Table of Contents

1 General

1.1 Data

1 .Main dimension data（Table 1－1）

Table 1-1

Item	HFJ7130 HFJ7160	HFJ7130E HFJ7130E3 HFJ7160E HFJ7160E3	HFJ7130A HFJ7130AE3
Overall Length（mm）	3885	3885	3885
Overall Width（mm）	1695	1695	1695
Overall Height(Rack or Spoiler)（mm）	1635(1683)	1635(1685)	1635(1683)
Wheelbase（mm）	2440	2440	2440
Track（Front/Rear）（mm）	1470/1470	1470/1470	1470/1470
Front Overhang（mm）	760	760	760
Rear Overhang（mm）	685	685	685

2. Mass data (Table 1-2)

Table 1-2

Item	HFJ7130 HFJ7130E HFJ7130E3	HFJ7160 HFJ7160E HFJ7160E3	HFJ7130A HFJ7130AE3
Kerb Weight（kg）	1180	1180	1150
Gross Vehicle Weight（kg）	1555	1555	1525
Seating Capacity	5		

3. Performance date (Table 1-3)

Table 1-3

Item	HFJ7130 HFJ7130E	HFJ7130E3	HFJ7160 HFJ7160E HFJ7160E3	HFJ7160	HFJ7130A HFJ7130AE3
	DA471Q	4G13	DA476Q	DA476Q	DA471QL
	MT	MT	MT	AT	MT
Max. Speed（km/h）	150	150	160	155	145
Max. Grade ability(%)	30				
Min. Turning Diameter（m）	10				
Fuel Tank Capacity(L)	50				
Min. Ground Clearance（mm）	150				

4. Engine data (Table 1-4)

Table 1-4

Item	HFJ7130 HFJ7130E	HFJ7130E3	HFJ7160 HFJ7160E	HFJ7130A HFJ7130AE3

			HFJ7160E3	
Model	DA471Q	4G13	DA476Q	DA471QL
Type	SOHC 16Valves,MPI	SOHC 16Valves,MPI	SOHC 16Valves,MPI	DOHC 16Valves,MPI
Displacement（ml）	1299	1299	1584	1302
Cylinder Bore（mm）	71	71	76	71
Piston Stroke（mm）	82	82	87.3	82.2
Compression Ratio	9.5	10	9.5	9.3
Max. Power	62.5kw/6000rpm	68.5kw/6000rpm	74.2kw/6000rpm	58kw/5400rpm
Max. Torque	108Nm/4500rpm	113Nm/4500rpm	133.4Nm/4500rpm	108Nm/4000 ~ 4500rpm
Min. fuel consumption (g/kW·h)	272	272	272	270
Idle speed (r/min)	750±50	750±50	750±50	800±50
Gasoline	Above or No. 90# unleaded gasoline	Above or No. 93# unleaded gasoline	Above or No. 90# unleaded gasoline/ Above or No. 93# unleaded gasoline(HFJ7160E3)	Above or No. 93# unleaded gasoline

5.Transmission（Table 1－5）

Table 1-5

Item	HFJ7130 HFJ7130E	HFJ7130E3	HFJ7160 HFJ7160E HFJ7160E3	HFJ7160	HFJ7130A HFJ7130AE3
	DA471Q	4G13	DA476Q	DA476Q	DA417QL
Type	5-speed manual		5-speed manual	4-speed automatic	5-speed manual
1st	3.583		3.583	2.842	3.416
2nd	1.947		1.947	1.529	1.894
3rd	1.343		1.343	1.000	1.280
4th	0.976		0.976	0.712	0.914
5th	0.804		0.804		0.757
Reverse	3.416		3.416	2.480	3.818

6.Final gear (Table 1-6)

Table 1-6

Item	HFJ7130 HFJ7130E	HFJ7130E3	HFJ7160 HFJ7160E HFJ7160E3	HFJ7160	HFJ7130A HFJ7130AE3
	DA471Q	4G13	DA476Q	DA476Q	DA417QL
Type	5-speed manual		5-speed manual	4-speed automatic	5-speed manual
Final Gear Ratio	4.333		4.052	4.406	4.105

7.Steering (Table 1-7)

Table 1-7

Item		Data
Steering Type		Rack and Pinion
Front Wheel Location	Camber Angle	0°±30'
	Kingpin Inclination	12°20'±1°30'
	Kingpin Caster	2°50'±30'
	Toe-In (mm)	1±2
Rear Wheel Location	Toe-In (mm)	3±2
	Camber Angle	-0°40'±30'

8.Tire (Table 1-8)

Table 1-8

Item	Data
Tyres	185/65R14 86H
Inflation Pressure (Front/Rear)(kPa)	200/180

9.Brake system (Table 1-9)

Table 1-9

Item	Data
Type	vacuum booster ,dual pipe hydraulic brake
Front Wheel Brake	auto-adjust clearance front disc
Rear Wheel Brake	auto-adjust clearance rear drum
Parking Brake	mechanical, tightwire(act in rear wheel)

10.Suspension (Table 1-10)

Table 1-10

Item	Data
Front Suspension	MacPherson strut, coil springs with stabiliser bar
Rear Suspension	Multi-link with stabiliser bar

1.2 Marking Plate and Code Number

- **Factory marking plate**

The factory marking plate is fixed on the center of outer cowl bar cover in the engine cabin.

- **Engine cylinder code**

The engine cylinder code is printed on the engine cylinder block.

- **Vehicle identification number（VIN）**

The vehicle identification number(VIN) is printed on the left side of the cowl bar cover in engine cabin and its plate is sticked on the right side of the instrument panel.

2 Inspection Data and Maintenance Period

2.1 Torque

The tightening performance of connecting bolt and nut is performed by screw thread. Each fastener should be tightened to the torque specified in each section with moment wrench during maintenance. (Table 2-1)

Table 2-1

System	Tighten position		□≺□⇕□≻□□□ ₊₀₊□_□	
			.·˙□∓	□□≻□ ∓
Engine	Water pump belt wheel bolt		_⌐□└─┘─	_⌐□□□└─□└─
	Alternator support bolt(side face)		_┌□□_┌□	_┌□□□_┌□□
	Alternator main pin bolt		─_──□□───	──□──□□□───
	Oil ruler pipe bolt		└─□□_└────	└─□□□_┌□_─
	Crankshaft bolt	M12×1.25	└──┘□□└──── □	└──┘□□□└──┘□ □
		M14×1.5	└─└─┌─□└─	└─└─□┌─□└────
	Spark plug		_┌□□_┌□	_┌□□□_┌□□
	Alternator nut		─_──□□───	──□──□□□───
	Ignition coil		──□└──┌─	□□──□└─□_┌─
	EGR valve bolt (MMC system)		└─⌐□_┌□	└─□_⌐□_┌□□
	Cover plate (UAES system)		└─□□_┌□	└─□□□_┌□□
	Camshaft position sensor bolt (MMC system)		──□└─□	□□──□└─□□
	Camshaft position sensor bolt (UAES system)		_⌐□□□──□□	□□_⌐□□□□──□
	Camshaft position sensor bracket bolt		└──┘□└─□	└─□_┌□└─□□
	Camshaft position sensor ratch plate bolt		└─⌐□_┌───	└─□_⌐□_┌□─
	Timing belt cover installing bolt		└─□□└──┌─	└─□□□└─□_┌─
	Timing belt tensioning wheel bolt		_┌□□_┌───	_┌□□□_┌□_⌐
	Crankshaft corner sensor (rotate speed sensor)		──□└─□	□□──□└─□□
	Crankshaft angle sensor (rotate speed sensor)		──□└─□	□□──□└─□□
	Engine right bracket installing nut/bolt(M10)		──□□──┌─	──□□□──□_┌─
	Engine right bracket installing bolt (M8)		└─⌐□_┌□	└─□_⌐□_┌□□
	Air intake pressure temperature sensor bolt		──□───	□□──□□□───
	Canister cleaning valve bracket bolt		──□└─□	□□──□└─□□
	Throttle body assembly installing bolt		└─□□_┌─┌─	└─□□□_┌□_┌─
	Fuel delivery assembly bolt		└─□□└────	└─□□□└─□_─
	Cover plate installing bolt		└─⌐□_┌□	└─□_⌐□_┌□□
	* Ignition shock sensor installing bolt		└─□□_┌□	└─□□□_┌□□
	O2 sensor (UAES system)		──□□──□	──□□□──□□
	O2 sensor (MMC system)		──□□□□	──□□□□□□
	Water temperature sensor (UAES system)		└─⌐──□_┌□	└─□_⌐──□_┌□□
	Water temperature sensor (MMC system)		└─□□──□└─□	└─□□──□└─□□
	Water intake pipe joint		└─⌐□_┌───	└─□_⌐□_┌□─
	Coolant temperature sensor		_┌□□──□	_┌□□□──□□
	Constant temperature case bolt		└─□□_┌───	└─□□□_┌□_─
	Water intake pipe bolt		└─□□└─□	└─□□□└─□□
	Water pump bolt		└──┘□└─□	└─□_┌□└─□□
	Intake manifold support bolt (M8)		└─□□_┌□	└─□□□_┌□□
	Intake manifold support bolt (M10)		_┌─⌐□──┌─	_┌□⌐□──□─
	Intake manifold bolt		└─□□_┌□	└─□□□_┌□□
	Exhaust manifold support bolt (M8)		└─□□_┌□	└─□□□_┌□□
	Exhaust manifold support bolt (M10)		_┌─⌐□──┌─	_┌□⌐□──□─
	Exhaust manifold bolt		_┌─⌐□──┌─	_┌□⌐□──□─

Continue

System	Tighten position		[illegible]	
			[illegible]	[illegible]
Engine	Engine suspender bolt		[illegible]	[illegible]
	Rocker room cover bolt		[illegible]	[illegible]
	Rocker shaft assembly bolt		[illegible]	[illegible]
	Adjusting screw		[illegible]	[illegible]
	Cylinder head bolt (turn to 49Nm (5.0kgfm), then loose it and then tighten as		[illegible] + [illegible]	[illegible] + [illegible]
	Transmission bracket bolt (10×20-7T)		[illegible]	[illegible]
	Transmission bracket bolt (8×40-7T)		[illegible]	[illegible]
	Draining oil plug		[illegible]	[illegible]
	Oil plate bolt (M6)		[illegible]	[illegible]
	Oil plate bolt (M8)		[illegible]	[illegible]
	Oil filter		[illegible]	[illegible]
	Front cover bolt		[illegible]	[illegible]
	Connection rod nut		[illegible] +	[illegible] +
	Flying wheel bolt		[illegible]	[illegible]
	Rear plate bolt		[illegible]	[illegible]
	Flying wheel case cover bolt		[illegible]	[illegible]
	Rear oil seal case bolt		[illegible]	[illegible]
	Bearing cover bolt		[illegible] +	[illegible] +
	Oil pressure switch		[illegible]	[illegible]
	Engine beam and body connecting bolt		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine beam and steering beam connecting		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine roll MTG and body connecting bolt		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine roll MTG and engine connecting nut		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine rear roll MTG and body connecting nut		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine rear roll MTG and engine connecting		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine left roll MTG and engine beam		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine left roll MTG and engine connecting		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine right roll MTG and engine connecting		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Engine right roll MTG and steering beam		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Transmission filling plug		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Transmission draining plug		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Fuel tank installing nut		[illegible]	[illegible]
	Fuel pump、Valve、fuel capacitance sensor nut		[illegible]	[illegible]
	High pressure tube and main pipe connecting		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	High pressure tube and engine oil delivery		[illegible] ~ [illegible]	[illegible] ~ [illegible]
	Oil pressure sensor		[illegible]	[illegible]
	Valve cover screw		[illegible]	[illegible]
	Intake manifold nut		[illegible]	[illegible]
	Intake manifold support screw		[illegible]	[illegible]
	Engine suspender screw		[illegible]	[illegible]
	Tensioner screw		[illegible]	[illegible]
	Synchronous chain cover screw	(M6)	[illegible]	[illegible]
		(M8)	[illegible]	[illegible]
	Exhaust manifold setscrew and retaining nut		[illegible]	[illegible]
	Oil collector screw		[illegible]	[illegible]
	Oil plate nut		[illegible]	[illegible]
	Oil plate drain plug		[illegible]	[illegible]
	Crankshaft belt wheel screw		[illegible]	[illegible]

	Camshaft bearing cap		□	□
	Throttle joint of cylinder body		□	□
	Cylinder cover bolt		□	□
	Connection rod bearing cover nut		□	□
	Transmission and cylinder body connecting screw and nut		□	□
	Crankcase screw	(inner)	□	□
		(outer)	□	□
	Stillness rail screw		□	□
	Flying wheel screw		□	□
	Spark plug		□	□
	O2 sensor		□	□
	Coolant temperature sensor		□	□
	Speed sensor screw		□	□
	Ignition shock sensor installing bolt		□	□
Air intake system	Air collector assembly, large syntony room and body connecting bolt and nut		□	□
	Output pipe and little syntony room connecting groment		□	□
Cooling system	Water pump installing bolt		□	□
	Temperature installing bolt		□	□
	Radiator installing bolt		□	□
Exhaust system	Exhaust pipe and manifold fastening bolt		□	□
	The TWC and front exhaust pipe assembly connecting bolt		□	□
	Hypo-muffler and main-muffler connecting bolt		□	□
	The TWC and hypo-muffler connecting nut		□	□
Transmission	Transmission support bracket installing nut		□	□
	Transmission case and engine connecting bolt		□	□
	Transmission Oil drain and fill plug		□	□
	Transmission support connecting nut		□	□
	Rear case cover bolt		□	□
	Transmission manipulate lever assembly installing bolt		□	□
Clutch	Clutch pressure hose hole bolt		□	□
	Cylinder pushing rod length adjusting bolt		□	□
	Retainer installing nut		□	□
	Clutch pedal assembly installing bolt		□	□
Drive shaft	Drive shaft and hub connecting nut		□	□
Suspension	Front stabilizer bar installing bracket bolt		□	□
	Front arm compl installing bolt(front)		□	□
	Front arm compl and knuckle connecting nut		□	□
	Front arm compl installing bolt (rear)		□	□
	Front frame assembly installing bolt (rear)		□	□
	Front frame assembly installing bolt(top)		□	□
	Carling installing bolt (front)		□	□
	Carling installing bolt (rear)		□	□
	Front shock absorber (top)		□	□

	Front shock absorber and knuckle connecting nut	□□~□□	□□~□□
	Rear shock absorber nut(top)	□~□	□~□
	Rear shock absorber nut(bottom)	□~□	□~□
	Rear trailing arm installing bolt(rear)	□~□	□~□
	Rear and bottom control arm and rear trailingarm connecting nut	□~□	□~□
	Rear and bottom control arm and bodywork connecting nut	□~□	□~□
	Rear and top control arm and bodywork connecting nut	□~□	□~□
	Rear and top control arm and rear trailingarm connecting nut	□~□	□~□
	Control rod assembly and bodywork connecting nut	□~□	□~□
	Control rod assembly and rear trailing arm connecting bolt	□~□	□~□
	Rear hub assembly locking nut	□~□	□~□
	Rear stabilizer bar installing bracket bolt	□~□	□~□
	Rear stabilizer bar fixing bracket bolt	□~□	□~□
Steering system	Steering tie rod and knuckle nuts	□~□	□~□
	Steering gear assy. installing bolts	□~□	□~□
	Toe-In of Front Wheel adjusting nut	□~□	□~□
	Return hose installing nut	□~□	□~□
	Pressure hose installing hole bolt	□~□	□~□
	Steering oil pump installing bolt	□~□	□~□
	Steering oil pump supporting rod	□~□	□~□
	Steering oil pump adjusting bolt	□~□	□~□
	Steering wheel installing bolt	□~□	□~□
	Steering column and shaft installing bolt	□~□	□~□
	Universal joint bolt	□~□	□~□
	Seal cover assembly installing bolt	□~□	□~□
	Lower shaft and gear assy. installing bolt	□~□	□~□
Acceleration transmission set	Acceleration cable and bodywork connecting bolt	□~□	□~□
	Acceleration pedal bracket and bodywork connecting bolt	□~□	□~□
Brake system	Brake pipe nut	□~□	□~□
	Bolt connecting brake hose and brake cliper	□~□	□~□
	Proportioning value nut	□~□	□~□
	Hydraulic unit installing nut	□~□	□~□
	Brake reservoir installing bolt	□~□	□~□
	Front brake bleeding screw	□~□	□~□
	Rear brake bleeding screw	□~□	□~□
	Rear brake back plate and rear axle bolt	□~□	□~□
	Master Booster cylinder and brake pedal bracket nut	□~□	□~□

	Brake pedal bracket bolt	□ ~ □	□ ~ □
	Speed sensor bolt	□ ~ □	□ ~ □
	Parking brake lever bolt	□ ~ □	□ ~ □
	Parking brake cable bolt	□ ~ □	□ ~ □
	Spare tyre bolt assembly	□ ~ □	□ ~ □
	Wheel nut	□ ~ □	□ ~ □
	Booster pushing rod and preparative tightening nut	□ ~ □	□ ~ □
	Brake caliper body and bracket bolt	□ ~ □	□ ~ □
	Brake caliper locating rod	□ ~ □	□ ~ □
	Rear wheel cylinder installing bolt	□ ~ □	□ ~ □
	Hydraulic unit bracket installing nut	□ ~ □	□ ~ □
	Four channel connecting bolt	□ ~ □	□ ~ □
	Six channel connecting bolt	□ ~ □	□ ~ □

Note: : “*” are special parts for UAES system.

The specified torque for the bolts and nuts not included in table 2-1 see table 2-2.

Bolt diameter (mm)	N·m	kgf·m		Bolt diameter (mm)	N·m	kgf·m
5	2～4	0.2～0.4		8	10～16	1.0～1.6
6	4～7	0.4～0.7		10	22～35	2.2～3.5

2.2 Inspection Data

Engine inspection data (DA471、DA476Q see table2-3 a , DA471QL see table2-3b)

Table 2-3a

Items					Standard	Limit
Rocker,Rocker Shaft and camshaft	Camshaft height (mm)			Intake	37.298	36.80
				Exhaust	37.161	36.66
	Diameter of camshaft journal (mm)				44.925～44.94	—
	Rocker shaft outer diameter (mm)				19.985～19.998	—
	Rocker inner diameter (mm)				20.017～20.035	—
Cylinder head and valve	Cylinder-to -contact- surface declination mm				Less 0.03	0.1
	Valve distance (mm)	Intake valve	Environment temperature	0～15℃	0.12±0.03	—
				15～25℃	0.14±0.03	—
				25～40℃	0.16±0.03	—
			Hot sequence		0.20	—
		Exhaust valve	Environment temperature	0～15℃	0.17±0.03	—
				15～25℃	0.19±0.03	—
				25～40℃	0.21±0.03	—
			Hot sequence		0.25	—
	Cylinder head total height mm				119.9～120.1	—
	Valve edge thickness mm			Intake valve	1.35	0.85
				Exhaust valve	1.85	1.35

	Valve stem diameter mm				5.5	—
	Clearance between valve stem and guide seat mm			Intake	0.020～0.036	0.10
				Exhaust	0.030～0.045	0.15
	Valve coniform angle				45^0～45.5^0	—
	Valve stem overhang (mm)			Intake valve	53.21	53.71
				Exhaust valve	54.10	54.60
	Valve total length (mm)			Intake valve	111.56	111.06
				Exhaust valve	114.71	114.21
	Valve spring free length (mm)				50.87	50.37
	Valve spring load/installing height (N/mm)				216/44.2	—
					588/34.7	—
	Valve spring perpendicular degree				2^0	4°
	Valve seat contact width (mm)				0.9～1.3	—
	Valve guide seat inner diameter (mm)				5.5	—
	Valve guide seat overhang (mm)				23.0	—
	Valve guide seat inner diameter enlarged cylinder head (mm)			Enlarge 0.05	10.605～10.615	—
				Enlarge 0.25	10.805～10.815	—
				Enlarge 0.50	11.055～11.065	—
	Valve seat hole diameter enlarged (mm)	DA471Q	Intake	Enlarge 0.3	28.425～28.445	—
				Enlarge 0.6	28.725～28.745	—
			Intake	Enlarge 0.3	26.425～26.445	—
				Enlarge 0.6	26.725～26.745	—
		DA476Q	Intake	Enlarge 0.3	30.425～30.445	—
				Enlarge 0.6	30.725～30.745	—
			Intake	Enlarge 0.3	28.425～28.445	—
				Enlarge 0.6	28.725～28.745	—
Oil pump and oil plate	Oil pump tip clearance(mm)				0.06～0.18	—
	Oil pump side clearance(mm)				0.04～0.11	—
	Oil pump case clearance(mm)				0.10～0.18	0.35
Piston and connecting rod	Piston fiducial outer diameter(mm)		DA471Q		70.97～70.98	—
			DA476Q		75.97～75.98	—
	Piston ring axial gap(mm)		NO.1 ring		0.03～0.07	0.1
			NO.2 ring		0.02～0.06	0.1
	Ring-to-ring groove gap (mm)	NO.1 ring			0.20～0.35	0.8
		NO.2 ring			0.35～0.55	0.8
		Oil ring	DA471Q		0.20～0.50	1.0

			DA476Q	0.10～0.40	1.0
	Piston pin diameter (mm)			18.003～18.005	—
	Piston pin pressing load (room temperature) (N)			4900～14700	—
	Crankshaft pin gap (Connecting rod journal gap) (mm)			0.02～0.04	0.1
	Axial clearance of connecting rod (mm)			0.10～0.25	0.4
	Connecting rod hole diameter(mm)			17.974～17.985	—
Crankshaft and cylinder body	Crankshaft axial clearance(mm)			0.05～0.18	0.25
	Crankshaft journal diameter (mm)			48.0	—
	Connecting rod journal diameter (mm)			42.0	—
	Crankshaft journal clearance(mm)			0.02～0.04	0.1
	Cylinder-to -contact- surface declination (mm)			0.03 以下	0.1
	Cylinder body total height(mm)			256	—
	Cylinder body column degree (mm)			0.01	—
	Cylinder body fiducial inner diameter(mm)		DA471Q	71.0	—
			DA476Q	76.0	—
	Piston and cylinder clearance (mm)			0.02～0.04	—
	Cylinder pressure(MPa)		DA471Q	1.48	—
			DA476Q	1.6	—
Preignition angle		MMC EGI system		10° ±1°	—
		USEA EGI system		8° ±5°	—

Table 2-3b

Items				Standard	Limit
Compressed pressure		Design value		1250kPa (12.5kg/cm2)	900kPa (9.0kg/cm2)
		Difference between any two cylinder		≤100kPa (1.0kg/cm2)	≤100kPa (1.0kg/cm2)
Valve distance		Intake	Cooling sequence(coolant temp. 15～25℃)	0.17～0.23mm	——
			Hot sequence(coolant temp. 60～68℃)	0.21～0.27mm	——
		Exhaust	Cooling sequence(coolant temp. 15～25℃)	0.17～0.23mm	——
			Hot sequence(coolant temp. 60～68℃)	0.20～0.26mm	——
Preignition angle				6° ~7° (idling)	——
Camshaft, spindle and valve	Camshaft	Cam height	Intake (mm)	38.06~38.22	37.93
			Exhaust (mm)	37.90~38.06	37.77
		Camshaft vibration (mm)		——	0.1mm
		Radial clearance of camshaft cover (mm)		0.045-0.087	0.12
		Diameter of camshaft bearing hole (mm)		23.00~23.021	
		Diameter of camshaft journal (mm)		22.934~22.955	
	Spindle	Out diameter of spindle (mm)		26.959~26.975	——
		Diameter of spindle hole (mm)		27.000~27.021	——
		Matching clearance (mm)		0.025~0.062	0.15

	Valve	Valve stem guide seat	Valve stem O.D (mm)	Intake	5.465~5.480	——
				Exhaust	5.440~5.455	——
			Valve guide seat I.D (mm)	Intake	5.500~5.512	——
				Exhaust		
			Valve guide-to-stem clearance (mm)	Intake	0.020~0.047	0.07
				Exhaust	0.045~0.072	0.09
			Valve stem end movement limit (mm)	Intake	0.14	——
				Exhaust	0.18	——
			Thickness of valve head (mm)	Intake	1.0	0.7
				Exhaust	1.5	0.5
			Valve head contact and sealing width (mm)	Intake	2.228~3.428	——
				Exhaust	1.987~3.387	——
Cylinder head			Cylinder-to -contact- surface declination (mm)		——	0.05mm
			Manifold install surface declination		——	0.10mm
			Valve seat contact width (mm)	Intake	1.57-1.97mm	——
				Exhaust	1.57-1.97mm	——
			Valve spring perpendicular degree (mm)		——	2.0mm
Cylinder			Cylinder-to -contact- surface declination (mm)		——	0.05mm
			I.D (mm)		——	71.070 mm
			Conicity and ellipticity		——	0.10mm
			Cylinder-to -piston- surface clearance (mm)		0.02~0.04 mm	——
Piston			Piston O.D (mm)	Standard	70.970~70.990mm	——
				Enlarge dimension 0.25mm	71.220~71.240mm	——
				Enlarge dimension 0.5mm	71.470~71.490mm	——
			Piston pin O.D (mm)		16.995~17.000 mm	——
			Piston pin I.D (mm)		17.006~17.014 mm	——
			Piston pin-to-connecting rod clearance		0.003~0.016mm	0.05mm
			Ring joint distance when assembly (mm)	NO.1 ring	0.03~0.07 mm	——
				NO.2 ring	0.02~0.06 mm	——
				Oil ring	0.06~0.15 mm	——
			Ring-to-ring groove gap (mm)	NO.1 ring	0.15~0.35mm	0.8mm
				NO.2 ring	0.30~0.50mm	1.1mm
				Oil ring	0.10~0.40mm	1.6mm
Crank shaft and connecting rod			Crankshaft vibration (mm)		——	0.04mm
			Axial movement of camshaft (mm)		0.11-0.31mm	0.35mm
			Connecting rod-to-bearing clearance (mm)		0.020-0.040mm	0.065mm

	Journal diameter (mm)		1	44.994-45.000mm	——
			2	44.988-44.994mm	——
			3	44.982-44.988mm	——
	Thickness of thrust patch (mm)	Standard		2.500mm	——
		Enlarge dimension:0.125mm		2.563mm	——
	Circularity and conicity of journal (mm)			——	0.01mm
	-To-bearing shell clearance (mm)			0.020-0.040mm	0.065mm
	Cam journal shaft I.D (mm) (excluding bearing shell)	marks	1	49.000-49.006mm	——
			2	49.006-49.012mm	——
			3	49.012-49.018mm	——
	Axial clearance of connecting rod (mm)			0.26-0.49mm	0.53mm
	Thickness of bearing shell	Identify marks	5	1.999~2.003mm	——
			4	2.002~2.006mm	——
			3	2.005~2.009mm	——
			2	2.008~2.012mm	——
			1	2.011~2.015mm	——
			0	2.014~2.018mm	——
	Crankshaft pin	Diameter (mm)	Identify mark 1	41.994～42.000	——
			Identify mark 2	41.988～41.994	
			Identify mark 3	41.982～41.988	
		Circularity and conicity (mm)		——	0.01mm
	Connecting rod	Bending (mm)		——	0.05mm
		Tortility (mm)		——	0.10mm

- Intake and exhaust system see table 2-4

Table 2-4

Items	Standard	Limit
Intake manifold installing deform(mm)	Within 0.15	0.20
Exhaust manifold installing deform (mm)	Within 0.15	0.20

- Clutch manipulate see table 2-5

Table 2-5

Items	Standard	Limit
Clutch pedal height (mm)	203.5～206.5	-
Clutch pedal pin assembly clearance (mm)	1～3	-
Clutch pedal free stroke (mm)	4～13	-
Clutch system pressure (MPa)	4.5	-
While do not mesh, clearance between the clutch pedal and foot shelf (mm)	Over 70	-

- Cooling system see table 2-6

Table 2-6

Items	Standard	Limit
Clam down 100N pressure on the belt between generator and water pump (mm)	8~12	12~15
Pressure at which radiator cap begins to open (kPa)	74～103	64
Coolant (antifreeze) concentration (%)	30～60	—
Temperature at which thermostat valve begins to open (℃)	82±1.5	—
Temperature at which thermostat valve become fully open (℃)	95	—
Thermostat valve lift (mm)	Over 8.5	—

- Acceleration and drive device see table2-7

Table 2-7

Items	Standard	Limit
Acceleration pedal cable clearance (mm)	1～2	—
Engine idling (r/min)	750±50	—

- Front axle see table 2-8

Table 2-8

Items	Standard	Limit
Front bearing axial clearance mm	—	0.05
Front bearing rotation starting torque N·m{kgf·cm}	—	1.8
Stabilizer bar installing overhang mm	20.5~23.5	—

- Rear axle see table 2-9

Table 2-9

Items	Standard	Limit
Rear bearing axial clearance mm	—	0.05
Rear bearing rotation sliding resistance N{kgf}	—	Less 22

- Wheel and tyre see table 2-10

Table 2-10

Items	Standard	Limit
Tyre type	—	1.6
Tyre pattem depth mm	—	Less 1.2
Steel wheel radial run out mm	—	Less 1.2
Steel wheel axial run out mm	200±10	—
Front tyre pressure kPa	180±10	—

- Suspension system see table 2-11

Table 2-11

Items	Standard	Limit
Stroke of front shock absorber (mm)	178	
Stroke of rear shock absorber (mm)	155	

Height of front spring (mm)	344.5	167.5
Height of rear spring (mm)	370	204

- Steering system see table 2-12

Table 2-12

Items	Standard	Limit
Inner wheel maximum steering angle	41°	39° ~43°
Outer wheel maximum steering angle	33°	31° ~35°
Steering wheel windage (mm)	0~10	
Steering gear rotation torque (N.m)	0.6~1.6	
Steering wheel diameter (mm)	Φ380	
Minimal steering radius (m)	10	
Steering gear assy. stroke (mm)	146±1	
Front wheel toe in (mm)	1±2 (185/65R14)	
Front wheel camber	0° ±30′	
Main pin caster	2° 50′ ±30′	
Main pin king-pin angle	12° 20′ ±1° 30′	
Sliding (mm/m)	0±3	
Rear wheel toe in (mm)	3±2	
Rear wheel camber	-0° 40′ ±30′	

- Brake system see table 2-13

Table 2-13

Items		Standard	Limit
Brake pedal height (mm)		229.4～232.4	—
Brake pedal clearance (mm)		3～8	—
Distance between pedal surface and floor while depress the pedal. (mm) (pedal force : about 490N)		Over 180	—
Vacuum booster handspike overhang (mm)		9.98～10.23	—
Test pressure without vacuum operation kPa{kgf/cm^2}	Pedal force 98N	Over 0	—
	Pedal force 294N	1824 以上	—
Test pressure with vacuum operation kPa{kgf/cm^2}	Pedal force 98N	4442～4952	—
	Pedal force 294N	10434～10944	—
Proportion valve	Inflexion (kPa)	2207～2707	—
	Output pressure (kPa) (input pressurekPa)	3187～3687 (6375)	—
	Output pressure difference(left and right) (kPa)	—	392
Front disc brake	Brake pad thickness (mm)	10.0	2.0
	Brake disc thickness (mm)	24.0	22.4

	Brake disc declination(mm)	—	0.06
	Brake sliding force (N)	78	—
Items		Standard	Limit
Rear drum brake	Brake pad thickness (mm)	4.3	1.0
	Brake drum inner diameter (mm)	203	205
Hub axial clearance (mm)		—	0.05
Parking brake lever store (hand) (force: about 196N)		5~7 teeth	—
Parking brake lever store (automatic) (force: about 500N)		4~6 rabbets	—
Resistance between wheel speed sensor connecters (kΩ)		1.275～1.495	
Insulating resistance of wheel speed sensor (kΩ)		Over 1000	

2.3 Maintenance Schedule

Maintaining (lubricating, adjusting, checking and inspecting) the system according to the specified schedule (mileage or months) , which makes the vehicle be in good state anytime and brings efficiency. In order to arrive this aim, the maintenance schedule is specified as following. (see table 2-14).

Table 2-14

NO.	Limit		months	2	6	12	18	24	30	36	42	48	54	60
			km*1000	2.5	10	20	30	40	50	60	70	80	90	100
DA471QL engine														
1	Pump belt (Check elasticity and abrasion)				—	I	—	I	—	I	—	R		
2	IN and EH valve clearance				—	I	—	I	—	I	—	I		
3	Oil and oil filter				R	R	R	R	R	R	R	R		
4	cooling hose and nib (leakage、damage)				—	I	—	I	—	I	—	I		
5	Coolant				—	—	—	R	—	—	—	R		
6	Exhaust system				—	I	—	I	—	I	—	I		
7	Wire and connector				—	—	—	I	—	—	—	I		
Ignition system														
8	Spark plug				R	R	R	R	R	R	R	R		
9	High tension damping wire				—	I	—	I	—	I	—	R		
Fuel system														
10	Air cleaner	Asphalted road			—	—	—	—	R	—	—	—		
11		Dust road		Check refer to inclement driving condition										
12	Fuel filter			Every 100,000 km replace										
Emission control system														
13	PCV valve				—	—	—	—	—	—	—	I		

14	Canister control valve			—	—	—	—	—	—	—	I		
DA471、DA476Q engine													
15	Inspect alternator transmission belt(crack, scraps, wearing,tension)		I		I		I		I		I		I
16	Inspect ignition cable(damage)						I				I		
17	Replace engine timing belt		R: every 100,000km										
18	Inspect crankcase hydro-pneumatic control system is normal or not.						I				I		
19	Replace spark plug.		R: every 40,000km										
20	Replace engine coolant.						R				R		
21	Inspect air filter core(block,damage)	Normal use condition			I		I		I		I		I
		Inclement use condition		I	I	I	I	I	I	I	I	I	I
22	Replace air filter core	Normal use condition					R				R		
		Inclement use condition	R: Frequent										
23	Replace lubricating oil of machine transmission	2WD Normal use condition											R
		2WD Inclement use condition						R					R
24	Inspect lubricating oil of automatic transmission.				I		I		I		I		I
25	Replace oil.	A API classify “SG grade” Normal use condition		R	R	R	R	R	R	R	R	R	R
		A API classify “SG grade” Inclement use condition	R: every 5, 000km										
	Replace lubricating oil of automatic transmission.	R: every 8000-10000km											
26	Replace oil filter.	Normal use condition		R	R	R	R	R	R	R	R	R	R
		Inclement use condition	R: every 5, 000km										
27	Inspect clutch fluid level		I										
28	Inspect engine idling and content of CO.		I		I		I		I		I		I
29	Inspect ignition timing.						I				I		
30	Inspect crankcase ventilation hose.						I				I		
31	Inspect valve clearance		I		I		I		I		I		I
32	Inspect EGR system				I		I		I		I		I
Steering system													
33	Steering wheel operating status						I				I		
34	Check the assembly of steering mechanism,	Normal use condition					I				I		

	gear, gearbox for loose	Inclement use condition			I		I		I		I		I
34	Check steering mechanism, gear, gearbox for leakage		I										
35	Check tie rod for damage						I				I		
36	Check connection position of tie rod for dust, dust bush for crack, damage	Normal use condition					I				I		
		Inclement use condition			I		I		I		I		I
37	Front wheel alignment						I				I		
38	Check powering steering system for loose, damage		I		I		I		I		I		I
39	Check powering steering system for leakage		I				I				I		
40	Check the assembly of powering steering mechanism for loose						I				I		
Brake system													
41	Inspect the clearance(brake pedal, stepped pedal and floor)				I		I		I		I		I
42	Inspect brake effect.				I		I		I		I		I
43	Inspect parking brake level(stroke)		I		I		I		I		I		I
44	parking brake effect				I		I		I		I		I
45	brake pedal and cable(loose,tension,damage)						I				I		
46	Braking hose and braking pipe (leakage and damage and shriveled)	Normal use condition			I		I		I		I		I
		Inclement use condition	I	I	I	I	I	I	I	I	I	I	I
47	Braking fluid quantity		I										
48	Replace braking fluid		One time every 2years										
49	Braking master cylinder, braking wheel cylinder, braking cliper(leakage)				I		I		I		I		I
50	Function of braking master cylinder, braking wheel cylinder, braking cliper(leakage,damage)						I				I		
51	Clearance of braking drum and braking pad				I		I		I		I		I
52	Smooth part of braking shoes and wearing of braking pad	Normal use condition			I		I		I		I		I
		Inclement use condition		I	I	I	I	I	I	I	I	I	I
53	Braking drum(wearing and damage)	Normal use condition					I				I		
		Inclement use condition			I		I		I		I		I
54	Clearance of braking disc and braking pad.				I		I		I		I		I

55	Braking flat(wearing)	Normal use condition			I		I		I		I		I
		Inclement use condition		I	I	I	I	I	I	I	I	I	I
56	Braking disc(wearing, damage)	Normal use condition					I				I		
		Inclement use condition			I		I		I		I		I
Suspension system													
57	Tire (pressure, crack and damage)		I										
58	Tire groove depth		I		I		I		I		I		I
59	Check bolts, nut of wheel for loose				I		I		I		I		I
60	Check front wheel bearing for loose						I				I		
61	Check rear wheel bearing for loose						I				I		
62	Suspension (loose, damage, click, damage)	Normal use condition					I				I		
		Inclement use condition			I		I		I		I		I
63	Damper (leakage, damage)						I				I		
Transmission system													
64	Clutch pedal gap		I		I		I		I		I		I
65	Check drive axle for leakage				I		I		I		I		I
66	Check connection position of drive axle for loose				I		I		I		I		I
67	Check drive axle universal joint for dust, cover dust for crack, damage	Normal use condition					I				I		
		Inclement use condition			I		I		I		I		I
68	Exchange lubrication grease of drive axle		R: every 80, 000 km										
Electrical device													
69	Cauterization、loosen for battery terminal				I		I		I		I		I
70	Loosen、damnification for link cables						I				I		
71	Check liquid surface of battery		I										
Emission control system													
72	Check fuel for leakage	Normal use condition	I				I				I		
		Inclement use condition	I		I		I		I		I		I
73	Check fuel vapor line for damage						I				I		
74	Canister (clog, damage)						I				I		
75	TWC installation (loose, damage)						I				I		
76	Heat shield (loose, damage)						I				I		
Other system													

77	Check whether headlamps, stop lamps, rear fog lamps, turn-signal lamps, and etc are dirty and injury.	I										
78	Exhaust pipe, muffler (loose, damage)			I		I		I		I		I
79	Muffler function					I				I		
80	Body structure (loose, damage)					I				I		
81	*oil filter					R				R		

Table note:

“ “Inclement use condition” is applied for the vehicles driving in the inclement conditions.

Inclement use condition including the following:

(1) Driving in the dust, or the vehicle often is stopped in the air with salt and seawater.

(2) Driving on the accidented road, water road or hill road.

(3) Driving in cool place.

(4) In cool season, the engine idling running for a long time or often driving a short distance.

(5) Use brake frequently, often quick braking. Tow the vehicle. Used as taxi or rented car.

(6) Towing another vehicle

(7) Used for taxi.

Over the temperature of 32℃, driving time in traffic jam city is over 50% of total time, or under the temperature of 30℃, driving time by the speed of 120km/h or over is over 50% of total time.

The sign in the table: I—Inspection; R—Replace; *-For UAES state;

3 Trouble Shooting

3.1 Engine

The condition, possible cause and correction for engine see Table 3-1.

Table 3-1

Condition	Possible cause	Correction
Poor starting	Starter will not run	
	Battery electrical pole or electrify not enough	Tighten or charge
	Circuit poorly connected	Check and repair
	Starter damaged	Repair or replace
	No sparking	
	Ignition timing is not be adjusted	Adjust
	Grounding is poor	repair
	Ignition coil damaged	replace
	Faulty spark plug	adjust or replace
	Electron ignition system damaged	repair or replace
	Malfunction of the fuel system	
	Fuel pump feed fuel pressure lack	repair or replace
	Fuel hose and fuel filter clogged	Clearness
	Cylinder compression pressure reduce	
	Cylinder gasket breach	replace
	Valve clearance improperly adjusted or damaged	adjust, repair and replace
	Loose manifold, permitting air to be drawn in	tighten
	Worn pistons, rings or cylinders	repair and replace
Insufficient power	Accelerator control and throttle cable improperly adjusted	adjust
	Cylinder compression pressure reduce	check valve、 spark plug、 cylinder gasket leakage
	Ignition timing is not correct	adjust
	fuel feeding reduce	adjust or repair
	Intake air lacking	Check intake system
	Exhaust clogged	Check exhaust system or clear away carbon deposit
	Spark plug clearance improper or damaged	Adjust or replace

Continue

Knock cylinder sound of engine inside	Bearing shell wear, cam of camshaft damaged	Replace
	Crankshaft,connecting rod journal and piston pin wear badly	Replace or repair
	Piston ring damaged	Replace
	Valve clearance improperly adjusted	Adjust
	Camshaft,crankshaft thrust clearance too big	Adjust
Overheat	Improper ignition timing	Adjuster
	Inexactitude clearance of spark plug or accumulated carbon.	Clearness or adjust
	Loose of air intake manifold or jam of exhaust manifold.	Tighten or clearness
	Loose of fan belt	Adjust
	Lack of coolant or jam of hose.	Filling or clearness
	Inexactitude clearance or damage of water pump.	Repair or replace
	Lack of oil	Filling
	Damage of oil pump or jam of lubricating way.	Clearness or replace
	Damage of gasket.	Replace
	Slipping of clutch.	Repair or replace
	Jam of radiator	Clearness or replace
Excessive consumption of oil	Abrasion or damage of valve guide sealing.	Replace
	Abrasion or damage oil ring.	Replace
	Inadequate position of piston ring cutting part.	Replace
	Abrasion of valve and valve guide.	Replace
	Damage of cylinder head gasket.	Replace
	Exhaust of oil through breeze hole by high pressure which caused by overheat	Check relative position

Continue

Big noise of clutch	Disengage bearing worn-out or damaged	Replace
	Input shaft bearing worn-out	Replace
	The driven plate wheel of friction disk assembly loose	Repair
	Crack at the part of friction disk assembly	Replace
	Clutch pressure plate and butterfly spring loose	Repair or replace
	Clutch disc oiled	Clearness or re[lace
	Clutch rubber damp pole or spring damage	Replace

3.2 Exhaust System and Cooling System

The condition, possible cause and correction for exhaust system and cooling system see table 3-2.

Table 3-2

Condition	Possible cause	Correction
Poor performance of muffler	Loose exhaust pipe connection	Retighten
	Loose exhaust manifold	Retighten
	Broken exhaust manifold and muffler	Repair or replace
	Broken muffler gasket	Replace
	Interference between vehicle body and muffler	Repair, eliminating any contact
	Exhaust pipe seal ring damaged	Replace
Poor emission	Damage of TWC and O2 sensor, which caused by use of lead fuel.	Replace
	Damage of TWC and O2 sensor, which caused by misfire of ignition system.	Replace
	Leakage of exhaust system, ECU can't get the right signal of O2 sensor, causing air/fuel ratio rich	Repair
Fan doesn't work	Fuse wire is not good	Replace
	No continuity of the relay	Repair or replace
	No continuity of the control	Repair or replace
	No continuity of wire or linker	Repair or replace
	Trouble of ECU	Replace
Fan always running	No continuity of the relay	Repair or replace
	No continuity of the control	Repair or replace
	No continuity of wire or linker	Repair or replace
	Trouble of ECU	Replace

3.3 Clutch

The condition, possible cause and correction for clutch see table 3-3.

Table 3-3

Condition	Possible cause	Correction
Dragging clutch	Leak of system	Repair
	Jam of pipe	Repair or replace
	Lack of fluid or interfuse the air	Filling or exhaust
	No enough cylinder stroke or piston locked	Repair or replace

3.4 Drive Shaft

The condition, possible cause and correction for drive shaft see table 3-4.

Table 3-4

Condition	Possible cause	Correction
Drive noise	Worn joints	R Replace
	Insufficient lubrication in joints	Lubricate
	Insufficient lubrication in differential	Lubricate
	Broken boot	Replace
	Leaking oil seal from differential	Replace

3.5 Brake System

The condition, possible cause and correction for brake system see table 3-5.

Table 3-5

Condition	Possible cause	Correction
Insufficient braking force	Brake fluid leakage from brake lines	Locate leaking point and repair
	Brake disc or pads stained with oil	Clean or replace
	Overheated brakes	Find cause and repair
	Badly contact between brake drum and shoe linings	Repair，adjust as prescribed
	Brake shoe linings stained with oil or water	Replace
	Badly worn brake shoe linings	
	Wheel cylinder malfunctioning	Replace
	Caliper assembly malfunctioning	Repair or replace
		Repair or replace
Brake Pull (Brake not working in union)	Shoe linings stained with oil or water	Replace
	Drum-to-shoe clearance out of adjustment	Check for inoperative auto adjusting
	Drum out of round in some brakes	
	Wheel tires inflated unequally	Replace
	Malfunctioning wheel cylinder	Inflate equally
	Disturbed front end alignment	Repair or replace
	Unmatched tires on same axle	Adjust as prescribed
	Restricted brake tubes or hoses	Use same tires on same axle
		Check for soft hoses and damaged lines.

	Loose suspension parts Loose calipers Malfunctioning caliper assembly	Replace with new hoses and tubes Check all suspension mountings Check and torque bolts to specifications Check for sluggish calipers, proper lubrication of caliper slide bush and caliper slide, and repair or replace
Excessive pedal travel	Partial brake system failure Air in brake system (pedal spongy phenomenon) Rear brake system not adjusted Bent brake shoes Worn brake shoes Insufficient brake fluid in master cylinder reservoirs	Check brake system and replace as necessary Brake system bleeding Adjust rear brakes(Repair auto adjusting mechanism) Replace brake shoes Replace brake shoes Fill reservoirs with approved brake fluid，check brake system for leaks
Dragging brakes（A very light drag is present in all disc brakes immediately after pedal is released）	Master cylinder pistons not returning correctly Restricted master cylinder returning Restricted brake tubes or hoses Incorrect parking brake Weakened or broken return spring in the brake Sluggish parking cables Wheel cylinder or caliper piston sticking	Repair master cylinder Clean Check for soft hoses and damaged lines. Replace with new hoses and tubes Check and adjust to correct specification Replace spring Repair or replace Repair as necessary
Pedal pulsation (Pedal pulsates when depressed for braking)	Damaged or loose wheel bearings Rear drums out of round Excessive disc lateral run out	Replace wheel bearings Check run out Check disc as specifications, repair or replace
Braking noise	Glazed shoe linings or foreign materials stuck to linings Worn or damaged shoe linings Loose front wheel bearings Distorted backing plates or loose mounting bolts	Repair or replace shoe linings or pads Replace shoe linings or pads Replace bearing Replace back plate, tighten or replace bolts
ABS warning lamp light	Old trouble codes not erased	Erase trouble codes with the diagnose tester Check trouble codes with the diagnose tester,

	Bad working or damaged ABS system parts	repair or replace

3.6 Suspension, Steering System and Tire

The condition, possible cause and correction for suspension, steering system and tyre see table 3-6.

Table 3-6

Condition	Possible cause	Correction
Steer difficult	Unsuitable tire pressure	Adjust pressure
	Locked tie rod joint	Repair or replace
	Maladjustment of steering gear case	Adjust
	Wear of column bearing or joint bearing	Replace
	Disturbed front wheel alignment	Adjust
Wobbly steering wheel (Shimmy, shake or vibration)	Wheel tires not adequately inflated	Adjust tire pressure
	Wobbly wheels	Repair or replace
	Large difference in tire diameter between right and left wheels	Replace
	Loose hub nuts	Retighten
	Damage or wear of wheel bearing	Replace
	Worn or loose tie rod ends	Replace or tighten
	Maladjustment or loose of steering gear case	Adjust or tighten
	ire or wheel out of balance	Balance wheel or replace tire
	Blister or bump on tire	Replace
	Disturbed front wheel alignment	Check front wheel alignment
Steering wheel pulling to one side（car pulls）	Unevenly worn wheel tires	Replace
	Brake dragging in one road wheel	Repair
	Wheel tires unequally inflated	Adjust tire pressure
	Worn or distorted tie rod	Replace
	Disturbed front wheel alignment	Check front wheel alignment
	Loose, bent or broken front or rear suspension parts	Retighten or replace suspension parts
	Bad meshed steering gear	Replace
Shocks coming to steering wheel (or wheel tramp)	Tire inflating pressure too high	Reduce to the specification
	Poor shock absorber performance	Replace
	Differences in tire diameter among four road wheels	Adjust
	Worn steering linkage connections	Replace
	Worn or broken front wheel bearings	Replace
	Loose front wheel	Retighten
	Blister or bump on tire	Retighten
	Small rotating torque of steering gear	Replace
Rapid wear or	Wheel tires improperly inflated	Adjust tire pressure

uneven wear of wheel tires (Abnormal or excessive tire wire)	Differences in diameter among four tires	Adjust or replace
	Worn or loose road wheel bearings	Replace
	Wobbly wheel tires	Repair or replace
	Wheel tires improperly “rotated” to result in unbalance	Adjust
	Disturbed wheel alignment	Adjust
	Disturbed driving conditions	Adjust
Steering noise	Loose bolts and nuts	Retighten
	Broken or otherwise damaged wheel bearing	Replace
	Wear of tie rod ends or drag rod ball joint	Lubricate or replace
Too much play in steering	Worn wheel bearings	Replace wheel bearing
	Steering gear box attachments loose	Tighten or repair
	Steering gear box adjustments	Check and adjust
	Wear of tie rod ends or drag rod ball joint	Replace tie rod end or tie rod
Poor returnability	Bind in tie rod end ball studs	Replace tie rod end
	Bind in steering column	Repair and replace
	Lack of lubricant steering gear box	Check, lubricate or replace
	Disturbed front end alignment	Check and adjust front end alignment
	Steering gear box adjustment	Check and adjust gear box torque
	Improper tire pressure	Adjust pressure
Abnormal noise, front end	Worn, sticky, loose tie rod ends or drag rod ball joint	Replace tie rod end, drag rod
	Damaged shock absorbers or mountings	Replace or repair
	Looseness of stabilizer bar	Tighten bolt or replace bushes
	Loose wheel nuts	Tighten
	Loose suspension bolts or nuts	Tighten bolts or nuts
	Broken or otherwise damaged wheel bearings	Replace
	Broken suspension springs	Replace
Wander or poor steering stability	Mismatched or uneven tires	Replace tire or inflate tires to proper pressure
	Loose tie rod ends or drag rod	Replace tie rod end or drag rod
	Faulty shock absorber or mounting	Replace absorber or repair mounting
	Looseness of stabilizer bar	Tighten or replace stabilizer bar or bushes
	Broken or sagging springs	Replace spring
	Steering gear box adjustment faulty	Check or adjust steering gear box torque
	Front wheel alignment	Check front wheel alignment
Wander or poor	Broken or sagging springs	Replace

steering stability	Overloaded Incorrect springs	Check loading Replace
Ride too soft	Faulty shock absorbers	Replace
Suspension bottoms	Overloaded Faulty shock absorber Incorrect, broken or sagging springs	Check loading Replace Replace
Body leans or sways in corners	Looseness of stabilizer bar Faulty shock absorber or mounting Broken or sagging spring Overloaded	Tighten bolt or replace bushes Replace shock absorber or tighten mounting Replace Check loading
Oil lever of power steering reservoir is too low	Air runs out of steering system. Leakage of steering gear, hose, pump and connection of oil groove	Refilling the oil to top limit Check leakage and tighten the connection
No any leakage, but the oil is filled by two times	Remaining air runs out of steering system Oil is leaked into the undee bush because of damage of steering rack.ui	Refilling the oil to top limit Replace steering gear assembly
Steering tread different is large and steering is heavy	Loosen of hose clip on centrifugal Oil passed by pump is little because of impurity Passing pressure is low Conglutination of pressure limit valve and flow limit valve There is impurity in valve control groove.	Installing hose clip Replace pump Check pressure or replace pump Replace pump Replace steering gear assembly
Noise of steering of power steering system	Oil lever of power steering reservoir is too low Idling is not steady. Drive belt is too loose. Bolt connecting pump and bracket is too loose Belt wheel installing bolt is too loose.	Refilling the oil to top limit Adjusting idling Adjusting drive belt Tighten connecting bolt Tighten connecting bolt
Oil is foamy or emulsible	Input joint connection and output joint connection is loose.(mixed air though of no leakage)	Tighten connecting bolt
The noise of (ZiZi) for steering gear. (even while steering wheel stops)	There is impurity in the Valve body.	Replace steering gear assembly
Noise of avulsion	Installing is too tighten.	Turn tie rod connecting bolt loosen,and then return it. Then tighten the steering gear connecting bolt.

4 Engine

4.1 General Description

The engine is the in-line 4 cylinders, water-cooled, 4-stroke cycle MPI engine. It is single overhead camshaft (SOHC) and 16 valves. Valves opening and closing through camshaft that is driven by crankshaft through synchronizing tooth type belt. See fig.4-1、fig.4-2. The engine used MPI system of MMC and MPI system of UAES M7.9.7. The content of the vehicle exhaust deleterious gas is reduced out and away. It can meet the green environmental-protection power of new emission regulation completely.

The engines adopts MPI system, involve the sensors and ECU ,and controlled by ECU (electronic control unit) according to the signals, which send out by the sensors including inspecting engine-working condition sensors. Administer equipment works controlled by ECU system, which has the functions of fuel injection controlled, idle controlled, ignition timing controlled. ECU also can simplify diagnostic mode when trouble happened.

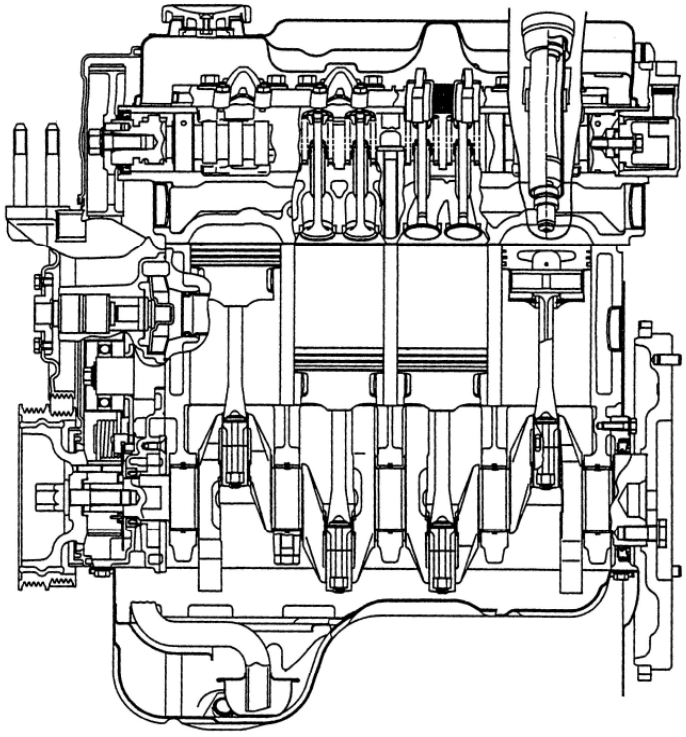


Fig 4-1

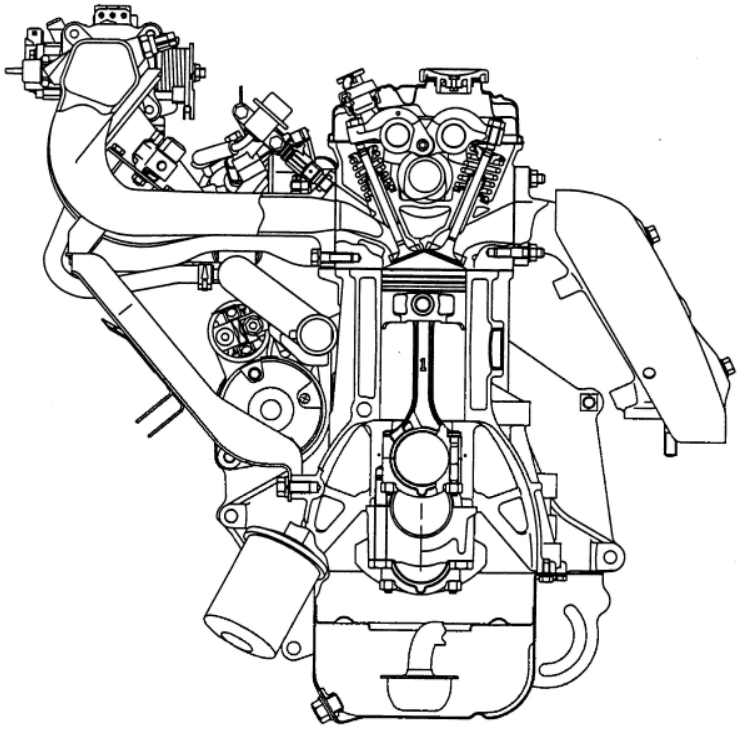


Fig 4-2

4.2 Engine’ s Inspection (not Require Engine Removal)

The following parts or components do not require engine removal to receive services (replacement, inspection or adjustment), see table 4-1:

Table 4-1

Part or Component	Nature of Service

①Spark Plug	Replacement or inspection
② Oil Filter	Replacement
③ Oil Pressure Sensor	Replacement
④ Valve Chamber Cover	Replacement
⑤ Rocker Arm Shaft	Replacement or inspection
⑥ Rocker Arm	Replacement or inspection
⑦ Rocker Arm Spring	Replacement or inspection
⑧ Camshaft	Replacement or inspection
⑨ Cylinder Head Cover	Replacement or inspection
⑩ Radiator	Replacement or inspection
⑪ Camshaft driven synchronization gear	Replacement or inspection
⑫ Crankshaft initiative synchronization gear	Replacement or inspection
⑬ Timing belt	Replacement
⑭ Oil basin and oil strainer	Replacement or inspection
⑮ Inlet manifold	Replacement
⑯ Alternating current generator	Replacement or inspection
⑰ Starter	Replacement or inspection
⑱ Water pump	Replacement
⑲ Belt pulley（crankshanft generator water pump）	Replacement, inspection or adjustment
⑳ Synchronization belt cover	Replacement or inspection
㉑ Cooling hose	Replacement or inspection
㉒ Oil pump、piston、piston ring and connecting rod	Replacement or inspection
㉓Water pump chain pulley	Replacement or inspection

4.3 Engine Removal

- Remove the fender apron under the engine;
- Unscrew the water drain plug of the radiator and cylinder , drain off coolant.
- Disconnect the anode cord of storage battery from engine;
- Disconnect the cathode cord of storage battery from storage battery;
- Disconnect the secondary bond strap of storage battery from pipe assy,fuel delivery;
- Disconnect the connector of backing-up lamp switch;
- Disconnect connector from the pole of alternating current generator;
- Disconnect A/C pipeline from compressor according to disassembly operates of about A/C.
- Disconnect accelerator cable from throttle body assembly;
- Disconnect the connection-pegs of the wires from the fuel injectors.
- Disconnect crankcase bleed pipe from air filter;
- Disconnect intake hose from throttle body assembly;
- Disconnect inlet fuel hoses and return fuel hoses(be the same with MMC MPI) from fuel rail

assembly.

CAUTION

BECAUSE PRESSURE IN THE FUEL PIPES IS VERY HIGHER WHILE THE ENGINE STOP RUN. DISCONNECT FUEL HOSE AFTER DRAIN FUEL, IN ORDER TO AVOID FUEL EJECTING AND HAPPENING DANGER.

- Disconnect flexible shaft of odometer from transmission.
- Disconnect water return and outlet hose of the heater.
- Disconnect inlet fuel hose and return fuel hose of power steering pump.
- Disconnect the high tension cable from ignition coil.
- Disconnect all the wire’s sensors and administer equipment s, the sensors and administer equipments see table 4-2:

Table 4-2

Number	Name	Position	Note
1	Intake temperature pressure sensor	Inlet manifold stability pressure chamber	
2	Throttle position sensor	Throttle assembly	
3	Rotate speed sensor	Cover, Assy, Clutch	
4	Camshaft position sensor	Backside of cylinder head	
5	Crankshaft phase sensor	Between t/belt front upper cover and t/belt front lower cover	
6	Coolant temperature sensor	Thermostat seat	
7	Water temperature sensor	On the tie-in of inlet water hose	
8	Idle adjuster	Throttle assembly	
9	Canister control valve	Bracket of canister on the inlet manifold	
10	Knock sensor	Between No.2 cylinder and No.3 cylinder	

- Disconnect vacuum booster hose from throttle body assembly;
- Disconnect water inlet and outlet hose from radiator;
- Disconnect hige-pressure oil hose of clutch multiple-flow pump;
- Disconnect the wire of oxygen sensor;
- Remove muffler from exhaust manifold and body frame;
- Remove drive shaft;
- Disconnect gear shift control cables from the transmission;
- Remove the lower cover of radiator;
- Support engine and transmission;
- Remove engine rear insulator assy from vehicle frame;
- Remove insulator assy from the engine;
- Remove the member assy from vehicle frame;
- Remove steering crossbeam assy from the vehicle body;

CAUTION
INSPECT ALL CONNECTORS AROUND THE ENGINE AGAIN, BE SURE ALL ARE REMOVED BEFORE REMOVING THE ENGINE.

- Raise the vehicle body, remove the engine assy(including engine member assy. and steering crossbeam assy) ;
- separate engine right insulator assy. from the engine assy;
- separate engine left insulator assy. from the engine assy;
- Remove the lower cover of clutch;
- remove the starter;
- separate the engine assy from the transmission.

4.4 Engine Removal and Installation

1. Workshop Regulations

1）Prepared the part boxes and the part shelves for placing the parts that are disassembled, in order to avoid happening confusion and inaccuracy, the boxes and shelves must be deposited orderly and be sticked label to be necessary.

2）In order to avoid shattering the machining surface, you must be carefully to overhauling the metal aluminium parts.

3） You must preparing enough assistant materials for overhaul.

4） You must screw down the bolts and other moored parts according to the regulatable numerical value by the special tools, if they are required to screwed down by standard torque.

5） After overhaul, the parts which are used only once must be rejected, you should instead the new parts.

6） You should use the exactitude tools to progressing removal and assembly.

7） You should consult the content in this manual when you are overhauling.

8） We advise you to consult the men who work at the product sell Dept in our company about the technology questions that you can’t solve when you are overhauling.

2. Needs Material for workshop

The material listed in the below table are indispensabilitied when you overhaul this type engines. So, you should prepare the material at any moment for using.

DAE Engine assembly submaterial see Table4-3:

Table 4-3

Number	Name	Location	Specification Trademark
1	Oil	Oil accession、Assembly oil	All year in the south，summer in the north：SAE15W-40；summer in the north（November every year to March next year）：SAE5W-30.The lever is SG and upward
2	Silica gel	Case Assy，Oil Pump、Pump Assy, Water、Pan Assy，Oil	LT5699
3	Sealants	Switch Assy, Oil Pressure、Setting Water Plug，Taper、Bolt, Flywheel	LT243
4	Sealants	Sensor, Water Temp	**LT648**
5	Silica gel	Case, Crankshaft Rear Oil Seal	LT5699
6	Gasolene		93# and above 93# without plumbum

Cylinder Head assembly submaterial see Table4-4:

Table 4-4

Number	AOS Use Material And Model	Material And Model Now	Location
1	Oil	All year in the south，summer in the north：SAE15W-40；summer in the north（November every year to March	Valve Head

		next year）：SAE5W-30.The lever is SG and upward	
2	Oil	All year in the south，summer in the north：SAE15W-40；summer in the north（November every year to March next year）：SAE5W-30.The lever is SG and upward	Camshaft Assy、Rocker Arm 、Rocker Shaft
3	Sealants TB1386D	LT271	Stud
4	Oil	All year in the south，summer in the north：SAE15W-40；summer in the north（November every year to March next year）：SAE5W-30.The lever is SG and upward.	Camshaft Oil Seal
5	Sealants	LT962T	Guide, Spark, Plug、Block, Cylinder/ Head, Cylinder Cap，Sealing、Nipple

3 **REMOVAL AND INSTALLATION**

1）**ALTERNATOR AND IGNITION SYSTEM**

Removal and installation steps：

UAES MPI see Fig.4-3a,MMC MPI see Fig.4-3b：

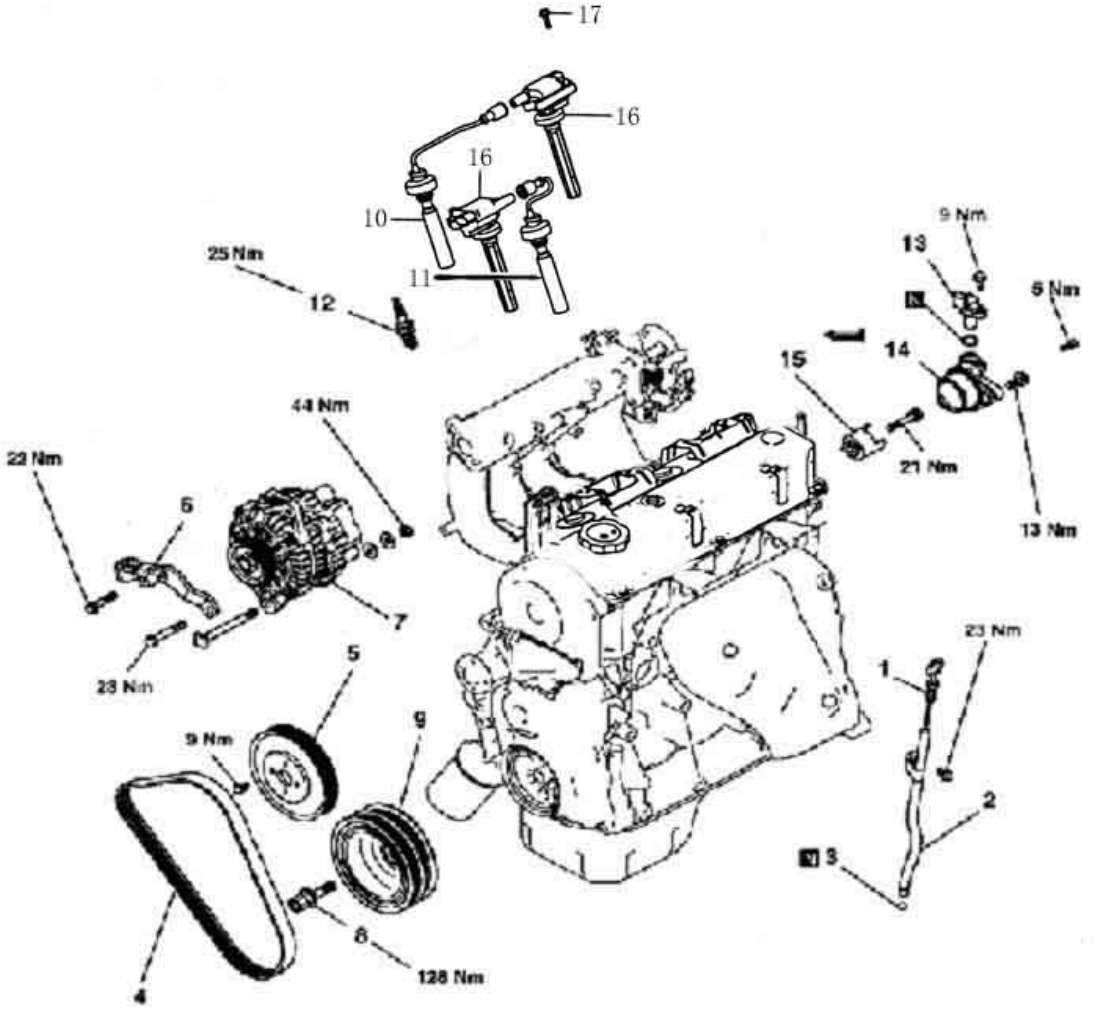


Fig.4-3a

Removal steps：

1	Oil level gauge	9	Crankshaft pulley
2	Oil level gauge guide	10	Spark plug cable
3	O-ring	11	Spark plug cable
4	V belt	12	Spark plug
5	Water pump pulley	13	Cam position sensor
6	Alternator brace	14	Cam position sensor support
7	Alternator	15	Cam position sensing cylinder
8	Crankshaft bolt	16	Ignition coil
		17	**B**olt

MMC MPI：

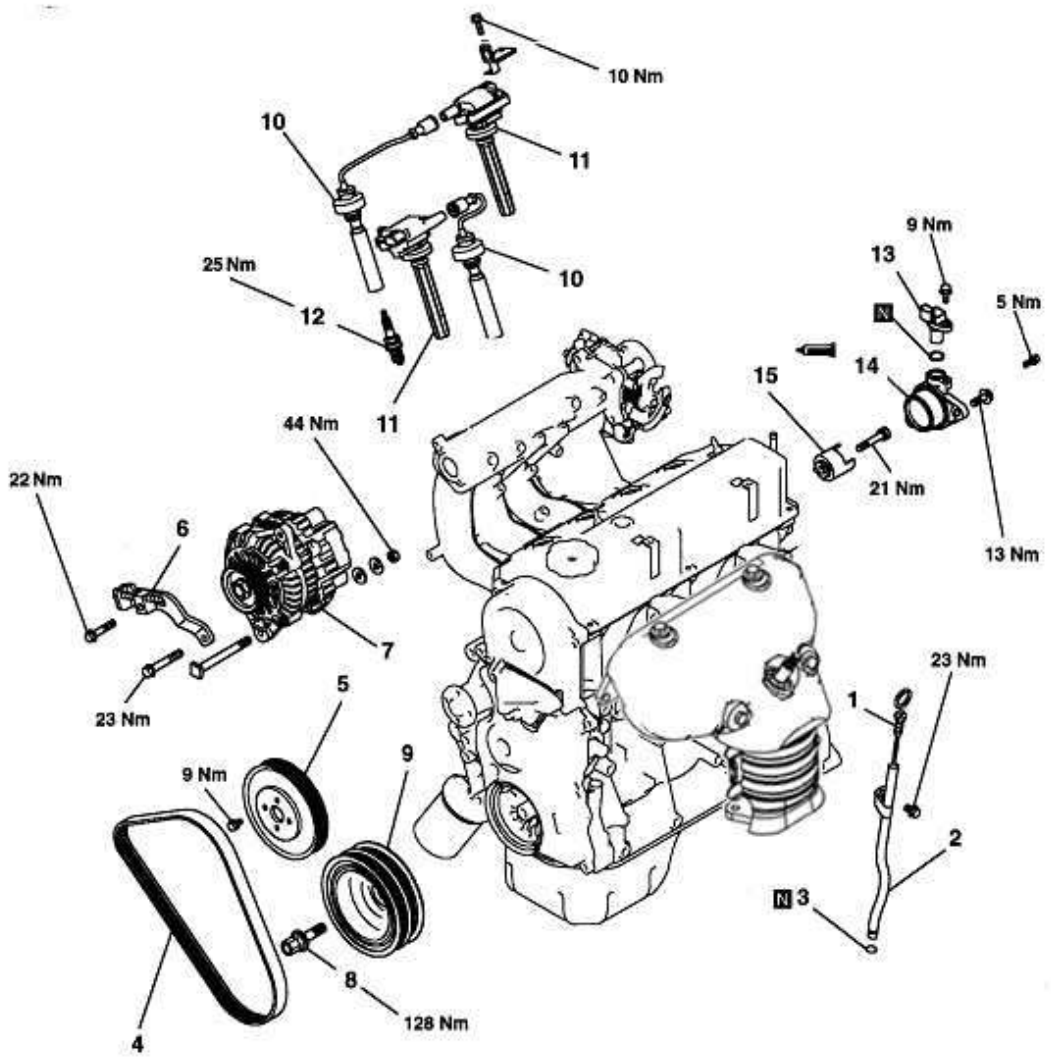


Fig.4-3b

Removal steps：

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. V belt
5. Water pump pulley
6. Alternator brace
7. Alternator
8. Crankshaft bolt
9. Crankshaft pulley
10. NO.1 spark plug cable assy
10. NO.3 spark plug cable assy
12. Spark plug
13. Cam position sensor
14. Cam position sensor support
15. Cam position sensing cylinder

SERVICE POINTS OF REMOVAL:

REMOVAL OF CRANKSHAFT PULLEY

Lock the flywheel or drive plate in position using the special tool shown in the illusreation below, the loosen crankshaft bolts, see Fig.4-4.

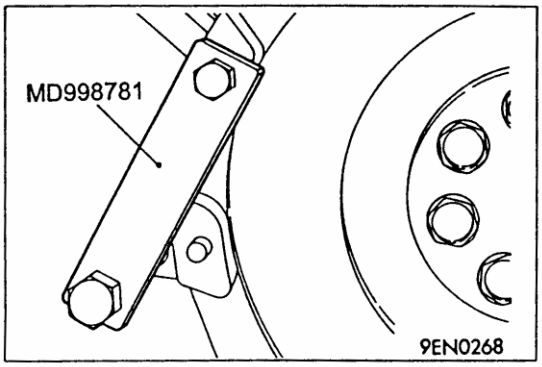


Fig.4-4

SERVICE POINTS OF INSTALLATION：

（1）INSTALLATION OF CAM POSITION SENSOR SUPPORT

Apply a 3 mm bead of form-in-place gasket（FIPG）to the area shown, see Fig.4-5。

Specified sealant: LT5699

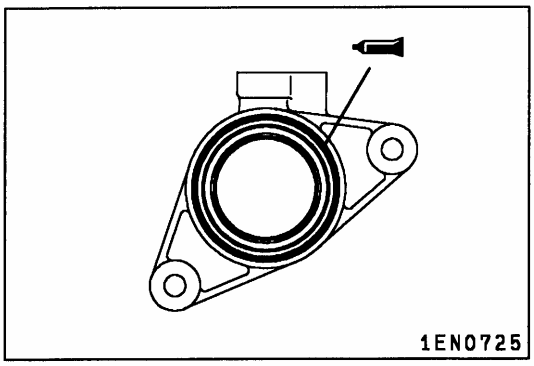


Fig.4-5

（2）INSTALLATION OF CRANKSHAFT PULLEY

Lock the flywheel or drive plate in position using the special tool shown in the illusreation, thentighten the crankshaft bolts, see Fig.4-6.

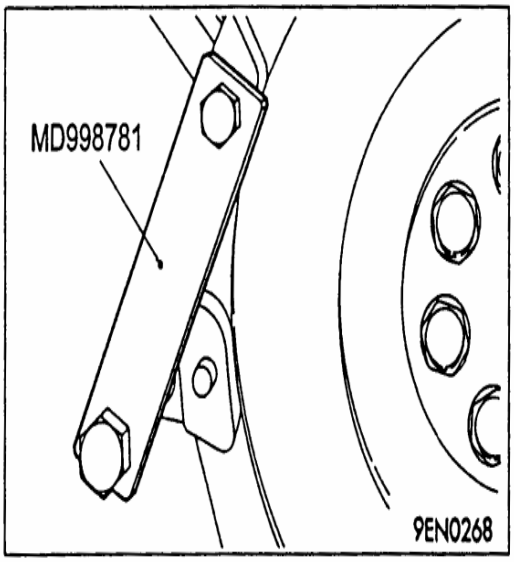


Fig.4-6

2）**TIMING BELT**

Removal and installation steps see Fig.4-7.

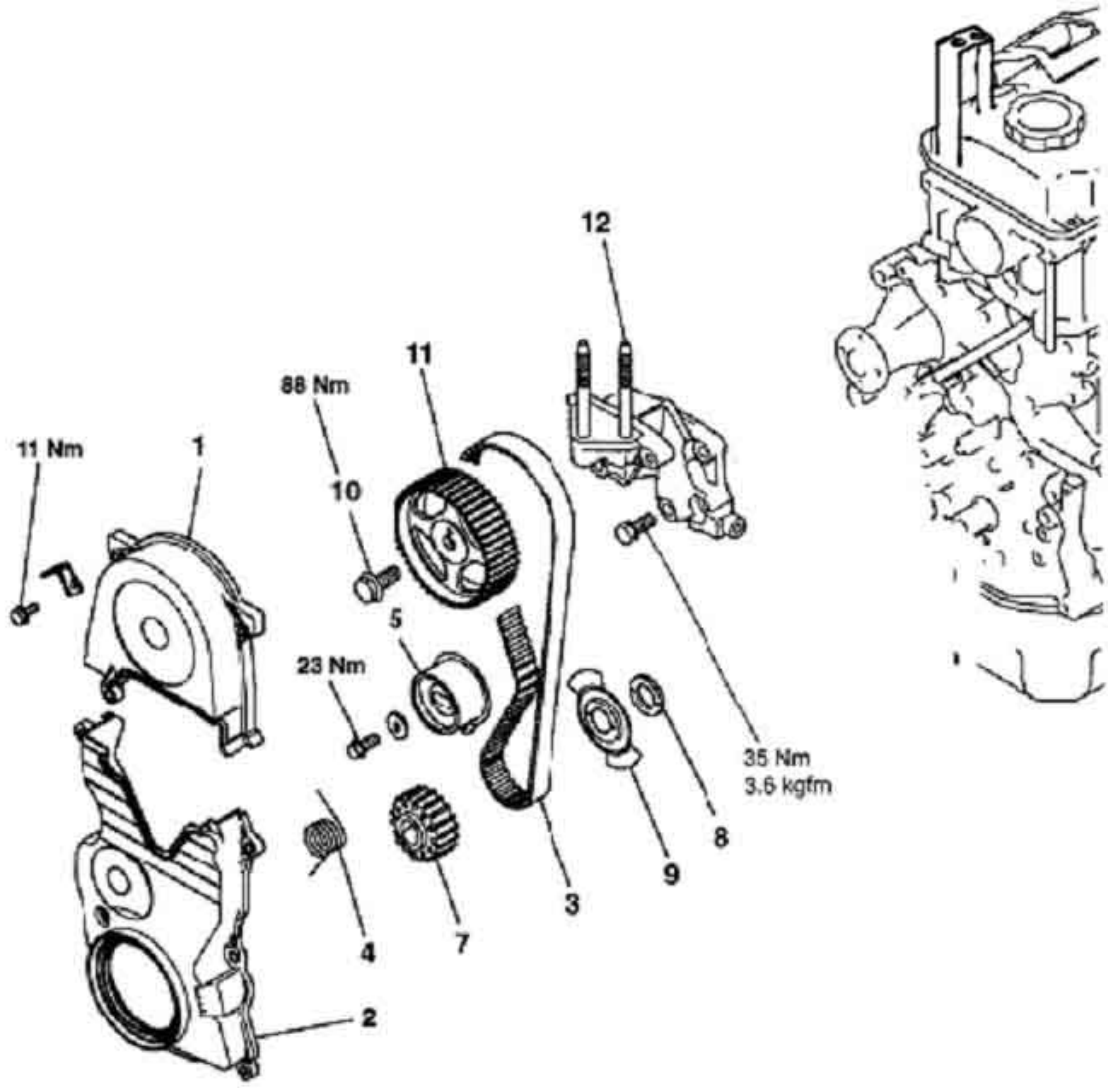


Fig.4-7

Removal steps：

1	Timing belt upper cover	8	Spacer
2	Timing belt upper cover	9	Sensing blade
3	Timing belt	10	Camshaft sprocket bolt
4	Tensioner spring	11	Camshaft sprocket
5	Timing belt tensioner	12	Engine support bracket
7	Crankshaft sprocket		

SERVICE POINTS OF REMOVAL:

(1) REMOVAL OF TIMING BELT/TENSIONER SPRING/TIMING BELT TENSIONER

a Using pliers, grip the tensioner spring projection and remove it from the oil pump case stopper. Then remove the tensioner spring, see Fig.4-8.

b Remove the timing belt tensioner.

c If the timing belt is to be reused, chalk an anrrow on the belt to indicate the direction of rotation before removing it.This will ensure the timing belt is fitted correctly when reused.

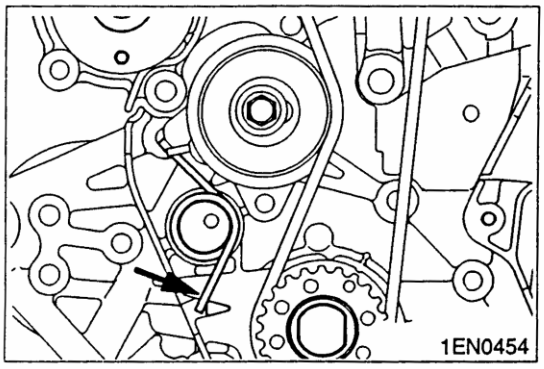


Fig. 4-8

(2) REMOVAL OF CAMSHAFT SPOCKET BOLT

a Using the special tools shown in the illustration, lovk the camshaft sprocket in position, see Fig.4-9.

b Loosen the camshaft sprocket bolt.

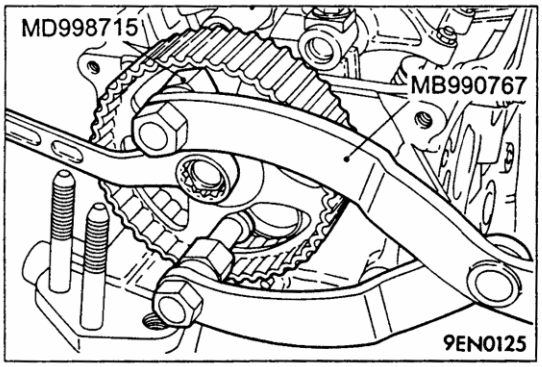


Fig.4-9

SERVICE POINTS OF INSTALLATION;

(1) INSTALLATION OF CAMSHAFT SPOCKET BOLT

a Using the special tools shown in the illustration, lock the camshaft sprocket in position.

b Tighten the camshaft sprocket bolt to the specified torque, see Fig.4-10.

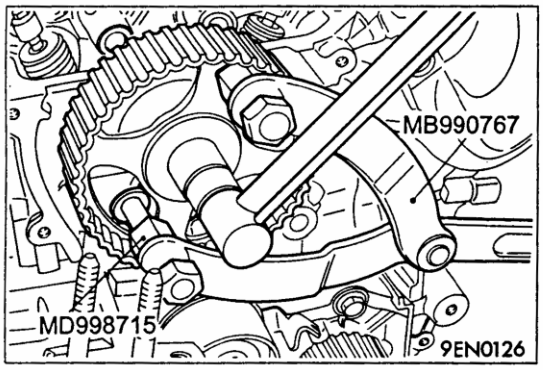


Fig.4-10

(2)INSTALLATION OF TENSIONER SPRING/TIMING BELT TENSIONER

a Lock the timing belt tensioner in the illustrated position, see Fig.4-11.

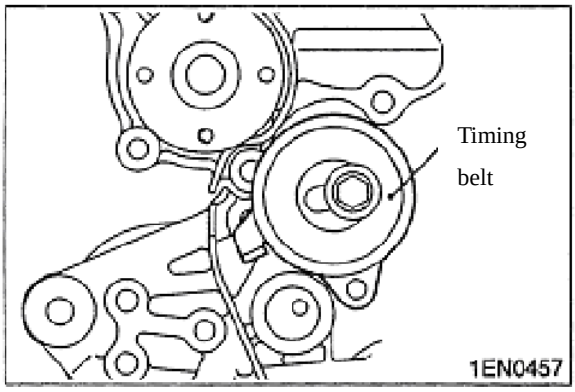


Fig.4-11.

b Fit one of the tensioner spring projections over the hooked portion of the timing belt tensioner and fit the tensioner onto the oil pump case, see Fig.4-12.

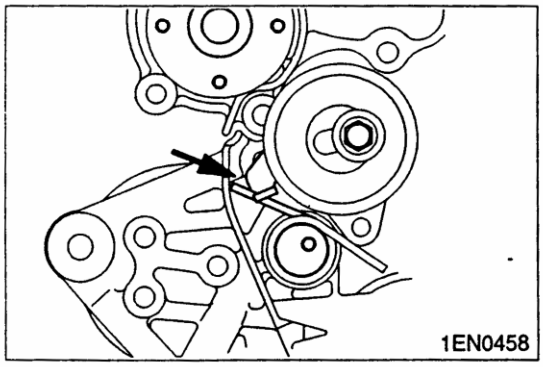


Fig.4-12

c Grip the other tensioner spring projection and fit it onto the oil pump case lug as shown in the illustration, see Fig.4-13.

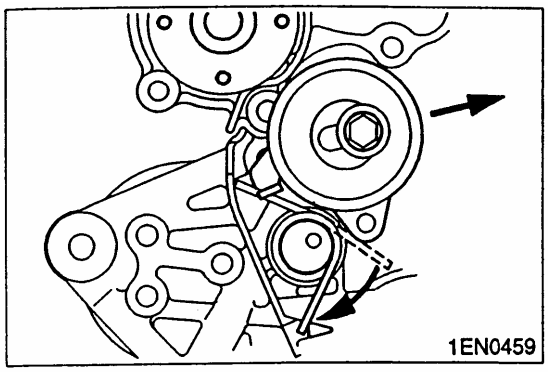


Fig.4-13

d Move the timing belt tensioner in the direction shown and temporarily tighten the bolt, see Fig.4-13.

(3)INSTALLATION OF TIMING BELT

a Align the camshaft timing mark with the timing mark on the cylinder head, see Fig.4-14.

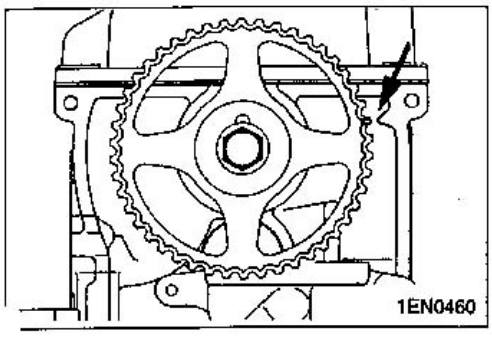


Fig.4-14

b Align the crankshaft timing mark with the timing mark on the front case, see Fig.4-15.

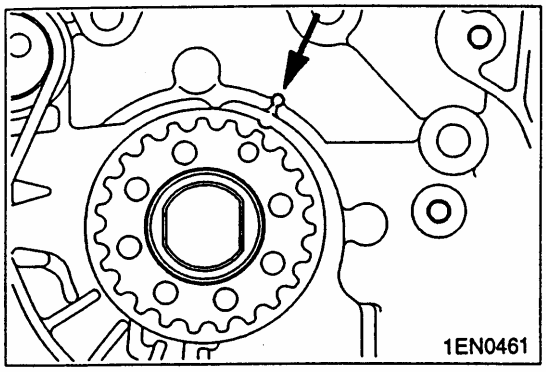


Fig.4-15

c Keeping the tension side of the timing belt tight, fit the timing belt onto the crankshaft sprocket, camshaft sprocket, and tensioner pulley in that order, see Fig.4-15.

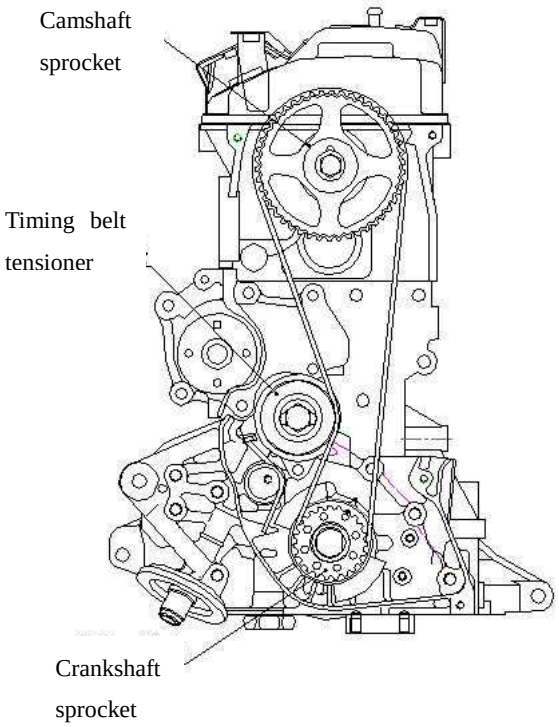


Fig.4-16

d Loosen the tensioner pulley mounting bolts by 1/4 to 1/2 of a turn and allow the tensioner spring to apply tension to the timing belt, see Fig.4-16.

e Turn the crankshaft twice in the normal totating direction (clockwise) and check that the timing marks are correctly aligned.

Caution
This procedure utilizes the camshaft's driving torque to apply tension evenlytothe timing belt. Be sure to turn the crankshaft as described above. Do not turn the crankshaft in reverse.

f Tighten the tensioner pulley mounting bolts.

3)FUEL AND EMISSION CONTROL SYSTEMS

Removal and installation steps,UAES MPI see Fig.4-17a, MMC MPI see Fig.4-17b：

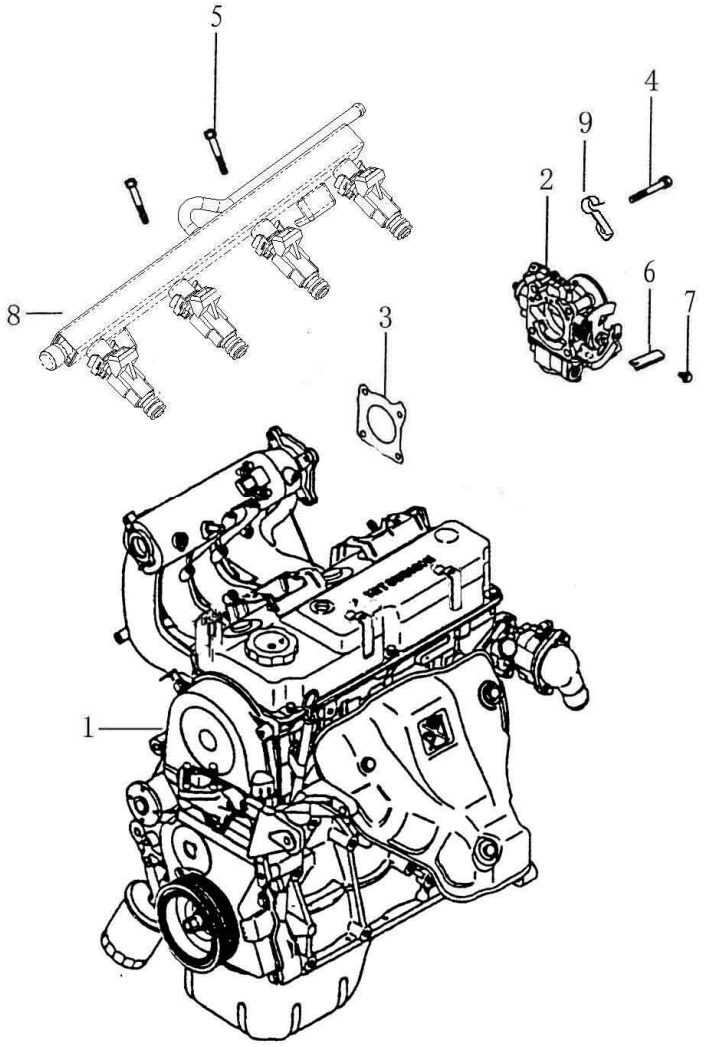


Fig.4-17a

1. Engine assembly 2. Throttle body assembly
3. Gasket 4. Bolt, washer assembled
5. Bolt, washer assembled 6. Harness bracket
7. Flange bolt 8. Fuel delivery pipe and injector assembly
9. Clip，hose

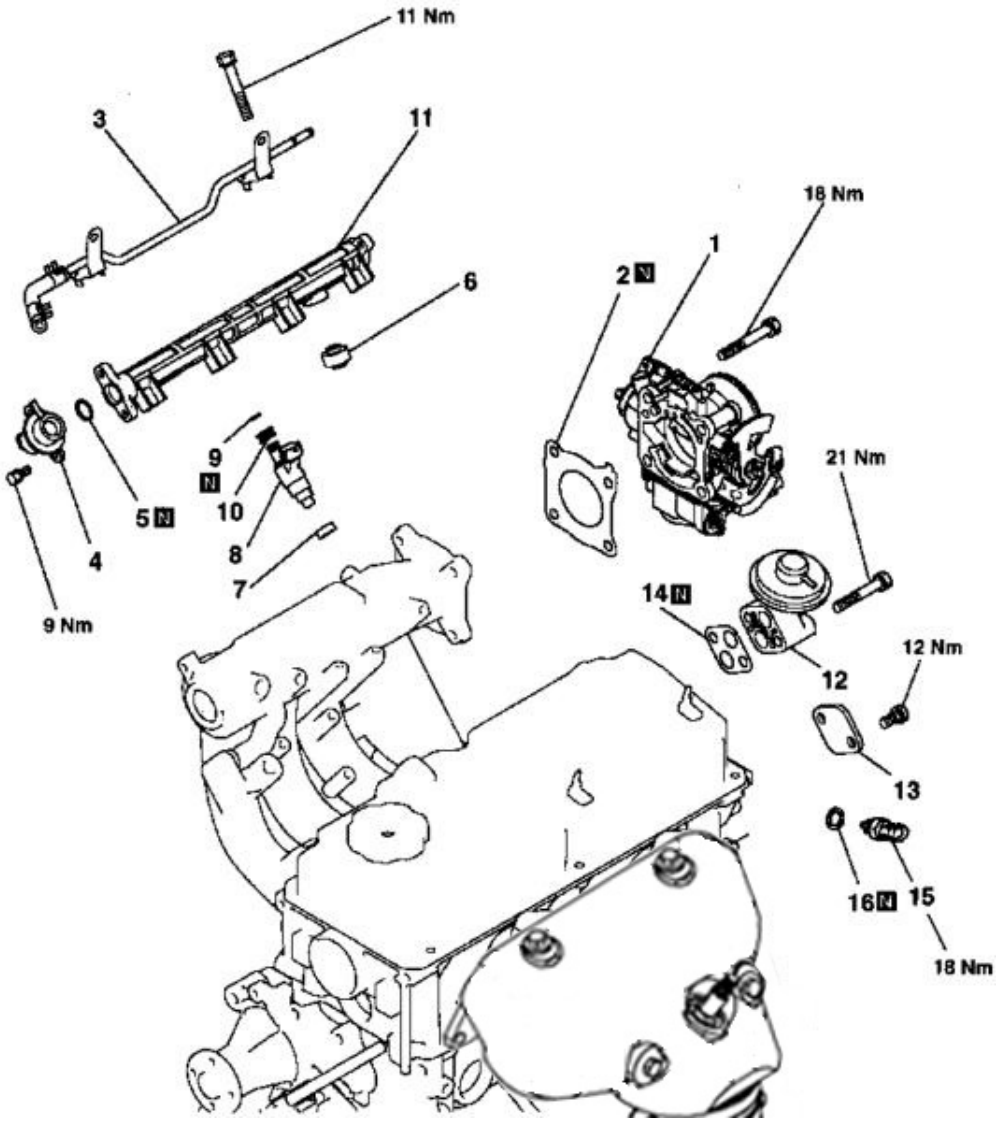


Fig.4-17b

1. Throttle body assembly
2. Gasket
3. Fuel return hose
4. Fuel pressure adjuster
5. O ring
6. Insulator
7. Insulator
8. Injector
9. O ring
10. Guard ring
11. Fuel rail main pipe
12. EGR valve
13. Valve cap
14.Spacer
15. Inlet temperature sensor
16. Spacer

SERVICE POINTS OF INSTALLATION:

THE INSTALLATION STEPS OF FUEL DELIVERY PIPE AND INJECTOR ASSEMBLY

a Befor the assembly installation, to make installation easy, please daub clearly lubricating oil on the o-ring

b Be carful don’t mar the o-ring when installing the injector.

c Peg 8 on the intake maniford with 5

4） WATER PUMP AND WATER HOSE

Removal and installation steps see Fig.4-18：

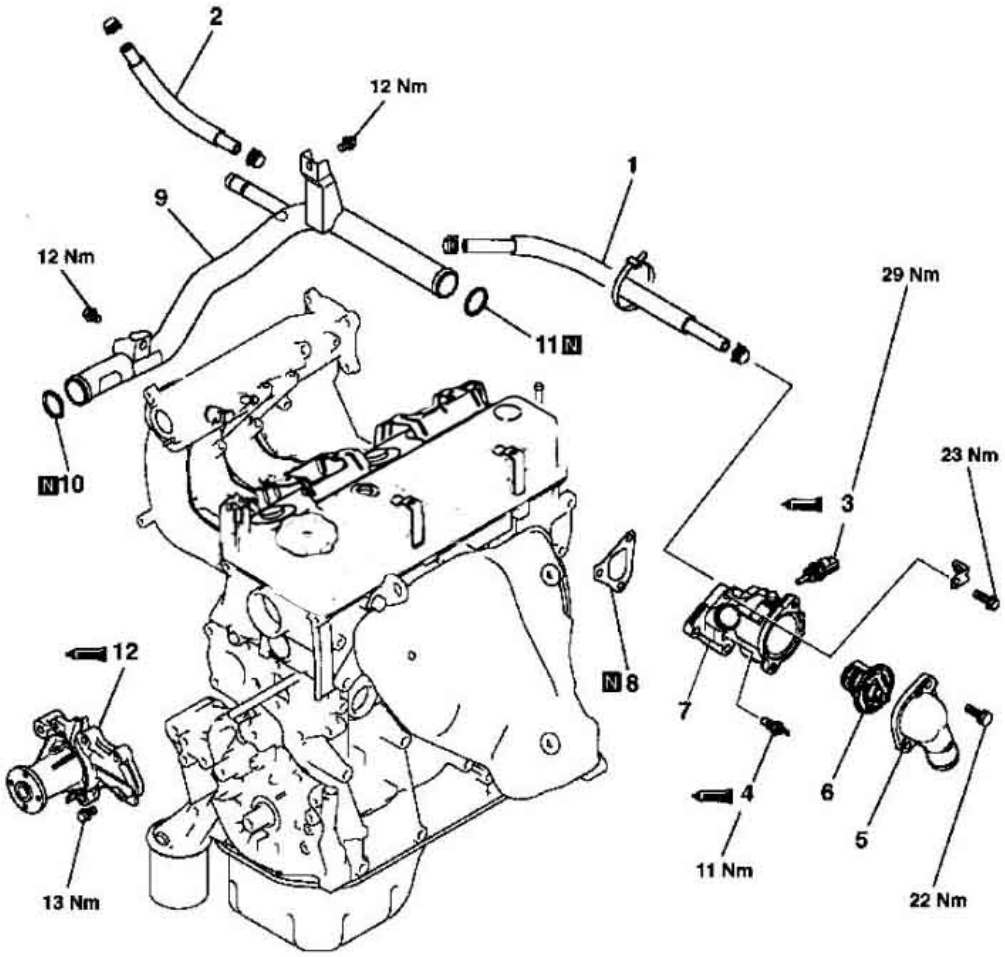


Fig.4-18

1. Water hors
2. Water hors
3. Water temperature sensor
4. Water temperature gauge unit
5. Water inlet fitting
6. Thermostat
7. Thermostat case
8. Gasket
9. Inlet pipe
10. O-ring
11. O-ring
12. Water pump

SERVICE POINTS OF INSTALLATION:

（1）THE INSTALLATION STEPS OF WATER PUMP(see Fig.4-19)

Daubing FIPG which will be 3mm to the install surface.

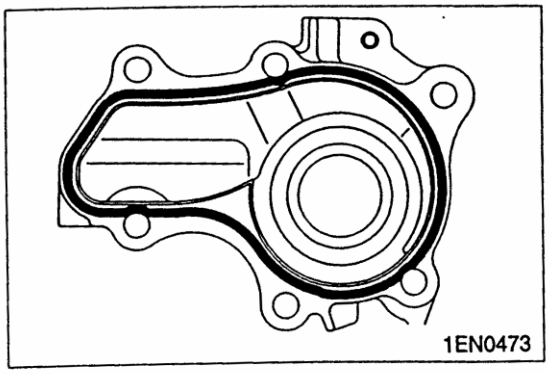


Fig.4-19

Specified sealant: LT5699

（2）THE INSTALLATION STEPS OF O-RING AND INLET PIPE

Use new o-ring to replace the old one, daub cooling fluit on the o-ring, that will be make them installed into the water pump and thermostat case easily.

Notice: 1. Don’t doub lubricant or other oil on the o-ring. 2.The pipe behind the thermostat case must be installed firmly.

（3） THE INSTALLATION STEPS OF THERMOSTAT

Make the valve on the top when installing the thermostat, see Fig.4-20.

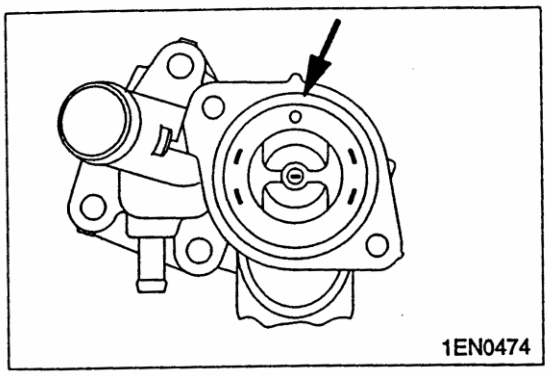


Fig.4-20

（4）THE INSTALLATION STEPS OF WATER TEMPERATURE GAUGE UNIT

If the water temperature gauge unit will still be used, please doub right sealant glue on its screw thread ,see Fig.4-21.

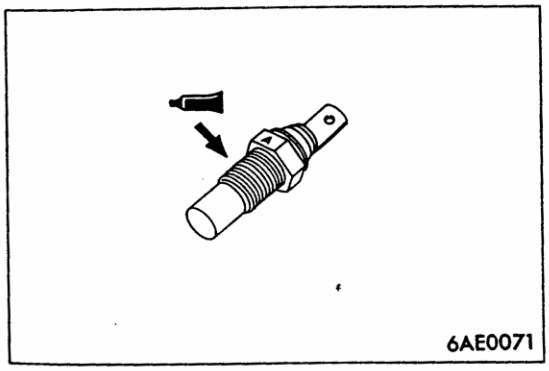


Fig.4-21

Specified sealant: LT648

（5） THE INSTALLATION STEPS OF WATER TEMPERATURE SENSOR

If the water temperature sensor will still be used, please doub right sealant glue on its screw thread,see Fig.4-22.

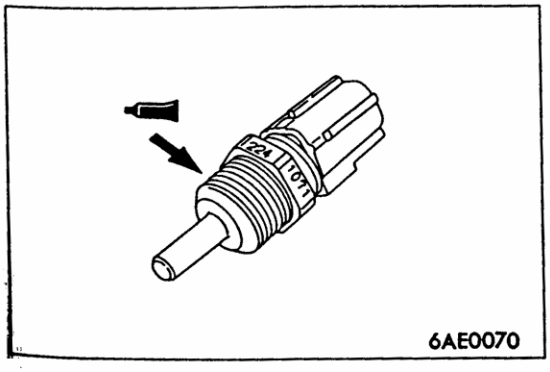


Fig.4-22

Specified sealant: LT648

5） INTAKE AND EXHAUST MANIFOLDS

Removal and installation steps UAES MPI ,see Fig.4-23a, MMC MPI ,see Fig.4-23b：

：

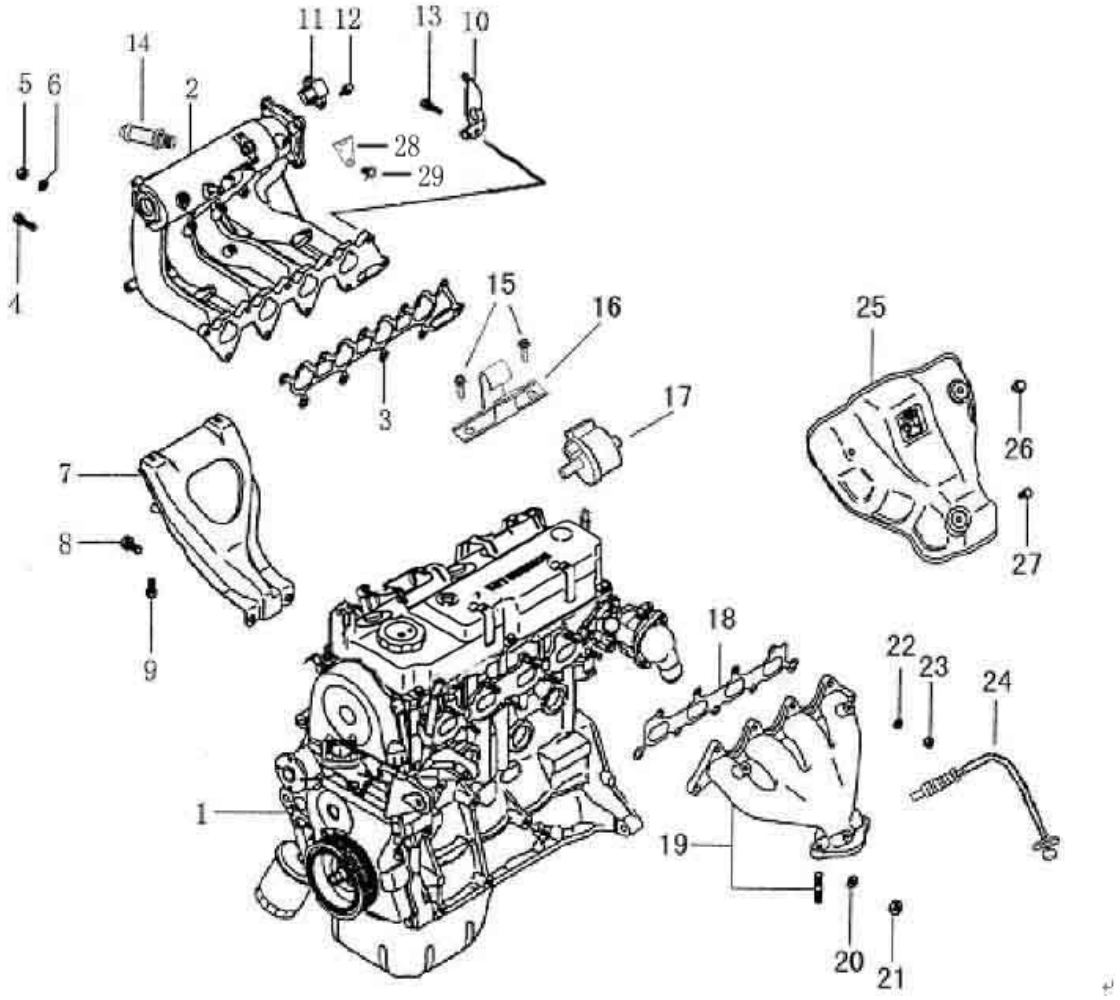


Fig.4-23 a

Removal steps

1. Engine sub assy	7. Intake manifold stay
2. Intake manifold	8. Bolt, washer assembled
3. Intake manifold gasket	9. Bolt, washer assembled
4. Bolt, washer assembled	10. Engine hanger
5. Nut	11. Boost sensor
6. Spring washer	12. Bolt, washer assembled
13. Bolt, washer assembled	14. Nipple
15. Bolt, washer assembled	16. Bracket
17. Canister purge valve	18. Exhaust manifold gasket
19. Exhaust manifold	20. Plain washer
21. Nut	22. Plain washer
23. Nut	24 O_2 sensor
25. Exhaust manifold cover	26. Flange bolt

27. Bolt, washer assembled 28. Bracket
29. Flange bolt

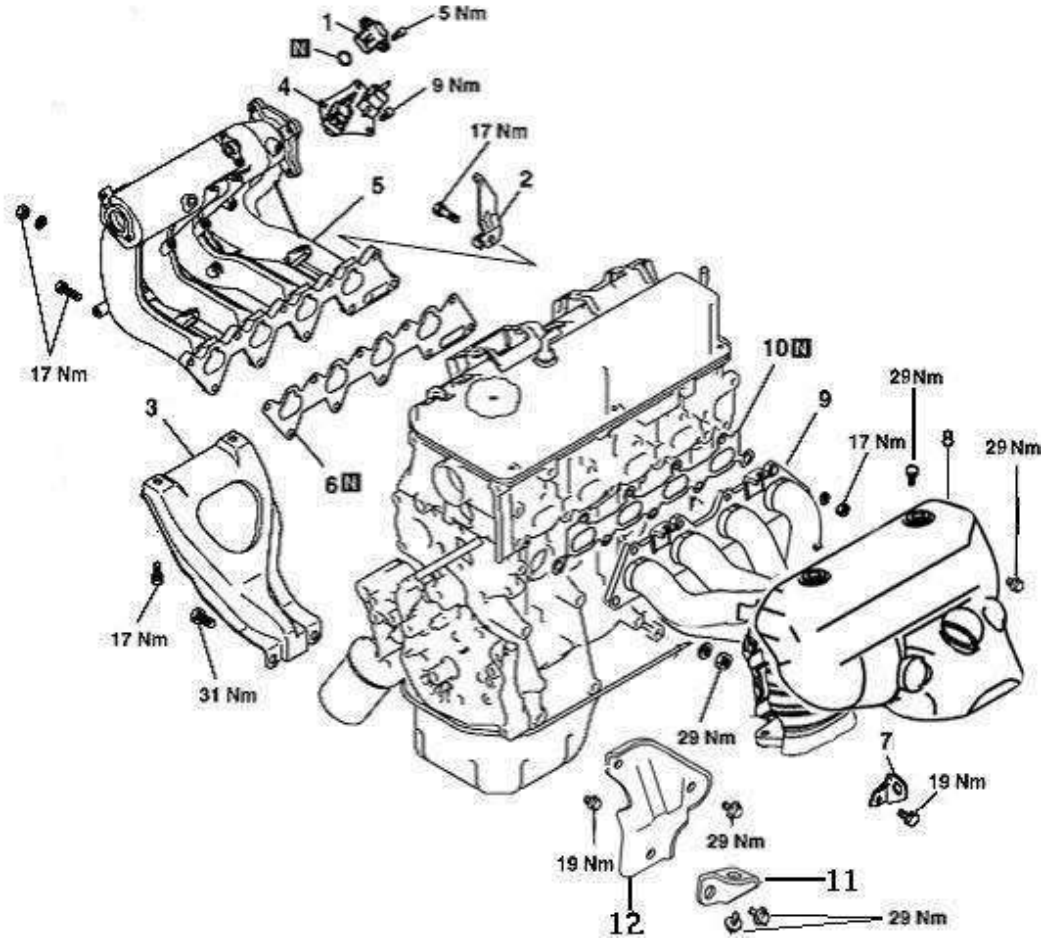


Fig.4-23b

Removal steps

1. Boost sensor 6.Intake manifold gasket
2. Engine hanger 7. Engine hanger
3. Intake manifold stay 8. Exhaust manifold cover
4. Electromagnetic valve assy. 9. Exhaust manifold
5. Intake manifold 10. Exhaust manifold gasket
11. Exhaust manifold brace B 12. Exhaust manifold brace A

6）ROCKER AEMS AND CAMSHAFTS

Removal and installation steps : UAES MPI see Fig.4-24a, MMC MPI see Fig.4-24b：

：

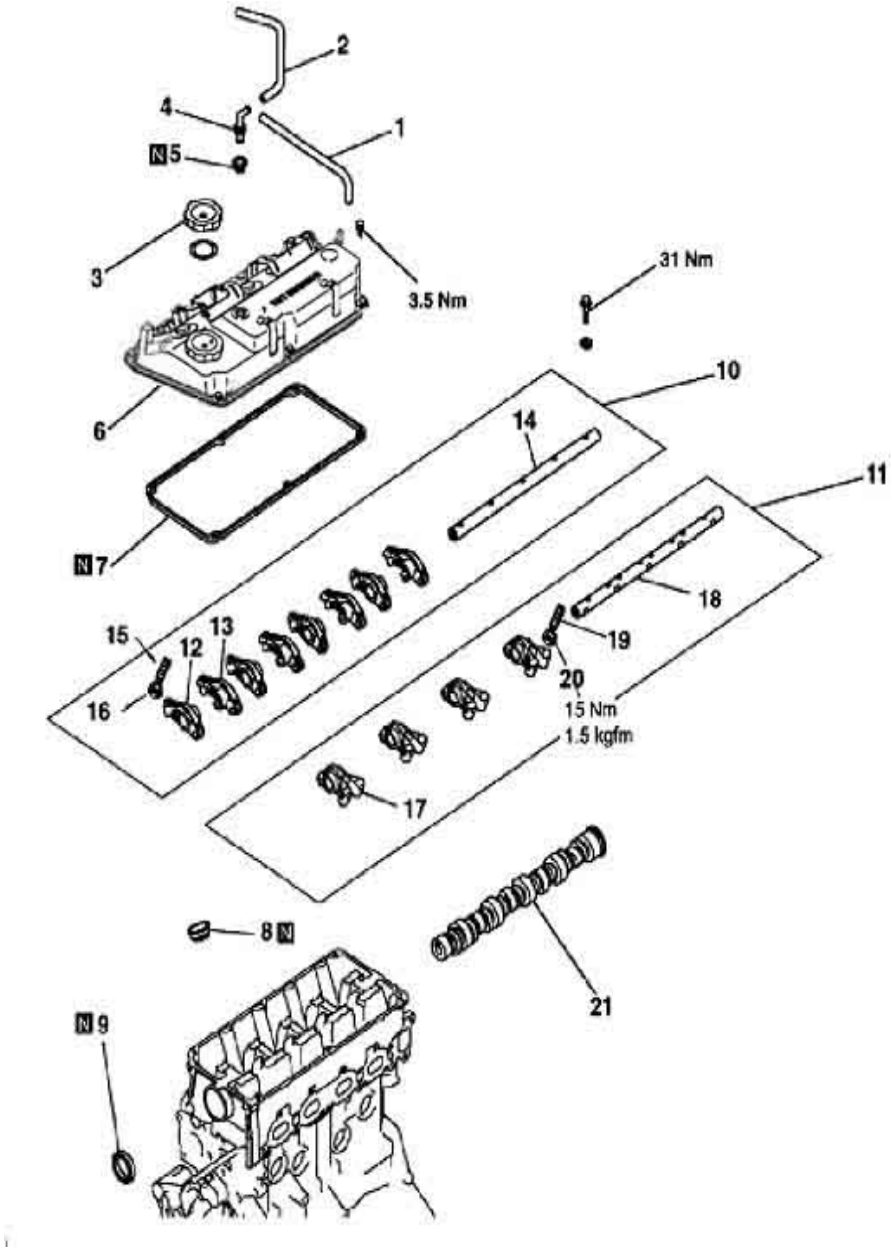


Fig.4-24a

Removal steps

1. Breather hose
2. P.C.V hose
3. Oil filler cap
4. P.C.V valve
5. P.C.V gasket
6. Rocker cover
7. Rocker cover gasket
8. Oil seal
9. Oil seal
10. Rocker arm and shaft assembly(intake)
11. Rocker arm and shaft assembly (exhaust)
12. Rocker arm A
13. Rocker arm B
14. Rocker arm shaft
15. Adjusting screw
16. Adjusting nut
17. Rocker arm C
18. Rocker arm shaft
19. Adjusting screw
20. Adjusting nut
21. Camshaft

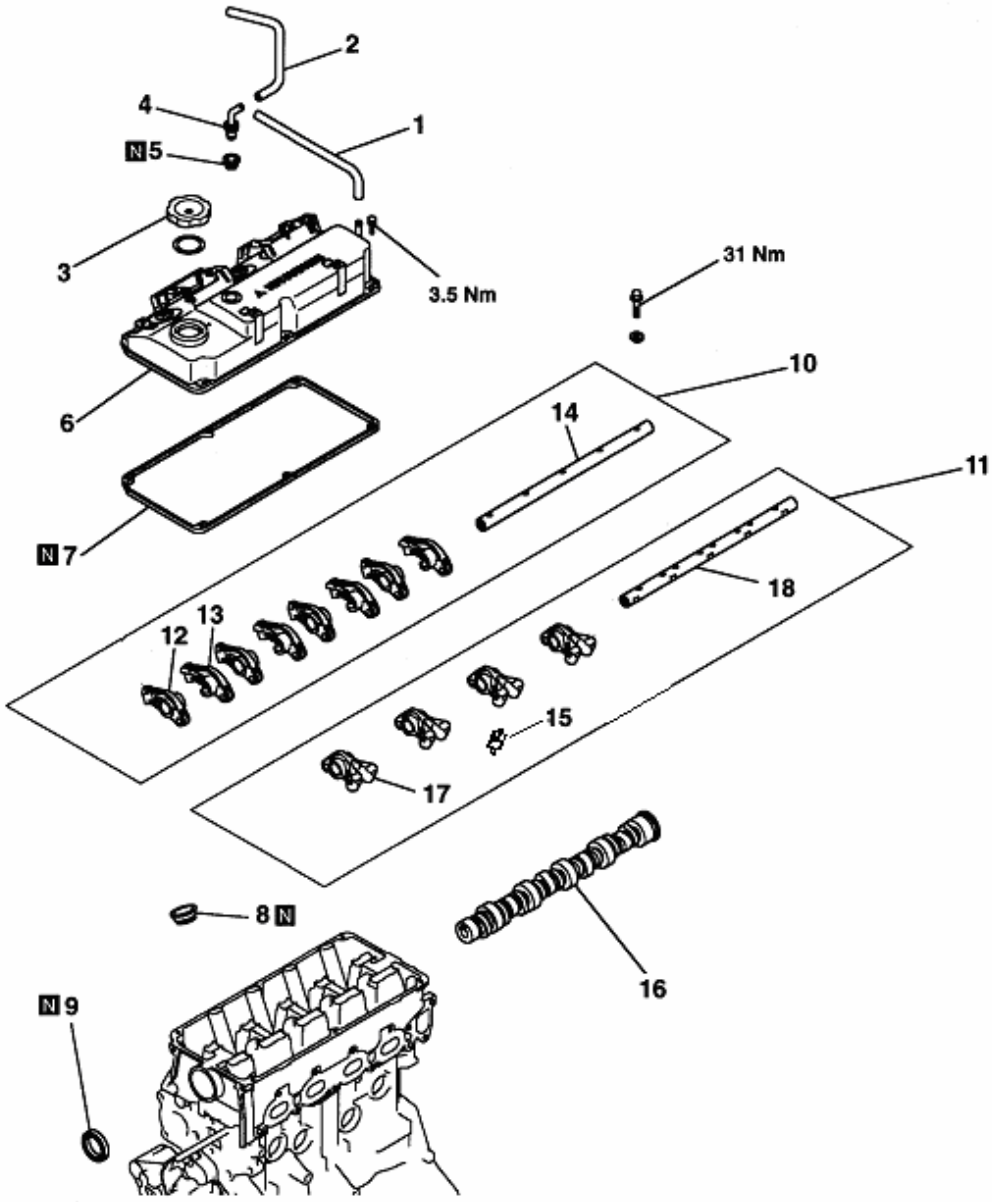


Fig.4-24b

Removal steps

1. Breather hose
2. Breather hose
3. Oil filler cap
4. P.C.V valve
5. P.C.V gasket
6. Rocker cover
7. Rocker cover gasket
8. Oil seal
9. Oil seal
10. Rocker arm and shaft assembly(intake)
11. Rocker arm and shaft assembly (exhaust)
12. Rocker arm B
13. Rocker arm A
14. Rocker arm shaft
15. hydraulic pressure lifter
16. Camshaft
17. Rocker arm C
18. Rocker arm shaft

SERVICE POINTS OF INSTALLATION:

（1） THE INSTALLATION STEPS OF ADJUSTING SCREW

Put the screw into the rocker arm, make the bottom of the screw equal or extrude a little (under 1mm) from the bottom of the rocker arm.

（2） THE INSTALLATION STEPS OF ROCKER ARM

a Set the more bevel side face to the timing belt.

Notice:There is 8 oil holes in the intake rocker arm.

b Set the side which has oil holes face to the cylinder head.

（3） THE INSTALLATION STEPS OF THE ROCKER ARM AND SHAFT ASSEMBLY

Pay attention to the identify mark on the rocker arms when install the rocker arm and shaft, afterwards, install the assembly on the cylinder head, see Fig.4-25.

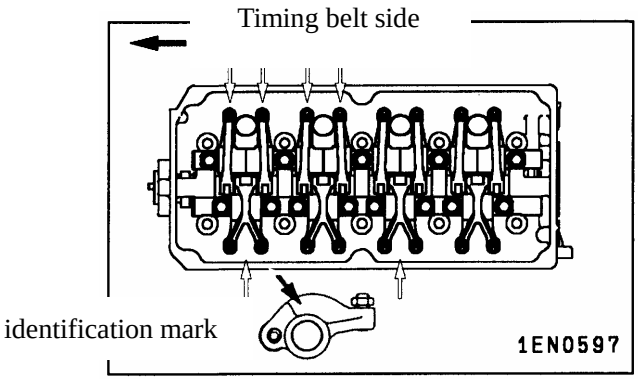


Fig.4-25

（4） THE INSTALLATION STEPS OF THE CAMSHAFT SEAL

Knock the seal into the cylinder head with the special tool in the picture, see.

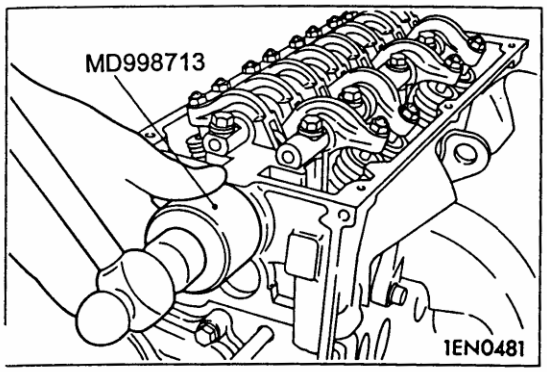


Fig.4-26

7） CYLINDER HEAD AND VALVE

Removal and installation steps, see Fig.4-27：

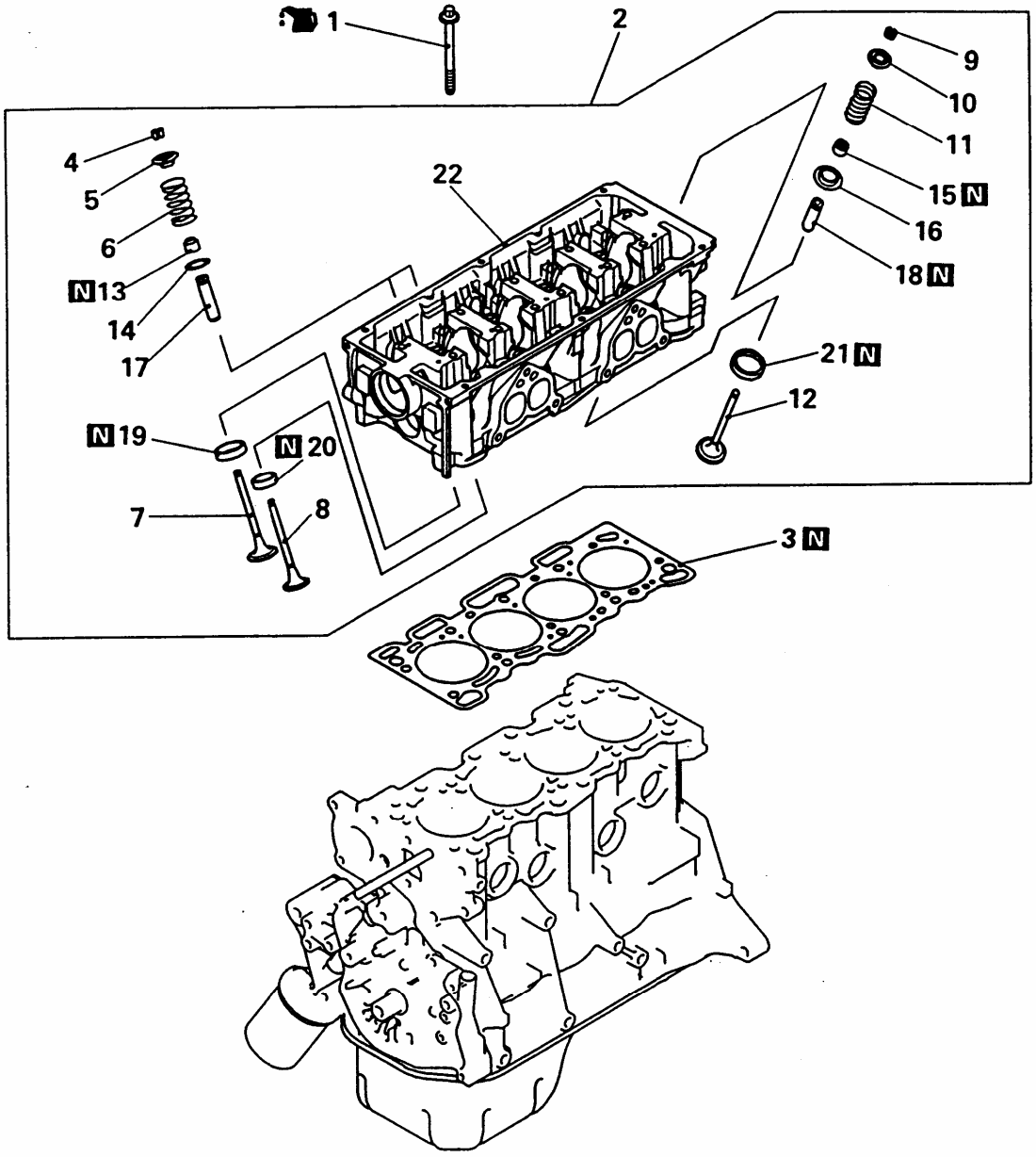


Fig.4-27

Removal steps

1. Cylinder head bolt	9. Retainer lock	17. Intake valve guide
2. Cylinder head assembly	10. Exhaust valve spring seat	18. Exhaust valve guide
3. Cylinder head gasket	11 Valve spring	19. Intake valve seat
4. Retainer lock	12. Exhaust valve	20. Intake valve seat
5. Intake valve spring seat	13. Valve stem seal	21. Exhaust valve seat
6. Valve spring	14. Valve spring seat	22. Cylinder head
7. Intake valve	15. Valve stem seal	
8. Intake valve	16. Valve spring seat	

SERVICE POINTS OF REMOVAL:

（1）THE REMOVAL STEPS OF CYLINDER HEAD BOLT

Remove the cylinder head bolt with the special tool in the picture, see Fig.4-28.

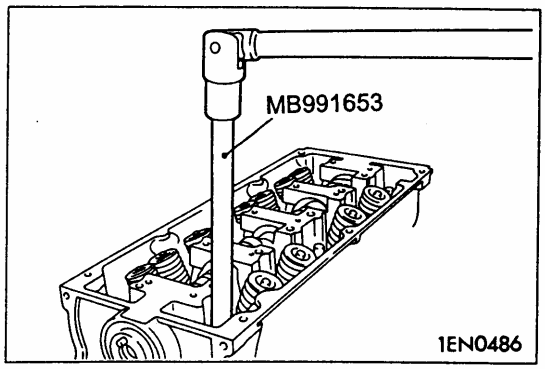


Fig.4-28.

（2）THE REMOVAL STEPS OF RETAINER LOCK

To reinstall easily, mark the cylinder number and the position on the valve, spring and other parts that have been removed, make sure the parts won't be losed, see Fig.4-29 and Fig.4-30.

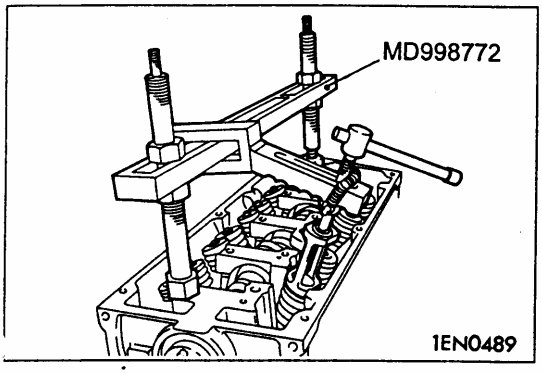


Fig.4-29

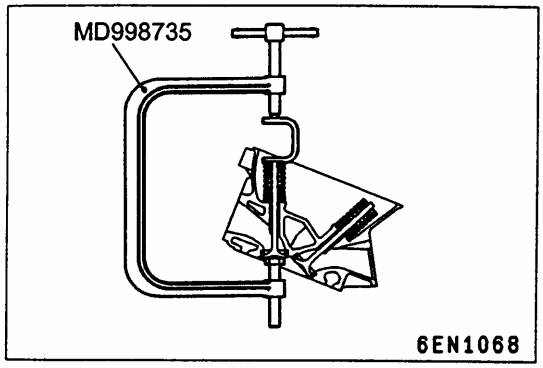


Fig.4-30

（3） THE REMOVAL STEPS OF VALVE STEM SEAL, see Fig.4-31

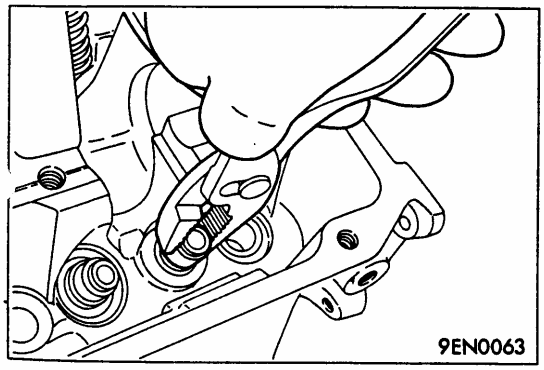


Fig.4-31

SERVICE POINTS OF INSTALLATION:

（1） THE INSTALLATION STEPS OF VALVE STEM SEAL

a Install the valve spring seat.

b Install the valve stem seal with the special tool which is in the picture, see Fig.4-32.

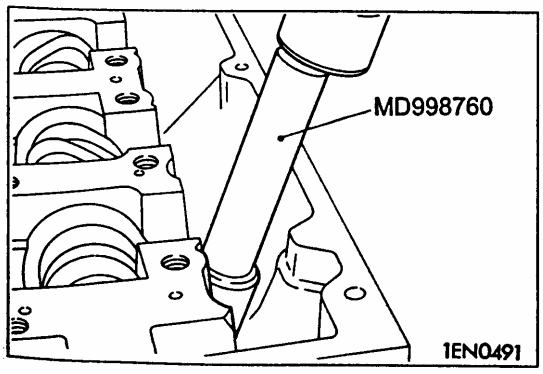


Fig.4-32

NOTICE: 1. The valve stem seal won't be used twice. 2. The valve stem seal must be installed with the right special tool, incorrect installation will cause oil leak from the valve guide.

（2） THE INSTALLATION STEPS OF VALVE SPRING

Make the painted side near to rocker arm when you install, see Fig.4-33.

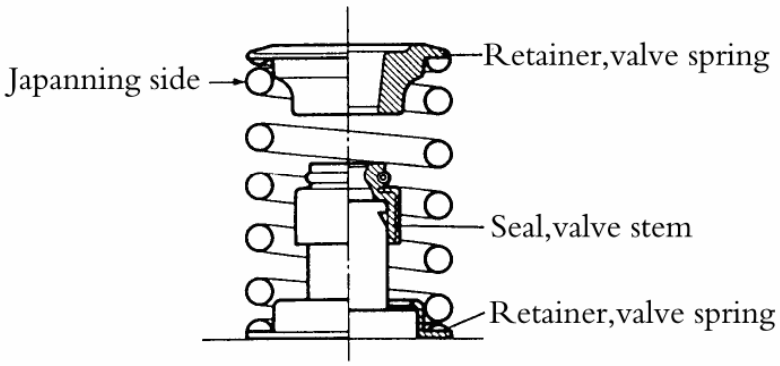


Fig.4-33

（3） THE INSTALLATION OF THE RETAINER LOCK(see Fig.4-29,Fig.4-30)

（4）THE INSTALLATION STEPS OF CYLINDER HEAD BOLT

a Make sure if the length of the used bolt is bigger than the limit, if it is, it must be replaced.

Limit: 103.2mm

b Install the gasket like which is in the picture, see Fig.4-34.

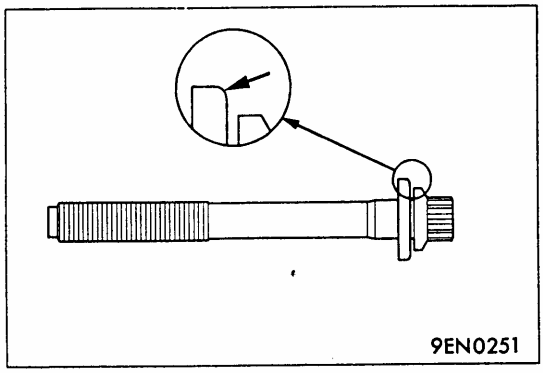


Fig.4-34

c Doub the lubricant on the screw thread of the bolt.

d Screw the bolt follow the steps in the picture, till the moment or every bolt reach 49Nm, see Fig.4-35.

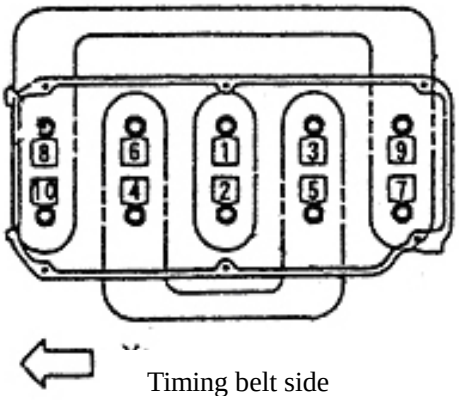


Fig.4-35

e Remove all bolts.

f Screw the bolt follow the steps in the picture again, till the moment or every bolt reach 20±2Nm, see Fig.4-35.

g Paint mark on the bolt head and cylinder head (like it in the picture) , see Fig.4-36.

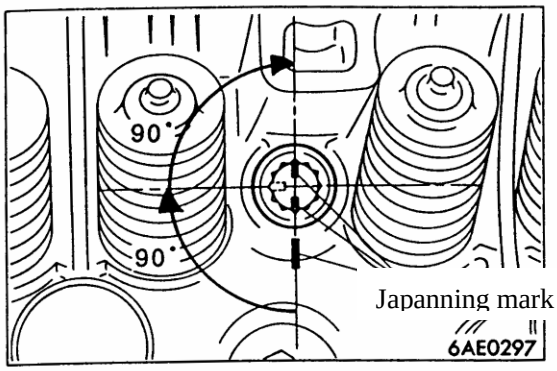


Fig.4-36

h Screw each bolt to 90° follow the steps.

k Screw each bolt to 90° again, make sure if the mark on the bolt head aim at the mark on the cylinder head.

NOTICE: If the screwed angle is smaller than 90°, it won't have enough power to peg the cylinder head. If the screwed angle is bigger than 90°, all of the bolt should be removed, install again.

If you have changed the used bolt, please follow the steps of（b）~（k）.

If you use the used bolt, please follow the steps of （b)、(c)、(f)、(g)、(h)、(k)

8）**OIL PUMP AND OIL PAN**

Removal and installation steps, see Fig.4-37：

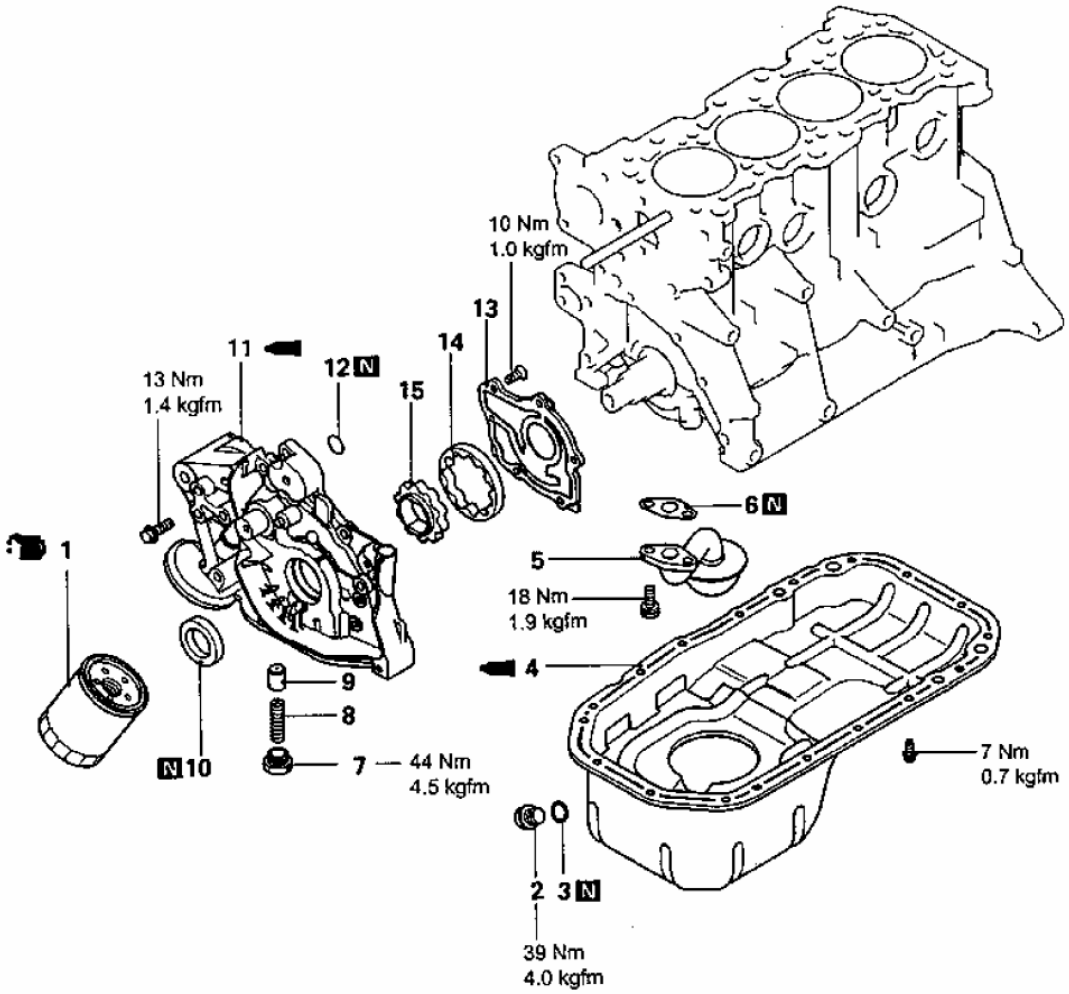


Fig.4-37

Removal steps

1. Oil filter	9. Relief plunger
2. Drain plug	10. Front oil seal
3. Gasket	11. Front case
4. Oil pan	12. O-ring
5. Oil screen	13. Oil pump cover
6. Gasket	14. Oil pump outer rotor
7. Relief valve	15. Oil pump inter rotor
8. Relief valve spring	

SERVICE POINTS OF REMOVAL:

（1）OIL PAN REMOVAL

a Remove the oil pan mounting bolts.

b Knock the special tool between the oil pan and cylinder block as shown in the illustration, see Fig.4-38.

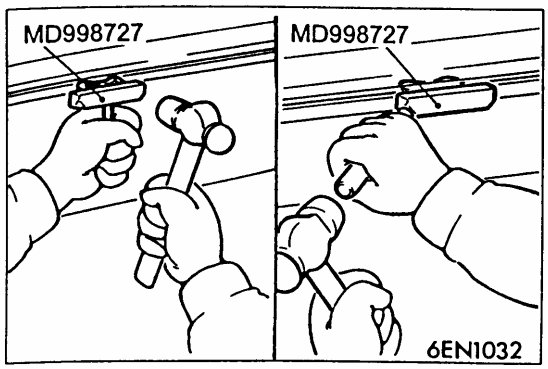


Fig.4-38

c Tapping the side of the special tool, slide the tool along the oil pan/cylinder block seal and thus remove the oil pan .

SERVICE POINTS OF INSTALLATION:

（1） FRONT OIL SEAL CASE INSTALLATION.

a Clean the sealant application surfaces on the cylinder block and front oil case, see Fig.4-39.

b Apply a 3 mm bead of form-in-place gasket to the entire circumference of the oil pan flange.

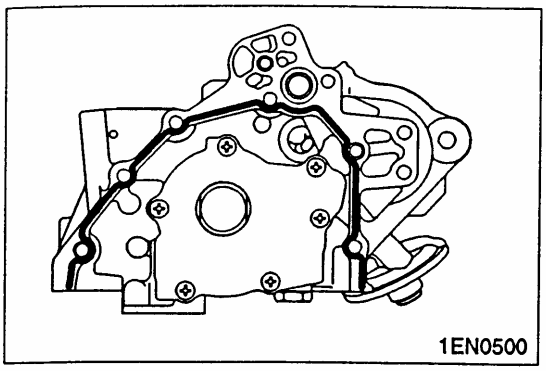


Fig.4-39

Specified sealant: LT5699

（2） FRONT OIL SEAL INSTALLATION

a Place the special tool on the crankshaft’s front end and apply engine oil to the its outer circumference, see Fig.4-40.

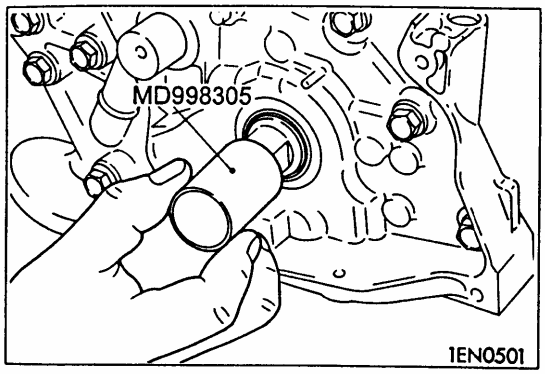


Fig.4-40

b Apply engine oil to the oil seal lip, then push the oil seal along the guide by hand until it touches the front case .Tap the oil seal into place using the special tool, see Fig.4-41.

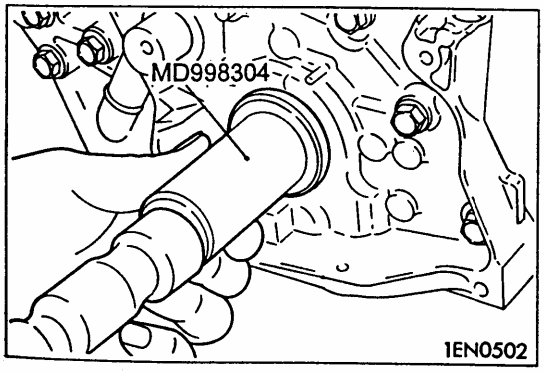


Fig.4-41.

（3） OIL PAN INSTALLATION, see Fig.4-42

a Clean the mating surface of the cylinder block and oil pan.

b Apply a 4 mm bead of form-in-place gasket to the outer circumference of the oil pan flange.

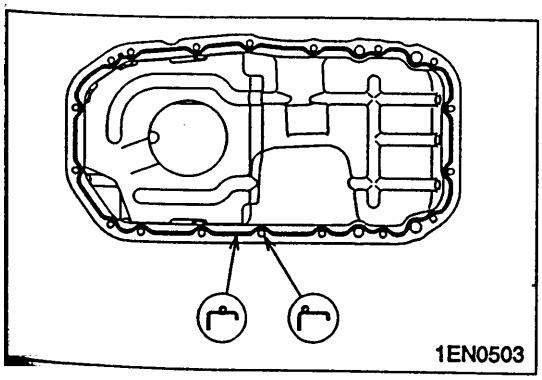


Fig.4-42

Specified sealant: LT5699

（4） DRAIN PLUG GASKET INSTALLATION

Replace the drain plug gasket with a new one. Fit the new gasket as shown, see Fig.4-43.

NOTICE: If the direction of gasket is wrong, it will lade to leak oil.

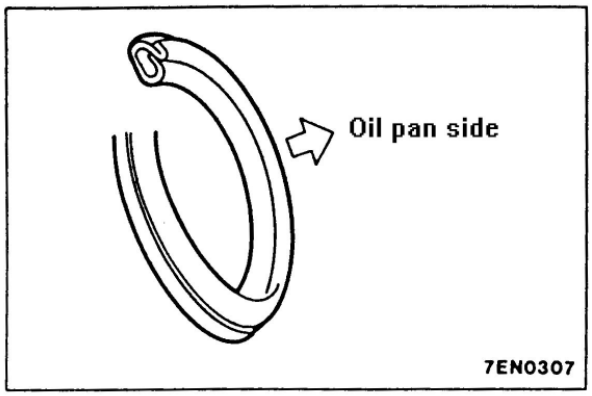


Fig.4-43

（5） OIL FILTER INSTALLATION

a Clean the filter mounting surface on the front case.

b Apply engine oil to the filter’s O-ring.

c Screw on the oil filter until the O-ring is seated on the mounting surface. Then, give the oil filter one further turn such that it is torqued to approximately 14 Nm.

NOTICE: The oil filter must be tightened using a commercially available filter wrench. If the filter is tightened by hand only, it will be insufficiently torqued, resulting in oil leaks.

9）PISTONS AND CONNECTING RODS

Removal and installation steps, see Fig.4-44：

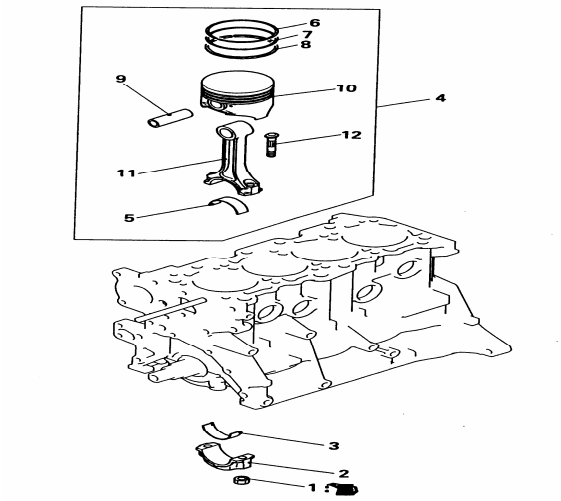


Fig.4-44

Removal steps

1. Connecting rod nut
2. Connecting rod cap
3. Connecting rod bearing
4. Piston and connecting rod assembly
5. Connecting rod bearing
6. Piston ring No.1
7. Piston ring No. 2
8. Oil ring
9. Piston pin
10. Piston
11. Connecting rod
12. Bolt

SERVICE POINTS OF REMOVAL:

（1）CONNECTING ROD CAP REMOVAL

Mark the cylinder number on the side of the connecting rod big end to facilitate reassembly, see Fig.4-45.

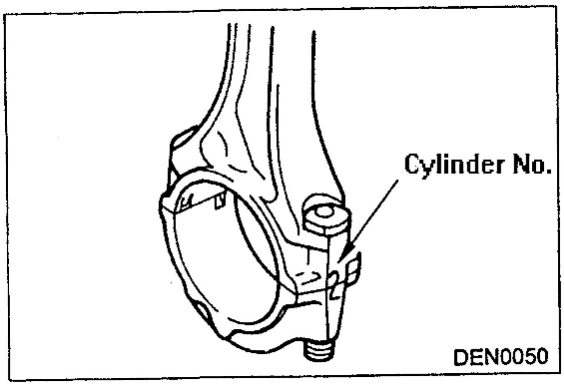


Fig.4-45

PISTON PIN REMOVAL

（1） Insert the push rod (special tool) from the front arrow mark side, then fit guide D, see Fig.4-46.

（2） Mount the piston and connecting rod assembly on the piston pin setting base (special tool) with the piston’s front mark pointing upward.

（3） Remove the piston pin using a press.

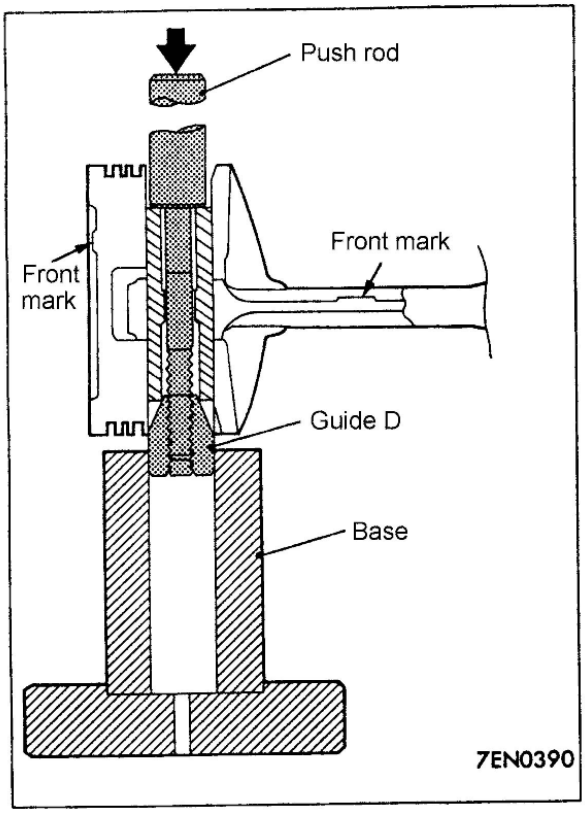


Fig.4-46

NOTICE: After removing the piston pin, keep the piston, piston pin, and connecting rods from different cylinders to become mixed up.

SERVICE POINTS OF INSTALLATION:

（1） PISTON PIN INSTALLATION

a Measure the following lengths (as shown) , see Fig.4-47:

A：Piston boss-to-piston boss outside dimension

B：Piston boss-to-piston boss inside dimension

C：Piston pin length

D：Connecting rod small end eye thickness

b Enter the measured values into the following formula:

$$L = \frac{(A-C)-(B-D)}{2}$$

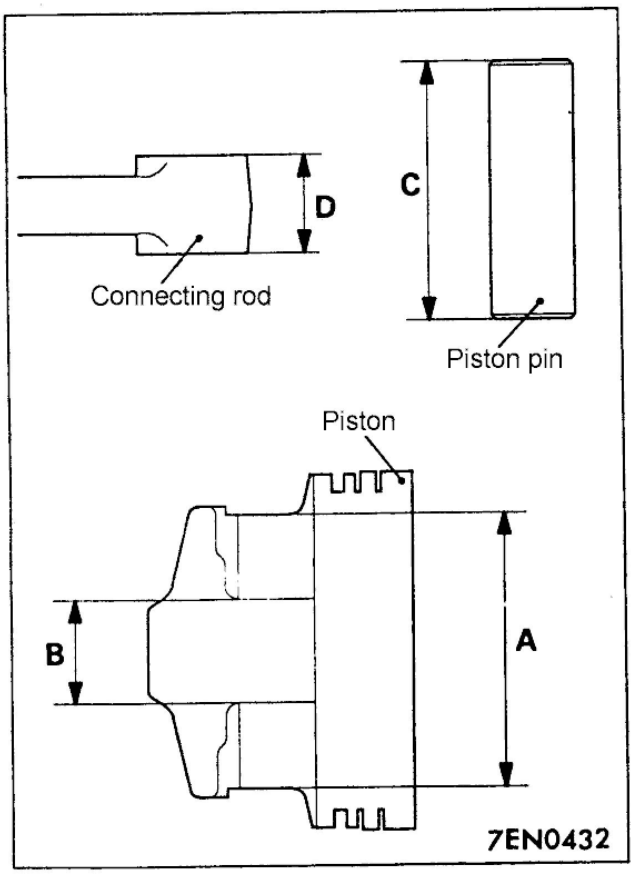


Fig.4-47

c Insert the push rod (special tool) into the piston pin, then fit guide A (special tool).

d Fit the piston and connecting rod together such that their front marks are on the same side.

e Apply engine oil to the outside of the piston pin.

f Into the front-mark side of the piston, insert the guide A, piston pin, and push rod, starting with guide A.

g Screw guide B into guide A. Leave a gap between the two guides of 3 mm plus the value (L) calculated in step (2) , see Fig.4-48.

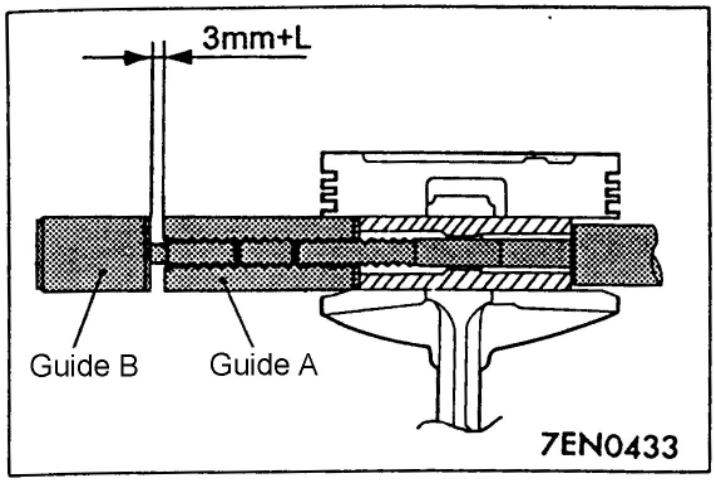


Fig.4-48

h Mount the piston and connecting rod on the piston pin which setting base (special tool) with the piston's front mark pointing upward, see Fig.4-49.

I Install the piston pin using a press. If the press-fitting load is out of specification, replace the piston pin and piston assembly or the connecting rod, or both.

Standard value: 1000±500 kg.f

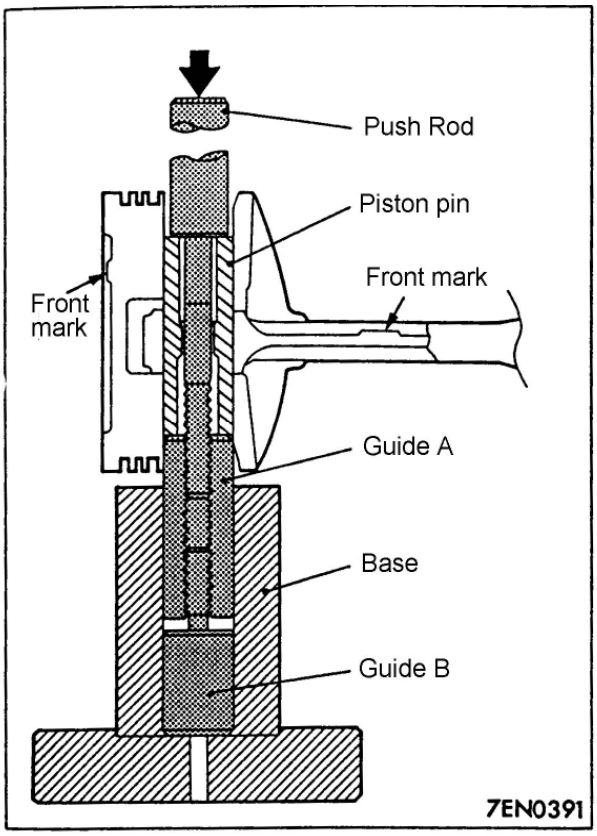


Fig.4-49

（2）OIL RING INSTALLATION

a Fit the oil ring spacer into the piston ring groove. Then, fit the upper and lower side rails, see Fig.4-50.

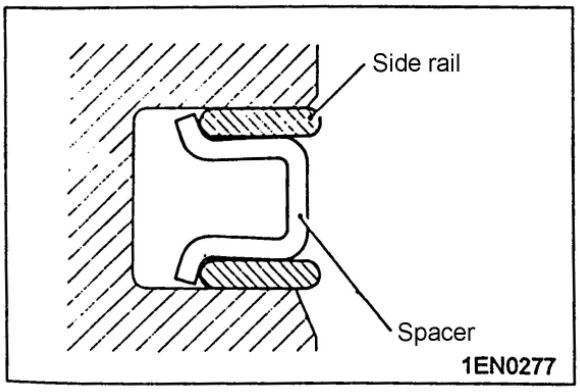


Fig.4-50

NOTICE: 1. The spacer and side rails may be fitted in either direction. No distinction is made between top and bottom

2. Spacer and side rail sizes are color-coded as follows:

Size	Color
Standard	None
O.S. 0.50mm	Blue
O.S.1.00mm	Yellow

b To install a side rail, fit one end of the rail into the groove then press the rest of the rail into position by hand as shown, see Fig.4-51.

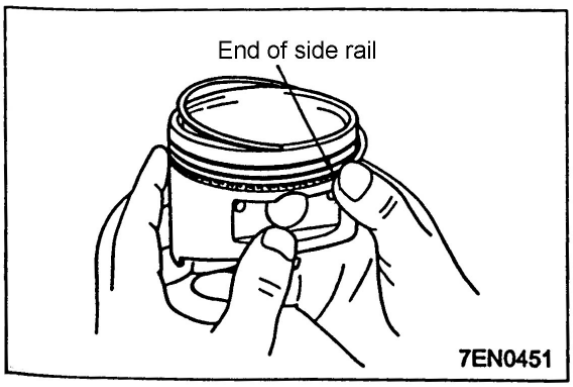


Fig.4-51

NOTICE:
Do not fit side rails using a piston ring expander since they may break.

c After installing the side rails, check that they move smoothly in both directions.

(3) PISTON RING No.2 / PISTON RING No.1 INSTALLATION

Using piston ring expander, fit No.2 and No.1 piston ring into position, install piston rings with identification mark facing up, to the piston crown side, see Fig.4-52.

Identification mark, see Fig.4-53:

N0.1 ring：1T

N0.2 ring：2T

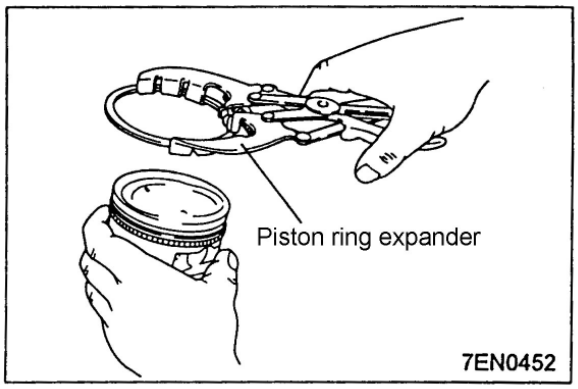


Fig.4-52

NOTICE:Size marks on piston rings are as follows Table 4-5:

Table 4-5

Size	Size mark
STD	None
O.S. 0.50mm	50
O.S.1.00mm	100

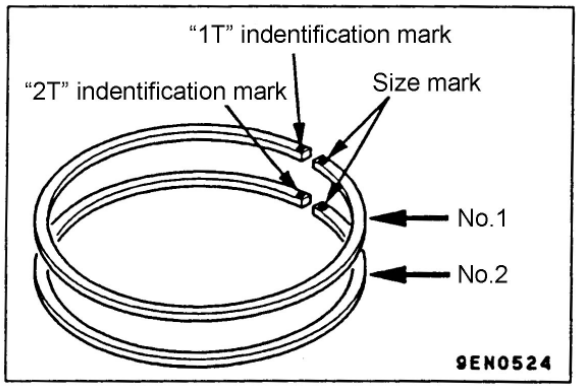


Fig.4-53

(4) PISTON AND CONNECTING ROD ASSEMBLY INSTALLATION

a Apply oil to piston, piston rings, and oil ring.

b Align the gaps of the piston rings and oil ring (side rails and spacer) as shown, see Fig.4-54.

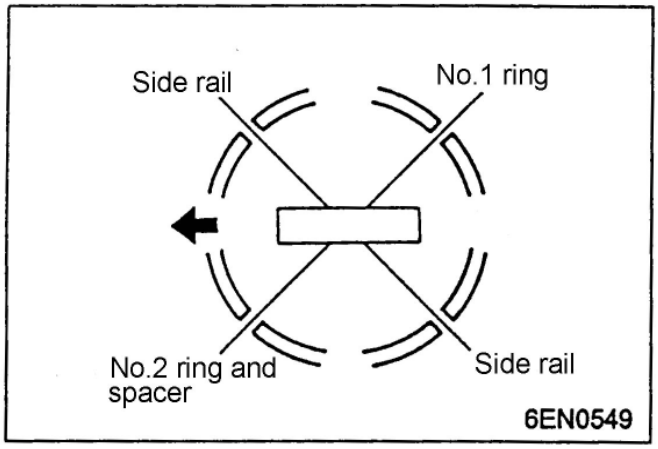


Fig.4-54

c With the piston crown's front arrow mark pointing toward the timing belt side, press the piston and connecting rod assembly into the cylinder from the top of the cylinder.

d Compress the piston rings tightly with a suitable ring compression tool, then press the piston and connecting rod fully into the cylinder. Do not strike the piston hard since the piston rings may break and the crank pin may be nicked, see Fig.4-55.

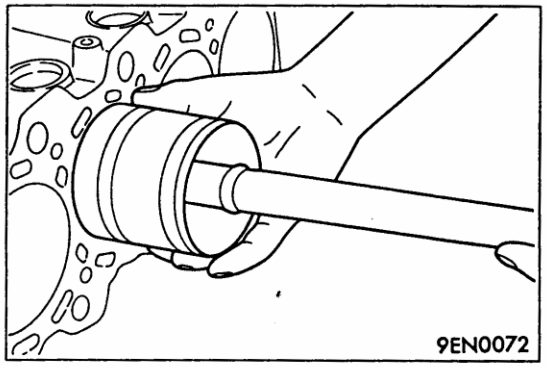


Fig.4-55

(5) CONNECTING ROD BEARING INSTALLATION

Select bearings according to crankshaft and connecting rod identification marks or color codes, , see Fig.4-56, Fig.4-57, Fig.4-58 referring to the following table 4-6.

Table 4-6

Crankshaft identification mark	Connecting rod identification color/mark	Bearing identification mark
Ⅰ.Yellow	1 white	1
	2 none	1
	3 yellow	2
Ⅱ.None	1 white	1
	2 none	2
	3 yellow	3
Ⅲ. White	1 white	2
	2 none	3
	3 yellow	3

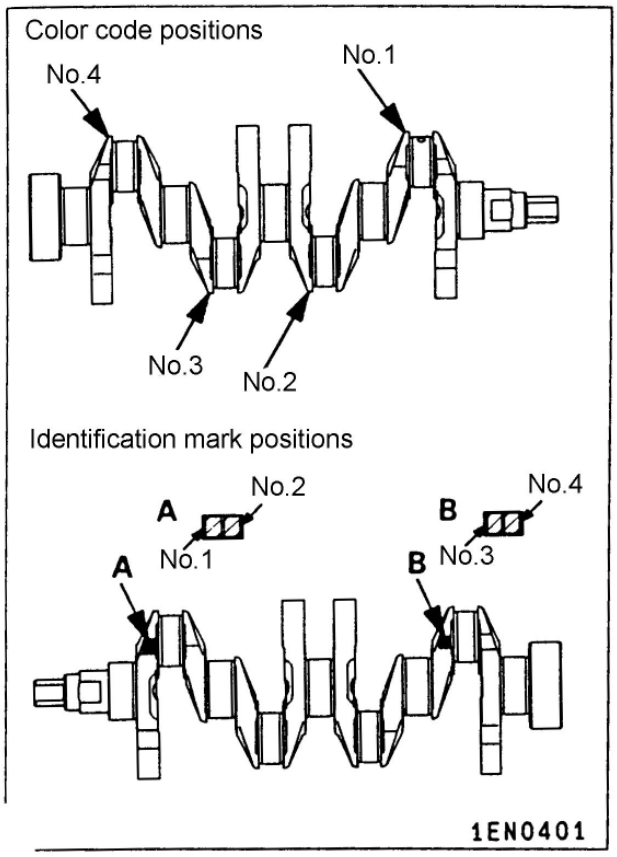


Fig.4-56

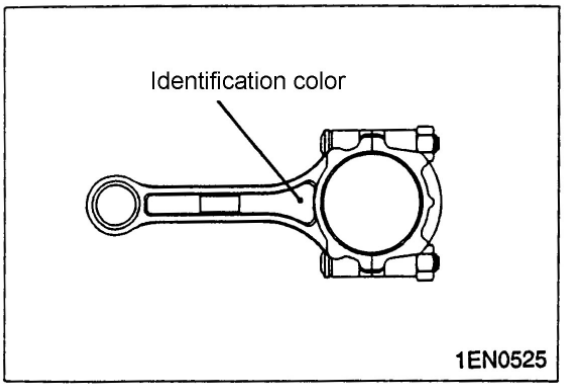


Fig.4-57

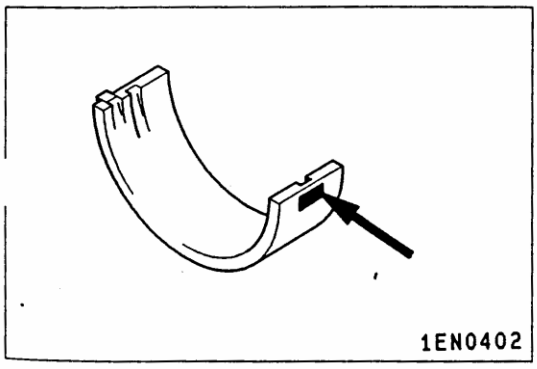


Fig.4-58

(6) CONNECTING ROD CAP INSTALLATION

a Aligning the marks made during disassembly, fit the bearing cap onto the connecting rod. If the connecting rod is new and has no index mark, ensure that the bearing locking notches are both on the same side, see Fig.4-59.

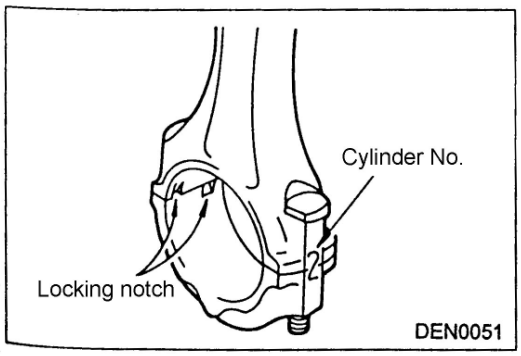


Fig.4-59

b Check that the connecting rod big end side clearance confirms with specifications, see Fig.4-60.

Standard value: 0.10 – 0.25mm

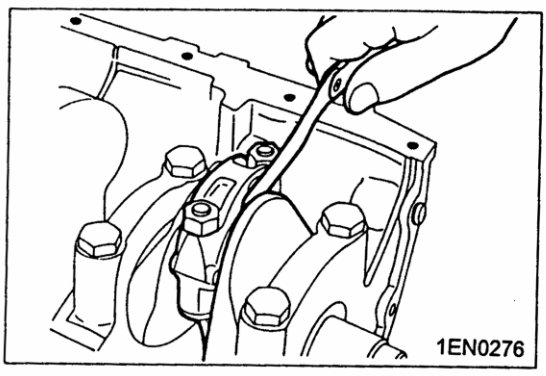


Fig.4-60

(7)CONNECTING ROD CAP NUT INSTALLATION

NOTICE: To fit the connecting rod cap nuts with the cylinder head in place, the spark plugs must be removed beforehand.

a The connecting rod bolts and nuts utilize the plastic region tightening method. The bolts must therefore be checked for stretching before reuse. To check a bolt for stretching, screw the nut down the entire length of the thread by hand. Unless the nut turns smoothly all the way, the bolt's threaded section is stretched and the bolt must be replaced.

b Before fitting the nuts, apply engine oil to their threads and seating surfaces.

c Fit the nuts onto the bolts and turn them until they are finger-tight. After this, the nuts must be tightened

alternately to ensure correct fitting of the cap.

d Tighten the nuts to a torque of 16.7±2.0Nm.

e Make a paint mark on the top of each nut as shown, see Fig.4-61.

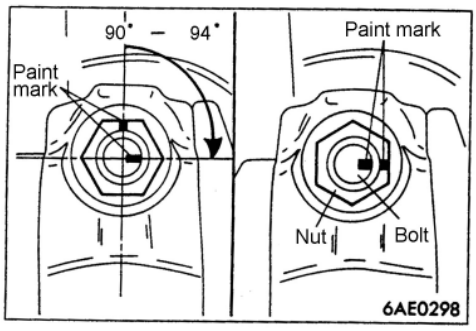


Fig.4-61

f Make paint marks on the bolts 90 to 94° clockwise from the paint marks on the nuts.

g Turn the nuts until their paint marks are aligned with the paint marks on the bolts.

NOTICE: 1.If the nuts are turned by less than 90° ,the cap may not be held on with sufficient strength.
2. If the nuts are turned by more than 94° , loosen them completely and carry out the tightening procedure again.

10) **CRANKSHAFT AND BLOCK，CYLINDER**

UAES MPI see Fig.4-62a, MMC MPI see Fig.4-62b：

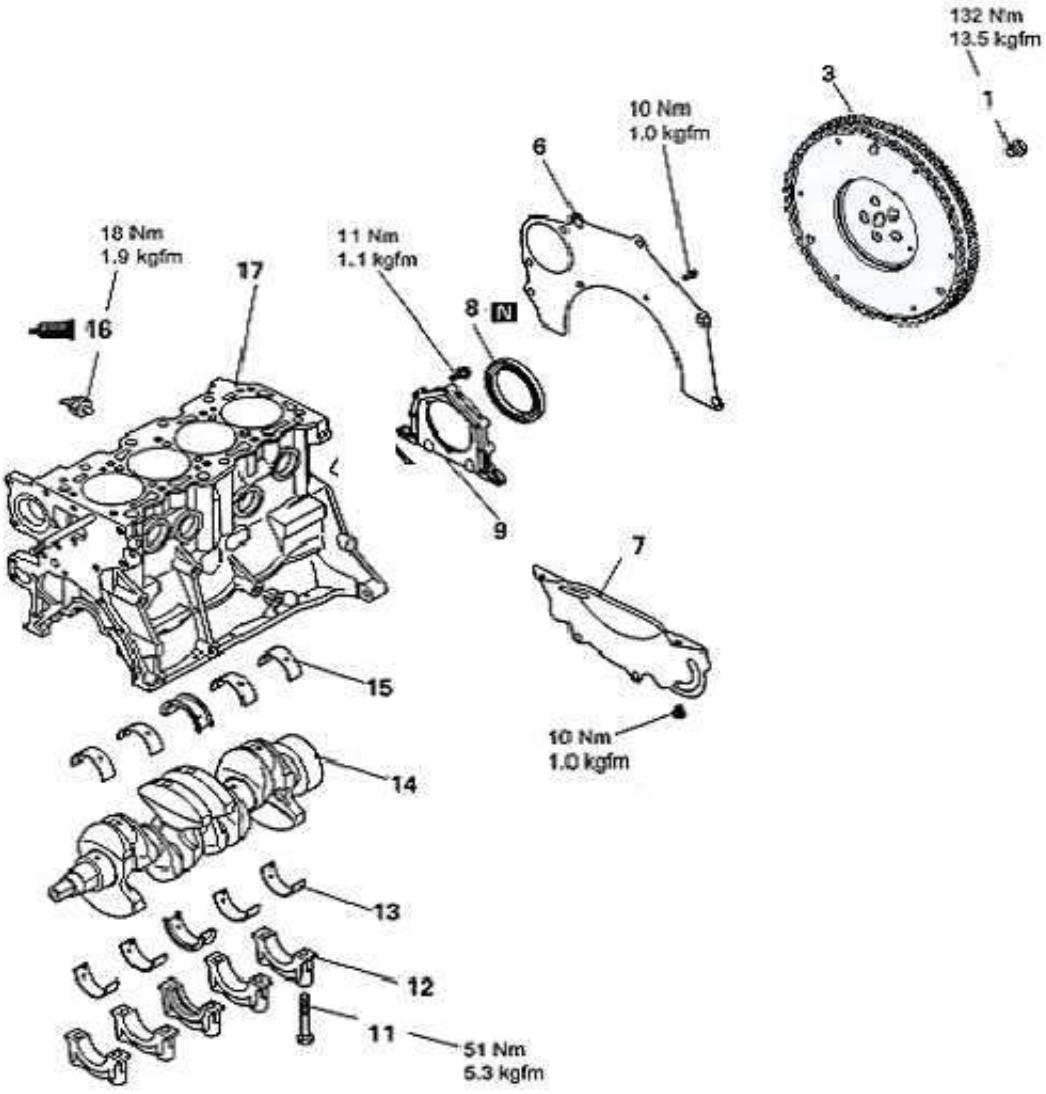


Fig.4-62a

Removal steps

1. flywheel bolt
3. Flywheel
6. Rear plate，
11. Bearing cap bolt
17. cylinder block
7. Bell houseing cover
8. Rear oil seal
9. Rear oil seal Case
12. Bearing cap
13. Crankshaft bearing (lower)
14. Crankshaft
15.Crankshaft bearing (upper)
16.oil pressure switch

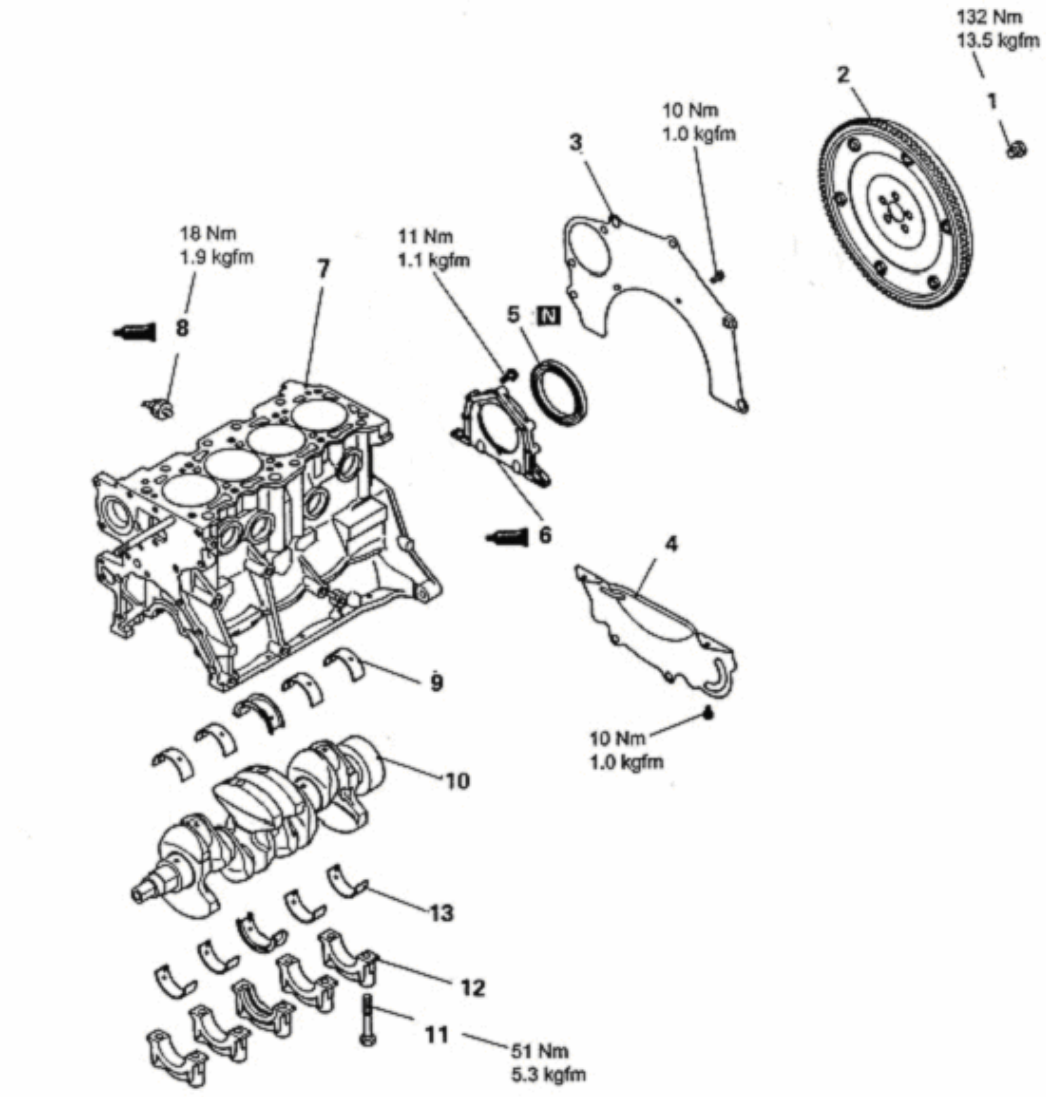


Fig.4-62b

Removal steps

1. flywheel bolt
2. Flywheel
3. Rear plate
6. Rear oil seal Case
7. cylinder block
8. oil pressure switch
11. Bearing cap bolt
12. Bearing cap
13. Crankshaft bearing (lower)

4. Bell houseing cover
5. Rear oil seal
9. Crankshaft bearing (upper)
10. Crankshaft

SERVICE POINTS OF REMOVAL:

OIL PRESSURE SWITCH REMOVAL

a Disconnect the oil pressure terminals.

b Using the special tool, remove the oil pressure switch, see Fig.4-63.

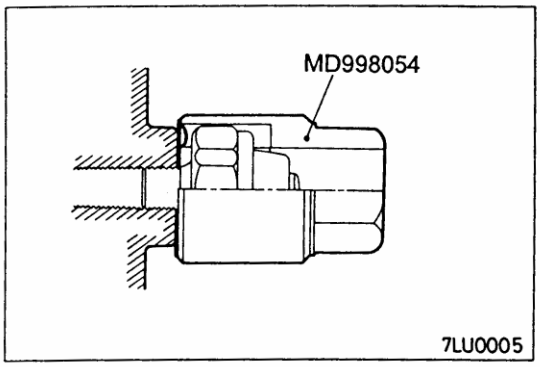


Fig.4-63

NOTICE: The thread is coated with sealant.take care not to bend it when removing the oil pressure switch.

SERVICE POINTS OF INSTALLATION:

（1）THE INSTALLATION OF THE OIL PRESSURE SWITCH

Smear specified sealant on the thread,then install oil pressure switch assy with special tool as followed, see Fig.4-64.

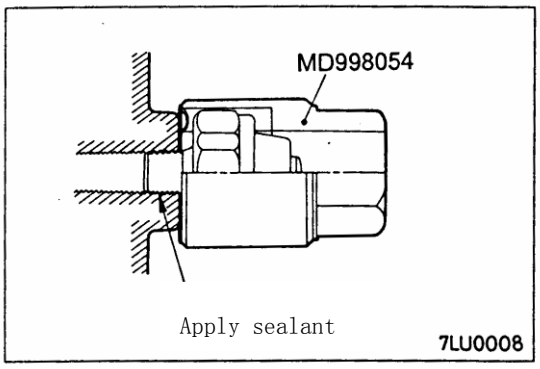


Fig.4-64

Specified sealant

NOTICE: 1. Apply the specified sealant to the thread, then fit the oil pressure switch using the special tool shown in the illustration.

2. Do not over-tighten the oil pressure switch . Torque: 15~22Nm

（2）INSTALLATION OF CRANKSHAFT BEARING

a Select bearings according to the crankshaft identification marks or color codes(referring to the following table 4-7) , see Fig.4-65, if they are not identifiable,measure the crankshaft journals and choose bearing to match the measurements.

Table 4-7

Crankshaf journal	Cylinderblock	Bearing

				bearing bore dia	
Range	Color code	Identification mark	Joural dia	Identification mark	Identification mark
1	Yellow	1	47.995 ~48.000	0	1
				1	2
				2	3
2	Colorless	2	47.988 ~47.995	0	2
				1	3
				2	4
3	White	3	47.982 ~47.988	0	3
				1	4
				2	5

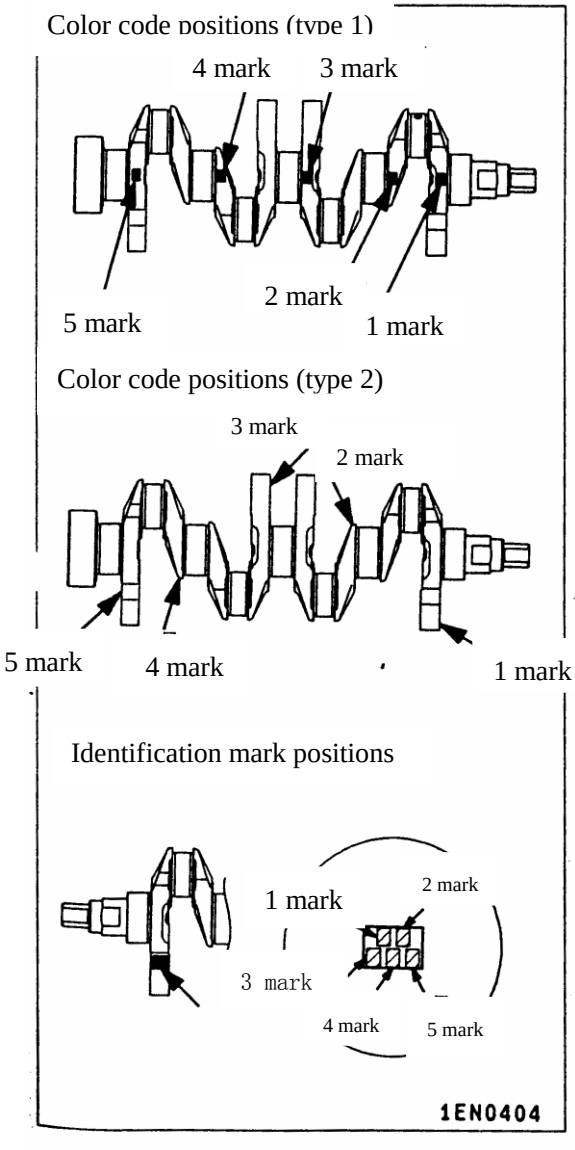


Fig.4-65

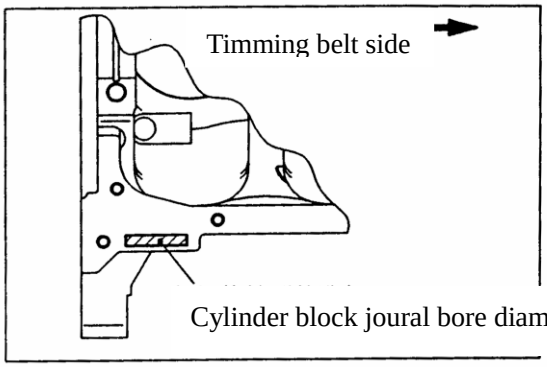


Fig.4-66

b Indentification marks showing the cylinder block bearing bore diameter are stamped in the position shown, with No.1 at the front of the engine. Bearings must be selected and installed in accordance with these identification matks, see Fig.4-66 and Fig.4-67.

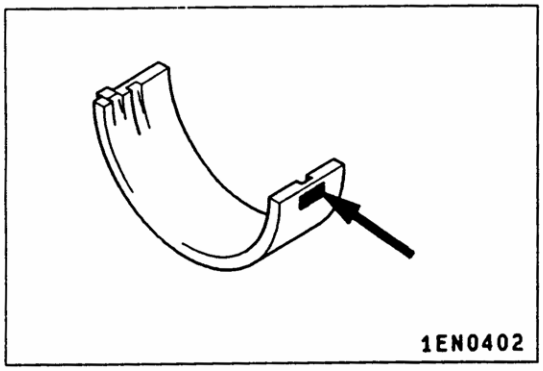


Fig.4-67

c Based on the identification markings verified in steps (1) and (2), select bearings from table 4-8 above.

See the following example:

1. If the measured crankshaft joural diameter is 48.000mm, this corresponds to classification 1 in the above table.

2. If the indentification mark on the cylinder block bearing hole is “1”, select a bearing with an identification mark of “2”.

d Except for the center bearing, all the upper bearings are grooved.the center bearings are grooveless and have flanges. The center bearings are the same at the top and bottom.

e The lower bearings are all grooveless.

See Fig.4-68.

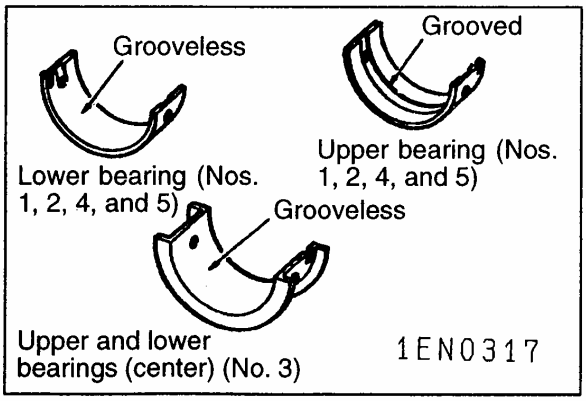


Fig.4-68

(3) BEARING CAP INSTALLATION

a On the bottom surface of each bearing cap is the cap’s number and an arrow.starting at the timing belt side. Fit the bearing caps in numerical order. Ensure that the arrows point toward the timing belt side, see Fig.4-69.

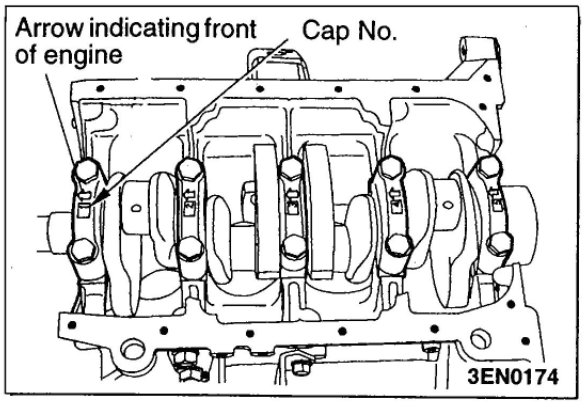


Fig.4-69

b After fitting the bearing caps, measure the end play in the crankshaft. If the measurement exceeds the specified limit, replace the crankshaft bearings, see Fig.4-70.

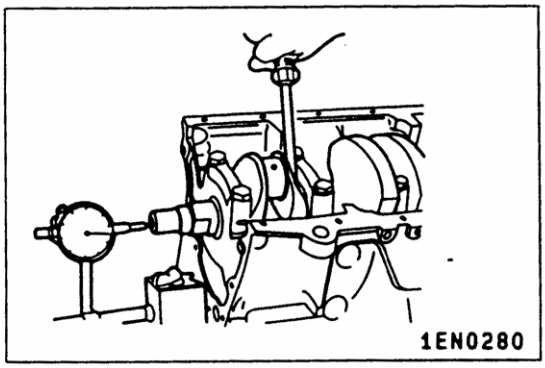


Fig.4-70

Standard value: 0.05-0.18mm

(4) REAR OIL SEAL INSTALLATION

Press-fit the rear oil seal using the special tool shown in the illustration, see Fig.4-71.

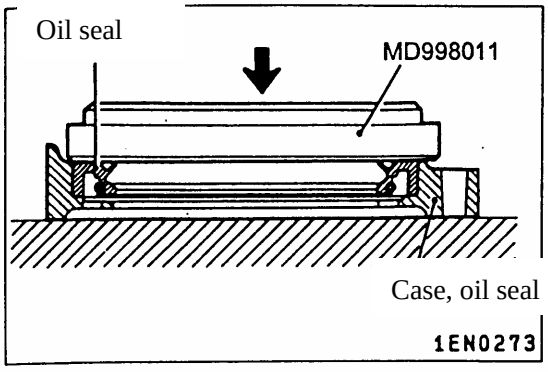


Fig.4-71

4.5 Engine Checking and Servicing

1. Alternator and ignition system

2.Timming belt

1） Timming belt

Check the timming belt closely. Replace the belt with a new one if any of the following defects is evident:

（1） Hardened backing rubber (the backing rubber is glossy, non-elastic, and so hard that scratching with fingernail leaves no mark), see Fig.4-72.

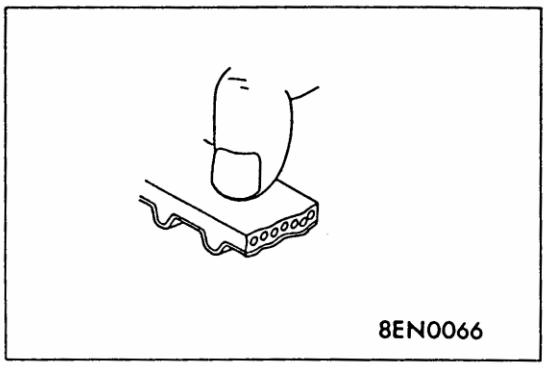


Fig.4-72

（2） Surface cracks in the backing rubber.

（3） Splits in the canvas and/or seperation of the canvas and rubber.

（4） Cracks at the bases of teeth.

（5） Cracks in the side of the belt, see Fig.4-73.

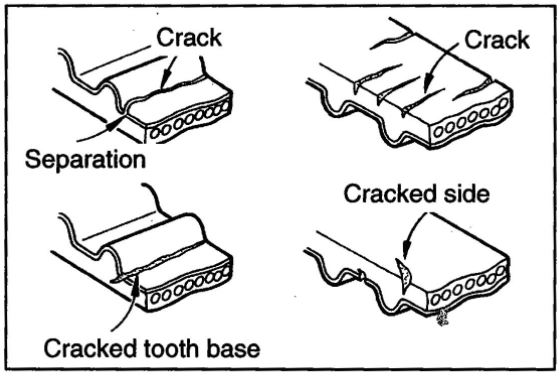


Fig.4-73

（6） Abnormal wear on the belt’s side, see Fig.4-74.

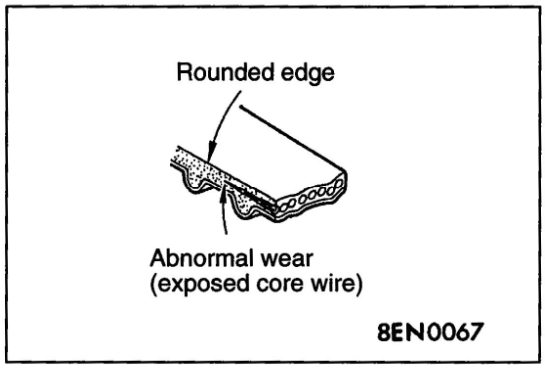


Fig.4-74

NOTICE: The side of the belt are normal if they are sharp as if cut by a knife.

（7） Abormal wear on teeth

Intial stage:

(Fluffy canvas fibers, rubbery texture gone, white discoloration, canvas texture indistinct)

Final stage:

Canvas worn, exposing rubber (tooth width reduced) , see Fig.4-75.

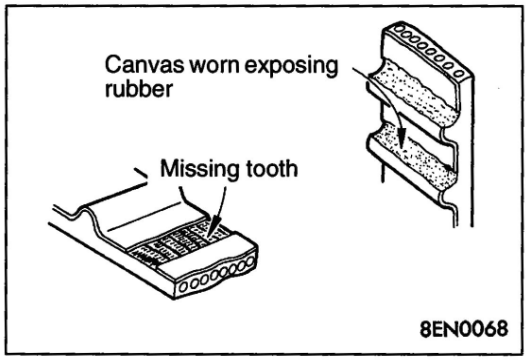


Fig.4-75

（8） Missing teeth

2） Tensioner pulley and idler pulley

Check that the pulleys turn smoothly without play and are not abnormally noisy. Replace either or both of the pulleys if necessary, see Fig.4-76.

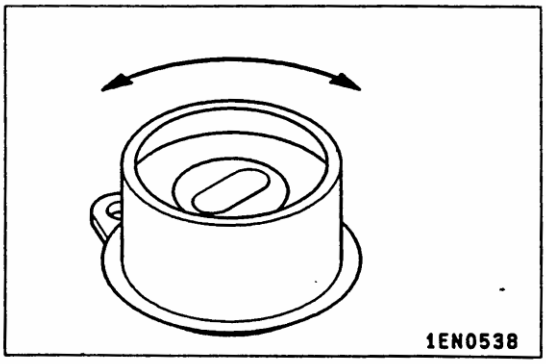


Fig.4-76

3.Fuel and emission control systems

4.Water pump and water hose

5.Intake manifold and exhaust manifold

6.Rocker arms and camshaft

1. Camshaft

Measure camshaft altitude,replace camshaft if the altitude exceed limit, see Table 4-8 and Fig.4-77.

Table 4-8

Camshaft altitude limit (mm)	Intake	36.8
	Exhaust	36.66

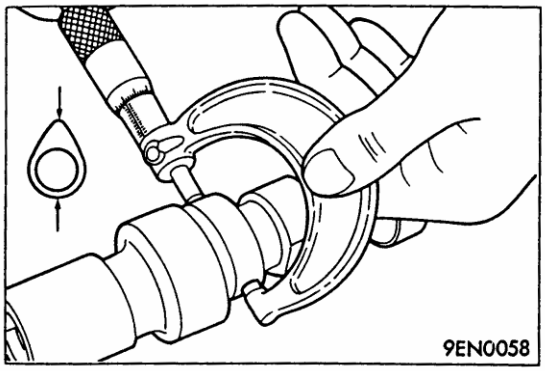


Fig.4-77

7.Cylinder head and valves

1）Cylinder head

（1） Before cleaning the cylinder head, check it for water leaks, gas leaks, cracks, and other damage.

（2） Remove all oil, waterv scale, sealant and carbon.after cleaning the oil passages, blow air through them to verify that they are not blocked.

（3） Check for distortion in the cylinder head gasket surface using a straight limit, grind the gasket surface to specification, see Fig.4-78.

Mat surface distortion standard valve : below 0.03mm

Cylinder attitude (new): 120±0.1mm

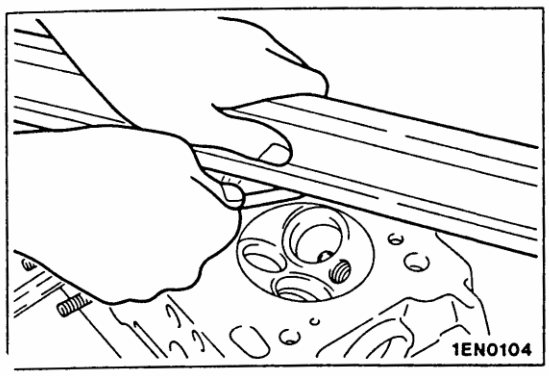


Fig.4-78

NOTICE

No more than 0.2mm of stock may be removed from the cylinder head and cylinder block mating surfaces in total.

2）Valves

（1）Check the valve face for correct contact. If contact is uneven or incomplete, reface the valve seat.

（2） If the margin is less than specified, replace the valve, see Fig.4-79.

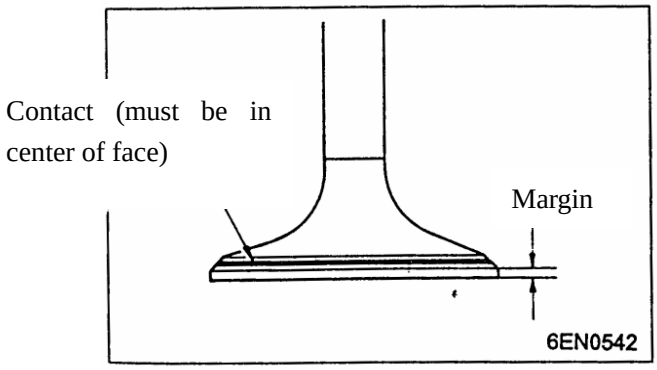


Fig.4-79

Standard: Limit:

Intake: 1.35mm Intake: 0.85mm

Exhaust: 1.85mm Exhaust: 1.35mm

（3）Measure the valve's total length. If the measurement is less than specified, replace the valve.

Standard: Limit:

Intake：111.56mm Intake：111.06mm

Exhaust：114.71mm Exhaust：114.21mm

3） Valve springs

（1） Measure the valve spring's free height, if the measurement is less than specified, replace the spring.

Standard：50.87 Limit：50.37

（2） Measure the squareness of the spring. If the measurement exceeds the specified limit, replace the spring, see Fig.4-80.

Standard value：2° Limit：4°

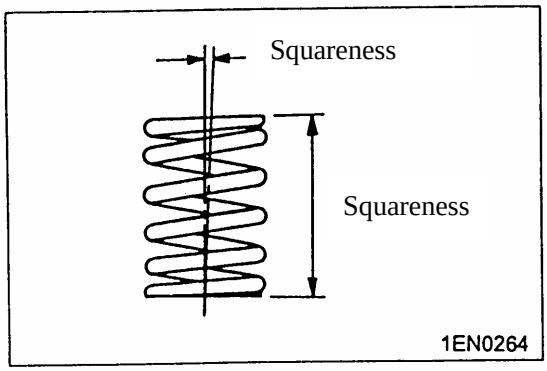


Fig.4-80

4）Valve guides

Measure the clearance between the valve guide and valve stem. If the clearance exceeds the specified limit, replace either or both components, see Fig.4-81.

Standard:

Intake: 0.020–0.036mm

Exhaust: 0.030–0.045mmm

Limit:

Intake: 0.10mm

Exhaust: 0.15mm

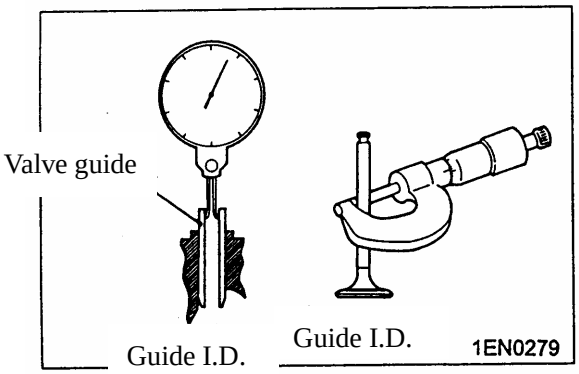


Fig.4-81

5） Valve seats

Assemble the valve , then measure the valve stem projection between the end of the valve stem and the spring seating surface. If the measurement exceeds the specified limit, replace the valve seat, see Fig.4-82.

Standard:	Limit:
Intake: 53.21mm	Intake: 53.71mm
Exhaust: 54.10mm	Exhaust: 54.60mm

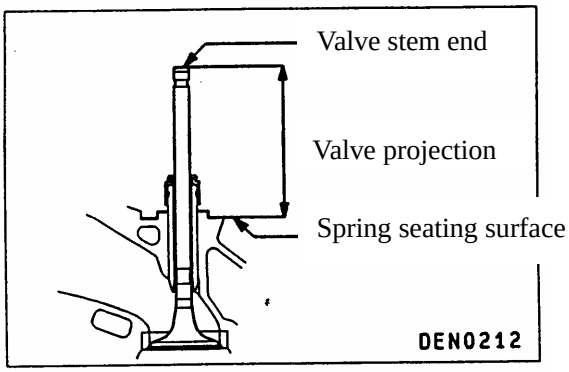


Fig.4-82

Valve seat correction service points

(1) Before correcting the valve seat, check the clearance between the valve guide and valve. If necessary, replace the valve guide.

(2) Using the appropriate special tool or seat grinder, correct the valve seat to achieve the specified seat width and angle.

(3) After correcting the valve seat, lap the valve and valve seat using lapping compound. Then, check the valve stem projection (refer to 5. valve seats in inspection) , see Fig.4-83.

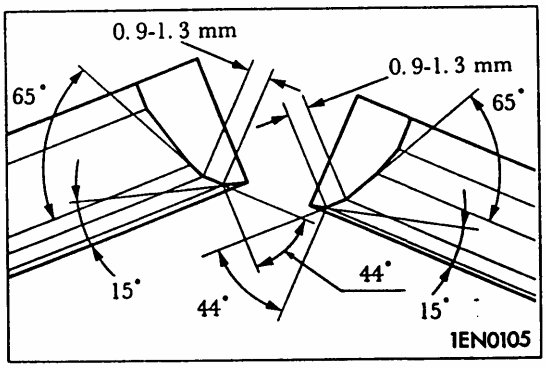


Fig.4-83

Valve seat replacement service points

（1） Cut the valve seat to be replaced from the inside to reduce the wall thickness. Then, remove the valve seat, see Fig.4-84.

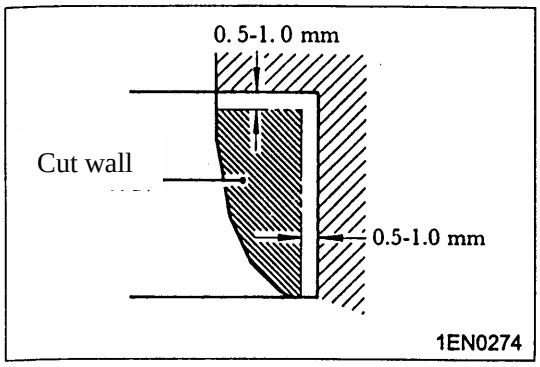


Fig.4-84

（2） Rebore the valve seat hole in the cylinder head to match the selected oversize valve seat diameter, see Fig.4-85.

Intake valve seat hole diameter (O.S.0.3mm)

DA471Q standard: 28.425-28.445mm

DA476Q standard: 30.425-30.445mm

Intake valve seat hole diameter (O.S.0.6mm)

DA471Q standard: 28.725-28.745mm

DA476Q standard: 30.725-30.745mm

Exhaust valve seat hole diameter (O.S.0.3mm)

DA471Q standard: 26.425-26.445mm

DA476Q standard: 28.425-28.445mm

Exhaust valve seat hole diameter (O.S.0.6mm)

DA471Q standard: 26.425-26.445mm

DA476Q standard: 28.725-28.745mm

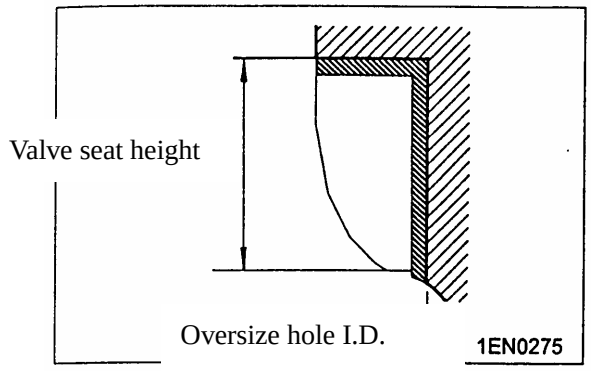


Fig.4-85

（3） Prevent galling of the cylinder head bore by cooling the valve seat with liquid nitrogen before press-fitting it.

（4） Correct the valve seat to achieve the specified width and angle (refer to valve seat correction service points).

Valve guide replacement service points

（1） Using a press, push the valve guide out toward the cylinder block side.

（2） Rebore the valve guide hole in the cylinder head to match the oversize valve guide that is to be fitted, see Fig.4-86.

NOTICE
Don’t install a valve guide of the same size again.

Valve guide hole diameters:

0.05O.S. : 10.605-10.615mm

0.25O.S. : 10.805-10.815mm

0.50O.S. : 11.055-11.065mm

（3） Press-fit the valve guide until it projects by the specified amount.

Standard: 23.0mm

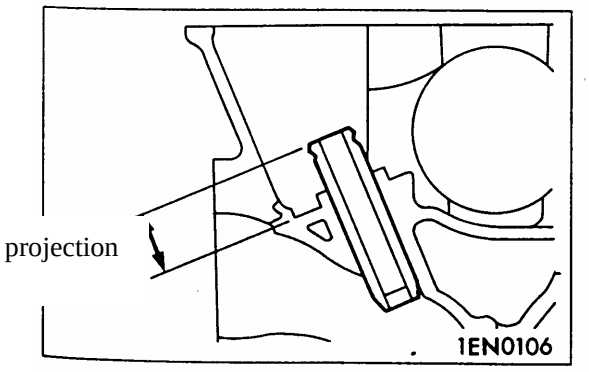


Fig.4-86

NOTICE: 1.The valve guide must be installed from the upper side of the cylinder head.
2. The valve guides differ in length on the intake and exhaust sides.
3. After press-fitting the valve guide,insert a new valve and check that it slides smoothly.

8.Oil pump and oil pan

11）Oil pump

(1) Fit the rotor into the front case.

(2) Check the tip clearance using a thickness gauge, see Fig.4-87.

Standard: 0.06－0.18mm

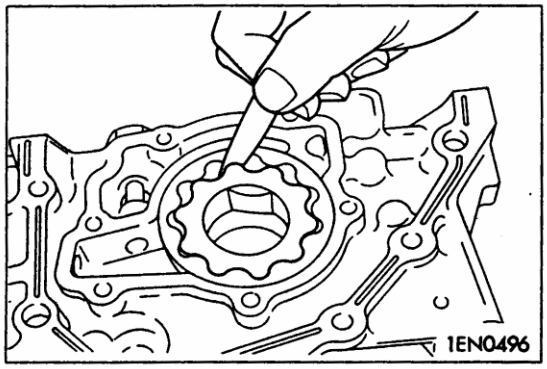


Fig.4-87

(3) Check the side clearance using a straight, see Fig.4-88.

Standard: 0.04－0.11mm

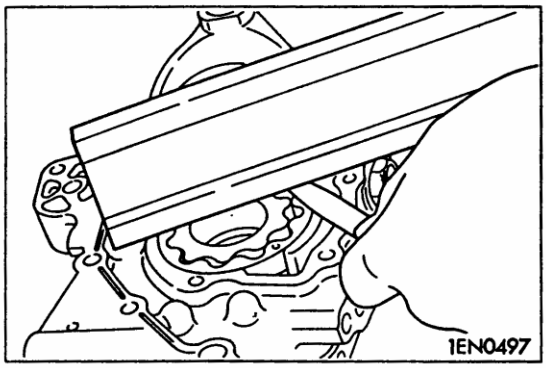


Fig.4-88

(4) Check the body clearance using a thickness gauge, see Fig.4-89.

Standard: 0.10－0.18mm Limit : 0.35mm

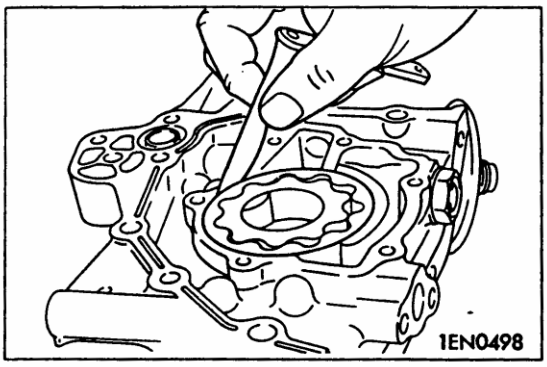


Fig.4-89

9. Piston and connecting rod

1） Piston rings

(1) Check the piston ring side clearance. If the clearance exceeds the specified limit, replace the ring or piston, or both, see Fig.4-90.

Standard:	Limit:
NO.1 ring: 0.03－0.07mm	NO.1 ring: 0.1mm

NO.2 ring: 0.02－0.06mm NO.2 ring: 0.1mm

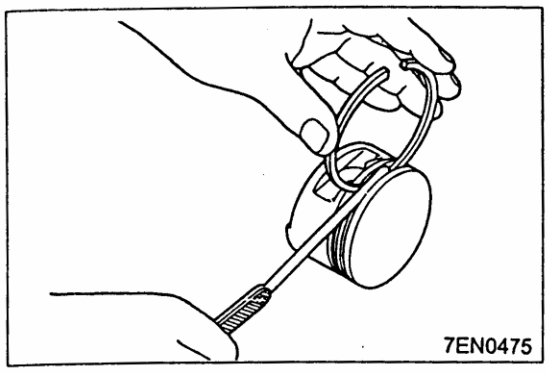


Fig.4-90

(2) Insert the piston ring into the cylinder bore and push it down with a piston . ensure that the piston's crown is in contact with the ring such that the ring is at 90° to the cylinder wall. Then, measure the end gap with a thickness gauge. If the gap is too large, replace the piston ring, see Fig.4-91.

Standard:

NO.1 ring: 0.20－0.35mm

NO.2 ring : 0.35－0.50mm

Oil ring: 0.10－0.40mm(DA471Q)

0.10－0.40mm(DA476Q)

Limit: NO.1 ring: 0.8mm

NO.2 ring : 0.8mm

Oil ring: 1.0mm

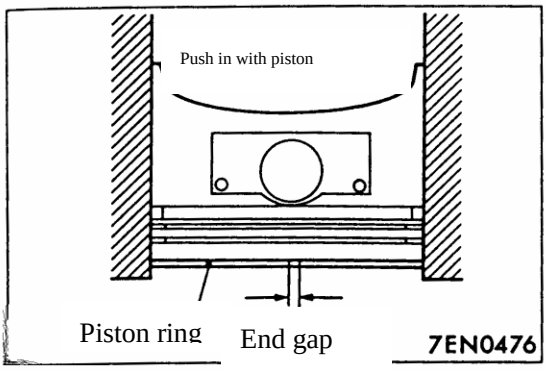


Fig.4-91

2） Bearing, connecting rod, std (Plastic gauge method)

(1) Wipe all oil off the crankshaft pin and connecting rod bearing.

(2) On the pin, place a plastic gauge that is cut to the same length as the bearing's width. The plastic gauge must be centered on the pin in parallel with the pin's axis.

(3) Gently place the connecting rod cap in position and tighten the bolts to the specified torque.

(4) Remove the bolts and gently remove the connecting rod cap.

(5) Measure the compressed part of plastic gauge at its widest point using the scale printed on the plastic gauge bag, see Fig.4-92.

Standard: 0.02－0.04mm

Limit: 0.1mm

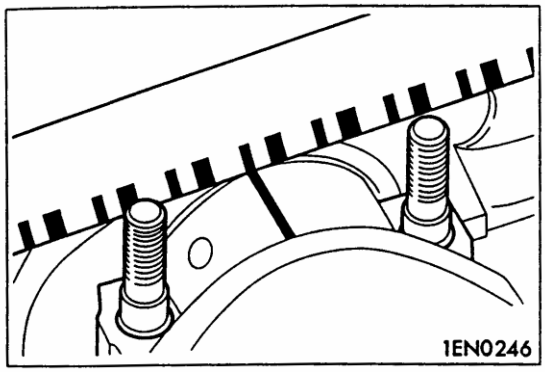


Fig.4-92

10.Crankshaft and cylinder block

1）Crankshaft oil clearance

The crankshaft oil clearance can be measured easily using a plastic gauge.

To check the crankshaft oil clearance with a plastic gauge, carry out the following procedure:

（1）Wipe all oil off the crankshaft journal and the bearing’s inside surface.

（2）Install the crankshaft.

（3）Cut the plastic gauge such that its length matches the width of the bearing, then place it on the journal along the journal’s axis, see Fig.4-93.

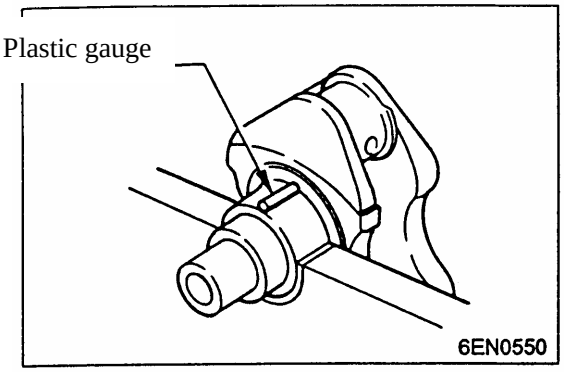


Fig.4-93

（4）Gently fit the crankshaft bearing cap and tighten the bolts to the specified torque.

（5）Remove the bolts and gently remove the crankshaft bearing cap.

（6）Using the scale printed on the plastic gauge bag, measure the plastic gauge’s crushed section at its widest point, see Fig.4-94.

Standard: 0.02－0.04mm

Limit:0.1mm

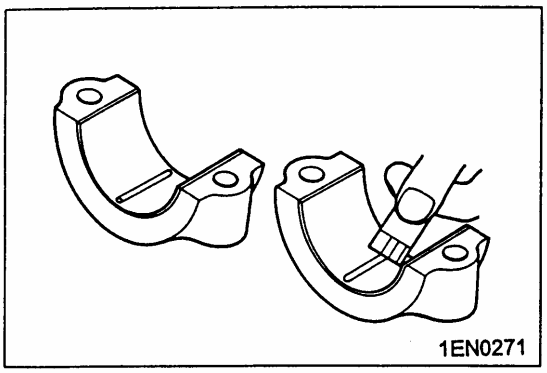


Fig.4-94

NOTICE

The crankshaft pins and journals are fillet-rolled and must not be machined to undersize dimensions, see Fig.4-95.

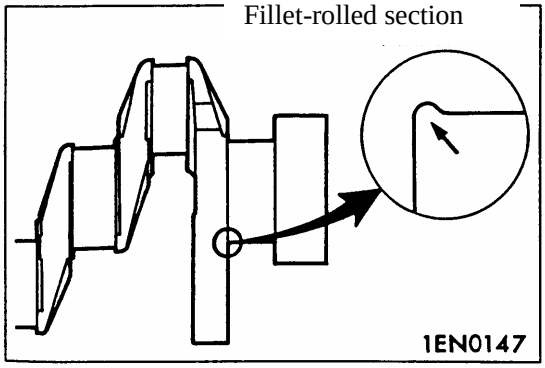


Fig.4-95

2）Cylinder block

（1）Visually check for cracks, rust, and corrosion, and inspect the cylinder block using a flaw detecting agent. Rectify defects where possible or replace the cylinder block.

（2）Ensure that the top surface is free of gasket chips and other foreign material. Check the cylinder block's top surface for distortion using a straight edge and thickness gauge, see Fig.4-96.

Standard: below 0.03mm

Limit: below 0.1 mm

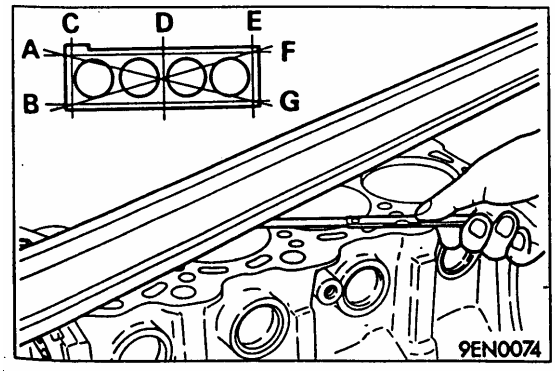


Fig.4-96

（3）Check the cylinder walls for cracks and seizure marks. If defects are evident, bore all the cylinders to oversize or replace the cylinder block.

（4）Using a cylinder gauge, measure each cylinder's bore and cylindricity. If any cylinder is severely worn, bore all the cylinders to oversize and replace the piston and piston rings accordingly. Take measurements at the points shown, see Fig.4-97.

Standard:

Cylinder bore: 71.0mm(DA471Q)

76.0mm(DA476Q)

Cylindricity: below 0.01mm

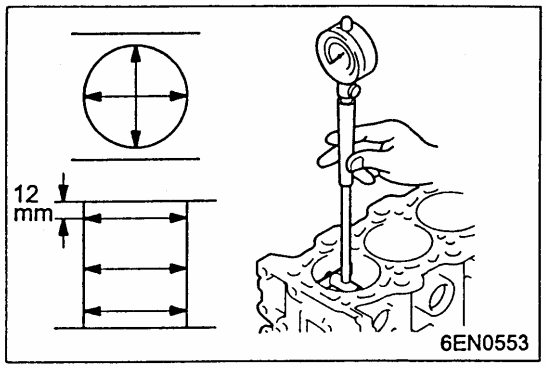


Fig.4-97

3） Boring cylinders

(1) Oversize pistons to be used should be determined on the basis of the cylinder with the largest bore.

(2) Oversize pistons are available with the following oversize dimensions: 0.25mm, 0.50mm, 0.75mm, and 1.00mm. measure the diameter of the piston to be used. Boring must be carried out such that the piston-to-cylinder clearance complies with the standard value. The piston's diameter should be measured at the points shown, see Fig.4-98.

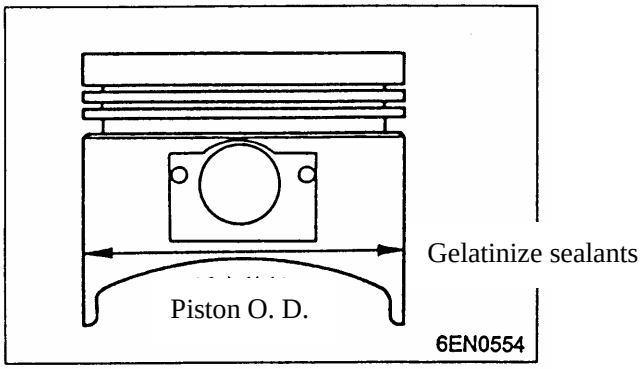


Fig.4-98

(3) Calculate the boring finishi dimension based on the piston diameter dimension.

● [boring finishi dimension]=[piston O.D.]+[piston-to-cylinder clearance (0.02-0.04mm)]-[honing margin (0.02mm)]

(4) Bore each cylinder to the calculated boring finishi dimension.

NOTICE
To prevent distortion caused by heat increases during boring bore the cylinders in the following order: no2, no4, no1, no3.

(5) Hone the cylinders to the final finishi dimension (piston O.D.+piston-to-cylinder clearance).

(6) Check the clearance between the pistons and cylinders

Standard: 0.02 – 0.04mm

4.6 MMC Electronic Control System

1. Summarize

Multipoint fuel injection (MPI) system is the important part of the engine, and this maintenance gist is used to DA471Q/DA476Q engine.

Multipoint fuel injection (MPI) system including the sensor which checks work instance of the engine, the electronic control unit (ECU) control this system according to the signal which those sensors send, every administer working under the control of ECU. ECU has the function including fuel injection control、Idle control、ignition timing control. ECU has several failure diagnose ways, and when the failure take place, the failure eliminated can be predigested.

(1) Fuel injection control

The Control of fuel injector drive timing and fuel injector timing, provides the best air/fuel mix ratio for engine, fitting for the working instance of the engine which always changes.

There is an unitary fuel injection at every intake of the cylinder. The fuel is sent from the fuel tank by the fuel pump, the pressure is adjusted by fuel pressure adjuster. The fuel adjusted is sent to every injector separately.

At the ecumenical instance , the crank shaft injects fuel once to every cylinder at every two rounds. The ignition order of every cylinder is 1-3-4-2.

(2) Idle air control

According to the idle working instance and the change of engine load when it is idling. control the air mass of throttle body and idle other gas path and make the idle speed kept at the best speed. ECU drive idle control (ISC) motor, according to the coolant temperature of engine and load of A/C, make engine kept working at the advance setting idle speed. Also, when turn on or turn off the A/C, ISC motor will adjust the air mass of throttle body and idle other gas path, avoiding the speed of engine fluctuating.

(3) Ignition timing control

The power transistor of ignition primary circuit control primary current which flows to ignition coil by switch on and switch off, by which it can control ignition timing, and it provides the best ignition timing according to the working instance of the engine. Ignition timing is decided by ECU according to the speed of engine、air intake mass、engine coolant temperature and atmosphere pressure.

(4) Self-diagnoses function

① When the sensor or administer which is relating to emission control detects the malfunction, the emergency warning lamp of engine will turn on, by which the driver can be informed.

② When the sensor or administer detects the malfunction, the failure code to which the malfunction is the same will be exported.

③ RAM data which can be read by MUT-Ⅱ relates to the sensor and administer in the ECU. And the administer can be drove forcibly at some time.

(5) Other control function

① Electric fuel pump control

Turn on the relay of electric fuel pump, and the electric fuel pump will be electrified at the crank shaft of engine working.

② Fan relay control

The speed of radiator fan and condenser fan is controlled according to the engine coolant

temperature and the vehicle speed.

③ EGR control magnet valve

Basic standard see Table 4-9

Table 4-9

Item		Standard
Throttle body	Throttle cavity	50
	Throttle position sensor	Variable resistance form
	Idle speed control servo mechanism	Stepper motor form(Stepper motor form by-pass air path control system, with air flow limiter)
	Idle speed position switch	Rotary contact form, in the throttle position sensor
ECU	Identify type	E2T69385
Sensor	Temperature pressure sensor	Semiconductor form
	Coolant temperature sensor	Thermistor form
	Rotate speed sensor	Magnetoresistance element form
	Phase sensor	Hall element form
	Crankshaft degree sensor	Hall element form
Actuator	Control relay form	Contact switch form
	Electric fuel pump relay form	Contact switch form
	The form and quantity of the fuel injector	Electromagnetic form, four
	Fuel injector identify mark	CDH210
	EGR control magnet valve	Break make system magnet valve
Fuel pressure adjuster	Modulator (kPa)	329

2. Service standard

Service standard see Table 4-10.

Table 4-10

Item		standard value
Basic idle speed(r/min)		750±50
The idle speed of A/C working (r/min)	part load	750±50
	high load	850±50
Throttle position sensor regulation voltage (mV)		335～935
Throttle position sensor resistance (kΩ)		2.0～4.0
Idle speed control servo mechanism coil resistance (Ω)		28～33(at 20℃)
Intake temperature sensor resistance (kΩ)	-20℃	13～17
	0℃	5.3～6.7
	20℃	2.3～3.0
	40℃	1.0～1.5
	60℃	0.56～0.76

	80℃	0.30～0.42
Coolant temperature sensor resistance (kΩ)	-20℃	14～17
	0℃	5.1～6.5
	20℃	2.1～2.7
	40℃	0.9～1.3
	60℃	0.48～0.68
	80℃	0.26～0.36
Oxygen sensor output voltage （underway）（V）		0.6～1.0
Fuel pressure (kPa)	Vacuum hose disconnection	At high-point about 324～343
	Vacuum hose connection	At high-point about 265
Fuel injector coil resistance (Ω)		13～16(at 20℃)

3.Sealant

Sealant standard see Table 4-11.

Table 4-11

Item	stated sealant	remark
The worm of the Coolant temperature sensor	3M nut lock, product NO.4171 or coordinative product	Dry quality sealant

4. Failure diagnosis function

1)The emergency warning lamp of the engine

If one of the following off-normal conditions which relate to the multipoint fuel injection system take place, the emergency warning lamp of the engine will be turned on.At the engine running,if the emergency warning lamp of the engine remains on or turned on, please check the failure diagnosis code which is output.

The emergency warning lamp of the engine checking item see Table 4-12.

2)The way of readind and clearing the failure diagnosis code

Please consult the specification of MUT-Ⅱ failure diagnosis.

3)The checking of using the MUT-Ⅱ databook and the actuator test

(1)Check with the MUT-Ⅱ databook and the actuator test function.if there are off-normal conditions,check and repair chassis electric wiring and element.

(2)After repairing,check with MUT-Ⅱ and see whether the off-normal input and output are good.

Table 4-12

Engine-ECU
Intake pressure sensor
Intake temperature sensor
Throttle position sensor
Coolant temperature sensor
Crankshaft degree sensor
Phase sensor
Fuel injector
Ignition coil，Power transistor

(3)Clear the failure diagnosis code in the memory storage.

(4)Pulling out MUT-Ⅱ.

(5)Start the engine,do the road test and see whether the failure has been cleared.

Protection form failure function see Table 4-13.

When the chief sensor failure has been detected by failure diagnosis function,the vehicle is controlled by the control logic circuit which is preestablished and used to keep the driving safe condition(see Table 4-14).

Table 4-13

Failure item	Control content at failure
Intake temperature sensor	Control the intake temperature at 25℃.
Throttle position sensor(TPS)	At speedup, don't increase the fuel injection quantity for the signal of the Throttle position sensor.
Coolant temperature sensor	Control the Coolant temperature at 80℃.
Phase sensor	Keep the fuel off for 4 second after detect the failure.(However, don't detect the upper dead point of the first cylinder,after the ignition coil has been at “ON”.
Intake pressure sensor	Control the intake pressure at 101kPa
Ignition coil，Power transistor	Cut the fuel in the ignition off-normal cylinder.
Oxygen sensor	Don't execute the air/fuel ratio feedback control(close the loop circuit control)
Alternating current generator FR terminal	Don't follow the electrical load to control the output of the alternating current generator(To work as the common alternating current generator).

The checking of the failure code Table 4-14

code	Failure diagnosis item
13	Intake temperature sensor system
14	Throttle position sensor system
21	Coolant temperature sensor system
22	Crankshaft degree sensor system
23	Phase sensor system
24	Vehicle speed sensor system
32	Air pressure sensor system
41	Fuel injector system
44	Ignition coil and Power transistor element system
64	Alternating current generator FR terminal system

Notice

To do it must be severely according to the specification of MUT-Ⅱ failure diagnosis.

4.7 The Trouble Table and Solution of the MMC Electronic Control System

1. INSPECTION FIG FOR TROUBLE SYMPTOMS

Trouble symptom is as shown Table 4-15.

Table 4-15

trouble symptoms		Inspection procedure No.
Communication with MUT-Ⅱ is impossible.	Communication with all systems is not possible	1
	Communication with ECU only is not possible	2
Engine warning lamp and related parts	The engine warning lamp dose not illuminating right after the ignition switch is turned to the "ON" position.	3
	The engine warning lamp remains illuminating and never goes out	4
Starting	No initial combustion（starting impossible）	5
	Initial combustion but no complete combustion （ starting impossible ）	6
	Long time to start （improper starting）	7
Idling stability （improper idling）	UnsTable idling（rough idling,、hunting）	8
	Idling speed is high.（Improper idling speed）	9
	Idling speed is low.（ Improper idling speed ）	10
Idling stability （ Engine stalls）	When the engine is cold ， it stalls at idling.（Die out）	11
	When the engine becomes hot，it stalls at idling.（ Die out ）	12
	The engine stalls when starting the car.（Pass out）	13
	The engine stalls when decelerating.	14
Driving	Hesitation, sag or stumble	15
	The feeling of impact or vibration when accelerating	16
	The feeling of impact or vibration when decelerating	17
	Poor acceleration	18
	Surge	19
	Knocking	20

Dieseling	21
Too high CO and HC concentration when idling	22
Low alternator output voltage（approx.12.3Ⅴ）	23
Idling speed is improper when A/C is operating	24
Fans （radiator fan 、A/C condenser fan）are inoperative	25

2. TROUBLE SYMPTOM TABLE（FOR YOUR INFORMATION）

Trouble symptom is as shown Table 4-16.

Table 4-16

Item		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgment can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall（Die out）	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicles is moving or not .
	Engine stall（Pass out）	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation sag	"Hesitation" is the delay in response of the vehicle speed(engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed(engine speed) during such acceleration.
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration.
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.

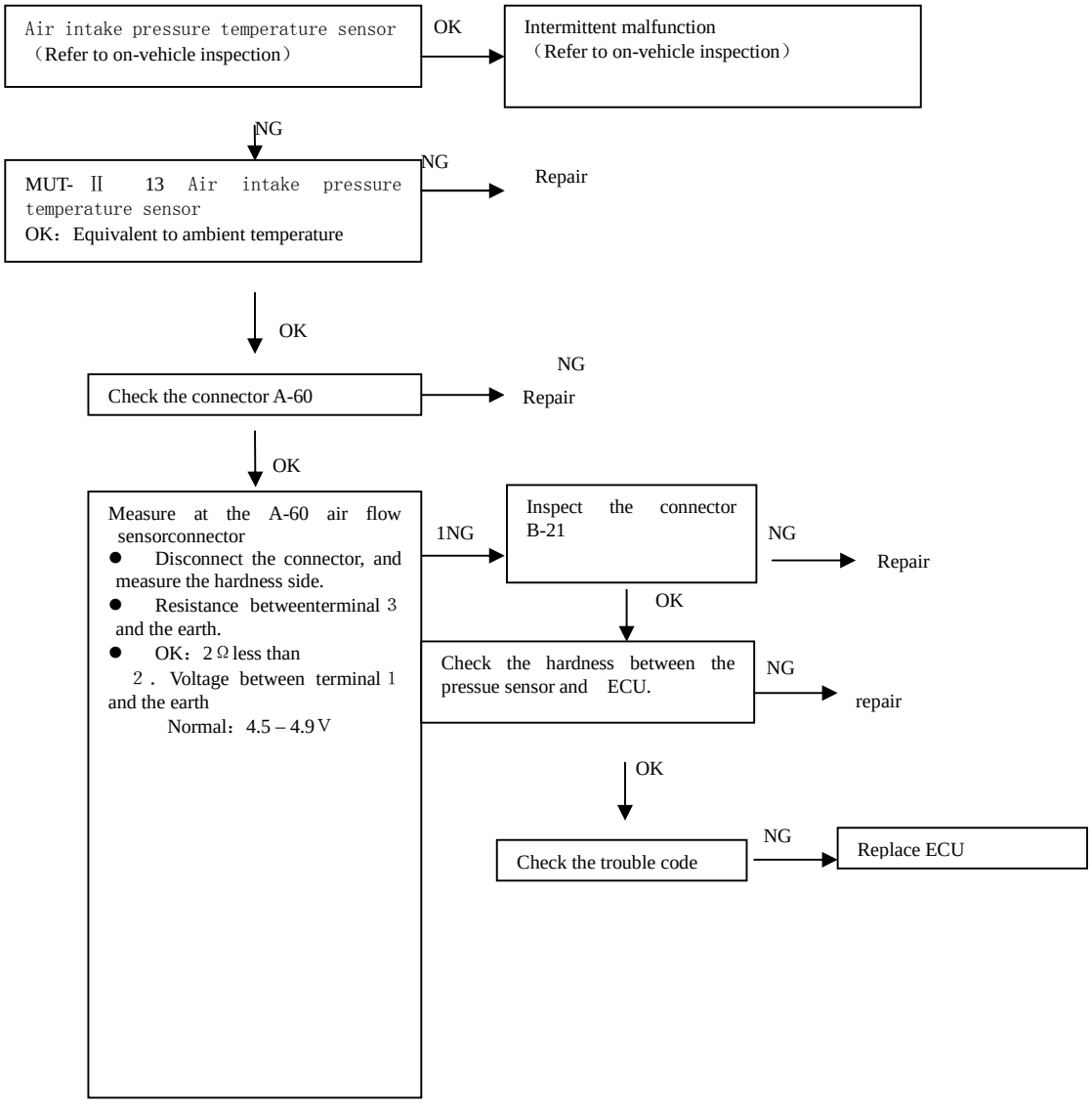
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Parking	Run on（“Dieseling”）	

3. Trouble code inspection sequence

Trouble code check sequence see Table 4-17~4-25、Fig. 4-99~4-107

Table 4-17

Code NO. 1 3 Air intake pressure temperature sensor	Proble Cause
Inspection range ● 2 seconds after ignition swith is set to “ON” position, or after the competion of start of the engine. Evaluation conditions ● The sensor output voltage is more than 4.6V for 4 seconds (Equivalent to air intake temperature of less than －45℃） The sensor output voltage is less than 0.2V for 2 seconds (Equivalent to air intake temperature of more than 125℃）	● Air intake pressure temperature sensor malfunction ● Air intake pressure temperature sensor circuit disconnect, short-circuit or connecter connect is defect. ECU malfunction.



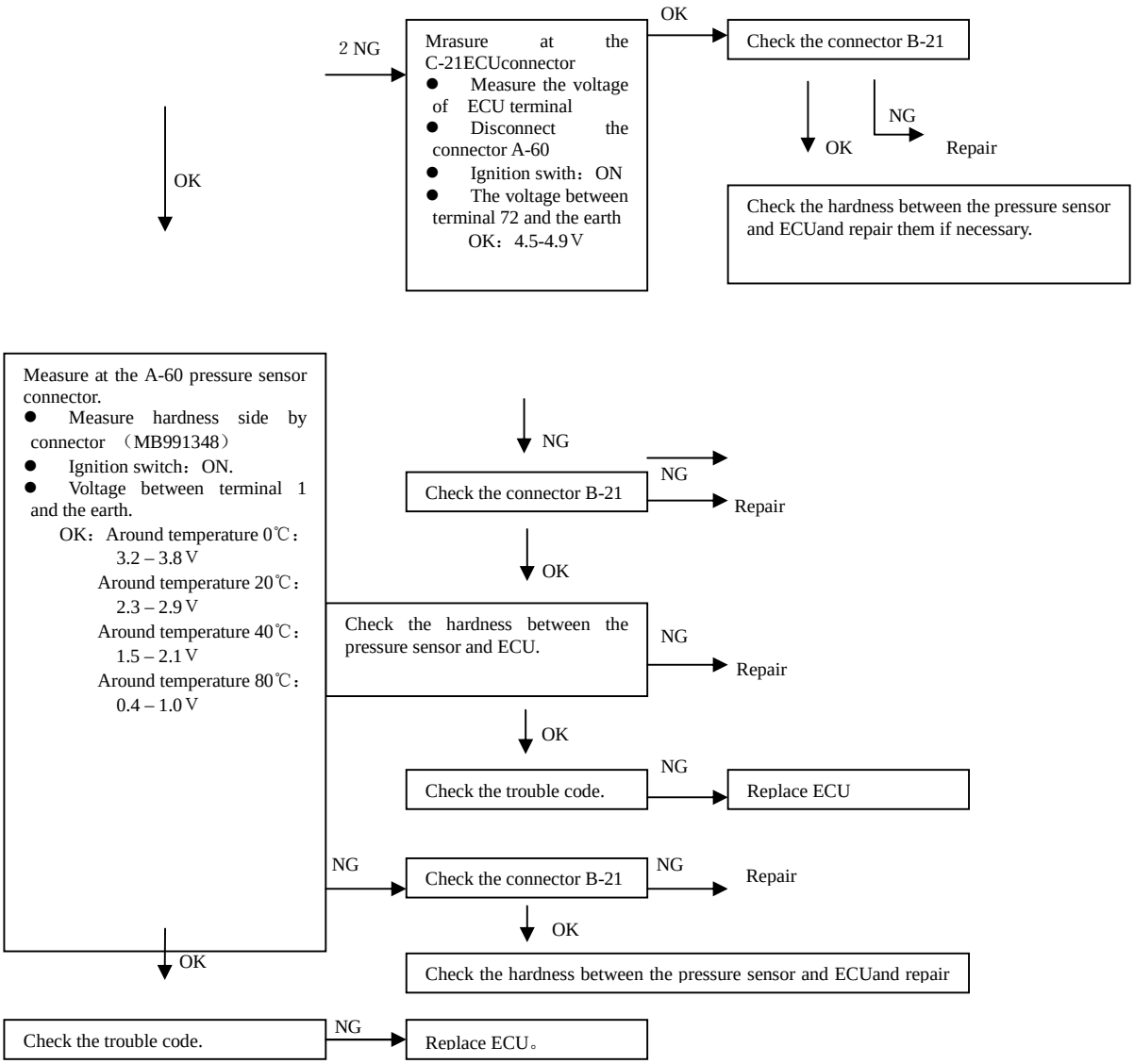
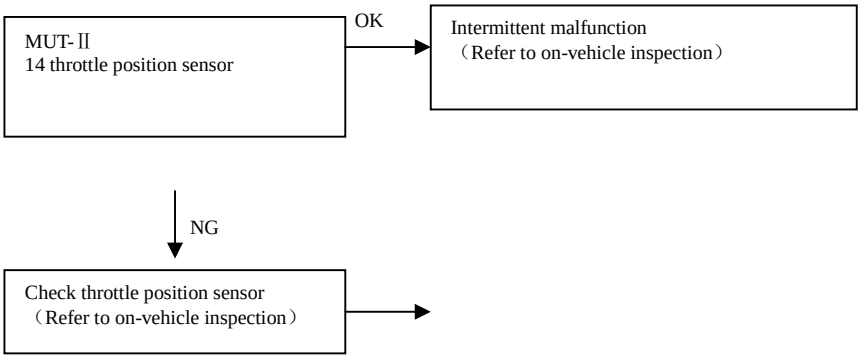
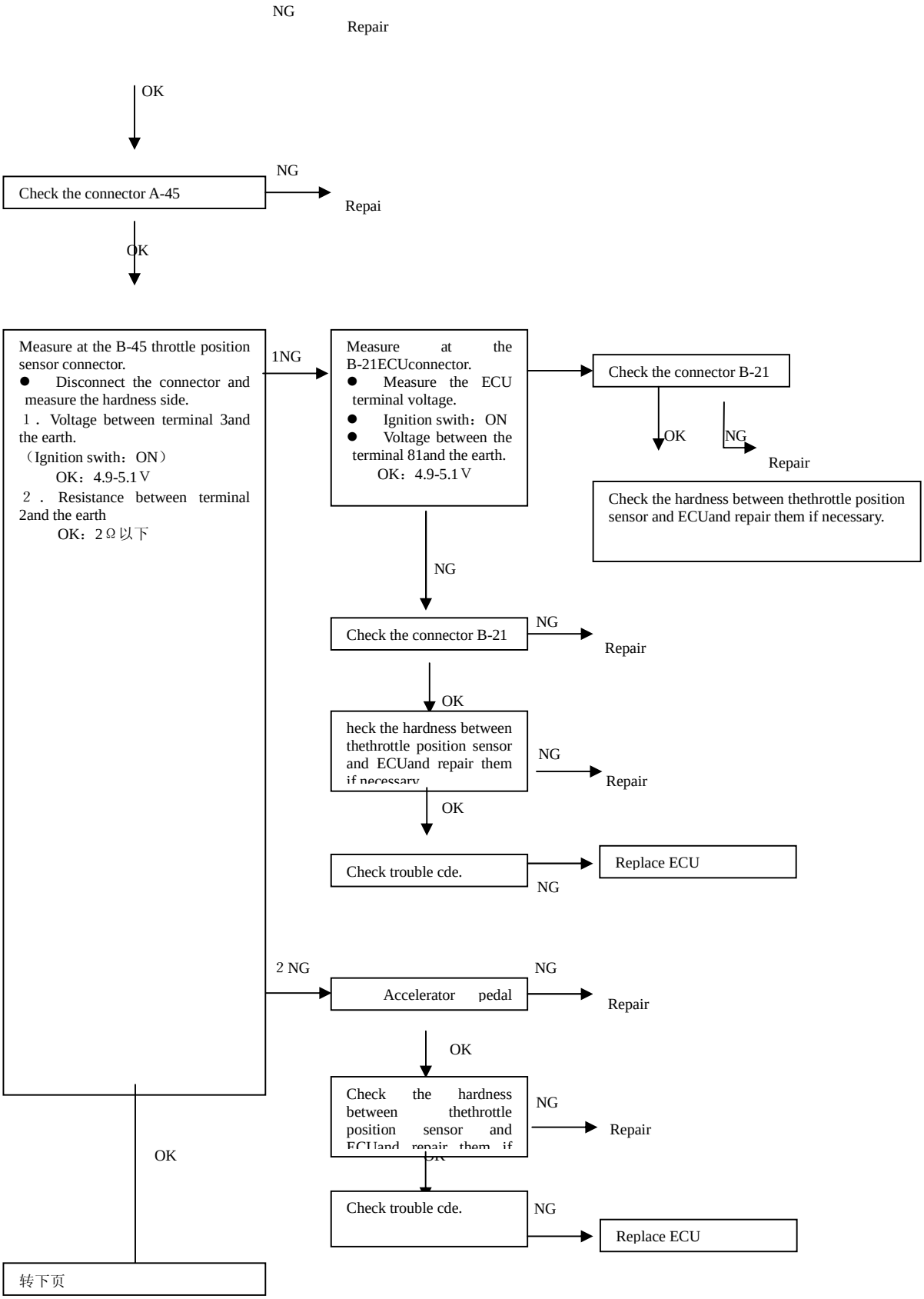


Fig. 4-99

Table 4-18

Code NO.14 throttle position sensor	Proble Cause
Inspection range ● 2 seconds after ignition swith is set to “ON” position, or after the competion of start of the engine. Evaluation conditions ● The engine rotate speed is less than 1,000r/min， and the intake manifold pressure is less than 48kPa 以下. The throttle position sensor output voltage is more than 4.6V for 2 seconds, or less than 0.2V for 2s.	● Throttle position sensor malfunction. ● Throttle position sensor circuit disconnect, short-circuit or connecter connect is defect. ● ECU malfunction,




NG
Repair
OK
Check the connector A-45
NG
Repai
OK
Measure at the B-45 throttle position sensor connector.
● Disconnect the connector and measure the hardness side.
1．Voltage between terminal 3and the earth.
（Ignition swith：ON）
OK：4.9-5.1Ⅴ
2．Resistance between terminal 2and the earth
OK：2Ω以下
1NG
Measure at the B-21ECUconnector.
● Measure the ECU terminal voltage.
● Ignition swith：ON
● Voltage between the terminal 81and the earth.
OK：4.9-5.1Ⅴ
Check the connector B-21
OK
NG
Repair
Check the hardness between thethrottle position sensor and ECUand repair them if necessary.
NG
Check the connector B-21
NG
Repair
OK
heck the hardness between thethrottle position sensor and ECUand repair them if necessary
NG
Repair
OK
Check trouble cde.
Replace ECU
NG
2 NG
Accelerator pedal
NG
Repair
OK
Check the hardness between thethrottle position sensor and ECUand repair them if
NG
Repair
OK
Check trouble cde.
NG
Replace ECU
OK
转下页

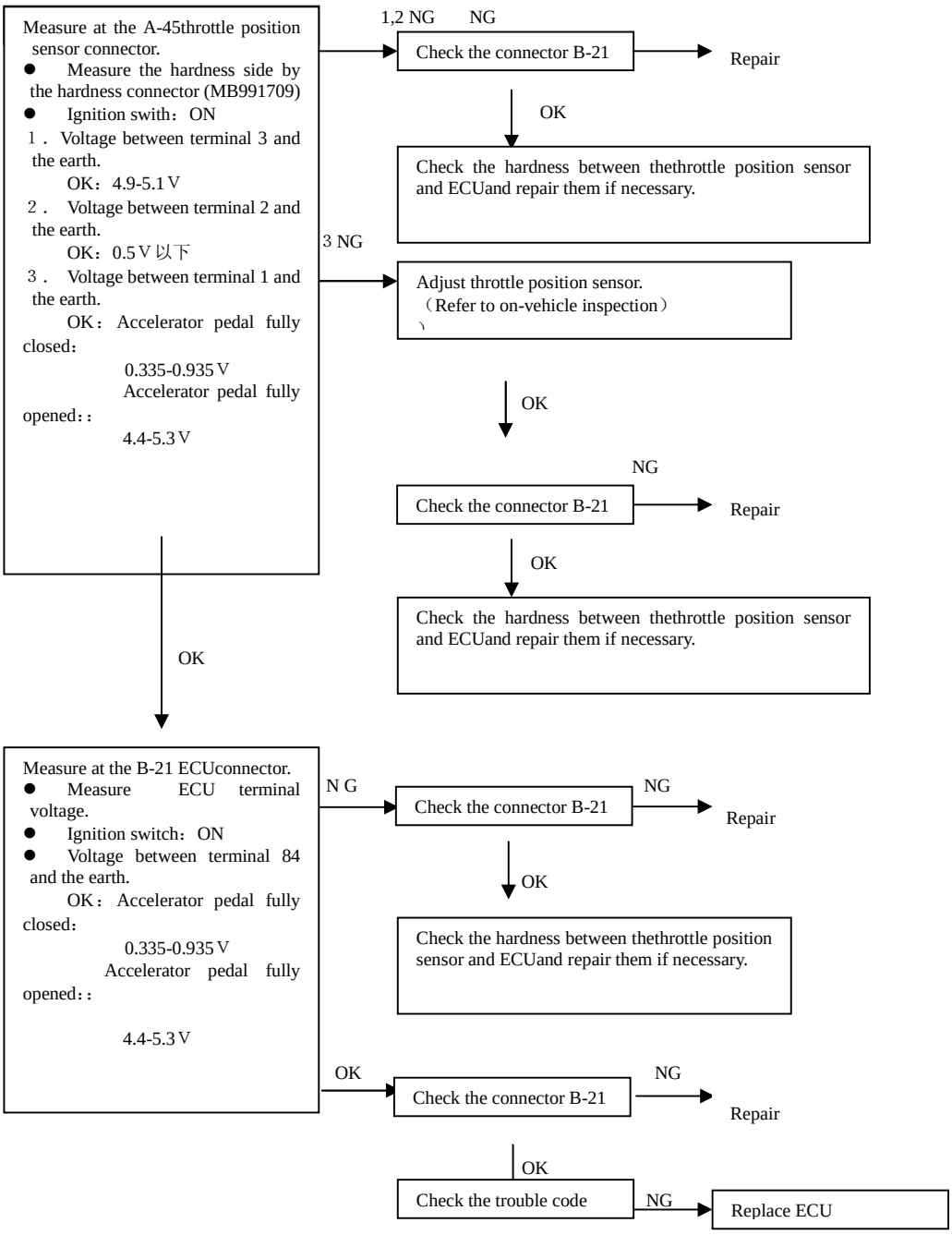
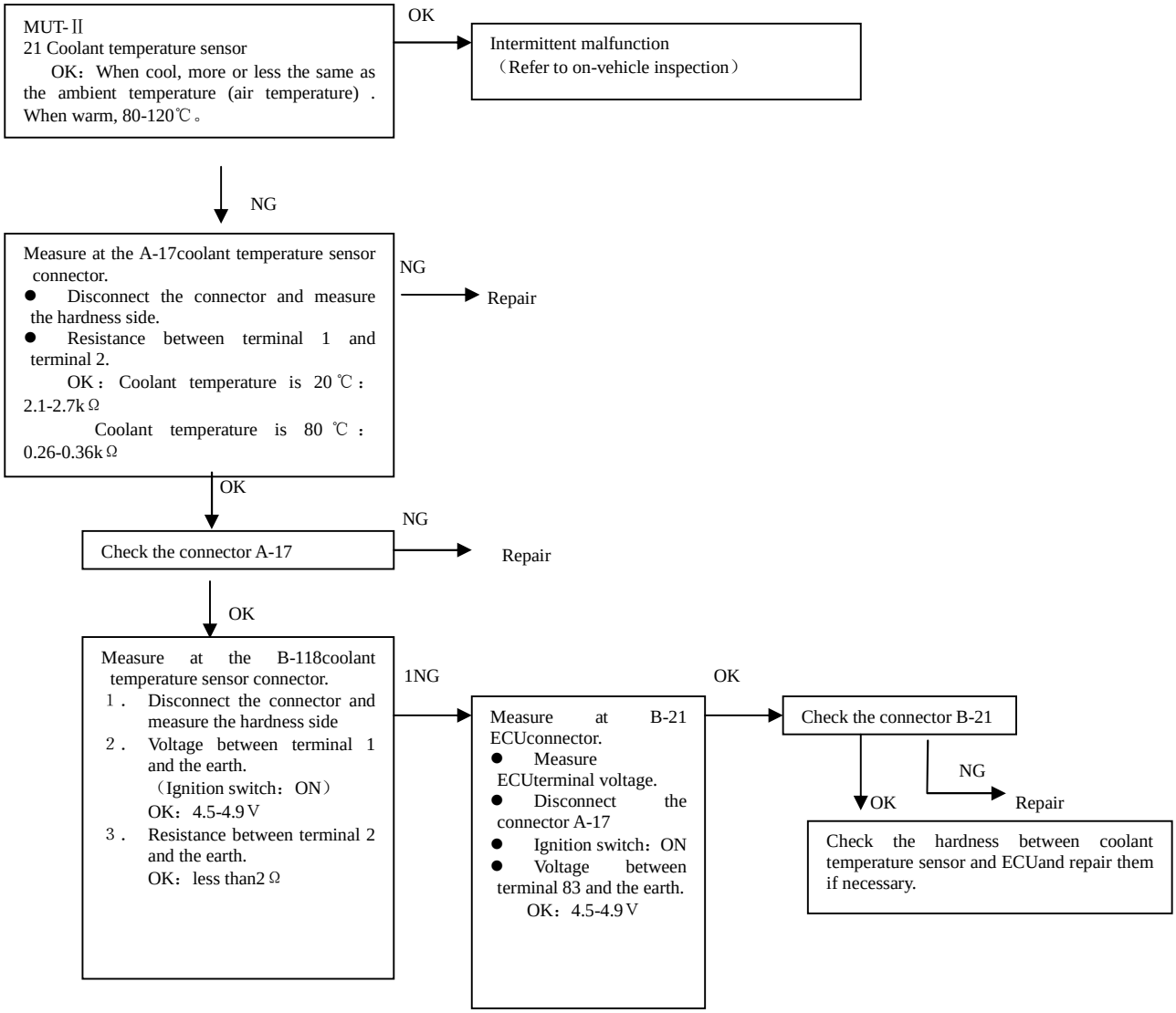


Fig. 4-100

Table 4-19

Code NO.21 engine coolant temperature sensor system	Proble Cause

Inspection range ● Engine：2 seconds after start of the engine. Evaluation conditions ● The sensor output voltage is more than 4.6V for 2 seconds (Equivalent to cooltant temperature of less than －45℃） or The sensor output voltage is less than 0.1V for 2 seconds (Equivalent to cooltant temperature of more than 140℃）	● Engine coolant temperature sensor malfunction. ● Coolant temperature sensor circuit disconnect, short-circuit or connecter connect is defect. ● ECU malfunction,
Inspection range ● Engine： after start of the engine. Evaluation conditions ● From less than 1.6V(equivalent to water temperature of more than 40℃), the sensor temperature rises to more than 1.6Ⅴ（equivalent to water temperature of less than 40℃）for more than 5min。	



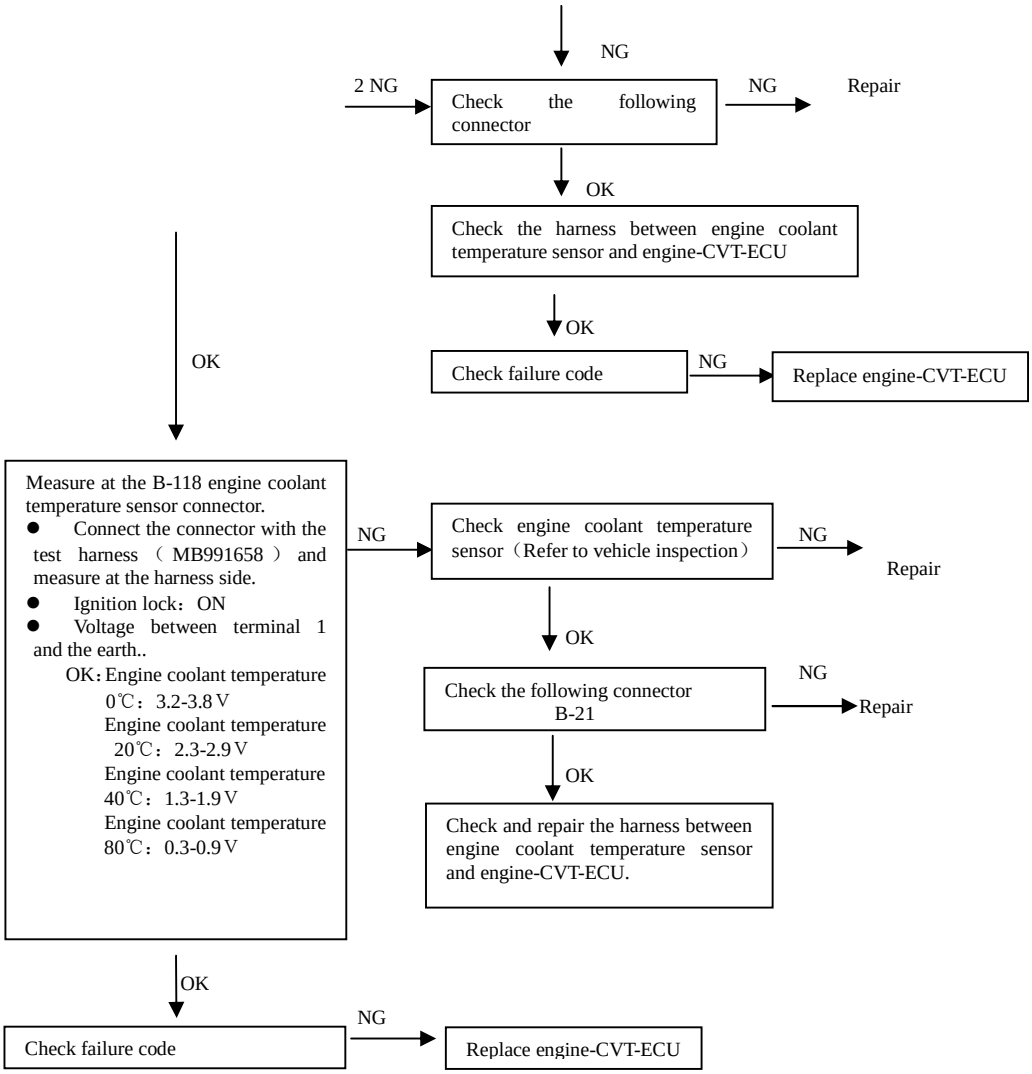
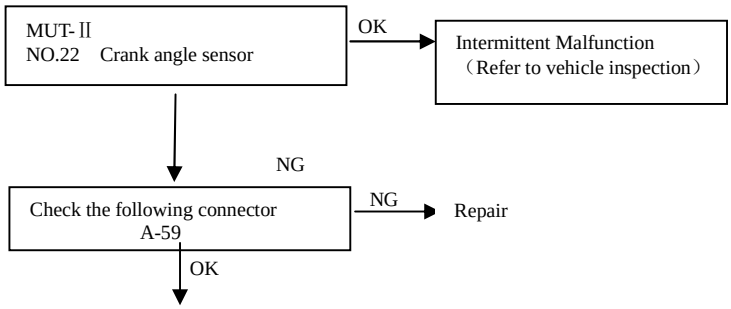
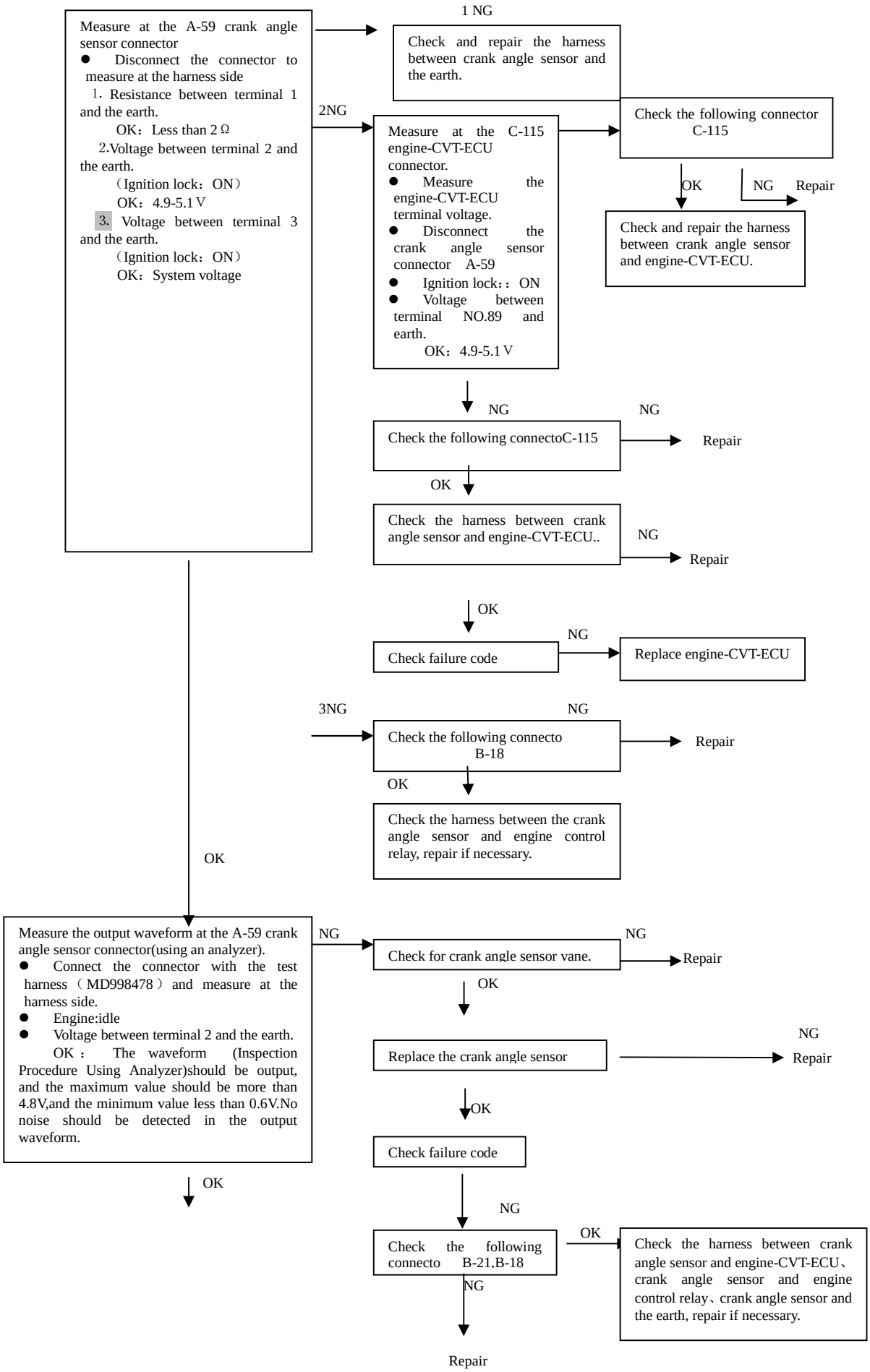


Fig.4-101

Table 4-21

Code NO.22 Crank angle sensor	**Probable cause**
Range of Check ● Engine crank is running. Enactment Conditions ● The sensor output voltage does not change for two seconds （no pulse signal output）	● Malfunction of crank angle sensor. ● Open or short circuit in the crank angle sensor circuit or loose connector contact. ● Malfunction of engine-CVT-ECU.




Measure at the A-59 crank angle sensor connector
● Disconnect the connector to measure at the harness side
1. Resistance between terminal 1 and the earth.
OK：Less than 2Ω
2.Voltage between terminal 2 and the earth.
（Ignition lock：ON）
OK：4.9-5.1V
3. Voltage between terminal 3 and the earth.
（Ignition lock：ON）
OK：System voltage
1 NG
Check and repair the harness between crank angle sensor and the earth.
2NG
Measure at the C-115 engine-CVT-ECU connector.
● Measure the engine-CVT-ECU terminal voltage.
● Disconnect the crank angle sensor connector A-59
● Ignition lock：：ON
● Voltage between terminal NO.89 and earth.
OK：4.9-5.1V
Check the following connector C-115
OK
NG
Repair
Check and repair the harness between crank angle sensor and engine-CVT-ECU.
NG
NG
Check the following connectoC-115
Repair
OK
Check the harness between crank angle sensor and engine-CVT-ECU..
NG
Repair
OK
NG
Check failure code
Replace engine-CVT-ECU
3NG
NG
Check the following connecto B-18
Repair
OK
Check the harness between the crank angle sensor and engine control relay, repair if necessary.
OK
Measure the output waveform at the A-59 crank angle sensor connector(using an analyzer).
● Connect the connector with the test harness（MD998478）and measure at the harness side.
● Engine:idle
● Voltage between terminal 2 and the earth.
OK： The waveform (Inspection Procedure Using Analyzer)should be output, and the maximum value should be more than 4.8V,and the minimum value less than 0.6V.No noise should be detected in the output waveform.
NG
NG
Check for crank angle sensor vane.
Repair
OK
NG
Replace the crank angle sensor
Repair
OK
Check failure code
OK
NG
Check the following connecto B-21.B-18
OK
Check the harness between crank angle sensor and engine-CVT-ECU、crank angle sensor and engine control relay、crank angle sensor and the earth, repair if necessary.
NG
Repair

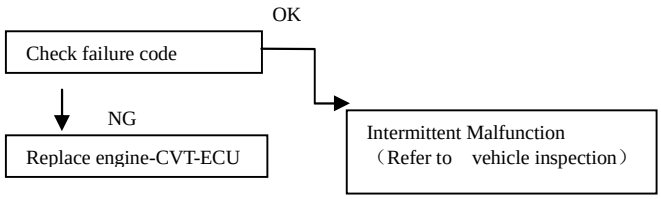


Fig.4-102

Table 4-21

Code NO.24 Vehicle speed sensor system	**Probable cause**
Range of Check ● The Engine：About 2 seconds after engine start ● The engine speed is more than 2500 r/min ● The high load of the engine. Enactment Conditions ● The sensor output voltage does not change for two seconds （no pulse signal output）	● Malfunction of vehicle speed sensor ● Open or short circuit in the vehicle speed sensor circuit or loose connector contact. ● Malfunction of engine-CVT-ECU.

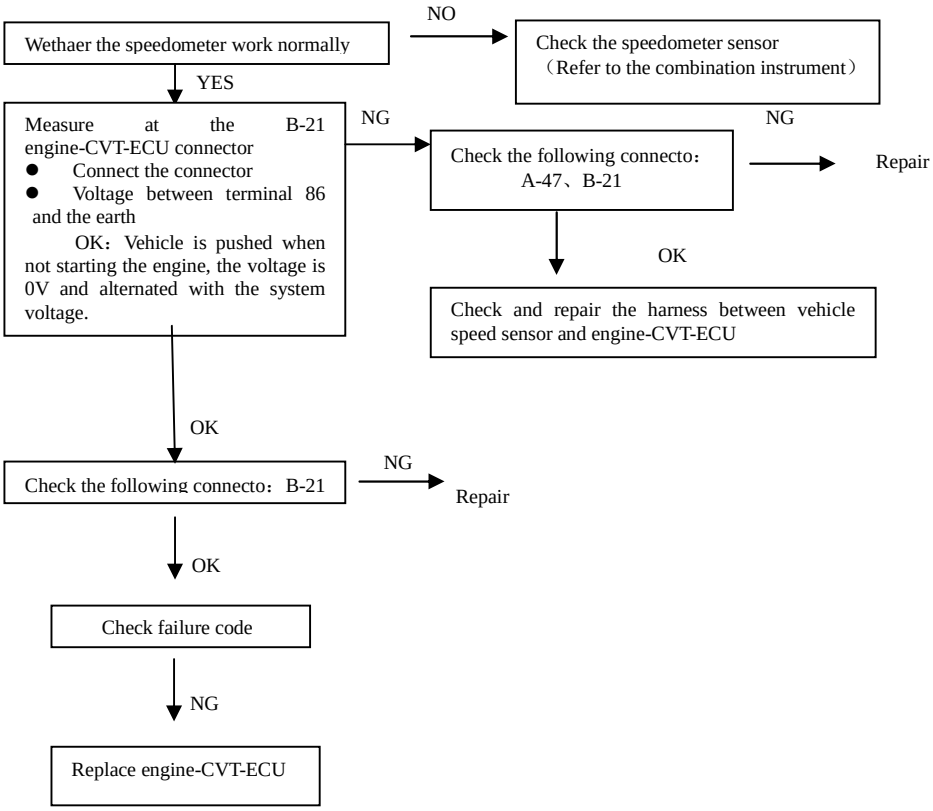
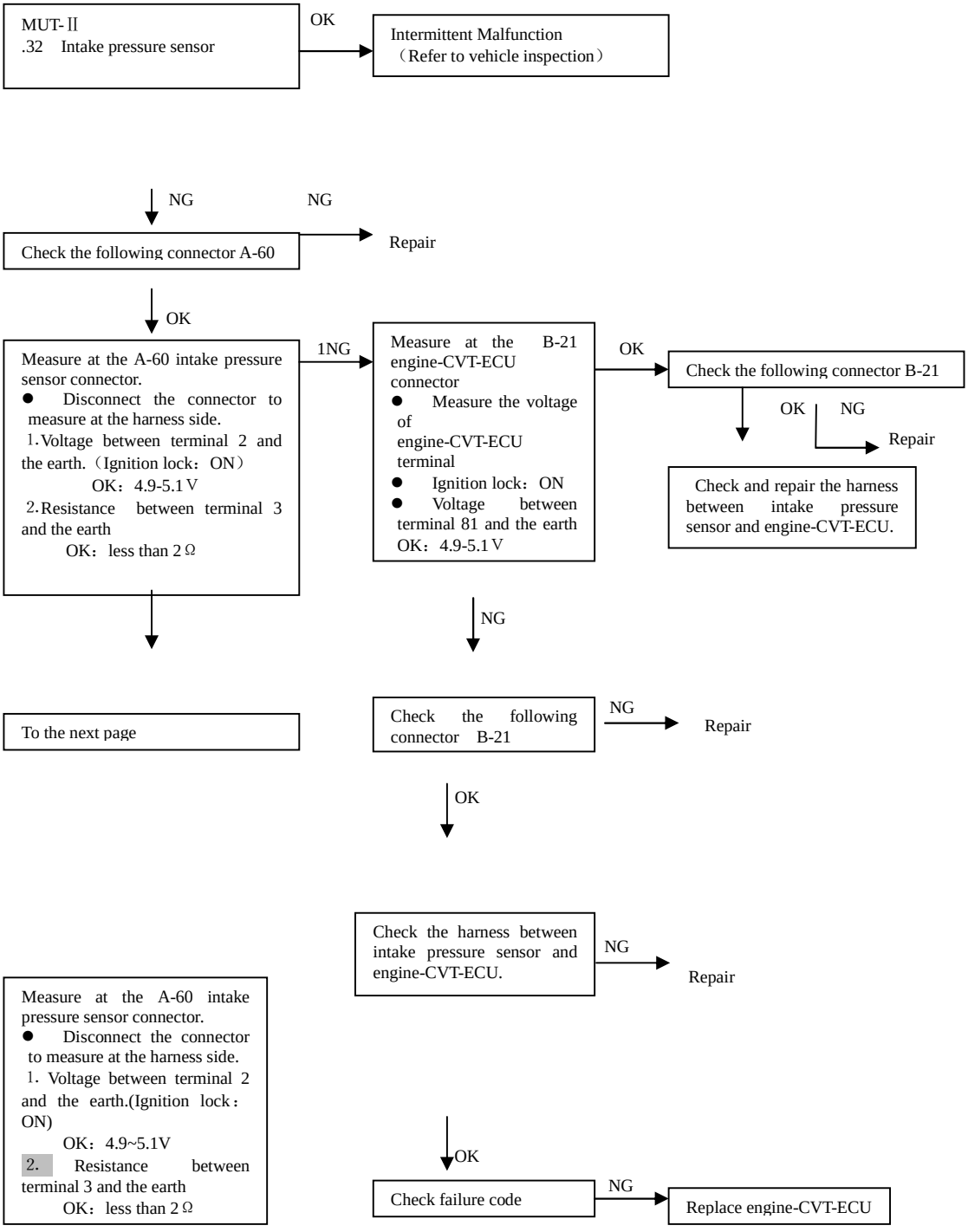


Fig.4-103

Table 4-22

Code NO.32 Intake pressure sensor system	**Probable cause**
Range of Check ● Ignition lock：ON Enactment Conditions ● Intake pressure sensor output voltage is more than 4.5V for 2 seconds（Equivalent to atmospheric pressure more than 115kPa）。	● Malfunction of Intake pressure sensor ● Open or short circuit in the Intake pressure sensor circuit or loose connector contact. ● Malfunction of engine-CVT-ECU.
Range of Check ● Throttle position sensor output voltage is more than 1.25V. ● Vehicle speed is steady Enactment Conditions ● Intake pressure sensor output voltage is less than 0.2V for 2 seconds（Equivalent to atmospheric pressure less than 4.9kPa）。	



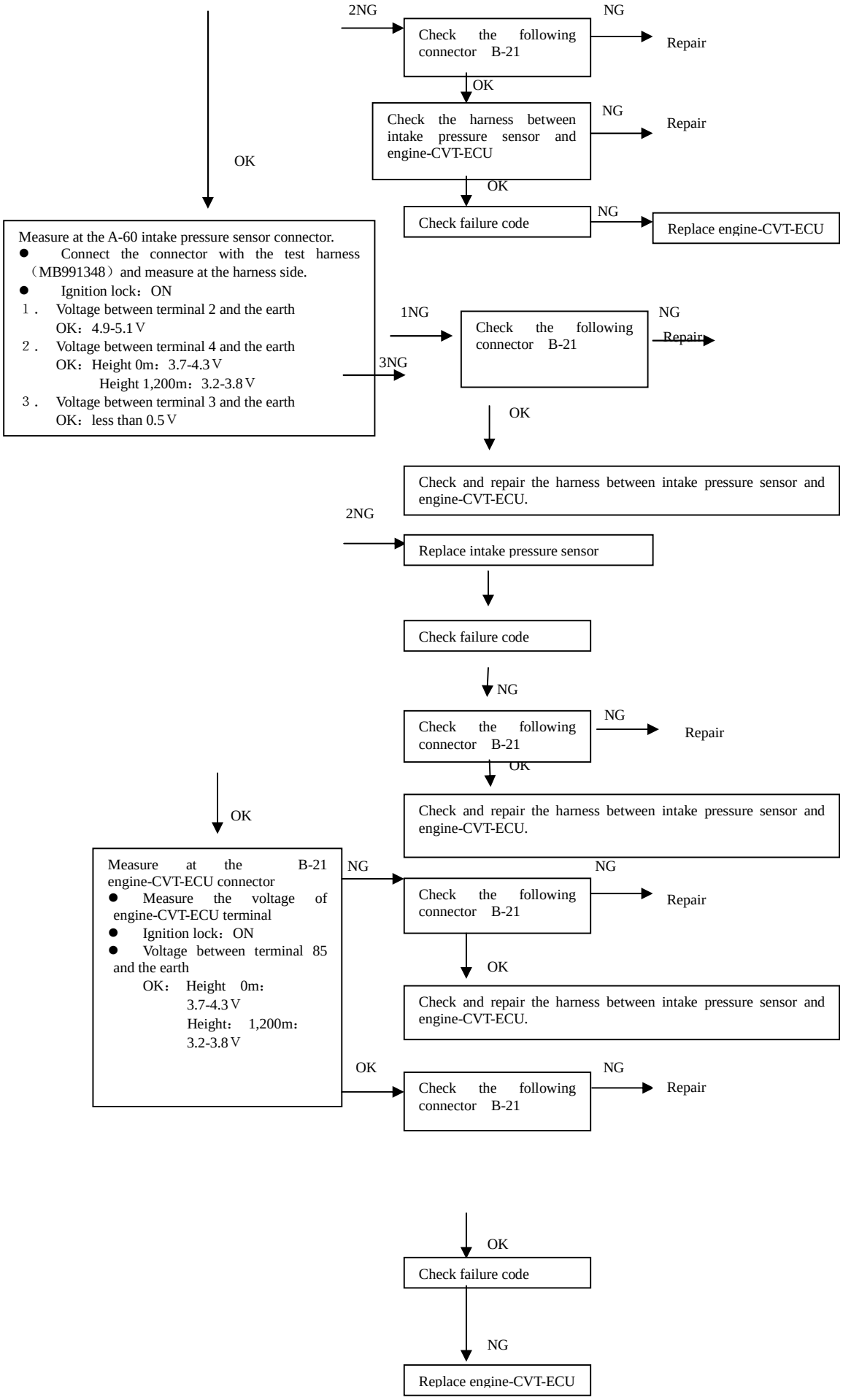
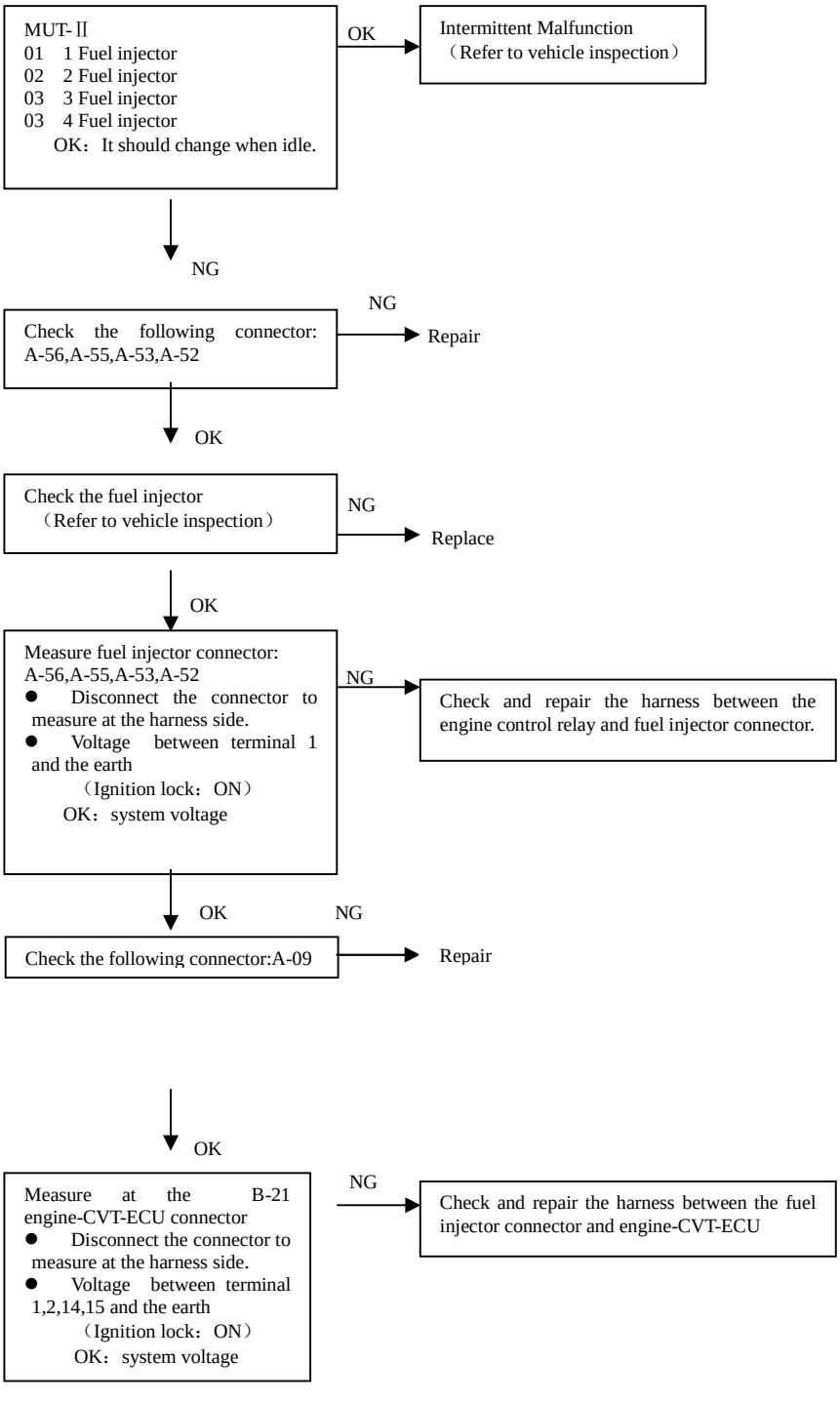

2NG
Check the following connector B-21
NG
Repair
OK
Check the harness between intake pressure sensor and engine-CVT-ECU
NG
Repair
OK
Check failure code
NG
Replace engine-CVT-ECU
OK
Measure at the A-60 intake pressure sensor connector.
● Connect the connector with the test harness （MB991348）and measure at the harness side.
● Ignition lock：ON
1． Voltage between terminal 2 and the earth
OK：4.9-5.1 V
2． Voltage between terminal 4 and the earth
OK：Height 0m：3.7-4.3 V
Height 1,200m：3.2-3.8 V
3． Voltage between terminal 3 and the earth
OK：less than 0.5 V
1NG
3NG
Check the following connector B-21
NG
Repair
OK
Check and repair the harness between intake pressure sensor and engine-CVT-ECU.
2NG
Replace intake pressure sensor
Check failure code
NG
Check the following connector B-21
NG
Repair
OK
Check and repair the harness between intake pressure sensor and engine-CVT-ECU.
OK
Measure at the B-21 engine-CVT-ECU connector
● Measure the voltage of engine-CVT-ECU terminal
● Ignition lock：ON
● Voltage between terminal 85 and the earth
OK： Height 0m：
3.7-4.3 V
Height： 1,200m：
3.2-3.8 V
NG
Check the following connector B-21
NG
Repair
OK
Check and repair the harness between intake pressure sensor and engine-CVT-ECU.
OK
Check the following connector B-21
NG
Repair
OK
Check failure code
NG
Replace engine-CVT-ECU

Fig 4-104

Table 4-24

Code NO.41 Fuel injector system	**Probable cause**
Range of Check ● The engine speed is about 50~1,000 r/min ● Throttle position sensor output voltage is less than 1.15 V ● Doesn't use MUT-Ⅱ Enactment Conditions ● Doesn't check the impact voltage of the fuel injector coil in 2 seconds.	● Malfunction of fuel injector ● Open or short circuit in the fuel injector circuit or loose connector contact. ● Malfunction of engine-CVT-ECU.



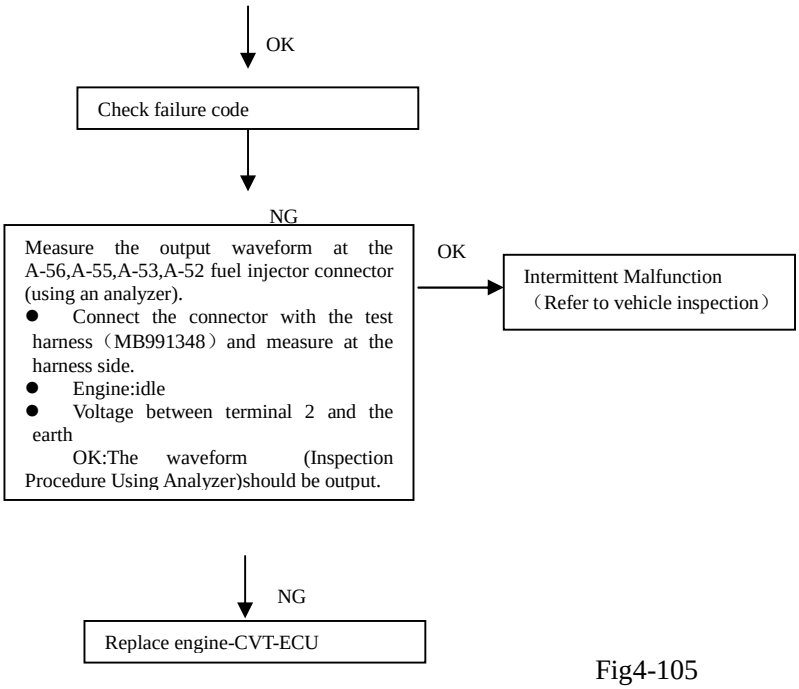
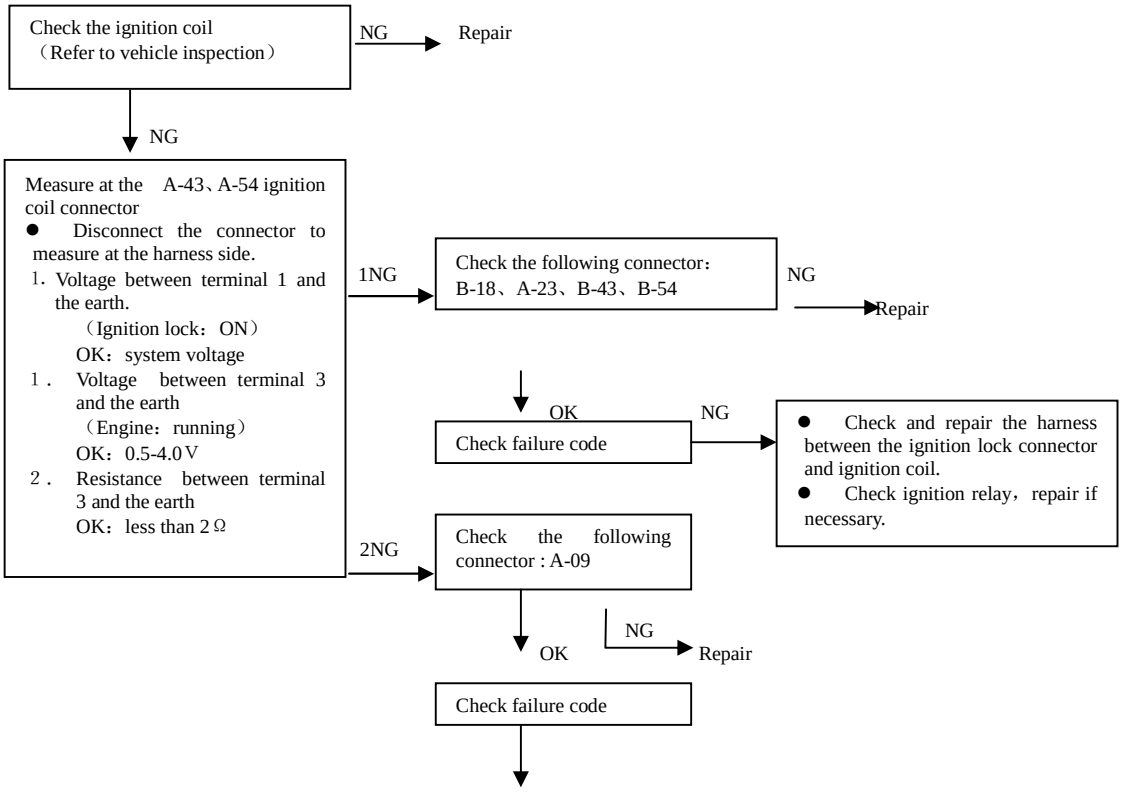


Fig4-105

Table 4-24

Code NO.44 Ignition lock	**Probable cause**
Range of Check ● The engine speed is about 50~4,000 r/min ● Except reduction and acceleration/ reduction abruptly. Enactment Conditions ● The first and the fourth or the second and the third cylinder is fired more than rating when the engine speed is 1,000 r/min.	● Malfunction of ignition coil ● Open or short circuit in the primary ignition coil circuit or loose connector contact. ● Malfunction of spark plug and spark plug cable. ● Compression ratio failure. ● Malfunction of engine-CVT-ECU



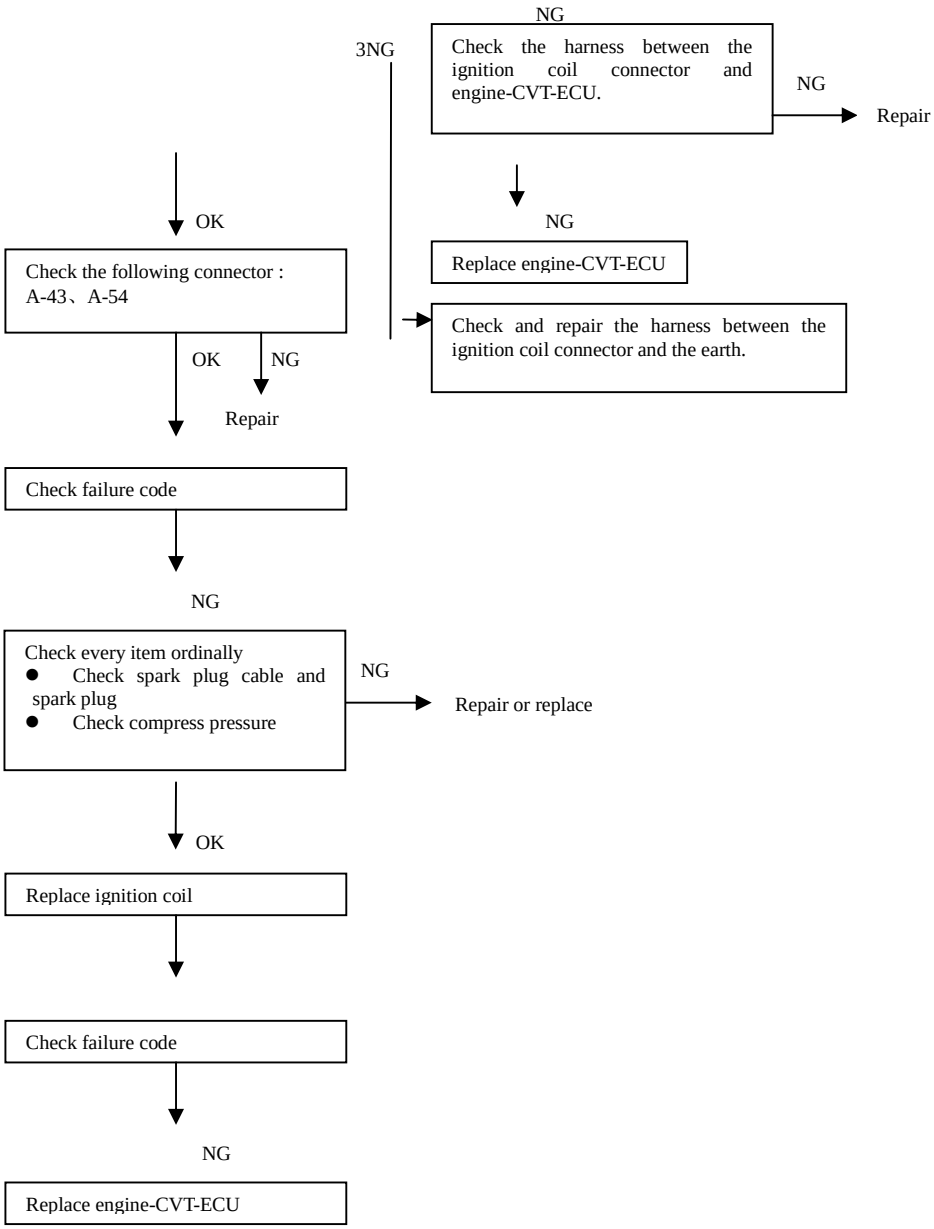


Fig4-106

Table 4-25

Code NO.64 Alternator FR terminal. system	Probable cause
● Range of Check ● The engine speed is more than 50 r/min ● Enactment condition ● Alternator FR terminal output voltage is the system voltage about 20 seconds.	● Open circui is in alternator FR terminal. ● Malfunction of engine-CVT-ECU.

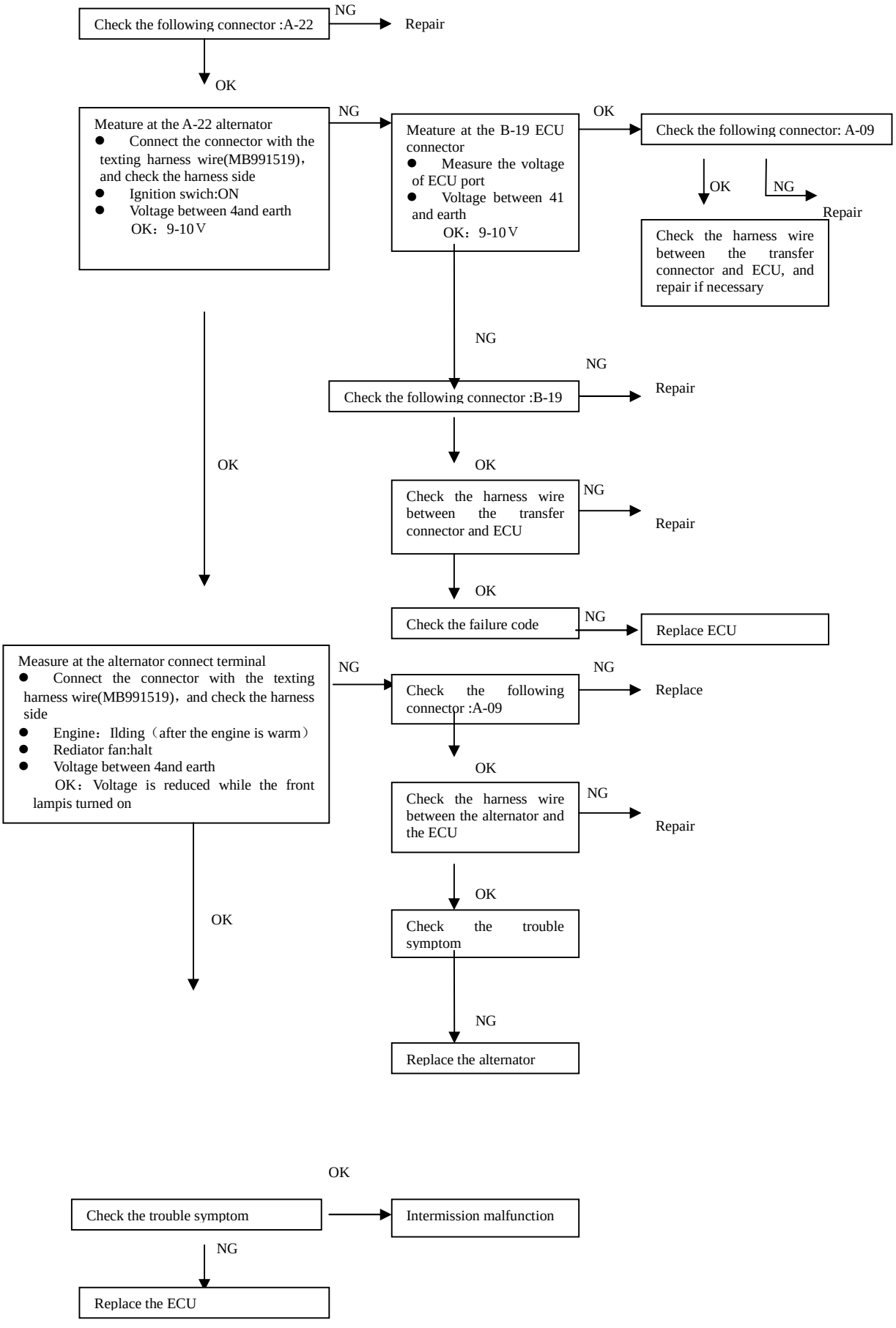

Check the following connector :A-22
NG
Repair
OK
Meature at the A-22 alternator
● Connect the connector with the texting harness wire(MB991519), and check the harness side
● Ignition swich:ON
● Voltage between 4and earth
OK：9-10V
NG
Meature at the B-19 ECU connector
● Measure the voltage of ECU port
● Voltage between 41 and earth
OK：9-10V
OK
Check the following connector: A-09
OK
NG
Repair
Check the harness wire between the transfer connector and ECU, and repair if necessary
NG
NG
Check the following connector :B-19
Repair
OK
OK
Check the harness wire between the transfer connector and ECU
NG
Repair
OK
Check the failure code
NG
Replace ECU
Measure at the alternator connect terminal
● Connect the connector with the texting harness wire(MB991519), and check the harness side
● Engine：Ilding（after the engine is warm）
● Rediator fan:halt
● Voltage between 4and earth
OK：Voltage is reduced while the front lampis turned on
NG
NG
Check the following connector :A-09
Replace
OK
Check the harness wire between the alternator and the ECU
NG
Repair
OK
Check the trouble symptom
OK
NG
Replace the alternator
OK
Check the trouble symptom
Intermission malfunction
NG
Replace the ECU

Fig 4-107

4. INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1　see Table4-26、Fig 4-108：

Table 4-26

Communication with MUT-II is not possible **（Communication with all system is not possible）**	**Probable cause**
The cause is probably a defect in the power supplysystem(include earth) for the diagnosis line	● Malfunction of the connector ● Malfunction of the harness wire

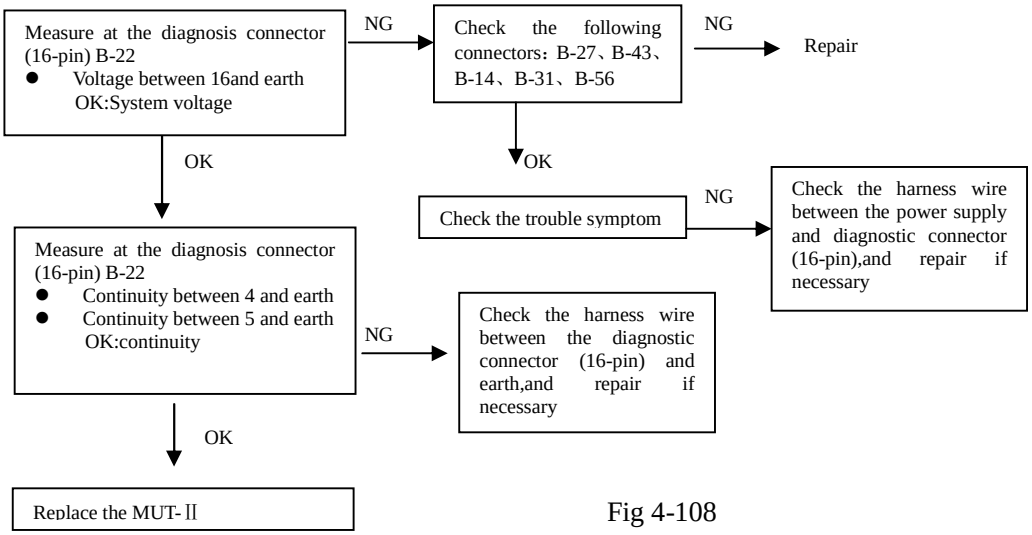
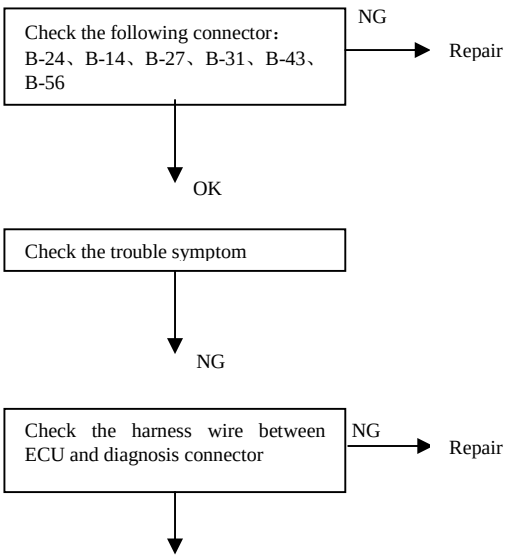


Fig 4-108

INSPECTION PROCEDURE 2　see Table 4-27、Fig 4-109：

Table 4-27

Communication with ECU is impossible	**Probable cause**
One of the following causes maybe sespected： ● No power supply to ECU ● Defective earth circuit of ECU ● Defective ECU ● Improper communication line between ECU and MUT-II	● Malfunction of ECU power supply circuit ● Malfunction of ECU ● Open circuit between ECU and diagnosis connector



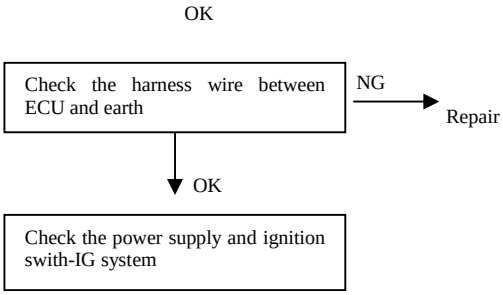


Fig 4-109

INSPECTION PROCEDURE 3　see Table 4-28、Fig 4-110：

Table 4－28

The engine warning lamp dose not illuminate right after the ignition swith is turned to the ON position	**Probable cause**
Because there is a burnt-out bulb,the ECU causes the engine waring lamp to illuminate for five seconds immediately after the ignition swith is turned to ON. If the engine warning lamp dose not illuminate right after the ignition swith is turned to ON, One of the malfunctions Tableed at right has probably occurred.	● Burnt-out bulb ● Defactive warning lamp circuit ● Malfunction of the ECU

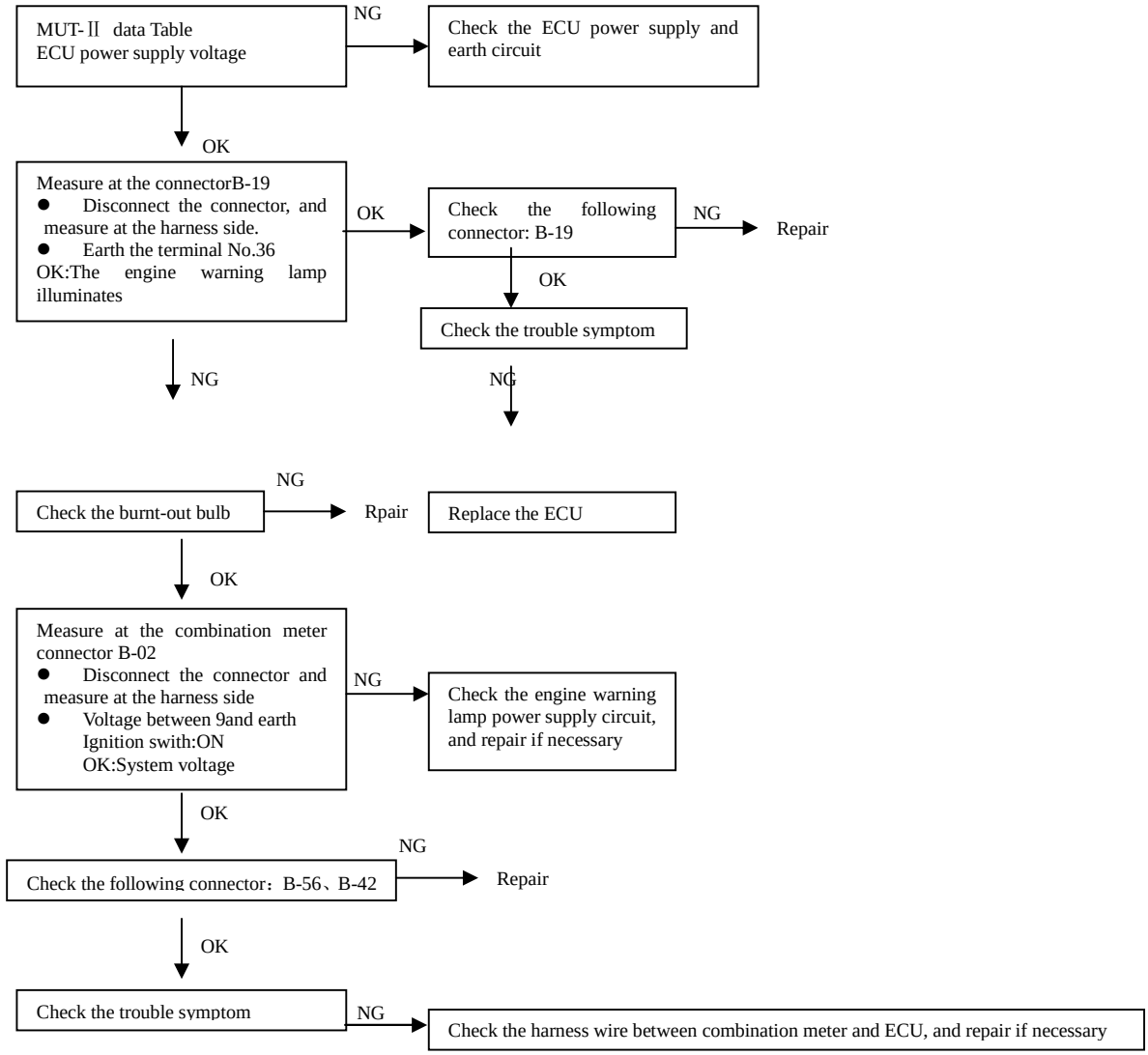


Fig 4-110

INSPECTION PROCEDURE 4　see Table 4-29、Fig 4-111：

Table 4-29

The engine warning lamp remain illuminating and never crush out	**Probable cause**
In cases such as the above, the cause is probably that the ECU is detecting a problem in a sensor or actuater,or that one of the malfunctions Tableed at ringt has occurred.	● Short circuit between the engine waring lamp and ECU ● Malfunction of the ECU

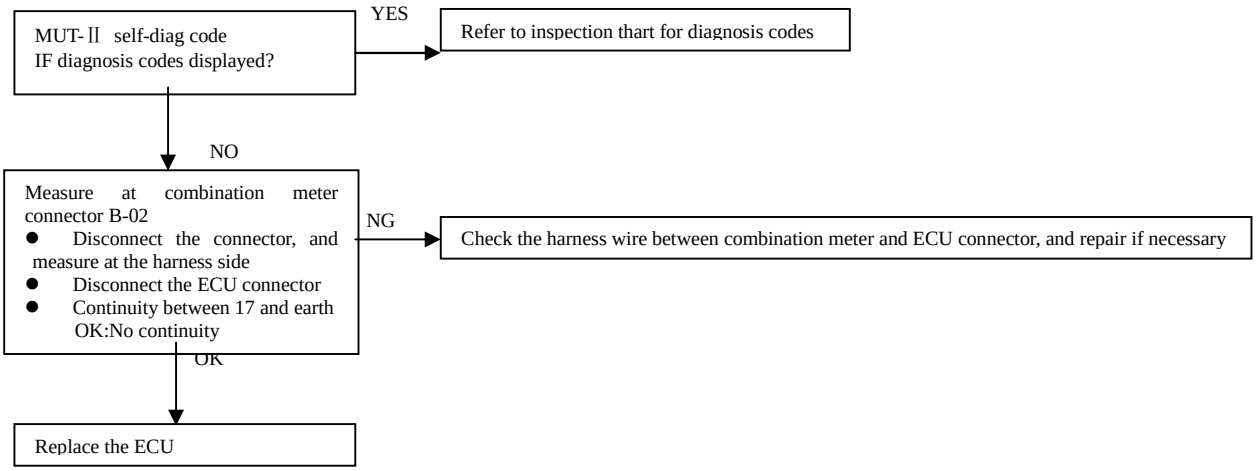
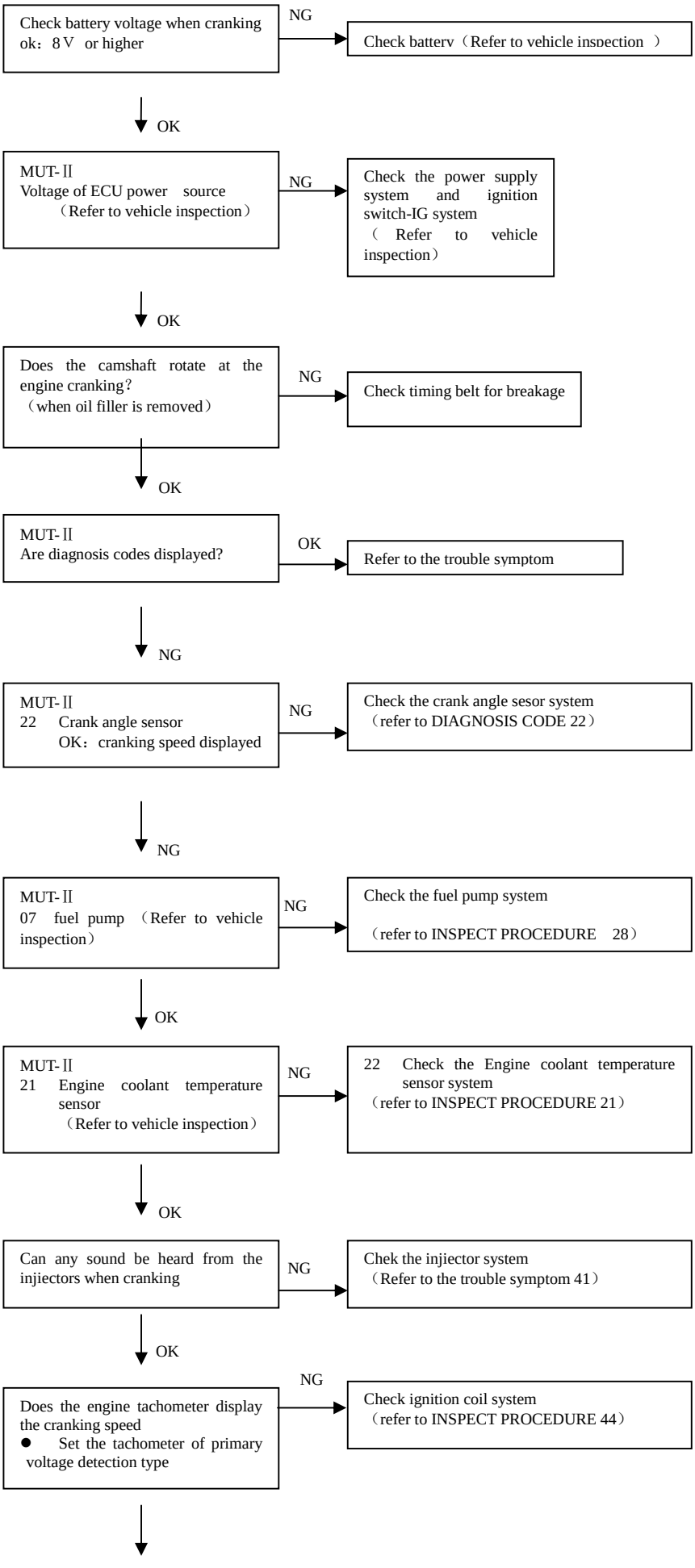


Fig 4-111

INSPECTION PROCEDURE 5　see Table 4-30、Fig 4-112：

Table 4-30

No initial combustion(starting impossible)	**Probable cause**
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials(water, kerosene, etc.) maybe mixed with the fuel.	● Malfunction of the ignition system ● Malfunction of thefuel pump system ● Malfunction of theinjectors ● Malfunction of theECU ● oreign materials in fuel


Check battery voltage when cranking ok：8Ⅴ or higher
NG
Check batterv（Refer to vehicle inspection ）
OK
MUT-Ⅱ
Voltage of ECU power source
（Refer to vehicle inspection）
NG
Check the power supply system and ignition switch-IG system
（ Refer to vehicle inspection）
OK
Does the camshaft rotate at the engine cranking?
（when oil filler is removed）
NG
Check timing belt for breakage
OK
MUT-Ⅱ
Are diagnosis codes displayed?
OK
Refer to the trouble symptom
NG
MUT-Ⅱ
22 Crank angle sensor
OK：cranking speed displayed
NG
Check the crank angle sesor system
（refer to DIAGNOSIS CODE 22）
NG
MUT-Ⅱ
07 fuel pump （Refer to vehicle inspection）
NG
Check the fuel pump system
（refer to INSPECT PROCEDURE 28）
OK
MUT-Ⅱ
21 Engine coolant temperature sensor
（Refer to vehicle inspection）
NG
22 Check the Engine coolant temperature sensor system
（refer to INSPECT PROCEDURE 21）
OK
Can any sound be heard from the injiectors when cranking
NG
Chek the injiector system
（Refer to the trouble symptom 41）
OK
Does the engine tachometer display the cranking speed
● Set the tachometer of primary voltage detection type
NG
Check ignition coil system
（refer to INSPECT PROCEDURE 44）

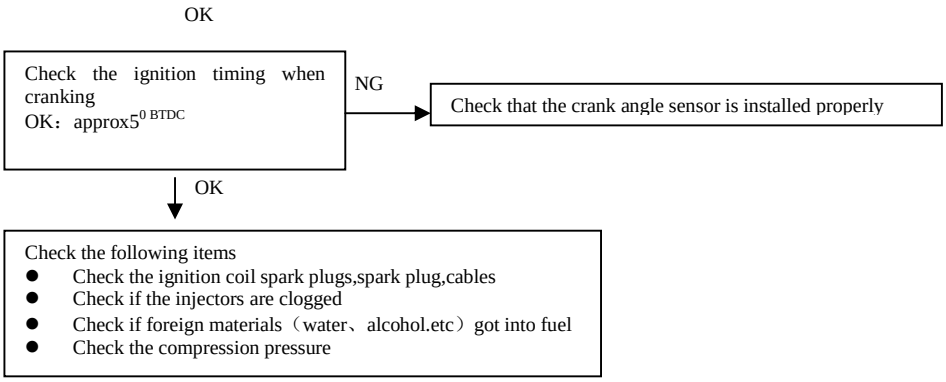
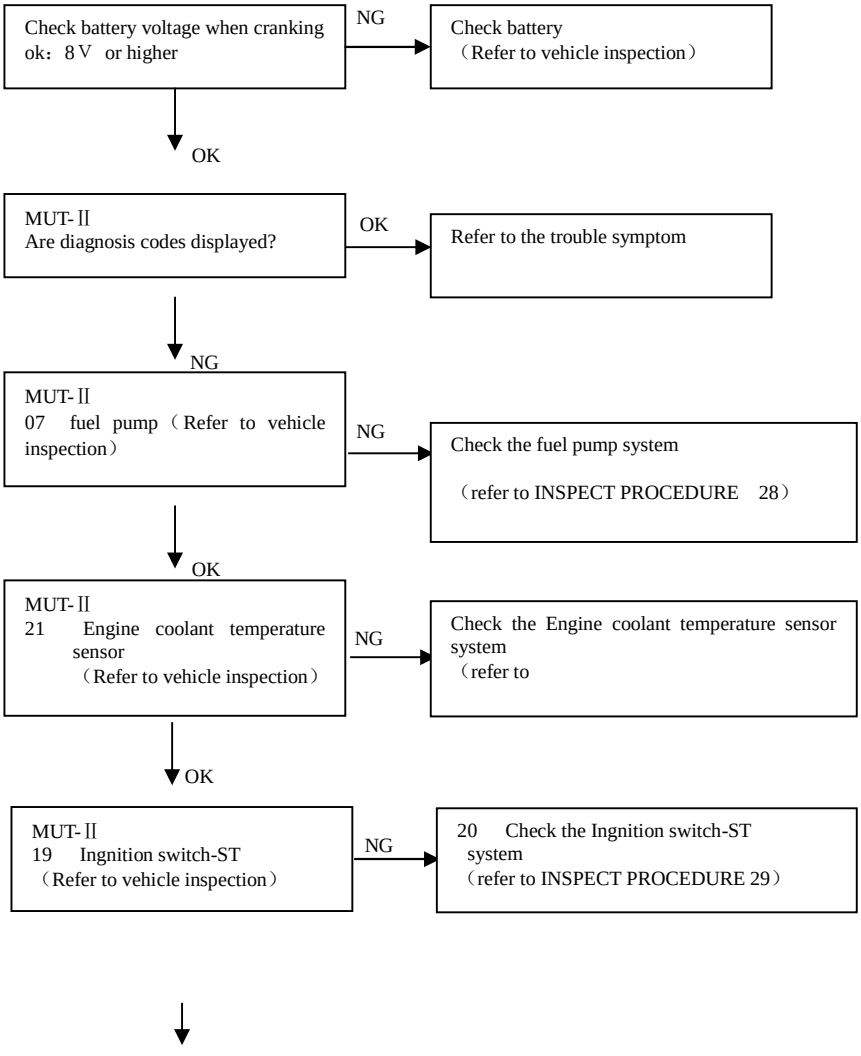


Fig 4-112

SPECTION PROCEDURE 6 Table 4-31、Fig 4-113：

Table 4-31

combustion but no complete combustion（starting impossible）	**Probble cause**
Such cases as the above ,the course is probably that the spark plugs are generating sparks but the sparks are weak ,or the initial mixture for starting is not appropriate.	● Malfunction of the ignition system ● Malfunction of the injector system ● Foreign materials in fuel ● Poor compression ● Malfunction of the ECU*



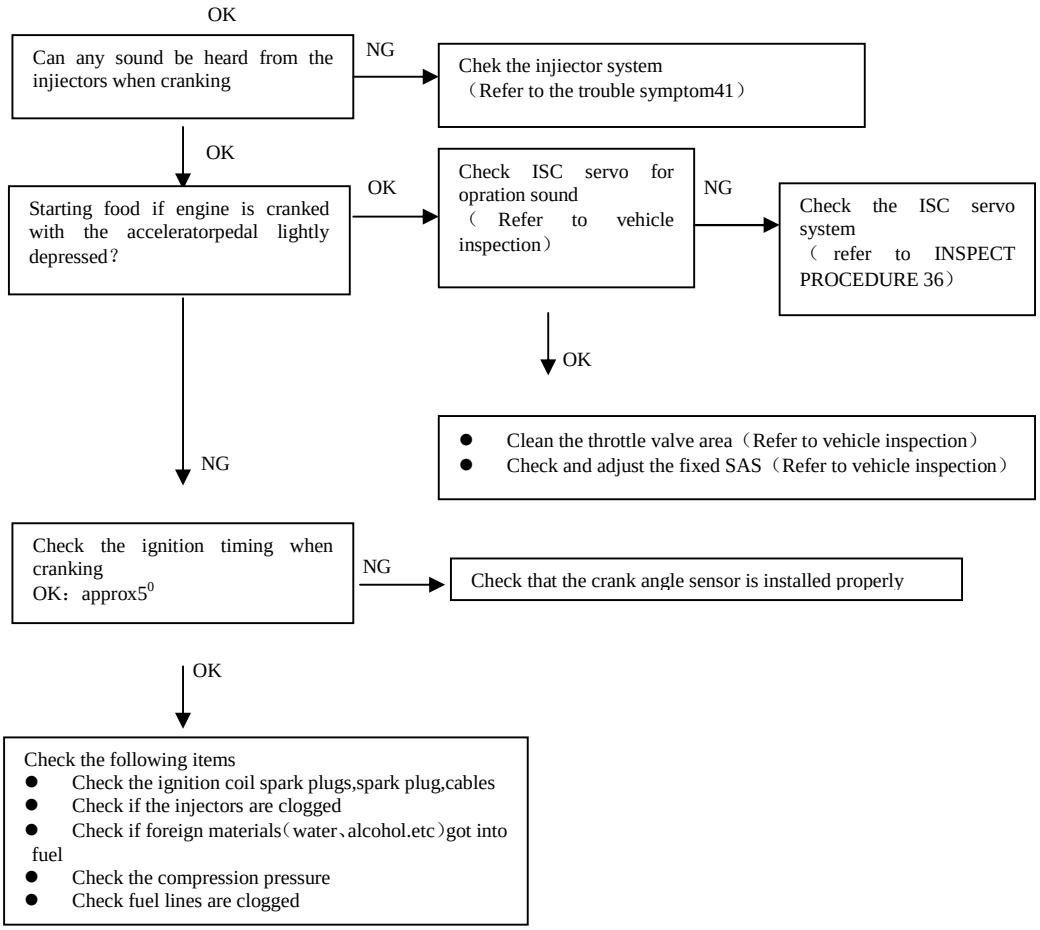
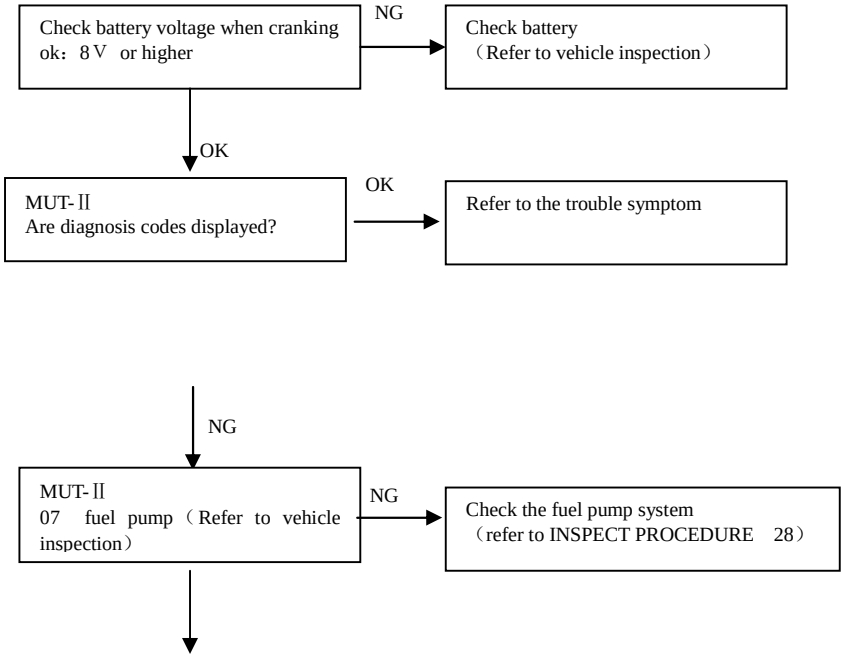


Fig 4-113

SPECTION PROCEDURE 7 Table 4-32、Fig 4-114：

Table 4-32

In take too lang time to start（incorrect starting）	**Probable cause**
In case such as above,the course is probably that the spark is weak and ignition is difficult. the initial mixture for starting is not appropriate,or sufficient compression pressare is not being obtained.	● Malfunction of the ignition system ● Malfunction of the injector system ● Inappropriate gasline use ● Poor compression



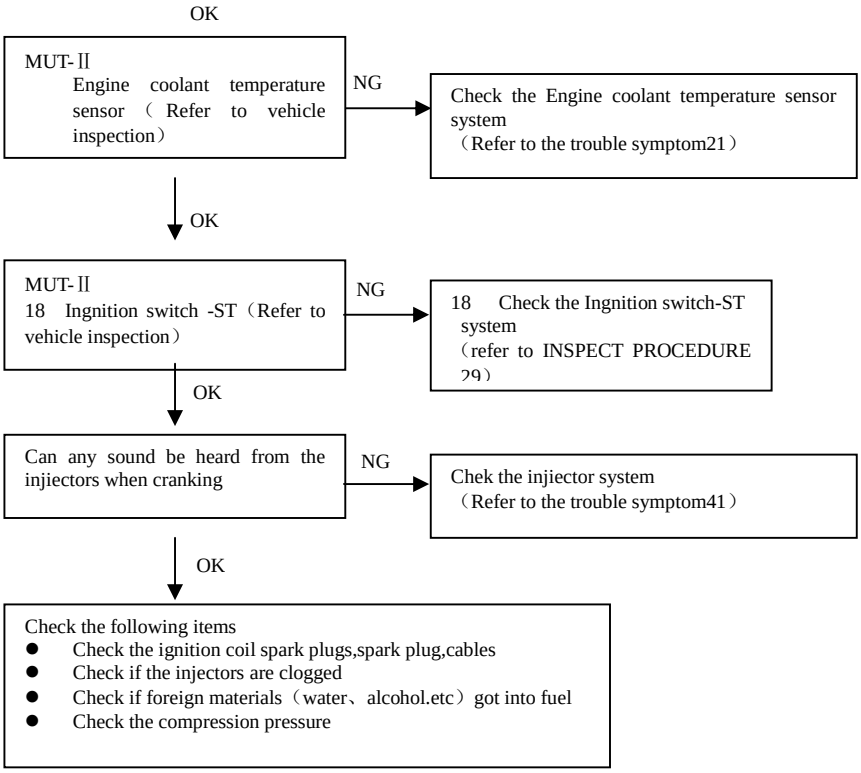
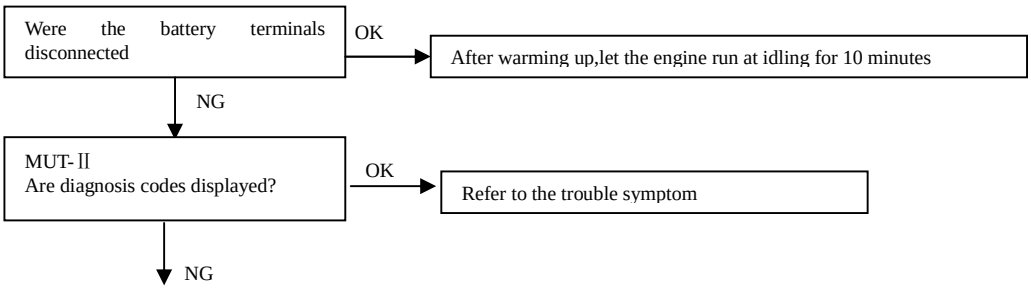


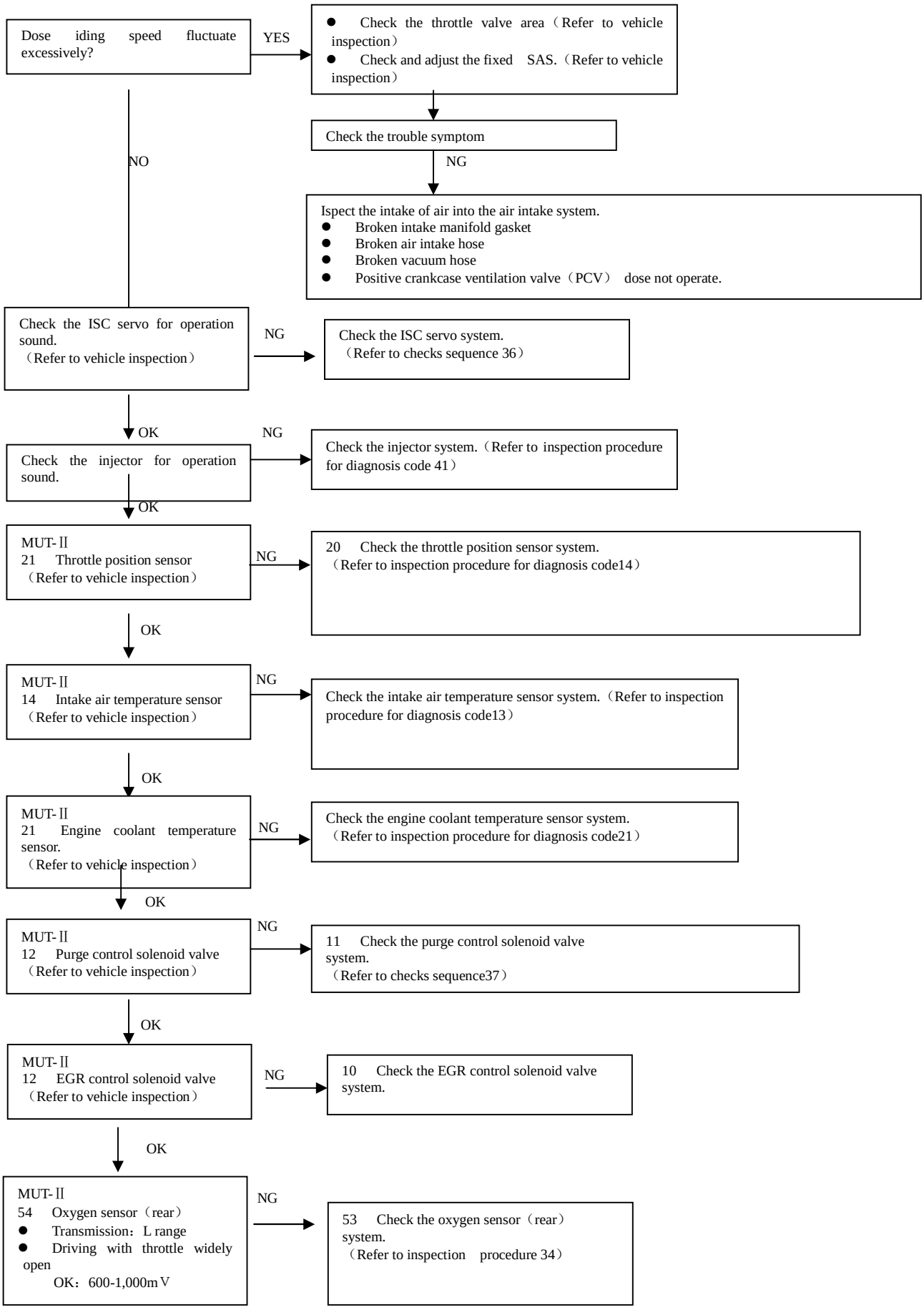
Fig 4-114

SPECTION PROCEDURE 8 Table 4-33、Fig 4-115：

Table 4-33

UnsTable idling（rough idling、hunting）	**Probable cause**
In case such as above,the course is probably that the ignition system、air/fuel mixture idle speed control (ISC) or compression pressure is defective Because the range of possible causes is broad inspectiong is narrowed dow to simple items.	● Malfunction of the ignition system ● Malfunction of air-fuel ratio control system ● Malfunction of ISC system ● Malfunction of the ECRsolenoid valve system ● Poor compression ● Drawing air into exhaust system




Dose iding speed fluctuate excessively?
YES
● Check the throttle valve area（Refer to vehicle inspection）
● Check and adjust the fixed SAS.（Refer to vehicle inspection）
Check the trouble symptom
NG
NO
Ispect the intake of air into the air intake system.
● Broken intake manifold gasket
● Broken air intake hose
● Broken vacuum hose
● Positive crankcase ventilation valve（PCV） dose not operate.
Check the ISC servo for operation sound.
（Refer to vehicle inspection）
NG
Check the ISC servo system.
（Refer to checks sequence 36）
OK
Check the injector for operation sound.
NG
Check the injector system.（Refer to inspection procedure for diagnosis code 41）
OK
MUT-Ⅱ
21 Throttle position sensor
（Refer to vehicle inspection）
NG
20 Check the throttle position sensor system.
（Refer to inspection procedure for diagnosis code14）
OK
MUT-Ⅱ
14 Intake air temperature sensor
（Refer to vehicle inspection）
NG
Check the intake air temperature sensor system.（Refer to inspection procedure for diagnosis code13）
OK
MUT-Ⅱ
21 Engine coolant temperature sensor.
（Refer to vehicle inspection）
NG
Check the engine coolant temperature sensor system.
（Refer to inspection procedure for diagnosis code21）
OK
MUT-Ⅱ
12 Purge control solenoid valve
（Refer to vehicle inspection）
NG
11 Check the purge control solenoid valve system.
（Refer to checks sequence37）
OK
MUT-Ⅱ
12 EGR control solenoid valve
（Refer to vehicle inspection）
NG
10 Check the EGR control solenoid valve system.
OK
MUT-Ⅱ
54 Oxygen sensor（rear）
● Transmission：L range
● Driving with throttle widely open
OK：600-1,000mV
NG
53 Check the oxygen sensor（rear）system.
（Refer to inspection procedure 34）

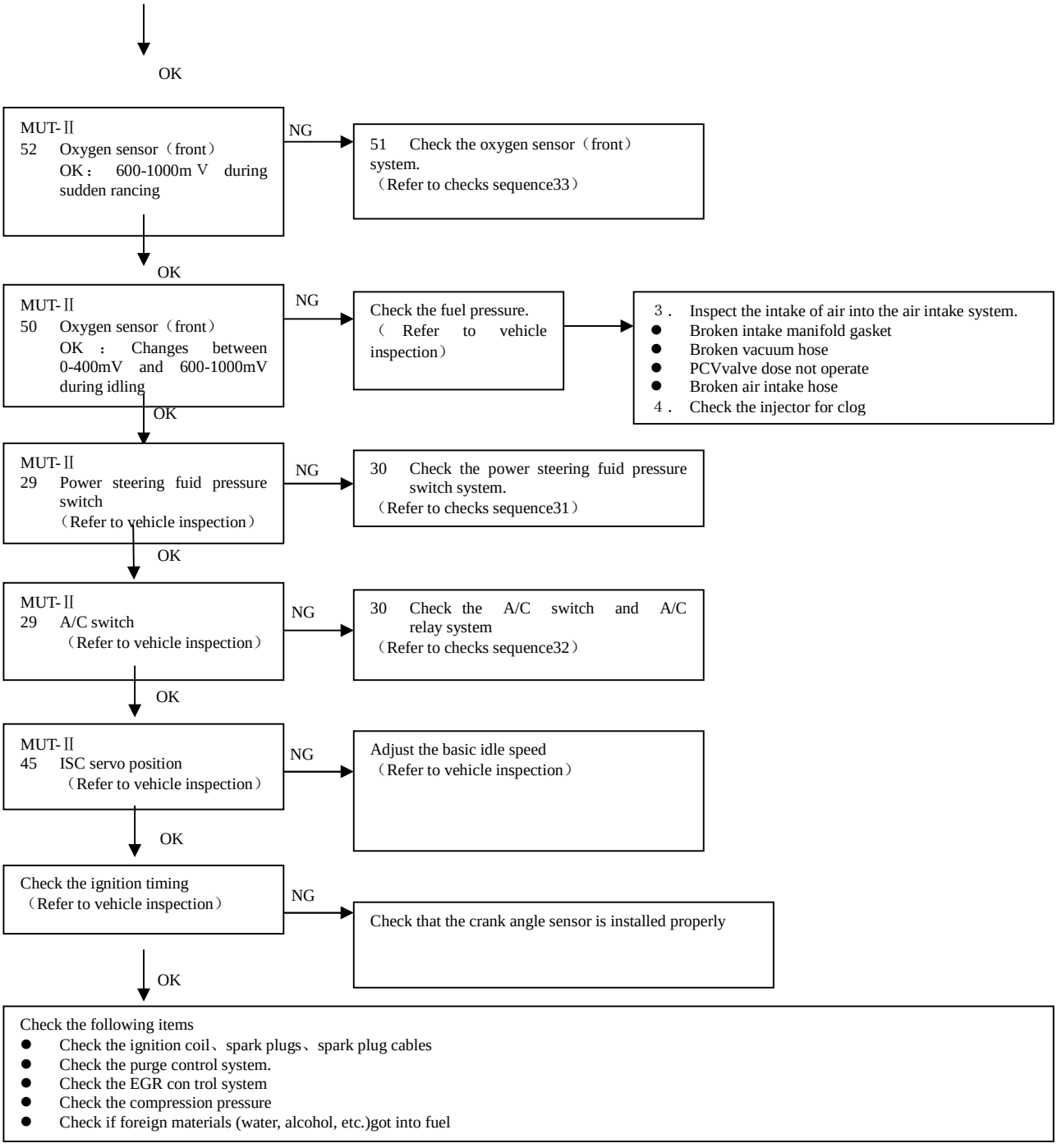


Fig 4-115

Inspection procedure 9 see the Table 4-34、4-116:

Table 4-34

Idling speed is high.（Improper idling speed）	**Probable cause**
In such cases as the above,the cause is probably that the intake air volume during isling too great.	● Malfunction of the ISC servo system ● Malfunction of the throttle body

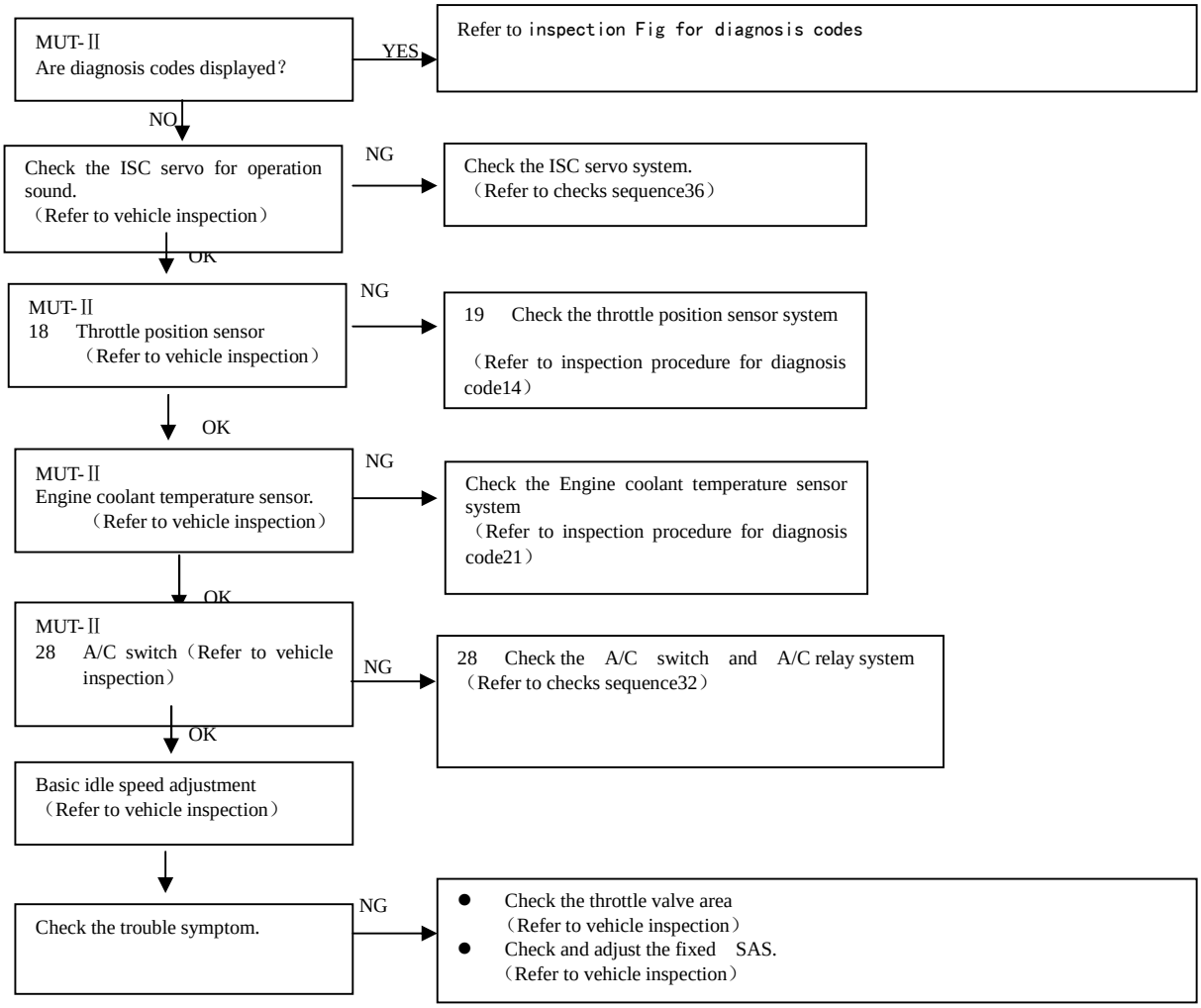


Fig 4-116

Inspection procedure 10 see the Table 4-35、Fig 4-117：

Table 4-35

Idling speed is low.（Improper idling speed）	**Probable cause**
In such cases as the above,the cause is probably that the intake air volume during isling too small.	● Malfunction of the ISC servo system ● Malfunction of the throttle body

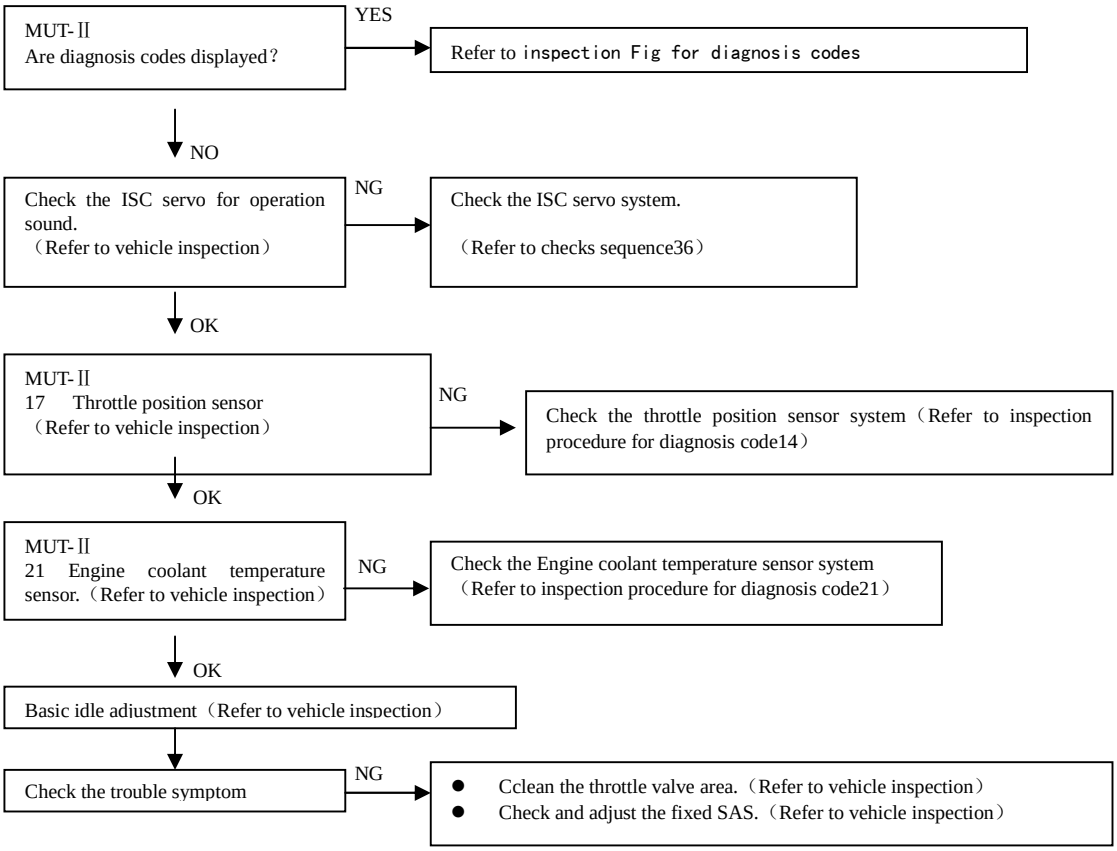
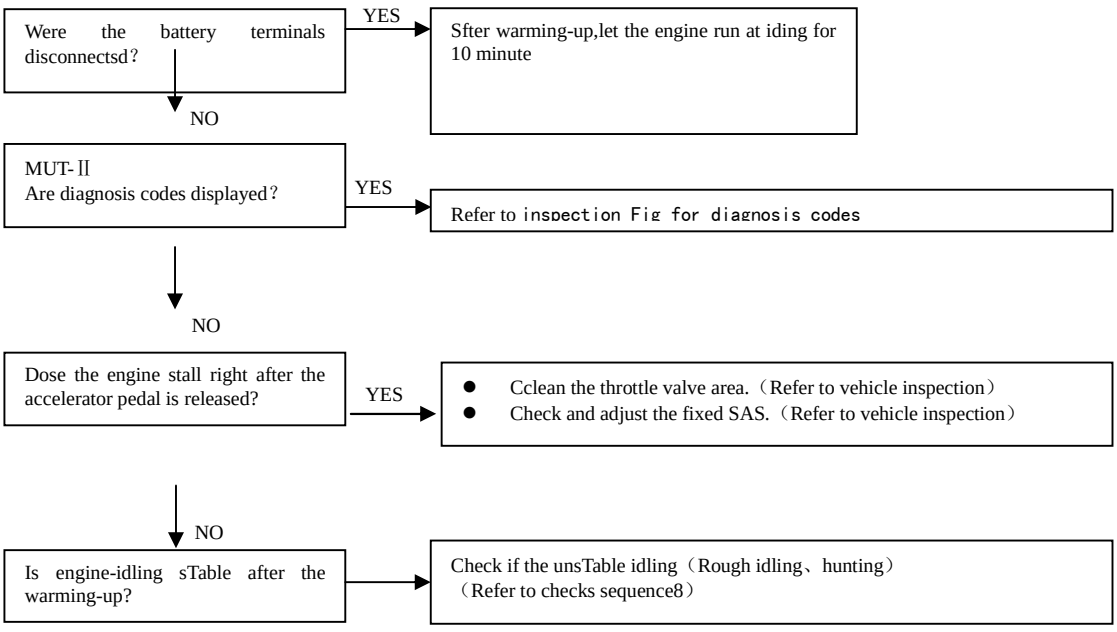


Fig 4-117

Inspection procedure 11see Table 4-36、Fig 4-118：

Table 4-36

When the engine is cold，it stalls iding.（Die out）	**Probable cause**
In such cases as the above, the cause is probablely that the air/fuel mixture is inappropriate when the engine is cold,or that intake air volume is insufficient.	● Malfunction of the ISC servo system ● Malfunction of the throttle body ● Malfunction of the injector system ● Malfunction of the ignition system



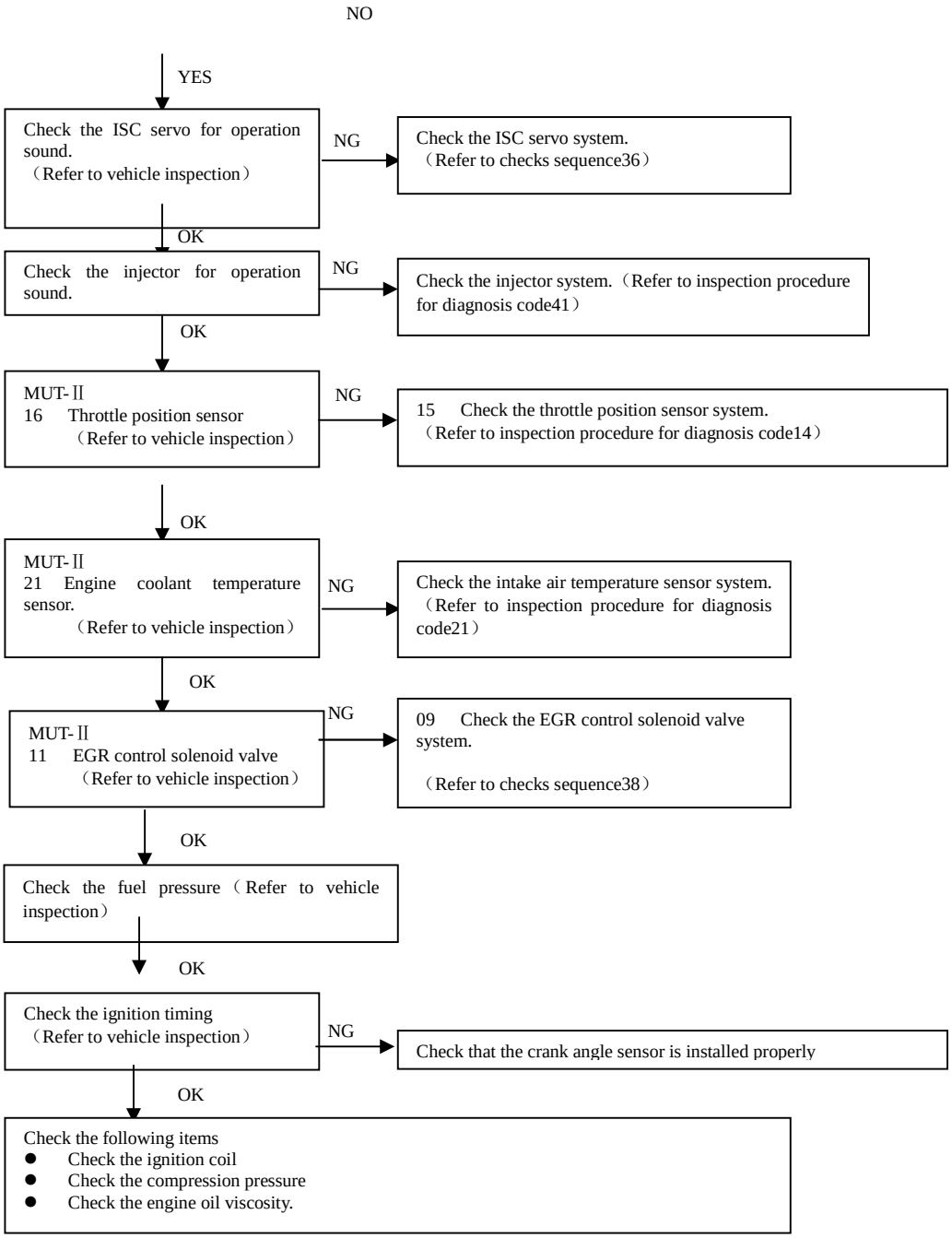
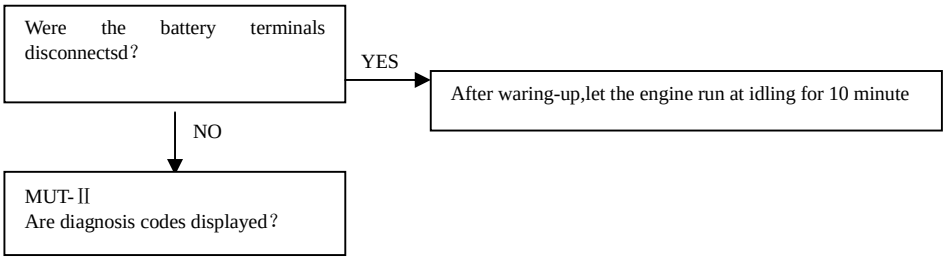


Fig 4-118

Inspection procedure 12 see 4-37、Fig 4-119：

Table 4-37

The engine is hot，it stall at idling.（Die out）	**Probable cause**
In such cases as the above, the cause is probablely that ignition system,air/fuel mixture,idle speed control(ISC) or compression pressure is defective. Besidesifthe engine suddenly stalls,the cause may also be a defective connector.	● Malfunction of the ignition system ● Malfunction of the air-fuel ratio control system ● Malfunction of the ISC system ● Drawing air into intake system ● Improper connector contact



YES → Refer to inspection Fig for diagnosis codes

NO

Check the ISC servo for operation sound.
（Refer to vehicle inspection）

NG → Check the ISC servo system.
（Refer to checks sequence36）

OK

Check the injector for operation sound.

NG → Check the injector system.
（Refer to inspection procedure for diagnosis code41）

OK

Dose the engine stall right after the accelerator pedal is released?

YES →
- Cclean the throttle valve area.（Refer to vehicle inspection）
- Check and adjust the fixed SAS.（Refer to vehicle inspection）

NO

Dose the engine stall easily again？

NO → While carrying out an intermittent malfunction simulation test（Refer to vehicle inspection）,check for sudden changes in the signals shown below.
- Crank angle sensor signal
- Primary and secondary ignition signal
- Injector drive signal
- Fuel pump drive signal
- ECU power supply voltage

YES

MUT-Ⅱ
14 Throttle position sensor
（Refer to vehicle inspection）

NG → Check the throttle position sensor system.（Refer to inspection procedure for diagnosis code14）

OK

MUT-Ⅱ
13 Intake air temperature sensor
（Refer to vehicle inspection）

NG → Check the intake air temperature sensor system.（Refer to inspection procedure for diagnosis code13）

OK

MUT-Ⅱ
21 Engine coolant temperature sensor.（Refer to vehicle inspection）

NG → Check the engine coolant temperature sensor system.
（Refer to inspection procedure for diagnosis code21）

OK

MUT-Ⅱ
10 EGR control solenoid valve
（Refer to vehicle inspection）

NG → 08 Check the EGR control solenoid valve system.
（Refer to checks sequence38）

OK

MUT-Ⅱ
59 Oxygen sensor（rear）
- Transmission：L range
- Driving with throttle widely open

OK：600-1,000mV

NG → Check the oxygen sensor（rear）system.
（Refer to inspection procedure 34）

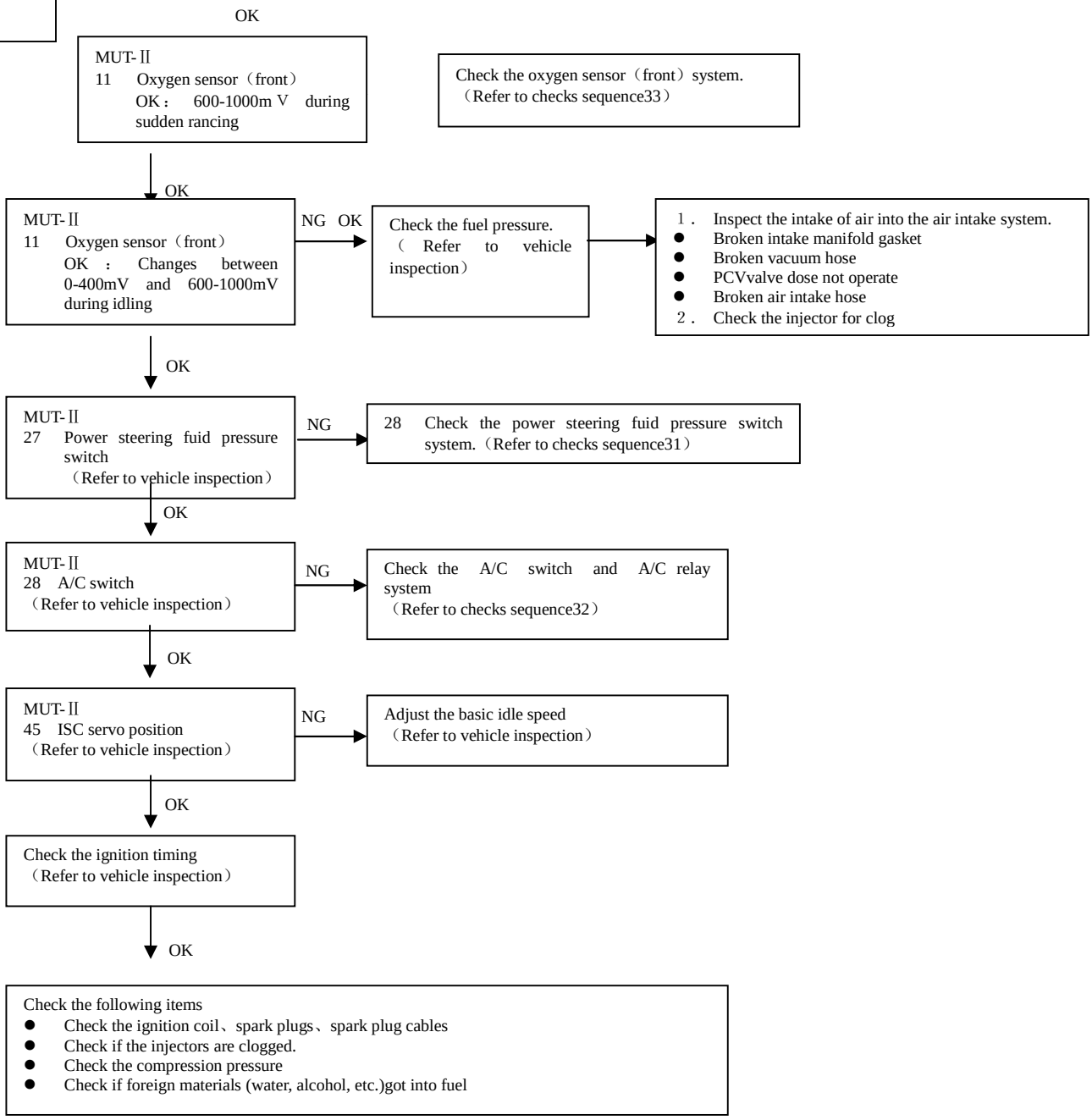

OK
MUT-Ⅱ
11 Oxygen sensor（front）
OK： 600-1000m V during sudden rancing
Check the oxygen sensor（front）system.
（Refer to checks sequence33）
OK
MUT-Ⅱ
11 Oxygen sensor（front）
OK ： Changes between 0-400mV and 600-1000mV during idling
NG OK
Check the fuel pressure.
（ Refer to vehicle inspection）
1． Inspect the intake of air into the air intake system.
Broken intake manifold gasket
Broken vacuum hose
PCVvalve dose not operate
Broken air intake hose
2． Check the injector for clog
OK
MUT-Ⅱ
27 Power steering fuid pressure switch
（Refer to vehicle inspection）
NG
28 Check the power steering fuid pressure switch system.（Refer to checks sequence31）
OK
MUT-Ⅱ
28 A/C switch
（Refer to vehicle inspection）
NG
Check the A/C switch and A/C relay system
（Refer to checks sequence32）
OK
MUT-Ⅱ
45 ISC servo position
（Refer to vehicle inspection）
NG
Adjust the basic idle speed
（Refer to vehicle inspection）
OK
Check the ignition timing
（Refer to vehicle inspection）
OK
Check the following items
Check the ignition coil、spark plugs、spark plug cables
Check if the injectors are clogged.
Check the compression pressure
Check if foreign materials (water, alcohol, etc.)got into fuel

Fig 4-119

Inspection procedure 13 see table 4-38、Fig 4-120：

Table 4-38

The engine stalls when starting the car .(Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	• Drawing air into intake system • Malfuncti on of the ignition system

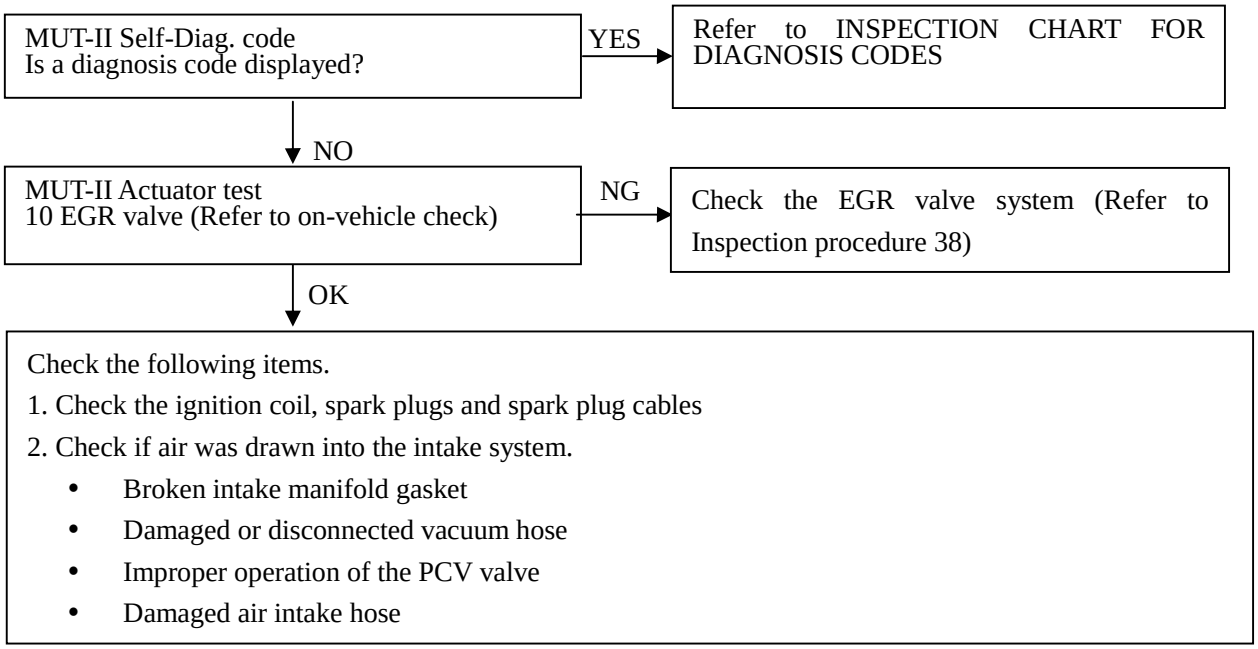


Fig. 4-120

INSPECTION PROCEDURE 14 (Refer to Table 4-30、Fig. 4-121)

Table 4-39

The engine stalls when decelerating	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective idle speed control (ISC) servo system.	• Malfunction of ISC system

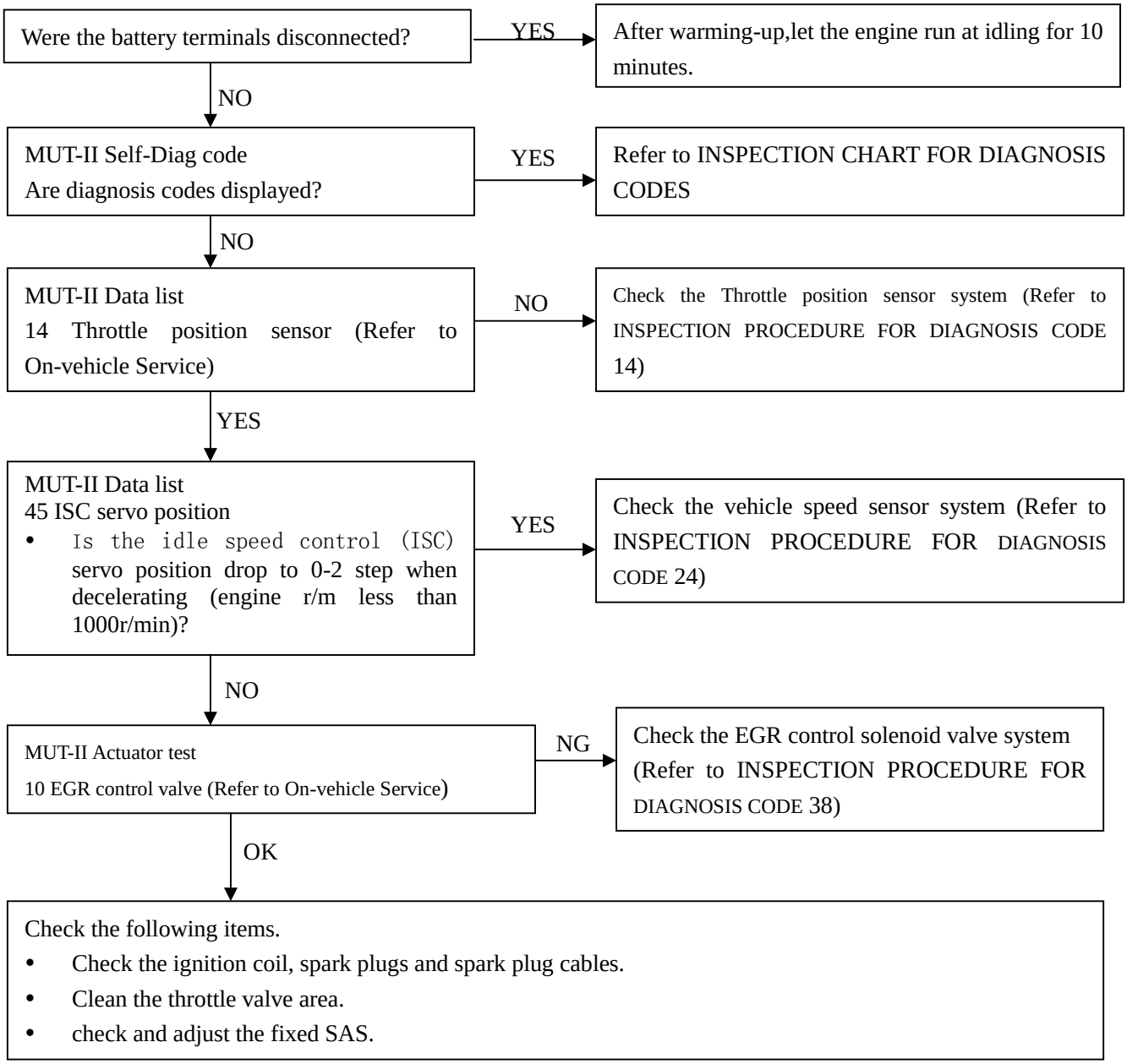


Fig. 4-121

INSPECTION PROCEDURE 15 （Refer to Table 4-40、Fig. 4-122

Table 4-40

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the fuel supply system • Malfunction of EGR control solenoid valve system • Poor compression

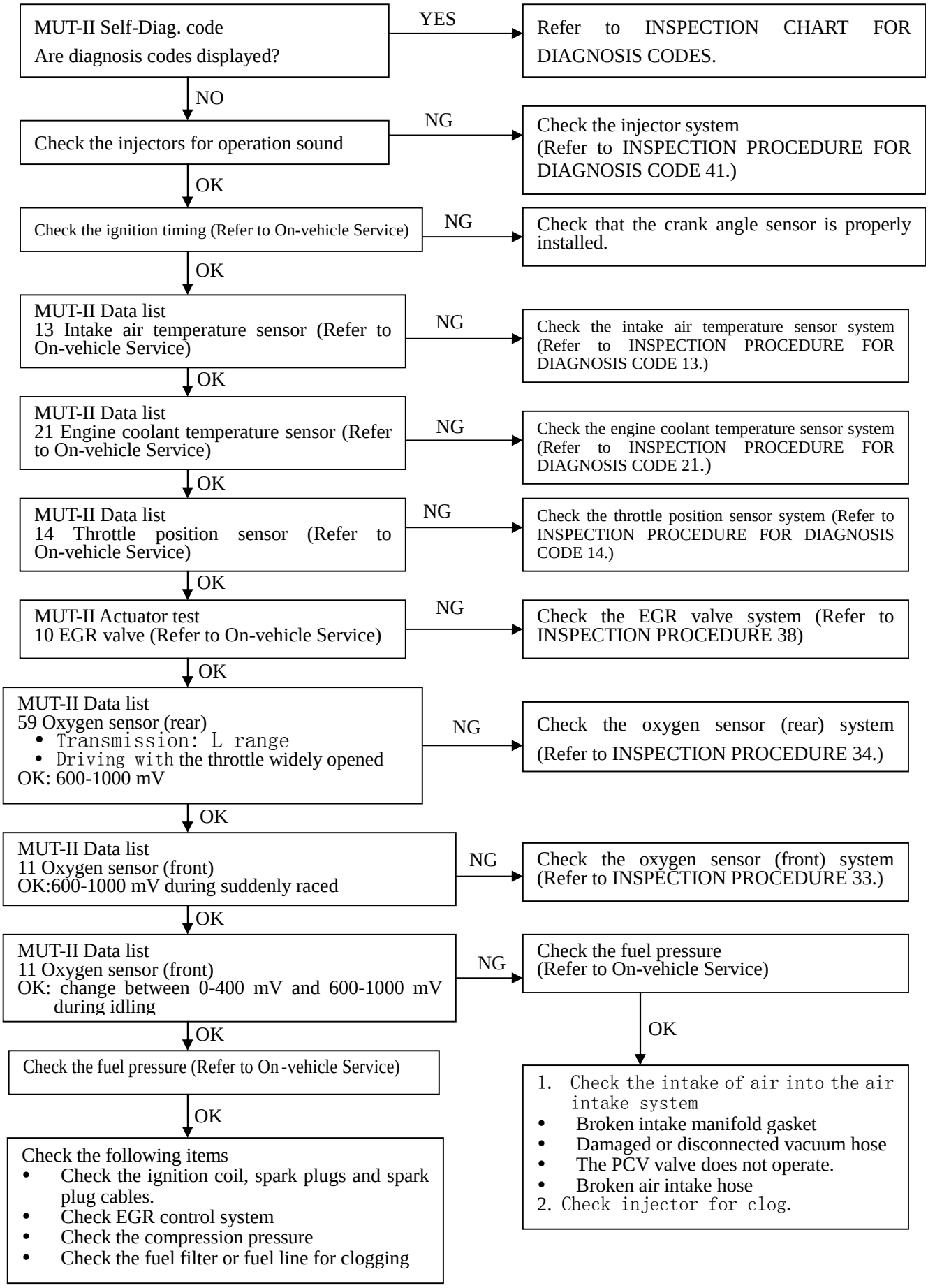

MUT-II Self-Diag. code
Are diagnosis codes displayed?
YES
Refer to INSPECTION CHART FOR DIAGNOSIS CODES.
NO
Check the injectors for operation sound
NG
Check the injector system
(Refer to INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK
Check the ignition timing (Refer to On-vehicle Service)
NG
Check that the crank angle sensor is properly installed.
OK
MUT-II Data list
13 Intake air temperature sensor (Refer to On-vehicle Service)
NG
Check the intake air temperature sensor system (Refer to INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK
MUT-II Data list
21 Engine coolant temperature sensor (Refer to On-vehicle Service)
NG
Check the engine coolant temperature sensor system (Refer to INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK
MUT-II Data list
14 Throttle position sensor (Refer to On-vehicle Service)
NG
Check the throttle position sensor system (Refer to INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK
MUT-II Actuator test
10 EGR valve (Refer to On-vehicle Service)
NG
Check the EGR valve system (Refer to INSPECTION PROCEDURE 38)
OK
MUT-II Data list
59 Oxygen sensor (rear)
• Transmission: L range
• Driving with the throttle widely opened
OK: 600-1000 mV
NG
Check the oxygen sensor (rear) system
(Refer to INSPECTION PROCEDURE 34.)
OK
MUT-II Data list
11 Oxygen sensor (front)
OK:600-1000 mV during suddenly raced
NG
Check the oxygen sensor (front) system (Refer to INSPECTION PROCEDURE 33.)
OK
MUT-II Data list
11 Oxygen sensor (front)
OK: change between 0-400 mV and 600-1000 mV during idling
NG
Check the fuel pressure
(Refer to On-vehicle Service)
OK
1. Check the intake of air into the air intake system
• Broken intake manifold gasket
• Damaged or disconnected vacuum hose
• The PCV valve does not operate.
• Broken air intake hose
2. Check injector for clog.
OK
Check the fuel pressure (Refer to On-vehicle Service)
OK
Check the following items
• Check the ignition coil, spark plugs and spark plug cables.
• Check EGR control system
• Check the compression pressure
• Check the fuel filter or fuel line for clogging

Fig. 4-122

INSPECTION PROCEDURE 16 (Refer to Table 4-41、Fig. 4-123)

Table 4-41

The feeling of impact or vibration when accelerating	Probable cause
In cases such as the above ,the cause is probably that ignition leak accompanying the increase in the spark plug demand voltage during acceleration	• Malfunction of the ignition system

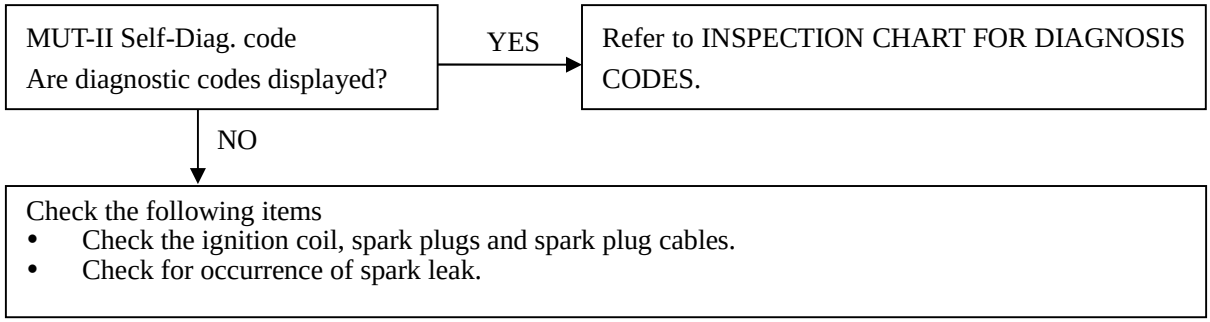


Fig. 4-123

INSPECTION PROCEDURE 17 (Refer to Table 4-42、Fig. 4-124)

The feeling of impact or vibration when decelerating	Probable cause
The malfunction of ISC system is suspected	• Malfunction of the ISC system

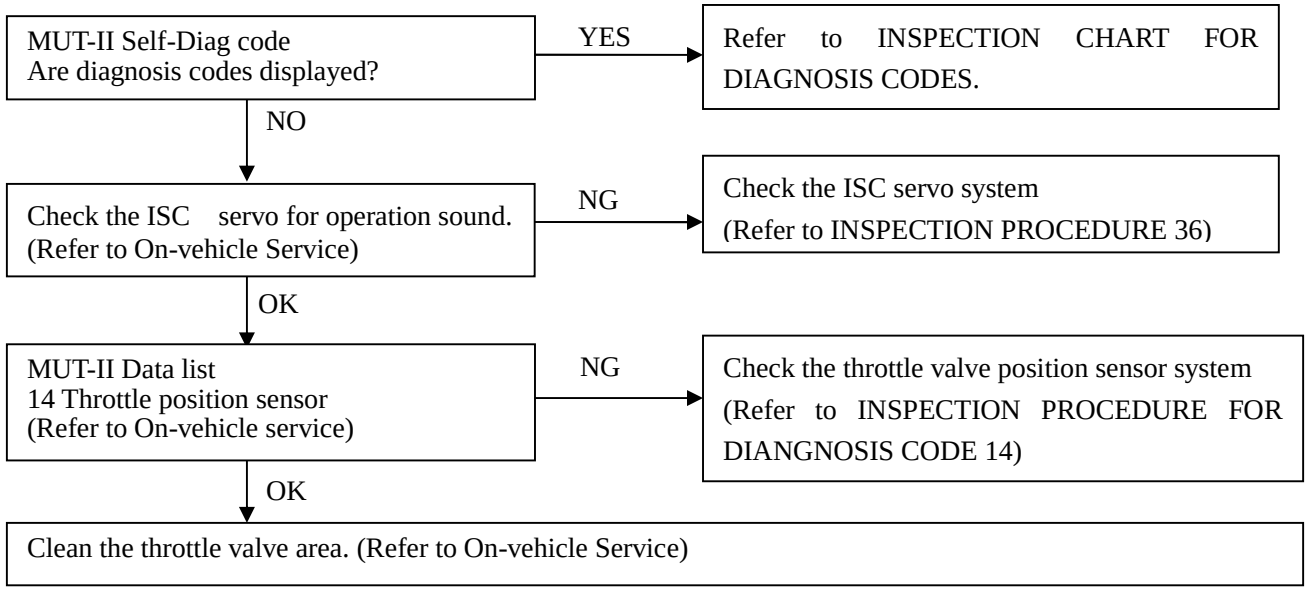


Fig. 4-124

INSPECTION PROCEDURE 18 (Refer to Table 4-43、Fig. 4-125)

Table 4-43

Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure. etc. are suspected.	• Malfunction of ignition coil • Malfunction of air-fuel ratios control • Malfunction of the fuel supply system • Poor compression pressure • Clogged exhaust system

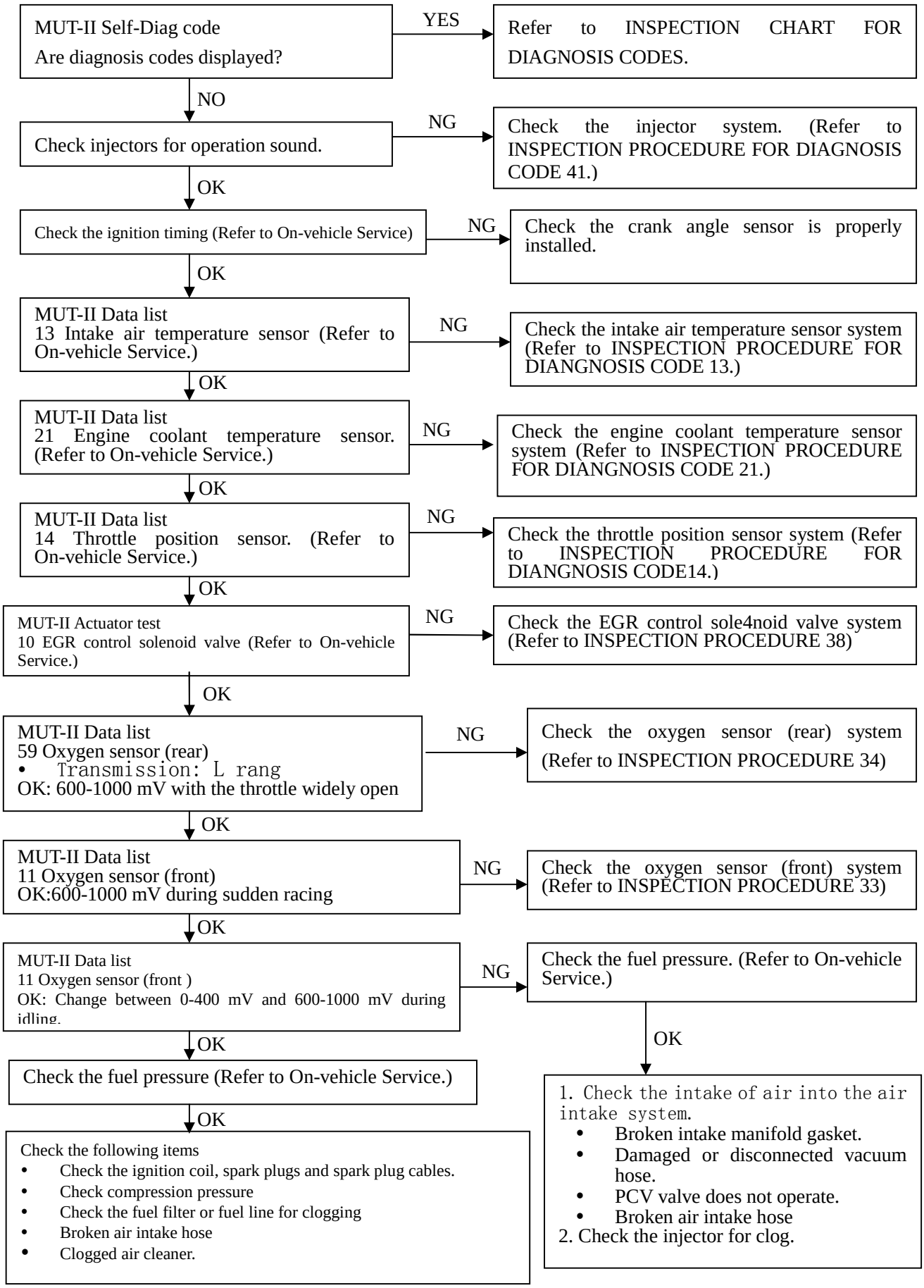

MUT-II Self-Diag code
Are diagnosis codes displayed?
YES
Refer to INSPECTION CHART FOR DIAGNOSIS CODES.
NO
Check injectors for operation sound.
NG
Check the injector system. (Refer to INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK
Check the ignition timing (Refer to On-vehicle Service)
NG
Check the crank angle sensor is properly installed.
OK
MUT-II Data list
13 Intake air temperature sensor (Refer to On-vehicle Service.)
NG
Check the intake air temperature sensor system (Refer to INSPECTION PROCEDURE FOR DIANGNOSIS CODE 13.)
OK
MUT-II Data list
21 Engine coolant temperature sensor. (Refer to On-vehicle Service.)
NG
Check the engine coolant temperature sensor system (Refer to INSPECTION PROCEDURE FOR DIANGNOSIS CODE 21.)
OK
MUT-II Data list
14 Throttle position sensor. (Refer to On-vehicle Service.)
NG
Check the throttle position sensor system (Refer to INSPECTION PROCEDURE FOR DIANGNOSIS CODE14.)
OK
MUT-II Actuator test
10 EGR control solenoid valve (Refer to On-vehicle Service.)
NG
Check the EGR control sole4noid valve system (Refer to INSPECTION PROCEDURE 38)
OK
MUT-II Data list
59 Oxygen sensor (rear)
• Transmission: L rang
OK: 600-1000 mV with the throttle widely open
NG
Check the oxygen sensor (rear) system (Refer to INSPECTION PROCEDURE 34)
OK
MUT-II Data list
11 Oxygen sensor (front)
OK:600-1000 mV during sudden racing
NG
Check the oxygen sensor (front) system (Refer to INSPECTION PROCEDURE 33)
OK
MUT-II Data list
11 Oxygen sensor (front)
OK: Change between 0-400 mV and 600-1000 mV during idling.
NG
Check the fuel pressure. (Refer to On-vehicle Service.)
OK
OK
Check the fuel pressure (Refer to On-vehicle Service.)
OK
1. Check the intake of air into the air intake system.
• Broken intake manifold gasket.
• Damaged or disconnected vacuum hose.
• PCV valve does not operate.
• Broken air intake hose
2. Check the injector for clog.
Check the following items
• Check the ignition coil, spark plugs and spark plug cables.
• Check compression pressure
• Check the fuel filter or fuel line for clogging
• Broken air intake hose
• Clogged air cleaner.

Fig. 4-125

INSPECTION PROCEDURE 19 (Refer to Table 4-44、Fig. 4-126)

Table 4-44

Surge	Probable cause
Defective ignition system ， abnormal air-fuel ratio etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the EGR control solenoid valve system

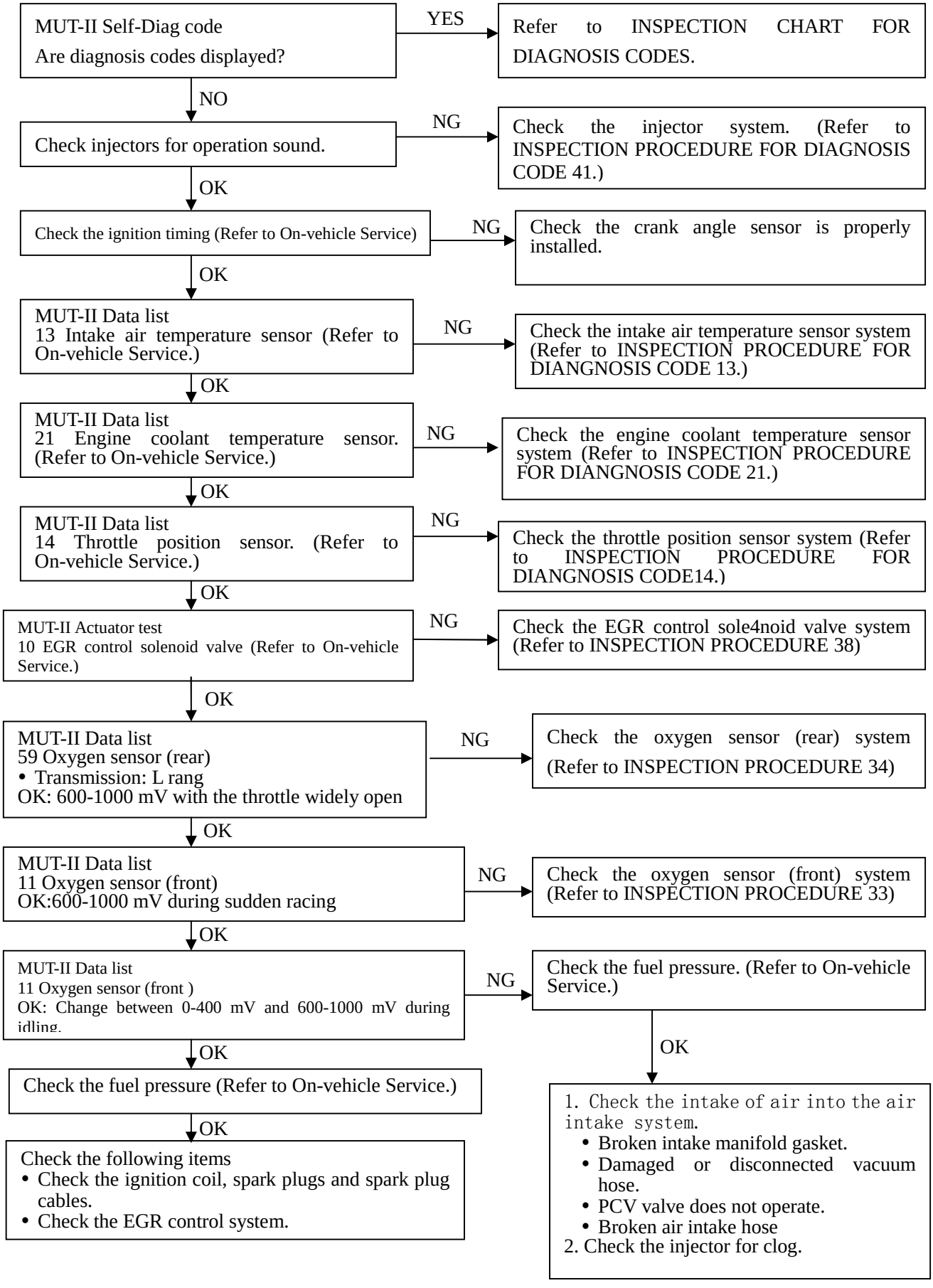

MUT-II Self-Diag code
Are diagnosis codes displayed?
YES
Refer to INSPECTION CHART FOR DIAGNOSIS CODES.
NO
Check injectors for operation sound.
NG
Check the injector system. (Refer to INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK
Check the ignition timing (Refer to On-vehicle Service)
NG
Check the crank angle sensor is properly installed.
OK
MUT-II Data list
13 Intake air temperature sensor (Refer to On-vehicle Service.)
NG
Check the intake air temperature sensor system (Refer to INSPECTION PROCEDURE FOR DIANGNOSIS CODE 13.)
OK
MUT-II Data list
21 Engine coolant temperature sensor. (Refer to On-vehicle Service.)
NG
Check the engine coolant temperature sensor system (Refer to INSPECTION PROCEDURE FOR DIANGNOSIS CODE 21.)
OK
MUT-II Data list
14 Throttle position sensor. (Refer to On-vehicle Service.)
NG
Check the throttle position sensor system (Refer to INSPECTION PROCEDURE FOR DIANGNOSIS CODE14.)
OK
MUT-II Actuator test
10 EGR control solenoid valve (Refer to On-vehicle Service.)
NG
Check the EGR control sole4noid valve system (Refer to INSPECTION PROCEDURE 38)
OK
MUT-II Data list
59 Oxygen sensor (rear)
• Transmission: L rang
OK: 600-1000 mV with the throttle widely open
NG
Check the oxygen sensor (rear) system (Refer to INSPECTION PROCEDURE 34)
OK
MUT-II Data list
11 Oxygen sensor (front)
OK:600-1000 mV during sudden racing
NG
Check the oxygen sensor (front) system (Refer to INSPECTION PROCEDURE 33)
OK
MUT-II Data list
11 Oxygen sensor (front)
OK: Change between 0-400 mV and 600-1000 mV during idling.
NG
Check the fuel pressure. (Refer to On-vehicle Service.)
OK
1. Check the intake of air into the air intake system.
• Broken intake manifold gasket.
• Damaged or disconnected vacuum hose.
• PCV valve does not operate.
• Broken air intake hose
2. Check the injector for clog.
OK
Check the fuel pressure (Refer to On-vehicle Service.)
OK
Check the following items
• Check the ignition coil, spark plugs and spark plug cables.
• Check the EGR control system.

Fig. 4-126

INSPECTION PROCEDURE 20 (Refer to Table 4-45、Fig. 4-127)

Table 4-45

Knocking	Probable cause
In the case as above, the cause is probably that the heat value of the spark plug is inappropriate.	• inappropriate heat value of the spark plug

Check the following items
- Spark plugs
- Check if foreign materials (water, alcohol, etc.) got into fuel.

Fig. 4-127

INSPECTION PROCEDURE 21 (Refer to Table 4-46、Fig. 4-128)

Table 4-46

Run-on (Dieseling)	Probable cause
Fuel leakage from injectors is suspected.	• Fuel leakage form injectors

Check the injectors for fuel leakage.

Fig. 4-128

INSPECTION PROCEDURE 22 (Refer to Table 4-47、Fig. 4-129)

Table 4-47

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	• Malfunction of the air-fuel ratio control system • Deteriorated Catalyst

INSPECTION PROCEDURE 23 (Refer to Table 4-48、Fig. 4-130)

Table 4-48

Low alternator output voltage (approximately 12.3V)	Probable cause
The cause is probably a malfunction of the alternator or one of the problems listed at right column.	• Malfunction of the charging system (Refer to ON-vehicle Service) • Open circuit between the alternator G terminal and the engine-ECU • Malfunction of the ECU

INSPECTION PROCEDURE 24 (Refer to Table 4-49、Fig. 4-131)

Table 4-49

Idling speed is improper when A/C is operating.	Probable cause
The ECU detects that the air conditioner is on, it activates the idle speed control (ISC) servo to control idle-up operation. The automatic compressor-ECU judges if the load caused by air conditioner is high or low, and converts it to voltage signal (high or low voltage) and inputs the signal to the ECU. Based on voltage signal, the ECU controls the idle-up speed (high or low load).	• Malfunction of the A/C control system • Open or short circuit, or loose connector contact • Malfunction of the ECU

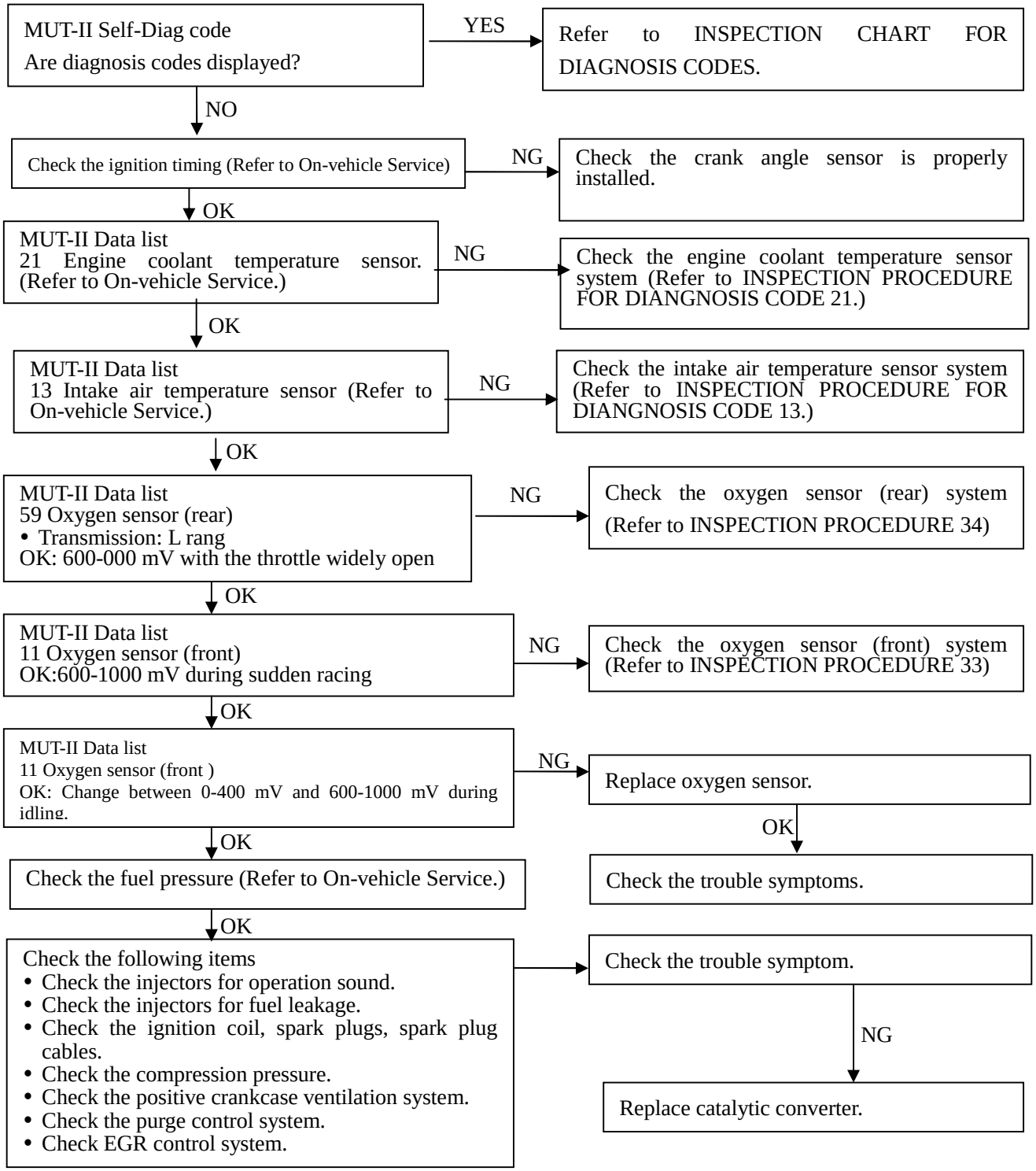

MUT-II Self-Diag code
Are diagnosis codes displayed?
YES
Refer to INSPECTION CHART FOR DIAGNOSIS CODES.
NO
Check the ignition timing (Refer to On-vehicle Service)
NG
Check the crank angle sensor is properly installed.
OK
MUT-II Data list
21 Engine coolant temperature sensor. (Refer to On-vehicle Service.)
NG
Check the engine coolant temperature sensor system (Refer to INSPECTION PROCEDURE FOR DIANGNOSIS CODE 21.)
OK
MUT-II Data list
13 Intake air temperature sensor (Refer to On-vehicle Service.)
NG
Check the intake air temperature sensor system (Refer to INSPECTION PROCEDURE FOR DIANGNOSIS CODE 13.)
OK
MUT-II Data list
59 Oxygen sensor (rear)
• Transmission: L rang
OK: 600-000 mV with the throttle widely open
NG
Check the oxygen sensor (rear) system (Refer to INSPECTION PROCEDURE 34)
OK
MUT-II Data list
11 Oxygen sensor (front)
OK:600-1000 mV during sudden racing
NG
Check the oxygen sensor (front) system (Refer to INSPECTION PROCEDURE 33)
OK
MUT-II Data list
11 Oxygen sensor (front)
OK: Change between 0-400 mV and 600-1000 mV during idling.
NG
Replace oxygen sensor.
OK
Check the trouble symptoms.
OK
Check the fuel pressure (Refer to On-vehicle Service.)
OK
Check the following items
• Check the injectors for operation sound.
• Check the injectors for fuel leakage.
• Check the ignition coil, spark plugs, spark plug cables.
• Check the compression pressure.
• Check the positive crankcase ventilation system.
• Check the purge control system.
• Check EGR control system.
Check the trouble symptom.
NG
Replace catalytic converter.

Fig. 4-129

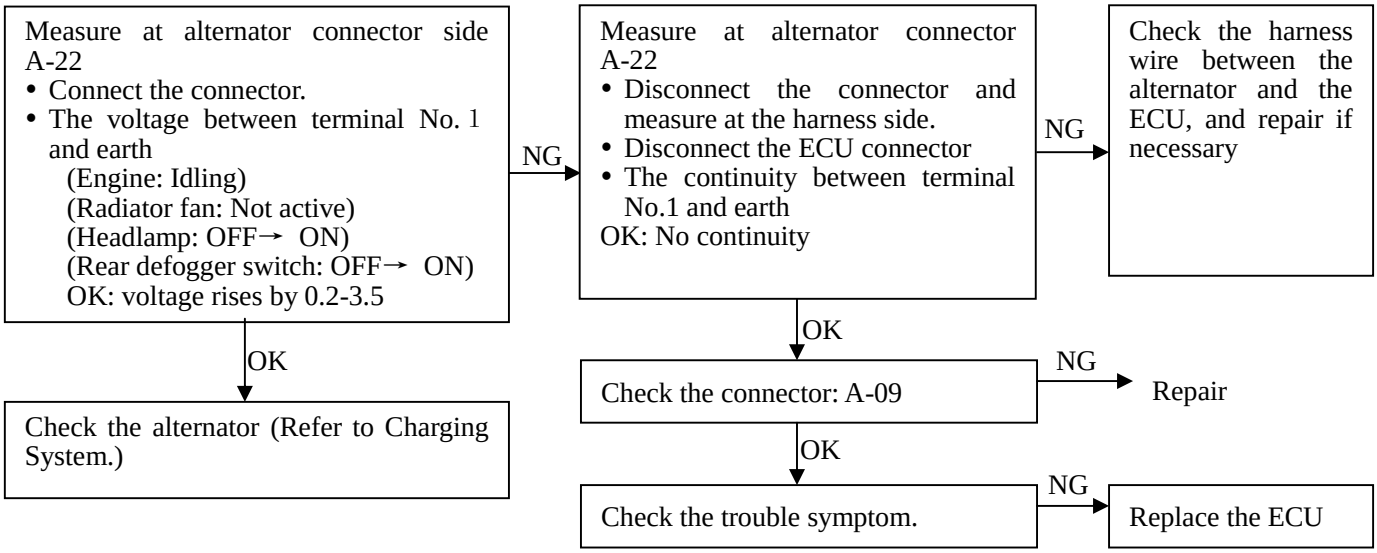


Fig. 4-130

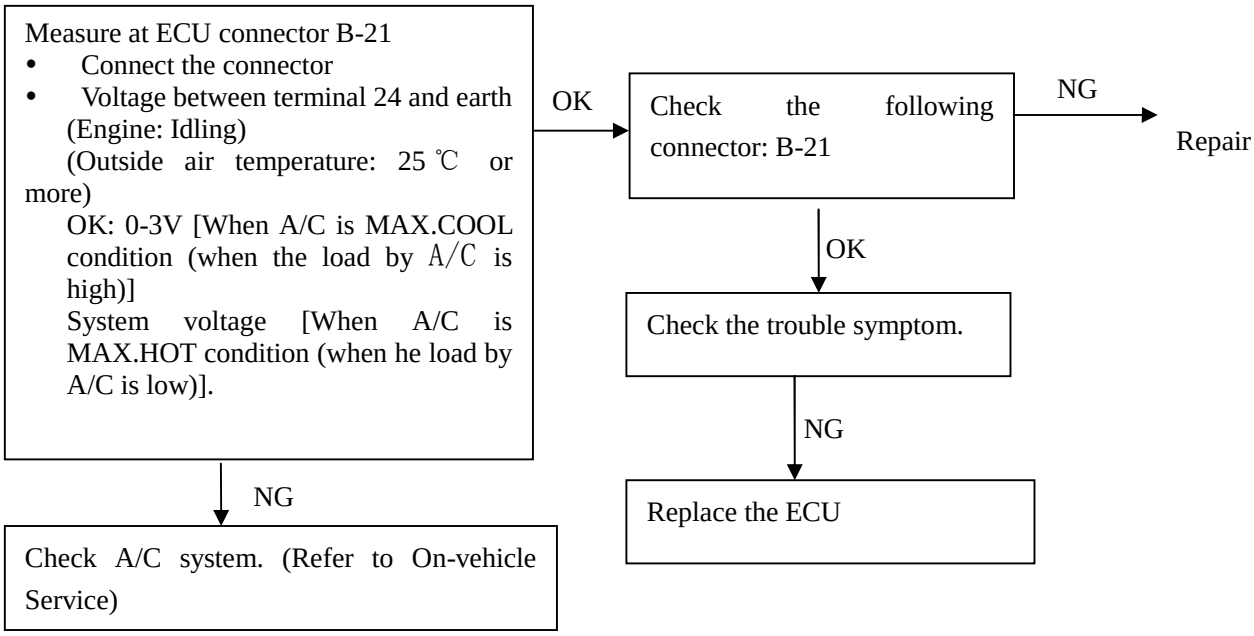


Fig. 4-131

INSPECTION PROCEDURE 25 (Refer to Table 4-50、Fig. 4-132)

Table 4-50

Fan(radiator fan , A/C condenser fan) are inoperative.	Probable cause
The ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed , or A/C switch. The fan controller control radiator fan and the condenser fan the speed, based on the signal.	• Malfunction of the fan motor replay • Malfunction of the fan motor inoperative • Malfunction of the fan controller • Open or short circuit, or poor connector contact • Malfunction of engine- ECU

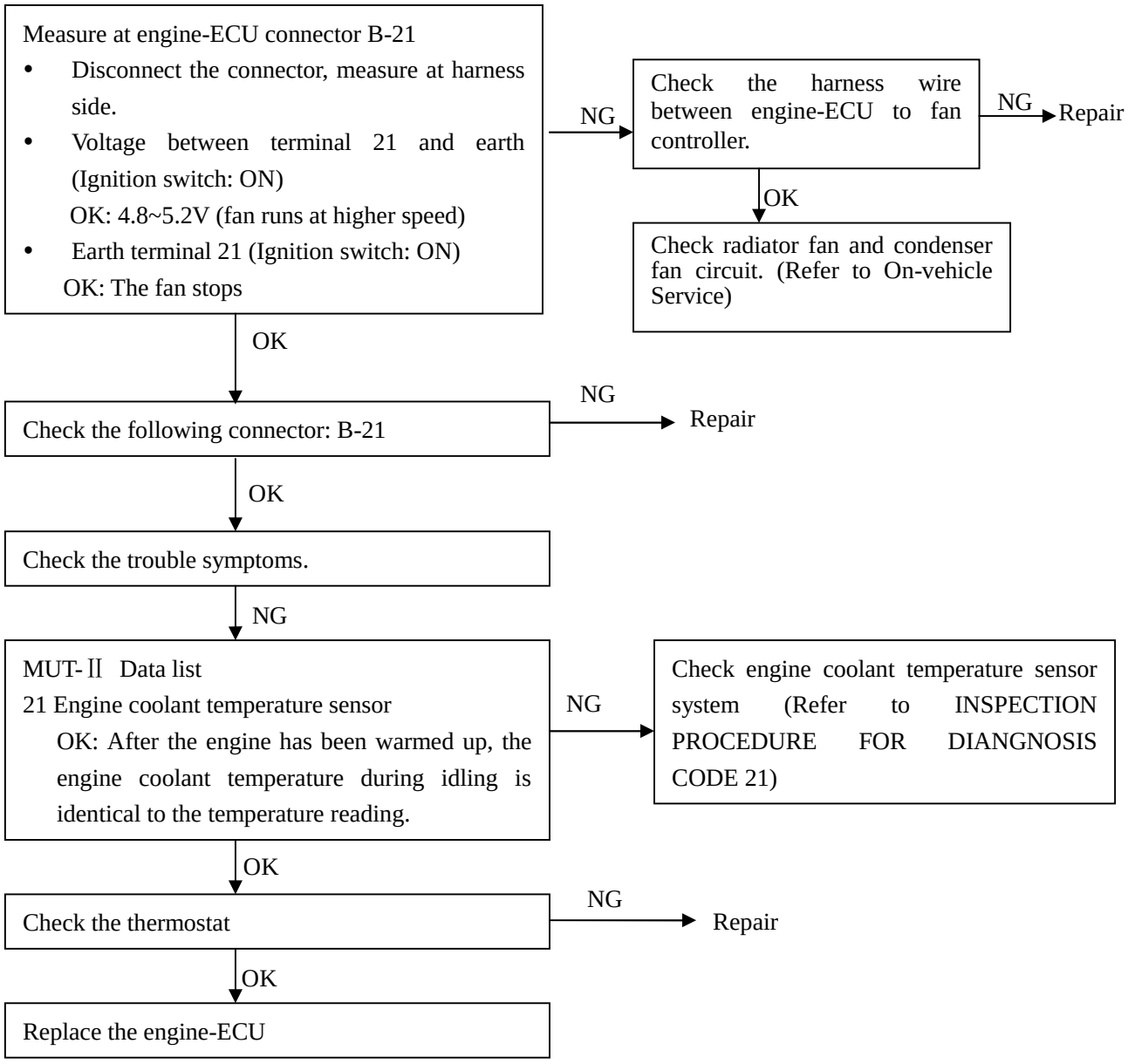


Fig. 4-132

INSPECTION PROCEDURE 26 (Refer to Table 4-51、Fig. 4-133)

Table 4-51

Check the engine-ECU power supply and earth circuit .

INSPECTION PROCEDURE 27 (Refer to Table 4-52、Fig. 4-134)

Table 4-52

Power supply system and ignition switch –IG system	Probable cause
When an ignition switch ON signal is input to the engine-ECU, the engine-ECU turns the control relay on. This causes battery voltage to be supplied to the engine-ECU, injectors and boost sensor..	• Malfunction of the ignition switch • Malfunction of the engine control relay • Improper connector contact, open circuit or short circuit harness wire. • Disconnected engine-ECU earth wire • Malfunction of the engine-ECU

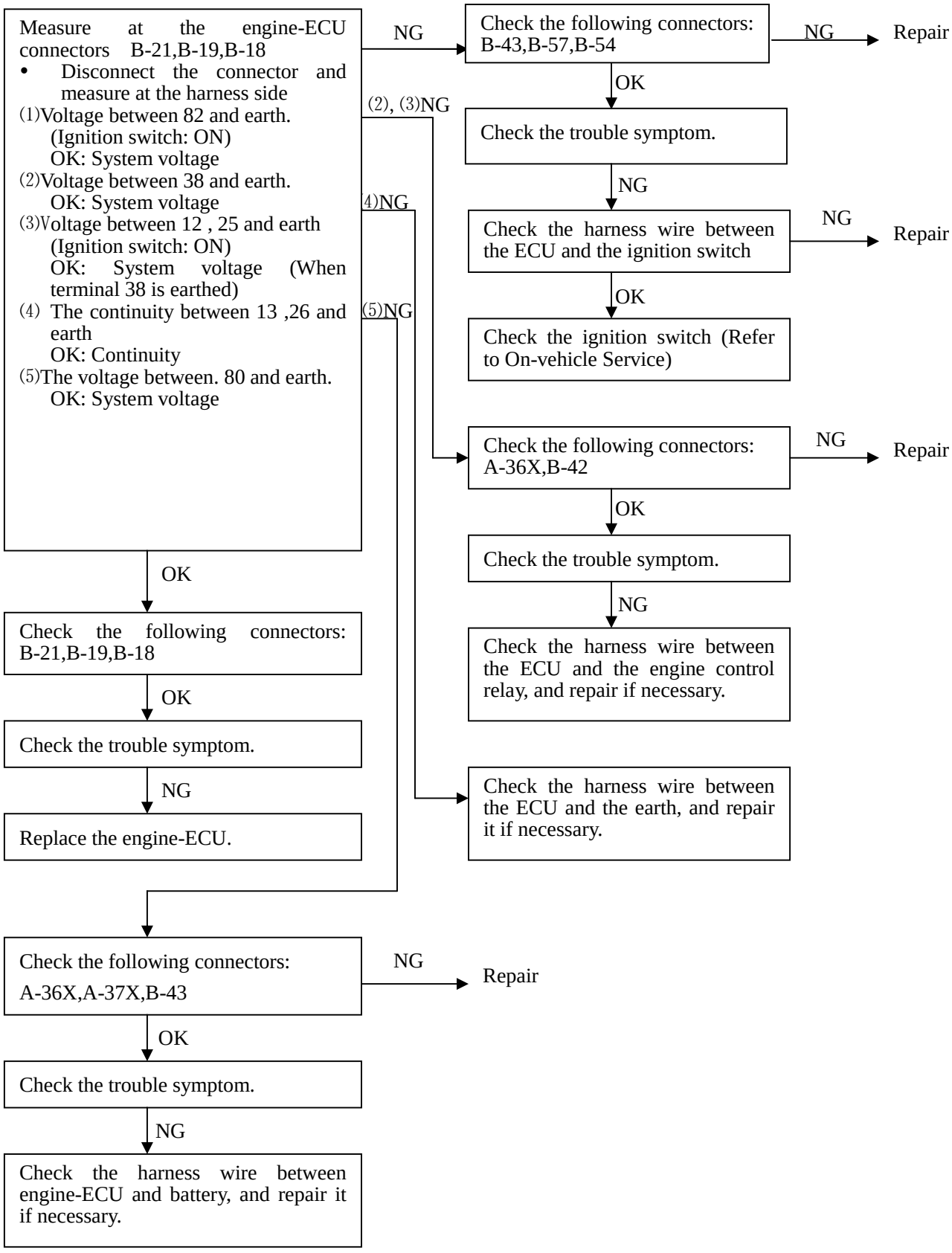

Measure at the engine-ECU connectors B-21,B-19,B-18
• Disconnect the connector and measure at the harness side
⑴Voltage between 82 and earth.
(Ignition switch: ON)
OK: System voltage
⑵Voltage between 38 and earth.
OK: System voltage
⑶Voltage between 12 , 25 and earth
(Ignition switch: ON)
OK: System voltage (When terminal 38 is earthed)
⑷ The continuity between 13 ,26 and earth
OK: Continuity
⑸The voltage between. 80 and earth.
OK: System voltage
NG
Check the following connectors: B-43,B-57,B-54
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the ECU and the ignition switch
NG
Repair
OK
Check the ignition switch (Refer to On-vehicle Service)
⑵, ⑶NG
⑷NG
⑸NG
Check the following connectors: A-36X,B-42
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the ECU and the engine control relay, and repair if necessary.
Check the harness wire between the ECU and the earth, and repair it if necessary.
OK
Check the following connectors: B-21,B-19,B-18
OK
Check the trouble symptom.
NG
Replace the engine-ECU.
Check the following connectors: A-36X,A-37X,B-43
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between engine-ECU and battery, and repair it if necessary.

Fig. 4-133

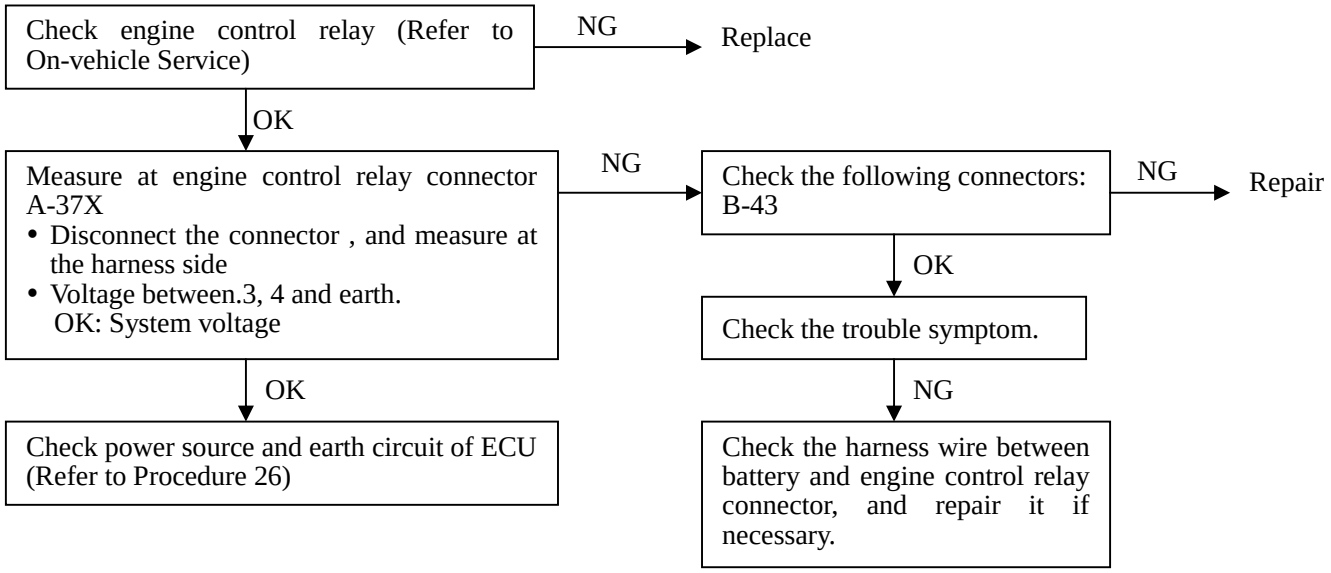


Fig. 4-134

INSPECTION PROCEDURE 28 (Refer to Table 4-53、Fig. 4-135)

Table 4-53

Fuel pump system	Probable cause
The engine-ECU turns the fuel pump relay ON when the engine is cranking or running, and the supplies power to drive the fuel pump.	• Malfunction of the fuel pump relay (1) • Malfunction of the fuel pump relay (2) • Improper connector contact, open circuit or short circuit harness wire. • Malfunction of the engine-ECU

INSPECTION PROCEDURE 29 (Refer to Table 4-54、Fig. 4-136)

Table 4-54

Ignition switch-ST system	Probable cause
The ignition switch-ST inputs a High signal to the engine-ECU while the engine is cranking. The engine-ECU controls fuel injection, etc. during starting based on this input.	• Malfunction of the ignition switch • Improper connector contact, open circuit or short circuit harness wire. • Malfunction of the engine-ECU

INSPECTION PROCEDURE 31 (Refer to Table 4-55、Fig. 4-137)

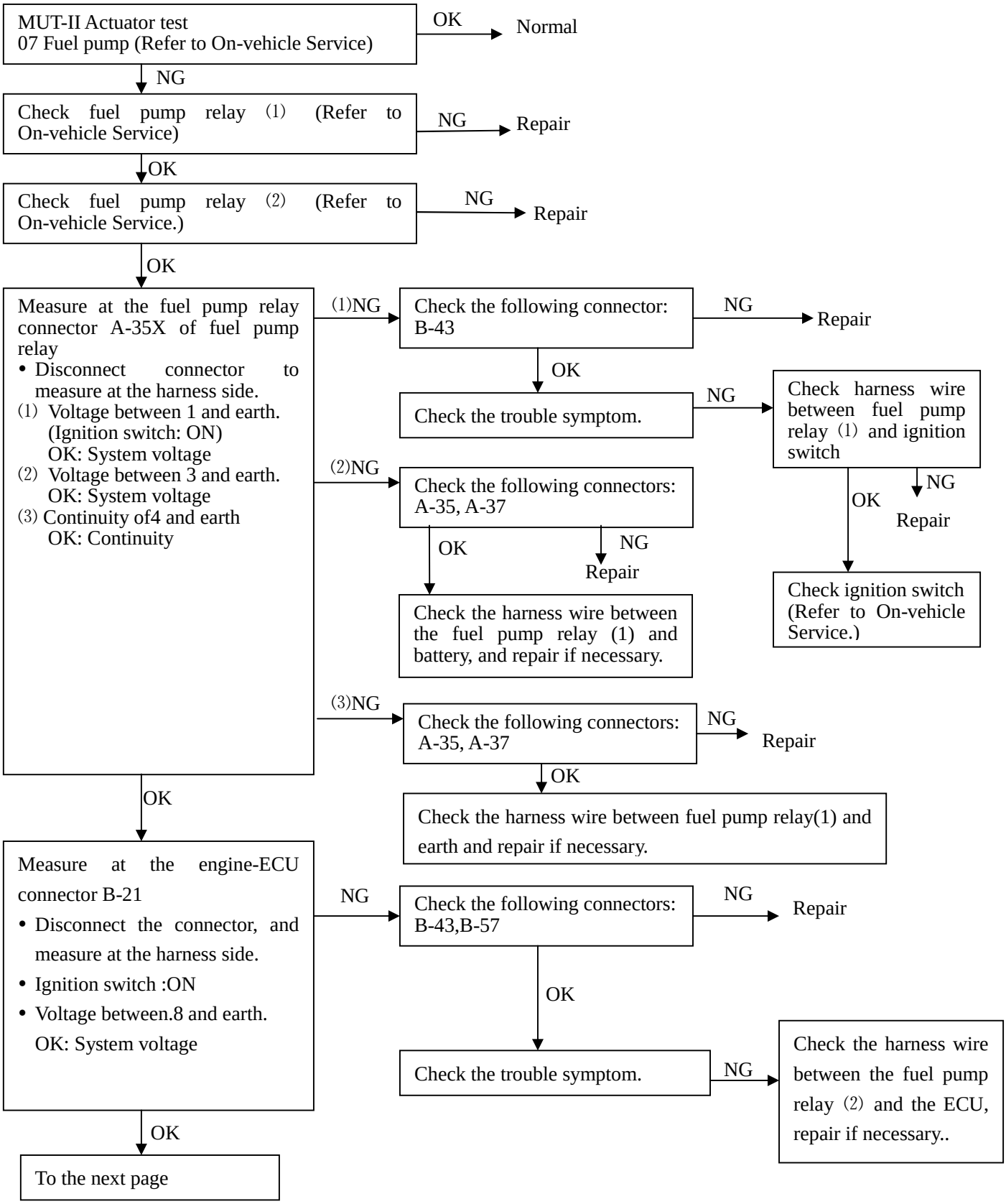
Table 4-55

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-ECU. The engine-ECU controls the idle speed control (ISC) servo based on the input.	• Malfunction of the power steering fluid pressure switch • Improper connector contact, open circuit or short- • circuited harness wire • Malfunction of the engine-ECU

INSPECTION PROCEDURE 32 (Refer to Table 4-56、Fig. 4-138)

Table 4-56

Check the A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine ECU, the ECU Carries out control of the idle speed control servo, and lso operates the A/C compressor magnetic clutch.	• Malfunction of the A/C control system • Malfunction of the A/C switch • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the engine-ECU


MUT-II Actuator test
07 Fuel pump (Refer to On-vehicle Service)
OK
Normal
NG
Check fuel pump relay (1) (Refer to On-vehicle Service)
NG
Repair
OK
Check fuel pump relay (2) (Refer to On-vehicle Service.)
NG
Repair
OK
Measure at the fuel pump relay connector A-35X of fuel pump relay
• Disconnect connector to measure at the harness side.
(1) Voltage between 1 and earth.
(Ignition switch: ON)
OK: System voltage
(2) Voltage between 3 and earth.
OK: System voltage
(3) Continuity of4 and earth
OK: Continuity
(1)NG
Check the following connector: B-43
NG
Repair
OK
Check the trouble symptom.
NG
Check harness wire between fuel pump relay (1) and ignition switch
NG
Repair
OK
Check ignition switch (Refer to On-vehicle Service.)
(2)NG
Check the following connectors: A-35, A-37
OK
NG
Repair
Check the harness wire between the fuel pump relay (1) and battery, and repair if necessary.
(3)NG
Check the following connectors: A-35, A-37
NG
Repair
OK
Check the harness wire between fuel pump relay(1) and earth and repair if necessary.
OK
Measure at the engine-ECU connector B-21
• Disconnect the connector, and measure at the harness side.
• Ignition switch :ON
• Voltage between.8 and earth.
OK: System voltage
NG
Check the following connectors: B-43,B-57
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the fuel pump relay (2) and the ECU, repair if necessary..
OK
To the next page

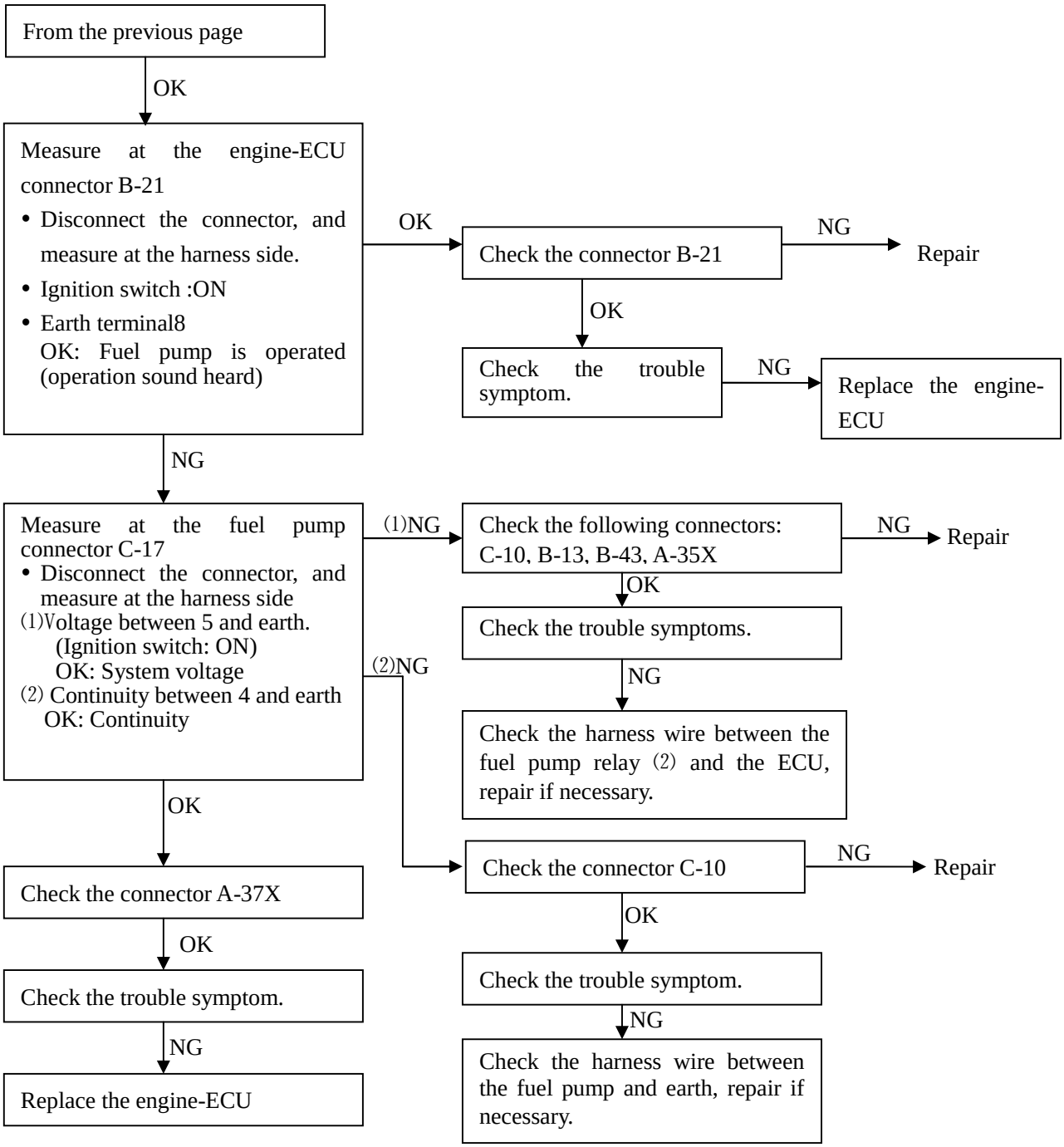

From the previous page
OK
Measure at the engine-ECU connector B-21
• Disconnect the connector, and measure at the harness side.
• Ignition switch :ON
• Earth terminal8
OK: Fuel pump is operated (operation sound heard)
OK
Check the connector B-21
NG
Repair
OK
Check the trouble symptom.
NG
Replace the engine-ECU
NG
Measure at the fuel pump connector C-17
• Disconnect the connector, and measure at the harness side
⑴Voltage between 5 and earth.
(Ignition switch: ON)
OK: System voltage
⑵ Continuity between 4 and earth
OK: Continuity
⑴NG
Check the following connectors: C-10, B-13, B-43, A-35X
NG
Repair
OK
Check the trouble symptoms.
NG
Check the harness wire between the fuel pump relay ⑵ and the ECU, repair if necessary.
⑵NG
OK
Check the connector A-37X
OK
Check the trouble symptom.
NG
Replace the engine-ECU
Check the connector C-10
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the fuel pump and earth, repair if necessary.

Fig. 4-135

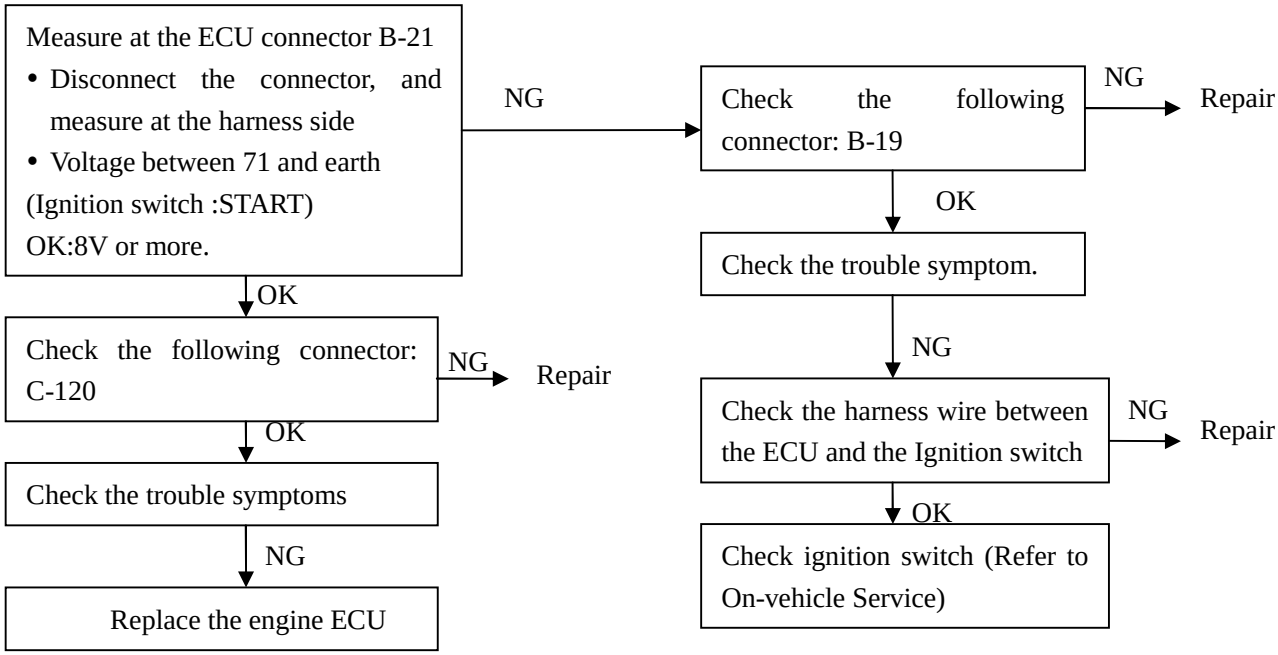


Fig. 4-136

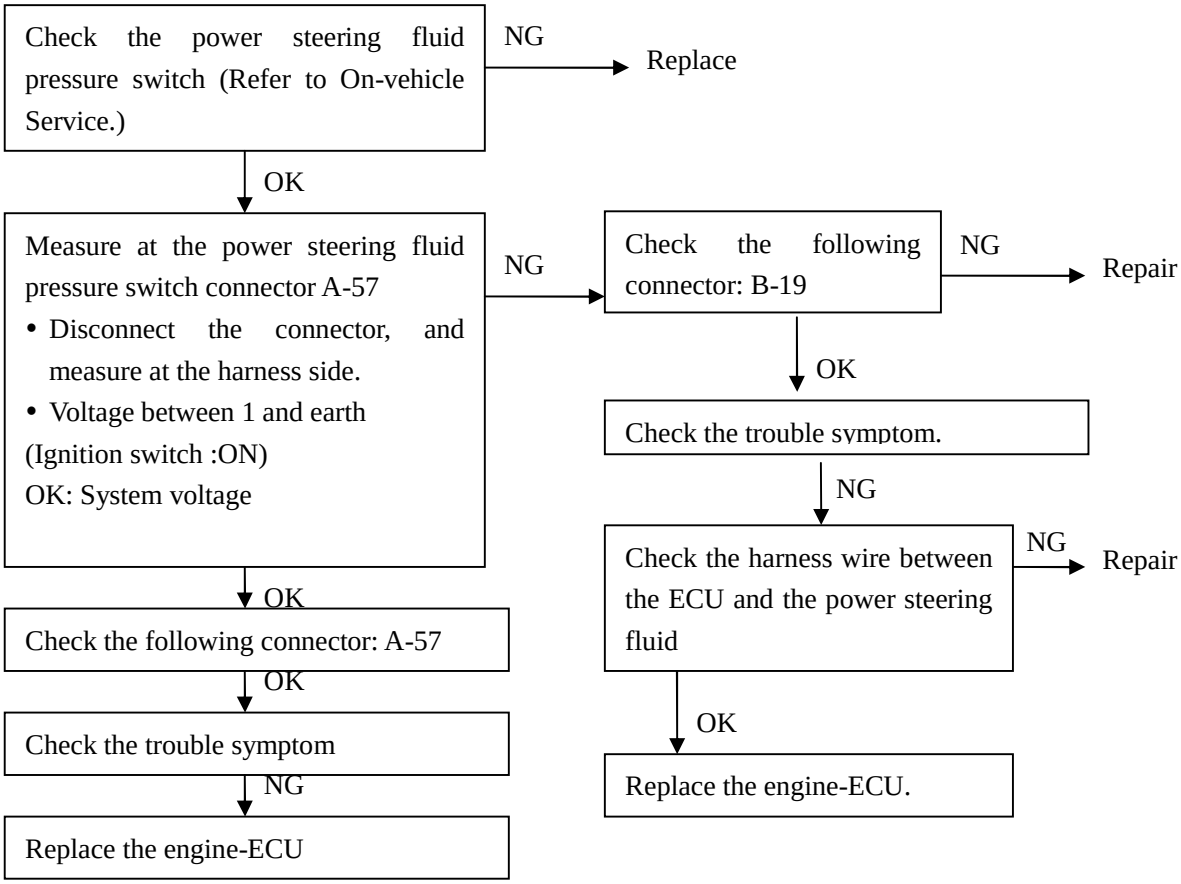


Fig. 4-137

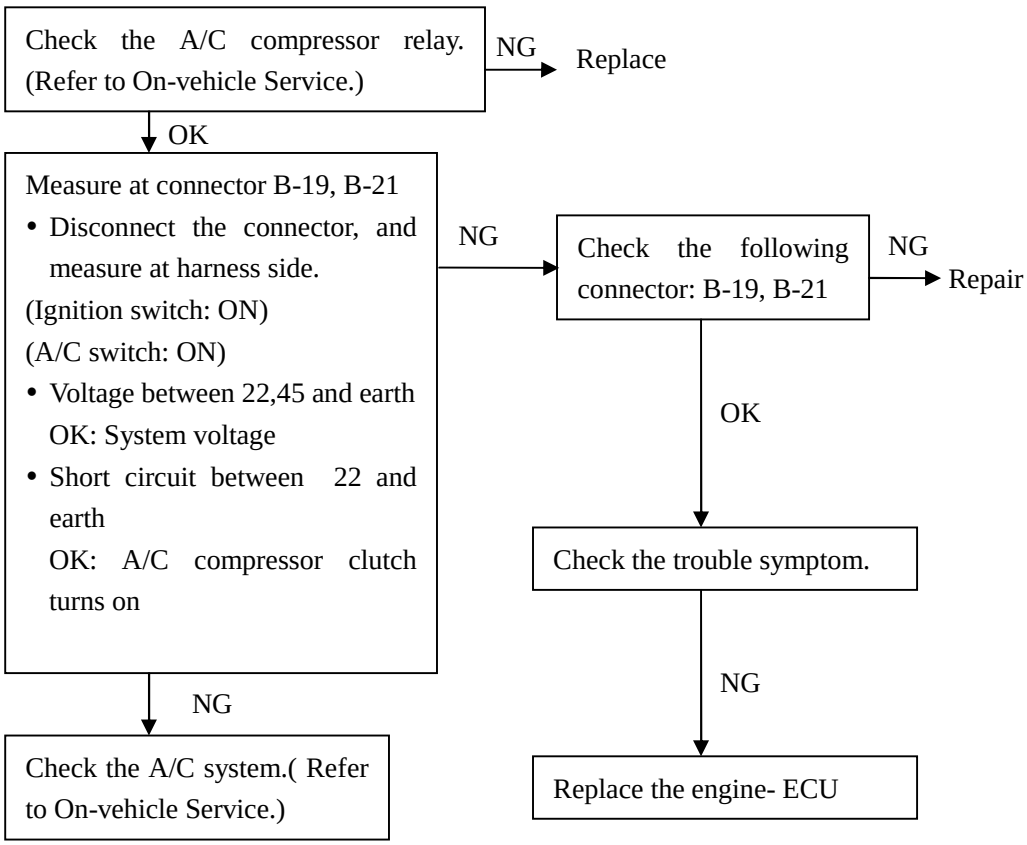


Fig. 4-138

INSPECTION PROCEDURE 33 (Refer to Table 4-57、Fig. 4-139)

Table 4-57

Oxygen sensor (front) system	Probable cause
• The oxygen sensor detects the oxygen content in exhaust gas, converts it to voltage, and send the voltage to the engine-ECU.. • The engine-ECU controls the fuel injector amount to adjust the air/fuel ratio to to a theoretical one.	• Malfunction of the oxygen sensor • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the engine-ECU

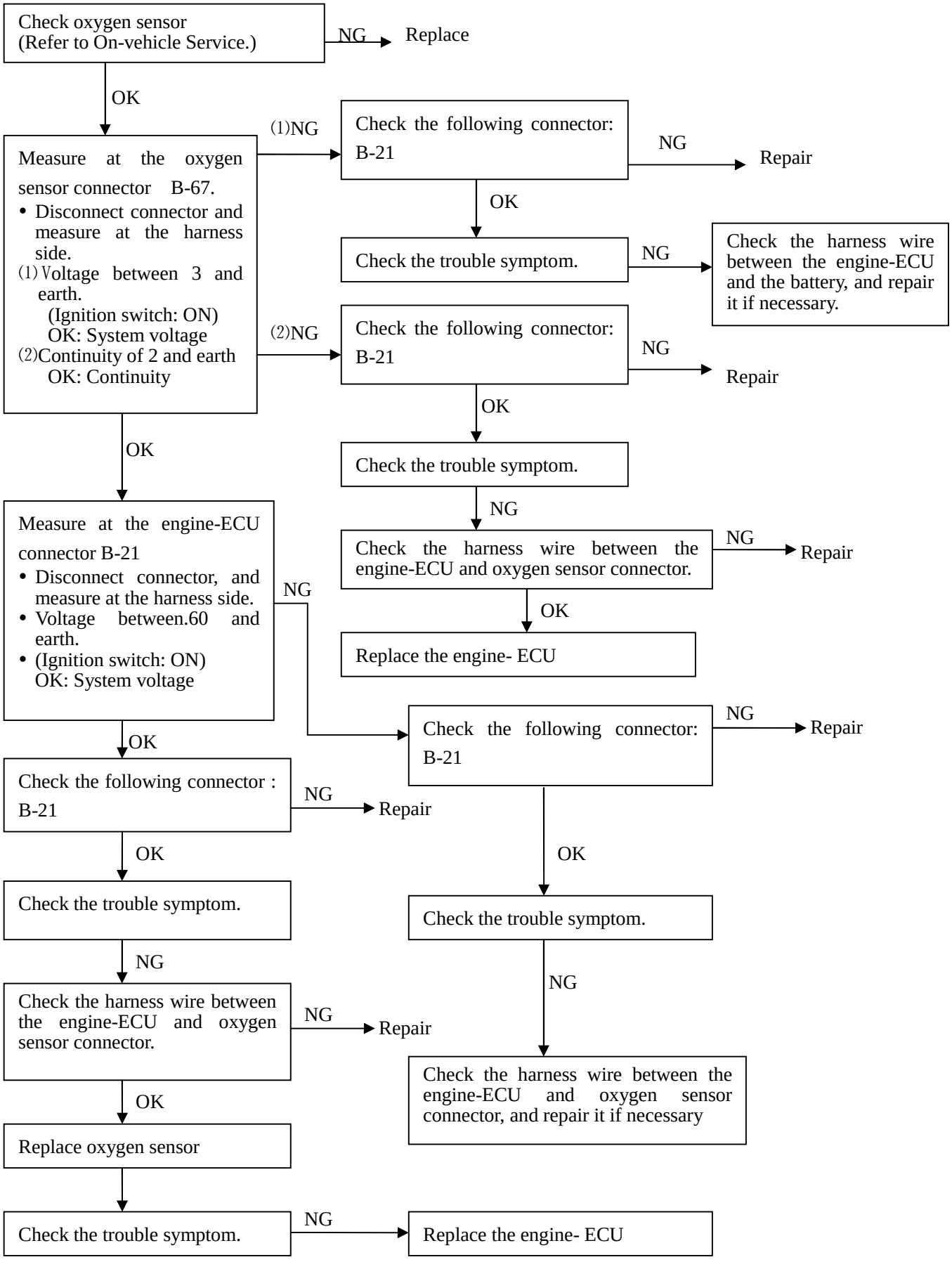

Check oxygen sensor
(Refer to On-vehicle Service.)
NG
Replace
OK
Measure at the oxygen sensor connector B-67.
• Disconnect connector and measure at the harness side.
(1) Voltage between 3 and earth.
(Ignition switch: ON)
OK: System voltage
(2) Continuity of 2 and earth
OK: Continuity
(1)NG
Check the following connector: B-21
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the engine-ECU and the battery, and repair it if necessary.
(2)NG
Check the following connector: B-21
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the engine-ECU and oxygen sensor connector.
NG
Repair
OK
Replace the engine- ECU
OK
Measure at the engine-ECU connector B-21
• Disconnect connector, and measure at the harness side.
• Voltage between.60 and earth.
• (Ignition switch: ON)
OK: System voltage
NG
Check the following connector: B-21
NG
Repair
OK
Check the following connector : B-21
NG
Repair
OK
Check the trouble symptom.
OK
Check the trouble symptom.
NG
Check the harness wire between the engine-ECU and oxygen sensor connector.
NG
Repair
NG
Check the harness wire between the engine-ECU and oxygen sensor connector, and repair it if necessary
OK
Replace oxygen sensor
Check the trouble symptom.
NG
Replace the engine- ECU

Fig. 4-139

INSPECTION PROCEDURE 34 (Refer to Table 4-58、Fig. 4-140)

Table 4-58

Oxygen sensor (rear) system	Probable cause
• The Oxygen sensor detects the oxygen content in exhaust gas, converts it to voltage and sends the voltage to the engine-ECU.	• Malfunction of the Oxygen sensor • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the engine-ECU

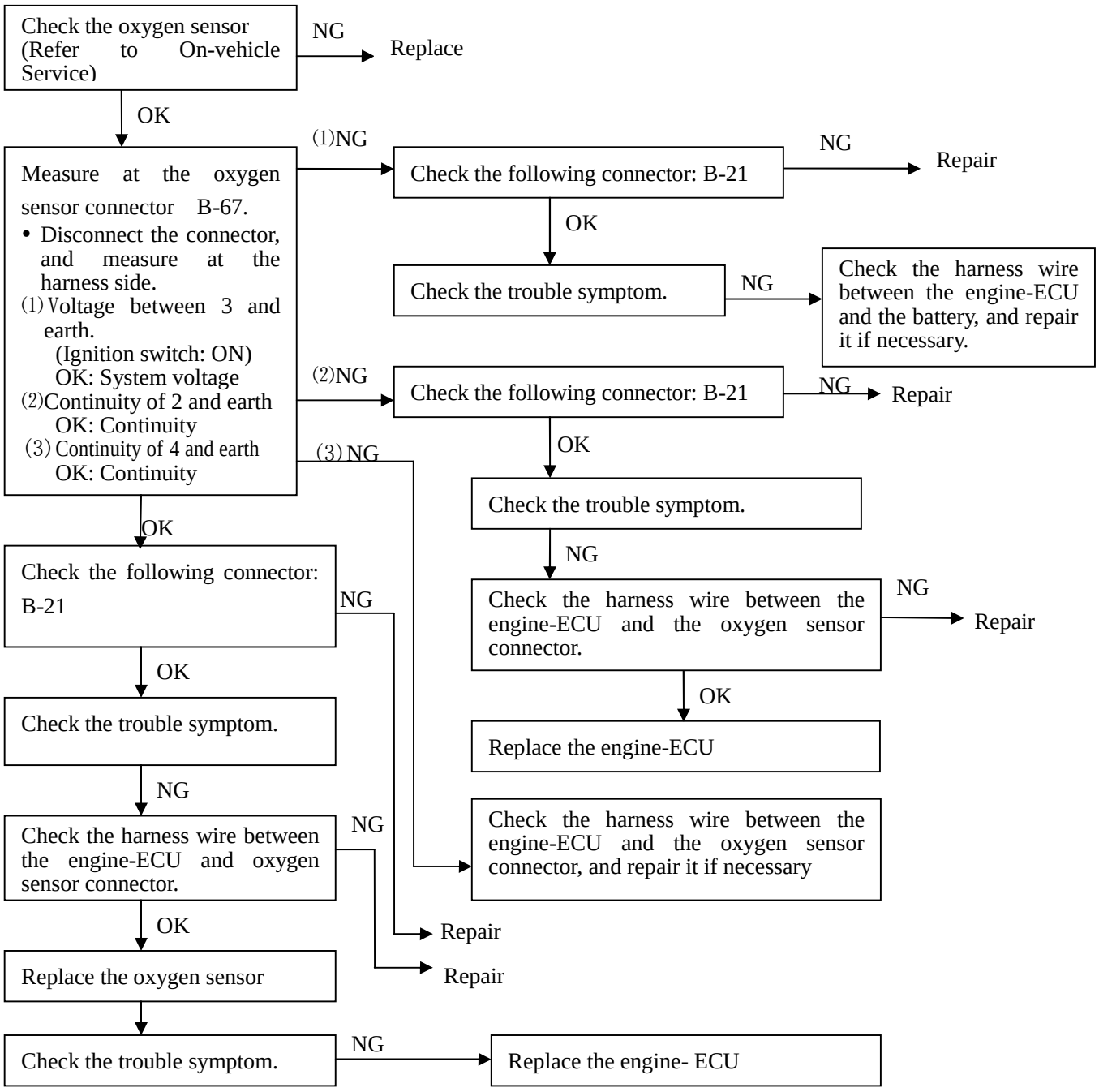


Fig. 4-140

INSPECTION PROCEDURE 36 (Refer to Table 4-59、Fig. 4-141)

Table 4-59

Idle speed control (ISC) servo (Stepper motor) system	Probable cause
The engine-ECU controls the intake air volume by opening and closing servo valve in the bypass air passage.	• Malfunction of ISC servo • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the engine-ECU

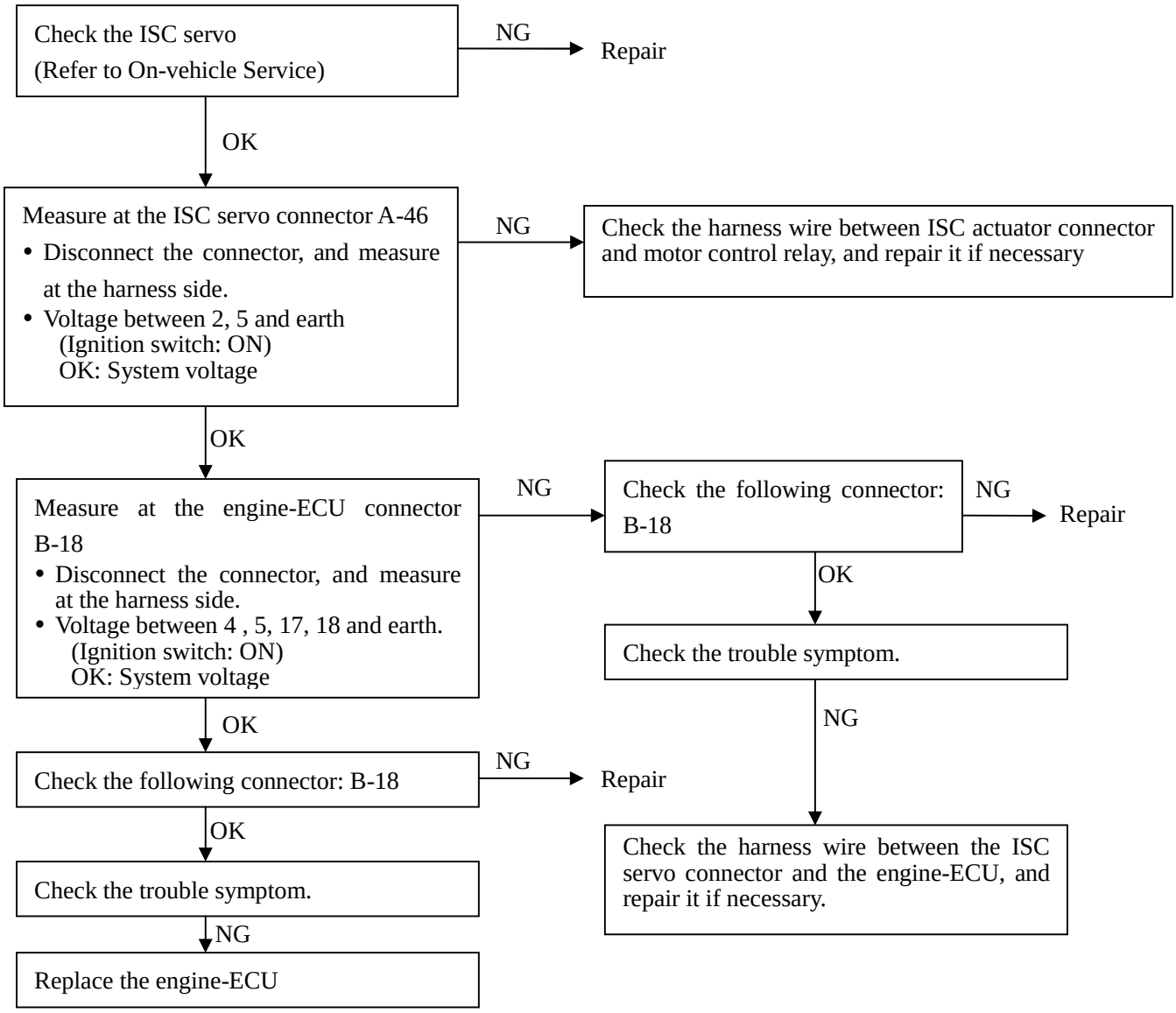


Fig. 4-141

INSPECTION PROCEDURE 37 (Refer to Table 4-60、Fig. 4-142)

Table 4-60

Purge control solenoid valve system	Probable cause
The purge control solenoid valve controls the purging of air from canister located inside the intake manifold.	• Malfunction of the purge control solenoid valve • Improper connector contact, open circuit or short circuited harness wire. • Malfunction of the engine-ECU

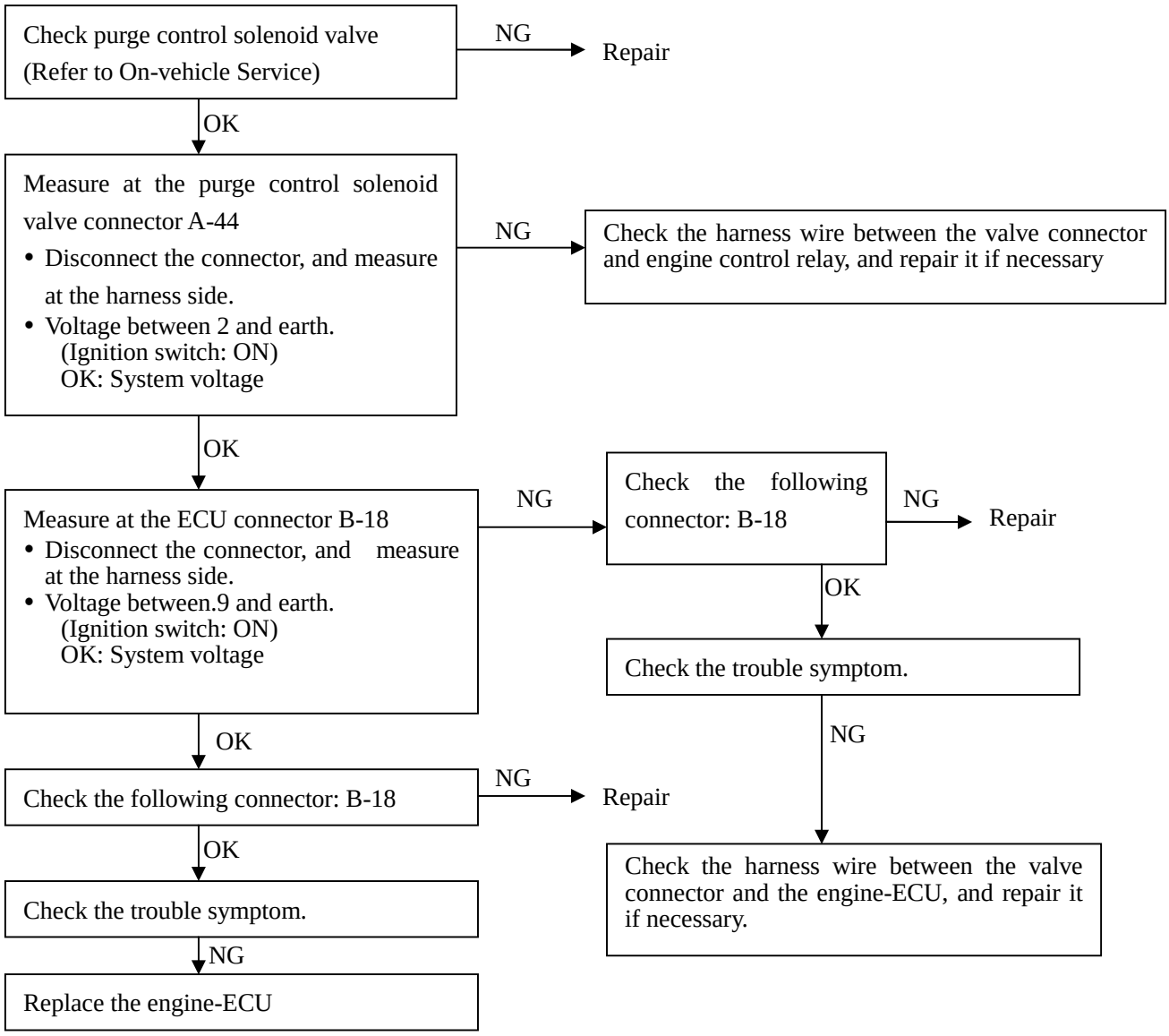


Fig. 4-142

INSPECTION PROCEDURE 38 (Refer to Table 4-61、Fig. 4-143)

Table 4-61

EGR control solenoid valve system	Probable cause
The EGR control solenoid valve is controlled by the negative pressure resulting from the EGR operation leaking to port " A." of the throttle valve.	• Malfunction of the solenoid valve • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the engine-ECU

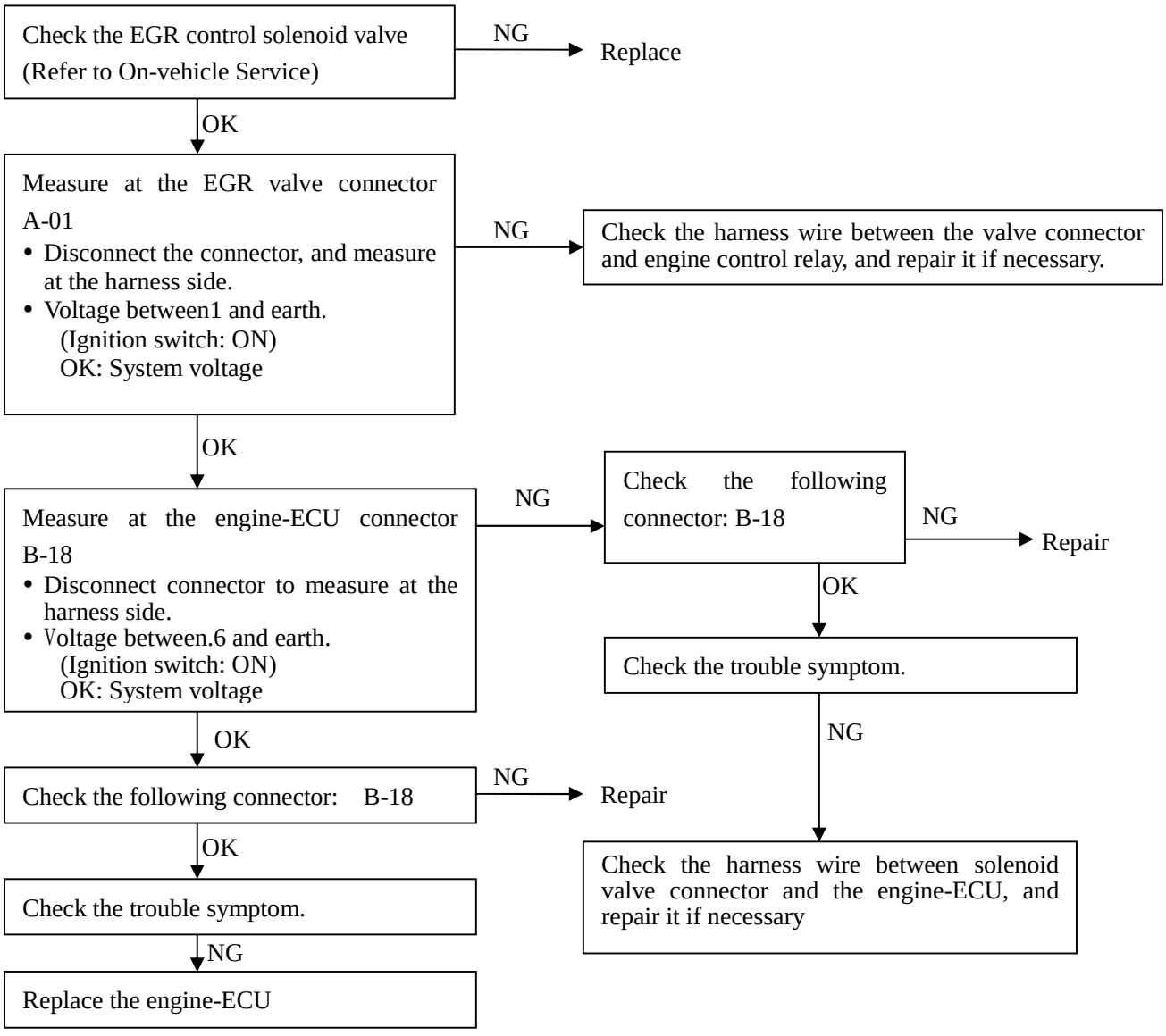


Fig. 4-143

5. DATA LIST REFERENCE TABLE (Refer to Table 4-62, Table 4-63)

> **Caution**
> **When shifting the selection lever to D range, the brakes should be applied so that the vehicle does not move forward.**

NOTE:

1. The Injector drive timing represents the time when the cranking speed is at 250r / min or below when the supply voltage is 11V.
2. In a new vehicle（driven approximately 500 km or less），the Injector drive timing is sometimes 10% longer than the standard time。
3. In a new vehicle（driven approximately 500 km or less），the step of the stepper motor is sometimes 30 steps greater than standard value.

Table4-62

Item No	Inspection item	Inspection contents		Normal condition	Inspection Procedure
11	Oxygen sensor	Engine: After having warmed up Air/fuel ratio is made leaner when decelerating, and is made richer when racing.	When at 4000 r/min, engine is suddenly decelerated.	200mV or less	Procedure No. 33
			When engine is suddenly raced	600-1000mV	
		Engine：After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the ECU.	Engine is idling	400mV or less （Changes） 600-1000mV	
			2500 r/min		
13	Intake air temperature sensor	Ignition switch：“ON” or with engine running	When intake air temperature is -20℃	-20℃	CODE No.13
			When intake air temperature is 0℃	0℃	
			When intake air temperature is 20℃	20℃	
			When intake air temperature is 40℃	40℃	
			When intake air temperature is 80℃	80℃	
14	Throttle position sensor	Ignition switch：“ON”	Set to idle speed	335-935 mV	CODE No 14
			Gradually open	Increase in proportion to throttle opening angle	
			Open fully	4400-5300 mV	
16	Battery voltage	Ignition switch：“ON”		System voltage	Procedure No 26

Item No	Inspection item	Inspection contents			Normal condition	Inspection Procedure
18	Cranking signal (Ignition switch-ST）	Ignition switch:“ON”	Engine：Stopped		OFF	Procedure No 29
			Engine：Cranking		ON	
21	Engine coolant temperature sensor	Ignition switch:“ON” or with engine running	When engine coolant temperature is -20℃		-20℃	CODE No 21
			When engine coolant temperature is 0℃		0℃	
			When engine coolant temperature is 20℃		20℃	
			When engine coolant temperature is 40℃		40℃	
			When engine coolant temperature is 80℃		80℃	
22	Crank angle sensor	• Engine：Cranking • Tachometer：Connected	Compare engine speed readings on tachometer and the MUT-II		Accord	CODE No 22
		• Engine：Idling	When engine coolant temperature is -20℃		1475-1675r/min（4G13） 1400-1600r/min（4G18）	
			When engine coolant temperature is 0℃		1345-1545r/min（4G13） 1300-1533r/min（4G18）	
			When engine coolant temperature is 20℃		1200-1400r/min	
			When engine coolant temperature is 40℃		1160-1225r/min（4G13） 1030-1230r/min（4G18）	
			When engine coolant temperature is 80℃		650-850r/min	
24	Vehicle speed sensor	Drive at 40 km/h			Approximately 40 km/h	Code No. 24
27	Power steering fluid pressure switch	Engine：Idling	Steering wheel stationary		OFF	Procedure No 31
			Steering wheel turning		ON	
28	A/C switch	Engine：Idling	A/C switch：ON	A/C compressor not operated	OFF	Procedure No 32
				A/C compressor operated	ON	

Item No	Inspection item	Inspection contents		Normal condition	Inspection Procedure
32	Vacuum sensor (manifold absolute pressure sensor)	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No 32
			At altitude of 600 m	95 kPa	
			At altitude of 1200 m	88 kPa	
			At altitude of 1800 m	81 kPa	
		• Engine coolant temperature: 80 - 95℃ • Lamps, electric cooling fan and all accessories: OFF	Engine：Idling	24.3-37.7kPa	
			When engine is suddenly raced	Increases	
41	Injectors	Engine: Cranking	When engine coolant temperature is 0 ℃(injection is carries out for all cylinders simultaneously)	13-23 ms（DA471Q） 23-25.5 ms（DA476Q）	—
			When engine coolant temperature is 20 ℃	26-46 ms（DA471Q） 28-38 ms（DA476Q）	
			When engine coolant temperature is 80 ℃	8-12 ms（DA471Q） 5.5-9.5 ms（DA476Q）	
		• Engine coolant temperature: 80 - 95℃ • Lamps, electric cooling fan and all accessories: OFF	Engine is idling	1.7-2.9 ms	
			2500 r/min	1.4-2.6 ms	
			When engine is suddenly raced	Increased	
44	Ignition advance	• Engine: After having warmed up. • Timing lamp is set(The timing lamp is set in order to check actual ignition timing)	Engine: Idling	0-20° BTDC（DA471Q） 2-18° BTDC（DA476Q）	—
			2500 r/min	19-39° BTDC（DA471Q） 25-45° BTDC（DA476Q）	
59	Oxygen sensor(rear)	• Transmission: L range • Drive with throttle widely open	3500 r/min		Procedure No 32

6 ACTUATOR TEST REFERENCE TABLE

ACTUATOR TEST REFERENCE TABLE refers to table 4-64.

Table 4-64

Item No	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection Procedure No
01	Injectors	Cut fuel to No.1 injector	Engine：After having warmed up/Engine is idling. （Cut the fuel supply to each injector in turn and check cylinders which don't affect idling）		Idling condition becomes different (becomes unstable)	Code No 41
02		Cut fuel to No.2 injector				
03		Cut fuel to No.3 injector				
04		Cut fuel to No.4 injector				
07	Fuel pump	Fuel pump operation and fuel is recirculated.	• Engine: Cranking • Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated	Pulse is felt.	Procedure No.28
				Listen near the fuel tank for the sound of fuel pump operation	Sound of operation can be heard.	
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch：“ON”		Solenoid sound of operation is heard when solenoid value is driven.	Procedure No.37
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON..	Ignition switch：“ON”		Solenoid sound of operation is heard when solenoid value is driven.	Procedure No 32
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine：Idling Timing light is set		5° BTDC	—
21	Fan controller	Drive the fan motor	Ignition switch : ‘ON”		Radiator fan and condenser fan operate at high speed	Procedure No.25

7 ENGINE-ECU CONNECTOR TERMINALS

ENGINE－ECU connector terminal arrangement refers to Fig. 4-144.

Fig. 4-144

ENGINE－ECU connector terminal check refers to Table 4-65.

Table 4-65

Terminal No.	Check item	Check condition（Engine condition）	Normal condition
A01	No.1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 11－14Ⅴ, momentarily drops slightly
A14	No.2 injector		
A14	No.3 injector		
A15	No.4 injector		
A04	Stepper motor coil（A）	Engine: Soon after the warmed up engine is started.	System voltage to 0 V (Changes repeatedly)
A17	Stepper motor coil（B）		
A05	Stepper motor coil（C）		
A18	Stepper motor coil（D）		
A06	EGR control solenoid valve	Ignition switch：”ＯＮ”	System voltage
		While engine is idling, suddenly depress the accelerator pedal.	From system voltage, momentarily drops
A08	Fuel pump relay	Ignition switch：”ＯＮ”	System voltage
		Engine: Idling	1V or less
A09	Purge control solenoid valve	Ignition switch：ＯＮ	System voltage
		Running at 3000 r/min while engine is warming up after having been started.	1Ⅴor less
A10	Ignition coil －No.1, No.4	Engine r/min：3000 r/min	0.3－3.0Ⅴ
A23	Ignition coil －No.2, No.3		
A12	ECU power supply	Ignition switch : “ON”	System voltage
A25			

Terminal No.	Check item	Check condition（Engine condition）		Normal condition
A21	Fan controller	Radiator and condenser fan is not operating		0－0.3Ⅴ
		Radiator and condenser fan is operating.		0.7 or more
A22	A/C relay	• Engine：Idling A/C switch: OFF→ON (A/C compressor runs)		System voltage or momentarily 6V or more →1V or less
B03	Alternator G terminal	• Engine：Warm，idle（radiator fan：OFF） • Headlamp：OFF→ON • Stop lamp ：OFF→ON • Rear defogger switch：OFF→ON		Voltage increase by 0.2 Ⅴ－3.5Ⅴ
B11	Alternator FR terminal	• Engine：Warm，idle（radiator fan：OFF） • Headlamp：OFF→ON • Stop lamp ：OFF→ON • Rear defogger switch：OFF→ON		Voltage decreases
C10	Oxygen sensor heater (front)	Engine：Idling after warming up		1Ⅴ or less
		Engine r/min：5000 r/min		System voltage
D02	Intake air temperature sensor	Ignition switch：“ON”	When intake air temperature is －20℃	3.8－4.4Ⅴ
			When intake air temperature is 0℃	3.2－3.8Ⅴ
			When intake air temperature is 20℃	2.3－2.9Ⅴ
			I When intake air temperature is 40℃	1.5－2.1Ⅴ
			When intake air temperature is 60℃	0.8－1.4Ⅴ
			When intake air temperature is 80℃	0.4－1.0Ⅴ
D06	Oxygen sensor (front)	Engine：Running at 2500 r/min after warmed up （Check using a digital type voltmeter）		0 Ⅴ to 0.8 Ⅴ (Changes repeatedly)
D09	Self-diagnosis power supply			
D11	Sensor impressed	Ignition switch：“ON”		4.9 －5.1Ⅴ
D13	Engine coolant temperature sensor	Ignition switch: “ON”	When engine coolant temperature is -20 ℃	3.9－4.5Ⅴ
			When engine coolant temperature is 0 ℃	3.2－3.8Ⅴ

Terminal No.	Check item	Check condition（Engine condition）		Normal condition
D13	Engine coolant temperature sensor	Ignition switch: “ON”	When engine coolant temperature is 20 ℃	2.3－2.9 V
			When engine coolant temperature is 40 ℃	1.3－1.9 V
			When engine coolant temperature is 60 ℃	0.7－1.3 V
			When engine coolant temperature is:80 ℃	0.30.9 V
D14	Throttle position sensor	Ignition switch: “ON”	Set throttle valve to idle position	0.335－0.935 V
			Fully open throttle valve	4.4－5.3 V
D15	Vacuum sensor	Ignition switch: “ON”	When altitude is 0 m	3.7－4.3 V
			When altitude is 1200 m	3.2－3.8 V
D16	Vehicle speed	• Ignition switch: “ON” • Move the vehicle slowly forward		0 to system voltage (Changes repeatedly)
D18	Camshaft position	Engine: Cranking		0.3－3.0 V
		Engine: Idling		0.5－3.5 V
D19	Crank angle sensor	Engine: Cranking		0.4－4.0 V
		Engine: Idling		1.5－2.5 V
D22	Sensor earth			

8. ENGINE-ECU HARNESS SIDE CONNECTOR TERMINALS

Engine-ECU harness side connector terminal arrangement refers to Fig.4-145

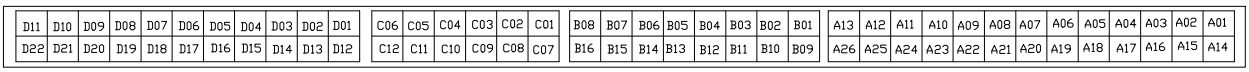


Fig.4-145

Engine-ECU harness side connector terminal check refers to Table 4-66.

Table 4-66

Terminal No.	Inspection item	Normal condition(Check condition)
A01－A12	No.1 injector	13－16 Ω (At 20℃)
A14－A12	No.2 injector	
A02－A12	No.3 injector	
A15－A12	No.4 injector	
A04－A12	Stepper motor coil (A)	28－33 Ω (At 20℃)
A17－A12	Stepper motor coil (B)	
A05－A12	Stepper motor coil (C)	
A18－A12	Stepper motor coil (D)	
A06－A12	EGR control solenoid valve	29－35 Ω (At 20℃)
A09－A12	Purge control solenoid valve	29－35 Ω (At 20℃)
A13－Body earth	ECU earth	Continuity
A26－Body earth	ECU earth	
C10－A12	Oxygen sensor heater	4.5－8.0 Ω(At 20℃)

4.8 UAES Electronic Control System

一、 Normal maintenance notice

- Only permit to use digital multimeter to check EMS.
- Please to use eligible parts and assy, when maintaining the system. Otherwise the natural working of EMS can't be assured.
- Only permit to use lead-free gasoline in maintenance process.
- Please according to canonical maintenance diagnostic flow to repair.
- Forbid to disassemble and remove the parts and assy of EMS in maintenance process.
- In maintenance process ,should be very careful when taking the electronic organs(ECU、sensors etc),can't drop them to the ground.
- Build up circumstances protection consciousness，should deal with the reject amenta availably bringed in the maintenance process.

二、 Notice proceeding of the maintenance process

Don't optionally disassemble any parts or plug of EMS from their installing position，for fear suddenness damage or water and oil dirt etc come into the plugs，effect natural working of EMS.

1) When cutting and connecting the pin ， must put ignition switch on the close place，otherwise the electronic organ can be damaged.
2) When being failure simulate of the heated working condition and other maintenance work that can raise the temperature， not to make the temperature of ECU exceed 80℃.
3) The fuel pressure of EMS is higher（about 350kPa），all the fuel pipelines must use fuel pipe pressure-resistant,even if the ENG don't running ， the fuel pressure in the fuel pipe is higher .So it should be noticed not to disassemble fuel pipe unless it is necessary in maintenance process，at the situation of need to maintain the fuel system ，should discharge pressure of the fuel system before disassemble fuel pipes，discharge pressure method as follows: disassemble fuel pump relay，start ENG and run it at idle speed, till the ENG crush out proper.Disassemble of fuel pipe and fuel filter replacing should be being in the place of drafty and by the speciality service personnel**.**
4) Don't electrify to the fuel pump when take it outoff the fuel tank，for fear produce electric spark and bring fire.
5) The fuel pump running test must not be being in dry condition or in the water，otherwise the using life of the fuel pump can be shortened，in addition the anode and cathode of fuel pump must not be connected mistakenly.
6) When to check the ignition system, don't do the testing of jumping spark unless it is necessary, and the time must be short, when to check it , don't open the throttle body ,otherwise which will lead to a lot of unburnt fuel going into the exhaust pipe, making the three-way catalysis broken.

7) Because adjust of idle is finished by EMS completely， needn't manpower adjust.Accelerograph limit screw of throttle body has adjusted well in the produce factory when it leave factory， its original position can't be changed optionally.

8) Anode and cathode of battery can't be connected mistakenly when they are connected，for fear damage electronic organ ，This system use negative to connect earth.

9) When the ENG is running，don't remove the battery cable.

10) Must remove the anode、cathode cable of battery and ECU before electric welding is actualizing on the vehicle.

11) Don't use the method of impaling the wire scarfskin to check theinput and output electric signal of the parts.

三、 **Service tools general view**（see fig.4-146～fig.4-154）

Fig.4-146

Tool name：

EMS diagnose instrument

function：

read/clean EMS failure code，observe data，parts movment testing etc.

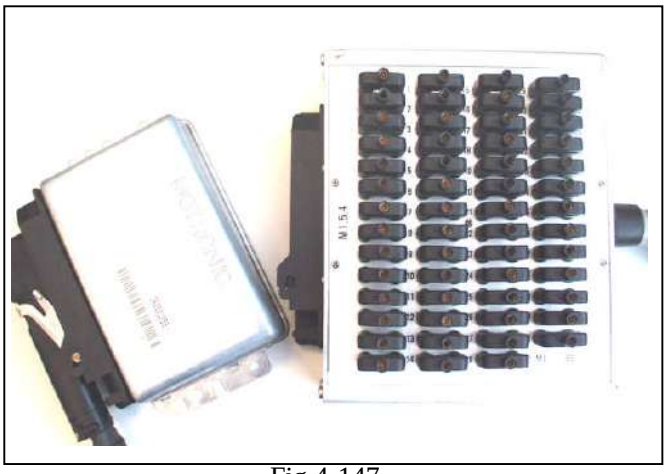


Fig.4-147

Tool name：

Commutator of EMS

Function：

Check electronic signal of ECU pin and wires condition etc.

Fig.4-148

Tool name：

Ignition timing lamp

Function：

Check ENG ignition timing etc.

Fig.4-149

Tool name：

Figure multimeter

Function：

Check voltage、 current、 resistance of EMS.

Fig.4-150

Tool name：

Vacuum gauge

Function：

Check pressure in the intake manifold.

Fig.4-151

Tool name：

Cylinder pressure gauge

Function ：

Check cylinder pressure of each cylinder.

Fig.4-152

Tool name：

Fuel pressure gauge

Function ：

Check fuel pressure of fuel system，determinant the working condition of the fuel pump and fuel pressure adiuster

Tool name：

Exhaust gas analyser

Function ：

Check the condition of exhaust emission，help to estimate the failure of EMS.

Fig.4-153

Tool name：

Fuel injectors cleanout analyser

Function ：

Clean and analyse the fuel injectors.

Fig.4-154

四、Note of the abbreviative words appear in the manual see Table 4-67.

Table 4-67

DG	Rotate speed sensor
DKG	Throttle position sensor
DR	Fuel pressure adjuster
DS-S-TF	Intake pressure and temperature sensor
ECU	Electronic Control Unit
EKP	Fuel pump
EMS	Engine management system
EWD	Idle adjuster /Rotary slide valve
EV	Electronic fuel pump
LSH	Hot mode oxygen sensor
KS	Knock sensor
KSZ	Fuel distribute pipe assy.
KVS	Fuel distribute pipe

PG	Phase sensor
ROV	Ignition system with distributor
RUV	Ignition system without distributor
TEE	Electronic fuel pump bracket
TEV	Canister control valve
TF-W	Coolant temperature sensor
ZSK	Ignition coil

五、 M7.9.7 system introduce

1. Rationale of system

●System summarize：

·System conFiguration

EMS usually is make up of sensor、ECU、administer three parts，control inlet Air、fuel injection capacity and spark advance angle for ENG working.Basal conFiguration as shown Fig.4-155.

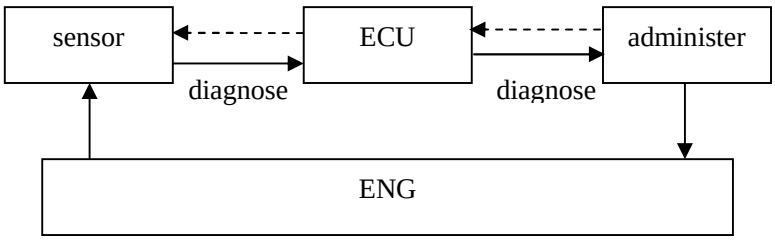
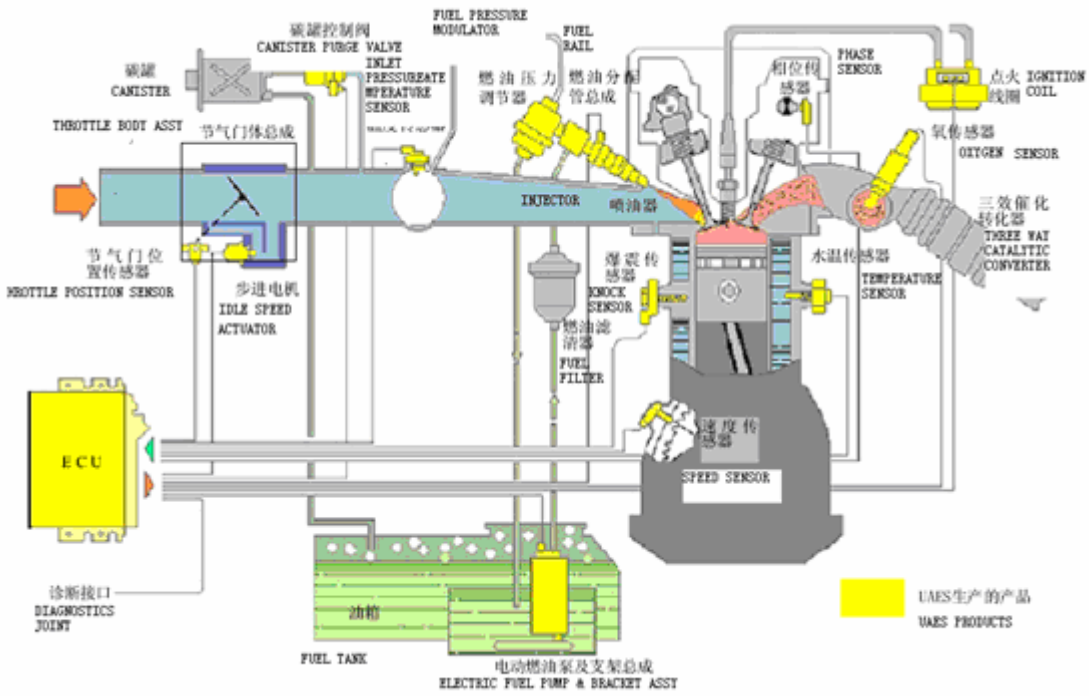


Fig 4-155 Composing of ENG electronic control system

In ENG electronic control system，the sensor is input part，using measure all kinds of physics signal（temperature、pressure etc），and turn it into corresponding electronic signal；The action of ECU is accept input signal of sensor，and being to calculate disposal according to the enactmented program，then produce corresponding control signal and transport it to power drive circuit，power drive circuit ,drive each administer and enforce it to do different action. Make ENG running according to established control policy；the same time ,the failure diagnose system of ECU supervise and control each part of system and control function，as soon as detect failure and affirm it ,then save failure code，transfer the function of“claudication go home”function，the natural value came back to be use when the failure is cleared up.

The maximal characteristic of M7.9.7 EMS is that it adopts the control strategy basing on torque.The primary aim is to make a lot of different control causes to contact together.This is alone method to integrate different function into the different transmutation of ECU according to the type of ENG and vehicle to choose agility.The conFiguration of M7.9.7 EMS as shown Fig 4-156.



·Fig 4-156 M7.9.7 EMS conFiguration

The base module of M7.9.7 EMS **see Table** 4-68：

Table 4-68

Electronic Control Unit（ECU）	Idle adjuster /Rotary slide valve
Vehicle speed sensor	Fuel injectors
Intake pressure and temperature sensor	Electronic fuel pump
Coolant temperature sensor	Fuel pressure adjuster
Throttle position sensor	Electronic fuel pump bracket
Phase sensor	Fuel distribute pipe
Rotate speed sensor	Canister control valve
Knock sensor	Ignition coil
Hot mode oxygen sensor	

·The function of M7.9.7 EMS：

M7.9.7-Motronic EMS is an electronic manipulative gasoline engine control system，which provides many control characteristic about operator and vehicle or equipment，and it adopts the way that open-loop and close-loop（feedback）control are joint，providing every kind of control signal for engine running.

The principal function of EMS ：

1)the basic management function of the engine which applies physics model

- ✧ system mechanism basing on torque，Intake pressure temperature sensor confirms the load capacity of the cylinder，and under the static and dynamic state，implement the control function of mixture gas—λ closed loop control；
- ✧ fuel orderly injects every cylinder、 ignition timing， including knock control of every cylinder and emission control function；
- ✧ three-way catalysis heated；

- ✧ canister control；
- ✧ Idle control；
- ✧ claudication go home；

2) advance reserving function

- ✧ cruise control；
- ✧ thief alarm function；
- ✧ the link of torque and external system（such as transmission mechanism or vehicle dynamic control）；
- ✧ The control for some kind of engine components；
- ✧ Provide the interface to match EOL-programme tool and service tool.

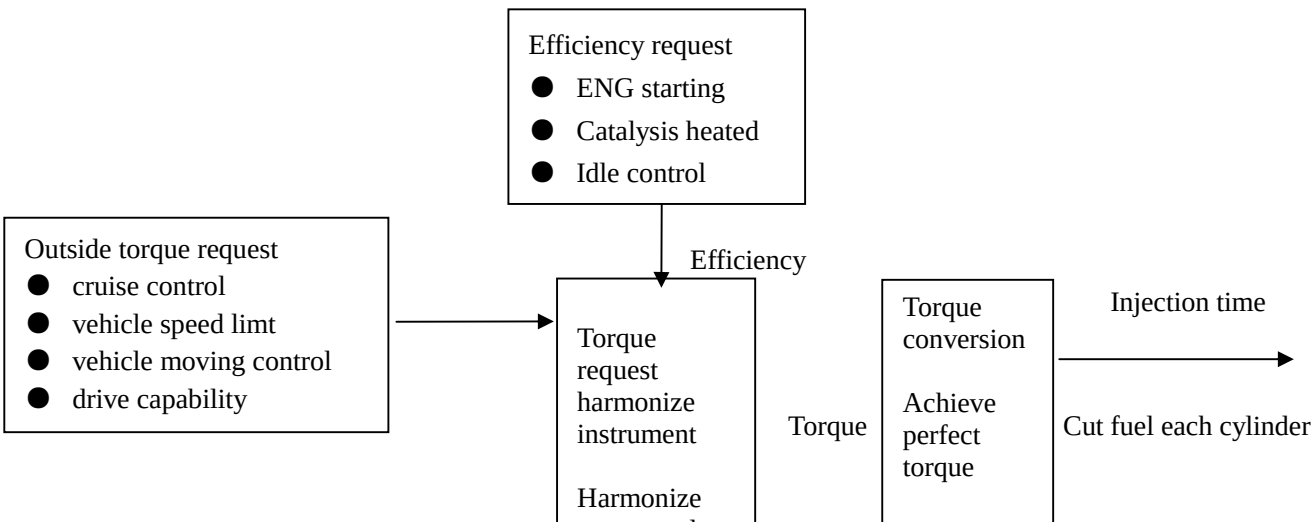
3) online diagnoses OBD II

- ✧ Complete a series of function of OBD II；
- ✧ the management system of function for diagnoses .

- ● Torque conFiguration：

M7.9.7 system base on torque control

In M7.9.7 ESM base on torque ，all intramural and external requirements of ENG are defined using torque or efficiency requirements of ENG，As shown Fig 4-157.Through translating different requirements of ENG into control variable of torque or efficiency，then at first the control variable is disposed in the module of central torque requirements harmonize equipment.The M7.9.7 system can array the requirements of ambivalent one another according to preferential seriation，and enforce the most emportant one. Receive ENG control parameter such as injection time 、ignition timing etc through torque transtltion module.Enforcing of the control variable will not affect other variables.This is the excellence of the system.



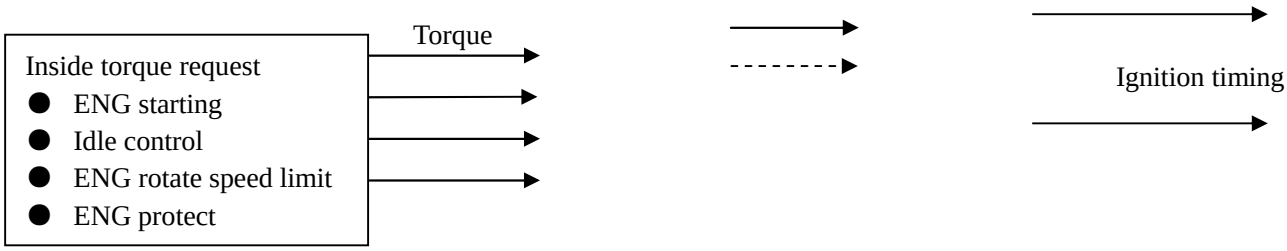


Fig 4-157 M7.9.7 system configuration base on torque

2.Control signal：

● M7.9.7 system iuput signal

Primary sensor input signal of ECU in M7.9.7 system including:

- Intake pressure signal
- Intake temperature signal
- Throttle comer signal
- Coolant temperature signal
- ENG rotate speed signal
- Phase signal
- Knock sensor signal
- Oxygen sensor signal
- Vehicle speed signal
- A/C pressure signal

● M7.9.7 system output signal

After upwards information come into ECU, produce necessary control signal of administer，these signals is blowed up in the output drive circuit diagram and transferred into administer， these control signals including：

- Idle adjuster opening
- Fuel injection timimg and fuel injection duration time
- Fuel pump relay
- Canister control valve opening
- Ignition coil closed angle and spark advance angle
- A/C relay
- Cooling fan relay

3. EMS function introduce

●starting control

At starting process， must use the especial calculate method to control air intake flux 、fuel injection time and ignition timing.At begin phase of the process， the air in intake manifold is immobile， the pressure in intake manifold is the atmosphere pressure of circumambience .when throttle closed , the idle adjuster show a fixed parameter that enacted according to starting temperature.

At the alike process， the specifically “fuel injection timing”is appointed original injection pulse.

The fuel injection flux changes with temperature of ENG，in order to form fuel film in intake manifold and cylinder wall. So before ENG reaches definite rotate speed， need excess mixture gas.

As soon as ENG begin running ， the system begin reduce starting excess at once. Until finished starting working condition （600-700rpm）, then cancel starting excess comletely.

At the starting working condition , ignition angle is adjusted constantly.It changes with temperature of ENG 、intake temperature and rotate speed of ENG.

● Warm up and three-way catalysis heated control

After start ENG at low temperature，cylinder air flux 、fuel injection and electronic ignition are all adjusted in order to compensate higher torque request of ENG；The process proceed until the the temperature is increased proper value.

At the moment，the most important is celerity heated of three-way catalysis. For it can reduce the exhaust emission greatly totransfer rapidly to three-way catalysis begin to work.At the working condition ，adopt the method of suspend spark advance angle reasonably to use exhaust gas to being “three-way catalysis heated”.

●Speedup 、speed-down and reverse dragging break fuel control

Some of the fuel injected to intake manifold don’t reach cylinder in time and join burning latter.Contrarily，it will form flat fuel film on the intake manifold wall.The fuel capacity deposited in the fuel film will increase rapidly according to load improving and fuel injection duration extending.

When the throttle opening increased，partial injection fuel is absorbed by the fuel film.So must inject fuel follow accordingly to compensate it, prevent mixture gas diluted at accelerating .As soon as load coefficient debased ，additive fuel included in the fuel film on the intake manifold wall released anew，at decelerate process，must reduce fuel injection duration accordingly .

Reverse dragging or draught working condition is the condition that ENG output power in the flywheel position is subtractive.At the condition ，friction of ENG and loss of pumping vapor may be vehicle decelerate.When ENG is reverse dragged or draughted condition，cut off fuel injection may reduce fuel consume and exhaust emission，the more important is protect three-way catalysis .

As soon as rotate drop to given resume feed fuel rotate upward idle，fuel system feed fuel anew.Actually，there is a resume rotate area in the ECU program.They are different according to parameter changing such as ENG rotate speed moving change and ENG temperature change etc，and preveng rotate speed drop to prescriptive lowest value through calculate.

As soon as fuel injection system feed fuel anew ，the system feed compensatory fuel with the first time injection pulse and rebuild fuel film on the intake manifold wall .After resume feed fuel ，the control system base on torque make ENG torque increase slowly and placidly（gentleness transition）.

●Idle control

EGN don’t offer torque to flywheel when it is idling.Closed loop control system must keep balance between produced torque and “power consume ”of ENG, in order to ensure ENG run stably at exhauste low idle.Need produce definite power when ENG is idling，in order to satisfy load request of apiece aspect.They include requests from EGN crankshaft 、valve mechanism and accessorial parts，as if inside wear of water pump.

Control policy of M7.9.7 system base on torque confirm ENG output torque of the any working condition to keep idle speed of needing according to closed loop idle control.The output torque raise with ENG rotate speed dropping and drop with ENG rotate speed raising .The system answer the new “disturb factor” through request the higher torque ，as if openning and closing of A/C compressor and A/T shift.When ENG temperature is lowwer ，need increae torque in order to compensate bigger wearing or keep higher idle speed .Summation of all the output torque request transferred to torque harmonize equipment. Then the torque harmonize equipment go alone disposal and calculate，educe homologous charge air density, mixture gas component and ignition timing .

● λ closed loop control

Exhaust behind disposal in the three-way catalysis is effective method that debase injurant concentration in the exhaust .Three-way catalysis may drops HC、 CO and NO_x to 98% or more than，turn them into H_2O，CO_2 and N_2.But then till excess air factor is near λ=1 that is a quite confined area the higher cfficiedcy will be reached，the aim of λ closed loop is that ensure mix gasoline concentration within this area.

λ closed loop control system work till the system is equipped oxygen sensor.The oxygen sensor inspect-measure oxygen content in the exhaust beside three-way catalysis ，rare mix gasoline （λ>1） produce about 100mV sensor

pressure，dense mix gasoline （λ<1）produce about 800mV sensor pressure.At λ=1，sensor pressure will has a spring.λ closed loop control will has an answer for input signal（λ>1=mix gasoline too rare，λ<1=mix gasoline too dense）and amend the control variable，it produce correct gene by way of IER in order to amend injection duration.

● Evaporative emission control

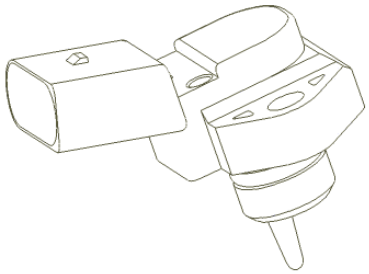
Due to transfer of outside radiant heat and return fuel heat ， fuel in the tank is heated and form fuel vapor.Because evaporative emission rule of law limited，these fuel vapor including a great of HC directly drain into the air is not allowed.Fuel vapor is collected into canister through pipe in the system, it will be blowed into inlet air path in the proper time and participate in burning process.Flux of blow air current is realized through canister control valve by ECU controled.The control work just at λ closed loop system is working.

● Knock control

The system check characteristic libration at knock happening through knock sensor installed on the propriety position on the ENG，then transform it to electric signal in order to send it into ECU and deal with it.ECU use especial disposal arithmetic ，in order to check ignition shock if happened in each burning Cyc of each cylinder.As soon as ignition shock is checked ,knock closed loop control is touched off.After ignition shock danger is eliminated，the cylinder ignition affected will gradually advance to preconcerted spark advance angle anew.

4. Part conFiguration and failure analyse of M7.9.7 system

● Intake pressure temperature sensor
sketch and stitch(see fig.4-158,fig.4-159)



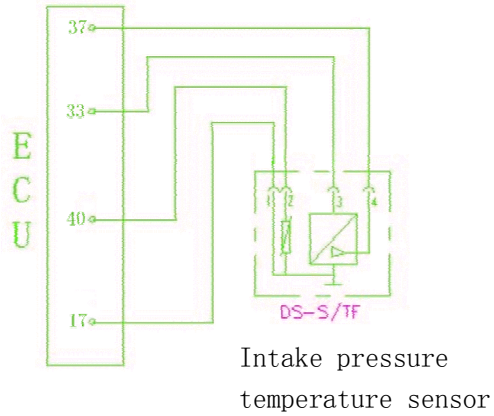


Fig.4-158 intake pressure temperature sensor　Fig.4-159 intake pressure temperature sensor circuit diagram

stitch：No.1 earthing；
No.2 output temperature signal；
No3 meet 5V；
No4 output pressure signal.

1) install position

This sensor is made up two sensors,they are intake manifold pressure sensor and intake temperature sensor，they are installed on the intake manifold.

2) failure phenomenon and estimating methods

·failure phenomenon：flameout、idle badness etc.

·Normal failure reason：1、exist abnormality high pressure and reverse big current in using process；2、damage vacuum organ in servicing process.

·Servicing notice points：forbid using high air striking vacuum organ in servicing process；when replace blooey sensor,check generator output pressure and current if normal.

·Simple measuring method：

temperature sensor part：

Disassemble tie-in,put Figure multimeter to ohm，two meter pen separate connect sensor 1#、2# stitch，at 20℃, rating resistance is 2.5kΩ±5%，other resistance numerical value may be measured through characteristic curve of above Fig..measuring may be using simulative method，namely send off wind to sensor using electric blower（notice can't alongside too near ），observe changing of resistance，here the resistance should be dropping.

pressure sensor part：

Connect tie-in,put Figure multimeter to volts d.c.，black meter pen connect earth，red meter pen separate connecting with 3#、4# stitch.At idle speed estate，3# stitch should has 5V consult pressure，4# stitch electric pressure is about 1.3V（concrete number is concerned with the type of the vehicle）；At empty load estate，open the throttle slowly，4# stitch electric pressure changing isn't very big；open the throttle quickly，4# stitch electric pressure may reach about 4V instant（concrete number is concerned with the type of the vehicle），then drop to about 1.5V（concrete number is concerned with the type of the vehicle）.

●Throttle position sensor

sketch and stitch(see fig.4-160,fig.4-161)

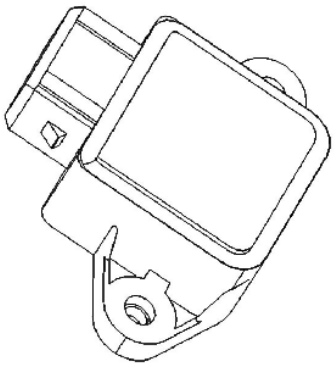


Fig.4-160 throttle position sensor

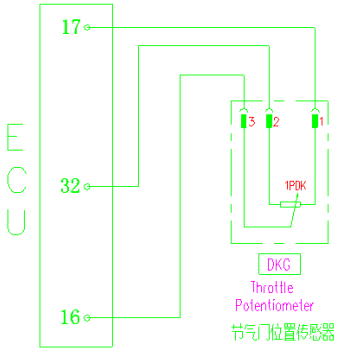


Fig.4-161 throttle position sensor circuit diagram

stitch：For the system mode of throttle opening big at turning athwart（along throttle axle see the throttle from sensor side ）：No.1 connect earth；No.2 connect 5V electrical source；No.3 output signal.

For the system mode of throttle opening big at turning arrange（along throttle axle see the throttle from sensor side ）：No.1 connect 5V electrical source；No.2 connect earth；No.3 output signal.

1)install position

Install on the throttle body.Tighten screw permissive tighten torque: 1.5N·m-2.5N·m.

2)failure phenomenon and estimating methods

·failure phenomenon：accelerate badly etc.

·Normal failure reason：artificial failure.

·Servicing notice points：notice installing position.

·Simple measuring method：（disassemble tie-in）put Figure multimeter to ohm，two meter pen separate connect sensor 1#、2# stitch，at normal temperature ,its resistance is 2kΩ±20%.two meter pen separate connect sensor 1#、3# stitch，turn the throttle ，its resistance change with throttle opening linearity，and No.2#、No.3# stitch are contrary instance.

note：When abserving resistance changing,，notice abserving resistanceif jumping is bigger.

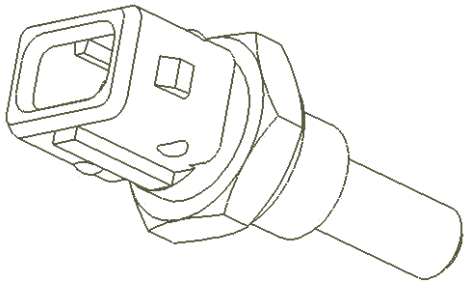
Connect tie-in,open the ignition switch ,but don't start ENG，put Figure multimeter to volts d.c.，black meter pen connect earth，red meter pen connect 2# stitch.Here it should has 5V consult preesure; it connect 3# stitch , at throttle

closed completely ,its electric pressure is about

0.3V（concrete number is concerned with the type of the vehicle）; at throttle opened completely, its electric pressure is about 3V（concrete number is concerned with the type of the vehicle）.

● Coolant temperature sensor

Sketch and stitch(see fig.4-162,fig.4-163)



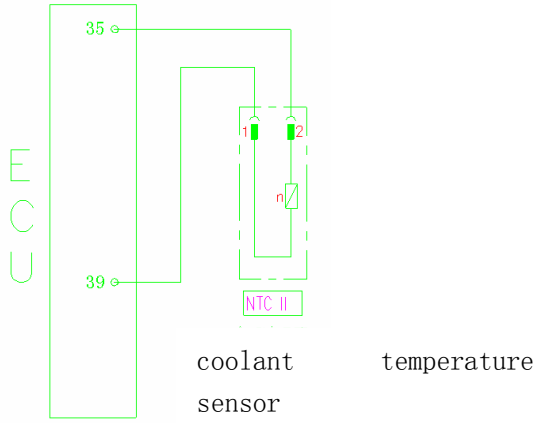


Fig.4-162 coolant temperature sensor

Fig.4-163 coolant temperature circuit diagram

stitch：This sensor has two stitches，may be using commutative.

1)install position

Install on the water outlet port of ENG..Permissive max. tighten torque is 20N•m.

2)failure phenomenon and estimating methods

·failure phenomenon：starting difficult etc.

·Normalfailure reason：artificial failure.

·Simple measuring method：

（disassemble tie-in）put Figure multimeter to ohm，two meter pen separate connect sensor 1#、2# stitch，at 20℃,rating resistance is 2.5kΩ±5%，else may measure through characteristic curve of above Fig..May use simulative method measuring，namely send working area of sensor into the boiled water（notice dipped in fully），observe sensor resistance changing，here resistance should drop to 300Ω-400Ω（idiographic numerical value decided by water temperature）.

● knock sensor

sketch and stitch(see fig.4-164,fig.4-165,fig.4-166)

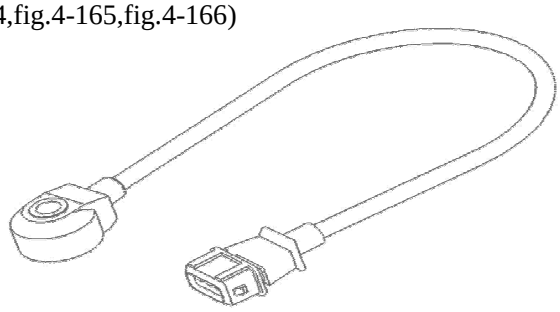
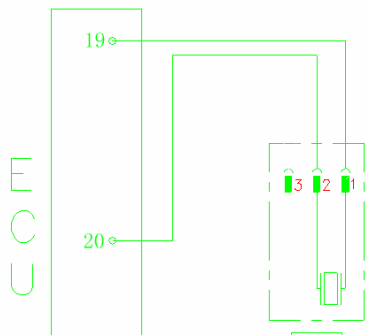
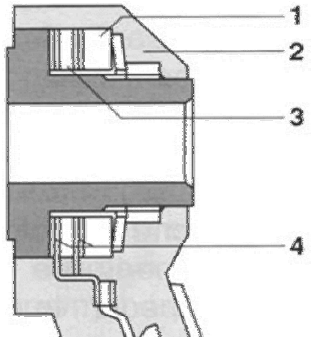


Fig.4-164 knock sensor with cable





1 shake block
2 DOS shell
3piezoelectricity pottery
4 tie-in
5 electric tie-in

Fig.4-165 knock sensor circuit diagram

Fig.4-166 knock sensor section Fig.

stitch：No.1 and No.2 connect ECU；No.3 connect screen wire.

1) install position

Installed on the position between No.2 cylinder and No.3 cylinder of ENG..

Knock sensor has a hole in its middle ， tightened on the cylinder body with a bolt of M8.Tighten torque is 20±5N•m.

2) failure phenomenon and estimating methods

·failure phenomenon：accelerate badly etc.

·Normal failure reason：all liquid as if oil、coolant、brake fluid、water etc contact the sensor long time ，the sensor will be eroded.

·Service notice points ：Sensor must be close to the cylinder with its metal face，and it is not permitted to use any kind of washer when it is installed. When the sensor's signal cable is arranged ,it should be remarked not to resonate with the signal cable，in case of breakage. It is not permitted to turn on the high voltage between the the sensor's 1# stitch and 2# stitch ，otherwise the piezoelectric element could be broken.

·Simple measuring method：

（disassemble tie-in）put Figure multimeter to ohm，two meter pen separate connect sensor 1#、2# and 1#、3# stitch，at normal temperature ,its resistance should exceed 1MΩ.Put Figure multimeter to milli-volt，use small hammer knocking lightly near the knock sensor，here should has electric pressure output.

● Oxygen sensor

Sketch and stitch(see fig.4-167,fig.4-168,fig.4-169)

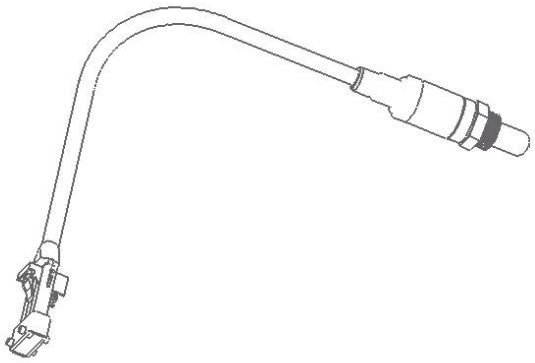
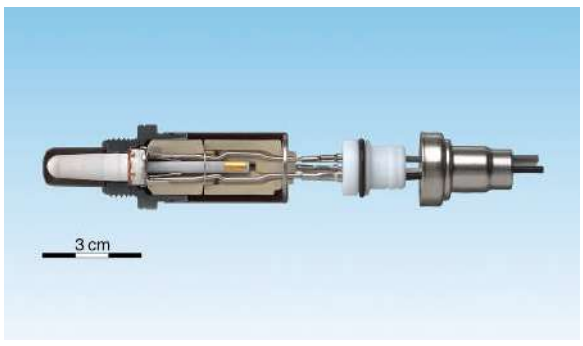


Fig.4-167 oxygen sensor Figure Fig.



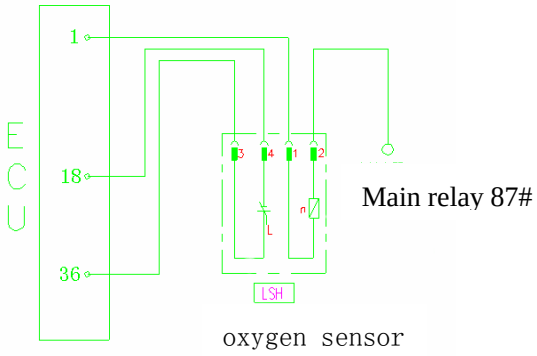


Fig.4-168 oxygen sensor Fig.4-169 oxygen circuit diagram

Oxygen sensor has a cable.Another end of cable connect a tie-in.There are 4 stitches in tie-in of oxygen sensor：

No.1 connect anode of hot electrical source（white）;

No.2 connect cathode of hot electrical source（white）;

No.3 connect cathode of signal（grey）;

No.4 connect anode of signal（black）.

1) install position

It is installed at the front end of the exhaust pipe.

NOTICE：

·NOT ALLOW USING WASH 、OIL LIQUID OR VOLATILITY SOLID ON THE PIN OF OXYGEN SENSOR.

·SCREW OF OXYGEN IS M18×1.5.

·THE HEX WRENCH SIZE OF OXYGEN SENSOR IS 22.

·TIGHTEN TORQUE OF OXYGEN SENSOR IS 40~60 N.m.

2) failure phenomenon and estimating methods

·failure phenomenon：Idle speed badly、accelerate badly、emission exceed standard、fuel cost increase etc.

·Normal failure reason：1、dank water-air come into sensor inside，the temperature change suddenly，bougie rupture；2、oxygen sensor “poisoning”.（Pb，S，Br，Si）

·Servicing notice points ：forbid using wash 、oil liquid or volatility solid on the oxygen sensor in the servicing process.

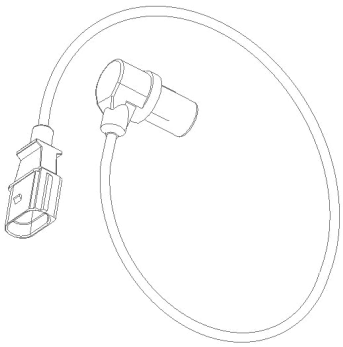
·Sketch measuring method：（disassemble tie-in）Put Figure multimeter to ohm，two meter pen separate connect sensor 1#(white)、2#(white) stitch，at normal temperature ,its resistance is 2.5～4.5Ω.

（connect tie-in）At idle speed estate ，put Figure multimeter to voltsd.d. after the working temperature of oxygen sensor reach 350℃，two meter pen separate connect sensor 3#(grey)、4#(black) stitch，here electric pressure should be moving between 0.1V and 0.9V quickly.

● Induce mode rotate speed sensor

Sketch and stitch,see Fig 4-170,fig.4-171,fig.4-172.

this system adopt the tie-in as shown Fig.4-173.



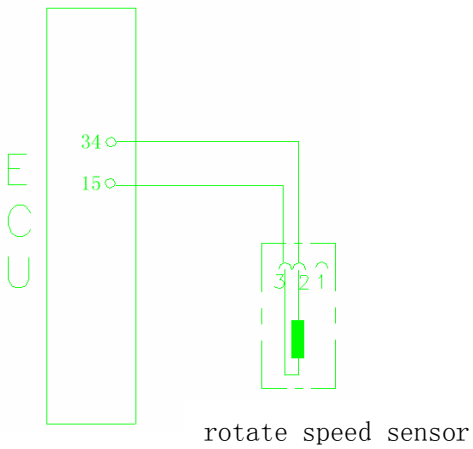


Fig. 4-170 Induce mode rotate speed sensor Fig. 4-171Induce mode rotate speed sensor circuit diagram

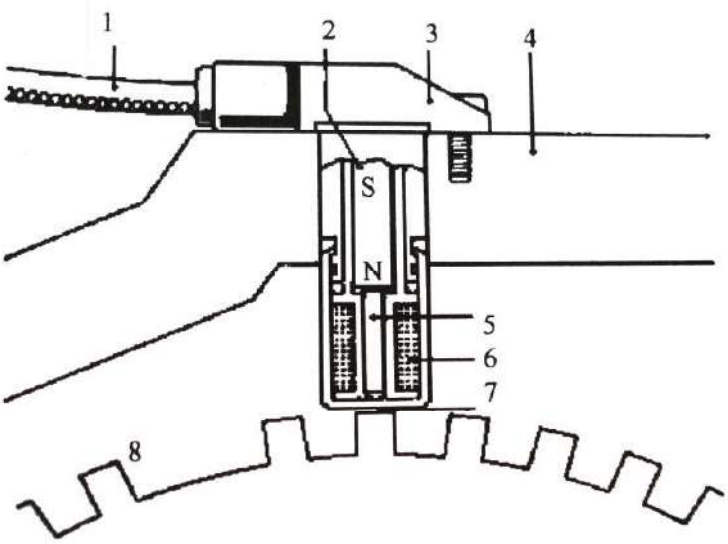


Fig.4-172

1- screen wire;2- magnet;3- crust of sensor;4-mounting bracket;5- soft core of magnet
6-coil;7- clearance of air;8- 60-2 tooth ring

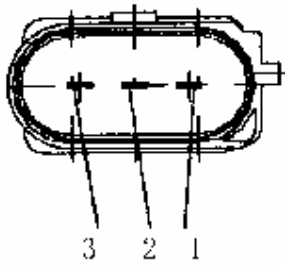


Fig.4-173

No.1 connect screen wire； No. 2 and No.3 connect signal wire.

1) Induce mode rotate speed sensor installed on the shell of the clutch

NOTICE：

·INDUCE MODE ROTATE SPEED SENSOR ONLY ALLOW TO TAKE OUT FROM WRAPPER BEFORE IT
WILL BE INSTALLED ON THE VEHICLE OR TEST SET AT ONCE.

·INSTALL INDUCE MODE ROTATE SPEED SENSOR ADOPT THE METHOD OF PRESSING INTO NOT HAMMERING.

·COMMEND FIXATION INDUCE MODE ROTATE SPEED SENSOR USE PARTIALLY TINY SEALING BOLT M6×16.

·TIGHTEN TORQUE 8±2N•M.

2) failure phenomenon and estimating methods

·failure phenomenon：can’t start etc.

·Normal failure reason：artigicial failure.

·Service notice points ： install using pressing into method and not hammering method in servicing process.

·Simple measuring method：

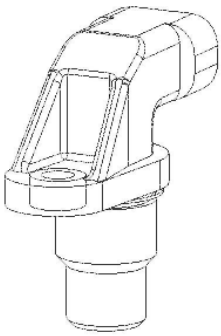
（disassemble tie-in）Put Figure multimeter to ohm，two meter pen separate connect sensor 2#、3# stitch，at 20℃ ,rating resistance is 860Ω±10%.

（connect tie-in）Put Figure multimeter to alternating current. two meter pen separate connect sensor 2#、3# stitch，start enginge, here should has output pressure. （advice using oscillograph check it,see fig.4-174）

Fig.4-174 test wave diagram

● Camshaft position sensor

Sketch and stitch, see Fig 4-175、176.



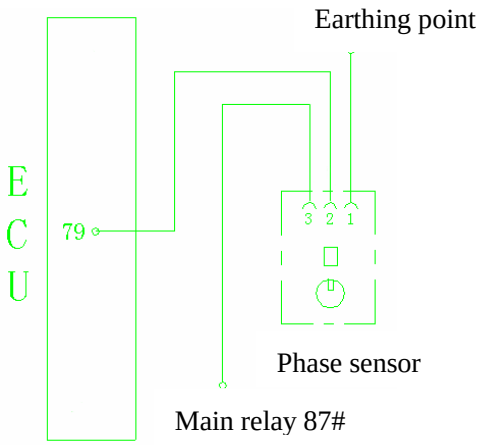


Fig. 4-175 phase sensor Fig.4-176 phase sensor circuit diagram

stitch：sign“1”show earthing；

sign“2”show signal output；

sign“3”show connecting electrical source anode.

1） install position

On the Camshaft position sensor bracket.The tighten torque of screw fixed is 7.5～8.5N·m.

2）failure phenomenon and estimating methods

·failure phenomenon：emission exceed standard，fuel consume increase etc.

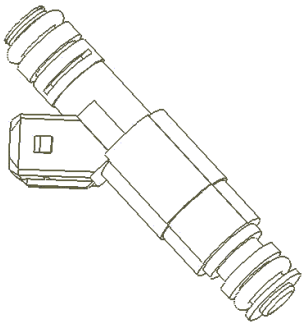
·Normal failure reason：artificial failure.

·Simple measuring method：

（connect tie-in）open ignition switch but don’t start ENG，Put Figure multimeter to ohm，two meter pen separate connect sensor 3#、1# stitch，insure consult pressure is 12V.Start ENG，here signal of 2# stitch may using oscillograph to check it.

●Electromagnetism fuel injuctor

Sketch and stitch(see fig.4-177,fig.4-178, fig.4-179,fig.4-180)



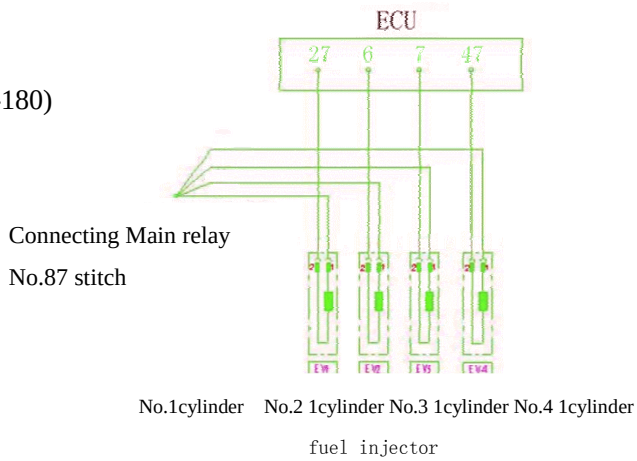
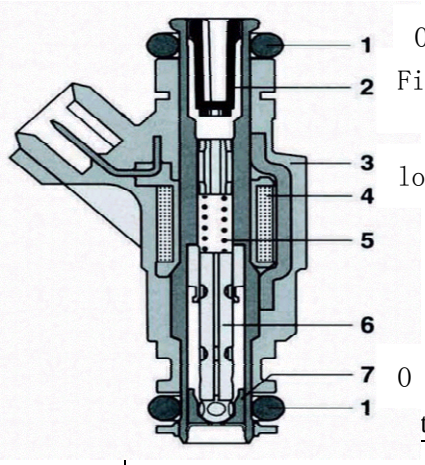


Fig .4-177 Electromagnetism fuel injuctor　　Fig.4-178　Electromagnetism fuel injuctor circuit diagram

stitch：each fuel injector has two stitches.Thereinto，that one with positive mark near the shell connecting main ralay output end is No.87 stitch；the other one separate connecting No. 27、6、7、47 stitch of ECU.

1）install position

Anear the inlet valve side of inlet manifold.



tism fuel injuctor sectional view

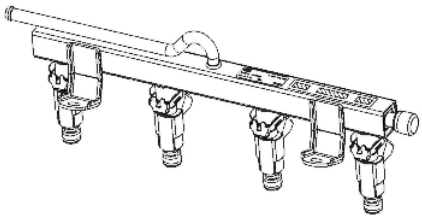


Fig 4-180 fuel injector on the fuel distribute pipe

NOTICE：

·FUEL INJECTOR ONLY CAN USE THE STATED FUEL ACCORD WITH NATIONAL STANDARD GB 17930-1999《VEHICLE LEAD-FREE GASOLINE》OF THE PEOPLE'S REPUBLIC OF CHINA AND NATIONAL CONDITION PROTECTING STANDARD GWKB 1-1999《CONTROL STANDARD FOR VEHICLE GASOLINE INJURANT》，AND REQUEST TO ADD WASH IN GASOLINE.

·NEED ESPECIALLY INDEX，IF THE TIME OF GASOLINE SAVED TOO LONG AND IT WILL BE DETEROPRATE.THE FUEL INJECTOR WILL BE DAMAGED .

·INSTALL FUEL INJECTOE WITH HAND，FORBID HAMMER FUEL INJECTOR WITH TOOLS LIKE HAMMER ETC.WHEN REMOVE AND INSTALL FUEL INJECTOR ANEW，MUST REPLACE O RING.HERE CAN’T DAMAGE SEAL SURFACE OF FUEL INJECTOR.

·BEARING WASHER OF O RING CAN’T PULL OUT FROM FUEL INJECTOR.WHEN INSTALLING IT, SHOULD ABSTAIN DAMAGE INLET FUEL END 、O RING、BEARING RING、SPRAY HOLE PLATE AND PLUG OF FUEL INJECTOR.IF THEY ARE DAMAGED ，FORBID USE THEM.

·TEST FUEL DISTRIBUTE PIPE SEALING CHARACTER AFTER FINISHING FUEL INJECTOR INSTALLING.IF WITHOUT LEAKAGE , IT IS ELIGIBILITY.

·DISASSEMBLE ABATE PART WITH HAND.AFTER DISASSEMBLE CLIP OF FUEL INJECTOR ，PULL OUT FUEL INJECTOR FROM SEAT OF FUEL INJECTOR.

AFTER DISASSEMBLE IT ,SHOULD INSURE FUEL INJECTOR SEAT IS CLEANNESS，ABSTAIN IT POLLUTED.

2）Failure phenomenon and estimate method

·Failure phenomenon：idle badness 、accelerate badness、can’t starting 、starting difficult etc.

·Normal failure reason：due to be absent for maintain，lead to appear colloid cumulus and abate in fuel injector inside.

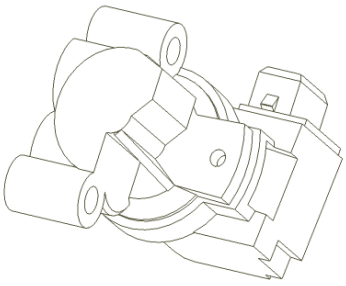
·Serviving notice points：（see installing notice points）

·Simple measuring method:（Disassemble tie-in）Put the Figure multimeter to ohm，two meter pen separate connecte two stitch of fuel injector，at 20℃, rating resistance is 11-13Ω.

suggestion：use fuel injectors cleanout analyser to Clean and analyse the fuel injectors regular.

●Idle executor stepper motor

Sketch and stitch(see fig.4-181,fig.4-182)



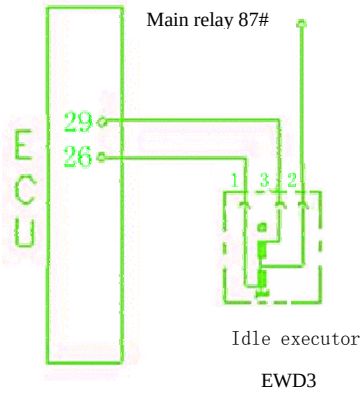


Fig.4-181 idle executor with stepper motor Fig.4-182 idle executor with stepper motor circuit diagram

stitch：No.1 connecting ECU No.26 stitch；

No.2 connecting electrical source anode；

No.3 connecting ECU No.29 stitch.

1）Install position

on the throttle body.

Notice：

·When the tighten bolt is installed, don't use washer； forbid smearing lipin or lube on bolt andnut's worm when installed.

·tighten bolt tighten torque：

The first step 2±1Nm；the second step 7±1Nm（if the two bolts screw down at the same time，it dosen't need the first step）

·Dust and sand will lead to EWD3's breakage.Air inhaled should go through the air filter before go into the EWD3.Air filter's efficiency should exceed 99%.It must assure that there is no dirt going into the air pipeline at replacing the air filter.

2）Failure electrophoresis and estimate method

·failure electrophoresis：idle too high、idle flameout etc.

·Normal failure reason： Adjuster element is locked because of severe pollution inside ,which will lead to invalidation.（there is a lack of maintain）

Air filter filtrating，Air filter's efficiency should exceed 99%.It must assure that there is no dirt going into the air pipeline at replacing the air filter，and can't use bad air filter.

·Simple measuring method：（Disassemble tie-in）hold Figure multimeter move with hand to ohm，two meter pen difference connecting with two stitch of adjuster 1# and 2#、2# and 3#，at 20℃, rated resistance is about 17.6/15.5Ω.
·Simple measuring method：（disassemble tie-in）put Figure multimeter to ohm position，two meter pens separate connecting No.1、No.2 and No.2、No.3 stitch of adjuster，at 20℃ rating resistance is about 17.6/15.5Ω.

●canister control valve
sketch and stitch(see fig.4-183,fig.4-184)

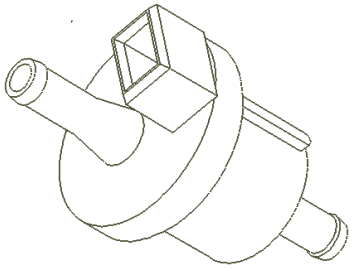


Fig.4-183 canister control valve TEV-2

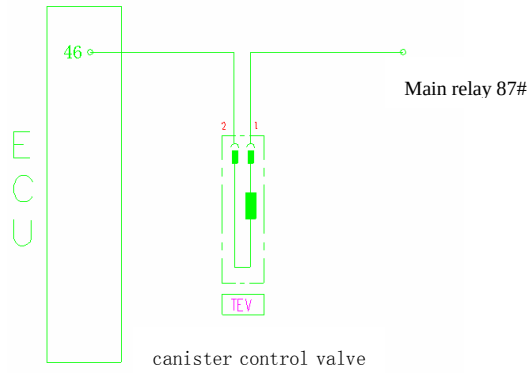


Fig.4-184 canister control TEV-2 canister control valve circuit diagram

stitch：canister control valve only has two stitchs，one connecte mainrelay fan-out No.84 stitch，other connecte No.46 stitch of ECU.
1）Install position
canister-vacuum tube line of intake manifold.
2）failure electrophoresis and estimate method
·Failure eletrophoresis：function abate etc.
·Ecumenic failure position：Due to eyewinker come into valve inside，lead to rust and leakage etc.
·Servicing notice eletrophoresis：①Air current must accord with provision when valve body is installed；②When control valve abate is found and the reason of the abate is black grain of valve body inside，control valve must be replaced ,at the same time should check canister；③Abstain water、oil etc come into valve in servicing process；④commend installing canister control valve to hose hang in the air for abstain voice of solid impressing.
·simple measuring method：
（disassembly tie-in）hold Figure multimeter move with hand to ohm，two meter pen difference connecting with two stitch of canister control valve ，at 20℃, rated resistance is 26±4 Ω.

●Steeliness fuel distribute pipe assy.
sketch(see fig.4-185)

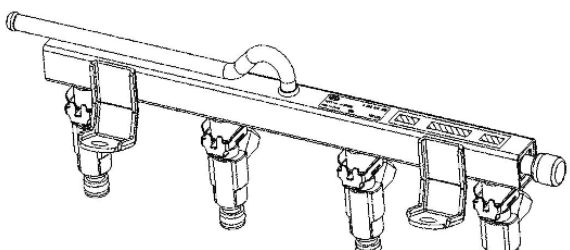


Fig.4-185 fuel distribute pipe assy.

1）Install position

on the engine intake manifold.

NOTICE：

·BEFORE INSTALL FUEL DISTRIBUTE PIPE ASSY. ，LUBRICATE O RING UNDER FUEL INJECTOR USING CLEANLY OIL.

2）Failure eletrophoresis and estimate method

Leak test of fuel distribute pipe may be test throuph pressure dropping method：testing throuph test o ring of fuel distribute pipe ，at 4.5bar，measure leakage limit≤1.5cm^3/min.

5. M7.9.7 system diagnose process according to failure electrophoresis repairing

Before begin failure diagnosis according to the failure electrophoresis，should ：

·first begin abecedarian checking：

（1） Affirm ENG diagnosis pilot lamp that working in gear；

（2）using diagnostic instrument checking，affirm hasn't failure information note；

（3）Affirm failure electrophoresis exist，find the condition of producing the failure .

·then check appearance：

（1） Check fuel pipe line leakage；

（2） Check vacuum tube line if rupture、knot，connecting if right；

（3） Check intake pipe line if jam、leakage、staved or damage；

（4） Check high tension cable of ignition system if rupture、aging，ignition order if right；

（5） Check wires earthing position if cleanlily、substance；

（6） Check each sensor、executant tie-in if become flexible or contact ill instance.

NOTICE：

IF ABOVE ELECTROPHORESIS EXIST，FOLLOW FIRST AIM AT THIS FAILURE ELECTROPHORESIS REPAIRING ，OTHERWISE WILL AFFECT DIAGNOSING AND REPAIRING WORKS BEHIND.

Repair assistance

1. Be sure there is not any fault code in ECU memory;
2. Be sure the malfunction really exist;
3. Be sure already finish the typical repair process and there is not any malfunction being found out;
4. Do not ignore the influence of cylinder pressure, ignition timing, fuel quality, fuel pressure and so on;
5. Replace ECU and test.

Here ,if failure can be eliminated，follow the failure position is in the ECU. Here if the failure all the same exist，follow replace back inhere ECU，repeat above process，check again.

●Phenomena of typical Malfunction ：

1） Engine can not rotate at starting.

·Ecumenic failure position：（1）Battery；（2）Starter；（3）Wires or ignition switch；（4）Engine machine parts.

·General Repair Process：（see Table 4-69）

Table 4-69

NO.	Repair Process	Result	Follow Process

1	Check the battery at engine starting, if the voltage in range 8V-12V.	Yes	Next
		No	Change battery
2	Keep the key at “start”, check positive pole of the starter, if the voltage in range 8V-12V.	Yes	Next
		No	Repair or replace wiring harness
3	Demount and check the starter, if some malfunction (such as open circuit with the winding and so on) exist.	Yes	Repair or replace starter
		No	Next
4	If the malfunction only take place at winter, check the engine oil first, if the engine oil suiTable.	Yes	Replace suiTable engine oil
		No	Next
5	Check mechanical parts of the engine, if the resistance torque too much.	Yes	Check engine internal resistance
		No	Repeat process above

2） Engine can rotate but can not start at starting.

·Ecumenic failure position：（1）Fuel tank without fuel；（2）Fuel pump；（3）Rotate speed sensor；）（4）Ignition coil；（5）Engine machine parts**.**

·General Repair Process：（see Table 4-70）

Table 4-70

NO.	Repair Process	Result	Follow Process
1	Install fuel piezometer（the connecting point is the fuel inlet front port of fuel distribute pipe assy）, starting engine, check the fuel pressure, if the pressure is about 350kPa.	Yes	Next
		No	Repair fuel supply system
2	Connect the tester, check the engine speed on the tester screen, if the engine speed nomal at starting.	Yes	Next
		No	Check engine speed sensor
3	Demount all fuel injectors connector, demount the ignition wire of cylinder 1, connect another spark plug and keep the negative pole of the spark plug near the cylinder head, starting engine, if strong spark exist.	Yes	Next
		No	Repair ignition system
4	Check pressure of each cylinder, if the pressure too low.	Yes	Check mechanical part of engine
		No	Next
5	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Goto **repair assistance**
		No	Check wiring harness accordingly

3） Engine can start but difficultly only at warm start.

·Ecumenic failure position：（1）Include water in fuel ；（2）Fuel pump；（3）Coolant temperature sensor；（4）Vacuum tube of fuel pressure adjuster；（5）Ignition coil.

·General Repair Process：（see Table 4-71）

Table 4-71

NO.	Repair Process	Result	Follow Process
1	Install fuel piezometer（the connecting point is the fuel inlet front port of fuel distribute pipe assy）, starting engine, check fuel pressure at engine idling, if the pressure is about 350kpa.	Yes	Next
		No	Repair fuel supply system
2	Demount all fuel injectors connector, demount the ignition wire of cylinder 1, connect another spark plug and keep the negative pole of the spark plug near the cylinder head, starting engine, if strong spark exist.	Yes	Next
		No	Repair ignition system
3	Demount coolant temperature sensor connector, starting engine, if the engine start easily.（otherwise there is a series-wound 300Ω instead of the coolant temperature sensor at the coolant temperature sensor connector, and see whether the engine can start successfully ）	Yes	Check coolant temp. sensor
		No	Next
4	Check vacuum tube connect with fuel pressure regulator, if the tube loose or leakage.	Yes	Repair or replace tube
		No	Next
5	Check the fuel quality, if the malfunction only take place after fuel change.	Yes	Replace fuel
		No	Next
6	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Goto **repair assistance**
		No	Check wiring harness accordingly

4） Engine can start but difficultly only at cold start.

·Ecumenic failure position：（1）Include water in fuel ；（2）Fuel pump；（3）Coolant temperature sensor；（4）Fuel injectors； （5）Ignition coil； （6）Throttle body and idle other gas path ；（7）Engine machine parts**.**

·General Repair Process：（see Table 4-72）

Table 4-72

NO.	Repair Process	Result	Follow Process
1	Install fuel piezometer, starting engine, check fuel pressure at engine idling, if the pressure is about 350kPa.	Yes	Next
		No	Repair fuel supply system
2	Demount all fuel injectors connector, demount the ignition wire of cylinder 1, connect another spark plug and keep the negative pole of the spark plug near the cylinder head, starting engine, if strong spark exist.	Yes	Next
		No	Repair ignition system
3	Demount coolant temperature sensor connector, starting engine, if the engine start easily. （otherwise there is a series-wound 2500Ω instead of the coolant temperature sensor at the coolant temperature sensor connector, and see whether the engine can start successfully.）	Yes	Check coolant temp. sensor
		No	Next

4	Press accelerator pedal light, starting engine, if the engine start easily.	Yes	Clean throttle valve body and air bypass
		No	Next
5	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Repair or replace fuel injector
		No	Next
6	Check the fuel quality, if the malfunction only take place after fuel change.	Yes	Replace fuel
		No	Next
7	Check pressure of each cylinder, if the pressure too low.	Yes	Check mechanical part of engine
		No	Next
8	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Goto **repair assistance**
		No	Check wiring harness accordingly

5） Engine rotate normal but start difficultly at anytime.

·Ecumenic failure position：（1）Include water in fuel ；（2）Fuel pump；（3）Coolant temperature sensor；（4）Fuel injectors； （5）Ignition coil； （6）Throttle body and idle other gas path ；（7）Air intake path；（8）Ignition timing；（9）Spark plug；（10）Engine machine parts.

·General Repair Process：（see Table 4-73）

Table 4-73

NO.	Repair Process	Result	Follow Process
1	Check the air filter and manifold, if block or leakage.	Yes	Check air supply system
		No	Next
2	Install fuel piezometer, starting engine, check fuel pressure at engine idling, if the pressure is about 350kPa.	Yes	Next
		No	Repair fuel supply system
3	Demount all fuel injectors connector, demount the ignition wire of cylinder 1, connect another spark plug and keep the negative pole of the spark plug near the cylinder head, starting engine, if strong spark exist.	Yes	Next
		No	Repair ignition system
4	Check all the spark plugs, if the type and clearance suiTable.	Yes	Next
		No	Replace spark plug
5	Demount coolant temperature sensor connector, starting engine, if the engine start easily.	Yes	Check coolant temp. sensor
		No	Next
6	Press accelerator pedal light, starting engine, if the engine start easily.	Yes	Clean throttle valve body and air bypass
		No	Next
7	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Repair or replace fuel injector
		No	Next
8	Check the fuel quality, if the malfunction only take place after	Yes	Replace fuel

	fuel change.	No	Next
9	Check pressure of each cylinder, if the pressure too low	Yes	Check mechanical part of engine
		No	Next
10	Check the firing order and ignition timing, if suiTable.	Yes	Next
		No	Check ignition timing
11	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to repair assistance
		No	Check wiring harness accordingly

6） Engine can start normally, but idle speed is unsTable at anytime.

·Ecumenical failure position：（1）Include water in fuel ；（2）Fuel injectors；（3）Spark plug；（4）Throttle body and idle other gas path ；（5）Air intake path；（6）Idle speed adjuster；（7）Ignition timing；（8）Engine machine parts.

·General Repair Process：（see Table 4-74）

Table 4-74

NO.	Repair Process	Result	Follow Process
1	Check the air filter and manifold, if block or leakage.	Yes	Check air supply system
		No	Next
2	Check idle speed actuator, if block and carbon accumulate.	Yes	Replace idle speed actuator
		No	Next
3	Check all the spark plugs, if the type and clearance suiTable.	Yes	Next
		No	Replace spark plug
4	Check throttle valve body and air bypass, if carbon accumulate.	Yes	Clean throttle valve body and air bypass
		No	Next
5	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Next Repair or replace fuel injector
		No	Next
6	Check the fuel quality, if the malfunction only take place after fuel change.	Yes	Replace fuel
		No	Next
7	Check pressure of each cylinder, if the pressure is much different from each other.	Yes	Check mechanical part of engine
		No	Next
8	Check the firing order and ignition timing, if suiTable.	Yes	Next
		No	Check ignition timing
9	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to repair assistance
		No	Check wiring harness accordingly

7）Engine can start normally, but idle speed is unsTable at warming.

·Ecumenical failure position：（1）Include water in fuel ；（2）Coolant temperature sensor；（3）Spark plug；（4）Throttle body and idle other gas path ；（5）Air intake path；（6）Idle speed adjuster；（7）Engine machine parts.
·General Repair Process：（see Table 4-75）

Table 4-75

NO.	Repair Process	Result	Follow Process
1	Check the air filter and manifold, if block or leakage.	Yes	Check air supply system
		No	Next
2	Check all the spark plugs, if the type and clearance suiTable.	Yes	Next
		No	Replace spark plug
3	Check throttle valve body and air bypass, if carbon accumulate.	Yes	Clean throttle valve body and air bypass
		No	Next
4	Demount coolant temperature sensor connector, starting engine, if the idle speed is unsTable at warming.	Yes	Check coolant temp. sensor
		No	Next
5	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Repair or replace fuel injector
		No	Next
6	Check the fuel quality, if the malfunction only take place after fuel change.	Yes	Replace fuel
		No	Next
7	Check pressure of each cylinder, if the pressure is much different from each other.	Yes	Check mechanical part of engine
		No	Next
8	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to repair assistance
		No	Check wiring harness accordingly

8） Engine can start normally, but idle speed is unsTable at end of warming.
·Ecumenic failure position：（1）Include water in fuel ；（2）Coolant temperature sensor；（3）Spark plug；（4）Throttle body and idle other gas path ；（5）Air intake path；（6）Idle speed adjuster；（7）Engine machine parts.
·General Repair Process：（see Table 4-76）

Table 4-76

NO.	Repair Process	Result	Follow Process
1	Check the air filter and manifold, if block or leakage.	Yes	Check air supply system
		No	Next
2	Check all the spark plugs, if the type and clearance suiTable.	Yes	Next
		No	Replace spark plug
3	Check throttle valve body and air bypass, if carbon accumulate.	Yes	Clean throttle valve body and air bypass
		No	Next
4	Demount coolant temperature sensor connector, starting engine, if the idle speed is unsTable at warming.	Yes	Check coolant temp. sensor

		No	Next
5	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Repair or replace fuel injector
		No	Next
6	Check the fuel quality, if the malfunction only take place after fuel change.	Yes	Replace fuel
		No	Next
7	Check pressure of each cylinder, if the pressure is much different from each other.	Yes	Check mechanical part of engine
		No	Next
8	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to repair assistance
		No	Check wiring harness accordingly

9） engine can start normally, but idle speed is unsTable or engine stall at A/C compressor is switched.

·Ecumenical failure position：(1)A/C system；(2)Idle speed adjuster；(3)Fuel injectors.

General Repair Process：（see Table 4-77）

Table 4-77

NO.	Repair Process	Result	Follow Process
1	Check throttle valve body and air bypass, if carbon accumulate.	Yes	Clean throttle valve body and air bypass
		No	Next
2	Connect the tester, check the engine speed on the tester screen, if engine speed increase before A/C compressor is switched.	Yes	Go to step 4
		No	Next
3	Connect pin adapter, demount pin 75, check voltage of the wiring harness, if the signal voltage is HI at A/C switch ON.	Yes	Next
		No	Repair A/C system
4	Check A/C system pressure, A/C compressor, if in good condition.	Yes	Next
		No	Repair A/C system
5	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Repair or replace fuel injector
		No	Next
6	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to **repair assistance**
		No	Check wiring harness accordingly

10) Engine can start normally, but idle speed is too high.

·Ecumenic failure position：(1)Throttle body and idle other gas path ；(2)Vacuum tube；(3)Idle speed adjuster；(4)Coolant temperature sensor；(5)Ignition timing.

·General Repair Process：（see Table 4-78）

Table 4-78

NO.	Repair Process	Result	Follow Process

1	Check accelerator pedal wire, if block or too tight.	Yes	Repair accordingly
		No	Next
2	Check the air filter and manifold, if block or leakage.	Yes	Check air supply system
		No	Next
3	Check throttle valve body and air bypass, if carbon accumulate.	Yes	Clean throttle valve body and air bypass
		No	Next
4	Demount coolant temperature sensor connector, starting engine, if the idle speed is too high.	Yes	Check coolant temp. sensor
		No	Next
5	Check the firing order and ignition timing, if suiTable.	Yes	Next
		No	Repair accordingly
6	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to repair assistance
		No	Check wiring harness accordingly

11) Engine speed can not increase accordingly when press accelerator pedal.

·Ecumenical failure position：(1)Include water in fuel ；(2)Air intake pressure sensor and throttle position sensor；(3)Spark plug；(4)Throttle body and idle other gas path ；(5)Air intake path；(6)Idle speed adjuster；(7)Fuel injectors；(8)Ignition timing；(9)Exhaust pipe.

·General Repair Process：（see Table 4-79）

Table 4-79

NO.	Repair Process	Result	Follow Process
1	Check the air filter and manifold, if block or leakage.	Yes	Check air supply system
		No	Next
2	Install fuel piezometer, starting engine, check fuel pressure at press accelerator pedal, if the pressure is about 350kPa.	Yes	Next
		No	Repair fuel supply system
3	Check all the spark plugs, if the type and clearance suiTable.	Yes	Next
		No	Replace spark plug
4	Check throttle valve body and air bypass, if carbon accumulate.	Yes	Clean throttle valve body and air bypass
		No	Next
5	Check manifold pressure sensor and throttle valve position sensor, if in good condition.	Yes	Next
		No	Repair or replace sensor
6	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Repair or replace fuel injector
		No	Next
7	Check the fuel quality, if the malfunction only take place after fuel change.	Yes	Replace fuel
		No	Next
8	Check the firing order and ignition timing, if suiTable.	Yes	Next
		No	Repair accordingly
9	Check exhaust pipe, if in good condition.	Yes	Next
		No	Repair or replace sensor

10	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to repair assistance
		No	Check wiring harness accordingly

12） Engine speed increase slowly when press accelerator pedal.

·Ecumenical failure position：（1）Include water in fuel ；（2）Air intake pressure sensor and throttle position sensor；（3）Spark plug；（4）Throttle body and idle other gas path ；（5）Air intake path；（6）Idle speed adjuster；（7）Fuel injectors；（8）Ignition timing；（9）Exhaust pipe.

·General Repair Process：（see Table 4-80）

Table 4-80

NO.	Repair Process	Result	Follow Process
1	Check the air filter and manifold, if block or leakage.	Yes	Check air supply system
		No	Next
2	Install fuel piezometer, starting engine, check fuel pressure at press accelerator pedal, if the pressure is about 350kPa.	Yes	Next
		No	Repair fuel supply system
3	Check all the spark plugs, if the type and clearance suiTable.	Yes	Next
		No	Replace spark plug
4	Check throttle valve body and air bypass, if carbon accumulate.	Yes	Clean throttle valve body and air bypass
		No	Next
5	Check manifold pressure sensor and throttle valve position sensor, if in good condition.	Yes	Next
		No	Repair or replace sensor
6	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Repair or replace fuel injector
		No	Next
7	Check the fuel quality, if the malfunction only take place after fuel change.	Yes	Replace fuel
		No	Next
8	Check the firing order and ignition timing, if suiTable.	Yes	Next
		No	Check ignition timing
9	Check exhaust pipe, if in good condition.	Yes	Next
		No	Repair or replace exhaust pipe
10	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to repair assistance
		No	Check wiring harness accordingly

13）Engine is disability and capability is bad when press accelerator pedal.

·Ecumenical failure position：（1）Include water in fuel ；（2）Air intake pressure sensor and throttle position sensor；（3）Spark plug；（4）Ignition coil；（5）Throttle body and idle other gas path ； （6）Air intake path； （7）Idle speed adjuster；（8）Fuel injectors； （9）Ignition timing；（10）Exhaust pipe.

·General Repair Process：（see Table 4-81）

Table 4-81

NO.	Repair Process	Result	Follow Process
1	Check the clutch if skid ; tyre pressure if lower and size if right ; brake if lock; four-wheels orientation if right etc.	Yes	Check it
		No	Next
2	Check the air filter and manifold, if block or leakage.	Yes	Repair air supply system
		No	Next
3	Install fuel piezometer, starting engine, check fuel pressure at press accelerator pedal, if the pressure in range is about 350kPa..	Yes	Next
		No	Repair fuel supply system
4	Demount all fuel injectors connector, demount the ignition wire of cylinder 1, connect another spark plug and keep the negative pole of the spark plug near the cylinder head, starting engine, if strong spark exist.	Yes	Next
		No	Repair ignition system
5	Check all the spark plugs, if the type and clearance suiTable.	Yes	Next
		No	Replace spark plug
6	Check throttle valve body and air bypass, if carbon accumulate.	Yes	Clean throttle valve body and air bypass
		No	Next
7	Check manifold pressure sensor and throttle valve position sensor, if in good condition.	Yes	Next
		No	Repair or replace sensor
8	Demount all fuel injectors, check the fuel injectors by special fuel injector clean and analyse equipment, if all fuel injectors in good condition.	Yes	Repair or replace fuel injector
		No	Next
9	Check the fuel quality, if the malfunction only take place after fuel change.	Yes	Replace fuel
		No	Next
10	Check the firing order and ignition timing, if suiTable.	Yes	Next
		No	Repair ignition system
11	Check exhaust pipe, if in good condition.	Yes	Next
		No	Repair or replace exhaust pipe
12	Connect pin adapter, key on, check power supply (pin12, 13, 44, 45, 63) and earth connect (pin3, 51, 53, 61, 80) of the ECU, if in good condition.	Yes	Go to repair assistance
		No	Check wiring harness accordingly

5 Engine Lubrication

5.1 Service Specification

Table 5-1

Items		Standard value
Oil pressure kPa	at idle	Over 29
	3500r/min	294～686

5.2 Engine Oil

Table 5-2

items	Specified oil	Quantity (L)
Engine oil	China southward、China northward in summer: SAE15W-40; China northward in winter (from November to the next March)SAE5W-30。Grade: SG or the upon.	Total 3.3
		Oil filter 0.3

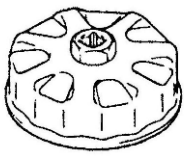
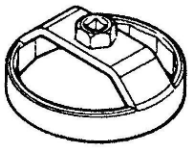
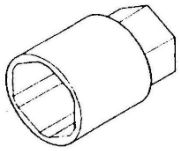
5.3 Sealant

Table 5-3

Items	Specified sealant
Oil pressure switch	damp-dry sealant: three-cement 1215 (MZ100077) ,three- bond 1141E

5.4 Specified Tools

Table 5-4

Tool	Number	Name	Use
	MB991396	Oil filter wrench	Removal and installation of engine oil filter (numbe : MD135737)
	MB991610	Oil filter wrench	Removal and installation of engine il filter (number : MD136466)
	MD998054	Oil pressure switch wrench	Removal and installation of oil pressure switch

5.5 On-Vehicle Service

1.ENGINE OIL CHECK

(1) Pull out the level gauge slowly and check that the oil level is in the illustrated range. Check that the oil is not excessively dirty, that there is no coolant or petrol mixed in, and that it has sufficient viscosity. (See Fig 5-1)

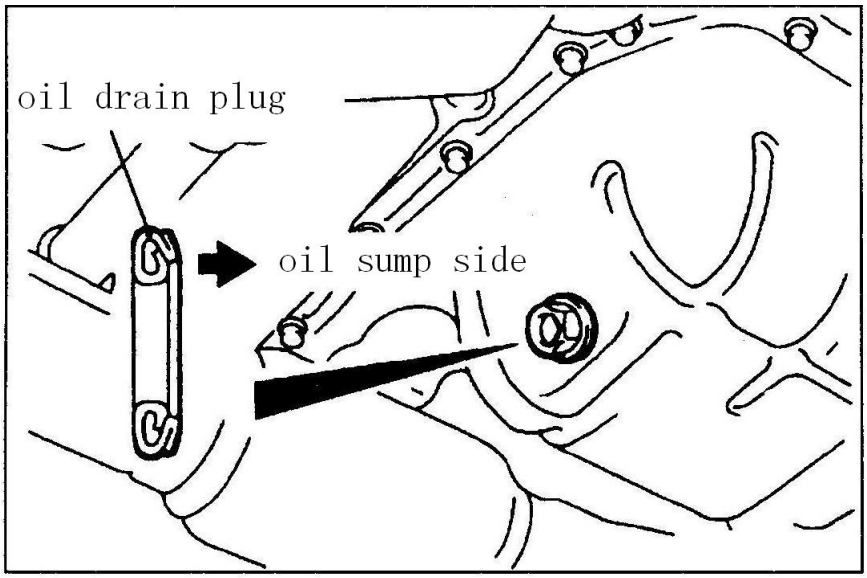


Fig 5-1

2. ENGINE OIL REPLACEMENT

(1) After the engine being warm up, stop it and remove the engine oil filter cap.

(2) Remove the drain plug to drain oil.

(3) Install a new drain plug gasket so that it faces in the direction shown in the illustration, and then tighten the drain plug to the specified torque.

Tightening torque: 39±5N·m

(4) Refill with specified quantity of oil.

(5) Install the engine oil filter cap.

(6) Start the engine and run for several minutes.

(7) Stop the engine, and confirm the oil quantity with oil gauge after several minutes.

3. OIL FILTER REPLACEMENT (See Fig 5-2、See Fig 5-3)

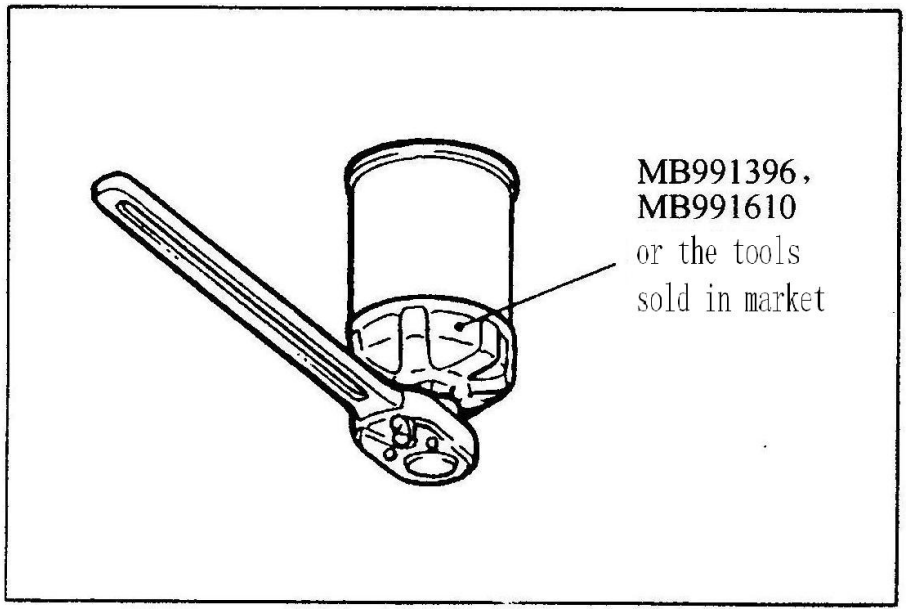


Fig 5-2

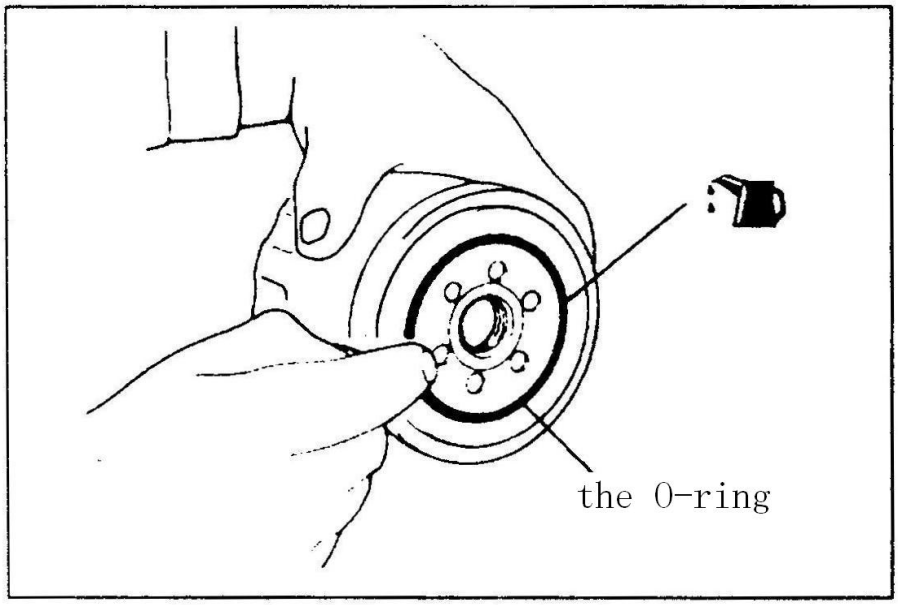


Fig 5-3

(1) After the engine being warm up, stop it and remove the engine oil filter cap.

(2) Remove the drain plug to drain oil.

(3) Remove the engine oil filter by using special tools.

(4) Clean the filter bracket side mounting surface.

(5) Apply a small amount of engine oil to the O-ring of the new oil filter.

(6) Once the O-ring of the oil filter is touching the flange, use the respective tool in the following Table to tighten to the specified torque.

(7) Install the drain plug and refill the engine oil.

(8) Race the engine 2-3 times, and check to be sure that no engine oil leaks from installation section of the oil filter.

Table 5-5

Number	Tool	Tightening torque
MD135737	MB991396 or equivalent	About one circle (14±2N・m)
MD136466	MB991610 or equivalent	About 3/4 circle (16±4N・m)
MD332687	Sale on market	

4. OIL PRESSURE CHECK

(1) Check engine oil quantity.

(2) Remove the oil pressure switch terminal (See Fig 5-4)

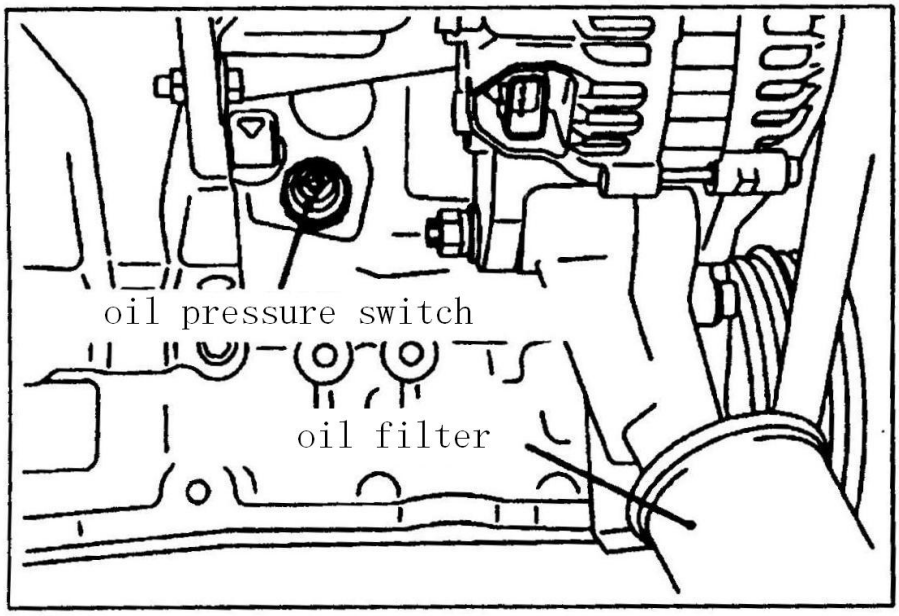


Fig 5-4

Caution Since sealant is applied to the thread of oil pressure switch, take care not to damage the oil pressure switch when removing it.

(3) Install the oil pressure gauge.

Use a adapter of PT1/8.

(4) Run the engine to warm it.

(5) After the engine has been warmed up, check that oil pressure is within the standard value.

Standard value:

At idle:29kpa or more

At 3500r/min:294～686kPa

(6) Remove the oil pressure gauge. (See Fig 5-5)。

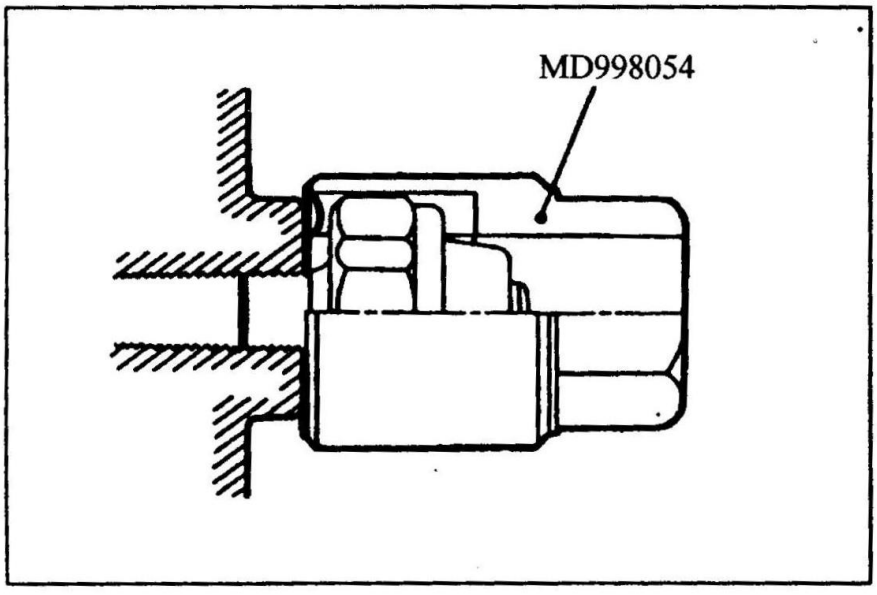


Fig 5-5

(7) Apply the specified sealant to the thread of oil pressure switch (See Fig 5-6) .

damp-dry sealant: three-cement 1215 or the equivalent.

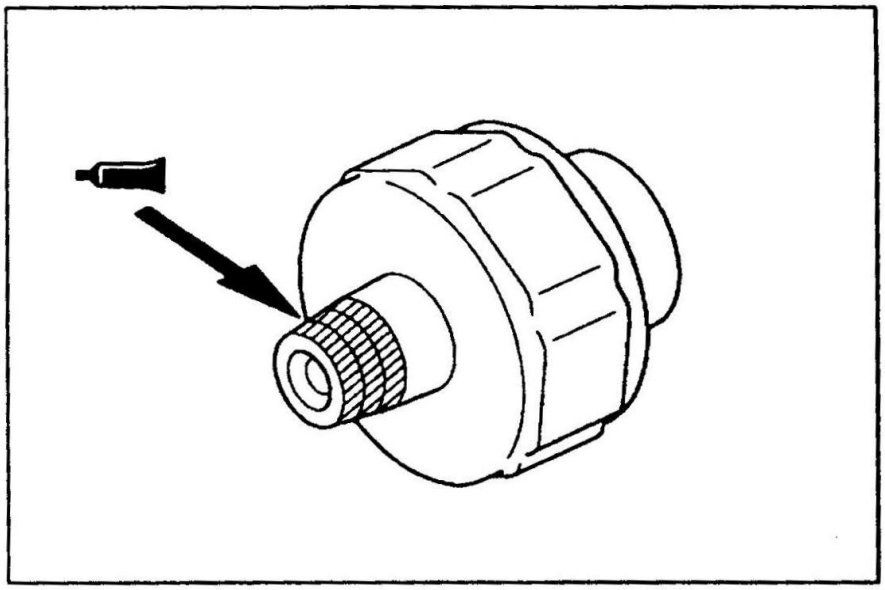


图 5-6

(8)Use the specified tool to tighten the oil pressure switch to the specified torque.(See Fig 5-7)。

Caution Do not start the engine within one hour after the oil pressure switch has been installed.

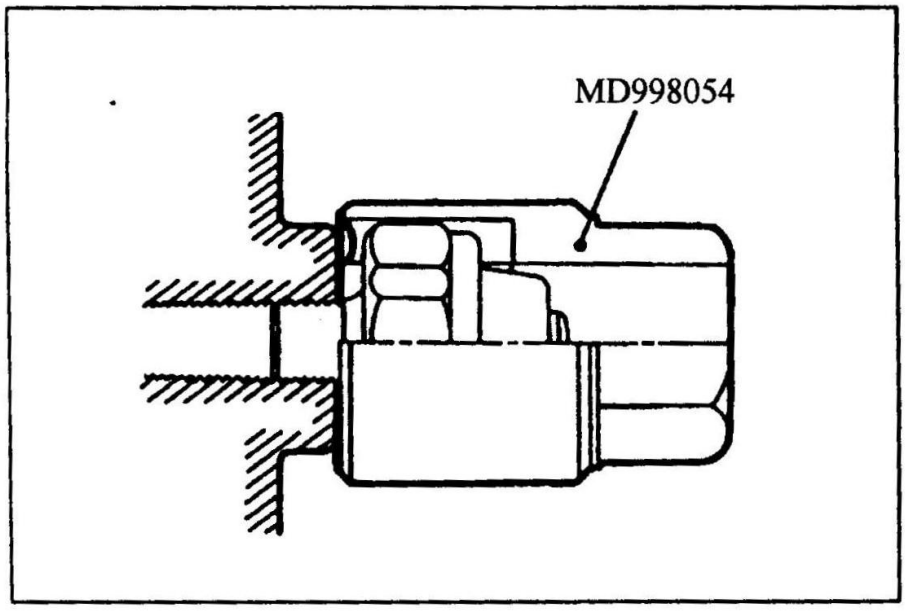


Fig 5-7

6 Fuel

6.1 Fuel Tank

1. REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining Fuel
- Prevent fuel from leaking
- Center Exhaust Pipe Removal

Post-installation Operation
- Refilling Fuel
- Checking for Fuel Leaks
- Center Exhaust Pipe Installation

1) Removal steps (see Fig.6-1)

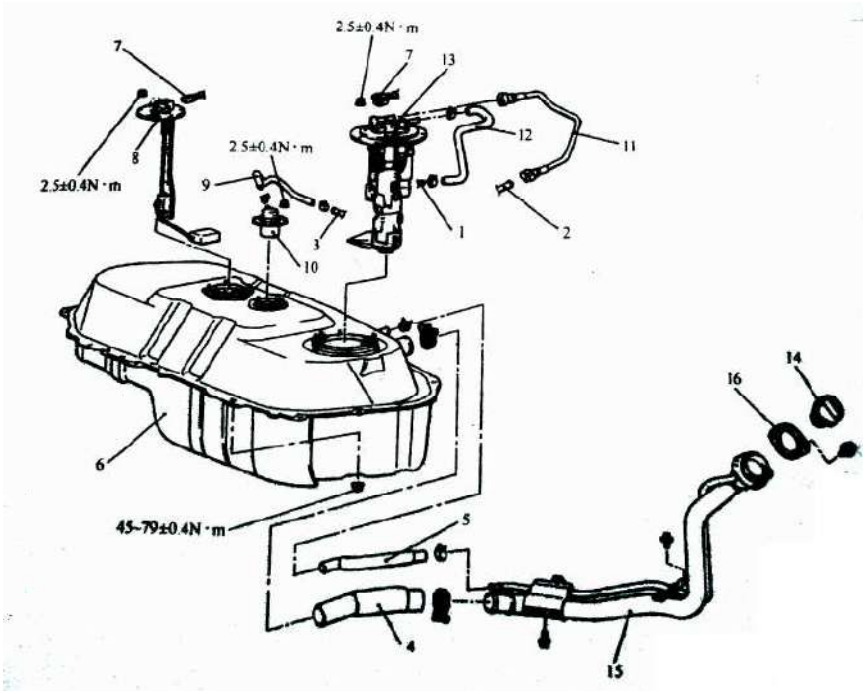


Fig.6-1

1)return hose connection
2)fuel hose connection
3)vapor hose connection
4)filler hose
5)filler ventilation hose
6)Fuel tank
7)harness pin
8)fuel sensor
9)Vapor hose
10)Fuel cut off valve

11)high-pressure hose

12)fuel pump hose

13)Fuel pump

14)filler cap

15)filler cap assembly

16) gasket

(2) INSTALLATION SERVICE POINT

1) FUEL PUMP INSTALLATION (see Fig.6-2)

Align nick on fuel pump and fuel tank.

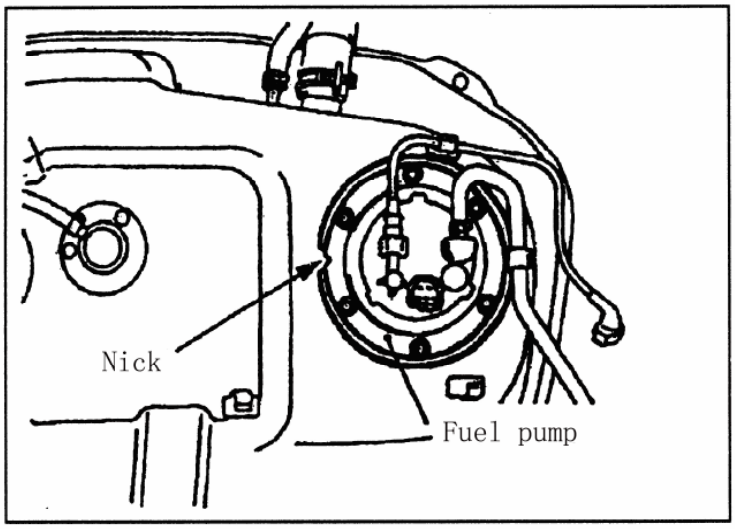


Fig.6-2

2) HIGH-PRESSURE FUEL HOSE AND FUEL PIPE INSTALLATION

Caution Snap the high-pressure fuel hose and fuel pipe one-touch joint into place, then pull back slightly on the hose to assure it is securely fitted. However, the connection should have a play of approx. 3 mm.

2. CHECK

(1) FUEL QUANTITY SENSOR AND FUEL PUMNP REPLACEMENT(see Fig.6-3)

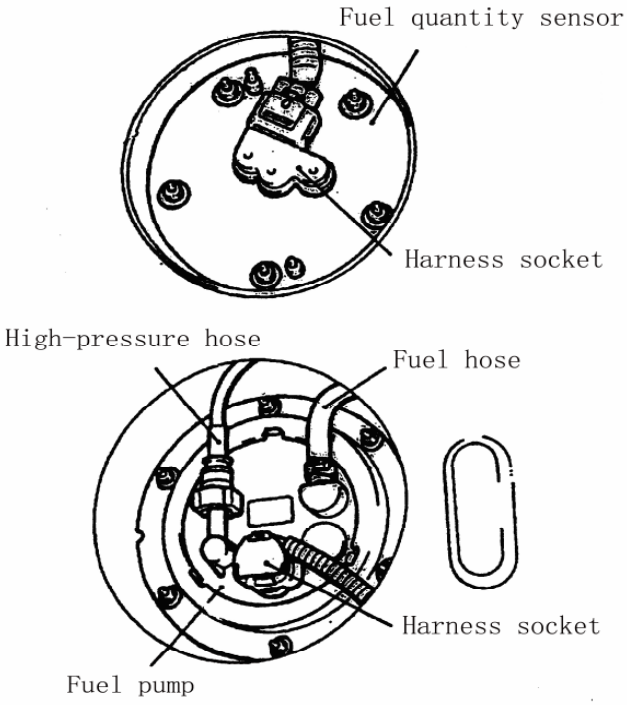


Fig.6-3

1) Remove rear seat, and then lift floor pad.

2) Remove checking cap.

3) Remove harness connector pin and fuel hose.

4) Remove mounting nut, and then remove fuel hose, fuel quantity sensor and fuel pump.

5) Install fuel hose, oil quantity sensor and fuel pump, then tighten to specified torque.

Tightening torque: 2.5±0.4N・m

6) Fuel hose and harness socket connection.

Caution
Snap the high-pressure fuel hose one-touch joint into place, then pull back slightly on the hose to assure it is securely fitted. However, the connection should have a play of approx. 3 mm.

7) Install checking cap.

8) Put floor pad back, and then install rear seat.

6.2 Fuel Pump

1. REVERAL AND INSTALLATION (see Fig.6-4)

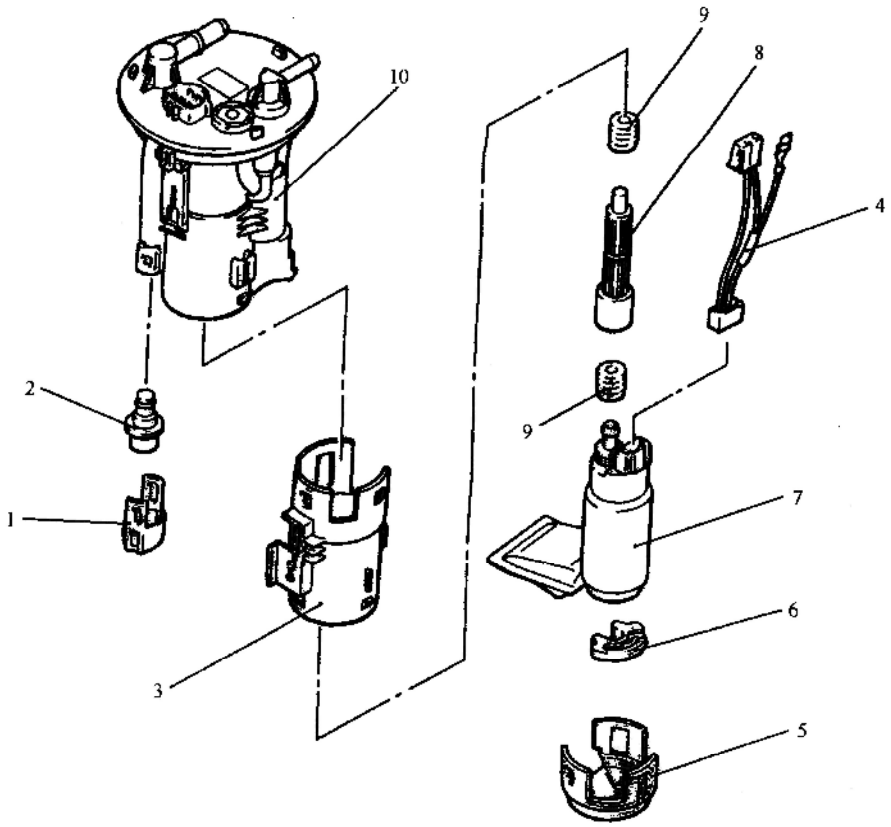


Fig.6-4

(1) Removal steps

(1) Cap (2) Fuel pressure regulator

(3) Shell (4) Pump harness

(5) Fuel pump bracket (6) Fuel pump cushion

(7) Fuel pump (8) Fuel hose

(9) Grommet (10) Fuel filter assembly

6.3 Fuel Filter

●FUEL FILTER REPLACEMENT

(1) Disconnect the connection parts of fuel pump.

(2) Before removing fuel pipe and fuel hose, the following steps should be carried out to release the pressure inside the lines to avoid fuel spurt out.

① Remove filler cap to release the pressure inside fuel tank.

Remove fuel pump relay. (Fig.6-5)。

② Start the engine and run it to stop, then turn the ignition switch to the “OFF”.

③ Install fuel filler cap.

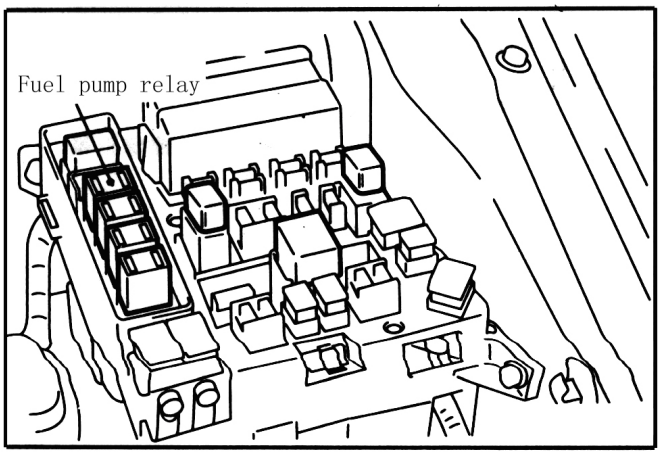


Fig.6-5

(3) Replace fuel filter

① Remove rear seat, and then lift floor pad.

② Remove checking cap.

③ Remove harness connector pin and fuel hose. (see Fig.6-6)。

④ Remove mounting nut, and then remove fuel hose, and fuel pump.

⑤ Remove fuel filter from fuel pump. (see Fig.6-7)。

⑥ Install new fuel filter.

Caution
Apply leadless fuel to guard ring and O ring before installing fuel filter

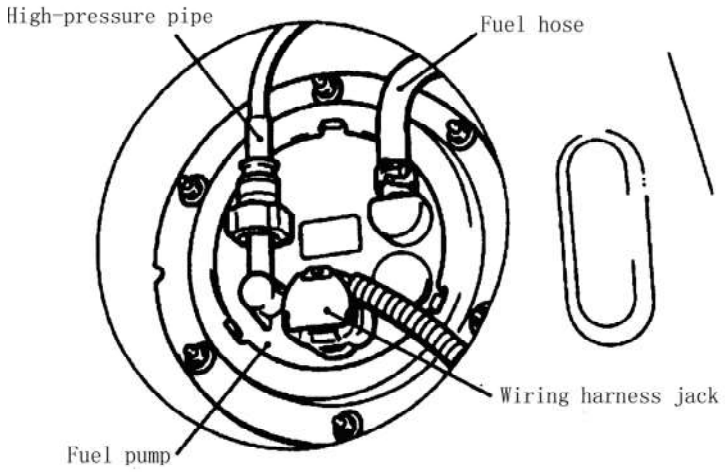


Fig.6-6

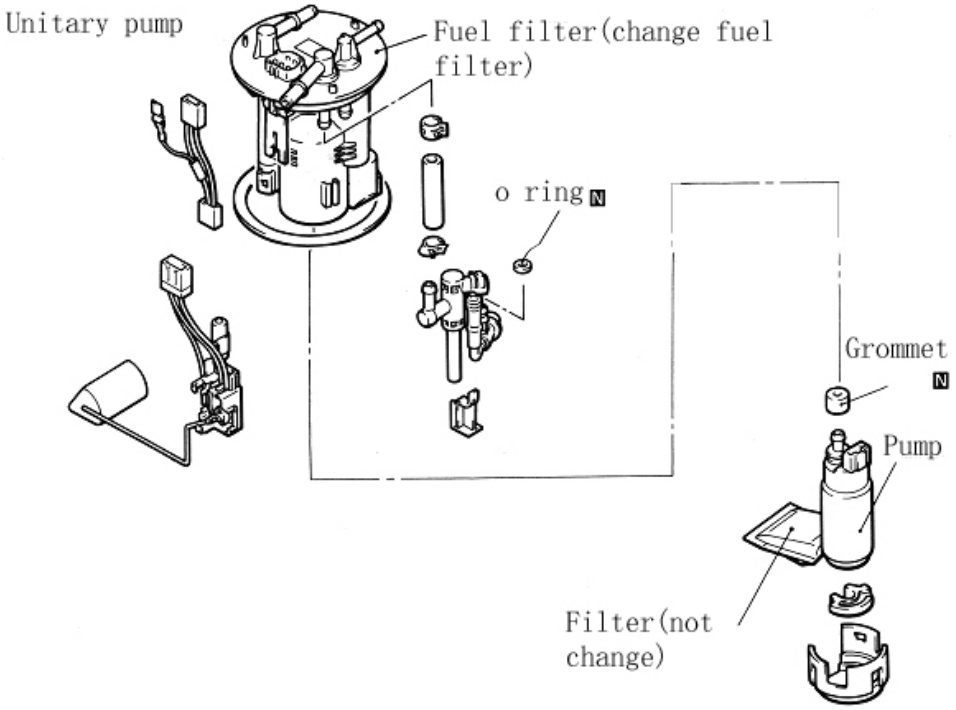


Fig.6-7

⑦Install fuel hose, oil quantity sensor and fuel pump, then tighten to specified torque.

Tightening torque: 2.5±0.4N・m

⑧Fuel hose and harness socket connection. (see Fig.6-6)。

Caution

Snap the high-pressure fuel hose one-touch joint into place, then pull back slightly on the hose to assure it is securely fitted. However, the connection should have a play of approx. 3 mm. (see Fig.6-8)。

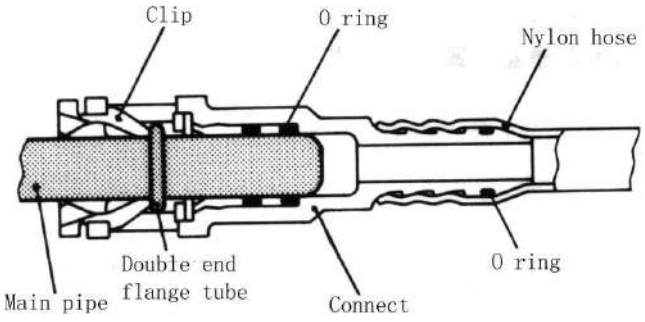


Fig.6-8

⑧Install checking cap.

⑨Put floor pad back, and then install rear seat.

7 Engine Cooling

7.1 Service Specifications

Table 7-1

Items	Standard Value	Limit
High pressure valve opening pressure of radiator cap (kPa)	74～103	64
Valve opening pressure of thermostat (℃)	82±1.5	-
Full-opening pressure of thermostat (℃)	95	-
Valve lift (mm)	Over 8.5	-

7.2 Coolant

Table 7-2

Items	Specified Coolant	Quantity L
Coolant quantity (including coolant reservoir)	Shell Freeze Guard	7.0

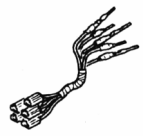
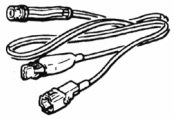
7.3 Sealant

Table 7-3

Items	Specified Sealant
Water pump	Sealant: LT5699(150g)
Thermostat shell assembly	

7.4 Special Tool

Table 7-4

Tool	Number	Name	Uses
A  B  C  D 	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: probe	Measurement of terminal voltage A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection

7.5 Troubleshooting of Fan

There is two ways of control: PWM control and temperature control.

1. PWM control fan

1) INSPECTION CHART FOR TROUBLE SYMPTOMS, see Table 7-5.

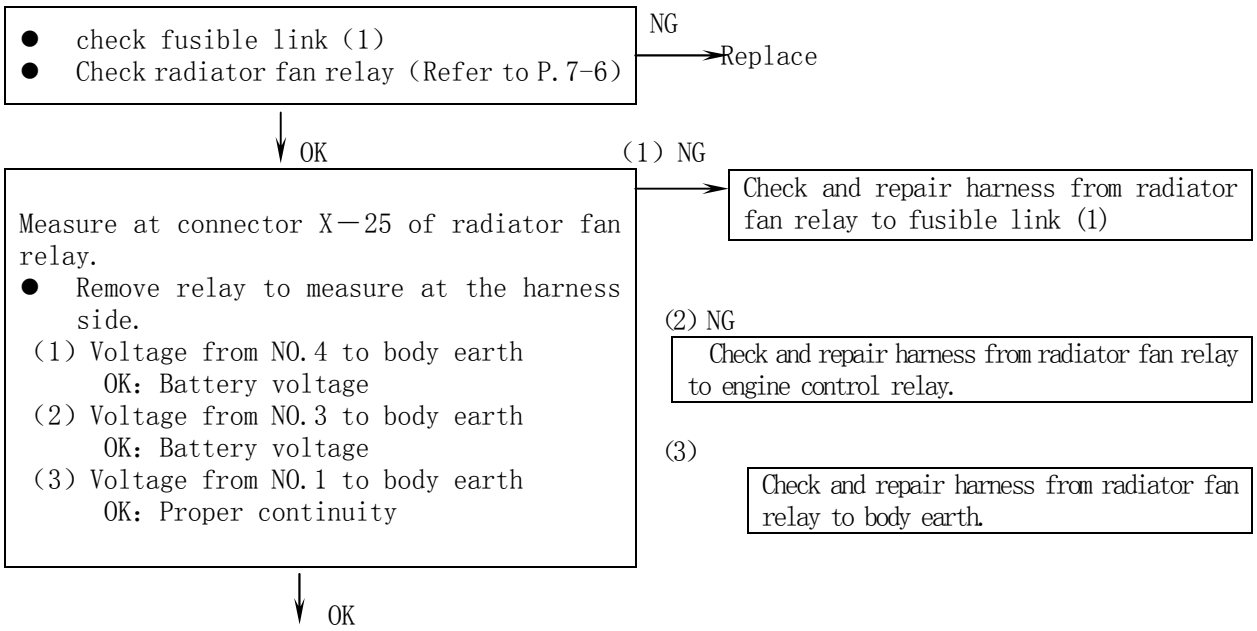
Table 7-5

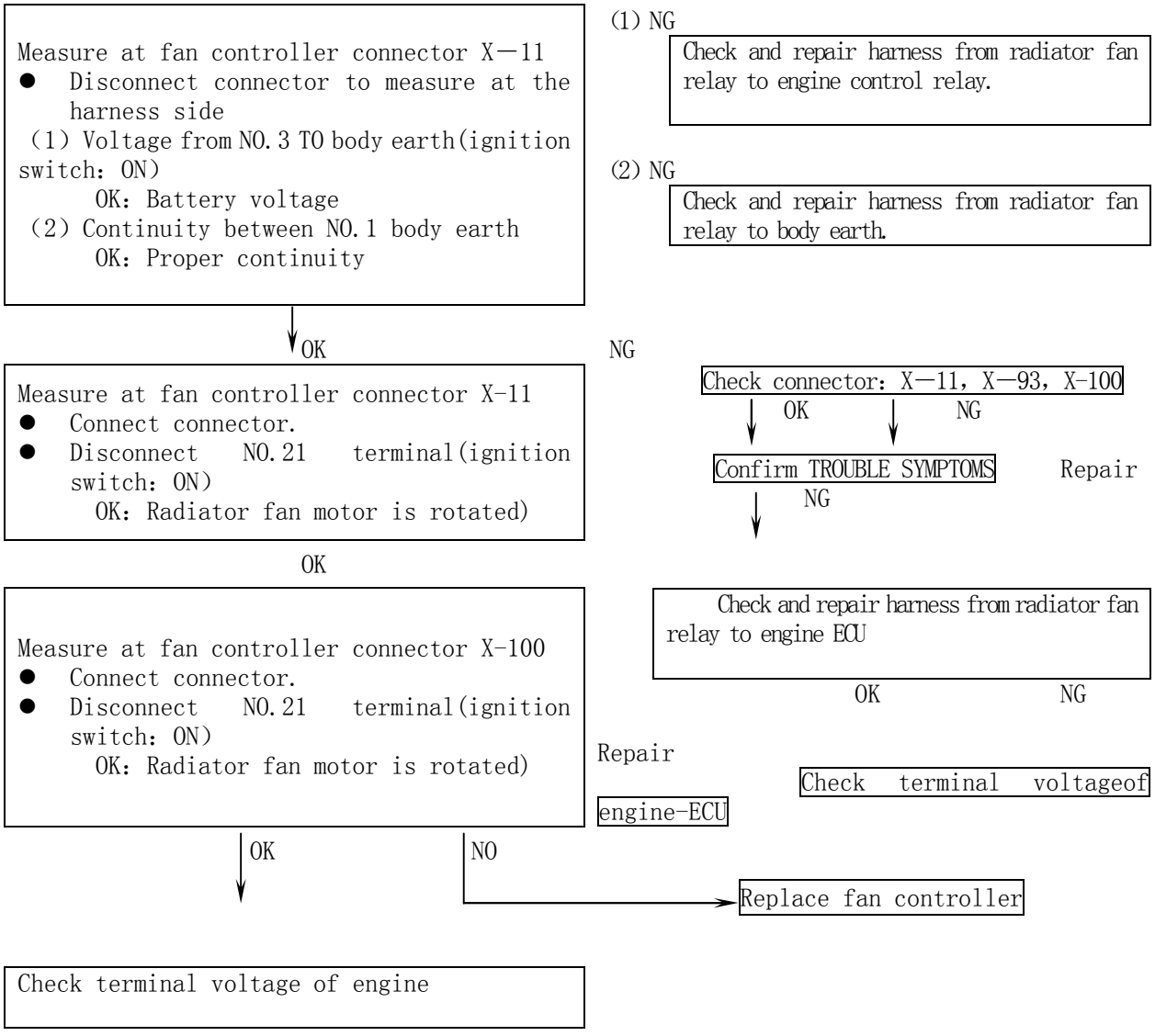
Trouble symptoms	Inspection procedure No.
Fan does not operate.	1
Fans does not change speed or stop.	2

2) INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS, see Table 7-6.

Table 7-6

Fan do not operate	Probable cause
Failure may occur on the power supply of the fan controller and the earth circuit. Failure may also occur on the fan controller and engine-ECU.	● Fusible links inoperable ● Radiator fan relay inoperable ● Fan controller inoperable ● Engine-ECU inoperable ● Harness, connector inoperable

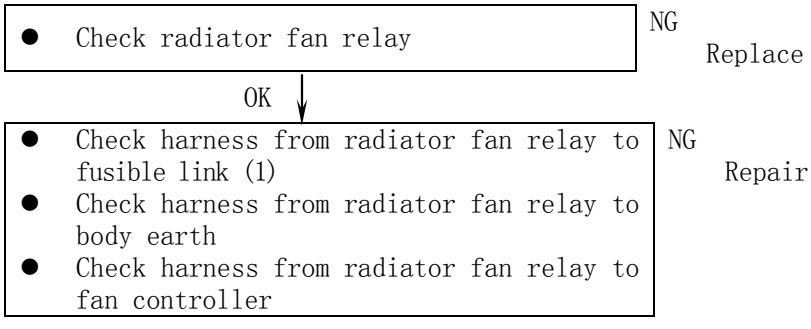


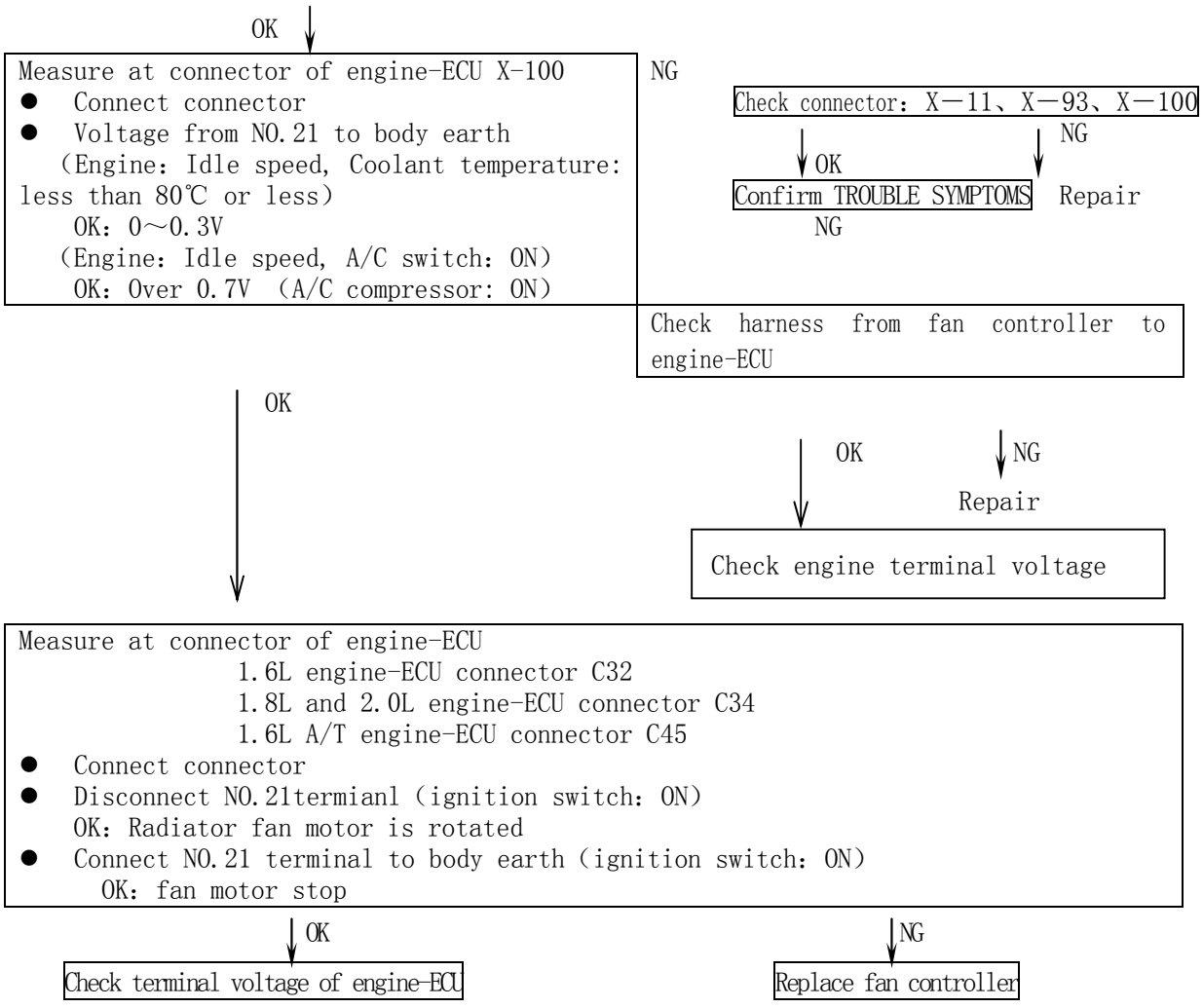


Inspection Procedure 2

Table 7-7

Fan do not change speed or stop	Probable cause
Fan controller uses the signal from engine-ECU to control radiator fan motor in a continuously variable mode.	● Fan relay inoperable ● Fan controller inoperable ● Engine-ECU inoperable ● Harness, connector inoperable





2. TEMPRETURE CONTROL

There are two kind of speed of temperature control fan, high speed and low speed, the speed is controlled according water temperature by the engine ECU.

High speed: ON-103℃ OFF-93℃

Low speed: ON-93℃ OFF-83℃

Table 7-8

Condition	Probable	Remedy
Fan can not operate	1.Open , short circuit or malfunction contact at connector pin	Check or replace
	2.Fault of Fan conversion contact	Replace
	2. Malfunction of low speed fan relay	Replace
	3.Fan motor power circuit is open	Check, repair or displacement

Fan can not operate at low speed	1. .Fault of Fan conversion contact	Replace
	2.Open , short circuit or malfunction contact at connector pin	Check or replace
Fan can not operate at high speed	1. Malfunction of high speed fan relay	Replace
	2. Malfunction of coolant temperature controller	Replace
	3. Malfunction of temperature sensor	Replace
	4. Open , short circuit or malfunction contact at connector pin	Check or replace

7.6 On-Vehicle Service

1. Radiator cap valve opening pressure check

   Standard value: 74～103kPa

   Limit : 64kPa

2. Coolant check

   (1) Check that if the coolant level in reserve tank is between “F” and “L”

   (2) Check that if oil is mixed into coolant.

3. COOLANT REPLACEMNET

   (1) Drain the engine coolant by removing the drain plug and then the radiator cap.

   (2) Remove the cylinder drain plug from the cylinder block to drain the engine coolant.(see Fig 7-1);

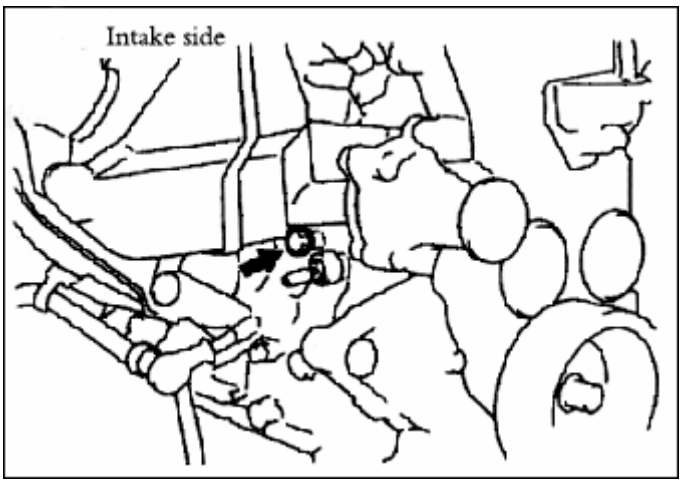


Fig.7-1

   (3) Remove the reserve tank to drain the engine coolant.

   (4) When the engine coolant has drained, pour in water from the radiator cap to clean the engine coolant line.

(5) Tighten the cylinder block drain plug to the specified torque.

Tightening torque: 40±5N·m

(6) Securely tighten the radiator drain plug.

(7) Install the reserve tank.

(8) Slowly pour the engine coolant into the mouth of the radiator until the radiator is full, and pour also into the reserve tank up to the FULL line.

Coolant: MITUBISHI GENUINE COOLANT

Quantity: 7.0L

(9) Install the radiator cap securely.

(10) Start the engine and warm the engine until the thermostat opens.

(11) After the thermostat opens, race the engine several times, and then stop the engine.

(12) Cool down the engine, and then pour engine coolant into the reserve tank until the level reaches the FULL line.

4. Check fan relay (see Fig.7-2)

Battery voltage	Terminal No.			
	1	2	3	4
When the current is not supplied	○		○	
When the current is supplied	○	○	○	○

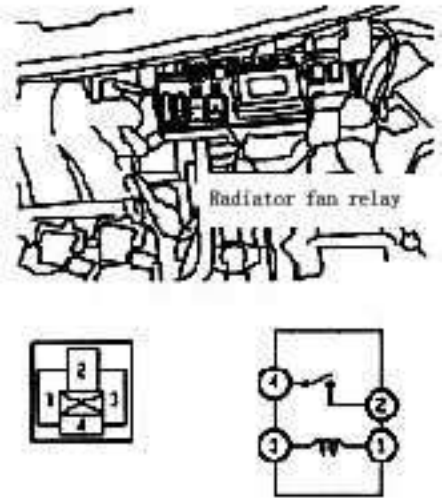


Fig.7-2

7.7 Thermostat

1 REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Drain and pour coolant (Refer to relative content of this GROUP))
- Removal and installation of the engine cover (Refer to relative GROUP of the manual)
- Removal and installation of air cleaner (Refer to relative GROUP of the manual)

- Removal and installation of battery and battery bracket.

Removal steps (see Fig 7-3)

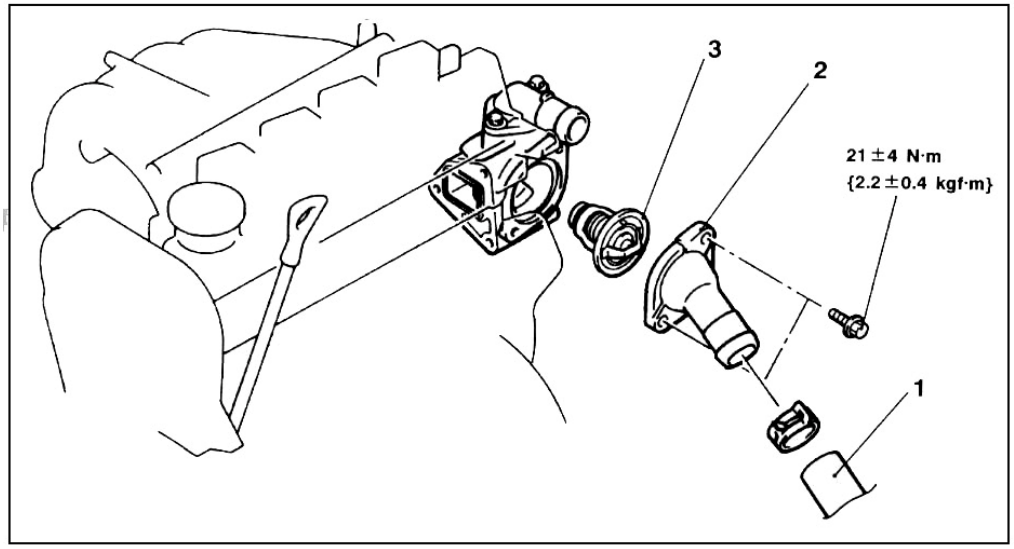


Fig 7-3

1- Radiator lower hose connection; 2-:Water inlet fitting; 3-Thermostat

REMOVE SERVICE POINT

Radiator lower hose removal

After marking mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINT

1) Thermostat installation

Be careful not to fold over or scratch the rubber ring when inserting. Install the thermostat so that the jiggle valve is facing

straight up. (See Fig 7-4)。

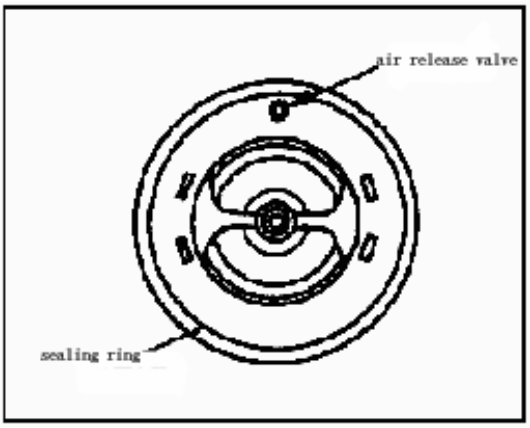


Fig 7-4

Caution: Make sure that no oil is adhering to the rubber ring of the thermostat. If the rubber ring is damage, replace the thermostat.

2)RADIATOR LOWER HOSE CONNECTION

(1)Insert each hose as far as the projection of the water inlet fitting.

(2)Align the mating mark on the radiator hose and hose clamp, then connect the radiator hose.

2. THERMOSTAT CHECK

(1)Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature. (See Fig 7-5)。

Standard value: 82±1.5℃

(2)Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature. (See Fig 7-6)。

Standard value: 95℃

Amount of valve lift: 8.5mm or more

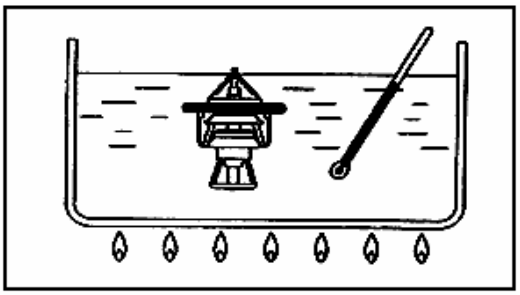


Fig 7-5

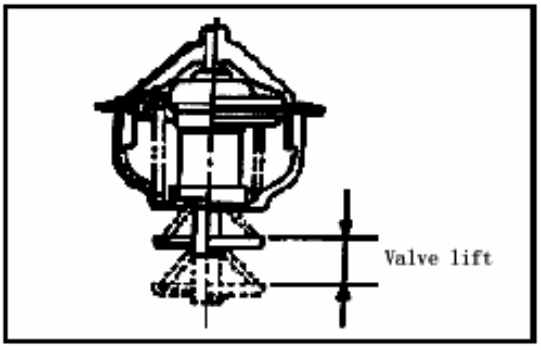


Fig 7-6

Caution:

Measure the valve height when the thermostat is fully closed, and use this measurement to calculate the valve height when the thermostat is fully open.

7.8 Water Pump

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying (refer to relative content of this GROUP)
- Timing Belt Removal and Installation (refer to relative GROUP of this manual)

Water pump and water hose removal and installation refer to engine service.

Removal steps (see Fig 7-7)

INSTALLATION SERVICE POINT

installation

2) WATER PUMP ASSEMBLY INSTALLATION

1 Use a gasket scraper or wire brush to completely eliminate the residual object on the gasket mounting surface.

2 Apply a series of the specified sealent:LT5699

3 With the sealant still wet (within 15min after the sealant applied), install the water pump.

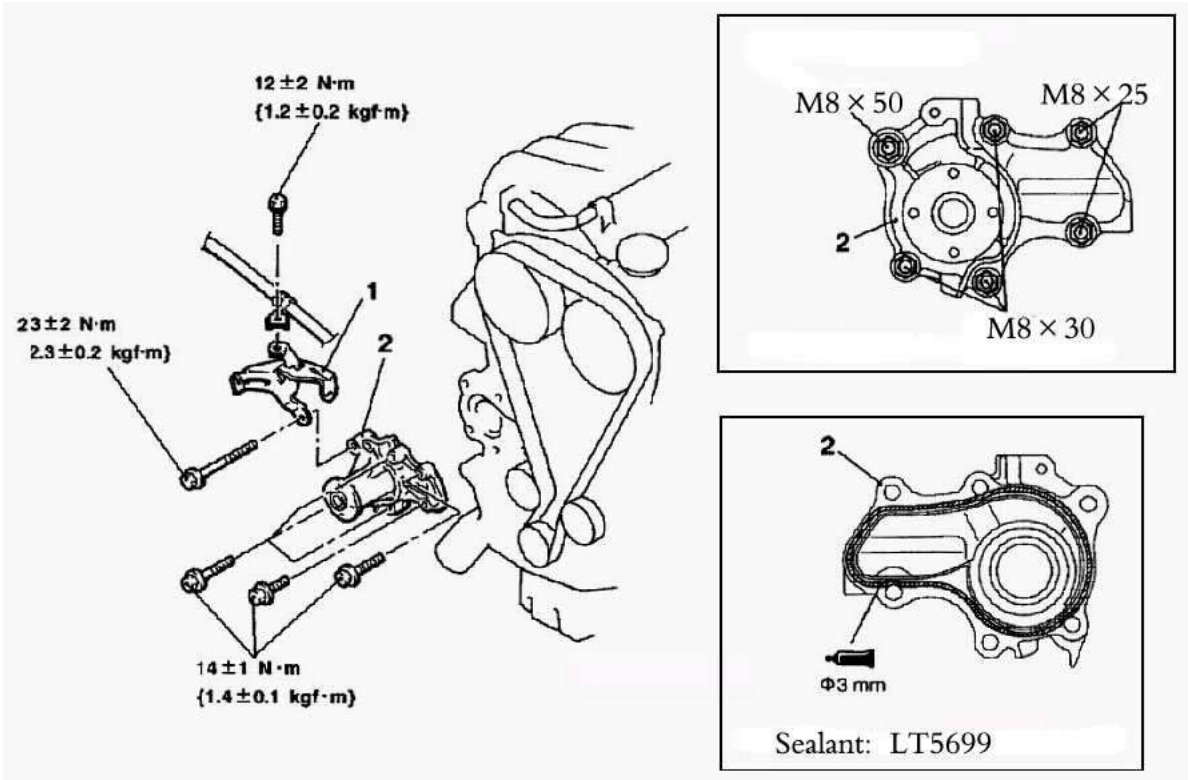


Fig 7-7

1-alternator anchor arm 2-water pump

7.9 Water Hose and Water Pipe

1. REMOVAL AND INSTALLATON

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying (refer to relative content of this GROUP)
- Engine cover removal and installation (refer to relative GROUP of this manual)
- Lower cover removal and installation
- Air cleaner removal and installation (refer to relative GROUP of this manual)
- Battery and battery bracket removal and installation

Removal steps (See Fig 7-8)

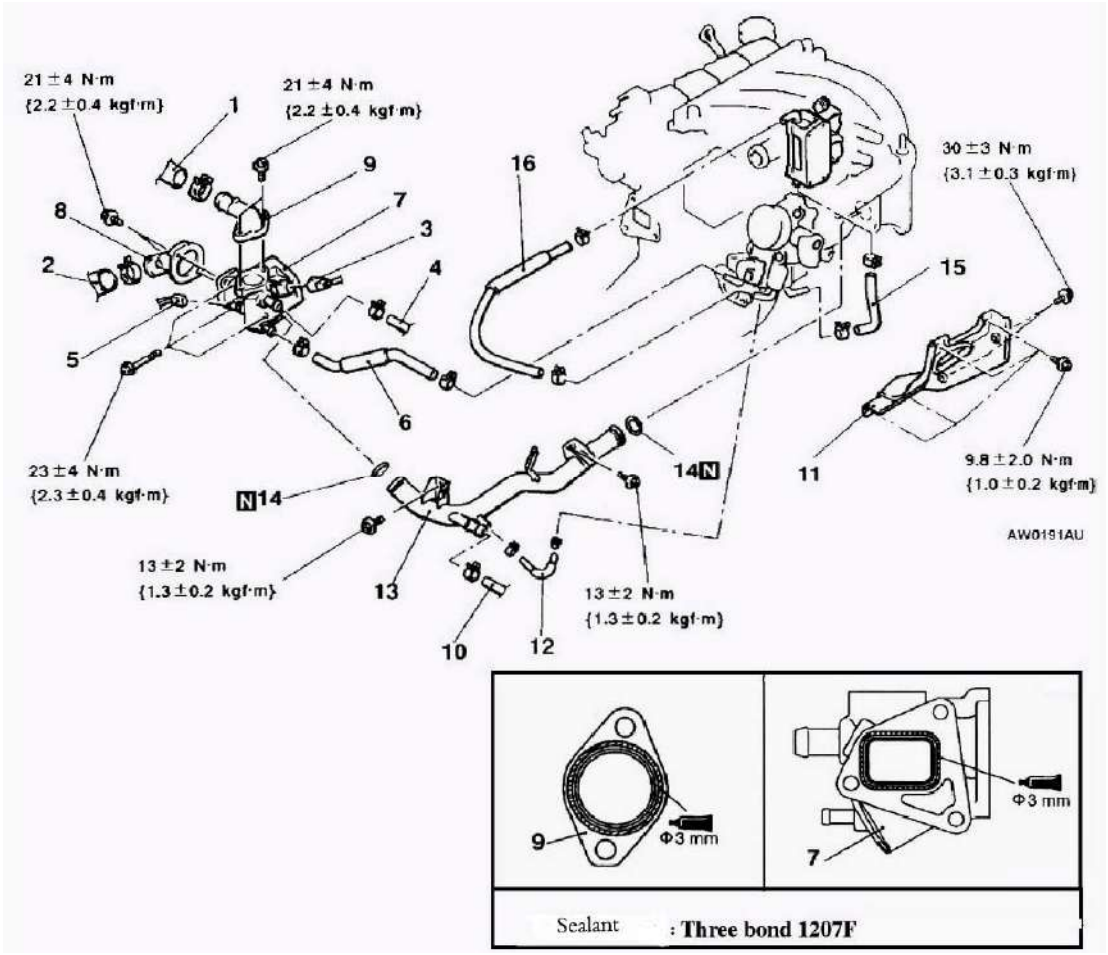


Fig 7-8

1.Radiator upper hose connection; 2.Radiator lower hose connection; 3.Heater hose connection; 4.Water temperature sensor connector; 5.Water temperature gauge unit connector; 6.Water hose; 7.Thermostat case assembly; 8. Water inlet fitting; 9. Water outlet fitting; 10. Heater hose connection; 11. inlet manifold stay; 12. Water hose; 13; Water inlet pipe 14.O-ring; 15.Water hose; 16. Water hose

REVOVAL SERVICE POINT:

(1) After making mating marks on the hose and the hose clamp, disconnect the hose.

(2) WATER INLET PIPE REMOVAL

Remove the mounting bolt of the surge tank resonator. Slide the surge tank resonator to remove the water inlet pipe. (See Fig 7-9)

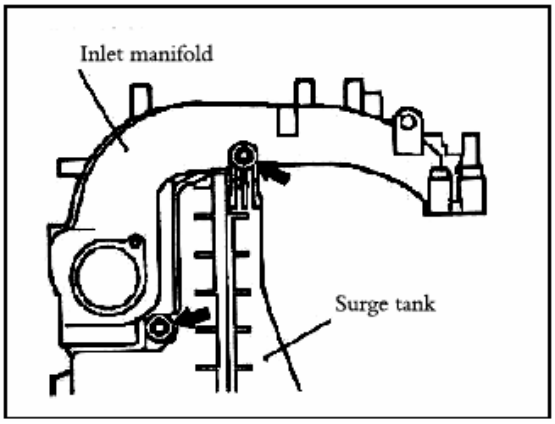


Fig 7-9

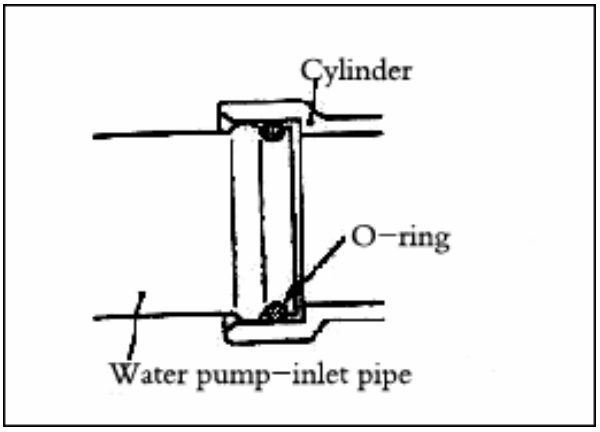


Fig 7-10

INSTALLATION SERVICE POINT

1) O-ring installation

Insert the O-ring to pipe, and coat the outer circumference of the O-ring with water. (See Fig 7-10)。

Caution
Care must be taken not to permit engine oil or other greases to adhere to the o-ring.

2) THERMOSTAT CASE ASSEMBLY INSTALLATION

4 Use a gasket scraper or wire brush to completely eliminate the residual object on the gasket mounting surface.

5 Apply a series of the specified sealent:LT5699

6 With the sealant still wet (within 15min after the sealant applied), install the thermostat case.

3) RADIATOR UPPER HOSE/RADIATOR LOWER HOSE CONNECTION

(1) Insert each hose as far as the projection of the water inlet fitting.

(2)Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

7.10 Radiator

1 RADIATOR REMOVAL AND INSTALLATION

1) Pre-removal Operation:

- Engine Coolant Draining

(1) Drain the engine coolant by removing the drain plug and then the radiator cap.

(2) Remove the cylinder drain plug from the cylinder block to drain the engine coolant.(See Fig 7-11);

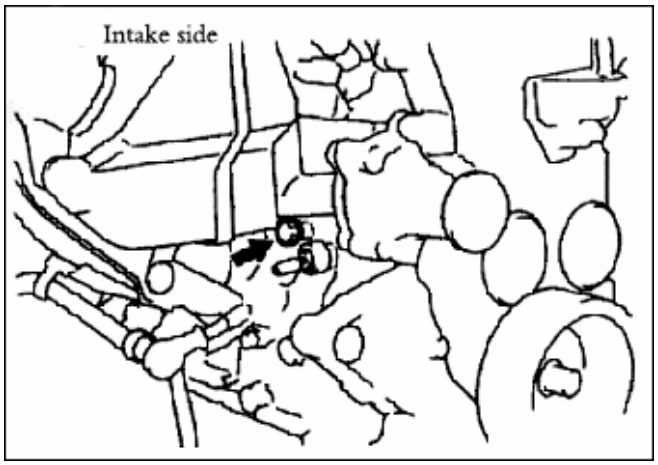


Fig 7-11

(3) Remove reserve tank, and drain coolant.

(4) When the engine coolant has drained, pour in water from the radiator cap to clean the engine coolant line.

(5) Remove lower cover.

(6) Remove air cleaner.

(7) Remove battery and battery bracket.

2) Post-removal Operation

- Engine Coolant Supplying and Checking

(1) Apply specified sealant to thread of cylinder drain valve, tighten to specified torque.(See Fig 7-12);

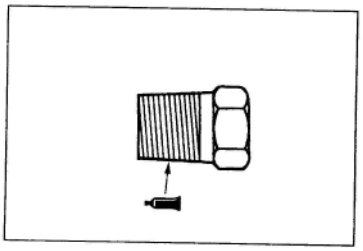


Fig 7-12

Sealant: LT5699

Eliminate old sealant before apply new sealant。

Tightening torque: 40±5N.m

(2) Tighten radiator drain plug.

(3) Reserve tank installation.

(4) Slowly pour the engine coolant into the mouth of the radiator until the radiator is full, and pour also into the reserve tank up to the FULL line.

Coolant: Shell Freeze Guard

Coolant quantity: 7L

(5) Radiator cap installation.

(6) Start the engine and warm the engine until the thermostat opens.

(7) Race the engine several times, and then stop the engine.

(8) Cool down the engine, and then pour engine coolant into the reserve tank until the level reaches the FULL line.

(9) ATF supply and check.

(10) Lower cover installation

(11) Battery and battery bracket installation.

(12) Air cleaner installation.

3) Removal steps (See Fig 7-13)

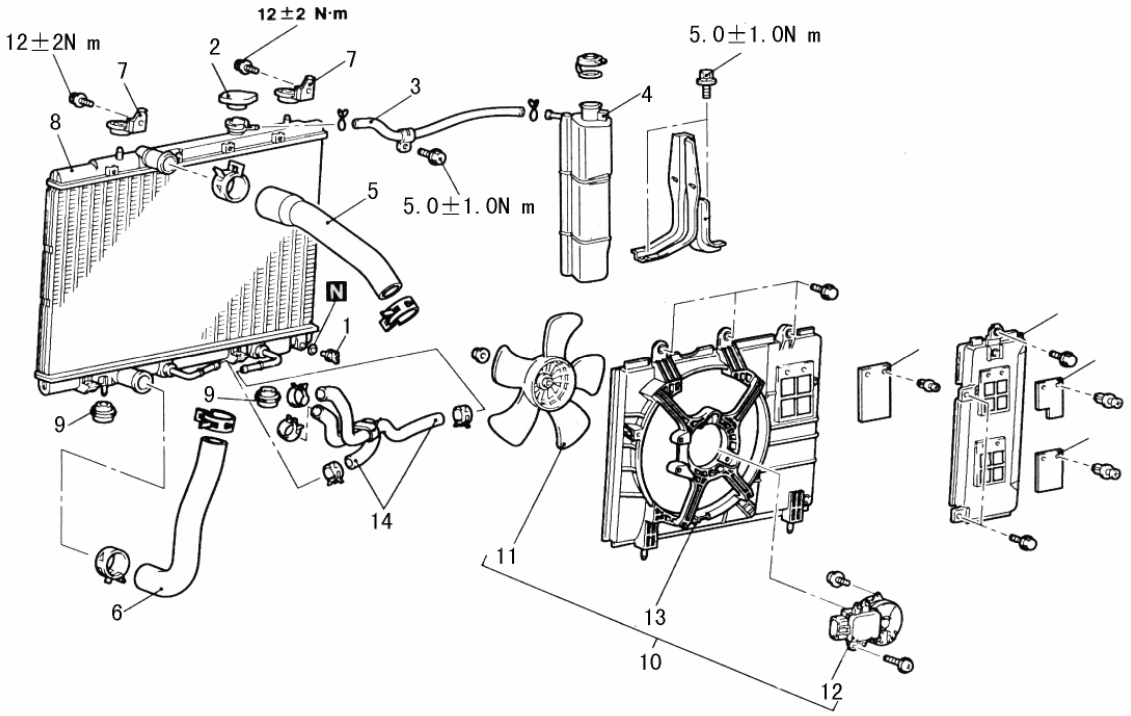


Fig 7-13

1-Radiator drain plug; 2-Radiator cap; 3-Water hose; 4-Reserve tank assembly; 5- Radiator upper hose; 6- Radiator lower hose; 7-Upper insulator; 8-Radiator assembly; 9-Lower insulator; 10- radiator fan motor assembly; 14-Transmission fluid cooler hose assembly

2 FAN ASSEMBLY REMOVAL AND INSTALLATION

Fan assembly removal steps refer to Fig.7-13:

3-Reverse tank hose; 5- Radiator upper hose; 7- Upper insulator; 10- Radiator fan motor assembly; 11- Fan; 12- Fan motor and fan controller; 13- Shroud; 14- Transmission fluid

cooler hos

3 REMOVAL SERVICE POINT

1) RADIATOR UPPER HOSE/RADIATOR LOWER HOSE/ TRANSMISSION FLUID COOLER HOS DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

2) TRANSMISSON FLUID COOLER HOSE REMOVAL

After making mating marks on the hose and the hose clamp, disconnect the hose.

After disconnecting the hose, plug it to avoid dust or foreign material.

4 INSTALLATION SERVICE POINT

1) RADIATOR UPPER HOSE/RADIATOR LOWER HOSE CONNECTION

Insert each hose as far as the projection of each fitting.

2) TRANSMISSION FLUID COOLER HOSE CONNECTION

Insert each hose as far as the projection of each fitting, align the mating marks on the hose and hose clamp.

8 Intake and Exhaust

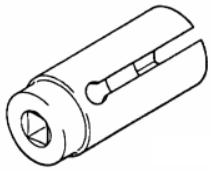
8.1 Service Specification

Table 8—1

Items	Standard value	Limit
Manifold distortion of the installation surface mm	0.15 or less	0.20
Items	Standard value	Limit

8.2 Special Tool

Table 8—2

Tool	Number	Name	Use
	MD998770	O_2 sensor wrench	Removal and installation of oxygen sensor

8.3 On-Vehicle Service

Check manifold pressure (Refer to GROUP 4)

8.4 Air Cleaner

1. Removal and installation

Caution

Parts marked by * are made of recycled-paper mixed plastic material, so observe the following precautions.

1. Avoid any shock or load to these parts when removing and installing them.
2. Engage the case hinges securely when assembling these parts.
3. It can be burnt as no use.

Removal steps (see Fig.8—1):

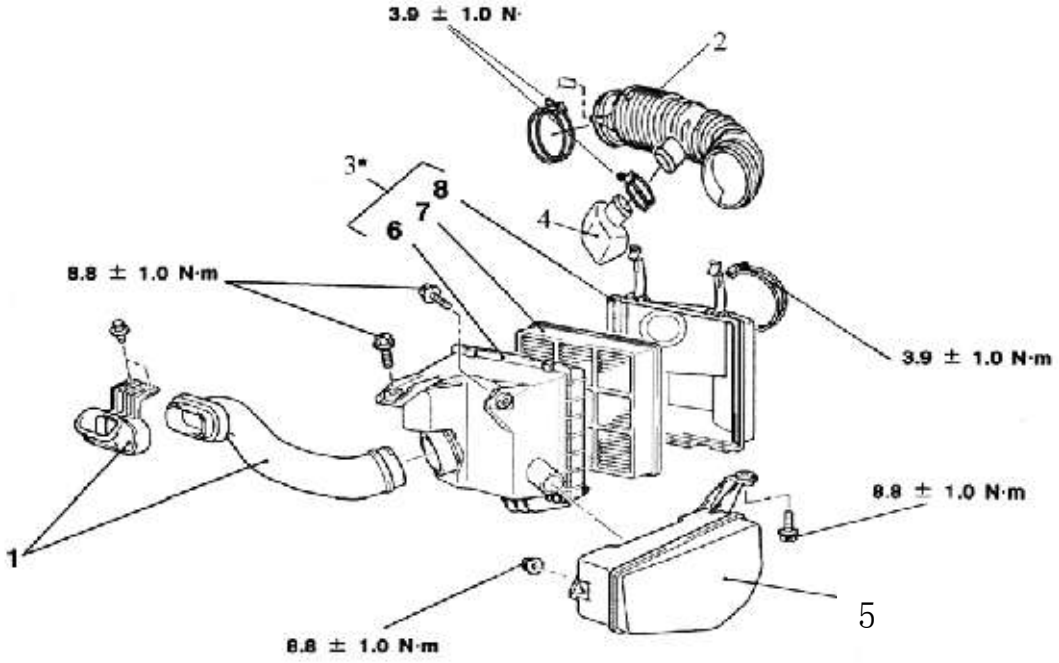


Fig. 8-1

1 Air intake hose
2 Air exhaust hose
3. Air cleaner assembly
4. Big resonant chamber
5. Air cleaner body
6. Air cleaner element
7. Air cleaner cover

8.5 Intake Manifold

1. REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
● Coolant Draining and Refilling (Refer to GROUP 7);
● Air cleaner Removal and Installation.
● Throttle Body Removal and Installation.

Removal steps (Refer to GROUP 4)

Removal service point

(1) Intake manifold removal

Remove intake manifold, after disconnect intake manifold resonator.

Installation service point

(1) Install the engine cover.

1) Pre-tighten mounting bolts until the engine cover can be moved with hands.

2) Tighten mounting bolts to specified torque.

Tightening torque: 3.0±0.4N·m

2. CHECK

INTAKE MANIFOLD CHECK

(1) Check intake manifold for damage and crack, replace if necessary.

(2) Check vacuum exhaust port for clogging, clean if there is clogging.

(3) Check installation surface distortion of cylinder cover with ruler or plug guage, replace if necessary.

Standard value: 0.15mm or less

Limit : 0.20mm

8.6 Exhaust Manifold

1.Pre-removal and Post-installation Operation

- The Engine Cover Removal and Installation.
- Lower cover removal and installation.

(Removal steps refer to GROUP 4)

Removal service point

(1) Power steering oil pump, A/C condenser transmission belt removal

1) Loosen power steering oil pump mounting bolts of A.B.C.

2) Loosen adjusting bolt D, remove transmission belt.

> Caution
> Draw a arrow (means turning to right)with a chalk on the back of the belt when necessary.

(2) Power steering oil pump and bracket assembly removal

Remove power steering pump attached with hose and bracket from oil pump bracket.

> Caution
> Tie the power steering pump and bracket removed to the place not to affect exhaust manifold removal and installation.

(3) Oxygen sensor removal.

2. CHECK

Exhaust manifold check

(1) Check exhaust manifold for damage and crack, replace if necessary.

(2) Check installation surface distortion of cylinder cover with ruler or plug gauge, replace if necessary.

Standard value: 0.15mm or less

Limit : 0.20mm

8.7 Exhaust Pipe and Muffler

1.REMOVAL AND INSTALLATION（see Fig.8—2a）

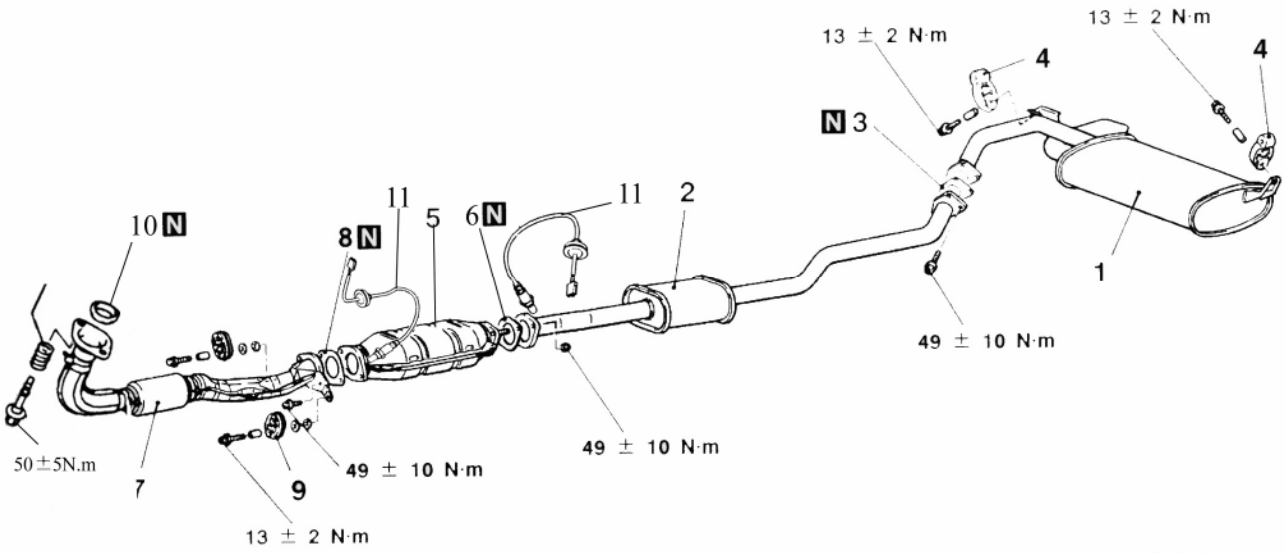


Fig.8-2a

☆Exhaust main muffler removal steps

1.Exhaust main muffler

3 Rear exhaust pipe gasket

4.Rear hanger

☆Exhaust secondary muffler removal steps

（Remove oxygen sensor before removing exhaust secondary muffler）

2. Exhaust secondary muffler

3. Rear exhaust pipe gasket

6. Exhaust pipe gasket

11Rear oxygen sensor

☆TWC removal steps（Remove oxygen sensor before removing exhaust secondary muffler）

5. TWC

6. Exhaust pipe gasket

8. Exhaust pipe gasket

☆ Front exhaust pipe assembly removal steps

7. Front exhaust pipe assembly

8. Exhaust pipe gasket

9. Front hanger

10. Seal ring

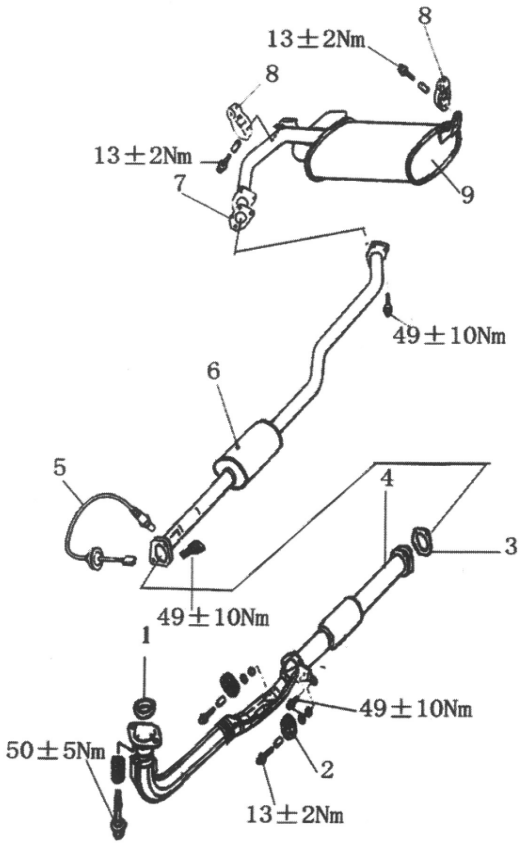


Fig.8-2b

☆Exhaust main muffler removal steps

9.Exhaust main muffler

7 Rear exhaust pipe gasket

8.Rear hanger

☆Exhaust secondary muffler removal steps

（Remove oxygen sensor before removing exhaust secondary muffler）

6. Exhaust secondary muffler

7. Rear exhaust pipe gasket

3. Exhaust pipe gasket

5. Oxygen sensor

☆TWC removal steps（Remove oxygen sensor before removing exhaust secondary muffler）

4. TWC

3. Exhaust pipe gasket

2. Front hanger

1. Seal ring

2.CHECK

Check parts and assemblys for weld fault and damage and so on, repair or replace if necessary.

9 Engine Electrical

9.1 Starting System

1. GENERAL INFORMATION

If the ignition switch is turned to the "START" position, current flows in the pull-up and holding coils provided inside magnetic switch, attracting the plunger. When the plunger is attracted, the lever connected to the plunger is actuated to engage the starter clutch. On the other hand, attracting the plunger will turn on the magnetic switch, allowing the B terminal and M terminal to conduct. Thus, current flows to engage the starter motor. When the ignition switch is returned to the "ON" position after starting the engine, the starter clutch is disengaged from the ring gear. An overrunning clutch is provided between the pinion and the armature shaft, to prevent damage to the starter.

System diagram see Fig.9-1.

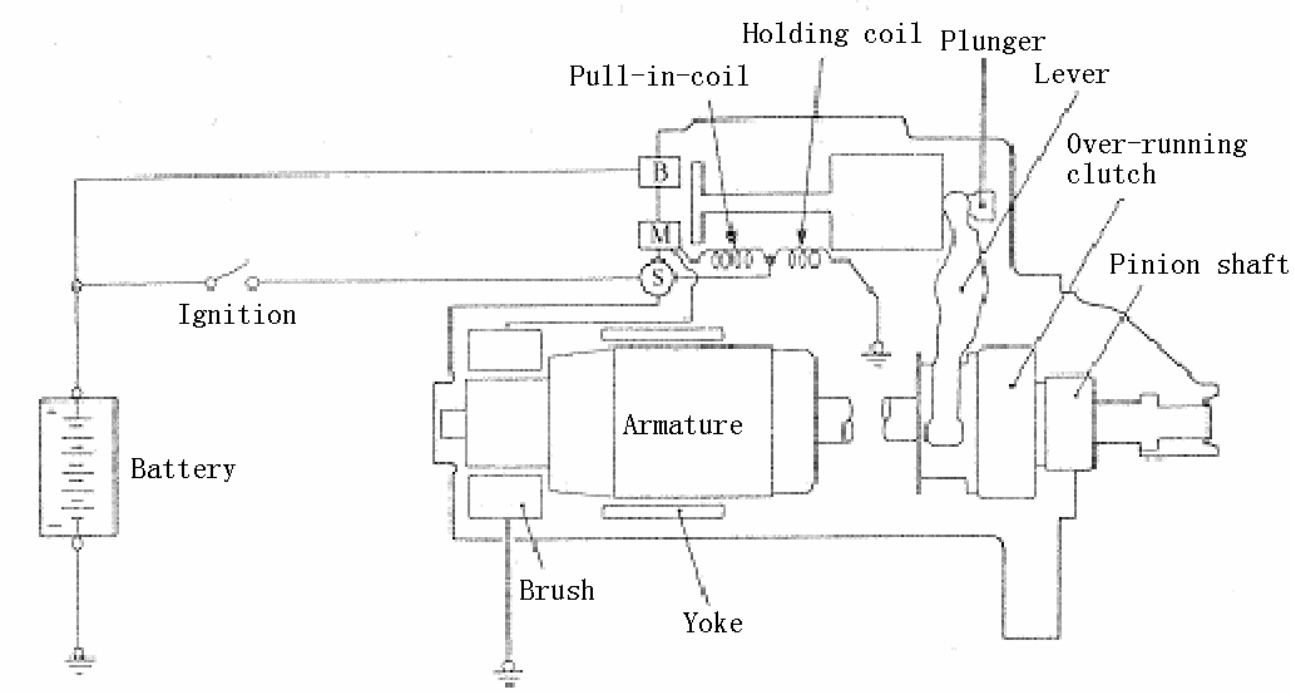


Fig. 9-1

Starter motor specifications (Table 9-1)

Table 9-1

Items	Specifications	
Type	Reduction drive with planetary	
Rated output (kw/h)	4G63 1.4/12	4G18 1.2/12
No. of pinion teeth	8	

Service specifications (Table 9-2)

Table 9-2

Items	Standard value	Limit
Pinion gap(mm)	0.65~2.0	-
Commutator outer diameter(mm)	32.0	31.4
Commutator ran out (mm)	-	0.05

Commutator outcut(mm)	0.5	0.2

2. Starter motor removal and installation

Removal steps see Fig. 9-2:

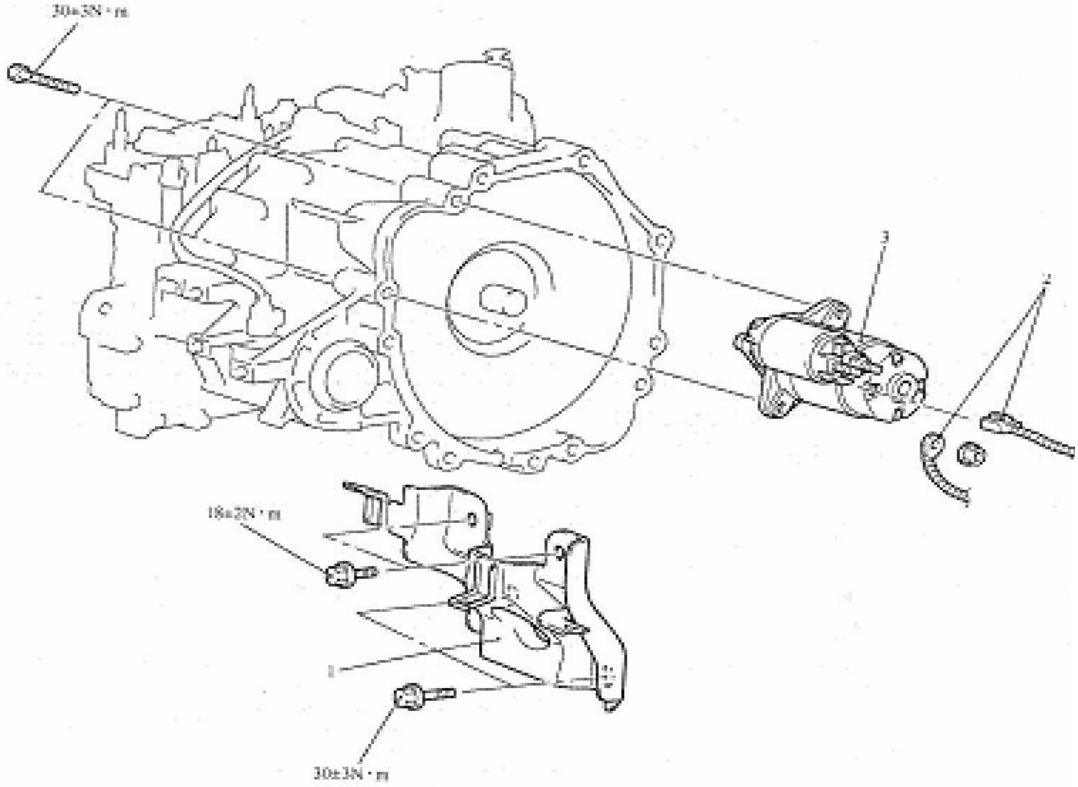


Fig. 9-2

1、intake manifold bracket 2、Starter connector 3、Starter

3. Inspection

1) **Pinion gap adjustment (see Fig.9-3)**

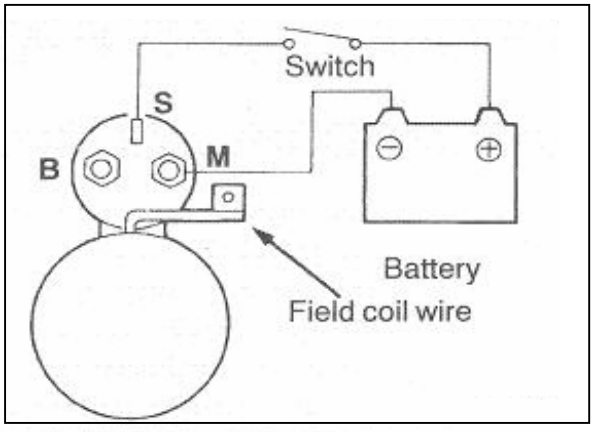


Fig. 9-3

(1) Disconnect field coil wire from M-terminal of magnetic switch.

(2) Connect a 12 V battery between S-terminal and M-terminal.

(3) When set switch to “ON” position, pinion should be held out.

Caution

This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

(4) Check the gap between pinion and stopper.(see Fig.9-4)。

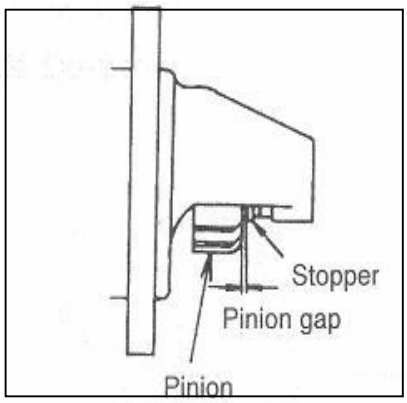


Fig. 9-4

Pinion gap：0.5 ～2.0

(5) If pinion gap is out of specification, adjust it by adding or removing gaskets between magnetic switch and front bracket. (see Fig.9-5)。

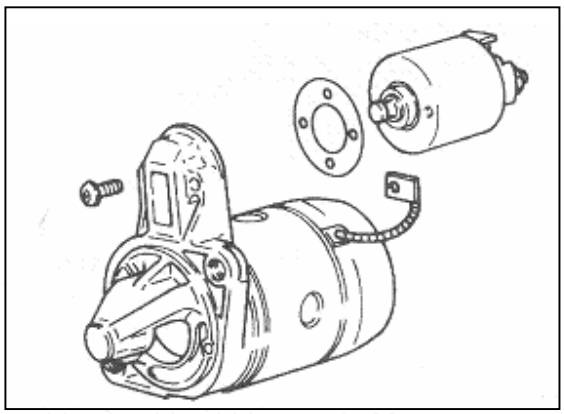


Fig. 9-5

2)Magnetic switch pull-in test(see Fig.9-6)

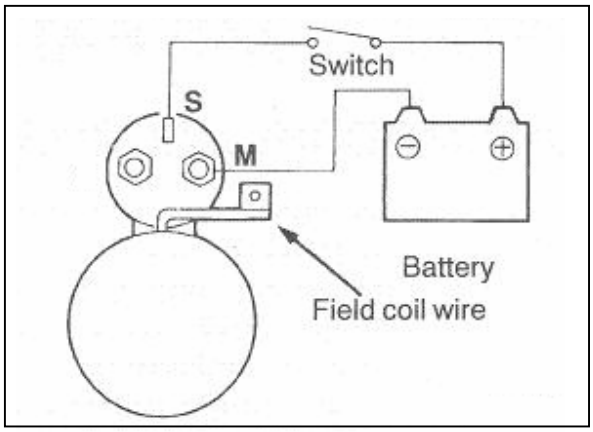


Fig. 9-6

(1) Disconnect field coil wire from M-terminal of magnetic switch。

(2) Connect a 12 V battery between S-terminal and M-terminal.

Caution
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

(3) If pinion moves out, then pull-in coil is good. If it doesn't , replace magnetic switch.

3) **Magnetic switch hold-in test** (see Fig.9-7)

(1) Disconnect field coil wire from M-terminal of magnetic switch.

(2) Connect a 12 V battery between S-terminal and M-terminal.

Caution
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

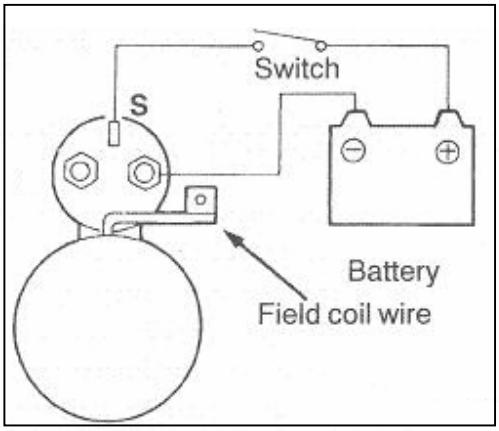


Fig. 9-7

(3) Manually pull out the pinion as far as the pinion stopper position.

(4) If pinion remains out, everything is in order. If pinion moves in, hold-in circuit is open. Replace magnetic switch.

4)Free running test (see Fig.9-8)

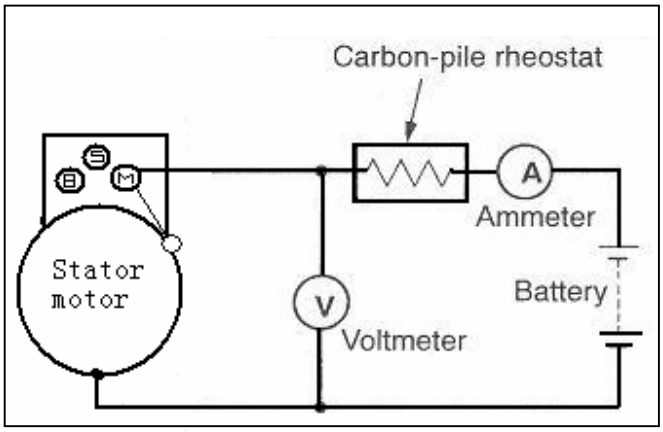


Fig. 9-8

(1) Place starter motor in a vise equipped with soft jaws and connect a fully-charged 12V battery to starter motor as follows:
(2) Connect a test ammeter and carbon pile rheostat in series with positive post and starter motor terminal 。
(3) Connect a voltmeter(15 V scale) across starter motor.。
(4) Rotate carbon pile to full-resistance position。
(5) Connect battery cable from battery negative post to starter motor body.
(6) Adjust the rheostat until the battery voltage shown by the voltmeter is 11.5 V. 。
(7) Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.
Current: max 60A

5)**Magnetic switch return test** (see Fig.9-9)

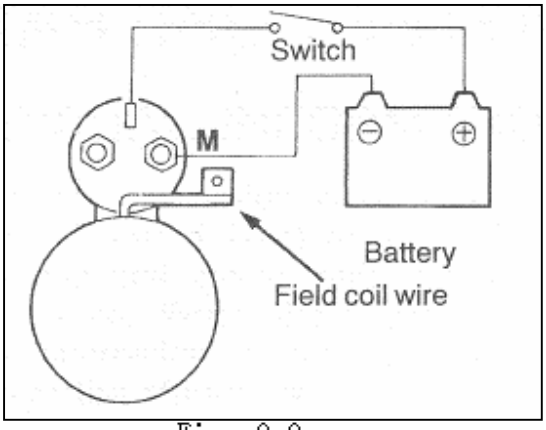


Fig. 9-9

(1) Disconnect field coil wire from M-terminal of magnetic switch.
(2) Connect a 12 V battery between M-terminal and body.

Caution
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

(3) Pull pinion out and release. If pinion quickly returns to its original position, everything is in order. If it doesn't, replace magnetic switch.

Caution
Be careful not to get your fingers caught when pulling out the pinion.

4. Disassembly and reassembly

Disassembly steps see Fig.9-10:

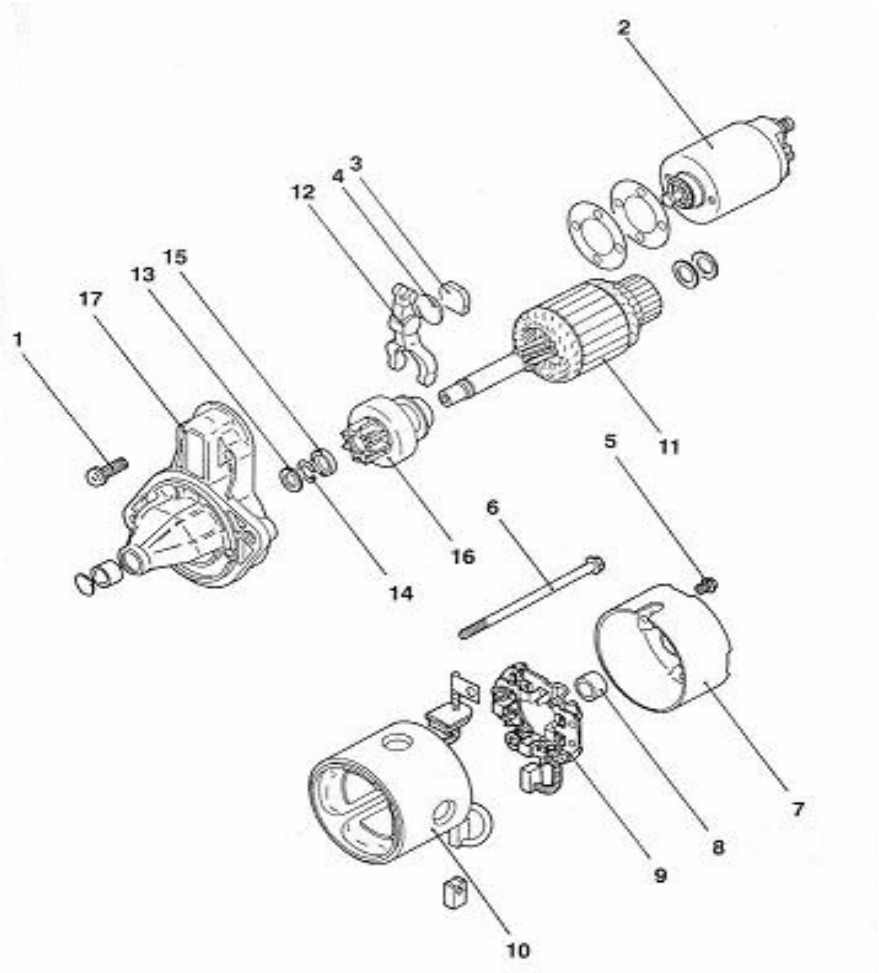


Fig. 9-10

1-Screw; 2-Magnetic Switch; 3-Packing; 4-Plate; 5-Screw; 6-Through bolt; 7-Rear bracket; 8-Rear bearing; 9-Brush holder assembly; 10-Yoke assembly; 11-Armature; 12-Lever; 13-Washer; 14-Snap ring ; 15-Stop ring; 16-Overrunning clutch; 17-Front bracket

1) **Disassembly service points**

(1) Magnetic Switch Removal see Fig.9-11:

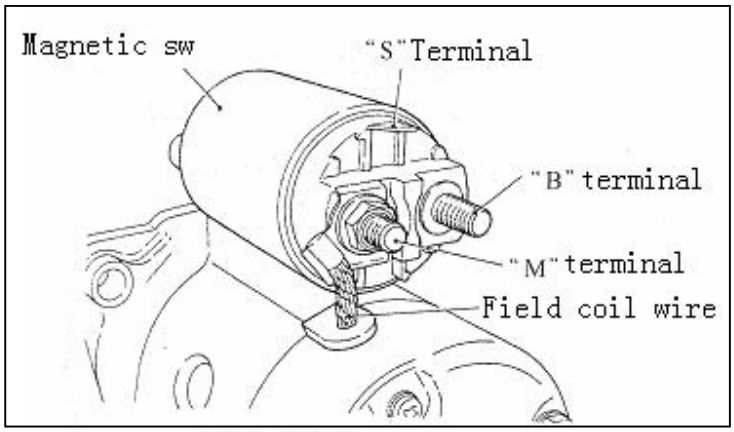


Fig. 9-11

Disconnect field coil wire from M-terminal of magnetic switch.

（2）Armature/Steel-bal Removal

Caution
When removal armature, don’ t loses the steel-roll of front bracket(uses as bearing).

（3）Snap ring/Stop ring removal

（a）Press stop ring off snap ring with a suitable shroud（see Fig.9-12）

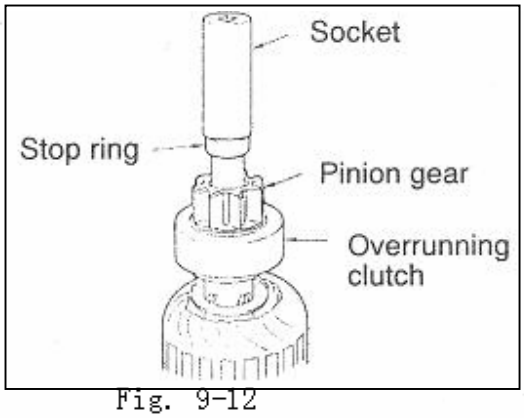


Fig. 9-12

（b）Remove snap ring with snap ring pliers and then remove stop ring and overrunning clutch.（see Fig.9-13）。

2) Starter motor parts cleaning

（1）Dot not immerse parts in cleaning solvent. Immersing the yoke and field coil assembly and/or armature will damage insulation.

（2）Do not immerse drive unit in cleaning solvent. Overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.

（3）The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

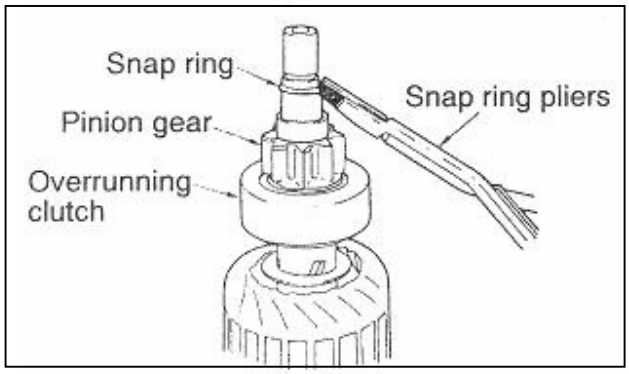


Fig. 9-13

3）**Reassembly service points**

Stop ring/snap ring installation（see Fig.9-14）：

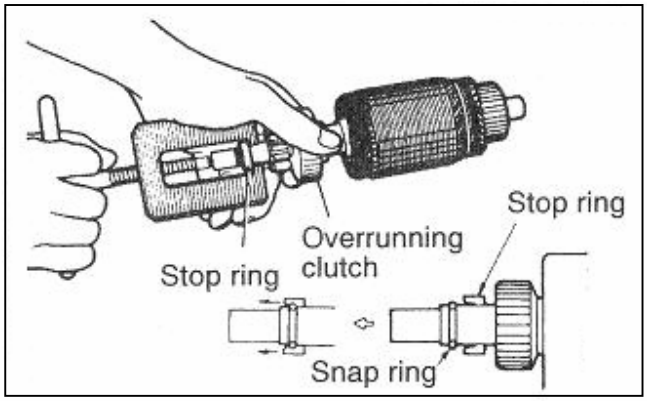


Fig. 9-14

Using a suitable pulling tool, pull overrunning clutch stop ring over snap ring.

4）Inspection

（1）Commutation

① Place the armature in a pair of “V” blocks and check the run-out with a dial indicator.（see Fig.9-15）。

Limit：0.05mm

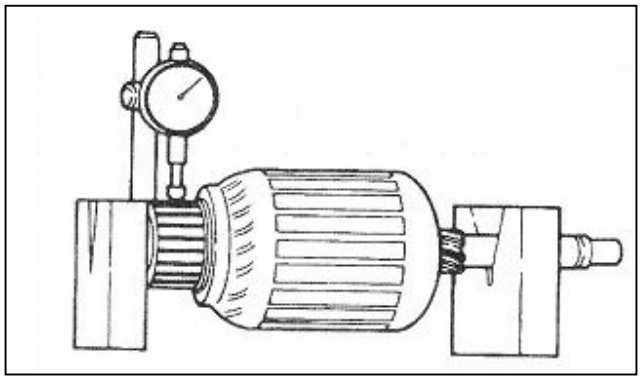


Fig. 9-15

② Measure the commutator outer diameter. See Fig.9-16。

Standard value：32.0mm

Limit：31.4mm

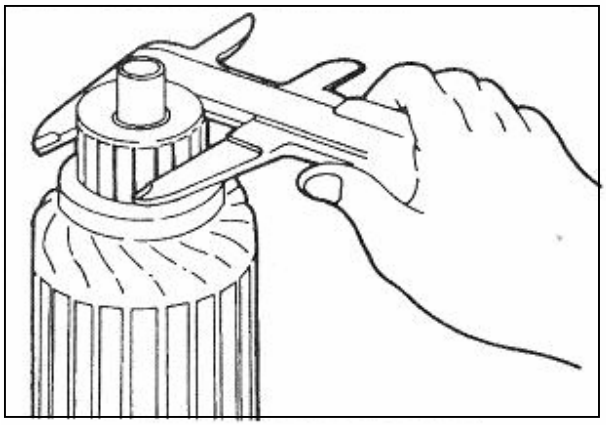


Fig. 9-16

③ Check the undercut depth between segments.（see Fig.9-17）。
Standard value：0.5mm
Limit：0.2mm

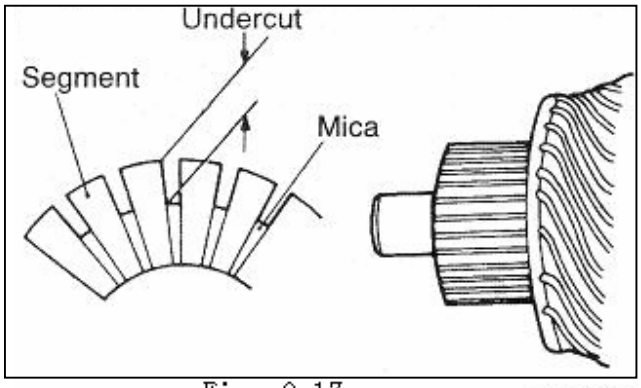


Fig. 9-17

(2)Field coil open-circuit test（Only directness drive type）
Check the continuity between field brushes. If there is continuity, the field coil is in order.（see Fig.9-18）.

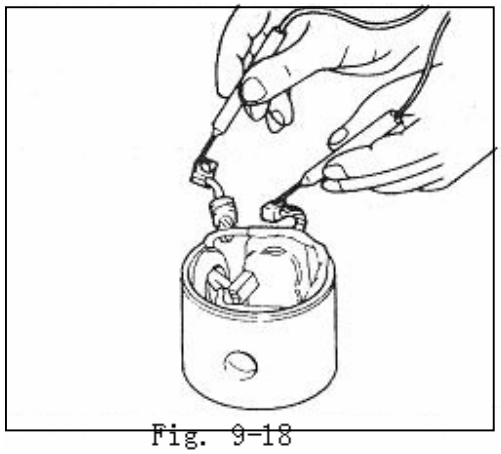


Fig. 9-18

（3）Field coil ground test（Only directness drive type）

Check the continuity between field coil brush and yoke. If there is no continuity, the field coil is free from earth.（see Fig.9-19）.

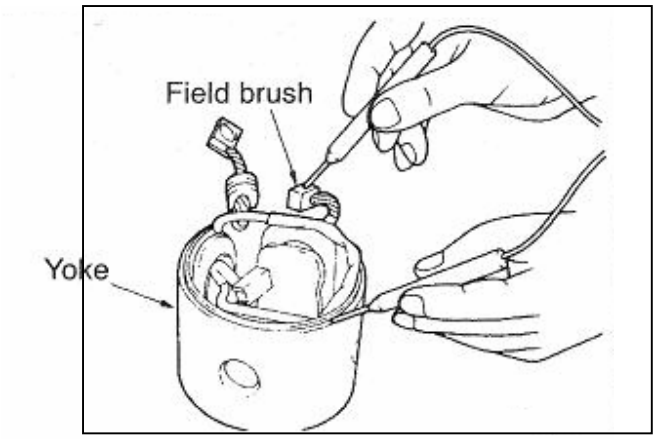


Fig. 9-19

（4）Brush holder

Check the continuity between brush holder plate and brush holder. If there is no continuity, the holder is in order.（see Fig.9-20）。

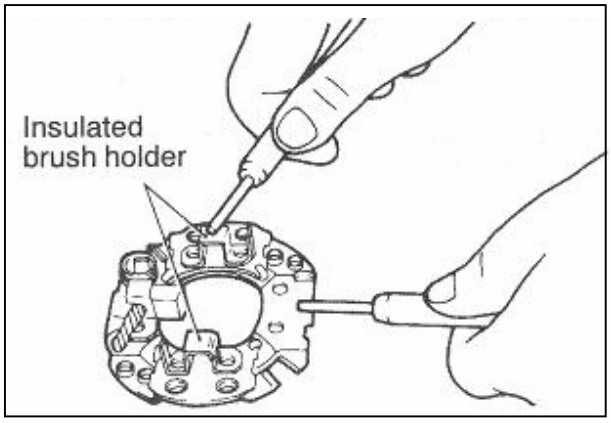


Fig. 9-20

（5）Overrunning clutch

① While holding clutch housing, rotate the pinion . Drive pinion should rotate smoothly in one direction, but should not rotate in opposite direction . If clutch does not function properly, replace overrunning clutch assembly.（see Fig.9-21）。

② Inspect pinion for wear or burrs. If pinion is worn or burred, replace overrunning clutch assembly. If pinion is damaged, also inspect ring gear for wear or burrs.

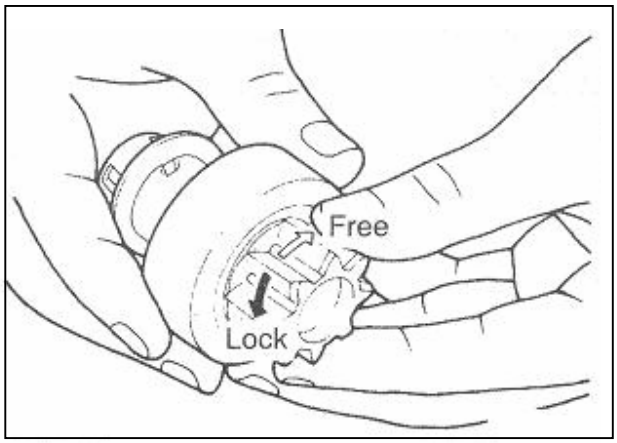


Fig. 9-21

（6）Front and rear bracket bushing

Inspect bushing for wear or burrs. If bushing is worn or burred, replace front bracket assembly or rear bracket assembly.

5）Brush and spring replacement（see Fig.9-22、Fig.9-23）

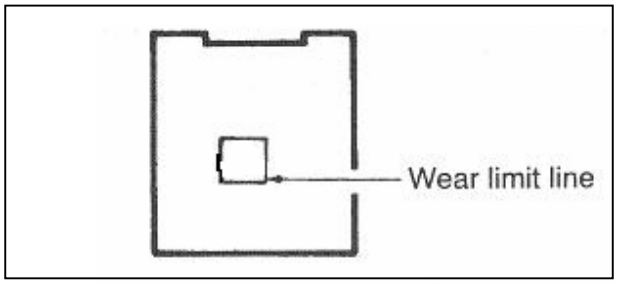


Fig. 9-22

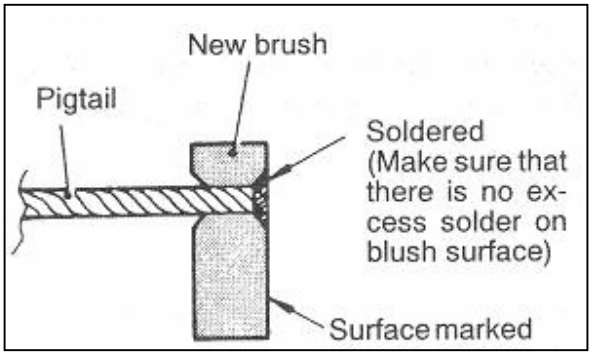


Fig. 9-23

Brushes that are worn beyond wear limit line, or are oil-soaked, should be replaced.

When replacing field coil brushes, crush worn brush with pliers, taking care not to damage pigtail.

Sand pigtail end with sandpaper to ensure good soldering.

Insert pigtail into hole provided in new brush and solder it.

Make sure that pigtail and excess do not come out onto brush surface.

When replacing ground brush, slide the brush from brush holder by prying retainer spring back.

6）Armature test

（1）Armature short-circuit test（see Fig.9-24）

① Place Armature in a growler.
② Hold a thin steel blade parallel and just above while rotating armature slowly in growler. A shorted armature will cause blade to vibrate and be attracted to the core. Replace shorted armature.

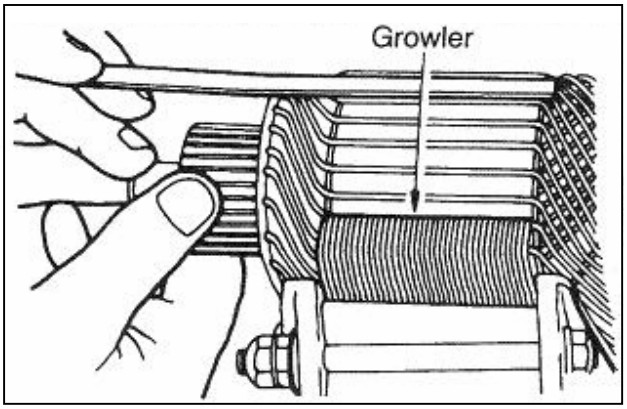


Fig. 9-24

（2）Armature coil earth test（see Fig.9-25）

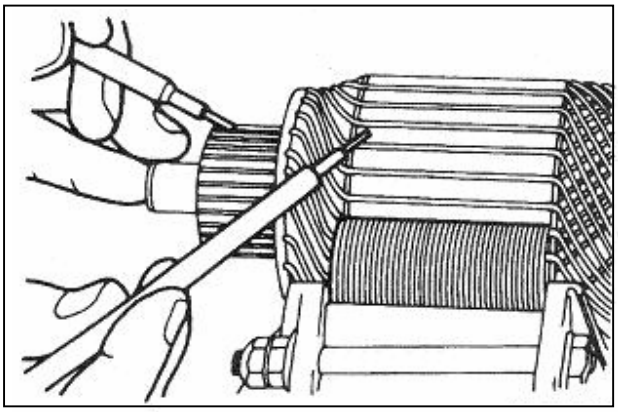


Fig. 9-25

Check the insulation between each commutator segment and armature coil core.
If there is no continuity, the insulation is in order.

（3）Armature coil open-circuit inspection（see Fig.9-26）

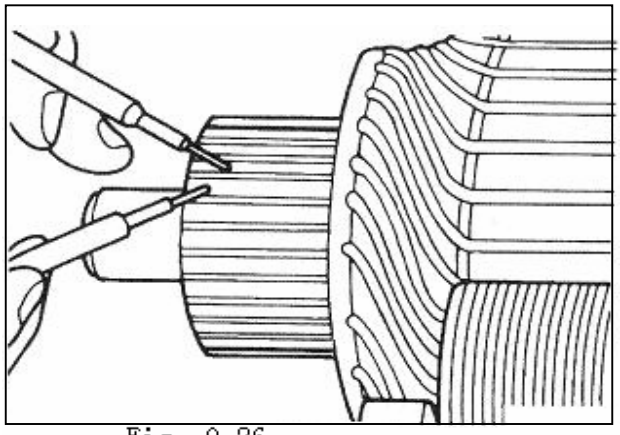


Fig. 9-26

Check the continuity between segments. If there is continuity, the coil is in order.

9.2 Charging System

1. GENERAL INFORMATION

The charging system uses the alternator output to keep the battery charged at a constant level under various electrical loads.

Operation

Rotation of the excited field coil generates AC voltage in the stator. This alternating current is rectified through diodes to DC voltage having a waveform shown in the fig.9-27. The average output voltage fluctuates slightly with the alternator load condition.

When the ignition switch is turned on, current flows in the field coil and initial excitation of the field coil occurs. When the stator coil begins to generate power after the engine is started, the field coil is excited by the output current of the stator coil.

The alternator output voltage rises as the field current increases and it falls as the field current decreases. When the battery voltage (alternator S terminal voltage) reaches a regulated voltage of approx. 14.4 V, the field current is cut off. When the battery voltage drops below the regulated voltage, the voltage regulator regulates the output voltage to a constant level by controlling the field current.

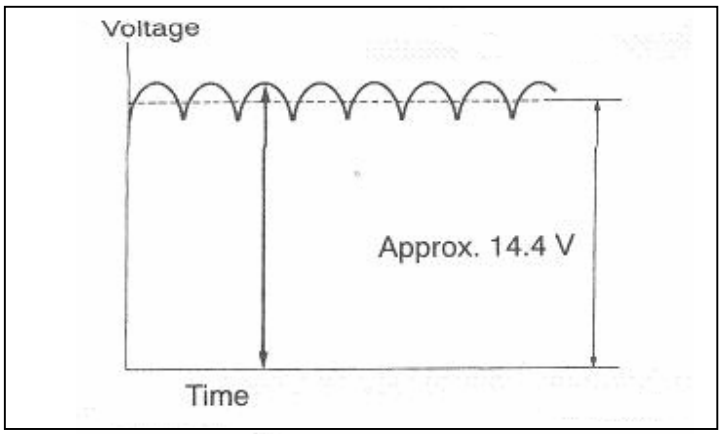


Fig. 9-27

Alternator specifications see Table 9-3

Table 9-3

Items	Specifications
Type	Battery voltage sensing
Rated output (V/A)	12/85
Voltage regulator	Electronic built-in type

Charging system diagram as shown in Fig. 9-28.

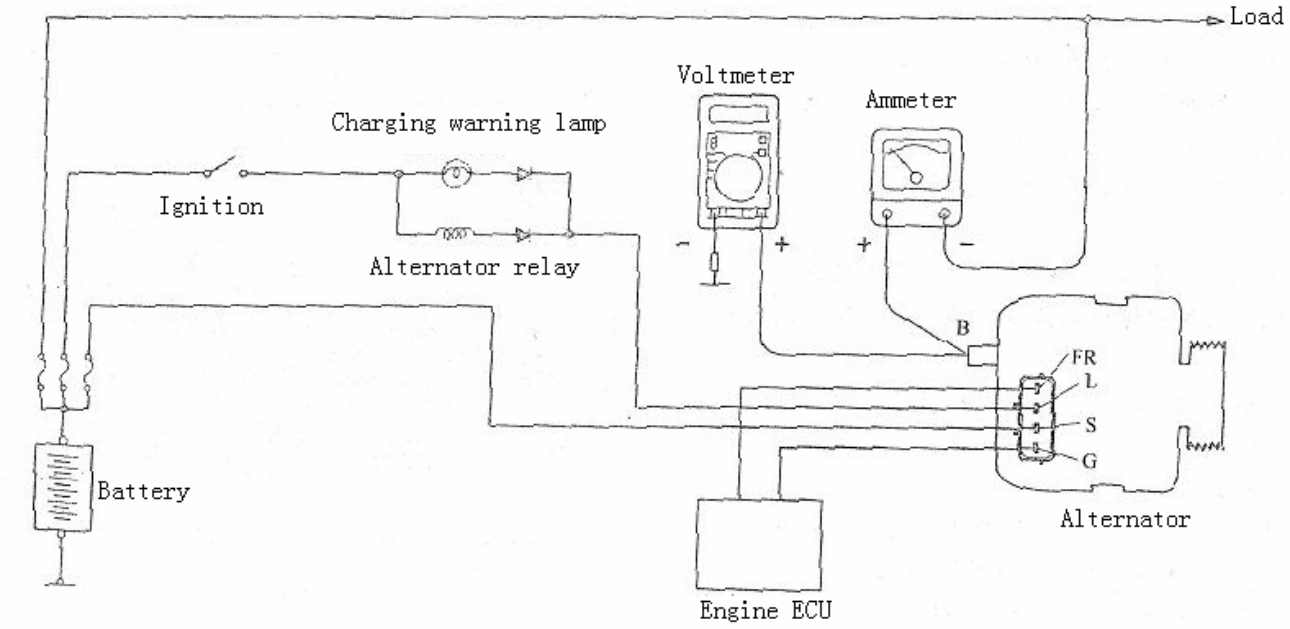


Fig. 9-28

Service specifications see Table 9-4。

Table 9-4

Items		Standard value	limit
Alternator out line voltage drop (at30A) (V)		-	Max.0.3
Regulated voltage ambient temp. at voltage regulator (V)	-20℃	14.2~15.4	-
	20℃	13.9~14.9	-
	60℃	13.4~14.6	-
	80℃	13.1~14.5	-
Output current		-	70% of normal output current

Special tool see Table 9-5

Table 9-5

Tool	Name	Use
Add diagram	Alternator test harness	Checking the alternator (S terminal voltage)

2.ON-VEHICLE SERVICE

1) **Alternator output line voltage drop test** (see Fig.9-29)

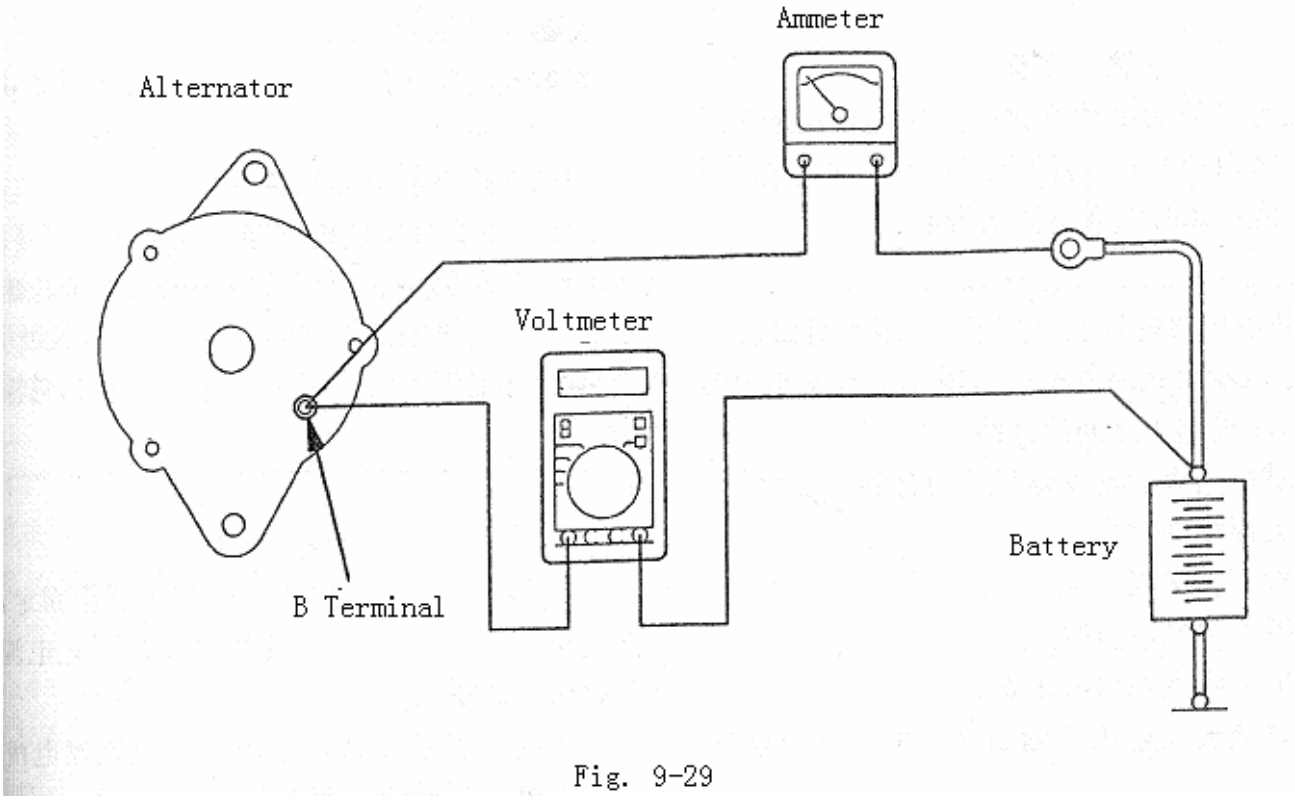


Fig. 9-29

This test determines whether the wiring from the alternator “B” terminal to the battery (+) terminal (including the fusible line) is in a good condition or not.

(1) Always be sure to check the following before the test.
① Alternator installation
② Alternator drive belt tension
③ Fusible link
④ Abnormal noise from the alternator while the engine is running
(2) Turn the ignition switch to the “LOCK” (OFF) position.
(3) Disconnect the negative battery cable.
(4) Disconnect the alternator output wire from the alternator “B” terminal and connect a DC test ammeter with a range of 0~100A in series between the “B” terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the “B” terminal, and then connect the (-) lead of the ammeter to the disconnected output wire.)

Note
An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended. Using this equipment will lessen the possibility of a voltage drop caused by a loose “B” terminal connection.

(5) Connect a digital-type voltmeter between the alternator “B” terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the “B” terminal and then connect the (-) lead of the voltmeter to the battery (+) cable.)
(6) Reconnect the negative battery cable.
(7) Connect a tachometer or the MUT－Ⅱ.
(8) Leave the hood open.
(9) Start the engine.
(10) With the engine running at 2500 r/min, turn the headlamps and other lamps on and off to adjust the alternator load so that the value displayed on the ammeter is slightly

above 30A. Adjust the engine speed by gradually decreasing it until the value displayed on the ammeter is 30A. Take a reading of the value displayed on the voltmeter at this time.

Limit max 0.3V

Note
When the alternator output is high and the value displayed on the ammeter does not decrease until 30A, set the value to 40 A. Read the value displayed on the voltmeter at this time. When the value range is 40A, the limit is max. 0.4V.

(11) If the value displayed on the voltmeter is above the limit value, there is probably a malfunction in the alternator output wire, so check the wiring between the alternator "B" terminal and the battery (+) terminal.

(12) After the test, run the engine at idle.

(13) Turn off all lamps and the ignition switch.

(14) Remove the tachometer or the MUT－Ⅱ.

(15) Disconnect the negative battery cable.

(16) Disconnect the ammeter and voltmeter.

(17) Connect the alternator output wire to the alternator "B" terminal.

(18) Connect the negative battery cable.

2） Output current test（see Fig.9-30）

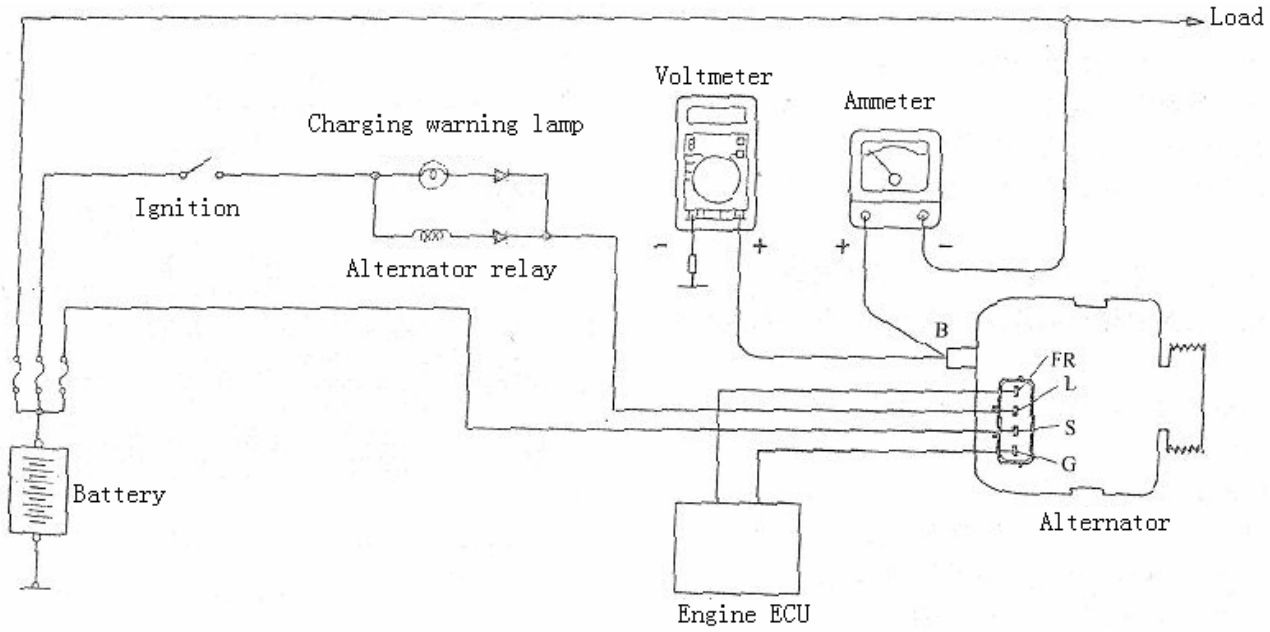


Fig. 9-30

Note
The battery should be slightly discharged. The load needed by a fully-charged battery is insufficient for an accurate test.

This test determines whether the alternator output current is normal.

（1）Always be sure to check the following before the test.

- Alternator installation
- Battery
- Alternator drive belt tension

• Fusible link
• Abnormal noise from the alternator while the engine is running

(2) Turn the ignition switch to the "LOCK" (OFF) position.
(3) Disconnect the negative battery cable.
(4) Disconnect the alternator output wire from the alternator "B" terminal and connect a DC test ammeter with a range of 0~100A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (-) lead of the ammeter to the disconnected output wire.)

Caution

Never use clips but tighten bolts and nuts to connect the line. Otherwise loose connections (e.g. using clips) will lead to a serious accident because of high current

Note

An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended.

(1) Connect a voltmeter with a range of 0-20V between the alternator "B" terminal and the earth. (Connect the (+) lead of the voltmeter to the "B" terminal and then connect the (-) lead of the voltmeter to the earth.)
(2) Connect the negative battery cable.
(3) Connect a tachometer or the MUT－Ⅱ.
(4) Leave the hood open.
(5) Check that the reading on the voltmeter is equal to the battery voltage.

Note

If the voltage is 0V, the cause is probably an open circuit in the wire or fusible link between the alternator "B" terminal and the battery (+) terminal.

(1) Turn the light switch on to turn on headlamps and then start the engine.
(2) Immediately after setting the headlamps to high beam and turning the heater blower switch to the high revolution position, increase the engine speed to 2500 r/min and read the maximum current output value displayed on the ammeter.
Limit: 70% of normal current output.

Note

• For the nominal current output, refer to the Alternator Specifications.
• Because the current from the battery will soon drop after the engine is started, the above step should be carried out as quickly as possible in order to obtain the maximum current output value.
• The current output value will depend on the electrical load and the temperature of the alternator body.
• If the electrical load is small while testing, the specified level of current may not be output even through the alternator is normal. In such cases, increase the electrical load by leaving the headlamps turned on for some time to discharge the battery or by using the lighting system in another vehicle, and then test again.
• The specified level of current also may not be output if the temperature of the alternator body or the ambient temperature is too high. In such cases, cool the alternator and then test again.

(3) The reading on the ammeter should be above the limit value. If the reading is below the limit value and the alternator output wire is normal, remove the alternator from the engine and check the alternator.
(4) Run the engine at idle after the test.
(5) Turn the ignition switch to the "LOCK" (OFF).

(6) Remove the tachometer or the MUT－Ⅱ.
(7) Disconnect the negative battery cable.
(8) Disconnect the ammeter and voltmeter.
(9) Connect the alternator output wire to the alternator “B” terminal.
(10) Connect the negative battery cable.

3) **Regulated voltage test** (see Fig.9－31)

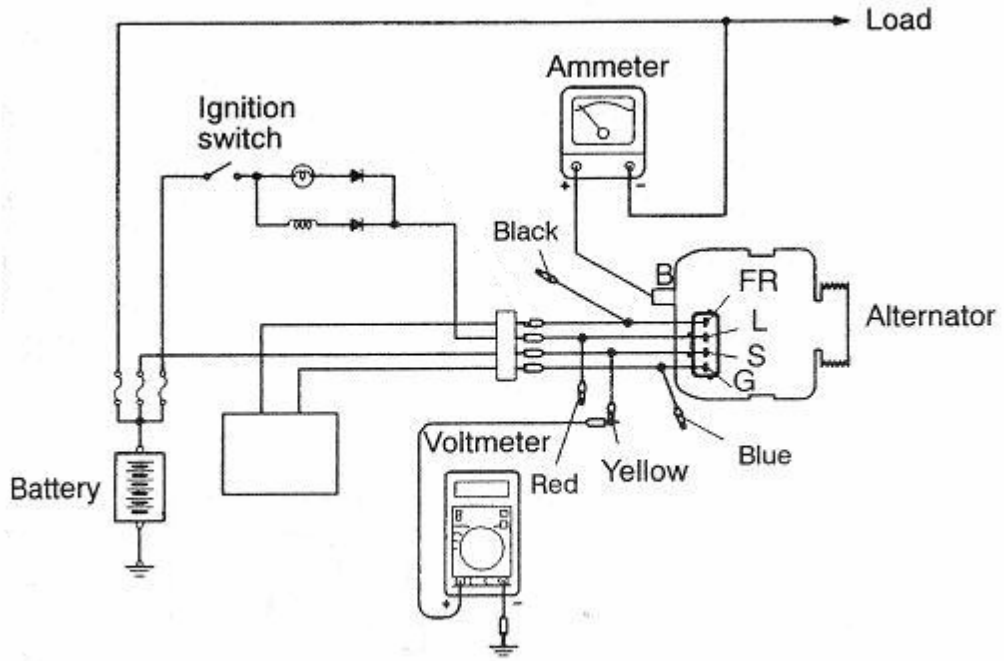


Fig.. 9-31

This test determines whether the voltage regulator is correctly controlling the alternator output voltage. alternator output current is normal.

(1) Always be sure to check the following before the test.
- Alternator installation
- Check that the battery installed in the vehicle is fully charged
- Alternator drive belt tension
- Fusible link
- Abnormal noise from the alternator while the engine is running

(2) Turn the ignition switch to the “LOCK” (OFF) position.
(3) Disconnect the negative battery cable.
(4) Use the special tool(Alternator test harness) to connect a digital voltmeter between the alternator S “B” terminal and earth (Connect the (+) lead of the voltmeter to the “S” terminal, and then connect the (-) lead of the voltmeter to a secure earth or to the battery (-) terminal.)
(5) Disconnect the alternator output wire from the alternator “B” terminal.
(6) Connect a DC test ammeter with a range of 0-100A in series between the “B” terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the “B” terminal. Connect the (-) lead of the ammeter to the disconnected output wire.)
(7) Connect the negative battery cable.
(8) Connect a tachometer or the MUT－Ⅱ.

(9) Turn the ignition switch to the ON position and then check that the reading on the voltmeter is equal to the battery voltmeter.

Note
If the voltage is 0V, the cause is probably an open circuit in the wire or fusible link between the alternator “B” terminal and the battery (+) terminal.

(10) Turn all lamps and accessories off.
(11) Start the engine.
(12) Increase the engine speed to 2500r/min.
(13) Read the Value displayed on the voltmeter when the alternator output current alternator becomes 10A or less.
(14) If the voltage reading conforms to the value in the voltage regulation, then the voltage regulator is operating normally. If the voltage is not within the standard value, there is a malfunction of the voltage regulator or of the alternator.
Voltage regulation see table 9-6。

Table 9-6

Inspection terminal	Voltage regulator ambient temperature (℃)	Voltage (V)
Terminal S	-20	14.20～15.4
	20	13..9～14.9
	60	13.4～14.6
	80	13.1～14.5

(15) After the test, lower the engine speed to the idle speed.
(16) Turn the ignition switch to the “LOCK”(OFF).
(17) Remove the tachometer or the MUT－Ⅱ.
(18) Disconnect the negative battery cable.
(19) Disconnect the ammeter and voltmeter.
(20) Connect the alternator output wire to the alternator “B” terminal.
(21) Remove the special tool, and return the connector to the original condition.
(22) Connect the negative battery cable.

3. Alternator removal and installation

Removal steps see Fig.9-32。

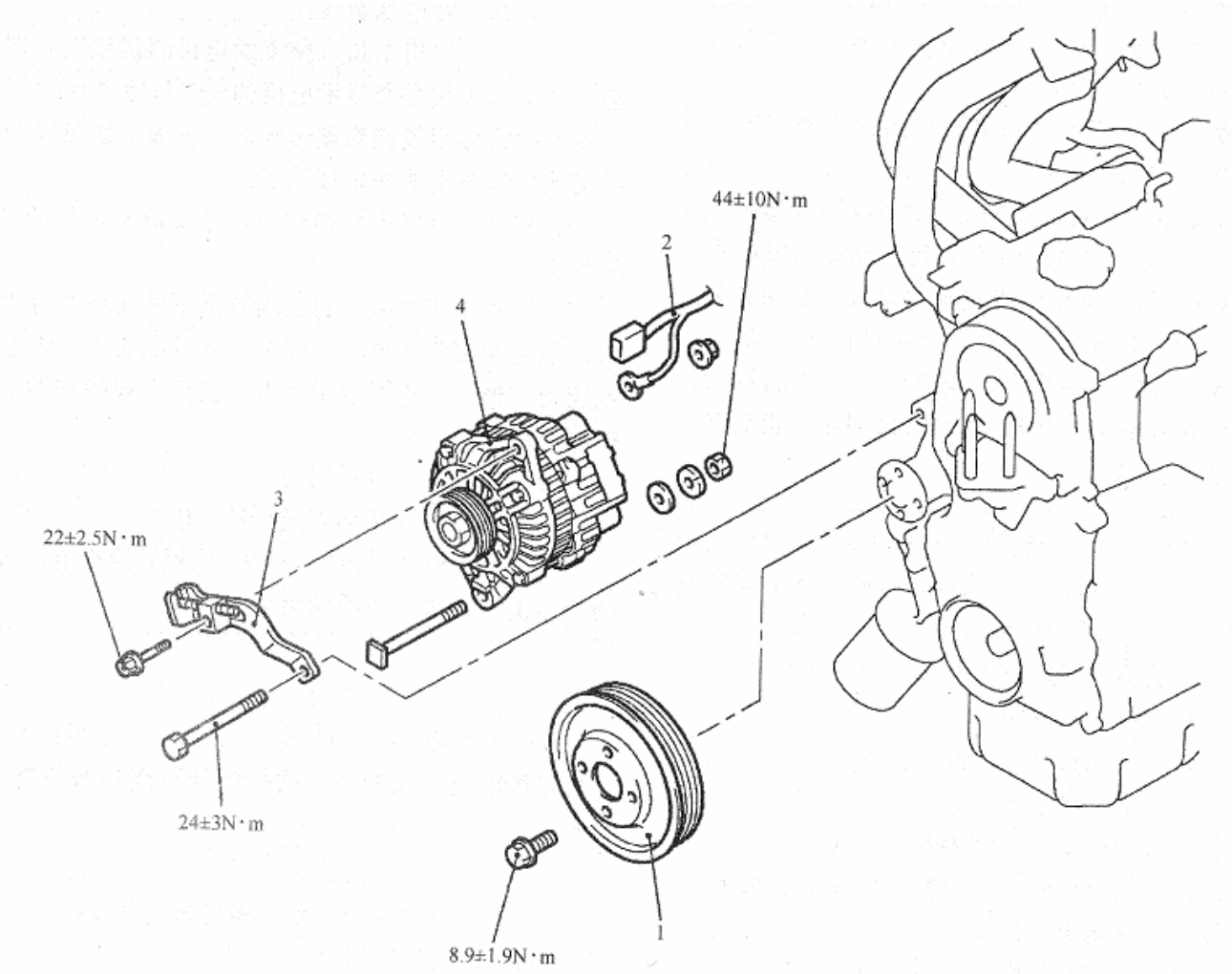
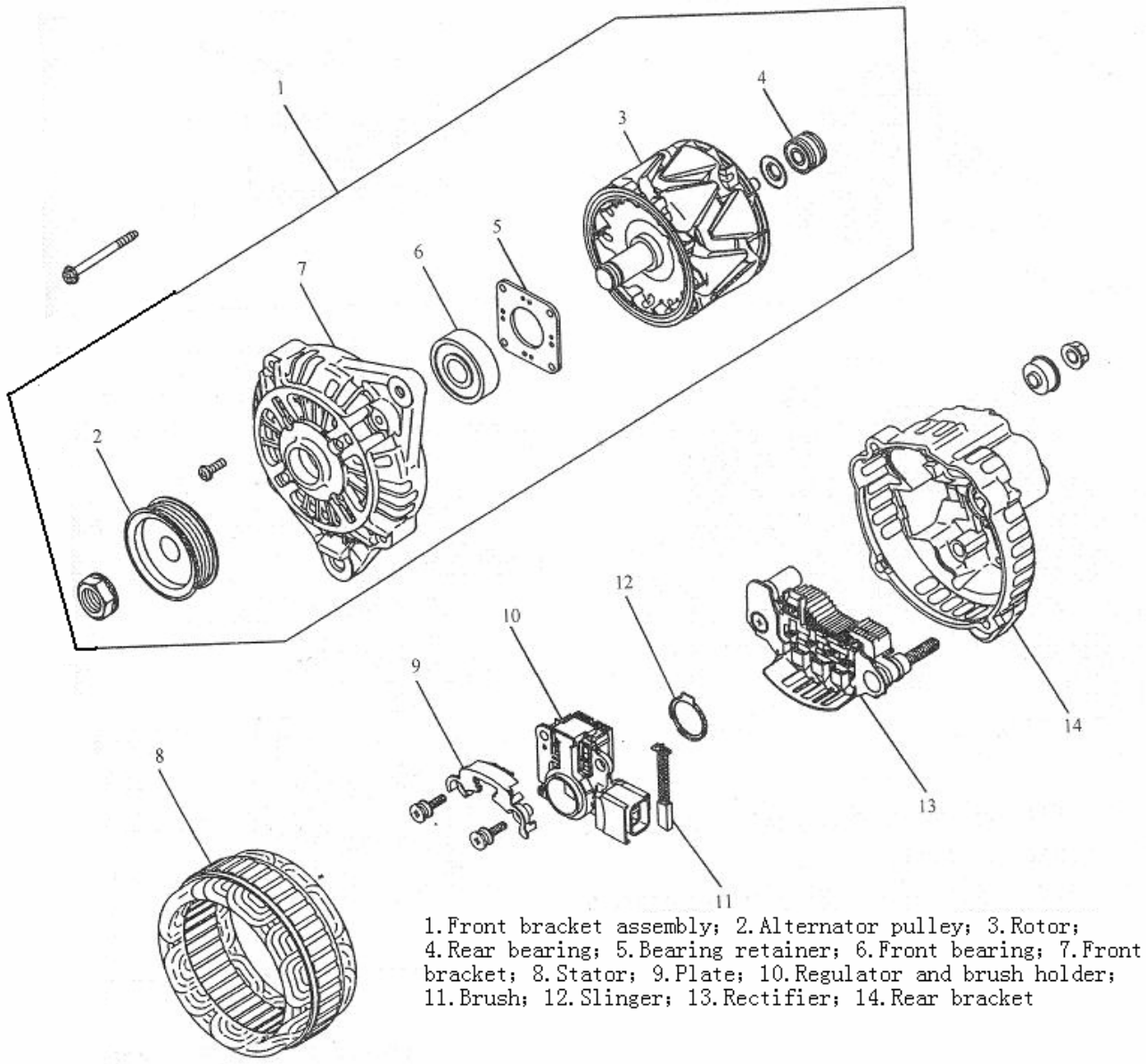


Fig. 9-32

1.Water pump pully, 2.Alternator, 3.Alternator brace, 4.Alternator

1）**Disassembly and reassembly**

Disassembly steps see Fig.9-33：



1.Front bracket assembly; 2.Alternator pulley; 3.Rotor; 4.Rear bearing; 5.Bearing retainer; 6.Front bearing; 7.Front bracket; 8.Stator; 9.Plate; 10.Regulator and brush holder; 11.Brush; 12.Slinger; 13.Rectifier; 14.Rear bracket

Fig. 9-33

2）**Disassembly service point**

（1）Front bracket assembly Removal（see Fig.9-34）

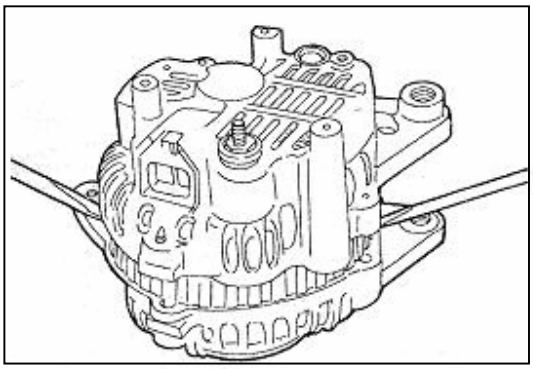


Fig. 9-34

Insert a flat-tipped screwdriver between front bracket and stator core and pry downwards. Removal the front bracket from the stator.

Caution
Do not insert a screwdriver too sleep, as the stator coil will be damaged.

(2) Alternator pulley removal (see Fig.9-55)

Clamp the rotor in a table vice, let pulley upwards , removal the pulley.

Caution
Don’ t damage the pulley.

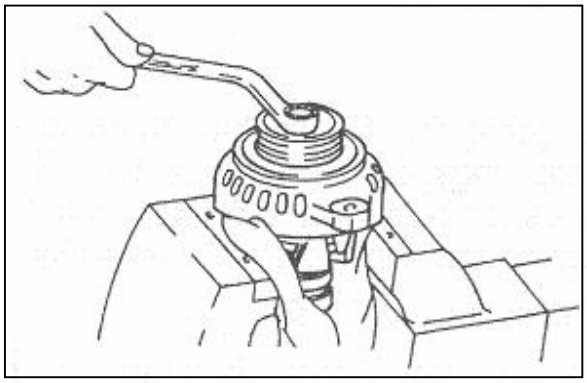


Fig.9-35

(3) Stator/regulator Removal (see Fig.9-36)

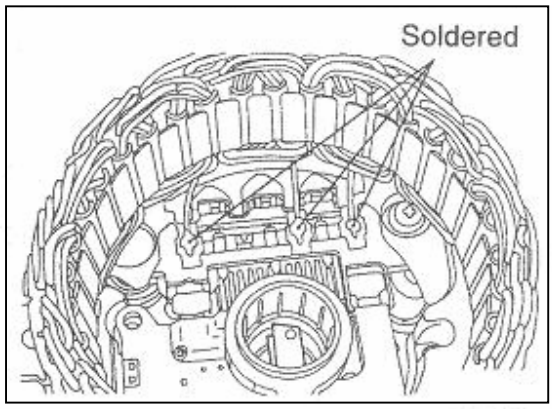


Fig. 9-36

(1) When removing stator, unsolder stator leads soldered to main diodes on rectifier.

(2) When removing rectifier from brush holder, unsolder soldered points to rectifier.

Caution

- When soldering or unsoldering, use care to make sure that heat of soldering iron is not transmitted to diodes for a long period. Finish soldering or unsoldering in as short a time as possible.
- Use care that no undue force is exerted to leads of diodes.

3) **Reassembly service point**

(1) Regulator installation (see Fig.9-37、9-38)

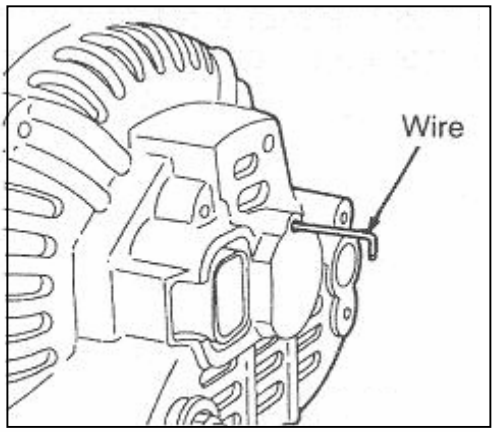


Fig. 9-37

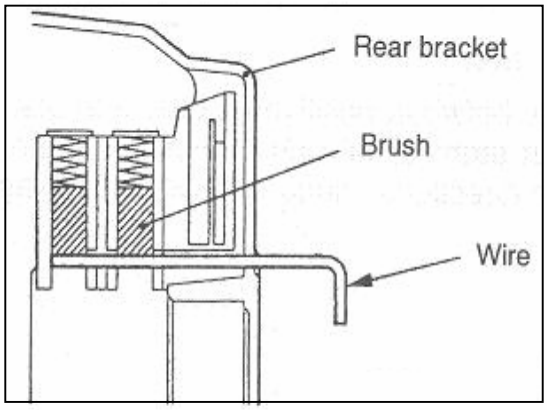


Fig. 9-38

After regulator installing, push brush into rear bracket, insert wire through small hole made in rear bracket to lift brush

Caution
Insert wire to lift brush, then the rotor will be ease to installing.

(2) Rotor installation (see Fig.9-39)

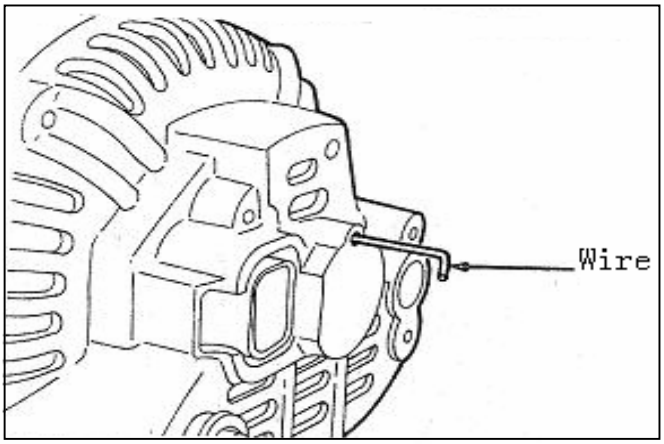


Fig. 9-39

After rotor has been installed, remove the wire.

4) Inspection

(1) Rotor assembly

① Check that there is continuity between rotor coil and slip rings. If resistance exceed standard value, replace rotor (see Fig.9-40) 。

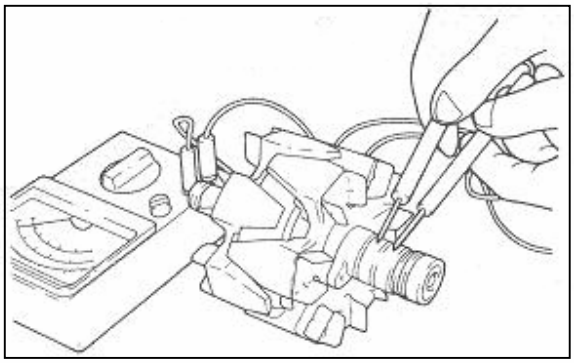


Fig. 9-40

Standard value: 3-5Ω

② Check that there is no continuity between slip ring and core. If there is continuity , replace rotor assembly (see Fig.9-41) 。

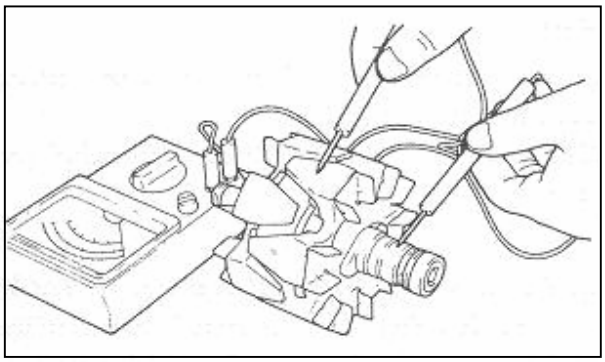


Fig. 9-41

(2) Stator

① Make continuity test on stator coil. Check that there is continuity between coil and core. If there is no continuity, replace stator assembly. (see fig.9-42) 。

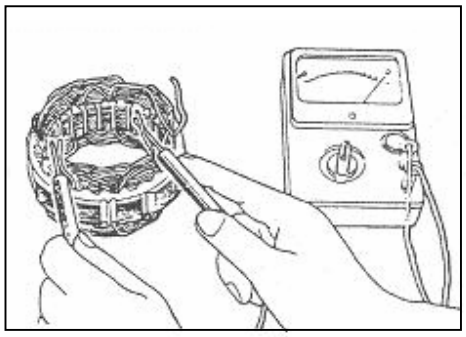


Fig. 9-42

② Make coil for earth. Check that there is continuity between coil and core. If there is continuity, replace stator assembly. (see fig.9-43)

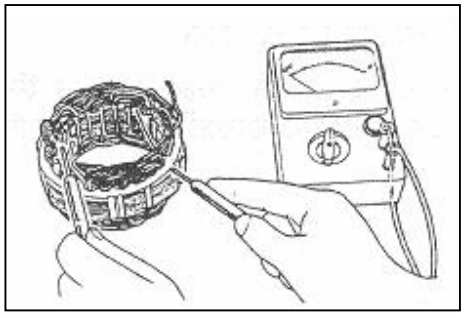


Fig. 9-43

(3) Rectifiers

①Positive rectifier test

Check for continuity between positive rectifier and stator coil lead connection terminal with an ohmmeter. If there is continuity in both directions, diode is shorted. Replace rectifier assembly. (see Fig.9-44) .

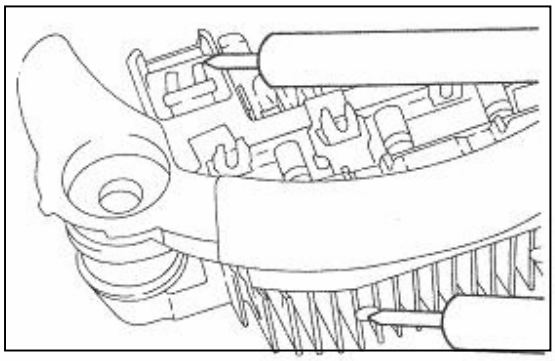


Fig. 9-44

②Negative rectifier test

Check for continuity between negative rectifier and stator coil lead connection terminal. If there is continuity in both directions, diode is shorted, and rectifier assembly must be replaced. (see Fig.9-45)

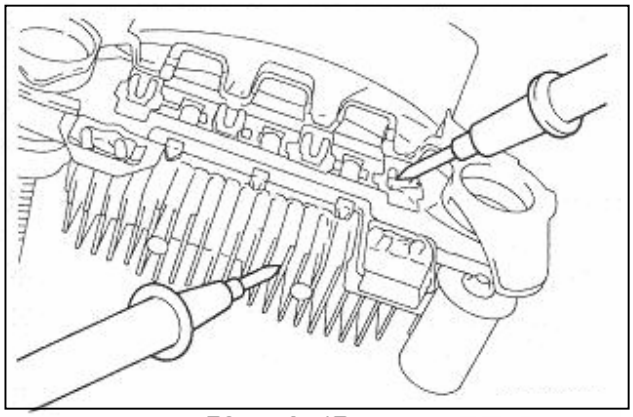


Fig. 9-45

③Diode trio test

Check three diodes for continuity by connect an ammeter to both ends of each diode. (see Fig.9-46).

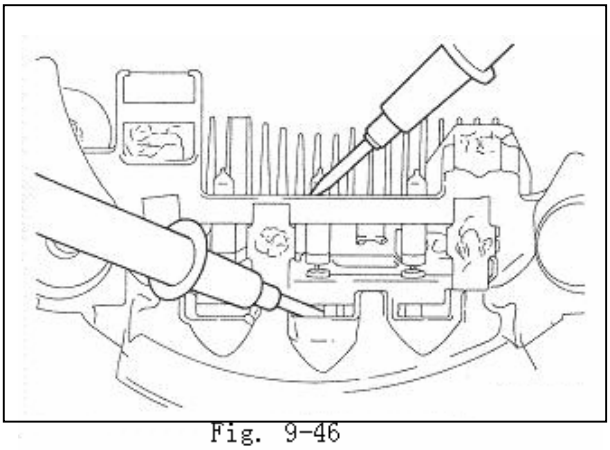


Fig. 9-46

If there is no continuity in both directions diode is faulty and rectifier assembly must be replaced.

（4）Brush replacement

① Replace brush by the following procedures if it has been worn to limit line as shown in Fig. 9-47.

Limit line：2mm

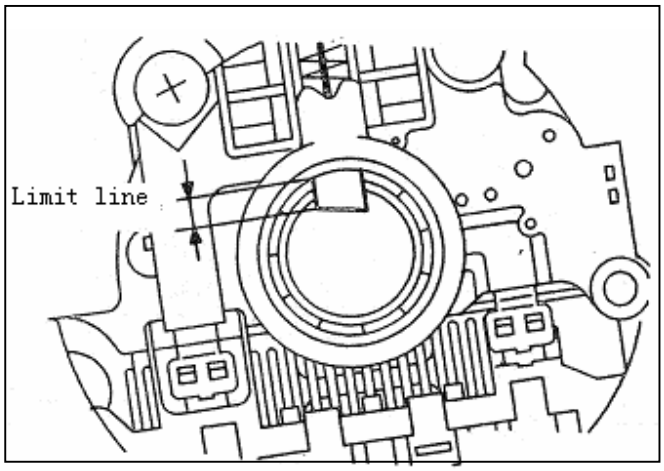


Fig. 9-47

② Unsolder pigtail and remove old brush and spring.。

③ When installing a new brush, push the brush in the brush holder as shown in Fig. 9-48,and solder the lead wire.

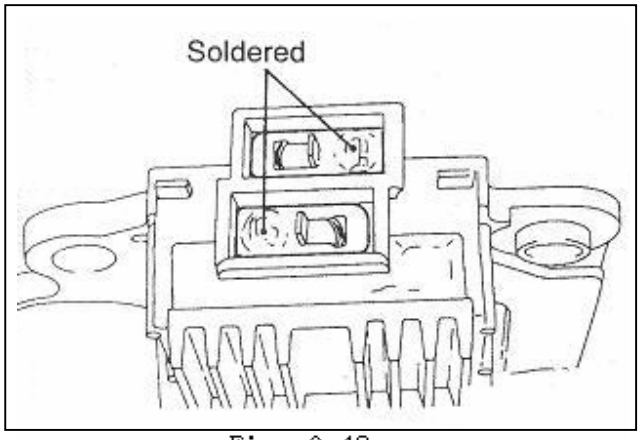


Fig. 9-48

9.3 Ignition System

1. GENERAL INFORMATION

The system is equipped with two ignition coils (A and B) with built-in power transistors for the NO.1 and NO.4 cylinders and the NO.2 and NO.3 cylinders respectively.

Interruption of the primary current flowing in the primary side of ignition coil A generates a high voltage in the secondary side of ignition coil A. The high voltage thus generated is applied to the spark plugs of NO.1 and NO.4 cylinders to generate sparks. Although the sparks are generated at both spark plugs, one cylinder is at the compression

stroke, the other cylinder is at the exhaust stroke, so that ignition of the compressed air/fuel mixture occurs only for the cylinder which is at the compression stroke.

In the same way, when the primary current flowing in ignition coil B is interrupted, the high voltage thus generated is applied to the spark plugs of NO.2 and NO.3 cylinders.

The engine ECU turns the two power transistors inside the ignition coils alternately on and off .This causes the primary currents in the ignition coils to be alternately interrupted and allowed to flow to fire the cylinders in the order 1-3-4-2 .

According to the signals from the camshaft position sensor and the crank angle sensor the engine ECU determines which ignition coil should be controlled .It also detects the crankshaft position , in order to provide ignition at the most appropriate timing in response to the engine operation conditions.

When the engine is cold or running at high altitudes, the ignition timing is slightly advanced to provide optimum performance.

Ignition system see Fig.9-49.

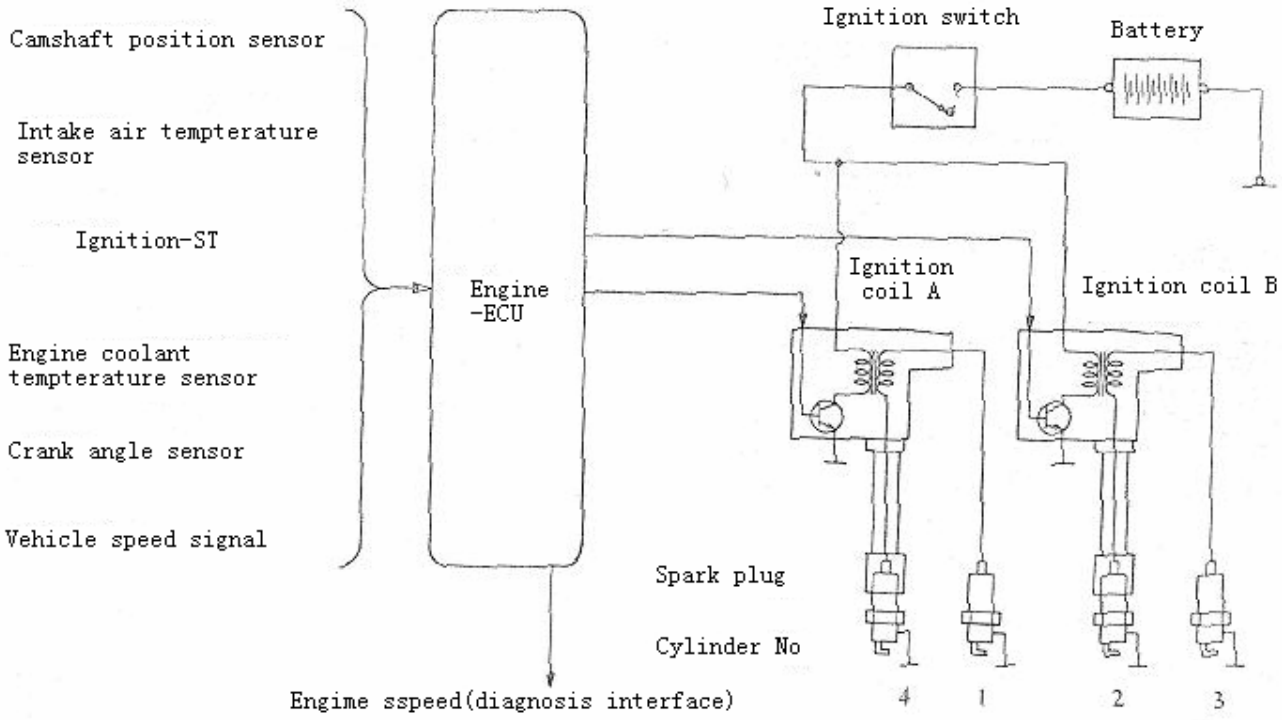


Fig. 9-49 Uaes-Delphi EMS

Ignition coil specifications(Table 9-7)

Table 9-7

Items	Specification
Type	Two coils

2. ON-VEHICLE SERVICE

1) Ignition coil (with built-in power transistor)check, see Fig.9-50.

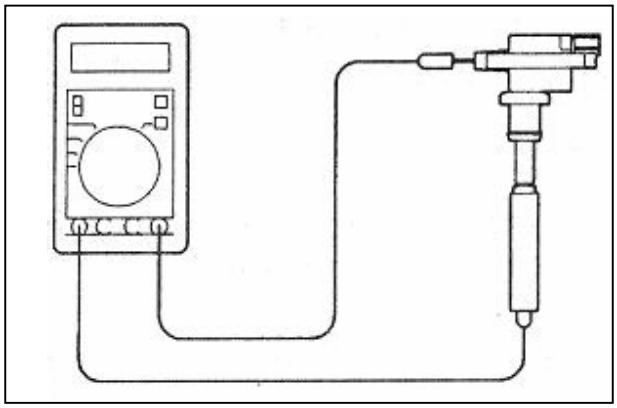


Fig. 9-50

Check by the following procedure ,and replace it if there is a malfunction.
Secondary coil resistance check ;
Measure the resistance between the high-voltage terminals of the ignition coil.
Standard value:11.7～14.3 kΩ

2) Primary coil and power transistor continuity check(Fig.9-51)

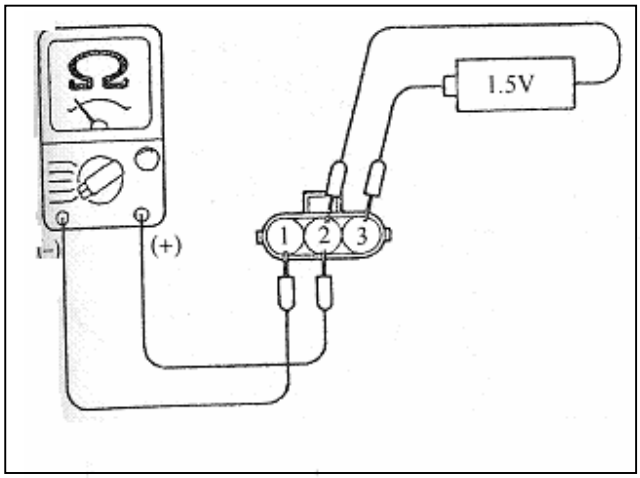
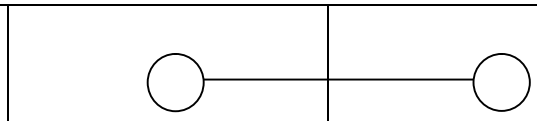


Fig. 9-51

An analogue-type circuit tester should be used. Connect the positive (+) (red) prove of the circuit tester to terminal 2;Connect the negative(-)(black) prove of the circuit tester to terminal 1.

Check the continuity between terminal 1 and terminal 2 when current is flowing or not.

	Terminal No.		
Voltage :1.5 V	1	2	3
When current is flowing			

When current is not flowing			

3) Resistive cord check (Fig.9-52)

Measure the resistance of the all spark plug cables.

Limit : max 22 KΩ

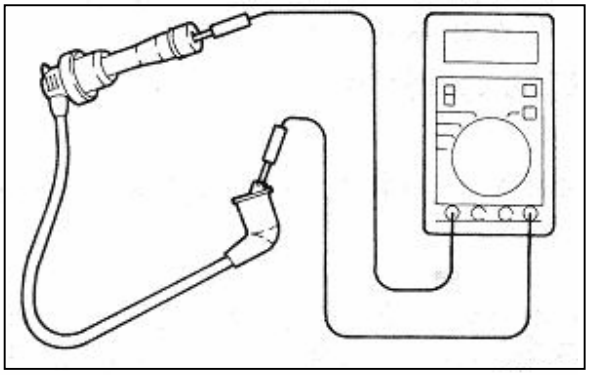


Fig. 9-52

4）Spark plug check 、 cleaning and change(Fig.9-53)

(1) Check the electrode for burned cuts, the ceramic insulator for damage and if the spark plug is well burned.

(2) If the spark plug must be cleaned due to deposits, use a spark plug cleaner or a wire brush.

(3) Use a plug gap gauge to check the spark plug gap and adjust it if the plug gap is not within the standard value range.

Standard value: 1.0-1.1 mm

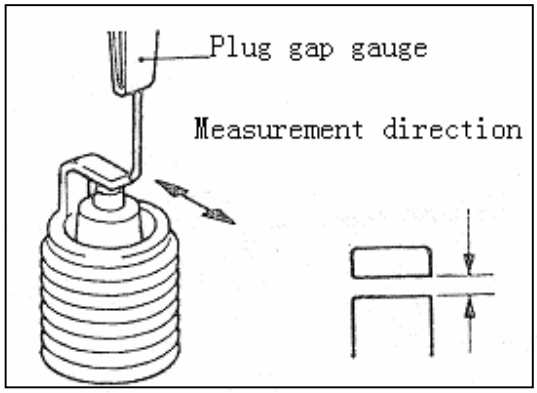


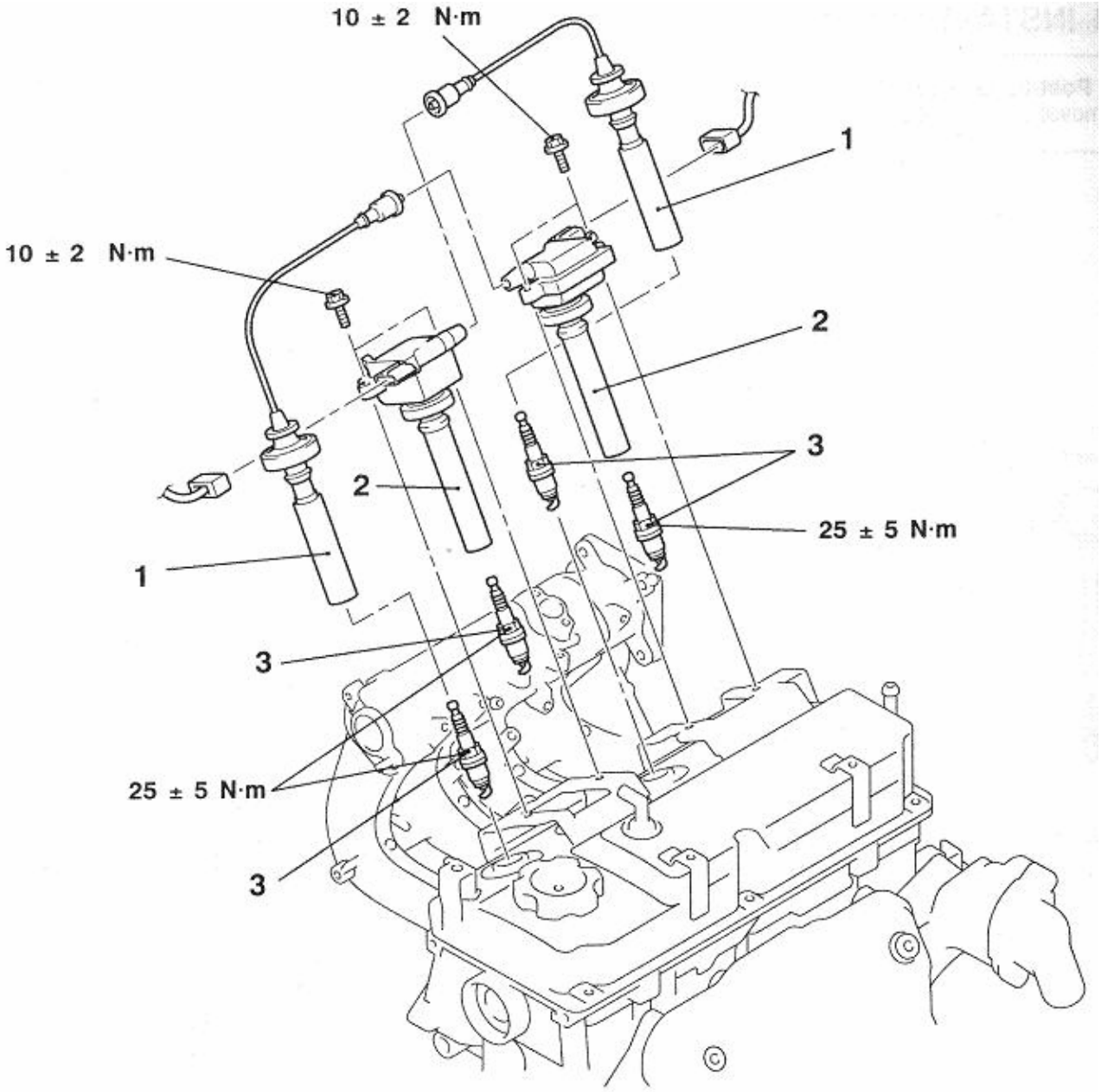
Fig. 9-53

3. Ignition advice removal and installation

1) Ignition coil

Removal and installation

Removal steps see Fig.9-54:



1. Spark plug cable, 2. Ignition, 3. Spark plug

Fig. 9-54

2) Camshaft position sensor

Removal and installation

Removal steps see Fig. 9-55:

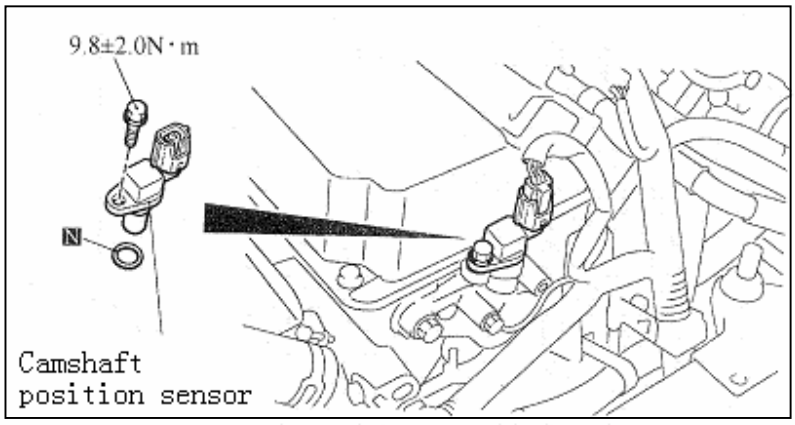


Fig. 9-55

3) Crank angle sensor
removal and installation
Removal steps see Fig.9-56:

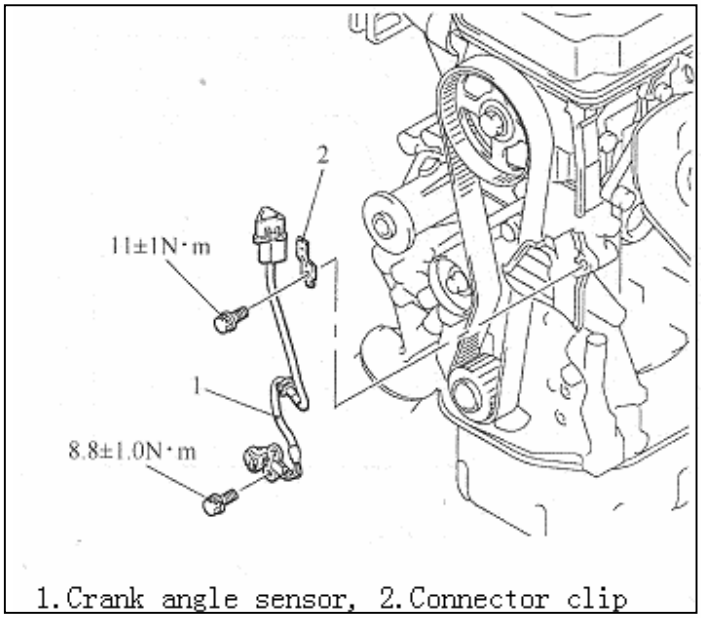


Fig. 9-56

10 Engine and Emission Control System

10.1 Engine Control System

1. SERVICE SPECIFICATION(Table 10-1)

Table 10-1

Items	Standard value
Engine idle speed(rpm)	750±50
Accelerator cable play(mm)	1～2

2 .ON-VEHICLE SERVICE

(1) ACCELERATOR CABLE CHECK AND ADJUSTMENT

- Make the vehicle be in the status before check.
- Confirm idle speed is at prescribed value.
  Standard value：750±50rpm

> Caution
> Idle speed running controlled by ISC system need not adjust. Check fuel control system if necessary.

- Stop engine(ignition switch OFF)；
- Confirm there is no sharp bend in accelerator cable.
- Check accelerator cable play.
  Standard value：1～2mm

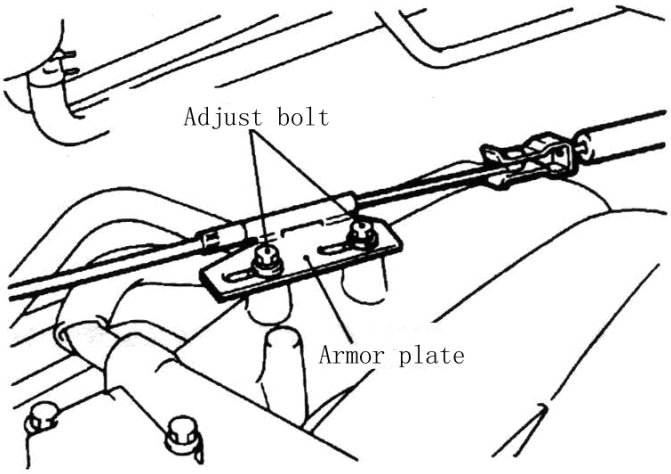


Fig.10-1

If accelerator cable play is not within the standard value, adjust play by the

following procedures.

a) Loosen adjusting bolts.

b) Move the plate until the accelerator cable play is at the standard value, and then tighten the adjusting bolt to the specified torque.

Tighten torque: 4.9±1.0N·m

(2) Accelerator cable and pedal removal and installation

Pre-removal and Post-installation Operation

- Cable adjustment;
- Engine lid removal and installation

Removal steps (see Fig.10-2)

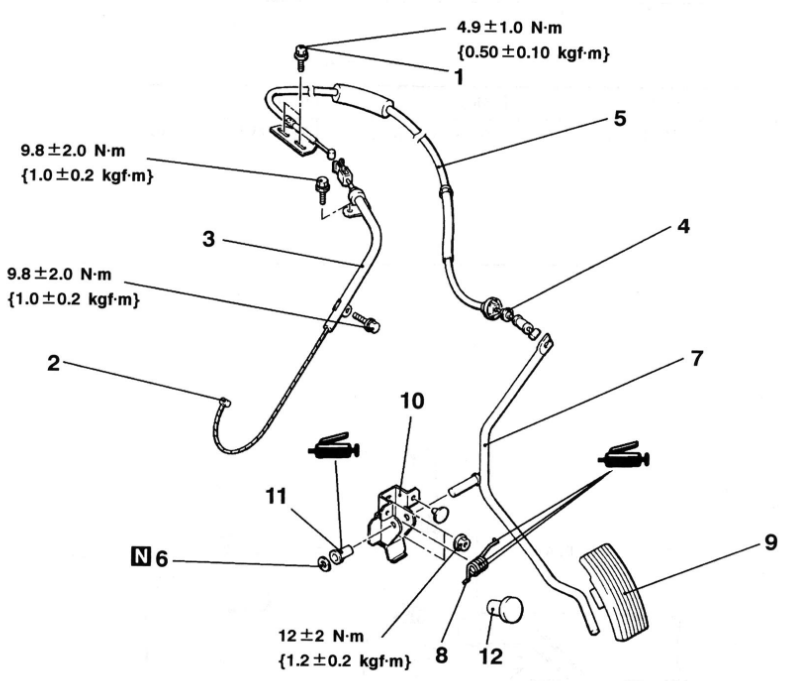


Fig. 10-2

1. Adjusting bolt 2.Stopper 3. Bushing 4. Connecting bushing

5.Accelerator cable 6.Open ring 7.Accelerator arm 8.Spring 9.Pedal

10. Accelerator pedal bracket

10.2 Emission System

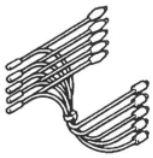
1 SERVICE SPECIFICATION

Table 10-2

Items	Standard value
Purge control solenoid valve coil resistance	36～44
EGR valve coil resistance(at 20℃)	10～20

SPECIAL TOOL

Table 10-3

Items	Number	Name	Use
 B991658	MB991658	Test harness set	Inspection of EGR valve

2 ON-VEHICLE SERVICE

(1) SYSTEM DIAGRAM (see Fig.10-3)

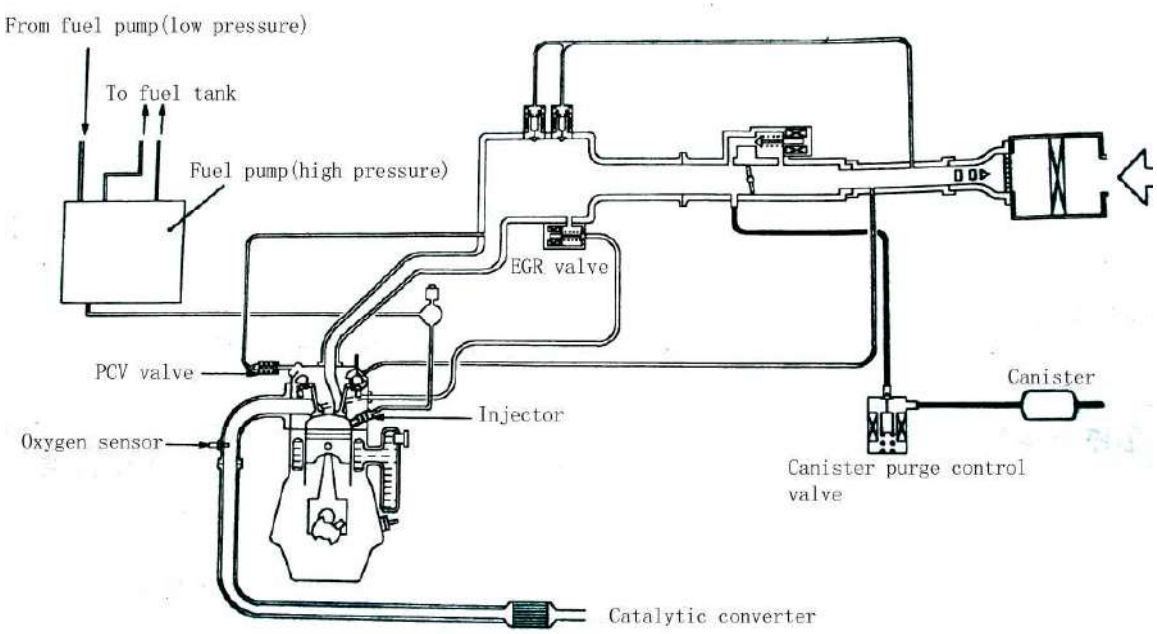


Fig. 10-3

(2) VACUUM HOSE PIPING DIAGRAM (see Fig.10-4)

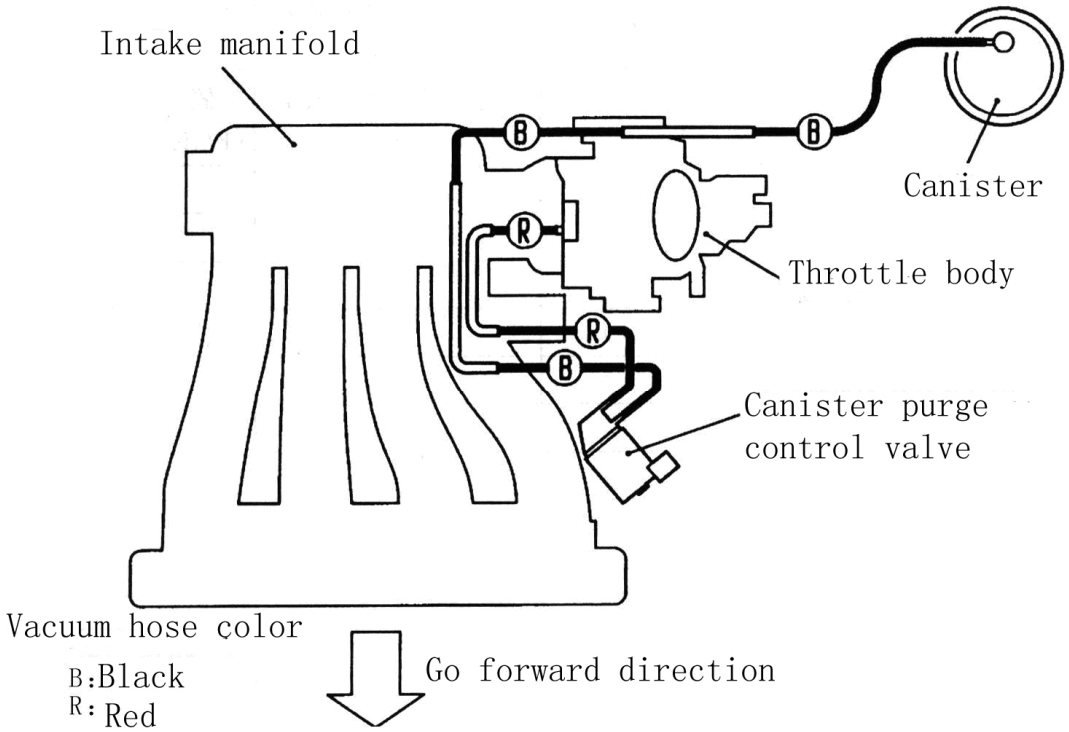


Fig. 10-4

●CHECK

• Using the piping diagram as a guide, check to be sure that the vacuum hoses are correctly connected.

• Check the connection condition of vacuum hoses, (removed, loose, etc) and check to be sure that there are no bends or damages.

(3) EMISSION CONTROL DEVICE REFERENCE Table(Table 10-4)

Table 10-4

Related parts	Air-fuel ratio control system	Leak gas deoxidization system	Evaporative emission control system	Exhaust gas recirculation system	Catalytic converter
Engine ECU	○				
Oxygen sensor	○				
Intake temperature sensor	○				
Intake pressure sensor	○				

Water temperature sensor	○				
Throttle position sensor	○				
Crankshaft speed sensor	○				
Cam position sensor	○				
Fuel injector	○				
Positive crankcase ventilation valve (PCV valve)		○			
Canister			○		
Purge control solenoid valve			○		
EGR valve				○	
Three-way catalytic converter					○

(4) EMISSION CONTROL DEVICE CHECK

Caution
Device check should be carried out after the engine check has be finished.

1) Air-fuel ratio control device. Refer to on-vehicle service.

2) POSITIVE CRANKCASE VENTILATION SYSTEM DIAGRAM(see Fig.10-5,Fig.10-6)

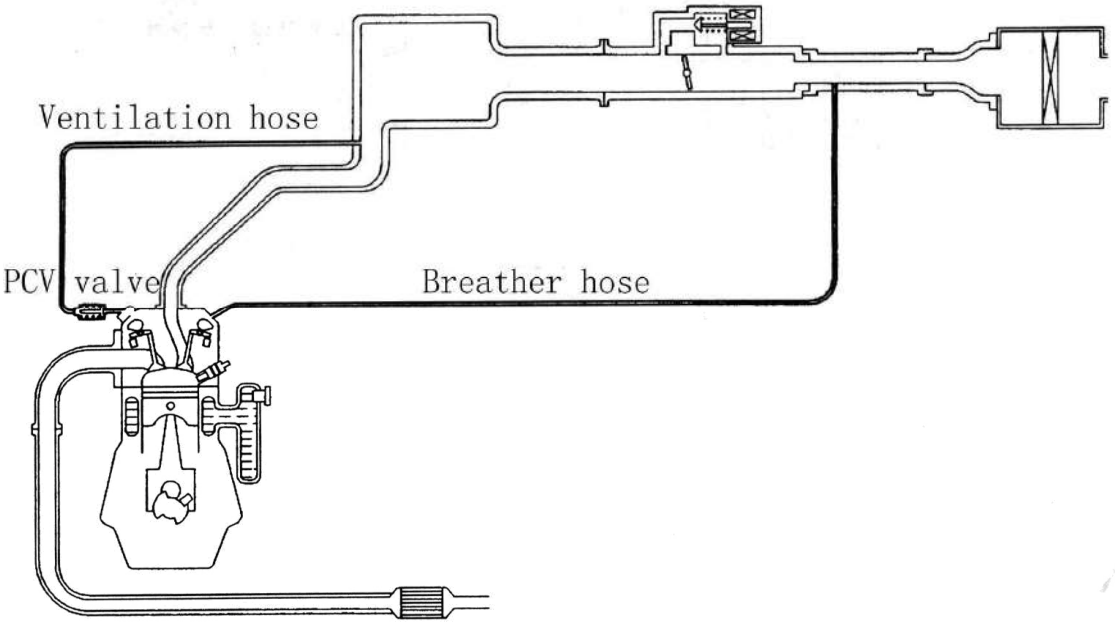


Fig. 10-5

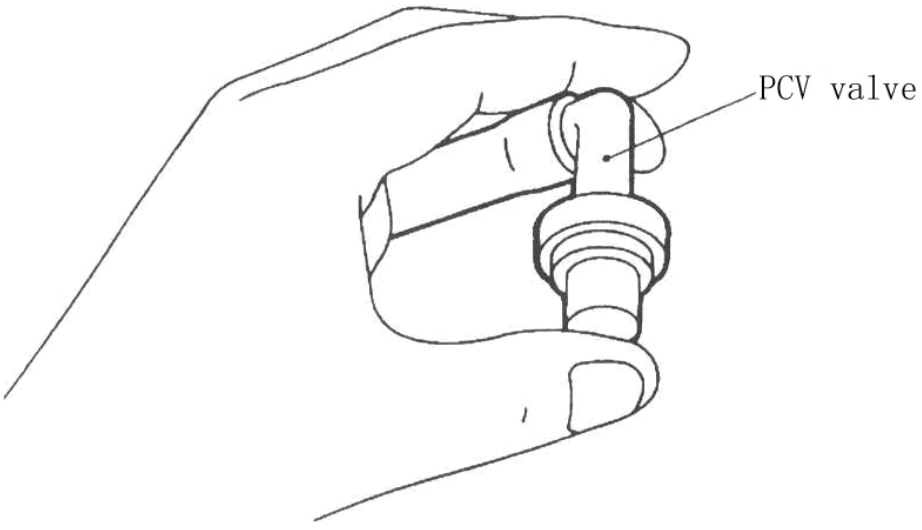


Fig. 10-6

● POSIVE CRANKCASE VENTILATIONS SYSTEM CHECK

- Remove the ventilation hose from the PCV.
- Remove the PCV valve from the rocker cover.
- Reinstall the PCV valve at the ventilation hose.
- Start the engine and run at idle.

• Place the finger at the opening of the PCV valve and check that vacuum of the intake manifold is felt.

Caution
At this moment, the plunger in the PCV moves back and forth.

• If vacuum is not felt, clean the PCV valve or replace it.

● PCV VALVE CHECK

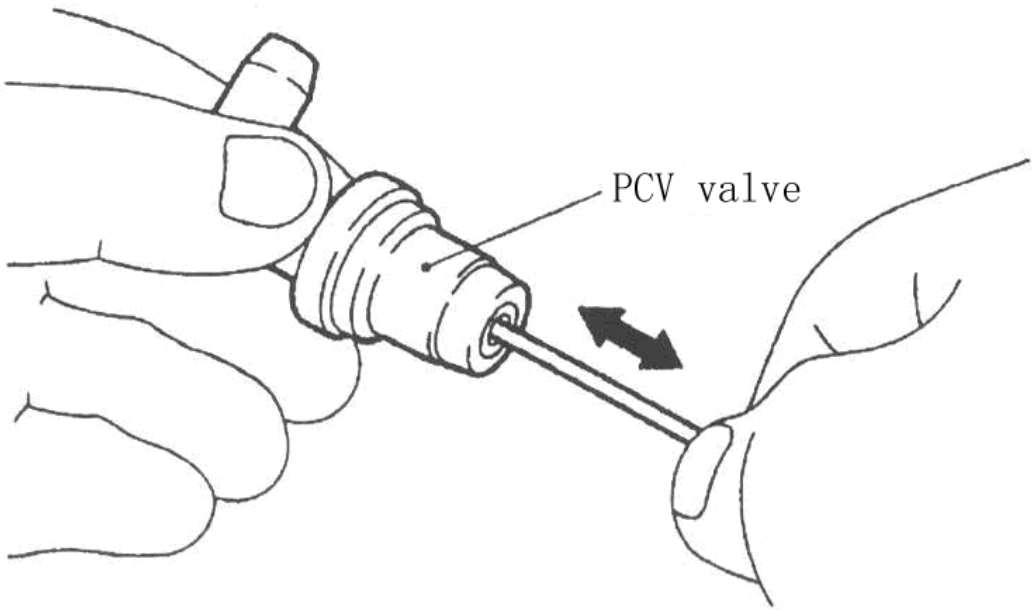


Fig. 10-7

•Insert a thin rod into the PCV valve fro the side shown in the illustration(rocker cover installation side), and move the rod back and forth to check that the plunger moves.

• If the plunger does not move, there is clogging in the PVC valve. In this case, clean or replace the PCV valve.

3) EVAPORATIVE EMISSION CONTROL SYSTEM

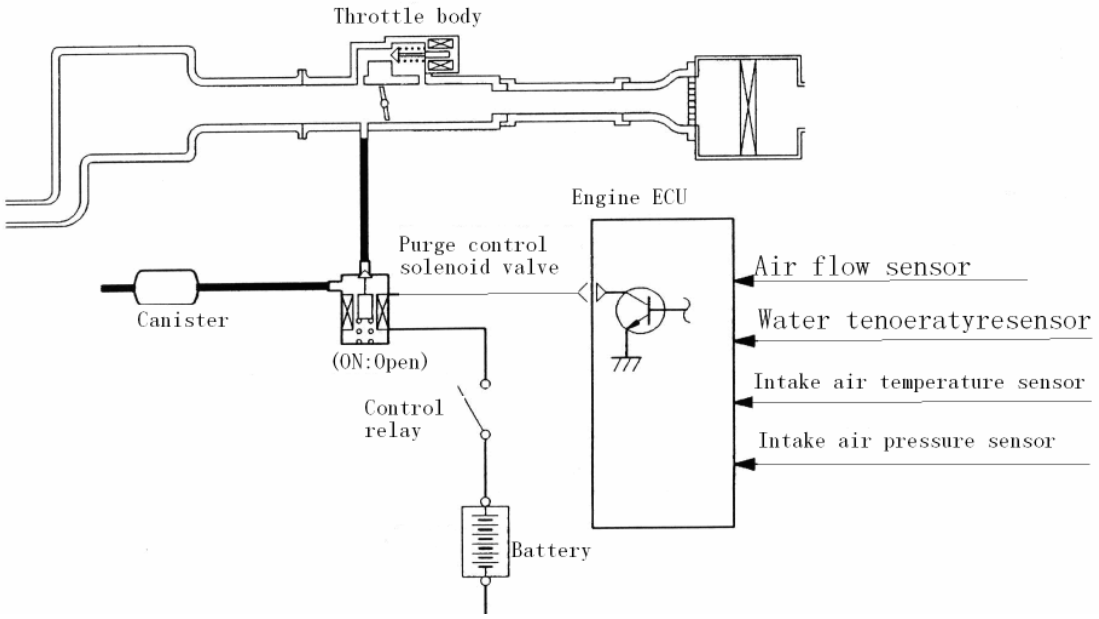


Fig. 10-8

● PURGE CONTROL SYSTEM CHECK

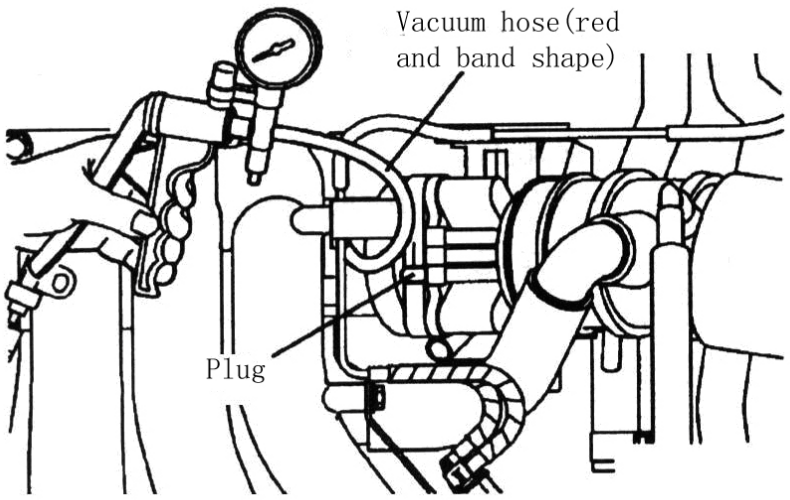


Fig. 10-9

- Disconnect the vacuum hose from the intake manifold and connect it to a hand vacuum pump.
- Plug the nipple from which the vacuum hose was removed.
- When the engine is cold or hot, apply a vacuum of 53kpa, and check the condition of the vacuum.

When the engine is cold,(Engine coolant temperature:40℃ or less)

Table 10-5

Engine status	Normal condition
At idle	Vacuum is maintained.
3000r/min	

When the engine is hot,(Engine coolant temperature:80℃ or higher)

Table 10-6

Engine status	Normal condition
At idle	Vacuum is maintained.
3000r/min Within 3min after engine starts	Vacuum will leak

● PURGE PORT VACUUM CHECK

• Disconnect the vacuum hose from the intake manifold purge vacuum nipple and connect a hand vacuum pump to the nipple(Fig.10-10)

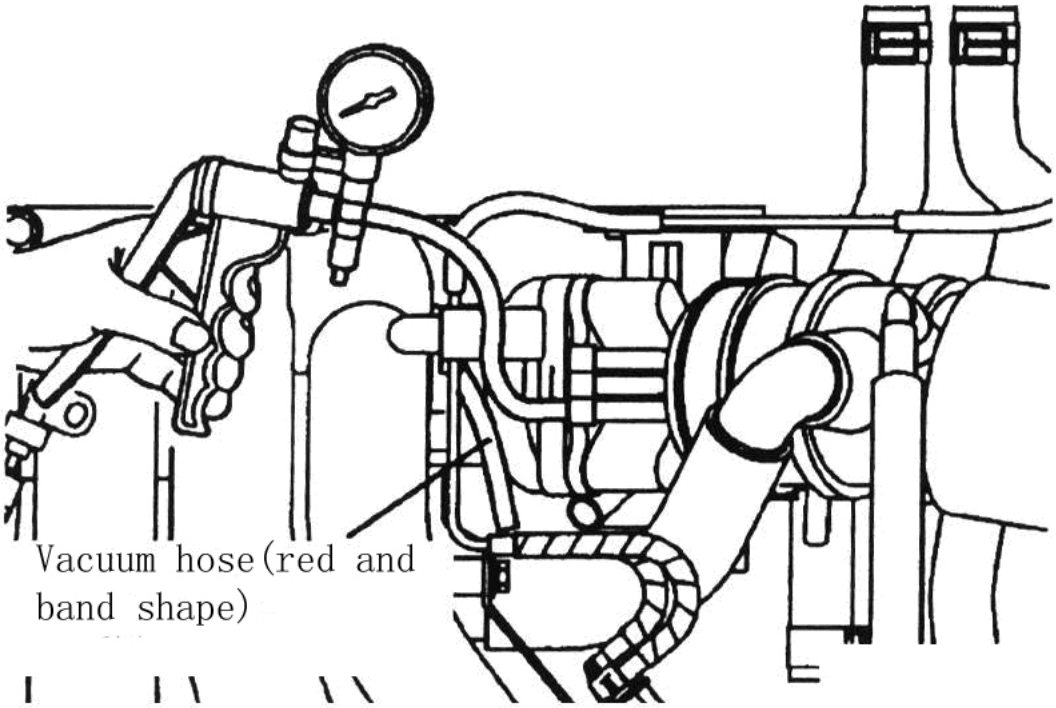


Fig.10-10

• Start the engine, and check that the vacuum remains fairly constant after racing the engine. If vacuum changes, it is possible that the throttle body purge port may be clogged and require cleaning, see Fig.10-11 .

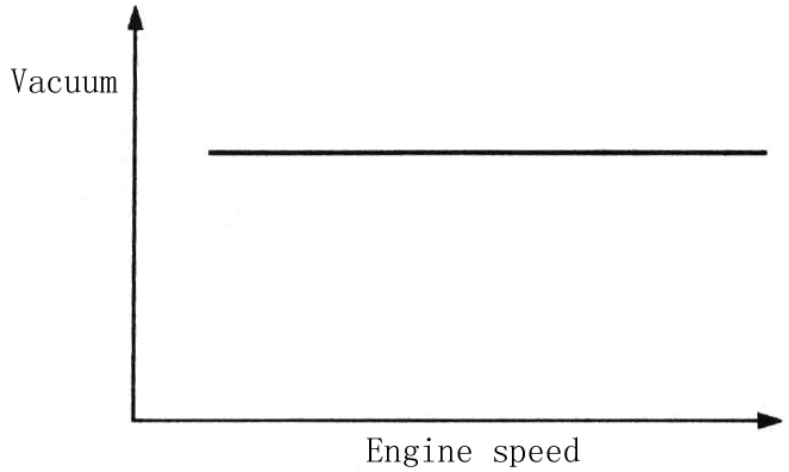


Fig. 10-11

● PURGE CONTROL SOLENOID VALVE CHECK

• Connect a hand vacuum pump to nipple(A) of the solenoid valve, see Fig. 10-12.

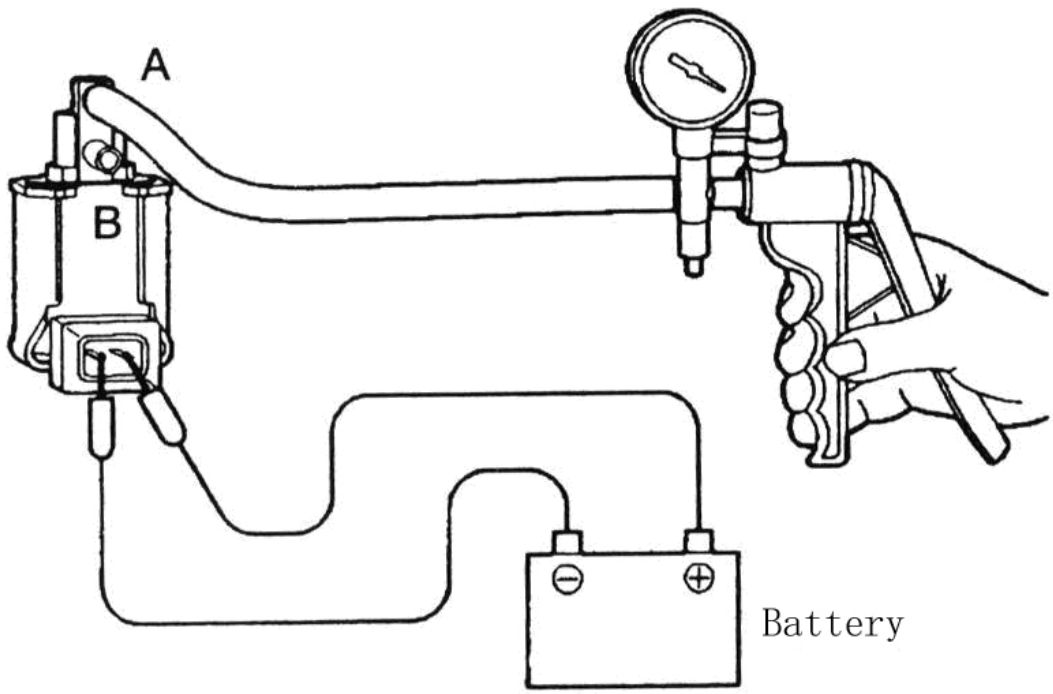


Fig. 10-12

Connect solenoid valve to the battery terminal by using harness.

• Disconnect harness to negative (-) terminal of battery, then check air tightness by applying a vacuum

Table 10-7

harness	Nipple (B) condition	Normal condition
Connection	Open	Vacuum will leak
	close	Vacuum is maintained.
Disconnection	Open	Vacuum is maintained.

● PURGE CONTROL COLENOID VALVE CHECK

• The resistance between the terminals of the solenoid valve.

Standard value: 36—44Ω (22℃)

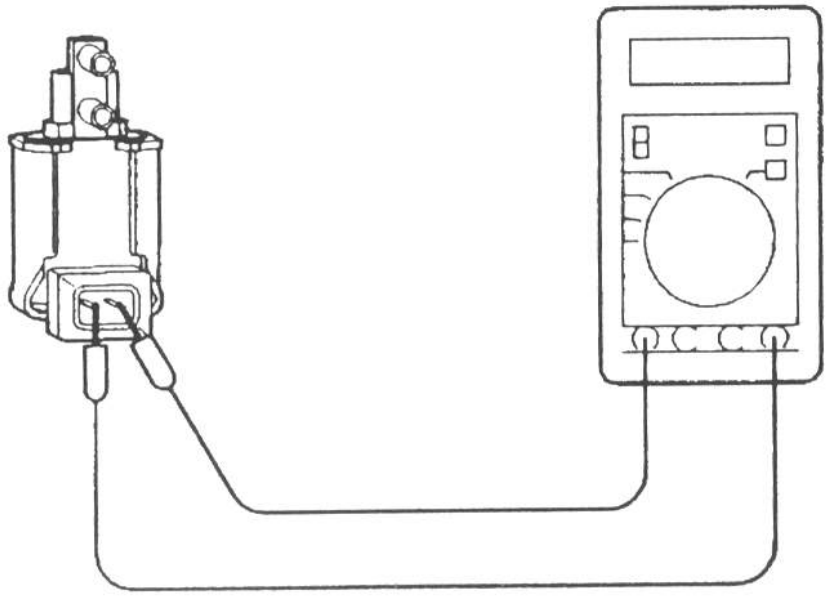


Fig. 10-13

4) EXHAUST GAS RCIRCULATION (EGR) SYSTEM(see Fig.10-14)

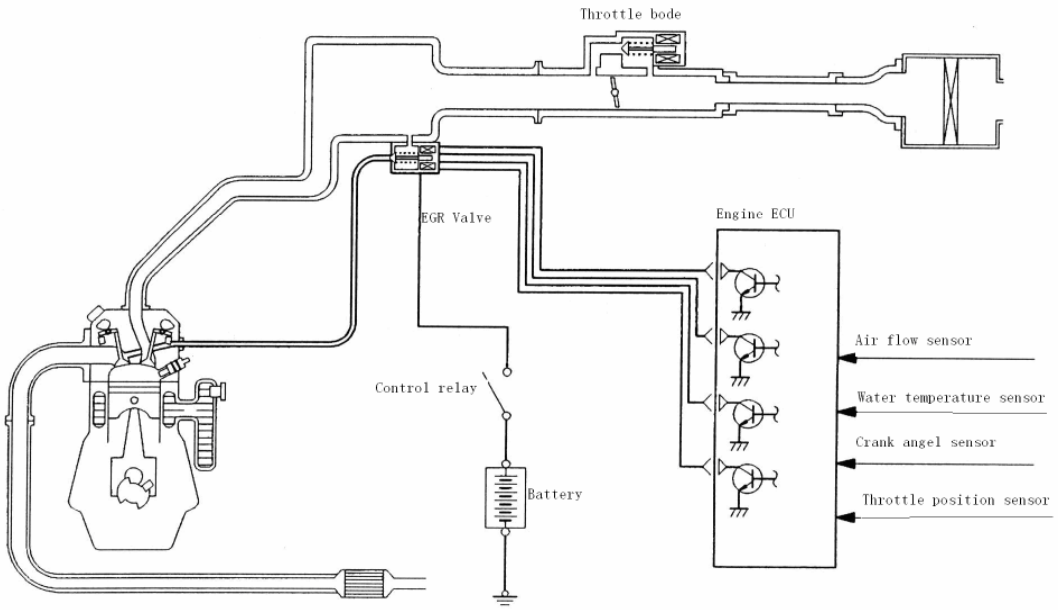


Fig.10-14

● EGR VALVE CHECK

• Check that the operation sound of the stepper motor can be heard from the EGR valve when the ignition switch is turned to “ON” POSITION(without starting the engine).

• If the operation sound can not be heard, check the stepper motor drive circuit.

● Checking the Coil Resistance

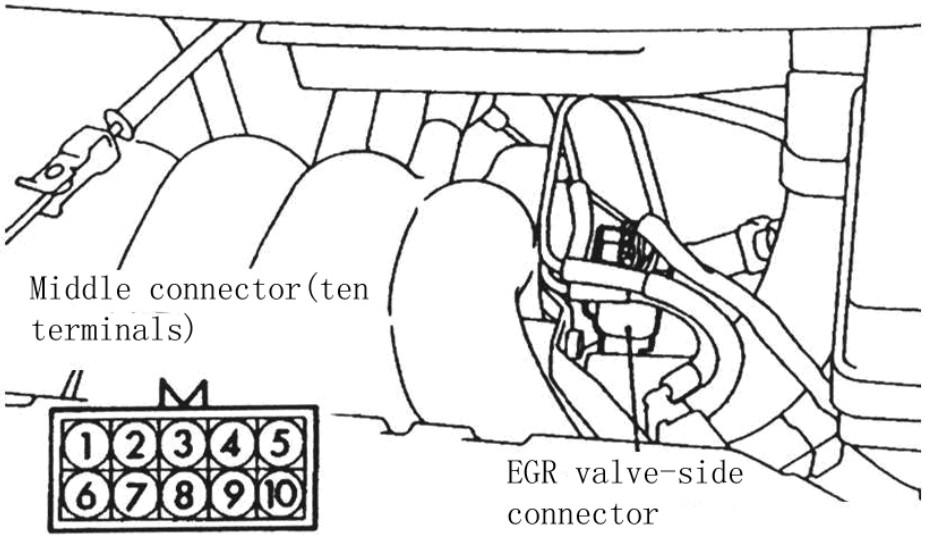


Fig.10-15

• Disconnect the EGR valve connector, see Fig.10-15.

Measure the resistance between the terminal NO.4 and terminal NO.1, terminal NO.2 and terminal NO.6 or terminal NO.7, see Fig.10-16.

Standard value: 10-20Ω (22℃)

• Connect the EGR valve connector.

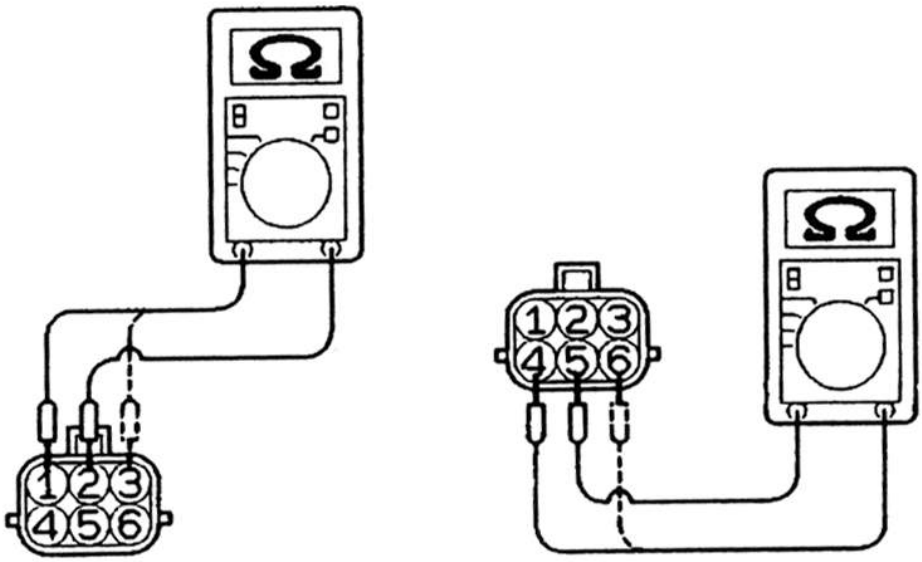


Fig.10-16

EGR valve body check

• Remove the EGR valve, see Fig.10-17.

• Measure the resistance between the EGR valve-side connector terminal NO.1 or NO.3.

• Measure the resistance between the EGR valve-side connector terminal NO.5 or NO.6.

Standard value: 10-20Ω (22℃)

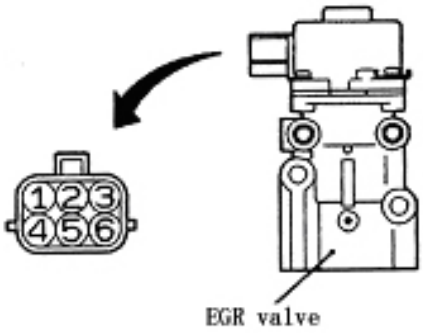


Fig.10-17

● Stepper motor check

• Remove the EGR valve.

• Connect the special tool (test harness: MB991658) to the EGR valve-side connector.

• Connect terminal No.2 and terminal No.5 to positive (+) terminal of the battery (about 6V).

• Connect terminals to the negative terminal of battery to test if any vibration occurs (as through the stepper motor is shaking slightly) due to the operation of the stepper motor, see Fig.10-18.

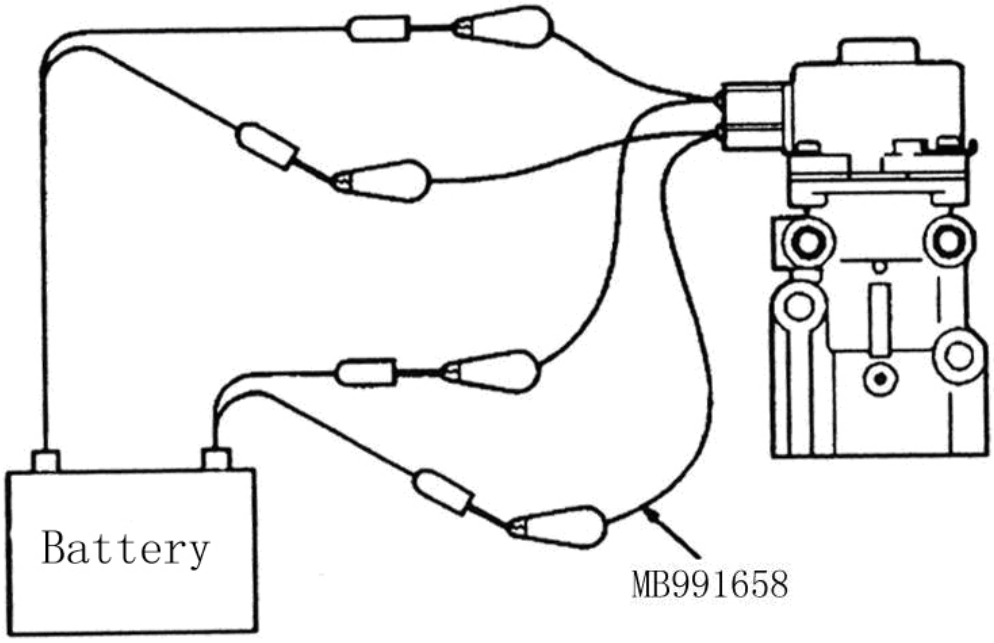


Fig. 10-18

a) Connect terminal No. 1 and terminal No. 4 to positive (+) terminal of the battery
b) Connect terminal No. 3 and terminal No. 4 to positive (+) terminal of the battery
c) Connect terminal No. 3 and terminal No. 6 to positive (+) terminal of the battery
d) Connect terminal No. 1 and terminal No. 6 to positive (+) terminal of the battery
e) Connect terminal No. 1 and terminal No. 4 to positive (+) terminal of the battery
f) Repeat steps from a) to e).

- If the result of testing show that the vibration could be felt, the stepper motor is normal.

10.3 EGR Valve Removal and Installation

● Clean EGR valve

Removal EGR valve, and confirm that there are no dirty object on it. Clean with steel brush if necessary.

Caution
Be sure not to use solvent and scour, because they can make the motor fault start.

10.4 Canister Removal and Installation

●CANISTER REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Air cleaner removal and installation (refer to relative GROUP)

• Battery and battery bracket removal and installation

Removal steps see Fig.10-19.

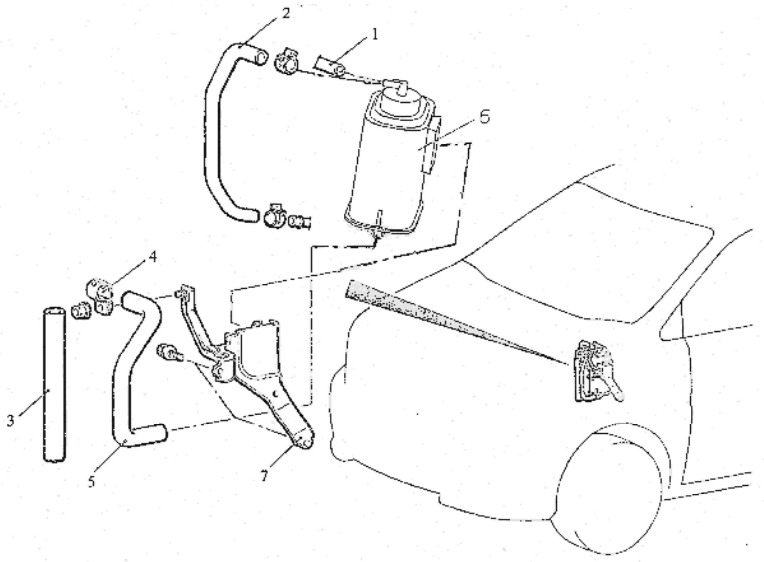


Fig.10-19

1. Vacuum hose connection
2. Vapor hose
3. Vapor hose
4. Hose clamp
5. Vapor hose
6. Canister
7. Canister bracket assembly

Installation steps

It is the reverse steps of removal.

11 Clutch Transmission

11.1 Specifications

11.1.1 GENERAL SPECIFICATIONS

11.1.1.1 CLUTCH

Table 11-1

Clutch disc type		Dry single diaphragm spring
Disatance of BHC to clutch cover（mm）		37.9
CLUTCH COVER	Clutch cover setting load（Nm）	4150±300
	Film spring leve ratio	2.833
	Film spring lever high(mm)	31.5±1.0
CLUTCH DISC	Clutch disc size（mm）	Φ200×Φ130
	Clutch disc material	B1675
	Spline size	$24/48\text{-}30^{0}$ 20NT
CLUTCH CONTROL	Clutch operating method	Hydraulic type
	Fork release leverage	1.726
	Clutch release cylinder i.d mm	19.05
	Clutch bearing	Auto adjust

11.1.1.2 TRANSMISSION

Table 11-2

Transmission model		DABS15-11	DABS15-1L	DABS15-11 D1
Engine model		DA4G18	DA4G13	DA4G18-A1,DA4G18-A3
Type		Manual 5-speed front wheel drive		
Final reduction ratio		4.052（77：19）	4.333(78/18)	4.052（77：19）
wheelbase（mm）		78－126－204		
length（mm）		390		
Appearance size（length×breadth×high）（mm）		390×543×365		
Gear ratio	1st	3.583（43:12）		
	2nd	1.947（37:19）		
	3rd	1.343（43:32）		
	4th	0.976（41:42）		
	5th	0.804（37:46）		
	Re	3.416（41:12）		
DIFFERENTIAL		4.2		
Drive efficiency	1st	0.98		
	2nd	0.98		
	3rd	0.98		
	4th	0.98		
	5th	0.98		

	Re	0.97		
Synchronizer size（mm） Sychronizer type	1st	Φ71 single synchronizer		Φ71 double synchronizer
	2nd	Φ71 single synchronizer		Φ71 double synchronizer
	3rd	Φ71 single synchronizer		
	4th	Φ71 single synchronizer		
	5th	Φ71 single synchronizer	Lever synchronizer	Lever synchronizer
	Re	non		Lever synchronizer
Shift control machine	Shift Leverage	73/22.37		
	Select Leverage	60/35		
Speedometer	Gear ratio	31/36		
	Type	electronic		
Lubricants	SAE viscosimet	80W-90(north summer)、75W-90（north winter） 80W-90 or 85W-140（south all-year）		
	API classification	GL－4 or higher		
	oiling（L）	2.1		
Weight(no clutch)（kg）	41			

11.1.2 TRANSMISSION(DABS15-11, DABS15-1L)

11.1.3 PRECAUTIONS

FORM-IN-PLACE GASKET

The transmission has several areas where the form -in-place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size. Since the RTV hardens as it reacts with the moisture in the atmospheric air, it is normally used in the metallic flange areas.

DISASSEMBLY

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces.

Surface Preparation

Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old sealant remaining in the bolt holes.

FORM-IN-PLACE GASKET APPLICATION

When assembling parts with the FIPG, you must observe some precautions, but the procedures is very simple as in the case of a conventional precut gasket.

Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only. In addition, do not apply any oil or water to the sealing locations or start the engine until a sufficient amount of time (about one hour) has passed after installation is completed.

The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

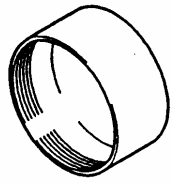
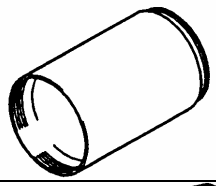
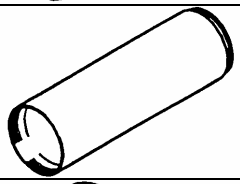
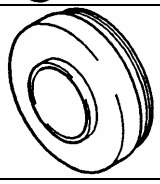
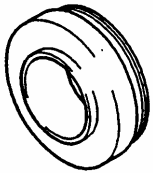
11.1.4 ASISSTANT MATERIAL

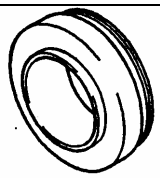
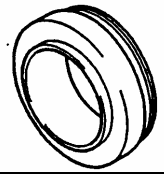
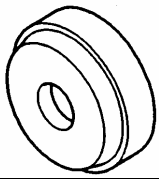
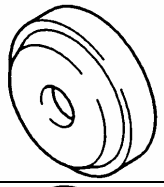
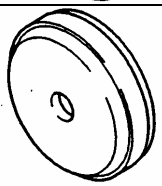
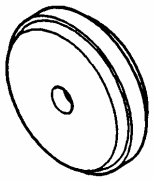
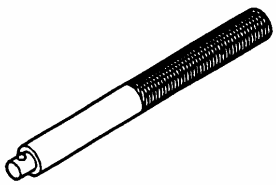
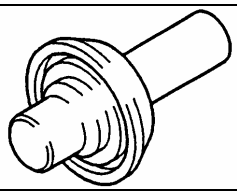
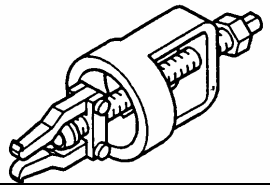
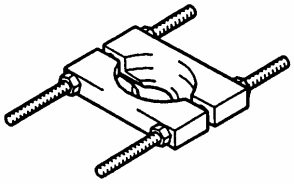
Table 11-3

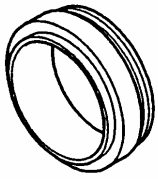
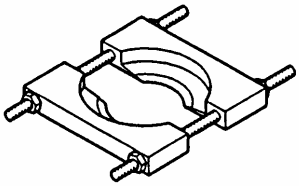
Material	Position
Mobilith SHC220 or Spartan syn EP 220	Shift fork
	Clutch bearing
Mobile HD80W-90 or Esso Gear Oil GX 80W-90	Input shaft oil seal
	Transmission assy
	Select shoe
LT480	Air brounth
Mobilith Lt or Rust-Ban330	Input shaft
Mobile HD80W-90 or Esso Gear Oil GX 80W-90	Input shaft needle bearing
	Output shaft needle bearing
LT243	Differential bolt
LT5699	Transmission case
Mobile HD80W-90 or Esso Gear Oil GX 80W-90	Control shaft and select lever
LT5699	Control housing

11.1.5 SPECIAL TOOLS

Table 11-4

Tool	Number	Name	Use
	MD998812	Installer cap	Use with installer and installer adapter
	MD998813	Installer—100	Use with installer cap and installer adapter
	MD998814	Installer—200	Use with installer cap and installer adapter
	MD998817	Installer adapter（34）	Installation of input shaft front bearing
	MD998818	Installer adapter（38）	Installation of input shaft rear bearing, roller bearing inner race, reverse gear ,needle roller bearing, reverse gear bearing sleeve and reverse bearring sleeve

	MD998820	Installer adapter（42）	Installation of 5th speed gear sleeve,2nd speed gear sleeve
	MD998822	Installer adapter（46）	Installation of 1st speed gear sleeve ,1st-2nd speed synchronizer hub
	MB990926	Installer adapter	Installation of clutch housing input shaft oil seal
	MB990927	Installer adapter	nstallation of sealing cap
	MD990934	Installer adapte	Installation of rolle bearing outer race
	MD990935	Installer adapter	Installation of differential case taper roller bearing outer race
	MD990938	Handle	Use with Installer adapte
	MB998325	Differential oil seal installer	Installation of differentia oil seal
	MB998346	Bearing outer race remover	Removal of roller bearing outer race
	MB998801	Bearing remover	Installation and removal of gears, bearings and sleeves

	MD998826	Installer adapt	Installation of 3rd-4th speed synchronizer hub
	MD998917	Bearing remover	Installation and removal of gears, bearings and sleeves

11.2 Assembly Workshop

11.2.1CLUTCH

11.2.1.1 SPECIFICATIONS

GENERAL SPECIFICATIONS Table 11-5

ITEMS	SPECIFICATIONS
Clutch operating method	Hydraulic type
Clutch disc type	Single dry disc type
Clutch disc size o.d.×i.d.mm	Φ200×Φ130
Clutch cover type	Diaphragm spring

SERVICE SPECIFICATIONS Table 11-6

ITEMS	SPECIFICATIONS(LIMIT)
Clutch disc facing rivet sink mm	0.3
Diaphragm spring end height difference mm	0.5
Release cylinder i.d.to piston o.d. clearance mm	0.15

TORQUE SPECIFICATIONS Table 11-7

ITEMS	N.m
Clutch tube flare nut	15（1.5）
Clutch damper mounting bolt	18（1.9）
Clutch release cylinder union bolt	22（2.3）
Clutch release cylinder air bleeder	11（1.1）
Clutch release cylinder mounting bolt	18（1.9）
Fulcrum	35（3.6）

11.2.1.2 REMOVAL AND INSTALLATION

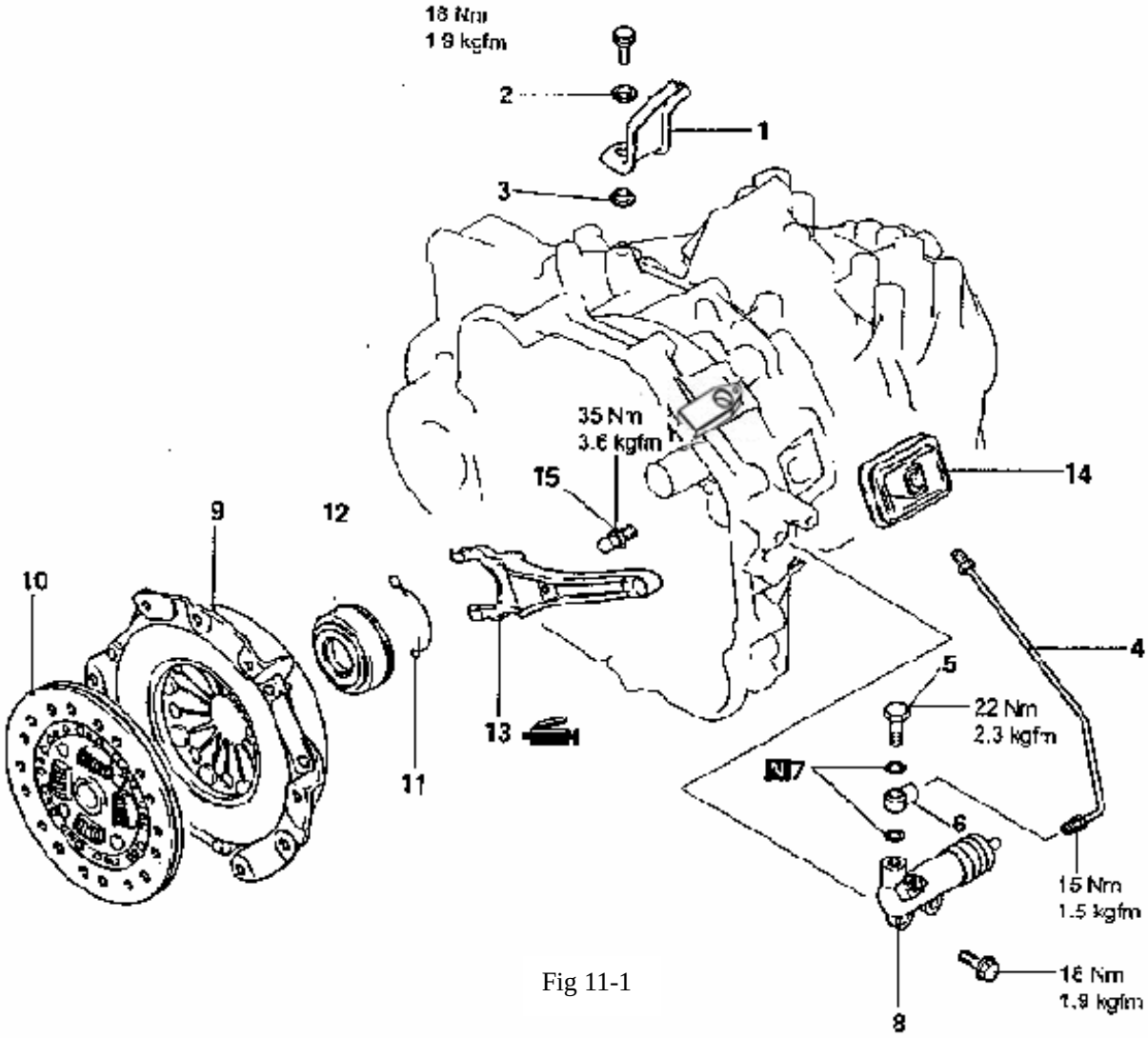


Fig 11-1

Removal steps:

1. Clutch fluid line bracket
2. Insulator
3. Washer
4. Clutch tube
5. Union bolt
6. Union
7. Gasket
8. Clutch release cylinder
9. Clutch cover
10. Clutch disc
11. Return clip
12. Clutch release bearing

◄A► ►A◄ 13. Release fork

14. Release fork boot
15. Fulcrum

REMOVAL SERVICE POINT:

◄A► RELEASE FORK REMOVAL

Move the release fork in the direction shown to remove the clip from the fulcrum

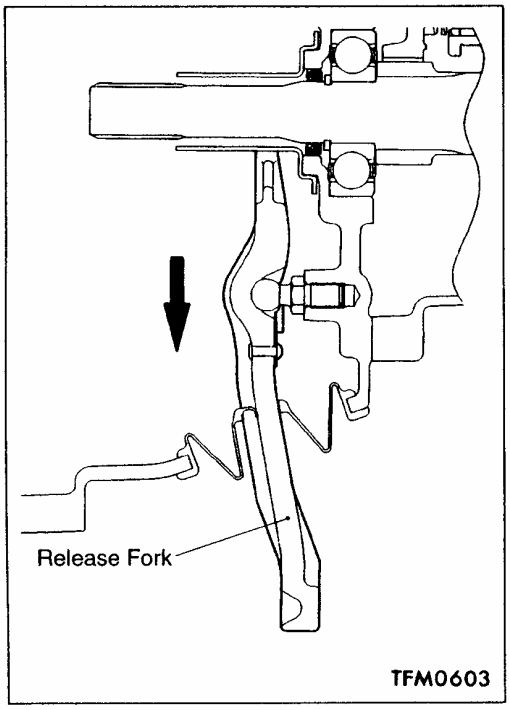


Fig 11-2

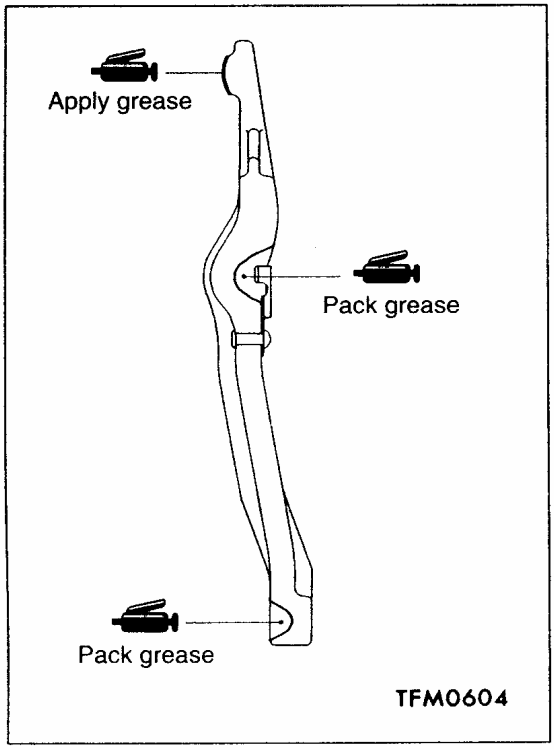


Fig 11-3

INSTALLATION SERVICE POINT：

►A◄ RELEASE FORK INSTALLATION
Apply/pack grease to the illustrated positions of the release fork
Specifide grease：**Esso Ronex、Esso Beacon EP 2 Or equibalent**

2） CLUTCH RELEASE CYLINDER DISASSEMBLY AND REASEMBLY：

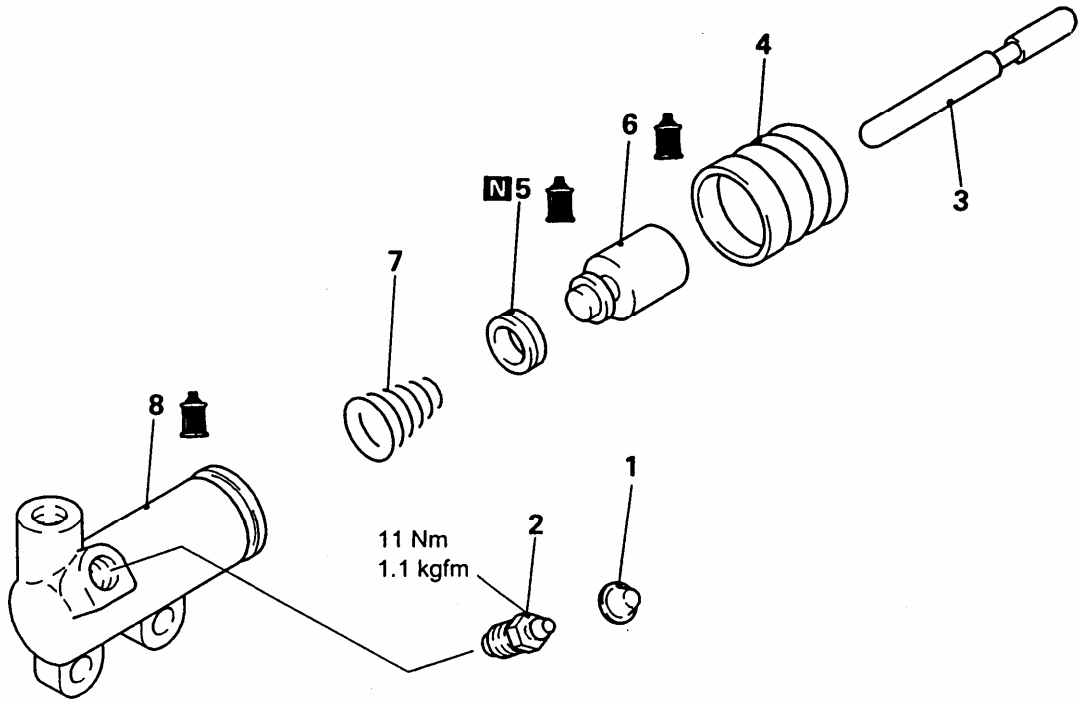


Fig 11-4

DISASSEMBLY STEPS：

1. cap
2. air bleeder
3. push rod
4. boot

◄A► ►A◄ 5. piston cup

◄A► ►A◄ 6. piston

7. conical spring
8. release cylinder

disassembly service point：

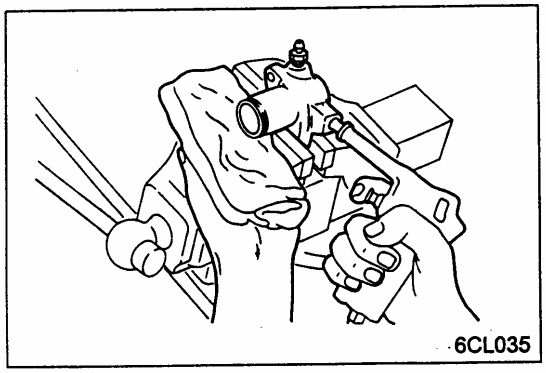


Fig 11-5

REASSEMBLY SERVICE POINT：

►A◄ PISTON/PISTON CUP INSTALATION

after applying brake fluid to the inside wall surface of the release cylinder and all the circumferential surfaces of the piston and piston cup, insert the piston and piston cup into the cylinder.

Specified brake fluid：

SAE J1703（DOT3）

◄A► piston cup/piston removal

removal the piston from the release cylinder using compressed air

caution：1. cover with shop towel to prevent the piston from popping out

2. Apply compressed air slowly to prevent brake fluid from splashing。

11.2.1.3 CHECK AND SERVICE

1. CLUTCH

1.1 CLUTCH COVER

（1）check the diaphragm spring end for wear and uneven height .replace if wear is evident or height difference exceeds the limit.

limit: 0.5mm。

（2）check the pressure plate surface for wear ,cracks and discoloration.

（3）check the rivets of the strap plate for looseness. If loose, replace the clutch cover.

1.2 CLUTCH DISC

Caution：

(1) **Don't clean the clutch disc in a cleaning fluid！**

(2) Check the facing for loose rivets. Uneven contace, evidence of seizure, or deposited oils and greases. If defective, replace the clutch disc.

Measure the rivet sink and replace the clutch disc if it is out of specification.

Limit ： 0.3mm

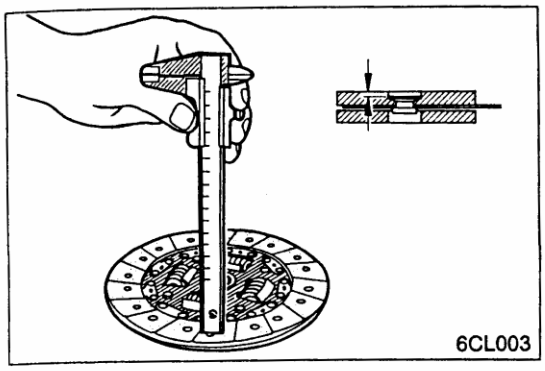


Fig 11-5

（3）Check the torsion spring for looseness and damage. If defective, replace te clutch disc.

（4）Combine the clutch disc with the input shaft and check for sliding condition and play in the rotating direction. if poor sliding condition is evident, clean, reassemble, and recheck. If excessive looseness is evident, replace the clutch disc and/or input shaft.

1.3 CLUTCH RELEADE BEARING

CAUTION：

Release bearing is packed with grease .therefore ,do not wash it in a fluid and the like.

（1）Check for seizure , damage, noise or improper rotation.

（2）Check for wear on the surface which contacts with the diaphragm spring.

（3）Check for wear on the surface which contacts with release fork. If abnormally worn, replace.

1.4 RELEASE FORK

If the surface which contacts with the bearing is abnormally worn, replace.

2. CLUTCH RELEASE CYLINDER INSPECTION

（1）Check the inside wall surface of the release cylinder for rust and damafe

（2）Using a cylinder gauge, measure the inside diameter of the release cylinder at about three positions(the deepest, middle and brim positions). If the clearance from outside diameter of the piston exceeds the limit, replace the release cylinder as an assembly.

Limit: 0.15mm

11.2.2 TRANSMISSION

11.2.2.1 SPECIFICATIONS

GENERAL SPECIFICATIONS Table 11-8

Transmission model	DABS15-11	DABS15-11 D1	DABS15-1L
Engine model	DA4G18	DA4G18-A1,DA4G18-A3	DA4G13
Final gear ratio	4.052		4.333
Model	Cable shift		
Gear ratio table	1st	3.583	
	2nd	1.947	
	3rd	1.343	
	4th	0.976	
	5th	0.804	
	reverse	3.416	
Speedometer gear ratio		31/36	

SERVICE SPECIFICATIONS

Table 11-9

Items	Allowable range	Limit
Input shaft front bearing end play mm	0－0.12	—
Input shaft rear bearing end play mm	0－0.09	—
Input shaft 5th speed gear end play mm	0－0.09	—
Output shaft front bearing end play mm	0－0.12	—
Output shaft rear bearing end play mm	0－0.09	—
Output shaft 3rd speed gear end play mm	0－0.09	—
Differential case end play mm	0.05－0.17	—
Differential case pinion backlash	0－0.150	—
Synchronizer ring back surface to gear clearance mm	—	0.5

NOTE: Standard play = 0 mm

SNAP RINGS,SPACERS AND THRUST PLATE ADJUSTMENT

Snap ring(For adjustment of input shaft front bearing end play) Table 11-10

Thickness mm	Identification	Part No.(MMC)	Part No.(DAE)
2.24	None	MD706537	BS15-1701037-1
2.31	Blue	MD706538	BS15-1701037-2
2.38	Brown	MD706539	BS15-1701037-3

Snap ring(For adjustment of input shaft bearing end play) Table 11-11

Thickness mm	Identification	Part No.(MMC)	Part No.(DAE)
2.31	Black （2）	MD747149	BS15-1701038-11
2.35	None	MD746561	BS15-1701038-1
2.39	Blue	MD746562	BS15-1701038-2
2.43	Brown	MD746563	BS15-1701038-3
2.47	Green	MD746564	BS15-1701038-4
2.51	White	MD746565	BS15-1701038-5
2.55	Yellow	MD746566	BS15-1701038-6
2.59	Black	MD746567	BS15-1701038-7
2.63	Orange	MD746568	BS15-1701038-8
2.67	Blue	MD746569	BS15-1701038-9
2.71	Brown	MD746570	BS15-1701038-10

Snap ring(For adjustment of output shaft front bearing end play) Table 11-12

Thickness mm	Identification	Part No.(MMC)	Part No.(DAE)
1.43	Green （2）	MD746708	BS15-1701039-1
1.51	White （2）	MD746709	BS15-1701039-2
1.59	Yellow （2）	MD746710	BS15-1701039-3

Snap ring(For adjustment of output shaft rear bearing end play) Table 11-13

Thickness mm	Identification	Part No.(MMC)	Part No.(DAE)
2.31	Black （2）	MD748800	BS15-1701040-1
2.35	None	MD748801	BS15-1701040-2
2.39	Blue	MD748802	BS15-1701040-3
2.43	Brown	MD748803	BS15-1701040-4
2.47	Green	MD748804	BS15-1701040-5
2.51	White	MD748805	BS15-1701040-6
2.55	Yellow	MD748806	BS15-1701040-7
2.59	Black	MD748807	BS15-1701040-8
2.63	Orange	MD748808	BS15-1701040-9
2.67	Blue	MD748809	BS15-1701040-10
2.71	Brown	MD748810	BS15-1701040-11

Snap ring (For adjustment of output shaft 3rd speed gear end play) Table 11-14

Thickness mm	Identification	Part No.(MMC)	Part No.(DAE)
2.81	Green	MD748782	BS15-1701041-1
2.85	White	MD748783	BS15-1701041-2
2.89	Yellow	MD748784	BS15-1701041-3
2.93	Black	MD748785	BS15-1701041-4
2.97	Orange	MD748786	BS15-1701041-5
3.01	Red	MD748787	BS15-1701041-6
3.05	Pink	MD748788	BS15-1701041-7
3.09	Blue	MD748789	BS15-1701041-8

Spacer(For adjustment of differential case end play) Table 11-15

Thickness mm	Identification	Part No.(MMC)	Part No.(DAE)
0.77	77	MD754476	BS15-1700015-1
0.86	86	MD720938	BS15-1700015-2
0.95	95	MD720941	BS15-1700015-3
1.04	04	MD720944	BS15-1700015-4
1.13	D	MD700270	BS15-1700015-5
1.22	G	MD700271	BS15-1700015-6
1.31	E	MD706574	BS15-1700015-7
1.40	---	MD706573	BS15-1700015-8
1.49	C	MD706572	BS15-1700015-9
1.58	B	MD706571	BS15-1700015-10
1.67	A	MD706570	BS15-1700015-11
1.76	F	MD706575	BS15-1700015-12

Spacer (For adjustment of differential case backlash) Table 11-16

Thickness mm	Identification symbol	Part No.(MMC)	Part No.(DAE)
0.75－0.82	－	MA180862	BS15-2303006-1
0.80－0.84	－	MR593562	BS15-2303006-2
0.83－0.92	－	MA180861	BS15-2303006-3
0.90－0.94	－	MR593561	BS15-2303006-4

0.93－1.00	－	MA180860	BS15-2303006-5
0.98－1.02	－	MR593460	BS15-2303006-6
1.01－1.08	－	MA180875	BS15-2303006-7
1.07－1.11	－	MR593559	BS15-2303006-8
1.09－1.16	－	MA180876	BS15-2303006-9
1.16－1.20	－	MR581571	BS15-2303006-10

TORQUE SPECIFICATIONS Table 11-17

Items	Nm（kgfm）
Interlock plate bolt	30（3.1）
Clutch housing-transmission case mounting bolt	44（4.5）
Clutch release bearing retainer mounting bolt	9.8（1.0）
Control housing mounting bolt	18（1.9）
Shift cable bracket mounting bolt	18（1.9）
Speedometer gear mounting bolt	3.9（0.4）
Stopper bracket mounting bolt	18（1.8）
Select lever mounting bolt	18（1.8）
Select lever mounting nut	11（1.2）
Differential drive gear mounting bolt	132（13.5）
Back-up lamp switch	32（3.3）
Front bearing retainer mounting bolt	18（1.8）
Poppet spring	32（3.3）
Restrict ball	32（3.3）
Reverse idler gear shaft mounting bolt	48（4.9）
Reverse shift lever mounting bolt	18（1.8）
Roll stopper bracket mounting bolt	69（7.0）

11.2.2.2 DISASSEMBLY AND REASSEMBLY

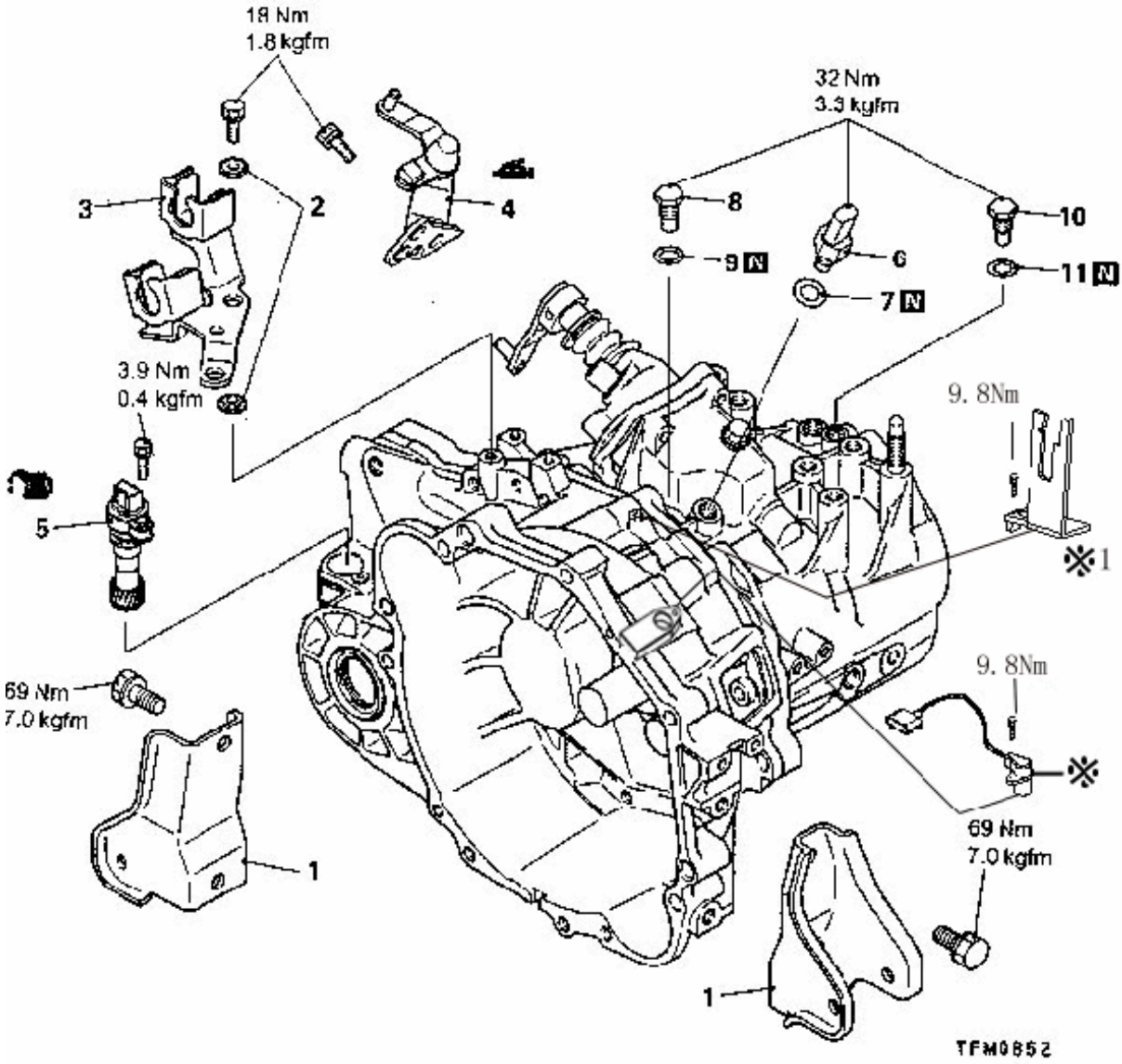


Fig 11-6

Disassembly steps：

1. Roll stopper bracket
2. Insulator washer（already cancel）
3. Shift cable bracket
►M◄ 4. Select lever
►L◄ 5. Speedometer gear
6. Back-up lamp switch
7. Gasket
8. Restrict ball
9. Gasket
10. Poppet spring
11. Gasket

※. Rotate speed sensor
※1.bracket

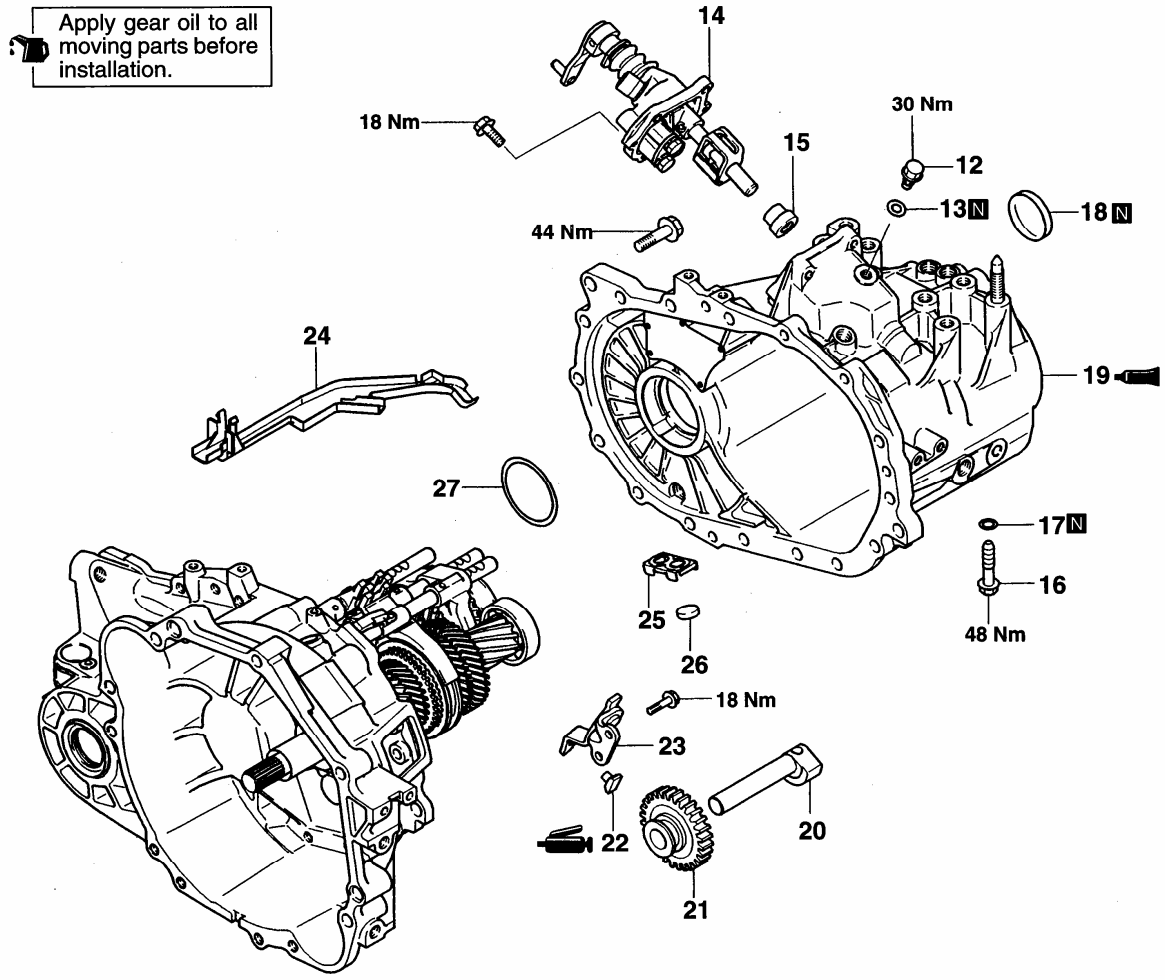


Fig 11-7

12. Interlock plate bolt
13. Gasket
►K◄ 14. Control housing
15. Neutral return spring
►J◄ 16. Reverse idler gear shaft bolt
17. Gasket
◄A► ►I◄ 18. Sealing cap
◄B► ►H◄ 19. Transmission case
◄C► ►G◄ 20. Reverse idler gear shaft
21. Reverse idler gear
22. Reverse shift lever shoe
23. Reverse shift lever
►F◄ 24. Oil guide
25. Magnet holder
26. Magnet
►E◄ 27. Spacer

Lubricate all internal pars with gear oil during reassembly

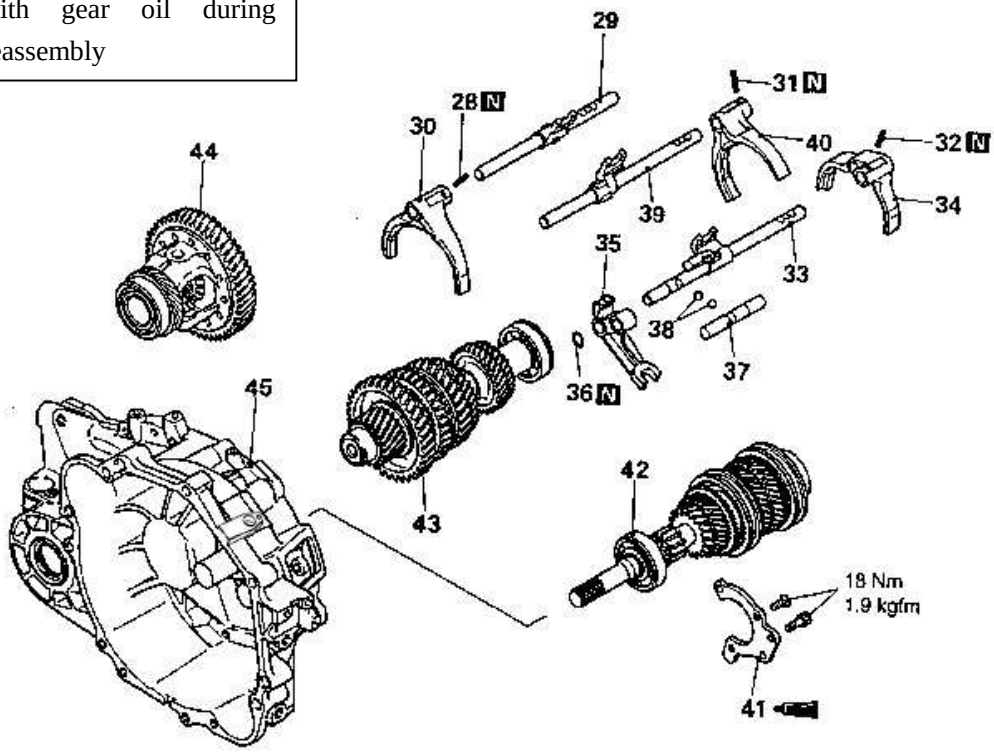


Fig 11-8

Disassembly steps:

►D◄ 28. Spring pin
29. 1st-2nd speed shift rail
30. 1st-2nd speed shift fork
►D◄ 31. Spring pin
►D◄ 32. Spring pin
◄D► ►C◄ 33. 5th speed shift rail
◄D► ►C◄ 34. 5th speed shift fork
◄D► ►C◄ 35. Reverse shift lug
◄D► ►C◄ 36. Snap ring
◄D► ►C◄ 37. Reverse interlock rai
◄D► ►C◄ 38. Steel ball
◄D► ►C◄ 39. 3rd-4th speed shift rail
◄D► ►C◄ 40. 3rd-4th speed shift fork
►B◄ 41. Front bearing retainer
◄E► ►A◄42. Input shaft
◄E► ►A◄43. Output shaft
44. Differential
45. Clutch housing

DISASSEMBLY SERVICE POINTS :

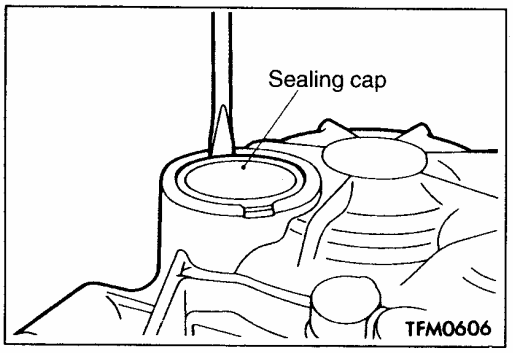


Fig 11-9

◄A► SEALING CAP REMOVAL

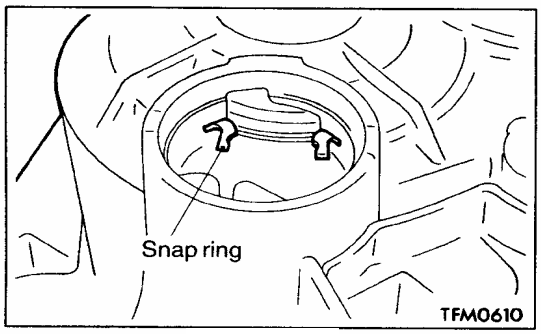


Fig 11-10

◄B► TRANSMISSION CASE REMOVAL

Expand the snap ring to remove it from the snap ring groove of the ball bearing.

NOTE

Expansion of the snap ring causes the snap ring groove to get out of position because of the output shaft's own weight.

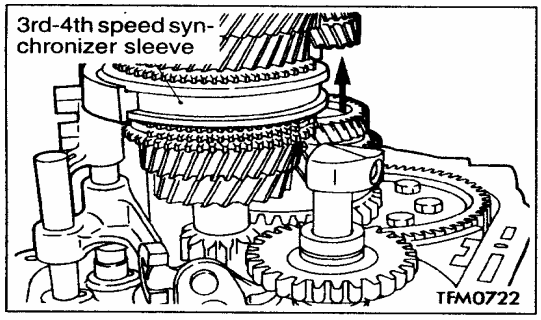


Fig 11-11

◄C► REVERSE IDLER GEAR SHAFT REMOVAL

Shift the 3rd-4th speed synchronizer sleeve toward the 4th speed side.

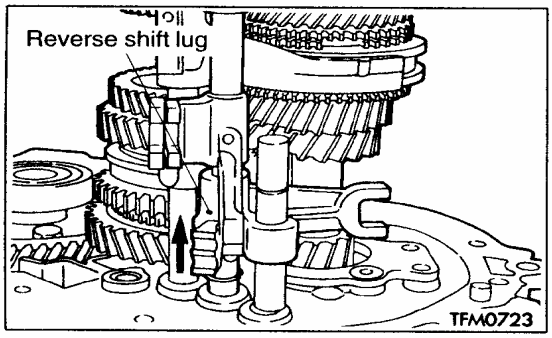


Fig 11-12

◄D► 3^{RD}-4^{TH} SPEED SHIFT RAIL / 3RD-4TH SPEED SHIFT FORK / 5TH SPEED SHIFT FORK / SNAP RING / REVERSE SHIFT LUG / 5TH SPEED SHIFT RAIL / STEEL BALL / REVERSE INTERLOCK RAIL REMOVAL

(1) While sliding the reverse shift lug in the direction shown, remove the 5th speed shift fork, 5th speed shift rail, reverse shift lug, snap ring, steel ball and reverse interlock rail.

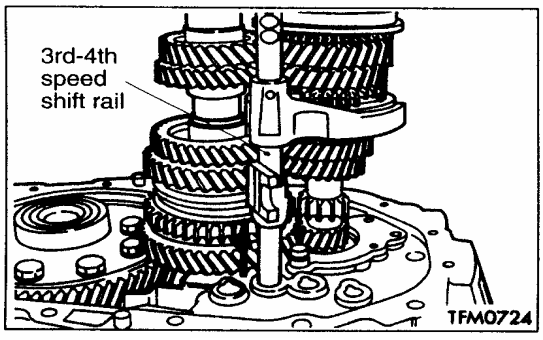


Fig 11-13

(2) While sliding the 3rd-4th speed shift rail in the direction shown, remove it together with the shift fork.

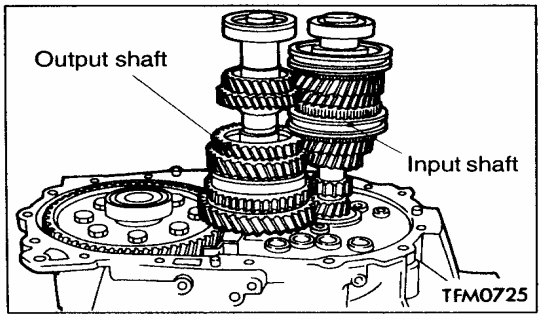


Fig 11-14

◄E► INPUT SHAFT / OUTPUT SHAFT REMOVAL

Remove the input and output shafts together.

ADJUSTMENT BEFORE REASSEMBLY :
SPACER SELECTION FOR DIFFERENTIAL CASE END PLAY ADJUSTMENT

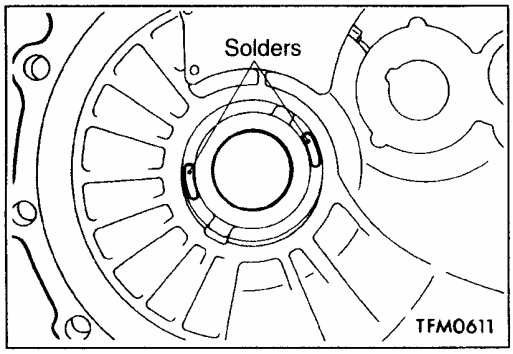


Fig 11-15

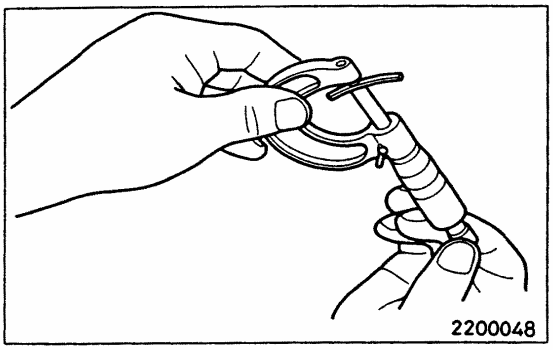


Fig 11-16

(1) Put solders (about 10 mm long, 1.6 mm in diameter) in the illustrated positions of the transmission case and install the differential.
(2) Install the clutch housing and tighten the bolts to the specified torque.
(3) If the solders are not crushed, put larger diameter solders and repeat Steps (1) and (2).
(4) Measure the thickness (T) of the crushed solder with a micrometer and select a spacer according to the following equation.

Spacer thickness:
(T - 0.05 mm) to (T - 0.17 mm)

REASSEMBLY SERVICE POINTS:

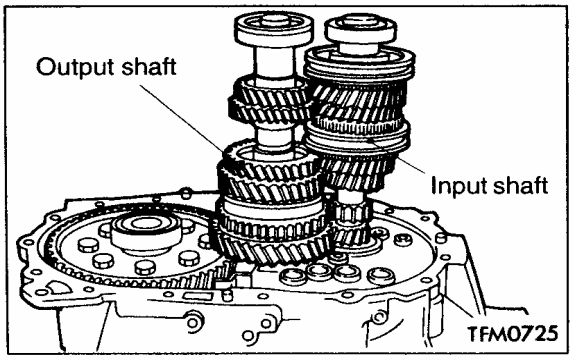


Fig 11-17

►A◄ OUTPUT SHAFT / INPUT SHAFT INSTALLATION
install the input and output shafts together.

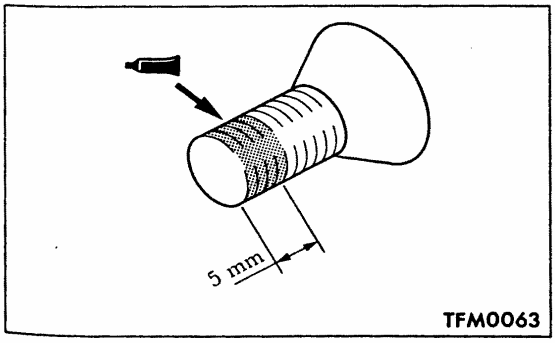


Fig 11-18

►B◄ FRONT BEARING RETAINER INSTALLATION
Apply a sealant to the front bearing retainer mounting bolts (countersunk bolts only).

Specified sealant:
3M STUD Locking No. 4170 or equivalent

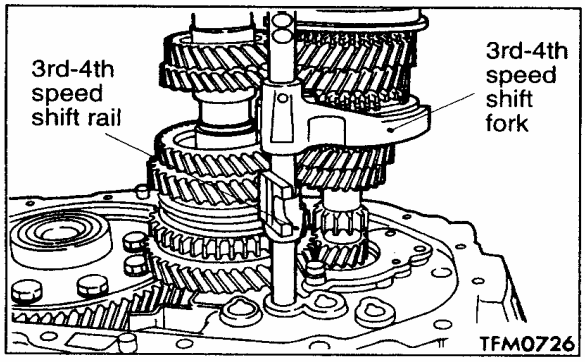


Fig 11-19

►C◄ REVERSE INTERLOCK RAIL / STEEL BALL / 5TH SPEED SHIFT RAIL / REVERSE SHIFT LUG / SNAP RING / 5TH SPEED SHIFT FORK / 3RD-4TH SPEED SHIFT FORK / 3RD-4TH SPEED SHIFT RAIL INSTALLATION

（1）Install the 3rd-4th shift rail and fork.

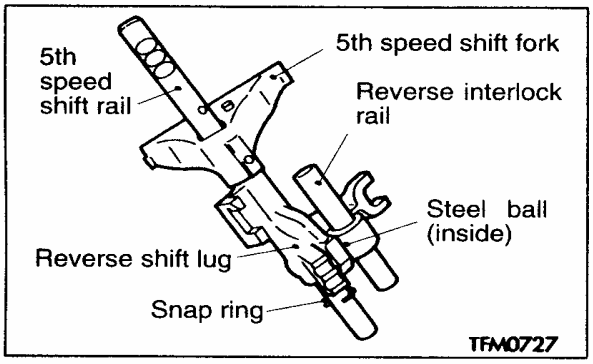


Fig 11-20

(2) Install the reverse interlock rail, steel ball, 5th speed shift rail, 5th speed shift fork, reverse shift lug and snap ring in the illustrated positions.

(3) While sliding the reverse shift lug in the direction shown, install the 5th speed shift fork, 5th speed shift rail, reverse shift lug, snap ring, steel ball and reverse interlock rail.

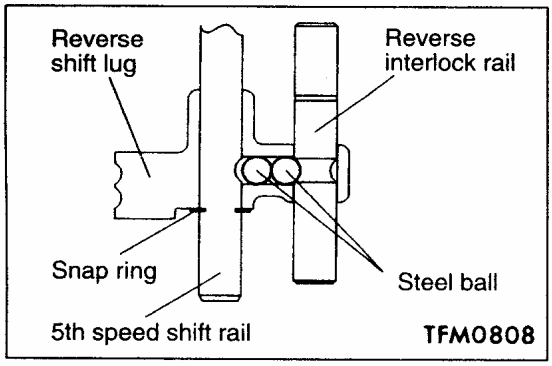


Fig 11-21

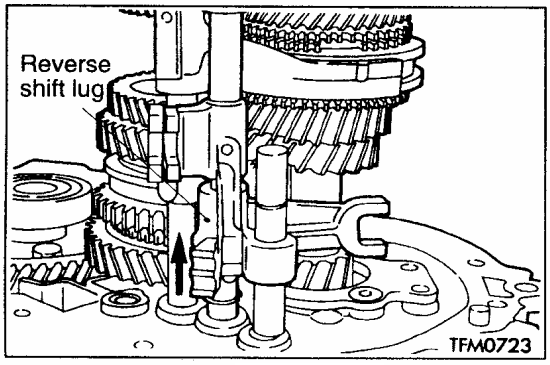


Fig 11-22

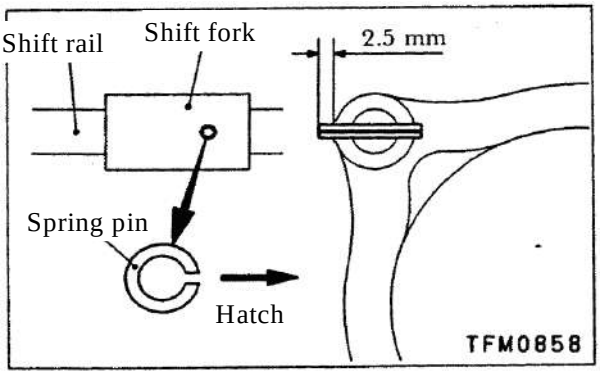


Fig 11-23

►D◄ SPRING PIN INSTALLATION

►E◄ SPACER INSTALLATION

Install the spacer selected in the section "ADJUSTMENT BEFORE REASSEMBLY"

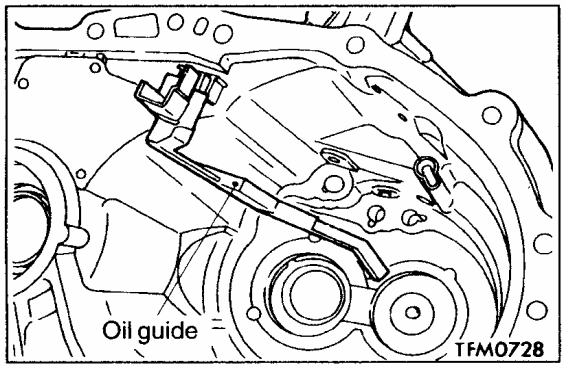


Fig 11-24

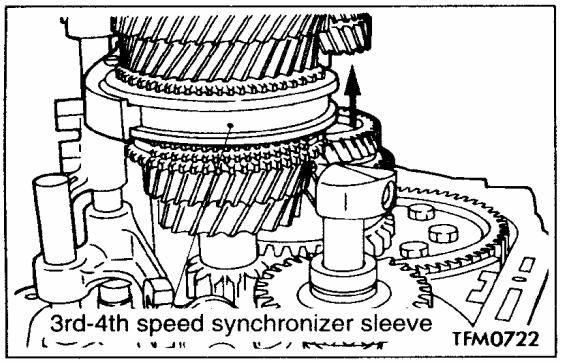


Fig 11-25

►G◄ REVERSE IDLER GEAR SHAFT INSTALLATION

(1) Shift the 3rd-4th speed synchronizer sleeve toward the 4th speed side.

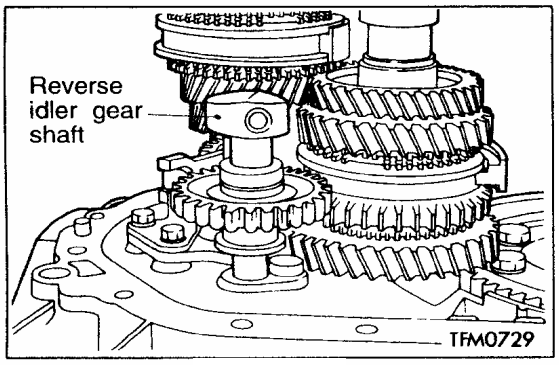


Fig 11-26

(2) Face the threaded hole of the reverse idler gear shaft toward the direction shown.

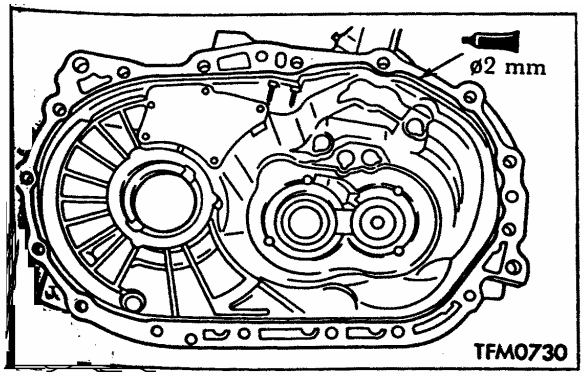


Fig 11-27

►H◄ TRANSMISSION CASE INSTALLATION

(1) Apply a 1.5 mm bead of sealant to the illustrated positions of the transmission case.

Specified sealant:
MITSUBISHI genuine sealant part No. MD997740 or equivalent

Caution
Squeeze out the sealant uniformly, while making sure that it is not broken or excessively applied.

►F◄ OIL GUIDE INSTALLATION

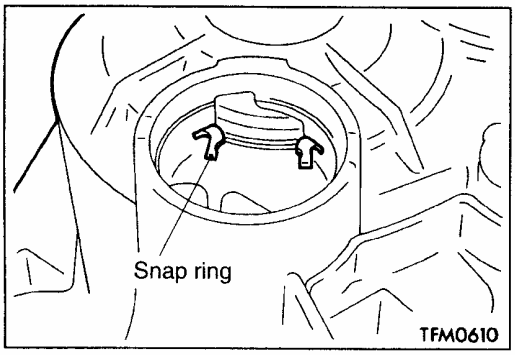


Fig 11-28

►I◄ SEALING CAP INSTALLATION

(2) Install the transmission case and expand the snap ring.
(3) Tighten the transmission case mounting bolts to the specified torque.

NOTE
Place the transmission upside down and let the snap ring fit in the groove by taking advantage of the output shaft's own weight.

Press-fit the sealing cap all the way up to the illustrated positio n.

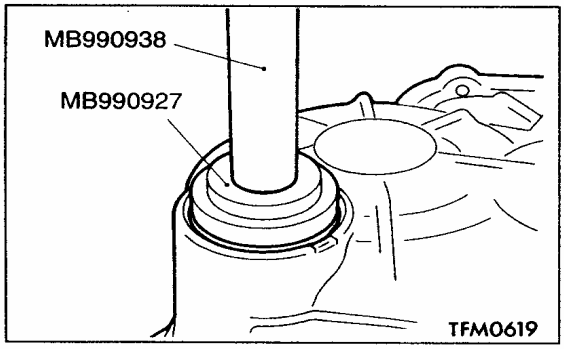


Fig 11-29

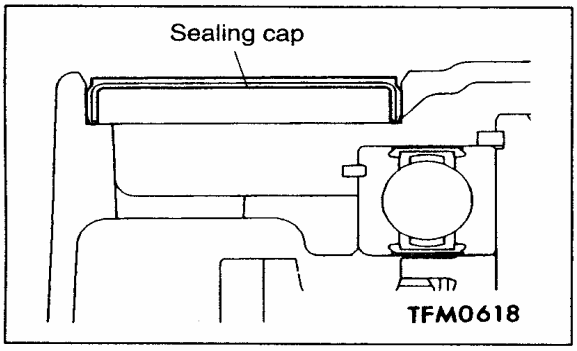


Fig 11-30

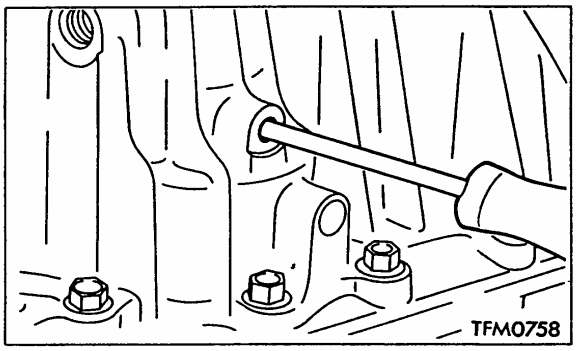


Fig 11-31

►J◄ REVERSE IDLER GEAR SHAFT BOLT INSTALLATION
Using a screwdriver (8 mm in shaft diameter), center the bolt hole.

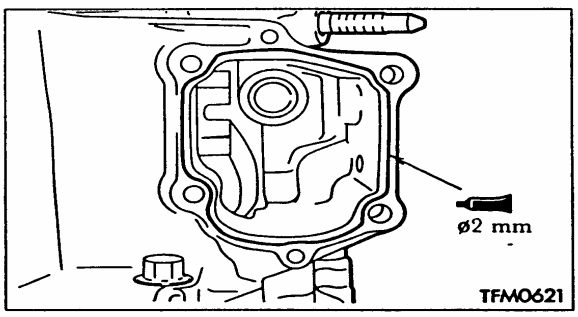


Fig 11-32

►K◄ CONTROL HOUSING INSTALLATION
Apply a 1.5 mm bead of sealant to the illustrated position of the transmission case.

Specified sealant:
MITSUBISHI genuine sealant part No. MD997740 or equivalent

Caution
Squeeze out the sealant uniformly, while making sure that it is not broken or excessively applied.

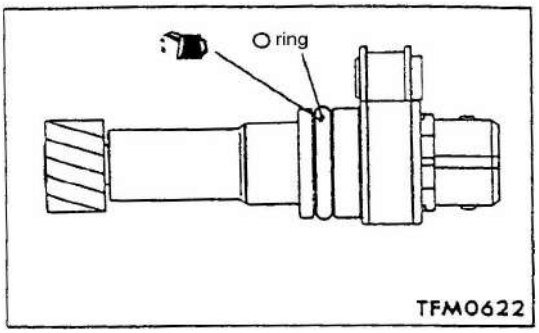


Fig 11-33

►L◄ SPEEDOMETER GEAR INSTALLATION

Apply transmission oil to the O-ring of the speedometer gear.

Transmission oil:
Hypoid gear oil SAE 75W-85W conforming to API classification GL-4 or higher

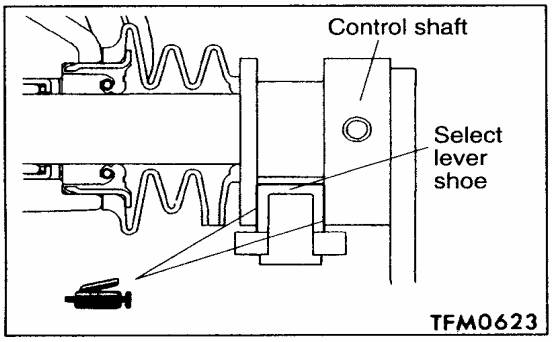


Fig 11-34

►M◄SELECT LEVER INSTALLATION

Apply grease to the control shaft sliding portion of the select lever shoe.

Specified grease:
MITSUBISHI genuine grease part No. 0101011 or equivalent

2）INPUT SHAFT(DABS15-1L)

DISASSEMBLY AND REASSEMBLY：

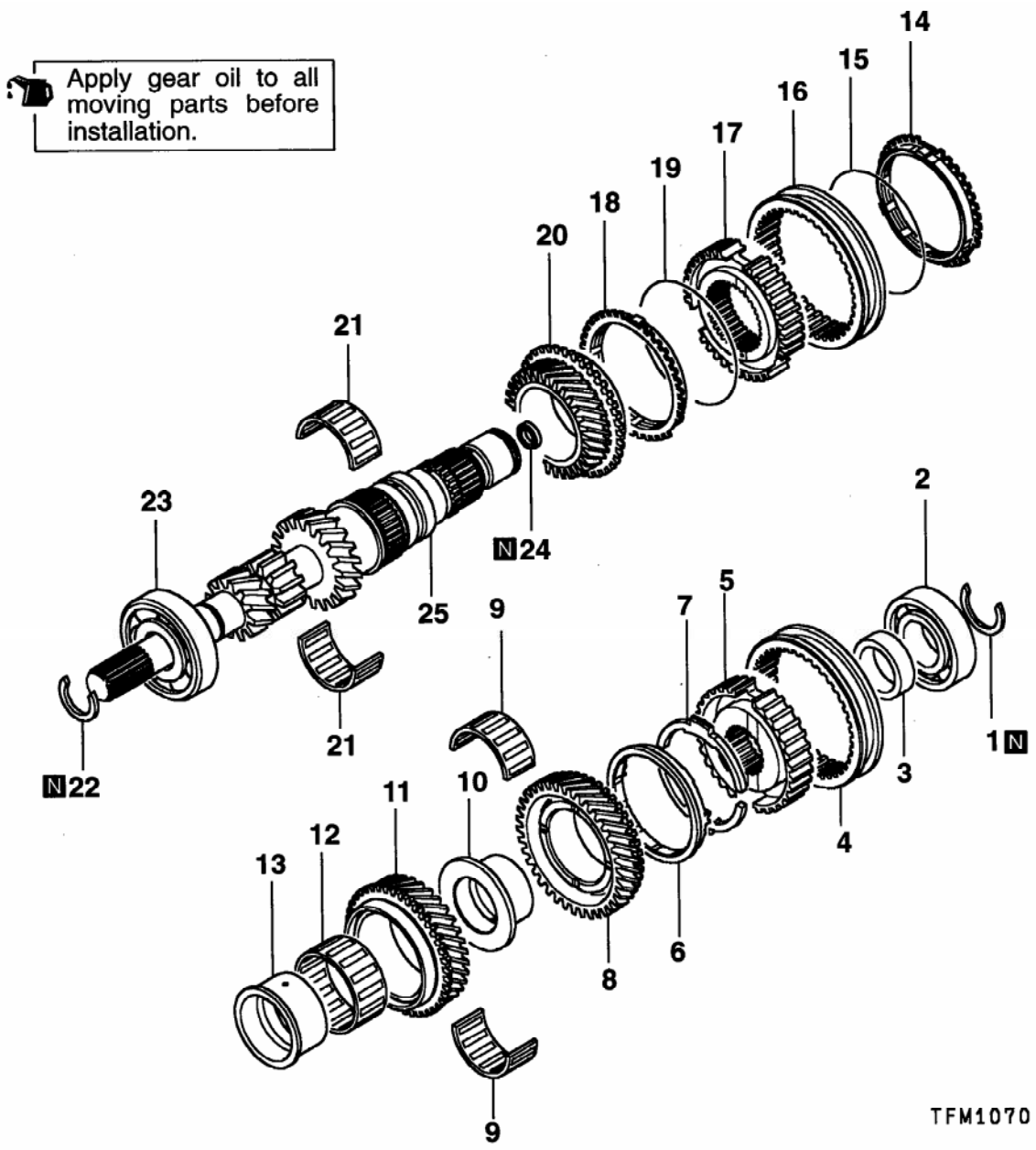


Fig 11-35

Disassembly steps:

►L◄ 1. Snap ring
◄A► ►K◄ 2. Ball bearing
3. sleeve
►J ◄ 4. Synchronizer sleeve
◄B► ►I ◄ 5. 5th-reverse speed synchronizer hub
6. Synchronizer ring
►D◄ 7. lever synchronizer
8. 5th speed gear
◄C► ►I◄ 9. Needle roller bearing
10. 5th speed gear sleeve
◄C► ►H◄ 11. 4th speed gear
12. Needle roller bearing
◄D► ►G◄ 13. 4th speed gear sleeve
14. Synchronizer ring
►D◄ 15. Synchronizer spring
►F◄ 16. Synchronizer sleeve
►E◄ 17. 3rd-4th speed synchronizer hub
18. Synchronizer ring
►D◄ 19. Synchronizer spring
20. 3rd speed gear
21. Needle roller bearing
►C◄ 22. Snap ring
◄E► ►B◄ 23. Ball bearing
►A◄ 24. Oil seal
25. Input shaf

INPUT SHAFT(DABS15-11 D1)

DISASSEMBLY AND REASSEMBLY：

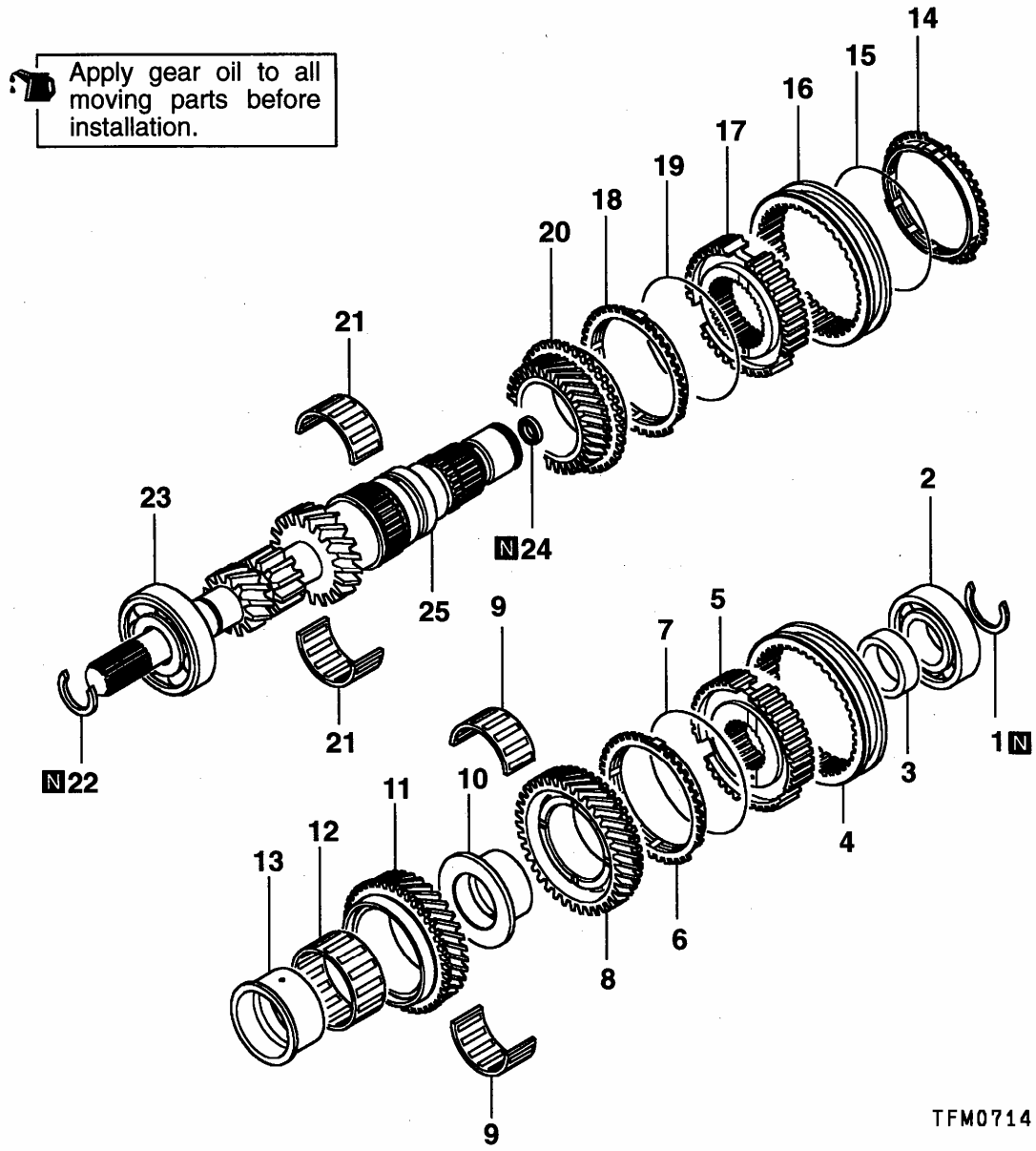


Fig 11-36

DISASSEMBLY STEPS

►M◄ 1.Snap ring
◄A► ►L◄ 2. Ball bearing
3.Coller
►J◄ 4.Synchronizer sleeve
◄C► ►I◄5.5th-reverse speed synchronizer hub
6.Synchronizer ring
►D◄7.Synchronizer spring
8.5th speed gear
9.Needle roller bearing
◄D► ►H◄10.5th speed gear sleeve
11.4th speed gear
12.Needle roller bearing
◄E► ►G◄ 13.4th speed gear sleeve
14.Synchronizer
►D◄15.Synchronizer spring
►F◄16.Synchronizer sleeve
►E◄17.3rd-4th speed synchronizer hub
18.Synchronizer ring
►D◄19.Synchronizer spring
20.3rd speed gear
21.Needle roller bearing
►C◄22.Snap ring
◄F► ►B◄23.Ball bearing
►A◄24.Oil seal
25.Input shaft

INPUT SHAFT(DABS15-11)

DISASSEMBLY AND REASSEMBLY：

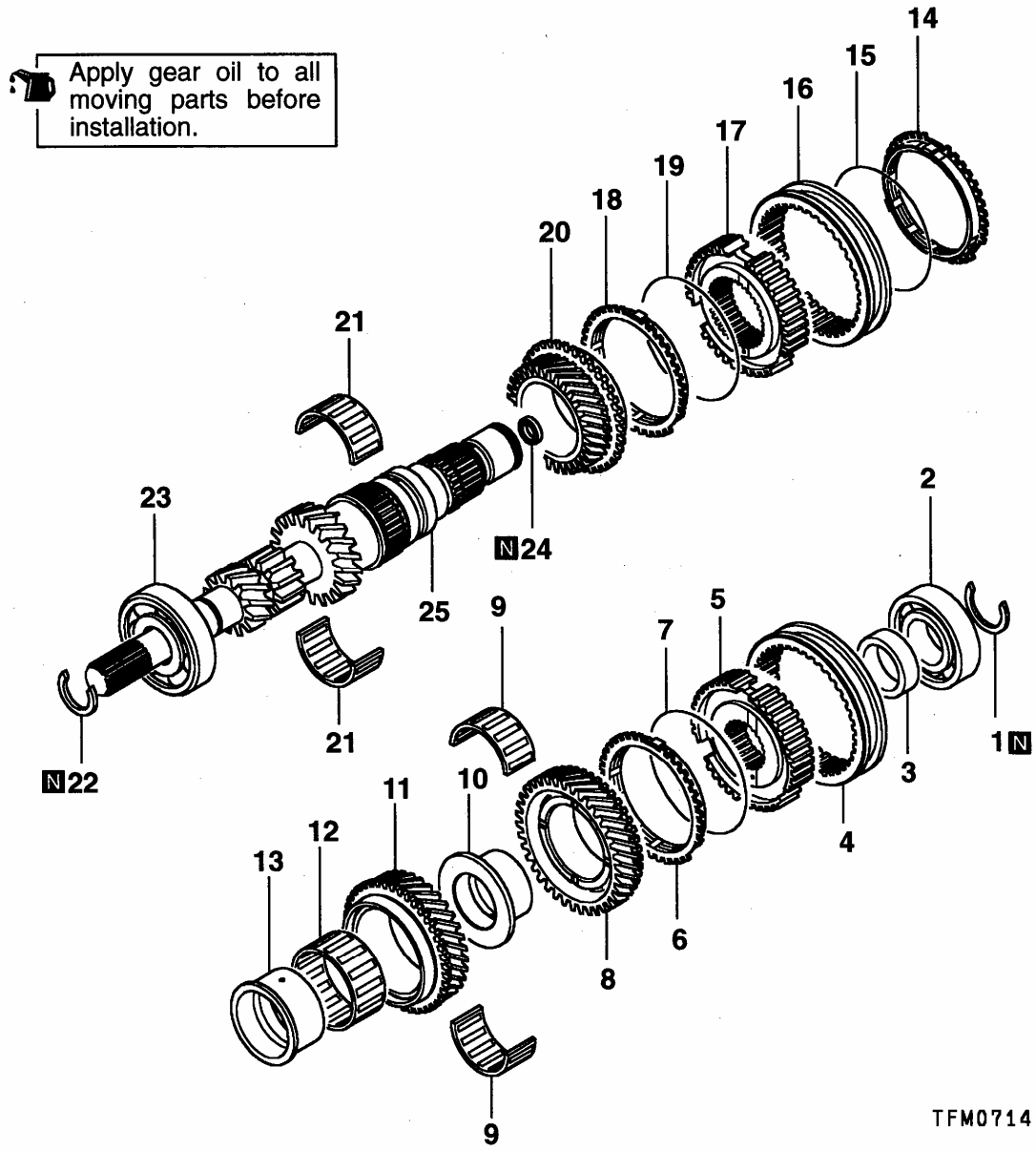


Fig 11-37

DISASSEMBLY STEPS

►M◄ 1.Snap ring
◄A► ►L◄ 2. Ball bearing
3.Coller
►J◄ 4.Synchronizer sleeve
◄C► ►I◄5.5th-reverse speed synchronizer hub
6.Synchronizer ring
►D◄7.Synchronizer spring
8.5th speed gear
9.Needle roller bearing
◄D► ►H◄10.5th speed gear sleeve
11.4th speed gear
12.Needle roller bearing
◄E► ►G◄ 13.4th speed gear sleeve
14.Synchronizer
►D◄15.Synchronizer spring
►F◄16.Synchronizer sleeve
►E◄17.3rd-4th speed synchronizer hub
18.Synchronizer ring
►D◄19.Synchronizer spring
20.3rd speed gear
21.Needle roller bearing
►C◄22.Snap ring
◄F► ►B◄23.Ball bearing
►A◄24.Oil seal
25.Input shaft

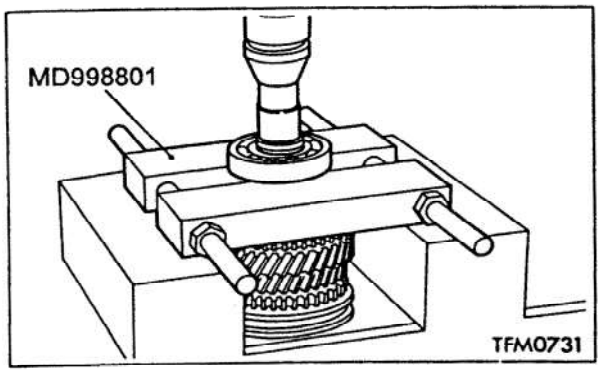


Fig 11-38

DISASSEMBLY SERVICE POINTS：

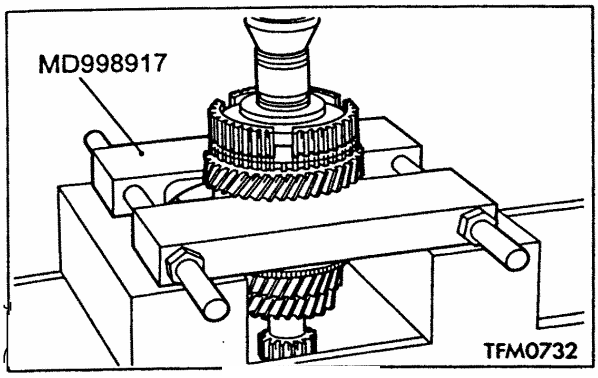


Fig 11-39

◄B►5TH-REVERSE SPEED SYNCHRONIZER HUB REMOVAL

Mount a special tool on the 5th speed gear and remove the 5th-reverse synchronizer hub.

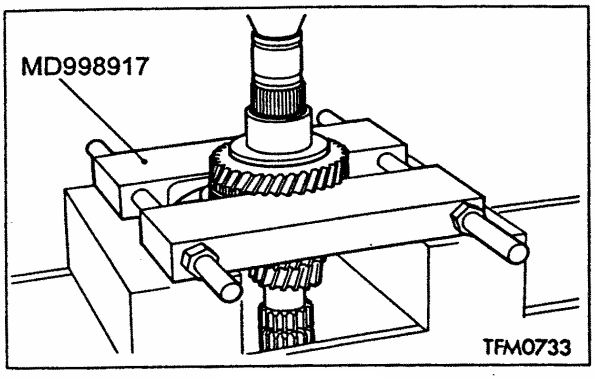


Fig 11-40

◄C►5TH SPEED GEAR SLEEVE REMOVAL

Mount a special tool on the 4th speed gear and remove the 5th speed gear sleeve.

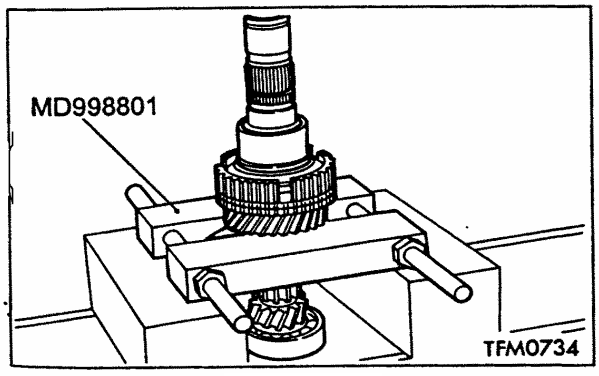


Fig 11-41

◄D►4TH SPEED GEAR SLEEVE REMOVAL

Mount a special tool on the 3rd speed gear and remove the 4th speed gear sleeve.

◄A► BALL BEARING REMOVAL

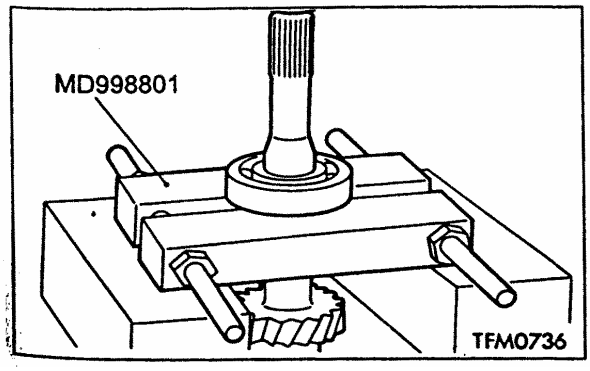


Fig 11-42

◄E► BALL BEARING REMOVAL

REASSEMBLY SERVICE POINTS:

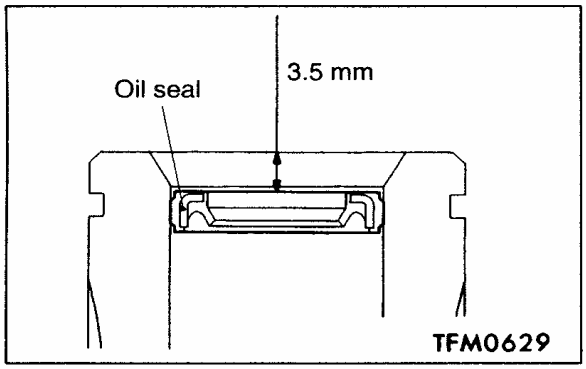


Fig 11-43

►A◄ OIL SEAL INSTALLATION

Drive in the oil seal all the way up to the illustrated dimension.

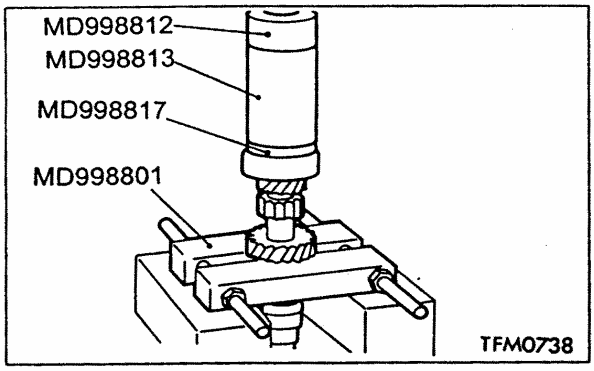


Fig 11-44

►B◄ BALL BEARING INSTALLATION

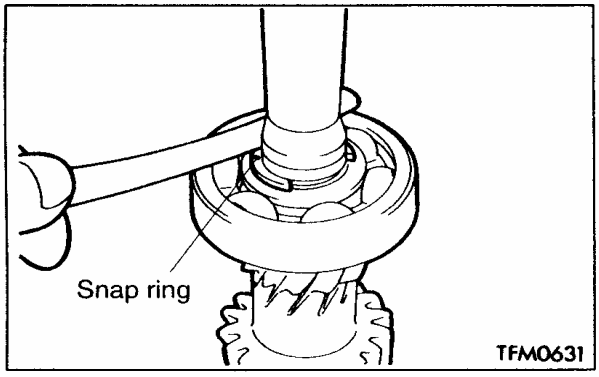


Fig 11-45

►C◄ SNAP RING INSTALLATION

Select and install a snap ring so that the input shaft front bearing end play will have the standard value.

Standard value: 0−0.12mm

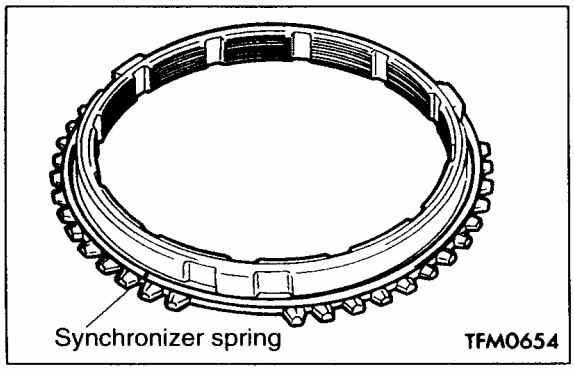


Fig 11-46

►D◄SYNCHRONIZER SPRING INSTALLATION

Install the synchronizer spring securely up to the illustrated position of the synchronizer ring.

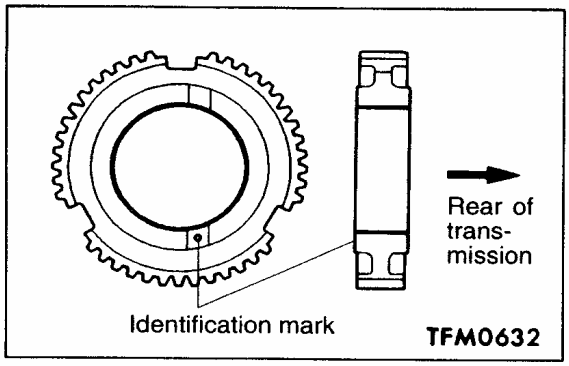


Fig 11-47

►E◄3RD-4TH SPEED SYNCHRONIZER HUB INSTALLATION

Install the 3rd-4th speed synchronizer hub in such a way that it will be oriented in the direction shown.

Caution

When the hub is installed, make sure that the synchronizer ring is not caught.

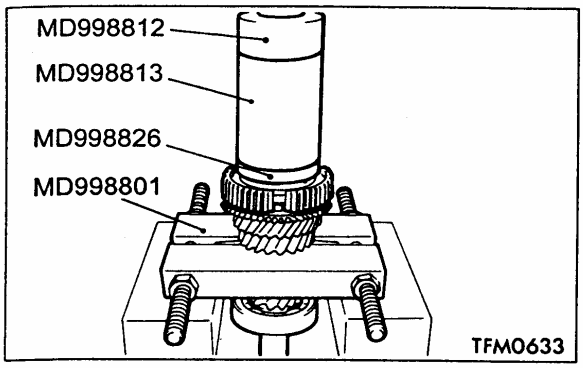


Fig 11-48

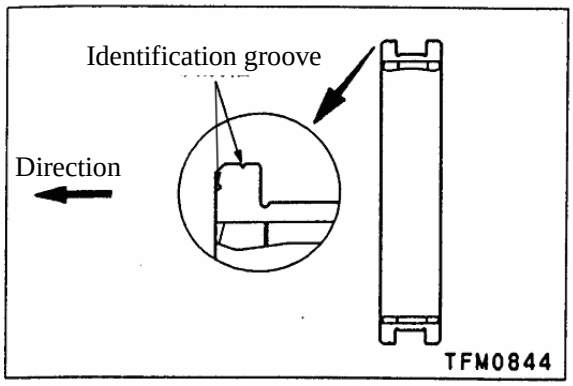


Fig 11-49

►F◄ SYNCHRONIZER SLEEVE INSTALLATION

(1) Install the synchronizer sleeve in such a way that it will be oriented in the direction shown.

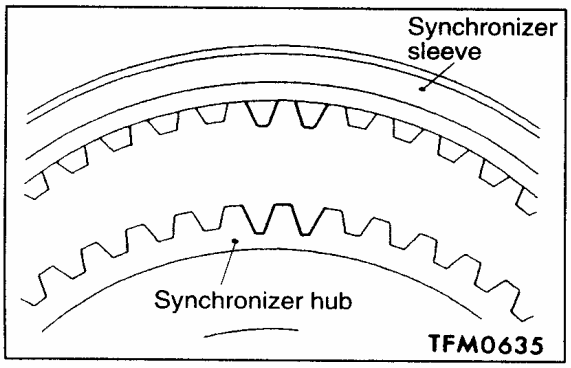


Fig 11-50

(2) When the synchronizer sleeve is installed, make sure that the deep groove portion of the synchronizer hub is aligned with the projecting portion of the sleeve.

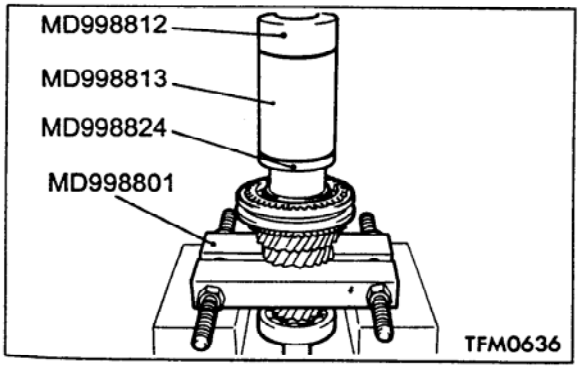


Fig 11-51

►G◄4TH SPEED GEAR SLEEVE INSTALLATION

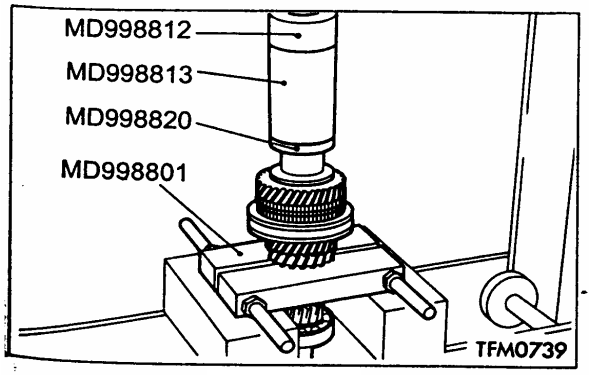


Fig 11-52

►H◄5TH SPEED GEAR SLEEVE INSTALLATION

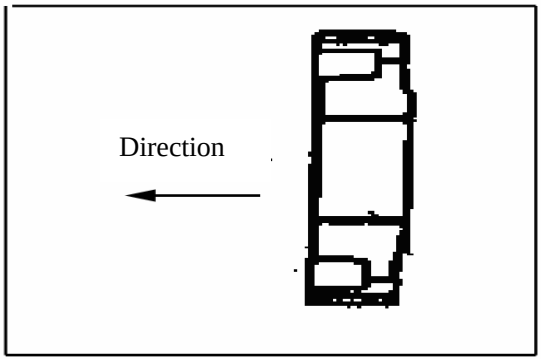


Fig 11-53

►I◄5TH-REVERSE SPEED SYNCHRONIZER HUB INSTALLATION

Install the 5th-reverse speed synchronizer hub in such a way that it will be oriented in the direction shown.

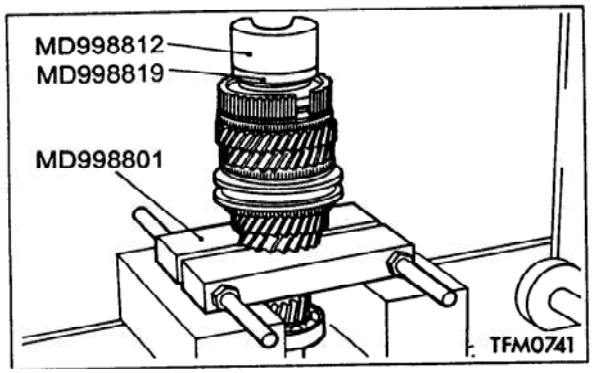


Fig 11-54

Caution
When the 5th-reverse speed synchronizer hub is installed, make sure that the synchronizer ring is not caught.

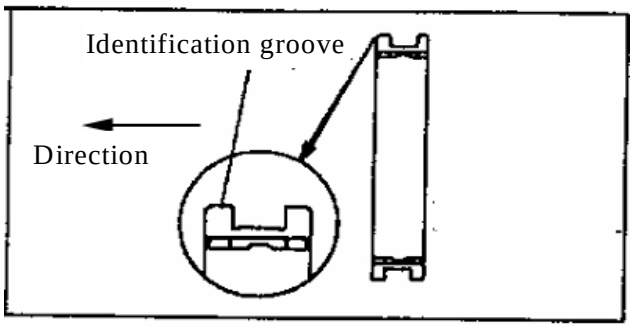


Fig 11-55

►J◄ SYNCHRONIZER SLEEVE INSTALLATION

(1) Install the synchronizer sleeve in such a way that it will be oriented in the direction shown.

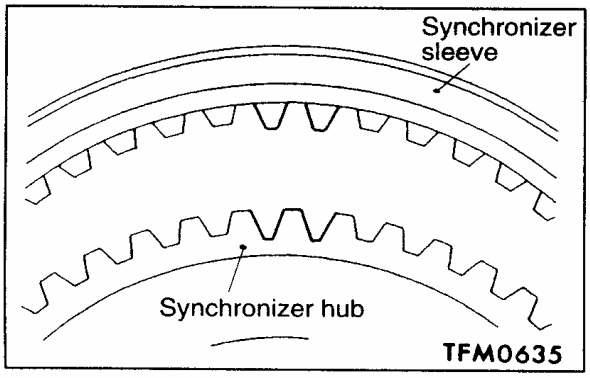


Fig 11-56

(2) When the synchronizer sleeve is installed, make sure that the deep groove portion of the synchronizer hub is aligned with the projecting portion of the sleeve.

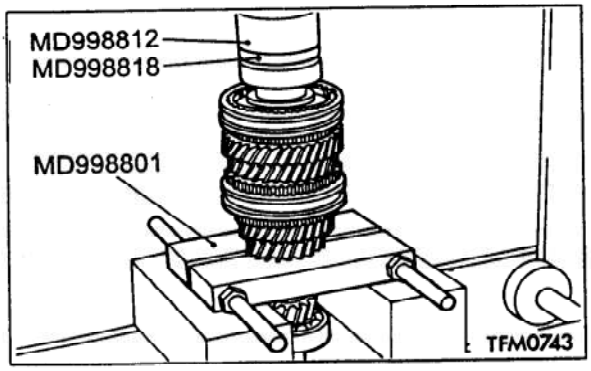


Fig 11-57

►K◄ BALL BEARING INSTALLATION

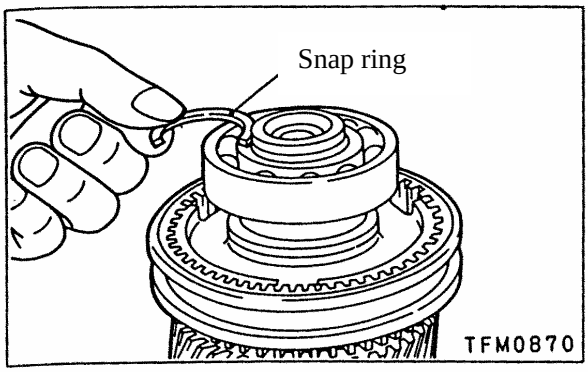


Fig 11-58

►L◄SNAP RING INSTALLATION

Select and install a snap ring so that the input shaft rear bearing end play will have the standard value.

Standard value: 0−0.09mm

DABS15-11 5TH-REVERSE SYNCHRONIZER INSTALLATION

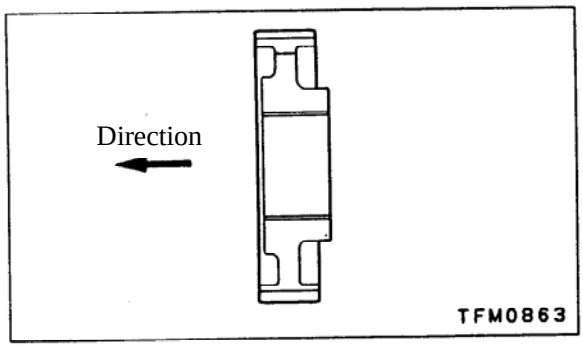


Fig 11-59

►I◄5TH-REVERSE SPEED SYNCHRONIZER HUB INSTALLATION

Install the 5th-reverse speed synchronizer hub in such a way that it will be oriented in the direction shown.

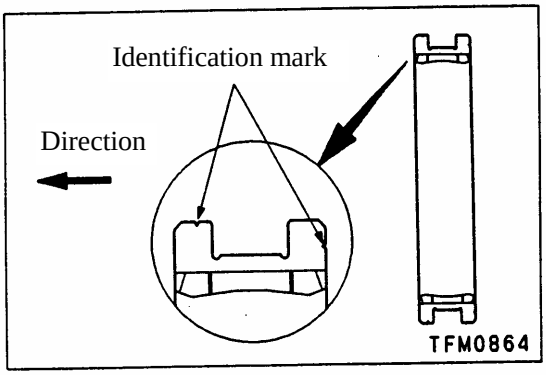


Fig 11-60

►J◄ SYNCHRONIZER SLEEVE INSTALLATION

(1) Install the synchronizer sleeve in such a way that it will be oriented in the direction shown.

3)OUTPUTSHAFT(DABS15-11,DABS15-1L)

DISASSEMBLYANDREASSEMBLY :

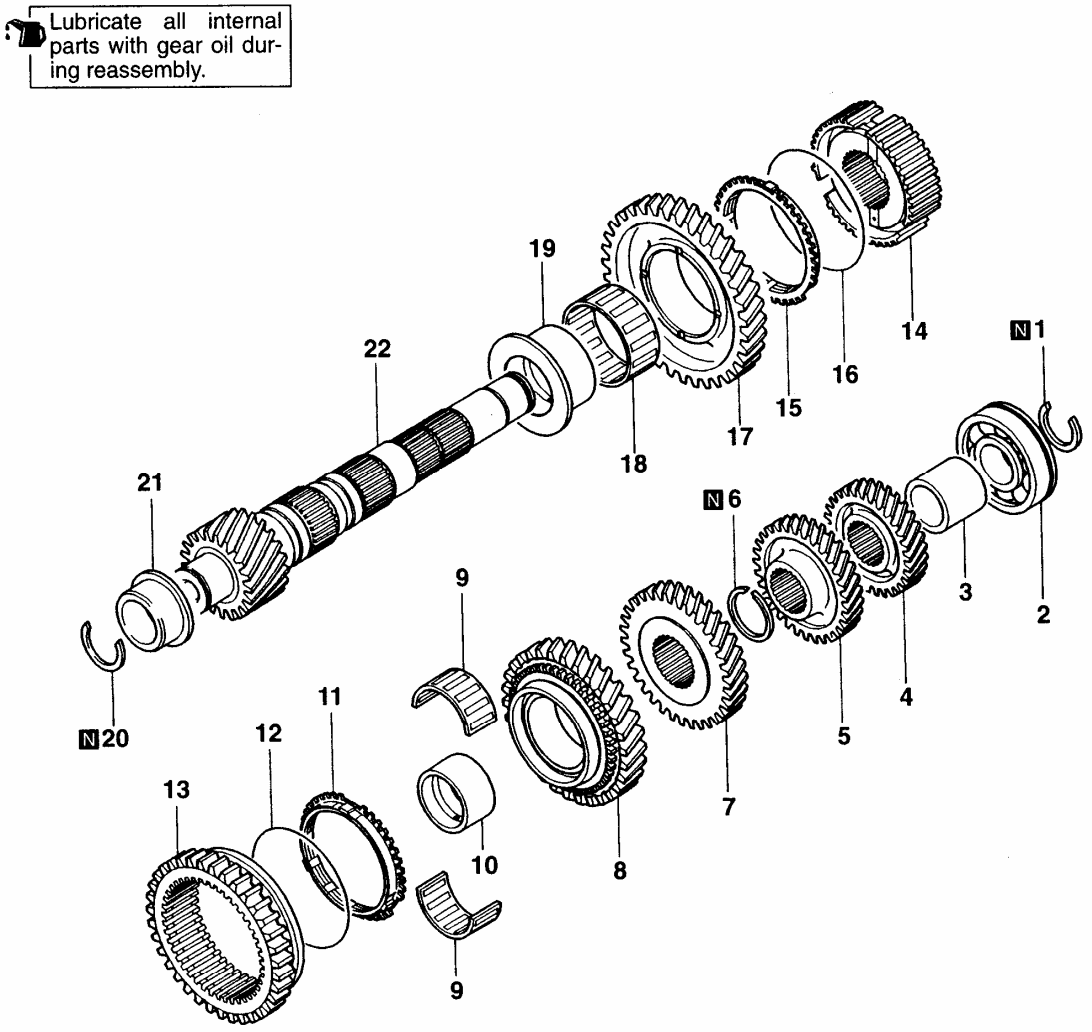


Fig 11-61

Disassembly steps

- ▶J◀ 1. Snap ring
- ◀A▶ ▶I◀ 2. Ball bearing
- 3. Collar
- 4. 5th speed gear
- 5. 4th speed gear
- ▶H◀ 6. Snap ring
- 7. 3rd speed gear
- 8. 2nd speed gear
- 9. Needle roller bearing
- ◀B▶ ▶G◀ 10. 2nd speed gear sleeve
- 11. Synchronizer ring
- ▶D◀ 12. Synchronizer spring
- ▶F◀ 13. Synchronizer sleeve
- ▶E◀ 14. 1st-2nd speed synchronizer hub
- 15. Synchronizer ring
- ▶D◀ 16. Synchronizer spring
- 17. 1st speed gear
- 18. Needle roller bearing
- ◀C▶ ▶C◀ 19. 1st speed gear sleeve
- ▶B◀ 20. Snap ring
- ◀D▶ ▶A◀ 21. Roller bearing inner race
- 22. Output shaft

3a)OUTPUTSHAFT(DABS15-11,D1)
DISASSEMBLYANDREASSEMBLY：

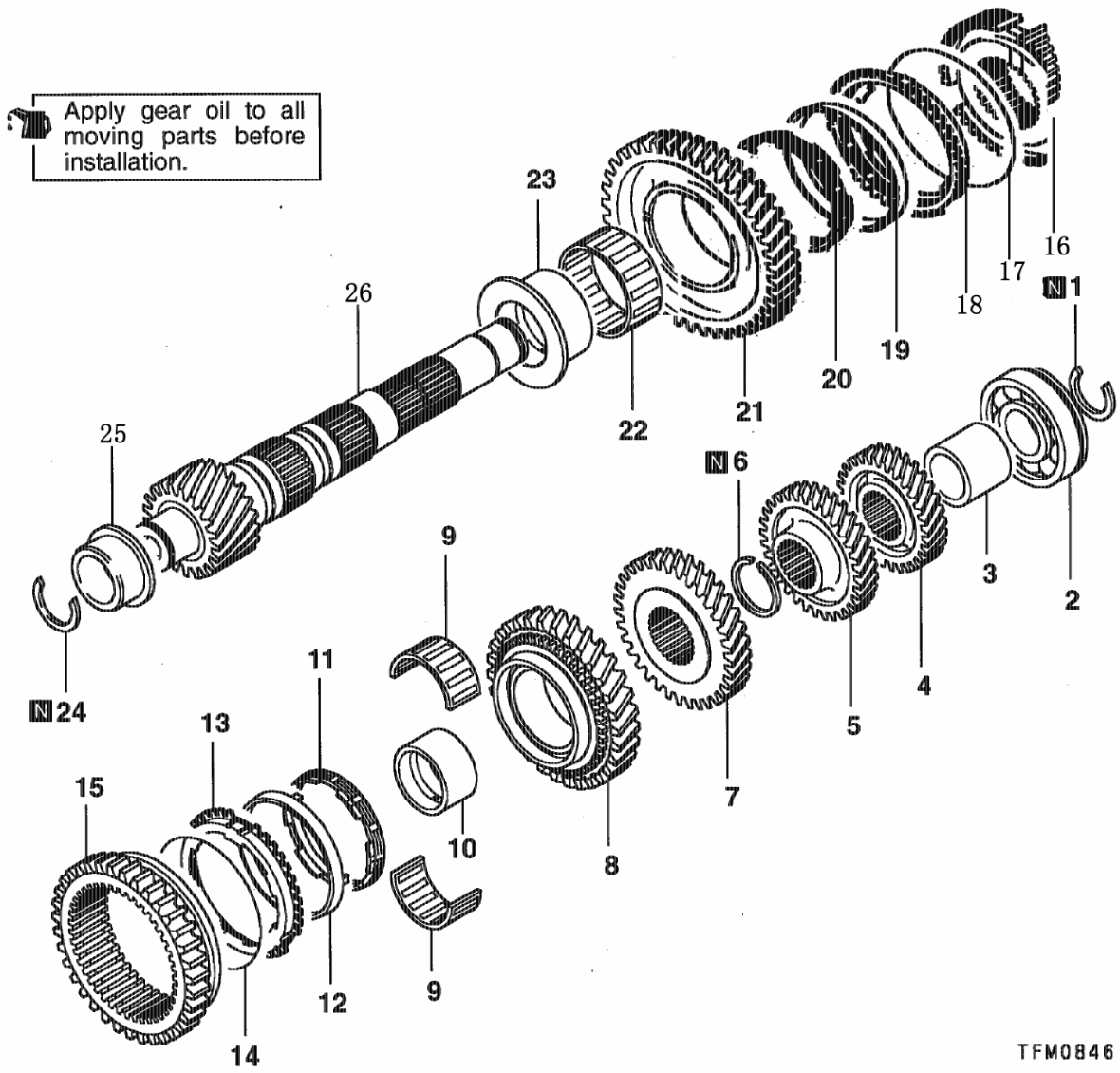


Fig 11-62

Disassembly steps:

►J ◄ 1. Snap ring
◄A► ►I ◄ 2. Ball bearing
3. Collar
4. 5th speed gear
5. 4th speed gear
►H◄ 6. Snap ring
7. 3rd speed gear
8. 2nd speed gear
9. Needle roller bearing
◄B► ►G◄10. 2nd speed gear sleeve
11. inner Synchronizer ring
12. Synchronizer cone
13.out Synchronizer ring
►D◄ 14. Synchronizer spring
►F◄ 15. Synchronizer sleeve
►E◄ 16. 1st-2nd speed synchronizer hub
►D◄ 17. Synchronizer spring
18. out Synchronizer ring
19. Synchronizer cone
20. inner Synchronizer ring
21. 1st speed gear
22. Needle roller bearing
◄C► ►C◄ 23. 1st speed gear sleeve
►B◄ 24. Snap ring
◄D► ►A◄ 25. Roller bearing inner race
26. Output shaft

DISASSEMBLY SERVICE POINTS

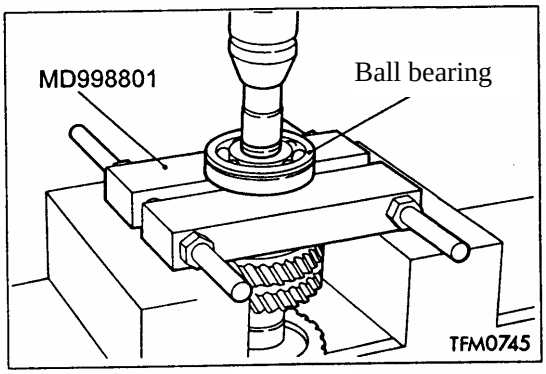


Fig 11-63

◄A► BALL BEARING REMOVAL

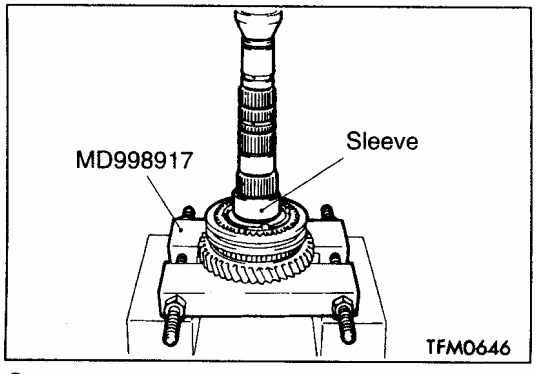


Fig 11-64

◄B► 2nd SPEED GEAR SLEEVE REMOVAL
Mount a special tool on the1st speed gear and remove the 2nd speed gear sleeve.

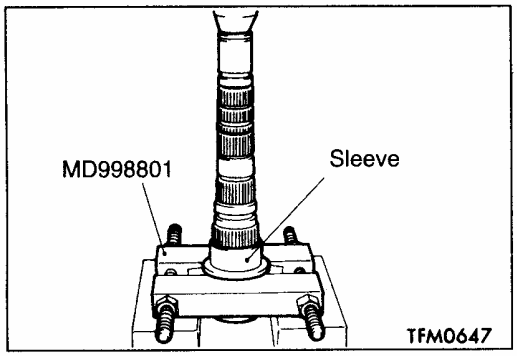


Fig 11-65

◄C► 1ST SPEED GEAR SLEEVE REMOVAL

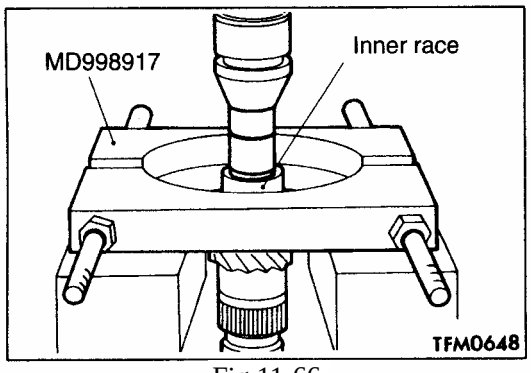


Fig 11-66

◄D► ROLLER BEARING INNER RACE REMOVAL

REASSEMBLY SERVICE POINTS

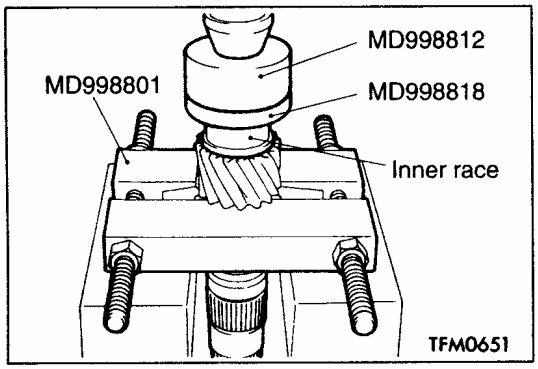


Fig 11-67

►A◄ ROLLER BEARING INNER RACE INSTALLATION

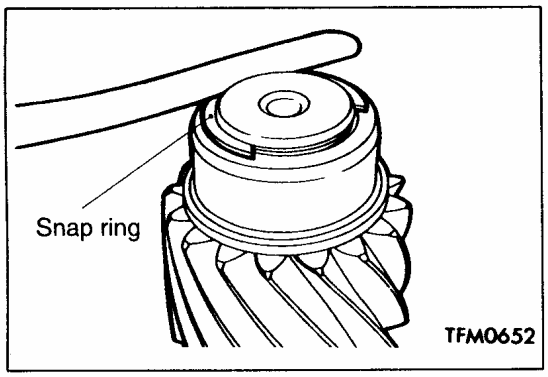


Fig 11-68

►B◄ SNAP RING INSTALLATION

Select and install a snap ring so that the output shaft front bearing end play will have the standard value.

Standard value: 0−0.12mm

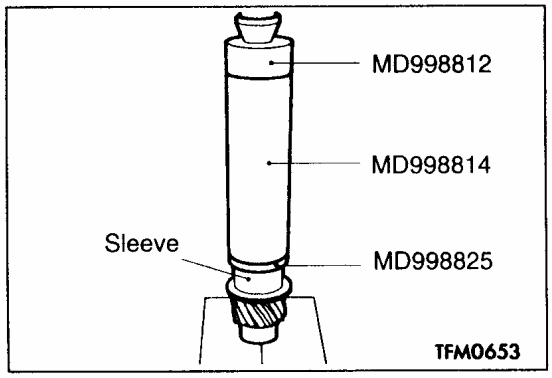


Fig 11-69

►C◄ 1ST SPEED GEAR SLEEVE INSTALLATION

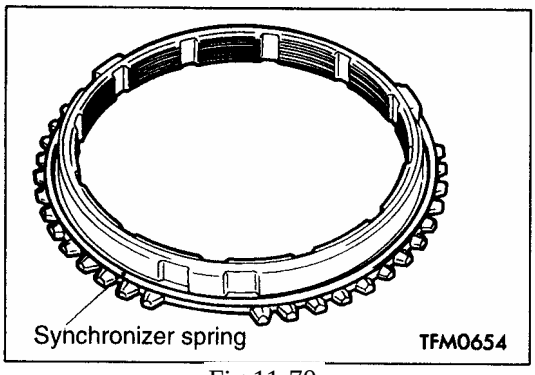


Fig 11-70

►D◄ SYNCHRONIZER SPRING INSTALLATION

Install the synchronizer spring securely up to the illustrated position of the synchronizer ring.

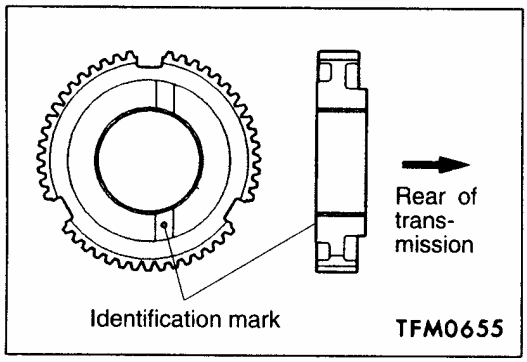


Fig 11-71

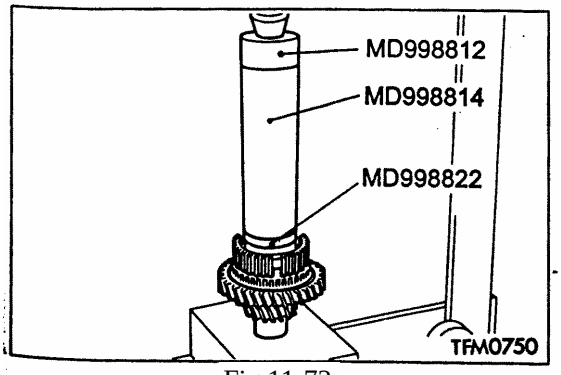


Fig 11-72

►E◄1ST-2ND SPEED SYNCHRONIZER HUB INSTALLATION

Install the 1st-2nd speed synchronizer hub in such a way that it will be oriented in the direction shown.

Caution
When the hub is installed, make sure that the synchronizer ring is not caught.

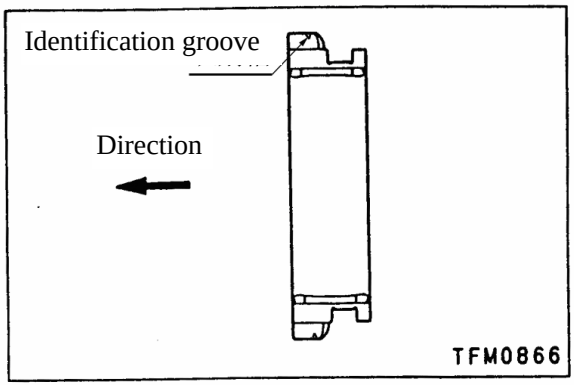


Fig 11-73

►F◄SYNCHRONIZER SLEEVE INSTALLATION

(1) Install the synchronizer sleeve in such a way that it will be oriented in the direction shown.

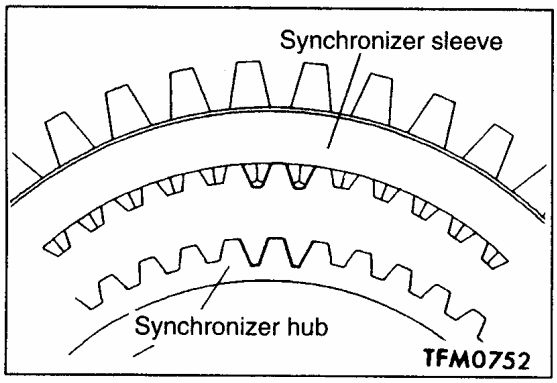


Fig 11-74

(2) When the synchronizer sleeve is installed, make sure that the deep groove portion of the synchronizer hub is aligned with the projecting portion of the sleeve.

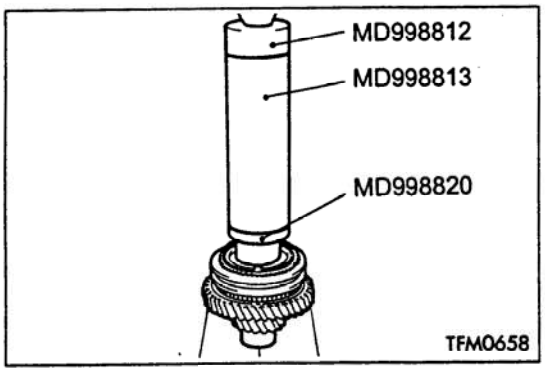


Fig 11-75

►G◄ 2ND SPEED GEAR SLEEVE INSTALLATION

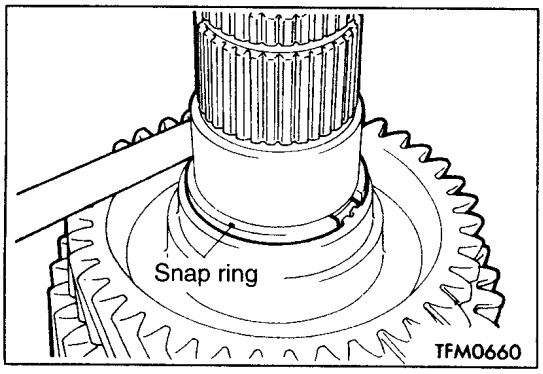


Fig 11-76

►H◄ SNAP RING INSTALLATION

Select and install a snap ring so that the output shaft 3rd speed gear end play will have the standard value.

Standard value：0−0.09mm

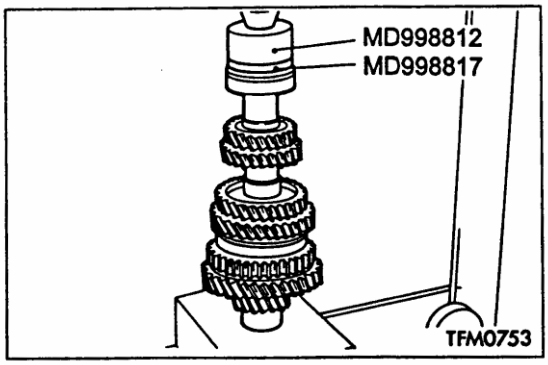


Fig 11-77

►I ◄ BALL BEARING INSTALLATION

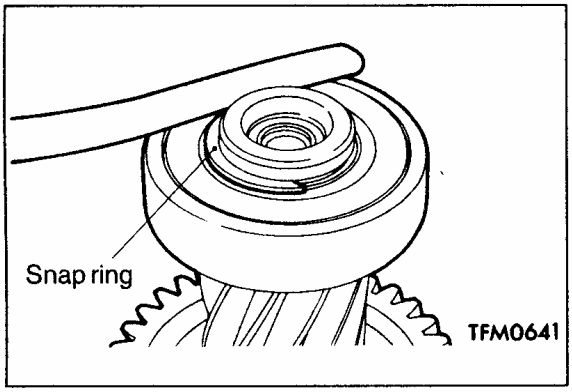


Fig 11-78

►J ◄ SNAP RING INSTALLATION

Select and install a snap ring so that the output shaft rear bearing end play will have the standard value.

Standard value：0−0.09mm

4）SPEEDOMETER GEAR
DISASSEMBLY AND REASSEMBLY

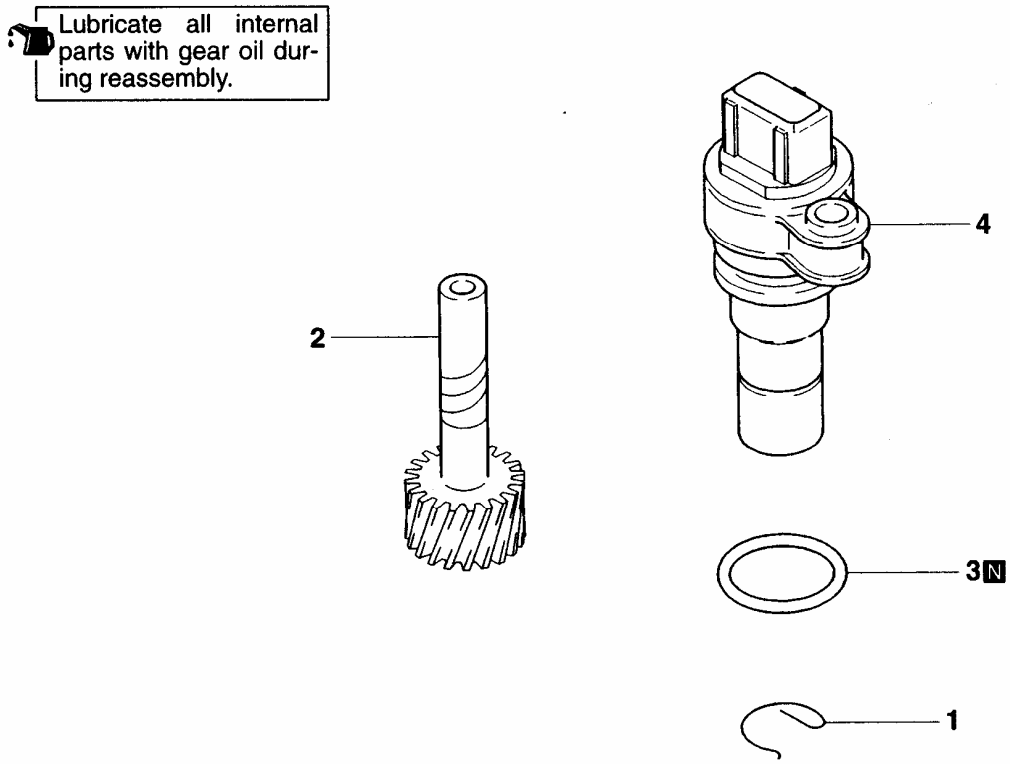


Fig 11-79

Disassembly steps:

1. e-clip
2. Speedometer driven gear
3. O-ring
4. Sleeve

(5) SELECT LEVER
DISASSEMBLY AND REASSEMBLY

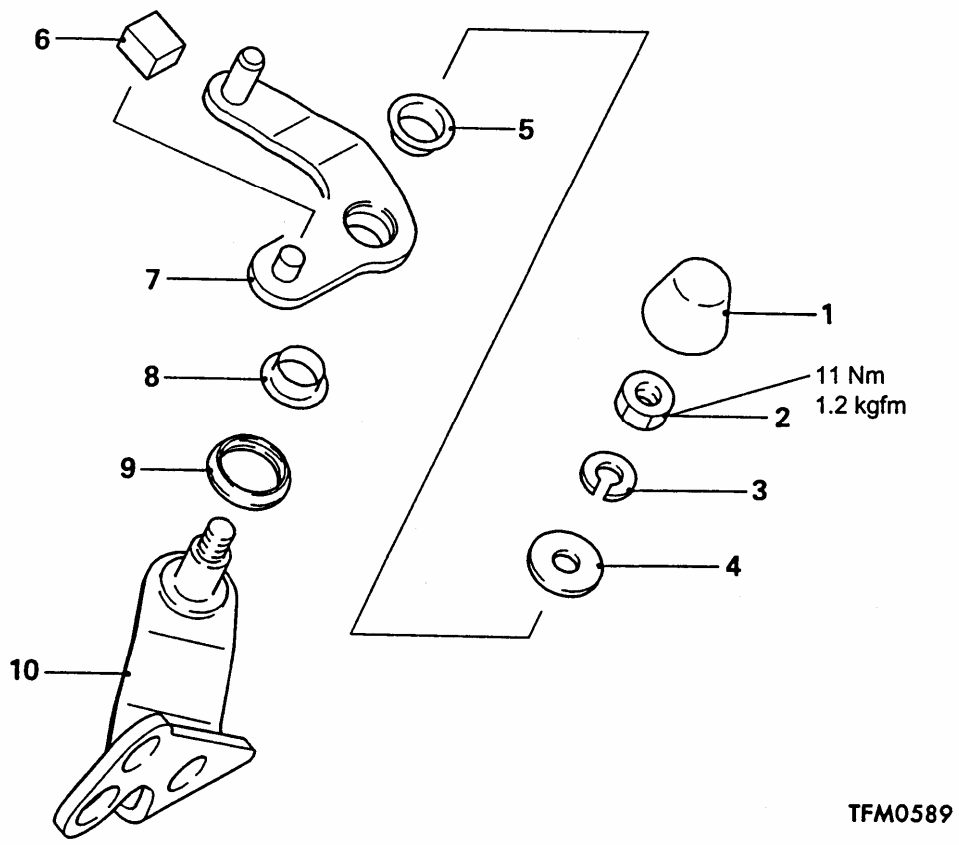


Fig 11-80

Disassembly steps:

►A◄ 1. Dust cover
2. Nut
3. Spring washer
4. Washer
5. Select lever bushing
6. Select lever shoe
7. Select lever
8. Select lever bushing
►A◄ 9. Dust cover
10. Select lever shaft

REASSEMBLY SERVICE POINT

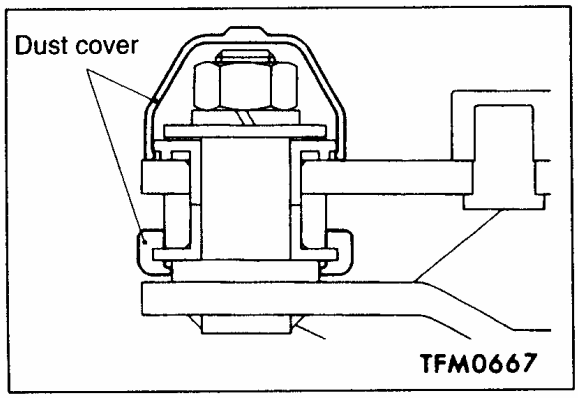


Fig 11-81

►A◄ DUST COVER INSTALLATION

6）CONTROL HOUSING
DISASSEMBLY AND REASSEMBLY

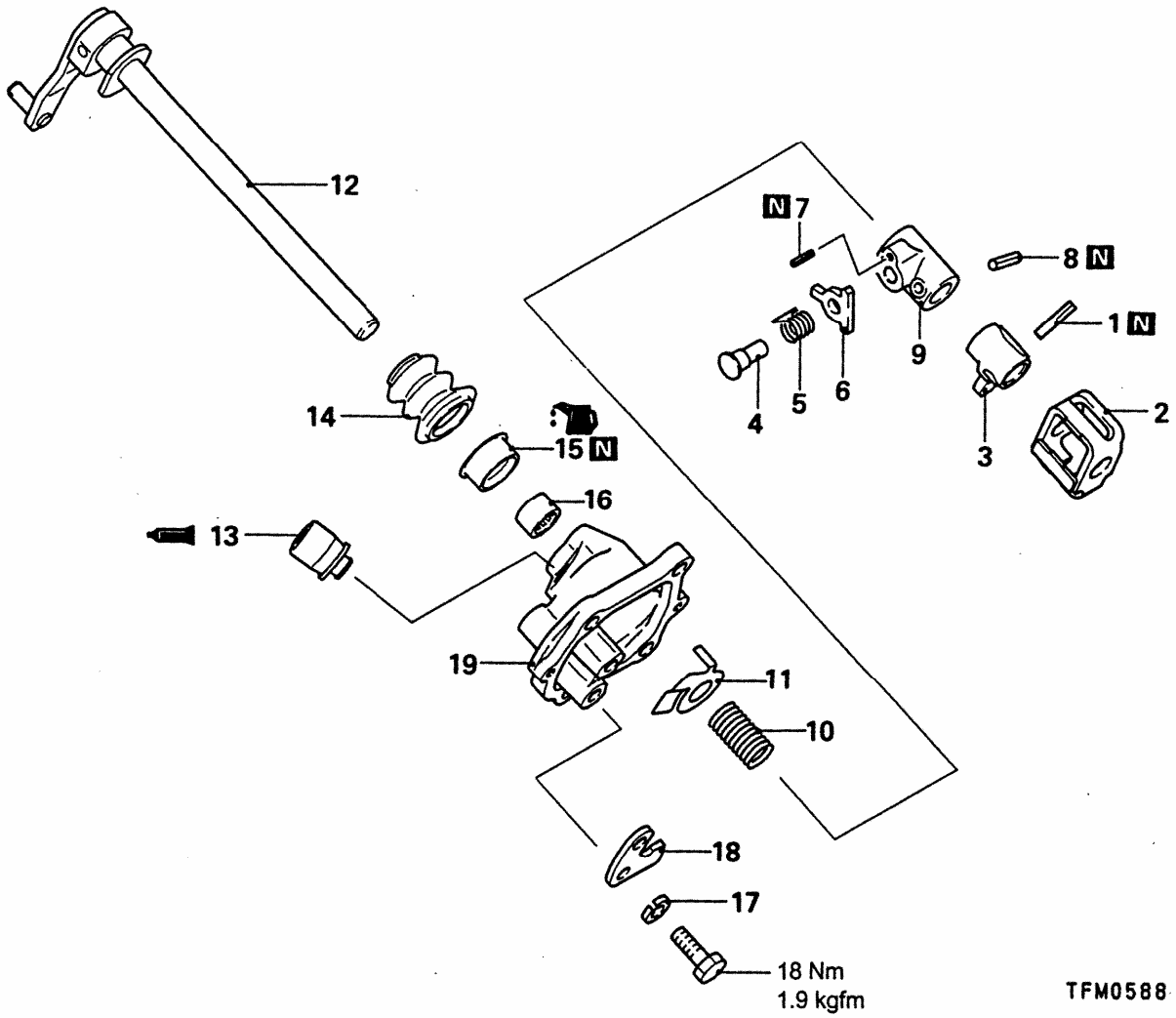


Fig 11-82

Disassembly steps:

◄A► ►F◄ 1. Lock pin
2. Inter lock plate
3 Control finger
4 Pin
5 Return spring
6. Stopper plate
►E◄ 7. Spring pin
►D◄ 8. Spring pin
9. Stopper body
10. Neutral return spring
11. Spacer
12. Control shaft
►C◄ 13. Air breather
14. Control shaft boot
►B◄ 15. Oil seal
►A◄ 16. Needle bearing
17. Spring washer
18. Stopper bracket
19. Control housing

DISASSEMBLY SERVICE POINT:

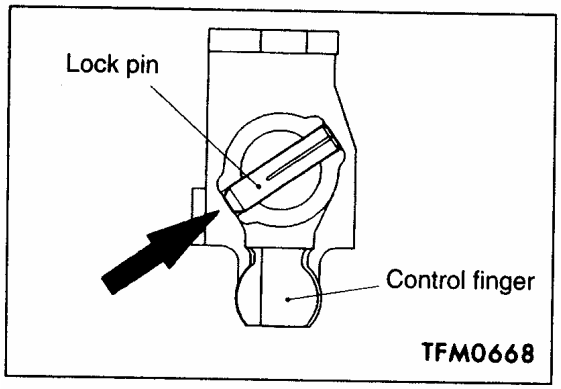


Fig 11-83

◄A► LOCK PIN REMOVAL

Drive the lock pin out of position from the direction shown.

REASSEMBLY SERVICE POINTS:

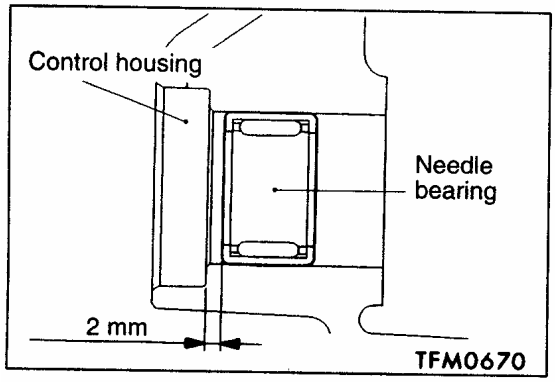


Fig 11-84

►A◄ NEEDLE BEARING INSTALLATION

Press fit the needle bearing up the illustrated dimension, while making sure that the model number stamped side is oriented in the direction shown.

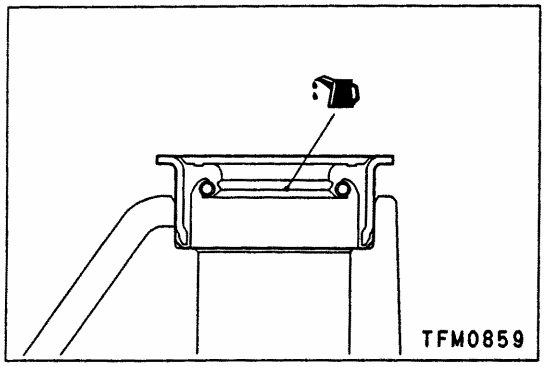


Fig 11-85

►B◄OIL SEAL INSTALLATION

Apply transmission oil to the oil seal lip area.

Specified oil:

Hypoid gear oil SAE 75W-85W conforming to API classification GL-4 or higher

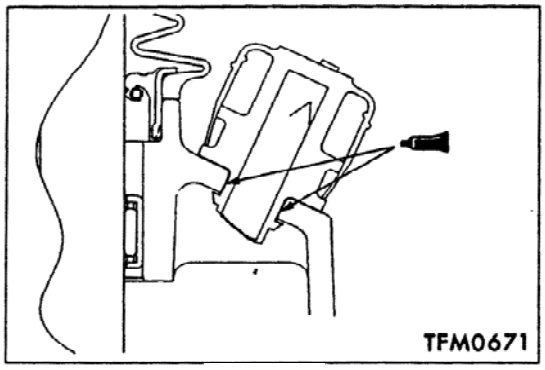


Fig 11-86

►C◄ AIR BREATHER INSTALLATION

(1) Apply a sealant to the outside circumference of the inserting portion.

Specified sealant:

3M SUPER WEATHERSTRIP No. 8001 or equivalent

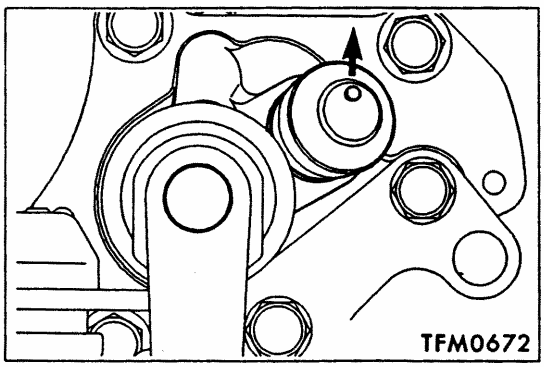


Fig 11-87

(2) Make sure that the projecting portion is oriented in the direction shown.

►D◄ SPRING PIN INSTALLATION

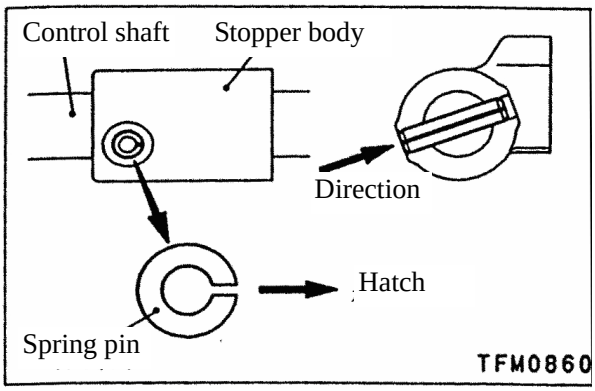


Fig 11-88

►E◄ SPRING PIN INSTALLATION

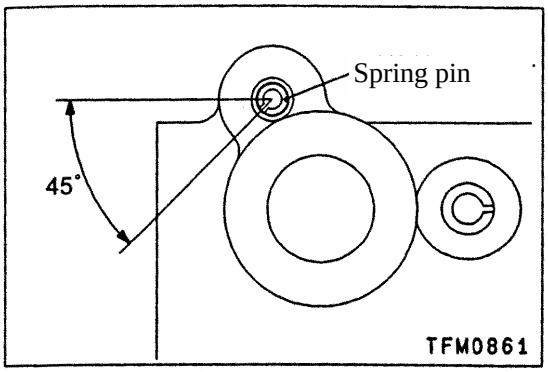


Fig 11-89

►F◄ PIN INSTALLATION

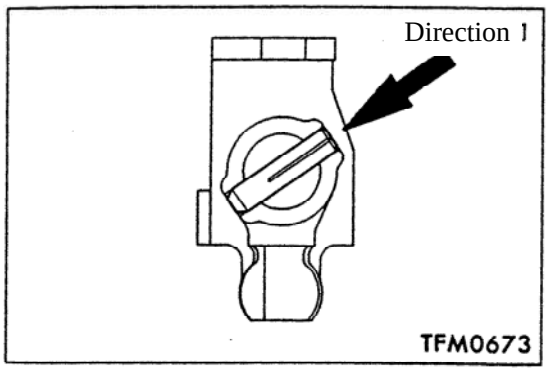


Fig 11-90

7）CLUTCH HOUSING
DISASSEMBLY AND REASSEMBLY

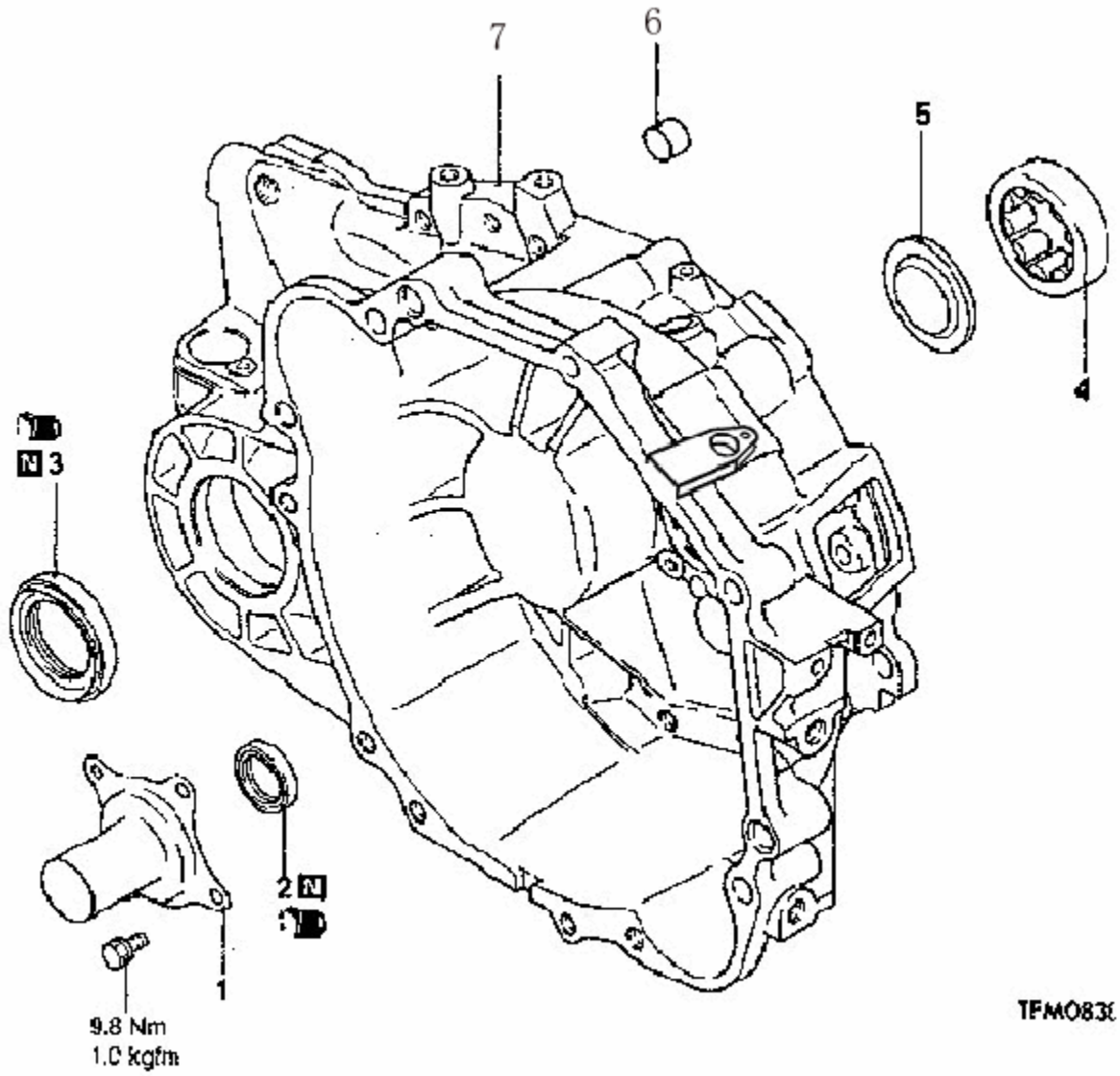


Fig 11-91

Disassembly steps：

1. Clutch release bearing retainer
►D◄ 2. Oil seal
►C◄ 3. Oil seal
◄A► ►B◄ 4. Outer race
5. Oil guide
►A◄ 6. Bushing *
7. Clutch housing

*ONLY CHANGE THE CLUTCH HOUSING。

DISASSEMBLY SERVICE POINTS:

►A◄ OUTER RACE REMOVAL

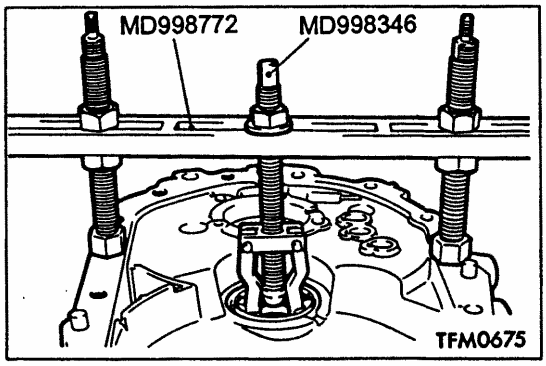


Fig 11-92

REASSEMBLY SERVICE POINTS:

►A◄ BUSHING INSTALLATION

Press fit the bushing up to the illustrated position, while making sure that the split ends of the bushing do not coincide with the air purge groove.

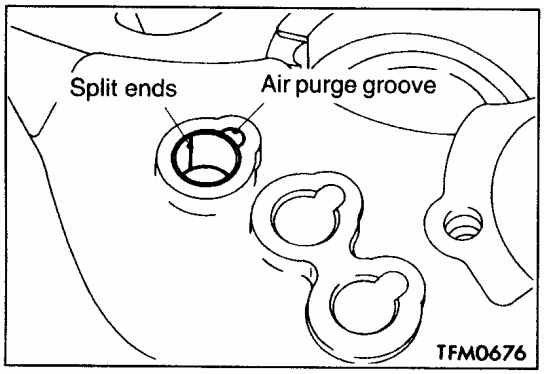


Fig 11-93

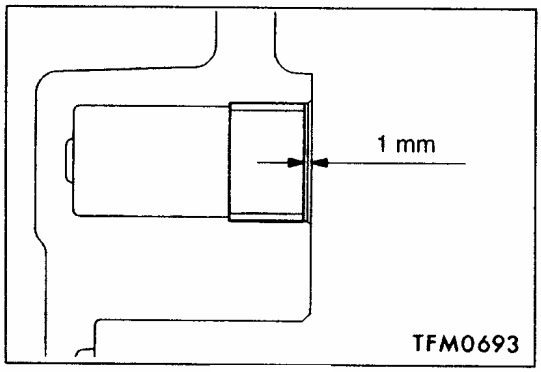


Fig 11-94

►B◄ OUTER RACE INSTALLATION

Install the outer race so that the model number stamped side will be oriented in the directi on shown.

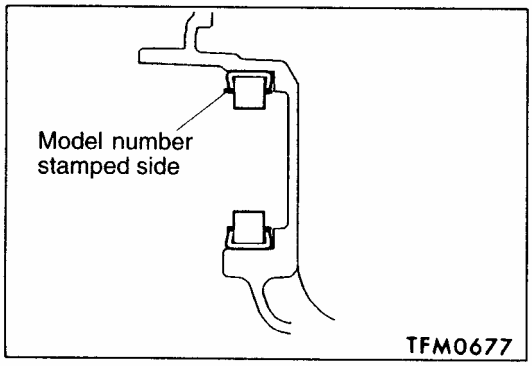


Fig 11-95

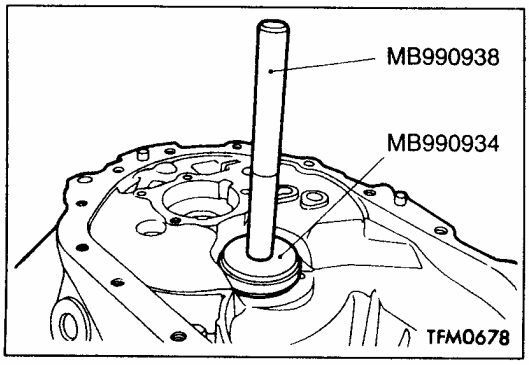


Fig 11-96

►C◄ OIL SEAL INSTALLATION

Pack grease in the oil seal lip area.

Specified grease:
Hypoid gear oil SAE 75W-85W conforming to API classification GL-4 or higher

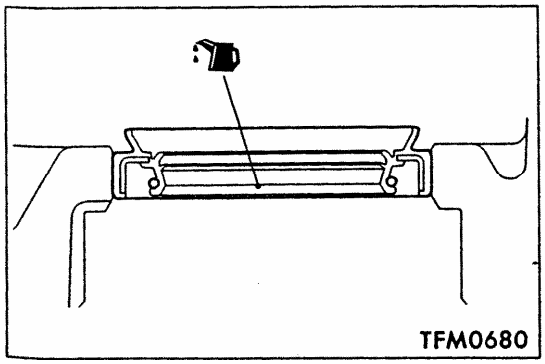


Fig 11-97

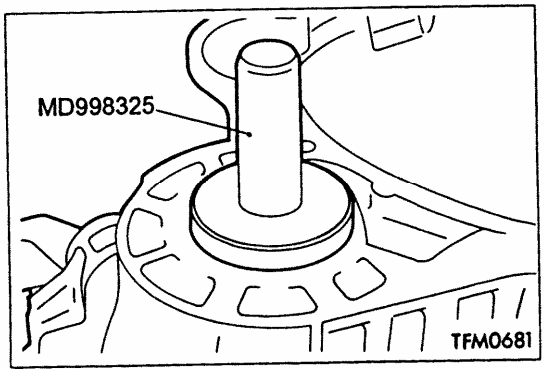


Fig 11-98

►D◄ OIL SEAL INSTALLATION

Pack grease in the oil seal lip area.

Specified grease:
MITSUBISHI genuine grease part No.0101011 or equivalent

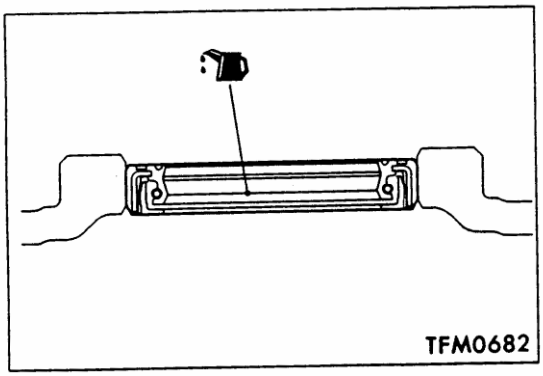


Fig 11-99

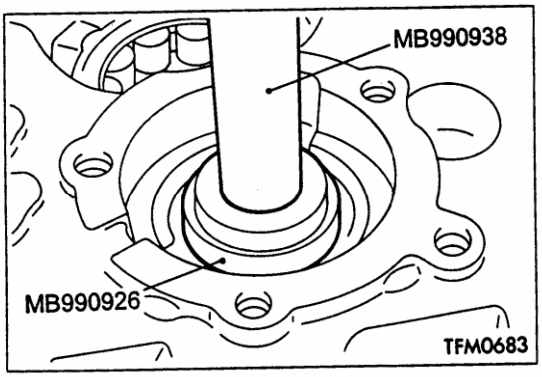


Fig 11-100

8） TRANSMISSION CASE
DISASSEMBLY AND REASSEMBLY

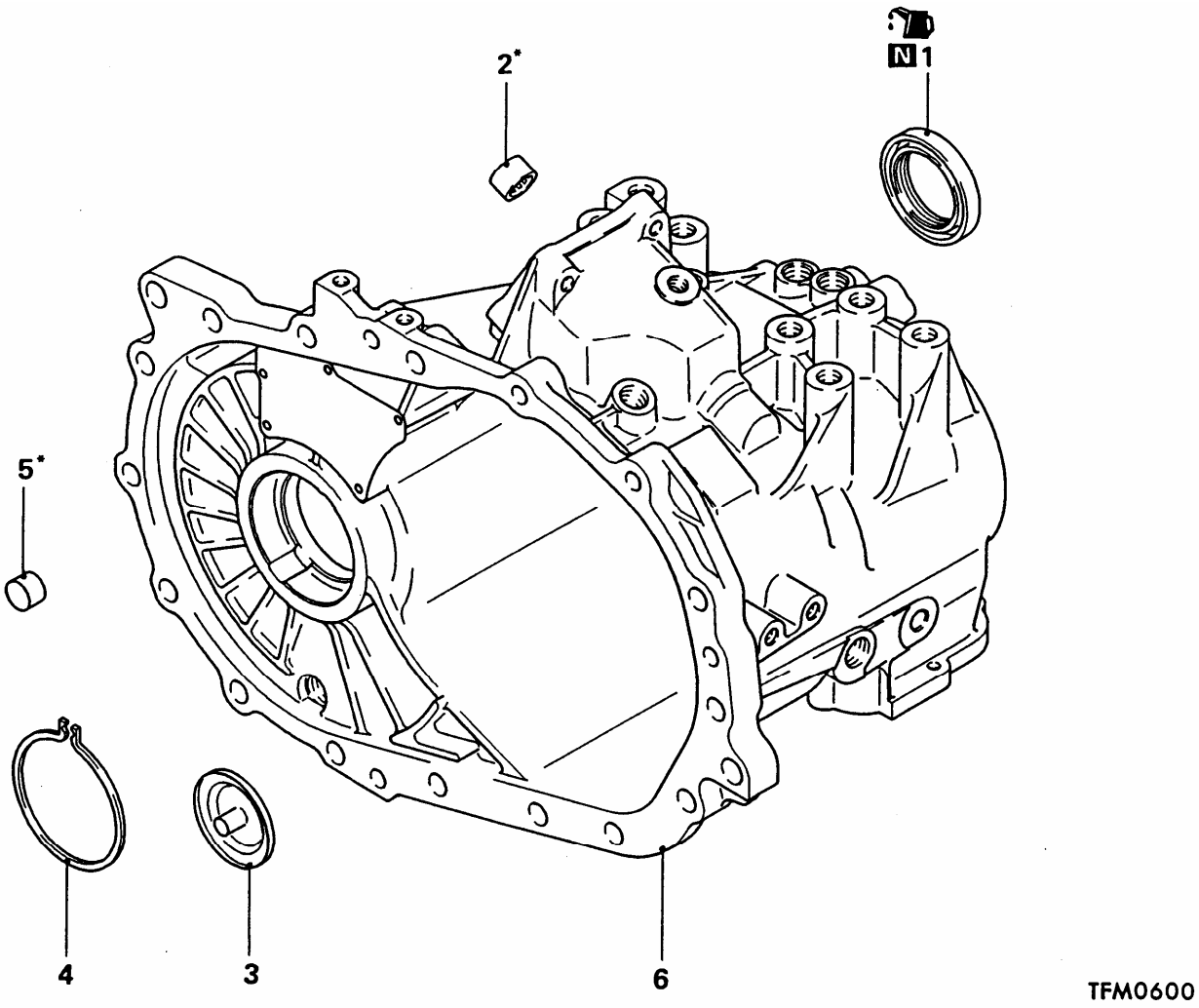


fig 11-101

Disassembly steps:

►C◄ 1. Oil seal
►B◄ 2. Needle bearing *
3. Oil guide
4. Snap ring
►A◄ 5. Bushing *
6. Transmission case

*ONLY CHANGE THE TRANSMISSION CASE

REASSEMBLY SERVICE POINTS:

►A◄ BUSHING INSTALLATION

Press fit the bushing up to the illustrated position, while making sure that the split ends of the bushing do not coincide with the air purge groove.

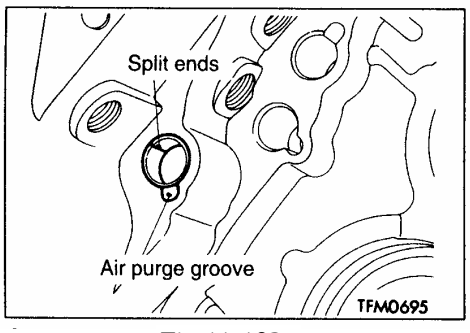


Fig 11-102

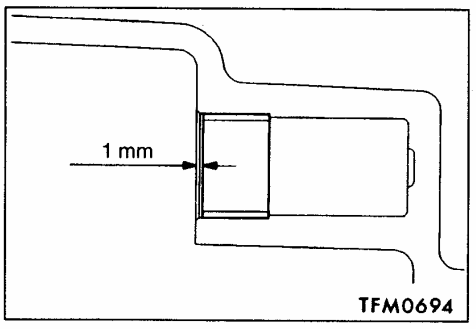


Fig 11-103

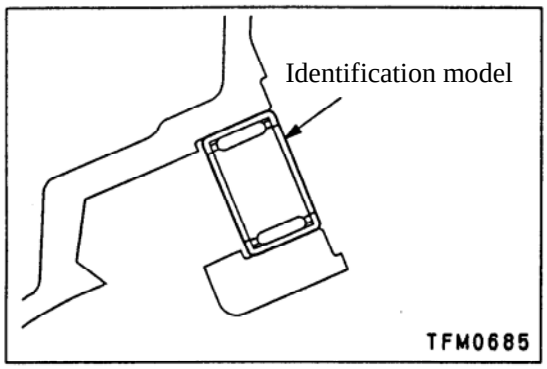


Fig 11-104

►B◄ NEEDLE BEARING INSTALLATION

Press fit the needle bearing Identification model case, while making sure that the model number stamped side is oriented in the direction shown.

►C◄ SEAL INSTALLATION

Apply transmission oil to the oil seal lip area.

Specified oil:
Hypoid gear oil SAE 75W-85W conforming to API classification GL-4 or higher

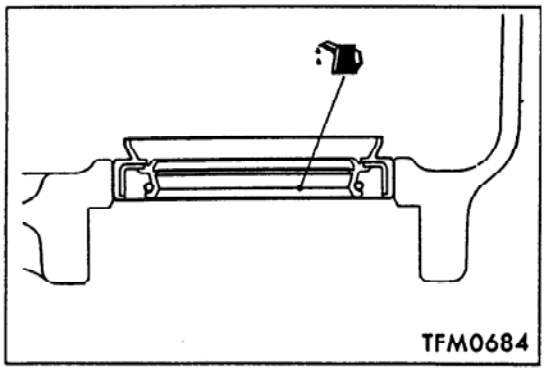


Fig 11-105

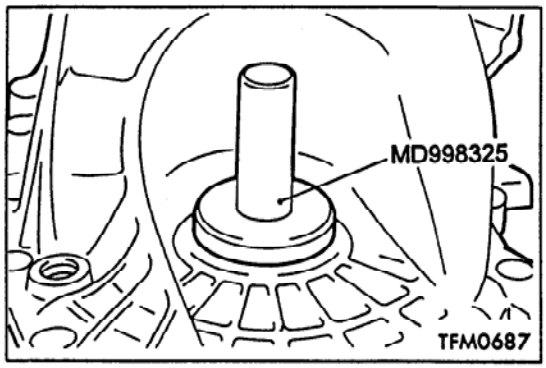


Fig 11-106

9）DIFFERENTIAL

DISASSEMBLY AND REASSEMBLY

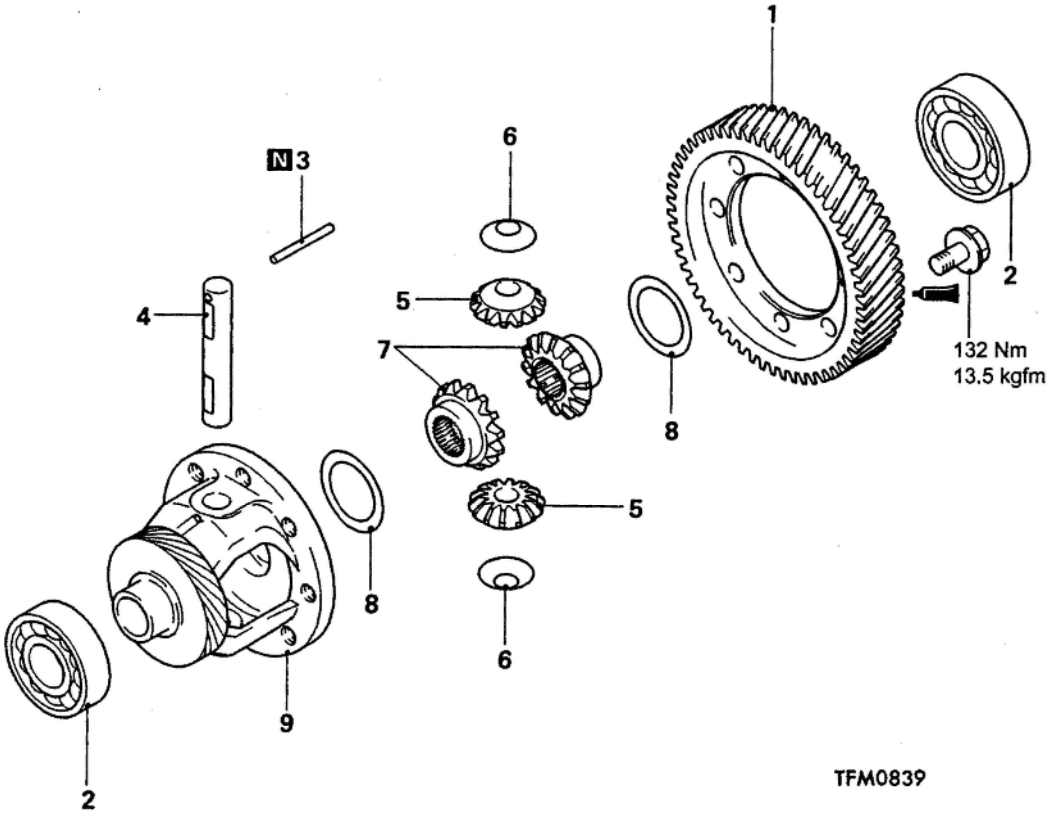


Fig 11-107

Disassembly steps：

►D◄ 1. Differential drive gear
◄A► ►C◄ 2. Ball bearing
►B◄ 3. Lock pin
►A◄ 4. Pinion shaft
►A◄ 5. Pinion
►A◄ 6. Washer
►A◄ 7. Side gear
►A◄ 8. Spacer
9. Differential case

DISASSEMBLY SERVICE POINTS

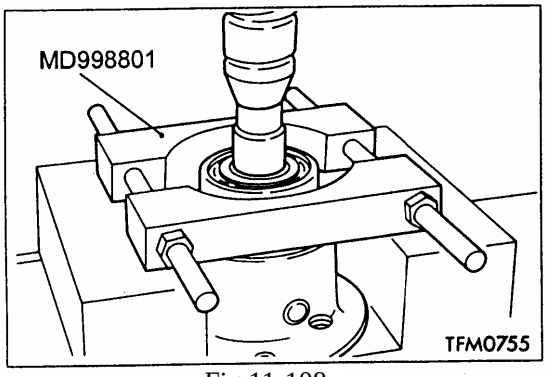


Fig 11-108

◄A► BEARING REMOVAL

REASSEMBLY SERVICE POINTS

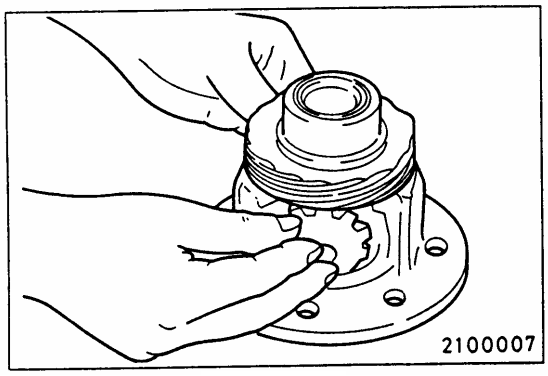


Fig 11-109

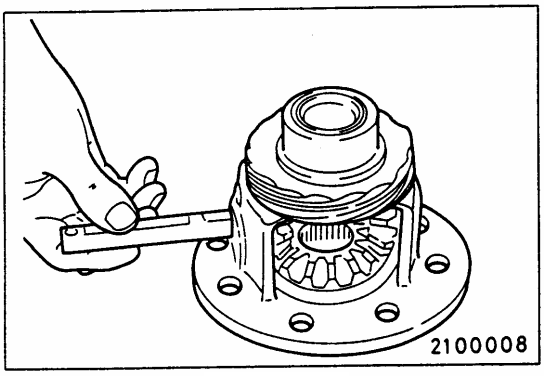


Fig 11-110

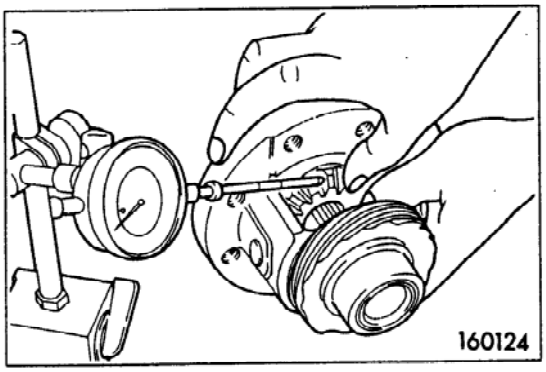


Fig 11-111

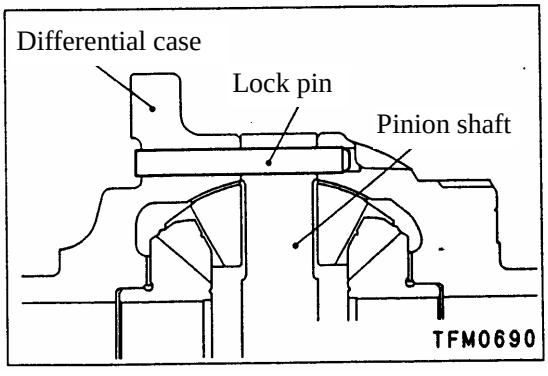


Fig 11-112

►A◄ SPACER / SIDE GEAR / WASHER / PINION / PINION SHAFT INSTALLATION

(1) After a spacer has been mounted on the back surface of the side gear, install the side gear in the differential case.

NOTE
When a new side gear is to be installed, mount a medium thickness spacer (0.93-1.00 mm).

(2) Set the washer on the back of each pinion, and put both pinions simultaneously in mesh with the side gears. While rotating them, install them in position.

(3) Insert the pinion shaft.

(4) Measure the backlash between the side gear and pinion.

Standard value:

0.025-0.150 mm

(5) If the backlash is out of specification, select a spacer and re-measure the backlash.

NOTE
Adjust until the backlashes on both sides are equal.

►B◄ LOCK PIN INSTALLATION

Install the lock pin in such a way that it will be oriented in the direction shown.

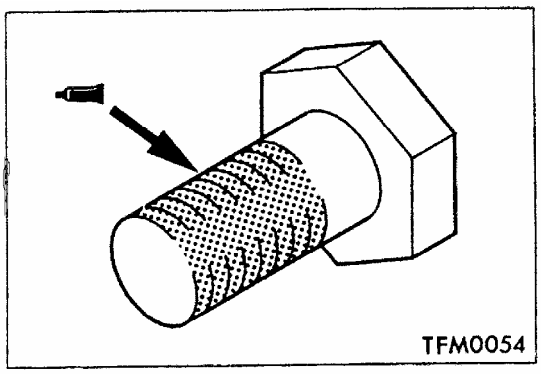


Fig 11-113

►C◄ BALL BEARING INSTALLATION

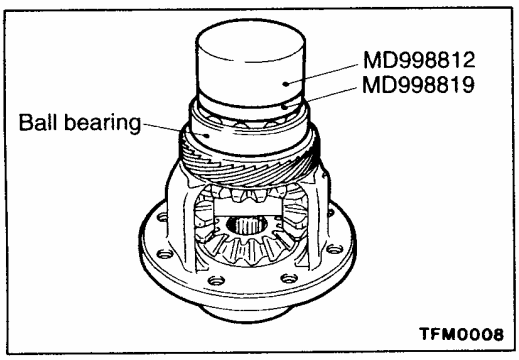


Fig 11-114

►D◄DIFFERENTIAL DRIVE GEAR INSTALLATION

（1）Apply a sealant to the entire threaded portion of the bolt.

Specified sealant:
3M STUD Locking No. 4170 or equivalent

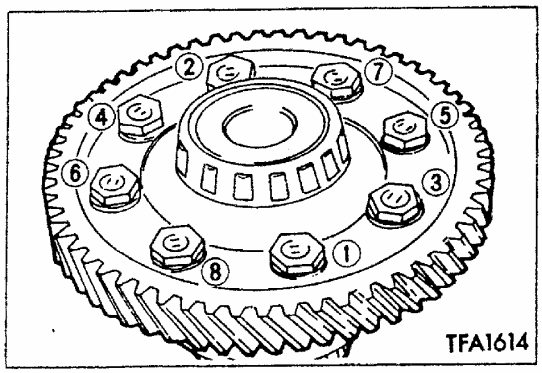


Fig 11-115

（2）Tighten to the specified torque in the illustrated sequence.

11.2.2.3 INSPECTION AND SERVICE

1） TRANSMISSION

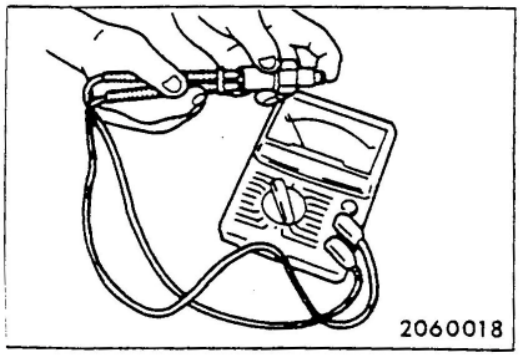


Fig 11-116

BACK-UP LAMP SWITCH:
Check for continuity between terminals.

Switch condition	continuity
Pressed	Not exist
Released	Exists

2）INPUT SHAFT

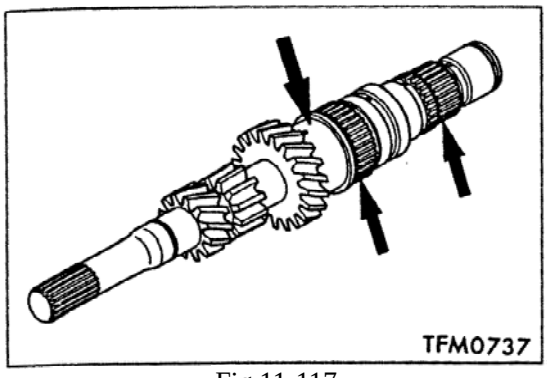


Fig 11-117

1．INPUT SHAFT

(1) Check the outside diameter of the needle bearing mounting portion for damage, abnormal wear and seizure.
(2) Check the splines for damage and wear.

2．NEEDLE ROLLER BEARING

(1) Check to ensure that when the input shaft, sleeve and gear are combined and made to rotate, they rotate smoothly without noise.
(2) Check to ensure that the cage is not deformed.

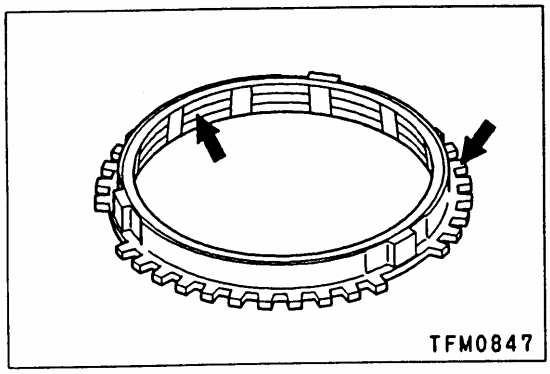


Fig 11-118

3．SYNCHRONIZER RING

(1) Check to ensure that the clutch gear tooth surfaces are not damaged and broken.
(2) Check to ensure that the cone inside diameter is not damaged or worn and that the threads are not crushed.

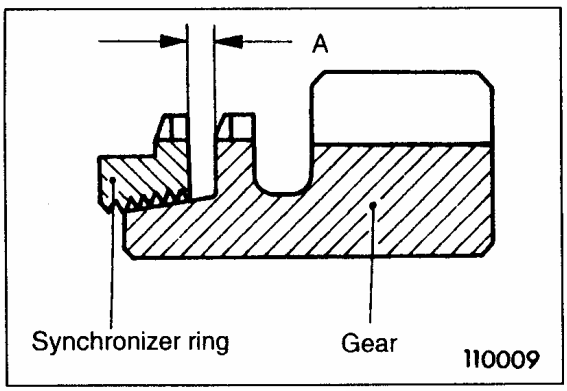


Fig 11-119

(3) Press the synchronizer ring against the gear and check clearance "A". If "A" is less than the limit, replace.

Limit: 0.5 mm

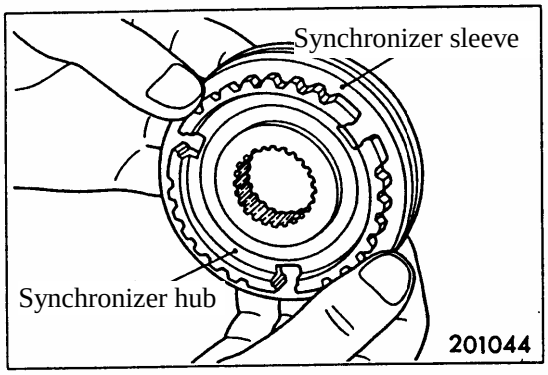


Fig 11-120

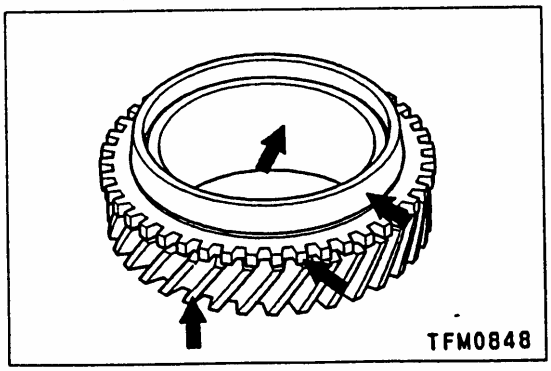


Fig 11-121

4．SYNCHRONIZER SLEEVE AND HUB

(1) Check to ensure that when the synchronizer sleeve and hub are combined and made to slide, they slide smoothly without binding.

(2) Check to ensure that the front and rear ends of the sleeve inside surface are not damaged.

Caution

When replacement of either the synchronizer sleeve or hub is necessary, make sure that the synchronizer sleeve and hub are replaced as a set.

5．SYNCHRONIZER SPRING

Check to ensure that the spring is not sagging, deformed or broken.

6．SPEED GEARS

(1) Check to ensure that the helical and clutch gear tooth surfaces are not damaged or worn.

(2) Check to ensure that the synchronizer cone surfaces are not roughened, damaged or worn.

(3) Check to ensure that the gear inside diameter and front and rear surfaces are not damaged and worn.

3）OUT SHAFT

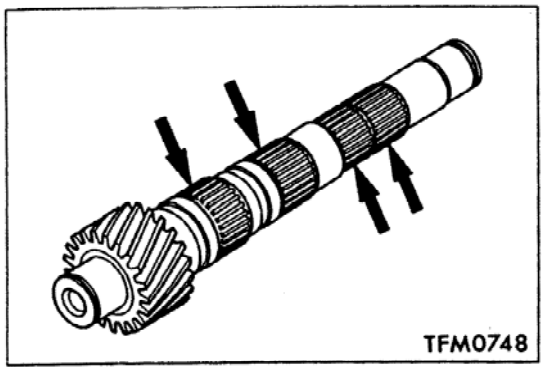


Fig 11-122

1. OUT SHAFT

Check the splines for damage and wear.

2．NEEDLE ROLLER BEARING

(1) Check to ensure that when the bearing sleeve and gear are combined and made to rotate, they rotate smoothly without looseness and noise.

(2) Check to ensure that the cage is not deformed.

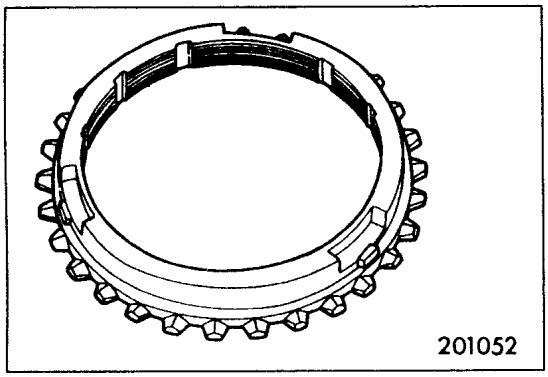


Fig 11-123

3．SYNCHRONIZER RING

(1) Check to ensure that the clutch gear tooth surfaces are not damaged and broken.

(2) Check to ensure that the cone inside diameter is not damaged or worn and that the threads are not crushed.

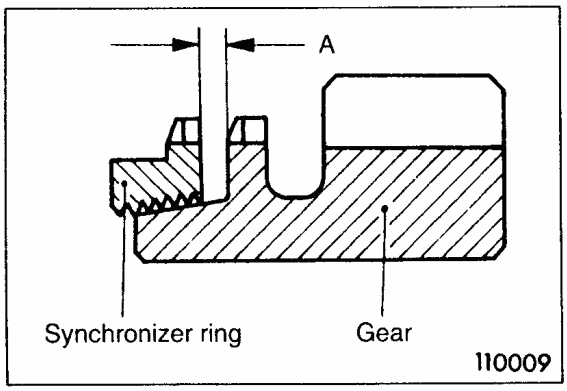


Fig 11-124

(3) Press the synchronizer ring against the gear and check clearance "A". If "A" is less than the limit, replace.
Limit: 0.5 mm

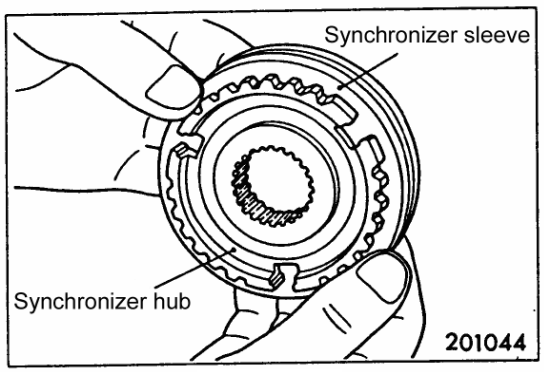


Fig 11-125

4. SYNCHRONIZER SLEEVE AND HUB

(1) Check to ensure that when the synchronizer sleeve and hub are combined and made to slide, they slide smoothly without binding.
(2) Check to ensure that the front and rear ends of the sleeve inside surface are not damaged.

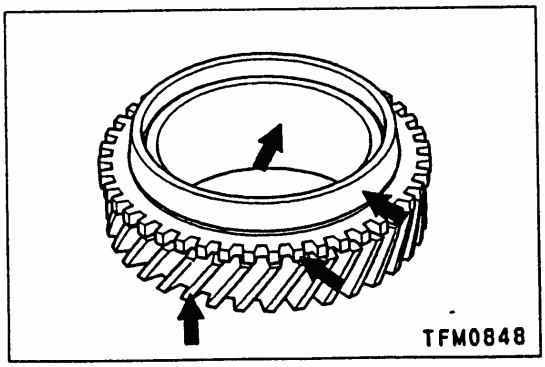


Fig 11-126

5. SYNCHRONIZER SPRING

Check to ensure that the spring is not sagging, deformed or broken.

6. SPEED GEARS

(1) Check to ensure that the helical and clutch gear tooth surfaces are not damaged or worn.
(2) Check to ensure that the synchronizer cone surfaces are not roughened, damaged or worn.
(3) Check to ensure that the gear inside diameter and front and rear surfaces are not damaged and worn.

4） SPEEDOMETER GEAR
5） SELECT LEVER
6） CONTROL HOUSING
7） CLUTCH HOUSING
8） TRANSMISSION CASE
9） DIFFERENTIAL

11.3 Clutch Control System

11.3.1 General information

The clutch is a dry single diaphragm type ;hydraulid pressure is used for the clutch control .

11.3.2 Service specifications see table 11-18

Table 11-18

Items	Standard value
Clutch pedal height mm	203.5～206.5
Clutch pedal clevis pin play mm	1～3
Clutch pedal free play mm	4～13
Distance between the clutch pedal and the toeboard when the clutch is disengaged mm	70 or more

11.3.3 Lubricants see table 11-19

Table 11-19

Items	Specified lubricants	Quantity
Clutch fluid	Brake fluid DOT3	As required
Push rod assembly	Rubber grease	
Boot		

11.3.4 On-vehicle service

Clutch pedal inspection and adjustment

(1)Turn up the carpet,etc.under the clutch pedal .

(2)Measure the clutch pedal height as shown Fig.11-127.

Standard value (A) 203.5～206.5mm

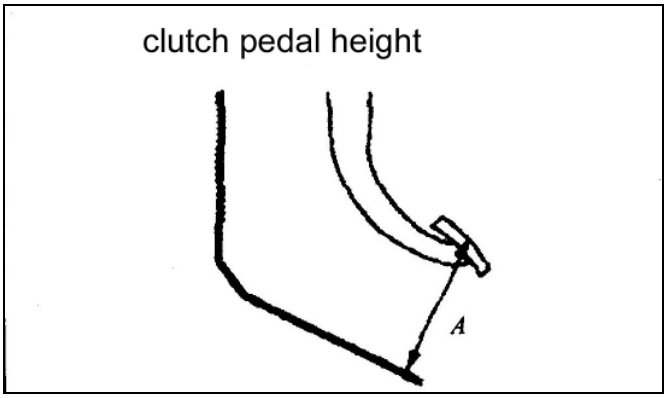


Fig.11-127

(3)If the height of the clutch pedal is outside the standard value ,loosen the adjusting nut to adjust the pedal height to the standard value as Fig.11-128.

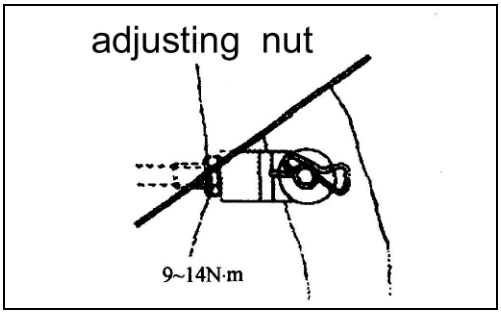


Fig.11-128

(4)Measure the clutch pedal clevis pin play see Fig.11-129.

Standard value(B): 1～3mm

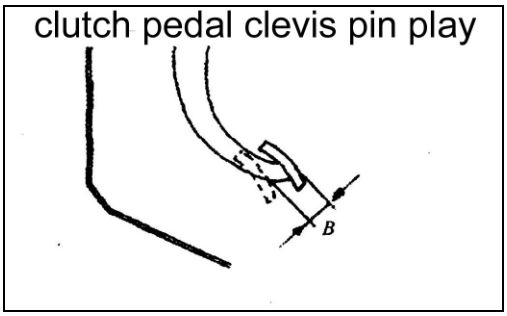


Fig.11-129

(5)If the clutch pedal clevis pin play is outside the standard values, loosen the adjusting nut ,move push rod to adjust.

Caution
Do not push in master cylinder push rod at this time

(6)After completing the adjustments ,comfirm that the clutch pedal free play (measured at the face of the pedal pad) and distance between the clutch pedal (the face of the pedal pad)and the clutch pedal stopper or toeboard when the clutch is disengaged are within the standard value ranges as Fig.11-130.

Standard value (C) 4～13mm

Standard value (D) 70mm or more

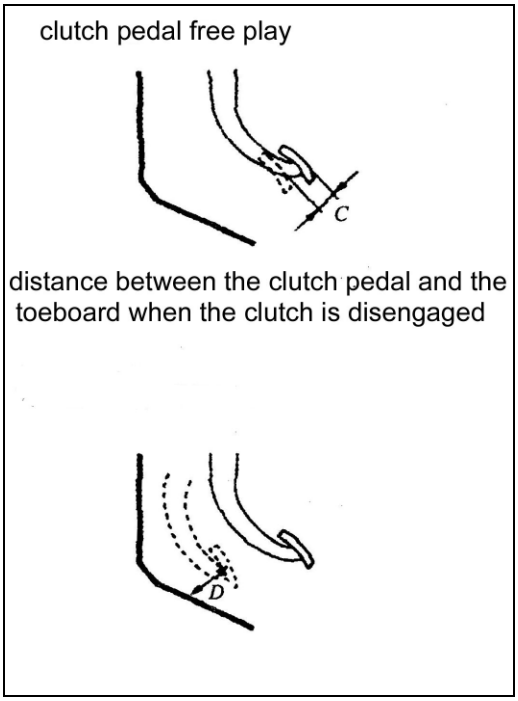


Fig.11-130

(7)If the clutch pedal free play and the distance between the clutch pedal and the clutch pedal stopper or toeboard when the clutch is disengaged do not areee with the standard values, it is probably the result of either air in the hydraulic system or a fault master cylinder ,clutch cylinder or clutch .Breed the air,or disassemble and inspect the master cylinder ,clutch cylinder or clutch.

(8)Turn back the carpet,etc.

(9)Bleeding as Fig.11-131.

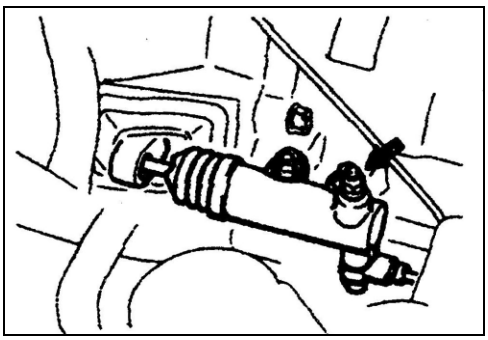


Fig.11-131

Specified fluid : brake fluid DOT3.

Caution
Use the specified brake fluid.Avoid using a mixture of the specified fluid and other fluid

11.3.5 Removal and installation

Pre-removal operation
●Clutch fluid draining

Post-installation operation
Clutch fluid supplying
clutch line bleeding
clutch pedal adjustment

Removal steps as Fig.11-132.

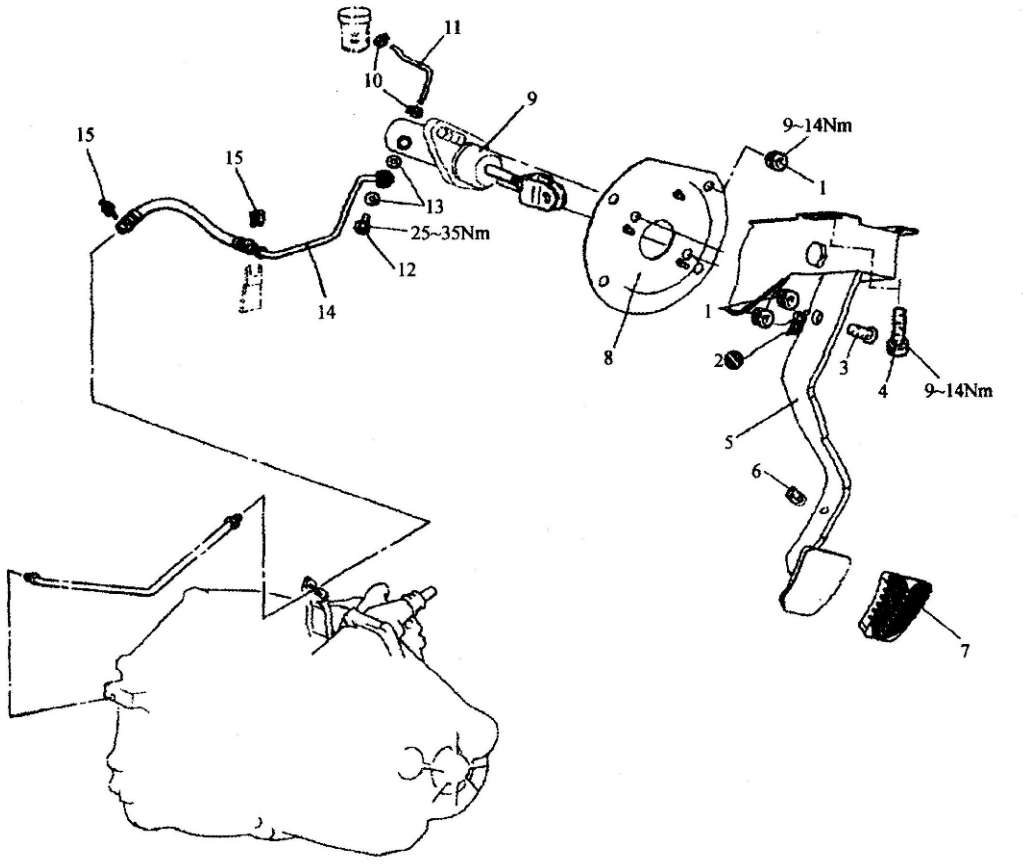


Fig.11-132

1-nut; 2-snap pin; 3-clevis pin assembly; 4-bolt; 5-clutch pedal assembly; 6-pedal stopper; 7-pedal pad; 8-retainer assembly; 9-clutch master cylinder; 10-clip; 11-reservoir hose; 12-eye bolt; 13-gasket; 14-clutch hose; 15-clip

11.3.6 clutch master cylinder disassembly and reassembly

disassembly steps as Fig.11-133.

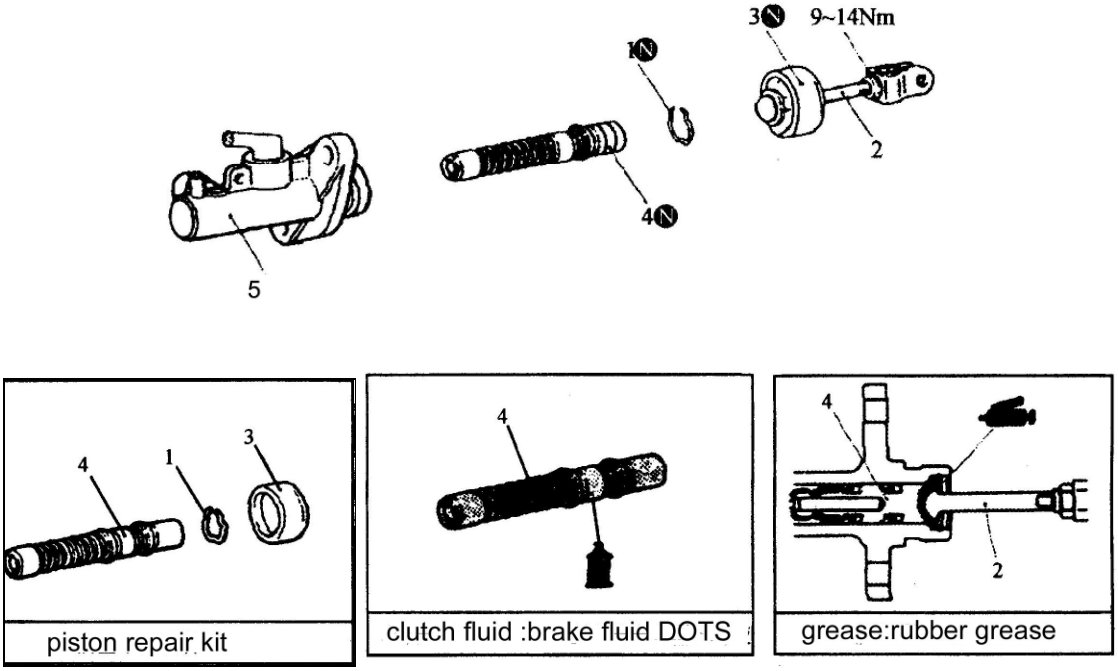


Fig.11-133

1-piston stopper ring; 2-push rod assembly; 3-boot; 4- piston assembly; 5-master cylinder body

Caution
Do not disassembly piston assembly

Installation service point

Push rod assembly installation

Set the length of the push rod assembly to the shown Fig.11-134 dimension to make the adjustment of make the adjustment of clutch pedal easier.

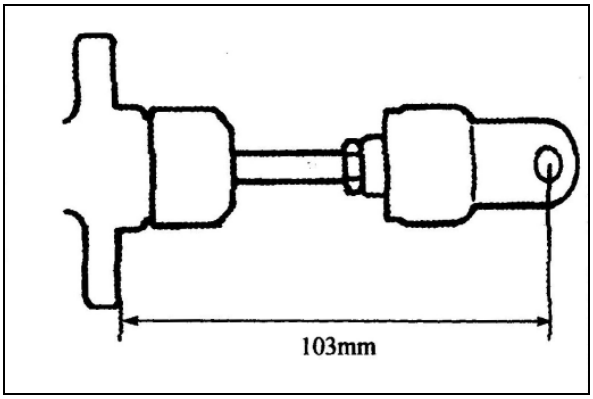


Fig.11-134

11.4 Manually Shift Control System

Pre-removal and Post-installation operation removal and installation air cleaner assembly

11.4.1 Remove and installation

Remove steps as Fig.11-135.

Caution Be careful not to subject the SRS-ECU to any shocks during removal and installation of the shift lever assembly ,shift cable and select cable assembly

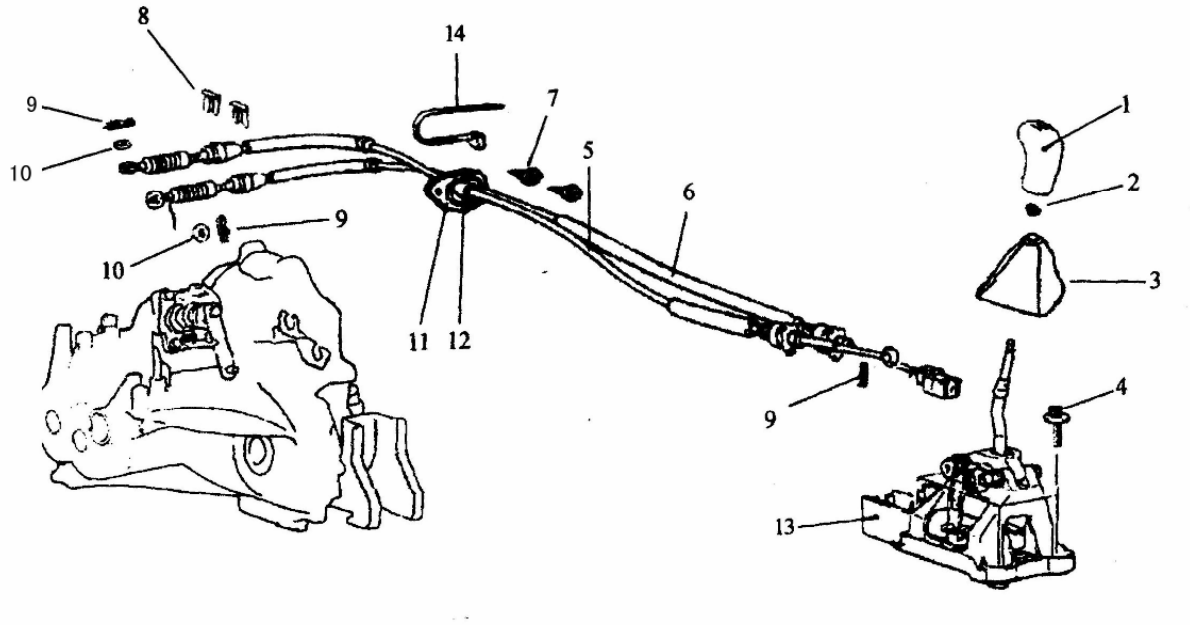


Fig.11-135

1-shift knob; 2-bushing; 3-shift cover assembly; 4-bolt; 5-select cable; 6-shift cable; 7-bolt; 8-clip; 9-snap pin; 10-washer; 11-guiding plate; 12-fixed plate; 13-shift lever assembly; 14-clip bend

1) installation service points

(1)shift cable and select cable assembly installation

a. move the shift lever of transmission to the N postion as Fig.11-136.

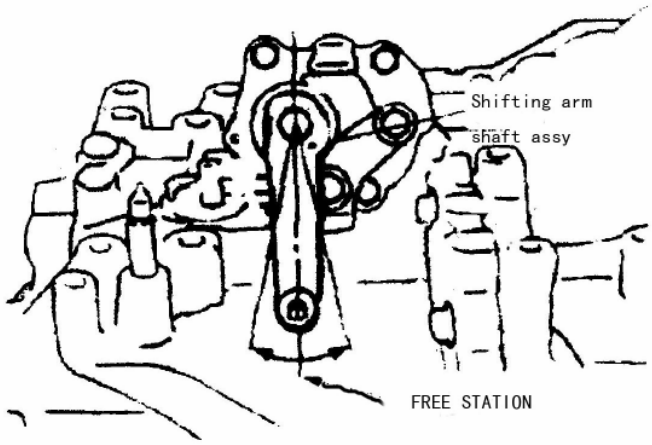


Fig.11-136

b.yellow and white paint mark of shift cable and select cable end for transmission side should be towords snap pin .

c.check the operation of the shift lever and the movement in each lever position.

2) shift knob and bushing installation

(1)tighten bushing to shift lever one circle.

(2)press shift knob to bushing, and tighten above seven circles.

(3) tighten shift knob ,then adjust shift Figure of knob.

(4) if above-mentioned steps is difficult to do,may turn back shift knob one circle at most, and then tinghen to adjust shift Figure.

11.4.2 Shift lever assembly

Disassembly and reassembly

Disassembly steps as Fig.11-137.

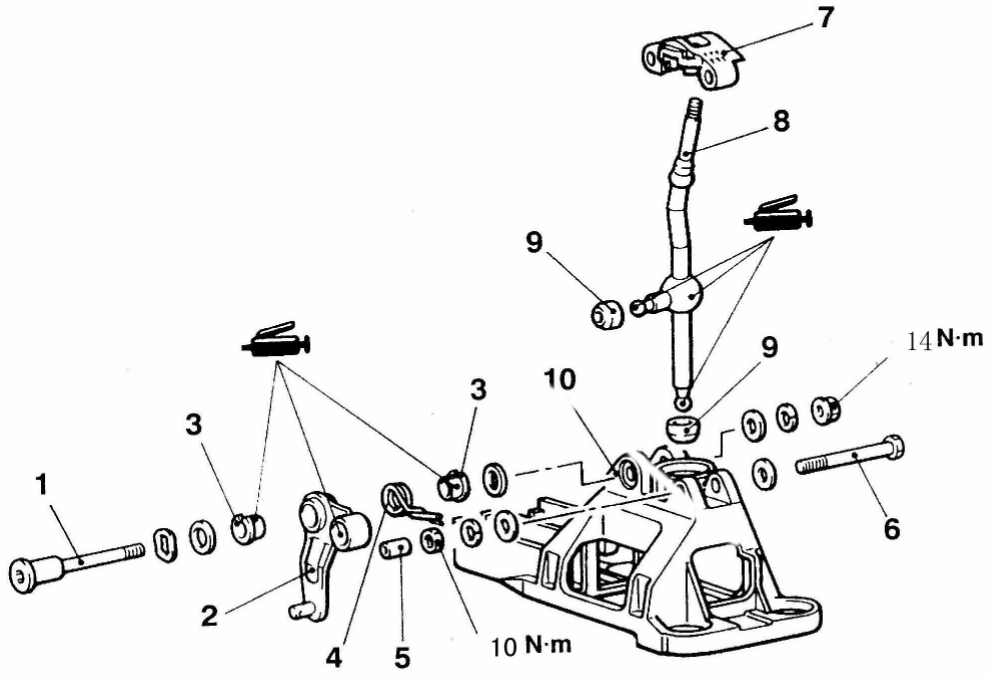


Fig.11-137

1-bolt; 2-select lever; 3-bushing; 4-return spring; 5-collar; 6-bolt; 7-cap; 8-shift lever; 9-shift lever bushing; 10-base block

11.5 Automatic Shift Control System

11.5.1 check and adjustment

1) inhibitor switch and shift cable adjustment as Fig.11-138.

(1) move the selector lever to the N position

(2) loosen the adjusting nut ,and set the neutral position .lever upper and lower to the free condition .

(3)Move the manual control lever lower to the neutral position.

(4)Loosen the inhibitor switch body mounting bolt ,and then turn the inhibitor switch to adjust so that the hole at the end of the manual control lever lower and the hole in the inhibitor switch body flange (sectionA—A) are aligned.

(5) tighten the inhibitor switch body mounting bolt to the specified torque.

Tightening torque: 11±1N. m.

Caution
Be careful not to let the inhibitor switch body slip out of place

(6)gently push the shift cable in the direction of B ,and tighten the adjusting nut to the specified torque.

Tightening torque: 24±4N. m.

(7)Check that the selector lever is at the N position.

(8)Check that the transmission shifts to the correct range corresponding to the position of the selector lever,and that it functions correctly in that range.

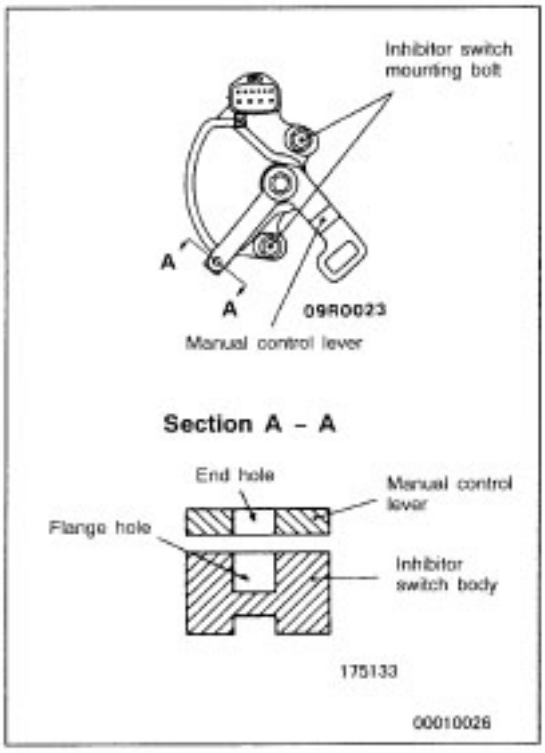


Fig.11-138

2)shift lever operation check as Fig.11-139

(1)apply the parking brake ,and check the shift lever moves smoothly and accurately to each range position.

(2)Check that the engine starts when the shift lever is at the N or P position,and that it does not start when the shift lever is in any other position.

(3)Start the engine, release the parking brake, and check that the vehicle moves forward when the shift lever is

moved from N range to D,3,2 or L range,and that the vehicle reverses when the shift lever is moved to R range.
(4)Stop the engine.

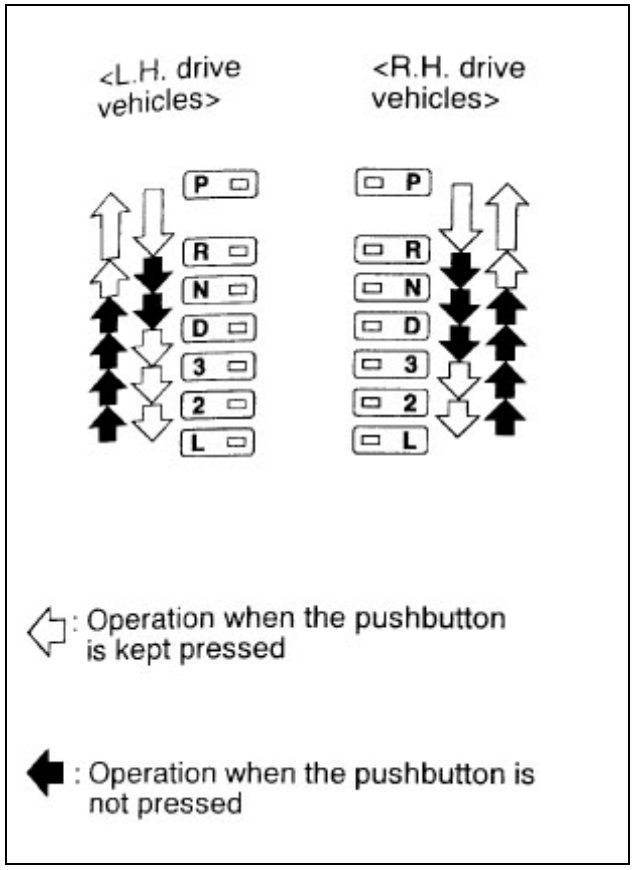


Fig.11-139

3)shift cable operation check as Fig.11-140

(1)Remove the battery and battery tray.

(2)Move the shift lever to the N position.

(3)Loosen the upper control lever adjustiong nut.

(4)Gently pull the transmission shift cable in the direction of the arrow, and then tighten the adjusting nut.

Tightening torque:12±2N.m

(5)Check that the transimission shifts to the correct range corresponding to the position of the shift lever, and that it functions correctly in that range.

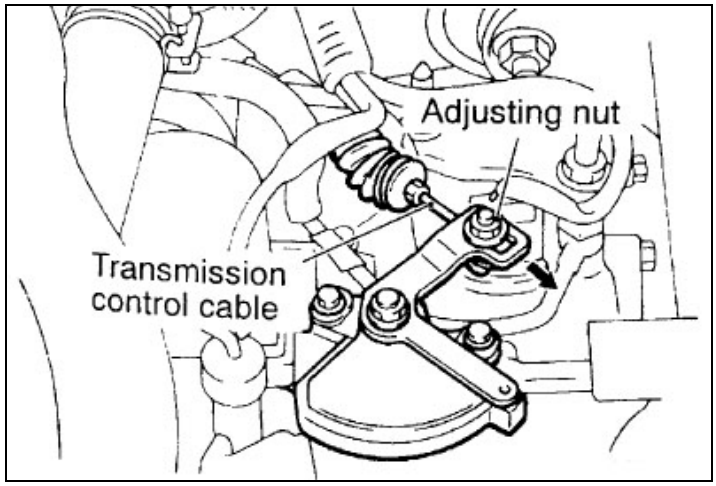


Fig.11-140

11.5.2 shift cable remove and installation

Caution
Be careful not to subject the SRS-ECU to any shocks during removal and installation of shift cable assembly

Pre-removal and Post-installation operation of shift cable

removal and installation air cleaner assembly(refer to corresponding chapters)

removal and installation battery and battery tray

removal and installation centre console assembly (refer to corresponding chapters).

Check the operation of shift lever, post-installation only (refer to corresponding chapters) .

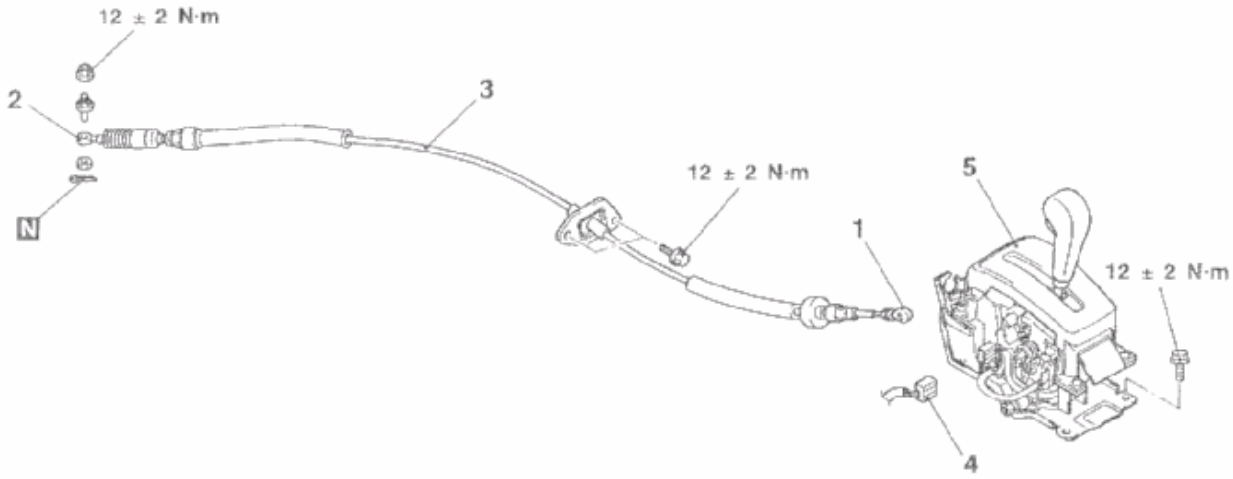


Fig.11-141

shift cable removal steps as Fig.11-141

1 shift cable connection (shift lever side)

2 shift cable connection (transmission side)

3 shift cable

shift lever assembly removal steps as Fig.11-141

1 shift cable connection (shift lever side)

4 indicator lamp connector

5 shift lever assembly

● installation service points(as Fig.11-142)

shift cable installation(transmission side)

(1) move the shift lever to the N position.

(2) check that the inhibitor switch at N range.

(3) gently pull the shift cable , in the direction of the arrow as Fig.11C-64,and then tighten the adjusting nut.

Tighten torque:12±2N.m

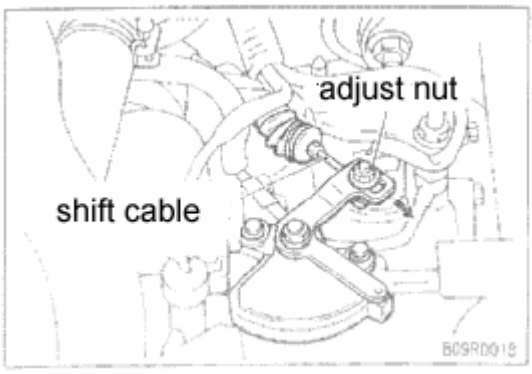


Fig. 11 -142

11.5.3 shift lever assembly disassembly and reassembly

disassembly steps as Fig. 11-143.

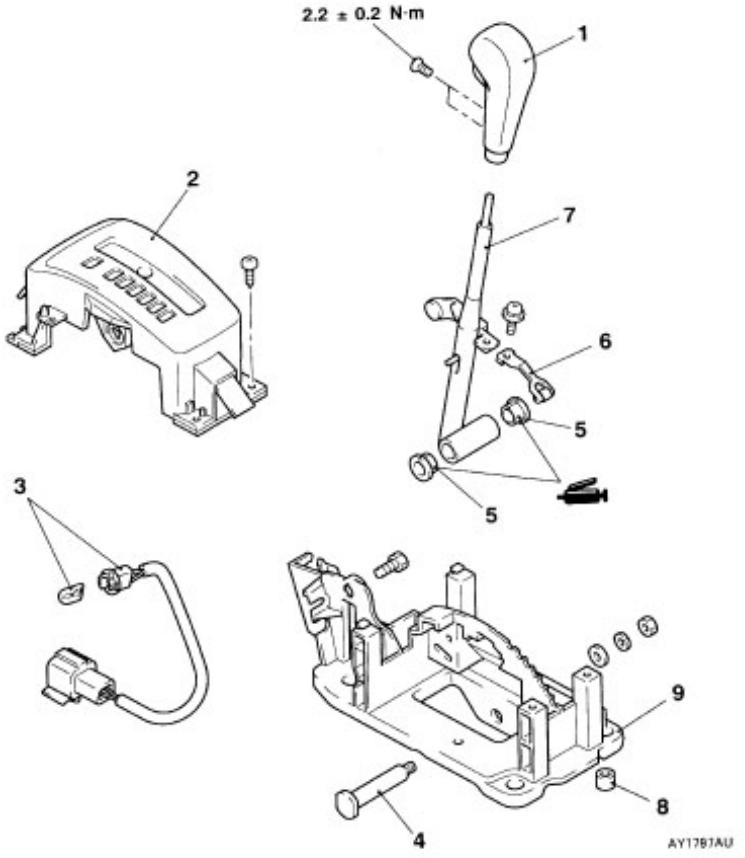


Fig. 11-143

1-shift knob; 2-indictor panel assembly; 3-position indicator lamp assembly; 4-bolt; 5-bushing; 6-detent spring; 7-shift lever assembly; 8- bushing; 9-bracket assembly

11A Automatic Transmission

11A. 1 General Information

The gear shifting clutches of F4A41 use hydraulic balancing mechanism to enable gear shifting of extra-high engine speeds (see Fig. 11A-1). The number of shaft has been decreased to two, increased use has been made of metal plates and the one-way clutch had been abolished, which all contribute to reduce the weight. Increased meshing ratios and improved rigidity of the gear supports and casing result in less noise. The number of oil cooler feed tubes are increased to two. The combination of highest-precision electric and mechanical technology heralds a new era in automatic transmission performance.

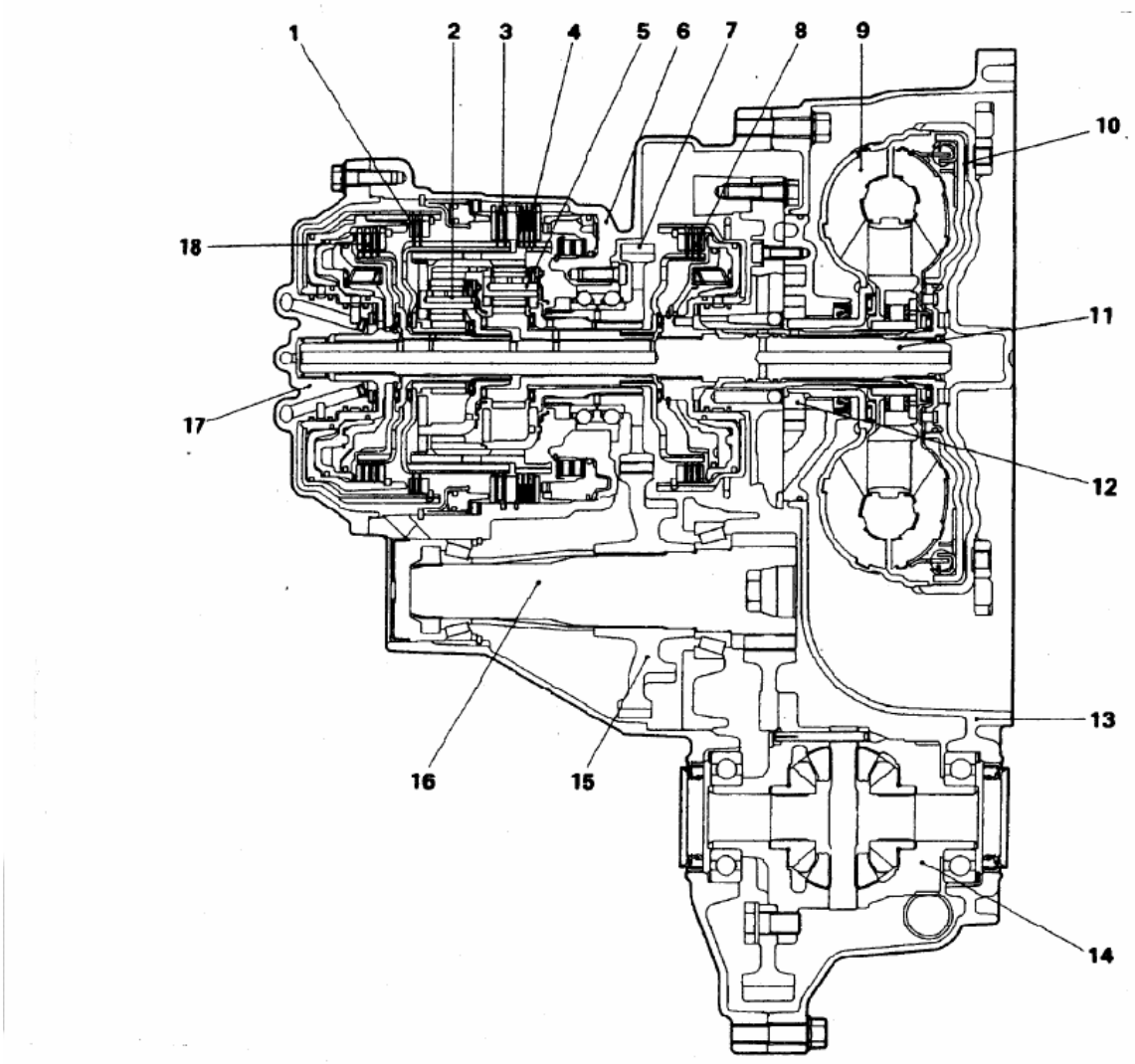


fig 11A-1

1- reverse clucth；2-overdrive planetary carrier；3- second brake；4- low-reverse brake；5-output planetary carrier；6-transmission case；7- Transfer drive gear；8- underdrive clutch；9-torque converter；10- damoer clutch；11-input shaft；12-oil pump；13-transfer case；14-differential；15- Transfer drive gear；16-output shaft；17-rear cover；18-overdrive clutch

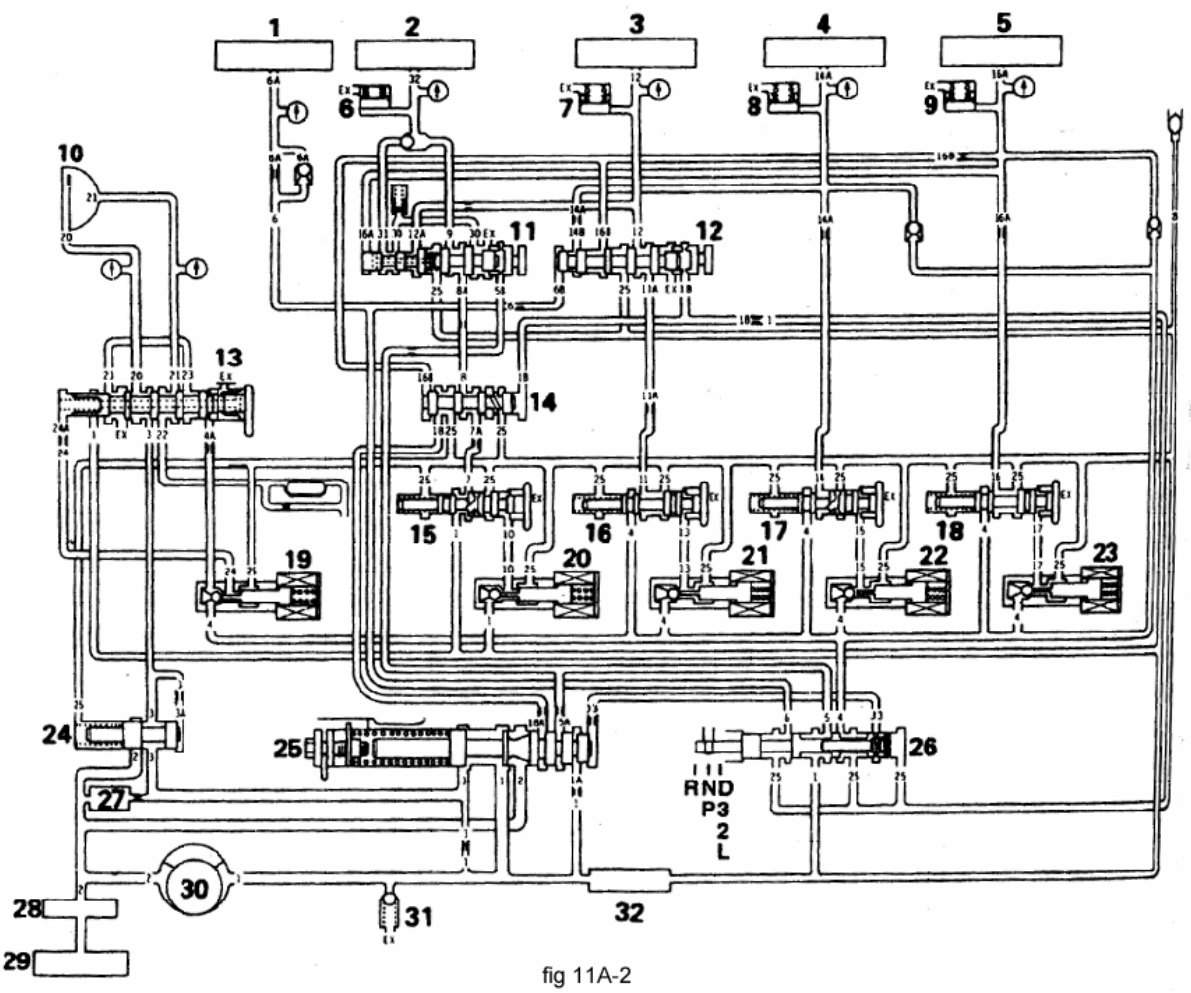


fig 11A-2

1-reverse clutch；2-low-reverse brake；3-second brake；4-underdrive clutch；5-overdrive clutch；6-low-reverse accumulator；7-second accumulator；8-underdrive accumulator；9-overdrive accumulator；10-damper clutch；11-fail-safe valve(A)；12- fail-safe valve (B)；13-damper clutch control valve；14-switching valve；15-low-reverse pressure control valve；16-second pressure control valve；17-underdrive pressure control valve；18-overdrive pressure control valve；19-damper clutch control solenoid valve；20-low-reserve solenoid valve；21-second solenoid valve；22-underdrive solenoid valve；23-overdrive solenoid valve；24-torque converter pressure control valve；25-regulator valve；26-manual valve；27-oil filter；28-oil filter；29-oil pan；30-oil pump；31-relief valve；32-oil strainer

1．GENTERAL SPECIFICATION （see table 11A-1)

Table 11A-1

Items		Parameter
Transmission name		F4A41
Transmission type		Electric control、4gear and automatic
Torque converter type		3-element with damper clutch
Gear ratio	1st	2.842
	2nd	1.529
	3rd	1.000

	4th	0.712
	reverse	2.480
Finally ratio		4.406
Speed meter ratio		31/36

2．SERVICE　SPECIFICATION (see table 11A-2)

Table11A-2

Items	Standard value (mm)
Output shaft preload	0.01-0.09
Brake reaction plate end play	0-0.16
Low-reverse brake end play	1.05-1.51
Second brake end play	0.49-0.95
Underdrive sun gear end play	0.25-0.45
Input shaft end play	0.70-1.45
Differential case end play	0.045-0.165
Underdrive clutch end play	1.25-1.45
Reverse and overdrive clutch return spring retainer end play	0-0.09
Overdrive clutch end play	1.2-1.4
Reverse clutch end play	1.2-1.4
Backlash between differential side gear and pinion	0.025-0.150

3．VALVE BODY SPRING IDENTIFICATION TABLE(see table 11A-3)

Table 11A-3

Spring	Wire diameter(mm)	Outside diameter (mm)	Free length (mm)	Number of loops
Regulator valve spring	1.8	15.7	86.7	24
Underdrive pressure control valve spring	0.7	7.6	37.7	25
Overdrive pressure control valve spring	0.7	7.6	37.7	25
Low-reverse pressure control valve spring	0.7	7.6	37.7	25
Second pressure control valve spring	0.7	7.6	37.7	25

Torque converter spring	1.6	11.2	34.4	12.5
Damper clutch control valve spring	0.7	5.9	28.1	19
Fail-safe valve(A) spring	0.7	8.9	21.9	9.5
Damper valve spring	1.0	7.7	35.8	17
Line relief valve spring	1.0	7.0	17.3	10
Orifice check ball spring	0.5	4.5	17.2	15

4．snap ring, spacer, thrust washer, thrust race and pressure plate for adjustment

(1)Thrust washer（for adjustment of input shaft end play，see table 11A-4）

Table 11A-4

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.
1.8	18	MD754509	2.4	24	MD753793
2.0	20	MD754508	2.6	26	MD753794
2.2	22	MD754507	2.8	28	MD753795

(2)Snap ring (for adjustment of underdrive clutch and overdrive clutch end plays，see table11A-5)

Table 11A-5

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.
1.6	None	MD759666	2.4	Brown	MD752129
1.7	Blue	MD759667	2.5	None	MD752130
1.8	Brown	MD759668	2.6	Blue	MD752131
1.9	None	MD752124	2.7	Brown	MD752132
2.0	Blue	MD752125	2.8	None	MD752133
2.1	Brown	MD752126	2.9	Blue	MD752134
2.2	None	MD752127	3.0	Brown	MD754680
2.3	Blue	MD752128			

(3)Snap ring（for adjustment of low-reverse brake and second brake reaction plates end plays，see table 11A-6）

Table 11A-6

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.

2.2	Blue	MD754786	2.4	None	MD758240
2.3	Brown	MD754787	2.5	Blue	MD758241

(4)Pressure plate（for adjustment of low brake and second brake end plays，see table 11A-7）

Table 11A-7

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.
1.6	6	MD759567	2.4	4	MD759417
1.8	1	MD759414	2.6	6	MD759418
2.0	0	MD759415	2.8	8	MD759419
2.2	2	MD759416	3.0	0	MD759420

(5)Snap ring（for adjustment of reverse clutch end play，see table 11A-8）

Table 11A-8

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.
1.9	None	MD752137	2.4	Brown	MD752142
2.0	Blue	MD752138	2.5	None	MD752143
2.1	Brown	MD752139	2.6	Blue	MD752144
2.2	None	MD752140	2.7	Brown	MD752145
2.3	Blue	MD752141	2.8	None	MD752146

(6)Snap ring（for adjustment of reverse clutch and overdrive clutch spring retainer end plays, see table 11A-9）

Table **11A-9**

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.
1.48	Brown	MD755600	1.58	Blue	MD755602
1.53	None	MD755601	1.63	Brown	MD755603

(7)Thrust race（for adjustment of underdrive sun gear end play，see table 11A-10）

Table 11A-10

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.
1.6	——	MD707267	2.2	——	MD723065
1.7	——	MD759681	2.3	——	MD754796

1.8	——	MD723064	2.4	——	MD724358
1.9	——	MD754794	2.5	——	MD754797
2.0	——	MD707268	2.6	——	MD754798
2.1	——	MD754795			

(8)Spacer（for adjustment of output shaft preload，see table 11A-11）

Table 11A-11

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.
1.88	88	MD756579	2.36	36	MD756591
1.92	92	MD756580	2.40	40	MD756592
1.96	96	MD756581	2.44	44	MD756593
2.00	00	MD756582	2.48	48	MD756594
2.04	04	MD756583	2.52	52	MD756595
2.08	08	MD756584	2.56	56	MD756596
2.12	12	MD756585	2.60	60	MD756597
2.16	16	MD756586	2.64	64	MD756598
2.20	20	MD756587	2.68	68	MD756599
2.24	24	MD756588	2.72	72	MD760685
2.28	28	MD756589	2.76	76	MD760686
2.32	32	MD756590			

(9)Spacer （for adjustment of differential case end play，see table 11A-12）

Table 11A-12

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.
1.28	N	MD710458	1.64	V	MD710766
1.36	P	MD710460	1.73	X	MD710468
1.46	R	MD710462	1.82	Z	MD710470
1.55	T	MD710464			

(10)Spacer （for adjustment of backlash between differential side gear and pinion, see table 11A-13）

Table 11A-13

Thickness (mm)	Identification symbol	Part No.	Thickness (mm)	Identification symbol	Part No.

0.75~0.82	——	MD755179	1.01~1.08	——	MD755175
0.83~0.92	——	MD755178	1.09~1.16	——	MD755176
0.93~1.00	——	MD755177			

5 TORQUE SPECIFICATIONS SEE TABLE 11A-14

Table 11A-14

Items		Torque specification N • m（kgf • m）
Automatic transmission	Roll stopper bracket	69(7.0)
	Wiring hardness bracket	23(2.3)
	Control cable bracket	23(2.3)
	Eye bolt	30(3.1)
	Oil cooler feed tube	9.8(1.0)
	Oil filter	12(1.2)
	Input shaft speed sensor	11(1.1)
	Output shaft speed sensor	11(1.1)
	Manual control lever	22(2.2)
	Inhibitor switch	11(1.1)
	Speedometer gear	4.9(0.5)
	Valve body cover	8.8(9.0)
	Valve body mounting bolt	11(1.1)
	Fluid temperature sensor	11(1.1)
	Manual control shaft detent	5.9(0.6)
	Rear cover	23(2.3)
	Torque converter housing	47(4.8)
	Oil pump	23(2.3)
	Transfer drive gear bearing	19(1.9)
	Output shaft lock nut	167(17.0)
	Output shaft bearing retainer	23(2.3)
Part	Transfer drive gear lock nut	191(19.5)
	Differential drive gear	132(13.5)
	Valve body	11(1.1)
	Solenoid valve bracket	5.9(0.6)
	plate	5.9(0.6)

6．SEALANT（ SEE TABLE 11A-15）

Table 11A-15

Items	Sealant
Rear cover	Mitsubishi genuine ， part No.MD974421or equivalent
Torque converter	
Valve body cover	

11A.2 Transmission Assembly

1 Transmission

Disassembly and reassembly (see Fig.11A-3、11A-4、11A-5、11A-6)

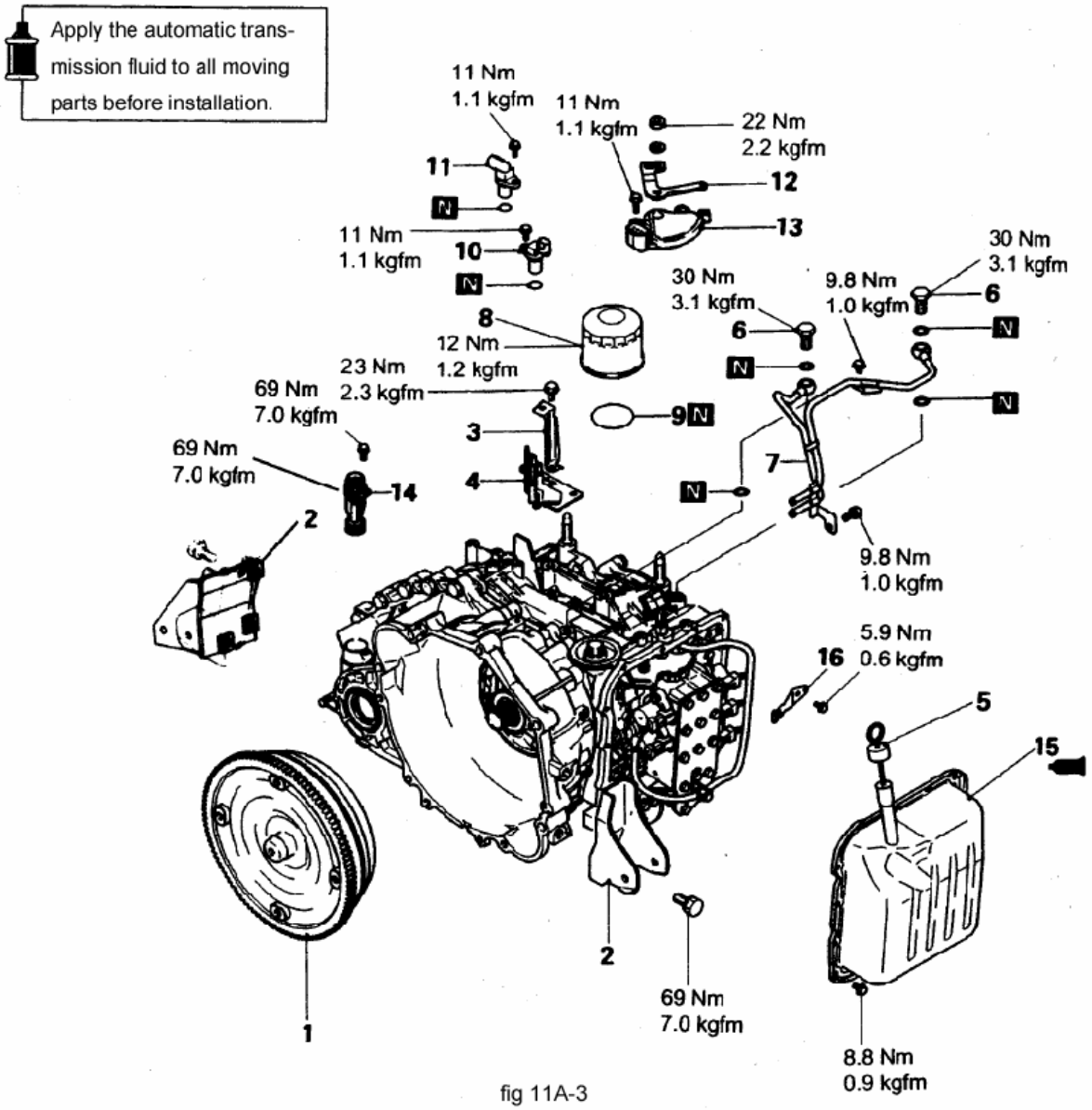


fig 11A-3

1 torque converter; 2 roll stopper bracket; 3 hardness bracket; 4 control cable support bracket; 5 oil level gauge; 6 eye bolt; 7 oil cooler feed tube; 8 oil fliter; 9 oil filter gasket; 10 Input shaft speed sensor; 11 output shaft speed sensor; 12 manual control lever;13 inhibiter switch;14 speedometer gear;15 valve body cover; 16 manual control shaft detent

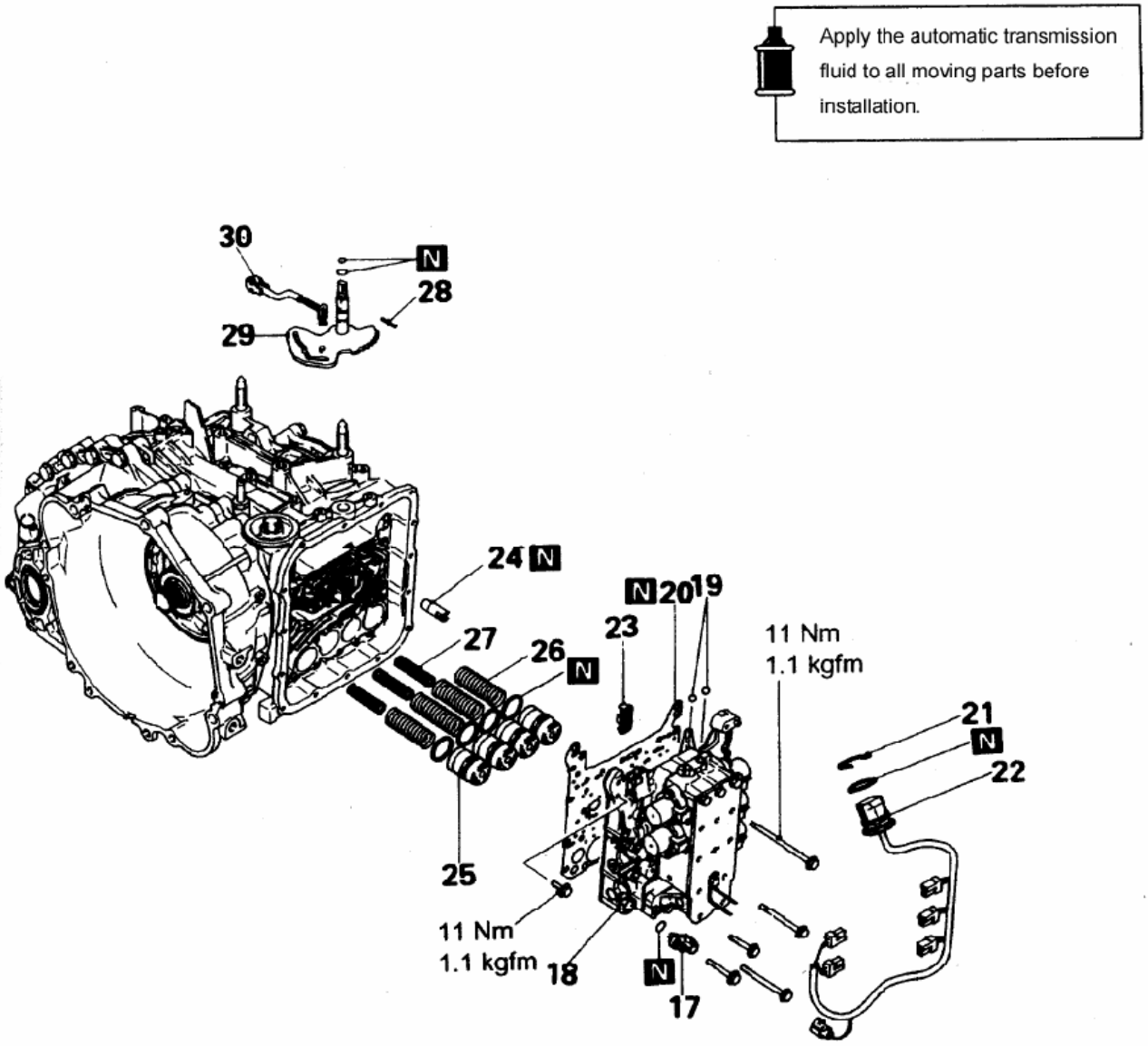


fig 11A-4

17 fluid temperature sensor; 18 valve body; 19 steel ball; 20 gasket; 21 snap ring; 22 solenoid valve hardness; 23 strainer 24 second brake retainer oil seal; 25 accumulator piston; 26 accumulator spring; 27 accumulator spring; 28 manual control lever roller; 29 manual control lever shaft; 30 parking pawl rod

lever roller; 29 manual control lever shaft; 30 parking pawl rod

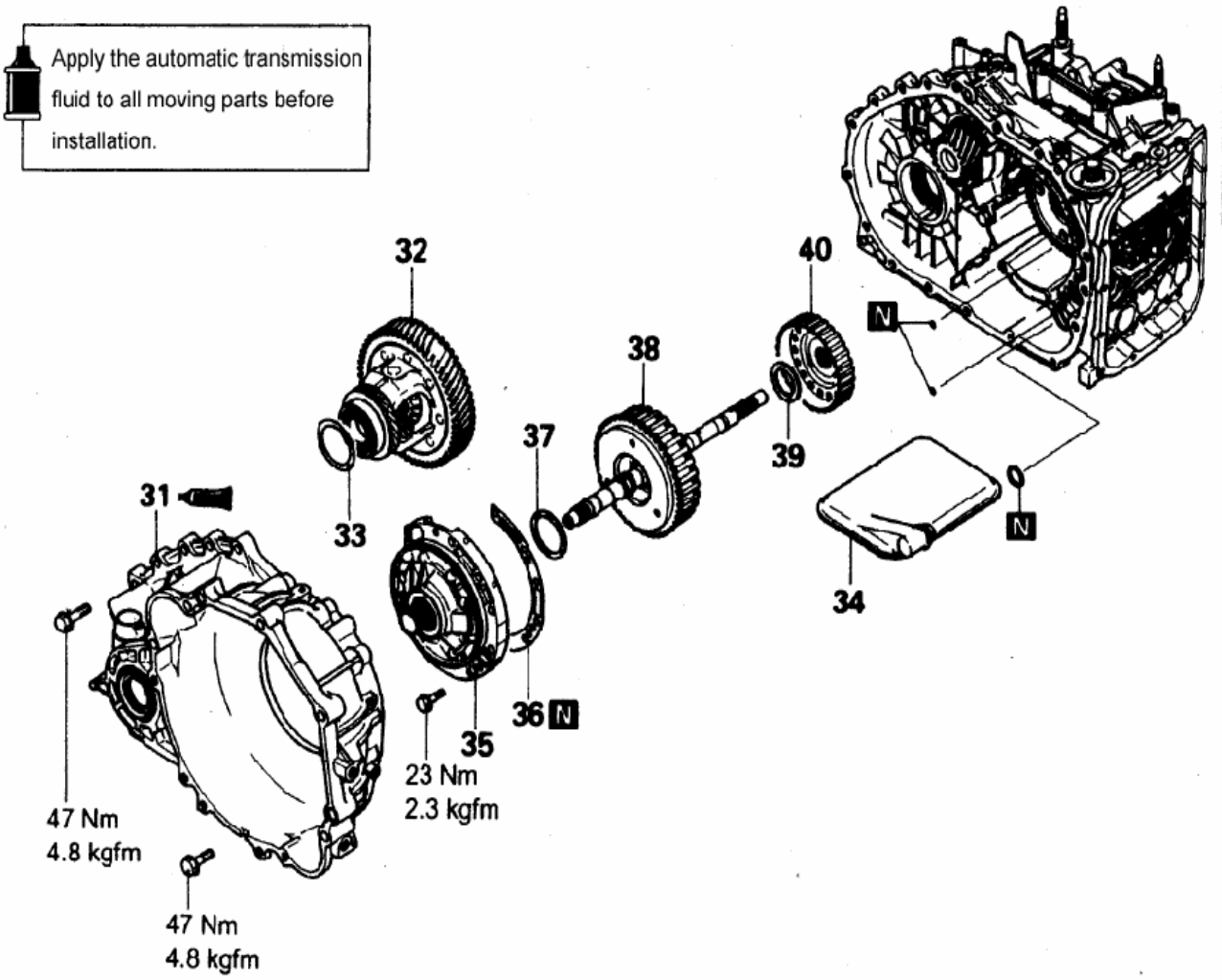


fig 11A-5

31 torque converter housing; 32 differential; 33 spacer; 34 oil filter; 35 oil pump; 36 gasket; 37 thrust washer 38 underdrive clutch and input shaft; 39 thrust bearing #2; 40 underdrive clutch hub

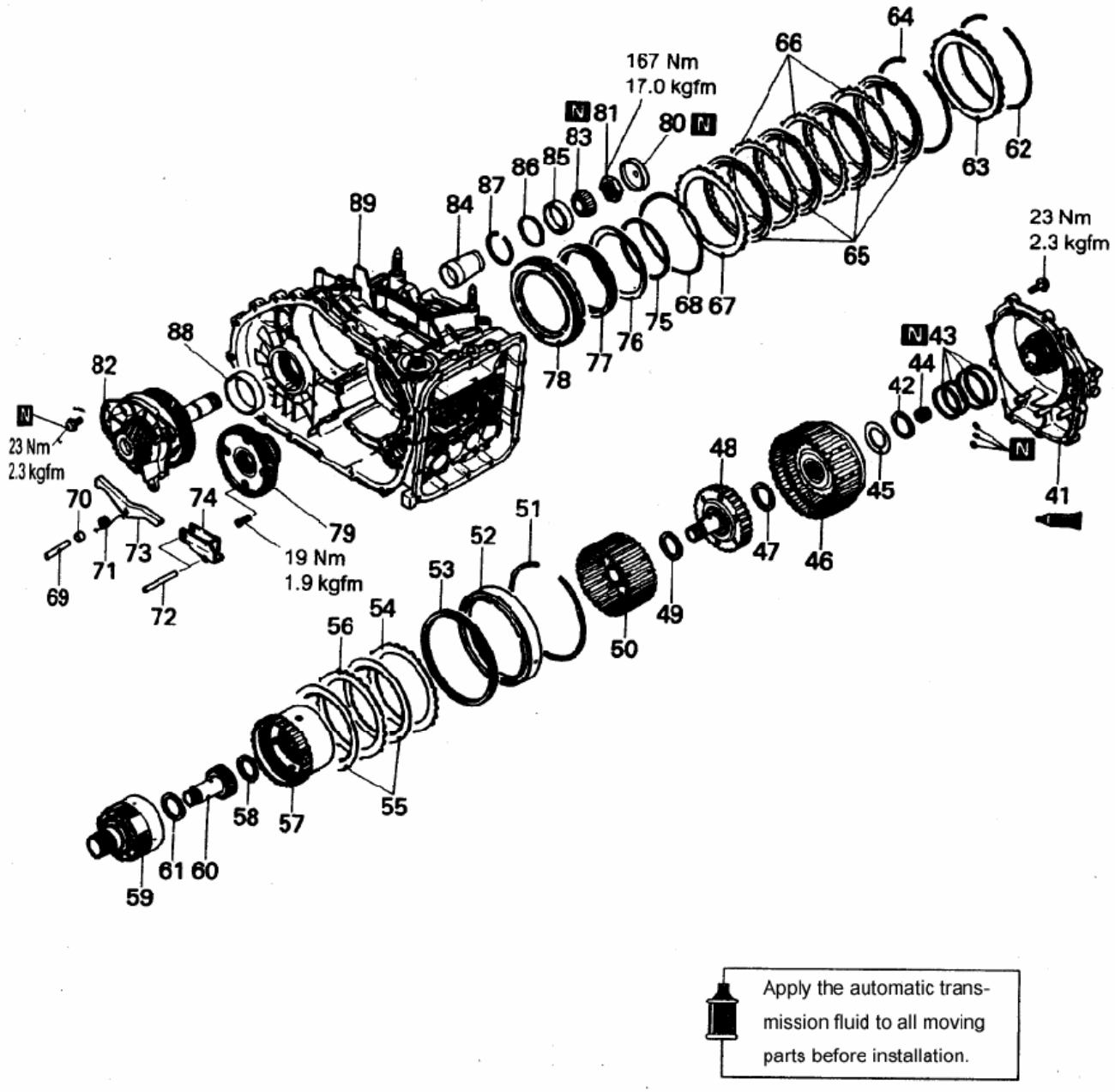


fig 11A-6

41 rear cover; 42 thrust race #8; 43 seal ring; 44 input shaft rear bearing; 45 thrust bearing #7; 46 reverse and overdrive clutch 47 thrust bearing #7; 48 overdrive clutch hub; 49 thrust bearing #5;50 planetary reverse sun gear; 51 snap ring; 52 second brake piston; 53 return spring; 54 pressure plate; 55 second brake plate; 56 second brake disc; 57 overdrive planetary gear carrier; 58 thrust bearing #4; 59 output planetary gear carrier; 60 underdrive sun gear; 61 thrust bearing #3; 62 snap ring;63 reaction plate 64 snap ring; 65 low-reverse brake disc; 66 low-reverse brake plate; 67 pressure plate; 68 wave spring; 69 parking pawl shaft ; 70 spacer ; 71 parking pawl spring; 72 parking roller support shaft; 73 parking pawl; 74 parking roller support; 75 snap ring; 76 spring retainer; 77 retum spring; 78 low-reverse brake piston; 79 transfer drive gear; 80 cap; 81 lock nut; 82 output shaft; 83 taper roller bearing; 84 collar; 85 outer race; 86 spacer; 87 snap ring; 88 outer race; 89 transmission case

Disassembly：

Caution

1 because the automatic transmission is manufactured from high-precision parts, sufficient care must be taken not to scratch or damage these parts during disassembly and reassembly.

2 Working area should be covered with a rubber mat to keep it clean at all times.

3 Do not wear any cloth groves and do not use rags during disassembly. Use nylon cloth or paper towels if you need to use something.

4 Parts which have been disassembled should all be cleaned. Metal parts can be cleaned with normal detergent, but they must be dried completely using compressed air.

5 Clutch discs, plastic thrust plates and rubber parts should be cleaned with automatic transmission fluid (ATF) so that they do not become dirty.

6 If the transmission body has been damaged, disassemble and clean the cooler system also.

（1） Remove the torque converter.

（2） Use the dial gauge to measure the input shaft end play. See Fig.11A-7。

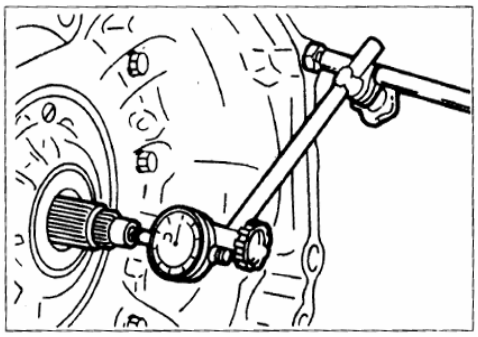


Fig 11A-7

（3） Remove each bracket.

（4） Remove oil level gauge.

（5） Remove the eye bolt.

（6） Remove the oil filter and oil filter gasket.

（7） Remove the input shaft speed sensor and the output shaft speed sensor. See Fig. 11A-8。

（8） Remove the manual control lever, and then remove the inhibitor switch. See Fig.11A-9。

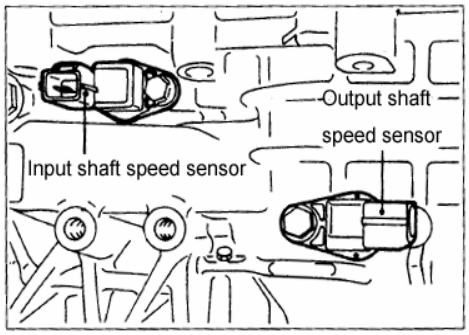


Fig 11A-8

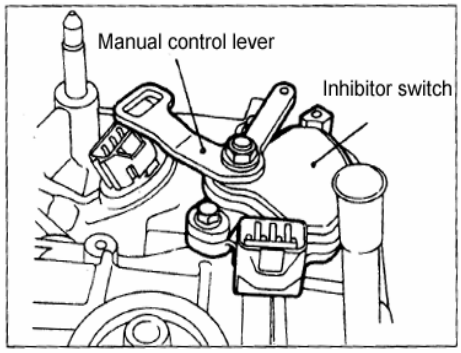


Fig 11A-9

（9） Remove the speedometer gear. See Fig.11A-10。

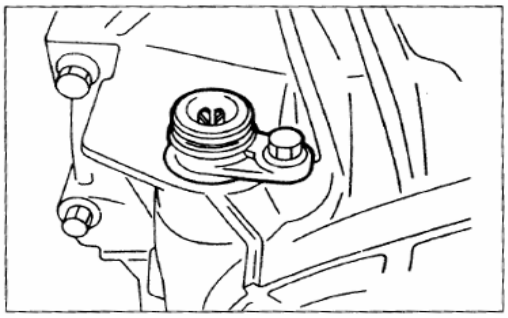


Fig 11A-10

（10）Remove the valve cover. See Fig.11A-11。

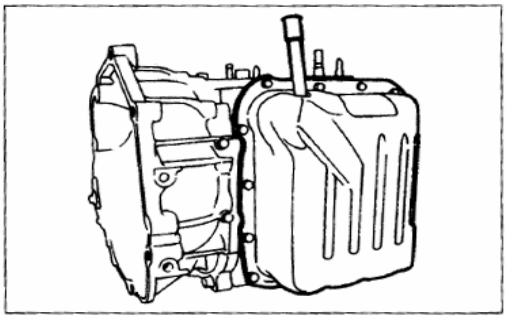


Fig 11A-11

（11）Remove the manual control shaft detent. See Fig.11A-12。

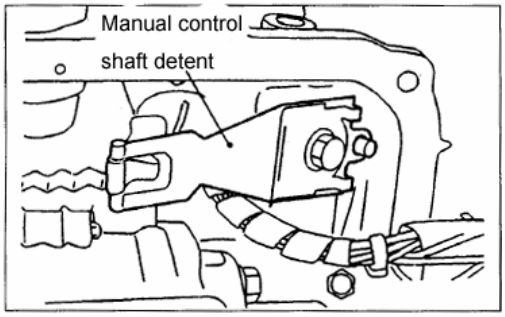


Fig 11A-12

Caution：

Make sure that the manual control lever and inhibition switch are removed.

（12）Disconnect the hardness from the valve body. See Fig.11A-13。

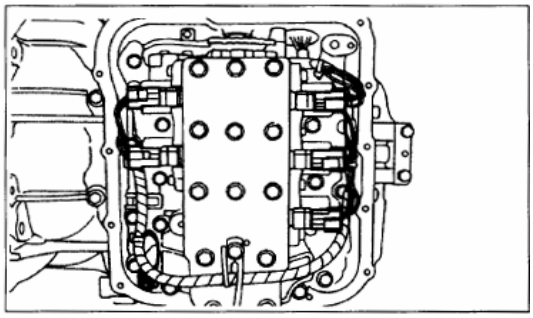


Fig 11A-13

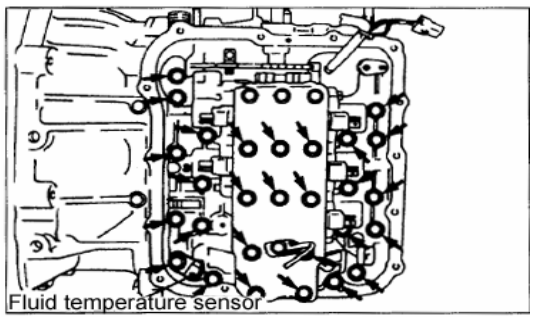


Fig 11A-14

caution：

Make sure that the valve body is installed before remove the manual control lever.

（13）Remove the valve body mounting bolts.（28 pieces），see Fig.11A-14。

（14）Remove the fluid temperature sensor.

（15）Remove the valve body, gasket and steel balls（2pieces），see Fig.11A-15。

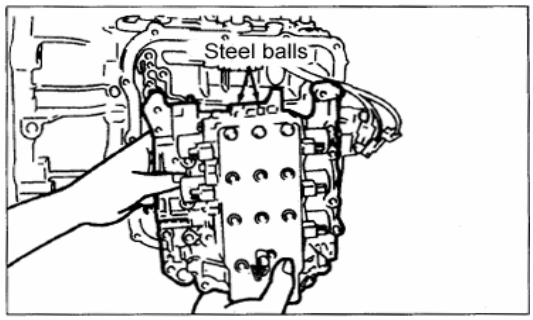


Fig 11A-15

Caution：

Do not lose the steel ball（2pieces）。

（16）Remove the snap ring, and then remove the solenoid valve hardness. See Fig.11A-16。

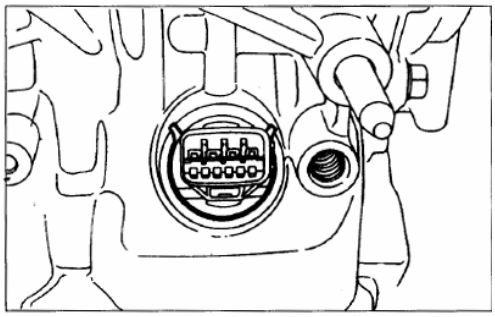


Fig 11A-16

（17）Remove the strainer and second brake retainer oil seal. See Fig.11A-17。

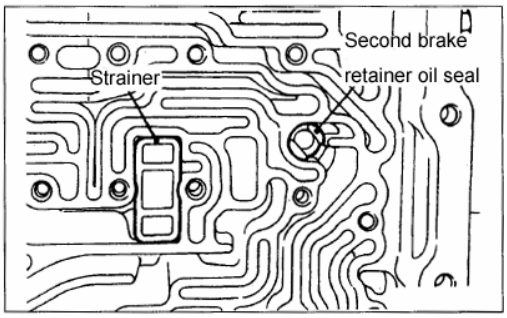


Fig 11A-17

（18）Remove each accumulator piston and spring. See Fig.11A-18。

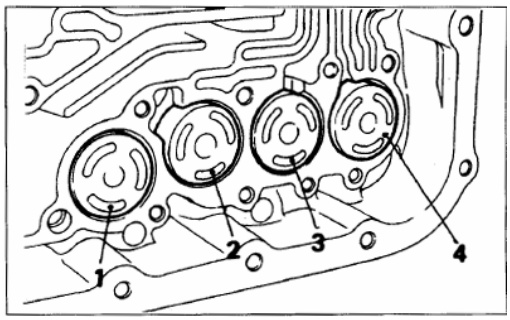


Fig 11A-18

No.	Name
1	For low-reverse brake
2	For underdrive clutch
3	For second brake
4	For overdrive clutch

（19）Remove the manual control lever shaft roller.

（20）Remove the manual control lever and parking pawl rod. See Fig.11A-19。

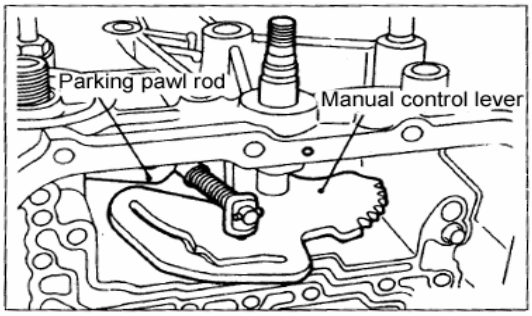


Fig 11A-19

（21）Remove the torque converter case mounting bolt（18pieces），and then remove the torque converter case. See Fig.11A-20。

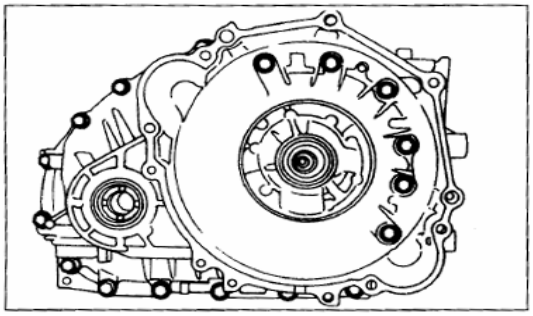


Fig 11A-20

（22）Remove the O-rings.（2pieces），see Fig.11A-21。

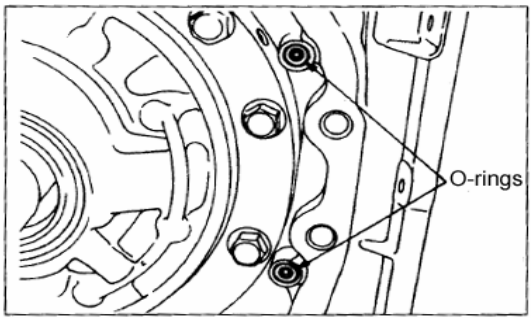


Fig 11A-21

（23）Remove the differential and spacer. See Fig.11A-22。

（24）Remove the oil filter. See Fig.11A-23。

（25）Remove the oil pump mounting bolts（6

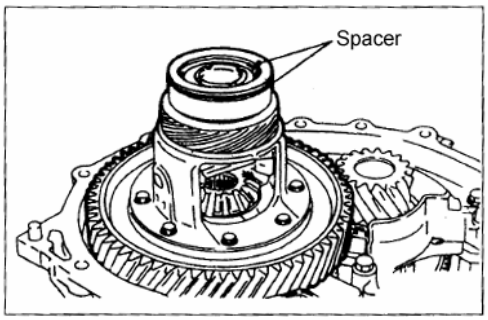


Fig 11A-22

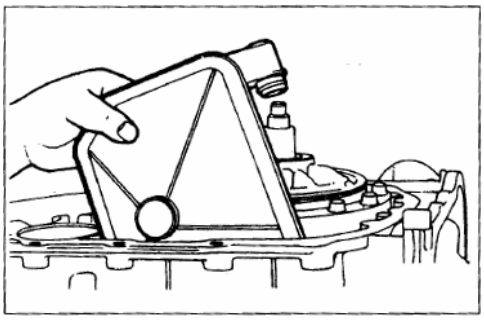


Fig 11A-23

pieces）。

（26）Install the special tool（MD998333）in hole A. see Fig.11A-24。

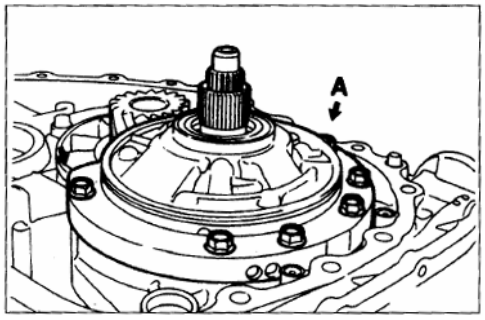


Fig 11A-24

（27）Screw the special tool to remove the oil pump. See Fig.11A-25。

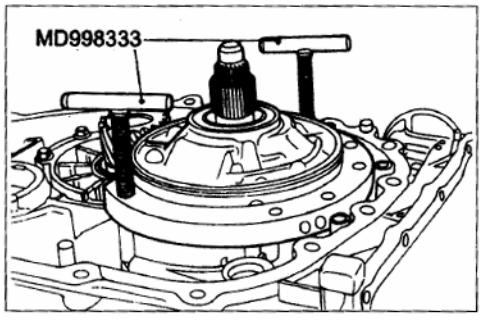


Fig 11A-25

（28）Remove the oil pump gasket.

（29）Remove the thrust washer #1. see Fig.11A-26。

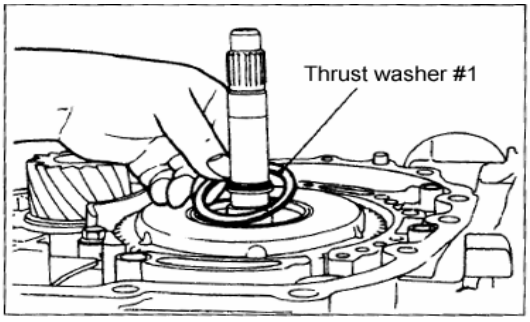


Fig 11A-26

（30）Hold the input shaft , and then remove underdrive clutch. See Fig.11A-27。

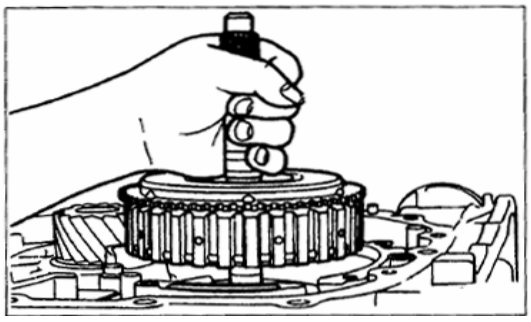


Fig 11A-27

（31）Remove the thrust bearing. See

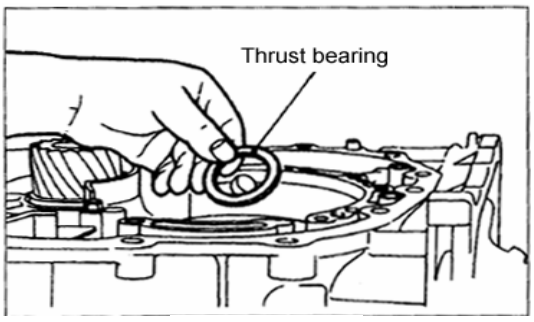


Fig 11A-28

Fig.11A-28。

（32）Remove the underdrive clutch hub.see

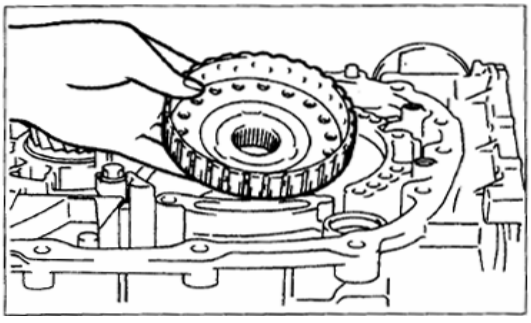


Fig 11A-29

Fig.11A-29。

（33）Remove the rear cover. See Fig.11A-30。

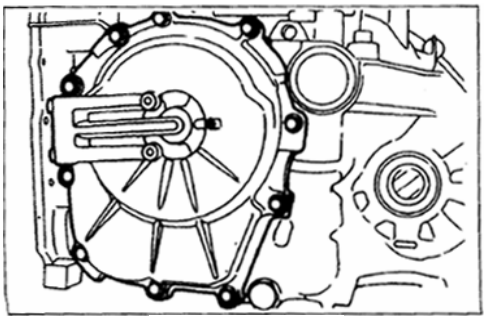


Fig 11A-30

（34）Remove the thrust race #8。

（35）Remove the seal rings（14 pieces）。

（36）Remove the input shaft bearing.

（37）Remove the O-rings（3 pieces），see Fig.11A-31。

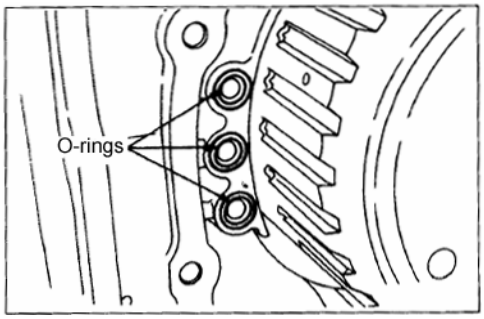


Fig 11A-31

（38）Remove the reverse and overdrive clutch and thrust bearing #7. see Fig.11A-32。

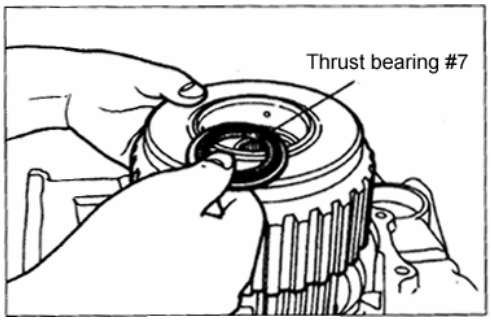


Fig 11A-32

（39）Remove the overdrive hub and thrust bearing #6，see Fig.11A-33。

（40）Remove the thrust bearing #5. see Fig.11A-34。

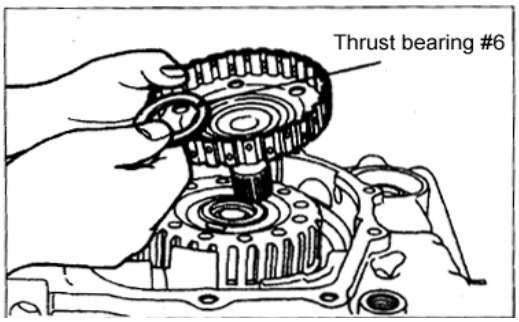


Fig 11A-33

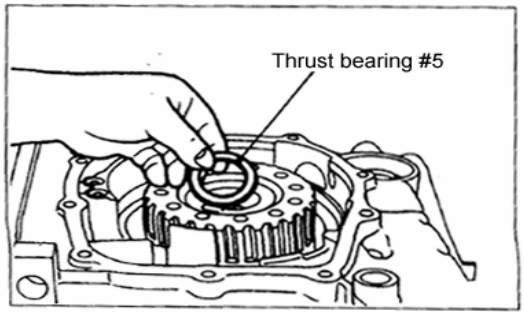


Fig 11A-34

（41）Remove the planetary reverse sun gear. See Fig.11A-35。

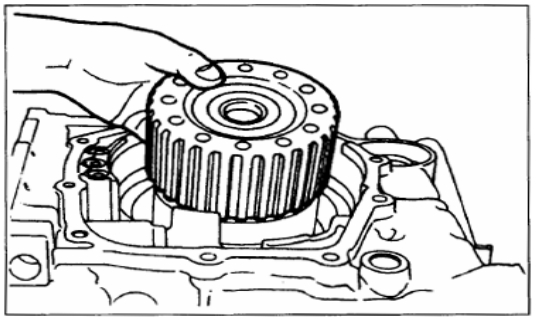


Fig 11A-35

（42）Remove the snap ring. See Fig.11A-36。

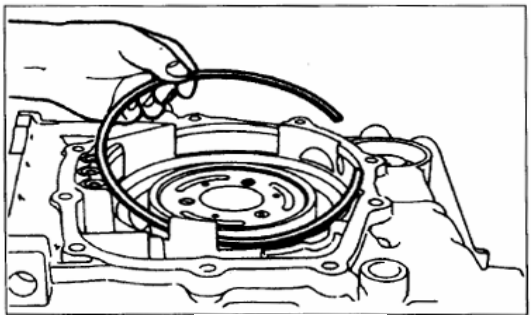


Fig 11A-36

（43）Remove the second brake piston and return spring. See Fig.11A-37。

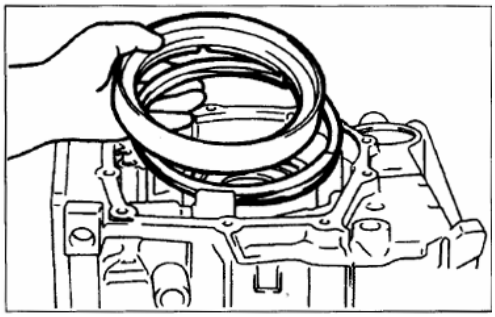


Fig 11A-37

（44）Remove the pressure plate, brake disc and brake plate. See Fig.11A-38。

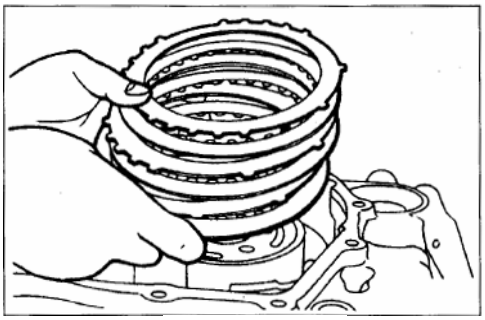


Fig 11A-38

（45）Remove the overdrive planetary carrier. See Fig.11A-39。

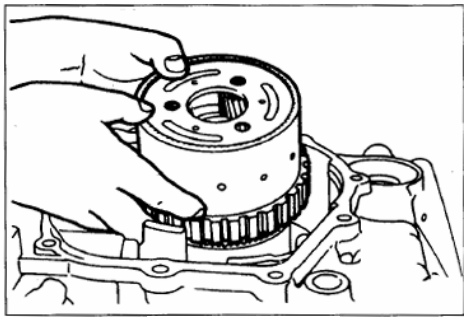


Fig 11A-39

（46）Remove the output planetary gear and thrust bearing #4. see Fig.11A-40。

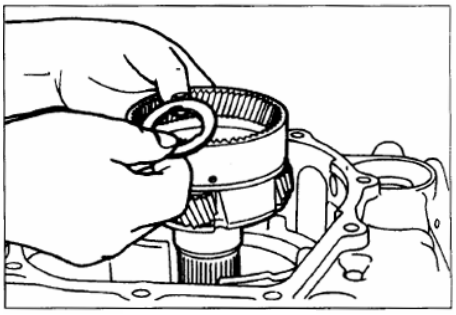


Fig 11A-40

（47）Remove the underdrive sun gear and thrust bearing #3 from the output planetary carrier. See Fig.11A-41。

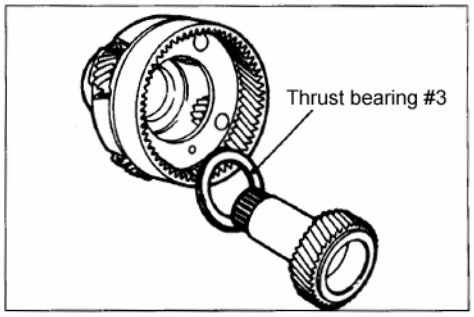


Fig 11A-41

（48）Remove the snap ring. See Fig.11A-42。

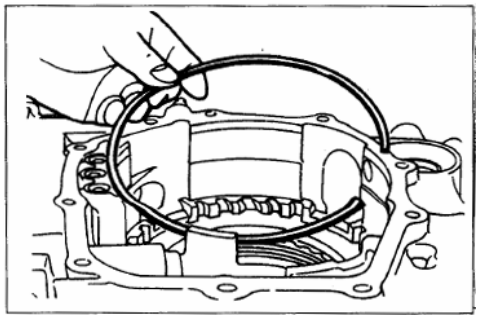


Fig 11A-42

（49）Remove the reaction plate and brake disc. See Fig.11A-43。

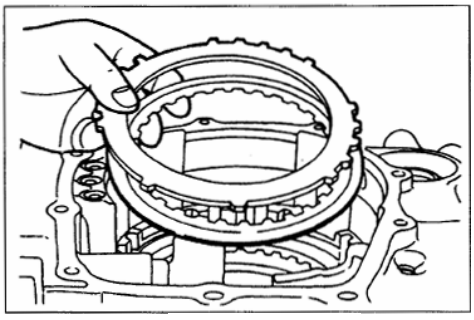


Fig 11A-43

（50）Remove the snap ring. See Fig.11A-44。

（51）Remove the brake plates, brake discs and pressure plate. See Fig.11A-45。

（52）Remove the wave spring. See Fig.11A-46。

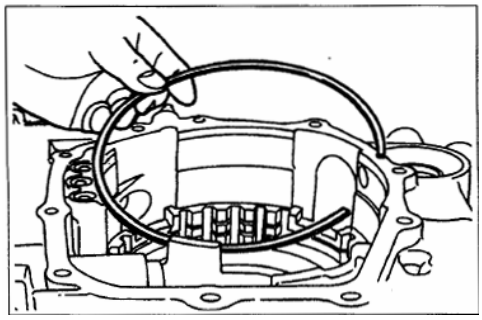


Fig 11A-44

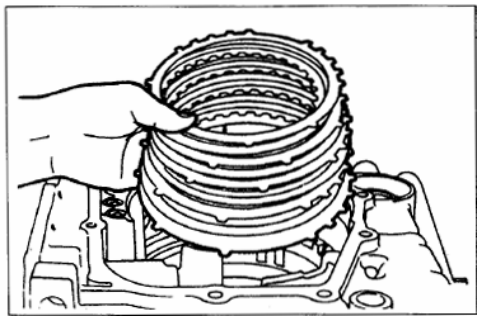


Fig 11A-45

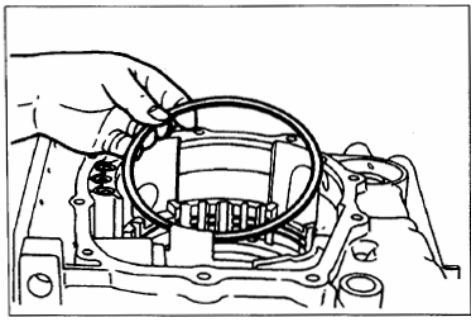


Fig 11A-46

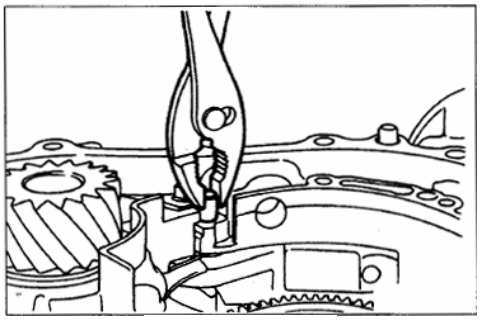


Fig 11A-47

（53）Remove the parking pawl shaft, and then remove the spacer and spring. See Fig.11A-47。

（54）Remove two parking roller support shafts, and then remove the parking pawl case and parking roller support. See Fig. See Fig.11A-48。

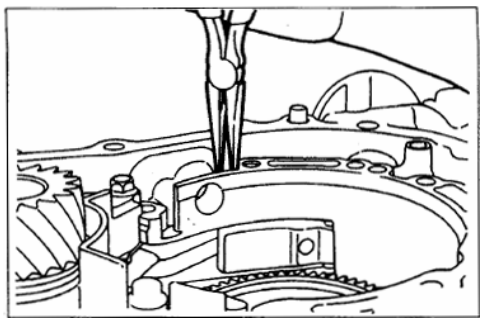


Fig 11A-48

（55）Remove the snap ring with special tool. See Fig. 11A-49。

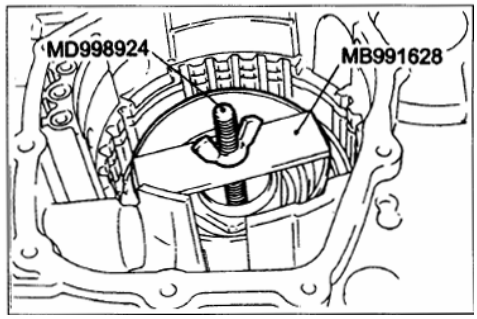


Fig 11A-49

（56）Remove the spring retainer, return spring and low-reverse brake piston.

（57）Remove the transfer drive gear mounting bolts（4 pieces），see Fig.11A-50。

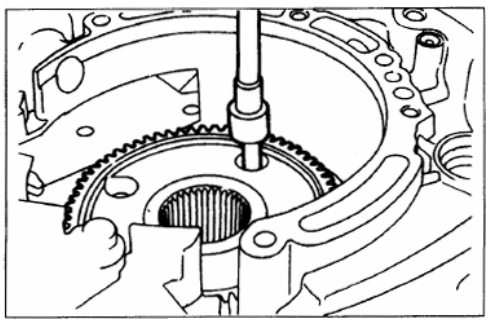


Fig 11A-50

（58）Remove the transfer drive gear. See Fig.11A-51。

（59）Remove the cap. See Fig.11A-52。

（60）Straighten the locking tab of the output

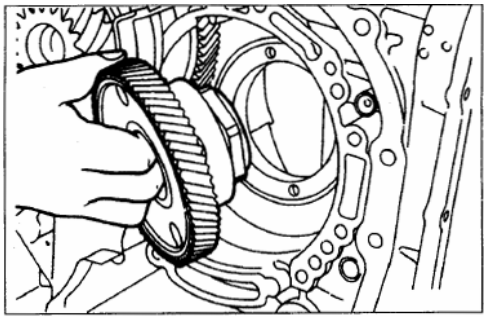


Fig 11A-51

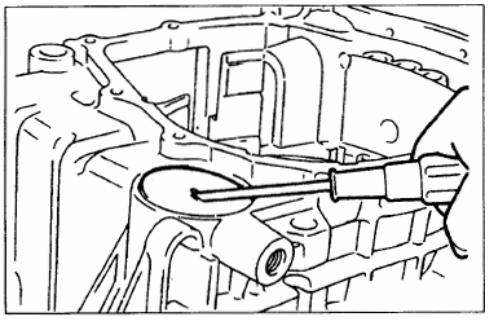


Fig 11A-52

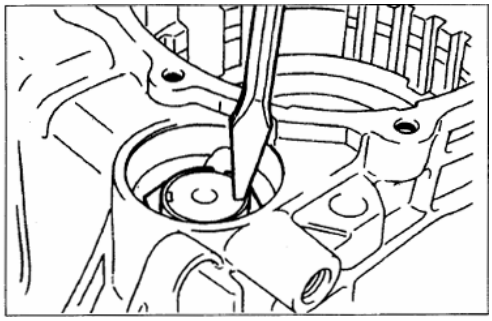


Fig 11A-53

shaft lock nut. See Fig.11A-53。

（61）Remove the output shaft lock nut with the special tool. See Fig.11A-54。

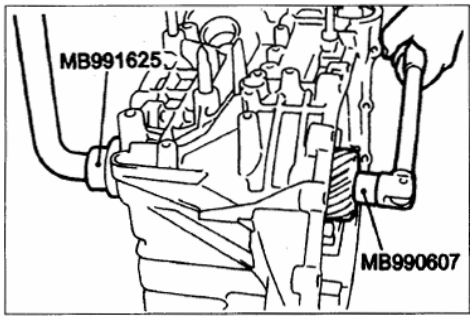


Fig 11A-54

Caution

The lock nut is left-handed screw.

（62）Remove the bearing retainer mounting bolt. See Fig.11A-55。

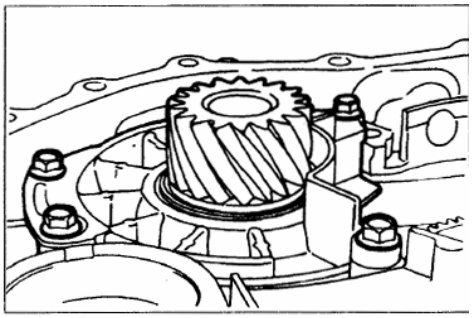


Fig 11A-55

（63）Tap on the rear of the output shaft to remove the output shaft, taper roller bearing and the collar. See Fig.11A-56。

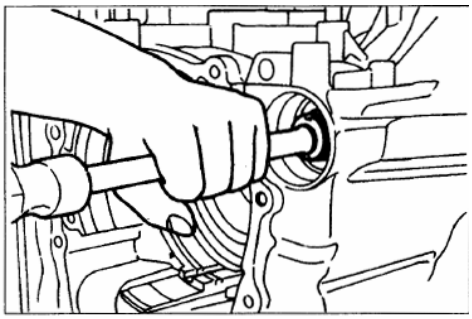


Fig 11A-56

（64）Remove the spacer and outside race. See Fig.11A-57。

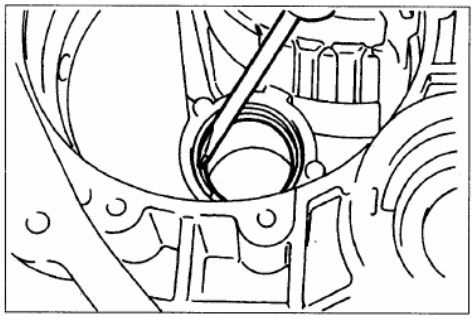


Fig 11A-57

（65）Remove the snap ring.

Caution

1. Never reuse the gasket, O-ring , oil seal, etc. always replace with a new one when reassembling.
2. Never use grease other than blue petrolatum jelly and white Vaseline.
3. Apply ATF for friction components, rotating parts and sliding parts before installing.
4. Never apply sealant or adhesive to gasket.
5. When replacing a pushing, replace the assembly which it belongs to.
6. Never use any cloth groves or any rags during reassembly. Use nylon cloth or paper towels if you need to use something.
7. Chang the oil in the cooler system.

Reassembly

（1） Use the special tools to tap the output shaft bearing outside race in the transmission case. See Fig. 11A-58。

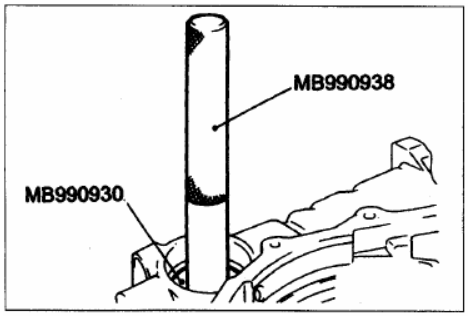


Fig 11A-58

（2） Install the used spacer and snap ring.
（3） Install low-reverse brake piston, return spring and spring retainer.
（4） Use the special tool to install snap ring. See Fig.11A-59。

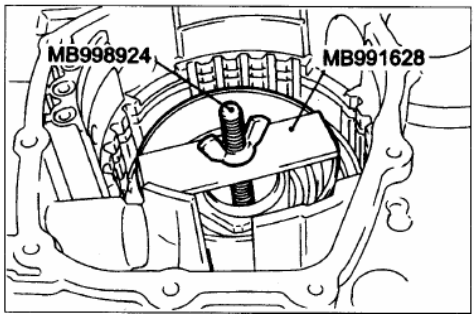


Fig 11A-59

（5） Install wave spring. See Fig.11A-60。

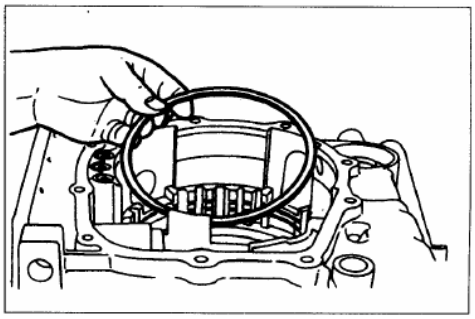


Fig 11A-60

（6） Use the special tool to replace the low-reverse brake pressure plate, and then install the brake disc, brake plate and snap ring as shown in the Fig.11A-61.

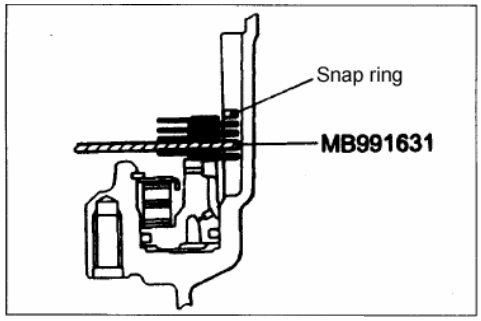


Fig 11A-61

（7） Install reaction plate and used snap ring.
（8） Move the special tool to measure the end

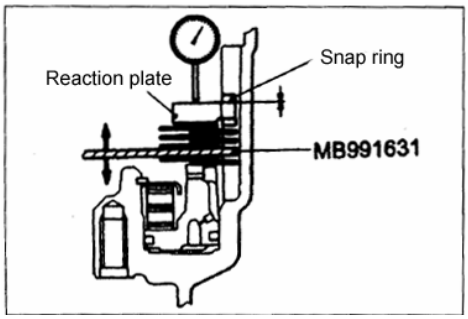


Fig 11A-62

play, and then replace the snap ring installed in step (7) to adjust the end play to standard value. See Fig. 11A-62。

Standard value：0-0.16mm。

（9） Use the special tool to replace the second brake pressureplate, and then install the brake disc and brake plate as shown in Fig.11A-63.

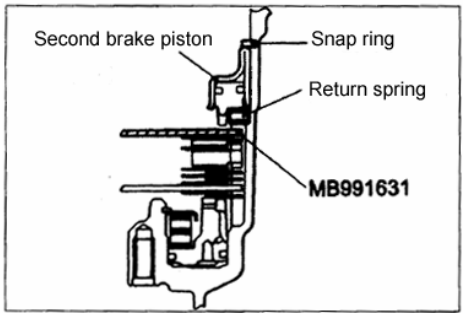


Fig 11A-63

（10）Install the return spring, second brake piston and snap ring.

（11）Move the special to measure the end play. See Fig.11A-64。

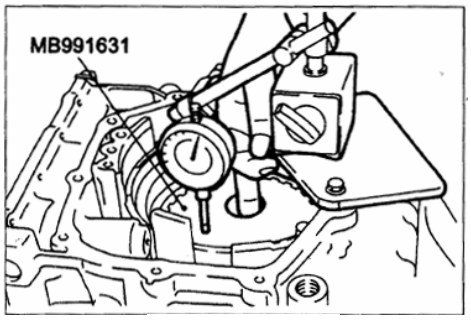


Fig 11A-64

Standard value：0.49~0.95mm。

Reference

Select the pressure whose thickness is within the following value, and use which to replace the special tool installed in step (9).

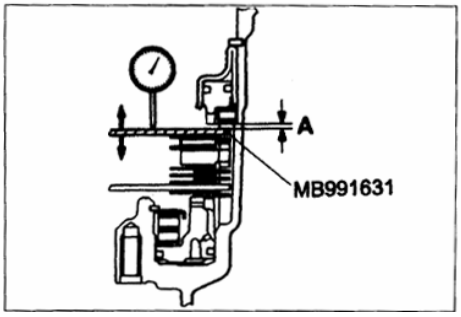


Fig 11A-65

[A（movement amount）+thickness of special tool（2.0mm）-0.95]to[A（movement amount）+ thickness of special tool（2.0mm）-0.49] ， see Fig.11A-65。

（12）Reverse the transmission.

（13）Install the special tool in a dial gauge, and then move the special tool to measure the end play. See Fig.11A-66。

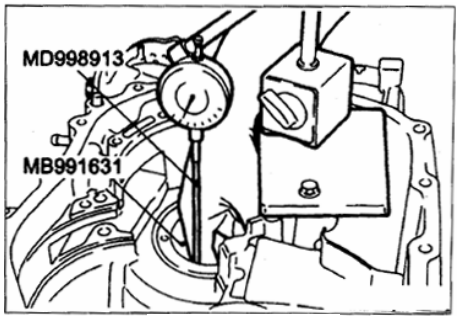


Fig 11A-66

Standard value：1.05-1.51mm

Reference

Select the pressure whose thickness corresponds to the following range, and use which to replace the special tool installed in step (6).

[A（movement amount）+ thickness of special tool（2.0 mm）-1.51]to[A（movement amount）+ thickness of special tool（2.0mm）-1.05] ， see Fig.11A-67。

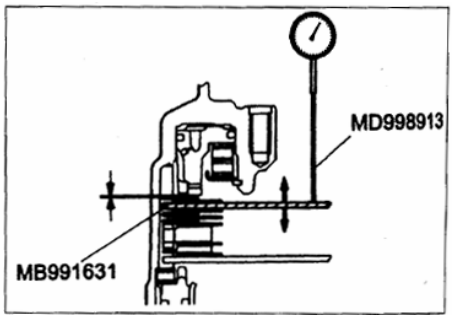


Fig 11A-67

（14）Remove the parts installed in steps (5) to （13）.

（15）Tighten the mounting bolts of the output shaft bearing retainer to specified torque. See Fig.11A-68。

（16）Install the output shaft to the transmission case, and then use the special tool to install the collar and taper roller bearing to the input shaft. See Fig.11A-69。

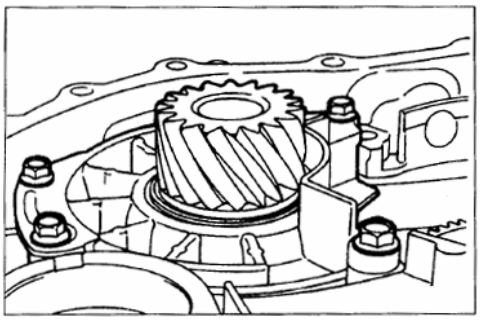


Fig 11A-68

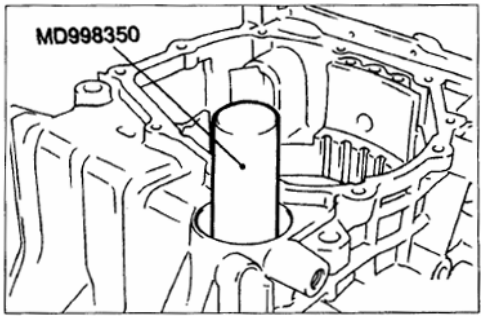


Fig 11A-69

（17）Apply ATF to a new lock nut, and use the special tool to tighten the lock nut to the specified torque. Then turn back one turn, and tighten it to specified torque. See Fig.11A-70。

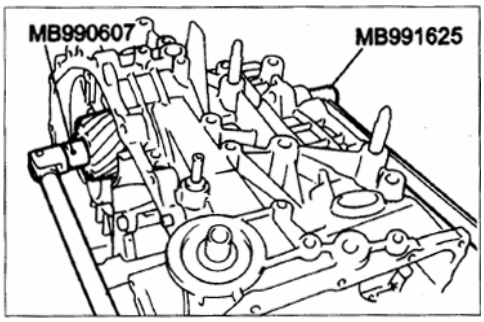


Fig 11A-70

Caution ：
Lock nut is left-hand screw.

（18） Move the output shaft to measure the operation amount（A），and then replace the spacer installed in step (3) with a new one which thickness is within the following value. See Fig.11A-71。

[A（operation amount）+B（thickness of the old spacer）+0.07mm]to[A（operation amount）+B（thickness of the old spacer）+0.09mm]

（19）Stake the lock nut with a punch.（2pieces），see Fig.11A-72。

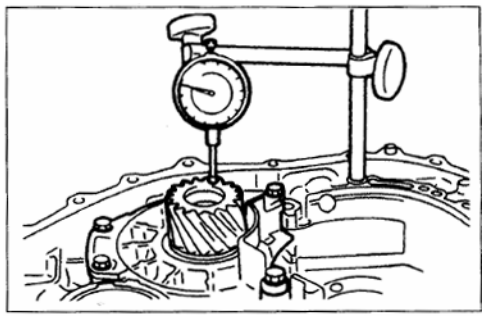


Fig 11A-71

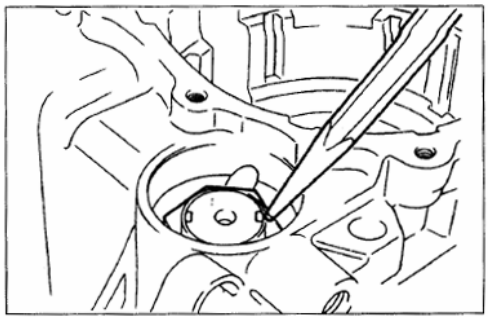


Fig 11A-72

（20）Install the cap as shown in the Fig.11A-73.

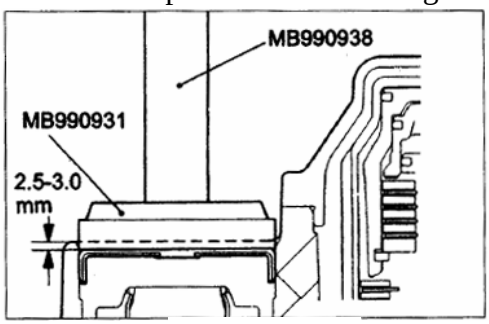


Fig 11A-73

（21）Use the special tool to install transfer drive gear as shown in the Fig.11A-74.

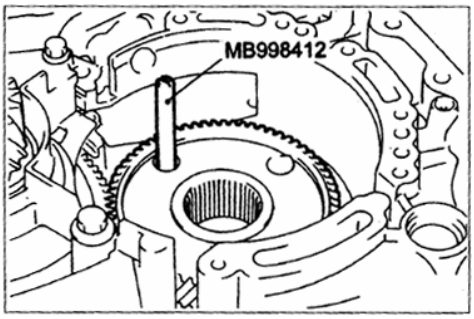


Fig 11A-74

（22）Tighten four mounting bolts of the transfer drive gear to the specified torque as shown in the Fig.11A-75.

（23）Install the parking pawl, spacer and spring,

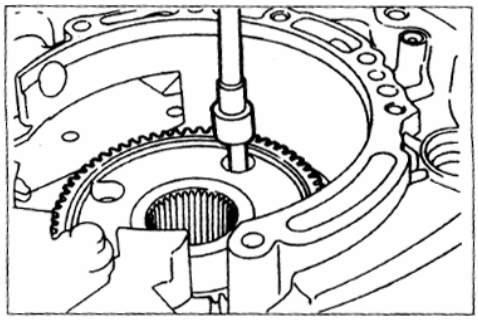


Fig 11A-75

then install the parking pawl shaft. See Fig.11A-76。

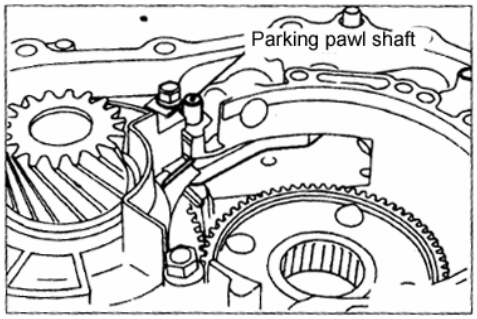


Fig 11A-76

（24）Install the parking roller bearing, and then install two parking roller support bearings. See Fig.11A-77。

（25）Install the underdrive sun gear and thrust bearing #3 to the output planetary gear bracket. See Fig.11A-78。

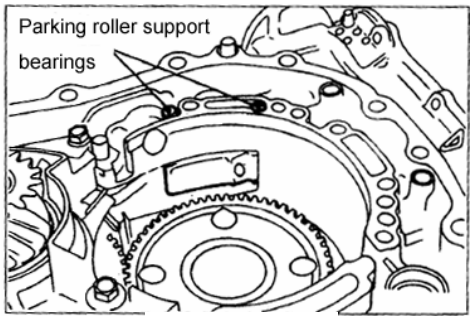


Fig 11A-77

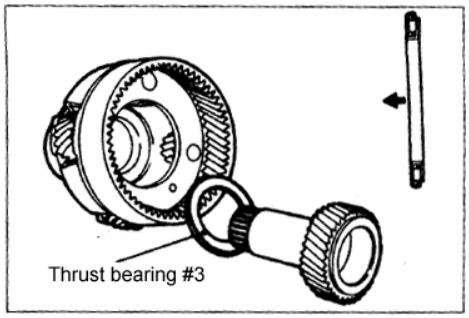


Fig 11A-78

Caution ：

Be careful about the installation direction of the thrust bearing.

Identification of thrust bearing, thrust races and thrust bearing see Fig.11A-79、table 11A-18：

Table 11A-18

O.D (mm)	I.D (mm)	thickness (mm)	Park No.	symbol	O.D (mm)	I.D (mm)	thickness (mm)	Park No.	symbol
59	47	1.8	MD754509	#1	48.9	37	1.6	MD707267	#8
59	47	2.0	MD754508	#1	48.9	37	1.7	MD759681	#8
59	47	2.2	MD754507	#1	48.9	37	1.8	MD723064	#8
59	47	2.4	MD753793	#1	48.9	37	1.9	MD754794	#8
59	47	2.6	MD753794	#1	48.9	37	2.0	MD707268	#8
59	47	2.8	MD753795	#1	48.9	37	2.1	MD754795	#8
49	36	3.6	MD756846	#2	48.9	37	2.2	MD723065	#8
49	36	3.6	MD756846	#3	48.9	37	2.3	MD754796	#8
45.3	31	3.3	MD757647	#4	48.9	37	2.4	MD724358	#8
49	36	3.6	MD756846	#5	48.9	37	2.5	MD754797	#8
49	36	3.6	MD756846	#6	48.9	37	2.6	MD754798	#8
59	47	2.8	MD754595	#7	—	—	—	—	—

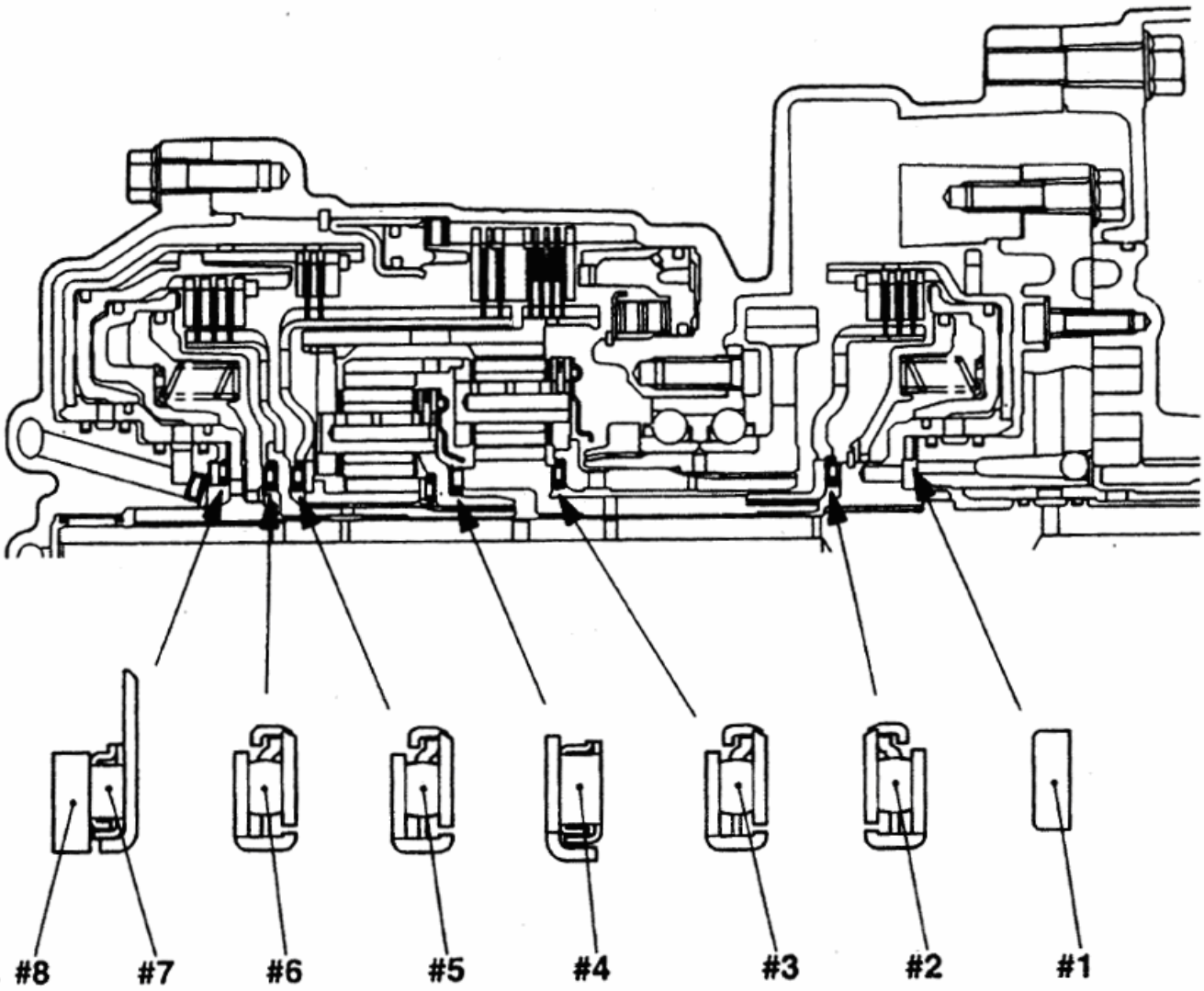


fig 11A-79

（26）install the output planetary carrier and thrust bearing #4，see Fig.11A-80。

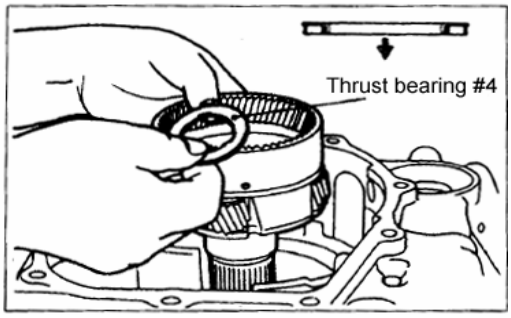


Fig 11A-80

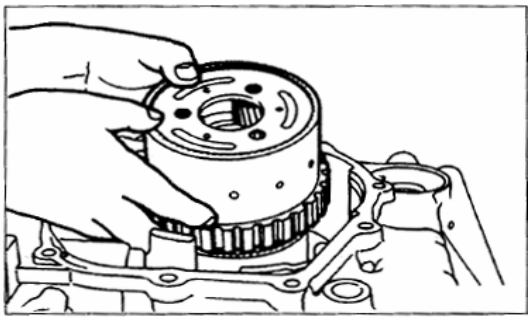


Fig 11A-81

（27）Install the overdrive planetary carrier. See Fig.11A-81。

（28）Install the planetary reverse sun gear. See Fig. 11A-82。

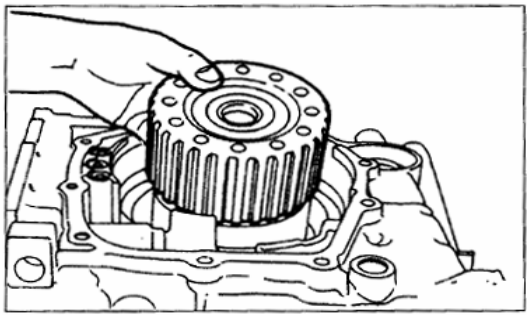


Fig 11A-82

（29）Install wave spring. See Fig.11A-83。

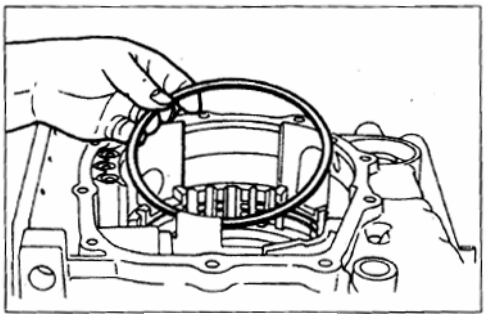


Fig 11A-83

（30）Install pressure plate, brake disc and brake plate. See Fig.11A-84。

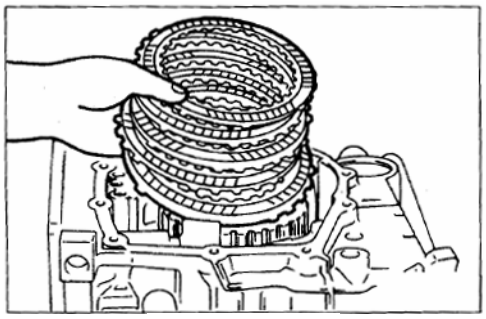


Fig 11A-84

（31）Install snap ring. See Fig.11A-85。

（32）Install reaction plate. See Fig.11A-86。

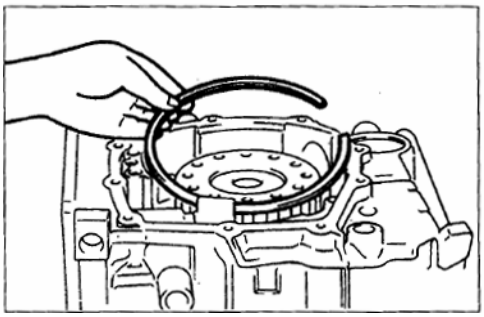


Fig 11A-85

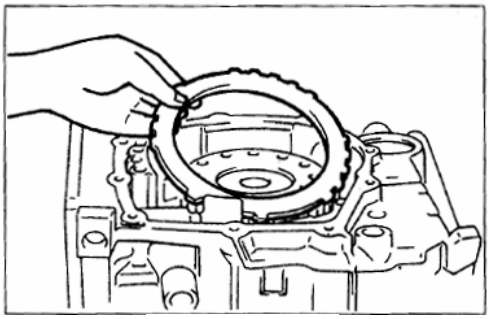


Fig 11A-86

（33）Install snap ring. See Fig.11A-87。

（34）Install brake disc, brake plate and pressure plate. See Fig.11A-88。

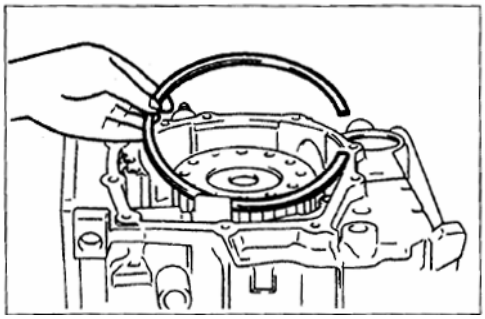


Fig 11A-87

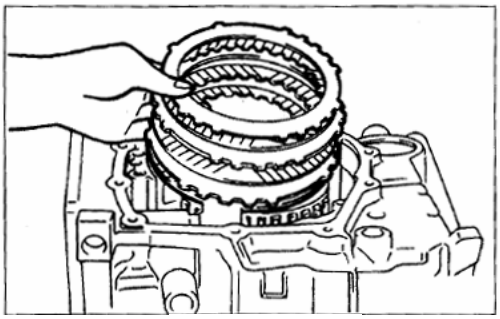


Fig 11A-88

（35）Install return spring and second brake piston. See Fig.11A-89。

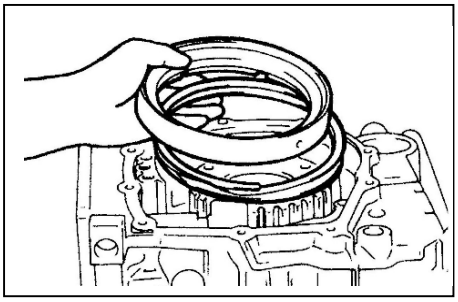


Fig.11A-89

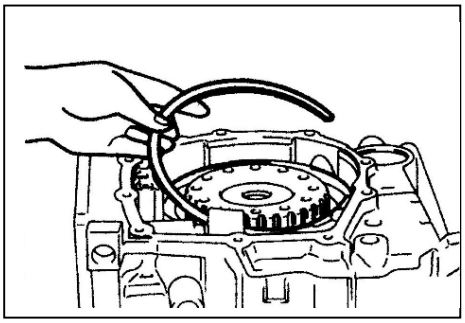


Fig.11A-90

（36）Install snap ring. See Fig.11A-90。

（37）Install thrust bearing #5. see Fig.11A-91。

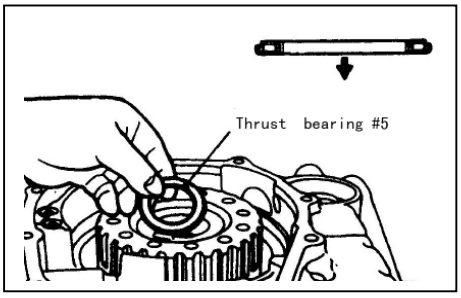


Fig.11B-91

Caution
Be careful about the installation direction of the thrust bearing.

（38）Install the overdrive clutch hub and thrust bearing #6 to reverse and overdrive clutch. See Fig.11A-92。

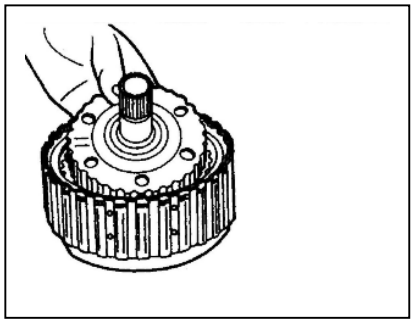


Fig.11A-92

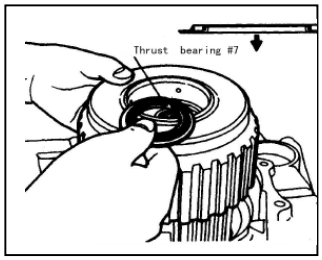


Fig.11A-93

Caution
Be careful about the installation direction of the thrust bearing.

（39）Install the reverse and overdrive clutch and thrust bearing #7. see Fig.11A-93。

Caution ：
Be careful about the installation direction of the thrust bearing.

（40）Install three O-rings. See Fig.11A-94。

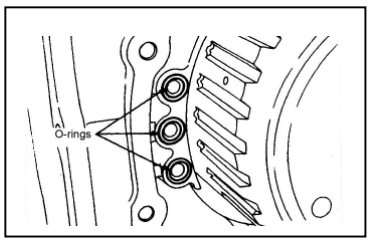


Fig.11A-94

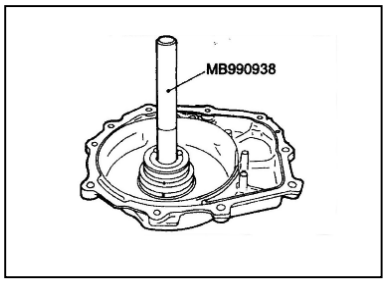


Fig.11A-95

（41）Install output shaft bearing. See Fig.11A-95。

（42）Install four seal rings.

（43）Install the thinnest thrust race #8， then install the rear cover.

（44）Measure the underdrive sun gear end play. Replace the thrust race installed in step (43) in order to adjust end play to standard value. See Fig.11A-96。

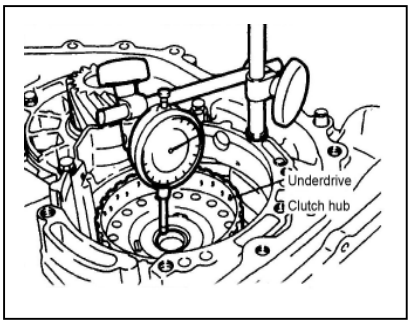


Fig.11A-96

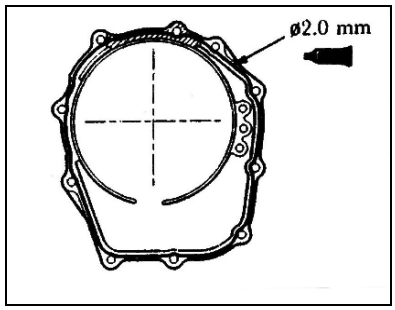


Fig.11A-97

Standard value：0.25~0.45mm。

Caution ：
Install underdrive clutch hub make it easy to measure underdrive gear end play.

（45）Squeeze out the liquid gasket and apply it shown points of rear cover. See Fig.11A-97.

Liquid gasket：

Mitsubishi genuine sealant, park NO. MD974421or equivalent.

Remark：

（1） Install rapidly the case while the sealant is wet (within 15min).

（2） Seal face does not connect oil after installing within 1h.

（46）Install rear cover, and tighten the mounting bolt to specified torque. See Fig.11A-98。

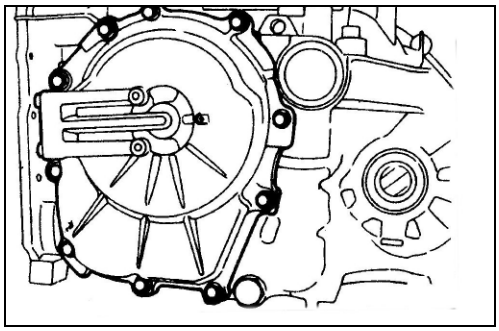


Fig.11A-98

（47）Install underdrive clutch hub. See Fig.11A-99。

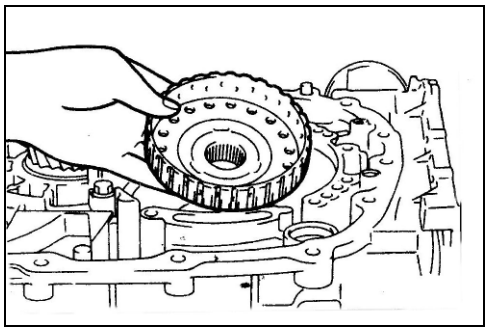


Fig.11A-99

（48）Install the thrust bearing #2. see Fig.11A-100。

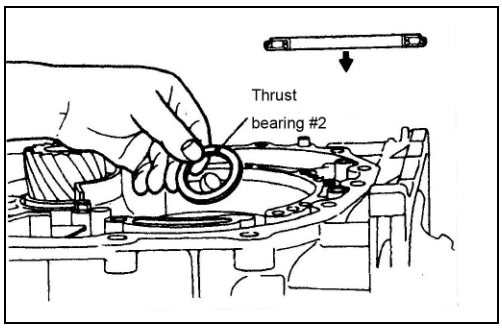


Fig.11A-100

Caution

Be careful about the installation direction of the thrust bearing.

（49）Hold the input shaft, and install underdrive clutch. See Fig. 11A-101。

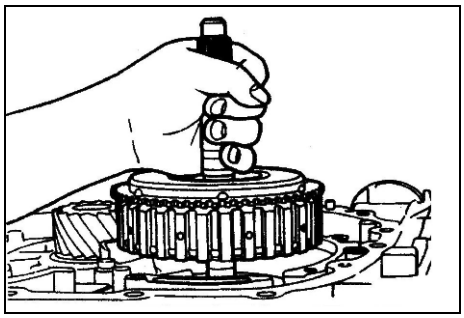


Fig. 11A-101

（50）Install old thrust bearing #1. see Fig.11A-102。

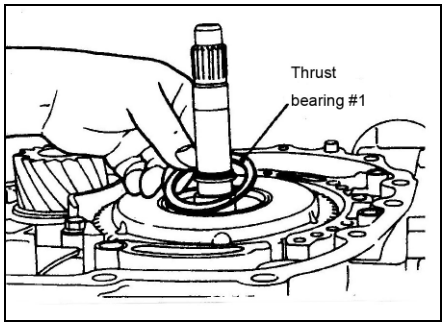


Fig.11A-102

（51）Use special tool to install a new oil pump gasket and oil pump. See Fig.11A-103。

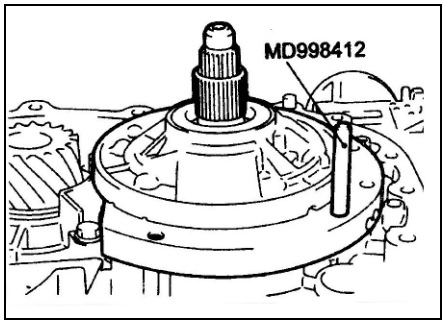


Fig.11A-103

Caution ：
Never reuse the old gasket.

（52）Tighten the mounting bolt to the specified torque.

（53）Measure the input shaft end play. Replace the thrust gasket installed in step (50) to adjust end play to standard value. See Fig.11A-104。

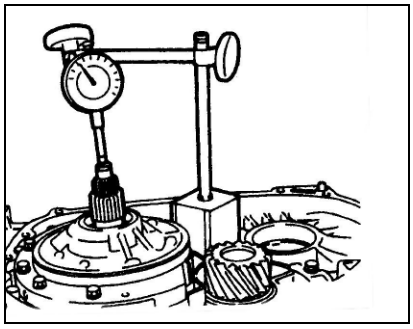


Fig.11A-104

Standard value：0.70~1.45mmm。

（54）Install the oil filter. See Fig.11A-105。

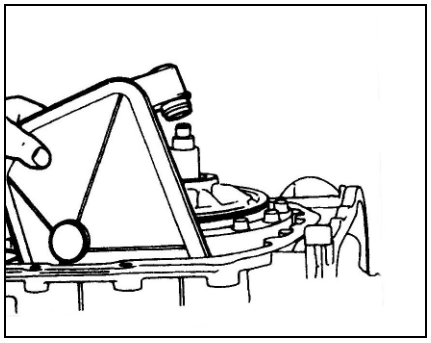


Fig.11A-105

（55）Install the differential. See Fig.11A-106。

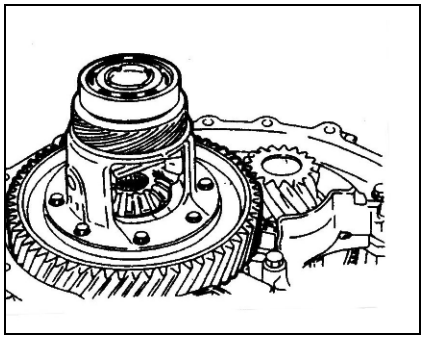


Fig.11A-106

（56）Place a solder（approx.10mm in the length，3mm in the diameter）on the differential as shown in the Fig.11A-107.

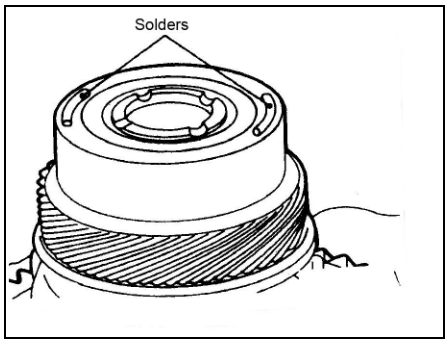


Fig.11A-107

（57）Install the torque converter housing to the transmission case without applying sealant. Tighten its mounting bolt to the specified torque. see Fig.11A-108

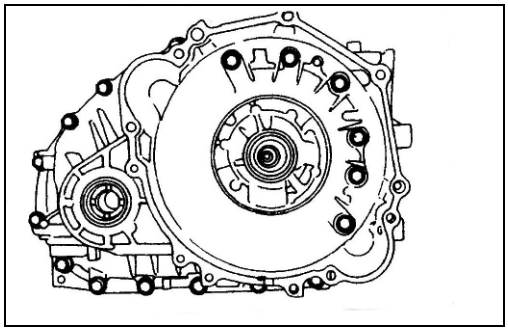


Fig.11A-108

（58）Loosen the bolt, and remove the solder.

（59）Use the micrometer to measure the thickness (T) of pressured solder. Select a spacer which thickness is within the following value. See Fig.11A-109

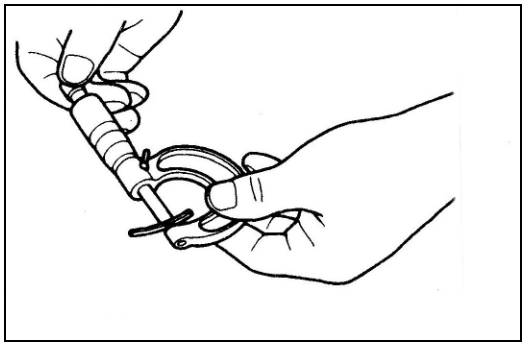


Fig.11A-109

T：0.045mm~0.165mm

（60）Place the spacer selected in the above step. See Fig.11A-110。

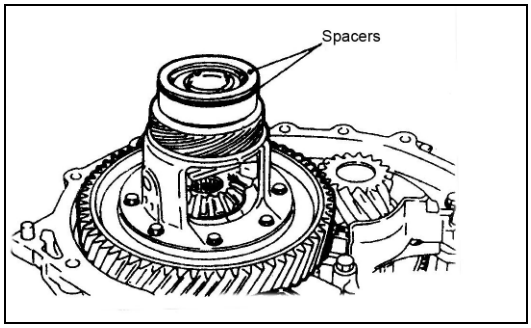


Fig.11A-110

（61）Set the spacer selected in step (59) and install the outer race to the torque converter housing. Use special tool to press in the outer race. See Fig. 11A-111。

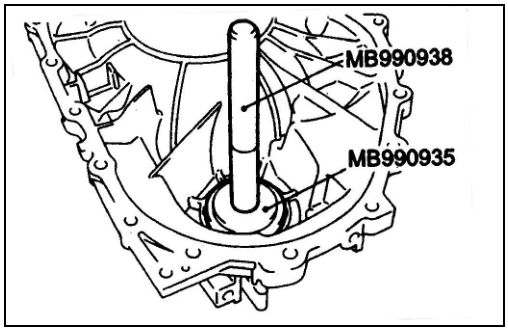


Fig. 11A-111

（62） Squeeze out the liquid gasket and apply it to the shown points of the torque converter. See Fig.11A-112

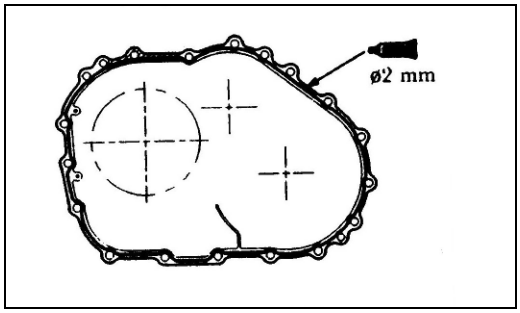


Fig.11A-112

Liquid graket：

Mitsubishi genuine sealant，part NO.MD974421 or equivalent.

Caution

（1）Install rapidly the case while the sealant is wet (within 15min).

(2) Seal face does not connect oil after installing within 1h.

（63）Install two O-rings. See Fig.11A-113。

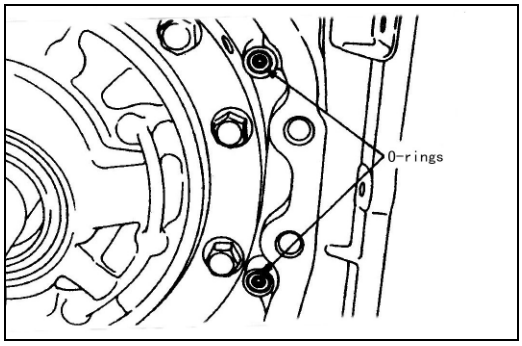


Fig.11A-113

（64）Install the torque converter, and then tighten 18 mounting bolts to the specified torque. (see Fig.11A-114)。

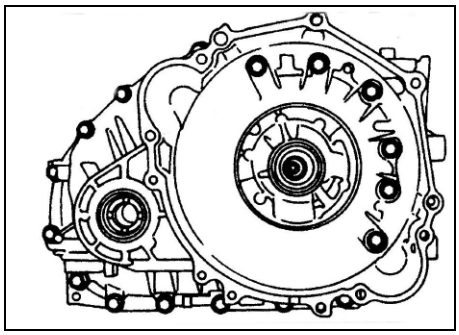


Fig.11A-114

（65）Install manual control lever shaft and parking pawl rod. See Fig.11A-115。

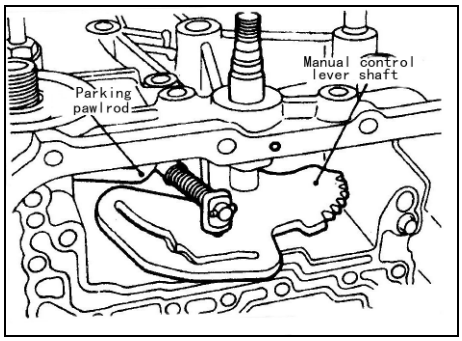


Fig.11A-115

（66）Install manual control shaft roller.

（67）Install accumulator piston, new seal rings and spring.see Fig.11A-116、table11A-19。

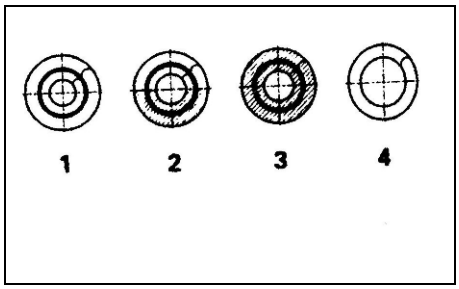


Fig.11A-116

Table 11A-19

NO.	Name
1	For low-reverse brake
2	For underdrive clutch
3	For second brake

4	For overdrive clutch

Caution
The accumulator spring is identified as shown in Fig.11A-117.

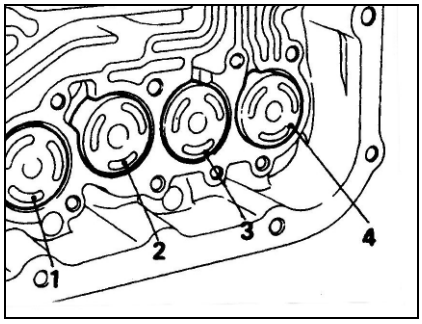


Fig.11A-117

（68）Install the strainer and second brake retainer oil seal. See Fig.11A-118。

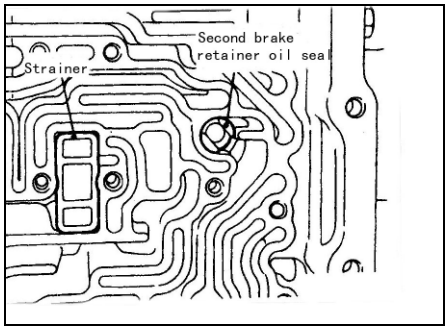


Fig.11A-118

（69）Install the solenoid valve hardness, and then secure the snap ring to the connector groove. See Fig.11A-119。

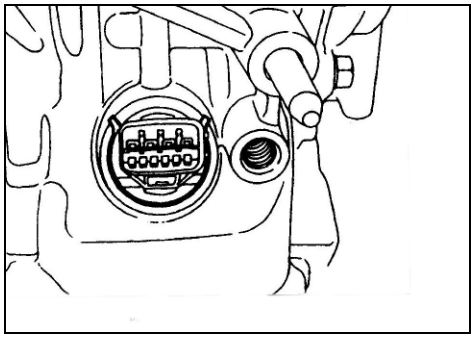


Fig.11A-119

（70）Install the valve body, gasket and two steel balls. See Fig.11A-120。

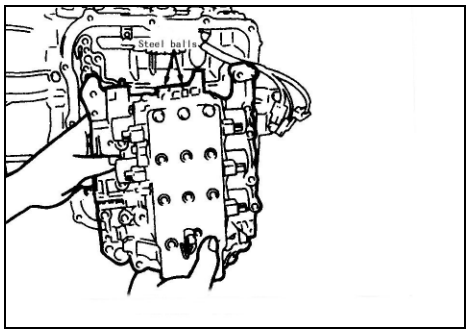


Fig.11A-120

（71）Install the fluid temperature sensor.。

（72）Install 28 mounting bolts of valve body. See Fig.11A-121。

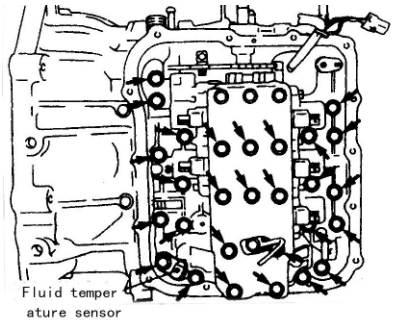


Fig.11A-121

（73）Connect the connector of the valve body. See Fig.11A-122、table 11A-20。

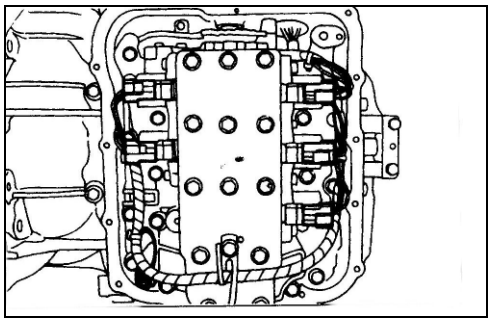


Fig.11A-122

Table 11A-20

NO.	Parts to be connected	Cable color	Connector housing color
1	Underdrive solenoid valve	white、red、red	black
2	Overdrive solenoid valve	Orange 、red	black
3	Low-reverse solenoid valve	brown、yellow	Milky white
4	Second solenoid valve	green、red、red	Milky white
5	Damper clutch control solenoid valve	blue、yellow、yellow	black
6	Fluid temperature sensor	black、red	black

（74）Install the manual control shaft detent. See Fig. 11A-123。

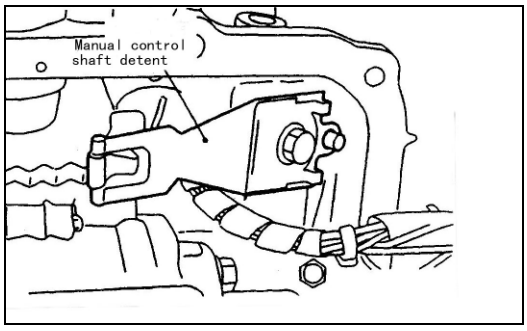


Fig. 11A-123

（75）Apply the liquid gasket to the valve body cover. See Fig.11A-124。

Liquid gasket：

Mitsubishi genuine sealant， part NO. MD974421or equivalent.

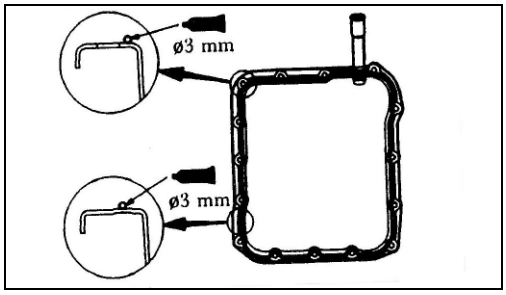


Fig.11A-124

Caution

（1）Install rapidly the case while the sealant is wet (within 15min).

(2) Seal face does not connect oil after installing within 1h.

（76）Install the valve body cover, and then tighten the mounting bolt to the specified torque. See Fig.11A-125。

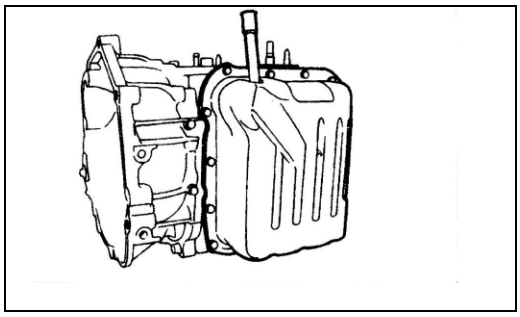


Fig.11A-125

（77）Install speedometer gear. See Fig.11A-126。

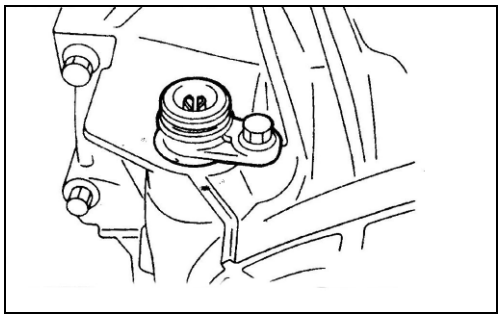


Fig.11A-126

（78）Install inhibitor switch and manual control lever. See Fig.11A-127。

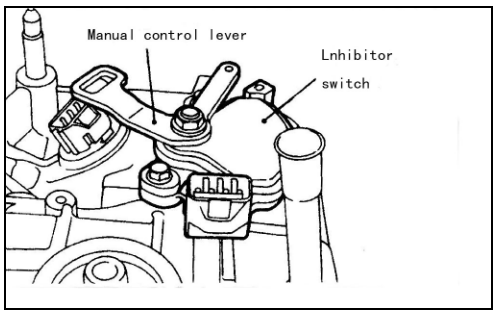


Fig.11A-127

（79）Install input shaft speed sensor and output shaft sensor. See Fig.11A-128。

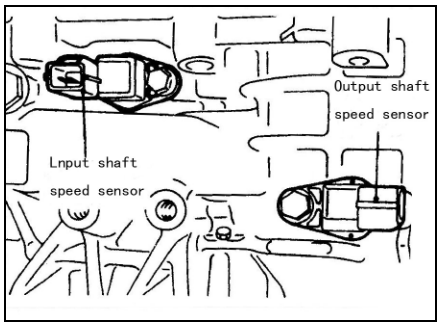


Fig.11A-128

（80）Apply a small amount of ATF to the fluid filter gasket, and tighten the fluid filter to specified torque. See Fig.11A-129。

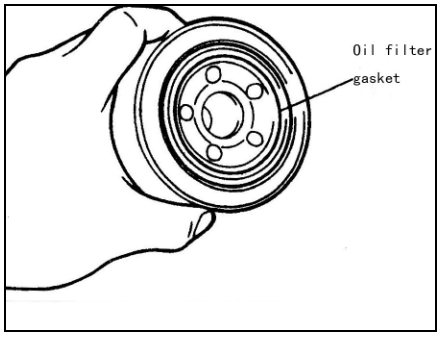


Fig.11A-129

（81）Install the eye bolt, new gasket and the oil cooler feed tube.

（82）Install the oil dipstick.

（83）Install the brackets.

（84） Install the torque converter, and secure it so that the shown dimension (A) meets the reference value.

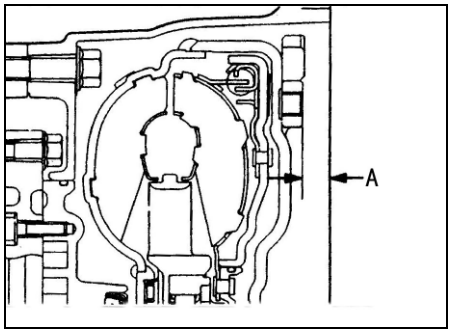


Fig.11A-130

Reference value：approx.12.2mm。

Caution
Apply ATF to the oil pump drive hub before installing torque contverter. Be careful not to damage the seal lip when installing torque converter.

2oil pump

disassembly and reassembly(see Fig.11A-131)

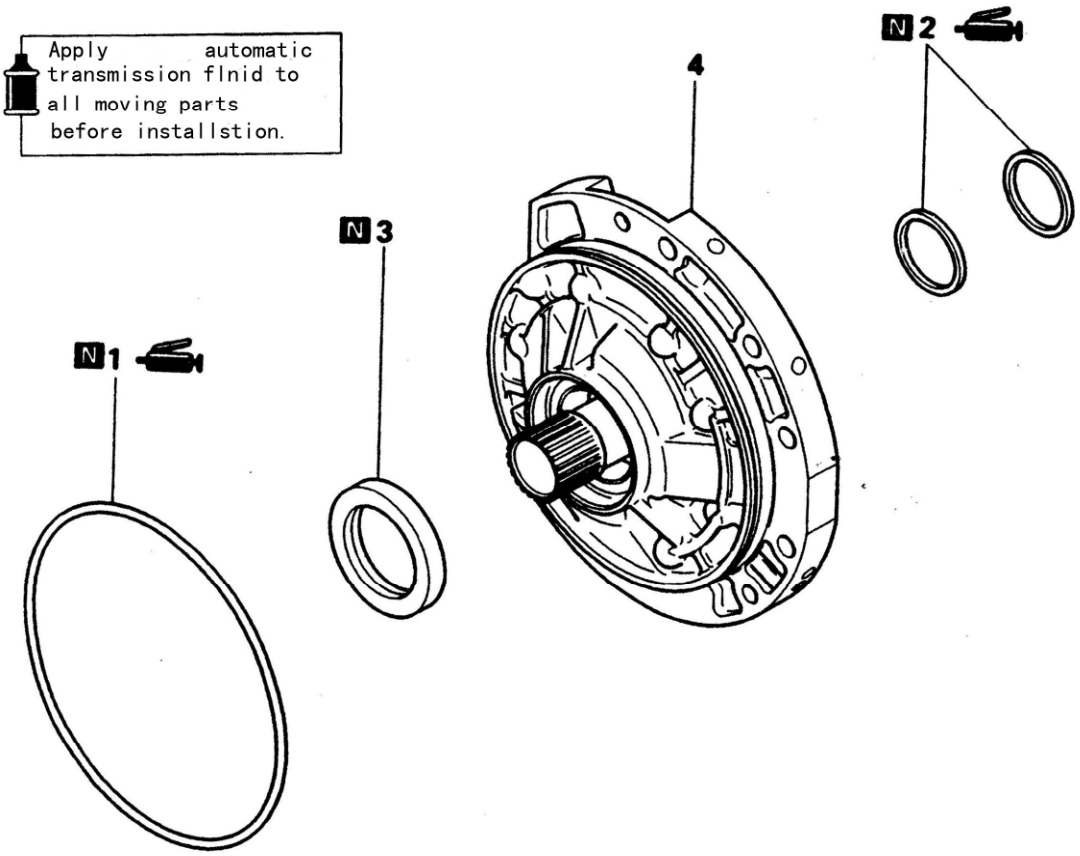


Fig.11A-131

1)disassembly steps:

1.O-ring 2.seal ring 3.oil seal 4.oil pump assembly

2)disassembly service points

(1)oil seal installing. Refer to Fig.11A-132。

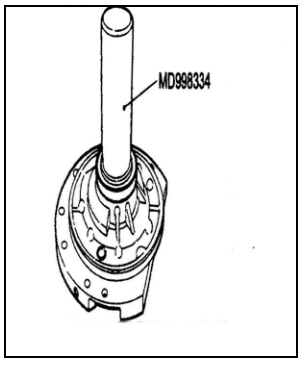


Fig.11A-132

(2)O-ring installing

Install a new O-ring to the outer groove of the oil pump, and apply ATF, blue vaseline and white Vaseline to the O-ring.

3underdrive clutch and input shaft

disassembly and reassembly(see Fig.11A-133)

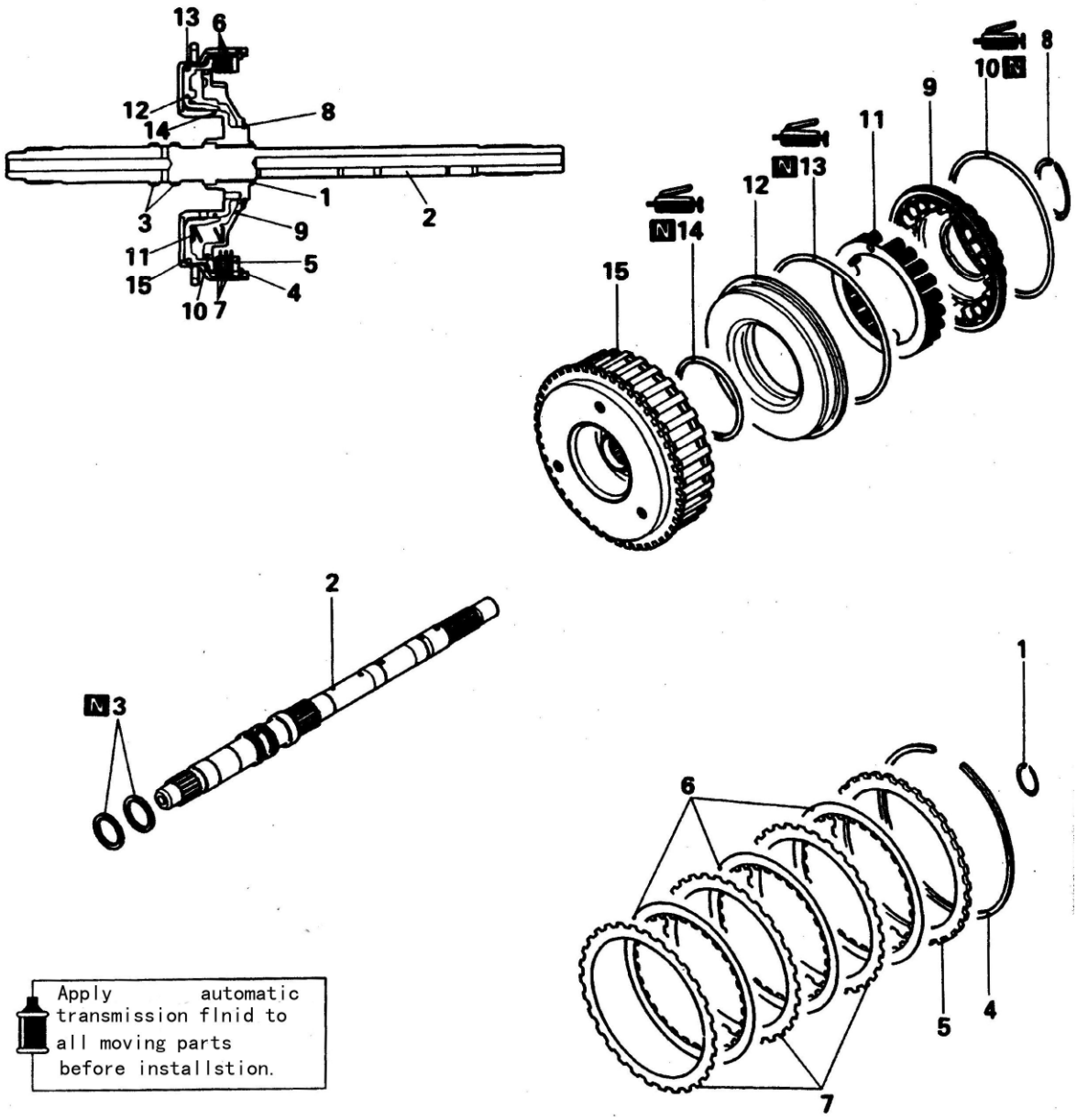


Fig. 11A-133

1)disassembly steps：

1. snap ring 2. input shaft 3. seal ring 4. snap ring 5.clutch reaction plate 6.clutch disc 7.clutch plate 8. snap ring 9.spring retainer 10.D-ring 11.return spring 12.underdrive clutch piston **13.**D-ring **14.** D-ring 15. underdrive clutch retainer

2) disassembly service points

snap ring removal, see Fig.11A-134。

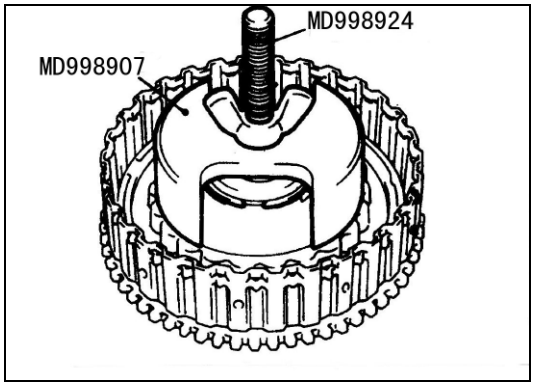


Fig.11A-134

3) reassembly service points

D-ring installation

Apply ATF, blue vaseline and white Vaseline to the D-ring, and install carefully.

Snap ring installation（refer to Fig.11A-135）

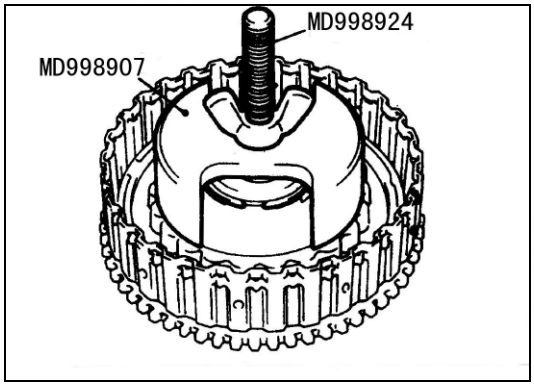


Fig.11A-135

Clutch plate, clutch disc and clutch reaction disc installation

（1） Align each teeth missing part (part A) of the clutch plate, clutch disc and clutch reaction plate to the circumference hole (part B) of the clutch retainer. See Fig.11A-136。

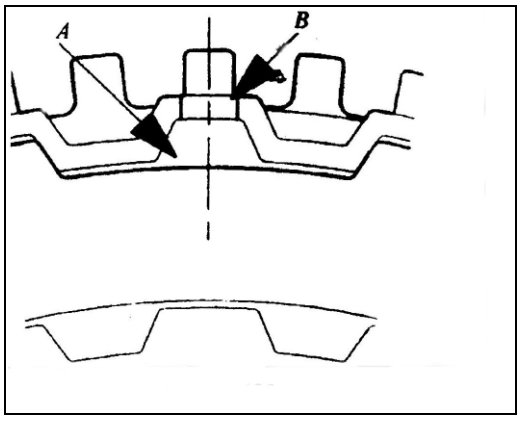


Fig.11A-136

Caution ： **Immerse the clutch disc in ATF before installing**

（2） Install the clutch reaction disc in the direction shown in the Fig.11A-137.

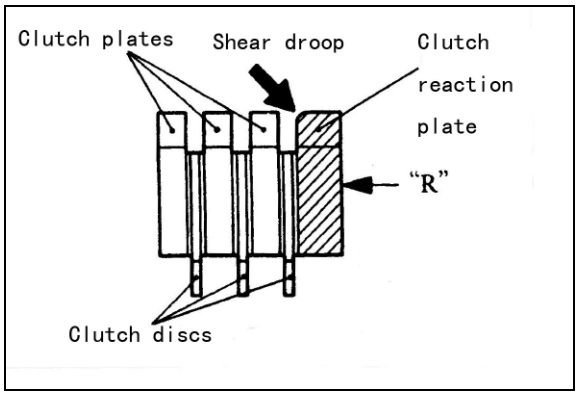


Fig.11A-137

◢C◣Snap ring installation

Check that the clearance between the snap ring and clutch reaction plate is within standard value. When measuring the clearance, use the special tool press the clutch reaction plate evenly. If not within the standard value, select a snap ring to adjust. See Fig.11A-138。

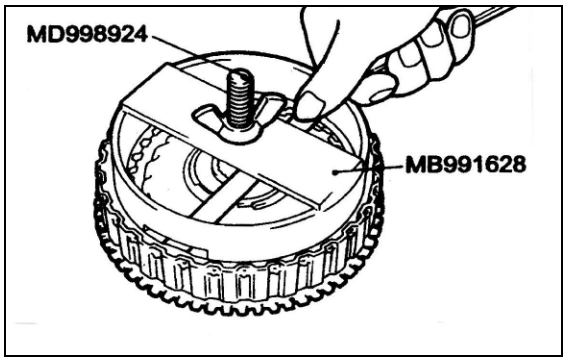


Fig.11A-138

Standard value：1.25-1.45mm

4 reverse and overdrive clutch

disassembly and reassembly（see Fig.11A-139）

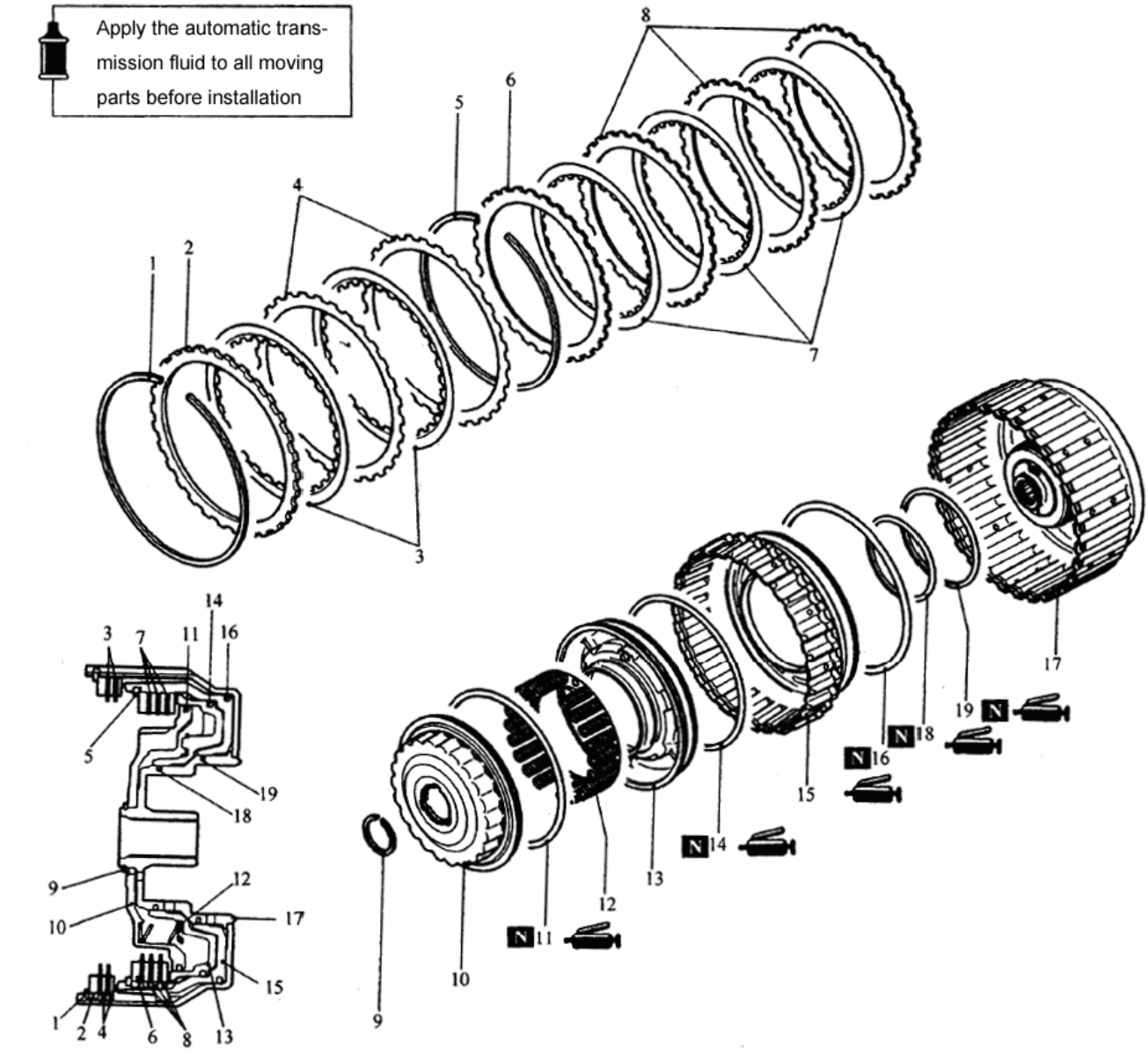


Fig 11A-139

Disassembly steps：

1.snap ring；2.clutch reaction plate；3.clutch disc；4.clutch plate；5.snap ring；6.clutch reaction disc；7.clutch disc；8.clutch plate；9.snap ring；10.spring retainer；11.D-ring；12.retun spring；13.overdrive clutch piston；14.D-ring； 15.reverse clutch piston； 16.D-ring； 17.reverse clutch retainer； 18.D-ring

19.D-ring

- **Disassembly service points**

Snap ring removal, see Fig.11A-140。

·reassembly service points

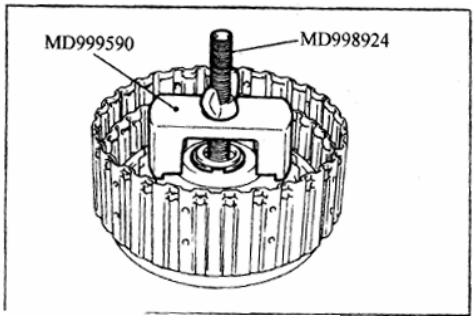


Fig 11A-140

D-ring installation

Apply ATF, blue vaseline and white Vaseline to the D-ring, and install carefully.

Reverse clutch piston installation

Align the outer circumference holes (part A and part B) when installing reverseclutch piston and reverse clutch retainer, see Fig.11A-141。

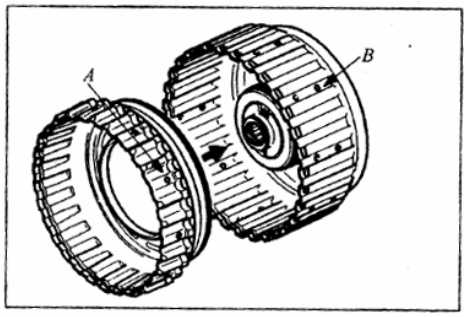


Fig 11A-141

Snap ring installation

（1） Use special tool to install the snap ring , see Fig.11A-142。

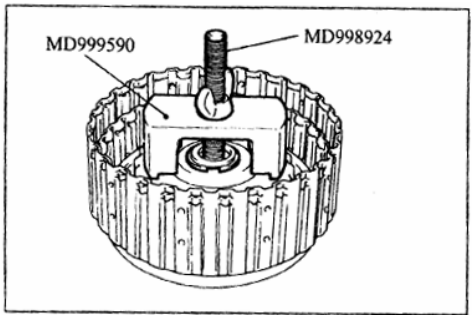


Fig 11A-142

（2） Check that the clearance between the snap ring and return spring retainer is within standard value. When measuring this clearance, press the return spring retainer evenly with the force of 49N（5kgf）. if not within the standard value, select a snap ring to adjust. See Fig. 11A-143。

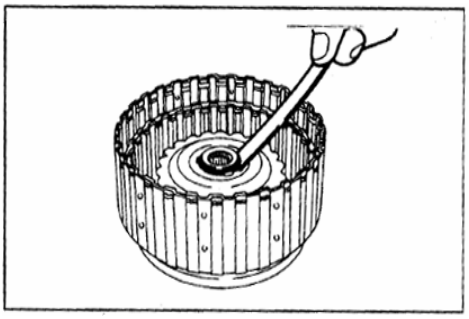


Fig 11A-143

Standard value：0-0.09mm。

Clutch plate/clutch disc/clutch reaction disc installation

Install the reaction disc in the direction shown in the Fig.11A-144.

Caution ：
Immerse the clutch disc in ATF before installing it.

Snap ring installation

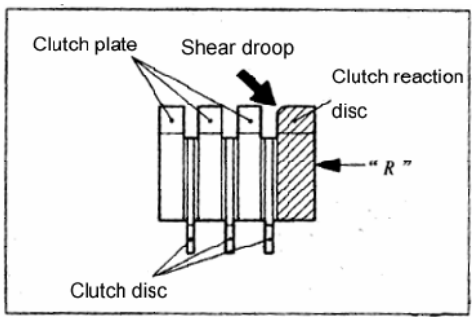


Fig 11A-144

Check that the clearance between the snap ring and clutch reaction plate is within standard value. When measuring the clearance, use the special tool press the clutch reaction plate evenly. If not within the standard value, select a snap ring to adjust. See Fig. 11A-145。

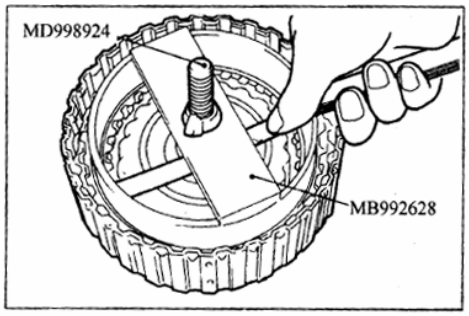


Fig 11A-145

Standard value：1.2-1.4mm

Clutch plate/clutch disc/clutch reaction disc installation

（1） Align each teeth missing part (part A) of the clutch plate, clutch disc and clutch reaction plate to the circumference hole (part B) of the clutch retainer. See Fig. 11A-146。

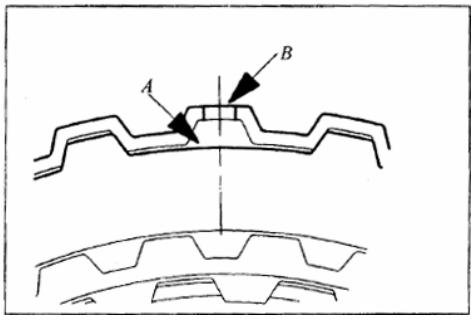


Fig 11A-146

Caution ：
Immerse the clutch disc in ATF before installing

（2） Install the clutch reaction disc in the direction shown in the Fig. 11A-147.

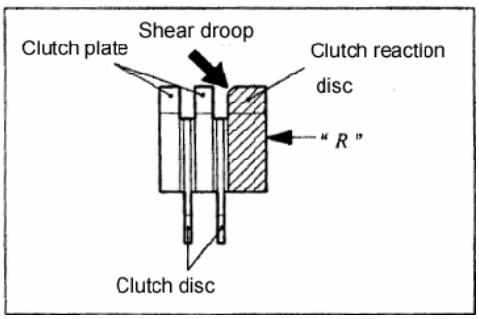


Fig 11A-147

Snap ring installation

Check that the clearance between the snap ring and return spring retainer is within standard value. When measuring this clearance, press the return spring retainer evenly with the force of 49N（5kgf）. if not within the standard value, select a snap ring to adjust. See Fig. 11A-148。

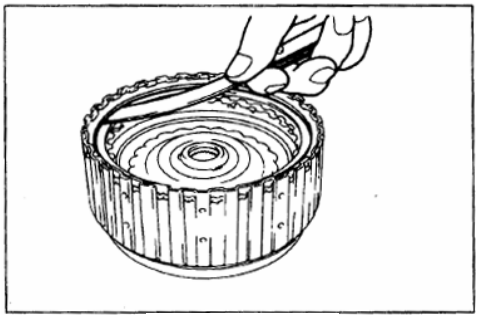


Fig 11A-148

Standard value：1.2-1.4mm

5 Overdrive planetary carrier

disassembly and reassembly.（see Fig.11A-149）

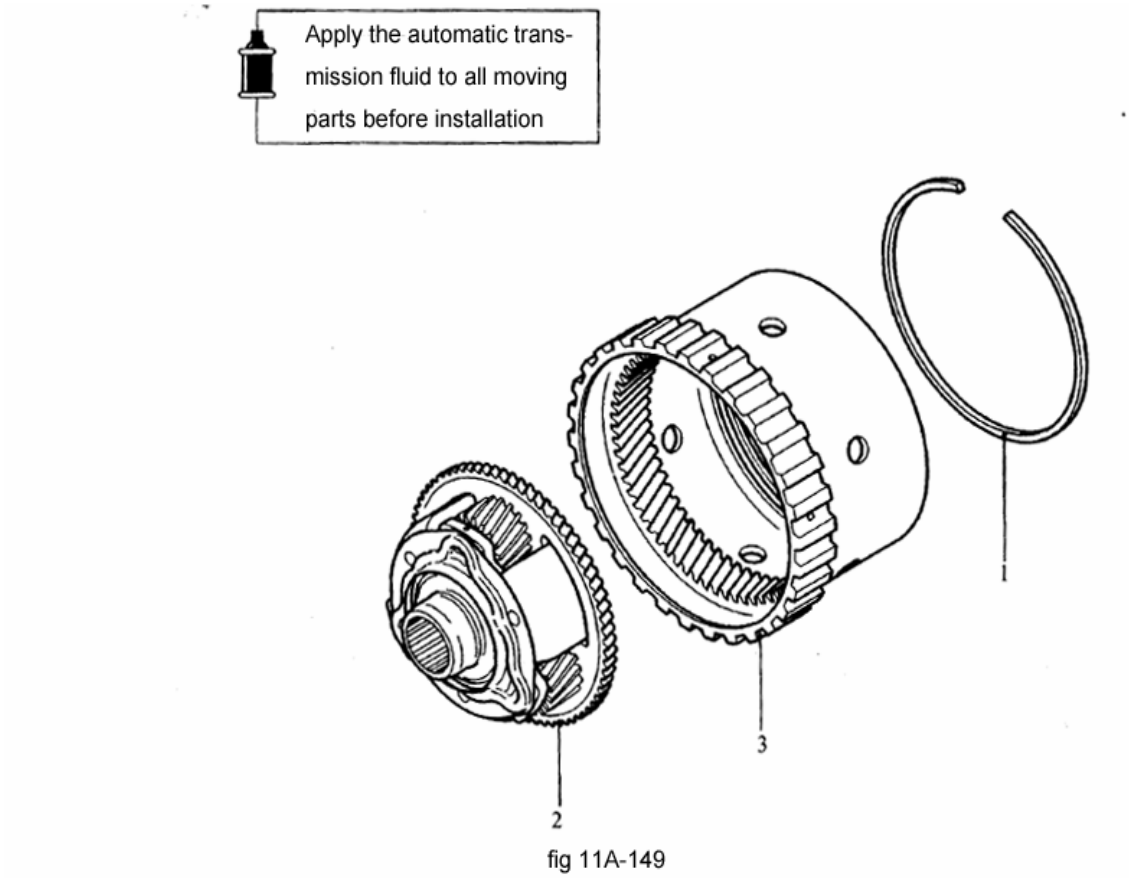


fig 11A-149

1) disassembly steps

2. snap ring；2.overdrive planetary carrier；3.overdrive annulus gear

6 Low-reverse brake

disassembly and reassembly.（see Fig.11A-150）

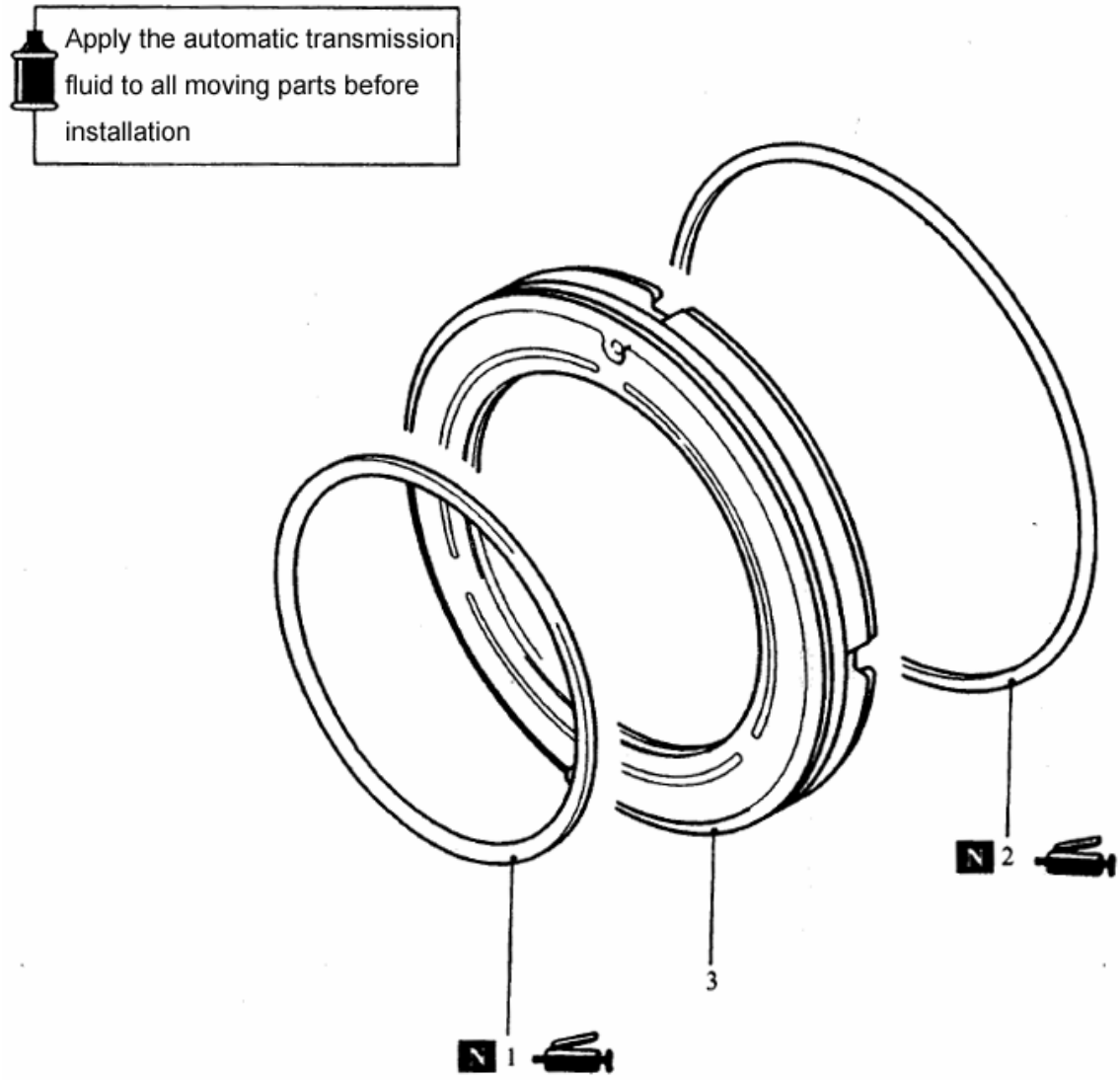


fig 11A-150

1) disassembly steps

1.D-ring； 2.D-ring； 3.low-reverse brake piston

2) reassembly service points

D-ring installation

Apply ATF, blue vaseline and white Vaseline to the D-ring, and install carefully.

7 Second brake

disassembly and reassembly.（see Fig.11A-151）

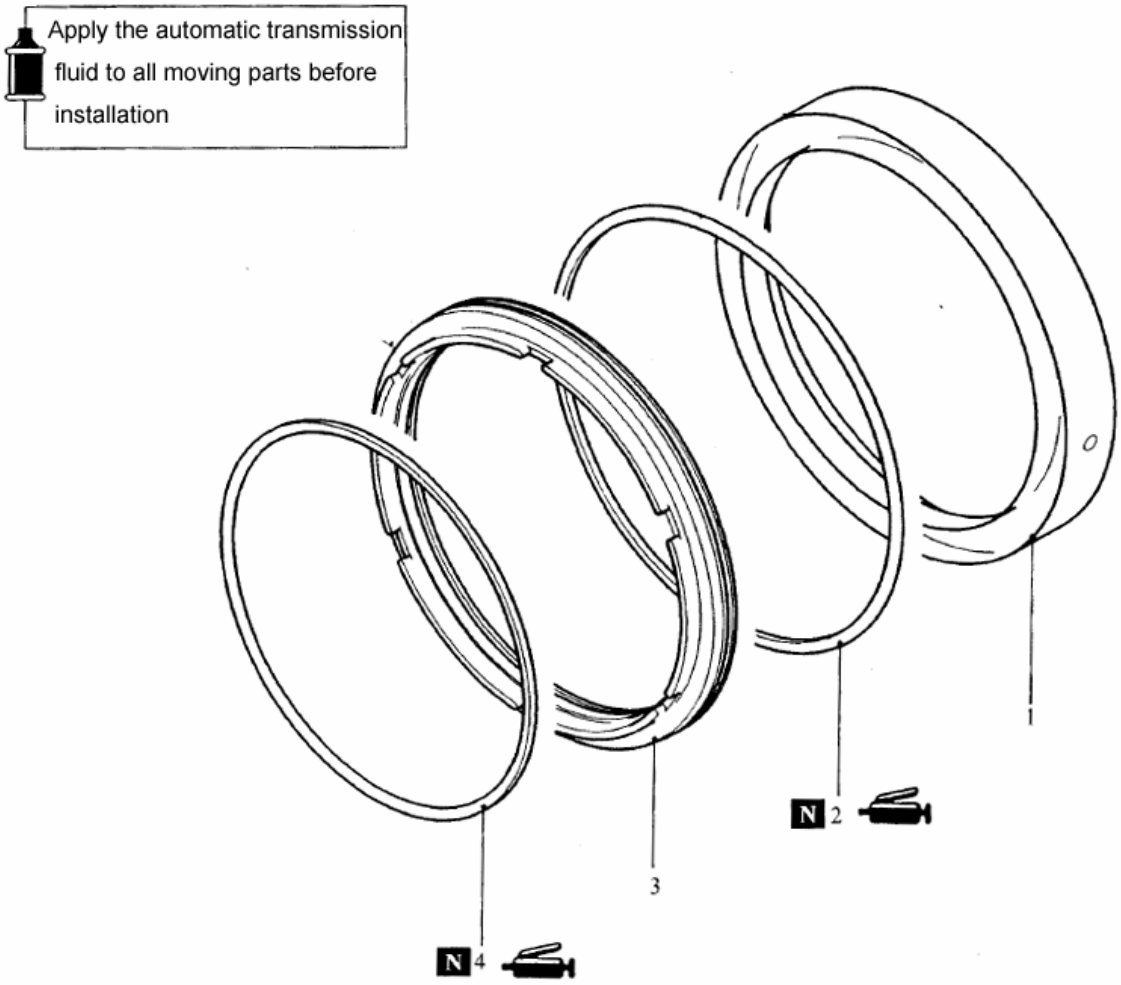


fig 11A-151

1) disassembly steps

1.second brake；2.D-ring；3.second brake piston；4.D-ring

2) reassembly service points

D-ring installation

Apply ATF, blue vaseline and white Vaseline to the D-ring, and install carefully.

8 output shaft

disassembly and reassembly.（see Fig.11A-152）

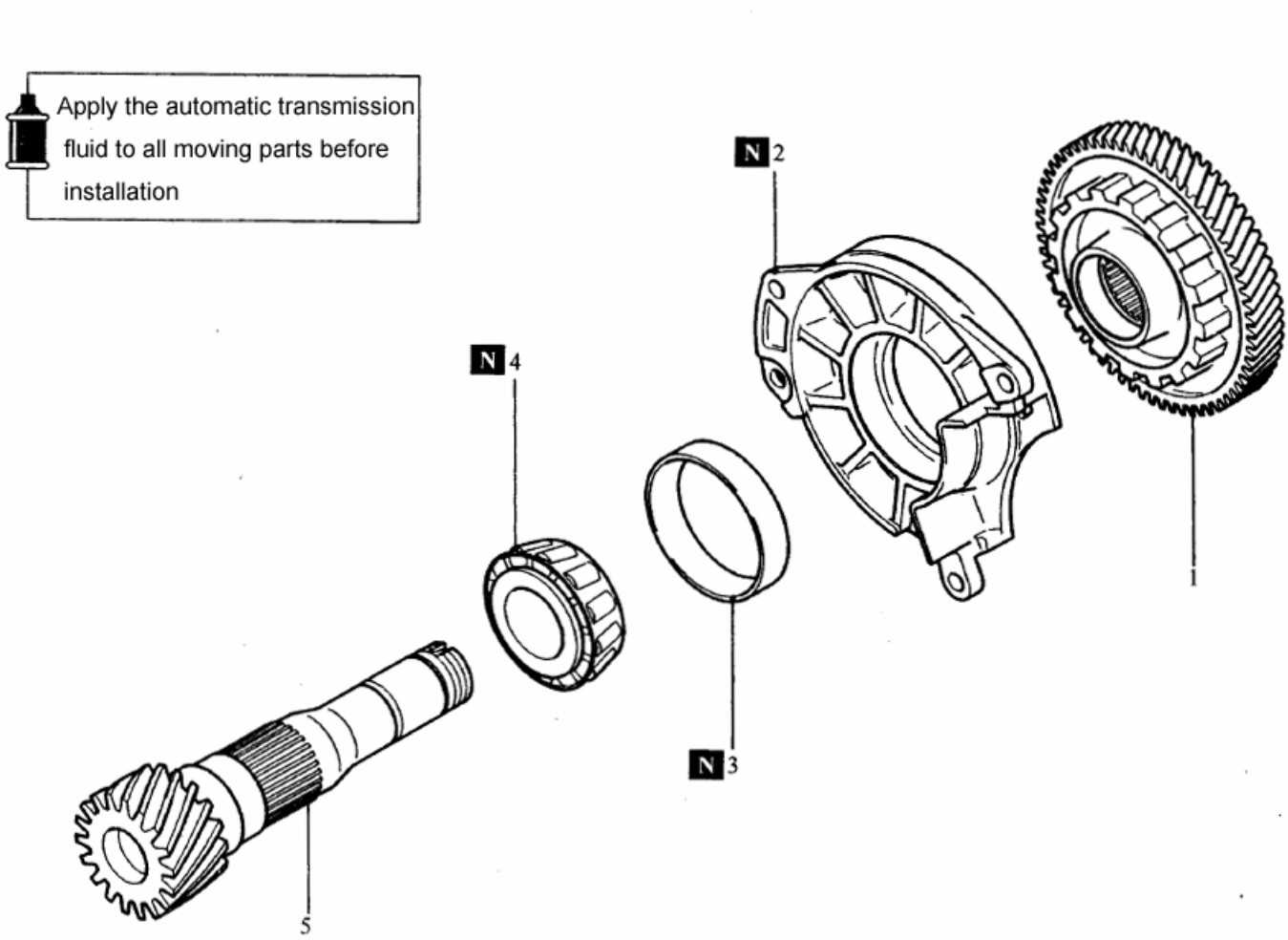


fig 11A-152

1) disassembly steps
1.transfer drive gear； 2.bearing retainer； 3.outer race；
4.taper roller bearing； 5.output shaft
2) disassembly steps
transfer drive gear removal, see Fig.11A-153。
Taper roller bearing removal, see Fig.11A-154。

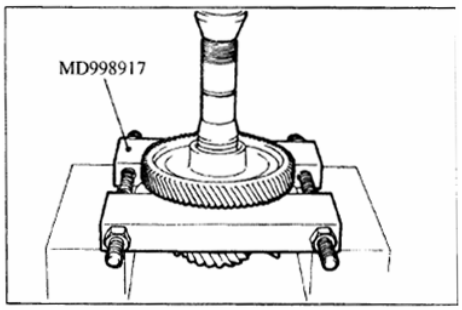


Fig 11A-153

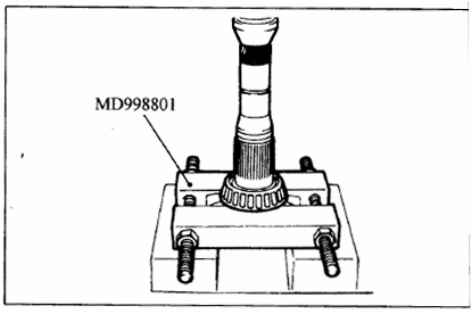


Fig 11A-154

3) reassembly service points

taper roller bearing installation, see Fig.11A-155。

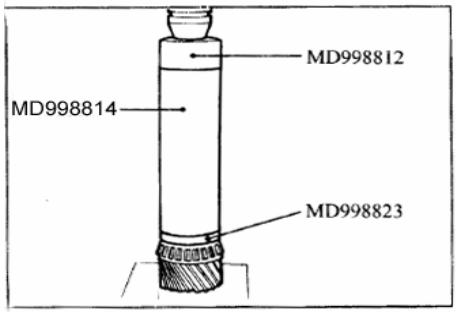


Fig 11A-155

Outer race installation, see Fig.11A-156。

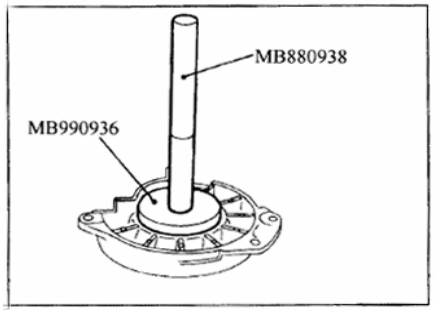


Fig 11A-156

Transfer drive gear installation, see Fig.11A-157。

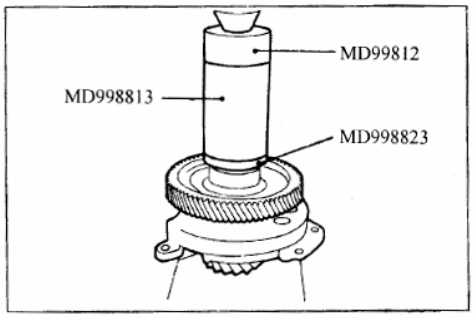


Fig 11A-157

9 transfer drive gear

disassembly and reassembly.（see Fig.158）

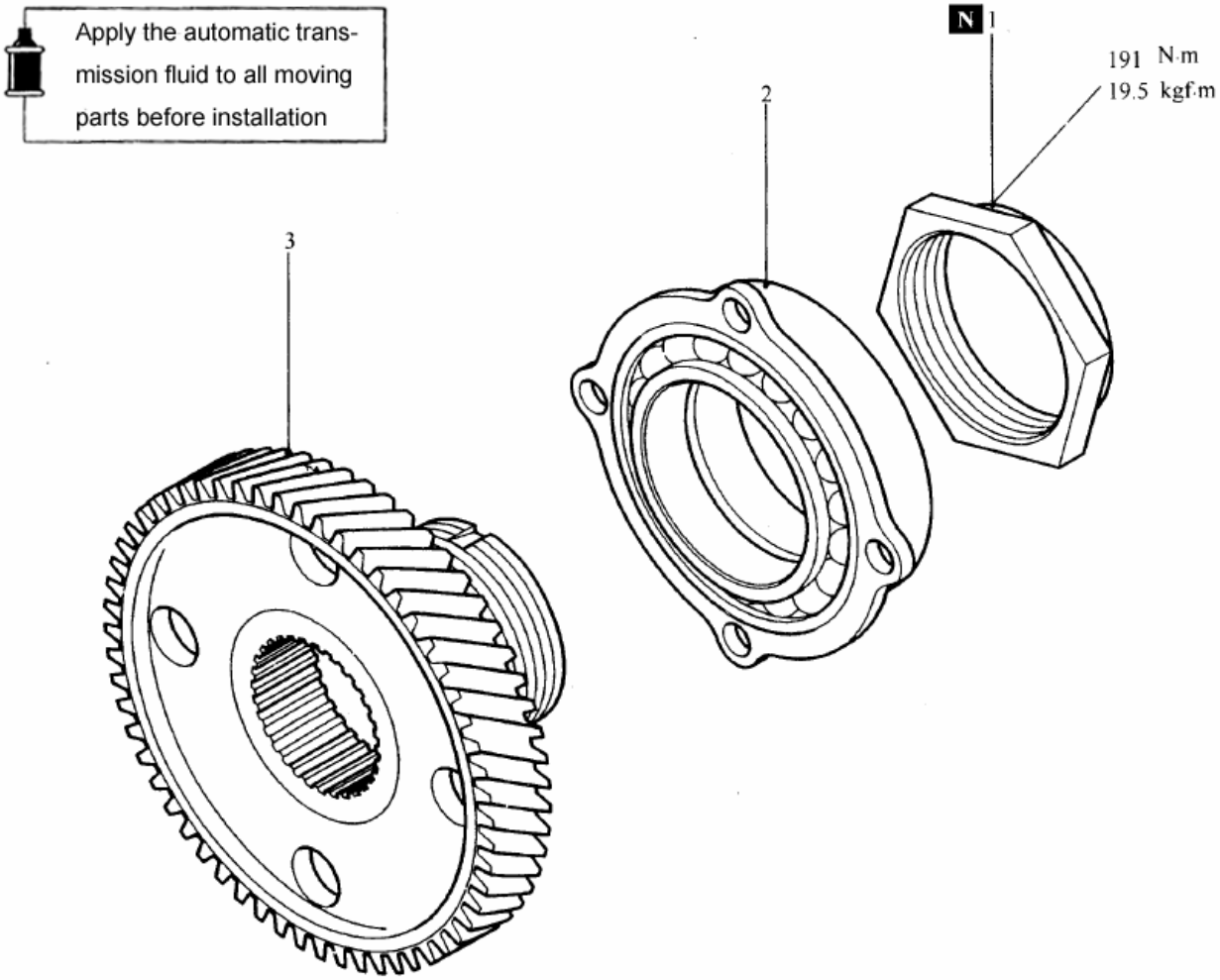


fig 11A-158

1) disassembly steps：

1.lock nut

2.transfer drive gear bearing

3. transfer drive gear

2) disassembly service points

lock nut removal

（1） Pull up the turning stopper of the lock nut. See Fig.11A-159。

（2） Use special tool to remove the lock nut, see Fig.11A-160。

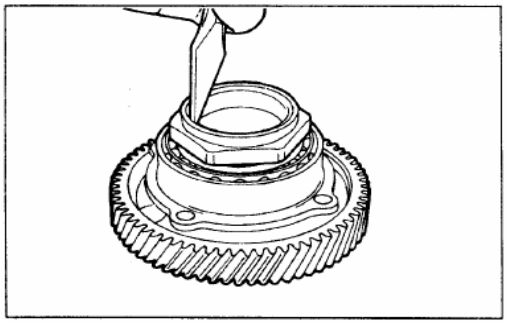


Fig 11A-159

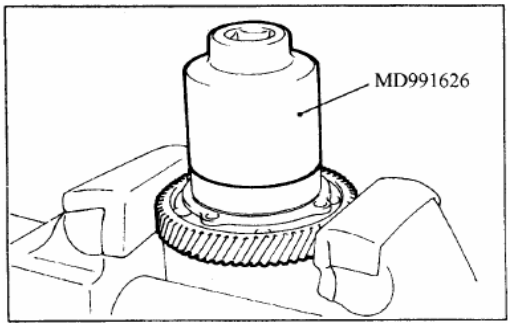


Fig 11A-160

Transfer drive gear bearing removal， see Fig.11A-161。

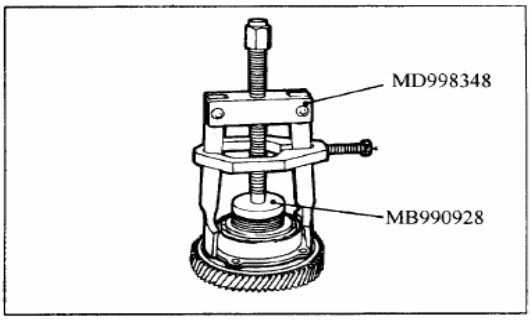


Fig 11A-161

3) reassembly service points

transfer drive gear bearing installation, see Fig.11A-162。

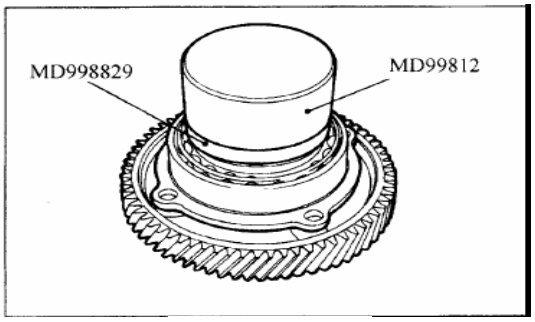


Fig 11A-162

Lock nut installation

（1） Apply ATF to a new lock nut, and tighten it to the specified torque. Then turn back one turn, and tighten it to the specified again, see Fig.11A-163。

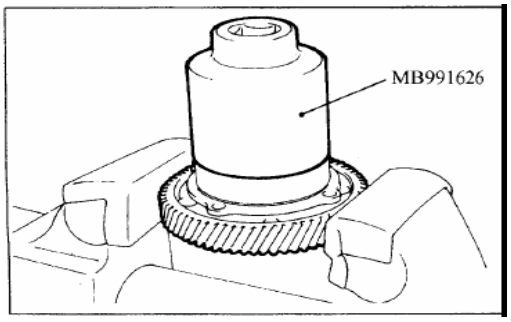


Fig 11A-163

（2） Use the punch or other to prevent the lock nut from turning (two points), see Fig 11A-164。

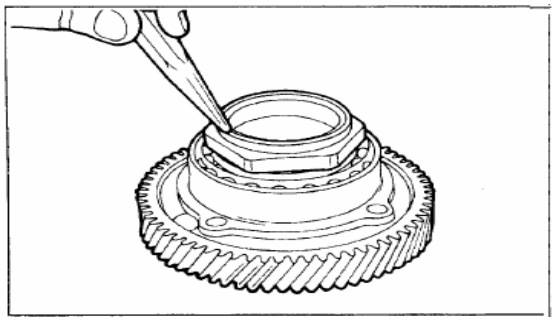


Fig 11A-164

10 differential

disassembly and reassembly（see Fig.11A-165）

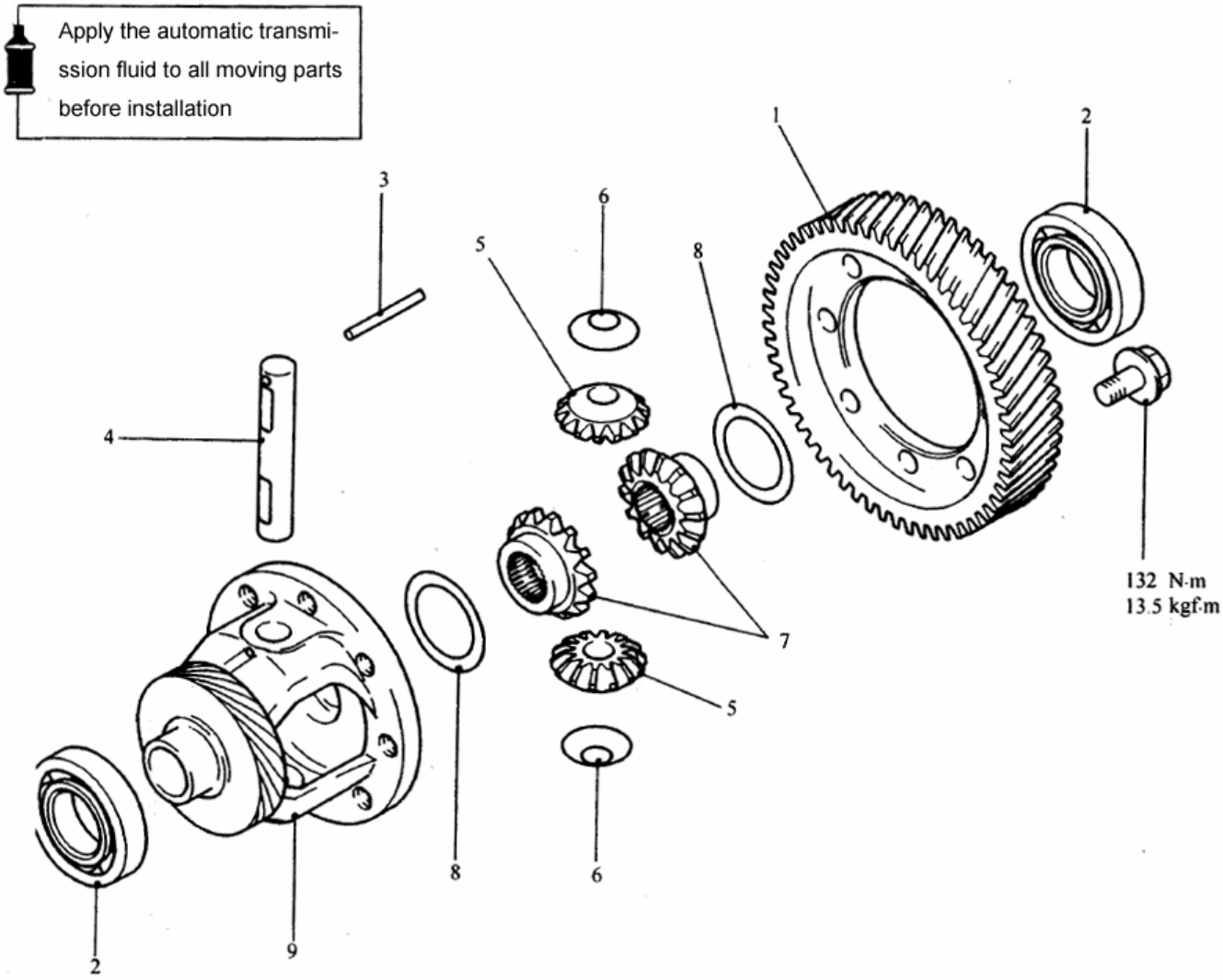


fig 11A-165

1) disassembly steps：

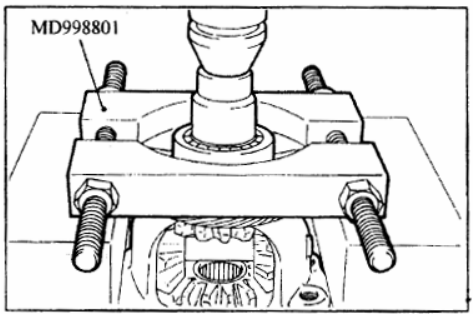
1.differential drive gear
2.ball bearing
3.lock pin
4.pinion shaft
5.pinion
6.washer
7.side gear
8.spacer
9.differential body

2) disassembly service points

ball bearing removal, see Fig.11A-166。

3) reassembly service points

spacer, side gear, washer, pinion and pinion shaft installation



Fig

（1） Install the spacer to the back side of the side gear, and then install side gear to the differential case,

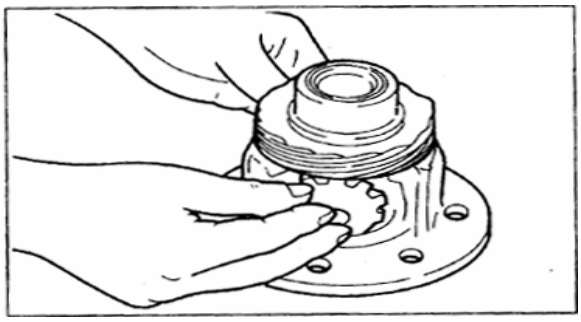


Fig 11A-167

see Fig.11A-167。

Caution ：
Select the medium size spacer （0.93-1.00mm）when installing new side gear.

（2） Attach the washer to the back side of the pinion, engaged the pinion simultaneously to the side gear, and settle the gear by turning.

（3） Insert the pinion shaft, see Fig.11A-168。

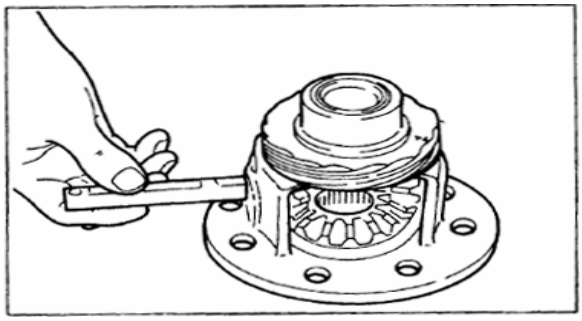


Fig 11A-168

（4） Measure the backlash between the side gear and pinion.
Standard value：0.025-0.150mm

（5） If not within the standard value, change the spacer, and then measure the backlash, see

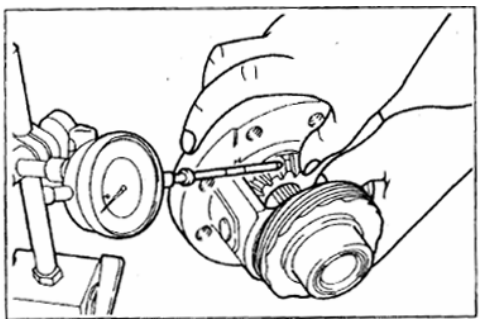


Fig 11A-169

Fig.11A-169。

Caution ：
Adjust so that two backlash is equal.

Lock pin installation

Install the lock pin as shown direction in the Fig.11A-170.

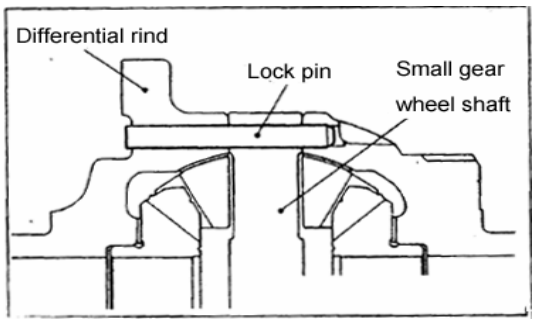


Fig 11A-170

Ball bearing installation, see Fig.11A-171。

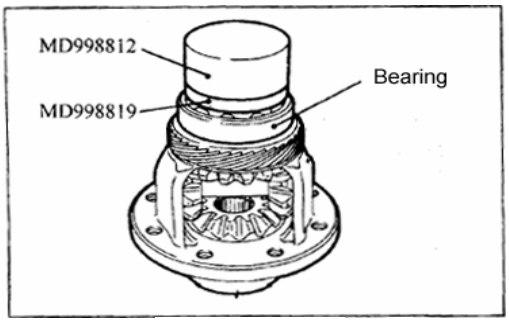


Fig 11A-171

Transfer drive gear installation

Apply ATF to the bolt, and tighten the bolt to specified torque as shown in the Fig.11A-172.

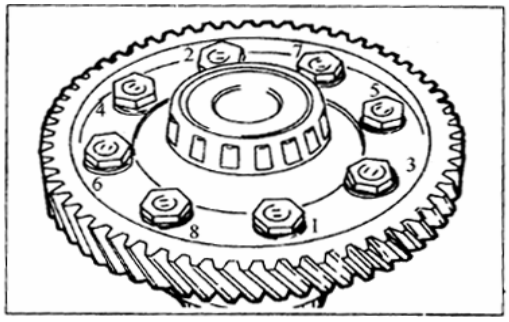


Fig 11A-172

11 valve body
disassembly and reassembly（see Fig.11A-173-175）

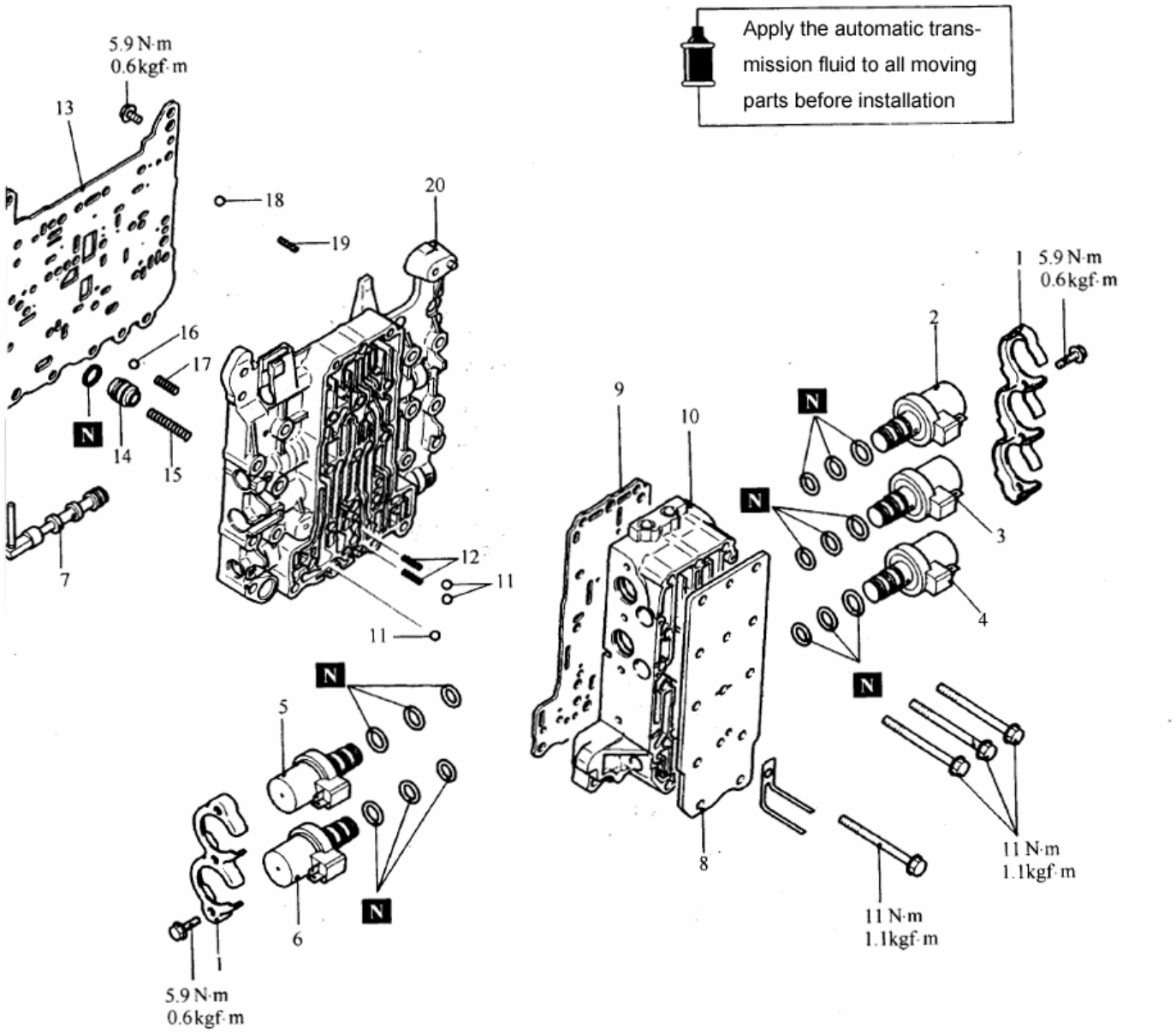


fig 11A-173

1) disassembly steps：

1.solenoid valve support
2.underdrive solenoid
3.second solenoid
4.damper clutch control solenoid
5.overdrive solenoid valve
6.low-reverse solenoid
7.manual valve
8.cover
9.plate
10.outside valve body assembly
21.roller
22.damper clutch control valve sleelve
11.steel ball（orifice check ball）
12.spring
13.plate
14.damper valve
15.damper valve spring
16.steel ball（line relief）
17.spring
18. steel ball（orifice check ball）
19.spring
20 inside valve body assembly

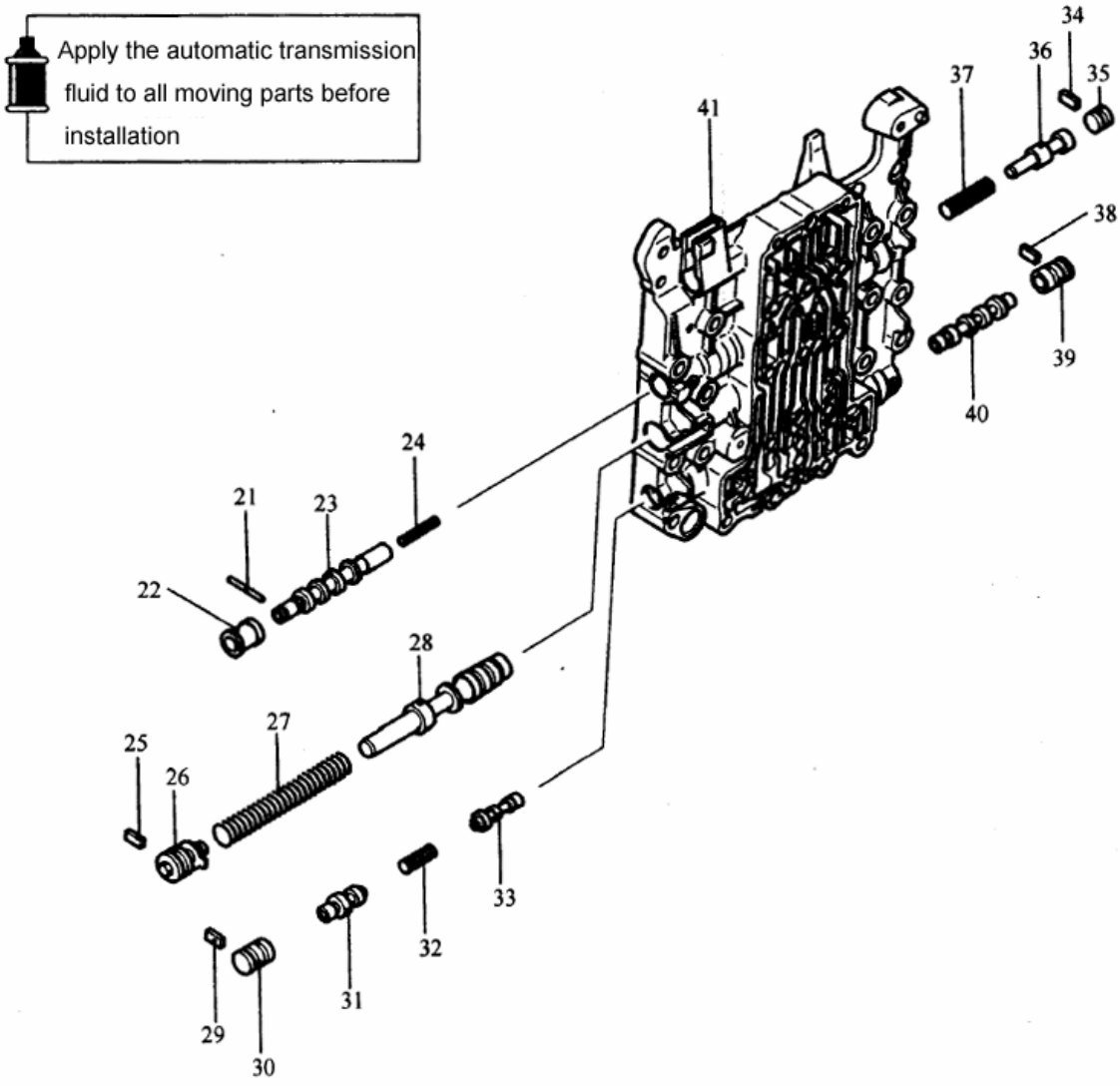


Fig 11A-174

23. damper clutch control valve
24. damper clutch control valve spring
25.plate
26.screw
27.regulator valve spring
28.regulator valve
29.plate
30.fail-safe valve (A) sleeve
31. fail-safe valve (A2)
32. fail-safe valve (A) spring
33. fail-safe valve (A1)
34.plate
35.plug
36.torque converter valve
37. torque converter spring
38.plate
39. fail-safe valve (B) sleeve
40. fail-safe valve (B)
41.inside valve body
42.roller

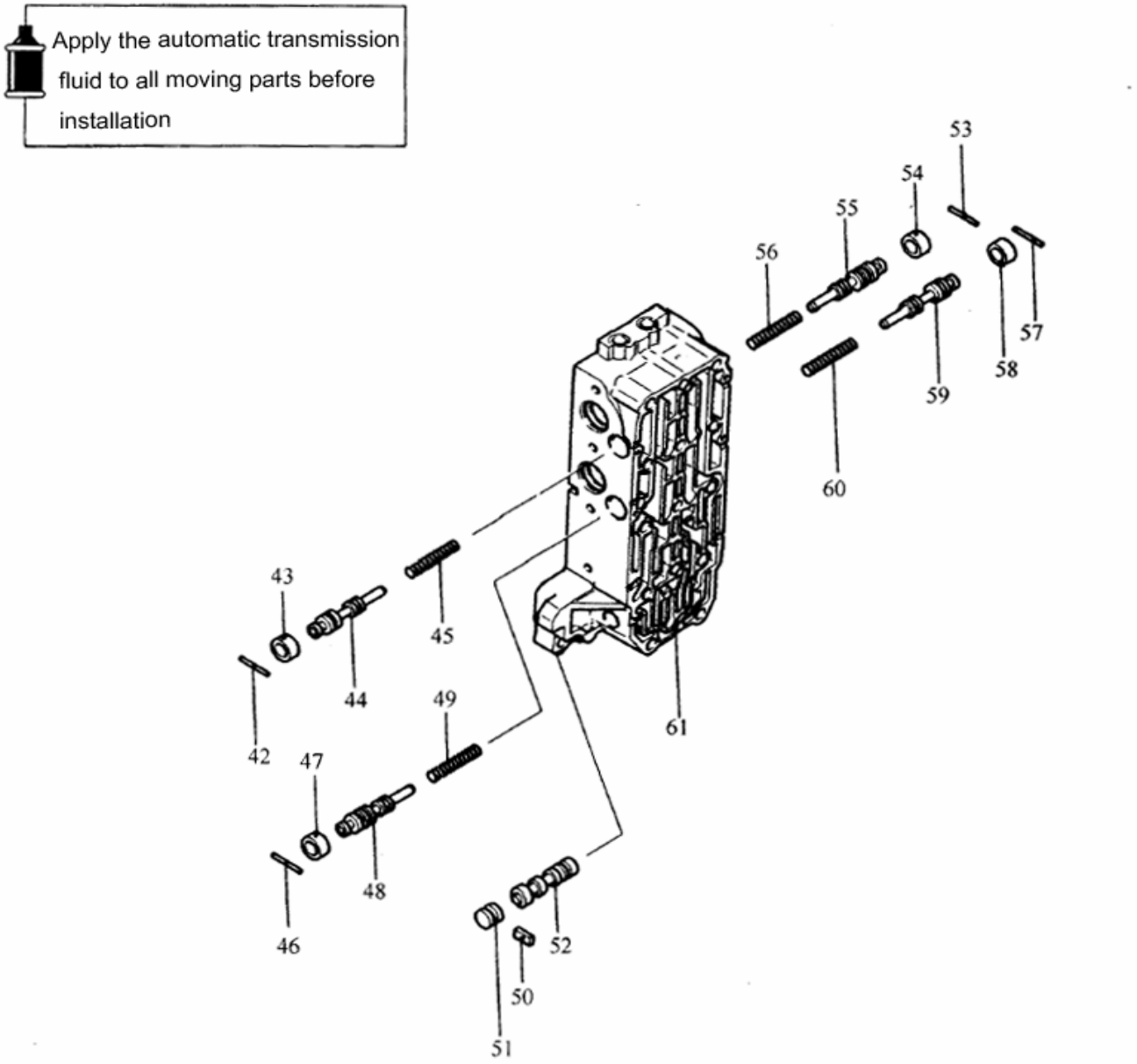


Fig 11A-175

43.overdrive control valve sleeve
44.overdrive pressure control valve
45. overdrive pressure control valve spring
46.roller
47.low-reverse pressure control valve sleeve
48. low-reverse pressure control valve
49. low-reverse pressure control valve spring
50.plate
51.plug
52.switch valve
53.roller
54.underdrive pressure control valve sleeve
55. underdrive pressure control valve
56. underdrive pressure control valve spring
57.roller
58.second pressure control valve sleeve
59. second pressure control valve
60. second pressure control valve spring
61.outside valve body

2) Disassembly service points

solenoid valve removal

Mark the solenoid by white paint to make reassembly easier.

3)Reassembly service points

spring、steel ball、damper valve、damper valve spring installation（refer tottheFig.11A-176）

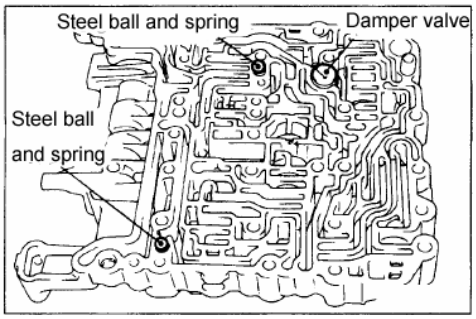


Fig 11A-176

spring、steel ball installation（refer to the Fig.11A-177）

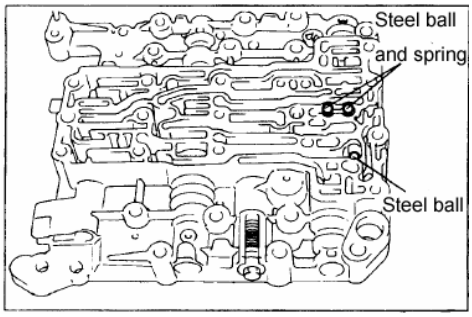


Fig 11A-177

solenoid valve installation

（1） Apply ATF, blue Vaseline or white Vaseline to the O-ring and install carefully.

（2） Install the solenoid valve by referring to the mark during disassembly. See Fig.11A-178、table 11A-21。

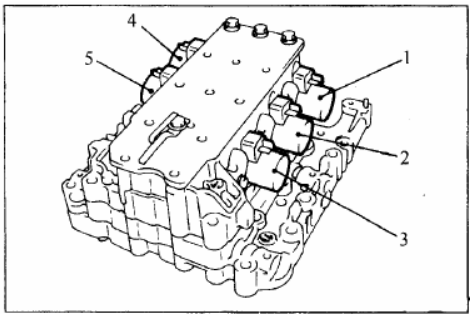


Fig 11A-178

Table 11A-21

NO.	Name
1	Underdrive solenoid valve
2	Second solenoid valve
3	Damper clutch control solenoid valve
4	Overdrive solenoid valve
5	Low-reverse solenoid valve

12speedometer gear

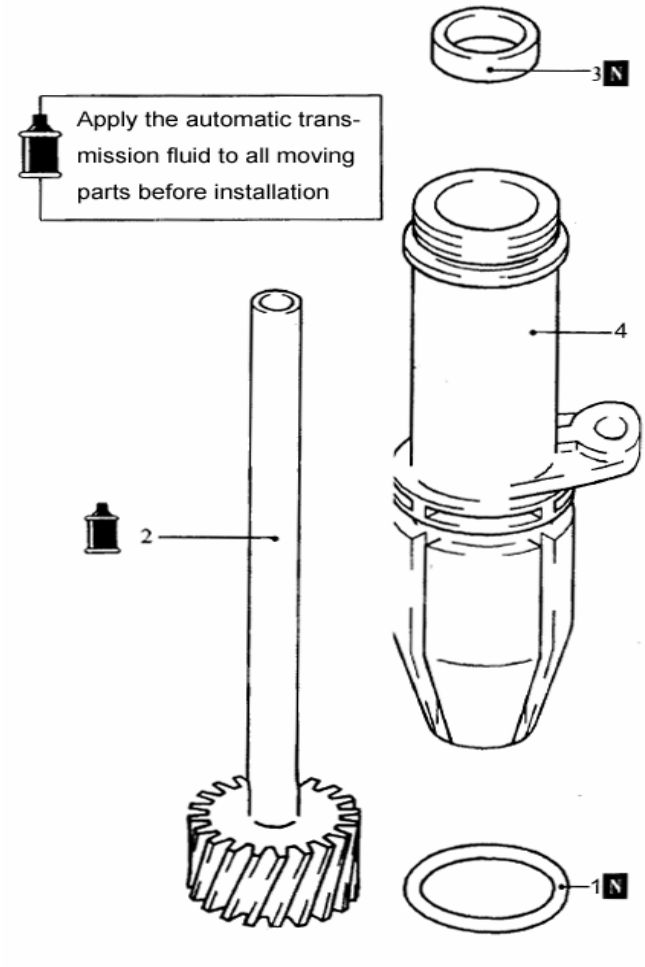


Fig 11A-179

disassembly and reassembly（see Fig.11A-179）

1) disassembly steps:

1.O-ring
2.speedometer drive gear
3.oil seal
4.sleeve

2) reassembly service points

oil seal installation

install the oil seal in the direction and the position shown in the Fig.11A-180.

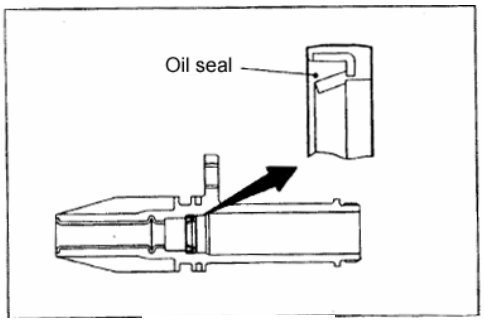


Fig 11A-180

13drive shaft oil seal

disassembly and reassembly（see Fig.11A-181）

1) disassembly steps:

1.oil seal

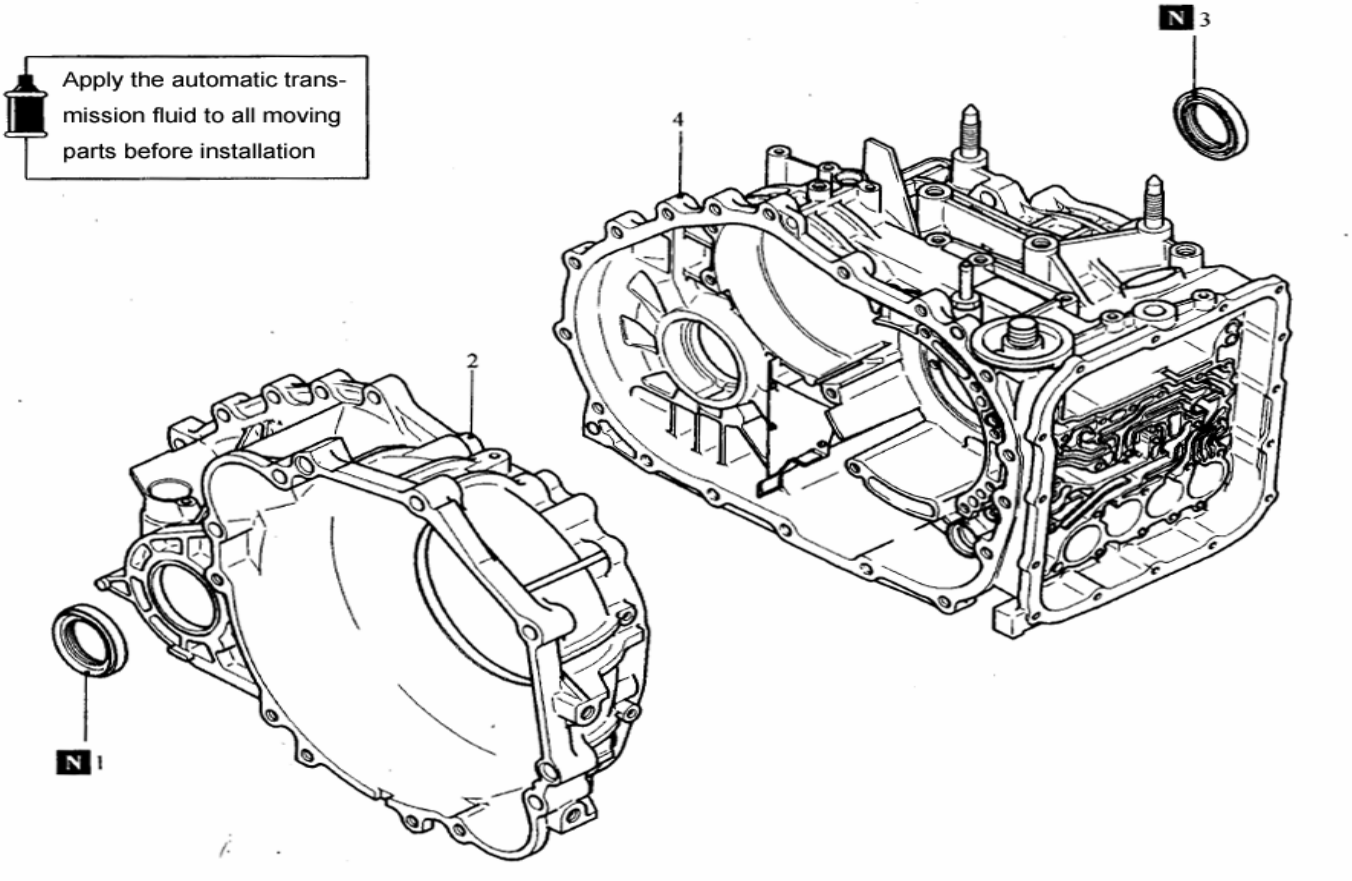


Fig 11A-181

2.torque converter housing
3. oil seal
4.transmission housing

2)reassembly service points

oil seal installation，see Fig.11A-182。

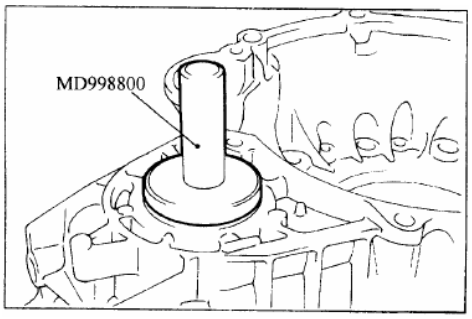


Fig 11A-182

oil seal installation，see Fig.11A-183。

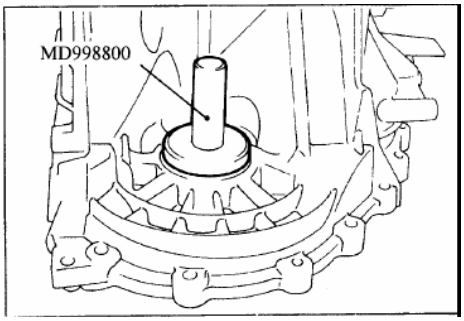


Fig 11A-183

11A.3 Automatic Transmission Fluid (ATF)

Automatic transmission fluid is abbreviated to “ATF”，the following short name is“ATF”。

1 On-vehicle service

1) Service points

·ATF inspection：

Warning：
Chang ATF if replace the transmission, heavy repair the transmission or drive in inclement conditions.

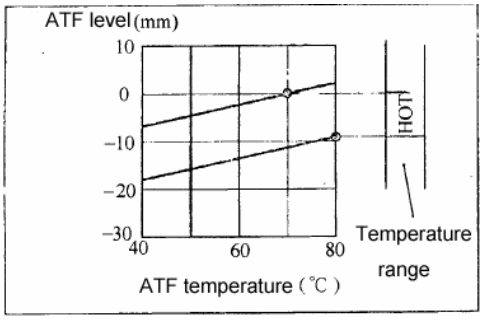


Fig 11A-184

(1) Start the vehicle to make the temperature of ATF to 70-80℃。

Caution ：

1）Measure the temperature of ATF by MUT-Ⅱ；

2）Inspect the dipstick while the temperature of ATF is 70~80℃.

(2) stop the vehicle on the plain rode.

(3)Move the shifting lever to all position to make the torque converter and fluid line fill ATF, and then put the selection lever on “N”.

(4)Put the dipstick into the transmission after wiping it， and check the level height of ATF.

Caution

If the ATF has a burnt smell,or if it has become very contaminated or dirty ,it means that the ATF has become contaminated by minute particles from bushings(metal)or worn parts.In such a case ,the transmission needs to be overhauled and the ATF cooler line needs to be flush out.

(5)check that the ATF level is between the HOT marks on the oil level gauge.If the ATF level is too low,add more ATF until the level reaches between the HOT marks as Fig.11B-185.

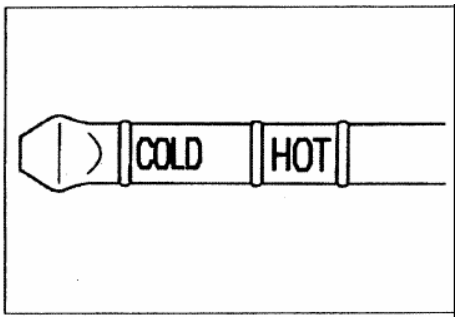


Fig 11A-185

Automatic transmission fluid ：

DIA QUEEN ATF SP Ⅲ or equivalent

Caution

If the ATF level is too low ,the oil pump draws air into the system along with the ATF ,and air bubbles will thus form in the fluid circuit.This will cause a drop in fluid pressure and cause the shift points to change and the clutches and brakes to slip.

If the ATF level is too high ,the gear will churn the ATF and cause bubbles to develop, which can then cause the same problems as when the ATF fluid is too low.In either case,the air bubbles can cause overheating and oxidation of the ATF ,and also prevent the valves ,clutches and brakes from operating normally .In addition,if bubbles develop in the ATF ,the ATF can overflow from the transmission vent holes and be mistaken for leaks.

(6)Securely re-insert the oil level gauge.

·**ATF replacement：**

Caution

Before replacing the transmission with a new one ,overhauling the exiting transmission ,or connecting the cooler pipe to the transmission ,the ATF cooler line should always be flushed out

If you have an ATF changer， use the ATF changer to flush the ATF. If you do not have an ATF changer， follow the procedure given below.

(1) As Fig.11A-186 ,remove the hose ,allows the ATF to flow from the ATF cooler(built into the radiator) to the transmission .

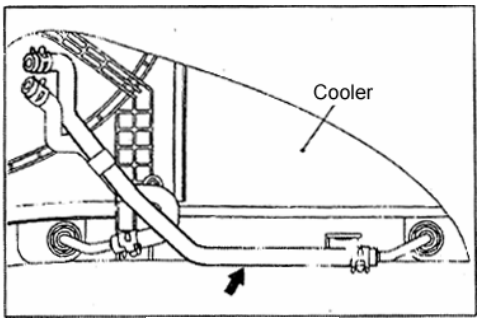


Fig 11A-186

(2) Start the engine and discharge the ATF.

Driving conditions： N range ,idling

Caution

The engine should be stopped within one minute of it being started .If the ATF has all been discharged before this ,stop the engine at that point

Discharge amount：approx 3.5L.

(3) Remove the drain plug at the bottom of the transmission case to drain out the remaining ATF as Fig.11A-187.

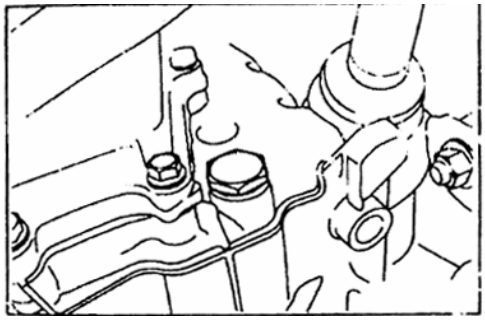


Fig 11A-187

Discharge amount：approx 2.0L.

(4) Install the drain plug with a gasket in between ,and tighten it to the specified torque.

Tighten torque：**32±2N·m.**

(5) Pour in new ATF through the oil filler tube.

Amount to add：approx **5.5L.**

Caution

Stop pouring in the ATF once 5.5L has been poured in

(6) Repeat the operation in step 2.

note

carry out steps(2)and(6) so that at least 7.0L has been discharged from the looler hose .After this ,discharge a small quantity of ATF and check for contamination .If the ATF is contaminated ,repeat steps (6) and (7).

(7) Pour in new ATF through the oil filler tube.

Amount to add：approx **3.5L.**

(8) Connect the hose which was disconnected in step 1,and then securely re-insert the oil level gauge.

(9) Start the engine,and let it run at idle for 1~2min.

(10) Move the selector lever to all positions once ,and then return it to the N position.

⑾ Check that the ATF level on the oil level gauge is at the COLD mark .If it is not up to this mark ,add more ATF.

⑿ Drive the vehicle until the ATF temperature reaches the normal temperature (70~80℃)， and then re-check the ATF level .

The ATF level must be between the HOT marks .

note

1）The COLD mark is for reference only ,the HOT marks should be used as the standard for judgment .

2）measure ATF temperature using MUT-Ⅱ.

3）check the oil level referring to the characteristics chart as Fig.11A-184 if it takes some time until reaching the normal operation temperature of ATF(70~80℃).

⒀ When ATF is under the specified level ,top up ATF .When ATF is over the specified level ,drain the excessive ATF from the drain plug to adjust ATF level to the specified level .

⒁ Securely insert the oil level gauge into the oil filler tube.

2 ATF cooler line flushing

Caution

If replacing the transmission with a new one ,if overhauling the exiting transmission ,or if the ATF has deteriorated or is contaminated,the ATF cooler line must always be flushed out

1. Remove the hose as Fig.11A-186 which allows the ATF to flow from the ATF cooler (built into the radiator) to the transmission .
2. start the engine and discharged the ATF.

Driving conditions： N range ,idling

Caution

The engine should be stopped within one minute of it being started .If the ATF has all been discharged before this ,stop the engine at that point

Discharge amount：approx 3.5L.

3. pour in new ATF through the oil filler tube.

Amount to add ： approx 3.5L.

Caution

Stop pouring in the ATF once 3.5L has been poured in

4. Repeat the operation in step 2.

note

carry out steps(2)and(4) so that at least 7.0L has been discharged from the looler hose .After this ,discharge a small quantity of ATF and check for contamination .If the ATF is contaminated ,repeat steps (4) and (5).

5. carry out the procedure in “ATF replacement”from step 3 onwards。

11A.4 Torque Converter Stall Test

Torque converter stall test see Fig 11A-188

The purpose of this test is to measure the maximum engine speed when the torque converter stalls in D or R ranges in order to check The torque converter (Stator and one-way clutch operation)and the holding performance of the clutches and brakes which are built into the transmission.

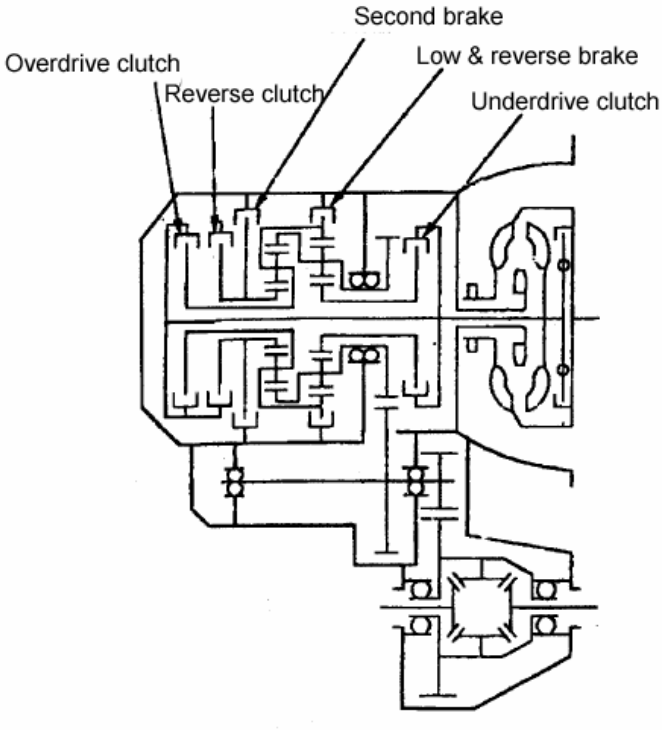


Fig 11A-188

Caution

For safety, the front and rear of the vehicle should be kept clear of other people while this test is being carried out.

1. Check the ATF level, the ATF temperature and the engine coolant temperature.
   - ATF level: HOT position on oil level gauge
   - ATF temperature:70 - 80℃
   - Engine coolant temperature: 80 - 100℃
2. Place wheel locks on both the left and right front wheels.
3. Pull the parking brake lever to apply the parking brake and depress the brake pedal fully.
4. Start the engine.
5. Move the selector lever to the D position, fully depress the accelerator pedal and quickly take a reading of the maximum engine speed at this time.

Caution

1) Do not keep the throttle fully open for any longer than 8 seconds.

2) lf carrying out the stall test two or more times, move the selector lever to the N position and run the engine at a speed of 1,000 r/min to let the ATF cool down before the next test is carried out.

Standard stalling engine speed:

2,100 - 2,600 r/min

Move the selector lever to the R position and repeat the test described above.

Standard stalling engine speed:

2,100 - 2,600 r/min

11A.5 Torque Converter Stall test Judgment Results

1. High stalling speed in both D and R ranges
   - Low line pressure
   - Low & reverse brake slipping
2. High stalling speed in D range only
   - Underdrive clutch slipping
3. High stalling speed in D range only
   - Reverse clutch slipping
   - Reduction brake slipping

4. High stalling speed in both D and R ranges

- Malfunctiono f torque converter
- Poor engine output

11A.6 Hydraulic Pressure Test

(1) Let the engine warm up until the ATF temperature is 70 - 80℃.

(2) Jack up the vehicle so that the tires can spin freely.

(3) Install the special tool (MD998330:2 ,992kPa oil pressure gauge) and the adapters(MD998332, MD998900)to each hydraulic pressure outlet port.(see Fig11A-189,Fig 11A-190,Fig11A-191)

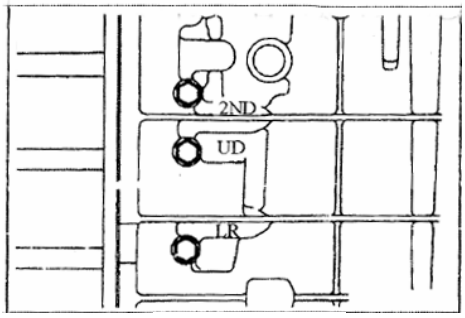


Fig 11A-189

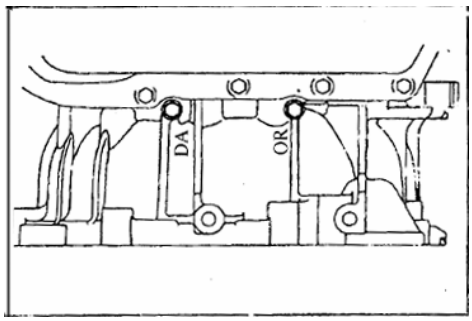


Fig 11A-190

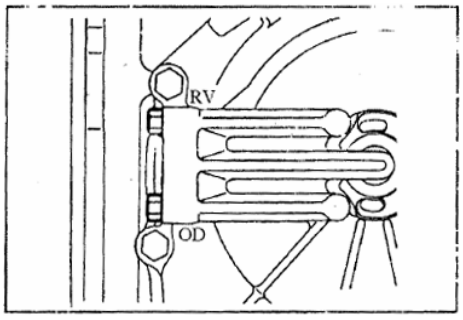


Fig 11A-191

NOTE

2ND : Second brake pressure port

UD : Underdrive clutch pressure port

LR : Low & reverse brake pressure port

DR : Torque converter Pressure Port

DA : Damper clutch pressure port

RV : Reverse clutch pressure port

OD : Overdrive clutch pressure port

(4)Measure the various hydraulic pressures under the conditions given in the standard hydraulic pressure table 11A-22, and check that the measurements are within the standard value ranges.

(5) lf the measurements are outside the standard value range, remedy the problem while referring to the hydraulic pressure test diagnosis table(table 11A-23).

Standard hydraulic pressure table

Table 11A-22

Measurement conditions			Standard hydraulic pressure kPa					
Shift lever position	Shift range position	Engine speed r/min	Underdrive clutch pressure [UD	Reverse clutch pressure [RC	Overdrive clutch pressure [OD	Low&brake pressure [LR pressure]	Second brake pressure [2nd	Torque converter pressure [DR

			pressure]	pressure]	pressure]		pressure]	pressure]
P	—	2500	—	—	—	260~340	—	500-700
R	Reverse	2500	—	1320~1720	—	1320~1720	—	500-700
N	—	2500	—	—	—	260~340	—	500-700
L	1st	2500	1010-1050	—	—	1010-1050	—	500-700
2	2nd	2500	1010-1050	—	—	—	1010-1050	500-700
3	3rd	2500	780-880	—	780-880	—	—	—
D	4th	2500	—	—	780-880	—	780-880	—

Hydraulic pressure test diagnosis table

Table 11A-23

Symptom	Problem location
All hydraulic pressures are too high	Malfunction of regulator valve
All hydraulic pressures are too low	Malfunction of oil pump Blocked oil filter Blocked oil cooler Malfunction of regulator valve Malfunction of relief valve Incorrect valve body installation
Abnormal hydraulic pressure in range only	Malfunction of regulator valve
Abnormal hydraulic pressure in 3rd or 4th only	Malfunction of regulator valve Malfunction of switch bulb
Abnormal UD pressure only	Malfunction of oil seal K,L,M or Q Malfunction of underdrive solenoid valve Malfunction of underdrive pressure control valve Abnormality with check ball Blocked orifices incorrect valve body installation
Abnormal REV pressure only	Malfunction of oil seal A,B or c Abnormality with check ball Blocked orifices incorrect valve body installation
Abnormal LR pressure only	Malfunction of oil seal I,J or P Malfunction of low&reverse solenoid valve (also used for the direct clutch) Malfunction of low&reverse pressure control valve Malfunction of switch bulb Malfunction of fail-safe valve B Blocked orifices incorrect valve body installation
Abnormal 2nd pressure only	Malfunction of oil seal G,H or O Malfunction of second solenoid valve Malfunction of second pressure control valve Malfunction of fail-safe valve B Blocked orifices incorrect valve body installation

Abnormal DR pressure only	Blocked oil cooler Malfunction of oil seal N Malfunction of damper clutch solenoid valve Malfunction of torque converter pressure control valve Blocked orifices incorrect valve body installation
Pressure applied to non-operating element	Incorrect transmission control cable adjustment Malfunction of manual valve incorrect valve body installation

11A.7 Oil Seal Layout

Oil seal layout see Fig 11A-192

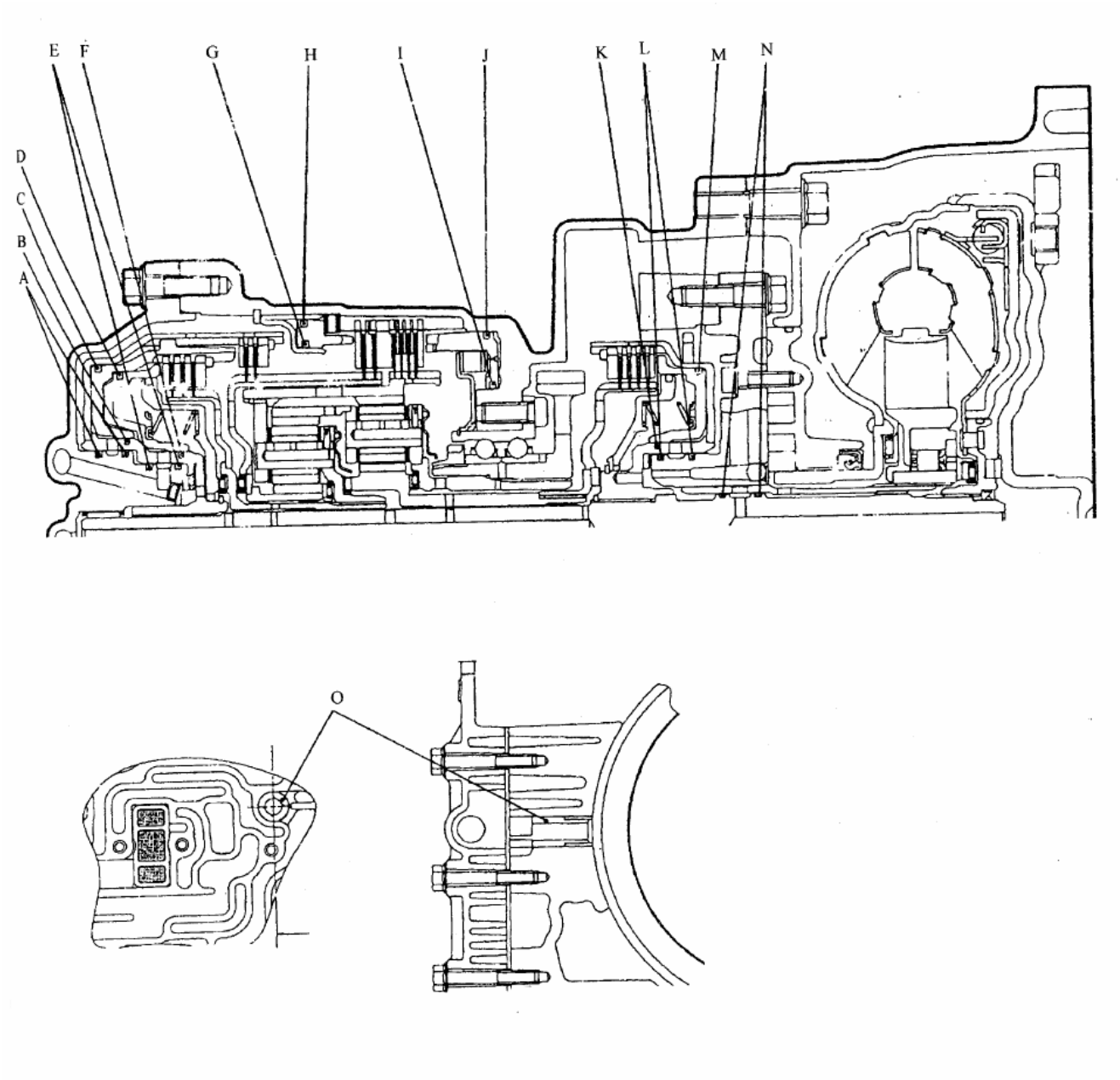


Fig 11A-192

11A.8 Line Pressure Adjustment

(1) Discharge the ATF ,and then remove the valve body cover

(2) Turn the adjusting screw shown in Fig 11A-193 to adjust the UD pressure until it is at the standard valve. The pressure increases when the screw is turned anti-clockwise.

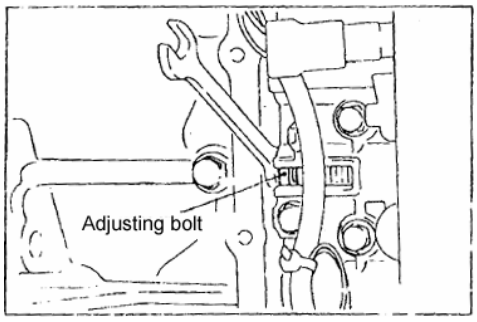


Fig 11A-193

NOTE

Adjust to the middle of the standard range when the transmission is at the 1st or 2nd gear.

Standard value: 1 ,010 1 ,050 kPa

Change in pressure for a single full turn of the adjusting screw: 35 kPa

(3) Install the valve body cover, and then pour in the specified amount of ATF.

(4) Carry out a fluid pressure test. Readjust if necessary.

12 Front Axle

12.1 Service Specification

Standard value see Table12-1

Table 12-1

Items		Standard value	Limit
Wheel bearing axial play (mm)		—	0.05
Wheel bearing rotation starting torque(N • m)		—	1.8
Protruding length of stabilizer bar mounting bolt (mm)		20.5~23.5	—
Setting of T.J boot length (mm)		101	—
Opening dimension of the special tool(mm)	When the R.J. boot band(small) is crimped	2.9	—
	When the R.J. boot band(big) is crimped	3.2	—
Crimped width of the R.J. boot band (mm)		1.0~1.5	—
Clearance between the R.J. boot(large diameter side) and the stepped phase of the R.J. housing(mm)		0.10~1.55	—

12.2 Lubricants

Lubricants see Table12-2

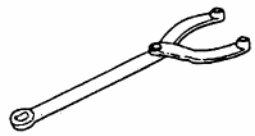
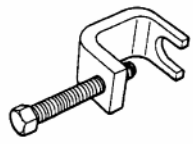
Table 12-2

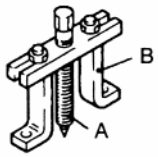
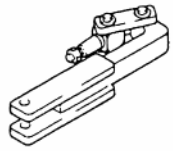
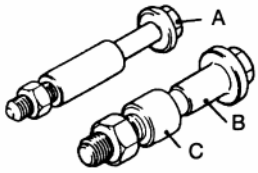
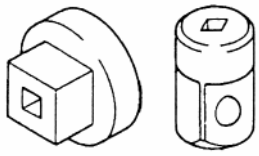
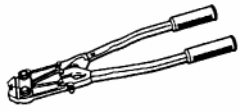
items	Specified lubricants	quantity(g)
T.J. boot grease	2#Lithium grease in motor	125±10
R.J. boot grease	MoS2 lithium grease	100±10

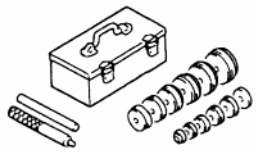
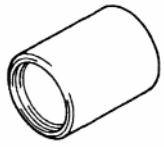
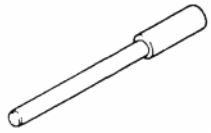
12.3 Special Tools

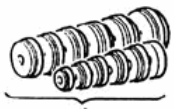
Special tool see Table**12-3**

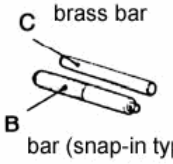
Table 12-3

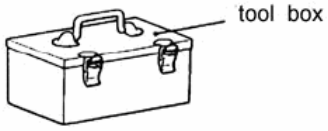
Tools	Number	Name	Use
	MB990767	End yoke holder	Fixing of the hub
	MB991618	Hub bolt remover	Removal of the hub bolt

	MB991406， MB990635 or MB991113	Steering linkage puller	Disconnection of ball joint
	MB990241 A：MB990242 B：MB990244	Axle shaft puller A：puller shaft B：puller bar	● Removal of the drive shaft ● Removal of the hub
	MB991056 or MB991355	Knuckle arm bridge	
	A：MB991017 B：MB990998 C：MB991000	A、B：front hub removal and installation C：spacer	● Provisional holding of the wheel bearing ● Measurement of wheel bearing rotation starting torque Measurement of wheel bearing axial play MB991000, which belongs to MB990998, should be used as a spacer..
	MB990326	Preload socket	Measurement of wheel bearing rotation starting torque
	MB991561	Boot band and clipping tool	Resin boot band installation

	MB990925	Bearing and oil seal installer set	Removal of wheel bearing
	MB990810	Side bearing puller	Removal of the wheel bearing inner race(outside)
	MB990847	Rear suspension bush remover& installer base	Removal of wheel bearing
	MB990947	Pipe type axle	Removal of the wheel bearing







	Tool number	Outer diameter(mm)		Tool number	Outer diameter(mm)
A	MB990926	39	A	MB990933	63.5
	MB990927	45		MB990934	67.5
	MB990928	49.5		MB990935	71.5
	MB990929	51		MB990936	75.5
	MB990930	54		MB990937	79
	MB990931	57	B	MB990938	—
	MB990932	61	C	MB990939	—

12.4 On-Vehicle Service

1) wheel bearing axial play check

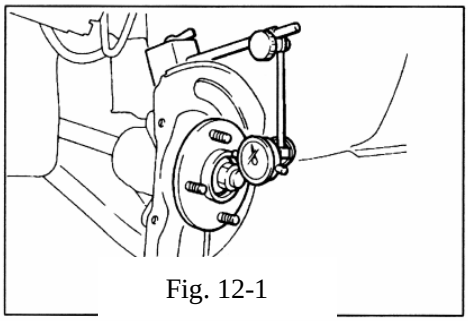


Fig. 12-1

（1）remove the disc brake caliper and suspend it with a wire, then remove the brake disc from the front hub.

（2）Attach a dial gauge as shown Fig. 12-1, and then measure the axial play while moving the hub in the axial direction.

limit value：0.05mm

（3）if axial play exceeds the limit, replace the front hub assembly.

2) Hub bolt replacement

（1）Remove the caliper assembly and secure it with wire so that it does not fall, then remove the brake disc.

（2）Use the special tools to remove the hub bolts.(see Fig.12-2)。

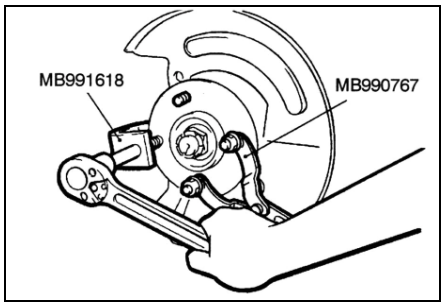


Fig.12-2

（3）Install the plain washer to the new hub bolt, and install the bolt with a nut.(see Fig.12-3)。

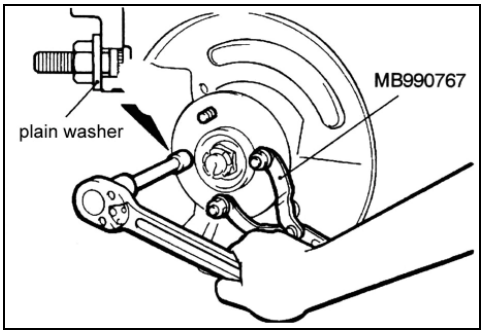


Fig.12-3

12.5 Front Hub Assembly

- **Removal and installation**

Post-installation operation
Check the dust cover for cracks or damage by pushing it with finger.

Removal steps see Fig.12-4

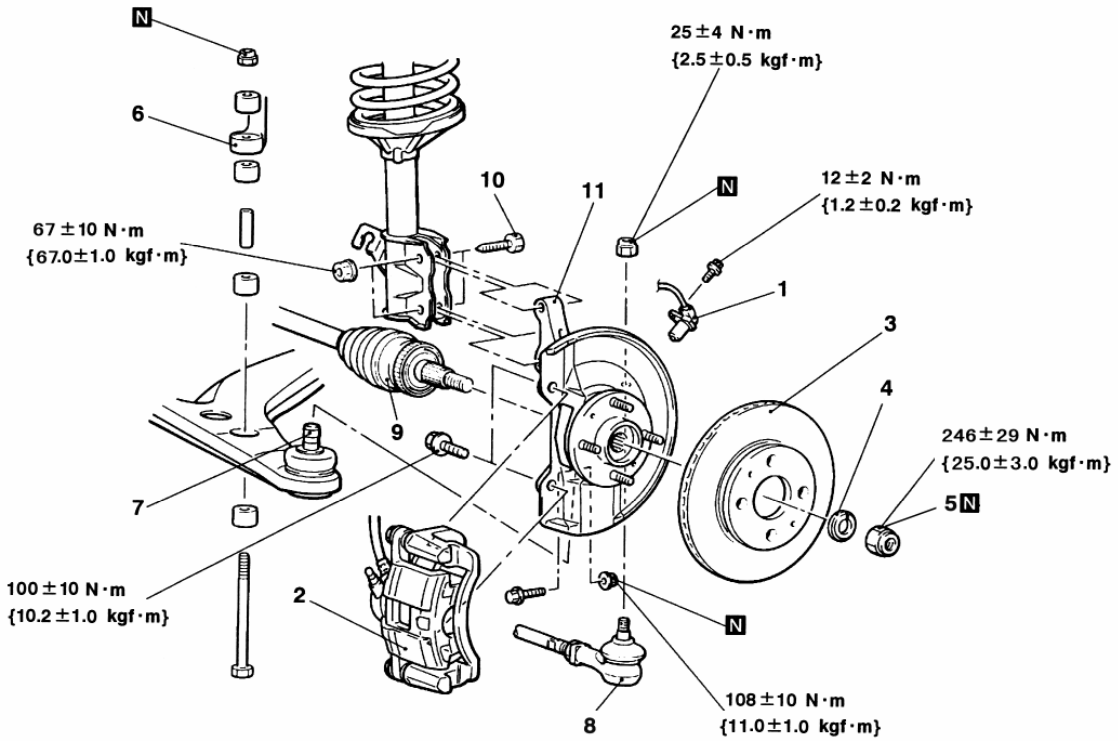


Fig.12-4

1. Speed sensor
2. caliper assembly
3. brake disc
4. washer
5. drive shaft nut
6. connection for stabilizer bar
7. connection for lower arm ball joint
8. connection for tie rod end
9. drive shaft
10. front strut to hub and knuckle mounting bolt and nut
11. hub and knuckle

1)Removal service points

(1)**Caliper assembly removal**

Remove the caliper assembly and secure it with wire so that it does not fall.

(2)**Drive shaft nut removal(see Fig.12-5)**

Caution

Do not apply the vehicle weight to the wheel bearing while loosening the drive shaft nut. Otherwise wheel bearing will be damaged.

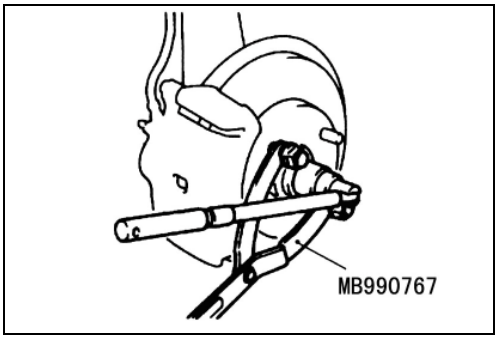


Fig.12-5

(3) **Tie rod end disconnection(see Fig.12-6)**

Caution

1．Loosen the nut only; do not remove it from the ball joint. Otherwise ball joint thread will be damaged.

2．The special tool should be suspended by a cord to prevent it from coming off.

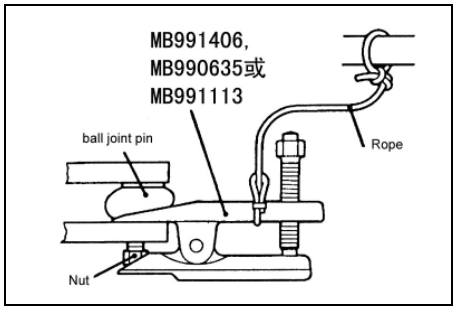


Fig.12-6

(4)**Drive shaft removal(see Fig.12-7)**

Pressuring out the drive shaft with special tool.

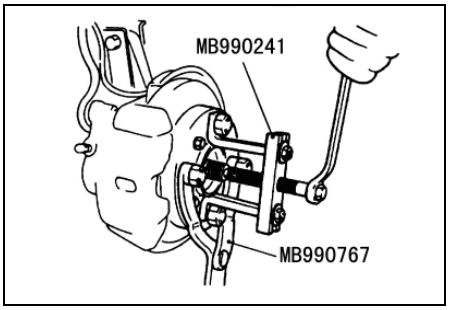


Fig.12-7

- **Damage installation service points**

(1) **Stabilizer bar installation(see Fig.12-8)**

Install the stabilizer bar so that the protruding length of the stabilizer bar mounting bolt meets its standard value（A）.

Standard value（A）：20.5~23.5mm

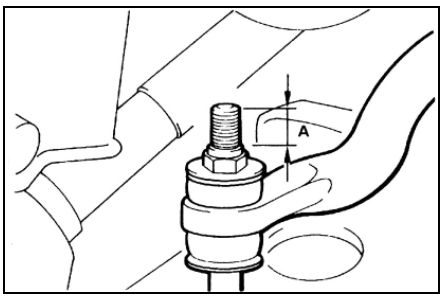


Fig.12-8

(2)Drive shaft nut and washer installation**(see Fig.12-9)**

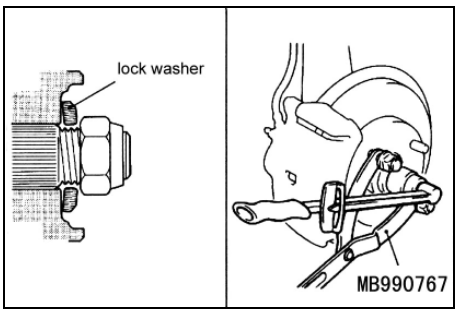


Fig.12-9

The fallet side of the washer faces to the lock nut side and using the special tool tighten the drive shaft nut.

Tightening torque:: 246±29N·m

2.Disassembly and reassembly(see Fig.12-11)

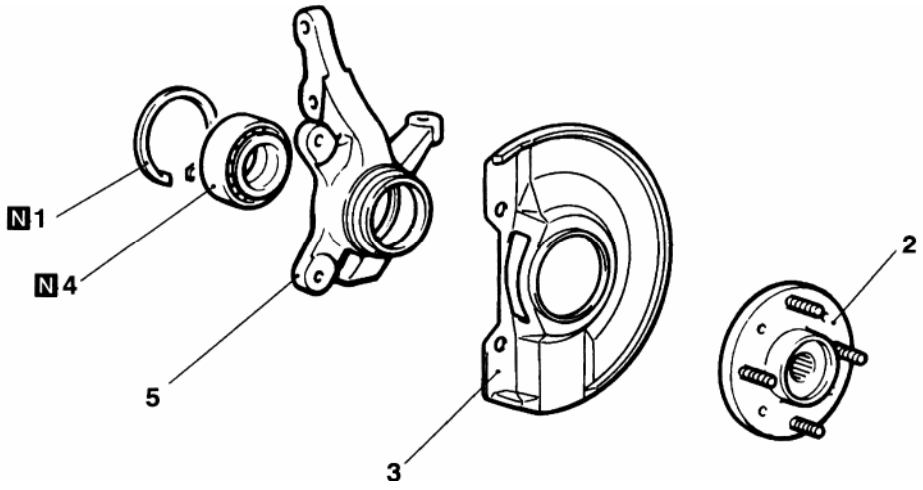


Fig.12-10

disassembly steps	**reassembly steps**
1. Snap ring	4. Wheel bearing
2.Hub	5. knuckle
3. Dust cover	

►B◄ ●Hub starting torque check

►C◄ ●Hub axial play check

1) Disassembly service points

(1)Hub removal**(see Fig.12-11)**

Caution

When the hub has been removed, always replace the wheel bearing with a new part.

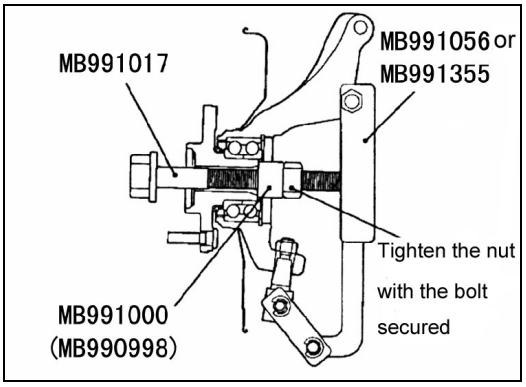


Fig.12-11

(2) Wheel bearing removal

a. Crush the oil seal in two places so that the tabs of the special tool will be caught on the wheel bearing inner race(outside)(see Fig.12-12).

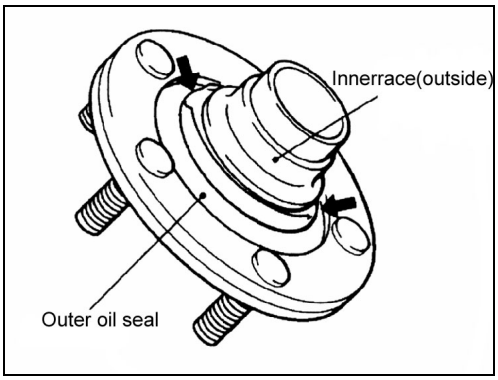


Fig.12-12

b. Remove the wheel bearing inner race(outside) from the front hub by using the special tool.(see Fig.12-13。

Caution

When removing the inner race(outside0 from the hub, be careful not to let the hub drop

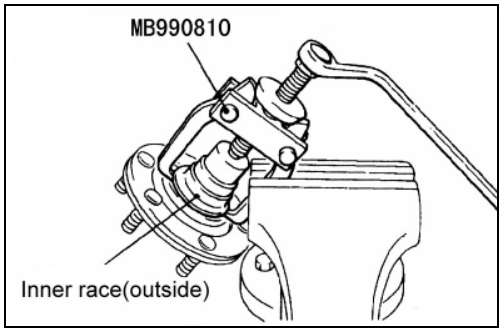


Fig.12-13

C. Install the inner race(outside) that was removed from the hub to the wheel bearing, and then use the special tool to remove the wheel bearing.(see Fig.12-14)。

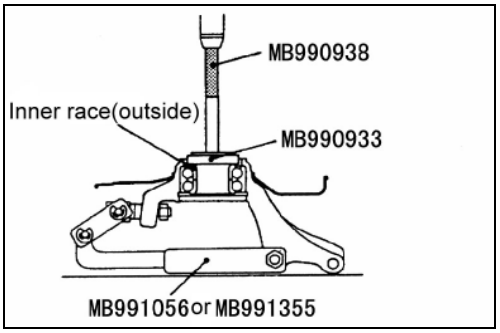


Fig.12-14

2) Reassembly service points

(1) **Wheel bearing installation see Fig.12-15**

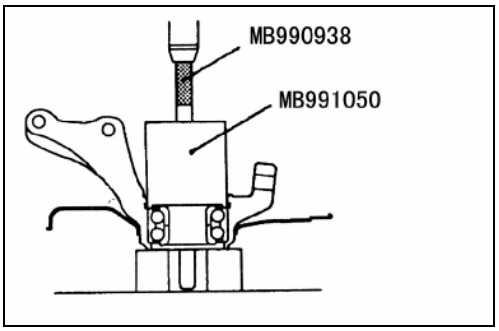


Fig.12-15

Caution

Press the outer race when pressing-in the wheel bearing.

(2) **Hub starting torque check**

a. Tighten the special tool to the specified torque, and then press the hub into the knuckle(see Fig.12-16)。

b. Rotate the hub in order to seat the bearing.

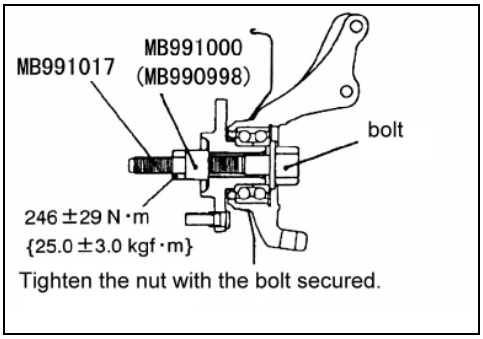


Fig.12-16

c. Measure the hub starting torque by using the special tools.(see Fig.12-17)。

Limit：1.8N·m{18kgf·cm}

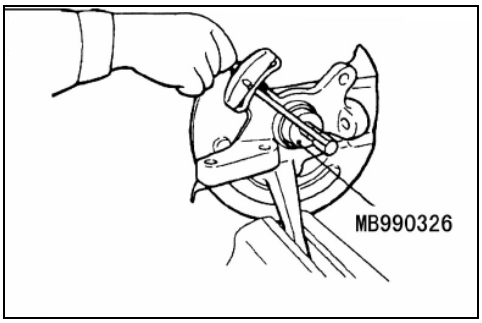


Fig.12-17

d. The starting torque must be within the limit and, in addition, the hub must not feel rough when rotated.

(3) Hub axial play check(see Fig.12-18)

a. Checking the axial play.

Limit：0.05mm

b. If the starting torque ans hub axial play are not within the limit range while the nut is tighted to （246±29N·m{25.0±3.0kgf·m}), the bearing, hub and knuckle have probably not been installed correctly. Replace the bearing and re-install.

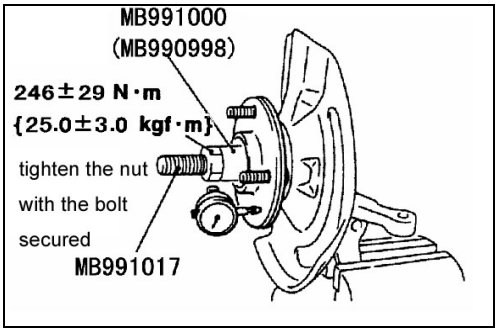


Fig.12-18

12.6 Drive Shaft

Removal and installation

Caution

Do not strike the ABS rorors installed to the R.J. outer race of drive shaft while removal and indtallation.

Post-installation operation

Check the dust cover for crack and damagebypushing it with finger.

Removal steps see Fig.12-19：

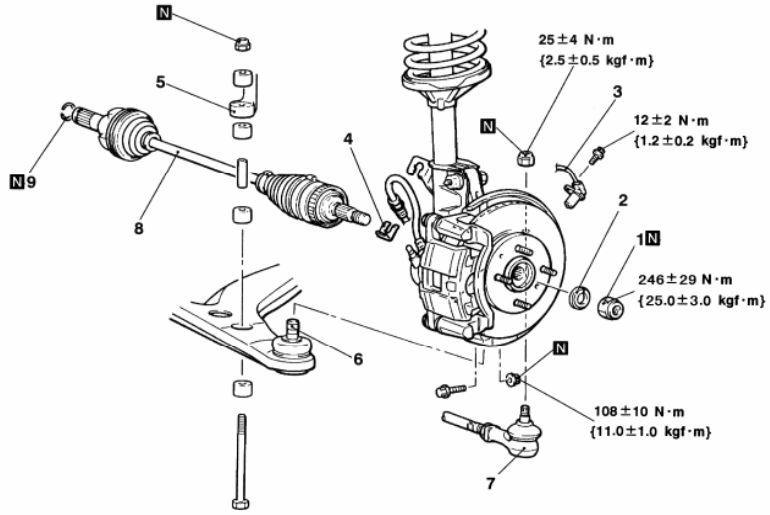


Fig.12-19

1. Drive shaft nut
2. Washer
3. Speed sensor
4. Brake hose cramp
5. Stabilizer bar
6. lower arm ball joint connection
7. Tie rod end connection
8. Drive shaft
9. Circlip

1) Removal service points

(1) Drive shaft nut removal see Fig.**12-20**

Caution

Do not apply the vehicle weight to the wheel bearing while loosening the drive shaft nut. Otherwise wheel bearing will be damaged.

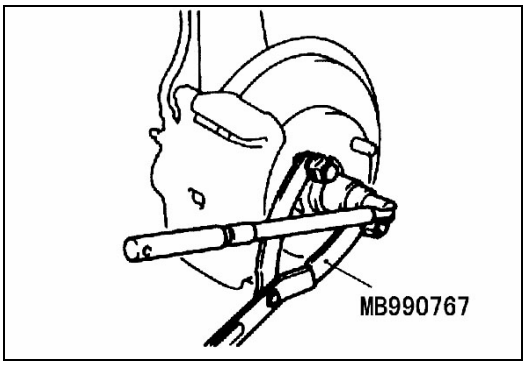


Fig.**12-20**

(2) **Tie rod end disconnection(see Fig.12-21)**

Caution

1. Loosen the nut only; do not remove it from the ball joint.
2. The special tool should be suspended by s cors to prevent it from coming off.

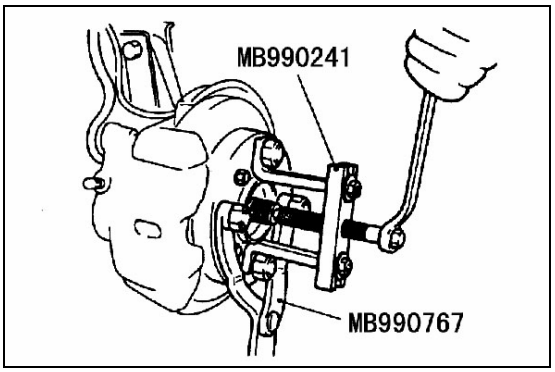


Fig.12-21

(3) **Drive shaft removal**

a. Use the special tools to push out the drive shaft from the hub(see Fig.12-22)。

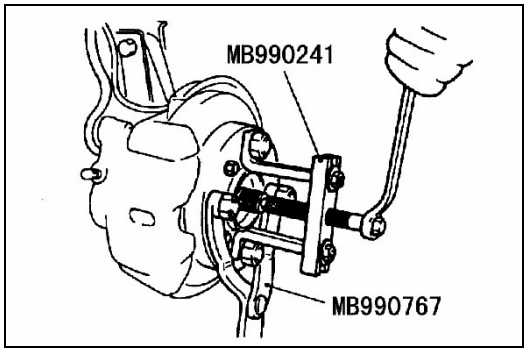


Fig.12-22

b. Withdraw the drive shaft from the hub by pulling the bottom of the brake disc towards you, and then remove the hub tetaining bolts.(see Fig.12-23)。

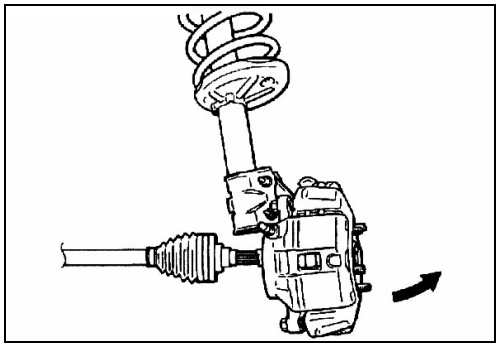


Fig.12-23

b. Insert a pry bar between the transmission case and the drive shaft and remove the drive shaft from the transmission . (see Fig.12-24、12-25)。

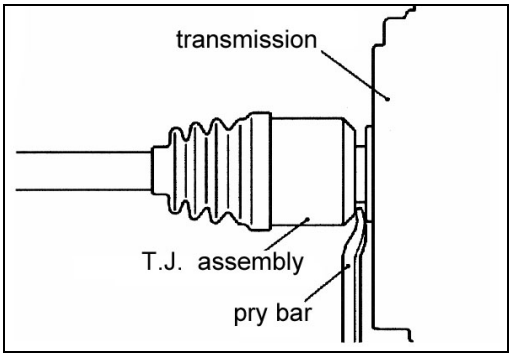


Fig.12-24

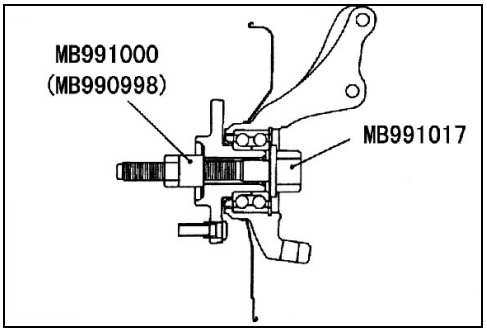


Fig. 12-25

Caution：

（1） Do not pull on the drive shaft; doing so will damage the T.J.; be sure to use the pry bar.

（2） Be careful that the spline part of the drive shaft does not damage the oil seal.

（3） **Do not apply the vehicle to the wheel bearing while loosening the drive shaft nut. If the vehicle weight must be applied to the bearing (because of moving the vehicle), temporarily secure the wheel bearing by using the special tool.**

2) Installation service points

(1) Drive shaft installation

caution

Do not damage the oil seal of the transmission by the drive shaft splines.

(2) **Stabilizer bar installation see Fig.12-26**

Install the stabilizer bar so that the protruding length of the stabilizer bar mounting bolt meets its standard value.

Standard value：20.5~23.5mm

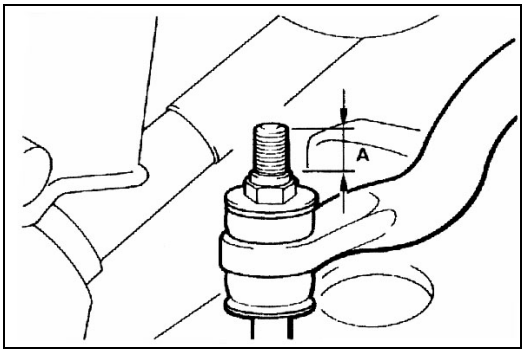


Fig.12-26

(3) Drive shaft nut installation

a. Washer installation direction as show Fig.12-27.

b. Using the special tool, tighten the drive shaft nut.

Tightening torque： 246±29N・m{25.0±3.0kgf・m}

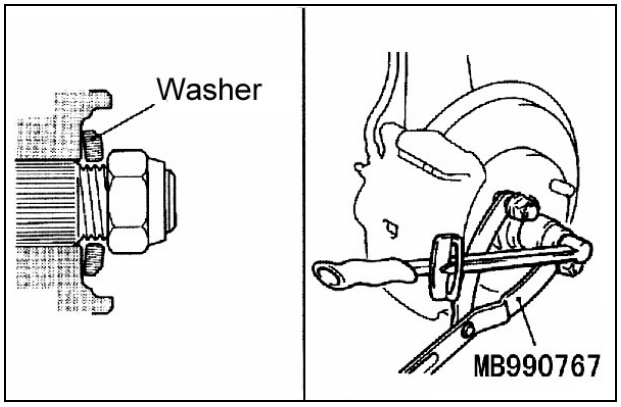


Fig.12-27

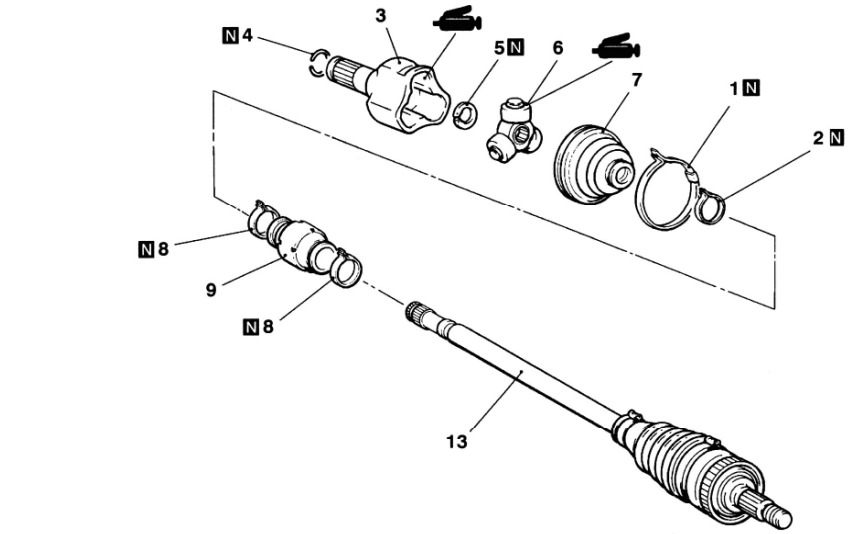
Caution

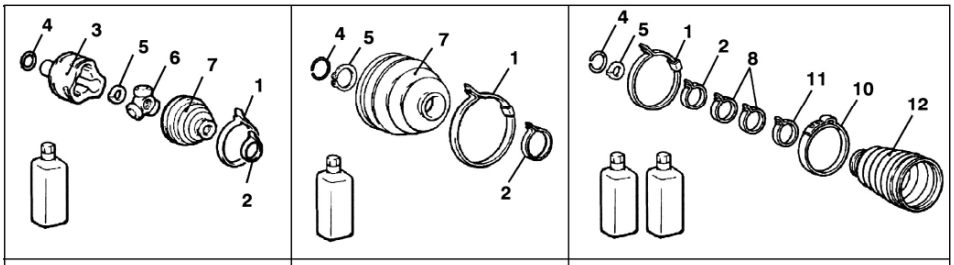
Before securely tightening the drive shaft nuts, make sure there is no load on the wheel bearings. Otherwise wheel bearing will be damaged.

2) Disassembly and reassembly

Caution
（1） When the drive shaft is disassemblied or reassemblied, be careful not to interfere with the ABS rotor installed to the R.J. outer race to prevent the rotor form damage.
（2） Never disassemble the R.J. assembly except when replacing the R.J. boot.

Disassembly steps see Fig.12-28：





T.J. repair kit	T.J. boot repair kit	R.J. boot repair kit

Fig.12-28

1. T.J. boot band（large）
2. T.J. boot band（small）
3. T.J. case
4. Circlip
5. Snap ring
6. Spider assembly
7. T.J. boot
8. Damper band
9. Dynamic damper
10. R.J. boot band（large）
11. R.J. boot band（small）
12. R.J. boot
13. R.J. assembly

1) Disassembly service points

(1) T.J. CASE/SPIDER ASSEMBLY REMOVAL

a. Wipe off grease from the spider assembly and the inside of the T.J. case.

b.Always clean the spider assembly when the grease contains water or foreign material.

Caution

Do not disassemble the spider assembly.

(2) T.J. boot removal

1. Wipe off grease the shaft spline.
2. When reusing the T.J. boot, wrap plastic tape around the shaft spline to avoid damaging the boot.

2) Reassembly service points

(1) **Dynamic damper/damper band/T.J. boot installation**

a. Install the dynamic damper to the place as shown Fig.12-29 using damper band and fix it.

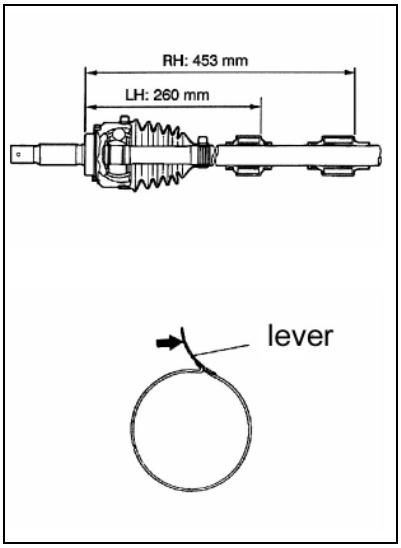


Fig.12-29

Caution

（1） There should be no grease adhered to the rubber part of the dynamic damper.

（2） Damper band and TJ boot band (small) are different in shape. Care should be taken to prevent wrong installation by checking identification numbers and colors indicated on the lever.

Item	Identification No
Damper band	31.3
T.J. boot band	33

b. Wrap plastic tape around the shaft spline, and then install the T.J. boot (small) and T.J. boot.

(2)Spider assembly/T.J. case installation

a. Apply the specified grease furnished in the repair kit to the spider assembly between the spider axle and the roller.

Specified grease：K575GS lithium grease

Caution

（3） The drive shaft joint uses special grease. Do not mix old and new or different types of grease.

（4） If the spider assembly has been cleaned, take special care to apply the specified grease.

b. Install the spider assembly to the shaft from the direction of the spline beveled section.

c. After applying the specified grease to the T.J. case, insert the drive shaft and apply grease one more time.(see Fig.12-30)。

Specified grease：K575GS lithium grease

Amount to use：125±10g

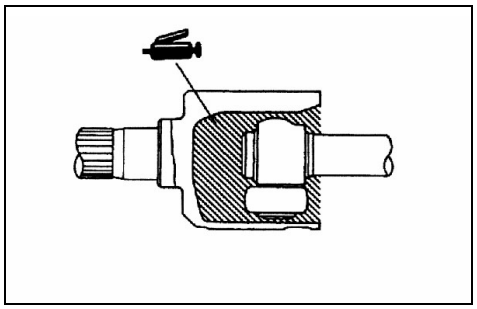


Fig.12-30

Note

The grease in the repair kit should be divided in half for use, respectively, at the joint and inside the boot.

Caution

The drive shaft joint uses special grease. Do not mix old ans new or different types of grease.

(3) T.J. boot band (small)/T.J. boot band (large) installation

Set the T.J. boot bands at the specified distance in order to adjust the amount of air inside the T.J. boot, and then tighten the T.J. boot bands securely.(see Fig.12-31)。

Standard value（A）：80±3mm

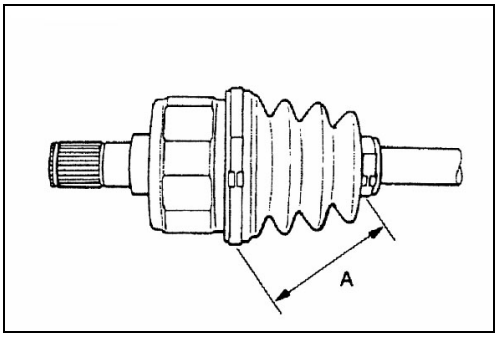


Fig.12-31

R.J. boot replacement

①Remove the R.J. boot bands (large and small).

②Remove the R.J. boot.

③Wrap a plastic tape around the shaft spline, and assemble the R.J. boot band and B.J. boot.(see Fig.12-32)。

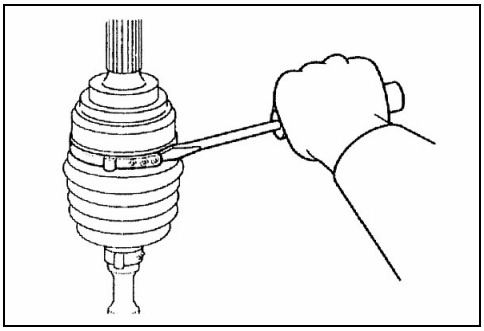


Fig.12-32

④Install the R.J. boot with the part with the smallest diameter in a position such that the shaft groove can be seen.(see Fig.12-33)。

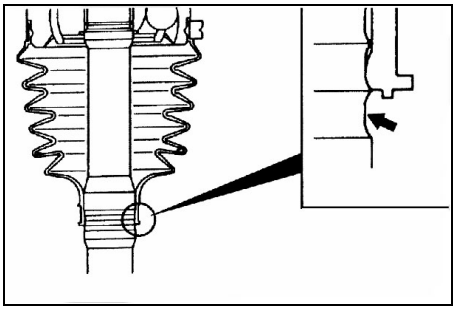


Fig.12-33

⑤Turn the adjusting bolt on the special tool so that the size of the opening(W) is at the standard value.(see Fig.12-34)

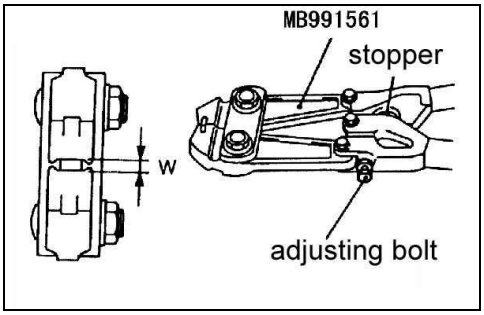


Fig.12-34

Standard value（W）：1.6mm

＜If it is larger than 1.6mm＞Tighten the adjusting bolt

＜f it is smaller than 1.6mm＞Loosen the adjusting bolt

Caution

（1）The value of W will change by approximately 0.7mm for each turn of the adjusting bolt.

（2）The adjusting bolt should not be turned more than once.

⑥ Place the R.J. boot band (small) against the projection at the edge of the boot, and then secure it so that there is a clearance left as shown by (A) in the Fig.12-35.

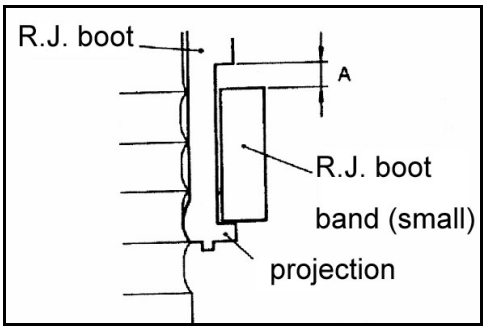


Fig.12-35

⑦ Use the special tool to crimp the R.J. boot band (small).

Caution

（1） Secure the drive shaft in an upright position and clamp the part of the R.J. boot band to be crimped securely in the jaws of the special tool.

（2） Crimp the R.J. boot band until the special tool touches the stopper.

⑧Check that the crimping amount (B) of the R.J. boot band is at the atandard value.(see Fig.12-36)。

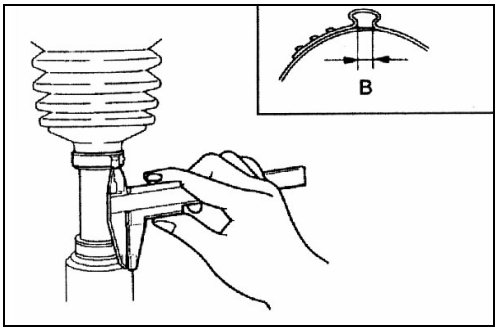


Fig.12-36

Standard value（B）：1.0mm~1.5mm

＜If the crimoing amount is larger than 1.5 mm＞Readjust the value of (W) in step 5 according to the following formula, and then repeat the operation in step 7.

W=5.5-B（example：if B=2.9 , then W=2.6）

＜If the crimoing amount is smaller than 1.0mm＞，Readjust the value of (W) in step 5 according to the following formula, and then repeat the operation in steps 6 and 7 using a new R.J. boot band.

W=5.5-B（example：if B=2.3，then W=3.2）

⑨Check that the R.J. boot band is not sticking out past the place where it has been installed.if the R.J. boot band is sticking out, remove it and then repeat the operation in steps 6 to 8 using a new R.J. boot band.(see Fig.12-37)。

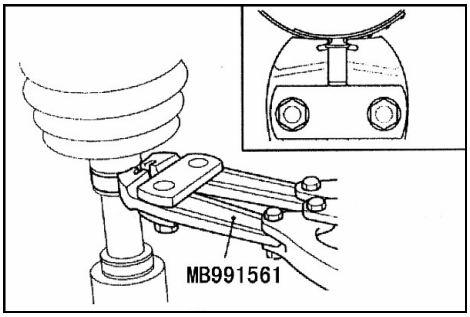


Fig.12-37

⑩ Fill the inside of the R.J. boot with the specified amount of the specified grease.

Specified grease： MoS_2 lithium grease

Amount to use：100±10g

Caution

The drive shaft joint uses special grease. Do not mix old and new or different types of grease.

11. Install the R.J. boot band (large) so that there is the clearance (C) between it and the R.J. housingisat the standard value. (see Fig.12-38)。

Standard value（C）：0.10~1.55mm

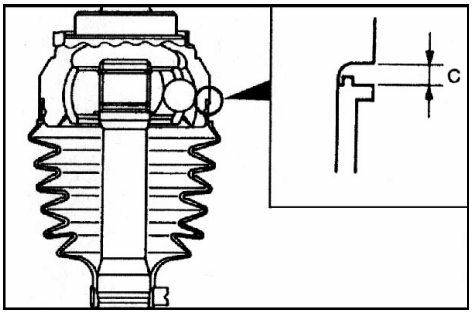
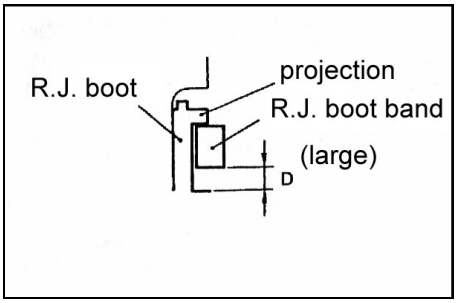


Fig.12-38

12. Ollow the same procedure as in step 5 to adjust the size of the opening (W) on the special tool sothat it is at the standard value.

Standard value（W）：3.2mm

13. Place the R.J. boot (large) against the projection at the edge of the boot, and then secure it so that there is a clearance left as shown by D in the Fig,12-39.



Fig,12-39

14．Use the special tool to crimp the R.J. boot band (large) in the same way as in steps 7.

15．Check that the crimping amount (E) of the R.J. boot band is at the standard value (see Fig.12-40).

Standard value（E）：1.0~1.5mm

< If the crimoing amount is larger than 1.5 mm > Readjust the value of (W) in step 12 according to the following formula, and then repeat the operation in step 714.

W=5.8-E（example：if E=2.9，then W=2.9）

< If the crimoing amount is smaller than 1.0mm > Remove the R.J. boot band, readjust the value of (W) in step 12 according to the following formula, and then repeat the operation in steps 13 and 14 using a new R.J. boot band.

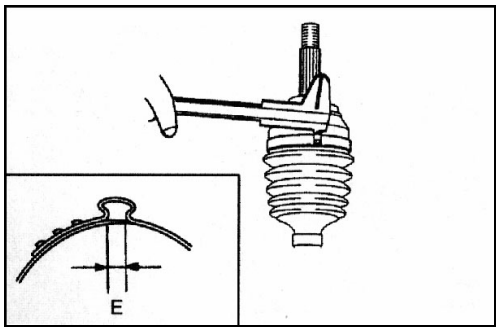


Fig.12-40

W=5.8-E（example：if E=2.3，then W=3.5）

16．Check that the R.J. boot band is not sticking out past the place where it has been installed.if the R.J. boot band is sticking out, remove it and then repeat the operation in steps 13 to 15 using a new R.J. boot band.

13 Rear Hub

13.1 Service Specification

Specification value see Table13-1

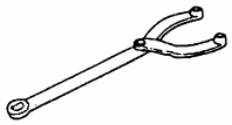
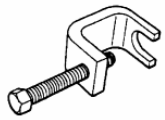
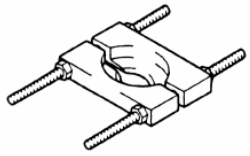
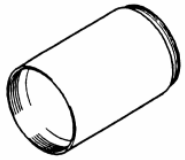
Table 13-1

Items	Standard value	Limit
Wheel bearing axial play(mm)	—	0.05
Wheel bearing rotary-sliding resistance(N)	—	22or less

13.2 Specified Tools

Specified Tools see Table **13-2**

Table 13-2

Tool	Number	Name	Use
	MB990767	End yoke holder	Hub fixing
	MB991618	Hub bolt remover	Removal of the hub bolt
	MD998801	Remover	Rear axle assembly fixing
	MD998812	Installer cap	Removal of ABStotor
	MD998813	Installer 100	
	MD998815	Installer adapter	

13.3 On-Vehicle Service

1.Wheel bearing axial play check

（1）Remove the hub cap and brake drum.

（2）Check the bearring's axial play.

Place a dial gauge as shown Fig.13-1 against the hub surface; then move the hub in the axial direction and check whether or not there is axial play.

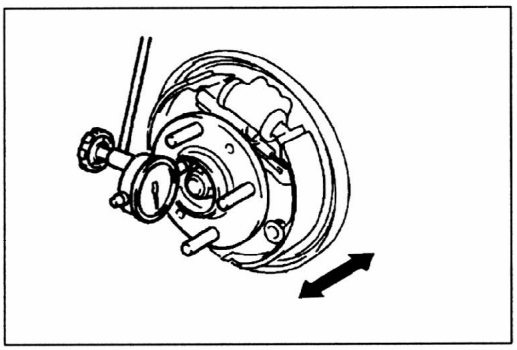


Fig. 13-1

Limit value：0.05mm

（3）If the axial play exceeds the limit, the lock nut should be tightened to the specified torque（172 ±24N・m）and check the axial play again.

（4）replace the rear hub assembly if an adjustment cannot be made to within the limit.

2．Wheel bearing rotary-sliding resistance check

（1）remove the brake dume.

（2）After turning the hub a few times to seat the bearing, wind a rope around the hub bolt and turn the hub by pulling at a 90 angle with a spring balance. Measure to determine whether or not the rotary-sliding resistance of the rear hub is at the limit value.(see Fig.13-2)。

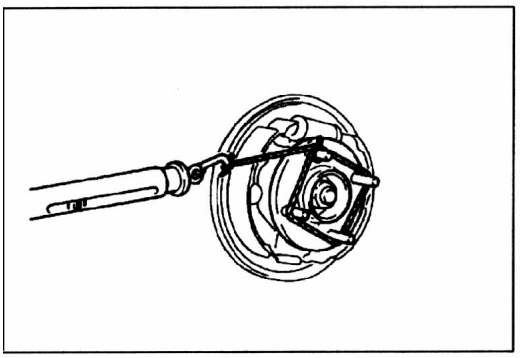


Fig.13-2

Limit value：22N（2.2 kgf）or less

（3）if the limit value is exceeded, loosen the flange nut and then tighten it to the specified forque （172±24N・m）and check the rear hub rotary sliding resistance again.

（4）replace the rear hub assembly if an adjustment cannot be made to witnin the limit.

3．Hub bolt replacement

（1）remove the brake drum.

（2）use the specical tools to remove the hub bolts. (see Fig.13-3)。

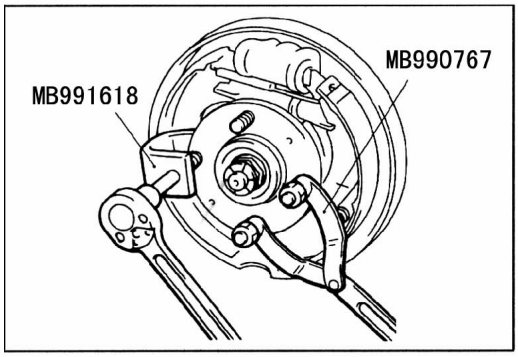


Fig.13-3

（3）install the plain washer to the new hub bolt, and install the bolt with a nut.(see Fig.13-4)。

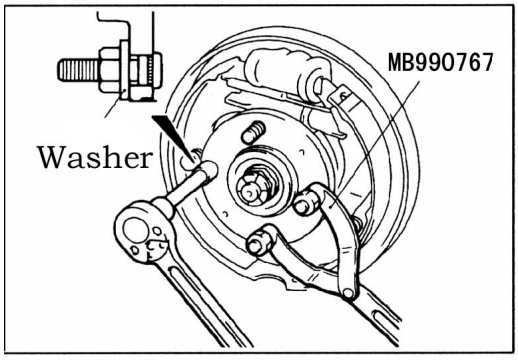


Fig.13-4

13.4 Rear Hub Assembly

1.Removal and Installation

Caution
The rear hub assembly should not be dismantled. When removing the rear hub assembly, the wheel bearing inner race may be left at the spindle side. In this case, always replace the rear hub assembly, otherwise the hub will damage the oil seal, causing oil leaks or excessive play.

Removal and installation see Fig.13-5.

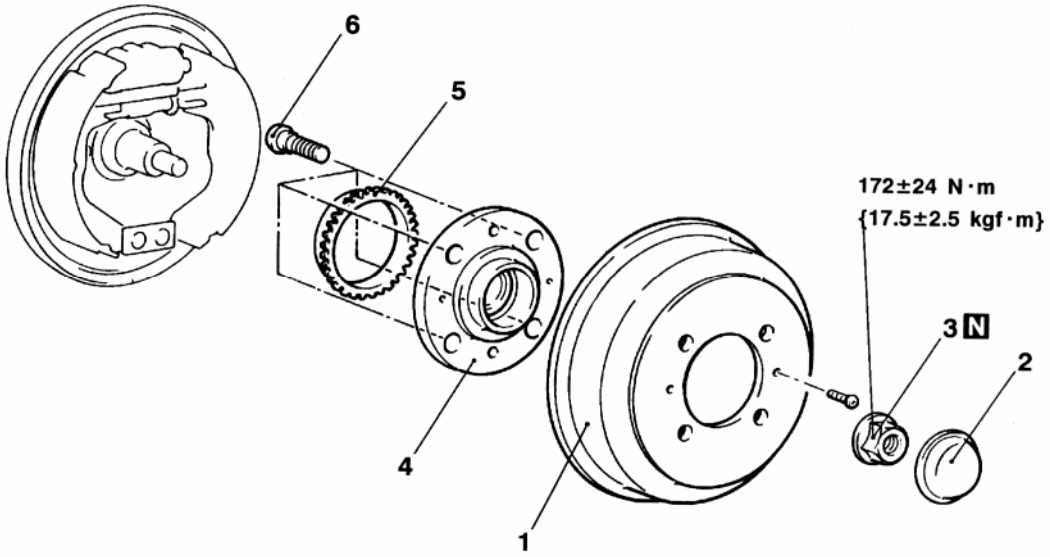


Fig. 13-5

1. brake drum
2. hub cap
3. lock nut
4. rear hub assembly
5. ABS rotor
6. hub bolt

1) Removal service points

(1)Lock nut removal(see Fig.13-6)

caution
Do not apply the vehicle weight to the wheel bearing while loosening the loch nut or the wheel bearing will be damaged.

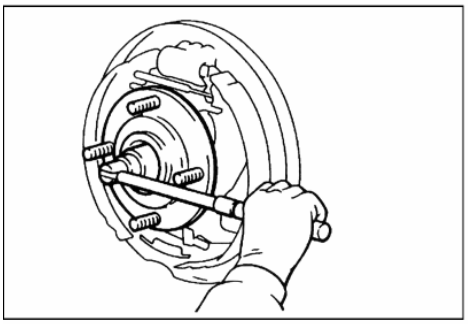


Fig. 13-6

(2) ABS rotor removal

Use the special tool to press out ABS rotor from the rear hub assembly.(see Fig.13-7)。

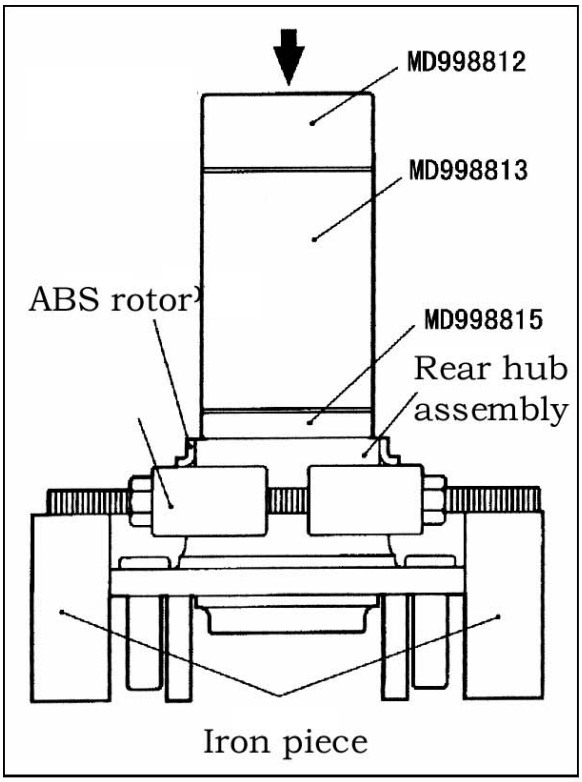


Fig. 13-7

Installation service point

(1) **ABS rotor installation(see Fig.13-8)**

press-fit the ABS rotor to the rear hub assembly.

Caution

When installing, take care not to deform the ABS rotor.

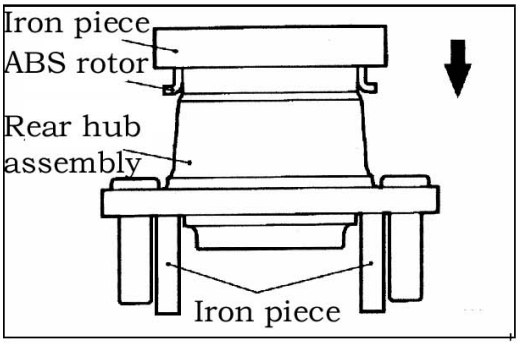


Fig. 13-8

(2) Lock nut installation(see Fig.13-9)

Caution
Before securely tightening the lock nuts, make sure there is no load on the wheel bearings. Otherwise the wheel bearing will be damaged.

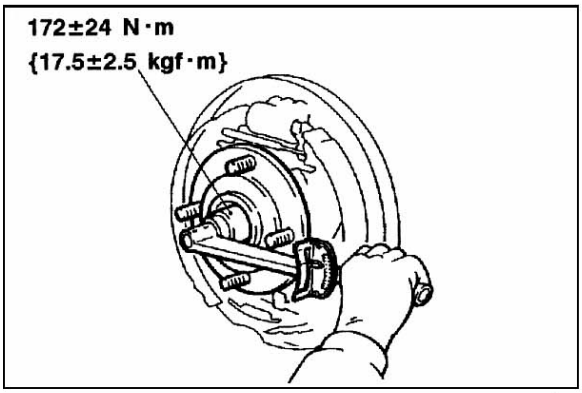


Fig. 13-9

14A.1 Service Specifications

Table 14A-1

Item	Standard value
Toe-in (mm)	1±2
Camber	0° 10′ ±30′ （difference between right and left wheels: less than 30′ ）
Caster	2° 50′ ±30′ （difference between right and left wheels: less than 30）
Side slip (mm/m)	0±3
Low arm ball joint rotation starting torque (N · m)	0～3.9
Protruding length of stabilizer bar mounting bolt (mm)	20.5～23.5

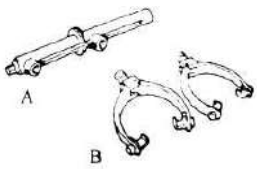
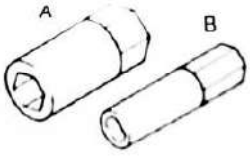
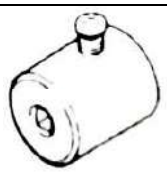
14A.2 Grease

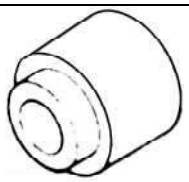
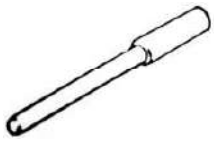
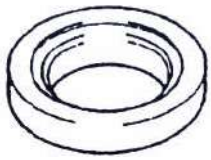
Table 14A-2

Items	Specified lubricant	Quantity
The lip and inside of the dust cover.	Multipurpose grease	As required

14A.3 Special Tools

Table 14A-3

Tools	Number	Name	Use
	MB991004	Wheel alignment gauge attachment	Wheel alignment measurement〈Vehicles with aluminium wheels〉
	A：MB991237 B：MB991238	A: Spring compressor body B: Arm set	Coil spring compression
	MB991680 A：MB991681 B：MB991682	Wrench set	Strut assembly disassembly and reassembly
	MB991006	Preload socket	Lower arm ball joint rotation starting torque measurement

	MB990800	Ball joint remover & installer	Lower arm ball joint dust cover press-in
	MB990883	Rear suspension bushing arbor	Lower arm bushing removal and press-fitting
	MB990971	Rear wheel bearing & installer joint	
	MB990887	Ring	
	MB990890	Rear suspension bushing base	
	MB991406 , MB990635 or MB991113	Steering linkage puller	Tie rod end and knuckle disconnection

14A.4 On-Vehicle Service

1. WHEEL ALIGNMENT CHECK AND ADJUSTMENT

1) The front suspension, steering system, and wheels should be serviced to normal condition prior to measurement of wheel alignment.

2) Measure the wheel alignment with the vehicle parked on a level surface.

(1) TOE-IN

Standard value：1±2mm

① Adjust the toe-in by undoing the clip and lock nut（14A-1）, and turning the left and right tie rod turnbuckles by the same amount(in opposite directions).

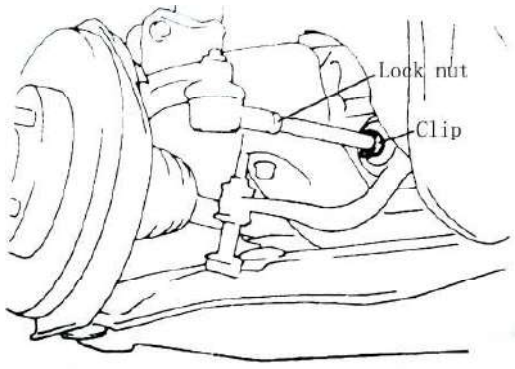


Fig.14A-1

② Use a turning radius gauge to check that the steering angle is at the standard value.

(2)CAMBER AND CASTER

CAMBER

Standard value： 0° 10′ ±30′（difference between right and left wheels must be less 30′ ）

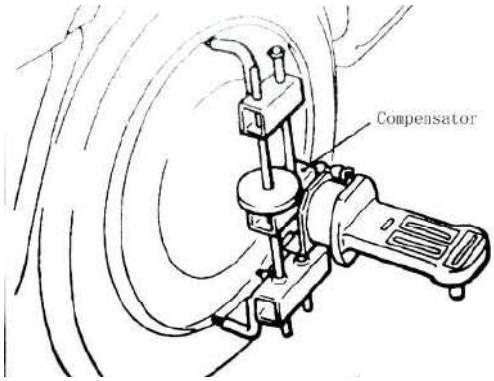


Fig.14A-2

CASTER

Standard value： 2° 50′ ±30′ （difference between right and left wheels must be less 30′ ）

1) Camber and caster are preset at the factory and cannot be adjusted.

2) For vehicles with aluminium wheels, attach the camber/caster gauge by using a compensator or special tool(MB991004). The special tool must be tightened to the drive shaft to the same torque 226±**49N.m as the drive shaft nut.（Fig.14A-2）**

Caution

To prevent the wheel bearing from damage, never subject the wheel bearing to the vehicle load when the drive shaft nuts are loosened.

(3) SIDE SLIP

Standard value:0±3mm(per 1m)

2. BALL JOINT DUST COVER CHECK

(1) Check the dust cover for cracks or damage by pushing it with finger.

(2)If the dust cover is cracked or damaged, replace the lower arm assembly.

Cracks or damage of the dust cover may cause damage of the ball joint.

14A.5 Strut Assembly

1. REMOVAL AND INSTALLATION

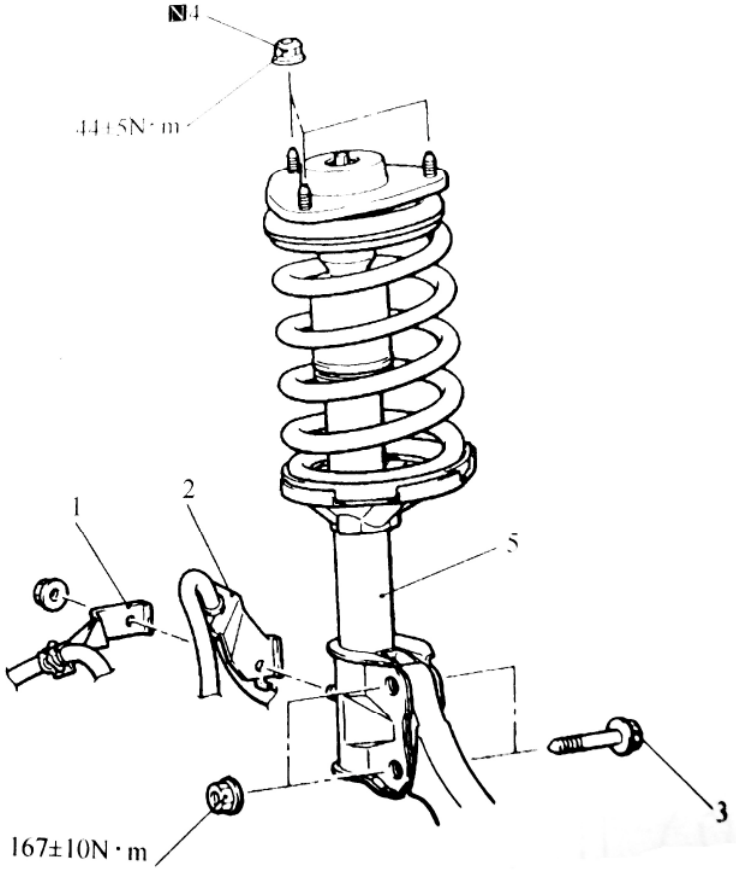


Fig.14A-3

Removal steps(Fig.14A-3)

1. Front wheel speed sensor harness bracket
2. Brake hose bracket
3. Knuckle connection
4. Strut mounting nut
5. Strut assembly

2. DISASSEMBLY AND REASSEMBLY

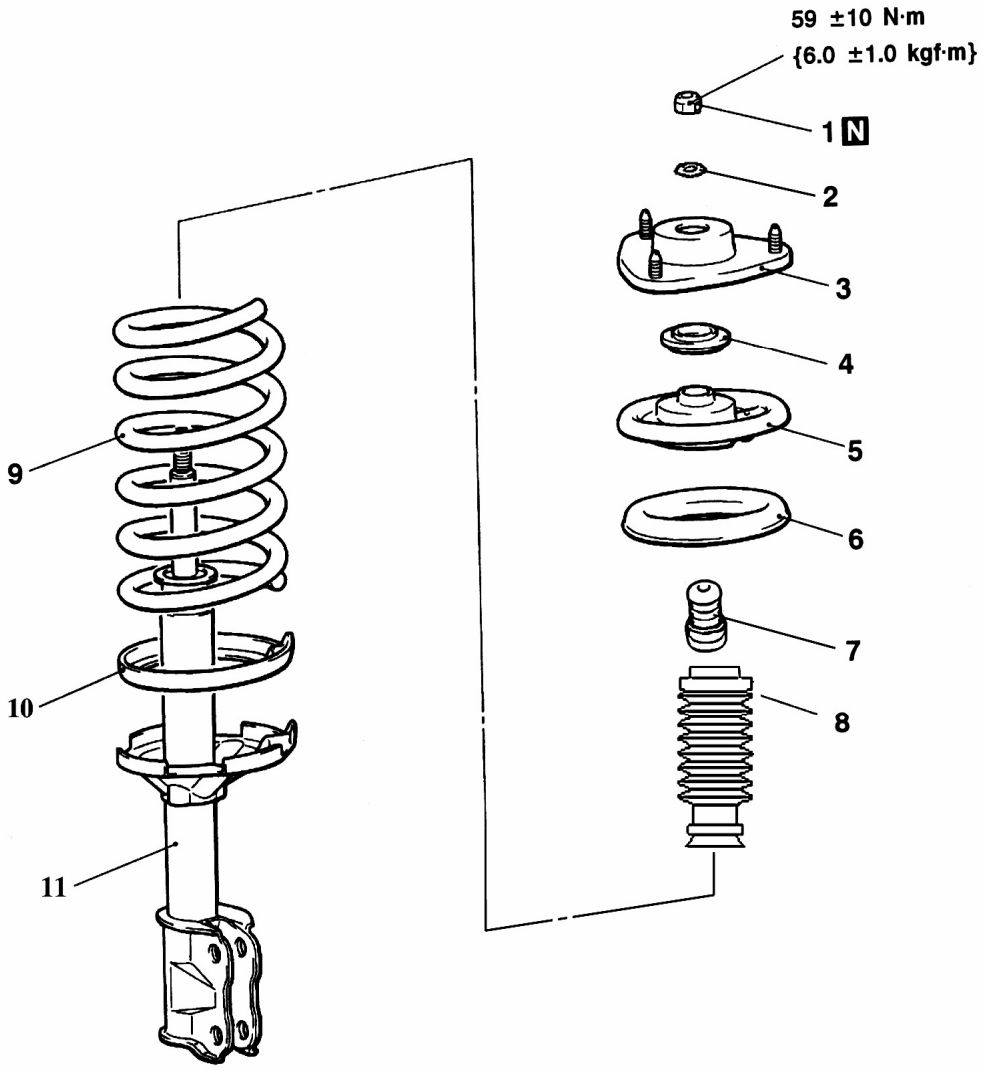


Fig.14A-4

Disassembly steps(Fig.14A-4)

1. Self-locking nut
2. Washer
3. Strut insulator assembly
4. Bearing
5. Upper spring seat
6. Upper spring pad
7. Bump rubber
8. Cover dust
9. Coil spring
10. Lower spring pad
11、Strut assembly

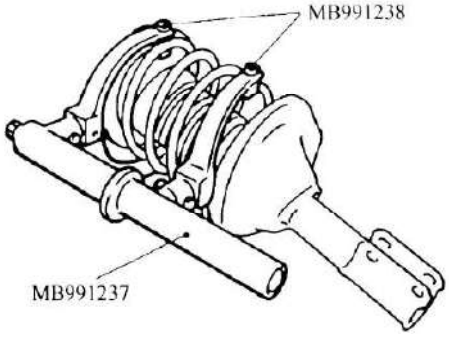


Fig.14A-5

DISASSEMBLY SERVICE POINT

1) SELF-LOCKING NUT ROMOVAL

(1) Use the special tools to compress the coil spring.(Fig.14A-5)

Caution

(1) Install the special tools evenly, and so that the maximum length will be attained within the installation range.

(2) Do not use an impact wrench as it will cause the bolt of the special tool to be seized.

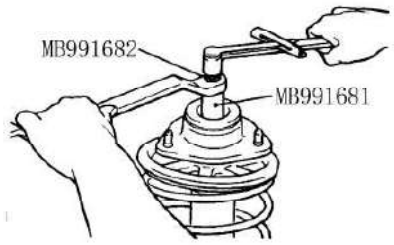


Fig.14A-6

(2) Using the special tools, loosen the self-locking nut.(Fig.14A-6)

Caution

To prevent the piston rod lock nut inside the strut from loosening, do not use an impact wrench when the self-locking nut is loosened.

2) **STURT ASSEMBLY REMOVAL**

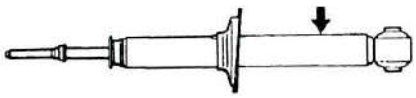


Fig.14A-7

To discard the strut assembly, place the assembly horizontally with its piston rod extended. Then drill a hole approx. 3 mm in diameter at the location shown in the illustration and discharge the gas.(Fig.14A-7)

Caution

The gas itself is harmless but it may issue out of the hole together with chips generated by the drill. Therefore, be sure to wear goggles.

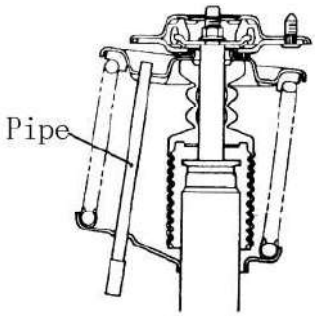


Fig.14A-8

REASSEMBLY SERVICE POINT

1) **SELF-LOCKING NUT INSRTALLATION**(Fig.14A-8,Fig.14A-9)

(1) Ensure that the bearing is seated correctly.

(2) While the coil spring is being compressed by the special tools, provisionally tighten the self-locking nut. Do not use an impact wrench as it will cause the bolt of the special tool to be seized.

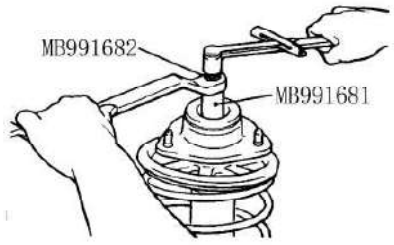


Fig.14A-9

(3) Align the hole in the strut assembly lower spring seat with the hole in the upper spring seat. (Using a pipe as shown facilitates the alignment)

(4) Correctly align both ends of the coil spring with the grooves in the spring seat, and then loosen the special tools.

(5) Using the special tools, tighten the self-locking nut to the specified torque.

Specified torque: 59±10N · m.

Caution

To prevent the piston rod lock nut inside the strut from loosening, do not use an impact wrench when the self-locking nut is tightened.

14A.6 Lower Arm Assembly

1. REMOVAL AND INSTALLATION

Caution

To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.

Post-installation Operation

- Check the dust cover for cracks or damage by pushing it with finger.
- Wheel alignment check and adjustment.

1) Removal steps (Fig.14A-10)

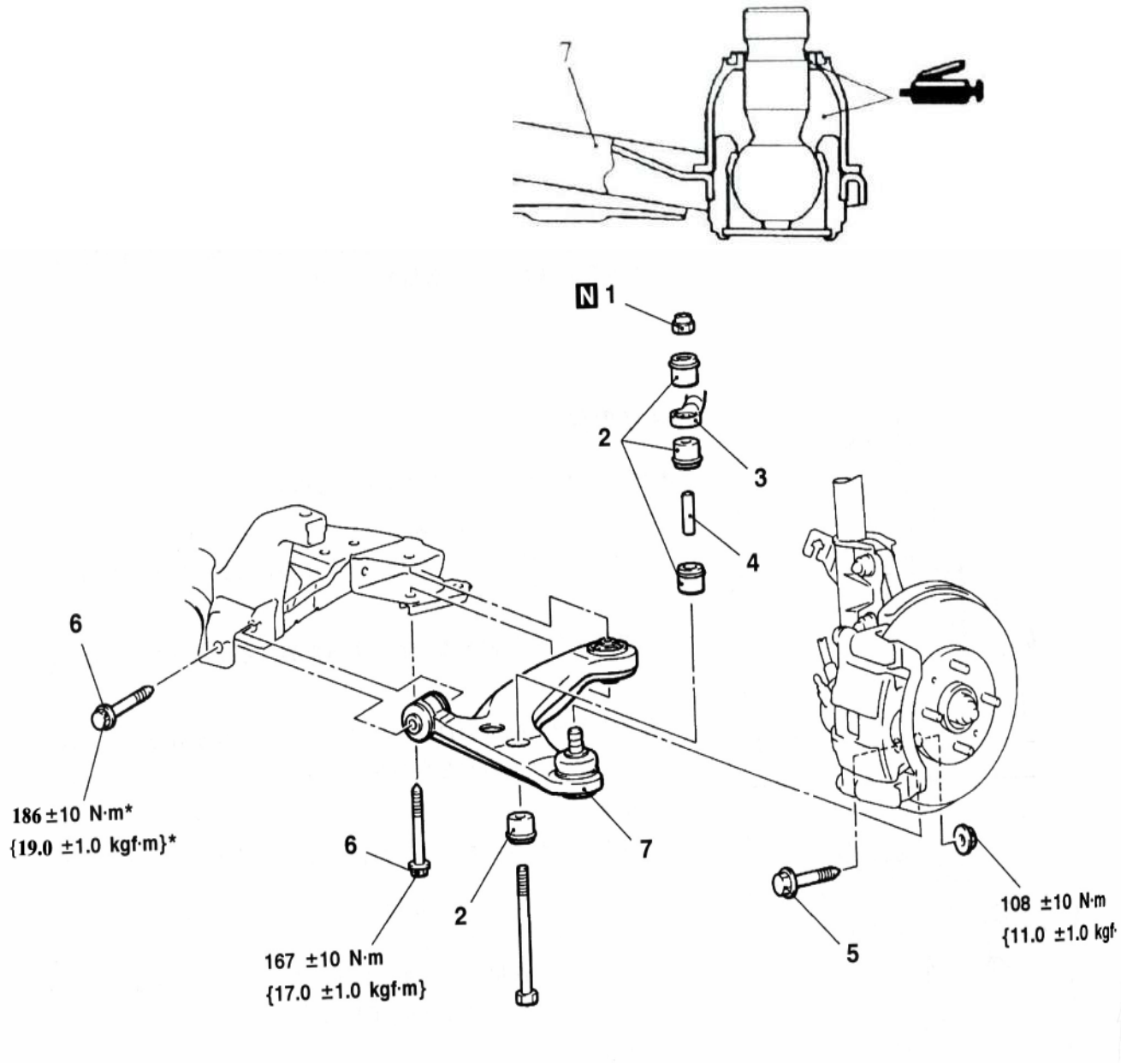


Fig.14A-10

1. Self-locking nut
2. Stabilizer rubber
3. Stabilizer bar
4. Collar
5. Lower arm and knuckle connection
6. Lower arm and crossmember connection
7. Lower arm assembly

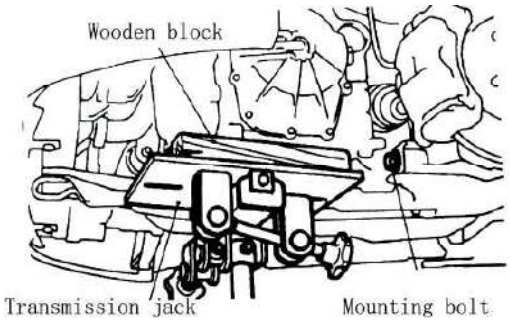


Fig.14A-11

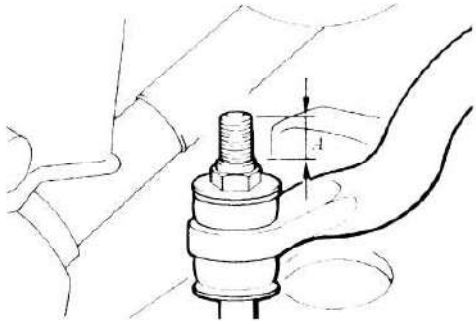


Fig.14A-12

2) REMOVAL SERVICE POINT

LOWER ARM AND CROSSMEMBER DISCONNECTION（Fig.14A-11)

Lift the transmission with a transmission jack, and then withdraw the front mounting bolt on the left lower arm assembly.

3) **INSTALLATION SERVICE POINT**

Tighten the self-locking nut until the bolt protruding length meets the standard value.(Fig.14A-12)

Standard value(A)：20.5～23.5mm

4) INSPECTION

(1)LOWR ARM BALL JOINT ROTATION STARTING TORQUE CHECK(Fig.14A-13)

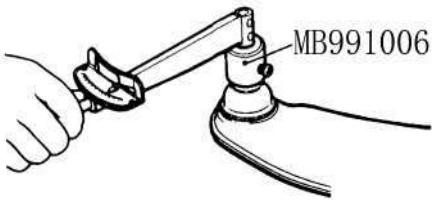


Fig.14A-13

1)After shaking the ball joint stud several times, use the special tool to measure the rotation starting torque of the lower arm ball joint.

Standard value：0～3.9N · m

2) When the measured value exceeds the standard value, replace the lower arm assembly.

3) When the measured value is lower than the standard value, check that the lower arm ball joint turns smoothly without excessive play. If there is no excessive play, the ball joint can be reused.

2) LOWER ARM BALL JOINT DUST COVER CHECK

1）Check the dust cover for cracks or damage by pushing it with finger.

2）If the dust cover is cracked or damaged, replace the lower arm.

> Caution:
>
> If the dust cover is cracked or damaged, it is possible that there may also be damage to the ball joint. When it is damaged during service work, replace the dust cover.

(3) LOWER ARM BALL JOINT DUST COVER REPLACEMENT

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows: (Fig.14A-14)

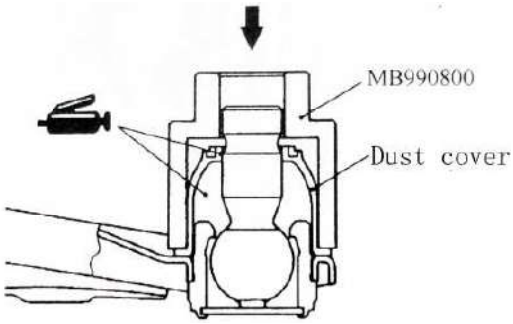


Fig.14A-14

(1)Remove the dust cover.

(2)Apply multipurpose grease to the lip and inside of the dust cover.

3) Using the special tool, press the dust cover until it contacts the lower arm assembly.

(4) Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.

(4)LOWER ARM BUSHING REPLACEMENT (Fig.14A-15,Fig.14A-16,Fig.14A-17)

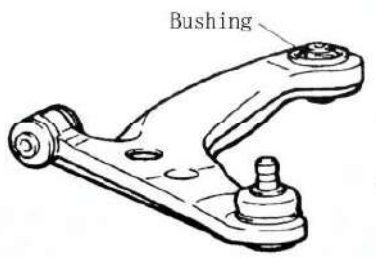


Fig.14A-15

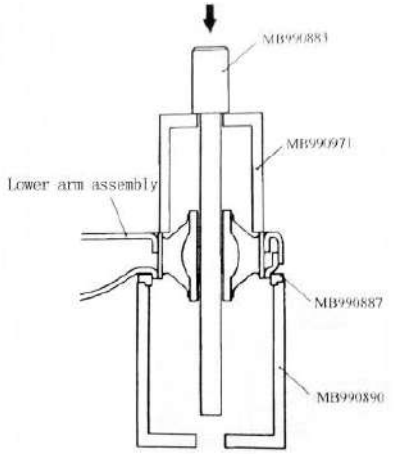


Fig.14A-16

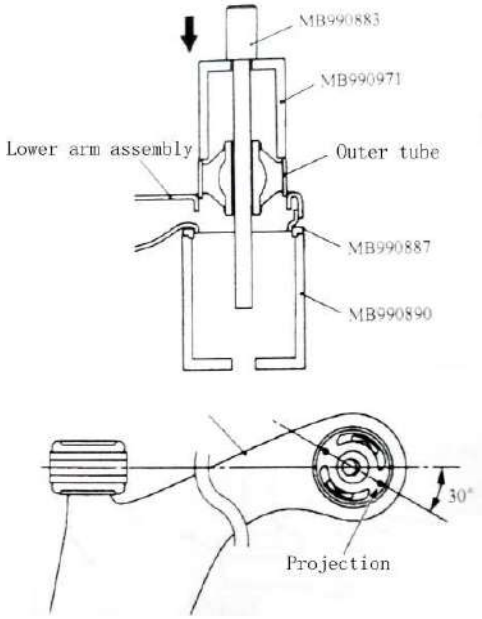


Fig.14A-17

Replace the bushing as follows:

①Using the special tools to drive out the bushings

②Use the special tool to press in the bushing.

③ Position the bushing so that its projection is as shown in fig. 14A-17.

④ Press the bushing until its outer tube is flush with the lower arm assembly surface.

14A.7 Stabilizer Bar

1.REMOVAL AND INSTALLATION

Caution:

1.Before removing the steering wheel and air bag module assembly, refer to GROUUP 19-Service Precautions and Air Bag Module and Clock Spring. And put the front wheels in straight-ahead position. Failure to do so may damage the SRS clock spring and render the SRS air bag inoperative, which results serious driver injury.

2.To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and

Post-installation Operation

Pre-removal Operation
- Steering wheel and Air Bag Module Assembly Removal
- Centermember Removal
- Front Exhaust Pipe Removal

- Front Exhaust Pipe Installation
- Centercross Installation
- Steering Wheel and Air Bag Module Assembly Installation
- Check the Dust Cover for Cracks or Damage by pushing it with Finger
- Check Steering Wheel Position with Wheels Straight Ahead
- Front Wheel Alignment Check and Adjustment

Removal steps(Fig.14A-18)

1) **REMOVAL SERVICE POINT**

(1) TIE ROD ENG AND KNUCKLE DISCONNECTION(Fig.14A-19)

Caution

1. To prevent ball joint thread from damage, the tie rod end mounting nut must be only loosened but not removed from the ball joint. Be sure to use the special tool.
2. Hang the special tool with a cord to prevent special tool from falling.

(2)FIXTURE/BUSHING/STABILIZER BAR REMOVAL

Carry out the following operations to ensure working space in order to remove the fixture, the bushing and the stabilizer bar. (Fig.14A-20)。

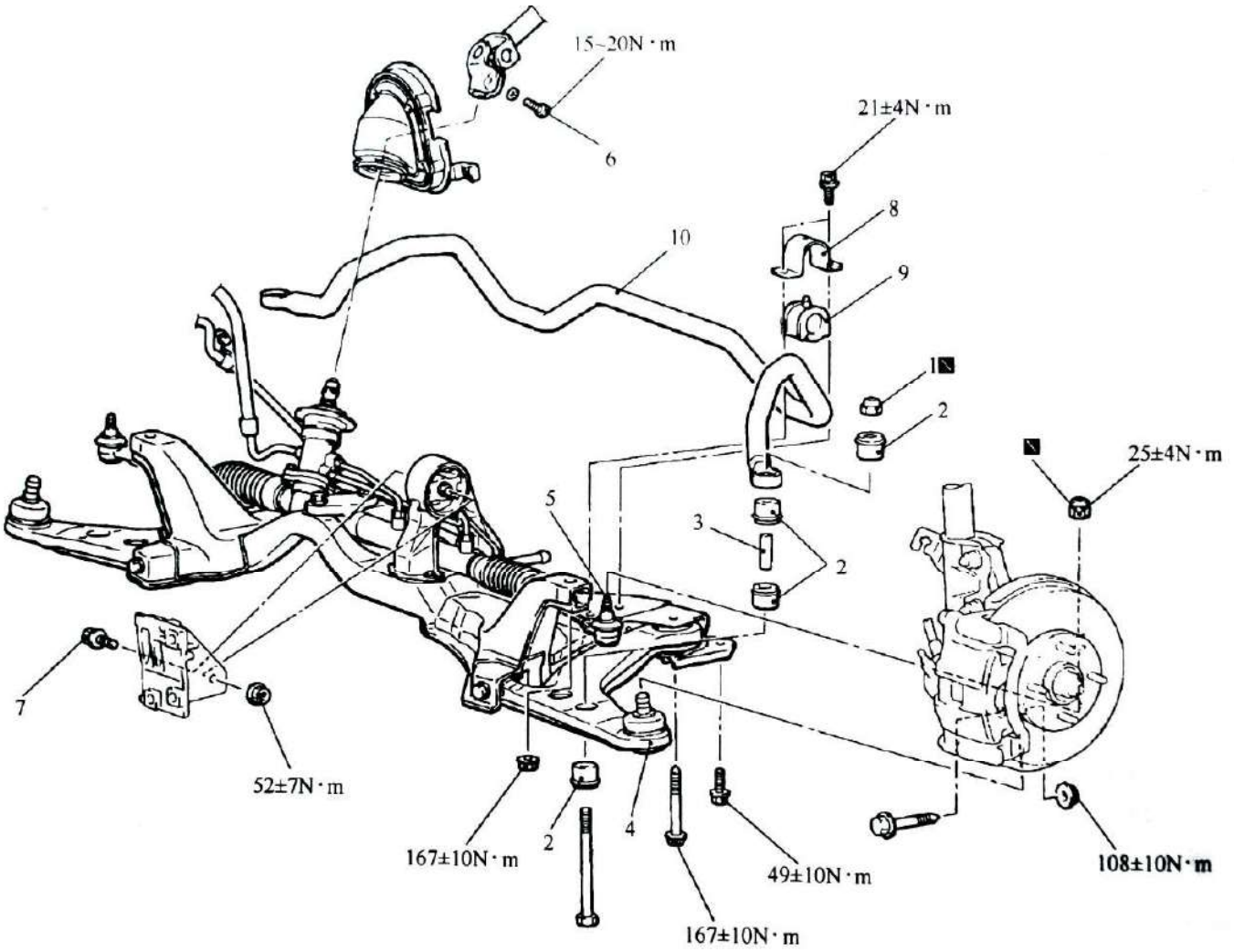


Fig.14A-18

1. Self-locking nut2. Stabilizer rubber3. Collar4. Lower arm and knuckle connection 5.Tie rod end and knuckle connection6. Steering gear and joint connecting bolt7. Rear roll stopper connecting bolt8. Fixture9. Bushing10. Stabilizer bar

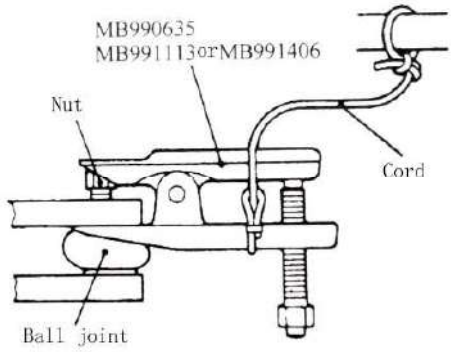


Fig.14A-19

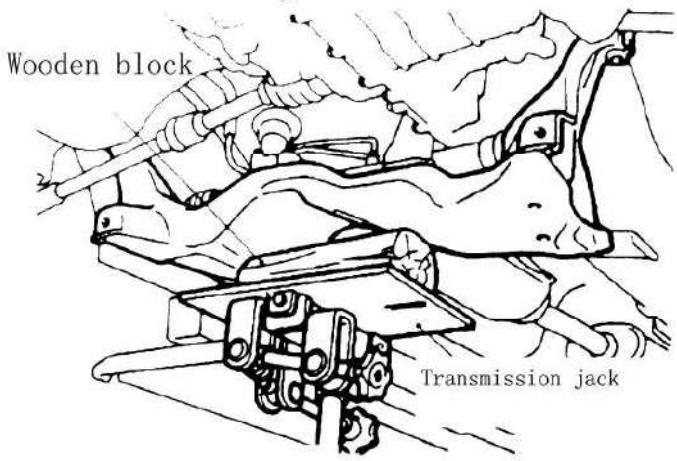


Fig.14A-20

a Use a transmission jack to hold the crossmember, and then remove the crossmember mounting nuts and bolts.

b Lower the crossmember until the fixture, the bushing and the stabilizer bar can be removed.

Caution
Be careful not to lower the crossmember excessively, otherwise the power steering return hose bracket may deform.

2)INSTALLATION SREVICE POINT

(1)STABILIZER BAR/BUSHING/FIXTURE INSTALLATION

Align the stabilizer bar identification mark with the right end of the bushing.(Fig.14A-21)

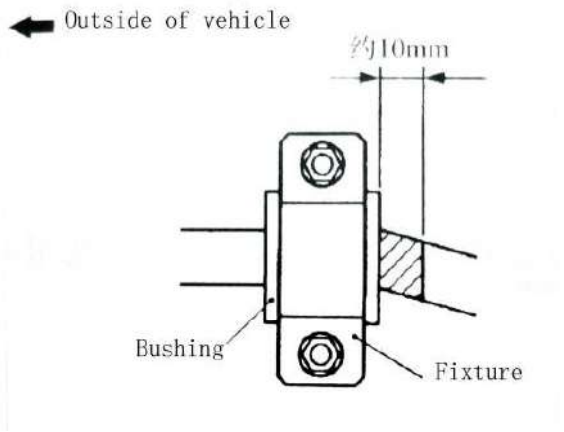


Fig.14A-21

(2)SELF-LOCKING NUT INSTALLATION

Tighten self-locking bolt until the protruding length meets the standard value(Fig.14A-22)

Standard value（A）：20.5～23.5mm

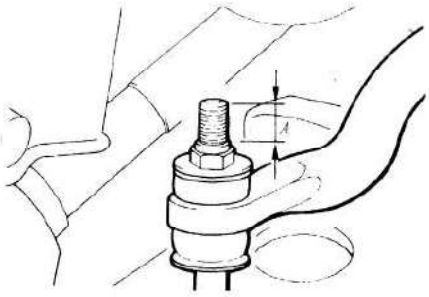


Fig.14A-22

14B Rear Suspension

14B.1 Service Specification

Table 14B-1

Items	Standard value
Toe-in(mm)	3±2
Camber	-0° 40′ ±30′ （difference between right and left wheels: less than 30′ ）
Slid slip	0° 00′ ±0° 09′
Protruding length of stabilizer link thread (mm)	6~8
ball joint rotation torque of stabilizer link(N. m)	0.5~1.5

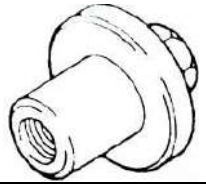
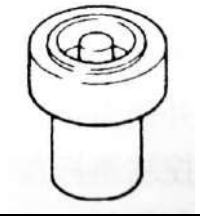
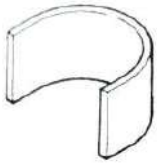
14B.2 Grease

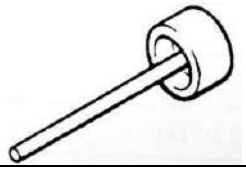
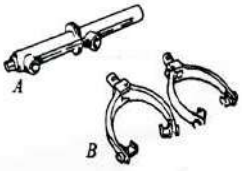
Table 14B-2

Items	Specified lubricant	Quantity
The lip and inside of the dust cover. of stabilizer link ball joint	Multipurpose grease	As required

14B.3 Special Tools

Table 14B-3

Tool	Number	Name	Use
	MB991004	Wheel alignment gauge attachment	Wheel alignment measurement(Vehicle with aluminium wheels)
	MB991447	Bushing remover and installer	Lower arm bushing removal and pressing and press-fitting
	MB991448	Bushing remover and installer base	
	MB991449	Bushing remover and installer supporter	

	MB991444	Bushing remover and installer arbor	Trailing arm bushing removal and press fitting
	MB991445	Bushing remover and installer base	
	MB991446	Bushing remover and installer sleeve	Trailing arm bushing removal and press fitting
	A：MB991237 B：MB991239	A ： Spring compressor body B：Arm set	Coil spring compression

14B.4 On-Vehicle Service

1.WHEEL ALIGNMENT CHECK AND ADJUSTMENT

• The rear suspension, wheels and tyres should be serviced to normal condition prior to measurement of wheel alignment.

• Measure the wheel alignment with the vehicle parked on a level surface.

(1) **TOE-IN**

Standard value：3±2mm

If toe-in is not within the standard value, adjustment by following procedures.

1) Be sure to adjust the camber before making toe adjustment.

2) Carry out adjustment by turning the toe adjusting bolt(control link mounting bolt which is located on the inner side of the body) (14B-1)：

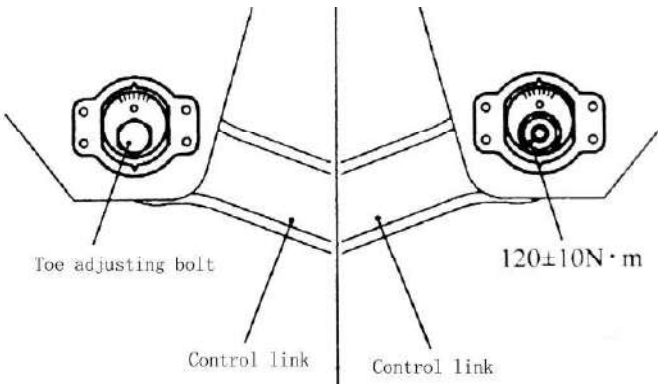


Fig.14B-1

Left wheel：Turning clockwise (+) toe-in

Right wheel：Turning clockwise(－) toe-in

NOTE

The scale has gradations of approximately 2.6mm(single side toe angle equivalent to 16')

(2) CAMBER

Standard value：-0° 40′ ±30′

For vehicle with aluminium wheels, attach the camber gauge by using a compensator or special tool. （The special tool must be tightened to the trailing arm spindle to the specified torque 172± 25N.m.（14B-2）

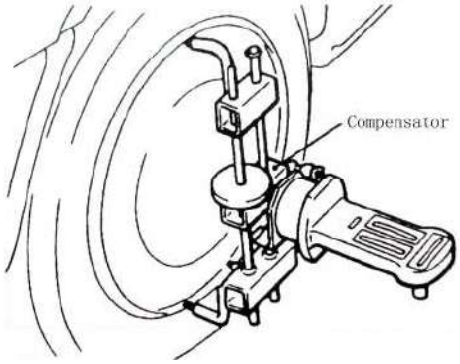


Fig.14B-2

Caution：

To prevent the wheel bearing from damage, never subject the wheel bearings to the vehicle load when the self-locking nuts are loosened.

If camber is not within the standard value, adjust by following procedures. (Fig.14B-3)：

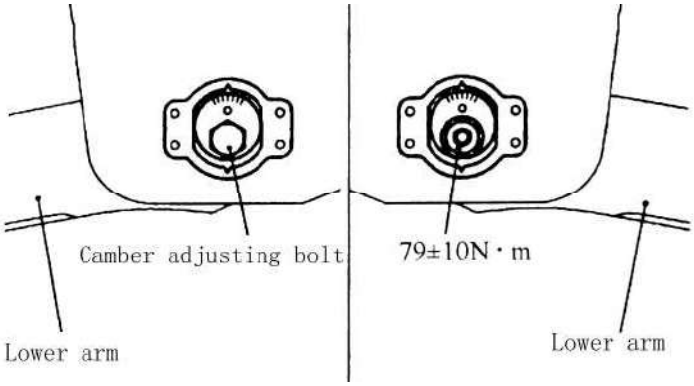


Fig.14B-3

1) Disconnect the conjunction of the control link and the trailing arm.
2) Carry out adjustment by turning the camber adjusting bolt（lower arm mounting bolt which is located on the inner side of the body）.

Left wheel：Turning clockwise (+) camber

Right wheel：Turning clockwise(－) camber

The scale has gradations of approximately 14’.

3) Tighten control link to the trailing arm(Fig.14B-4)

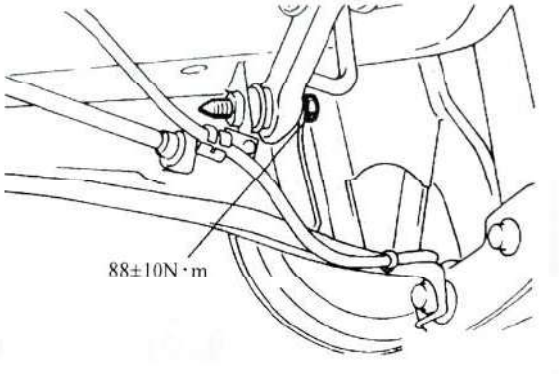


Fig.14B-4

4)After adjusting the camber, the toe should be adjusted.

2. BALL JOINT DUST COVER CHECK

（1） Check the dust cover for cracks or damage by pushing it with finger.

(2) If the dust cover is cracked or damaged, replace the stabilizer link..

14B.5 Control Link/Upper Arm/Lower Arm

1. REMOVAL AND INSTALLATION (Fig.14B-5)

Caution **To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground I the unladen condition.**

Post-installation operation Wheel Alignment Check and Adjustment.

Control link/Upper arm removal

1. **Control link**
2. **Upper arm**

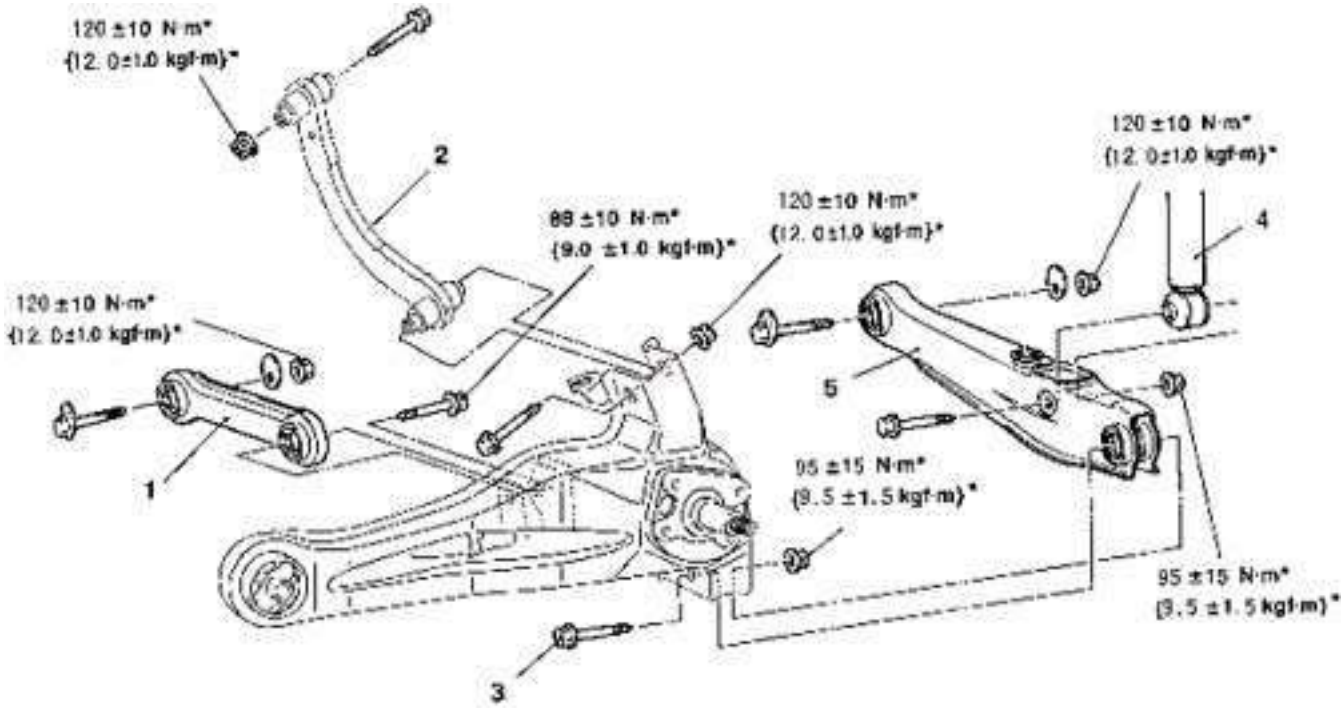


Fig.14B-5

Lower arm removal steps

3. Stabilizer link connection
4. Lower arm and trailing arm connection
5. Shock absorber connection
6. Lower arm

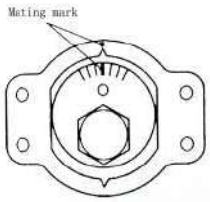


Fig.14B-6

1）REMOVAL SERVICE POINTS

(1)CONTROL LINK/LOWER ARM REMOVAL

After making a mating mark on the toe-in or camber adjusting bolt, remove the control link or lower arm. (Fig.14B-6)

(2)UPPER ARM REMOVAL

After supporting the lower arm with a jack, (Fig.14B-7)，separate the upper arm and the trailing arm.

(3) LOWER ARM AND TRAILING ARM DISCONNECTION

After supporting the lower arm with a jack, separate the lower arm and the trailing arm.

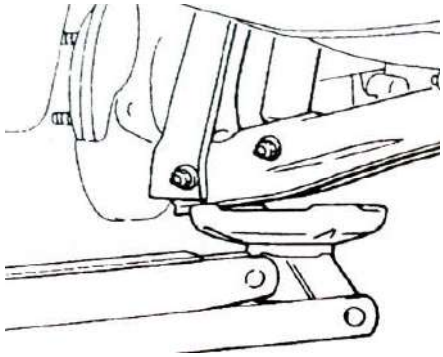


Fig.14B-7

2）INSTALLATION SERVICE POINT

(1) STABILIZER LINK INSTALLATION

Tighten self-locking bolt until the protruding length meets the standard value (Fig.14B-8)

Standard value（**A**）：**6～8mm**

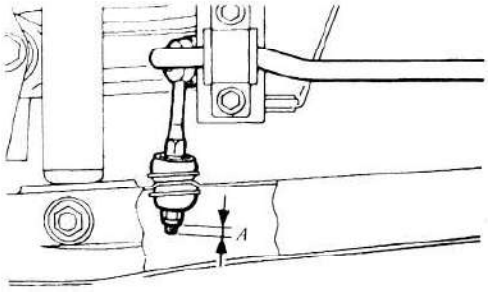


Fig.14B-8

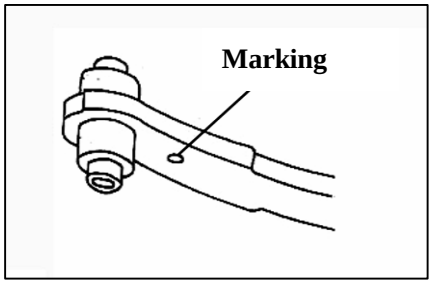


Fig.14B-9

(2)UPPER ARM INSTALLATION

Install the upper arm so that its hole faces inside of the vehicle. (Fig.14B-9)

2.LOWER ARM BUSHING R EPLACEMENT

Use the special tools to drive and press fit the lower arm bushing. (Fig.14B-10，Fig.14B-11)

Caution

Because the outside diameter of both edges of the bushing are different, be careful not to mistake the direction when driving out an d press fitting.

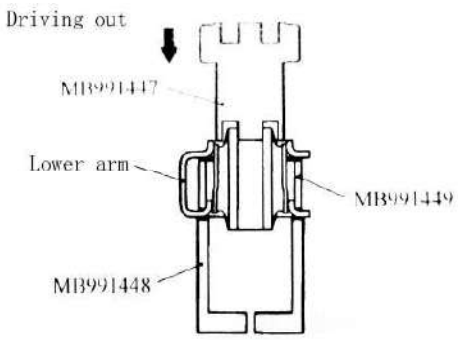


Fig.14B-10

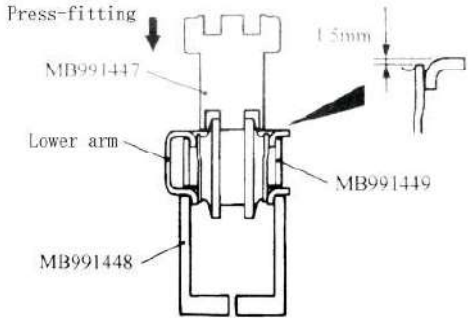


Fig.14B-11

14B.6 Trailing Arm

1. REMOVAL AND INSTALLATION

Caution
To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground I the unladen condition.

Pre-removal and Post-installation Operation
Rear Hub Assembly Removal an Installation

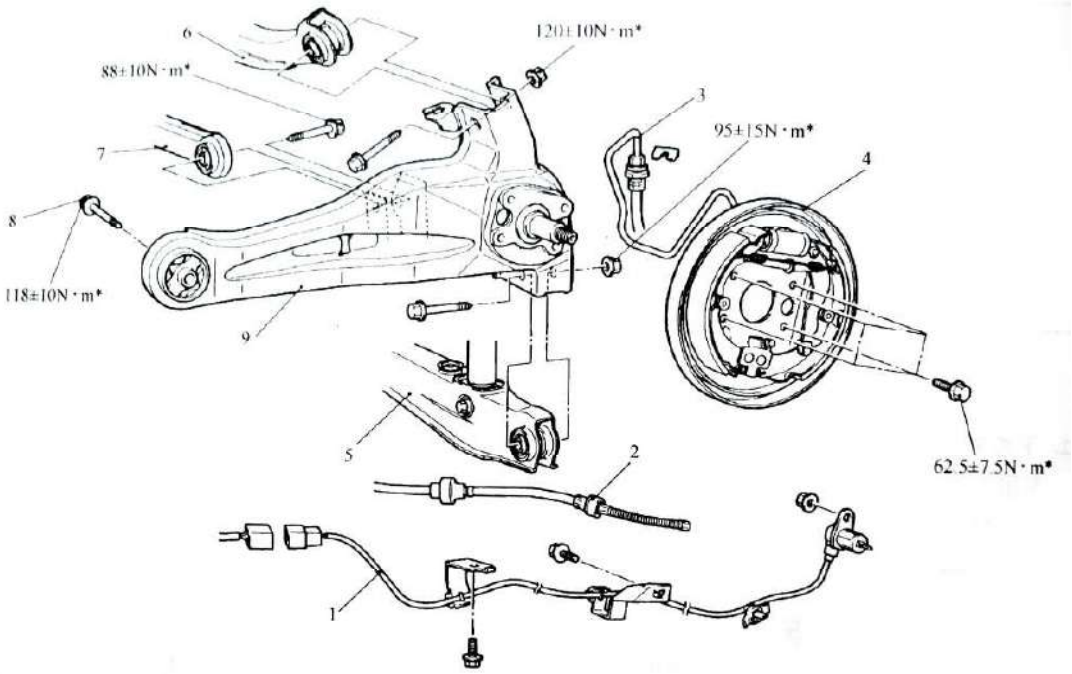


Fig.14B-12

Removal steps (Fig.14B-12)

- Lifting point connection.

1. Rear wheel speed sensor
2. Parking brake cable connection
3. Brake hose and trailing arm
4. Rear brake assembly
5. Lower arm and trailing arm connection

6.Upper arm and trailing arm connection
7. Control link and trailing arm connection
8. Trailing arm and body connecting bolt
9.Trailing arm

REMOVAL SERVICE POINTS

(1) LIFTING POINT

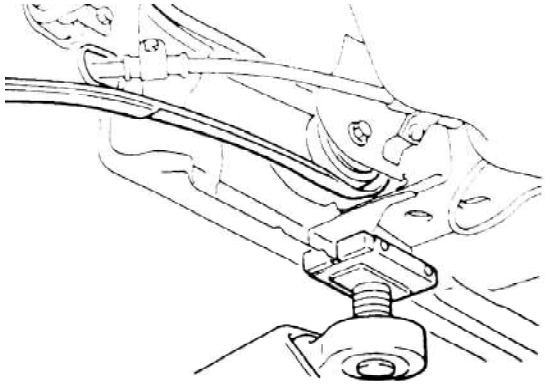


Fig.14B-13

When removing the trailing arm, move the lifting arm slightly towards the front of the vehicle so that it will not be in the way.(Fig.14B-13)

(2)**REAR BRAKE ASSEMBLY REMOVAL**

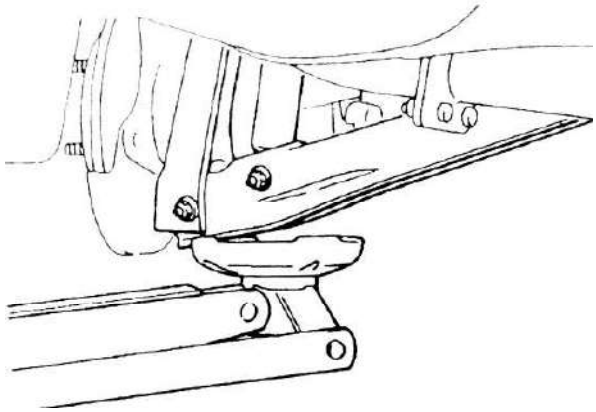


Fig.14B-14

After removing the rear brake assembly, suspend it to the body with a cord to prevent it from dropping.

Caution
Be careful not to bend the brake pipe when suspending the rear brake assembly.

(3) LOWER ARM AND TRAILING ARM DISCONNECTION

After supporting the lower arm with a jack, separate the lower arm and trailing arm connection.(Fig.14B-14)

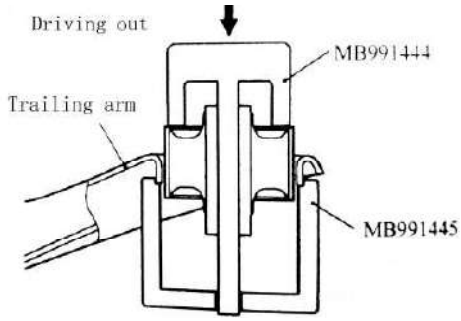


Fig.14B-15

2. TRAILING ARM BUSHING REPLACEMENT

(1) Use the special tools to drive out the trailing arm bushing. (Fig.14B-15)

(2) Set the installation direction and installation location of the trailing arm bushing.

1) Place the long projection end of the trailing arm bushing inner pipe towards the inside of the vehicle.

2) Make sure that the hollow of the railing arm bushing is located as shown in the illustration.(Fig.14B-16)

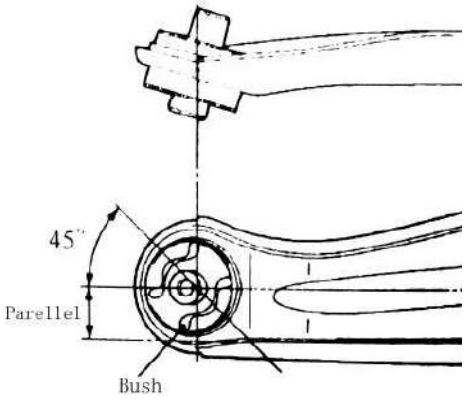


Fig.14B-16

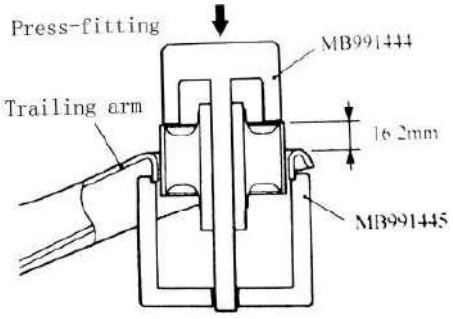


Fig.14B-17

(3)Using the special tool, press the trailing arm bushing into the position shown.(Fig.14B-17)

14B.7 Shock Absorber Assembly

1. REMOVAL AND INSTALLATION

Caution
To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground I the unladen condition.

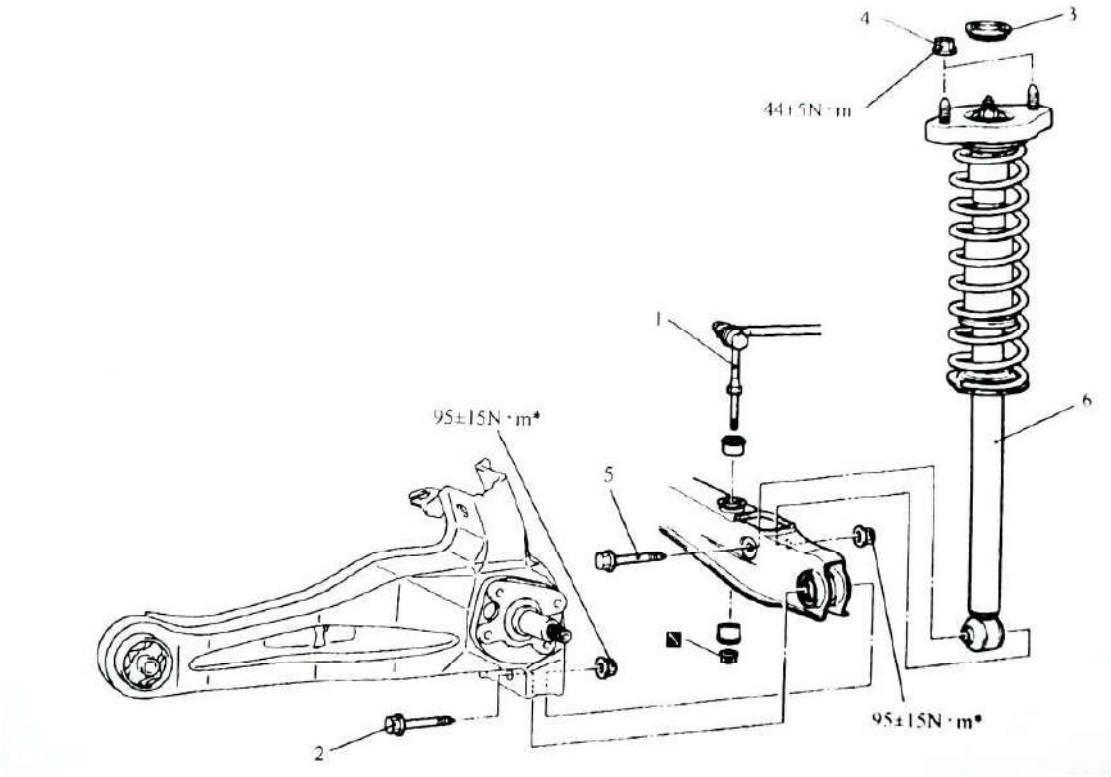


Fig.14B-18

Removal steps (Fig.14B-18)

1. Lower arm and trailing arm connection
2. Shock absorber mounting nut
3. Shock absorber and lower arm connecting bolt
4. Shock absorber assembly

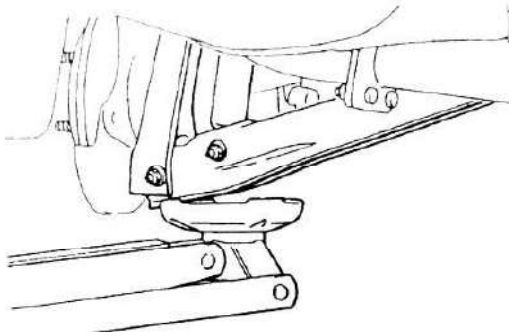


Fig.14B-19

1）REMOVAL SERVICE POINT

LOWER ARM AND TRAILING ARM DISCONNECTION

After supporting the lower arm with a jack, seperate the lower arm and trailing arm

connection(Fig.14B-19).

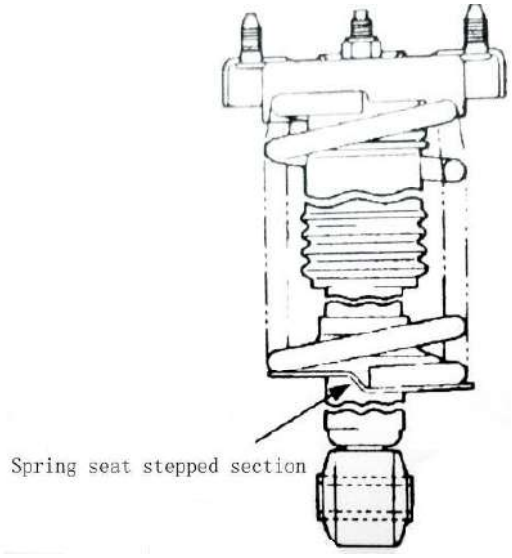


Fig.14B-20

2）INSTALLATION SERVICE POINTS

(1)SHOCK ABSORBER ASSEMBLY INSTALLATION

Install the spring seat stepped section so that it points towards the rear side of the vehicle(Fig.14B-20)

(2) STABILIZER BAR LINK INSTALLATION

Tighten self-locking bolt until the protruding length meets the standard value (Fig.14B-21)

Standard value(A)：6~8mm

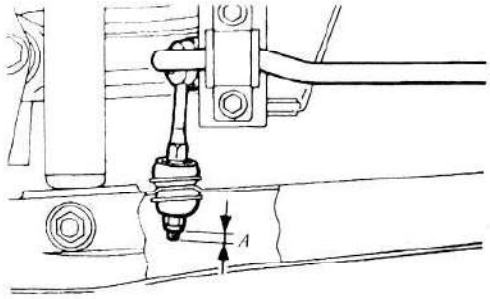


Fig.14B-21

2.DISASSEMBLY AND ASSEMBLY

Disassembly steps(Fig.14B-22)

1. Self-locking nut
2. Washer
3. Upper bushing（A）
4. O ring
5. Bracket assembly
6. Collar
7. Upper spring seat
8. Upper bushing（B）
9. Plate
10. Bump rubber
11. Coil spring
12 .Shock absorber

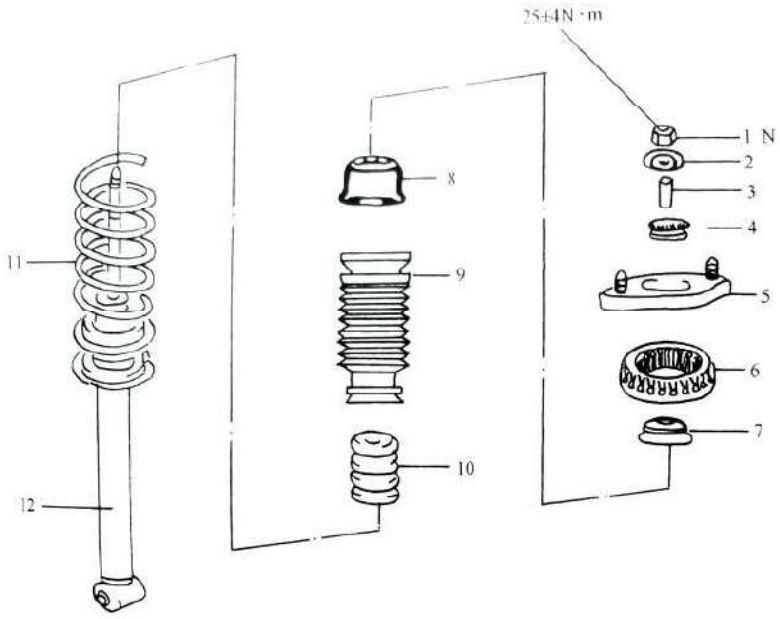


Fig.14B-22

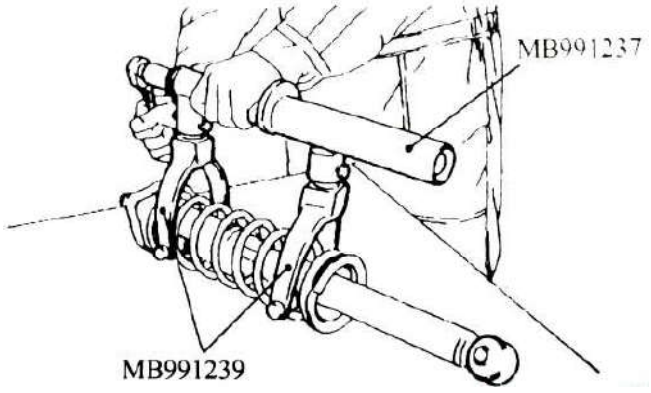


Fig.14B-23

1）DISASSEMBLY SERVICE POINT

(1)SELF-LOCKING NUT REMOVAL

a Use special tools to compress the coil spring. (Fig.14B-23)

Caution (1) Install the special tools evenly, and so that the maximum length will be attained within the installation range. (2) Do not use an impact wrench as it will cause the boltof the special tool to be seized.

b Holding the piston rod, remove the self-locking nut.

Caution
To prevent the piston rod lock nut inside the strut from loosening, do not use an impact wrench when the self-locking nut is loosened.

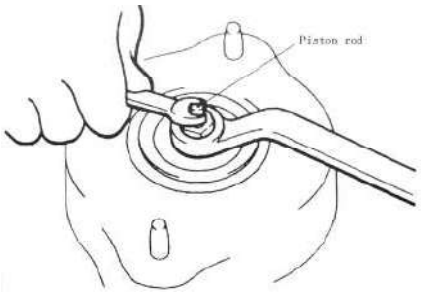


Fig.14B-24

(2)**SHOCK ABSORBER DISASSEMBLY SERVICE POINTS**

To discard the strut assembly, place the assembly horizontally with its piston rod extended. Then drill a hole approx. 3 mm in diameter at the location shown in the illustration and discharge the gas.

Caution

The gas itself is harmless but it may issue out of the hole together with chips generated by the drill. Therefore, be sure to wear goggles.

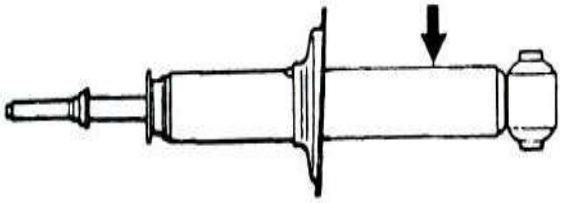


Fig.14B-25

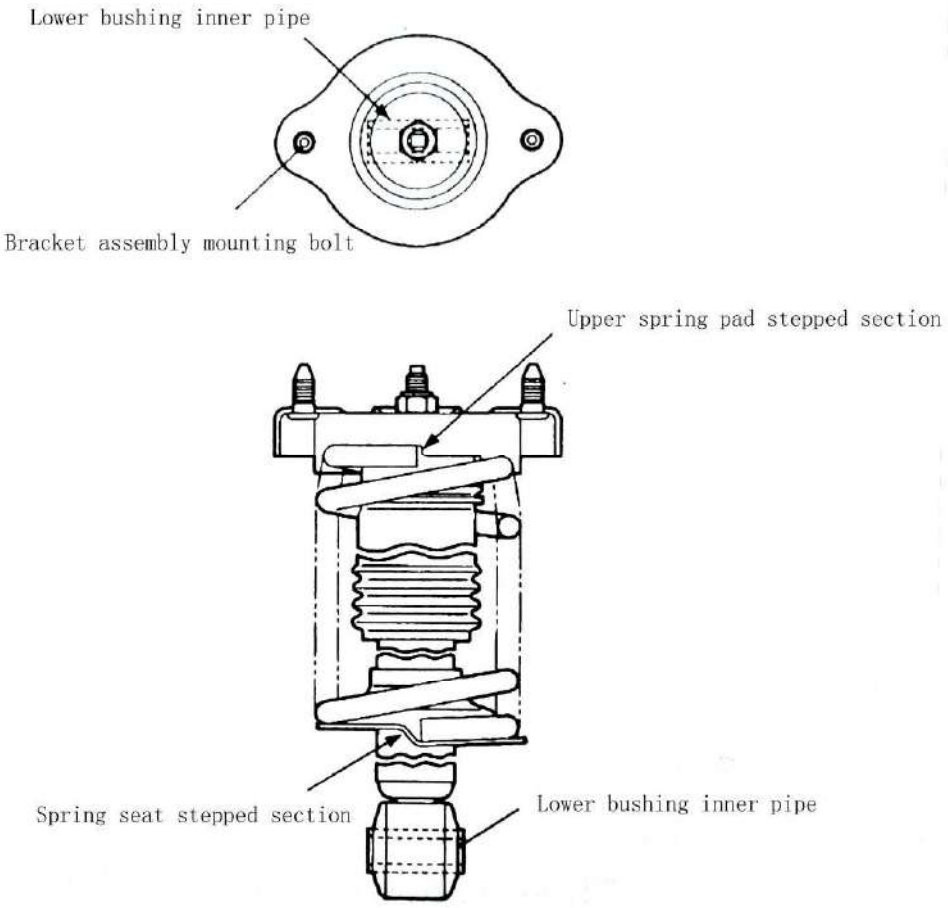


Fig.14B-26

2）REASSEMBLY SERVICE POINTS(Fig.14B-26)

(1)**COIL SPRING INSTALLATION**

a Use the special tools to compress the coil spring.

Caution **Do not use an impact wrench as it will cause the bolt of bolt of the special tool to be seized.**

b Align the end of the coil spring with the stepped section of the spring seat of the shock absorber.

(2)**UPPER SPRING PAD INSTALLATION**

Align the stepped section of the upper spring pad with the end of the coil spring, and install the upper spring pad.

(3) **BRACKET ASSEMBLY INSTALLATION**

Installation the bracket assembly so that the lower bushing inner pipe of the shock absorber and the line between the bracket mounting bolts are straight when looking from above.

(4) **SELF-LOCKING NUT INSTALLATION**

a Provisionally tighten the self-locking nut.

b After removing the special tools(MB991237，MB991239）, tighten the self-locking nut to the specified torque.

Specified torque:25±4N.m

Caution
To prevent the piston rod lock nut inside the strut from loosening, do not use an impact wrench when the self-locking nut is tightened.

14B.8 Stabilizer Bar

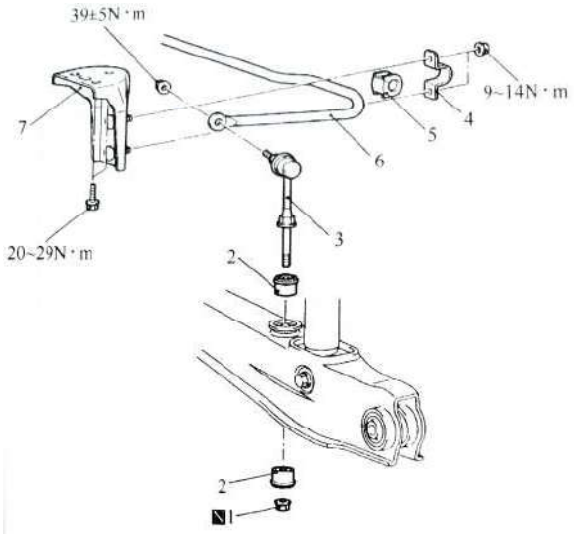


Fig.14B-27

1. REMOVAL AND INSTALLATION

Removal steps (Fig.14B-27)

1. Self-locking nut
2. Stabilizer rubber
3. Stabilizer link
4. Fixture
5. Bushing
6. Stabilizer bar
7. Bracket assembly

INSTALLATION SERVICE POINT

(1) STABILIZER BAR/BUSHING/FIXTURE INSTALLATION

Align the stabilizer bar identification mark with the right end of the bushing.（Fig.14B-28）

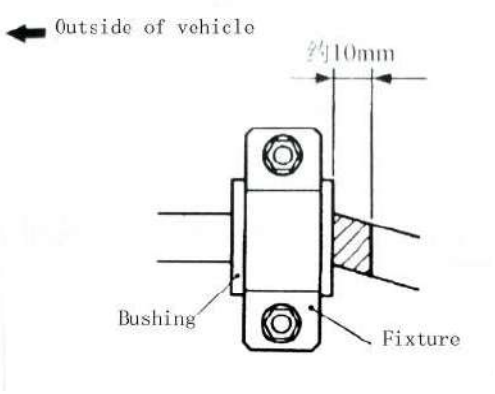


Fig.14B-28

(2) SELF-LOCKING NUT INSTALLATION

Tighten self-locking bolt until the protruding length meets the standard value (Fig.14B-29)

Standard value（A）：6～8mm

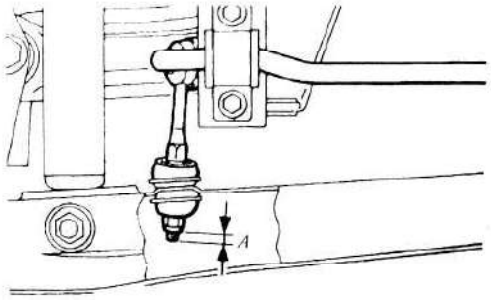


Fig.14B-29

2. CHECK

(1) Check stabilizer bar link ball joint rotation torque.

1) After shaking the ball joint stud several times, and then install nut. Use the special tool to measure the rotation torque of the ball joint.（Fig.14B-30）

Standard value：0.5～1.5N．m

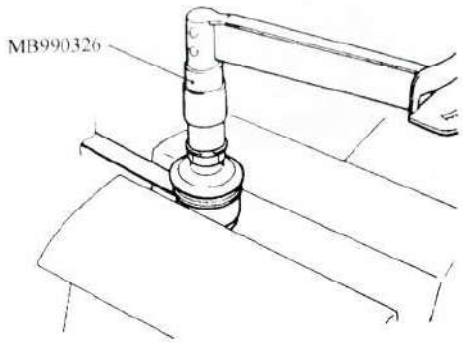


Fig.14B-30

2) When the measured value exceeds the standard value, replace the stabilizer link assembly.

3) When the measured value is lower than the standard value, check that the stabilizer bar link ball joint turns smoothly without excessive play. If there is no excessive play, the ball joint can be reused.

(2) **STABILIZER BAR LINK BALL JOINT DUST COVER CHECK**

1) Check the dust cover for cracks or damage by pushing it with finger.

2) If the dust cover is cracked or damaged, replace the stabilizer bar link.

> Caution
>
> If the dust cover is cracked or damaged, it is possible that there may also be damage to the ball joint. When it is damaged during service work, replace the dust cover.

3. STABILIZER BAR LINK BALL JOINT DUST COVER REPLACEMENT

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows:

1) Remove the dust cover. (Fig.14B-31)

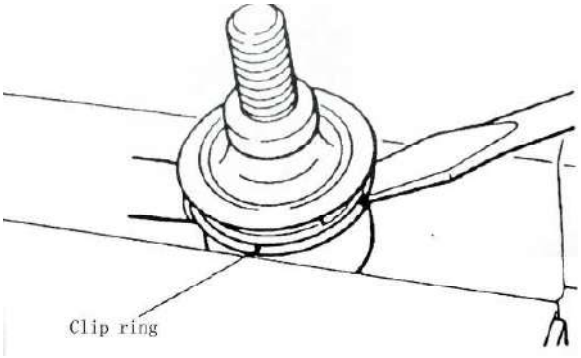


Fig.14B-31

2) Apply multipurpose grease to the lip and inside of the dust cover.

3) Install dust cover onto stabilizer bar link after wrap PVC insulation belt on bolt thread..

4) Fix the dust cover with clip.

5) Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.

15 Wheel and Tyre

15.1 Service Specifications

Table15-1

Tyre size		Standard value	Limit
Tread depth of tyre (mm)		—	1.6
Steel wheel runout (mm)	Radial runout	—	1.2 and less
	Lateral runout	—	1.2 and less
Tyre inflation pressure (kPa)	Front	200±10	—
	Rear	180±10	—

15.2 Wheel and Type Specifications

Table 15-2

Steel wheel size	14×5 1/2 J
Amount of wheel offset (mm)	46±1
Pitch circle diameter（P.C.D） (mm)	100
Tyre size	185/65 R14 86S
Wheel and tyre balance(N·m)	≤0.0172

15.3 On-Vehicle Service

1. TYRE REPLACEMENT

When replacement is required, the specified size tire should be used .replacement tires should be of the same size as those originally equipped on the car, replace two tyres on same axle.

2. WHEEL REPLACEMENT

Wheels must be replaced when they are bend, damaged, and have excessive lateral or radial vibration, or when appeared exposure of welding point, enlargement of bolt holes, and corrosion.

Replacement wheel should be same as original part with load, diameter, rim width, offset and installing style.

3. TYRE INFLATION PRESSURE CHECK

For information on tyre inflation pressure, refer to the label attached near the driver's side door striker.

4 .TYRE WEAR CHECK

Measure the tread depth of tyres

Limit ： 1.6mm

Caution

When the tread depth of tyres is reduced to 1.6mm or less，wear indicators will appear.

5. WHEEL RUNOUT CHECK (see Fig.15-1)

Limit： Lateral runout 1.2mm or less

Radial runout 1.2mm or less

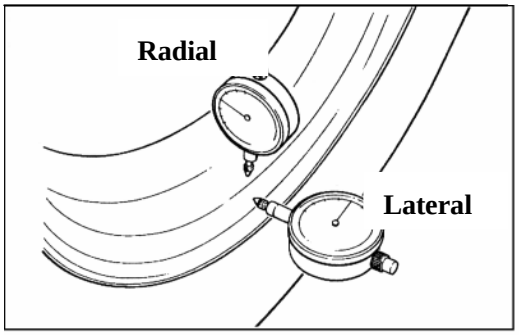


Fig.15-1

6. Tyre Transposition

Tyre position should be changed every 5000Km, for even wear， see Fig.15-2：

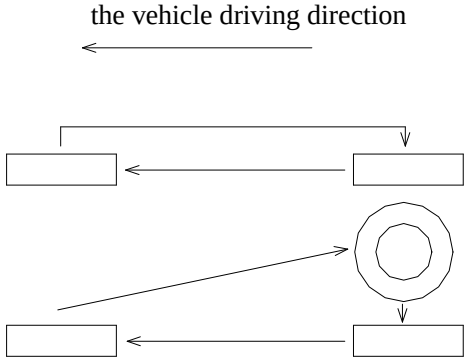


Fig.15-2

15.4 Wheel and Tyre

1. Wheel Replacement

(1) Loosen wheel nut by approximately 180°.

(2)Lift up the car with jack.

(3) Remove wheel tyre.

> Caution
>
> It is unhallowed to heat wheel to loosen wheel, for wheel life reducing and bearing

2. Wheel Installation

Tighten wheel nuts according to the following order, fig.15-3.

Tightening torque: 98±10N·m

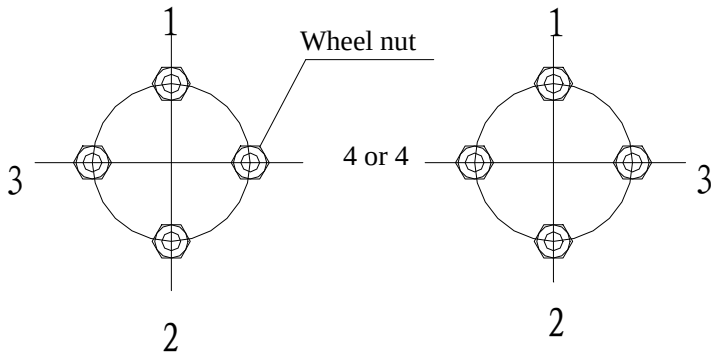


Fig.15-3

CAUTION

Tighten wheel nut according to specified order, avoid bend deformation Of wheel, brake drum, brake disc.

Before installing wheel, remove any buildup of corrosion on wheel mounting surface and brake drum or disc mounting surface with scraper or wire brush.

3. Tyre removal

When replacing tires of wheels, use tire replacing device. Replacing by hand tools or tire lever only can cause damage to tire head and wheel rim.

4. Tyre installation

Before installing tyre using installing device, remove grease、 old rubber、 corrosion on tire head and wheel rim with wire brush or wire cotton, then apply lubrication oil to bead seat of rim. After installing, charge pressure by specified limit so that bead is closely contacted.

After charging, do dynamic balance using balance machine.

Caution

(1)Do not charge overfull, if not, can damage tyre badly.

(2)When charging, if specified pressure can not make tyre and rim contact completely, deflate the tyre, lubricate and recharge.

(3) After inflation, balance adjustment should be carried out. If not, bump and sway will happen while running. Which will affect the lift of wheels, tyres as well as other parts

16 Brake System

16.1 Service Brake System

1. Service specification(see Table 16-1)

Table **16-1**

Items			Standard value	Limit
Brake pedal height (mm)			229.4～232.4	—
Brake pedal free play (mm)			3～8	—
Distance between Brake pedal and floorboard (mm) （brake pedal force about 490N）			above 180	—
Protruding amount of booster push rod (mm)			9.98～10.23	—
Hydraulic pressure with vacuum booster (kPa)		brake pedal force 98N	above 0	—
		brake pedal force 294N	above 1824	—
Hydraulic pressure without vacuum booster (kPa)		brake pedal force 98N	4442～4952	—
		brake pedal force 294N	10434～10944	—
Proportion valve		Inflexion (kPa)	2207～2707	—
		Output pressure(kPa) （input pressure(kPa)	3187～3687 (6375)	—
		Output pressure difference(left and right) (kPa)	—	392
Front disc brakes	Brake pad thickness (mm)		10.0	2.0
	Brake disc thickness (mm)		24.0	22.4
	Brake disc tolerance (mm)		—	0.06
	Force of wheel mounting bolts (N)		78	—
Rear drum brakes	Brake shoe thickness (mm)		4.9	1.0
	Drum inner diameter (mm)		203	205
Clearance of wheel hub in the axial direction(mm) (mm)			—	0.05

2. Grease (see Table 16-2)

Table 16-2

Items	Specified lubrication	Capacity(g)
Brake fluid	SHELL DOT3	Seemliness
Piston boot, piston seal, washer	Rubber grease	
Guide pin ,lock pin		
Pin boot		
Piston, body of wheel cylinder	SHELL DOT3	
Brake back plate	Lithium grease used on the vehicle	
Brake shoe and lining assembly		
Adjustment service assembly		

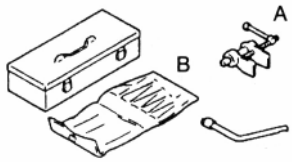
3. Sealant and adhesives (see Table 16-3)

Table 16-3

Used place	Specified lubrication
Installation	Subarid sealant adhesives

4.Special tools （see Table 16-4）

Table 16-4

Tool	code	Name	Use
	MB990964 A：MB990520 B：MB990619	Brake tool set	● Pushing -in of brake piston ● Installation of drum brake wheel cylinder piston cup

5. On-vehicle service

1) Brake pedal inspection and adjustment

（1）Brake pedal height inspection and adjustment

① Roll up carpet and other goods under brake pedal

② Measuring brake pedal height (see Fig. 16-1)。

Standard value（A）：229.4～232.4mm

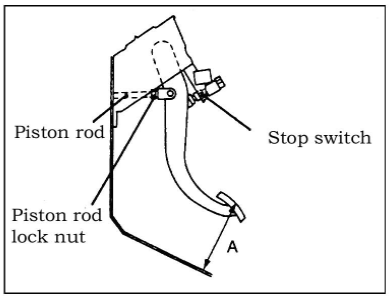


Fig. 16-1

③ If the brake pedal height is not within the standard value, adjust as follows.

a. Disconnect the stop lamp switch connector

b.Move the stop lamp switch about 1/4 circle in anticlockwise direction to make it loose.

c. Adjust the brake pedal height by turning the operation rod with pliers (with the operation rod lock nut loosened) until standard value brake pedal height is obtained (see Fig. 16-2).

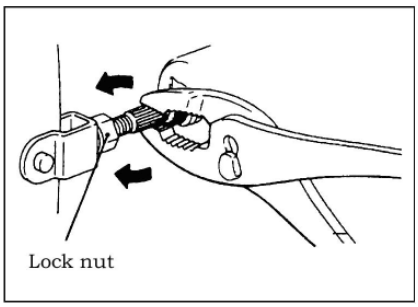


Fig. 16-2

d. After screwing in the stop lamp until it contacts the brake pedal stopper (just before the brake pedal is caused to move).

e. Return the stop lamp to the position as Fig.16-3, round it 1/4 circle in clockwise direction and then fix by tightening the lock nut.

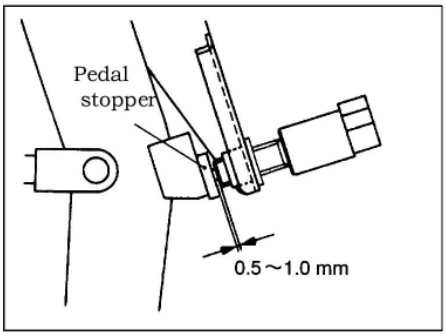


Fig. 16-3

f. Connect the connector of stop lamp switch.

Caution
Make sure the stop lamp doesn't light when the brake pedal is released

④ Reassembly the carpet and other goods under the brake pedal.

（2）Inspection brake pedal clearance (see Fig. 16-4)

① With the engine stopped ,depress the brake pedal two or three times .After eliminating the vacuum in the power brake booster, press the pedal down by fingers and confirm that the amount of movement before resistance is met (the free play) is within the standard value range.

standard value（B）：3～8mm

② If the free play exceeds the standard value ,it is probably due to excessive play between the clevis pin and brake pedal arm. Check for excessive clearance and replace faulty parts as required.

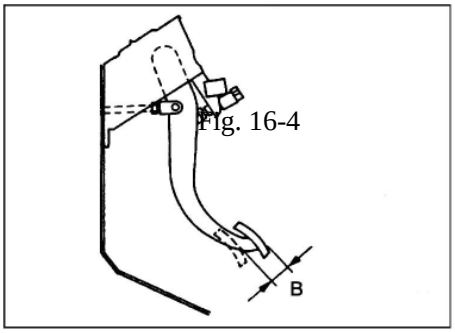


Fig. 16-4

3.Inspection and adjustment the clearance between brake pedal and floor (see Fig. 16-5)

① Roll up carpet and other goods under brake pedal.

② Start the engine depress the brake pedal with approximately 294N {30kgf} of force, and measure clearance between the brake pedal and the floor.

standard value（**C**）：**over 180mm**

③ If the clearance is exceed the standard value, check if air trapped in the brake line , check the lining in the brake disc and the shoe in the drum and dragging in the parking brake ,or replace defective parts as required.

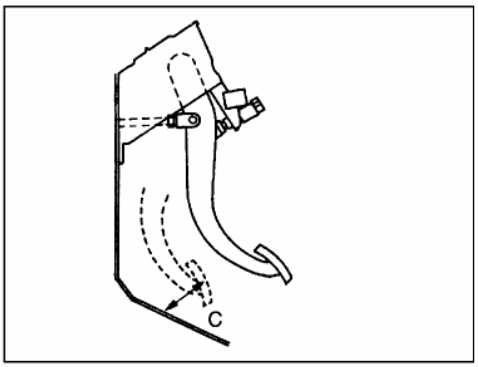


Fig 16-5

④ Put down carpet and other goods under brake pedal.

2） Brake booster operating test

（1） Inspection model without test (see Fig. 16-6~16-8)

① Simple checking of the brake booster operation ,carry out as the following test:

a. Start the engine for 1-2 minutes and then stop it .Depress the pedal with normal force ,if the travel becomes shorter gradually at the second, third time than the first time, the booster is operation properly ,if the pedal height remains unchanged, the booster is defective.

b. With the engine stopped, step on the brake pedal several times. Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.

c. With the engine running, step on the brake pedal and then stop the engine，hold 30 seconds. If the brake pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective.

② The booster performance can be determined as good if all three tests are okay. If one of the above three test is not okay, the check valve, vacuum hose, or booster may be defective。

（2） Inspection with simple test method

① Before inspection ,check valve operation.

② Remove the vacuum hose from the booster .Connect the vacuometer with the booster, connect the vacuometer and the booster with the vacuum hose without the valve, connection

of the manometer and ergometer as follows Fig.16-9 , after letting out the air in the manometer, carry out operation as follows.

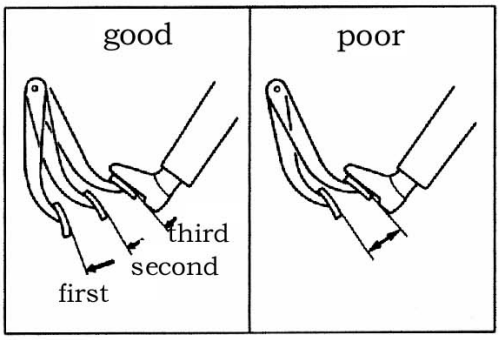


Fig. 16-6

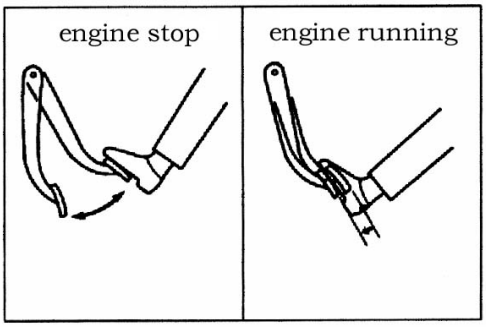


Fig.16-7

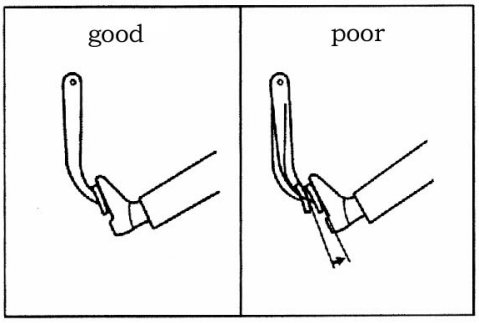


Fig. 16-8

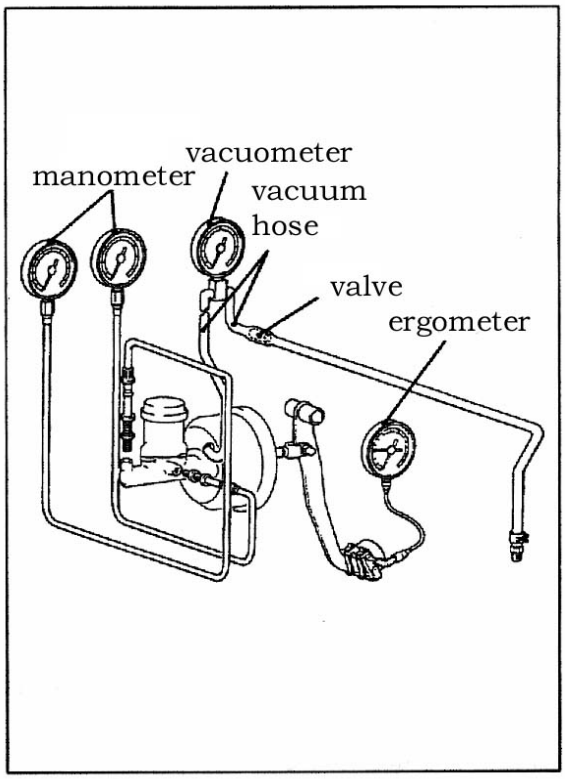


Fig. 16-9

a. Airproof test unload.

when vacometer pressure value is –67kPa (500mmhg), booster is in good condition if the pressure go down to–3.3kPa (25mmHg) after engine stop 15 seconds.

b. Airproof test load.

Start engine, depress the brake pedal with approximately 196N {20kgf} force, stop when vacuometer pressure value is –67kPa, if the pressure go down to –3.3kPa (25mmHg), the booster is in good condition.

c. Test for vacuum booster

This test is carried out after 1）and 2）。

● Test without vacuum effect

With the engine running and vacuometer pressure value is 0kPa, measured the hydraulic pressure when pedal force is 98N and 294N.

Standard value (see Table 16-5)。

Table 16-5

Item	Pedal force	
	98N	294N
Hydraulic pressure(kPa)	Over 0	Over 1824

● Test with vacuum effect

Start the engine and vacuometer pressure value is -67kPa, measured the hydraulic pressure when pedal force is 98N and 294N.

Standard value (see Table **16-6)**。

Table 16-6

Item	Pedal force	
	98N	294N
Hydraulic pressure(kPa)	4442～4952	10434～10944

Vaccum test must be carried out with the simple method. Vacuum booster assembly must be checked on test-bed required by manufacturer when vacuum booster is not good.

3) check valve operation (see Fig.16-10)

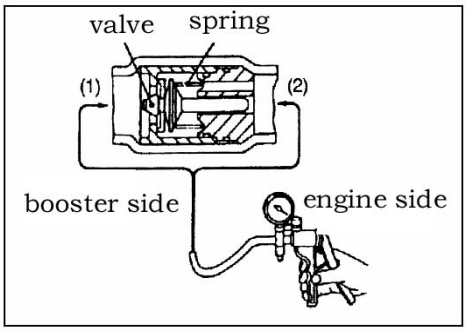


Fig. 16-10

（1）Remove the vacuum hose.

Caution
Do not remove the valve from the vacuum hose.

（2）Check the operation of valve by using a vacuum pump (see Table16-7)。

Table16-7

Vacuum pump connection	Accept/reject criteria
Connection at the booster (1)	A negative pressure (vacuum) is created and held.
Connection at the engine(2)	A negative pressure is not created.

Caution
Replace valve together with vacuum hose when it work poor

4) Proportioning valve function test（vehicles without ABS）

（1） connect two pressure gauges to the outputport of the master culinder and output port of the proportioning valve.(see Fig.16-11)。

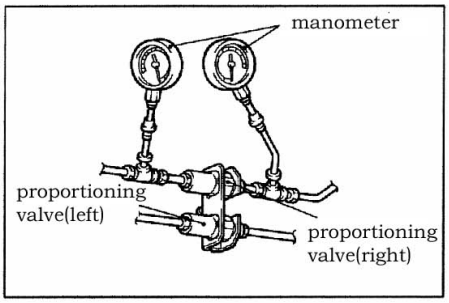


Fig. 16-11

Caution
The proportioning valves are installed independently for the right and left brake lines. Always measure each valve.

（2）Bleed the brake line and the pressure gauges.

（3）Depress the brake pedal gradually. Then check that the split point, where the output fluid pressure begins to drop in proportion to the output fluid pressure, is at the standard value. (see Fig.16-12)。

Standard value：2207～2707kPa

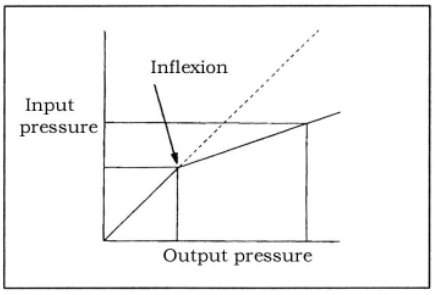


Fig. 16-12

(4)Depress the brake pedal more strongly than at the above step. Then check that the output fluid pressure is at the standard value when the input fluid pressure is 6375 kPa.

Standard value：3187～3687kPa

（5）Measure each output fluid pressure at both valves, and check that the difference between the two is at the limit value or less.

Limit ： within 392kPa

5) Bleeding

BRAKE FLUID: HZY3(DOT3).

Caution
Use the specified brake fluid; do not use other types together

(1) Bleeding from master cylinder (see Fig.16-13)

The booster has no valve, bleeding from booster as following sequence can make it easier including the gas from brake pipeline. (No brake fluid inside the master cylinder.)

① Fill the reserve tank with brake fluid

② Keep the brake pedal depressed

③ press the master cylinder outlet with finger with another people.

④ Keep（3）states ,release the brake pedal.

⑤ Repeat 3～4 times repeat（2）～（4）steps to fill inner master cylinder with brake fluid.

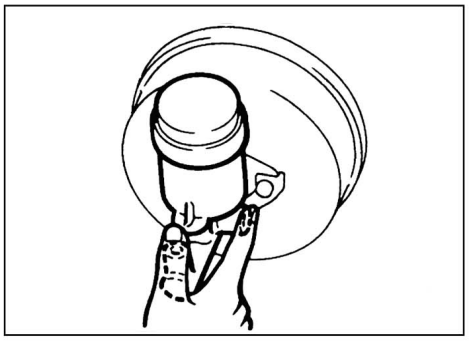


Fig. 16-13

(2) Bleeding from brake pipeline

Bleeding sequence is shown in the Fig. 16-14

6) Brake fluid level sensor inspection

The brake fluid level sensor is in good condition if there is no continuity when the float surface is above “MIN” and if there is continuity when the float surface is below “MIN”（see Fig. 16-15）

7) Disc brake pad inspection and replacement

Caution

If the thickness of the brake pad is about 2.0 mm, and the sound happened from the wear indicator when touching the brake disc, you must change the brake pad.

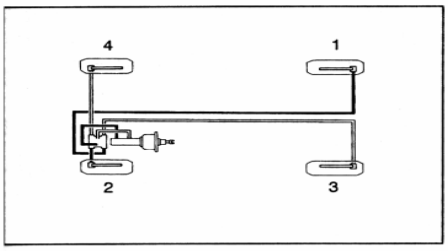


Fig. 16-14

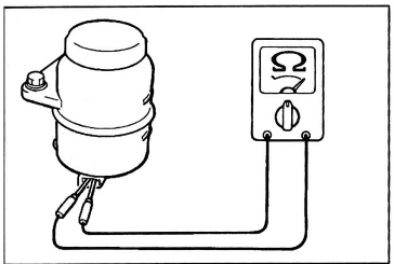


Fig. 16-15

（1）Check brake pad thickness through caliper body check port by eye(see Fig. 16-16).

Standard value:10.0mm

Limit:2.0mm

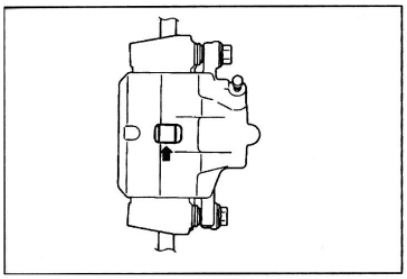


Fig. 16-16

（2）When the thickness is under the limit , replace the pads assembly on both sides of wheels at the same time.

（3）Remove lock pin from the caliper, lift caliper assembly fixed with wires.(see Fig.16-17)

Caution

Do not dirty the lock pin, when applying special grease to the lock pin.

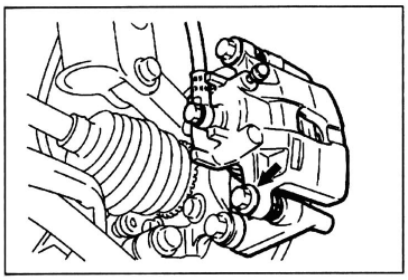


Fig. 16-17

（4）Remove the following parts from caliper support.(See Fig. 16-18)。

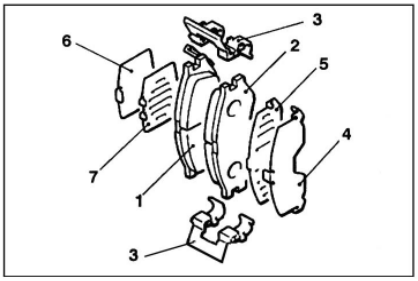


Fig. 16-18

1. Pad and wear indicator assembly　2. Pad assembly　3. Clip　4. Outer shim
5. Outer shim　6. Inner shim　7. Inner shim

（5）Measure hub torque with pad removed in order to measure brake drag torque ,after pad installation.

（6）Apply repair kit grease to the attaching faces of pad and inner shim and to the attaching faces of inner and outer shims. Apply so as not to spread it out from the edge of shim (see Fig. 16-19)。

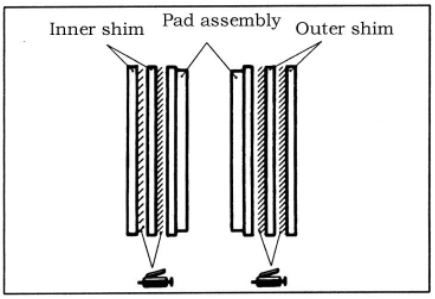


Fig. 16-19

Caution
Do not deposit grease or other dirt on pad or brake disc friction. Kit grease: rubber grease

（7）Install brake disc assembly, and inspect brake drag torque.

8) Brake disc thickness inspection (see Fig.16-20)

(1) Wipe off dirty and rust on the face of brake disc,

（2） Measure disc and pad(slid part) thickness, at least 4 positions.

Standard value:24.0mm

Limit:22.4mm

（3）If one positions of the disc thickness is beyond the limit ,replace the brake disc both left and right side of the vehicle and the brake pad

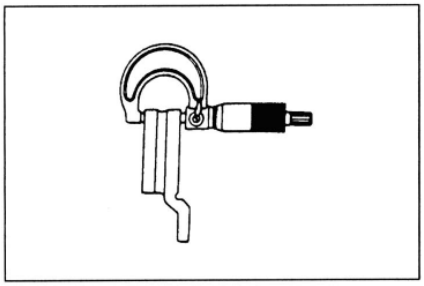


Fig. 16-20

9) Brake disc run-out check

（1）Remove the caliper assembly, and fixed by wire.

（2）Put a dial gauge at place which approximately 5mm around brake disc ,and measure the run-out of the disc（see Fig. 16-21）

Limit:0.06mm

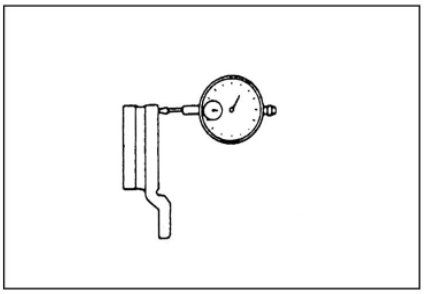


Fig. 16-21

（3）If the run-out of the brake disc exceeds the limit value,carring out as follows:

① Before removing the brake disc, chalk both sides of the wheel stud, and chalk on the side at which run out is greatest

② Remove the brake disc.

Place a dial gauge as Fig. 16-22 and measure the play of the hub in the axial direction

③ If the play exceeds the limit value, disassemble the brake hub and knuckle, inspect each part.

④ If the play does not exceed the limit value, install the brake disc at a position away from the chalk mark again and then check the run-out of the brake disc once again.

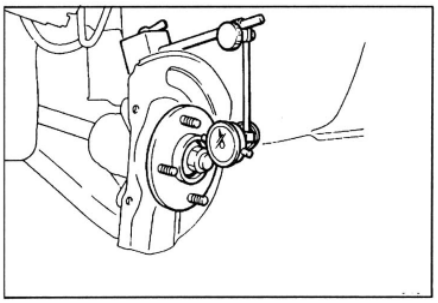


Fig. 16-22

（4）If the run-out can not be corrected by changing brake phase of the brake disc, replace the brake disc.

10) Brake lining thickness inspection

（1）Remove the brake drum.

（2）Measure the thickness of the brake lining at the place where worn is serious(see Fig. 16-23)

Standard value（A）：5.5mm

Limit（A）：1.0mm

（3）Replace the shoe and lining assembly both left and right sides of the vehicle, if brake lining and shoe thickness exceeds the limit. For information concerning the sequences for installation of the brake shoe and lining assembly, refer to the rear drum brake.

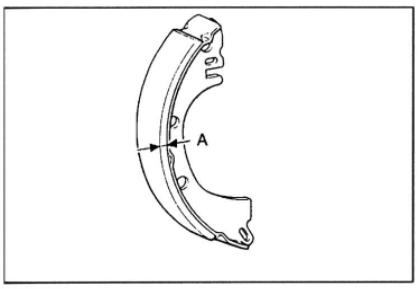


Fig. 16-23

Notice
If there is obvious difference in the thickness of the shoe and lining assemblies on the left and right sides of the vehicle, check the sliding condition of the piston.

11) Brake drum inner diameter inspection

（1）Remove brake drum

（2）Measure brake drum inner diameter at 2 place or more(see Fig. 16-24)

Standard value（A）：203mm

Limit（A）：205mm

（3）If brake drum inner diameter exceeds the limit value or has obvious worn ,replace brake drum.

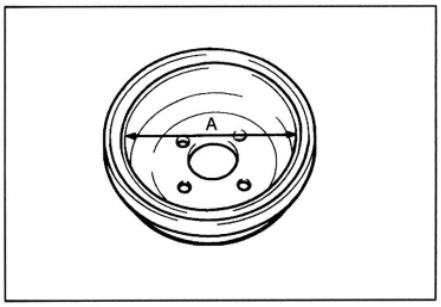


Fig. 16-24

12) Brake lining and brake drum gap inspection

（1）Remove the brake drum , the shoe and lining assembly (see Fig 16-25)。

（2）Chalk inner surface of brake drum and rub with shoe and lining assembly

（3）Replace shoe and lining assembly or brake drums if very irregular contact area

（4）Clean off chalk after check.

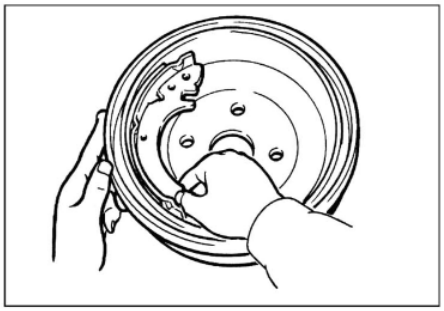


Fig. 16-25

6 Brake pedal

1) Removal and installation

Post installation operation Adjusting brake pedal

Removal and installation sequence see Fig.16-26.

2) Inspection

Inspect the stop lamp switch continuity status

（1）Connect the multimeter to the stop lamp switch connector.

（2）The stop lamp switch is in good condition if there is no continuity when the plunger is pushed in to a depth shown Fig.16-25 from the outer surface and if there is continuity when it is released.

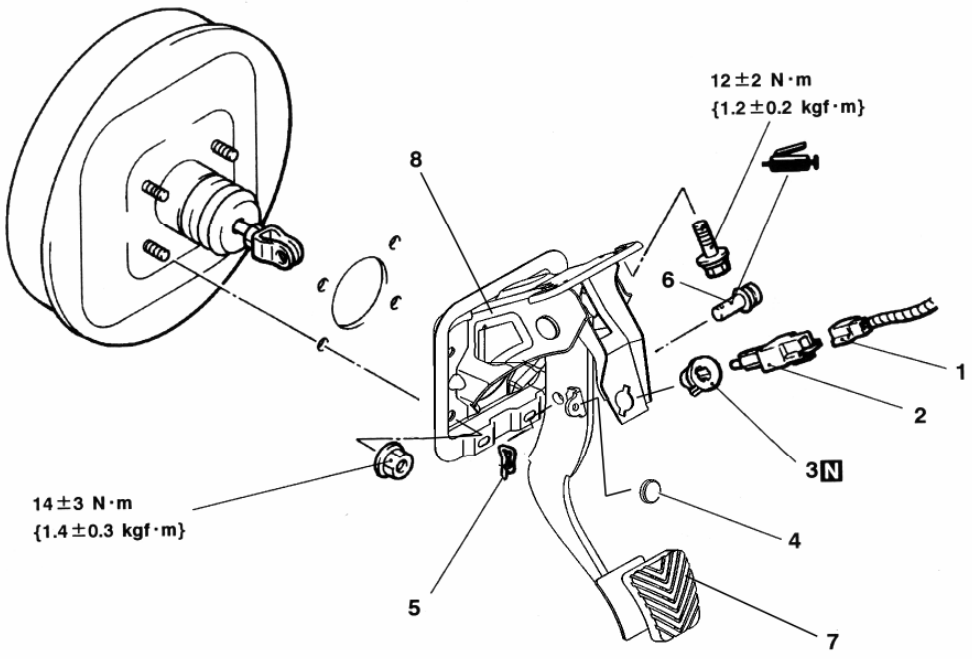


Fig. 16-26

1. Connecter
2. Stop lamp switch
3. Adjuster
4. Limit block
5. Pin
6. Pin assembly
7. Pedal pad
8. Brake pedal assembly

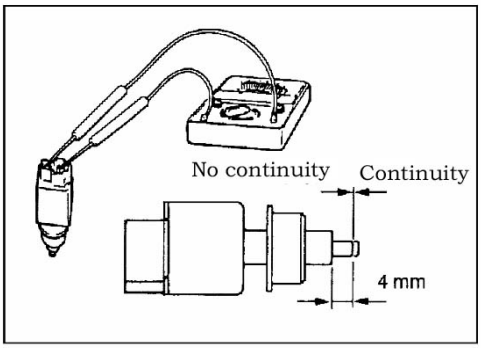


Fig. 16-27

7. Master cylinder and brake booster

1) Removal and installation

Pre-removal operation: draining of brake fluid

post installation operation: ● supplying brake fluid、bleeding ● adjusting brake pedal

Removal and installation sequence see Fig.16-28.

2) Key point of installation

(1) Connection of vacuum hose

Insert securely and completely until the vacuum hose at the engine side contacts the edge of the hexagonal part of the fitting, and then fix by the hose clip.

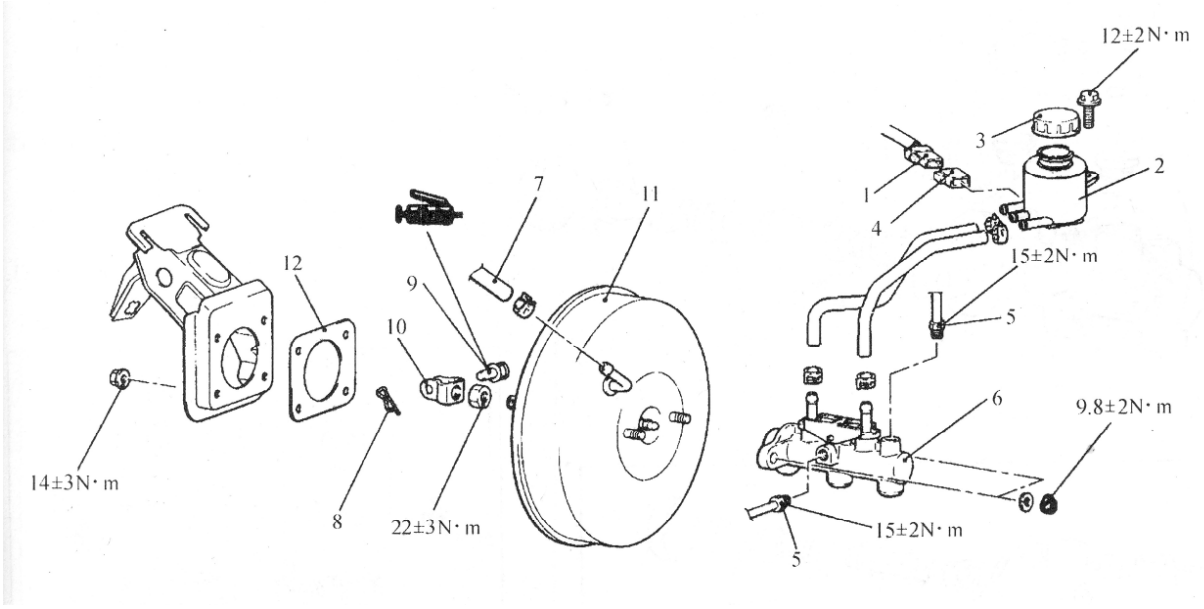


Fig. 16-28

1．Connector for brake fluid limit sensor　2.　Brake reservoir　3．Brake reservoir　cap
4 .Brake fluid limit sensor　5. Brake pipe　6 Master cylinder　7 Vacuum hose(with valve)
8 B-pin　9 Pin assembly　10 Push rod fork ofvacuum booster　11 Vacuum booster
12 Sealer

(2) Adjustment of clearance between brake booster push rod and primary piston

①．Measurement A value (see Fig.16-29)。

Standard value:9.98～10.23mm

If vacuum booster is loaded, the clearance(A) will be 10.28～10.53mm.

② If the value is over the standard value range ,adjust the push rod length by turning the screw of the push rod (see Fig 16-30)。

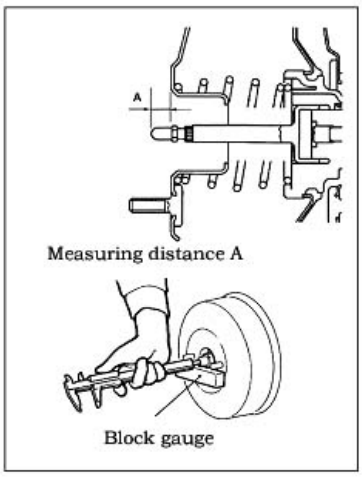


Fig. 16-29

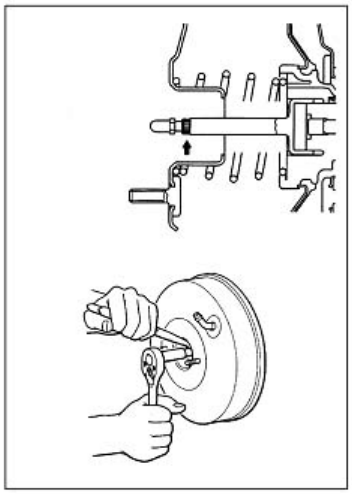


Fig. 16-30

8 Master cylinder

Remove and installation

Remove sequence see Fig.16-31.

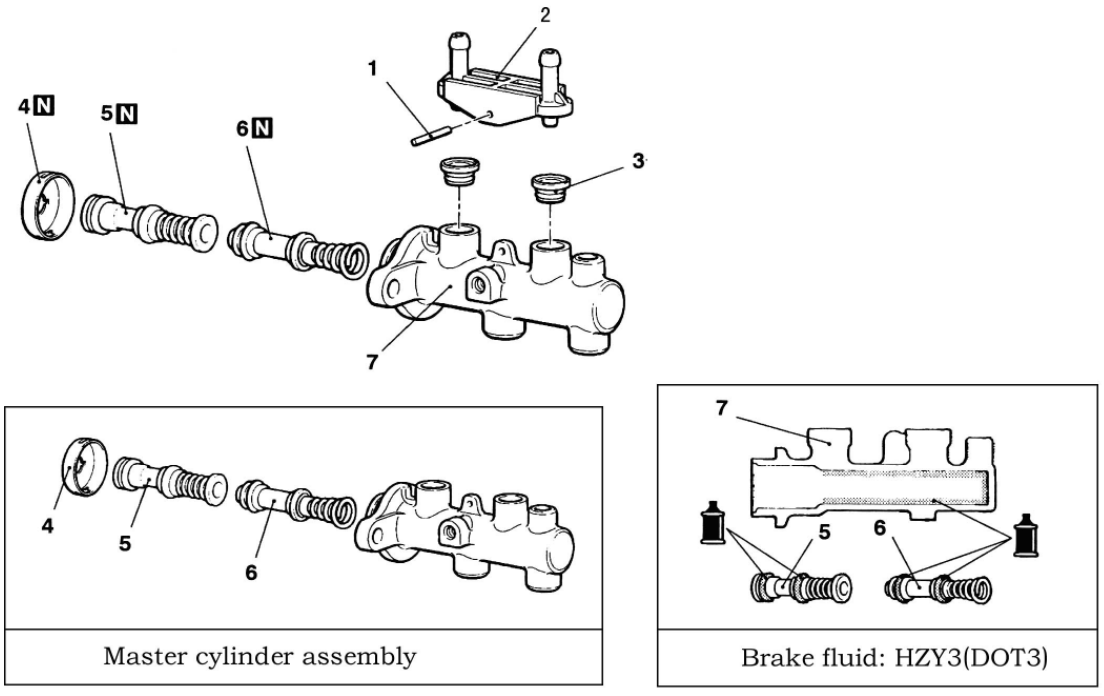


Fig. 16-31

1. Spring pin 2. Reservoir joint 3 Seal 4 Piston snap ring 5 First piston assembly 6 Second piston assembly 7 Master cylinder body

9. Disc brake assembly

1) Removal and installation

Removal and installation sequence see Fig.16-32.

Pre-removal operation: draining of brake fluid	Post installation operation: supplying brake fluid、bleeding brake lines

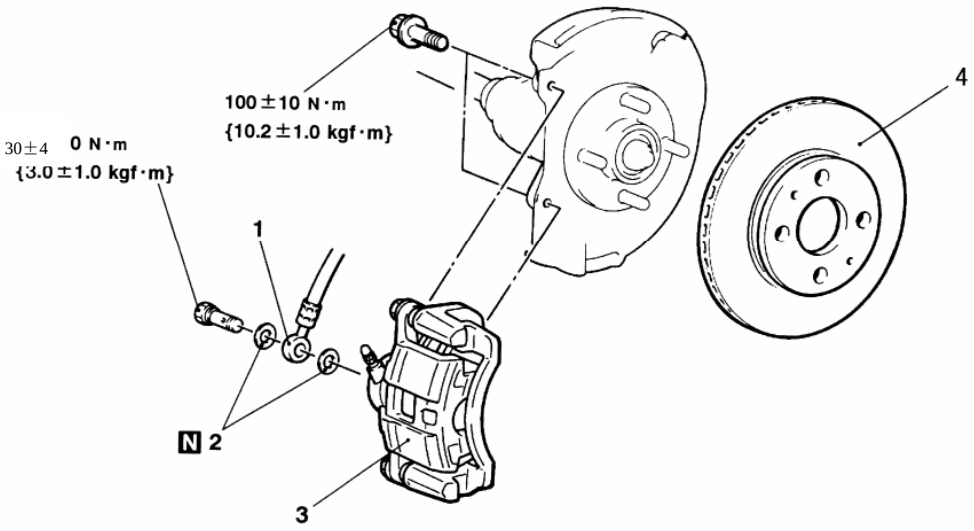


Fig.16-32

1．Connection of brake hose
2．Washer
3．Brake disc assy
4．Brake disc

2) Installation service point

(1) Disc brake assembly installation

① In order to measure the brake drag force after pad installation, measure the rotary-sliding resistance of the hub by the following procedure with the pads removed.

a Withdraw the drive shaft.

b.Shown as Fig.16-33，attch the specical tool to the front hub assembly and tighten it to the specified torque.

c Use a spring balance to measure the rotary-sliding resistance of the hub in the clip to the caliper support.。

② Install the caliper support to the knuckle, and then assemble the pad and the clip to the caliper support.

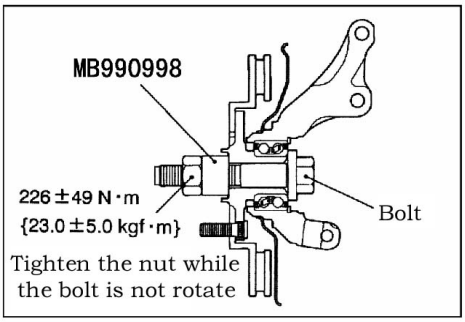


Fig. 16-33

Caution

Do not contaminate the friction surface of the pads and brake discs by any oil or grease.

③ Clean the pison and insert it into the cyclinder with the special tool.(see Fig.16-34)。

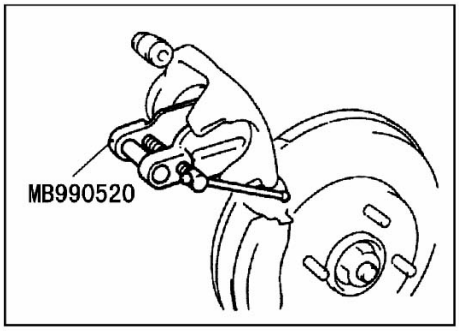


Fig. 16-34

④ Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the guide pin to the caliper.

⑤ Start the engine, and then depress the brake pedal two or three times strongly. Then stop the engine.

⑥ Turn the brake disc forward 10 times。

⑦ Use a spring balance to measure the rotary-slidingresistance of the hub in the forward direction. (see Fig.16-35)。

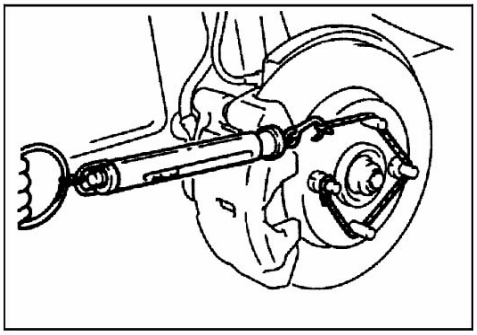


Fig. 16-35

⑧ Calculate the drag force of the disc brake（difference between the values measured at steps 1and 7）。

Standard value：78N

⑨ If that drag force exceeds the standard value, disassemble the piston assembly. Then check the piston for contamination or rust, and confirm if the piston or the piston seal is deteriorated, and if the slide pins slide smoothly.

3) Remove and installation

Remove sequence see Fig.16-36

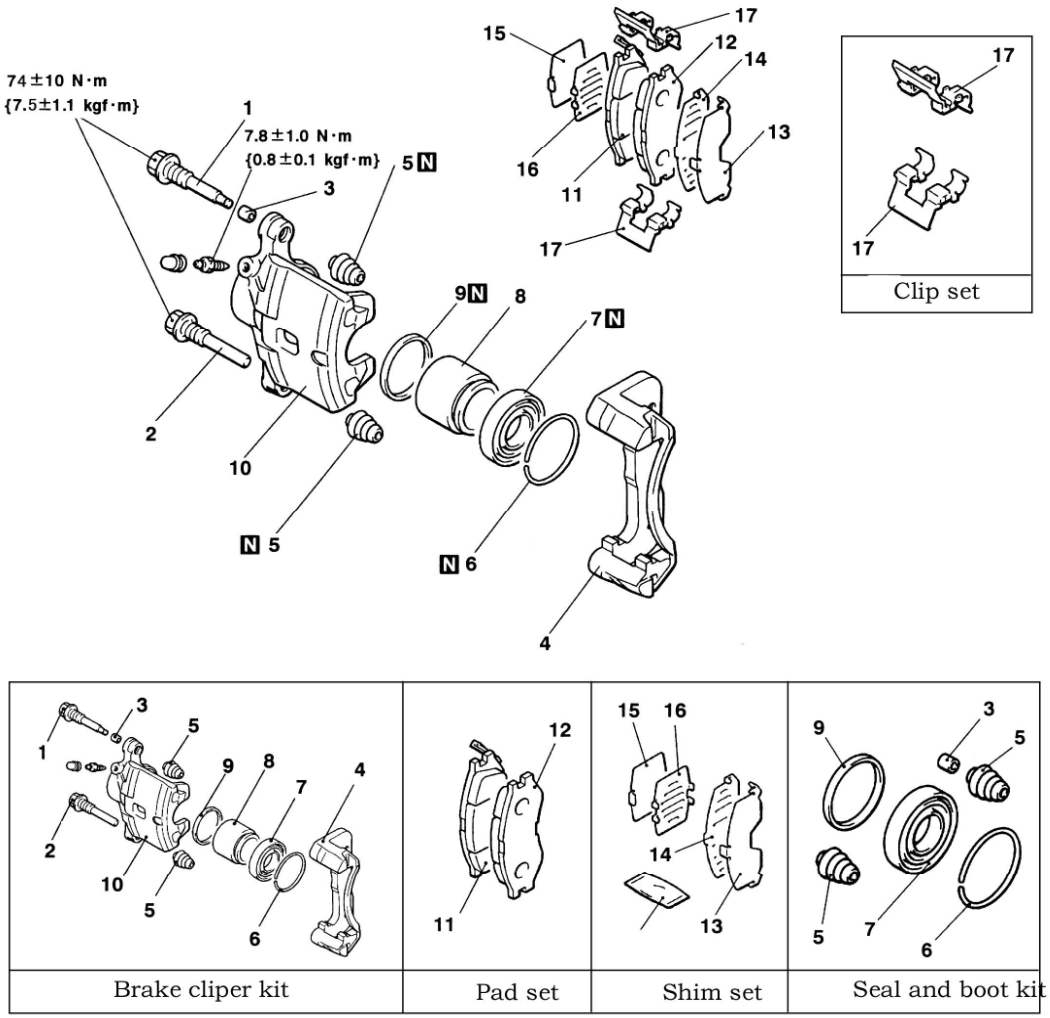


Fig. 16-36

1．Slide pin(main)
2．Slide pin(sub)
3．Bushing
9．Piston seal
10．Caliper body
11．Pad and wear indicator assembly

4. Caliper support
（including pad,clip,and shim）
5. Pin boot
6. Bushing
7. Piston boot
8. Piston
12. Pad assembly
13. Outer shim
14. Outer shim
15. Inner shim
16. Inner shim
17. Clip

4) Lubrication points see Fig.16-37.

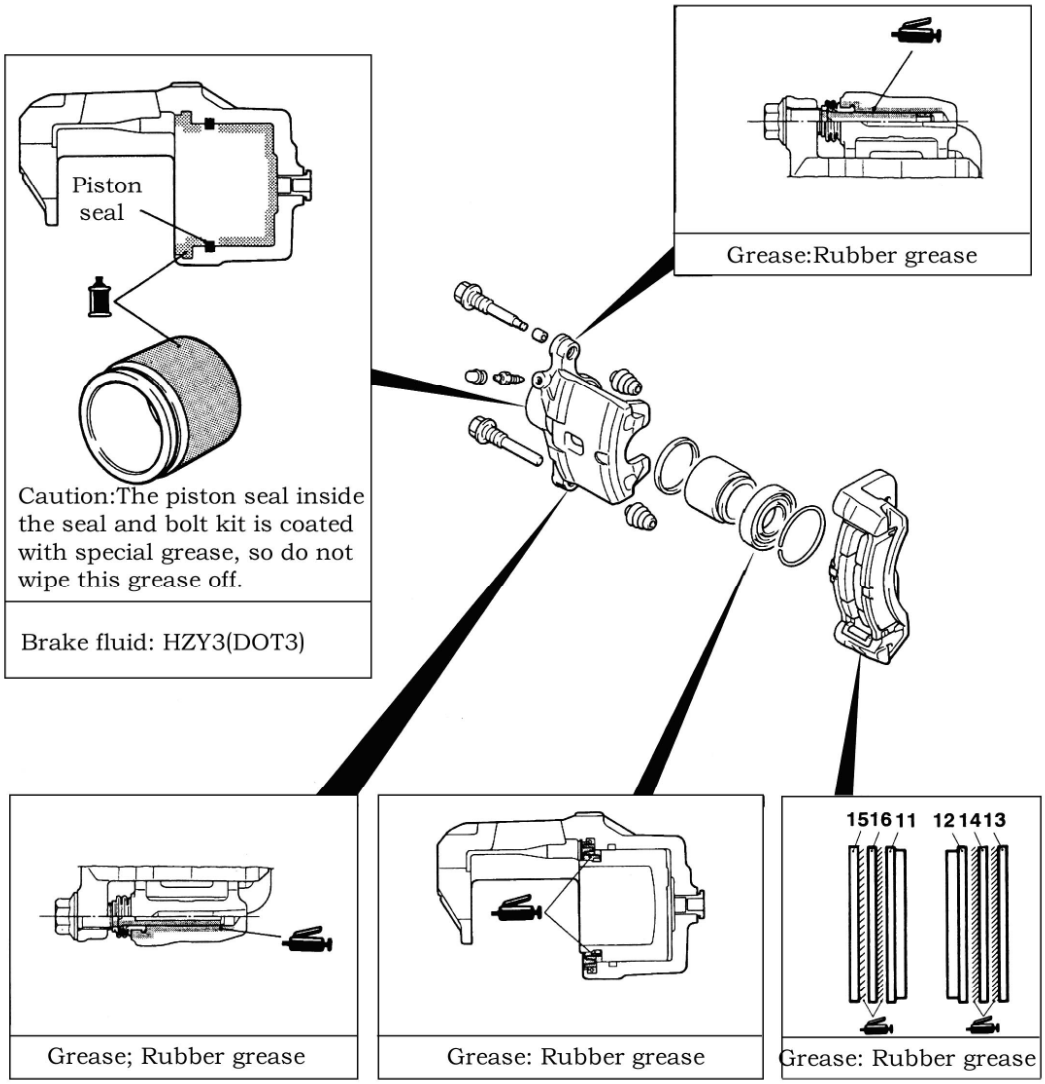


Fig. 16-37

5) Disassembly service points

(1) Piston boot/piston removal

Use a piece of wood to protect the caliper body outer side, and then apply compressed air through the brake hose connection hole to withdraw the piston and piston boot.(see Fig.16-38)。

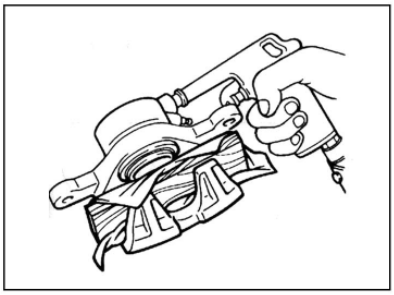


Fig. 16-38

Caution
If air is blown into the caliper body suddenly, the piston will pop out, causing damage to the caliper body. Be sure to apply compressed air graduslly.

(2)Piston seal removal

1) Remove the piston seal with finger tip.(see Fig.16-39)。

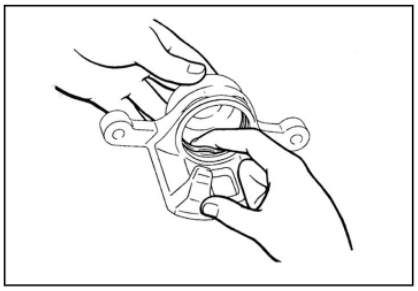


Fig. 16-39

Caution
Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cyclinder.

2) Clean piston surface and inner bore with trichloroethylene, alcohol or the specified brake fluid.

Specified brake fluid; DOT3

6) Installation service point

Slide pin(sub)/Slide pin(main) installation

Affirmed the signal on the slide pin(sub) and slide pin(main), then install them.(see Fig.16-40)。

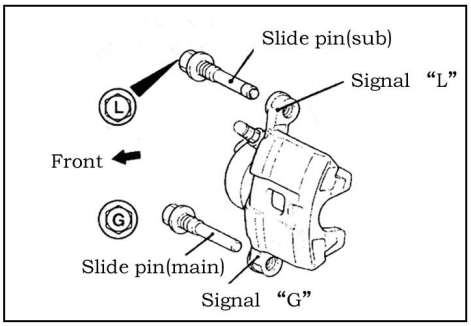


Fig. 16-40

7) Inspection

Pad wear check(see Fig.16-41)

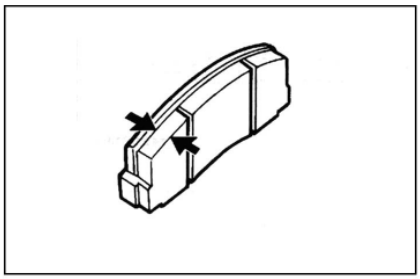


Fig. 16-41

Measure thickness at the thinnest and worn area of the pad. Replace the pad assembly if the pad thickness is less than the limit value.

Standard value：10.0mm

Limit value：2.0mm

Caution

1. Always replace the brake pads as an axle set.
2. If an excessive difference is found in the thickness between the right and left brake pads, check moving parts.

10. Rear drum brake

1) Remove and installstion

Remove and installstion sequence see Fig.16-42.

Pre-removal operation

- Loosening the parking brake cable adjusting nut.
- Brake fluid draining

Post-installation operation

- Parking brake lever storke adjustment
- Brake fluid supplying and air bleeding

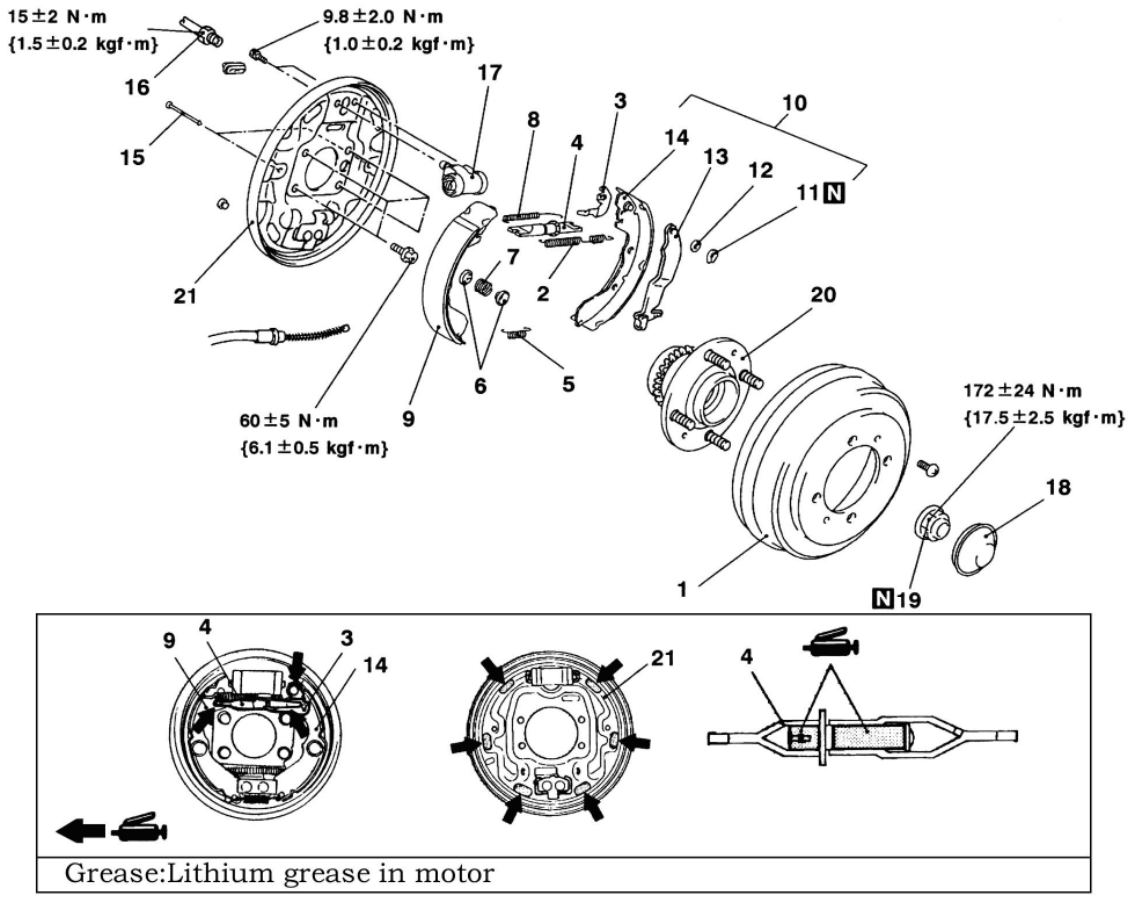


Fig. 16-42

1. Brake drum
2. Spring
3. Adjuster lever
4. Auto-adjuster assembly
5. Retainer spring
6. Shoe hold-down cup
7. Shoe hold-down cup spring
8. Shoe-to-lever spring
9. Shoe and lining assembly
10. Shoe and level assembly
11. Retainer
12. Wave washer
13. Parking lever
14. Shoe and lining assembly
15. Shoe hold-down pin
16. Brake pipe connection
17. Wheel cyclinder
18. Hub cap
19. Lock nut
20. Rear hub assembly
21. Backing plate

2) Removal service points

Retainer removal

Use a flat-tipped screwdriver or the like to open up the retainer joint, and remove the retainer.(see Fig.16-43)。

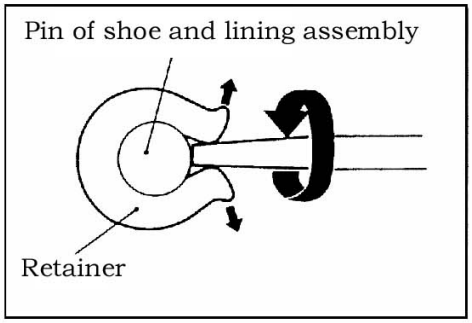


Fig. 16-43

3) Installation service points

(1) Wave washer installation

Installthe wave washer in the direction shown in Fig.16-44.

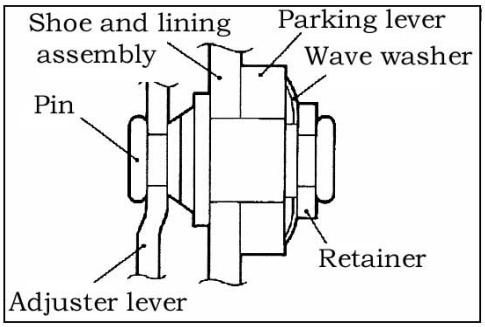


Fig. 16-44

(2) Retainer installation

Use pliers or the like to crimp the retainer or the pin positively(see Fig.16-45)。

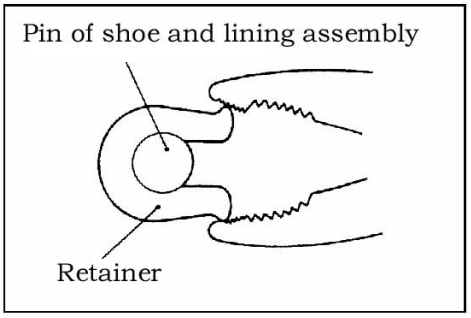


Fig. 16-45

4) Inspection

(1) Brake lining thickness check

Refer to before mention

(2)Brake drum inside diameter check

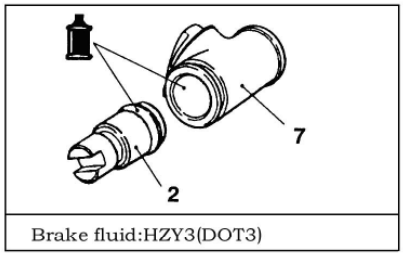
Refer to before mention.

(3)Brake lining and brake drum contact check

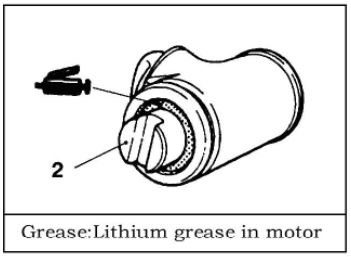
Refer to before mention.

5) Disassembly and reassembly

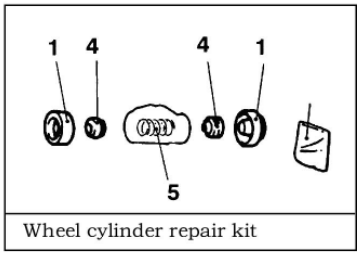
Disassembly sequence see Fig.16-46:



Brake fluid:HZY3(DOT3)



Grease:Lithium grease in motor



Wheel cylinder repair kit

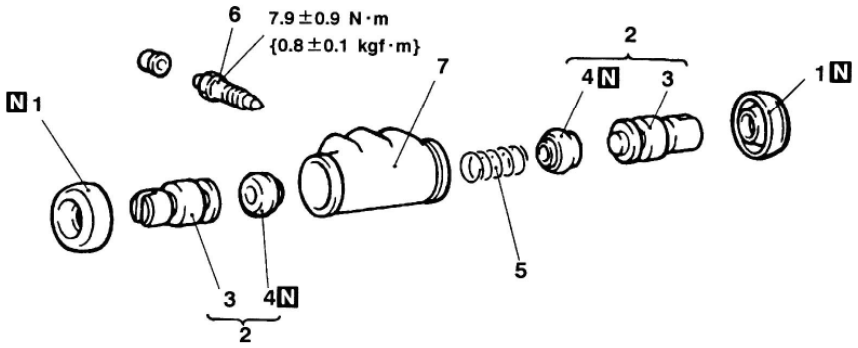


Fig. 16-46

1. Boots
2. Piston assembly
3. Piston
4. Piston cups
5. Spring
6. Bleeder screw
7. Wheel cyclinder body

6) Reassembly service point

Piston cups/pistons reassembly(see Fig.16-47)

① Use trichloroethylene, alcohol or the specified brake fluid to clean the piston.

Specified brake fluid：HZY3(DOT3)

② Apply the specified brake fluid to the piston cups and the outer circumference of the special tool.

③ Set the special tool on the piston, and then fit the piston cup onto the special tool with the lip of the cup facing upwards.

④ Slide the piston cup down the outside of the tool into the piston groove carefully, making sure that the piston cup is twisted or slanted.

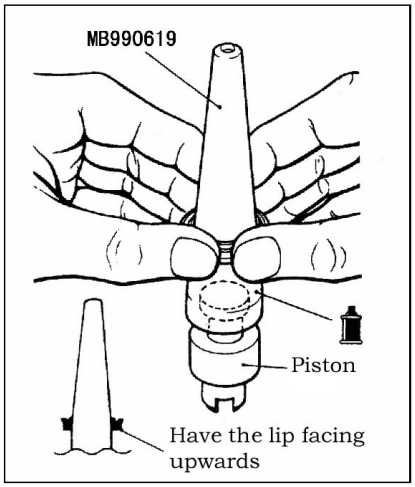


Fig. 16-47

16.2 Parking Brake system (Manual)

1.Service specification

See Table 16-8.

Table 16-8

Item	Standard Value	Limit
Parking brake lever stroke（Operation force:Approx.196N）	5～7 notches	—
Brake lining thickness(mm)	5.5	1.0
Brake drum diameter(mm)	203	205

2. Lubricants

See Table 16-9.

Table 16-9

Items	Specified Lubricant	Capacities
Rear brake backing plate	Lithium grease in motor	Appropriate volume
Shoe and lining assembly		
Auto adjuster assembly		

3. Construction diagram

See Fig.16-48.

4. On-vehicle service

1) Parking brake lever stroke check

(1) Pull the parking brake lever with a force of approx. 196N and count the number of notches

Caution
196N force of the parking brake lever must be strictly observed.

Standard value：5～7 notches

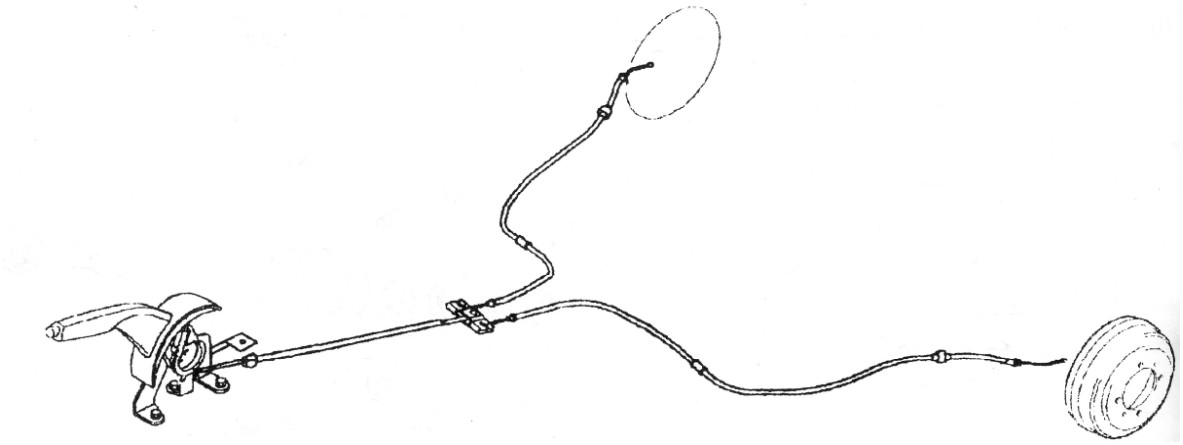


Fig. 16-48

2. If the parking brake lever stroke is not the standard value, adjust as described below.

（1）Loosen the adjusting nut to move it to the cable rod end so that the cable will be free.(see Fig.16-49)。

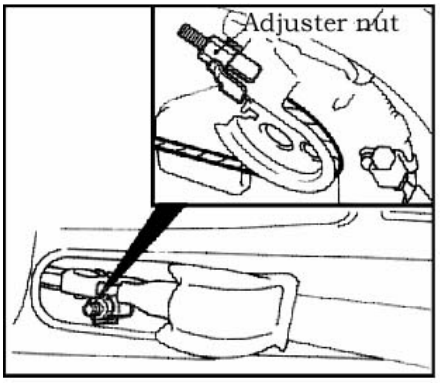


Fig. 16-49

（2）Depress the brake pedal 5or 6 times repeatedly until the lever has no chang in its stroke. Depressing the brake pedal repeatedly adjusts shoe clearance correctly.

（3）Turn the adjusting nut to adjust the parking brake lever store to the standard value. After adjusting, check that there is no space between the adjusting nut and the parking brake lever. Check that the adjusting nut is secured with the nut holder.

Check the adjusting nut is fixed or not.

Caution

If the parking brake lever stroke is below the standard value and the braking is too firm, the rear brakes may drag.

（4）After adjusting the parking brake level stroke, jack up the rear end of the vehicle, and then release the parking brake and turn the rear wheels to check that the rear brakes are not dragging.

2)Parking brake switch check

(1)．Remove the floor console.

(2)．Check for continuity between the parking brake switch terminal and the switch mounting bolt.(see Fig.16-50、Table16-10)。

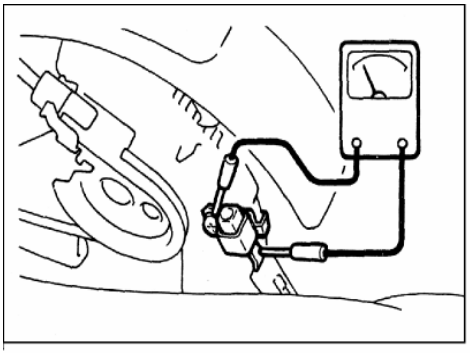


Fig. 16-50

Table16-10

When parking brake lever is pulled	Continuity
When parking brake lever is released	No continuity

5. Parking brake lever

Removal and installation

Pre-removal Operation: Floor Console Removal	Post-installation Operation (1) Parking Brake Lever Stroke Adjustment (2) Floor Console Installation

Removal sequence (see Fig.16-51)

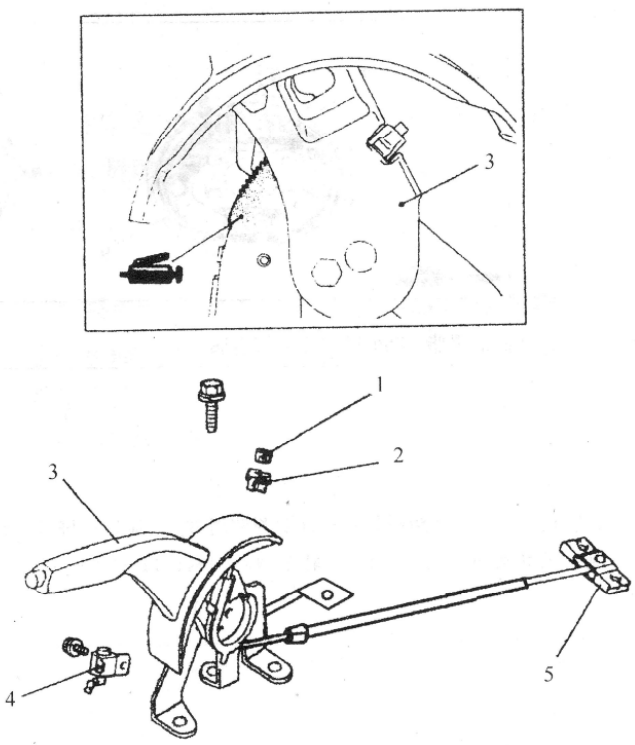


Fig. 16-51

1．Parking brake lever assembly;

2．Parking brake switch;

3. cable adjusting nut;

4. limit plate

6. Parking brake cable

removal and installation

Pre-removal Operation: Floor Console Removal

Post-installation Operation Parking Brake Lever Stroke Adjustment and floor Console Installation

Removal sequence see Fig.16-52：

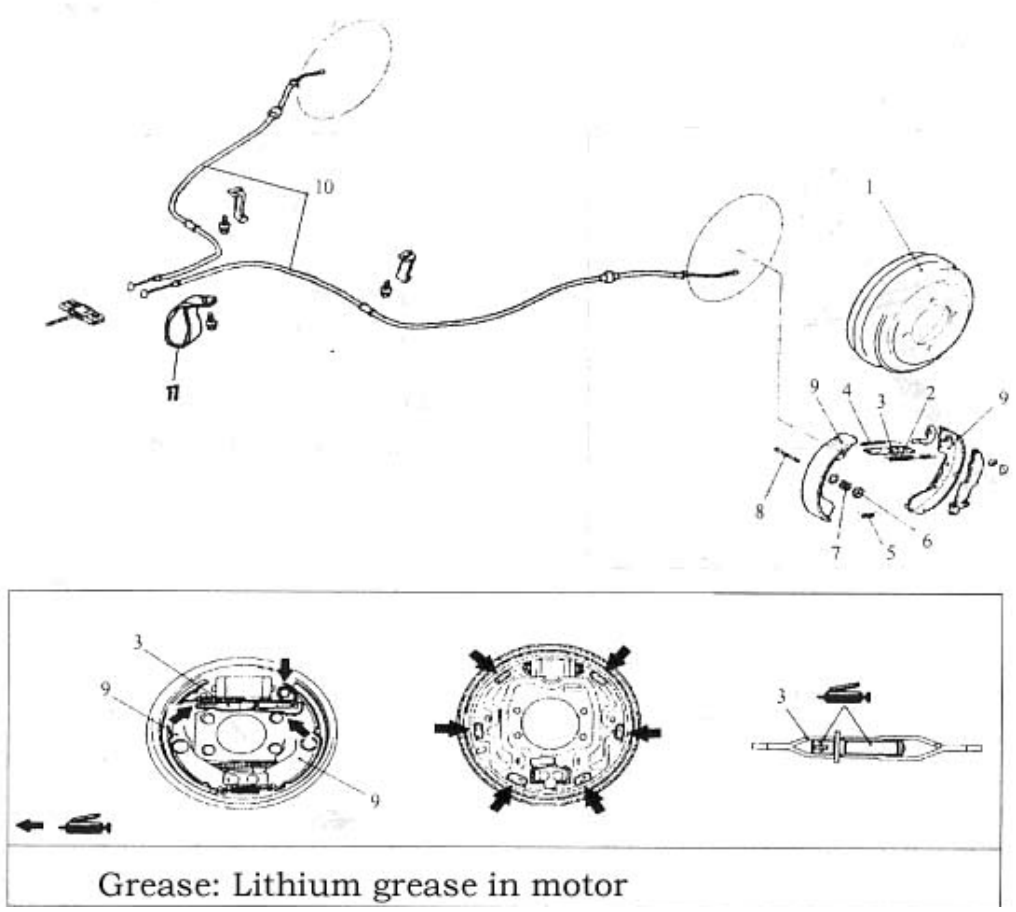


Fig. 16-52

1. Rear brake drum
2. Shoe spring
3. Auto adjuster assembly
4. Shoe spring
5. Retainer spring
6. Shoe hold-down cup
7. Shoe hold-down spring
8. Shoe hold-down pin
9. Shoe and lining assembl
10. Rear cable assembly
11. Groment

16.3 Parking Brake System (Automatic)

This chapter is applicable for parking brake system manipulated by foot.

1 Service specification (see Table16-1)

Table 16-1

Item	Standard Value	Limit
Parking brake pedal stroke （ Operation force:Approx.196N）	4～6notches	—
Brake lining thickness(mm)	4.3	1.0
Brake drum diameter(mm)	203	205

2lubricants (see Table16-2)

Table 16-2

Items	Specified Lubricant	Capacities
Rear brake backing plate	Lithium grease in motor	Appropriate volume
Shoe and lining assembly		
Auto adjuster assembly		

3. On-vehicle service

1) Parking brake pedal stroke check and adjuster

(1). Parking brake pedal stroke check

Standard value：4～6 notches (pedal force: Approx.500N)

(2) Parking brake pedal stroke adjuster

If the parking brake pedal stroke is not the standard value, adjust as described following.

① Loosen the adjusting nut to the cable rod end so that the cable will be free.

② Depress the brake pedal repeatedly until the stoke do not change .

Caution
Depressing the brake pedal repeatedly so as to adjust correctly shoe clearance.

③ Turn the adjusting nut to adjust the parking brake pedal store to the standard value. After adjusting, check that there is no space between the adjusting nut and the parking brake pedal Check that the adjusting nut is secured with the nut holder.(see Fig. 16-53)

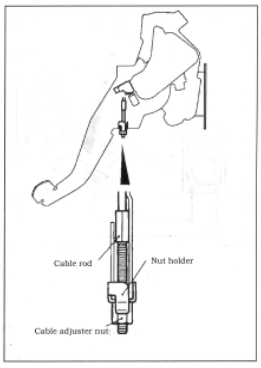


Fig. 16-53

Caution
If the parking brake pedal stroke is below the standard value and the braking is too firm, the rear brakes may drag.

④ After adjusting the parking brake pedall stroke, jack up the rear end of the vehicle, and then release the parking brake and turn the rear wheels to check that the rear brakes are not dragging.

2) Parking brake switch check

Check for continuity between the parking brake switch terminal and the switch mounting bolt.(see Fig.16-54、Table16-13).

Table 16－13

When parking brake lever is pulled	Continuity
When parking brake lever is released	No continuity

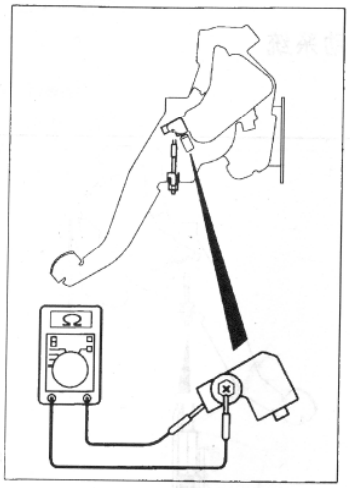


Fig. 16-54

4 Praking brake pedal

1) Removal and installation (see Fig.16-55)

Post-installation operation
Check and adjust parking brake store.

- **Installation service points**

Spring installation

Grease the lubricants in connection between spring and pedal and installing spring as direction shown Fig. 16-56.

- **Removal and installation(see Fig.16-57)**

1) Front parking brake cable

(1) Pre-removal operation

• remove the left ornamental plate on the front of vehicle.
• remove the chair of driver.
• remove the console and foot pad.

5 Parking brake cable

- **Removal and installation(see Fig.16-57)**

Front parking brake cable

Pre-removal operation

• remove the left ornamental plate on the front of vehicle.
• remove the chair of driver.
• remove the console and foot pad.

（2）post-installation operation

• install the console and foot pad.
• install the left ornamental plate on the front of vehicle.
• check and adjust parking brake pedal store.

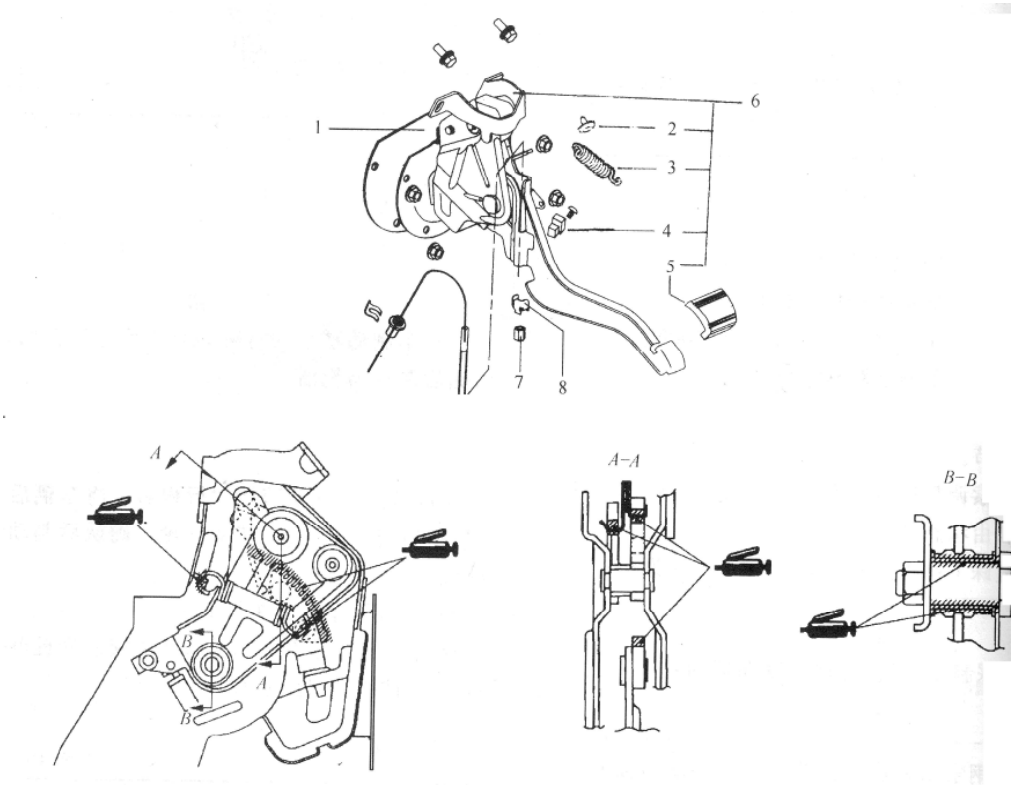


Fig. 16-55

1．Sealer　　2．Gasket　　3．Spring　　4．Parking brake lamp switch
5．Pedal pad　　6．Parking brake pad assembly　　7．Cable adjusting nut

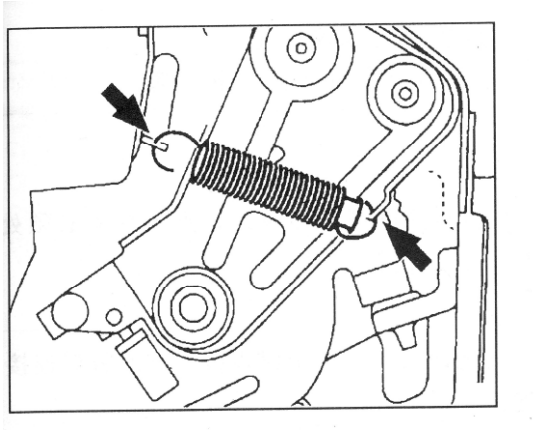


Fig. 16-56

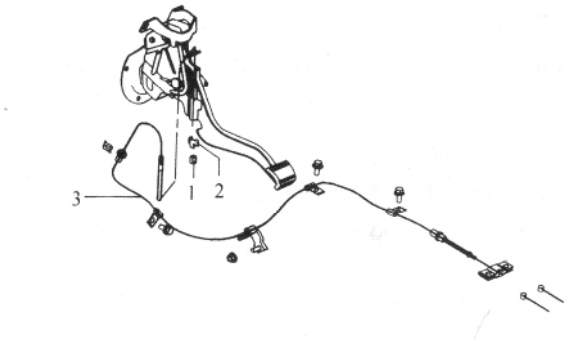


Fig. 16-57

1. Cable adjusting nut 2 .Holder nut 3.Front cable assembly

16.4 ABS System

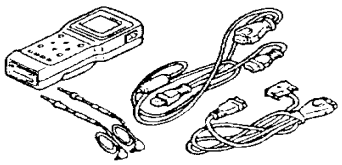
1. Service standard value (see Table16-14)

Table 16-14

Items	Standard value(kΩ)
The resistance between wheel speed sensor terminals (KΩ)	1.275～1.495
The insulation resistance of wheel speed sensor (KΩ)	1000 以上

2. Special tools (see Table 16-15)

Table 16-15

tools	Name	Use
	Hi-Scan(Pro)	For checking of ABS troubleshooting

3. Troubleshooting diagnosis

1) Note for troubleshooting diagnosis

(1) ABS controls the hydraulic brake pressure according to instruction of ECU.The phenomena listed in the following Table16-16 are normal.

Table 16-16

Phenomenon	Explanation
When starting the engine, a thudding sound can sometimes be heard coming from inner engine compartment. This is because the system operation check is being performed.	The system self-checking is being performed, it is normal operation.
1. Sound of the motor inside the ABS hydraulic unit operation(whine). 2. Sound is generated along with vibration of the brake pedal(scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release(Thump 、 suspension、 squeak、 tires)	ABS operation sound , it is normal operation.
Pedal kick back	Pedal kick back is normal operation.

(2) When running on the sand stone and deep snow road, brake distance will become long as contrasted with no installing ABS, should control vehicle speed, suggest customer

control the vehicle speed ,keep enough safe during vehicle is driving on the road.

（3）Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in “Comment” are met.

2) Checking ABS warning lamp

（1） When the ignition key is turned to “ON”, the ABS warning lamp illuminates for approximately 3seconds and then switches off.

（2） When the ignition key is turned to “START”, the ABS warning lamp remains illuminated .

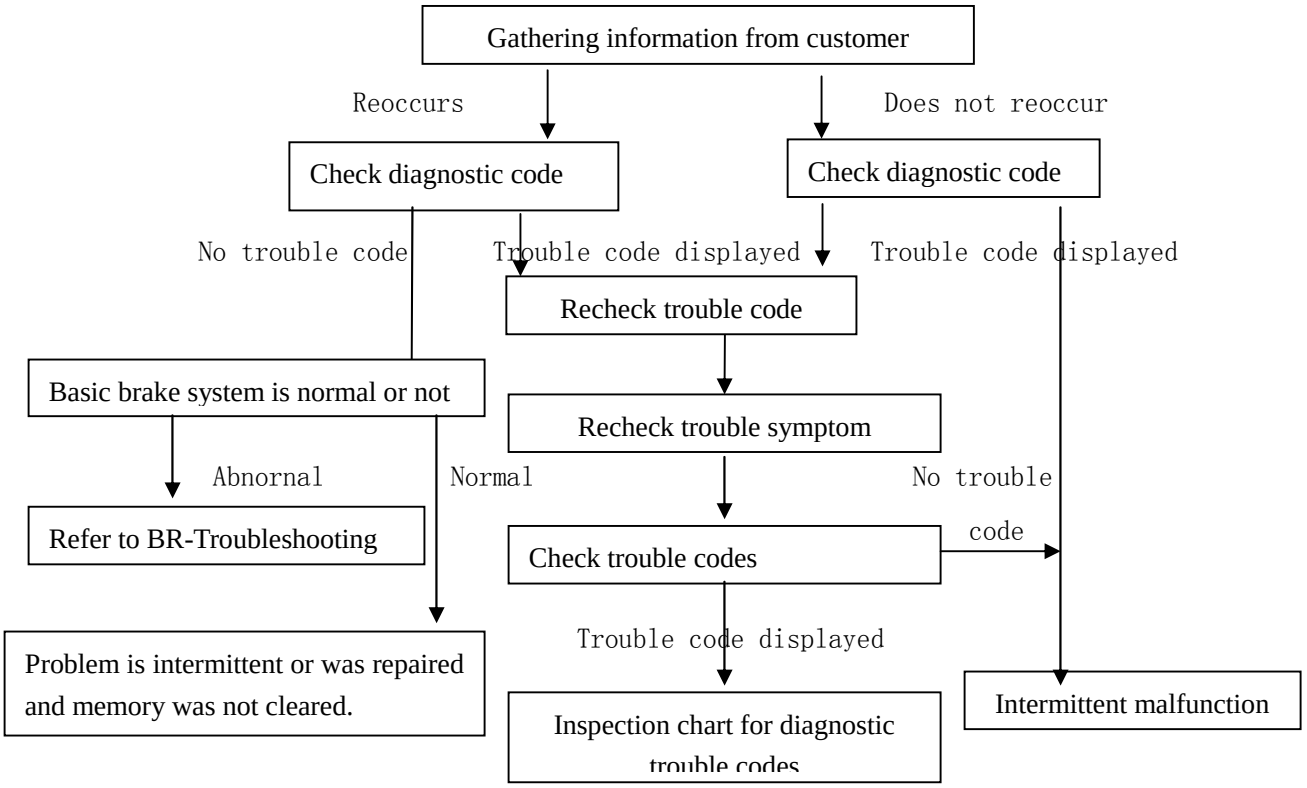
（3） When the ignition key is turned from “START” back to “ON” , the ABS warning lamp illuminates for approximately 3seconds and then switches off.

（4） If the illumination is other than the above ,check the diagnosis codes.

Note：ABS warning lamp may always light when the vehicle speed is below 10km/h。

3) Diagnosis function

（1）Standard flow of diagnostic troubleshooting



（2）Hi-Scan(Pro) check

① Turn the ignition OFF.

Caution
connect or disconnect the Hi Scan(Pro),must turn the ignition OFF .

② Connect the Hi-Scan (Pro) to the Data Link Connector located underneath the dash pad panel.

③ Turn the ignition ON.

④ Use the Hi-Scan (Pro) to check for diagnostic trouble codes.

⑤ After completion of the repair or correction of the problem, erase the stored fault codes using the clear key on the Hi-Scan (Pro).

⑥ Turn the ignition OFF,Disconnect the Hi-Scan(Pro).

(3) Connector check

① Remove the negative battery(-) terminal.

② Disconnect the connectors and check terminals following the troubleshooting sequence.

CAUTION
When you check the terminals be sure to use a small enough pin so as to not damage the connector terminals.

2) Fault code lists(see Table 16-17)

Inspect according to fault code lists

Table 16-17

DTC on Hi-Scan(Pro)	Failure Location	Failure Cause	Condition for Detection	Management/ Detect Mode				
				A	B	C	D	E
FL: C1 200 FR: C1 203 RL: C1 206 RR: C1 209	ECU) Sensor (wiring, harness, exciter,	Short to GND, Short to BATT, Open	The wheel velocity is below 7km/h and the offset voltage of the sensor is outside the permitted range(2.15-3.5V). If this condition continues for more than 140msec.	+3) +3) +3) +3)	+3) +3) +3) +3)	+4) +4) +4) +4)	+3) +3) +3) +3)	+3) +3) +3) +3)

FL: C1 201 FR: C1 204 RL: C1 207 RR: C1 210	ECU)	Speed Jump	This monitoring is performed for the schedule that the velocity of each wheel exceeds 2km/h. 1. Controller counts the number of the wheel acceleration of 100g[(25km/h) for 7ms]. When the numbers at one wheel exceed 56 times, or When the numbers at more two wheels exceed 5 times, controller recognize the failure. 2. Controller counts the number of the wheel acceleration of 40g[(10km/h) for 7ms]. When the numbers at one wheel exceed 126 times, or When the numbers at more two wheels exceed 5 times, controller recognize the failure. 3. Controller counts the number of the wheel deceleration of -100g[(-25km/h) for 7ms]. When the numbers at each wheel exceed 56 times, controller recognize the failure. 4. The wheel deceleration of -100g[(-25km/h) for 7ms] causes the controller to start monitoring this failure and to compare the wheel velocity with the vehicle velocity from next cycle. When its difference of -100g is continued for more than 140msec, controller recognizes the failure. 5. In case that any sensor failure at other wheel was already detected, When the numbers of 100g at each wheel exceed 5 times, or When the numbers of 40g at each wheel exceed 20 times, controller recognize the failure.	- - - -	+3) +3) +3) +3)	+4) +4) +3) +4)	+3) +3) +3) +3)	+3) +3) +3) +3)

FL: C1 202 FR: C1 205 RL: C1 208 RR: C1 211		Large Air-Gap	This monitoring is performed for the schedule that the minimum velocity raises from 2km/h to 10km/h. 1. When the minimum wheel velocity is 2km/h and the velocity of other wheels exceed 10km/h with the acceleration of < 0.4g, the controller start comparing the velocity of other wheels except the min. wheel. if their difference below 4km/h is continued for 140msec, Otherwise, if their difference beyond 4km/h or >0.4g is continued for 2 minutes. 2. In < 0.4g, when the velocity of more two wheels is 2km/h and the max. wheel velocity exceeds 10km/h, the condition is continued for 20 sec. Otherwise, In >0.4g, the condition is 2 minutes. 3.After velocity of 4 wheels exceed 10km/h,when velocity of 1 or 2 wheel is 2km/h and velocity of the other 2 wheels are above 10km/h and difference velocity of those 2 wheels is less than 4km/h,if that conditions are continued for 12 seconds.	- - - -	+3) +3) +3) +3)	- - - -	+3) +3) +3) +3)	+3) +3) +3) +3)
FL: C1 201 FR: C1 204 RL: C1 207 RR: C1 210	ECU) SENSOR (wiring, harness, exciter, ECU)	Wrong Exciter	1. Wheel velocity is between 20km/h, and the wheel velocity is 40% of max. wheel velocity. if this condition is lasted for 2 minutes. 2.Max. wheel velocity exceeds 40km/h and the wheel velocity is 60% of max. wheel velocity. if this condition is lasted for 2 minutes.	- - - -	+3) +3) +3) +3)	+4) +4) +4) +4)	+3) +3) +3) +3)	+3) +3) +3) +3)
FL: C1 202 FR: C1 205 RL: C1 208 RR: C1 211		long term ABS mode	1) During the ABS control cycle, if the wheel velocity of 2km/h is lasted for more than 12sec. 2) If the ABS control cycle is continued for more than 16sec.	- - - -	- - - -	+4) +4) +4) +4)	- - - -	- - - -
C2 112	Valve Relay (ECU, wiring harness)	Open	When the valve relay is switched on, the reference voltage of valve relay is under the permitted range, which is continued for 56msec.	+1)	+1)	+1)	+1)	-
		Short	When the valve relay is switched off, the reference voltage of valve relay is over the criterion, which is continued for 56msec.	+1)	-	-	-	+1)
C1 604	Solenoid Valve (ECU, wiring harness)	Open, Short, Leakage Current	1) When the valve relay is switched off, the drain voltage of the solenoid drive MOSFET is over the criterion, which is continued for 56msec. 2) When the valve relay is switched on and a solenoid off, the drain voltage of the solenoid drive MOSFET is under the criterion, which is continued for 56msec.	+1)	+1)	+1)	+1)	+1)

			3) When the valve relay and a solenoid are switched on, the drain voltage of the solenoid drive MOSFET is over the criterion, which is continued for 56msec.					
C2 402	Motor Relay, Motor (ECU, wiring harness)	Short to BATT Motor Relay Open or Motor Short to BATT	When the motor relay is switched on, the reference voltage of motor is over the criterion, which is continued for 49msec.	-	+2)	+6)	+2)	-
		Lock Motor Lock	The controller starts monitoring the motor voltage for 84msec from the time when the motor relay is switched off. if the motor voltage is over the criterion for 49msec after shutting off the motor, the motor is reactivated for 500msec after shutting off the motor 84msec and the above check is performed again for a maximum of two times. When the motor voltage is not normal even on the second check, the controller recognizes it as failure.	-	+2)	-	+2)	-
		Motor Short to BATT	The controller starts monitoring the motor after 1.8sec from the time when the motor relay is switched off. if the motor voltage is under the criterion for 200msec.	+2)	+2)	-	+2)	+2)
		Motor Open	The controller starts monitoring the motor after 1.8sec from the time when the motor relay is switched off. if the motor voltage is under the criterion for 200msec.	+2)	+2)	-	+2)	+2)
C1 102	Power Supply	Low Voltage	1) When V_{ign}<9.4V is continued for 500msec. 2) When V_{ign}>9.6V is continued for 500msec, the controller recovers to normal state. 3) During ABS control or standstill, detection voltage = 8.4V, recovery voltage = 8.6V.	+5)	+5)	+5)	+5)	+5)
			4) When V_{ign}<7.2V is continued for 28msec. 5) When V_{ign}>7.5V is continued for 28msec, the controller recovers to state 1).	+1)	+1)	+1)	+1)	+1)

C1 101		Over Voltage	When V_{ign}>17V is continued for 500msec. When V_{ign}>19V is continued for 49msec. 3) if the voltage recovers normal operating range, the controller is reset.	+1)	+1)	+1)	+1)	+1)
C1 604	ECU	EEPROM Failure	When the MCU can't erase or write a data of the EEPROM.	+1)	+1)	+1)	+1)	+1)
		MCU Failure	If the master/slave processor detects abnormal operation in RAM, status register, interrupt, timer, A/D converter and cycle time.	+1)	+1)	+1)	+1)	+1)

The following Tables describe the failure location, the failure cause, the condition for detection, the failure code, the management of failure detected and the detect

(1) Detect mode

A : Initial check

B : Outside the ABS control cycle

C : Inside the ABS control cycle

D : Diagnosis mode

E : Failure mode

(2) The condition to detect a failure

+ : Detect the failure

- : Not detect the failure

(3) The management of failure detection

① System down. Both the ABS and the EBD function are inhibited and the ABS and If this happens, the valve relay and all solenoids are prevented from being switched on.

② Only the ABS function is inhibited. The ABS warning lamp is activated. And the EBD warning lamp is not activated.

③ Sensor failure outside the ABS control cycle.

a Only one sensor fails : The ABS warning lamp is activated.

b More than two sensors fail : take the same action as in management 1. the ABS and the EBD warning lamps are activated.

④ Sensor failure inside the ABS control cycle.

a One front sensor fails : inhibit the ABS control of the failed-wheel and maintain ABS control of the normal wheels.After the controller completes the ABS control, The ABS warning lamp is activated.

b One rear sensor fails : inhibit ABS control of both front wheels and the pressure

of both rear wheels is decreased.

After the controller completes the ABS control, The ABS warning lamp is activated.

c More than two sensor fail : the ABS warning lamps are activated. the EBD function are inhibited

⑤ Low operating voltage

a Outside the ABS control cycle : inhibit the ABS control of front wheels and allow ABS control of rear wheels, deactivating the motor. The ABS warning lamp is directly switched on.

When the voltage recovers to the normal operating range, enable the ABS function and the

b Inside the ABS control cycle : inhibit the ABS control of the front wheels and allow the ABS control of rear wheels, deactivating the motor. The ABS warning lamp is directly switched on and remains on. The error code is always stored.

⑥ Inhibit the ABS control of the front wheels and allow the ABS control of rear wheels, while deactivating the motor.(Only in motor failure).

5)Actuator driving

The Hi-Scan(Pro) activates the following actuators for testing.

Note:

(1) It should ensure ABS HECU's harness connect correctly before actuator testing.

(2) Actuator testing is only possible when the vehicle is stationary . If the vehicle speed during actuator testing exceeds 10km/h, forced actuation will be canceled.

Actuator test specifecations(see Table 16-18)

Table 16-18

No.	Description	Condition	Recognition	Time
1	Motor	KEY IN ENG. OFF	Motor pump relay operation(click sounds)	2 seconds
2	Front left valve(in)		Front left solenoid valve operation(click sounds)	
3	Front right valve(in)		Front right solenoid valve operation(click sounds)	
4	Rear left valve(in)		Rear left solenoid valve operation(click sounds)	
5	Rear right valve(in)		Rear right solenoid valve operation(click sounds)	
6	Front left valve(out)		Front left solenoid valve operation(click sounds)	

7	Front right valve(out)		Front right solenoid valve operation(click sounds)	
8	Rear left valve(out)		Rear left solenoid valve operation(click sounds)	
9	Rear right valve(out)		Rear right solenoid valve operation(click sounds)	

6) ABS-HECU terminals check

Draw out the lever of locking mechanism of ABS-HECU connector as shown Fig 16-58, disconnect ABS-HECU connector, measure the output voltage at the harness-side connector. Resistance. See Table 16-19 Table 16-59.

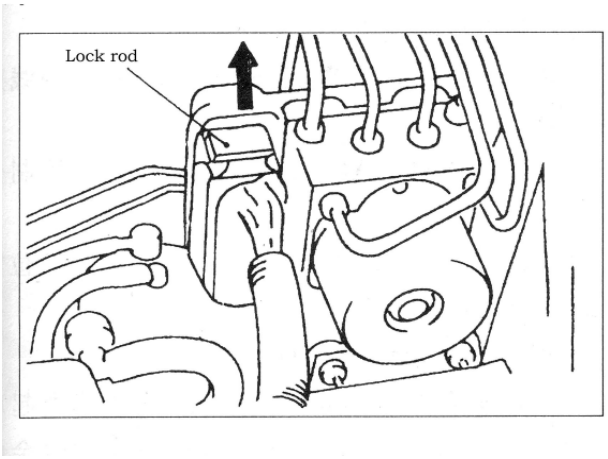


Fig.16-58

Fig 16-59

Table 16-16

Terminal No.	Description	Condition	Output
25	Battery power source 1 Solenoid valve power source	Always	Battery voltage
24	Ground	Always to ABS control	
7	Diagnosis interface terminal (K-Line)	Data to the Hi-Scan(Pro)	

6 2 20 23	Wheel speed sensor(RL) Wheel speed sensor (FL) Wheel speed sensor (FR) Wheel speed sensor (RR)		Resistance R=1275 ～ 1495Ω
5 1 19 22	Wheel speed sensor (RL) Wheel speed sensor (FL) Wheel speed sensor (FR) Wheel speed sensor (RR)		
4	Power input via ignition 2 switch	ignition 2 switch	Checking high voltage wave 16～20V Checking keeping voltage wave 6.5～16V
9	-Power source 2 -Motor power source	Always	System voltage Maximal current:I ＜ 100A(time t＜100ms＝ Rating current:I ＜ 30A(time t＞100ms)
8	Ground line-2(engine)		
16	ABS and EBD warning lamp output terminal	Electrifying and driving ABS system	Maximal current:I ＜ 200mA Maximal voltage:V ＜ 40V
18	Brake lamp switch input terminal		Input voltage value1.0～2.75V 5.0～16V
21	EBD control		Maximal current:I ＜ 200mA
3	Speed signal		Maximal current:I ＜ 10mA Outer resistance:10Ω or over

4 . On-vehicle service

1) Wheel speed sensor output voltage check

(1) Lift up the vehicle and release the parking brake.

(2) Draw out the lever of locking rod of ABS-HECU connector as shown Fig 16-60, disconnect ABS-HECU connector.

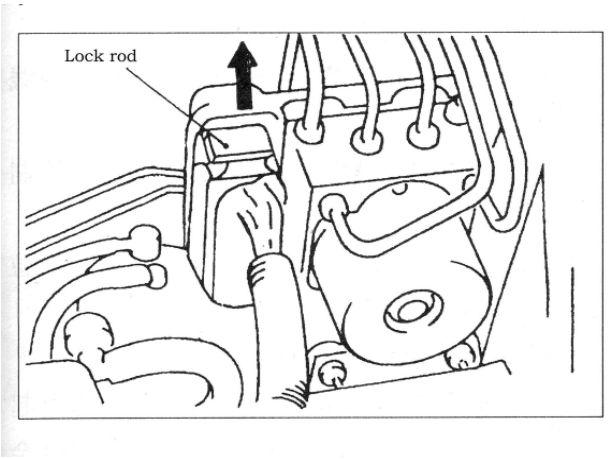


Fig. 16-60

(3)Rotate the wheel to be measured approximately 1/2 to 1 rotation per second, and check the output voltage using a multimeter or an oscilloscope

Terminal code (see Table 16-20):

Table 16-20

FL	FR	RL	RR
1	19	5	23
2	20	6	22

Output voltage :

When measuring with multimeter: 42 mV or more

When measuring with oscilloscope : 100mV Peak-to-peak or more

(4) If the output voltage is lower than the above values ,the reason could be as follow ,So replace the wheel speed sensor.

- Air gap become large between wheel speed sensor pole and rotor
- Wheel speed sensor is faulty.

2)Inspecting Waveforms With An Oscilloscope

After checking the connection of the sensor harness and HECU' s harness is in good condition, and observing the output voltage waveform from each wheel sensor with an oscilloscope according to the following method.

Start the engine, and rotate the front wheels by engaging 1st gear (vehicles with manual transmission).Turn the rear wheels manually so that they rotate at a constant speed.

(1) The waveform measurements can also be taken while the vehicle is actually moving.

(2) The output voltage will be small when the wheel speed is low ,and similarly it will be large when the wheel speed is high.

3)Points in waveform measurement(see Table 16-21)

Table 16-21

Symptom	Probable causes	Remedy
Too small or zero waveform amplitude	Faulty wheel speed sensor	Replace sensor
Waveform amplitude fluctuates excessively (this is no problem if the minimum amplitude is 100mV or more)	Axle hub eccentric or with large runout	Replace hub
	Faulty HECU’s grand	Repaired
Noisy or disturbed waveform	Open circuit in sensor	Replace sensor
	Open circuit in harness	Correct or replace harness
	Incorrectly mounted wheel speed sensor	Mount correctly
	Rotor with missing or damaged teeth	Replace rotor

Caution

The wheel speed sensor cable moves following motion of the front of rear suspension .Therefore, it is likely that it has an open circuit only when driving on rough roads and it functions normally on ordinary roads. It is ,therefore ,recommended to observe sensor output voltage waveform also under special conditions, such as rough road driving.

4)ABS CHECK

（1）Jack up the vehicle and support the vehicle with rigid racks placed at the specified jack-up points or place the wheels which are checked on the rollers of the braking force tester.

Caution

1）The roller of the braking force tester and the tyre should be dry during testing.
2）When testing the front brakes ,apply the parking brake ,and when testing the rear brakes ,stop the front wheels by chocking them.

（2）Turn the ignition switch off before connecting the Hi-Scan(Pro).

Caution

Turn the ignition switch off before connecting or disconnecting the Hi-Scan(Pro).

(3) After checking that the shift lever is in neutral ,start the engine.

（4）Use the Hi-Scan(Pro) to force-drive the actuator.

① Must ensure ABS-HECU ’s harness connect correctly before testing.

② ABS lamp lights, ABS’ s controlling is failure during testing.

(5) After inspection and turning the ignition switch off , disconnect the Hi-Scan(Pro) .

5) Remedy for a flat battery

When booster cables are used to start the engine when the battery is completely flat and then the vehicle is immediately driven without waiting for the battery to recharge itself to some extent , the engine may misfire, and driving might not be possible .

This happens because ABS consumes a great amount of current for its self-check function ; the remedy is to either allow the battery to recharge sufficiently , or to remove the fusible link for its self-check function ; the remedy is to either allow the battery to recharge sufficiently, or to remove the fusible link for ABS circuit , thus disabling the anti-skid brake system . The ABS warning lamp will illuminate when the fusible link (for ABS) is removed.

After the battery has sufficiently recharged, install the fusible link (for ABS) and restart the engine; then check to be sure the ABS warning lamp is not illuminated.

5. Hydraulic unit ABS-HECU

1) Removal and installation sequence see Fig.16-61。

Pre-removal Operation	Post - installation Operation
1) Drain Brake Fluid 2) Remove air cleaner	1) Brake Fluid Supplying , Brake Line Bleeding 2) Examine HECU 3) installing air filter

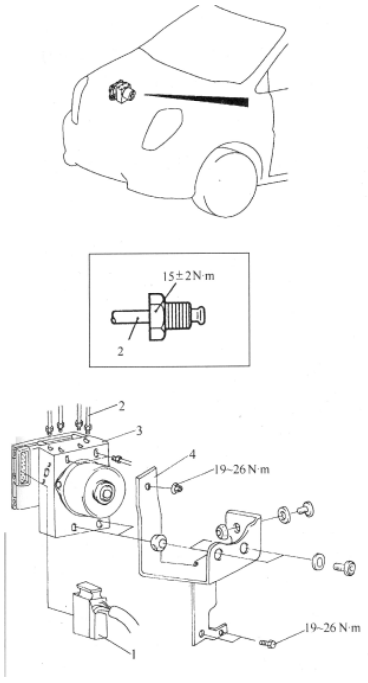


Fig. 16-61

1. wire connector
2. connecting of brake pipe
3. HECU
4. HECU bracket

2) Removal service point

Removal ABS-HECU connector

Draw out the lever of locking rod of ABS-HECU connector as shown Fig. 16-62, disconnect ABS-HECU connector.

Removal hydraulic unit.

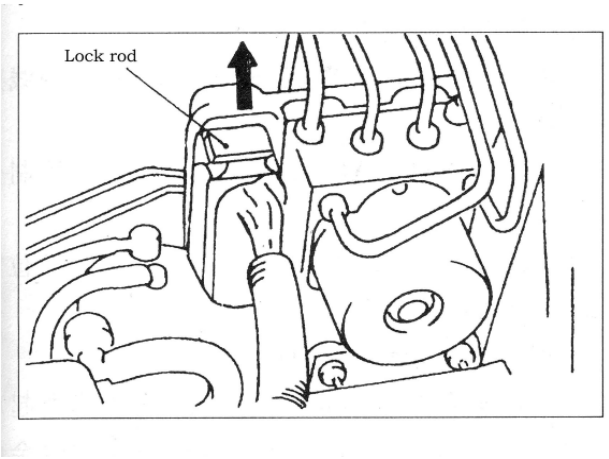


Fig. 16-62

Caution
(1) The hydraulic unit assembly is heavy ,and so care should be taken when removing it. (2) The hydraulic unit assembly is not to be permit; its nuts and bolts should absolutely not be loosened. (3) The hydraulic unit assembly must not be dropped or otherwise subjected to impact shocks. (4) The hydraulic unit assembly must not be turned upside down or laid on its side. it should transport and lay in on vertical location and sealing connector. (5) Don't drain off brake fluid in HECU.

3) Installation key Point

Installation brake pipes

Connect the pipes to the hydraulic unit assembly as shown in the illustration see Fig. 16-63.

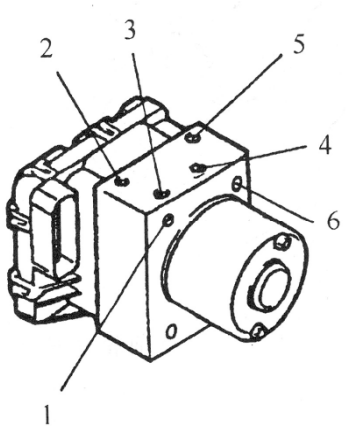


Fig. 16-63

1. From the master cylinder (Secondary);
2. To the front brake (LH)
3. To connector assy ,four channels (rear brake ,RH);
4. To connector assy ,four channels (rear brake ,LH);
5. To the front brake (RH);
6. From the master cylinder (Primary);

4) Bleeding and Filling of brake system

The steps as the following:

(1) Remove the reservoir cap and fill the brake reservoir with brake fluid.

Brake fluid: SHELL DOT3

Caution
If there is any brake fluid on any painted surface, wash it off immediately.

(2) Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the

other end of the tube into a half filled clear plastic bottle.

(3) Connect the Hi-Scan(Pro) to the Data Link Connector located underneath the dash panel.

(4) Select and operate according to the instructions on the Hi-Scan(Pro) screen.

Caution
You must obey the maximum operating time of the ABS motor with the Hi-Scan (Pro) to prevent the motor pump from burning.

(5) Depress the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then tighten the bleeder screw.

(6) Repeat step 5 until there are no more bubbles in the fluid for each wheel.

Bleeder screw tightening torque :**7～9N・m**

6. Wheel Speed Sensor

1) Removal and Installation **(see Fig. 16-64)**

Post-installation Operation
Wheel speed sensor output voltage check.

2) Removal service point

(1) Removal front/rear wheel speed sensor according to Fig 16-65.

Caution
Be careful when handling the pole piece at the tip of the speed sensor and the toothed edge of the rotor so as not to damage them by striking against other parts.

3) Inspection

(1) Measure the resistance between the speed sensor terminals.

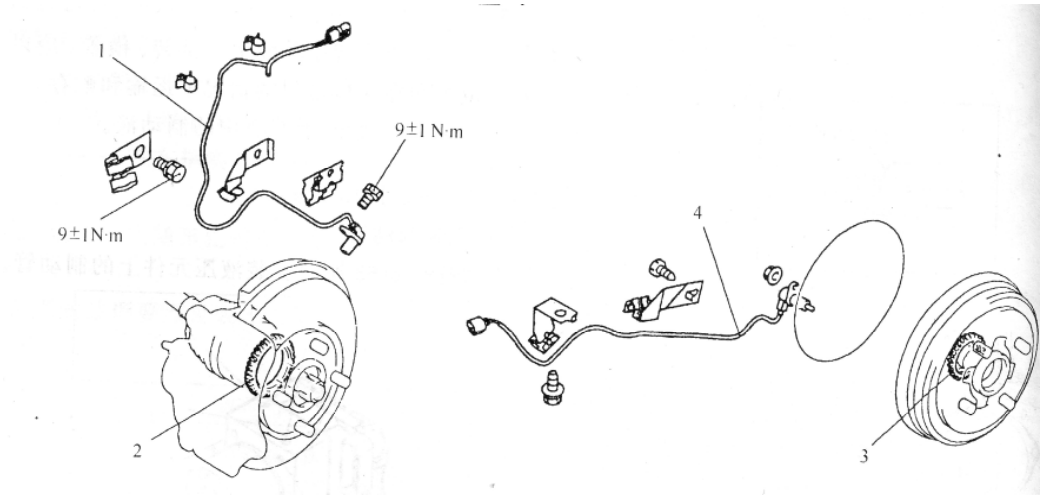


Fig. 16-64

Remove sequence for front wheel speed sensor　　Remove sequence for rear wheel

speed sensor

1. Front wheel speed sensor
2. Front toothed rotor
3. Rear toothed rotor
4. Rear wheel speed sensor

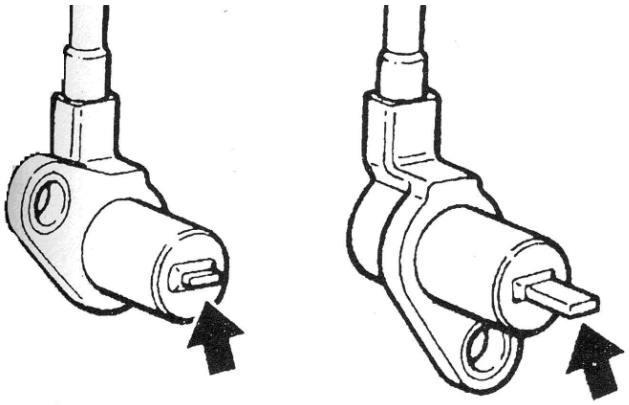


Fig.16-65

Notice

The pole piece can become magnetized because of the magnet but into the speed sensor with the result that metallic foreign material easily adheres to it .Moreover the pole piece may not be able to function to correctly sense the wheel rotation speed if it is damaged.

1) Measure the resistance between the speed sensor terminals(see Fig. 16-66). If the internal resistance of the speed sensor is not within the standard value ,replace with a new speed sensor.

Standard value:1.275～1.295KΩ

2) Check the speed sensor cable for breakage ,damage or disconnection ;replace with a new one if a problem is found.

When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not temporary disconnection occurs.

(2) Speed sensor insulation inspection

1) Remove all connections from the speed sensor ,and then measure the resistance between terminals No.1 and No.2 and the body of the speed sensor. see Fig. 16-67.

Standard value: over 1000KΩ

2) If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

(3) Toothed rotor inspection.

Check whether rotor teeth are broken or deformed, and ,if so ,replace the rotor.

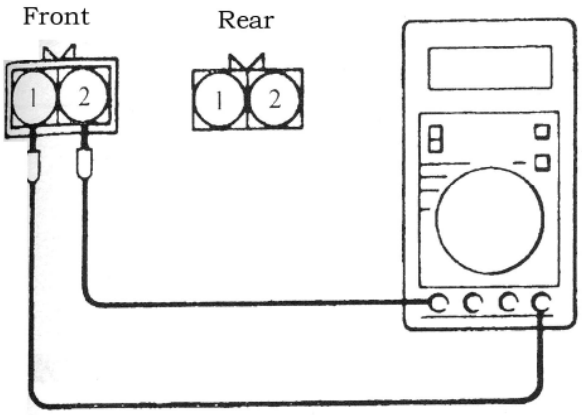


Fig. 16-66

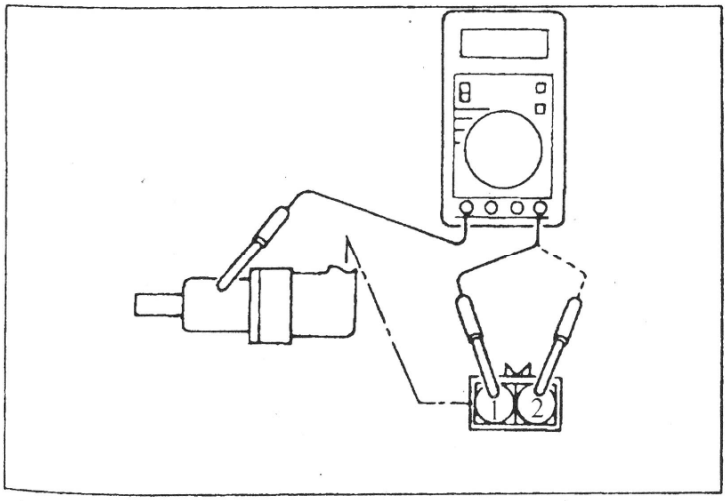


Fig. 16-67

17 Steering System

Note

1. Airbag is dangerous. The user must read the user's guide handbook first before installing or disassembling the product. If necessary, please come to the service station for help.

For the vehicle installing SRS, before removing steering wheel and SRS components equipped the vehicles, must read service precautions and air bag and clock spring assembly involved contents in nineteenth chapter.

2.When removing and installing components with * in contents, must does not shock any SRS-related components.

17.1 Service Specifications

SERVICE SPECIFICATIONS(Table17-1)

Table17-1

Items			Standard valve	Limit
Steering wheel free play (mm)	when engine running		-	30 or less
	with engine stopped		0～10	-
Steering angle	Inner wheel		41°±2°	-
	Outer wheel		33°±2°	-
Ball joint turning torque N.m			0.5～2.5	-
Stationary steering effort N		Steering effort	28 or less	-
		Fluctuation allowance	5.9 or less	-
Oil pump relief pressure (MPa)			9.2	-
Pressure under no-load conditions (MPa)			0.2～0.7	
Steering gear retention hydraulic pressure(MPa)			9.2	

Oil pressure switch operating pressure (MPa)	OFF → ON	1.5～2
	ON → OFF	0.7～2.0
Total pinion torque (N.m)	Total rotation torque	0.6～1.6
	Torque variation	0.4 or less
Tie rod joint swing resistance(N)(Tie rod joint swing torque N.m)		6～19(1.5～4.9)
Opening dimension of special tool mm(MB991561)		2.9

17.2 Lubricants

LUBRICANTS (Table17-2)

Table17-2

Items	Specified lubricant	Quantity
Power steering fluid	(Shell Dolax TA)	Approx.0.6L
Tie rod bellows	Silicone grease	As required
Pinion and valve assembly	Repair kit grease	As required
Rack assembly	Repair kit grease	As required
Inside ball joint dust cover	Repair kit grease	As required

17.3 Sealant

Sealant (Table 17-3)

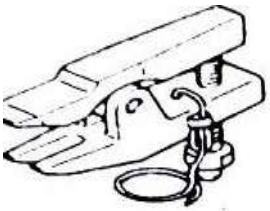
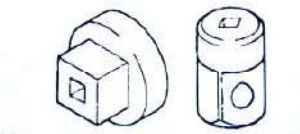
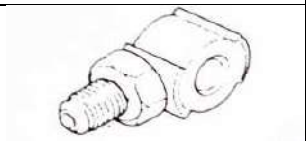
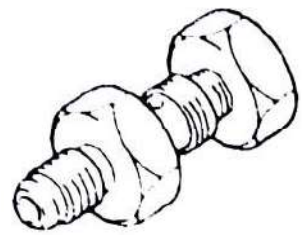
(Table 17-3)

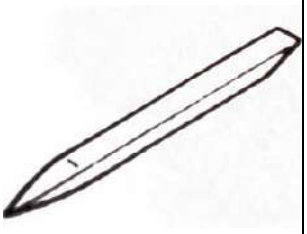
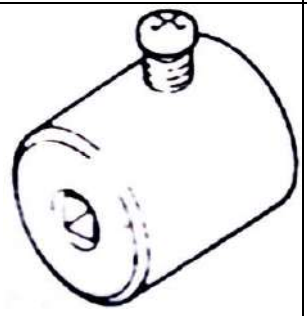
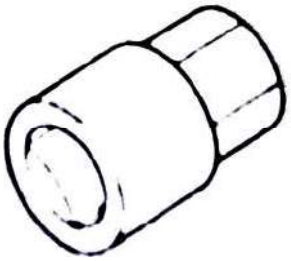
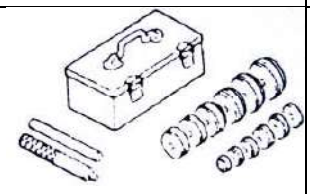
Items	Specified sealant
Joint cover installation nut	XY-407sealant

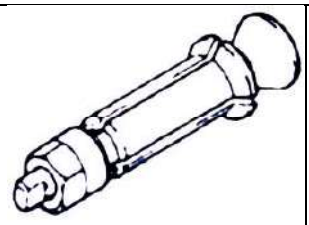
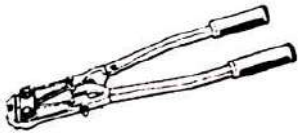
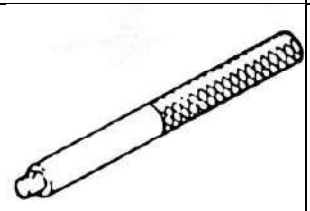
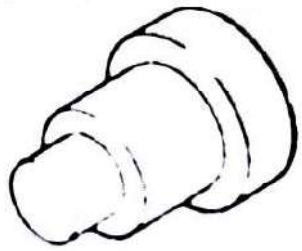
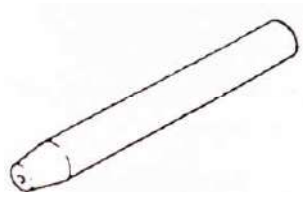
17.4 Special Tools

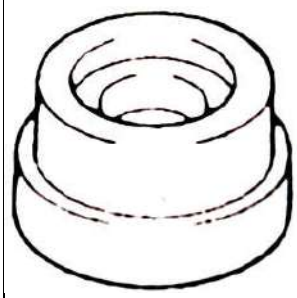
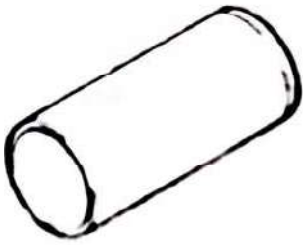
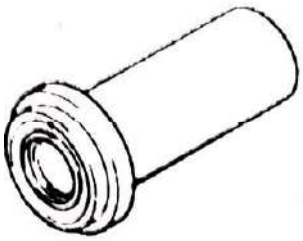
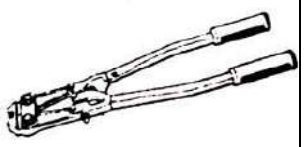
Special tools(Table 17-4)

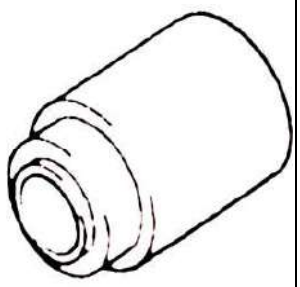
Table17-4

Tool	Number	Name	Use
	MB990635 MB991113 or MB991406	Steering linkage puller	Disconnection of tie rod end
	MB990326	Preload socket	Measurement of the ball joint turning torque
	MB990993	Power steering oil pressure gauge adapter(pump side)	Measurement of oil pressure
	MB990994	Power steering oil pressure gauge adapter(hose side)	
	MB990662	Power steering oil pressure gauge assembly	

	MB990784	Accessories removal tool	Remove lower cover of steering wheel
	991006	Preload socket	Measurement of the total pinion torque
	MB991204	Torque wrench socket	● Removal and installation of steering gear housing ● Adjustment of the total pinion torque
	MB990925	Bearing and oil seal installer set	Installation of the oil seal and bearing

	MB991120	Needle bearing puller	Removal of rack housing needle bearing
	MB991199	Seal installation tool	●Press fitting of rack housing bearing. ●To press in the oil seal for the rack
	MB991197	Bar (long type)	
	MB991202	Oil seal and bearing installer	Press fitting of rack housing bearing To press in the oil seal for the rack
	MB991213	Rack installer	Rack installation

	MB991203	Oil seal and bearing installer	Installation of the oil seal and bearing
	MB991317	Seal ring installer	Compression of the seal rings after replacement of the pinion seal rings
	MB990941	Torque tube bearing installer	Installation of valve housing oil seal
	MB991561	Boot band crimp-ing tool	Installation of bellows band

	MB990776	Front axle base	Installation of dust cover for tie rod end ball joint

17.5 On-Vehicle Service

1.STEERING WHEEEL FREE PLAY CHECK

（1）With engine running (hydraulic operation),set front wheels straight ahead.

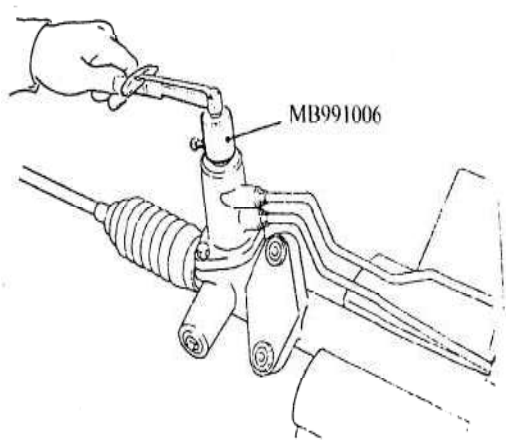
（2）Measure the play on steering wheel circumference before wheels start to move when sightly moving steering wheel in both directions.

Limit:30mm or less

（3）When play exceeds the limit,check for play on steering shaft connection and steering linkage.Correct or replace.

（4）After checking third item ,If the free play still exceeds the limit value,set steering wheel straight ahead with engine stopped.Load 5 N towards steering wheel circumference and check play.

Standard value:0-10mm



（5）After checking fourth item ,If the play exceeds the standard value,remove steering gear box and check total pinion torque.(Refer to fig 17-1).

Fig 17-1

2.STEERING ANGLE CHECK

(1) Locate front wheels on turning radius gauge and measure steering angle.

Standard value(Table17-5)

Table 17-5

Inner wheel	41°±2°
Outer wheel	33°±2°

（2）When the angle is not within the standard value,the toe-in is probably incorrect .Adjust the toe-in and recheck steering angle.

3.TIE ROD END BALL JOINT STARTING TORQUE CHECK(Fig 17-2　Fig17-3)

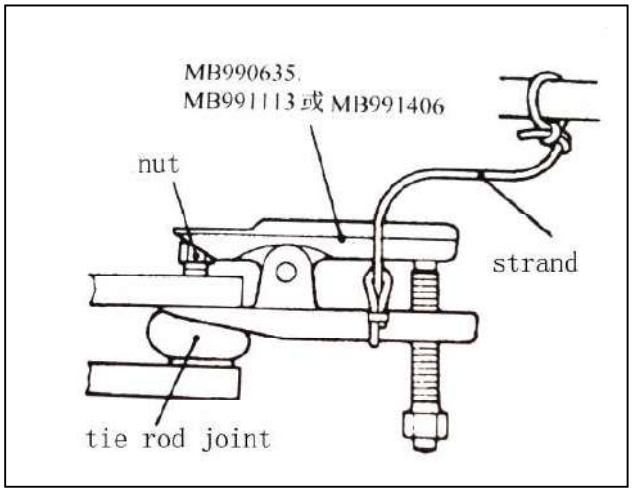


Fig 17-2

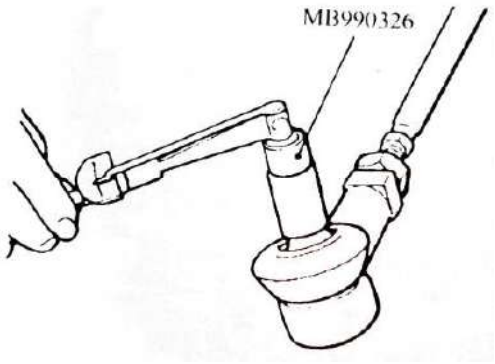


Fig 17-3

（1） Disconnect tie rod and knuckle with special tool.

Caution

(1)Loosen the nut of the special tool,but do not remove it.If it is removed,the ball joint thread may be damaged.

(2)Tie the special tool with a cord so as not to fall off.

（2）Move ball joint stud several times and install nut on stud.Measure ball joint turning torque with special tool.

Standard value:0.5-2.5N.m

（3）When the starting torque exceeds the standard value,replace tie rod end.

（4）When the starting torque is under the standard value,check ball joint for end play or ratcheting .If none of these,the joint is still serviceable.

4.**STATIONARY STEERING EFFORT CHECK**

(1)With the vehicle stopped on a flat,paved surface,turn the steering wheel to the straight ahead position.

（2）Start the engine and set it to 1000±100r/min.

（2） Attach a spring balance to the outer circumference of the steering wheel and measure the steering force required to turn the steering wheel from the straight ahead position to the left and right (within a range of 1.5 turns).Also check to be sure that there is no significant fluctuation of the required steering force.(See fig 17-4)

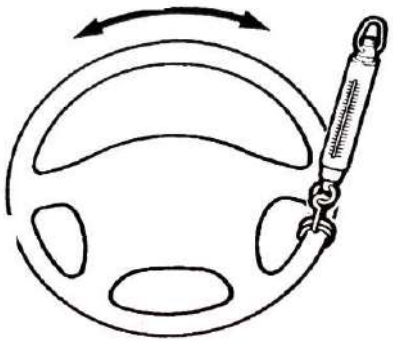


Fig 17-4

Standard value:(Table17-6)

Table17-6

Steering effort	28N or less
Fluctuation allowance	5.9N or less

(4) If the standard values are not met,check and adjust the related parts.

5.**CHECKING STEERING WHEEL RETURN TO CENTRE**

To make this test,conduct a road test and check as follows.

（1） Make both gradual and sudden turns and check the steering “feeling ”to be sure that there is not difference in the steering force required and the wheel return between left and right turns.

(2)At a speed of 35 km/h,turn the steering wheel 90°and release the steering wheel after 1-2 seconds.If the steering wheel then returns 70°or more ,the return can be judged to be satisfactory. (See fig 17-5)

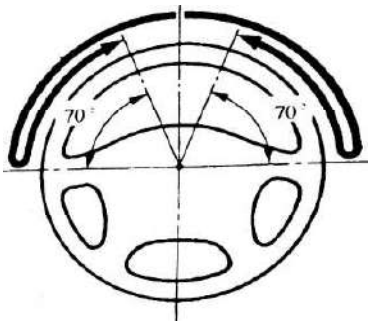


Fig 17-5

NOTE

There will be a momentary feeling or “heaviness”when the wheel is turned quickly,but this is not abnormal.(This is because the oil pump discharge amount is especially apt to be insufficient during idling)

6.**DRIVE BELT TENSION CHECK AND ADJUSTMENT(REFER TO INVOLED PART OF THE MANUAL)**

7.POWER STEERING FLUID LEVEL CHECK(See fig 17-6)

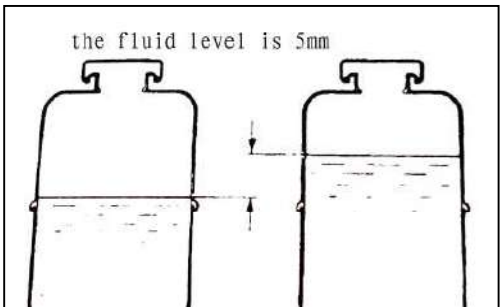


Fig 17-6

（1）Park the vehicle on a flat,level surface,start the engine,and then turn the steering wheel several times to raise the temperature of the fluid to approximately 50-60℃。

（2）With the engine running ,turn the wheel all the way to the left and right several times.

（3）Check the fluid in the oil reservoir for foaming or milkiness.

（4）Check the difference of the fluid level when the engine is stopped,and while it is running.If the change of the fluid level is 5mm or more,air bleeding should be done.

8、**POWER STEERING FLUID REPLACEMENT(See fig 17-7)**

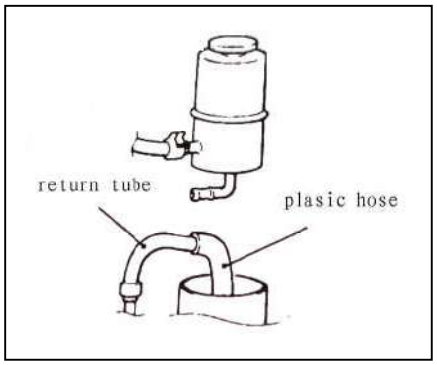


Fig 17-7

（1）Raise the front wheels on a jack ,and then support them with rigid racks.

（2）Disconnect the return hose connection.

（3）Connect a vinyl hose to the return hose,and drain the oil into a container.

(4)Disconnect the ignition coil connectors.

(5)While operating the starting motor intermittently,turn the steering wheel all the way to the left and right several times to drain all of the fluid.

（6）Connect the return hoses securely,and then secure it with the clip.

（7）Fill the oil reservoir with specified fluid (Shell Dolax TA)up to between “MAX”and “MIN”marks,and then bleed air.

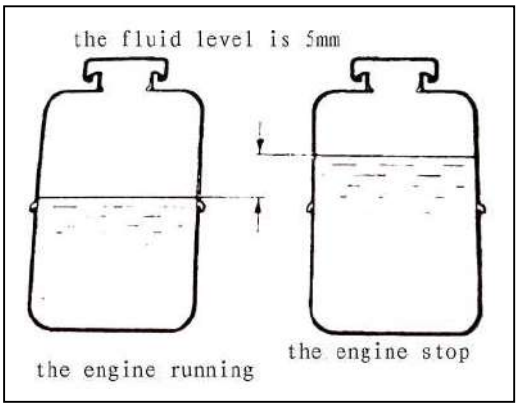


Fig.17-8

9.POWER STEERING SYSTEM BLEEDING(See fig 17-8)

(1)Jack up the vehicle and support the front wheels with rigid racks.

(2)Disconnect the ignition coil connectors.

(3)Cranking the engine with the starter several times intermittently (during15 to 20 seconds),turn the steering wheel left and right fully five or six times.

Caution

(1) During the bleeding, refill the fluid so that the level is always above "MIN" mark on the oil reservoir.

(2) Be sure to bleed air only while cranking. If the bleeding is done with the engine running, the air will be broken up and absorbed into the fluid.

(4)Connect the ignition coil connectors and idle the engine.

(5)Turn the steering wheel left and right fully until no bubble comes out in the oil reservoir.

(6)See that the fluid is not milky and that the fluid level is between "MAX" and "MIX" marks.

(7)See that the fluid level changes little when the steering wheel is turned left and right.

(8)Check difference in fluid levels between the engine stopped and running.

(9)If the level changes more than 5mm, the air is bled. So, bleed air again.

Caution

(1)If the fluid level rises suddenly after the engine is stopped, the bleeding is incomplete.

(2)Incomplete bleeding causes abnormal noise from the pump and the flow-control valve could lessen the life of the pump and the parts.

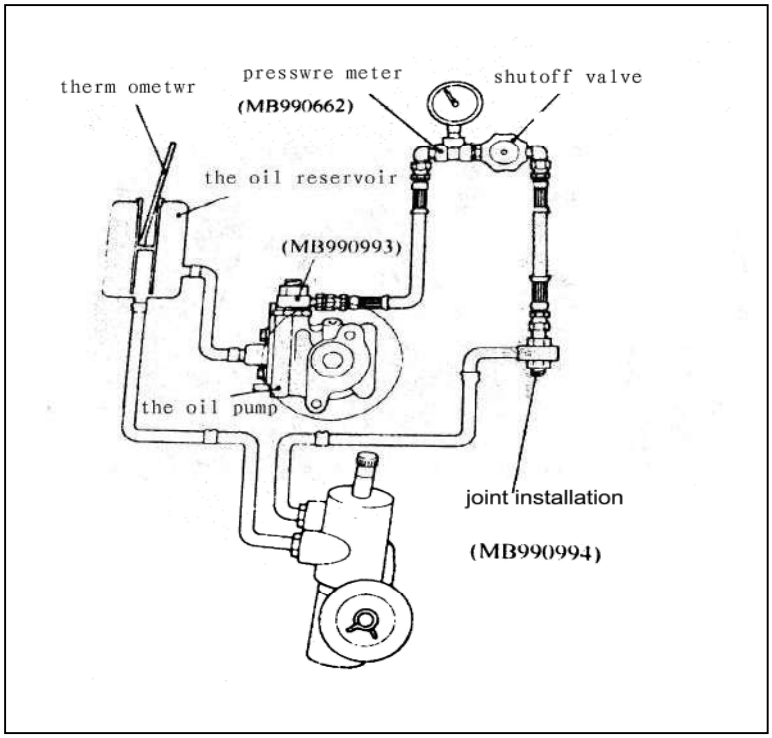


Fig.17-9

10 OIL PUMP PRESSURE TEST (See fig .17-9)

(1)Disconnect the pressure hose from the oil pump, and then connect the special tools.

(2)Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50-60℃.

(3)Start the engine and idle it at 1000±100r/min.

(4)Fully close the shut-off valve of the pressure gauge and measure the oil pump relief pressure to confirm that it is within the standard value range.

Standard value:8.0-8.5MPa

(5)If the standard value is not met, disassemble and assemble the oil pump again. Then, measure oil pressure.

(6)With the pressure gauge shut-off value fully open, check the hydraulic pressure in unladen condition.

Standard value: 0.2- 0.7Mpa

(7)If the standard value is not met, the oil line or steering gear is probably defective. So, repair

and measure oil pressure again.

(8)Turn the steering wheel fully either left or right and check the retention hydraulic pressure.

Standard value:9.2Mpa

(9)If the pressure is below the standard value, disassemble and reassemble the steering gear. If above, disassemble and reassemble the components of the oil pump flow control valve. Then, measure oil pressure again.

(10)Remove the special tools, and tighten the pressure hose to the specified torque.

Tightening torque:57±7Nm

(11)Bleed the system.

11.**POWER STEERING OIL PRESSURE SWITCH CHECK(See Fig 17-10)**

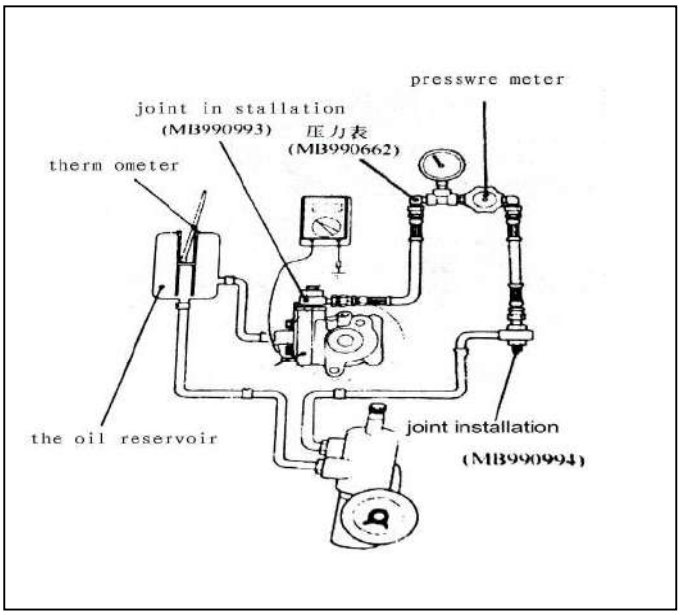


Fig 17-10

(1)Disconnect the pressure hose from the oil pump, and then connect the special tools.

(2)Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50-60℃.

(3) The engine shoule be idling.

(4)Disconnect the connection of the connector for the oil pressure switch,and set an ohmmeter in position.

(5) Gradually close the shut-off valve of the pressure gauge and increase the hydraulic pressure ;then check whether or not the hydraulic pressure that activates the switch is the standard value..

Standard value: 1.5- 2.0Mpa

(6)Gradually open the shut-off valve and reduce the hydraulic pressure ;then check whether or not the hydraulic pressure that deactivates the switch is the standard value..

Standard value: 0.7- 2.0Mpa

(7)Remove the special tools, and tighten the pressure hose to the specified torque.

Tightening torque:57±7Nm

(8)Bleed the system.

12.BALL JOINT DUST COVER CHECK

(1) Check the dust cover for cracks or damage by pushing it with finger.

(2) If the dust cover is cracked or damaged,replace the tie rod end.

NOTE:

Cracks or damage of the dust cover may cause damage of the ball joint.

17.6 Steering Wheel

1.REMOVAL AND INSTALLATION

Post-installation Operation

Checking Steering Wheel Position with Wheels Straight Ahead

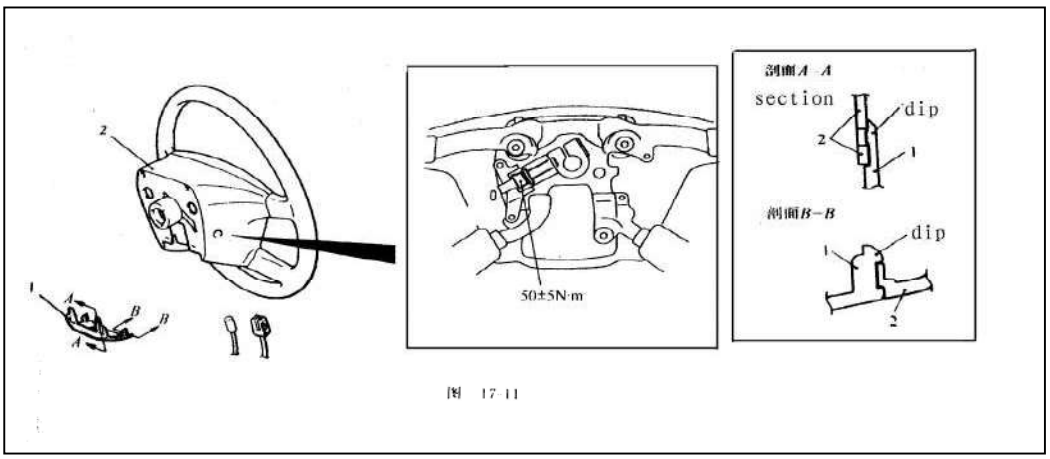


图 17-11

Fig 17-11

Removal steps(See fig 17-11)

1. Cover

2. Steering wheel and air bag module assembly

Caution:

Before removing the air bag module and clock spring ,refer to 19 chapter service precautions and Air Bag Module and Clock Spring.

REMOVAL SERVICE POINTS:

1） COVER REMOVAL

Insert the special tool from the indicated position as shown fig 17-12 to remove the cover.

NOTE:

The special tool can be inserted through the notch behind the position shown Fig 17-12,

2) **STEERING WHEEL AND AIRBAG MODULE ASSEMBLY REMOVAL**

1) By sliding section A of the clock spring connector shown in the illustration in the arrow direction,disconnect the connector.

2) Loosen the bolt completely.Then, remove the steering wheel and airbag module assembly. (See fig 17-13)

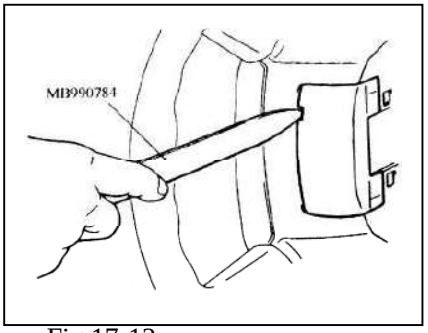


Fig 17-12

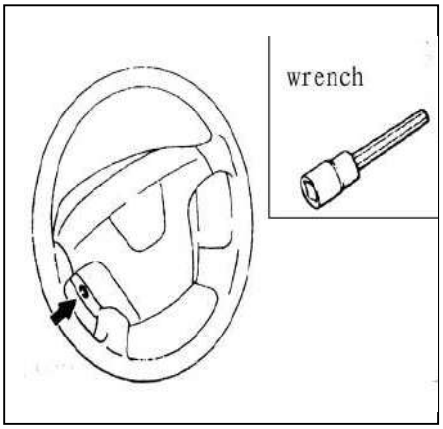


Fig 17-13

17.7 Steering Shaft

1.REMOVAL AND INSTALLATION

Pre-removal Operation
Remove steering wheel and airbag module assembly
Remove column switch assembly

Post-installation Operation
Install column switch assembly
Install airbag module assembly

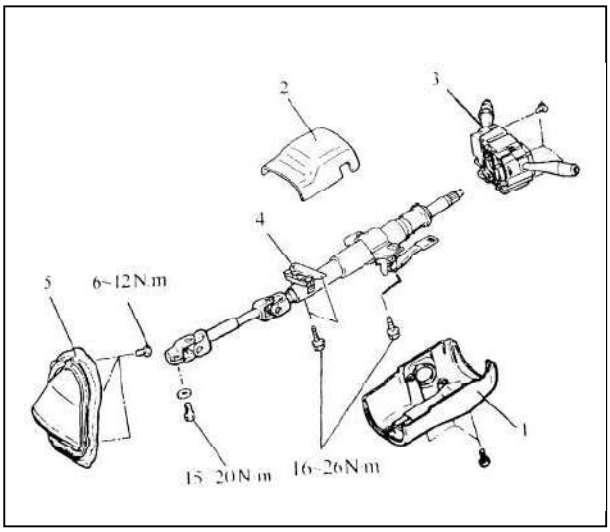


Fig 17-14

Removal steps (See fig 17-14)

1)Lower column cover

2)Upper column cover

3) Column switch assembly

4) Steering column shaft assembly

5)Cover assembly

2.DISASSEMBLY AND REASSEMBLY(See fig 17-15)

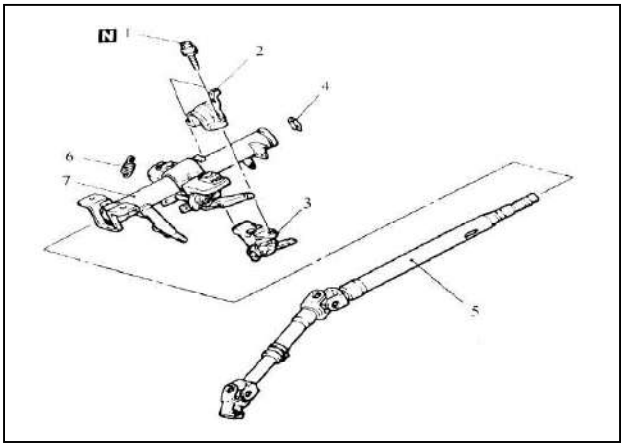


Fig 17-15

DISASSEMBLY SERVICE POINT

(1) **SPECIAL BOLT REMOVAL(See fig 17-16)**

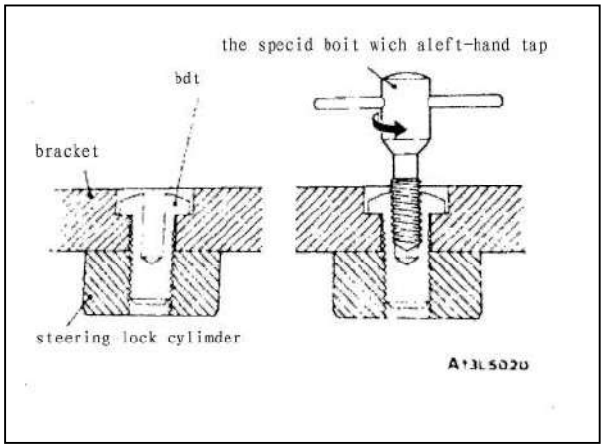


Fig 17-16

1) Drill in the special bolt a hole deep enough for the tap to stand.

2)Remove the special bolt with a left-hand tap.

REASSEMBLY SERVICE POINT

(1) STEERING LOCK CYLINDER ASSEMBLY .STEERING LOCK BRACKET.SPECIAL BOLT INSTALLATION**(See fig 17-17)**

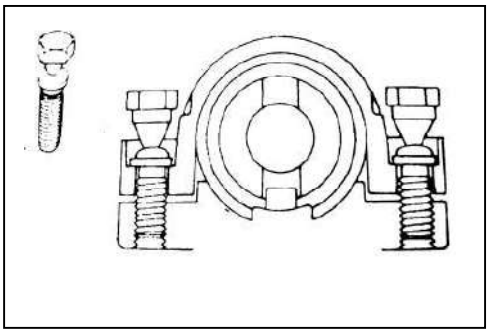


Fig 17-17

1)When installing the steering lock cylinder assembly and steering lock bracket to the steering column assembly, temporarily install the steering lock in alignment with the column boss.

2)Check that the steering lock works properly.Then,tighten the special bolts until the heads twists off.

17.8 Power Steering Gear Box and Linkage

1. REMOVAL AND INSTALLATION

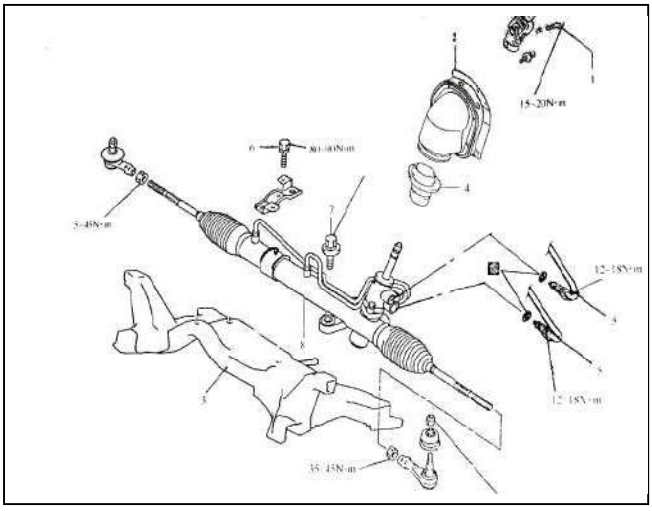


Fig 17-18

Removal steps(See fig 17-18)

1) Bolt
2) Cover assembly
3) Crossmember

4) Joint cover gromment

5) Return tube connection

6) Bolt assembly

7) Bolt assembly

8) Steering gear and linkage

INSPECTION

(1) **GEAR BOX PINION TOTAL ROTATION TORQUE CHECK(See fig 17-19)**

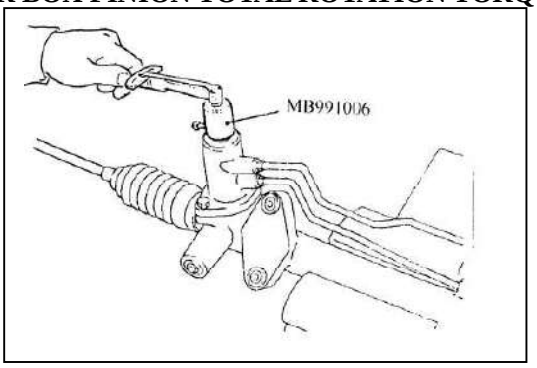


Fig 17-19

Using the special tool,turn the pinion gear at a speed of one rotation per 4 to 6 seconds to measure total rotation torque.

Standard values:

Total rotation torque : 0.6～1.6N.m

Torque fluctuation: 0.4N·m or less

Caution
Secure the steering gear box and linkage in their mounting positions only.Otherwise,deformation or damage could result.

(2) **Measure**

1） Remove the bellows from the rack housing.

2）Measure the total rotation torque by turning the special tool left and right 180°from the neutral position.

3) If the standard values are not met ,adjust the pinion total rotation torque.

4) In case the adjustment is impossible,disassemble and check the components,and repair if necessary.

(3) **TIE ROD SWING RESISTANCE CHECK**

1) Swing the tie rod 10 times hardly.

2) With the tie rod end downwards as shown fig 17-20,use a spring scale to measure swing resistance

Standard value: 1.5～4.9N.m

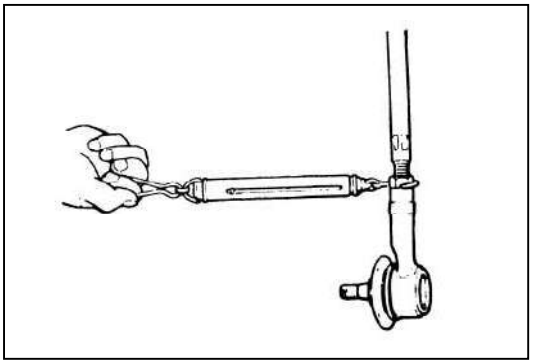


Fig.17-20

3) If the measured value is above the standard value,replace the tie rod.

4) If below,check the ball joint for looseness or ratcheting.The tie rod is still serviceable when the ball joint swings smoothly.

(4) TIE ROD END BALL JOINT DUST COVER CHECK

1) Check the dust cover for cracks or damage by pushing it with finger.

2) If the dust cover is cracked or damaged,replace the tie rod end.

NOTE:

A cracked or damaged dust cover may damage the ball joint.Replace the dust cover when it is damaged during service work.

2.DISASSEMBLY AND REASSEMBLY

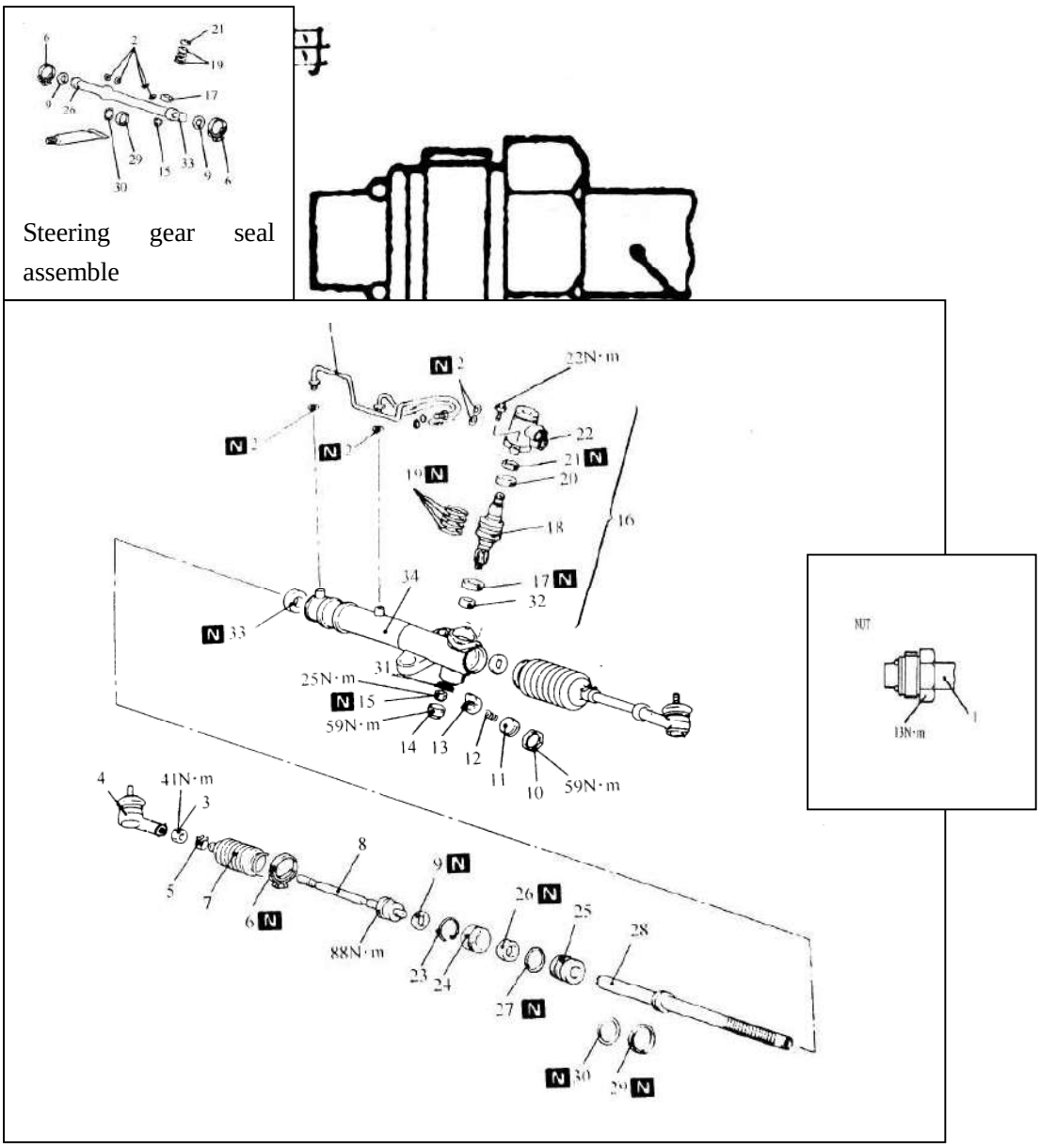


Fig 17-21

Disassembly steps(See fig 17-21)

1) Feed pipe；2-O-ring；3-Lock nut；4-Tie rod end；5-Clip；6-Band；7-Bellows；8-Tie rod；9-Tab washer；10-Lock nut；11-End plug；12-Support spring；13-Rack support；14-Bearing cover；15-Lock nut；16-Valve housing assembly；17-Oil seal；18-Pinion and valve assembly；19-Seal ring；20-Bearing；21-Oil seal；22-Valve housing；23-Limit ring；24-Rack stopper；

25-Rack bushing；26-Oil seal；27-O-ring；28-Rack assembly；29-Seal ring；30-O-ring；31-Bearing；32-Upper bearing；33-Oil seal；34-Gear housing.

2. Lubrication and sealing points(See fig 17-22)

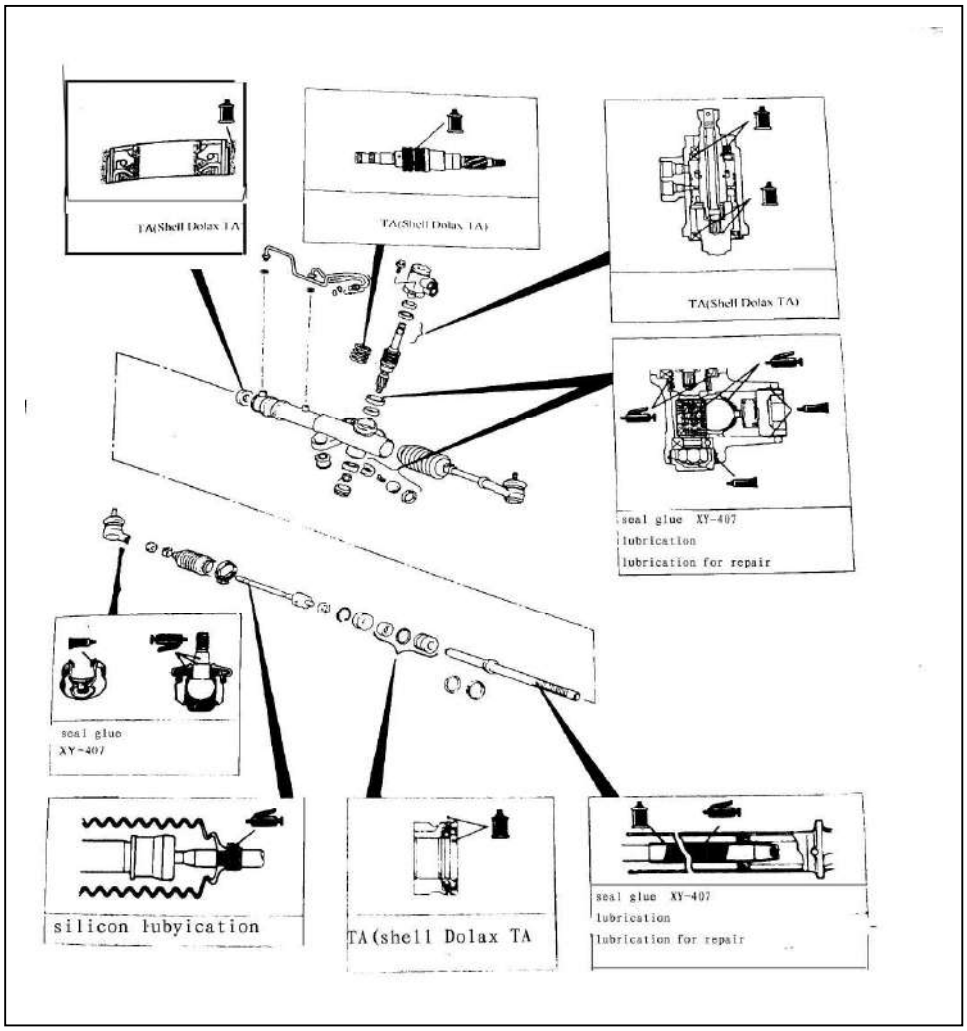


Fig 17-22

(1)DISASSEMBLY SERVICE POINTS

1)RACK SUPPORT COVER REMOVAL**(See fig 17-23)**

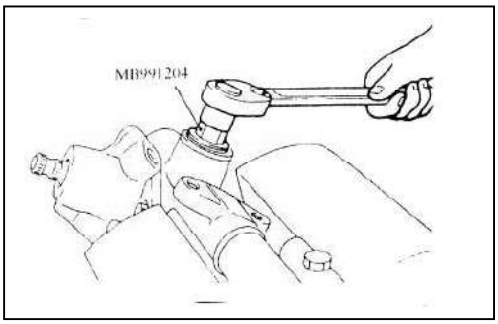


Fig 17-23

2)LOWER OIL SEAL /PINION AND VALVE ASSEMBLY REMOVAL**(See fig 17-24)**

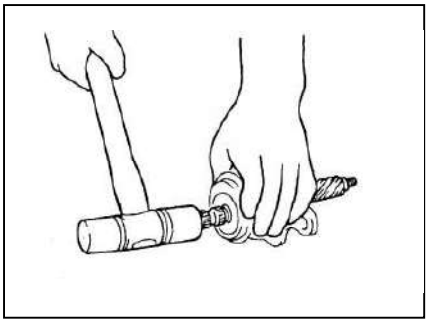


Fig.17-24

With a plastic hammer,lightly tap the pinion and valve assembly in its spline to remove the lower oil seal and pinion and valve assembly from the valve housing.

3) **SEAL RING REMOVAL(See fig 17-25)**

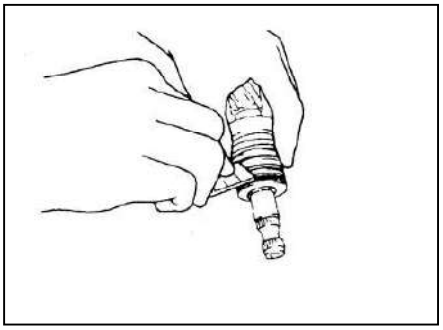


Fig 17-25

Cut the seal ring to remove from the pinion and valve assembly.

Caution:

When cutting the seal ring ,be careful not to damage the pinion and valve assembly.

4) **UPPER BEARING/UPPER OIL SEAL REMOVAL(See fig 17-26)**

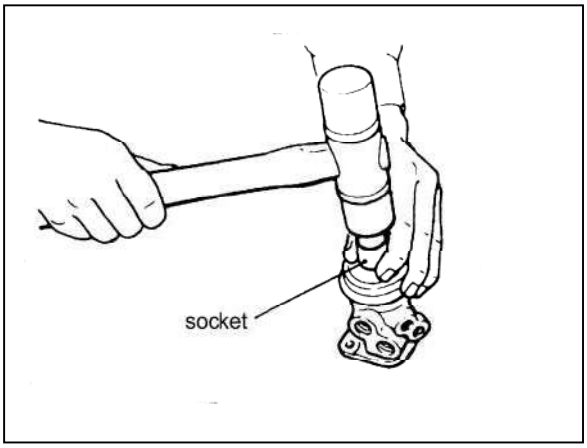


Fig 17-26

Using a socket,pull out the upper oil seal and bearing from the valve husing.

5) **CIRCLIP REMOVAL(See fig 17-27)**

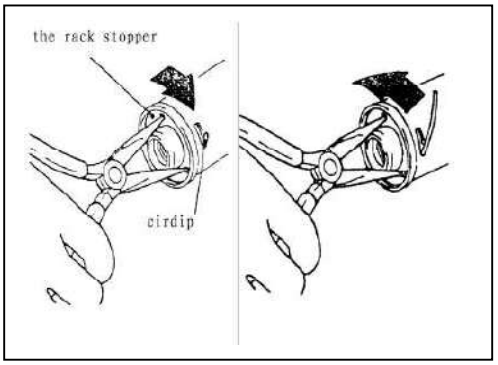


Fig 17-27

a Turn the rack stopper clockwise until the circlip end comes out of the slot in the rack housing.

b Turn the rack stopper anticlockwise to remove the circlip.

Caution

Do not turn the rack stopper anticlockwise first.Otherwise,the circlip will get caught in the slot in the housing,which makes the rack stopper unable to turn.

6) RACK STOPPER/RACK BUSHING/OIL SEAL/O-RING/RACK ASSEMBLY REMOVAL

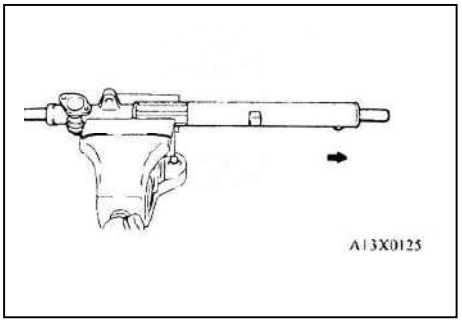


Fig17-28

a Remove the rack stopper,rack bushing,oil seal and O-ring together by pulling out the rack gently. **(See fig 17-28)**

b Partaly bend the oil seal to remove from the rack bushing . **(See fig 17-29)**

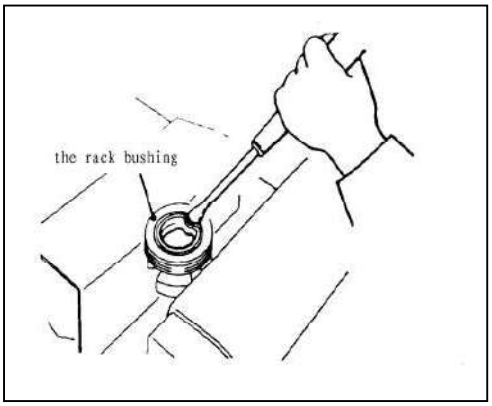


Fig 17-29

Caution
Use care not to damage the oil seal press-fitting surface of the rack bushing.

7)**LOWER BEARING REMOVAL(See fig 17-30)**

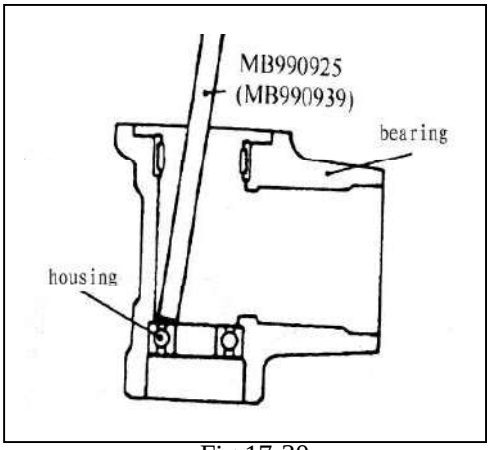


Fig 17-30

8) **NEEDLE BEARING REMOVAL(See fig 17-31)**

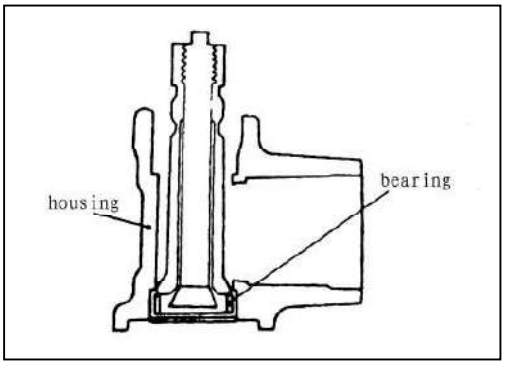


Fig 17-31

Caution:
Do not open the special tool to much,otherwise it may damage the inside surface of the valve housing.

9) **OIL SEAL REMOVAL(See fig 17-32)**

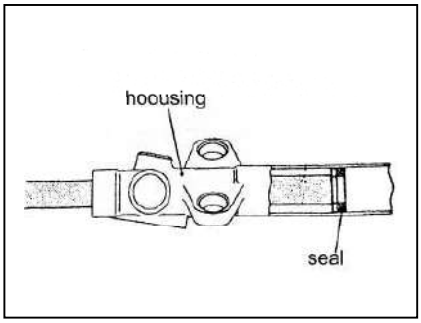


Fig 17-32

Use a pipe or the like to pull out the oil seal.

(2)REASSEMBLY SERVICE POINTS

1) **OIL SEAL INSTALLATION(See fig 17-33)**

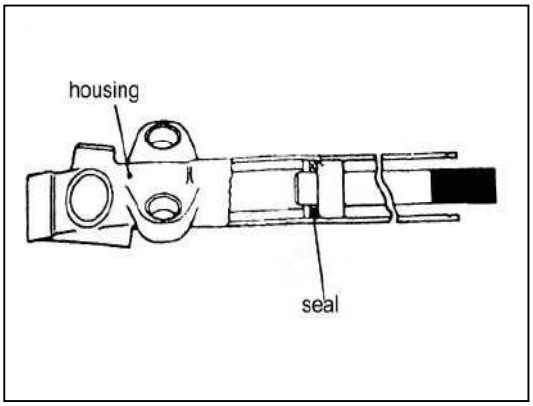


Fig 17-33

2) **NEEDLE BEARING/LOWER BEARING INSTALLATION(See fig 17-34)**

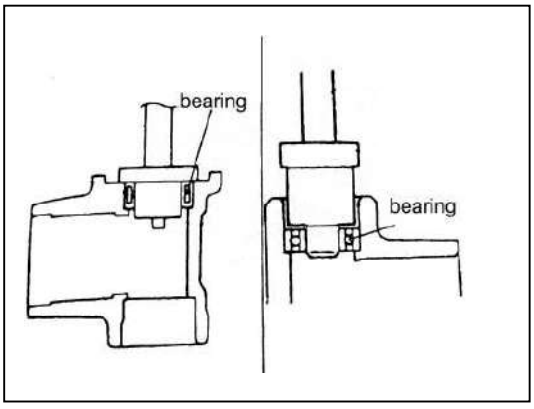


Fig 17-34

3) **RACK ASSEMBLY INSTALLATION(See fig 17-35)**

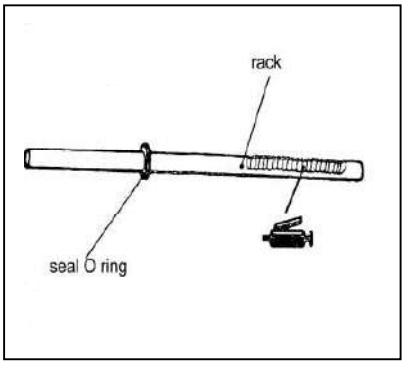


Fig 17-35

a Apply repair kit grease to the teeth of the rack assembly.

Caution：Use care not to close the vent hole in the rack with grease。

b Cover the serrations of the rack assembly with the special tool。

c Apply special fluid to the outer surfaces of the special tool,seal ring and O-ring. **(See fig 17-36)**

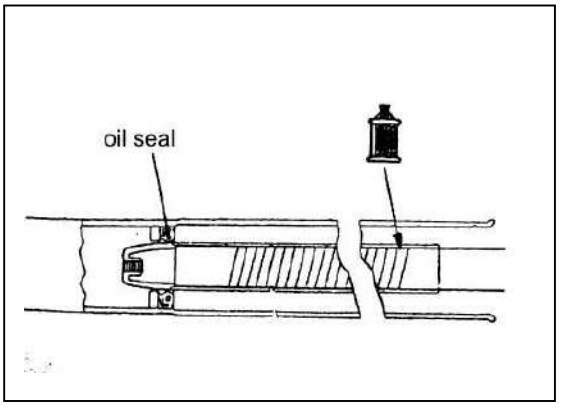


Fig 17-36

d Slowly insert the rack covered with the special tool from the power cylinder side of the gear housing。

Caution：

Carefully push in the rack with the oil seal centre and the special tool end matched.This is to avoid the retainer spring coming off.

4) **OIL SEAL/RACK BUSHING INSTALLATION**

a Apply specified fluid to the outer surface of the oil seal .Using the special tool ,press in the oil

seal until it is flush with the bushing end face. **(See fig 17-37)**

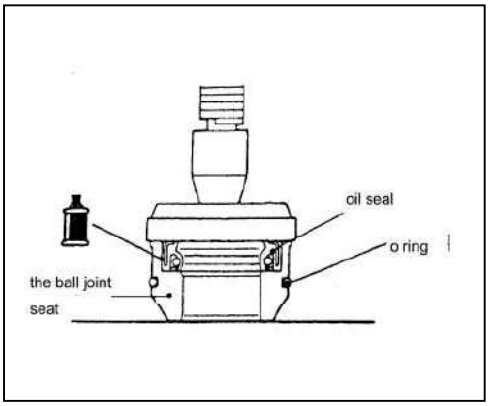


Fig 17-37

b Apply the specified fluid to the oil seal inner surface and the O-ring.

c Wrap the rack end with plastic tape,and push the rack bushing onto the rack. **(See fig 17-38)**

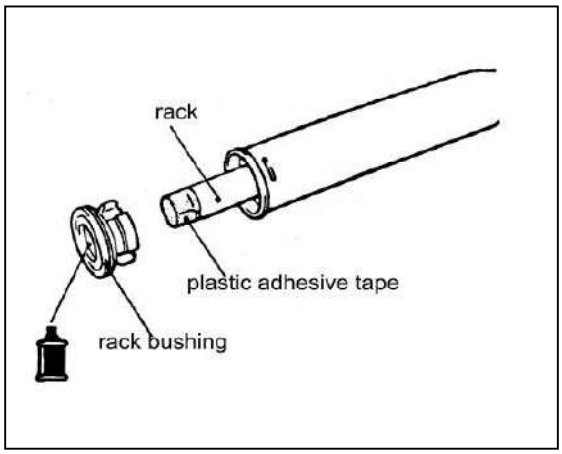


Fig 17-38

5)CIRCLIP INSTALLATION

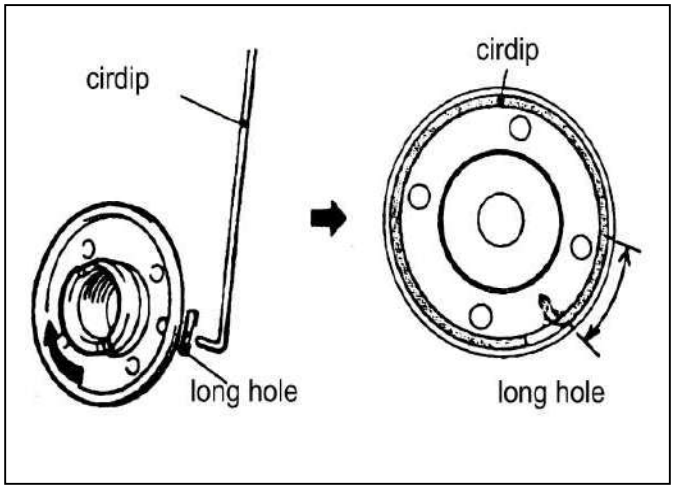


Fig 17-39

Align the mark on the rack stopper and the slot in the cylinder.Then ,insert the circlip into the rack stopper hole through the cylinder hole.Turn the rack stopper clockwise and insert the circlip firmly. **(See fig 17-39)**

6)**UPPER OIL SEAL/UPPER BEARING INSTALLATION(See fig 17-40)**

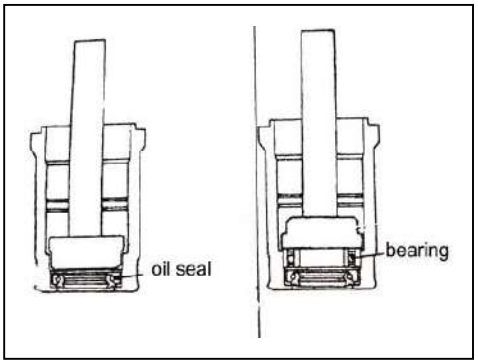


Fig 17-40

7)**SEAL RING INSTALLATION**

After installation ,using the special tool or by hand,compress seal rings that expand during installation. **(See fig 17-41)**

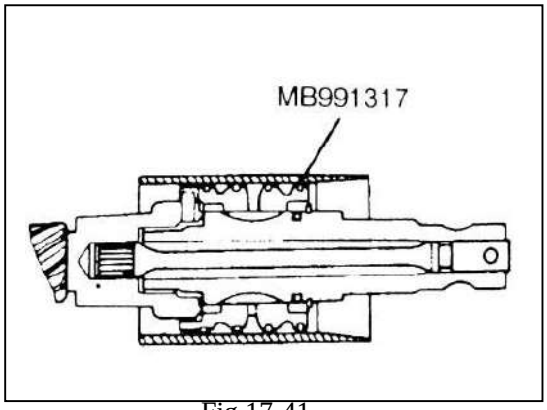


Fig 17-41

8) **LOWER OIL SEAL INSTALLATION**

Using the special tool,press the oil seal into the valve housing.The upper surface of the oil seal must project outwards about 1 mm from the housing end surface. **(See fig 17-42)**

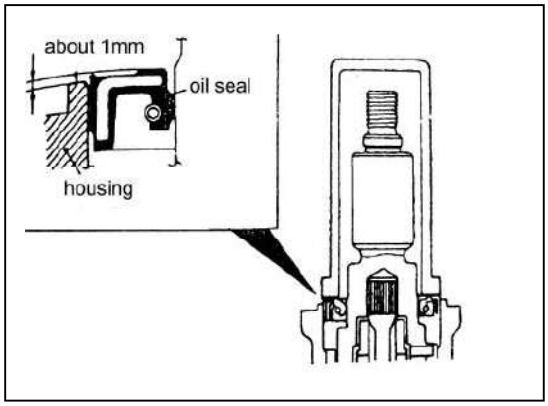


Fig 17-42

Caution:

When the oil seal is flush with or lower than the housing edge,reassemble the components.Otherwise,oil leaks will result.

9) **END PLUG INSTALLATION(See fig 17-43)**

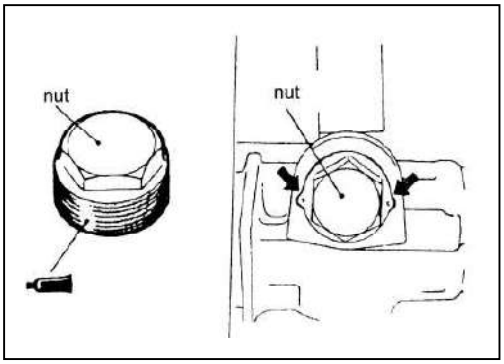


Fig 17-43

a Apply specified sealant to the threaded section of the end plug ,and then install the end plug to the gear housing。

b Use a punch to bend over the two tabs on the sides of the end plug to stop the end plug from turning。

10) **RACK SUPPORT COVER/LOCKING NUT INSTALLATION**

a Apply specified sealant to the rack cover support thread。

b Using the special tool ,tighten the rack support cover to 23±2Nm。

c Return the rack support cover by about 30°。

d Tighten the locking nut to the specified torque ,using the special tool to prevent the rack support cover from spinning。

11)**PINION TOTAL ROTATION TORQUE ADJUSTMENT**

a Using the special tool ,measure total rotation torque by turning the pinion gear at a speed of one rotation per 4 to 6 seconds.

Standard values: Total rotation torque : 0.6～1.6N.m

Torque fluctuation: 0.4N·m or less

b If the total rotation torque or torque fluctuation does not meet the standard values,adjust by returning the rack support cover within a range of 0°～30°.

Caution

(1) Adjust around the maximum limit of the standard values.

(2) See that no ratcheting or catching are present when operating the rack towards the shaft direction.

(3) Measure the total pinion torque through the whole stroke of the rack.

(4) If the adjustment is impossible in the given range,check the components of the rack support cover,and replace if necessary.

12）**TAB WASHER/TIE ROD INSTALLATION(See fig 17-44)**

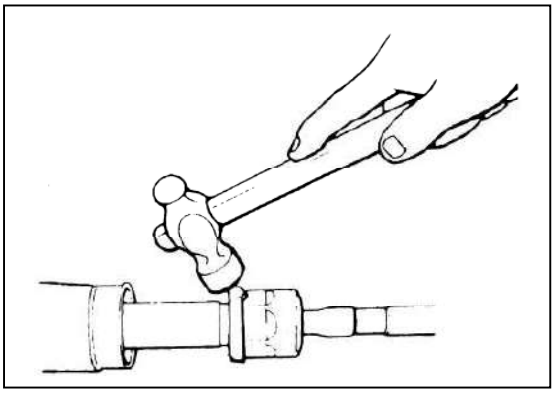


Fig 17-44

After installing the tie rod to the rack,fold the tab washer end to the tie rod notch.

13)**BELLOWS BAND INSTALLATION(See fig 17-45)**

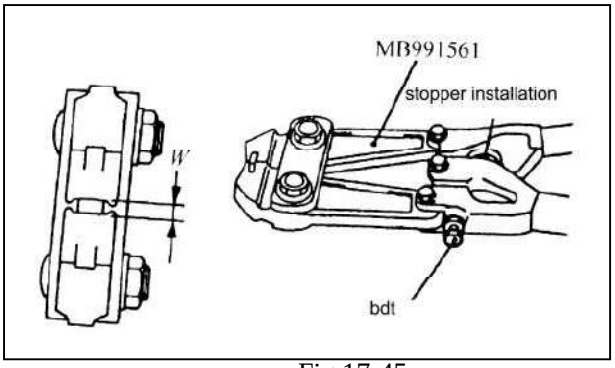


Fig 17-45

a Turn the adjusting bolt of the special tool to adjust the opening dimension (W) to the standard value.

Standard value(W):2.9mm

〈When more than 2.9mm〉 Screw in the adjusting bolt.

〈When less than 2.9mm〉 Loosen the adjusting bolt.

b **Use the special tool to crimp the bellows band.(See fig 17-46)**

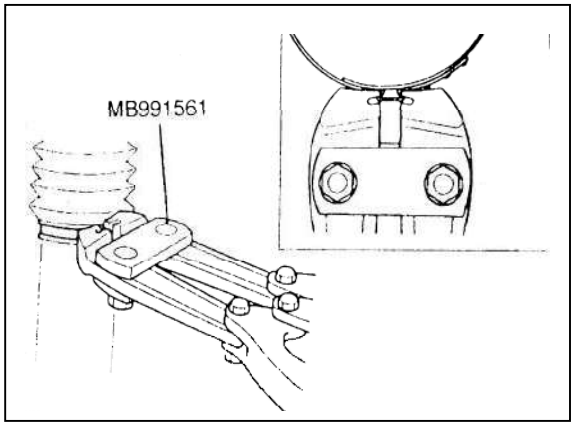


Fig 17-46

Caution:
(1) Hold the rack housing,and use the special tool to crimp the bellows band securely.
(2) Crimp the bellows band until the special tool touches the stopper.

c See that the crimped width (A) meets the standard value.

Standard value(A):2.4-2.8mm

〈When more than 2.8mm〉

Readjust the dimension (W)of step (1)to the value calculated by the following equation,and repeat step (2).

W=5.5mm-A［Example:If(A)is 2.9mm,(W)is 2.6mm.］

〈When less than 2.4mm〉

Remove the bellows band ,readjust the dimension (W) of step (1) to the value calculated by the following equation,and use a new bellows band to repeat steps b to c

W=5.5mm-A［Example:If(A)is 2.3mm,(W)is 3.2mm.］(See fig 17-47)

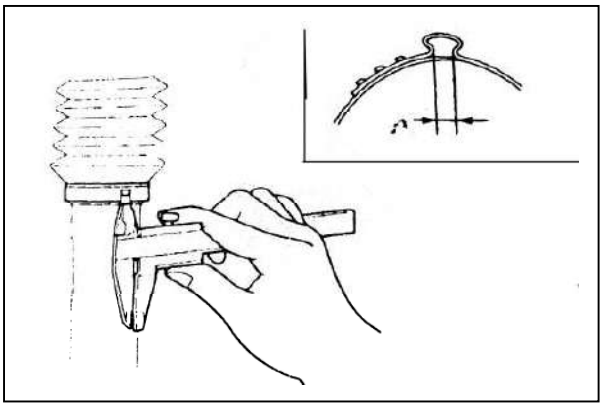


Fig 17-47

14)**TIE ROD END/LOCKING NUT INSTALLATION**

Screw in the tie rod end until the dimension shown fig 17-48 is achieved. Then ,temporarily tighten with the locking nut.

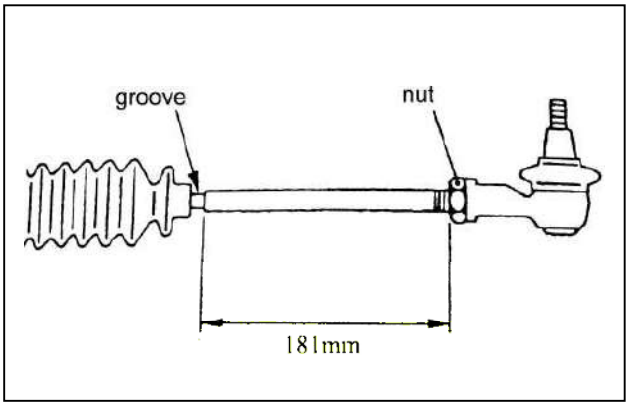


Fig 17-48

The locking nut must be tightened securely only after the power steering gear box and linkage are installed to the vehicle and toe-in is adjusted.

(3) TIE ROD END BALL JOINT DUST COVER REPLACEMENT(See fig 17-49)

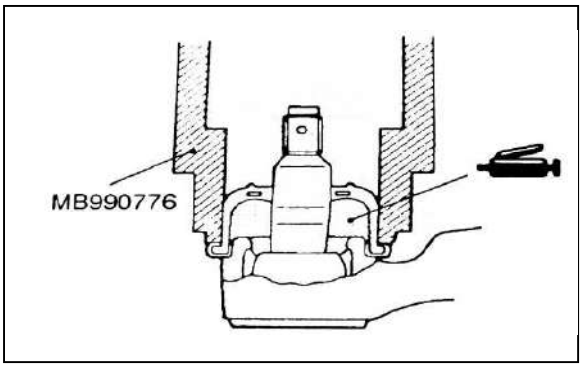


Fig 17-49

Only when the dust cover is damaged accidentally during service work ,replace the dust cover as follows:

1) Apply grease to the inside of the dust cover.

2) Apply specified sealant to installation surface of ball joint dust cover。

3) Drive in the dust cover with special tool until it is fully seated。

4) Check the dust cover for cracks or damage by pushing it with finger。

17.9 Power Steering Oil Pump

1. **REMOVAL AND INSTALLATION**

Pre-removal operation	Post-installation operation
Power steering fluid draining	Power steering fluid supplying and bleeding Drive belt tension adjusting

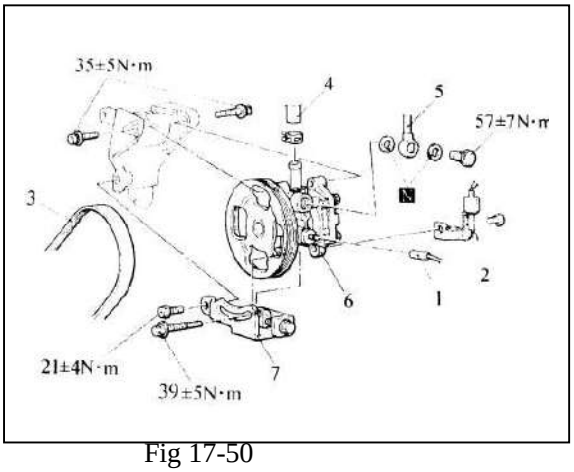


Fig 17-50

Removal steps(See fig 17-50)

1、 Pressure switch connector

2、A/C compressor harness connector

3 Drive belt

4Suction hose connection

5、Pressure hose connection

6、Oil pump assembly

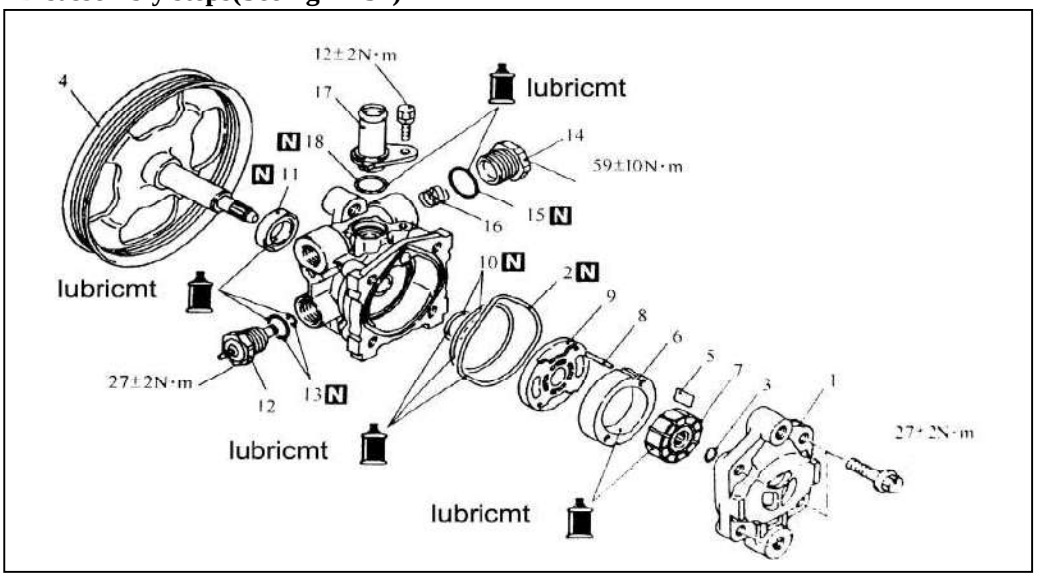
7、Oil pump

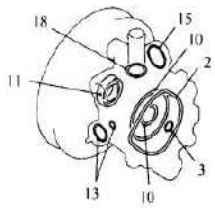
2.**DISASSEMBLY AND REASSEMBLY**

Caution:

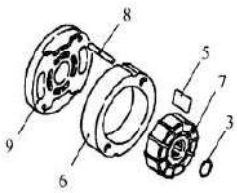
Never disassemble the terminal assembly unable to be reassemble

Disassembly steps(See fig 17-51)

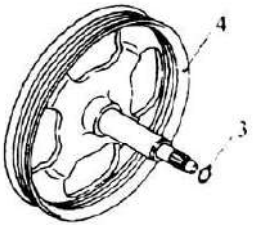




Tleoil pump seal assemble



Pewer steering parts



Pulley and shaft

Fig 17-51

1-Pump cover；2-O-ring；3-Snap ring；4-Pulley and shaft；5-Valve(Vanes)；6-Cam ring；7-Rotor；8-Pin；9-Side plate；10-O-ring；11-Oil seal；12-Terminal assembly；13-O-ring；

14-Plug assembly；15-O-ring；16-Flow control spring；17-Suction connector；18-O-ring.

REASSEMBLY SERVICE POINTS

(1)**O-RING INSTALLATION(See fig 17-52)**

No	ID×Width mm
1	15.8×2.4
2	21.0×1.9
3	14.8×2.4
4	14.8×1.9
5	3.8×1.9

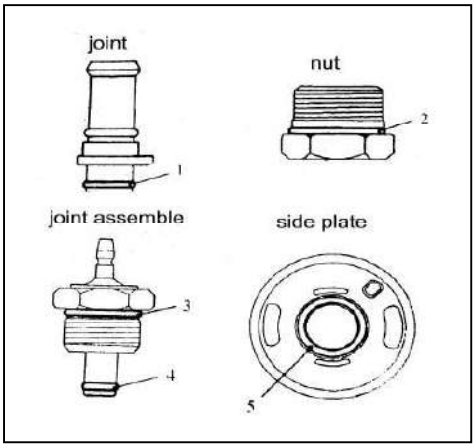


Fig 17-52

(2) **OIL SEAL INSTALLATION(See fig 17-53)**

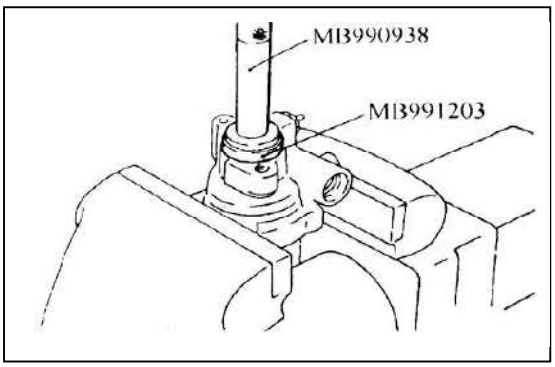


Fig 17-53

(2) CAM SHAFT INSTALLATION(See fig 17-54)

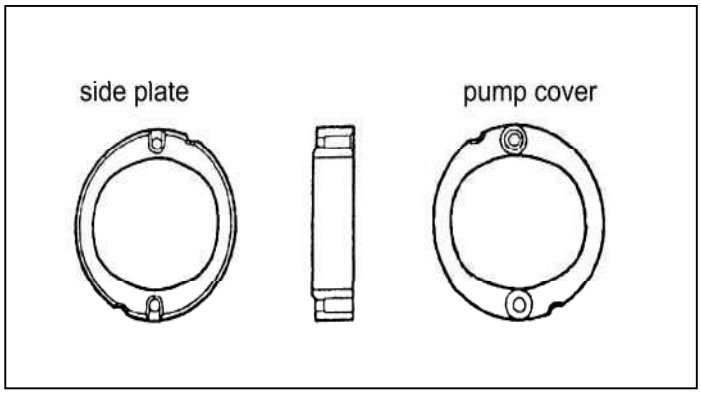


Fig 17-54

Caution:

Care should be taken for installation direction of the cam to prevent wrong installation.

17.10 Power Steering Oil Hoses

1.REMOVAL AND INSTALLATION

Pre-removal and Post-ingstallation Operation

Power steering fluid Draining and supplying and bleeding

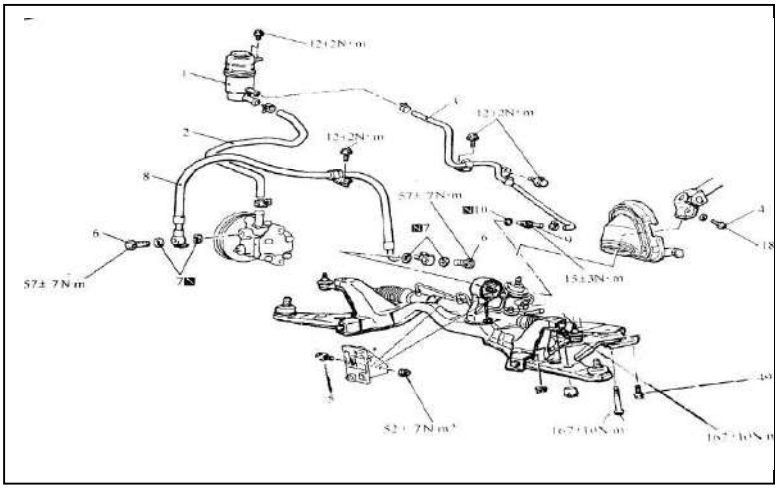


Fig 17-55

Removal steps(See fig 17-55)

1-Oil reservoir；2-Suction hose；3-Return hose；4-Steering gear and joint connecting bolt；5-Engine bracket connecting bolt；6-Eye bolt；7-Gasket；8-Pressure hose assembly；9-Return tube assembly；10-O-ring.

REMOVAL SERVICE POINTS:

EYE BOLT/RETURN TUBE REMOVAL

Loosen the crossmember mounting bolts and nuts.and lower the crossmember to a position so that the eye bolts or return tube an the steering gear side can be removal.

NOTE

(1)In this case,do not remove the crossmember mounting bolts and nuts.

(2)Remove the eye bolts or return tube.

18 The Body Accessories

18.1 Assembly and Disassembly Windshield Glass

1.General tools

(1) Piano wire

(2) The sponge used for painting the primer

(3) The gauze used for painting the unleaded gasoline

(4) The unleaded gasoline used for cleaning the surfaces

(5) Spoons to use for revising the area of adhesive

(6) Adhesive guns used for painting the adhesive

(7) Vacuum plate (2 pieces) used for remove the glasses

(8) The penknife used for finish machining of adhesive's area

(9) The awl used for helping the piano wire throughout

(10) The sharp-mouth pincers used for helping the piano wire throughout

(11) Adhesive and primer, the primer is used on the surface of glass and body

2.To assembly windshield glass

1) The body:

Cleaning the adhesive surface: cut off the solidified adhesive, but reserve the adhesive whose thickness is less than 2 mm, clean the adhesive surfaces with the unleaded gasoline, and dry it more than 10 minutes.

Painting the primer: painting the primer on the matching surfaces sufficiently, and dry it more than 10 minutes.

2) Windshield glass:

(1) the glass that is want to be reused

Cleaning the adhesive surface: cue off all the solidified adhesive, clean the adhesive surfaces with the unleaded gasoline, and dry it more than 10 minutes.

(2) the glass that is new

Cleaning the adhesive surface: clean the adhesive surfaces with the unleaded gasoline and cut off the entire adhesive, and dry it more than 10 minutes.

Painting the primer: paint the primer on the matching surfaces sufficiently (at specified area), and dry it more than 10 minutes.

Painting the adhesive: paint the adhesive a equably and sufficiently on the surface of inner side of glass within 30 minutes after the primer has been painted.

(3) Assembly windshield glass: by using the vacuum plate, press the glass on the body frame after

the adhesive has been painted, and make sure that they match fully .If the adhesive is squeezed out, use a spoon to take away the redundant adhesive, clean the glass and body with the unleaded gasoline.

(4) Confirming water leakage： Perform the shower test after the glass has been installed for one hour and make sure that there is no leakage.

3. Time is needed so as to get better intensity:

After working, time is needed more than:

During winter: About 10℃,6 to 8 hours .

During spring: About 20℃,3 to 4 hours .

During Summer: About 30℃,1 to 2 hours .

The time, which is needed to solidify, is different because of temperature. The environmental temperature is lower, the time is longer. Using infrared lamp to raise the temperature can shorten time.

Attention
⑴If the temperature is too high, the adhesive will bubbling .It is necessary to control the temperature below 100 ℃.
⑵If the glass is removed in minimal static time, the adhesive may be bad.

Primer

The primer is an important measure that enhances the force between the glass and the body frame.

Attention
The primer must use the specified type.

The usage of adhesive and primer:

⑴ Adhesive can become ineffective after it is manufactured for six months .You can buy it when need.

⑵ Adhesive and primer should be stored in the cold dark place.

⑶ Adhesive can solidify when it touches with moisture in the atmosphere. You can open it just before use. If there is left, use it in the future.

⑷ Primer should be wave well before use .You should not use it if there is suspended thing in it .

⑸You must wash the skin with unleaded gasoline etc immediately when the adhesive or the primers touched the skin. and then wash clearly with the soap.

⑹ Keep the primer off the fire because it is combustible. And place it in ventilated place.

4. The disassembly of windshield glass (See the figure18-1)

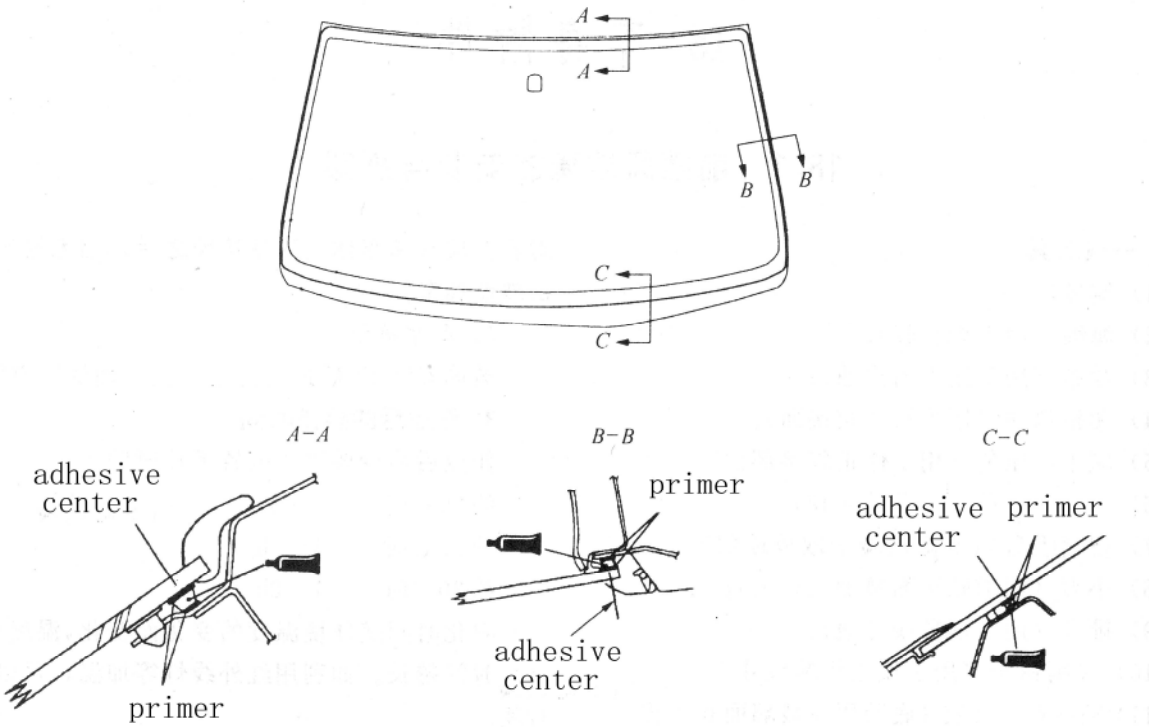


Fig. 18-1

Procedure:

(1) Keep the bodywork with cloth-adhesive around the glass.

(2) Cut off a part of sealing by using the knife.

(3) Bore a small hole in the adhesive by using a sharp awl,

(4) Through the piano wire in the hole from the car inside.

(5) Along the windshield glass, push and pull the piano wire , cutting off to adhesive .(See the figure18-2)

Attention
The piano wire cannot get in touch with the bottom of the windshield glass.

（6）Mark the body and windshield glass, remove the windshield glass with vacuum plate. (See the figure18-3)

Fig.18-2

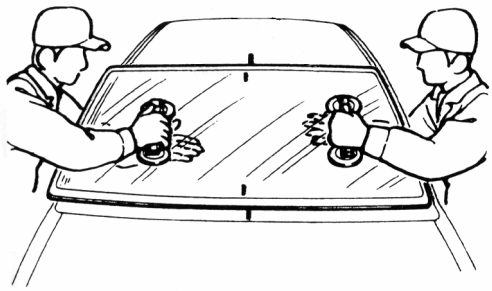


Fig.18-3

18.2 Installation and Disassembly of Seats

The whole car seat divide into front seat and rear seat，front seat include driver's and passenger's. The front seats can adjust the angle of backrest adjust the height of cushion and adjust the cushion forward or backward. Rear seat back can be folded ahead.

1. Installation and disassembly of front seat

The procedure of seats disassembly sees figure1 18-4

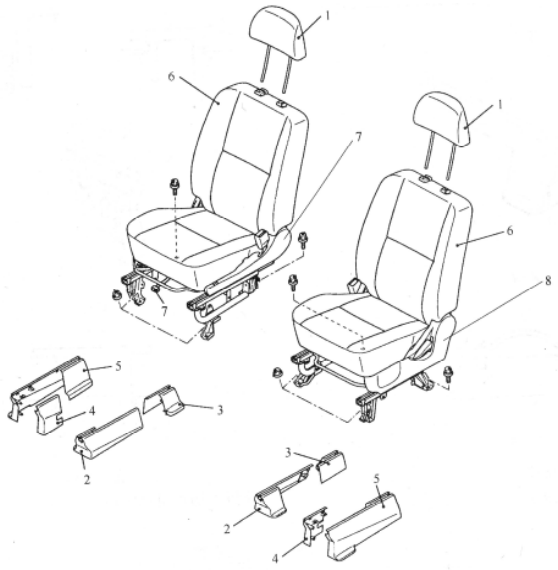


Fig. 18-4

1) Headrest; 2) Front inner trim ,LH/RH;3) Rear inner trim ,LH/RH;4)outer inner trim LH/RH;5) outer trim LH/RH;6) driver(passenger) 's seat 7) garnish (A); 8) garnish (B)

(1) Points of installation

When the cushions is unloaded, locked the inner of sliders, screw down the nuts and bolts, according to

procedure A,B,C,D. see Fig.18-5

(2) Installation of seat trims

Installation of front inner trim see Fig.18-6.

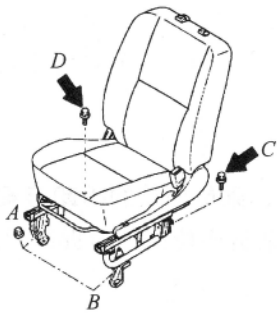
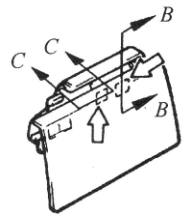


Fig. 18-5



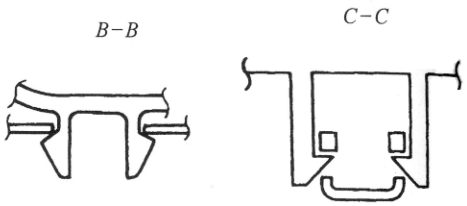
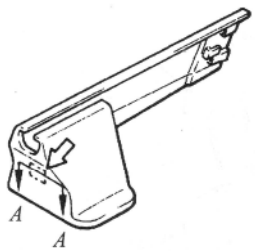
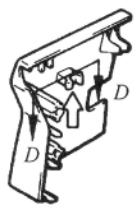
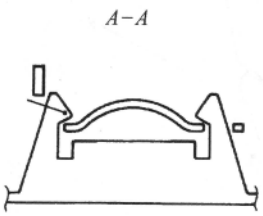


Fig. 18-7







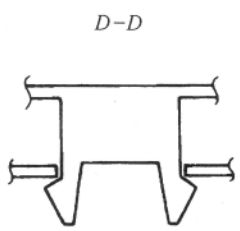


Fig. 18-6

Fig. 18-8

Rear inner trim see Fig.18-7.

Outer inner trim see Fig.18-8.

Outer trim see Fig.18-9.

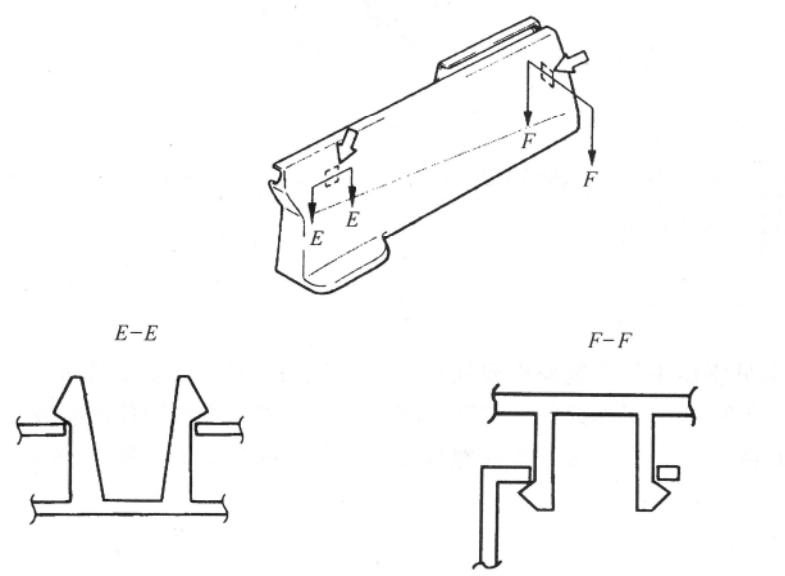


Fig. 18-9

Garnish (A) see Fig.18-10.

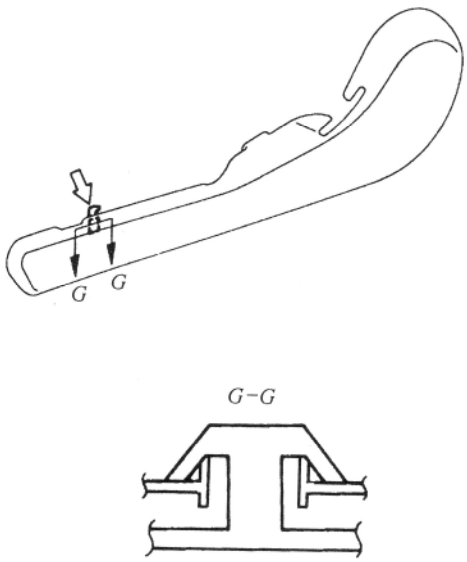


Fig. 18-10

Garnish (B) see Fig.18-11

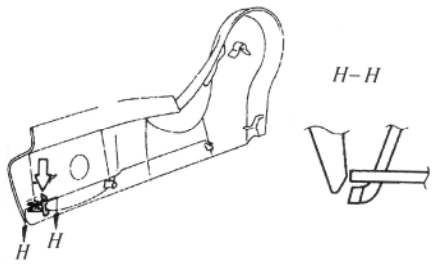


Fig. 18-11

(3) Points of disassembly

headrest disassembly see Fig.18-12.

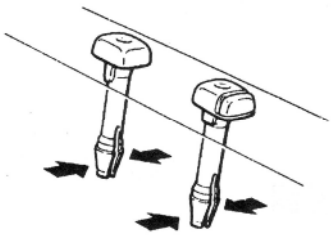


Fig. 18-12

2. The Installation and disassembly of rear seat

The procedures of rear seat disassembly see figure18-13:

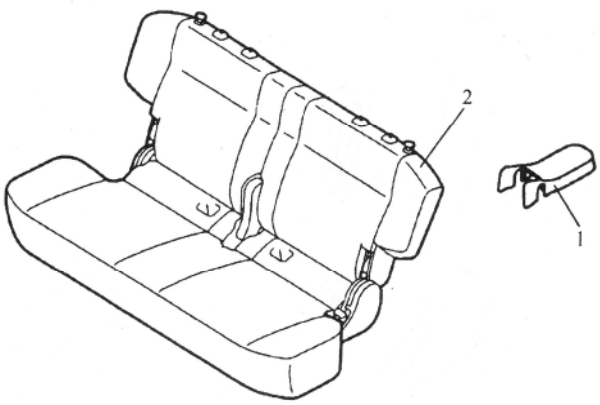


Fig. 18-13

1-seat hinge cover;2-rear seat

(1) Installation of seat trim see Fig.18-14.

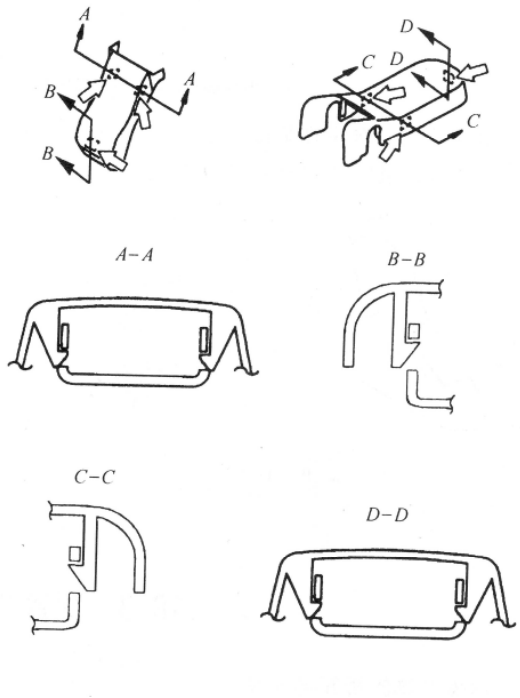


Fig. 18-14

(2) Disassembly and installation

procedure of disassembly see Fig.18-15.

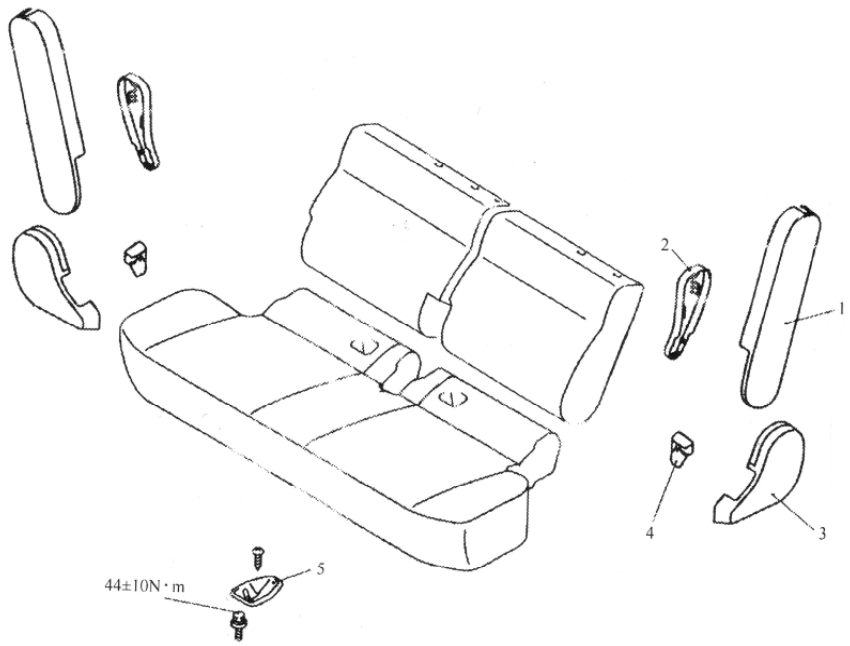


Fig. 18-15

1-hinge cover; 2-free hingecover;3- acclivitous cover; 4-inner cover;5- lock hook trim

(3) Installation of rear seat trim

1) Acclivitous cover (see Fig.18-16)

2) lock hook trim(see Fig.18-17)

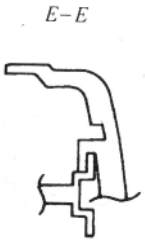


Fig. 18-16

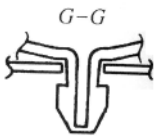


Fig. 18-17

18.3 Installation and Disassembly of Headliner

The installation and disassembly of headliner

Procedure of disassembly see Fig.18-18:

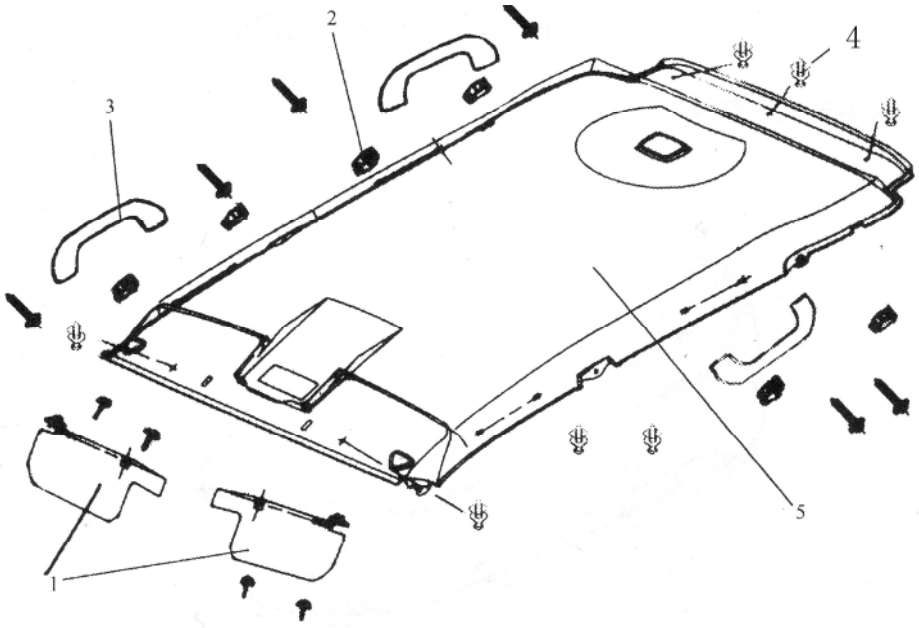


Fig. 18-18

1- sun visor;2- grab cover;3- grab ;4- plastic clip;5- headliner

The procedure of installation is opposite to disassembly.

18.4 Installation and Disassembly of Front Grill

Procedure of disassembly:

⑴tear down the clip on body (see Fig.18-19);

⑵ when pulling the grill, along the arrow, button the clips by screwdriver, teardown the grill;

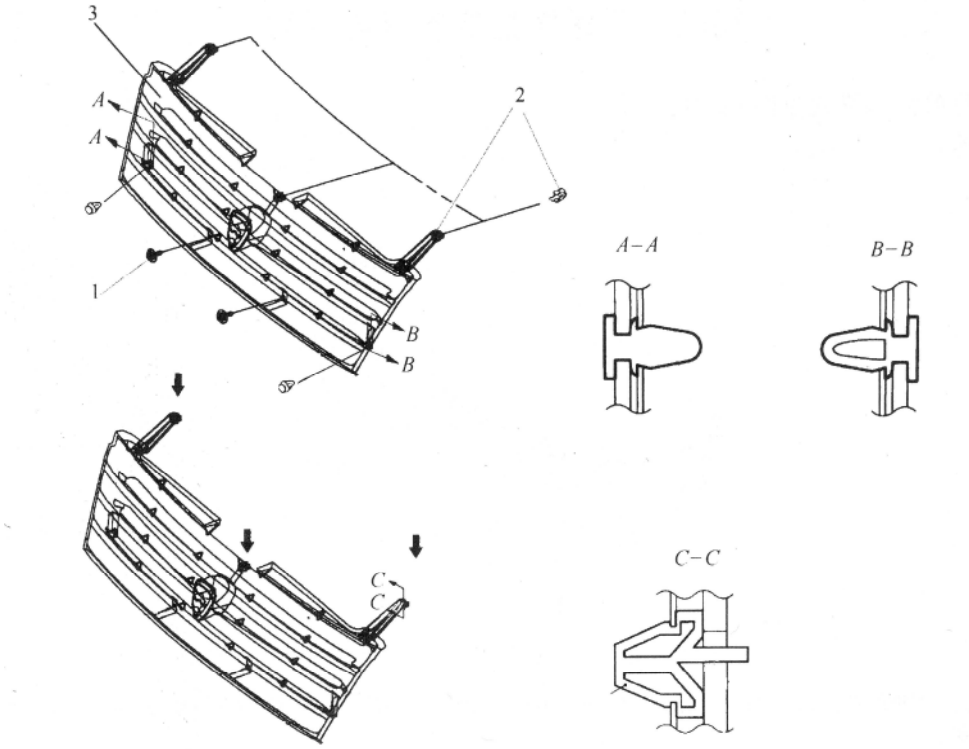


Fig. 18-19

18.5 Installation and Disassembly of Front Bumper

Procedure of disassembly: (see figure18-20)

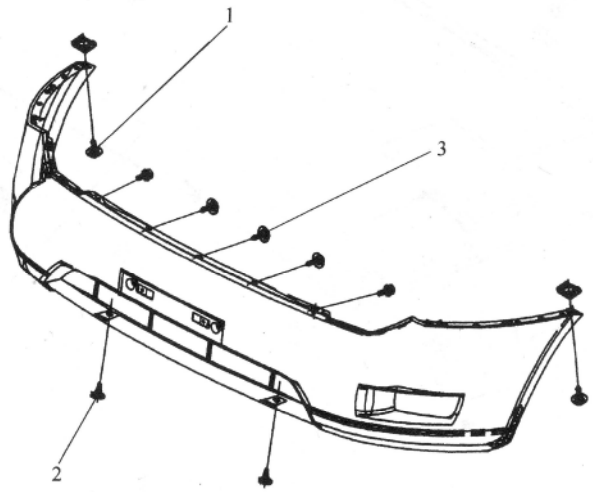


Fig. 18-20

1- Remove the screw on front wheel housing;2- Remove the screw on front grill; 3-Remove the screw on body ;4-Remove series pin of wiring harness on front bumper, then remove front bumper along level direction;

The procedure of installation is opposite to disassembly.

18.6 Installation and Disassembly of Rear Bumper

Procedure of disassembly: (see figure18-21)

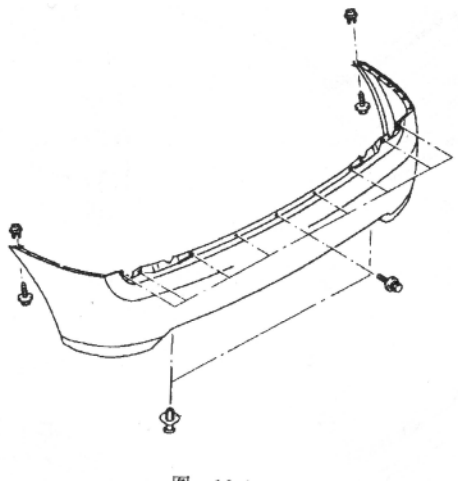


Fig. 18-21

1-Remove clip on rear wheel housing ;2-Remove the screw on body ;3- Remove series pin of wiring

harness on rear bumper ,then remove rear bumper .

The procedure of installation is opposite to disassembly.

18.7 Assembly and Disassembly of Bonnet

Disassembly procedure of bonnet latch sees figure18-22

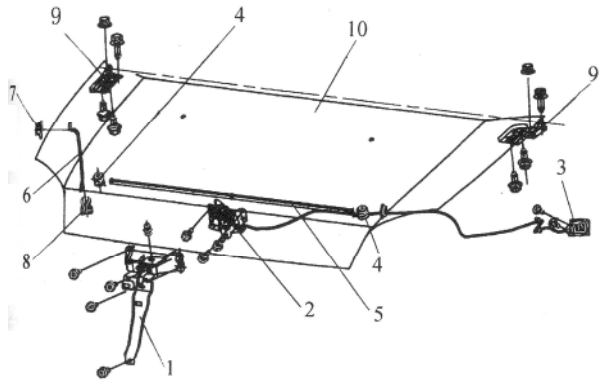


Fig.18-22

1-Bonnet latch bracket; 2-Bonnet latch ;3-Bonnet lock cable assy

Disassembly procedure of bonnet: 4-Buffer;5-bonnet sealing 6-Bonnet support beam 7-plug 8-clip;9-Comp bonnet hinge;10- Bonnet

① Adjust clearance all around bonnet ASM (see figure18-23)

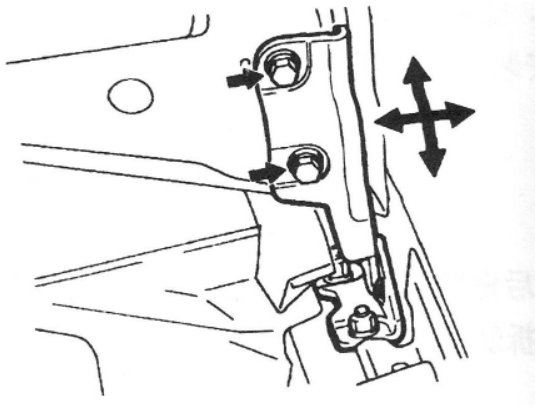


Fig.18-23

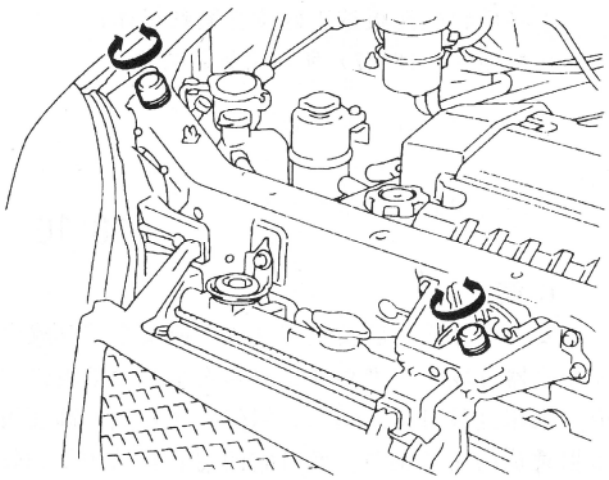


Fig.18-24

② Adjust height of bonnet ASM (see figure18-24)

③ Adjust meshing between bonnet latch and bonnet striker (see Fig.18-25)

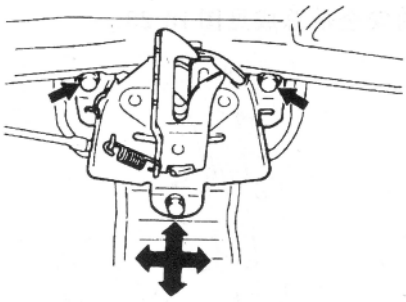


Fig.18-25

18.8 Installation and Disassembly of Front Wheel Housing

1. Procedure of installation

(1) Keep the front wheel housing to the body in correct position.

(2) along the arrows, fix the front wheel housing to the body by clips.(see figure18-26)

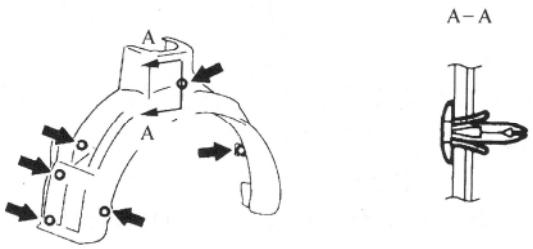


Fig. 18-26

The procedure of installation is opposite to disassembly.

18.9 Installation and Disassembly of Rear Wheel Housing

Procedure of disassembly (see figure18-27):

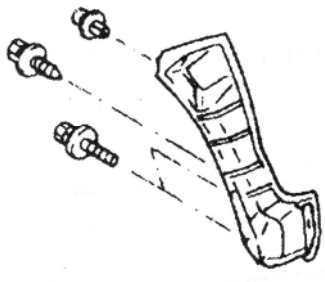


Fig. 18-27

The procedure of installation

(1) Keep the rear wheel housing to the body in correct position.

(2) Screw down the screws.

18.10 Safety Belt

1、summary

Safety belt include front safety belt and rear safety belt. Front safety belt include front anchor, front retractor and belt slider. The passenger can adjust the height of fix point by slider. Its retractor is pre-locked, the terminal can influence the signal from driver. When the car brake peremptorily or crash, the safety belt can reduce the injury or death of the passenger. Front safety belt include front retractor、front buckle and slide; Rear safety belt include rear retractor、rear buckle.

2、 disassembly

1) Front safety belt asm (see figure18-28)

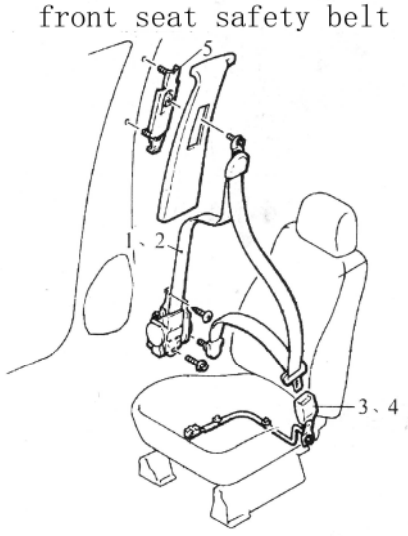


Fig.18-28

Disassembly

① Open the cover of safety belt upper fixing point up and remove the bolt and disassembly the upper belt.

② Disassemblies the center pillar upper trim.

③ Take down the two M12 inch bolts, which are used to fix slide of safety belt to disassembly slide of safety belt.

④ Take down the M12 inch bolts, which are used to fix belt on lower point from the center pillar trim, disassembly the center pillar lower trim

⑤ Take down the tapping screws and M12 inch bolts, which are used to fix front retractor upper point, remove the retractor.

⑥ Take down the M12 inch bolts, which are used to fix anchor on front seat, remove the anchor, take off the terminal on the anchor under the seat.(it only for driver's seat.)

3) Rear safety belt asm(see figure18-29)

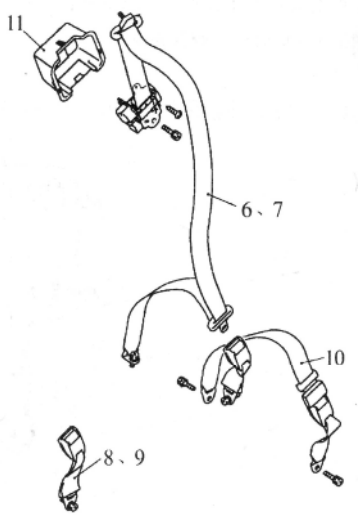


Fig.18-29

① Open the cover of safety belt upper fixing point and remove the M12 bolt.

② Take the rear quarter lower trim down.

③ Take the tapping screws on upper fix point and M12 inch bolts on lower fix point down to disassemble the retractor.

④ Lift up the carpet; take the M12 inch bolt, which is used to fix belt lower point down from the ext. rear quarter lower trim. Remove the belt.

⑤ Take down the M12 inch bolts, which are used to fix two-point safety belt on the rear seat to

disassemble them.

⑥ Take the M12 inch bolts, which are used to fix anchor on the rear seat to disassemble them.

3. Installation

（1）front safety belt asm

① Fix the M12 inch bolt of anchor lh/rh to the front seat. The closing torque is 44±10N·m.

② Put the terminal which on the anchor into the port under the front seat.(only for driver's seat)

③ Fix the retractor on the upper point by tapping screws and M12 inch bolt on the lower point. The closing torque is 44±10N·m.

④ Fix the two M12 inch bolts of slider on body, the closing torque is 44±10N·m.

⑤ Install the center pillar upper trim and lower trim.

⑥ Fix the belt on the top point on belt slide way by two M12 inch bolt. The closing torque is 44±10N·m.close the cover on upper point.

⑦ Fix the belt on lower point on center pillar lower trim by two M12 inch bolt.

2) rear safety belt asm

① Install safety belt box

② Fix the retractor on the upper fix point by tapping screw and on the lower fix point by M12 inch bolt to install the retractor. The closing torque is 44±10N·m

③ Install the rear quarter lower and upper trim.

④ Fix the upper point of safety belt by M12 inch bolt. The closing torque is 44±10N·m.

⑤ Fix the lower fix point on the safety belt to floor by M12 inch bolt. The closing torque is 44±10N·m.

⑥ Fix safety belt on rear seat by two M12 inch bolts. The closing torque is 44±10N·m.

⑦ Fix anchor on rear seat by three M12 inch bolts. The closing torque is 44±10N·m.

Do not permit locked during using the front and rear safety belt after assembly.

Caution

The driver and passenger must wear the safety belt when driving

18.11 Fuel Filler Lid and Fuel Filler Lid Latch

1. Summary

The driver can take the handle that is behind the dashboard to open the filler lid. The operation is easy and fast.

Fuel filler lid asm include bolt assembled、fuel filler lid and spring clip. Fuel filler lid lock asm include tapping screw、 fuel filler lid lock、 handle and fuel filler lid cable .The structure see Fig.18-30.

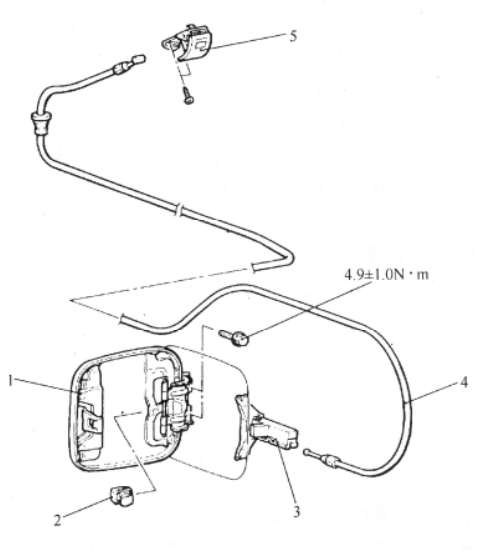


Fig.18-30

1-fuel filler lid asm;2-spring clip;3-fuel filler lid lock asm;4-fuel filler lid lock cable;5-handle

2. Disassembly

① Taking the two bolts down from fuel filler lid and remove the fuel filler lid.

② Disassembly the front inner rocker cover、rear quarter lower trim and external rear quarter lower trim step by step.

③ Take the two tapping screws of handle fixed under the dashboard, remove the cable from the clip on the left of the floor, and remove the fuel filler lid latch.

④ Tear down the parts of the fuel filler lid lock assy、handle and fuel filler lid lock cable assy which are assemble together into part.

3) Installation

① Fix the fuel filler door on the body using two assembled bolts. The closing torque is 4.9±1.0N·m.

② Assembly the fuel filler door lock assy、handle and fuel filler door lock cable assy together.

③ Install the fuel filler lid lock cable by clips along the floor left side.

④ Fix the handle on the bracket under the dashboard by two tapping screws. Insert the fuel filler lid lock comp into the hole on body.

⑤ Install external rear quarter trim、rear rocker cover、front inner rocker cover step by step.

18.12 Air Outlet

1. Disassembly

Remove rear bumper，remove Radiator grill on body.

2. Installation

Fix air outlet on the body and fix rear bumper.

Caution:
Because the pressing panel is thin, you must careful when set up or down.

18.13 Damping Foam

1. Disassembly

(1) Take down the dashboard, remove the foam between the side inner panel and side outer panel.

(2) Take down the B pillar lower trim and retractor, remove the foam in the cavum of retractor.

(3) Take down the rear quart lower trim, remove the foam between the side inner panel and side outer panel.

2. Installation

(1) Installation the foam into the cavum of side inner panel and side outer panel, and installation the dashboard.

(2) Installation the foam into the cavum under the retractor, and installation the retractor and B pillar lower trim.

(3) Installation the foam into the cavum of side inner panel and side outer panel, and installation the rear quart lower trim.

Caution
You must put the foam even, and installation it firmly.

18.14 Installation and Disassembly of the Side Glass

The side glass is felt on the body by adhesive. It is connected with body, so the intensity and airproof is advanced.

The structure see Fig.18-31.

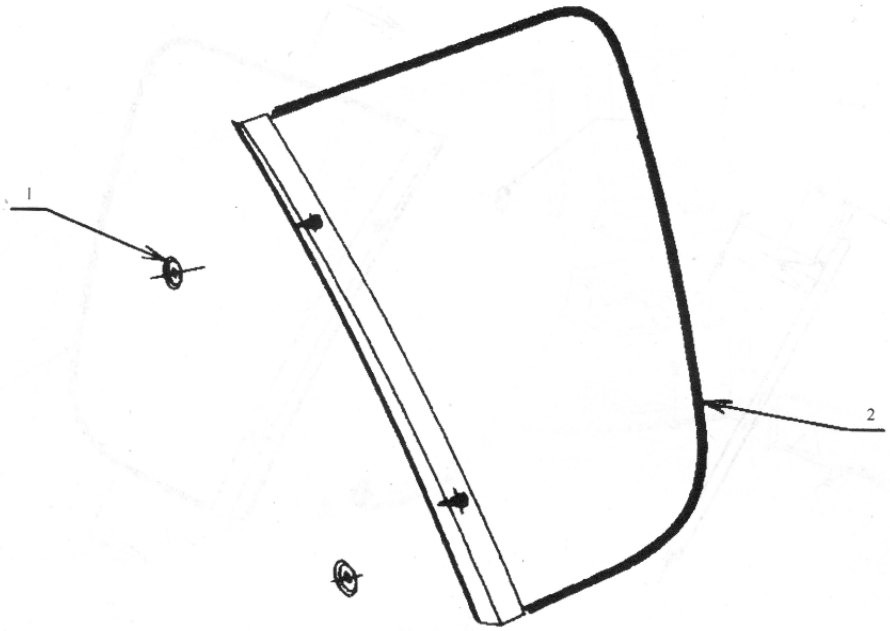


Fig. 18-31

Material and tools is same as windshield.

1) Procedure of installation of side glass

(1) Cleaning the adhesive surface of glass and body, and dry it more than 10 minutes.

(2) Painting the primer on the body sufficiently, and dry it more than 10 minutes.

(3) Cleaning the match surface of glass by cloth. If you have used organic impregnate, dry it more than 10 minutes.

(4) Painting the primer on the matching surfaces sufficiently on the glass, see Fig.18-32, (the connected line is the center of adhesive.) and dry it more than 10 minutes.

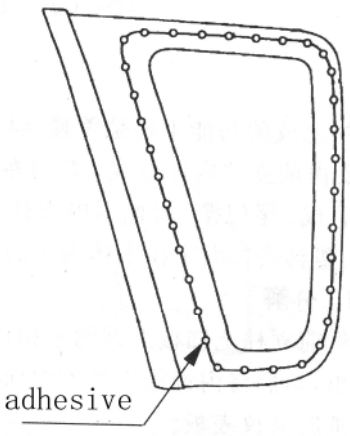


Fig. 18-32

(5) Painting adhesive on the primer, you must painting it equably and don't destroy the primer insure. The height of adhesive see Fig.18-33.

(6) Insert the plug into the hole on the side outer panel.

(7) Remove the side glass with vacuum plate, put the clips of weather strip into the plug, cement the glass onto the body. Press the glass emphatically. If the adhesive is cemented on body or glass, use organic impregnate to wipe off.

2) Disassembly of side glass

(1) In order to protect the paint of body, cement cloth belts onto the body around the side glass.

(2) Remove the rear quart upper trim, cut off the adhesive around the glass inside the car, removes the glass by vacuum plate.

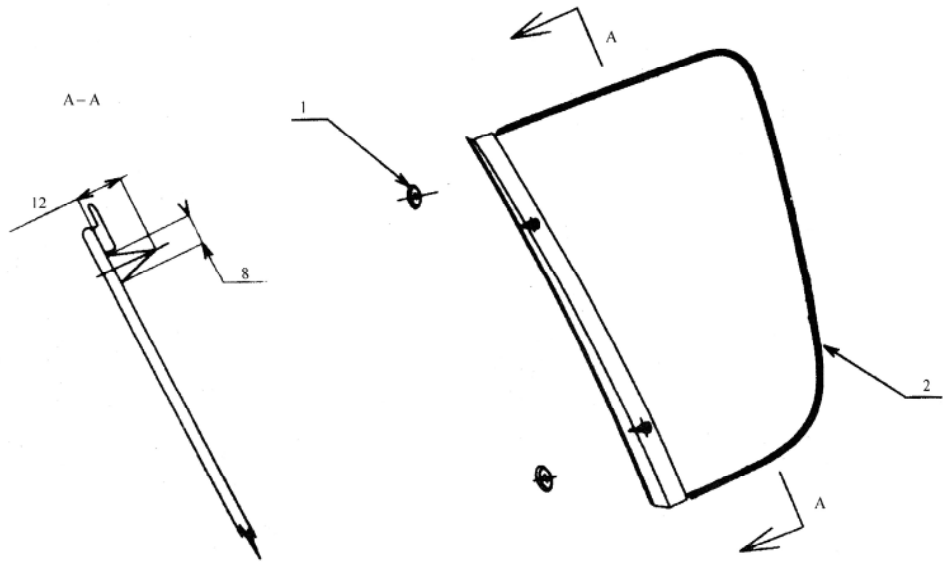


Fig.18-33

18.15 Installation and Disassembly of the Side Trim

1.Summary

The function of the side trim is prevent the noise、heat and vibration into car .It include front pillar trim、front rocker cover、rear rocker cover、tail gate trim 、center pillar trim and rear quarter trim .It is fastened on the body by using screws and clips

2.Disassembly

（1） Draw the front pillar upper trim from the body forcibly.

（2） Remove the front rocker cover and rear rocker cover.

（3） Tear down the clips, which is used to fix front pillar lower trim, draw the front pillar lower trim from side inner panel.

（4） Raise the cover of belt, take down the M12bolt from safety belt upper, draw the center pillar upper trim.

（5） Raise the cover of belt, take down the M12bolt from safety belt lower, draw the center pillar lower trim.

（6） Take the crews which is used to fix trunk lid trim, draw the runk lid trim from body.

（7） Raise the cover of screw; Take the five screws, which are used to fix rear quarter lower trim down to disassembly rear quarter lower trim.

（8） Raise the cover of screw; take the screws, which are used of fix side upper trim on the bottom to disassembly side upper trim.

1- front rockercover;2-rear rocker cover;3- front pillar lower trim;4- front door weather strip sealing;5--rear door weather strip sealing;6- front pillar upper trim; 7- B-pillar upper trim; 8- B-pillar lower trim;9-extra rear quarter upper trim ;

10- extra rear quarter lower trim;11- trunk lid finisher;12- rear quarter cover trim ;

3.Installation

The procedure of installation is opposite to disassembly. Put the clip in the position that lies on trim. Install the trim to the correctly position on the body and strike it lightly with a hammer. Insert the nut into the body to install the trim with screws.

See Fig.18-34.

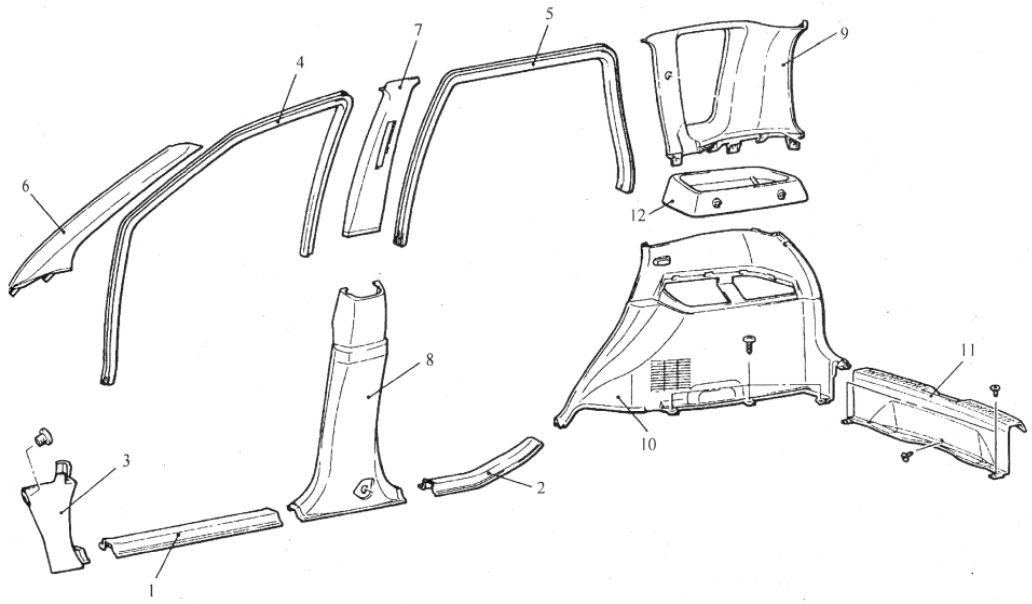


Fig. 18-34

18.16 Door and Accessories

1. Front and rear door

1) Disassembly procedure

(1) Inner handle cover

(2) Bracket electric-regulator switch

(3) Inner trim

(4) Waterproof protection film

(5) Outer and inner weather strip sealing

(6) Screw of fixing glass

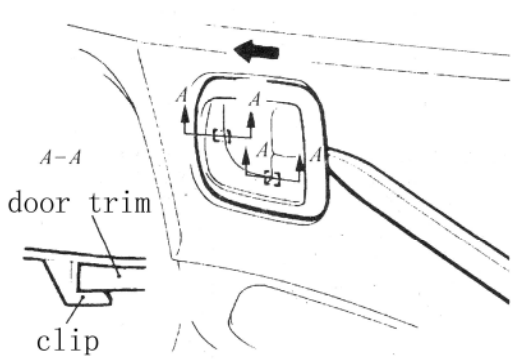
(7) Pull the glass rear end and underside ， then take out the glass

2) Main points

(1) According to Fig.18-35, open the rear end of handle by hand or tools, slide along the arrow, disassembly inner handle cover

(2) According to Fig.18-36, open the rear end of the bracket of regulator switch-bezel by hand or tools, slide along the arrow, disassembly the bracket of regulator switch-bezel.

(3) Down the glass, put away on the outer weather strip sealing by using putty-knife which is covered with adhesive-tape (or screwdriver) , and then remove the screw of glass fixed.see Fig.18-37.



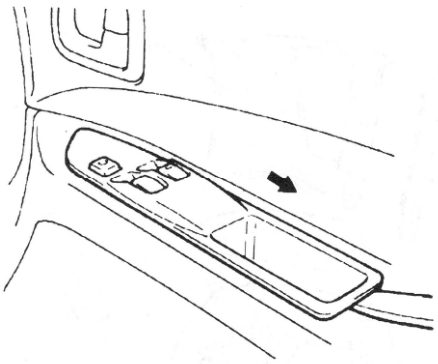


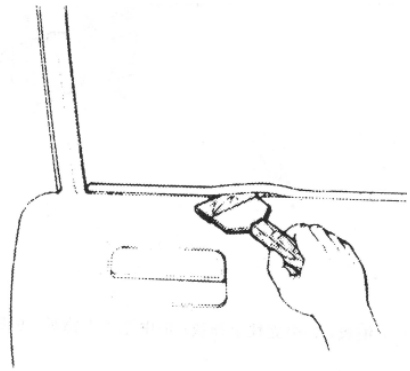
Fig. 18-35 Fig. 18-36

3) Inspection

(1) Check if the glass regulator is distorted or damaged.

(2) Check if the glass regulator rope is lessening.

4) Installation



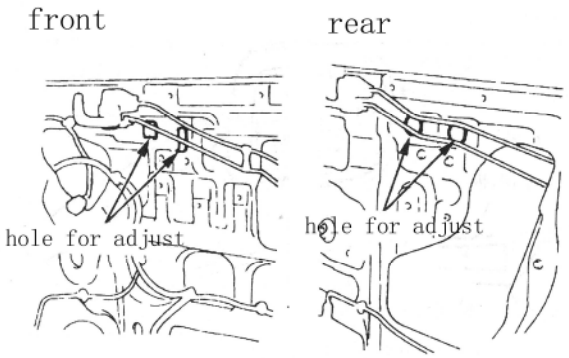


Fig. 18-37 Fig. 18-38

The installation procedure is opposite to the disassembly procedure, be sure to attentions:

(1) Grease the sliding parts.

(2) After taking glass in regulator, closing the glass by using regulator, adjust clearance between glass and slot, so that clearance is same, and fixed it in regulator. The hole for adjust see Fig.18-38.

2. Lock ASM

Front door lock ASM（see figure18-39）

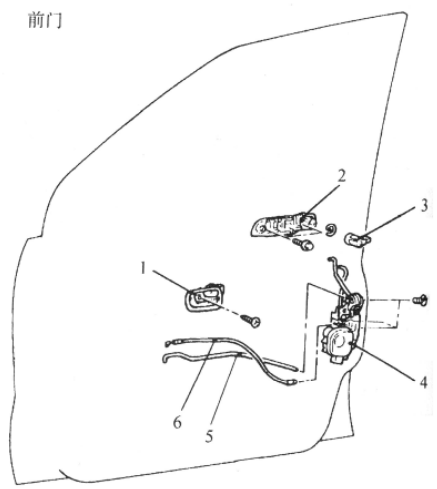


Fig. 18-39

1- inner handle;2-outer handle;3-key cylinder;4-door latch; 5-inner handle rod 6-safety rod

Rear door lock ASM（see figure18-40）

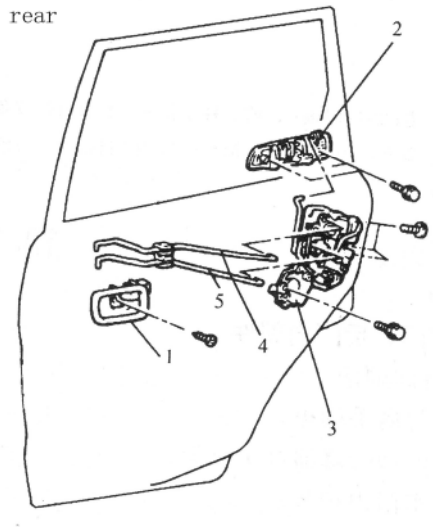


Fig.18-40

1-inner handle;2-outer handle;3-door latch; 4-safety rod 5-inner handle rod;

1) Disassembly the following parts

(1) Inner handle cover

(2) Bracket electric-regulator switch

(3) Inner trim

(4) Waterproof protection film

(5) Rod asm and latch assy

2) Installation

The installation procedure is opposite to the disassembly procedure.

3) Main points

(1) When fix the rod 1 to outer handle“2” ,be sure to A=1.4±2.5mm(see figure18-41)

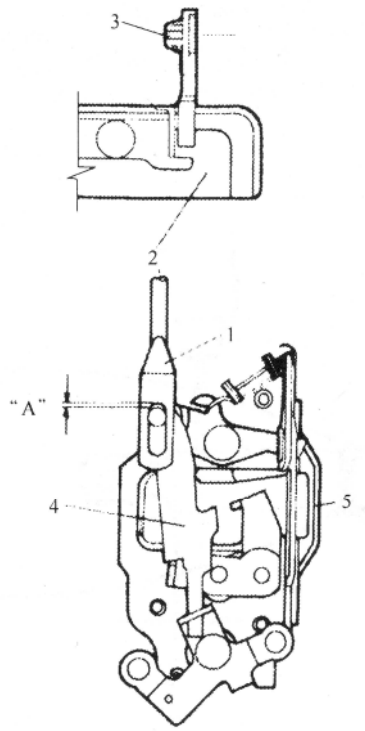


Fig.18-41

1- rod outer open 2-outer handle asm 3-clip 4- outer handle rod 5-latch assy A-3.7±1.5 mm

(2) When install inner handle, attention of the following: (see figure18-42)

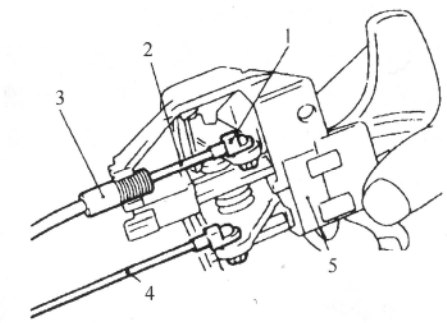


Fig.18-42

1- clip;2-safety rod ;3-rod plug;4- inner handle rod;5- inner handle

1) Put the end of safety rod in clip, lock the knob, so that completely lock.

2) Put the safety rod of inner handle in the inner handle.

3) Install the inner handle rod in the inner handle.

4) Install the inner handle in door inner panel.

(3)Striker

Adjust striker height with shims so that the clearance between door and body “D” area is to be 10.6~12.6mm,see Fig.18-43,adjust striker position up and down so that the center of striker matched latch. see Fig.18-43。

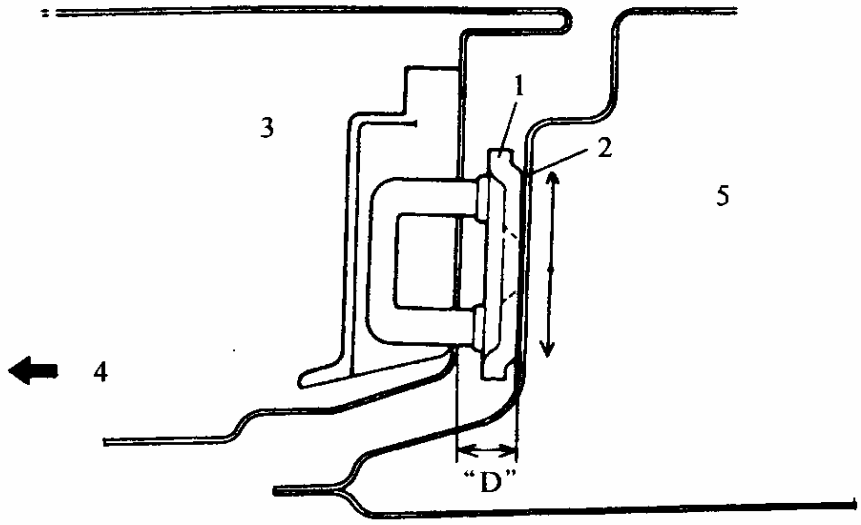


Fig. 18-43

1-striker;2- shim;3-door;4-forward;5-body

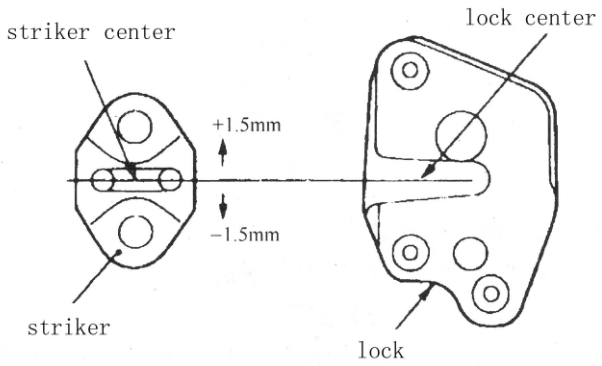


Fig. 18-44

Caution

The striker must be adjusted up and down and the latch must not be adjusted.

The striker axes must be greased or lubed periodically.

2. Doors adjustment

1) Disassembly procedure of front and rear door

(1) Front fender;

(2) Harness terminal;

(3) Bolt for stopper in the body;

(4) Bolts for hinge in the body;

(5) Door assy;

(6) Holding the door assy by the jack, by using a block between jack and door assy, see Fig.18-45.

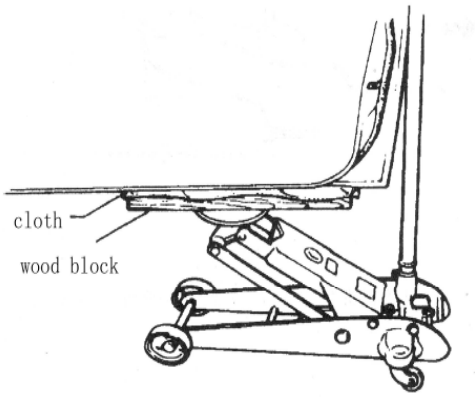


Fig. 18-45

Caution
Handle with care

2) Installation procedure of front and rear door

The installation procedure is opposite to the disassembly procedure.

3) Main points

(1) If the gap between the door and the body side is inconsistent (>1.5mm),to loosen the bolt fixing the door hinge at the body side ,and move the door to adjust so that the gap and the flush around the door becomes consistent.

(2) If the door vertical deflection when close, to adjust the alignment of the striker and the door latch using the shims. Adjust the door by moving the shims at all directions.

4. Tail gate

1) Disassembly procedure

⑴ rear syringe tube

⑵ harness terminal

⑶ tailgate dumper

⑷ tailgate assy

2) Main points of tailgate dumper

⑴ after disassembly the dumper, keep it away from high temperature or fire.

⑵ if the tailgate dumper is useless, must exhaust by boring holes. After package it with plastic bag and tie it up, boring holes (2~3mm) upright cross the bag .see Fig.18-46.

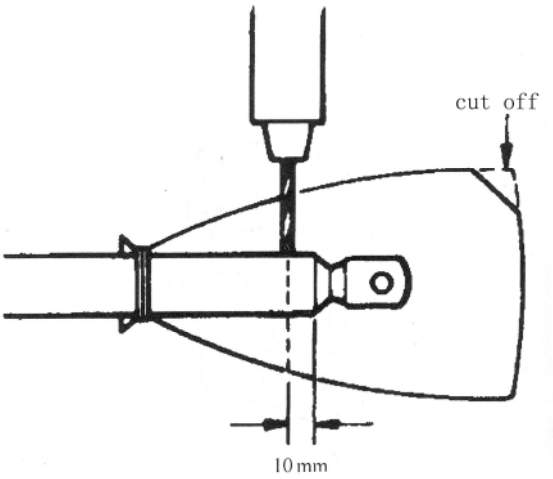


Fig. 18-46

⑶ Be careful when disassembly the dumper, do not damage the expose surface of piston rod. And keep the surface away from oil or paint.

⑷ The piston rod being full out, not permit turn it around.

3) Installation and adjust tailgate assy

⑴ To adjust the alignment of the door striker and door latch,by moving the shims up and down or outside and inside, see figure18-47. Be sure the dimension tolerance between the center of striker and the center of the latch is±1.5mm, see figure18-44

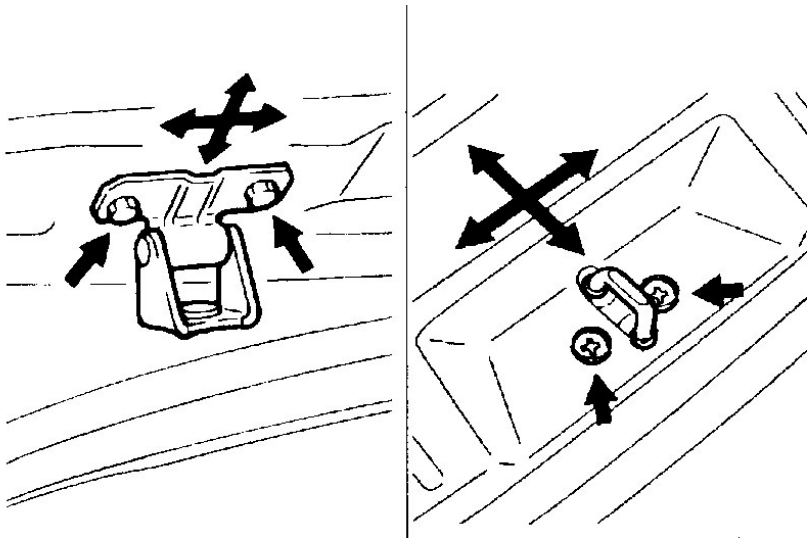


Fig. 18-47

⑵If the gap between the door and the body side is inconsistent, adjust the attach area of the hinge and the striker. See Fig.18-47.

4) Disassembly and assembly tailgate glass

(1) The disassembly procedure. See figure18-48.

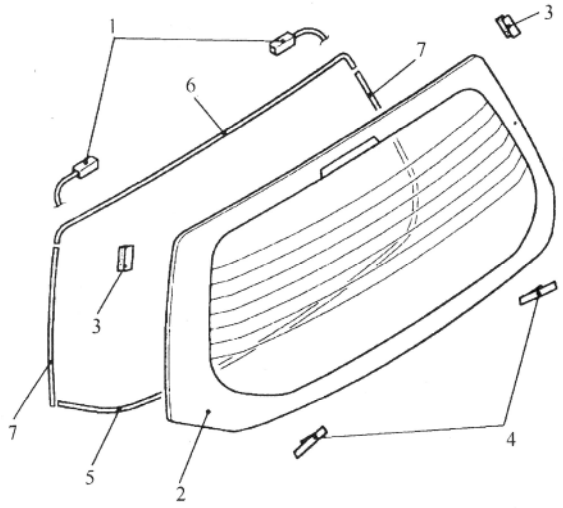


Fig.18-48

①harness terminal ②tail gate glass ③ fastener④ lower sealing

⑤ upper sealing ⑥ side sealing

5) Main points of disassembly

Disassembly the glass is same as windshield disassembly procedure.

6) Installation

The installation procedure is opposite to the disassembly procedure.

7) Main points of installation

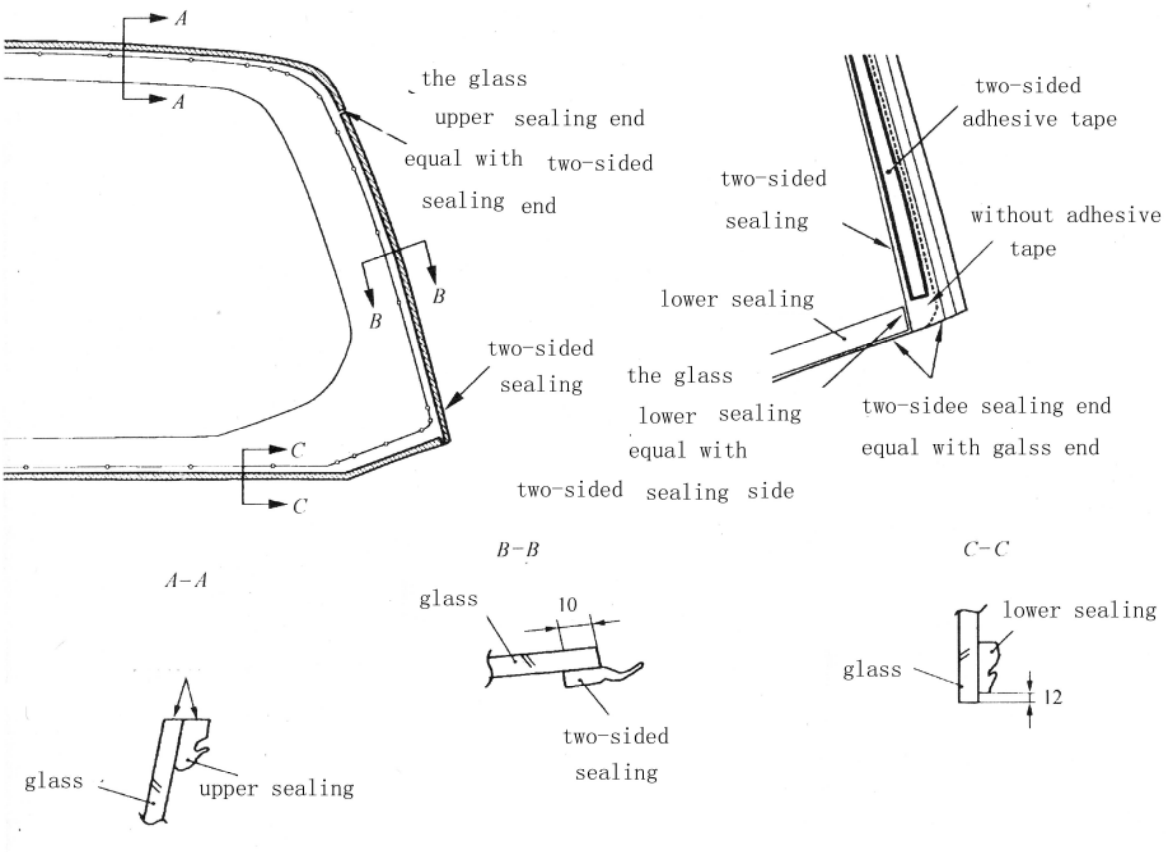


Fig. 18-49

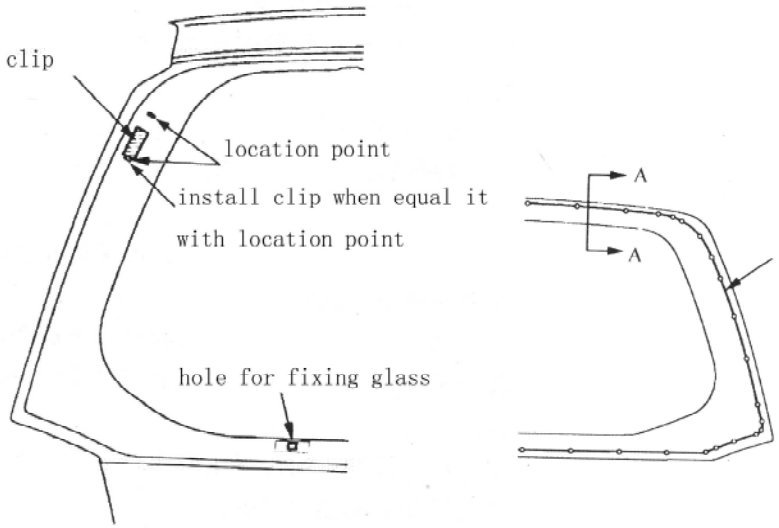
① Clean the adhesive surface of the glass with isopropyl alcohol

② Installation the sealing according to the following steps: side sealing 、upper sealing 、lower sealing ,position and relations of all parts see Fig.18-49.

③ Position of fastener on the tailgate located of the mark, see Fig.18-50.

④ Paint the adhesive along the centerline around the glass, see figure18-51.

⑤ Installation procedure is the same as the windshield



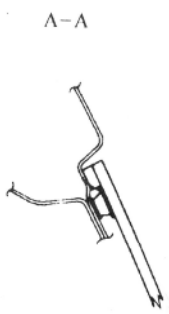


Fig.18-50 Fig.18-51

19 Supplemental Restraint System

19.1 SRS Service Precautions

In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing,read carefully follow all the precautions and procedures described in this manual.

1.When servicing the SRS ,read and carefully follow all the precautions and procedures specified on the chapter。

2.Do not use any electrical test equipment on or near SRS components, except those specified on the chapter。

3.Never attempt to repair the following components。

(1).SRS air bag control unit (SRS-ECU)

(2).Driver's air bag modules

(3). Clock spring

(4). Front passenger's air bag modules.

(5).Preloading retractor safety belt

4.Do not attempt to repair the wiring harness connectors of the SRS . If the connectors are diagnosed as defective,replace the wiring harness(See fig 19-1).If the harness are diagnosed as faulty , replace or repair the wiring harness according to the table that follows.(Table 19-1)

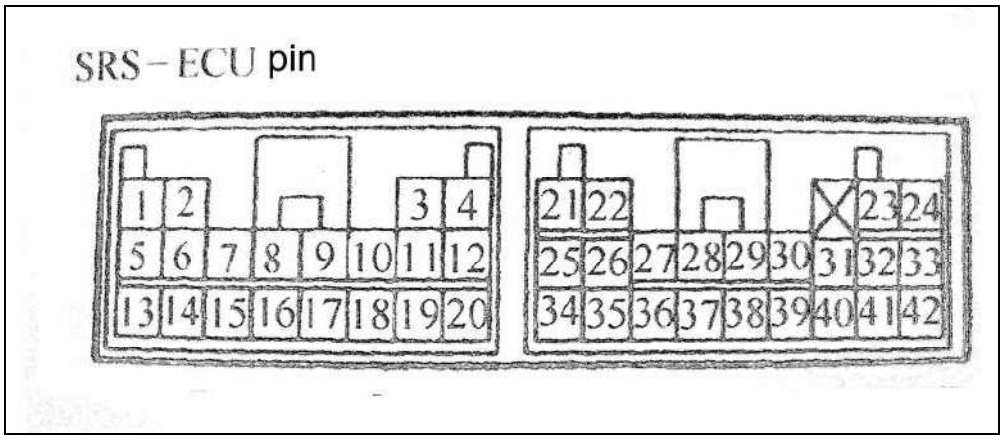


Fig.19-1

Table 19-1

SRS－ECU Terminal No.	Destination of harness	Corrective action
7	Instrument panel wiring harness→Earth	Repair or replace each wiring harness
8	Instrument panel wiring harness→Combination meter(SRS warning lamp)(See fig 19-2)	
9、10	Instrument panel wiring harness→Front passenger's air bag modules.	
11、12	Instrument panel wiring harness→Clock spring→ Driver's air bag modules(See fig 19-4)	Repair or replace the dash wiring harness.Replace clock spring.
13	Instrument panel wiring harness→Junction block	Repair or replace each wiring harness
16	Instrument panel wiring harness→Junction block	
20	Instrument panel wiring harness→Diagnosis connector	
29、30	Floor wiring harness（RH）→Driver's preloading retractor installation	Repair or replace each floor wiring harness
27、28	Floor wiring harness（LH）→Front passenger's preloading retractor installation (see fig19-3)	

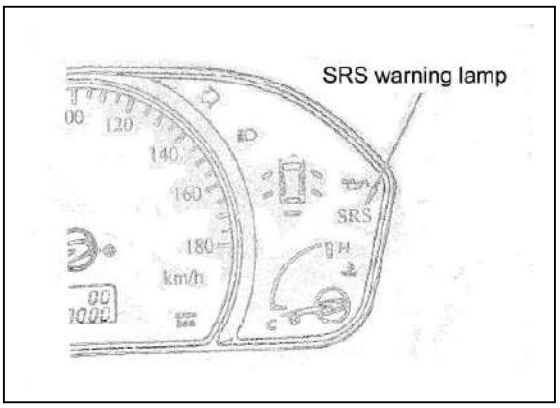


Fig 19-2

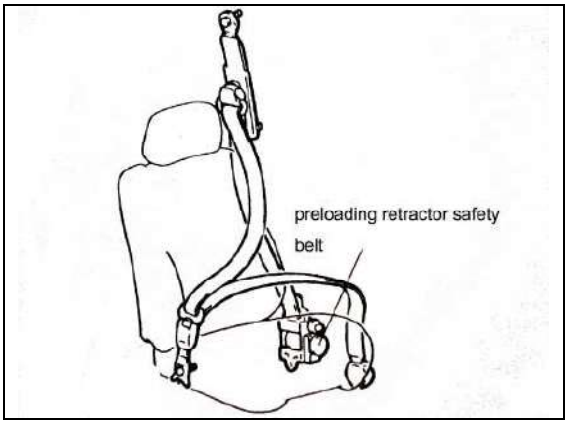


Fig 19-3

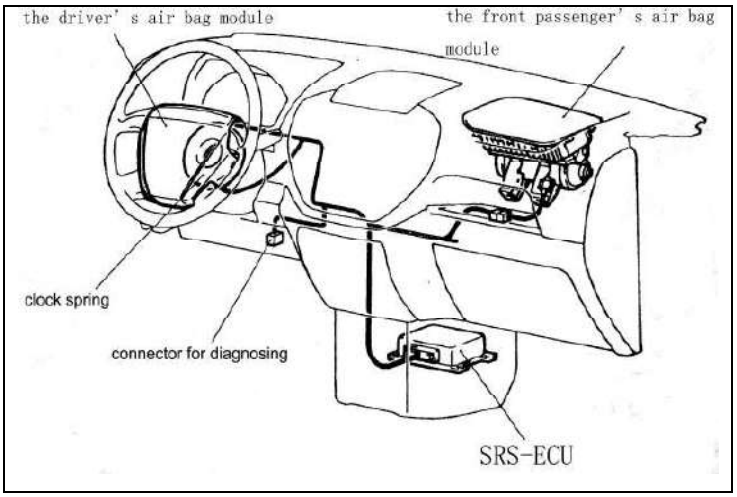


Fig 19-4

5. After disconnecting the negative(-) battery cable, wait 60 seconds at least before any service and insulate the disconnected cable with tape .The SRS retain enough voltage to deploy the air bags for a short time even after the disconnection of the battery. So ,serious injury may result by accidental air bag deployment if a work is done on the SRS just after the disconnection of the battery.(See fig 19-5)

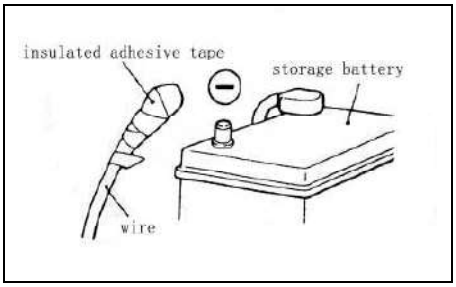


Fig 19-5

6.SRS components should not be subjected to temperature over 93℃,so remove the SRS-ECU,driver's and front passenger's air bag modules, clock spring ,preloading retractor safety belt before drying or baking the vehicle after painting.

- SRS-ECU,driver's and front passenger's air bag modules, clock spring ： over 93℃
- Preloading retractor safety belt：over 90℃

7 .Whenever you finish servicing the SRS,check warning lamp operation to make sure that the system functions properly.。

8. Inspection of the SRS-ECU harness connector should be carried out by the following procedure.(See fig 19-6,fig19-7)

Insert the special tool (probe,in the harness set) into the connector from harness side (rear side), and connect the tester to this probe. If any tool than specified is used. Damage to the harness and other components will result. Furthermore, measurement should not be carried out by touching the probe directly against the terminals from the front of the connector. The terminals are plated to increase their conductivity,so that if they are touched directly by the probe, the plating may break,which will cause drops in reliability.

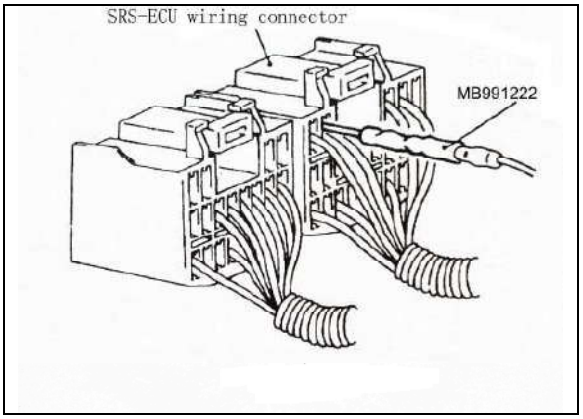


Fig 19-6

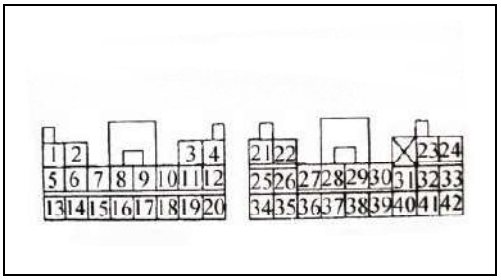


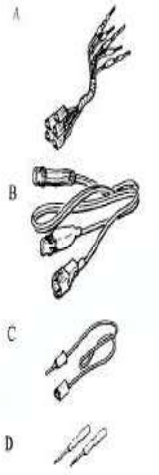
Fig 19-7

19.2 Special Tools

Special tools see table19-2

Table 19-2

Tool	Number	Name	Use
	MB991502	MUT－Ⅱ sub assembly	Reading and erasing diagnosis codes Reading trouble period Reading erase times
	MB991606 or MB991613	SRS check harness	Checking SRS electrical circuitry

	MB372530	SRS air bag adapter harness	Deploying driver's air bag module inside vehicle
	MB686560	SRS air bag adapter harness	Deploying front passenger's air bag module , preloading retractor safety belt inside or outside vehicle
	MB991223 A：LMB991219 B：MB991220 C：MB991221 D：MB991222	Harness set A：Check harness B：LED harness C：LED harness adapter D：Probe	Checking continuity and measuring voltage at SRS-ECU harness connector.

19.3 Test Equipment

Test equipment(See table 19-3)

Table19-3

Tool	Name	Use
	Digital multi-meter	Checking SRS electrical circuitry Use multi-meter for which the maximum test current is 2 mA or less at minimum range of resistance measurement

19.4 **Troubleshooting**

1. STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to How to use Troubleshooting/Inspection Service Points.

2. DIAGNOSIS FUNCTION

(1) Diagnosis codes check

Connect the MUT-II to the diagnosis connector(16-pin) under the instrument under cover ,then check diagnosis codes.

Refer to How to use Troubleshooting/Inspection Service Points.

(2) Erasing diagnosis code

Connect the MUT-II to the diagnosis connector and erase the diagnosis code。

Refer to How to use Troubleshooting/Inspection Service Points.

3.SRS WARNING LAMP CHECK(See fig 19-8)

(1) Check that the SRS warning lamp comes on when the ignition switch is turned ON。

(2) Check that the SRS warning lamp illuminates for about 6~8 seconds and then goes out and continues over five seconds。

(3) If this is not cause ,check the diagnosis codes.

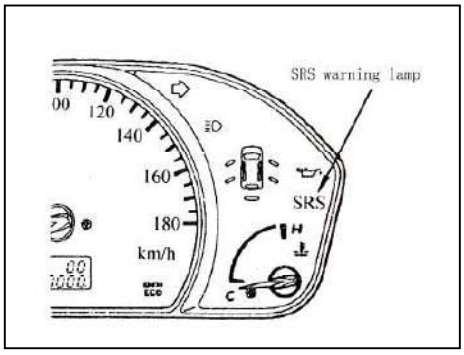


Fig 19-8

4. INSPECTION CHART FOR DIAGNOSIS CODES(See table 19-4)

Table 19-4

Code No.	Diagnosis item	
14	Front impact analog G-sensor system inside SRS-ECU.	
15、16	Front impact safing G-sensor system inside SRS-ECU.	
21※2、22※2、61、62	Driver's air bag module (squib)system	
24※2、25※2、64、65	Front passenger's air bag module (squib)system	
26※2、27※2、66、67	Driver's preloading retractor （squib）system	
26※2、27※2、66、67	Front passenger's preloading retractor （squib）system	
31、32	DC-DC converter inside SRS-ECU	
34※1	Connector lock system	
35	SRS－ECU system	
41※1	Power circuit system	
42※1	Power circuit system	
43※1	SRS warning lamp drive circuit system	Lamp does not illuminate.
		Lamp does not go out off
44※1	SRS warning lamp drive circuit system	
45	Inernal circuit system of non-volatile memory(EEPOM) inside SRS-ECU.	
51、52	Driver's air bag module (squib ignition drive circuit)system	
54、55	Front passenger's air bag module (squib ignition drive circuit)system	
56、57	Driver's preloading retractor installation（squib）ignition drive circuit system	

58、59	Front passenger's preloading retractor installation（squib）ignition drive circuit system

NOTE：

（1）*1:If the trouble are removed,the SRS warning lamp go out with diagnosis code history stored.

（2）*2:If the trouble are removed,the SRS warning lamp will go out with diagnosis code history automatically erased.

（3）When the battery has been discharged,diagnosis code Nos.41 or 42 is stored.Check the battery when either of these is displayed。

5. INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No. 14、15、16、31、32、45、51、52、54、55、56、57、58、59、System inside SRS-ECU	Probable cause
Malfunction is present inside SRS-ECU.see table 19-5 below for what each code	Malfunction of SRS -ECU

Table 19-5

Code No.	Defective parts	Trouble
14	Front impact analog G-sensor .	● Not operating ● Abnormal characteristics ● Abnormal output
15	Front impact analog G-sensor .	Short in the circuit
16		Open in the circuit
31	DC-DC converter	Terminal voltage of the converter higher than specified for five seconds or more.

32		Terminal voltage of the converter lower than specified for five seconds or more (this code is not detected when code No.41 or 42,which indicates discharged battery,has been detected.).
45	Non-volatile memory(EEPROM)	Defective parts inside
51	Driver’s air bag module (squib) ignition drive circuit	Short in the circuit
52		Open in the circuit
54	Front passenger’s air bag module (squib) ignition drive circuit	Short in the circuit
55		Open in the circuit
56	Driver’s preloading retractor installation（squib）ignition drive circuit system	Short in the circuit
57		Open in the circuit
58	Front passenger’s preloading retractor installation（squib）ignition drive circuit system	Short in the circuit
59		Open in the circuit

Replace SRS－ECU

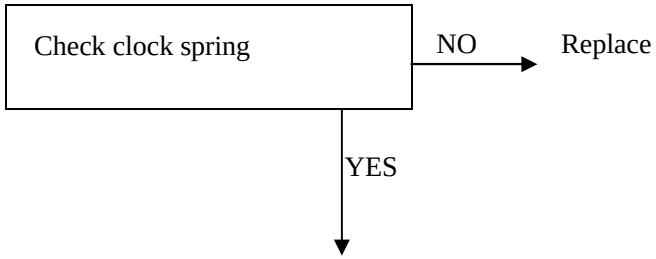
Code No .21、22、61、62 Driver’s air bag module (squib)system	Probable cause
When abnormal resistance is present between input terminals of driver’s air bag module(squib) These code will display. Probable cause of all codes refer to table 19-6..However,once the trouble of Code No 21,22 has been resolved ,SRS warning lamp will go out.(Diagnosis code will remain stored)	● Malfunction of clock spring. ● Connector malfunction ● Short-circuit of driver’s air bag module (squib) or harness ● SRS－ECU malfunction ● Semi-disconnection due to clock spring neutral position defect.

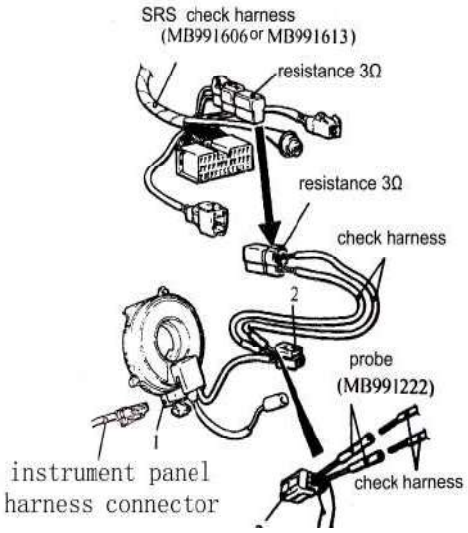
Table 19-6

Code	Probable cause
21	● Short-circuit of driver's air bag module (squib) or harness ● Short-circuit of clock spring. ● Connector malfunction
22	● Disconnection of driver's air bag module (squib) or harness ● Disconnection of clock spring. ● Disconnection of driver's air bag module (squib) connector ● Semi-disconnection due to clock spring neutral position defect. ● Connector contact defect
61	The driver's air bag module (squib) harness has short-circuited to the power supply.
62	The driver's air bag module (squib) harness has short-circuited to the earth.

NOTE

The shorting bars, which short positive(+)and negative(-) wires to prevent the air bags from accidental deployment during the disconnection of the connector ,are set in the squib circuit connectors. In a defective connector, the short –bar may be still working even after the connection of the connector.





MUT-II Self-diag code

- Connect B-55 clock spring connector No.1 and the harness side connector(2-pin).
- Insert the probe(MB991222) from the rear of clock spring connector No.1 and connect the check harness to the probe.
- Never insert the probe directly to the terminals from the front of the connector.
- Disconnect the resistance connector from theSRS check harness（MB991606 or MB991613）.
- Connect the negative (-) battery terminal.
- Erase diagnosis code memory.

  Is code No .21 ,22,61,62 displayed?

YES

Check connector ： B—55、B-62

YES

Check the trouble symptoms

NO

Repair

NO

Replace the driver’s air bag module(squib)

Check the wiring harness between the clock spring and

NO

YES

Replac SRS-ECU

Repair

Fig 19-9

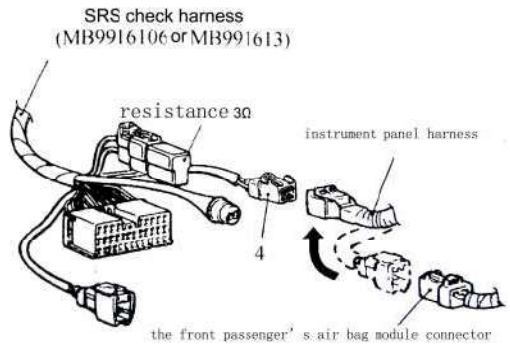
Code 24、25、64、65 Front passenger's air bag module (squib)system	**Probable cause**
When abnormal resistance is present between input terminals of driver's air bag module(squib) These code will display. Probable cause of all codes refer to table 19-7..However,once the trouble of Code No 24,25 has been resolved ,SRS warning lamp will go out.(Diagnosis code will remain stored)	● Connector malfunction ● Short-circuit of front pasenger's air bag module (squib) or harness ● SRS－ECU malfunction

Table 19-7

Code	**Probable cause**
24	● Short-circuit of front passenger's air bag module (squib) or harness ● Connector malfunction
25	● Disconnection of the front passenger's air bag module(squib) or harness disconnection ● Connector contact defect
64	The front passenger's air bag module (squib) harness has short-circuited to the power supply.
65	The front passenger's air bag module (squib) harness has short-circuited to the earth.

Caution

The shorting bars, which short positive(+)and negative(-) wires to prevent the air bags from accidental deployment during the disconnection of the connector ,are set in the squib circuit connectors. In a defective connector, the short –bar may be still working even after the connection of the connector.



MUT-Ⅱdiagnosis

- B—01Disconnect the front passenger's air bag module connector and connect harness side connector to SRS check harness （MB991606 or MB991613）connector No.4
- Connect negative(-) battery terminal.
- Erase diagnosis code memory

Is code No.24、25、64、65 output?

YES → Check connector：B—01、B—62

OK → Check trouble symptoms

NO → Repair

NG → Check the wiring harness between the front passenger's air bag module and SRS-ECU

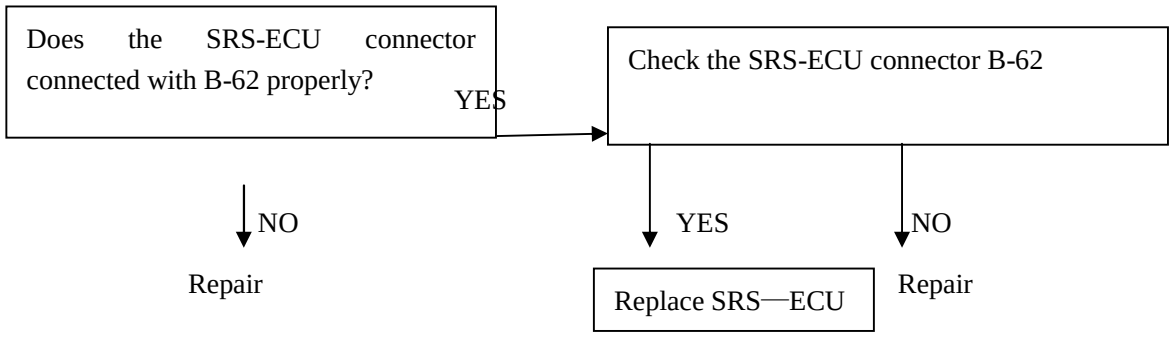
OK → Replace SRS—ECU

NO → Repair

NO → Replace front passenger's air bag module (aquib)

Fig.19-10

Code No.34 connector lock system	Probable cause
The SRS-ECU connector is mounted with a connector lock switch terminal for detecting the connected state of the connector. SRS-ECU connector is poorly connected. However,when the vehicle condition returns to normal,this code No34 will be automatically erased , and the SRS warning lamp will go out.	● Connector malfunction ● SRS—ECU malfunction

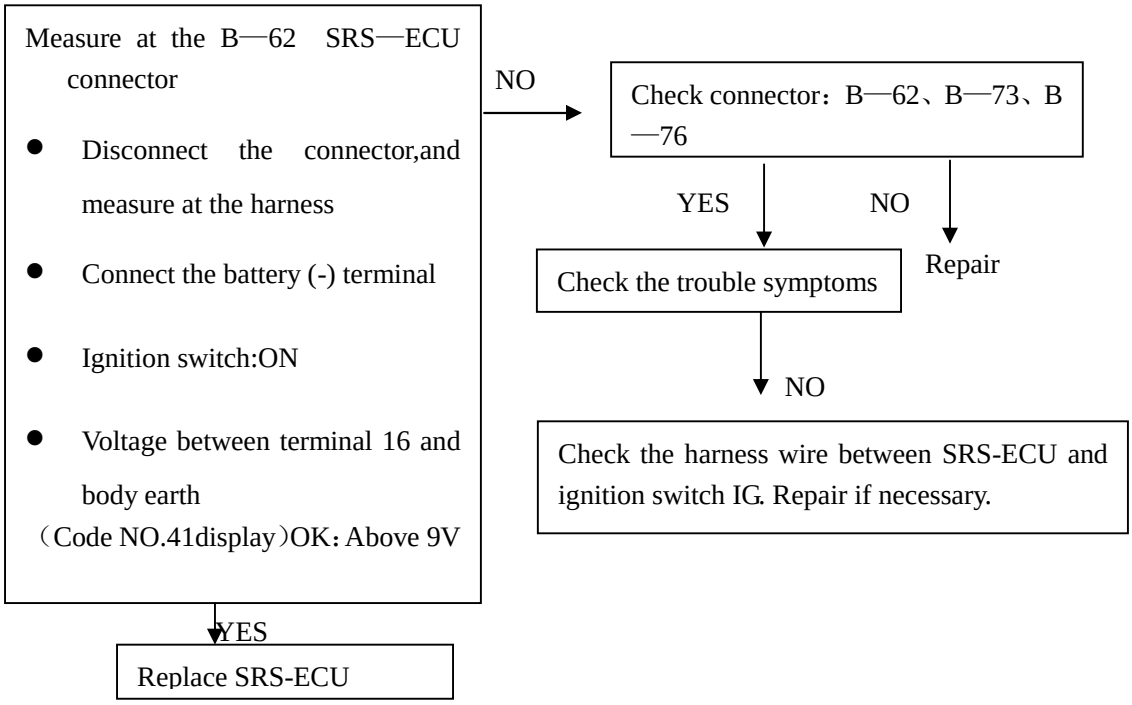


Code No.35 SRS-ECU (deployed air bag)system	Probable cause
This code is displayed after deployment of air bags.If displayed before deployment,the code indicates malfunction probably present in SRS-ECU.	Malfunction of SRS-ECU.

Replace SRS——ECU

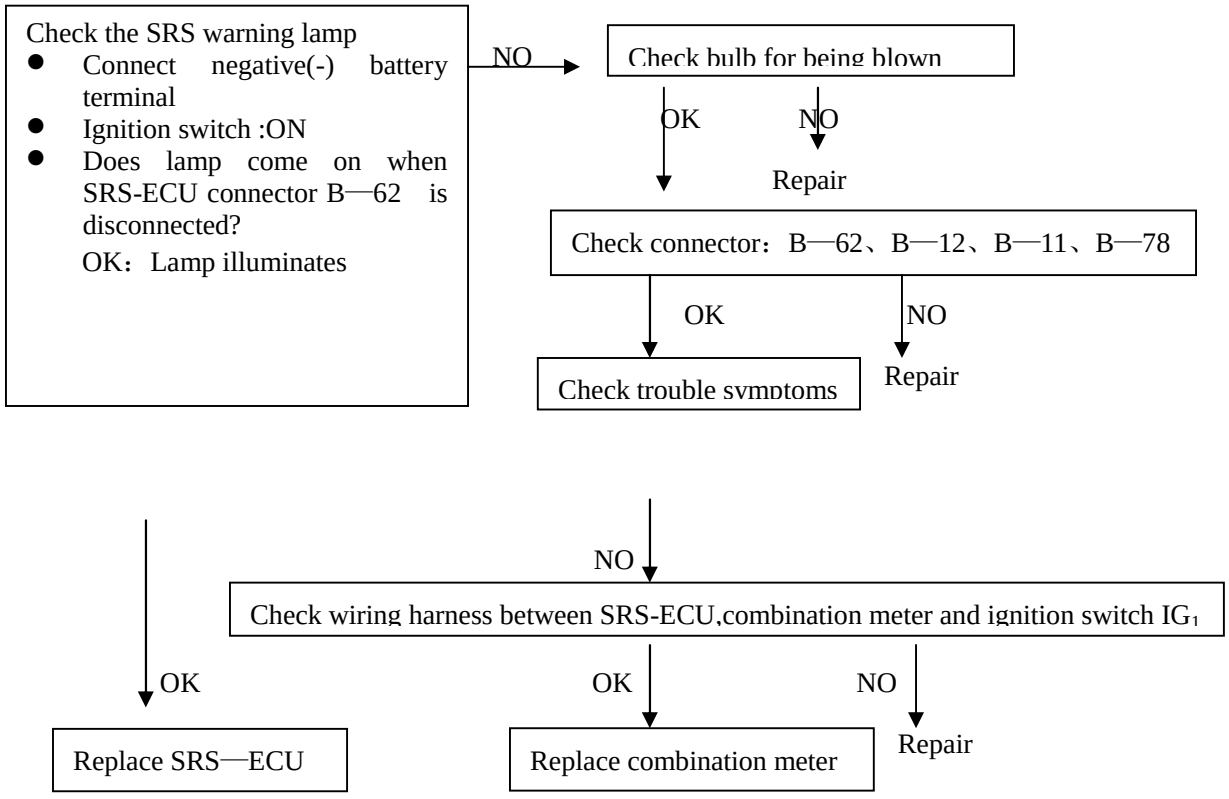
Code No.41Power circuit system (fuse No.2 circuit) Code No.41Power circuit system (fuse No.2 circuit)	Probable cause

Code No.41 is displayed if voltage between IG_1terminal(SRS-ECU,terminal 16) and earth is lower than specified for 5 successive seconds or more. Code No.42 is displayed if voltage between IG_1terminal(SRS-ECU,terminal 13) and earth is lower than specified for 5 successive seconds or more.。 However,once the trouble has been removed, these codes will be automatically erased,and SRS warning lamp will go out. If code Nos.41 and 42 are displayed together,check battery first as vehicle may have discharged battery.	● Defective wiring harnesses or connectors ● Malfunction of SRS-ECU.

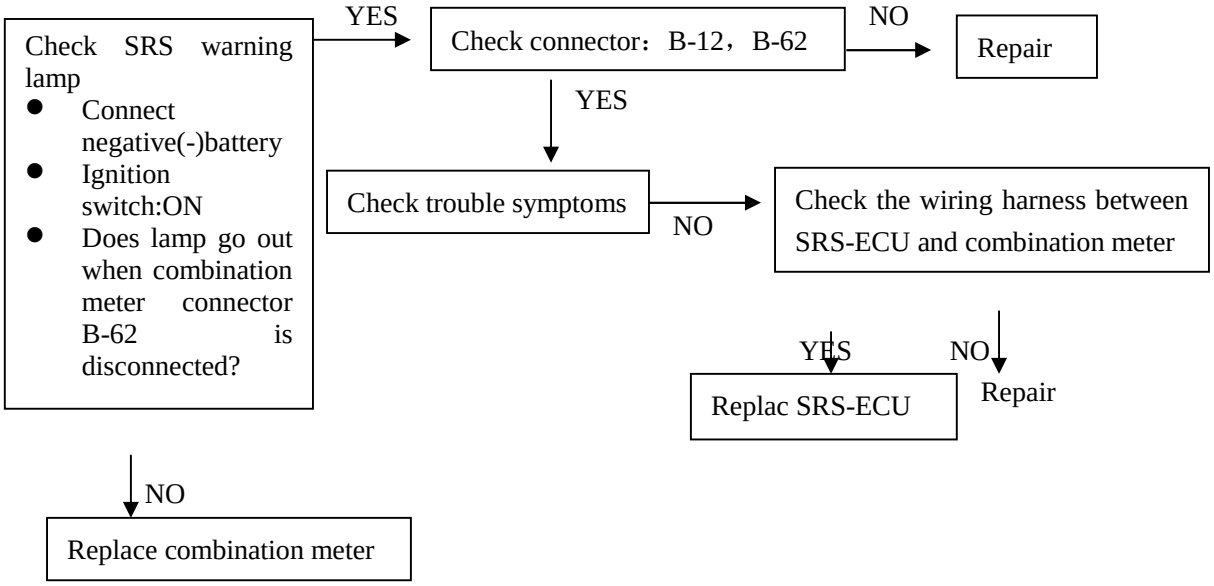


Code No .43 SRS warning lamp drive circuit system(Lamp does not illuminate)	**Probable Cause**
Open circuit is present for 5 successive seconds or more in SRS warning lamp drive circuit.However,once trouble is	● Defective wiring harnesses or connectors

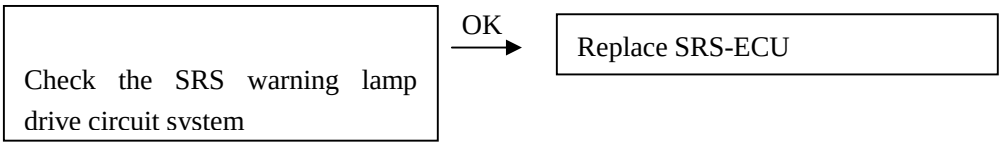
extinguished,this code No.43,if displayed due to open circuit,will be automatically erased.	• Blown bulb • Malfunction of SRS-ECU • Malfunction of combination meter



Code No .43 SRS warning lamp drive circuit system(Lamp does not go out off)	**Probable Cause**
Harness between SRS warning lamp and SRS-ECU is being shorted to earth..However,once trouble is extinguished,this code,if displayed due to open circuit,will be automatically erased.	• Defective wiring harnesses or connectors • Malfunction of SRS-ECU Malfunction of combination meter



Code No.44 SRS warning lamp drive circuit system	**Probable cause**
Short is present in SRS warning lamp drive circuit ,or output transistor in SRS-ECU is defective.However,once trouble is extinguished,this code will be automatically erased. And SRS warning lamp will go out.	● Defective wiring harnesses or connectors ● Malfunction of SRS-ECU



NO.26,27,66,67 driver's side pre-tensioned structure of seat belt (squib) system	Failure cause
When these numbers' electric resistances are abnormal among the SRS-ECU driver's side pre-tensioned structure of seat belts(squib) input terminal, they will be output. For the failure cause of these numbers, please refer to the Table 19-8.However, when the NO.26,27 come to normal, SRS alarm lights will extinguish.(Diagnosis circuit storage signal isn't canceled.)	·Harnesses and connectors are defective. ·Driver's side pre-tensioned structure of seat belt(squib) are defective . ·SRS-ECU is defective.

Table 19-8

NO.	Failure cause
26	·Passenger's side pre-tensioned device of seat belts(squib)shorts or harnesses short ·Connectors are in the state of defection.
27	·Passenger's side pre-tensioned device of seat belts(squib)opens or harnesses open ·Connectors are in the state of defection.
66	·Passenger's side pre-tensioned device of seat belts(squib) harnesses short with power
67	·Passenger's side pre-tensioned device of seat belts(squib) harnesses short with ground

Notice
The shorting bars, which short positive(+)and negative(-) wires to prevent the air bags from accidental deployment during the disconnection of the connector ,are set in the squib circuit connectors. In a defective connector, the short –bar. may be still working even after the connection of the connector.

NO.28,29,68,69driver's side pre-tensioned seat belt(squib) system	Failure cause
When these numbers' electric resistances are abnormal among the SRS－ECU driver's side pre-tensioned structure of seat belts(squib) input terminal, they will be output. For the failure cause of these numbers, please refer to the Table 19-9 Check the subsequence as shown in picture 19-11. However, when NO.28and NO.29 come to normal, the SRS alarm light will extinguish. (Diagnosis circuit storage signal isn't canceled.)	·Harnesses and connectors are defective. ·structure of passenger's side pre-tensioned seat belts(squib) is defective ·SRS-ECU is defective

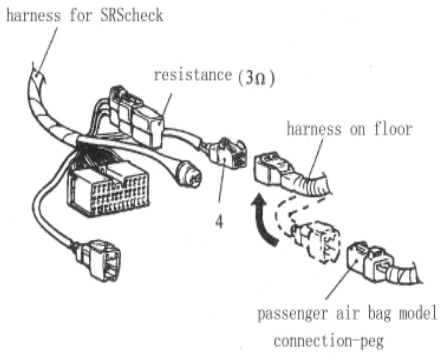
Table 19-9

NO.	Failure cause

28	·Passenger’s side pre-tensioned structure of seat belts structure (squib) shorts or harnesses short ·Connectors are defective.
29	·Passenger’s side pre-tensioned structure of seat belts structure (squib)opens or harnesses open ·Connectors are defective.
68	·Passenger’s side pre-tensioned structure of seat belts structure (squib) harnesses short with power
69	· Passenger’s side pre-tensioned structure of seat belts structure (squib) harnesses short with ground

Notice

The shorting bars, which short positive(+)and negative(-) wires to prevent the air bags from accidental deployment during the disconnection of the connector ,are set in the squib circuit connectors. In a defective connector, the short –bar may be still working even after the connection of the connector.



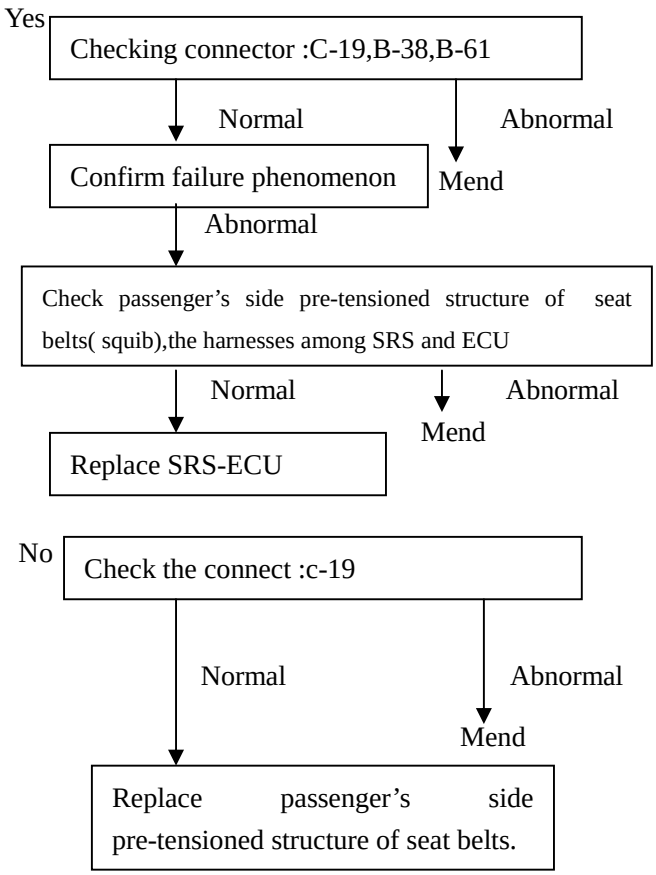
MUT-Ⅱ diagnosis circuit

·Cut C-19 drive's side pre-tensioned structure of seat belts connector, connect the other end of the harnesses with SRS checking harnesses whose NO.4 circuit harness.(MB991606 or MB991613).

·Connect the connector of accumulator

·Cancel diagnosis circuit storage signal

Whether NO.28,29,68,69 are output or not.



6.INSPECTION CHART FOR TROUBLE SYMPTOMS (See table 19-10)

Table 19-10

Trouble	Inspection procedure No(s).
Communication with MUT-II is impossible.	1
warning lamp does not illuminate.	See diagnosis code No.43
SRS warning lamp does not go out off.	See diagnosis code No.43,44.

7.INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 1

Communication with MUT-II is impossible	Probale cause
When communication with all systems is impossible,diagnosis circuit is suspected as faulty. When only communication with SRS air bags is impossible.open in diagnosis output circuit or power supply circuit including earth circuit may be present.	SRS warning lamp does not go out off.

19.5 Post-Collision Diagnosis

Whether or not the air bags have deployed, check and service the vehicle after collision as follows。

1. SRS-ECU MEMORY CHECK

(1) Connect the MUT-II to the diagnosis connector.

(2) Use the MUT-II to read all displayed diagnosis codes.

> Caution
>
> If battery power supply has been shut down by the collision,the MUT-II cannot communicate with the SRS-ECU,Check and repair if necessary,the instrument panel wiring harness before the next job.

(3) Use the MUT-II to read the data list (how long troubles have continued and how often memory have been erased).

1) Maximum time to be stored:9999 minutes (approximately 7 days)

2)Maximum times to be stored:250

(4) Erase the diagnosis codes and after waiting 45 seconds or more read (and write down)all displayed diagnosis codes.

However ,when air bag deploy, if SRS-ECU is malfunction, Does not erase the diagnosis codes.

2 .REPAIR PROCEDURE

(1)Deployed driver’s and front passenger’s air bags and preloading retractor safety belt.

1)Replace the following parts with new ones.

a、SRS－ECU

b、Driver’s air bag module

c、Front passenger’s air bag module

d、preloading retractor safety belt

2) Check the following parts and replace if malfunction is found。

- Clock spring
- Steering wheel ,steering column and intermediate joint.

3) Check the driver’s air bag module for proper installation to the steering wheel。

1） Check the steering wheel for noise,binds or difficult operation and excessive free play。

2） Check the harness for binding,connectors for damage, poor connections,and terminals for deformation.

(2) UNDEPLOYED AIR BAGS IN LOW-SPEED COLLISION

1)Check the SRS components, preloading retractor safety belt.

2)If visible damage such as dents,cracks,or deformation are found on the SRS components, replace,them with new ones。

3)Concerning parts and cautions in working,refer to INDIVIDUAL COMPONENT SERVICE.

3. SRS－ECU(See fig 19-12)

(1) Check the SRS-ECU case and bracket for dents,cracks,or deformation。

(2) Check the connector for damage,and terminals for deformation。

(3) Check the SRS-ECU and bracket for proper installation。

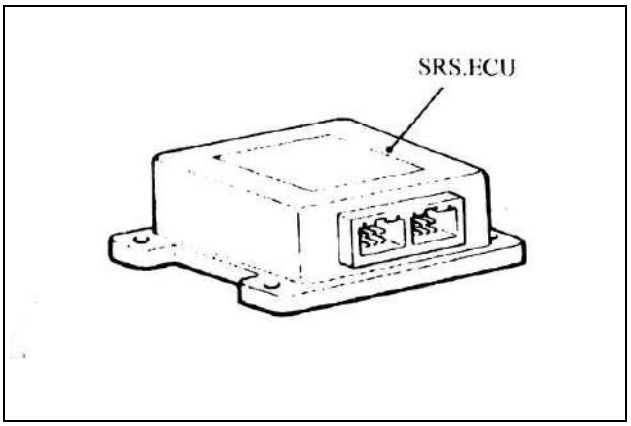


Fig 19-12

4. Driver’s and passenger’s air bag modules(See fig 19-13)

a. Check the covers for dents, cracks or deformation。

b. Check the connectors for damage ,the terminals deformities,and the harness for binds。

c. Check the air bag inflator cases for dents,cracks or deformities。

d. Check the air bag module installation .

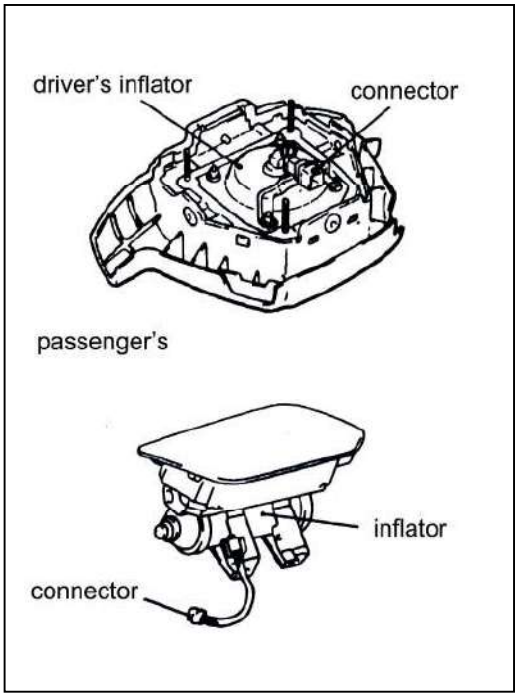


Fig 19-13

5.Clock spring(See fig 19-14)

(1) Check the clock spring connectors and protective tubes for damage, and terminals for deformation，

(2) Visually check the case for damage.

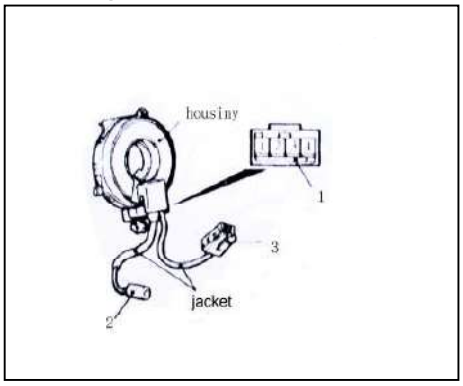


Fig 19-14

6.Steering wheel ,steering column and intermediate joint.

(1) Check the driver's air bag module for proper installation to the steering wheel。

(2) Check the steering wheel for noise,binds or difficult operation and excessive free play。

7.Harness connector(Instrument panel wiring harness)

8. Check the harness for binds,the connector for damage and the terminals for deformation。

19.6 Individual Component Service

If the SRS components are to be removed or replaced as a result of maintenance, troubleshooting etc,follow the service procedures that follow.

Caution

1.SRS components should not be subjected to temperature over 93℃,so remove the SRS-ECU,driver's and front passenger's air bag modules, clock spring . preloading retractor safety belt .before drying or baking the vehicle after painting.

- SRS－ECU、air bag modules、clock spring：over 93℃.
- preloading retractor safety belt：over 90℃.

2.If the SRS components are removed for the purpose of check,sheet metal repair ,painting,etc.,they should be stored in a clean, dry place until they are reinstalled.

19.7 Warning/Caution Labels

Caution labels on the SRS are attached in the vehicle as shown.Follow label instructions when servicing the SRS .If the label(s) are dirty or damaged,replace with new one(s).

（1）Steering wheel(See fig 19-15)

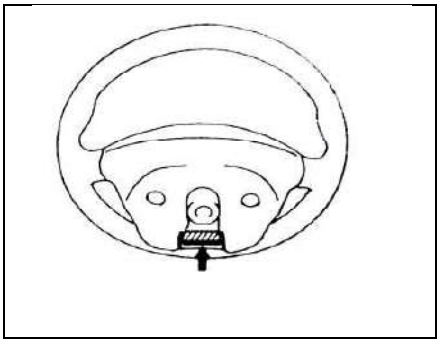


Fig 19-15

（2） Driver's air bag module(See fig 19-16)

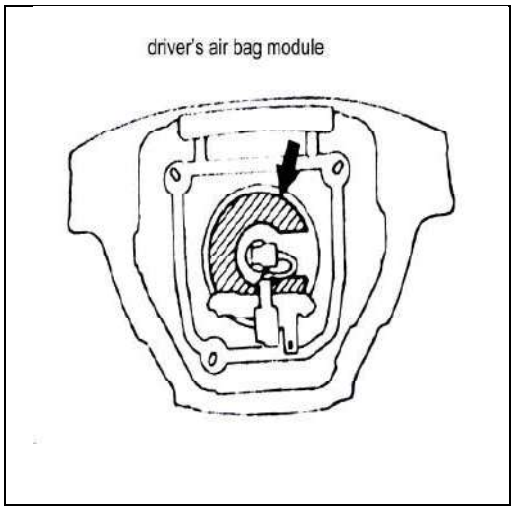


Fig 19-16

（3）Clock spring(See fig 19-17)

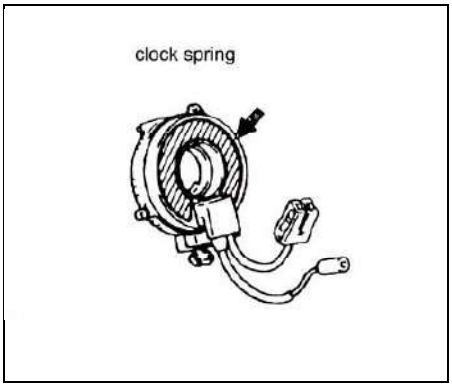


Fig 19-17

（4）Front passenger’s air bag module(See fig 19-18)

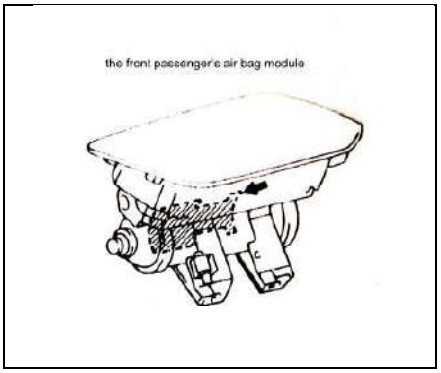


Fig 19-18

(5) SRS－ECU (See fig 19-19)

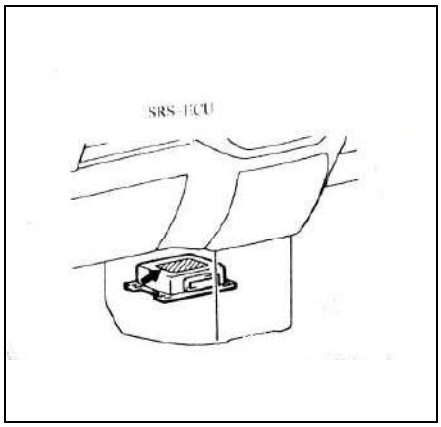


Fig 19-19

（6）Sun visor(See fig 19-20)

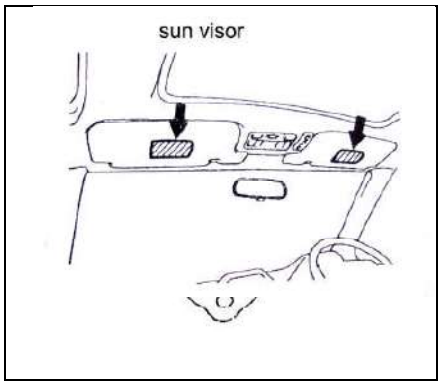


Fig 19-20

（7）Preloading retractor safety belt (See fig 19-21)

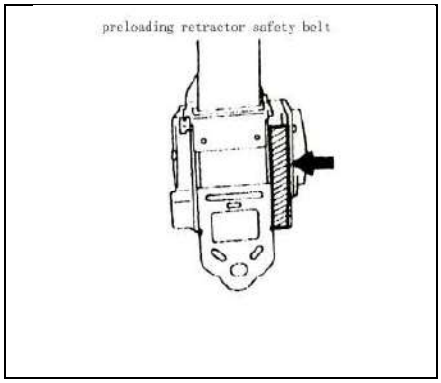


Fig 19-21

19.8 （SRS－ECU）SRS AIR BAG Control Unit

Caution

1. Disconnect the negative(-) battery terminal and wait for 60 seconds or more before starting work.Also, the disconnected battery terminal should be insulated with tape.
2. Never attempt to disassemble or repair the SRS-ECU .If faulty,just replace with a new one。
3. Do not drop or subject the SRS-ECU to impact or vibration.If denting ,cracking,deformation,or rust are found in the SRS-ECU ,replace it with a new one.Discard the old one.
4. After deployment of the air bags,replace the SRS-ECU with a new one.

REMOVAL AND INSTALLATION(See fig 19-22)

Pre-removal Operation

- Turn Ignition Key to LOCK(OFF) Position.
- Disconnect the Negative (-)Battery Terminal.

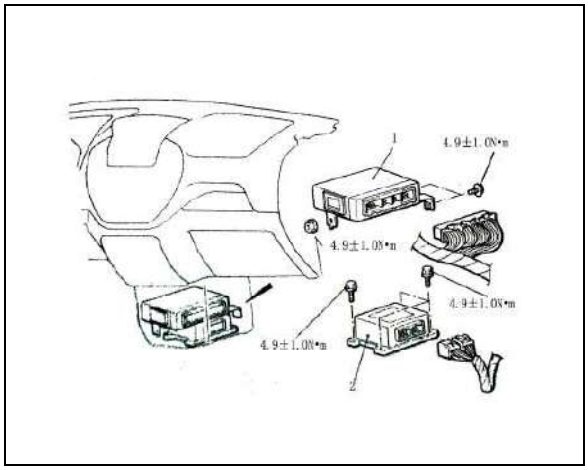


Fig 19-22

Removal steps

- Front floor console

1. Engine ECU

2. SRS－ECU

Installation steps

2. SRS－ECU

1. Engine ECU

- Front floor console
- Negative (-) battery terminal connection

INSTALLATION SERVICE POINTS:

(1) SRS－ECU INSTALLATION

Caution

Be sure to install the SRS-ECU properly. Otherwise,the SRS air bags do not activate,which results in serious injury or death of vehicle's occupants.

(2)Post-installation check(See fig 19-23)

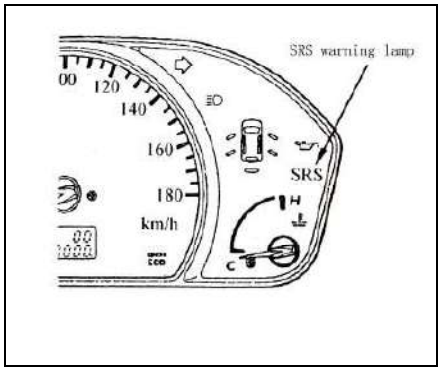


Fig 19-23

1). Turn the ignition switch to ON.

2). Does the SRS warning lamp illuminate for about 6-8 seconds and then go out for more than 5seconds?

3). Yes: The SRS warning lamp is working properly ,No: Go to Troubleshooting。

INSPECTION

1). Check the SRS-ECU and bracket for dents,cracks or deformation.

2). Check connector for damage, and terminals for deformation.

Caution

If a dent ,crack,deformation or rust are present replace the SRS-ECU with a new one.

To check the SRS-ECU in other items than described above,go to Troubleshooting.

19.9 AIR BAG Modules and Clock Spring

Caution

1. Disconnect the negative(-) battery terminal and wait for 60 seconds or more before starting work.Also, the disconnected battery terminal should be insulated with tape.
2. Never attempt to disassemble or repair the air bag modules and clock spring .If faulty,just replace with a new one。
3. Do not drop the air bag modules or clock spring or allow contact with water ,grease or oil. Replace if a dent,crack,deformation or rust are present.
4. Store the air bag modules on a flat surface with the deployment surface facing up.Do not place anything on top of them.
5. Do not store the air bag modules in a place more than 93℃.
6. When the driver's and front passenger's air bag modules with new ones.
7. Put on gloves and safety glasses when handling deployed air bags.
8. When discarding the undeployed air bag module(s),be sure to deploy the air bag(s) in advance as specified in the service procedure.

1.REMOVAL AND INSTALLATION

Driver's air bag module,clock spring(See fig 19-24)

Pre-removal Operation

(1) Draw out ignition switch key after setting steering wheel and front wheels straight ahead.

(2) Disconnect the Negative (-) Battery Terminal。

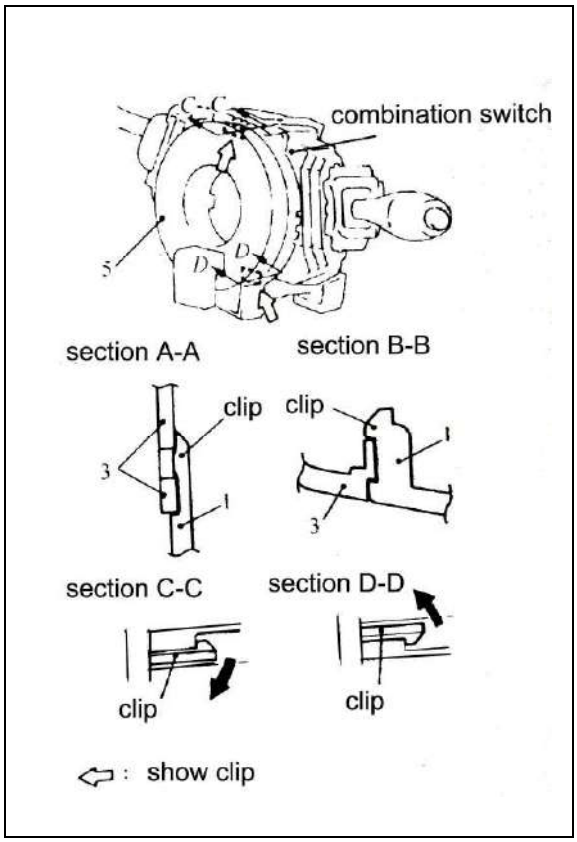


Fig 19-24

Driver's air bag module removal steps：

1. Cover

2 .Steering wheel and air bag module assembly

3. Steering wheel

4. Driver's air bag module

Clock spring removal steps：

1.cover

1. Column cover；

2.Clock spring steering wheel and air bag module assembly

Driver's air bag module installation steps：

(1) Pre-installation inspection

1- **Driver's air bag module**；2-Steering wheel；3Steering wheel and air bag module assembly；4-Cover。

(2) Negative (-) battery terminal connection

(3) Post-installation check

Clock spring installation steps

(1) Pre-installation inspection

5-Clock spring

(2) Colum cover

1-Steering wheel and air bag module assembly

2-Column cover

(3) Negative (-) battery terminal connection

(4)Post-installation check

Front passenger's air bag module(See fig 19-25)

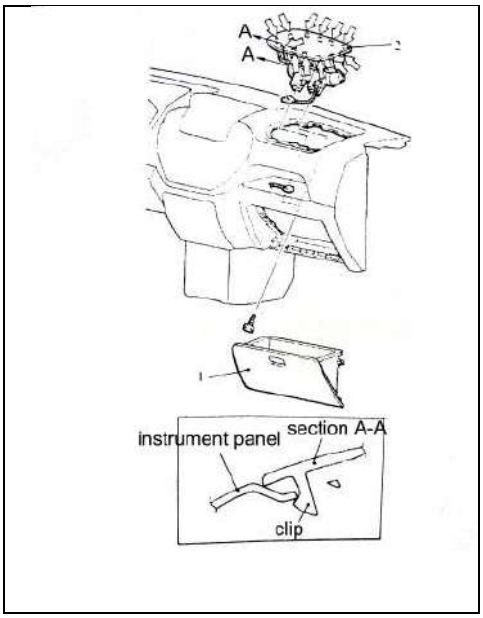


Fig 19-25

Removal steps：

1.Glove box

2.Passenger's air bag module

Installation steps

2.Passenger's air bag module

1.Glove box

- Negative (-) battery cable connection

REMOVAL SERVICE POINTS:

(1) Cover removal

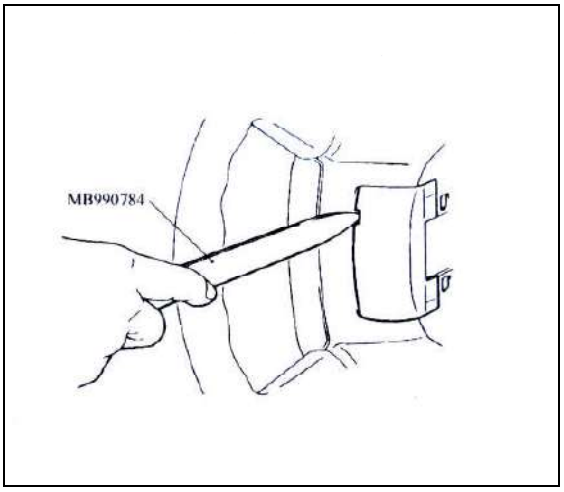


Fig 19-26

Insert the special tool as shown fig 19-26 in the illustration to remove the cover。

(2)Steering wheel and air bag module assembly removal(See fig 19-27)。

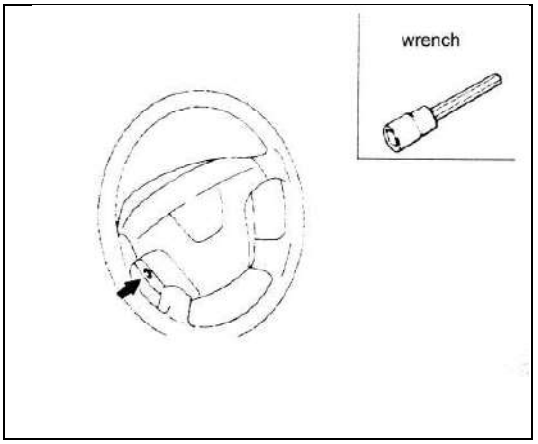


Fig 19-27

① By sliding the A section (in the Fig.) of the clock spring connector in the arrow direction,disconnect the connector.

② Insert the hexagonal bit socket into the arrow section in the Fig. .Completely loosen the bolt,and then remove the steering wheel airbag module assembly。

(3)**Driver's air bag module removal point**

Caution

1.The air bag module must not be measured with such equipment as an ohmmeter,。

2.The removal air bag module should be stored in a clean ,dry place with the deployment surface facing up。

(4)Clock spring removal

Caution

The removed clock spring should be stored in a clean, dry place。

(5)Passenger's air bag module removal

The removed passenger's air bag module should be stored in a clean,dry place with facing the deployment surface facing up。

INSTALLATION SERVICE POINTS

(1)Post-installation check

① Even new air bag modules and a clock spring require inspection before installation。

Caution

When discarding the air bag module,deploy the air bag as specified in the service procedure.

②Connect the negative (-) battery terminal。

③Connect the MUT-II to the diagnosis connector(16-pin).

Caution

Turn the ignition switch to lock (off) position when connect ing and disconnecting the MUT-II 。

④Turn the ignition switch to ON。

⑤Read a diagnosis code to Refer to that the SRS is operating properly except an open in the air bag module circuit。

⑥Turn the ignition switch to LOCK (OFF) position.。

⑦Disconnect the negative (-) battery cable and insulate with tape.

Caution：

Wait at least 60 seconds after the disconnection of the battery cable before any further job。

(2)Clock spring installation

Align the mating marks on the clock spring as mentioned in the next step. Then ,after putting the front wheels in straight-ahead position,install the clock spring to the column switch.

Fully turn the clock spring clockwise and then turn it back about 3 times counterclockwise to align the mating marks.(See fig 19-28)

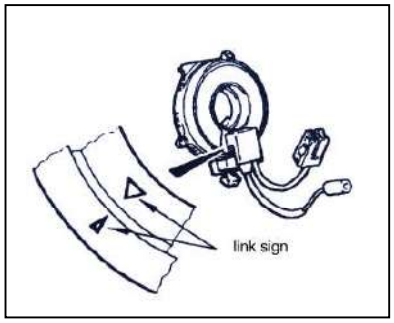


Fig 19-28

Caution

Unless the mating marks are properly aligned,the steering wheel gets stuck amid a turn or the flat cable in the clock spring is cut.These hinder the SRS air bag from proper operation,resulting in serious injury to the vehicle’s driver.

(3)Steering wheel and air bag module assembly installation

①Refer to first that the clock spring has been centred properly .Then ,install the steering wheel and air bag module assembly。

Caution

Be sure ,when installing the steering wheel and air bag module assembly ,not to have the clock spring harness caught or tangled。

②After the installation,check the steering wheel for proper operation by turning it fully right and left。

(4)Post-installation check

①Lightly turn the steering wheel right and left to Refer to that noise and malfunction are not present.（driver's air bag module，clock spring）

②Turn the ignition switch to "ON"。

③Does the SRS warning lamp illuminate for about 6-8 seconds and then go out for 5 seconds or more?(See fig 19-29)

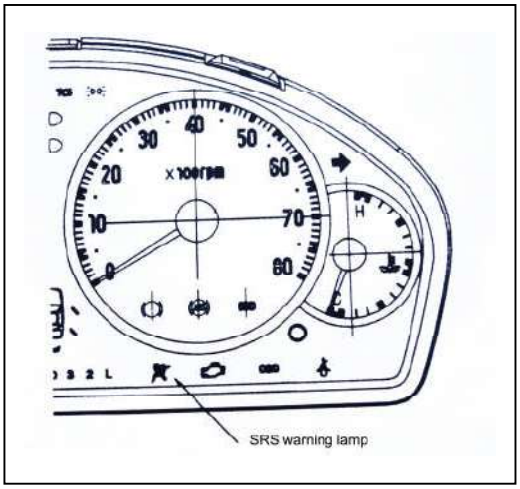


Fig 19-29

④Yes:The SRS is working properly.No:Go to Troubleshooting .。

2.INSPECTION

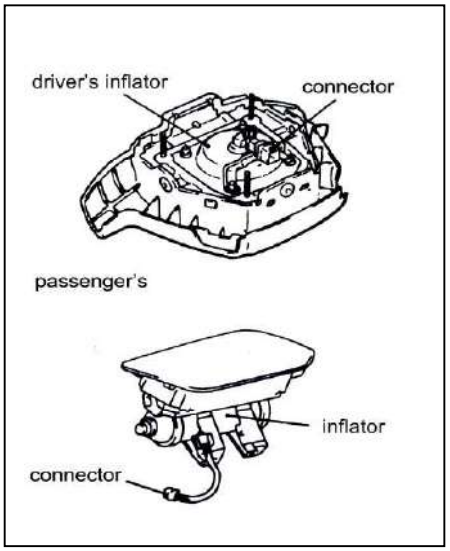


Fig 19-30

1)Driver's and passenger's air bag module inspection. (See fig 19-30)

If any malfunction is found in the following inspection, replace the air bag module(s) with new one(s)。

Discard the old one(s) after deployment as specified in the service procedure.

Caution

Never measure circuit resistance in the air bag modules (squib) even with the specified tester.Measuring the circuit resistance with a tester causes accidental air bag deployment due to current that flows or static,resulting in serious personal injury.

(1) Check the covers for dents, cracks or deformation。

(2)Check the connectors for damage ,the terminals deformities,and the harness for binds。

(3)Check the air bag inflator cases for dents,cracks or deformities。

(4)With air bag module installed

Caution

If dents ,cracks,deformation,or rust are present in the air bag modules,replace with new one(s). Discard the old one(s) as specified in the service procedure.

(2) Clock spring check(See fig 19-31、fig 19-32)

If any malfunction is found in the following inspections ,replace the clock spring with a new one。

1)Check the connectors and protective tubes for damage,and terminals for deformation.

2)Visually check the case for deformage.

3)Refer to that the clock spring has continuity between connector No.1 and terminal No.2。

4)Insert the probe from the rear of connector No.3 of the clock spring。

Caution：

The probe must not be inserted directly to the terminals from the front of the connector.

5) Connect a digital multi-meter to the probe as shown fig 19-32 ,to check that conductivity is present between the terminals.

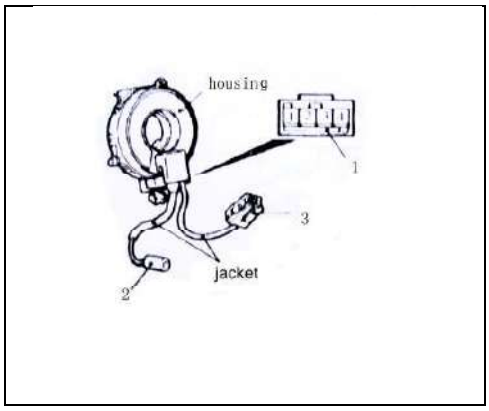


Fig 19-31

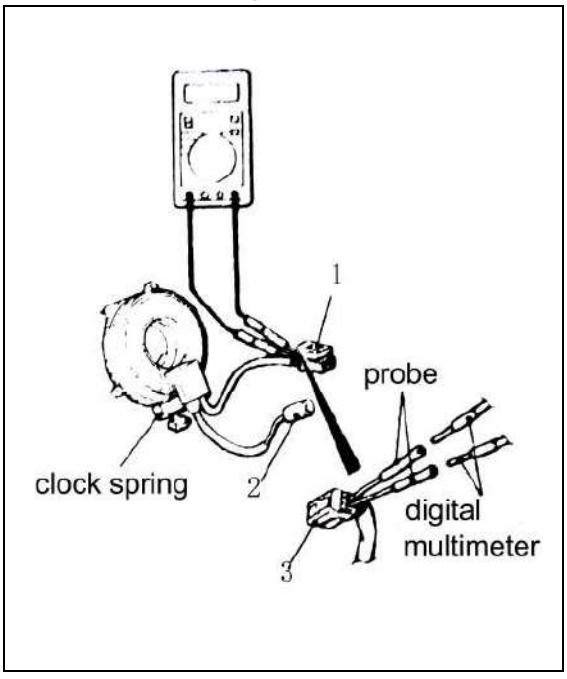


Fig 19-32

19.10 Pre-Tensioned Seat Belt

1. Disassemble the negative pole of the accumulator 60 seconds, then operate it. The disassembled negative pole of the accumulator is wrapped well with tape in order to insulate.
2. Don't break up or mend the pre-tensioned seat belt ,if it can't work properly, please replace a new one.
3. For the pre-tensioned seat belt, please don't make it on the floor, submerged in the water or oil. Additionally, if it has depression, flaw, deformation, you must replace a new one.
4. Don't put other things on the pre-tensioned seat belt.
5. Keep the pre-tensioned seat belt under the temperature of 90℃.
6. After operating the pre-tensioned seat belt, you should replace a new pre-tensioned seat belt.
7. After operating the pre-tensioned seat belt, you must wear glove and protective glasses.
8. When abolishing the un-operated pre-tensioned seat belt, you must abolish it after operating.

1. Disassembly and installation(see Fig. 19-33)

Operation before Disassembly

(1) Put ignition switch on the position of OFF

(2) Open connection of the negative pole of the accumulator

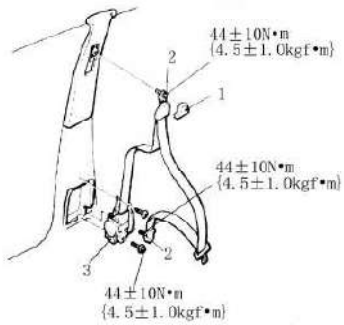


Fig. 19-33

Subsequence of disassembly

1. Window frame pilot cover
2. Connect the outside seat belt
3. The pre-tensioned seat belt

Subsequence of installation

3. The pre-tensioned seat belt
2. Connect the outside seat belt
1. Window frame pilot cover

Connect the negative pole of the accumulator

2. Check

Check the pre-tensioned structure of seat belt

Check the following ones, when you find a little defection, you must also replace a new pre-tensioned seat belt.

For the old parts, you must abolish them after operating the pre-tensioned seat belt according to the specified subsequence.

Notice
For the circuitous resistance of the pre-tensioned structure of seat belt, you use the authorized testing instrument but you can't test it. If you use testing instrument to test the circuitous resistance, it is mostly impossible to route the current through squib, sometimes it will cause accidental development because of static etc, which will lead to a heavily damaged accident.

(1) Whether the pre-tensioned seat belt has depression, flaw, deformation or not.

(2) Whether the connector of the harness is damaged and the connector is deformed or not.

Point of installation

1) Check before installation

When installing a new pre-tensioned seat belt, you should check it before installing.

Notice

When canceling the pre-tensioned seat belt, you must abolish it after operating the pre-tensioned seat belt according to the specified subsequence.

(1) Connect the negative pole of the accumulator

(2) Connect MUT－Ⅱ with diagnosis connector 16.

Notice

When connecting or cutting MUT－Ⅱ, you must put ignition switch on the position of OFF.

(3) Put ignition switch on the position of ON.

(4) When reading diagnosis circuit storage signal, please make sure the circuit of the pre-tensioned structure is normal outside the fault-line.

(5) Put ignition switch on the position of OFF.

(6) Disassemble the negative pole of the accumulator and wrap it well with tape in order to insulate.

Notice

Disassemble the negative pole of the accumulator 60 seconds, then operate it.

2) Check after installation

(1) Put ignition switch on the position of ON.

(2) Make sure that SRS alarm light is lighted in 6-8 seconds, after lasting 5secnods it will extinguish(Fig.19-34).

(3) If light doesn't extinguish, please clear the fault.

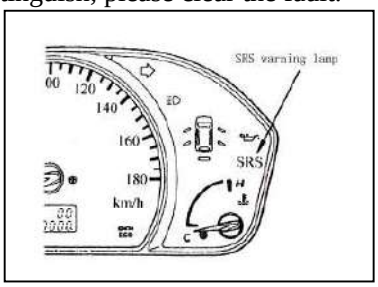


Fig.19-34

19.11 Air Bag Module Disposal Procedures

When discarding the air bag module , preloading retractor safety belt or a vehicle with SRS air bags and preloading retractor safety belt ,be sure to deploy the air bags in advance as specified in the service procedure that follows.

1.Undeployed air bag modules and preloading retractor safety belt disposal

Caution

1.If the vehicle is to be scrapped or otherwise disposed of ,deploy the air bags and preloading

retractor safety belt inside the vehicle .If the vehicle is still to be used and only the air bag modules and preloading retractor safety belt are to be discarded, deploy the air bags and preloading retractor safety belt outside the vehicle.

2.Since a large amount of smoke is produced when the air bags and preloading retractor safety belt are deployed , avoid residential areas whenever possible.

3.Since there is substantial report when the air bags and preloading retractor safety belt are deployed ,avoid residential areas whenever possible. If anyone is nearby, give warning of the impending noise.

4.Suitable ear protection must be put on by personnel performing these procedures or by people in the immediate area.

- **DEPLOYMENT INSIDE THE VEHICLE**

1) Move the vehicle to flat and isolated spot.

2) Disconnect the negative (-) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

Caution

Wait at least 60 seconds after the disconnection of the battery cables before any further job.

3) Deploy each air bag module and preloading retractor safety belt as specified in the service procedures that follow.

(1)Driver's air bag module

①Remove the steering column cover ,lower.

② Disconnect the clock spring 2-pin connector and instrument panel wiring harness connector (2-pin, yellow)(See fig 19-35)

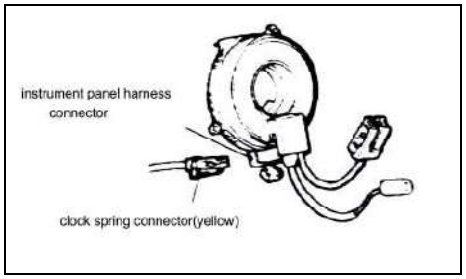


Fig 19-35

NOTE

Once disconnected from the instrument panel wiring harness,both electrodes of the clock spring connector short automatically. This prevents the driver's air bag from accidental deployment caused by static, etc.

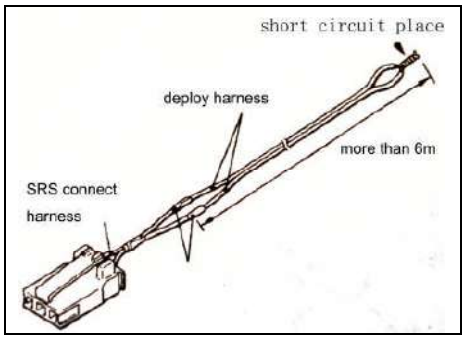


Fig 19-36

③ Connect deployment harnesses longer than 6m to each SRS air bag adapter harness and insulate the connections with plastic tape. (See fig 19-36)

Also ,connect the deployment harnesses in the other ends to short ,thereby preventing the driver's air bag from accidential deployment caused by static etc.

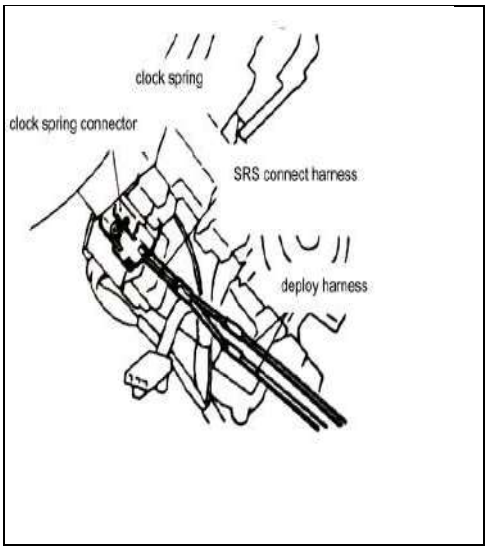


Fig 19-37

④ Connect the SRS air bag adapter harness to the clock spring 2-pin connector and route the deployment harnesses out of the vehicle. (See fig 19-37)

⑤ Close all the doors with the windows fully closed and put a cover over the vehicle to minimize

report.

Caution：

The cover is required as the glass,if already damaged, may break。

⑥ Separate the deployment harnesses as far from the vehicle as possible and connect to the terminals of the battery removed from the vehicle,Then deploy . (See fig 19-38)

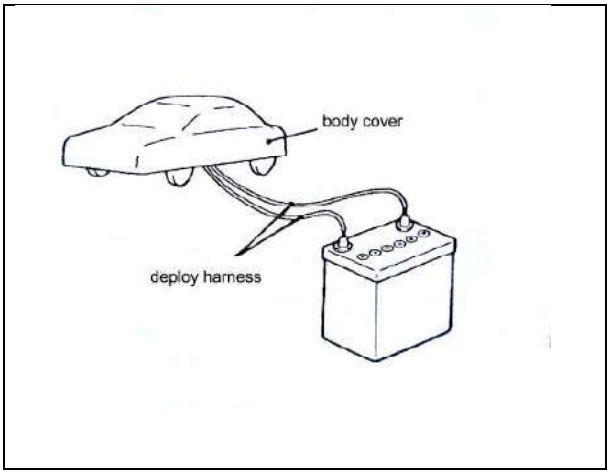


Fig 19-38

Caution

1.Before deploying the air bag ,see that no one is in and near the vehicle. Also ,put on safety glasses.。

2.The deployment makes the inflator of the driver’s air bag very hot ,Before handing the inflator ,wait more than 30 minutes for cooling.

3.If the air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

7) Discard the deployed air bag module according to Deployed Air Bag Module Disposal Procedures.

(2)Front passenger’s air bag module

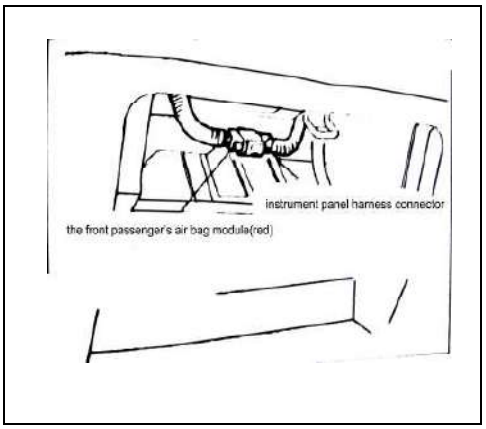


Fig 19-39

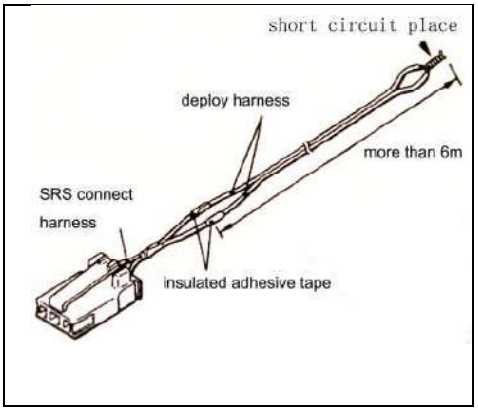


Fig 19-40

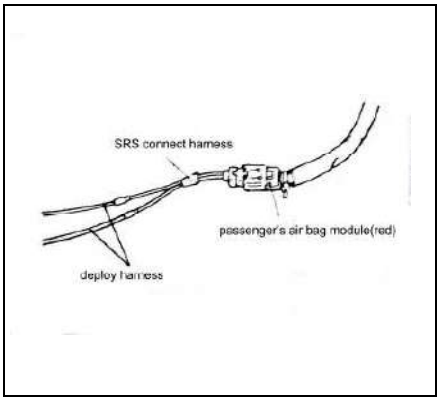


Fig 19-41

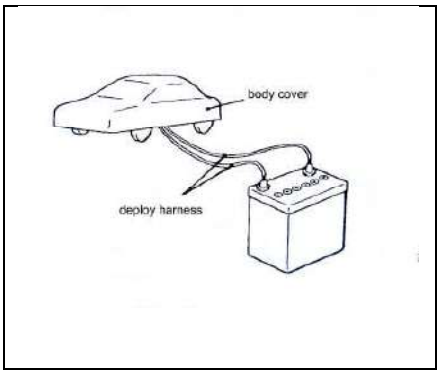


Fig 19-42

① Remove the glove box.

② Disconnect the front passenger's air bag module 2-pin connector (red) and instrument panel wiring harness connector(2-pin,red).(See fig 19-40)

NOTE

Once disconnected from the instrument panel wiring harness , both electrodes of the front passenger's air bag module short automatically. This prevents the front passenger air bag from accidental deployment caused by static.etc.

③ Connect deployment harnesses longer than 6m to each SRS air bag adapter harness and insulate the connections with plastic tape. (See fig 19-40)

Also ,connect the deployment harnesses in the other ends to short ,thereby preventing the driver's air bag from accidential deployment caused by static etc.

④Connect the SRS air bag adapter harness to the front passenger's air bag module 2-pin connector (red) and route the deployment harnesses out of the vehicle. (Seefig 19-41)

⑤ Close all the doors with the windows fully closed and put a cover over the vehicle to minimize report.

Caution

The cover is required as the glass,if already damaged, may break。

⑥ Separate the deployment harnesses as far from the vehicle as possible and connect to the terminals of the battery removed from the vehicle,Then deploy . (See fig 19-42)

Caution

1.Before deploying the air bag ,see that no one is in and near the vehicle. Also ,put on safety glasses.。

2.The deployment makes the inflator of the front passenger's air bag very hot ,Before handing the inflator ,wait more than 30 minutes for cooling.

3.If the air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

⑦ Discard the deployed air bag module according to Deployed Air Bag Module Disposal Procedures.

(3) Preloading retractor safety belt (See fig 19-43、fig 19-44、fig 19-45、fig 19-46)

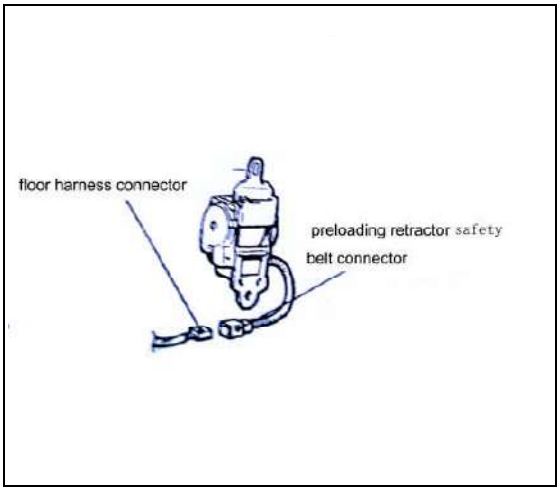


Fig 19-43

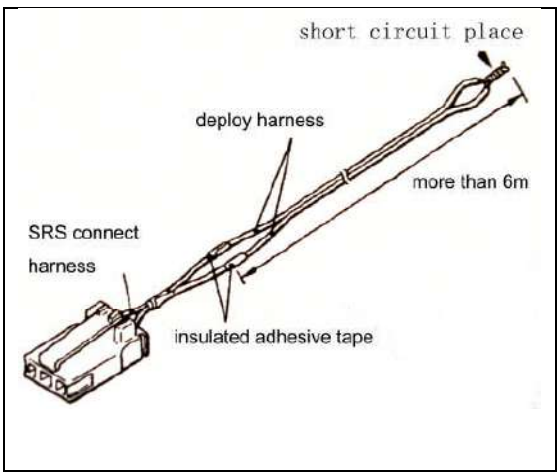


Fig 19-44

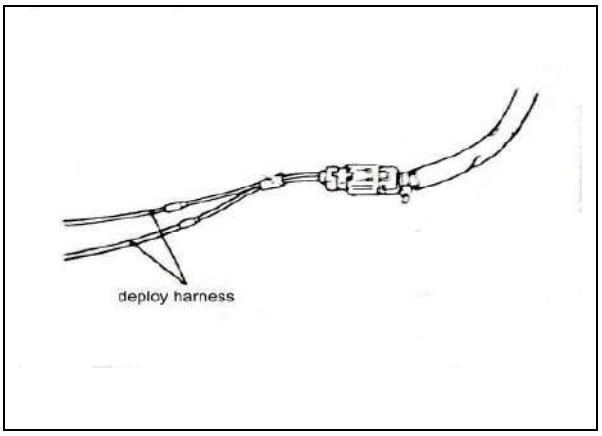


Fig 19-45

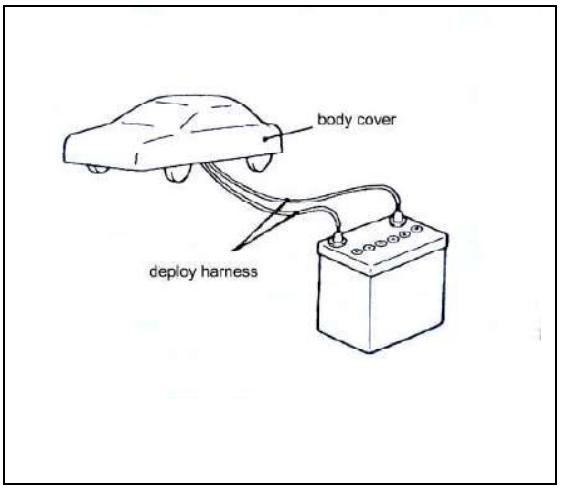


Fig 19-46

● Deployment outside the vehicle

Caution

• This must be carried out in a wide,flat area at least 6 m away from obstacles and other people.

• Do not deploy outside when wind is high .Even in a soft wind ,ignite windward the air bag modules.

1) Disconnect the negative (-) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

Caution

Wait at least 60 seconds after the disconnection of the battery cables before any further job .

2)Deploy each air bag module as specified in the service procedures that follow.

(1)Driver's air bag module

1) Remove the driver's air bag module from the vehicle.

Caution

Once disconnected ,both electrodes of the driver's air bag module connector short automatically to prevent accidental deployment caused by static etc. Still ,in consideration of the accidental deployment ,store the air bag module on flat place with deployment surface facing up. Also, do not put anything on it.

2) Prepare two wires longer than 6 m for deployment and connect the terminals in one end to short-circuit.This is to prevent accidental deployment caused by static etc.

3) Touch the vehicle's body with bare hands to discharge static in you.。

Caution

Never fail to do Step (3) in order to prevent accidental deployment caused by static。

4) Using pliers,cut the driver's air bag module connector from the harnesses.Connect the deployment harnesses to each harnesses that has been cut and insulate the connections with plastic tape。(See fig 19-48)

5) Install a nut to the bolt behind the driver's air bag module and tie thick wire there for securing。

6) Rout the deployment harnesses connected to the driver's air bag module beneath an old tyre and wheel assembly .Then ,using the wire tied to the bolt, secure the driver's air bag module to the tyre and wheel assembly with deployment surface facing up. (See fig 19-49)

7) Place three old tyres without wheels on the tyre secured with the driver's air bag module.(See fig 19-50)

8) Separate the deployment harnesses as far from the driver's side air bag module as possible and connect to the terminals of the battery removed from the vehicle,Then deploy . (See fig 19-51)

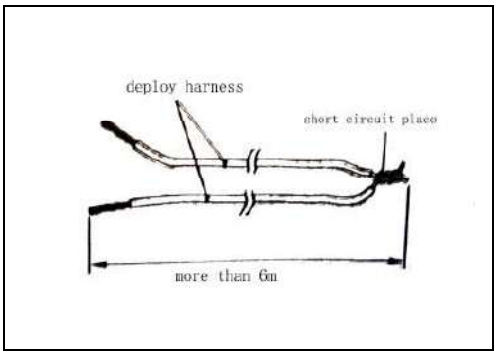


Fig 19-47

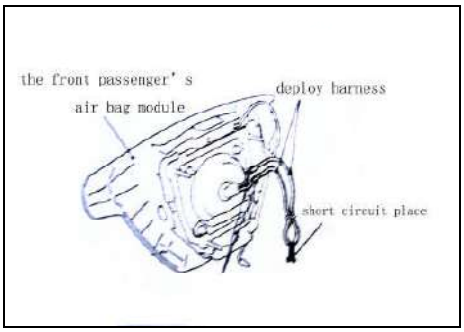


Fig 19-48

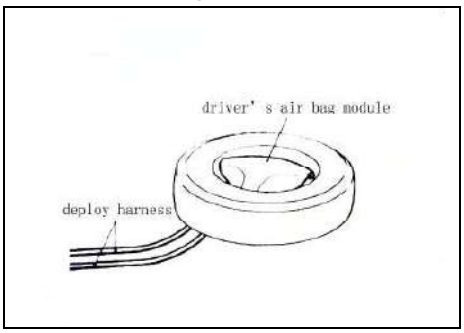


Fig 19-49

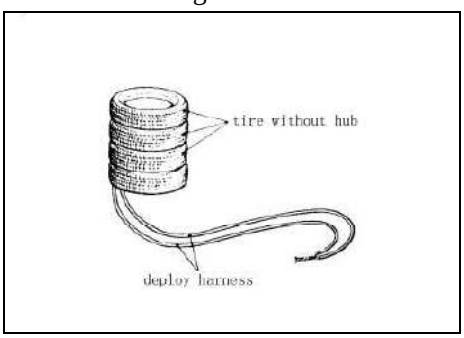


Fig 19-50

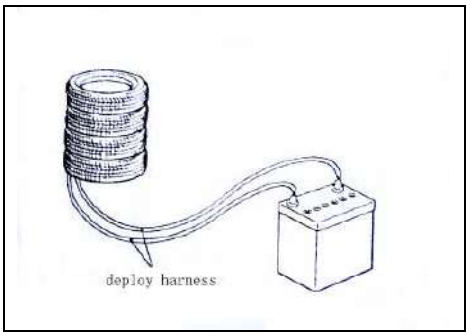


Fig 19-51

Caution

1. Before the deployment,see that no one is near around the driver's air bag module.

2.The deployment makes the inflator of the front passenger's air bag very hot ,Before handing the inflator ,wait more than 30 minutes for cooling.

3.If the air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

9) Discard the deployed air bag module according to Deployed Air Bag Module Disposal Procedures.。

(2)Front passenger's air bag module

1) Remove the front passenger's air bag module from the vehicle.

Caution

Once disconnected ,both electrodes of the front pssenger's air bag module connector short automatically to prevent accidental deployment caused by static etc. Still ,in consideration of the accidental deployment ,store the air bag module on flat place with deployment surface facing up. Also, do not put anything on it.

2) Connect deployment wires 6 m or longer with the SRS air bag adapter harness respectively. Insulate the connection with tape.Also ,connect the other ends of the deployment harness each other to short , thereby preventing the front passenger's air bag from accidental deployment caused by static etc.(See fig 19-52)

3) Route the SRS air bag adapter harness with the deployment harnesses beneath an old tyre and wheel assembly, Then, connect the harnesses to the front passenger's air bag module.

4) Route a thick wire through the holes in the front deployment surface facing up,secure the front

passenger's air bag module to the old tyre and wheel assembly. (See fig 19-53)

Caution

1.The adapter harness below the wheel should be loose .If it is too tight,the reaction when the air bag deploys could damage the adapter harness。

2.Place the connector of the SRS air bag adapter harness so that it is not clamped by the tyre at deployment。

5) Put three old tyres without wheels on the tyre secured to the front passenger's air bag module.Secure all the tyres with ropes (4 locations). (See fig 19-54)

Caution

The tyres must be bound because the passenger's air bag inflates more than the driver's air bag.

6) Disconnect the deployment harnesses as far from the front passenger's air bag module as possible and connect the harnesses to the battery removed from the vehicle. (See fig 19-55)

Caution

1. Before the deployment,see that no one is near around the front passenger's air bag module.

2.The deployment makes the inflator of the front passenger's air bag very hot ,Before handing the inflator ,wait more than 30 minutes for cooling.

3.If the air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

7) Discard the deployed air bag module according to Deployed Air Bag Module Disposal Procedures.

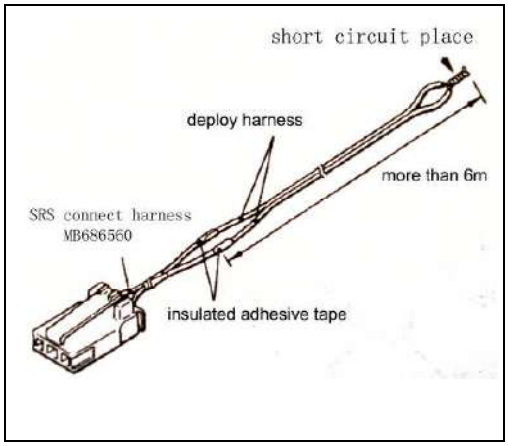


Fig 19-52

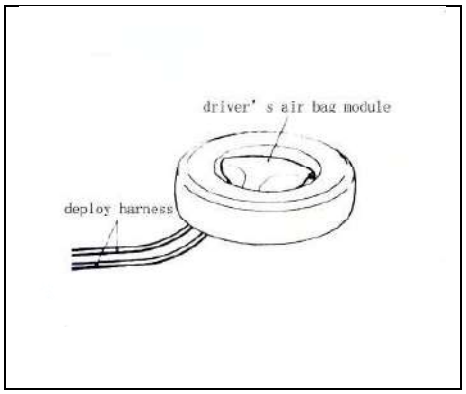


Fig 19-53

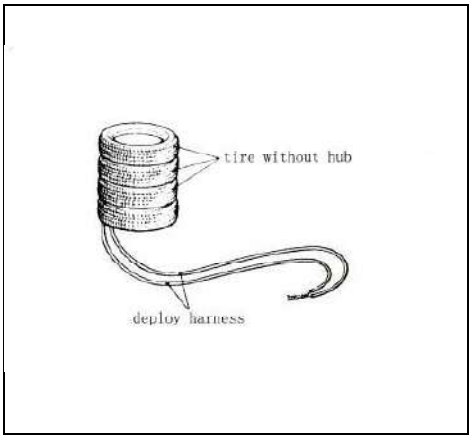


Fig 19-54

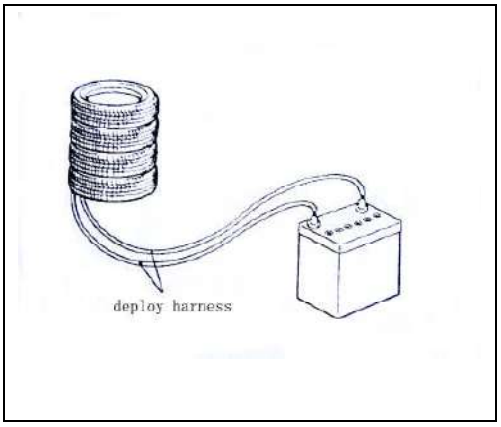


Fig 19-55

(3)The pre-tensioned structure of seat belt

1)Take the pre-tensioned structure of seat belt from the car

Notice
When the pre-tensioned structure of seat belt is during the disconnection of the connector, both sides of the terminal will short and develop automatically. Then the development is put upwards and on the flat, but don’t put other things on it .

2) Connect deployment wires 6 m or longer with the SRS air bag adapter harness respectively. Insulate the connection with tape. Also, connect the other ends of the deployment harness each other to short , thereby preventing the front passenger's air bag from accidental deployment caused by static etc.

3) Route the SRS air bag adapter harness with the deployment harnesses beneath an old tyre and wheel assembly, Then, connect the harnesses to the front passenger's air bag module.

4) Route a thick wire through the holes in Route a thick wire through the holes in the front deployment surface facing up, secure the front passenger's air bag module to the old tyre and wheel assembly.

Notice
When the connectors of the SRS air bag adapter harness develop, don't make it jammed by the tyre.

5)Rout the seat belt out of the tyre , then put an old tire without wheel hub.

6)Far from the pre-tensioned structure of seat belt as possible as you can, cut the connect of the development harnesses ,then connect them with both sides of the battery taken from the car and make them developed.

Caution
1. Before the deployment,see that no one is near around the front passenger's air bag module.
2. The deployment makes the inflator of the front passenger's air bag very hot ,Before handing the inflator ,wait more than 30 minutes for cooling.
3. If the air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

7)Discard the deployed preloading retractor safety belt according to Deployed Air Bag Module Disposal Procedures.

2. DEPLOYED AIR BAG MODULE DISPOSAL PROCEDURES：

After the deployment,discard the air bag modules the same way as any other scrap parts ,respecting local laws and/or legislation that may be in force： However, note the following points at the disposal:

1) The inflators will be quite hot just after deployment .So ,wait at least 30 minutes to cool it before

handling.

2) Do not put water or oil on the air bags after deployment.

3) There may be, adhered to the deployed air bag after deployed air bag modules, material that could irritate the eye and /or skin ,so put on gloves and safety glasses when handling the deployed air bag module.

4) Discard the air bag module and preloading retractor safety belt in a vinyl bag tightly sealed.(See fig 19-56)

5) Be sure to always wash your hands after completing this operation.

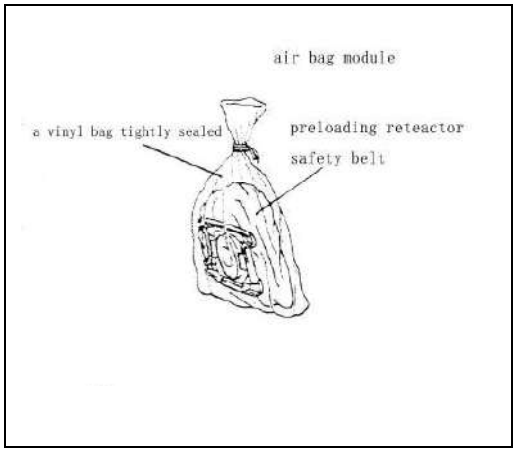


Fig 19-56

20 Electrical Equipment

20.1 Battery

1、ON-VEHICLE SERVICE

(1) The battery is free-service battery, shown in fig.20-1 .A densimeter used to estimate the status of the battery，shown in fig.20-2.

(2) The densimeter shows green when the battery's capability over 65%. The battery works normally.

(3) The densimeter shows black when the battery's capability less than 65%. The battery needs to be charged.

(4) (3)If the densimeter looks limpidity, the battery is broken. Replace it.

2、CHARGING

(5) Disconnect cable to prevent electric component from damaging when battery is charged on vehicle.

(6) The normal charging current is a value in amperes which is 1/10th of the battery capacity. If the battery needs to be charged rapidly because of reasons such as time limitations, the maximum charging current for rapid charging is the battery capacity expressed as an ampere value.

Caution

- Explosions may occur if the battery is brought close to any naked flames during charging.
- Be careful to avoid tasks that might produce sparks or other danger while the battery is charging.

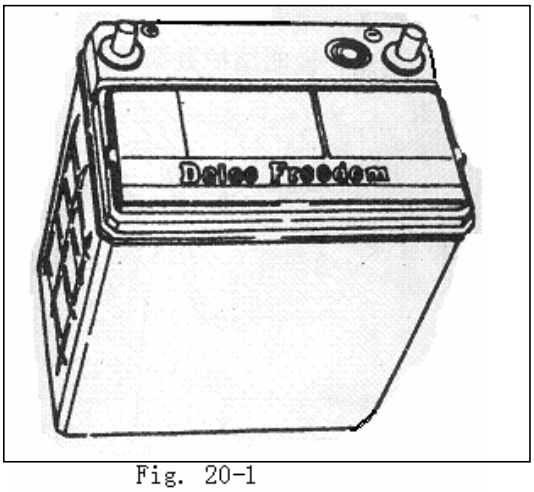


Fig. 20-1

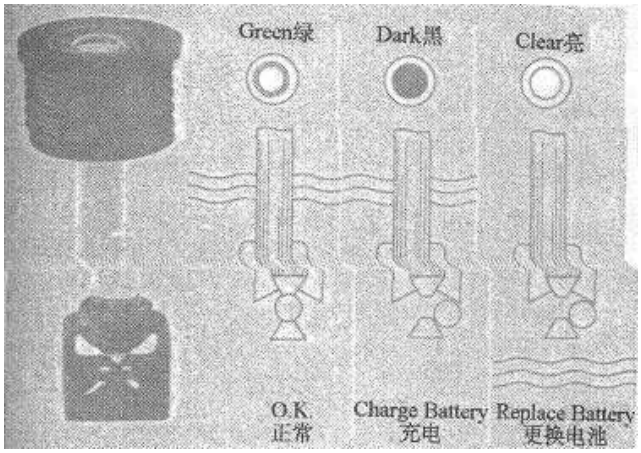


Fig.20-2

3、BATTERY SPECIFICATION AND PARAMETER(see table 20-1)

Table 20-1

Battery type	Capacity	Start current	Remark
MX100-S6LMF	45Ah	430	MT
75023L	70Ah	550	AT

20.1A Troubleshooting Means and Detection Essentials

Troubleshooting of electronic control systems for the MUT-Ⅱ can be finished as below. Furthermore, even in systems which the MUT-Ⅱ cannot be used, part of these systems can still follow this outline.

1. TROUBLESHOOTING CONTENTS

(1) **Standard flow of diagnosis troubleshooting**

·Diagnosis steps see fig.20-3。

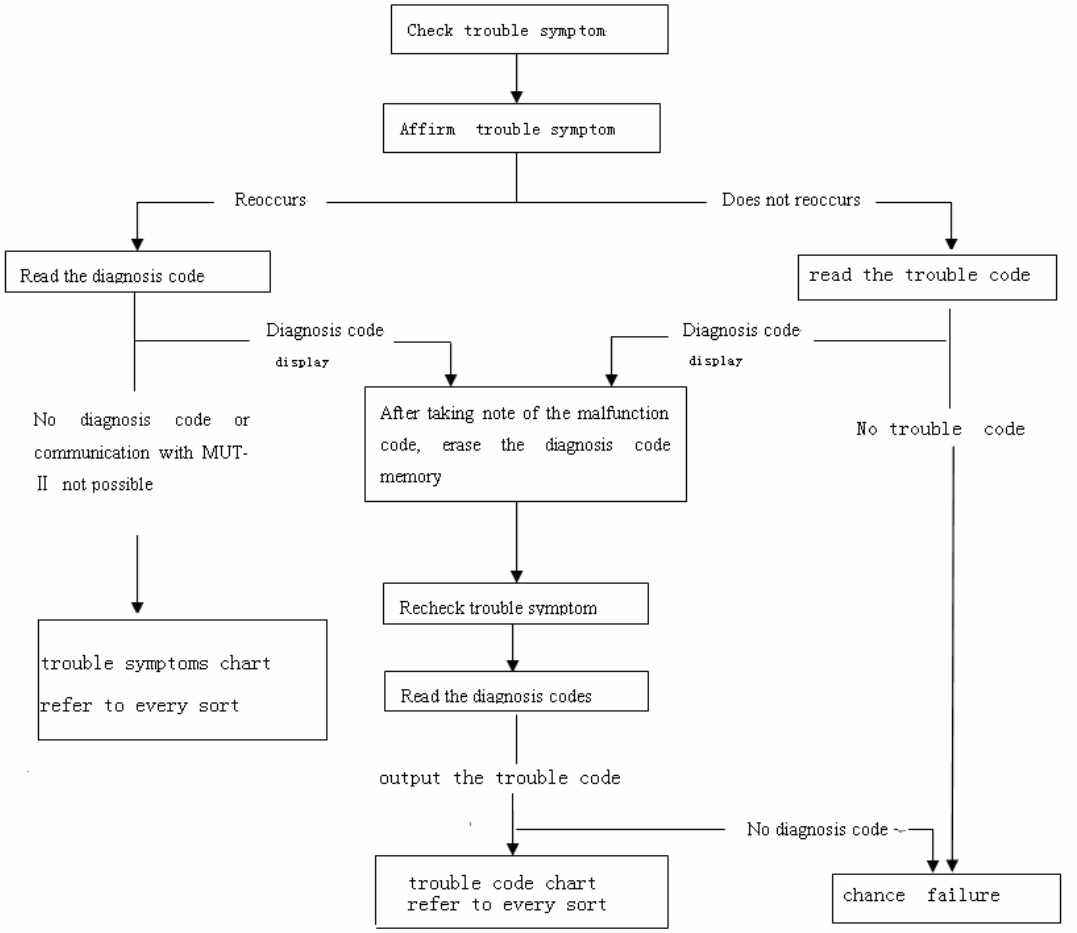


Fig.20-3

(2) SYSTEM OPERATION AND SYSTEM VERIFICATION TESTS

If verification of the trouble symptoms is difficult, procedures for checking operation and verifying trouble symptoms are shown.

(3)DIAGNOSIS FUNCTION

Details which are different from those in the “Diagnosis function” section (refer to the following content).

(4)INSPECTION CHART FOR TROUBLE CODE

Indicate the troubles code and relevant troubles.

(5)INSPECTION STEPS FOR **CLASSIFIC TROUBLE CODE**

Indicates the inspection procedures corresponding to each diagnosis code.(refer to the following content).

(6)**INSPECTION CHART FOR TROUBLE SYMPTOMS**

If there are trouble symptoms even though the results of inspection using MUT-II show that all diagnosis codes are normal, inspection procedures for each trouble symptoms will be found by means of this chart.

(7)**INSPECTION PROCEDURE FOR TROUBLE SYMPTOM**

Indicates the inspection procedures corresponding to each trouble symptoms classified in the Inspection Chart for Trouble Symptoms. (Refer to the following content).

(8)**SERVICE DATA REFERENCE TABLE**

Inspection items and normal judgment values have been provided in this chart as reference information.

(9)CHECK AT ECU TERMINALS

Terminal numbers for the ECU connectors, inspection items and standard values have been provided in this chart as reference information.

(10)INSPECTION PROCEDURES USING AN OSCILLOSCOPE

Explain the main points and ways what can be used oscilloscope to inspection.

2. DIAGNOSIS FUNCTION

1） Method of reading diagnosis codes .(See fig.20-4)

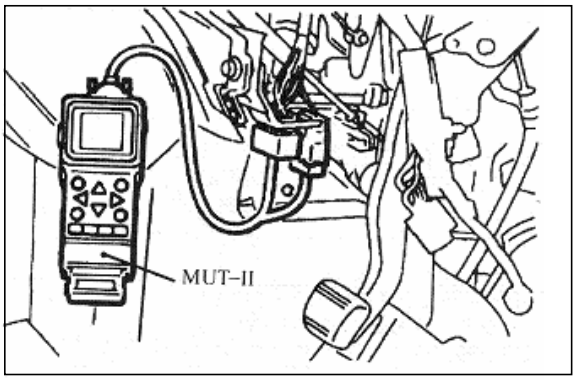


Fig.20-4

①When using the MUT-II (see fig.20-5)

Connect the MUT-II to the diagnosis connector and take a reading of the diagnosis codes.

Caution
Turn the ignition switch to "LOCK"(OFF) position before connecting or disconnecting the MUT-Ⅱ.

NOTE:

MUT-II is connected, if ignition coil turn ON position, some warning lamp will be flashing due to the NO.1 terminal of diagnosis connector which connect to the earth ,what indicates some system show function OK, isn't abnormal.

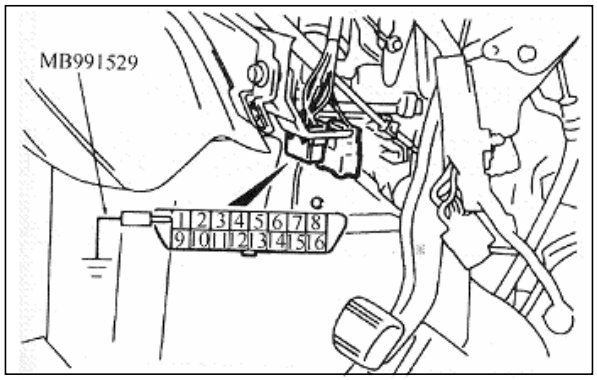


Fig.20-5

②When using the warning lamp

(1)Use the special tool to earth No.1 terminal (diagnosis control terminal) of the diagnosis connector.

(2)Turn on the ignition switch.

(3)Read out a diagnosis code by observing how the warning lamp flashes.。

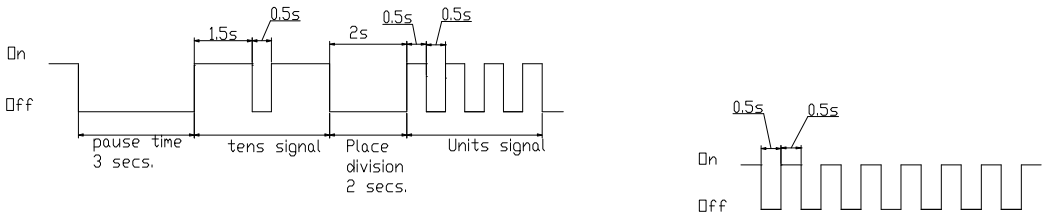
- **Applicable systems(see table 20-2)**

Table 20-2

System name	Warning lamp name
MPI	Engine warning lamp

AT	Neutral position indicator lamp
ABS	ABS warning lamp

- **Indication of diagnosis code by warning lamp(see fig. 20-6)**



When the diagnosis code No.24 is output When no diagnosis code is output

Fig.20-6

2） METHOD OF ERASING DIAGNSIS CODES

①When using the MUT-II

Connect the MUT-II to the diagnosis connector and erase the diagnosis codes.

Caution
Turn off the ignition switch to "LOCK" (OFF) position before connecting or disconnecting the MUT-II.

②When not using the MUT-II

(1)Turn off ignition switch to "LOCK"(OFF) position.
(2) After disconnecting the battery cable from the battery(-) terminal for 10 seconds or more , reconnect the cable.
(3) After the engine has warmed up, run it at idle for about 15 minutes.

3） INPUT SIGNAL CHECK(SWS)

·When using the MUT-II

(1) Connect the MUT-II to the diagnosis connector and erase the diagnosis code.

Caution
Turn off the ignition switch to "LOCK"(OFF) position before connecting or disconnecting the MUT-II.

(2) If the MUT-II buzzer sounds once when each switch is operated (ON/OFF), the input signal for that switch circuit system is normal.

·When using a voltmeter

(1) Using the special tool to connect the ETACS terminal (No.9) and the earth terminal (No.4 or No.5) of the diagnosis connector to the voltage meter.(fig.20-7)
(2) If the needle of the voltage meter flickers sounds once when each switch is operated (ON/OFF), the input signal for that switch circuit system is normal.

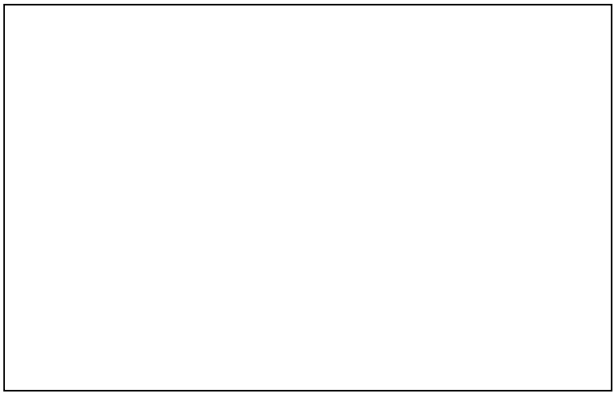


Fig. 20-7

3. **INSPECTION PROCEDURES AND STEPS (see fig.20-8)**
   The causes of a high frequency of problems occurring in electronic circuitry are generally the connectors, components, the ECU and the harnesses between connectors, in that order. These inspection procedures follow this order, and they first try to discover a problem with a connector or a defective component.

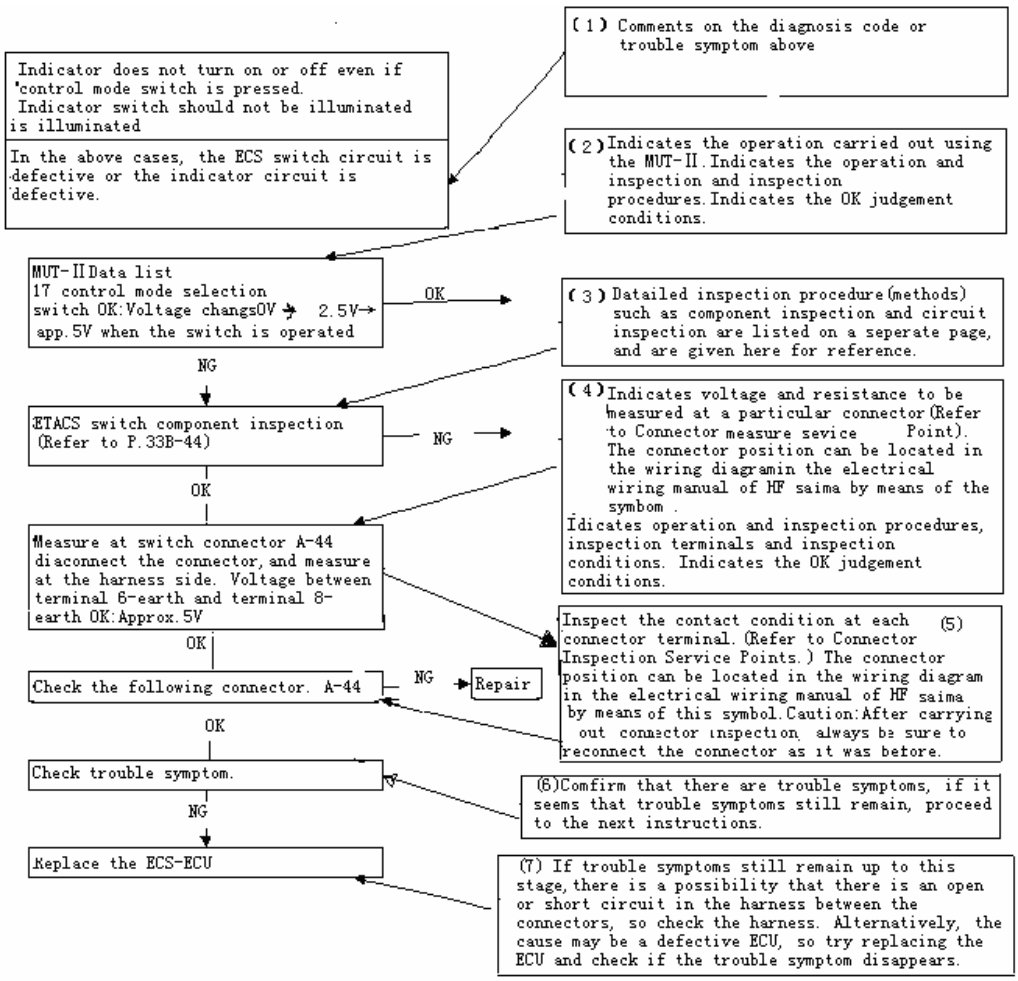


Fig. 20-8

1）Harness inspection

Check for an open or short circuit in the harness between the terminals which were defective according to the connector measurements. Carry out this inspection while referring to.《the electrical wiring manual- HF SAIMA》.Here, “Check harness between power supply and terminal xx” also includes checking for blown fuses. For inspection service points when there is a blown fuse, refer to “6” Inspection Service Points for a Blown Fuse.

2）Measures to take after replacing the ECU

If the trouble symptoms have not disappeared even after replacing the ECU, repeat the inspection procedure from the beginning.

4．Connector measurement service points

Turn the ignition switch to OFF when disconnecting the connectors, and turn the ignition switch to ON when measuring if there are no instructions to be contrary.

1） If inspecting with the connector connected (with circuit in a condition of continuity)

·Waterproof connectors

Be sure to use the special tool (harness connector). Never insert a test bar from the harness side, because to do so will reduce the waterproof performance and result in corrosion.

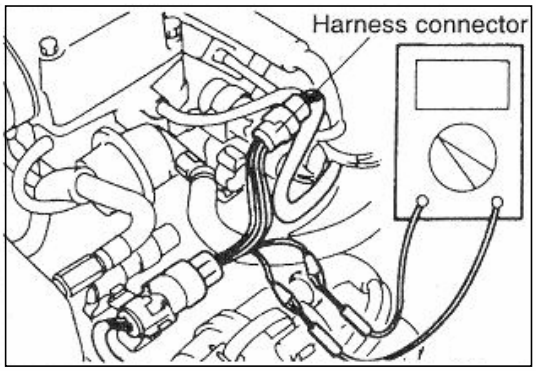


Fig. 20-9

·Ordinary (non-waterproof connectors)

Check by inserting the test bar from the harness side. Note that if the connector (control unit, etc.) is too small to permit insertion of the test bar, it should not be forced; use a special tool (the extra-thin probe in the harness set for checking for this purpose.)

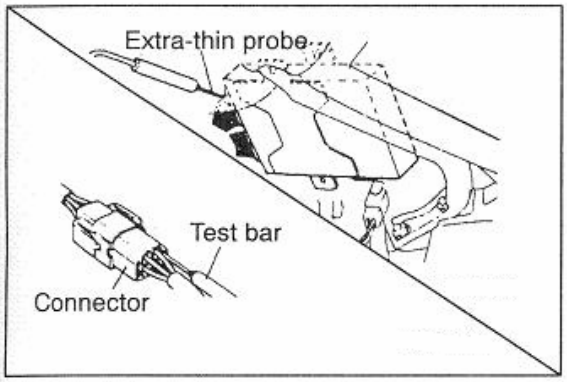


Fig. 20-10

2） **If inspecting with the connector disconnected**

·When inspecting a female pin (see Fig.20-11)

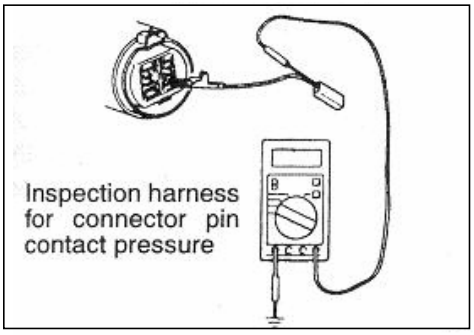


Fig. 20-11

Use the special tool (inspection harness for connector pin contact pressure in the harness set for inspection).

.The inspection harness for connector pin contact pressure should be used, the test bar should never be forcibly

inserted, as it may cause a defective contact.

·When inspection a male pin(see fig.20-12)

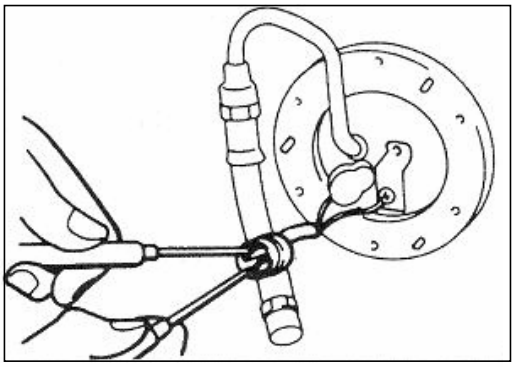


Fig. 20-12

Touch the pin directly with the test bar.

Caution
If the pin of contact terminal is shorted the inner of ECU will be broken.

5 CONNECTOR INSPECTION

1）Visual inspection

·Connector is disconnected or improperly connected.(See fig.20-13)

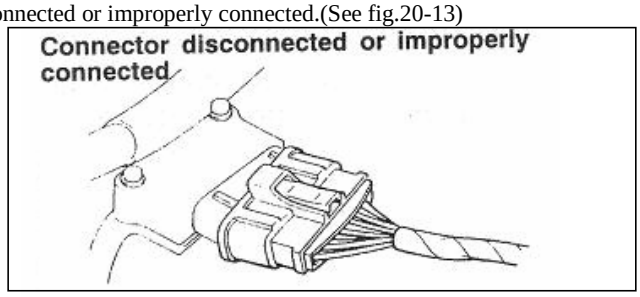


Fig. 20-13

·Connector pins are pulled out

·Due to harness tension at terminal section.(See fig.20-14)

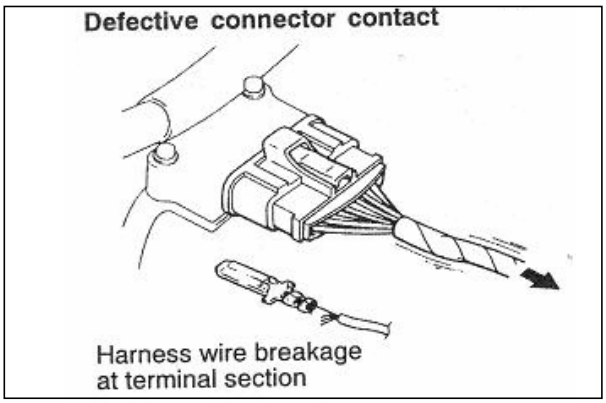


Fig. 20-14

·Low contact pressure between male and female terminals.(See fig.20-15)

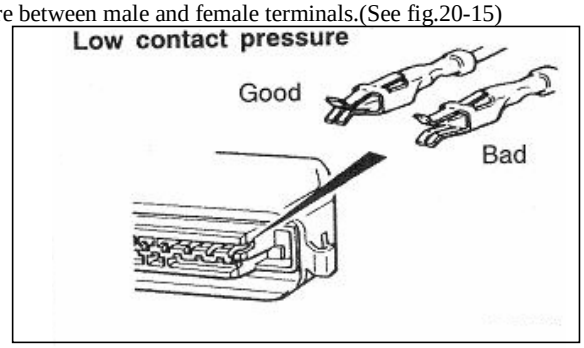


Fig. 20-15

·Due to rusted terminals or foreign matter lodged in terminals

2） Connector pin inspection

If the connector pin stopper is damaged, the terminal connections (male and females pins) will not be perfect even if the connector body is connected, and the pins may pull out of the reverse side of the connector. Therefore, gently pull the harnesses one by one to make sure that no pins pull out of the connector. (See fig.20-16)

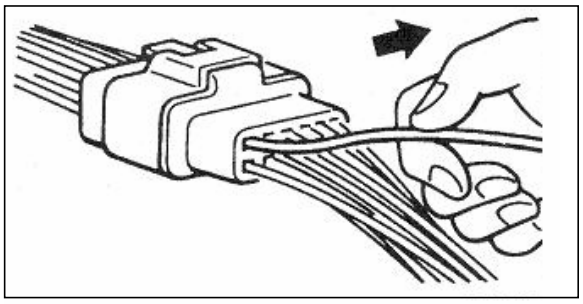


Fig. 20-16

3） Connector engagement inspection

Use the special tool (connector pin connection pressure inspection harness of the inspection harness set) to inspect the engagement of the male pins and females pins.(Pin drawing force: 1N or more). (See fig.20-17)

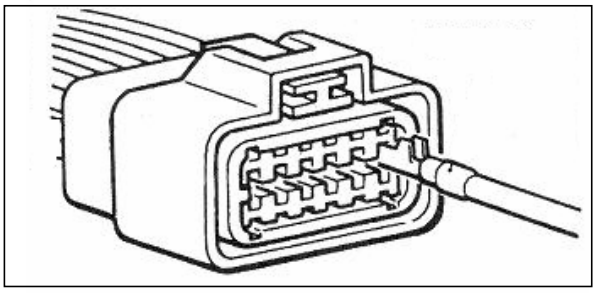


Fig. 20-17

6. INSPECTION SERVICE POINTS FOR A BLOWN FUSE

Remove the blown fuse and measure the resistance between the load side of the blown fuse and the earth. Set the switches of all circuits which are connected to this fuse to a condition of continuity. If the resistance is 0Ω at this time, there is a short somewhere between these switches and the load. If the resistance is not 0Ω, there is no short at the present time, but a momentary short has probably caused the fuse to blow. (See fig.20-18)

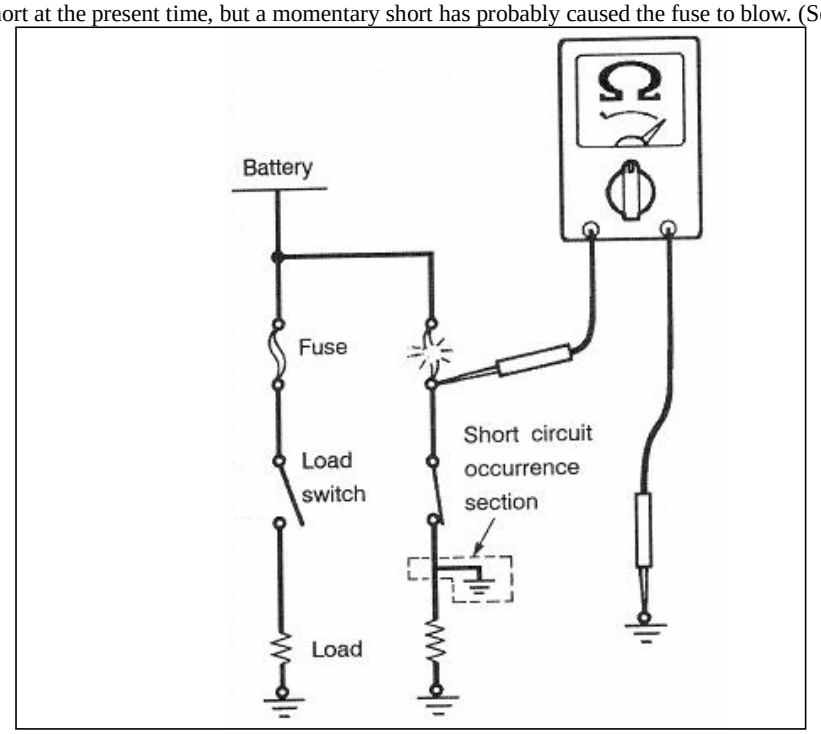


Fig. 20-18

The main causes of a short circuit are the following:

·Harness being clamped by the vehicle body
·Damage to the outer casing of the harness due to wear or heat
·water getting into the connector or circuitry
·Human error (mistakenly shorting a circuit, etc.)

7. POINTS TO NOTE FOR INTERMITTENT MALFUNCTIONS

Intermittent malfunctions often occur under certain conditions, and if these conditions can be ascertained, determining the cause becomes simple. In order to ascertain the conditions under which an intermittent malfunction occurs, first ask the customer for details about the driving conditions, weather conditions,

frequency of occurrence and trouble symptoms, and then try to recreate the trouble symptoms. Next, ascertain whether the reason why the trouble symptom occurred under these conditions is due to vibration, temperature or some other factor. If vibration is thought to be the cause, carry out the following checks with the connectors and components to confirm whether the trouble symptom occurs.

The objects to be checked are connectors and components which are indicated by inspection procedures or given as probable cause (which generates diagnosis codes or trouble symptoms.) (see fig.20-19)

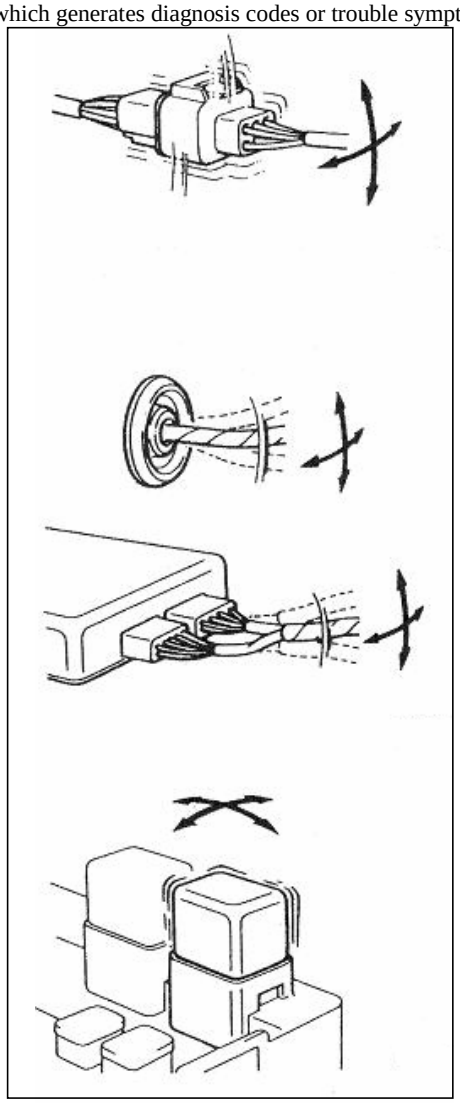


Fig. 20-19

·Gently shake the connector up, down and to the left and right.
·Gently shake the wiring harness up, down and to the left and right.
·Gently rock each sensor and relay ,etc .
·Gently shake the wiring harness at suspensions and other moving parts.

20.1B Precautions before Service

1. SUPPELEMENTAL RESTRAINT SYS (SRS)

1）Items to follow when servicing SRS

(1) Be sure to read the SRS part of this manual. For safe operations, please follow the directions and heel all warnings；

(2) Wait at least 60 seconds after disconnecting the battery cable before doing any further work. The SRS system is designed to retain enough voltage to deploy the air bag even after the battery has been disconnected. Serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cable is disconnected.；

(3) Warning labels must be heeded when servicing or handling SRS components. Warning labels are located in the following locations.

·Sun visor；
·SRS-ECU
·Steering wheel
·Clock spring

(4) Always use the designated special tool and test equipment on this manual；

(5) Store components removed from the SRS in a clean and dry place. The air bag module should be stored on a flat surface and placed so that the pad surface is facing upward. Don’t place anything on top of it；

(6) Never attempt to disassemble or repair the SRS components (SRS-ECU, air bag module, clock spring) ,replace it when has a trouble.

(7) Whenever you finish servicing the SRS, check SRS warning lamp operation to make sure that the system functions properly.

2）Observe the following when carrying out operations ′s places where SRS components are installed, including operations not directly related to the SRS air bag.

(1) When removing or installing parts do not allow any impact or shock to the SRS components. .

(2) SRS-ECU, air bag module, clock spring: 93℃ or more. After re-installing them, check the SRS warning lamp operation to make sure that the system functions properly.

2. SERVICING THE ELECTRICAL SYSTEM

Before replacing a component related to the electrical system and before undertaking any repair procedures involving the electrical system, be sure to first disconnect the negative (-) cable from the battery in order to avoid damage caused by short-circuiting.(see fig.20-20)

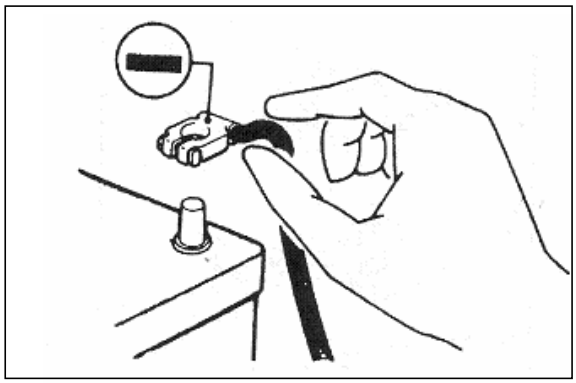


Fig. 20-20

Caution
Before connecting or disconnecting the negative (-) cable, be sure to turn off the ignition switch and the lighting switch. (If this is not done, there is the possibility of semiconductor parts being damaged.)

3. VEHICLE WASHING

- **High-pressure car-washing or steam car-washing equipment**

  If high-pressure car-washing equipment or steam car-washing equipment is used to wash the vehicle, be sure to note the following information in order to avoid damage to plastic components, etc.

  ·Spray nozzle distance: Approx. 40 cm or more. (See fig.20-21)

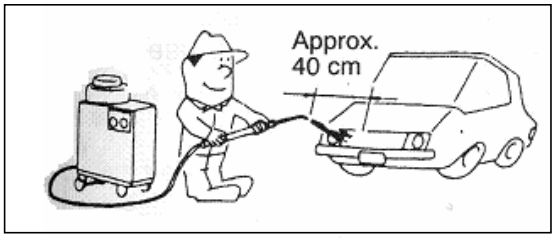


Fig. 20-21

Fig.20-21: 约 40cm,Appr. 40cm.

·Spray pressure: 3900 kPa (40 kg/cm^2) or less.

·Spray temperature: 82℃ or less.

·Time of concentrated spray to one point: within 30 s.

- **Auto car-washing equipment**

  To the best of avoid using auto car-washing equipment abilities, because it will pulls the surface of lacquer accordingly loses the clean degree, and accelerates wear, in particular, the nick of the fuscous car is even more distinctness.

4. MUT-II

(1)Refer to the “MUT-II REFERENCE MANUAL” or “MUT-II OPERATING INSTRUCTIONS” for instructions on handling the MUT-II. (See fig.20-22)

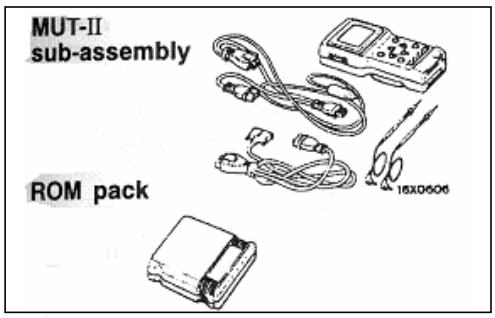


Fig. 20-22

(2)Connect the MUT-II to the diagnosis connector as shown in the illustration.

20.2 Combination Switch

1、REMOVAL AND INSTALLATION(AS FIG 20-23)

Removal steps as fig 20-23

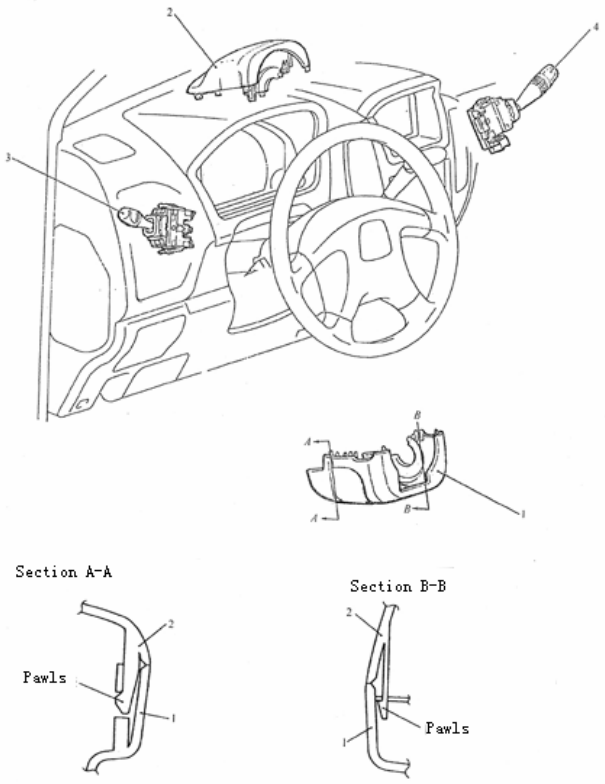
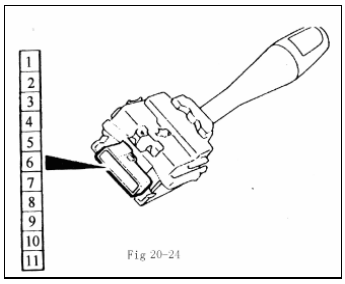


Fig 20-23

1. Lower column cover 2. Upper column cover 3. Lighting switch
4. Wiper/washer switch

2、INSPECTION

(1) Illumination switch continuity check(as fig 20-24)

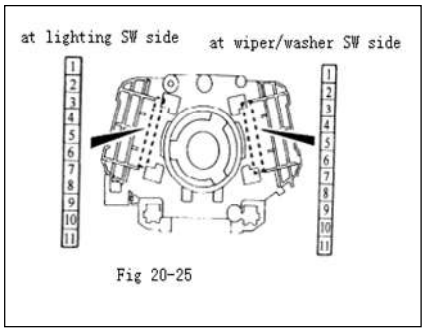


Switch position	Terminal NO..										
	1	2	3	4	5	6	7	8	9	10	11
OFF											
position lamp			○				○				
Headlamp			○			○					
High beam			○					○			
Pass lamp			○						○		
Turn signal lamp RH			○								
Turn signal lamp LH			○							○	○

(2) Combination switch continuity check(at|switch body) (as fig 20-25)

①Removal illumination switch and wiper/washer switch

②Among individual connectors of column switch body remaining in steering column, check for continuity between same number terminals(3~11).



Terminal NO.		Connector at illumination switch side										
		1	2	3	4	5	6	7	8	9	10	11
Connector at Wiper&Washer switch	1											
	2											
	3			○								
	4				○							
	5					○						
	6						○					
	7							○				
	8								○			
	9									○		
	10										○	
	11											○

20.3 Ignition Switch

1、 **REMOVAL AND INSTALLATION**

Removal steps as fig 20-26

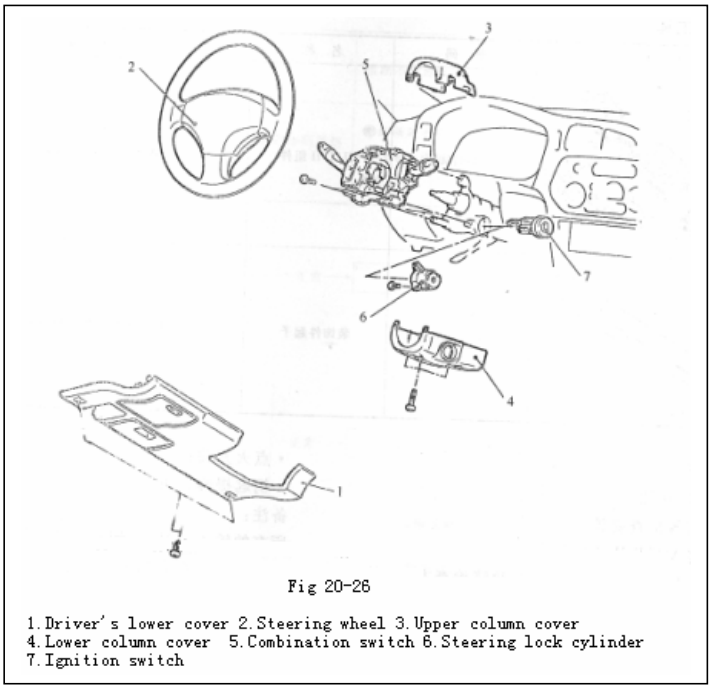


Fig 20-26

1. Driver's lower cover 2. Steering wheel 3. Upper column cover
4. Lower column cover 5. Combination switch 6. Steering lock cylinder
7. Ignition switch

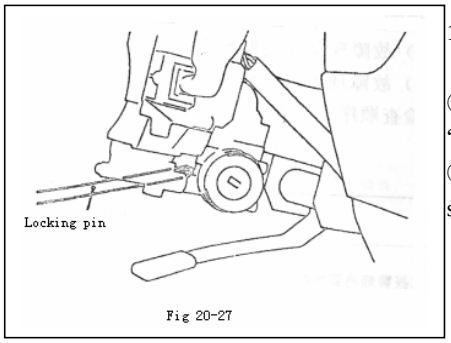


Fig 20-27

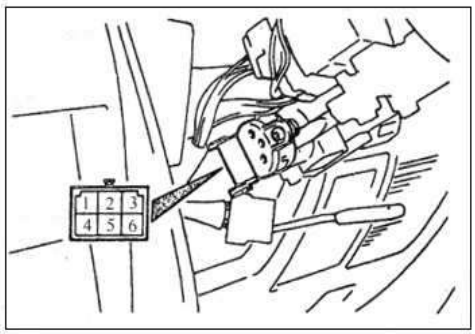
1) Removal service point

Steering lock cylinder removal

①Insert key into steering lock cylinder to turn ignition key to "ACC" position

②Insert locking pin with small plus screwdriver,etc.,and remove steering lock cyliner. (as Fig20-27)。

2 INSPECTION



Ignition switch position	Terminal NO.				
	1	2	3	4	5
LOOK					
ACC	○				○
ON	○	○	○		○
START	○	○		○	

Fig 20-28a

IGNITION SWITCH CONTINUITY CHECK

Disconnect ignition switch connector for iinspection（as ig 20－28a）。

KEY REMINDER SWITCH CONTINUITY CHECK

With key reminder switch installed on the vehicle,disconnect key reminder switch connector for inspection（as fig20－28b）。

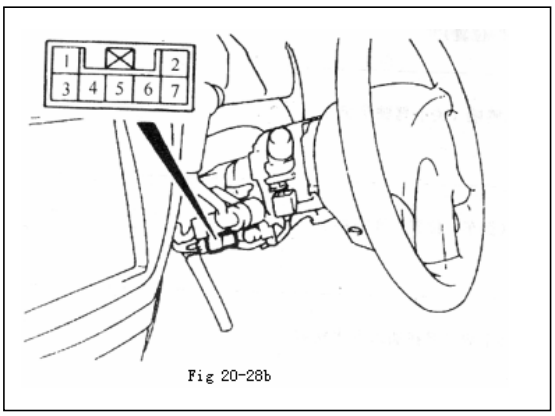
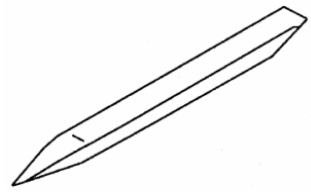


Fig 20-28b

3 SPECIAL TOOL

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Check the ETACS-ECU input signals
	MB990784	Ornament remover	Instrument panel left lower bezel and column cover removal

4 TROUBLESHOOTING

1）Diagnosis function

（1）Input signal check point

Input signals can be checked using MUT-II or coltmeter connected to the diagnosis connector.(Refer to 20.1A troubleshooting/inspection service points)

（2）Check switch input signals as following

·Door switch

·Ignition switch

·Key reminder switch

Caution:

All input signal do not check using the MUT-II,should Consider that diagnosis circuit have problem.

2）Trouble symptoms table as table 20-5

table 20－5

Trouble symptom		Inspection step
Ignition key removal reminder buzzer	Ignition key removal reminder buzzer sound, even though the key on 'ON' position.(once driver door closed, the buzzer do not sound.)	**1**
	With the ignition key inserted, opening driver's door, the ignition key removal reminder buzzer don't sound(the ignition key is on "LOCK[OFF]"position).	**2**
	Even though the ignition key is pulled out,the buzzer still sound (once driver door closed, the buzzer do not sound.)	**3**
R(reverse) selected buzzer	Even though the ignition key is on "ON" position and the reverse lever on "R" position, the buzzer still not sound.	**5**
Buzzer of illumination monitor	With the tail lamp lighting, opening driver's door, the buzzer doesn't sound.(but when the ignition key is inserted, Ignition key removal reminder buzzer	**-**

	sound) 。	

3） Trouble symptoms inspection step 1 as table 20-6、fig 20-29

table 20－6

Even though the ignition key is on "ON" position, the Ignition key removal reminder buzzer sounding continually(once driver door closed, the buzzer doesn't sound.)	**Probable cause**
The ignition switch input circuit fault or ETACS-ECU fault. General fuse fault or harness short circuit.	●fuse fault ●Harness or connector fault ●ETACS—EC**U** fault

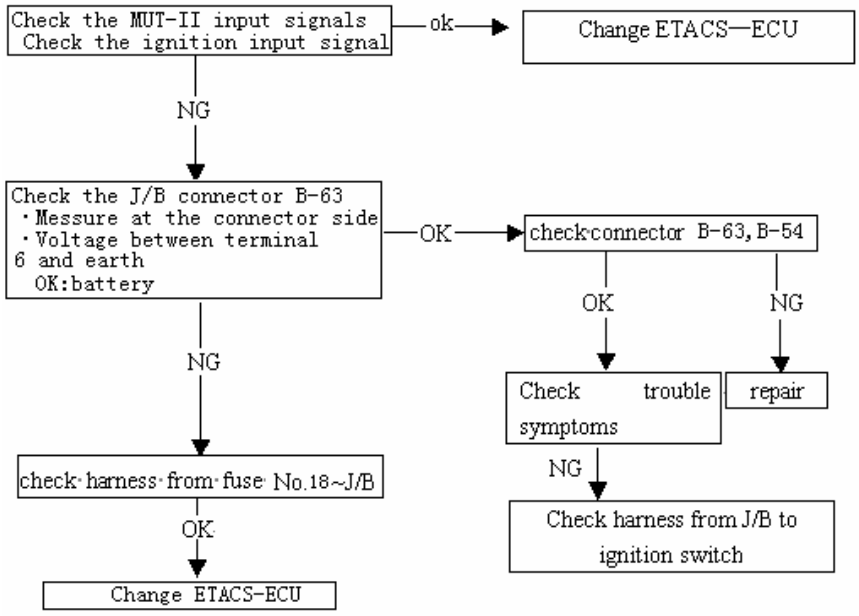


Fig 20－29

4) Trouble symptoms inspection step 2 as table 20－7、fig 20－30

Table 20-7

With the ignition key inserted, opening driver's door, the ignition key removal reminder buzzer don't sound(the ignition key is on "LOCK[OFF]"position).。	**Probable cause**
It's probably that the door switch input circuit or the key reminder switch fault when the illumination degression room lamp fault.	●door switch fault ●key reminder switch fault ● Connector fault ●ETACS—ECU fault

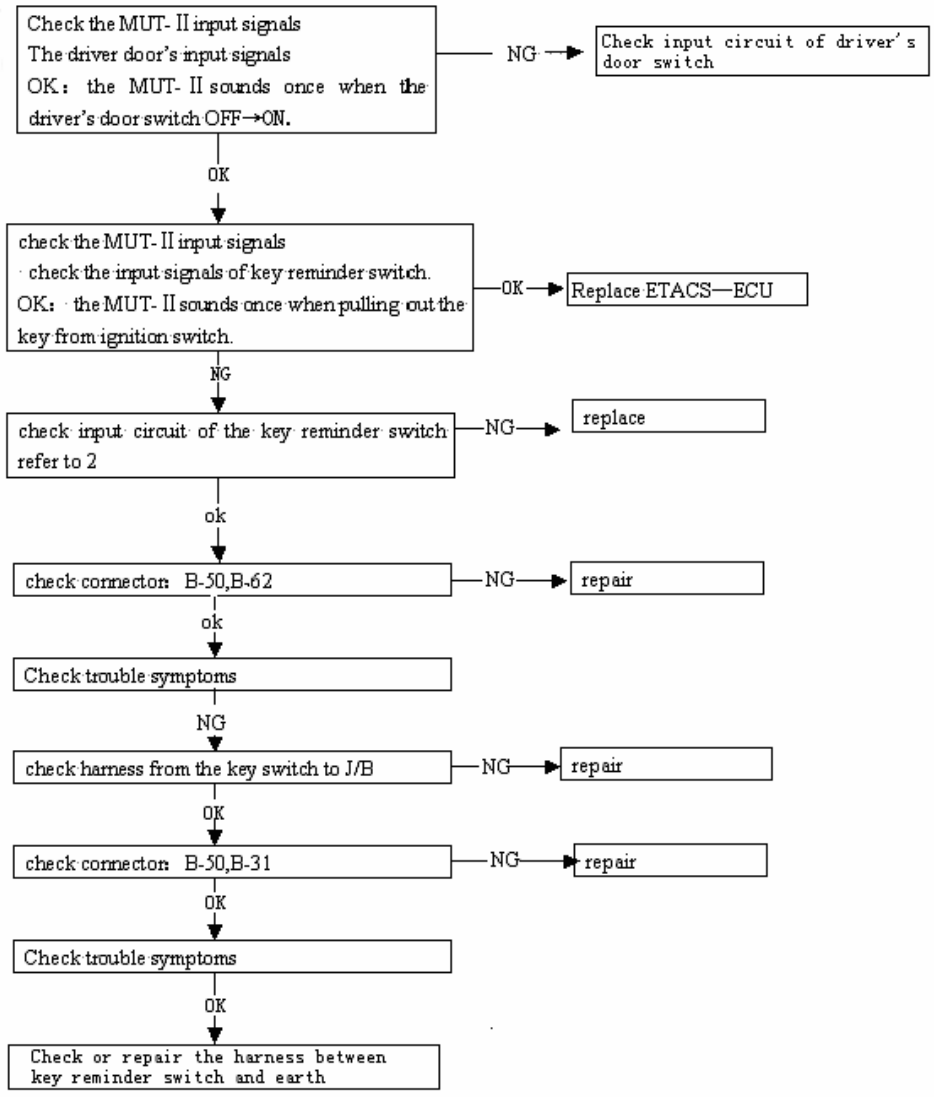


Fig 20－30

5) Trouble symptoms inspection step 3 as table 20－8、fig 20－31

Table 20-8

With the ignition key inserted, open the driver's door, the ignition key removal reminder buzzer sounding continually.(The buzzer stop sound after the driver's door closed).	**Probable cause**
The ignition key removal reminder buzzer input circuit fault or ETACS-ECU fault.	• key reminder switch fault ● Harness or connector fault ● ETACS—ECU fault

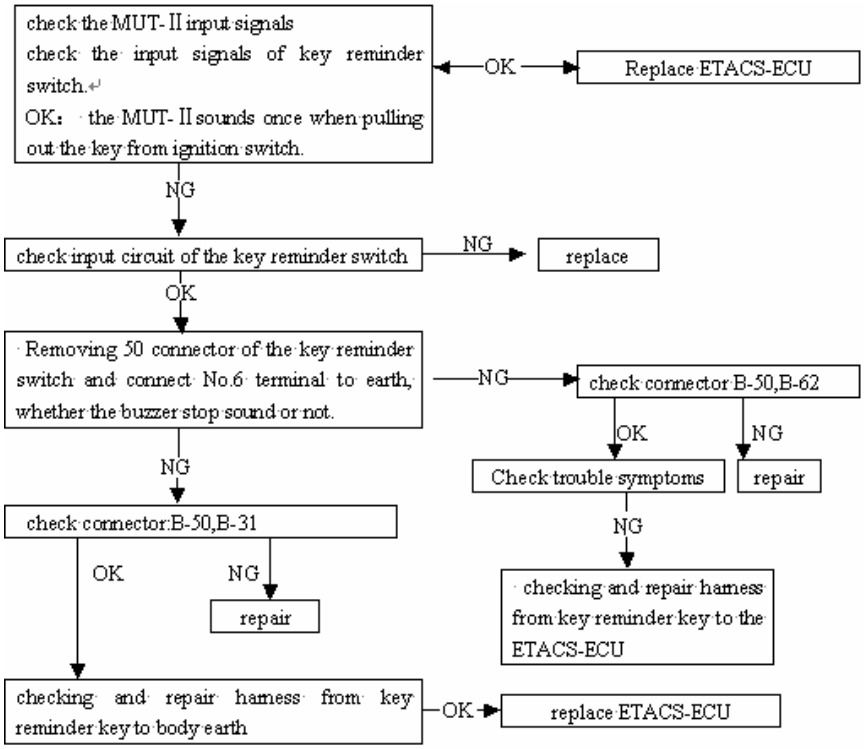


Fig 20－31

6) Trouble symptoms inspection step 4 as fig 20－32

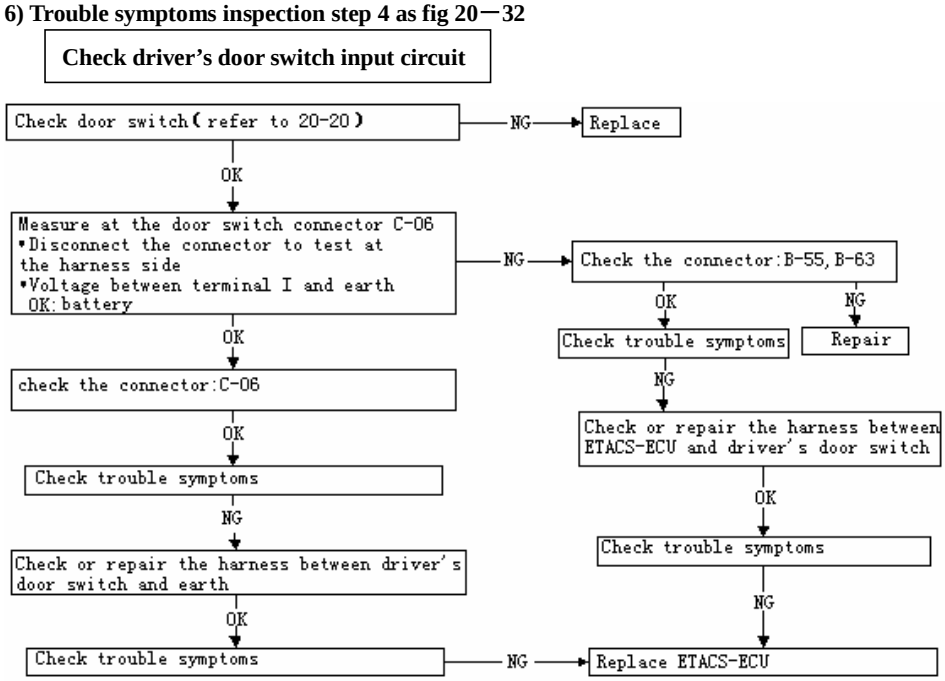


Fig 20-32

7) Trouble symptoms inspection step 5 as table 20-9、fig20-33 **Table 20-9**

Even though the ignition key is on "ON" position and the reverse lever on "R" position, the buzzer still not sound.	**Probable cause**
ETACS-ECU fault	● Harness or connector fault ● ETACS—ECU fault

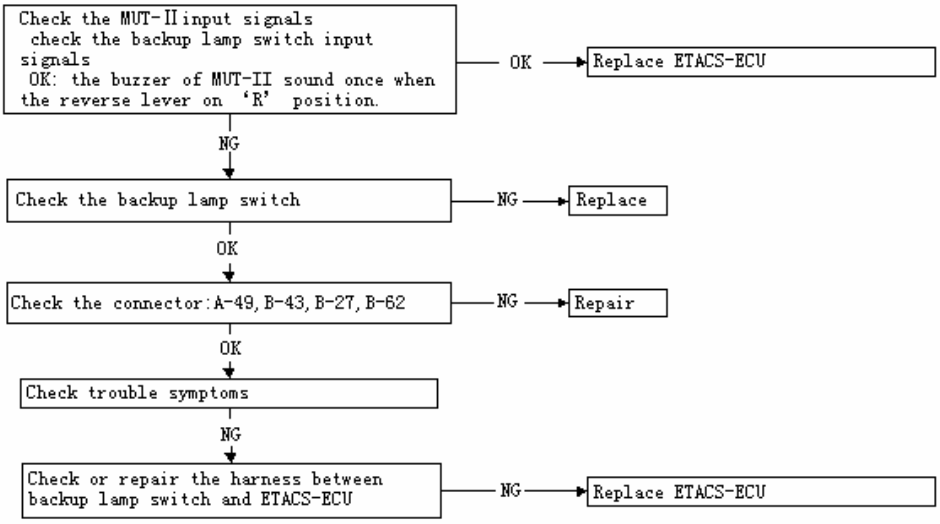


Fig 20-33

20.4 Horn

1、REMOVAL AND INSTALLATION

Removal step(as fig 20-34)

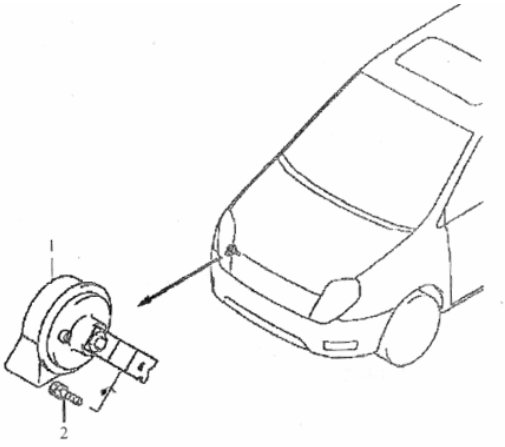
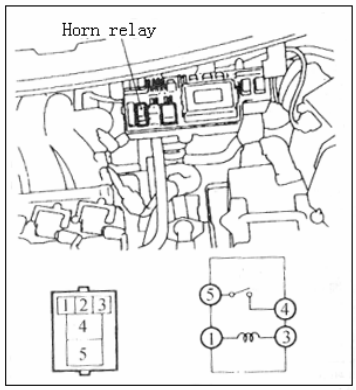


Fig 20-34

1. Horn 2. Comibination bolt

2.INSPECTION



Switch position	Terminal NO.			
	1	3	4	5
OFF	○	○		
ON	⊕	○	○	○

Fig 20-35

20.5 Hazard Switch

1、 REMOVAL AND INSTALLATION

Removal step as fig 20-36

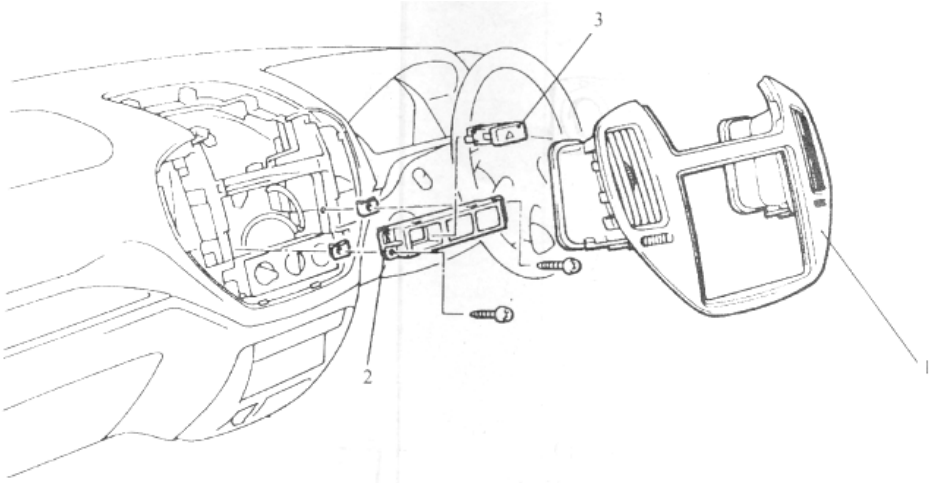


Fig 20-36

1.Center air outlet panel assembly 2.Hazard switch bezel 3.Hazard switch

2、INSPECTION

Hazard switch continuity check(as fig 20-37)

Switch position	Terminal NO.				
	1	2	3	ILL	4
OFF			○	⊗	○
ON	○	○	○	⊗	○

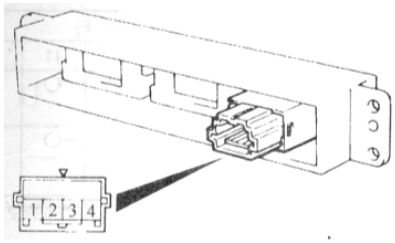


Fig 20-37

20.6 Cigarette Lighter

1、REMOVAL AND INSTALLATION

Removal step as fig 20-38

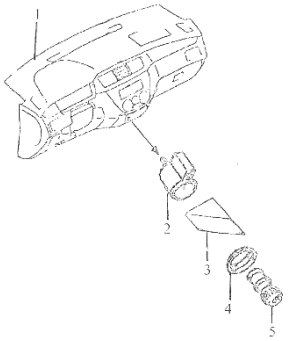


Fig 20-38

1.instrument board 2.shell 3.bezel 4. fixing ring 5.plug

2、INSPECTION AS FIG 20-39

带格式的：项目符号和编号

Removal plug and check for wear on spot and residual cigarette or foreign object on element.

With circuit tester,check for element continuity

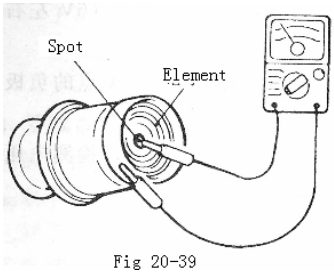


Fig 20-39

20.7 Rear Window Demister Switch

1.Removal and installation

Removal steps（see Fig.20-40)

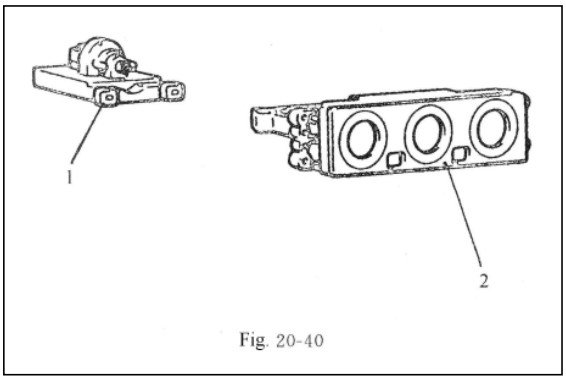


Fig. 20-40

1.Rear window demister switch 2.**Heater control unit**

- 2.Inspection
-

The switch continuity check (see Fig. 20-41)

Apply battery voltage between terminal 3 and terminal 10, and then check.

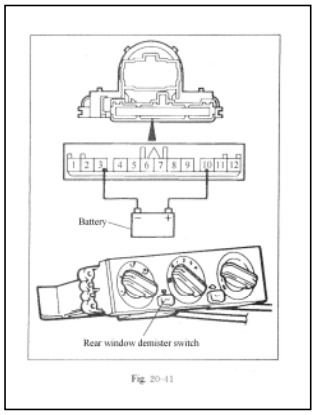


Fig. 20-41

Switch position	Terminal No.				
	3	10	—	11	12
OFF	○	⊖	○	○	
	⊖	⊕			
ON	○		○	○	
	⊖	⊕			
	○				○

Caution:

Turn on the rear window demister switch, and make sure that terminal 3 and terminal 12 are continuous. Turn off the rear window demister switch after 9~13minutes.

20.8 Rear Window Demister

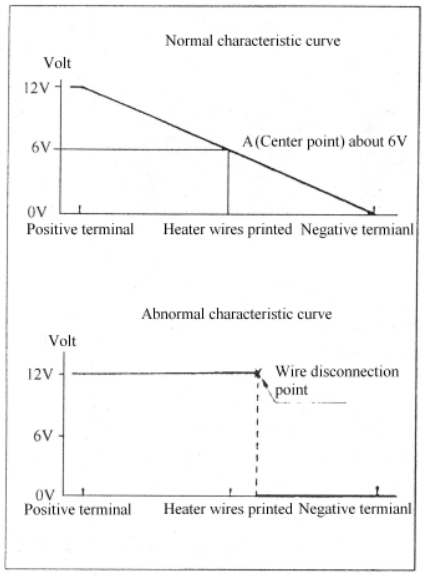


Fig. 20-42

1. On-vehicle service

Check the heater wires (see Fig. 20-42)

1) Run the engine and adjust the engine speed to2000r/min， check the heater wires on condition that keep the battery as fully charged.
2) Turn on the rear window demister switch, ， measure the voltage of heater wires with multimeter on the rear window glass center point “A”(about 6V means proper).
3) If the voltage of point “A” is 12V,， the negative terminal near point “A” has bean damaged.

   Move the multimeter pole to the negative terminal slowly, check and measure the position of voltage changing suddenly(OV).
4) If the voltage of point “A” is 0V，the positive terminal near point “A” has bean damaged, check and measure the position of voltage changing suddenly following above way.(12V).

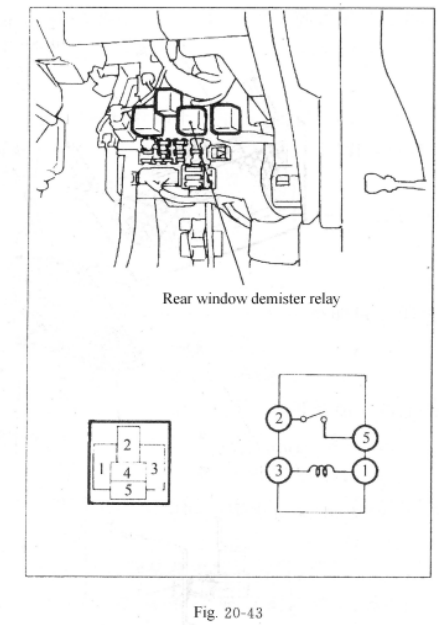


Fig. 20-43

2、Rear window demister relay continuity check (see Fig. 20-43)

Power	Terminal No.			
	1	3	2	5
OFF	○——	——○		
ON	○——	——○	○——	——○

20.9 Head Lamp

1.REMOVAL AND INSTALLATION

Removal procedure as fig 20-44.

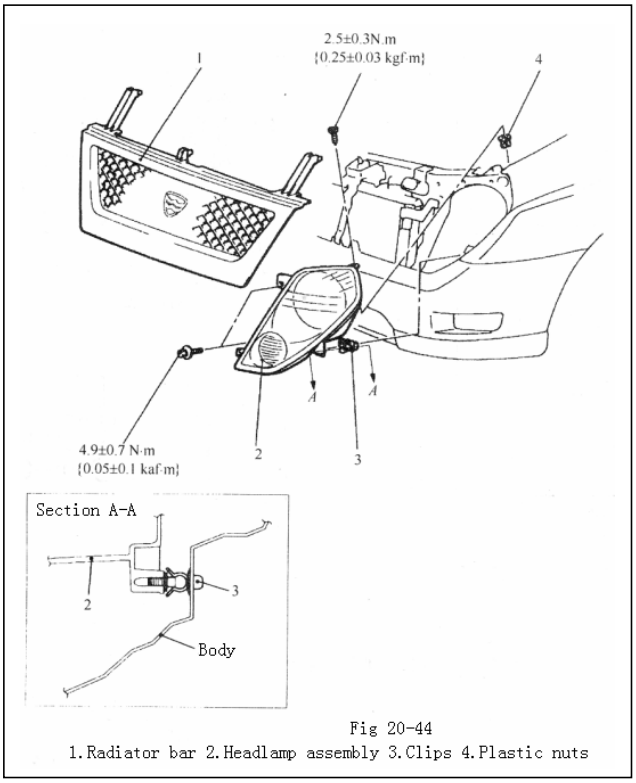


Fig 20-44

1.Radiator bar 2.Headlamp assembly 3.Clips 4.Plastic nuts

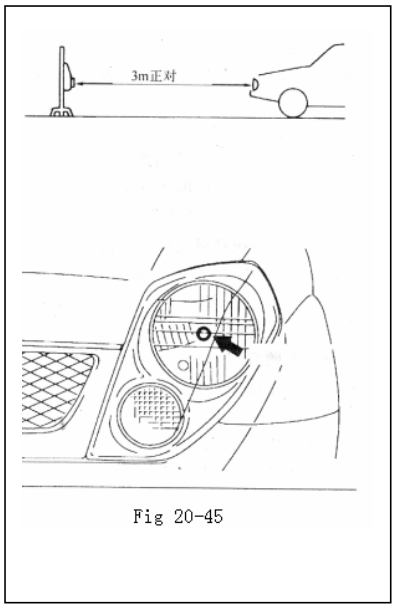


Fig 20-45

2. ON-VEHICLE SERVICE

ADJUSTMENT OF HEADLIGHT AIMING

1) **USING THE BEAM SETTING EQUIPMENT**

(1) The headlamps should be aimed with the proper beam setting equipment.

(2) Alternately turn the adjusting screw to adjust the headlamp aiming

2) **USING A SCREEN**

(1) Charge the tyre pressure to the prescriptive value, can't put other load except driver or putting the substitution(75kg) to the driver's seat.

(2) Adjust the distance between the screen and headlamp aiming centerline as fig 20-45.

3) Inspect whether projection on the screen of the headlamp beam accord with standard value or not.

STANDARD VALUE:

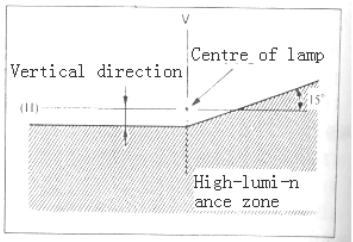


Fig 20-46

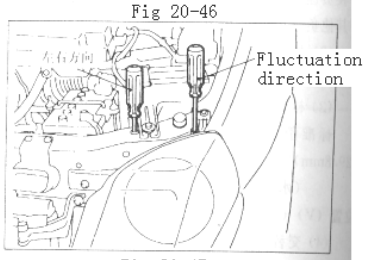


Fig 20-47

4) Alternately turn the adjusting screw to adjust the headlamp beam aiming .

CAUTION

Be sure to adjust the aiming adjustment screw in the tightening direction. as fig20-47.

3.HEADLAMP INTENSITY MEASURMENT

Using a photometer, measure the headlamp intensity and check to be sure that the limit value is satisfied.

Limit value:18000cd or more

(1).Maintain an engine speed of 2000r/min,with the battery in the charging condition

(2)If an illuminometer is used to make the measurements, convert its values to photometer values by using the following formula.

$I=Er^2$ Where: I=intensity(cd)

E=illumination(lux)

R=DISTANCE(M)FROM HEADLAMPS TO ILLUMINOMETER

4.HEADLAMP'S BULB REPLACEMENT

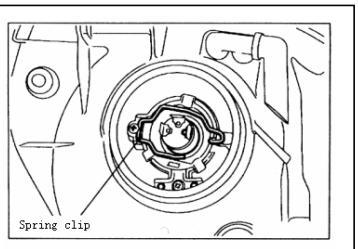


Fig 20-48

①Disconnect connector

②Remove socket cover

③Remove bulb mounting spring to pull out bulb(as fig 20-48)

④After bulb is replaced, properly reconnect connector

CAUTION

Do not touch bulb surface bare-handed or with dirty gloves. if dirt is attached on glass surface of the bulb, immediately use alcohol or thinner to remover dirt, and install the bulb after well dried.

5 .NOTES ON HEADLAMP AND FRONT TURN SIGNAL LAMP

Plastic outer lens are equipped with headlamp and turn signal lamp, for handling, care should be taken for the following items:

·Headlamps should not be illuminated for more than 3 minutes with scratch preventive protector, etc. covered on them.

·Masking such as plastic bag should not be attached on outer lens.

·Outer lens surface should not be rubbed with a sharp-edged tool, etc.

·Specified wax remover should be used for insistently washing

·The bulbs must be used according to the permissive product list.

6 SPECIAL TOOL AS CHART

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Checking the ETACS-ECU input signals

7.TROUBLESHOOTING

1）DIAGNOSIS FUNCTION

Input signal check(with Multimode keyless entry system)

(1)Input signals can be checked using MUT-II or voltmeter connected to the diagnosis connector.(Refer to 20.1A)

(2) Check the following switch input signal

·Illumination switch[Headlamp, tail lamp, passing lamp, turnsignal lamp]

·Turn signal lamp switch[RH,LH]

·Hazard switch

CAUTION：

All input signal could not check using the MUT-II,should Consider that diagnosis circuit have problem.

2） ETACS FUNCTION ADJUSTMENT

The input switch can be specially configured to disable or enable the functions listed below.The settings are retained even when the battery is disconnected.

·Headlamp automatic cut-off function be configured to disable or enable

·Initialization of ETACS all functions

(1) Configuration mode selection conditions

Set each switch as follows, the ETACS-ECU built-in buzzer sounds once and function adjustment mode is

selected.

·Hazard lamp switch: OFF

·Diagnosis control: ON(either connect MUT-II or ground the diagnosis code connector terminal 1.)

·Key reminder switch: OFF(Ignition key inserted)

·Ignition switch: LOCK (OFF)position.

·Driver's door switch OFF(driver's door closed).

·When all conditions , the windshield washer switch is continuously ON for ten seconds or longer.

(2) Configuration mode cancellation conditions

Any one of the following conditions cancels ETACS-ECU function adjustment mode.

·Diagnosis control: OFF(either disconnect MUT-II or disconnect diagnosis connector terminal 1 from earth)

·Key reminder switch: ON(ignition key remover)

·Ignition switch: any position except LOCK(OFF)

·Driver's door switch: ON(driver's door open)

·No adjustment made within three minutes of entry to function adjustment mode.

·Other buzzer sounds input.

（3）Adjusting the functions(as table20-9)

Table20－9

Function	**Adjustment procedure**
Headlamp automatic cut off function	When the passing switch is turned on for more than 2 seconds with the headlamp switch turned to ON position and the turn signal switch to RH(LH) position, the headlamp auto cut-off is switched in enabled and disabled: · Enabled: Buzzer sounds once(initial status) · Disabled: Buzzer sounds twice.
Initializing the above functions of ETACS(Enable)	When the windshield washer switch is held continuously On for 20 seconds or longer, the buzzer sounds twice and all the functions are initialized(The "function adjustment mode" selected buzzer sounds after 10 seconds, but the switch must be kept on for 20 seconds to achieve initialization of all functions) If the windshield washer switch is kept ON continuously for 20 seconds when function adjustment mode is NOT selected, after 10 seconds function adjustment mode is selected but the functions will not all be initialized.

3）Trouble symptom table(Table 20-10)

Table 20-10

Trouble symptoms	.Inspection procedure No.
Tail lamp or headlamp light, remove the key, even if driver's door is opened, light monitor buzzer do not sound(once insert the key, key reminder buzzer sound).When headlamp automatic cut-off function work, after buzzer sound one second, headlamp cut-off, buzzer stop sound.	1
Tail lamp or headlamp light, remove the key, even if driver's door is opened, headlamp automatic cut-off function do not work normally(But light monitor	2 K-7

buzzer sound).	
The headlamps(low or high-beam)don't transform when the dimmer switch is ON	3 K-5
The headlamps(high-beam) do not light when the passing switch is ON	4 K-4
The turn signal lights do not light	5 M-1
The hazard lamps do not light	6 M-2
Adjustment fail	7

TROUBLE SYMPTOM CHECK PROCEDURE:

(1)Checking procedure No.1 as table20-11 and fig20-49.

Table20－11

Tail lamp or headlamp light, remove the key, even if driver's door is opened, light monitor buzzer do not sound(once insert the key, key reminder buzzer sound)	Probable cause
Illumination switch input circuit fault or ETACS-ECU fault. Ignition key removal reminder buzzer sound, even though tail lamp or headlamp light, light monitor buzzer do not sound.	· Harness or connector fault ·ETACS-ECU fault

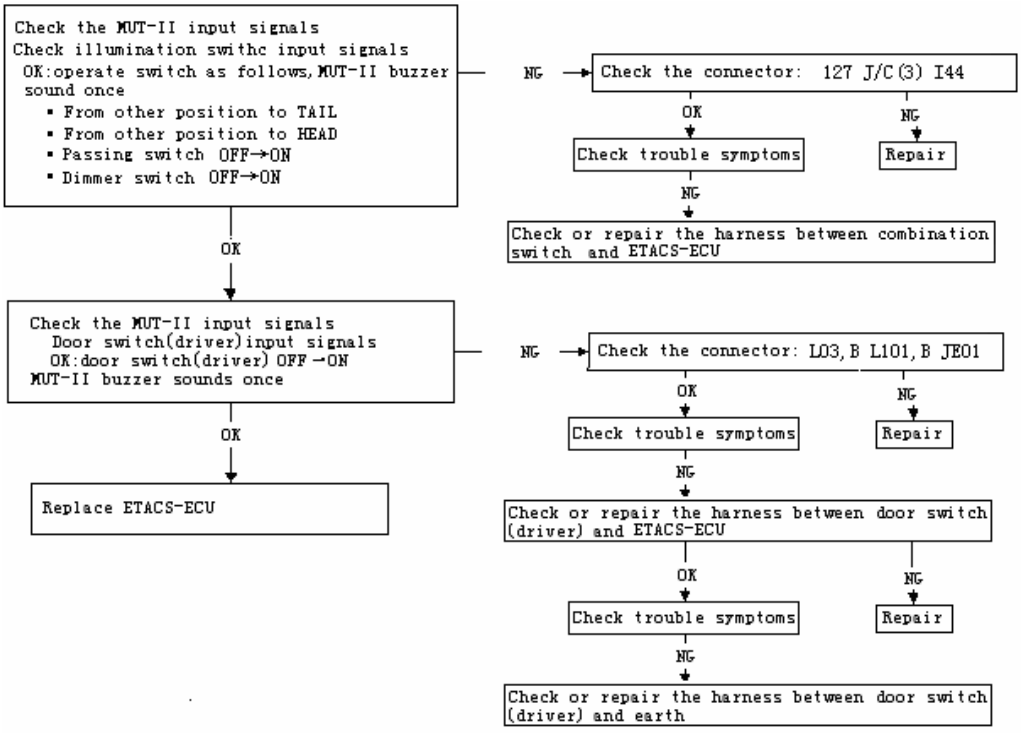


Fig 20-49

(2)Checking procedure No.2 as table20-12 and fig20-50.

Table 20－12

Tail lamp or headlamp light, remove the key, even if driver's door is opened, headlamp automatic cut-off function do not work normally(But light monitor buzzer	Probable cause

sound)	
Ignition switch and driver's door switch input circuit or ETACS fault	·Harness or connector fault ·ETACS-ECU fault

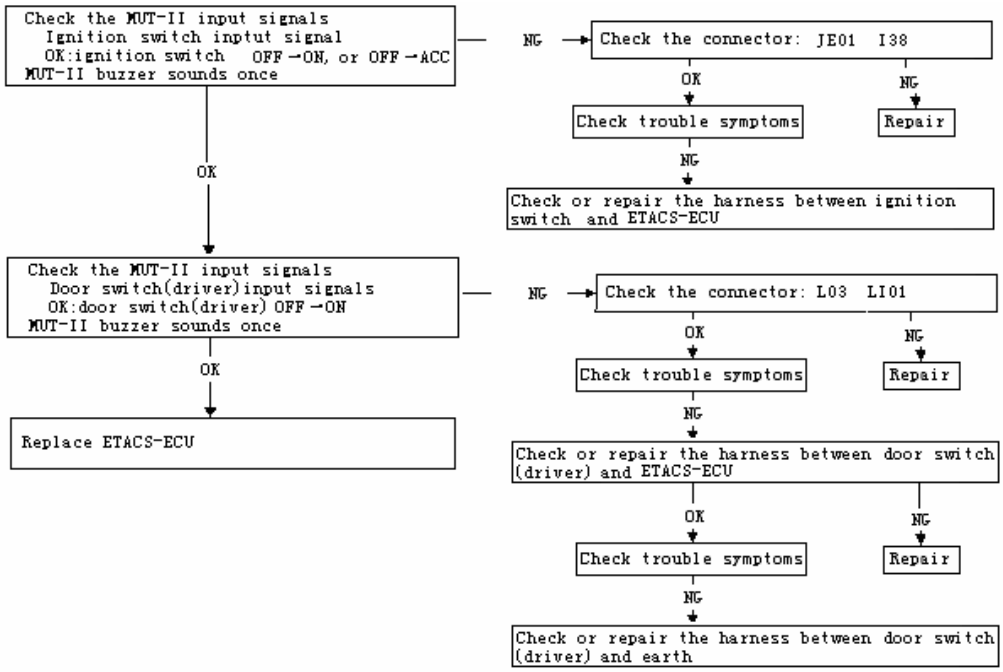


Fig 20-50

(3)Checking procedure No.3 as table20-13 and fig20-51.

Table20－13

The headlamps(low or high-beam)don't transform when the dimmer switch is ON	Probable cause
Dimmer switch input circuit may be defective. either ETACS-ECU or front ECU fault	·Harness or connector fault ·ETACS-ECU fault ·Front ECU fault

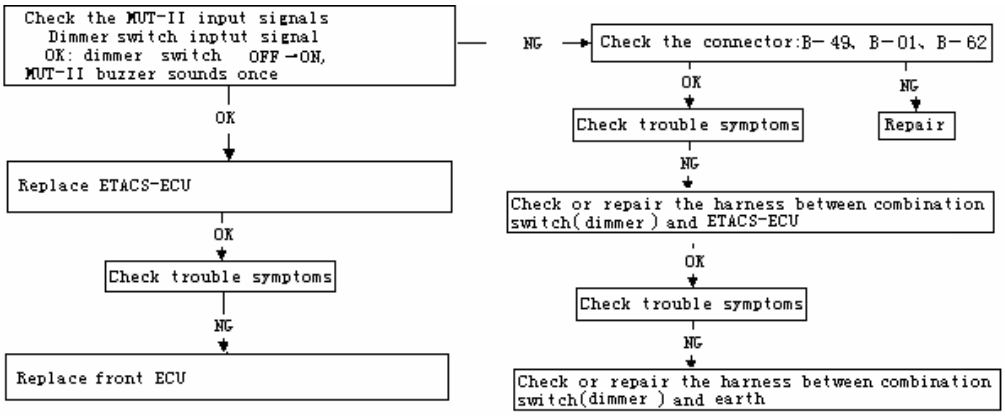


Fig 20-51

(4)Checking procedure No.4 as table20-14 and fig20-52.

Table20－14

The headlamps high-beam)don't transform when the passing switch is ON	Probable cause
Passing switch input circuit may be defective. either ETACS-ECU or front ECU fault	·Harness or connector fault ·ETACS-ECU fault ·Front ECU fault

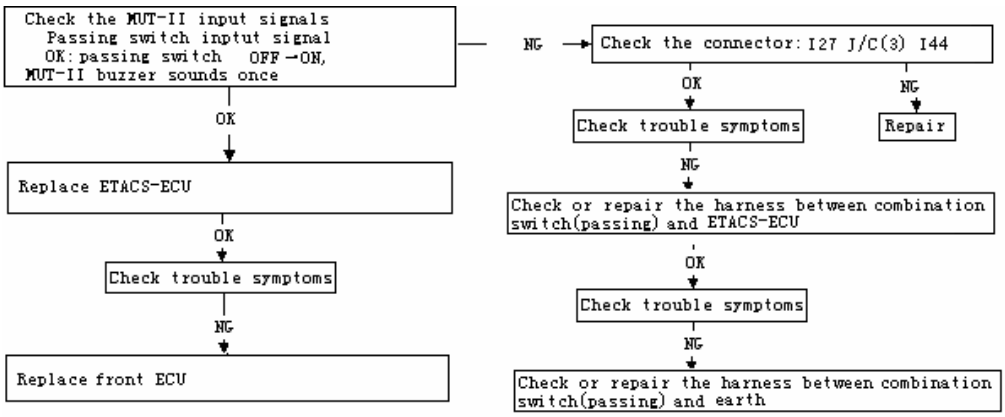


Fig 20-52

(5)Checking procedure No.5 as table20-15 and fig20-53.

Table20-15

The turn signal lights do not light	Probable cause
The turnsignal lamp's switch input circuit may be defective. either ETACS-ECU fault	·Harness or connector fault ·ETACS-ECU fault

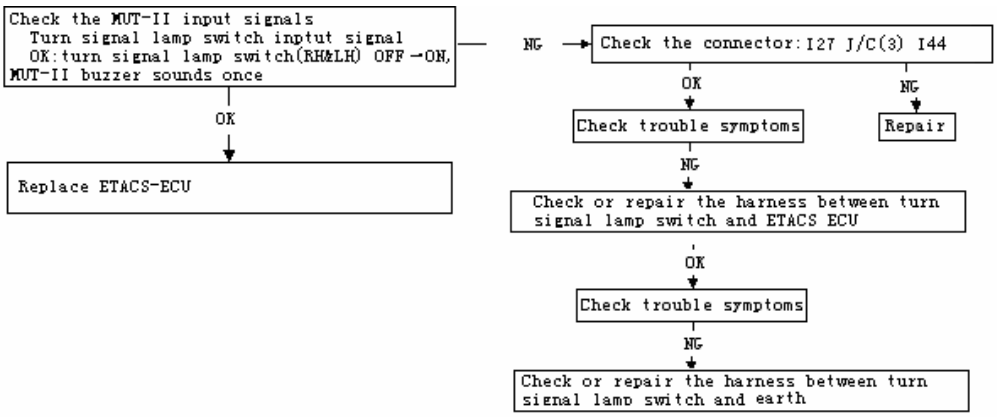


Fig 20-53

(6)Checking procedure No.6 as table20-16 and fig20-54.

Table20-16

The hazard lamps do not light up	Probable cause
The hazard lamp's switch input circuit system or the ETACS-ECU may be defective	·Harness or connecter fault ·ETACS-ECU fault

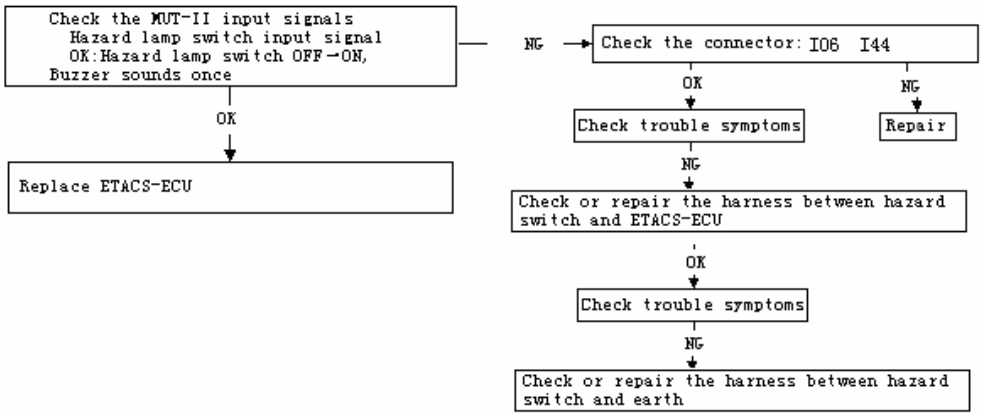


Fig 20-54

20.10 Rear Combination Lamp

1.REMOVAL AND INSTALLATION

Removal procedures as fig20-55

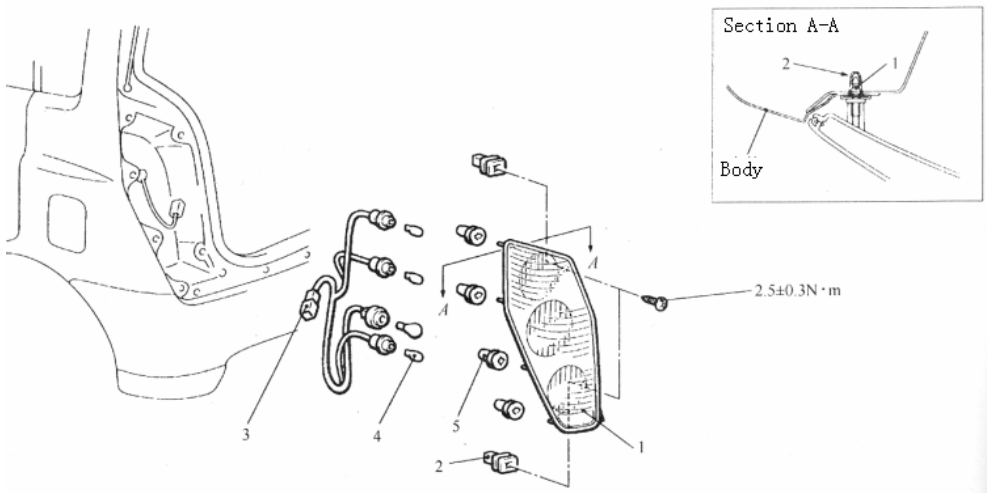


Fig 20-55

1.Rear combination lamp;2.Combination clips;3.Socket assembly;4.Bulb;5.Grommet

20.11 Side Turn-signal Lamp

SIDE TURN-SIGNAL LAMP REMOVAL

Use special tool to remove side turn-signal lamp(as Fig 20-56)

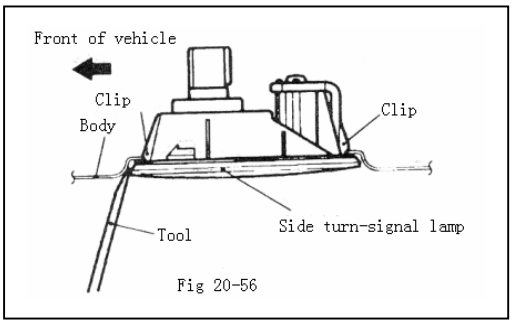


Fig 20-56

20.12 High-Mounted Stop Lamp, License Plate Lamp

1、REMOVAL AND INSTALLATION

Removal step as Fig 20-57

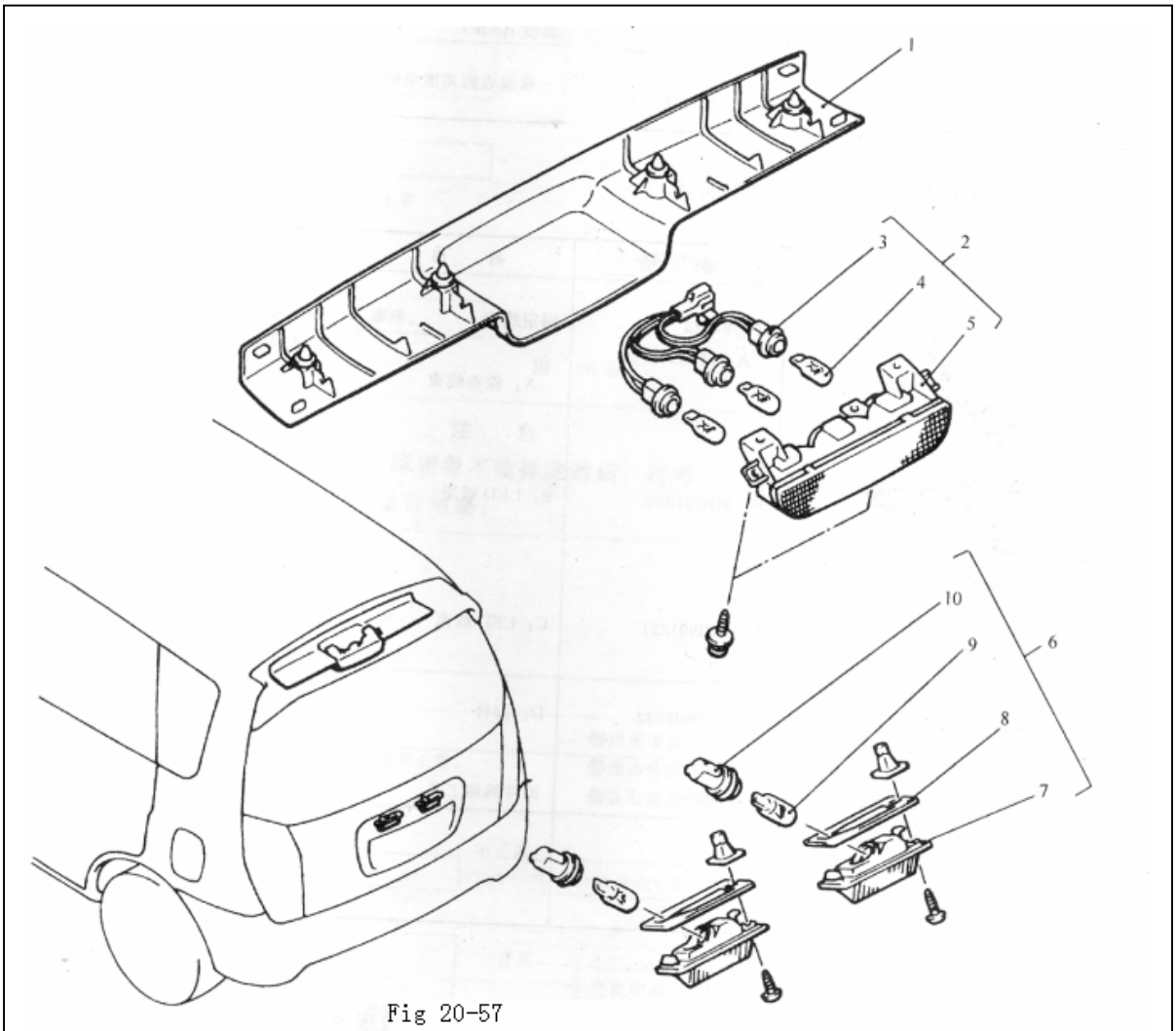


Fig 20-57

1.Rear door trim(top);2.High-mounted stop lamp assembly;3.Socket assembly;4.Bulb
5.High-mounted stop lamp body;6.License plate lamp assembly;7.License plate lamp body;
8.Seal pillow;9.Bulb;10.Socket

20.13 Combination Meter

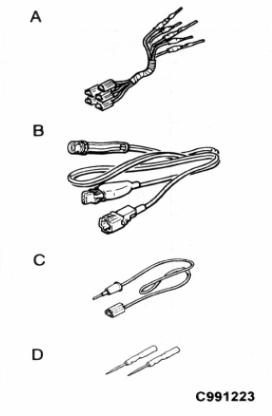
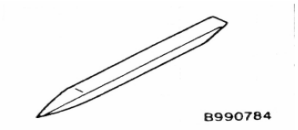
1、SERVICE SPECIFICATIONS (as Table 20—17)

Table 20-17

Items		standard value	limit value
Indication range of speedometer km/h	At 35~40 km/h	40	-
	At 75~80 km/h	80	-
	At 114~120 km/h	120	-
	At 152~160 km/h	160	-
Deflection of speedommeter point(km/h) (Vehicle speed:35km/h or more)		-	±3
Basic resistance of fuel gauge unit(Ω)	Position F	3±1	-
	Position E	110±1	-
Float height of fuel gauge unit(mm)	Position F	60.6	-
	Position E	224.3	-
Basic resistance of engine coolant temperature gauge (Ω)		104±13.5	-

2、SPECIAL TOOLS (AS TABLE 20-18)

Table 20-18

Tools	Number	Name	Use
	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A:inspection harness B:LED harness C:LED harness adapter D:probe	Brief test for fuel gauge and water temperature gauge A:For inspection of connector pin contact pressure B:For inspection of power circuit C:For inspection of power circuit D:For connecting commercially available tester
	MB990784	Ornament remover	Meter bezel removal

3、TROUBLESHOOTING

(1) Diagnosis function

Input signal inspection procedure

(2)Trouble symptom (as Table 20-19)

Table 20—19

Trouble symptom	Inspection procedure NO.
Speedometer inoperative	1
Fuel gauge inoperative	2
Water temperature gauge inoperative	3

(3) Inspection procedure for trouble symptoms

Inspection procedure 1 as Table 20—20、Fig 20—58

Table 20—20

Speedometer inoperative	Probable cause
Speed sensor input signal trouble Speed sensor is public for Speedometer, engine ECU and so on.	● speed sensor fault ● Harness or connector fault ● Meter assembly fault

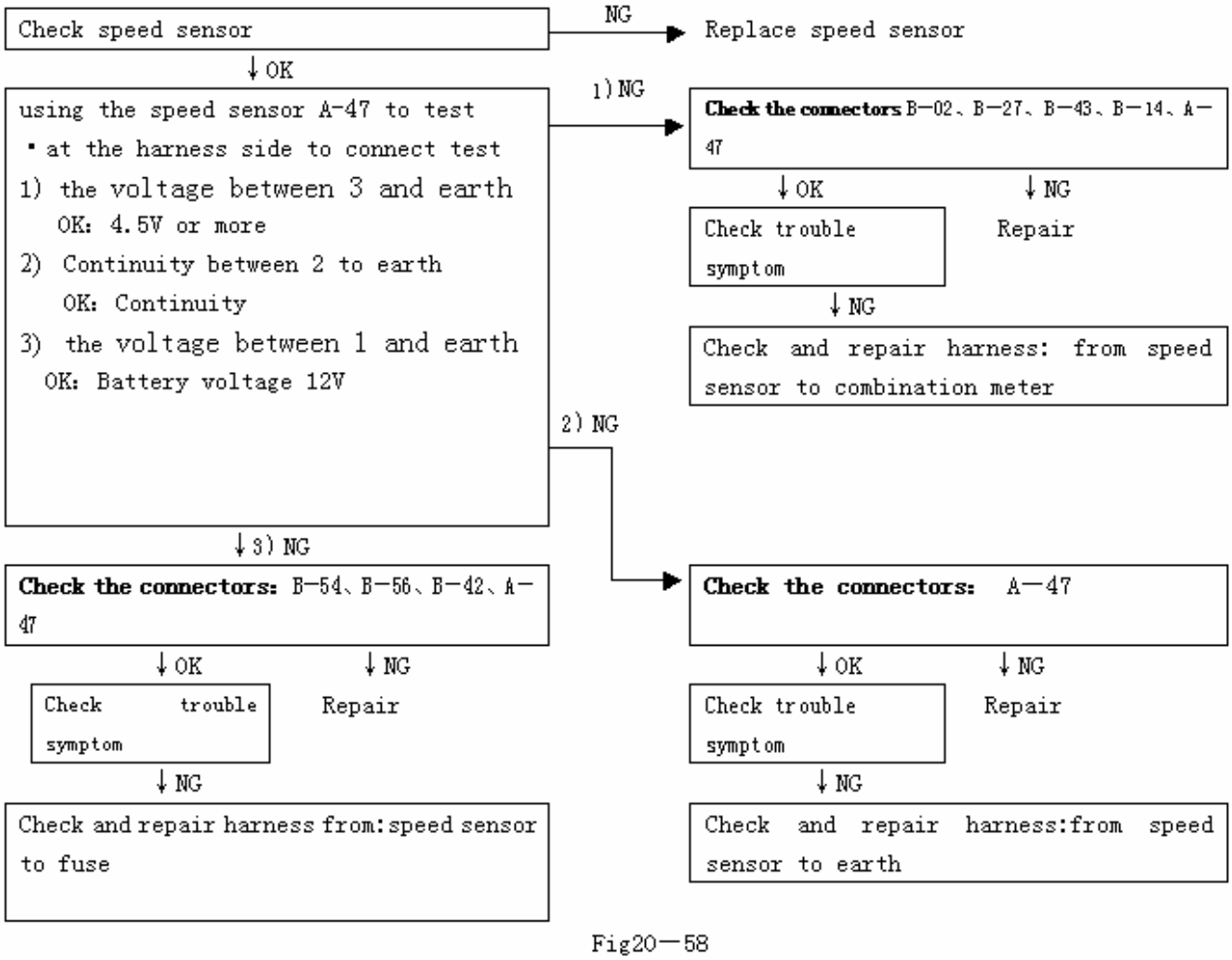


Fig20—58

CAUTION

By serious checking ways above, the trouble symptom couldn't exclude. The probable cause may be there are short circuit on the export side of speed sensor, such as harness, speedmeter and ENG -ECU.

Inspection producedure 2 as Table 20—21，图 20—59

Table 20—21

Fuel gauge inoperative	Probable cause
Speedometer is properly operate and harness from power to combination is normal	● Fuel gauge fault ● Fuel sensor fault ● Harness or connector fault

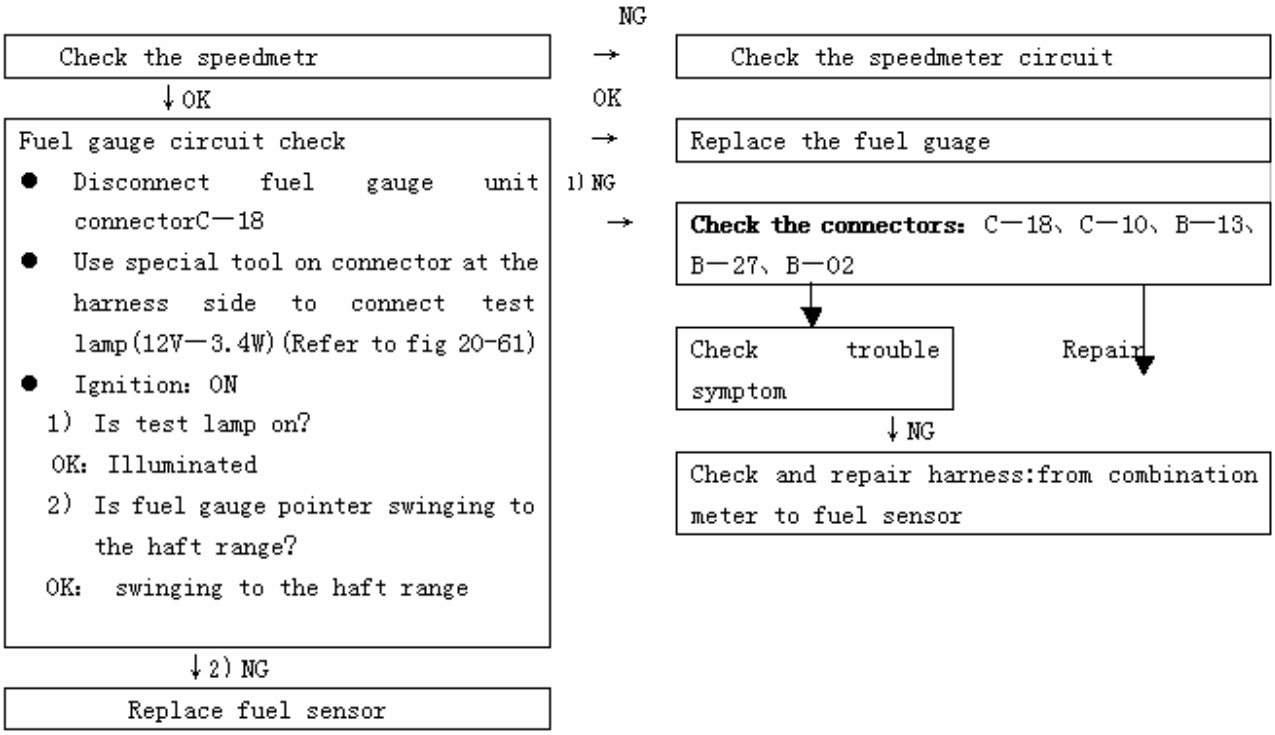


Fig20—59

Inspection procedure 3 as Table2—22、Fig 20—60 Table 20—22

Water temperature gauge inoperative	Probable cause
When speedmeter is properly operated,harness from power to combination meter is normal	● Water temperature gauge fault ● Water temperature sensor fault ● Harness or connector fault

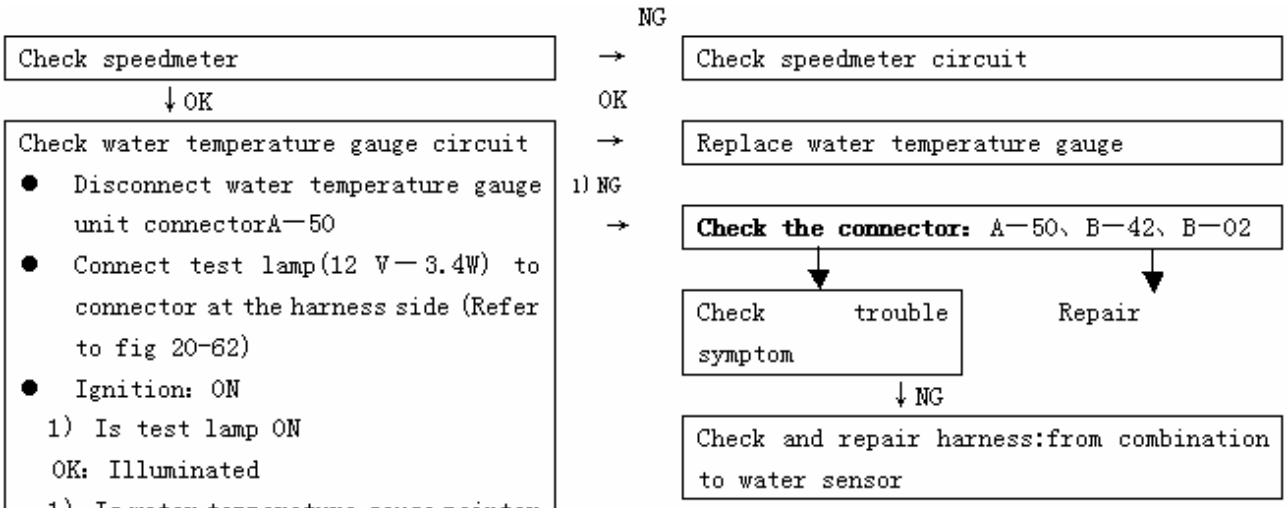


Fig 20—60

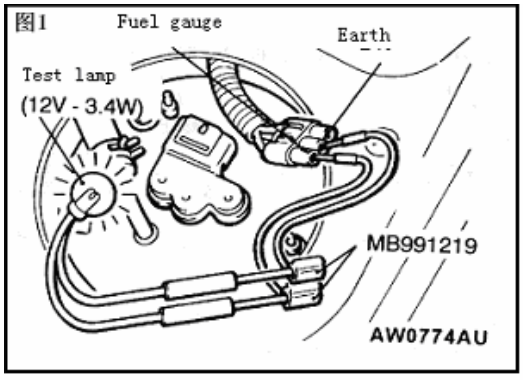


Fig 20-61

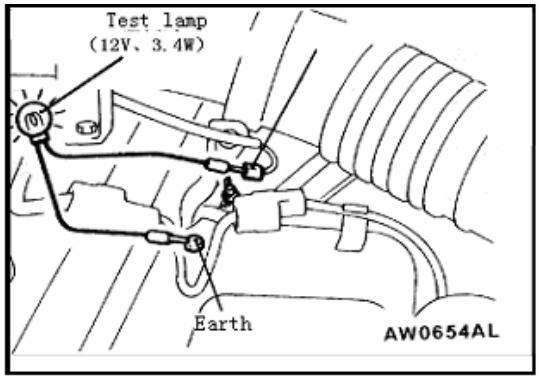


Fig 20-62

4、ON-VEHICLE SERVICE

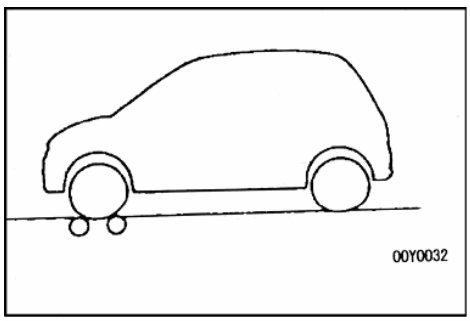
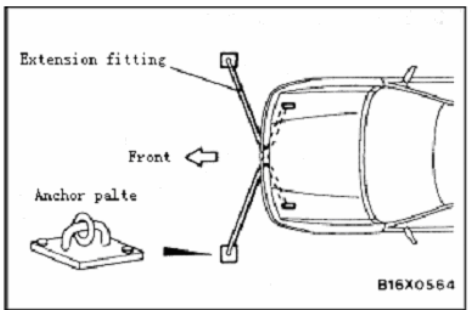


Fig 20-63



1) Speedometer check(as Fig 20-63,Fig 20-64)

① Ensure that tire pressure indicates the value of tire pressure label.

② Place the vehicle on speedometer tester.

③ Place stoppers at rear wheels,and properly engage parking brake

④ For prevention of front wheel lateral runout,install extension fittings on front towing eye and tie down hook,and install both ends on anchor plate.

⑤ For prevention of vehicle from starting out,install chain or wire(the other end of which is tightly fixed on rear towing eye)on the vehicle

⑥ Ensure that speedometer indication range is within standard value,or pointer deflection is within limit value.

Caution

During operation avoid excessive acceleration

①

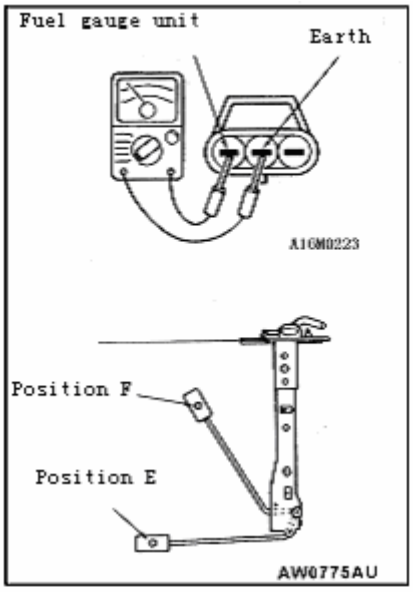


Fig 20-65

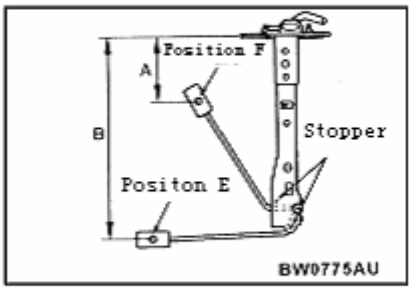
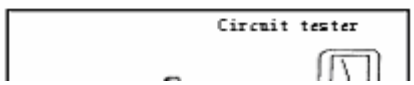


Fig 20-66



2) Fuel gauge unit check

Remove fuel gauge unit from fuel tank

① Basic resistance of fuel gauge unit

a、When folat of fuel faufe unit is in position F and E, ensure that resistance between fuel gauge unit terminal and earth terminal is within standard value (as Fig 20-65)。

standard value (as Table 20-7):

Table 20-7

Float position	Resistance of gauge(Ω)
Position F	3±1
Position E	110

b、When float is moved slowly between positon F and E, also ensure that resistance is smoothly changing.。

② Float hight of fuel gauge unit

When folat is moved to contact float arm on stopper, check the position is on positon F(A) or position E(B)(as Fig 20-66)

standard value(as Table 20-28)

Table 20-28

Float Position	Float center height(mm)

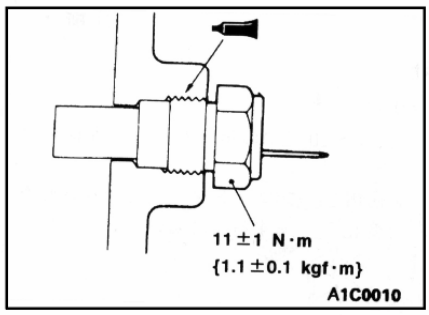


Fig 20-68

Position F (A)	60.6
Position E (B)	224.3

3) Engine coolant temperature gauge unit check

①Drain coolant.

②Remove water temperature gauge unit

③Put water temperature gauge unit into the hot water in specified temperature,and ensure that basic resistance is within standard value.(as Fig 20-67)。

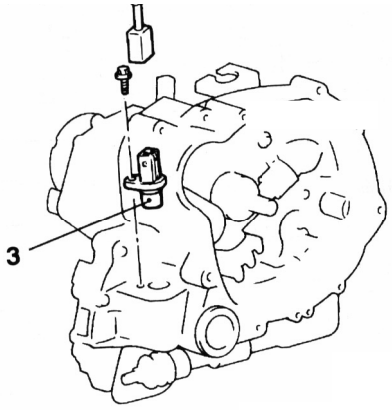
Standard value：104±13.5Ω

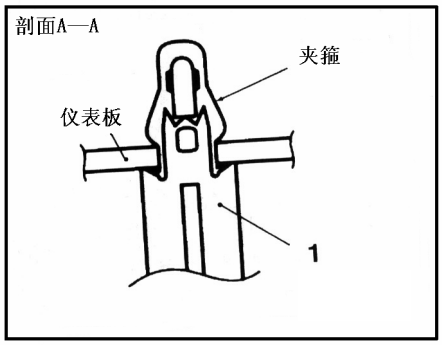
④ after inspection,apply specified sealant at threads of water temperautre gauge unit,and tighten to the specified torque. (as Fig 20-68)。

⑤ Refill coolant.

5、REMOVAL AND INSTALLATION

1) Removal step as Fig 20-69:





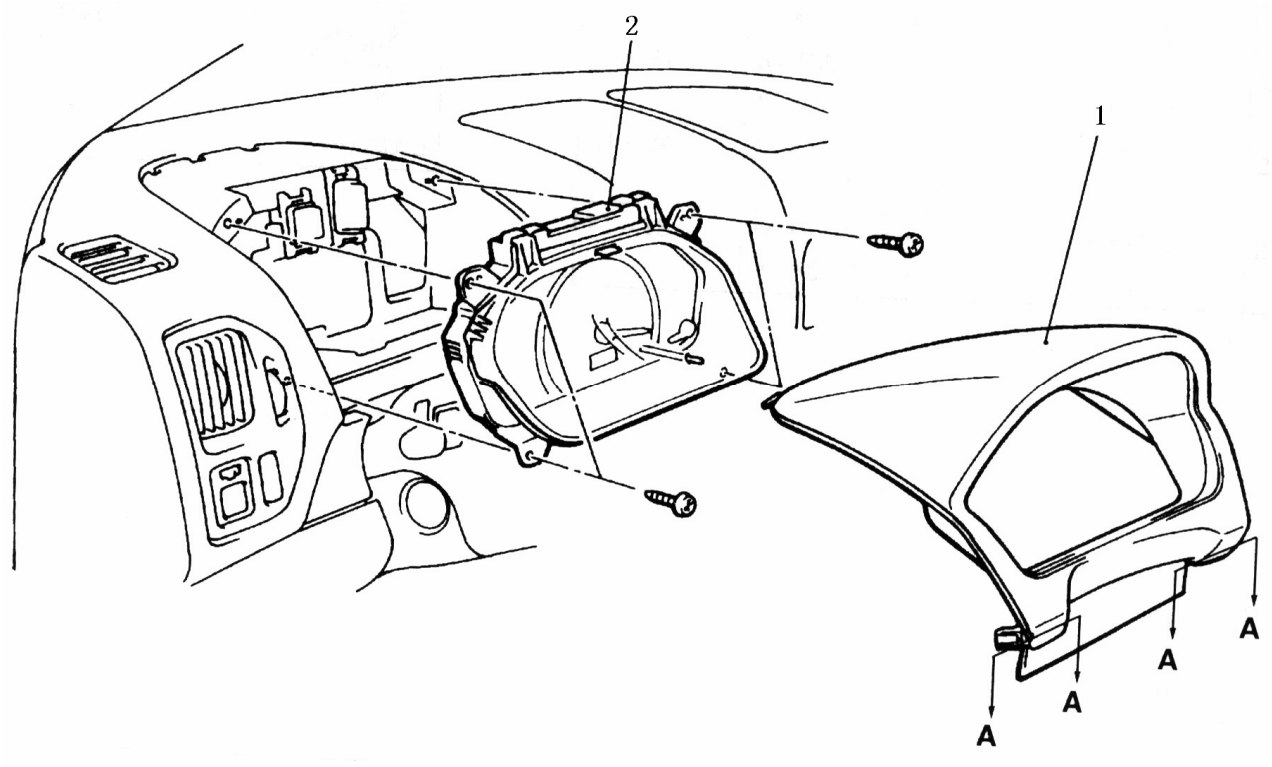


Fig 20-69

1. Meter bezel
2. Combination meter
3. Speed sensor

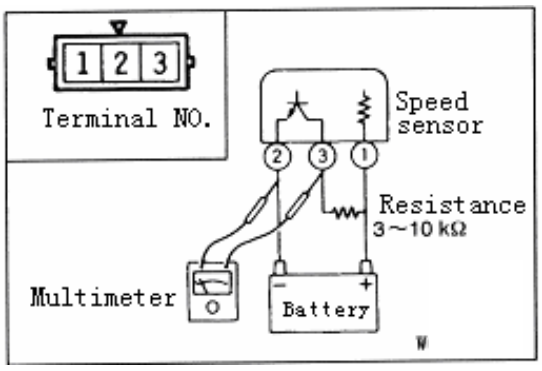


图 20-70

2) inspection

Check speed sensor

①Raise the vehicle.;

②Connecting the terminals by the resistance (value 3~10kΩ) as Fig 20-70 after Removal the connector of speed sensor;

③When the front wheel circumgyrating, measure the volt value variety from terminal NO.2 to NO.3 by multimeter. (four pulses every circle).

6、DISASSEMBLY AND REASSEMBLY

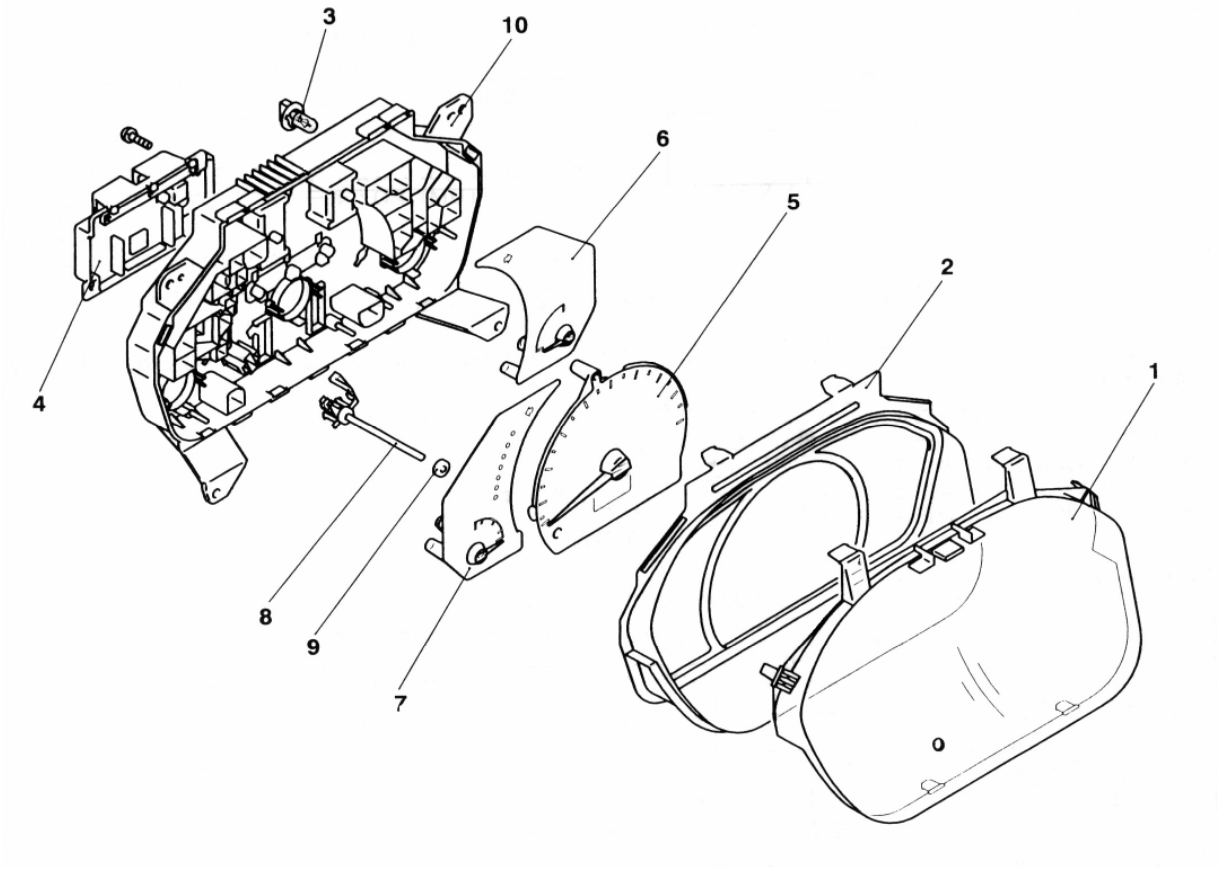


Fig 20-71

1) Disassembly step as Fig 20-71

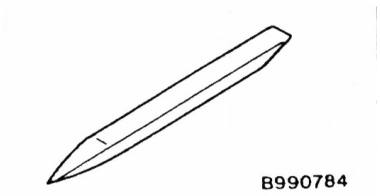
1. Glass
2. Window plate
3. Blub
4. Control assembly
5. Speddometer assembly
6. Water temperature gauge assembly
7. Fuel gauge assembly
8. Reset button
9. Cringle
10. Meter case

Install order as reverse sequences.

20.14 Clock

SPECIAL TOOL AS Table 20-26

Table 20-26

Tool	Number	Name	Use
	MB990784	Ornament remover	Hood panel and center hood removal

1、REMOVAL AND INSTALLATION

Removal step as Fig 20-72。

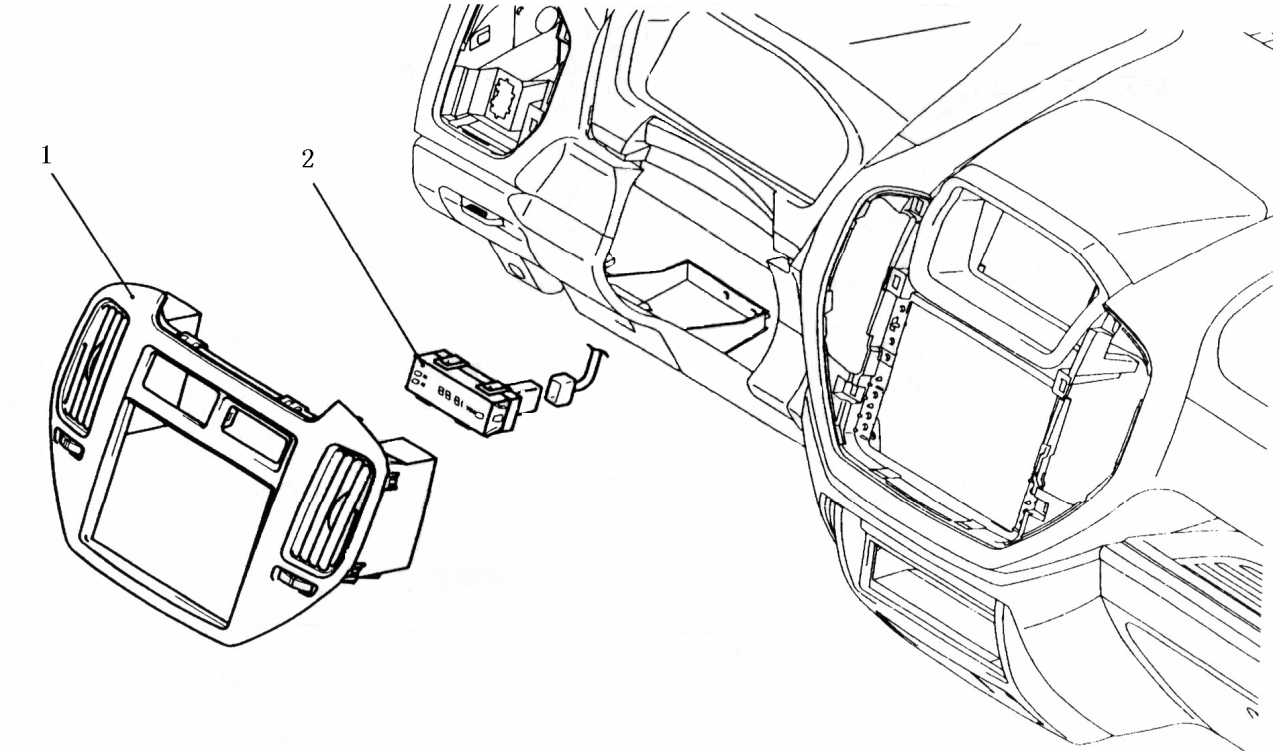


Fig 20-72

1. Center air outlet panel 2. Clock

Install order as reverse sequences.

20.15 Audio Radio

1、TROUBLESHOOTING

There is noise when starting the engine as Table 20—27.

Table 20—27

Nosie type sounds are in parenthesser()	Conditions	Cause	Remedy
AM、FM: Ignition noise (Poping, snapping, scracking, buzzing)	• Increasin the engine speed causing the popping up, and volume decreases. • Disappears when the ignition switch is turned to ACC	Mainly due to the spark plugs	• Check or replace the earth cable or bolt. • Check CD earth to be install credibility.
AM、FM: Wiper motor nosie (hoot)	Noise with wiper synchronous. the wiper speed, the noise then speeds; the wiper stop, the noise then stop	Due to the wiper motor spark.	Replace the wiper motor.
FM: Power mirror motor	Appears when the power mirror work.	Due to the power mirror motor	Replace the power mirror

nosie		spark.	
Other electrical components	—	Noise may appear as electrical components become older.	Repair or replace electriical components.
Static electricity (Cracking,crinkling)	Disappear when the vehicle iscompletely stopped.	Occurs when parts or wiring move for some reason and contact metal parts of the body	Return parts or wiring to their proper position.
	Various noises are produced depending on the body part of the vehicle.	Due to detachment from the body of the front hood,bumpers,exh aust pipe andmuffler,suspe nsion,etc.	Tighten the mounting bolts securely.Cases where the problem is not eliminated by a single response to one area are common,due to several body parts being imperfectly earth.Earth harness as Fig 20-27.
Tape: • Ignition nosie • interlaced noise	The noise is very clear on the intermission time of two songs when the tape playing.。	Due to the noise radiation of the rear harness of tape player.	Keep distance from body harness to tape player’s harness.。

Caution

1. Check that there is no external noise.Since failure caused vy this may result in misdiagnosis due to inability to identify the noise source,this operation must bu performed.
2. Noise prevention should be performed by suppressing strong sources of noise step by step.
3. Ensure the CD earth,antenna ect. to be fixed credibility.

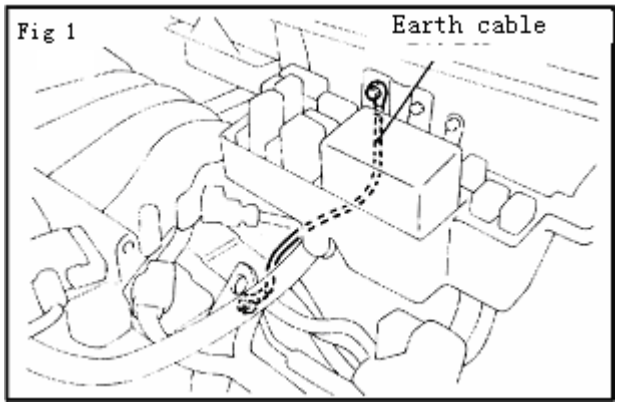


Fig 20-73

2、RADIO

Removal and installation

Removal step as Fig 20-74

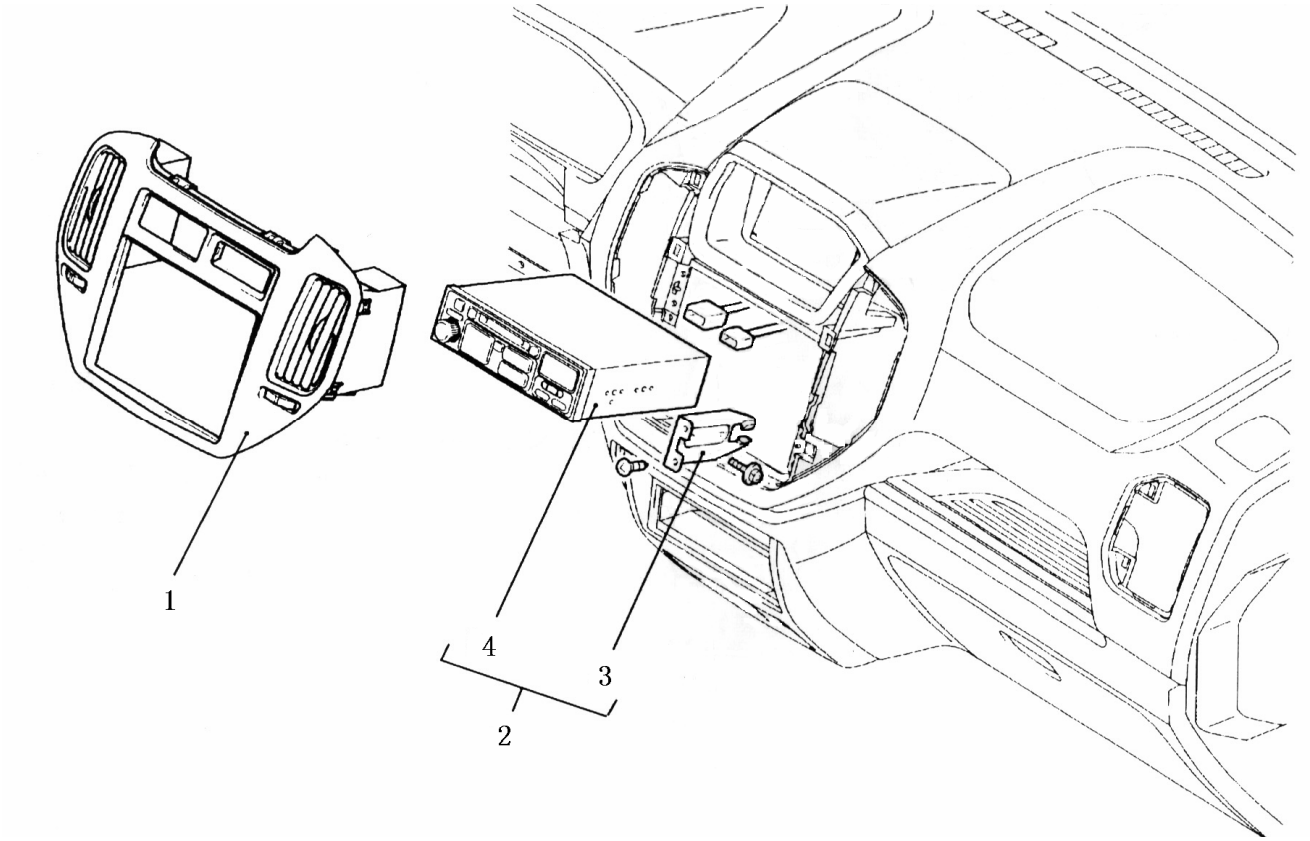


Fig 20-74

1. Center air outlet panel; 2. Radio assembly; 3. Radion bracket4. Radio

3、SPEAKER

Removal and installation

Removal step as Fig 20-75

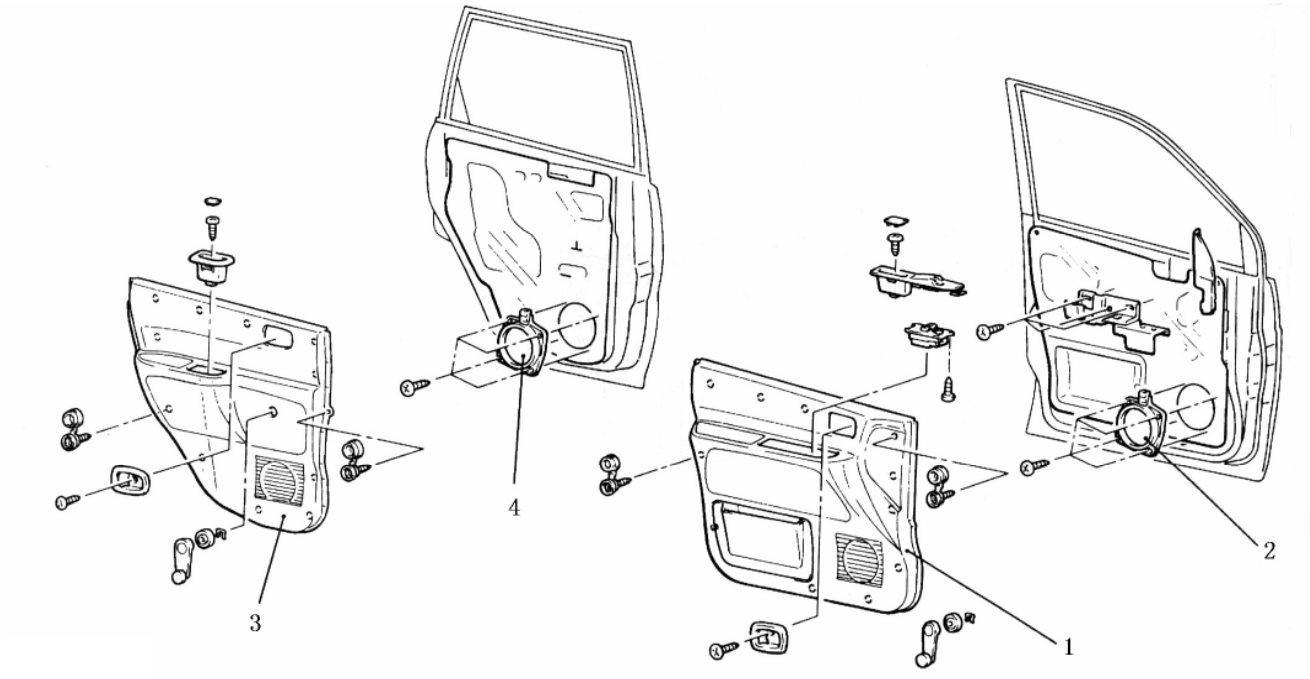


Fig. 20-75

1. Front door trim
2. Front door speaker
3. Rear door trim
4. Rear door speaker

4、ANTENNA

Removal and installation

Removal step as Fig 20-76

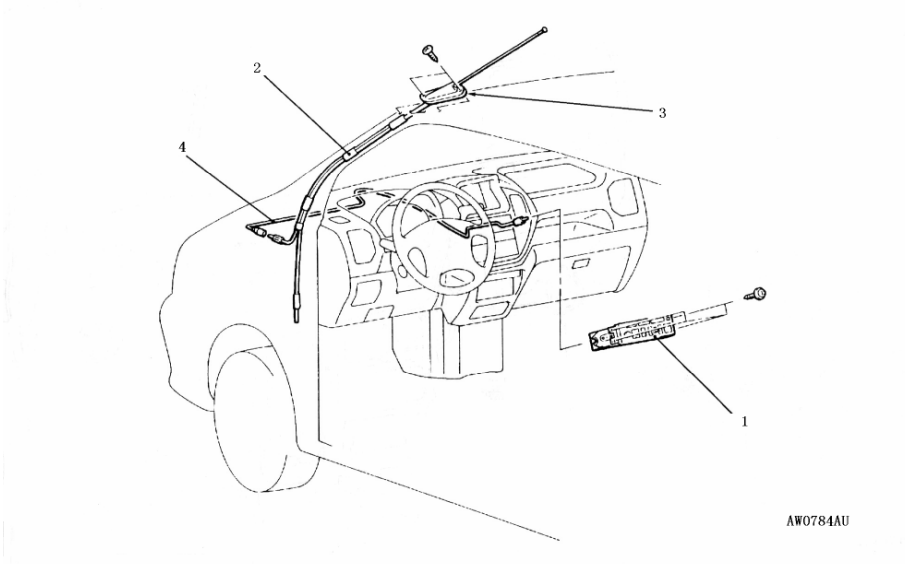


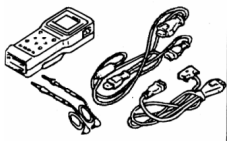
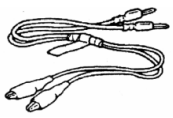
Fig 20-76

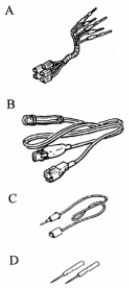
1. Radio （ Instrument under cover）
2. Antenna assembly
3. Antenna base
4. Antenna feeder cable

20.16 Room Lamp

SPECIAL TOOL AS Table 20—28

Table 20—28

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Check the ETACS-ECU input signals
	MB991529	Diagnosis code check harness	For checking input signals by voltmeter

	MB991223 A: MB991219 B:MB991220 C: MB991221 D: MB991222	A:Inspection harness B:LED harness C:LED harness adapter D:Probe	Check the ETACS-ECU connector pressure A:For inspection of connector pin contact pressure B:For inspection of power circuit C:For inspection of power circuit D:For connecting commercially available teater

Troubleshooting

1. Diagnosis function

Switch input signal check

(1) Input signals can be checked using MUT-II or coltmeter connected to the diagnosis connector.(Refer to 20.1A troubleshooting/inspection service points)

(2) Check the following switch input signal

- Door switch
- Ignition switch
- Key reminder switch
- keyless entry sender

Caution:

All input signal do not check using the MUT-II,should Consider that diagnosis circuit have problem.

2. Trouble symptom Table(as Table 20—29)

Table 20—29

Trouble symptom	Inspection procedure NO
Open all door,room lamp do not come off. DO not reduce light action.	1
Room lamp switch put position “DOOR LAMP”, Open any the car door regardless,all room lamp do not light.	2
The room lamp don’t extinguish when the ignition switch on ‘ON’ position (It extinguish after light reducing)	3
Room lamp do not come off(But room lamp switch OFF)	4

Inspention step as Table 20—30、Fig 20—77

Table 20—30

Open all door,room lamp do not come off. DO not reduce light action.	Probable cause
Earth or ETACS-ECU fault	• Harness or connector fault • ETACS-ECU fault

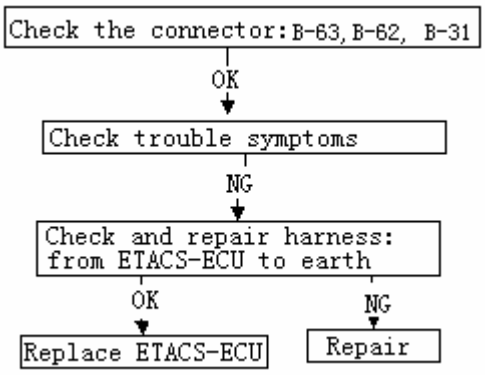


Fig 20—77

Inspection step2 as tabl20-31、Fig 20—78。

Table 20—78

Room lamp switch put position “DOOR LAMP”, Open any the car door regardless, all room lamp do not light.	Probable cause
Room lamp fault or ETACS-ECU fault, fuse break, harness fault, if fuse break, the the door lamp indication ofcombination meter fault too.	• Roome lamp fault • Fuse lamp fault • Harness or connector fault • ETACS-ECU fault

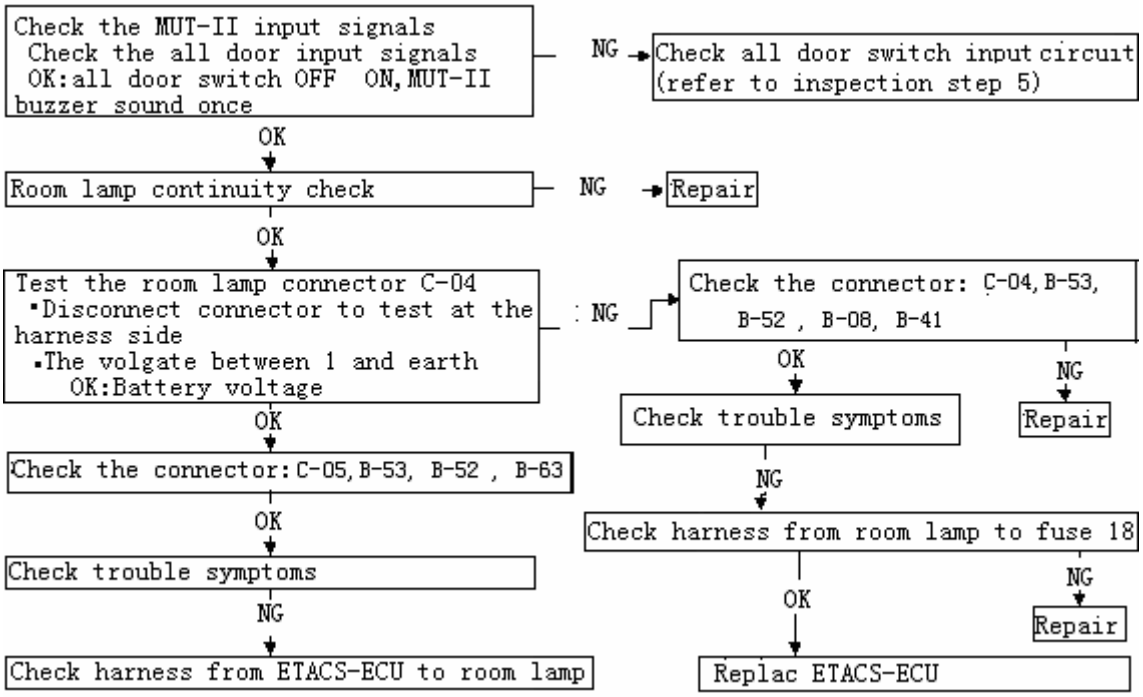


Fig 20—78

Inspection step3as Table 20—32、Fig 20—79

Table 20—32

The room lamp don’ t extinguish when the ignition switch on ‘ON’ position(It extinguish after light reducing)	Probable cause

Ignition circuit or ETACS-ECU fault,harness	• Harness fault • Connector fault • ETACS failt

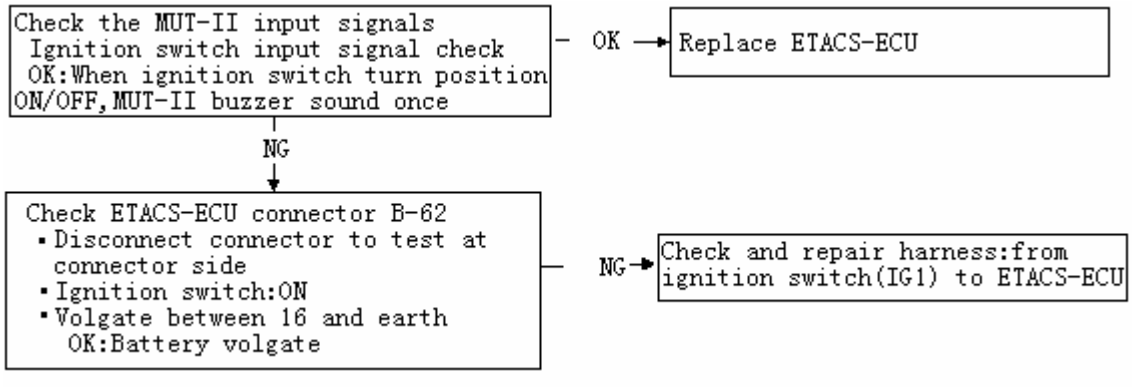


Fig 20—79

Inspection step4 as Table 20—33、Fig 20—80

Table 20—33

Room lamp do not come off(But room lamp switch OFF)	Probable cause
Harness short circuit,all door switch fault	• Door switch fault • Harness fault

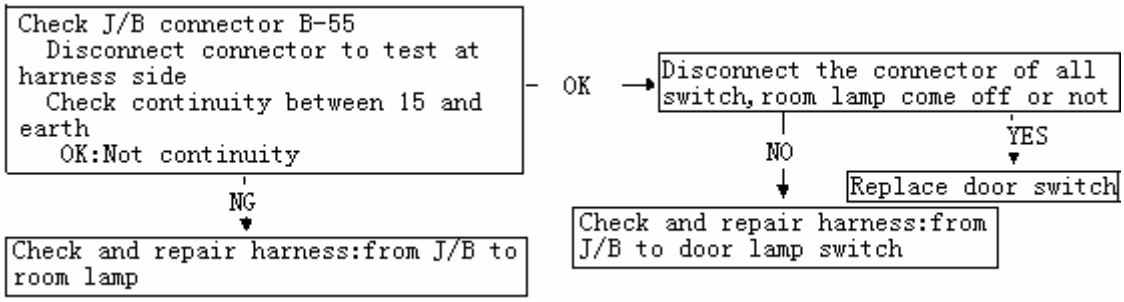


Fig 20—80

Inspection step 5as Table 20—34、Fig 20—81

Table 20—34

Check all door switch input circuit system

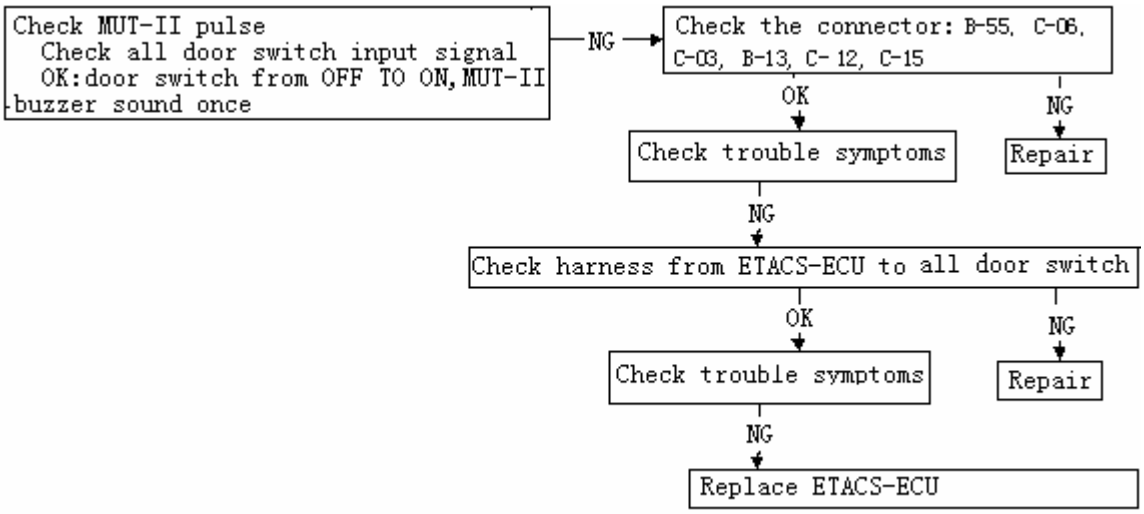


Fig 20—81

20.17 Front Fog Lamp

REMOVAL AND INSTALLATION (AS FIG 20-82)

Removal step:

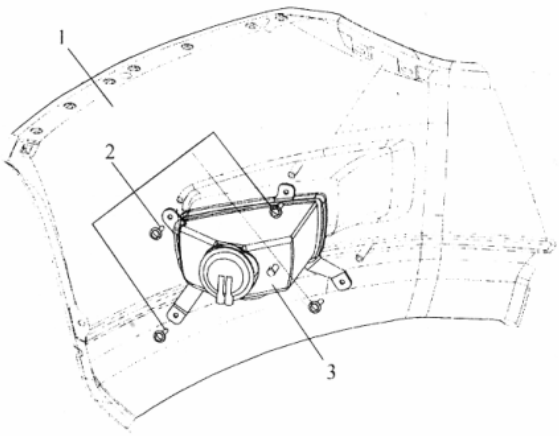


Fig 20-82

1.Front bumper; 2.Self-cutting screw; 3.Front fog lamp

INSTALLATION STEP:

Install order as reverse sequences.

20.18 Rear Fog Lamp

REMOVAL AND INSTALLATION (AS FIG 20-83)

Removal step:

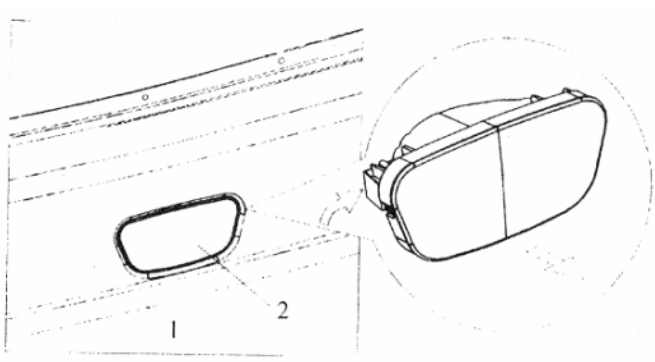


Fig 20-83

1.Rear bumper; 2.Rear fog lalmp

Installation step:

Install order as reverse sequences.

20.19 Windshield Wiper, Washer

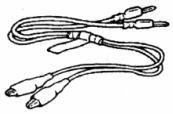
SERVICE SPECIFICATIONS (as Table 20—35)

Table 20—35

Item		Standard value (mm)
Windshield and wiper arm/ brush assembly stop position [The distance from left wiper brush to cowlbar trim panel.] [The distance from the end of righ t wiper brush to front hood hinger' s trim panel.]	left side	34±5
	Right side	30±5

SPECIAL TOOL AS Table 20—36

Table 20—36

Tool	Number	Name	Use
	MB991502	MUT-II assembly	• Check trouble code • Check the ETACS-ECU input signals
	MB991529	Diagnosis code check harness	• Check trouble code • Check the ETACS-ECU input signals

Trouble Diagnosis

1. Diagnosis function

Input check point(ETACS)

(1) Input signals can be checked using MUT-II or coltmeter connected to the diagnosis connector.(Refer to 20.1A troubleshooting/inspection service points)

(2) Check the following switch input signal

Wiper switch

- LO position
- HI position
- INT position

Washer switch

Caution
All input signal do not check using the MUT-II, should Consider that diagnosis circuit have problem.

2 Trouble symptom Table(as Table 20—37)

Table 20—37

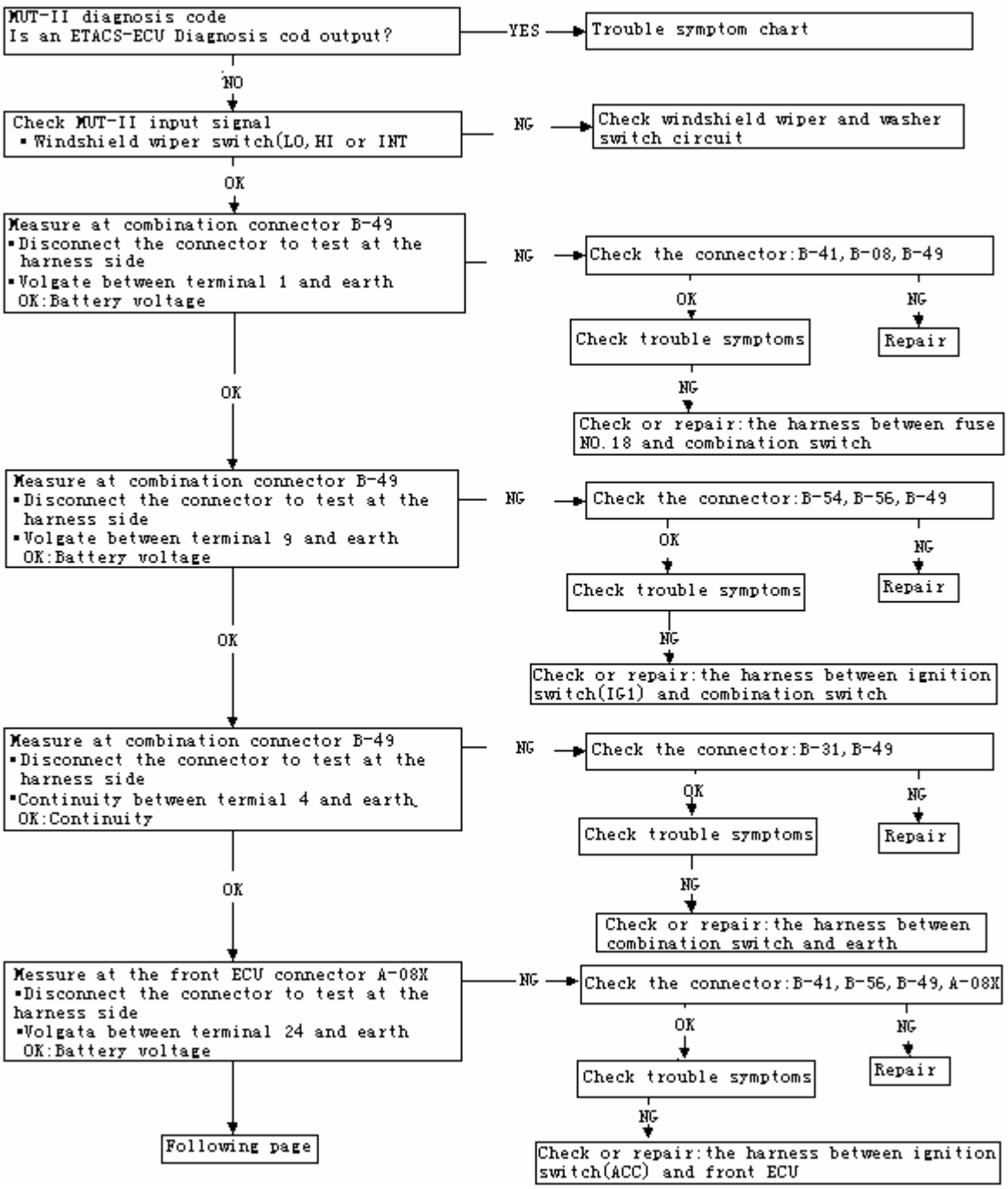
Trouble symptoms	.Inspection step
Do not communication with MUT-II	Refer to 20.24 SWS
The windshield wipers do not work at all	1
The windshield wiper do not work at “LO” speed	2
The windshield wiper do not work at “HI” speed	3
Windshield wiper are not operated with the switch in INT(Windshiel wipers operate nornal with the swith in “LO” or “LH”	4
The windshield wiper do not stop with the switch in OFF	5
The windshield wiper do not stop in the normal predetermined position with switch in OFF	6
Windshield washer do not work with switch in ON(Windshield wiper motor work normally)	7
The windshield washer motor do not work with switch in ON(windshield washer work normally)	8

3 Trouble symptoms inspection step

Inspection steps as Table 20—38、Fig 20—84

Table 20—38

The windshield wipers do not work at all	Probable cause
Maybe windshield wiper switch circuit is problem,harness or connector fault.Either the winshield wiper motor,or front ECU may be defective	• Combination switch fault • Harness or connector fault • Windshield wiper motor fault • Front ECU fault


MUT-II diagnosis code
Is an ETACS-ECU Diagnosis cod output?
YES
Trouble symptom chart
NO
Check MUT-II input signal
▪ Windshield wiper switch(LO, HI or INT
NG
Check windshield wiper and washer switch circuit
OK
Measure at combination connector B-49
▪Disconnect the connector to test at the harness side
▪Volgate between terminal 1 and earth
OK:Battery voltage
NG
Check the connector:B-41, B-08, B-49
OK
Check trouble symptoms
NG
Repair
NG
Check or repair:the harness between fuse NO.18 and combination switch
OK
Measure at combination connector B-49
▪Disconnect the connector to test at the harness side
▪Volgate between terminal 9 and earth
OK:Battery voltage
NG
Check the connector:B-54, B-56, B-49
OK
Check trouble symptoms
NG
Repair
NG
Check or repair:the harness between ignition switch(IG1) and combination switch
OK
Measure at combination connector B-49
▪Disconnect the connector to test at the harness side
▪Continuity between termial 4 and earth
OK:Continuity
NG
Check the connector:B-31, B-49
OK
Check trouble symptoms
NG
Repair
NG
Check or repair:the harness between combination switch and earth
OK
Messure at the front ECU connector A-08K
▪Disconnect the connector to test at the harness side
▪Volgata between terminal 24 and earth
OK:Battery voltage
NG
Check the connector:B-41, B-56, B-49, A-08K
OK
Check trouble symptoms
NG
Repair
NG
Check or repair:the harness between ignition switch(ACC) and front ECU
Following page

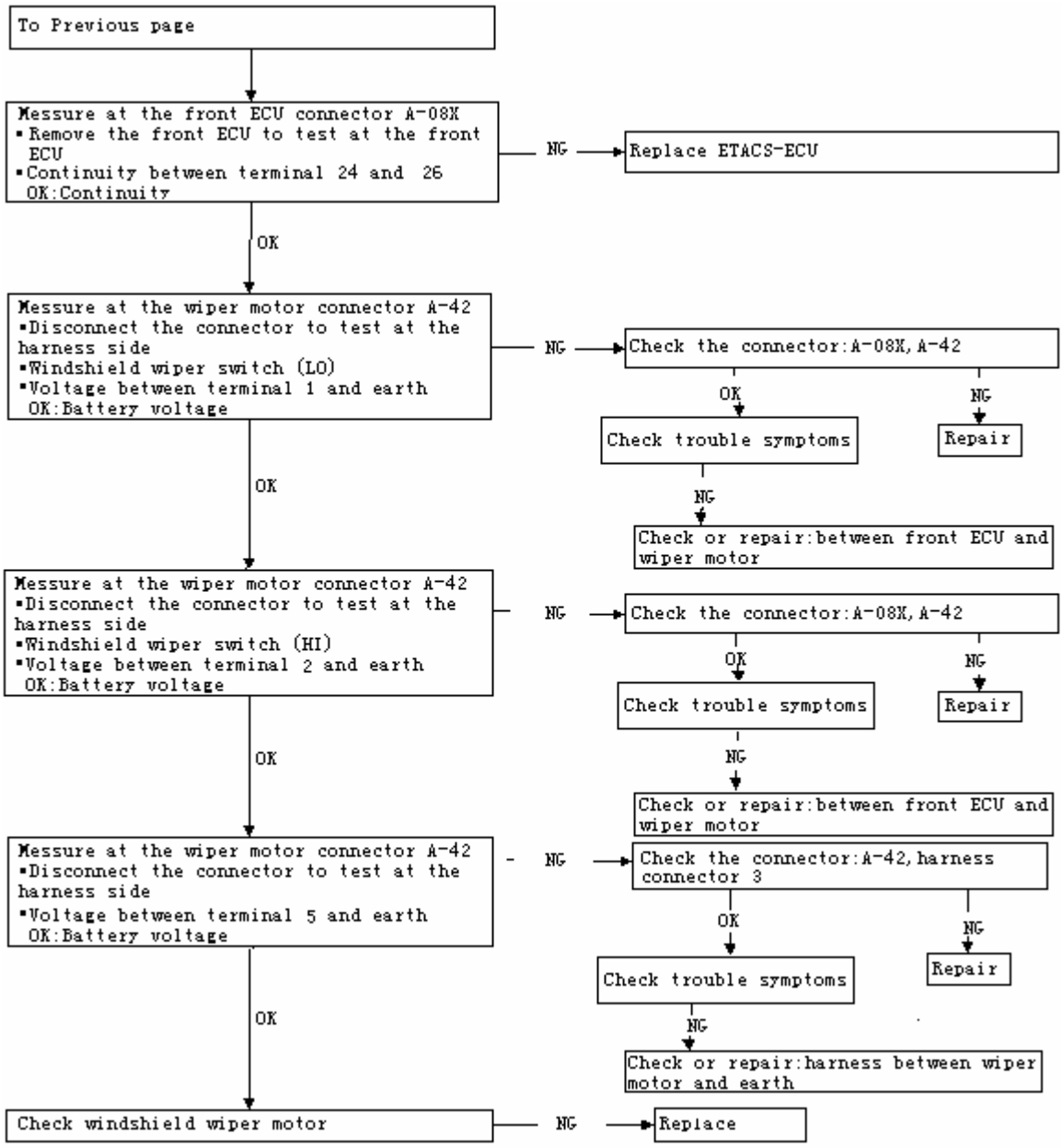


Fig 20—84

Inspection step 2as Table 20—39、Fig 20—85

Table 20—39

The windshield wiper do not work at "LO" speed	Probable cause
Maybe windshield wiper switch circuit is problem,harness or connector fault.Either the winshield wiper motor,or front ECU may be defective	• Combination switch fault • Harness or connector fault • Windshield wiper motor fault • Front ECU fault

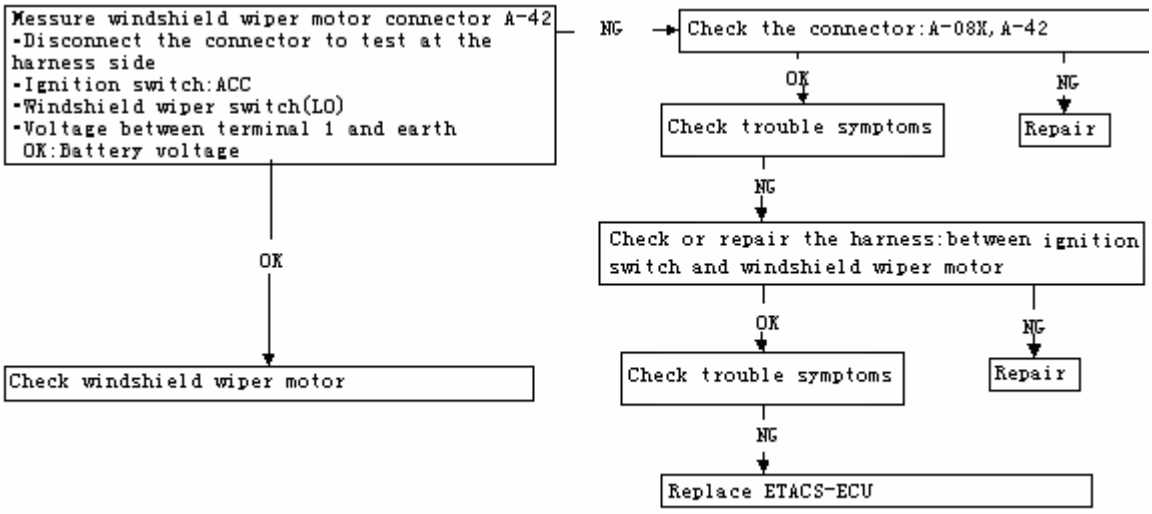


Fig 20—85

Inspection step 3 as Table 20—40, Fig 20—86

Table 20—40

The windshield wiper do not work at "HI" speed	Probable cause
Maybe windshield wiper switch circuit is problem,harness or connector fault.Either the winshield wiper motor,or front ECU may be defective	• Combination switch fault • Harness or connector fault • Windshield wiper motor fault • Front ECU fault

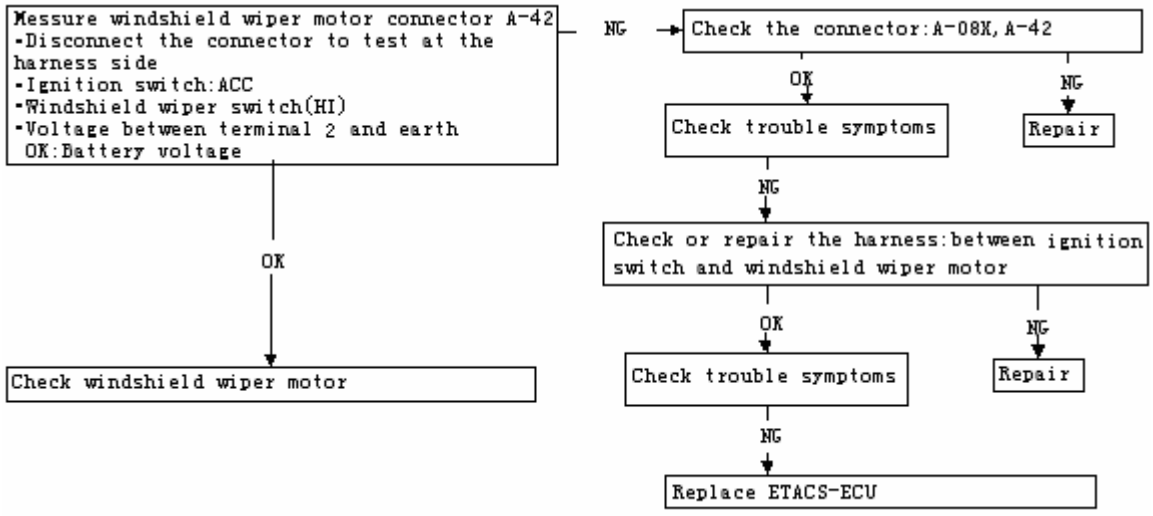


Fig 20—86

Inspection step 4 as Table 20—41、Fig 20—87

Table 20—41

Windshield wiper are not operated with the switch in INT(Windshiel wipers operate nornal with the swith in "LO" or "LH"	Probable cause
Maybe windshield wiper switch circuit is problem,harness or connector fault. wipers	• Combination switch fault • Harness or connector fault

operate nornal with the swith in “LO” or “LH”,so front ECU may be defective	• ETACS-ECU fault

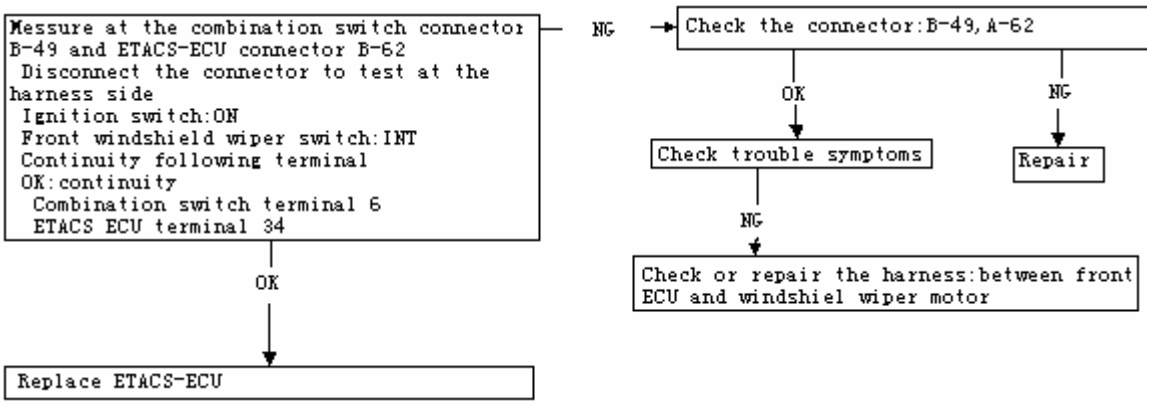


Fig 20—87

Inspection step 5 as Table 20—42、Fig 20—88

Table 20—42

The windshield wiper do not stop with the switch in OFF	Probable cause
May be due to the windshield wiper motor short circuit or the fault on communication line.Because of fault protection of front ECU,it keep previous fault state.	• Windshield wiper fault • Harness or connector fault • Combination switch fault

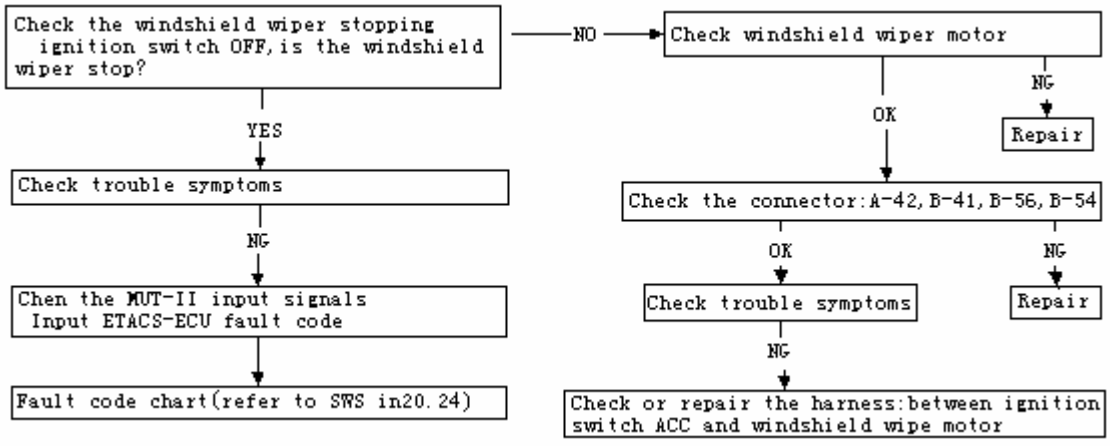


Fig.20—88

Inspection step 6 as Table 20—43、Fig 20—89

Table 20—43

The windshield wiper do not stop in the normal predetermined position with switch in OFF	Probable cause
May be due to the windshield wiper motor short circuit or fault protection of front ECU	• Windshield wiper motor fault • Harness or connector fault • Combination switch fault • Front ECU fault

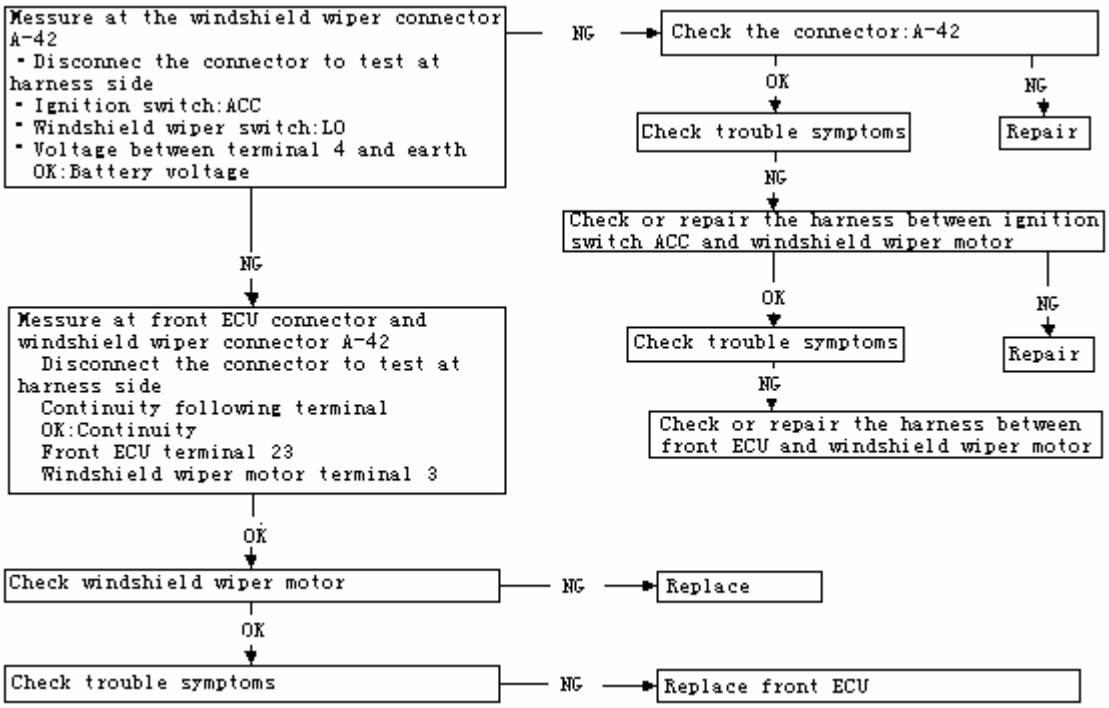


Fig 20—89

Inspection step 7 as Table 20—44、Fig 20—90

Table 20—44

Windshield washer do not work with switch in ON(Windshield wiper motor work normally)	Probable cause
May be windshield washer switch ,harness or connector fault,may be due to wiper motor or front ECU fault	• Combination switch fault • Harness or connector fault • Windshield washer motor fault • Front ECU fault

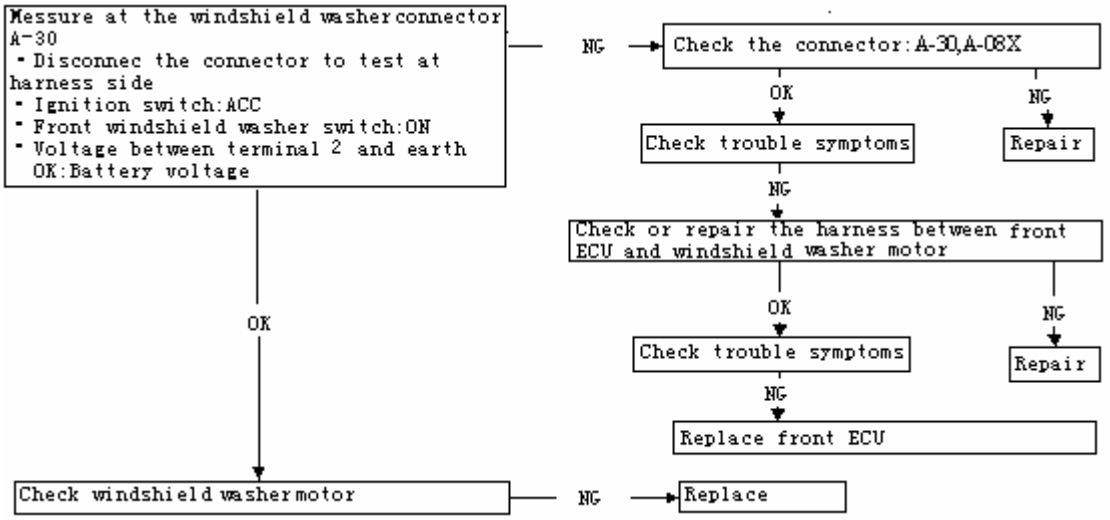


Fig 20—90

Inspection step 8 as Table 20—45、Fig 20—91。

Table 20—45

The windshield washer motor do not work with	Probable cause

switch in ON(windshield washer work normally)	
May be windshield wiper motot ,harness or connector fault,may be due to front ECU fault	• Windshield wiper motor fault • Harness or connector fault • Front ECU fault

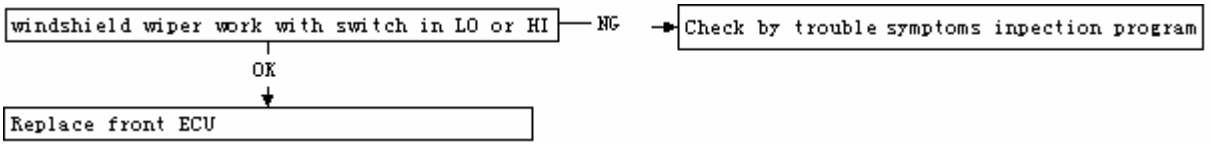


Fig 20—91

Inspection step 9 as talbe 20—46、Fig 20—92

Table 20—46

Check the windshield wiper/washer switch communication circuit

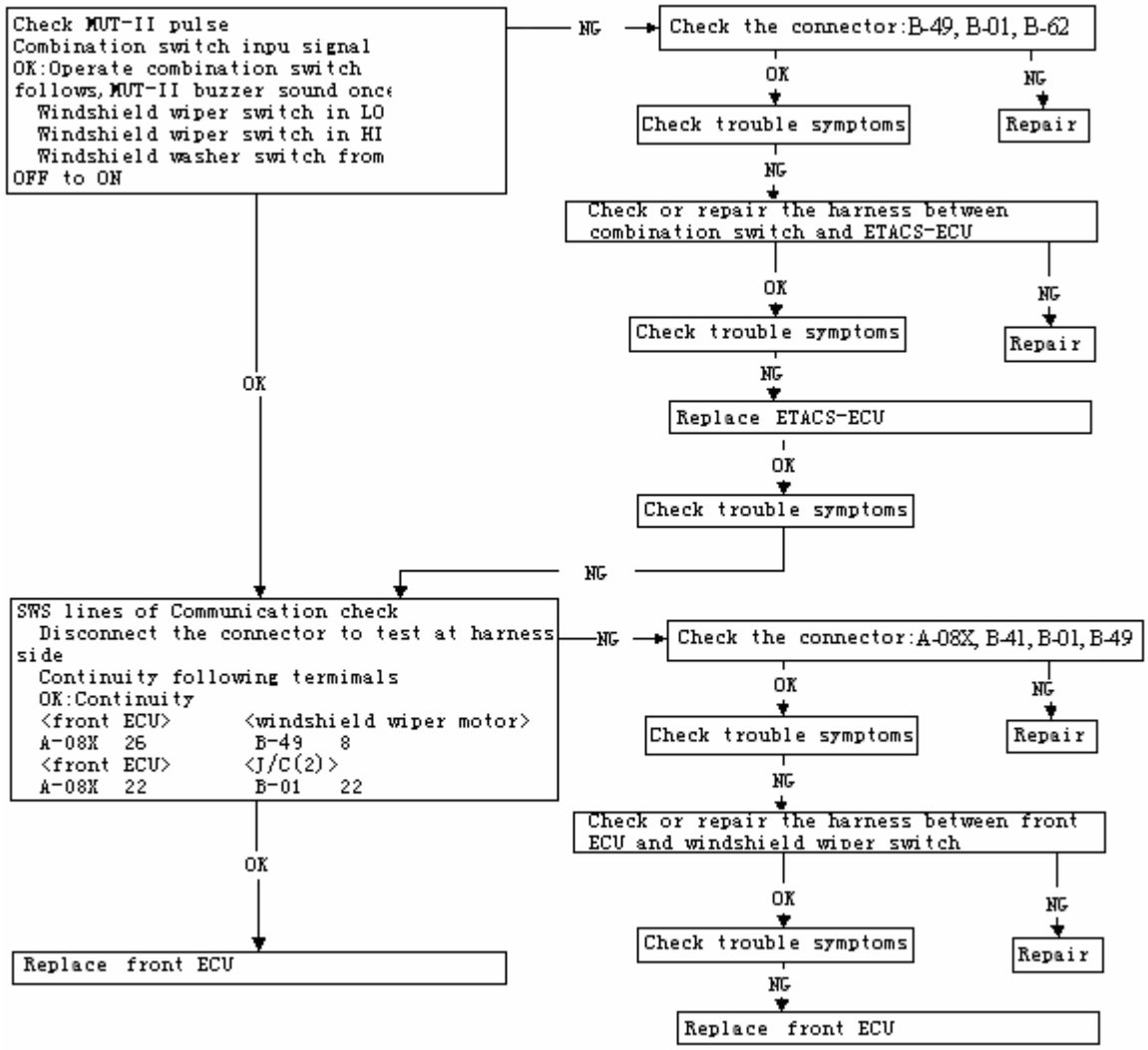
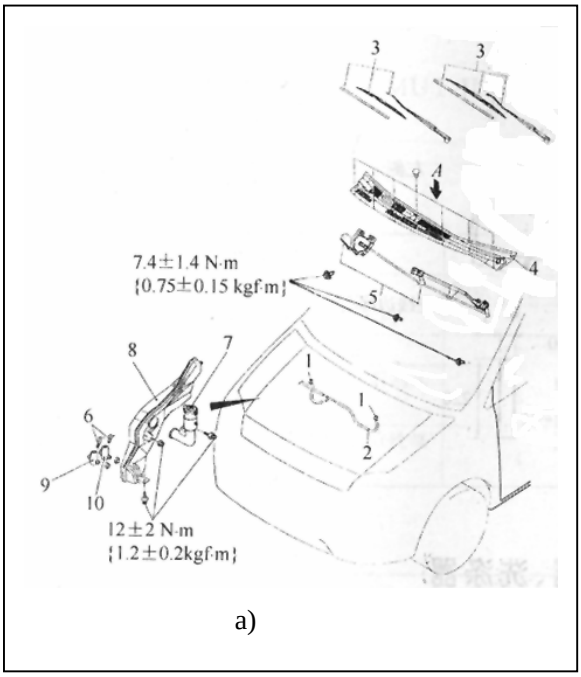


Fig 20—92

Removal and installation



a)

Washer nozzle removal step:

1 connect the washer tube

2 washer nozzle

Wiper motor and Links assembly removal step:

3 wiper arm and brush assembly

4 vent-cover bezel

5 wiper motor an links assembly

Washer tank removal step:

• front fender

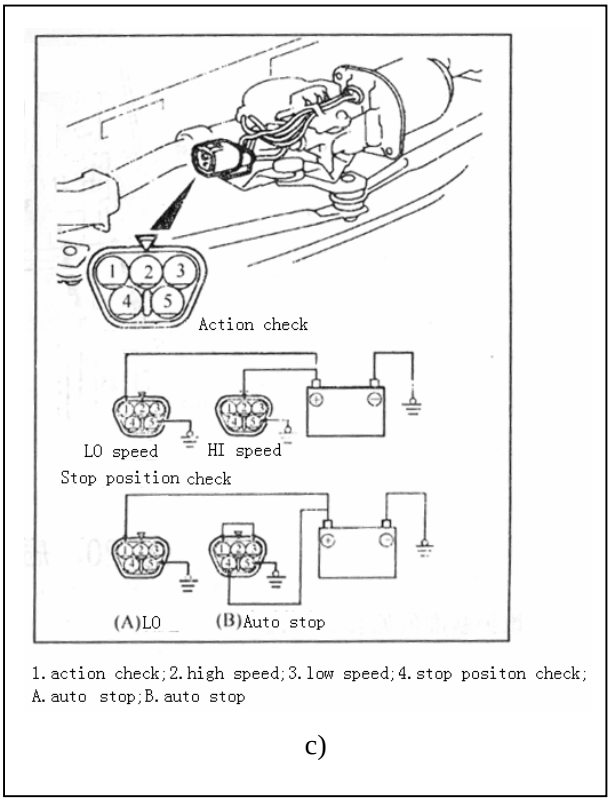
6 connect washer tube

7affusion gap assembly

8washer tank assembly

9 front washer motor

10 rear washer motor



1. action check; 2. high speed; 3. low speed; 4. stop positon check; A. auto stop; B. auto stop

c)

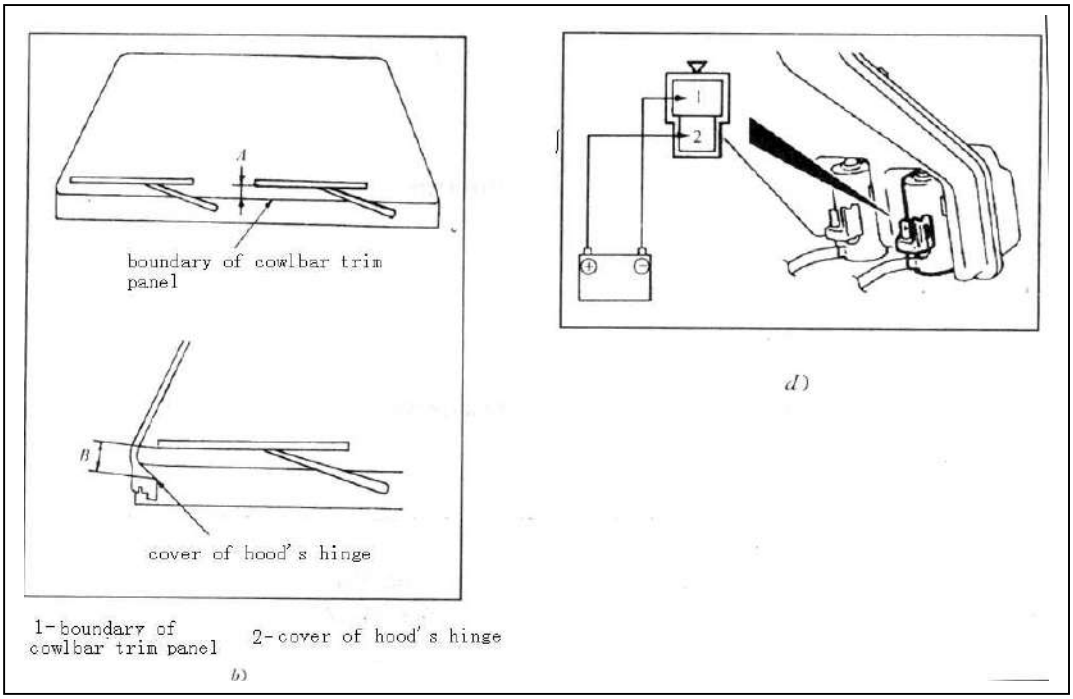


Fig 20-93

INSPECTION POINT:

Wiper arm and brush assembly installation

The arm&brush must be stop on the correct position according to prescriptive value (as Fig 20－93b).

standard value: (A)34±5mm　(B) 30±5mm

INSPECTION

1 Wiper motor inspection

Check the wiper motor after install wiper motor in body and disconnect the connector.

·Check the wiper motor action with the wiper motor in LO&HI speed.

As Fig20-93b: Adding battery power to motor,check wiper motor' s action of high&lower speed.

·Inspection stop position of the wiper motor.

(1) As Fig20-93c: The wiper motor act in lower speed after adding power from battery .Disconnect the terminals from battery suddenly while the wiper motor actting to making the motor stopping.

(2) As Fig20-93c:After connect the terminals and battery,check the stop position of wiper is on auto stopping position or not with the wiper motor in lower speed.

2 Inspection of washer motor

(1) Checking washer motor after wash liquid infused with the wash tank install correctly.

(2)　Checking the wash liquid spraying or not after connect terminal 2 to battery + and connect terminal 1 to earth (as Fig 20－93d)。

3 Inspection of washer nozzles' spray area

Adjusting nozzles until it' s spray stream in the area as Fig 20-94

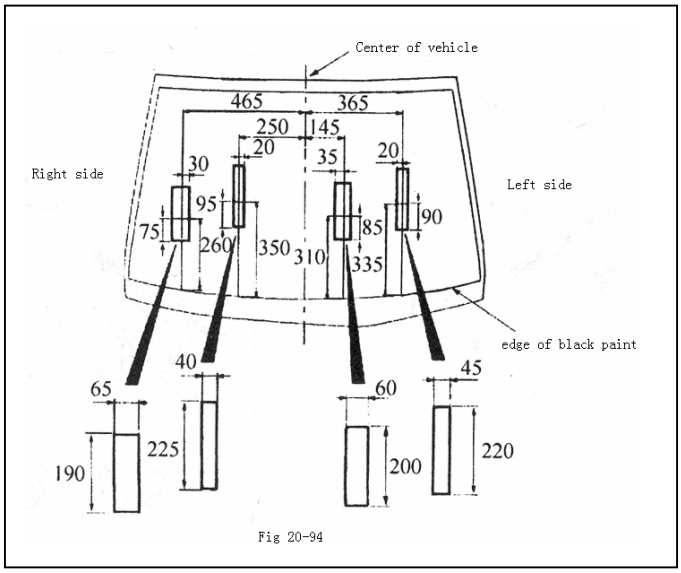


Fig 20-94

20.20 Rear Wiper, Washer

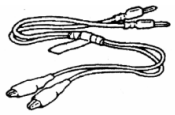
SERVICE　SPECIFICATIONS AS TABLE 20－47

Table 20－47

Item	Standard value (mm)
wiper arm/ brush assembly stop position (the distance from blade front edge to black boundary of tail door glass)	16±5

SPECIAL TOOL AS Table 20—48

Table 20—48

Tool	Number	Name	Use
	MB991502	MUT-II assembly	• Check trouble code •Check the ETACS-ECU input signals
	MB991529	Diagnosis code check harness	• Check trouble code •Check the ETACS-ECU input signals

Trouble Diagnosis

1. Diagnosis function

Input check point(ETACS)。

(1) Input signals can be checked using MUT-II or coltmeter connected to the diagnosis connector.(Refer to 20.1A troubleshooting/inspection service points)

(2) Check the following switch input signal。

Rear wiper switch;

Rear washer switch。

Caution
All input signal do not check using the MUT-II, should Consider that diagnosis circuit have problem.

2 Trouble symptom Table(as Table 20—49)

Table 20—49

Trouble symptoms	.Inspection step
Do not communication with MUT-II	Refer to 20.24 SWS
The rear wiper do not work with the rear wiper switch in ON	1
The rear wiper do not stop with the switch in OFF	2
The washerr do not work with the wahser switch in ON(rear wiper work)	3
The wiper motor do not work with the washer switch in ON(washer work)	4

3 Trouble symptoms inspection step

Inspection steps as Table 20—50、Fig 20—95

Table 20—50

The rear wiper do not work with the rear wiper switch in ON	Probable cause
Maybe windshield wiper switch circuit is problem, harness or connector fault. Either the winshield wiper motor, or ETACS-ECU may be defective	• Combination switch fault • Harness or connector fault • rear wiper motor fault • ETACS-ECU fault

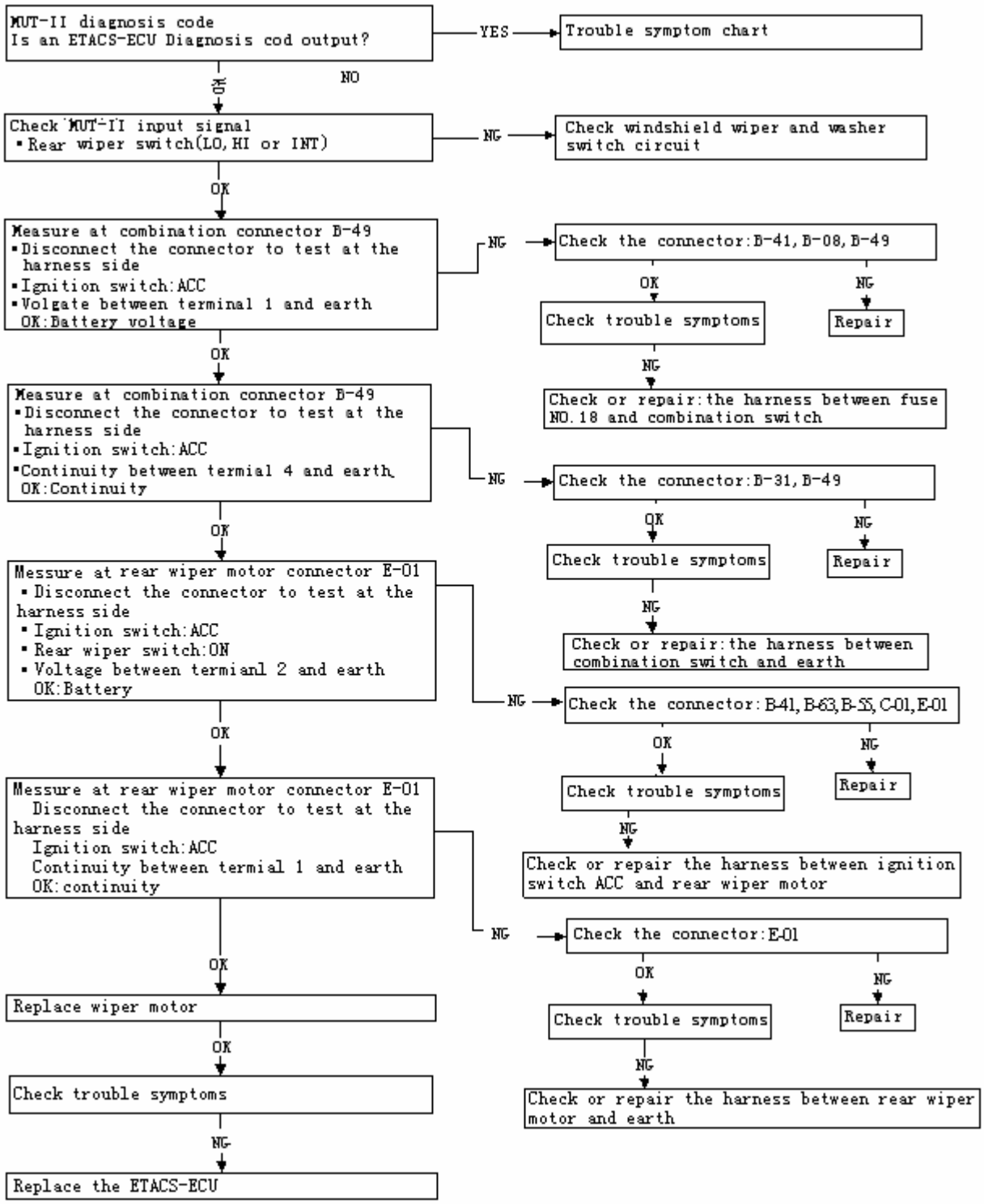


Fig 20—95

Inspection step 2as Table 20—51、Fig 20—96

Table 20—51

The rear wiper do not stop with the switch in OFF	Probable cause
Either the winshield wiper motor, or harness may be short circuit. Maybe combination switch or ETACS-ECU fault	• Rear wiper motor fault • Harness or connector fault • Combination switch fault • ETACS-ECU fault

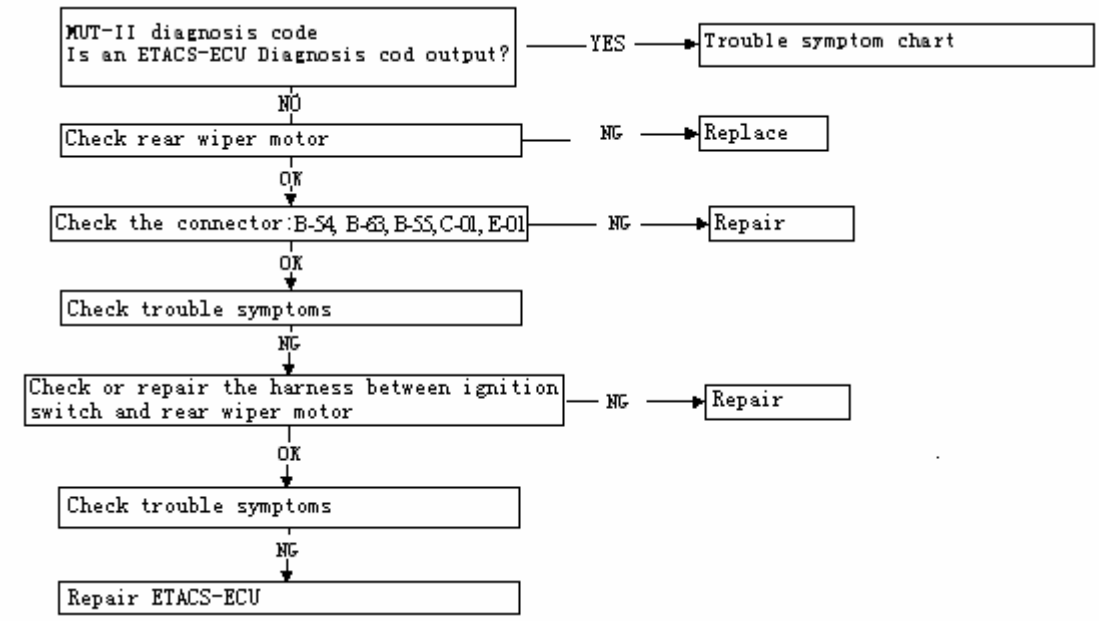


Fig 20—96

Inspection step as Table20—52、Fig 20—97

Table 20—52

The washerr do not work with the wahser switch in ON(rear wiper work)	Probable cause
Either the winshield wiper switch or harness/connector fault. Maybe rear washer motor or ETACS-ECU fault	• Combination switch fault • Harness or connector fault • Rear washer motor fault • ETACS-ECU fault

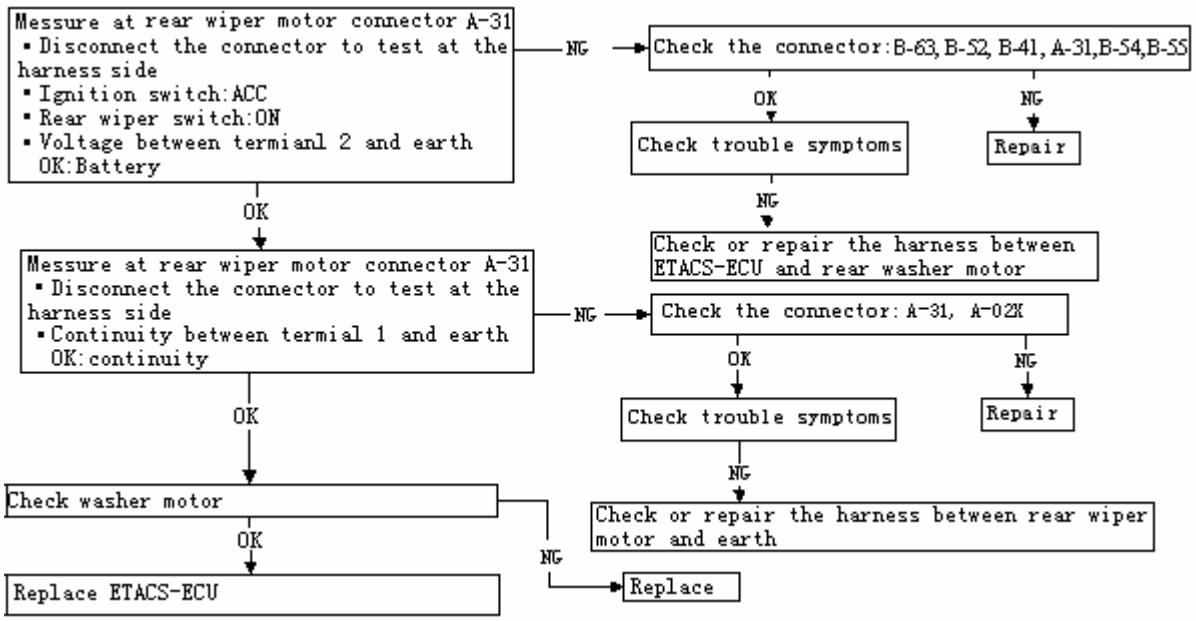


Fig 20—97

Inspection step 4 as Table 20—53、Fig 20—98

Table 20—53

The wiper motor do not work with the washer switch in ON(washer work)	Probable cause
Maybe rear washer motor fault Either harness/connector or ETACS-ECU fault.	• Rear wiper motor fault • Harness or connector fault • ETACS-ECU fault

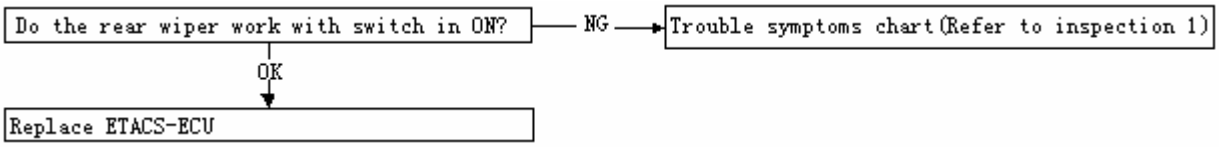


Fig 20—98

Inspection step 5 as Table 20—54、Fig 20—99

Table 20—54

Check rear wiper and rear washer switch communication circuit

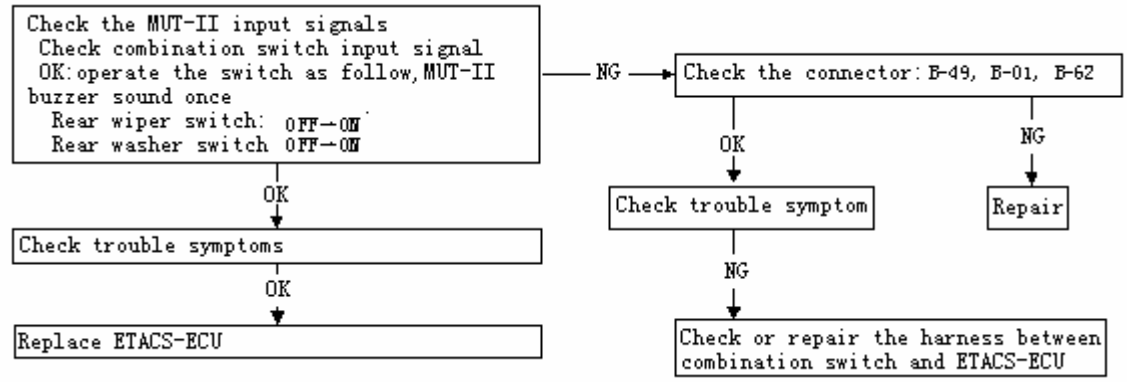


Fig 20—99

Removal and installation as Fig 20—100

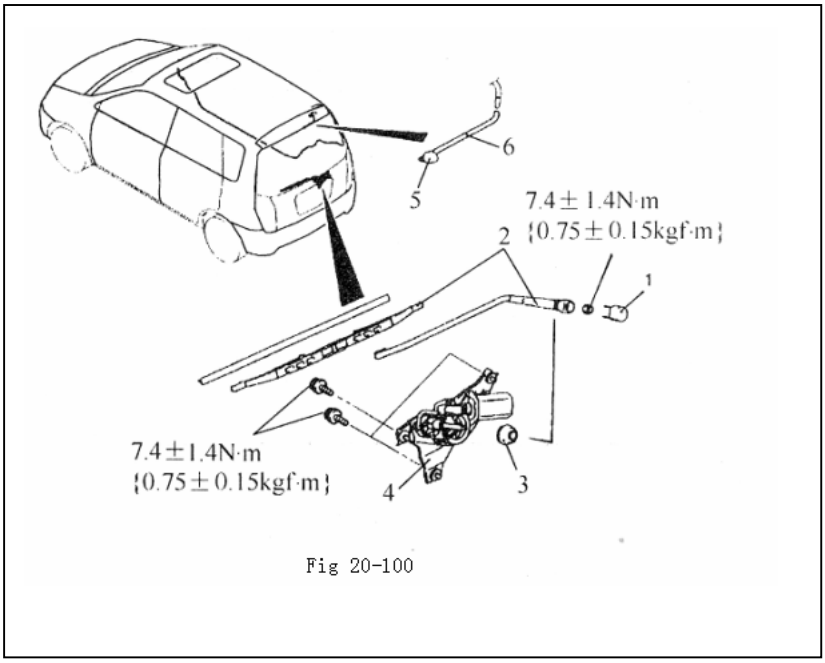


Fig 20-100

Rear wiper motor removal step:

•Lower trim of tail door removal step (refer to correlative content)

• Waterproof film of tail door removal step (refer to correlative content)

1 Cover

2 Wiper brush and arm assembly(A)

3 Elastomeric gasket (B)

4 Wiper motor assembly

Rear washer removal step:

•Top trim of tail door removal step (refer to correlative content)

• High-nounted stop lamp removal(refer to correlative content)

5 Rear nozzle of washer

Installation point

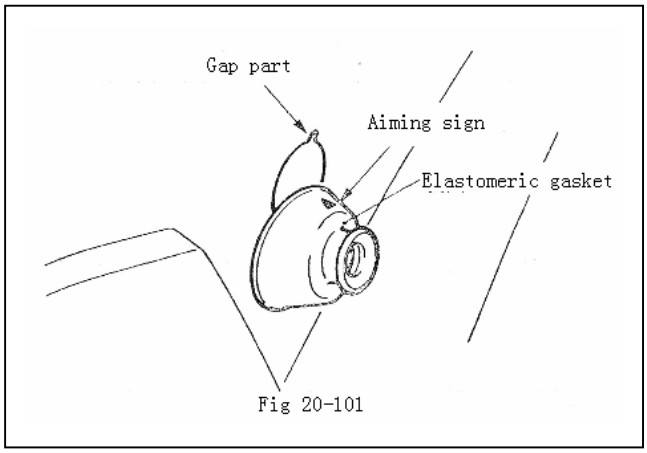


Fig 20-101

A: Wiper arm and brush assembly installation

The top of wiper brush should be fixed after putting it on stated position(standard value)

Standard value: 16±5mm

B Elastomertic gasket installation

Elastomertic gasket should be fixed after that gap part aim at the aiming sign (as Fig 20—101)。

INSPECTION

1 Wiper motor inspection (as Fig 20—102)

Disconnect the connector of harness to check when wiper motor fixing the body.

• Wiper motor action inspection

Connect the motor to the battery and check the action of wiper motor(as Fig 20-102)

• Wiper motor stop position inspection

(1)Let the wiper motor to act with above means, during the action, disconnect the motor from battery to stop the action of motor.

(2) As Fig 20—102, connec the battery and check the motor stop on the auto stop position after motor act.

2 Washer motor inspection (as Fig 20-103)

(1) Check the washer motor after motor be fixed on the washer tank and washer tank be fitted on water

(2)Connect the terminal 2 to the battery, affirm the terminal 2 earth, check whether the water jet fast.

3 Inspection of washer nozzles' spray area

Adjusting nozzles until it's spray stream in the area as Fig 20-104

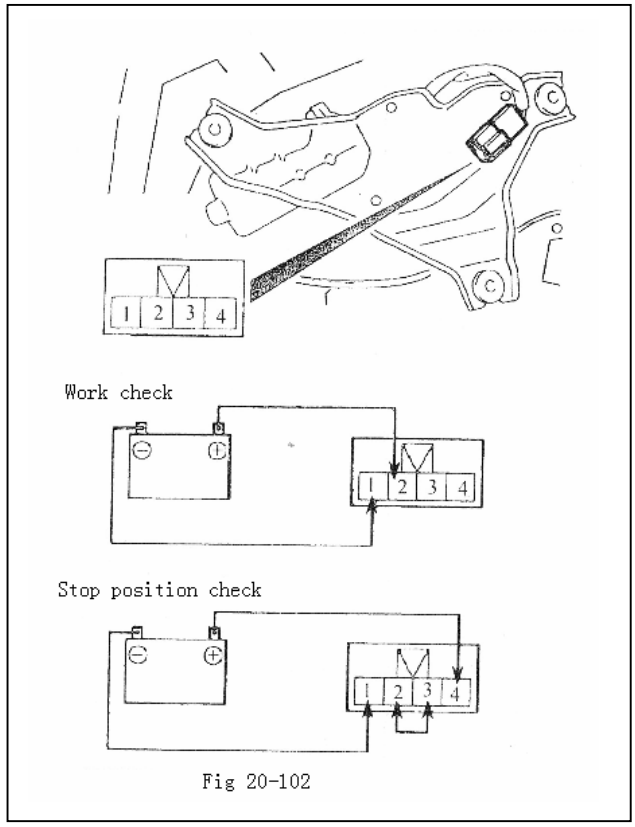


Fig 20-102

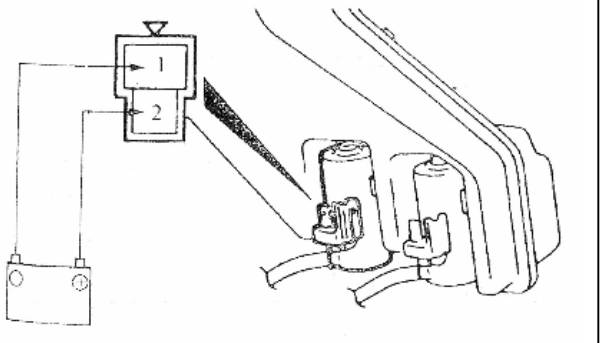


Fig 20-103

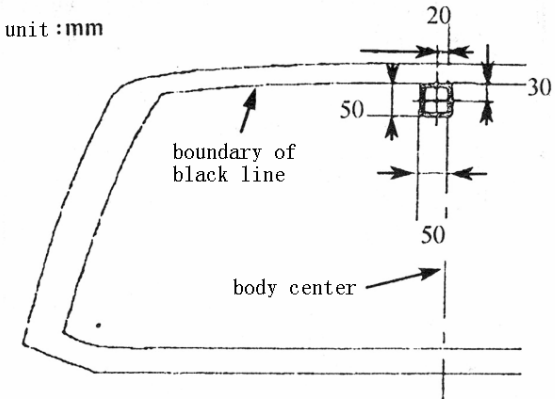
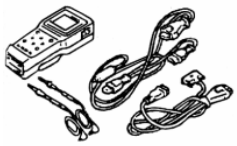
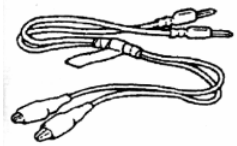


Fig 20-104

20.21 Remote Control Mirror Switch

SPECIAL TOOL AS Table 20—55

Table 20—55

Tool	Number	Name	Use
	MB991502	MUT-II assembly	•Check the ETACS-ECU input signals
	MB991529	Diagnosis code check harness	• Check ETACS-ECU input signal use pressure tester

TROUBLE SYMPTOMS ANALYSIS

1 Trouble symptoms Table (as Table 20—56)

Table 20—56

Trouble symptom	Inspection step NO.
Check Remote control mirror switch input circuit	1

Inspection step 1 as Table 20—105

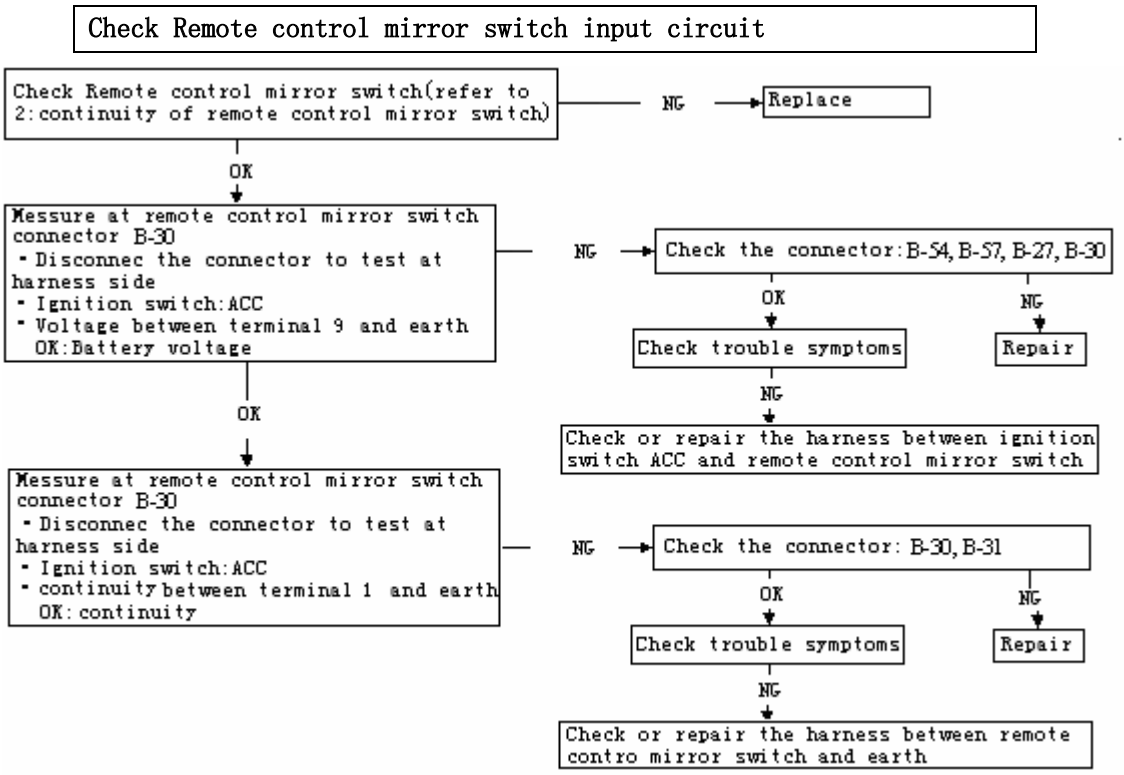


Fig 20—105

INSPECTION

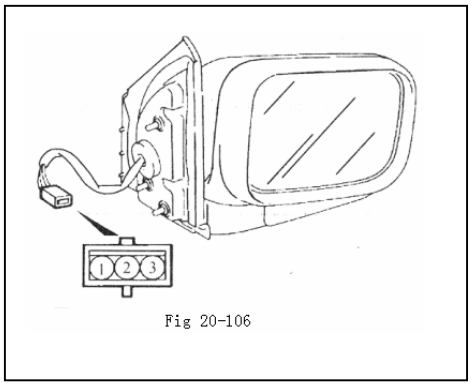


Fig 20-106

1 Inspection of remote control mirror action(as Fig 20－106、Table 20－56)

Table 20－56

Connector			Action
1	2	3	
⊖		⊕	UP
⊕		⊖	DOWN
⊕	⊖		LH
⊖	⊕		RH

2 Continuity of remote control mirror switch(as Table 20－57、Fig 20－107)

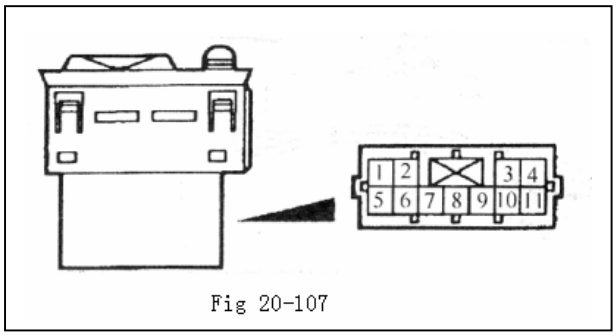


Fig 20-107

Table 20－57

Switch	Switch position	Terminal number									
		LH					RH				
		1	6	9	10	11	1	2	3	6	9
remote control mirror switch	Up	○	○				○		○	○	
				○		○			○		○
	Low		○	○			○		○		
		○				○				○	○
	Lh side		○	○			○	○			
		○			○					○	○
	Rh side	○	○				○			○	
				○	○			○			○

20.22 Power Window, Central Locking

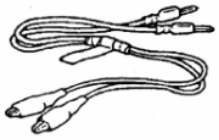
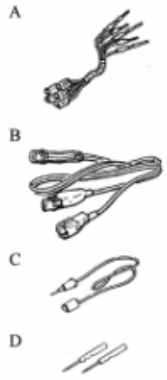
MAINTENANCE STANDARD VALUE AS TABLE 20－58

Table20－58

Item	Standard value (A)
Power window work current(power voltage:14.5,25℃)	5±1

SPECIAL TOOLS AS TABLE 20－59

Table 20－59

Tool	Number	Name	Use
	MB991502	MUT-II subassembly	For SWS inpections(diagnosis cod display and input signal check by MUT-II)
	MB991529	Diagnosis code check harness	For checking input signals by volmeter
	MB991223 A: MB991219 B:MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	For checking voltage at harness and connectots A: For checking connector pin contact voltage B: For checking power supply circuits C: For checking power supply circuits D : For connection to commercially available testers

TROUBLE DIAGNOSIS

1. Diagnosis function

Input signal check point(ETACS)

Input signals can be checked using MUT-II or coltmeter connected to the diagnosis connector.(Refer to 20.1A troubleshooting/inspection service points)

(1) Check door lock actuator input signal

- LOCK
- UNLOCK

Caution
All input signal do not check using the MUT-II, should Consider that diagnosis circuit have problem.

2. Trouble symptoms Table (as Table 20−60)

Table 20−60

Trouble symptoms		Inspection step
be relative to power window	Power windows not working at all	1
	Power windows are not operated with the power window main switch	2
	Driver’ s power window not responding to power window main switch	3
	Windows not responding to passenger or rear power windows	4
	Passenger or rear power windows not responding to power window main switch	5

	While window is winding up,it suddenly starts coming down again.	6
	Safety mechanism(to prevent jamming of fingers,ect.) not working	7
be relative to door lock	Do not LOCK or UNLOCK door(do not install keyless entry system) using driver's lock handle(including key operation)	8
	Do not LOCK or UNLOCK door(install keyless entry system) using driver's lock handle(including key operation)	9
	Despite lock or unlock,all door do not act	10

3. Trouble symptoms inspection step

Inspection step as Table 20—61、Fig 20—108

Table 20—61

Power windows not working at all	Probable
Power window relay or power window relay drive circuit may be fault.ETACS-ECU may be defecive	• Power window relay fault • ETACS-ECU fault • Harness or connector fault

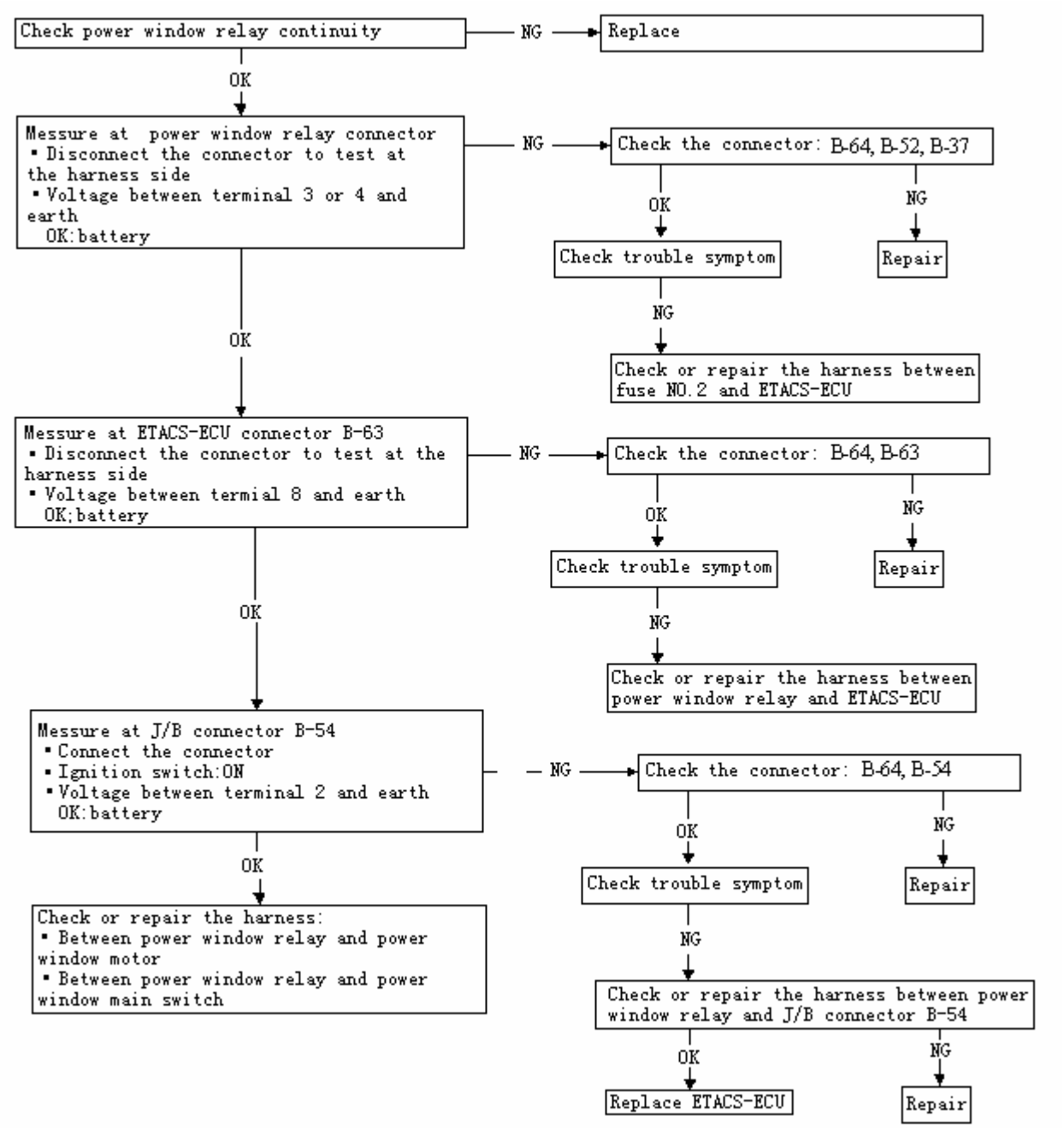


Fig 20—108

Inspection step 2 as Table 20—62、Fig 20—109

Table 20—62

Power windows are not operated with the power window main switch	Probable
Power window main switch power circuit or earth may be fault.Power window main switch may be defecive	• Power window main switch fault • Harness or connector fault

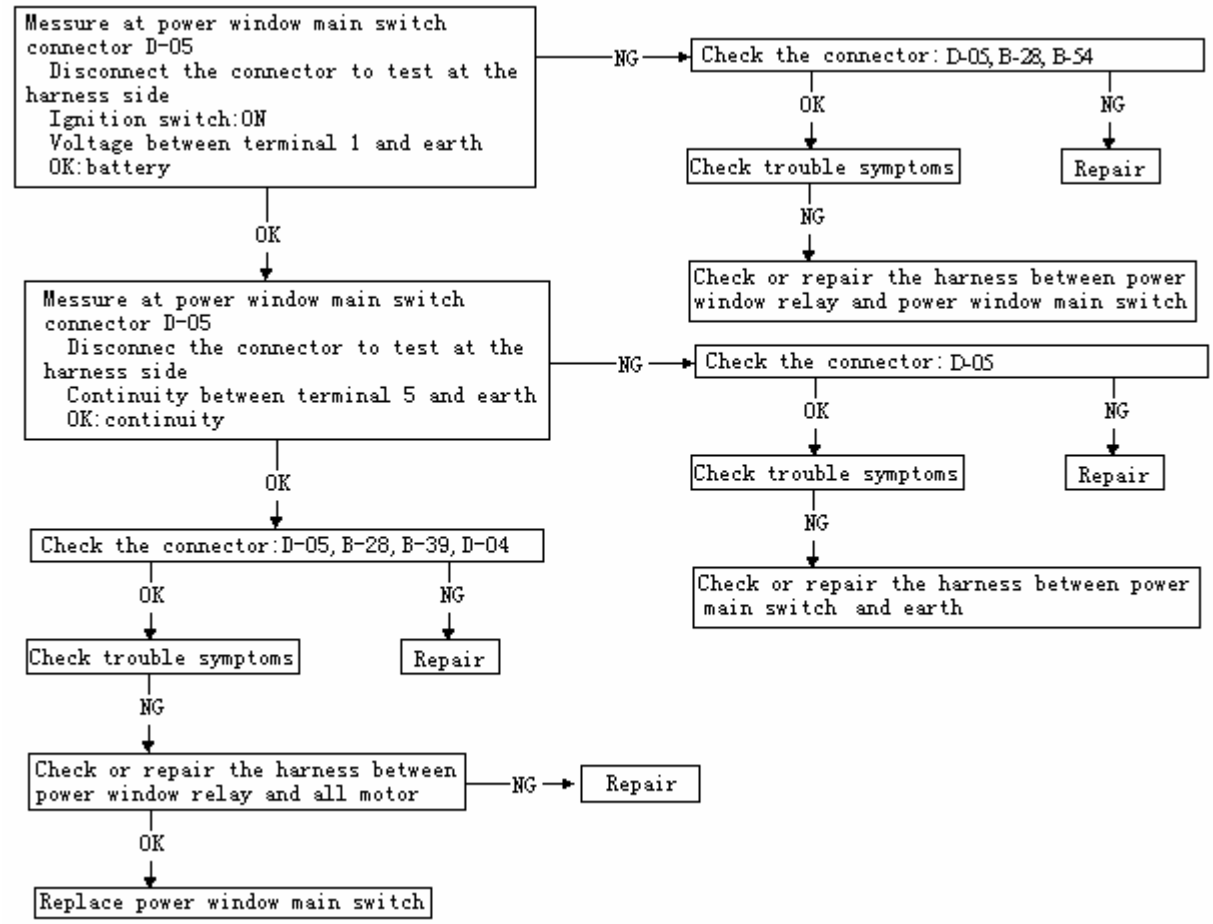


Fig 20—109

Inspection step 3 as Table 20—63、Fig 20—110

Table 20—63

Driver’s power window not responding to power window main switch	Probable cause
Power circuit of power window motor or earth circuit fault. Power window motor fault or communication fault from powerwindow main switch to power window assy.	• Power window main switch fault • Power window motor fault • Harness or connecor fault

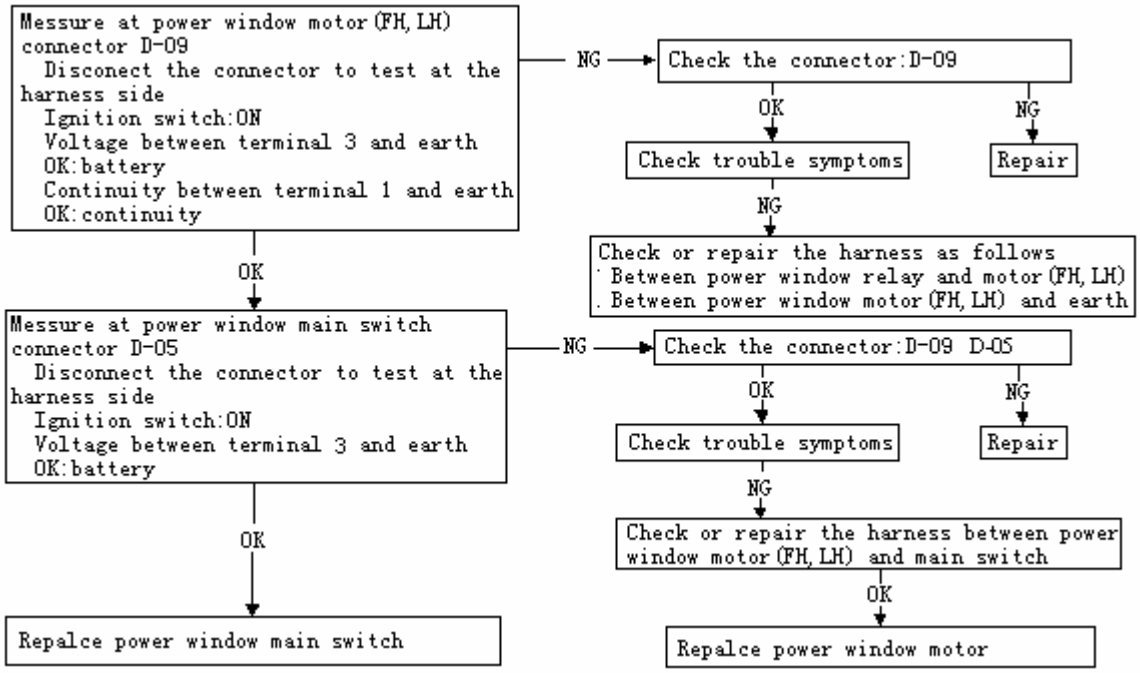


Fig 20—110

Inspection step 4 as Table 20—64、Fig 20—111

Table 20—64

Windows not responding to passenger or rear power windows	Prabable cause
All power window motors power circuit or earth may be defective. Either power window motor assembly or power window sub switch fault	• All power window motor fault • All power window sub switch fault • Harness or connector fault

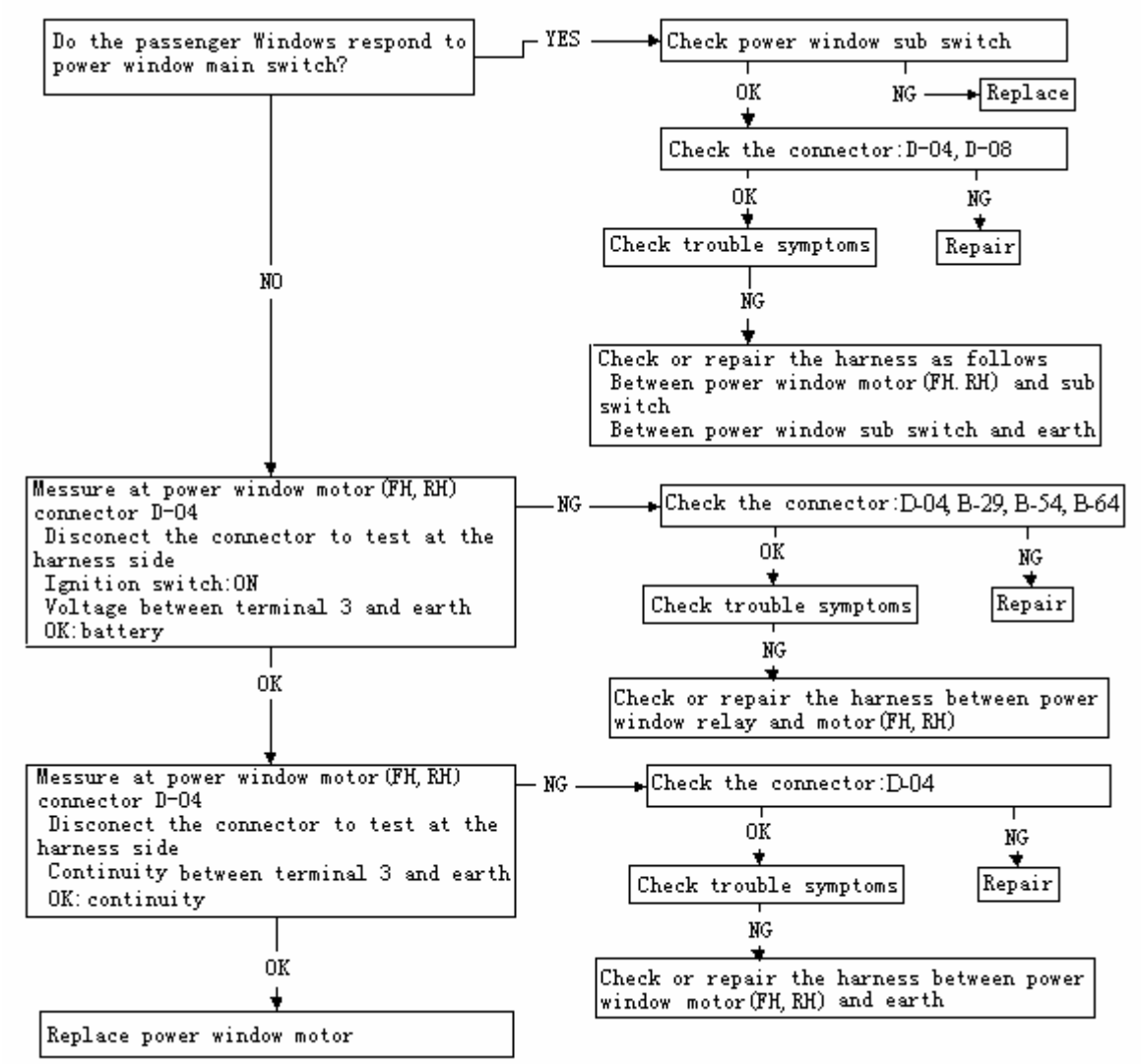


Fig 20—111

Inspection step 5 as Table 20—65、Fig 20—112

Table 20—65

Passenger or rear power windows not responding to power window main switch	Prabable cause
Communication circuit from power window main switch power to passenger power window motor short circuit or cut circuit .Maybe power window main switch fault too.	• Harness or connector fault • Power window main switch

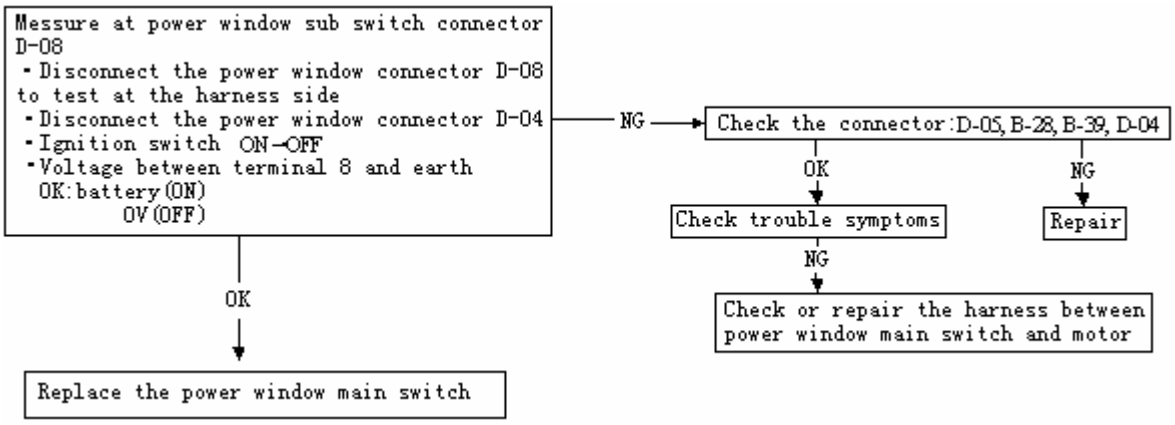


Fig.20—112

Inspection step 6 as Table 20—66、Fig 20—113

Table 20—66

While window is winding up, it suddenly starts coming down again	Prabable cause
While window is winding up, it get grear glide resistance, maybe nip some thing that make power window come down 150mm	• Power window adjustion fault • window glide part fault or transFiguration

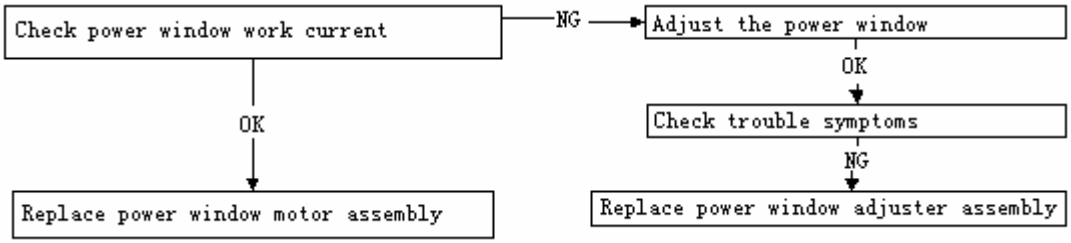


Fig 20—113

Inspection step 7 as Table 20—67、Fig 20—114

Table 20—67

Safety mechanism(to prevent jamming of fingers, ect.) not working	Prabable cause
Revolving inspection sensor of Power window motor assembly fault	• Power window motor assembly fault

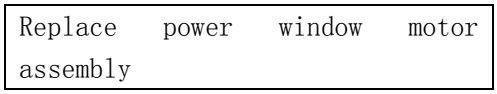


Fig.20—114

Inspection step 8 as Table 20—68、Fig 20—115

Table 20—68

Do not LOCK or UNLOCK door(do not install keyless entry system) using driver's lock handle(including key operation)	Probable cause
Front door lock switch or ETACS-ECU may be defective. Harness or connect fault too.	• Front door lock switch fault • ETACS-ECU fault

	• Harness or connector fault

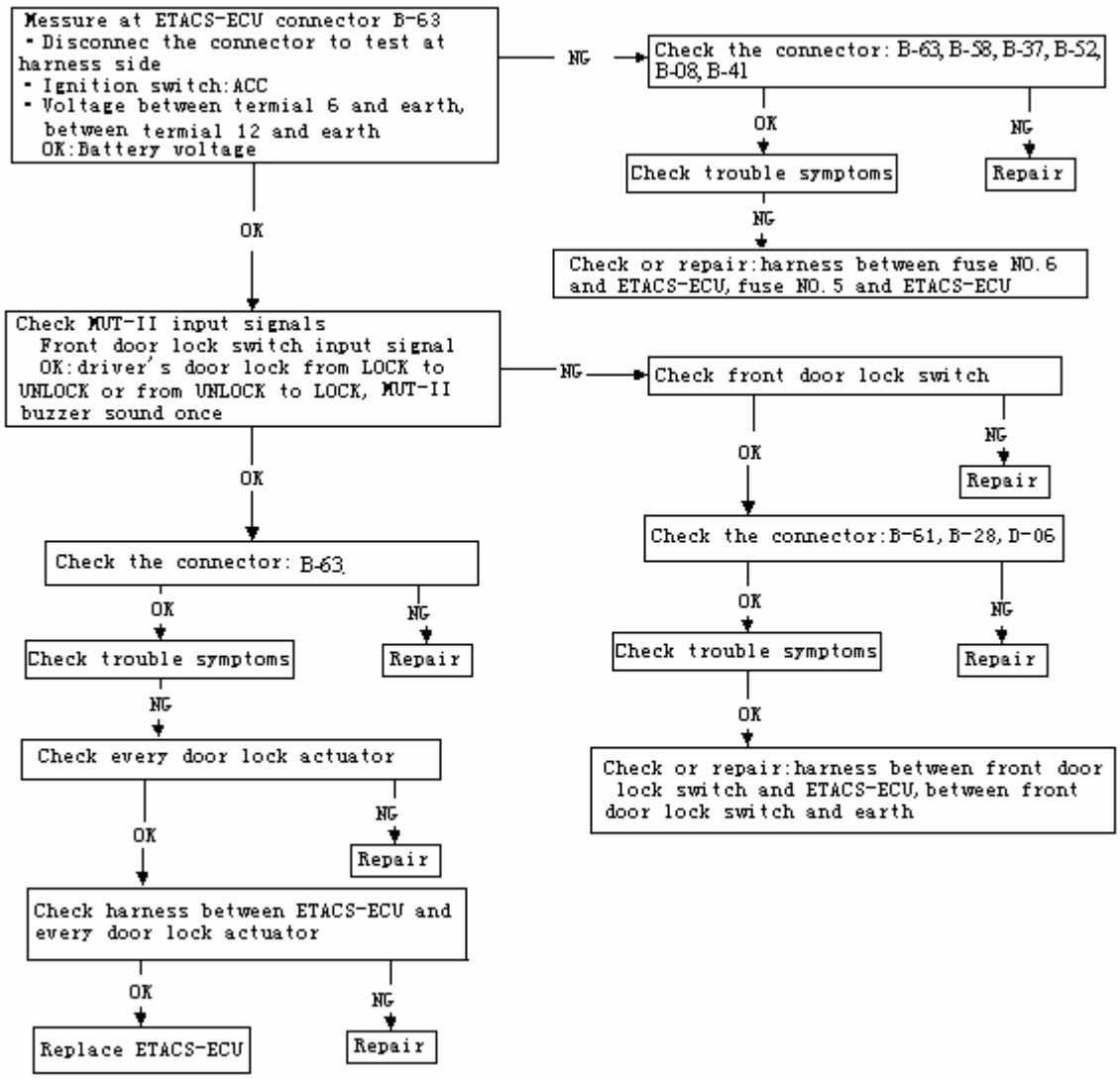


Fig 20—115

Inspection step 9 as Table 20—69、Fig 20—116

Table 20—69

Do not LOCK or UNLOCK door(install keyless entry system) using driver's lock handle(including key operation)	Probable cause
Front door lock switch or ETACS-ECU may be defective.Harness or connect fault too.	• Front door lock switch fault • Front door actuator fault • ETACS-ECU fault • Harness or connector fault

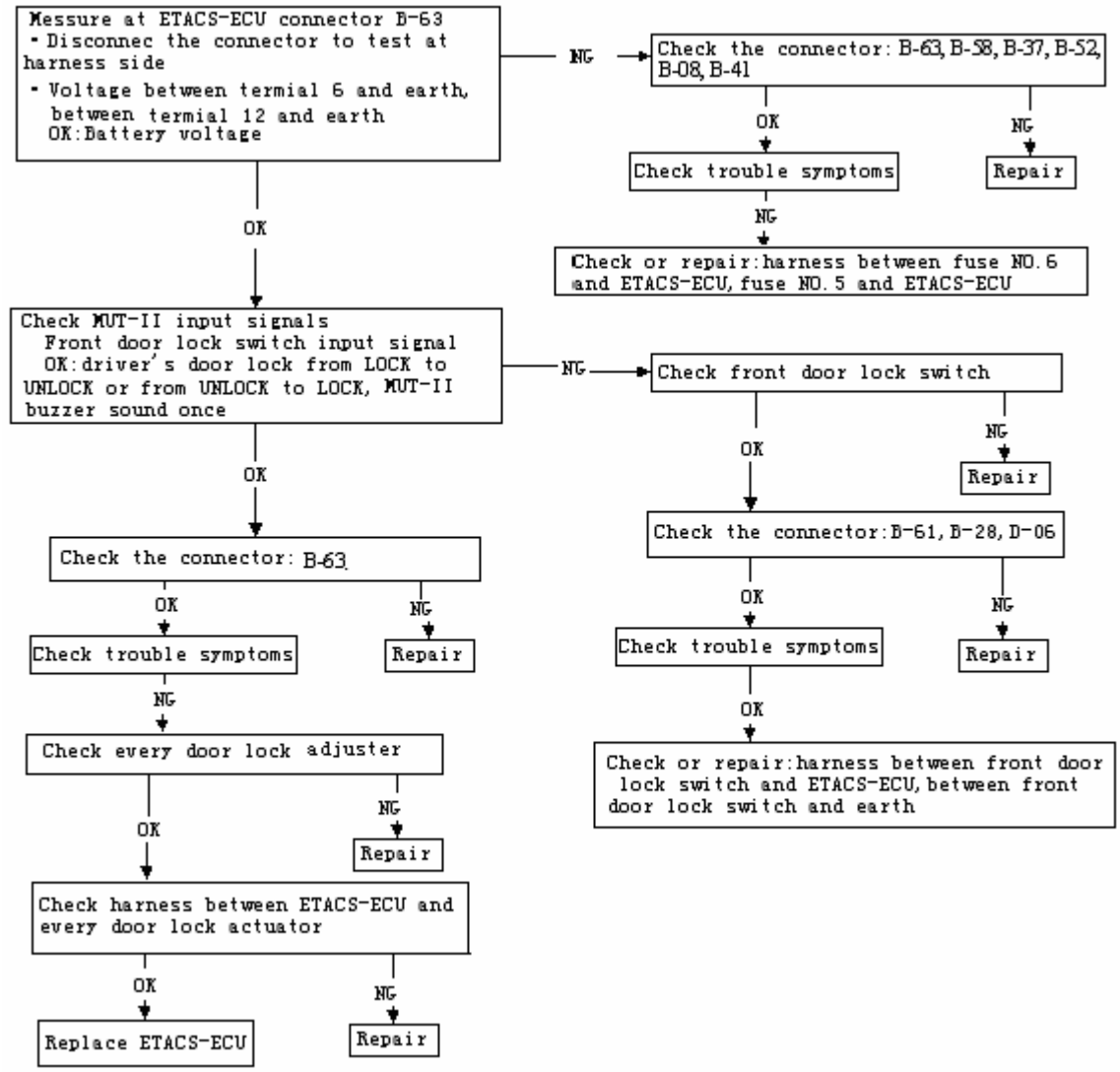


Fig 20—116

Inspection step 10 as Table 20—70、Fig 20—117

Table 20—70

Despite lock or unlock,all door do not act	Probable
Door lock switch or door lock actuator may be defective.Harness or connect fault too.	• Door lock actuator fault • Harness or connector fault

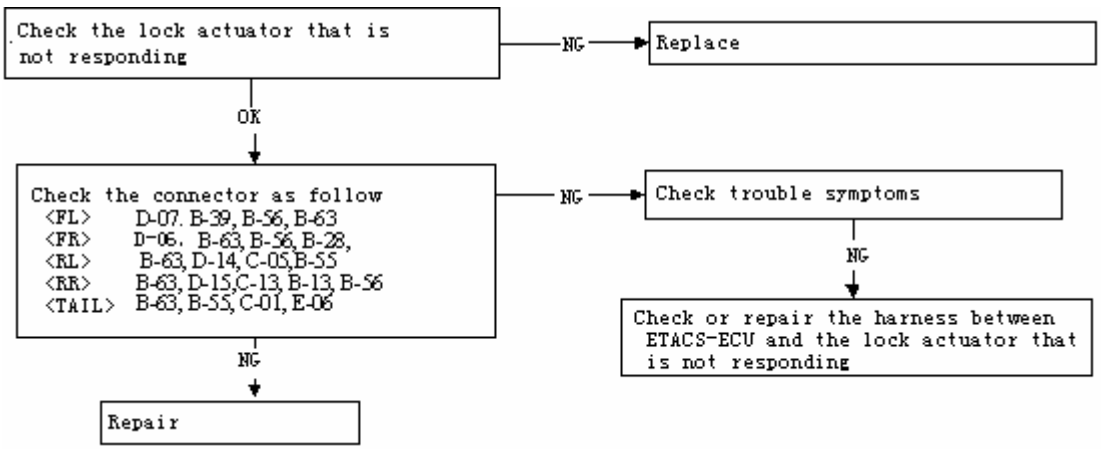


Fig 20－117

- **Inspection**

1. Power window work current inpection

(1) Remove the power window fuse,connect multimeter as Fig 20-118

(2) There are great electric current in the circuitry while starting and closing power window switch.So the measured value should be in the middle of the circuitry except two extremity values.

Standard value: 5±1A(battery voltage:14.5±0.5V时, 25℃)

(3) Departure standard value,refer to trouble analyse.

2 Circuit breaker inpection(install power window motor)

(1) After helding the power window switch “UP”position and closing window completely;operate switch continuously for 10 seconds or longer

(2) Withdraw the hand and press “DOWN” position of power window switch at the same time,if the window down in 60 seconds,can judge the circuit breaker right.

3. Door switch inpection as Fig **20－119**

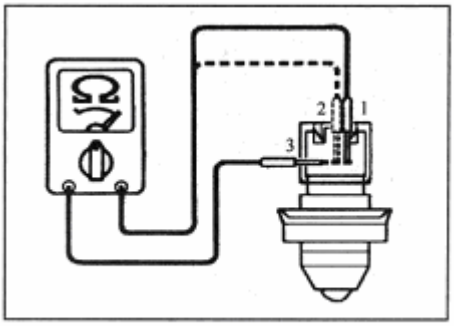


Fig 20-119

Power window subsidiary switch inpection as Fig 20－120、Table 20－71

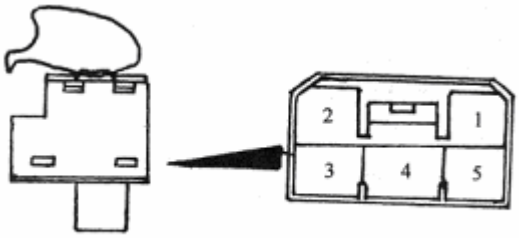


Fig20-120

Table 20-71

Switch	Terminal NO.				
Position	1	2	3	4	5
UP	○	○	○	○	○
DOWN	○		○	○	○
OFF	○	○		○	○

Caution

Power window main switch inpection refer to 20.24 SWS system.

4. Power window relay inspection as Fig **20－121、Table 20－72**

Table 20－72

Voltage of battery	Terminal No.			
	1	3	4	5
turn off	○	○		
power on	⊕	⊖	○	○

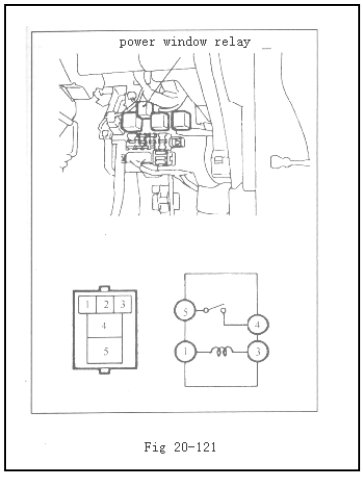


Fig 20-121

5.Check of electric regulator power

(1) Connect the terminal of power with the accumulator; check the power, if it operates smoothly.

(2) Change the polarity of accumulator; check the power, if it operates rollback.

(3) When the power operates badly, change it.

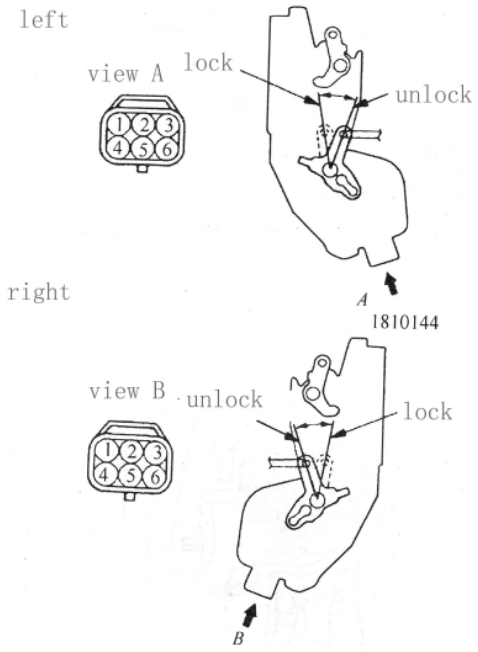


Fig. 20－122

front door latch administer (see Fig. 20－122、Table 20－73、Table20－74)

〈right〉 **Table 20－73**

Latch position	Terminal number		Latch action
	4	6	
lock	⊕	⊖	Lock →unlock
unlock	⊖	⊕	unlock →lock

〈left〉

Table20－74

Latch position		Terminal number					Latch action
		1	2	3	4	6	
administer	lock	———		———	⊖	⊕	Lock →unlock
	unlock	———		———	⊕	⊖	unlock →lock
action sign		○ ———		○			
	———	———	○	○			

6. Rear door latch administer, see Fig. 20－123、Table20－75、Table 20－76。

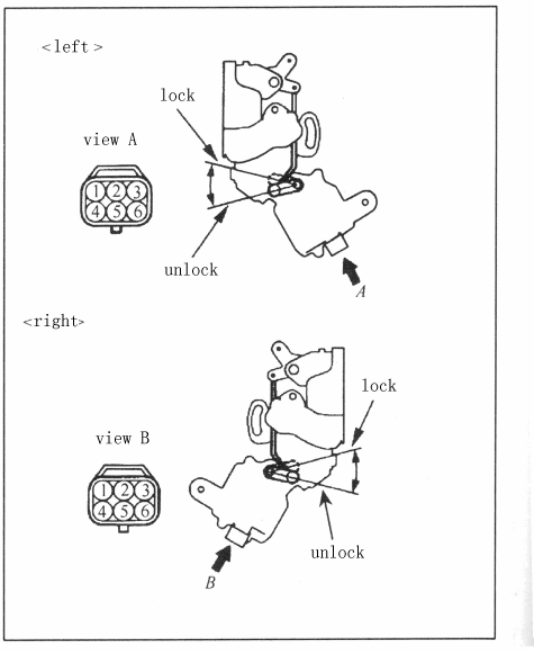


Fig. 20－123

〈left〉 **Table 20－75**

Latch position	Terminal number		Latch action
	2	3	
lock	⊕	⊖	Lock →unlock
unlock	⊖	⊕	unlock →lock

〈right〉 **Table20－76**

Latch position	Terminal number		Latch action
	2	3	
lock	⊖	⊕	Lock →unlock
unlock	⊕	⊖	unlock →lock

7. Tailgate latch administer, see Fig. 20－124、Table 20－77。

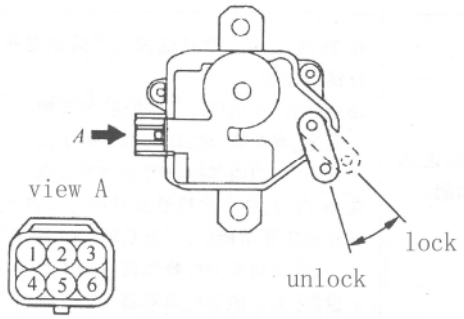


Fig. 20－124

Table 20－77

Latch position	Terminal number		Latch action
	2	3	
lock	⊕	⊖	Lock →unlock
unlock	⊖	⊕	unlock →lock

8. Tailgate on-off see Fig. 20－125、Table 20－78。

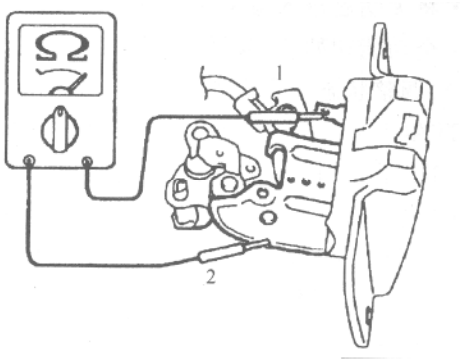


Fig.20-125

Table 20－78

Switch position	Terminal number	
	1	2 earthing
ON	○——○	
OFF		

20.23 Keyless Entry System

Special tool as Table 20-79

Table 20—79

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Code registration

- **Troubel diagnosis**

1. Diagnosis function

1) Check input signal point

(1)Input signals can be checked using MUT-II or coltmeter connected to the diagnosis connector.(Refer to 20.1A troubleshooting/inspection service points)

(2) Check switch input signals as following

- Ignition switch(IG1 or ACC)
- Front door switch LH
- All door switch
- Key reminder switch
- Front door lock switch(LH)
- Center door lock LOCK/UNLOCK
- Keyless entry transmitter(LOCK,UNLOCK)

CAUTION
All input signal do not check using the MUT-II,should Consider that diagnosis circuit have problem.

2) ETACS function adjustment point.

The input switchs can be specially conFig.d to disable or enable the functions listed below.The settings are retained even when the battery is disconnected.

- keyless entry function be conFig.d to disable or enable.
- initialization of ETACS all functions

(1) ConFiguration mode selection conditions

Set each switch as follows,the ETACS-ECU's buzzer sounds once and function adjustment mode is seclected.

- Hazard switch:OFF
- **diagnosis control**: ON(connect to MUT-II or connect No1 **diagnosis terminal to earth**)
- Key reminder switch:OFF
- Ignition switch:LOCK(OFF)
- Driver's door switch:OFF(driver's door close)
- . When all conditions , the windshield washer switch is continuously O for ten seconds or longer.

(2) ConFiguration mode cancellation conditions

Any one of the following conditions cancels ETACS-ECU function adjustment mode.

- Diagnosis control:OFF(either disconnect MUT-II or disconnect diagnosis connector terminal

1 from earth)

• Key reminder switch:ON(ignition key remover)

• Ignition switch:any positon except LOCK(OFF)

• Driver’ s door switch: ON (driver;s door open)

• No adjustment made after entry to function adjustmen mode for more than 3 minutes(within three minutes of entry to function adjustmen mode, the inspect operation should be done again).

.

• Other buzzer sounds input

(3) All functions **adjustment** as **Table 20-80**

Table 20—80

Function	Adjustment procedure
Keyless entry system hazard answerback function	Turning the transmitter LOCK switch ON twice within two seconds inverts the keyless entry system’ s locked hazard answerback function, toggling it between enabled and disabled. • When function enable:Buzzer sounds once • When function disenbled:Buzzer sounds twice Turning the transmitter UNLOCK switch ON twice within two seconds inverts the unlocked hazard answerback function, toggling it between enabled and disabled • When function enable:Buzzer sounds once • When function disenbled:Buzzer sounds twice
Initializing the above functions(Enable)	When the windshield washer switch is held continuously On for 20 seconds or longer, the buzzer sounds twice and all the functions are initialized((The “function adjustment mode” seleted buzzer sounds after 10 seconds, but the switch must be kept on for 20 seconds to achieve initialization of all functions)

2.Trouble symptoms Table (as Table 20—81)

Table20—81

Trouble symptom	Inspection sequence
Do not lock or unlock using transmitter	1
Can lock or unlock door using transmitter, but room lamp or turn signal lamp do not light.	2
Code registration fault	3
Power window do not work(LOCK, UNLOCK act all)using transmitter	4

3 TROUBLE SYMPTOMS INSPECTION SEQUENCE

Inspection sequence 1 as Table 20—82, Fig 20—126

Table20—82

Do not lock or unlock door using transmitter	**Probable cause**
The transmitter, ETACS-ECU fault or ETACS-ECU and J/B connection fault. self-buy transmitter bring on the ill input voltage from ETACS-ECU, causing ETACS-ECU do not receive LOCK and UNLOCK inptut signals. Otherwise, either key reminder	• Transmitter fault • ETACS-ECU fault • Harness or connector fault • Key reminder switch fault • Door switch fault • ETACS-ECU and J/B connect fault

switch circuit or door switch circuit fault.	• self-buy transmitter bring on the ill input voltage from ETACS-ECU

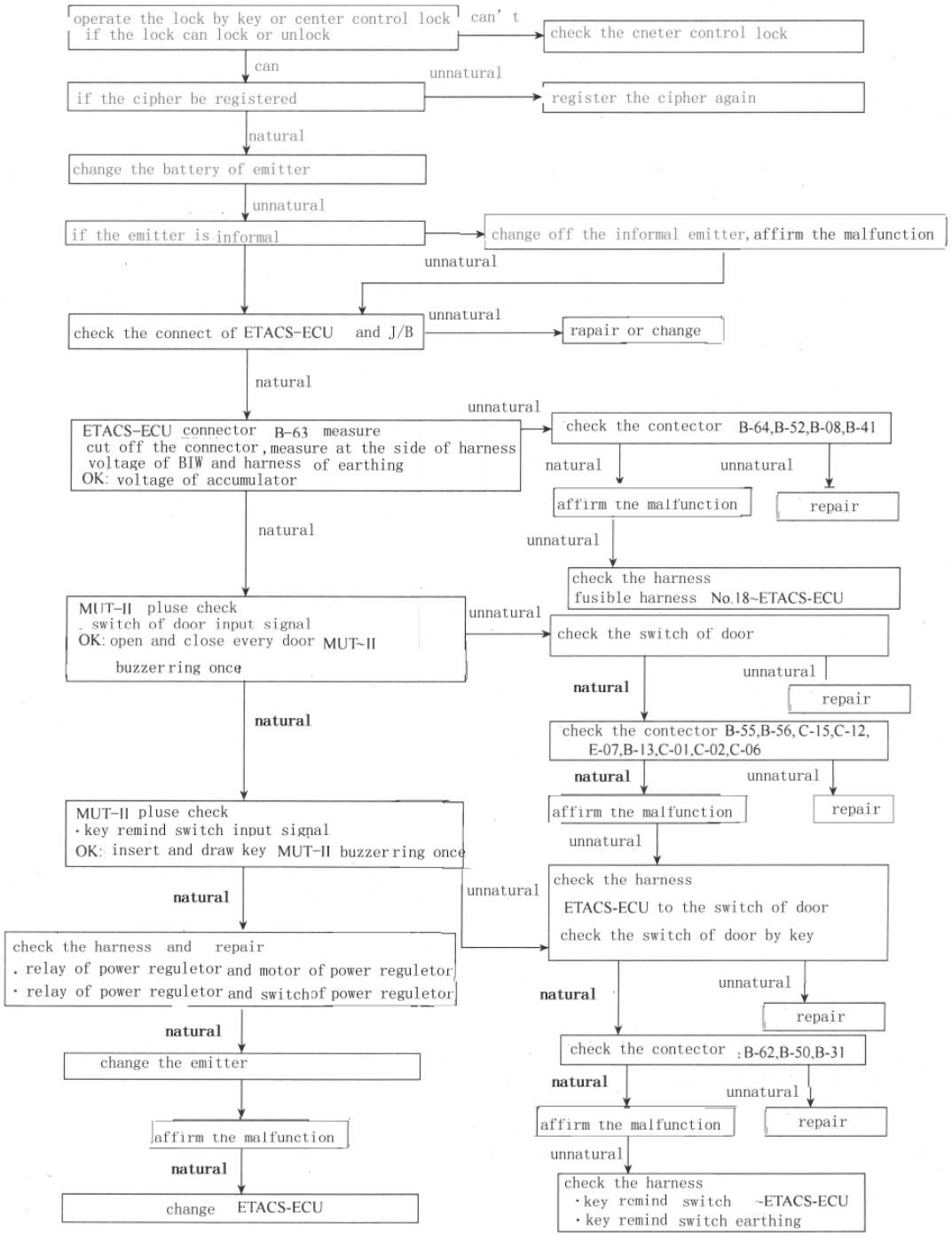


Fig. 20-126

CAUTION
Replacing keyless entry transmitter or ETACS-ECU can lead up to encrypted code

Inspection sequence 2 as Table 20—83,Fig 20—127

Table20—83

Can lock or unlock door using transmitter,but room lamp or turn signal lamp do not light.	Probable cause
Room lamp and turn signal lamp do not light all, ETACS-ECU or driver’s door lock switch may be defective Only one do not light,room lamp or turn lamp circuit may be defective	• ETACS-ECU fault • Driver’s dool lock gearing fault • Turn signal lamp bulb fault • Harness or connector fault

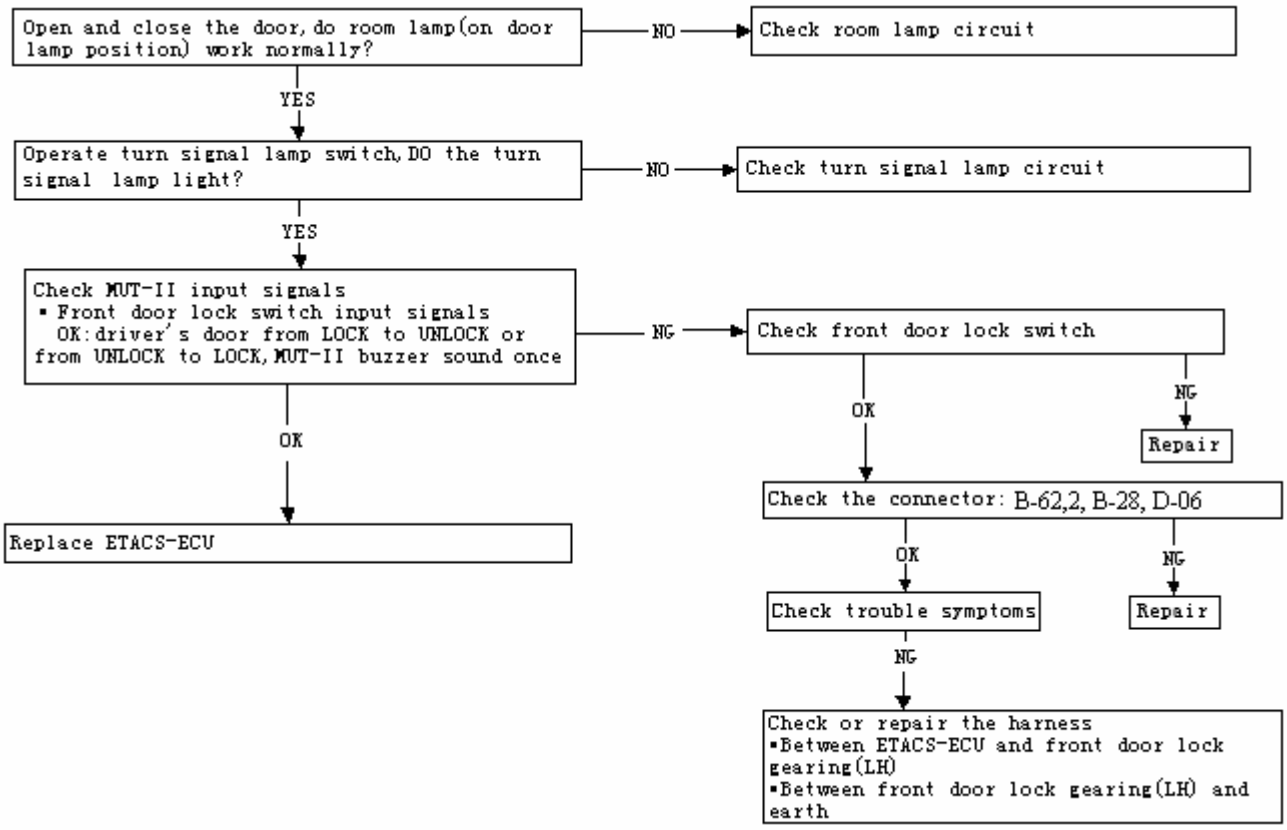


Fig 20—127

Inspection sequence 3 as Table 20—84,Fig 20—128

Table20—127

Code registration fault	Probable cause
Maybe MUT-II connector fault.Ether ETACS-ECU or input circuit be defective	• MUT-II fault • ETACS-ECU fault • Harness or connector fault

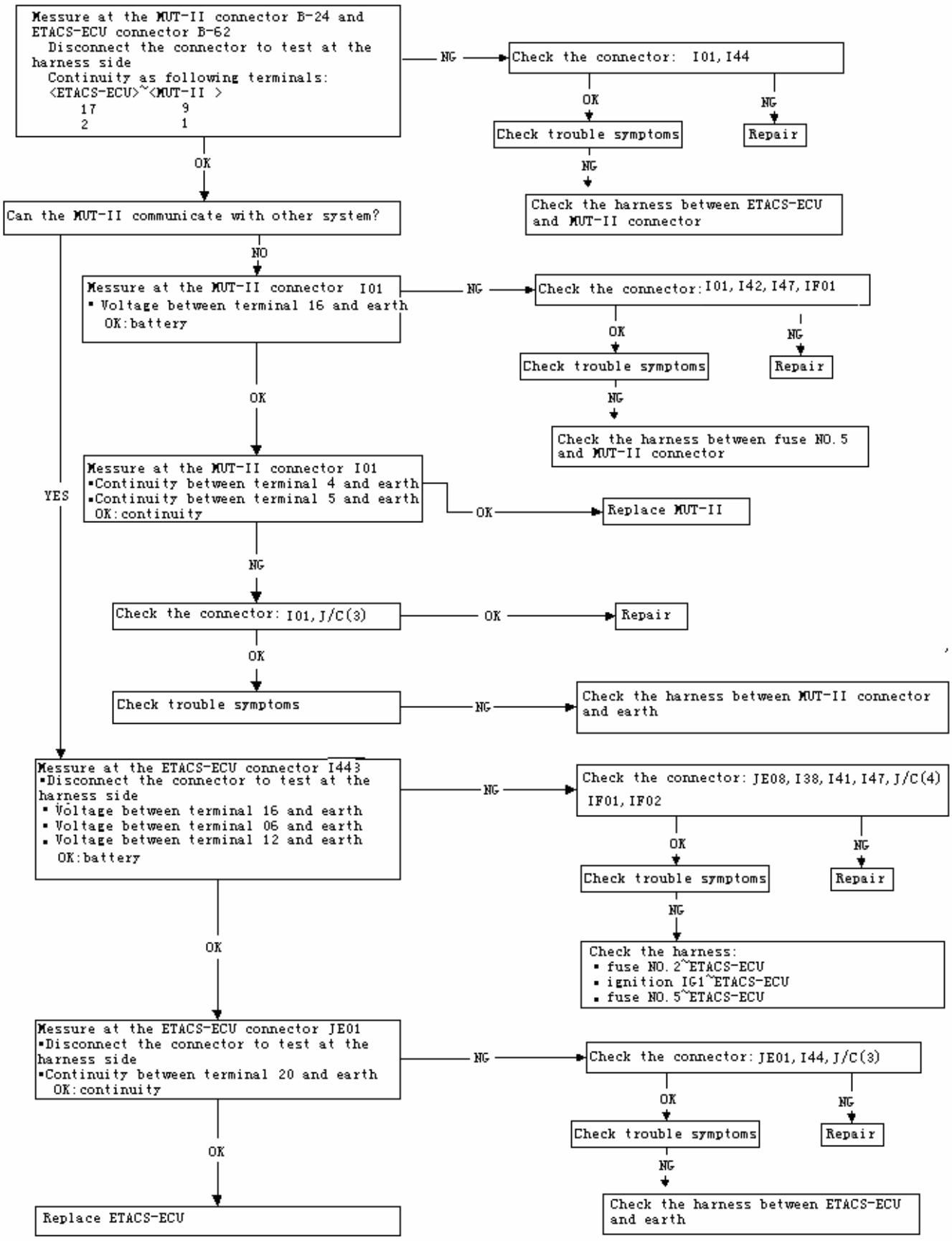

Messure at the MUT-II connector B-24 and ETACS-ECU connector B-62
Disconnect the connector to test at the harness side
Continuity as following terminals:
<ETACS-ECU>~<MUT-II >
17 9
2 1
NG
Check the connector: I01, I44
OK
Check trouble symptoms
NG
Repair
NG
Check the harness between ETACS-ECU and MUT-II connector
OK
Can the MUT-II communicate with other system?
NO
YES
Messure at the MUT-II connector I01
• Voltage between terminal 16 and earth
OK: battery
NG
Check the connector: I01, I42, I47, IF01
OK
Check trouble symptoms
NG
Repair
NG
Check the harness between fuse NO. 5 and MUT-II connector
OK
Messure at the MUT-II connector I01
•Continuity between terminal 4 and earth
•Continuity between terminal 5 and earth
OK: continuity
OK
Replace MUT-II
NG
Check the connector: I01, J/C(3)
OK
Repair
OK
Check trouble symptoms
NG
Check the harness between MUT-II connector and earth
Messure at the ETACS-ECU connector I443
•Disconnect the connector to test at the harness side
• Voltage between terminal 16 and earth
• Voltage between terminal 06 and earth
• Voltage between terminal 12 and earth
OK: battery
NG
Check the connector: JE08, I38, I41, I47, J/C(4) IF01, IF02
OK
Check trouble symptoms
NG
Repair
NG
Check the harness:
• fuse NO. 2~ETACS-ECU
• ignition IG1~ETACS-ECU
• fuse NO. 5~ETACS-ECU
OK
Messure at the ETACS-ECU connector JE01
•Disconnect the connector to test at the harness side
•Continuity between terminal 20 and earth
OK: continuity
NG
Check the connector: JE01, I44, J/C(3)
OK
Check trouble symptoms
NG
Repair
NG
Check the harness between ETACS-ECU and earth
OK
Replace ETACS-ECU

Fig 20—128

Inspection sequence 4 as Table 20—84、Fig 20—129

Table 20—85

Power window do not work(LOCK,UNLOCK act all)using transmitter	Probable cause
Maybe communication fault	• ETACS-ECU fault • Power window main switch fault • Harness or connector fault

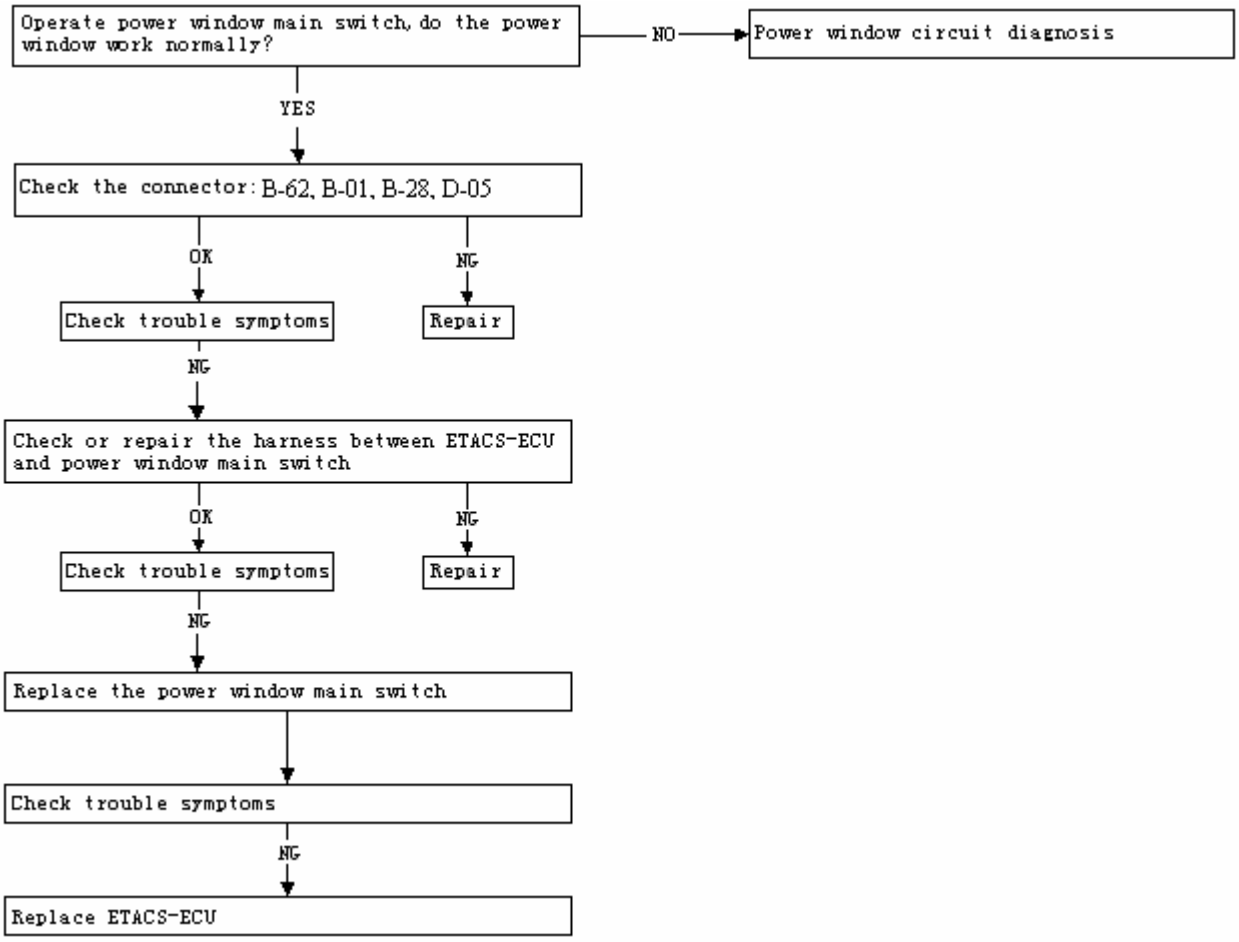


Fig 20—129

4. Keyless entry system

Removal and installation

Removal sequence as Fig 20-130

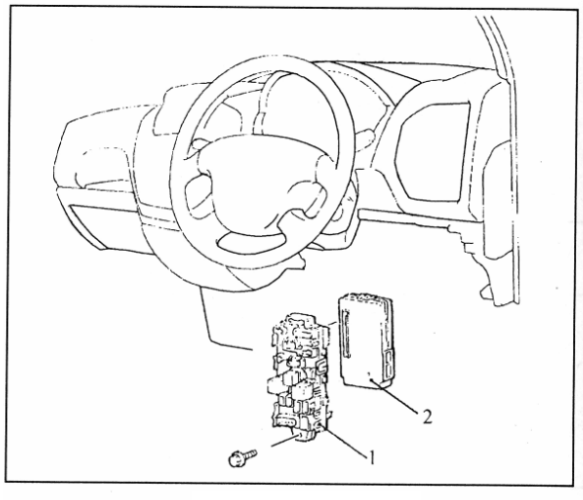


Fig.20-130

1. J/B Box; 2. ETACS-ECU

●Transmitter

Hang on the key chain.

● Battery installation

Battery [+] toward top when replace the battery

● Battery type

Panasonic (CR2032, 3V) lithium battery.

●Code registration method

Need apply for ETACS' s EEPROM to code registration in the following situation.

・Replace transmitter and ETACS-ECU.

・Adding transmitter

・Because of fault,confer code registration fault

EEPROM memorizer can deposited four code.after code registered first, previous the codes are deleted.So when register two or more transmitter code or add transmitter,all the transmitters must register again.

●Code registration sequence

1. Open the door normally using the key.

2 Insert the ignition key to the ignition key cylinder.

3 Connect the MUT-II to the diagnosis connector.

Caution
When connect or disconnect the MUT-II,the ignition must on LOCK(OFF) position.

4. After connec the MUT-II,please press hazard switch six times in ten seconds. as Fig 20-131

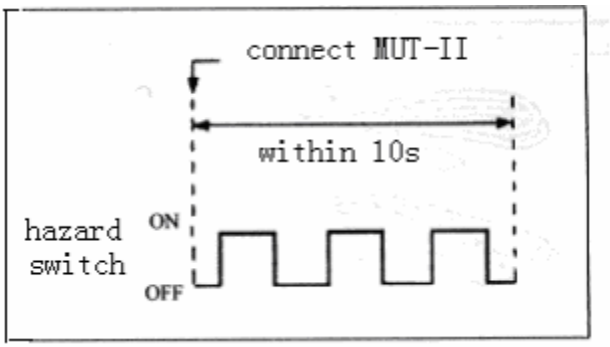


Fig.20-131

Caution
(1) After press hazard switch six times,the door lock and unlock once,enter the registration state. (2)The hazard switch change one time after pressing it from 'OFF' to 'ON' position.

5.Press the transmitter switch on. Press the the transmitter switch two times within 10 seconds again,the code register successfully.

6.After code registration over, can lock and unlock door once automatically (LOCK and UNLOCK)

7. Two or more transmitter register and add transmitter,when registration begin,all transmitter must finish register in 1 minute(registration method as first)

8 .Any one of the following conditions end the registration state

- Four transmitter code register
- enter registration state for 1 mintie
- disconnect MUT-II connector(disconnect earth line)
- Pull out ignition key

9 .After code registration,do work as following,affirm keyless entry system act or not.

- Pull out ignition key
- Close all door

20.24 Smart Wiring System(SWS)

●Communication circutiry

Communication in front ECU,ETACS-ECU、center display (optional), column ECU. (as Fig20—132)

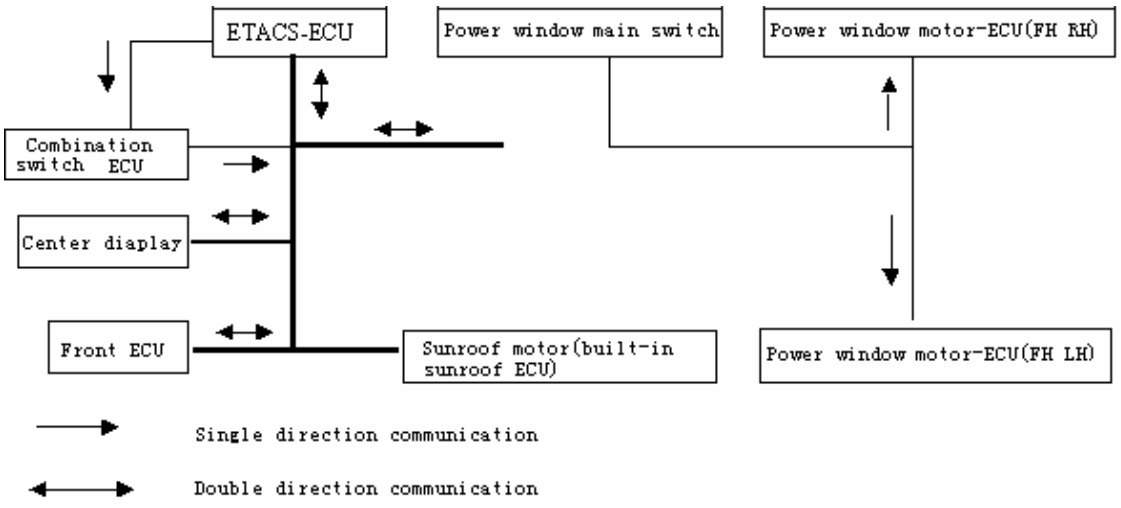
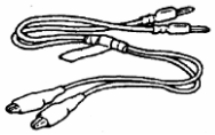
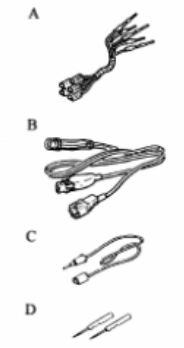


Fig 20—132

Special tools as Table20—86 Table 20—86

Tool	Number	Name	Use
	MB91502	MUT-II subassembly	For SWS inspections(diagnosis code display and input signal check by MUT-II)
	MB991529	Diagnosis code check harness	Repair by using simply checking ways.

	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Check connector: A: Check harness B: LED harness C: LED harness adapter D: Probe	Fuel guage check simply. Water temperatur meter check simply. A: For checking connector pin contace voltage B: For checking power supply circuits C: For checking power supply circuits D:For connection to commercially available testers

TROUBLESHOOTING

1. Trouble diagnosis basic procedure.

Refer to 20.1A troubleshooting/inspection service points

2 Trouble diagnosis function

1) Reading diagnosis

Read the diagnosis codes using MUT-II or simple diagnosis mode.

Refer to 20.1A troubleshooting/inspection service points

Connect MUT-II to the 16-pin diagnosis connector (black).

2) Trouble diagnosis codes cleanup.

Refer to 20.1A troubleshooting/inspection service points.

3) Troubleshooting/inspection by using simple diagnosis mode.

(1)Enter switch diagnosis state using simple diagnosis mode.

Refer to 20.1A troubleshooting/inspection service points.

(2) Can check switch input signal in this mode.

The switch can be checked as Table 20-87.

Table 20—87

Input signal		Buzzer or LED operation condition
ETACS	Ignition switch(IG1)	When ignition switch turned from OFF to ON
	Ignition switch(ACC)	When ignition switch turned from OFF to ON
	Front door switch (Front,Lh side)	When driver’s door opened from closed
	ALL door switchs	When any door opened when all doors were closed
	Key reminder switch	When ignition key is removed from the ignition key cylinder(from the inserted position)
	Driver’s door lock switch	When driver’s center lock knob is moved from the LOCK to UNLOCK or from UNLOCK to LOCK
	Hazard lamp switch	When switch truned from OFF to ON

	Stop lamp switch	Steering the handel from another position to R(reverse) position.
	Keyless entry transmitter (LOCK, UNLOCK)	When switch truned from UNLOCK to LOCK or from OFF to ON
Combination switch	Travel lamp switch	Illumination switch turned to driver positon
	Passing switch	When switch truned from OFF to ON
	Dimmer switch	
	Right-hand turn signal lamp switch	
	Left-hand turn signal lamp switch	
	Front windshield mist wiper switch	
	Front windshiel wiper switch	
	Front windshield wiper intermittent timing switch	
	Front windshield wiper LO speed switch	
	Front windshield wiper HI speed switch	
	Rear windshield wiper intermittent timing switch	
	Rear windshield washer switch	
Power window main switch	All door switchs	
Center display(optional)	All switchs	
Sunroof(optional)	All switchs	

3 Diagnosis code Table (Table 20—88)

Table 20—88

Code NO.	Diagnosis item
11	ETACS-ECU-related failure
12	Combination switch-related failure or fault in connecting to ETACS-ECU
13	Front ECU-related failure or fault in connecting to ETACS
21	Short circuit in communication

4 Diagnosis code inspection procedures

Sequence 1as Table 20—89, Fig 20—133

Table 20—89

Code NO.11 ETACS-ECU-related failure	Probable cause
The ETACS-ECU monitors its own communication data,outputting this diagnosis code when data error occurs 15 consecutive times(for 0.6 seconds). The diagnosis code output stops when the ETACS-ECU confirms that its data was transmitted normally 15 consecutive times(for 0.6 seconds)	• ETACS-ECU fault

Replace ETACS-ECU

Fig 20—133

Sequence 2 as Table20—90、Fig 20—134

Table 20—90

Code NO.12 combination switch-related fault or fault in connecting to ETACS-ECU	Probable cause
The diagnosis code is output when a combination switch output a signal (at least three times a second) that is not in accordance with the transmission request signal from ETACS-ECU. The diagnosis code output stops when the combination switch continuously outputs for one second a signal that accords with the ransmission request signal from ETACS-ECU	• Combination switch fault • Connector fault • Harness fault • ETACS-ECU fault

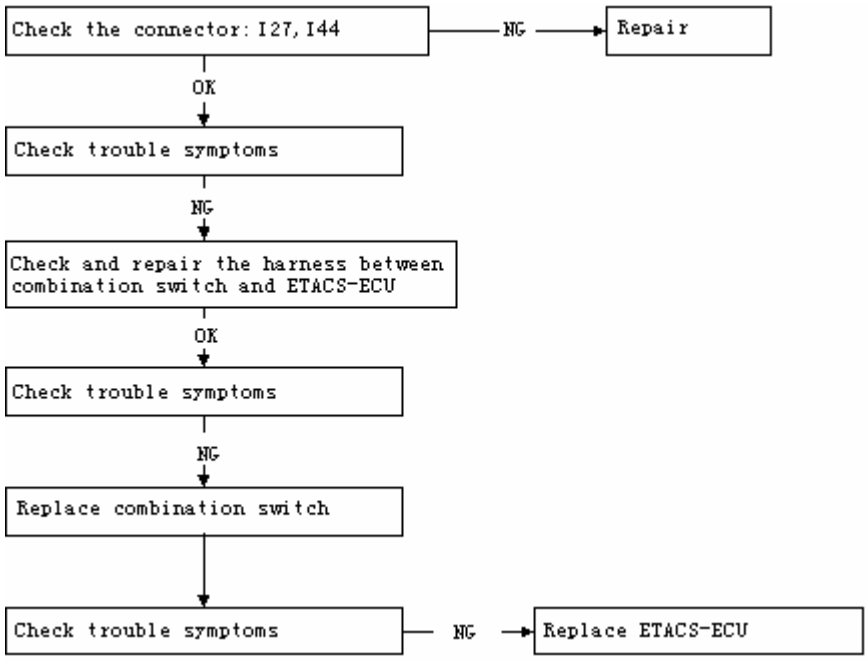


Fig 20—134

Sequence 3 as Table 20—91、Fig 20—135

Table 20—91

Code NO. 13 front ECU-related fault or fault in connection to ETACS-ECU	Prabable cause
This diagnosis code is output when the signal output from the front ECU to ETACS-ECU contains an error for 15 consecutive communication cycles(0.6 seconds). The diagnosis code output stops when the signal output from the front ECU to ETACS-ECU is normal for 15 consecutive communication cycles(0.6 seconds)	• Front ECU fault • Connector fault • Harness fault • ETACS-ECU fault

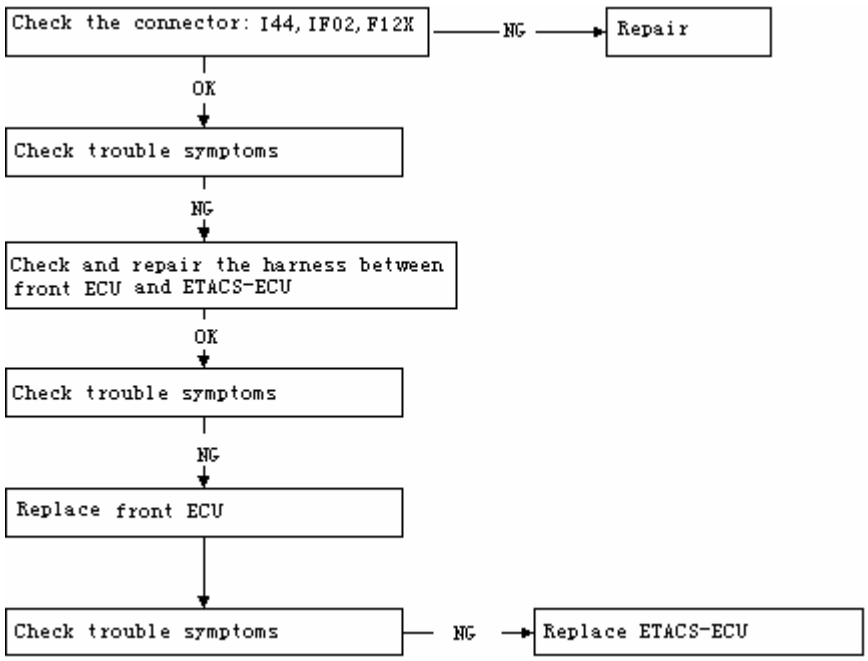


Fig 20—135

Sequence 4 as Table 20—92、Fig 20—136

Table 20—92

Code NO.21 short circuit in communication lines	Probable cause
This diagnosis code is output when the voltage on an SWS communication line goes LOW for 0.3 seconds. The diagnosis code output stops when the ETACS-ECU data line voltage goes HIGH for 0.3 seconds, or when the ETACS-ECU receives a normal signal from another ECU or switch. During the output of this code, other codes are suppressed.	• Front ECU fault • Connector fault • Harness fault • ETACS-ECU fault

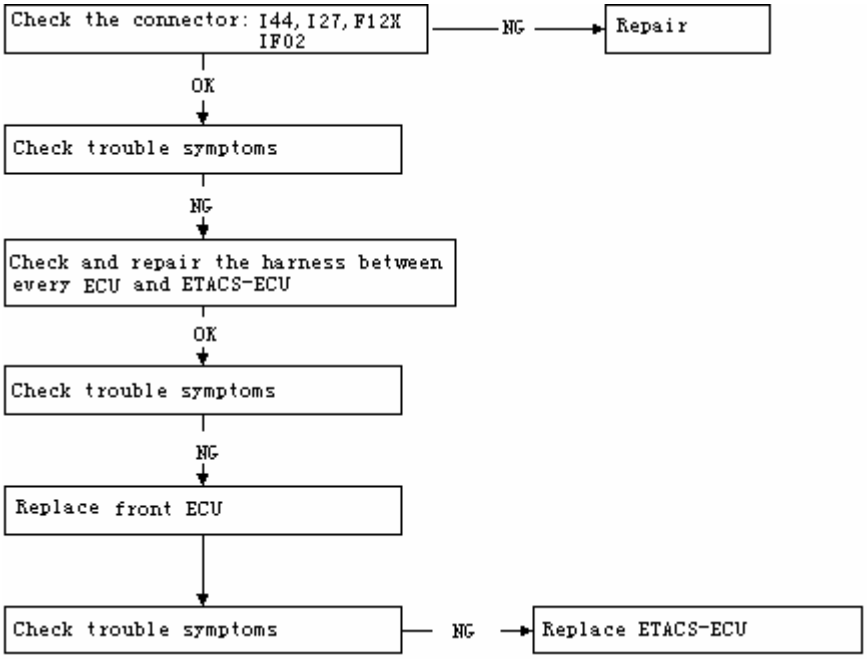


Fig 20-136

5 Trouble symptoms Table(Table 20-93)

Table 20—93

Diagnosis symptoms	Inspection sequence
No commiunition with MUT-II	1

6 Inspection sequence (Table 20—94、Fig 20—137)

Table 20—94

No commiunition with MUT-II	Probable cause
Either the ETACS-ECU power supply circuit system or the harness or connector between the diagnosis connector and ETACS-ECU may be defective	• Harness or connector fault • ETACS-ECU fault

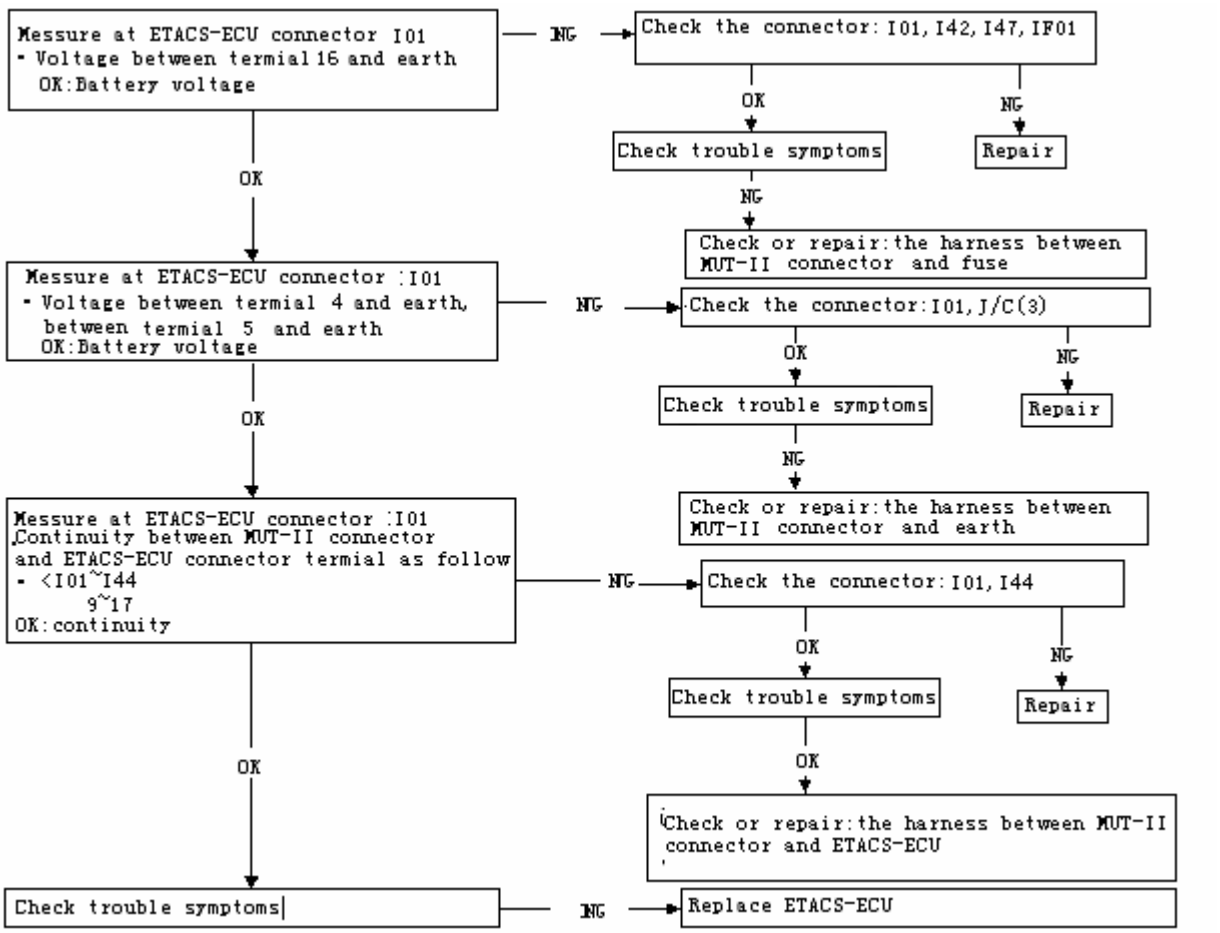

Messure at ETACS-ECU connector I01
- Voltage between termial 16 and earth
OK:Battery voltage
NG
Check the connector: I01, I42, I47, IF01
OK
NG
Check trouble symptoms
Repair
NG
Check or repair:the harness between MUT-II connector and fuse
OK
Messure at ETACS-ECU connector :I01
- Voltage between termial 4 and earth, between termial 5 and earth
OK:Battery voltage
NG
Check the connector:I01, J/C(3)
OK
NG
Check trouble symptoms
Repair
NG
Check or repair:the harness between MUT-II connector and earth
OK
Messure at ETACS-ECU connector :I01
Continuity between MUT-II connector and ETACS-ECU connector termial as follow
- <I01~I44
9~17
OK:continuity
NG
Check the connector: I01, I44
OK
NG
Check trouble symptoms
Repair
OK
Check or repair:the harness between MUT-II connector and ETACS-ECU
OK
Check trouble symptoms
NG
Replace ETACS-ECU

Fig 20—137

21 Air Conditioning System

21.1 General Description

Air conditioning system equipped in the vehicle is full bidirectional air-mixed system with high performance and low noise. The system is capability to blow air to face area independently and cooling air . Basically,, the system is same as aiir conditioning system generally used, but new type of refrigerant is applied in the system for restriction for old type of refrigerant with 'CL' element.HFC,so use new refrigeration system. material parameter show in table 21-1. The main parts which construct the system are shown in Tabel 21-1.

Table 21-1

Item	Model
Heater	Full bidirectional air-mixed
Heater control panel assembly	Dial
Compressor	Rotary vane <MSC90>
Refrigerant(g)	R-134a，550±25

SAFTY NOTICE

R-134a refrigerant is a kind of HFC compound, which uses chlorine atom substitute hydrogen atom,so it is not injure to ozone layer.

Both liquid state and gas state of R-134a refrigerant are translucent and achromatism.it's boiloff point is -29.8℃,so it will boiloff under normal temperature and normal pressure.This gas overweight than air,not flammable,not volatile.

When handling R-134a, pay attentions as follows：

Caution

1.Wear goggles to protect your eyes，whenever the cooling system is repaired.
At a state of normal temperature and normal pressure, R-134a is evaporated so rapidly that anything that touch the refrigerant may be frozen. So be careful to operate it at anytime. Keep liquid refrigerant out from your skins, especially your eyes.Wear goggles to protect your eyes whenever you do anyting that is relative to cooling system, and prepare a bottle of asepsis mineral oil. In case liquid refrigerant enters your eyes, drop some mineral oil on eyes for cleaning refrigerant because of R-134a being absorbed rapidly by oil. Moreover use quantities of cool water to wash your eyes. After handling by yourself, call a doctor immediately for help to prevent them from inflammation.

2.Don't heat R-134a refrigerant higher than 40℃
Generally, it is necessary to make the proper level of temperature when charging or refilling refrigerant, so that the pressure of refrigerant in container is higher than the pressure of refrigerant in A/C system.
So use hot water below 40℃ in barrel or large pan to heat the container fully. Don't heat the container by jet-lamp or other ways to lift temperature and pressure of the container so that don't exceed the temperature prescribed. Don't weld or wash by steam near parts or pipes of A/C system.

3.Keep the service can upright when charging A/C system.
Keep the service can upright when charging. If the service can is lying or inverted, liquid refrigerant may be drawn into the compressor, which may damage it.

4.Use special leakage inspection meter for R-134a to inspect leakage of refrigerant.

5.Do not touch bright metals with liquid refrigerant.
Refrigerant can tarnish the surfaces of bright metals including chrome steel, and refrigerant combined with moisture is corrosive heavily to surfaces of all metals.

21.2 Service Specifications

Standard value (see table 21-2)

Table 21-2

Item		Standard value
Idling speed(rpm):		650±50
Idling speed(rpm):	AC ON (Low-load)	700±50
	AC ON (Low-load)	850±50
Register resistance (for	HI-LO(between terminals 1 and 3)	2.54

blow motor)(Ω)	HI—ML（between terminals 1 and 6）	1.24
	HI—MH（between terminals 1 and 4）	0.6
A/C compressor magnetic clutch clearance (mm)		0.3~0.5
Refrigerant temperature switch operating temperature (℃)	ON	Slightly below 150
	OFF	150 or higher(until temperature falls to 120 when OFF)

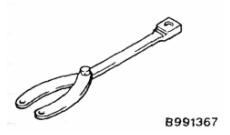
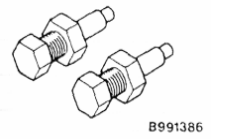
Lubricants (see table 21-3)

Table21-3

Item	Specified lubricants	Quantity
Compressor oil（cc）	SUN PAG56	140{140}
Pipe coupling（cc）	SUN PAG56	As requird
Refrigerant （g）	R134a(HFC-134a)	550±25

Special tools (see table 21-4)

Table 21-4

Tool	Number	Name	Use
	MB991367	Special spanner	For use the air conditioner compressor armature locknut
	MB991386	Pin	For use the air conditioner compressor armature locknut

TROUBLESHOOTING

Inspection procedures (see table 21-5)

Table 21-5

Inspection sequence	Trouble				
	1. A/C fails to work at all.	2.tempreture inside is not drop when A/C is working	3.blower fails to work	4.blower fails to stop	5. Air cannot be switched between inside and outside
Fuse	1	—	—	1	1
Harness connectors	2	—	—	2	2
Refrigerant	3	1	—	—	—
Compressor relay	4	6	—	—	—
Magnetic clutch	5	7	—	—	—
Refrigerant temperature switch	6	2	—	—	—
A/C switch	7	—	—	—	—
Blower relay	—	—	3	—	—
Blower	—	—	4	—	—
Blower switch	8	—	5	3	3
Registor	—	—	6	4	4
A/C Pressure sensor	9	3	—	—	—
Compressor controller	10	4	—	—	—
Fan controller	—	5	—	—	—
Air selection switch	—	—	—	—	3

Air selection motor	—	—	—	—	4
Engine ECU	11	—	—	—	—

Note ： The number shows check steps.

Troubleshooting（see table 21-6）

Table 21-6

Trouble	Possible cause	Remedy
1. A/C fails to work at all.	Fuse broken	Replace
	Harness connectors faulty	Repair
	leak or excessive charge of refrigerant	Fill. repair or discharge excessive refrigerant
	A/C Compressor relay faulty	Replace
	A/C Compressor Magnetic clutch faulty	Replace
	Refrigerant temperature switch faulty	Replace
	A/C switch faulty	Replace
	Blower switch faulty	Replace
	Compressor controller faulty	Replace ssor controller
	Engine ECU faulty	Replace
2.tempreture inside is not drop when A/C is working	Refrigerant leak	Fill and repair
	Refrigerant temperature switch faulty	Replace efrigerant temperature switch
	Autokinetic Compressor controller faulty	Replace
	Refrigerant Fan controller faulty	Replace
	A/C Compressor relay faulty	Replace
	A/C Compressor Magnetic clutch faulty	Replace
3.blower fail to work	Fuse broken	Replace
	Harness connectors faulty	Repair
	Blower relay faulty	Replace
	Blower faulty	Replace
	Blower switch faulty	Replace
	Registor faulty	Replace
4.blower fail to stop	Fuse broken	Replace
	Harness connectors faulty	Repair
	Blower switch faulty	Replace
	Timing Resistor faulty	Replace
5.inside and outside gas fail to switch	Fuse broken	Replace
	Harness connectors faulty	Repair
	Air selection switch faulty	Replace
	Air selection motor faulty	Replace

2. Inspection at ECU terminal (see Fig. 21-1, Table 21-7)

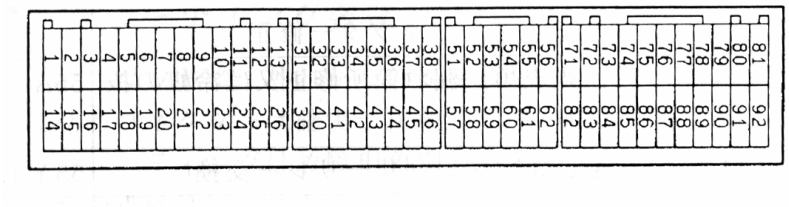


Fig. 21-1

Table 21-1

Terminal no.	Check item	Check when	Normal state
21	Blower controller output	A/C switch：OFF	5V
		A/C switch：ON	0V
22	output	A/C Compressor relay：OFF	0V
		A/C Compressor relay：ON	Battery voltage
45	Compressor controller input	A/C not work	0V
		A/C work	3V or more
42	A/C compressor sensor input	Refer to 21.3	Refer to 21.3
81	A/C compressor sensor power cable	normal	5V
92	compressor sensor earth cable	normal	0V

3.Inspection at compressor controller terminal (see Fig 21-2, Table21-8)

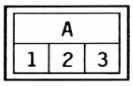


Fig .21-2

Table 21-8

Terminal No.	Check item	Check when	Normal state
1	Engine ECU output	A/C not work	0V
		A/C work	3V or more
2	A/C switch input	A/C switch：OFF or Blower switch：OFF	0V
		A/C switch：ON Ignition switch：ON Blower switch：ON	3V or more
3		Normal	0V

带格式的：两端对齐

带格式的：两端对齐

21.3 On-Vehicle Service

1. REFRIGERANT LEVEL TEST THROUGH PERFORMANCE TEST

The sight glass is the indicator of refrigerant charging amount. Clean the sight glass when look at the flowing state of the refrigerant. Inspect and repair as shown below:

①Start the engine。

②Turn on the A/C switch, and set the temperature selection dial to MAX COOL.

③Set the engine speed to 1500r/min.

④Check the refrigerant level (bubble state) through the sight glass.Refer to Fig. 21-3 and Table 21-9.

⑤Charge refrigerant as insufficient , and take back refrigerant as excessive.

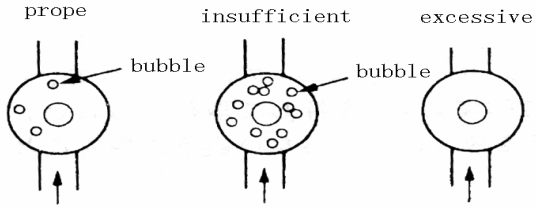


Fig. 21-3

Table 21-9

Item	State
Proper	Bubbles are seen by accident. Bubbles disappear when speed of engine rises slightly.
Insufficient refrigerant	Many bubbles are seen. If refrigerant is extremely insufficient, white bubbles appears.
Excessive refrigerant	No bubbles are seen.

CAUTION
Must operate at the low pressure service valve

2. RECEIVER DRIER TEST

Operate the unit and check the piping temperature by touching the receiver outlet and inlet.
If there is a different in the temperature s, the receiver drier is retricted.
Replace the receiver drier.

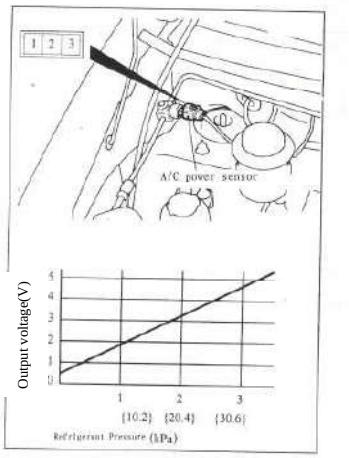


Fig.21-4

3. A/C PRESSURE SENSER CHECK

(1) Install a gauge manifold to the high-pressure side servie valve of the refrigerant line.
(2) Start the engin and operate the system.
(3) Check the voltage between between the pressure sensor terminal 2 and earth. The standard value is shown in Fig.21-4

4. COMPRESSER DRIVE BELT ADJUSTMENT

Refer to the GROUP of Engine Adjustment.

5. CHARGING（see Fig.21-5, Fig.21-6, Fig.21-7, Fig.21-8）

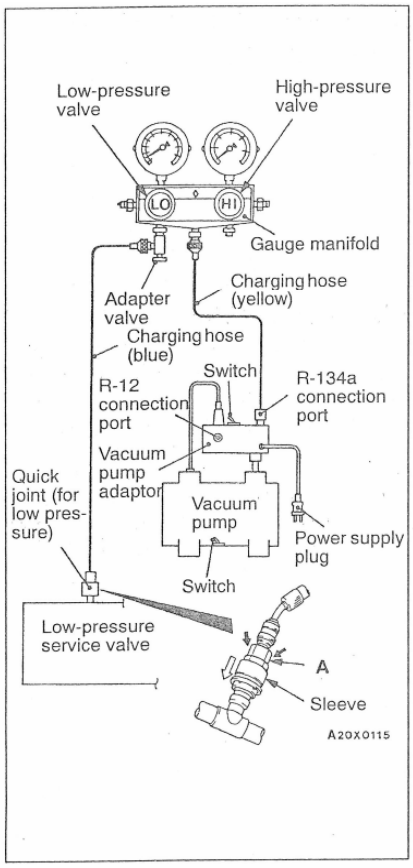


Fig. 21-5

(1) With the handles turned back all the way (valve closed), install the adaptor valve to the low-pressure side of the gauge manifold.

(2) Connect the charging hose (blue) to the adaptor valve.

(3) Connect the quick joint (for low-pressure) to the charging hose (blue).

(4) Connect the quick joint (for low-pressure) to the low-pressure service valve.

NOTE

The low-pressure service valve should be connected to the suction hose。

CAUTION

1. Use tools that are suited to R134a.
2. To install the quick joint, press section “A” firmly against the service valve until a click is heard. When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.

(5) Close the high and low-pressure valves of the gauge manifold.

(6) Install the vacuum pump adaptor to the vacuum pump.

(7) Connect the vacuum pump plug to the vacuum pump adaptor.

(8) Connect the charging hose (yellow) to the R-134a connection port of the vacuum pump adaptor.

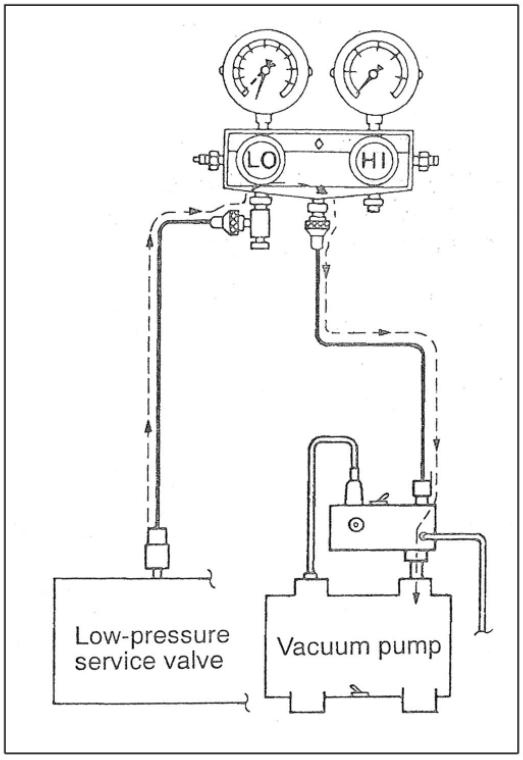
(9) Turn in the handles of adaptor (valve open).

(10) Open the low-pressure valve of the gauge manifold.

(11) Turn the power switch of the vacuum pump to the “ON” position.

NOTE

Even if the vacuum pump power switch is turned to “ON” position, the vacuum pump would not operate because of the power supply connnection in step (7).\



(12) Turn the switch of vacuum pump adaptor to the R134a side to start the vacuum pump.

Caution

Do not run the compressor for evacuation。

(13) Evacuate to a vacuum reading of 100 kPpa (1.0kgf/cm2) or higher (takes Approx. It takes about 10 minutes).

(14) Turn the vacuum pump adapter switch OFF and allow to stand it for 5 minuttes.

Caution

Do not operate the compressor in the vaccuum condition; damage may occur.

(15) Carry out a leake test (Good l if the negative pressure does not drop).

Caution

If the negative pressure drops, increase the tightness of the connections, and then repeat the evacuation Sequences from step (12).

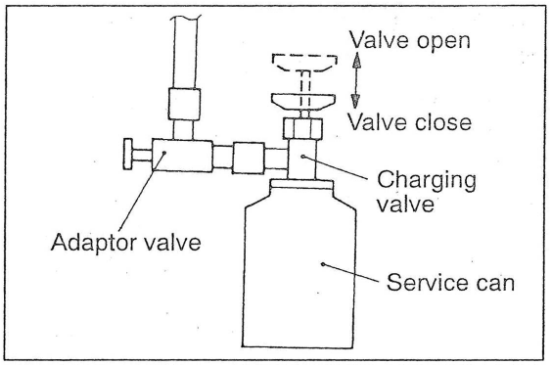


Fig. 21-7

(16) With the handle turned back all the way (valve open), install the charging valve to the service can.

(17) Turn the handle of the adaptor valve back all the way (valve closed), remove it from the gauge manifold and install the service can.

(18) Tighten the handle of the charging valve (valve closed) to puncture the service can.

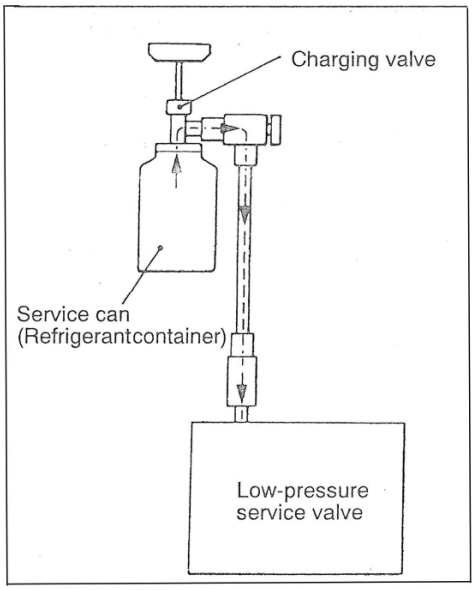


Fig.21-8

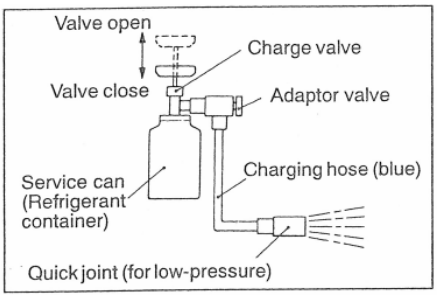


Fig.21-9

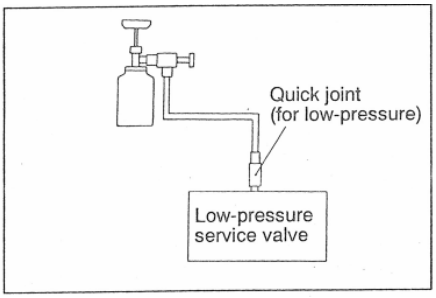


Fig.21-10

(19) Turn the handle of the charging valve back (valve open) and tighten the handle of the adaptor valve (valve open) to charge the system with refrigerant。

(20) If the refrigerant is not drawn in, turn the handle of the adaptor valve back all the way (valve closed)。

(21) Check for gas leaks using a leak detector..

If a gas leak is detected, re-tighten the connections, and then repeat the charging Sequence from step(12)。

(22) Start the engine.

(23) Operate the A/C and set to the lowest temperature (MAX. COOL).。

(24) Fix the engine speed at 1,500rpm..

(25) Tighten the handle of the adaptor valve (valve open) to charge the required volume of refrigerant.

Caution

If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

(26) After charging with refrigerant, turn the handle of the adaptor valve back all the way (valve closed).

(27) Tighten the charging valve handle (valve closed).

Remove the quick joint (for low pressure) from low-pressure charging valve.

NOTE

If the service can is not emptied completivly,keep the handles of the charging valv and adaptor valve closed for the next chargeing.

6. CORRECTING LOW REFRIGEERANT LEVEL IN CASE THE SERVICE CAN IN USED

(1) Install the charge valve with the handle turned all the way back (valve open) to the service can.

(2) Install the adapter valve with the handle turned all the way back (valve closed) to the charging valve.

(3) Connect the charging hose (blue) to the adapter valve.

(4) Connect the charge hose (blue) to the quick joint (for low-pressure).

(5) Tighten the handle of the charge valve (valve closed) and pierce the service can.

(6) Turn the handle of the adaptor to bleed the air.

(7) Install the quick joint (for low-pressure) to the low-pressure service valve.

NOTE

The low-pressure service valve should be connected to the suction hose.

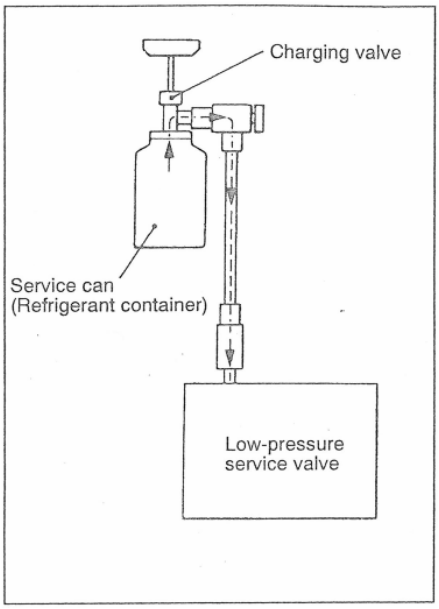


Fig.21-11

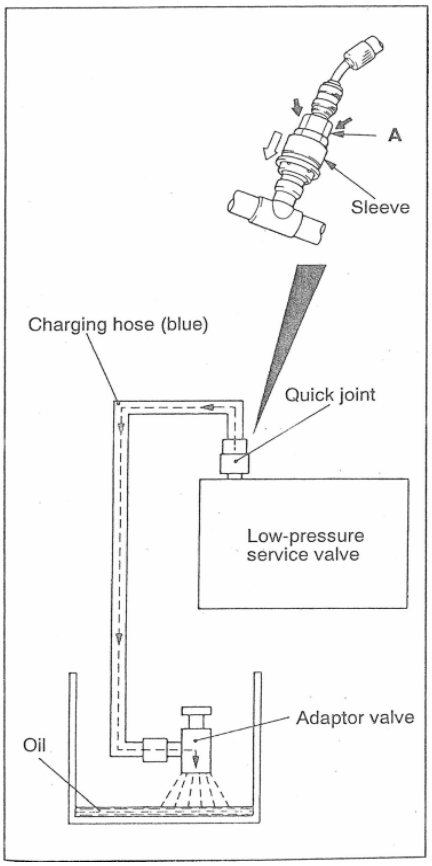


Fig. 21-12

(8) Start the engine.
(9) Operate the air conditioner and set at the lowest temperature (MAX.COOL).
(10) Fix the engine speed at 1,500 r/min.
(11) Tighten the handle of the adaptor valve(valve open), and replenish refrigerant while checking the quantity through the sight glass.

Caution

If the service can is inverted, liquid refrigerant may be draw into the compressor damaging it by liquid compression .Keep the service can upright to ensure that refrigerant in charging in gas state...Keep the service can upright to ensure that refrigerant in charging in gas state.

(12) After replenishing is completed, turn the handle of the adaptor valve all the back(valve close), and remove the quick joint.

NOTE

when there is remainder of refrigerant in the service can, keep it for next use with the charging valve and the valve of the adaptor valve being closed.

7. DISCHARGING SYSTEM

(1) Run the engine at an engine speed of 1,200-1,500 r/min for approximately 5 minutes withe the A/C operating to return to the oil.

NOTE

Returning the oil will be more effective if it is done while driving.

(1) Stop the engine.
(2) Connect the charging hose (blue) to the adaptor valve with the its handle turned back all the way (valve closed)
(3) Connect the quick joint to the charge hose (blue).
(4) Install the quick joint to low-pressure service valve.

NOTE

The low-pressure service valve should be connected to the suction hose.

Caution

To connect the quick joint , press section ”A” firmly against the service valve until a click is heard.

When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.

(5) Place the adaptor valve inside the container and

discharge the refrigerant by opening the handle gradually so that oil does not gush out.

NOTE

Any oil remaining tin the container should be returned to the A/C system.

8. REFILLING OF OIL IN THE A/C SYSTEM

Too little oil will provide inadequate compressor lubrication and cause a compressor failure. Too much oil will increase discharge air temperature.

When a compressor is installed at the factory, it contains 140 ml of refrigerant oil. While the A/C system is in operation, the oil is carried through the entire system by the refrigerant.After discharge refrigerant，Some of this oil will be trapped and retained in various parts of the system.

When the following parts are changed, it is neccessary to add oil to the system to replace the oil being removed with the component.

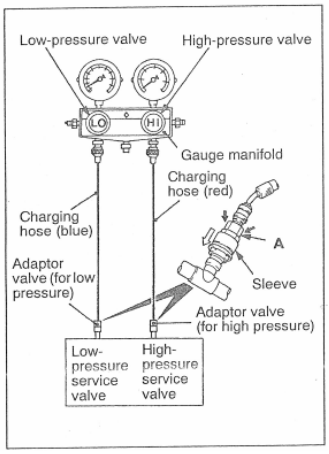


Fig.21-13

Compressor oil: SUN PAG 56

Quantity:

Condenser： 15ml

Evaporator： 60 ml

Piping： 10 ml

Receiver： 10 ml

9. PERFORMANCE TEST

(1) The vehicles to be tested should be in a place that is not in direct sunlight.

(2) Close the high and low-pressure valve of the gauge manifold.

(3) Connect the charging hose (blue) to the low-pressure valve and connect the charging hose (red) to the high-pressure valve of the gauge manifold.

(4) .Install the quick joint (for low-pressure) to the charging hose (blue), and connect the quick joint (for high-pressure) to the charging hose (red).

(5) Connect the quick joint (for low-pressure) to the low-pressure service valve and connect the quick joint (for high-pressure) to the high-pressure service valve.

NOTE

The high pressure service valve is on liquid pipe A and the low pressure service valve is on the suction hose.

Caution

To connect the quick joint, press section “A” firmly against the service valve until a clatter is heard.When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.

(6) .Start the engine.

(7) Set the controls to the A/C as follows:

- A/C switch： ON position
- Mode selection: FACE position
- Temperature control: MAX COOL position
- Air selection: RECIRCULATION position
- Blower switch: HI position

(8) With magnetic clutch engaged, keep engine speed to 1500r/min.

(9) Ensure the high pressure within 1667~1765kPa（17~18kgf/cm2）

NOTE

Cool the condenser by fan if the high pressure is higher than above value. If the high pressure is lower than above value, cover the condenser by other thing so that adjust ventilation and pressure.

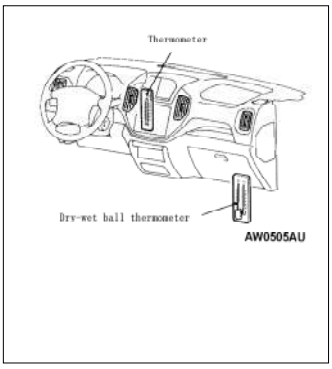


Fig.21-14

(10) Insert a thermometer in the central air outlet of instrument panel, and install a dry-wet ball thermometer into air inlet port(see Fig21-14).

NOTE

1. Cooled air must be blown to the position of feeling temperature of thermometer.
2. Put the dry-wet ball thermometer to the place where cooled air can not blow directly.

(11) After the temperature of air outlet is stable (operating A/C for 10~15minutes), measure the temperatures of air outlet and air inlet.

(12) Draw a point using the readings in step 11 on below figure; it is proper if the point is below the judgmentline. (See fig 21-15)

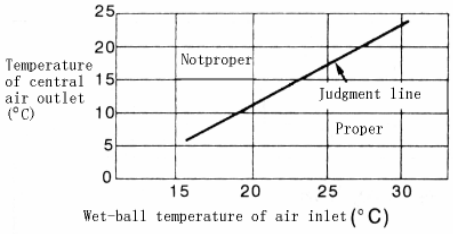


Fig.21-15

10. REFRIGERANT LEAK REPAIR

LOST CHARGE

If the system has lost charge due to a leak::

(1) Evacuate the system;(refer to foregoing contents)
(2) Charge the system with approximately 0.5kg of refrigerant;
(3) Check for leaks;
(4) Discharge the system;
(5) Repair leaks;
(6) Replace receiver.

Caution

Replacement filter-drier units must be sealed while in storage. The drier used in these units will saturate water quickly upon exposure to the atmosphere. When installing a drier, have all tools and supplies ready for quick reassembly to avoid keeping the system open any longer than necessary.

(7) Evacuate and charge system.

LOW CHARGE

If the system has not lost all of its refrigerant charge; locate and repair all leaks. Find the leak (because of an especially low charge) by adding refrigerant to increase the system pressure if necessary. It is possible to repair the leak without discharging the system. Refer to the sequence for correcting low refrigerant level.

HANDLING TUBING AND FITINGS

Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. The following precautions must be observed. The system must be completely discharged before opening any fitting of connection in the cooling system. Open fitting with caution even after system has been discharged. If any pressure is noticed as a fitting is loosened, allow trapped pressure to bleed off very slowly.

Never attempt to rebend formed lines to fit. Use the correct lines for the installation you are servicing. A good rule for the flexible hose lines is that keep the radius of all bends at least 10 times the diameter of the hose.

Sharper bends will reduce the flow of refrigerant.

The flexible lines should be routed so that they are at least 80mm from the exhaust manifold.

It is good practice to inspect all flexible hose lines at least once a year to make sure they are in good condition and properly routed.

Unified plumbing connections with O-rings, these O-rings are not reusable.

11. COMPRESSOR NOISE

You must first know the conditions when the noise occurs. These conditions are: weather, vehicle speed, in gear or neutral, engine temperature or any other special conditions.

Noises that develop during A/C operation can often be misleading. For example: what sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose clutch assembly. Verify accessory drive belt tension (power steering or alternator).

ADJUSTMENT

(1) Select a quiet area for testing. Duplicate conditions as much as possible. Switch compressor on and off several times to clearly identify compressor noise. To duplicate high ambient conditions (high head pressure), restrict air flow through condenser. Install manifold gauge set to make sure discharge pressure doesn't exceed 2.070kPa(2.11kgf/cm^2).
(2) Tighten all compressor mounting bolts, clutch mounting bolt, and compressor drive belt. Check to assure clutch coil is tight (no rotation or wobble).
(3) Check refrigerant hoses for rubbing or interference that can cause unusual noises.
(4) Check refrigerant charge. (refer to foregoing contents).
(5) Recheck compressor noise as in step 1.
(6) If noise still exists, loosen compressor mounting bolts and retighten. Repeat step 1.
(7) If noise continues, replace compressor and repeat step 1.

12. BLOWER RELAY CONTINUITY CHECK (See Fig 21-16 Table 21-10)

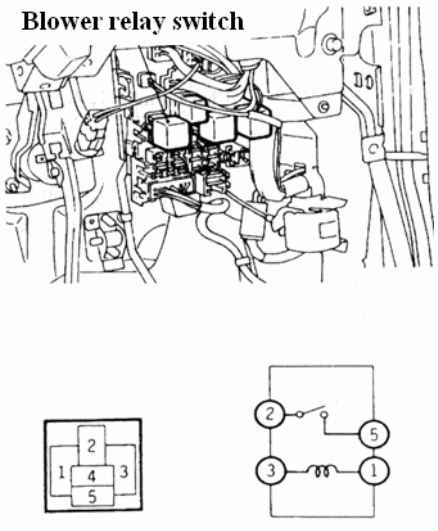


Fig.21-16

Table 21-10

System voltage	Terminal No.			
	1	3	2	5
When current is not supplied	○	○		
When current is supplied	⊕	⊖	○	○

13. A/C COMPRESSOR RELAY CONTINUITY CHECK(See Fig21-17, Table 21-11)

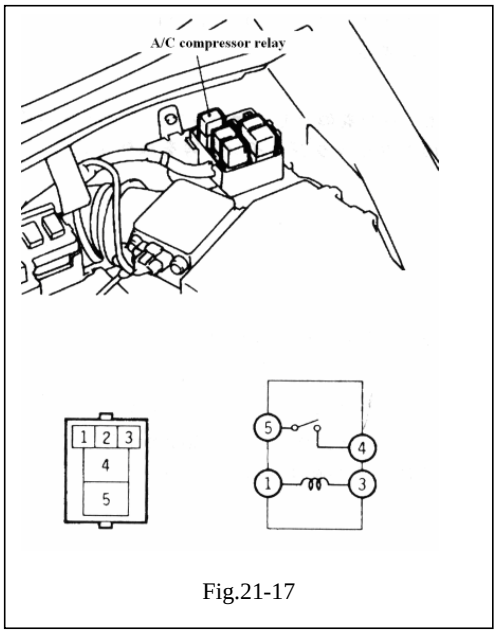


Fig.21-17

A/C compressor relay

Table 21-11

System voltage	Terminal No.			
	1	3	2	5
When current is not supplied	○	○		
When current is supplied	⊕	⊖	○	○

14. FAN CONTROLLER CHECK

Refer to parts of Inspection and repair of radiator.

15. IDLE-UP OPERATION CHECK

(1) Set the vehicle in the pre-inspection condition:

·Engine coolant temperature:80 - 90℃。

·Lamps, electric refrigerant fan and all accessories:： OFF。

·Transmission: N or P range.

(2) Check that the idle speed is within the standard value.

Standard value：650±50r/min

NOTE

The idle speed is controlled by engine ECU system and should not be adjusted.

(3) The idle speed should be within the standard valve when the A/C is operating.

Standard value：

< Low-load> 700±50r/min

<High-load> 850±50r/min

21.4 Heater Control Unit

INSTALLATION AND REMOVAL

REMOVAL STEPS:(See Fig 21-18)

Refer to installation of AUDIO.

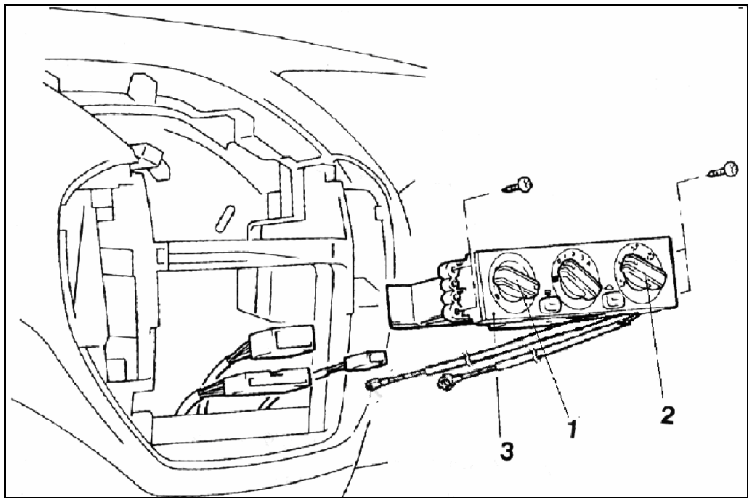


Fig.21-18

1-Temperature damper cable connected to Air mix door cable.
2-Mode switching damper cable connected to Mode control door.
3-Heater control unit.

1) INSTALLATION SERVICE POINTS

.....

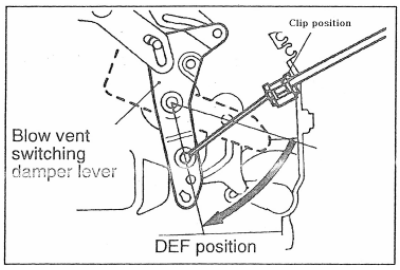


Fig.21-19

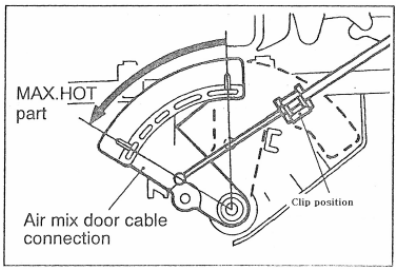


Fig.21-20

BLOW VENT SWITCHING DAMPER CABLE CONNECTION(See Fig21-19)

(1) Set the heater control unit's blow mode switching knob to the "DEF" position.
(2) Set the heater unit's blow mode switching damper relay to the "DEF" position (turn the damper relay to the left until it stops) and install the cable.
(3) Line up the I cable assembly with the heater unit case and secure with a clip.

TEMPERATURE DAMPER CABLE CONNECTION(See Fig21-15)

(1) Turn the heater control unit's temperature adjustment knob all the way to the"MAX HOT" side.
(2) Set the heater unit's air mix door lever to the "MAX HOT" position (turn the damper lever all the way to the right until it stops) and attach the cable.
(3) Line up the I cable assembly with the heater unit case and secure with a clip.

2) INSPECTION

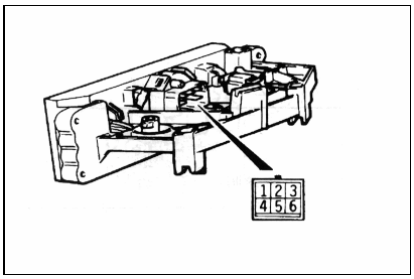


Fig 21-21

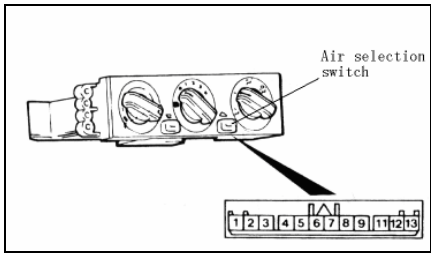


Fig 21-22

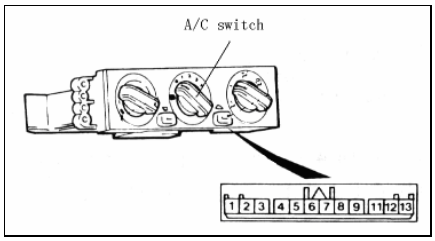


Fig.21-23

1. Continuity Inspection of blower switch(see Fig 21-21、table 21-12)

Table 21-12

Switch position	Terminal no.					
	1	2	3	4	5	6
0（OFF）						
1			○		○	
2	○		○			
3			○			○
4			○	○		

2.Continuity Inspection of air selection switch(see fig 21-22、table21-13)

Table 21-13

Switch position	Terminal no.						
	1	2	3	IND	4	8	9
Inner air circulate position（RECIRC）		○	○	⌇	○		
Outer air enter position（FRESH）	○		○				

3. Continuity Inspection of A/C switch (see 21-23、table 21-14)

Table 21-14

Switch position						
	5	IND	6	7	8	9
OFF						
ON 位	○	⌇	○	○	ILL	

DISASSEMBLY AND REASSEMBLY (See Fig. 21-24)

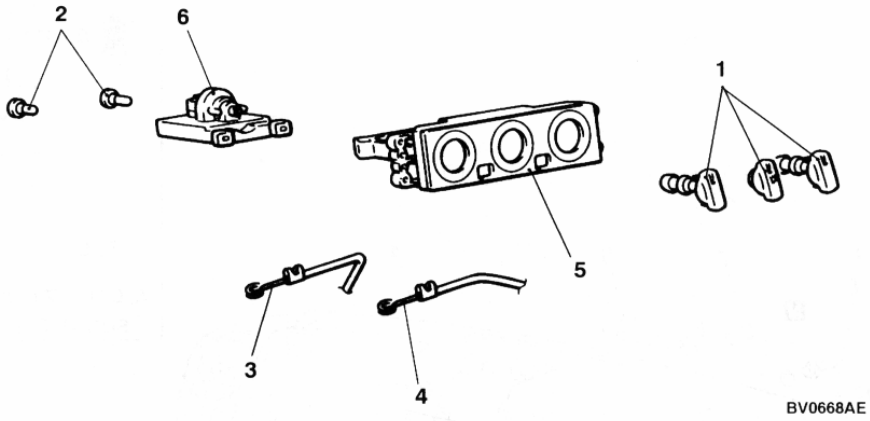


Fig 21-24

Removal steps

1.knob subassembly
2.valve
3.Blow mode switching damper cable
4.Temperature damper cable
5.control unit
6.switch subassembly

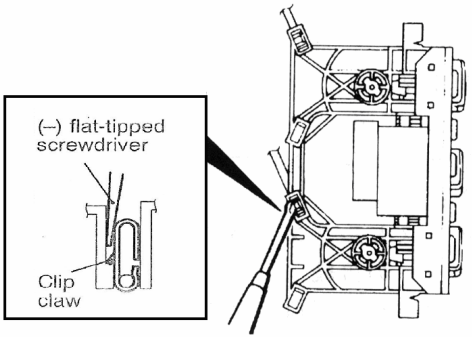


Fig.21-25

Removal service points

Remove blow mode switching damper cable and temperature damper cable

Cable clip Removal

Insert a flat-tipped screwdriver into th clip hrough the inside to th control base and prise out the clip claw to disconnect the cables,see Fig.21-25.

21.5 HVAC Assembly

1. HEATER UNIT AND BLOWER ASSEMBLY (Fig.21-26)
   - REMOVAL AND INSTALLATION

Preoperations before removal and operations after installation

- Drain and charge coolant（refer to relative chapter in the manual）
- Removal and installation of instrument panel（refer to relative chapter in the manual ）
- Removal and installation of steering column（refer to relative chapter inher chapter this manual）
- Disconnection and connection of air bag（refer to relative chapter in other chapter this manual）
- Removal and installation of filter and enter air hoses（refer to r relative chapter in this manual）
- Removal and installation of heater control unit（refer to foregoing contents of this chapter）
- Refrigerant draining and charging（refer to foregoing contents of this chapter）.

CAUTION

Do not touch to SRS-ECU with anything when the HVAC assembly is removed from a vehicle which equips airbag.

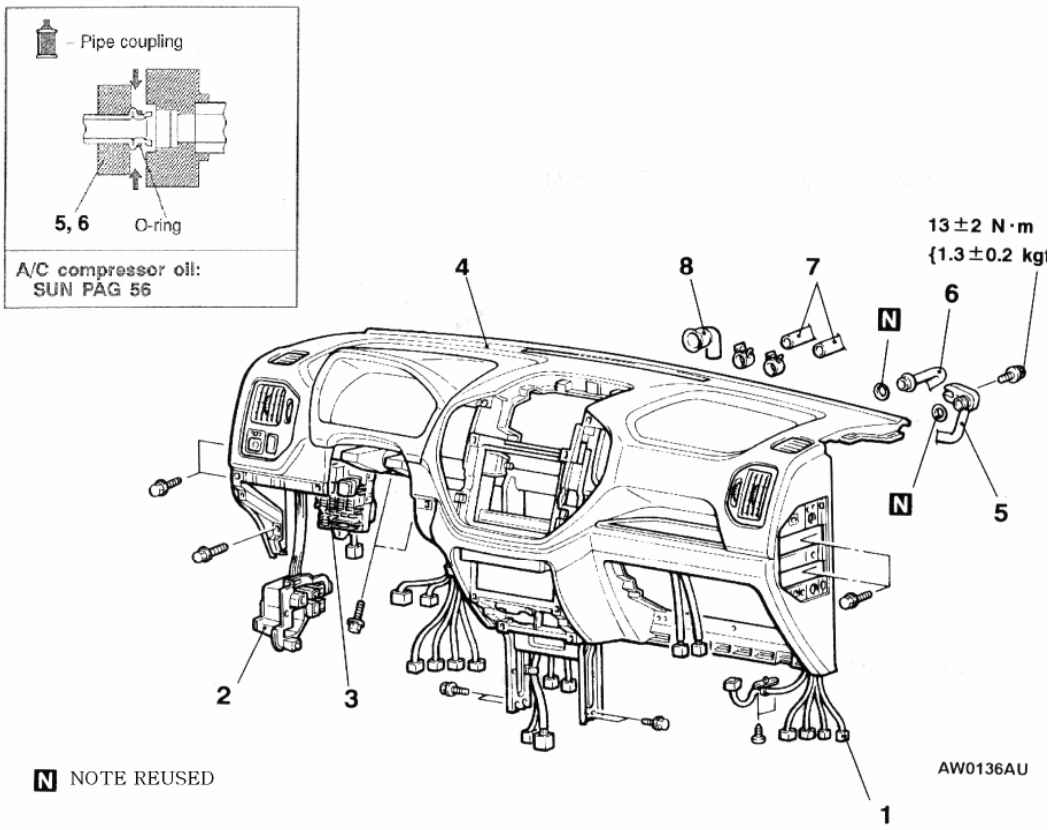


Fig.21-26a)

Heater unit and blower assembly
removal steps

1. Instrument panel harness connectors connection
2. Connectors connection
3. J/B connection
4. Instrument panel
5. Flexible suction hose connection
6. Liquid pipe connection
7. Heater water hoses connection
8. Drain hoses

REMOVAL SERVICE POINTS

Flexible sunctin hose and liquid pipe disconnection

To prevent the entry dust or other foreign bodies, plug the sismantled hose and the nipples of the expansion valves.

Caution

As the compressor oil and receiver air highly moisture absorbent, use a non-porous material to plug the hose and nipples

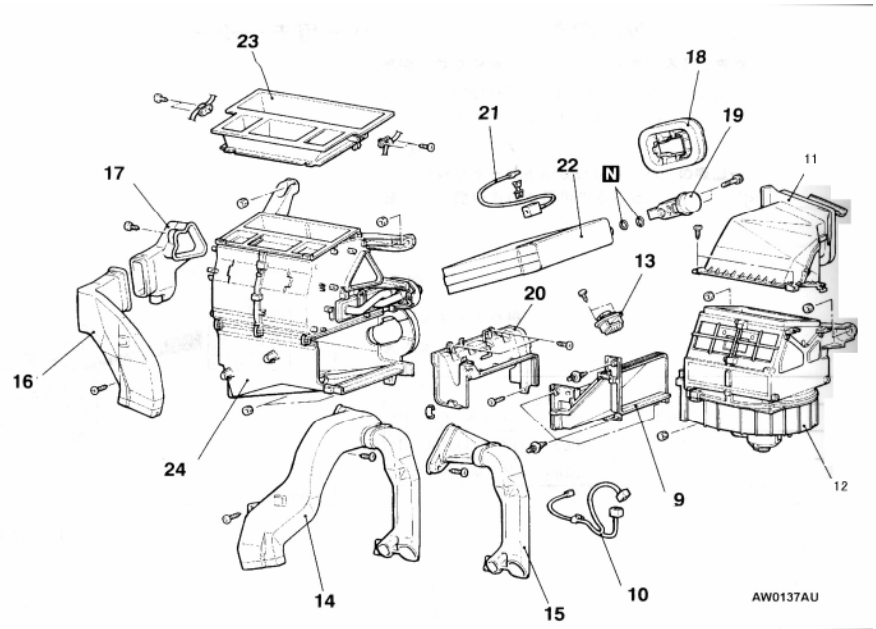


Fig. 21-26b)

DISASSEMBLY AND REASSEMBLY

Removal steps of Hvac assembly

9. Joint low case
10. A/C Harness
11. Intake duct
12. Blower
13. Register
14. Right-hand rear duct “A”
<Rear duct mounted vehicle>
15. Right-hand foot duct
< Rear duct not mounted vehicle >
16. lLeft-hand rear duct “A”
17. <Rear duct mounted vehicle>
18. Sealant
19. Expansion valve
20. Joint upper case
21. Compressor controller
22. Evaporator
23.Center ventilation case
24.Heater Assembly

- INSPECTION

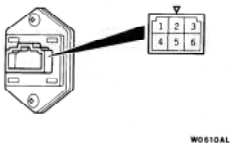


Fig.21-27

Register Check

Standard value：

Table 21-15

Mensurate Terminal	Standard value(Ω)
HI-LO（betmeen terminals 1 and 3）	2.54
HI-HL（betmeen terminals 1 and 6）	1.24
HI-MH（betmeen terminals 1 and 4）	0.6

- REMOVAL AND INSTALLATION (See Fig. 21-28)

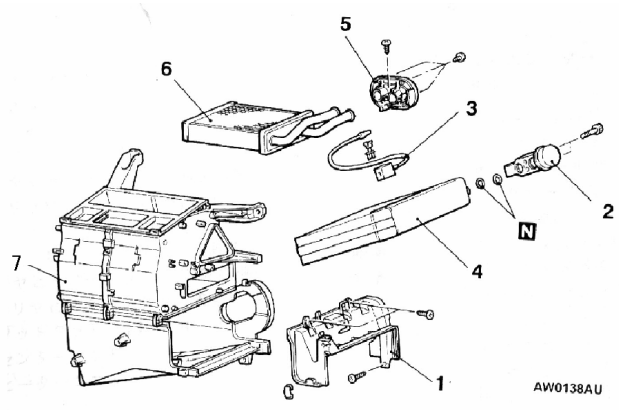


Fig 21-28

Removal steps

1. Joint duct
2. Expansion valve
3. Compressor controller
4. Evaporator
5. Holder
6. Heater core
7. Heater case

2. BLOWER MOTOR AND INSIDE/OUTSIDE CHANGEOVER DAMPER MOTOR

1) REMOVAL AND INSTALLATION (See Fig 21-29)

Inside/outside changeover damper motor removal steps

- Removal and installation of mixed box（Refer to the relative chapter in this manual）

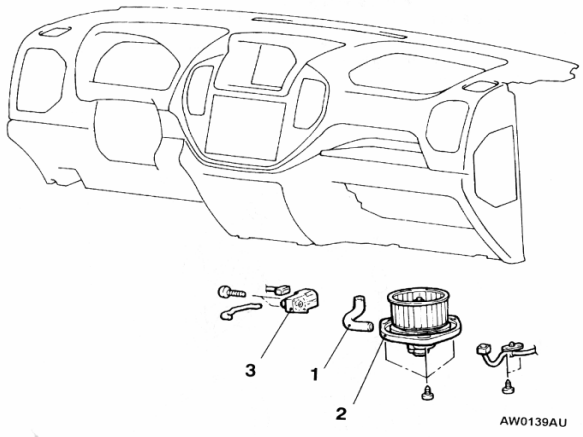


Fig.21-29

Blower Motor Removal steps
1. Blower moter duct
2. Blower Motor
3. Inside/outside changeover damper motor Air selection motor

2) Inspection(see Fig.21-30,21-31)

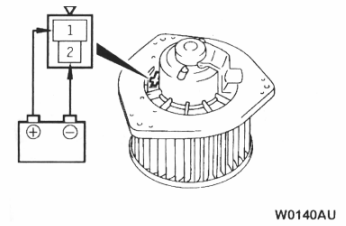


Fig 21-30

(1) Blower Motor Check

Check that the motor is running when the battery voltage is applied between the terminals.Check that the motor is not producing any abnormal noise at that time.

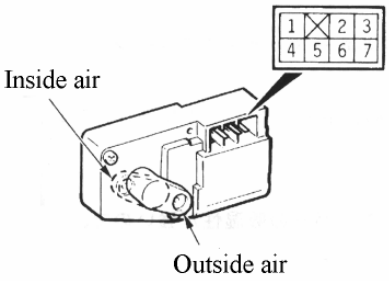


Fig 21-31

(2) Air selection Motor Check(see table 21-16)

Table 21-16

Battery connection terminal lever operation			Operating the lever
4	6	7	
	⊖	⊕	Turn to outside air side
⊖		⊕	Turn to cabin air side

Caution

When the lever is in the OFF position ,no power is supplied.

21.6 Compressor

- REMOVAL AND INSTALLATION

Pre-removal and Post-installation operations

- Refrigerant draining (Refer to foregoing contents this chapter).
- Refrigerant charging (Refer to foregoing contents this chapter）.
- Inspection of tension of engine drive belt (Refer to part of Adjustment of engine).

Removal steps

1. Flexible suction hose connection
2. Flexible discharge hose connection
3. Drive belt
4. Compressor
5. Compressor mounting bracket

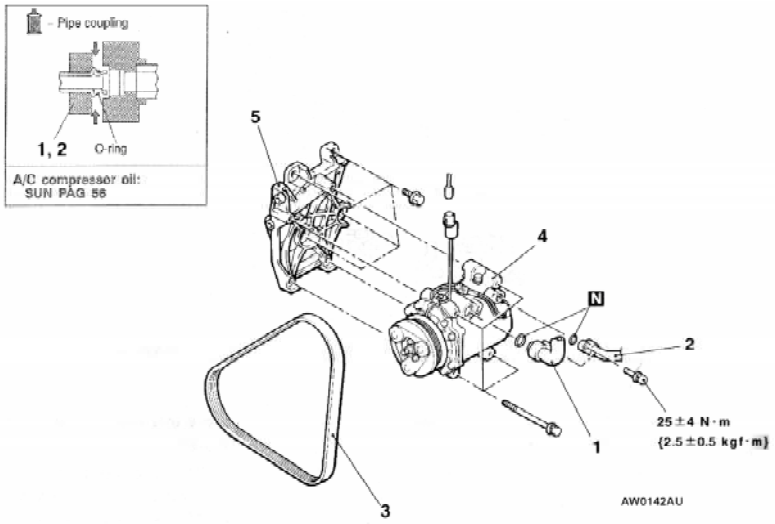


Fig.21-32

1) Removal service points

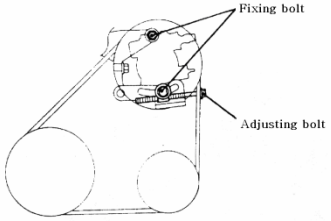


Fig. 21-33

(1) Flexible sunction hose and flexible discharg hose disconnection

To prevent the entry dust or other foreign bodies, plug the dismantled hose and the nipples of the expansion valves.

Caution

As the compressor oil and receiver air highly moisture absorbent, use a non-porous material to plug the hose and nipples

(2) Drive belt removal

a) Loosen the bolt securing the drive belt.

b) Loosen the adjusting bolt and remove the drive belt.

(3) Compressor Removal

Take care not to spill any compressor oil when removing the compressor

2) Installation service points

When installing a new compressor, first adjust the oil level as follows:

(1) Measure the oil in the compressor you removed [Xcm^3(cc).

(2) Drain the amount of oil calculated by the following formula from the new compressor. Now install the compressor the amount of oil sealed in the new compressor at the compressor（cc）—X（cc）=Y（cc）

NOTE

(1) Y (cc) indicates the amount of oil in the refrigerant line, condenser and evaporator.

(2) When replacing following parts as compressor replaced, Y(cc)should subrid the amount of oil regulated as follows, and drain the amount of oil

Item	quantity
condenser：	15cm^3（15cc）
evaporator：	60 cm^3（60cc）
tube：	10 cm^3（10cc）
receiver drier：	10 cm^3（10cc）

- Inspection

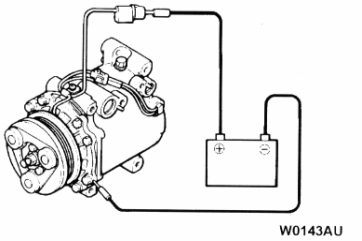


Fig. 21-34

Compressor magnetic clutch operation check（See Fig 21-34）
Connect the compressor connector terminal to the battery positive (+) terminal and ground the battery's negative (-) terminal to the compressor unit. At that time, the magnetic clutch should make a definite operating sound.

- DISASSEMBLY AND REASSEMBLY (See Fig. 21-35)

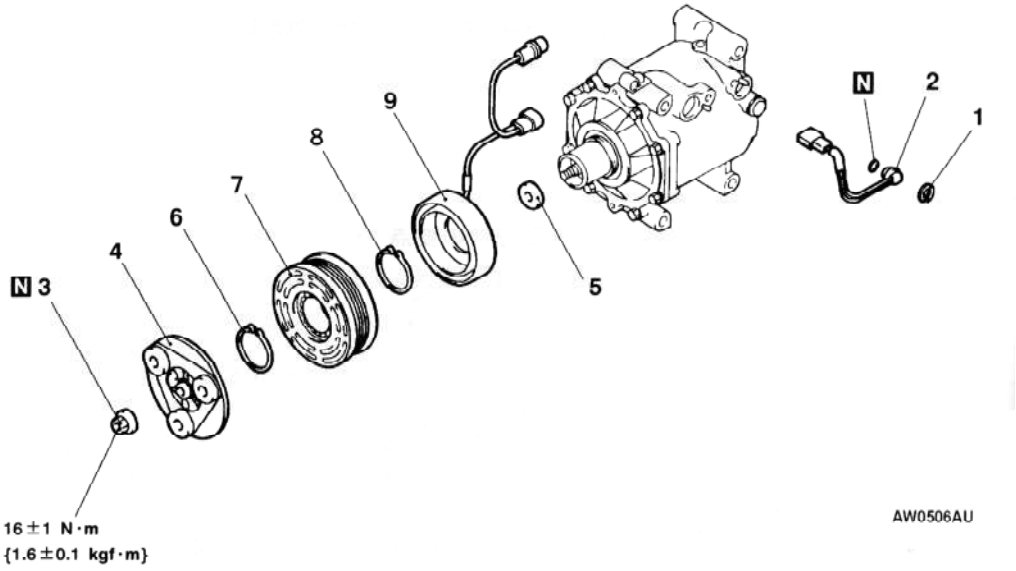


Fig 21-35

Cooling temperature switch dismantling steps
1. Snap ring
2. Cooling temperature switch
Magnetic clutch dismantling steps
3.locknut；
4.armature board；
5. Shim
6. Snap ring
7.Rotor；
8 Snap ring 9-clutch winding

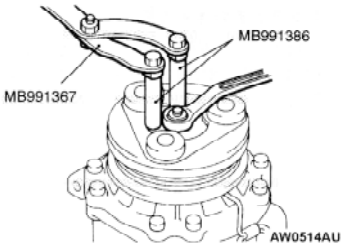


Fig. 21-36

1) Disassembly service points
Dismantling of self-lock nut sees Fig. 21-36.

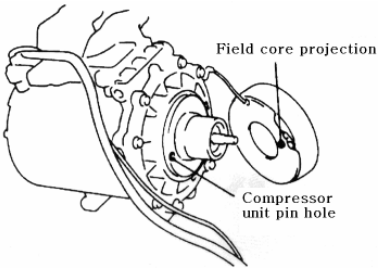


Fig. 21-37

2) Assembly service points

(1) Field core attachmentI

Line up the pin hole on the compressor unit with the fiedl core projection and attach.（as shown in Fig.21-37）.

(2) Snap ring installation

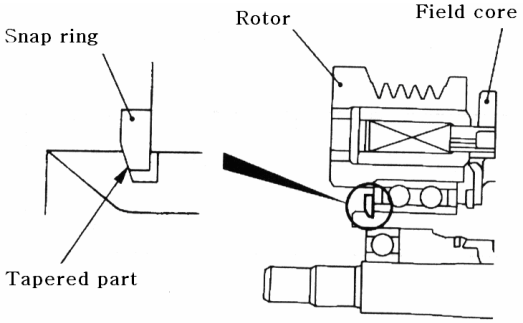
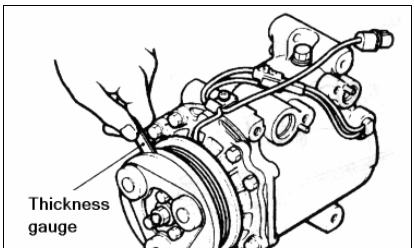


Fig21-38

Using smap ring pliers, fit the snap ring so that the snap ring's tapered part isn on the outside (as shown in Fig. 21-38).

(3) Self-locking nut installation

Using a special tool, as when removing the nut, secure the amature and tighten the self-locking nut.



(4) Air gap adjustment

Apply voltage from the battery to the magnetic clutch and check that the clutck air gap is inside the typ, value.If outside the type.valute, use a shim to adjust the gap.

Standard value：0.3 - 0.5mm

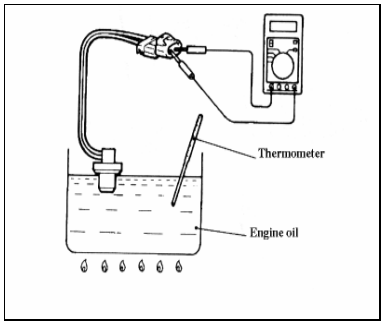


Fig. 21-40

3) INSPECTION

Cooling temperature switch

(1) Dip the metal part of the cooling temperature switch into engine oil and increase the oil temperature using a gas burner or similar.（shown in Fig 21-40）。

Caution

Do not heat more than necessary.

(2) When the oil temperature reaches the standard value,

check continuity by a tester between the terminals.

Standard value:

Continuity	Slightly below 150℃
No continuity	150℃ or higher (until temperature falls to 120℃ or lower when OFF)

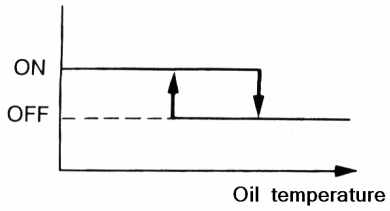


Fig.21-41

21.7 Condenser Assembly

- REMOVAL AND INSTALLATION

Preoperations before removal and operations after installation

- Refrigerant draining and charging（Refer to foregoing contents of this chapter）
- Removal and installation of radiator grid（Refer to relative chapter in this manual）

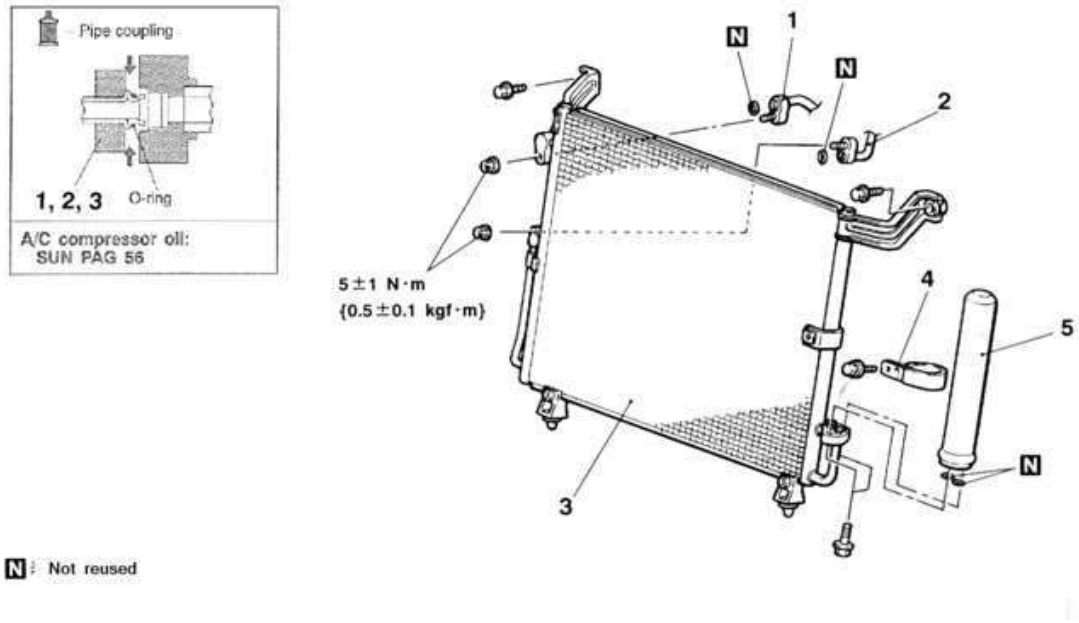


Fig. 21-42

Removal steps(See Fig 21-42)

1. Flexible discharge hose connection
2. Liquid pipe A connection
3. Condenser assembly
4. Clamp
5. Receiver

REMOVAL SERVICE POINTS

REMOVAL OF HOSES AND PIPES

To prevent the entry dust or other foreign bodies, plug the dismantled hose and the nipples of the expansion valves.

Caution

As the compressor oil and receiver air highly moisture absorbent, use a non-porous material to plug the hose and nipples

21.8 Referant Lines

- REMOVAL AND INSTALLATION

Preoperations before removal and operations after installation
- Refrigerant draining and charging（Refer to foregoing contents of this chapter）
- Removal and installation of radiator grid（Refer to relative other chapter in this manual）
- Removal and installation of air filter（Refer to relative chapter in this manual）

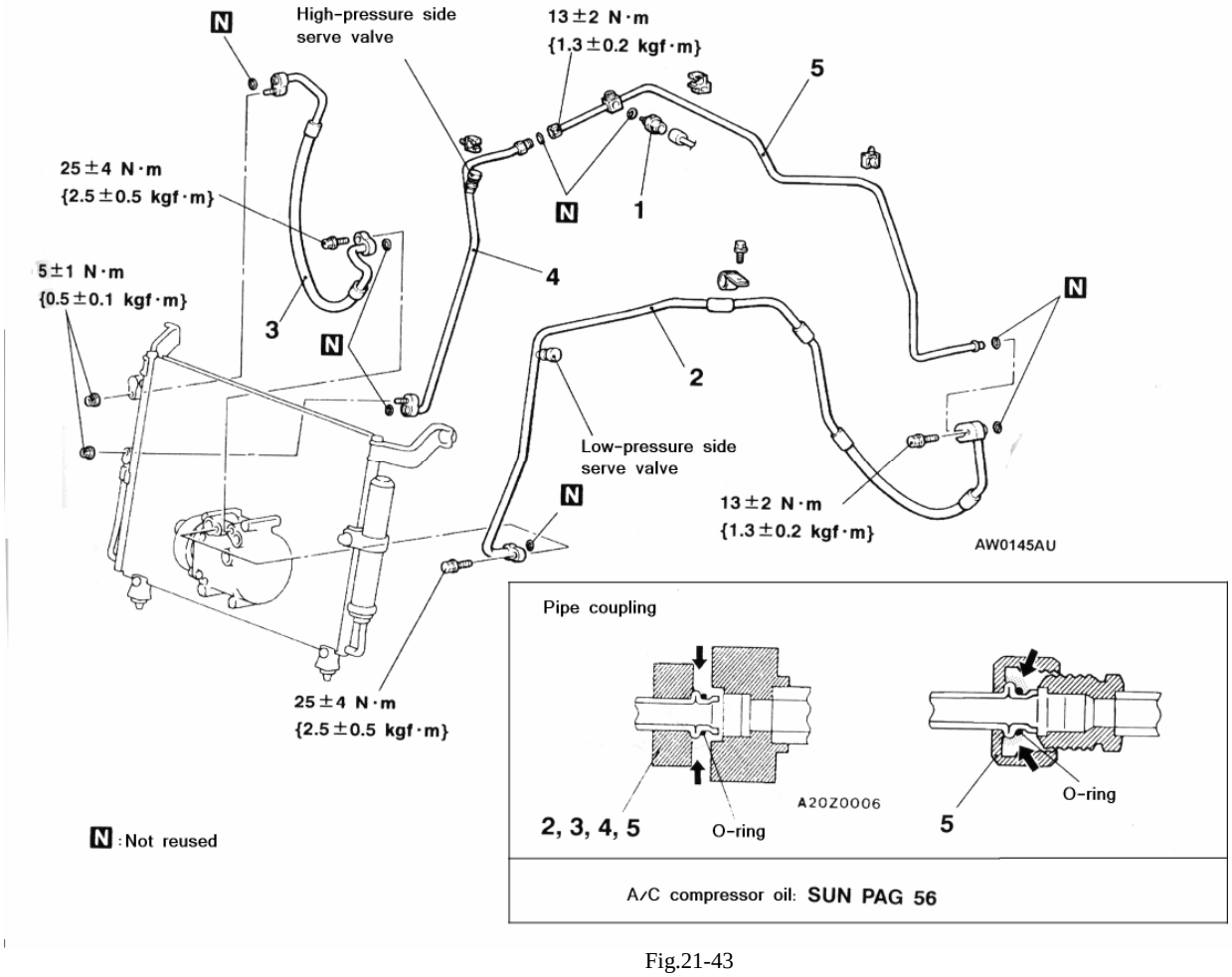


Fig.21-43

Removal steps
1. A/C pressure sensor
2. Flexible suction hose
3. Flexible discharge hose
4. Liquid pipe A
5. Liquid pipe B

REMOVAL SERVICE POINTS
REMOVAL OF HOSES AND PIPES
To prevent the entry dust or other foreign bodies, plug the dismantled hose and the nipples of the expansion valves.
Caution
As the compressor oil and receiver air highly moisture absorbent, use a non-porous material to plug the hose and nipples

21.9 Ducts

- REMOVAL AND INSTALLATION(See Fig.21-44)

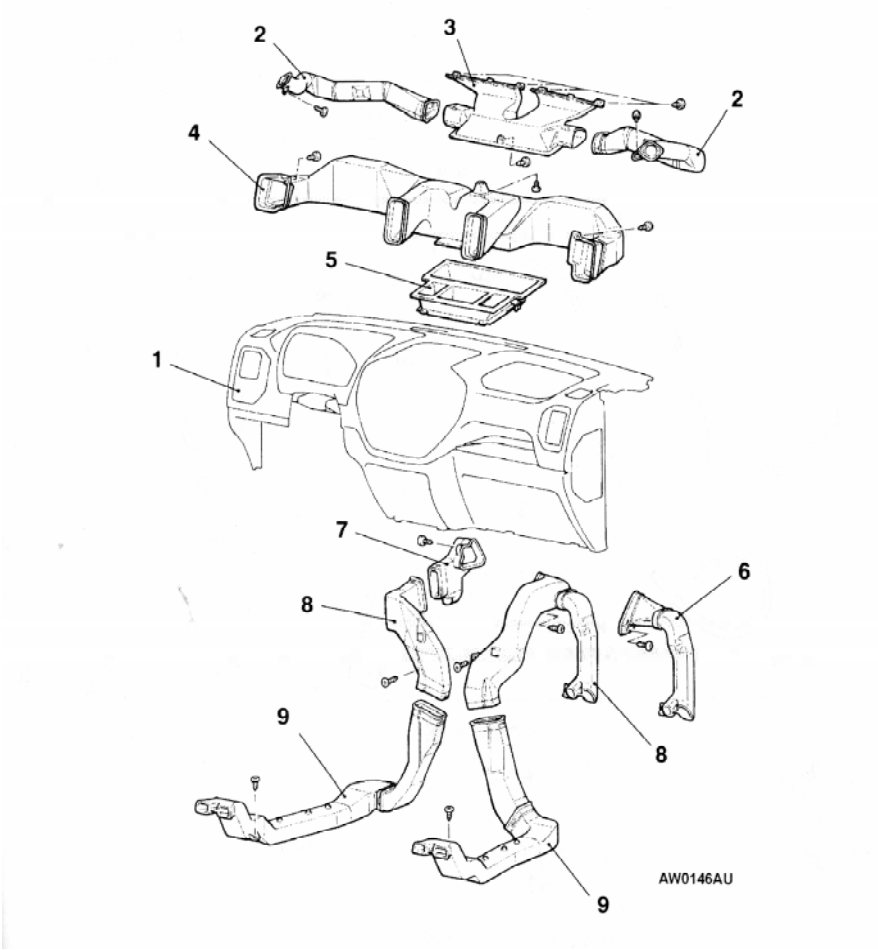


Fig 21-44

Defroster nozzle 、Ventilator duct and DUCT,VENTILATOR, CTR removal steps:

1. Instrument panel（Refer to the relative chapter in this manual）
2. Side defroster duct
3. Ventilator duct
4. Defroster nozzle
5. Distribution duct

Removal steps of Blow feet hoses and Back warm air hoses “A”

6. Right-hand foot duct <Rear duct not mounted vehicle>
7. Left-hand foot duct
8. Rear heater duct “A” < Rear duct not mounted vehicle >

Rear duct “B” removal steps

·Instrument panel（Refer to the relative chapter in this manual）

·Floor carpet and floor pads

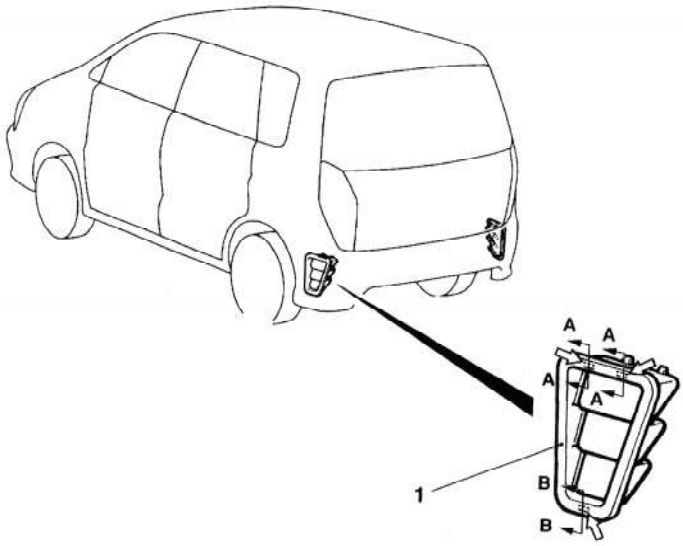
9. Rear heater duct

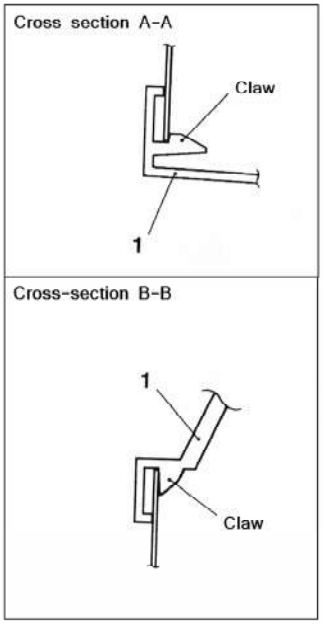
21.10 Ventilation

REMOVAL AND INSTALLATION (See Fig 21-45)

Preoperations before removal and operations after installation

• Removal and installation of bumper（refer to the relative chapter in this manual）





1-Rear ventilation

Note: ⇦Location of claws

Fig.21-45

Removal service points

Removal of rear ventilation duct

Take upper claws off, then pull the duct down, at last take low claws off..