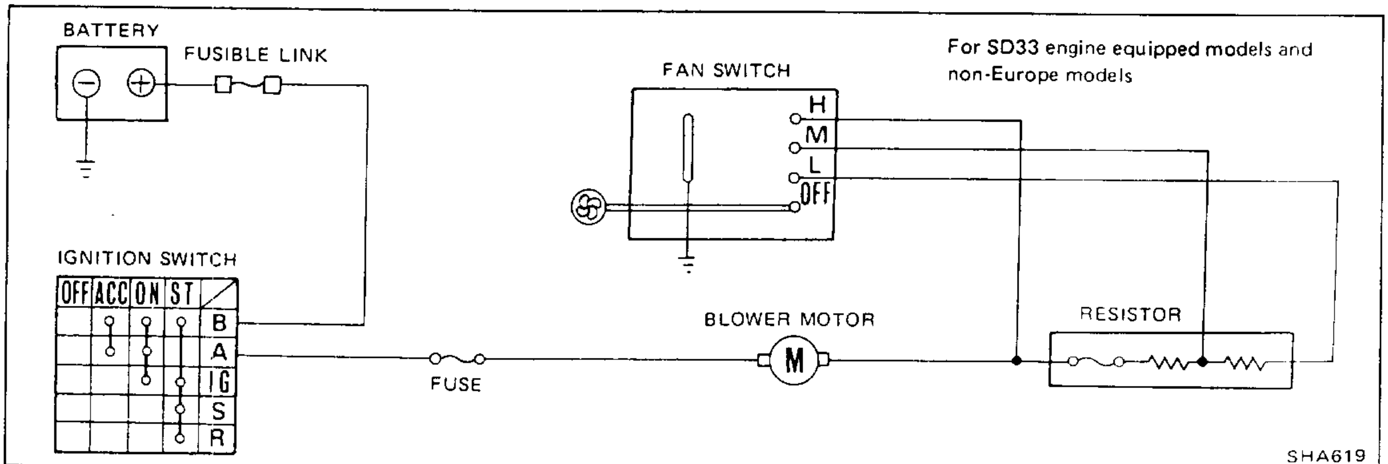
Test continuity through relay with an ohmmeter.



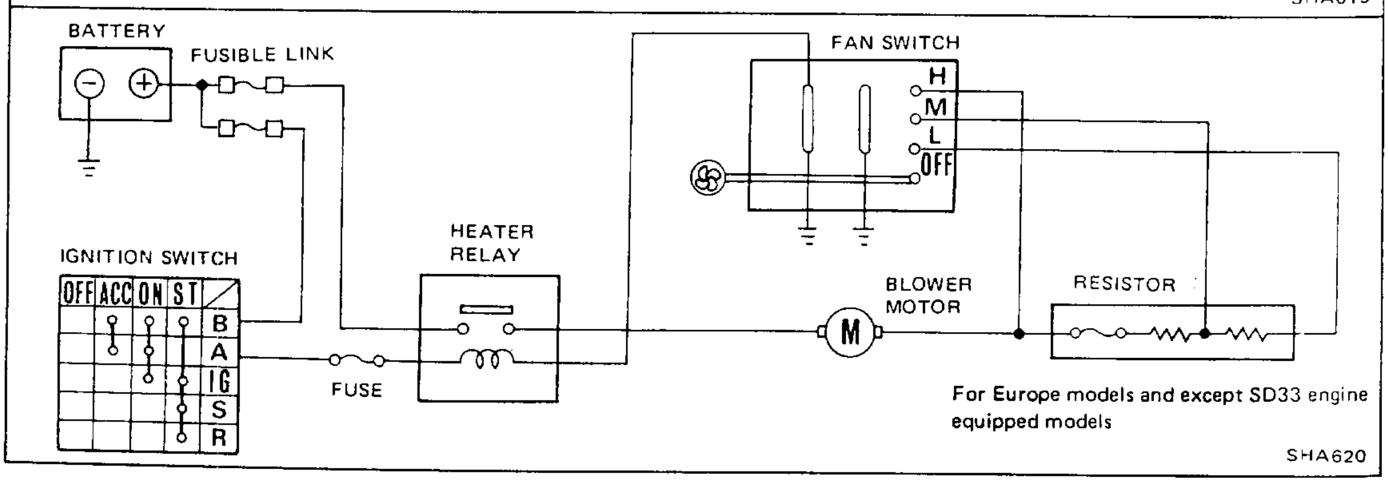
SEL140

ELECTRICAL CIRCUIT

SCHEMATIC



SHA619



SHA620

TROUBLE DIAGNOSES AND CORRECTIONS

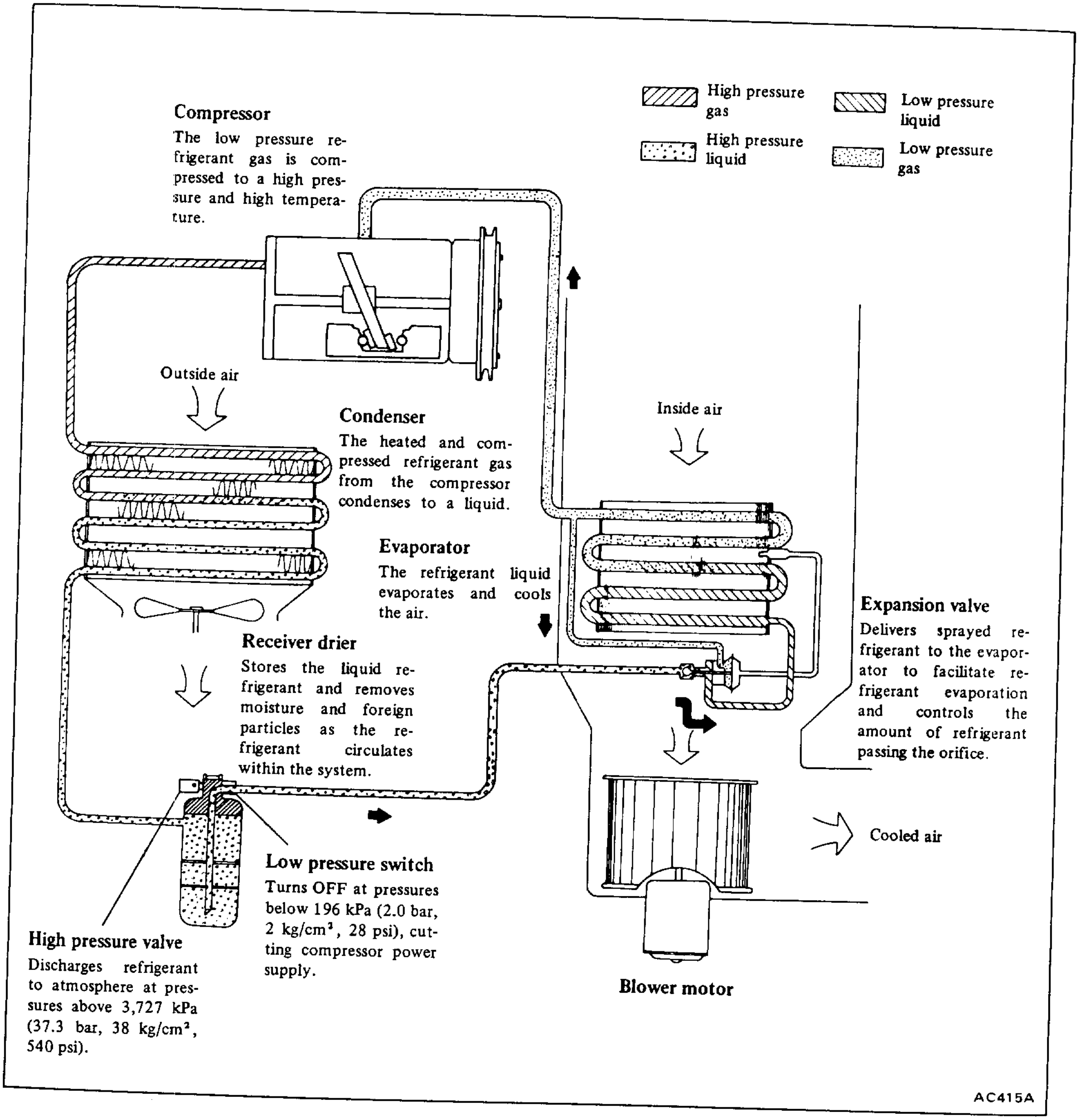
Condition	Probable cause	Corrective action
Insufficient heating performance. No heated air discharged.	Cooling water temperature too low. Heater core plugged. Insufficient cooling water level. Malfunctioning air mix door. Malfunctioning water cock.	Check thermostat. Replace as necessary. Clean. Refill. Adjust control cable. Check water cock. Replace as necessary. Adjust control cable.
Insufficient air flow to floor.	Blower motor speed too low. Malfunctioning floor door.	Check motor terminal voltage. Repair poor connection and discontinuity. Replace motor if necessary. Adjust control cable.
Insufficient defrosting performance. Cold air discharged.	Refer to "No heated air discharged".	
Insufficient air flow to defroster.	Malfunctioning floor door. Defroster nozzle plugged. Leak at defroster duct-to-nozzle connection.	Adjust control cable. Clean. Correct.
Heated air discharged in VENT and COLD position	Malfunctioning water cock. Malfunctioning air mix door.	Check water cock. Replace as necessary. Adjust control cable. Adjust control cable.
Blower motor does not operate.	Faulty fan switch. Faulty resistor. Faulty blower motor. Faulty heater relay (For 180 wattage). Burned fuse. Loose connector.	Replace. Replace. Replace. Replace. Replace. Connect securely.
Control lever drags.	Inner wire rubbing against outer case end. Control cable bent excessively. Malfunctioning doors, door levers, etc.	Adjust control cable. Correct. 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.

DESCRIPTION

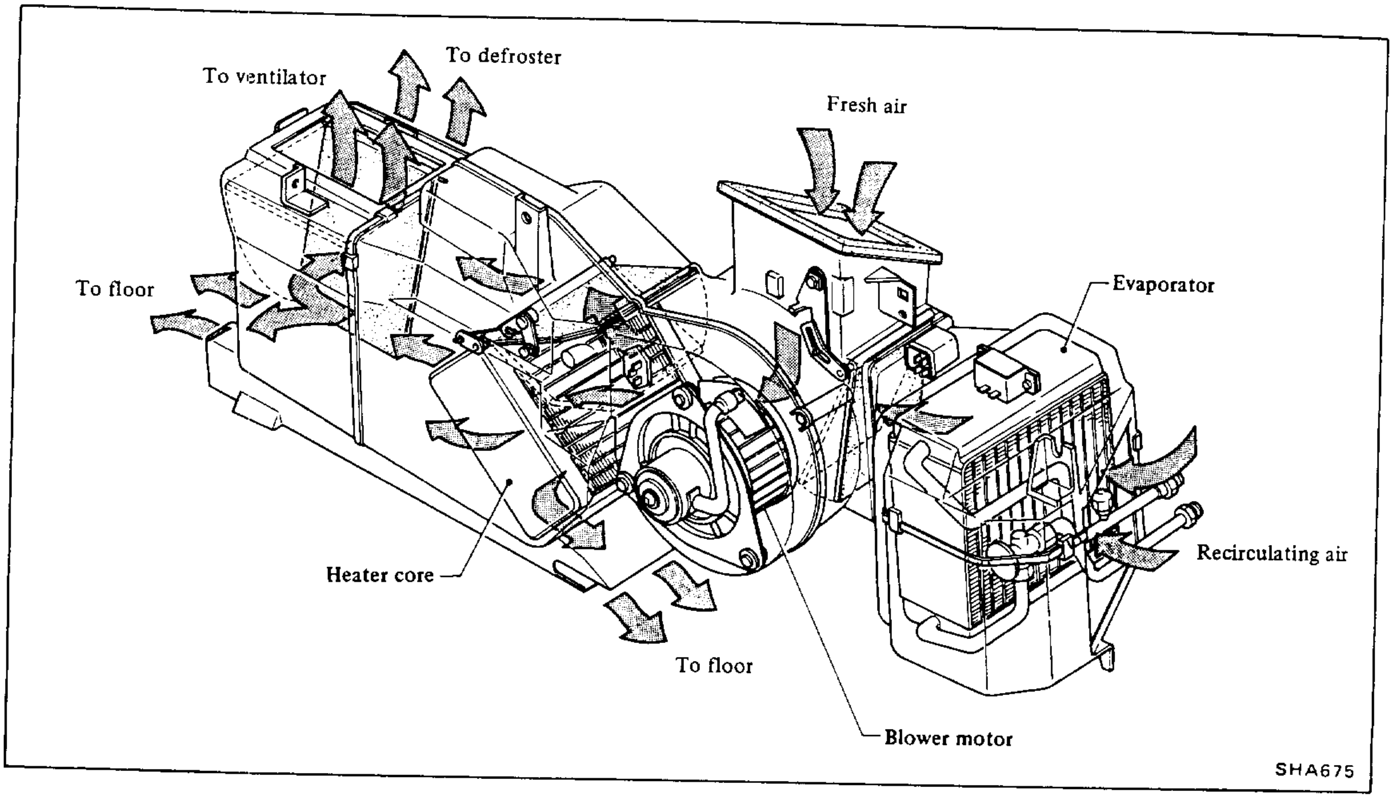
REFRIGERATION SYSTEM

If you were to paint your finger with alcohol, your finger would feel cold. This is because the liquid alcohol takes heat away from your finger while it evaporates. If a quickly evaporating liquid such as alcohol is placed in a container inside a box, the temperature inside the box will drop. This is because the alcohol is evaporated absorbing the heat from the air inside the box. If the gaseous alcohol is collected and cooled with cold water, it will be changed back into a liquid by absorption of its heat by the cold water.

The cooler operates on this principle. The liquid used is the refrigerant R-12. The heat inside the passenger compartment is absorbed by changing the refrigerant from a liquid to a gas and then dissipated to the outside by changing the refrigerant from a gas back to a liquid.

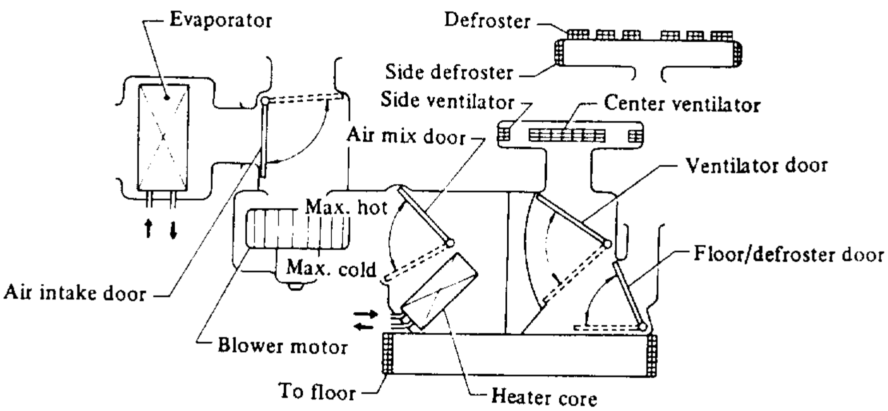


AIR FLOW



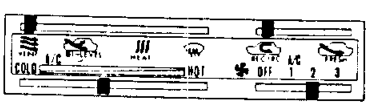
SHA675

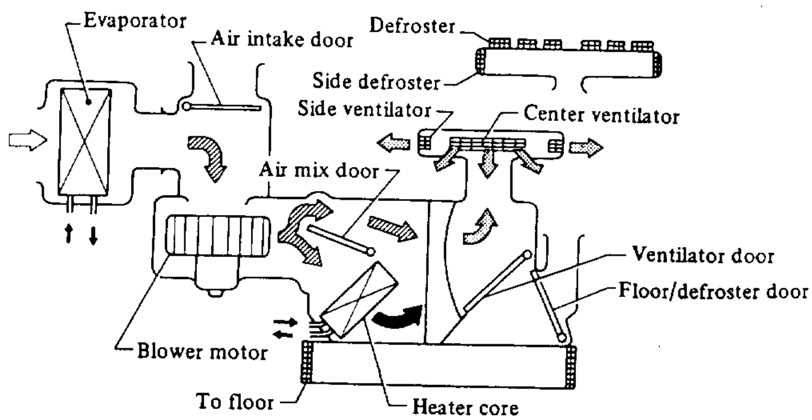
OFF



SHA601

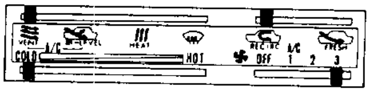
VENT-A/C-position

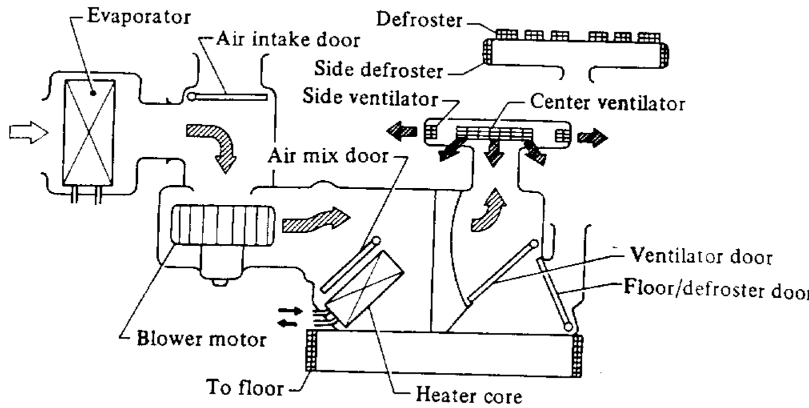




SHA602

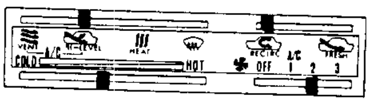
VENT-A/C-position
(Max. cooling)

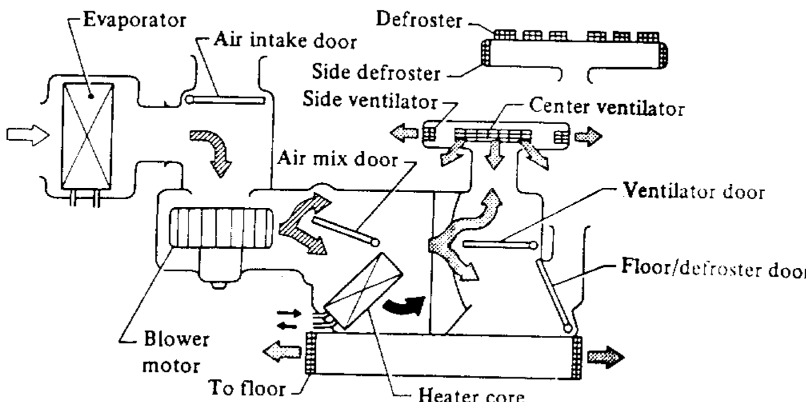




SHA603

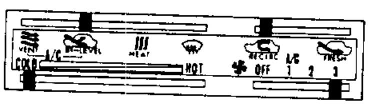
BI-LEVEL-A/C-position

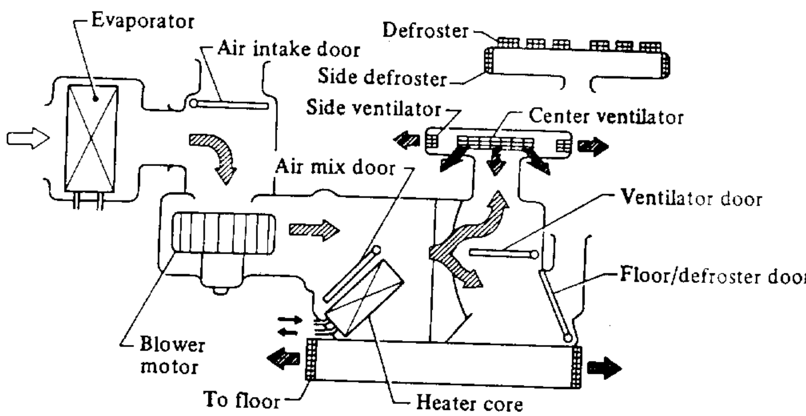




SHA605

BI-LEVEL-A/C-position
(Max. cooling)





SHA604

HEAT, HEAT (Fast heating),
and (Fast defrosting) position

Refer to Description in Heater.

GENERAL SERVICE

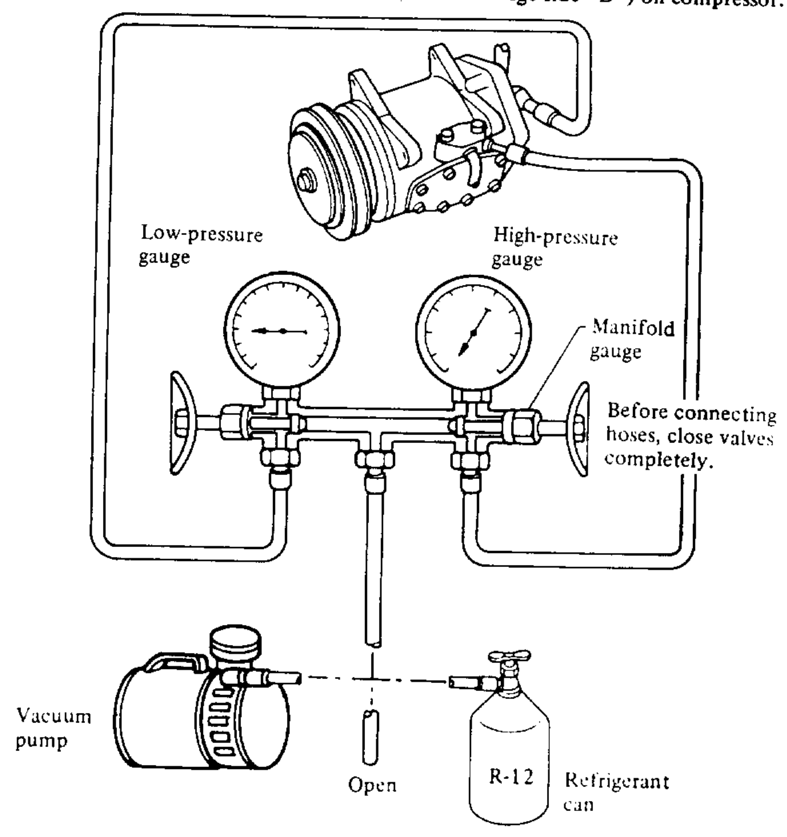
PRECAUTIONS

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.

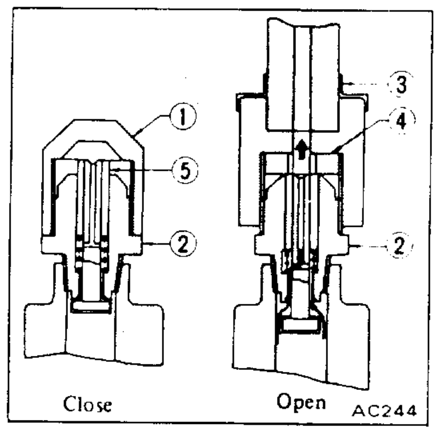
INSTALLING MANIFOLD GAUGE

Hoses for the low pressure valve (suction valve) and high pressure valve (discharge valve) should be connected securely to "high" and "low", respectively, on the manifold. Refer to identification marks (suction side; "S" discharge side "D") on compressor.



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

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.

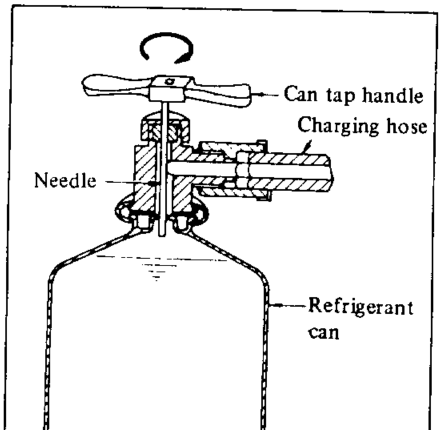
CAUTION:
Do not over-tighten valve cap.

HANDLING REFRIGERANT SERVICE CAN TAP

The following procedures apply to conventional can taps.

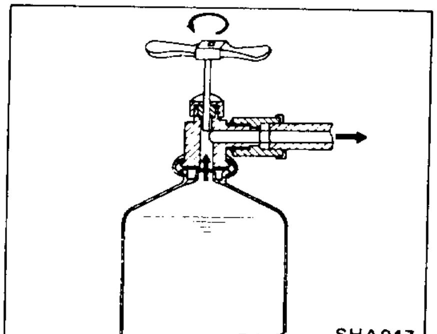
For the correct usage, refer to the manufacturer's instructions.

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.



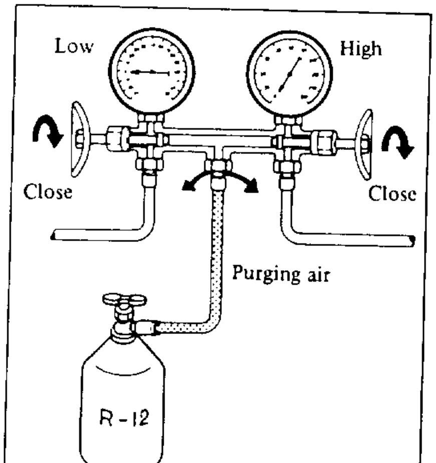
SHA046

5. Turn the handle fully counterclockwise to raise the needle. Refrigerant gas will flow up to the manifold gauge.



SHA047

6. Purge air from charging hose by loosening charging hose nut at manifold gauge.



SHA048

DISCHARGING REFRIGERANT

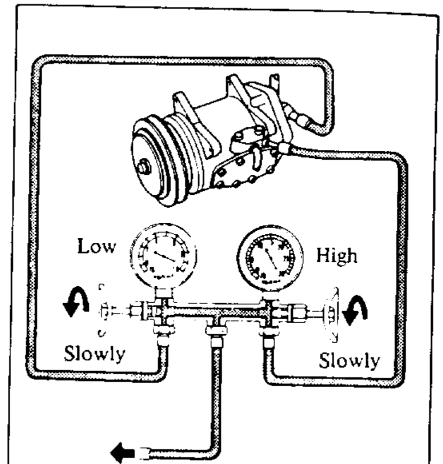
The pressurized refrigerant gas inside the system must be discharged at a pressure approaching atmospheric pressure prior to evacuating refrigerant inside the system.

1. Close high- and low-pressure valves of manifold gauge fully.
2. Connect two charging hoses of manifold gauge to their respective service valves.

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 to discharge refrigerant from system.

Do not allow refrigerant to rush out. Otherwise, compressor oil will be discharged along with refrigerant.



SHA049

EVACUATING AND CHARGING REFRIGERANT SYSTEM

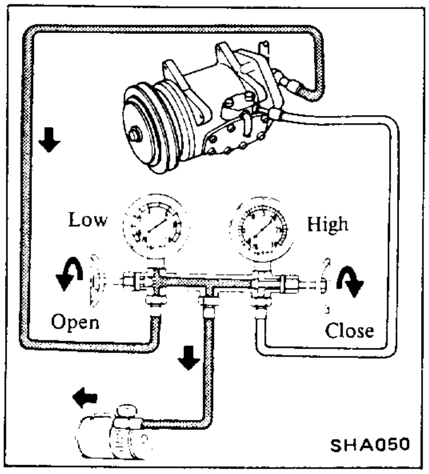
EVACUATING REFRIGERANT SYSTEM

1. Install manifold gauge on system and discharge refrigerant from system until pressure reaches atmospheric pressure.

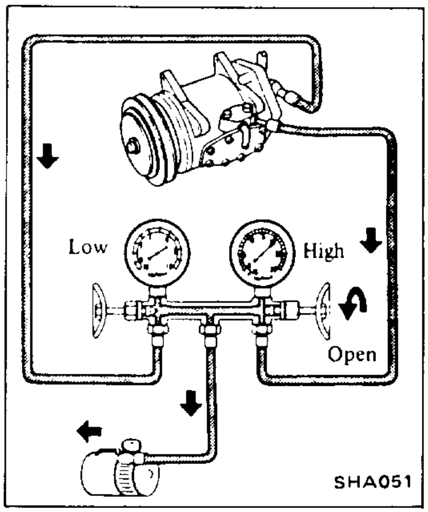
WARNING:
Securely connect high pressure (discharge) service valve to that of manifold gauge with a hose; also connect low pressure (suction) service valve to that of manifold gauge.

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 to approximately 66.7 kPa (667 mbar, 500 mmHg, 19.69 inHg), slowly open high-pressure valve.



6. When pressure inside system has dropped to 94.6 kPa (946 mbar, 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 (33 mbar, 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 (mbar, mmHg, inHg)
0 (0)	94.6 (946, 710, 27.95)
300 (1,000)	91.3 (913, 685, 26.97)
600 (2,000)	88.0 (880, 660, 25.98)
900 (3,000)	84.6 (846, 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 (33 mbar, 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).

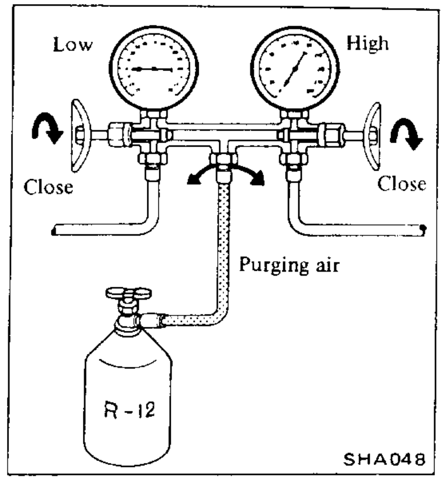
(3) Discharge refrigerant again, and then evacuate system.

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.

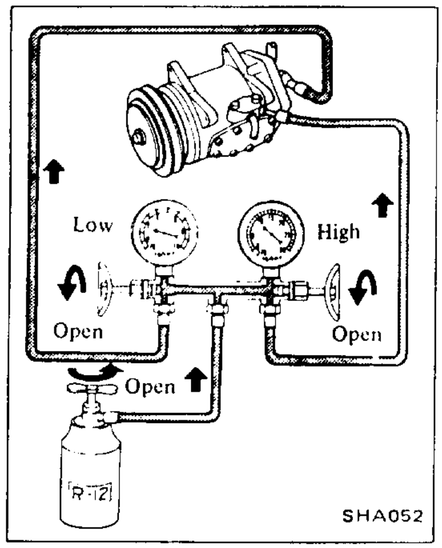
(2) Break seal of refrigerant can and purge air from center charging hose.



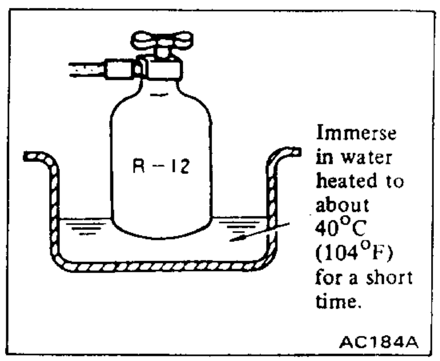
4. Charge refrigerant into system.

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.

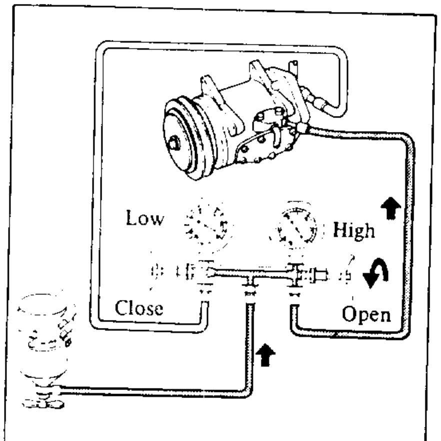


> **WARNING:**
> a. Under any circumstances the refrigerant can must not be warmed in water heated to a temperature of over 52°C (126°F).
> b. A blow torch or stove must never be used to warm up the can.

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.**



SHA053

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.

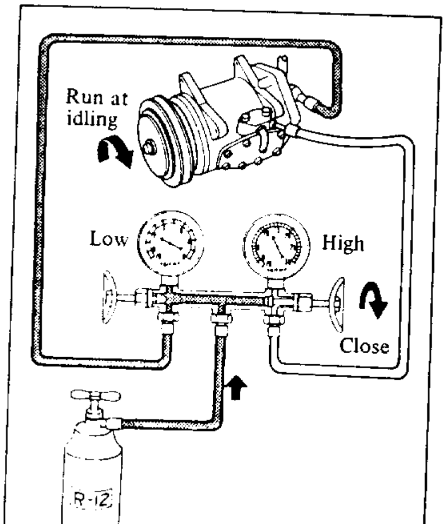
(1) **Shut off high pressure valve of manifold gauge.**

(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 (2.75 bar, 2.8 kg/cm², 40 psi) or less by turning in or out low-pressure valve of manifold gauge.

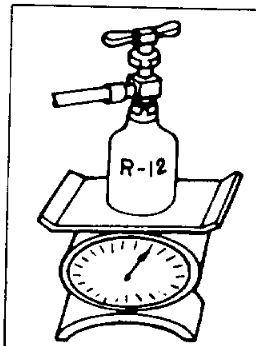
> **WARNING:**
> **Never charge refrigerant through high pressure side (discharge side) of system since this will force refrigerant back into refrigerant can and can may explode.**



SHA054

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.



Measure the amount of charged refrigerant with a scale. Make a note of the amount charged from can.
AC252

Refrigerant capacity:
1.0 - 1.2 kg
(2.2 - 2.6 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.

COMPRESSOR OIL LEVEL CHECK

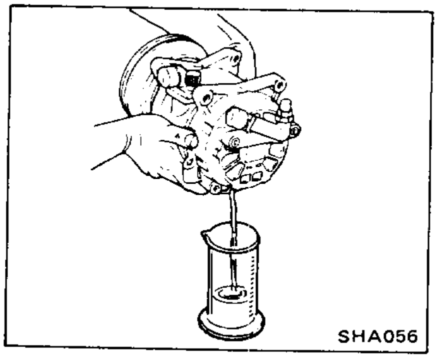
The oil used to lubricate compressor circulates into system from the oil sump while compressor is operating. Therefore, to correctly measure compressor oil, the amount of oil flowing in the system must be considered. **If a considerable amount of leakage of refrigerant gas occurs, the leakage of compressor oil is also considered.**

When checking the level of compressor oil or when replacing any component part of the system, use the following service procedure. This helps to return oil to compressor.

Dual air conditioner compressor oil should be contained in compressor and receiver drier. It is advisable to use receiver drier [filled with 70 mℓ (2.5 Imp fl oz) compressor oil] designed for use with dual air conditioner.

1. Operate compressor at engine idling speed (1,000 rpm or below), with controls set for maximum cooling and high blower speed, for 20 to 30 minutes in order to return compressor oil to compressor.

2. Stop the engine and discharge refrigerant of system and then remove compressor from the vehicle.
3. Remove compressor drain plug. Drain compressor oil from compressor oil sump and measure the amount.



SHA056

If the amount is less than specification, refrigerant may have leaked. Conduct leak tests on connections of each system, and if necessary repair or replace faulty parts.

Residual oil:
270 mℓ
(9.5 Imp fl oz)

4. Check the purity of the oil. If the oil contains chips or other foreign material, clean oil sump with new oil.
5. Discard the used oil and fill with the same amount of new oil. Add oil if found less than above amount.

If compressor is inoperative due to faulty compressor or heavy loss of refrigerant, remove compressor and repair as necessary. Then pour oil up to correct level and install on engine. After above steps have been completed, recheck oil level; drain oil to correct level if level is excessive.

PERFORMANCE TEST

PERFORMANCE CHART

TEST CONDITION

Test vehicle location	: Indoor or in the shade	Temperature lever	: Max. cold
Door windows	: Open	Fan switch	: 3rd
Hood	: Open	Engine speed	: 1,500 r.p.m.
Air lever	: A/C		

TEST READING

Compressor type : SWP123

Inside air (Recirculating air) at cooling unit inlet		Discharged air temperature at center outlet °C (°F)
Relative humidity %	**Air temperature °C (°F)**	
50	25 (77)	7.5 (46)
	30 (86)	12.4 (54)
	35 (95)	17.2 (63)
	40 (104)	22.0 (72)
60	25 (77)	9.1 (48)
	30 (86)	14.3 (58)
	35 (95)	19.3 (67)
	40 (104)	24.2 (76)
70	25 (77)	11.0 (52)
	30 (86)	16.5 (62)
	35 (95)	22.0 (72)
	40 (104)	27.2 (81)

Relative humidity %	Ambient air temperature °C (°F)	Pressure high (Discharge side) kPa (bar, kg/cm^2, psi)	Pressure low (Suction side) kPa (bar, kg/cm^2, psi)
50	25 (77)	981 (9.81, 10.0, 142)	122.6 (1.226, 1.25, 17.8)
	30 (86)	1,177 (11.77, 12.0, 171)	150.0 (1.500, 1.53, 21.8)
	35 (95)	1,383 (13.83, 14.1, 201)	191.2 (1.912, 1.95, 27.7)
	40 (104)	1,579 (15.79, 16.1, 229)	225.6 (2.256, 2.30, 32.7)
70	25 (77)	1,089 (10.89, 11.1, 158)	148.1 (1.481, 1.51, 21.5)
	30 (86)	1,324 (13.24, 13.5, 192)	191.2 (1.912, 1.95, 27.7)
	35 (95)	1,559 (15.59, 15.9, 226)	235.4 (2.354, 2.40, 34.1)
	40 (104)	1,775 (17.75, 18.1, 257)	274.6 (2.746, 2.80, 39.8)

Compressor type : SWP167

Inside air (Recirculating air) at cooling unit inlet		Discharged air temperature at center outlet °C (°F)
Relative humidity %	Air temperature °C (°F)	
50	25 (77)	4.1 (39)
	30 (86)	9.0 (48)
	35 (95)	13.9 (57)
	40 (104)	18.5 (65)
60	25 (77)	6.0 (43)
	30 (86)	11.0 (52)
	35 (95)	16.3 (61)
	40 (104)	21.3 (70)
70	25 (77)	7.8 (46)
	30 (86)	13.3 (56)
	35 (95)	18.9 (66)
	40 (104)	24.2 (76)

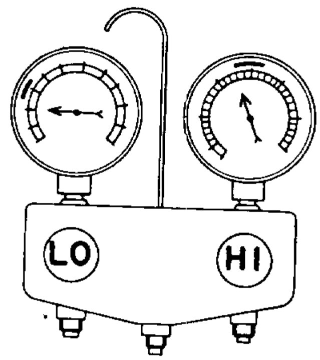
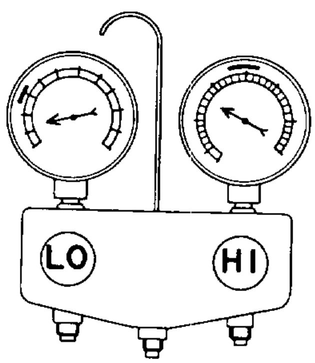
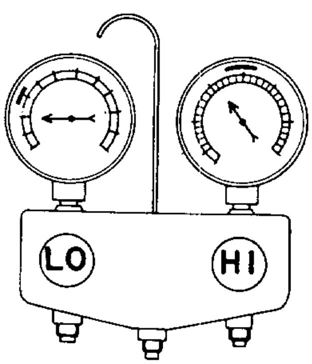
Relative humidity %	Ambient air temperature °C (°F)	Pressure high (Discharge side) kPa (bar, kg/cm^2, psi)	Pressure low (Suction side) kPa (bar, kg/cm^2, psi)
50	25 (77)	1,128 (11.28, 11.5, 164)	98.1 (0.981, 1.00, 14.2)
	30 (86)	1,393 (13.93, 14.2, 202)	137.3 (1.373, 1.40, 19.9)
	35 (95)	1,638 (16.38, 16.7, 237)	176.5 (1.765, 1.80, 25.6)
	40 (104)	1,912 (19.12, 19.5, 277)	220.7 (2.207, 2.25, 32.0)
70	25 (77)	1,275 (12.75, 13.0, 185)	122.6 (1.226, 1.25, 17.8)
	30 (86)	1,569 (15.69, 16.0, 228)	171.6 (1.716, 1.75, 24.9)
	35 (95)	1,863 (18.63, 19.0, 270)	220.7 (2.207, 2.25, 32.0)
	40 (104)	2,177 (21.77, 22.2, 316)	269.7 (2.697, 2.75, 39.1)

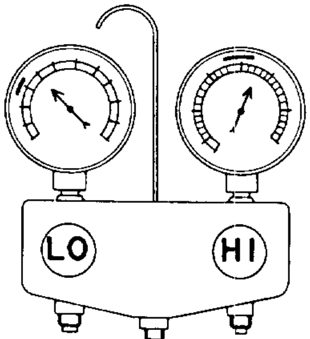
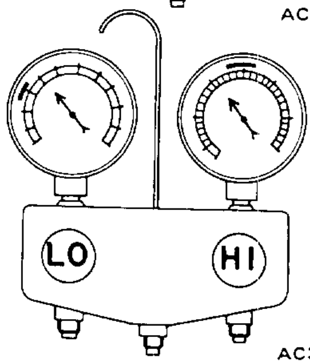
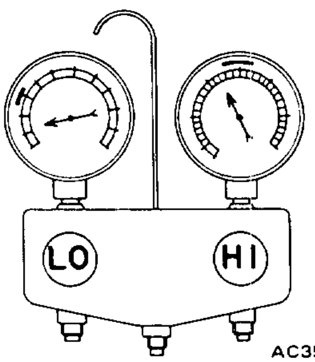
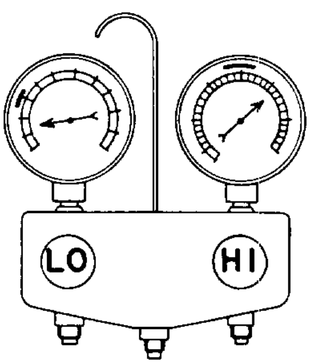
PERFORMANCE TEST DIAGNOSES

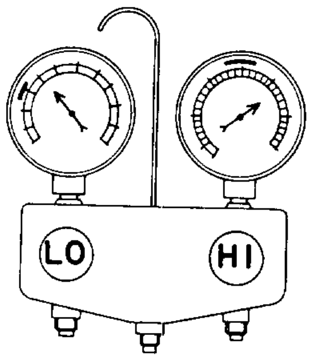
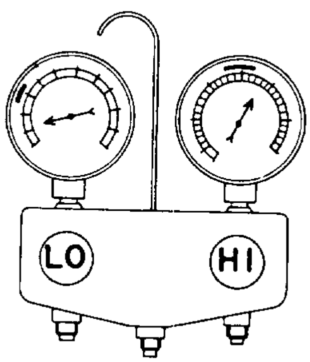
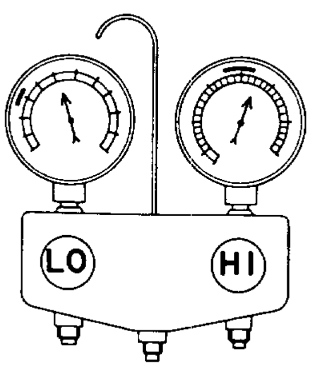
Characteristics revealed on the manifold gauge reading for the air conditioning system are shown in the following.

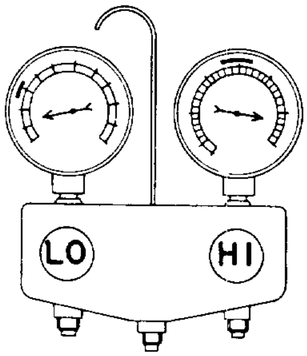
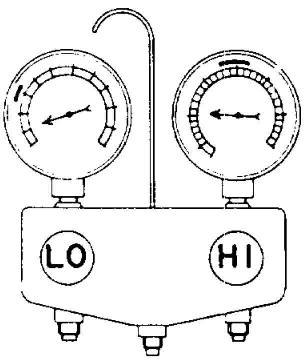
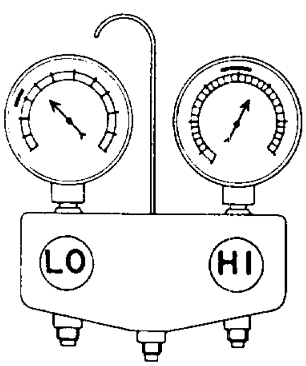
As to the method of a performance test, refer to the item of "Performance Test".

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. **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.

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.
FAULTY SUCTION THROTTLE VALVE  AC357A	Insufficient cooling. Frosted evaporator.	Suction throttle valve is inoperative.	1. Discharge system. 2. Replace valve. 3. Evacuate and charge system.
 AC358A	Insufficient cooling.	Suction throttle valve restricts refrigerant flow.	1. Discharge system. 2. Replace valve. 3. Evacuate and charge system.

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 (0.39 bar, 0.4 kg/cm^2, 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.	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.**

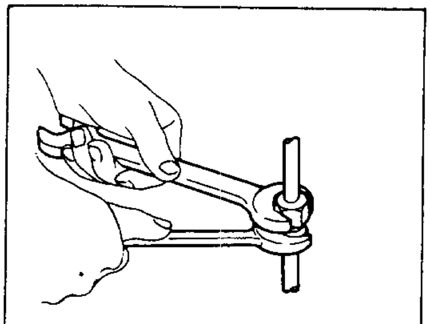
Condition		Probable cause	Corrective action
HIGH PRESSURE LINE BLOCKED  AC362A	Insufficient cooling. Frosted high pressure liquid line.	Drier clogged, or restriction in high pressure line	1. Discharge system. 2. Remove receiver drier or strainer and replace it. 3. Evacuate and charge system.
FAULTY COMPRESSOR  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.

SERVICE PROCEDURES

PRECAUTIONS FOR REMOVAL AND INSTALLATION

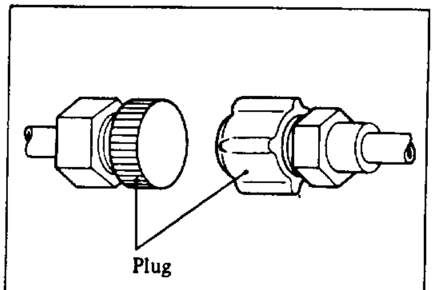
When replacing refrigerant cycle component, observe the following:

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.



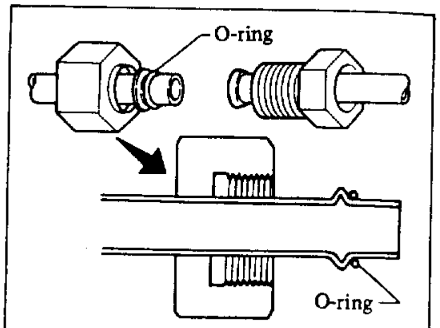
SHA057

4. After disconnecting tubes, plug all openings immediately to prevent entrance of dirt and moisture.



SHA058

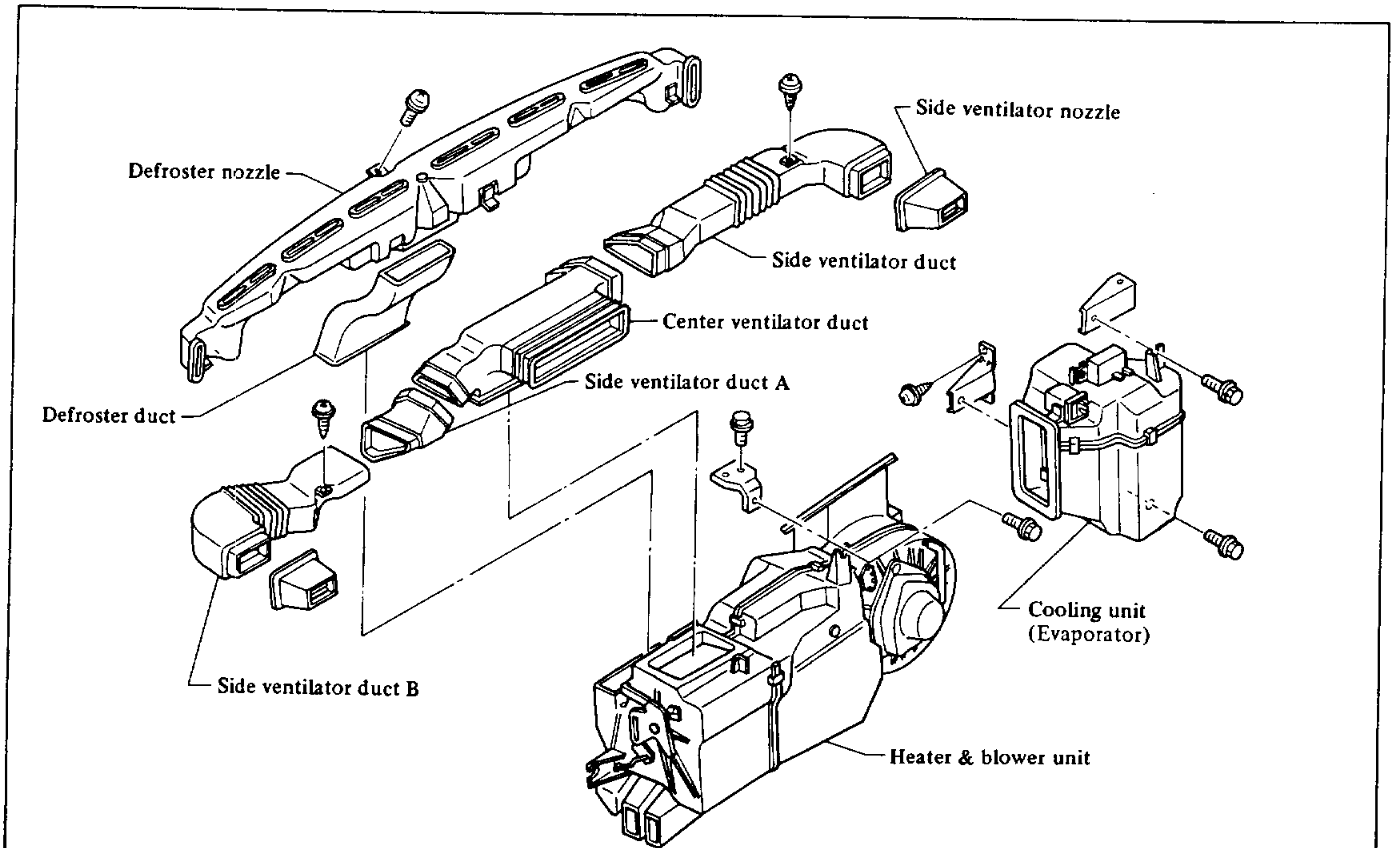
5. Compressed air must never be used to clean dirty line. Clean with refrigerant gas.
6. When connecting tubes, be sure to apply compressor oil to seating surface and O-ring.



SHA059

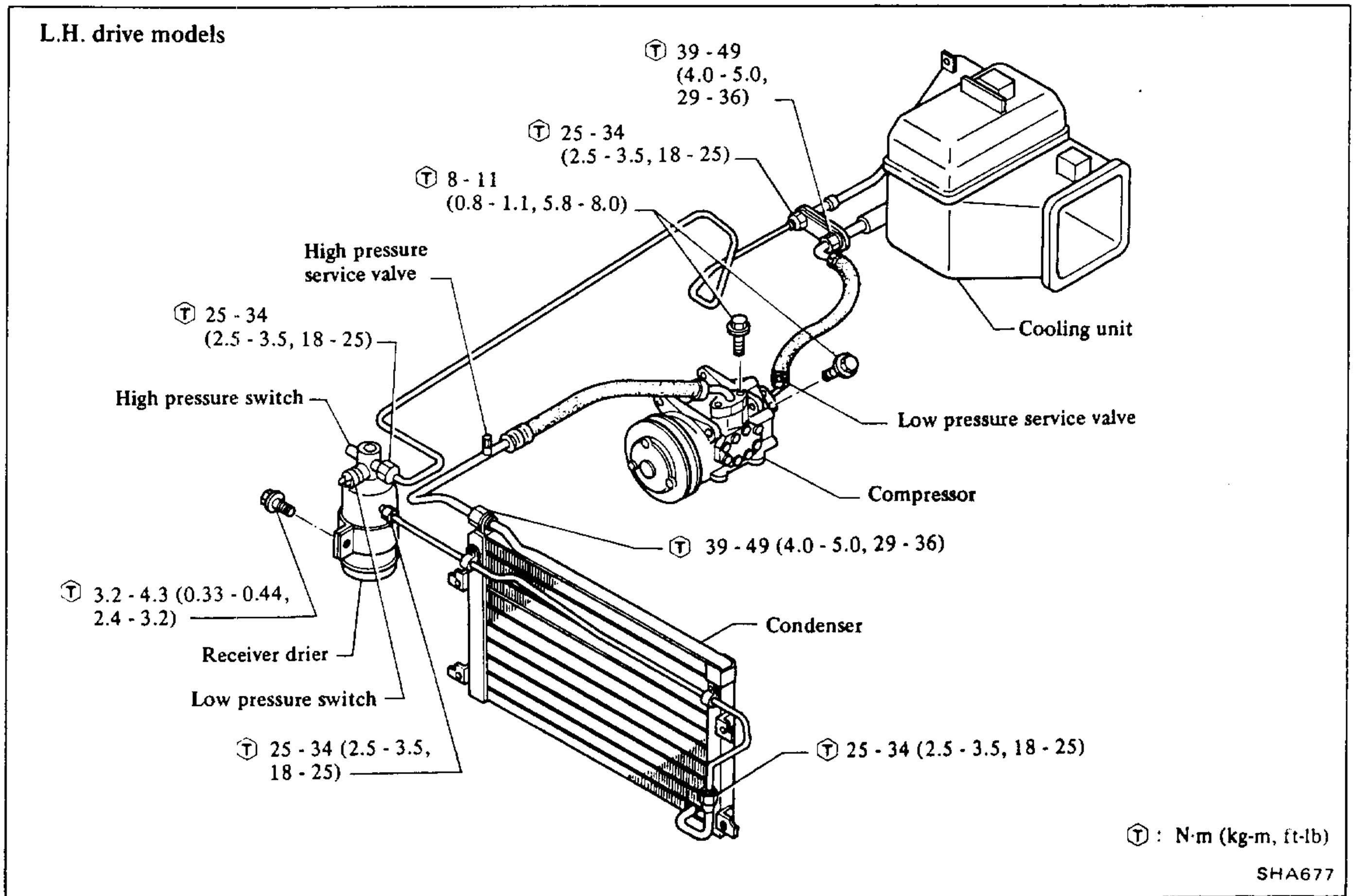
7. Check tightening torque of connections to specification.
8. Check all components to insure they are neither damaged nor interfere with adjacent parts.
9. Conduct leak test and make sure that there is no leak from connections.
10. Determine quantity of oil to be charged into compressor by referring to Compressor Oil Level Check in General Service.

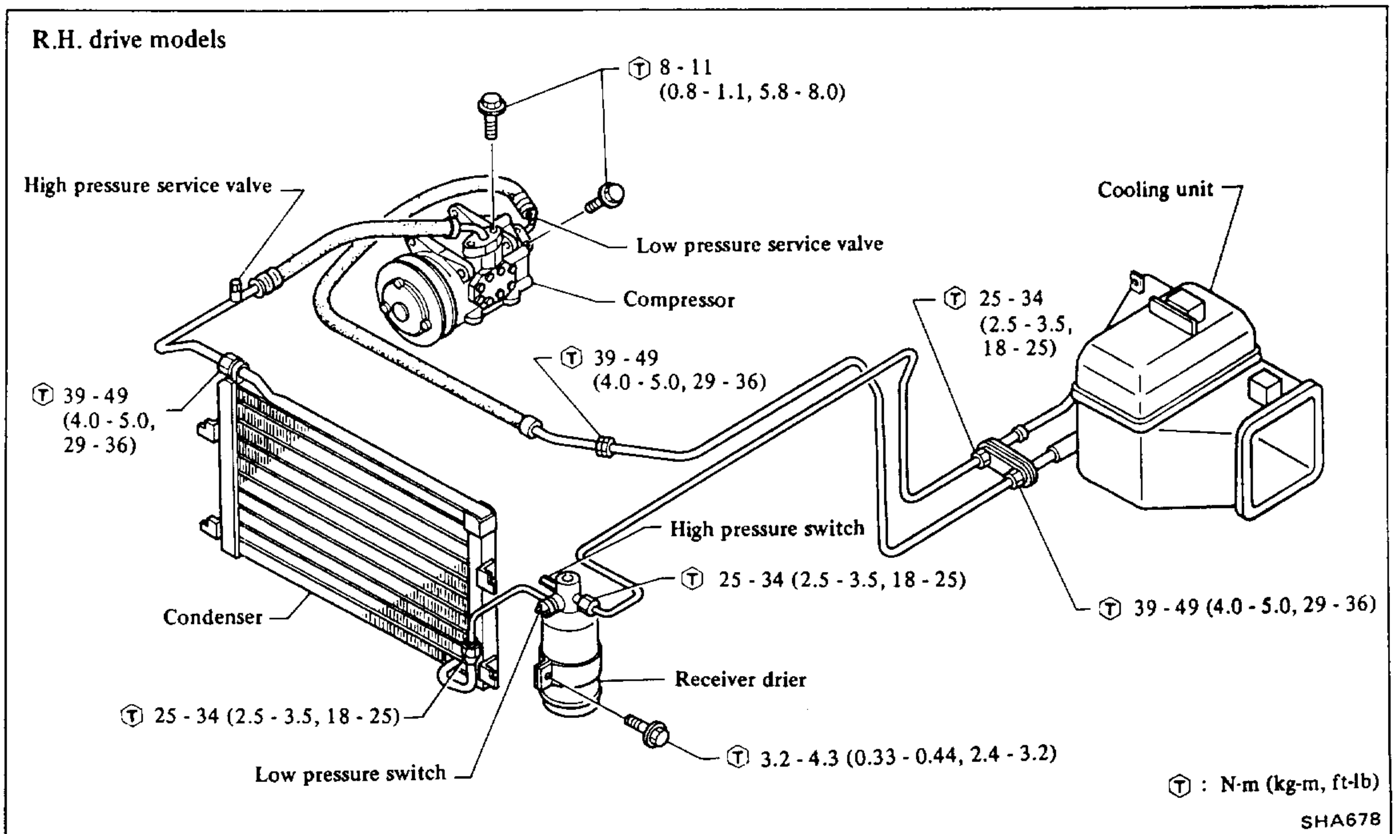
AIR CONDITIONER COMPONENTS



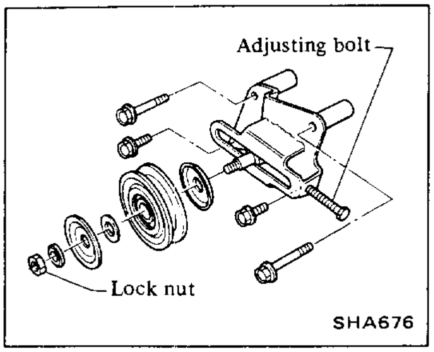
SHA643

REFRIGERANT LINES





COMPRESSOR IDLER PULLEY



FAST IDLE CONTROL DEVICE (F.I.C.D.)

ADJUSTMENT OF IDLE SPEED

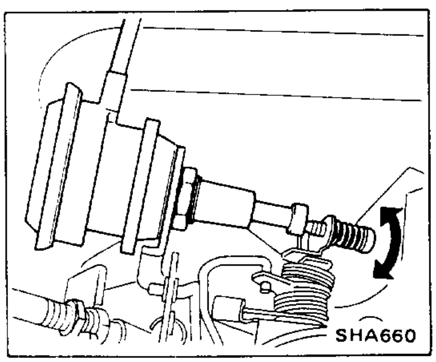
1. Warm up engine.
2. Make sure engine is at correct idle speed with air conditioner in OFF position.

Idle 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).

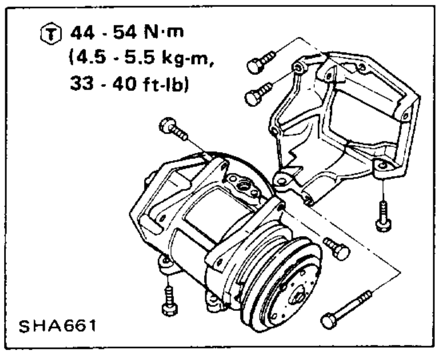
(1) To adjust, rotate adjusting screw located on accelerator lever.

Engine rpm (Air conditioner: ON)
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.

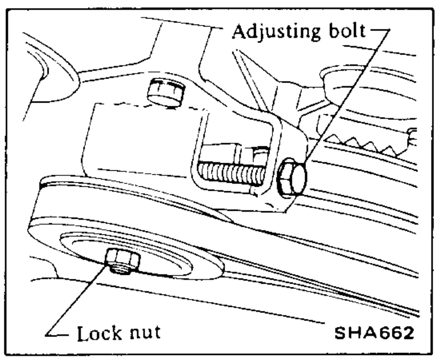
COMPRESSOR



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. Discharge system. Refer to Discharging Refrigerant in General Service.
3. Remove compressor drive belt.

(1) Loosen idler pulley lock nut.
(2) Fully loosen adjusting bolt.



4. Disconnect high (discharge) and low (suction) flexible hoses from compressor.
5. Disconnect compressor clutch harness.
6. Remove compressor.

CAUTION:
Do not attempt to leave the compressor on its side or upside down for more than 10 minutes.

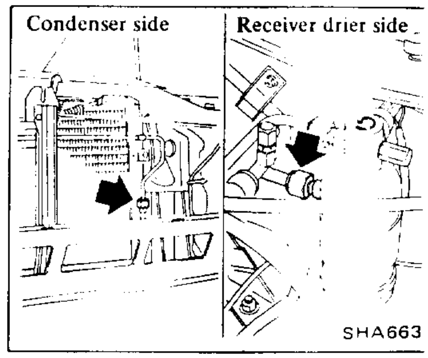
7. Installation is in the reverse order of removal.

CONDENSER

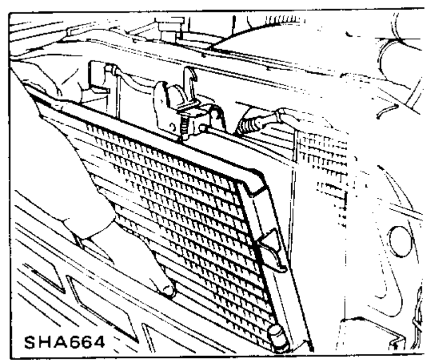
REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Discharge system. Refer to Di charging Refrigerant in General Se vice.
3. Remove radiator grille.
4. Disconnect refrigerant lines froı receiver drier and condenser.

CAUTION:
a. Use wrench to fix union on con denser, and then loosen flare nut oí refrigerant line with anothei wrench.
b. Plug up all openings in condensei and system.



5. Remove condenser.



INSPECTION

Inspect joints of inlet and outle pipes for cracks and scratches. Upoı finding any problem which may caus gas to leak, repair or replace con denser.

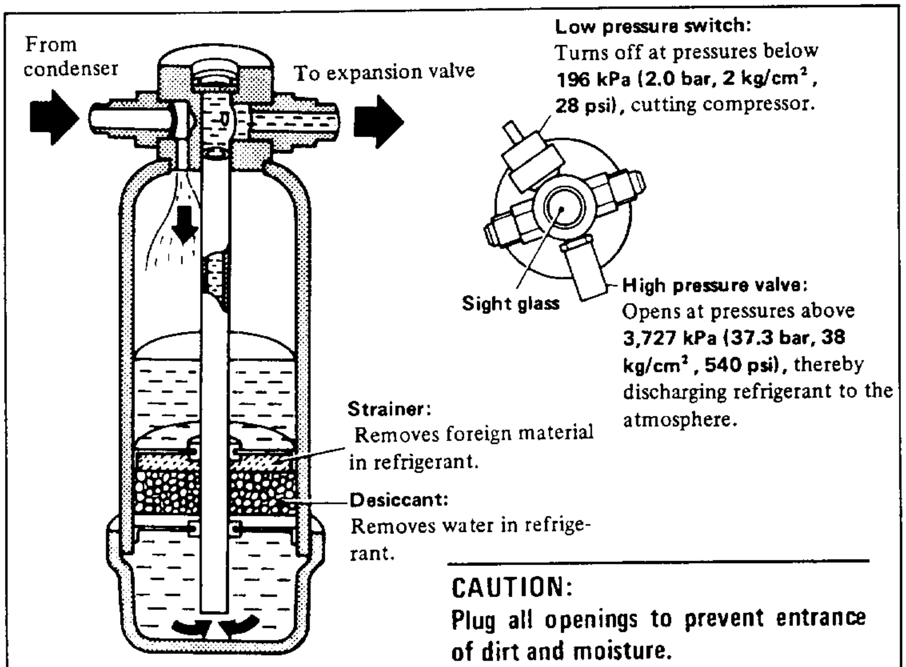
Condenser fins or air passages clogged with dirt, insects or leaves will reduce cooling efficiency of condenser. In such a case, clean fins or air passages with compressed air.

CAUTION:
Do not clean condenser with steam. Be sure to use cold water or compressed air.

5. Installation is in the reverse order of removal.

Adjust air intake control cable. Refer to Adjusting Heater Control in Heater.

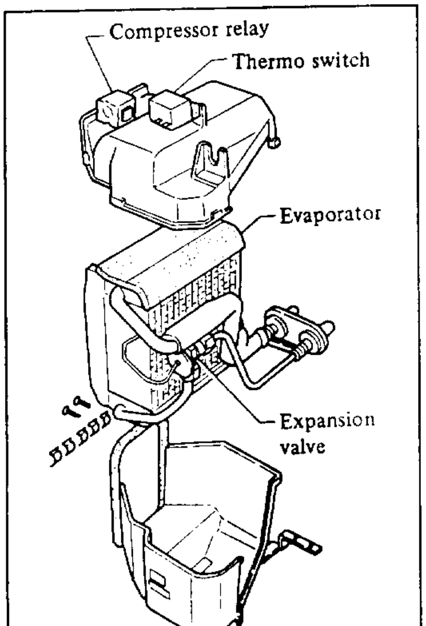
RECEIVER DRIER (Liquid tank)



CAUTION:
Plug all openings to prevent entrance of dirt and moisture.

SHA066

DISASSEMBLY AND ASSEMBLY



SHA646

AIR CONDITIONER CONTROL

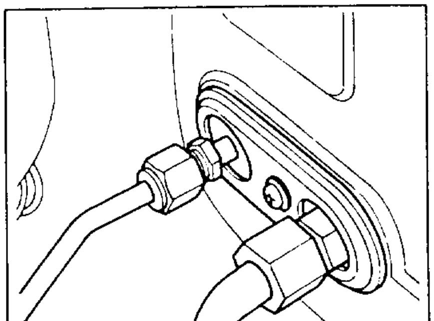
Refer to Heater/Air Conditioner Control in Heater.

COOLING UNIT

REMOVAL AND INSTALLATION

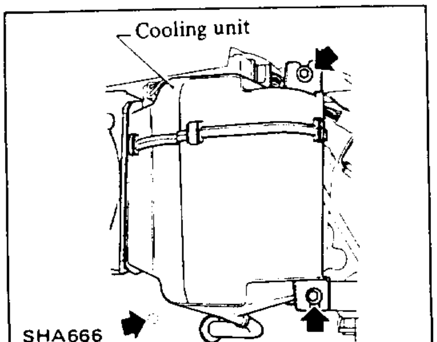
1. Remove battery ground cable.
2. Discharge system. Refer to Discharging Refrigerant in General Service.
3. Disconnect pipe.

CAUTION:
a. Use wrench to fix union on condenser, and then loosen flare nut of refrigerant line with another wrench.
b. Plug up all openings in condenser and system.



SHA665

4. Remove bolt and then remove cooling unit.



SHA666

INSPECTION

Evaporator assembly

1. Clean fins and check for crack or corrosion.

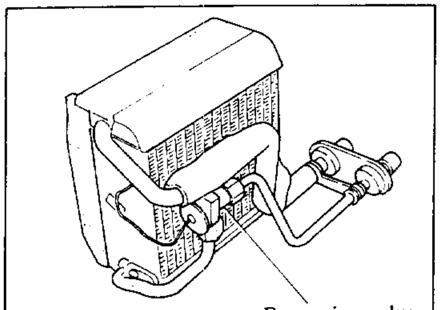
CAUTION:
Do not clean evaporator with steam. Be sure to use cold water or compressed air.

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



SHA647

THERMOSTAT

REMOVAL AND INSTALLATION

1. Remove cooling unit.
2. Remove thermostat.

CAUTION:
Capillary tube should not be bent too sharply.

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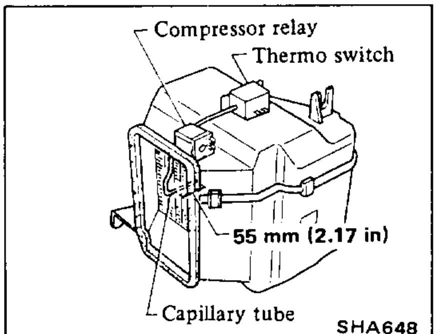
3. Install thermostat as follows.

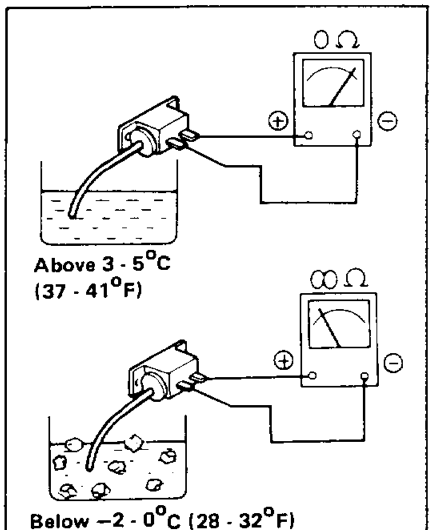
- Insert capillary tube end between the core fins at 55 mm (2.17 in) from end of the core.



SHA648

INSPECTION

Test continuity through thermostat with a test lamp or ohmmeter.

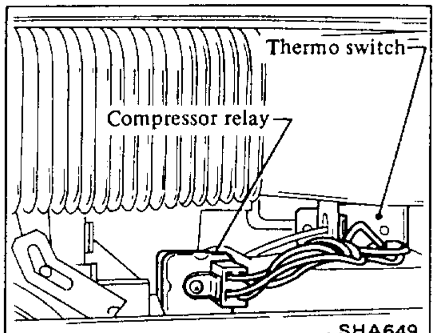


SHA248

COMPRESSOR RELAY

REMOVAL AND INSTALLATION

1. Remove cooling unit.
   Refer to Cooling Unit.
2. Disconnect relay connector and then remove relay.

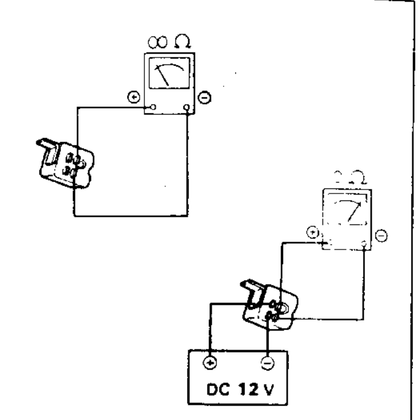


SHA649

3. Installation is in the reverse order of removal.

INSPECTION

Test continuity through switch with a test lamp or ohmmeter.



SHA250

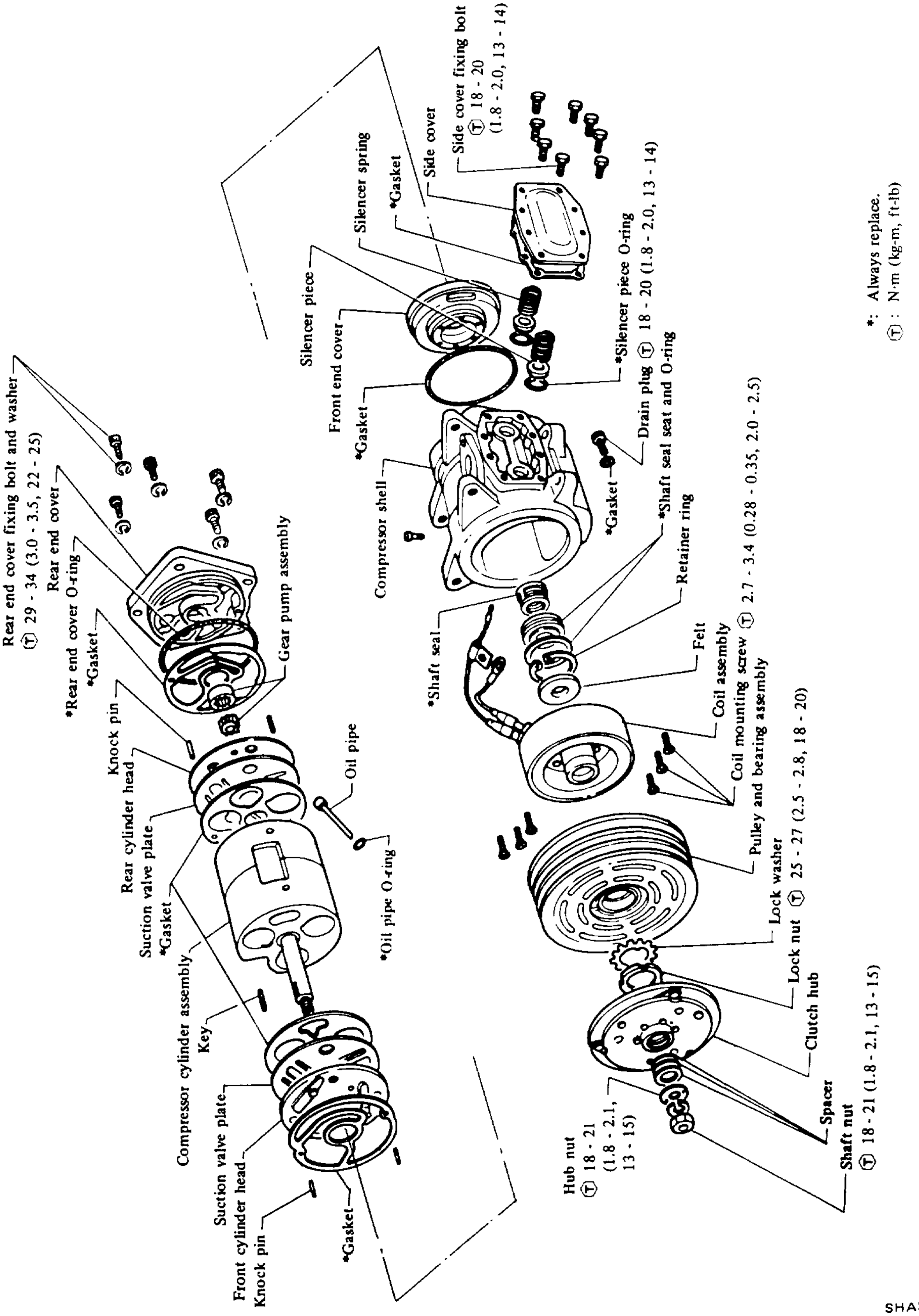
ACCESSORY RELAY

Refer to Accessory Relay in EL section.

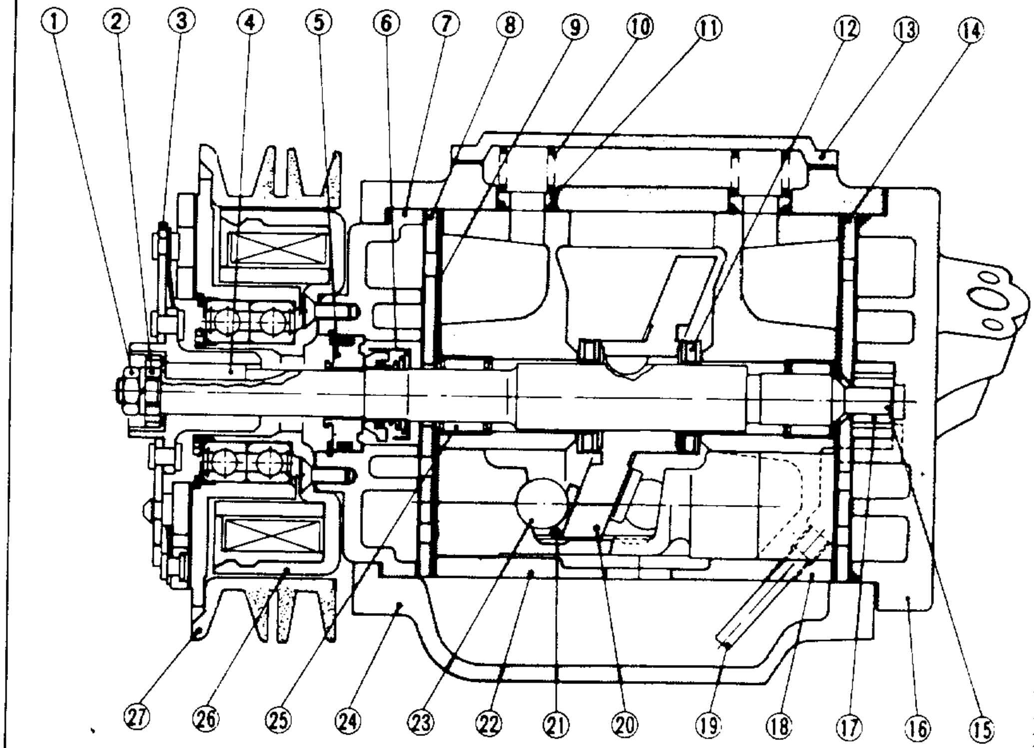
BLOWER UNIT

Refer to Blower Unit in Heater.

COMPRESSOR (Disassembly and assembly)



SHA391



1 Shaft nut
2 Hub nut
3 Clutch hub
4 Key
5 Shaft seal seat
6 Shaft seal
7 Front end cover
8 Front cylinder head
9 Suction valve plate
10 Silencer spring
11 Silencer piece
12 Thrust bearing
13 Side cover
14 Rear cylinder head
15 Compressor shaft
16 Rear end cover
17 Oil pump
18 Rear cylinder
19 Oil pipe
20 Swash plate
21 Shoe disc
22 Front cylinder
23 Drive ball
24 Shell
25 Needle bearing
26 Clutch coil
27 Pulley and bearing assembly

SHA164

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.

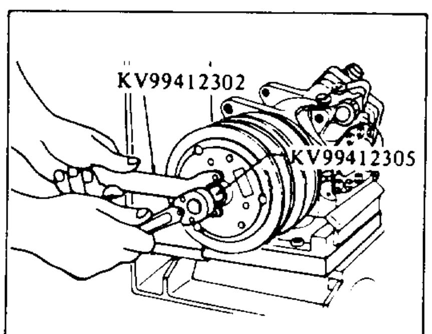
COMPRESSOR CLUTCH

The most common problem is clutch slippage. Service procedures are listed below. Exercise 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.

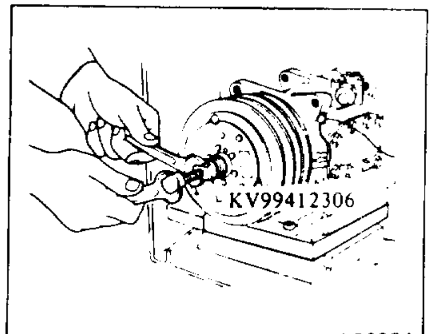
REMOVAL

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.



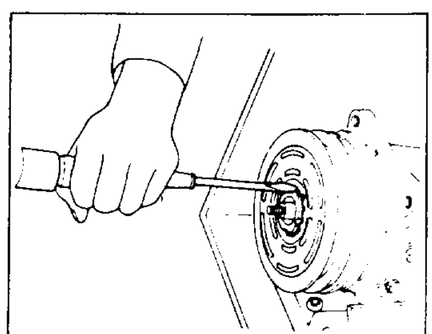
AC024A

3. Using Tool, remove clutch hub. Thread tool into the bore of clutch hub, hold tool with wrench, and then thread in center bolt.



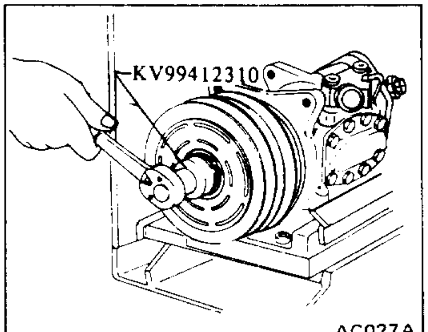
AC025A

4. With an ordinary screwdriver, flatten lock washer tab.



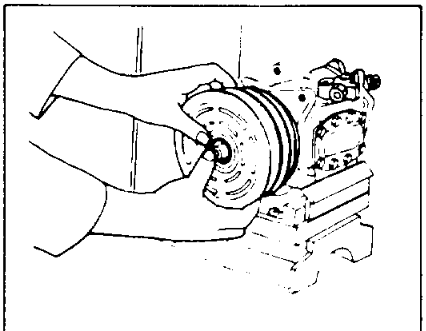
AC026A

5. Using Tool, loosen lock nut. Remove lock nut and lock washer.

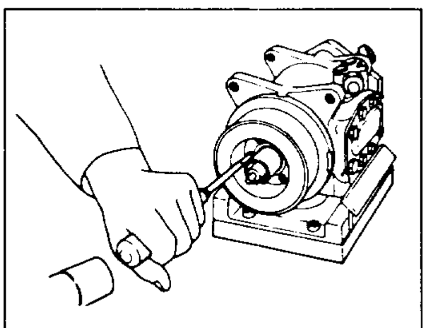


AC027A

6. Remove pulley and bearing assembly. When the assembly can not be removed by hand, use a puller, Puller Adapter KV99412313 and Puller Pilot KV99412312.


AC028A

7. Using an impact tool, loosen six coil mounting screws. Use of the impact tool is advisable as screws have been calked.


AC680

8. Remove coil mounting screws and separate coil assembly.

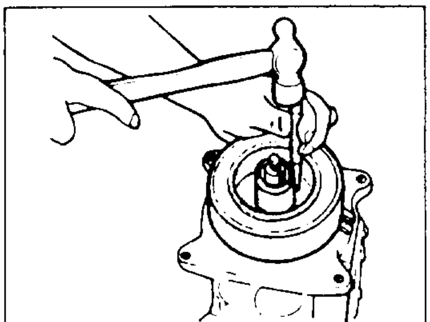
INSPECTION

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)


AC029

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.

Ⓣ : Hub nut
18 - 21 N·m
(1.8 - 2.1 kg-m,
13 - 15 ft-lb)

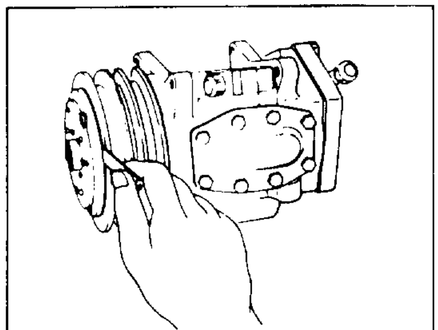
5. Tighten shaft nut with locking agent in place.

Ⓣ : Shaft nut
18 - 21 N·m
(1.8 - 2.1 kg-m,
13 - 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.


AC029A

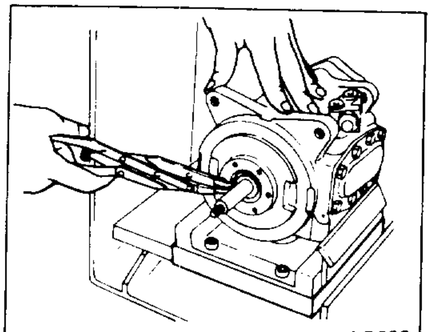
When replacing compressor clutch assembly, do not forget break-in operation, accomplished by engaging and disengaging the clutch some thirty times. Break-in operation raises the level of transmitted torque.

SHAFT SEAL

REMOVAL

1. Remove drain plug, thereby draining the oil.

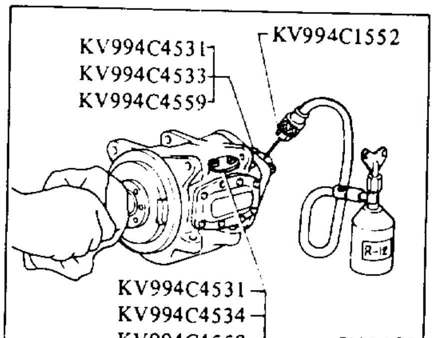
2. Remove clutch hub, pulley and bearing assembly, and coil assembly. Proceed according to information under "Compressor Clutch".
3. Using snap ring pliers, compress and remove retainer ring.



AC682

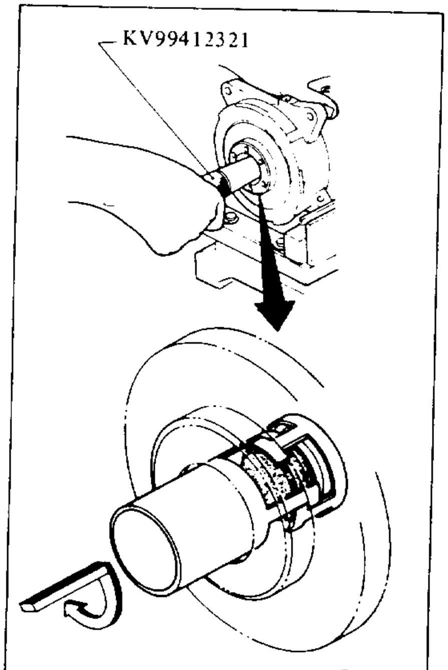
4. Plug high pressure (discharge) opening of compressor with Tools KV994C4531, KV994C4532 and KV994C4559 or blind plate and gasket located on service compressor.
5. Wrap shaft end with rag. Apply refrigerant pressure of 196 to 490 kPa (2.0 to 4.9 bar, 2 to 5 kg/cm^2, 28 to 71 psi) through low pressure line of compressor until shaft seal seat is received at rag.

CAUTION:
a. Do not use air to prevent entry of moisture, dust, etc.
b. If shaft seal seat is not plucked out, install it again applying refrigerant pressure.



SHA165

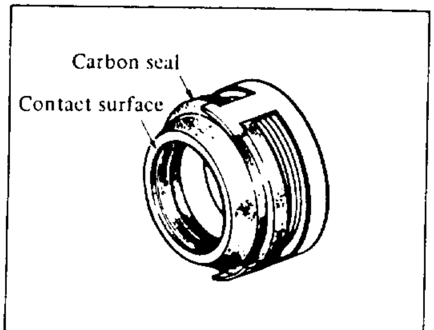
6. Insert Tool through the open end of front end cover. Depress the carbon seal and hook the Tool at the case projection of shaft seal. Slowly pull out the Tool, thereby removing shaft seal.



SHA083

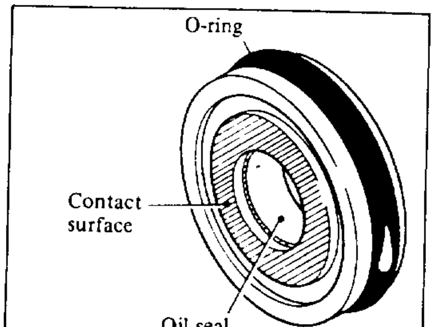
INSPECTION

1. Check the carbon seal surface of shaft seal for damage.



SHA084

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 end cover is not damaged.



SHA085

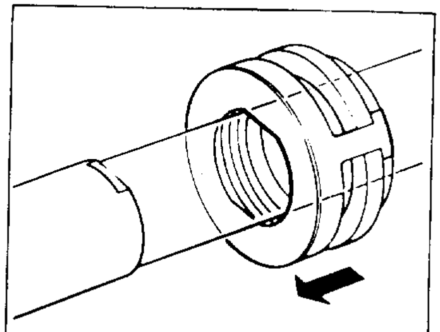
INSTALLATION

Do not re-use shaft seal seat and shaft seal.

CAUTION:
In placing a new seal 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.
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.

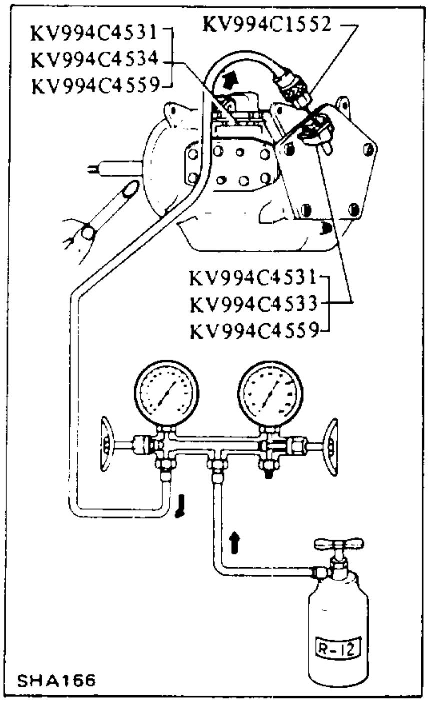


AC037

4. Fit O-ring to the outside groove of shaft seal seat, making sure that it seats properly.
5. Apply an ample coat of oil to contact surface and shaft seal seat so that seat easily slides on inner side of front end cover.

Also apply a thin coat of grease or oil to shaft. Push shaft seal seat into front end cover until it bottoms up to land.
6. Using snap ring pliers, compress retainer ring and fit it into front end cover. Seat retainer ring firmly in the groove.
7. Install Tool KV99412329 to compressor shaft and turn shaft 5 to 6 turns clockwise. Then, check for gas leakage as follows:

(1) Plug low-pressure joint into compressor with blind caps, and plug high pressure (discharge) joint into compressor with Tools KV994C4531, KV994C4532 and KV994C4559 or blind plate and gasket located on service compressor.
(2) Connect charging hose to low pressure gauge of manifold gauge and lower pressure (Suction) side of compressor.
Connect center hose of manifold gauge to refrigerant can.
(3) Open valve of can tap, charge refrigerant from low pressure side and purge air from high pressure side by loosening blind plate.
(4) Conduct a leak test. If there is a leak, remove and then install again.

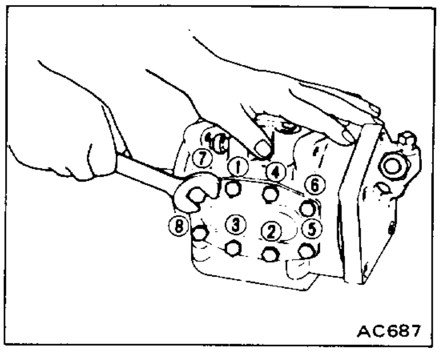


SHA166

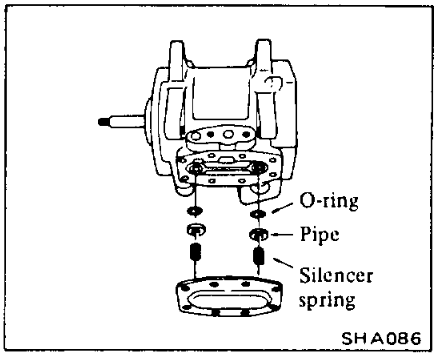
SIDE COVER

REMOVAL

1. Drain oil.
2. Loosen and remove side cover mounting bolts in an alternate pattern. Note that two silencer springs inside the cover will force up side cover.


AC687

3. Remove side cover and side cover gasket. Discard the gasket.
4. Remove silencer springs, pieces, and O-rings. Do not damage O-ring surface of silencer piece during this process. Discard used O-rings.



SHA086

INSPECTION

1. Make sure that side cover gasket surface and shell gasket surface are not damaged.
2. Make sure that silencer pieces and shell contact surfaces in contact with O-ring are not damaged.

INSTALLATION

Do not reuse old gasket and O-ring.

1. Place the mounting surface of side cover upward.
2. Make sure that holes of cylinder and shell are aligned and install O-rings.
3. Coat O-ring and the area around shell hole with an ample amount of compressor oil. Install O-ring into the shell hole with KV99412328. Then install silencer piece with Tool KV99412327.
4. Coat the gasket surface of shell with compressor oil and position gasket and side cover.
5. Hold side cover in place by hand and thread in eight mounting bolts. Tighten these bolts evenly in an alternating pattern.

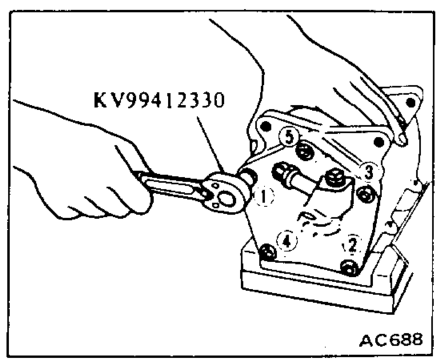
Ⓣ : **Side cover**
18 - 20 N·m
(1.8 - 2.0 kg-m,
13 - 14 ft-lb)

6. Fill with compressor oil.
7. Upon completion of the above operations, conduct a gas leak test by referring to the item "Installation" under the topic "Shaft Seal".

REAR END COVER AND REAR CYLINDER HEAD

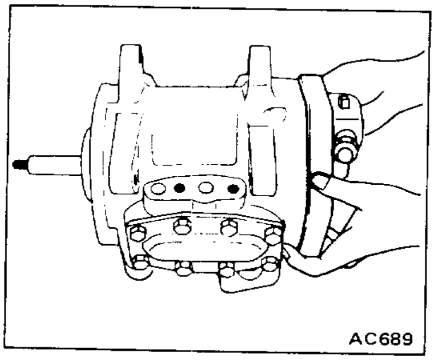
REMOVAL

1. Drain oil.
2. Remove rear end cover mounting bolts with Tool. Starting at the top, loosen all bolts one turn in an alternating pattern. Then remove bolts in turn.



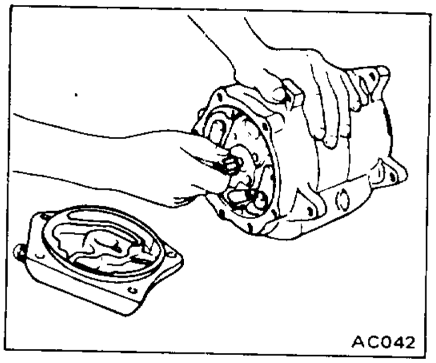
AC688

3. Grasp rear end cover and carefully separate it from compressor. Tap the flange lightly and alternately as required with a plastic mallet. **Do not tap on the compressor shaft.**



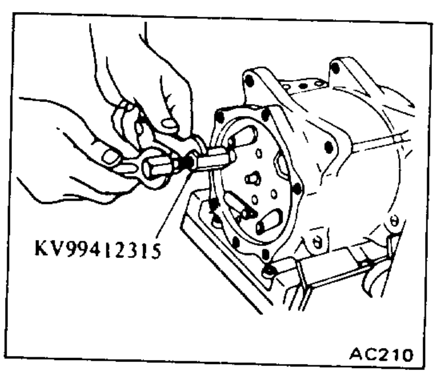
AC689

4. Remove pump gear. Do not allow pump gear to damage the surface.



AC042

5. Remove O-ring, gasket and two pins. Discard the O-ring and gasket.
6. Remove rear cylinder head, suction valve plate and gasket. Discard the gasket. Carefully remove suction valve plate, avoiding deformation.
7. When removal proves difficult, use Tool KV99412315. Insert 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.



AC210

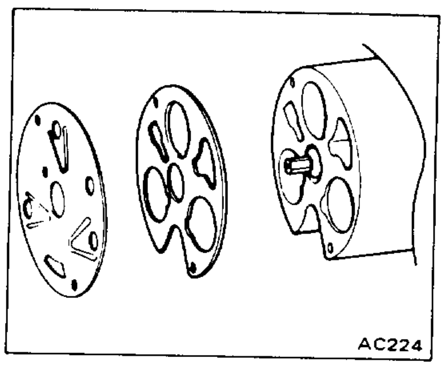
INSPECTION

1. Make sure that the gasket contact surface is free of damage.
2. If replacement of rear end cover connector and check valve is necessary, replace rear end cover with a new one.
3. Check suction valve plate and cylinder head for broken valves.
4. Check pump gear for wear and damage.

INSTALLATION

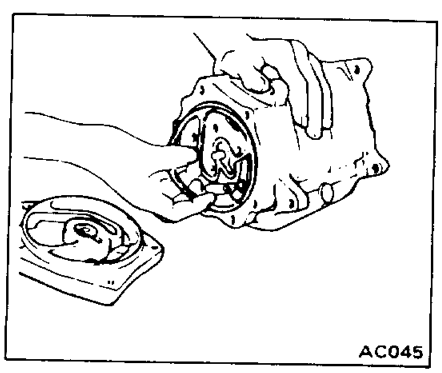
Do not reuse old gasket and O-ring.

1. Using suitable blocks, position compressor with the front face downward and the rear upward.
2. Insert two pins in the rear of cylinder.
3. Coat both surfaces of cylinder head gasket with compressor oil and align gasket with cylinder.
4. Install suction valve plate, making sure that the three valves properly align with cylinders and gasket cutouts.

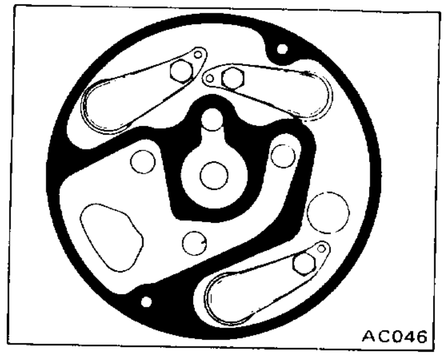


AC224

5. Install cylinder head, gasket, and O-ring in the order listed. Coat gasket and O-ring beforehand with an ample amount of compressor oil.

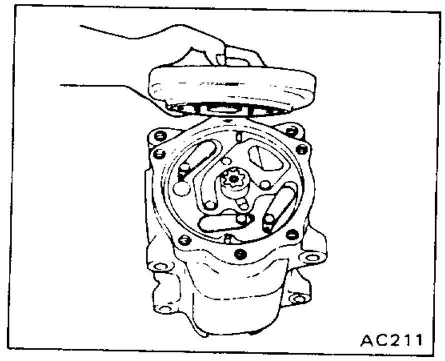


AC045



AC046

6. Fit pump gear to rear end cover.
7. Carefully fit rear end cover to the rear of compressor.



AC211

8. Tighten up bolts in an alternating pattern, starting at the top with KV99412330. Do not forget lock washers.

(T) : **Rear end cover**
29 - 34 N·m
(3.0 - 3.5 kg-m
(22 - 25 ft-lb)

9. Fill with compressor oil.
10. Upon completion of the above operation, conduct a leak test by referring to the topic under "Shaft Seal".

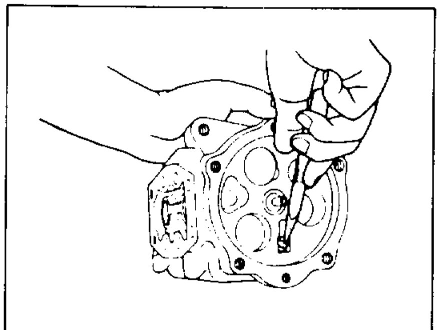
REPLACEMENT OF CYLINDER

REMOVAL

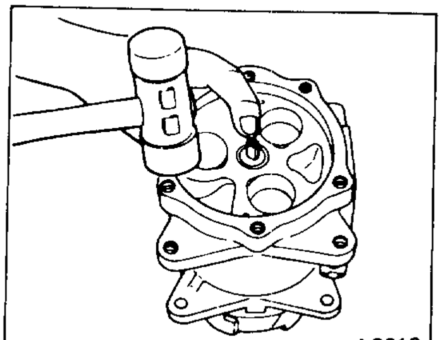
1. Drain oil.
2. Remove compressor clutch assembly. Refer to "Compressor Clutch".

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 end cover. In fact, this approach facilitates work.
4. Remove side cover. Refer to "Side Cover".
5. Remove rear end cover. Refer to "Rear End Cover and Rear Cylinder Head". Remove O-ring, gasket, two pins, cylinder head, suction valve plate, and gasket in the order listed. This exposes the rear part of cylinder.
6. Using long nose pliers or other suitable tool, pull out oil pipe. Proceed carefully as oil pipe is easily bent.

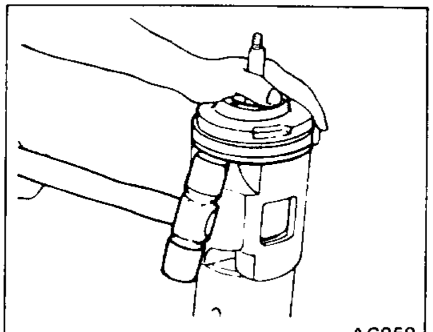
CAUTION:
Unless oil pipe has been removed, do not attempt the following steps.


AC212

7. With the front facing downward support compressor shell. Using a plastic mallet, tap at the rear end of the shell flange, driving shell straight downward. Discard front end cover gasket.


AC213

8. Detach front end cover from cylinder assembly. Using a plastic mallet, drive end cover upward. Refrain from excessive force to avoid cover damage.

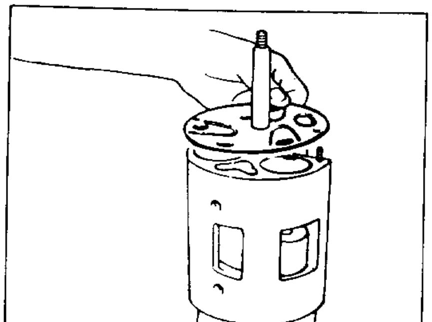

AC050

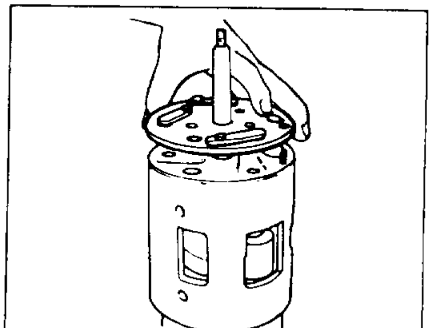
9. Remove shaft seal from the shaft.
10. Remove two pins, gasket, cylinder head, suction valve plate, and gasket. In removing two pins, proceed carefully to avoid cylinder head damage. Do not deform suction valve plate in removing suction valve plate. Discard old gasket.

CAUTION:
Do not deform suction valve plate when removing it.

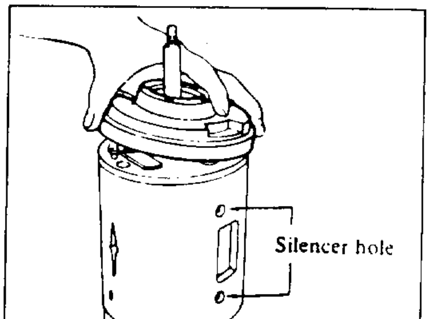
INSTALLATION

1. Using suitable blocks, face cylinder assembly upward. Insert two pins. Position gasket and suction valve plate in the order listed while making sure that three valves of suction valve plate are aligned with the cylinder and gasket cutouts. Coat gasket with compressor oil prior to assembly. Gaskets and suction valve plates are the same for front and rear. The cylinder head with the smaller numbers of holes goes to the front. Do not mix front and rear parts.


AC051


AC052

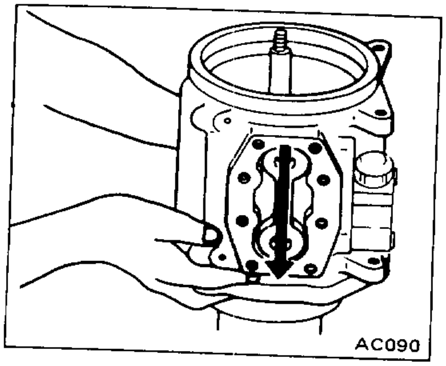
2. Align shaft seal with the shaft cutaway. Firmly seat shaft seal at the shaft land. Attempt to turn shaft seal to the left and right, confirming that it is seated properly.
3. Place gasket on cylinder head and install front end cover. Coat gasket with compressor oil beforehand. Gasket differs for the front and rear. Make sure that the correct gasket is used. After completing this work, gasket protruding from front end cover and cylinder head should be adjusted by hand.



AC053

4. Fit gasket to front end cover. Then bring the shell into place over the cylinder assembly. At this time,

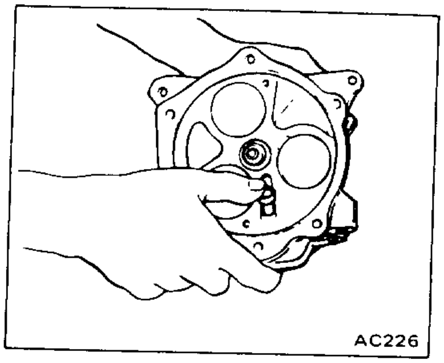
make sure that the two holes of side cover and the cylinder holes are matched. Note that later adjustment will no longer be possible, as inside and outside diameters of these are not perfectly round. Note that moving the shell up and down may cause the gasket to slip out of place.



AC090

5. Turn over the assembled shell and cylinder assembly, so that the front faces downward.

6. Coat oil pipe and O-ring with an ample amount of oil. Insert oil pipe at the rear of the cylinder. After making sure that the hole lines are matched as specified in step (4), continue with step (6) work.



AC226

7. Continue with work up to installation of rear end cover, according to "Installation" under "Rear End Cover and Rear Cylinder Head".

8. Continue with work up to installation of side cover, according to "Installation" under "Side Cover".

9. Install shaft seal seat according to instructions in "Installation" under "Shaft Seal".

10. Install and adjust compressor clutch according to instructions in "Installation" under "Compressor Clutch".

11. Fill with compressor oil, and tighten oil plug with copper gasket in place.

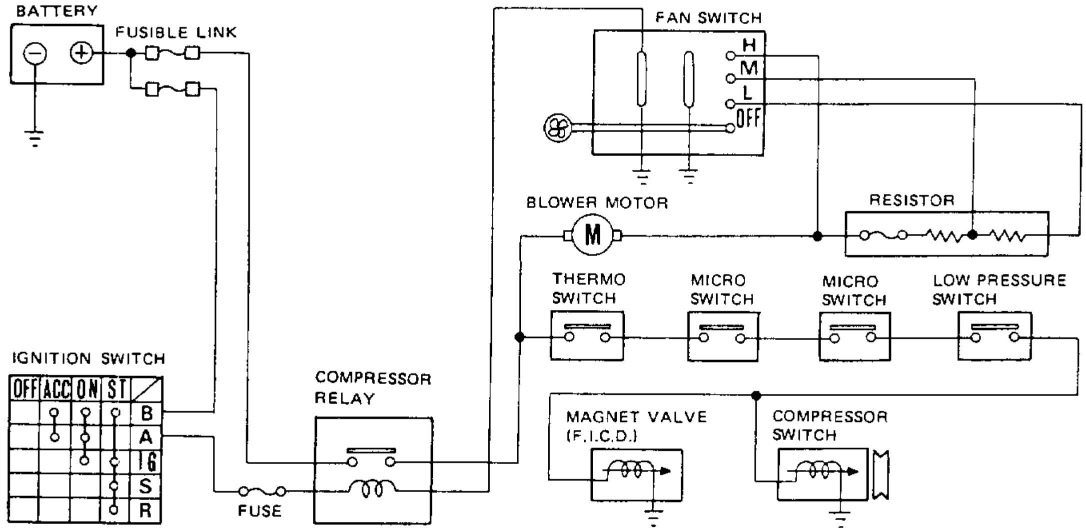
Ⓣ : **Oil plug**
18 - 20 N·m
(1.8 - 2.0 kg-m,
13 - 14 ft-lb)

12. Conduct a leak test by referring to the topic under "Shaft Seal".

ELECTRICAL CIRCUIT

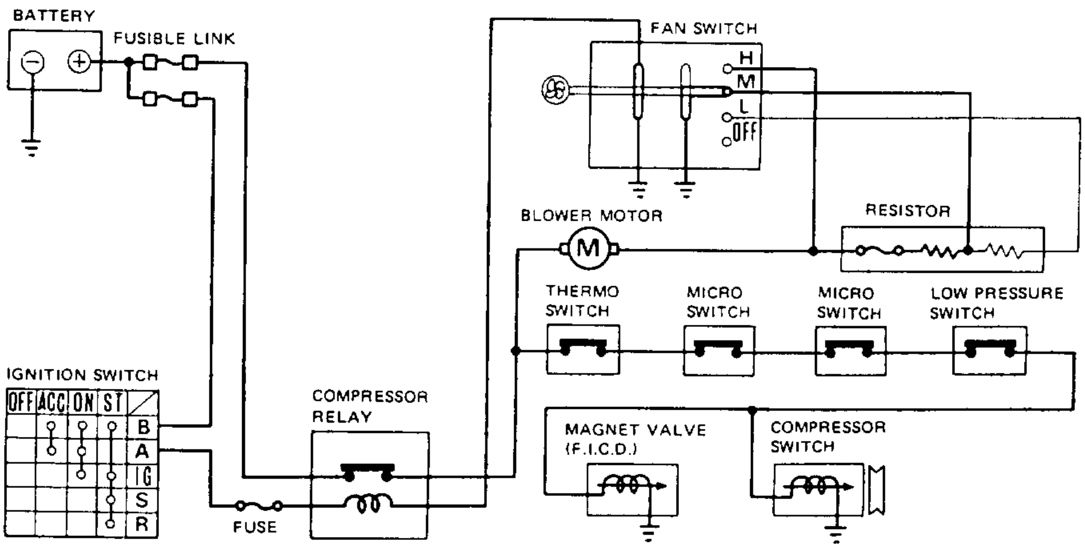
SCHEMATIC

OFF



SHA613

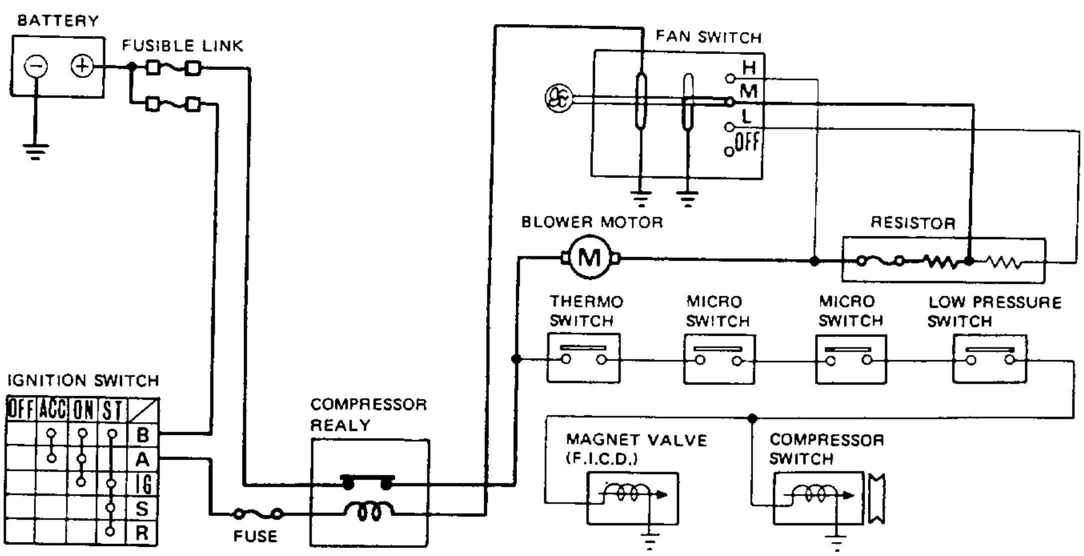
VENT AND BI-LEVEL position



Note: Cooler compressor operates only when intake door is in "RECIRC" position.

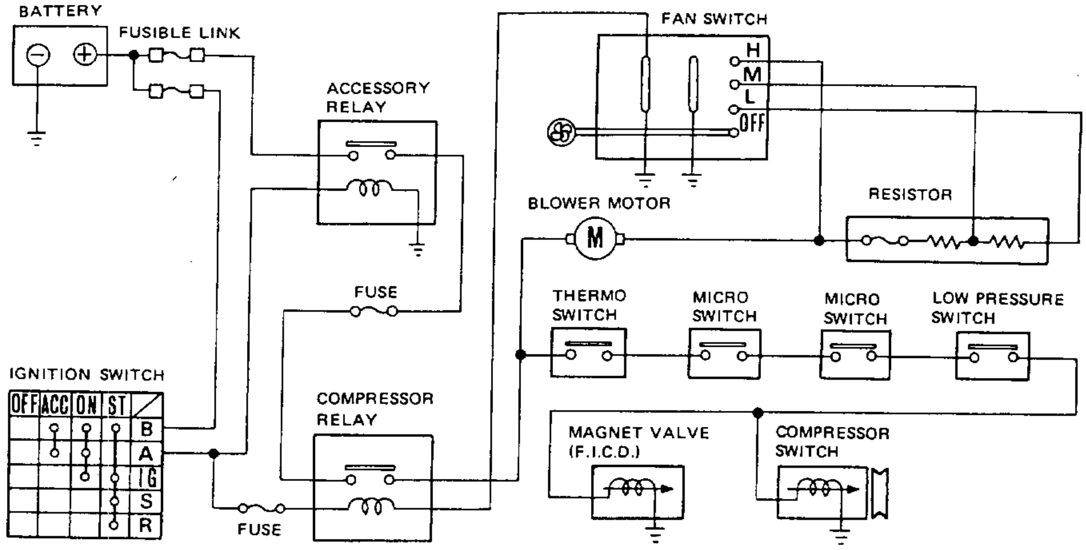
SHA615

HEAT AND position



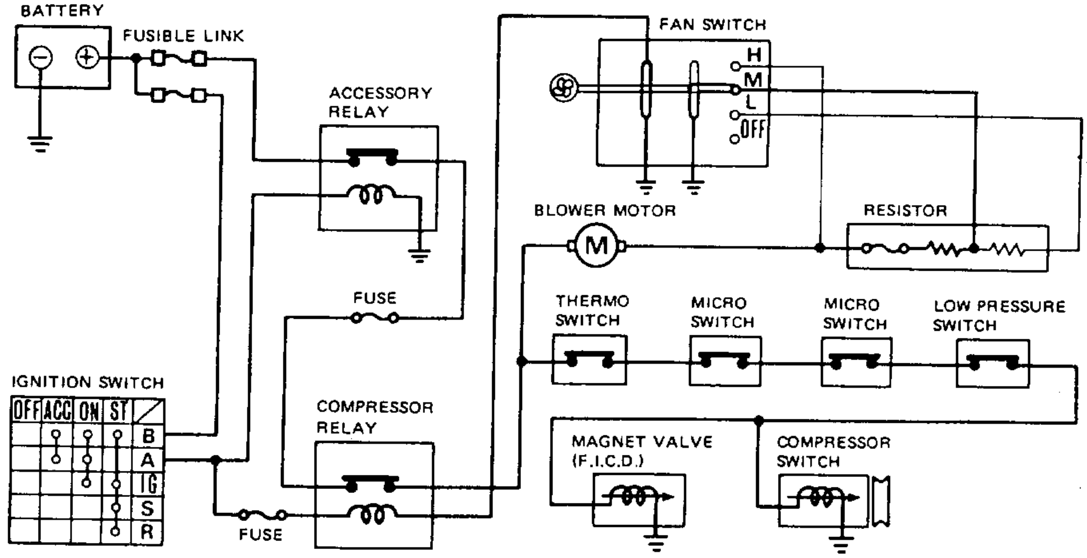
SHA614

OFF



SHA616

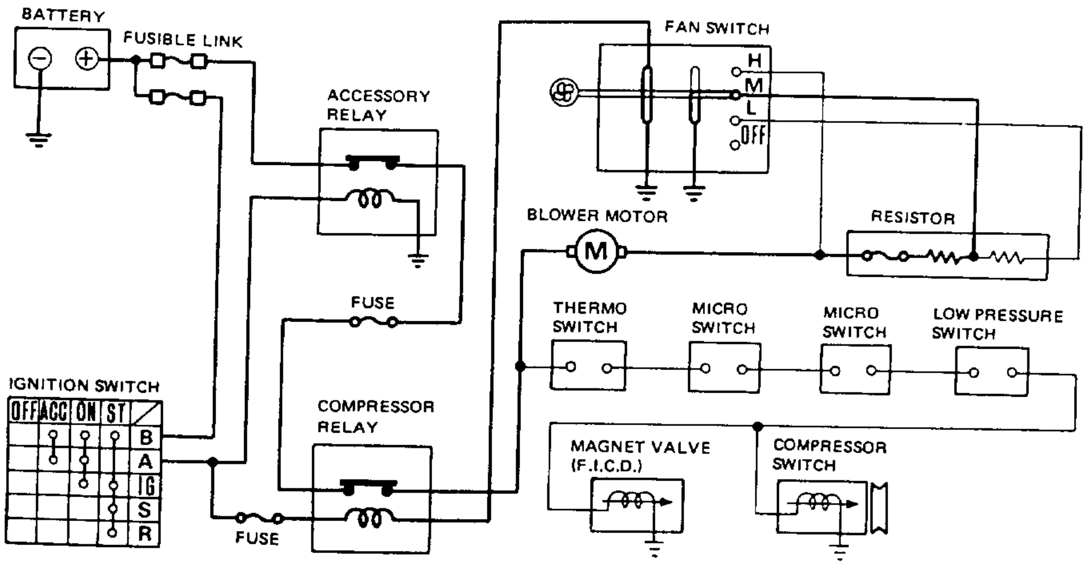
VENT, BI-LEVEL, AND A/C position



Note: Cooler compressor operates only when intake door is in "RECIRC" position.

SHA617

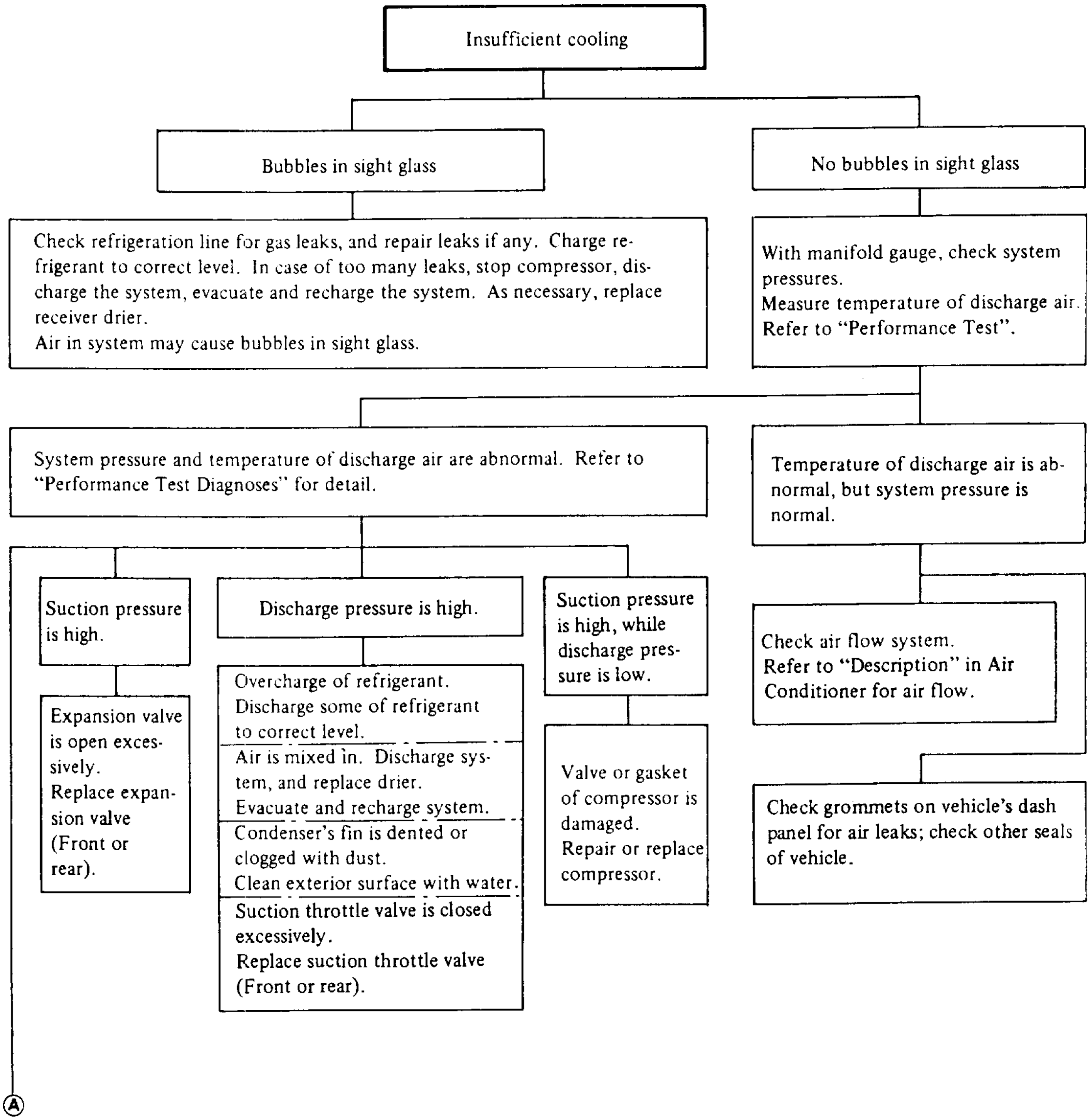
HEAT AND 🄦 position



SHA618

TROUBLE DIAGNOSES AND CORRECTIONS

AIR CONDITIONER DIAGNOSES



Ⓐ

- Suction pressure is low.
  - Pipe at receiver drier outlet has low temperature. Receiver drier is restricted. Replace receiver drier.
  - Fin and tube of evaporator have some dents.
    Replace or repair evaporator.
  - Expansion valve is closed excessively, or gas leakage from thermo bulb.
    Replace expansion valve.
    - Suction throttle valve is closed excessively.
      Replace suction throttle valve (Front or rear)

- Noisy
  - Compressor OFF
    - Bearings of compressor clutch or idler pulley make noise.
      Repair.
    - Blower makes noise.
      Repair or replace blower.
  - Compressor ON
    - Belt is loose.
      Adjust belt.
    - Compressor itself makes noise.
      Repair or replace compressor.
    - When engine rpm is changed, there are resonant sounds.
      Retighten compressor bracket bolts.

- Blower does not rotate.
  - Refer to "Blower Motor Diagnoses".

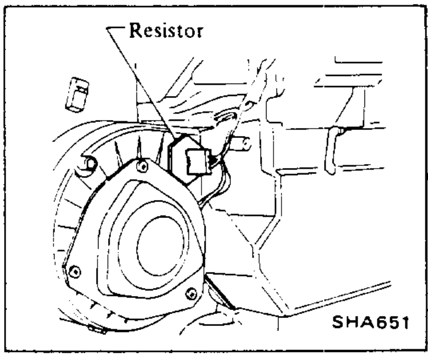
- Compressor does not run.
  - Refer to "Compressor Diagnoses".

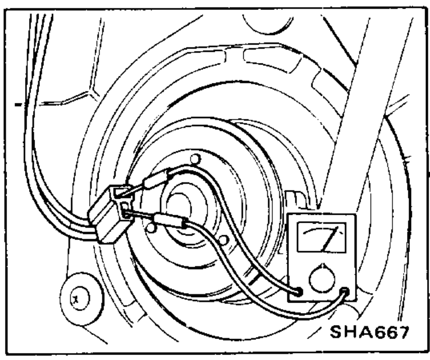
BLOWER MOTOR DIAGNOSES

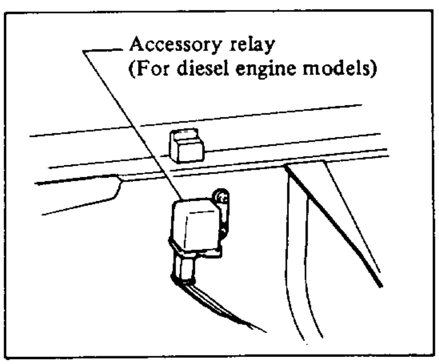
Set ignition switch to "ACC".

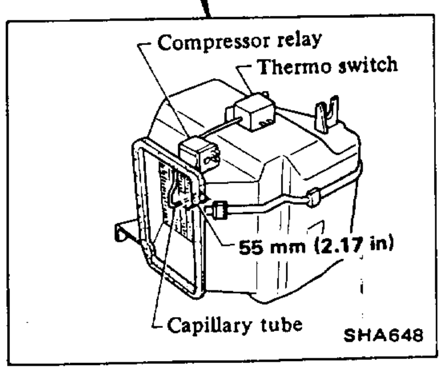
Set fan switch to positions 1, 2 and 3 in that order.

- Blower motor runs only when fan switch is in position 2 or 3. → Faulty resistor. Replace.
- Blower motor runs only when fan switch is in position 3. → Faulty resistor. Replace.
- Blower motor does not run at all. → Check fuse & fusible link. If blown, replace. → Check if current exists at blower motor.
  - Yes → Faulty blower motor. Replace if necessary.
  - No → Check compressor and accessory relay. If blown, replace.









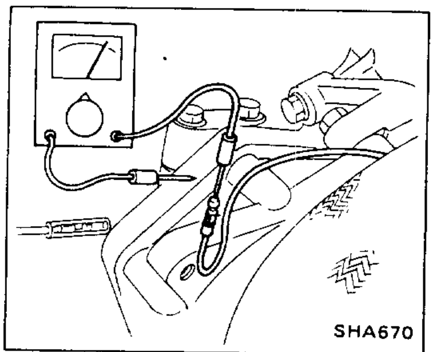
COMPRESSOR CLUTCH DIAGNOSES

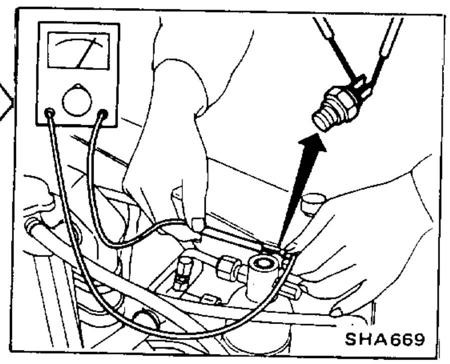
Test condition

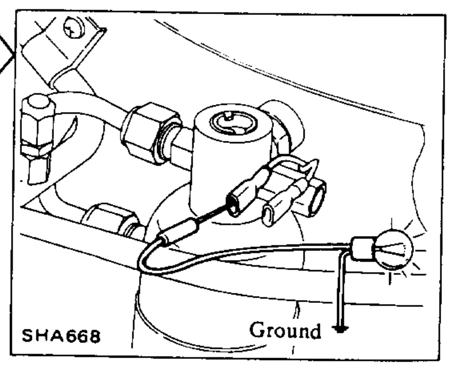
Battery	:	O.K.
Fusible link (black)	:	O.K.
Ignition switch	:	O.K.
Position of ignition switch	:	ACC
Position of mode dial	:	Max. cold
Position of fan dial	:	ON
(double-line box)	:	Condition
(thin-line box)	:	Check
(thick-line box)	:	Probable cause

Compressor clutch is not engaged.

- Blower motor does not run.
  - Correct blower motor system. Refer to "Blower Motor Diagnoses."
- Blower motor runs
  - Ambient temperature is above 5°C (41°F).
    - Disconnect blue wire leading from magnet clutch. Connect test light to green/black wire leading to magnet clutch.
      - Light ON
        - Ground earth terminals leading to magnet clutch.
          - Clutch is not engaged.
            - Faulty magnet clutch without problem in lead wire connection. — Repair.
          - Clutch is engaged.
            - Broken ground wire of magnet clutch. — Repair.
      - Light OFF
        - (Remove radiator grille.)
        - Disconnect lower pressure switch harness connector and check continuity of low pressure switch.
          - ∞Ω
            - Faulty low pressure switch. — Replace.
          - 0Ω
            - Connect test light to green/white wire leading to low pressure switch.
              - Light ON
                - Loose connection. — Repair.
              - Light OFF
                - Ⓐ


SHA670


SHA669



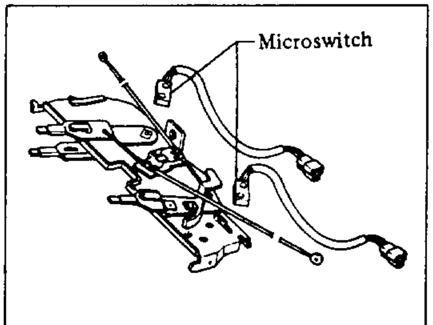
SHA668

Ⓐ

Check fuse and fusible link.
If blown, replace.

Check main and accessory relay.
If blown, replace.

Check thermo switch.	Check microswitch.	Check microswitch.



SHA680

COMPRESSOR DIAGNOSES

Compressor clutch is engaged, but compressor does not run.

- Clutch slipping
  - Check and readjust gap of clutch.
  - Clean oil or dust on contact surface of clutch.
  - If slipping continues, replace compressor clutch.
- Belt slipping
  - Check belt tension and adjust it. If belt is worn out or damaged, replace it.
- Seizured compressor
  - Internal problem in compressor cylinder. Check system. Repair or replace if necessary.

Clutch slipping / Belt slipping → High torque

- Overcharge of refrigerant
  - Discharge refrigerant gas to an extent that sight glass of receiver drier has only a few bubbles. Engine speed: 1,500 rpm
    - Check for discharge pressure. OK if discharge pressure is reduced.
    - Discharge pressure is not reduced. → Air in refrigeration system
- Air in refrigeration system
  - Discharge system from service valve on discharge side. Evacuate and recharge the system.
    - When torque is still great, repair or replace compressor.

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 noisy still, 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.

FAST IDLE CONTROL DEVICE (F.I.C.D.) DIAGNOSES

Test condition

Compressor clutch is engaged.

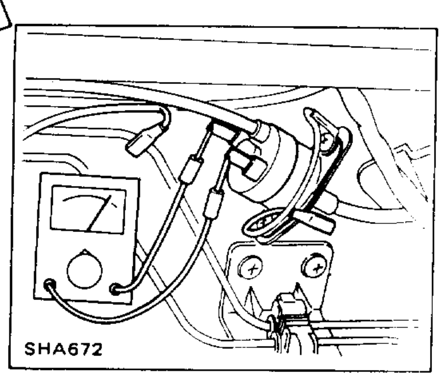
Position of ignition switch: ACC

- (double-line box) : Condition
- (thin-line box) : Check
- (thick-line box) : Probable cause

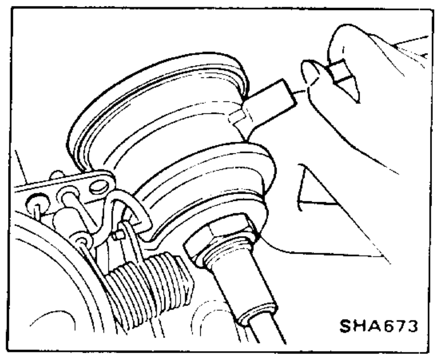
F.I.C.D. is not engaged.

Disconnect F.I.C.D. magnet valve harness.
Check continuity of F.I.C.D. magnet valve.

- ∞Ω → Faulty F.I.C.D. magnet valve. → Replace.
- Needle deflects. → Disconnect vacuum hose from F.I.C.D. actuator and check vacuum.
  - Vacuum O.K.
    - Faulty F.I.C.D. actuator. → Replace.
    - F.I.C.D. out of adjust ment → Readjust.
  - Vacuum N.G. → Check vacuum hose. → Broken. → Replace.



SHA672



SHA673

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

COMPRESSOR

Model	SWP167	SWP123
Type	Swash plate	
Displacement cm^3 (cu in)/rev.	167 (10.19)	123 (7.51)
Cylinder bore x stroke mm (in)	37.2 x 25.7 (1.465 x 1.012)	32.0 x 25.4 (1.260 x 1.000)
Direction of rotation	Clockwise	
Type of driving belt	A type	

LUBRICATING OIL

Type	SUNISO 5GS
Capacity mℓ (Imp fl oz)	270 (9.5)

REFRIGERANT

Type	R-12
Air conditioner kg (lb)	1.0 - 1.2 (2.2 - 2.6)

INSPECTION AND ADJUSTMENT

ENGINE IDLE SPEED

Transmission	When A/C is ON
Manual rpm	800

BELT TENSION

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

COMPRESSOR

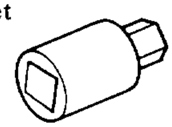
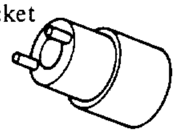
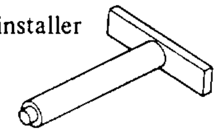
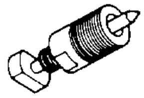
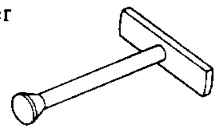
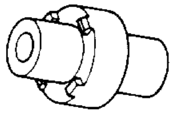
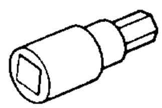
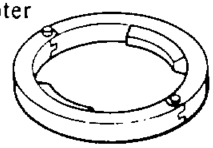
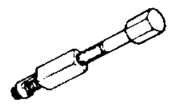
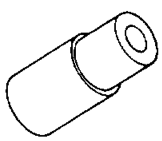
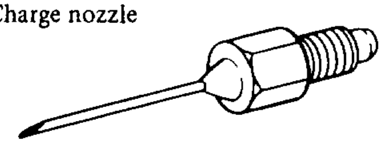
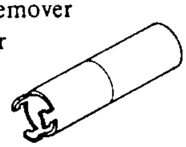
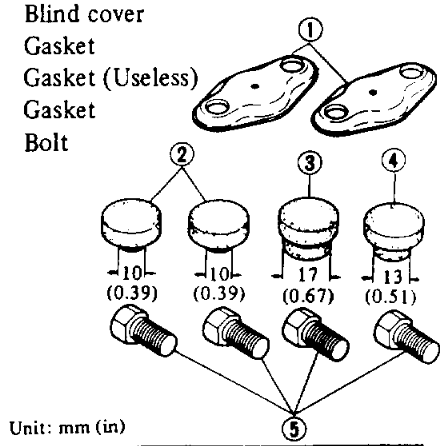
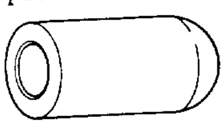
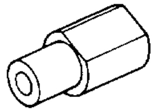
Clutch hub to pulley clearance mm (in)	0.5 - 0.8 ((0.020 - 0.031))

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 Condenser to high pressure line	39 - 49	4.0 - 5.0	29 - 36
Compressor to high pressure line	8 - 11	0.8 - 1.1	5.8 - 8.0
Cooling unit to low pressure line	39 - 49	4.0 - 5.0	29 - 36
Compressor to low pressure line	8 - 11	0.8 - 1.1	5.8 - 8.0
Cooling unit to tube	25 - 34	2.5 - 3.5	18 - 25
Receiver drier to tube	25 - 34	2.5 - 3.5	18 - 25
Condenser to tube	25 - 34	2.5 - 3.5	18 - 25
Compressor Shaft nut	18 - 21	1.8 - 2.1	13 - 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 end cover bolt	29 - 34	3.0 - 3.5	22 - 25
Side cover bolt	18 - 20	1.8 - 2.0	13 - 14
Oil plug	18 - 20	1.8 - 2.0	13 - 14

SPECIAL SERVICE TOOLS

The following table lists special tools designed for use with compressor.

Tool number	Tool name	Tool number	Tool name
KV99412302	Clutch hub wrench 	KV99412324	Allen socket 
KV99412305	Hub nut socket 	KV99412327	Silencer piece installer 
KV99412306	Clutch hub puller 	KV99412328	O-ring installer 
KV99412310	Lock nut socket 	KV99412330	Allen socket 
KV99412313	Puller adapter 	KV99412315	Cylinder head remover 
KV99412312	Puller pilot 	KV994C1552	Charge nozzle 
KV99412321	Shaft seal remover and installer 	KV994C4548 ① KV994C4531 ② KV994C4532 ③ KV994C4533 ④ KV994C4534 ⑤ KV994C4559	Blind cover set Blind cover Gasket Gasket (Useless) Gasket Bolt 
KV99412322	Shaft seal pilot 		
KV99412329	Shaft handle socket 		

ELECTRICAL SYSTEM

SECTION EL

CONTENTS

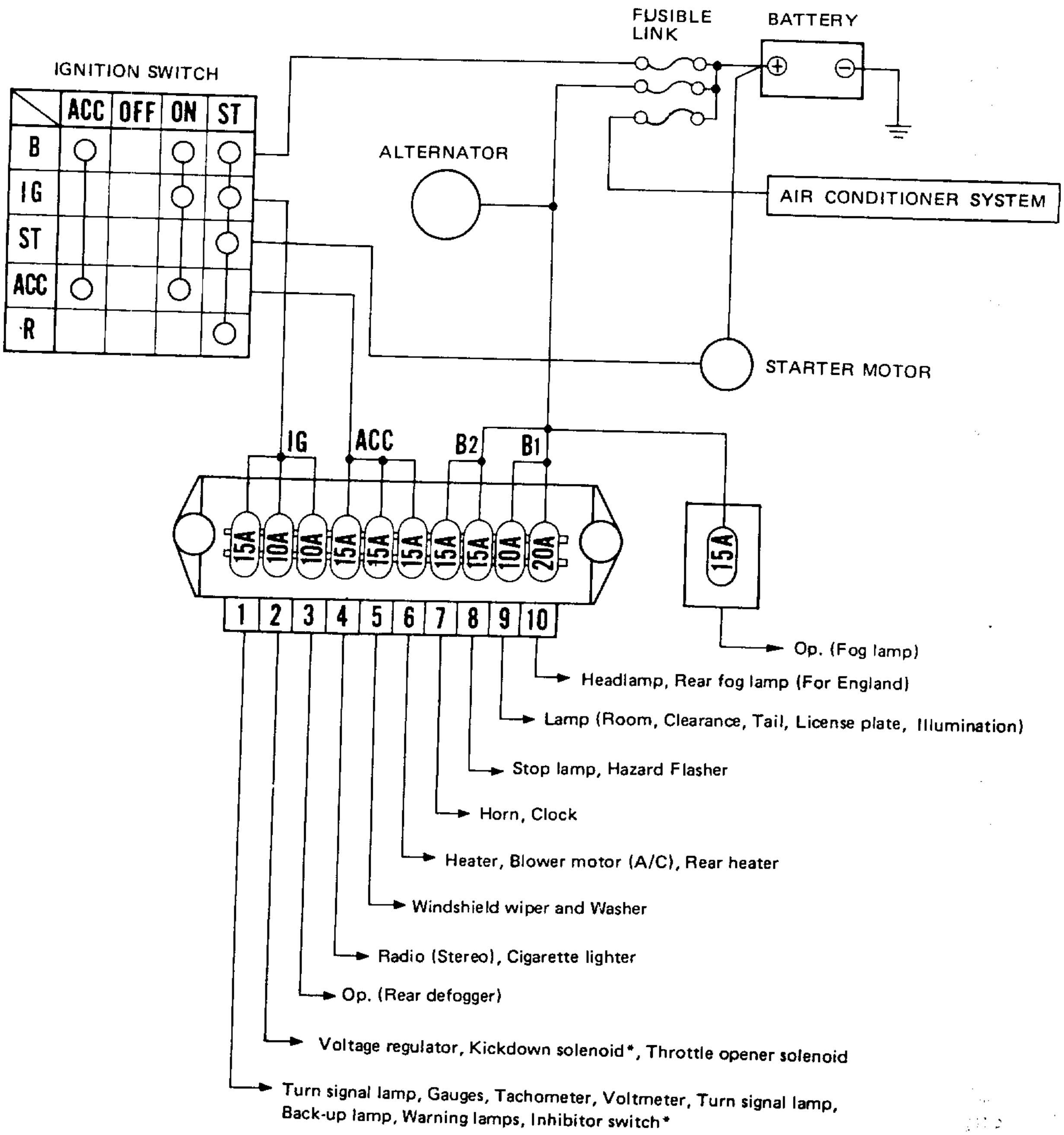
POWER SUPPLY ROUTING

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

SCHEMATIC/POWER SUPPLY ROUTING

MODEL 160 SERIES

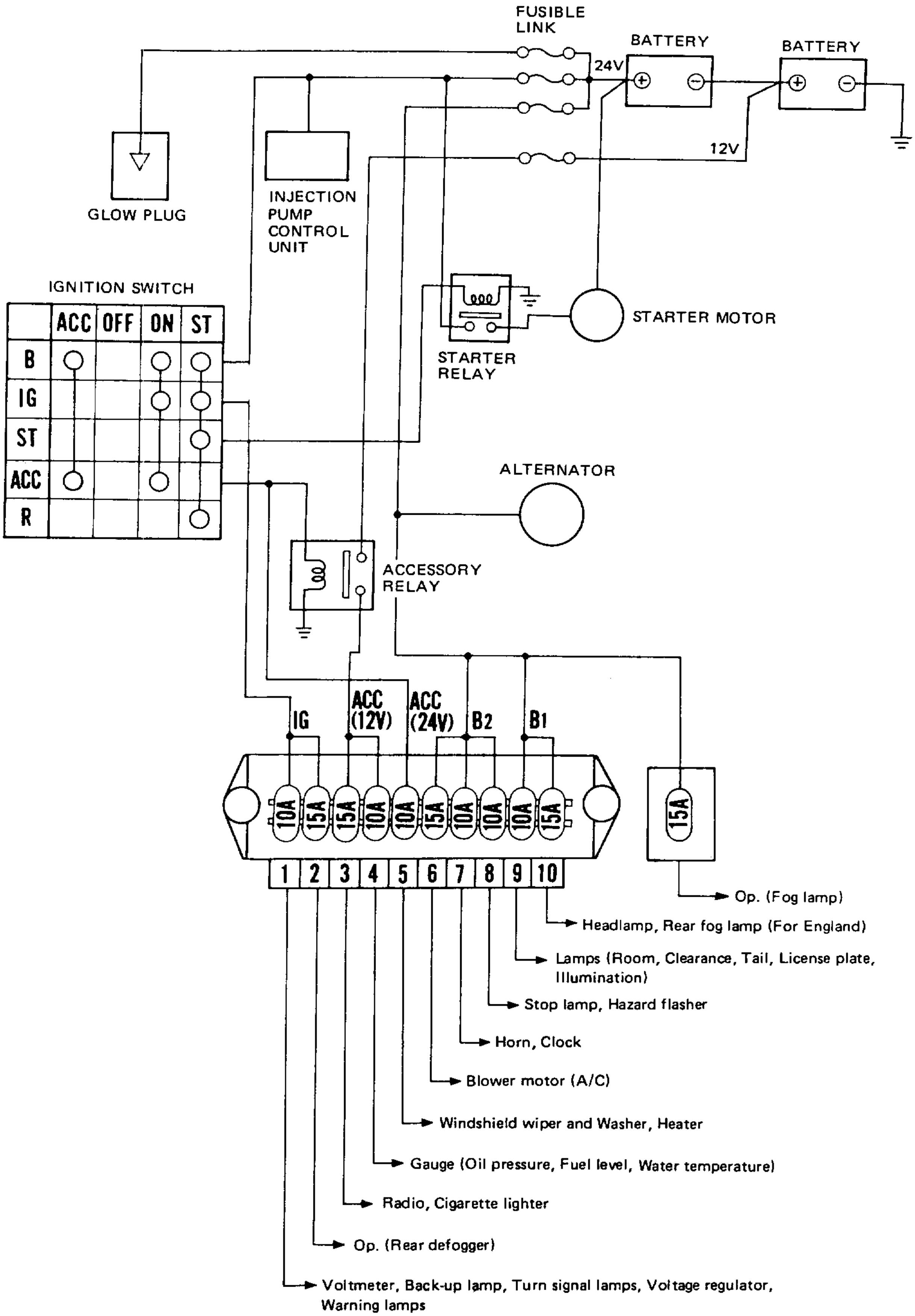
Gasoline engine equipped models



* Automatic transmission models (L28 engine, except for Europe)

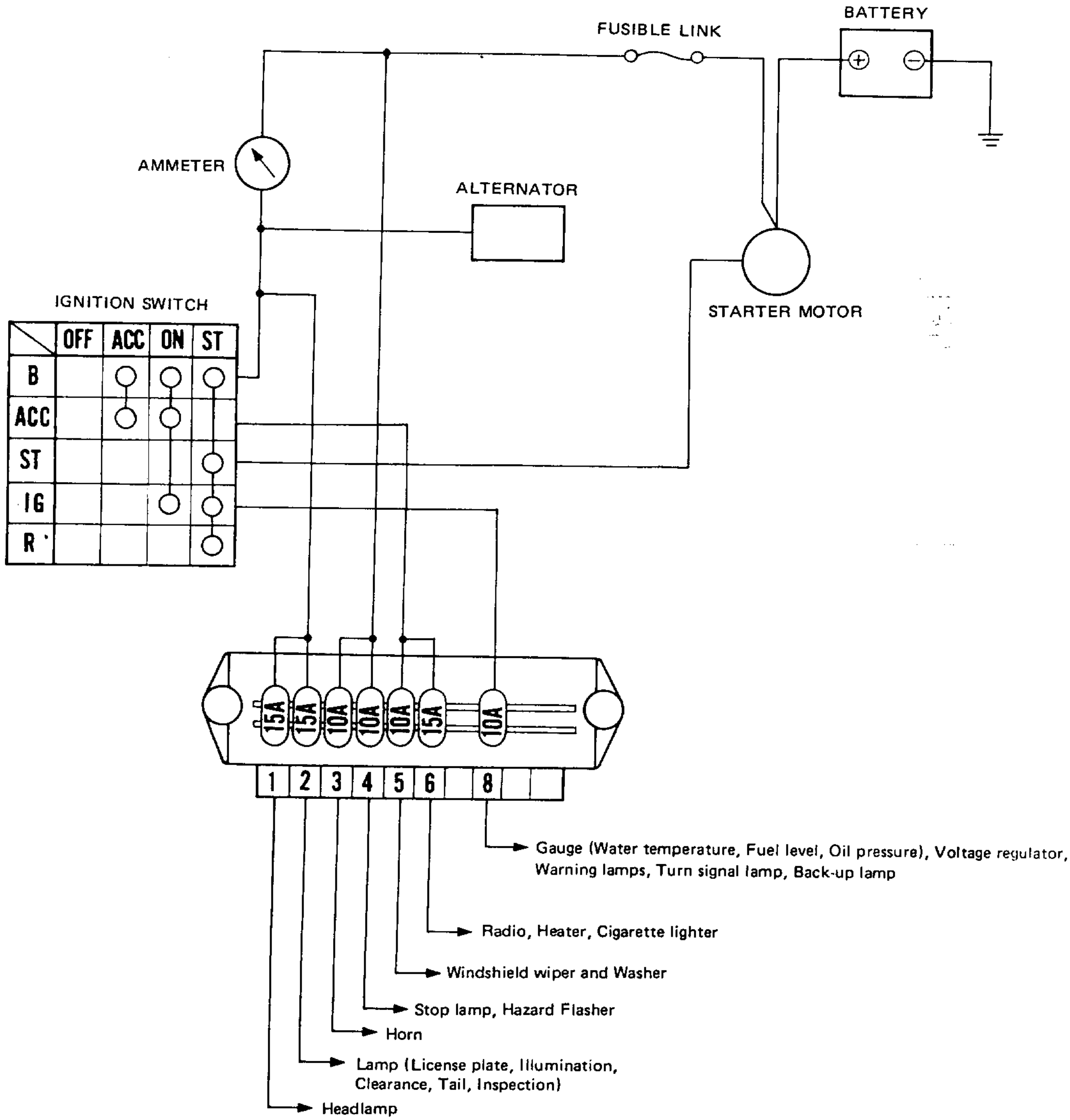
SEL991

Diesel engine equipped models



SEL992

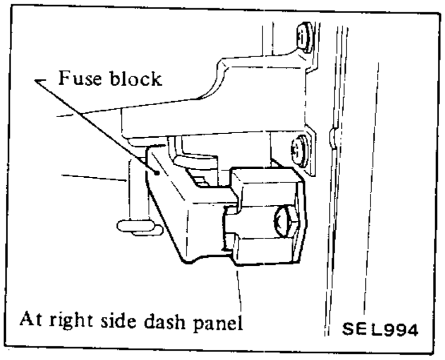
MODEL 61 SERIES



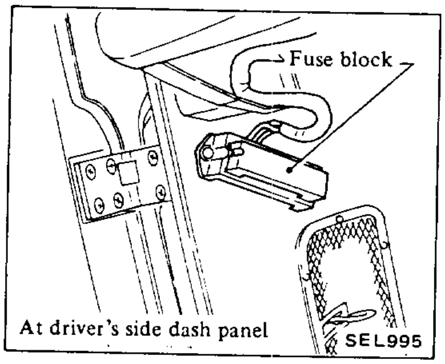
SEL993

FUSE

MODEL 160 SERIES



MODEL 61 SERIES



a. If fuse is blown, be sure to eliminate the cause of the problem before installing new fuse.

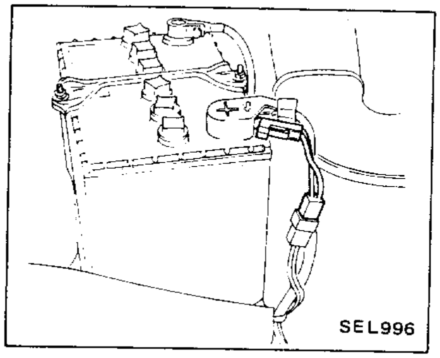
b. Never use fuse of more than specified rating.

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.

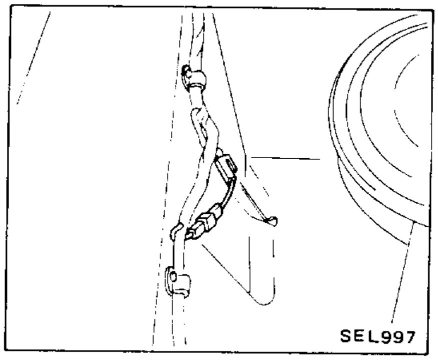
d. Do not install fuse in oblique direction, always snap it into fuse holder properly.

FUSIBLE LINK

MODEL 160 SERIES



MODEL 61 SERIES



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.

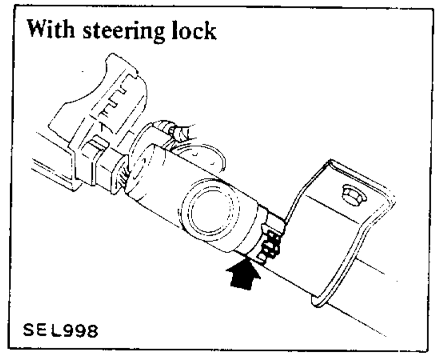
A melted fusible link can be detected either by visual inspection or by feeling with finger-tip. If its condition is questionable, use circuit tester or test lamp, as required, to conduct continuity test. This continuity test can be performed in the same manner as for any conventional fuse.

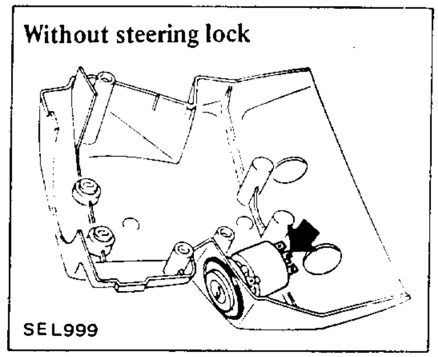
IGNITION SWITCH

REMOVAL AND INSTALLATION

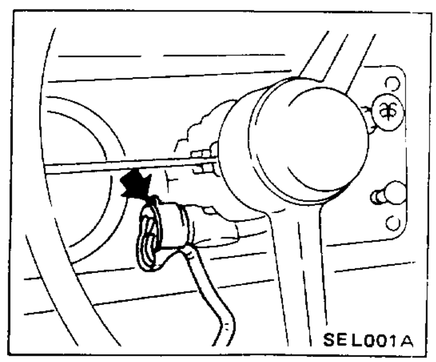
1. Disconnect battery ground cable.
2. Remove steering column cover.
3. Disconnect ignition switch harness connector.
4. Remove ignition switch.
5. Installation is in the reverse order of removal.

Model 160 series



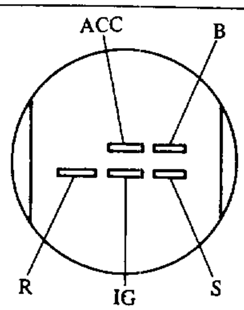


Model 61 series



INSPECTION

Test continuity through switch with an ohmmeter.



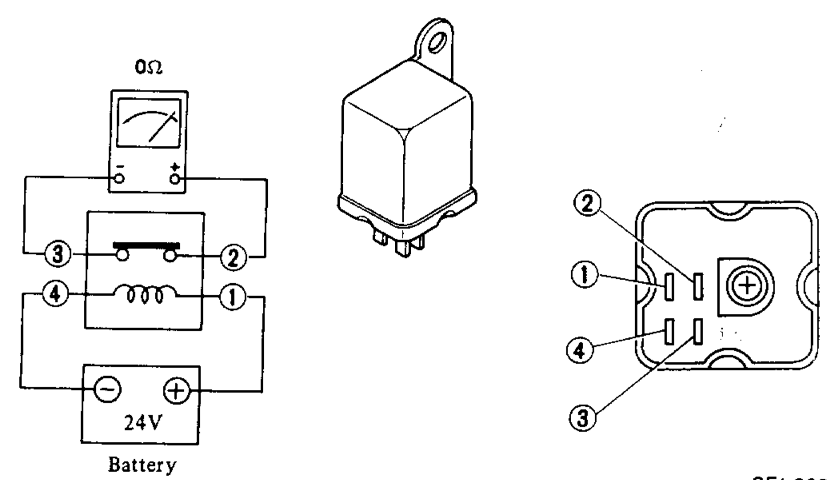
	ACC	OFF	ON	ST
B	O		O	O
IG			O	O
ST				O
ACC	O		O	
R				O

O–O : Continuity should exist.

SEL156A

ACCESSORY RELAY (SD33 engine equipped models)

INSPECTION



SEL002A

BATTERY

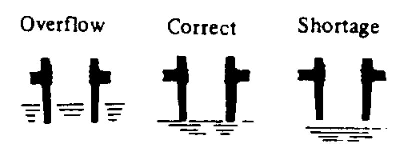
CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

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.

CHECKING ELECTROLYTE LEVEL

Check for electrolyte level in **each cell.**



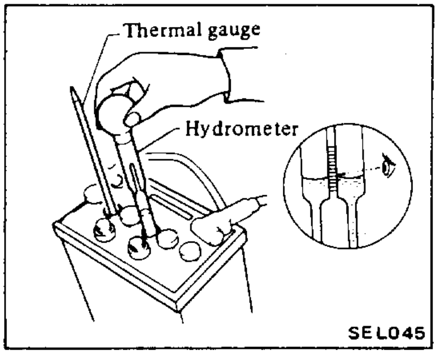
EE358

If the level is low, fill with **distilled water.**

CHECKING SPECIFIC GRAVITY

1. Read hydrometer and thermal gauge indications at eye level.

Read top level with scale.



SEL045

2. Correct **specific gravity at 20°C (68°F).**

$S_{20} = St + 0.0007\,(t - 20)$

Where,

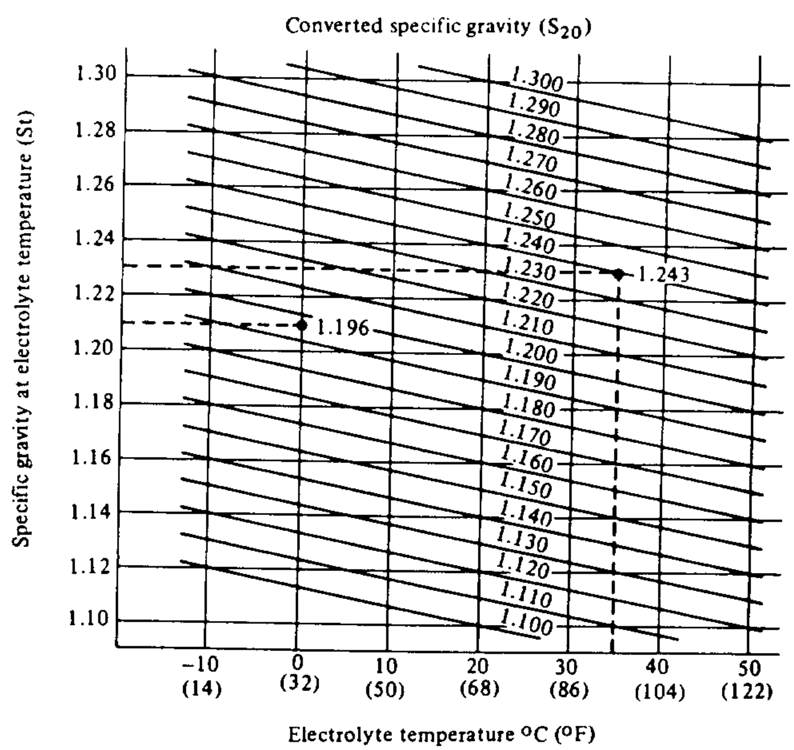
St: Specific gravity of electrolyte at t°C

S_{20}: Specific gravity of electrolyte corrected at 20°C (68°F)

t: Electrolyte temperature

Examples:

1. When electrolyte temperature is 35°C (95°F) and specific gravity of electrolyte is 1.230, specific gravity corrected at 20°C (68°F) is 1.243.
2. When electrolyte temperature is 0°C (32°F) and specific gravity of electrolyte is 1.210, specific gravity corrected at 20°C (68°F) is 1.196.



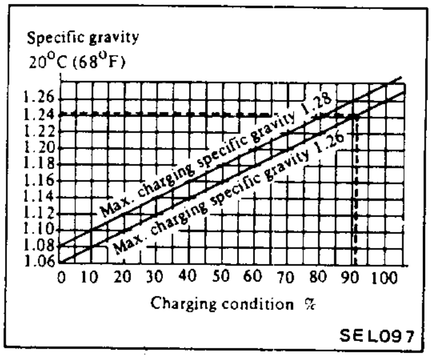
SEL096

3. Determine charging state of battery.

Examples:

Charging state of battery whose max. charging specific gravity is 1.26, and whose specific gravity corrected at 20°C (68°F) is 1.243, is 92%.

For battery whose max. charging specific gravity is 1.28, charging state is 82% at a corrected specific gravity of 20°C (68°F).



SEL097

4. Recharge battery if its rate drops below 70% of full charge.

CHARGING

CAUTION:

a. Carry out charging with negative cable removed.

b. Do not allow electrolyte temperature to go over 45°C (113°F).

Clean corroded terminal with a brush and common baking-soda solution.

WARNING:

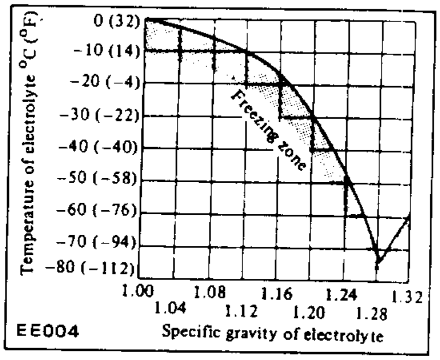
a. Keep battery away from open flame while it is being charged.

b. When connecting charger, connect leads first, then turn on charger. Do not turn on charger first, as this may cause a spark.

BATTERY FREEZING

CAUTION:

Use extreme caution to avoid freezing battery.



EE004

SERVICE DATA AND SPECIFICATIONS

BATTERY

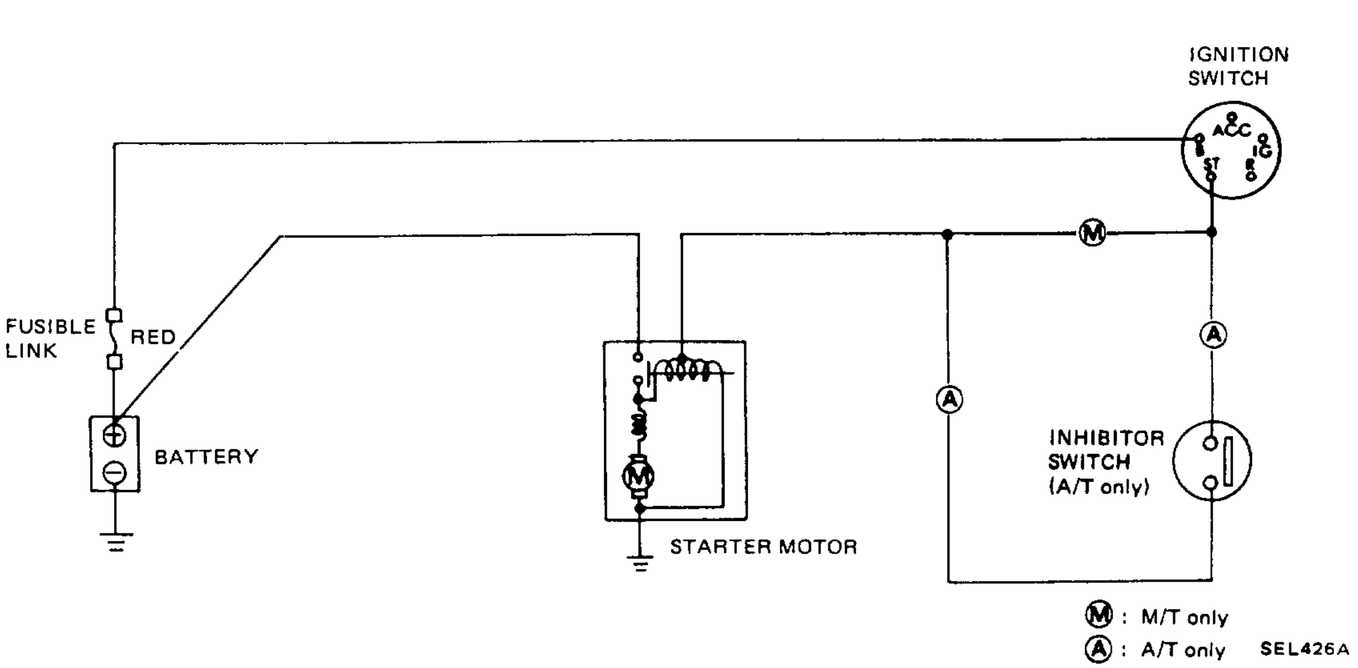
		N50Z	N70Z	NX120-7	NX110-5
Capacity	V-A, H	12-60	12-70	12-80	12-65
Full charging specific gravity at 20°C (68°F)		1.26	1.28	1.28	1.26

STARTING SYSTEM

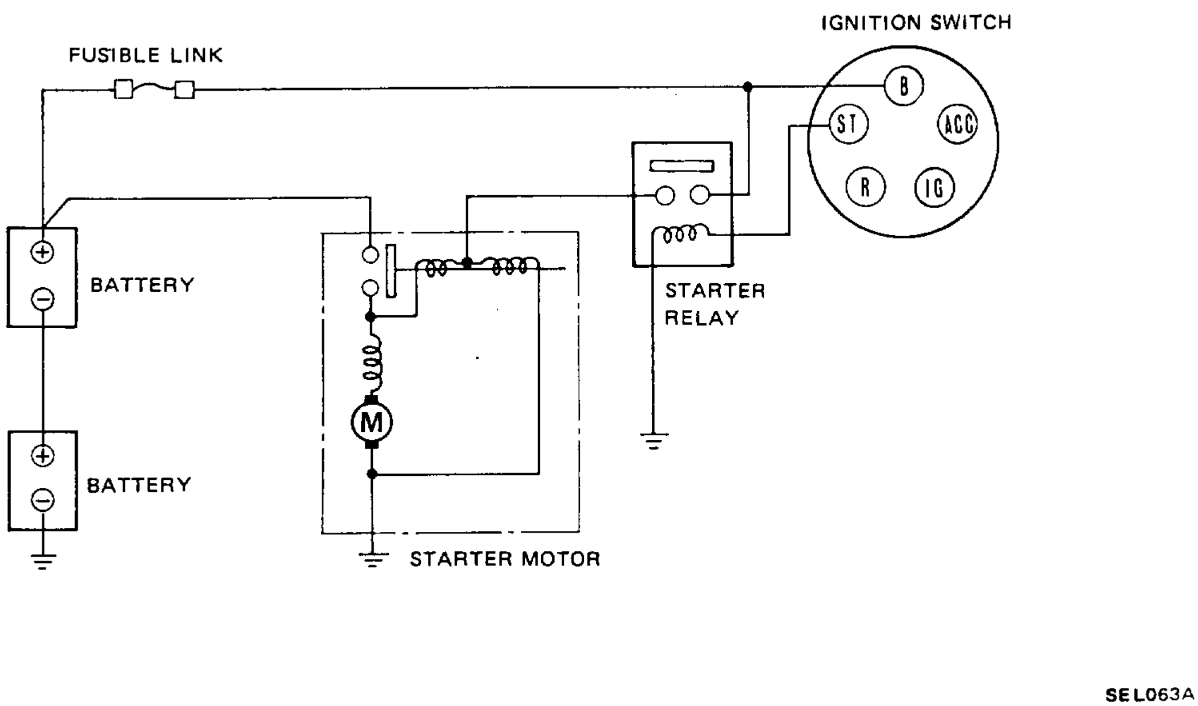
CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

SCHEMATIC

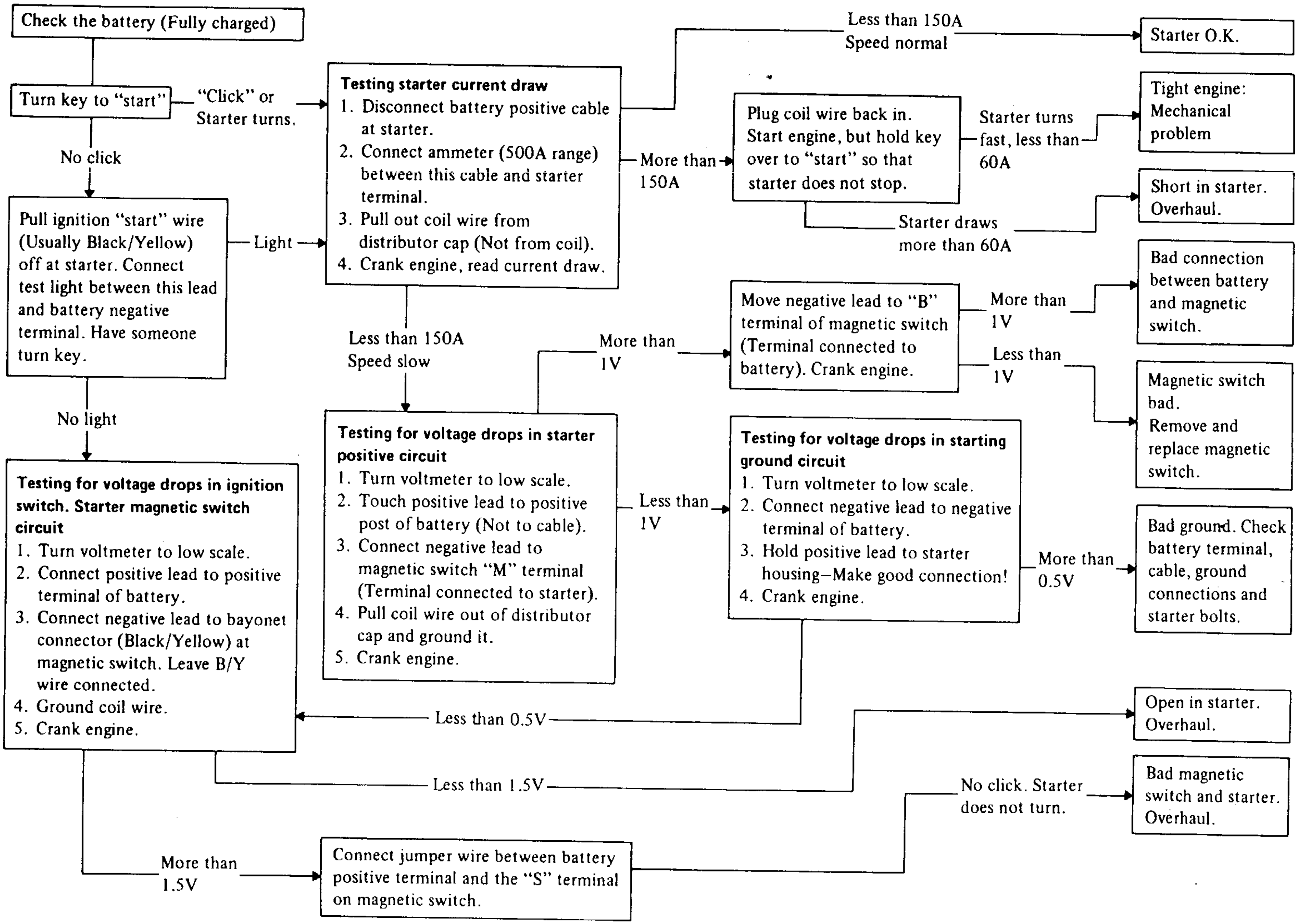
Gasoline engine



Diesel engine

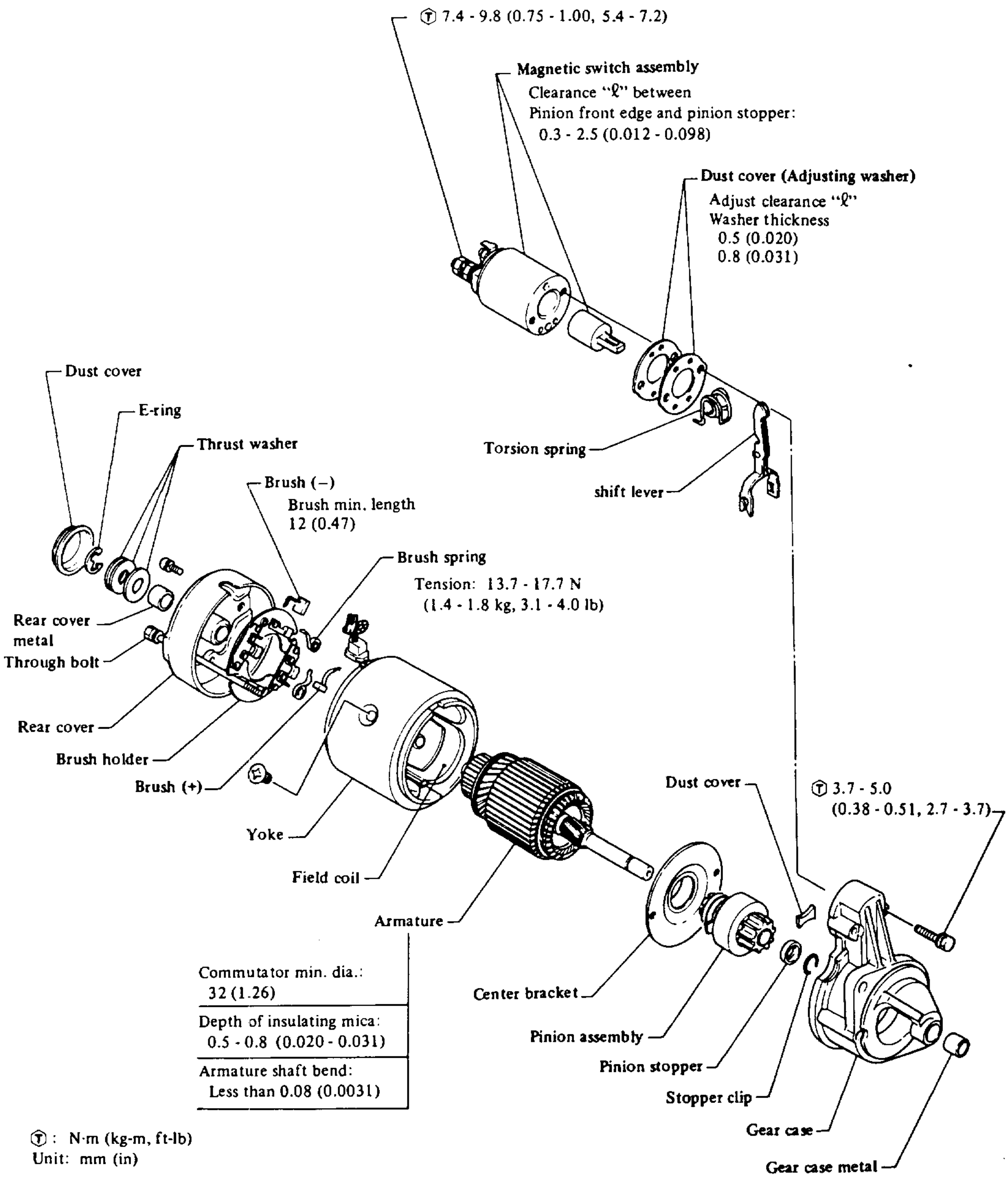


STARTING SYSTEM TROUBLE-SHOOTING



STARTER MOTOR

Non-reduction gear type (Gasoline engine)

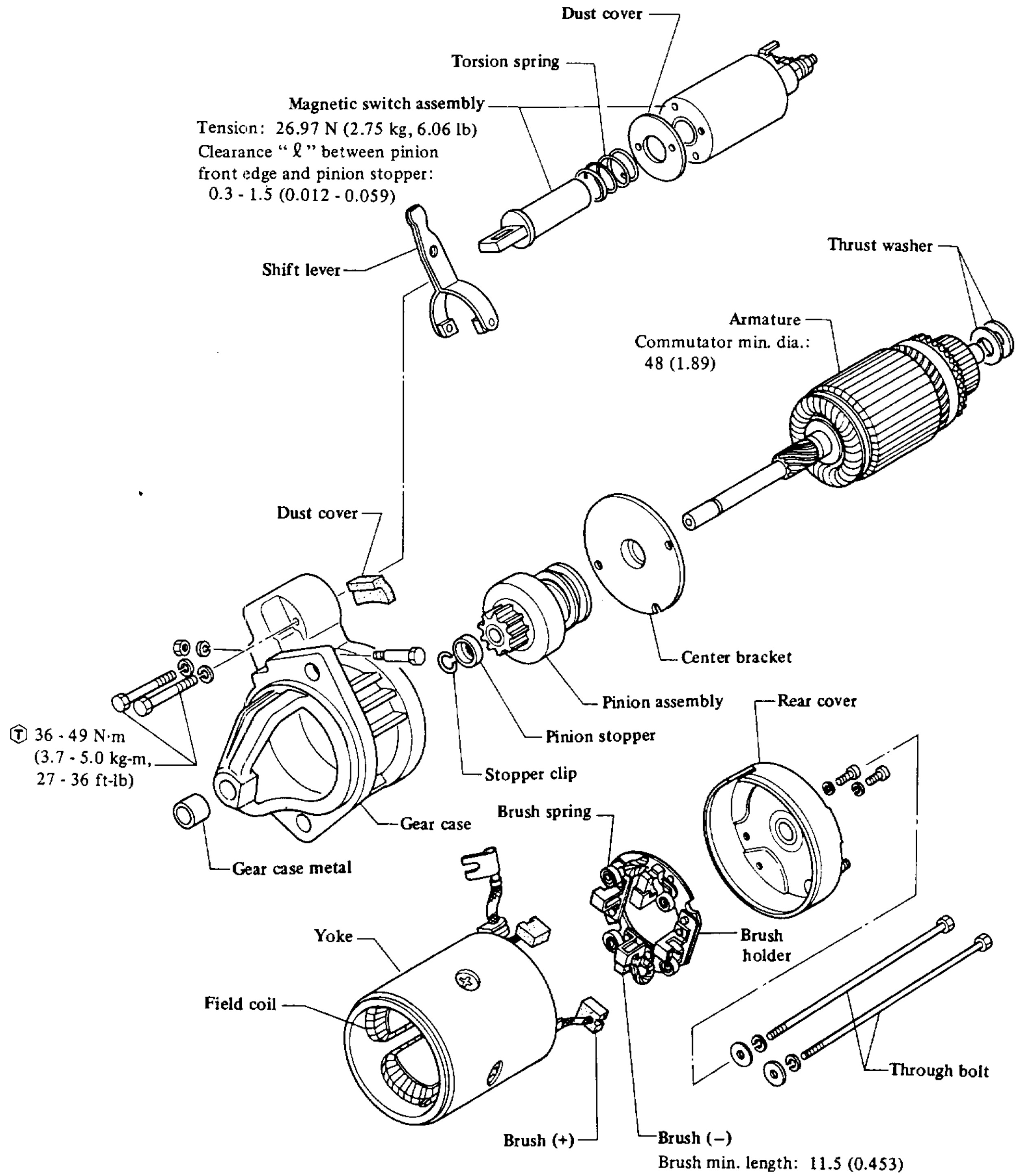


Commutator min. dia.: 32 (1.26)
Depth of insulating mica: 0.5 - 0.8 (0.020 - 0.031)
Armature shaft bend: Less than 0.08 (0.0031)

Ⓣ : N·m (kg-m, ft-lb)
Unit: mm (in)

SEL007

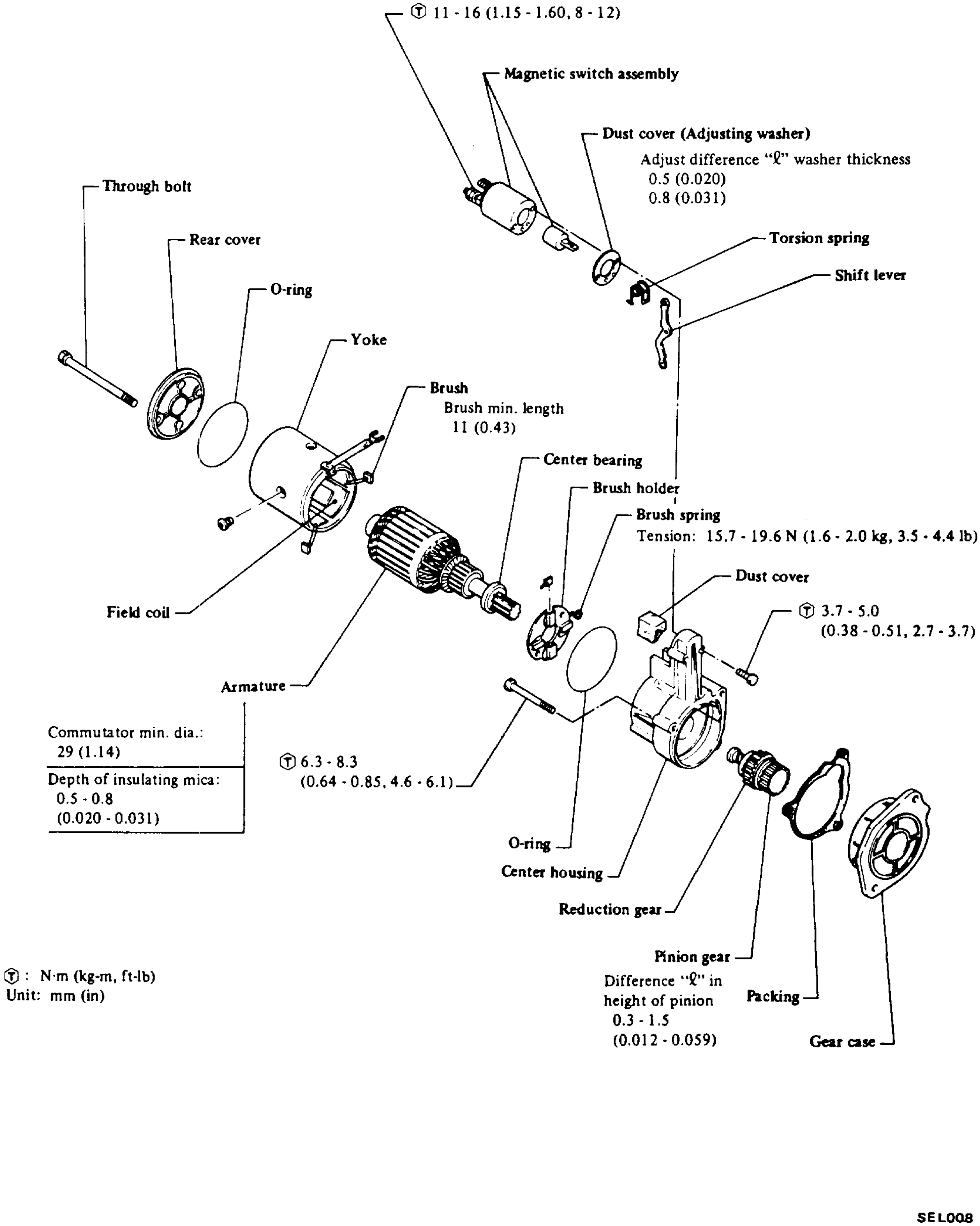
Non-reduction gear type (Diesel engine)



Unit: mm (in)

SEL065A

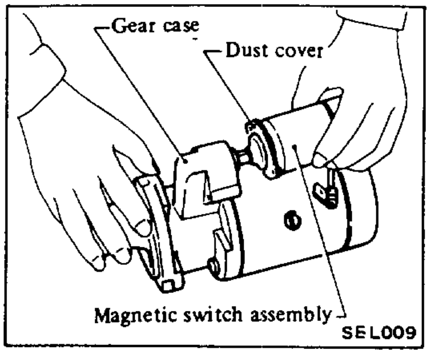
Reduction gear type



DISASSEMBLY

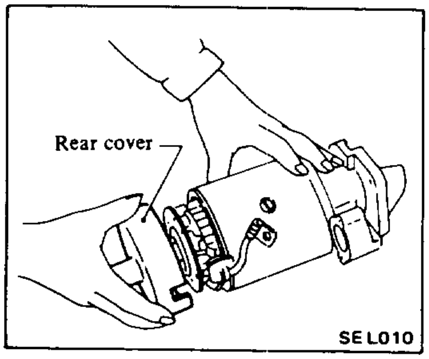
Non-reduction gear type

1. Remove magnetic switch.



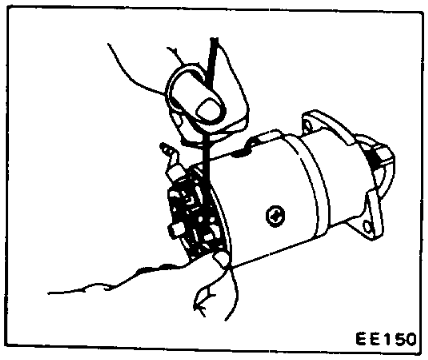
SEL009

2. Remove rear cover.
(1) Remove dust cover, E-ring and thrust washers. (Gasoline engine)
(2) Remove brush holder setscrews.
(3) Remove through bolts.

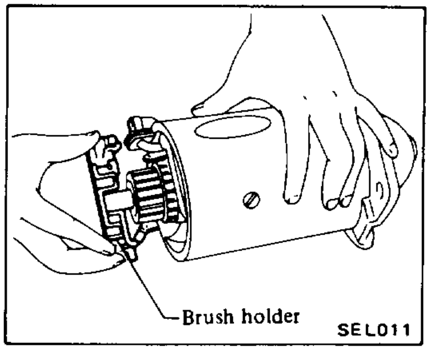


SEL010

3. Lift up brush springs.

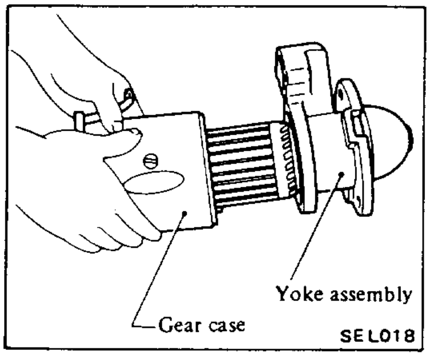

EE150

4. Remove brush holder.



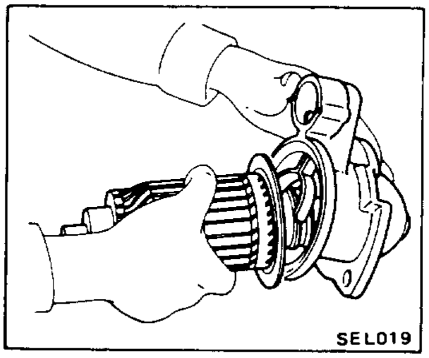
SEL011

5. Remove yoke.

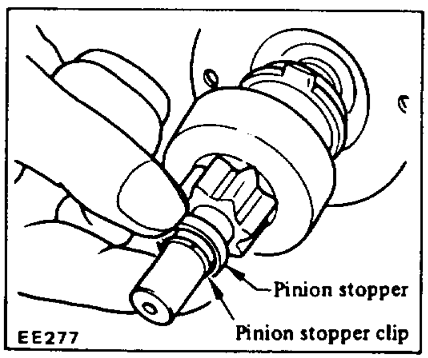


SEL018

6. Withdraw armature and shift lever.


SEL019

7. Remove overrunning clutch.
- Remove pinion stopper clip, pushing pinion stopper toward clutch side.



EE277

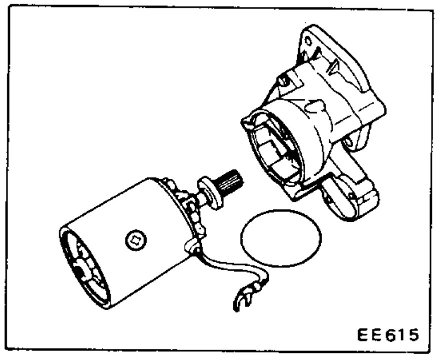
Reduction gear type

1. Remove magnetic switch assembly.
2. Remove torsion spring.
3. Remove through bolts and rear cover with O-ring.

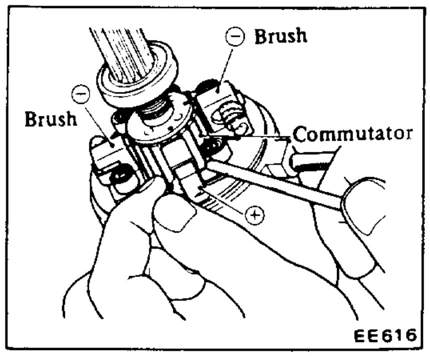
CAUTION:
Be careful not to damage O-ring.

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.


EE615

5. Remove center housing.
6. Remove pinion gear with reduction gear.
7. Lift up brush springs.
8. Remove brushes from brush holder.



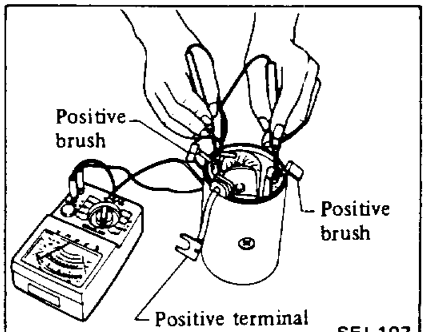
EE616

9. Remove brush holder.
10. Separate yoke and armature.

INSPECTION

Field coil

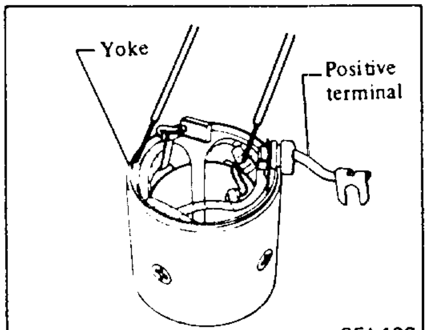
1. Continuity test (between field coil positive terminal and positive brushes).



SEL107

- No continuity ... Replace field coil.

2. Ground test. (between field coil positive terminal and yoke).



SEL108

- Continuity exists ... Replace field coil.

Brush

Check the surface condition of brush contact.

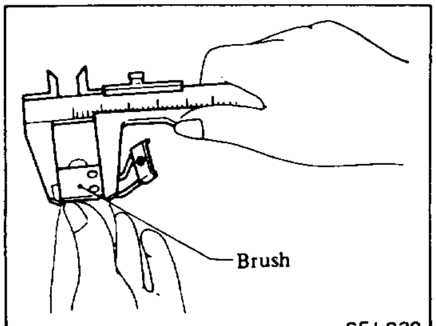
- Loose contact ... Replace.

Check wear of brush.

Minimum length of brush:

Non-reduction gear type:
Gasoline engine
More than 12 mm (0.47 in)
Diesel engine
More than 11.5 mm (0.453 in)
Reduction gear type:
More than 11 mm (0.43 in)

- Excessive wear ... Replace.



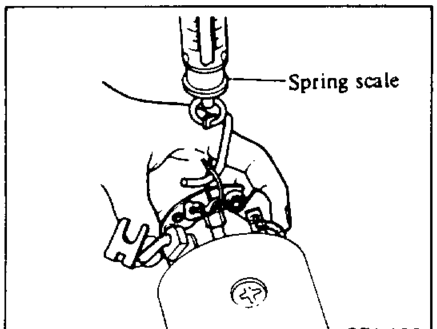
SEL030

Brush spring

Check brush spring tension.

Spring tension:
Model S114-182G, S114-173F:
16.7 - 22.6 N
(1.7 - 2.3 kg,
3.7 - 5.1 lb)
Model S25-131:
24.03 - 29.91 N
(2.45 - 3.05 kg,
5.40 - 6.73 lb)
Model F114 - 254D:
17.7 - 21.6 N
(1.8 - 2.2 kg,
4.0 - 4.9 lb)

- Not in the specified value. ... Repair or replace.



SEL109

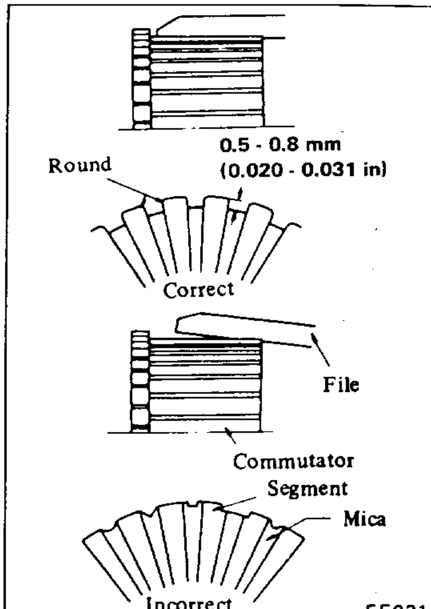
Armature assembly

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)

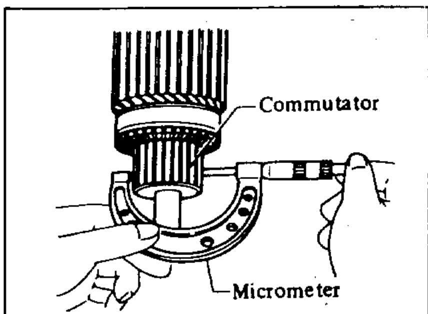


EE021

3. Check diameter of commutator.

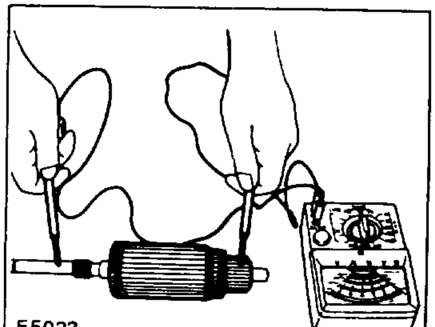
Commutator minimum diameter:
Non-reduction gear type
Gasoline engine
Model S114-182G
More than
39 mm (1.54 in)
Model S114-173F
More than
39 mm (1.54 in)
Diesel engine
Model S25-131
More than
47 mm (1.85 in)
Reduction gear type:
Model S114-254D
More than
29 mm (1.14 in)

- Less than specified value ... Replace.



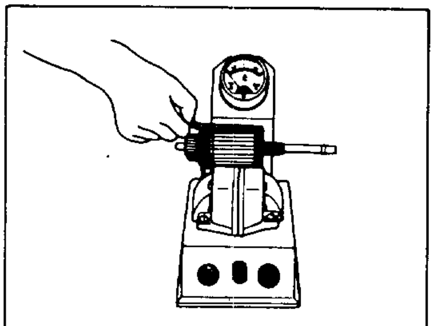
SEL031

4. Ground test (between each commutator bar and shaft).


EE022

- Continuity exists ... Replace.

5. Short test with armature tester (growler) and a piece of iron over armature core.


EE023

- Plate vibrates ... Replace.

6. Continuity test (between two segments side by side).

- No continuity ... Replace.

Overrunning clutch assembly

1. Inspect smooth sliding of pinion gear.

- Abnormal resistance ... Repair.

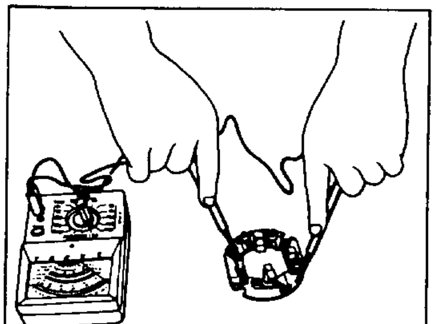
2. Inspect pinion teeth.

- 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).


EE025

- 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.

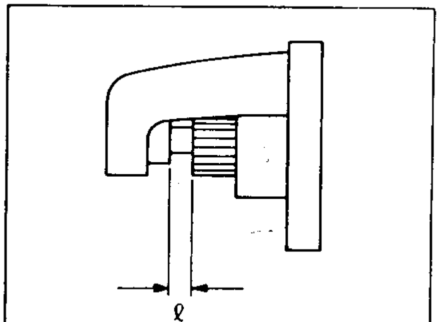
ASSEMBLY

- 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":
Model S114-182G:
0.3 - 2.5 mm (0.012 - 0.098 in)
Model S25-131:
0.3 - 1.5 mm (0.012 - 0.059 in)
Model S114-173F:
0.3 - 2.5 mm (0.012 - 0.098 in)

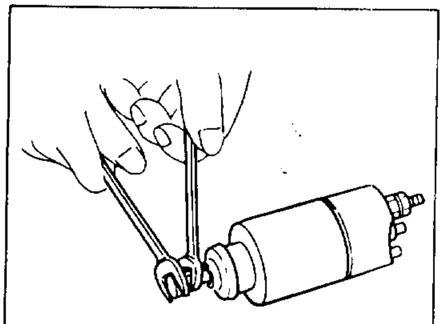


SEL015

- 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)

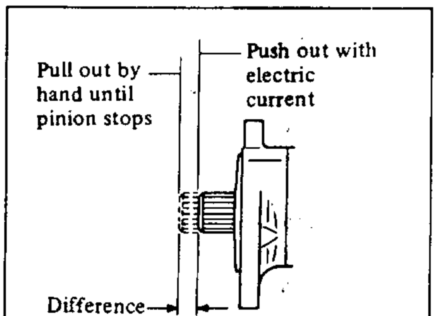
- If the gap is not within the specified value, readjust it.


SEL032

(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)



SEL016

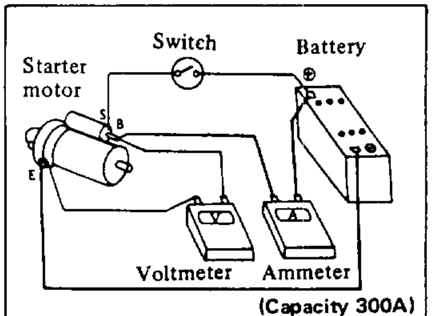
- Not in the specified value ... Adjust by adjusting washer(s).

Adjusting washer thickness:
0.5 mm (0.020 in)
0.8 mm (0.031 in)

TESTING

Performance test

No-load test



SEL095

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.
(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.

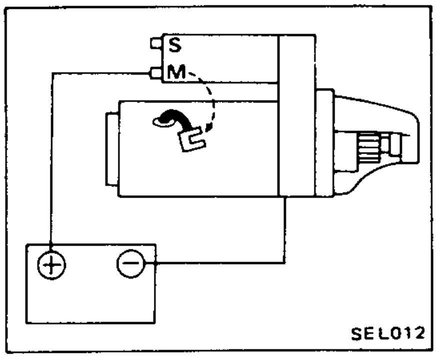
- Weak brush spring tension
- Thrust out of mica in commutator
- Loose contact between brush and commutator.

3. Low current draw and low no-load speed.

(1) Loose connections.
(2) Dirty commutator.
(3) Burned out commutator bar.

Magnetic switch returnability

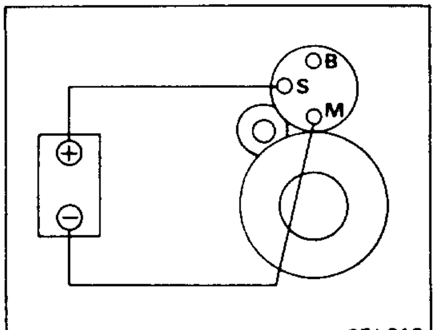
1. Disconnect lead wire from terminal "M" of magnetic switch.
2. Connect terminal "M" and positive ⊕ terminal of battery with a jumper lead wire.
3. Connect starter motor body and negative ⊖ terminal of battery with a jumper lead wire.
4. Pull pinion gear all the way out with your hands.
5. Release your hands from pinion gear.
6. If pinion gear returns to its original position, magnetic switch is properly functioning.



SEL012

Series coil

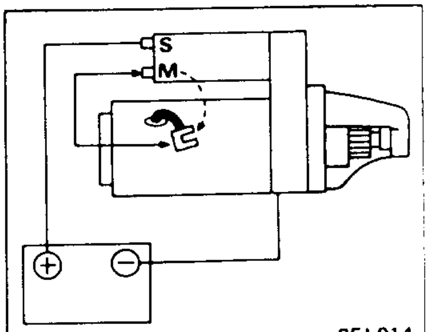
1. Connect terminal "M" of magnetic switch and negative ⊖ terminal of battery with a jumper lead wire.
2. Connect terminal "S" of magnetic switch and positive ⊕ terminal of battery with a jumper wire.
3. With these connections having been made, if plunger is pulled in by force, series coil is properly functioning.



SEL013

Shunt coil

1. Disconnect lead wire which connects terminal "M" of magnetic switch and starter 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 starter 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.



SEL014

STARTER RELAY (For diesel engine)

This relay is the same in type and design as accessory relay. Therefore for inspection. **Refer to Accessory Relay on page EL-6.**

SERVICE DATA AND SPECIFICATIONS

STARTER MOTOR

Model			Non-reduction gear type			Reduction gear type
			S114-182G	S25-131	S114-173F	F114-254D
Applied engine model			P40	SD33	L28	P40, L28
System voltage		V	12	24	12	12
No load	Terminal voltage	V	11.5	24	11.5	11
	Current	A	Less than 60	Less than 90	Less than 60	Less than 100
	Revolution	rpm	More than 5,000	More than 6,000	More than 6,000	More than 3,900
Outer diameter of commutator		mm (in)	More than 39 (1.54)	More than 47 (1.85)	More than 39 (1.54)	More than 29 (1.14)
Minumum length of brush		mm (in)	More than 12 (0.47)	More than 11.5 (0.453)	More than 12 (0.47)	More than 11 (0.43)
Brush spring tension		N (kg, lb)	16.7 - 22.6 (1.7 - 2.3, 3.7 - 5.1)	24.03 - 29.91 (2.45 - 3.05, 5.40 - 6.73)	16.7 - 22.6 (1.7 - 2.3, 3.7 - 5.1)	17.7 - 21.6 (1.8 - 2.2, 4.0 - 4.9)
Clearance between bearing metal and armature shaft		mm (in)	0.2 (0.008)			–
Clearance "ℓ" between pinion front edge and pinion stopper		mm (in)	0.3 - 2.5 (0.012 - 0.098)	0.3 - 1.5 (0.012 - 0.059)	0.3 - 2.5 (0.012 - 0.098)	0.3 - 1.5 (0.012 - 0.059)

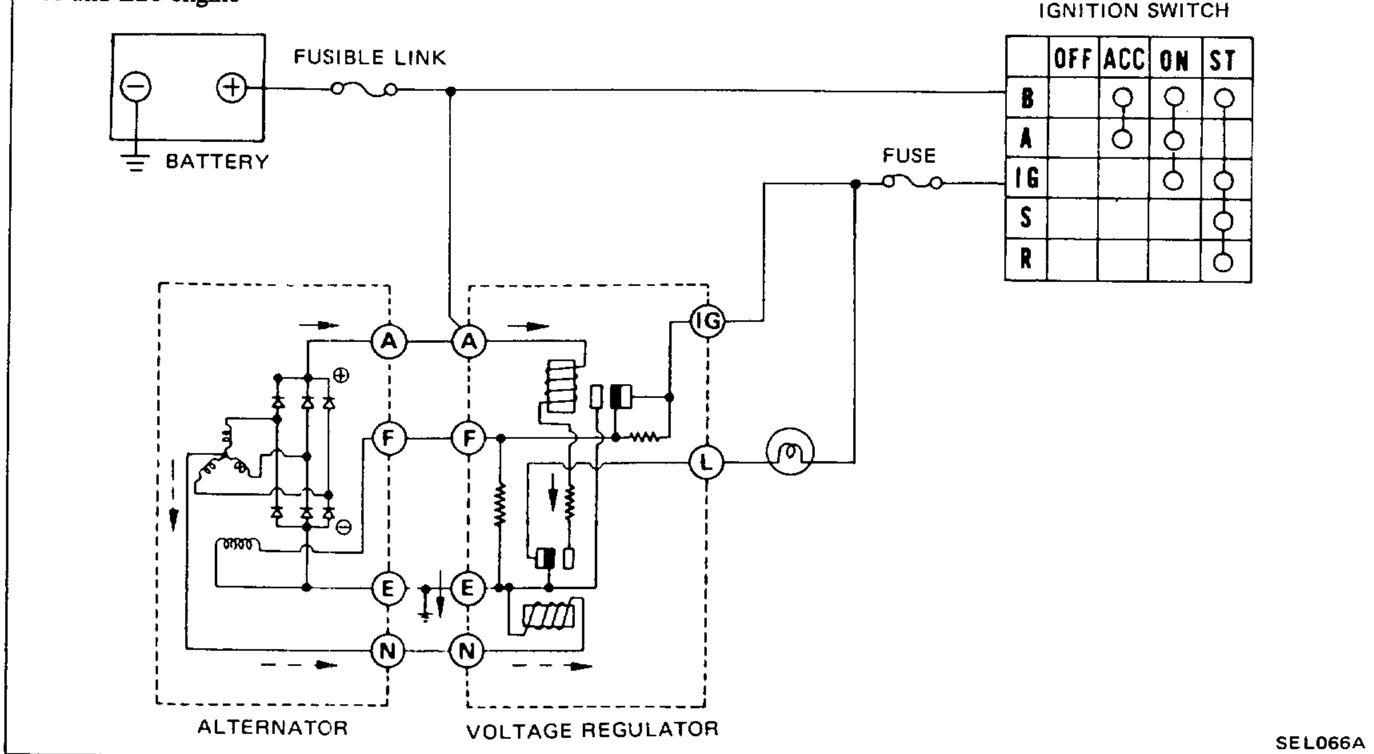
CHARGING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

SCHEMATIC

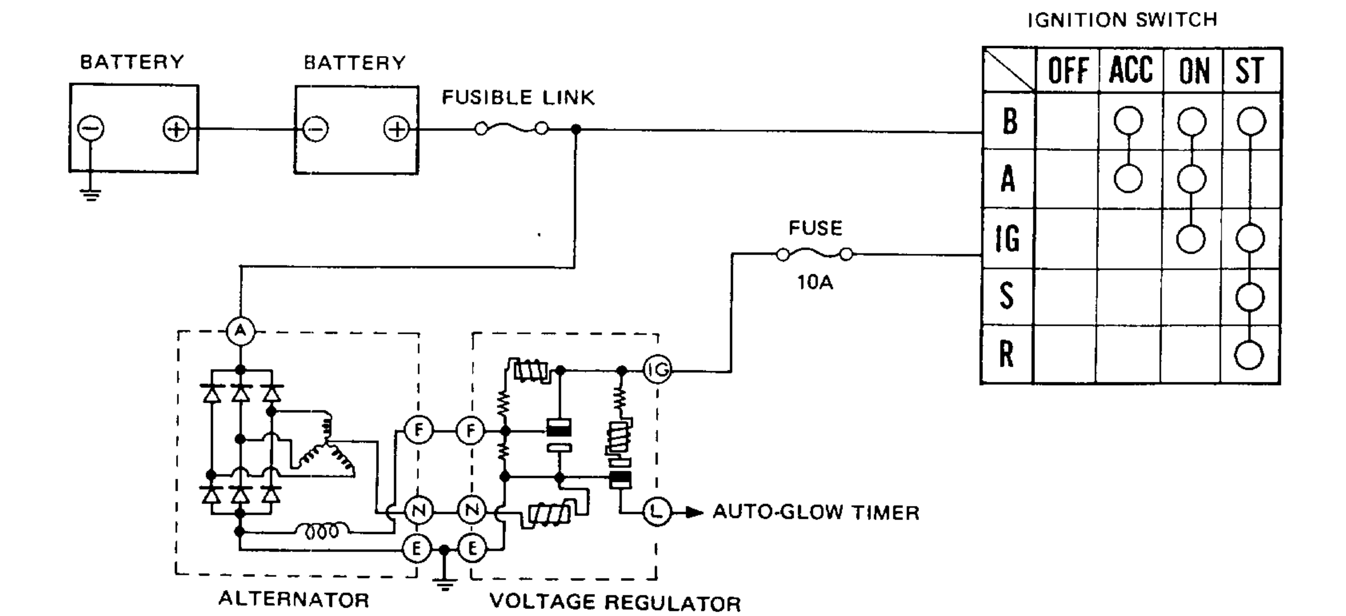
Except Europe

P40 and L28 engine



SEL066A

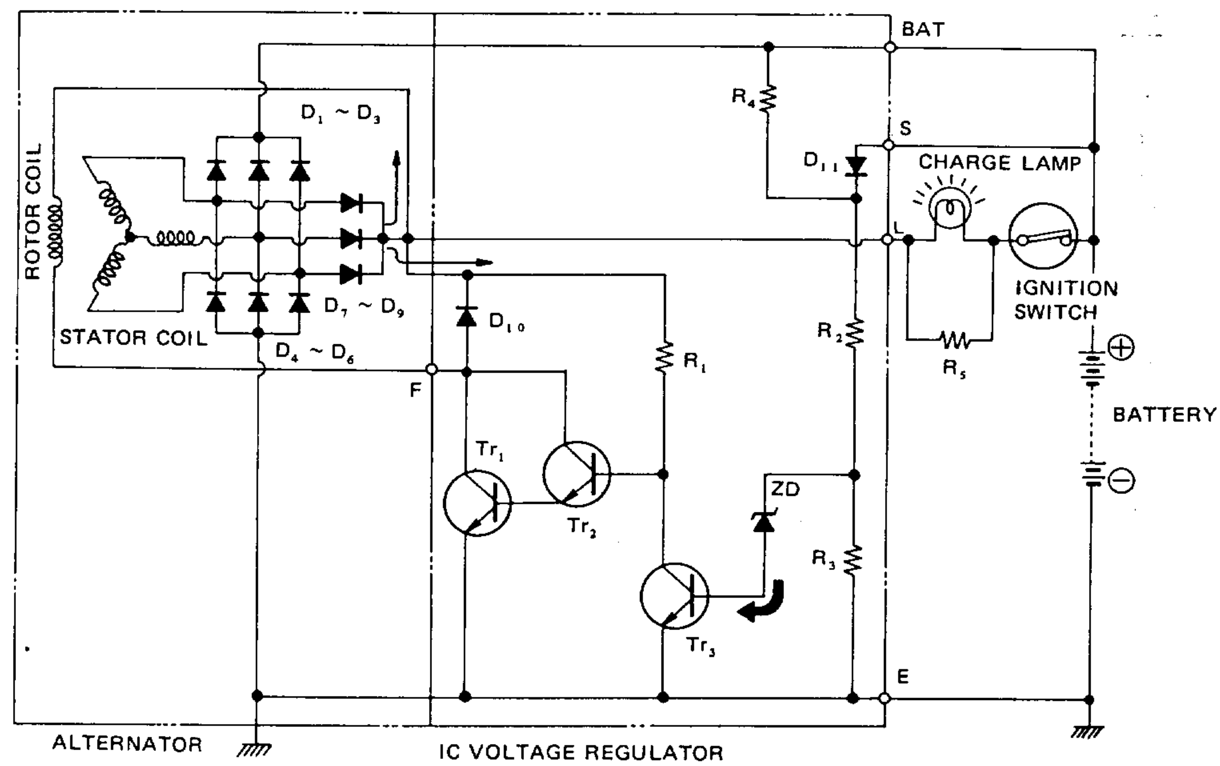
SD33 engine



SEL067A

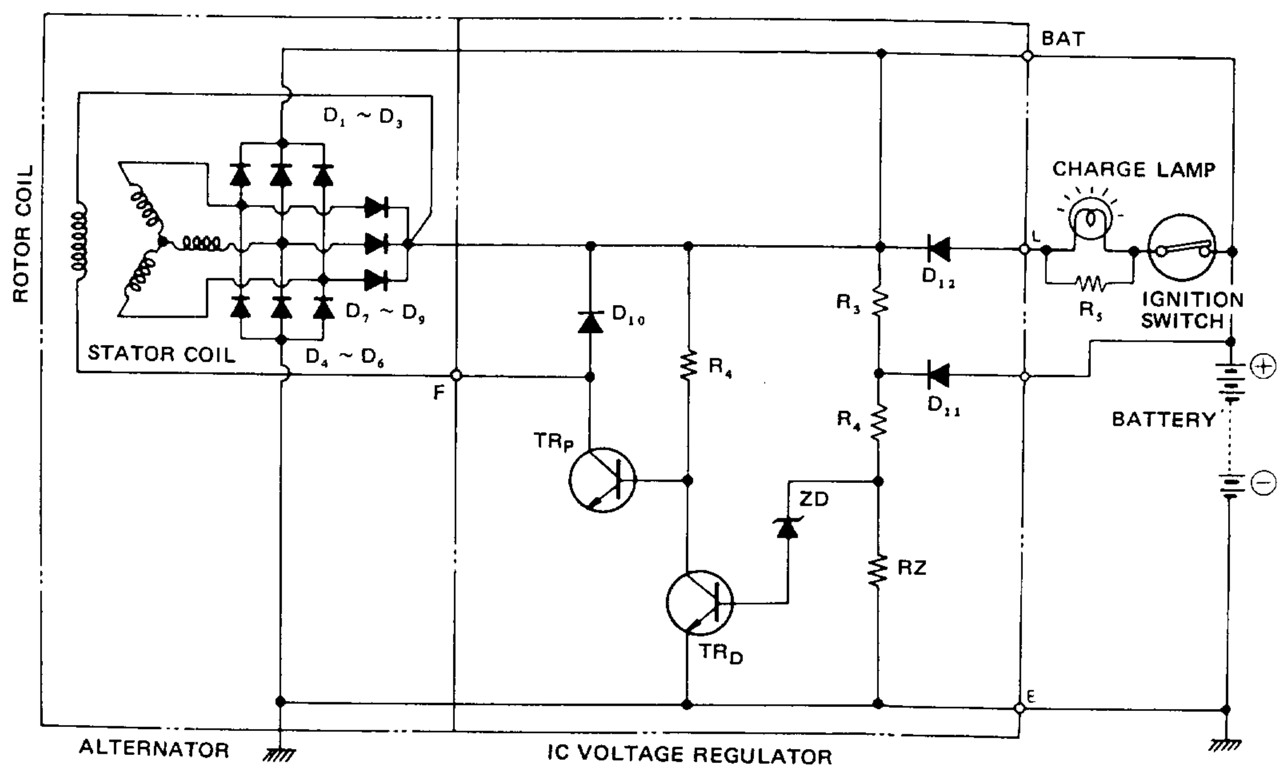
For Europe

P40 and L28 engine (IC voltage regulator built in)



SEL043B

SD33 engine (IC voltage regulator built in)



SEL044B

CHARGING SYSTEM TROUBLE-SHOOTING (LT135, LT150, LT160, LT225)

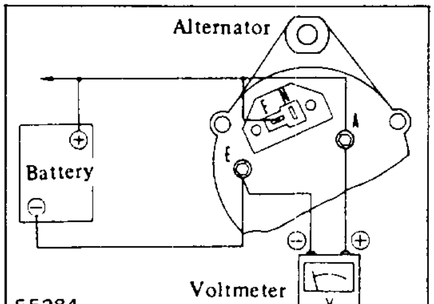
Before conducting an alternator test, make sure battery is fully charged.

To conduct test, it is necessary to use a 30-volt voltmeter and suitable test probes.

Set up a test circuit as shown in figure and test alternator in manner indicated in flow chart below:

1. Disconnect connectors at alternator.
2. Connect "A" terminal to "F" terminal.
3. Connect one test probe from voltmeter positive terminal to "A" terminal. Connect the other test probe to ground. Make sure that voltmeter registers battery voltage.
4. Turn on headlights and switch to High Beam.
5. Start engine.
6. Increase engine speed gradually until it is approximately 1,100 rpm, and take the voltmeter reading.

Measured value: Below 12.5 volts ... Gasoline engine Below 24 volts ...... Diesel engine Alternator is run-down. Remove and check it for condition.	Measured value: Over 12.5 volts ... Gasoline engine Over 24 volts ...... Diesel engine Alternator is in good condition.



EE284

a. **Do not run engine at more than 1,100 rpm while test is being conducted on alternator.**
b. **Do not race engine.**

CHARGING SYSTEM TROUBLE-SHOOTING (LR150, LR160, LR225)

Before conducting an alternator test, make sure that the battery is fully charged.

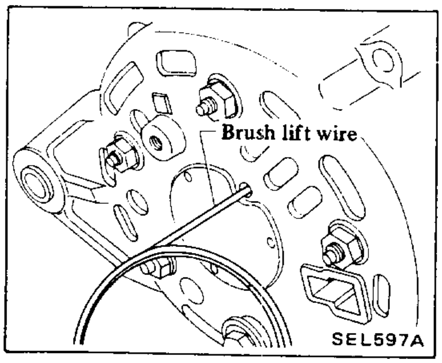
A 30-Volt voltmeter and suitable test probes are necessary for the test.

The alternator can be checked easily by referring to the Inspection Table.

Ⓐ

- Ignition switch "ON" (Check light for operation)
  - Light "OFF"
    - Disconnect connector (S, L) and ground L lead wire (Check light for operation)
      (With alternator side L terminal grounded, internal short occurs when + diode is short-circuited.)
      - Light "OFF" — Burned-out bulb. Replace and Proceed to "A"
      - Light "ON" — * Connect connector (S, L) and ground F terminal (Check light for operation)
        - Light "ON" — Faulty IC-RG, Replace
        - Light "OFF" — Faulty A.C.G.
  - Light "ON"
    - Engine idling (Check light for operation)
      - Light "ON" (Dim light / Light flickers / Bright light) — Faulty A.C.G.
      - Light "OFF"
        - Engine speed: 1,500 rpm Lighting switch "ON" (Check light for operation)
          - Dim light — Engine idling (Measure the voltage across "B" and "L" terminals)
            Contact positive lead (+) of voltmeter on B terminal and negative lead (–) to L terminal.
            - More than 0.5V — Faulty A.C.G.
            - Less than 0.5V — O.K.
          - Light "OFF" — Engine speed: 1,500 rpm (Measure B terminal voltage)
            Make sure "S" terminal is connected correctly
            - More than 15.5V — Faulty IC-RG, Replace
            - 13 to 15V — Engine idling Lighting switch "ON" (Check light for operation)
              - Light "ON" — Faulty A.C.G.
              - Light "OFF" — O.K.

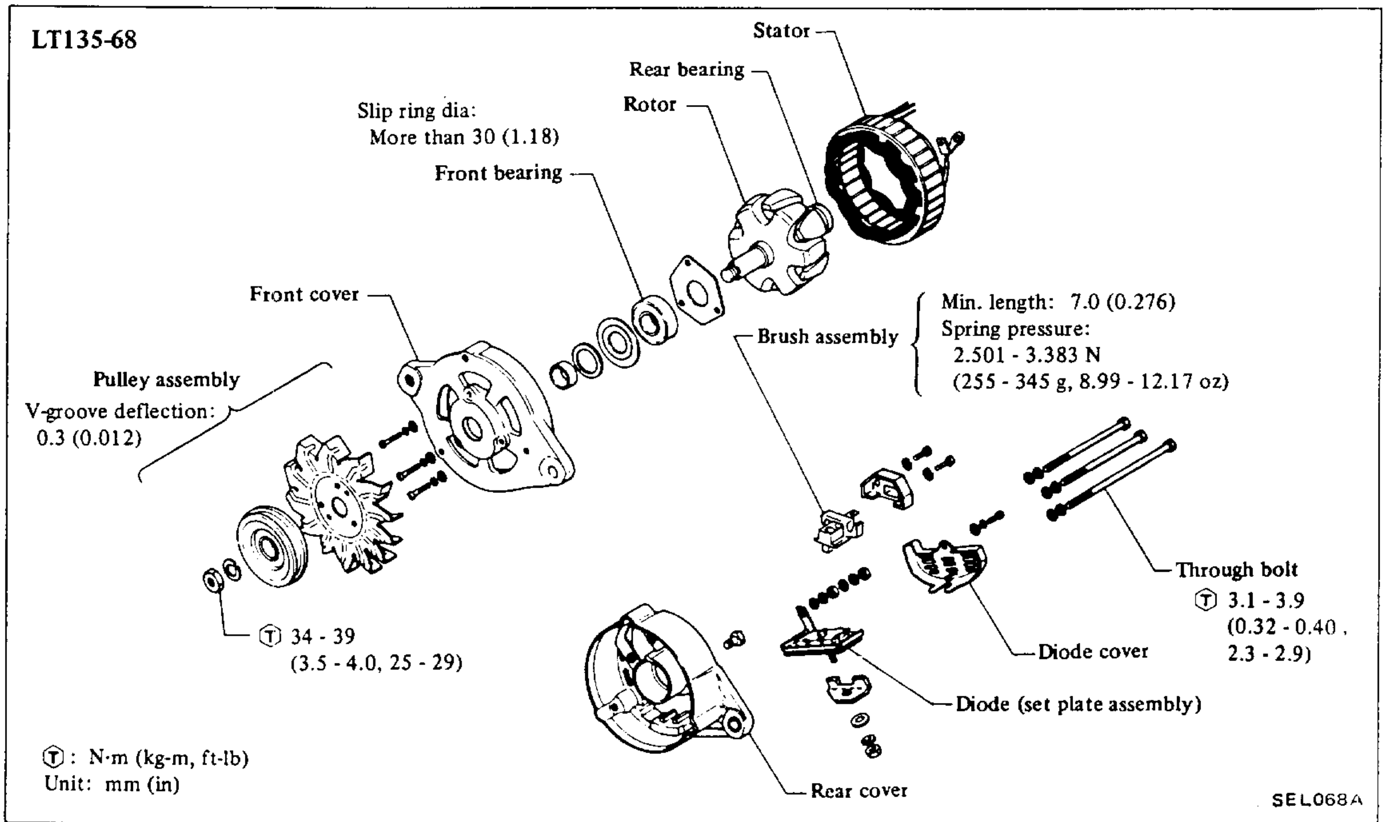
1) **Use fully charged battery**
2) **Light : Charge warning light**
   A.C.G. : Alternator parts except IC regulator
   IC-RG : IC regulator
   O.K. : IC-alternator is in good condition
3) **When reaching "Faulty A.C.G.", remove alternator from car and disassemble, inspect and correct or replace faulty parts**
4) *** Method of grounding F terminal**
   Contact tip of wire with brush and attach wire to alternator body.

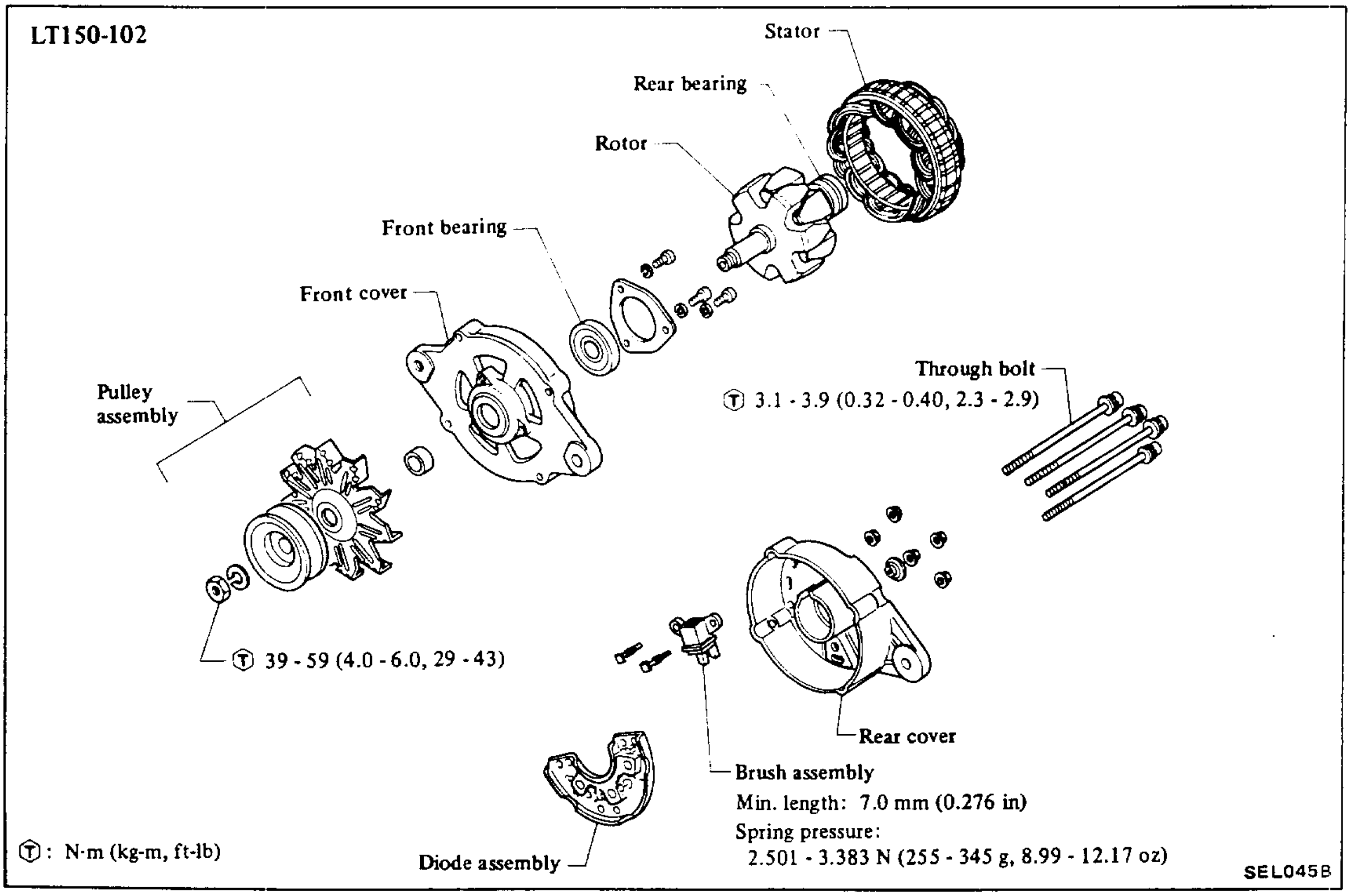


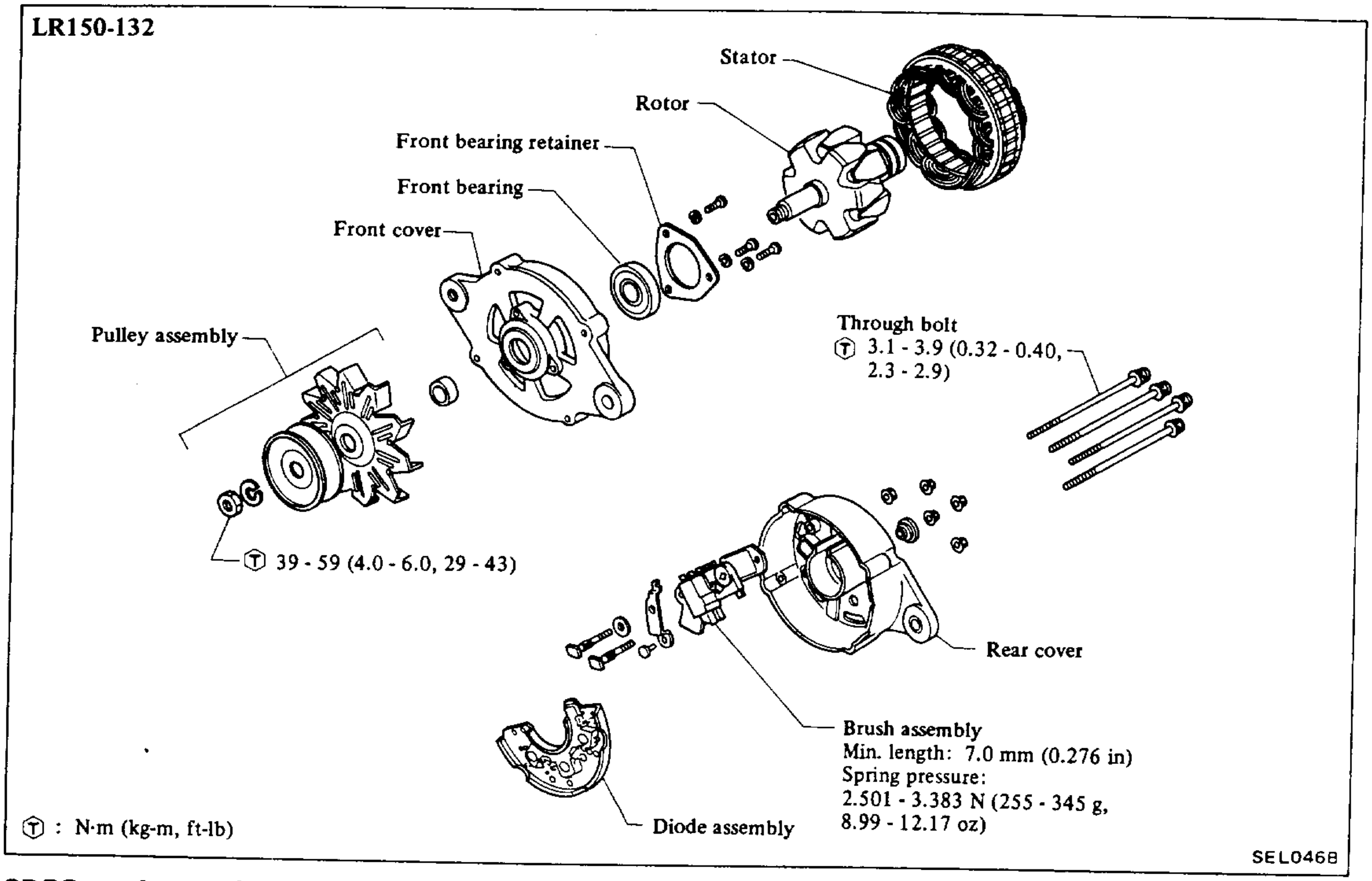
5) **Terminals "S", "L", "BAT" and "E" are marked on rear cover of alternator.**

ALTERNATOR

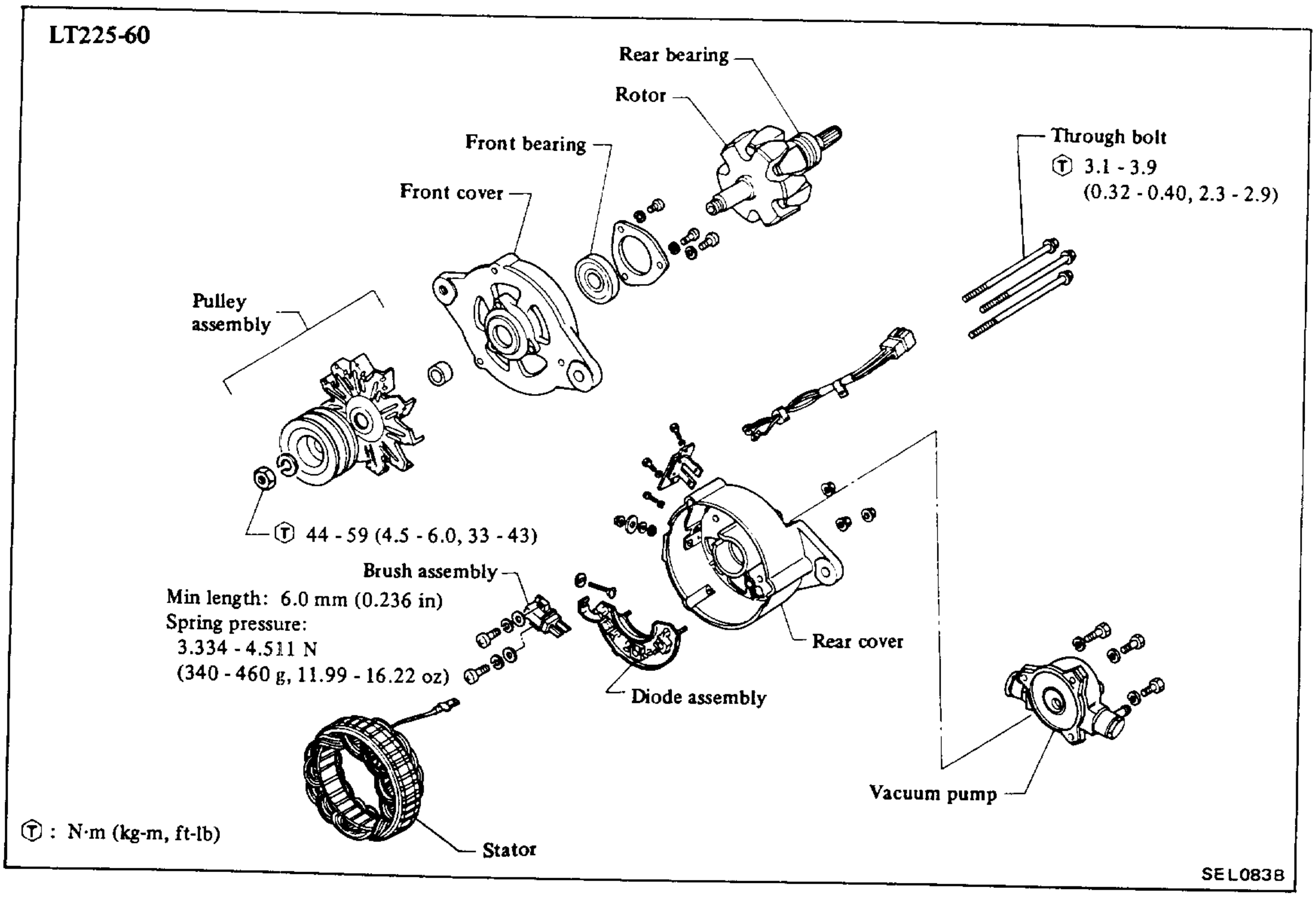
P40 engine equipped model

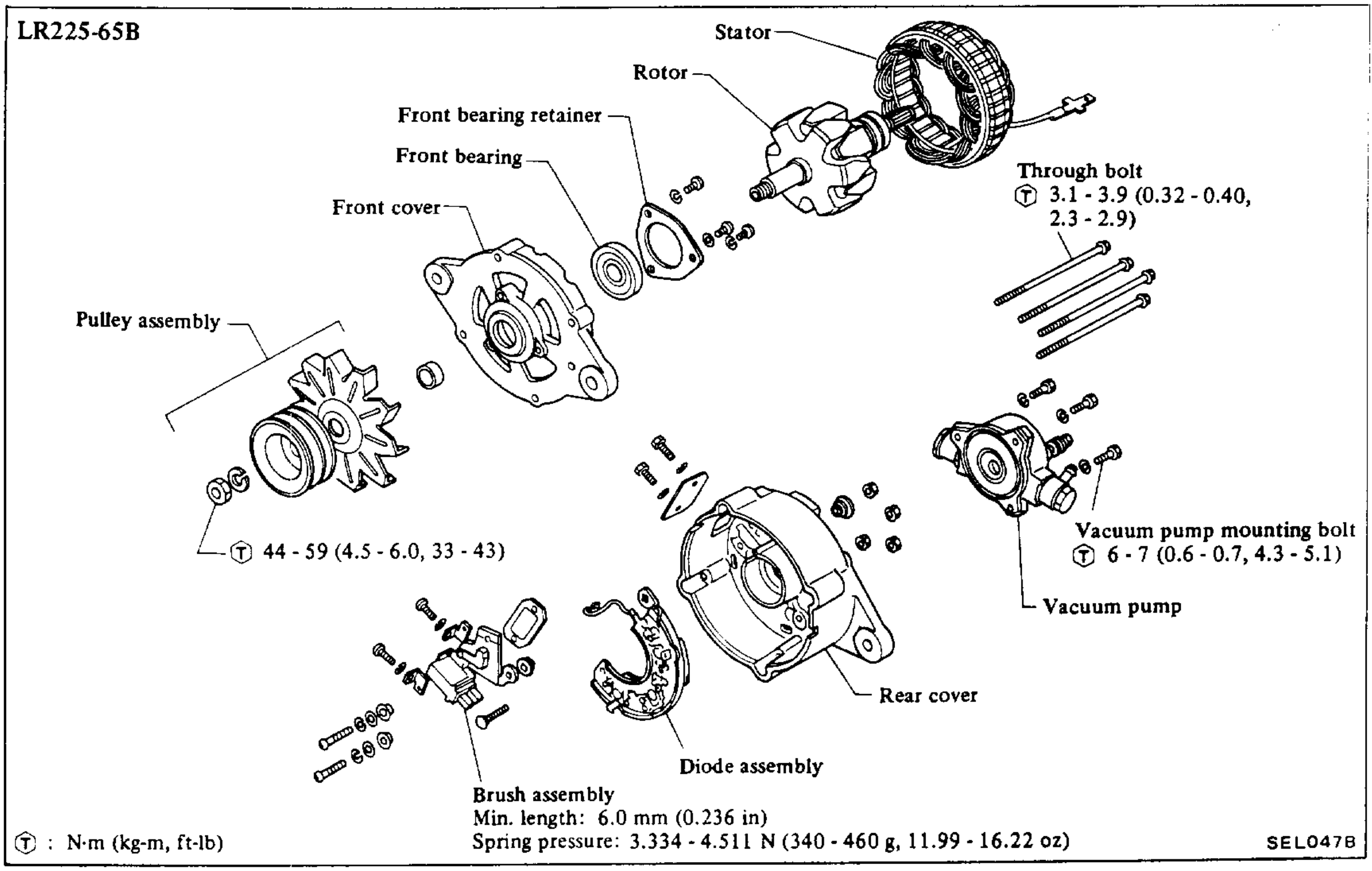




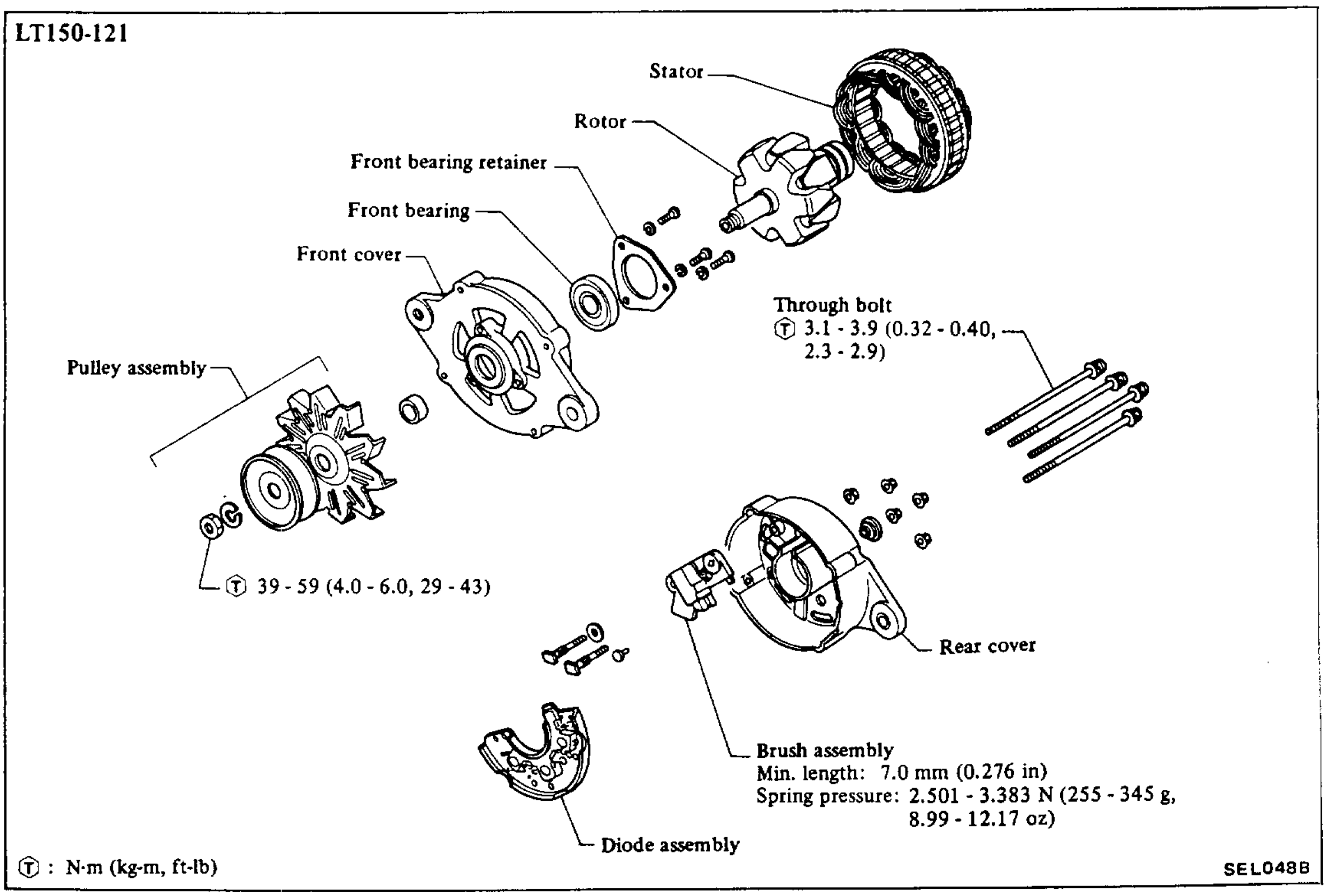


SD33 engine equipped model

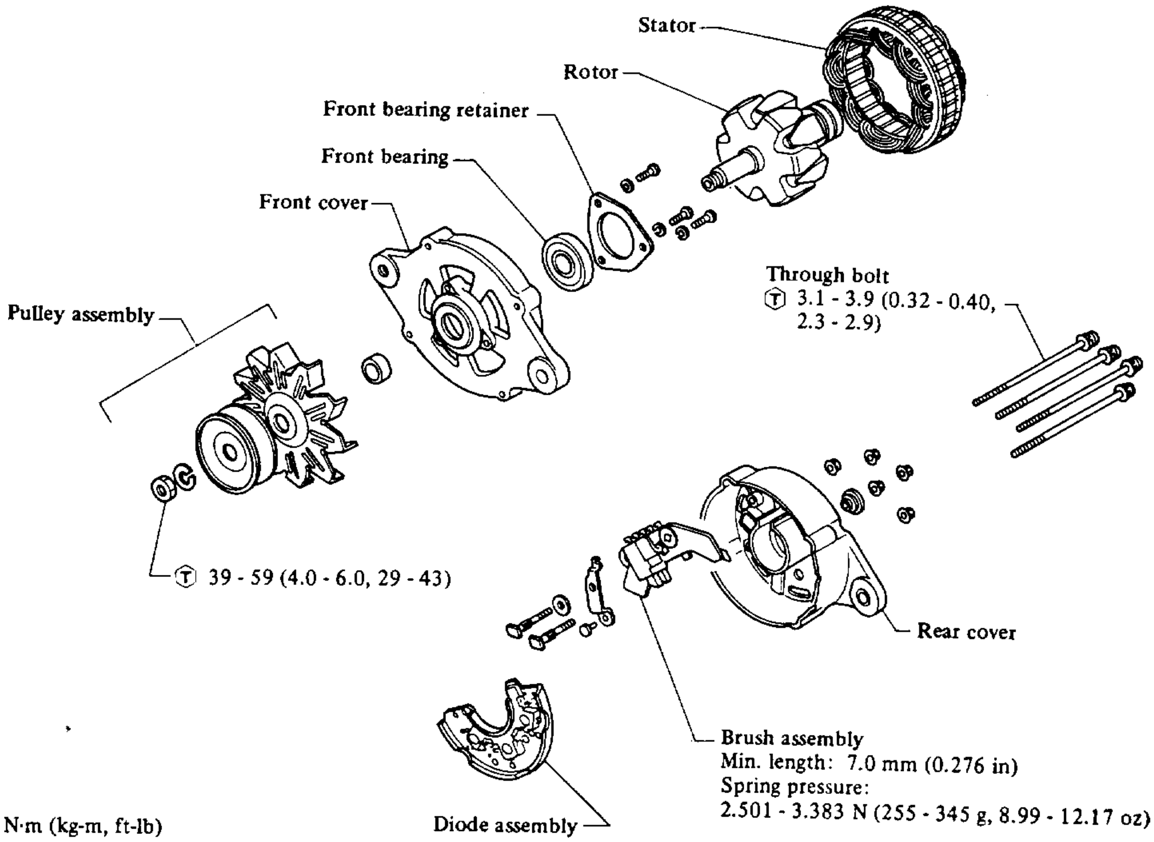




L28 engine equipped model



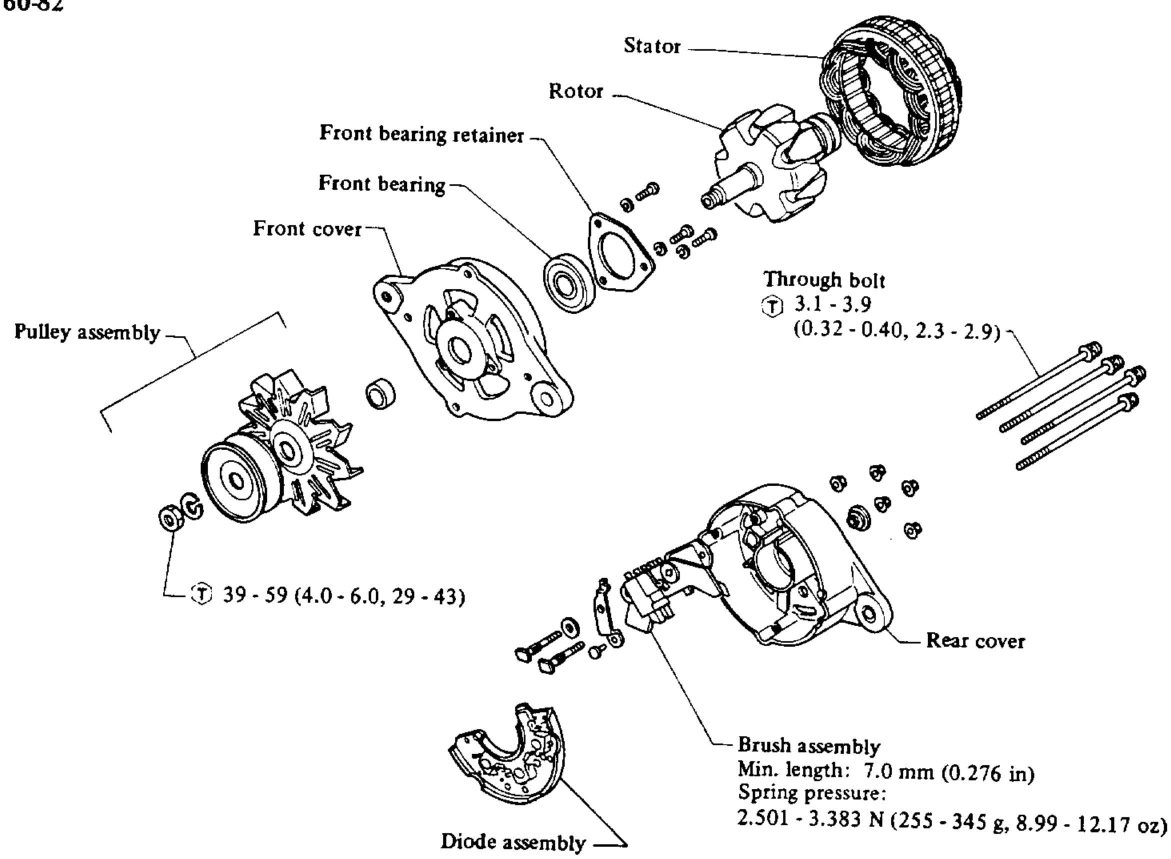
LT160-87



Ⓣ : N·m (kg-m, ft-lb)

SEL049B

LR160-82



Ⓣ : N·m (kg-m, ft-lb)

SEL050B

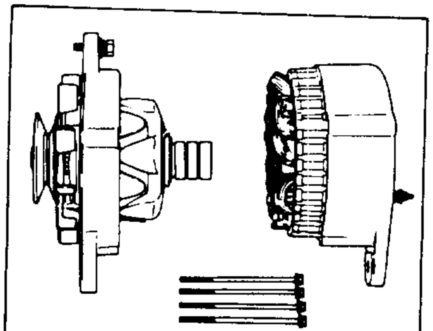
DISASSEMBLY

CAUTION:

Place packings and insulators in order so that they can be placed back in their original places or locations from which they were removed.

LT135-68

1. Remove through bolts.
2. Separate front cover from rear cover.

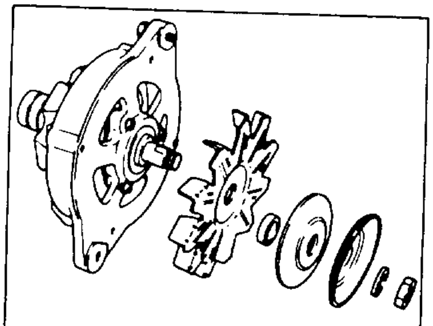


SEL061

3. Remove pulley and fan.

(1) Place rear cover side of rotor in a vise.

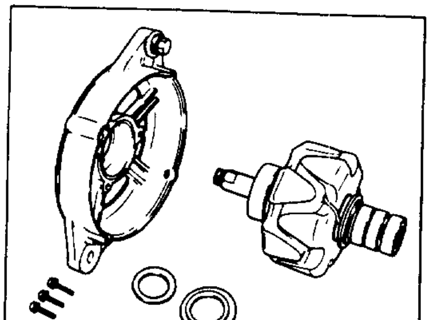
(2) Remove pulley nut.



SEL062

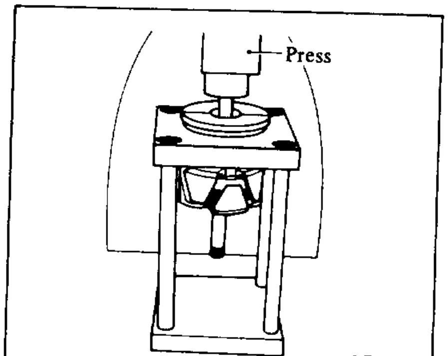
4. Separate rotor front cover.

- Remove setscrews from bearing retainer.

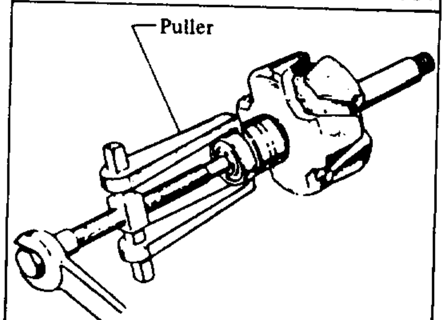


SEL063

5. Pull rear bearing off rotor assembly.

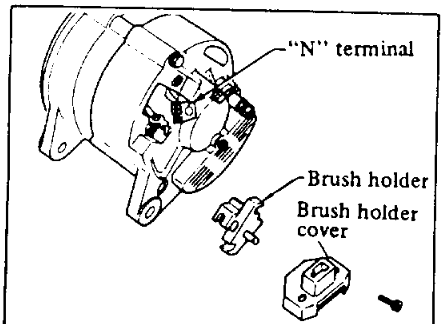


SEL064



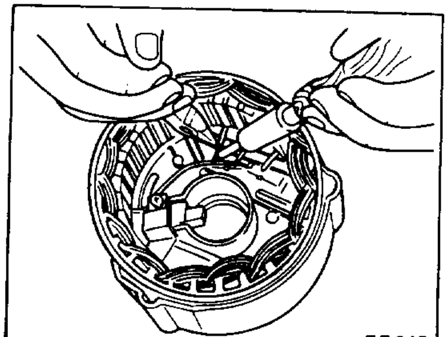
SEL065

6. Remove brush holder cover.
7. Remove brushes together with brush holder.



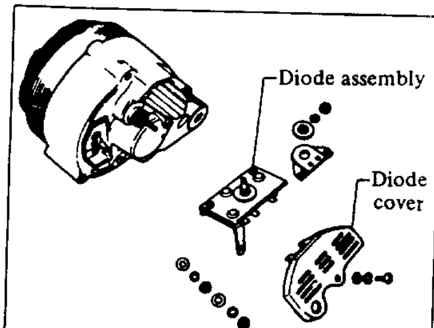
SEL976

8. Remove diode cover.
9. Disconnect stator coil lead wires from diode terminal with a soldering iron.



EE648

10. Remove "A" terminal nut and diode installation nut.
11. Remove diode assembly.



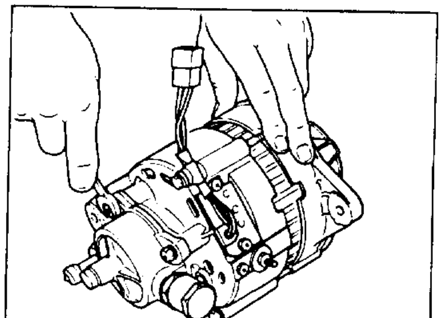
SEL067

12. Pull stator coils out of rear cover.

LT225-60

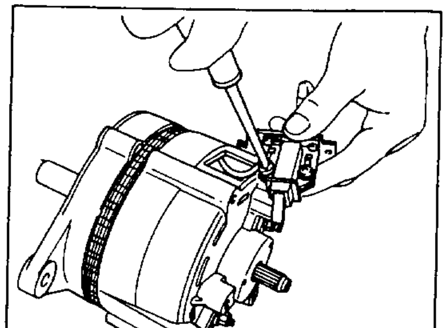
1. Remove vacuum pump.

Refer to Section BR for vacuum pump.



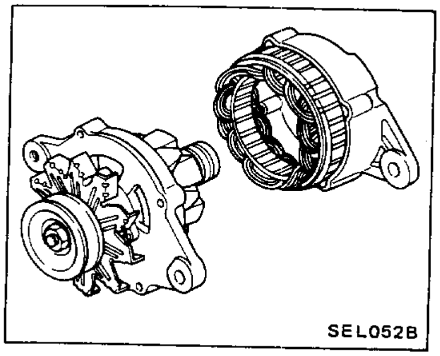
SEL706

2. Remove brush.



SEL061B

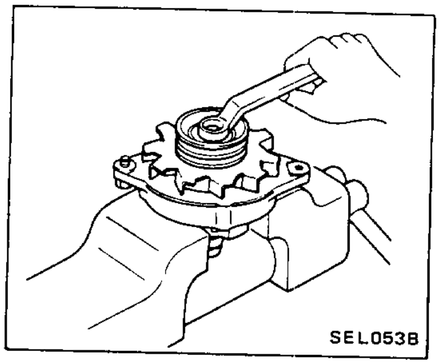
3. Separate front cover from rear cover.



SEL052B

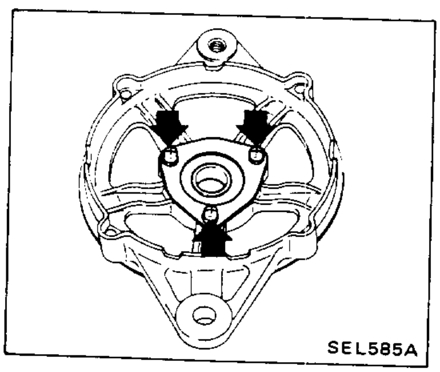
Use serration cap (Attach vinyl type) to prevent scratching oil seals.

4. Remove pulley and fan.
(1) Place rear cover side of rotor in a vice.
(2) Remove pulley nut.



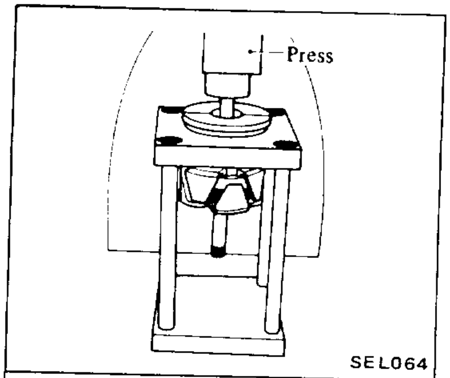
SEL053B

5. Remove screws from bearing retainer.

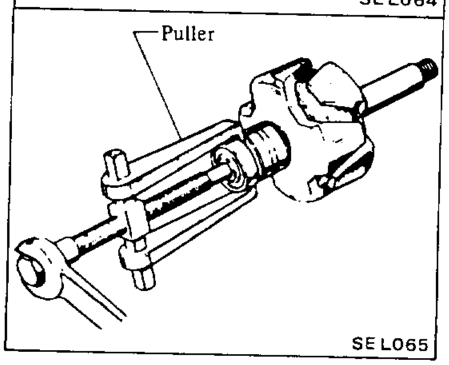


SEL585A

6. Pull rear bearing off rotor assembly.

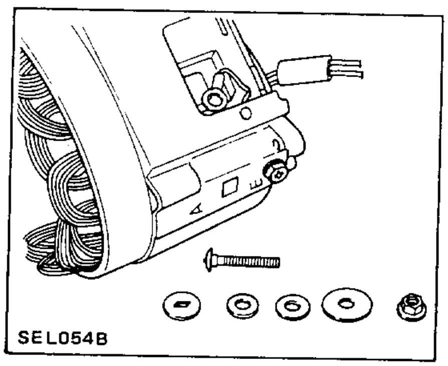


SEL064



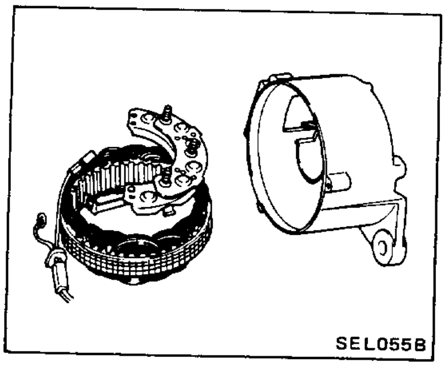
SEL065

7. Separate rear cover.
(1) Remove two "A" terminal nuts, then remove "A" terminal bolts.



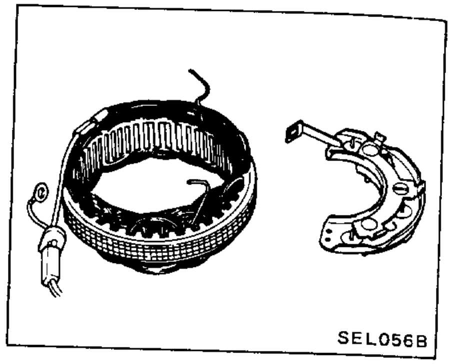
SEL054B

(2) Remove three M5 nuts that secure diode, then separate rear cover and stator.



SEL055B

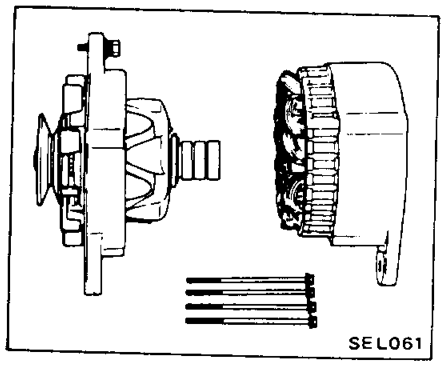
(3) Remove solder between stator coil and diode, the stator and diode can be separated.



SEL056B

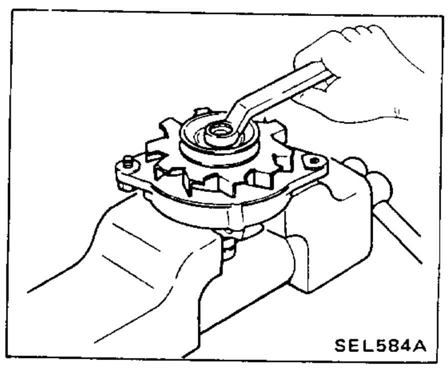
LT150, LT160, LR150 and LR160

1. Remove through bolts.
2. Separate front cover from rear cover.



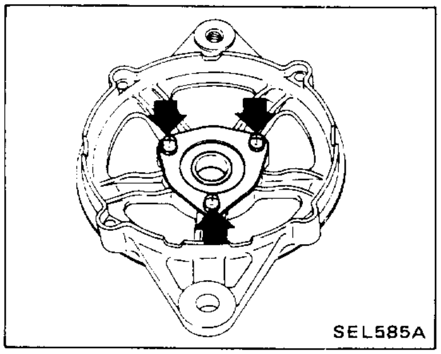
SEL061

3. Remove pulley and fan.
(1) Place rear cover side of rotor in a vice.
(2) Remove pulley nut.



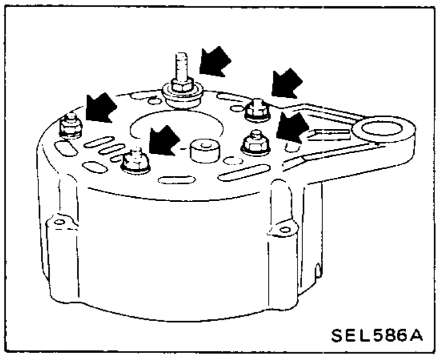
SEL584A

4. Remove screws from bearing retainer.



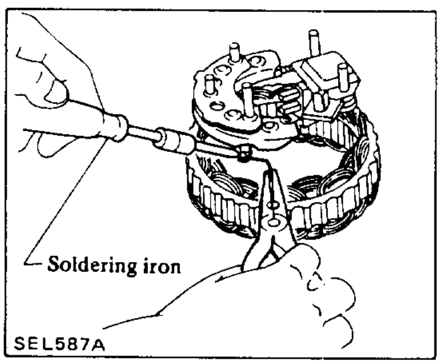
SEL585A

5. Remove attaching nuts and take out stator assembly.



SEL586A

6. Disconnect stator coil lead wires from diode terminals.



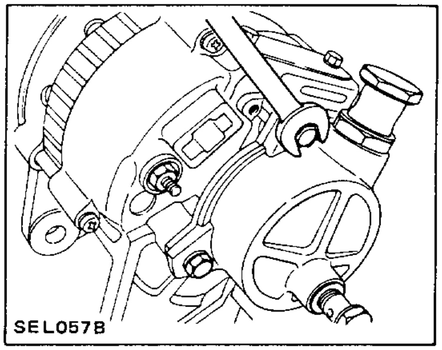
SEL587A

LR225-65B

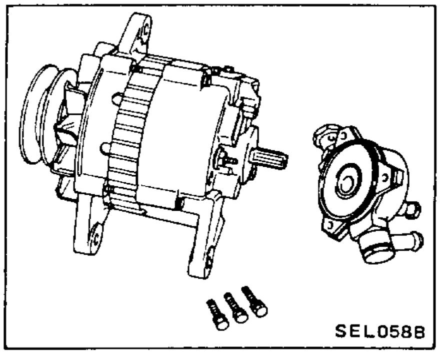
1. Remove vacuum pump.

- Remove the three bolts mounting the vacuum pump.

Pull the pump in the shaft direction.



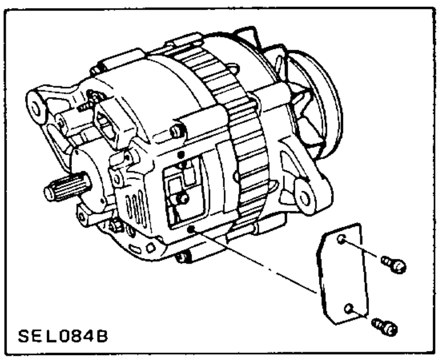
SEL057B



SEL058B

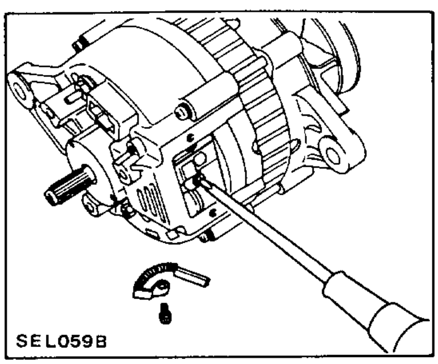
2. Remove brushes.

(1) Remove screw and then remove brush cover.



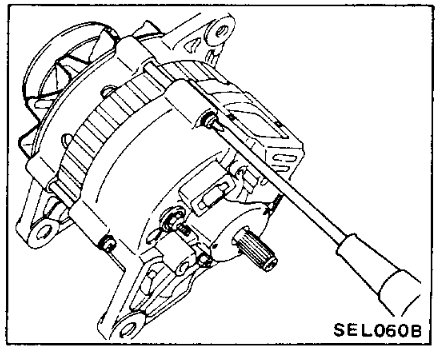
SEL084B

(2) Remove screw and then separate the brushes.

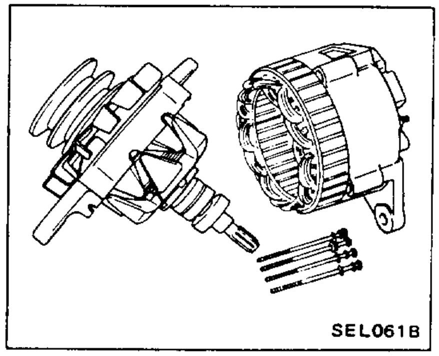


SEL059B

3. Loosen the four through bolts and then separate to the front and rear.



SEL060B



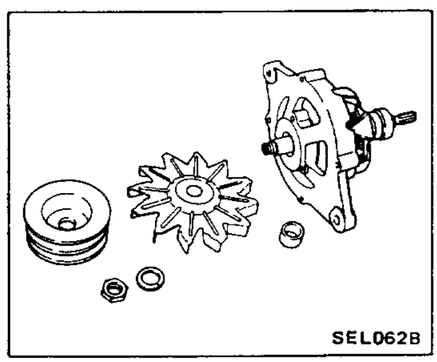
SEL061B

Use serration cap (Attach vinyl tape) to prevent scratching oil seals.

4. Remove pulley.

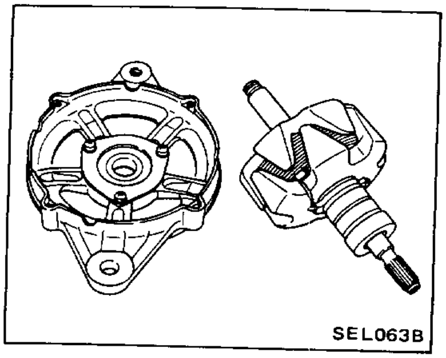
(1) Clamp the rotor in a vice and remove the pulley nut.

(2) After removing the nut, remove the pulley, fan and spacer.



SEL062B

5. Pull out the rotor by hand.

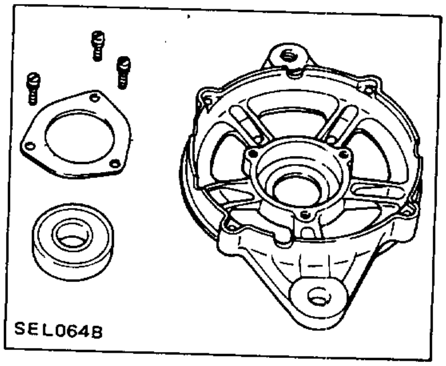


SEL063B

6. Remove front bearing.

(1) Loosen the three bearing ratainer screues and remove the bearing retainer.

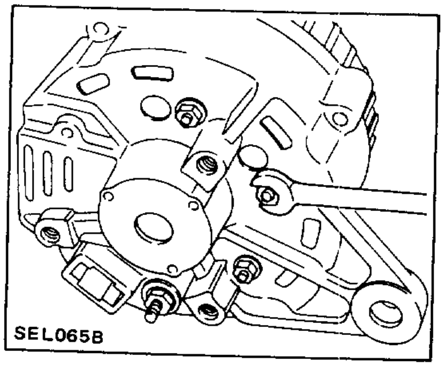
(2) Push out the bearing by hand slowly **so as not to damage the bearing.**



SEL064B

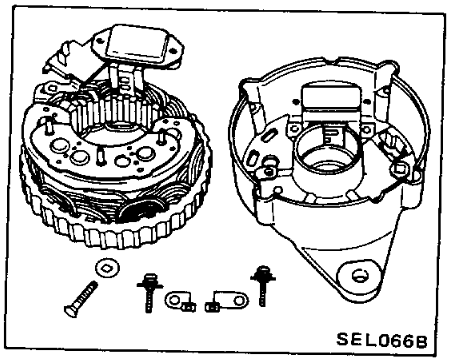
7. Remove stator coil.

(1) Remove the BAT terminal nut and the three nuts mounting diodes.



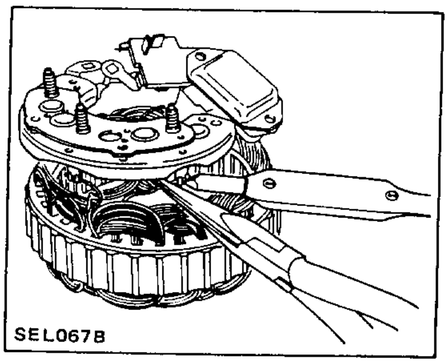
SEL065B

(2) Loosen the two screw mounting brush holder and regulator, and then remove the stator with diode assembly, regulator and brush holder from rear side.



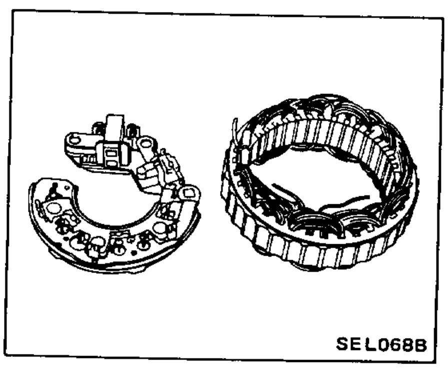
SEL066B

(3) Unsolder the stator coil and diodes connection.



SEL067B

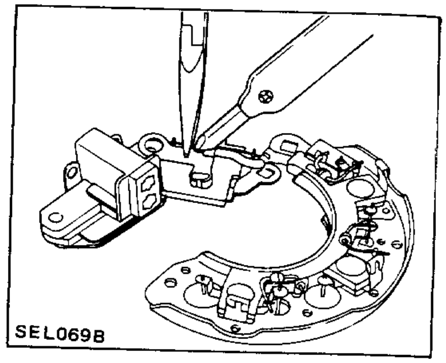
(4) Separate the stator and diode assembly with regulator and brush holder.



SEL068B

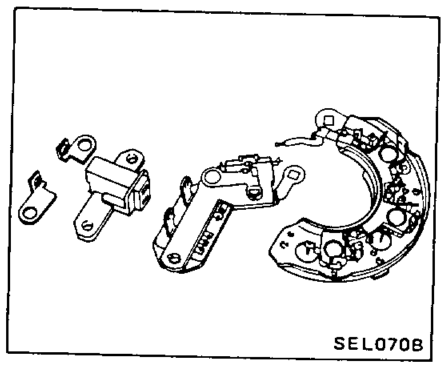
8. Remove the brush holder and regulator from diode assembly.

(1) Unsolder the terminal block and lead wire connection.



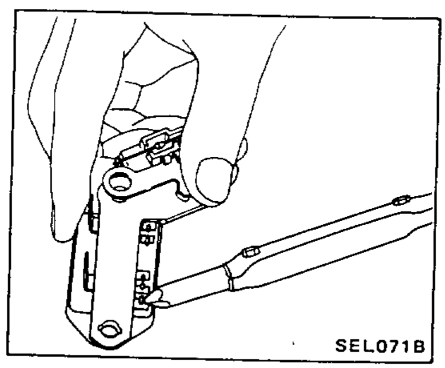
SEL069B

(2) Separate the brush holder, regulator with terminal block and diode assembly.



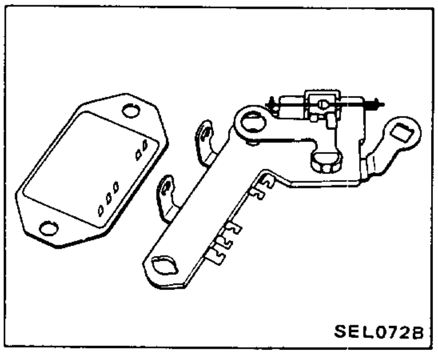
SEL070B

(3) Unsolder the terminal of regulator and terminal block connection.



SEL071B

(4) Separate the regulator and terminal block.

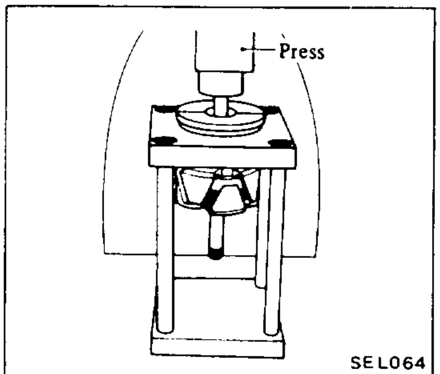


SEL072B

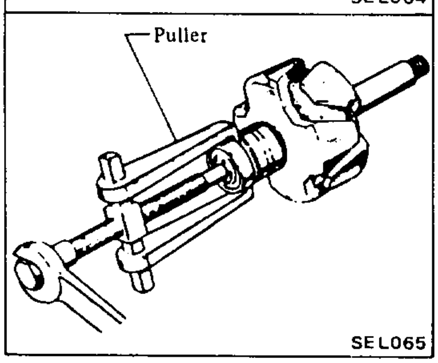
Rotor (All models)

Pull rear bearing off from rotor assembly with a press or bearing puller.

Once removed, bearing cannot be reused. Replace with a new one.



SEL064

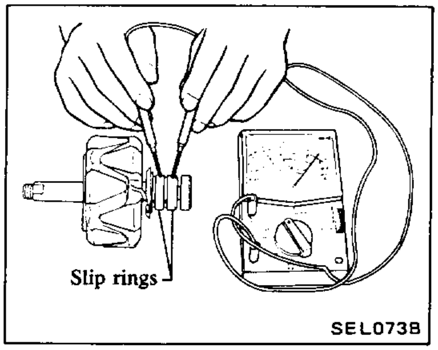


SEL065

INSPECTION

Rotor

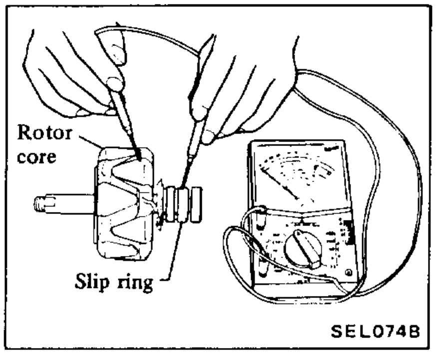
1. Continuity test.



SEL073B

- No continuity ... Replace rotor.

2. Ground test

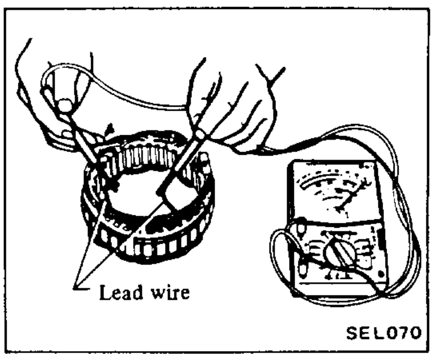


SEL074B

- Continuity exists ... Replace rotor.

Stator

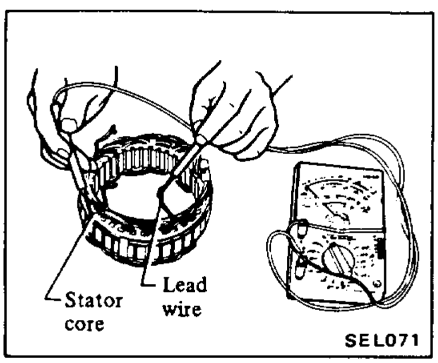
1. Continuity test



SEL070

- No continuity ... Replace stator.

2. Ground test



SEL071

- Continuity exists ... Replace stator.

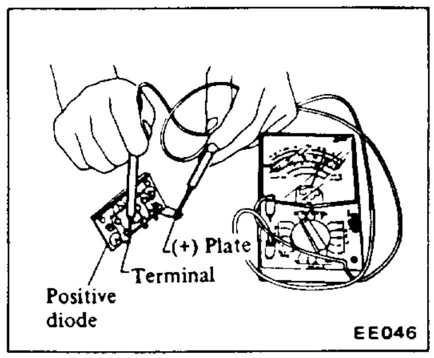
Diode

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

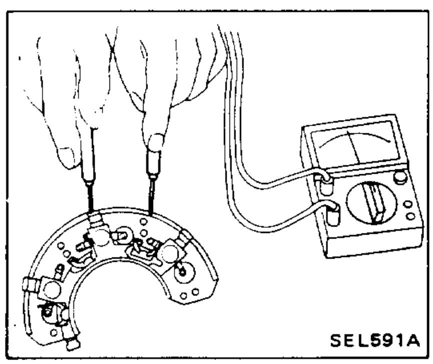
Positive diode

LT135-68



EE046

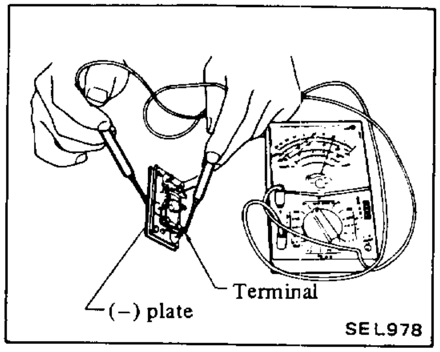
LT150, LT160, LT225, LR150, LR160 and LR225



SEL591A

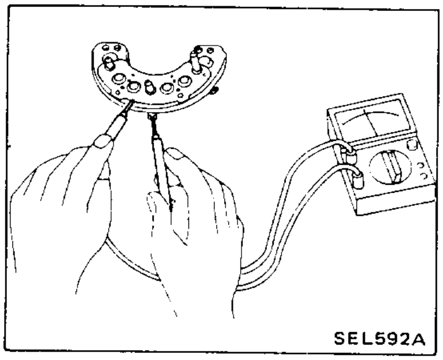
Negative diode

LT135-68 and LT150-121



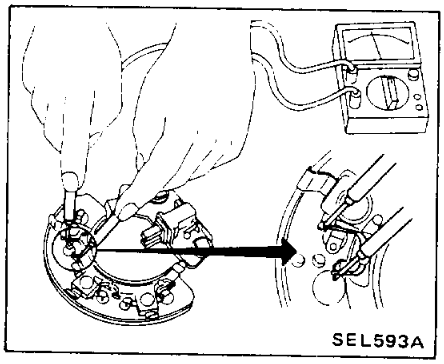
SEL978

LT150-102, LT160, LT225, LR150, LR160 and LR225


SEL592A

Sub- diode

LR150, LR160 and LR225


SEL593A

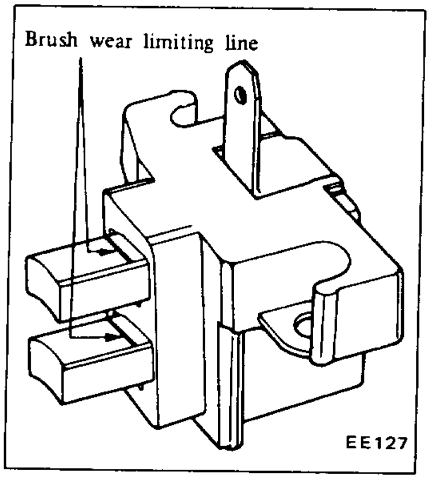
Brush

1. Check smooth movement of brush.

- Not smooth ... Check brush holder and clean.

2. Check brush for wear.

Min. brush length:
Gasoline engine
7.0 mm (0.276 in)
Diesel engine
6.0 mm (0.236 in)



EE127

- Less than the specified value ... Replace.

3. Check brush pig tail for damage.

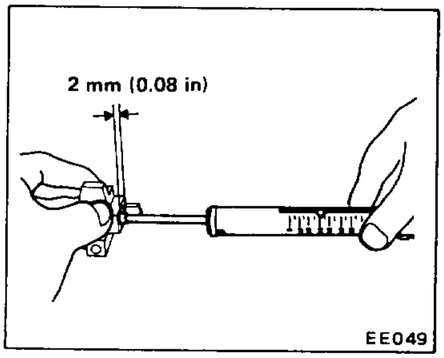
- Damaged ... Replace.

4. Check brush spring pressure.

Measure brush spring pressure with brush projected approximately 2 mm (0.08 in) from brush holder.

Spring pressure:
Refer to S.D.S.

When brush is worn, pressure decreases approximately 0.196 N (20 g, 0.71 oz) per 1 mm (0.04 in) wear.



EE049

- Not in the specified value ... Replace.

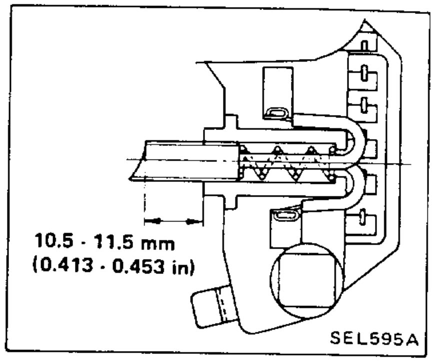
ASSEMBLY

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 (LT150, LT160, LR150 and LR160 type)

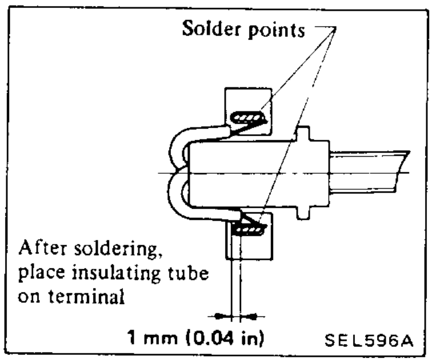
(1) Position brush so that it extends 11 mm (0.43 in) from brush holder.



SEL595A

(2) Coil lead wire 1.5 times around terminal groove. Solder outside of terminal.

When soldering, be careful not to let solder adhere to insulating tube as it will weaken the tube and cause it to break.

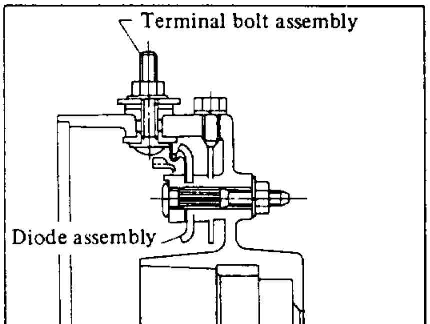


SEL596A

Ⓣ : **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)

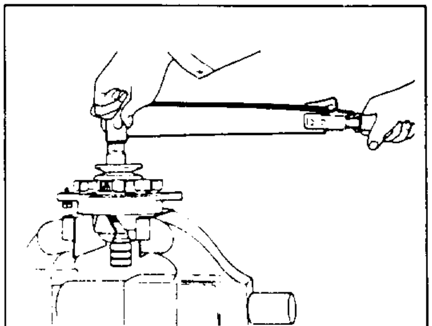
Bearing retainer
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m,
2.3 - 2.9 ft-lb)

2. When installing diode "A" terminal, install insulating bushing correctly. (LT225 type)



SEL651

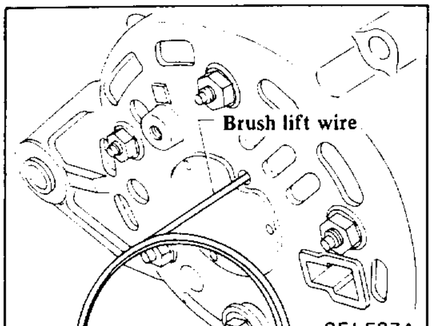
3. Tighten pulley nut and make sure that deflection of V-groove is proper.


EE051

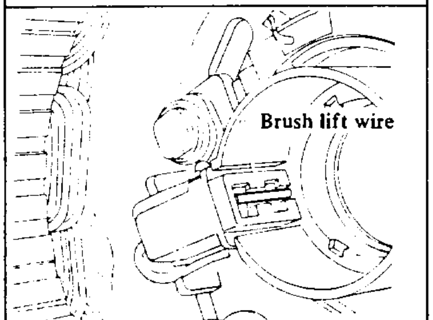
Ⓣ: Pulley nut
LT135
34 - 39 N·m
(3.5 - 4.0 kg-m,
25 - 29 ft-lb)
LT150, LT160, LR150 and LR160
39 - 59 N·m
(4.0 - 6.0 kg-m,
29 - 43 ft-lb)
LT225 and LR225
44 - 59 N·m
(4.5 - 6.0 kg-m,
33 - 43 ft-lb)

V-groove deflection:
0.3 mm (0.012 in)

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.



SEL597A



SEL598A

5. After installing front and rear sides of alternator, pull brush lift wire by pushing toward center.

Do not pull brush lift by pushing toward outside of cover as it will damage slip ring sliding surface.

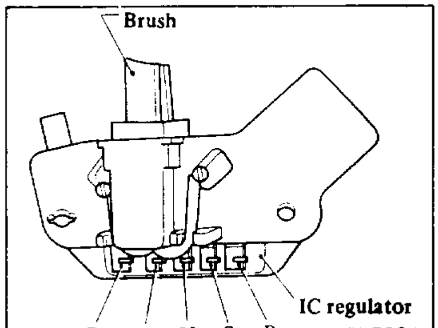
6. Tighten through bolts.

Ⓣ: 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.

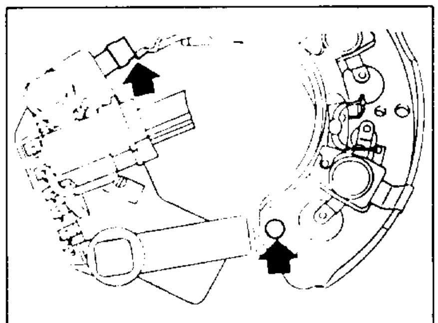


SEL599A

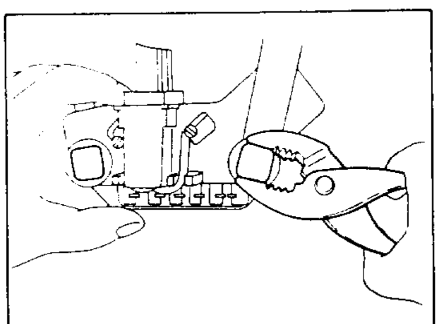
REPLACEMENT

Removal should be done only when IC regulator is being replaced.

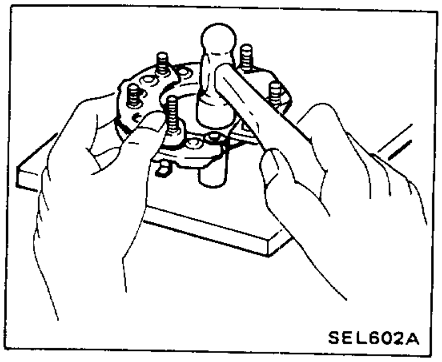
1. Remove rivet and solder.


SEL600A

2. Remove the terminal's solder and take out bolts.


SEL601A

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.


SEL602A

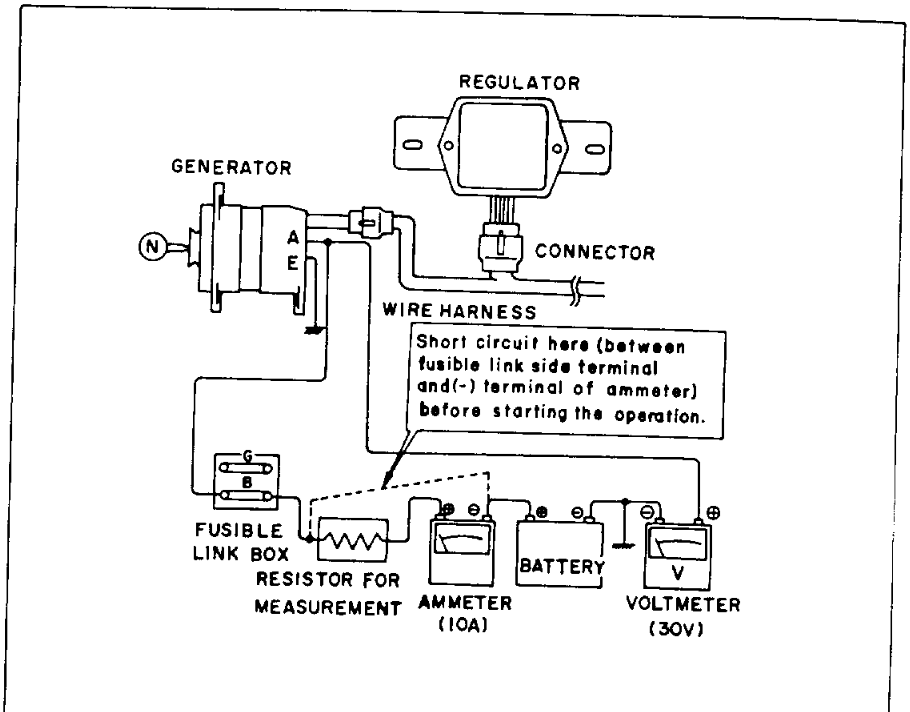
VOLTAGE REGULATOR

MEASUREMENT OF REGULATING VOLTAGE

1. Connect DC voltmeter (15-30V), DC ammeter (15-30A), battery and resistor (0.25Ω) with cables as shown.

Check to be sure that all electrical loads such as lamps, air conditioner, radio, etc. are disconnected.

CAUTION:
Before starting engine, be sure to make short circuit with a cable as shown in figure.
Failure to follow this caution causes a damaged ammeter.



SEL106

2. Refer to the following chart to determine if regulator and relative parts are in good condition:

1. Start engine.
2. Rotate engine at 2,500 rpm for several minutes.

After racing for several minutes, ammeter reading – below 5A. (2A ... SD33)

After racing for several minutes, ammeter reading – over 5A. (2A ... SD33)

Fully charged battery available.
1. Replace with fully charged battery.
2. Check to see if current falls below 5A. (2A ... SD33)

Fully charged battery not available.
1. Connect a 0.25Ω resistor in series.

Current falls below 5A. (2A ... SD33)

Current does not fall below 5A. (2A ... SD33)

Recharge battery and see if current falls below 5A. (2A ... SD33)

Reduce engine speed to idling and then raise it to 2,500 rpm while observing needle of voltmeter.

Needle of voltmeter held within limits shown in the table below.
Regulator functioning properly.

Needle of voltmeter out of limits shown in the following chart.
Regulator out of order. Have it repaired at authorized shop.

Temperature °C (°F)	Voltage V	
	P40 and L28	SD33
–10 (14)	14.7 - 15.25	29.4 - 30.5
0 (32)	14.60 - 15.2	29.2 - 30.4
10 (50)	14.5 - 15.15	29.0 - 30.3
20 (68)	14.4 - 15.1	28.8 - 30.2
30 (86)	14.3 - 15.05	28.6 - 30.1
40 (104)	14.2 - 15.0	28.4 - 30.0

a. Do not measure voltage immediately after driving. Do this while regulator is cold.

b. To measure voltage, raise engine speed gradually from idling to rated speed.

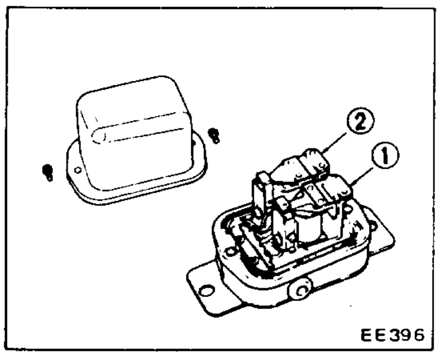
c. Voltage may be approximately 0.3V higher than the rated for two to three minutes after engine is started, or more specifically, when regulator becomes self-heated. Measurements should then be made within one minute after starting engine, or when regulator is cold.

d. The regulator is of a temperature-compensating type. Before measuring voltage, be sure to measure surrounding temperature.

ADJUSTMENT

Voltage regulator

Adjusting regulating voltage

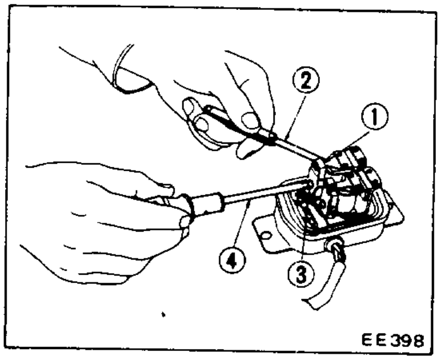


1 Charge relay
2 Voltage regulator

1. Inspect contact surface.
Rough ... Lightly polish with sand paper (#500 or 600).

2. Measure each gap. Adjust core gap and point gap in that order. No adjustment is required for yoke gap.
3. Adjusting core gap
   Loosen screw which is used to secure contact set on yoke, and move contact upward or downward properly.

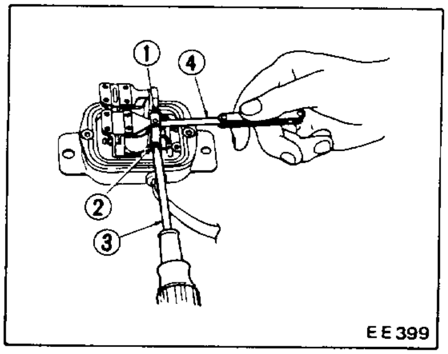
Core gap:
P40 and L28
0.6 - 1.0 mm (0.024 - 0.039 in)
SD33
0.8 - 1.2 mm (0.031 - 0.047 in)



1 Contact set
2 Thickness gauge
3 4 mm (0.16 in) dia. screw
4 Crosshead screwdriver

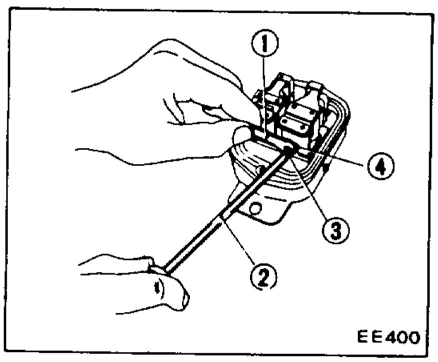
4. Adjusting point gap
   Loosen screw used to secure upper contact, and move upper contact upward or downward adequately.

Point gap:
P40 and L28
0.35 - 0.45 mm
(0.014 - 0.018 in)
SD33
0.45 - 0.55 mm
(0.018 - 0.022 in)



1 Thickness gauge
2 3 mm (0.12 in) dia. screw
3 Crosshead screwdriver
4 Upper contact

5. Adjusting voltage
   Adjust regulating voltage as follows:
   Loosen lock nut securing adjusting screw. Turn this screw clockwise to increase, or counterclockwise to decrease, regulating voltage.

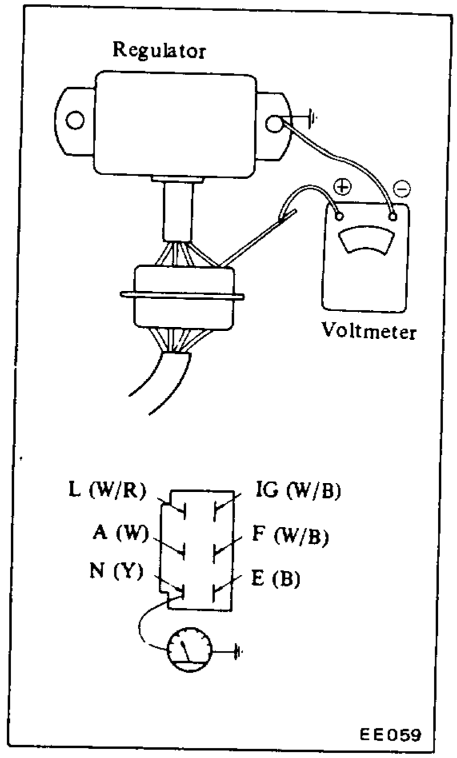


1 Wrench
2 Crosshead screwdriver
3 Adjusting screw
4 Lock nut

Charging relay

Normal relay operating voltage is 8 to 10V as measured at alternator "A" terminal. Relay itself, however, operates at 4 to 5V.

Use a DC voltmeter, and set up a circuit as shown in figure.



1. Connect positive terminal of voltmeter of regulator lead connector "N" terminal with negative terminal grounded.
2. Start engine and keep it idle.
3. Take voltmeter reading.

0 Volt
1. Check for continuity between "N" terminals of regulator and alternator.
2. Alternator circuit defective if continuity exists.

Below 5.2 Volts (10.4 Volts ... SD33)
(Pilot lamp remains lit.)
1. Check fan belt tension.
2. If correct, remove regulator and adjust as necessary.

Over 5.2 Volts (10.4 Volts ... SD33)
(Pilot lamp does not light.)
Pilot lamp relay assembly is in good condition.

Over 5.2 Volts (10.4 Volts ... SD33)
(Pilot lamp remains lit.)
Pilot lamp relay coil or contact points out of order.
Replace regulator.

SERVICE DATA AND SPECIFICATIONS

ALTERNATOR

Area	General areas					Europe		
Model	LT135-68	LT150-102	LT225-60	LT150-121	LT160-87	LR150-132	LR225-65B	LR160-82
Applied engine model	P40		SD33	L28		P40	SD33	L28
Nominal rating V-A	12 - 35	12 - 50	24 - 25	12 - 50	12 - 60	12 - 50	24 - 25	12 - 60
Ground palarity	Negative							
Minimum revolution under no load rpm	Less than 1,000	Less than 950	Less than 1,000			Less than 1,000		Less than 1,000
	When 14 volts is applied		When 28 volts is applied	When 14 volts is applied			When 26 volts is applied	When 14 volts is applied
Hot output current A/rpm/V	More than 27.5/2,500/14 More than 35/5,000/14	More than 17/1,300/14 More than 42/2,500/14 More than 50/5,000/14	More than 25/5,000/28	More than 40/2,500/14 More than 50/5,000/14	More than 50/2,500/14 More than 60/5,000/14	More than 15/1,300/14 More than 42/2,500/14 More than 50/5,000/14	More than 25/5,000/27	More than 50/2,500/14 More than 60/5,000/14
Pulley ratio	2.17		1.86	Check on pulley ratio as necessary, as it varies with each model				2.09
Minimum length of brush mm (in)	7.0 (0.276)		6.0 (0.236)	7.0 (0.276)		7.0 (0.276)	6.0 (0.236)	7.0 (0.276)
Brush spring pressure N (g, oz)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)		3.334 - 4.511 (340 - 460, 11.99 - 16.22)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)		2.501 - 3.383 (255 - 345, 8.99 - 12.17)	3.334 - 4.511 (340 - 460, 11.99 - 16.22)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)
Slip ring outer diameter mm (in)	31.6 (1.244)			More than 31.6 (1.244)		31.6 (1.244)		More than 31.6 (1.244)

VOLTAGE REGULATOR

Model			TL1Z-61D	TL2Z-26
Applied engine model			P40 and L28	SD33
Regulator voltage [At 20°C (68°F)] (With fully charged battery)		(V)	13.8 - 14.8	27.7 - 29.7
Voltage coil resistance [At 20°C (68°F)]		(Ω)	10.3	51.5
Rotor coil inserting resistance		(Ω)	10	120
Voltage coil series resistance		(Ω)	31	107
Smoothing resistance		(Ω)	40	150
Core gap		mm (in)	0.6 - 1.0 (0.024 - 0.039)	0.8 - 1.2 (0.031 - 0.047)
Point gap		mm (in)	0.35 - 0.45 (0.014 - 0.018)	0.45 - 0.55 (0.018 - 0.022)
Charge relay	Release voltage at "N" terminal	(V)	4.2 - 5.2	8.4 - 10.4
	Voltage coil resistance	(Ω)	31.9	104
	Core gap	mm (in)	0.8 - 1.0 (0.031 - 0.039)	0.6 - 0.8 (0.024 - 0.031)
	Point gap	mm (in)	0.4 - 0.6 (0.016 - 0.024)	0.4 - 0.6 (0.016 - 0.024)

IGNITION SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

DESCRIPTION

The ignition circuit consists of the ignition switch, coil, distributor, wiring, spark plugs and battery.

The circuit is equipped with a resistor. During cranking, electrical current bypasses the resistor, thereby connecting the ignition coil directly to battery. This provides full battery voltage at coil and keeps ignition voltage as high as possible.

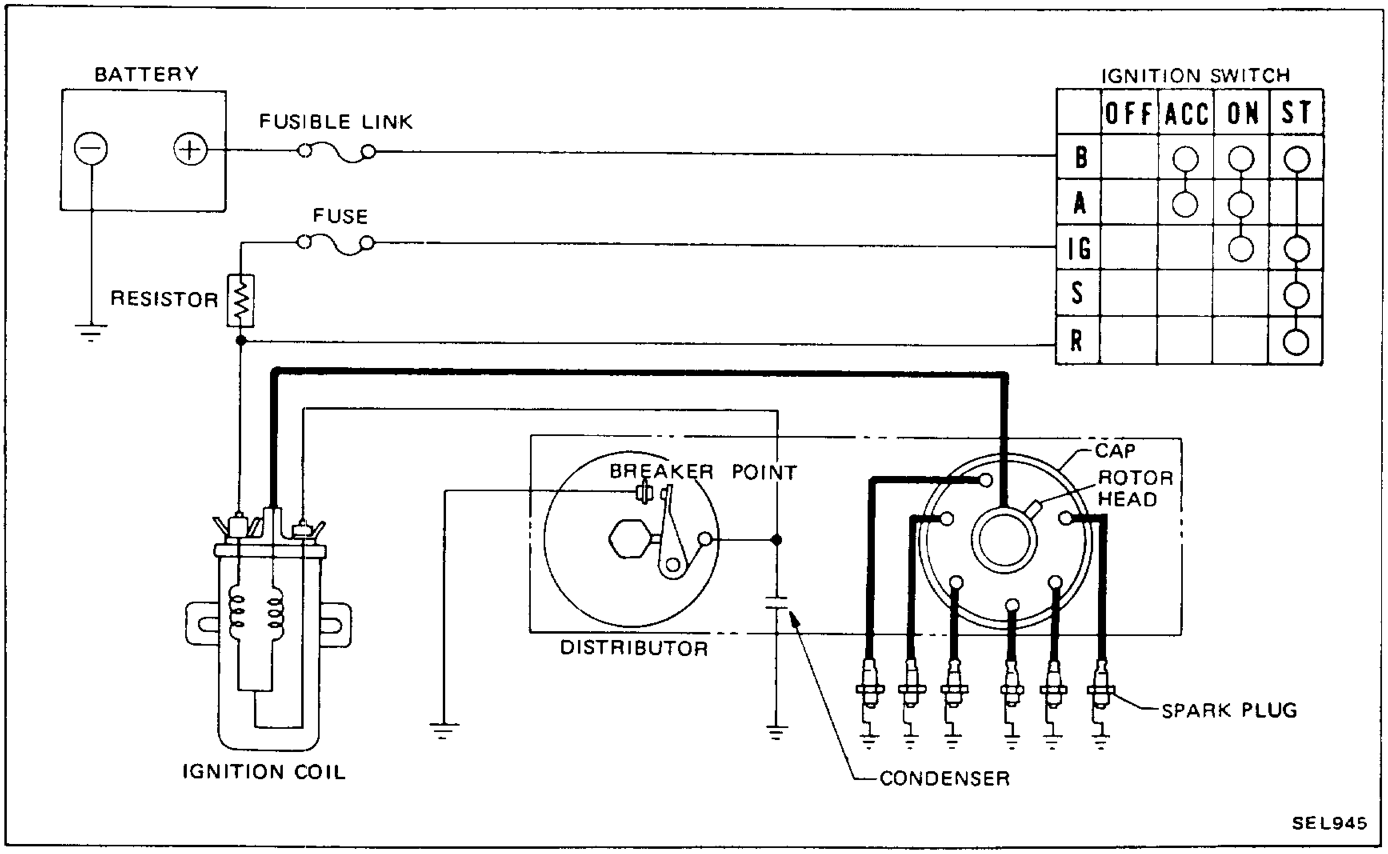
Low voltage current is supplied by the battery or alternator and flows through the primary circuit. It consists of the ignition switch, resistor, primary winding of the ignition coil, distributor contact points, condenser and all connecting low tension wiring.

High voltage current is produced by the ignition coil and flows through the secondary circuit, resulting in high voltage spark between the electrodes of the spark plugs in engine cylinders. This circuit contains the secondary winding of the ignition coil, high tension wiring, distributor rotor and cap.

When the ignition switch is turned on and the distributor contact points are closed, the primary current flows through the primary winding of the coil and through the contact points to ground.

When the contact points are opened by the revolving distributor cam, the magnetic field built up in the primary winding of the coil moves through the secondary winding of the coil inducing high voltage. The high voltage is produced every time the contact points open. The high voltage current flows through the high tension wire to the distributor cap. Then the rotor distributes the current to one of the spark plug terminals in the distributor cap.

The spark is obtained when the high voltage current jumps the gap between the insulated electrode and the ground side electrode of the spark plug. This process is repeated for each power stroke of the engine.



IGNITION SYSTEM TROUBLE-SHOOTING

DIAGNOSTIC TABLE

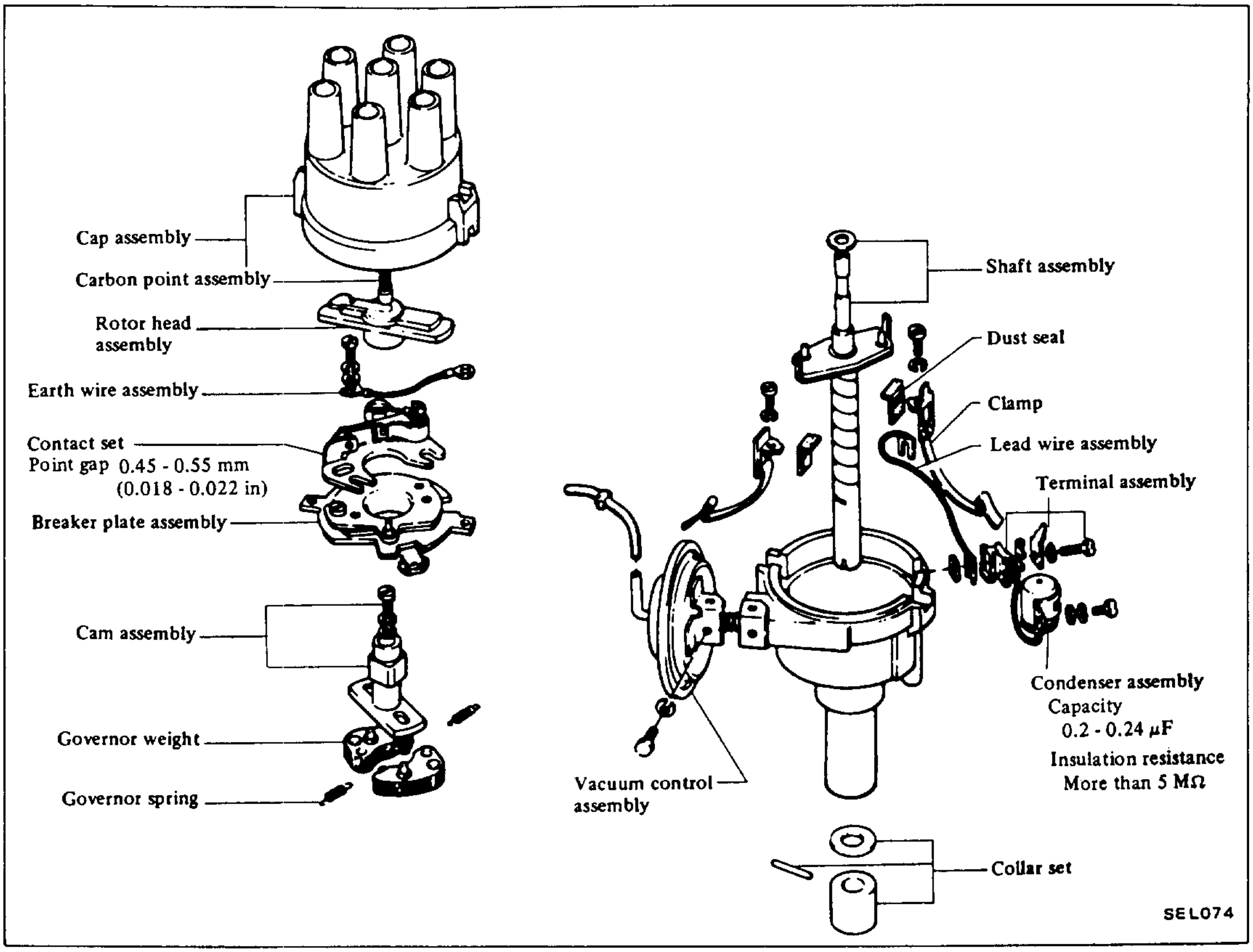
1. When engine does not start.
   If there is no trouble in fuel system, ignition system should be checked.

Condition	Trouble location	Probable cause	Corrective action
No sparks at all	Distributor	Damaged insulation of condenser.	Replace.
		Breakage of lead-wire on low tension side.	Repair.
		Door insulation of cap and rotor head.	Replace.
		Point gap wider than specification.	Adjust.
	Ignition coil	Wire breakage or short circuit of coil.	Replace with a new one.
	High tension cable	Wire coming off.	Repair.
		Faulty insulation.	Replace.
1 to 2 mm (0.04 to 0.08 in) or irregular.	Distributor	Point gap too wide.	Correct.
		Oil sticking on point.	Clean.
		Point burnt too much.	Replace.
Spark length More than 6 mm (0.24 in)	Spark plugs	Spark plug gap too wide.	Correct or replace.
		Too much carbon.	Clean or replace.
		Broken neck of insulator.	Replace.
		Expiration of plug life.	Replace.

2. When engine turns over but does not run smoothly.

Engine misses.	Distributor	Dirty point.	Clean.
		Improper point gap.	Correct.
		Leak of electricity of cap and rotor head.	Repair or replace.
		Faulty insulation of condenser.	Replace.
		Faulty arm.	Oil shaft.
		Faulty spring of arm.	Replace assembly.
		Breakage of lead wire.	Replace.
		Worn out or shaky breaker plate.	Replace assembly.
		Worn out or shaky distributor shaft.	Replace assembly.
	Ignition coil	Layer short circuit or inferior quality coil.	Replace with good one.
	High tension cable	Deterioration of insulation with consequent leak of electricity.	Replace.
	Spark plugs	Fouled.	Clean.
		Leak of electricity at upper porcelain insulator.	Repair or replace.
Engine knocks very often.	Distributor	Improper ignition timing (too advance).	Correct the fitting.
		Coming off or breakage of governor spring.	Correct or replace.
		Worn pin or hole governor.	Replace.
	Spark plugs	Burnt too much.	Replace.
Engine does not give enough power.	Distributor	Improper ignition timing (too retarded).	Correct the fitting.
		Improper functioning governor.	Replace assembly.
		Foreign particles stuck in point gap.	Clean.
	Spark plugs	Fouled.	Clean.

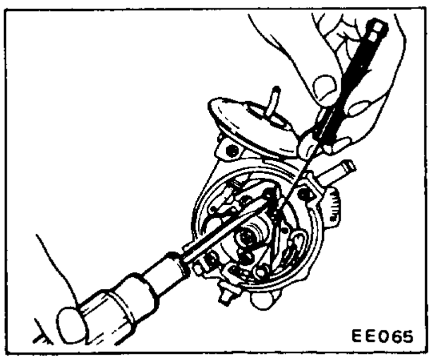
DISTRIBUTOR



CHECKING AND ADJUSTMENT

Cap and rotor head

Check cap and rotor head for dust, carbon deposits and cracks.

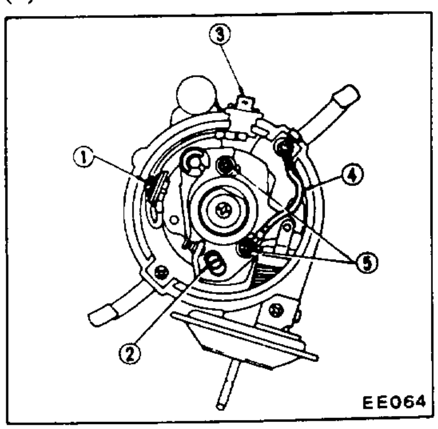


Contact point

1. Adjust point gap.
   Loosen point screw and adjust gap with a gap gauge.
   Point gap:
   0.45 - 0.55 mm
   (0.018 - 0.022 in)

2. Check the point surface.
   Take off any irregularities with fine sandpaper (No. 500 or 600) or with oil stone.

3. Removal of contact point
   (1) Disconnect primary lead wire from contact set.
   (2) Remove contact set fixing screws.
   (3) Remove contact set.



1 Screw
2 Adjuster
3 Primary lead terminal
4 Earth lead wire
5 Set screw

Condenser

Checking of condenser is made by a capacity tester. This can also be made by a circuit tester with its range set to high resistance reading. When needle of tester swings violently and then moves back to infinite gradually, it is an indication that condenser is in good condition.

If needle shows any steady reading or if it registers zero, the likelihood is that transformer is out of order, calling for replacement.

Condenser capacity:
0.2 - 0.24 μF
Condenser insulation resistance:
More than 5MΩ

Advance mechanism

Specifications .

Refer to S.D.S.

Vacuum advance mechanism mechanical parts

1. Check vacuum inlet for signs of leakage 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 part, use distributor tester to check its characteristic.

When nothing is wrong with its characteristic, conceivable causes are break-down or abnormal wearing-out of driving part or others. So do not disassemble it.

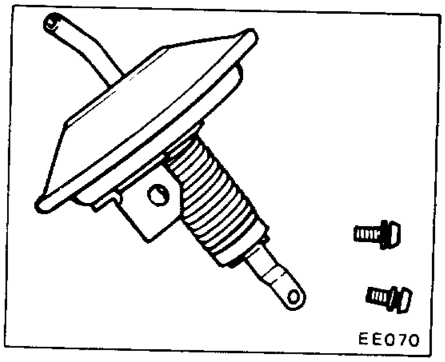
In case of improper characteristic, take off contact breaker assembly part and check closely cam assembly, governor weight, shaft and governor spring, etc.

In case centrifugal advance mechanical part is reassembled, be sure to check advance characteristic with distributor tester.

DISASSEMBLY

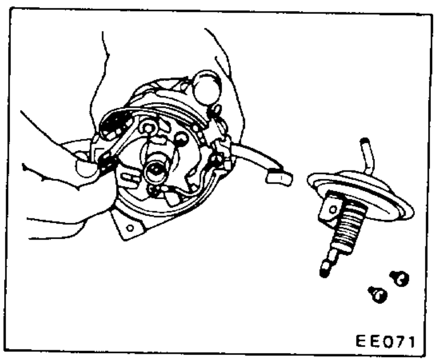
To disassemble, follow the procedure below.

1. Take off cap and remove rotor head.
2. Remove vacuum controller.



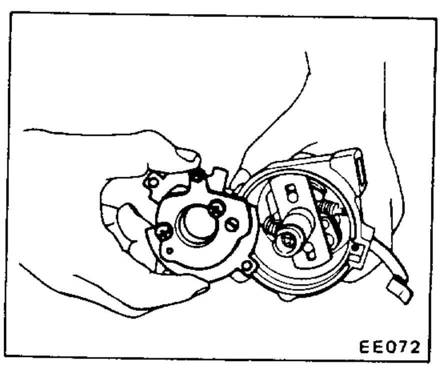
EE070

3. Remove contact set.



EE071

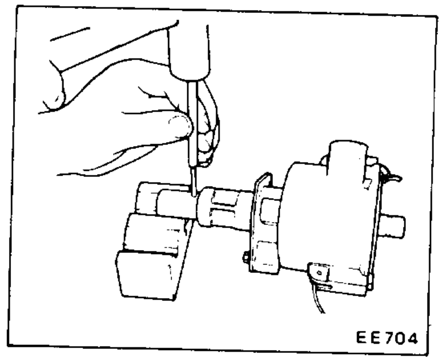
4. Remove contact breaker.



EE072

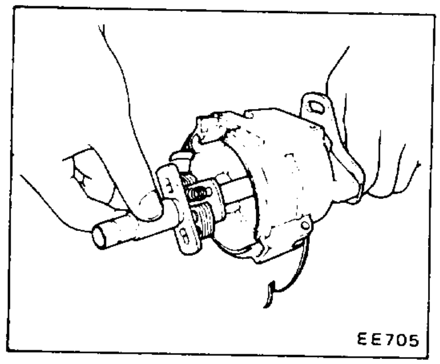
Be careful not to lose steel balls between breaker spring and breaker plate.

5. Pull knock pin out and disconnect collar.



EE704

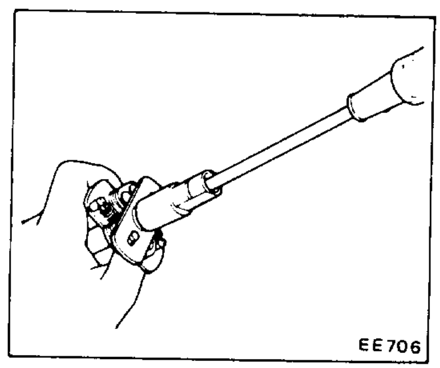
6. Remove the entire rotating parts.



EE705

7. Remove set screw at shaft head, and remove cam.

CAUTION:
Put match mark across cam and shaft so that original combination can be restored at assembly.



EE706

8. Remove governor weight and spring.

CAUTION:
Be careful not to stretch or deform governor spring.

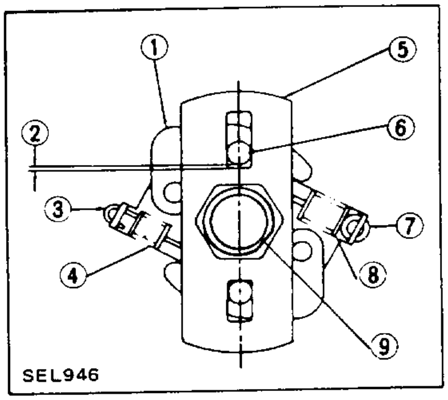
Apply grease to governor weight.

ASSEMBLY

To assemble, reverse the order of disassembly.

Carefully observe the following instructions.

1. Rotor head positioning tip at cam is set on governor spring circular hook side.
2. Weight pin for governor spring "A" with circular hook fits in long rectangular hole.
3. Check to be sure that weight pin on spring "A" is in slit in cam plate with a clearance between the two at beginning and end of governor operation. Meanwhile, weight pin on opposite side fits in short rectangular hole.
4. With unit assembled, check to be sure that driven slit and rotor positioning tip are set in the same direction.
5. Apply grease to top of cam assembly as required.
6. After assembly, check operation of governor before installing it on engine.
7. Ignition timing should be tested with unit mounted on engine.



1 Governor weight
2 Clearance for start and end of advancing angle
3 Rectangular hook
4 Governor spring (B)
5 Cam plate
6 Weight pin
7 Circular hook
8 Governor spring (A)
9 Rotor positioning tip

SERVICE DATA AND SPECIFICATIONS

DISTRIBUTOR

Model		D610-58	D610-57	D609-62
Applied engine model		P40		L28
Firing order		1-5-3-6-2-4		
Rotation direction		Counterclockwise		
Dwell angle at point gap 0.5 mm (0.020 in)	degree	35° - 41°		
Point gap	mm (in)	0.45 - 0.55 (0.018 - 0.022)		
Cap insulation resistance	MΩ	More than 50		
Rotor head insulation resistance	MΩ	More than 50		
Cap carbon point length	mm (in)	More than 12 (0.47)		More than 10 (0.39)
Vacuum advance [Distributor degree/distributor kPa (mbar, mmHg, inHg)]		0°/13.3 (133, 100, 3.94) 4.1°/26.7 (267, 200, 7.87) 6°/35.3 (353, 265, 10.43)	0°/33.3 (333, 250, 9.84) 2.15°/36.99 (369.9, 277.5, 10.925) 3.5°/40.0 (400, 300, 11.81)	0°/20.0 (200, 150,5.91) 5°/36.0 (360, 270, 10.63) 9°/53.3 (533, 400, 15.75)
Centrifugal advance [Distributor degree/distributor rpm]		0°/450 10°/1,250	0°/490 10°/1,790	0°/550 9°/1,200

IGNITION COIL

Model		HP5-10E	CIZ-200	HP5-13E10	C6R-206
Applied model		Except Europe model		Europe model	
Primary voltage	V	12			
Spark gap	mm (in)	More than 7 (0.28)			
Primary resistance [At 20°C (68°F)]	Ω	1.25 - 1.76	3.42 - 4.18	1.28 - 1.56	1.35 - 1.65
Secondary resistance [At 20°C (68°F)]	KΩ	6.9 - 10.3	6.4 - 9.6	7.23 - 9.78	6.8 - 10.2
Ballast resistor	Ω	–		1.6	

SPARK PLUG

Applied model		Except Europe model		Europe model	
Applied engine model		P40	L28	P40	L28
Model		B-5ES, L46W	BP6ES, L45PW	BPR5ES	BPR6ES
Size (Screw dia. x reach)	mm (in)	14 x 19 (0.55 x 0.75)			
Plug gap	mm (in)	0.7 - 0.8 (0.028 - 0.031)	0.8 - 0.9 (0.031 - 0.035)	0.7 - 0.8 (0.028 - 0.031)	0.8 - 0.9 (0.031 - 0.035)

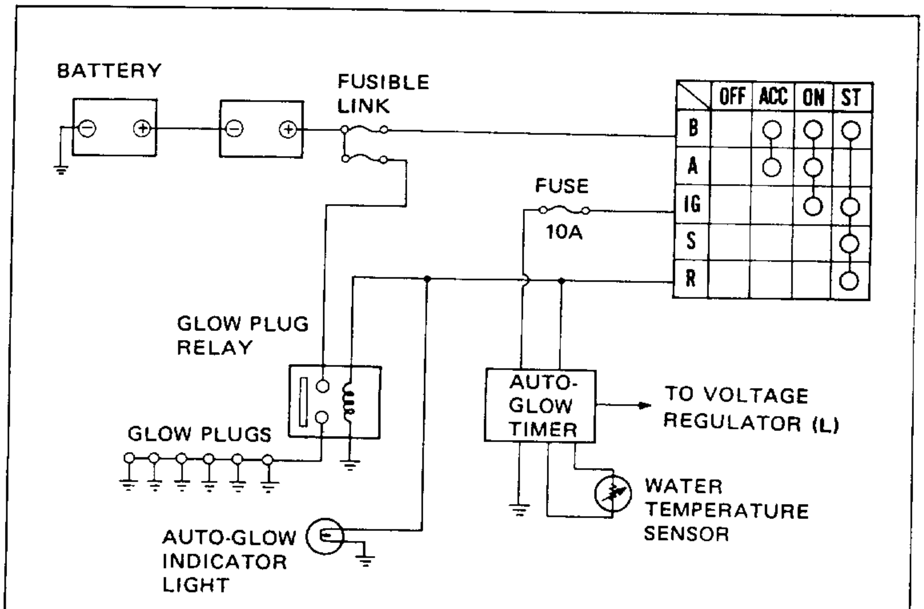
AUTO-GLOW SYSTEM (Diesel engine)

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

DESCRIPTION

The auto-glow plug system is designed to control the preheating time of the glow plugs automatically by monitoring the engine coolant and by means of the timer.

1. Starting switch "ON"
   The glow plugs are automatically preheated by means of the timer and at the same time the auto-glow indicator lamp comes on. After the glow plugs are heated sufficiently, the lamp goes out.
2. Starting switch "START"
   After the engine starts, the timer stops due to a signal from the charging circuit of the voltage regulator.
3. When preheating the glow plugs again.
   When preheating the glow plugs again, place the starting switch to the "ACC" or "OFF" position and then place it to the "ON" position. This activates the timer again to preheat the glow plugs for a period of time specified by the coolant temperature.



SEL070A

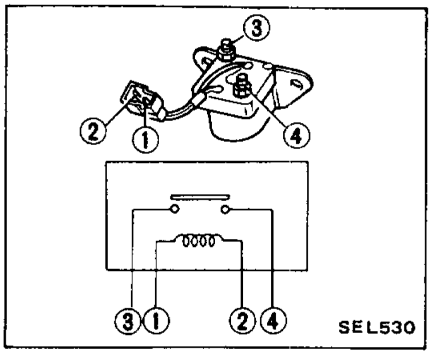
AUTO-GLOW SYSTEM TROUBLE-SHOOTING

Condition	Probable cause	Corrective action
Starting SW "ON"		
Auto-glow indicator light does not come on.	Burned bulb.	Replace.
	Faulty auto-glow timer or water temperature sensor.	Replace.
Auto-glow indicator light does not go out within specified length of time.	Faulty auto-glow timer or water temperature sensor.	Replace.
Glow plug indicator does not glow.	Faulty glow plug indicator.	Replace.
	Faulty glow relay II.	Replace.
	Faulty auto-glow timer or water temperature sensor.	Replace.
Glow plug indicator glows.		
1) Glow plug glows red prematurely (before auto-glow indicator light goes out).	Shorted glow plug/glow plug circuit.	Replace.
2) Glow plug does not glow red (before auto-glow indicator light goes out).	Open glow plug circuit or low current flow.	Replace.

Engine	Time required for light to go out after turning on.
Engine hot	about 1 sec.
Engine cold	about 30 sec.

REMOVAL AND INSPECTION

GLOW PLUG RELAY

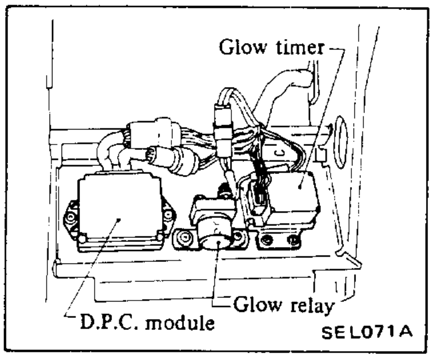


SEL530

Inspection

There must be continuity between terminals ③ and ④ when 12 volts d.c. is applied between ① and ②.

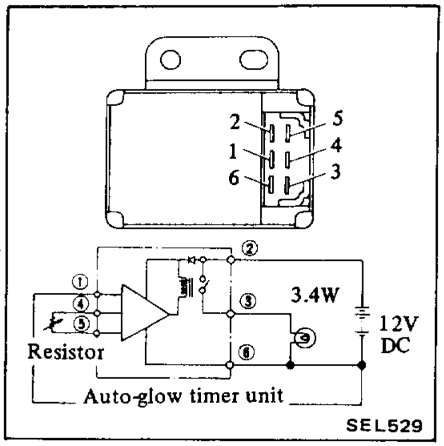
AUTO-GLOW TIMER UNIT



SEL071A

Inspection

1. Connect lead wires as shown.



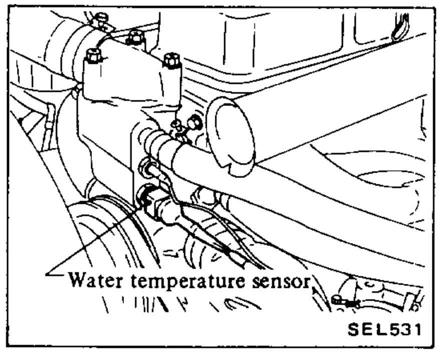
SEL529

2. Insert following resistors between terminals ④ and ⑤ , and make sure that lamp goes out within specified time.

Resistor (KΩ)	Time at which lamp goes out (seconds)
More than 6.7	30 - 48
2.5	11 - 20
Less than 0.8	Less than 5

3. Insert a resistor of more than 6.7 kilo ohms between terminals ④ and ⑤ , and make sure that lamp goes out immediately after disconnecting terminal ①.

WATER TEMPERATURE SENSOR

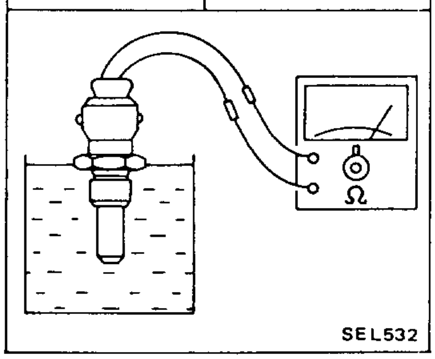


SEL531

Inspection

Measure resistance to temperature as shown.

Temperature °C (°F)	Resistance kΩ
10 (50)	32.5 - 41.5
20 (68)	22.5 - 27.5
50 (122)	7.4 - 9.4
80 (176)	2.9 - 3.6



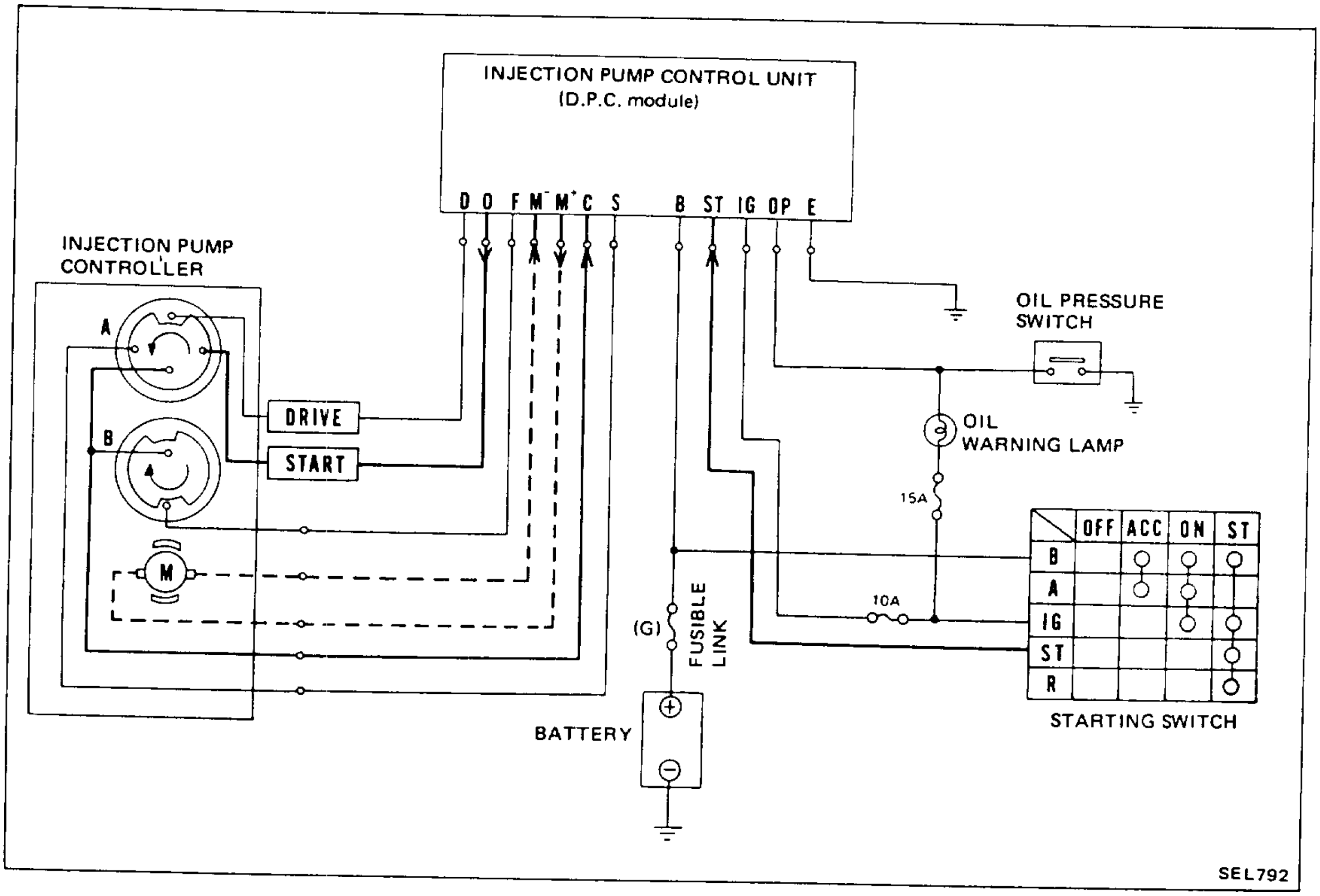
SEL532

INJECTION PUMP CONTROL SYSTEM (Diesel engine)

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

DESCRIPTION

FUEL EXCESS OPERATION

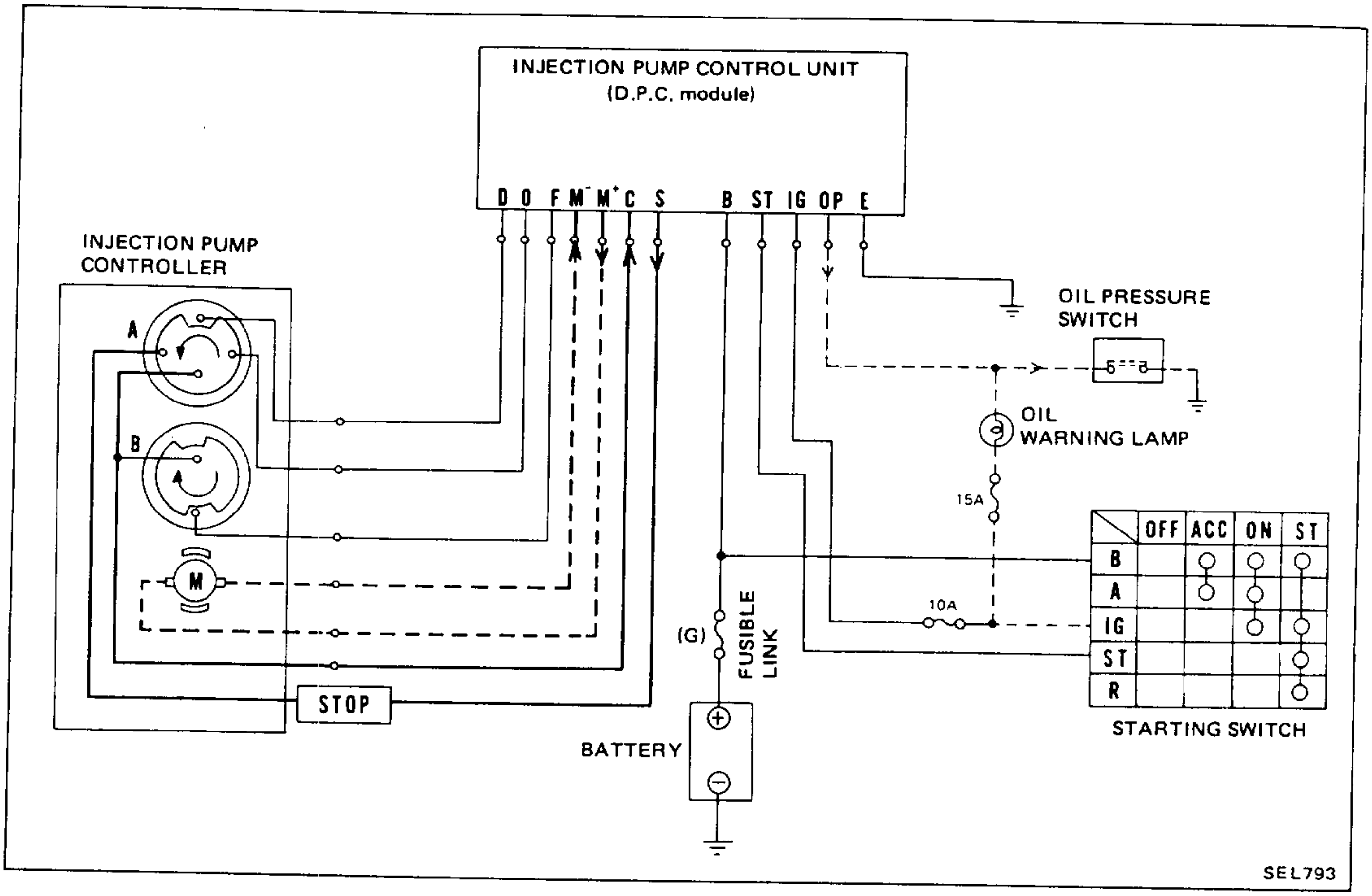


When the starting switch is turned to "START", the fuel injection control unit activates. This permits an electrical current to flow in sequence via rotor A of the fuel injection pump controller, from terminal 0 to rotor A and terminal C, causing the fuel injection controller motor to run.

As the motor runs, rotor A rotates and, when it reaches its start position, current flow between terminal 0 and C is broken, which stops the motor's operation. The controller is thus brought to its START position.

When the starting switch is turned to "ON" position, the fuel injection pump controller will activate and is then set at its DRIVE position.

ENGINE STOP OPERATION



SEL793

When the starting switch is turned to "OFF" or when the oil pressure switch turns "ON", the fuel injection pump control unit will activate. When this happens, current flows in sequence through terminal S, rotor A and terminal C, causing the controller's motor to rotate as well as rotor A. As the rotor reaches the stop position, current flow between terminals S and C is broken and the motor will then stop. The controller is thus set at its STOP position.

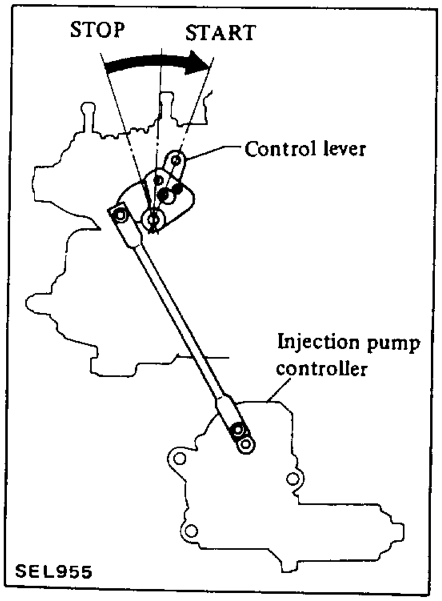
INSPECTION

ENTIRE SYSTEM

Inspect entire system for any irregularities. If any are found, refer to Trouble Diagnoses and Corrections chart in order to locate problems' cause and eliminate them as required.

(1) "START" operation

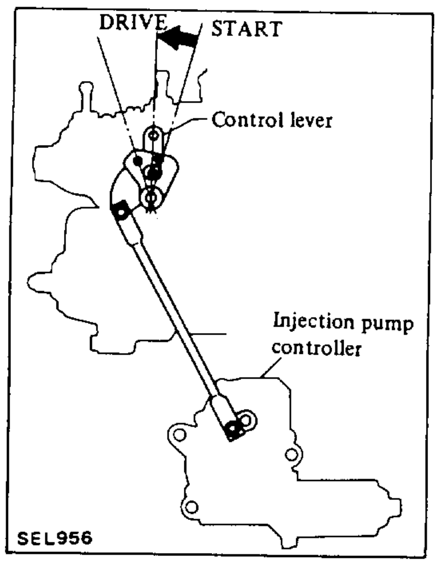
Turn ignition key to "START" in order to ensure that injection pump control lever moves to the start position.



SEL955

(2) "DRIVE" operation

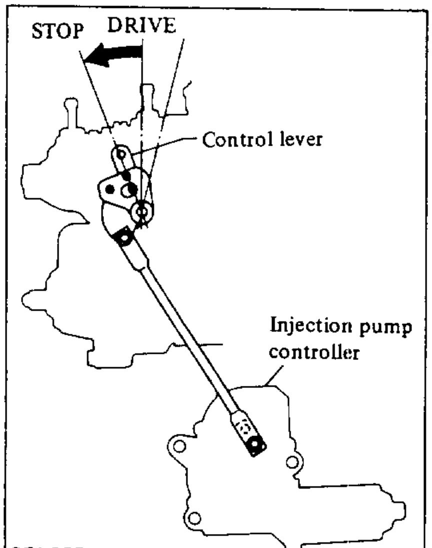
Turn ignition key to '"ON" in order to ensure that injection pump control lever moves to the drive position.



SEL956

(3) "STOP" operation

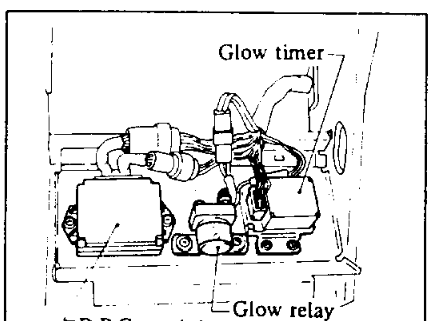
1. Turn ignition switch to "OFF" in order to ensure that injection pump control lever moves to the stop position.
2. Start engine. Disconnect and ground oil pressure switch connector with a suitable lead wire to see if injection pump control lever moves to the stop position.



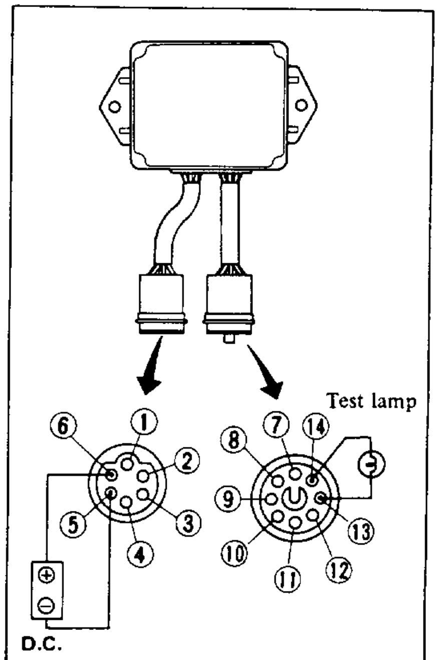
SEL957

INJECTION PUMP CONTROL UNIT (D.P.C. module)

Injection pump control unit (D.P.C. module) is installed on the right side of hoodledge. To check injection pump control unit (D.P.C. module), fabricate adapters as shown in the following illustration, and utilize the following procedures in the order listed.



SEL071A



SEL794

Failure to observe the order of these test procedures may lead to incorrect test results.

If results of the following tests are satisfactory as indicated below, injection pump control unit (D.P.C. module) is functioning properly.

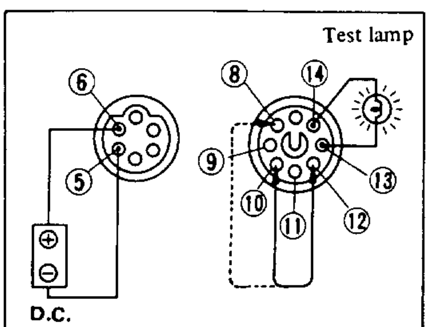
Be careful not to connect lead wires to the wrong terminals as this will damage injection pump control unit (D.P.C. module).

Test A

When lead wire is connected between;

Terminals ⑫ and ⑩ , or ⑫ and ⑧ :
Test lamp comes on and goes out in about 15 seconds.

Terminals ⑫ and ⑪ , or ⑫ and ⑨ :
Test lamp should not come on.



SEL795

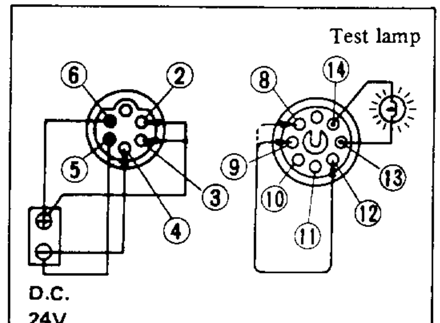
Test B

Connect positive lead wire to terminals ② and ③ , and connect negative lead wire to terminal ④ .

When lead wire is connected between;

Terminals ⑫ and ⑨ , or ⑫ and ⑧ :
Test lamp comes on and goes out in about 15 seconds.

Terminals ⑫ and ⑪ , or ⑫ and ⑩ :
Test lamp should not come on.

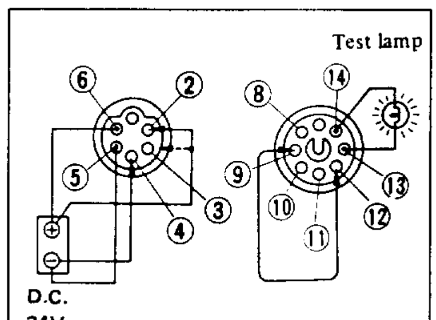


SEL796

Test C

Connect lead wire between ⑫ and ⑨ , and then disconnect lead wire from terminal ③ .

Test lamp should go out in 10 seconds.



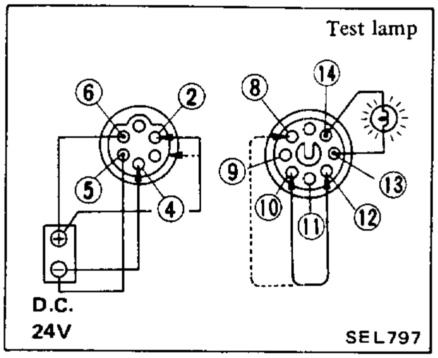
SEL799

Test D

When lead wire is connected between;

Terminals ⑫ and ⑩, or ⑫ and ⑧:
Test lamp comes on and goes out in about 15 seconds.

Terminals ⑫ and ⑪, or ⑫ and ⑨:
Test lamp should not come on.



SEL797

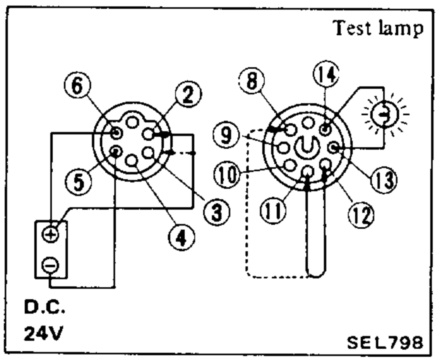
Test E

Disconnect lead wire from terminal ④.

When lead wire is connected between;

Terminals ⑫ and ⑪, or ⑫ and ⑧:
Test lamp comes on and goes out in about 15 seconds.

Terminals ⑫ and ⑩, or ⑫ and ⑨:
Test lamp should not come on.



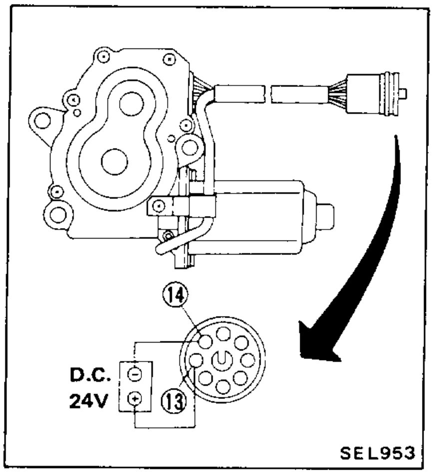
SEL798

INJECTION PUMP CONTROLLER

Test A

Connect positive lead wire to terminal ⑬, and negative lead wire to terminal ⑭.

Injection pump controller motor should run.

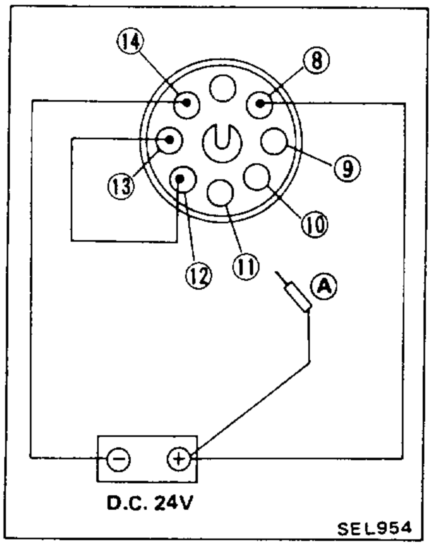


SEL953

Test B

Fabricate adapters, as shown in the following illustration, and connect terminal Ⓐ to each of terminals listed in the table below. Injection pump control lever should stop at corresponding position.

Connect terminal Ⓐ to:	Corresponding position of injection pump control lever
Terminal ⑨	START
Terminal ⑩	DRIVE
Terminal ⑪	STOP



SEL954

Be careful not to connect lead wire to the wrong terminals as this will damage injection pump controller.

TROUBLE DIAGNOSES AND CORRECTIONS

CASE 1

ENGINE DOES NOT START.

↓

Turn ignition switch to START to ensure that injection pump control lever moves to START position. — Yes → Check fuel system, glow plugs, etc.

↓ No

Check whether connecting rod is disengaged. — Yes → Connect.

↓ No

Check injection pump controller for any irregularities. — Yes → *1 Replace.

↓ No

Check injection pump control unit (D.P.C. module) for any irregularities. — Yes → Replace injection pump control unit (D.P.C. module).

↓ No

Check wiring harness, ignition switch and oil pressure switch.

*1: Whenever injection pump controller is replaced, disconnect 6-pin connector from injection pump control unit (D.P.C. module) and connect again, then check operation of injection pump controller.

CASE 2

ENGINE STARTS BUT SOON STOPS.

↓

After engine starts, turn ignition switch to ON to ensure that injection pump control lever moves to DRIVE position.
- Yes → Check fuel system, venturi, etc.
- No ↓

With ignition switch ON, disconnect oil pressure switch connector to see if injection pump control lever remains in DRIVE position.
- Yes → Check oil pressure lines and oil pressure switch.
- No ↓

Check injection pump controller for any irregularities.
- Yes → *1 Replace injection pump controller.
- No ↓

Check injection pump control unit (D.P.C. module) for any irregularities.
- Yes → Replace injection pump control unit (D.P.C. module).
- No ↓

Check wiring harness and ignition switch.

*1: Whenever injection pump controller is replaced, disconnect 6-pin connector from injection pump control unit (D.P.C. module) and connect again, then check operation of injection pump controller.

CASE 3

ENGINE CONTINUES TO RUN WHEN IGNITION SWITCH IS TURNED OFF.

- Check whether connecting rod is disengaged.
  - Yes → Connect.
  - No ↓
- Check injection pump controller for any irregularities.
  - Yes → *1 Replace injection pump controller.
  - No ↓
- Check injection pump control unit (D.P.C. module) for any irregularities.
  - Yes → Replace injection pump control unit (D.P.C. module).
  - No ↓
- Check wiring harness and ignition switch.

*1: Whenever injection pump controller is replaced, disconnect 6-pin connector from injection pump control unit (D.P.C. module) and connect again, then check operation of injection pump controller.

CASE 4

ENGINE CONTINUES TO RUN IN REVERSE DIRECTION.

- Turn ignition switch off to see if engine stops.
  - No → Refer to Case 3 above.
  - Yes ↓
- Disconnect and ground oil pressure switch connector with a suitable lead wire to see if engine stops.
  - Yes → Check oil pressure switch, oil pressure lines, etc.
  - No ↓
- Check harness and ignition switch.

LIGHTING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

BULBS

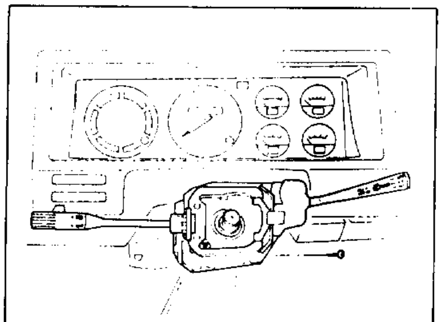
BULB SPECIFICATION

Item \ Model	Capacity: Model 160 series – Gasoline engine equipped models	Capacity: Model 160 series – Diesel engine equipped models	Capacity: Model 61 series
Headlamp			
Sealed beam	12V-50/40W	24V-75/55W	12V-50/40W
Semi-sealed beam	12V-45/40W	24V-55/50W	–
Semi-sealed beam (Halogen)	12V-60/55W	–	–
Front combination lamp			
Turn signal	12V-21W	24V-21W	12V-21W
Clearance	12V-5W	24V-5W	12V-5W
Side marker lamp	12V-6W, 5W	24V-6W, 5W	–
Rear combination lamp			
Turn signal	12V-21W	24V-21W	12V-21W
Back-up	12V-21W	24V-21W	12V-21W
Stop/Tail	12V-21/5W	24V-21/5W	12V-21/5W
License plate lamp	12V-10W	24V-12W, 10W	12V-10W
Front fog lamp			
Conventional	12V-35W	24V-35W	12V-35W
Halogen	12V-35W	–	–
Rear fog lamp	12V-21W	24V-21W	–
Room lamp	12V-5W	24V-6W	–
Rear room lamp (Station Wagon only)	12V-5W	24V-6W	–
Inspection lamp	12V-10W	12V-10W	12V-10W
Meter illumination lamp	12V-3.4W	24V-3.4W	12V-1.5W
High beam pilot lamp	12V-3.4W	24V-3.4W	12V-3.4W
Brake warning lamp	12V-1.7W	24V-1.7W	–
Turn signal pilot lamp	12V-3.4W	24V-3.4W	12V-3.4W
4-wheel drive indicator lamp	12V-1.7W	24V-1.7W	12V-3.4W
Glow plug warning lamp	–	24V-1.7W	–
Charge warning lamp	12V-1.7W	24V-1.7W	–

COMBINATION SWITCH (Model 160 series)

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.

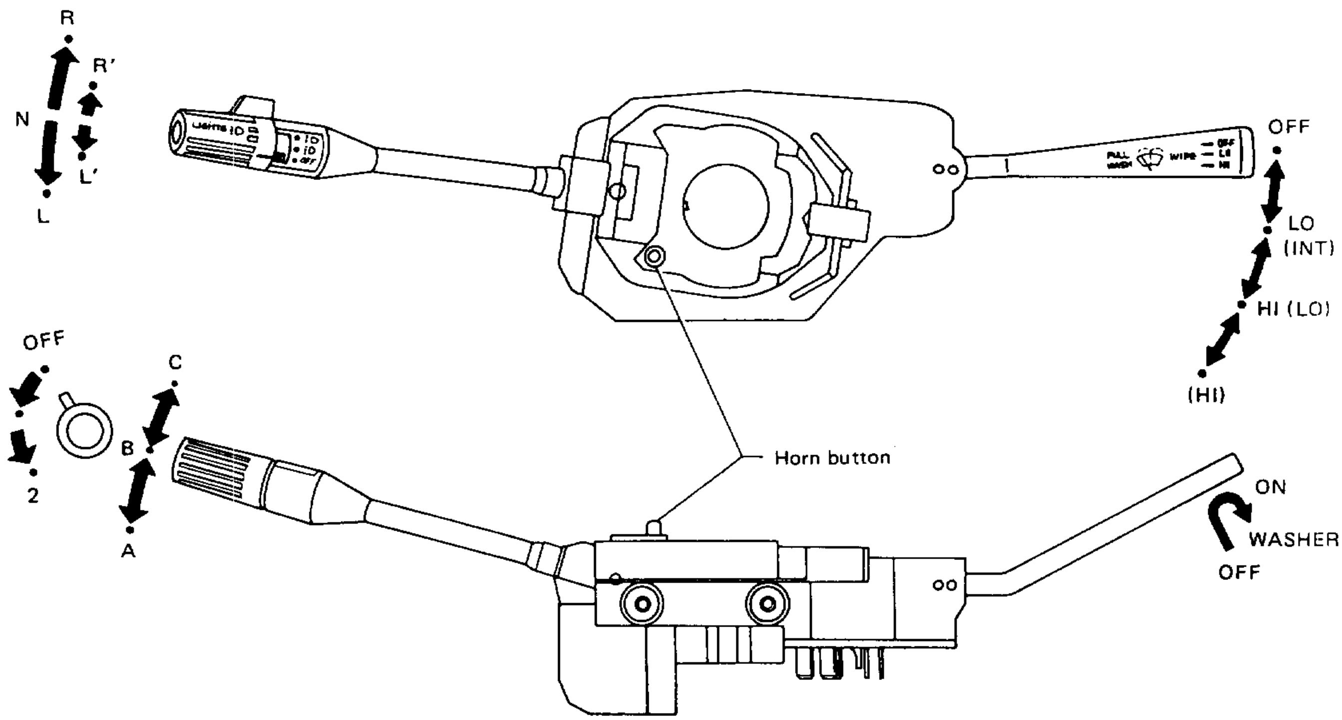


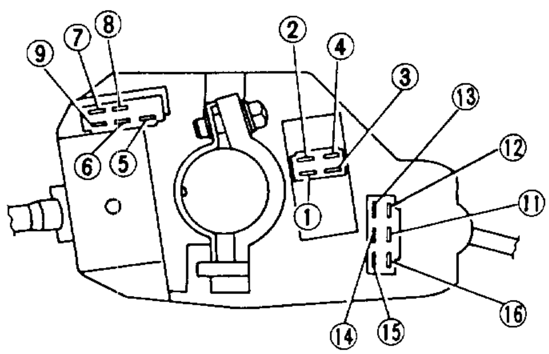
SEL003A

INSPECTION

Test continuity through switch with a test lamp or ohmmeter.

L.H. drive model





LIGHTING

	OFF			1			2		
	A	B	C	A	B	C	A	B	C
5			○			○	○	○	○
6			○			○	○		○
7								○	
8				○	○	○	○	○	○
9				○	○	○	○	○	○

TURN SIGNAL

	LEVER			HORN
	R – R'	N	L – L'	
1	○		○	
2	○			
3			○	
4				○

HORN

WIPER
(Without intermittent wiper amplifier)

	WIPER			WASH
	OFF	LO	HI	
11				○
12	○			
13	○	○		
(14)				
15			○	
16		○	○	○

(With intermittent wiper amplifier)

	WIPER				WASH
	OFF	INT	LO	HI	
11					○
12	○	○			
13	○	○	○		
14		○			
15				○	
16		○	○	○	○

SEL004A

LIGHTING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

BULBS

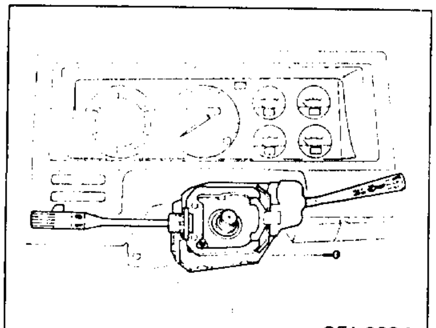
BULB SPECIFICATION

Item \ Model	Capacity		
	Model 160 series		Model 61 series
	Gasoline engine equipped models	Diesel engine equipped models	
Headlamp			
Sealed beam	12V-50/40W	24V-75/55W	12V-50/40W
Semi-sealed beam	12V-45/40W	24V-55/50W	–
Semi-sealed beam (Halogen)	12V-60/55W	–	–
Front combination lamp			
Turn signal	12V-21W	24V-21W	12V-21W
Clearance	12V-5W	24V-5W	12V-5W
Side marker lamp	12V-6W, 5W	24V-6W, 5W	–
Rear combination lamp			
Turn signal	12V-21W	24V-21W	12V-21W
Back-up	12V-21W	24V-21W	12V-21W
Stop/Tail	12V-21/5W	24V-21/5W	12V-21/5W
License plate lamp	12V-10W	24V-12W, 10W	12V-10W
Front fog lamp			
Conventional	12V-35W	24V-35W	12V-35W
Halogen	12V-35W	–	–
Rear fog lamp	12V-21W	24V-21W	–
Room lamp	12V-5W	24V-6W	–
Rear room lamp (Station Wagon only)	12V-5W	24V-6W	–
Inspection lamp	12V-10W	12V-10W	12V-10W
Meter illumination lamp	12V-3.4W	24V-3.4W	12V-1.5W
High beam pilot lamp	12V-3.4W	24V-3.4W	12V-3.4W
Brake warning lamp	12V-1.7W	24V-1.7W	–
Turn signal pilot lamp	12V-3.4W	24V-3.4W	12V-3.4W
4-wheel drive indicator lamp	12V-1.7W	24V-1.7W	12V-3.4W
Glow plug warning lamp	–	24V-1.7W	–
Charge warning lamp	12V-1.7W	24V-1.7W	–

COMBINATION SWITCH (Model 160 series)

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.

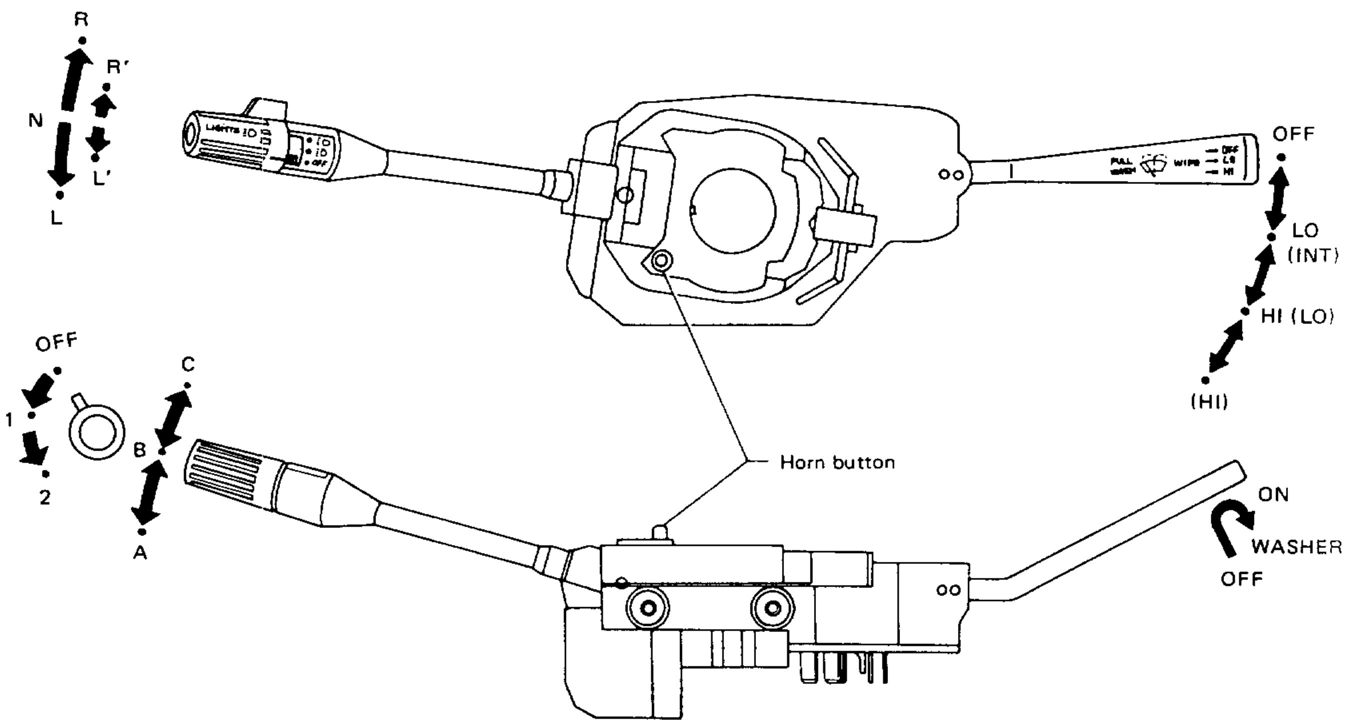


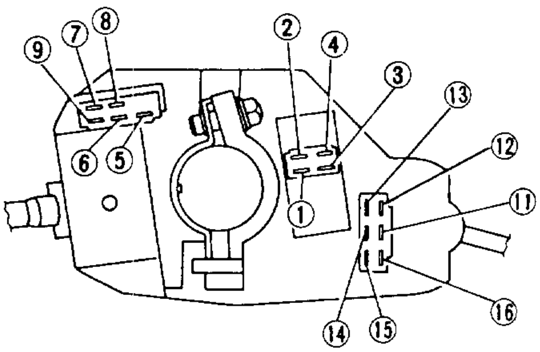
SEL003A

INSPECTION

Test continuity through switch with a test lamp or ohmmeter.

L.H. drive model





LIGHTING

	OFF			1			2		
	A	B	C	A	B	C	A	B	C
5			○			○	○	○	○
6			○			○	○		○
7								○	
8				○	○	○	○	○	○
9				○	○	○	○	○	○

TURN SIGNAL

	LEVER			HORN
	R – R'	N	L – L'	
1	○		○	
2	○			
3			○	
4				○

HORN

WIPER
(Without intermittent
wiper amplifier)

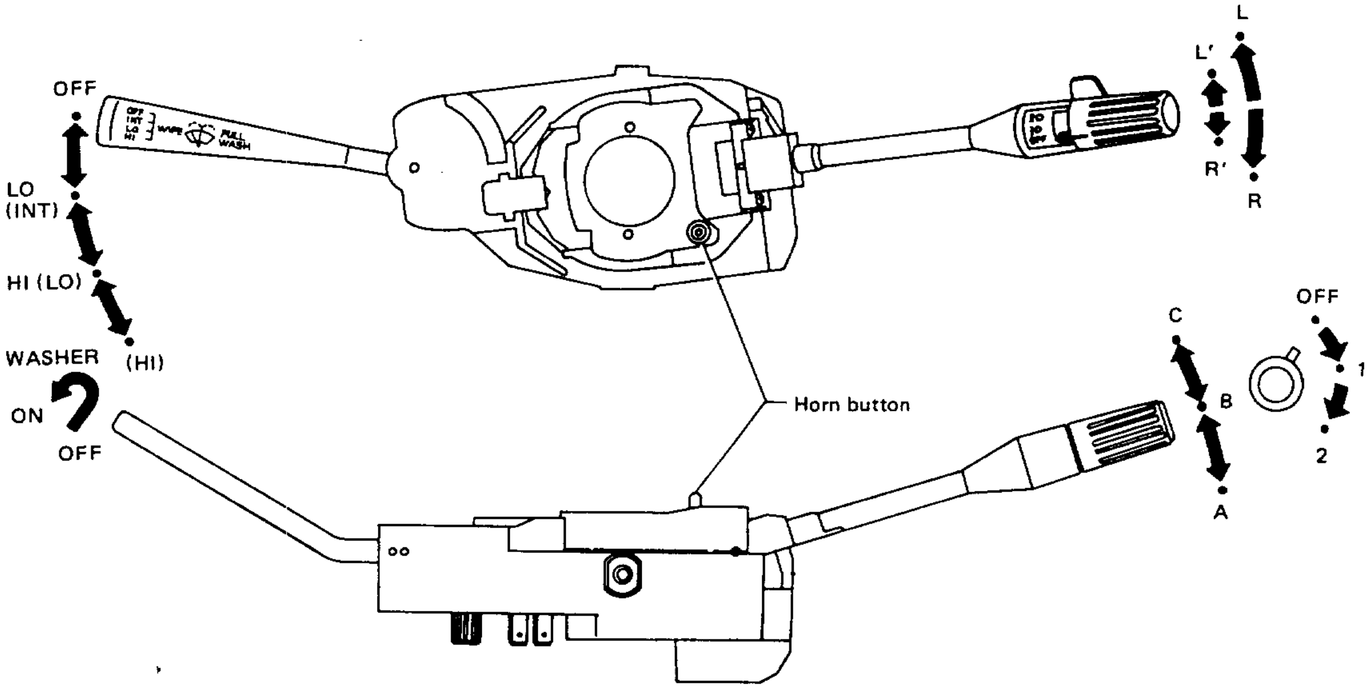
	WIPER			WASH
	OFF	LO	HI	
11				○
12	○			
13	○	○		
(14)				
15			○	
16		○	○	○

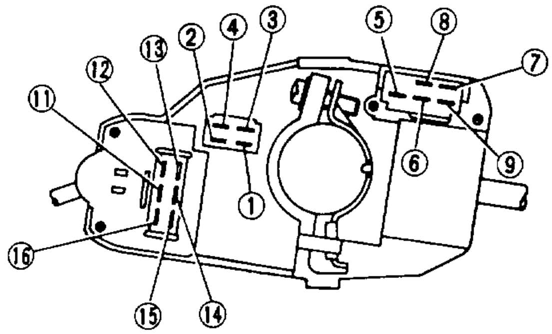
(With intermittent wiper amplifier)

	WIPER				WASH
	OFF	INT	LO	HI	
11					○
12	○	○			
13	○	○	○		
14		○			
15				○	
16		○	○	○	○

SEL004A

R.H. drive model





WIPER
(Without intermittent wiper amplifier)

	WIPER OFF	WIPER LO	WIPER HI	WASH
11				O
12	O			
13	O	O		
(14)				
15			O	
16		O	O	O

LIGHTING

	OFF A	OFF B	OFF C	1 A	1 B	1 C	2 A	2 B	2 C
5			O			O	O	O	O
6			O			O	O		O
7								O	
8				O	O	O	O	O	O
9				O	O	O	O	O	O

(With intermittent wiper amplifier)

	WIPER OFF	WIPER INT	WIPER LO	WIPER HI	WASH
11					O
12	O	O			
13	O	O	O		
14		O			
15				O	
16		O	O	O	O

TURN SIGNAL

	LEVER R – R'	LEVER N	LEVER L – L'	HORN
1	O		O	
2	O			
3			O	
4				O

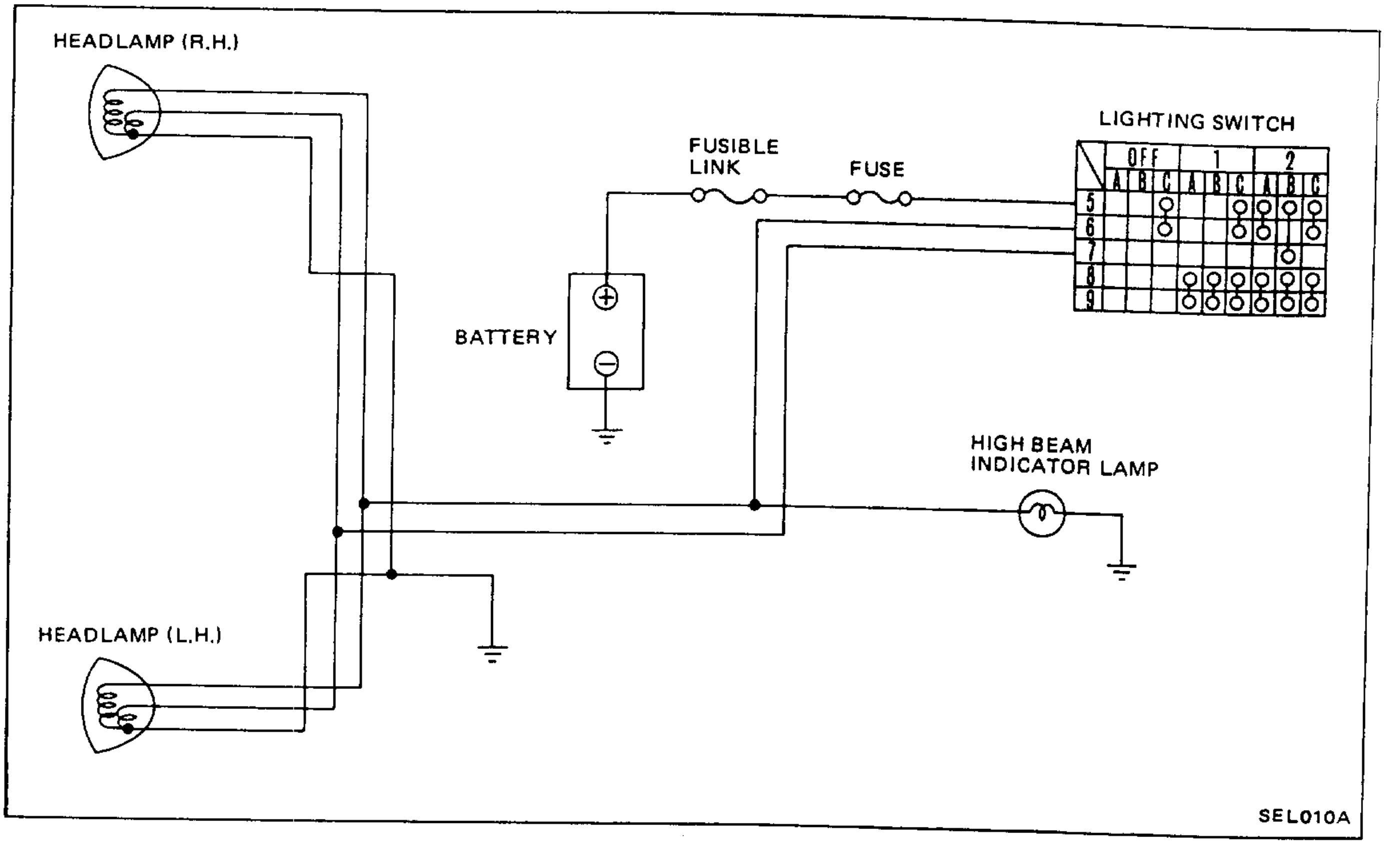
HORN

SEL005A

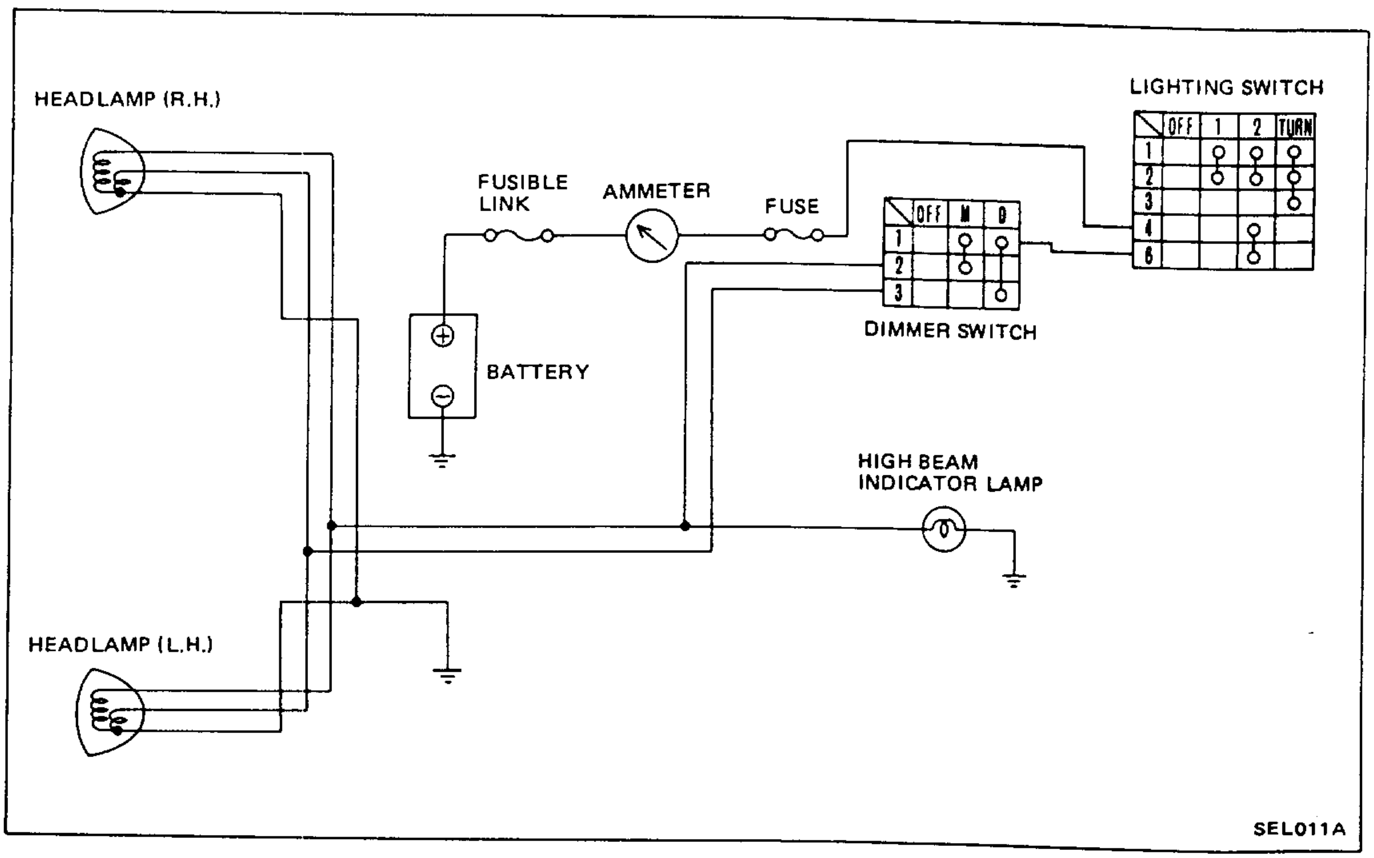
HEADLAMP

SCHEMATIC

Model 160 series



Model 61 series



TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Headlamps do not come on, either high or low beams.	Blown out fusible link or fuse.	Correct cause and replace fusible link or fuse.
	Loose connection or open circuit.	Check wiring and/or repair connection.
	Faulty lighting switch.	Replace if necessary.
High beam cannot be switched to low beam or vice versa.	Faulty lighting switch.	Replace if necessary.
	Faulty dimmer switch (Model 61 series).	Replace if necessary.
Headlamps dim.	Partly discharged or run-down battery.	Measure specific gravity of electrolyte and recharge or replace battery if necessary.
	Inoperative charging system.	Measure voltage at headlamp terminals with engine running. If it is less than 12.8V, check charging system for proper operation.
	Poor ground or loose connection.	Clean and/or tighten.
Headlamp lights on only one side.	Loose headlamp connection.	Repair.
	Faulty headlamp beam.	Replace.

LIGHTING SWITCH

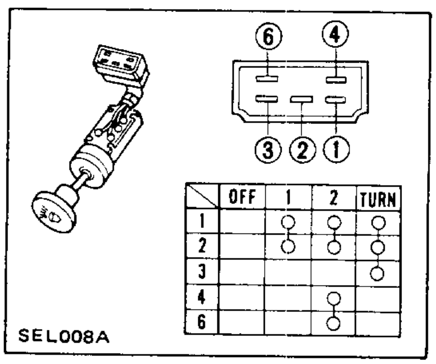
Model 160 series

Refer to Combination Switch (Page EL-54).

Model 61 series

Inspection

Test continuity through switch with a test lamp or ohmmeter.



SEL008A

DIMMER SWITCH

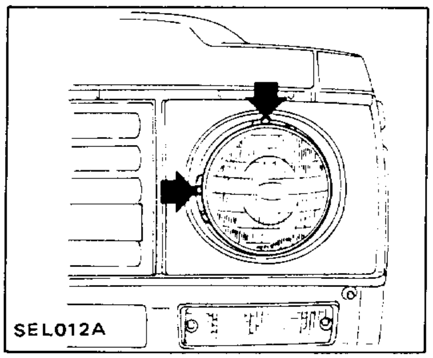
Model 61 series

Refer to Turn Signal and Dimmer Switch (Page EL-66).

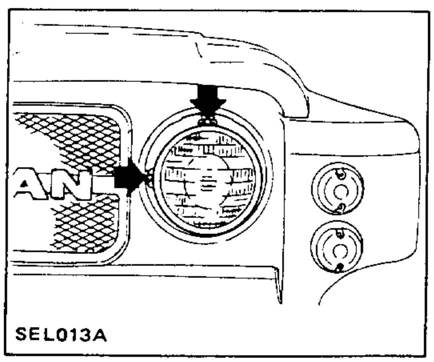
AIMING ADJUSTMENT

To adjust vertical aim, use adjusting screw on upper side of headlamp; and to adjust horizontal aim, use adjusting screw on side of headlamp.

Model 160 series


SEL012A

Model 61 series


SEL013A

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.

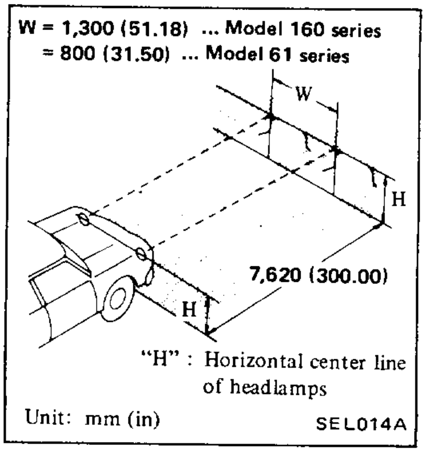
c. See that there is no load in vehicle (coolant, engine oil filled up to correct level and full fuel tank) other than the driver (or equivalent weight placed in driver's position).

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:

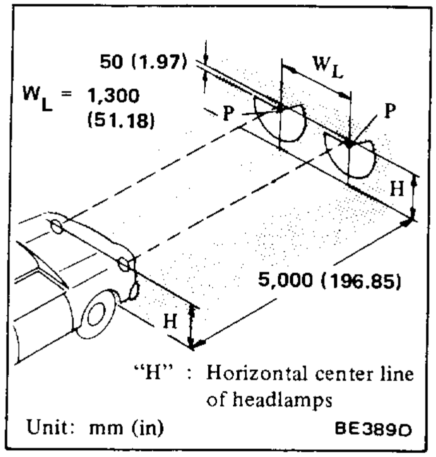
Turn headlamp low beam on.

Sealed beam type



- Adjust headlamps so that upper edge of hot spot is equal in height to headlamp height.
- The illustration shows headlamp aiming pattern for driving on right side of road; for driving on left side of road, aiming pattern is reversed.
- Dotted lines in illustration show center of headlamp.

Semi-sealed beam type

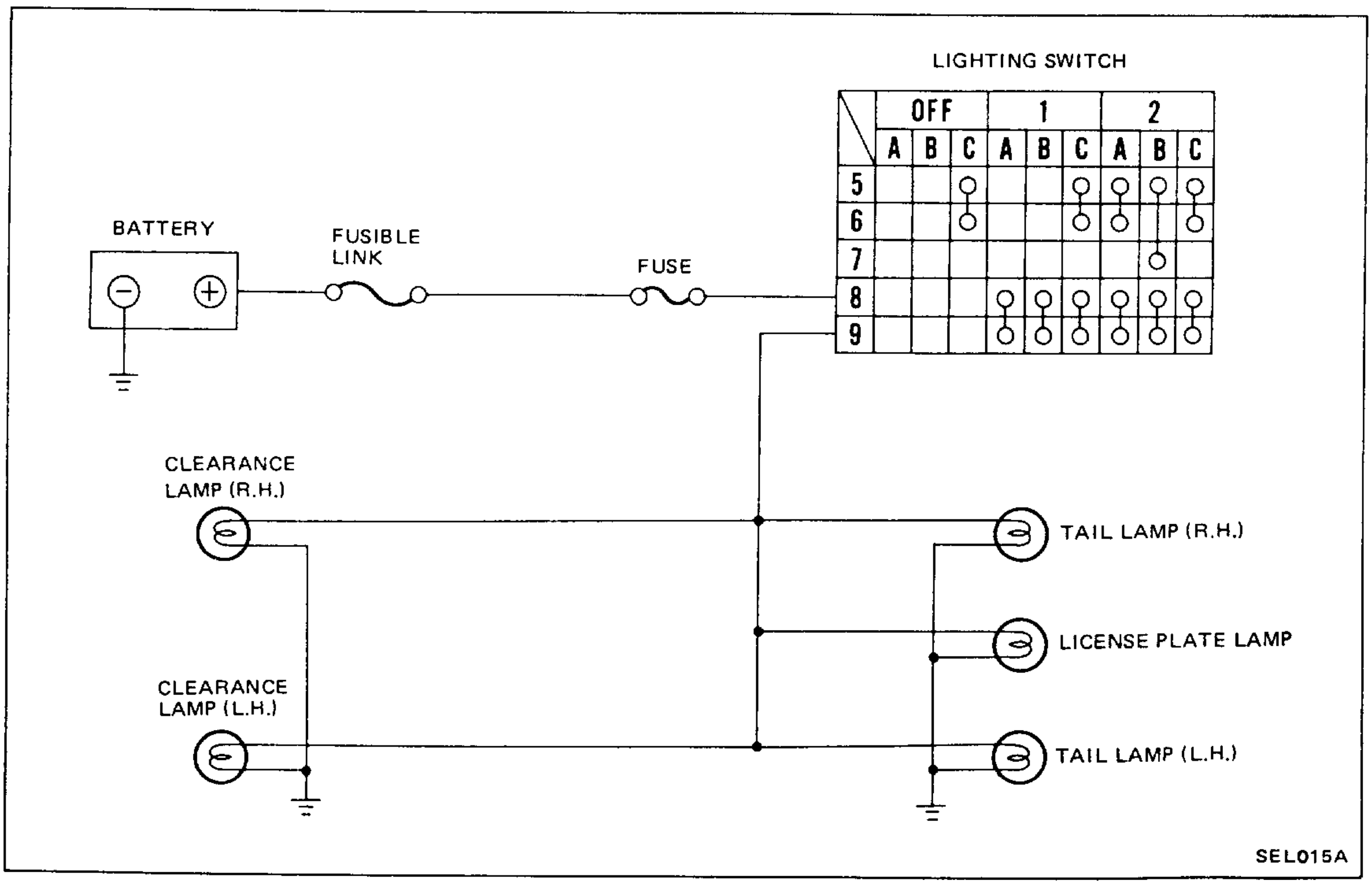


- Adjust headlamps so that main axis of light is parallel to center line of body and is aligned with point P shown in illustration.
- The illustration shows headlamp aiming pattern for driving on right side of road; for driving on left side of road, aiming pattern is reversed.
- Dotted lines in illustration show center of headlamp.

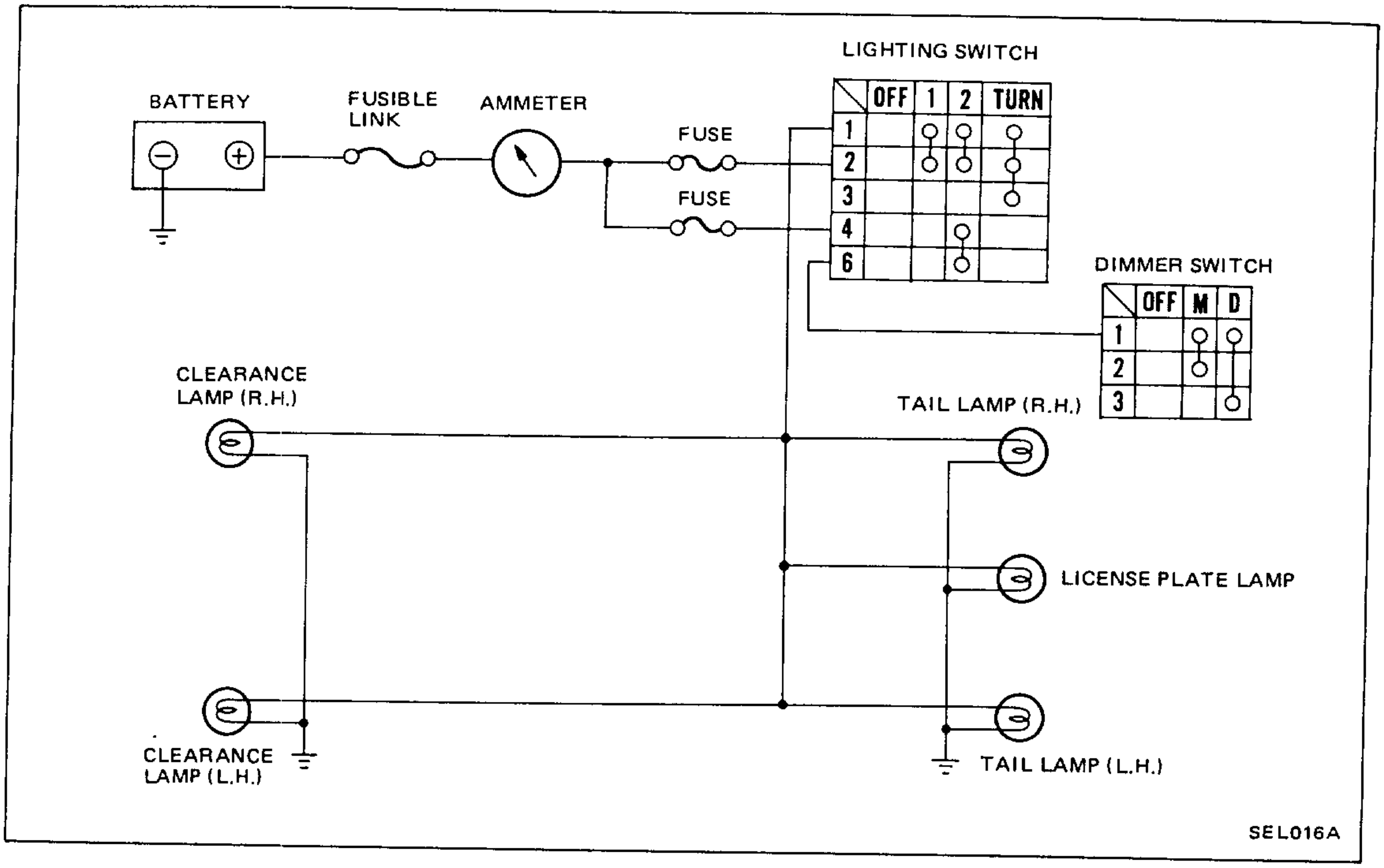
EXTERIOR LAMPS (Clearance, tail and license plate lamps)

SCHEMATIC

Model 160 series



Model 61 series



TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Neither left nor right lamp lights.	Blown out fusible link or fuse. Loose connection or open circuit. Faulty lighting switch.	Correct cause and replace. Check wiring and/or repair connection. Replace if necessary.
Lamp on only one side lights.	Burned out bulb. Loose bulb. Loose connection to lamp.	Replace. Correct. Correct.

LIGHTING SWITCH

Model 160 series

Refer to Combination Switch (Page EL-54).

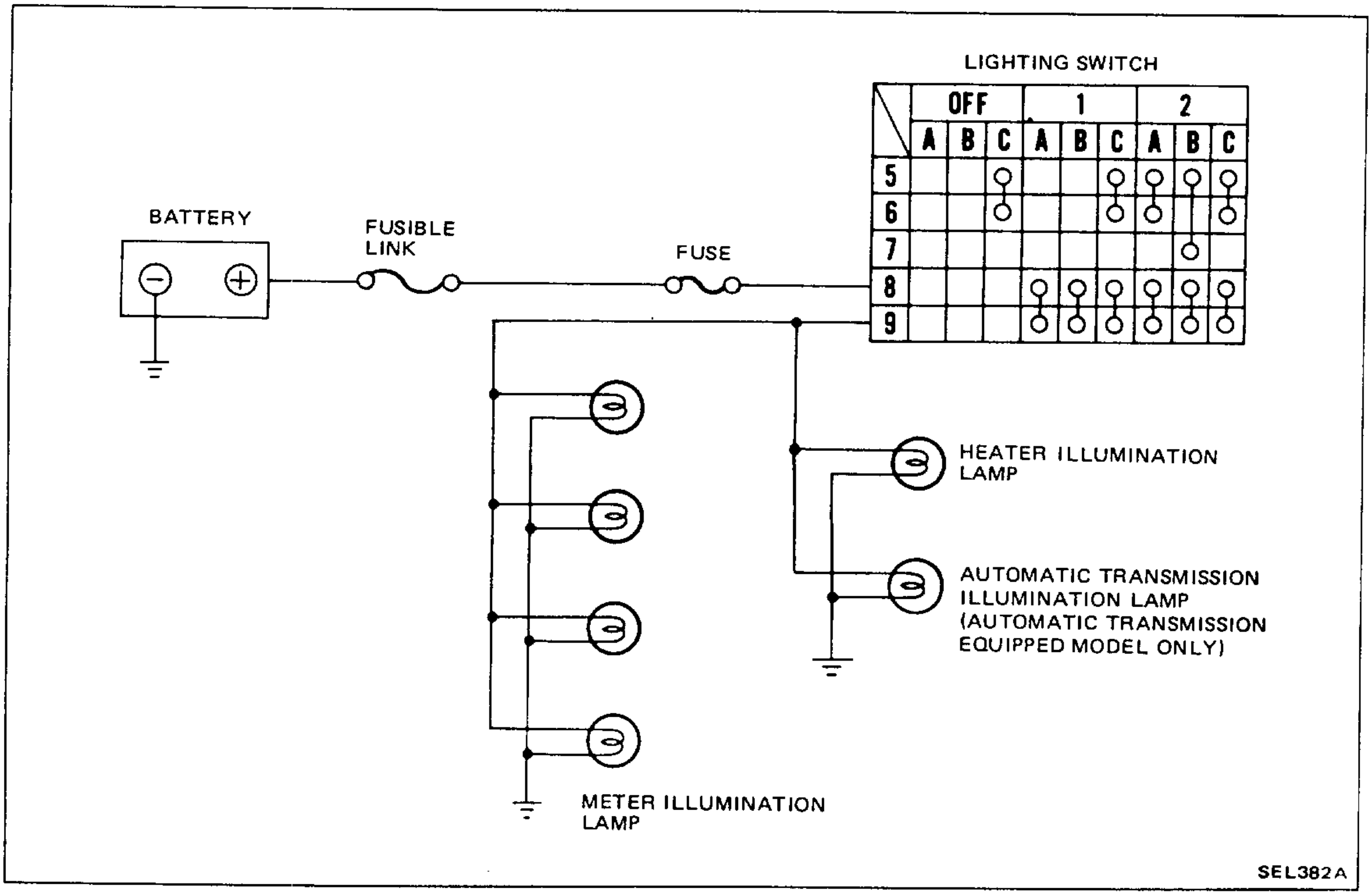
Model 61 series

Refer to Lighting Switch (Page EL-58).

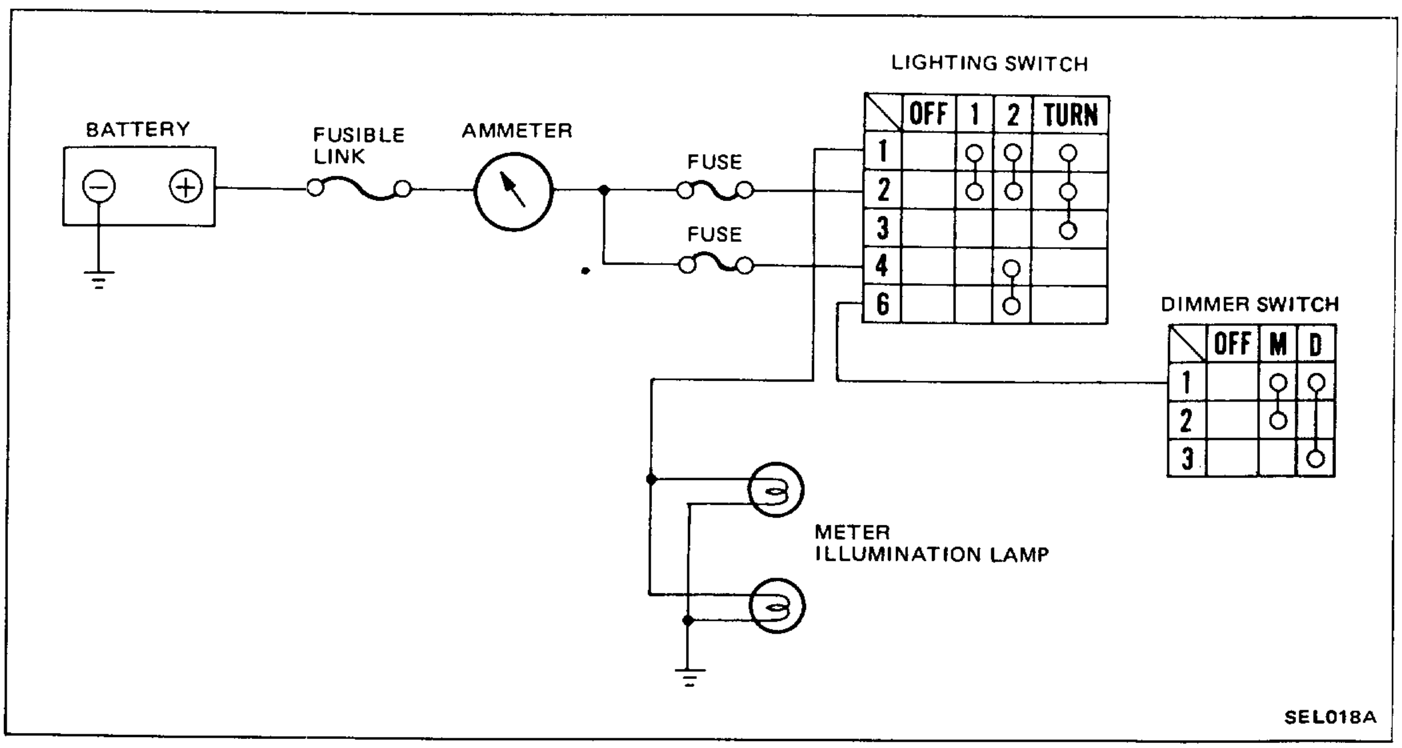
ILLUMINATION LAMPS

SCHEMATIC

Model 160 series

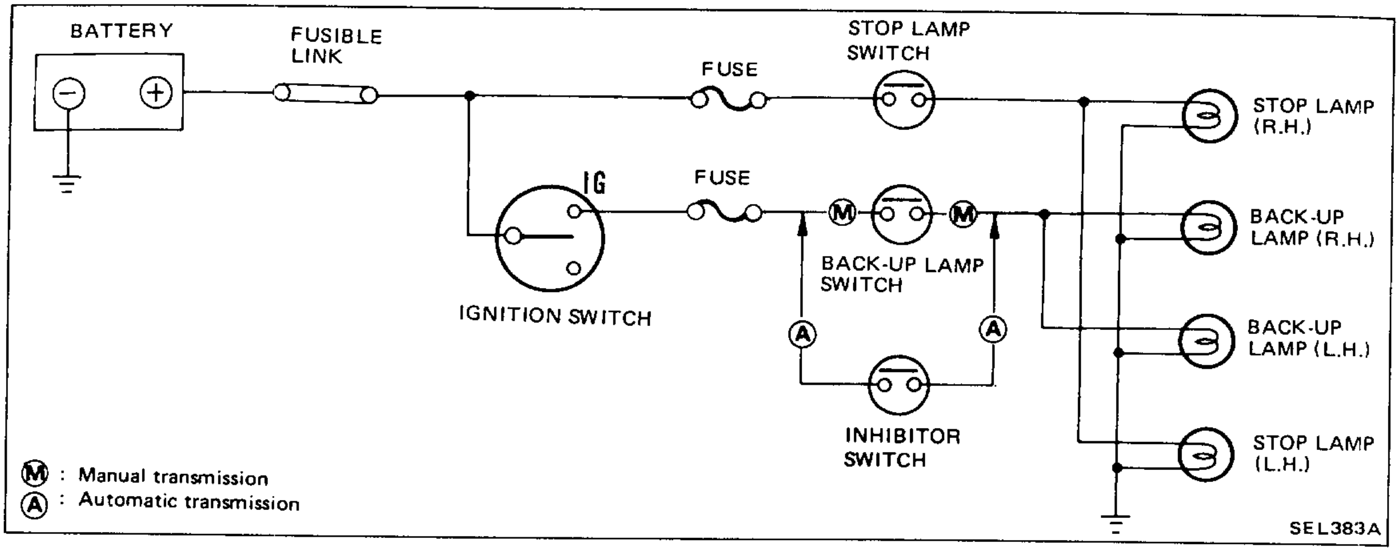


Model 61 series



STOP AND BACK-UP LAMPS

SCHEMATIC



TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Stop lamp Neither left nor right lamp lights.	Blown out fusible link or fuse. Faulty stop lamp switch. Loose connection or open circuit.	Correct cause and replace. Conduct continuity test and replace if necessary. Check wiring and/or repair connection.
Lamp on only one side lights.	Burned out bulb. Loose bulb. Loose connection or open circuit.	Replace. Repair lamp socket. 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). Blown out fusible link or fuse. Loose connection or open circuit.	Conduct continuity test and replace if necessary. Correct cause and replace. Check wiring and/or repair connection.
Lamp on only one side lights.	Burned out bulb. Loose bulb. Loose connection or open circuit.	Replace. Repair lamp socket. 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

Back-up lamp switch is installed on transmission.

Inspection

When transmission lever is in "R" position, there should be continuity between two terminals.

INHIBITOR SWITCH

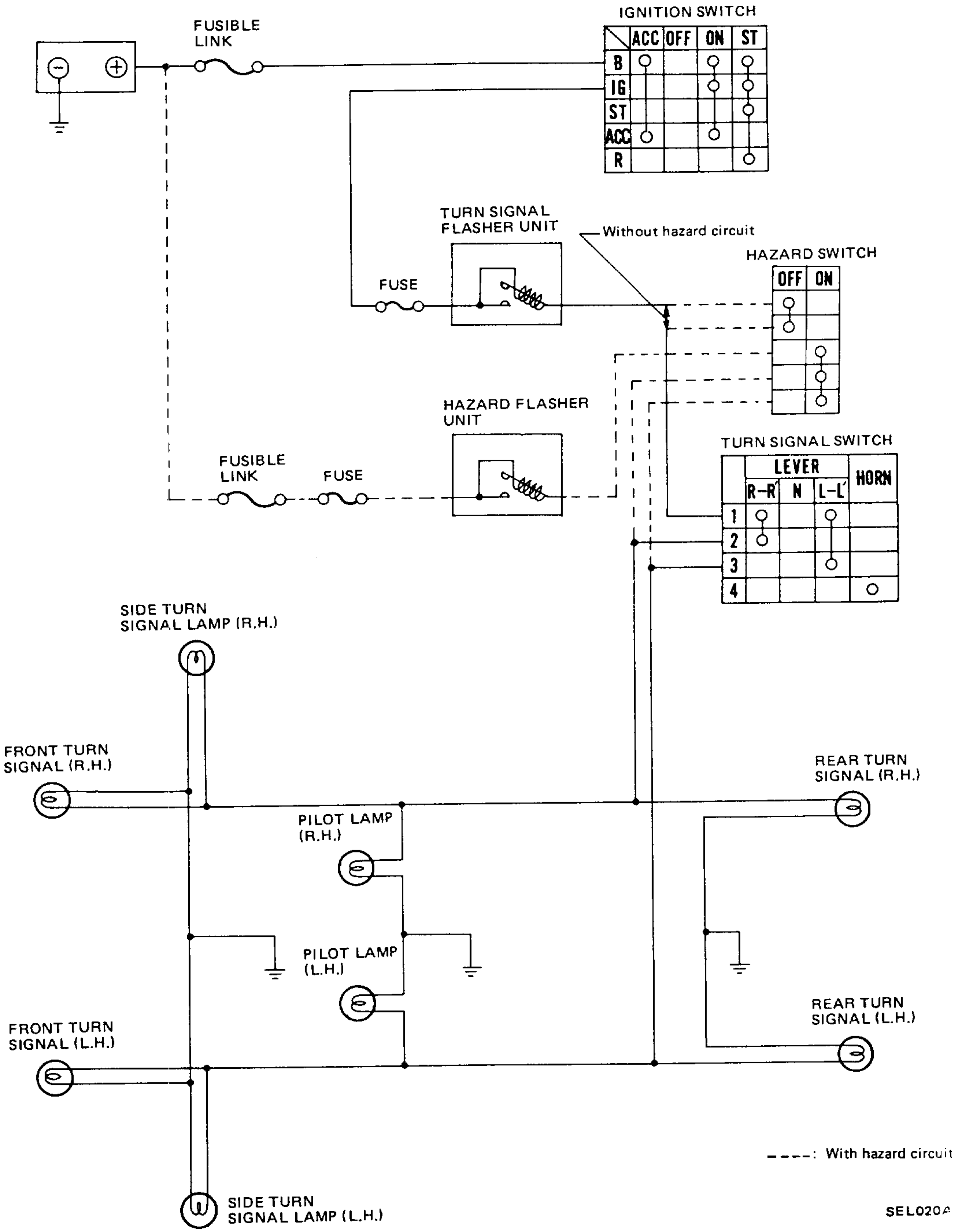
Inspection

Refer to AT section.

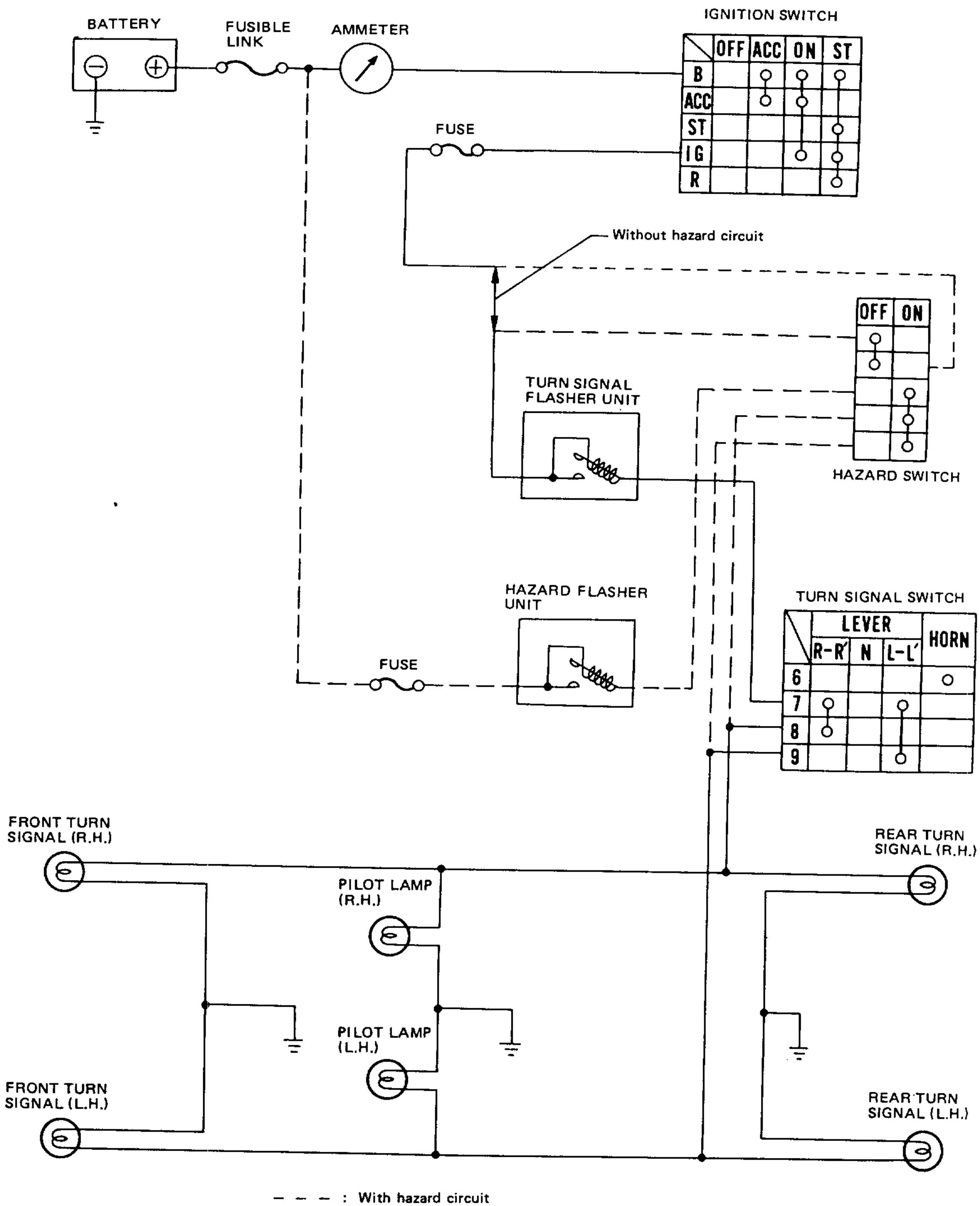
TURN SIGNAL AND HAZARD WARNING LAMPS

SCHEMATIC

Model 160 series



Model 61 series



SEL127A

TROUBLE DIAGNOSES AND CORRECTIONS

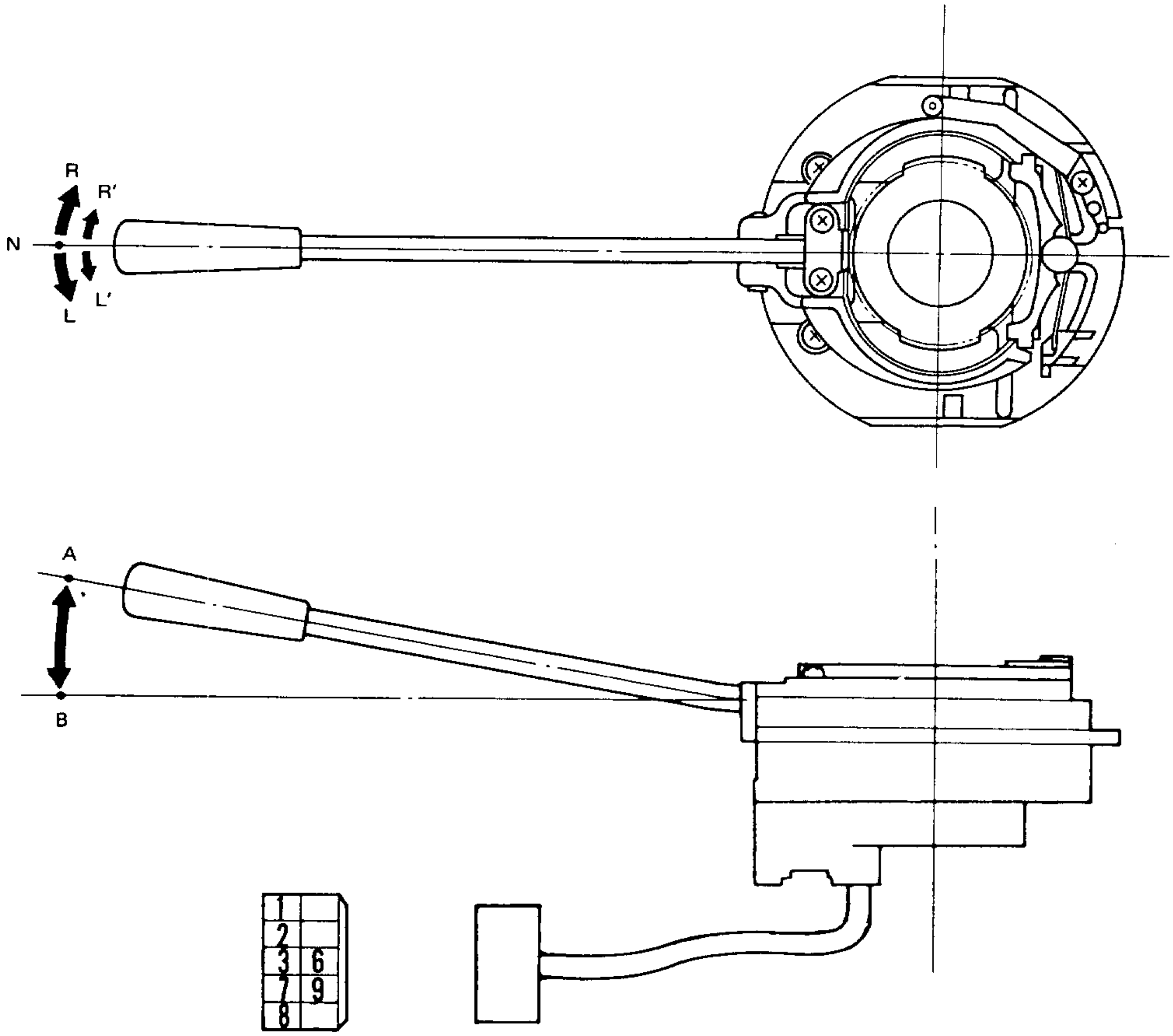
Condition	Probable cause	Corrective action
Turn signals do not operate. (Hazard warning lamps operate).	Blown out fusible link or fuse. Loose connection or open circuit. Faulty flasher unit. Faulty turn signal switch. Faulty hazard switch.	Correct cause and replace. Check wiring and/or repair connection. Replace. Conduct continuity test and replace if necessary. Replace if necessary.
Hazard warning lamps do not operate. (Turn signals operate).	Blown out fusible link or fuse. Faulty hazard warning flasher unit. Faulty hazard switch.	Correct cause and replace. Replace. Replace if necessary.
No flasher click is heard.	Burned out bulb. Loose connection.	Replace. Reconnect firmly.
Flasher cycle is too slow (Pilot lamp does not go out.), or too fast	Bulb other than specified wattage being used. Burned out bulbs. Loose connections. Faulty flasher unit.	Replace with one specified. Replace. Repair. Replace.
Flashing cycle is irregular.	Burned out bulb. Loose connection. Bulbs other than specified wattage being used.	Replace. Repair. Replace with one specified.

TURN SIGNAL SWITCH (Model 160 series)

Refer to Combination Switch (Page EL-54).

TURN SIGNAL AND DIMMER SWITCH (Model 61 series)

Inspection



TURN SIGNAL

	LEVER R-R'	LEVER N	LEVER L-L'	HORN
6				O
7	O		O	
8	O			
9			O	

DIMMER

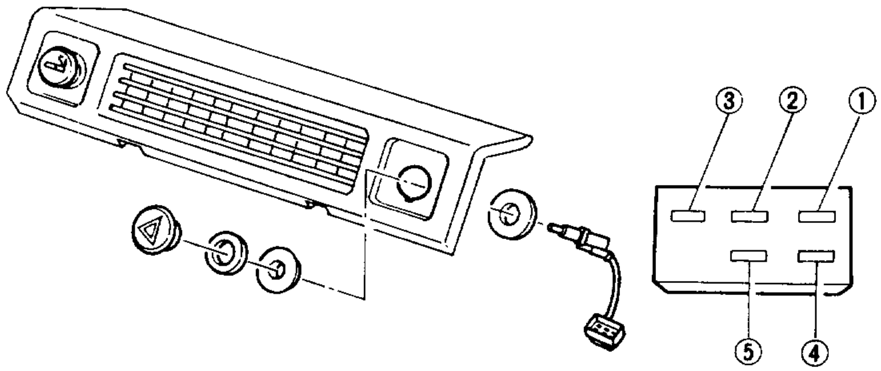
	B (M)	A (D)
1	O	O
2	O	
3		O

SEL007A

HAZARD SWITCH

Inspection

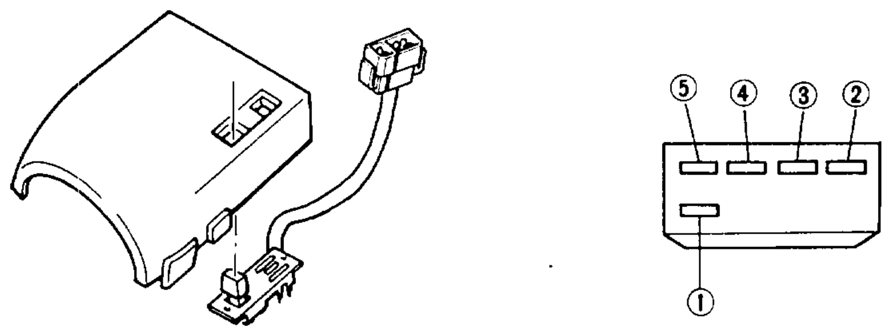
Model 160 series



	OFF	ON
1	○	
2	○	
3		○
4		○
5		○

SEL022A

Model 61 series



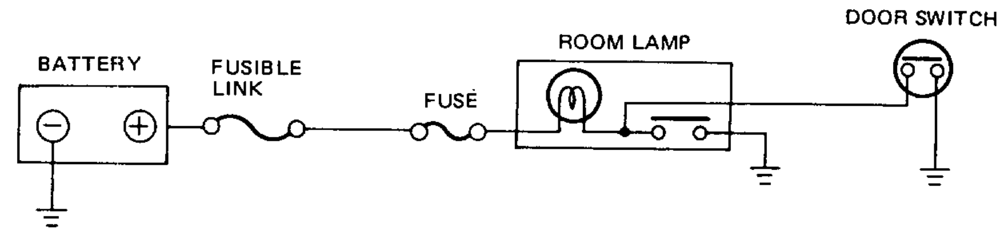
	OFF	ON
1	○	
2	○	
3		○
4		○
5		○

SEL023A

ROOM LAMP (Model 160 series)

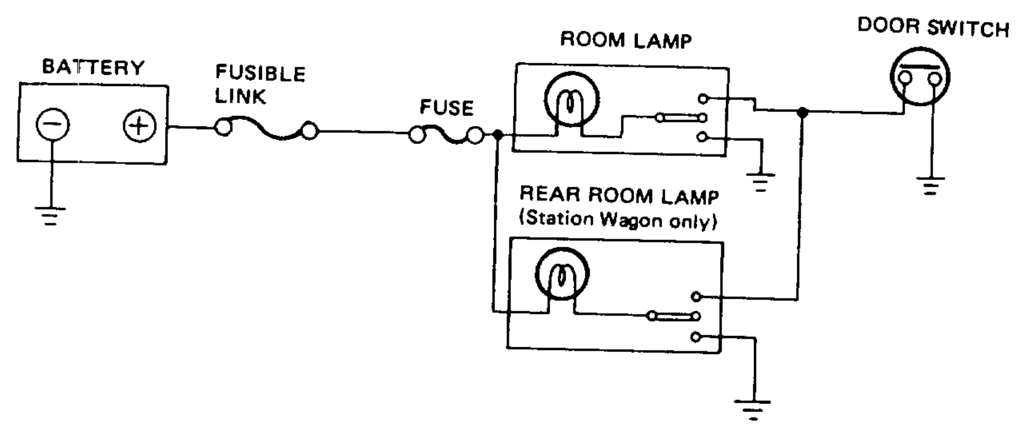
SCHEMATIC

Hardtop, High-roof Hardtop and Pick-up



SEL024A

Van and Station Wagon



SEL384A

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Correction action
Lamp does not light when door is opened.	Blown out fusible link or fuse.	Correct cause and replace.
	Burned out bulb.	Replace.
	Loose bulb.	Correct.
	Loose connection to lamp.	Correct.
	Faulty door switch.	Replace if necessary.
	Faulty room lamp switch.	Replace if necessary.

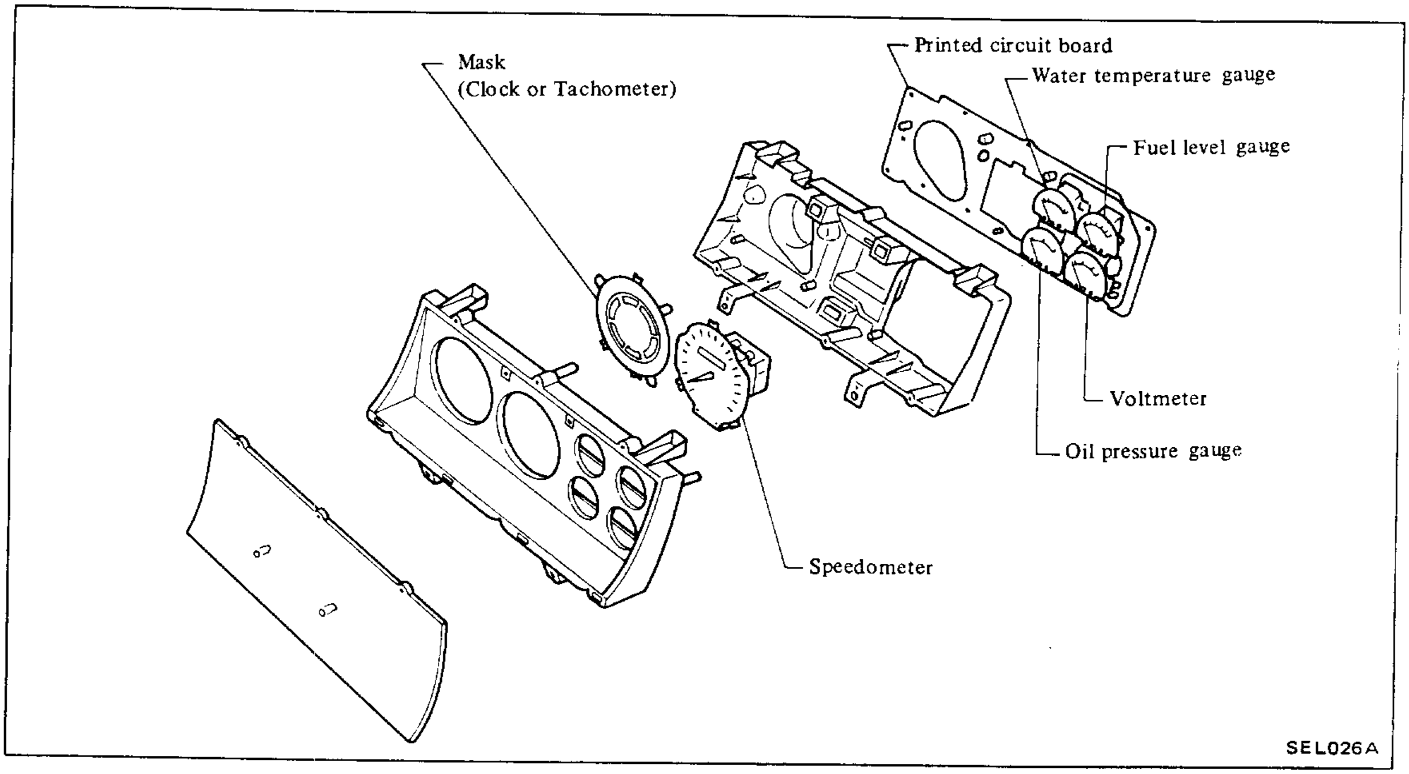
METERS, GAUGES AND WARNING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

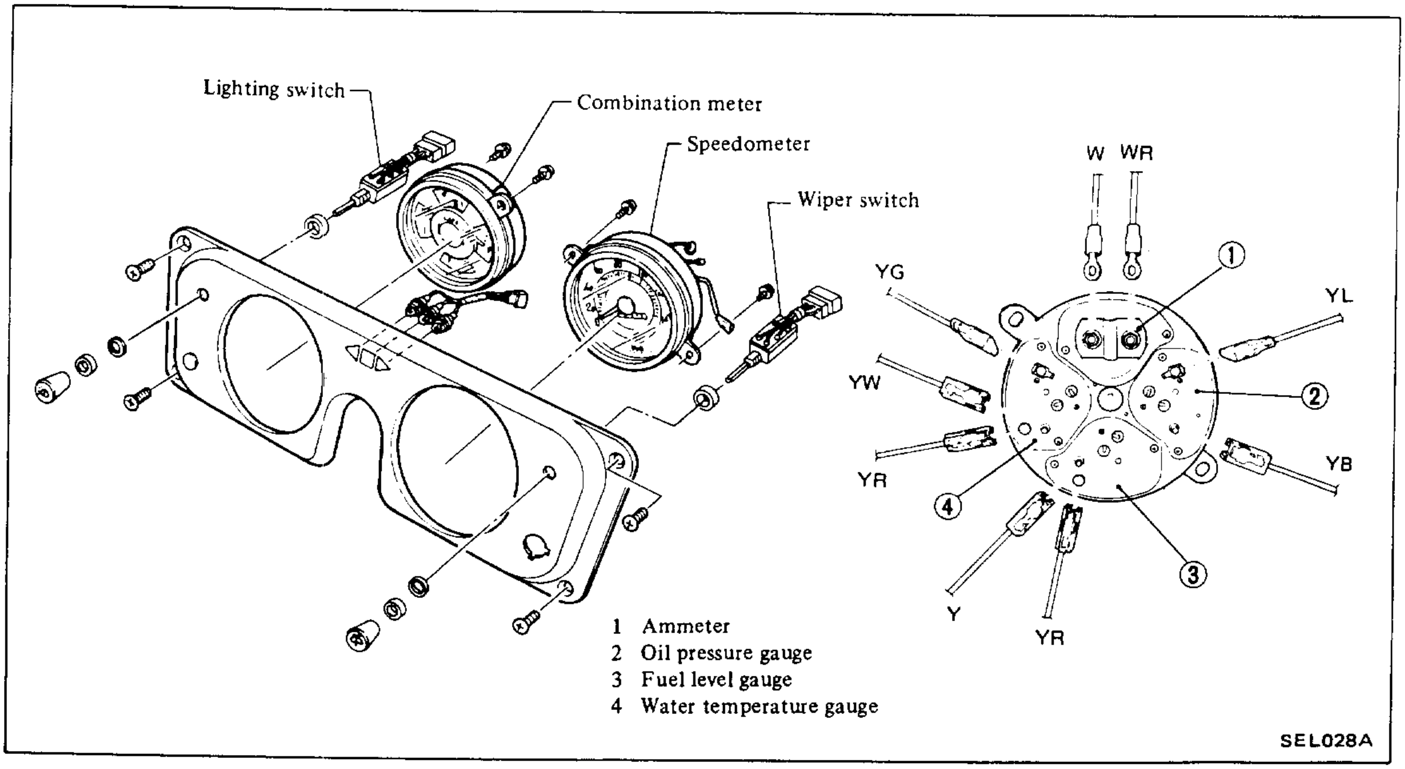
COMBINATION METER

DISASSEMBLY AND ASSEMBLY

Model 160 series

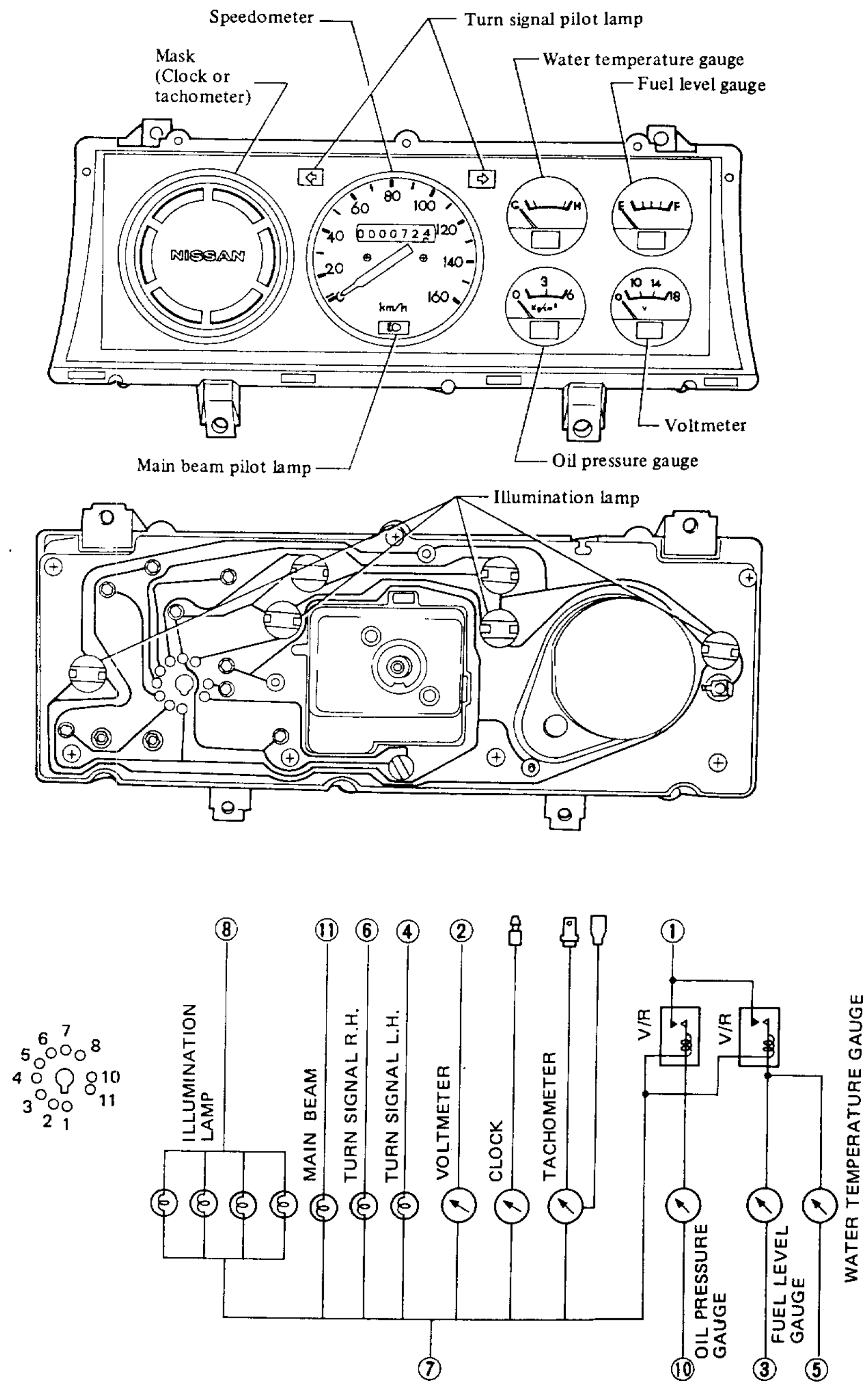


Model 61 series



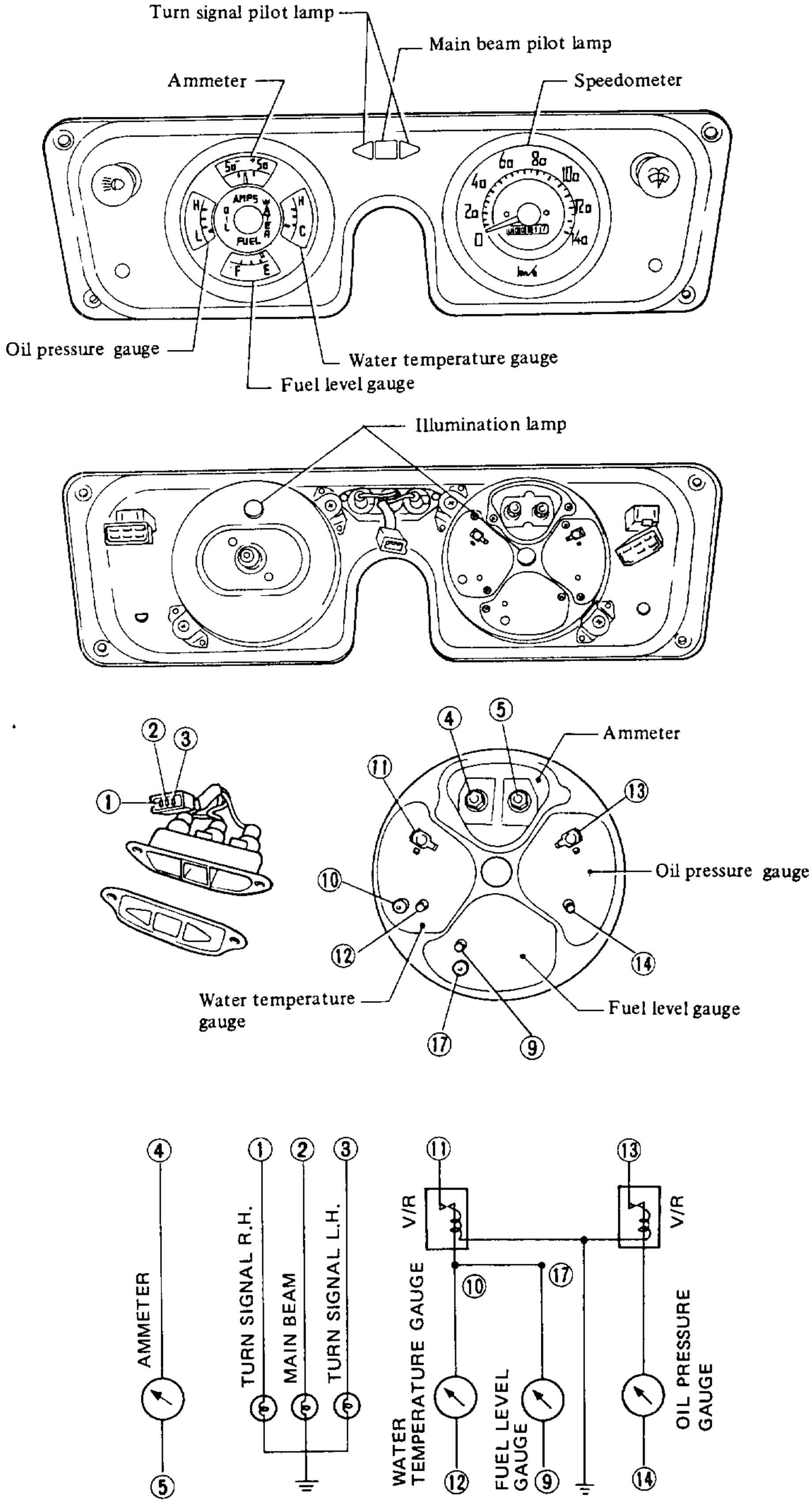
SCHEMATIC

Model 160 series



SEL027A

Model 61 series



SEL029A

TROUBLE DIAGNOSES AND CORRECTIONS

Speedometer

Condition	Probable cause	Corrective action
Neither speedometer pointer nor odometer operates.	Loose speedometer cable connector. Broken speedometer cable. Damaged speedometer drive pinion gear (Transmission side). Faulty speedometer.	Retighten. Replace. Replace. Replace.
Unstable speedometer pointer.	Loose speedometer cable connector. Damaged speedometer cable. Faulty speedometer.	Retighten. Replace. Replace.
Unusual sound occurs in response to increase in driving speed	Excessively bent or twisted speedometer cable inner wire or lack of lubrication. Faulty speedometer.	Replace or lubricate. Replace.
Inaccurate speedometer indication.	Faulty speedometer.	Replace.
Inaccurate odometer operation.	Faulty speedometer.	Replace.

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 wire is grounded) Faulty fuel level gauge. Loose connection or open circuit. Faulty voltage regulator built into water temperature gauge.	Replace. Replace. Check wiring and/or repair connection. 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.) Faulty fuel level gauge. (Gauge pointer indicates "F" position even after ignition switch has been turned off.)	Replace. Replace.
Fuel level gauge does not operate accurately.	Faulty fuel tank gauge unit. Faulty fuel level gauge. Poor or loose connection.	Replace. Replace. 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.
	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.
	Faulty water temperature gauge. (Gauge pointer indicates maximum temperature even after ignition switch is turned off.)	Replace.
Gauge does not operate accurately.	Faulty water temperature gauge.	Replace.
	Loose or poor connection.	Correct connector terminal contact.

Oil pressure gauge

Condition	Probable cause	Corrective action
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 (Model 160 series)

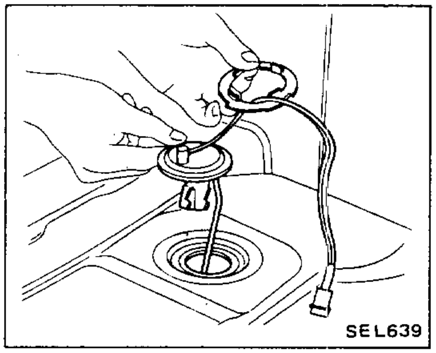
Condition	Probable cause	Corrective action
Voltmeter does not operate or indicates incorrectly.	Faulty voltmeter.	Replace.
	Loose or poor connection.	Check wiring and/or repair connection.

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.

FUEL TANK GAUGE UNIT

Removal and installation



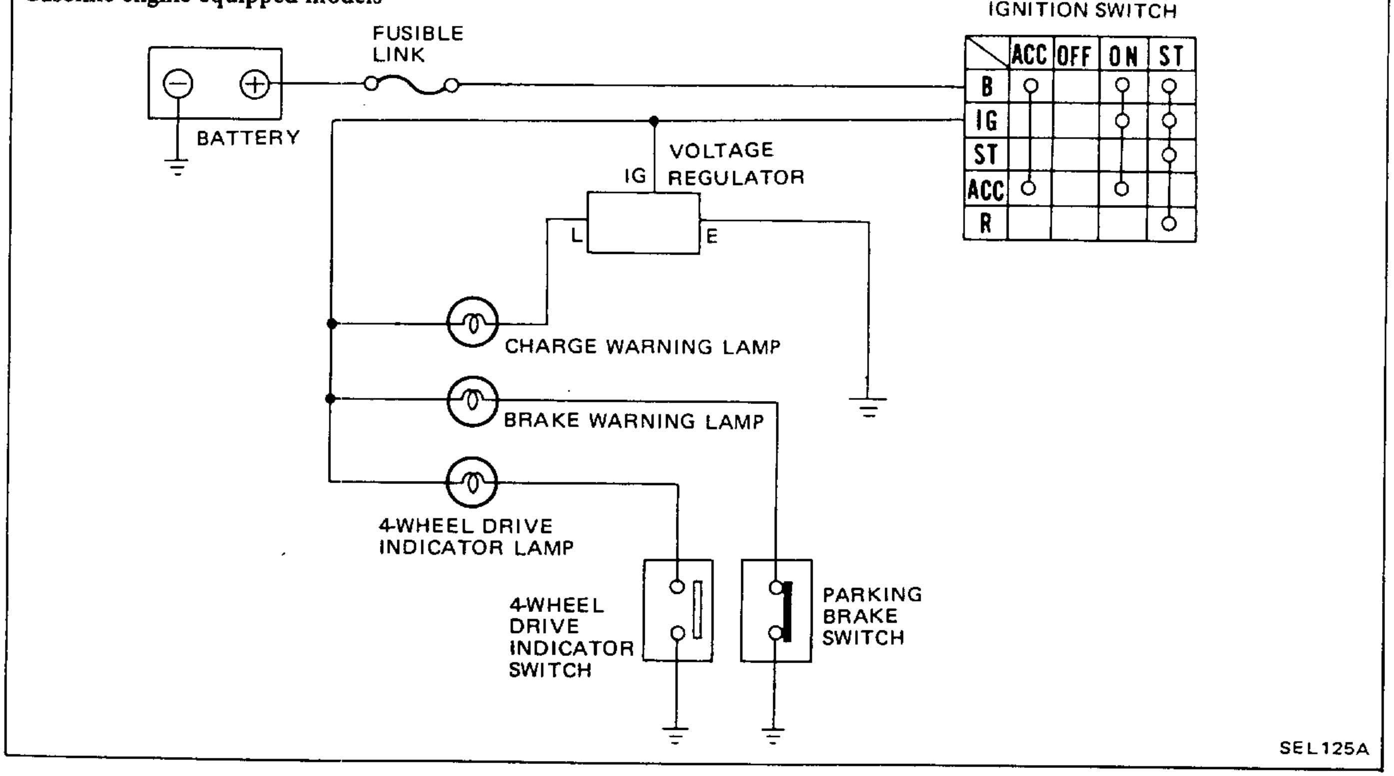
SEL639

WARNING SYSTEM

SCHEMATIC

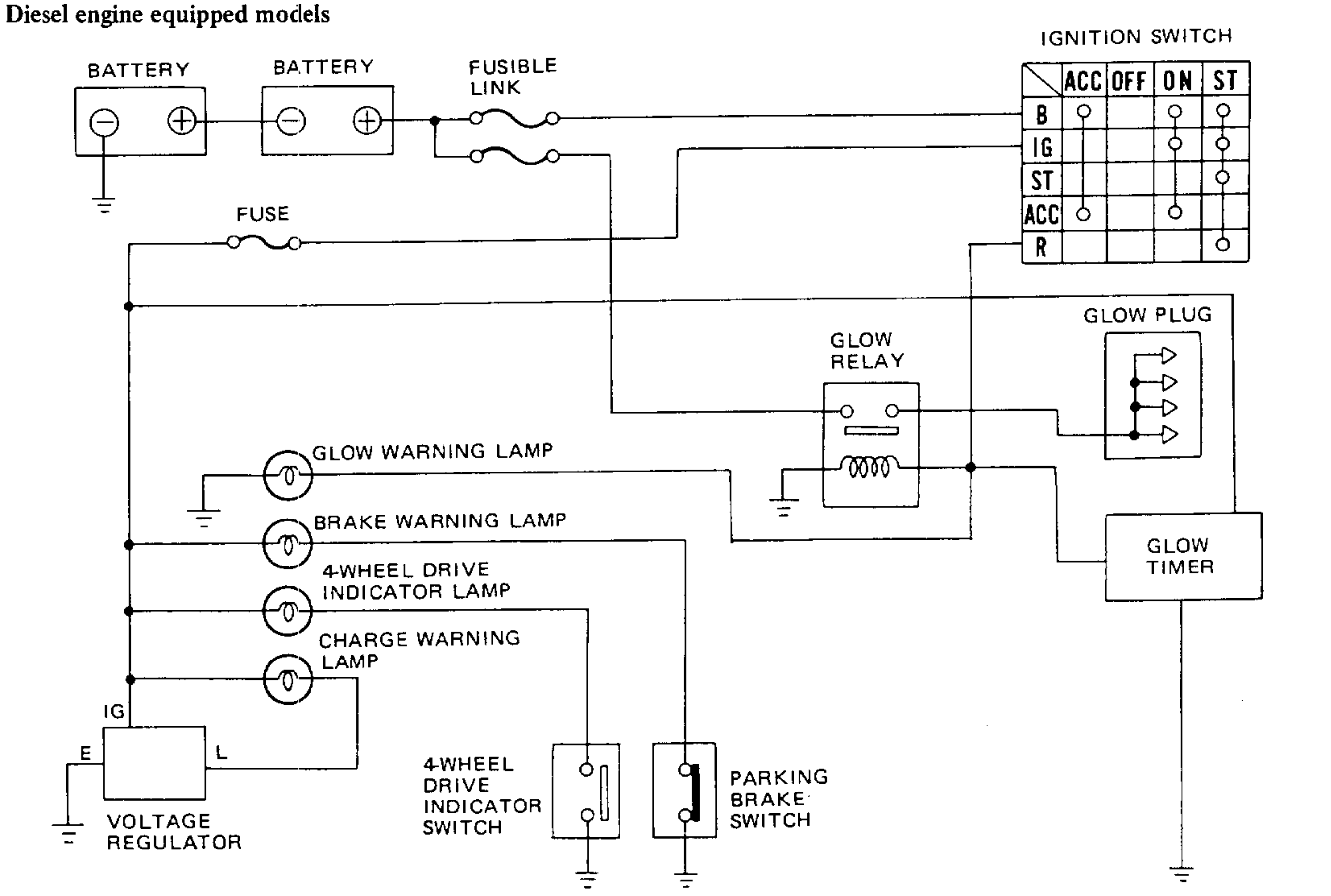
Model 160 series

Gasoline engine equipped models



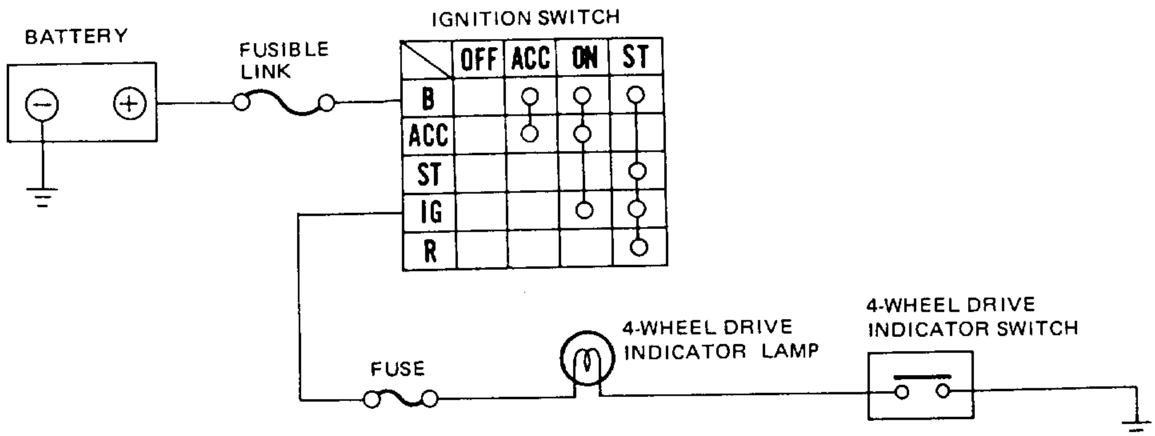
SEL125A

Diesel engine equipped models



SEL126A

Model 61 series



SEL025A

TROUBLE DIAGNOSES AND CORRECTIONS

Charge warning lamp

Condition	Probable cause	Corrective action
Lamp does not go out when engine is started.	Faulty charging system.	Inspect charging system.

Brake warning lamp

Condition	Probable cause	Corrective action
Lamp does not go out when engine is running.	Faulty parking brake switch (When parking brake lever is released.). Faulty brake level switch (When brake	Replace.

Glow warning lamp

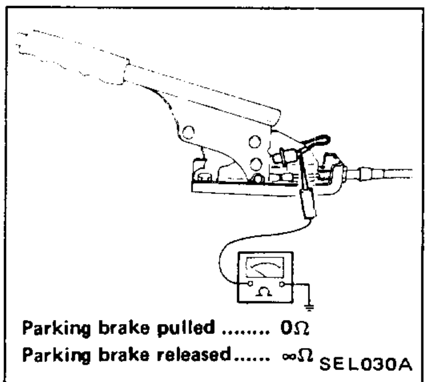
Condition	Probable cause	Corrective action
Lamp does not glow.	Faulty auto-glow system.	Inspect auto-glow system.

4-wheel drive indicator lamp

Condition	Probable cause	Corrective action
Lamp does not go out when 4-wheels are driven.	Faulty 4-wheel drive indicator switch.	Replace.

PARKING BRAKE SWITCH

Inspection



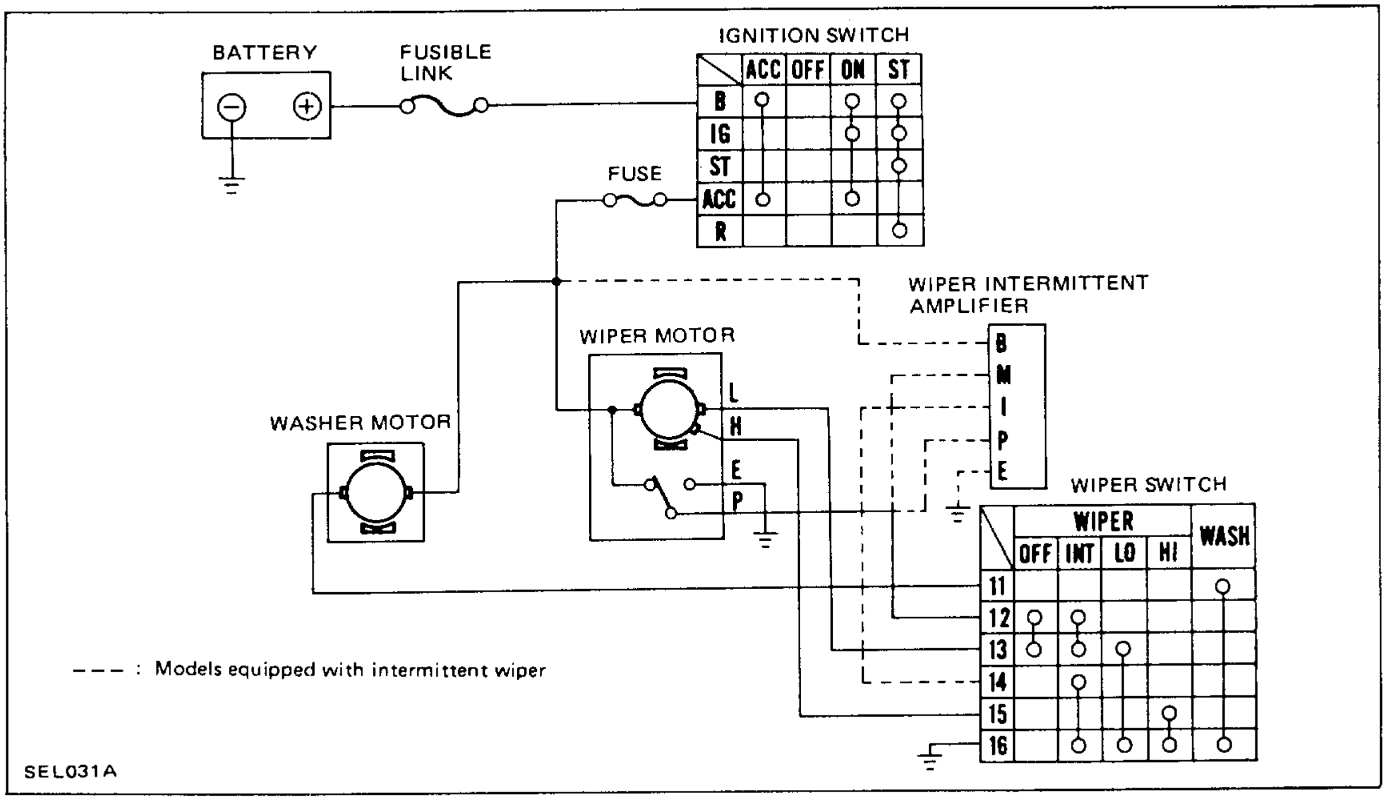
WIPER AND WASHER

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

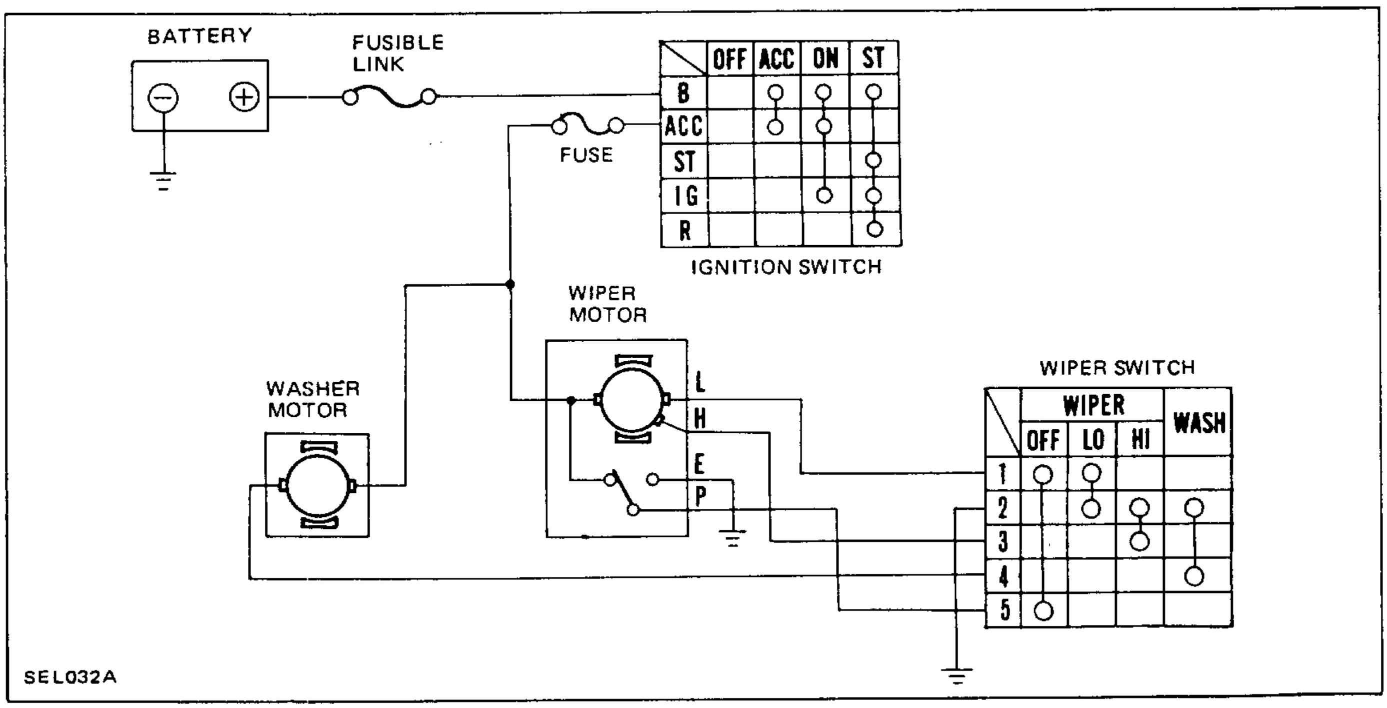
WINDSHIELD WIPER AND WASHER

SCHEMATIC

Model 160 series



Model 61 series



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 or fuse.	Check short-circuit, burnt component inside motor or other part for operation, and correct problem.
		Loose, open or broken wiring.	Correct.
		Improper grounding.	Correct.
	Switch	Improper switch contact.	Correct.
	Link	Foreign material interrupts movement of link mechanism.	Correct.
		Disconnect link rod.	Correct.
		Seized or rusted arm shaft.	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 washer switch is on.		Blown out fusible link or fuse.	Correct cause and replace.
		Faulty switch.	Replace.
		Faulty washer motor.	Replace.
		Loose or poor connection contact at motor or switch.	Replace.
Washer motor operates but washer fluid is not ejected.		Clogged washer nozzle.	Clean nozzle or replace.

INTERMITTENT WINDSHIELD WIPER

The sign for corrective action

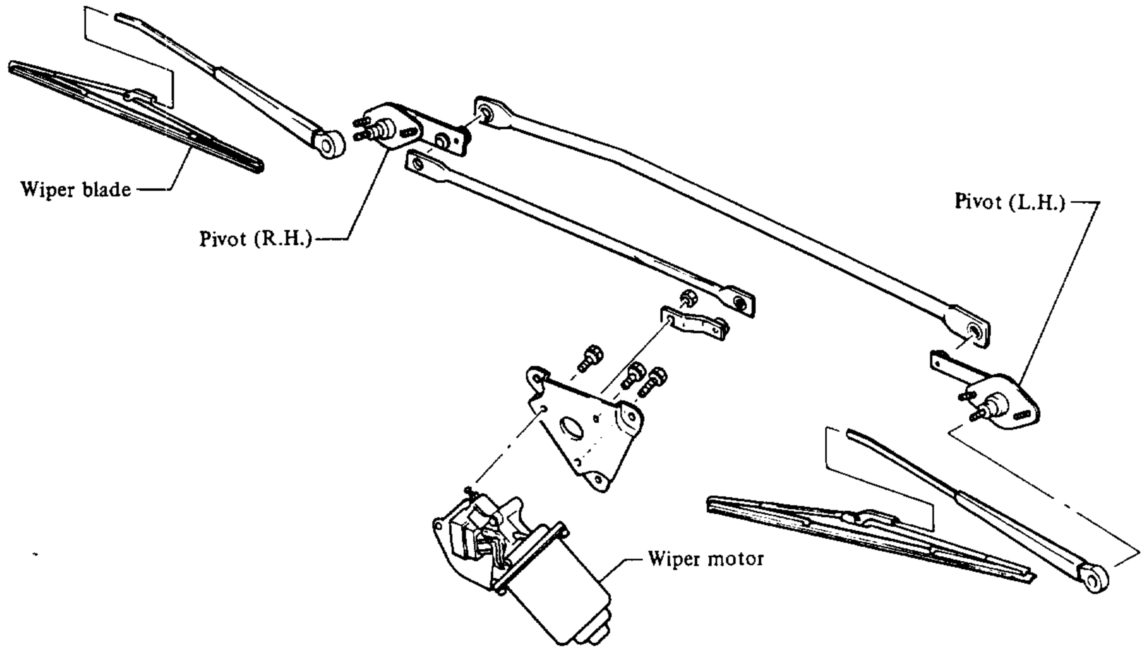
A. Measure voltage across positive (+) and negative (–) terminals of intermittent amplifier with a circuit tester.
B. Check continuity of all wiper switch positions.
C. Check continuity of terminals of wiper motor, wiper switch and intermittent amplifier.
D. Check continuity in wiper motor circuit.
E. 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. Faulty wiper switch. Faulty wiring. Faulty intermittent amplifier.	A: Replace if necessary. B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Intermittent period is too short for proper wiping.	Line voltage too high. Faulty wiper motor (auto-return device). Faulty intermittent amplifier.	A: Replace if necessary. D: Replace if necessary. Replace.
Intermittent period is too long for proper wiping.	Line voltage below 10 volts. Faulty wiper switch. Faulty wiring. Faulty intermittent amplifier.	A: Replace if necessary. B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Wipers do not shut off.	Faulty wiper motor. Faulty intermittent amplifier.	D: Replace if necessary. Replace.
Wipers operate intermittently with wiper switch OFF.	Faulty wiper switch. Faulty wiring. Faulty intermittent amplifier.	B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Intermittent period is erratic.	Line voltage fluctuation excessive. Faulty wiper switch. Faulty wiring. Faulty wiper motor. Faulty intermittent amplifier.	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. Faulty intermittent amplifier.	A: Replace if necessary. Replace.
Wiper motor is not interconnected when washer switch is on, but intermittent operation is normal.	Connections poor. Faulty intermittent amplifier.	C: Repair or replace if necessary. Replace.
Wiper motor simultaneously operates (or: does not delay) when washer switch is on.	Faulty intermittent amplifier.	Replace.
Wipers do not make a complete wiping stroke when washer switch is first turned on and is quickly turned off.	Faulty intermittent amplifier.	Replace.

WINDSHIELD WIPER

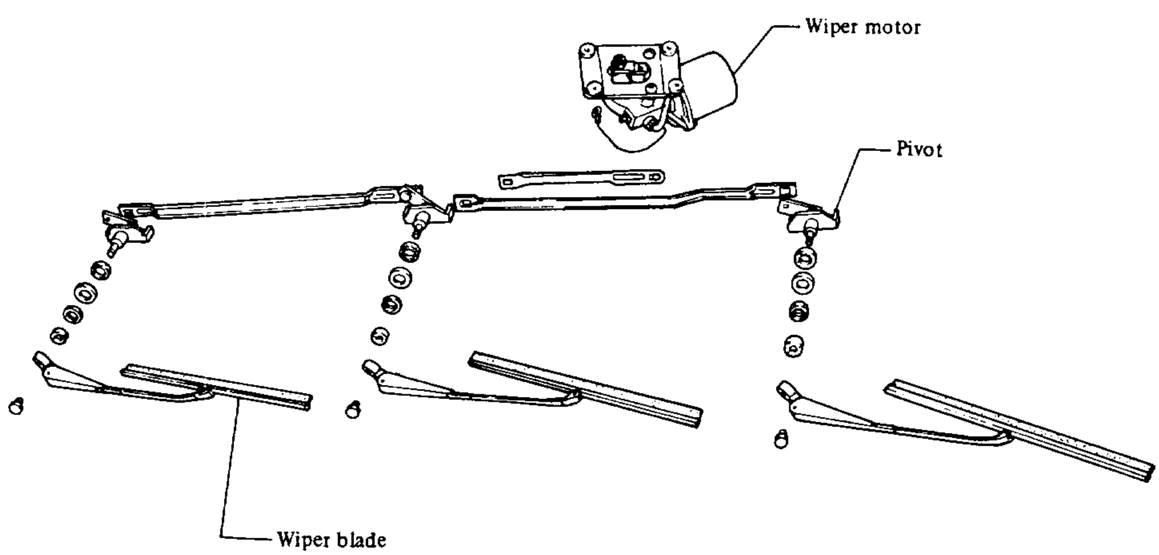
Removal and installation

Model 160 series



SEL033A

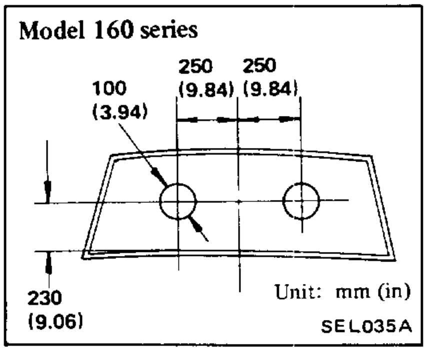
Model 61 series



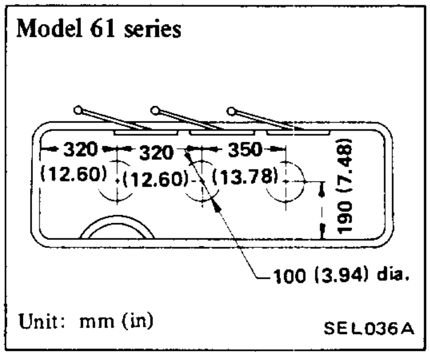
SEL034A

WINDSHIELD WASHER

Washer nozzle adjustment



SEL035A



SEL036A

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 AND WASHER SWITCH

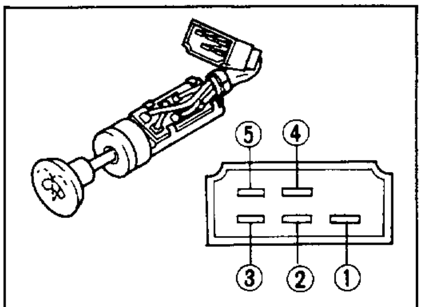
Model 160 series

Refer to Combination Switch (Page EL-54).

Model 61 series

Inspection

Test continuity through switch with a test lamp or ohmmter.



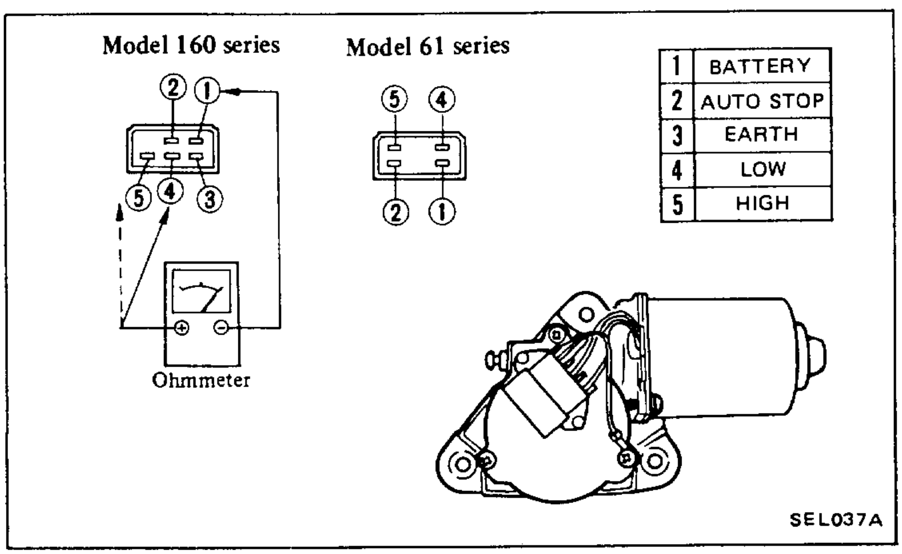
	OFF	LO	HI	WASH
1	O	O		
2		O	O	O
3			O	
4				O
5	O			

SEL009A

WINDSHIELD WIPER MOTOR

Inspection

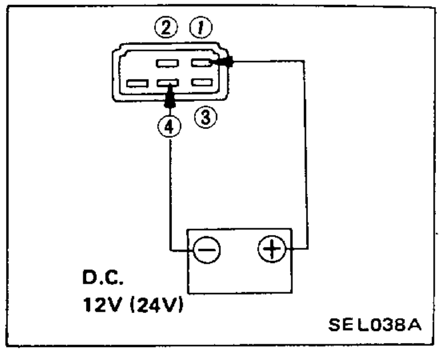
1. There should be continuity between terminals ① and ④, and ① and ⑤.



1	BATTERY
2	AUTO STOP
3	EARTH
4	LOW
5	HIGH

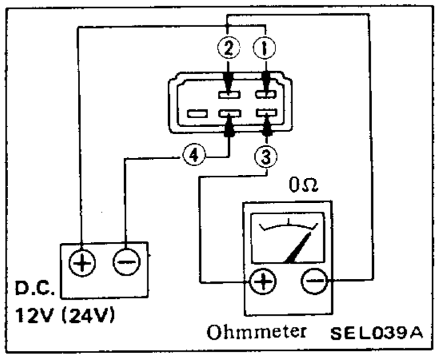
SEL037A

2. Connect positive lead wire to terminal ①, and ground lead wire to terminal ④. The motor should be run at low speed.



SEL038A

3. Keep the motor running.
Check continuity between terminals ② and ③.
Continuity should repeat "ON" and "OFF" periodically.

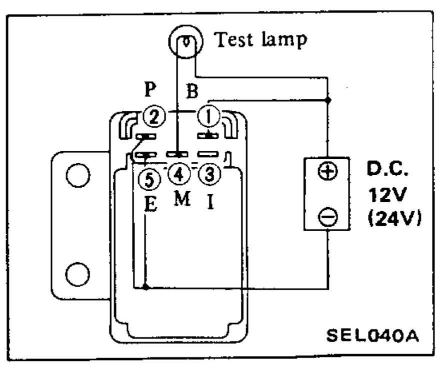


SEL039A

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.



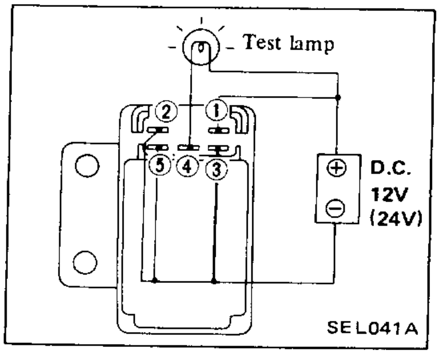
SEL040A

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.

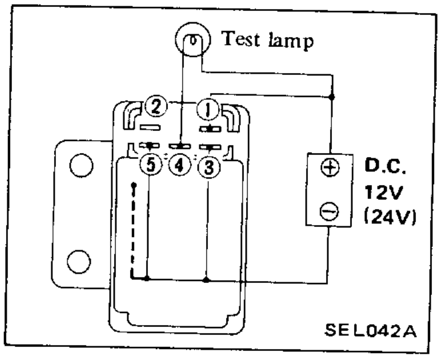
Be careful not to connect lead wires to incorrect terminals as this will damage intermittent amplifier.

1. Make sure that test lamp comes on when negative lead wire is connected to terminal ③.



SEL041A

2. Disconnect lead wire from terminal ②. Test lamp should go out and comes on in about 6 seconds.



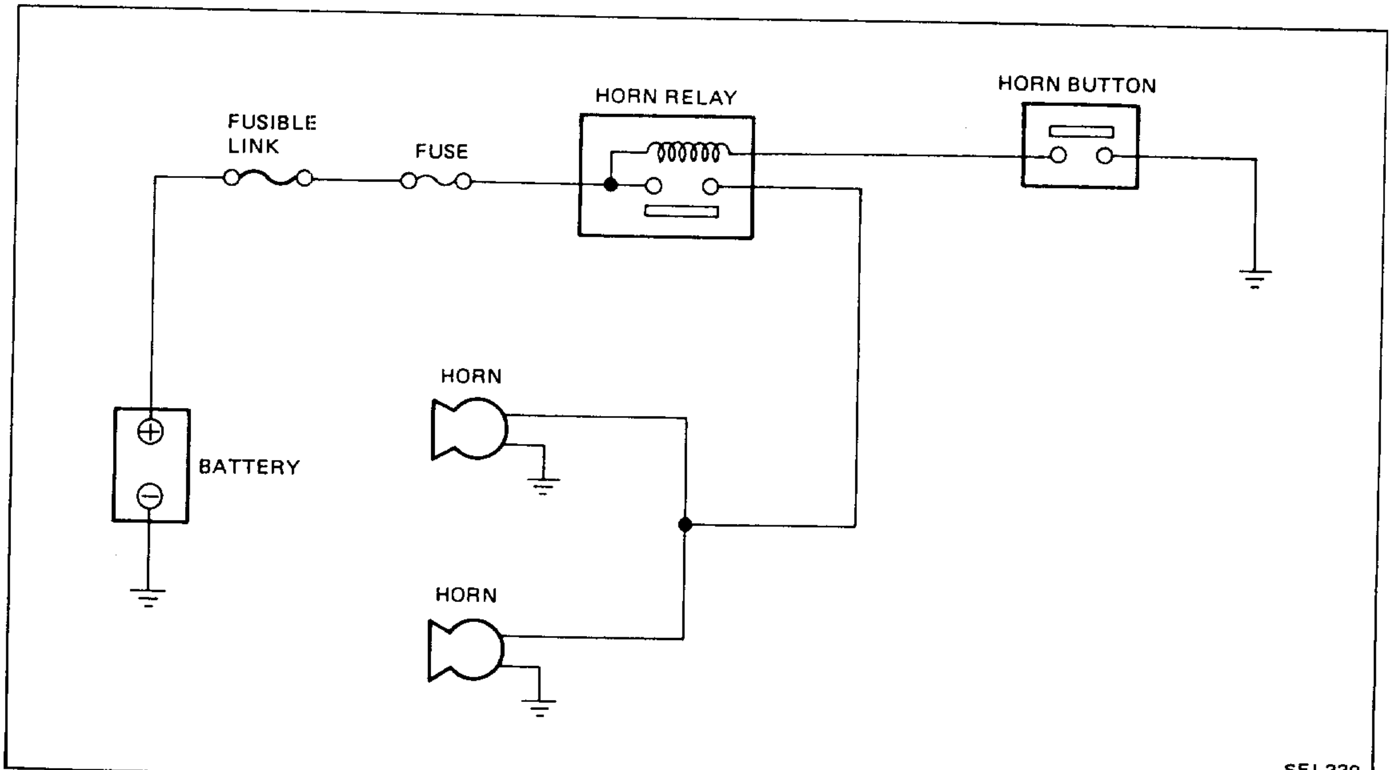
SEL042A

ELECTRICAL ACCESSORIES

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

HORN

SCHEMATIC



SEL339

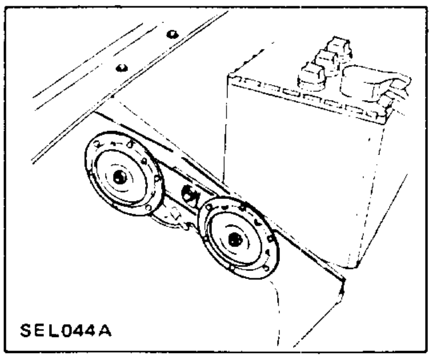
TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Horn does not operate.	Discharged battery. (Measure specific gravity of electrolyte.)	Recharge.
	Burnt fuse.	Correct cause and replace fuse.
	Faulty horn button contact.	Repair horn button.
	Faulty horn relay.	Replace.
	Faulty horn or loose horn terminal connection.	Correct horn terminal connection or replace horn.
Horn sounds continuously.	Short-circuited horn button and/or horn button lead wire.	Repair horn button or its wiring.
	Faulty horn relay.	Replace.
Reduced volume and/or tone quality.	Loose or poor connector contact. (Fuse, relay, horn and/or horn button.)	Repair.
	Faulty horn.	Adjust or replace.

HORN

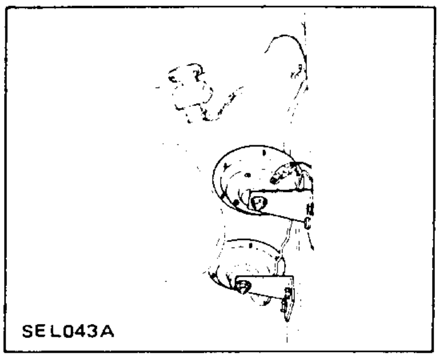
Removal and installation

Model 160 series



SEL044A

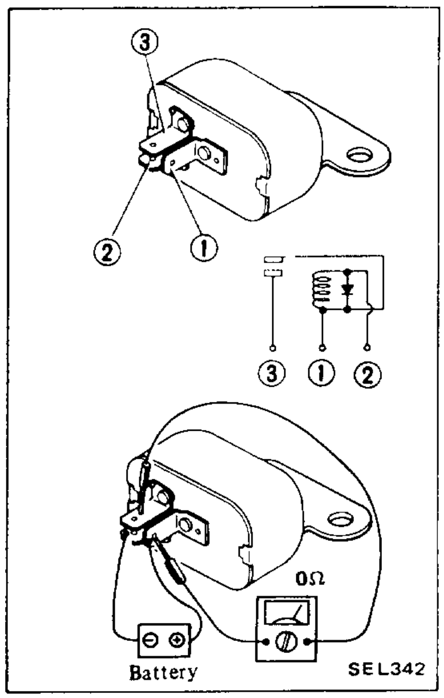
Model 61 series



SEL043A

HORN RELAY

Inspection

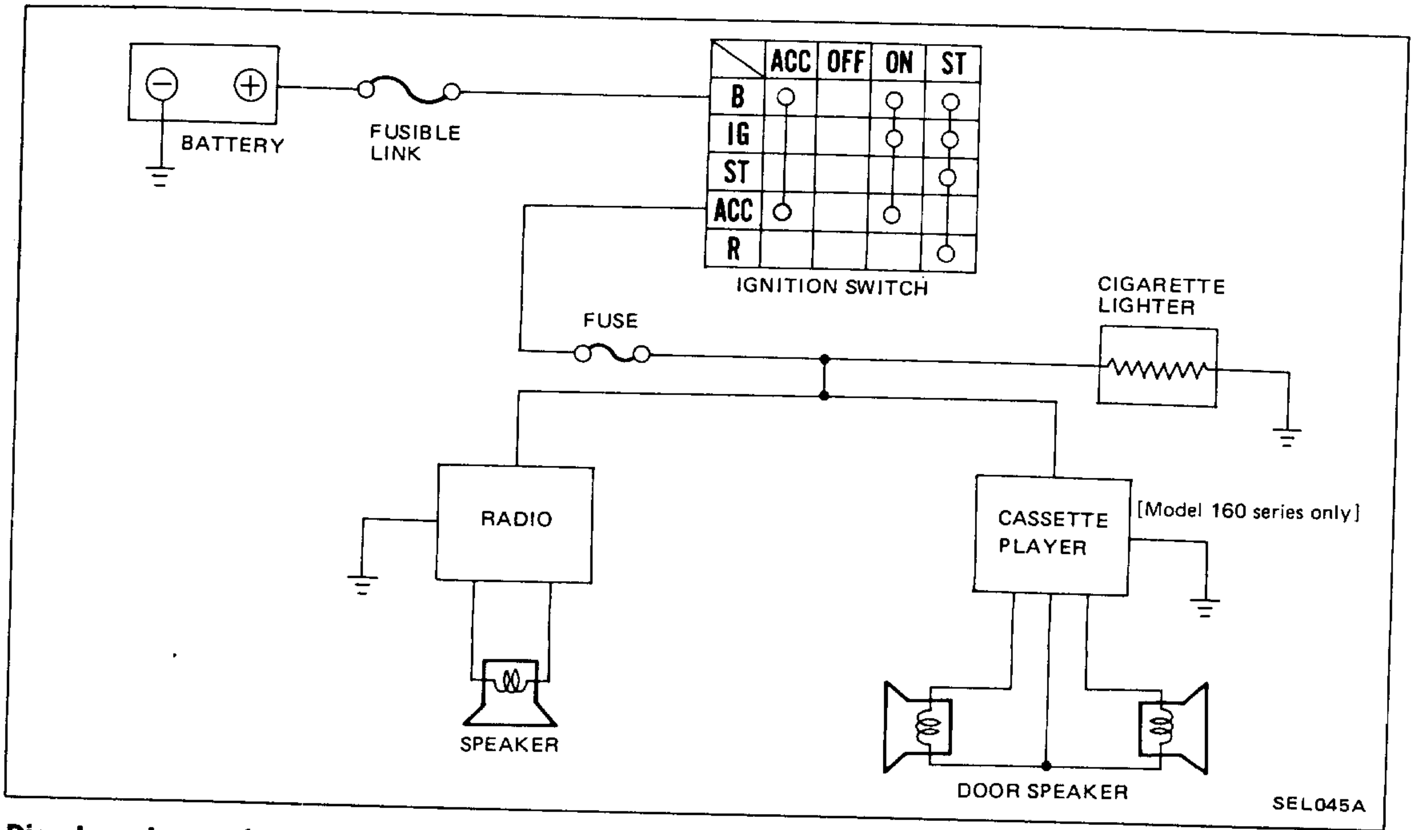


SEL342

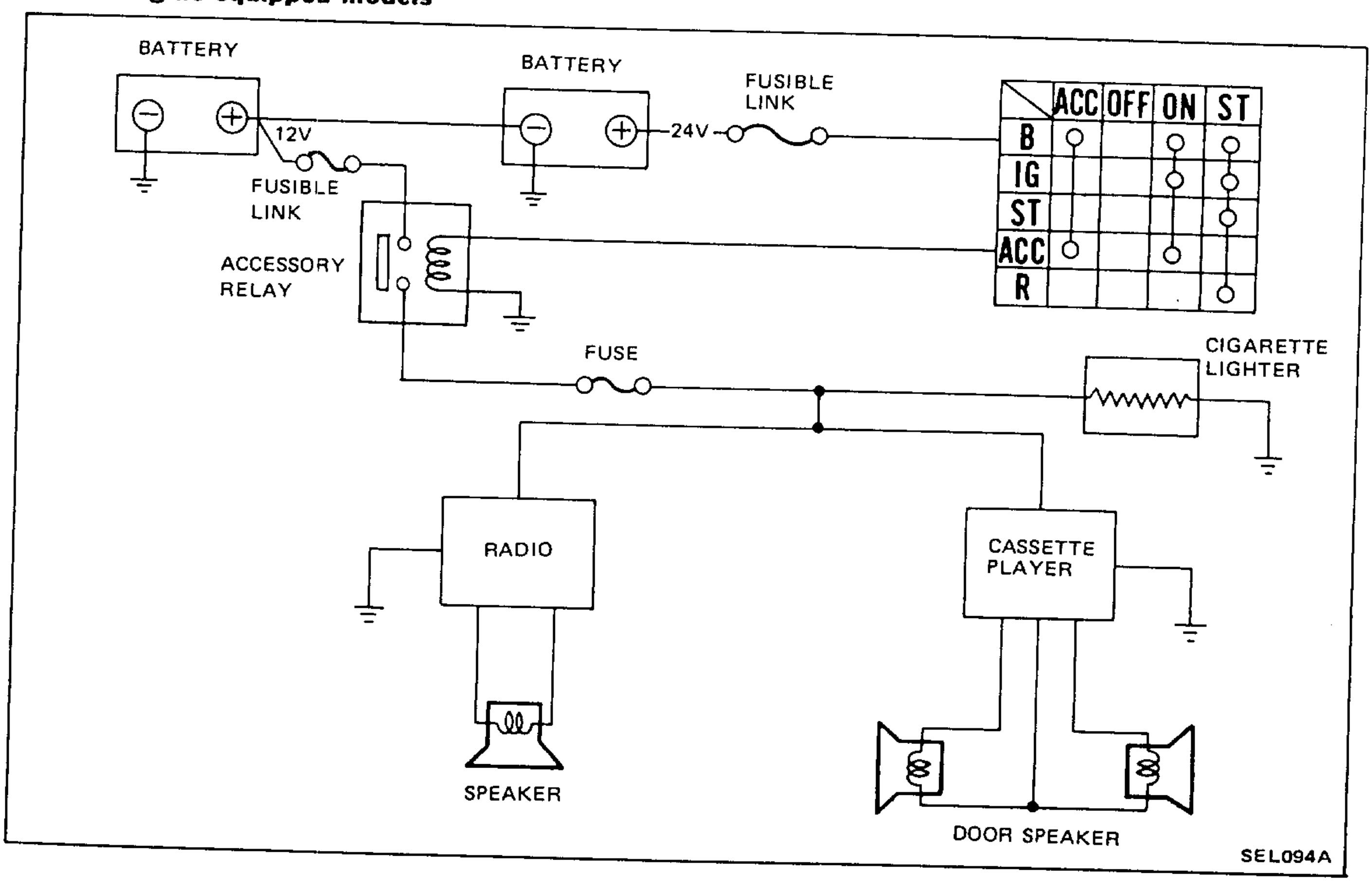
CIGARETTE LIGHTER, RADIO AND STEREO

SCHEMATIC

Gasoline engine equipped models



Diesel engine equipped models



TROUBLE DIAGNOSES AND CORRECTIONS (Radio)

Fading and weak radio reception

↓

Check feeder cable connections
- O.K. ↓
- N.G. → Connect or repair.

Check antenna grounding
- O.K. ↓
- N.G. → Tighten securely.

Adjust antenna trimmer
- Unchanged ↓

Replace radio
- Revised ↓ Faulty radio
- Unchanged → Faulty speaker.

Noisy radio reception

↓

Stop engine and turn off all other switches
- Revised ↓
- Unchanged → See "Fading and weak reception"

Check ignition cables
- O.K. ↓
- N.G. → Replace

Check noise prevention parts (Condenser, bending wire, etc.)
- O.K. ↓
- N.G. → Retighten or replace.

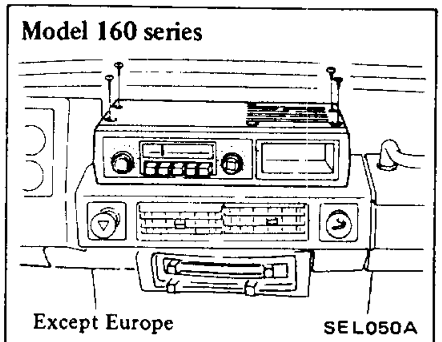
Check spark plugs
- O.K. ↓
- N.G. → Replace

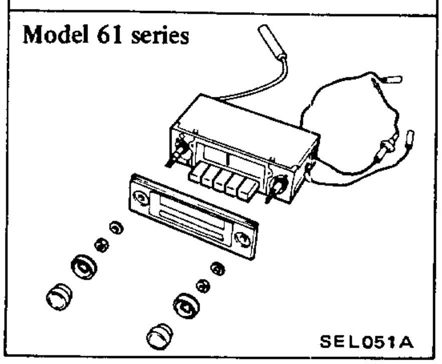
Check feeder cable routing
- O.K. ↓
- N.G. → Repair

Replace radio
- Revised ↓ Faulty radio
- Unchanged → Faulty speaker

RADIO

Removal and installation





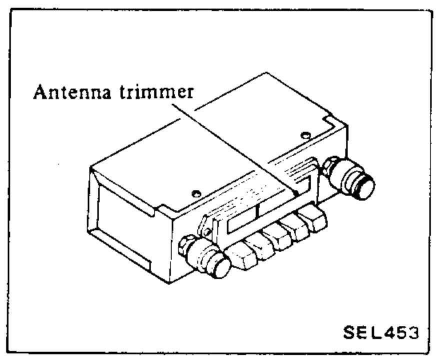
Antenna trimmer adjustment

The antenna trimmer should be adjusted in the following cases:

- Fading and weak MW (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.

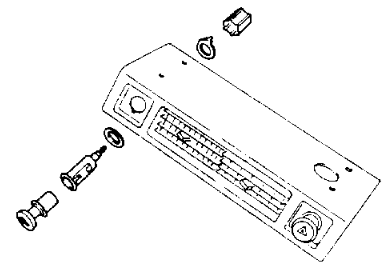


CAUTION:
Do not turn antenna trimmer more than one-half turn.

CIGARETTE LIGHTER

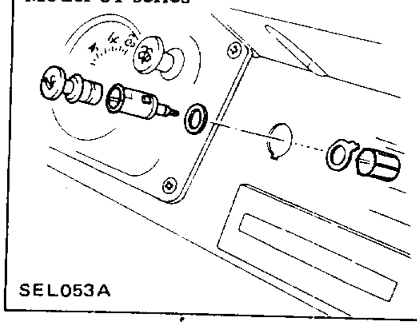
Removal and installation

Model 160 series



SEL052A

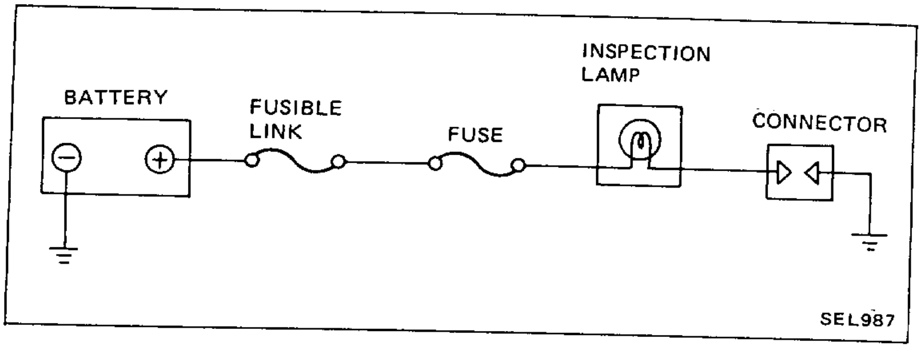
Model 61 series



SEL053A

INSPECTION LAMP (Model 160 series)

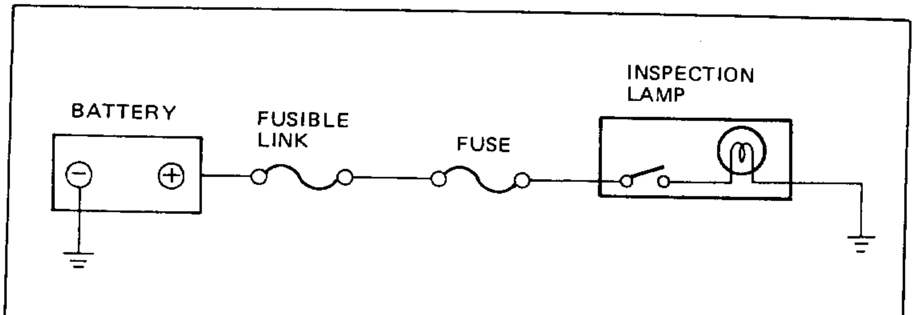
SCHEMATIC



SEL987

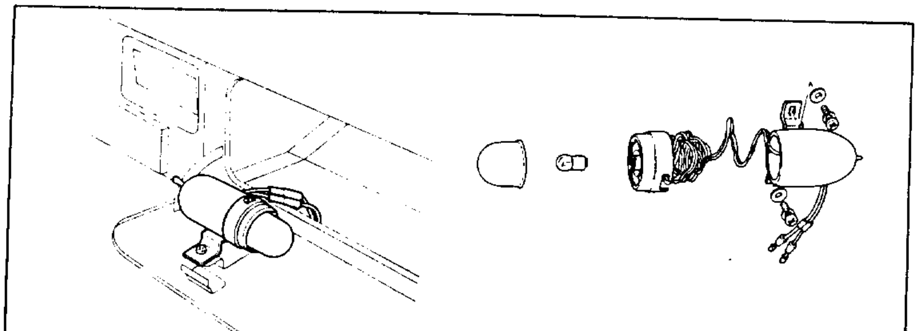
INSPECTION LAMP (Model 61 series)

SCHEMATIC



SEL054A

REMOVAL AND INSTALLATION



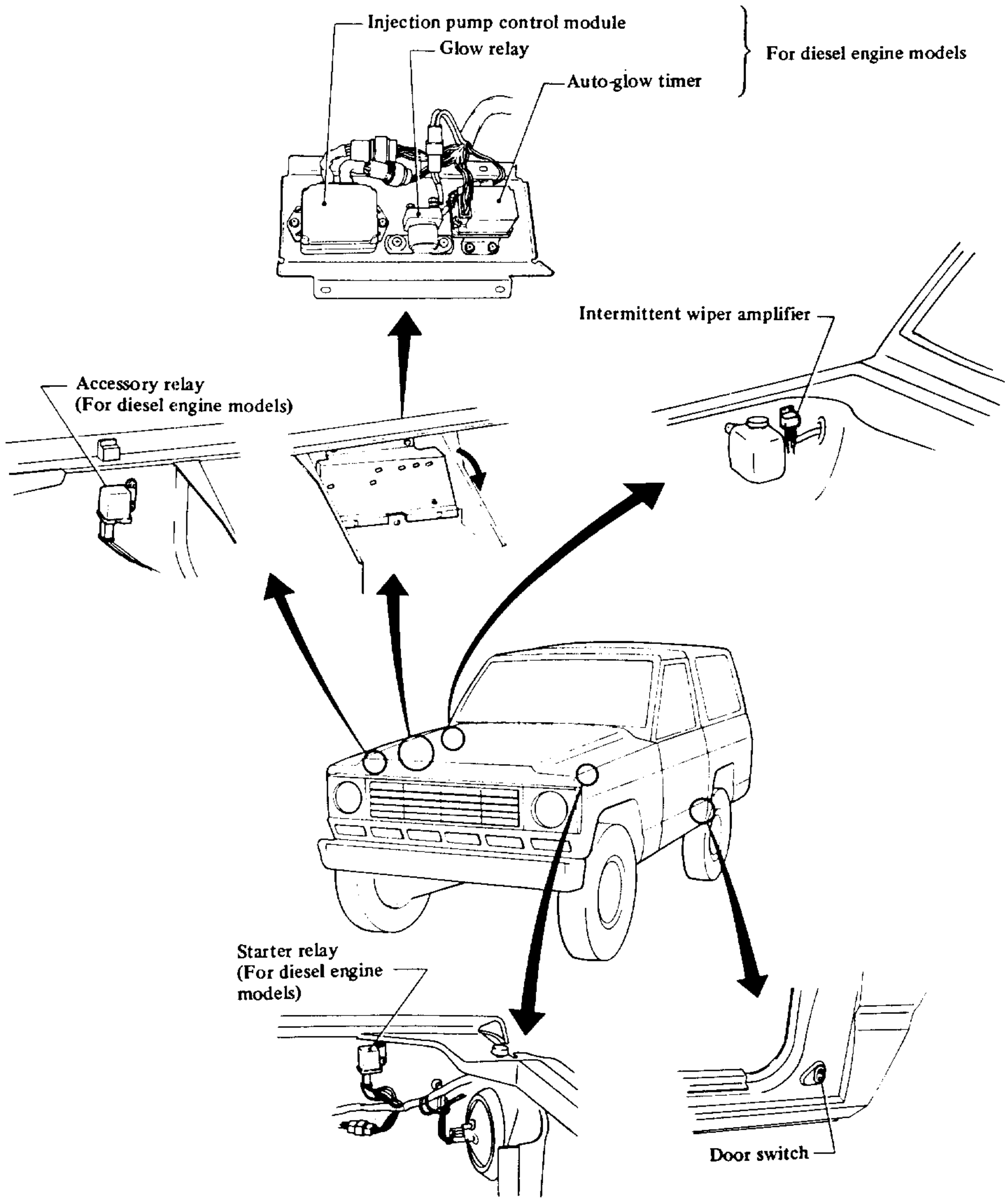
SEL055A

LOCATION OF ELECTRICAL UNITS

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

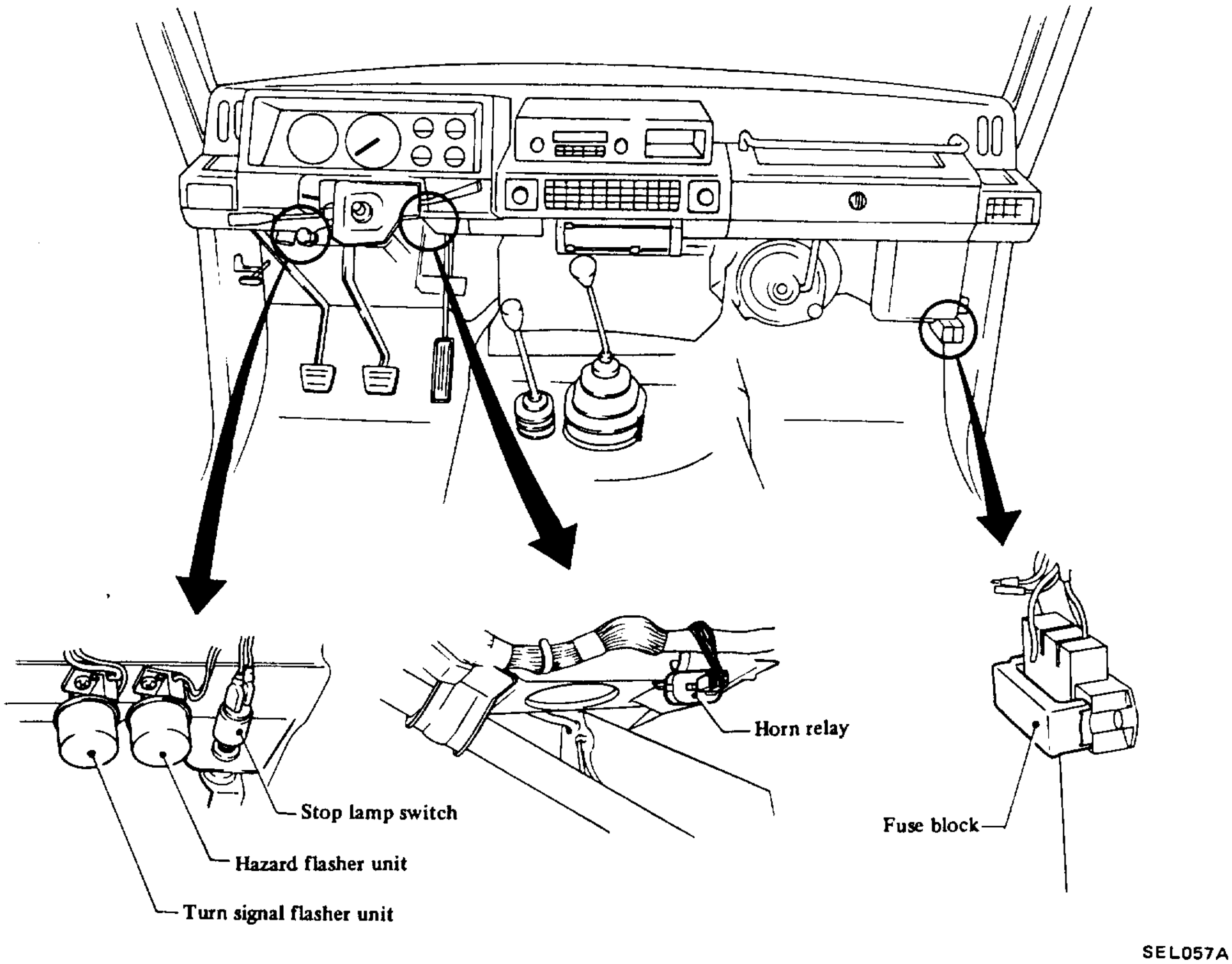
MODEL 160 SERIES

ENGINE COMPARTMENT SIDE

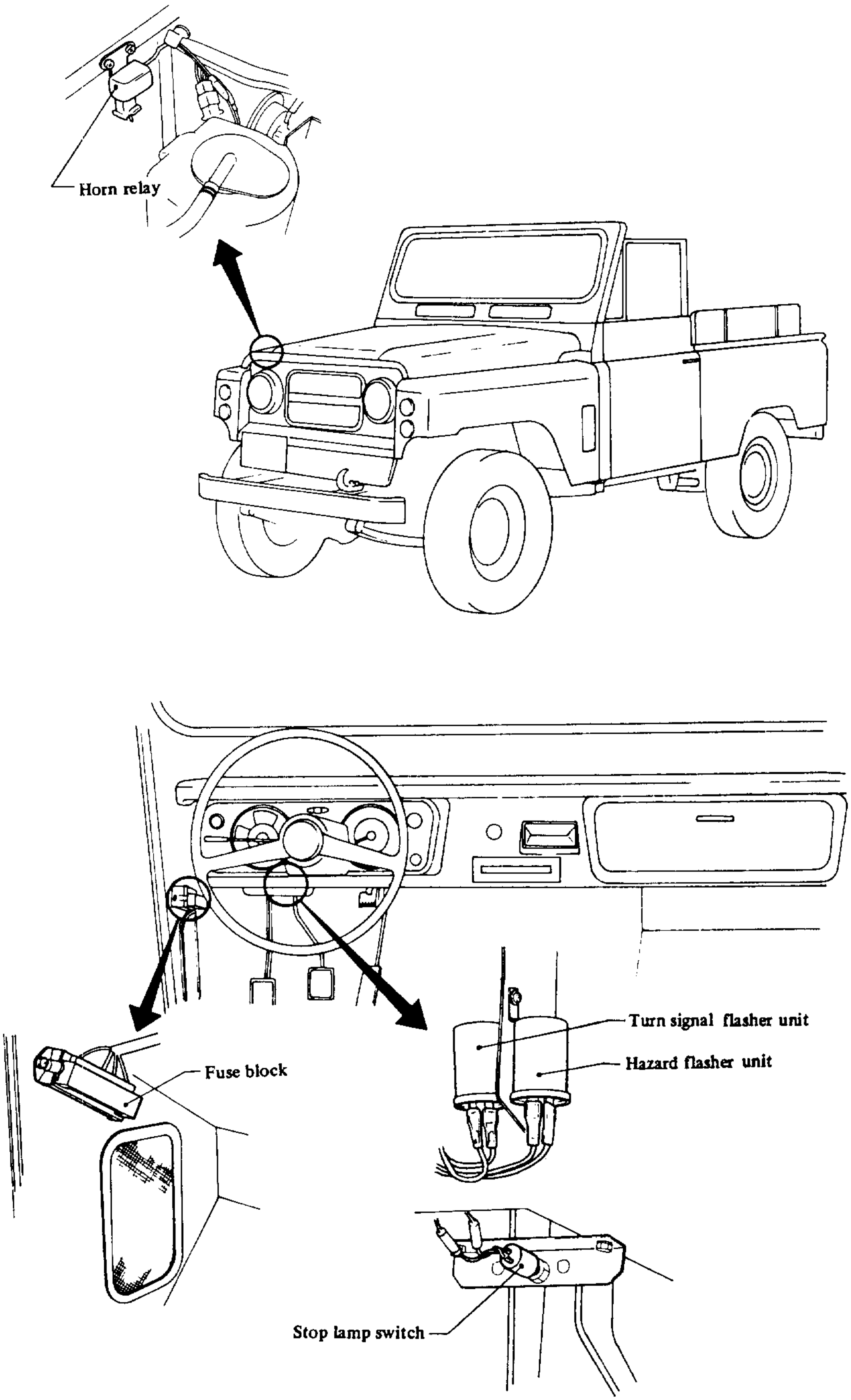


SEL056A

PASSENGER COMPARTMENT SIDE



MODEL 61 SERIES



SEL058A

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 table at right.

Circuit system	Color
Starting and ignition system	B (Black)
Charging system	W (White)
Lighting system	R (Red)
Signal system	G (Green)
Instrument system	Y (Yellow)
Others	L (Blue) Br (Brown) Lg (Light green)
Grounding system	B (Black)

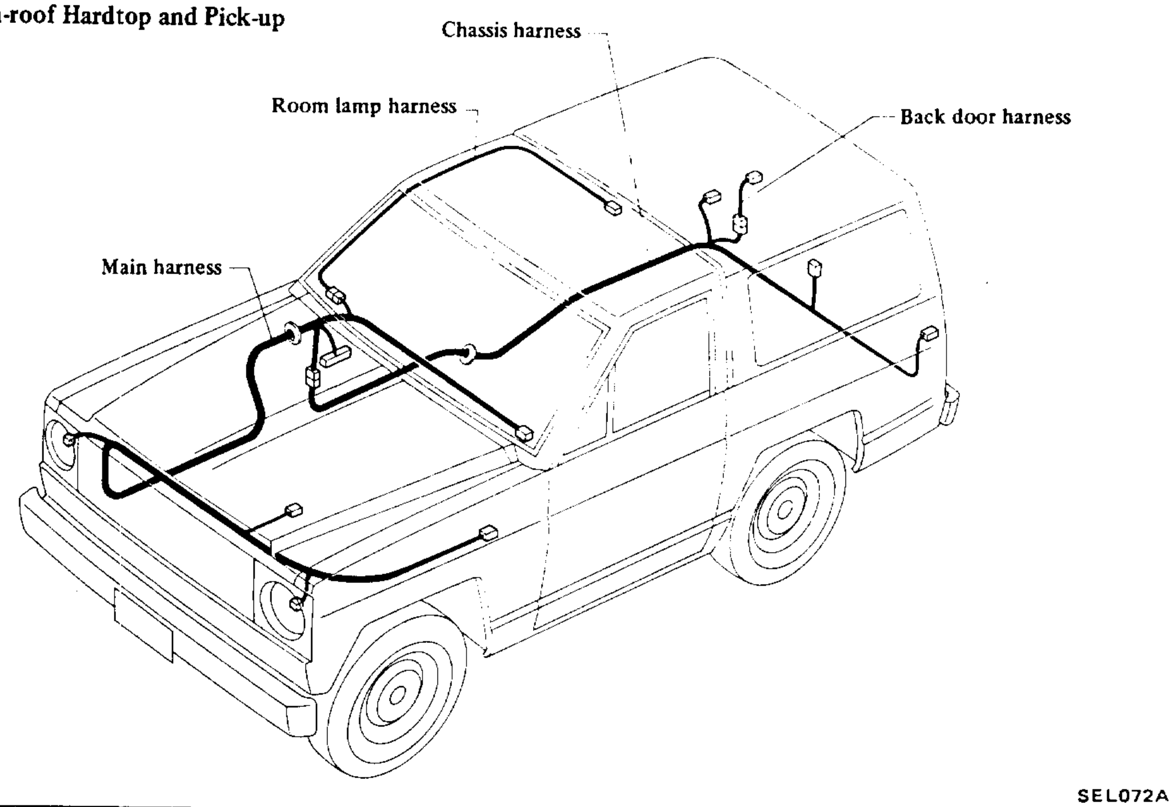
The main cable of each system is generally coded with a single color. These colors are represented by such letters as G, W, or Br. Minor items of each circuit's terminal are coded with a two-tone color as follows:

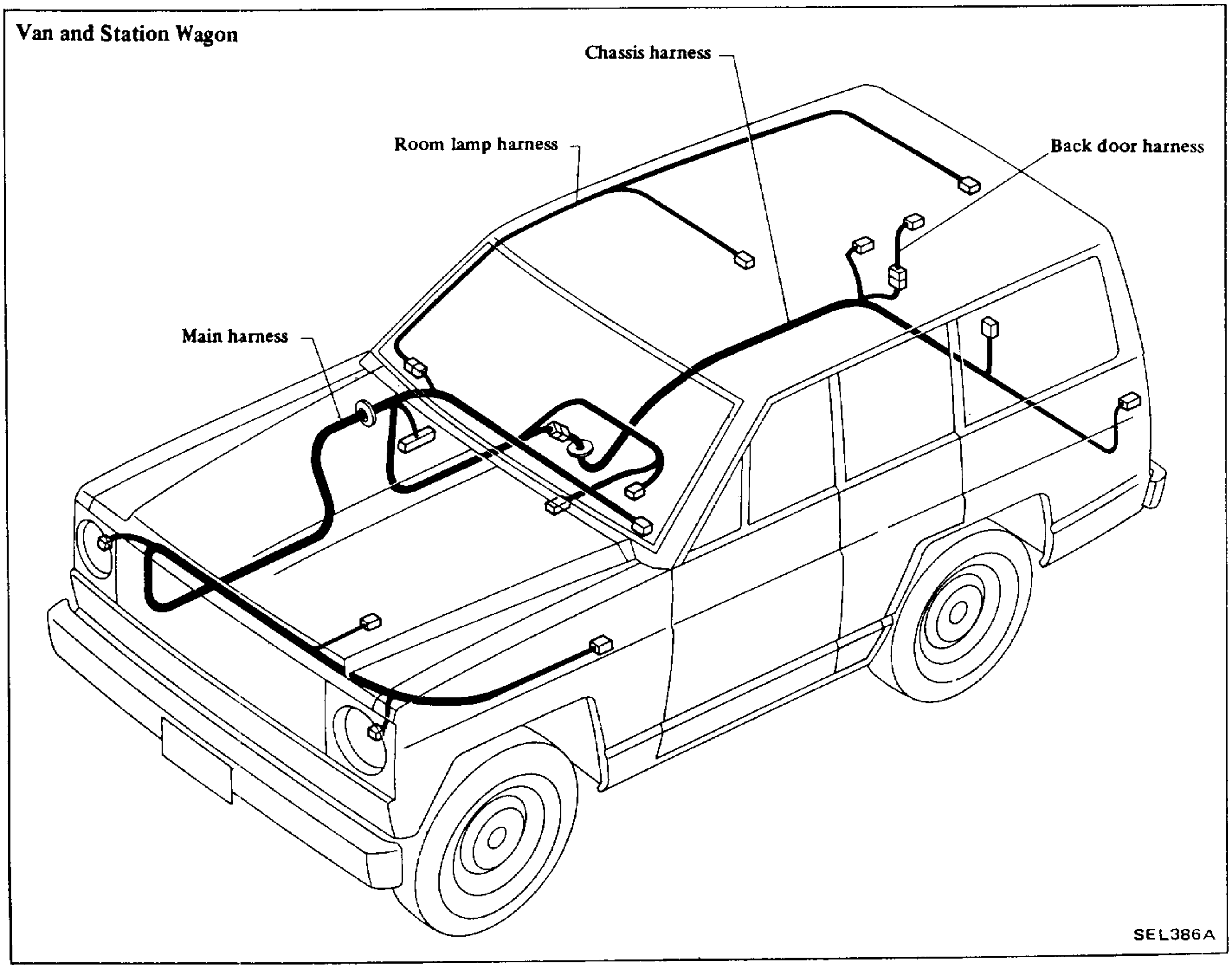
BW: Black with white stripe
LgR: Light green with red stripe

HARNESS LAYOUT (Model 160 series)

LAYOUT

Hardtop, High-roof Hardtop and Pick-up

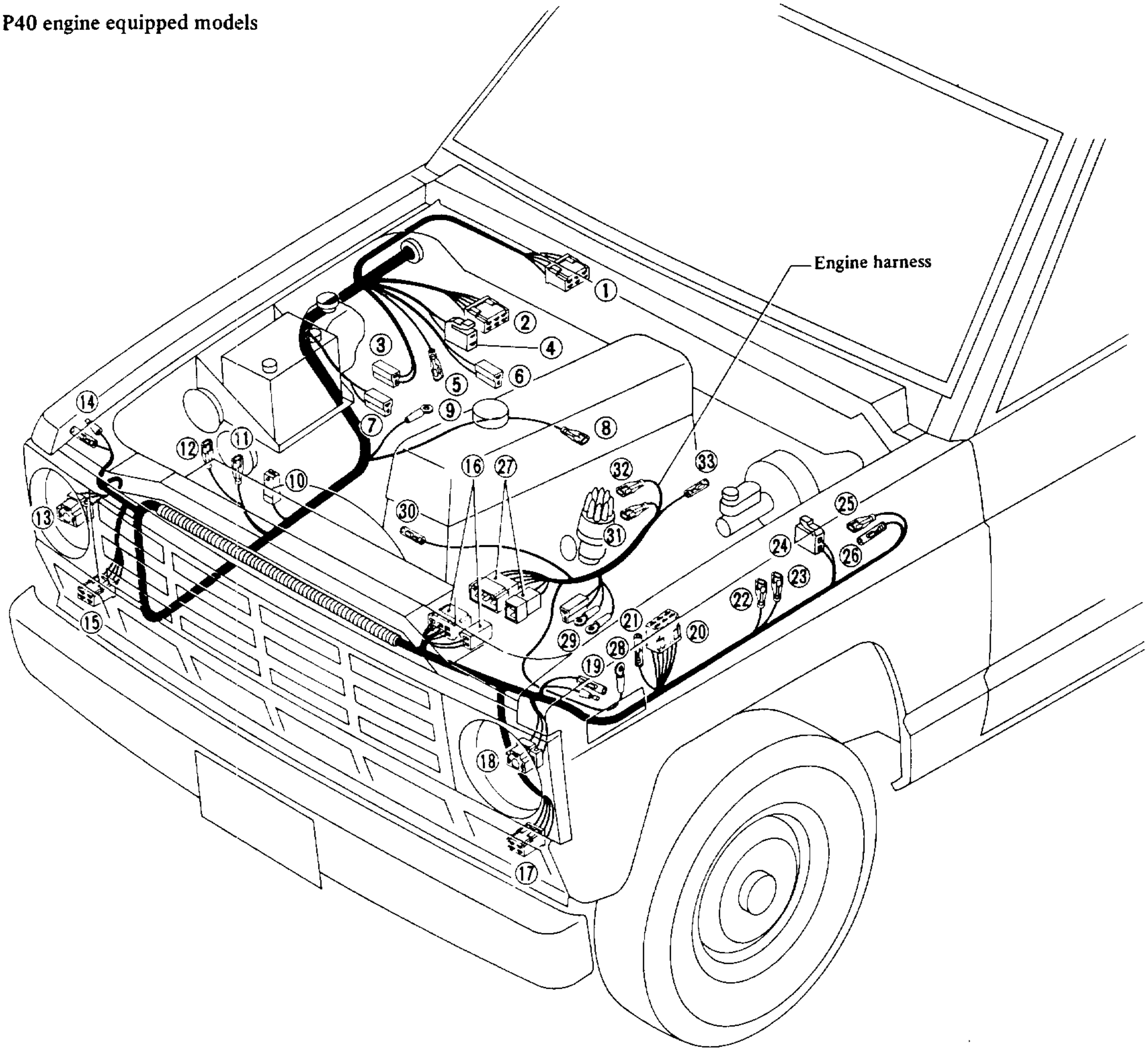



Van and Station Wagon
Chassis harness
Room lamp harness
Back door harness
Main harness
SEL386A

MAIN HARNESS

Engine compartment side

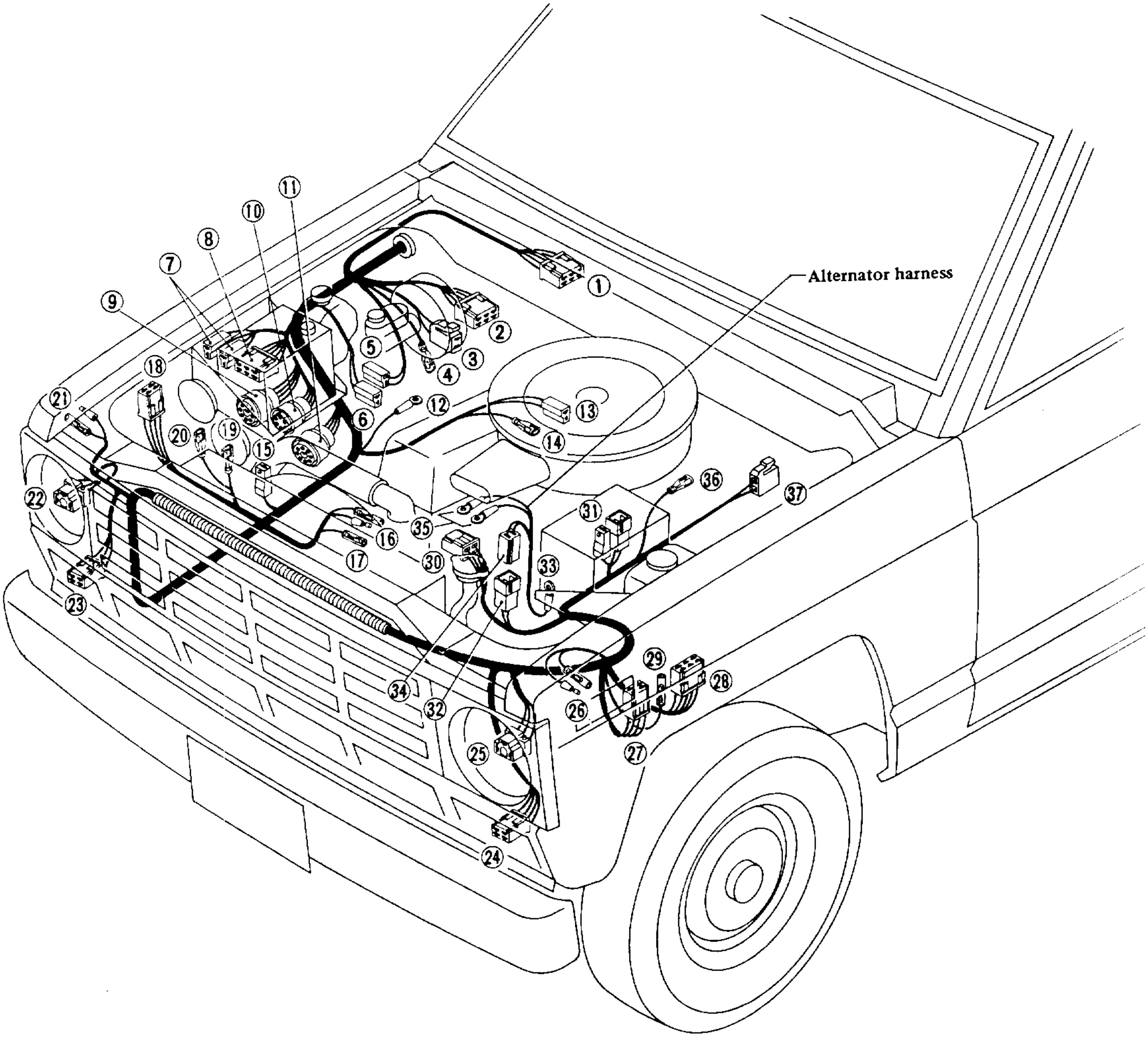
P40 engine equipped models



1 Wiper motor
2 Intermittent wiper amplifier
3 Windshield washer motor
4 Brake fluid level switch
(R.H. drive model only)
5 To fog lamp calbe
6 Tachometer resistor
7 To air conditioner harness "B"
8 Starter motor
9 Ground
10 Fusible link
11 Horn "Low"
12 Horn "High"
13 Headlamp (R.H.)
14 Side flasher lamp (R.H.)
15 Front combination lamp (R.H.)
16 To engine harness
17 Front combination lamp (L.H.)
18 Headlamp (L.H.)
19 Side flasher lamp (L.H.)
20 Voltage regulator
21 Condenser
22 Resistor
23 Resistor
24 Blake fluid level switch
(L.H. drive model only)
25 Ignition coil
26 Condenser
27 To main harness
28 Ground
29 Alternator
30 Thermal transmitter
31 Distributor
32 Distributor ground
33 Oil pressure unit

SEL073A

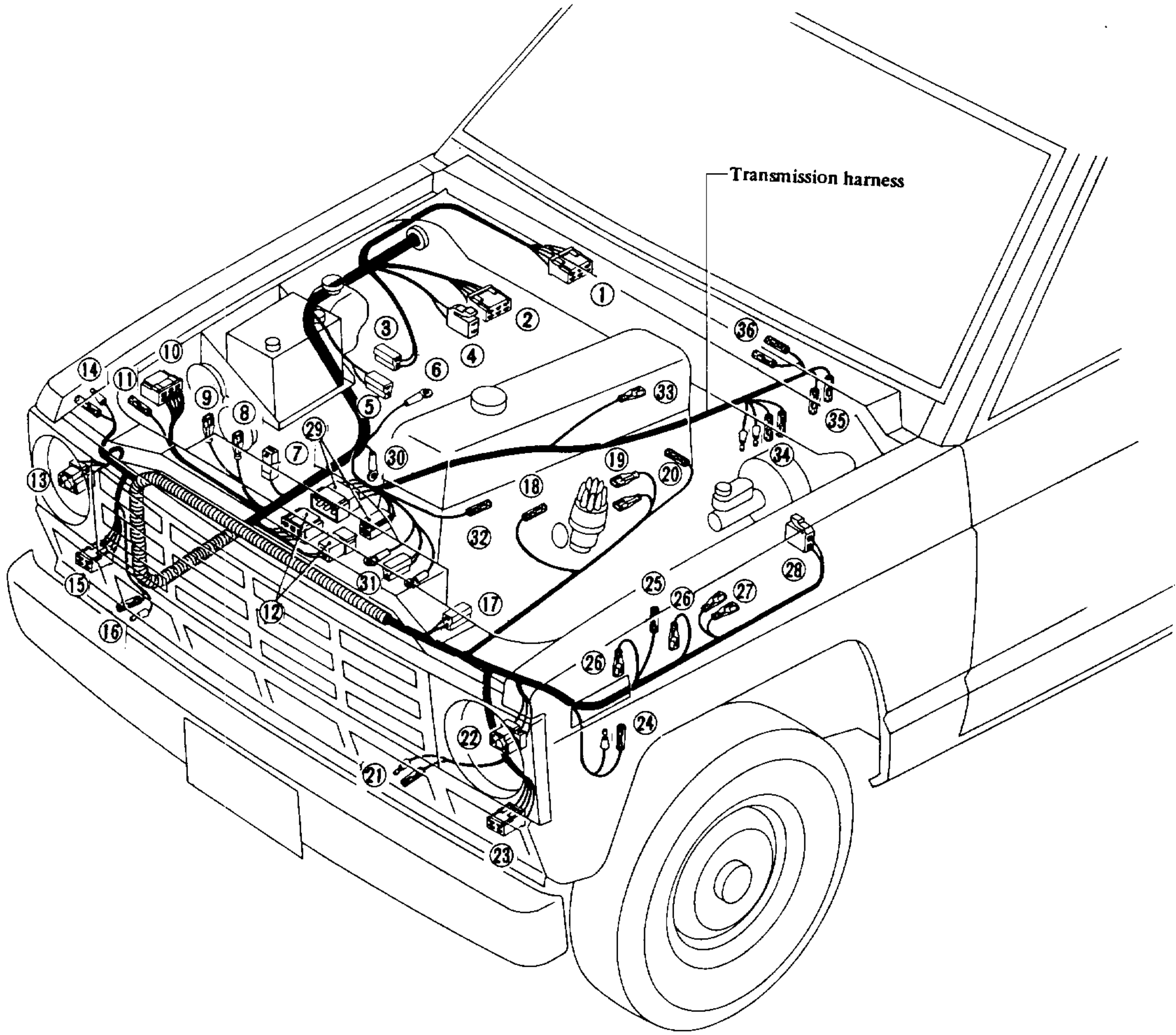
SD33 engine equipped models



1 Wiper motor
2 Intermittent wiper amplifier
3 Brake fluid level switch (R.H. drive model only)
4 To fog lamp cable
5 Windshield washer motor
6 To air conditioner harness "B"
7 Glow relay
8 Glow timer
9 Injection pump control module
10 Injection pump control module
11 Injection pump control unit
12 Ground
13 Oil pressure unit
14 Glow plug
15 Fusible link
16 Thermo sensor
17 Thermal transmitter
18 Accessory relay
19 Horn "Low"
20 Horn "High"
21 Side flasher lamp (R.H.)
22 Headlamp (R.H.)
23 Front combination lamp (R.H.)
24 Front combination lamp (L.H.)
25 Headlamp (L.H.)
26 Side flasher lamp (L.H.)
27 Starter relay
28 Voltage regulator
29 Condenser
30 Alternator
31 Fusible link
32 To alternator harness
33 Ground
34 To main harness
35 Alternator
36 Starter motor
37 Brake fluid level switch (L.H. drive model only)

SEL074A

L28 engine equipped models



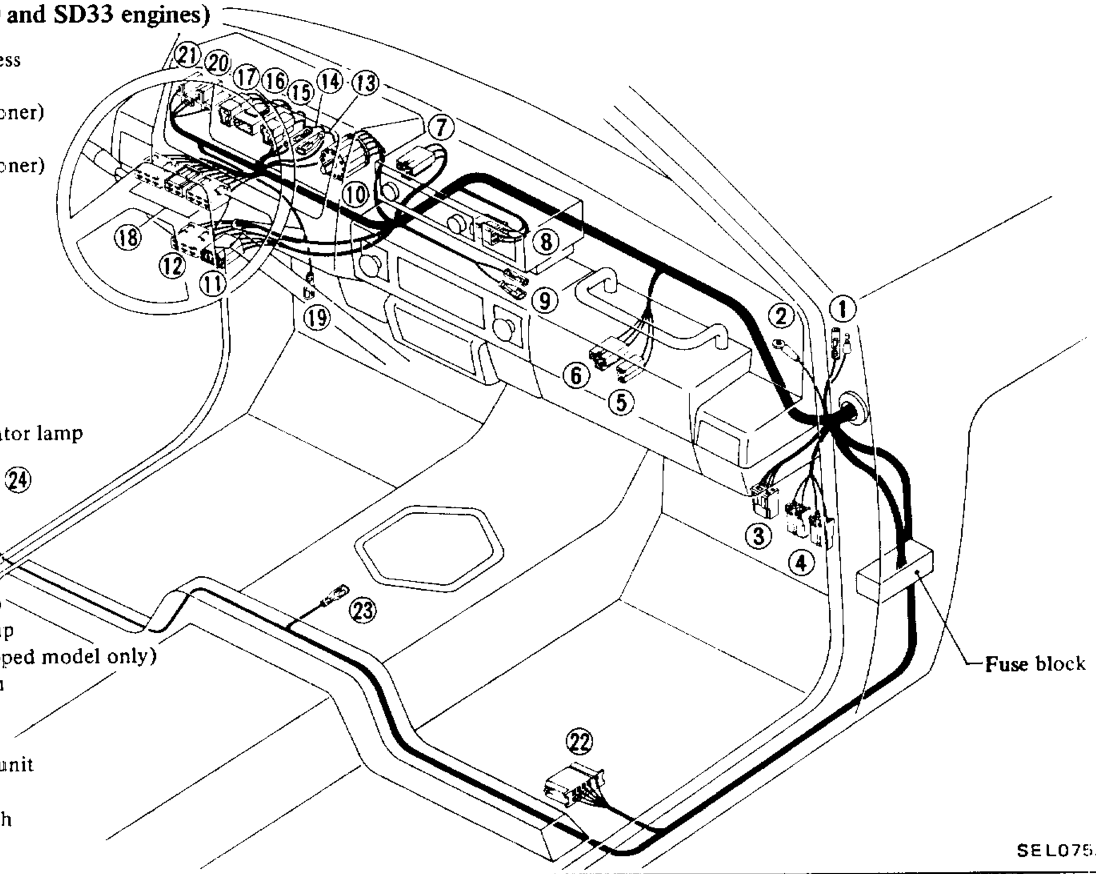
1 Wiper motor
2 Intermittent wiper amplifier
3 Windshield washer motor
4 Brake fluid level switch (R.H. drive model only)
5 To air conditioner harness "B"
6 Ground
7 Fusible link
8 Horn "Low"
9 Horn "High"
10 Voltage regulator
11 Condenser
12 To transmission harness
13 Headlamp (R.H.)
14 Side flasher lamp (R.H.)
15 Front combination lamp (R.H.)
16 Fog lamp (R.H.)
17 To tachometer harness
18 Thermal transmitter
19 Distributor
20 Throttle opener
21 Fog lamp (L.H.)
22 Headlamp (L.H.)
23 Front combination lamp (L.H.)
24 Side flasher lamp (L.H.)
25 Condenser
26 Resistor
27 Ignition coil
28 Brake fluid level switch (L.H. drive model only)
29 To main harness
30 Ground
31 Alternator
32 Oil pressure unit
33 Starter motor
34 Inhibitor switch (A/T model only)
35 Kickdown switch (A/T model only)
36 Back-up lamp switch (M/T model only)

SEL387A

Passenger compartment side

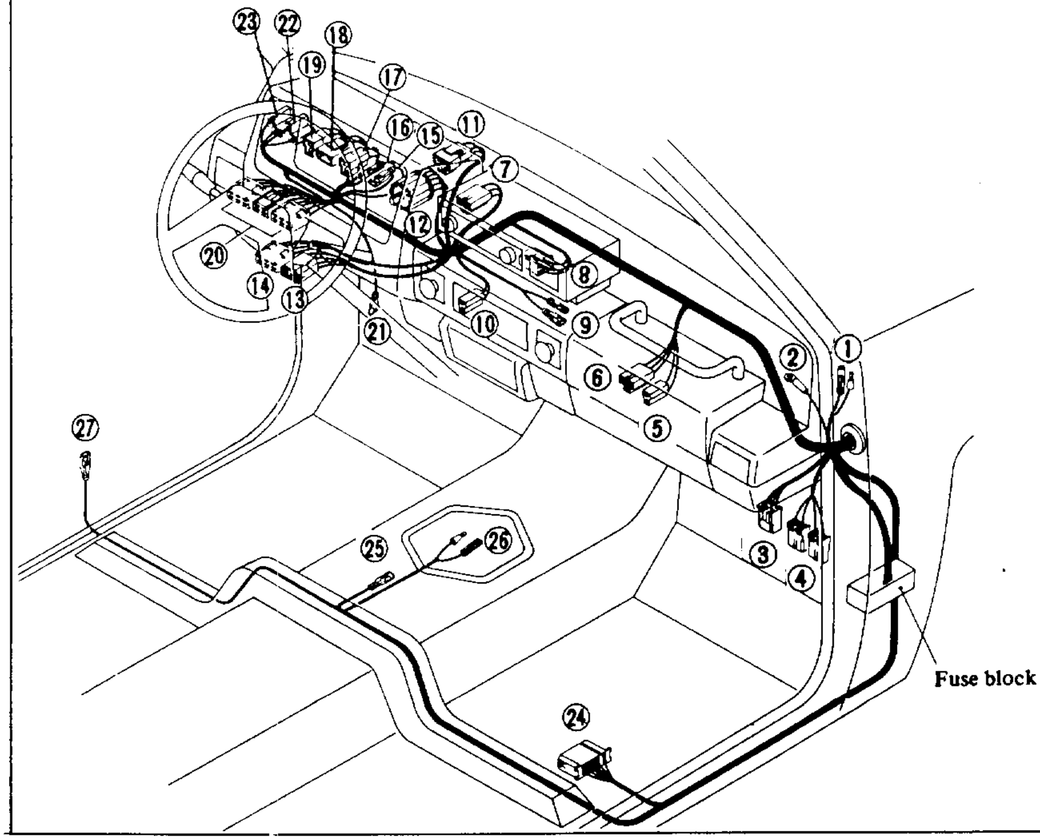
L.H. drive models (P40 and SD33 engines)

1 To room lamp harness
2 Ground
3 Option (Air conditioner)
4 Option
5 Option (Air conditioner)
6 To heater harness
7 Horn relay
8 Radio
9 Cigarette lighter
10 Combination meter
11 Hazard switch
12 Ignition switch
13 Tachometer
14 Clock
15 4-wheel drive indicator lamp
16 Brake warning lamp
17 Glow plug pilot lamp (SD33 engine equipped model only)
18 Combination switch
19 Stop lamp switch
20 Hazard flasher unit
21 Turn signal flasher unit
22 To chassis harness
23 Parking brake switch
24 Door switch



SEL075A

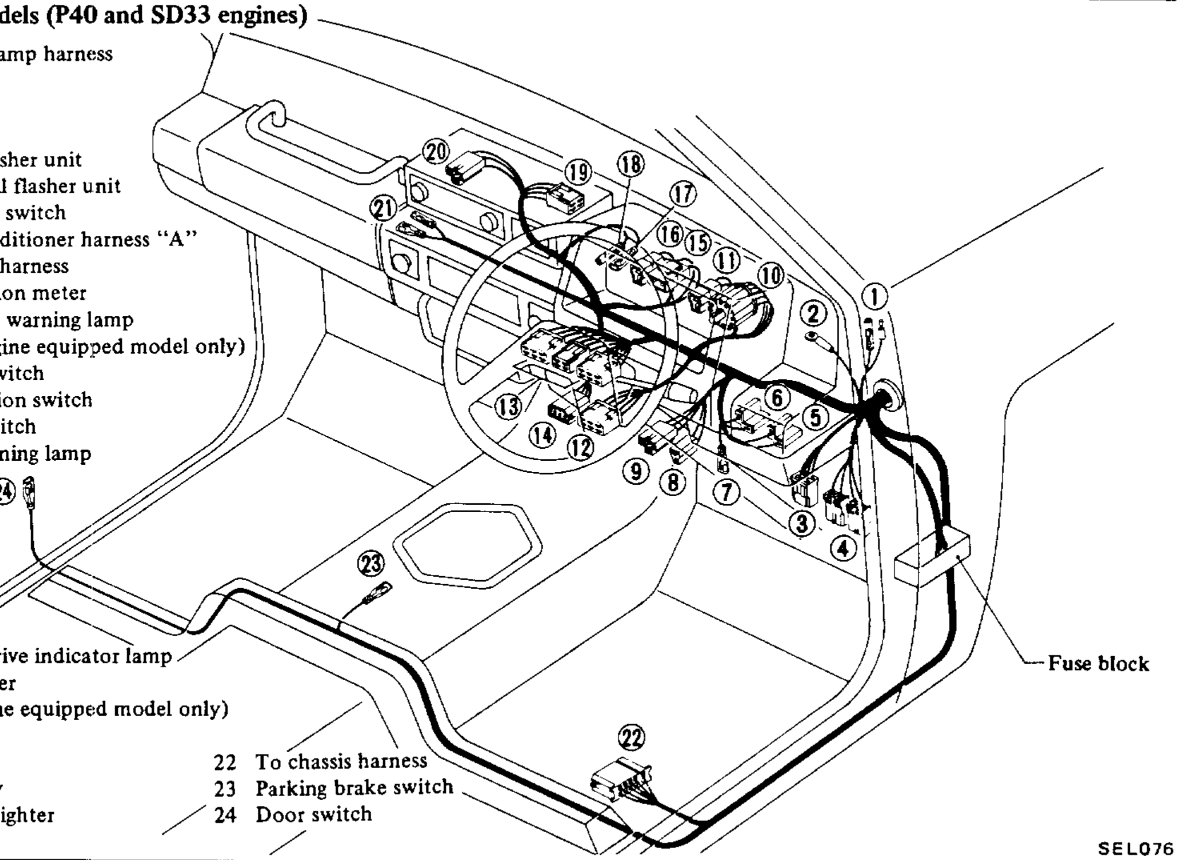
L.H. drive models (L28 engine)



1 To room lamp harness
2 Ground
3 Option (Air conditioner)
4 Option
5 Option (Air conditioner)
6 To heater harness
7 Horn relay
8 Radio
9 Cigarette lighter
10 Kickdown switch (A/T model only)
11 Throttle opener switch
12 Combination meter
13 Hazard switch
14 Ignition switch
15 Tachometer
16 Clock
17 4-wheel drive indicator lamp
18 Brake warning lamp
19 Charge warning lamp
20 Combination switch
21 Stop lamp switch
22 Hazard flasher unit
23 Turn signal flasher unit
24 To chassis harness
25 Parking brake switch
26 A/T indicator lamp (A/T model only)
27 Door switch

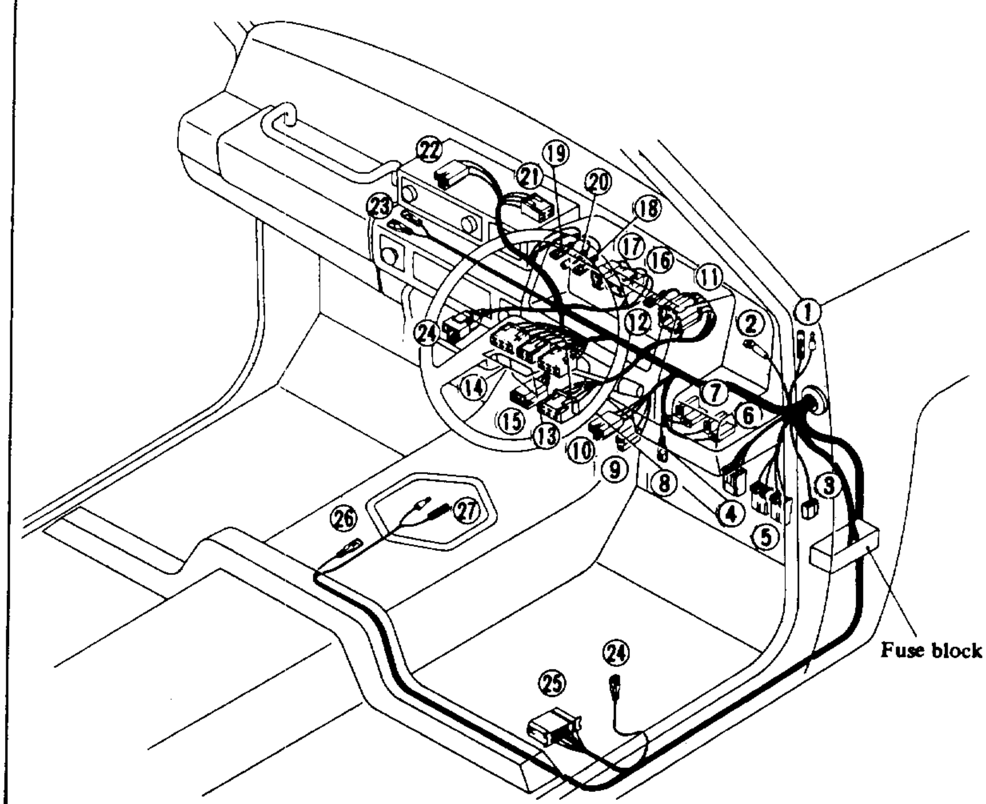
SEL388A

R.H. drive models (P40 and SD33 engines)



1 To room lamp harness
2 Ground
3 Option
4 Option
5 Hazard flasher unit
6 Turn signal flasher unit
7 Stop lamp switch
8 To air conditioner harness "A"
9 To heater harness
10 Combination meter
11 Glow plug warning lamp (SD33 engine equipped model only)
12 Ignition switch
13 Combination switch
14 Hazard switch
15 Brake warning lamp
16 4-wheel drive indicator lamp
17 Tachometer (P40 engine equipped model only)
18 Clock
19 Radio
20 Horn relay
21 Cigarette lighter
22 To chassis harness
23 Parking brake switch
24 Door switch

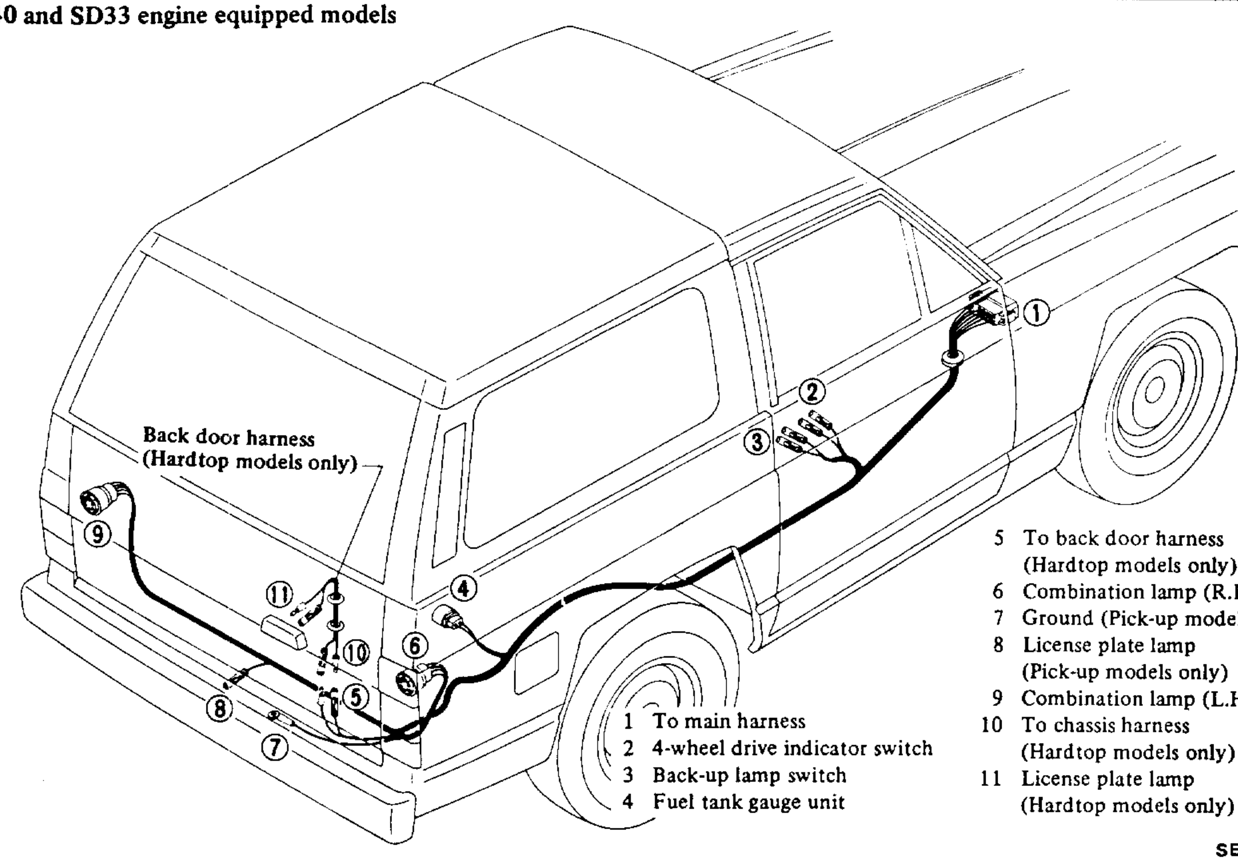
R.H. drive models (L28 engine)



1 To room lamp harness
2 Ground
3 Kickdown switch (A/T model only)
4 Option
5 Option
6 Hazard flasher unit
7 Turn signal flasher unit
8 Stop lamp switch
9 To air conditioner harness "A"
10 To heater harness
11 Combination meter
12 Parking brake warning lamp
13 Ignition switch
14 Combination switch
15 Hazard switch
16 Brake warning lamp
17 4-wheel drive indicator lamp
18 Tachometer
19 Clock
20 Charge warning lamp
21 Radio
22 Horn relay
23 Cigarette lighter
24 Door switch
25 To chassis harness
26 Parking brake switch
27 A/T indicator lamp (A/T model only)

CHASSIS HARNESS

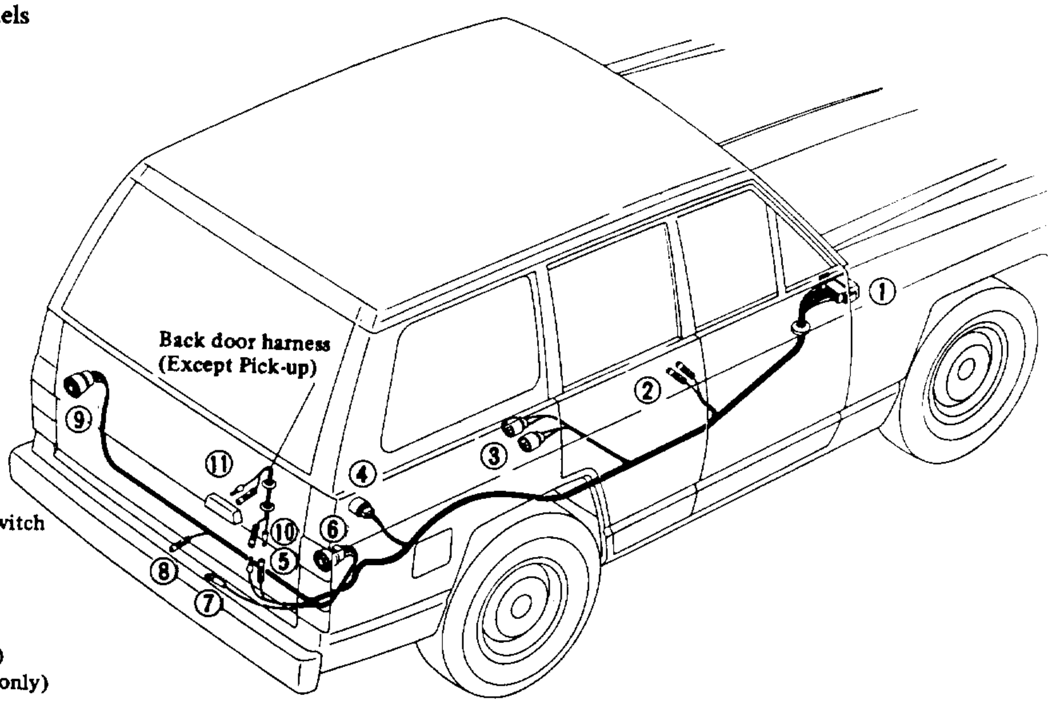
P40 and SD33 engine equipped models



1 To main harness
2 4-wheel drive indicator switch
3 Back-up lamp switch
4 Fuel tank gauge unit
5 To back door harness (Hardtop models only)
6 Combination lamp (R.H.)
7 Ground (Pick-up models only)
8 License plate lamp (Pick-up models only)
9 Combination lamp (L.H.)
10 To chassis harness (Hardtop models only)
11 License plate lamp (Hardtop models only)

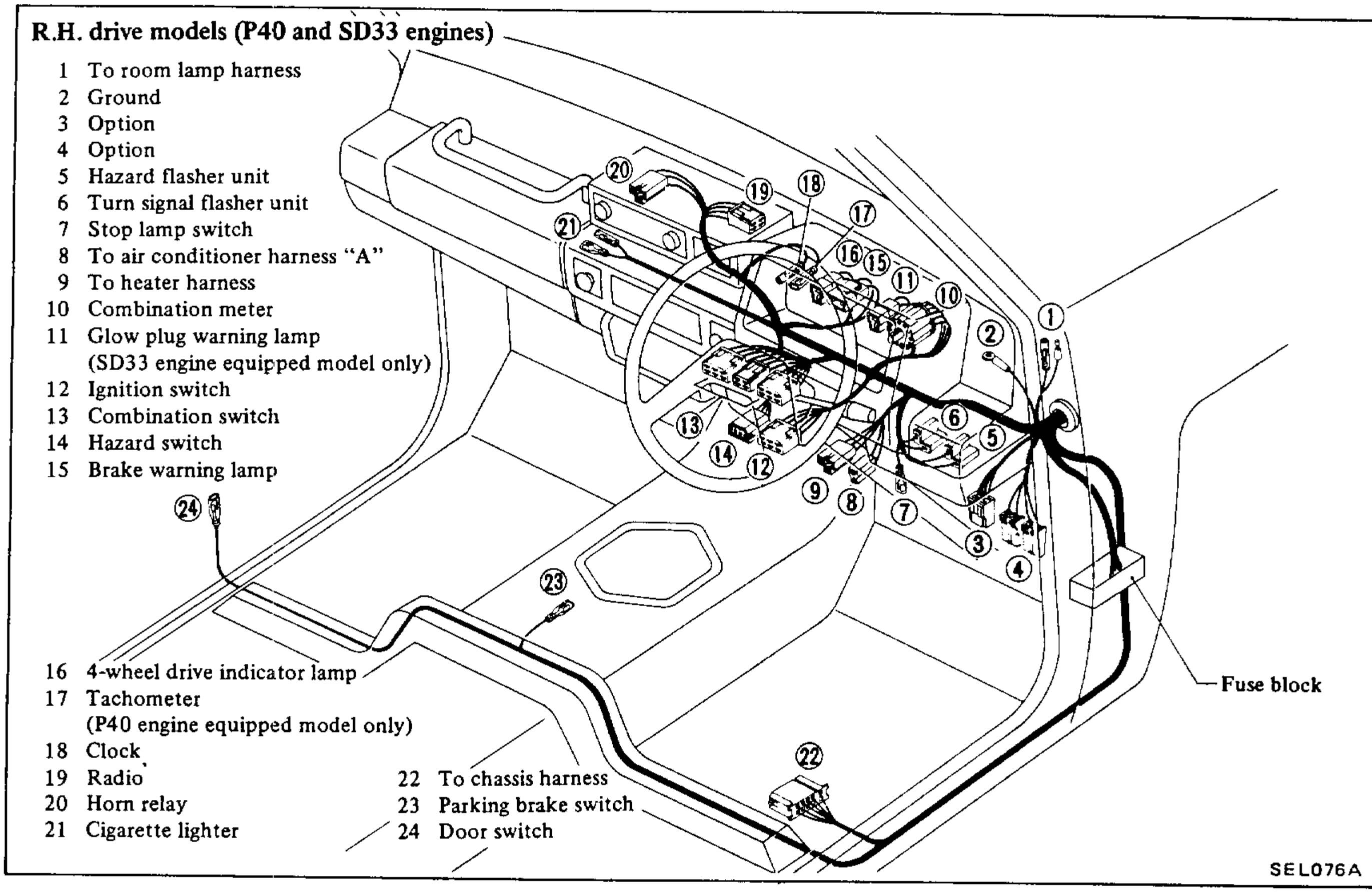
SEL077A

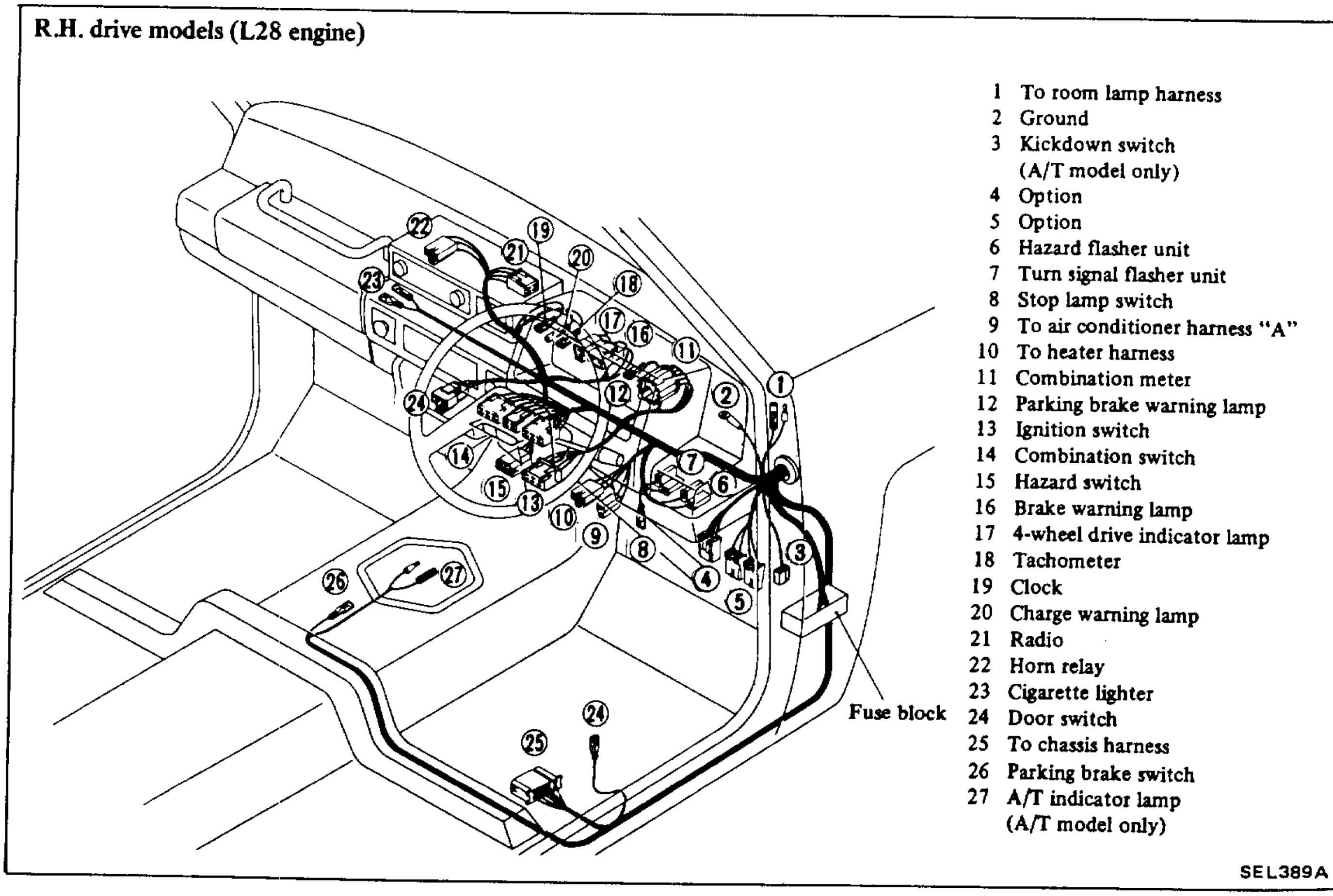
L28 engine equipped models



1 To main harness
2 4-wheel drive indicator switch
3 Fuel injection pump
4 Fuel tank gauge unit
5 To back door harness (Except Pick-up)
6 Combination lamp (R.H.)
7 Ground (Pick-up models only)
8 License plate lamp (Pick-up models only)
9 Combination lamp (L.H.)
10 To chassis harness (Except Pick-up)
11 License plate lamp (Except Pick-up)

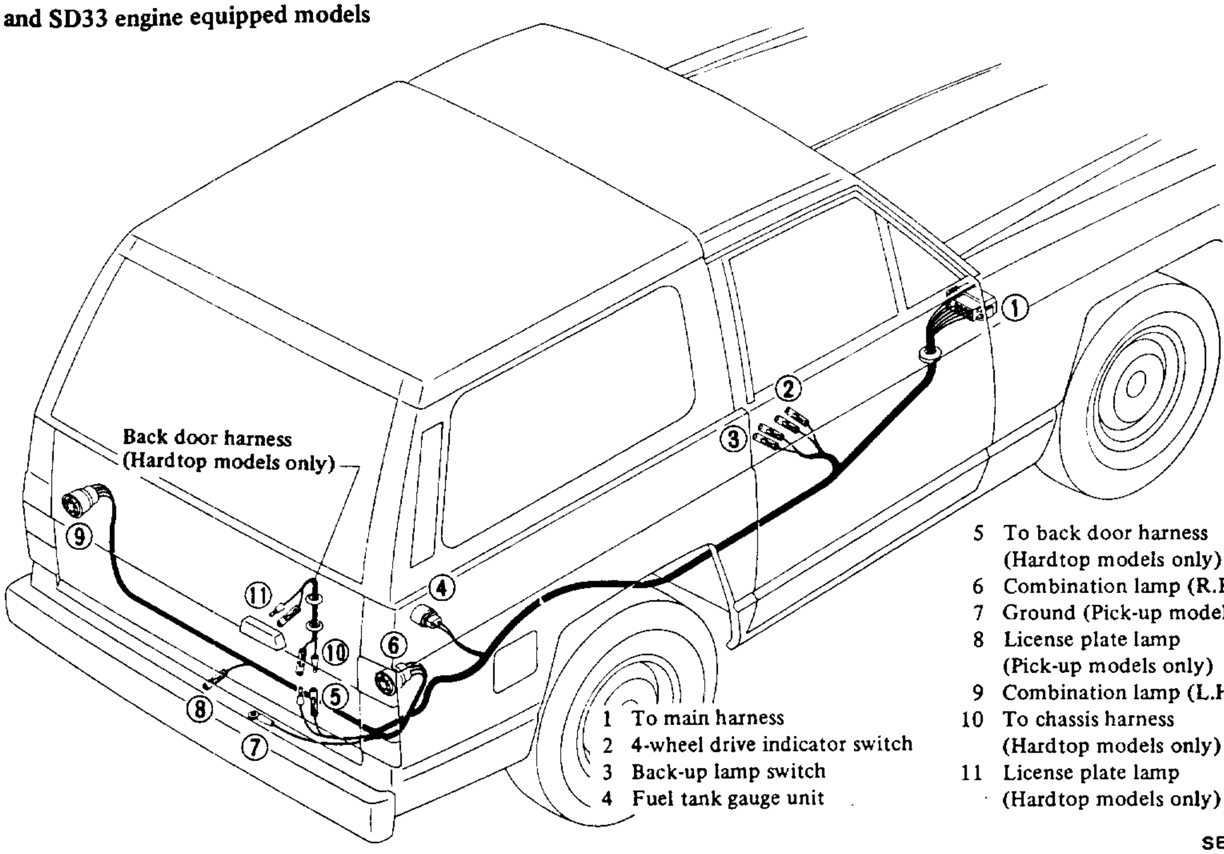
SEL390A


R.H. drive models (P40 and SD33 engines)
1 To room lamp harness
2 Ground
3 Option
4 Option
5 Hazard flasher unit
6 Turn signal flasher unit
7 Stop lamp switch
8 To air conditioner harness "A"
9 To heater harness
10 Combination meter
11 Glow plug warning lamp (SD33 engine equipped model only)
12 Ignition switch
13 Combination switch
14 Hazard switch
15 Brake warning lamp
16 4-wheel drive indicator lamp
17 Tachometer (P40 engine equipped model only)
18 Clock
19 Radio
20 Horn relay
21 Cigarette lighter
22 To chassis harness
23 Parking brake switch
24 Door switch
Fuse block
SEL076A


R.H. drive models (L28 engine)
1 To room lamp harness
2 Ground
3 Kickdown switch (A/T model only)
4 Option
5 Option
6 Hazard flasher unit
7 Turn signal flasher unit
8 Stop lamp switch
9 To air conditioner harness "A"
10 To heater harness
11 Combination meter
12 Parking brake warning lamp
13 Ignition switch
14 Combination switch
15 Hazard switch
16 Brake warning lamp
17 4-wheel drive indicator lamp
18 Tachometer
19 Clock
20 Charge warning lamp
21 Radio
22 Horn relay
23 Cigarette lighter
24 Door switch
25 To chassis harness
26 Parking brake switch
27 A/T indicator lamp (A/T model only)
Fuse block
SEL389A

CHASSIS HARNESS

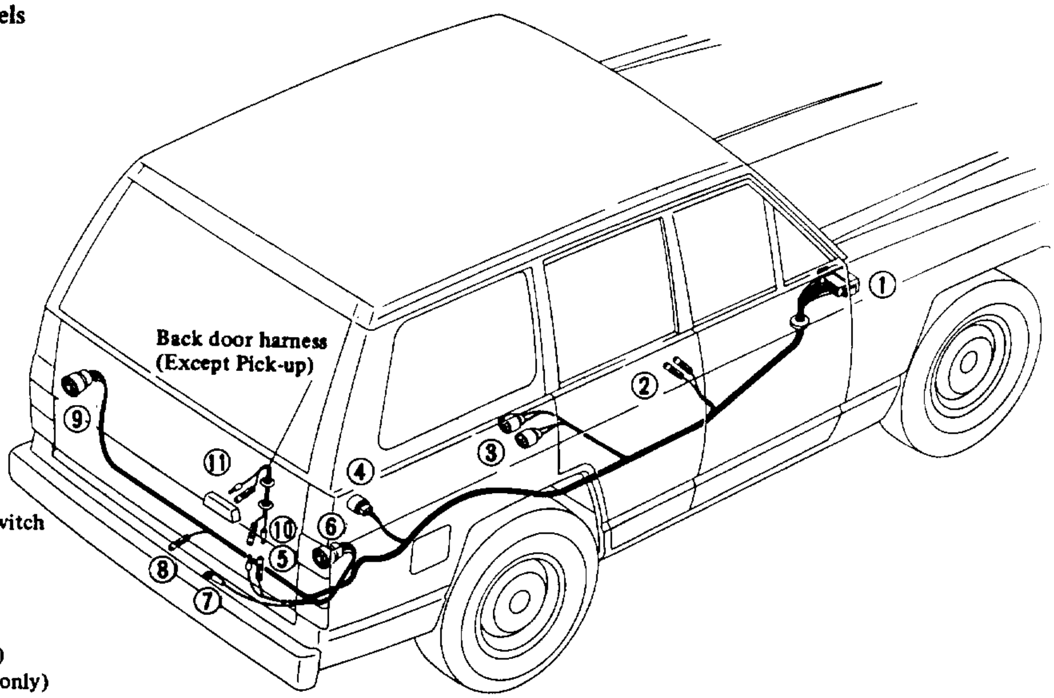
P40 and SD33 engine equipped models



1 To main harness
2 4-wheel drive indicator switch
3 Back-up lamp switch
4 Fuel tank gauge unit
5 To back door harness (Hardtop models only)
6 Combination lamp (R.H.)
7 Ground (Pick-up models only)
8 License plate lamp (Pick-up models only)
9 Combination lamp (L.H.)
10 To chassis harness (Hardtop models only)
11 License plate lamp (Hardtop models only)

SEL077A

L28 engine equipped models

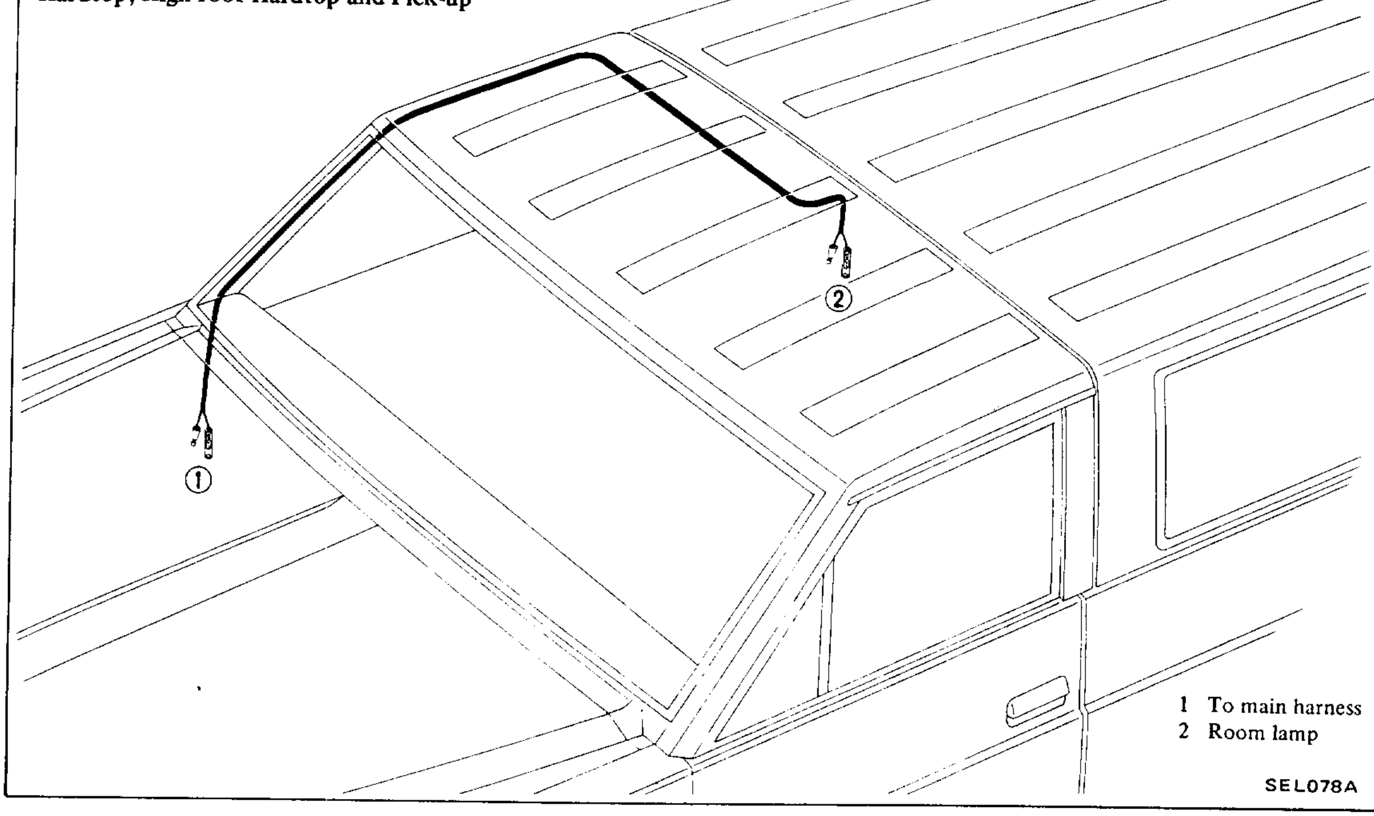


1 To main harness
2 4-wheel drive indicator switch
3 Fuel injection pump
4 Fuel tank gauge unit
5 To back door harness (Except Pick-up)
6 Combination lamp (R.H.)
7 Ground (Pick-up models only)
8 License plate lamp (Pick-up models only)
9 Combination lamp (L.H.)
10 To chassis harness (Except Pick-up)
11 License plate lamp (Except Pick-up)

SEL390A

ROOM LAMP HARNESS

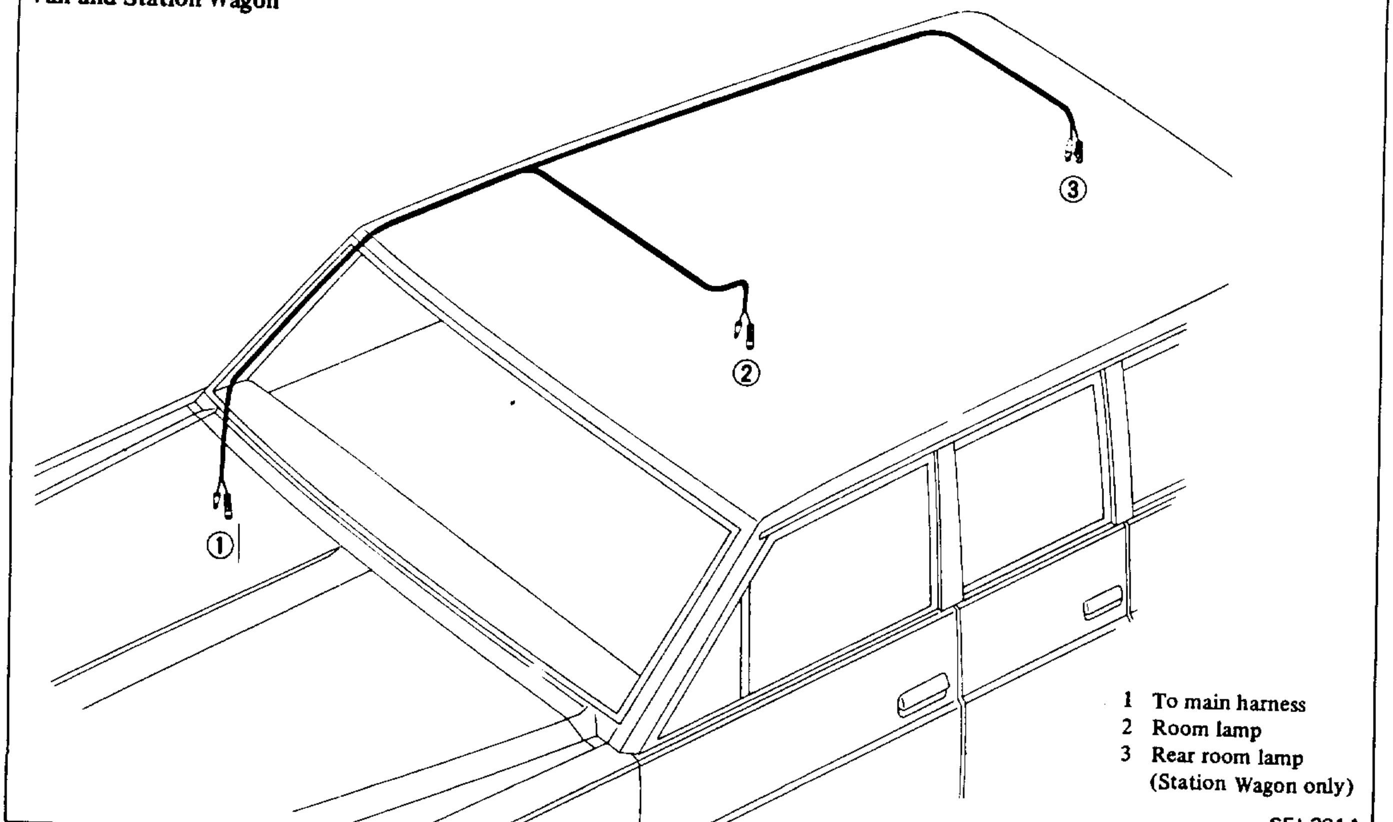
Hardtop, High-roof Hardtop and Pick-up



1 To main harness
2 Room lamp

SEL078A

Van and Station Wagon

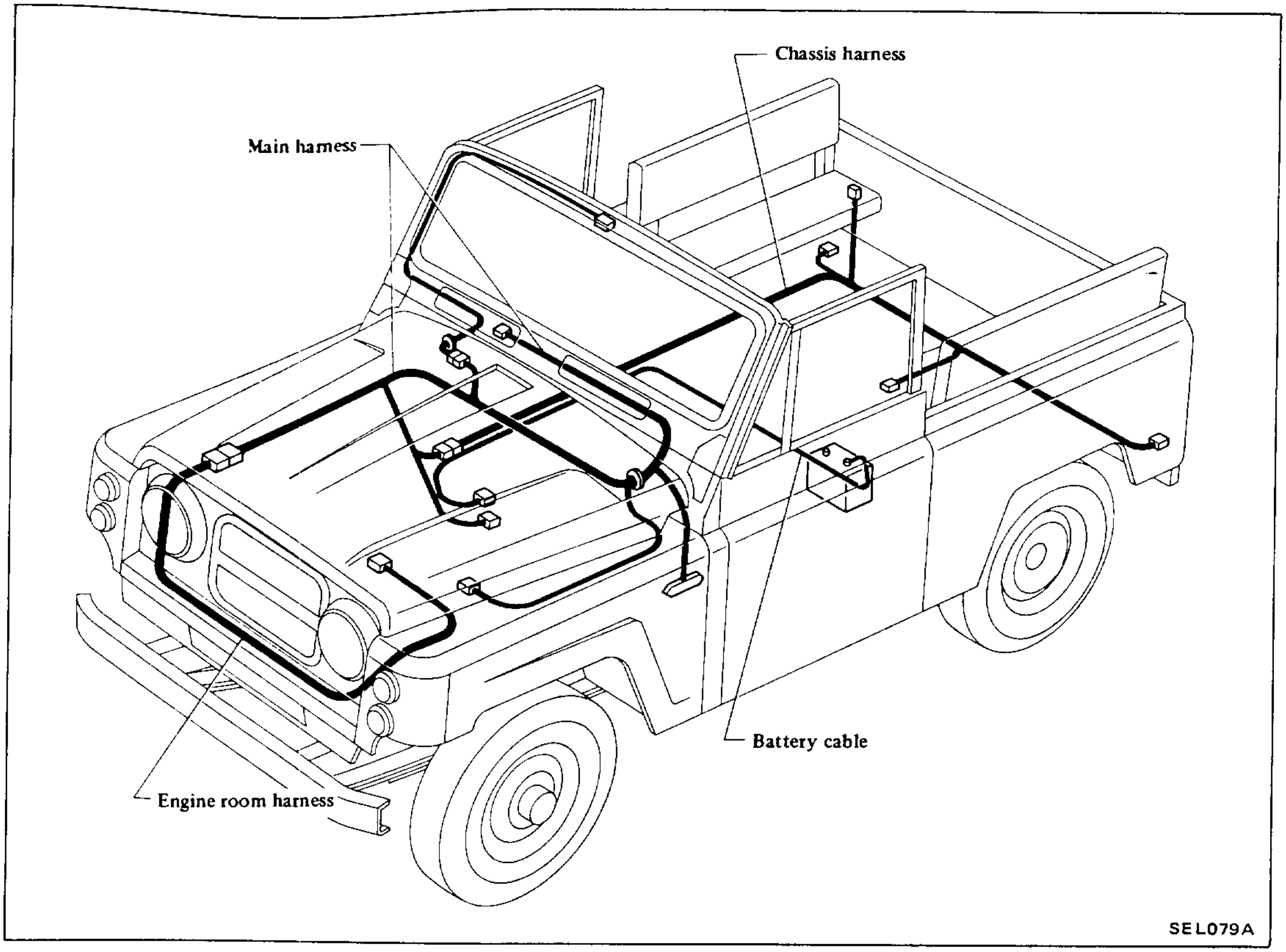


1 To main harness
2 Room lamp
3 Rear room lamp (Station Wagon only)

SEL391A

HARNESS LAYOUT (Model 61 series)

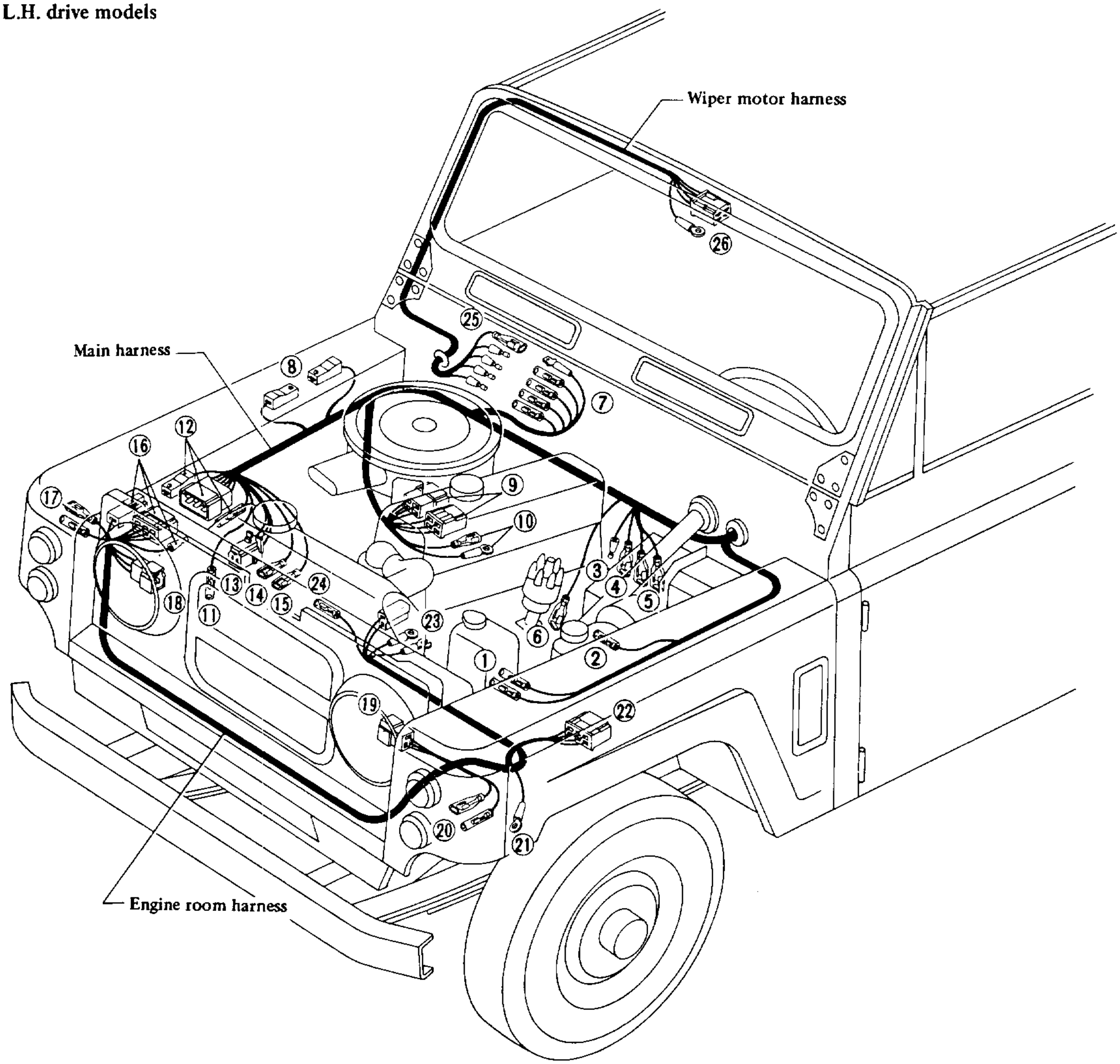
LAYOUT



MAIN HARNESS

Engine compartment side

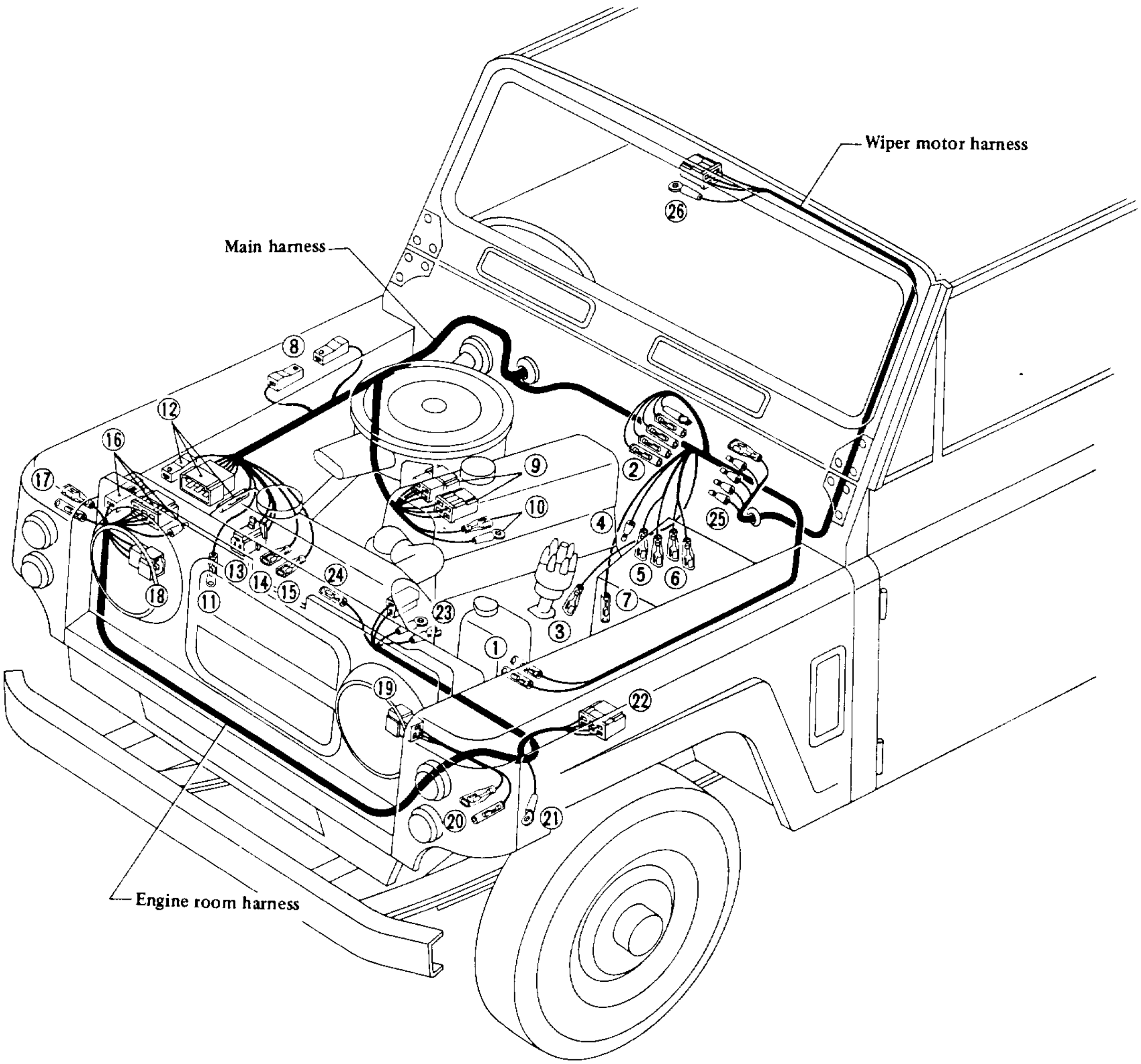
L.H. drive models



1 Windshield washer motor
2 Oil pressure unit
3 Condenser
4 Ignition coil
5 Resistor
(Models for cold area)
6 Ground (Distributor)
7 To wiper motor harness
8 Fusible link
9 To chassis harness
10 Starter motor
11 To fog lamp harness
12 To engine room harness
13 Horn relay
14 Horn (High)
15 Horn (Low)
16 To main harness
17 To front combination lamp (R.H.)
18 Headlamp (R.H.)
19 Headlamp (L.H.)
20 Front combination lamp (L.H.)
21 Ground
22 Voltage regulator
23 Alternator
24 Thermal transmitter
25 To main harness
26 Wiper motor

SEL080A

R.H. drive models

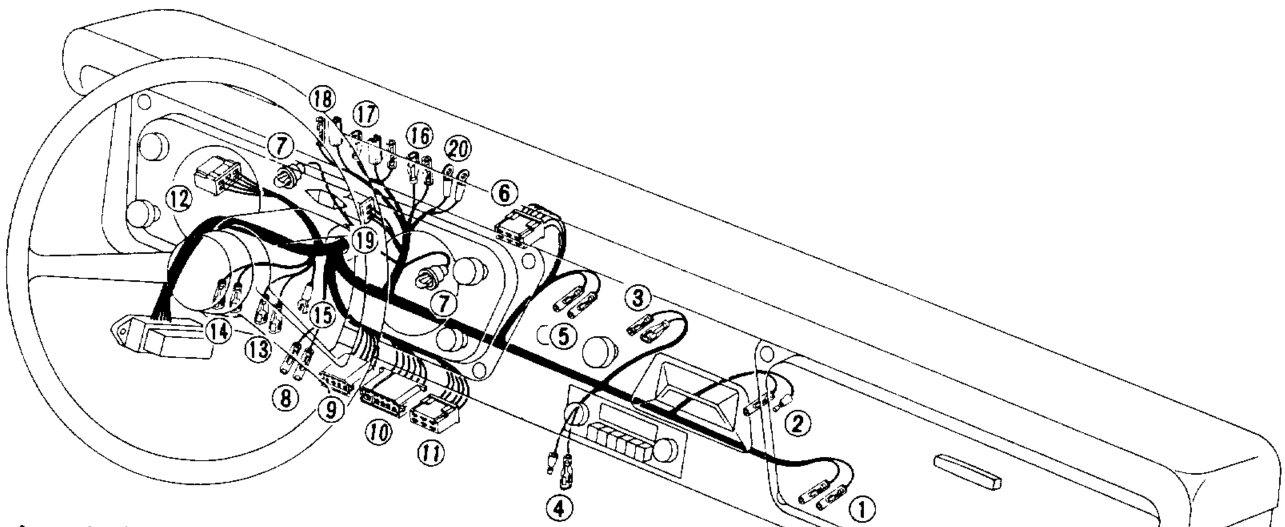


1 Windshield washer motor
2 To wiper motor harness
3 Ground (Distributor)
4 Condenser
5 Ignition coil
6 Resistor (Models for cold area)
7 Oil pressure unit
8 Fusible link
9 To chassis harness
10 Starter motor
11 To fog lamp harness
12 To engine room harness
13 Horn relay
14 Horn (High)
15 Horn (Low)
16 To main harness
17 Front combination lamp (R.H.)
18 Headlamp (R.H.)
19 Headlamp (L.H.)
20 Front combination lamp (L.H.)
21 Ground
22 Voltage regulator
23 Alternator
24 Thermal transmitter
25 To main harness
26 Wiper motor

SEL081A

Passenger compartment side

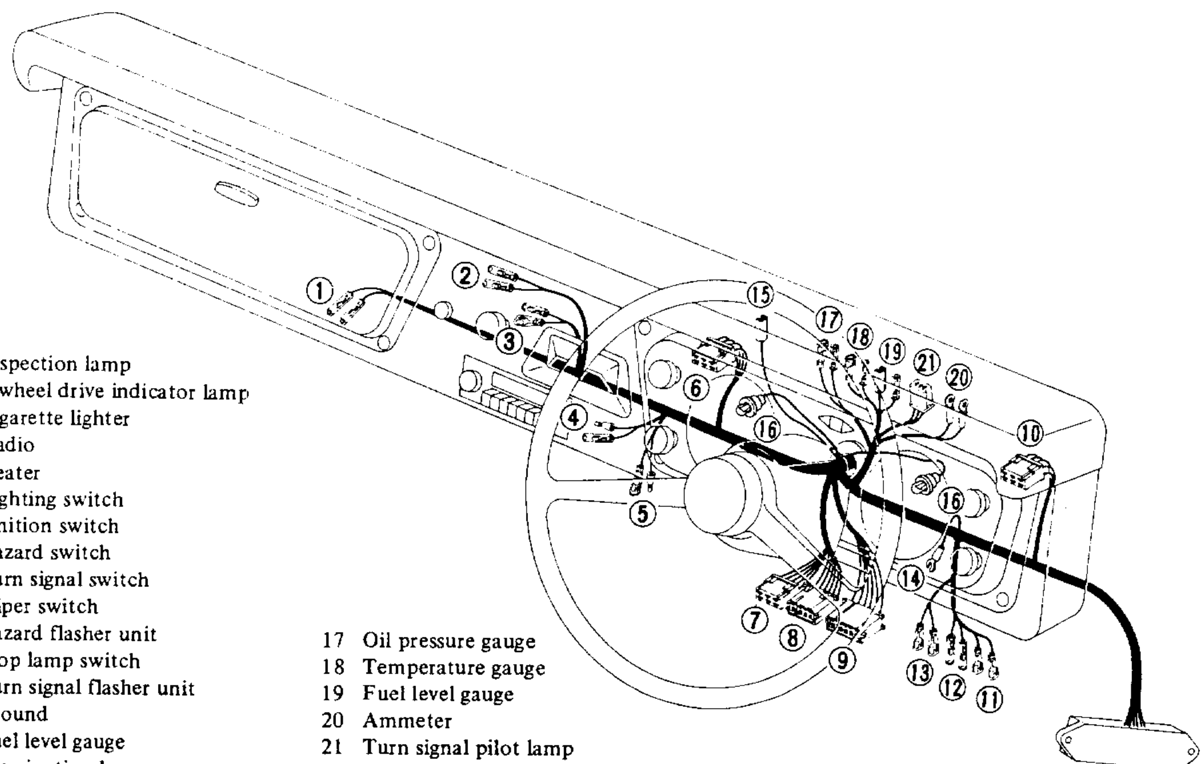
L.H. drive models



1 Inspection lamp
2 Radio
3 Cigarette lighter
4 Heater switch
5 4-wheel drive indicator lamp
6 Wiper switch
7 Illumination lamp
8 Stop lamp switch
9 Hazard switch
10 Turn signal switch
11 Ignition switch
12 Lighting switch
13 Turn signal flasher unit
14 Hazard flasher unit
15 Ground
16 Oil pressure gauge
17 Temperature gauge
18 Fuel level gauge
19 Turn signal pilot lamp & main beam pilot lamp
20 Ammeter

SEL082A

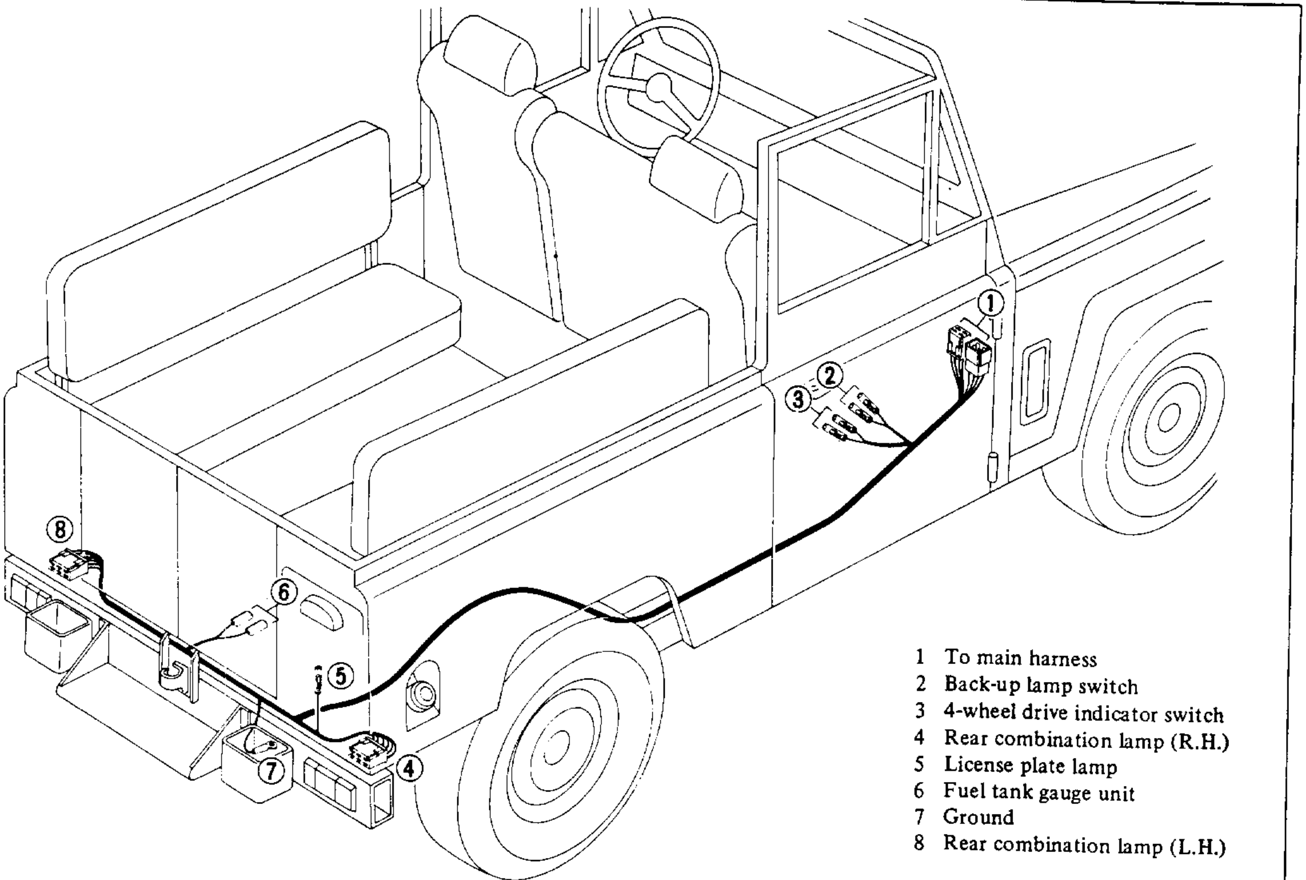
R.H. drive models



1 Inspection lamp
2 4-wheel drive indicator lamp
3 Cigarette lighter
4 Radio
5 Heater
6 Lighting switch
7 Ignition switch
8 Hazard switch
9 Turn signal switch
10 Wiper switch
11 Hazard flasher unit
12 Stop lamp switch
13 Turn signal flasher unit
14 Ground
15 Fuel level gauge
16 Illumination lamp
17 Oil pressure gauge
18 Temperature gauge
19 Fuel level gauge
20 Ammeter
21 Turn signal pilot lamp & main beam pilot lamp

SEL083A

CHASSIS HARNESS



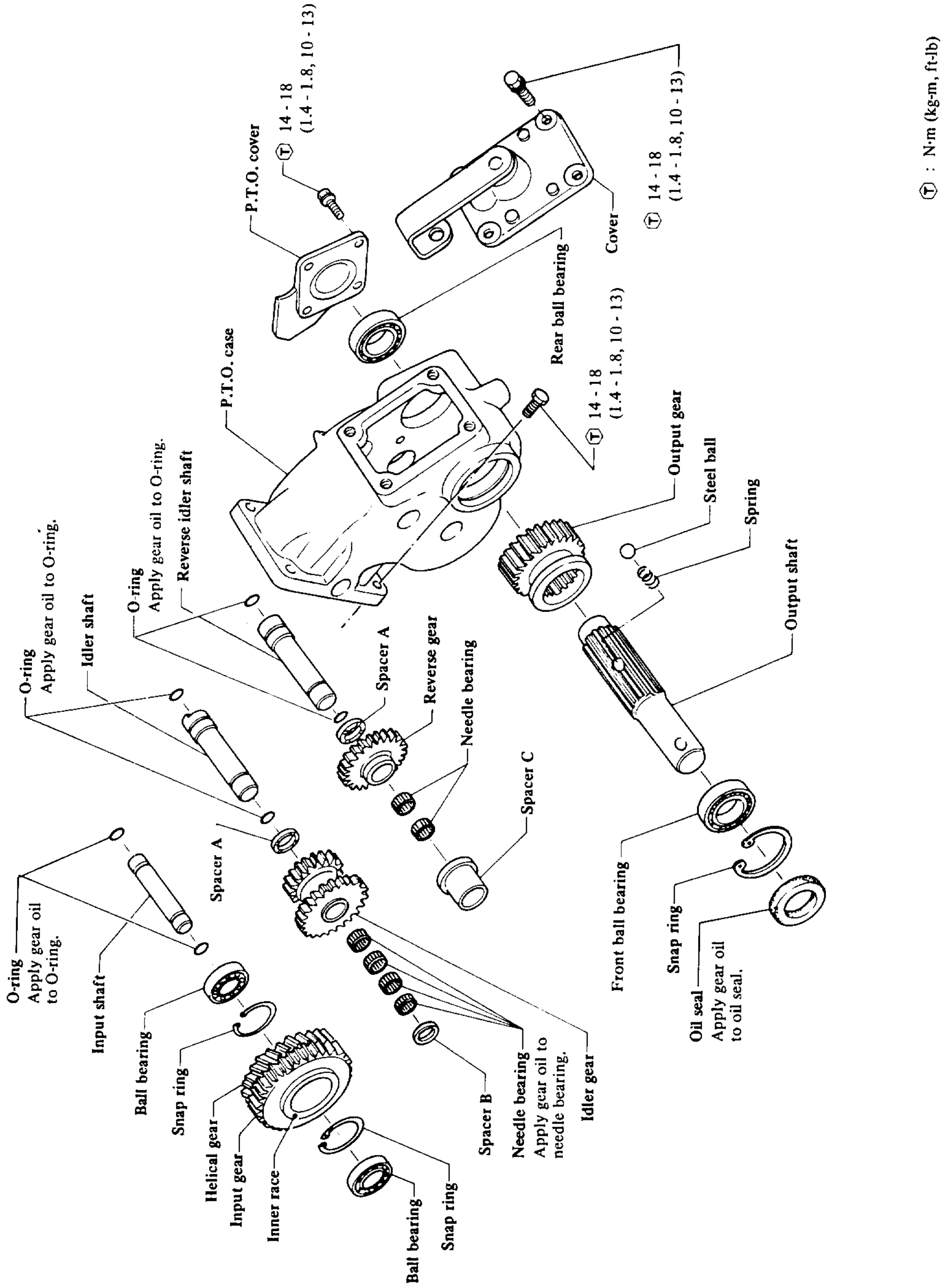
1 To main harness
2 Back-up lamp switch
3 4-wheel drive indicator switch
4 Rear combination lamp (R.H.)
5 License plate lamp
6 Fuel tank gauge unit
7 Ground
8 Rear combination lamp (L.H.)

SPECIAL EQUIPMENT

SECTION SE

CONTENTS

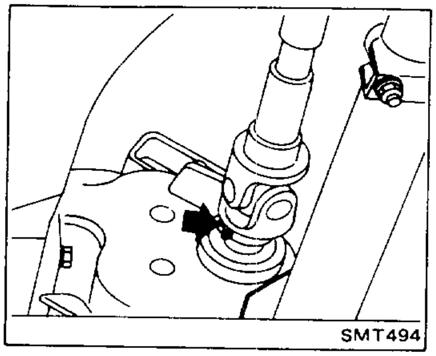
P.T.O. (Power Take-Off)



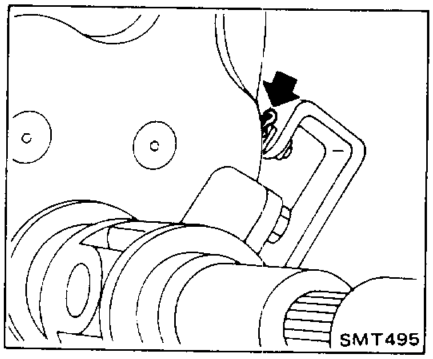
SSE036

REMOVAL

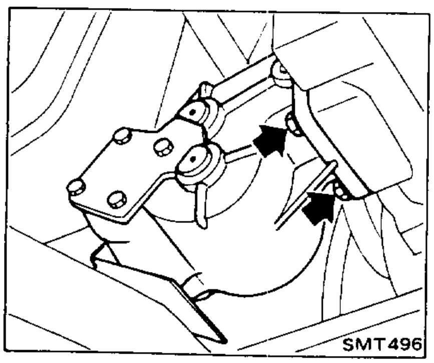
1. Drain oil from transmission case.
2. Remove pin from drive shaft.


SMT494

3. Slide rear joint of drive shaft forward.
4. Remove P.T.O. control cable.


SMT495

5. Remove P.T.O. unit.


SMT496

INSTALLATION

Install P.T.O. unit in reverse order of removal, paying attention to the following points.

- Before installing, clean mating surfaces of P.T.O. case and transmission case.
- Remove filler plug and fill transmission with recommended gear oil to the level of the plug hole.

  Oil capacity:
  2.7 liters
  (4-3/4 Imp pt)

- **Apply sealant to threads of filler plug,** and install filler plug to transmission case.

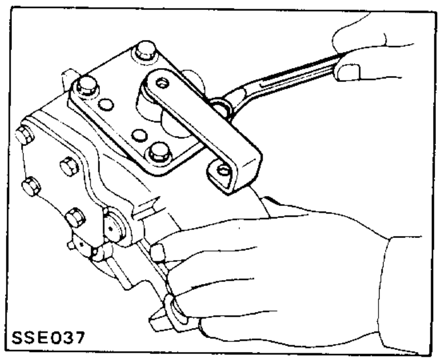
Ⓣ : **Filler plug**
25 - 34 N·m
(2.5 - 3.5 kg-m, 18 - 25 ft-lb)

- Tighten bolts securing transmission to P.T.O. unit.

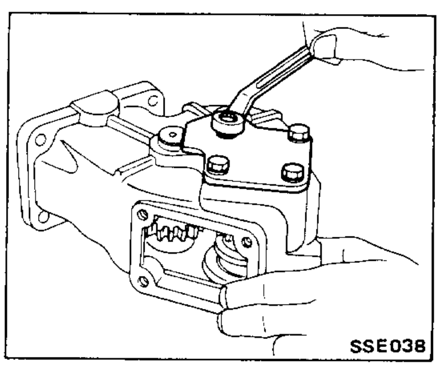
Ⓣ : **14 - 18 N·m**
(1.4 - 1.8 kg-m, 10 - 13 ft-lb)

DISASSEMBLY

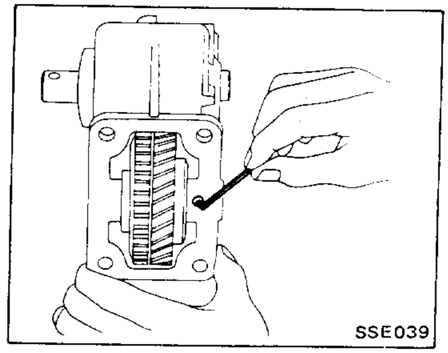
1. Remove cover and gasket.


SSE037

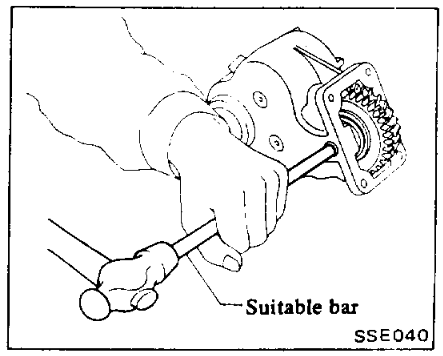
2. **Measure gear end play.**
   Refer to Gears and Shafts for inspection.
3. Remove P.T.O. cover and gasket.


SSE038

4. Remove screw.

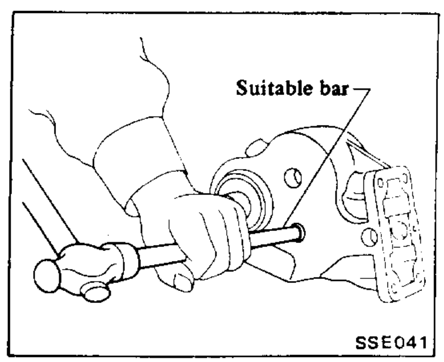

SSE039

5. Remove input shaft by tapping it.
   Helical and input gears, inner race and ball bearings can be removed together.



SSE040

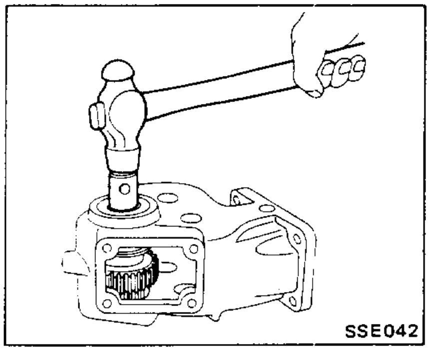
6. Remove idler shaft by tapping it. Idler gear, needle bearings and spacers A and B can be removed.



SSE041

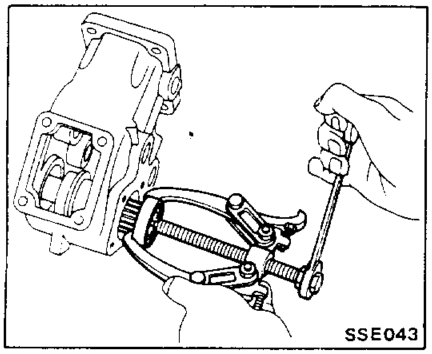
7. Remove reverse idler shaft, reverse gear, spacer A, spacer C and needle bearings in the same manner as step 6.

8. Tap front end of output shaft to remove front ball bearing.



SSE042

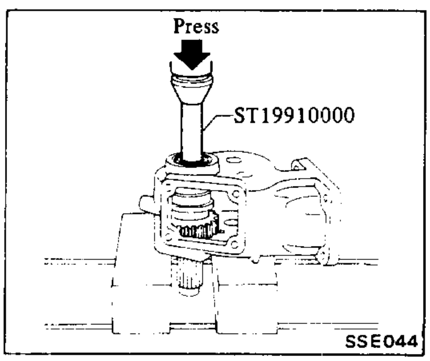
9. Remove rear ball bearing.



SSE043

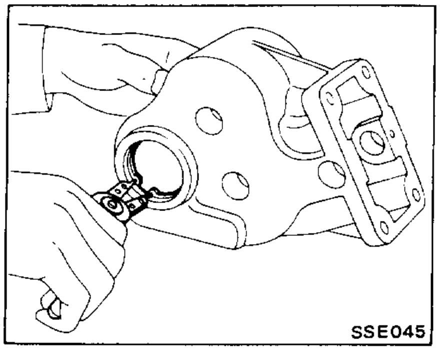
10. Press out output shaft, output gear and front ball bearing.

Be careful not to lose steel ball and spring.



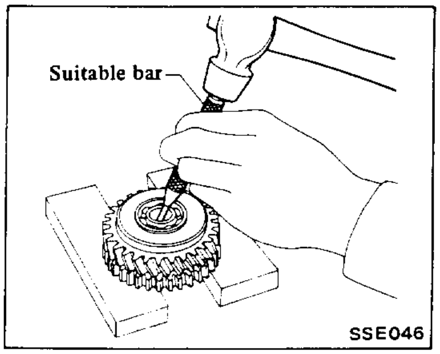
SSE044

11. Remove oil seal then remove snap ring.



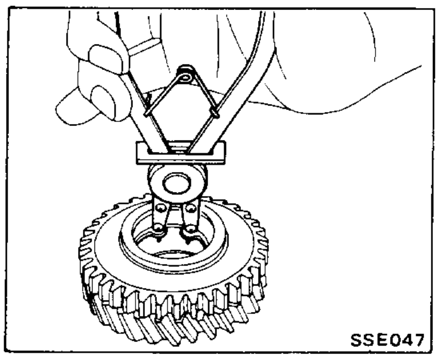
SSE045

12. Remove ball bearings from inner race.



SSE046

13. Remove snap rings.



SSE047

INSPECTION

P.T.O. CASE

1. Clean with solvent and check for cracks or cavities by means of dyeing test.
2. Check mating surface of P.T.O. case for small nicks or projection.

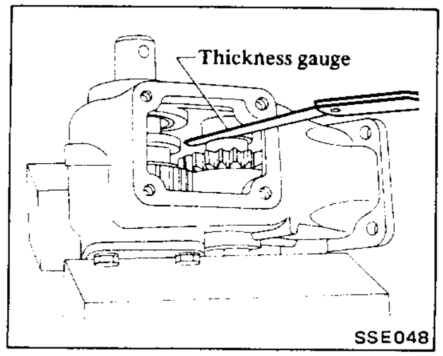
GEARS AND SHAFTS

1. Check all gears for excessive wear, chips or cracks; replace as required.
2. Check shaft for bending, cracks, wear, and worn spline; if necessary, replace.
3. **Measure gear end play:**

- It is necessary to measure end play before disassembling reverse and idler gears and after reassembling reverse and idler gears.
- Measure end play to insure that it is within specified limit.

(1) Measure idler gear end play with thickness gauge.

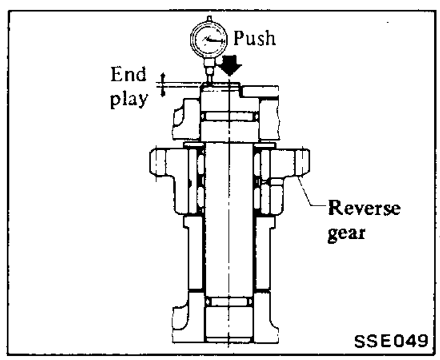
Idler gear



SSE048

(2) Measure reverse gear end play by moving idler shaft.

Reverse gear



SSE049

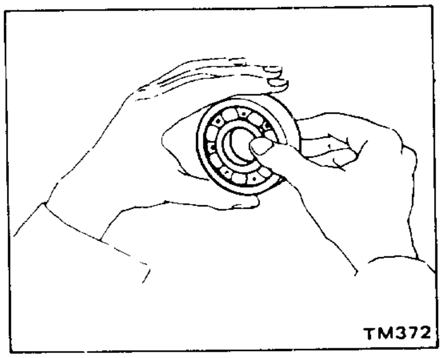
Standard end play:
Reverse gear
0.02 - 0.50 mm
(0.0008 - 0.0197 in)
Idler gear
0.02 - 0.50 mm
(0.0008 - 0.0197 in)

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

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.



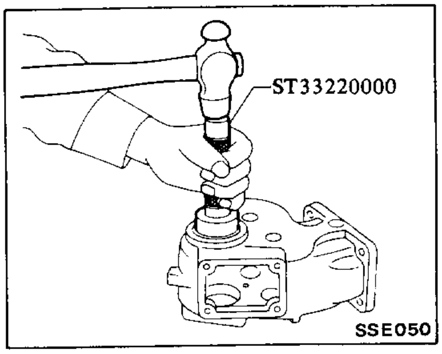
2. When race and ball surfaces are worn or rough, or when balls are out-of-round or rough, replace bearing with a new one.
3. Replace needle bearing if worn or damaged.

OIL SEALS

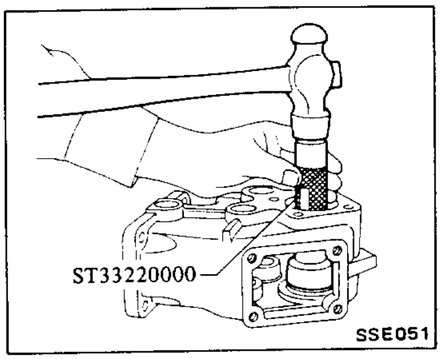
1. Replace oil seal if sealing lip is deformed or cracked. Also discard oil seal if spring is out of position.
2. Check the oil seal lip contacting with shaft; if necessary replace oil seal and shaft as a set.

ASSEMBLY

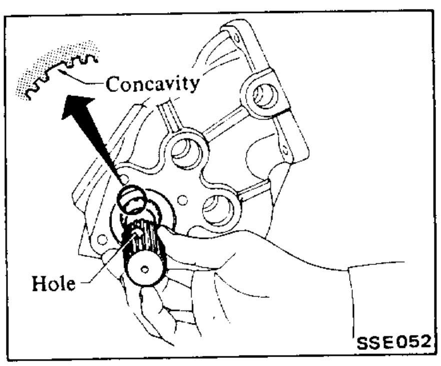
1. Install snap ring.
2. Apply coat of gear oil to oil seal surface, then drive new seal into place.



3. Press output shaft front ball bearing.

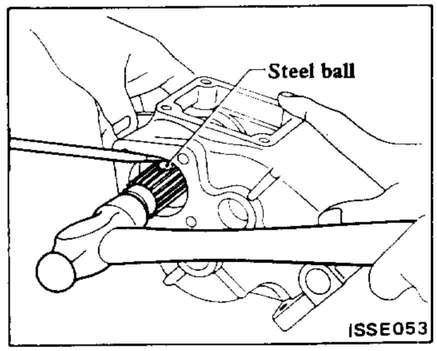


4. Install output gear into P.T.O. case then install output shaft into output gear.

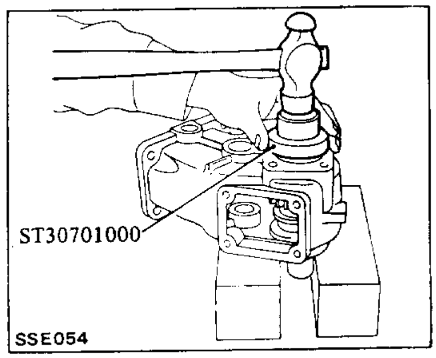


When installing output shaft, be sure to align hole in output shaft with concavity in output gear.

5. Install spring and steel ball into place.
6. While pushing steel ball, tap output shaft.

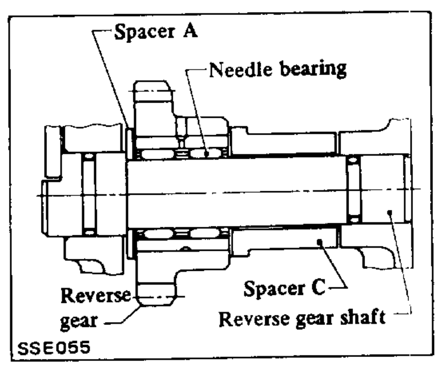


7. Install rear ball bearing.
   Then install P.T.O. cover temporarily.



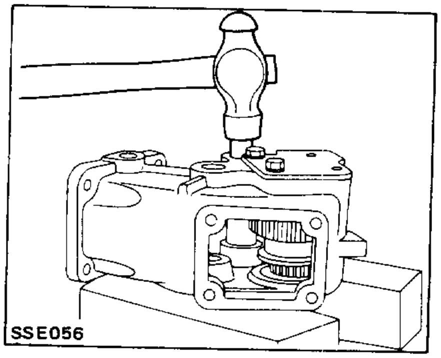
8. Install spacer C, needle bearings, reverse gear, spacer A and O-rings.

When installing spacer A, make sure that oil groove faces toward gear.



- **Apply gear oil to new O-rings then install them to reverse idler shaft.**

9. Tap idler shaft aligning it with center of spacers and bearing.

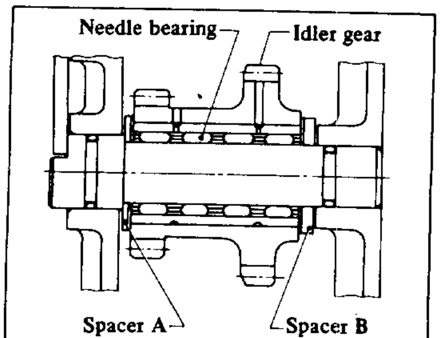


SSE056

10. Install spacer B, needle bearings, idler gear, spacer A and O-rings.

a. **When installing spacers A and B, make sure that oil groove faces toward gear.**

b. **Apply gear oil to new O-rings then install them to idler shaft.**



SSE057

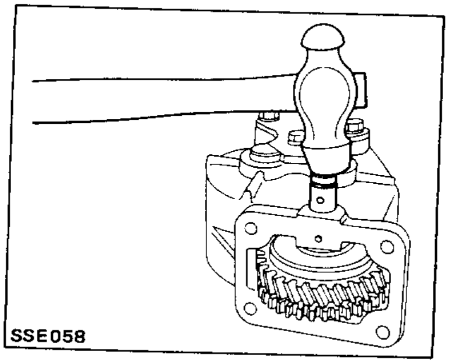
11. Align hole of idler shaft with that of P.T.O. case. Then, tap idler shaft by aligning it with center of spacers and bearings.

12. Install snap rings to inner race then press ball bearings into inner race.

13. Install inner race together with helical and input gears in P.T.O. case.

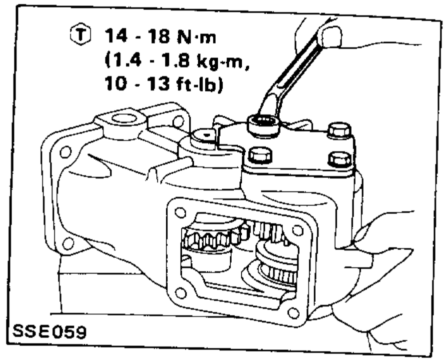
14. Apply gear oil to new O-rings then install them to input shaft.

15. Tap input shaft aligning it with center of ball bearings. Then tighten screw.



SSE058

16. **Apply sealant to threads of bolts** and both faces of gasket. Install P.T.O. cover and gasket.



SSE059

17. **Measure gear end play.**
Refer to Inspection.

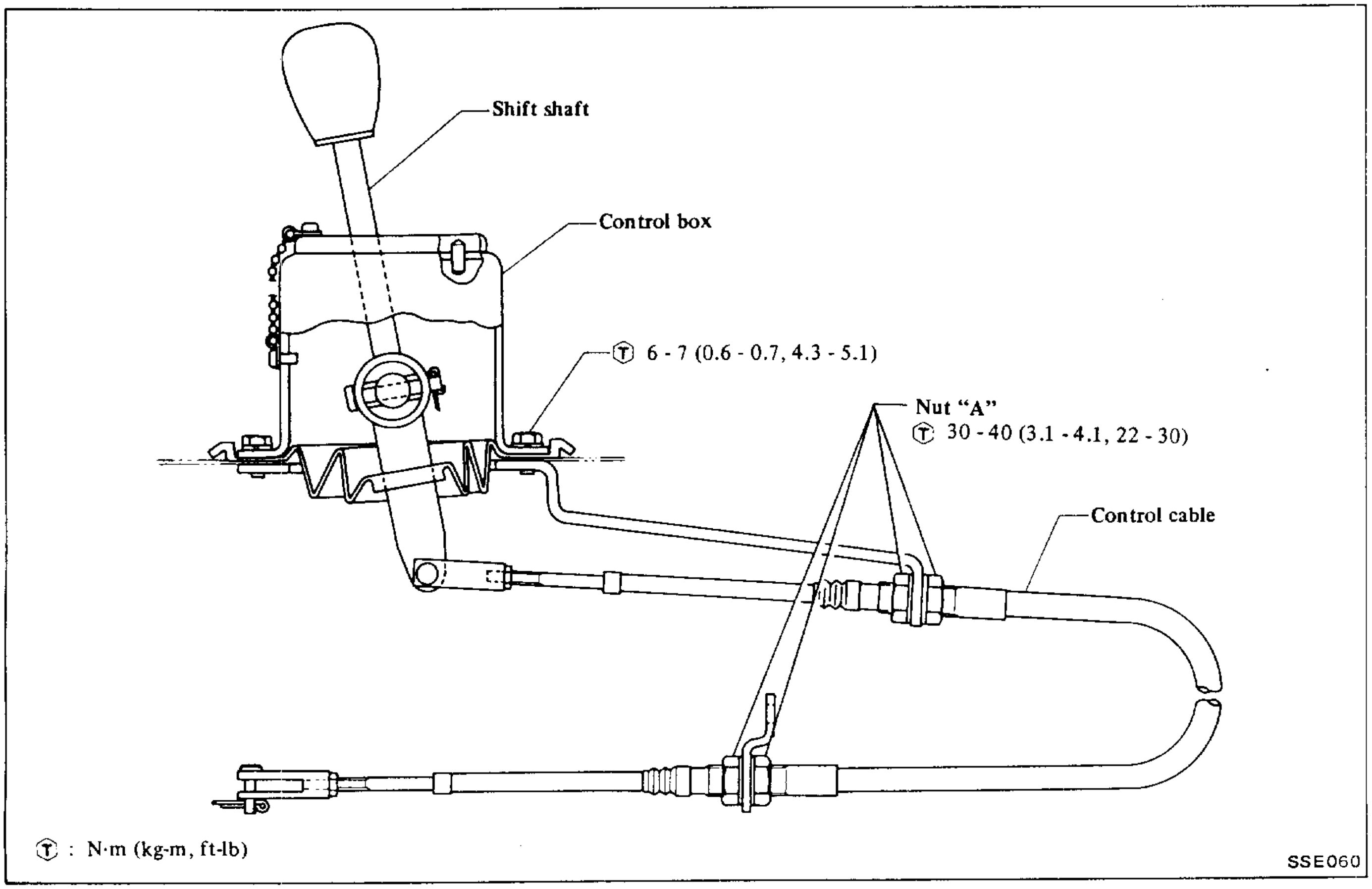
18. Apply sealant to threads of bolts, then install gasket and cover.

Before installing cover, be sure to align fork with groove on output gear.

Ⓣ **: Cover securing bolt**
14 - 18 N·m
(1.4 - 1.8 kg-m,
10 - 13 ft-lb)

19. Make sure that gears rotate smoothly at any position.

CONTROL CABLE



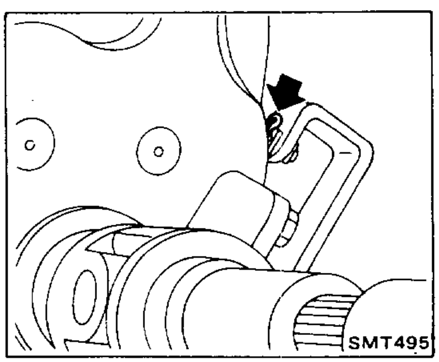
ADJUSTMENT

1. Set shift shaft at "F" position.
2. Loosen nuts "A" and set them in middle portion of threads.
3. Tighten nuts "A".
4. Make sure that shift shaft can be shifted at all positions and move smoothly.

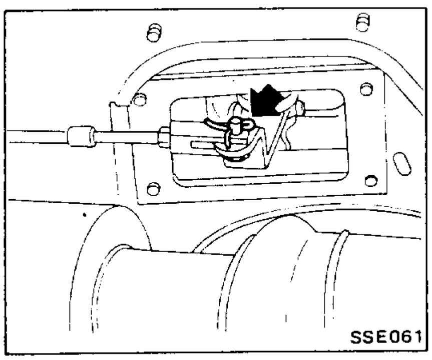
REMOVAL

1. Remove P.T.O. control cable.

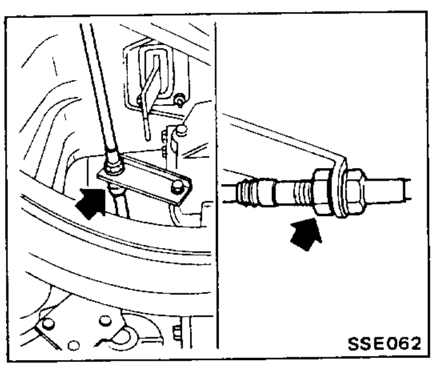
P.T.O. unit side



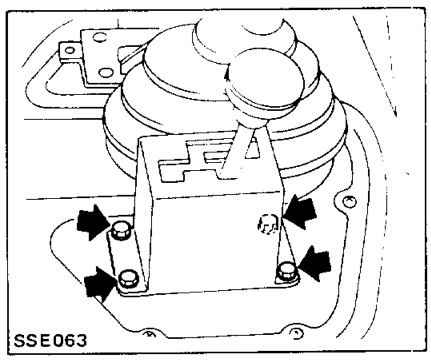
Shift shaft side



2. Remove nuts and control cable.



3. Remove control box.

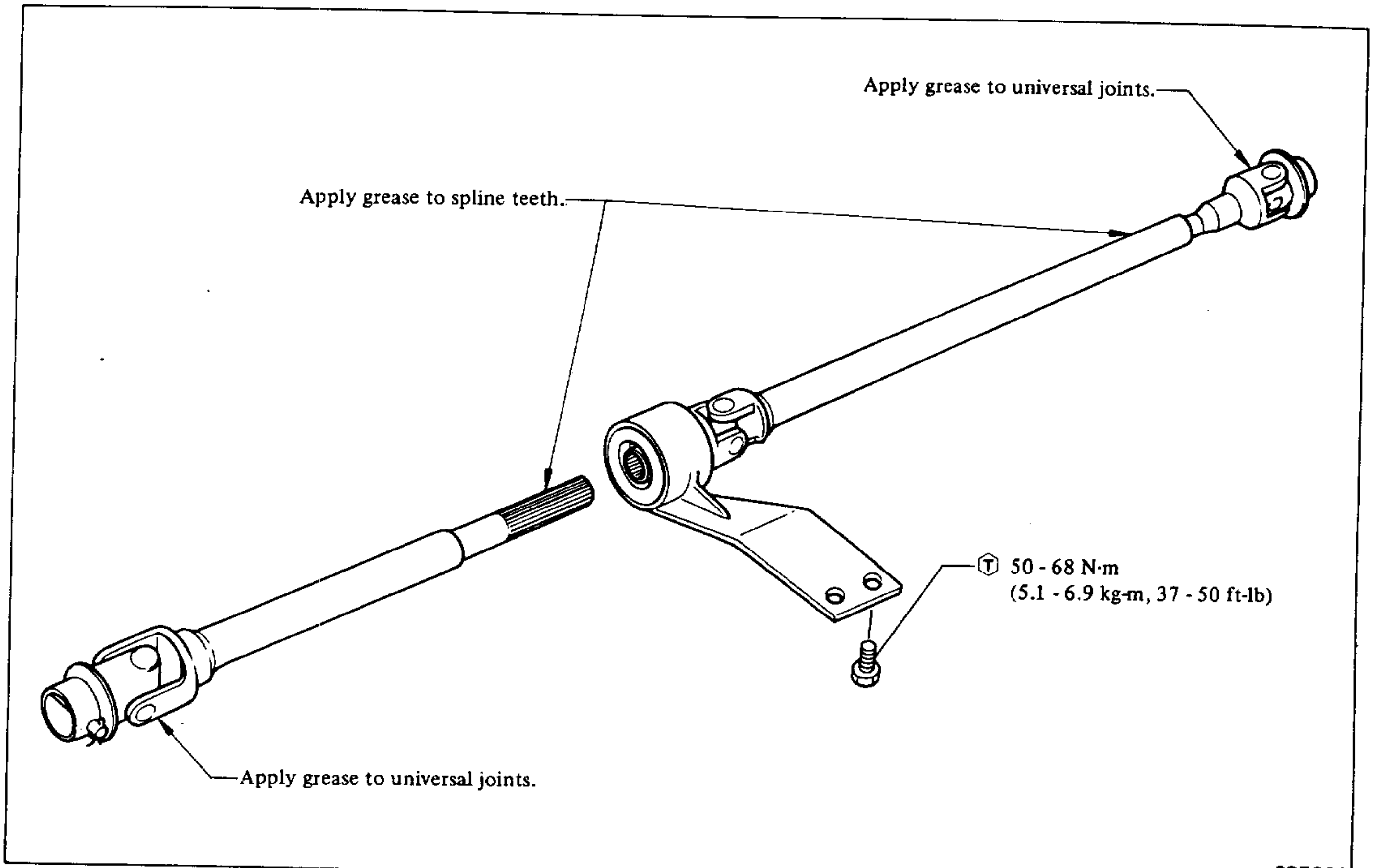


INSTALLATION

Install control cable in reverse order of removal, then adjust control cable.
Refer to Control Cable for adjustment.

T : Control box securing bolt
6 - 7 N·m
(0.6 - 0.7 kg-m,
4.3 - 5.1 ft-lb)
Control cable securing nut:
30 - 40 N·m
(3.1 - 4.1 kg-m,
22 - 30 ft-lb)

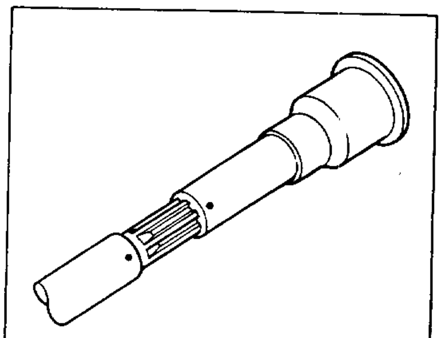
DRIVE SHAFT



SSE064

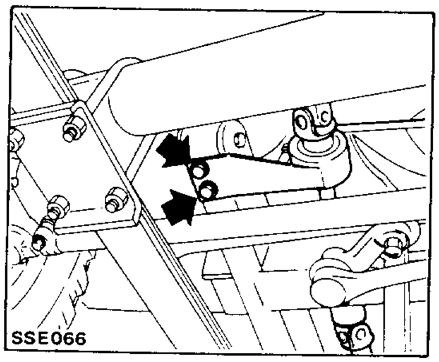
REMOVAL

1. Put "match" marks on splined yokes and splined shafts.



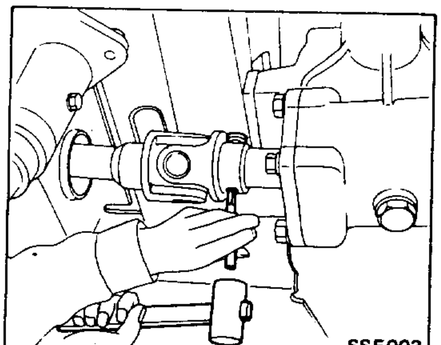
SSE065

2. Remove center bearing bracket securing bolts.



SSE066

3. Disconnect shear pin on winch side. If it proves difficult to remove, knock it out with a suitable tool.



SSE003

INSPECTION

1. Check splined shaft for excessive play, wear or damage and replace as an assembly if required.
2. Check joint and shear pin for any bends or deformation.

ASSEMBLY

Assemble drive shaft in the reverse order of disassembly, noting following.

Apply grease to splines and joints.

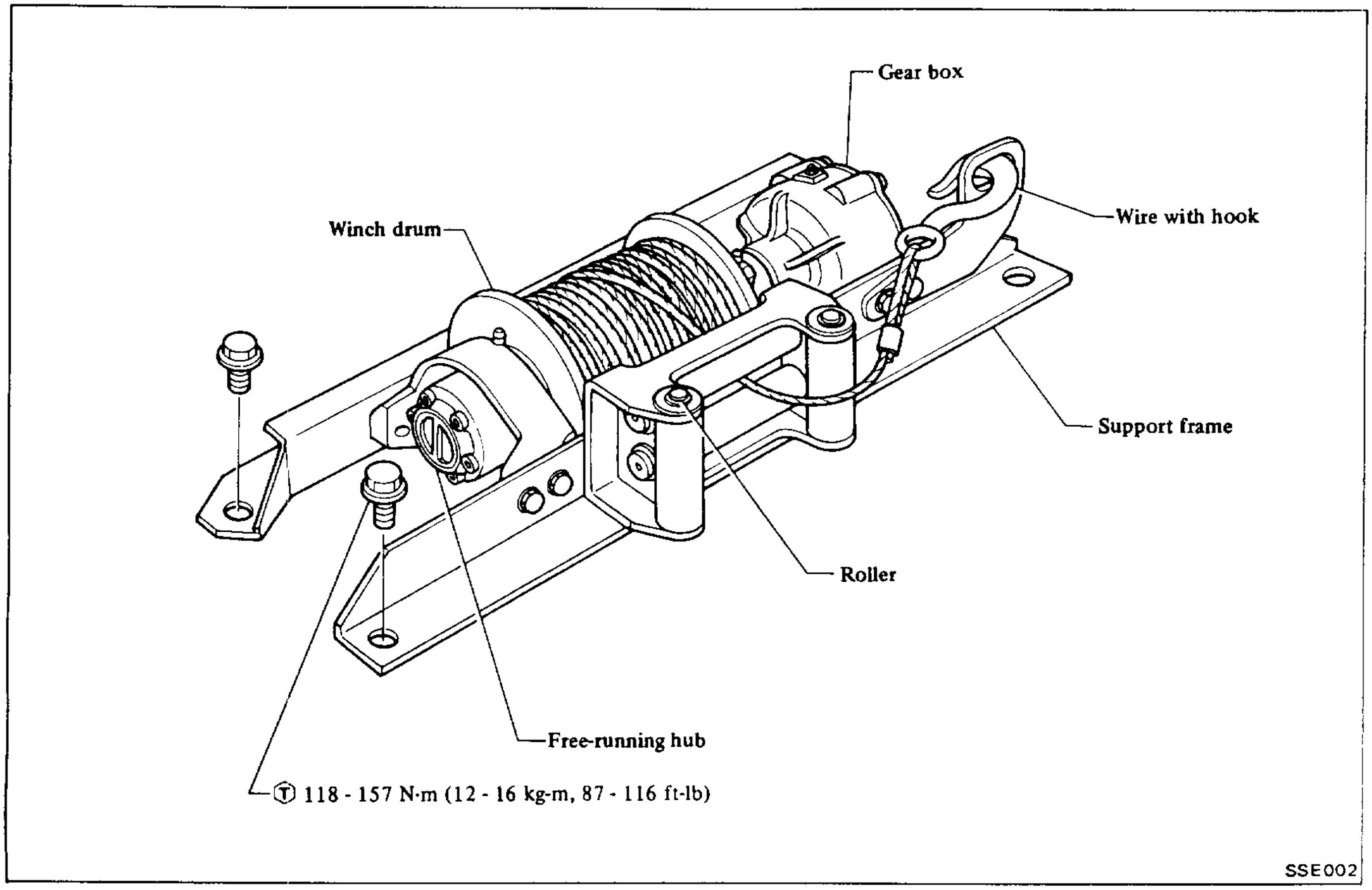
INSTALLATION

Install drive shaft in the reverse order of removal, noting following.

Align "match" marks on splined yoke and splined shaft, then assemble.

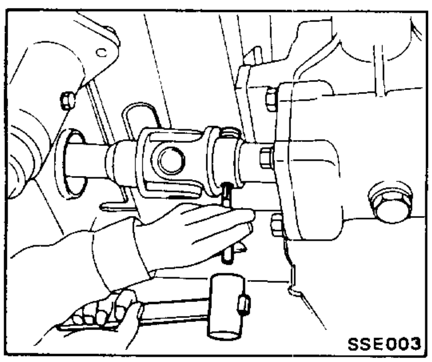
Ⓣ: Center bearing bracket securing bolt
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)

WINCH ASSEMBLY

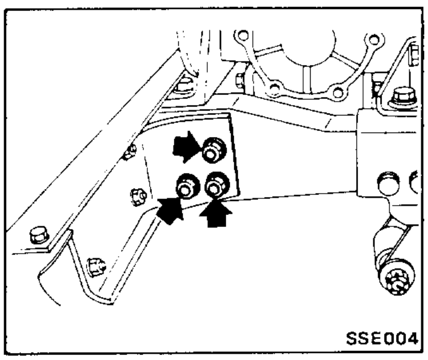


REMOVAL

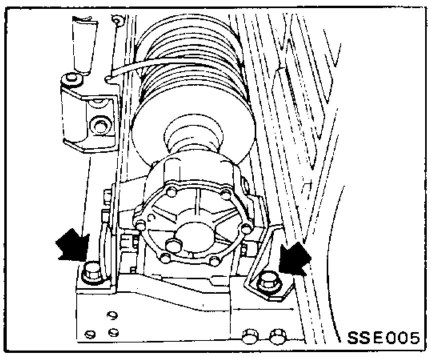
1. Disconnect shear pin on winch side. If it proves difficult to remove, knock it out with a suitable tool.



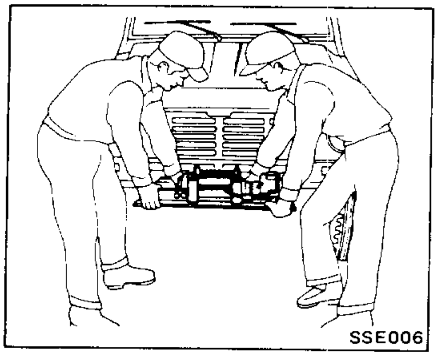
2. Remove bumper assembly.



3. Remove bolts securing winch assembly support frame.



4. Slide winch assembly support frame forward, above the chassis frame, to ensure that winch assembly is completely disconnected from drive shaft.
5. Remove winch assembly support frame.



SSE006

INSTALLATION

Install winch assembly in the reverse order of removal, observing the following:

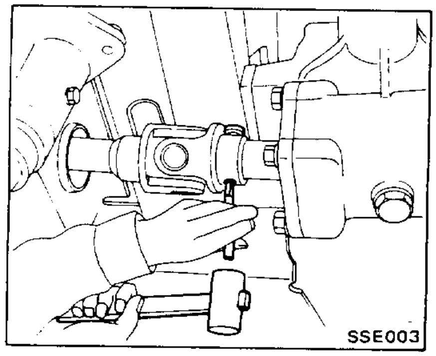
- Always use a genuine shear pin when connecting winch assembly to drive shaft.

Ⓣ : Bumper fixing bolt
54 - 72 N·m
(5.5 - 7.3 kg-m,
40 - 53 ft-lb)
Support frame fixing bolt
118 - 157 N·m
(12 - 16 kg-m,
87 - 116 ft-lb)

SHEAR PIN REPLACEMENT (On-vehicle)

Replace shear pin if it is cracked or deformed.

1. Remove shear pin. If it proves difficult to remove, use a suitable tool to knock it out.



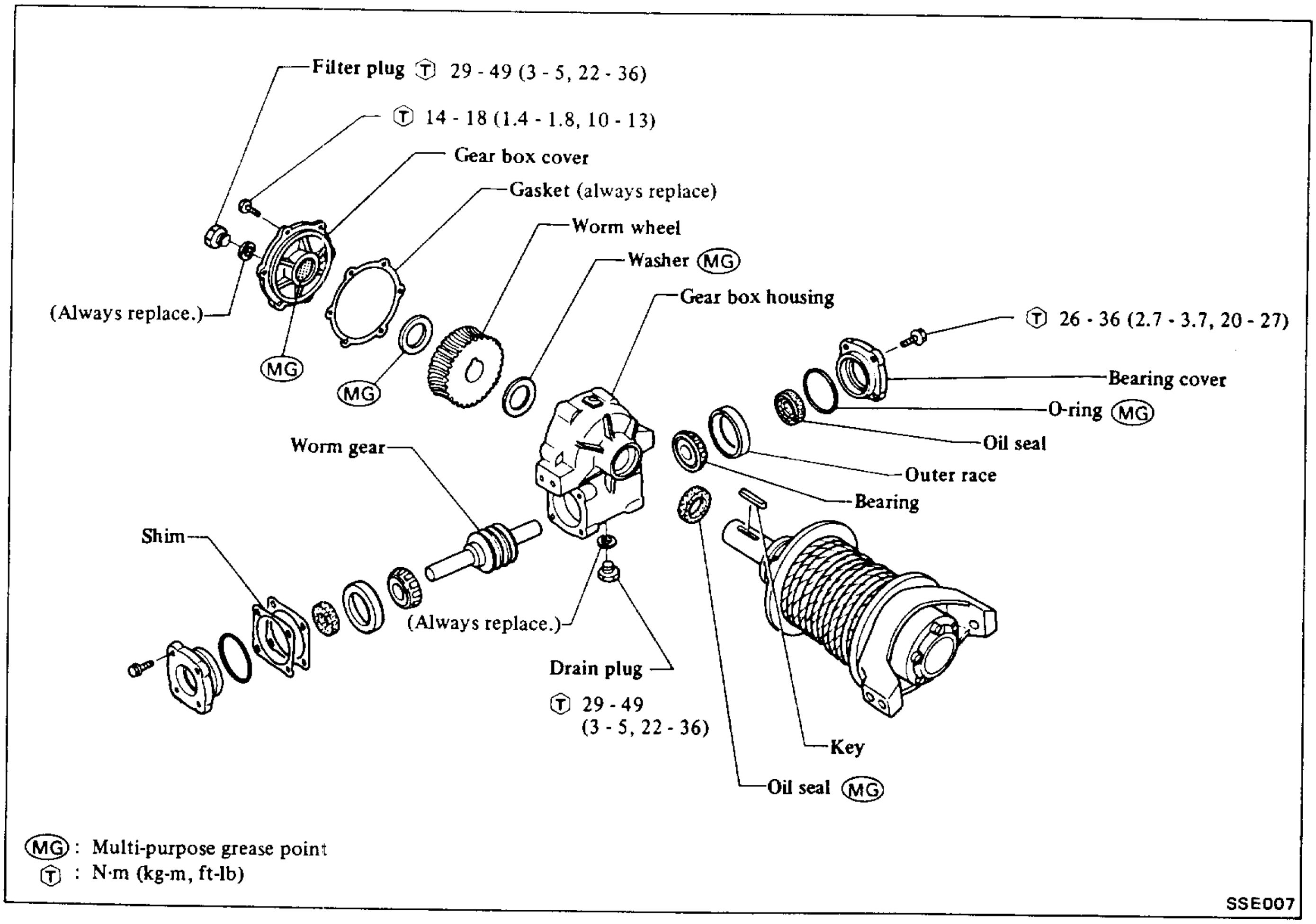
SSE003

2. Install new shear pin.

Always use a genuine shear pin.

3. Install cotter pin.

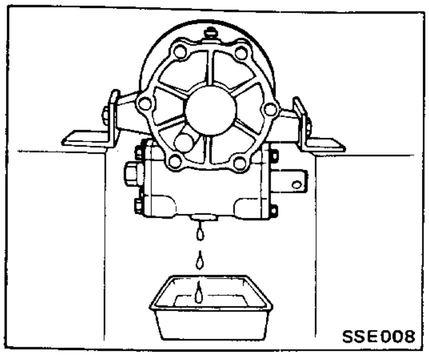
GEAR BOX



SSE007

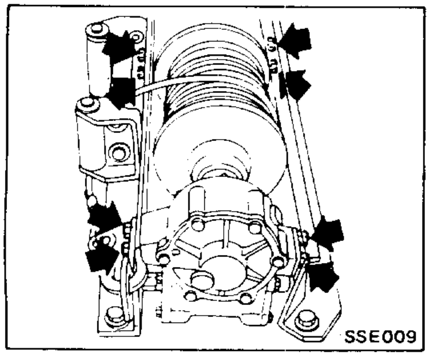
DISASSEMBLY

1. Remove winch assembly. **Refer to "Removal" section for procedures.**
2. Drain gear box oil.



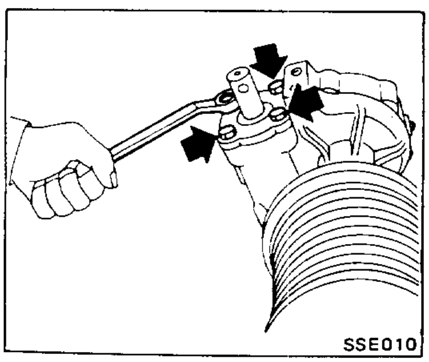
SSE008

3. Remove support frame.



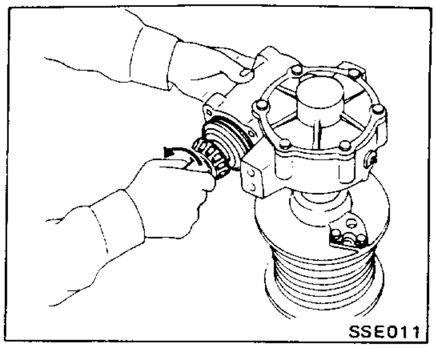
SSE009

4. Remove both side bearing covers.



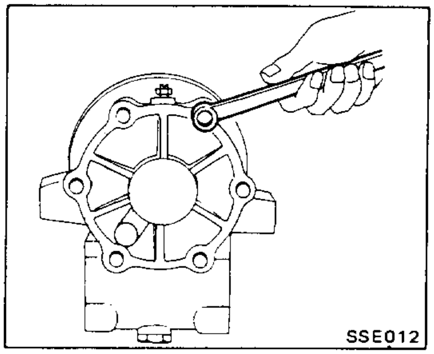
SSE010

5. Turn worm gear counterclockwise to remove it.



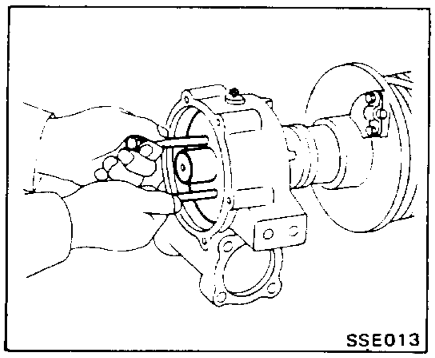
SSE011

6. Remove gear box cover.



SSE012

7. Remove worm wheel, key and washer.



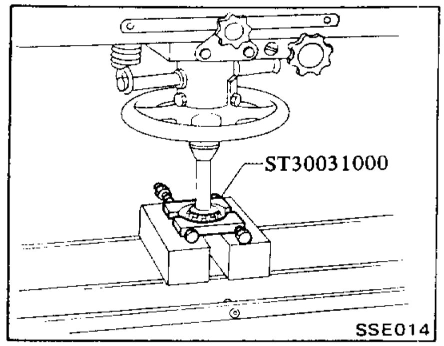
SSE013

8. Remove gear box housing.

Worm gear bearing replacement (Inner race)

If inspection reveals that bearing is faulty, replace it as follows:
Replace bearing as a set.

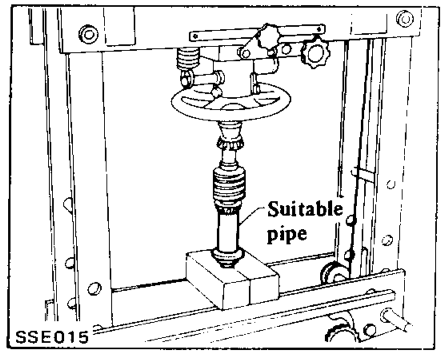
1. Remove bearing using a press and **Tool.**



SSE014

Be careful not to drop worm gear.

2. Apply gear oil and install new bearing in worm gear.

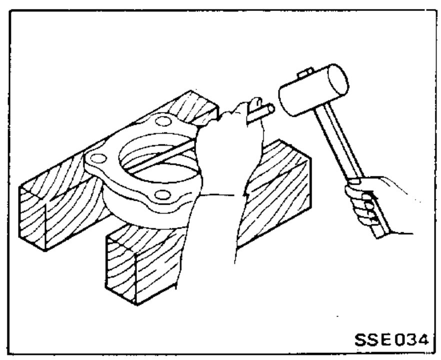


SSE015

Bearing cover bearing replacement (Outer race)

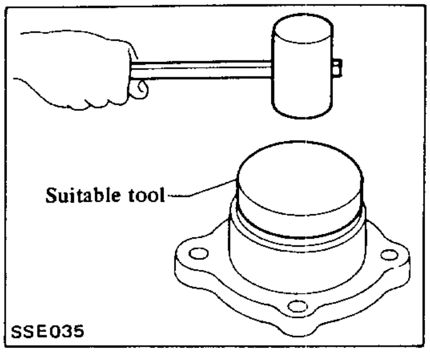
If inspection reveals that bearing is faulty, replace it as follows:
Replace bearing as a set.

1. Remove bearing using a suitable tool.



SSE034

2. Apply oil to bearing and small bearing on bearing cover.

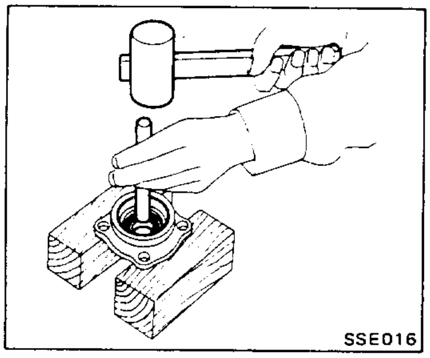


Drive bearing straight.

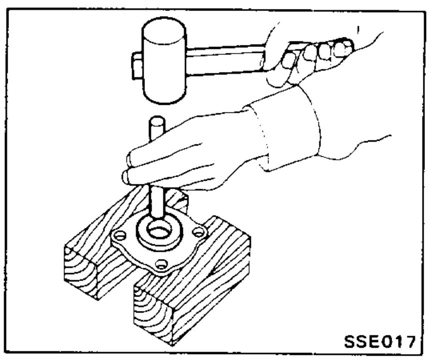
Oil seal replacement

If oil seal is found to be damaged, replace it as follows:

1. Remove oil seal using a suitable tool.



2. Apply grease to new oil seal and install it.



Always install oil seal on gear box properly.

INSPECTION

Clean all parts thoroughly and dry with compressed air.

Support frame

Check for deformities or damage and replace if necessary.

Worm gear and worm wheel

Check for excessive wear, chips or cracks and replace if necessary.

Gear box cover and bearing cover

- Check for cracks or deformities and replace if necessary.
- Check gear box cover bushing for wear or deformation.
  Replace gear box cover if necessary.

Gear box housing

Check for cracks or deformities and replace if necessary.

Oil seal

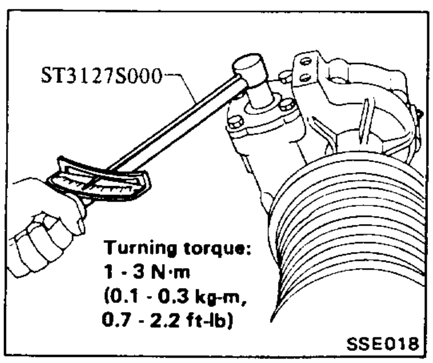
Check for cracks or deformities and replace if necessary.

ASSEMBLY

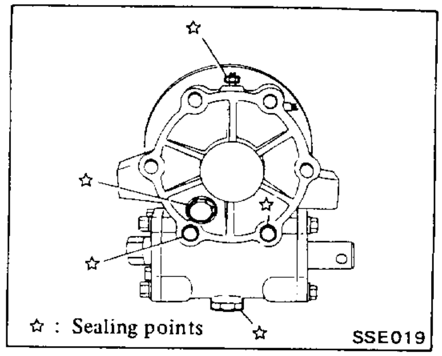
Assemble gear box in the reverse order of disassembly, observing the following:

1. After worm gear, bearings and bearing covers have been installed, check preload to determine the required number of shims to be used.

Tighten bearing cover bolts to the specified torque.



2. Use new gaskets and O-rings.
3. Apply grease to:
- Mainshaft surface and oil seal
- Bearing cover O-ring
4. Apply gear oil to:
- Worm wheel
- Worm gear and bearings
5. Apply sealant to points indicated in the following figure.



6. Add gear oil until it begins to run out of filler plug.

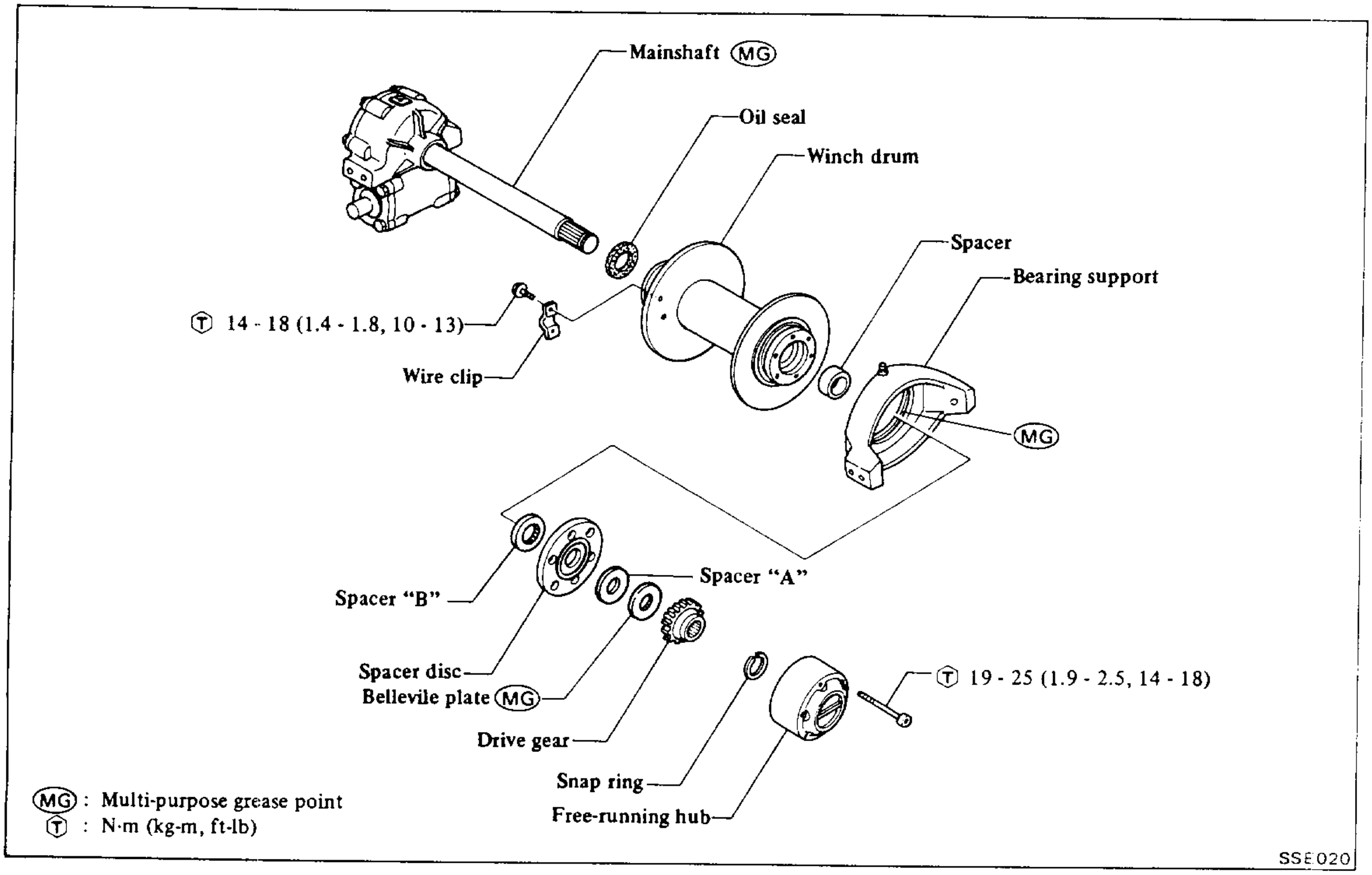
Use the specified oil or its equivalent. Otherwise worm wheel will wear abnormally.

Ⓣ : Gear box cover fixing bolt
14 - 18 N·m
(1.4 - 1.8 kg-m,
10 - 13 ft-lb)
Bearing cover fixing bolt
26 - 36 N·m
(2.7 - 3.7 kg-m,
20 - 27 ft-lb)
Drain and Filler plug
29 - 49 N·m
(3 - 5 kg-m,
22 - 36 ft-lb)

7. Install winch assembly. **Refer to "Installation" section for procedures.**

Ⓣ : Winch assembly to support frame fixing bolt
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)

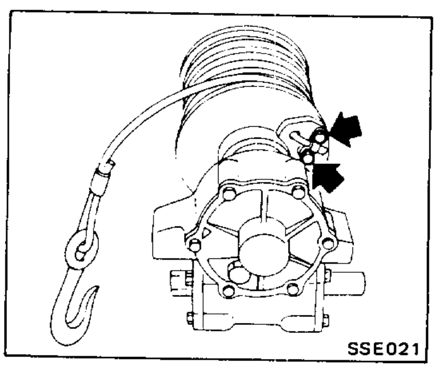
WINCH DRUM



SSE020

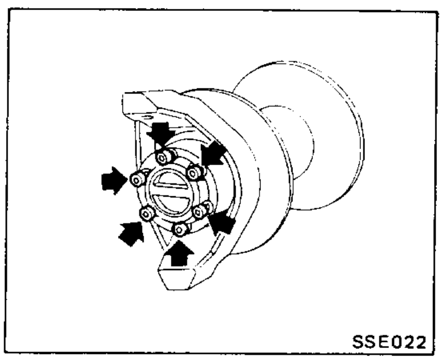
DISASSEMBLY

1. Remove winch assembly. **Refer to "Removal" section for procedures.**
2. Remove support frame.
3. Remove wire (Free-running hub in "FREE" position).



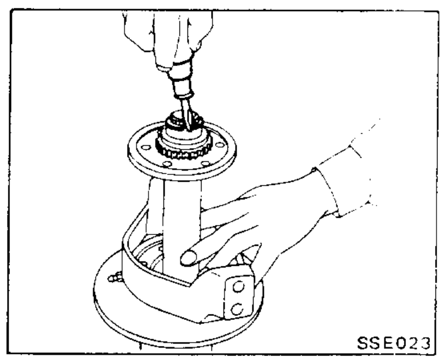
SSE021

4. Remove free-running hub assembly **using torx wrench.**



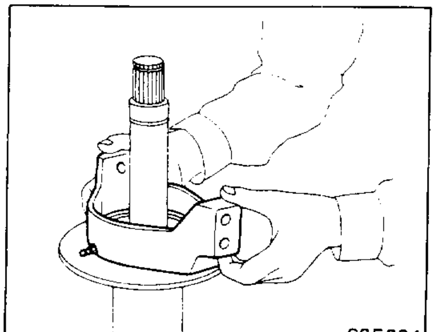
SSE022

5. Remove snap ring, drive gear and spacer "A".



SSE023

6. Remove spacer disc and bearing support.



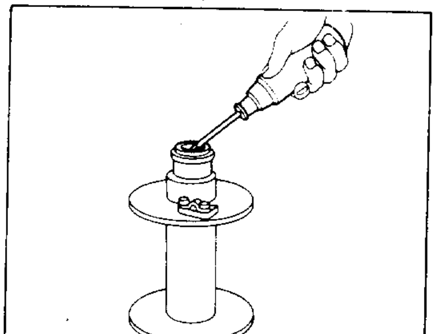
SSE024

7. Remove spacer "B" and winch drum.

Oil seal replacement

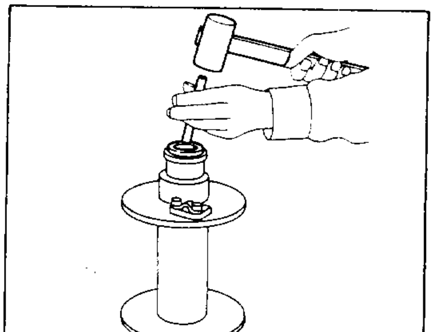
If oil seal is faulty, replace it as follows:

1. Pry off oil seal.



SSE025

2. Apply grease to new oil seal and install it.



SSE026

Always install oil seal on winch drum properly.

INSPECTION

Clean all parts thoroughly and dry with compressed air.

Bearing support

Check for cracks or deformities and replace if necessary.

Winch drum

Check for cracks or deformities and replace if necessary.

Drive gear

Check for cracks or deformities and replace if necessary.

Free-running hub

Check for excessive wear, chips or cracks and replace if necessary.

Wire

Check for kinks, breaks or deformities and replace if necessary.

Oil seal

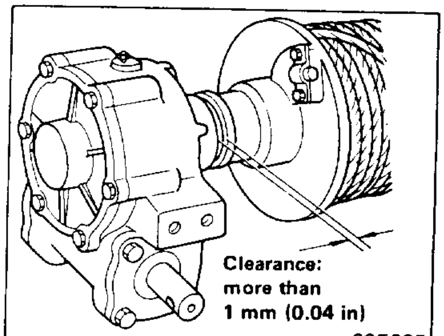
Check for cracks or deformities and replace if necessary.

ASSEMBLY

Assemble winch drum in the reverse order of disassembly, observing the following:

1. Apply grease to:
- Bearing support inner surface
- Mainshaft surface
- Bellevile plate surface

2. After winch drum has been installed, check clearance between it and the gear box to determine whether it is within the specified range.



SSE027

3. Also be sure that winch drum and free-running hub knob rotate smoothly.
4. Always wind wire on the drum neatly.

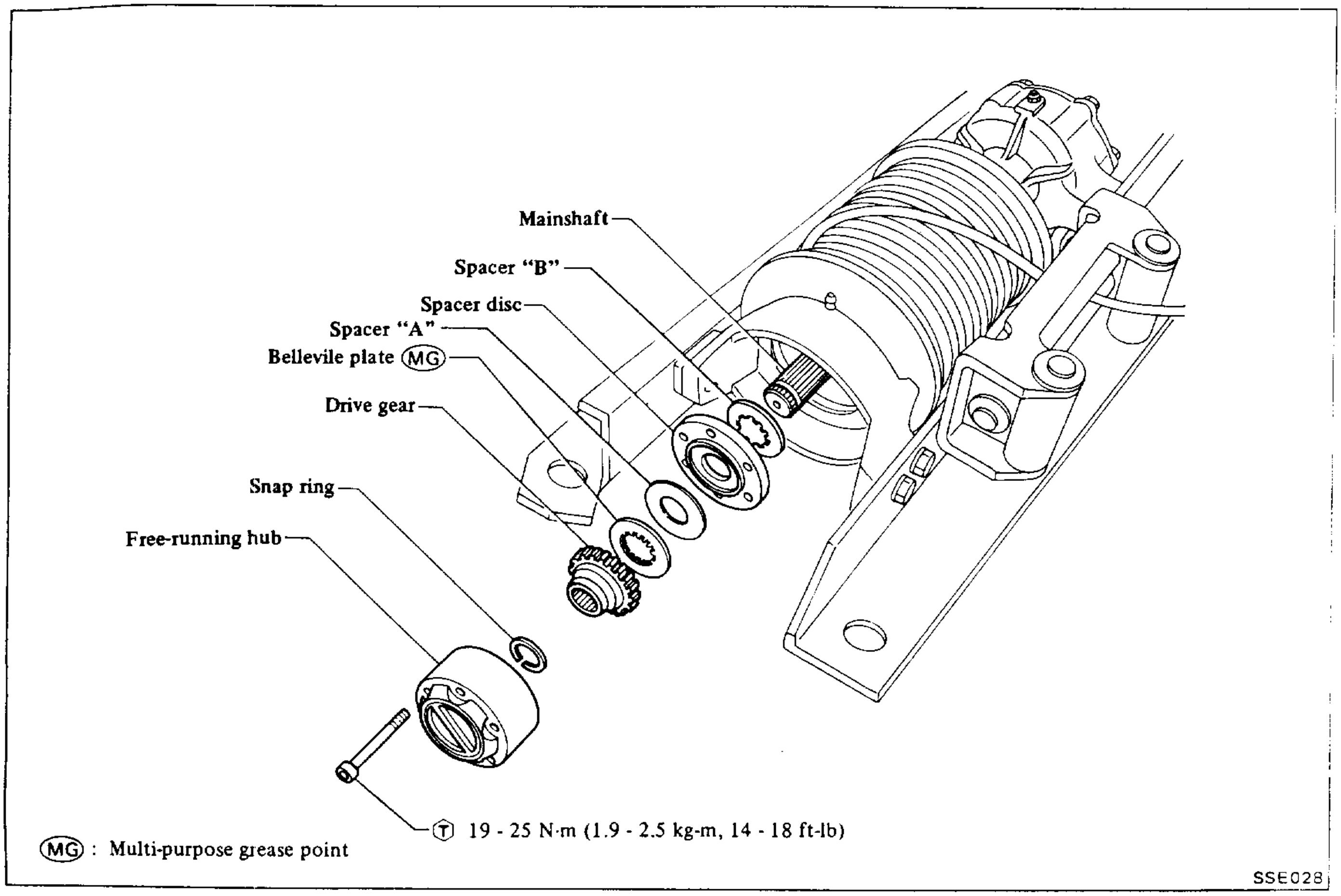
Ⓣ : **Wire clamp fixing bolt**
14 - 18 N·m
(1.4 - 1.8 kg-m,
10 - 13 ft-lb)
Free-running hub fixing bolt
19 - 25 N·m
(1.9 - 2.5 kg-m,
14 - 18 ft-lb)

5. Install support frame.

Ⓣ : **Support frame to winch assembly**
50 - 68 N·m
(5.1 - 6.9 kg-m,
37 - 50 ft-lb)

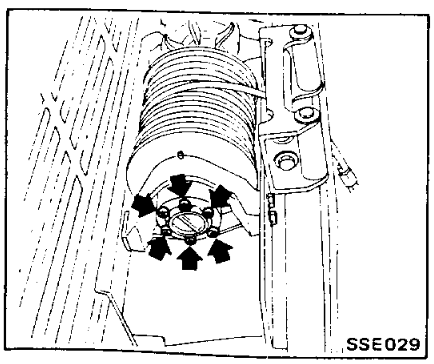
6. Install winch assembly and support frame on chassis frame as a unit.

FREE-RUNNING HUB (On-vehicle)

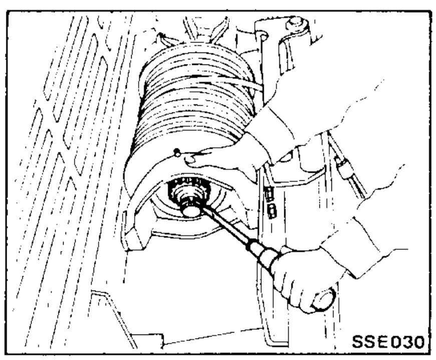


REMOVAL

1. Remove free-running hub using a torx wrench.



2. Remove snap ring and drive gear.



INSPECTION

Free-running hub

Check inner gear for excessive wear, chips or cracks and replace if necessary.

Drive gear

Check for excessive wear, chips or cracks and replace if necessary.

INSTALLATION

Install free-running hub in the reverse order of removal, observing the following:

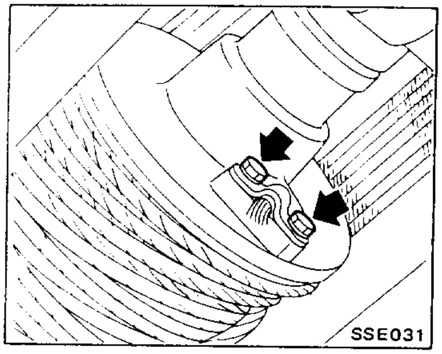
- After free-running hub has been installed, make sure that knob turns smoothly.

(T) : Free-running hub fixing bolt
19 - 25 N·m
(1.9 - 2.5 kg-m,
14 - 18 ft-lb)

Wire replacement (On-vehicle)

If wire is excessively kinked, broken or deformed, replace it.

1. Remove wire clamp and wire.


SSE031

2. Install new wire.

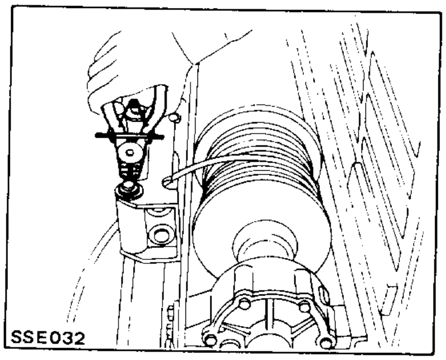
Always wind wire on the drum neatly.

Ⓣ : **Wire clamp bolt**
14 - 18 N·m
(1.4 - 1.8 kg-m,
10 - 13 ft-lb)

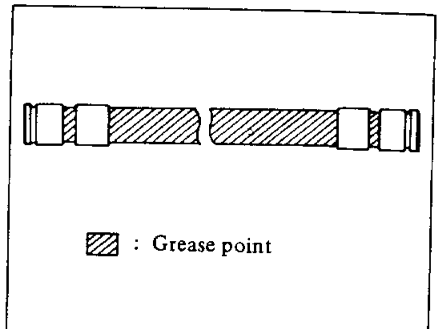
Roller replacement (On-vehicle)

If roller is excessively deformed, replace it.

1. Remove roller shaft snap ring, then roller shaft and roller.


SSE032

2. Apply grease to roller shaft surface and re-install roller shaft and roller.



SSE033

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

POWER TAKE-OFF

Gear ratio	Forth	0.928
	Reverse	1.185

WINCH SYSTEM

Type	Mechanical
Capacity	14,711 N (1,500 kg, 3,308 lb)
Wire size (diameter x length)	8 mm x 40 m (0.31 in x 131 ft)
Wire winding speed/ Engine speed	9.5 m (31.2 ft)/min./ 1,000 rpm
Type of wire Number of strands x Number of core wires	7 x 19 Plated
Type of winch oil	Mobile cylinder oil 600W or equivalent
Oil capacity ℓ (Imp pt)	0.4 (3/4)

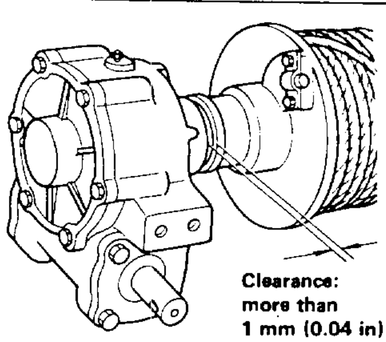
INSPECTION AND ADJUSTMENT

POWER TAKE-OFF

End play mm (in)	Reverse gear	0.02 - 0.50 (0.0008 - 0.0197)
	Idler gear	0.02 - 0.50 (0.0008 - 0.0197)

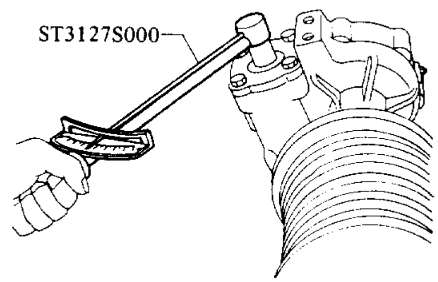
WINCH ASSEMBLY

Winch drum and gear box clearance	More than 1 mm (0.04 in)



SSE027

Worm gear turning torque	1 - 3 N·m (0.1 - 0.3 kg-m, 0.7 - 2.2 ft-lb)



SSE018

TIGHTENING TORQUE

POWER TAKE-OFF

Unit	N·m	kg-m	ft-lb
Power take-off securing bolt	14 - 18	1.4 - 1.8	10 - 13
P.T.O. cover securing bolt	14 - 18	1.4 - 1.8	10 - 13
Cover securing bolt	14 - 18	1.4 - 1.8	10 - 13

CONTROL CABLE

Unit	N·m	kg-m	ft-lb
Control box securing bolt	6 - 7	0.6 - 0.7	4.3 - 5.1
Control cable securing nut	30 - 40	3.1 - 4.1	22 - 30

DRIVE SHAFT

Unit	N·m	kg-m	ft-lb
Center bearing bracket securing bolt	50 - 68	5.1 - 6.9	37 - 50

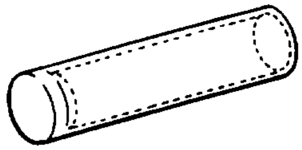
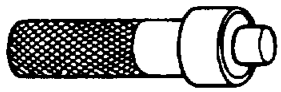
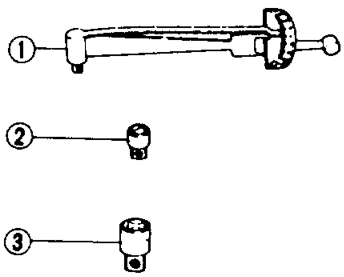
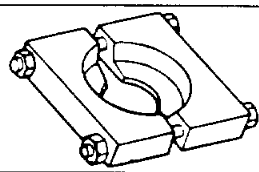
WINCH ASSEMBLY

	N·m	kg-m	ft-lb
Bumper fixing bolt	54 - 72	5.5 - 7.3	40 - 53
Winch assembly support frame to chassis frame	118 - 157	12 - 16	87 - 116
Gear box cover fixing bolt	14 - 18	1.4 - 1.8	10 - 13
Bearing cover fixing bolt	26 - 36	2.7 - 3.7	20 - 27
Drain and filler plug	29 - 49	3 - 5	22 - 36
Free-running hub bolt	19 - 25	1.9 - 2.5	14 - 18
Winch assembly to support frame fixing bolt	50 - 68	5.1 - 6.9	37 - 50
Wire clamp fixing bolt	14 - 18	1.4 - 1.8	10 - 13

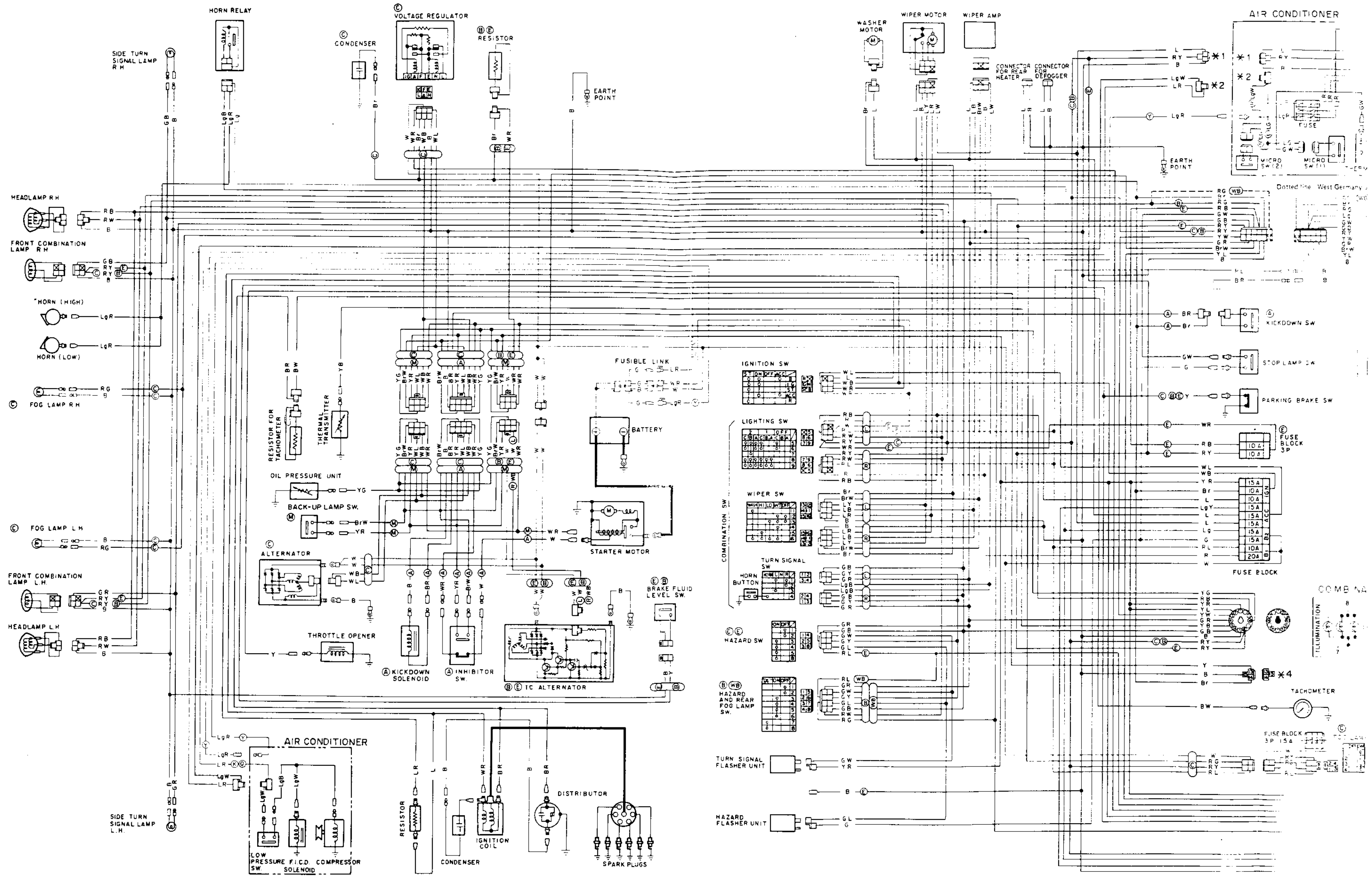
TROUBLE DIAGNOSES AND CORRECTIONS

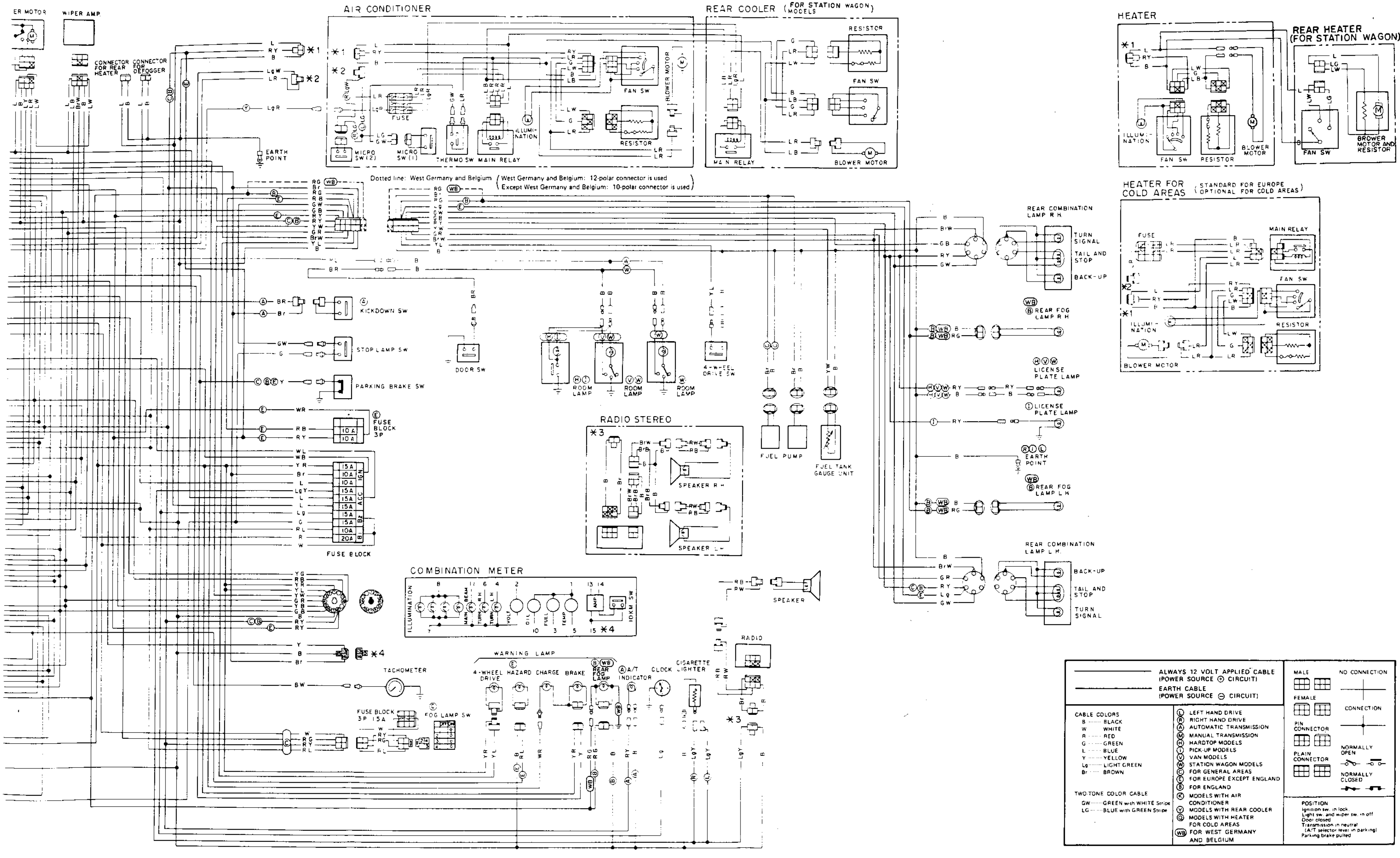
Condition	Probable cause	Corrective action
WINCH DRUM DOES NOT ROTATE OR ROTATES FREELY.	Free-running hub not engaged.	Check or replace free-running hub. ① Free-running hub operation. ② Drive gear
	P.T.O. gear and transmission gear will not engage.	Check shift position.
	• Loosen shift linkage.	Repair or replace.
WINCH DRUM DOES NOT RUN SMOOTHLY	Drive shaft bent	Replace.
	Mainshaft bent	Replace.

SPECIAL SERVICE TOOLS

Tool number	Tool name	
ST19910000	Bearing drift	
ST33220000	Bearing drift	
ST30701000	Drift	
ST3127S000 ① GG91030000 ② HT62940000 ③ HT62900000	Preload gauge ① Torque wrench ② Socket adapter ③ Socket adapter	
ST30031000	Bearing puller	

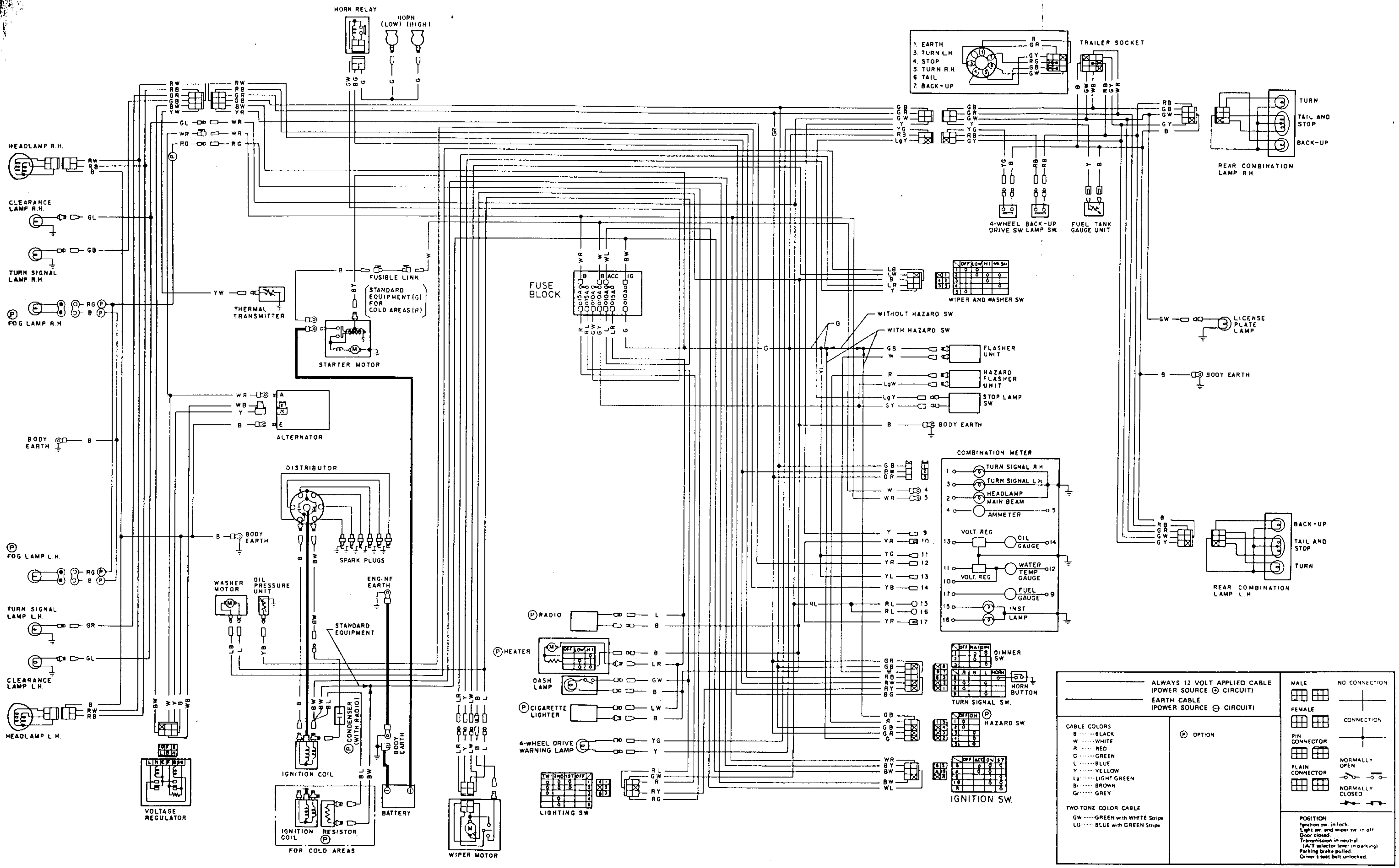
MODEL 160 SERIES (Equipped with L28 engine)



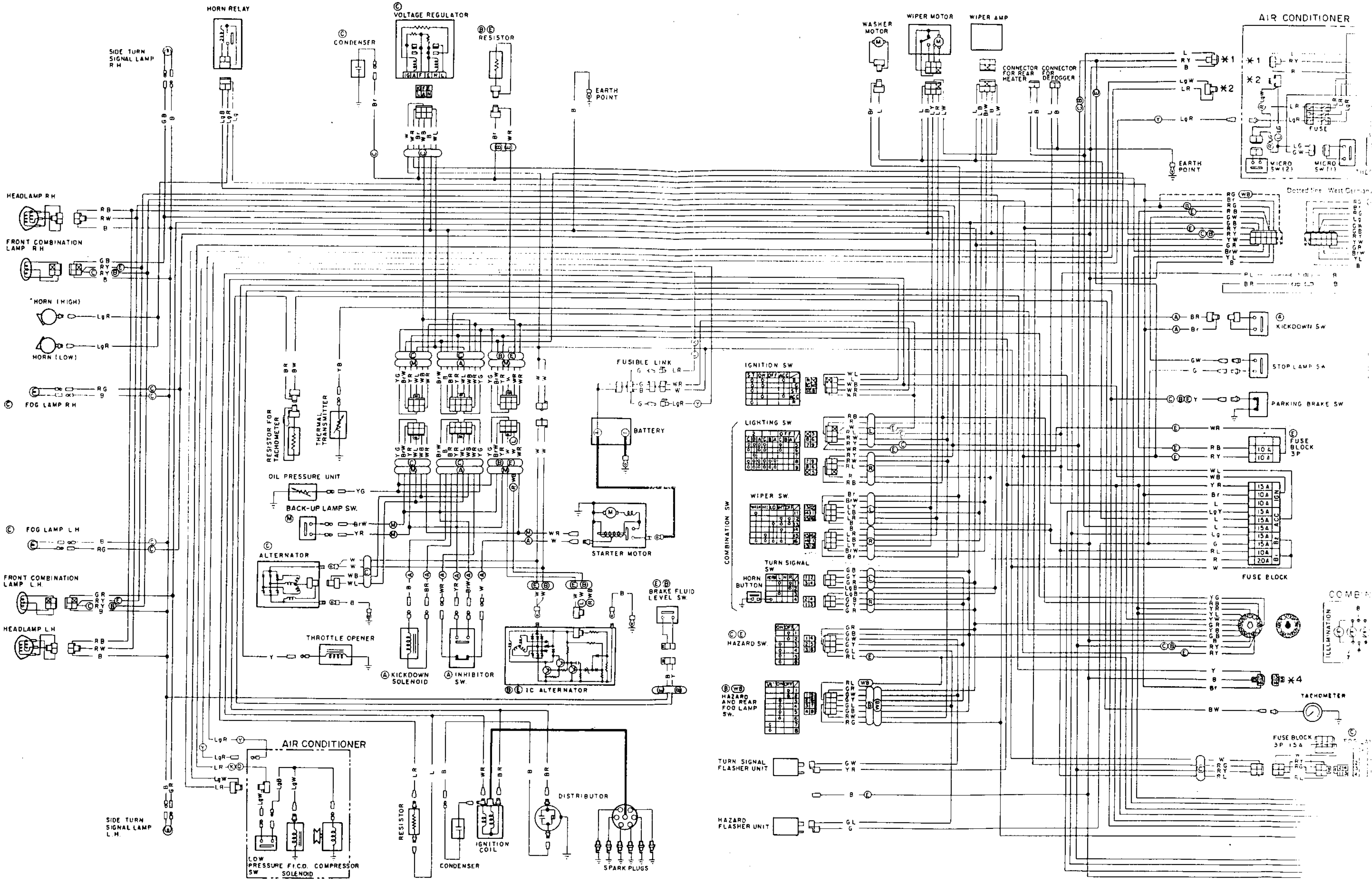


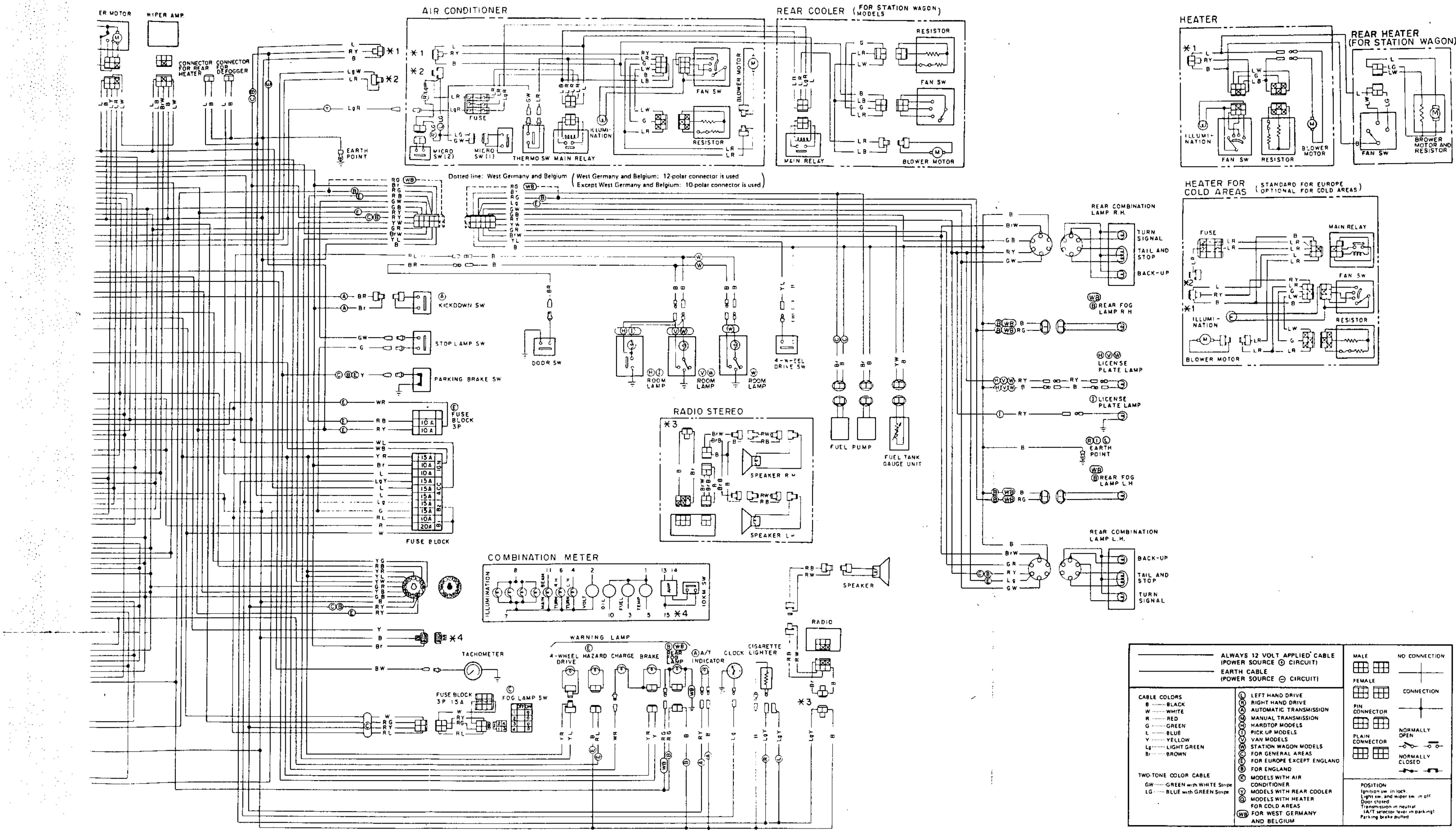
WIPER AMP
CONNECTOR FOR REAR HEATER
CONNECTOR FOR DEFOGGER
EARTH POINT
AIR CONDITIONER
FUSE
MICRO SW (2)
MICRO SW (1)
THERMO SW
MAIN RELAY
ILLUMI-NATION
FAN SW
BLOWER MOTOR
RESISTOR
REAR COOLER (FOR STATION WAGON MODELS)
RESISTOR
FAN SW
MAIN RELAY
BLOWER MOTOR
HEATER
ILLUMI-NATION
FAN SW
RESISTOR
BLOWER MOTOR
REAR HEATER (FOR STATION WAGON)
FAN SW
BROWER MOTOR AND RESISTOR
HEATER FOR COLD AREAS (STANDARD FOR EUROPE OPTIONAL FOR COLD AREAS)
FUSE
MAIN RELAY
FAN SW
RESISTOR
BLOWER MOTOR
Dotted line: West Germany and Belgium (West Germany and Belgium: 12-polar connector is used / Except West Germany and Belgium: 10-polar connector is used)
KICKDOWN SW
STOP LAMP SW
PARKING BRAKE SW
DOOR SW
ROOM LAMP
ROOM LAMP
ROOM LAMP
4-WHEEL DRIVE SW
FUEL PUMP
FUEL TANK GAUGE UNIT
FUSE BLOCK 3P
FUSE BLOCK
REAR COMBINATION LAMP R.H.
TURN SIGNAL
TAIL AND STOP
BACK-UP
REAR FOG LAMP R.H.
LICENSE PLATE LAMP
LICENSE PLATE LAMP
EARTH POINT
REAR FOG LAMP L.H.
REAR COMBINATION LAMP L.H.
BACK-UP
TAIL AND STOP
TURN SIGNAL
RADIO STEREO
SPEAKER R.H.
SPEAKER L.H.
SPEAKER
COMBINATION METER
ILLUMINATION
MAIN BEAM
TURN R.H.
TURN L.H.
VOLT
OIL
FUEL
TEMP
10KM SW
WARNING LAMP
4-WHEEL DRIVE
HAZARD
CHARGE
BRAKE
REAR FOG LAMP
A/T INDICATOR
CLOCK
CIGARETTE LIGHTER
RADIO
TACHOMETER
FUSE BLOCK 3P 15A
FOG LAMP SW
ALWAYS 12 VOLT APPLIED CABLE (POWER SOURCE ⊕ CIRCUIT)
EARTH CABLE (POWER SOURCE ⊖ CIRCUIT)
CABLE COLORS
B ...... BLACK
W ...... WHITE
R ...... RED
G ...... GREEN
L ...... BLUE
Y ...... YELLOW
Lg ...... LIGHT GREEN
Br ...... BROWN
TWO-TONE COLOR CABLE
GW ...... GREEN with WHITE Stripe
LG ...... BLUE with GREEN Stripe
Ⓛ LEFT HAND DRIVE
Ⓡ RIGHT HAND DRIVE
Ⓐ AUTOMATIC TRANSMISSION
Ⓜ MANUAL TRANSMISSION
Ⓗ HARDTOP MODELS
Ⓘ PICK-UP MODELS
Ⓥ VAN MODELS
Ⓦ STATION WAGON MODELS
Ⓒ FOR GENERAL AREAS
Ⓔ FOR EUROPE EXCEPT ENGLAND
Ⓑ FOR ENGLAND
Ⓚ MODELS WITH AIR CONDITIONER
Ⓨ MODELS WITH REAR COOLER
Ⓠ MODELS WITH HEATER FOR COLD AREAS
ⓌⒷ FOR WEST GERMANY AND BELGIUM
MALE
FEMALE
PIN CONNECTOR
PLAIN CONNECTOR
NO CONNECTION
CONNECTION
NORMALLY OPEN
NORMALLY CLOSED
POSITION
Ignition sw. in lock
Light sw. and wiper sw. in off
Door closed
Transmission in neutral (A/T selector lever in parking)
Parking brake pulled

MODEL 61 SERIES



MODEL 160 SERIES (Equipped with L28 engine)





WIPER MOTOR
WIPER AMP
CONNECTOR FOR REAR HEATER
CONNECTOR FOR DEFOGGER
EARTH POINT
AIR CONDITIONER
FUSE
MICRO SW (2)
MICRO SW (1)
THERMO SW
MAIN RELAY
ILLUMINATION
FAN SW
BLOWER MOTOR
RESISTOR
REAR COOLER (FOR STATION WAGON MODELS)
RESISTOR
FAN SW
MAIN RELAY
BLOWER MOTOR
HEATER
ILLUMINATION
FAN SW
RESISTOR
BLOWER MOTOR
REAR HEATER (FOR STATION WAGON)
FAN SW
BROWER MOTOR AND RESISTOR
Dotted line: West Germany and Belgium
West Germany and Belgium: 12-polar connector is used
Except West Germany and Belgium: 10-polar connector is used
HEATER FOR COLD AREAS (STANDARD FOR EUROPE OPTIONAL FOR COLD AREAS)
FUSE
MAIN RELAY
FAN SW
ILLUMINATION
RESISTOR
BLOWER MOTOR
KICKDOWN SW
STOP LAMP SW
PARKING BRAKE SW
DOOR SW
ROOM LAMP
ROOM LAMP
ROOM LAMP
4-WHEEL DRIVE SW
FUSE BLOCK 3P
FUSE BLOCK
REAR COMBINATION LAMP R.H.
TURN SIGNAL
TAIL AND STOP
BACK-UP
REAR FOG LAMP R.H.
LICENSE PLATE LAMP
LICENSE PLATE LAMP
EARTH POINT
REAR FOG LAMP L.H.
REAR COMBINATION LAMP L.H.
BACK-UP
TAIL AND STOP
TURN SIGNAL
RADIO STEREO
SPEAKER R.H.
SPEAKER L.H.
FUEL PUMP
FUEL TANK GAUGE UNIT
SPEAKER
RADIO
COMBINATION METER
ILLUMINATION
MAIN BEAM
TURN R.H.
TURN L.H.
VOLT
OIL
FUEL
TEMP
AMP
10KM SW
TACHOMETER
WARNING LAMP
4-WHEEL DRIVE
HAZARD
CHARGE
BRAKE
REAR FOG LAMP
A/T INDICATOR
CLOCK
CIGARETTE LIGHTER
FUSE BLOCK 3P 15A
FOG LAMP SW
ALWAYS 12 VOLT APPLIED CABLE (POWER SOURCE ⊕ CIRCUIT)
EARTH CABLE (POWER SOURCE ⊖ CIRCUIT)
CABLE COLORS
B ······ BLACK
W ······ WHITE
R ······ RED
G ······ GREEN
L ······ BLUE
Y ······ YELLOW
Lg ······ LIGHT GREEN
Br ······ BROWN
TWO-TONE COLOR CABLE
GW ······ GREEN with WHITE Stripe
LG ······ BLUE with GREEN Stripe
Ⓛ LEFT HAND DRIVE
Ⓡ RIGHT HAND DRIVE
Ⓐ AUTOMATIC TRANSMISSION
Ⓜ MANUAL TRANSMISSION
Ⓗ HARDTOP MODELS
Ⓘ PICK UP MODELS
Ⓥ VAN MODELS
Ⓦ STATION WAGON MODELS
Ⓒ FOR GENERAL AREAS
Ⓔ FOR EUROPE EXCEPT ENGLAND
Ⓑ FOR ENGLAND
Ⓚ MODELS WITH AIR CONDITIONER
Ⓨ MODELS WITH REAR COOLER
Ⓠ MODELS WITH HEATER FOR COLD AREAS
(WB) FOR WEST GERMANY AND BELGIUM
MALE
FEMALE
PIN CONNECTOR
PLAIN CONNECTOR
NO CONNECTION
CONNECTION
NORMALLY OPEN
NORMALLY CLOSED
POSITION
Ignition sw. in lock
Light sw. and wiper sw. in off
Door closed
Transmission in neutral
(A/T selector lever in parking)
Parking brake pulled

MODEL 61 SERIES