LIFAN MOTORS

Service Mnual

LIFANX60

LIFAN INDUSTRY(GROUP) IMP&EXP CO.,LTD

LIFAN X60 Service manual

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Chapter I Complete Vehicle's Performance

Section 1 Overview

LIFAN X60 is a kind of urban sports utility vehicle and the first SUV model of LIFAN Motor (Group) Co., Ltd.

Vehicle identification

1. Vehicle Identification Number (VIN)

(1) Vehicle identification number (VIN) description

There are 3 vehicle identification numbers (VIN): 1, the VIN is stamped on the engine compartment bulkhead; 2, the VIN is provided on the vehicle plate; 3, the VIN is on a plate fastened to the top left of the dashboard on the driver's side, as shown in Figure 1-1. For the composition of the VIN, see Table 1-1.

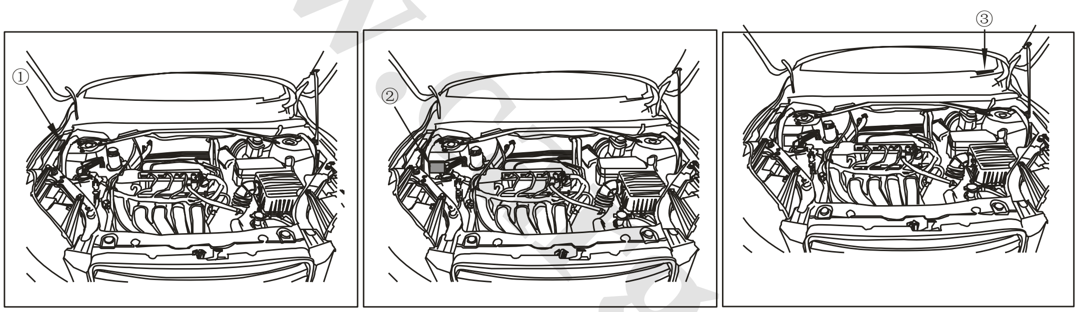

Figure 1-1 Vehicle Identification Number

Table 1-1 Vehicle Identification Number

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
L	C	N	6	4	E	D	5	×	×	0	×	×	×	×	×	×
Factory			Vehicle type	Vehicle length, maximum total mass	Body type	Wheelbase	Engine power (kW) / Fuel type	Check digit	Year	Plant code	Sequence number					

(2) Vehicle plate

LF6430 vehicle plate is shown in Figure 1-2.

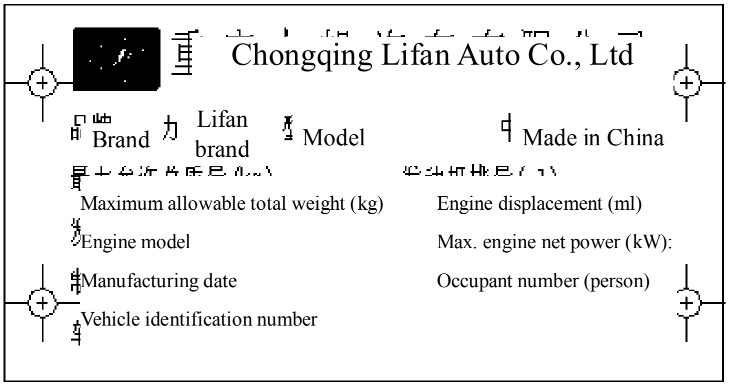

Figure 1-2 Vehicle Plate

Engine Assembly

It adopts LFB479Q engine, which is a 16-valve double overhead camshaft (DOHC) multipoint electronic fuel injection (EFI) engine adopting independent sequential ignition and VVT-i.

Chassis

1. Suspension: the MacPherson type independent suspension is applied in the front suspension while the spatial 3-linkage trailing arm independent suspension is applied in the rear suspension.

2. Clutch: Clutch pedal unit and hydraulic clutch operating device.

3. Transmission: 5-speed manual gear transmission or4-speed automatic transmission 4. Steering gear: Hydraulic power rack and pinion steering gear; the steering column is provided with impact absorption ability.

5. Brake: Both the front and rear brakes are vented disc brakes, equipped with anti-lock brake system (ABS) and electronic brake-force distribution (EBD) system.

6. Tires: 215/65 R16 102H, Wheel rims: 6.5J×16.

Vehicle body

1. The vehicle body adopts high-clearance integral body construction. The

cage-shaped body frame is equipped with laser welded stiff steel plate of variable thickness. Both the rear and the front of the vehicle body are provided with impact absorption functions.

2. The inner trim parts adopt fire-retardant and recyclable engineering plastics and textiles with high strength and environment-friendly odor.

3. A/C system: Manual adjustment type A/C with outer circulation air intake filter layer replaceable periodically.

4. Rearview mirror: Anti-dazzling type interior rearview mirror and electric exterior rearview mirror.

Electrical Equipment

The electrical equipment of LIFAN X60 series models is provided with a single wire system, negative earth, DC, and a rated voltage of 12V.

Engine and Electronic Fan

The electronic cooling fan of engine adopts the arrangement of two-stage speed regulation dual fan.

Power Start and Charging System

Battey: 80 Ah maintenance free lead-acid battery;

Alternator: 14V/90A integral alternator with built-in voltage regulator.

Starter: 1.4kw permanent magnetic starter.

Ignition EFI system

Ignition switch: electrical starting

The electronic fuel injection (EFI) system of engine adopts the MT22.1 EFI system of Delphi Corp., so the standards of EFI shall prevail. The main components of EFI system include: engine control unit (ECU); sensors: intake pressure temperature sensor, knock sensor, oxygen sensor, camshaft position sensor, crankshaft position sensor, coolant temperature sensor, accelerator pedal position sensor, throttle position sensor and weak acceleration sensor; and actuators: electronic throttle valve assembly (throttle regulator motor), Canister solenoid, fuel rail and fuel injector assembly, ignition coil, fuel pressure regulator, three-way catalytic converter, OCV valve, etc.

Warning sign

The warning sign system of LIFAN X60 series models can send out warning and direction signals to the ambience. It mainly involves horn, turn signal lamp signal, emergency light switch, reverse light and brake lamp and their switches, as well as front and rear fog lights.

Instrument and display screen

Instrument cluster: The instrument cluster of electronic odometer, which comprises coolant temperature gauge, engine tachometer, speedometer, fuel gauge and gear indicator display.

Indicator lights: Battery recharging indicator, engine oil pressure indicator light, engine fault detection indicator light, hand brake indicator light, air bag indicator light, fuel alarm indicator light, instrument light, high beam indicator light, low beam indicator light, steering (emergency light) indicator light, ABS indicator light, "door is not secured" indicator light. Reverse radar display, low brake fluid level indicator light, width lamp indicator light, front and rear fog lights indicator light, rear defrosting indicator light, electronic burglar indicator light, snow-mode indicator lamp, transmission oil temperature warning indicator lamp, etc; multi-functional display screen: Safety belt indicator light, environment thermometer and electronic clock display.

Electrical auxiliary devices

Front windshield wiper system: Controlled by combination switch handle, with wiper motor and connecting rod arranged in the front of dash panel.

CD audio system: Single disc CD player (DVD optional) of 6 speakers installed on the dash board, with functions like radio reception, disc playing, time display, etc. In addition, both CD player and DVD are provided with USB interfaces, which can be connected with removable storage devices as per customer needs.

Cigarette lighter: 1 cigarette lighter, which can also be used as onboard external power supply.

Rear defroster: The rear window adopts heating glass and is controlled by switch.

Heated front seats: heated by carbon fiber, equipped with switch control. (Optional)

Close 4-door car windows: Four doors' layout, master control of the driver's door, and independent control of the 4 doors and windows, with operating switch arranged on the door armrest. Central locking: Unified switch for the installation of the 4 doors, with remote control function and adopting BCM centralized control.

Electronic anti-theft devices: Centrally controlled by BCM for electronic anti-theft.

A/C system: It adopts WXH-106-AP scroll compressor with displacement of 106ml/r and good refrigeration effect.

It consists of condenser, evaporator, thermostat, sensor, pressure switch, blower, etc.

Anti-theft safety devices

Air bags: Electronic dual air bags respectively located at the steering wheel and the dash board of the vice cab.

ABS safety devices. Anti-theft devices (optional):

The anti-theft system is mainly controlled by the BCM of the body controller and is connected with the ECU of engine by a communication line. After the ignition key is put in place, if the detected signal is correct, the ignition system will work normally, otherwise the engine will not start. This is a commonly used anti-theft system.

Other electrical parts

Other electrical parts include: wire harness, center control box, relay, safety plate, connector clip, switch, corresponding fixing supports and ties. Its use comply with relevant requirements.

Section 2 Main Technical Parameters

Basic Performance Parameters

1. Complete vehicle's main parameters (see Table 1-01 Complete Vehicle's Main Parameters)

Table 1-01 Complete Vehicle's Main Parameters

Item			LIFAN X60
Basic model			2-compartment and 5-door SUV model
Drive model			Transverse front engine; front wheel drive
Overall dimension	Length	mm	4325
	Width	mm	1790
	Height (no load)	mm	1690
Wheel base		mm	2600
Track	Front (no load)	mm	1515
	Rear (no load)	mm	1502
Front overhang		mm	830
Rear overhang		mm	895
Trafficability	Approach angle	(°)	25.1
	Departure angle	(°)	23
	Minimum ground clearance	mm	179

	Minimum turning diameter	m	10.8
Capacity of luggage boot		L	405
Weight	Curb weight	kg	1330
	Axle load distribution (front and rear)	kg	734/596
	Gross vehicle weight	kg	1705
	Axle load distribution (front and rear)	kg	830/875
	Full load axle load percentage (front and rear)	%	49/51

2. Complete vehicle's performance parameters (See Table 1-02)

Table 1-01 Complete Vehicle's Performance Parameters

Item			LIFAN X60
Performance parameters	Maximum speed	km/h	170
	Acceleration performance (0-100km)	s	≤14.5
	Fuel consumption of comprehensive operation mode	L/100km	8.2 Manual / 8.7 Automatic
	Maximum grade ability	(%)	≥32
Seats		Person(s)	5

Main Assemblies' Structure and Parameters

Main technical parameters of engine assembly (See Table 1-02 Main Technical Parameters of Engine Assembly)

Table 1-03 Main Technical Parameters of Engine Assembly

Item	Parameters
Engine type	Four-cylinder inline, four-stroke, double overhead camshaft, 16-valve, sequential fuel injection independent ignition, VVT-i electronic fuel injection gasoline engine
Displacement	1794ml
Engine type	Four-cylinder inline engine
Camshaft type	Double overhead camshaft, with intake camshaft turning angle variable continuously.
Combustion chamber	Weir type
Cylinder bore × stroke	79mm×91.5mm
Compression ratio	10： 1
Feed system	Oil supply system without oil return; electronic throttle system
EFI system type	Delphi MT22.1
Maximum power	98kW/6000 rpm
Maximum torque	168N•m/(4200-4400) rpm
Minimum fuel consumption	265 g/kW.h

No-load stable speed (idle speed)	750±50 r/min
Ignition order	1-3-4-2
Ignition advance angle (idle speed)	5±3°
Intake valve clearance (cold)	0.20～0.25 mm
Exhaust valve clearance (cold)	0.30～0.35 mm
Capacity of lubricant	3.3—3.5L
Fuel model	93 # unleaded gasoline
Engine oil model	≥SL grade (selecting proper engine oil depending on different regions). Recommended viscosity grades: a). 5W/30: (common engine oil); b). 0W/40: (refer local clamit condition.)
Start method	Electric start
Lubrication method	Pressure and splashing combined type
Cooling method	Compulsory water cooling circulation
Overall dimension (excluding transmission)	640×641×644mm

Main chassis assembly types and parameters (See Table 1-04 Main Chassis Assembly Types and Parameters)

Table 1-04 Main Chassis Assembly Types and Parameters

Name	Structure and parameters	
Air intake system	Intake pipeline and air cleaner	
Fuel supply system	Electric fuel pump, fuel filter, pressure regulator, fuel tank, etc.	
Exhaust system	2 of three-way catalytic converter and 2 muffler	
Cooling system	Ribbon-tubular radiator and double speed dual electronic fan	
Clutch model	Single diaphragm spring friction clutch	
Transmission model	Manual 5th gear constant mesh gear transmission / 4-speed automatic transmission	
Drive shaft	Model	Three-pin drive shaft for the inner side while ball-cage drive shaft for the outer side
Suspension	Front suspension	MacPherson type independent suspension
	Rear suspension	Special 3-connecting rod trailing arm independent suspension
Tyre	Tyre type	Radial tyre
	Tyre specification	215/65 R16 102 H
	Wheel rim specification	6.5J×16
	Tyre pressure	250kPa

Wheel location	Front wheel camber	-1°12′±30′ (no load)
	Toe-in angle of front wheel	-0°43′±30′ (no load)
	Kingpin inclination	11º2′±30′ (no load)
	Kingpin caster	2°44′±30′ (no load)
	Rear wheel camber	-0°57′±30′ (adjustable)
	Toe-in angle of rear wheel	0°6′±30′ (no load)
	Steering angle	Left steering angle for left wheels:(+35°31′)～(+39°31′) Left steering angle for right wheels:(+29°18′)～+33°18′) Right steering angle for left wheels:(-29°18′)～(-33°18′) Right steering angle for right wheels: (-35°31′)～(-39°31′)
Steering system	Steering gear type	Rack and pinion hydraulic power steering gear
	Steering system	Adjustable tubular column angle; O.D. of steering wheel: 378mm
Brake system	Structure type	Hydraulic dual vacuum booster equipped with ABS and EBD devices

	Driving brake	Disc brake for both front and rear wheels
	Parking brake	Mechanical rope-type rear wheel drum brake

Vehicle body structure type and parameters

Table 1-05 Vehicle Body and Interior & Exterior Trimming

Name		Structure and parameters
Vehicle body	Model	Integral 2-compartment and 5-door vehicle body
	White body	All-metal cage type structure
	Door assembly	Integral, with four counterclockwise-opening doors; clip door key, with side door beam; hatchback rear door, with air spring for balance.
	Engine hood	Open backward, with curved hinge
	Front and rear bumpers	Injection molding
Interior and exterior trimming	Interior trimming	Injection molding structure with surface texture
	Dash board	Injection molding structure with surface texture
	A, B, C pillars and inside door board	Injection molding frame with needled velvet finish
	Windshield	Front windshield: laminated glass; rear windshield: tempered glass
	Rearview mirror	Exterior rearview mirror: convex mirrors for both right and left sides, with electric control

		Interior rearview mirror: anti-dazzling type
	Seat	Front seats: independent seats, with front and rear positions, backrest angle and headrest adjustable, and without safety belts; Rear seats: dependent seats with safety belts, which is foldable in certain proportion.
A/C	Structure type	Scroll compressor for refrigeration and engine warm water for heating
	Operation	Knob-type control, which can control airflow direction, select and adjust air speed, temperature and air circulation, with electric control adopted for luxury ones.
	Refrigerant	Type: R134a; filling capacity: 500g±20g

Structure and parameters of electrical system (see Table 1-06 Structure and Parameters of Electrical System)

Table 1-06 Structure and Parameters of Electrical System

Name	Structure and parameters	
Power and engine electrical appliances	Wiring	Single wire system, negative earth, DC 12V
	Alternator	Integral, AC, built-in voltage regulator, spec. 14V/90A
	Battery	80 Ah maintenance free lead-acid battery
	Starter	1.4kw permanent magnetic starter
	Electronic fan	Two-stage speed regulation dual fan
Body lighting and signal	Front group lamps	Headlamp (55W, white, 2), position lamp (0.54W, white), turn signal lamp (21W, amber, 2)

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	Side turn signal lamp	12V, 0.6W, amber, 2
	Front and rear fog lights	Front fog light (55W, white, 2), rear fog light (21W, red), rear width lamp (0.32W, red)
	Rear group lamps	Brake lamp (1.9W, red, 2), Reverse light (21W, white, 2), turn signal lamp (3.13W, amber, 2), rear width lamp (0.8W, red)
Body lighting and signal	Rear license plate light	5W, white, 2
	High-mounted brake lamp	LED, red, 1
	Interior grouped roof lights	5W, white, 4
	Step lamp	0.8W, red, 2
Instrument system	Instrument cluster	Instrument cluster with electronic odometer, including LCD coolant temperature gauge, fuel gauge, speedometer, engine tachometer, etc.
	Indicator lights	Including charge indicator, engine oil pressure indicator, fuel alarm indicator,, low brake fluid level indicator light, engine fault detection indicator, hand brake indicator, anti-theft indicator, safety belt indicator, air bag indicator, instrument light, high beam indicator, fog light indicator, turn signal lamp (emergency light) indicator, ABS indicator light, "door is not

		secured" indicator light, snow-mode indicator lamp, transmission oil temperature warning indicator lamp, etc.
Electrical auxiliary service		Including CD player (or DVD), cigarette lighter, rear defroster, wiper washer, remote door lock, anti-theft device, air bag, window regulator, etc.

Lubricant, fuel, steering fluid, brake fluid, coolant, A/C refrigerant and their capacity

Lubricant (See Table 1-07 Lubricant)

Table 1-07 Lubricant

Item	Lubricant	Model	Weight
Bearing and ball pin	Lithium base grease	7022	0.34kg

Fuel (See Table 1-08 Fuel Model and Fuel Tank Capacity)

Table 1-08 Fuel Model and Fuel Tank Capacity

Name	Performance index
Fuel model	93 # unleaded gasoline
Fuel tank capacity (L)	55/L

Steering fluid, brake fluid, coolant, A/C refrigerant (See Table 1-09 Steering Fluid, Brake Fluid, Coolant, A/C Refrigerant)

Table 1-09 Steering Fluid, Brake Fluid, Coolant, A/C Refrigerant

Name	Model	Capacity / Weight

Power steering fluid	ATF220	1.5L-1.65L
Brake fluid	DOT4	0.85-0.9L
Coolant	Antifreeze G11	8.5L
A/C refrigerant	R134a	520±20g
Windshield washer fluid	NFC-60	6.4L

Section 3 Maintenance Regulations

LIFAN X60 Maintenance Program can ensure driving stability, reduce failures, and realize safe and economical driving. Please see the Schedule for the maintenance interval based on the readings or time intervals of the odometer. The maintenance projects over the deadline shall also be maintained as per the same interval. Rubber hoses (for cooling and heating system, brake system and fuel system) shall be maintained as per the maintenance regulations of LIFAN. The hoses suffering from aging, crack or damage should be replaced immediately. Please ask professional technicians to check in accordance with LIFAN X60 Maintenance Program.

Basic Maintenance Items

Electrical Equipment

1. Check the vehicle's interior and exterior lighting and electrical equipment: dash board indicator light, headlight, front fog light, rear fog light, front width lamp, rear width lamp, front turn signal lamp, rear turn signal lamp, brake lamp, reverse light, license plate lamp, trunk light, cigarette lighter, horn, power window regulator, electric exterior rearview mirror, and ventilation system.

2. Air bag: Visual check the appearance for damage.

3. Self-diagnosis: Use LIFAN's special diagnostic equipment to read the fault information of each system in the memory.

Exterior

1. Door limiter, fixed pin, door lock, engine hood, luggage hood hinge and lock catch: Lubricate and check their functions.

2. Window: Check its function, clean the guide and coat it with special grease.

3. Wiper/cleaning devices: Add cleaning solution, check function and adjust the nozzle as necessary.

Engine hood

1. Visually check each part for damage and leakage.

2. Cooling system: Check and add antifreeze as necessary.

3. Power steering system: Check for leakage, check the steering hydraulic fluid level and add power steering fluid as necessary.

4. Brake system: Check the brake pipeline for leakage, check the brake fluid level and add brake fluid as necessary.

5. Replace brake fluid: Replaced every 2 years or every 40,000km.

6. Air cleaner: Clean the filter element for 5,000km and replace the filter element for 10,000km.

7. Engine oil filter: Replace the filter element every 5,000km.

8. Fuel filter: Replace the filter element every 10000km.

9. Battery: Check if the positive and negative connections of the battery are firm. Check the inspection hole.

Engine and Underbody

1. Underbody: Check the fuel pipe, brake oil pipe and underbody protection layer for damage; check the exhaust pipe for leakage and check if the fixing is firm.

2. Steering tie rod: Check the interval and check if the connection is firm (i.e. check if the boot is worn).

3. Brake friction plate: Check its thickness.

4. Parking brake devices: Check and adjust the cable length as necessary.

5. Tyre (including spare tyre): Check tyre wear and tyre pressure.

6. Wheel alignment check: With wheel aligner.

7. Wheel fixed bolt: Check as per torque regulations.

8. Headlight: Check and adjust as necessary.

9. Commissioning: Performance check.

Standard Bolt Torques

Tightening Torques of Common Thread Specifications

Thread type	Thread specification	Tightening torque (N.m)		
		Grade 8.8	Grade 10.9	Grade 12.9
Coarse thread	M4	3	4.4	5.1
	M5	5.9	8.7	10
	M6	10	16	18
	M8	25	36	43
	M10	49	72	84
	M12	86	126	145
	M14	135	200	236
	M16	210	310	365
	M18	300	430	600
	M20	425	610	710
Fine thread	M8*1	27	39	46
	M10*1.25	52	76	90
	M12*1.25	93	135	160
	M12*1.5	89	130	155
	M14*1.5	145	215	255
	M16*1.5	226	330	390
	M18*1.5	340	485	570
	M20*1.5	475	680	790

Maintenance Schedule

Table 14 Maintenance Program

Interval / Maintenance items	Odometer readings or months, whichever first												
	×1000Km	3	8	13	18	23	28	33	38	43	48	53	58
	Months	3	9	15	21	27	33	39	45	51	57	63	69
Transmission belt (alternator, power steering and A/C compressor)		I	I	I	I	I	I	I	I	I	I	I	I
		It must be replaced every 2 years or every 80,000km.											
Engine oil and engine oil filter element		R	R	R	R	R	R	R	R	R	R	R	R
Cooling system hose and connector		I	I	I	I	I	I	I	I	I	I	I	I
Engine coolant		I		R		R		R		R		R	
		Add engine coolant as necessary.											
Fuel filter		I		R		R		R		R		R	
Fuel pipe and connector		I		I		I		I		I		I	
Spark plug		I	I	I	R	I	I	I	R	I	I	I	R
AT automatic transmission oil		Replace every 3 years or 60,000km											
Transmission gear oil		I	R	It must be replaced every 2 years or every 40,000km.									
Throttle body				C		C		C		C		C	
Injection nozzle				C		C		C		C		C	

Engine timing chain	I		I		I		I		I		I	
Air cleaner element		R	I	R	I	R	I	R	I	R	I	R
Exhaust pipe connector and support	I	I	I		I		I		I		I	
Brake/clutch fluid	I	I	I	I	I	I	I	I	I	I	I	I
	It must be replaced every 2 years or every 40,000km.											
Brake pad and brake disc		I	I	I	I	I	I	I	I	I	I	I
Brake pipe connector and hose	I		I		I		I		I		I	
Parking brake system	I	I	I	I	I	I	I	I	I	I	I	I
Power steering fluid	I	I	I	I	R	I	I	I	R	I	I	I
A/C air filter	I	C	R	C	R	C	R	C	R	C	R	C
Fastening/fixing of chassis and chassis bolts and nuts	I	I	I	I	I	I	I	I	I	I	I	I
Electrical connectors and earthing points	I	I	I	I	I	I	I	I	I	I	I	I

R: Replace I: Inspect, adjust, clean and replace as necessary C: Clean

Chapter II Overview

Section 1 EFI system

Repair Specifications

1. Table of Technical Specifications

Intake VVT valve working voltage	11~14V
Intake VVT valve resistance	9.4~10.6Ω
Working voltage of intake air temperature/pressure sensor	5V±0.1V
Working current of intake air temperature/pressure sensor	12mA (maximum)
Intake air pressure test range	10kPa~110 kPa
Intake air temperature test range	-40~125℃
Working voltage of canister control valve	8~16V
Minimum canister solenoid starting voltage	7V
Working temperature of canister solenoid	-30~120℃
Limit working voltage of canister solenoid	25V（< 60 s)
Coil inductance of canister solenoid	12~15mH
Canister solenoid impedance	19-22Ω
Operating temperature of exhaust end of oxygen sensor	200~850℃
Working temperature at oxygen sensor mounting position	<600℃
Working temperature at connecting position of oxygen sensor cable and metal buckle	≤250℃
Storage temperature of oxygen sensor	-40~100℃
oxygen sensor heater resistance	9.6±1.5Ω
Working gap of crankshaft position sensor	0.25~1.75 mm
Crankshaft position sensor coil resistance	560Ω
Working temperature of crankshaft position	-40~150℃

sensor	
Working voltage of coolant temperature sensor	5V
Limit working temperature of coolant temperature sensor	-40~135℃
Response time of coolant temperature sensor	17~27 s
Resistance when coolant temperature sensor is at 20°C	2.3~2.5kΩ
Effective sealing pressure of coolant temperature sensor	145 kPa
Working temperature of camshaft position sensor	-40~150℃
Working voltage of camshaft position sensor	4.5~13 V
Peak voltage of camshaft position sensor	24 V（1h）
Working gap of crankshaft position sensor	0.3~2mm
Low electric level output of crankshaft position sensor	0~700mV
High electric level output of crankshaft position sensor	3.2~5 V
Working conditions of electrically-controlled throttle valve housing	-40~120℃
Diameter of valve hole of electrically-controlled throttle valve housing	Φ57mm
Maximum air flow when the throttle fully open (standard atmospheric pressure)	67g/s
Minimum bypass air flow when throttle is completely closed	1.7g/s
Opening range of throttle position sensor	7% ～ 93%
Working voltage of throttle position sensor	5±0.1V
throttle position sensor resistance	1.6~2.4 kΩ
Knock sensor working temperature	-40~150 ℃
Resistance of knock sensor	>1MΩ（ 25℃）

Knock sensor capacitance	1480~2220p25℃ @1000Hz
Frequency response of knock sensor.	3~18kHz
Sensitivity to 5kHz signal of new sensor of knock sensor	17~37mV/g
Fuel pump output pressure	>350 kPa
Fuel pump output flow	>10 g/s
Fuel pump safety relief	<900 kPa
Keeping fuel pump pressure	≈ 24 kPa
Fuel pump working voltage	8~16V
Fuel pump overpressure protection	-13.5~26（<60 s）
Fuel pump fuel-free operation	<60s
Resistance value of fuel level sensor.	<150Ω
Maximum operating current of fuel level sensor	<130mA
Suited temperature of electric fuel pump working conditions	-40~70℃
Opening voltage range of electric fuel pump	6~14.2V
Rated current of fuel sensor of electric fuel pump	1~80 mA
Fuel pressure range of electric fuel pump	300~350kPa
Working temperature of oil track	-30~115℃
Fuel pressure regulator has no fuel return system pressure settings	350 kPa
Rated resistance of fuel injector at 20°C	12.0±0.4Ω

2. Torque Specifications

Item	N • m
ECM fixing bolts	20
Fixing bolts of intake air temperature/pressure sensor	21~25
Fixing bolt of coolant temperature sensor	20
Fixing bolt of crankshaft position sensor	6~10

Fixing bolt of camshaft position sensor	6~10
Oxygen sensor	40~60
Knock sensor	15~25
VVT valve fixing bolts	6~10

Precautions

1. Regardless of whether the engine is running or not, as long as the ignition switch at ON position, never disconnect any 12V electrical device. When this device is disconnected, any coil will generate highly transient voltage due to self-inductance. As a result, ECM and sensor are seriously damaged.
2. When the engine is running, it is not allowed to pull out any sensor wire plug (connector). Otherwise, there is artificial fault code (false code) in ECM, which will affect judgment and troubleshooting of maintenance staff.
3. If it is required to disconnect negative cable of the battery, it is necessary to turn ignition switch to OFF position, and all electric load shall be turned off. After negative cable was disconnected for 60s, other electrical equipment can be maintained.
4. Parts of EFI system have high reliability. When complete vehicle or engine has a fault, firstly, check related mechanical parts, system connector and wire harness, earthing wire,high tension cable connector.
5. Before installing, use sealant scraper or steel wire brush to remove sundries on mounting surface and confirm sealing surface is smooth, without oil stain. Do not forget to clean sealant in assembling hole, in thread hole and on the thread.
6. When installing the sensor and actuator, tighten fixing bolts according to specified value.
7. When installing and handling the sensor, in order to protect it from being damaged, it shall be handled with care. Any impact and falling may damage its performance seriously.
8. Do not use needle to puncture wire harness to check electrical signal of the system.
9. When dismantling and replacing oxygen sensor, the sensor shall not contact water or other liquid.
10. Fuel pump cannot run for a long time without gasoline. It cannot run with gasoline in the air.

11. Most of EFI parts cannot be repairable. After any part is damaged, replace it normally.

12. The system should use anti-interference type spark plugs and high tension cablehigh-tension cable. The non-resistor type spark plugs and high tension cable will not only produce the interference waves, but also have a impact on the ECM which is ignition coil drive-module.

13. Do not disassemble ECM.

14. Do not use test lamp to check electrical control system sensor and ECM control unit (including connecting terminal).

15. Except special instructions in testing procedure, normally a pointer type multi-meter is not used to check the resistance of electrical control system. High resistance digit multi-meter (above 10MΩ) or special instrument of electrical control system shall be used.

16. On the vehicle provided with electronic control system, it is forbidden to use spark test or wire removal friction spark testing the circuit.

17. When a vehicle equipped with electronic control engine is required to bridge power supply of any other vehicle for starting, firstly turn the ignition switch to OFF position and turn off all electrical loads on electronic control vehicle, then dismantle and install the jumper.

18. When welding is made on the vehicle equipped with electronic control system, ECM power supply shall be disconnected to avoid ECM from being damaged due to high voltage.

19. When repairing the vehicle body near ECM or the sensor, please be careful to avoid these electronic components from being damaged.

20. When dismantling wire joint of electronic control system, firstly turn the ignition switch to OFF position and disconnect negative cable of the battery. If only checking electronic control system, only turn off ignition switch (turn it to OFF).

21. Remember all power supply systems on electronic control vehicle are negative earth. When installing the battery, positive and negative electrodes of the battery shall not be reversed.

22. When installing or removing the ECM, the operator should make himself earth. Otherwise, his body's static electricity can cause damage to the ECM circuit.

23. Before dismantling any fuel line, first release fuel system pressure. When repairing fuel line system, please keep away from open fire.

24. Poor contact may be due to connector terminal corrosion, external dirt intruding into the terminal or contact pressure reduction between connector plug and socket. Disconnect the connector and then reconnect it. Normal contact may be restored. When making fault diagnosis, check if wire harness and connector are abnormal and confirm they are normal. But, after checking, the fault disappears. It may be wiring or connector fault.

25. When washing or overhauling the engine on a rainy day, water shall be prevented from splashing on ECM and other circuits.

26. Electronic control system faults are mainly wire harness and connector faults. Normally, wire harness is broken, connector is poor contact, connector terminal is pulled out or not inserted completely or the accessory is earthing.

27. As wire harness is seldom broken in its middle section and often broken at the connector section in most case, it is necessary to carefully inspect wire at sensor and connector.

28. Before connecting the V30 diagnostic scanner, be sure to turn off the ignition switch (turn it to OFF). After the completion of connecting the diagnostic scanner, turn on the ignition switch (turn it to ON).

Fuel Supply System Control Logic

1. Fuel Pump Logic

(1) Fuel pump "ON" logic

After the ignition switch is turned on, the fuel pump will run for 2 seconds;

If no effective 58X signal is detected, the fuel pump will stop running;

The engine starts to run, as soon as effective 58X signal is detected by ECM, the fuel pump will start running.

(2) Fuel pump "OFF" logic

The fuel pump will stop running 0.6s after the rotation speed signal is lost or the fuel pump will stop running

2. Start pre-injection

Start pre-injection only once in the normal start process, with start conditions as follows:

(1) The engine run (at least 58 effective tooth signals are detected by ECM).

(2) The actuation of fuel pump relay.

(3) The fuel pump running time is over the accumulating delay time.

(4) Pre-injection has not been carried out.

(5) Once the above conditions are met, pre-injection shall be started at the same time in fall cylinders.

3. Calculation of fuel injection pulse width (see Figure 1-11)

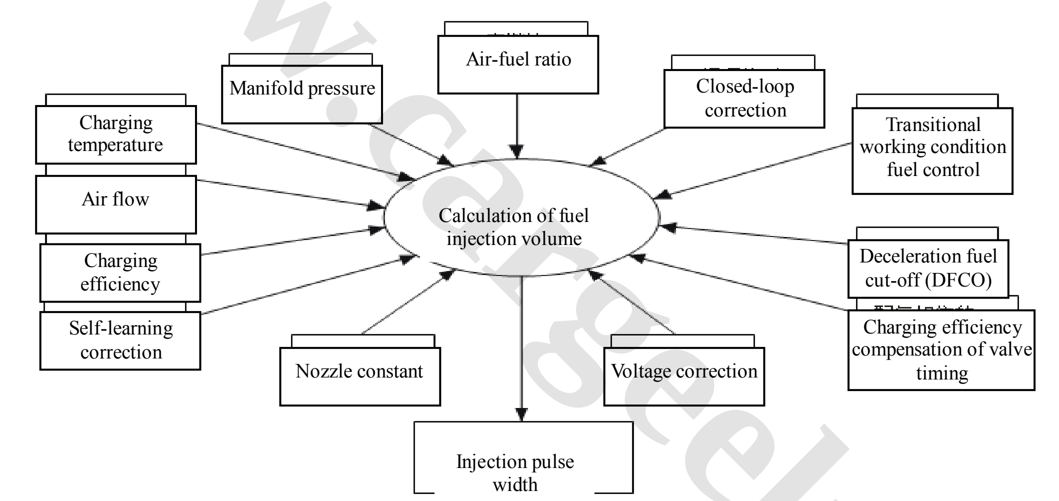


Fig. 1-11 Calculation of Fuel Injection Pulse Width

(1) Air-fuel ratio

The air-fuel ratio for start, air-fuel ratio for normal start, air-fuel ration for removal of flooded cylinder, air-fuel ratio during engine running, air-fuel ratio at clod engine state, air-fuel ratio at warm engine state, theoretical air-fuel ratio, power enriched air-fuel ratio, air-fuel ratio for catalyst overheating protection, and air-fuel ratio for engine overheating protection.

(2) Intake manifold absolute pressure

The manifold absolute pressure is directly read through intake pressure temperature sensor MAP installed on the intake manifold.

(3) Charging efficiency

The charging efficiency means the ratio between the actual air flow in cylinder and the air flow computed as per ideal state.

(4) Charging efficiency compensation of valve timing

The change of valve timing will influence engine's charging efficiency. The basic charging efficiency table is made when the valve timing control system has no motion while the relevant positions of camshaft and crankshaft are in original positions. After the valve timing control system moves, the system will make corresponding charging efficiency compensation to ensure accurate calculation of air intake flow.

(5) Self-learning

Self-learning is used to correct the slow change of engine resulting from the increase of running time and the production aberration of engine and complete vehicle.

(6) Closed-loop feedback correction

Closed-loop feedback correction is to control actual air-fuel ratio around theoretical air-fuel ratio through the feedback signals from oxygen sensor.

(7) Transitional working condition fuel control

The system adopts a complicated calculation method, establishes the evaporation model of fuel film to calculate the air-fuel mix, takes engine's water temperature, air intake temperature and engine's working condition into full account, reaches the best fuel injection volume, and greatly improves the fuel control performance of each transitional working condition, including (emergency) acceleration and deceleration working conditions.

(8) Protective fuel cut

The system will stop fuel injection in the following conditions:

• Fuel will be cut off when engine speed is higher than 6,500rpm and recover when lower than 6,300rpm.

• Fuel will be cut off when ignition failure is detected by the system.

• When the system voltage is higher than 18V, the system will turn into electronic throttle body functional restriction mode (forced idling mode).

• Fuel will be cut off during deceleration.

(9) Basic fuel injection constant

The basic fuel injection constant is to provide system with engine displacement and nozzle flow.

(10) Battery voltage correction

When battery voltage changes, voltage correction will ensure correct fuel injection volume.

Ignition Control Logic

1. Coil magnetization control

Ignition coil magnetization time determines the ignition energy of spark plug. If the magnetization time is too long, it will damage coil or coil drive; if the magnetization time is too short, it may cause a fire.

2. Start mode

In start mode, the system will adopt a fixed ignition angle to ensure the gas mixture in the cylinder has been ignited and to provide positive torque: after the engine starts, its speed will rise; after it goes into self-running, the ignition angle will quit start mode.

3. Calculation of ignition advance angle, see Fig. 1-12

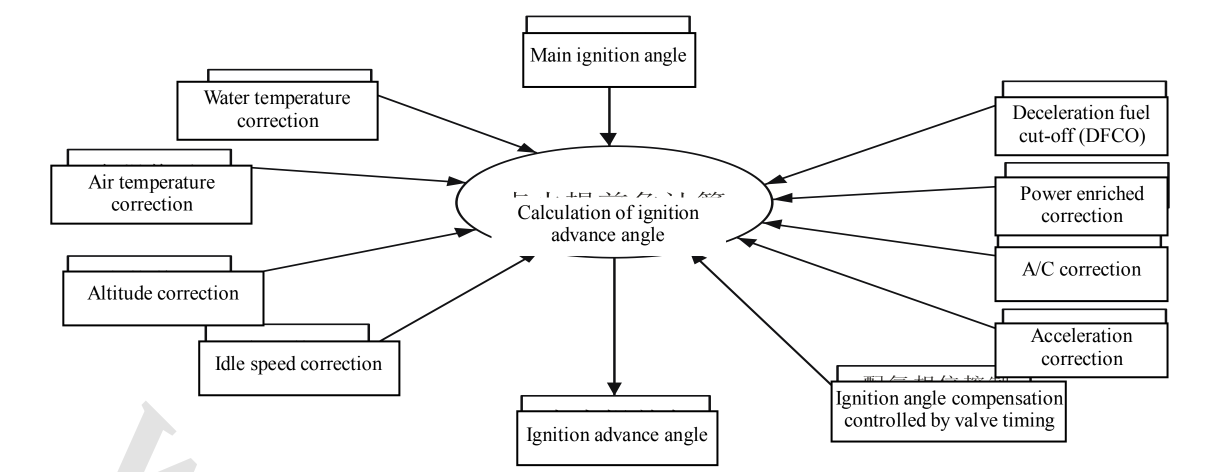


Fig. 1-12 Calculation of Ignition Advance Angle

(1) Main ignition advance angle

When engine water temperature returns to normal, generally, the main ignition advance angle when the throttle opens is the minimum ignition angle for the best torque point (MBT) or the knock critical point (KBL). At idle speed, the ignition angle should be lower than MBT point for idle stability. Provided that no influence on cold-state driving, to ignite catalytic converter as soon as possible, during the heating process of catalytic converter, the basic ignition angle may not be the MBT or KBL ignition angle, and it may be delayed as much as possible in the case of no influence on driving.

(2) Correction of ignition advance angle

Water temperature correction, intake air temperature correction, altitude compensation correction, idle speed correction, acceleration correction, power enriched correction, deceleration fuel cut-off correction, A/C control correction, and exhaust gas recirculation correction.

(3) Acceleration correction

Ignition advance angle acceleration correction is to alleviate engine speed fluctuation caused by drive system twist shock and eliminate knock shock that may take place during acceleration to make acceleration process smooth.

(4) Power enriched correction

To get better power and torque, the air-fuel ratio will be enlarged to the best torque and the lowest air-fuel ratio point (LBT) nearby the outer characteristic point, so as to correct ignition angle to reach MBT point.

(5) Ignition angle compensation controlled by valve timing

After valve timing control system is actuated, engine intake and exhaust overlap angle will change and influence internal exhaust gas recirculation rate and in-cylinder temperature. For different valve timings, it is required to correct ignition advance angle, so as to ensure the best ignition advance angle under current valve timing.

(6) Deceleration fuel cut-off correction

When stopping deceleration fuel cut-off, ignition angle may be corrected to make throttle close and exit smoothly.

(7) A/C control correction

Close A/C and correct the ignition advance angle when the engine is at idle speed so as to make engine speed transit smoothly.

Electronic Throttle Body Functional Restriction Mode

1. Forced flameout mode: ECM reported faults mean that air intake system or throttle body cannot control air intake flow well. The countermeasure is to cut off fuel, ignition and throttle, stall engine and no longer output power.

2. Power management mode of forced idle speed: When the engine is at idle speed, The ETC system cannot reliably use throttle to control engine power, at this moment, the ETC will cancel its control for throttle and its opening will return to default status. The power of engine can only be controlled by conrtoling a cylinder's fuel injection and delaying ignition angle.

3. Forced idle speed mode: When there is no reliable access to catch a driver's intent, For instance, all pedal signals fail, The engine can only work at idle speed to maintain its cooling, heating, Power supply and lighting functions. The engine will make no response when the accelerator pedal is depressed, so it is unable to drive a vehicle under this mode.

4. Restricted power management mode: The ETC system cannot use throttle properly to control engine power. Under this mode, the system will judge idle speed or acceleration as

per pedal signals. The engine will control its power output by switching on/off a cylinder's fuel injection and delaying ignition advance angle, so the output fluctuation of engine is comparatively obvious and staying in this mode for a long time will cause damage to engine and exhaust system. In this mode, vehicles can be driven but cannot be driven in normal flow of traffic or climb steep slopes.

5. This mode is used when detection reliability on driving intent declines or no high power can be output: for instance, when two-way pedal has signal input but with great difference, the output torque of engine will be restricted and the response of engine to pedal change will slow down, the driver will obviously feel the weakening of engine output but can also drive the vehicle in normal flow of traffic.

6. Normal mode: The vehicle can be driven completely in accordance with the driver's intent.

Variable Valve Timing Control Logic

1. Actuation condition of variable valve timing control system

When the following conditions are met, the valve timing control system can move as per the requirements of the engine management system and control the relative positions of camshaft and crankshaft to make the engine achieve the best economy, power and emission performance.

(1) The system voltage must be 10.5-16V.

(2) The water temperature of engine must not be higher than 115℃.

(3) The engine speed must be 900-6,500rpm.

(4) No valve timing control system faults detected (For details, see fault list).

2. When the above condition are met, the variable valve timing control system will run to determine proper valve timing in accordance with the current working condition (speed and load) of engine.

Idle Speed Control Logic

Idle speed air flow control enables the engine control system to maintain target speed when throttle fully closed and keep steady speed when engine load changes at idle speed.

1. Calculation of target idle speed

(1) Basic target idle speed

Basic target idle speed setting at different coolant temperatures (Table 1-13 target idle speed value at each water temperature). To improve driving performance during oil recovery and parking at the time of vehicle speed compensation and deceleration adjustment, keep target idle speed during driving 50rpm higher than that during parking, and gradually decrease to the target idle speed under parking condition during deceleration and parking.

Table 1-13 Target Idle Speed Value at Each Water Temperature

Cooling temperature	Target idle speed	Cooling temperature	Target idle speed	Cooling temperature	Target idle speed	Cooling temperature	Target idle speed
30	1050	45	950	60	850	80	750
40	1000	55	900	70	800	90	750

(2) A/C compensation

When the A/C is started, the target idle speed will increase by 100rpm.

(3) Voltage compensation

Under two conditions:

1) Increase the control target idle speed by 300rpm when the system voltage is lower than 12V and the system recovers in 10s, so as to increase the generating capacity of the alternator.

2) When the system receives impact transient voltage fluctuation from external electrical load at idle speed, the system will automatically compensate for air intake flow, so as to restrict the transitional fluctuation of engine speed.

Knock Control Logic

Knock control function is used to eliminate possible knock during combustion, so as to optimize engine power and fuel economy. MT22.1 system will carry out independent knock control on different engine cylinders.

1. Knock control working conditions

The knock control system will start when the following conditions are met:

(1) The vehicle is equipped with a knock sensor and will start knock control functions.

(2) The engine runs and the running time is more than 2s.

(3) The water temperature of engine is higher than 70°.

(4) The engine speed is higher than 600rpm.

2. Knock control mode

After knock or in the case of possible knock, the system will rapidly and properly delay ignition advance angle. The system basic ignition advance angle is provided with normal ignition advance angle parameter and safe ignition advance angle parameter table. The adjustment of knock control will be carried out between the two tables.

The control program mainly include following modes:

(1) Steady knock control

During normal operation of engine, the ECM will collect and analyze the sound during engine combustion through the knock sensor, after filtering, the knock will be detected. If the knock intensity is over the permitted limit, the system will rapidly delay the ignition advance angle of the cylinder suffering from knock. The knock will be eliminated during subsequent combustion cycle and the ignition advance angle will gradually return to normal.

(2) Transient knock control

Knock will happen easily during urgent acceleration or sharp change of engine speed. When possible knock is detected, the system will automatically delay the ignition advance angle to avoid overrun (strong) knock. When knock is detected, the system will rapidly delay 3-5° of ignition advance angle in accordance with engine speed and then return to normal control in the subsequent 2-3s.

(3) Adaptability adjustment of ignition angle

There is difference between engines due to manufacturing error and long-term wear. When the system and engine adopt the initial or the ECM is recharged, there may be knocking during engine operation, and the system will record this. After a period of running-in, the system will automatically generate an adaptive ignition adjustment correction value (self-learning value). When the engine turns into the same working condition, the system will automatically carry out adaptive adjustment on ignition advance angle to avoid strong knock. The adaptability learning of system will be continuously updated during engine operation.

A/C Control Logic

The ECM will monitor A/C request input and A/C evaporator temperature sensor input, and control A/C compressor clutch through A/C relay. The system will automatically identify A/C system based on plug and play.

1. A/C working conditions

The A/C system will start when the following conditions are met:

(1) The engine runs and the running time is more than 7s.

(2) The A/C switch is connected.

(3) All A/C cut-off modes do not work.

2. A/C cut-off mode

In some cases, to ensure power or protect engine or protect A/C system, the ECM must cut off A/C compressor or prohibit start of A/C system. Meanwhile, in order to avoid frequent on-off of compressor clutch, once the A/C turns into cut-off mode, the ECM must leave certain time to re-pull A/C clutch by means of delay, etc.

The following modes are mainly included:

(1) A/C cut-off mode when engine speed is too high: to protect A/C system

• When A/C is off, it is required to start compressor when engine speed is lower than

5,800rpm.

• When A/C is working, it is required to cut off A/C compressor when engine speed is higher than 6,000rpm.

(2) A/C cut-off mode when engine cooling water temperature is too high: to protect engine

• When A/C is off, it is required to start compressor when cooling water temperature is below 102°C.

• When A/C is working, It is required to cut off A/C compressor when cooling water temperature is above 104°C.

Three-way Catalytic Converter Protective Control Logic

The system will forecast the working temperature of three-way catalytic converter during engine operation. When the predicted temperature is higher than the protective temperature, it will start timing; if the working temperature of catalytic converter is always higher than the protective temperature in the given time, the system will control fuel supply and enrich air-fuel ratio to reduce the working temperature of catalytic converter. Later, when the predicted temperature of catalytic converter is reduced, the previous air-fuel ratio will recover and it is required to continuously forecast the working temperature of catalytic converter to prepare for protection.

The canister solenoid will control the switching time and timing of the bypass between the charcoal canister and the air intake pipe to control the fuel steam intake flow and time into the cylinder, so as to reduce the vehicle's evaporative emission to the hilt and reduce the influence on engine performance as much as possible.

Canister solenoid's working conditions

To reduce the influence of fuel steam on the normal combustion of engine, the following conditions must be met before the canister solenoid is started:

(1) The system voltage is between 8V and 18V;

(2) The water temperature of engine is higher than 0°.

(3) The air intake temperature of engine is above 0°C;

(4) No related system failures

(Failure list as below):

Fuel system failure
Fuel pump failure
Idle speed failure (too high/too low)
Air intake pressure sensor failure
Engine misfire
Front oxygen sensor heating failure
Front oxygen senor signal failure
System voltage failure (too high/too low)
Crankshaft position sensor failure
Ignition coil fault
Fuel injection nozzle failure;
Canister solenoid output fault

2. Canister solenoid's working mode

The opening of canister solenoid is determined by the ECM on the basis of duty ratio (PWM) signal based on engine conditions. In the case of non-idle speed, the maximum opening of canister solenoid is determined by closed-loop air flow, with the maximum of 100%.

Control Logic of Fan

The cooling fans of engine and A/C will be controlled by the system. The ECM will determine whether open each fan in accordance with the engine coolant temperature and based on if the conditions for starting an A/C are met. The system can support two switch-control fans and a PWM (pulse-width modulation)-control fan.

Fan's working way and working conditions:

When the water temperature is higher than 94℃, Low-speed fan starts to run;

When the water temperature is less than 90℃, Low-speed fan starts to run;

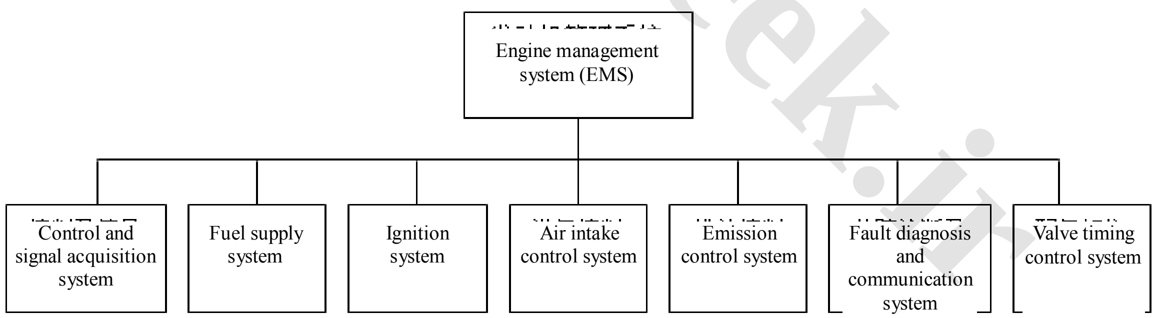
When the water temperature is higher than 98℃, High-speed fan starts to run;

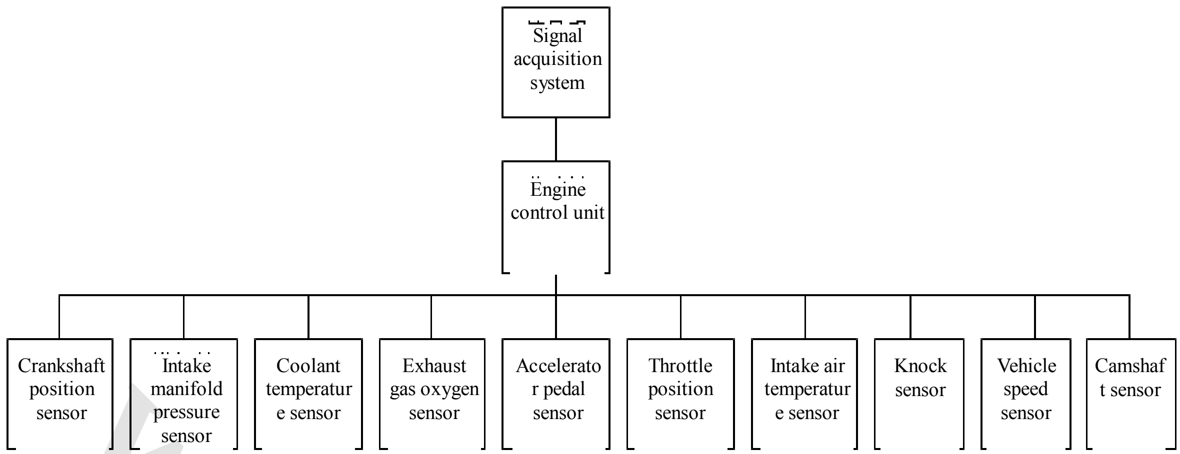
When the water temperature is less than 93℃, High-speed fan starts to run;

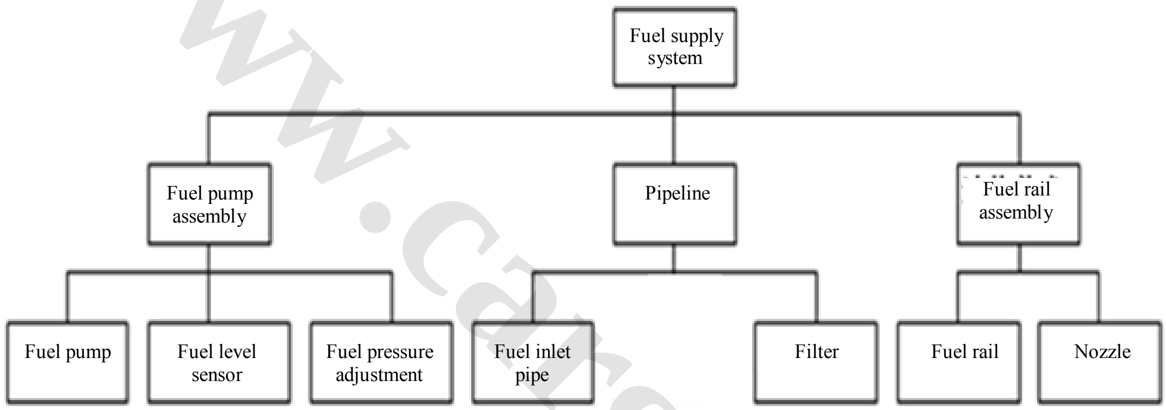
When A/C is on, in spite of coolant temperature, when the medium-voltage switch of A/C is turned on, the engine fan will run at a high speed.

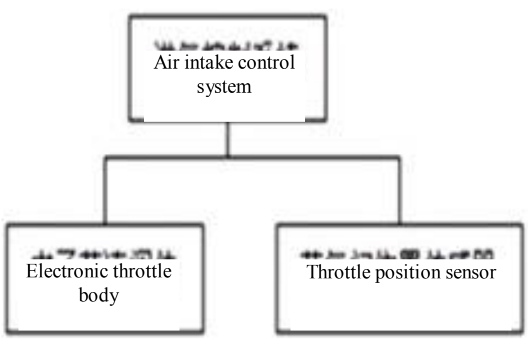
System Components

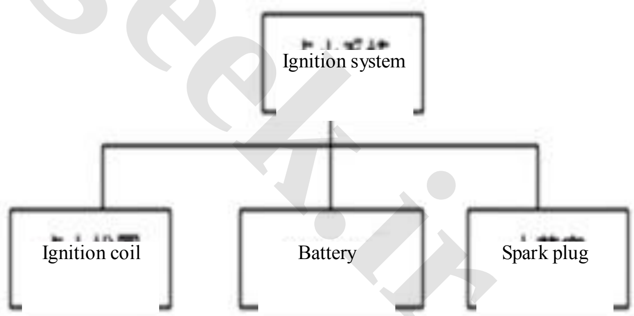
The hardware of engine management system works under the control of the engine control unit (ECM), which consists of control and signal acquisition, fuel supply, ignition, air intake control, exhaust control, fault diagnosis and communication sub-system. (See Fig. 1-17 Engine Management System)




Signal acquisition system
Engine control unit
Crankshaft position sensor
Intake manifold pressure sensor
Coolant temperatur e sensor
Exhaust gas oxygen sensor
Accelerato r pedal sensor
Throttle position sensor
Intake air temperatur e sensor
Knock sensor
Vehicle speed sensor
Camshaf t sensor


Fuel supply system
Fuel pump assembly
Pipeline
Fuel rail assembly
Fuel pump
Fuel level sensor
Fuel pressure adjustment
Fuel inlet pipe
Filter
Fuel rail
Nozzle


Air intake control system
Electronic throttle body
Throttle position sensor


Ignition system
Ignition coil
Battery
Spark plug

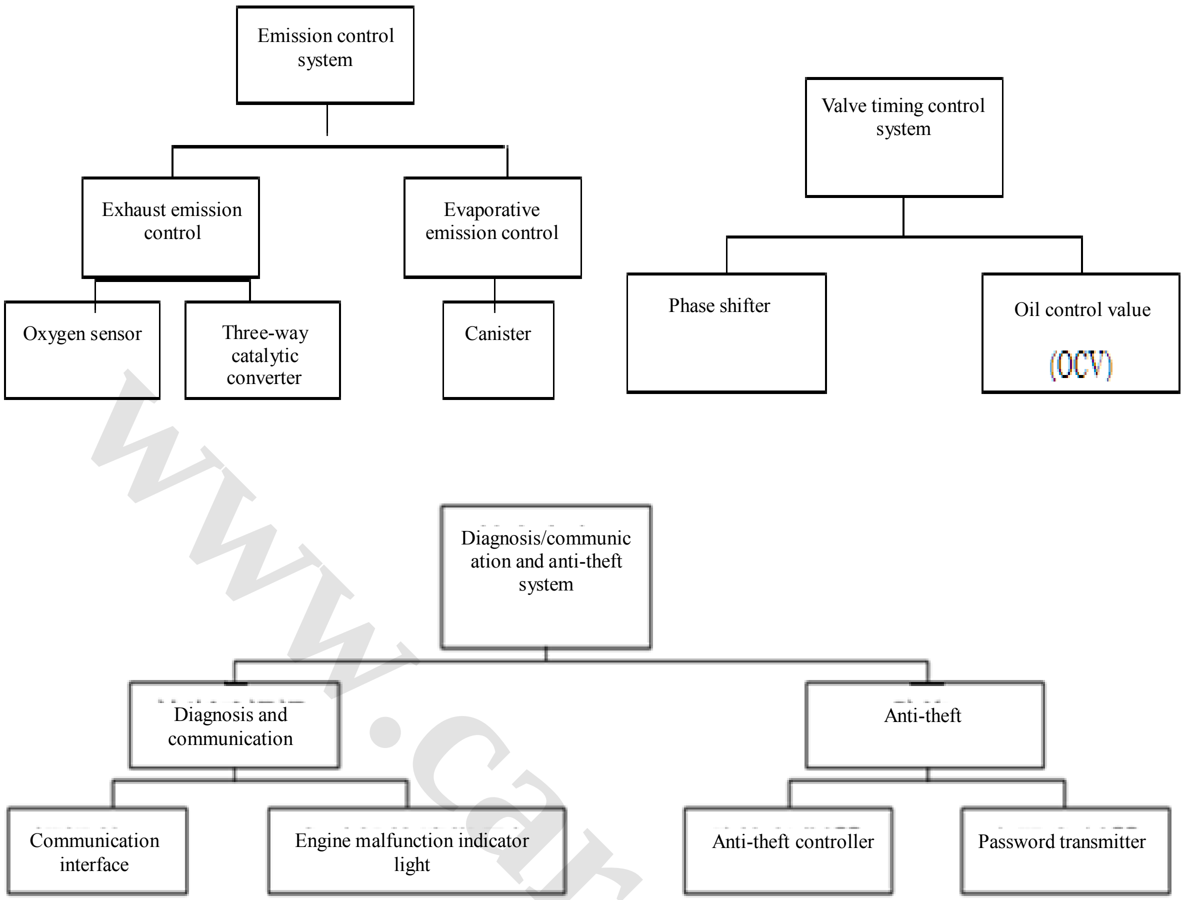


Fig.1-17 Engine Management System

Table 1-17 MT22.1 Basic Functional Component List of Engine Management System

S/N	Part Name	Qty.
1	Engine electronic control module	1
2	Intake air pressure and temperature sensor	1
3	Knock sensor	1
4	Oxygen sensor	2
5	The fuel rail assembly	1

6	Ignition coil	4
7	Coolant temperature sensor	1
8	Crankshaft position sensor	1
9	Camshaft position sensor	1
10	Electronic throttle motor assembly	1
11	Weak acceleration sensor	1
12	Crankshaft position sensor	1

Engine Control Module (ECM)

Function

The engine control module (Fig. 1-19 ECU) is a single-chip microprocessor. Its function is to process the sensor data from different parts of the complete vehicle, judge the working condition of the engine, and then accurately control the engine through the actuator.

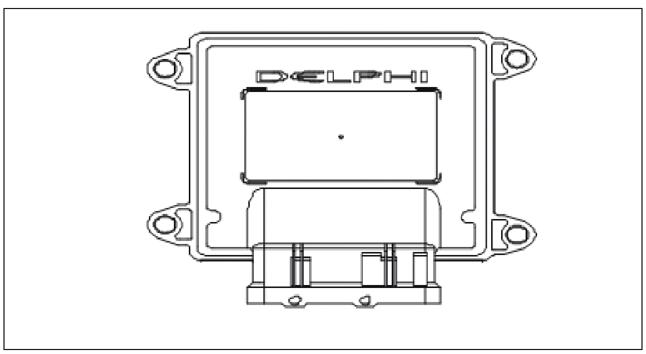


Fig. 1-19 ECU

CPU parameters

• 16-bit main chip;

• 40MHz clock frequency;
• 512K FLASH chip storage;
• 12K RAM memory;
• 4K EEPROM memory.

Working parameters

• Working voltage range

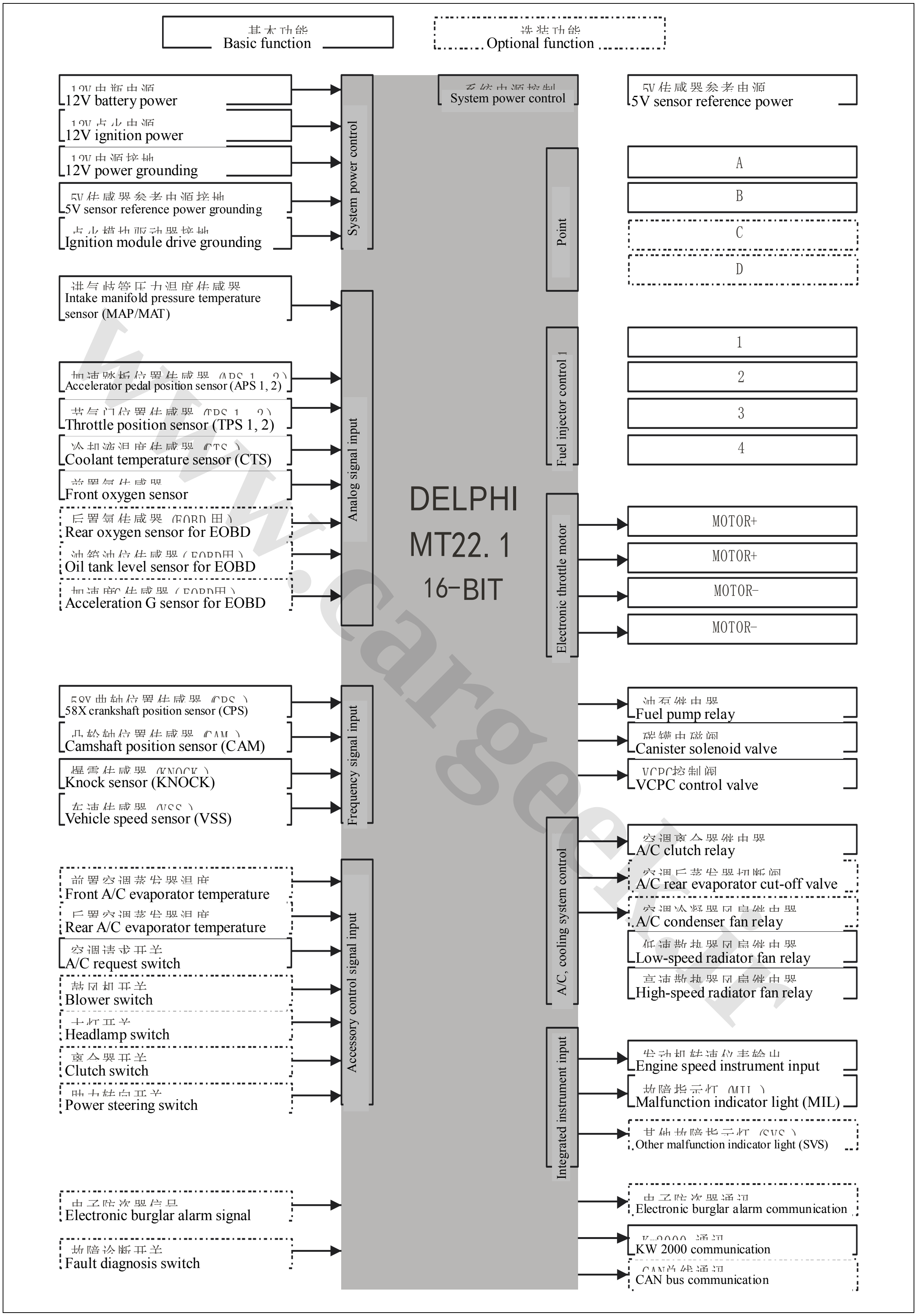
Normal working voltage range	9.0-16 V
Overvoltage and reversed polarity voltage protection	2. 4V/-14V＜60 seconds

• Installation

MT22． 1 ECM is designed to be installed in the engine compartment (not on the engine block), where is easily accessible for repair. ECU housing and fixed bolts should be directly connected to the electrical system of chassis.

• Temperature

Storage temperature	-40-125℃
Working temperature	-40-105℃


Basic function
Optional function
12V battery power
12V ignition power
12V power grounding
5V sensor reference power grounding
Ignition module drive grounding
Intake manifold pressure temperature sensor (MAP/MAT)
Accelerator pedal position sensor (APS 1, 2)
Throttle position sensor (TPS 1, 2)
Coolant temperature sensor (CTS)
Front oxygen sensor
Rear oxygen sensor for EOBD
Oil tank level sensor for EOBD
Acceleration G sensor for EOBD
58X crankshaft position sensor (CPS)
Camshaft position sensor (CAM)
Knock sensor (KNOCK)
Vehicle speed sensor (VSS)
Front A/C evaporator temperature
Rear A/C evaporator temperature
A/C request switch
Blower switch
Headlamp switch
Clutch switch
Power steering switch
Electronic burglar alarm signal
Fault diagnosis switch
System power control
Analog signal input
Frequency signal input
Accessory control signal input
DELPHI
MT22. 1
16-BIT
System power control
Point
Fuel injector control 1
Electronic throttle motor
A/C, cooling system control
Integrated instrument input
5V sensor reference power
A
B
C
D
1
2
3
4
MOTOR+
MOTOR+
MOTOR-
MOTOR-
Fuel pump relay
Canister solenoid valve
VCPC control valve
A/C clutch relay
A/C rear evaporator cut-off valve
A/C condenser fan relay
Low-speed radiator fan relay
High-speed radiator fan relay
Engine speed instrument input
Malfunction indicator light (MIL)
Other malfunction indicator light (SVS)
Electronic burglar alarm communication
KW 2000 communication
CAN bus communication

1-20 Delphi Schematic Diagram

Crankshaft position sensor

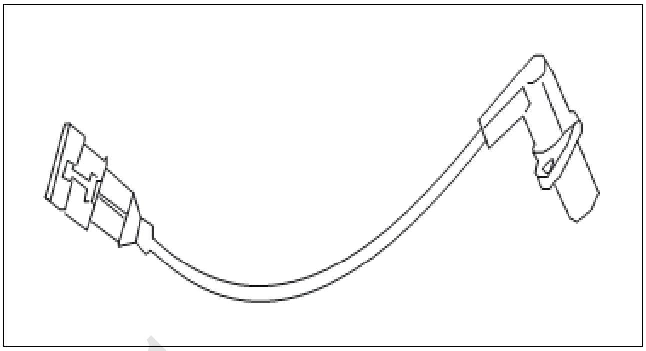


Fig.1-21 Crankshaft Position Sensor

Function

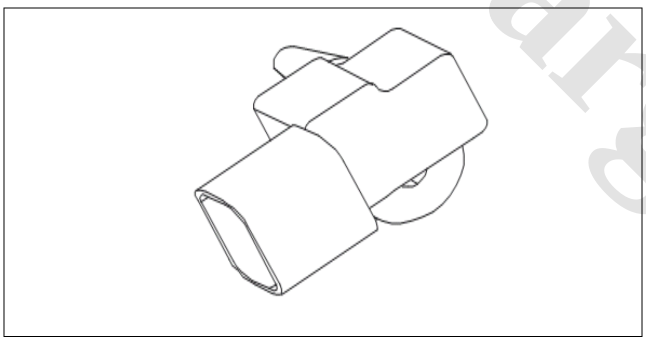
The output of the crankshaft position sensor can be used to determine the rotation position and speed of the crankshaft. The engine speed and crankshaft position sensor is a magnetoelectric sensor which is installed near the crankshaft and works together with the 58X gear ring on the crankshaft. During crankshaft rotation, the top gear box tooth gap of 58X will pass through the sensor in different distances, and the sensor should sense the change of magnetic resistance, this alternating magnetic resistance generates alternating output signals, but the gap position on the 58X gear ring should correspond to the upper dead center of engine. At the upper dead center of the first cylinder, the sensor will aim at the falling edge of the 20th tooth of the 58X gear ring, and the ECM will use this signal to determine the rotation position and speed of the crankshaft.

Performance

• No power supply required	
• Temperature range	-40-150℃
• Temperature range	-40-150℃;
• Output voltage	Increase with rotation speed (400mV/60rpm)

• Clearance to 58X gear ring:	0.3-1.5mm
• Coil resistance	560Ω±10%/25±5℃
• Coil inductance	240mH±15%/1kHZ
• Installation position	The sensor is installed in a position perpendicular to the crankshaft, which will work together with the 58 gear ring installed on the crankshaft. Connectors
• Connection terminals	With tail: 1-signal+, 2-signal-, and 3-shield;
	Without tail: 1-signal+, 2-signal-

Intake Manifold Pressure/Temperature Sensor



Function

The intake manifold absolute pressure/temperature (MAP/TAT) sensor integrates the intake manifold absolute pressure sensor and the function of intake manifold absolute temperature sensor into the same sensor to simultaneously feed back the intake manifold absolute pressure and temperature. The absolute pressure sensor will measure the air intake flow of engine, which is an important element of the measurement method of speed density air flow. The intake manifold absolute pressure (MAP) sensor consists of a sealed elastic diaphragm and an iron magnetic core that are accurately placed in the coil. When pressure is sensed, it will generate an input signal in direct proportion to input pressure and reference voltage; the sensor will directly sense the absolute pressure condition in the engine intake manifold, and the engine control module (ECM) will refer to other engine condition parameters based on this reference signal and adjust the fuel supply into the engine.

The temperature sensor will adopt a quick-response NTC (negative temperature coefficient) thermistor sensor. The ECM will measure the air temperature into the engine cylinder through this sensor.

Working parameters

Manifold pressure sensor:

• Pressure range	10kPa~110 kPa
• Working temperature	-40~125℃
• Working voltage	5±0.1 V
• Working voltage	12 mA (maximum)
• Output voltage	-100～100mv
• Output impedance	<10Ω
• DC load	30kΩ (minimum), 51kΩ
• Pressure sensor output function	

See Table 1-23 Manifold Pressure Sensor Pressure and Output Voltage Comparison for reference values (only for reference):

Table 1-23 Manifold Pressure Sensor Pressure and Output Voltage Comparison

Pressure (Kpa)	15	40	94	102
Output voltage (V)	0.12～0.38	1.52～1.68	4.44～4.60	4.86～5.04

Intake air temperature sensor (see Table 1-24 Intake Air Temperature Sensor No-load Resistance-Temperature Characteristics):

• Typical working voltage	5V DC
• Working temperature	-40~135℃
•·Dissipation constant	9mv / ℃
• Thermal response time	＜15s

Table 1-24 Intake Air Temperature Sensor No-load Resistance-Temperature Characteristics

Temperature（℃）	Rresistance (Ω)	Temperature（℃）	Rresistance (Ω)	Temperature（℃）	Rresistance (Ω)	Temperature（℃）	Rresistance (Ω)
-40	48,153	5	4,707	50	851	95	214
-35	35,736	10	3,791	55	721	100	186
-30	26,885	15	3,075	60	612	105	162
-25	20,376	20	2,511	65	522	110	142
-20	15,614	25	2,063	70	446	115	125
-15	12,078	30	1,715	75	383	120	110
-10	9,428	35	1,432	80	329	125	97
-5	7,419	40	1,200	85	284	130	85
0	5,887	45	1,009	90	246		

Installation position

It is installed on the voltage regulation cavity of engine.

Connectors

• Connection terminals: 1-signal ground, 2-temperature signal, 3- +5V, 4-pressure signal.

Use and maintenance instructions

This sensor is installed with an angle less than 30° in the vertical direction, so as to avoid condensate water on the wiring terminal flowing into the sensor, which will directly influence the reliability and durability of the sensor. When necessary, the sensor can be cleaned with is propanol and then wait for air dry. The soak time in isopropanol should not be more than 1 minute. There must be no cleaning solution flowing into the sensor during cleaning.

Coolant temperature sensor

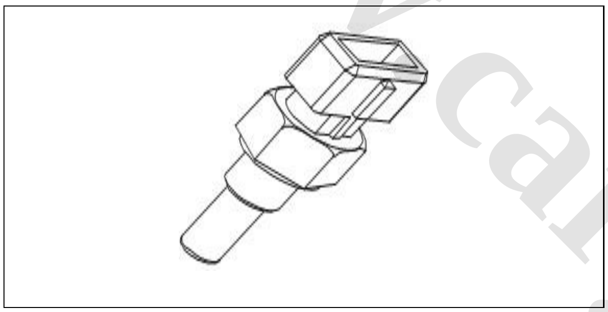


Fig.1-25 Coolant Temperature Sensor

Function

The coolant temperature sensor is used to check the working temperature of the engine. The ECM will provide the engine with the best control scheme in accordance with different temperatures. The coolant temperature sensor adopts a NTC (negative temperature coefficient) thermistor sensor. When the coolant temperature rises, the resistance will decrease. The coolant temperature sensor is ordinarily installed on the main channel of engine.

Performance

• Working voltage:	5V DC
• Working temperature:	-40~135℃
• Dissipation constant:	25mv / ℃
• Thermal response time:	17～27s

Mechanical property

• Hexagon nut	18.90mm
• Screw thread dimension:	M12×1.5
• Effective sealing pressure	145kpa
• Installation torque:	20N•m
• Installation position	The main channel of engine
• Connection terminals	C-5V power and A-temperature signal

Camshaft position sensor

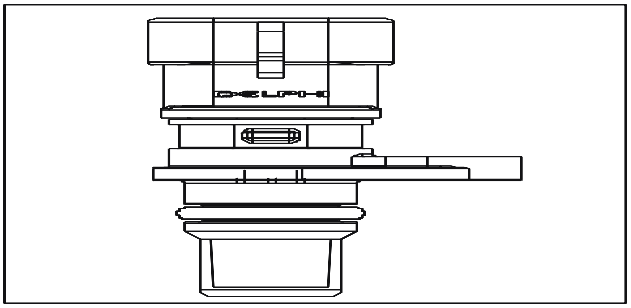


Fig.1-26 Camshaft Position Sensor

Function

The camshaft position sensor is a Hall Effect sensor, which is installed near the camshaft of the cylinder head and works together with the signal round on the camshaft. The signal round is corresponding to the specific position of engine. The ECM will measure and get the digital voltage signals through this sensor, so as to determine engine's working cylinder and carry out one-to-one control.

Performance

Working temperature	-40～150℃
Working voltage	4. 5～13V
Working clearance	0.3～2mm
Installation position	Near the camshaft
Connection terminals	1- +5V, 2-signal ground, and 3-signal

Knock sensor

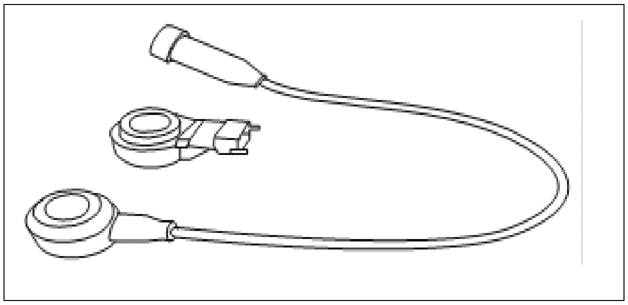


Fig.1-27 Knock Sensor

Function

This system adopts a frequency response type knock sensor installed in the engine part sensitive to knock to sense the knock generated from the engine. The ECM will detect the knock intensity through the knock sensor and optimize the engine power, fuel economy and emission level.

Performance

Output signals	
Frequency	Output signals
5kHz	17～37mv/g
8kHz	+15% to that at 5kHz
13kHz	+30% to that at 5kHz
18kHz	Twice as much as that at 13kHz
Under any circumstances	＞17Mv/g
Frequency range	3～18kHz
Capacitance:	1480～2220pf (under 25℃ and 1,000Hz)

Resistance	＞1MΩ (under 25°C)
Working temperature	-40～150℃
Installation position	between the No. 2 and No. 3 cylinders
Connection terminals	1-signal and 2-grounding through the shielding layer.

Oxygen sensor

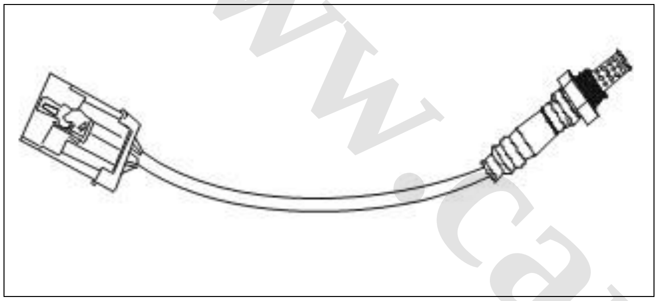


Fig.1-28 Oxygen Sensor

Function

The oxygen sensor is an important symbolic part of the closed-loop fuel control system, which adjusts and keeps an ideal air-fuel ratio to make the three-way catalytic converter reach the best conversion efficiency. When the air-fuel ratio participating in engine combustion becomes thin, the oxygen content in the exhaust will increase and the output voltage of the oxygen sensor will decrease, and vice verse, thus to feed back air-fuel ratio condition to the ECM.

The sensitive material of the oxygen sensor is zirconia, with hollow part and external sensitive part. When zirconia components are activated by heating (>300°C), the reference air will go into the hollow part of the zirconia component through the lead, the exhaust air will pass through the zirconia outside electrode, and the oxygen ions will move from the zirconia center to the outside electrode, thus a simple atomic battery is formed, which will generate voltage between the two poles; the zirconia can change this output voltage according to the oxygen concentration in the exhaust air, so as to judge the oxygen content in the exhaust air. Generally speaking, the oxygen sensor is designed to change a voltage amplitude near the theoretical air-fuel ratio (14.7:1), which will help the ECM accurately judge the air-fuel ratio.

Performance

• Performance parameters:

Temperature	260℃	450℃	595℃
Thick output voltage (mv)	＞800	＞800	＞750
Thin output voltage (mv)	＜200	＜200	＜150
Thin-to-thick response time (ms)	＜75	＜75	＜50
Thick-to-thin response time (ms)	＜150	＜125	＜90
Internal resistance (Ω)	<100K		

• Maximum operating temperature (continuous):

Storage temperature: -40～100℃.

Maximum operating temperature (continuous):	
Exhaust temperature:	＜930℃:
Mounting seat:	＜600℃
Shell’s hexagon area:	＜500℃

Lead and protective sleeve:	＜275℃
Lead gasket:	＜250℃
Plug connector:	＜125℃
Storage temperature:	-40～100℃

Recommended operating conditions

Exhaust temperature:	200～850℃
Permitted fuel impurity content must be less than:	Lead-0.005 g/l
	Phosphorus-0.0002 g/l
	Sulfur-0.04% (proportion by weight)
	Silicon-4ppm
	MMT-0.0085 g / l
Oil consumption	not more than 0.02 l/h
Installation position	between the exhaust valve and the three-way catalytic converter
Connectors	1-low signal, B-high signal, 3-heating power negative, and 4-heating power positive

Fuel rail

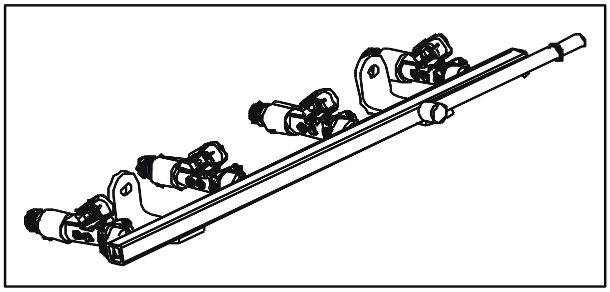


Fig.1-29 Fuel Rail Assembly with Fuel Injection Nozzle

Function

The fuel rail assembly consists of fuel distribution pipe, fuel injector and some fixed components. Its function is to provide storage space for certain pressure fuel, provide pipeline for flowing to each nozzle, and provide support for fixing nozzle.

Working parameters:

Working temperature	-30～115℃
Installation position	Installed on the intake manifold

Fuel Injector

Function

The nozzle adopts a ball valve device with magnetic switch. The coil leads to the two poles through the engine wire harness to connect with the ECM and power. When the coil completes the ground conductivity of system under the control of ECM, it will generate magnetic force to overcome spring force, fuel pressure and manifold vacuum suction. When the valve core is sucked up, the fuel will pass through the valve seat hole and spray out of the pilot hole to the intake valve in mist status. After the power is off, the magnetic force will disappear, under the spring force and the fuel pressure, the nozzle will be closed.

The upper part of the fuel injector adopts the reliable pressure fuel seal formed from rubber seal ring and fuel guide rail interface; the lower part of the fuel injector also adopts the rubber seal and engine intake manifold to seal air.

Product characteristics:

Working temperature	-40～130℃
Minimum working voltage	4.5V
Coil resistance	12.0±0.4Ω
Installation position	It is fastened to the intake manifold through the fuel rail assembly
Connectors	A—+12V, B—ECM

Iginition coil

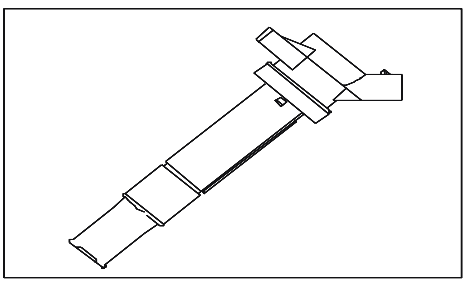


Fig. 1-30 Pencil Ignition Coil

Function

Delphi pencil ignition coil consists of a black shell and a columnar coil with a three-terminal electrical plug. The coil is a high-energy-conversion device formed from low-voltage primary coil, secondary high-voltage coil and iron core mutually insulated, which is finally coated with epoxy resin.

Working principle

A Delphi pencil ignition coil is only for a cylinder. Under the control of the ECM, the primary coil should be charged to save magnetic energy, the secondary coil winding should sense high voltage, so as to make the spark plug connected to the coil spark over and orderly control the output high voltage energy from the ignition coil of each cylinder to the spark plug.

Delphi pencil ignition coil is connected with the engine control parts on the vehicle, so as to control ignition time, dwell time and spark progress. The ignition function is carried out along with the current of the primary coil in the electronic ignition system flowing to the integrated coil. The switch will be controlled by the electronic spark timing signal from the pulse code modulation. When the electronic spark timing signal falls to or below a specific critical voltage level, the primary current will be cut off to make the electricity rotate from the primary winding to the secondary winding. The electricity generated in the secondary winding will be directly transmitted to the spark plug.

Technical parameters:

Voltage range	6～16V
Primary charging time	2.15msec
Primary operating current peak	7.5Amp
Minimum ignition duration	1.0ms
Minimum ignition energy	35mJ
Connection terminals	1 -ignition switch power positive, GND-ground wire, and 3-to ignition module (inserted into the ECM).

Electronic throttle body

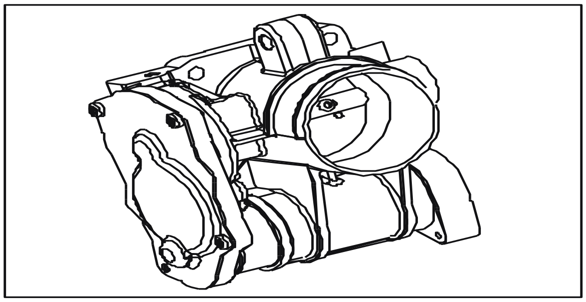


Fig.1-31 Electronic Throttle Body Assembly

Function

The throttle opening of the electronic throttle body assembly should be determined by the ECM. The ECM will calculate the required engine output power of the vehicle at this moment and under this condition based on the throttle pedal control input signals controlled by the driver and other sensor input signals, and thus control the fuel supply (injection) of the engine and correct the control parameters in accordance with the feedback signals, so as to ensure the best control condition of the engine. The electronic throttle body is newly provided with drive motor, gear drive mechanism, as well as throttle position sensor with better function and higher reliability.

Product characteristics:

Valve hole diameter: Φ57mm

Maximum air flow for wide open throttle

(Under standard atmospheric pressure) > 67 g/s

Minimum air flow when throttle fully closed: 1.7 g/s

Installation position and notes:

The throttle body is installed in front of the intake manifold.

Carefully install the wire harness, avoid damage to the terminal. And avoid unnecessary plug.

Do not let any throttle body fall from a height above 500mm to the solid ground.

Canister solenoid valve

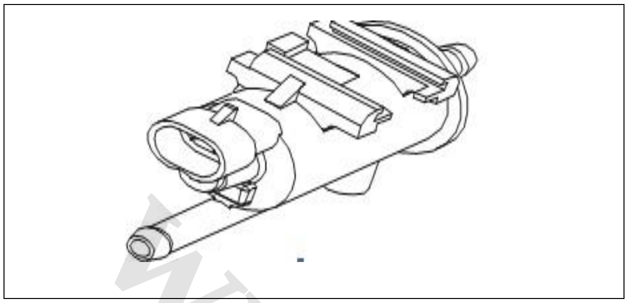


Fig.1-32 Canister Solenoid

Function

The ECM will control the gasoline vapor into the intake manifold from the canister through the CanCV canister purge control solenoid value; the ECM will output pulse square wave, and the duty ratio of the ventilatory capacity and the control pulse square wave should be in a linear relationship.

The ECM will change the work time and speed of canister purge in accordance with the engine speed and load. The function of idle speed control valve is to control the circulation area of the throttle bypass air passage.

Product characteristics:

• Rated working voltage	+12V
• Working voltage range	8～16V
• Limit voltage	25V（＜ 60 s)
• Working temperature	-40～120℃
• Coil resistance	19～22Ω

• Coil inductance	12～15mH
• Installation position	the engine compartment between the fuel vapor canister and the intake manifold.
• Connection terminals	1—+12V、2—ECM

Weak acceleration sensor

1. Function

The weak acceleration sensor is used to detect and judge the complete vehicle vibration so as to avoid mistaken misfire judgment and mistaken ignition and effectively control engine operation. When driving on bumpy roads, due to fluctuation of crankshaft rotation speed, the angular velocity vector of crankshaft will be influenced by wheel vibration. The result caused by fluctuation of crankshaft rotation speed is similar to the result of mistaken ignition of engine. In order to avoid ignition failure due to the mistaken judgment of the engine electronic control system on ignition when driving on bumpy roads, it is necessary to record the peak acceleration of the vehicle body with auxiliary sensors and avoid mistaken ignition on these occasions.

2. Product characteristics:

Working temperature: -40～125

European On-Board Diagnostics (EOBD)

Instructions on EOBD

When the system goes into working condition and the engine runs, the ECM will control the work of all parts and monitor the parts directly connected with it in real time. When a part (or several parts) in the system works abnormally, the system will alarm automatically. Each fault is provided with an unique code. Once there is a fault, the system will output the code (i.e. fault code) through the diagnostic interface and turn on the "engine malfunction indicator light” to remind the driver of timely maintenance. The fault code will indicate the potential fault position.

When there is a fault detected, the system can also use the temporary emergency program to control the operation of the engine, so as to make the driver drive the vehicle to the repair station instead of breaking down by the road.

Instructions on Malfunction Indicator Light (MI)

The malfunction indicator light is the indicator connected to the OBD system, which is used to remind the drive when any parts associated with emission and the OBD system have faults.

As shown in Fig. 1-33 Malfunction Indicator Light:

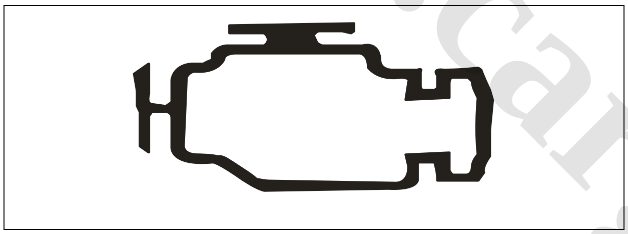


Fig.1-33 Malfunction Indicator Light

Working Rules of Fault Indicator Lights

When component or system faults make vehicle emission surpass regulated requirements, the malfunction indicator light must be activated at the required time. Please activate the malfunction indicator lights as per the following criteria in accordance with whether the fault has influence on emission and its severity:

Fault codes influencing emission:

Type A: Activate MI indicator light and record fault codes when happen a time;

Type B: Activate MI indicator light and record fault codes when respectively happen a time in two continuous strokes;

Type E: Activate MI indicator light and record fault codes when respectively happen a time in three continuous strokes;

Fault codes without influence on emission:

Type C: Record fault codes but not activate MI indicator light when faults take place. The manufacturer may activate the SVS light as required.

Type D: Record fault codes but not activate any indicator lights when faults take place.

Turn off malfunction indicator (MI):

If the detection system in charge of activating MI detects no malfunction or other faults that may separately activate MI in three continuous strokes, the MIL will be turned off.

Removal of fault codes:

If the same fault does not take place again in 40 or over 40 engine warm-up cycles, the on-board diagnostic system will eliminate this fault code and the driving distance when this fault takes place to verify each data information.

Note: A stroke means the drive cycle that all OBD tests can be carried out, which can follow the testing program (Part I + Part II) of GB 4 emission.

Fault Code Details

Steps for reading

DTC of LIFAN X60 engine electric control system is read by special diagnostic scanner provided by LIFAN. If fault is read by diagnostic scanner not provided by LIFAN, the result is unreliable. The diagnostic scanner used for reading and removing the following DTC is a LIFAN special V30 diagnostic scanner.

(a). Connect Lifan V30 diagnostic scanner to the diagnostic connector.

(b). Turn on the diagnostic scanner, and enter into "Chongqing Lifan diagnosis system".

(c). Select Diagnostic Program version " V5.2", and then click "OK."

(d). Choose model X60.

(e). Select to enter into"Power Train"

(f) Select to enter into "engine system (Delphi VVT ETC)".

(g). Select to enter into "Read DTC".

(h). Read engine DTC information.

DTC clearing

1. Description

(a). Removing DTC is to remove the fault record from the auto computer.

(b). The DTC can be cleared only after the vehicle fault has been troubleshoot.

(c). After the completion of erasing the DTC, the tester will perform the operation of reading the DTC once automatically. If the tester can still read a DTC, it is an indication that there is still a certain fault which has not been eliminated.

(d). Using the function of 'Clear DTC' to remove some DTCs which can be directly removed from the ECM fault memory after repair.

Note:

Some DTC may light MIL in OBD system, it is necessary to start several times according to corresponding calibration mode to clear it automatically.

2. Clearing procedure

The usual methods for removing DTC include: using instrument, disconnecting the battery negative cable and disconnecting the master fuse of electrical control system. DTC of LIFAN X60 model is cleared by special V30 diagnostic scanner.

(a). Connect Lifan V30 diagnostic scanner to the diagnostic connector.

(b). Turn on the diagnostic scanner, and enter into "Chongqing Lifan diagnosis system".

(c). Select Diagnostic Program version " V5.2", and then click "OK."

(d). Choose model X60.

(e). Select to enter into "Power Train"

(f) Select to enter into "engine system (Delphi VVT ETC)".

(a). Click "Clear DTC" to clear DTC.

(h). Select "OK" to clear DTC.

Delphi MT22.1 Engine Management System Fault Code Table (See Fig.1-34)

Fig.1-34 Table of Delphi MT22.1 Fault Codes

Component/Sy	DTC	Details	Type

stem			
Catalytic converter	P0420	Catalytic converter deterioration diagnosis	A
Front oxygen sensor	P0031	Front oxygen sensor heater low voltage	A
	P0032	Front oxygen sensor heater high voltage	A
	P0131	Front oxygen sensor short circuit to low voltage	E
	P0132	Front oxygen sensor short circuit to high voltage	E
	P0133	Front oxygen sensor response is too slow	E
Front oxygen sensor	P0134	Front oxygen sensor open circuit	A
	P1167	Diagnose if the front oxygen sensor is thick during deceleration and fuel cut-off	E
	P1171	Diagnose if the front oxygen sensor is thin during acceleration and concentrating	E
Rear oxygen sensor	P0037	Rear oxygen sensor heater low voltage	A
	P0038	Rear oxygen sensor heater high voltage	A
	P0137	Rear oxygen sensor short circuit to low voltage	E
	P0138	Rear oxygen sensor short circuit to high voltage	E

	P0140	Rear oxygen sensor open circuit	E
Fire	P0300	Single-cylinder or multi-cylinder fire	B (Emission damage)
			A (Catalytic converter damage)
Bumpy road test	P0317	Bumpy road signal source diagnosis	C
	P1396	Wheel speed signal fluctuation overrun diagnosis	C
	P1397	No wheel speed signal	C
Intake air pressure sensor	P0105	Intake air pressure sensor signal clamped	E
	P0106	Intake air pressure/throttle position reasonable fault	E
Intake air pressure sensor	P0107	Intake air pressure sensor line low voltage, open circuit	A
	P0108	Intake air pressure sensor line high voltage	A
Intake air temperature sensor	P0112	Intake air temperature sensor line low voltage	A
	P0113	Intake air temperature sensor line high voltage or open circuit	A
Coolant temperature	P0117	Coolant temperature sensor line low voltage	A

sensor	P0118	Coolant temperature sensor line high voltage or open circuit	A
Electronic throttle	P0122	Throttle position sensor 1 low voltage	A
	P0123	Throttle position sensor 1 high voltage	A
	P0222	Throttle position sensor 2 low voltage	A
	P0223	Throttle position sensor 2 high voltage	A
	P2135	Throttle position sensor relationship	A
	P2119	Throttle restores default position	C
	P2122	Accelerator pedal position sensor 1 low voltage	A
	P2123	Accelerator pedal position sensor 1 high voltage	A
	P2127	Accelerator pedal position sensor 2 low voltage	A
	P2128	Accelerator pedal position sensor 2 high voltage	A
	P2138	Accelerator pedal position sensor relationship	A
	P0068	Air flow executive diagnosis	A
	P2101	Electronic throttle drive secondary diagnosis	A
Electronic	P1516	Electronic throttle steady drive diagnosis	A

throttle	P0641	Reference voltage A diagnosis	A
	P0651	Reference voltage B diagnosis	A
	P2104	Forced idling	A
	P2106	Limit performance	A
	P2110	Power management	A
	P2105	Forced flameout	A
	P060B	Accelerator pedal two-way analog/digital input signal relativity diagnosis	A
	P060D	Electronic throttle dual-path consistency diagnosis	A
	P0504	Brake switch correlation fault	C
	P0571	Brake light troubleshooting	C
Nozzle	P0201	1# nozzle fault	A
	P0202	2# nozzle fault	A
Nozzle	P0203	3# nozzle fault	A
	P0204	4# nozzle fault	A
Knock sensor	P0324	Knock control system failure	C
	P0325	Knock control system failure	C
Crankshaft position sensor	P0336	Crankshaft position sensor line signal interference	E

	P0337	No crankshaft position sensor line signal	A
	P1336	58-tooth gear error not learnt	A
Camshaft Position Sensor	P0340	Camshaft position sensor state diagnosis	A
	P0341	Camshaft H standard wheel diagnosis	A
	P0016	Camshaft offset diagnosis	B
	P0012	Variable camshaft phase error diagnosis	A
	P0011	Variable camshaft phaser response diagnosis	B
	P0026	Hydraulic control valve clamped	A
Variable cam phase	P0076	Hydraulic control valve coil low voltage	A
	P0077	Hydraulic control valve coil high voltage	A
Ignition coil output	P0351	Ignition coil 1# output fault	A
	P0352	Ignition coil 2# output fault	A
	P0353	Ignition coil 3# output fault	A
	P0354	Ignition coil 4# output fault	A
Vehicle speed sensor	P0502	No vehicle speed sensor signal	E
System voltage	P0562	Low system voltage	C
	P0563	High system voltage	C
A/C clutch	P0646	A/C clutch line output low voltage	C

	P0647	A/C clutch line output high voltage	C
Fuel pump relay	P0230	Fuel pump relay failure	C
Power steering	P0551	Power steering failure	C
Malfunction indicator light	P0650	Malfunction indicator light fault	C
Canister solenoid valve	P0458	Canister solenoid valve low voltage	E
	P0459	Canister solenoid valve high voltage	E

Cooling fan	P0480	Low-speed fan failure	C
	P0481	Low-speed fan failure	C
Main relay	P0685	Main relay failure	A
Fuel system	P0171	The fuel system is too thin under non-idling working conditions	E
	P0172	The fuel system is too thick under non-idling working conditions	E
	P2187	The fuel system is too thin under idling working conditions	E
	P2188	The fuel system is too thick under idling working conditions	E
Clutch	P0807	Clutch switch line low voltage	A
	P0808	Clutch switch line high voltage	A
Computer self-diagnosis	P0606	Computer self-diagnosis	A
Burglar alarm	P0633	Burglar alarm not learning fault	C
	U0167	Burglar alarm no response	C
	U0426	Burglar alarm authentication failure	C

When there is a fault, the system can also adopt temporary emergency measures to control the work of engine, so as to ensure the driver to drive the vehicle to the service station for repair rather than stop by the road.

Description of Fault Code

P0113	A DTC will appear when there is an open circuit of the intake air temperature sensor or a short circuit of the 5V reference voltage.
P0112	A DTC will appear when the intake air temperature sensor is short-circuited to the ground and the MAT voltage signal changes to 0.
P0420	When the coolant temperature is higher than 70°C and the fuel system is in closed loop, the vehicle shall be made to drive at a constant speed for a certain distance and then to drive at idle speed after it stops. The system will compare the signals of front and rear oxygen sensors and calculate the oxygen amount difference of the catalytic converter. If the oxygen amount is less than the set value, the system will report this fault.
P0118	A DTC will appear when there is an open circuit of the signal line of the coolant temperature sensor or a short circuit of the 5V reference voltage. Then the coolant temperature shall be the calibration value changing with the driving time by default. The engine operates steadily and the vehicle can be driven.
P0117	A DTC will appear when the signal line of the coolant temperature sensor is short-circuited to the ground. Then the coolant temperature shall be the calibration value changing with the driving time by default. The engine operates steadily and the vehicle can be driven.
P0336	If the clearance between the crankshaft position sensor and the flywheel teeth tip is unsuitable or they two interfere with each other seriously, which may weaken the signal of the crankshaft position sensor and mix it with the background noise

	signal, the engine shall be started. When the number of teeth identified by the system is quite different from 58 teeth, a DTC will appear. On the basis of different faults, a fire, back fire or flame out may happen to the engine.
P0337	When the crankshaft position sensor is disconnected or short-circuited to the ground or the 12V voltage during the rotation of the crankshaft and the camshaft of the engine, the fault timer of the crankshaft position sensor will begin to work. After the accumulated time of the timer exceeds 2s, a fault will be reported and the engine can not be started.
0351 /P0353 /P0354 /P0352	If the ignition coil control end is disconnected or short-circuited to the ground or the 12V voltage, a DTC will appear and the cylinder with the DTC will stop injecting fuel. Then the rotation speed of the engine will fluctuate. If the DTC is not eliminated for a long time, there may be a fire fault.
P0171	If the non-idle study module value of the fuel closed-loop control is much higher than the normal value, the fuel shall be too thin.
P0172	If the non-idle study module value of the fuel closed-loop control is much less than the normal value, the fuel shall be too thick.
P2187	If the idle study module value of the fuel closed-loop control is much higher than the normal value, the fuel shall be too thin.
P2188	If the idle study module value of the fuel closed-loop control is much less than the normal value, the fuel shall be too thick.
P0201 ～ P0204	If the nozzle control end is disconnected or short-circuited to the ground or the 12V voltage, a DCT will appear. The rotation speed of the engine is unstable for abnormal fuel supply. If the DTC is not eliminated for a long time, a flame out fault may happen.
P0325	Under the conditions of 1,600 rpm or higher and some load, the signal of the knock sensor is disconnected and then a DTC appears. The engine operates

	steadily and the vehicle can be driven.
P0324	Under the conditions of 1,600 rpm or higher and some load, any circuit of the knock sensor signal line is grounded and then a DTC appears. The engine operates steadily and the vehicle can be driven.
P0108	When the MAP sensor is short-circuited to the power supply or the 5v reference voltage under the idle speed, a DTC will appear. The engine operates steadily and the vehicle can be driven.
P0107	When the MAP sensor is open-circuited or it is short-circuited to the ground under the idle speed, a DTC will appear. The rotation speed of the engine will fluctuate slightly and then recover to the stable and the vehicle can be driven.
P0106	The water temperature is higher than 60°C during the operation of the engine and there are no faults of the intake air pressure sensor, coolant temperature sensor, electronic throttle position sensor, fuel injector, or ignition coil. If the corrected value of the atmospheric pressure is higher than the maximum or lower than the minimum for more than 15s, a fault will be reported.
P0105	When the engine starts with the rotation speed of higher than 350rpm and the difference between the intake air pressure and the intake air pressure during the start is lower than 2kPa, which lasts more than 1s, a fault will be reported. Then the intake air pressure shall be the calibration value changing with the engine working conditions by default. The engine operates steadily and the vehicle can be driven.
P0650	If the status of the fault indicator output circuit does not follow the expectancy of the ECM, a fault will be reported.
P0300	Under stable working conditions, the fluctuation of the crankshaft revolving speed monitored by the ECM exceeds the value set by the system. If the fire is small, which only affects the emission, and there is no emergency control plan,

	only the DTC shall be recorded and the data stream shall be frozen; then the fault MI light will be lit. If the fire is big, which may overheat the catalytic converter, the working conditions of the fuel open-loop control will be entered forcibly and the correction study of the rear oxygen sensor will be prohibited. Then the fault indicator will flash at the frequency of 1Hz to remind the driver to reduce the engine rotation speed and load immediately and drive to the service station as soon as possible.
P0031	If the heater of the front oxygen sensor is grounded or open-circuited, a DTC will appear. The engine operates steadily and the vehicle can be driven.
P0032	If the heater of the front oxygen sensor is short connected to 12V power supply, a DTC will appear. The engine operates steadily and the vehicle can be driven.
P1171	When the engine enters the power enrichment (PE) condition and the voltage of the oxygen sensor signal, detected by the ECM, is lower than 0.35V, which lasts more than 12s, a fault will be reported and the closed-loop fuel control will be stopped.
P0134	A DTC will appear when the engine operates for over 60s, the water temperature is higher than 70°C and the front oxygen sensor control line is disconnected for more than 80s. The engine operates relatively steadily and the vehicle can be driven.
P0133	The coolant temperature is higher than 70°C and the engine operates for more than 60s at the speed between 1700RPM and 2300RPM. The response time of the oxygen sensor to the concentration changes of oxygen in exhaust exceeds the limit set by the system.
P1167	When the engine enters the deceleration fuel cut off (DFCO) condition and the voltage of the oxygen sensor signal, detected by the ECM, is lower than 0.55V, which lasts more than 12s, a fault will be reported and the closed-loop fuel control will be stopped.

P0132	The engine operates for over 60s, the water temperature is higher than 70°C and the front oxygen sensor signal is short-circuited to the power supply. If this situation lasts more than 13s, a DTC will appear. The engine operates relatively steadily and the vehicle can be driven.
P0131	The engine operates for over 60s, the water temperature is higher than 70°C and the front oxygen sensor is short-circuited to the ground. If this situation lasts more than 13s, a DTC will appear. The engine operates relatively steadily and the vehicle can be driven.
P0037	If the heater of the front oxygen sensor is grounded or open-circuited, a DTC will appear. The engine operates steadily and the vehicle can be driven.
P0038	If the heater of the front oxygen sensor is short connected to 12V power supply, a DTC will appear. The engine operates steadily and the vehicle can be driven.
P0140	The engine operates for over 60s, the water temperature is higher than 70°C and the rear oxygen sensor signal value exceeds the reasonable scope. If this situation lasts more than 165s, a DTC will appear. The engine operates relatively steadily and the vehicle can be driven.
P0138	The engine operates for over 60s, the water temperature is higher than 70°C and the rear oxygen sensor signal is short-circuited to the power supply. If this situation lasts more than 13s, a DTC will appear. The engine operates relatively steadily and the vehicle can be driven.
P0137	The engine operates for over 60s, the water temperature is higher than 70°C and the rear oxygen sensor is short-circuited to the ground. If this situation lasts more than 25s, a DTC will appear. The engine operates relatively steadily and the vehicle can be driven.
P0563	If the ignition switch is placed at the electrification position and the system voltage is higher than 16V, which lasts 40s, a fault will be reported.

P0562	If the ignition switch is placed at the electrification position and the system voltage is lower than 11V, which lasts 40s, a fault will be reported.
P1336	If the engine operates, the 58-tooth gear study is not carried out and the gear study mark is not set, a fault will be reported.
P0502	Drive the vehicle at the 3rd gear low speed under the engine hot status and disconnect the signal line of the vehicle speed sensor. Fiercely press down the accelerator to speed up to above 4,000 rpm and release the accelerator. Then the rotation speed of the engine, the vehicle speed and the MAP value begin to decrease. When the fault judgment window is entered, a DTC will be reported; at this moment the driving is slightly influenced. Drive the vehicle at the 4th gear low speed under the engine hot status and disconnect the signal line of the vehicle speed sensor. Press down the accelerator to reach a medium speed. Then the rotation speed of the engine, the vehicle speed and the MAP value enter the fault judgment window and a DTC is reported; at this moment the driving is slightly influenced.
P0571	The brake lamp switch signal is disconnected, the vehicle is locked and the diagnosis window is entered. A DTC will appear after the brake is applied several times. The engine operates relatively steadily and the vehicle can be driven.
P0504	The brake switch signal is disconnected. When the vehicle is locked, the switch signal does not change.
P2138	Signals of APSl and APS2 are different. If the difference of the input signals is higher than 8％, a DTC will appear. The engine operation is based on ETCMODE.
P2123	When the APSl signal end is short-circuited to the power supply and the input signal is higher than 97.5％, a DTC will appear. The engine operation is based

	on ETCMODE.
P2122	When the APSl signal end is grounded or disconnected and the input signal is lower than 3. 5%, a DTC will appear. The engine operation is based on ETCMODE.
P2128	When the APS2 signal end is short-circuited to the power supply and the input signal is higher than 55%, a DTC will appear. The engine operation is based on ETCMODE.
P2127	When the APS2 signal end is grounded or disconnected and the input signal is lower than 2.5%, a DTC will appear. The engine operation is based on ETCMODE.
P060D	If the throttle positions are not the same via the calculation by the two paths of the computer, a DTC will appear. The engine operation is based on ETCMODE.
P2104	When some faults happen to the throttle, the accelerator pedal, and the brake sensor, the idle speed mode shall be entered forcibly and a fault will be determined.
P2105	When some faults happen to the accelerator pedal, the brake sensor, and the ECM, the engine will be stopped forcibly and a fault will be determined.
P2106	When some faults happen to the throttle or the accelerator pedal sensor, the performance limitation mode shall be entered forcibly and a fault will be determined.
P2110	When some faults happen to the throttle or the accelerator pedal sensor, the power management mode shall be entered forcibly and a fault will be determined.
P1516	If the actual throttle position is quite different from the expectancy of the system under the stable working conditions, a DTC will appear. The engine operation is

	based on ETCMODE.
P2101	If there's a big difference between the expected position of the system of the throttle and the actual position, the fault code will appear and operation condition of the engine depends on ETCMODE.
P0123	When the TPSl signal end is short-circuited to the power supply and the input signal is higher than 96.5%, a DTC will appear. The engine operation is based on ETCMODE.
P0122	When the TPSl signal end is grounded or disconnected and the input signal is lower than 3.5%, a DTC will appear. The engine operation is based on ETCMODE.
P0223	When the TPS2 signal end is short-circuited to the power supply and the input signal is higher than 96.5%, a DTC will appear. The engine operation is based on ETCMODE.
P0222	When the TPS2 signal end is grounded or disconnected and the input signal is lower than 3.5%, a DTC will appear. The engine operation is based on ETCMODE.
P2135	Short connect the TPS1 or TPS2 signal end to power supply or connect them to the ground to dissimilate signals from the two wheels. The fault code will appear if the input signal difference is higher than 12%. Operation condition of the engine depends on ETCMODE.
P2119	If opening of the throttle fails to meet the requirement for return test during several times of Key off, the fault code will appear. Operation condition of the engine depends on ETCMODE.
P0641 /P0651	Self-diagnosis of interior chips

P0480	If the circuit at the controlling end of fan 1 is open or short connected, the fault code will appear. The engine will be operating stably, and you may drive the vehicle.
P0481	If the circuit at the controlling end of fan 2 is open or short connected, the fault code will appear. The engine will be operating stably, and you may drive the vehicle.
P1397	No wheel speed signal is detected under working condition of the vehicle, and the default code appears. The engine will be operating stably, and you may drive the vehicle.
P1396	Monitor the wheel speed signal changes. If there's a big difference between the front wheel speed and the precious sampling value of wheel speed, a fault is confirmed. The engine will be operating stably, and you may drive the vehicle.
P0317	If the signal received by the monitoring ECM is not the same as the design signal value, a fault is confirmed. The engine will be operating stably, and you may drive the vehicle.
P0551	If the power-assisted steering signal is detected under certain working condition, a fault is confirmed. The engine will be operating stably, and you may drive the vehicle.
P0068	P0068 Compare the two way A/D sampling values of the accelerator pedal position sensor. If the difference between the two values exceeds the specified limit, a fault is confirmed. Operation condition of the engine depends on ETCMODE.
P0068	The engine is running, no fault is detected in the intake pressure sensor and the intake temperature sensor, and the difference between the estimated air flow at the electronic throttle position and the air flow calculated using speed density method is more than 200g/second, and it last for more than 4 second, a fault will

	be reported. Operation condition of the engine depends on ETCMODE.
P0606	Computer self-diagnosis
P0230	When controlling circuit of the oil pump relay is open, or is short connected to the power supply/ground, a fault will be reported.
P0685	State of the controlling circuit of the main relay is different from the ECM expected state, a fault is confirmed.
P0647	Controlling end of the A/C relay is short connected to 12V power supply, the fault code will appear. The engine will be operating stably, and you may drive the vehicle.
P0646	If the controlling end of the A/C relay is opened or connected to the ground, the fault code will appear. The engine will be operating stably, and you may drive the vehicle.
P0077	If the hydraulic control valve is short connected to 12V power supply, a fault will be confirmed. VVT function can not be started. The engine will be operating comparatively stably, and you may drive the vehicle.
P0076	If the hydraulic control valve coil is disconnected or connected to the ground, a fault is confirmed. VVT function can not be started. The engine will be operating comparatively stably, and you may drive the vehicle. In the case of short connection to the ground, the vehicle may be difficult to start or stop when idling, as the OCV valve is always open and VVT opening is big.
POOl2	If the phaser is in a comparatively stable condition, and the duty ratio of the hydraulic control valve is higher than the upper limit or lower than the minimum limit; or the difference between the actual phase opening and the target opening is bigger than 15° crank angle, a fault is confirmed. You may drive the vehicle.

POOl1	If the response ratio of the phaser is lower than the specified limit, a fault is confirmed, and you may drive the vehicle.
POOl6	If the opening of the phaser is 0, and drifting of the corresponding 58X polarization of the camshaft is higher than the specified limit, a fault is confirmed, and you may drive the vehicle.
P0341	If the number of target wheel measuring events during each turn of the camshaft is different from the specified number, a fault is confirmed. You may drive the vehicle.
P0026	If the actual phase of the camshaft is higher or lower than the target, and the phase error exceeds the specified value, a fault is confirmed. You may drive the vehicle.
P0340	Position sensor of the camshaft is disconnected, or is connected the ground or short connected to power supply, the fault will appear. You may drive the vehicle.
P0807	Disconnect the clutch switch or short connect the switch to high voltage, start the vehicle and speed up to more than 52km/h, or slow down from above 52km/h to below 3km/h. After the fault code appears several times, the engine will be operating comparatively stably, and you may drive the vehicle.
P0808	Short connect the clutch switch or connect the switch to the ground, start the vehicle and speed up to more than 52km/h, or slow down from above 52km/h to below 3km/h. After the fault code appears several times, the engine will be operating comparatively stably, and you may drive the vehicle.
P0633	For vehicles with burglar alarms, when Key On, and the burglar alarms does not study or fails in study, a fault will be reported, and the vehicle can not be started.

U0167	For vehicles with burglar alarms, when Key On, and the burglar alarms does not respond, a fault will be reported, and the vehicle can not be started.
U0426	For vehicles with burglar alarms, when Key On, and the burglar alarms requires failure verification, a fault will be reported, and the vehicle can not be started.

Transmission electronic-control module (AT)

1. About the System

1.1 Features

Transmission electronic control module (TCM) works to monitor and control the transmission continuously. In the modern transmission management system, TCM is a core element. According to the data from sensors, TCM tests and calculates the duty ratio or current of the solenoid valve as needed. TCM directly controls the shifting process of the transmission in various conditions (incl.: upshift, downshift, static shift and torque reduction, etc.) and the working conditions of other accessories (e.g. gearshift action, gear display and other devices possibly employed).

The quantity of parts actually employed varies with the application of transmission management system. TCM controls the working conditions of the transmission via some signal input sensors and output control actuators. The sensors provide measured and induced data to TCM, while the output control actuators adjust the performance of the transmission according to the control data stored in TCM beforehand that have been debugged and calibrated.

1.2. System function introduction

1.2.1 Duty Ratio Control for Transmission-shift Solenoid Valve

By controlling the duty ratio of the gearshift solenoid valve during shifting, the pressure of gearshift clutch fluid is put under precision control to engage or disengage the gearshift clutch smoothly.

1.2.2 Duty Ratio Control for Hydraulic Torque Converter Solenoid Valve

Change oil pressure exerted to the lockup clutch of hydraulic torque converter (HTC) by controlling the duty ratio of the HTC solenoid valve in light of different driving conditions, so as to lock or unlock HTC.

1.2.3 Upshift and Downshift

Select the right time of gear shifting in light of the driving conditions, in order to have the best match of power performance and fuel efficiency.

1.2.4 Torque Reduction Control

Reduce or limit engine torque during shifting and when the driver steps on the accelerator suddenly to protect the transmission and shift the gear smoothly.

1.2.5 Shift Quality Control

Take different shift control strategies for different shift types in order to shift gear quickly without any impact.

1.2.6 Gearshift Displacement Control

Switch to reverse or forward gear directly by controlling the gearshift solenoid valve.

1.3 Working Modes of TCM

1.3.1 Extremely Low Oil Temperature

This mode is used to protect the transmission when the automatic transmission fluid temperature is extremely low. When the oil temperature is lower than the limit, TCM will fall in the mode of extremely low oil temperature. Under this mode, the transmission is allowed to be in gear 2 at most. After the transmission reaches gear 2, it will be locked there until retreating from the mode.

1.3.2 High Oil Temperature

When transmission oil temperature exceeds the threshold, thus falling in the mode of high oil temperature, TCM will lead transmission to lower the temperature. After falling in the mode, upshift will be made later than in the normal mode and the hydraulic torque converter will be locked. This can reduce slip frequency and heat of the hydraulic torque converter.

1.3.3 Manual Control

When the gearshift moves to manual, TCM falls in the manual control mode. This mode comes first in priority. Gear is shifted via the upshift or downshift button. In the manual mode, the car can be upshifted to gear 3 directly, so that it can start on a slippery road. Also, the manual mode can restrict or compel upshifting or downshifting to prevent the engine from stalling.

1.3.4 Snow Mode

If your car has a snow mode, there is a SNOW button in front of the gearshift. Press it to enter the snow mode in which the car will start from gear 3.

1.3.5 Low Oil Temperature

When the transmission oil temperature is too low, TCM will fall in the low oil temperature mode. in which the car can't be downshifted, but upshifted only. This can help the hydraulic torque converter generate heat to improve oil temperature as soon as possible.

1.3.6 Uphill/Downhill Control

TCM8 can calculate the road gradient real-time and compare with the limits kept in the memory to conclude the road is flat, uphill or downhill. If the road is regarded as uphill or downhill, TCM will fall in the uphill/downhill control mode. In the uphill mode, gear will be shifted later than in the normal mode, so that the car has a large running power. In the downhill mode, the transmission will remain at a low gear as far as possible, making the engine more powerful in braking.

1.3.7 Normal Mode

This mode is made in default, under which all normal upshifts and downshifts are allowed. Meanwhile, consideration is given to both power performance and fuel efficiency.

1.3.8 Atmospheric Pressure Compensation

TCM adjusts the shift curve according to the altitude.

1.4 Protection of TCM8

1.4.1 Overspeed Protection

The engine can be protected from damage due to overspeed in the manual mode.

1.4.2 Reverse Lockup Protection

When the speed exceeds a limit, you can't switch to reverse.

1.4.3 Downshift

In the course of downshifting, the car can switch to a lower gear only when the engine speed corresponding to the new gear is lower than the safety threshold of the engine. If higher, downshifting will be delayed until the threshold is met.

1.4.4 Default Mode

If TCM detects a serious fault when the car is running, the transmission will fall in the default mode in which different transmissions will switch to a different default gear in light of their mechanical structure.

2. Transmission Control Module (TCM)

2.1 Main Structure

The housing of TCM8.0 results from aluminum alloy molding and sealing by potting.

The maximal overall size of the housing of TCM8.0 is 168.8mm×159.8mm×47.7mm.

Width: 167.8 + / – 1.0mm

Length: 158.8 + / – 1.0mm

Thickness: 46.7 + / – 1.0mm

TCM8 employs Delphi Packard 100-pin connectors. The park number of combination connector for the harness is: connector (black) 13755653.

The harness terminal of TCM8 is square-sectioned and it is numbered as 15426818.

2.2 Working principle

TCM detects and induces the actual working conditions of transmission management system via the sensors of the system, and drives the actuators of the system to optimize and control the working conditions of the transmission according to the calibration data that have been kept in the memory beforehand.

The sensors used for transmission management system provide the parameters concerning the transmission to TCM. The main sensors of TCM8 include transducer of input shaft speed (TISS), transducer of output shaft speed (TOSS) and transmission oil temperature transducer (TOIL), etc.

2.3 Parameters

Normal working voltage: 9V~16V

Normal working current: ＜10A

2.4 Signal Processed by TCM

2.4.1 Input of TCM

From engine: engine speed (CAN)

Engine torque (CAN)

Position of accelerator pedal (CAN)

Atmospheric pressure (CAN)

From transmission: input shaft speed

Output shaft speed

Transmission oil temperature

From the vehicle: choose P, R, N, D or manual upshift of downshift via the gearshift

Choose the standard mode or the snow mode via the switch.

Diagnostic message (CAN)

2.4.2 Output of TCM

Solenoid valve

Electronic pressure regulating valve (EDS)

Engine torque reduction and information: engine torque reduction means the signal sent out by TCM requesting the engine to reduce the torque it outputs, in order to improve the shifting quality during shifting.

Power supply for solenoid valve

OBD message (CAN)

Fan request (CAN)

Fault indicator request (CAN)

3. Installation and Use of TCM

TCM is mounted with Q1410625T1F30 standard bolts. The housing must keep in good contact with the electric appliances of the chassis. The working voltage of TCM ranges from 9-16V. When the input voltage for the system is lower than 9V, some functions of TCM may be disabled.

4. Troubleshooting of TCM

4.1 Description of Diagnostic System

When the transmission fails, its electronic control system finds out the fault through self diagnosis and reminds the driver timely. TCM concludes whether or not there is any fault according to the input and output data of the monitoring system. When the car meets the diagnostic conditions, the computer starts diagnosis and it will give the fault code and alarm by light according to the relevant rules if finding a fault. If the computer does not find any fault, it will cancel the current fault and let the warning light go out according to the rules.

Each fault type is expressed by a 4-digit number, which is called fault code. Once any system fault is found, the relevant fault code is submitted to the diagnostic data management module, which turns on the warning light.

The computer, if finding a fault occurring to any input or output part, will respond accordingly in order to keep the system working continuously and protect the transmission soundly. And the system will fall in the default mode.

4.2 Working Rules of Fault Indicator Lights

Please refer to the working rules of ECM fault indicator lights.

4.3 Description of Fault Code

List of TCM Fault Codes

DTC	Type	Chinese expression
P0736	A	Gear ratio of reverse incorrect
P0731	A	Gear ratio of gear 1 incorrect
P0732	A	Gear ratio of gear 2 incorrect
P0733	A	Gear ratio of gear 3 incorrect
P0734	A	Gear ratio of gear 4 incorrect
P0717	A	No signal output from input shaft speed sensor
P0722	C	No signal output from output shaft speed sensor
P0741	E	Clutch of hydraulic torque converter not locked
P0742	E	Clutch of hydraulic torque converter locked by mistake

P0706	A	Gearshift switch and rational fault
P0826	E	Manual upshift/downshift switch fault
P0712	E	Transmission oil temperature sensor fault, short or low
P0713	E	Transmission oil temperature sensor fault, short or high
P0714	E	Transmission oil temperature sensor signal jump
P0710	E	Transmission oil temperature sensor signal jammed
U0073	A	CAN communication fault
U0001	A	CAN data transmission overtime
P0977	A	EDS4 short-connected to high level
P0976	A	EDS4 short-grounding or open-circuit
P0980	A	EDS5 short-connected to high level
P0979	A	EDS5 short-grounding or open-circuit
P0983	A	EDS6 short-connected to high level
P0982	A	EDS6 short-grounding or open-circuit
P0986	A	EDS3 short-connected to high level
P0985	A	EDS3 short-grounding or open-circuit
P0880	A	Fault of power supply A and B for solenoid valve
P0963	A	Control circuit of switching valve MV1 short-connected to high level
P0962	A	Control circuit of switching valve MV1 short-connected to low level
P0960	A	Control circuit of switching valveMV1, open-circuit
P0967	A	Control circuit of switching valve MV2 short-connected to high level

P0966	A	Control circuit of switching valve MV2 short-connected to low level
P0964	A	Control circuit of switching valve MV2, open-circuit
P0562	A	Low system voltage
P0563	A	High system voltage
P0606	A	TCM processor fault
P0601	A	TCM computer memory fault

Troubleshooting

Fault code P0562: low voltage of system

Diagnostic conditions:

● Self diagnosis of TCU hardware

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0563: high voltage of system

Diagnostic conditions:

● Self diagnosis of TCU hardware

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0601: TCU memory fault

Diagnostic conditions:

● Self diagnosis of TCU hardware

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0606: TCU memory fault

Diagnostic conditions:

● Self diagnosis of TCU hardware

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0736: gear ratio diagnosis for reverse gear

Diagnostic conditions:

● When the car is reversing, there is no other fault, the battery voltage is normal, the transmission oil temperature is higher than the calibration value, the speed of both transmission input shaft and output shaft is high enough, and the delay after switching from N to R is sufficient.

Fault reportable condition: the actual gear ratio deviates from the theoretic value.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0731: gear ratio diagnosis for gear 1

Diagnostic conditions:

● When the car is running under gear 1, there is no other fault, the battery voltage is normal, the transmission oil temperature is higher than the calibration value, the speed of both transmission input shaft and output shaft is high enough, and the delay after shifting is sufficient.

Fault reportable condition: the actual gear ratio deviates from the theoretic value.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0736: gear ratio diagnosis for gear 2

Diagnostic conditions:

● When the car is running under gear 2, there is no other fault, the battery voltage is normal, the transmission oil temperature is higher than the calibration value, the speed of both transmission input shaft and output shaft is high enough, and the delay after shifting is sufficient.

Fault reportable condition: the actual gear ratio deviates from the theoretic value.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0733: gear ratio diagnosis for gear 3

Diagnostic conditions:

● When the car is running under gear 3, there is no other fault, the battery voltage is normal, the transmission oil temperature is higher than the calibration value, the speed of both transmission input shaft and output shaft is high enough, and the delay after shifting is sufficient.

Fault reportable condition: the actual gear ratio deviates from the theoretic value.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0734: gear ratio diagnosis for gear 4

Diagnostic conditions:

● When the car is running under gear 4, there is no other fault, the battery voltage is normal, the transmission oil temperature is higher than the calibration value, the speed of both transmission input shaft and output shaft is high enough, and the delay after shifting is sufficient.

Fault reportable condition: the actual gear ratio deviates from the theoretic value.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0717: no input shaft speed signal

Diagnostic conditions:

● The battery voltage is normal, the engine is working, the gearshift remains at D, the output shaft speed sensor is not faulty, and the car speed is high enough.

Fault reportable condition: The rev signal is lower than the rated limit.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0722: no output shaft speed signal

Diagnostic conditions:

● The battery voltage is normal, the engine is working, the gearshift remains at D, there is no other relevant fault, and the car speed is high enough.

Fault reportable condition: The rev signal is lower than the rated limit.

Action of TMS after a fault is reported: If there is any CAN fault simultaneously, the system falls in the default mode; otherwise, there is no special action.

Fault code P0741: hydraulic torque converter not locked.

Diagnostic conditions:

● There is no other relevant fault, the controlled DC of hydraulic torque converter is higher than the set value and the set time is extended.

Fault reportable condition: hydraulic torque converter not locked.

Action of TMS after a fault is reported: the signal of torque converter control keeps open absolutely.

Fault code P0742: hydraulic torque converter not turned on.

Diagnostic conditions:

● The engine is working, its working time is more than the set value, there is no relevant fault, APS is more than the set limit, the gearshift lever remains at D, the oil temperature is more than the set value between shifts, TOSS is more than the set value, and the controlled DC of torque converter is 0 continuously for a preset period.

Fault reportable condition: hydraulic torque converter not unlocked.

Action of TMS after a fault is reported: the signal of torque converter control keeps open absolutely.

Fault code P0706: rational fault to gearshift switch.

Diagnostic conditions:

● There is no relevant fault, the engine speed is more than the set value, and the battery voltage is more than the set value.

Fault reportable condition: the signal of shift switch is wrong or the switch stays in the middle for long.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0826: manual upshift/downshift signal fault

Diagnostic conditions:

● There is no relevant fault, the engine speed is more than the set limit, and the battery voltage is normal.

Fault reportable condition: logic error occurs to manual upshift/downshift signal and gear signal comparison.

Action of TMS after a fault is reported: turn off manual upshift/downshift.

Fault code P0712: Short circuit occurs to oil temperature signal earthing

Diagnostic conditions:

● There is no other relevant fault, the engine is working, and the battery voltage is normal.

Fault reportable condition: The original voltage value output by the oil temperature sensor is lower than the limit.

Action of TMS after a fault is reported: close the extremely low temperature, high temperature oil, and low temperature oil modes. Oil temperature is set as default.

Fault code P0713: Short circuit occurs to oil temperature signal to power source

Diagnostic conditions:

● There is no other relevant fault, the engine is working, the battery voltage is normal, and the ambient temperature is more than the set limit or the transmission input shaft speed is more than the set limit continuously for long enough, or the engine water temperature is more than the set limit.

Fault reportable condition: The original voltage value output by the oil temperature sensor is higher than the limit.

Action of TMS after a fault is reported: close the extremely low temperature, high temperature oil, and low temperature oil modes. Oil temperature is set as default.

Fault code P0714: oil temperature signal jump

Diagnostic conditions:

● There is no other relevant fault, the engine is working.

Fault reportable condition: the original voltage value output by the oil temperature sensor jumps or changes.

Action of TMS after a fault is reported: close the extremely low temperature, high temperature oil, and low temperature oil modes. Oil temperature is set as default.

Fault code P0710: oil temperature signal is jammed

Diagnostic conditions:

● There is no other relevant fault, the engine is working, and the working time of the engine is more than the set limit.

Fault reportable condition: The difference of the current oil temperature from that when the engine is started is lower than the set value; Or the difference of oil temperature when the engine is started during the current key cycle from that during the previous key off is lower than the set value on the condition that the difference of the water temperature when the engine is started during the current key cycle from that during the previous key cycle is more than the set limit.

Action of TMS after a fault is reported: close the extremely low temperature, high temperature oil, and low temperature oil modes. Oil temperature is set as default.

Fault code U0073: CAN communication fault

Diagnostic conditions:

● The delay after TCU is turned on exceeds the set value, the input shaft speed exceeds the set value when not in the limp mode, and the battery voltage is normal.

Fault reportable condition: CAN equipment fault.

Action of TMS after a fault is reported: fall in the default mode.

Fault code U0001: CAN data transmission is overtime

Diagnostic conditions:

● The delay after TCU is turned on exceeds the set value, the input shaft speed exceeds the set value when not in the limp mode, and the battery voltage is normal.

Fault reportable condition: no CAN signal is received.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0976: EDS4 open-circuit or short-grounding

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects low level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0977: EDS4 short-connected to high level.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects high level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0979: EDS5 open-circuit or short-grounding

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects high level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0980: EDS5 short-connected to high level.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects high level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0982: EDS6 open-circuit or short-grounding

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects low level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0983: EDS6 short-connected to high level.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects high level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0985: EDS3 open-circuit or short-grounding

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects low level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0986: EDS3 short-connected to high level.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects high level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0880: Power source fault of solenoid valve

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects power source.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0962: switching valve MV1 short-connected to low level.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode. The computer is reenergized after it is disconnected from power supply, and the chip detects an external circuit is short-connected to low level or the system is turned OFF once.

Fault reportable condition: the chip detects low level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0963: switching valve MV1 short-connected to high level.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects high level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0960: switching valve MV1 is open-circuit.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode. The computer is reenergized after it is disconnected from power supply, and the chip detects an external circuit is short-connected to low level or the system is turned OFF once.

Fault reportable condition: The chip detects open circuit.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0966: switching valve MV2 short-connected to low level.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode. The computer is reenergized after it is disconnected from power supply, and the chip detects an external circuit is short-connected to low level or the system is turned OFF once.

Fault reportable condition: the chip detects low level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0967: switching valve MV2 short-connected to high level.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode.

Fault reportable condition: the chip detects high level.

Action of TMS after a fault is reported: fall in the default mode.

Fault code P0964: switching valve MV2 is open-circuit.

Diagnostic conditions:

● The key-on time is longer than the limit, the working time of the engine is longer than the limit, there is no other relevant fault, and the system is not in the limp mode. The computer is reenergized after it is disconnected from power supply, and the chip detects an external circuit is short-connected to low level or the system is turned OFF once.

Fault reportable condition: The chip detects open circuit.

Action of TMS after a fault is reported: fall in the default mode.

5. Typical Faults and Maintainence Methods

5.1 Typical Faults

Symptoms	Cause	Trouble Shooting	Remarks
The transmission warning lamp or the car maintenance signal lights up when in operation.	TCM has recorded the system fault message.	Check it at the repair station as soon as possible.	Don't dismount TCM by yourself, or it may lose the diagnosis information.

5.2 Process Procedure and Method Against Fault

If finding TCM may have failed, please mount it to another car without any fault to verify. If permitted, you may have the TCM fault information read by a diagnostic scanner to decide the fault type.

5.3 Use, Maintenance and Replacement

TCM shall not be subject to any instantaneous voltage more than 16V from the system!

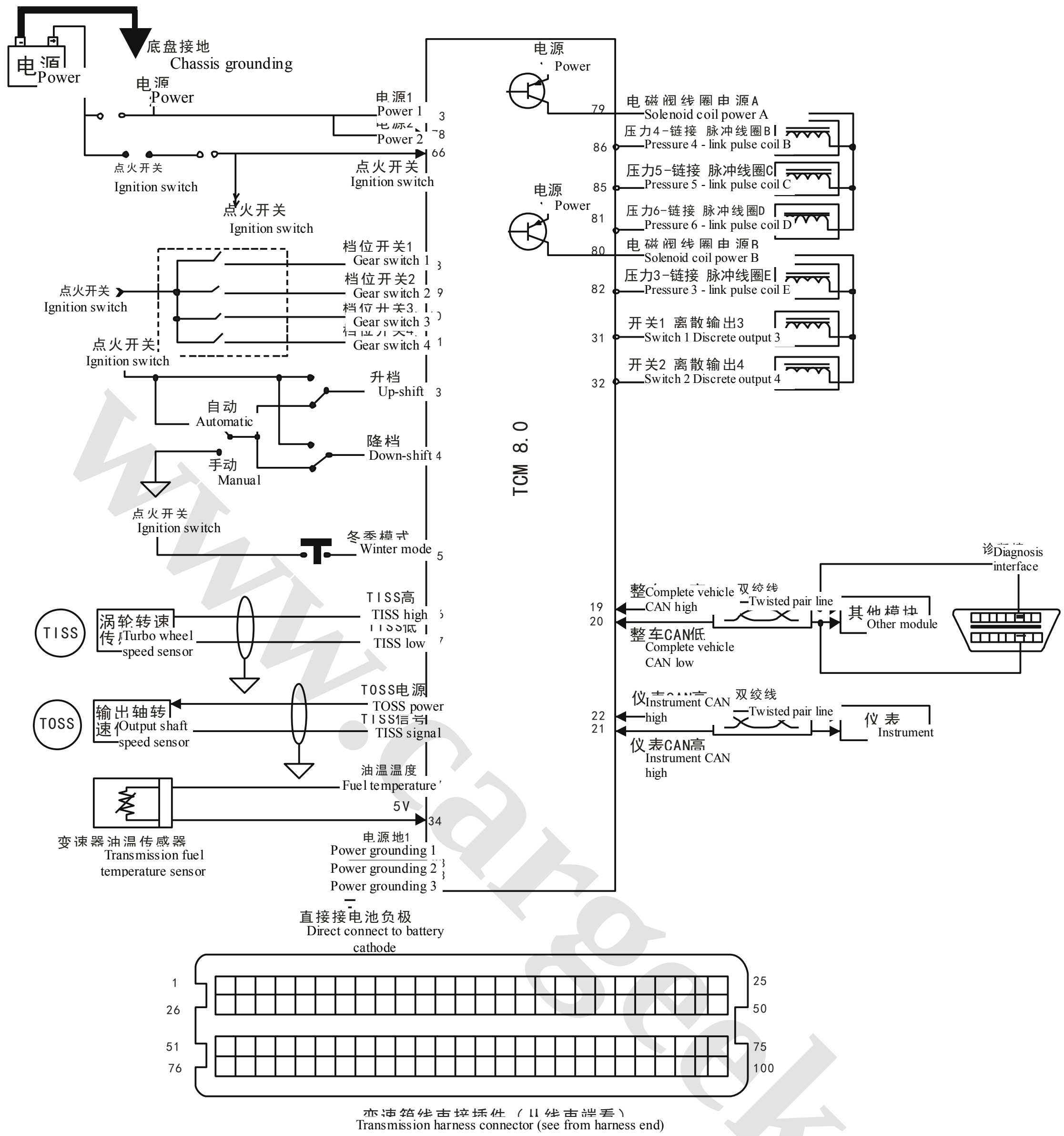
When connecting TCM to harness connector, the power supply for the system shall be disconnected, i.e. the ignition switch of the engine or the car is shut off.

Don't connect the power supply for TCM reversely!

TCU is free of any maintenance or calibration.

TCU shall be replaced by the professionals we designate.

6. Circuit Diagram


电源
Power
底盘接地
Chassis grounding
电源
Power
电源1
Power 1
Power 2
点火开关
Ignition switch
点火开关
Ignition switch
点火开关
Ignition switch
档位开关1
Gear switch 1
档位开关2
Gear switch 2
Gear switch 3
Gear switch 4
点火开关
Ignition switch
点火开关
Ignition switch
升档
Up-shift
自动
Automatic
降档
Down-shift
手动
Manual
点火开关
Ignition switch
Winter mode
TISS
涡轮转速
Turbo wheel
speed sensor
TISS高
TISS high
TISS low
TOSS
输出轴转
Output shaft
speed sensor
TOSS电源
TOSS power
TISS signal
油温温度
Fuel temperature
5V
变速器油温传感器
Transmission fuel
temperature sensor
电源地1
Power grounding 1
Power grounding 2
Power grounding 3
直接接电池负极
Direct connect to battery
cathode
TCM 8.0
电源
Power
电磁阀线圈电源A
Solenoid coil power A
压力4-链接 脉冲线圈B
Pressure 4 - link pulse coil B
压力5-链接 脉冲线圈C
Pressure 5 - link pulse coil C
电源
Power
压力6-链接 脉冲线圈D
Pressure 6 - link pulse coil D
电磁阀线圈电源B
Solenoid coil power B
压力3-链接 脉冲线圈E
Pressure 3 - link pulse coil E
开关1 离散输出3
Switch 1 Discrete output 3
开关2 离散输出4
Switch 2 Discrete output 4
Diagnosis
interface
Complete vehicle
CAN high
双绞线
Twisted pair line
其他模块
Other module
整车CAN低
Complete vehicle
CAN low
Instrument CAN
high
双绞线
Twisted pair line
仪表
Instrument
仪表CAN高
Instrument CAN
high
1
26
51
76
25
50
75
100
Transmission harness connector (see from harness end)

Section 2 Daily Usage and Maintenance

Fuel and Lubricant

No. 93 unleaded gasoline shall be used during the system development to ensure the normal operation of the system, the engine and the complete vehicle. For fuel difference in different areas, the vehicle user can use fuel of a higher level. Lead and heavy metal content in the unleaded gasoline shall meet the requirements of the current national standards. Lead and heavy metal in fuel will poison the oxygen sensor and the three-way catalytic converter and make them lose effects permanently. Sulfur content in fuel shall also meet the emission requirements, because sulfur may cause the oxygen sensor and the three-way catalytic converter to lose effects temporarily. If sulfur poisoning happens, the vehicle shall be driven at the speed of 70km/h, which may reduce the harm of sulfur poisoning. Generally, the color of the gasoline with high sulfur content shall be dark brown. The consumption of engine oil shall be normal. If engine oil enters the cylinder for combustion, the phosphorus in the oil will make the oxygen sensor and the three-way catalytic converter to lose effects permanently.

Daily Usage and Maintenance

Do not operate any mechanism on the engine (including accelerator) when starting the engine. Cut the clutch in cold weather;

Make the complete vehicle operate at a high speed periodically to eliminate the possible carbon deposits in the engine and the exhaust system;

If the check light of the engine is lit during the operation of the engine, find out causes and solve the problem as soon as possible;

The unburned mixture will burn in the exhaust manifold, which may damage the oxygen sensor and the three-way catalytic converter. Therefore, the vehicle shall be stopped and checking and elimination shall be carried out if one cylinder is on fire. If the fault of the ignition is not eliminated immediately, the fuel supply nozzle plug of the cylinder on fire can be disconnected temporarily and the vehicle shall be driven to the service station at a medium or low speed for service;

If the system is powered on, the fuel injection will begin as soon as the engine gets the rotation signal. As a result, the engine can not be started by outside force when the voltage of the accumulator is insufficient or a fault happens to the starter. If the engine does not work for a long time, the unburned fuel will be saved in the three-way catalytic converter, which may damage the catalytic converter once the engine begins to work.

The valve clearance shall be in regulated range. If the exhaust valve is not tightly closed, the exhaust temperature may be too high to shorten the life of the three-way catalytic converter.

During the long-term storage, the engine or the complete vehicle shall be operated every two months to avoid the glue solidification of the nozzle and the fuel pump.

Replace the fuel filter every 10000km. Based on the normal usage conditions, the throttle body and the nozzle shall be cleaned every year or every 20,000km. When the removal-free method is used to clean the fuel injector, the used additive shall be confirmed not to contain materials harmful to the oxygen sensor and the three-way catalytic converter;

During the twin-idle emission check, the engine and the three-way catalytic converter shall be warmed up. The high idle speed shall be measured first and then the low idle speed shall be measured.

Recommended methods for warming up the engine and the catalytic converter:

• Drive the vehicle with the 3rd gear and at the speed of 70km/h for 5 minutes or more and check the emission within 8 minutes.

• Press down the accelerator, race the engine with the rotation speed of 4,500rpm or higher for more than 2 minutes.

Service Tools

Basic Service Tools

Removal and installation of parts and components of the electric control system---removal and installation tools for common auto machinery parts and components:

Circuits of the electric control system and electric signal of the system---digital multimeter (with a buzzer):

Square and pulse signals of the system---oscilloscope

Fuel pressure---manometer with the measuring range of 0-1 Mpa

Diagnosis of the electric control system faults and detection of the engine working conditions---diagnostic scanner V30 of the electric control system faults.

Engine malfunction indicator light

When a fault happens to the system or some part during the operation of the engine, the engine fault indicator will be lit automatically to remind the driver to do checking and repair in time.

Note: After the fault is removed, the diagnostic scanner shall be used to eliminate DTCs to avoid affecting fault judgment during the next repair.

Diagnostic Scanner

A diagnostic scanner shall be provided with main functions like reading the working data stream of the system and the system information, controlling and detecting the system parts and components, and reading or eliminating DTCs. Because of easy operation, it becomes the current main tool for judging the faults of a complete vehicle and detecting the status of the system.

Typical Faults and Service Methods

Notes for Service

Preparations before service:

• The vehicle can not be serviced at a gas station;

• The fuel system shall not be serviced near a combustion source;

• Smoking is prohibited during repair.

When components of the fuel system are removed (like replacement of the filter, removal of the fuel pump or fuel rail inlet/outlet pipeline)

• The negative pole of the accumulator shall be disconnected to prevent fuel steam from being ignited by discharge spark for accidental short circuit;

• The fuel pipe joint shall be covered by a piece of cloth and then be loosened carefully to relieve the fuel pressure in the pipeline;

• Fuel shall be kept from falling to the engine and its high-temperature exhaust pipeline during the operation;

• Keep gasoline away from rubber or leather parts;

When parts and components of the electronic control system are removed and serviced:

• For reliable parts and components of the electronic injection system, in case of abnormalities of the complete vehicle or the engine, the relevant machinery parts and components shall be checked first and then the system interfaces and harnesses, grounding wires, high-voltage line connectors of the spark plug, and vacuum pipes of fuel pressure regulator; the substitution tests shall be done repeatedly to check if the electronic injection parts are damaged.

• When the voltage of the accumulator is insufficient or a fault happens to the starter, the engine can not be always started by outside force to avoid damaging the three-way catalytic converter.

• If service is necessary, the ignition switch or the negative pole of the accumulator shall be first disconnected. Electronic parts and components shall not be removed or installed during electrification;

• The electric signal of the system shall not be checked through needling the harness;

• The accumulator connector shall not be pulled out rashly during the operation of the engine;

• The accumulator and ECM connectors shall be disconnected during electric welding, for which, outside electric system tools are used.

• The method of pulling the high tension ignition cable shall not be used to check if the ignition system works, because the nozzle is still working and gasoline injected but un-used will burns in the three-way catalytic converter and damage it;

• It shall be noted whether the vehicle is equipped with a computer burglar alarm or not when ECM is replaced. If it is, the burglar alarm shall be powered off and then the ECM shall be replaced, or the new ECM to be locked by the burglar alarm can not work on other vehicles;

• The parts shall not be knocked furiously during removal and installation;

• The ECM cover shall not be opened;

• The oxygen sensor shall not touch water or other liquids during its removal and installation;

• Without fuel, the fuel pump can not operate for a long time; with gasoline, it can not operate in air;

• Many electronic injection parts can not be repaired so the damaged ones shall be replaced generally;

• The system shall use anti-interference spark plug and high-voltage line. The non-resistance spark plug and the high-voltage line not only release interference wave but also have bad influence on the ignition coil drive module inside ECM and even damage ECM.

Completion:

• Confirm all the joints and the fuel pipelines are connected well and fixed;

• The broken part of a line shall be wrapped during service;

• The high-voltage lead must be connected well;

• Do not reverse the positive and the negative poles when connecting the accumulator connector and make sure the connector is fixed.

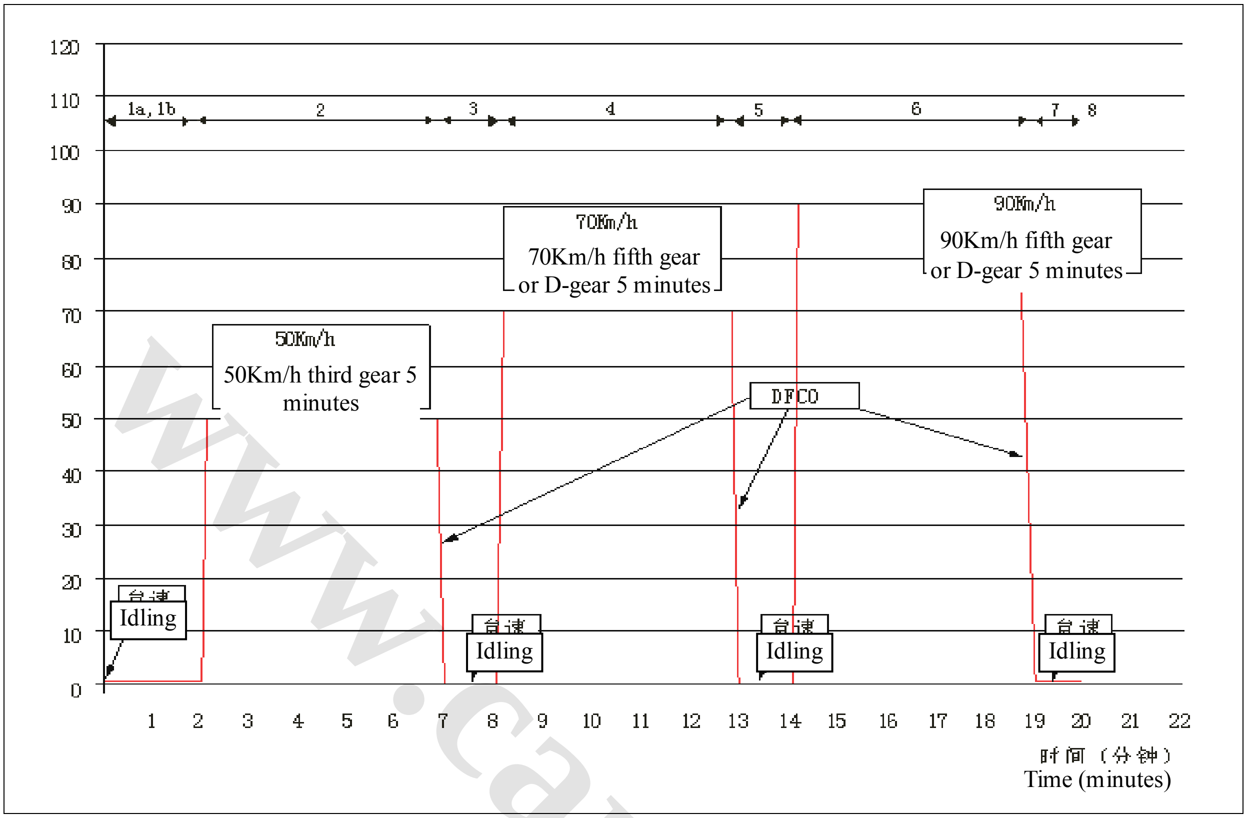


Fig. 133 Test Steps after Fault Code Recovery

Fault Diagnosis and Elimination Method of Fault-free Code

Table 1-36 Fault Diagnosis and Elimination Method of Fault-free Code	
Fault 01: The diagnostic scanner fails to communicate with the system.	
Potential causes	Reference elimination methods
1) The connection of the diagnostic wire is not firm.	1) Re-connect the diagnostic connection wire.
2) The function of the diagnostic scanner is not in conformity with the system.	2) Use the diagnostic scanner in line with the model and the system

3) Diagnostic scanner fault	3) Eliminate the diagnostic scanner fault.
4) The diagnostic interface is not in line with the ECM connector terminal.	4) Repair the wire harness.
5) Lead wire related to diagnosis interface is disconnected.	5) Repair the wire harness.
S) ECM communication fault	6) Replace the ECM.
Fault 02: Fails to start	
Potential causes	Reference elimination methods
Malfunction indicator light:	
1) Flicker	1) Check if the key is right or damaged.
Security key error	Re-learn the key.
Anti-theft system line fault	Check the line and reconnect the plug.
Burglar alarm damage	Replace the burglar alarm and learn the procedures.
2) “OFF”	2)
Fuse/fusible link	Replace
Ground wire open circuit	Check and repair
ECM connector	Re-connect
Bulb and line	Repair the wire harness and the bulb.
ECM fault	Replace the ECM.

3) "ON"—check with the diagnostic apparatus	3) Check with the diagnostic apparatus.
With fault code	Eliminate the fault detected.
Without fault code	Check the system power, signal acquisition system and oil supply.
	The system, the ignition system, the idle speed control system, the engine and the complete vehicle mechanical system
System power:	
1) The system voltage during the operation of starter	1) Check with the diagnostic apparatus.
<8 V	Replace or charge the battery.
>8 V	Check other systems.
Signal acquisition system:	
1) Signal acquisition system:	1)
Open circuit of crankshaft position sensor wire harness	Repair the wire harness.
Reverse connector terminal of crankshaft position sensor	Reverse connector terminal of crankshaft position sensor
The clearance between the sensor and the 58X target gear is incorrect.	Adjust the clearance: 0.3—1.5mm.
Impurities flow into the sensor.	Clean the sensor.

Magnetic degradation or damage of the sensor	Replace the sensor.
2) Data stream with rotation speed	2) Data stream with rotation speed
The 58x gear is not in line with the top dead center.	Check: the falling edge of the #20 tooth should be the top dead center of 1 cylinder.
Fuel supply system:	1) Connect in the right way.
1) Intake/fuel return pipe reverse	2) Repair the complete vehicle wire harness. Reconnect the fuel pump plug.
2) Fuel pump line open circuit	3) Slightly flooded: full open the throttle and start the starter.
3) Flooded engine	Severely flooded: remove the spark plug and start the starter, which shall recover after the cylinder and spark plug residual oil becomes dry.
4) The nozzle is blocked.	4) Replace the nozzle.
Ignition system:	1) Reconnect the connector.
1) Ignition coil connectors	2) Connect the coil and spark plug as per the coil tips.
2) Incorrect cylinder sequence	3) Replace the spark plug.
3) The spark plug is damaged.	4) Replace the ignition coil.
4) The ignition coil is damaged.	

Fault 03: The engine is turned on but cannot be started.	
Potential causes	Reference elimination methods
Fuel supply system:	
1) The fuel inlet pipe pressure is <350 kPa	1) Check the reason for insufficient oil pressure
2) Fuel shortage of fuel tank	2) Add fuel
3) The fuel filter is blocked	3) Replace the fuel filter.
4) Fuel inlet pipe leakage	4) Replace the fuel inlet pipe.
5) The fuel pressure regulator is damaged	5) Replace the fuel pressure regulator.
6) The fuel pump pressure is insufficient.	6) Replace the fuel pump.
Intake/exhaust system:	
1) The fuel filter is blocked	1) Clean the air inlet and replace the filter element.
2) The three-way catalytic converter is blocked.	2) Replace the three-way catalytic converter.
3) The catalytic converter is broken.	3) Replace the three-way catalytic converter.
4) Combustion is blocked by impurities.	4) Repair the engine. 2) Replace the three-way catalytic converter.
Fault 04: Abnormal idling	
Potential causes	Reference elimination methods
1) The complete vehicle is power off and the system is power on for the first time.	1) Turn off the ignition switch and restart it 10s later.

2) The ECM uninterrupted power supply is cut off during parking.	2) Recover the ECM UPS.
Fault 05: Unstable idling	
Potential causes	Reference elimination methods
1) Poor connection of high tension ignition cable	1) Reconnect
2) The clearance of spark plugs is different.	2) Adjust to 0.7-0.8mm
3) The fuel pressure regulator vacuum pipe is separated or damaged.	3) Check, repair or replace the vacuum pipe.
4) Several fuel injectors are blocked.	4) Clean or replace the fuel injectors with fault.
5) 58x gear ring dislocation	5) Ensure that the falling edge of the #20 tooth is the top dead center of 1 cylinder.
Fault 06: Engine stalls during normal operation.	
Potential causes	Reference elimination methods
1) Poor connection of the power system	1) Check all the connectors in the power positive/negative lines.
2) Fuel shortage of fuel tank	2) Add fuel
3) Fuel inlet pipe leakage	3) Replace the fuel inlet pipe.
Fault 07: Slow acceleration	
Potential causes	Reference elimination methods
1) Unsmooth air intake system	1) Clean the air inlet and replace the filter

	element.
2) The intake manifold pressure sensor hole is blocked.	2) Clean the intake manifold pressure senor probe hole and replace the sensor when necessary.
3) The throttle cannot be full opened.	3) Adjust the throttle limit screw to make the throttle full open.
4) The fuel injector is blocked.	4) Clean or replace the fuel injectors with fault.
5) The exhaust system is not smooth.	5) Check and repair the exhaust system and the three-way catalytic converter.
Fault 08: Insufficient engine power	
Potential causes	Reference elimination methods
1) Unsmooth air intake system	1) Clean the air inlet and replace the filter element.
2) The throttle cannot be full opened.	2) Adjust the throttle limit screw to make the throttle full open.
3) The exhaust system is not smooth.	3) Check and repair the exhaust system and the three-way catalytic converter.
4) The resistance of the power transmission system is too large.	4) Check and repair the power transmission system and the relevant parts.
5) Engine overheating	5) Check and repair the engine and the cooling system.
6) The fuel injector is blocked.	6) Clean or replace the fuel injectors with fault.

Failure 09: Driving joggling	
Potential causes	Reference elimination methods
1) Current leakage of the ignition system high-voltage line	1) Reconnect all connectors and replace the parts damaged.
2) The fuel injector is blocked.	2) Clean or replace the fuel injectors with fault.
Fault 10: Acceleration joggling	
Potential causes	Reference elimination methods
1) Current leakage of the ignition system high-voltage line	1) Reconnect all connectors and replace the parts damaged.
Fault 11: Knock	
Potential causes	Reference elimination methods
1) Unqualified fuel	1) Use fuel with octane rating higher than #93.
2) Engine overheating	2) Check and repair the engine cooling system.
3) 58x gear ring dislocation	3) Ensure that the falling edge of the #20 tooth is the top dead center of 1 cylinder.
Fault 12: Afterburning (parallel temperature is too high)	
Potential causes	Reference elimination methods
1) A cylinder of engine is out of work	1) Recover the ignition lack of cylinder. If it is unable to recover for the time being,
	the cylinder nozzle connector should be disconnected to protect the three-way catalytic

	converter.
2) Engine exhaust valve fault	2) Repair the engine.
3) 58x gear ring dislocation	3) Ensure that the falling edge of the #20 tooth is the top dead center of 1 cylinder.
Fault 13: Excessive emission test by means of working condition	
Potential causes	Reference elimination methods
1) Abnormal engine status	1) Check and repair the engine.
2) Abnormal control of EFI system	2) Check and repair the EFI system as per related technical requirements
3) Air leakage at the connection between the cylinder head and the three-way catalytic converter	3) Fix the relevant bolts and change the washer as necessary.
4) Oxygen sensor thread air leakage	4) Fix the oxygen sensor.
5) Fuel pressure regulator fault	6) Replace the fuel pressure regulator.
6) Extended use of the three-way catalytic converter and the oxygen sensor	7) The life is higher than 80,000km under standard condition. Replace it as necessary.
7) Heavy metal poisoning or overheating damage of the three-way catalytic converter and the oxygen sensor	8) Replace the catalytic converter and the oxygen sensor.
8) Sulfur poisoning of the three-way catalytic converter and the oxygen sensor	9) Run for 10 minutes at 70km/h (third gear).
9) Poor grounding of ECM and EFI system	10) Improve the ground wire position of the system.

10) ECM case ground	11) Insulate ECM case.
11) 58x gear ring dislocation	12) Ensure that the falling edge of the #20 tooth is the top dead center of 1 cylinder.
Fault 14: Excessive emission test by means of simple working condition	
Potential causes	Reference elimination methods
1) The complete vehicle has not been fully preheated.	1) Preheat the engine.
2) Others	2) See "excessive emission test by means of working condition".
Fault 15: High CO and HC concentration at idle speed	
Potential causes	Reference elimination methods
1) The complete vehicle has not been fully preheated.	1) Preheat the engine and carry out test at high idle speed.
2) Others	2) See "excessive emission test by means of working condition".
Fault 16: Abnormal fuel evaporative emission	
Potential causes	Reference elimination methods
1) The canister connecting pipe is broken.	1) Replace the connecting pipe.
2) The canister is damaged.	2) Replace the canister.
3) The canister is too small.	3) Use proper canister.
4) The connector has not been firmly	4) Reconnect

connected.	
5) ECM fault	5) Replace the ECM.
Fault 17: Abnormal fuel consumption	
Potential causes	Reference elimination methods
1) Incorrect measuring method	1) Adopt reliable measuring methods.
2) Complete vehicle status	2) Check and repair the vehicle.
3) Engine status	3) Check and repair the engine.
4) The thermostat is damaged.	4) Replace the thermostat.
5) Coolant temperature sensor fault	5) Replace the coolant temperature sensor.
6) EFI system status	6) Check and repair the EFI system as per Complete Vehicle Commissioning Procedure and Test Technical Condition.
7) Oil leakage of nozzle	7) Replace the nozzle damaged.
8) The fuel pressure regulator is damaged	8) Replace the regulator.
9) Oxygen sensor fault	9) Replace the oxygen sensor.
10) ECM fault	10) Replace the ECM.
Fault 18: A/C system's relevant faults take place in the vehicle without A/C	
Potential causes	Reference elimination methods
The standby plug of the EFI system for A/C equipment is polluted.	1) Clean the standby plug for A/C and carry out proper dust-proof and water-proof protection. Turn off the ECM power for 10 minutes.

Fault 19: ECM is locked by the burglar alarm.	
Potential causes	Reference elimination methods
1) Burglar alarm relevant wire harness fault	1) Repair the wire harness.
2) The connection of connectors is not firm.	2) Reconnect
3) The security key is damaged.	3) Replace and re-learn the new security key.
4) Deblocking required	4) Send ECM back to Delphi for decoding.
5) Others	5) Contact the supplier of the burglar alarm for corresponding service.
Fault 20: The security key is lost or the burglar alarm is damaged.	
Potential causes	Reference elimination methods
1) The security key is lost or the burglar alarm is damaged.	1) Contact the supplier of the burglar alarm for corresponding service: send ECM back to Delphi for decoding.
Fault 21: Irregular ON/OFF of malfunction indicator light during vehicle operation	
Potential causes	Reference elimination methods
1) Poor connection of connectors	1) Check and reconnect all the terminals of the EFI system. Reconnect connectors

Typical Data Stream of Delphi EFI System

Routine Check

• Wire harness connectors are reliably connected;

• Oil line and vacuum line are fixed reliably;

• Fix the interface end bolts of the oxygen sensor and the three-way catalytic converter to ensure seal of joint surface: check the exhaust system with 1.3 atmospheric pressure when necessary and there should be no obvious leakage.

System initialization settings

• Initialization of EFI control system: rotate the ignition switch to running gear, cut it off 3s later, and then the system initialization setting will be completed 10s later.

• Initialization of fuel supply system: rotate the ignition switch to running gear, cut it off 3s later, restart it 1s later, repeat the steps for 5 times, and then the initialization setting of the fuel supply system will be completed.

Check the status of the system and the vehicle

Step 1: Cold, rotate the key switch to "ON", and keep engine still for 30s (See table 1-37-1 "ON" Static Check)

Table 1-37-1 "ON" Static Check

Items	
1. Display fault codes	No
2. Engine fault indicator light	On
3. Battery voltage	11.5～13V
4. Coolant temperature sensor	Normal temperature
5. Intake air temperature sensor	Ambient temperature
6. Intake manifold absolute pressure sensor	Ambient atmospheric pressure (about 101kPa)
7. Throttle position sensor operating range	0-100%

Step 2: Rotate the key switch to "OFF" (See Table 1-37-2)

Table 1-37-2 “ON” Static Check

Items	
1. Whether the ECM power is cut off	Suspended
2. Engine fault indicator light	OFF

Step 3: X60 diagnostic data stream (See Table 1-37-3)

Table 1-37-3 X60 diagnostic data stream - To be translated

S/N	Project name of data stream	"ON" position	Idling	2000rpm
1	Current calculated load value	0.00	36.08%	26.27%
2	Coolant temperature	93℃	94 ℃	94 ℃
3	Short-term fuel adjustment (Group 1)	0.00	0.78%	— 1.56%
4	Long-term fuel adjustment (Group 1)	— 0.0391	— 2.34%	— 0.78%
5	Intake manifold absolute pressure	95 kPa	36 kPa	27.0 kPa
6	Engine speed	0.00RPM	773.5 RPM	2005.25 RPM
7	Vehicle speed	0Kkph	0.0 Kkph	0.0 kph
8	Cylinder 1 ignition timing advance angle	46.0 Deg	0.0 Deg	32.0 Deg
9	Intake air temperature	58℃	46.0 ℃	56.0 ℃

10	Absolute throttle position	0.20	14.51%	17.25%
11	(B1-S1) O2 voltage	0.065V	0.145 V	0.685 V
12	(B1-S1) Short-term fuel adjustment	0.00	0.78%	0.78%
13	(B1-S2) O2 voltage	1.275V	0.650V	0.735 V
14	(B1-S2) Short-term fuel adjustment	FF%	FF%	FF%
15	Ignition voltage	12.6V	14.1 V	14.0 v
16	Coolant temperature (start)	92.0℃	30.0 ℃	30.0 ℃
17	Target idle speed	1062.5 RPM	737.5 RPM	737.5 RPM
18	Atmospheric pressure	95.57 KPA	95.94 KPA	95.94 KPA
19	Air fuel ratio	10.5 Ratio	14.5 Ratio	14.5 Ratio
20	Engine operating time	0Seconds	1039.0 Seconds	1039.0 Seconds
21	Tacho temperature of computer	600.0 ℃	621.0 ℃	621.0 ℃
22	Knock retard	0.0 °Adv	0.0 °Adv	0.0 °Adv

Step 4: A/C check At normal idle speed, the A/C system will be close

Items	
A/C request signals	NO

Start A/C (see Table 1-37-4 Dynamic A/C Check)

Table 1-37-4 Dynamic A/C Check, 10s later after staring A/C

Table 1-37-4

Items	
1. Engine idling	750±50 rpm
2. A/C request signals	ON
3. A/C relay	ON
3. A/C relay	ON
5. Fan 1	ON

Step 5: Driving Check

Items	
A/C request signals	NO
Items	
1. Engine fault indicator light	OFF
2. Fault code	NO
3. Coolant temperature	80～100 ℃
4. Battery voltage	13.5～14.5 V
5. Intake manifold absolute pressure sensor	15 kPa～atmospheric pressure
6. Throttle position sensor operating	0～100%

range	

The following operation must be carried out during driving check:

• The opening of throttle is above 10% for successive 15s;

• Direct gear; when the vehicle speed reaches 80km/h, the time for throttling down the engine is above 5s.

• At normal idle speed, the A/C system will be closed (see Table 1-37-5 Dynamic A/C Check).

Table 1-37-5 Dynamic A/C Check

Items	
A/C request signals	NO
Items	
1. Engine fault indicator light	OFF
2. Fault code	NO
3. Coolant temperature	80～100℃
4. Battery voltage	13.5～14.5V
5. Intake manifold absolute pressure sensor	15 kPa～atmospheric pressure
6. Throttle position sensor operating range	0～100%

Description

1. Routine Check

• Poor connection of connectors make signal delivery and control out of correctness;

• The inlet/outlet fuel pipe can not be reversed. The pressure balancing vacuum pipe of the fuel pressure regulator shall be connected. If not, the abnormal emission and fuel consumption may be increased;

• The canister can not be reversed and shall be connected. If not, idle speed may become abnormal;

• Check if the fixing clips of transmission oil cooling pipe are secure. If they become loose, the transmission may be exposed.

• If the sealing is bad between the cylinder cover of the engine and the three-way catalytic converter, outside air will enter the engine which is operating to break the balance of air/fuel ratio and reduce the efficiency of the three-way catalytic converter.

2. System initialization settings

• After ECM is installed and electrified for the first time and then disconnected, ECM will initialize the settings of the system;

• The fuel pump will work for 1.5s every time when the key switch is turned on. When the vehicle is off the production line, the fuel pipeline provided with no fuel shall be filled with fuel.

Check the status of the system and the vehicle

When the key switch is rotated to the operation gear, the engine shall stop

• The engine fault indicator is lit but there shall be no DTCs.

• The absolute pressure sensor of the intake manifold shall display the local current atmospheric pressure value;

• The accelerator cable and the pedal screws shall be adjusted to ensure that the closing and the opening of the throttle;

• When the oxygen sensor is being heated, it shall display that the value will descend from above 1000mV; after it is heated, the value shall fluctuate between 100mV---800mV;

• During the idle speed, the opening of the ETC (electronic throttle) shall be small under hot engine and be big under cold engine.

Key switch is rotated to “STOP”

• After the key switch is turned off and the idle speed control valve does not operate, the ECM power shall be cut off to check if the ECM mains are mistakenly connected to the ignition switch. It may be difficult for the engine to restart, make the engine stop and affect the emission performance.

Start the engine

• In case of bad start performance, check if the initialization operations are completed, if there is fuel in the fuel pipeline and if the fuel pipeline is unblocked; check parts of the fuel supply system and its connections, parts of the ignition system and its connections;

• If there is no problem above, the idle-speed control valve shall be checked to confirm if instructions work.

Idle-speed check

• Engine malfunction indicator light is off and without fault code

·If the accumulator voltage means the alternator works normally; Too high: it may be the fault of the alternator regulator; Too low: it may be the improper connections of the alternator or the fault of the engine;

• The intake manifold pressure can show if there is leakage and the valve clearance. If the valve clearance is too small, it means the value is too high, which may affect the drive of the engine or increase the exhaust temperature to shorten the life of the oxygen sensor and the three-way catalytic converter because the exhaust valve opens too early; In addition, the blocking of the exhaust system (foreign materials in the exhaust line or the breakdown of the inner three-way catalytic converter) will make this value too high;

• If the electronic throttle position value is too low, it shall mean there is leakage in the intake system; if it is too high, it shall mean part of the throttle is blocked.

• Too few jumps of the oxygen sensor mean the oxygen sensor loses effect.

A/C check

• When the A/C is started, the target idle speed will increase by 100RPM.

Driving check

• Faults of the vehicle speed and the oxygen sensor are diagnosed during this process and the alternate control plan will take effect after the faults are detected.

Attachment 2 Gear Study Procedure of EOBD System

Target Gear Teeth Error Study of Crankshaft Position Sensor

When the vehicle with a new computer does not carry out gear study and starts and then the fault indicator is lit, the diagnostic scanner will display the fault of P1336;

The vehicle starts and the water temperature reaches 60°C. After the vehicle operates for more than 10s, other loads on the vehicle shall be closed;

The diagnostic scanner sends an instruction of starting gear study (instruction 30 2c 07ff);

When the accelerator is pressed to the end quickly and held, the ECM shall carry out the gear study. The engine repeats 2-5 cycles from 1300 to 4500 and vibrates around 4500rpm and then the study ends;

(The above are the typical characteristics of the engine rotation speed when the gear study is carried out, based on which, it can be judged if the gear study is carried out and ends).

The diagnostic scanner sends an instruction of stopping gear study (instruction 30 2C 00);

The engine stops and starts after 15s. Then DTCs are eliminated and the engine is stopped;

Start the engine after 15s and use the diagnostic scanner to check if P1336 passes.

Air Supply and Exhaust System

Air intake system

Removal and Installation

It shall be dismounted in the reverse order, or assembled in the order as diagrammed.

Precautions

1. For the convenience of assembly, first install the filter element to the upper housing, then push them into the lower housing. When they are secured in place, press down the spring clip.

2. Do not excessively tighten the hoop for connecting the air filter upper housing to the engine intake pipe, otherwise deformation occurs at the connection point.

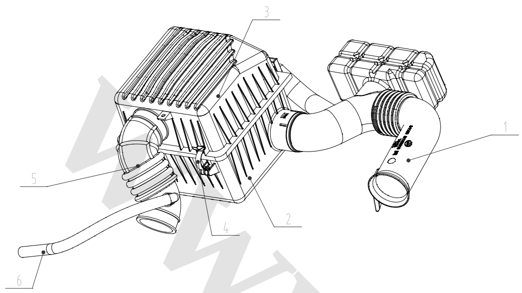


Fig. 1-38 Air Filter Assembly

1-Air filter inlet cluster	4-Spring clip
2-Air cleaner lower cover	5-Engine tachometer
3-Air cleaner upper cover	6-Crankshaft ventiduct

Removal and Installation of Exhaust Pipe and Muffler

Removal and Installation

Precautions

When the engine works, the temperature of the exhaust pipe is very high, this may cause burn. Please turn off the engine during check and repair, and remove the exhaust system till the engine and the exhaust system cools down.

Removal and Installation

Remove the rear oxygen sensor.

It shall be dismounted in the reverse order, or assembled in the order as diagrammed. (MT)

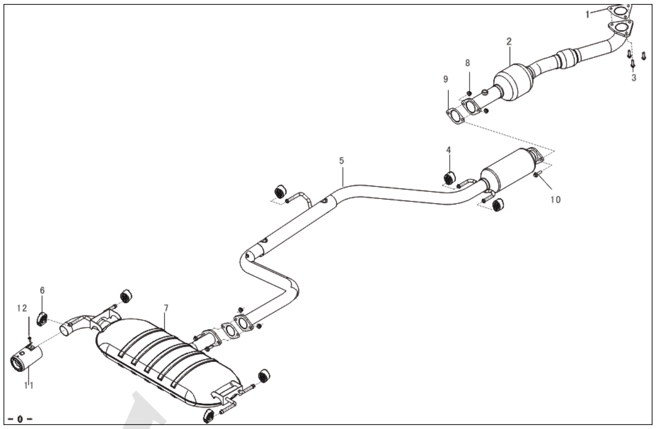


Fig. 139 Removal Order of Exhaust Pipe and Muffler

1-Gasket assembly	7-Rear muffler assembly
2-Catalytic converter assembly	8-Lock nut
3-Lock bolt	9-Small gasket
4-Rear muffler rubber suspension block	10-Connecting bolt
5-Joint pipe	11-Trim cover for tail pipe
6-Muffler mounting block	12-Lock bolt

It shall be dismounted in the reverse order, or assembled in the order as diagrammed. (AT)

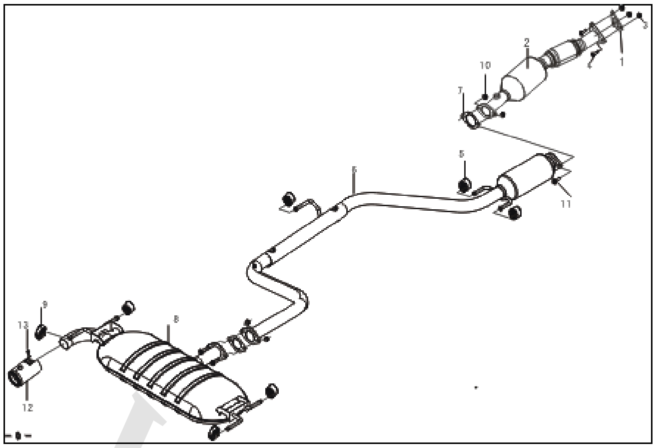


Fig. 139 Removal Order of Exhaust Pipe and Muffler

1-Gasket assembly	8-Rear muffler assembly
2-Catalytic converter assembly	9-Muffler mounting block
3-Connecting nut	10-Lock nut
4-Connecting bolt	11-Lock bolt
5-Rear muffler rubber suspension block	12-Trim cover for tail pipe
6-Joint pipe	13-Lock bolt
7-Small gasket	

Check

Start the engine to check each assembly component of the exhaust system for leakage, if there is leakage, it must be repaired or replaced as necessary. Check each component or assembly, if harmful defects such as break and damage are detected, it must be replaced as required.

Chapter III Mechanical Part

Section 1 Cylinder pressure check

Repair Specifications

Cylinder pressure	Standard cylinder pressure	1.2MPa
	Minimum cylinder pressure	1.0MPa
	Maximum cylinder pressure	1.3MPa
	Cylinder pressure difference limits	0.1MPa
Oil pressure:	Idle speed	80~300kPa
	Rated speed	330~430kPa
Minimum diameter of exhaust camshaft timing sprocket		97.3mm
Minimum diameter of crankshaft timing sprocket		51.6mm
Maximum thickness of timing chain rail		1.0mm
Cylinder head flatness	Cylinder block joint surface	0.05mm
	Intake side	0.10mm
	Exhaust side	0.10mm
Camshaft radial runout		0.03mm
Maximum lift of intake/exhaust camshaft	Intake camshaft	44.168~44.268mm
	Exhaust camshaft	43.705~43.805mm
Camshaft journals	No.1 exhaust	24.949~24.965mm
	Others	22.949~22.965mm
Camshaft axial clearance	Standard axial clearance	0.040~0.095mm
	Maximum axial clearance	0.1mm
Valve spring	Free length	43.40mm
	Elastic force of the installatio	153~169N•m (33.88mm)

		Maximum working elasticity	335.3~370.7N•m (24.1mm)
Valve spring verticality		Maximum deviation	1.6mm
		Maximum deviation angle	2°
Valve edge thickness		Standard Thickness	1.0mm
		Minimum thickness	0.7mm
Valve length	Intake:	Standard length	88.65mm
		Minimum length	88.35mm
	Exhaust Valve	Standard length	88.69mm
		Minimum length	88.39mm
Valve stem diameter		Intake:	5.470~5.485mm
		Exhaust Valve	5.465~5.480mm
Width of valve-seat contact		Width of intake valve-seat	1.0~1.4mm
		Width of exhaust valve-seat	1.0~1.4mm
Valve guide inner diameter			5.510~5.530mm
Thickness of mechanical tappet head			5.055~6.005
Valve oil-film clearance	Intake:	Standard oil-film clearance	0.025~0.060mm
		Maximum oil-film clearance	0.08mm
	Exhaust Valve	Standard oil-film clearance	0.030~0.065mm
		Maximum oil-film clearance	0.10mm
Valve-guide mounting-hole inner diameter			10.285~10.306mm
Valve-guide specified pressing-in capacity			8.7~9.1mm
Valve clearance (cold)	Intake:		0.20~0.25mm
	Exhaust Valve		0.30~0.35mm
Standard piston diameter			78.925~78.935mm
Piston oil film clearance		Standard oil-film clearance	0.065~0.085mm

		Maximum oil-film clearance	0.085mm
Piston pin mounting hole diameter			20.006~20.015mm
Piston pin outer diameter			20.004~20.013mm
Piston-connecting-rod axial clearance		Standard axial clearance	0.16~0.34mm
		Maximum axial clearance	0.34mm
Piston-connecting-rod oil-film clearance		Standard oil-film clearance	0.030mm~0.054mm
		Maximum oil-film clearance	0.08mm
Piston pin oil film clearance (piston pin mounting holes)		Standard oil-film clearance	0.002~0.011mm
		Maximum oil-film clearance	0.011mm
Connecting-rod small end hole inner diameter			20.012~20.021mm
Oil film clearance of piston pin (small end hole of connecting rod)		Standard oil-film clearance	0.001~0.017mm
		Maximum oil-film clearance	0.017mm
Piston ring groove clearance		1st ring groove	0.03~0.08mm
		2nd ring groove	0.03~0.07mm
Piston ring opening clearance	Standard piston ring gap	Top compression ring	0.20~0.35mm
		Second compression ring	0.40~0.55mm
		Film loop	0.20~0.70mm
	Maximum piston ring gap	Top compression ring	1.05mm
		Second compression ring	1.20mm
		Film loop	1.10mm
Maximum connecting-rod distortion			0.05mm/100mm
Maximal unstraightness of connecting rod			0.05mm/100mm
Connecting-rod bolt diameter		Standard diameter	7.30~7.40mm
		Minimum diameter	7.20mm
Maximum crankshaft radial runout			0.03mm

Crankshaft main journal diameter		47.982~48.000mm
Maximum taper and bore out of round of main journal of crankshaft		0.02mm
Crankshaft-connecting-rod journal diameter		43.992~44.000mm
Taper an bore out of round of connecting rod journal of crankshaft		0.02mm
Crankshaft oil film clearance	Standard oil-film clearance	0.014~0.032mm
	Maximum oil-film clearance	0.10mm
Cylinder block main bearing cap fixing bolt diameter	Standard diameter	8.80~9.00mm
	Minimum diameter	8.70mm
Top surface warping on upper of cylinder block (maximum warping)		0.05mm
Cylinder block bore diameter		79.00~79.13mm

Check the compression pressure of the 4 cylinders as Fig. 1-40 Cylinder Pressure Check

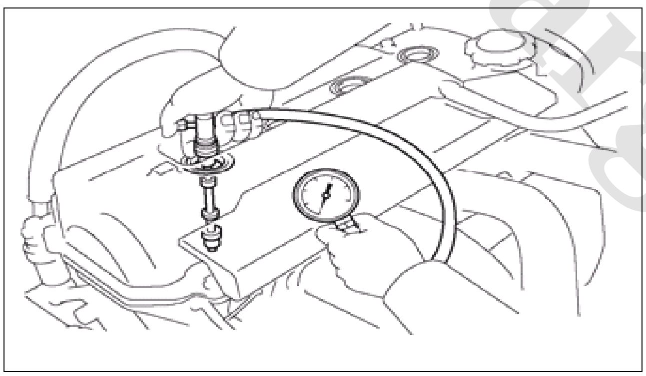


Fig. 1-40 Cylinder Pressure Check

Preheat the engine.

Turn off the engine after preheating.

Disconnect the wire harness connectors of the fuel injector.

Remove fuel pump relay

Remove all ignition coil assemblies and spark plugs.

Put special tools into the spark plug holes.

For manual transmission, depress the clutch (reduce the engine starting load) and depress the accelerator pedal to the maximum to make the throttle open.

Start the engine with the battery and read the maximum pressure on the compression pressure gauge.

Repeat above steps in a short time to measure the rest cylinders' pressure and get each cylinder's readings.

Item	compression pressure
standard	1300 Kpa (13.3kg/cm²×189psi)
Minimum pressure	1000 Kpa (10.2kg/cm²×145psi)
Maximum pressure difference among cylinders	100 Kpa (1.0kg/cm²×15psi)

Table 1-37 Normal Cylinder Pressure Value

◎ Fully charged battery must be used to start the engine to make the rotation speed reach above 250rpm.

◎ If the compression pressure of a cylinder or several cylinders is too low, it is feasible to fill a small amount of engine oil into the cylinder through the spark plug hole and repeat the steps 5-7 for the cylinder with low compression pressure. If the engine oil can improve the compression pressure, the piston ring and/or the cylinder wall may be worn or damaged. If the pressure is still low, the valve may be stuck, the closure may be unsealed, or there may be leakage at cylinder head gaskets sealing.

Engine Oil Pressure Check

Note:

The following items should be checked before engine oil pressure check:

◎ Oil level in the oil dish

In case of low oil level, it is required to add oil to the full mark of the oil scale.

◎ Quality of engine oil

The engine oil should be replaced in case of discoloration or deterioration.

◎ Oil leakage

It should be repaired in case of oil leakage.

Remove the engine oil pressure alarm sensor from the cylinder block

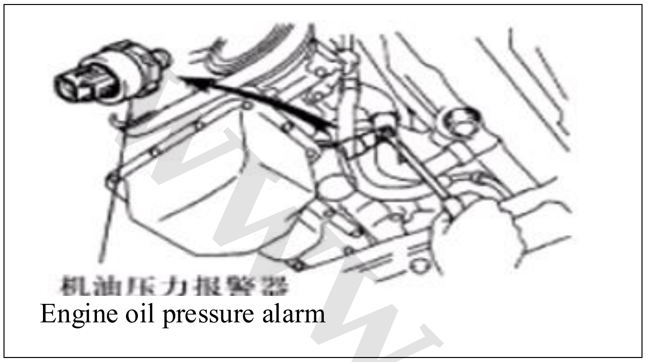


Fig. 1-40-1 Oil Pressure Alarm Position

Install the special tool (oil pressure gauge) into the empty screw hole.

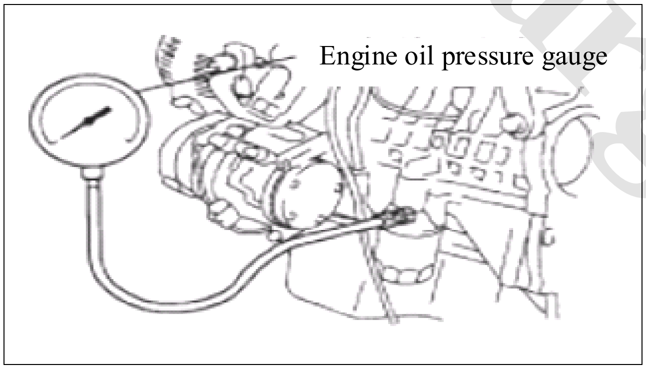


Fig. 141-2 Engine Oil Pressure Gauge Connection

Start the engine and preheat it to the normal working temperature.

Increase the engine speed to 4,000rpm and measure the oil pressure after preheating.

Oil pressure standard:

350-430kpa（3.5～4.3kg/cm，46.9～61.1psi）at 4000r/min

Turn off the engine and remove the oil pressure gauge after oil pressure check.

It is required to coat the screw thread of the engine oil pressure alarm sensor with anaerobic pipe thread sealant (see Fig. 1-40-3 Anaerobic Pipe Thread Sealant) and screw down the engine oil pressure alarm sensor as per the specified torque before re-installing the engine oil pressure alarm sensor. (Torque: 15±4 N•m)

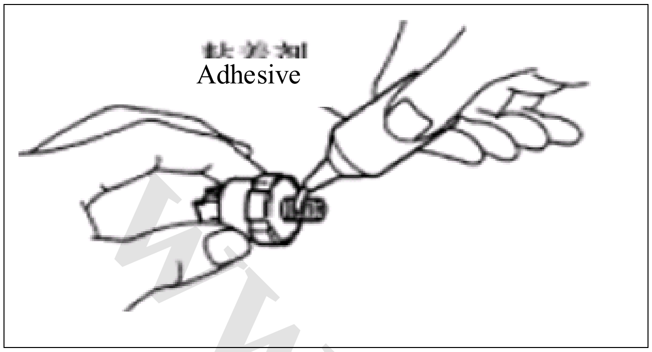


Fig. 1-40-3 Anaerobic Pipe Thread Sealant

Start the engine and check the engine oil pressure alarm sensor for leakage.

Turn off the engine and connect the terminal to the terminal of the engine oil pressure alarm sensor.

Section 2 Check and Adjustment of Valve Clearance

Disconnect the battery negative wire.

Remove the cylinder head hood (see the cylinder head hood).

1. Set #1 cylinder as the top dead center (TDC) of the compression stroke, see Fig. 1-41 Align Timing at #1 Cylinder TDC

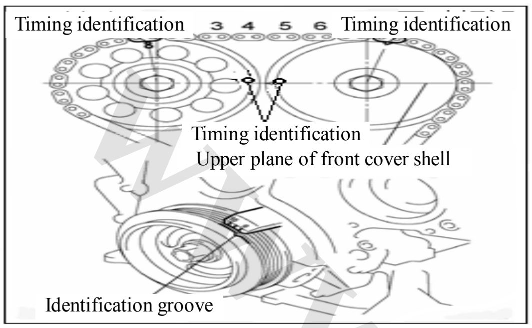


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Fig. 1-41 Align Timing at #1 Cylinder TDC

Rotate the crankshaft pulley and make the groove on the pulley keep in line with the "0" timing identification on the front cover shell.

Check if the camshaft timing sprocket identification is in line with the timing chain identification shown in the Fig. If not, please rotate the crankshaft till the identification is aligned.

Check the valve clearance.

Measure the clearance between the valve tappet and the camshaft with feeler gauge. **(**See Fig. 1-42 **#1 Cylinder TDC Measurable Valve Clearance)**

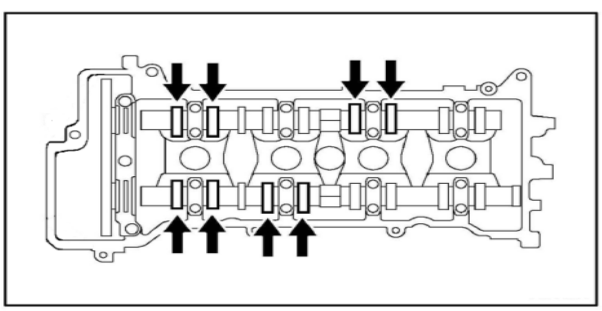


Fig. 1-42 #1 Cylinder TDC Measurable Valve Clearance

Hint:

◎ Record the measured valve clearance value unqualified. These data will be used to determine which tappet should be replaced.

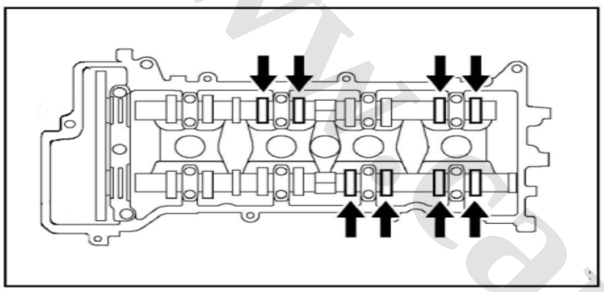
Valve clearance (cold):

Intake: 0.20-0.25mm

Exhaust: 0.30-0.35mm

Rotate the crankshaft pulley for a cycle and set #4 cylinder as the top dead center (TDC) of the compression stroke.

Measure the clearance between the valve tappet and the camshaft with feeler gauge (see Fig. 1-43).



Hint:

◎ Record the measured valve clearance value unqualified.

These data will be used to determine which tappet should be replaced.

Valve clearance (cold):

Intake: 0.20-0.25mm

Exhaust: 0.30-0.35mm

Remove the alternator and the water pump belt (see Fig. 1-44 Remove the Alternator and the Water Pump Belt)

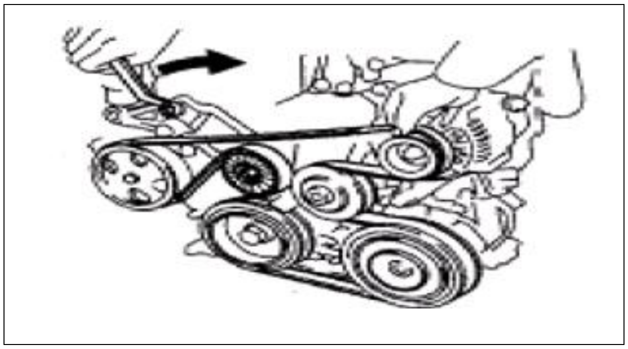


Fig. 1-44 Remove the Alternator and the Water Pump Belt.

Adjust the valve clearance.

Set #1 cylinder as the top dead center (TDC) of the compression stroke.

Align the timing identification of the timing chain with the timing identification of the camshaft.

Remove two nuts and remove the chain tensioner assembly. (See Fig. 1-45-1)

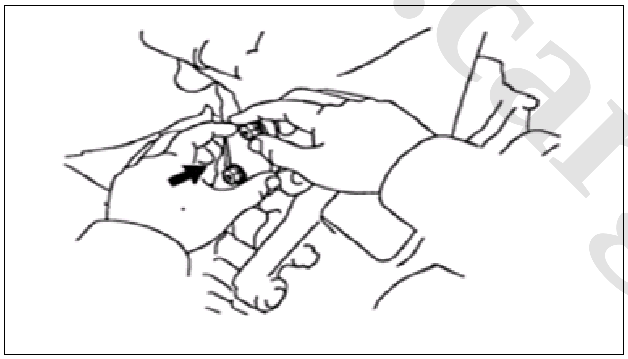


Fig. 1-45-1

Fix the exhaust camshaft with monkey wrench and then unscrew the timing sprocket bolt of the exhaust camshaft and remove the exhaust timing sprocket.

Note: Do not hurt valve tappet.

Unscrew and remove 11 bearing cover bolts evenly in accordance with the order shown in the Fig. below (see Fig. 1-45-2).

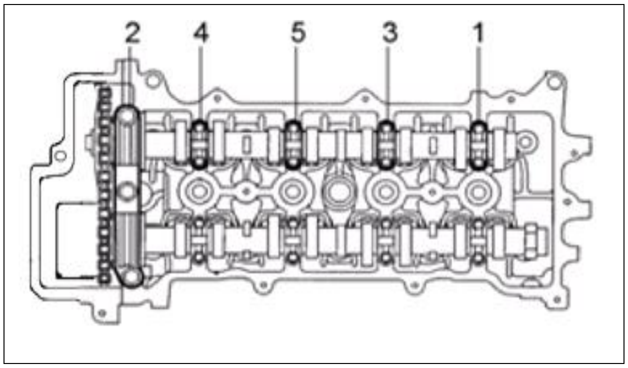


Fig. 1-45-2

Remove the bearing cover of the exhaust camshaft and the camshaft.

Unscrew and remove 8 bearing cover bolts in proper order (see Fig. 1-45-3).

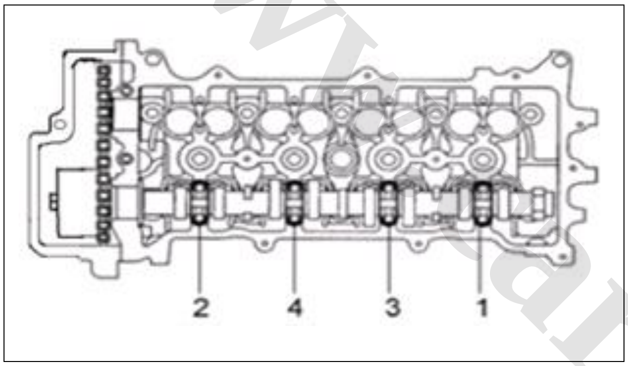
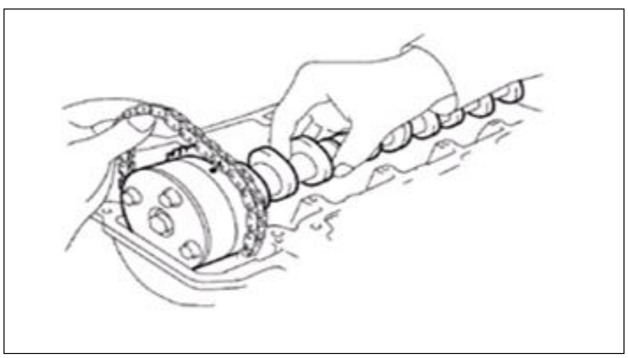


Fig. 1-45-3

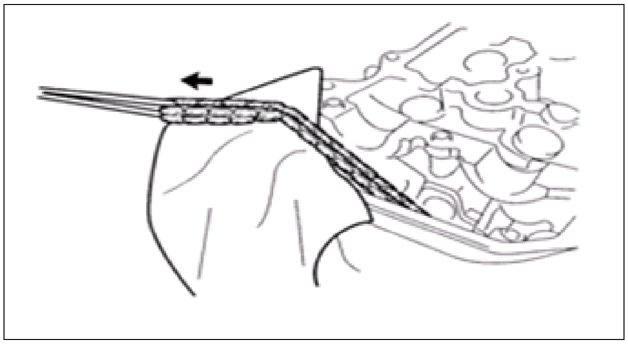
Remove the bearing cover of the intake camshaft.

Fix the timing chain by hand as shown in the Fig. and remove the intake camshaft. (See Fig. 1-45-4)



See Fig. 1-45-4

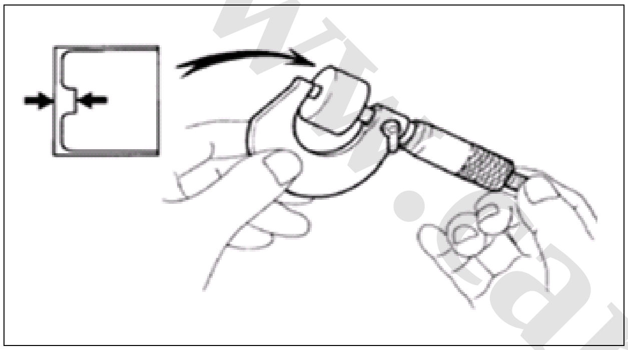
Fix the timing chain with rope as shown in the Fig. (See Fig. 1-45-5).



See Fig. 1-45-5

Remove the valve tappet.

Measure the thickness of the removed valve tappet with micrometer. (See Fig. 1-45-6)



See Fig. 1-45-6

Calculate the thickness of the new valve tappet to make the valve clearance stay in the specified range.

A	Thickness of new valve tappet
B	Thickness of old valve tappet
C	Valve clearance

Clearance should stay in the specified range.

Calculate valve clearance:

Intake valve: A = B + (C-0.20mm)

Intake valve: A = B + (C-0.32mm)

Select the new valve tappet with thickness close to the calculated value as much as possible.

Hint:

There are valve tappets of 45 kinds of thickness, with dimension varying from 5.06mm to 5.94mm (difference: 0.02mm).

Install the timing chain on the intake timing sprocket as shown in Fig. 1-45-7 to make the chain and link identification be in line with the identification on the intake timing sprocket.

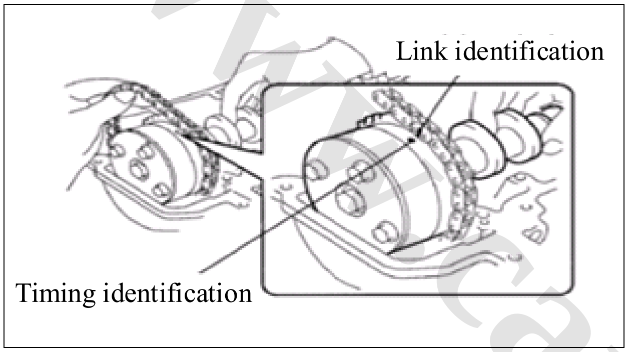
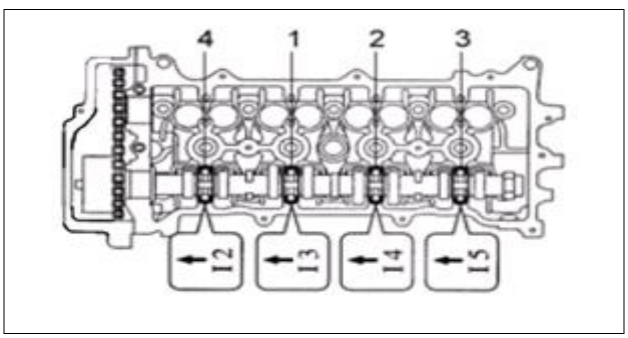


Fig. 1-45-7

Check the forward mark and the order of the camshaft bearing cover for correctness. Screw down the bearing cover bolt in the order shown in Fig. 1-45-8.



Torque: 13N·m

Install the 3 bolts of #1 camshaft bearing cover.

Torque: 23N·m

Fix the exhaust camshaft with monkey wrench (see Fig. 1-45-12) and then screw down the exhaust camshaft bolts.

Torque: 54 N•m

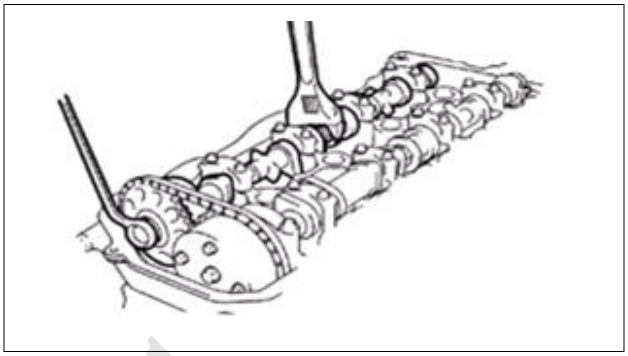


Fig. 1-45-12

Note:

Do not hurt the valve tappet in the process of screwing down.

Check if the camshaft timing sprocket identification is in line with the timing chain identification shown in the Fig. and if the groove on the pulley is in line with the “0” timing identification on the front cover shell. (See Fig. 1-45-13)

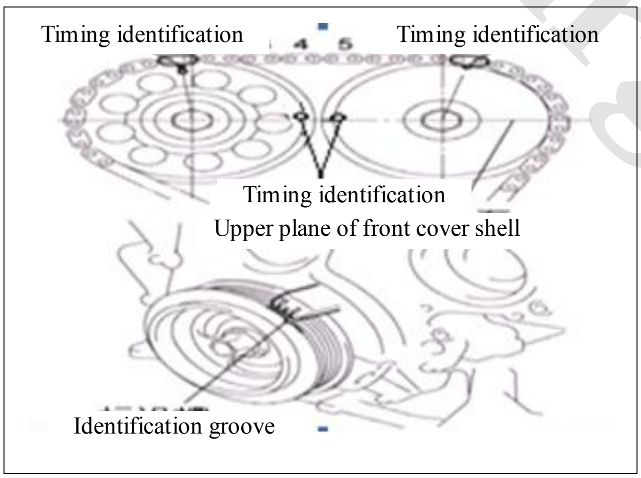


Fig. 1-45-13

Connect the locating pin of the tensioner to the hasp as shown in Fig. 1-46.

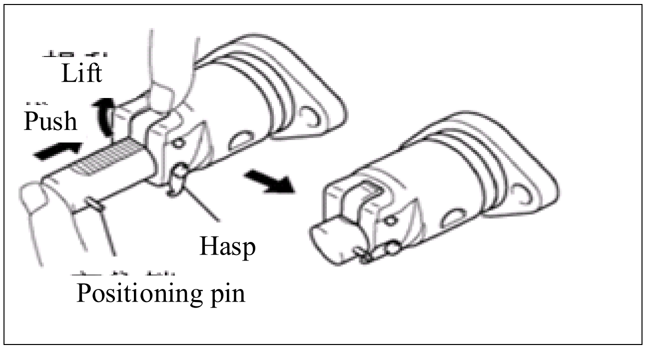


Fig. 1-46

Install the tensioner assembly with two nuts (see Fig. 1-47).

Torque: 11N·m

Fig. 1-47

Rotate the crankshaft counterclockwise to remove the locating pin from the hasp. (See Fig. 1-48)

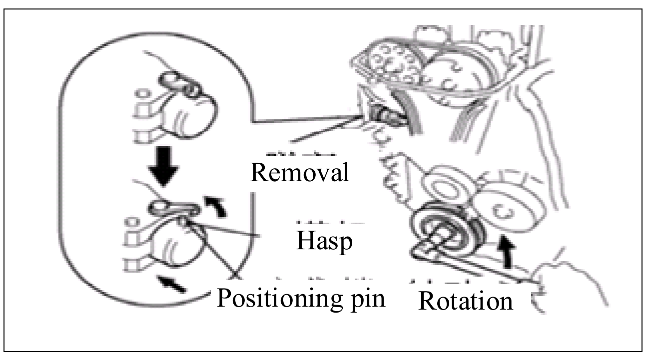


Fig. 1-48

Rotate the crankshaft clockwise to check if the slide block has been pushed in the device by the plunger (See Fig. 1-49).

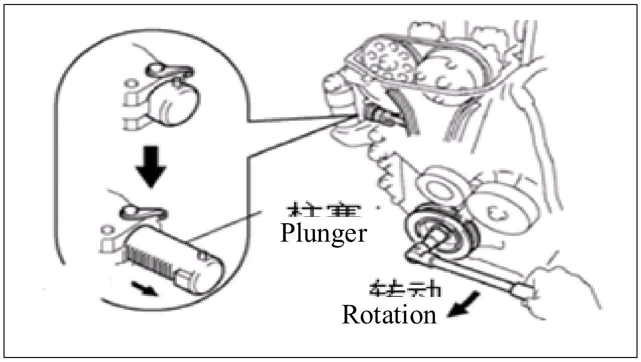


Fig. 1-49

Caution: If the plunger cannot spring back, please press the slide block into the chain tensioner by fingers or screwdriver to separate the hasp and the locating pin, as a result, the plunger will spring back.

Install the timing belt tensioner with 2 bolts (see Fig. 1-50).

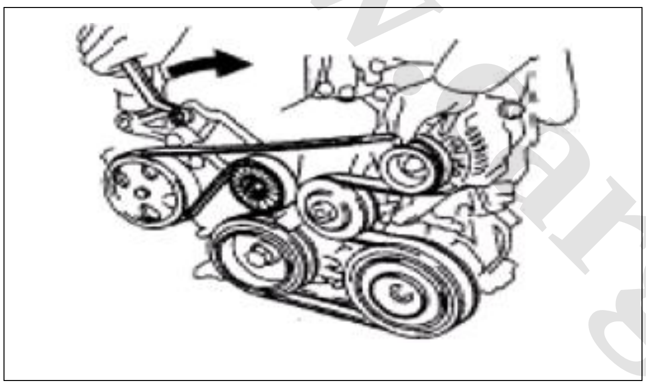


Fig. 1-50

Torque: 29N·m (nut A)

Torque: 69N·m (bolt B)

Coat the sealant as shown in the Fig. See “Cylinder head hood” section for installing parts like cylinder head hood (See Fig.1-51).

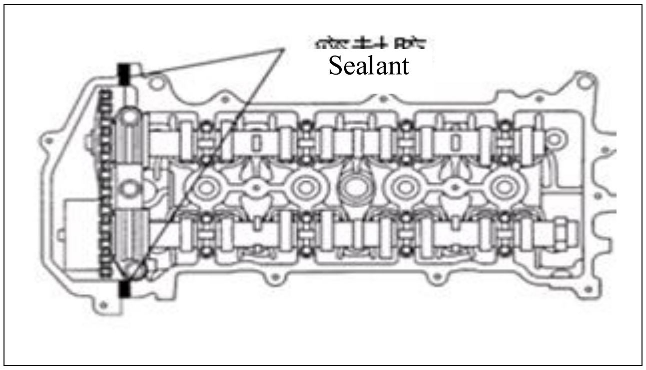


Fig. 1-51

Removal and Installation of Thermolator Assembly

Removal

Drain all engine coolant

Cut off the battery negative power

Remove the water inlet pipe and connectors

Remove the thermolator

Installation of Thermolator

Install new thermolator gaskets. Install and place the inching valve upwards as shown in the Fig. 1-52

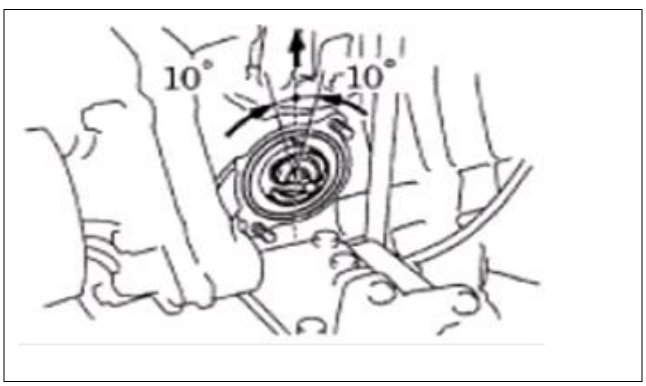
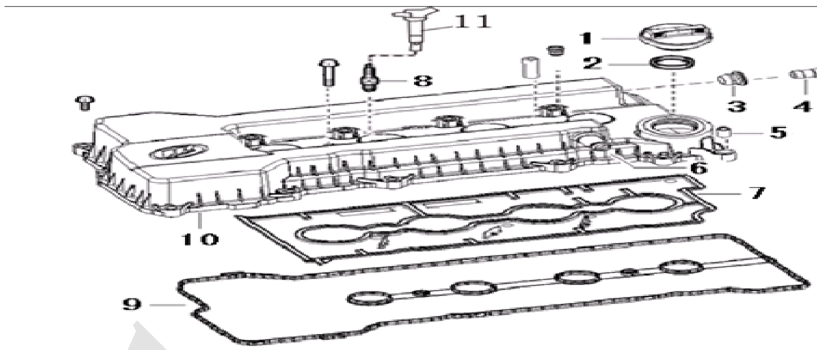


Fig. 1-52

Install the water inlet pipe and connectors, torque: 11 N·m

Connect the battery negative power, add engine coolant and drain all air in the cooling system, check if there is leakage of coolant.

Cylinder Head Hood



1. Filler cap
2. Filler cap seal ring
3. PVC valve seal ring
4. PCV valve assembly
5. Cylinder head hood bolt sleeve 1
6. Cylinder head hood vent
7. Oil deflector
8. Spark plug
9. Cylinder head hood sealing pad assembly
10. Cylinder head hood body
11. Ignition coil

Removal

Disconnect the battery positive and negative wires, remove the battery, and remove the engine wire harness. (See Fig. 1-53-2)

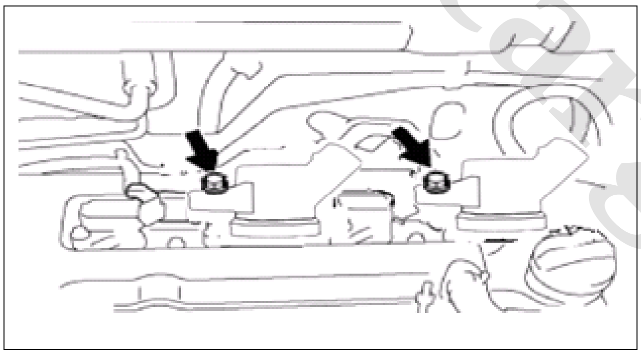


Fig. 1-53-2

Remove 4 ignition coils.

Disconnect the PCV valve ventilation hose. (See Fig. 1-53-3)

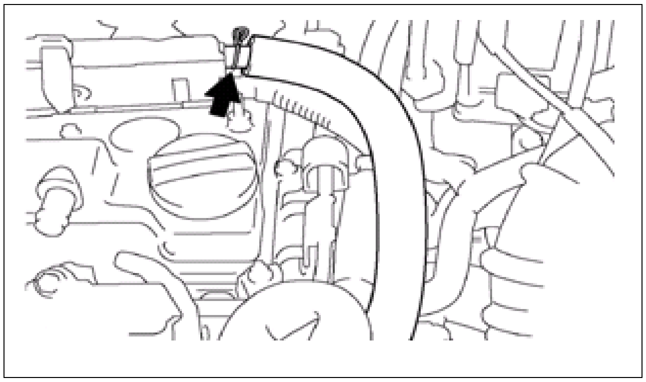


Fig. 1-53-3

Disconnect the long ventilation hose. (See Fig. 1-53-4)

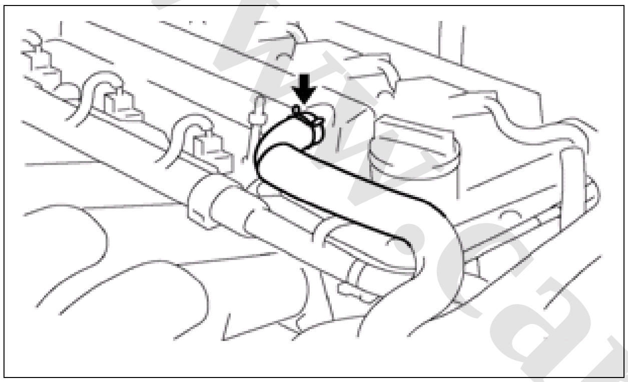


Fig. 1-53-4

Remove the filler cap. (See Fig. 1-53-5)

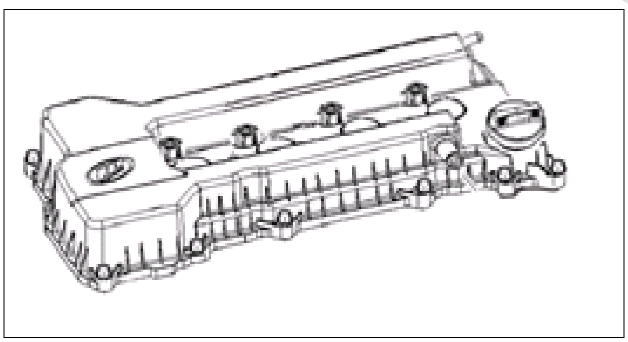


Fig. 1-53-5

Remove the PVC valve seal ring and the PCV valve from the cylinder head hood (see Fig. 1-53-6).

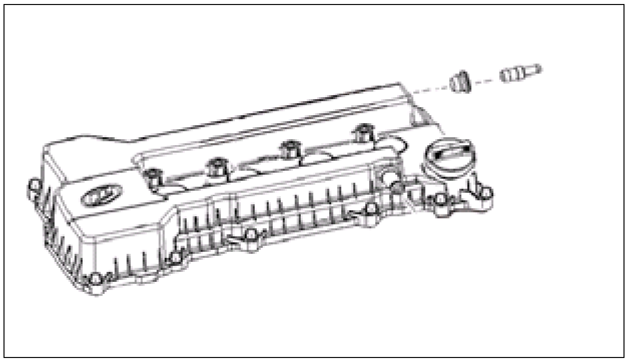


Fig. 1-53-6

Remove the spark plug with special tools.

Remove 15 bolts and 2 bolt gaskets from the cylinder head hood. (See Fig. 1-53-7)

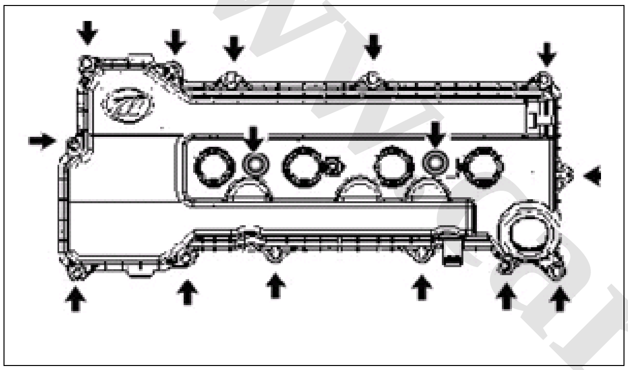


Fig. 1-53-7

Remove the cylinder head hood gasket. (See Fig. 1-53-8)

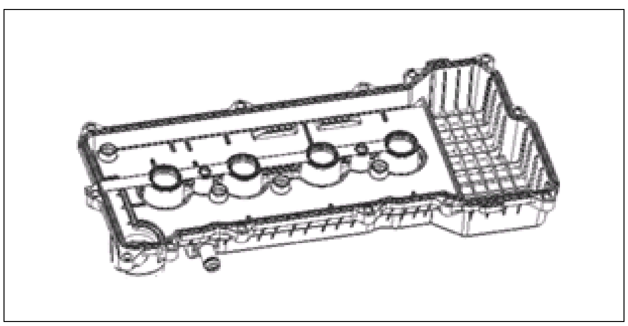


Fig. 1-53-8

Installation

Install the cylinder head hood gasket into the cylinder head hood (see Fig. 1-53-9).

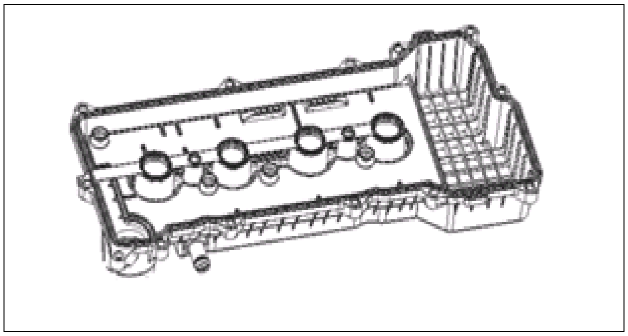


Fig. 1-53-9

Install the cylinder head hood on the cylinder head with 15 bolts (see Fig. 1-53-10).

Torque: 11N·m

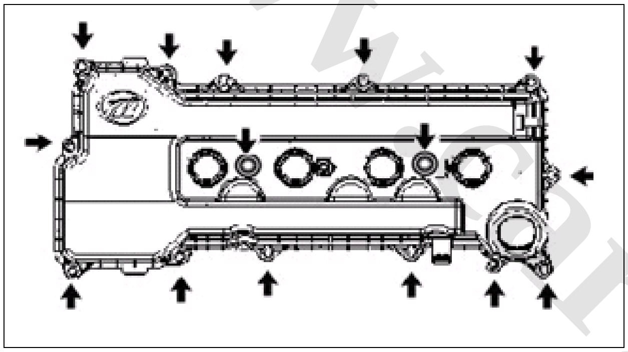


Fig. 1-53-10

Install the spark plug with special tools (see Fig. 1-53-11).

Torque: 30 N•m

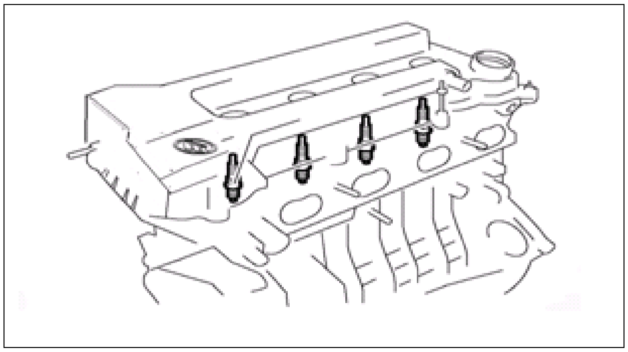


Fig. 1-53-11

Install the ignition coil with 4 bolts

Torque: 11 N•m

Install the PCV valve seal ring and the PCV valve (see Fig.1-53-12).

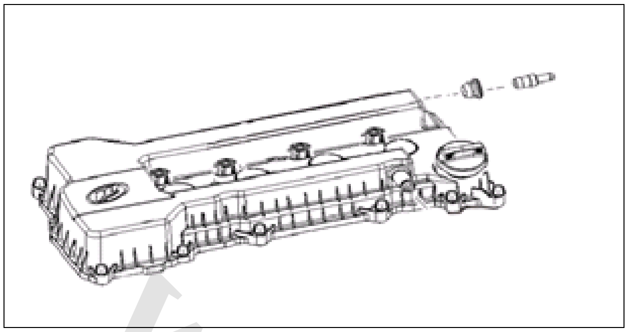


Fig. 1-53-12

Install the filler cap (see Fig.1-53-13).

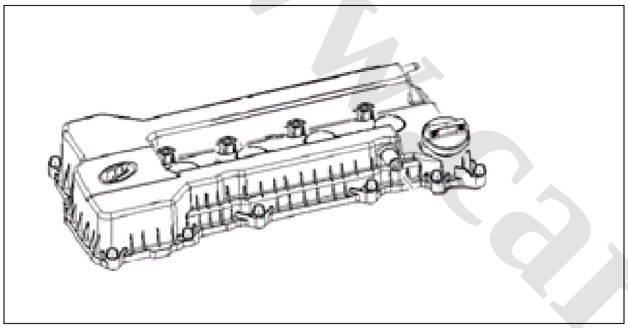


Fig. 1-53-13

Connect the long ventilation hose to the cylinder head hood (see Fig. 1-53-14).

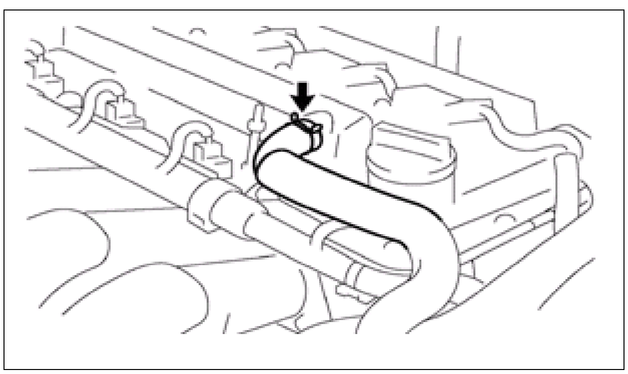


Fig. 1-53-14

Connect the PCV valve ventilation hose to the cylinder head hood (see Fig. 1-53-15).

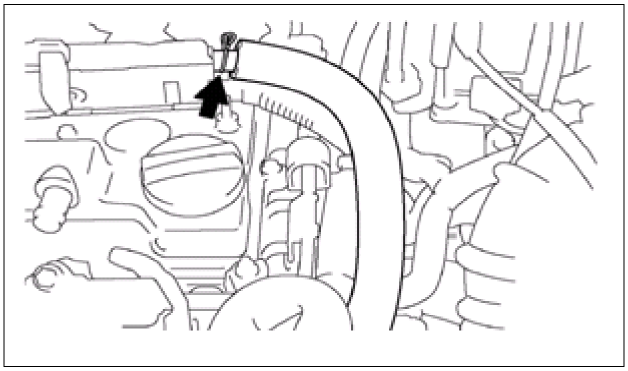


Fig. 1-53-15

Install the ignition coil (see Fig.1-53-16).

Torque: 11N·m

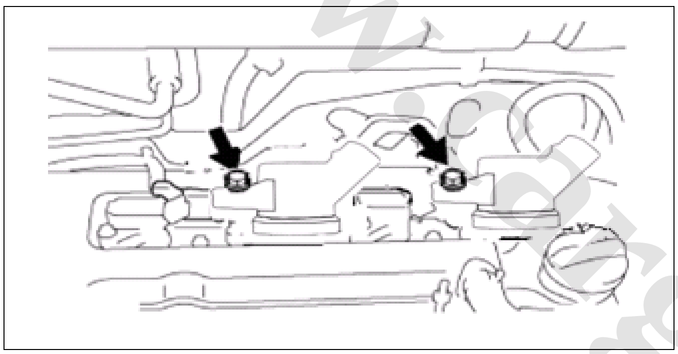


Fig. 1-53-16

Install the engine wire harness and connect each plug/socket.

Connect the battery positive and negative wires.

Note:

Check each part carefully for deterioration or damage prior to installation and replace it if there are any defects.

Carefully prevent the cylinder head hood seal ring from removal during the installation of the cylinder head hood.

Throttle Body and Intake Manifold

Removal

Disconnect the battery negative wire.

Disconnect the electrical wire.

Remove the intake manifold.

Remove the following hoses:

◎ Disconnect the vacuum booster hose from the intake manifold.

◎ Remove the PCV valve hose from the intake manifold and the throttle body.

◎ Disconnect the canister solenoid valve hose from the intake manifold.

Remove 4 bolts, 2 nuts (see Fig. 1-54-1), 2 fixed supports, as well as the intake manifold and the throttle assembly.

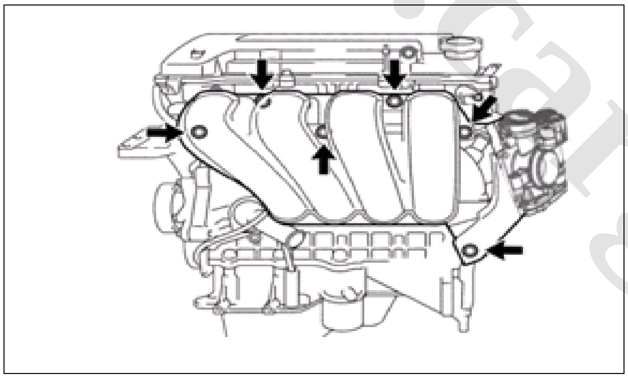


Fig. 1-54-1

Remove the gasket from the intake manifold.

Installation

Install as per the reverse order of removal and pay attention to the following items (see Fig. 1-54-2).

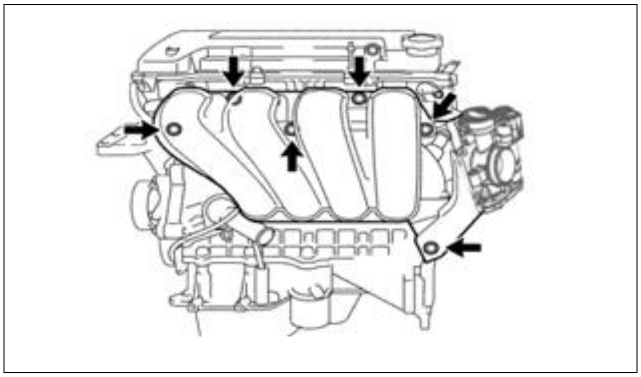


Fig. 1-54-2

Install new gaskets on the intake manifold.

Screw down bolts and nuts as per the specified torque.

Torque: Intake manifold-30N.m, support bolt-23 N.m.

Exhaust Manifold

Warning:

Do not maintain the exhaust manifold when it is at thermal state, so as to avoid burn. Repair it when the system cools down.

Removal

Disconnect the battery negative wire.

Remove the 3 bolts under the exhaust manifold and remove the exhaust manifold support (see Fig. 1-55-1).

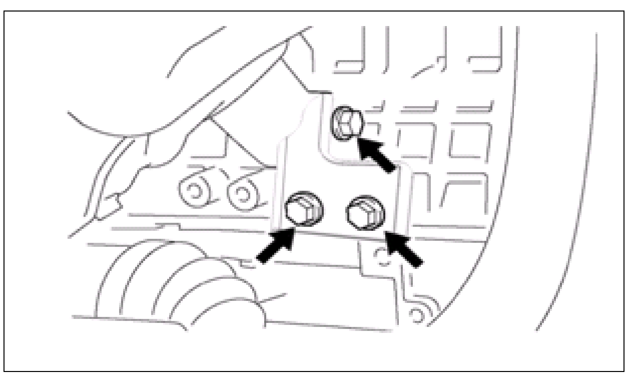


Fig. 1-55-1

Remove 6 bolts and then remove the upper insulator of the exhaust manifold (see Fig. 1-55-2).

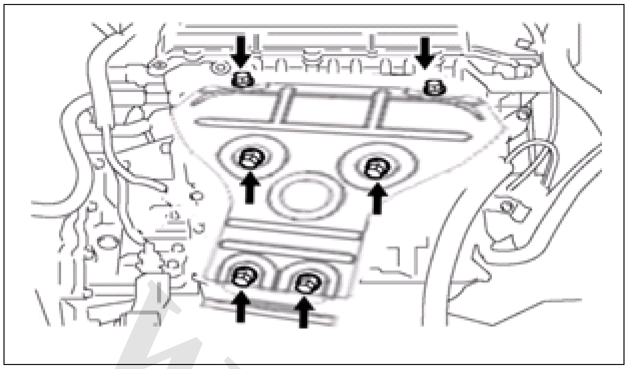


Fig. 1-55-2

Remove 5 nuts and the exhaust manifold and the heat-insulating pad (see Fig. 1-55-3).

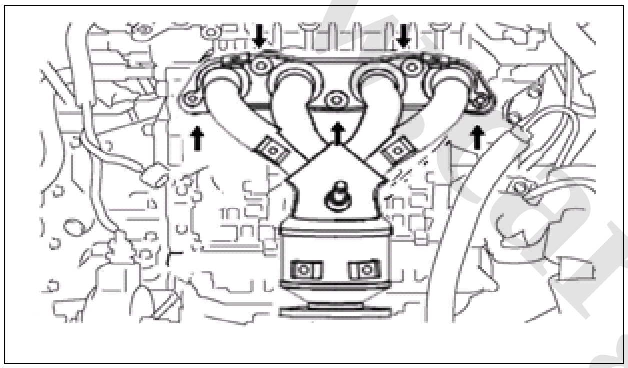


Fig. 1-55-3

Remove 4 bolts and then remove the lower insulator of the exhaust manifold.

Installation

Install the lower insulator of the exhaust manifold with 4 bolts.

Torque: 18N.m

Install the exhaust manifold gasket and the exhaust manifold assembly with 5 bolts (see Fig. 1-55-4). It is required to check the heat-insulating pad for deformation or damage before the installation of the exhaust manifold gasket. If any, it should be replaced and the relevant nuts should be screwed down as per the given torque. e: 18N.m

Torque: 37N.m

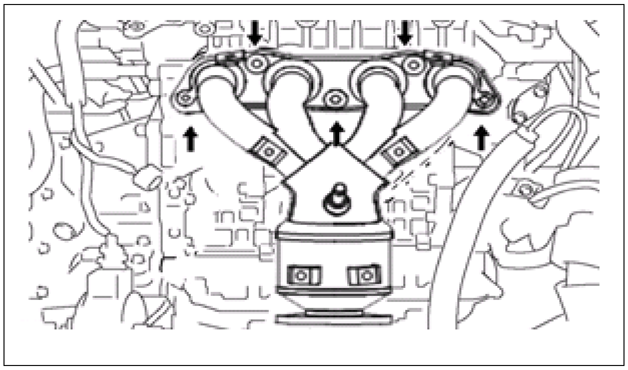


Fig. 1-55-4

Install the upper insulator of the exhaust manifold with 6 bolts (see Fig. 1-55-5).

Torque: 18N.m

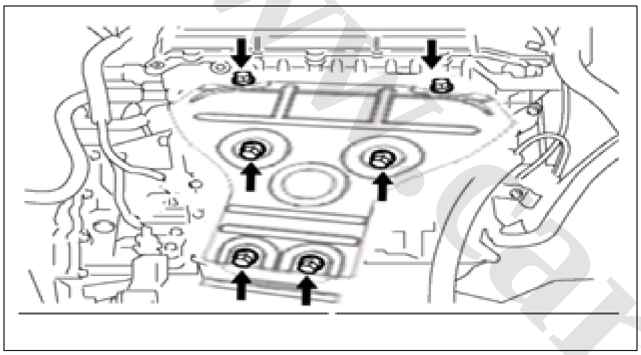


Fig. 1-55-5

Install the upper insulator of the exhaust manifold bracket with 3 bolts (see Fig. 1-55-6).

Torque: 30N•m Connect the battery negative wire.

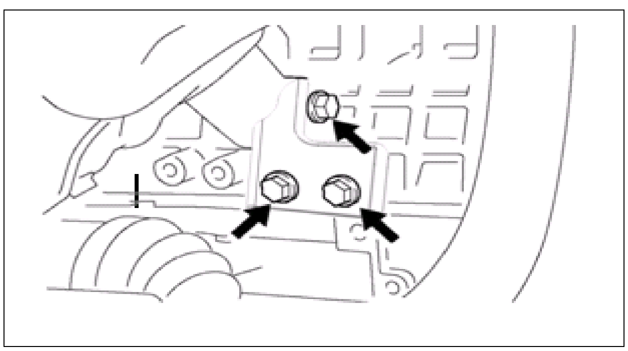
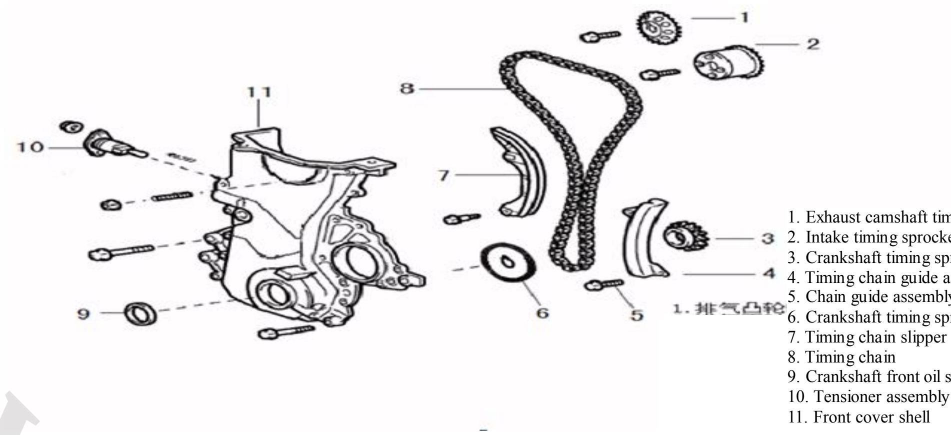


Fig. 1-55-6

Check the exhaust system for leakage.

Timing Part



1. Exhaust camshaft timing sprocket
2. Intake timing sprocket assembly (VVT)
3. Crankshaft timing sprocket
4. Timing chain guide assembly
5. Chain guide assembly positioning bolt
6. Crankshaft timing sprocket stopper
7. Timing chain slipper assembly
8. Timing chain
9. Crankshaft front oil seal
10. Tensioner assembly
11. Front cover shell

Timing Part and Relevant Components

Removal

Disconnect the battery negative wire, discharge the engine coolant and remove the water pump alternator belt.

Remove the tensioner assembly, the timing belt tensioner, the A/C compressor and the power steering pump assembly.

Remove the cylinder head hood and see the cylinder head hood for details. Remove 3 bolts and then remove the right suspension of the engine (see Fig. 1-56-1).

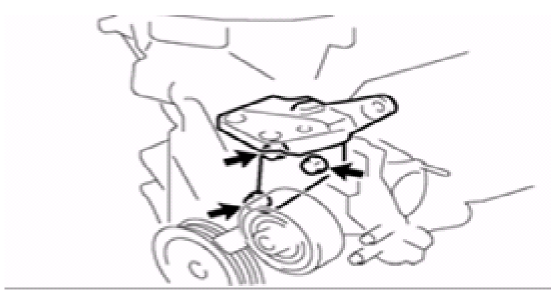


Fig. 1-56-1

Remove 5 bolts and then remove the water pump (see Fig.1-56-2).

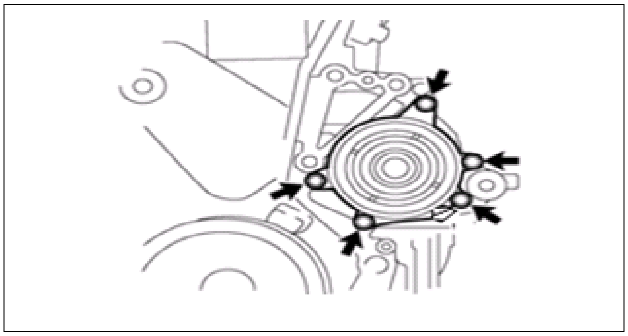


Fig. 1-56-2

Remove the O-ring seal of the water pump (see Fig.1-56-3)

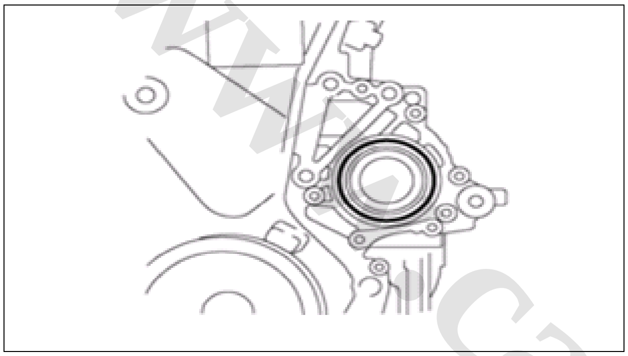


Fig. 1-56-3

Remove the pulley bolts with special tools and remove the crankshaft pulley (see Fig.1-56-4).

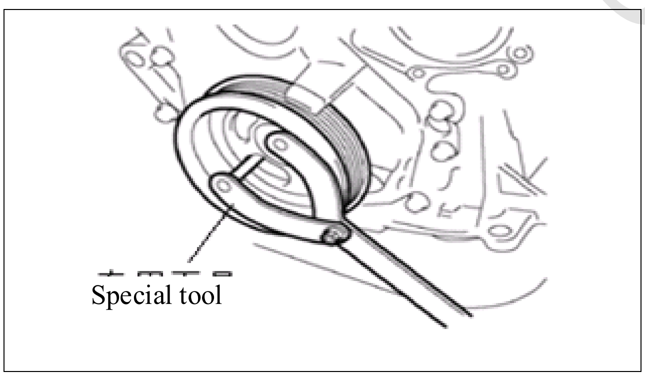


Fig. 1-56-4

Rotate the crankshaft pulley and make the groove on the pulley keep in line with the “0” timing identification on the front cover shell.

Check if the camshaft timing sprocket identification is in line with the timing chain identification shown in the Fig. If not, please rotate the crankshaft till the identification is aligned. Remove 11 bolts and then remove 1 nut (see Fig. 1-56-6).

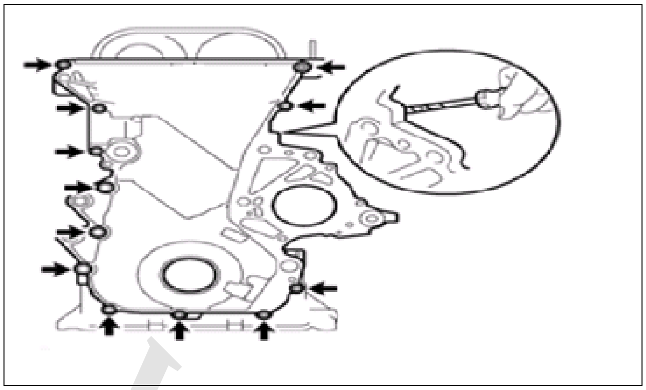


Fig. 1-56-6

Pry the chimb between the cylinder head and the crankcase with screwdriver as shown in the Fig. and remove the front cover shell.

Caution: Take care not to hurt the joint surface of the front cover shell, the cylinder head and the crankshaft.

Place the front cover shell on the board and then remove the crankshaft front seal with screwdriver (see Fig.1-56-7).

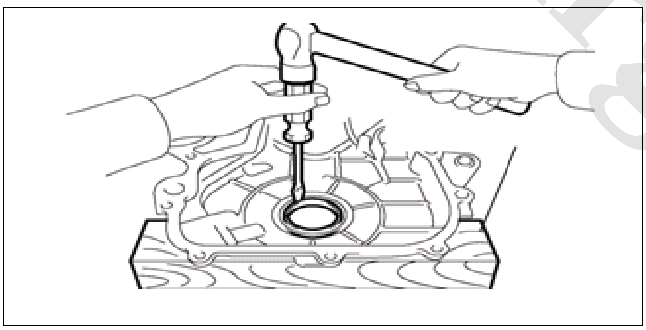


Fig. 1-56-7

Remove the crankshaft timing sprocket barrier from the crankshaft (see Fig.1-56-8).

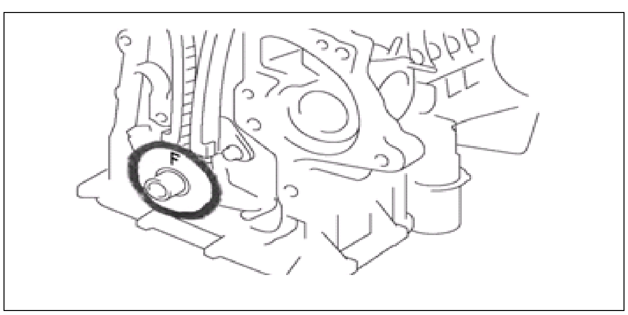


Fig. 1-56-8

Remove the set bolts of the mobile rail assembly (see Fig.1-56-9).

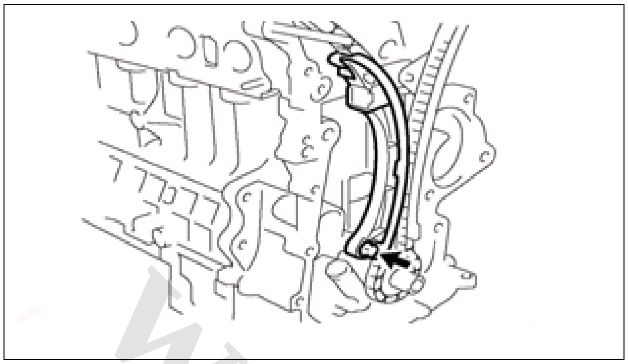


Fig. 1-56-9

Pry out the crankshaft timing chain with 2 screwdrivers as shown in the Fig. (See Fig. 1-56-10).

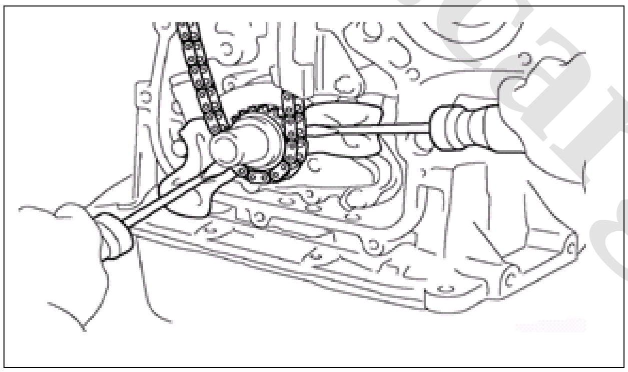


Fig. 1-56-10

Remove 2 bolts and then remove the fixed rail of the timing chain (see Fig.1-56-11).

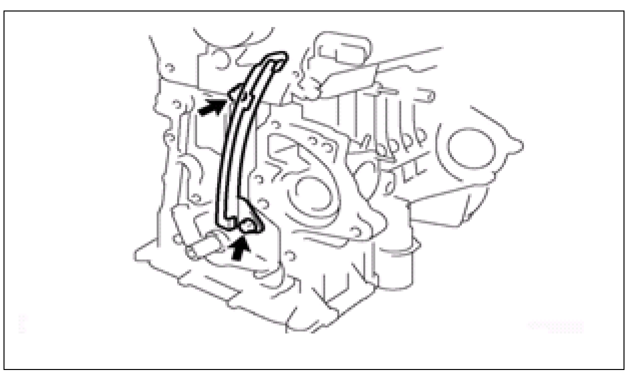


Fig. 1-56-11

Remove a bolt and then remove the camshaft engine oil control valve (see Fig. 1-56-12).

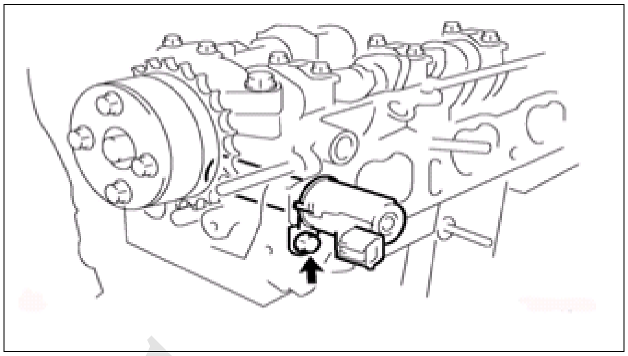


Fig. 1-56-12

Check the VVT drive assembly.

Check the locking status of the timing sprocket.

Clamp the camshaft with jaw vice and confirm that the VVT drive has been locked. Release the locking pin.

Seal the 5 oil ducts of the intake camshaft with vinyl tape, as shown in the Fig. (See Fig. 1-56-13).

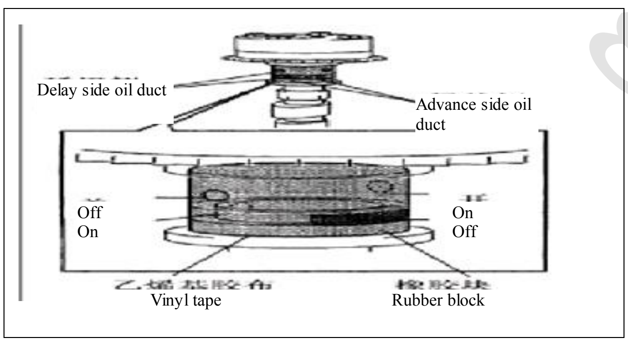


Fig. 1-56-13

On the relative groove side, cut a hole on the surface vinyl tape of the advance side oil duct and the delay side oil duct.

Put into the 2 oil ducts (advance side oil duct and delay side oil duct) with surface tape cut under the pressure of about 150KPa.

(See Fig. 1-56-14)

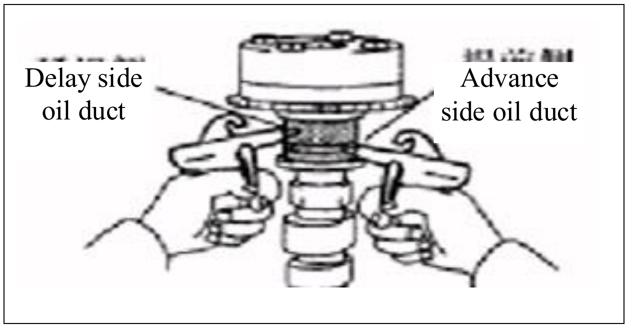


Fig. 1-56-14

Check if the timing sprocket of the VVT drive will rotate to the advance timing position when the pressure of the timing delay side oil duct declines. (See Fig. 1-56-15)

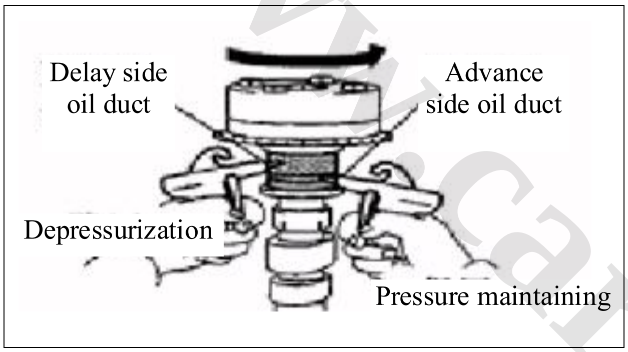


Fig. 1-56-15

When the camshaft timing sprocket rotates to the maximum advance timing position, please release the air pressure in the timing delay side oil duct, and then release the air in the timing advance side oil duct.

Check the rotation for balance. Rotate the VVT drive assembly in the rotatable range except for the maximum delay position and check if the rotation is smooth.

Check the fixing state of the maximum delay position. Confirm that the camshaft timing sprocket assembly is fixed at the maximum delay position.

Remove the VVT drive assembly.

Clamp the camshaft with jaw vice and confirm that the VVT drive has been locked.

Seal the 5 oil ducts of the camshaft bearing journal with vinyl tape, as shown in the Fig.

On the relative groove side, cut a hole on the surface vinyl tape of the advance side oil duct and the delay side oil duct. (See Fig. 1-56-16).

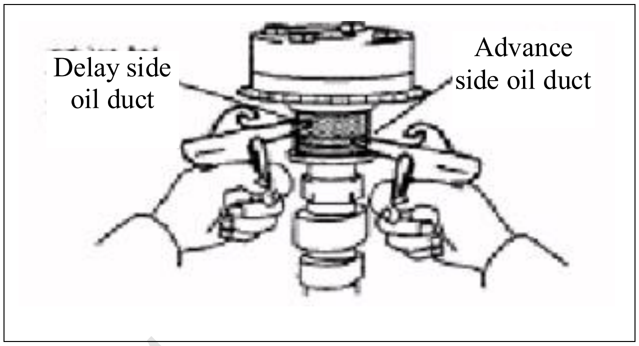


Fig. 1-56-16

Put into the 2 oil ducts (advance side oil duct and delay side oil duct) with surface tape cut under the pressure of about 150KPa.

Check if the timing sprocket of the VVT drive will rotate to the advance timing position when the pressure of the timing delay side oil duct declines. (See Fig. 1-56-17)

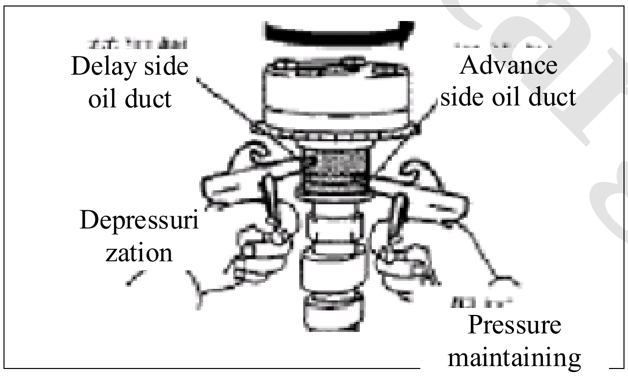


Fig. 1-56-17

When the camshaft timing sprocket rotates to the maximum advance timing position, please release the air pressure in the timing delay side oil duct, and then release the air in the timing advance side oil duct.

Remove the fixed bolts of the VVT drive (see Fig.1-56-18).

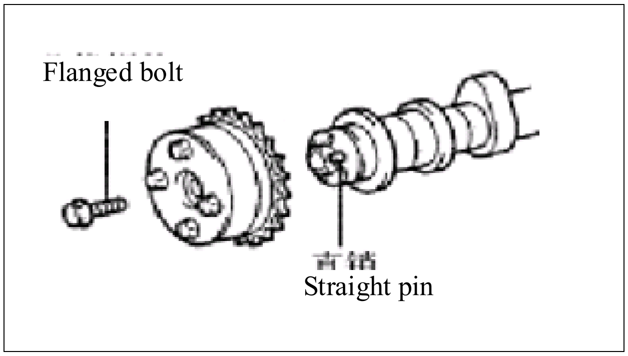


Fig. 1-56-18

Check

Check the tensioner assembly (see Fig.1-56-19)

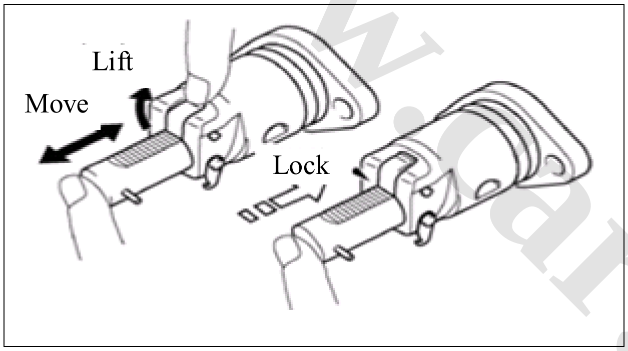


Fig. 1-56-19

Check the timing chain.

Apply force of 140N to the timing chain using spring pressure gauge and the measure the length of chain with dial caliper

(See Fig. 1-56-20)

Maximum extension of chain: 1226mm

If the maximum length exceeds the maximum extension of the chain, the chain should be replaced.

Hint: Select 3 or more than 3 points at random as per the above method to check the length of chain.

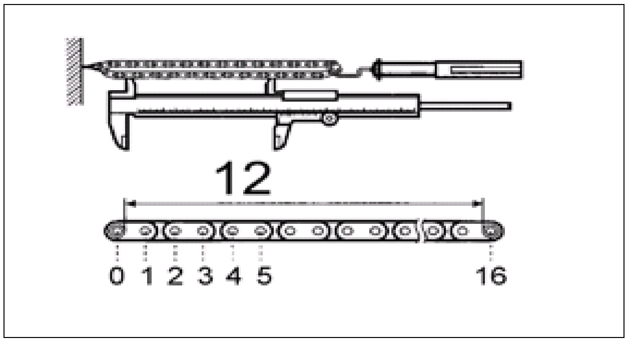


Fig. 1-56-20

Check the timing sprocket of the exhaust camshaft. Wind the chain on the timing sprocket of the exhaust camshaft as shown in the Fig.

Measure the diameter of the camshaft timing sprocket with timing chain using dial caliper (see Fig. 1-56-21).

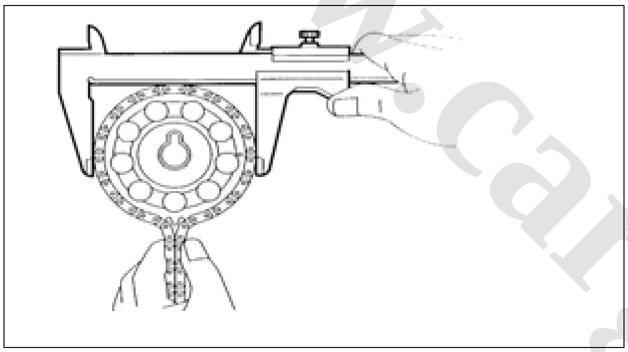


Fig. 1-56-21

Minimum diameter of sprocket (with chain): 97.3mm

If the sprocket diameter is less than the minimum sprocket diameter, it is required to replace the camshaft timing sprocket.

Note: The two measurement feet of the dial caliper must be close to the chain roller during measurement.

Check the crankshaft timing sprocket.

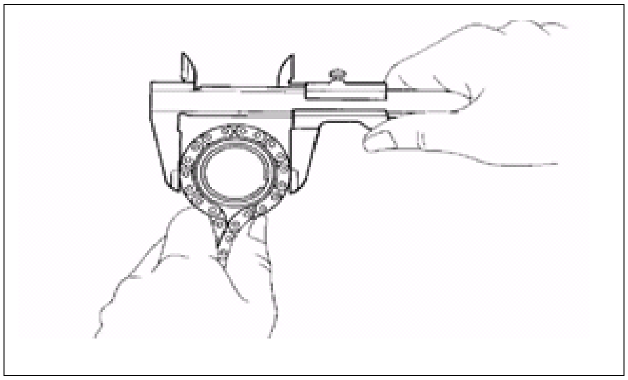


Fig. 1-56-22

Wind the chain on the crankshaft timing sprocket as shown in Fig. 1-56-22.

Measure the diameter of the crankshaft timing sprocket with timing chain using dial caliper.

Minimum diameter of sprocket (with chain): 51.6mm

If the sprocket diameter is less than the minimum sprocket diameter, it is required to replace the crankshaft timing sprocket.

Note: The two measurement feet of the dial caliper must be close to the chain roller during measurement.

Check the timing chain slipper assembly.

Measure the thickness of the timing chain mobile rail with dial caliper (see Fig. 1-56-23).

Maximum thickness: 1.0mm

If the thickness of the guide rail is higher than the maximum thickness, the timing chain slipper assembly should be replaced.

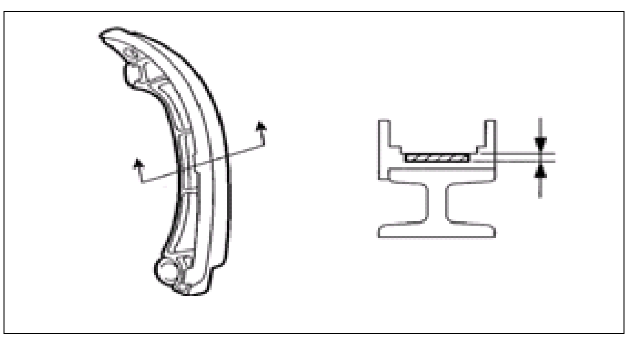


Fig. 1-56-23

Installation

Install the camshaft oil control valve.

Coat the new O-ring seal with engine oil and install it to the camshaft oil control valve.

Install the camshaft engine oil control valve with bolt (see Fig. 1-56-24).

Torque: 11±1N•m

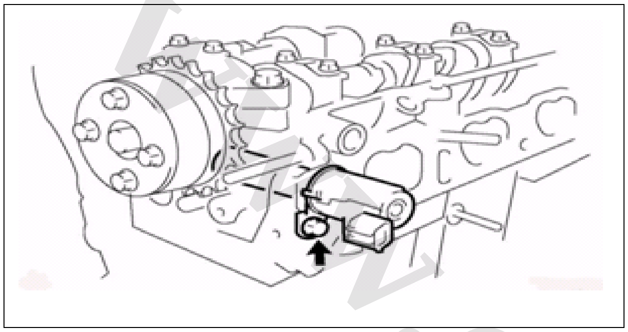


Fig. 1-56-24

Install the the fixed rail of the timing chain with 2 bolts (see Fig.1-56-25)

Torque: 11±1N•m

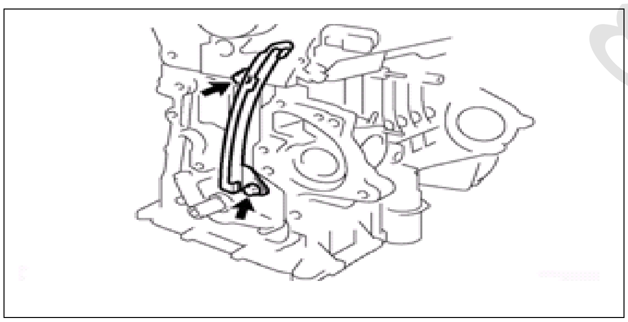


Fig. 1-56-25

Install the timing chain to the crankshaft timing sprocket, align the two identifications, and then install it to the crankshaft along the keyway direction. (See Fig. 1-56-26)

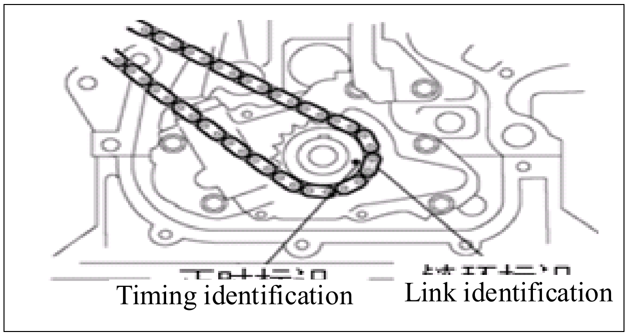


Fig. 1-56-26

Install the crankshaft timing sprocket with special tools and make the link identification of the timing chain keep in line with the timing identification of the crankshaft timing sprocket. (See Fig. 1-56-27)

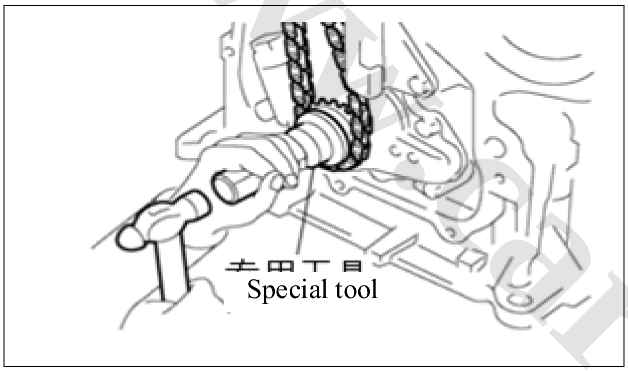


Fig. 1-56-27

Install the timing chain and make the link identification of the timing chain keep in line with the timing identification of the camshaft (see Fig. 1-56-28).

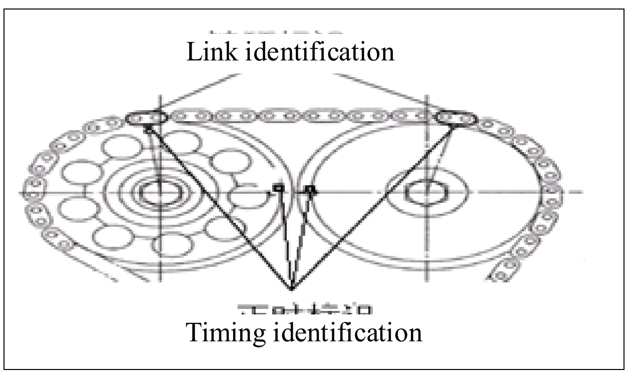


Fig. 1-56-28

Install the the fixed rail of the timing chain with bolts (see Fig.1-56-29)

Torque: 23±2N•m

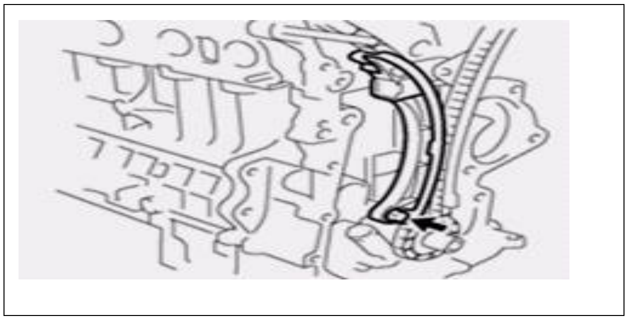


Fig. 1-56-29

Install the crankshaft timing sprocket stopper along the keyway direction (see Fig. 1-56-30).

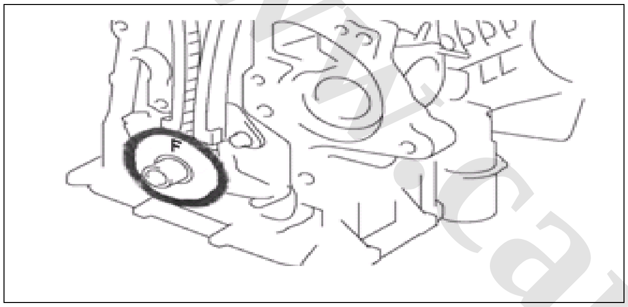


Fig. 1-56-30

Install the crankshaft front seal.

a) Place the front cover shell assembly on the board.

b) Hammer the crankshaft front seal into the front mask assembly with the special tool and make the oil seal end surface keep in line with the front cover shell end surface. (See Fig. 1-56-31)

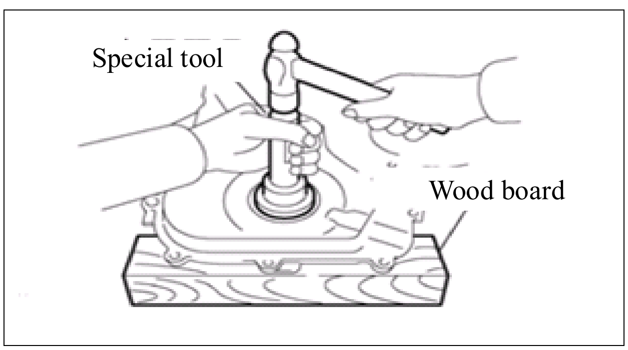


Fig. 1-56-31

Note:

Please coat the oil seal lip with grease prior to installation.

Coat plane sealant as shown in Fig. 1-56-32.

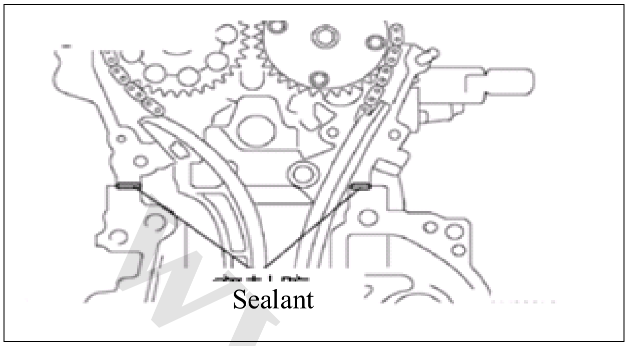


Fig. 1-56-32

Install the front cover shell assembly.

Remove all the old fillings and prevent the installation surface from engine oil leakage.

Coat the front cover shell end surface with sealant as shown in Fig. 1-56-33.

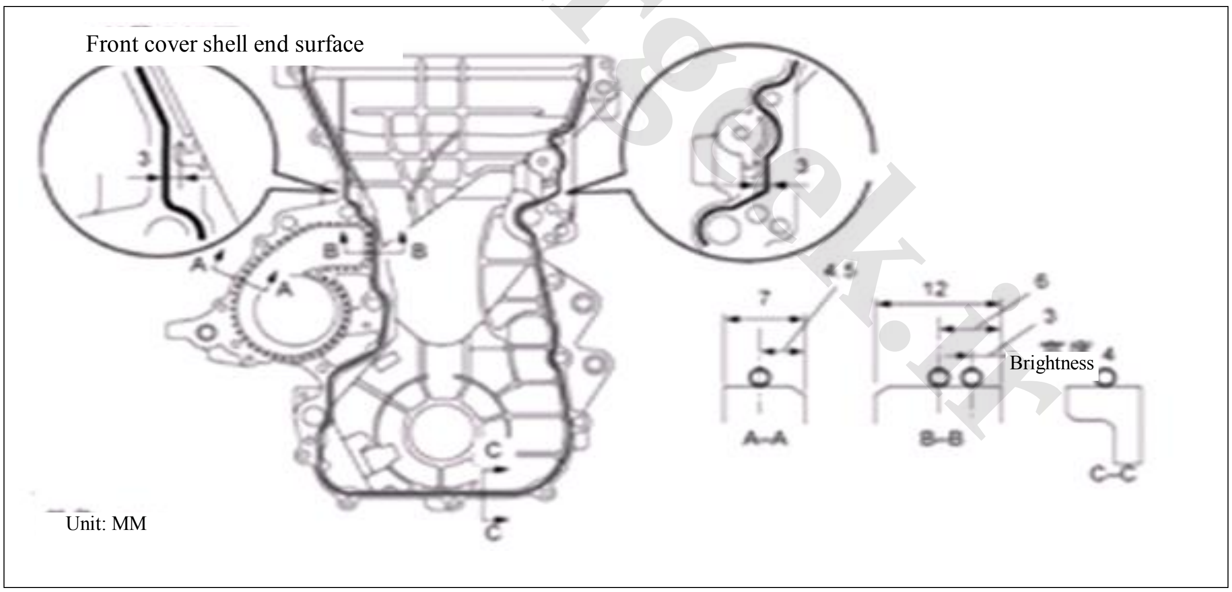


Fig. 1-56-33

Note:

◎ Clean the oil stain on the installation surface.

◎ Complete the installation of the front cover shell in 3 minutes after the sealant is coated.

◎ Do not add engine oil in 2 hours after the front cover shell is installed.

Install the front cover shell assembly with 12 bolts and 1 nut (see Fig. 1-56-34).

Torque: 11N·m (bolt A and nut A) Torque: 23N·m (bolt B and bolt C)

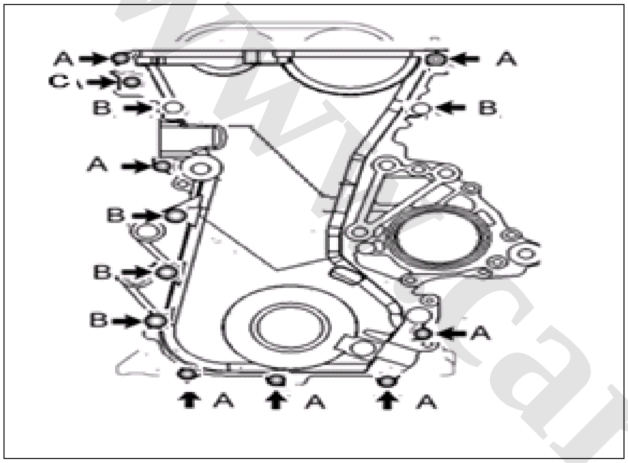


Fig. 1-56-34

Connect the locating pin to the hasp as shown in Fig. 1-56-35.

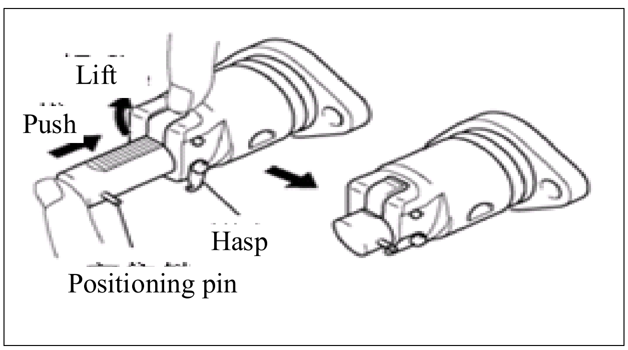


Fig. 1-56-35

Install the tensioner assembly with two nuts (see Fig. 1-56-36).

Torque: 11N·m

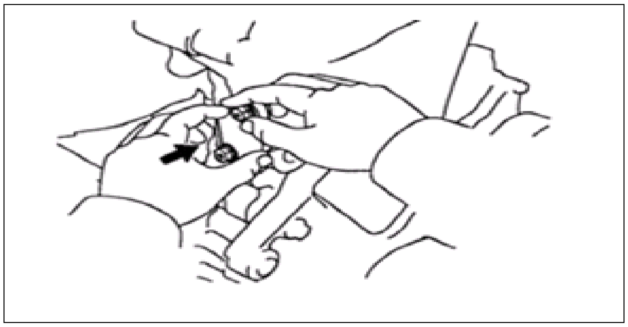


Fig. 1-56-36

Install the crankshaft pulley.

Install the crankshaft pulley with special tools (see Fig. 1-56-37).

Torque: 138N·m

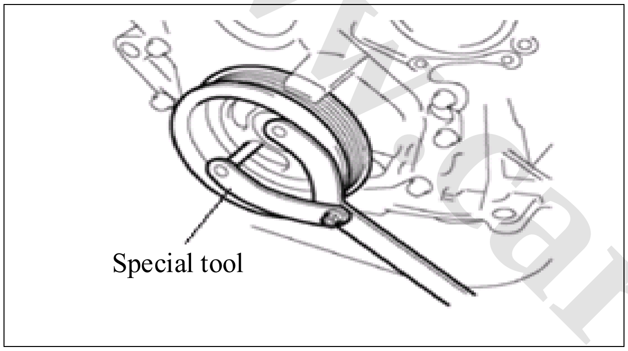


Fig. 1-56-37

Rotate the crankshaft counterclockwise to remove the locating pin from the hasp. (See Fig. 1-56-38)

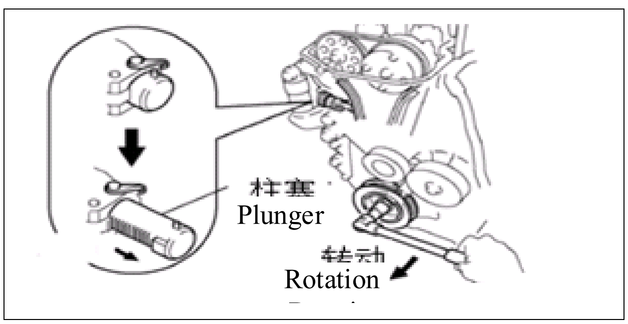


Fig. 1-56-38

Rotate the crankshaft clockwise to check if the slide block has been pushed in the device by the plunger.

Caution: If the plunger cannot spring back, please press the slide block into the chain tensioner by fingers or screwdriver to separate the hasp and the locating pin, as a result, the plunger will spring back.

Install the O-ring seal of the new water pump (see Fig.1-56-39).

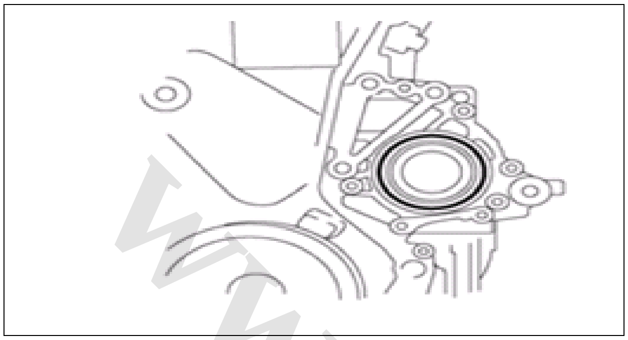


Fig. 1-56-39

Install the water pump by tightening 5 bolts as shown in the Fig. (See Fig. 1-56-40)

Torque: 9N·m (bolt A)

Torque: 11N·m (bolt B)

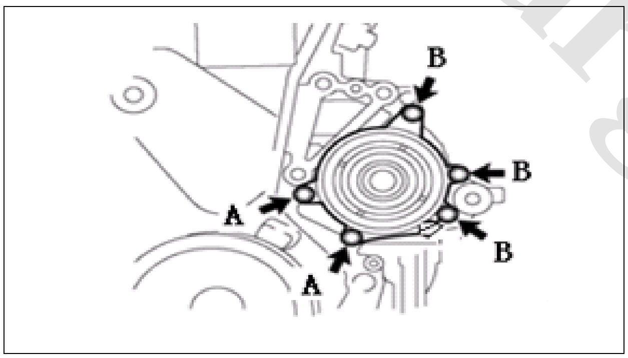


Fig. 1-56-40

Install the right suspension of the engine with 3 bolts (see Fig. 1-56-41).

Torque: 75N·m

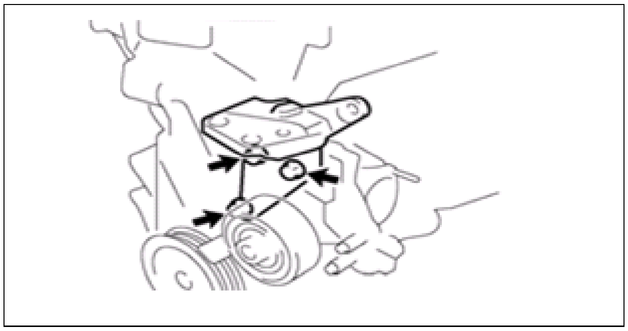


Fig. 1-56-41

Install the cylinder head hood.

Install the timing belt tensioner, the alternator, the A/C compressor and the power steering pump.

Install and adjust the water pump alternator belt.

Add coolant into the cooling system and drain the air in the system.

Install the battery and connect the negative wire.

Confirm that there is no coolant leakage at the hose connection.

Oil Pan and Oil Strainer

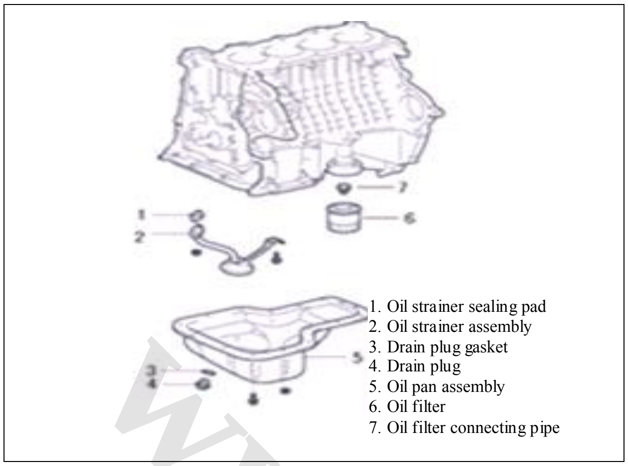


Figure 1-57-1

Dismounting

Remove the drain plug and the washer from the oil pan and drain the engine oil (See Fig. 1-57-2).

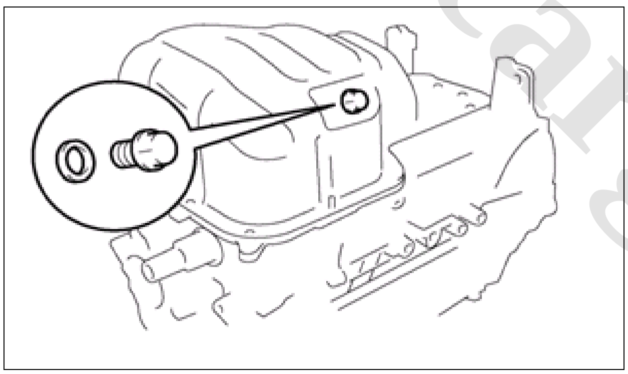


Figure 1-57-2

Remove 14 bolts and 2 nuts (See Fig. 1-57-3).

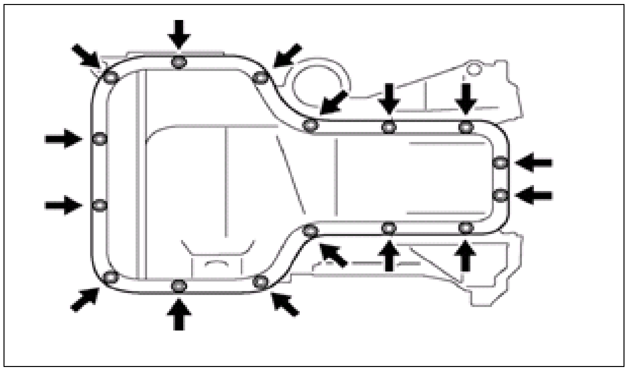


Figure 1-57-3

Insert the blade of the special service tool between the cylinder body and the oil pan (see Fig. 1-57-4),

Cut open the coated sealant, and remove the oil pan.

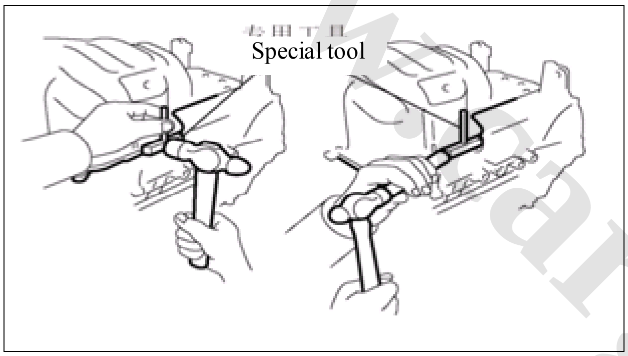


Figure 1-57-4

Note: Do not hurt the joint plane of the cylinder block and the oil pan.

Remove a bolt and 2 nuts (see Fig. 1-57-5).

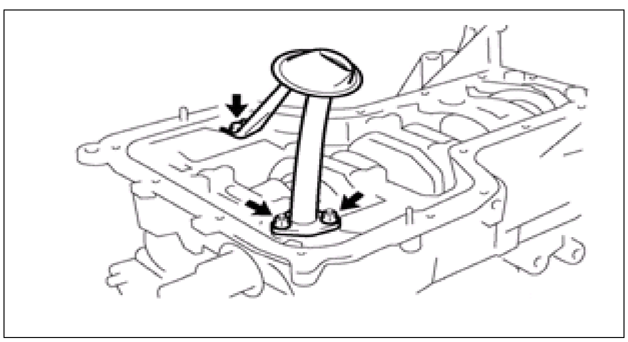


Figure 1-57-5

Remove the oil strainer (see Fig. 1-57-6).

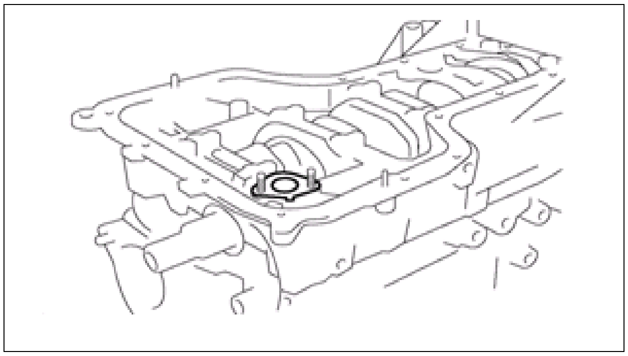


Figure 1-57-6

Remove the oil strainer gasket from the lower part of the engine block (see Fig. 1-57-7).

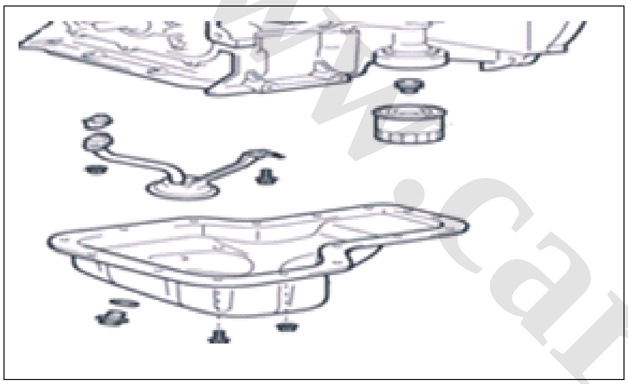


Figure 1-57-7

Clean the joint surface of the oil pan and the cylinder block. Clean the engine oil, old sealant and stain on the fitting surface and clean the inside of the oil pan.

Clean the oil strainer.

Installation

Install oil strainer gaskets on the positions shown in.

Install the oil strainer with 2 nuts and a bolt (see figure 1-57-8).

Torque：11N·m

Clean the fitting surface of the oil pan and the cylinder block.

Remove all the old fillings from the washer and the seal groove with blade and washer cleaner.

Clean all parts thoroughly. Remove all loosened materials.

Coat the sealant as shown in Fig. 1-57-8.

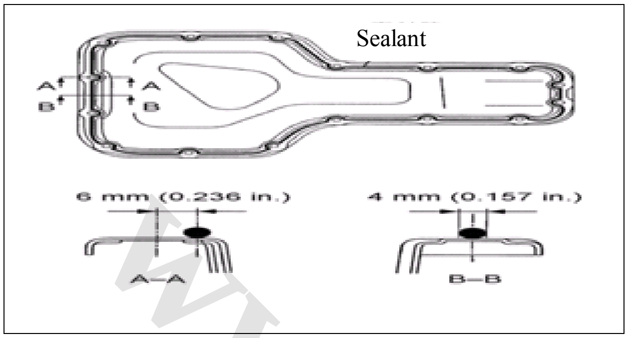


Figure 1-57-8

Note: l Clean the oil stain on the contact surface.

l Complete the installation of the oil pan in 3 minutes after the sealant is coated.

l Do not add engine oil in 2 hours after the oil pan is installed.

Install the oil pan assembly with 14 bolts and 2 nuts.

Torque：11N·m

Install the drain plug and the washer on the oil pan.

Torque：44±2N•m

Note: Add new oil into the engine and confirm that there is no engine oil leakage at each connection.

Oil Pump

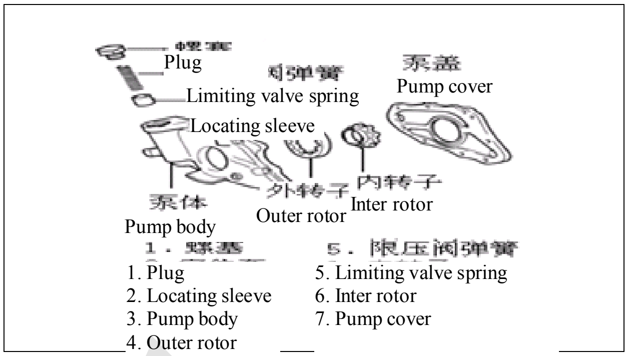


Figure 1-58-1

Dismounting

Disconnect the battery negative wire.

Remove the timing chain as mentioned above.

Take out the crankshaft timing sprocket (see figure 1-58-2).

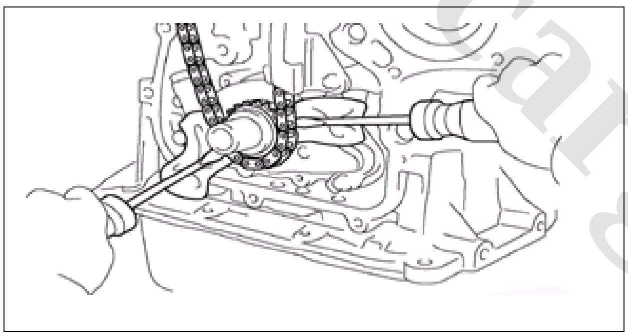


Figure 1-58-2

Remove the oil pan and the oil strainer as mentioned above.

Remove 5 bolts and then remove the oil pump assembly (see figure 1-58-3).

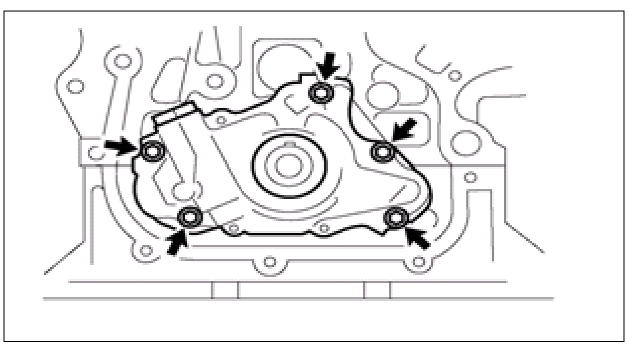


Figure 1-58-3

Dismounting

1. Remove the oil pump pressure-limiting valve plug, spring and locating sleeve (see Figure 1-58-4).

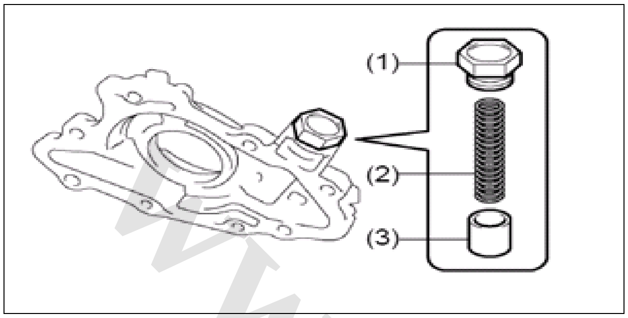


Figure 1-58-4

Remove 3 cross screws and then remove the oil pump cover (see Figure 1-58-5).

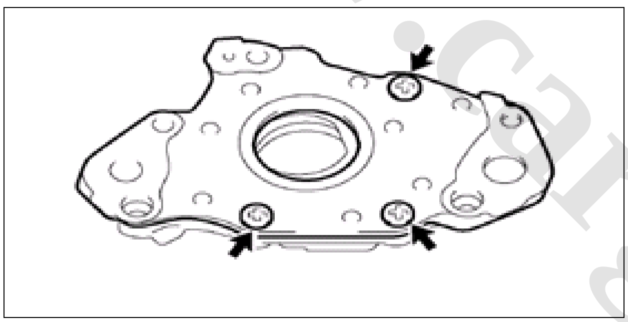


Figure 1-58-5

Check

Check the oil seal lip for defect or damage. Replace it as required.

Coat the oil seal lip with grease prior to installation.

Note: It is required to press the assembly during the installation of the oil seal till the oil seal end surface is in line with the pump cover surface.

Coat the oil pump with engine oil and check if the engine oil can flow into the pump body by its own weight (see Figure 1-58-6).

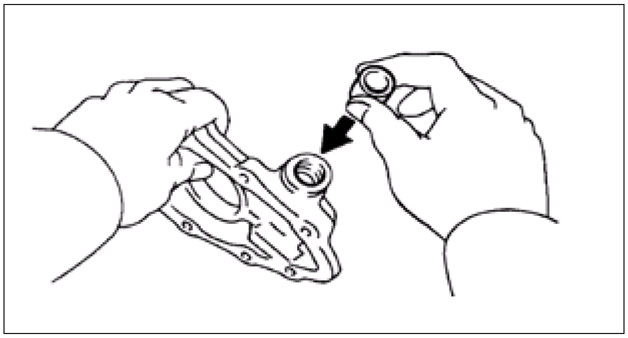


Figure 1-58-6

Check the inner rotor, outer rotor, pump cover and pump body for excessive wear or damage (see Figure 1-58-7).

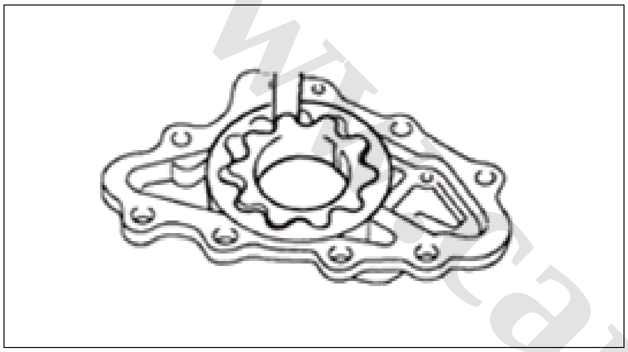


Figure 1-58-7

Measurement

Radial clearance

Check the radial clearance between the outer rotor and the pump body with feeler gauge (see Figure 1-58-8).

If the clearance is higher than the maximum value, the outer rotor and the pump body should be replaced.

Standard radial clearance: 0.260-0.325mm

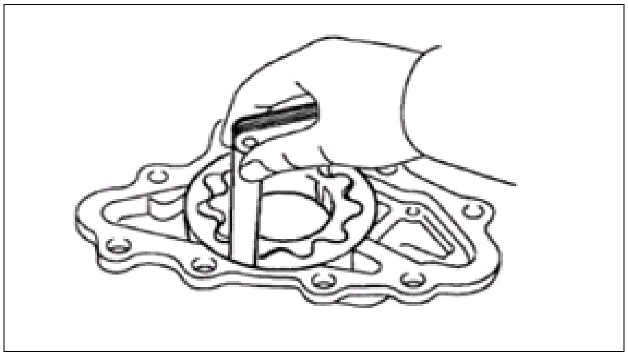


Figure 1-58-8

Backlash

Measure the backlash with ruler and feeler gauge (see Fig. 1-58-9).

Standard backlash: 0.025—0.071mm

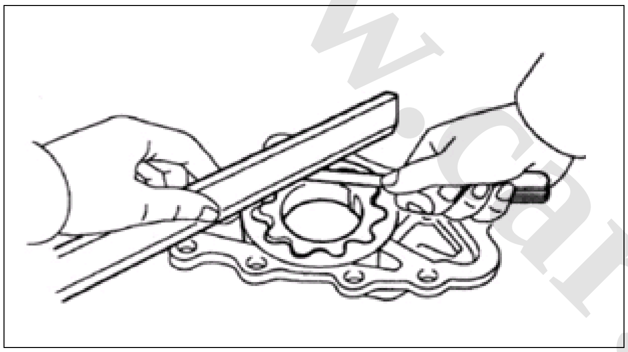


Figure 1-58-9

Assembly

Clean and dry all the parts removed.

Coat the inner rotor, outer rotor, pump body and pump cover with a layer of engine oil.

Install the inner and outer rotors into the pump body as shown in 1-58-10.

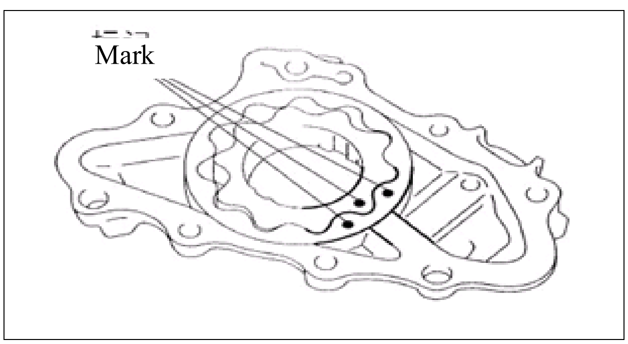


Figure 1-58-10

Install the pump cover with 3 screws (see fig. 1-58-11).

Torque：11N·m

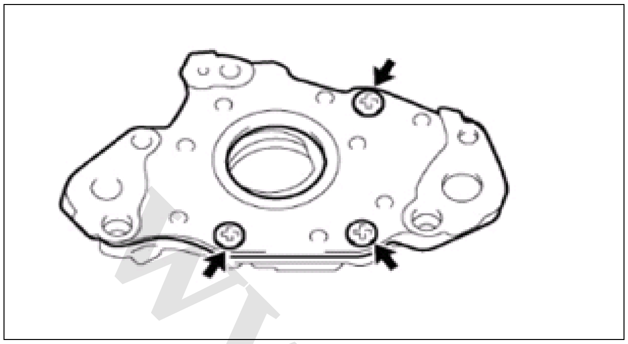


Figure 1-58-11

Check the rotation of gears by hand after the pump cover is installed.

Install the oil pump pressure-limiting valve locating sleeve, spring and plug.

Torque: 37N.m

Installation

Install 2 oil pump locating pins and new gaskets to the cylinder block.

Install the oil pump to the crankshaft with special tools (see Fig. 1-58-12).

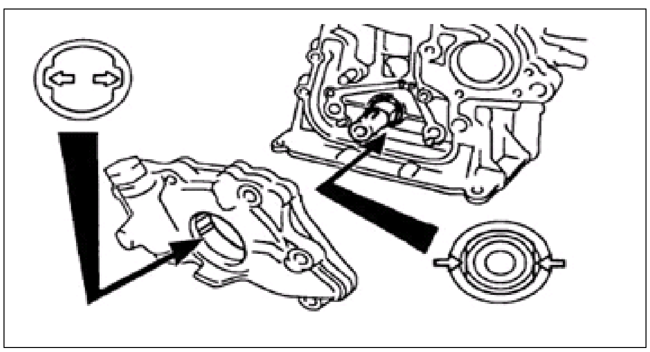


Figure 1-58-12

Install the oil pump with 5 bolts, Torque: 11N•m

Install the oil strainer, oil pan and other parts as mentioned above.

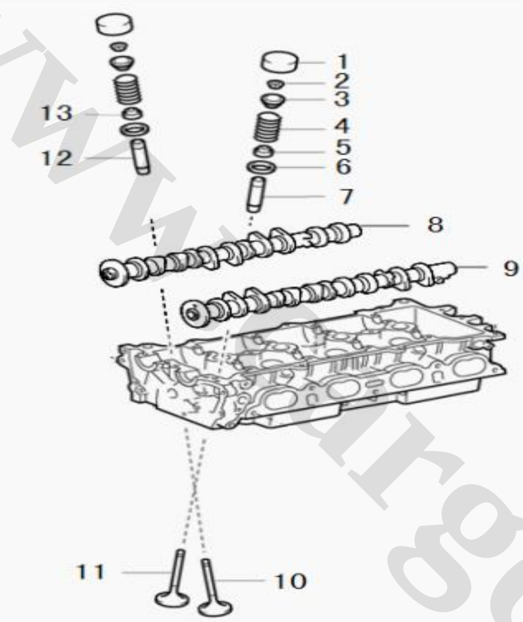
Check and ensure that all parts removed have been reinstalled. Install other parts required.

Add new oil into the engine after the installation is completed.

Add new coolant into the cooling system and drain the air in the system.

Start the engine and check the oil pressure.

Valve, Camshaft and Cylinder Head



1. Tappet
2. Valve cotter
3. Valve spring retainer
4. Valve spring
5. Intake valve oil seal
6. Intake valve spring base
7. Intake valve guide
8. Exhaust camshaft
9. Intake camshaft
10. Exhaust valve
11. Intake valve
12. Exhaust valve guide
13. Exhaust valve oil seal

Figure 1-59-1

Dismounting

Disconnect the lead from the battery and remove the battery.

Evacuate the cooling system.

Remove the intake pipe.

Remove the harness.

Remove the following hoses.

◎ Disconnect the vacuum booster hose from the intake manifold.

◎ Disconnect the PCV valve hose from the intake manifold and the throttle.

◎ Disconnect the canister solenoid valve hose from the intake manifold.

◎ Disconnect the long ventilation hose from the cylinder head cover.

Remove the intake and exhaust manifolds as above mentioned.

Remove the ignition coil and the cylinder head cover as above mentioned.

Remove the timing part as above mentioned.

Screw off 19 bolts one by one as per the figure and take down 9 main bearing covers. (See Figure 1-59-2)

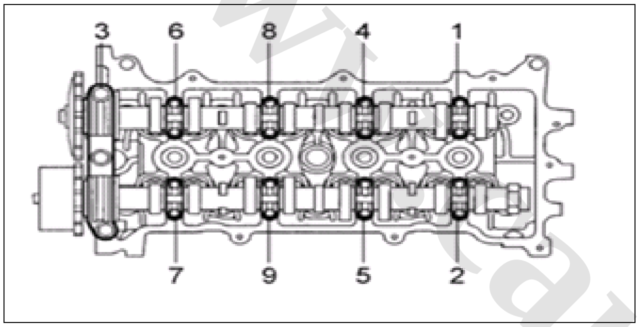


Figure 1-59-2

Use a stock vice to clip the exhaust camshaft and remove the bolt and the exhaust timing chain wheel. (See Figure 1-59-3)

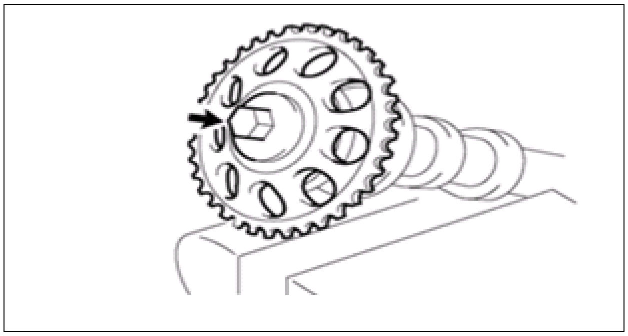


Figure 1-59-3

Use a stock vice to clip the intake camshaft and remove the bolt and intake timing chain wheel. (See Figure 1-59-4)

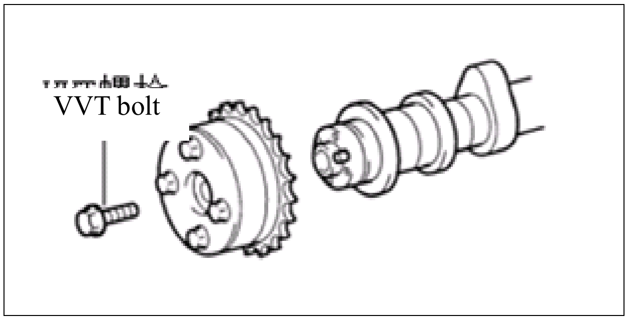


Figure 1-59-4

As the order shown in the figure, screw off the cylinder head bolt and remove them. （See Figure 1-59-5）

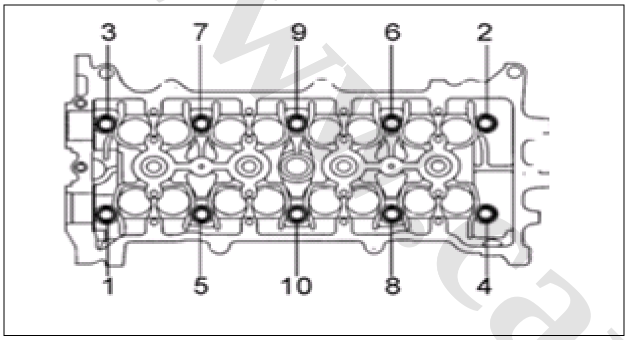


Figure 1-59-5

Check if there is any components require moving or removing near the cylinder head; if necessary, move or remove those things.

Remove the cylinder head

Use internal hexagonal wrench 10 to remove the waterway blockage of the cylinder head and its washer. (See Figure 1-59-6)

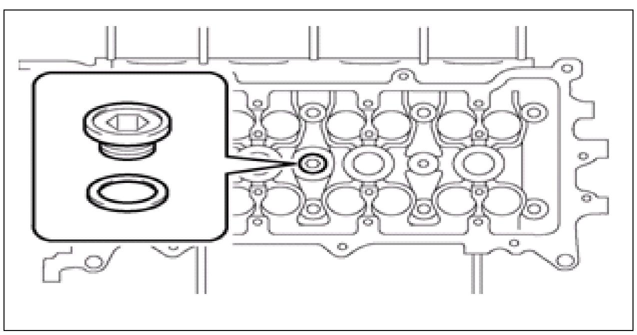


Figure 1-59-6

Take out the valve tappet from the cylinder head. (See Figure 1-59-7)

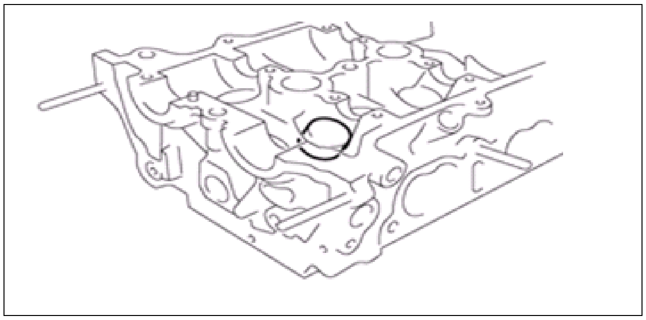


Figure 1-59-7

Place the cylinder head assembly on the wood board.

Use special assembly and disassembly tools of the valve to press down the valve spring and take out the valve keeper. (See Figure 1-59-8)

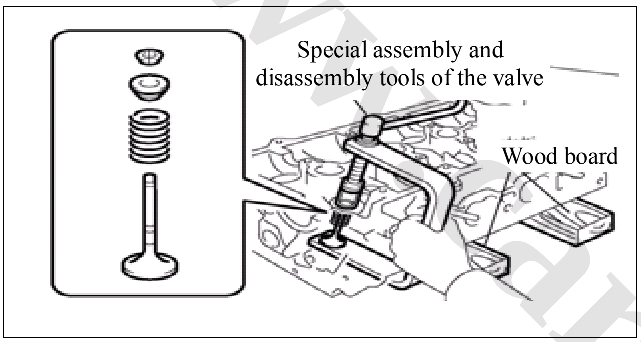


Figure 1-59-8

Take out the valve spring retainer, the valve spring and the valve orderly.

Remove the valve oil seal with a clamp (See Figure 1-59-9).

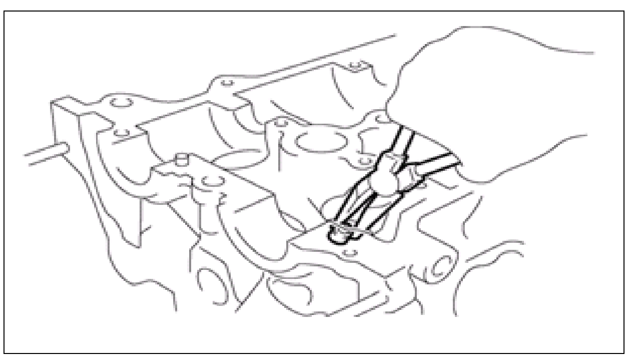


Figure 1-59-9

Note:

◎ Once the oil seal was removed; it should not be used again. While assembly, new oil seal must be used.

Use a compressed air gun and magnetic needle to take out the valve spring base. (See Figure 1-59-10)

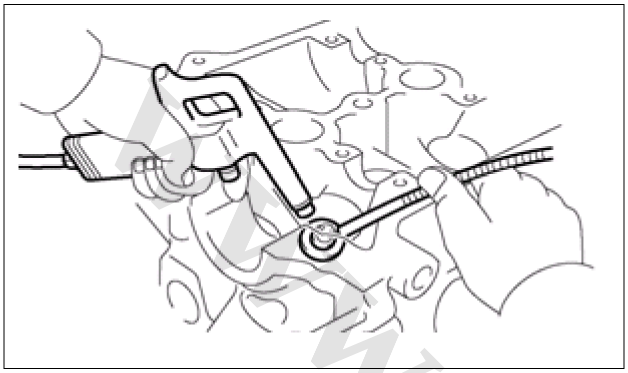


Figure 1-59-10

Use a thread sleeve wrench to remove 8 double end stud bolt. (See Figure 1-59-11)

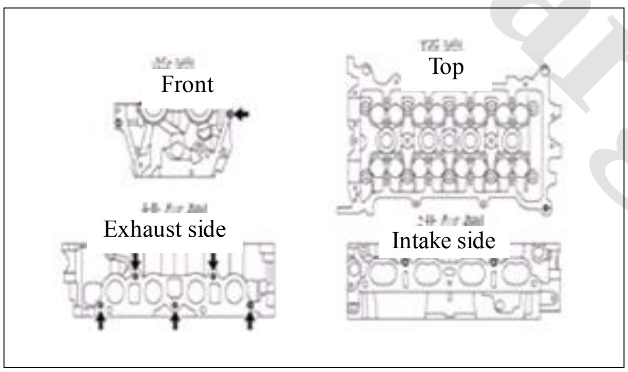


Figure 1-59-11

Check

Cylinder head

Clean the carbon deposit in the combustion chamber.

Note:

◎ Never scrape the carbon deposit with any sharp tool. Pay attention that never scratch or damage the metal surface while cleaning the carbon deposit. It's the same for the valve and the valve seat.

Cylinder head flatness

Use a precise straight edge and a feeler gauge to

check the flatness of the cylinder joint surface and the exhaust side.

Maximum flatness:

Cylinder joint surface: 0.05mm

Intake side: 0.10mm

Exhaust side: 0.10mm

If the flatness exceeds the maximum, replace the cylinder head. （See Figure 1-59-12）

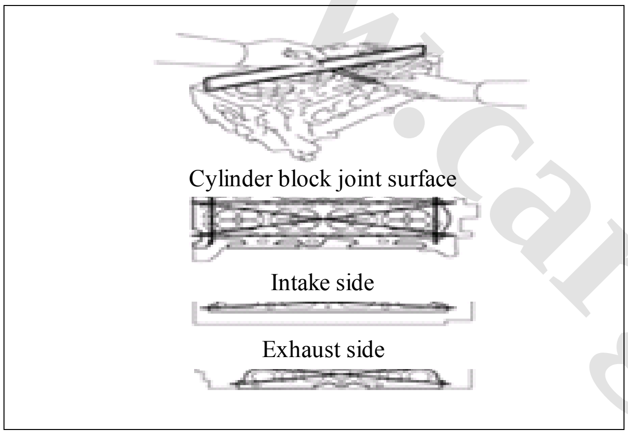


Figure 1-59-12

Check crack:

Use color paint to check the combustion chamber, intake and exhaust seat ring and the cylinder head surface for crack. (See Figure 1-59-13)

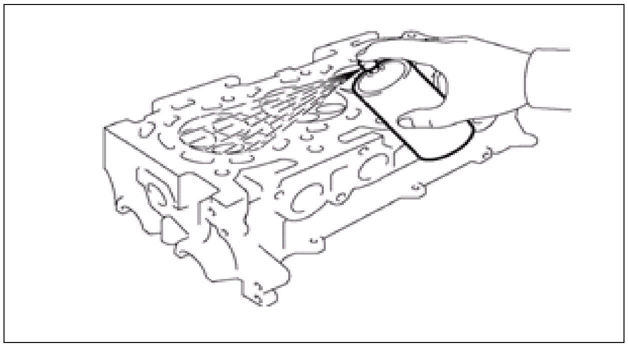


Figure 1-59-13

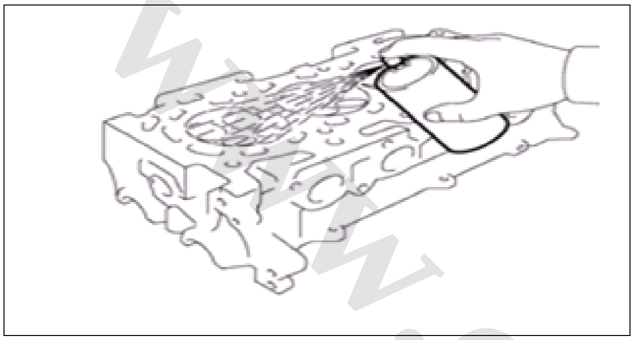


Figure 1-59-13

Width of valve-seat contact（See Figure 1-59-14）:

Usually mark the contact trace on the valve. For example, Apply a layer of mark film evenly to the valve seat and rotate the valve seat and the valve head to check them. Valve grinding tool must be used (for valve grinding).

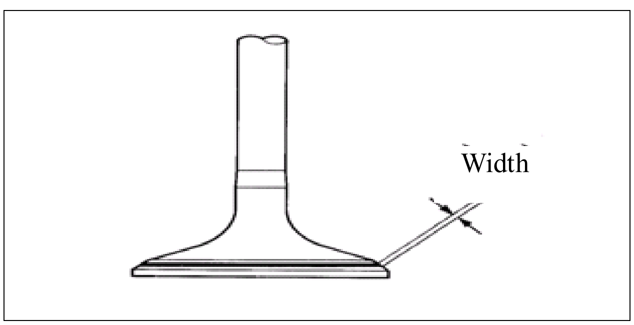
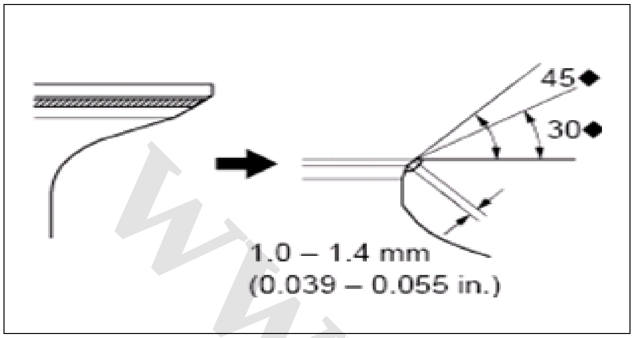


Figure 1-59-14

The mark shape on the valve mating surface. It must be continuous ring mark and its width must be in the specified range (See Figure 1-59-15).

Standard width of the mark on the valve surface	Intake	1.0-1.4mm
	Exhaust	



Maintenance of the valve seat:

If the mark generated by the valve seat contacting the valve is uneven or its width exceeds the specified range, regrind, or cut or accurately grind and polish it.

Intake valve seat: repair it twice with a valve seat reamer. Two reamers must be used for repairing: one for 15° and one for 45°. The required valve seat width must be obtained after the second repairing.

（See Figure 1-59-16）.

Width of the intake valve seat: 1.0-1.4mm

Exhaust valve seat: The recovery procedure is the same as that of the exhaust valve.

Width of the exhaust valve seat: 1.0-1.4mm

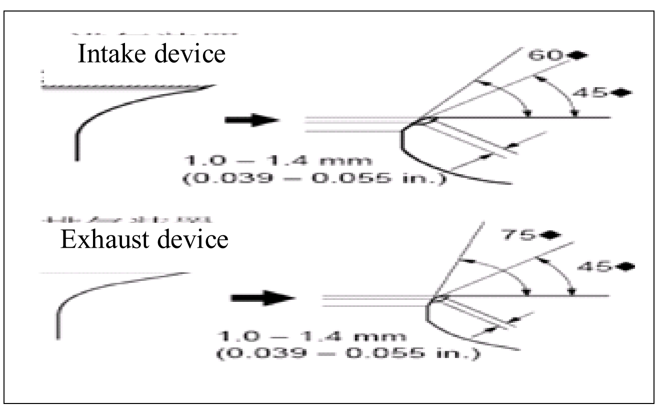


Figure 1-59-16

Valve grinding: apply the primary grinding paste to the end surface to grind it and use the fine grinding paste to grind it. Use the valve grinding tool to grind it as per the normal methods.

Check the Camshaft

Place the camshaft on the V-plate to check its radius run-out.

Measure the circumference radius run-out with a micrometer at the middle shaft neck. (See Fig. 1-59-17)

Maximum circumference radius run-out: 0.03mm

If the circumference radius run-out exceeds the maximum, replace the camshaft.

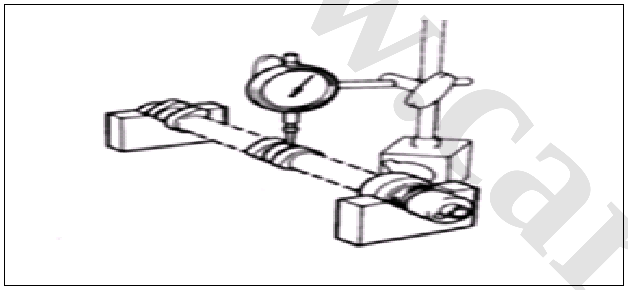


Figure 1-59-17

Check the cam angle

Use a spiral micrometer to measure the height of the cam angle.

Standard height of the cam angle:

Intake: 44.168～44.268mm

Exhaust: 43.705～43.805mm

If the height of the cam angle fails to meet the regulation, replace the camshaft. (See Fig. 1-59-18)

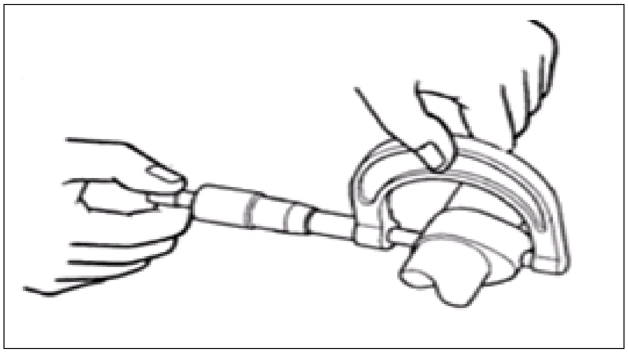


Figure 1-59-18

Check the camshaft shaft neck

Check the shaft neck and bearing cover of the camshaft for iron mold, slide mark, abrasion or damage. If any abnormal condition is found, replace the camshaft or cylinder head or camshaft cover.

Use a spiral micrometer to measure the diameter of the shaft. (See Fig. 1-59-19):

No.1 exhaust: 24.949-24.965mm

Other exhaust: 22.949-22.965mm

If the diameter of the shaft neck fails to meet the regulation, check the clearance of the oil film, check the oil film clearance.

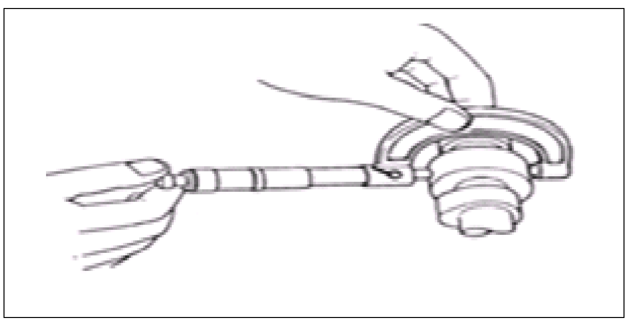


Figure 1-59-19

Camshaft axial clearance

Install intake and exhaust camshafts.

Move the camshaft back and forth and check the axial clearance of the camshaft with a micrometer. （See Figure 1-59-20）

Standard axial clearance: 0.040-0.095mm

Maximum axial clearance: 0.0110mm

If the axial clearance exceeds the maximum, replace the cylinder head. If there is scratch on the camshaft surface, replace the camshaft.

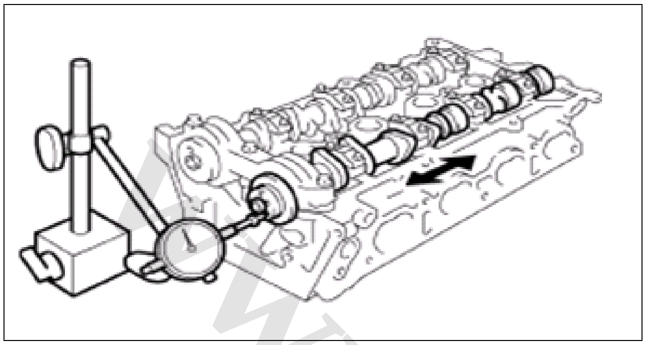


Figure 1-59-20

Check the valve tappet

Use a micrometer to measure the diameter of the valve tappet. (See Figure 1-58-21)

The diameter of the valve tappet is 30.966-30.976 mm.

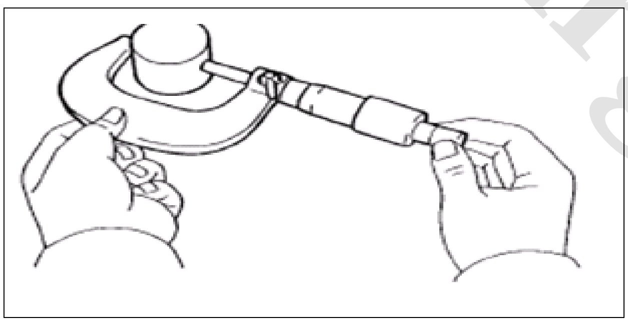


Figure 1-59-21

Check the oil clearance of the valve tappet

Use an inner diameter dialgauge to measure the diameter of the valve tappet hole on the cylinder head. (See Figure 1-59-22)

Diameter of the valve tappet hole: 31.000-31.025mm

The diameter of the valve tappet hole deducts the diameter of the valve tappet to get the oil clearance.

Standard oil clearance: 0.024-0.059mm

Maximum oil clearance: 0.059mm

If the oil clearance exceeds the maximum, replace the valve tappet.

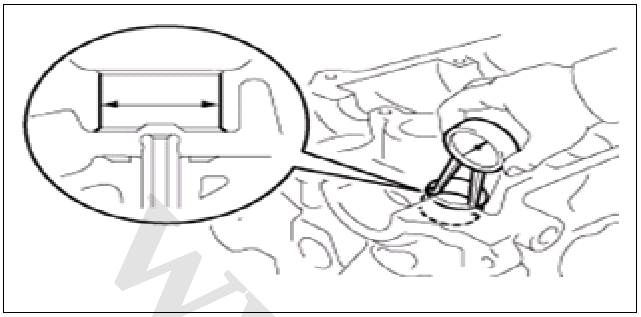


Figure 1-59-22

Check the valve spring

Use a dial caliper to measure the length of the valve spring in the free state. (See Figure 1-59-23)

Free length: 43.40mm

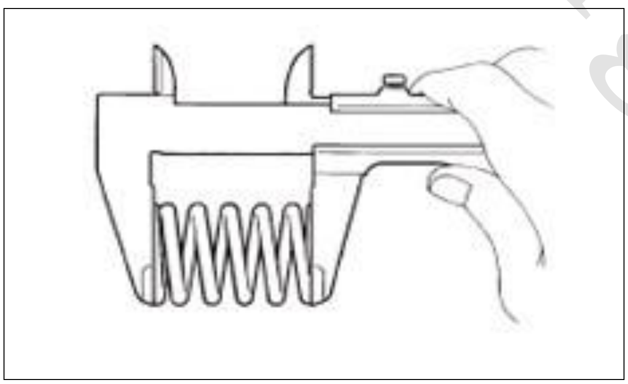


Figure 1-59-23

Use a spring dynamometer to measure the elastic force of the spring in the standard compressed length. (See Figure 1-59-24)

Elastic force of the installation: 153-169N（33.88mm）

Maximum working elastic force: 335.3-370.7N（24.1mm）

If the elastic force of the installation is beyond the specified range, the spring must be replaced.

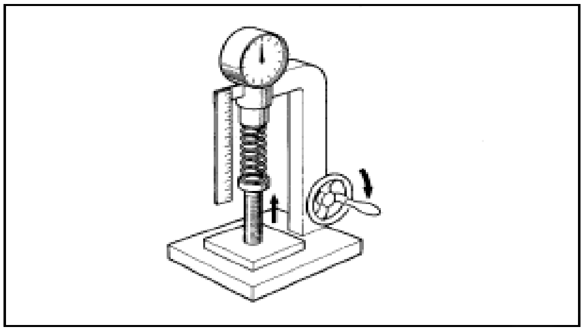


Figure 1-59-24

Valve spring verticality

Use a straight edge and a flat to check the verticality of each spring as per the gap between the end of the valve spring and the straight edge.

(See Figure 1-59-25).

If the gap is beyond the maximum below, the valve spring must be replaced.

Maximum deviation value: 1.6mm

Maximum deviation angle: 2°

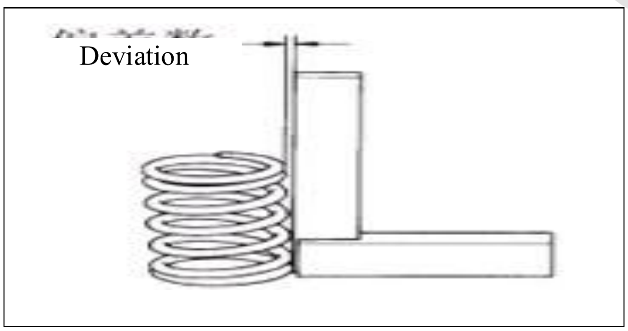


Figure 1-59-25

Check the valve:

Clean all the carbon deposit on the valve. And check each working surface of the valve and the valve stem for abrasion, burning loss or deformation; if necessary, replace the valve.   Measure the thickness of the valve edge. (See Figure 1-59-26)

Standard thickness: 1.0mm

Minimum thickness: 0.7mm

If the measured value is lower than the minimum thickness, replace the valve.

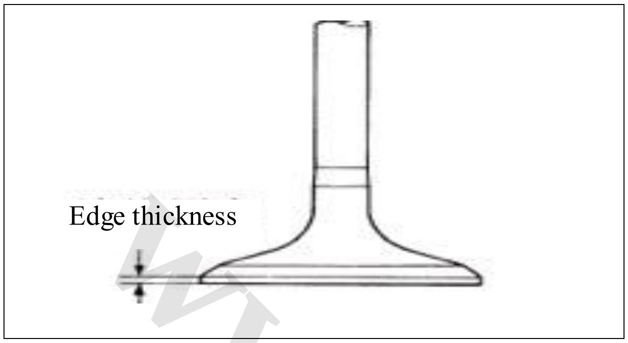


Figure 1-59-26

Use a height gauge to measure the total length of the valve. (See Figure 1-59-27)

Standard total length:

Intake valve: 88.65 mm Exhaust valve: 88.69 mm

Minimum total length:

Intake valve: 88.35 mm Exhaust valve: 88.39 mm

If the total length of the valve is lower than the minimum, replace the valve.

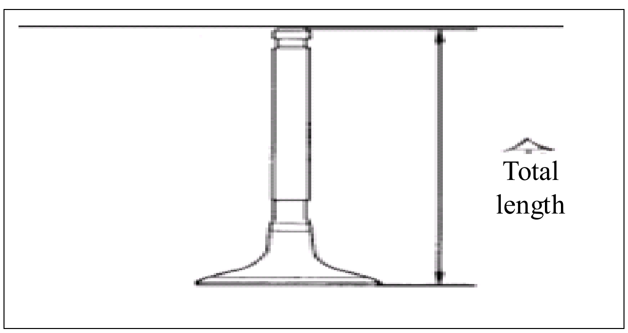


Figure 1-59-27

Measure the diameter of the valve stem with a micrometer. (See Figure 1-59-28)

Diameter of the stem:

Intake valve: 5.470-5.485 mm

Exhaust valve: 5.465-5.480 mm

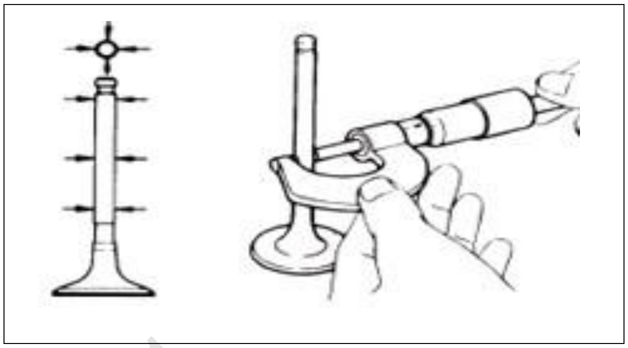


Figure 1-59-28

Check the oil clearance of the valve guide:

a) Use an inner diameter dial indicator to check the inner diameter of the valve guide. (See Figure 1-59-29)

Inner diameter of the valve guide: 5.510-5.530mm

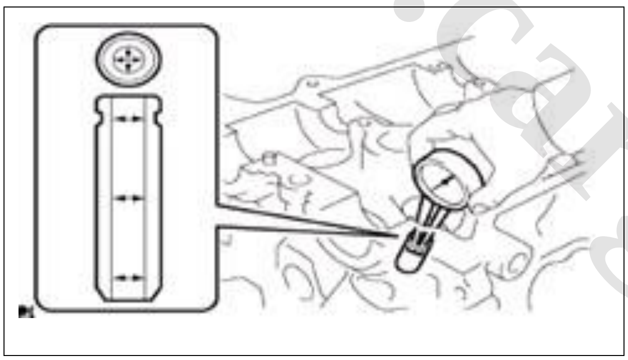


Figure 1-59-29

b) The inner diameter of the valve guide deducts the diameter of the valve stem to get the oil clearance of the valve guide.

Standard oil clearance:

Intake valve: 0.025-0.060mm

Exhaust valve: 0.030-0.065mm

Maximum oil clearance:

Intake valve: 0.08mm

Exhaust valve: 0.10mm

If the oil clearance exceeds the maximum, replace the valve and the valve guide.

Valve guide:

Heat the cylinder head to 80-100°C. (See Fig. 1-59-30)

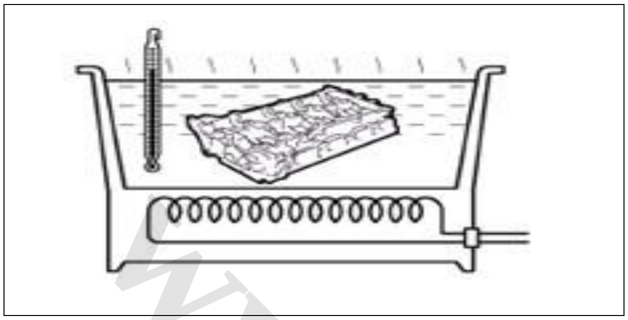


Figure 1-59-30

Place the cylinder head on the wood board.

3) Use a special tool to remove the valve guide from the cylinder head. (See Fig. 1-59-31)

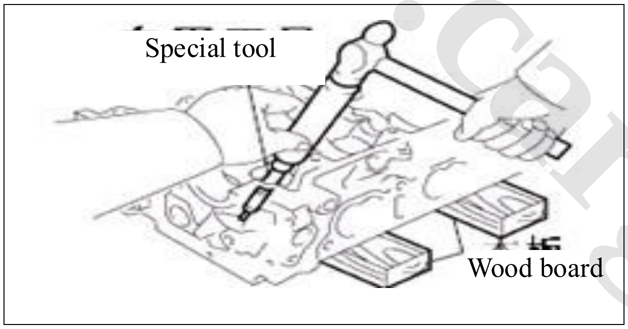


Figure 1-59-31

Note:

The valve guide can not be used again once it's dismantled.

Install a new valve guide (a larger one).

Use a special tool to measure the inner diameter of the valve guide hole. (See Figure 1-59-32)

Inner diameter: 10.285-10.306mm

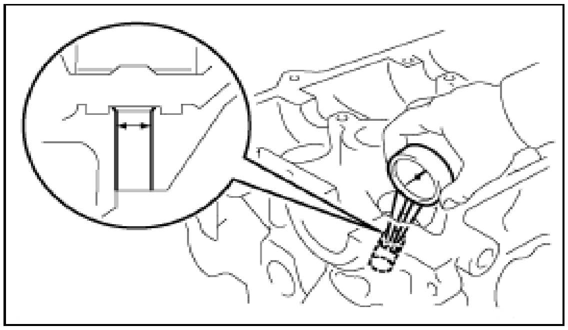


Figure 1-59-32

If the inner diameter of the guide hole exceeds the maximum, process the guide hole of the cylinder head to 10.335-10.350mm for installing a larger valve guide.

Hint: (See Figure 1-59-33)

Figure 1-59-33

Diameter of the valve guide	Inner diameter of the valve guide (mm)
STD	10.285-10.306
O/S0.05	10.335-10.356

Assembly

Heat the cylinder head to 80-100°C.

Place the cylinder head on the wood board.

Ream a guide hole with a special tool (11mm reamer) to remove the burr before installing the valve guide on the cylinder head.

Press the new valve guide into the valve guide hole to the specified pressing depth with a special tool till the special tool contacts the cylinder head.

Specified pressing depth: 8.7-9.1mm

Use a special tool (5.5mm reamer) to ream the inner hole of the valve guide to the standard oil clearance. (See Figure 1-59-34)

Standard oil clearance:

Intake valve: 0.025-0.060mm

Exhaust valve: 0.030-0.065mm

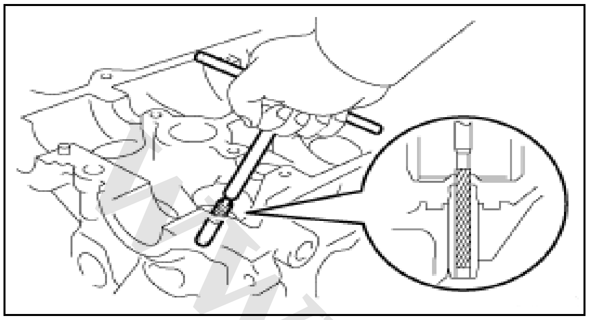


Figure 1-59-34

Fill the oil into the oil seal and the main shaft of the special tool, install the oil seal on the main shaft, and use a special tool to install the oil seal on the valve guide. (See Figure 1-59-35)

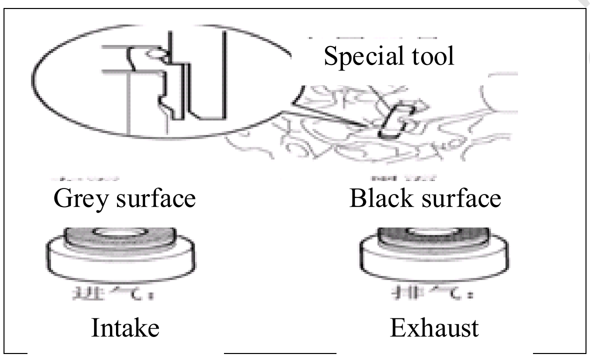


Figure 1-59-35

Note:

◎ The oil seal of the intake valve is grey and that of the exhaust valve is black.

◎ The oil seal can not be used again once it is removed. A new oil seal must be used for installation.

◎ In the installation, never lightly knock or beat the special tool with a hammer or other things. Only push and press the special seal to install the oil seal on the guide. To lightly knock or beat the special tool may cause oil seal damage.

Install the valve spring on the cylinder head. (See Figure 1-59-36)

Figure 1-59-36

Install the valve

Place the cylinder head on the wood board.

Install the valve, the valve spring and the valve spring retainer.

Use a special tool to press the valve spring and press the two valve keepers into the valve lock clip groove.

Use 5# sharp puncher to slightly knock the end surface of the valve stem to reliably install the valve keeper. (See Fig. 1-59-37)

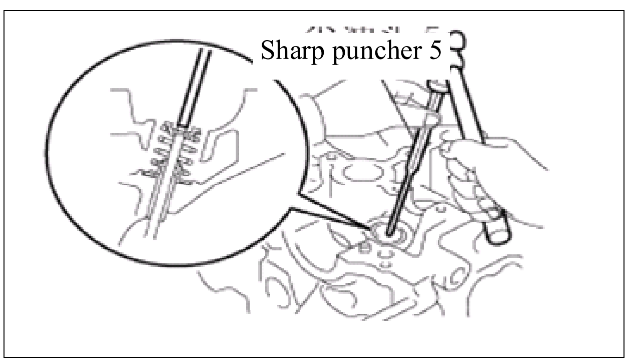


Figure 1-59-37

Note:

◎ Never damage the end surface of the valve stem.

Install the valve tappet

Apply a little engine lubricant to the surface of the valve tappet.

Install the valve tappet on the cylinder head.

Install the waterway blockage of the cylinder head.

Use 10# internal hexagonal sleeve to install the waterway blockage of the cylinder head.

Torque: 44N.m

Place the new gasket on the cylinder block. (See Fig. 1-59-38)

Note:

◎ The surface with marker (letter) should be up in the installation.

Install the cylinder head assembly. (See Fig. 1-59-39)

Place the cylinder head on the cylinder head washer.

Apply a thin layer of oil to the mounting bolt thread of the cylinder head.

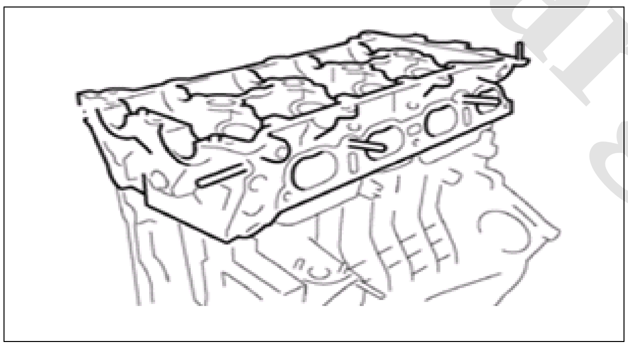


Figure 1-59-39

Screw down 10 cylinder head bolts evenly as per the order shown in the figure. (See Fig. 1-59-40)

Torque:

The first time 60 N•m

The second time 90 N•m

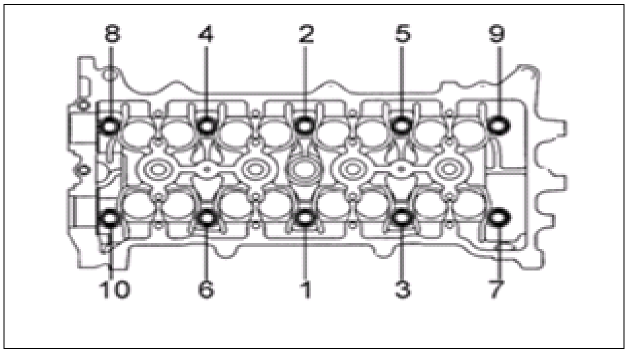


Figure 1-59-40

Install the intake camshaft timing sprocket

Install the camshaft positioning pin to the intake timing sprocket groove.

Install the intake camshaft timing sprocket bolt.

Torque: 60N•m

Note: Apply a thin layer of oil to the thread while installing the intake timing sprocket assembly. (See Fig.1-59-41)

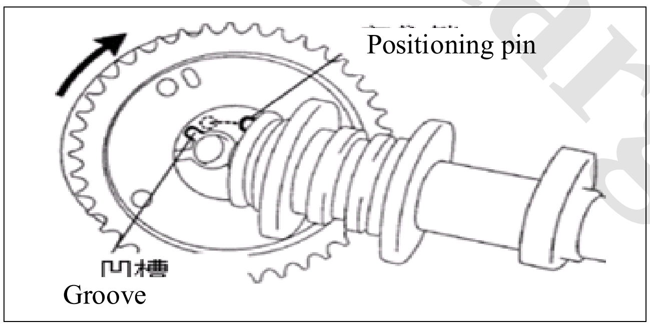


Figure 1-59-41

Use a stock vice to clip the intake camshaft and install the bolt and exhaust timing sprocket (See Fig 1-59-42).

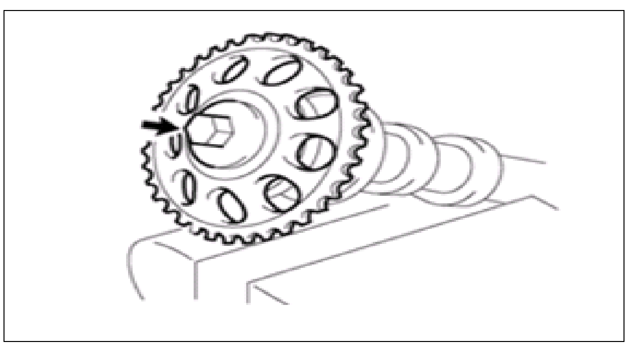


Figure 1-59-42

Install the camshaft

Place the intake camshaft and exhaust camshaft respectively on the cylinder head and then apply a thin layer of oil to the shaft neck of the camshaft.

See fig. 1-59-43 for the direction of the intake camshaft and the exhaust camshaft angle of the 1st cylinder.

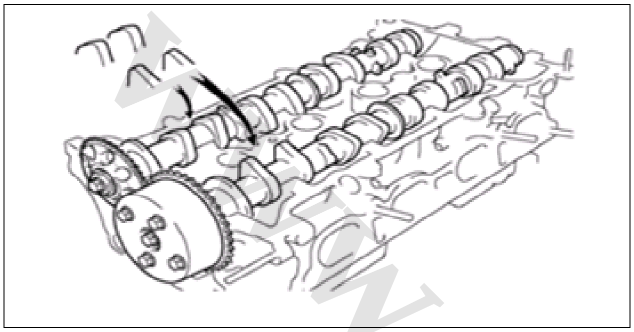


Figure 1-59-43

Check the forward mark and the order of the camshaft bearing cover for correctness. Screw down the bearing cover bolt in the order shown in fig. 1-59-44.

Torque：13N·m

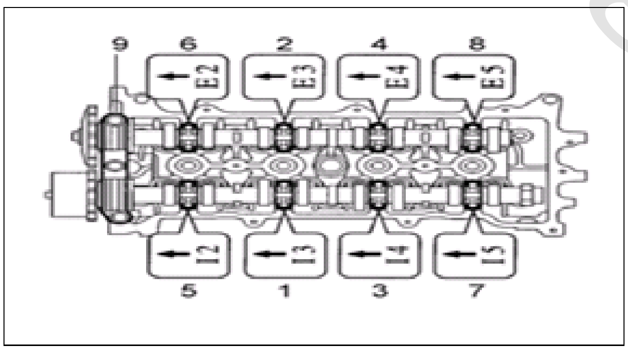


Figure 1-59-44

Install the 3 bolts of #1 camshaft bearing cover.

Torque：23N·m

Adjust the clearance between the intake valve and the exhaust valve as above mentioned.

Install the timing part as above mentioned.

Install the cylinder head cover assembly as above mentioned.

Install the intake manifold and the exhaust manifold as above mentioned.

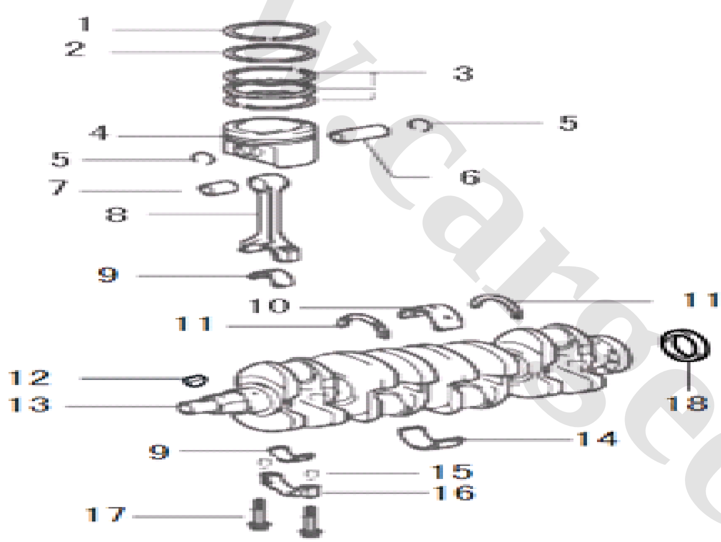
Adjust the water pump alternator belt tension.

Check and confirm if the removed parts have been moved back. Reinstall all the components failing to be installed.

Fill up the coolant again to exhaust in the system.

Install the battery and connect the lead of the battery.

Piston, Piston ring, Connecting Rod and Crankshaft



1. Piston ring I
2. Piston ring Ⅱ
3. Combined oil ring
4. Piston
5. Piston pin snap ring
6. Piston pin
7. Connecting rod small end bushing
8. Connecting rod body
9. Connecting rod bearing bushing
10 .Crankshaft upper bearing bushing
11. Crankshaft thrust washer
12 .Half-round key
13. Crankshaft
14. Crankshaft lower bearing bushing
15. Connecting rod cap positioning pin
16. Connecting rod cap
17. Connecting rod bolt
18. Crankshaft rear oil seal

Fig. 160-1 Piston, piston ring, connecting rod and crankshaft assembly

Removal and check

Remove the cylinder head from the crankcase body as the above mentioned.

Discharge the engine oil.

Dismantle the oil pan and the oil strainer as the above mentioned.

Mark the cylinder number on all pistons with quick-drying paint.

Dismantle the drain bolt and lean the cylinder block to empty it. (See Fig. 1-60-2)

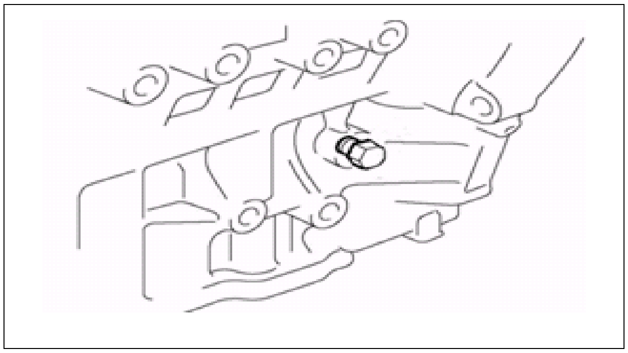


Figure 1-60-2

Move the connecting rod back and forth and measure its axial clearance with a micrometer. (See Figure 1-60-3)

Standard axial clearance: 0.16mm～0.34mm

Maximum axial clearance: 0.34mm

If the axial clearance exceeds the maximum, replace the connecting rod component.

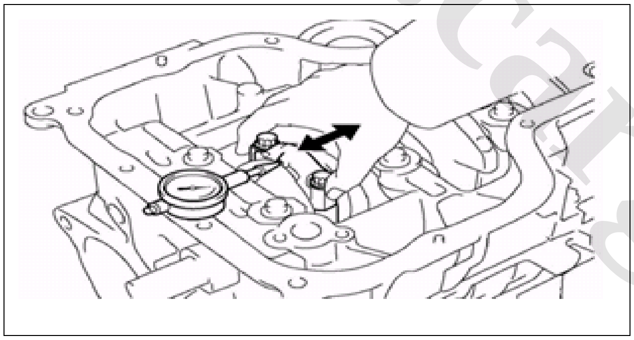


Figure 1-60-3

Check the match mark of the connecting rod and the cover to ensure the correct re-assembly. (See Figure 1-60-4)

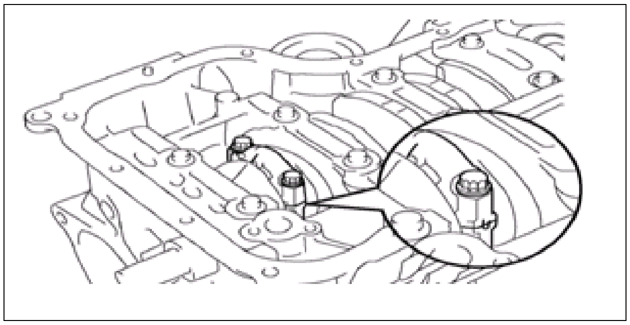


Figure 1-60-4

Remove the connecting rod cover bolt. (See Figure 1-60-5).

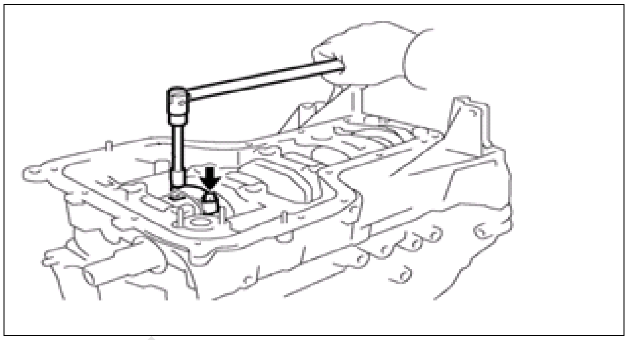


Figure 1-60-5

Clean the connecting rod cap and the connecting rod bearing bushing.

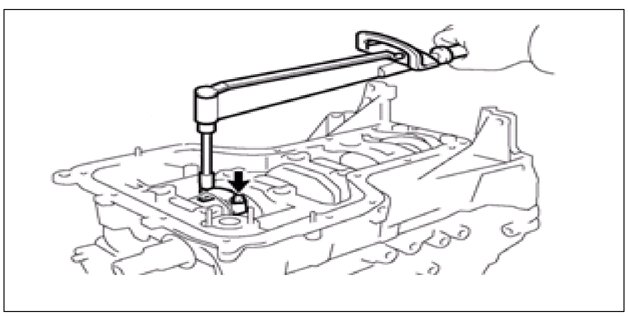
Check the connecting rod cap and the connecting rod bushing for pockmark and scratch. If the connecting rod cap and the connecting rod bushing are damaged, replace the connecting rod bearing bushing. If necessary, polish or replace the crankshaft.

Check the oil film clearance

Insert a plastic oil clearance gauge into a crankshaft connecting rod neck.

Install the connecting rod cap and screw down the connecting rod bolt with a torque wrench. (See Figure 1-60-6)

Torque：50N·m



See Fig. 1-60-6

Check the match mark of the connecting rod and the connecting rod cap. (See Figure 1-60-7)

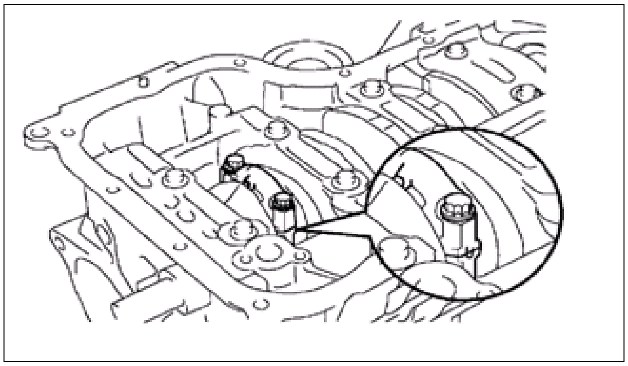


Figure 1-60-7

Dismantle the connecting rod cap.

Measure the oil clearance of the plastic at the widest point.

Standard oil film clearance: 0.030mm～0.054mm

Maximum oil film clearance: 0.054mm

If the oil film clearance exceeds the maximum, replace the bearing bushing.

If necessary, polish or replace the crankshaft. (See Fig. 1-60-8)

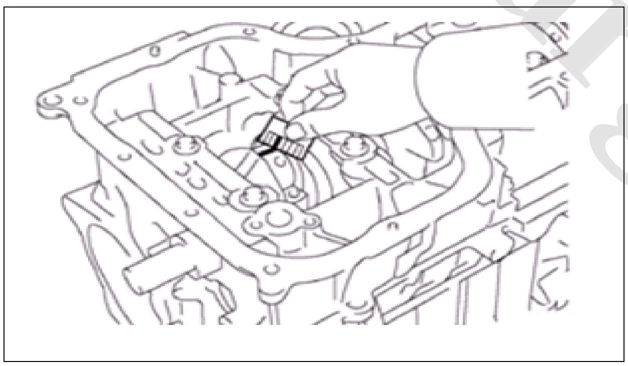


Figure 1-60-8

Tip: If the bushing number is not clear or re-matching the bushing is required after replacing a new crankshaft and a connecting rod, the numbers on the connecting rod and the crankshaft together add and deduct one to match the bushing. This will guarantee to choose the correct bearing bushing. （See Fig. 1-60-9a/Fig. 1-60-9b）

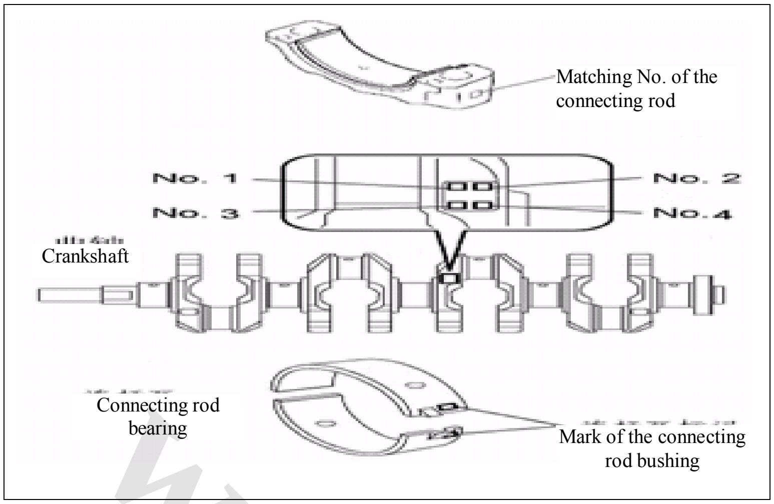


Figure 1-60-9a

Figure 1-60-9b

	Mark No.					
Connecting rod body	1		2°		3	
Crankshaft	1	2°	1	2°	1	2°
Matched bearing bushing	1	2°	2°	3	3	4

Central wall thickness of the standard size bearing bushing (See Fig. 1-60-10):

Mark No. “1”:

1.481mm～1.485mm

Mark No. “2”:

1.485mm～1.489mm

Mark No. “3”:

1.489mm～1.493mm

Mark No. “4”:

1.493mm～1.497mm

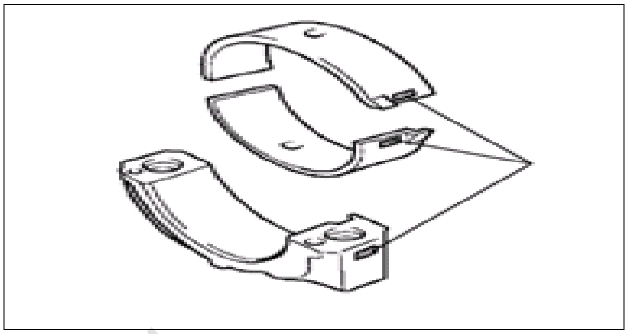


Figure 1-60-10

Take out all the plastic oil clearance gauges.

Remove the piston and the connecting rod assembly. .

Clean all the carbon deposits on the top of the cylinder with a cylinder port reamer. (See Figure 1-60-11)

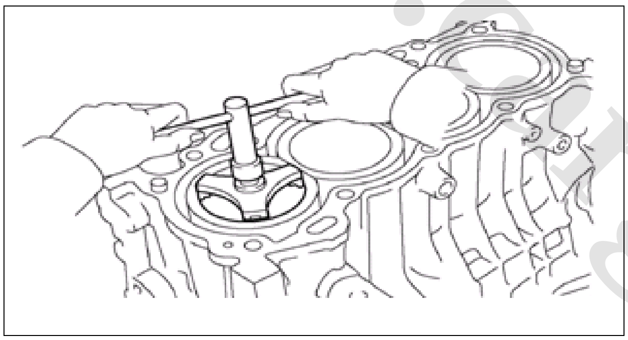


Figure 1-60-11

Push the piston, the connecting rod assembly and the upper bearing bushing through the top of the cylinder block. (See Figure 1-60-12)

Note:

◎ Place the bearing bushing, the connecting rod and the connecting rod cap together.

◎ Place the piston and the connecting rod assembly in a correct order.

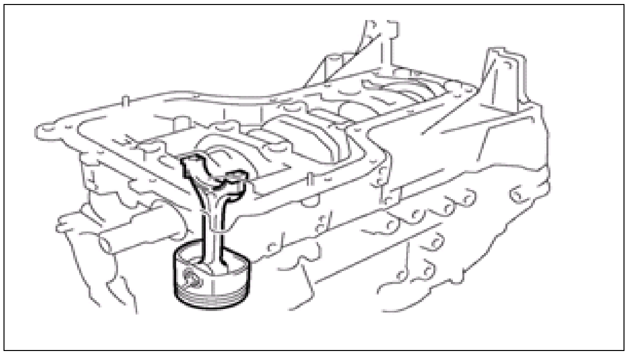


Figure 1-60-12

Remove the connecting rod bearing bushing

Remove the connecting rod bushing from the connecting rod cap. (See Figure 1-60-13)

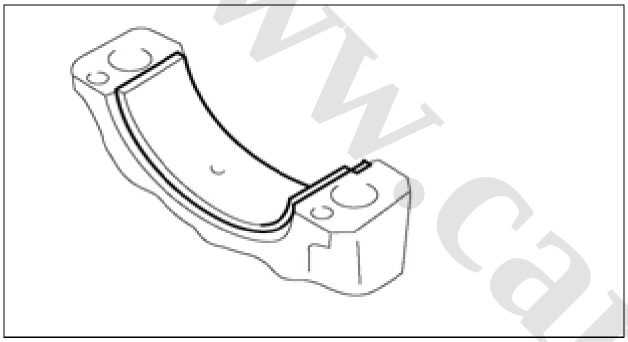


Figure 1-60-13

Remove the connecting rod bearing bushing from the connecting rod body. (See Figure 1-60-14)

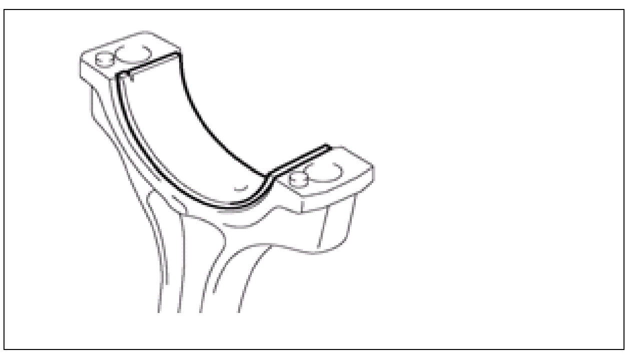


Figure 1-60-14

Remove the piston ring

Dismantle two compression rings with a piston ring expander. (See Figure 1-60-15)

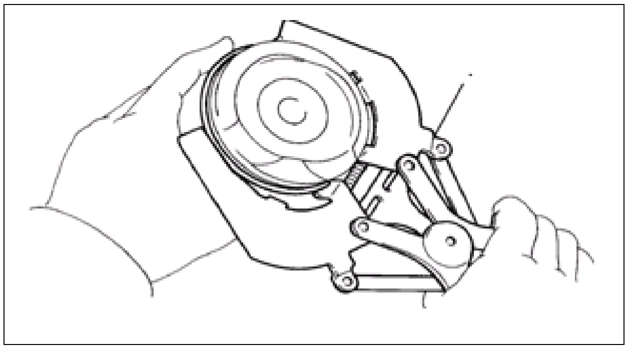


Figure 1-60-15

Remove 2 piece rings and bushing rings.

Note:

◎ Place piston in a correct order.

Remove the piston pin snap ring and the piston pin

Use a clamp to take out 2 piston pin snap rings. (See Figure 1-60-16)

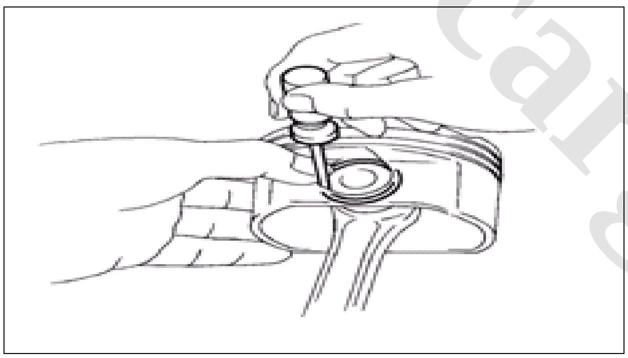


Figure 1-60-16

Place the copper sheet under the end surface of the piston pin, slightly hammer the piston pin with a plastic hammer and a round rod and take out the connecting rod. (See Figure 1-60-17).

Note:

◎ The connecting rod, the pin and the piston are accessories.

◎ Place piston, pin, ring, connecting rod and bearing in a correct order.

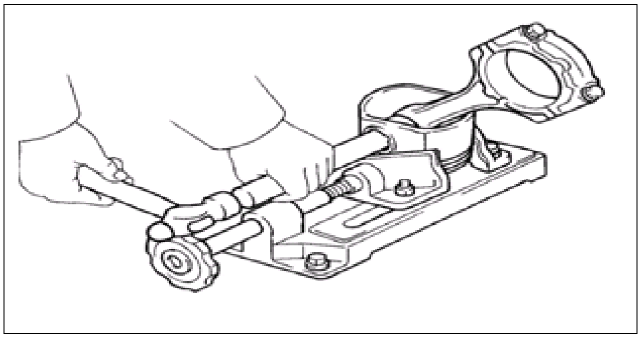


Figure 1-60-17

Remove the crankshaft

Remove 10 upper and lower body connecting bolts of the crankcase (See Figure 1-60-18).

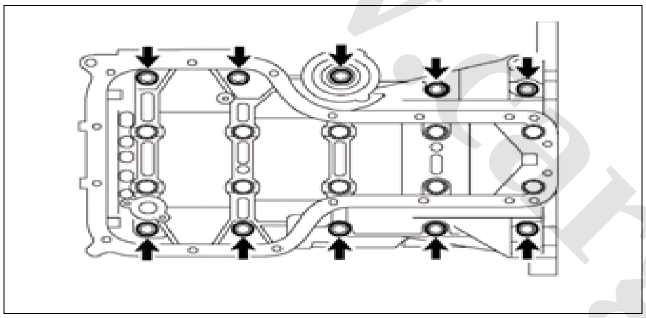


Figure 1-60-18

Screw off and dismantle the retaining bolt of the crankcase main bearing cover evenly as per the order shown in 1-60-19.

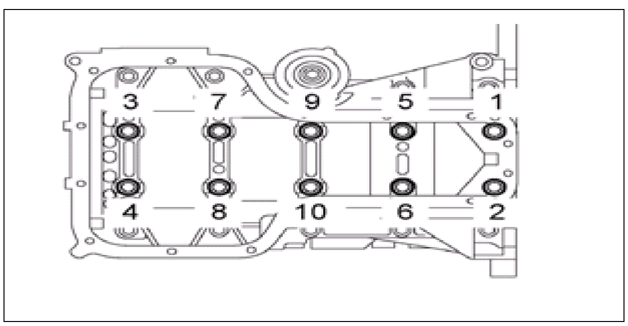


Figure 1-60-19

Use a screw driver to pry the crankcase lower body assembly as per fig. 1-60-20 and take down the crankcase lower body assembly.

Note:

◎ Never damage the mating surface of the upper body and the lower body of the crankcase and the bearing bushing surface.

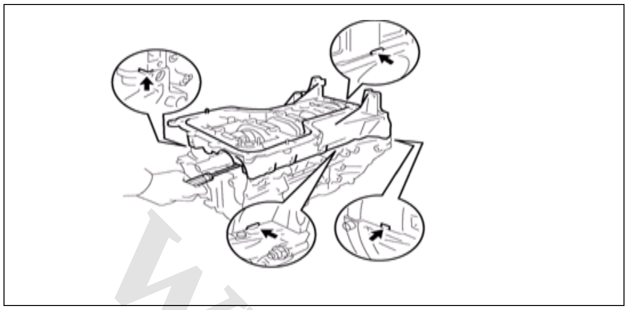


Figure 1-60-20

Remove the crankshaft from the crankcase upper body assembly. (See Figure 1-60-21)

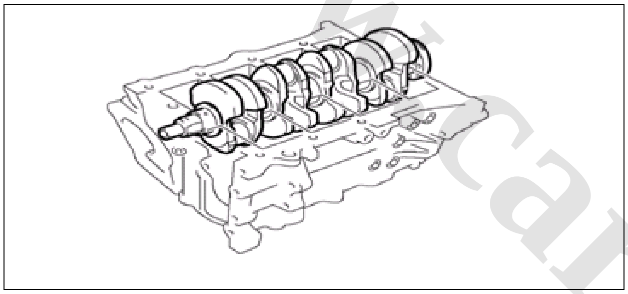


Figure 1-60-21

To check the axial clearance of the crankshaft, pry the crankshaft back and forth with a flat screw driver and measure the axial clearance with a micrometer.

(See Fig. 1-60-22)

Standard axial clearance: 0.04mm-0.30mm

Maximum axial clearance: 0.30mm

If the axial clearance exceeds the limit, replace the whole set of thrust washer.

Thickness of the thrust washer: 2.43mm-2.48mm

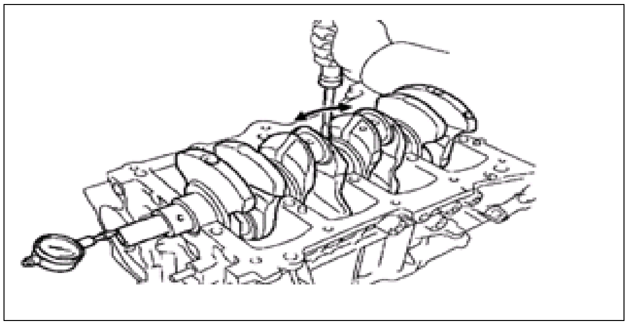
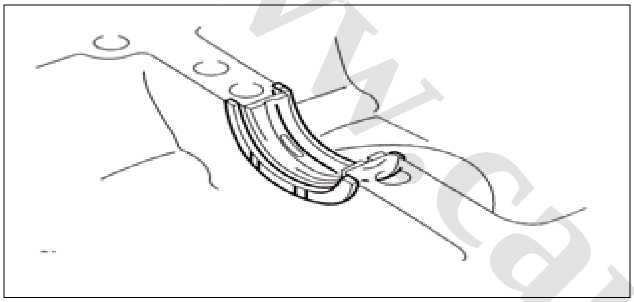


Figure 1-60-22

Remove the crankshaft thrust plate

Remove 2 crankshaft thrust plates from the crankshaft upper body assembly. (See Figure 1-60-23)



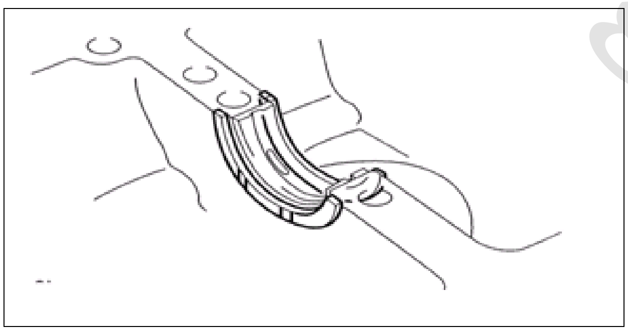


Figure 1-60-23

Remove the upper and lower crankshaft bearings

Take down 5 upper crankshaft bearings from the crankcase upper assembly.

Note:

◎ Place the upper crankshaft bearing orderly (See Figure 1-60-24).

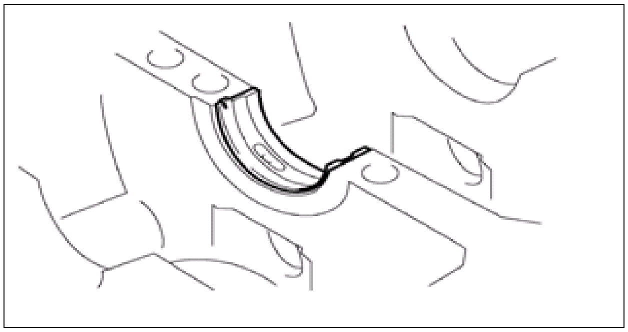


Figure 1-60-24

Dismantle 5 lower crankshaft bearings from the crankcase lower body assembly. (See Figure 1-60-25)

Note:

◎ Place the upper crankshaft bearing in correct order.

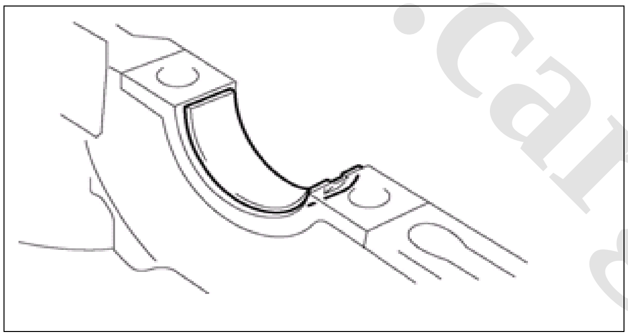


Figure 1-60-25

Remove the stud bolt

Take down 8 stud bolts at the position shown in 1-60-26.

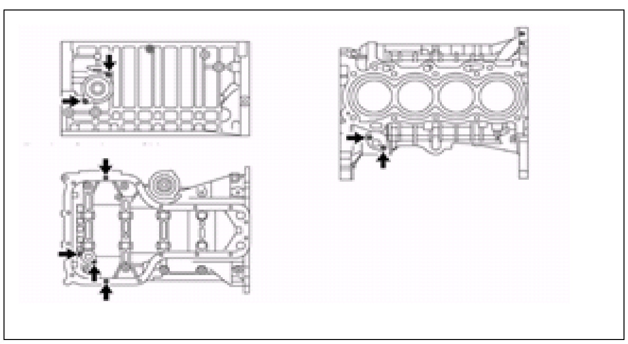


Figure 1-60-26

Check the top surface of the crankcase upper body for warpage

Clean out all the washer materials from the top surface of the cylinder block with a washer scraper.

Clean the cylinder block with a soft brusher and some solvent.

Measure the warpage of the top surface of the crankcase with a precise ruler and a feeler gauge.

Maximum warpage: 0.05mm

If the warpage exceeds the maximum, replace the cylinder block (See Figure 1-60-27).

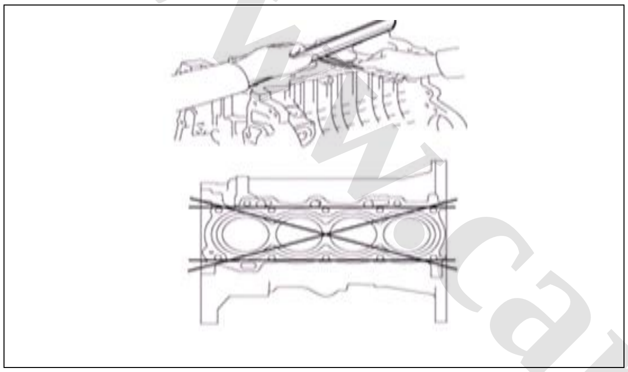


Figure 1-60-27

Check the diameter of the cylinder bore of the crankcase upper body.

Measure the diameter of the cylinder bore at A, B and C in the thrust direction and axial direction with a cylinder bore gauge.

(See Fig. 1-60-28)

Standard diameter: 79.00mm-79.13mm

Calculate the differential value between the maximum and the minimum of the 6 measured values.

Maximum differential value: 0.10mm

If it exceeds the maximum, replace the crankcase body.

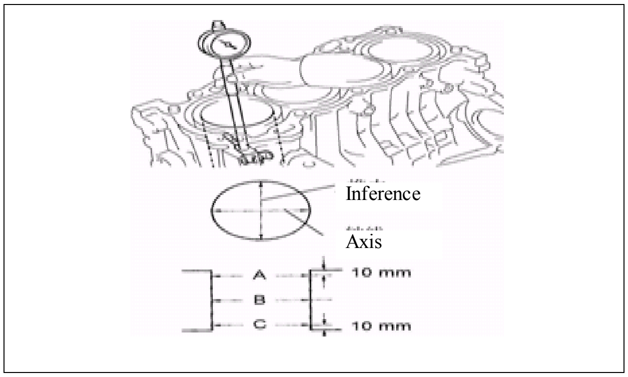


Figure 1-60-28

Check the piston

Check the diameter of the piston

Measure the diameter of the piston at right angles to the centerline of the piston pin with a micro-micrometer at 25.6mm to the top of the piston. (See Fig. 1-60-29)

Diameter of the piston:

Standard: 78.925mm～78.935mm

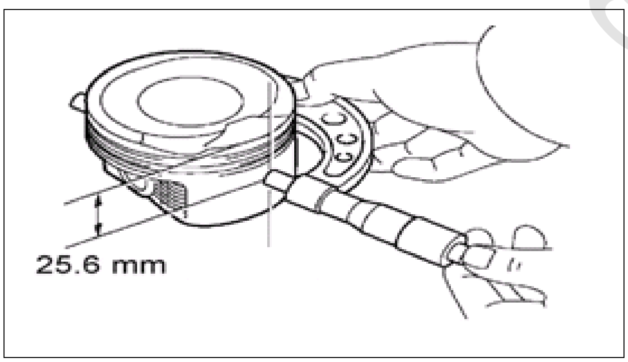


Fig. 1-60-29

Check the oil film clearance of the piston

The measured inner diameter of the cylinder bore deducts the measured diameter of the piston.

Standard oil film clearance: 0.065mm-0.085mm

Maximum oil film clearance: 0.085mm

If the oil film clearance exceeds the maximum, replace all 4 pistons and re-bore the 4 cylinders.

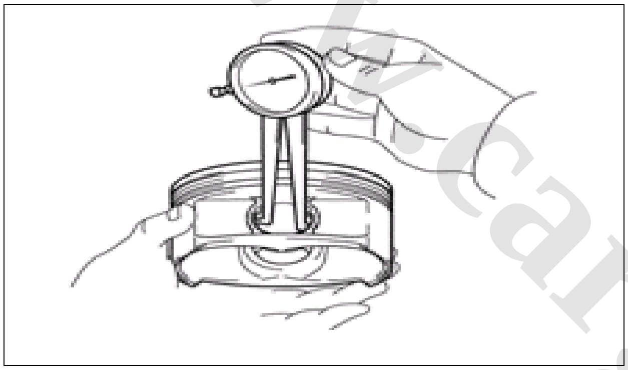
If necessary, replace the cylinder block.

Mark the piston with the same number for the diameter of the cylinder bore.

Check the oil film clearance of the piston pin

Measure the diameter of the piston pin bore with a caliper. (See Fig. 1-60-30）

Diameter of the piston pin bore: 20.006mm-20.015mm

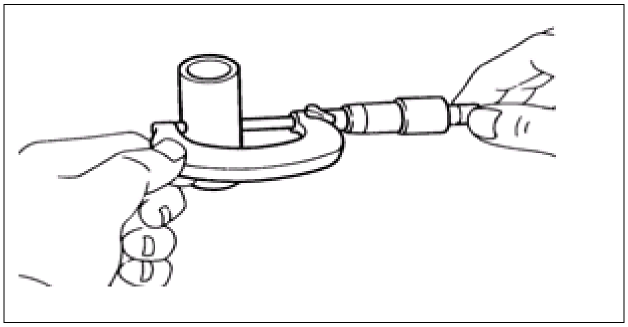


Mark	Size (mm)
White	20.006～20.009
White	＞20.009～20.012
Yellow	＞20.012～20.015

Fig. 1-60-30

Measure the diameter of the excircle of the piston pin with a micro-micrometer. (See Figure 1-60-31).

Diameter of the excircle of the piston pin: 20.004mm～20.013mm



Mark	Size (mm)
A	20.004～20.007
B	＞20.007～20.010
C	＞20.010～20.013

Fig. 1-60-31

Measure the inner diameter of the connecting rod small end hole with a caliper. (See Figure 1-60-32).

Inner diameter of the small end hole of the connecting rod: 20.012mm～20.021mm

Mark	Size (mm)
A	20.012～20.015
B	＞20.015～20.018
C	＞20.018～20.021

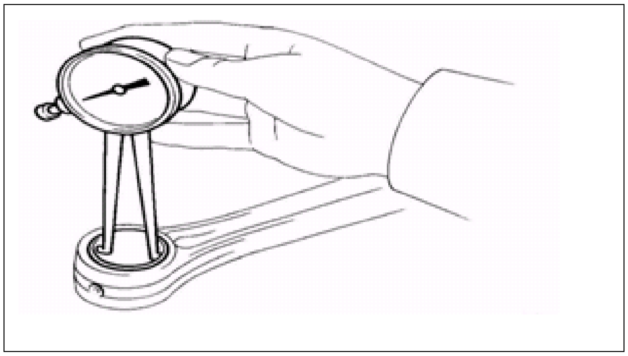


Fig. 1-60-32

The diameter of the inner circle of the piston pin hole deducts the diameter of the excircle of the piston pin.

Standard oil film clearance: 0.002mm～0.011mm

Maximum oil film clearance: 0.011mm

If the oil film clearance exceeds the maximum, replace the piston pin; if necessary, replace the piston.

The diameter of the inner circle of the connecting rod small end deducts the diameter of the excircle of the piston pin.

Standard oil film clearance: 0.001mm～0.017mm

Maximum oil film clearance: 0.017mm

If the oil film clearance exceeds the maximum, replace the connecting rod; if necessary, replace the piston and the connecting rod. (See Fig. 1-60-33)

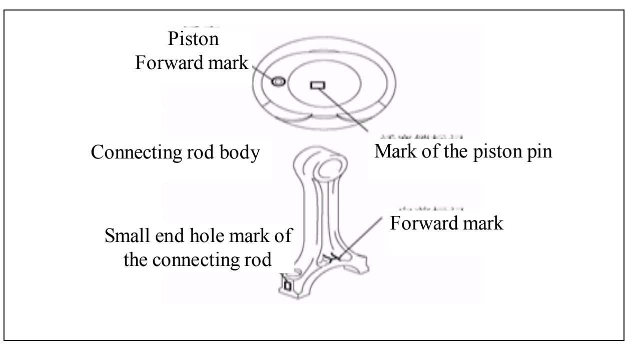


Fig. 1-60-33

Check the clearance of the piston groove

Measure the clearance between the new piston ring and the ring wall with a thickness gauge. (See Fig. 1-60-34)

Ring groove clearance:

1st ring groove: 0.03mm-0.08mm

2nd ring groove: 0.03mm-0.07mm

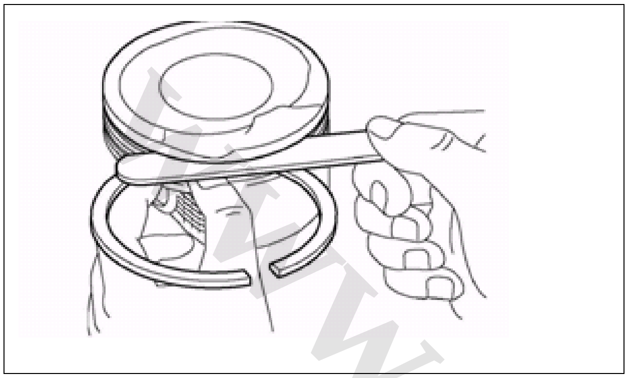


Fig. 1-60-34

If the clearance exceeds the maximum, replace the piston.

Check the open clearance of the piston ring.

Insert the piston ring in the cylinder bore.

Push the piston ring to a position exceeding the bottom of the ring travel. (See Figure 1-60-35)

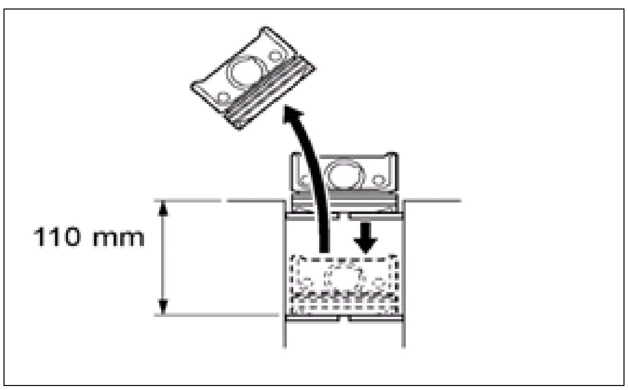


Fig.1-60-35

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Measure the open clearance with a thickness gauge (See Fig. 1-60-36).

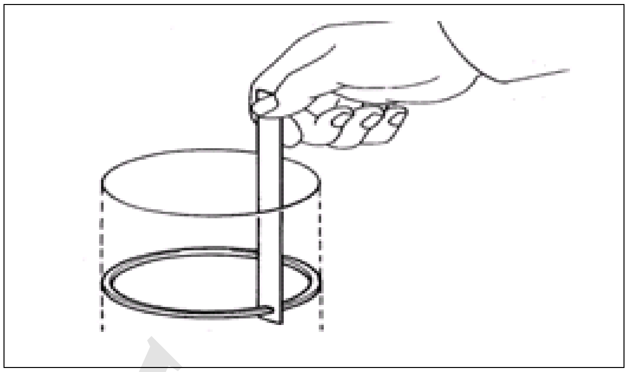


Fig. 1-60-36

Standard open clearance:

1st ring groove: 0.20 mm～0.35 mm

2nd ring groove: 0.40 mm～0.55 mm

Wafer ring: 0.20mm-0.70mm

Maximum open clearance:

1st ring groove: 1.05 mm

2nd ring groove: 1.20 mm

Wafer ring: 1.10 mm

If the open clearance exceeds the maximum, replace the piston ring. If new piston ring is used, but the open clearance is still beyond the maximum, re-bore the 4 cylinders or replace the cylinder block.

Check the connecting rod

Check the torsion resistance (See Fig. 1-60-37)

Maximum torsion resistance: 0.05mm/1.0mm

If the torsion resistance exceeds the maximum, replace the connecting rod component.

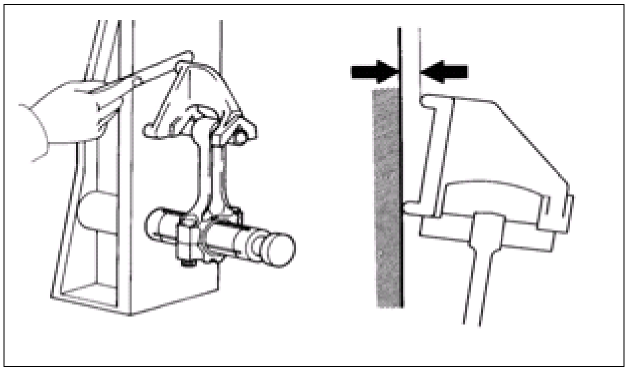


Fig. 1-60-37

Check the alignment condition of the connecting rod with a collimator and a thickness gauge. (See Fig. 1-60-37)

Maximum misalignment degree: 0.05mm/1.0mm

If the misalignment exceeds the maximum, replace the connecting rod component.

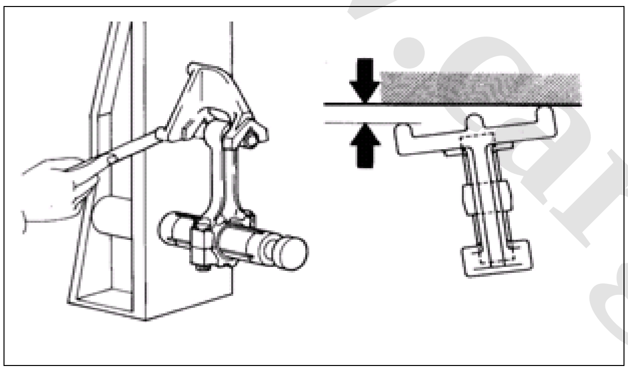


Fig. 1-60-37

Check the diameter of the connecting rod bolt.

Measure the outer diameter of the connecting rod bolt with a dial caliper. (See Fig. 1-60-38)

Standard outer diameter: 7.30mm～7.40mm

Minimum outer diameter: 7.30 mm

If the outer diameter exceeds the minimum, replace the whole set of connecting rod bolts and nuts.

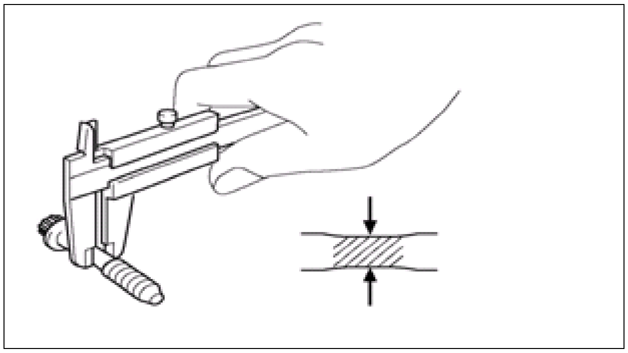


Fig. 1-60-38

Check the radius run-out of the crankshaft

Place the crankshaft on the V-block.

Measure the radius run-out of the intermediate journal with a micrometer. (See Fig. 1-60-39)

Maximum radius run-out: 0.03mm

If the radius run-out exceeds the maximum, replace the crankshaft.

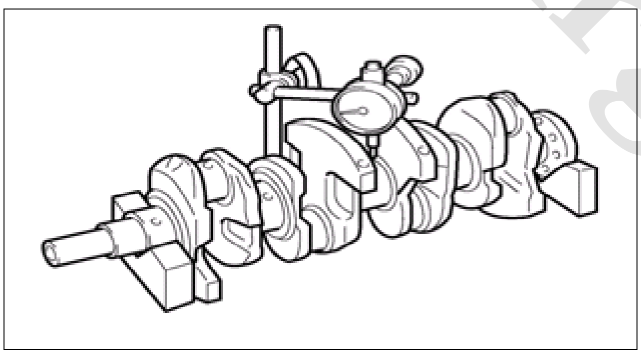


Fig. 1-60-39

Measure the diameter of each main journal with a micrometer.

main journal standard diameter： 47.982mm～48.000mm

If the diameter is disqualified, check the oil film clearance;

If necessary, polish or replace the crankshaft.

As shown in Fig. 1-60-40, check the taper of each main journal and the connecting rod journal.

Maximum taper and out-of-roundness: 0.02mm

If the taper and out-of-round exceed the maximum, replace the crankshaft.

Measure the diameter of each connecting rod journal with a micrometer.

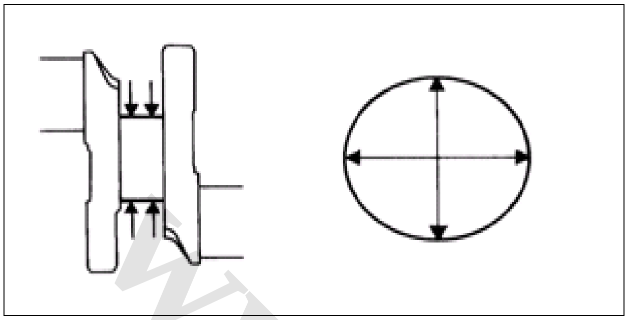


Fig. 1-60-40

connecting rod journal standard diameter： 43.992- 44.000mm

If the diameter is disqualified, check the oil film clearance;

If necessary, polish or replace the crankshaft.

As shown in figure, check the taper and out-of-roundness of each connecting rod journal.

Maximum taper and out-of-roundness: 0.02mm

If the taper and out-of-round exceed the maximum, replace the crankshaft.

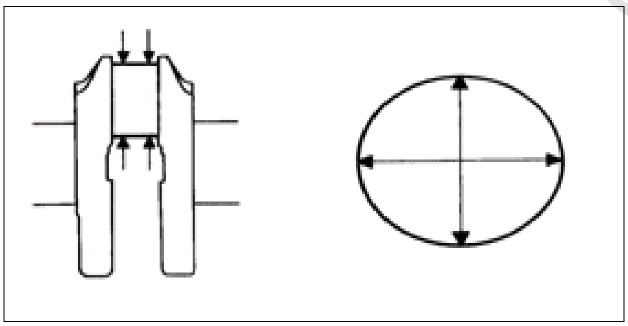


Fig. 1-60-41

Check the retaining bolt of the crankcase main bearing cover.

Measure the outer diameter of the retaining bolt of the crankcase main bearing cover with a dial caliper. (See Fig. 1-60-42)

Standard outer diameter: 8.80mm～9.00mm

Minimum outer diameter: 8.80mm

If the outer diameter is lower than the minimum, replace the whole set of crankcase main bearing cover retaining bolts.

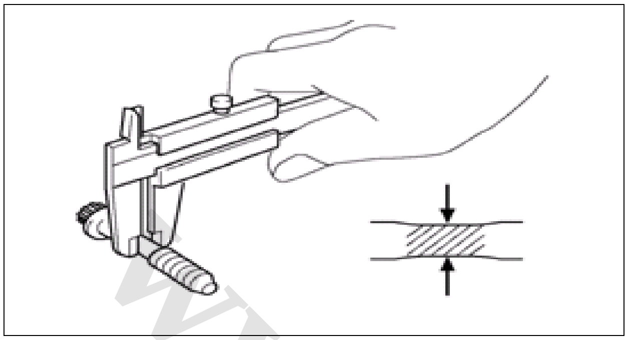


Fig. 1-60-42

Check the oil film clearance of the crankshaft

Clean all the crankshaft journal and crankshaft bearing bushing.

Install the crankshaft on the upper body of the crankcase.

Insert a part of the plastic oil gap gauge in the main axial diameter of the crankshaft (See figure)

Note: Never turn the crankshaft.

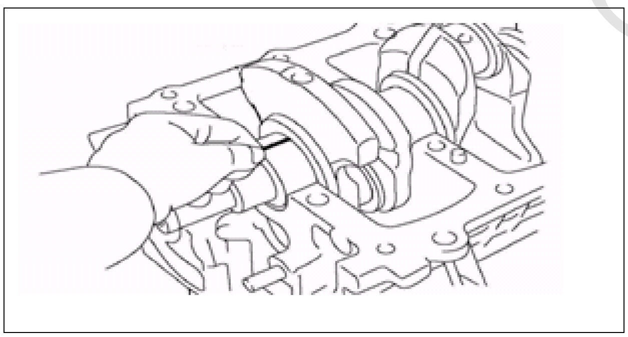


Fig. 1-60-43

Install the lower body assembly of the crankcase, as shown in figure; screw down 10 retaining bolts of the crankcase main bearing cover.

Torque:

40 N m for the 1st time

60 N·m for the 2nd time

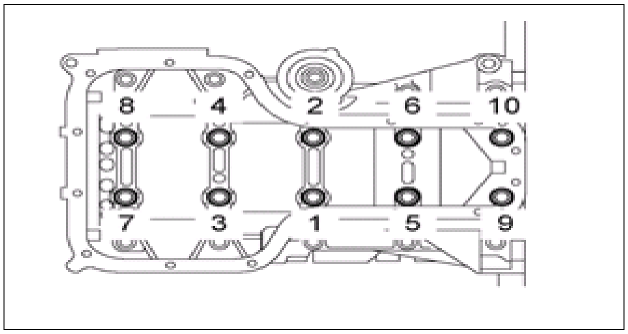


Fig. 1-60-44

Dismantle 10 bolts from the upper and lower body of the crankcase (See figure).

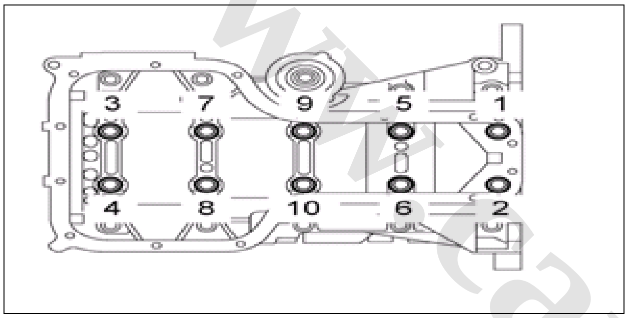


Fig. 1-60-45

Dismantle the retaining bolt of the crankcase main bearing cover orderly as shown in Fig. 1-60-40.

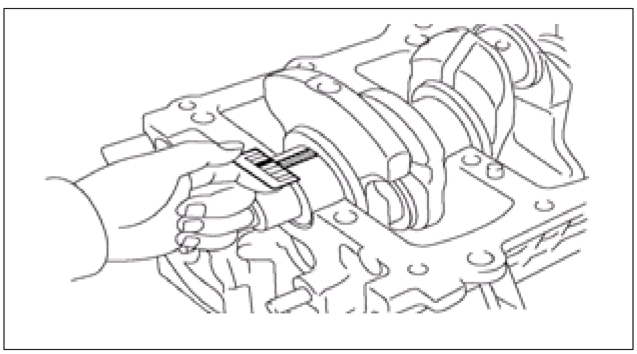


Fig.1-60-46

Measure the plastic oil gap gauge at the widest place.

Standard oil film clearance: 0.014mm～0.032mm

Maximum oil film clearance: 0.032mm

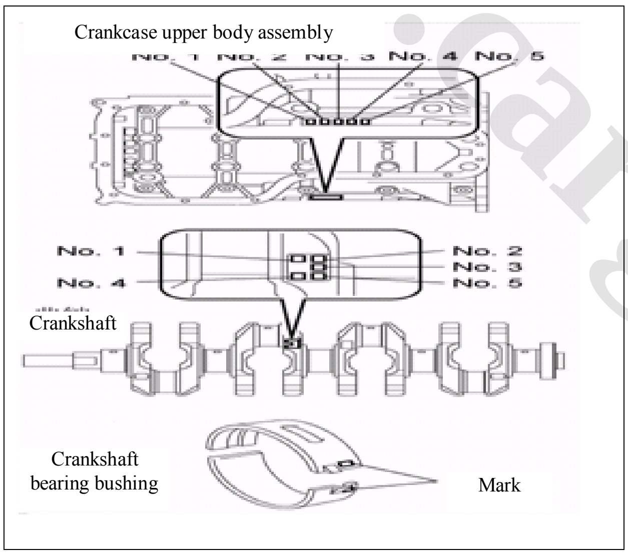
Note:

◎ In case of replacing the cylinder block component, the standard clearance of the bearing bushing should be 0.014mm-0.032mm.

◎ If the oil film clearance exceeds the maximum, replace the bearing bushing. If necessary, polish or replace the crankshaft.

◎ If a standard bearing bushing is used, replace it with the bearing bushing with the same number.

◎ If the number of the bearing bushing is undefined, use the numbers on the cylinder block and the crankshaft to add or deduct 1 to match the bushing, and then choose the bearing bushing with the same number as the summation number to ensure correct bushing match. There are 5 standard bearing bushing sizes: "1", "2", "3", "4" and "5". (See Fig. 1-60-47).



	Mark No.								
Cylinder block	1			2°			3		
Crankshaft	1	2°	3	1	2°	3	1	2°	3
Matched	1	2°	3	2°	3	4	3	4	5

bearing bushing									

Fig. 1-60-47

"3"(No. 3 cylinder block) +"1" (No. 1 crankshaft)-"1"="3" (adopted No. "3" bearing bushing)

Reference table of standard bearing bushing (see Figure 1-60-48):

	Mark No.	mm
Inner diameter of the cylinder block main journal	"1" "2" "3"	52.000～52.006 ＞52.006～52.012 ＞52.012～52.018
Diameter of the crankshaft journal	"1" "2" "3"	47.994～48.000 ＞47.988～47.994 ＞47.982～47.988
Central thickness of the standard bearing bushing	"1" "2" "3" "4" "5"	1.990～1.993 ＞1.993～1.996 ＞1.996～1.999 ＞1.999～2.002 ＞2.002～2.005

Figure 1-60-48

Assembly

Install the positioning pin

Install 9 positioning pins on the crankcase with a plastic hammer as shown in the figure.

(See Fig. 1-60-49)

Standard extension length:

A: 5mm

B: 7.5mm

C: 12mm

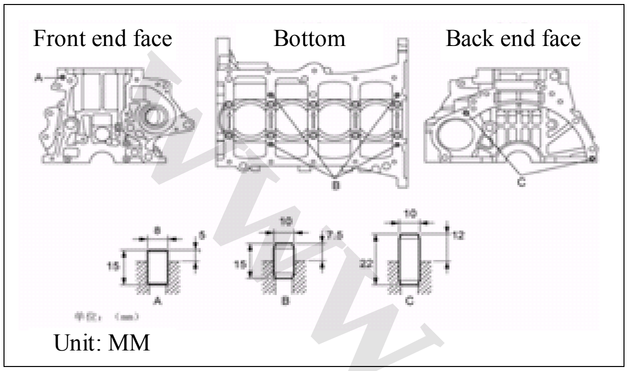


Fig. 1-60-49

Install the ring pin

Install 5 ring pins on the crankcase with a plastic hammer as shown in the figure. (See Fig. 1-60-50)

Standard extension length:

A: 6mm

B: 7mm

C: 10mm

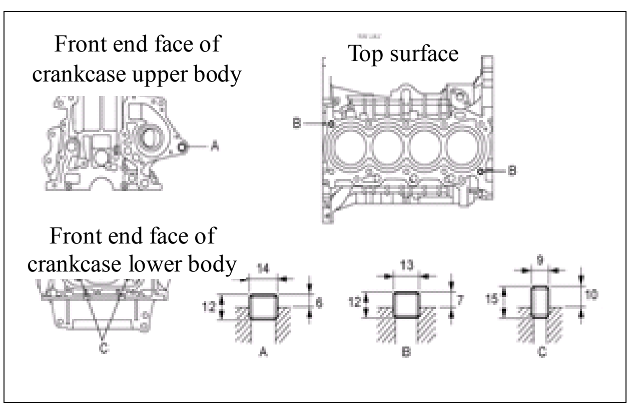


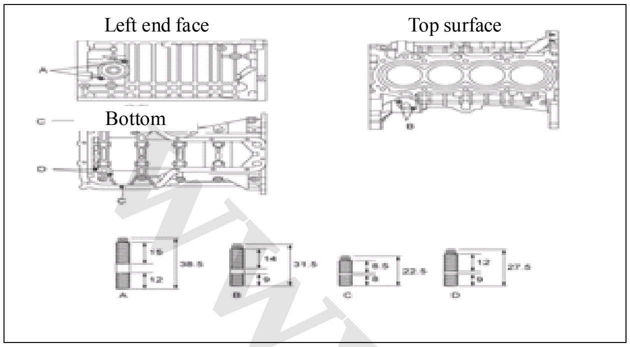
Fig. 1-60-50

Install the stud bolt

Install the stud bolt at position 8 with a special tool as shown in the figure. (See Fig. 1-60-51)

Torque:

A、C、D、E: 9N·m B:11N·m



Install the piston pin snap ring

Install the piston pin snap ring at one side of the piston pin hole with a caliper (See Fig. 161).

Note: Keep the end of the piston pin snap ring at the opening of the piston pin hole.

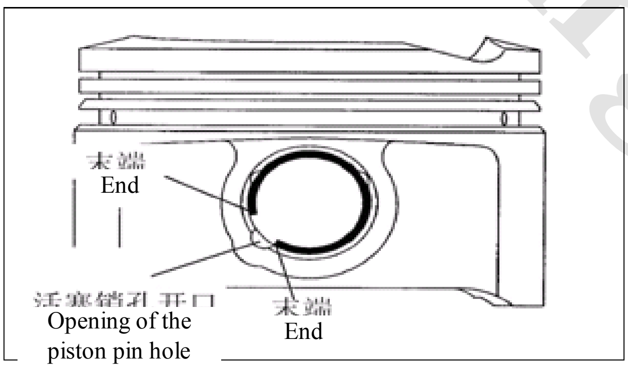


Fig. 161

Align the piston with the forward mark of the connecting rod, and install the piston pin. (See Fig. 1-62)

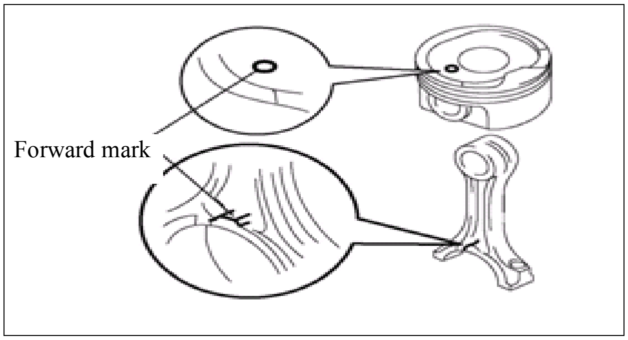


Figure 1-62

Install the piston pin snap ring at one side of the piston pin hole with a caliper. (See Fig. 1-63)

Note: Keep the end of the piston pin snap ring at the opening of the piston pin hole.

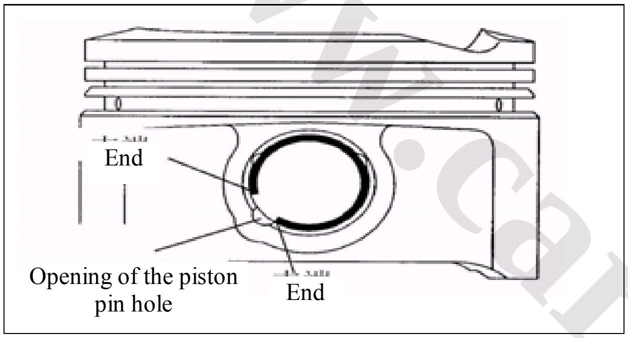


Figure 1-63

Install the piston ring

Manually install the wafer ring and the backing ring.

Install 2 gas rings with a piston ring expander with the code facing up. (See Fig. 164)

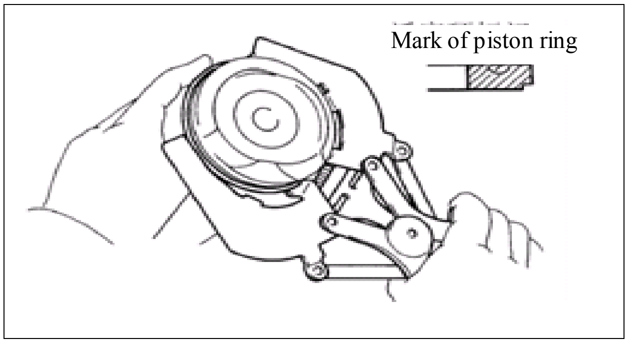


Fig. 164

Keep the open end at the piston ring position as shown in Fig. 165.

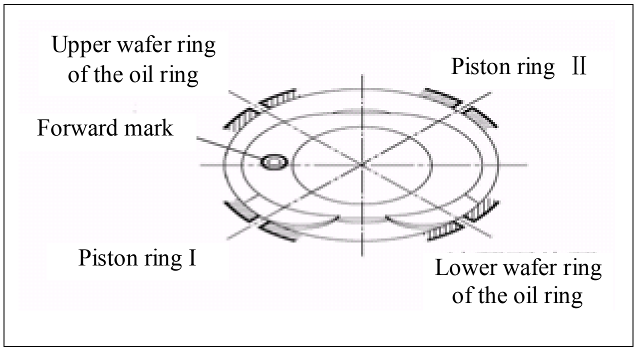


Fig. 165

Install the bearing bushing

Align the upper bearing bushing of the crankshaft with the oil hole and install it to the crankcase upper body assembly. (See Fig. 166)

Never apply engine oil to the contact surface of the bearing bushing and the crankcase.

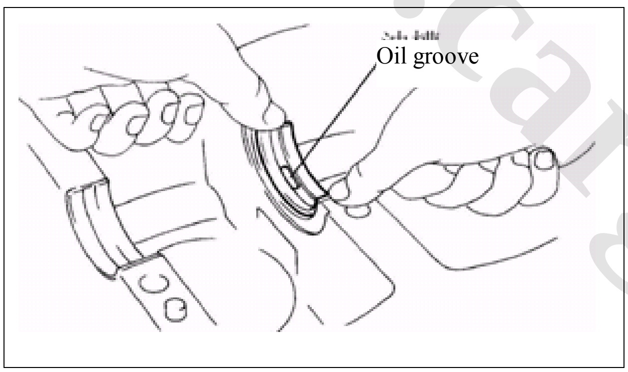


Fig. 166

Install the lower bearing bushing of the crankshaft on the crankcase lower body assembly. (See Fig. 167)

Hint: Never apply engine oil to the contact surface of the bearing bushing and the crankcase.

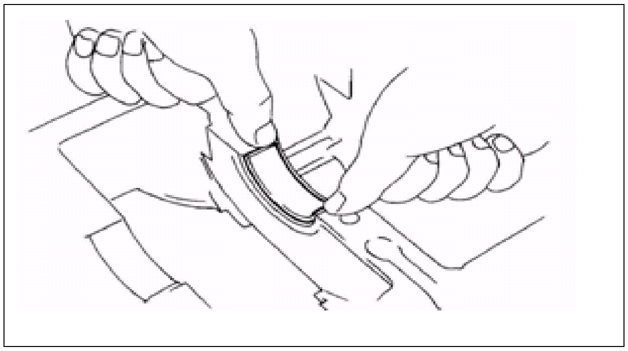


Fig.167

Install the crankshaft

Install 2 thrust washers below No. 3 journal of the cylinder block and keep the oil groove outward. (See Fig. 128)

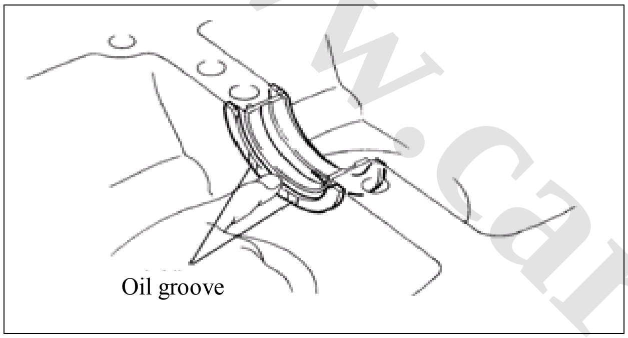


Fig.128

Apply a thin layer of engine oil to the bearing bushing surface.

Apply a thin layer of engine oil to the bolt head and the thread of the main bearing cover bolt.

Install the crankshaft to the crankcase upper body assembly. (See Fig. 169)

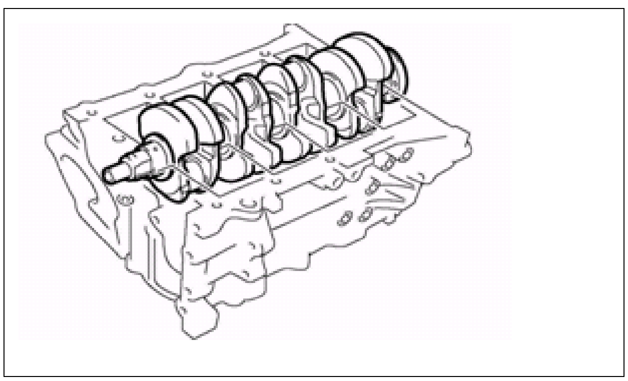


Fig.169

Install the crankcase lower body assembly

Evenly apply plane sealant (thickness of 2.5mm-3mm) to the position shown in the figure. （See Fig. 170）

Note:

◎ Keep no oil on the gluing surface.

◎ Install the crankcase lower body assembly within 3 minutes after gluing.

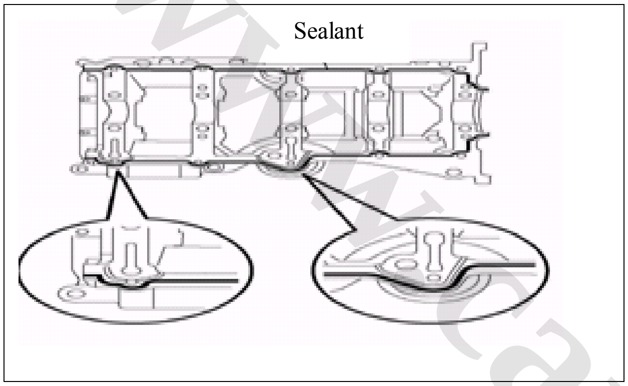


Fig. 170

As shown in the figure, screw down 10 retaining bolts of the crankcase main bearing cover. (See Fig. 171)

Torque: 40N.m for the 1st time and 60N.m for the 2nd time

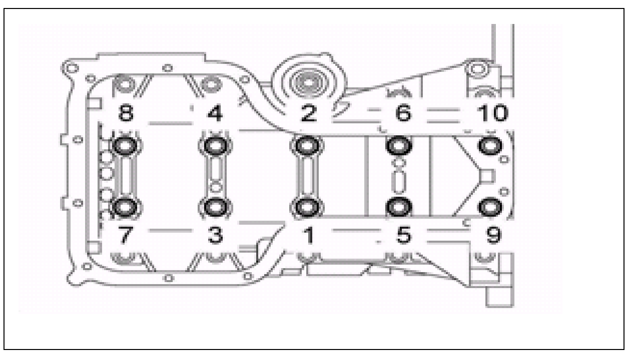


Fig. 171

Install 10 bolts of the crankcase upper and lower body. （See Fig 1-72）

Torque: 18N.m

Install the connecting rod bushing

Align the raised part of the bearing bushing with the groove of the connecting rod cover.

Install the drain bolt. (See Fig. 1-57-2)

Apply 2-3 layers of sealant to the middle of the bolt thread and install the drain bolt within 3 minutes.

Torque: 23 N.m

Installation should obey the reverse order of the removal.

Check the gap between the intake valve and the exhaust valve.

Make sure that all removed components have been returned to the original positions. Reinstall all new components.

Re-fill engine oil as per the regulations of engine oil replacement.

Connect the negative wire of the battery.

Check and verify all the joints for gasoline leakage, engine oil leakage and air leakage.

Tightening torque table for engine

Name of fasteners	Tightening torque
No. 1 camshaft bearing cover and cylinder head	23 N•m
Other camshaft bearing covers and cylinder heads	13 N•m
Exhaust manifold and cylinder head	37 N•m
Exhaust manifold upper and lower heat shield bolt	18 N•m
Cylinder head and cylinder block	90 N. m (60 N. m for the 1st time)

Exhaust timing sprocket and camshaft	60±3 N•m
VVT, camshaft	60 N•m
Main bearing cover and cylinder block	60N•m
Flywheel---crankshaft	88 N. m (49 N. m for the 1st time)
Knock sensor---cylinder block	18 N•m
Engine lifting lug---engine	38 N•m
Intake manifold and cylinder block	30 N•m
Ignition coil and cylinder head cover	11N•m
Belt tensioner bolt/nut	69/29 N•m
Crankshaft pulley bolt	138 N•m
Chassis bolt	30 N•m
Motor start-up bolt	37 N•m
Engine right mounting bracket (suspending) bolt	52 N•m
Connecting rod bolt	50 N•m
Crankcase upper and lower body connecting bolt (peripheral) 1	18 N•m
Dynamic rail bolt	19 N•m
Retaining bolt for rail	13 N•m
Cylinder head cover bolt	11 N•m

Water temperature sensor---cylinder head	20 N•m
Chain tensioner nut	11 N•m
Water pump bolt	long bolt of 11 N•m and short bolt of 9 N•m
Belt tensioner	Bolt of 69 N. m and nut of 29 N. m
Engine oil pressure alarm	15 N•m
Front cover shell	M8 bolt of 23 N. m and others of 13 N. m
Drain plug	30 N•m
Throttle body bolt and nut	11 N•m
Fuel rail bolt	11 N•m
Throttle body reinforced plate	23 N•m
Water channel blockage	23 N•m
Oil duct blockage	23 N•m
Transmission bolt	Long bolt of 64 N. m, middle bolt of 47 N. m and short bolt of 23 N. m
Generator bolt	Short bolt of 25 N. m and long bolt of 54 N. m
Power steering oil pump bolt	45 N•m
Air compressor bolt	25 N•m
Exhaust manifold bracket bolt	30 N•m

Chapter IV Chassis

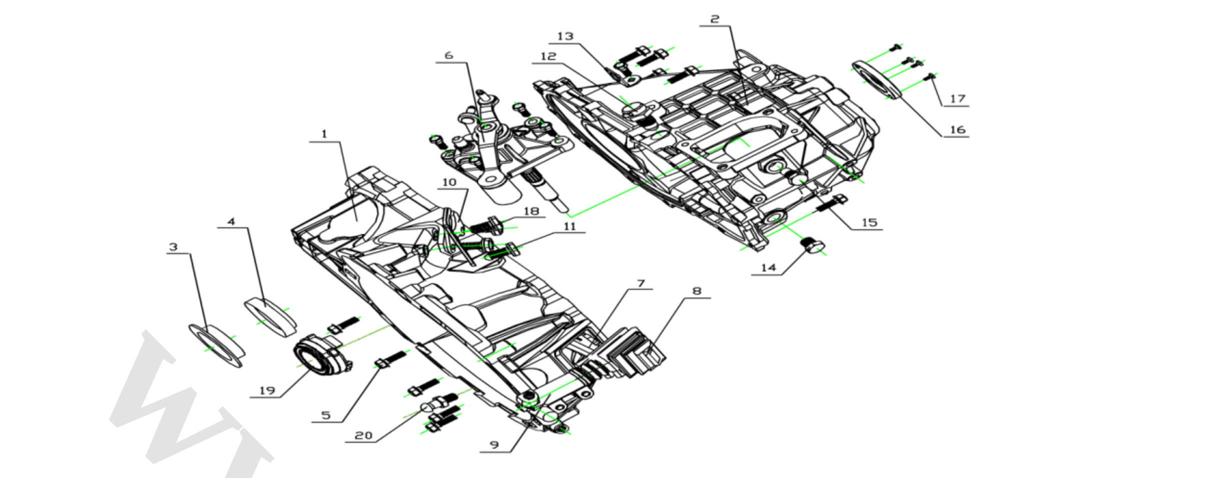
Section 1 Manual transmission (MT)

Main Technical Parameters of 1.8L Transmission

Model of transmission	ZQC5T18/LD517MF
Transmission ratio: Z2/Z1 main transmission	56:13=4.308
Gear I	35:11=3.182
Gear II	36:19=1.895
Gear III	35:26=1.346
Gear IV	34:33=1.0303
Gear V	31:34=0.912
Reverse gear	47:15=3.133
Rated power	100 kW
Rated torque	170N•m
Rated rotation speed	6000r/min
Lubricant quantity	2.0~2.2L
Model of lubricant	SAE 80W-90 (API GL-4) gear oil
Overall dimension	498×415×346mm
Clutch release way	Hydraulic pressure

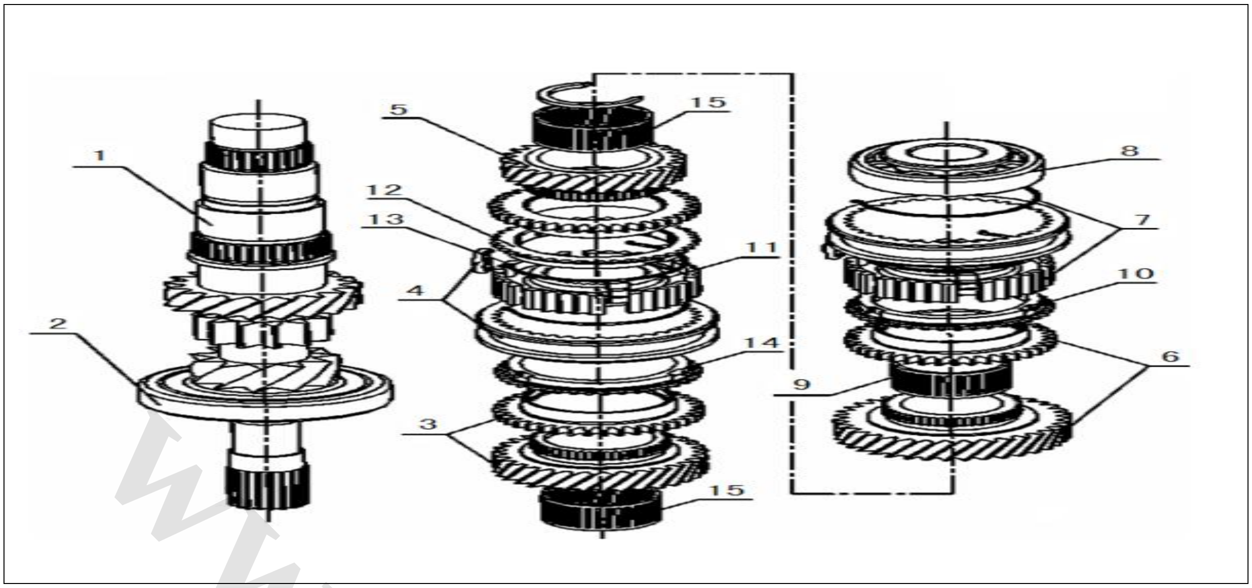
1.8L Transmission Assembly

Structural analysis of 1.8L transmission clutch and transmission housing assembly

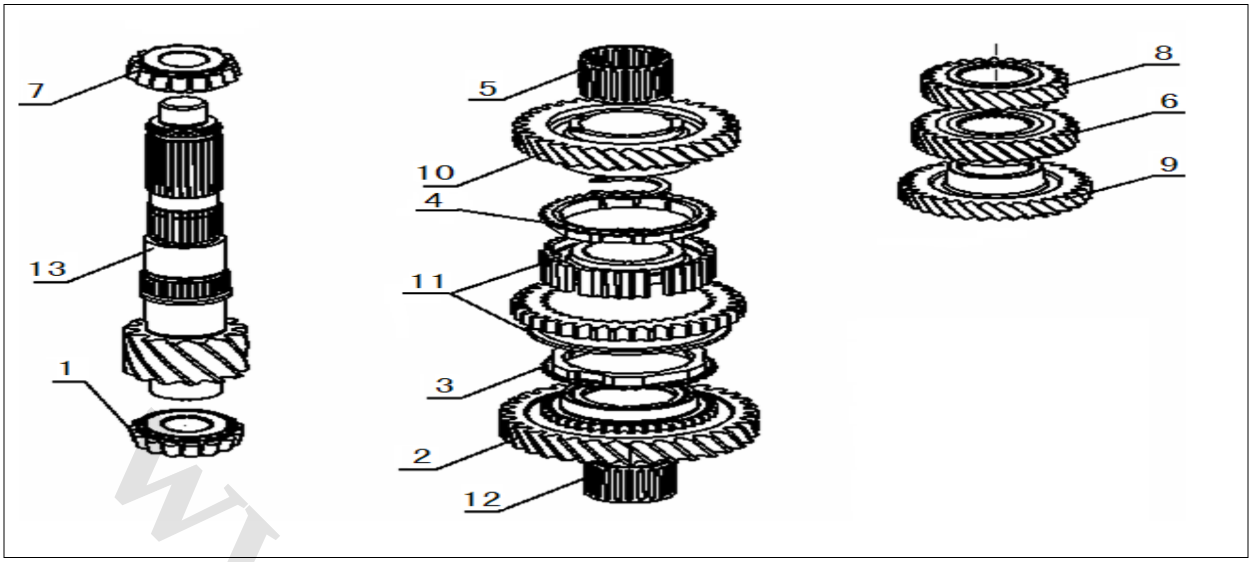


1-Clutch housing	11-Hexagon flange bolt
2-Clutch housing	12-Reverse lamp switch
3-Differential protection sleeve	13-Oil pipe support
4-Differential rear oil seal	14-Magnetic plug
5-Hexagon flange bolt	15-Shift locator assembly
6-Shifting guide shaft assembly	16-Output shaft rear end cover
7-Disengaging yoke	17-Rear end cover connecting bolt
8-Disengaging yoke protection sleeve	18-Shifting rocker arm cable bracket
9-Hydraulic cylinder	19-Release bearing
10-Shifting rocker arm cable bracket	20-Disengaging yoke supporting nail

Analysis of input shaft



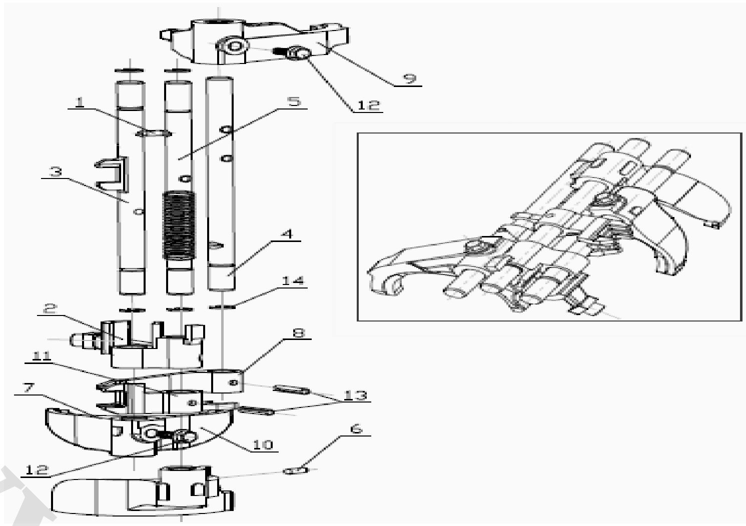
1-input shaft	9-5th gear needle bearing
2-Output shaft front bearing	10-5th gear synchronizer ring
3-3rd gear drive gear assembly	11-4th gear thrust washer
4-3rd & 4th gear synchronizer assembly	12-4th gear synchronizer ring
5- 4th gear drive gear assembly	13-Synchronizer hub retainer ring
6-5th gear drive gear assembly	14-3rd gear synchronizer ring
7-5th gear synchronizer assembly	15-3rd-4th needle bearing
8-input shaft rear bearing	



Structure analysis of output shaft

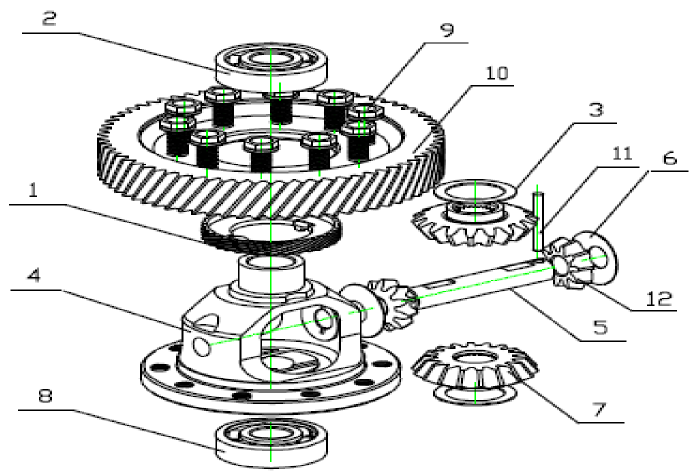
1-output shaft front bearing	8-5th gear driven gear
2-1st gear driven gear assembly	9-3rd gear driven gear
3-1st gear synchronizing ring	10-Driven gear,2nd speed
4-2nd gear synchronizing ring	11. 1st & 2nd gear synchronizer assembly
5-2nd needle bearing	12-1st needle bearing
6-4th gear driven gear	13-output shaft
7-output shaft rear bearing	

Structure analysis of 1.8L transmission Shift shaft assembly



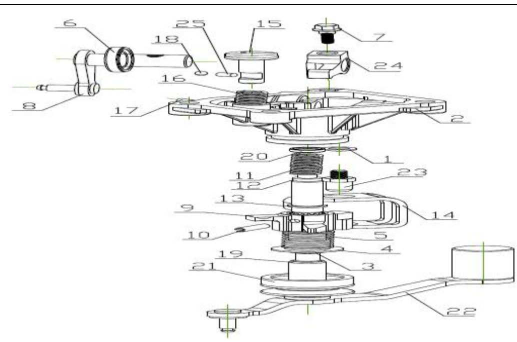
1-interlock pin	8-1st & 2nd gear shift guide block
2-Guide block of reverse gear	9-1st and 2nd gear reverse gear fork
3-3rd and 4th gear fork shaft	10-5th gear reverse gear fork
4-1st and 2nd gear fork shaft	11-5th gear reverse gear guide block
5-5th gear reverse gear fork shaft	12-Fork retaining bolt
6-interlock pin	13-elastic cylindrical pin
7-3rd and 4th gear reverse gear fork	14-Snap retainer ring

Structure analysis of 1.8L transmission differential assembly



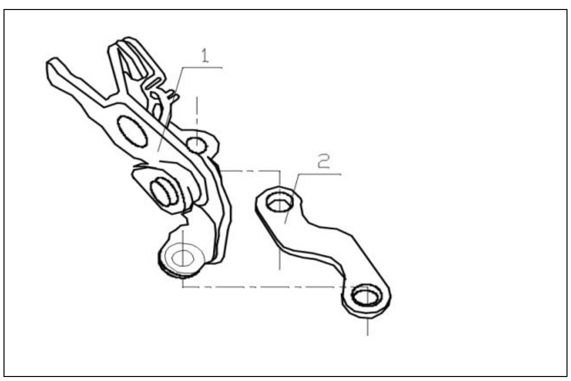
1-Odometer gear ring	7-half-shaft gears
2-Differential front bearing	8-Differential rear bearing
3-Washer,axle shaft gear	9-Differential gear ring retaining bolt
4-Differential housing	10-Main reducing driven gear
5-the planet gear shaft	11-elastic cylindrical pin
6-Washer,differential gear	12-differential gear

Structure analysis of 1.8L transmission shift mechanism assembly



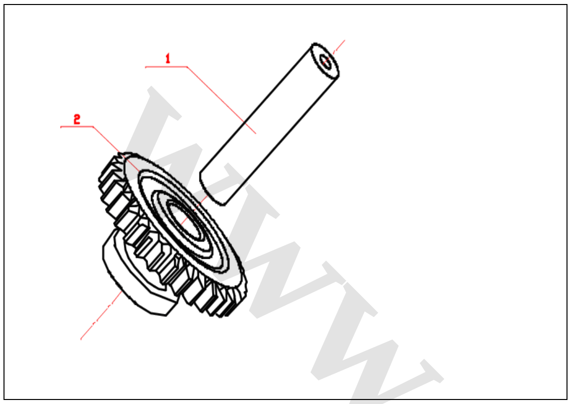
1-Breather valve washer	14-Interlock plate
2-Shift knob housing	15-Interlock cam,5th speed-reverse
3-Retainer ring of shift guide shaft	16-Interlock cam,5th speed-reverse
4-spring seat	17-Positioning pin of shift housing
5-return spring	18-Steel ball
6-Gear-selecting shaft oil seal	19-Alignment spacer ring of shift guide shaft
7-Switchover swing link retaining bolt	20-Shift shaft oil seal
8-Gear-shifting shaft assembly	21-dustproof cover
9-Shift swing lever	22-Shifting guide shaft assembly
10-elastic cylindrical pin	23-Breather valve assembly
11-return spring	24-Switchover swing link
12-Nylon pad	25-Interlock cam,5th speed-reverse
13-Retainer ring of shift guide shaft	

1.8L transmission reverse gear swing arm bracket assembly



1-Reverse gear swing arm bracket assembly
2-Reverse gear swing arm bracket pad

1.8L transmission reverse gear middle gear assembly



1-Reverse gear middle gear shaft
2-Reverse gear middle gear

Common Fault Diagnosis of 1.8L Transmission

As the increase of driving range and improper operation, the auto transmission parts may suffer abrasion and deformation, thus causing common faults of transmission like abnormal noise, gear engaging difficulty, trip stop, gear mis-engaging, heating, oil leakage, etc. The following methods for diagnosing the common faults of 1.8L transmission are provided for reference.

Abnormal noise of transmission

The abnormal noise of transmission is mainly subject to the bearing looseness due to abrasion and the improper engagement of gears, including noise at the neutral position and the engaged position.

Noise at the neutral position

Phenomenon: There is abnormal noise when the engine is running idly and the transmission is at the neutral position. Step down the clutch pedal and the noise may disappear.

Cause:

① In the installation of the transmission and the engine, the 1st shaft centerlines of the crankshaft and the transmission aren't concentric, or the transmission housing is deformed.
② Abrasion, dirt and fluff of the 2nd shaft front bearing.
③ Abrasion of normally engaged gear of the transmission, too big gap between gears or gear teeth breakage of individual gear.
④ Constant mesh gear isn't changed in pairs or engaged properly.
⑤ Looseness, damage of the bearing and too big axial clearance of the gear
⑥ Too large gap between the fork and the joint sleeve.

Noise after engagement

Symptom:

Noise after transmission gear engagement.

When the vehicle is driving at a speed over 40Km/h, there is an abnormal noise. The faster the vehicle is, the louder the noise is. The noise may drop or be eliminated when the vehicle is sliding or running at a low speed.

Causes:

① Flexural deformation of the shaft, and looseness of the connection between the shaft spline and the sliding gear hub.

② Improper gear engagement or looseness of the bearing.
③ Connection looseness of the operation mechanism and deformation of the shift fork
④ Too big clearance of the connection between the drive and the driven taper gear of the differential.

Diagnosis:

The noise of the transmission is from the vibration of the gear or the shaft and other sources, which is spread to the transmission housing wall to form resonance. The diagnosis steps are:

① When the engine is idle running, there is abnormal noise of the transmission at the neutral position. Step down the clutch pedal, the noise disappears, mainly caused by gear poor engagement.

② In each gear of the transmission, there is noise; because the basic part, the shaft, the gear and the spline abrasion cause the form and position exceed the limit.

③ When there is heavy noise while engaging a gear, the gear has been severely damaged.

④ After start-up, there is noise when the gear isn't engaged yet and heavy noise while changing the vehicle speed, showing that the front and rear shaft of the output shaft make a noise.

Trip stop of transmission

Symptom:

In the driving, the shifting lever automatically turns to the neutral position. (Suddenly change in the middle and high speed load or the vehicle moves strenuously.)

Essence of trip stop: axial thrust>selflocking force+friction force.

Time of trip stop: commonly at the direct gear, in the filling and vibration.

Causes:

As the gear is tapered due to abrasion, there is axial force in the engagement. And the vibration and rotation speed change in the operation cause the meshing gear disconnect from the transmission along the shaft. The specific performances are as follows:

Abrasion of the shift fork shaft groove and the positioning ball invalidates the self-locking device.

Abrasion and looseness of the transmission shaft and the bearing or too big axial clearance cause run-out and axial run-out due to poor engagement of gear in the rotation.

3.3 Gear engagement difficulty of transmission

Symptom:

Gear engagement difficulty and knock noise from synchronizer gear.

Causes:

Bend and deformation of the shift fork shaft;

Crack and blockage of self-locking or interlock steel ring;

Improper adjustment or damage of the shift connecting rod;

Abrasion or defection of the synchronizer;

Deformation of the transmission shaft or damage of the spline.

In addition to the transmission fault, halfway release of the clutch and improper specification of the gear oil also may cause gear engagement difficulty.

3.4 Gear mis-engagement of transmission

Symptom:

When the vehicle starts or shifts gear in the driving, the engaged gear should be complied with the required gear. Or the required gear is engaged but it's unable to return or engage two gears at one time.

Causes:

① Looseness and damage of the shift lever and the shift lever prod end excessive abrasion of the inner hole of the shift lever prod end.

② The compression amount of the transmission shift return spring fails to meet the requirement.

③ Too serious abrasion of the shift sliding rod interlock pin hole and the interlock pin invalidate the interlocking function.

3.5 Transmission overheating

Symptom:

After driving a certain distance, touch the transmission, you may feel hot.

Causes:

① Too tight bearing assembly.

② Too small gear engagement gap.

③ Shortage of gear oil or too low viscosity of gear oil.

3.6 Oil leakage of transmission

Symptom:

The gear oil in the transmission leaks from the bearing cover or the mating part.

Causes:

Poor seal of each seal liner, oil seal damage or looseness of retaining bolt of transmission.

Breakage of the transmission housing.

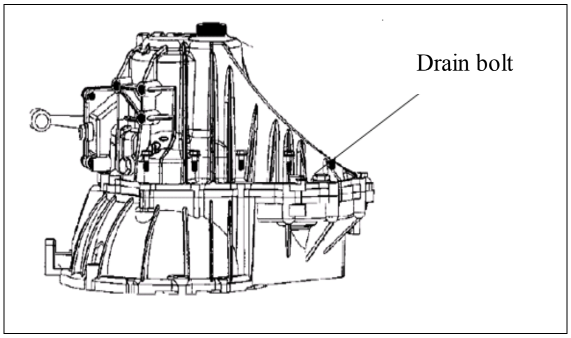
Too much gear oil.

Blockage of transmission drain bolt or breather hole.

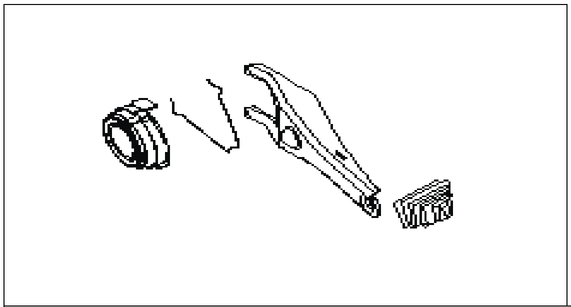
Removal, assembly and maintenance of transmission

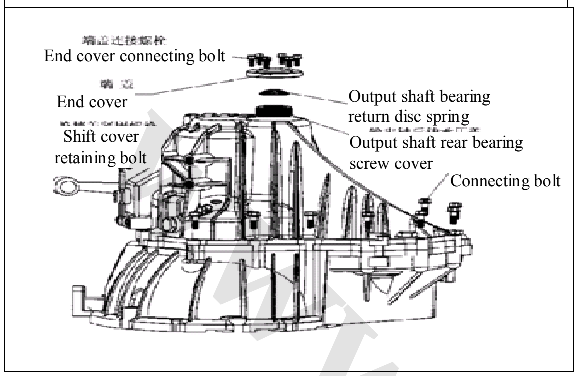
Disassembly and assembly

Place the transmission on the drain oil stand, screw off the drain oil screw plug on the transmission and drain the oil.



Take out the clutch release bearing, disengaging yoke and disengaging yoke dustproof cap.





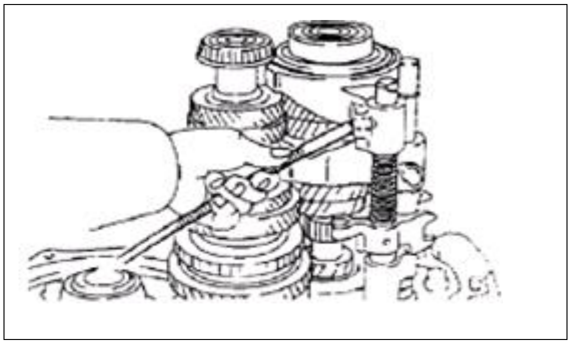
Screw down the shift cover retaining bolt, take out the gear-selecting and shift mechanism assembly and the reverse lamp switch, and remove the reverse gear shaft locking screw with a special tool.

Firstly loosen the end cover connecting bolt, take out the end cover and send it out. And then, place the bearing return disc spring in 4 holes of the output shaft rear bearing screw cover with a special wrench with 4 bulges on the end face, and screw it out. Loosen the shift cover retaining bolt to take out the shift cover assembly. Loosen the connecting bolt of the transmission, screw off the retaining bolt of the transmission housing and the clutch housing and take down the transmission housing.

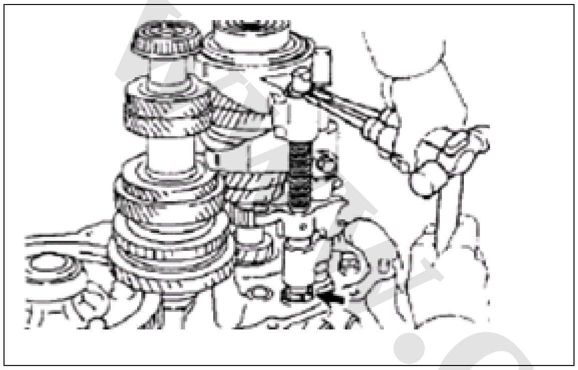
Screw off the retaining bolt on the reverse gear swing arm bracket mechanism and take out the reverse gear swing arm bracket and the reverse gear intermediate gear shaft.

Slightly knock out the differential, input and output shaft assembly with a special tool. Firstly take down the differential assembly, the fork shaft assembly, the output shaft assembly and the input shaft assembly, and then disassemble each assembly with a special tool.

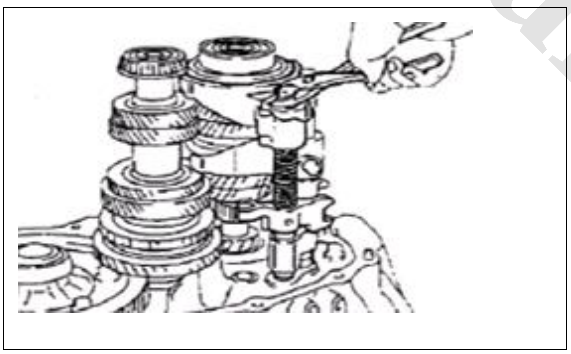
Take out the lock pin with a magnetic bar.



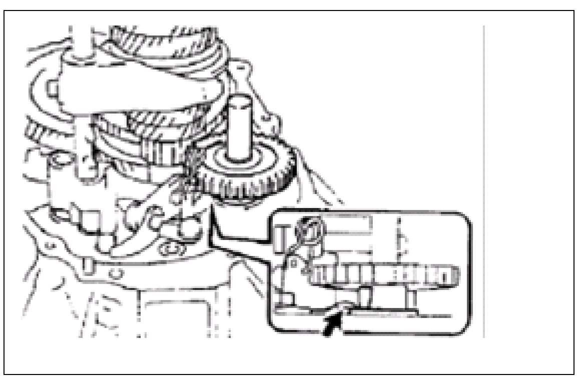
As shown in the figure, take down the fork shaft snap ring.



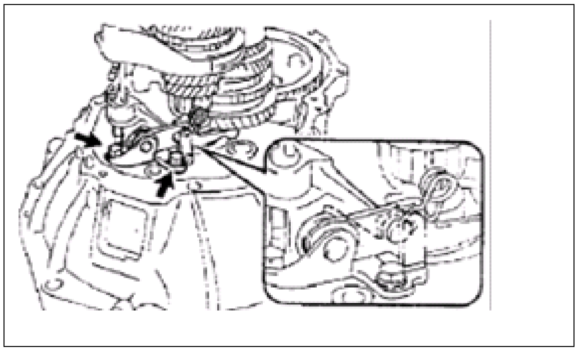
Clamp the upper part of the fork shaft packed with a cloth and pull out the fork shaft



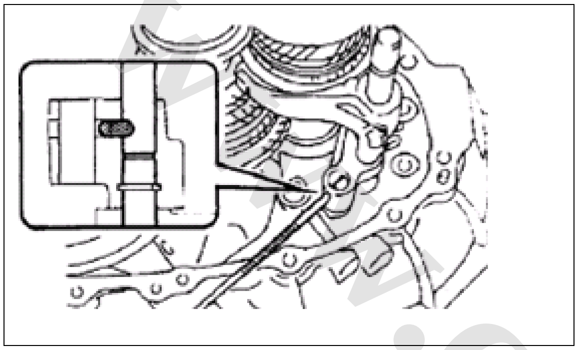
Take out the reverse gear and the reverse gear shaft



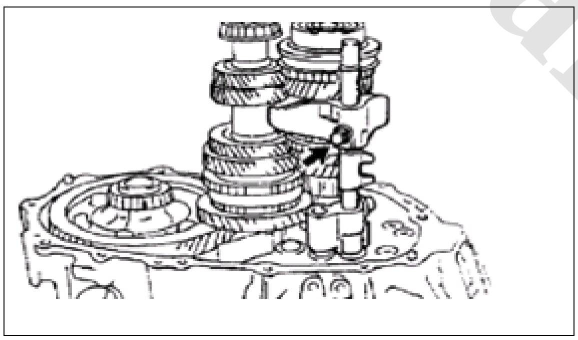
As shown in the figure, remove 2 bolts and reverse gear swing arm bracket.

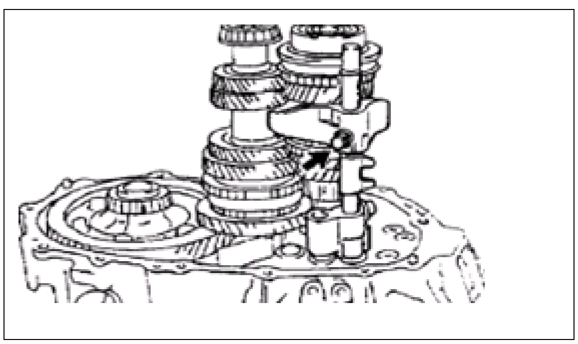


Remove the interlock pin with a magnetic bar and pull out the fork shaft and the fork.

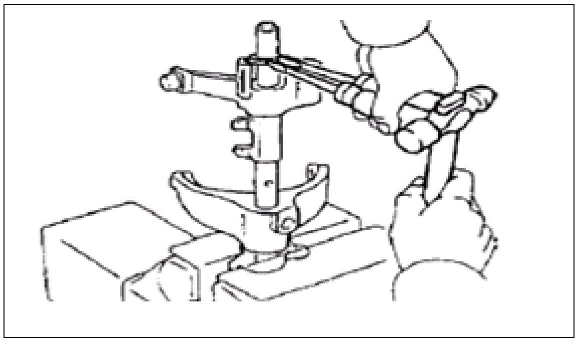


As shown in the figure, remove the bolt and the fork shaft.

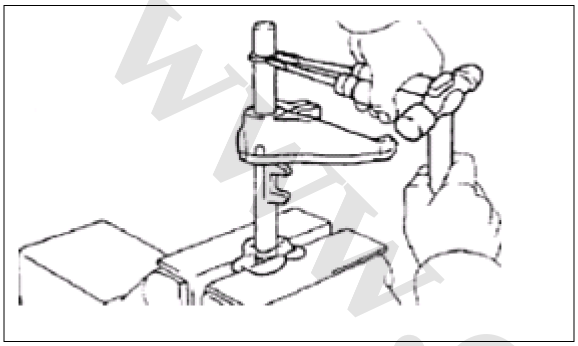




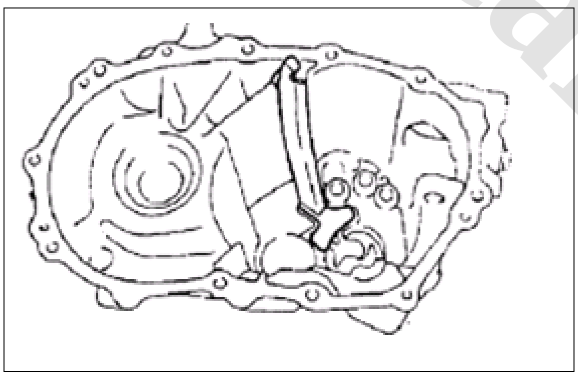
As shown in the figure, remove the snap ring.



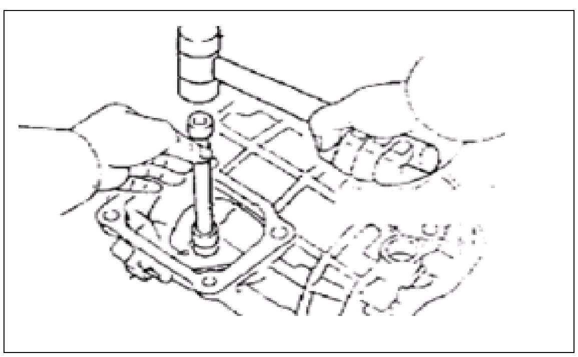
Remove the snap ring and take out the pin.



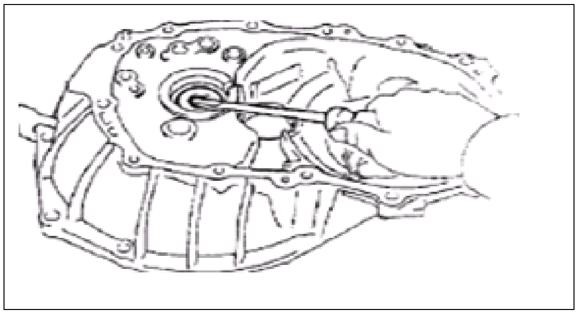
Remove the lubricating pipe.



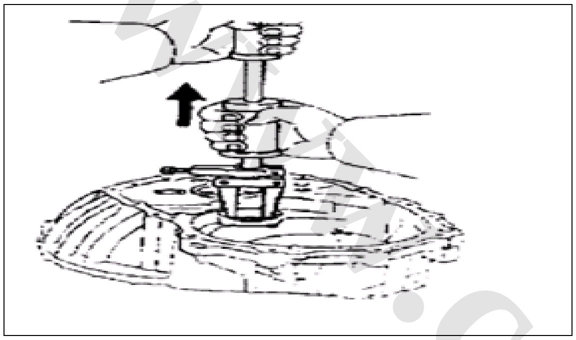
As shown in the figure, take out the bushing.



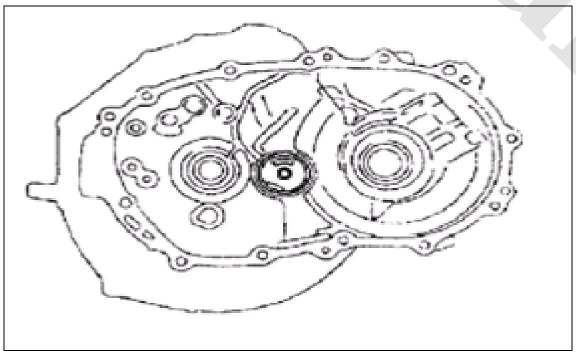
Take out the oil seal.



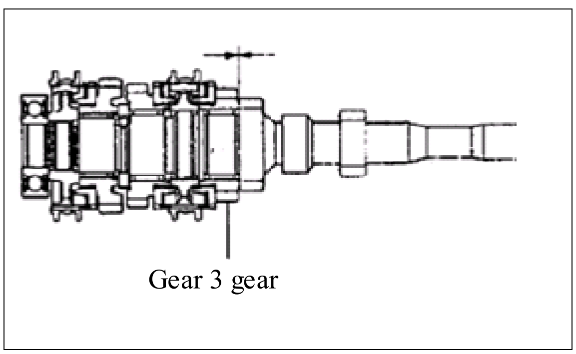
Take out the bearing outer ring with a tool.



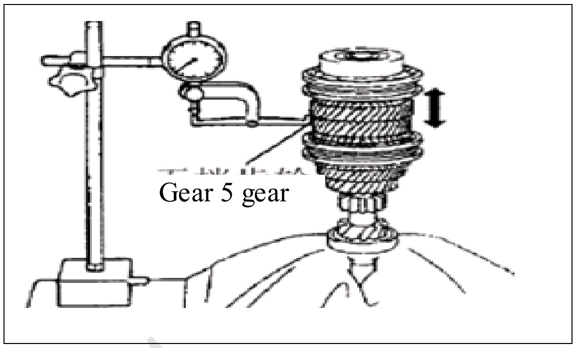
Remove the oil guide end cover.



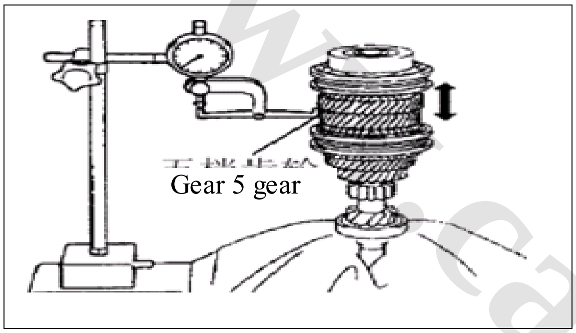
Measure gear 3 gear shaft clearance with a feeler gauge. The standard value is 0.1-0.35mm.



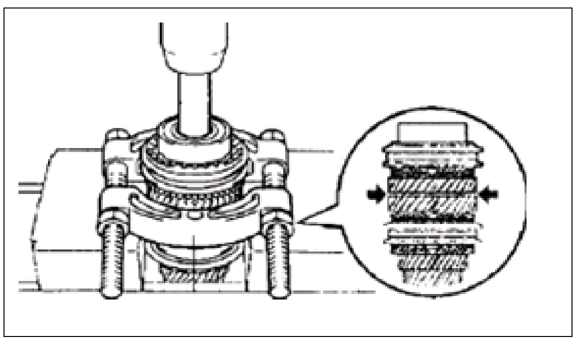
Measure the axial clearance of gear 5 gear shaft. The standard value is 0.1-0.5mm.



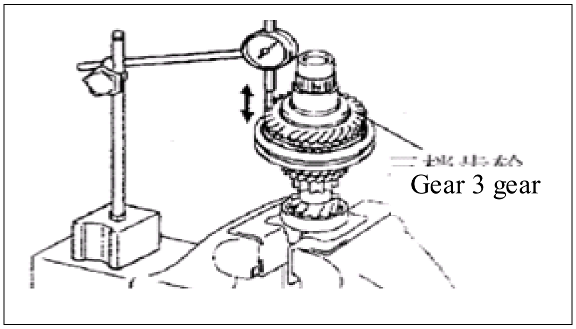
As shown in the figure, measure the clearance between gear 4 gear and gear 5 gear. The standard value is lower than 0.058mm.



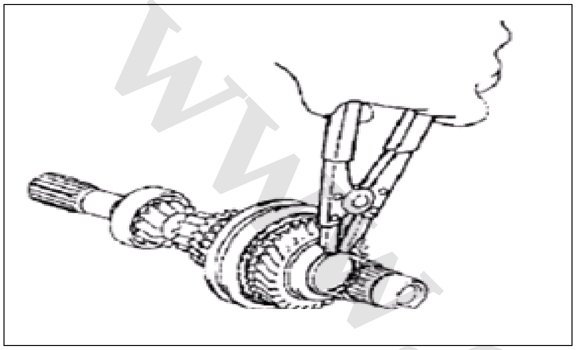
As shown in the figure, position the input shaft assembly with a press machine, hold the bottom of the input shaft with one hand, and remove the gear sleeve, hub and gear 5 gear.



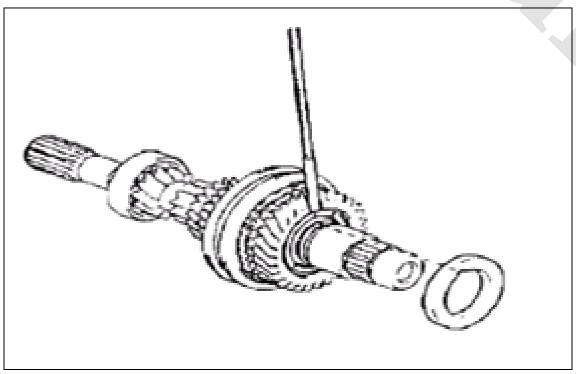
Measure the axial clearance of gear 4 gear. The standard value is 0.1-0.55mm.



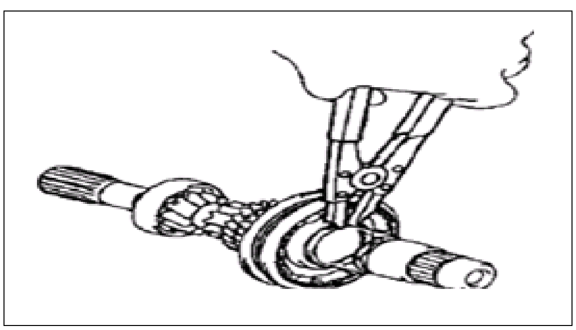
Take down the snap ring for shaft with a snap ring.



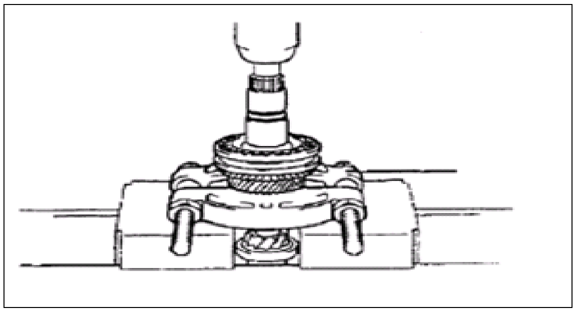
Take out the positioning ball with a magnetic bar, and dismantle gear 3 and gear 4 synchronizer gear rings.



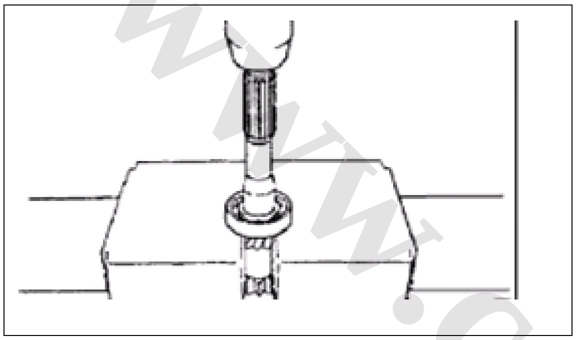
Take down the snap ring with a snap ring.



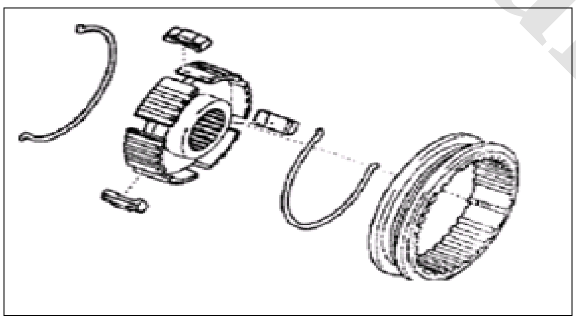
As shown in the figure, remove the synchronizer, synchronizing ring and gear 3 gear.



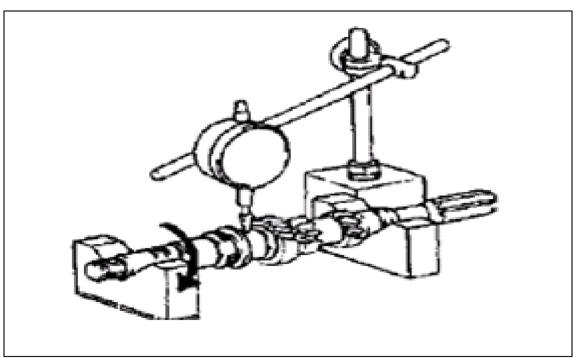
Take down the radial bearing.



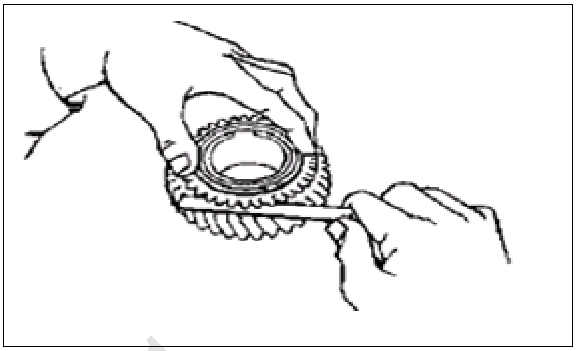
As shown in the figure, disassemble the synchronizer assembly.



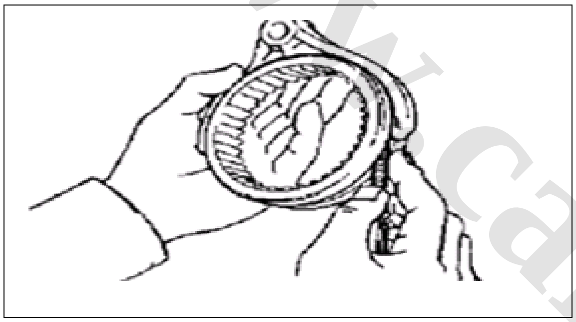
As shown in the figure, check the radius run-out of the input shaft. The maximum is 0.04mm.



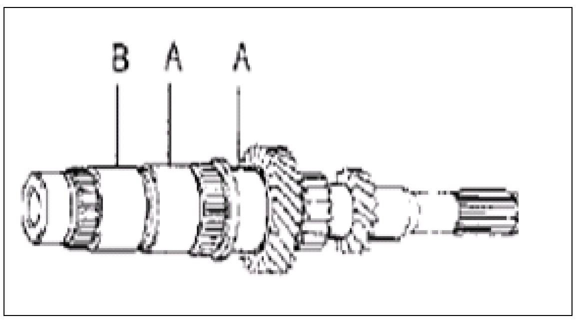
Measure the clearance between the synchronizing ring and the gear end face with a feeler gauge. The minimum is 0.2mm. Otherwise, replace the synchronizing ring.



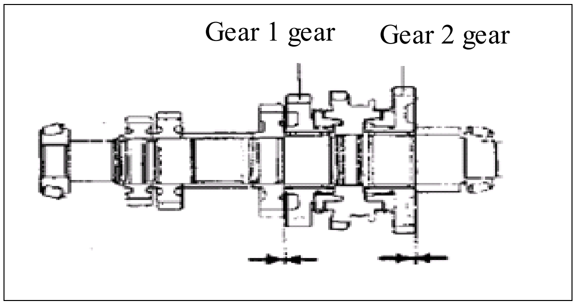
Check the distance between the gear sleeve and the shift fork with a feeler gauge. The maximum is 0.80mm. Otherwise, replace the gear sleeve and shift fork.



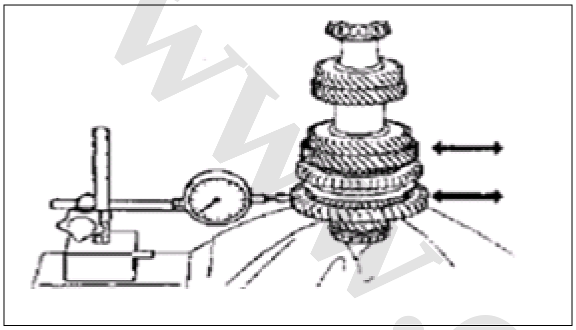
Measure the abrasion of the input shaft with a micrometer. The minimum diameter of surface A is 33.985mm. If exceeding the limit, replace the input shaft.



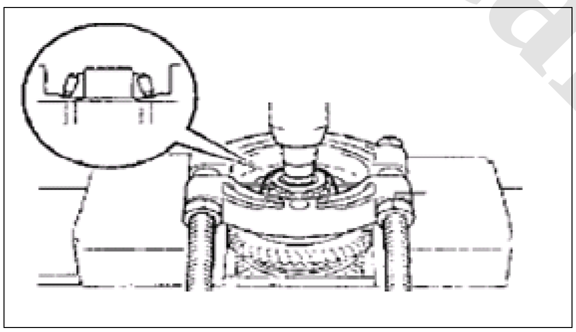
Measure the axial clearance of gear 1 and gear 2 gears of the output shaft with a feeler gauge: 0.1-0.35mm (gear 1) and 0.1-0.35mm (gear 2).



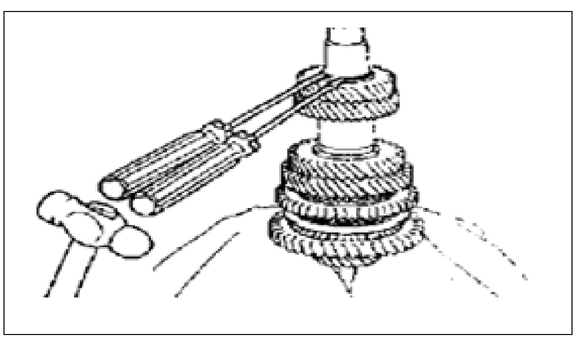
As shown in the figure, measure the radius run-out of gear 1 and gear 2 gears. The maximum is 0.056mm.



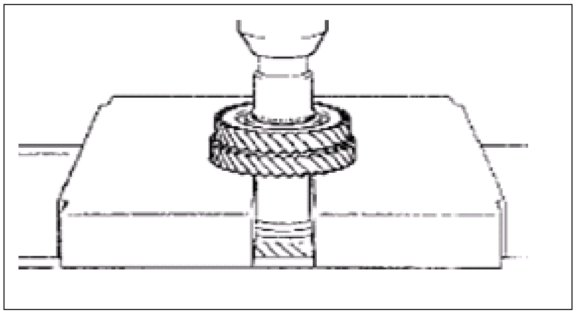
As shown in the figure, take down the conical bearing.



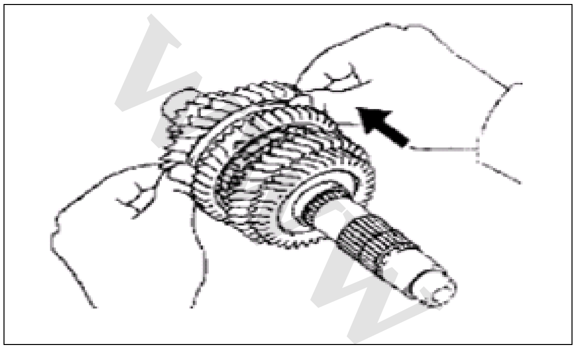
As shown in the figure, remove the spring snap ring from the output shaft.



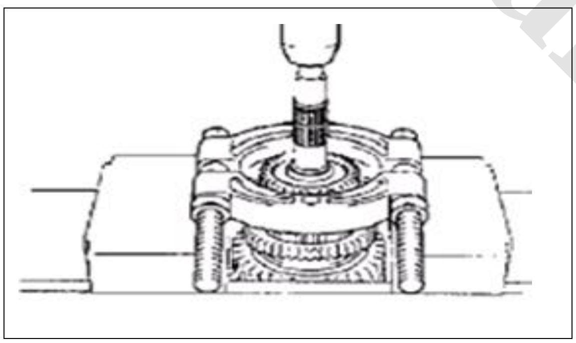
Take down gear 4 and gear 5 gears with a press machine.



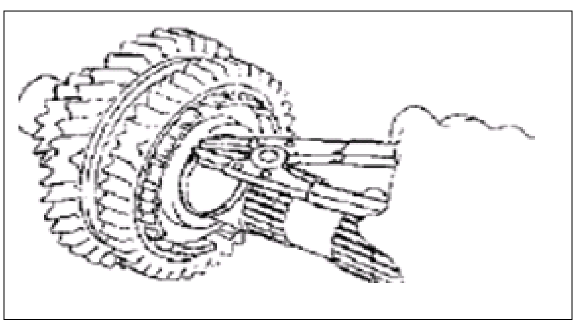
Move gear 1 and gear 2 gear sleeves to gear 1 gear.



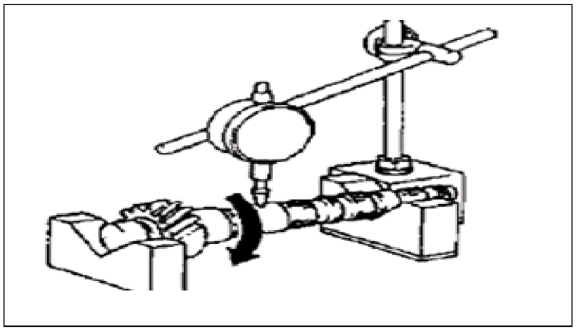
Remove gear 3 gear, needle bearing, synchronizing ring and gear 2 gear with a press machine.



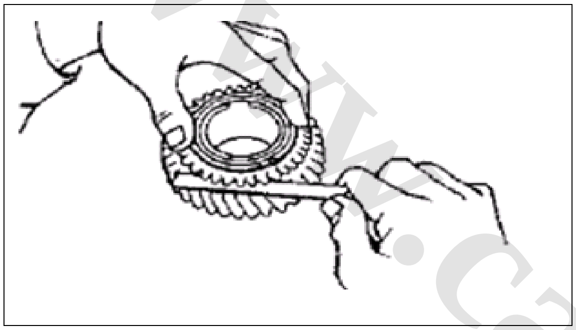
Remove the snap ring with a snap ring.



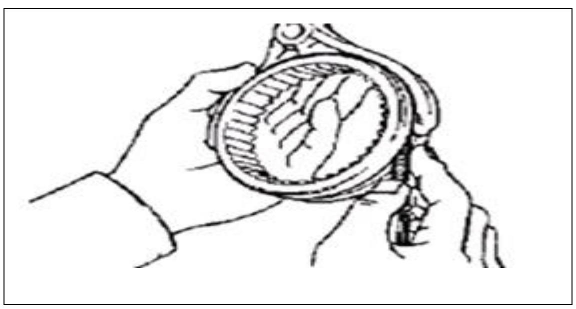
As shown in the figure, measure the circular run-out of the output shaft. The maximum is 0.03mm. If exceeding the limit, replace the output shaft.



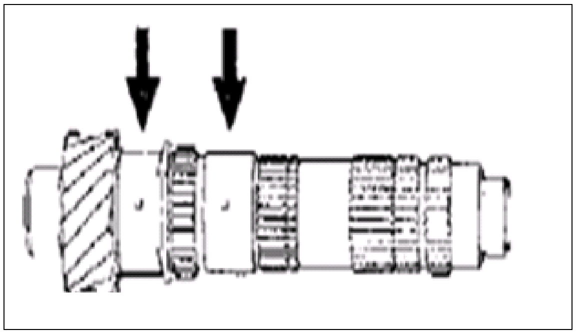
Check the clearance between the back of the synchronizing ring and the gear spline end face with a feeler gauge. The minimum clearance is 0.2mm. If exceeding the limit, replace the synchronizing ring.



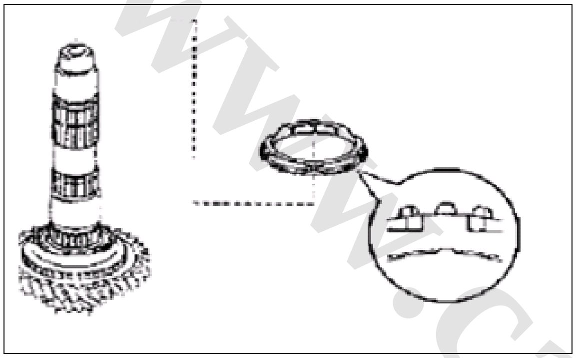
Check the distance between the gear sleeve and the shift fork with a feeler gauge. The maximum is 0.35mm. Otherwise, replace the gear sleeve and shift fork.



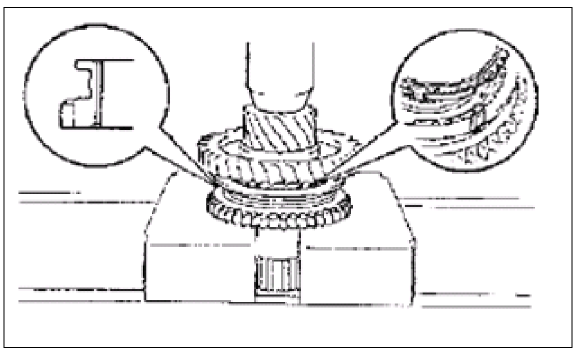
Measure the abrasion of the output shaft with a micrometer. The minimum diameter of the surface is 33.984mm. If exceeding the limit, replace the output shaft.



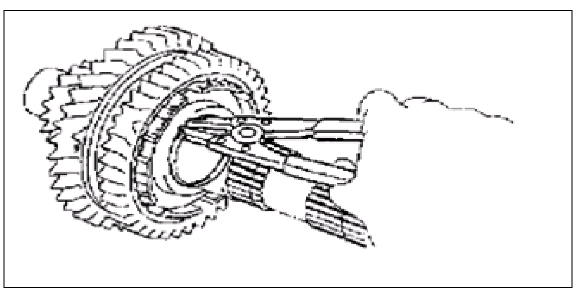
Install the output shaft. Install gear 1 gear and the synchronizing ring in the direction shown in the figure.



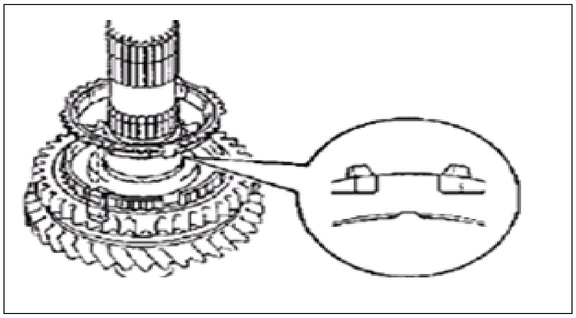
Install gear 1 and gear 2 synchronizers in the output shaft in the direction shown in the figure.



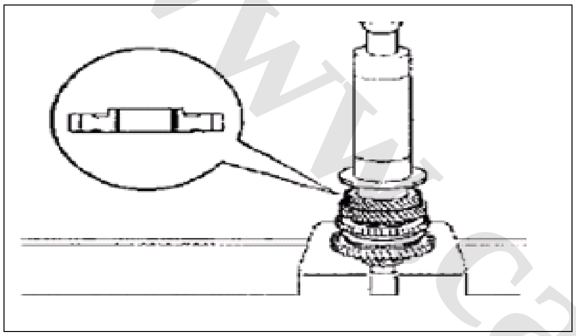
Replace the stretching spring with a new snap ring for shaft.



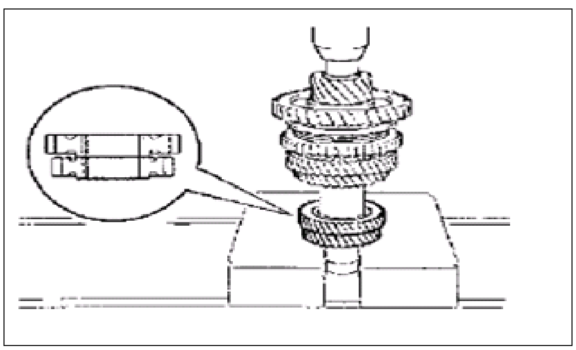
Install the synchronizer, the needle bearing and gear 2 gear.



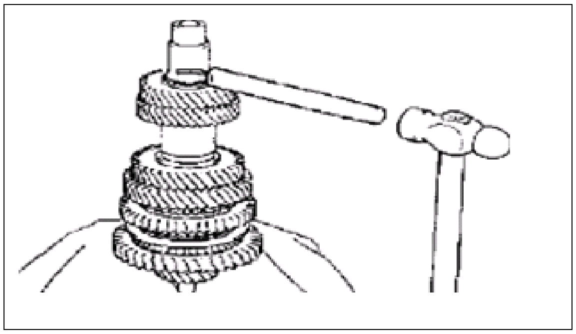
As shown in the figure, press gear 3 gear in the output shaft with a press machine in the direction shown in the figure.



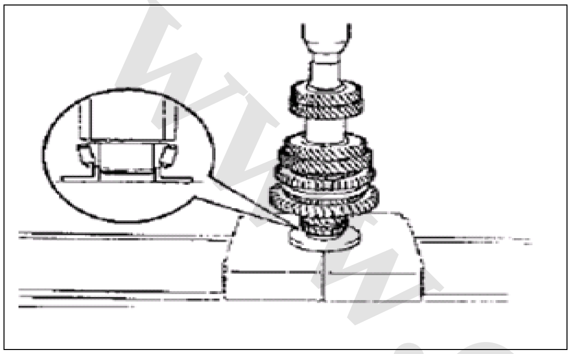
Press gear 4 and gear 5 gears in the output shaft with a press machine in the direction shown in the figure.



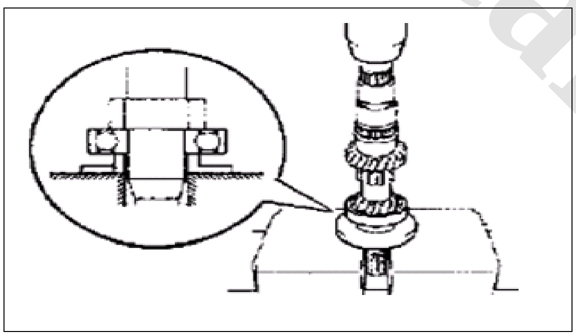
Install a new snap ring in the output shaft.



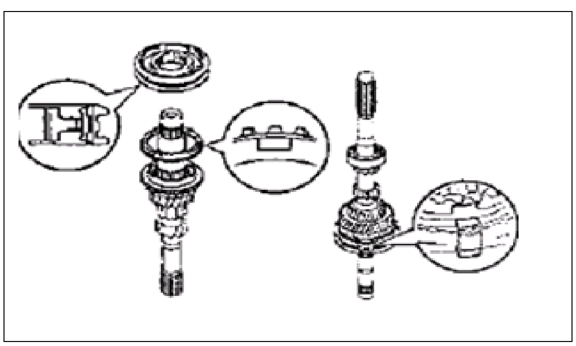
Press the taper bearing in the output shaft.



Install input shaft. Press the taper bearing in the input shaft with a press machine.



As shown in the figure, install the needle bearing, gear 3 gear and 3rd gear synchronizing ring and install the synchronizer assembly in the direction shown in the figure.



Install a new snap ring in the input shaft.

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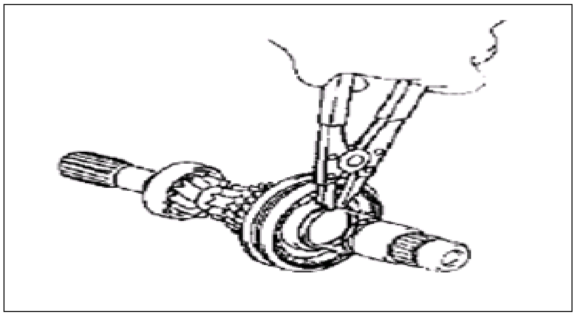
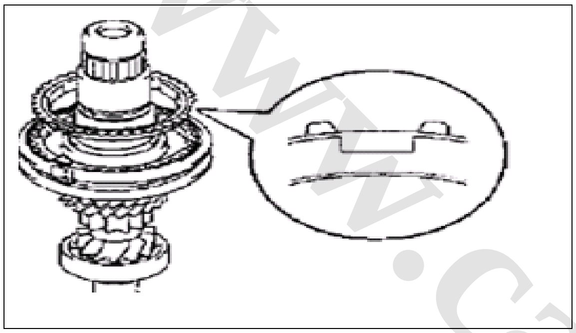
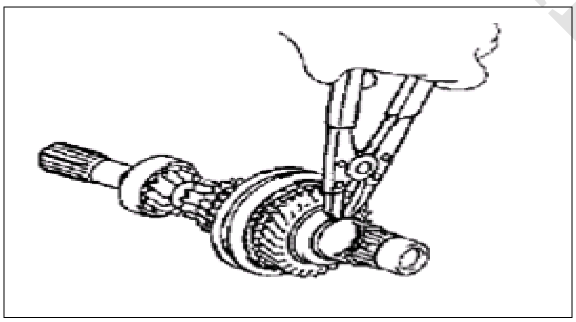


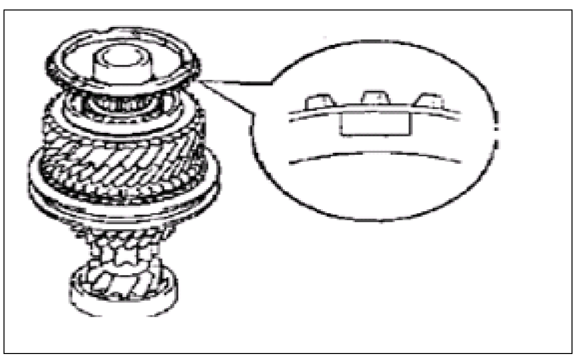
Install the needle bearing, Synchronizer, 3rd-4th speed assembly in the direction shown in the figure, gear 4 gear in the input shaft and the positioning ball and pass the 5th gear thrust washer smoothly through the ball and to the input shaft.



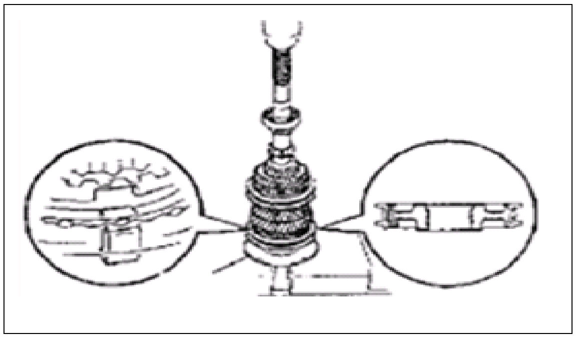
Install the snap ring with the above-mentioned method.



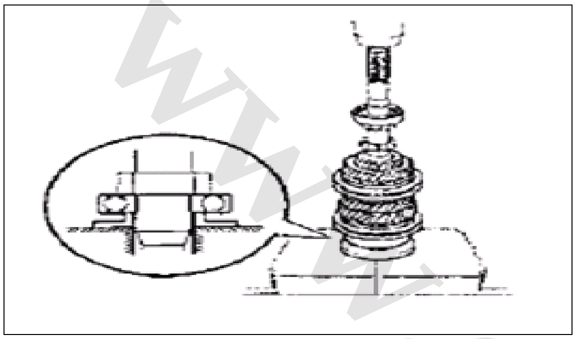
Install the needle bearing, gear 5 gear, 5th gear synchronizing ring as shown in the figure.



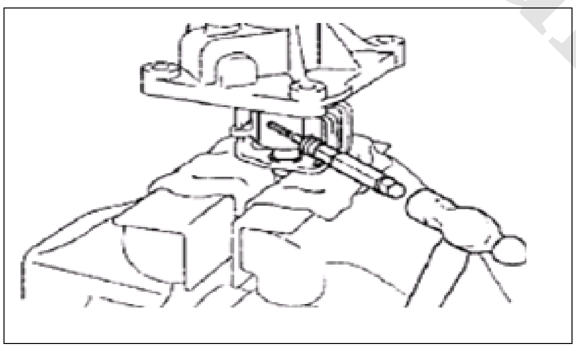
Install the synchronizer assembly in the direction shown in the figure.



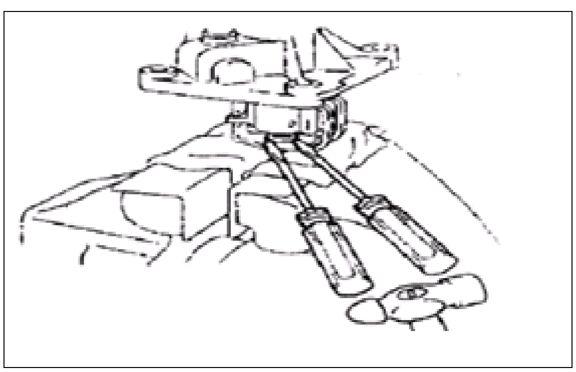
Press the bearing in the input shaft with a press machine.



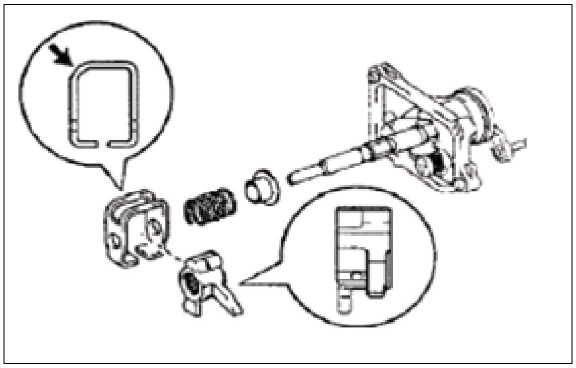
Remove the shift mechanism: Take down the elastic cylindrical pin from the shift swing link with a pin remover and a hammer.



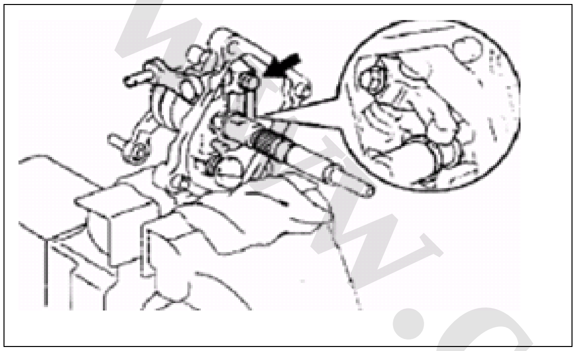
Take down the snap ring as shown in the figure.



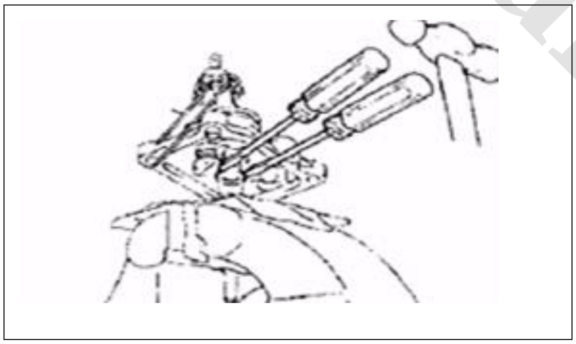
Disassemble the interlock bracket, shift swing link and washer as shown in the figure.



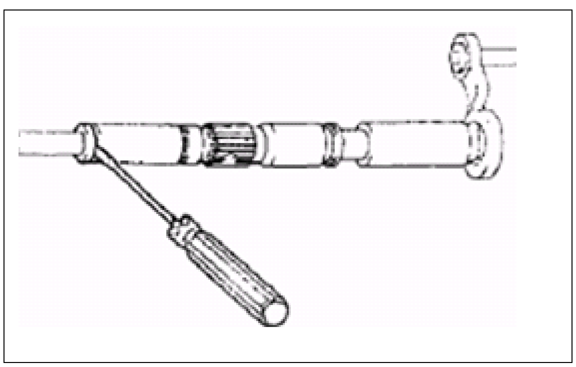
Remove the shift swing link and the bolt.



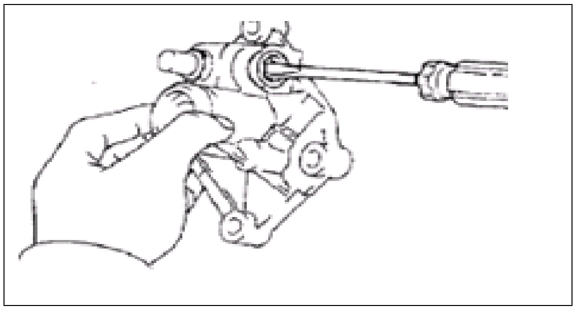
Remove the snap ring as shown in the figure.

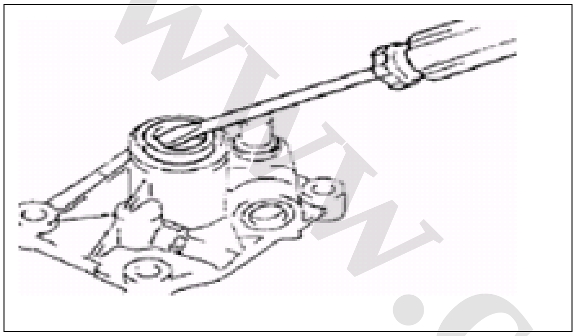


Remove the shift shaft and dustproof cap from the shift cover and take down the washer as shown in the figure.

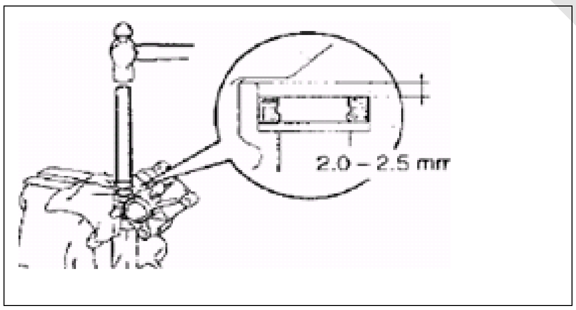


Take down the shift cover oil seal with a screw driver as shown in the figure.

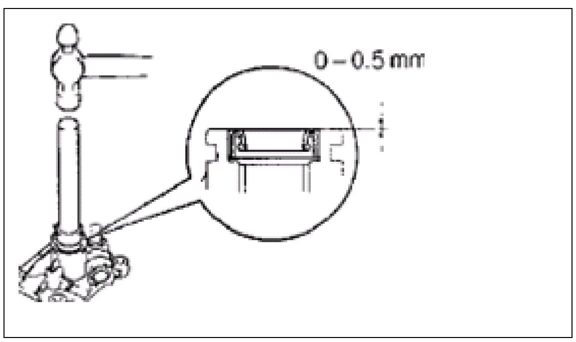




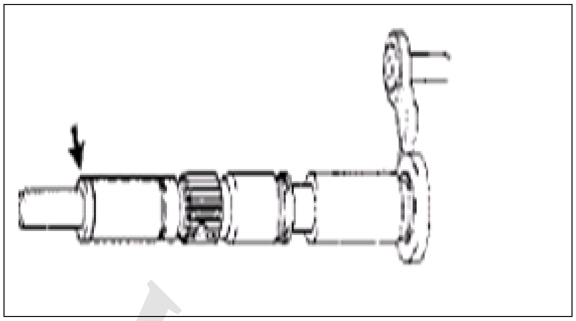
Installation: Press down the shift cover oil seal as shown in the figure. After that, the distance between the oil seal end face and the oil seal hole end face is 1.0-1.5mm.



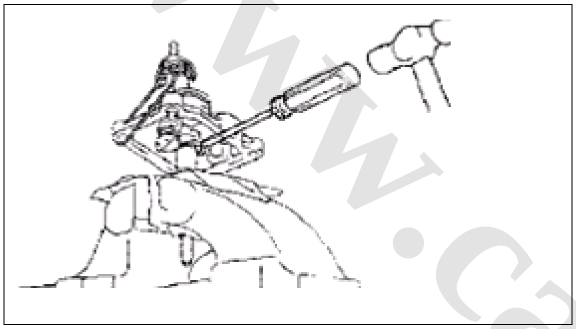
Press down another oil seal as shown in the figure. After that, the distance between the oil seal end face and the oil seal hole end face is 0-0.5mm.



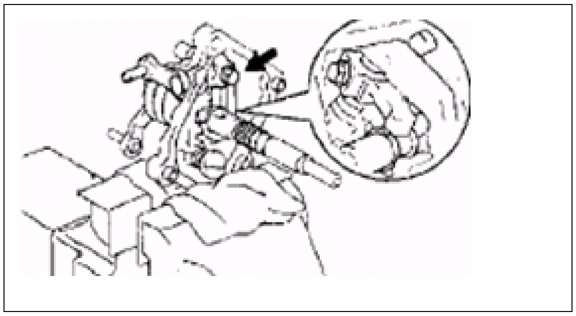
Install the washer into the shift guide shaft, and the dustproof cap on the guide shaft and then the shift cover.



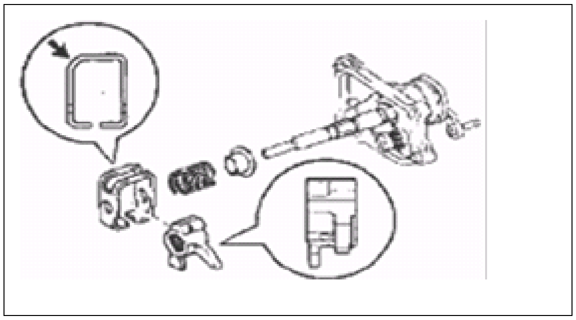
Press a new snap ring in the shift guide shaft.



Apply the fastening sealant to the bolt, and then connect the switchover swing link shaft with the switchover cover with a bolt. The torque is 18-20N.m.

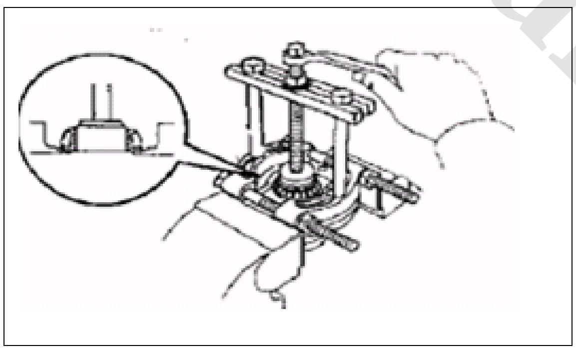


Install A washer, spring, interlock frame and shift swing link on the shift guide shaft orderly in the direction shown in the figure, and then install the elastic cylindrical pin in the shift swing link. After that, the distance between the rear end and the hole mouth is 0-0.5mm.

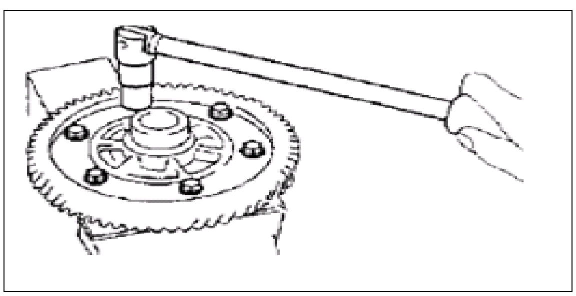


Install a new snap ring as shown in the figure.

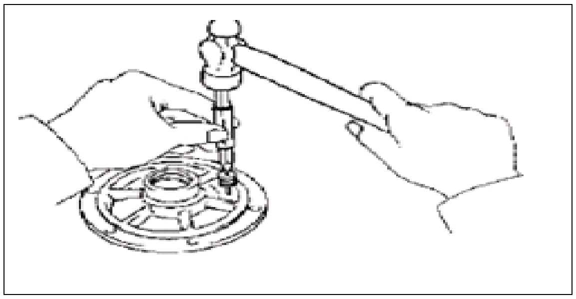
Remove the differential housing bearing as shown in the figure.



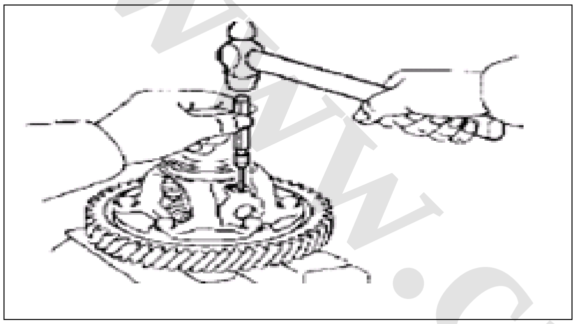
Orderly remove the retaining bolt of the differential and main reduction gear



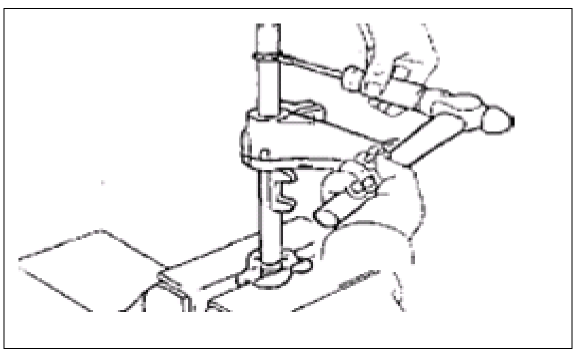
Take out the elastic cylindrical pin with a pin remover, and orderly take out two differential gear and washers, two semi-cycle gears and washers and gear shafts.



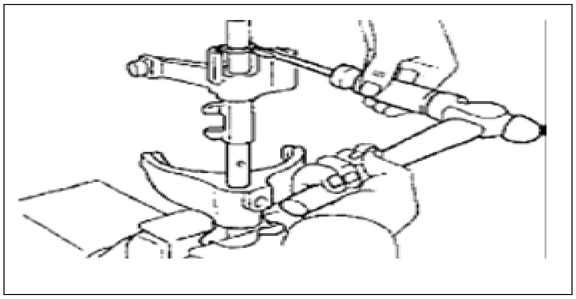
Installation: Orderly press two half-shaft gears and washers differential housing, and two planet gears and washers in the differential housing, insert the planet gear shaft and a new elastic cylindrical pin as shown in the figure.



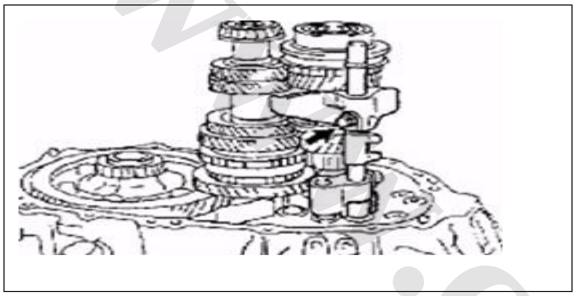
Installation: Install gear 3th and gear 4th fork shafts as shown in the figure and press in a new fork shaft snap ring.



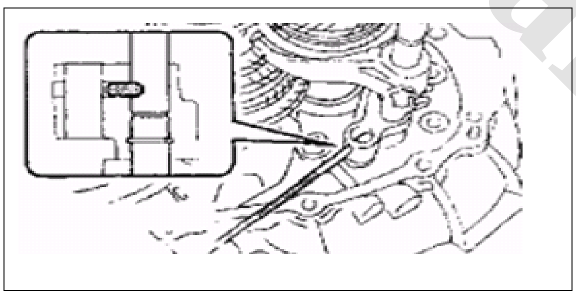
As shown in the figure, install the reverse gear piece and fork shaft spring.



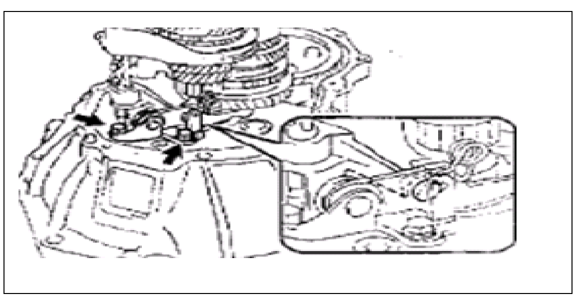
Install gear 3th and gear 4th fork shafts in the clutch housing end face, and gear 3th and gear 4th shift fork in the gear sleeve groove and screw down the bolt. The torque is 10-12N.m.



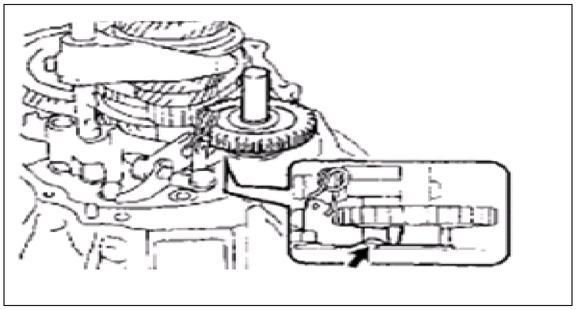
As shown in the figure, install the interlock pin in the reverse gear shift.



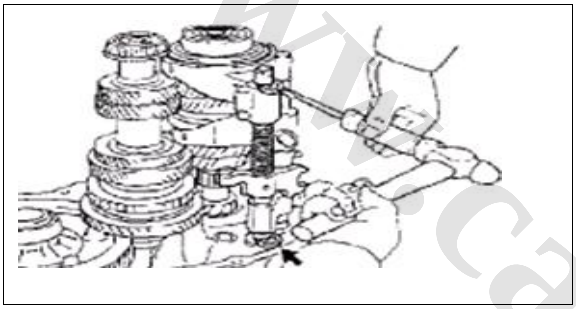
As shown in the figure, use two bolts to install reverse gear swing arm bracket. The torque is 17N.m. And put the reverse gear head in relevant hole of the reverse gear swing arm.



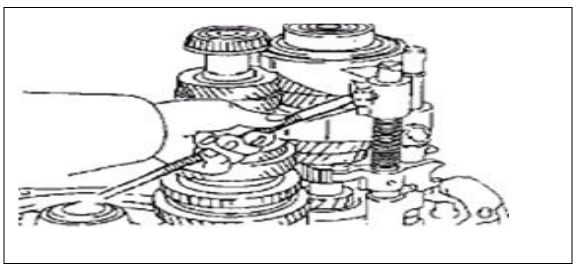
As shown in the figure, put the head of the reverse gear swing arm in the reverse gear groove.



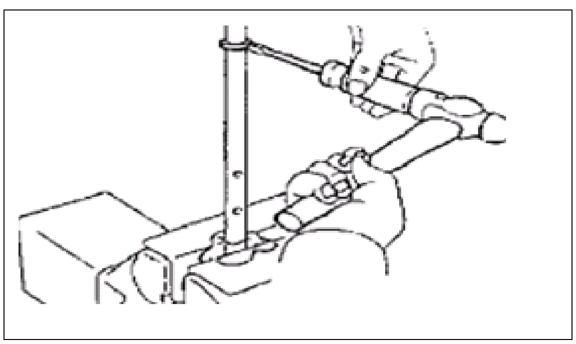
As shown in the figure, install the reverse gear fork, spring and 5th gear reverse gear guide block on the 5th gear reverse gear fork shaft, and put 5th gear reverse gear fork in the gear 5 gear sleeve, and then install them to the clutch housing end face.



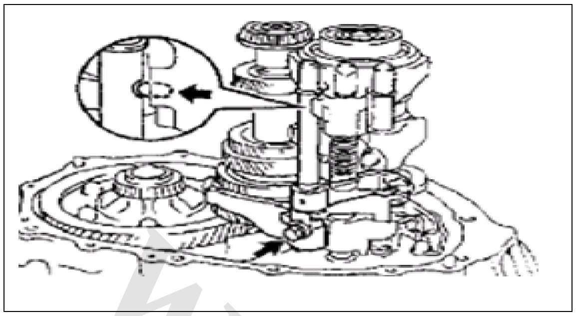
Install two new fork shaft snap rings and install the interlock pin in the position shown in the figure.



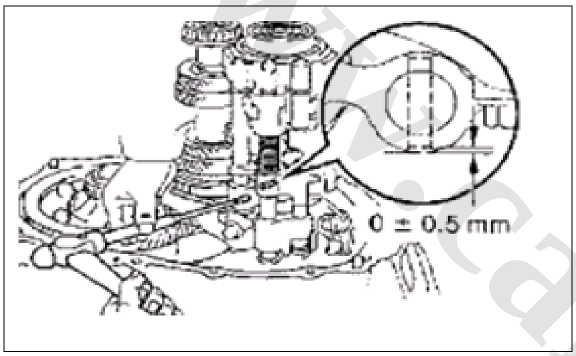
Install two new fork shaft snap rings.



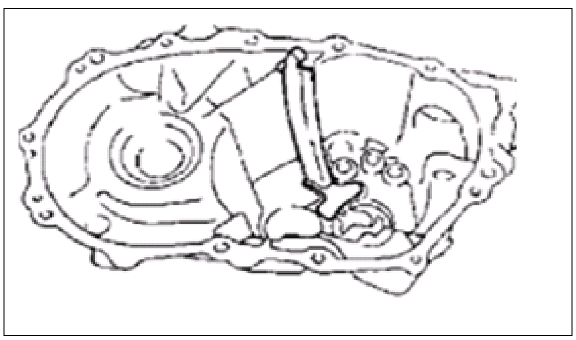
Install gear 1 and gear 2 reverse gear forks to the fork shaft and put the fork claw in gear 1 and gear 2 gear sleeves and put them in gear 1 and gear 2 guide blocks. Screw down the bolt. The torque is 10-12N.m.



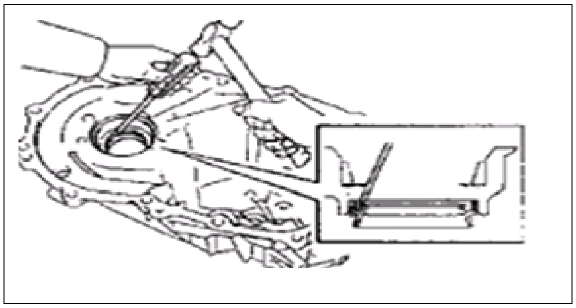
As shown in the figure, install the elastic cylindrical pin to the guide block.



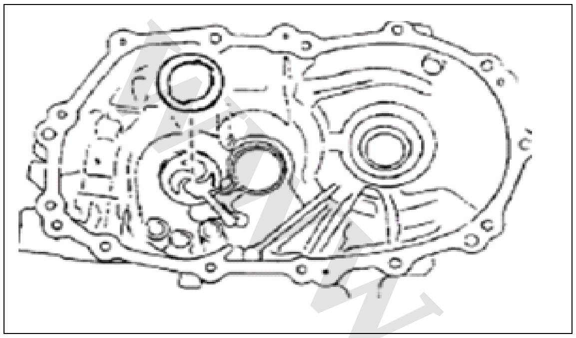
Install the lubricating pipe as shown in the figure.



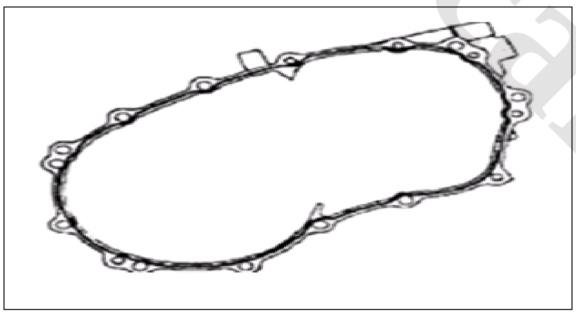
Take out the oil seal as shown in the figure, and install a new oil seal to the transmission housing.



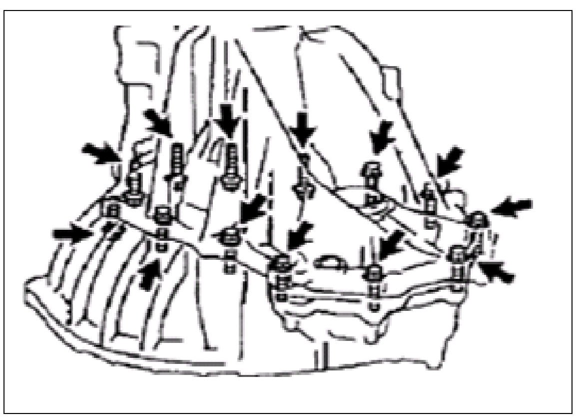
Install the selected regulation washer to the transmission housing.



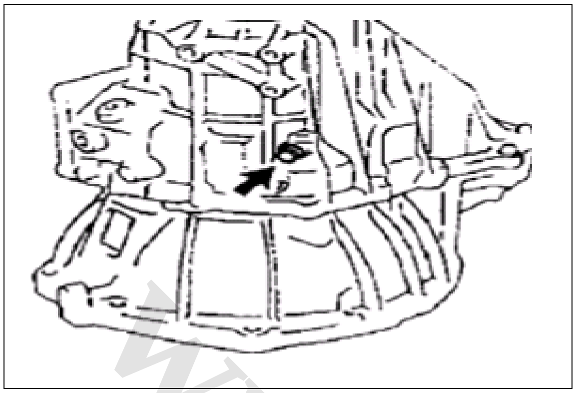
As shown in the figure, apply sealant to the house mating surface.



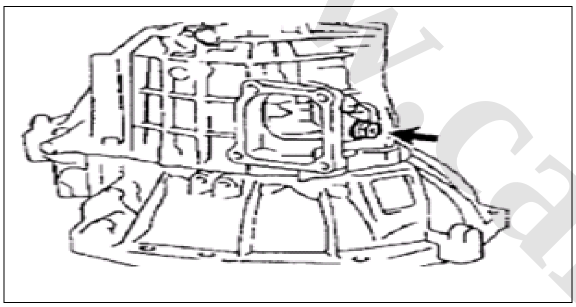
As shown in the figure, screw down relevant bolts connecting the clutch. The torque is 24-28N.m.



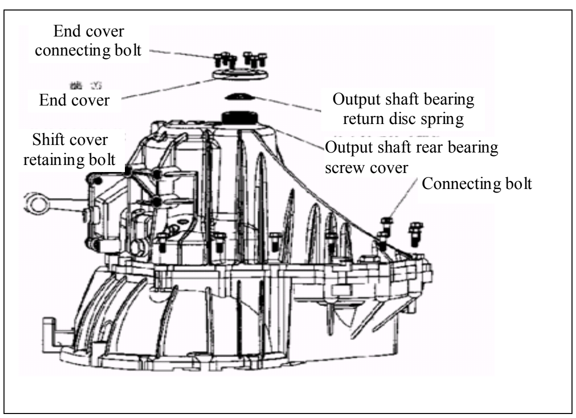
Apply the fastening glue of bolt to the connecting bolt of the reverse gear shaft, cover the washer and fasten the reverse gear shaft on the transmission housing. The torque is 24-28 N.m.



Install the shift lever positioning assembly on the transmission housing. The torque is 37N.m.



Press the output shaft rear bearing cover in the transmission housing. The torque is 40N.m. Put the output shaft bearing return disc spring in the output rear bearing screw cover in the direction shown in the figure. Screw down the screw cover with a bolt. The torque is 8-10N.m.



Assembly Instruction

The transmission assembly should obey the reverse order of the removal and must comply with the following notes:

Clean the parts before assembly to maintain the cleanness of the case and ensure the lifetime of the transmission.

In the installation, be careful to avoid oil leakage due to oil seal scratch. And use special protection sleeve.

Clean the mating face before applying the sealant to avoid oil leakage.

Tightening torque of all screws should comply with the values shown in Attached Table 1.

When installing the input shaft oil seal and the differential oil seal, apply the lubricating grease to the lip mouth of the oil seal and press the oil seal in the transmission housing with a special tool.

Installation of the bearing stopper ring and the needle bearing. Pay attention to the direction of the bearing stopper ring and contact the inner diameter of the bearing stopper ring with the bearing seat.

Keep the side with tooth face the 1st gear driven gear in the installation of 1st gear and 2nd gear synchronizers.

Install the reverse idler and idler shaft into the clutch housing. Keep the idler shaft screw hole outward.

Install the reverse idler and idler shaft into the clutch housing. Keep the idler shaft screw hole outward.

Firstly put the fork shaft balance spring in the fork shaft hole of the clutch housing in the installation of the fork shaft. Install the fork assembly in the proper position.

In the installation of the gear-selecting and shift mechanisms, turn each gear of the transmission to the neutral position, put the shift return spring in the mounting hole of the shift guide shaft. After adjusting the position of the gear-selecting and shift mechanism, align them and install them to the gear-selecting and shift positioning seat.

Repair and Adjustment

To ensure the repair quality of the driver, carefully operate it and keep it clean. Try to use special repair tools.

Sealant

The sealant must be replaced after the transmission is disassembled. Clean the contact surface before replacing. The sealant should be even and suitable.

Oil seal

Before installation, apply a thin layer of lubricant to the outer circumference and fill up the opening of the oil seal with lubricating grease.

After installation, check the lubricant quantity of the driver and refill lubricant.

Snap ring

Never overextend the snap ring to avoid deformation; otherwise replace it. Keep the snap ring completely in the ring groove.

Bolt-nut

Loosen and screw down the bolts and nuts on the end cover and the housing of the driver diagonally. Tightening torque is suitable for oil-free bolt and nut.

Bearing

In the installation of the needle bearing, keep the thicker side toward the mounting tool. Lubricate all bearing with transmission oil when installing. Before installation, heat the inner ring of the cone needle bearing to 100°C. The same size inner ring and outer ring are irreplaceable.

Replace the cone needle bearings on the same shaft at the same time. The bearing models are the same.

Adjusting washer

Repeatedly measure the thickness of the adjusting washer at several positions with a caliper. Check the adjusting washer for burr or damage. If so, replace it.

Synchronizing ring

Use the synchronizing ring corresponding to the original gear.

Lubricate it with transmission lubricant in the installation.

Gear

Clean and heat the gear to about 100ºC before installation.

Transmission lubricant level

Lean leftward 5º in the installation of the transmission assembly. At that time, check the oil level. Even if the oil volume is normal, the lubricant may still overflow in the observation. The remaining lubricant may get weak lubricating effect.

To ensure normal lubricant of 1.8L transmission, the following notes must be obeyed:

The transmission is always sealed. So check the outer tightness of the transmission rather than the lubricant level (not opening the lubricant filling bolt)

After disassembly and repair of the transmission, refill 2-2.2 lubricant before reassembly.

Check the oil level on the removed transmission. Place the transmission at plane position, screw off the drain plug of the lubricant and keep the oil level parallel with drain plug hole.

In case of checking the oil level or replacing the sealing ring, carefully screw off the drain plug in a short time and reinstall it immediately.

Regulation of the tightening torque

Name	Assembly torque (N•m)
Shift locking ball pressure plate	6.9-9.8
Shift lever and shift swinglever licking nut	19.6-29
Shift lever and shift swinglever locking nut	39-49
Shift swinglever bracket assembly	8-10
Release lever assembly	29.4-39.2

Transmission housing and rear end cover closer bolt	8-10
Input shaft assembly locking nut	98.1—137.3
Output shaft assembly locking nut	98.1—137.3
Output shaft bearing locking plate bolt	6.9—9.8
Input shaft bearing locking plate bolt	14.7—21.5
Clutch housing and transmission housing closer	24—28
Odometer lock plate bolt	6.9—9.8
Air plug	9.8—12.7
Reverse gear switch assembly	27—30
Inlet plug	28—34
Drain plug	28—34
Differential assembly	93.2—104.9

Transportation, safekeeping and operation

Transportation and safekeeping of 1.8L transmission

Take anti-rust measures to avoid rust in the transportation and safekeeping of the transmission.

Before transportation, pack the transmission and place it on the transportation rack to avoid damaging the transmission in the normal transportation.

Store the transmission in the dry and ventilated warehouse.

Notes for 1.8L transmission operation

Completely step down the clutch pedal in the shift to make the transmission rapidly control the gear lever without the engine torque.

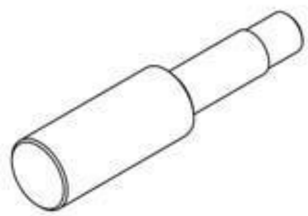
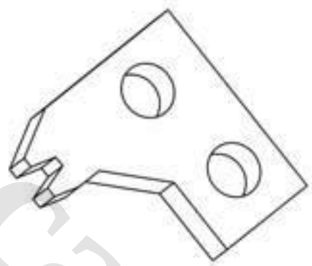
Select the low speed gear while climbing and turning, and never slide while the clutch is disengaged.

When it’s difficult to operate the gear lever, stop to check the cause with slight push power.

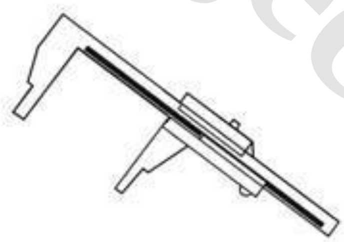
Clutch

Preparation

1. Special Tools

S/N	Tools	Contour Drawing	No.	Description
1	Clutch pressure plate positioning tool			Used for installing and positioning the clutch pressure plate and driven plate
2°	Flywheel stopper			Used for preventing the flywheel from rotating when removing the clutch pressure plate

2. Recommended Tools

S/N	Tools	Contour Drawing	No.	Description
1	Vernier Caliper			For measuring the clutch wear
2°	Pipe wrench			Remove the oil pipe bolt and the clutch bleed plug

Repair Specifications

1. Table of Technical Specifications

Height from the clutch to the floor	150±15mm
Clutch Pedal Free Stroke	≤10mm
Clutch pressure plate diaphragm spring wear limit	0.8mm
Clutch driven plate wear limit	1.3mm

2. Torque Specifications

Item	N·m
Locknut of stop bolt	12~18
Push rod lock nut	20~25
Connecting bolt between the clutch pedal and the bracket	12~18
Joint between clutch operating tube I and clutch master cylinder	20～26
Clutch master cylinder (master pump) fixing nut	19~24
Clutch slave cylinder fixing bolt	20~26
Clutch pressure plate fixing bolt	30~34

Precautions

1. It is recommended to use clutch hydraulic oil brake fluid "DOT4", and do not use mineral oil such as gasoline or kerosene. Otherwise it will corrode the rubber parts in the hydraulic system.
2. Do not re-use the drained clutch hydraulic oil.
3. Do not splash clutch hydraulic oil over the vehicle body paint surface.
4. Clutch pressure plate can’t be washed with gasoline!
5. Don't clean the release bearing with oil or liquid substances because the release bearing is filled with grease.
6. While mounting the clutch, the temperature and pressure resistant grease shall be

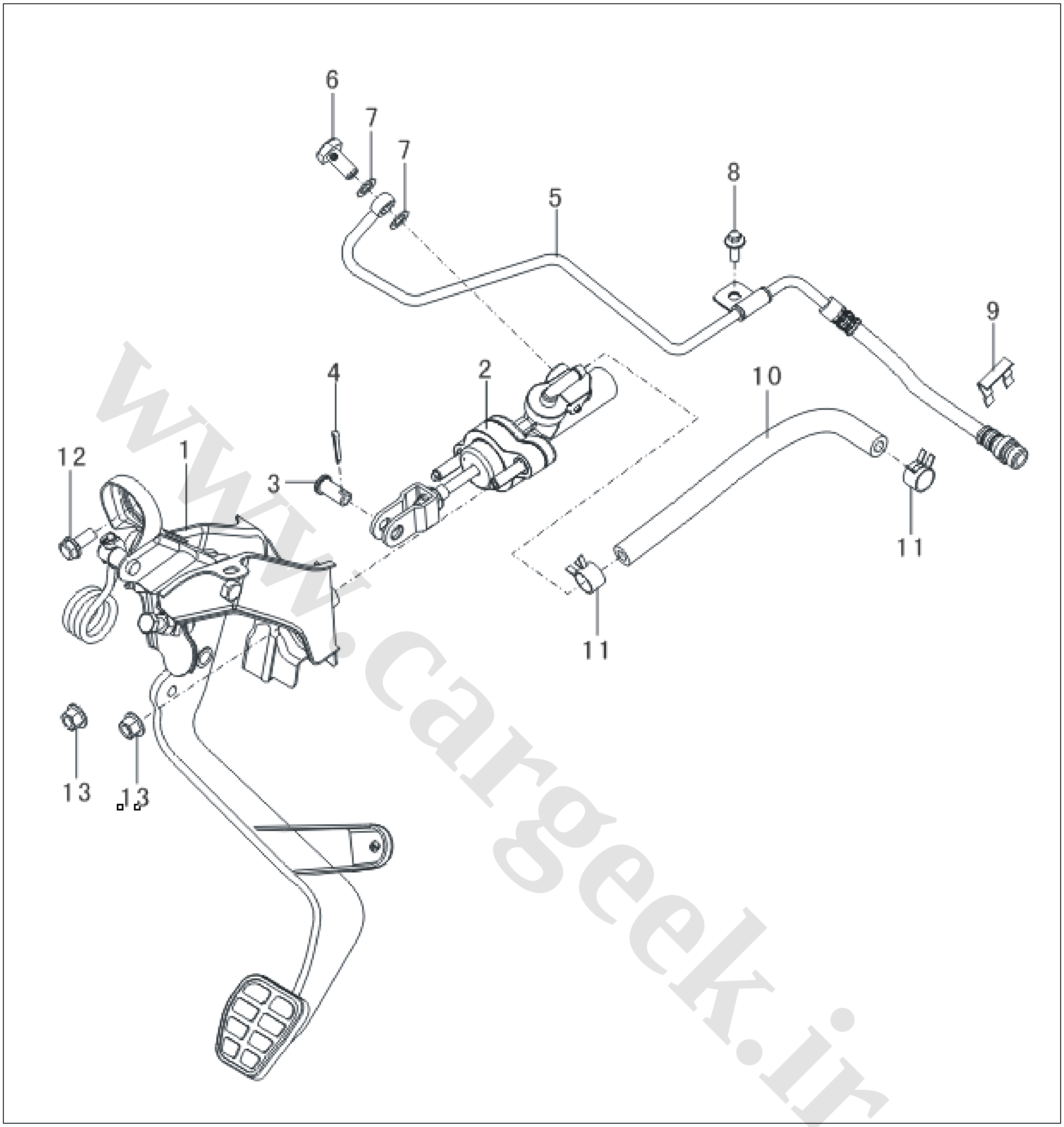
used to properly lubricate the driven plate spline and the transmission first shaft spline to ensure the driven plate could move freely on the transmission first shaft spline. (Excessive lubrication will result in slipping of the friction plates)

7. When the friction plate is worn down to the prescribed limit, the driven plate assembly should be replaced timely, in order to avoid scratches on the pressure plate and flywheel surfaces due to slipping of the clutch.

Warning:

Please use a vacuum cleaner but never compressed air to clean the clutch friction plates!

Component Figure (Clutch Operating Mechanism)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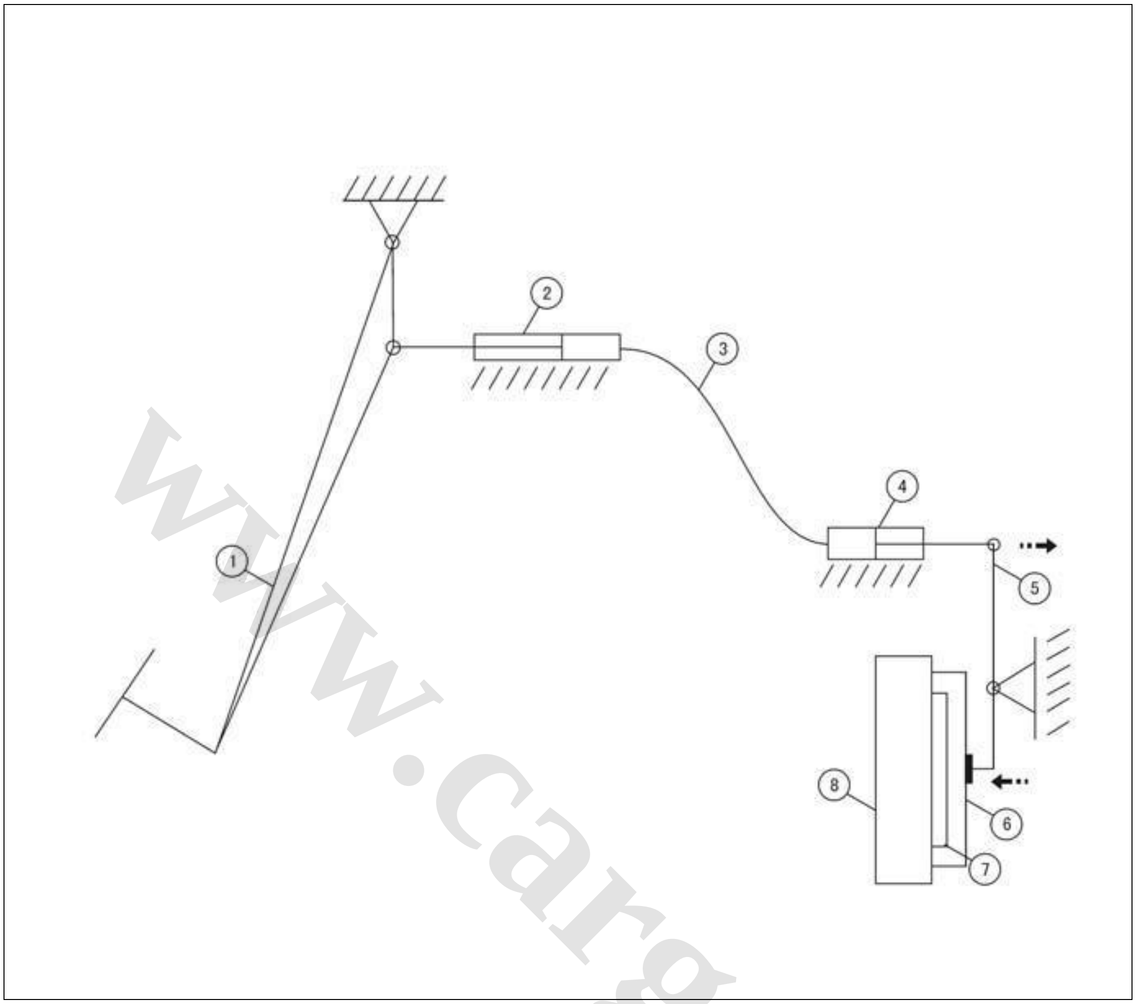
1	Clutch pedal assembly	8	Hexagon bolt with flange
2°	Clutch master cylinder assembly	9	Card
3	Axle pin	10	Master oil inlet I of clutch master cylinder
4	Split pin	11	Steel belt type elastic hoop
5	clutch operating tube Ⅰ	12	Hexagon-headed bolt and taper spring washer component
6	Clutch hollow bolt	13	Hexagon bolt with flange
7	Gasket		

System Description

1. Clutch Operation Schematic



1	Clutch pedal	5	Clutch release fork
2	Clutch master cylinder	6	Pressure plate
3	Clutch hydraulic line	7	Driven plate
4	Clutch release cylinder	8	Flywheel

2. Descriptions of Principles

Clutch control can control the engagement and release of clutch through remote hydraulic control method, to achieve power transmission and cut off between engine and transmission. Detailed processing is shown as follows:

(a). While releasing: driver depresses clutch pedal and by using push rod on pedal and clutch main cylinder to push clutch-used special hydraulic oil in existing main cylinder into separation cylinder through pipeline consisting clutch hard pipe and hose. And then push release bearing shaft move forwards through shift fork. So as to push the release of clutch pressure plate diaphragm spring, and enlarge the distance between pressure plate and flywheel and clearance of chamber formed by driven plate and flywheel. Driven plate gradually can't transmit power to input shaft of transmission due to gradual reduction. Power transmission is cut off.

(b). When engaging: driver slowly release clutch pedal. Release of diaphragm spring of pressure plate refers to gradual return due to reduction of pressure. Lever effect makes sub-cylinder liquid chamber reduce, while liquid chamber of main cylinder slowly increase and push clutch pedal gradually rise up. Meanwhile the clearance between pressure plate and flywheel gradually reduces, so the clearance between driven plate, flywheel and pressure plate reduces and driven plate gradually can transmit power to input shaft of transmission due to the gradual increase of friction and power is transmitted.

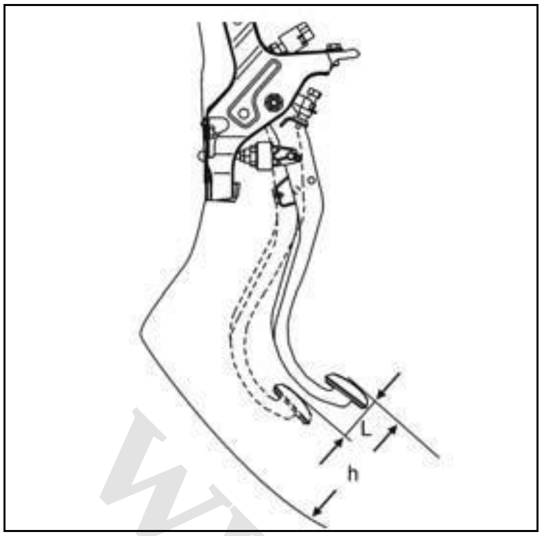
On-Vehicle Check

1. Check the clutch

(a). When engine is at idle speed, only depress clutch pedal almost completely can clutch be cut off; or when depress clutch pedal, you feel that it is difficult to gear on or transmission gear produces sharp crash sound; or vehicle begins to travel even when clutch pedal isn't released after gear on, all of which indicate the incomplete separation of clutch.

(b). Causes of clutch slipping: clutch pedal has small free stroke and release bearing often presses on diaphragm spring, and pressure plate is always in semi-release condition; pressure plate spring of clutch is soft or broken. Screw connecting clutch and flywheel is loose.

(c). If the clutch has any abnormal sound during operation, it is not normal. The causes of fault: release bearing has serious abrasion, and return spring of bearing is too soft or broken and diaphragm spring bracket has fault, etc.



2. Inspection of clutch pedal

(a). Inspect whether the height h of clutch pedal is correct. If not, adjust it.
Height from pedal to floor:
150±15mm

(b). Depress the pedal until you feel a resistance, and check whether the clutch pedal free stroke L is correct or not. If not, adjust it. Pedal free stroke:
≤10mm

Troubleshooting

Problem Symptoms Table

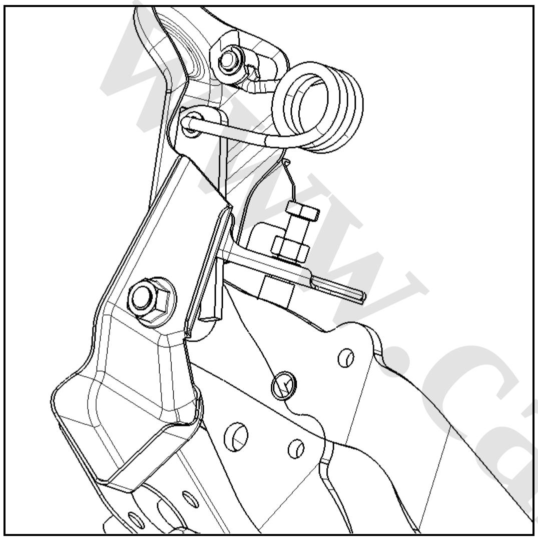
Use the table below to help you find the cause of the problem. Check each part in order. If necessary, repair or replace these parts.

Symptom	Suspected Area	Recommended Action
Clutch seizure/judder	1. Engine or transmission fixed bracket (loose)	Tighten the fixing bolts
	2. Clutch driven plate (big swing action)	Replace the driven plate.
	3. Clutch driven plate (oil stained)	Clean the driven plate
	4. Clutch driven plate (polish)	Replace the driven plate.
	5. Clutch driven plate(hardened)	Replace the driven plate
	6. Driven plate spring (elasticity is weak or spring is broken)	Replace the driven plate.
Clutch pedal soft	1. Clutch oil pipe (air intake)	Exhaust air in clutch system
	2. Rubber cup of master cylinder (damaged)	Replace the master cylinder
	3. Rubber cup of slave cylinder	Replace the cup

	(damaged)	
Abnormal clutch noise	1. Clutch release bearing (worn, damaged)	Replace the release bearing.
	2. Clearance between external spline of input shaft of transmission and spline groove inside driven plate (big)	Replace the driven plate
	3. Driven plate spring (elasticity is weak or spring is broken)	Replace the driven plate.
Clutch won't be disengaged	1. Clutch pedal (free stroke is out of tune)	Adjust the free stroke.
	2. Clutch oil pipe (air intake)	Exhaust air in clutch system
	3. Master cylinder leather (damaged)	Replace the cup
	4. Rubber cup of slave cylinder (damaged)	Replace the cup
	5. Clutch driven plate (deformed)	Replace the driven plate.
	6. Clutch driven plate (big swing action)	Replace the driven plate.
	7. Clutch driven plate (damaged during friction)	Replace the driven plate.
	8. Clutch driven plate (stained or burned)	Replace the driven plate.
	9. Clutch driven plate (oil stained)	Clean the driven plate.
	10. Clutch driven plate (lack of grease on the spline)	Coat the lubricating oil

Symptom	Suspected Area	Recommended Action
Clutch slipping	1. Clutch pedal (free stroke is out of tune)	Adjust the free stroke.
	2. Clutch driven plate (oil stained)	Clean the driven plate.

	3. Clutch driven plate (polish)	Replace the driven plate.
	4. Driven plate spring (elasticity is weak or spring is broken)	Replace the driven plate.
	5. Clutch pressure plate (deformed)	Replace the clutch pressure plate.
	6. Flywheel (deformed)	Replace



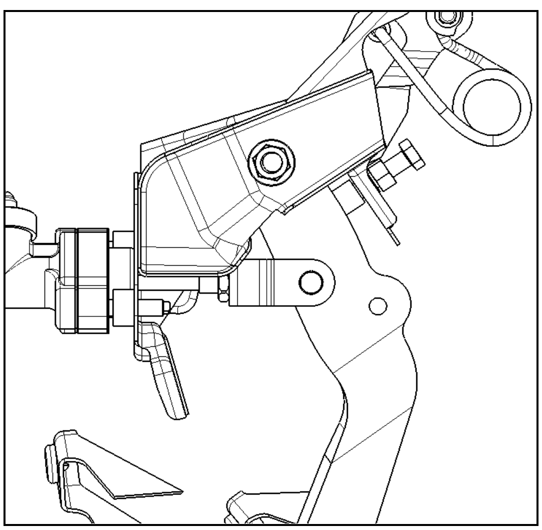
1. Adjust the height of clutch pedal.

(a). Take apart the lower left panel of the dashboard (see the section “Dashboard and auxiliary dashboard” – lower left panel of the dashboard with regard to replacement)

(b). Unscrew locknut of stop bolt of clutch pedal, and adjust pedal to proper height through the adjustment of height of stop bolt.

(c). Tighten locknut of stop bolt.

Torque：12~18N•m



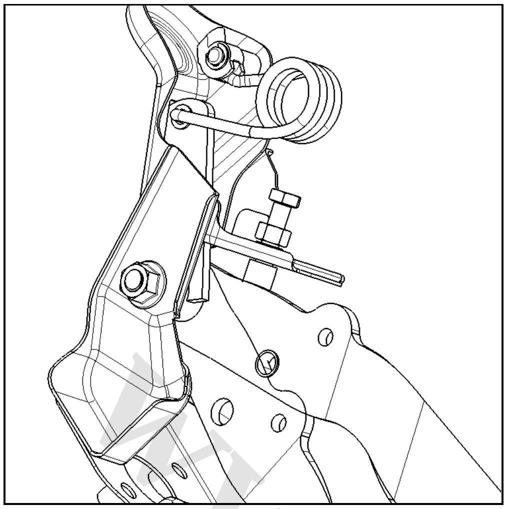
2. Adjust free stroke of clutch pedal

(a). Unscrew locknut of pull rod, and rotate pull rod to adjust the length of pull rod until free stroke of pedal is in proper range.

(b). Tighten locknut.

Torque：20~25N•m

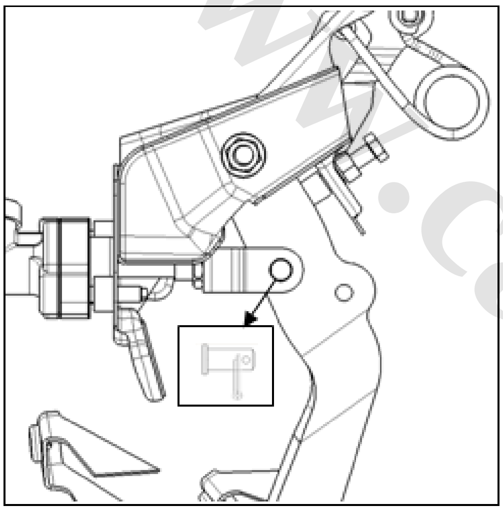
Replace



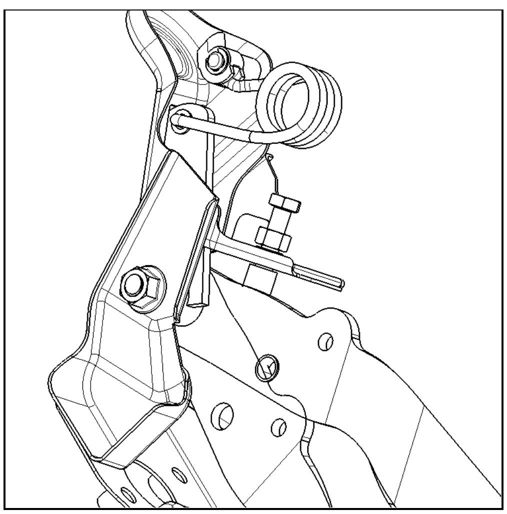
1. Take apart the clutch pedal

(a). Dismantle lower panel of dashboard. (see the section "Dashboard and auxiliary dashboard" – lower left panel of the dashboard with regard to replacement)

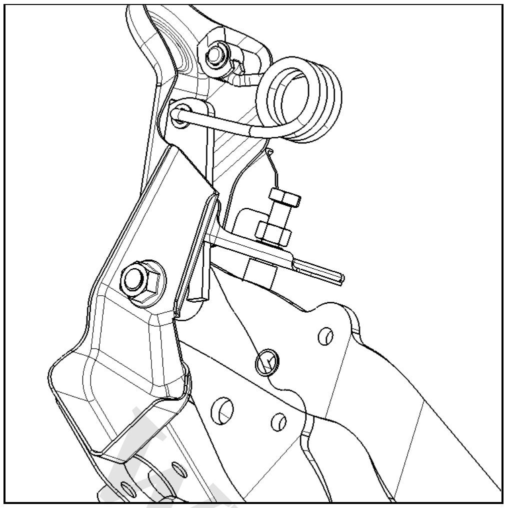
(b). Dismantle return spring of clutch pedal.



(c). Dismantle lock of axis pin of clutch pedal and clutch master cylinder, and remove axis pin.



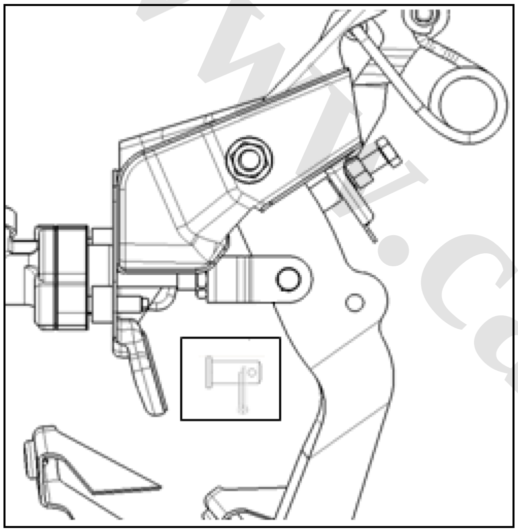
(d). Dismantle connecting bolt of clutch pedal and bracket, and remove clutch pedal.



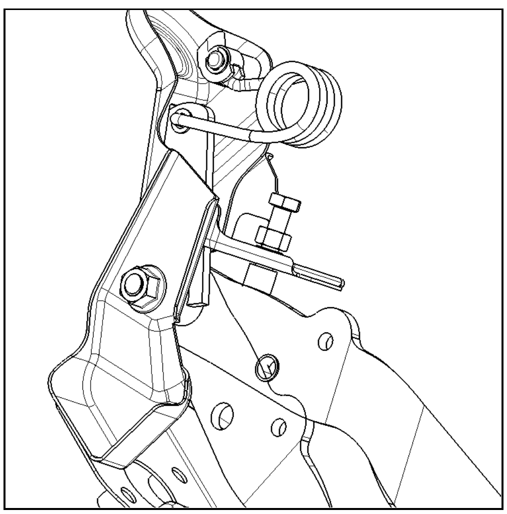
2. Mounting Clutch Pedal

(a). Mount clutch pedal to clutch bracket, mount and fasten bolts and nuts.

Torque: 18~25N•m



(b). Mount the clutch pedal and the clutch master cylinder pin shaft, and then mount the lock pin of the pin shaft.



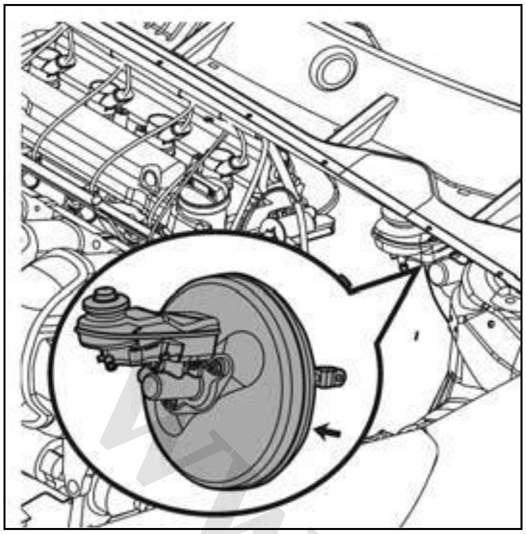
(c). Install return spring of clutch pedal.

(d). Adjust height and free stroke of clutch pedal.

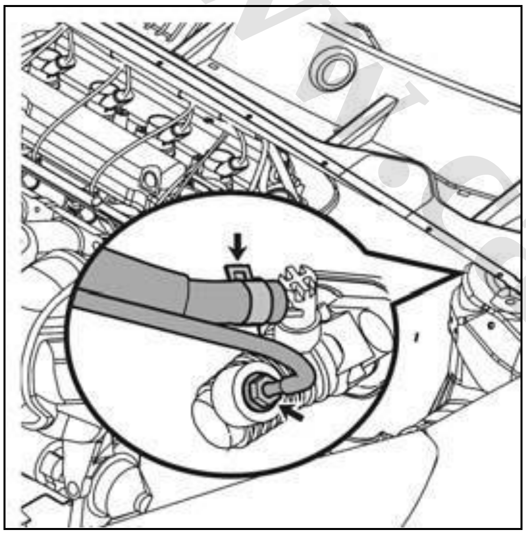
(e). Install lower pedal of dashboard. (see the section "Dashboard and auxiliary dashboard" – lower left panel of the dashboard with regard to replacement)

Clutch master cylinder

Replace



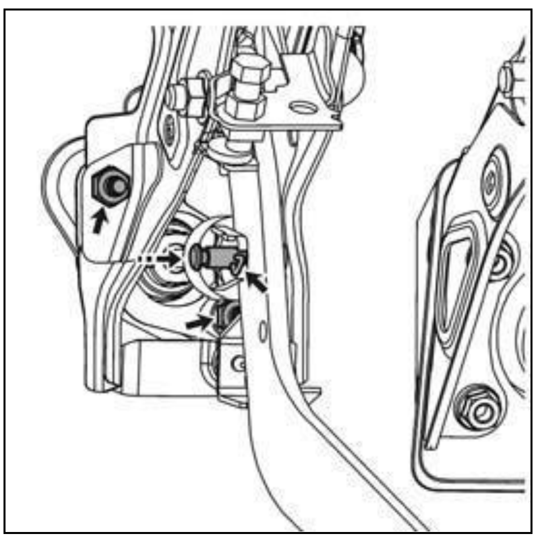
1. Take apart air filter and bracket (see the section "intake and exhaust systems" – air filter with regard to replacement)
2. Drain hydraulic oil in the brake oil can and the clutch line.
3. Take apart brake master cylinder and vacuum booster (see the section "driving brake" – vacuum booster with regard to replacement)



4. Dismantle inlet hose of clutch master cylinder and clutch control oil pipe.

(a). Dismantle inlet hose with elastic snap ring of clutch master cylinder, and unplug inlet hose of clutch master cylinder.

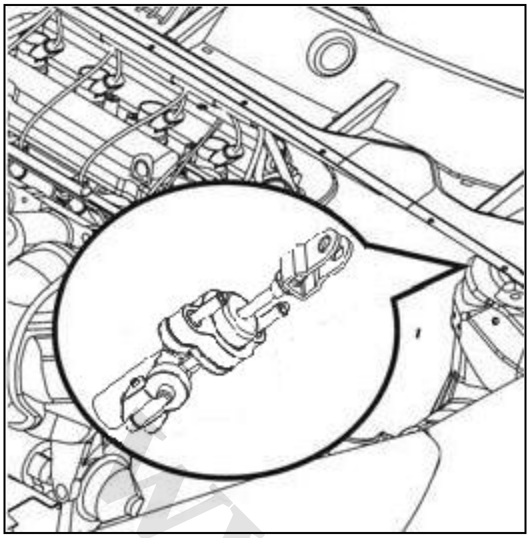
(b). Dismantle nut of clutch control oil pipe, and disconnect clutch control oil pipe.



(c). Dismantle left lower panel assembly of dashboard. (see the section "Dashboard and auxiliary dashboard" – lower left panel of the dashboard with regard to replacement)

(d). Dismantle lock of axis pin of pull rod of clutch master cylinder, and unplug axis pin.

(e). Dismantle fixed nuts of clutch master cylinder.



(f). Take clutch master cylinder out of engine compartment.

5. Mount the clutch master cylinder.

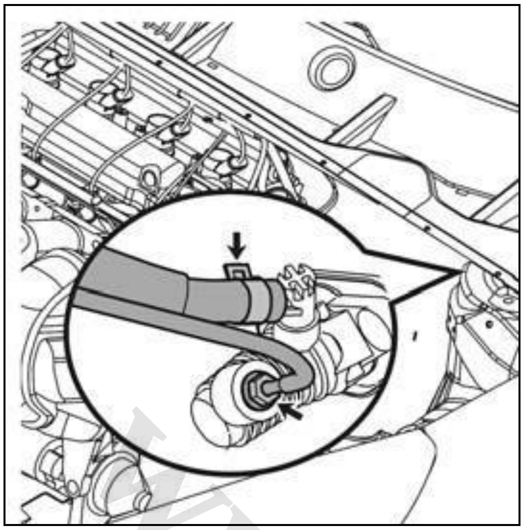
(a). Mount the clutch master cylinder onto the chassis mounting holes from the engine compartment; mount the fixing nuts from the engine compartment.

Torque: 19 ~24N•m

(b). Mount the clutch master cylinder push rod shaft lock pin, and then mount the pin shaft.

Hint:

After installation, adjust pedal height and free stroke of pedal.



6. Install inlet hose of clutch master cylinder and clutch control oil pipe.

(a). Mount the clutch master cylinder inlet oil pipe onto the clutch master cylinder and then tighten it by the steel strip elastic hoop.

(b). Install clutch control oil pipe, and tighten nut of clutch control oil pipe joint.

Torque: 20~26N•m

7. Mount brake master cylinder and vacuum booster
(see the section “driving brake” – vacuum booster with regard to replacement)

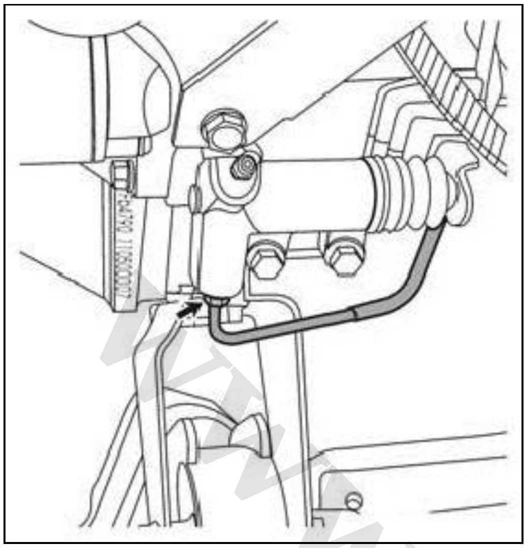
8. Mount air filter and bracket (see the section “intake and exhaust systems” – air filter with regard to replacement)

9. Fill brake fluid, and exhaust air from brake system and clutch system.

10. Confirm whether clutch function is normal.

Clutch slave pump

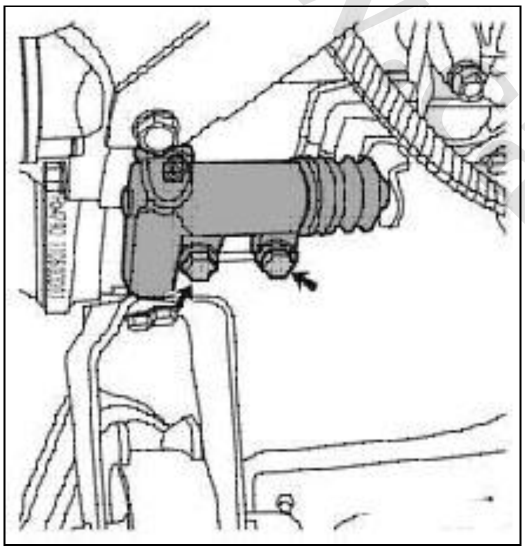
Replace



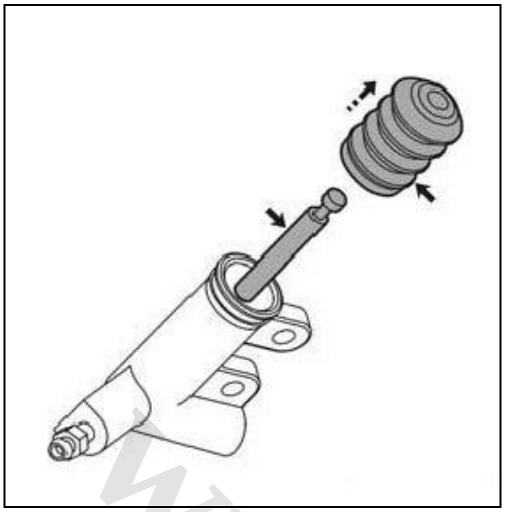
1. Dismounting of clutch slave cylinder

(a). Open the engine hood.

(b). Disconnect the clutch slave cylinder oil pipe.

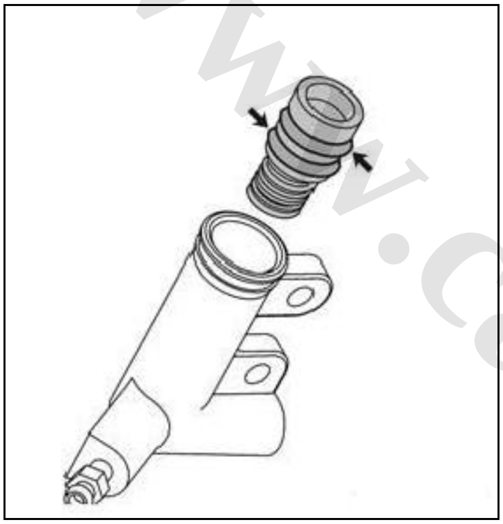


(c). Remove fixing bolts of clutch slave cylinder and then take off the clutch slave cylinder.



2. Disassembling of clutch slave cylinder

(a). Dismantle dustproof sleeve and pull rod from clutch slave cylinder.

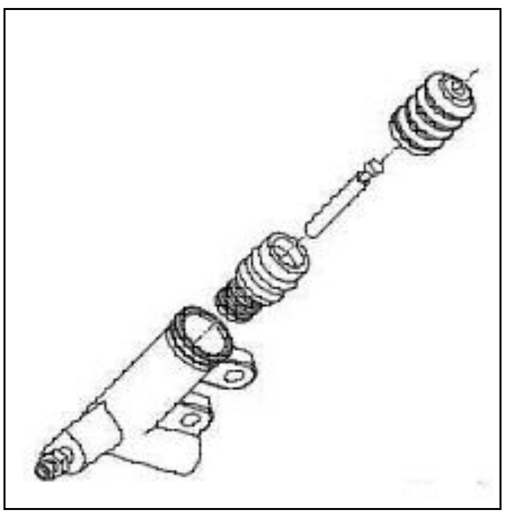


(b). Remove the piston and the spring from the cylinder body.

Note:

Do not damage internal surface of the cylinder body.

(c). Remove the piston rubber cup.



3. Assembling of clutch slave cylinder

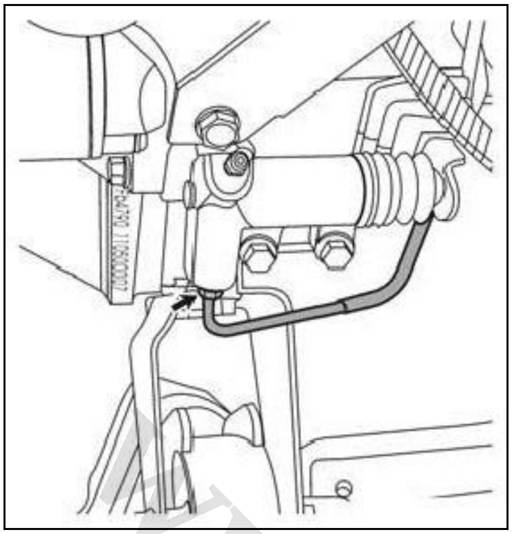
(a). Install rubber cup onto the piston.

(b). Smear grease on the piston and mount the piston and the springonto the cylinder body.

Note:

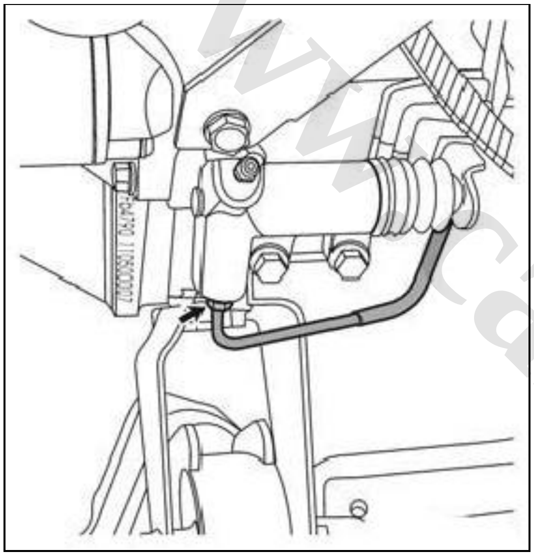
Do not damage internal surface of the cylinder body.

(c). Install dustproof sleeve and pull rod of clutch slave cylinder.



4. Mounting of clutch slave cylinder

(a). Make the clutch slave cylinder push rod against the clutch fork and then mount the fixing bolt; fix it on the transmission. Torque: 20~26N•m



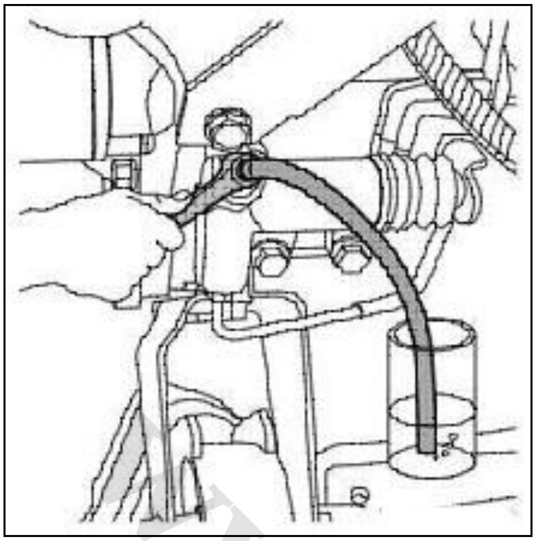
(b). Install oil hose of clutch slave cylinder
Torque: 14~18N•m

(c). Exhaust air from clutch slave cylinder.

Exhaust

Note:

After dismantling clutch pipeline, clutch main cylinder, clutch slave cylinder, hydraulic release bearing or when clutch pedal is soft, exhaust air from system.



1. When transparent rubber pipe and collecting tank are connected onto outlet port of clutch slave cylinder, use wrench to release exhaust bolt of clutch slave cylinder.

Hint:

When bleeding, two persons are required to work together - one sitting in cab and depressing the pedal; and another operating the exhaust bolt.

2. A driver continuously depresses the clutch pedal 2 or 3 times and then depresses the pedal to the bottom and holds it; loosen the exhaust bolt and exhaust air in the clutch slave cylinder and the oil pipe.
3. Tighten the exhaust bolt, and lift up the clutch pedal
4. Repeat operation until the hydraulic oil drained from system is clean and without air bubbles, and tighten exhaust bolt.

Note:

Fill the clutch hydraulic system with more hydraulic oil; always keep the level height in the oil reservoir.

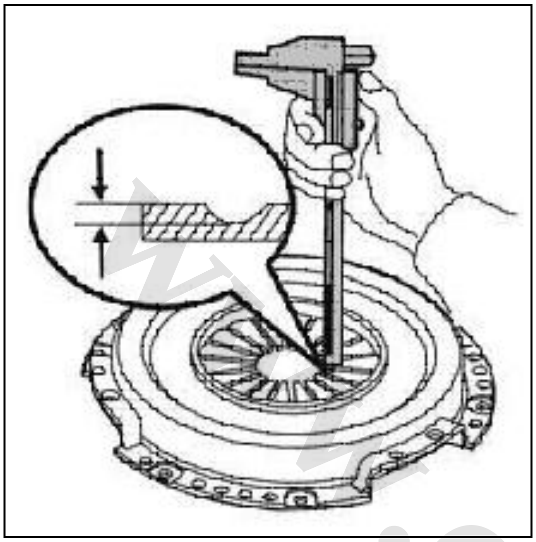
5. Confirm that the clutch works normally.

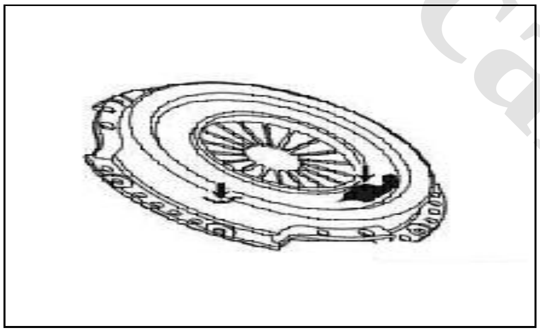
(a). Start the engine, depress the clutch pedal, and wait about 2s before shifting carefully to the reverse gear. If large noise is heard in selecting a gear, depress the clutch pedal completely 5 times to exhaust the system.

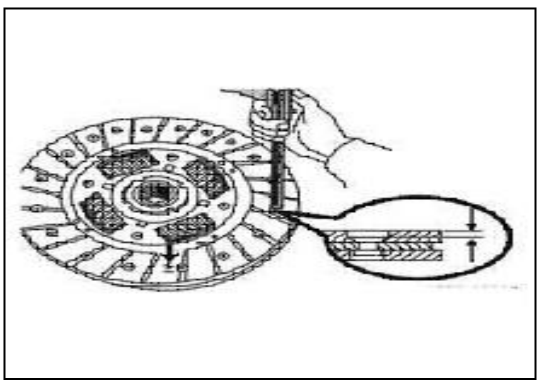
(b). Wait about 30s, and then check the clutch operating conditions. If there is still big noise, repeat exhaust system.

Clutch assembly

Check







1. Examination of clutch pressure plate

(a). Check the diaphragm spring end for wear or height difference. If there is significant wear or there is a height difference exceeding the limited value, replace the clutch pressure plate.
Limit: 0.8mm

(b). Check the clutch pressure plate spring for softness or crack, if necessary, replace it.

(c). Check the pressure plate surface for wear, crack or discoloration.

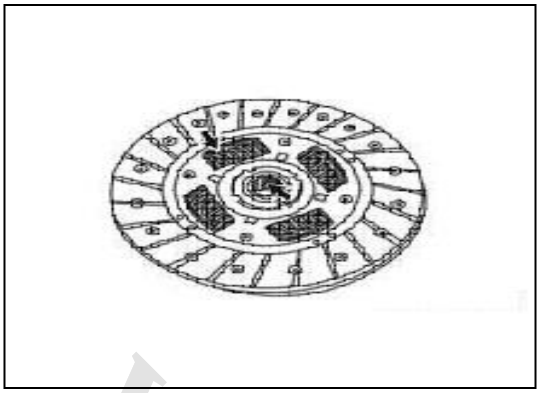
(d). Check the pressure plate rivets for looseness. If any, replace the clutch pressure plate.

(e). Check whether the surface is contaminated with engine oil, and if any, clean it up.

2. Examination of driven plate

Note:
Don't clean the clutch driven plate with gasoline!

(a). Check the surface for rivet looseness, single-face contacting, burning resulting in deterioration, attached grease or any. If you find any one of the above problems, replace the clutch



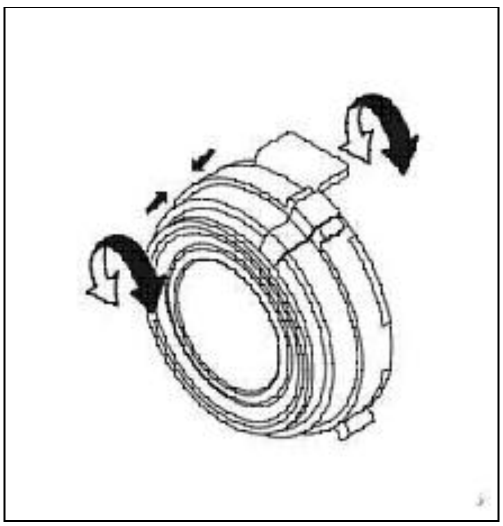
driven plate.

(b). Measure the depth of rivet embedded in the driven plate. If such depth exceeds the limited value, replace the clutch driven plate.
Limit: 1.5mm

(c). Check whether the torsional spring is loose or broken, and if there is any fault, the clutch driven plate should be replaced.

(d). Check whether the spline in the spline shaft sleeve is worn, and if worn, replace it.

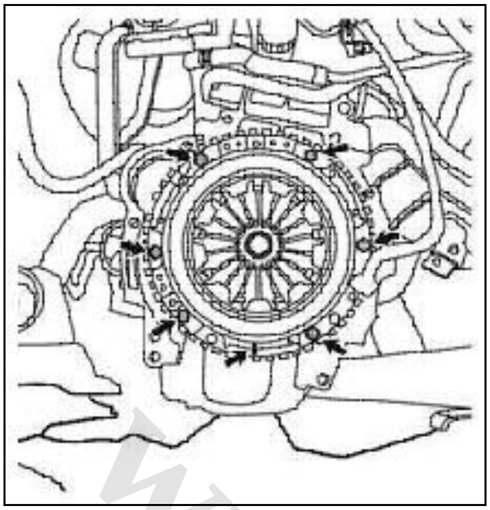
(e). Fit the clutch driven plate onto the input shaft, and check its sliding state and whether there is any looseness in the direction of rotation. If it moves poorly, clean it. And re-install it before rechecking it. If there is obvious looseness, replace the clutch driven plate or input shaft, or replace both at the same time.



3. Inspection of clutch release bearing

(a) Apply a force in a peripheral direction and rotate the release bearing. If necessary, replace the release bearing.

Replace



1. Take apart clutch pressure plate and driven plate

(a). Remove the transmission assembly. (See the section “Manual transmission – transmission assembly” concerning replacement)

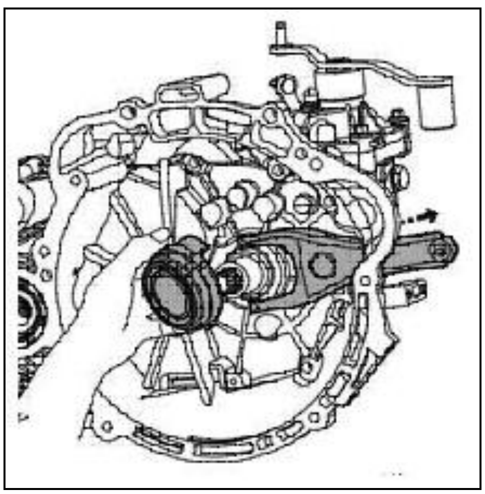
(b). Use paint or needle to make a mark of pressure plate on flywheel to facilitate assembly.

(c). Dismantle the fixing bolts between the clutch pressure plate and the flywheel.

△ Hint:

Install the flywheel stopper to prevent the flywheel from rotating with the clutch pressure plate when removing the bolts.

(d). Remove the clutch pressure plate and driven plate.

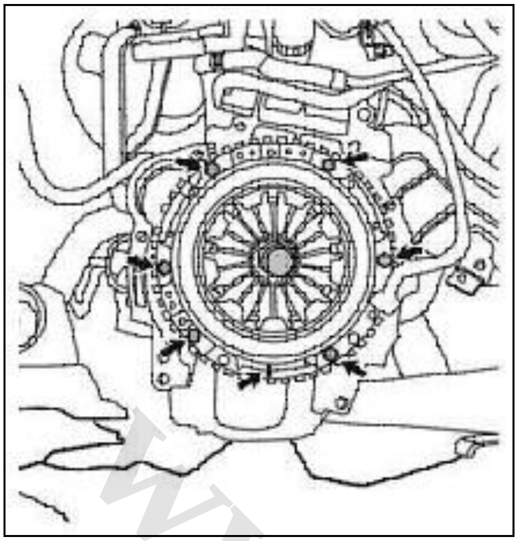


2. Removal of clutch release bearing and fork

(a). Draw out the clutch release fork from the transmission outward a little to allow it to disengage the release bearing.

(b). Remove the release bearing from the transmission input shaft.

(c). Pull out the release fork from the sheath towards the inside of the housing. Remove the release fork sheath.



3. Mount clutch pressure plate and driven plate

(a). Align the clutch pressure plate and driven plate to the flywheel center with the clutch concentric positioning tool.

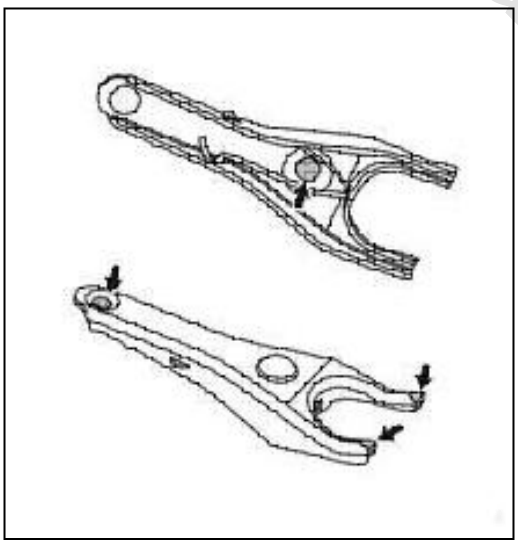
(b). Install the fixing bolts of the clutch pressure plate by aligning to the marks which have been made when removing.

(c). Tighten the pressure plate bolts evenly and tighten the fixing bolts in a crossover manner.

Torque：30~34N•m

(d). Remove the clutch concentric positioning tool.

(e). Install the transmission assembly. (See the section “Manual transmission – transmission assembly” concerning replacement)

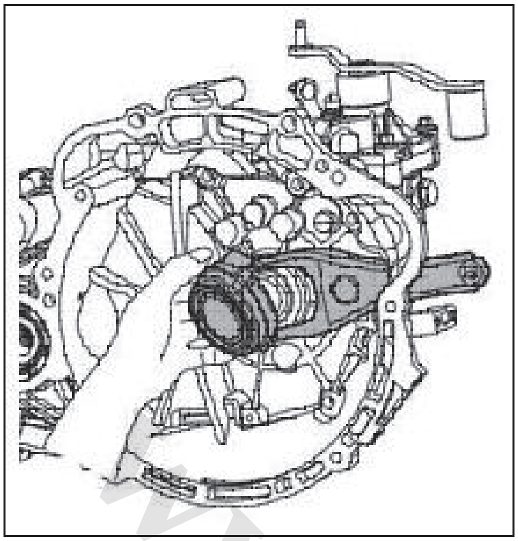


4. Installation of clutch release bearing and fork

(a). Check the clutch release fork.

△ Hint:

Coat grease onto the contacting faces between the release fork and the release bearing and between the release fork and the push rod, as well as onto the release fork pivot.



(b). Put clutch release fork into transmission fork, and install release bearing onto input shaft.

(c). Install the release fork to the retaining groove of the release bearing and clip the fork circlip to the release fork shore.

(d). Install the release fork sheath.

Note:

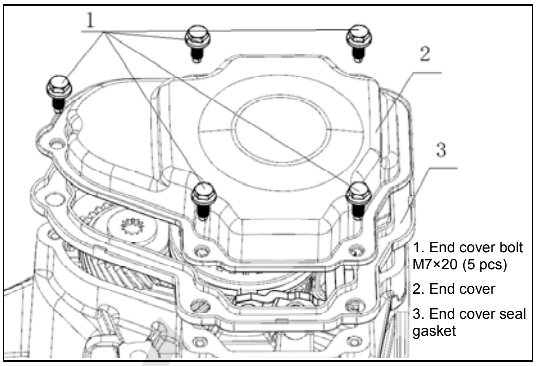
After installation, move the release fork forward and backward to check whether the release bearing can slide smoothly.

(e). Install the transmission assembly. (See the section “Manual transmission transmission assembly” concernin replacement)

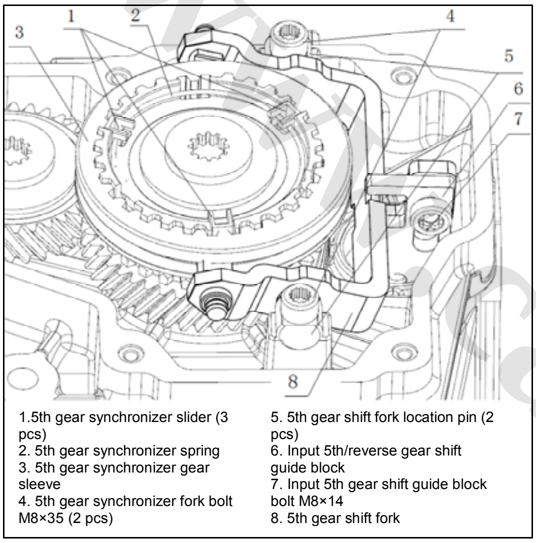
(f). Mount drive shaft and front wheels.

LD525MFA02 transmission assembly

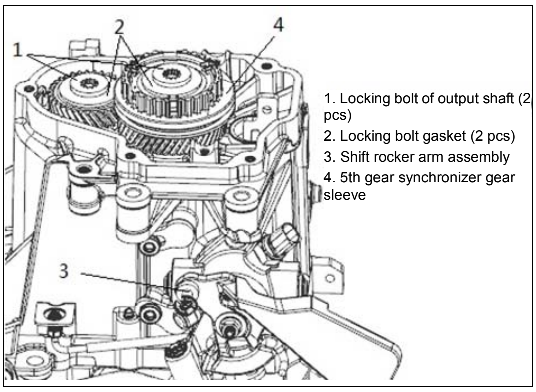
Dismantle transmission assembly



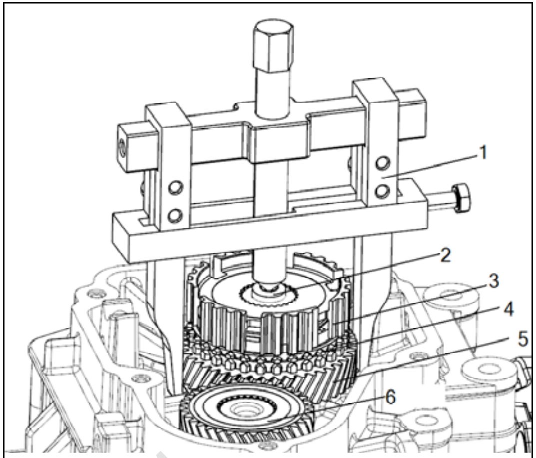
1. Discharge gear oil.
2. Remove 5 end cover bolts M7*20“1”, end cover “2” and end cover gasket “3” on transmission, and place transmission on idle gear position;



3. Remove adjustment fixing bolt “7” of 5th gear shift fork, take out the 5th gear shift guide block “6”; remove fixing bolt “4” of 5th shift fork locating pin, extract locating pin “5” of fork and take out 5th gear shift fork “8”;
4. Remove 5th gear synchronizer spring “2”, extract 5th gear tooth sleeve “3” and take out 5th gear synchronizer sliding block “1” at the same time.



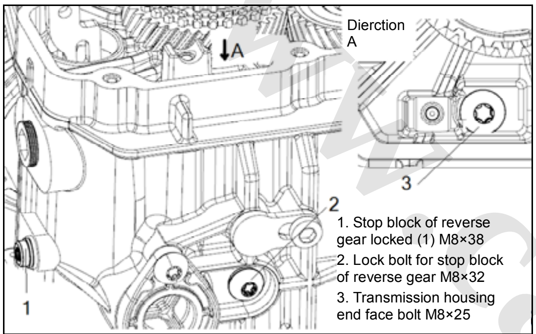
5. Install tooth sleeve of 5th gear synchronizer on tooth hub of 5th gear synchronizer again, such as “arrow 4” turns downward, and engage 5th gear.
6. Engage transmission on 3rd gear “arrow 3” by mean of shifting arm assembly, and the transmission is engaged on 3rd gear and 5th gear at the same time, the transmission is locked.



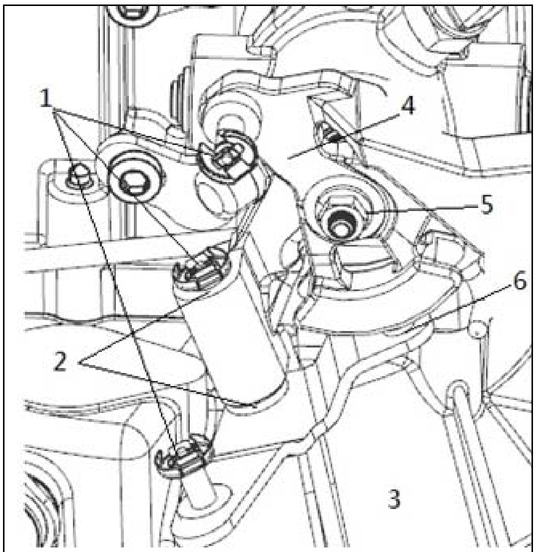
1. LD525 5th gear drawing
2. 10mm Bolt
5th gear synchronizer hub
4. Input 5th gear ring
5. Input shaft 5th gear assembly
6. 5th gear for output shaft

7. Use the pneumatic wrench to remove input shaft, output shaft locking bolt “1” on end surface of 5th gear on output shaft.

8. Use special tools (LD525 5th gear fork) “1” and 10mm nut “2” to extract tooth hub “3” of 5th gear and 5th gear “6” of output shaft.

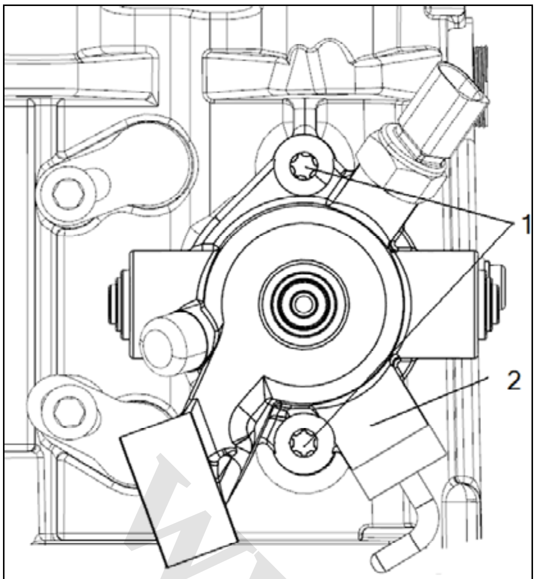


9. Remove three bolts “1”, “2” and “3” of reverse limitation block.



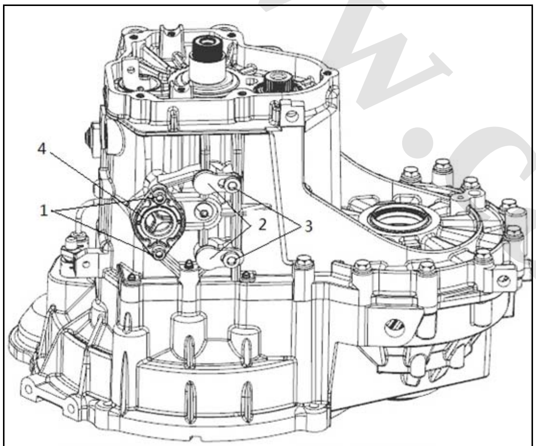
1. Selector arm clamp (3 pcs)
2. Selector pin sleeve 1 (2 pcs)
3. Selector arm assembly
4. Shift arm assembly
5. Counterweight block disc nut
6. Selector pin sleeve 2

10. Take out of selector arm clamp “1” firstly, remove selector arm “3”, and then use pneumatic wrench to remove counterweight block disc nut “5”, and take out the counterweight block “4”."



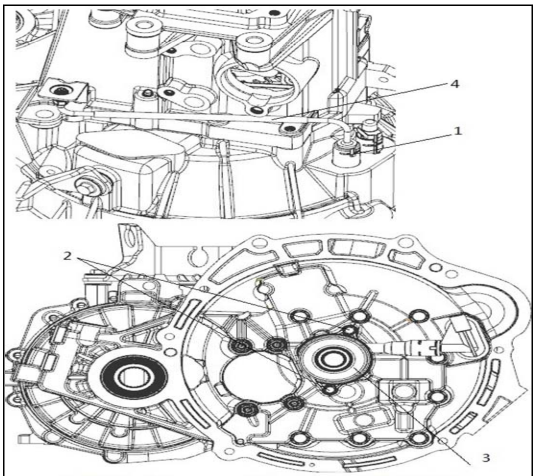
1. Gearshift box bolt M8×25 (2pcs)
2. Gearshift box assembly

11. Adjust shift axle to idle gear position, remove bolt “1” of gearshift box, and remove gearshift box assembly “2” from transmission shell.



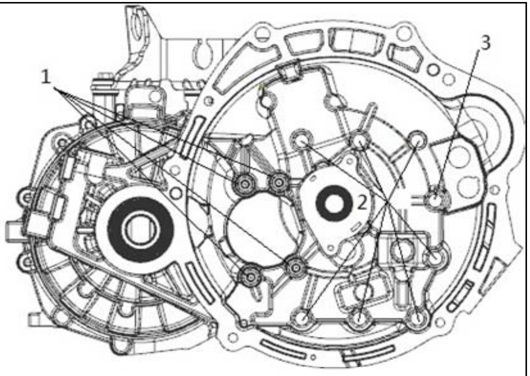
1. Gearshift box bolt M8×25 (2 pcs)
2. Shift fork support pillar (4 pcs)
3. Shift fork support pillar bolt M8×22 (4 pcs)
4. Rear location seat of gearshift box

12. Remove rear locating seat “4”, 4 fork support columns “2” and support column bolt “3” of gearshift box (another 2 pieces are on reverse side).



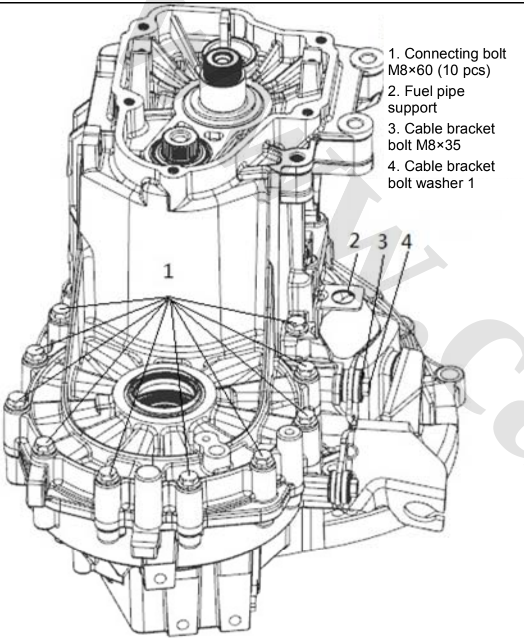
1. Oil pipe joint snap spring
2. Hydraulic release bearing bolt M7×20 (2 pcs)
3. Integrated hydraulic release bearing
4. Fuel pipe

13. Remove oil pipe joint snap ring “1” and hydraulic release bearing bolt “2”, and then take out of hydraulic disengagement bearing “3” and oil pipe “4” at the same time."



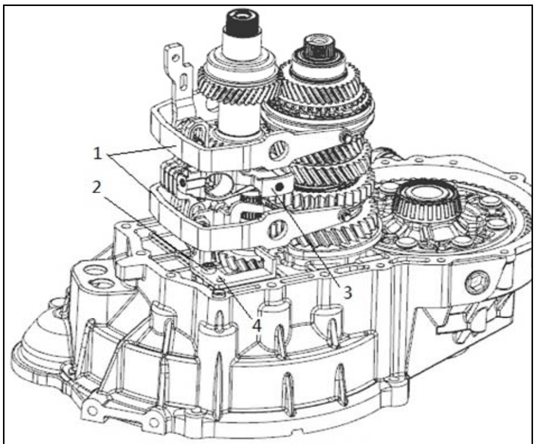
1. Output pressure plate nut (4 pcs) 3. Connecting bolt
2. Connecting bolt M8×60 (7 pcs)

14. Remove connecting bolts “2” and “3” used to fix transmission shell from clutch housing, remove output press disc nut “1” from output shaft bearing support.



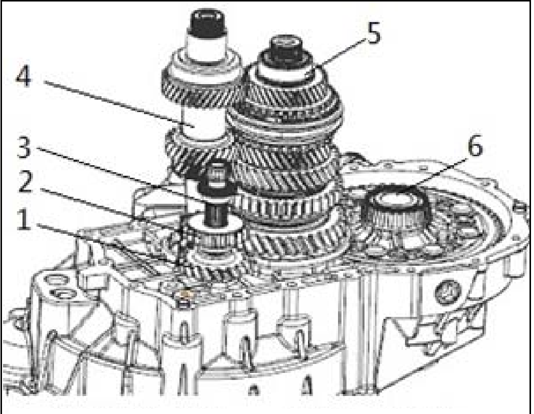
1. Connecting bolt M8×60 (10 pcs)
2. Fuel pipe support
3. Cable bracket bolt M8×35
4. Cable bracket bolt washer 1

15. Remove “1” and “2” and one of “3” and “4” in fixed differential from shell body of transmission.



1. Shift fork assembly
2. Reverse gear swing arm bracket bolt
3. Shift stop block
4. Reverse gear swing arm bracket assembly

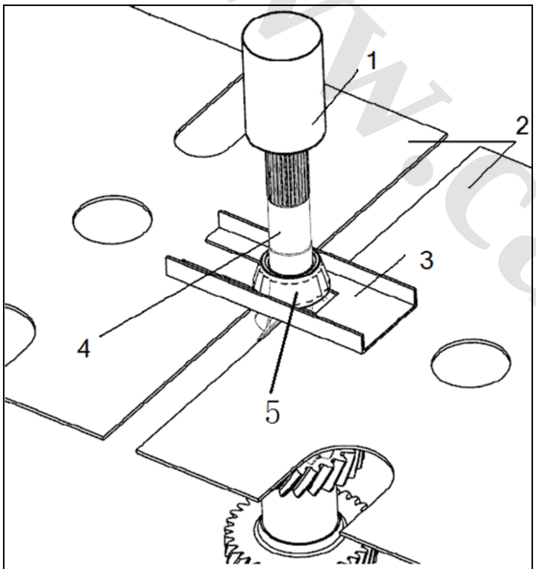
16. Remove transmission shell body, be sure not to damage sealing surface."
17. Take out of shift fork assembly “1”, remove reverse swing arm bracket bolt “2”, take out of reverse swing arm bracket “3” and remove reverse limitation block “4”.



1. Reverse gear (2)
2. Reverse gear (1)
3. Reverse gear shaft
4. Input shaft assembly
5. Output shaft assembly
6. Differential assembly

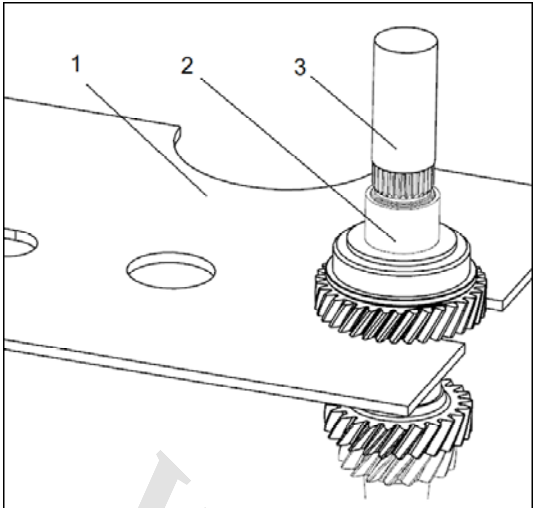
18. Take out of reverse gear axle “3”, reverse gear 1“2” and reverse gear 2“1”, and then take out of input shaft assembly “4” and output shaft assembly “5”, take out of differential assembly “6”."

Disassemble input shaft assembly



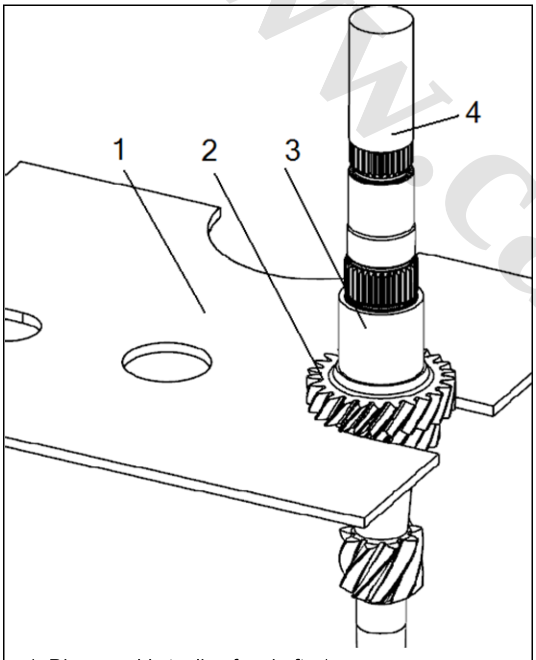
1. Install locating sleeve by press fitting
2. Disassembly tooling for shafts 1 (2 pcs)
3. Disassembly tooling for shaft 2 (2 pcs)
4. Input shaft assembly
5. Input shaft front bearing

1. Use axle category removal tooling “1” “2” “3” etc. special tools to press out of front bearing inner ring “5” of input shaft. (Note: if front bearing of input shaft isn’t damaged, it is not necessary to remove this bearing)."



1. Disassembly tooling for shafts 1
2. Input shaft assembly
3. Install locating sleeve by press fitting

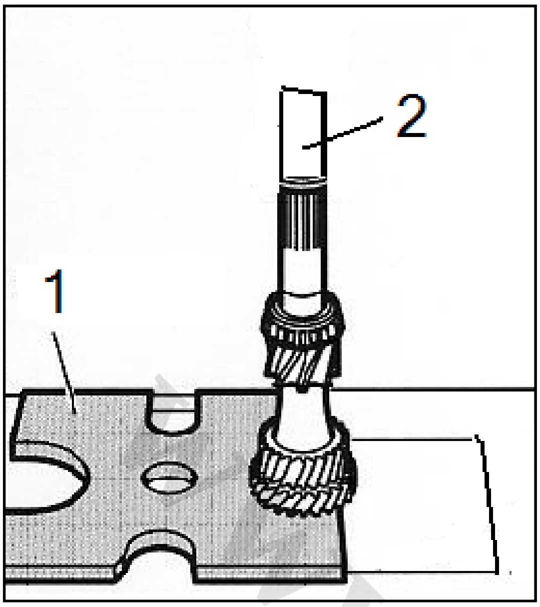
2. Use bearing removal tooling “1” to press out of input 4th gear, rear bearing inner ring of input shaft and output 4th gear washer.



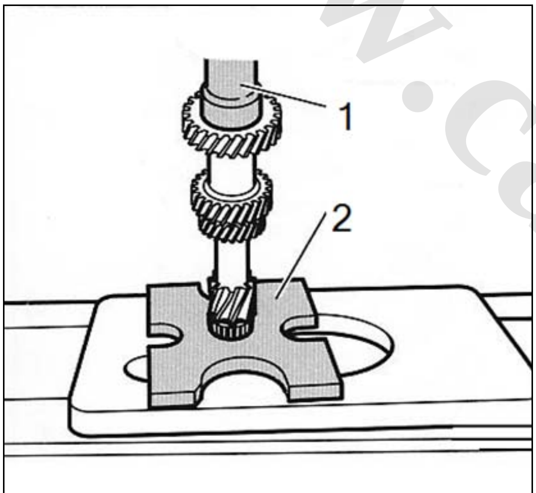
1. Disassembly tooling for shafts 1
2. Input 3rd gear
3. Input 3rd gear and 4th gear spacer
4. Install locating sleeve by press fitting

3. Use special tools and hydraulic press to press out of 3rd gear “2”, and then take out of input 3rd gear and 4th gear spacer “3” at the same time.

Assemble input shaft assembly

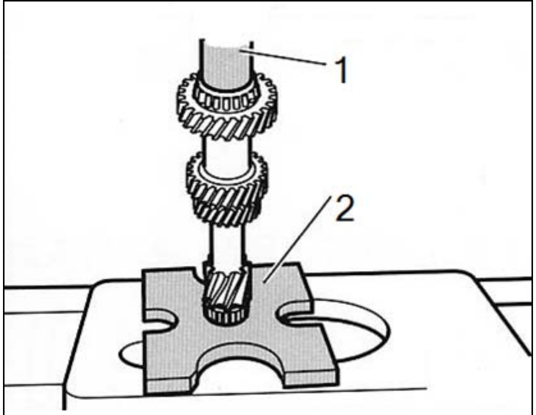


1. Use special tools to press in input 3rd gear, end surface with boss of inner ring of this gear shall face towards 4th gear during installation.



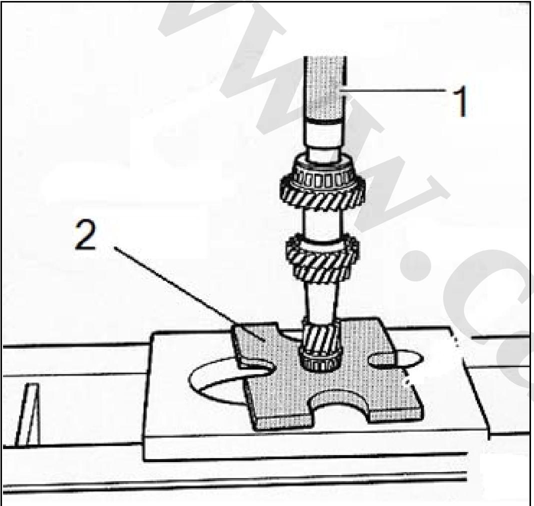
1. Install locating sleeve by press fitting
2. Disassembly tools for shafts 1

2. Install input 3rd gear and 4th gears isolation sleeves, and use special tools to press in input 4th gear, end surface with boss of inner ring of this gear shall face towards 3rd gear during installation.



1. Install locating sleeve by press fitting
2. Disassembly tooling for shafts 2

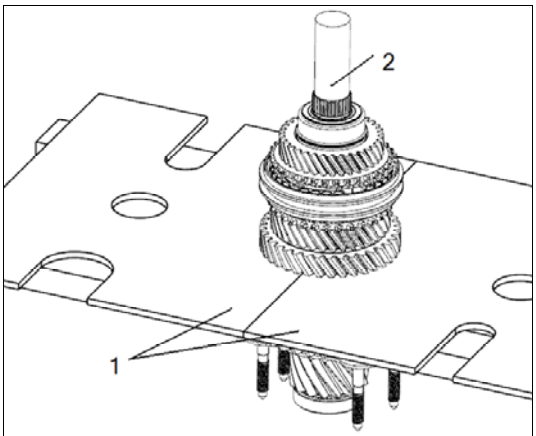
3. Use special tools to press in inner ring of input shaft rear bearing.



1. Install locating sleeve by press fitting 2
2. Disassembly tooling for shafts 1

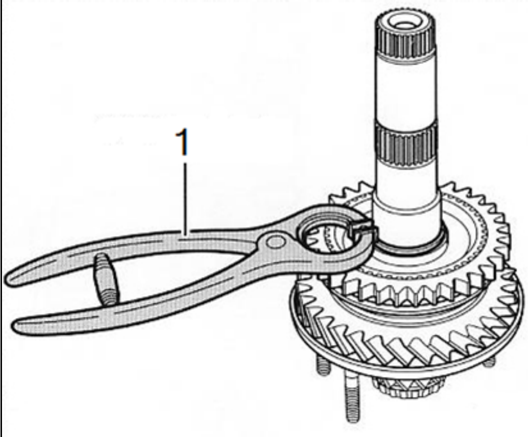
4. Assemble output 4th gear washer and use special tools to press in output 4th gear axle sleeve.

Disassemble the output shaft



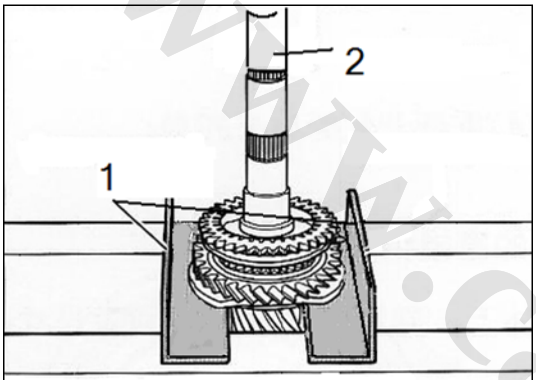
1. Disassembly tooling for shafts 1
2. Install locating sleeve by press fitting 1 (2 pcs)

1. Use special tools “1” and “2” to press out of 2nd gear, 3rd gear and 4th gear synchronizer assembly, and output 4th gear, output 4th gear washer (flat washer) and output shaft rear bearing inner ring.



1. Clamp spring plier

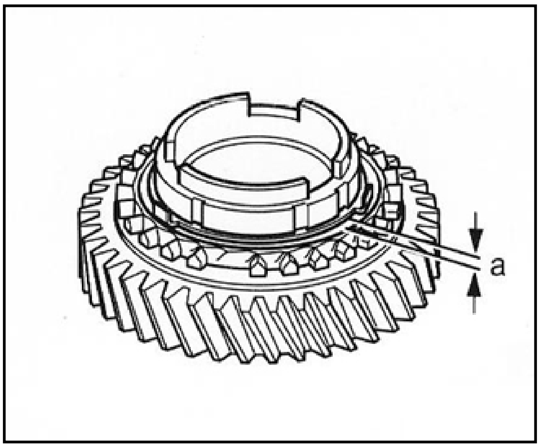
2. Use clamp spring pliers to remove output 1st and 2nd gear synchronizer clamp ring.



1. Angle iron (2 pcs)
2. Install locating sleeve by press fitting

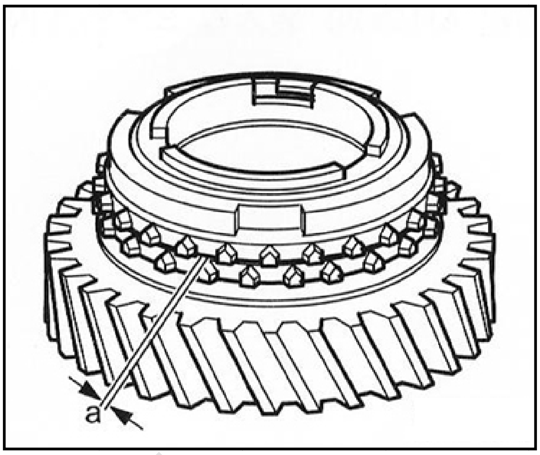
3. Use angle iron "1" and special tooling "2" to press out of tooth hub of 1st and 2nd gear synchronizer, 1st and 2nd gear tooth sleeves, middle bearing press disc of output 1st gear output shaft

Assemble the output shaft



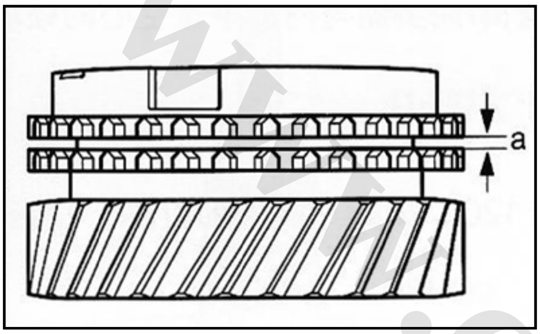
1. Inspect abrasion conditions of 1st and 2nd gear synchronizer tooth rings, and place inner tooth ring of synchronizer on tape surface of shifting gear, and use filler gauge to measure clearance size -a-, refer to following table for standard:"

Clearance -a-	Installation dimension	Wear limit
1st and 2nd gear	0.75-1.25mm	0.3mm



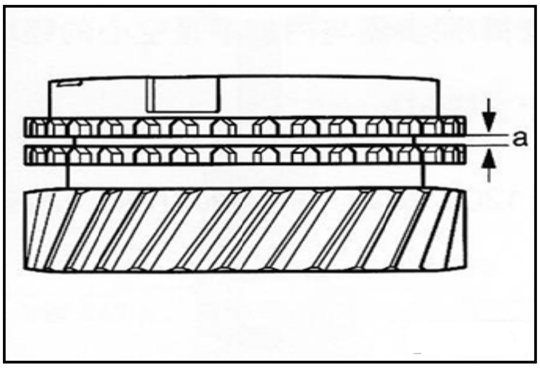
2. Place inner tooth ring, middle ring of synchronizer and external tooth ring of synchronizer on tape surface of shifting gear, and use filler gauge to measure clearance size -a-, refer to following table for standard:"

Clearance -a-	Installation dimension	Wear limit
1st and 2nd gear	1.25-1.85mm	0.5mm



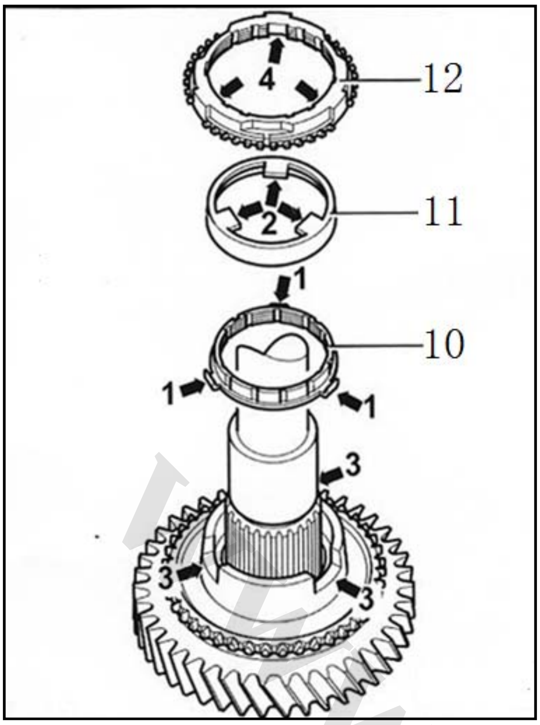
3. Inspect abrasion conditions of 3rd gear and 4th gear synchronizer tooth rings, and place tooth ring of synchronizer on tape surface of shifting gear, and use filler gauge to measure clearance size -a-, refer to following table for standard:"

Clearance -a-	Installation dimension	Wear limit
3rd and 4th gear	1-1.7mm	0.5mm

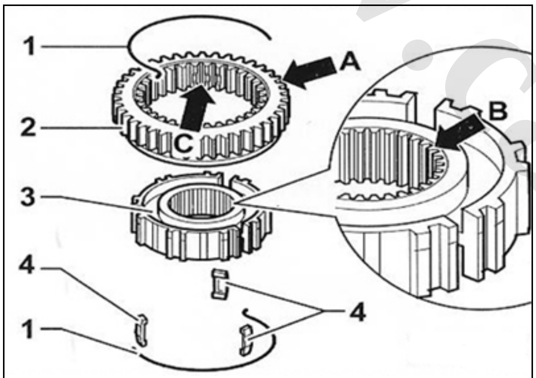


4. Inspect abrasion conditions of fifth speed synchronizer tooth rings, and place tooth ring of synchronizer on tape surface of shifting gear, and use filler gauge to measure clearance size -a-, refer to following table for standard:"

Clearance -a-	Installation dimension	Wear limit
5th gear	1-1.7mm	0.5mm

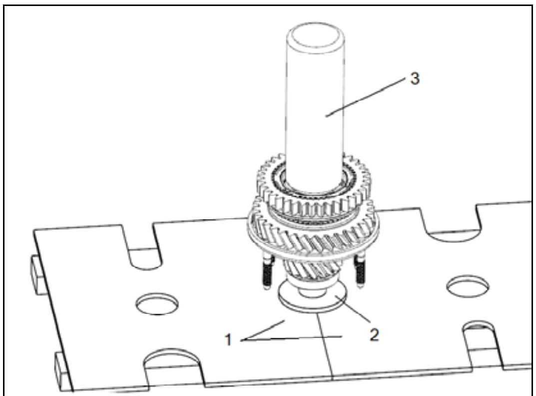


5. Place in output 1st gear washer, boss faces towards inner ring of bearing. Install 1st gear needle bearing, output 1st gear and tooth rings of synchronizer, be sure that gap of synchronizer tooth ring shall be aligned to boss position.



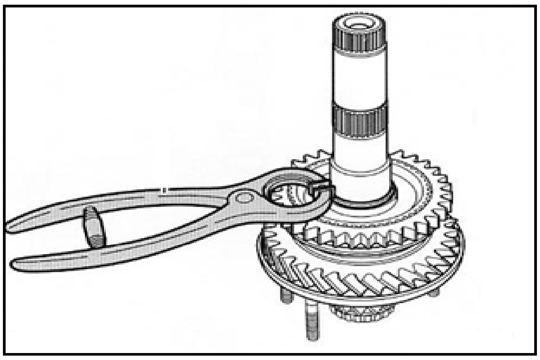
1. 1st and 2nd gear synchronizer spring
2. 1st and 2nd gear synchronizer gear sleeve
3. 1st and 2nd gear synchronizer gear hub
4. 1st and 2nd gear synchronizer sliding block

6. Install tooth hubs of 1st and 2nd gear synchronizers, and then install 1st and 2nd gear tooth sleeves, “arrow A” at side of tooth sleeve outer ring with reverse gear shall face towards second speed gear, and pay attention to installation position of synchronizer tooth ring.

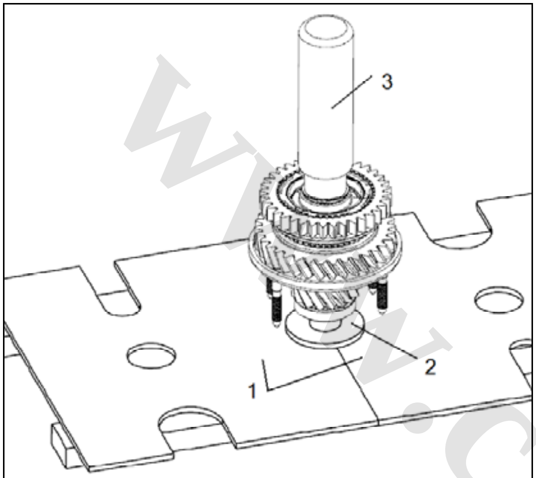


1. Disassembly tooling for shafts 2. Locating seat
3. Install locating sleeve by press fitting

7. Use special tools to press in tooth hubs of 1st and 2nd gear synchronizers. Note: The gap of 1st gear synchronizer tooth ring shall be aligned with boss position, and output shaft shall be supported by locating seat “2”.

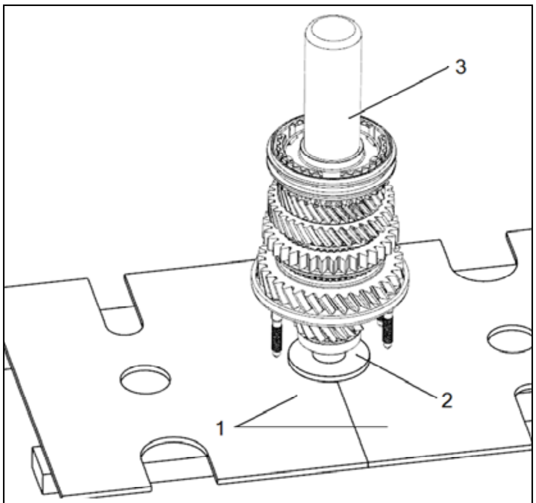


8. Use clamp spring pliers to install output 1st and 2nd gear synchronizer clamp rings at end surface of 1st and 2nd gear synchronizer tooth hub, and then place output second speed roller isolation ring.



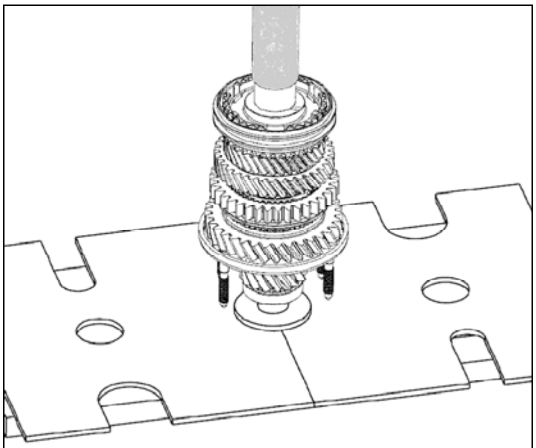
1. Disassembly tooling for shaft 2. Locating seat
3. Install location sleeve by press fitting

9. Install second speed synchronizer tooth ring and needle bearing and second speed gear, be sure that gap of synchronizer tooth ring shall be aligned to boss position.
10. Assemble output second speed washer (flat washer) on end surface of 2nd gear, and use special tools to press in output 3rd gear axle sleeve.



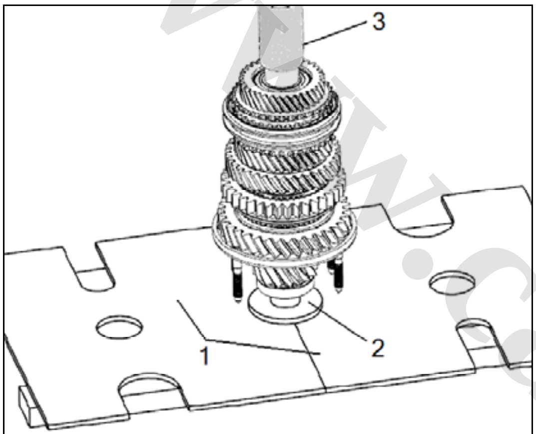
1. Disassembly tooling for shaft 2. Locating seat
3. Install locating sleeve by press fitting

11. Assemble output 3rd gear component, two 3rd gear needle bearings and 3rd gear synchronizer tooth ring.
12. Use press locating sleeve “3” to press in 3rd gear and 4th gear synchronizer assemblies, be sure that gap of synchronizer tooth ring shall be aligned to boss position.



1. Disassembly tooling for shaft 2. Locating seat
3. Install locating sleeve by press fitting

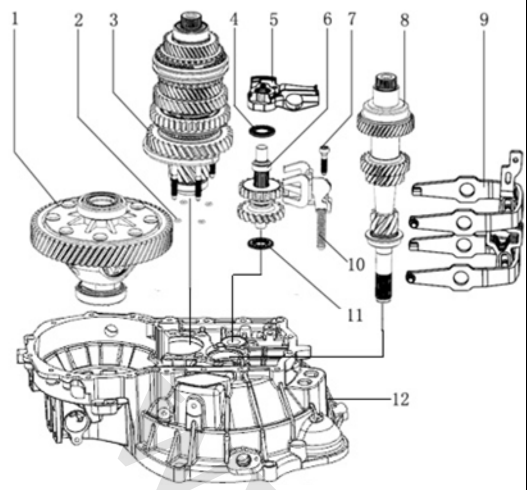
13. Use press locating sleeve to press in output 4th gear axle sleeve.



1. Disassembly tooling for shaft 2. Locating seat
3. Install locating sleeve by press fitting

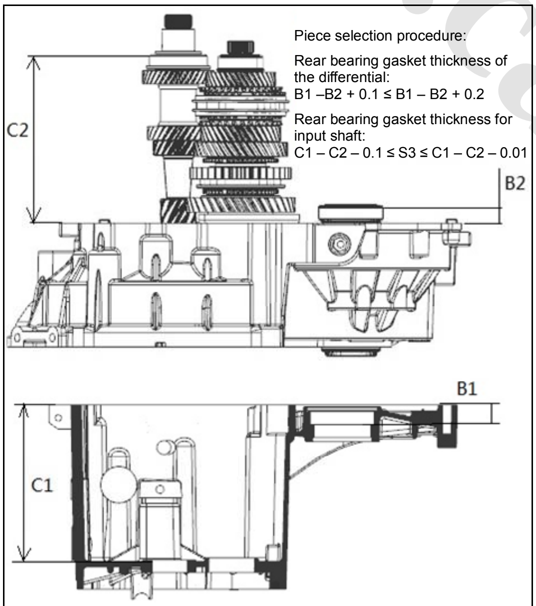
14. Install 4th gear synchronizer tooth ring and 4th gear needle bearing and output 4th gear component, be sure that gap of synchronizer tooth ring shall be aligned to boss position.
15. Assemble output 4th gear washer (flat washer) at end of output 4th gear, use press locating sleeve to press rear bearing inner ring of output shaft into output shaft.

Install transmission assembly



1. Differential assembly	2. O-ring for output pressure plate
3. Output shaft assembly	4. Rear thrust bearing of reverse gear
5. Stop block of reverse gear	6. Reverse gear assembly
7. Reverse gear swing arm bracket bolt	8. Input shaft assembly
9. Shift fork assembly	10. Reverse gear swing arm bracket assembly
11. Front thrust bearing of reverse gear	12. Clutch housing assembly

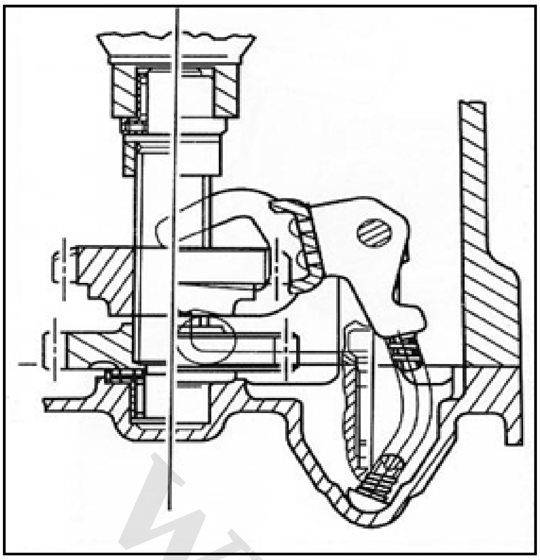
1. Assemble differential assembly, input shaft assembly, output shaft assembly into clutch housing, and then assemble reverse gear (1), end surface of reverse gear (1) with boss shall face towards rear cover, and then reverse axle, reverse gear (2) and reverse limitation block." Note: replace four output press disc O-ring 7.1×2 on output middle bearing press disc, shown as “arrow”.



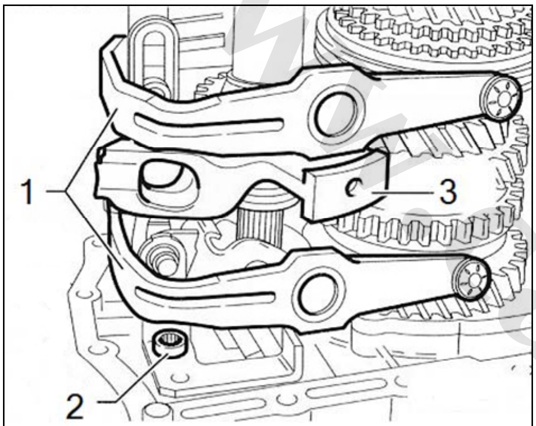
2. Use height rule to measure B1, B2, C1, C2, and then calculate according to pad selection formula."

Adjustment pad S2 of differential bearing (pad selection formula: B1 - B2 + 0.1 ≤ S1 ≤ B1 - B2 + 0.2);

Adjustment pad thickness S3 of input shaft bearing (pad selection formula: C1 - C2 - 0.1 ≤ S1 ≤ C1 - C2 - 0.01).

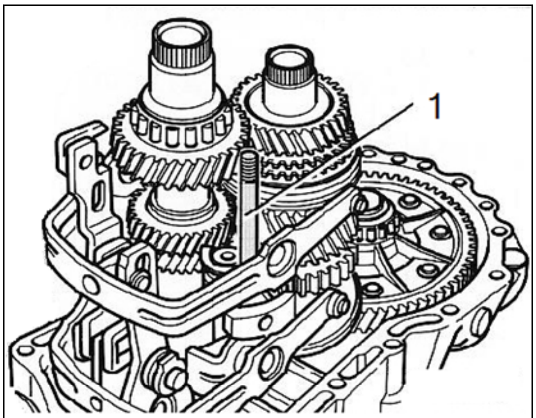


3. Assemble reverse swing arm support assembly, swing arm support shall be sleeved on reverse gear (2), and make reverse gear (2) on idle status, locating boss on support shall be aligned to locating hole on shell, and then tighten reverse swing arm support bolt “2” according to regulation (tightening torque: 23 ± 1.5N.m)."



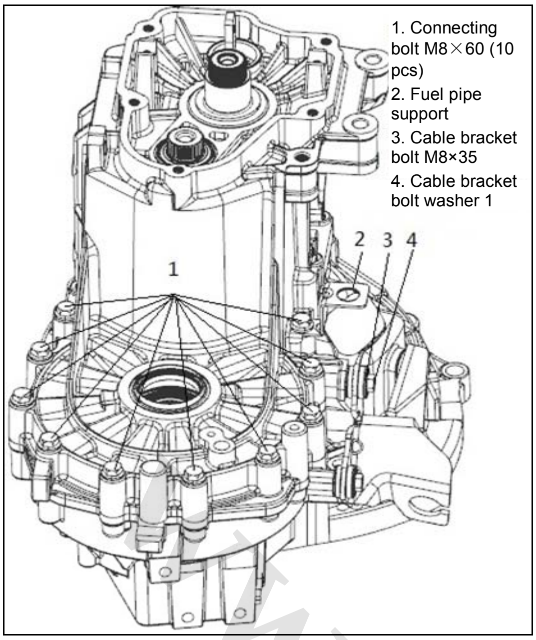
1. Reverse shift fork assembly
2. Reverse support assembly bolt
3. Stop block of reverse gear

4. Assemble shift fork assembly “1”, be sure to assemble fork into tooth sleeve slot, reverse fork shall be assembled on reverse limitation block."

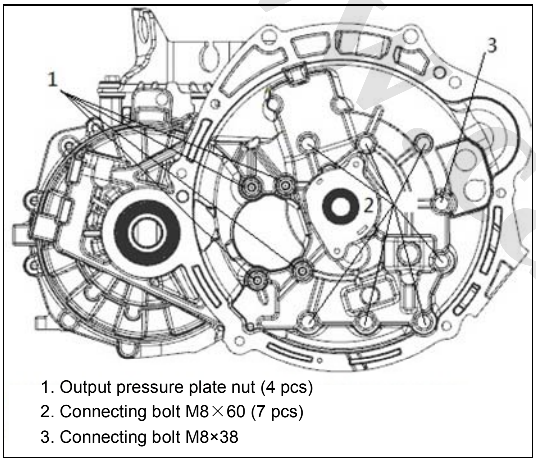


1. 8×100 headless bolt

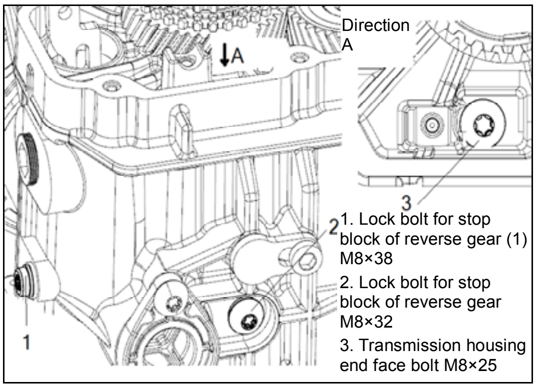
5. Tighten 8×100 headless bolt “1” on reverse limitation block.



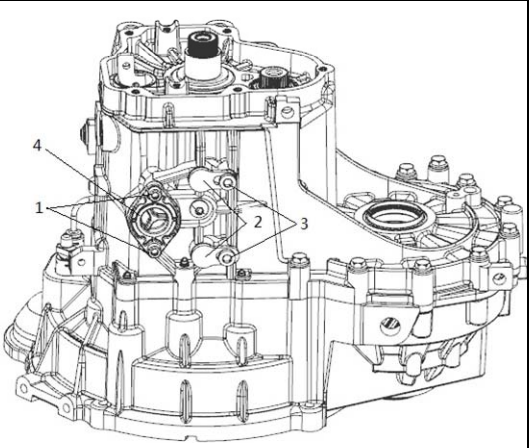
6. Remove original sealing glue residual between clutch housing and transmission shell, coat new sealing glue evenly, don't coat sealing glue too thick and inspect whether locating ring is correct.



7. Assemble transmission shell, install connecting bolts "1" and "2" between transmission shell and clutch housing, diagonally tighten to specified value step by step according to regulation (tightening torque: 23 ± 1.5N.m), assemble "4" tighten cable support bolt "3", diagonally tighten 4 output press disc nut "3" of output middle bearing press disc (tightening torque: 25-28N.m), 7 connecting bolts M8X60"2" and 1 connecting bolt M8X38"3" (tightening torque: 23 ± 1.5N.m).



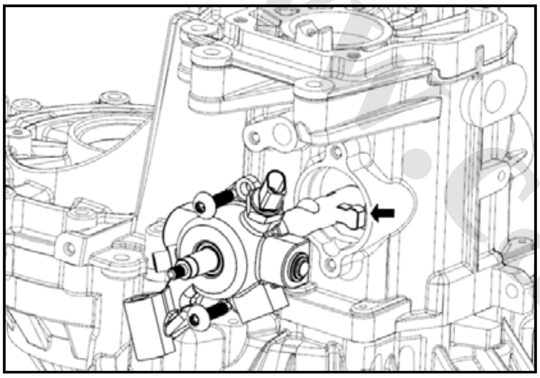
8. Assemble reverse limitation block locking bolt M8x32 "2", tighten headless bolt "A" (fourth step), assemble end bolt "3" of transmission shell, assemble reverse limitation block locking bolt M8x38 "1", and tighten 3 bolts on reverse limitation block according to regulation (tightening torque: 20±1.5N.m)."



1. Gearshift box bolt M8×25 (2 pcs)
2. Shift fork support pillar (4 pcs)
3. Shift fork support pillar bolt M8×22 (4 pcs)
4. Rear locating seat of gearshift box

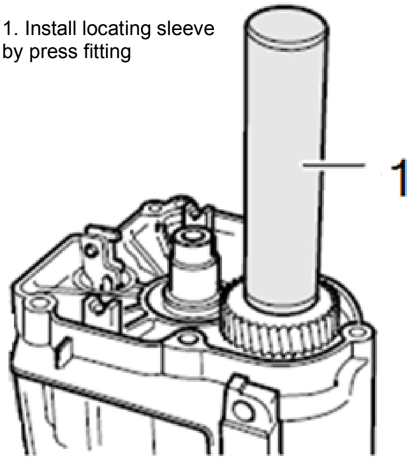
9. Assemble four fork support columns "2" of shift fork assembly, (another two are on opposite face, when O-ring on support column is necessary to be replaced, use screwdriver to turn shift fork assembly until corresponding fork support column is assembled on position, assemble fork support column bolt "3" and tighten this bolt according to regulation (tightening torque: 20±1.5N.m)."

10. After sealing surface of rear locating seat "4" of gearshift box is coated with sealing glue, assemble on transmission shell.

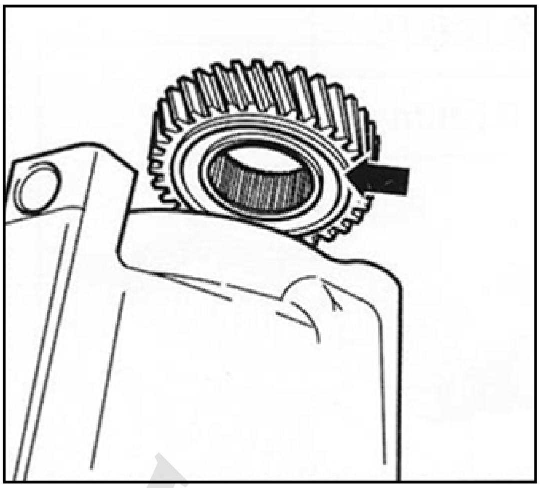


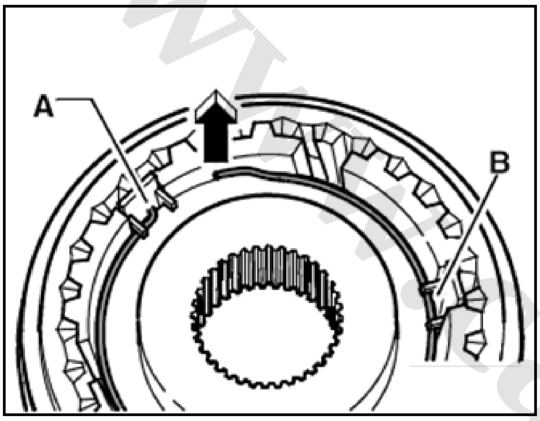
11. Place gearshift box assembly on idle status, coat sealing glue on sealing surface of gearshift box assembly, assemble in transmission assembly, pay attention to installation direction "arrow" of gearshift box assembly, and tighten gearshift box bolt (tightening torque: 20±1.5N.m."

1. Install locating sleeve by press fitting

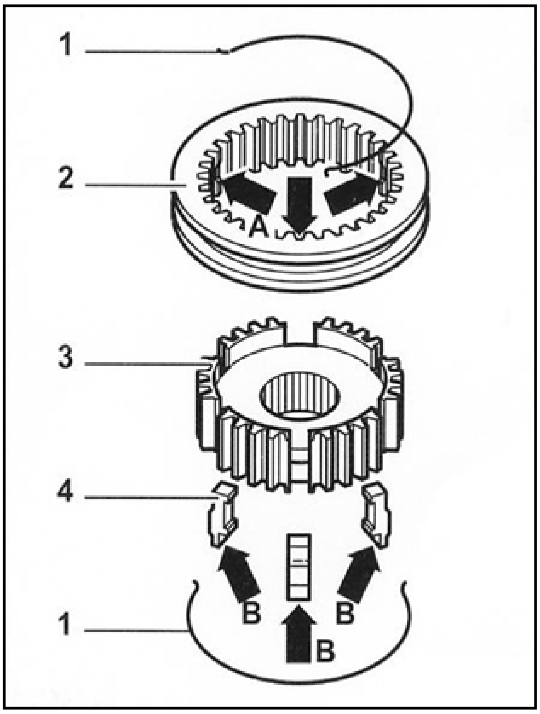


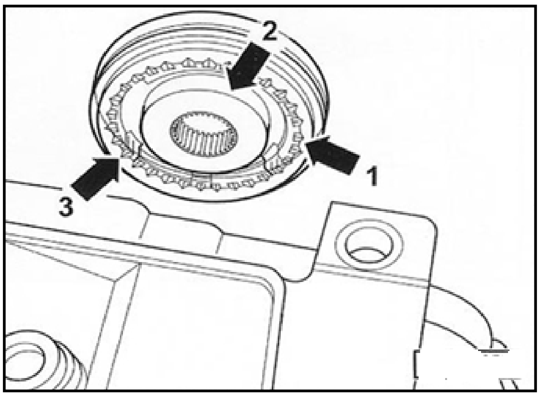
12. Heat up 5th gear of output shaft to 100°C, use press locating sleeve "1" to install output shaft 5th gear, concave of gear is appointed to transmission shell as "arrow".



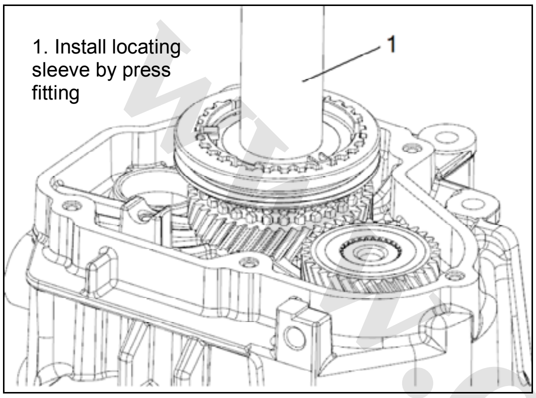


13. Assemble 5th gear synchronizer tooth hub, tooth sleeve and sliding block, end surface of synchronizer tooth hub inner ring with boss and end surface of tooth sleeve “2” with sharp tooth “arrow” and “arrow B” of sliding block at end with gap shall face towards same direction, synchronizer spring must be assembled in groove of synchronizer sliding block, end in bending hook shape is always away from synchronizer.

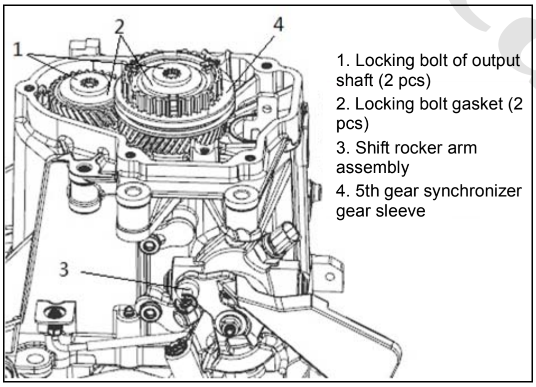




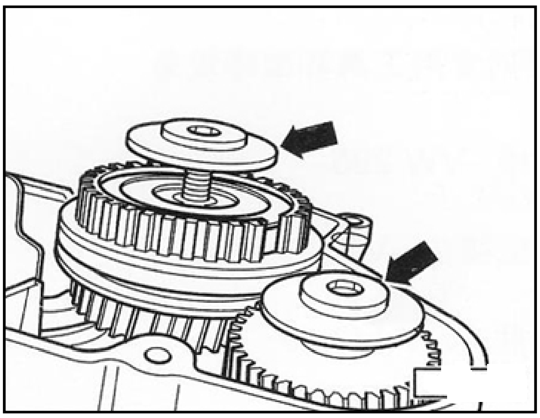
14. Assemble input 5th gear assembly of input shaft, 5th gear bearing and 5th gear synchronizer tooth ring, assemble input 5th gear synchronizer assembly, be sure that end surface of tooth hub inner ring with boss “arrow 2” and end surface of tooth sleeve with sharp tooth “arrow 1” shall face towards shell body.



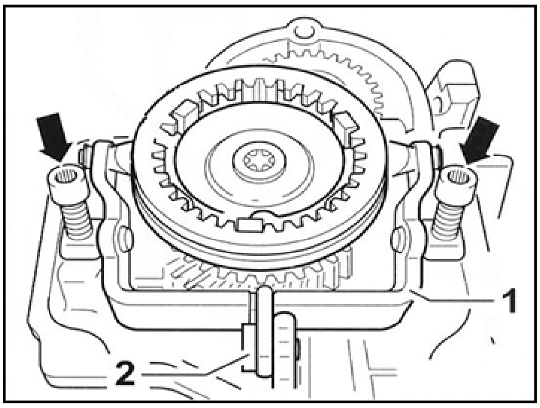
15. Use press locating sleeve “1” to press in 5th gear synchronizer tooth hub and tooth sleeve on input shaft, be sure that gap of synchronizer tooth ring shall be aligned to boss position. Use hammer to press in 5th gear synchronizer tooth hub and tooth sleeve on input shaft, be sure that gap of synchronizer tooth ring shall be aligned to boss position.



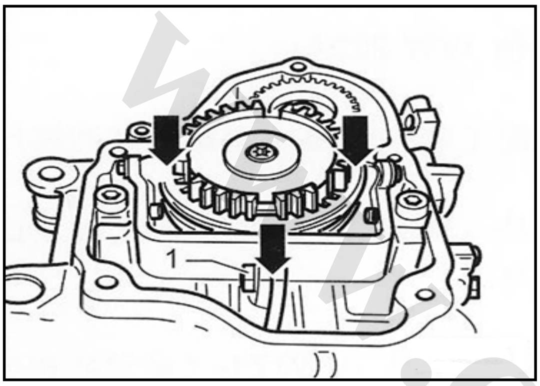
16. Directly engage 5th gear tooth sleeve on 5th gear, use gearshift box assembly to engage transmission on 3rd gear, and the transmission is engaged on 3rd gear and 5th gear at the same time, the transmission is locked.



17. Install locking bolt washer and locking bolts of output shaft top 5th gears, use torque wrench to tighten these two bolts as regulations (tightening torque: 105±3N.m), pay attention to installation position of locking bolt washer (taper angle faces upward).



18. Place transmission on idle gear status, install 5th gear shift fork “1”, tighten locating pin bolt “arrow” of 5th gear shift fork (tightening torque: 23±1.5N.m) and input 5th gear reverse guiding block bolt (tightening torque: 20±1.5N.m) “2”



19. Adjust installation position of input 5th gear shift fork assembly, engage 5th gear, loosen bolt “1”, press 5th gear tooth sleeve and fork opening along arrow direction, tighten bolt “1” again. Standard: insert filler gauge with thickness of 0.2mm between 5th gear tooth sleeve and 5th gear, and don’t slide. Repeat adjustment if necessary. Transmission is engaged on idle gear, tooth ring of synchronizer must move freely.

20. After transmission is engaged in all gears, no fault phenomenon appears, install rear end cover of transmission assembly (tightening torque of end bolt M7×20: 10±1N.m) and outer component as specification requirement, and hydraulic release bearing (tightening torque of hydraulic disengagement bearing bolt M7×1×20: 16±1N.m) and oil pipe, use a clip to fix.

Section 2 Automatic Transmission (4AT)

Introduction

4FA24-21K AUTOMATIC TRANSAXLE
4FA24-21K is a four speed automatic transaxle designed for cars with front wheel drive and a transversely mounted engine.

The transaxle has a hydrodynamic torque converter with a controlled slip lock up clutch. A planetary gear train establishes the mechanical gear ratios. The integral constant ratio can be adapted to the engines power output and the vehicles weight. The electronic hydraulic control makes controlled power shifts and various shift programs possible. In selector lever position ‘P’, the output is locked mechanically.

The special feature of this transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

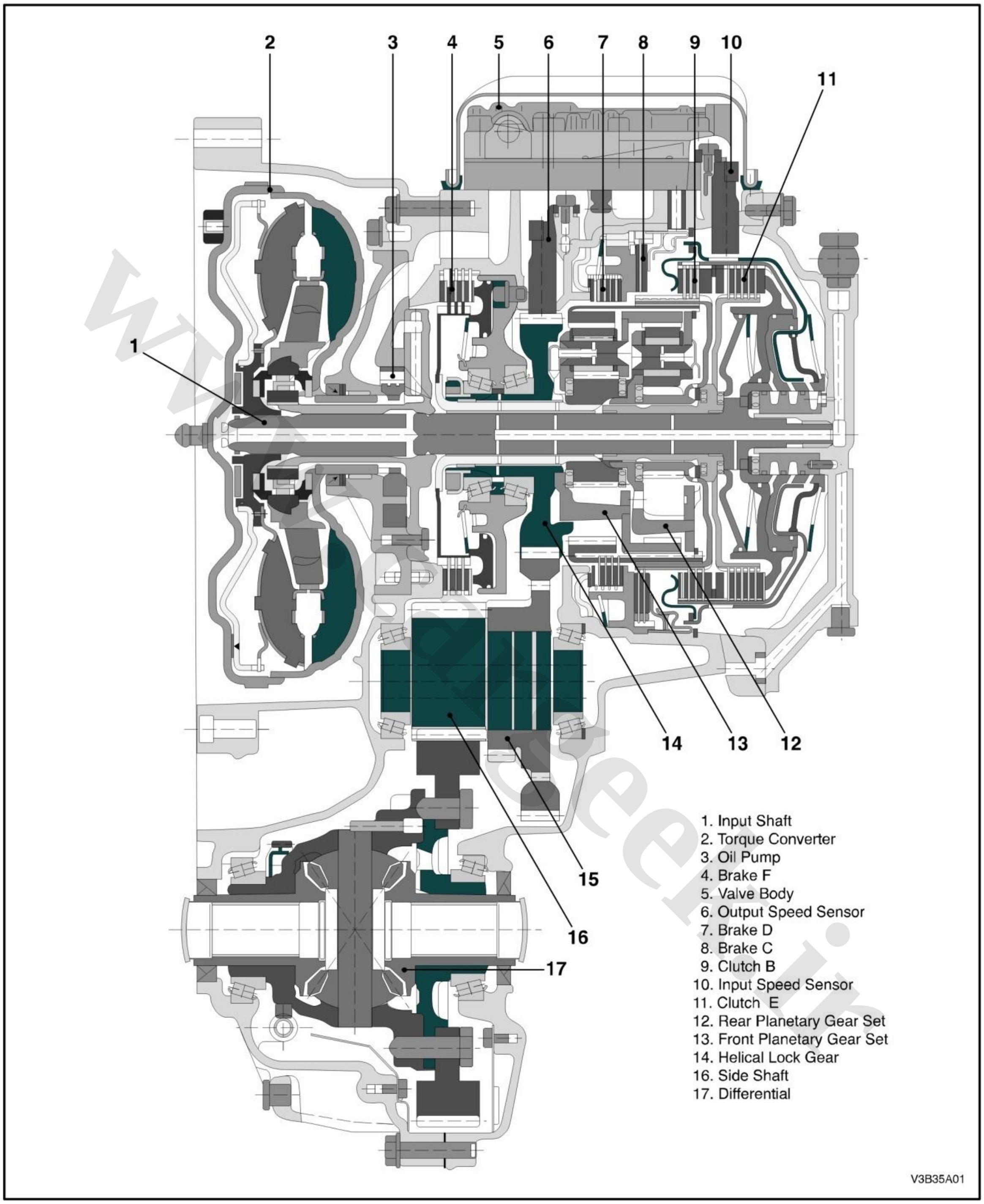
The advantage of overlap shifting is as follows:

-The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements

-Lower drag losses, i.e. higher efficiency

-Lower peak torques acting on the components and driveline.
However, overlap shifting necessitates high performancew hard are and software, and precision engine signals

TRANSAXLE COMPONENTS



SPECIFICATIONS

GENERAL SPECIFICATIONS

Name	Definition
Transaxle Type	4 speed and transverse engine
Input Torque	240N•m
Transaxle Weight	76kg

TRANSAXLE GEAR RATIO

Gear level	*Ratio*
1	*2.719*
2	*1.487*
3	*1.000*
4	*0.717*
R	*2.529*
Final	*3.945*

FASTENER TIGHTENING SPECIFICATIONS

Application	N •m
Bearing Plate Bolts	23.5
Slotted Nut	220
Rear Cover Attachment Bolts	23.5
Baffle Plate Attachment Bolts	10
Park/Neutral Position Switch	10
Fluid Pump Connecting Bolts	10
Fluid Filter Housing Cover Attachment Bolts	10
Input Speed sensor Attachment Bolts	8
Output Speed Sensor Attachment Bolts	8
Valve Body Bolts	8
Valve Body Upper & Lower Fixing Bolts	6
Fluid Pan Connecting Bolts	6
Fluid Pan Drain Plug	45
Fluid Level Plug	45
Line Pleasure Plugs	20
Valve Housing 1 Cover Attachment Bolts	6

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Solenoid Valve Attachment Bolts	6
Pressure Control Regulator(EDS) Attachment Bolts	6
Oil Cooler Inlet Pipe Bolts	35
Oil Cooler Outlet Pipe Bolts	35
Shift Control Cable Adjuster Pinch Nut	8
Shift Control Cable Attachment Nut	8
Upper Transaxle-to-Engine Bolts	75
Selector Lever(On Transaxle Case)	15
Torque Converter Attachment Bolts	45
Shift Control Assembly Mounting Bolt, Nut	8
Lower Engine-to-Transaxle Bolts(a)	75
Lower Engine-to-Transaxle Bolt(b)	21
Lower Engine-to-Transaxle Bolts(c)	31
Rear Transaxle Mounting Bracket Bolts	62
Damping Block Connection Bolt and Nut	68
Left Transaxle Mount Bracket Cage Bolt(a)	110
Left Transaxle Mount Bracket Cage Bolt(b)	65
Left Transaxle Mount Bracket Cage Nut(c)	65
Left Transaxle Mounting Bolts	48

Torque Converter Capacity

Torque Converter	*9.72 kg*
Transaxle Fluid Type *(manufacture company)*	*ESSO LT 71141 or TOTAL ATF H50235*
Transaxle Fluid Capacity	*6.9±0.2L*

GENERAL DESCRIPTION AND SYSTEM OPERATION

The 4FA24-21-K automatic transaxle consists primarily of the following components.

Mechanical

1) Torque converter with TCC
2) Drive link assembly
3) Two multiple disk clutch assemblies : Clutch B,E
4) Three multiple brake assemblies : Brake C,D,F

5) Lock-up clutch valve
6) Two planetary gear sets
7) One oil pump
8) Final drive and differential assembly

Electronic

1) Two shift solenoid valve(sol.1,2)
2) Four pressure control solenoid valve(EDS)
3) Two speed sensors : A/T ISS and A/T OSS
4) Fluid temperature sensor
5) Automatic transaxle control module(TCM)
6) Wiring harness assembly

MECHANICAL COMPONENTS

Torque Converter

The converter consists of the impeller, the turbine wheel, the reaction member (stator) and the oil to transmit torque.

The impeller, which is driven by the engine, causes the oil in the converter to flow in a circular pattern. This oil flow meets the turbine wheel, where is direction of flow is deflected. At the hub, the oil leaves the turbine and reaches the reaction member (stator), where it is once again deflected so that it reaches the impeller at the correct angle of flow.

The reversal effect generates movement in the stator, the reaction torque then amplifies the turbine torque.

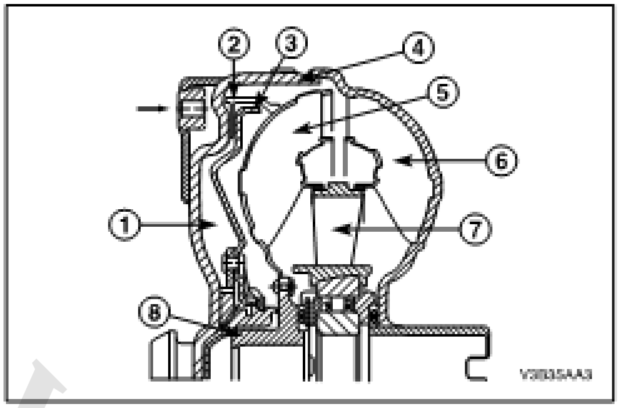
The ratio between turbine torque and torque is referred to as torque multiplication.

The greater the difference is speed between the pump and turbine, the greater the torque multiplication; it is at its highest when the turbine is at a standstill. The higher the speed of the turbine, the lower the torque multiplication.

When the turbine speed reaches about 85%of the pump speed, torque multiplication=1, i.e. the turbine torque equivalent to pump torque.

The stator, which bears against the housing via the free-wheel, is then rotating freely in the oil flow and the free-wheel is over come. From this point onwards, the converter acts as a straightforward fluid coupling

Space Behind Lock-up Clutch Piston



1. Friction lining
2. Lock-up clutch piston
3. Converter cover
4. Turbine wheel
5. Impeller
6. Stator
7. Turbine hub
8. Torque converter impeller hub

Torque Converter Lock-up Clutch (TCC)

The converter lock-up clutch is a device, which eliminates converter slip and thus helps to improve fuel consumption.

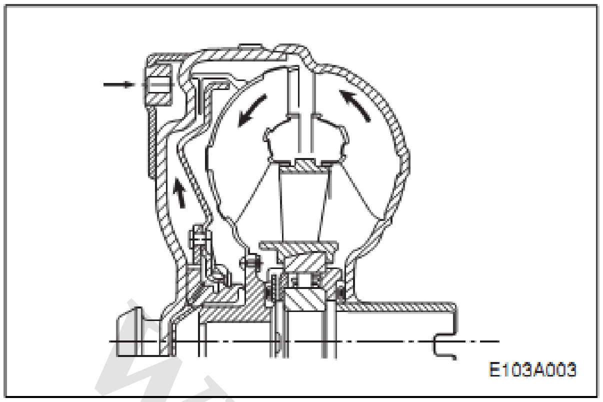
The previous control principle for converter lock p clutch operation has been replaced by a controlling function on the 4FA24-21-K The converter lock-up clutch is engaged and released in a controlled manner. During the controlled phase, a slight speed difference between the impeller and turbine wheel is established. This ensures that the engine’s rotating vibration is not phased on to the transaxle.

The result is optimum shift quality.

An electronic pressure-egulating valve determines pressure regulation of the lock p converter clutches piston.

When open (conversion range), the oil pressure behind the converter lock p clutch piston and in the turbine zones equal. The direction of flow is through the turbine shaft and through the space behind the piston, to the turbine chamber.

To engage the lock-up clutch, the direction of flow is modified (reversed) via a valve in the hydraulic selector unit. At the same time, the space behind the lock-up clutch piston is vented. The oil pressure passes from the turbine chamber to the lock-up clutch piston and presses it against the converter’s cover. The turbine is thus blocked by way of the linings between the piston and cover, and permits rigid through drive with no slip (or reduced slip if controlled) to the mechanical stage of the transaxle.



Fluid Pump

The fluid pump is located between the torque converter and the transaxle case and is driven directly by the torque converter. The pump sucks the fluid through a filter and delivers it to the main pressure regulator valve of the control system. Excess fluid flows back to the pump. The fluid pump fulfills the following functions:

. Generates line pressure.

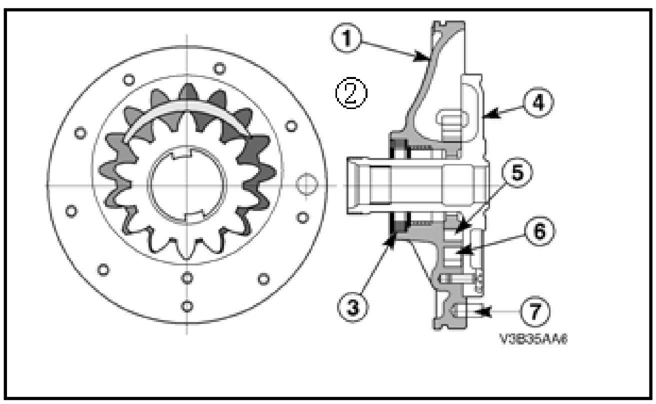
. Delivers fluid under pressure to the torque converter, thus preventing air bubbles in the fluid.

. Induces a flow of fluid through the torque converter in order to eliminate heat.

. Supplies fluid pressure to the hydraulic control system.

. Supplies fluid pressure to the shift components.

. Lubricates the transaxle with fluid.



Pump Housing

1. Disc

2. Shaft seal
3. Stator shaft
4. Pump wheel
5. Pump ring gear
6. Dowel pin

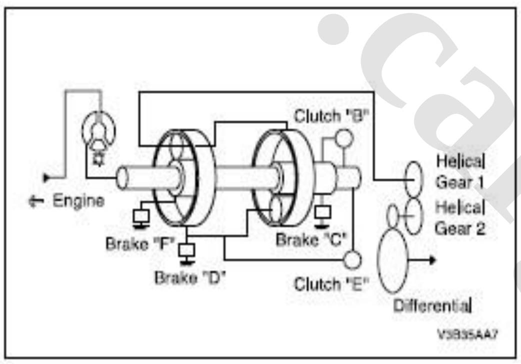
Planetary Gears

The 4FA24-21-K automatic transaxle is equipped with a one sun gear, 4 planetary gears, planetary carrier, ring gear. Each gear is located one directly behind the other and are linked together. In other words, front ring gear is permanently linked to rear planet carrier, front planet carrier is linked to rear ring gear.

The individual gear ratios are obtained by linking together the gear set elements in different ways by means of clutches and brakes.

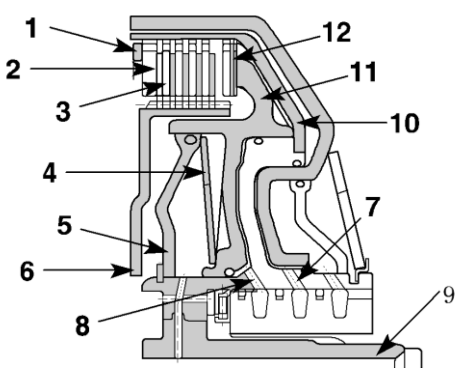
On the 4FA24-21-K, the power flow is directed into the planetary gear set via rear planet carrier or rear sun gear, or via both simultaneously, depending on the gear in question.

The output is always via the front planet carrier.



Shift Elements: Multi-disc Clutches and Brakes

The purpose of the shift elements is to perform shifts under load without the tractive flow being interrupted.



The shift elements consist of the following.

1. Snap Ring

2. Steel Disc
3. Lined Disc
4. Cup Spring
5. Baffle Plate
6. Disc Carrier
7. Input Shaft
8. Oil Supply to Dynamic Pressure Equalizer
9. Oil Supply to Clutch
10. Cylinder
11. Piston
12. Spring Disc

The shift elements are engaged hydraulically. The pressurized oil reaches the space between the cylinder and piston, as a result the discs are compressed. The clutch/brake is engaged when the oil pressure drops, the cup spring acting on the piston presses the piston back into its initial position. The clutch/brake is now released again.

Depending on the gear, the multi-disc clutches B and E. supply the engine torque to the planetary gear train, with multi-disc brakes C, D and F directing the torque into the housing.

The dynamic pressure at clutches B and E is equal : i.e.the dynamic pressure in front of and behind the piston is equal. This equalizing effect is achieved in the following way.

The space between the baffle plate and piston is filled with unpressurized oil. A dynamic pressure dependent on the engine speed builds up. The space between pressure also builds up. However, there is simultaneously a static pressure, which causes the clutch to engage. If the static pressure is relieved, the cup spring is able to force the piston back into its original position.

The advantages of this dynamic pressure equalization are:

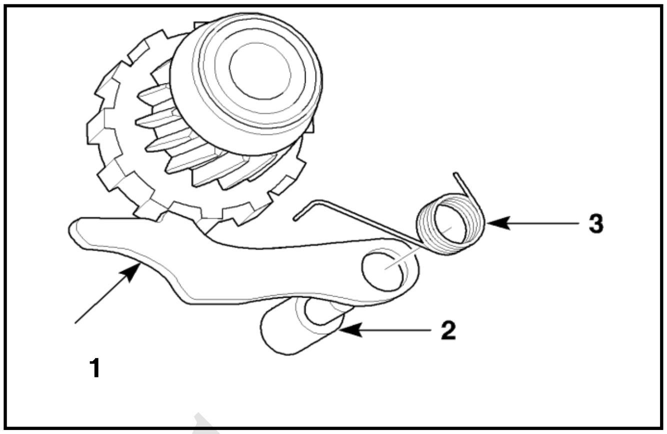
. Reliable clutch opening in all speed ranges

. Smoother shifts.

Parking Lock

The parking lock is actuated via the selector lever when in position P. It protects the vehicle mechanically against rolling away

The stop plate is actuated by the selector shaft, which is permanently connected to the selector lever via a pull cable. The parking lock pawl on the parking lock gear is welded onto the lateral shaft of the transaxle and this prevents the drive wheels from turning.



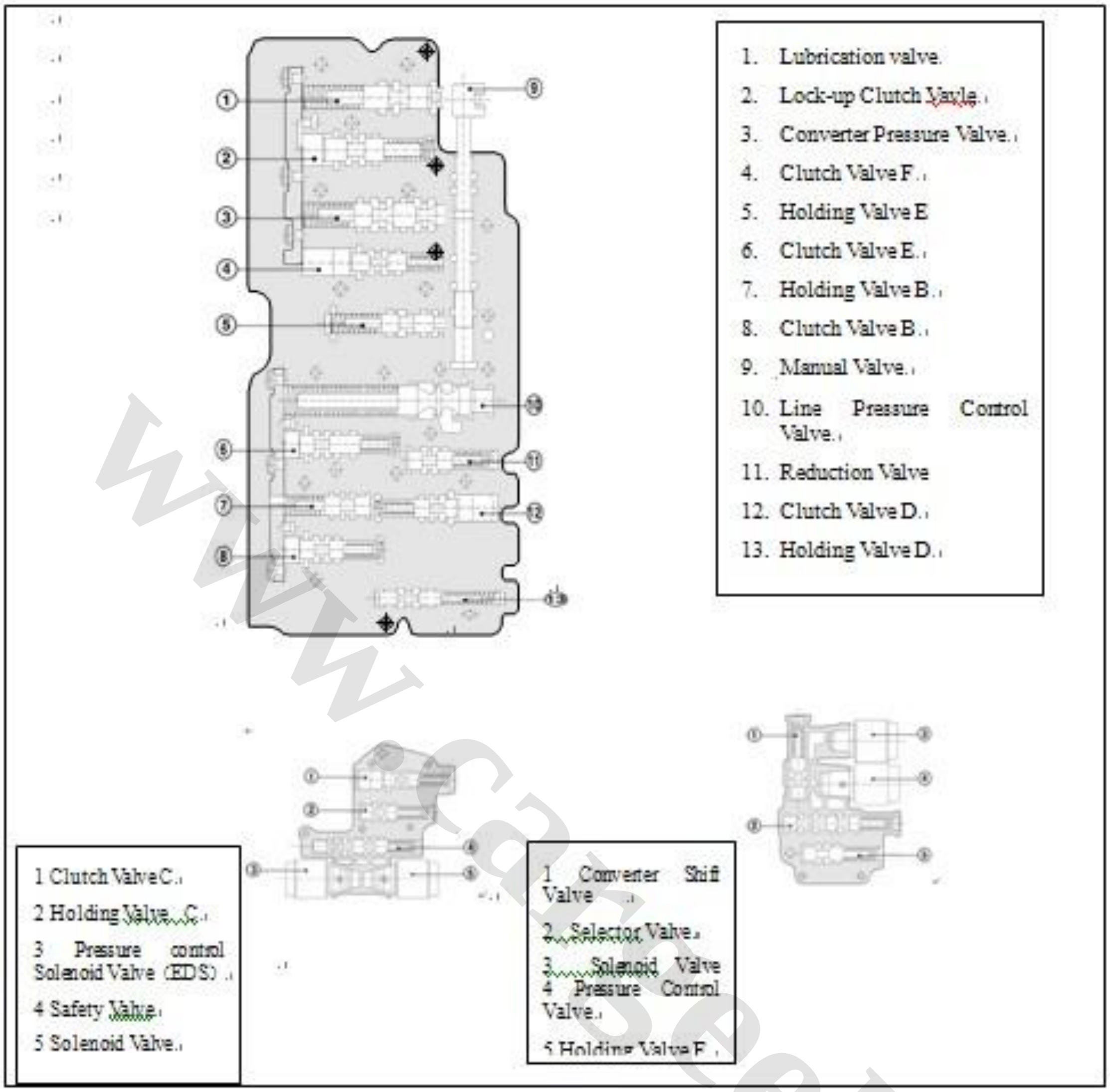
This blocks the driven wheels.

1. Pawl
2. Supporting Bolt
3. Leg Spring

Valve Body

Valve body performs the following tasks:

- Generates the line pressure needed for actuating the shift elements.
- Actuates the individual shift elements via the clutch valves.
- Assures limited operation of the automatic transaxle in the event of the electronics failing.
- Actuating the lock-up clutch.
- Generating the lubricating pressure for the transaxle



ELECTRONICAL COMPONENTS

Selector Lever/Program Switch

The driver engages the travel position via the selector lever:

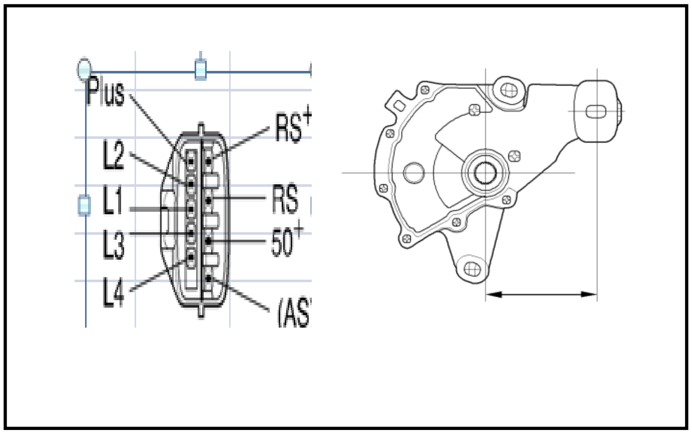
P : Park Position

R : Reverse

N : Neutral

D : Forward Speeds

Park/Neutral Position Switch



The Park/Neutral Position Switch is located on the selector shaft and informs the TCM of the current selector lever position P-R-N-D

The selector lever position is transmitted to the

TCM in encoded form along 4 lines. The encoding is such that malfunctions in the connecting lead are identified.

The Park/Neutral Position Switch is located on the selector shaft, which is connected to the selector lever via a pull cable. In addition, the Park/Neutral Position Switch controls the starter interlock, the reversing light and the selector lever position indicator on the instrument panel.

Signal Combination

	L1	L2	L3	L4
P	0	0	1	0
R	0	0	0	1
N	0	12	0	0
D	1	1	1	0

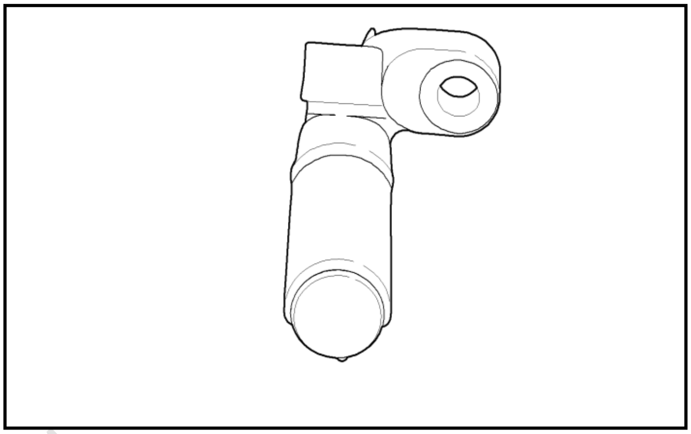
Automatic Transaxle Output Speed Sensor (A/T OSS)

The vehicle A/T OSS is a magnetic inductive pickup that relays information relative to vehicle speed to the TCM.

Vehicle speed information is used by the TCM to control shift timing, line pressure, and TCC (lock-up clutch) apply and release.

The output speed sensor mounts in the case at the speed sensor rotor, which is pressed onto the spur gear. An air gap of 0.1mm~1.3mm(0.004~0.05in) is maintained between the sensor and the teeth on the spur gear teeth. The sensor consists of a permanent magnet surrounded by a coil of wire.

As the differential rotates, an AC signal is generated by the output speed sensor (OSS).



Automatic Transaxle Input Speed Sensor

(A/T ISS)

The A/T ISS is a magnetic inductive pickup that relays information relative to transaxle input speed to the TCM.

The TCM uses transaxle input speed information to control line pressure, TCC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and TCC slippage.

The input speed sensor mounts onto piston B that is inside of valve body.

An air gap of 1.8~2.2mm(0.07~0.086inch) is maintained between the sensor and the piston B.

The sensor consists of a permanent magnet surrounded by a coil of wire. As the piston B is driven by the turbine shaft, an AC signal induced in the input speed sensor.

Higher vehicle speeds induce a higher frequency and voltage measurement at the sensor.

Sensor resistance should measure between 825~835Ω at 20℃ (68F). Sensor can measure from

1,000~8,000HZ.

Shift Solenoid Valve: Solenoid 1,2

The shift solenoids are two identical, normally open electronic exhaust work that control up shifts and downshifts in all forward gear ranges. These shift solenoids valves together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms (clutches, brakes).

Solenoid 1 controls the high or low of the line pressure(flow to each clutch valve) by the operation type (ON/OFF), i.e. solenoid 1is ON, line pressure will be low(87~116 psi (6~8bar)), solenoid 1 is OFF, line pressure will be high (232~261 psi (16~18bar)).

Solenoid 2 controls the oil flow to clutch valve E or lock-up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear for the vehicle operating conditions.

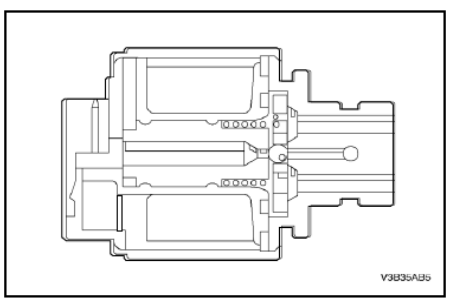
	Line Pressure Resistance	Resistance
Solenoid valve 1/ Solenoid valve 2	ON(low)6.2~6.8 bar OFF(high)15.3~17.46bar	26.5±0.5Ω

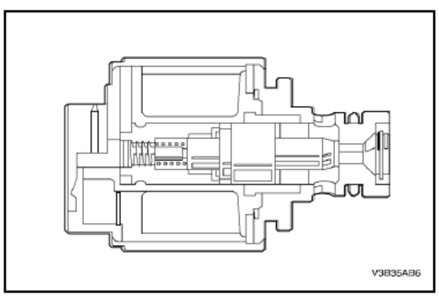
Gear	Solenoid 1	Solenoid 2
Park, Neutral	ON	ON
1	ON/OFF	ON
2	ON/OFF	OFF
3	ON/OFF	OFF
4	ON/OFF	OFF
R	ON/OFF	ON

Pressure Control Solenoid Valve (EDS VALVE 3,4,5,6)

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operation of the clutches, brakes and the lock p clutch.

The valve reduces the system pressure with which the down stream solenoid valves and electrical pressure regulating valves are supplied. It is possible to use smaller solenoid valves as a result. The EDS require a constant input pressure.

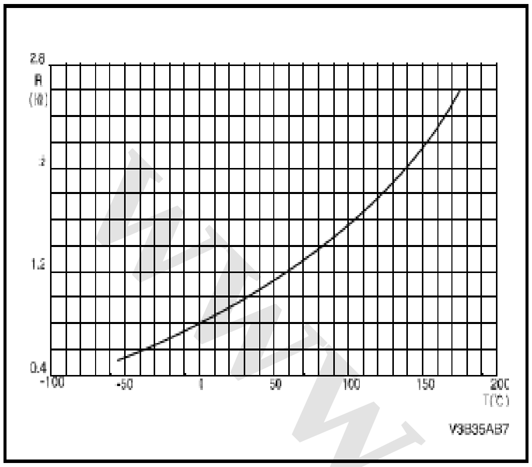


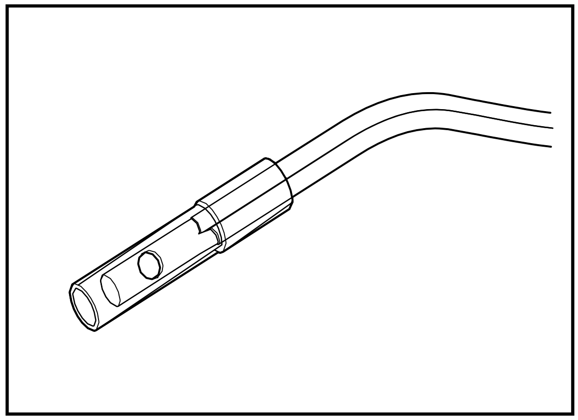


Transaxle Fluid Temperature (TFT) Sensor

The TFT sensor is a positive temperature coefficient. Thermistor (temperature sensitive resistor) that provides information to the TCM regarding transaxle fluid temperature. The temperature sensor is located in valve body. Calculated temperature is a factor used to determine the shift time and shift delay time. The internal electrical resistance of the sensor varies in relation to the operating temperature of the transaxle fluid

(see chart).





The TCU sends a 5 volt-reference signal to the temperature sensor and measures the voltage rise in the electrical circuit. A higher fluid temperature creates a higher resistance in the temperature sensor, thereby measuring a lower voltage signal.

The TCU measures this voltage as another input to help control line pressure, shift schedules and TCC apply. When transaxle fluid temperature reaches 140 ℃ (284f)

TFT – Temperature Resistance Voltage (approximate)

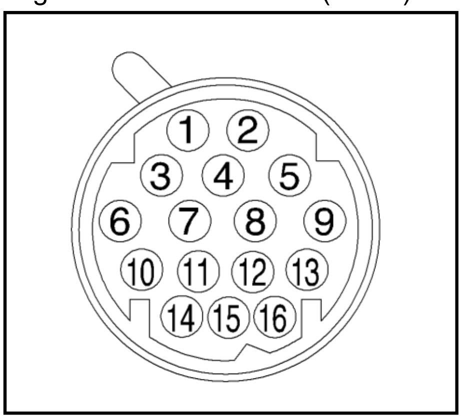
℃(℉)	R High	R Low	℃(℉)	R High	R Low (Ω)
–40	5	5	50	1,	1,17
–30	6	6	60	1,	1,25
–20	6	6	70	1,	1,34
–10	7	7	80	1,	1,43
0	8	7	90	1,	1,52
10 (50)	8	8	100	1,	1,61
20 (68)	9	9	110	1,	1,71
25 (77)	1	9	120	1,	1,81
30 (86)	1	1	130	2,	1,92
			140	2,	2,02

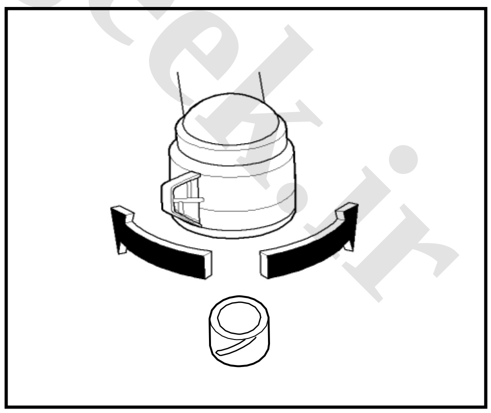
The Resistance of The Solenoids

Component	Pin	Resistance20ºC (68 ºF) Ω	Resistance140ºC (212ºF) Ω
S 1	3, 12	26.5±0.5Ω	26–345Ω
S 2	3, 13	26.5±0.5Ω	26–345Ω
EDS3	5, 6	5.7±0.45Ω	5.3–6.3Ω
EDS4	5, 7	5.7±0.45Ω	5.3–6.3Ω
EDS5	5, 10	5.7±0.45Ω	5.3–6.3Ω
Pressure Control Solenoid (EDS6)	5, 11	5.7±0.45Ω	
Transaxle Temperature Sensor	4, 9	980–1,000 Ω	
Input Speed Sensor	15, 16	830±5Ω	
Output Speed Sensor	1, 2	∞	

Transaxle Electrical Connector

The transaxle electrical connector is a very important part of the transaxle operating system. Any interference with the electrical connection can cause the transaxle to set Diagnostic Trouble Codes (DTCs) and/or affect proper operation.





The following items can affect the electrical connections:

Bent pins in the connector from rough handling during connection and disconnection.

Wires backing away from the pins

or coming un clamped (in either internal or external wiring harness).

Dirt contamination entering the connector when disconnected.

Pins in the internal wiring connector backing out of the connector or pushed out during re-connection.

Excessive transaxle fluid leaking into the connector, wicking up into the external wiring harness, and degrading the wire insulation

Pin	Description
1	Output Speed sensor (+)
2	Output Speed sensor (–)
3	Solenoid (+)
4	Transaxle Temperature Sensor(–)
5	Pressure Control Solenoid (+)
6	Pressure Control Solenoid (EDS3)
7	Pressure Control Solenoid (EDS4)
8	None
9	Transaxle Temperature Sensor (+)
10	Pressure Control Solenoid (EDS5)
11	Pressure Control Solenoid (EDS6)
12	Solenoid 1
13	Solenoid 2
14	None
15	Input Speed sensor (–)
16	Input Speed sensor (+)

The following items can affect the electrical connections:

Bent pins in the connector from rough handling during connection and disconnection.

Wires backing away from the pins or coming un clamped (in either internal or external wiring harness).

Dirt contamination entering the connector when disconnected.

Pins in the internal wiring connector backing out of the connector or pushed out during re-connection.

Excessive transaxle fluid leaking into the connector, wicking up into the external wiring harness, and degrading the wire insulation

Low pin retention in the external connector from excessive connection and disconnection of the wiring connector assembly.

Pin corrosion from contamination.

Broken/cracked connector assembly.

Points to remember when working with transaxle wiring connector assembly.

To remove the connector, squeeze the two tabs towards each other and pull straight up (refer to illustration).

Carefully limit twisting or wiggling the connector during removal. Bent pins can occur.

DO NOT pry the connector off with a screwdriver or other tool.

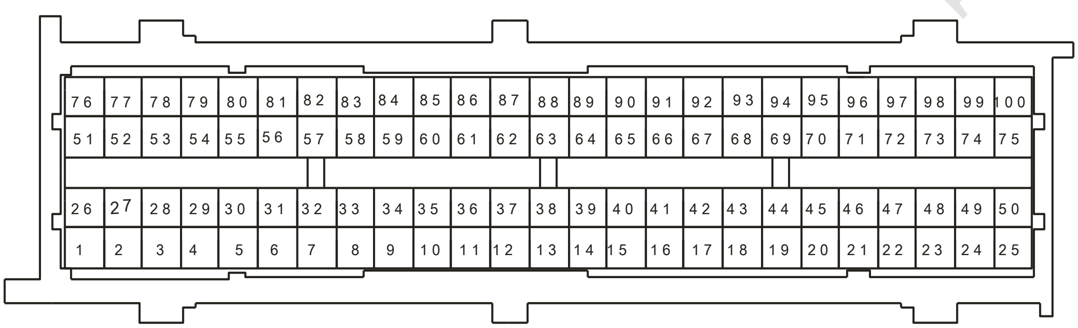
To reinstall the external wiring connector, first orient the pins by lining up arrows on each half of the connector.

Push the connector straight down into the transaxle without twisting or angling the mating parts.

The connector should click into place with a positive feel and/or noise.

Transaxle Control Module (TCU)

The transaxle control module (TCU) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, switches, and components to process for use within its control program. Based on this input information, the TCU controls various transaxle output functions and devices.



Pin	Description	Pin	Description
1		51	
2	Output Speed sensor (–)	52	
3	Ground	53	Battery
4	Transaxle Temperature Sensor(–)	54	
5	Pressure Control Solenoid (+)	55	
6	Output Speed sensor (+)Pressure Control Solenoid (EDS3)	56	
7	Pressure Control Solenoid (EDS4)	57	
8	None	58	PRNDL Sensor switch 1
9	Transaxle Temperature Sensor (+)	59	PRNDL Sensor switch 2
10	Pressure Control Solenoid (EDS5)	60	PRNDL Sensor switch 3
11	Pressure Control Solenoid (EDS6)	61	PRNDL Sensor switch 4
12	Solenoid 1	62	
13	Solenoid 2	63	Manual shift up
14	None	64	Manual shift down
15	Input Speed sensor (–)	65	Winter mode request
16	Input Speed sensor (+)	66	Ignition
17		67	
18		68	
19	Vehicle CAN High	69	
20	Vehicle CAN Low	70	
21	Instrument CAN High	71	
22	Instrument CAN Low	72	

23		73	
24		74	
25		75	
26		76	
27		77	
28	Ground	78	Battery
29		79	Solenoid power
30		80	Solenoid power
31	Discrete Output 3	81	TCU Solenoid D control
32	Discrete Output 4	82	TCU Solenoid E control
33	Ground	83	
34	5V return	84	
35		85	TCU Solenoid C control
36		86	TCU Solenoid B control
37	Transmission oil temperature	87	
38		88	
39		89	
40		90	
41		91	
42		92	
43		93	
44		94	

45		95	Input speed signal high
46		96	Input speed signal high
47		97	
48		98	
49		99	
50		100	

Data Link Connector (DLC)

The data link connector (DLC) is a multiple cavity connector. The DLC provides the means to access serial data from the TCM to aid in power train diagnosis. The DLC allows the technician to use a scan tool to monitor various systems and display diagnostic trouble codes (DTCs).

The DLC connector is located within the drivers compartment, directly below the steering column.

DIAGNOSTIC INFORMATION AND PROCEDURES

You must be familiar with some basic electronics to use this section of the Service Manual. They will help you to follow diagnostic procedures.

Notice :

Lack of the basic knowledge of this transaxle

when performing diagnostic procedures could result in in-correct diagnostic performance or damage to transaxle components.

Do not, under any circumstances, attempt to diagnose a transaxle problem without this basic knowledge.

Notice :

If a wire is probed with a sharp instrument and not properly sealed afterward, the wire will corrode and an open circuit will result.

Diagnostic test probes are now available that allow you to probe individual wires without leaving the wire open to the environment. These probe devices are inexpensive and easy to install, and they permanently seal the wire from corrosion.

Special Tools

You should be able to use a Digital Tester Meter

(DVM), a circuit tester, jumper wires or leads and a line pressure gauge set.

The functional check procedure is designed to verify the correct operation of electronic components in the transaxle.

This will eliminate the unnecessary removal of transaxle components.

FUNCTIONAL CHECK PROCEDURE

Begin with the Functional Check Procedure which provides a general outline of how to diagnose automatic transaxle.

The following functional check procedure will indicate the proper path of diagnosing the transaxle by describing the basic checks and then referencing the locations of the specific checks.

-Check the fluid level according to the Fluid Level Service Procedure.

-Check the transaxle for fluid leaks.

-Check if the transaxle fluid is not burnt by color and smell.

-Ensure that the transaxle is not in Limp Home Mode(LHM).

-Check the battery terminals and the ground connections for corrosion or looseness.

-Check that the cooler flow is not restricted.

-Check all electrical connections for tightness.

-Use on board diagnostic tool or a scan tool to see if any transaxle trouble codes have been set. Refer to the appropriate diagnostic Trouble Code (DTC) information and repair the vehicle as directed. After repairing the vehicle, perform the road test and verify that the code has not set again.

-Perform the Electrical/Garage Shift Tests.

-Perform the Road Test Procedure in this section.

-Inspect the oil and check for metal or other contaminants in the oil pan.

CLUTCH B、E OIL PRESSURE CHECK PROCEDURE

Before check the oil pressure, we should confirm if the Pressure Control Solenoid received correct signal from the TCU：

1. Connect the Scanner V30.
2. Start the engine and set parking brake
3. Check for a stored pressure control solenoid diagnostic trouble code, and other diagnostic trouble codes.

4. Repair vehicle, if necessary.

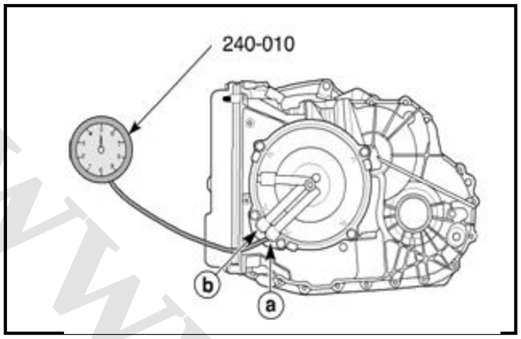
4.1 Inspect: Fluid level.

4.2 Manual linkage. Install or Connect:

4.3 Oil pressure gauge at line pressure port (clutch B or E ports on transaxle case)

Remark : a is CLTCH B

b is CLUTCH E



5. Put gear selector in Park and set the parking brake.
6. Start engine and allow it to warm up at idle.
7. Access the 'solenoid 1 Control Mode' on the scanner.
8. Switching solenoid 1 ON/OFF, accelerating the engine to 2,500rpm, and then read the line pressure at the each gear.

Notice :

Total test running time should not exceed 2 minutes, or transaxle damage could occur.

CAUTION : Brake must be applied at all times to prevent unexpected vehicle motion.

If pressure readings differ greatly from the line pressure chart, refer to the Diagnosis Charts contained in this section.

Notice :

Clutch damage may occur.

The scanner is only able to control the pressure control solenoid in Park and Neutral with the vehicle stopped.

This protects the clutches from extremely high or low pressures in Drive or Reverse rang.

Gear Range	Solenoid	Line Pressure	B	E
P / N	ON	low	6.2~8.6 bar	
	OFF	high	15.3~17.4 bar	

R	ON	low	6.2~8.6 bar	
	OFF	high	15.3~17.4 bar	
D	ON	low		6.2~8.6 bar
	OFF	high		9.5~11.2 bar

ROAD TEST PROCEDURE

-Perform the road test using a scan tool.

- This test should be performed when traffic and road conditions permit.

- Observe all traffic regulations.

The TCU calculates up shift points based primarily on two inputs : throttle angle and vehicle speed. When the TCU wants a shift to occur, an electrical signal is sent to the shift solenoids which in turn moves the valves to perform the up shift.

The shift speed charts reference throttle angle instead of in “min throttle” or “wot” to make shift speed measurement more uniform and accurate. A scan tool should be used to monitor throttle angle. Some scan tools have been programmed to record shift point information. Check the introduction manual to see if this test is available.

Up shift Procedure

With gear selector in drive(D)

1. Look at the shift speed chart contained in this section and choose a percent throttle angle of 10 or 25%.

2. Set up the scan tool to monitor throttle angle and vehicle speed.

3. Accelerate to the chosen throttle angle and hold the throttle steady.

4. As the transaxle up shifts, note the shift speed and commanded gear changes for :

- Second gear.

- Third gear.

- Fourth gear.

Important :

Shift speeds may vary due to slight hydraulic delays responding to electronic controls. A change from the original equipment tire size affects shift speeds.

Note when TCC applies. This should occur in fourth gear.

If the apply is not noticed by an rpm drop, refer to “the Lock-up Clutch Diagnosis” information contained in this section.

The Lock up clutch should not apply unless the transaxle has reached a minimum operating temperature of 8℃(46℉) TRANS TEMP AND engine coolant temp of 50℃(122℉)

5.Repeat steps 1-4 using several different throttle angles.

Part Throttle Detent Downshift

At vehicle steeds of 55 to 65km/h (34 to 40mph) in Fourth gear, quickly increase throttle angle to greater than 50%.

Verify that :

TCC apply.

Transaxle downshift to 3rd gear.

Solenoid 1 turns ON to OFF.

Solenoid 2 turns OFF.

Full Throttle Detent Downshift

At vehicle speeds of 55 to 65km/h (34 to 40mph)in Fourth gear, quickly increase throttle angle to its maximum position（100%）

Verify that :

TCC apply.

Transaxle downshift to Second gear immediately.

Solenoid 1 turns ON to OFF.

Solenoid 2 turns OFF.

Coasting Downshifts

1. With the gear selector in Overdrive(D), accelerate to Fourth gear with TCC applied.
2. Release the accelerator pedal and lightly apply the brakes, and observe that :

-TCC release.

-Down shifts occur at speeds shown ON the shift speed chart.

Use a scan tool to see if any transaxle trouble codes have been set. Refer to 'Diagnostic Trouble Codes' in this section and repair the vehicle as directed. After repairing the vehicle, perform the hoist test and verify that the code has not set again.

If the transaxle is not performing well and no trouble codes have been set, there may be an intermittent condition. Check all electrical connections for damage or a loose fit. You also have to perform a snapshot test which can help catch an intermittent condition that dose not occur long enough to set a code.

You may want to read 'Electronic Component Diagnosis' in this section to become familiar with transaxle conditions caused by transaxle electrical malfunction.

If no trouble codes have been set and the condition is suspected to be hydraulic, take the vehicle on a road test.

TORQUE CONVERTER LOCK-UP CLUTCH(TCC) DIAGNOSIS

To properly diagnosis the lock-up clutch(TCC) system, perform all electrical testing first and then the hydraulic testing.

The TCC is applied by fluid pressure which is controlled by a solenoid Located inside the valve body. The solenoid is energized by completing an electrical circuit through a combination of switches and sensors.

Functional Check Procedure

Inspect

1. Install a tachometer or scan tool.
2. Operate the vehicle unit proper operating temperature is reached.
3. Drive the vehicle at 80 to 88km/h (50 to 55 mph)with light throttle(road load).
4. Maintaining throttle position, lightly touch the brake pedal and check for release of the TCC and a slight increase in engine speed(rpm).
5. Release the brake slowly accelerate and check for a reapply of the Lock-up clutch and a slight decrease in engine speed(rpm).

Torque Converter Evaluation

Torque Converter Stator

The torque converter stator roller clutch can have one of two different type malfunctions :

A. Stator assembly freewheels in both directions.

B. Stator assembly remains Locked up at all times.

Condition A

-Poor Acceleration Low Speed

The car tends to have poor acceleration from a stand still.

At speeds above 50 to 55km/h(30 to 35mph), the car may act normal. If poor acceleration is noted, it should first be determined that the exhaust system is not blocked, and the transaxle is in 1st(First) gear when starting out. If the engine freely accelerates to high rpm in N(Neutral),it can be assumed that the engine and exhaust system are normal. Checking for poor performance in “Drive” and “Reverse” will help determine if the stator is freewheeling at all times.

Condition B

–Poor Acceleration High Speed

Engine rpm and car speed limited or restricted at high speeds. Performance when accelerating from a standstill is normal. Engine may overheat. Visual examination of the converter may reveal a blue color from overheating.

If the converter has been removed, the stator roller clutch can be checked by inserting two fingers into the splined inner race of the roller clutch and trying to turn freely clockwise, but not turn or be very difficult to turn counter clockwise.

Noise

Torque converter whine is usually noticed when the vehicle is stopped and the transaxle is in “Drive” or “Reverse” The noise will increase when engine rpm is increased.

The noise will stop when the vehicle is moving or when the torque converter clutch is applied because both halves of the converter are turning at the same speed.

Perform a stall test to make sure the noise is actually coming from the converter :

1. Place foot on brake.
2. Put gear selector in drive
3. Depress accelerator to approximately 1200rpm for no more than six seconds.

Notice :

If the accelerator is depressed for more than six seconds, damage to the transaxle may occur.

A torque converter noise will increase under this load.

Important :

This noise should not be confused with pump whine noise which is usually noticeable in P (Park), N(Neutral) and all other gear ranges. Pump whine will vary with pressure ranges.

The torque converter should be replaced under any of the following conditions:

-External leaks in the hub weld area.

-Converter hub is scored or damaged.

-Converter pilot is broken, damaged or fits poorly into crankshaft.

-Steel particles are found after flushing the cooler and cooler lines.

-Pump is damaged or steel particles are found in the converter.

-Vehicle has TCC shudder and/or no TCC apply.

Replace only after all hydraulic and electrical diagnoses have been made.(Lock up clutch material may be glazed.)

-Converter has an imbalance which cannot be corrected. (Refer To Converter Vibration Test Procedure.)

-Converter is contaminated with engine coolant containing antifreeze.

-Internal failure of stator roller clutch.

-Excess end play.

-Heavy clutch debris due to overheating (blue converter).

-Steel particles or clutch lining material found in fluid filter or on magnet when no internal parts in unit are worn or damaged(indicates that lining material came from converter).The torque converter should not be replace if :

-The oil has an odor, is discolored, and there is no evidence of metal or clutch facing particles.

-The threads in one or more of the converter bolt
holes are damaged. correct with thread insert.

-Transaxle failure did not display evidence of damage or worn internal parts, steel particles or clutch plate lining material in unit and inside the fluid filter.

-Vehicle has been exposed to high mileage(only).

The exception may be where the Lock up clutch damper plate lining has seen excess wear by vehicles operated in heavy and/or constant traffic, such as taxi, delivery or police use.

TCC shudder should only occur during the APPLY and/or
RELEASE of the Lock up clutch.

While TCC Is Applying Or Releasing

If the shudder occurs while TCC is applying, the problem can be within the transaxle or torque converter.

Something is not allowing the clutch to become fully engaged, not allowing clutch to release, or is trying to release and apply the clutch at the same time. This could be caused by leaking turbine shaft seals, a restricted release orifice, a distorted clutch or housing surface due to long converter bolts, or defective friction material on the TCC plate.

Shudder Occurs After TCC Has Applied :

In this case, most of the time there is nothing wrong with the transaxle! As mentioned above, once the TCC has been applied, it is very unlikely that will slip. Engine problems may go unnoticed under light throttle and load, but become noticeable after TCC apply when going up a hill or accelerating, due to the mechanical coupling between engine and transaxle.

Important :

Once TCC is applied there is no torque converter assistance. Engine or driveline vibrations could be unnoticeable before TCC engagement.

Inspect the following components to avoid misdiagnosis of TCC shudder and possibly disassembling a transaxle and/or replacing a torque converter unnecessarily :

-Spark plugs -Inspect for cracks, high resistance or broken insulator.

-Plug wires-Lock in each end, if there is red dust (ozone) or black substance (carbon) present, then the wires are bad. Also look for a white discoloration of the wire indicating arcing during hard acceleration.

-Distributor cap and rotor -look for broken or un-crimped parts.

-Coil-look for black on bottom indication arcing while engine is misfiring.

-Fuel injector -filter may be plugged.

-Vacuum leak-engine won't get correct amount of fuel. May run rich or lean depending on where the leak is.

-MAP sensor-like vacuum leak, engine won't get correct amount of fuel for proper engine operation.

-Carbon on intake valves -restricts proper flow or air/fuel mixture into cylinders.

-Flat cam -valves don't open enough to let proper fuel/air mixture into cylinders.

-Oxygen sensor-may command engine too rich or too lean for too long.

-Fuel pressure-may be too low.

-Engine mounts-vibration of mounts can be multi-plied by TCC engagement.

-Axle joints-checks for vibration.

TPS-TCC apply and release depends on the TPS in many engines. If TPS is out of specification, TCC may remain applied during initial engine starting.

-Cylinder balance-bad piston rings or poorly sealing valves can cause low power in a cylinder.

-Fuel contamination-causes poor engine performance.

Lock-up Clutch Shudder Diagnosis

The key to diagnosing lock-up clutch(TCC) shudder is to note when it happens and under what conditions.

INPUT SIGNAL WHICH AFFECT 4FA24-21-K TRANSAXLE'S TCU

Throttle Position Sensor

Provide the throttle position data to TCU, which the P/N start switch and TCU decide open or lock。

The error data would affect shift gear type was incorrect, or gear change not smooth ,or affect the TCU's function.

ISS

Provide the vehicle speed data to TCU,which decide TCC control mode and calculate the gear ratio.

The error data would affect shift gear type was incorrect, or gear change not smooth ,or affect the TCC control mode.

OSS

Provide the drive axle speed data to TCU, which decide TCC control mode and calculate the gear ratio.

Coolant Temperature Sensor

Provide the coolant temperature to TCU, Which decide TCC initial running.

The error data would affect incorrect TCC control.

The Engine Speed

The ignition module provide data to TCU..

TCU control the throttle and PWM solenoid and TCC duty ratio by the speed of engine information.

Brake Lamp Switch

TCU provide brake information to control TCC.

The error data would affect TCC running.

TFT

On high temperature condition (high temperature mode),TFT provide the fluid temperature signal to TCU, which control the gear shift type and TCC control mode.

The error signal affect that gear shift was no good, and TCC mistaken.

DIAGNOSTIC TROUBLE CODE DIAGNOSIS

P0731、P0732、P0733、P0734、P0736

1.DTC Identification

DTC	Description	Indication	Default Action
P0731	Gear 1 incorrect Ratio	The exact gear ratio is different with the theory ratio.	Default Mode
P0732	Gear 2 incorrect Ratio		
P0733	Gear 3 incorrect Ratio		
P0734	Gear 4 incorrect Ratio		
P0736	Gear R incorrect Ratio		

2.Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0731 P0732 P0733 P0734 P0736	1.Check the wiring route. 2.Check the Clutch B/E &Line oil pressure. 3.Check the fluid's quality.	Input speed sensor & Output speed sensor received the speed discrepancy over the TCU's standard.(slipping)	1.Main oil pressure is too low 2. The friction piece of excessive wear、 3.the sensors are damaged、 4.The clutch & Brake are decompression.

3..Inspection Procedure

Inspection Condition	Detail/Result/Action
	Check the fluid level(too low & too high),fluid quality is normal or not? B. Check the main pressure ,Clutch B/E fluid's pressure.。 No normal，Clutch B/E malfunction。 Pressure is normal，The friction piece of excessive wear。

P0717、P0722

1.DTC Identification

DTC	Description	Indication	*Default Action*
P0717	Input speed sensor don't out signal	Speed data less than the standard	Default Mode
P0722	Output speed sensor don't out signal		

2.Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0717 P0722	1.Check the wiring route. 2.Read the data steam by Scanner , Check the signals of all the sensors are complete or not	The battery voltage is normal, Engine is RUN, Gear position is "D" ,There is no other fault, the speed is high enough.	The harness and the connectors ; Sensors ; TCU

3.Inspection Procedure

Inspection Condition	Detail/Result/Action
	Was the transaxle harness connector jointed good? Are there some other thing. Yes , Please clean it, and restore。 Were the sensors' harness connector jointed good? Yes , replace it。 Was the sensor malfunction? Yes , change the sensor.

P0741

1.Condition for setting the DTC

DTC	Description	Indication	*Default Action*
P0741	The converter clutch cann't lock-up	The converter clutch cann't lock-up	The converter control signal keep opening always.

2.Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0717	Check the harness & connector. Check the Solenoid EDS3	There are no others faults , the converter control DC more than the standard and delay the standard time.	The converter. EDS3 The Clutch Lock-up Valve

3.Inspection Procedure

Inspection Condition	Detail/Result/Action
	1.Check the Throttle Position Sensor is normal, or not? Not, please replace or adjust it. Was the EDS3 connector joint good enough? Was there other thing in it? Yes，clean and restore it. Check the EDS3 resistance，it is not normal，replace it。 If we finished the upper operations, we can not resolve，Change the converter.

DTC P0742

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0742	The converter locked up incorrectly	The converter can not open	The converter control signal keep opening always.

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0742	Check the harness & connector. Check the Solenoid EDS3	The engine is running，the running time is longer than standard, no any faults，APS bigger than standard, Gear shift level stay on “P”，when we change the shift level, the temperature of the fluid is higher than standard, output speed is higher than standard，the converter control DC is “0”,keep the standard time.	1.The converter. 2.EDS3 3.The Clutch Lock-up Valve

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1. Was the EDS3 connector joint good enough? Yes，clean and restore it.

	Check the EDS3 resistance，it is not normal，replace it。 If we finished the upper operations, we can not resolve，Change the converter.

P0706

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0706	PARK/NEUTRAL Position Switch malfunction	The P/N Position Switch malfunction signal was error or stayed the middle long time	Default Mode

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0706	The instrument indicator show same, or not?	There were no others faults，the rotation speed of the engine was higher than standard. The voltage of the battery was higher than standard.	The P/N switch & Its position The drag line adjustment position. The shift gear machine

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1.Was the shift gear machine loosen? Yes，replace or adjust it； 2.Was the P/N switch position is same with the instrument indictor? No，replace or adjust it； 3.Was the P/N switch is correct? No，replace or adjust it； 1. Release the upper factors，the P/N switch was be damaged。

P0826

1. Condition for setting the DTC

DTC	Description	Indication	Default Action

P0826	Manual Increase or Decrease switch malfunction	Manual Increase or Decrease switch compare with the P/N switch that has logic fault.	Shut off Manual Increase or Decrease switch function.

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0706	The reality is same with the instrument indictor, or not?	There were no others faults ,the rotation speed of the engine was higher than standard. The voltage of the battery was normal , the shift level place on Manual position.	1 P/N switch 2 Manual Increase or Decrease switch 3.the fuse burn

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1. Was the fuse burn? Yes, replace new one. 2. Was the Manual Increase or Decrease switch normal? No, Adjust or replace it.

P0712、P0713、P0714、P0710

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0712	Transaxle fluid temperature sensor directly received low voltage pulse	The voltage of TFS is lower than the initial bottom limit data.	Shut off the lowest temperature Mode/High oil temperature mode/low oil temperature mode.oil temperature mode turn into default mode.
P0713	Transaxle fluid temperature sensor directly received high voltage pulse	The voltage of TFS is higher than the initial bottom data.	
P0714	**TFT** signal	The voltage of TFS changed	

	turning sharp	sharply.	
P0710	**TFT** signal turning delayed	The different data of the reality oil temperature between with the oil temperature when initial started that is lower than standard, or the different data of this time start engine coolant temperature between with the last time shut off engine coolant temperature that is higher than standard , or the different data of this time start engine oil temperature between with the last time shut off engine oil temperature that is lower than standard.	

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0712	The real resistance is less than normal data.	There are no others malfunctions , the engine was running normal, the voltage of the battery is normal.	1.Transaxle Fluid Temperature Sensor 2.Harness
P0713	The real resistance is more than normal data.	There are no others malfunctions , the engine was running normal, the voltage of the battery is normal. the temperature of environment is higher than standard, or the input speed of transaxle over the standard, and keeping time long enough, or the coolant temperature over the standard.	1.Transaxle Fluid Temperature Sensor 2.Harness
P0714	At especial temperature the resistance will be	There are no others malfunctions , the engine was running normal, the voltage of the battery is normal.	1.Transaxle Fluid Temperature Sensor

	changed		2.Harness
P0710	The resistance change as the temperature, but it is not sensitive.	There are no others malfunctions , the engine was running normal, the voltage of the battery is normal.	1.Transaxle Fluid Temperature Sensor 2.Harness

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1.Was the same what the real fluid temperature compare with that the instrument showed ? Was the oil cooler traffic? Was the fluid lack? Yes ,clean and supply the fluid. 2.Was normal the harness connector? No, adjust and replace it. 3.Was normal the transaxle fluid temperature sensor? No, adjust and replace it.

U0073、U0001

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
U0073	CAN communicate malfunction	CAN device was malfunction.	Turn into default mode
U0001	CAN data transfer over limited time	No received any CAN signal	

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
U0073 U0001	Inspect the hardware and route	Losing communication signal, the signal is logic error.	1.CAN ; 2.ECU ; 3.TCU 4.DLC

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	Was the harness loosen or damaged? Yes, adjust and replace it. Use V30(Scanner) release DTCs, check the harness, re-connect the V30(Scanner) , and check the DTCs, if

	there are some DTCs, check the TCU & ECU.

P0977、P0980、P0983、P0986

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0977	EDS4 directly received high voltage pulse	Core received high voltage pulse	Turn into default mode
P0980	EDS5 directly received high voltage pulse	Core received high voltage pulse	Turn into default mode
P0983	EDS6 directly received high voltage pulse	Core received high voltage pulse	Turn into default mode
P0986	EDS3 directly received high voltage pulse	Core received high voltage pulse	Turn into default mode

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0977 P0980 P0983 P0986	Inspect the hardware and route	Key on time over the limited , the engine running time is over the limited, there are no others malfunction, not in limp driving mode.	Solenoids TCU Harness

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1. Was the harness loosen or damaged? Yes, adjust and replace it. 2. Were the voltage and the resistance normal? No, replace relative parts. 3. Check the ground points, adjust them in time.

P0976、P0979、P0982、P0985

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0976	EDS4 directly	Core received high	Turn into default mode

	connect ground point or opening.	voltage pulse	
P0979	EDS5 directly connect ground point or opening	Core received high voltage pulse	Turn into default mode
P0982	EDS6 directly connect ground point or opening	Core received high voltage pulse	Turn into default mode
P0985	EDS3 directly connect ground point or opening	Core received high voltage pulse	Turn into default mode

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0976 P0979 P0982 P0985	Inspect the hardware and route	Key on time over the limited , the engine running time is over the limited, there are no others malfunction, not in limp driving mode.	1.Solenoids 2.TCU 3.Harness

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1. Was the harness loosen or damaged? Yes, adjust and replace it. 2. Were the voltage and the resistance normal? No, replace relative parts. 3. Check the ground points, adjust them in time.

P0880

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0880	The Pin 79 & 80 of the solenoid were malfunction	Core found the ACC malfunction.	Turn into default mode

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0880	Check the	Key on time over the	1.TCU connector is not

	wire route. Check the voltage.	limited , the engine running time is over the limited, there are no others malfunction, not in limp driving mode.	effective. 2.check the wire open circuit or short circuit. 3.TCU malfunction

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	Inspect the voltage between pin 79 and 80. If it zero , the TCU malfunction. Not zero, the wire route were open circuit or short circuit.

P0963、P0967

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0963	Valve MV1 directly received high voltage pulse	Core recieved high voltage pulse	Turn into default mode
P0967	Valve MV2 directly received high voltage pulse		

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0963	Inspect the hardware and route	Key on time over the limited , the engine running time is over the limited, there are no others malfunction, not in limp driving mode.	1.Solenoids ; 2.Transaxle harness ; 3.TCU
P0967			

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1. Was the harness loosen or damaged? Yes, adjust and replace it. 2. Were short circuit or open circuit between pin 12,13 with pin 3 of the transaxle harness? Yes , the solenoid was malfunction, no ,check the TCU and

	TCU harness.

P0962、P0966

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0962	Valve MV1 directly received low voltage pulse	Core recieved low voltage pulse	Turn into default mode.
P0966	Valve MV2 directly received low voltage pulse		

2.Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0962	Inspect the hardware and route	Key on time over the limited , the engine running time is over the limited, there are no others malfunction, not in limp driving mode.	1.Solenoids； 2.Transaxle harness； 3.TCU
P0966			

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1. Was the harness loosen or damaged? Yes, adjust and replace it. 2. Were short circuit or open circuit between pin 12,13 with pin 3 of the transaxle harness? Yes , the solenoid was malfunction, no ,check the TCU and TCU harness.

P0960、P0964

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0960	The valve MV1 control wire was open circuit	Core not recieved any voltage signal	Turn into default mode.
P0964	The valve MV1		

	control wire was open circuit		

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0962 P0966	Inspect the hardware and route	Key on time over the limited , the engine running time is over the limited, there are no others malfunction, not in limp driving mode.	1.Solenoids ; 2.Transaxle harness ; 3.TCU

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	1. Was the harness loosen or damaged? Yes, adjust and replace it. 2. Were short circuit or open circuit between pin 12,13 with pin 3 of the transaxle harness? Yes , the solenoid was malfunction, no ,check the TCU and TCU harness.

P0562、P0563、P0606、P0601

1. Condition for setting the DTC

DTC	Description	Indication	Default Action
P0562	The voltage of the system is low	TCU Diagnosis himself	Turn into default mode
P0563	The voltage of the system is high	TCU Diagnosis himself	Turn into default mode
P0606	TCU malfunction	TCU Diagnosis himself	Turn into default mode
P0601	TCU memory malfunction	TCU Diagnosis himself	Turn into default mode

2. Condition for setting the DTC

DTC	Inspection Method	Condition	Malfunction Parts
P0976	TCU Diagnosis	When the ignition	1.TCU

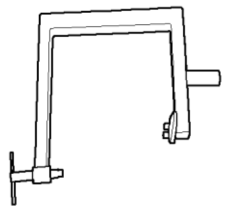
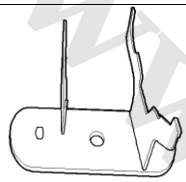
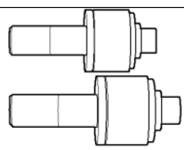
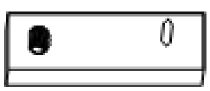
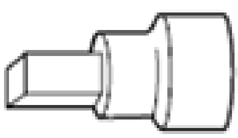
P0979	himself	switch turn on, diagnosis malfunction himself	2.Harness
P0982			
P0985			

3. Inspection Procedure

Inspection Condition	Detail/Result/Action
	Connect the V30(Scanner) Were there any DTCs in AT system? Yes, first solve them, no ,replace TCU.

MAINTENANCE AND REPAIR

Special Tools

	260–020 Transaxle Holding Fixture
	260–010 Transaxle Support Fixture
	260–030 Axle Seal Installer
	260–050 P/N Position Switch Installer
	260–070 Transaxle Plug Remover/Installer

ON VEHICLE SERVICE TRANSAXLE FLUID LEVEL CHECKING PROCEDURE

Tools Required

260-070 Plug Remover/Installer

Inspection Procedure

1. Start the engine and allow the engine to idle for approximately 5 minutes, or, if possible,

drive the vehicle for a few kilometers(miles) to warm the transaxle fluid. Check the fluid level when the transaxle is over 40±5℃

2. Press the brake pedal and move the shift lever through the gear ranges, pausing 2-3 seconds in each range. Return the shift lever to the park position. (Left-Hand Drive Shown, Right-Hand Drive Similar.)
3. Raise and suitably support the vehicle
4. Place a fluid container below the fluid level plug.

CAUTION : Do not remove the fluid level plug if the transaxle fluid is hot. This may cause injury if the fluid drains from the plug hole.

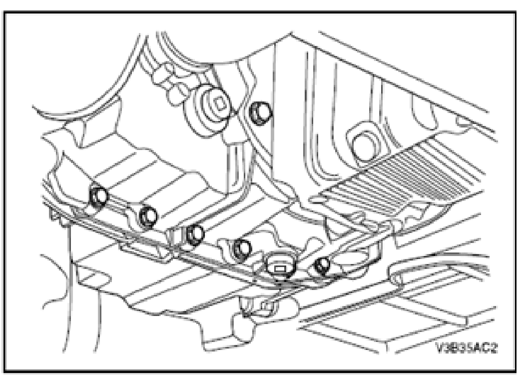
5. Remove the fluid level plug using the plug remover/installer 260-70. Because the transaxle operates correctly over a range of levels, fluid may or may not drain out of the plug hole when the plug is removed.
6. Check the oil fluid level. If fluid does not drain

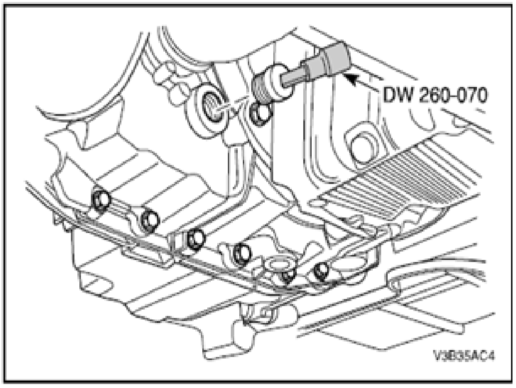
through the plug hole after adding a total of 4 liters, then the transaxle was either under filled or the transaxle is leaking fluid. Inspect the transaxle for fluid leaks. Fix any leaks before setting the transaxle fluid level.

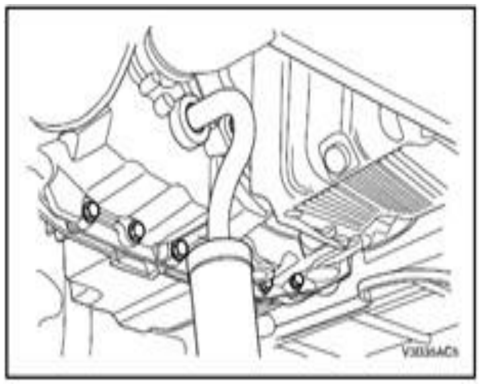
7. Install the fluid level plug using the plug remover/installer 260-70.

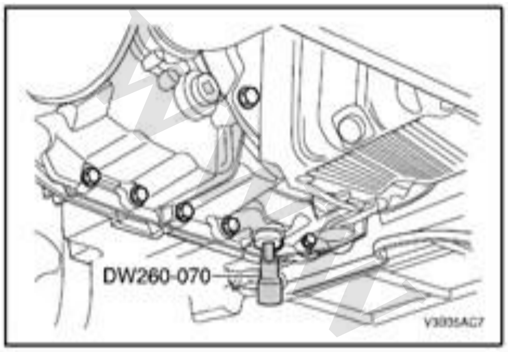
Tighten the Plug to 45 N.m

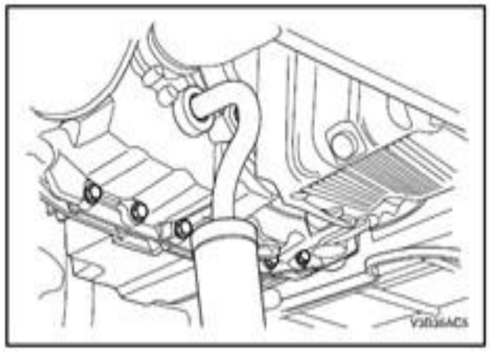
8. When the fluid level checking procedure is completed, wipe any fluid from the transaxle case with a rag or shop towel. Also, check that the fluid fill cap and the vent tube are properly installed.











Fluid Quality Turn Bad：

The oil's color is too black；there are mixed some mental powder and friction material powder. The smell is so strange. 。

remark：the oil's color from yellow turn deep dark what is normal.

CHANGING THE FLUID

Tools Required：

260-070 Remover/Installer

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Place a fluid container below the fluid drain plug.
3. Remove the transaxle fluid drain plug using the plug remover/installer 260-070 release the oil plug.

   Plug torque: 45N.m

4. Adding transaxle fluid. Refer to 'Transaxle Fluid Level Checking Procedure' in this section.

REPAIRING FLUID LEAKS

Locating Leaks

1. Verify that the leak is transaxle fluid.

2. Thoroughly clean the suspected leak area.
3. Operate the vehicle for about 25 kilometers (15miles) or until the transaxle reaches normal operating temperature, 88℃
4. Park the vehicle over clean paper or cardboard.
5. Turn the engine off and look for fluid spots on the paper.
6. Make the necessary repairs to correct the leak.

FLUID LEVEL SET AFTER SERVICE

1. Add transaxle fluid through the fill cap hole prior to adjusting the fluid level. The amount of fluid to add should be based on the type of service done.

Adjustment Notice

-Use ESSO LT 71141 $TOTAL H50235 transaxle fluid .If we mixed to use the two type transaxle fluid, there is no bad influence for the Transaxle.

-Oil pan removed : 4L

-Torque converter removed : 2L

-Complete overhaul : 6.7L

-Drain plug removed : 4L

2.Check the transaxle fluid level. Refer to ‘transaxle Fluid Level Checking Procedure’ in this section.

3.Add additional fluid through the fill cap hole in 0.5 liter increments until the fluid comes out through the plug hole.

4.Allow the fluid to finish draining out through the plug hole, then install the fluid level plug.

5.When the fluid level setting procedure is completed, wipe any fluid from the transaxle case with a rag or shop towel. Also, check that the fluid fill cap and the vent tube are properly installed.

TRANSAXLE CONTROL MODULE(TCU)

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the wiring connectors.
3. Remove the transaxle control module(TCU) from the bracket.

Installation Procedure

1. Install the TCU into the bracket.
2. Connect the wiring connectors.
3. Connect the negative battery cable.

PARK/NEUTRAL POSITION SWITCH

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the park/neutral position switch electrical connector.
3. Disconnect the shift control cable and the retaining clip.
4. Remove the shift lever nut and the shift lever.
5. Remove the park/neutral start switch.

Tools Required

260-50 P/N Switch Installer

Installation Procedure

Install the park/neutral start switch.

Tighten the bolts to 10 N

2. Adjust the park/neutral switch using the P/N switch installer 260-50.

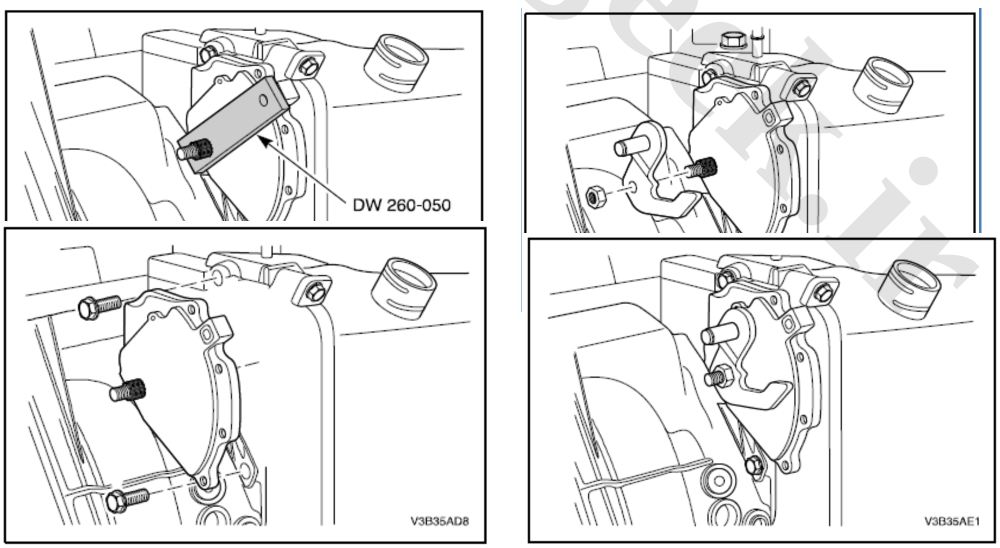
Notice :

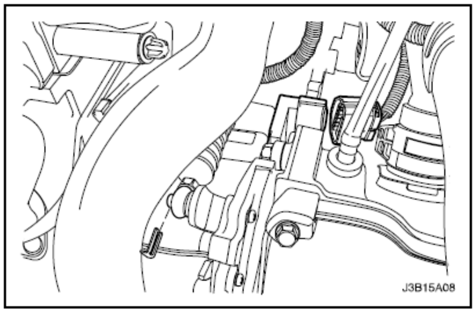
When install the park/neutral switch, using the special service tools and the shift lever must be positioned” neutral”

3.Install the shift lever and the shift lever nut.

Tighten the shift lever nut to 10 N

4. Connect the shift control cable and the retaining clip.
5. Connect the park/neutral position switch electrical connector.
6. Connect the negative battery cable.





OIL COOLER PIPES/HOSES

Removal Procedure

Important :

Place a drip pan under the hoses to catch the fluid that will run out of the lines.

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the engine under cover. Refer to Section 9N, Frame and Underbody.
4. Remove the oil cooler outlet pipe bolt from the right lower side of the radiator.
5. Remove the oil cooler outlet pipe bracket bolt.
6. Remove the oil cooler outlet pipe bolt from the transaxle side.
7. Remove the oil cooler outlet pipe assembly.
8. Remove the oil cooler inlet pipe bolt from the left lower side of the radiator.
9. Remove the oil cooler inlet pipe bolt from the transaxle side.
10. Remove the oil cooler inlet pipe assembly.

Installation Procedure

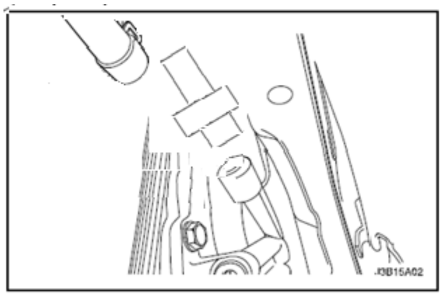
Install the oil cooler inlet pipe assembly and the bolts.

Tighten the oil cooler inlet pipe bolts to 35 N

2. Install the oil cooler outlet pipe assembly and the bolts.

Tighten the oil cooler outlet pipe bolts to 35 N

3. Refill the transaxle fluid. Refer to “Transaxle Fluid Checking Procedure” in this section.
4. Install the engine under cover. Refer to Section 9N,Frame and Underbody.
5. Connect the negative battery cable.



DRIVE AXLE OIL SEAL

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the drive axles. Refer to Section 3A, Automatic Transaxle Drive Axle.

Notice :

Be careful not to damage the bore of the transaxle case.

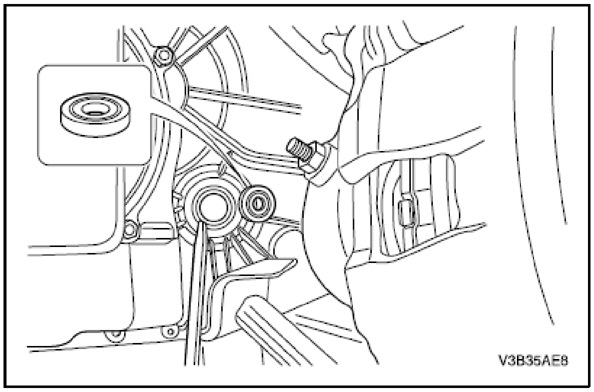
3. Remove the transaxle drive seal using a screwdriver. If necessary, crush the seal first with the screw driver in order to loosen the seal from the case.

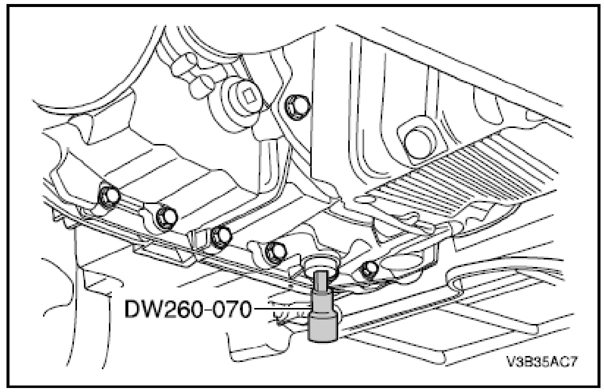
Tools Required

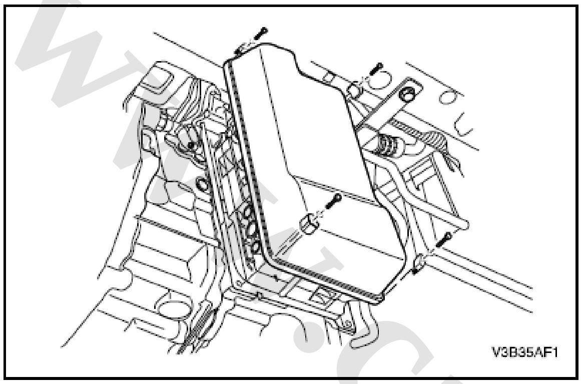
260-30 Axle Seal Installer

Installation Procedure

1. Install the transaxle drive seal using the axle seal installer 260-30
2. Install the drive axles. Refer to Section 3A, Automatic Transaxle Drive Axle.
3. Connect the negative battery cable.







OIL PAN, OIL PAN GASKET

Tools Required

260-70 Plug Remover/Installer

Removal Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the engine under cover. Refer to Section 9N, Frame and Underbody.
4. Place a fluid container below the fluid drain plug.
5. Remove the transaxle fluid drain plug using the plug remover/installer 260-70 and drain the transaxle fluid.
6. Remove the oil cooler inlet and outlet pipes. Refer to “oil Cooler Pipe/Hose” in this section.
7. Remove the oil pan and oil pan gasket.

Installation Procedure

1. Install the oil pan, oil pan gasket and bolts.

Tighten the oil pan bolts to 6 N

2. Install the oil cooler inlet and outlet pipes. Refer to “oil Cooler Pipe/Hose”in this section.

3. Install the transaxle fluid drain plug using the plug remove/installer 260-70.

4. Install the engine under cover. Refer to

Section 9N,Frame and Underbody.

5. Refill the transaxle fluid. Refer to “transaxle Fluid Level Checking Procedure” in this section.

6. Connect the negative battery cable.

CONTROL VALVE BODY ASSEMBLY

Tools Required

260-70 Plug Remover/Installer

Removal Procedure

1. Disconnect the negative battery cable.

2. Disconnect the transaxle wiring harness and the park/neutral position switch electrical connector.

3. Raise and suitably support the vehicle.

4. Remove the engine under cover. Refer to

Section

9N, Frame and Underbody.

5. Remove the transaxle fluid drain plug using the plug remover/installer 260-70 and drain the transaxle fluid.

6. Remove the oil pan, oil pan gasket. Refer to “oil Pan, Oil Pan Gasket” in this section.

7. Remove the valve body mounting bolts.

8. Remove the automatic transmission input speed sensor mounting bolt.

9. Remove the automatic transmission output speed sensor mounting bolt.

10. Remove the control valve body.

Installation Procedure

1. Install the control valve body and the bolts.

Tighten the valve body mounting bolts to 8 N.m

2. Install the input speed sensor mounting bolt.

Tighten the input speed sensor mounting bolt to 8N.m

3. Install the output speed sensor mounting bolt.

Tighten the output speed sensor mounting bolt to 6N.m

4. Install the oil pan and oil pan gasket. Refer to “oil Pan Gasket” in this section.

5. Install the transaxle fluid drain plug using the plug remove/installer 260-70.

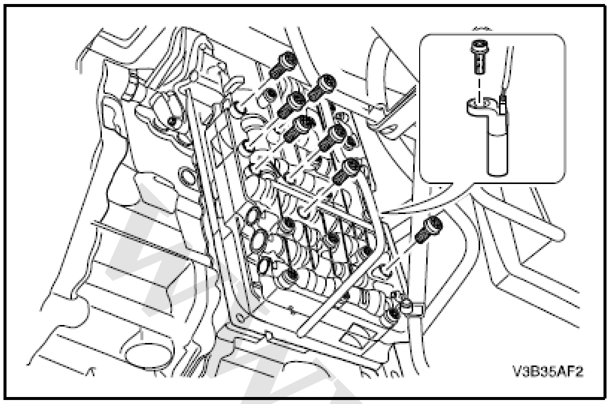
6. Install the engine under cover. Refer to Section 9N,Frame and Underbody.

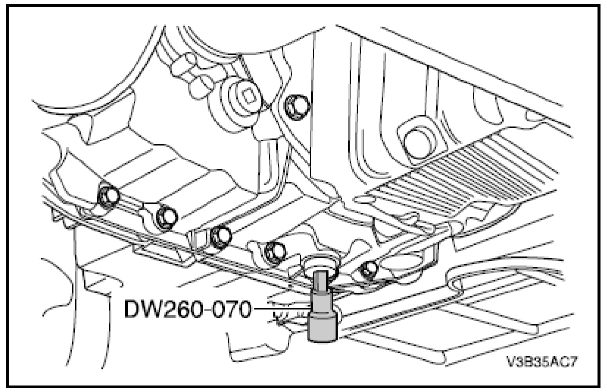
7. Lower the vehicle.

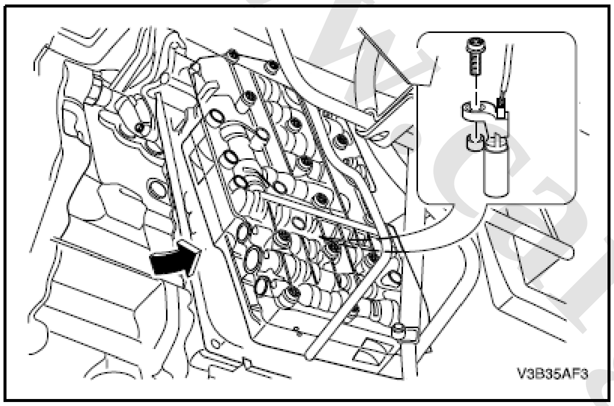
8. Connect the transaxle wiring harness and the PNP switch electrical connector.

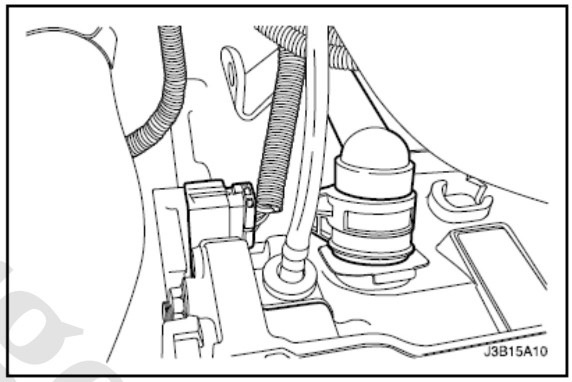
9. Refill the transaxle fluid. Refer to “transaxle Fluid Level Checking Procedure” in this section.

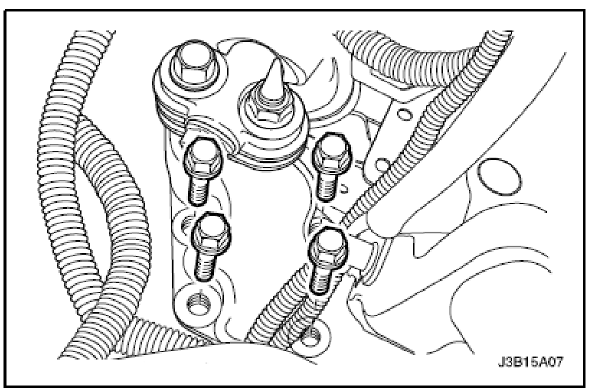
10. Connect the negative battery cable.











UNIT REPAIR

TORQUE CONVERTER

Disassembly and Assembly Procedure

1. Remove the transaxle assembly. Refer "to transaxle Assembly" in this section.
2. Remove the torque converter assembly.

3. Installation should follow the removal procedure in the reverse order.

TRANSAXLE HOLDING FIXTURE

ASSEMBLY

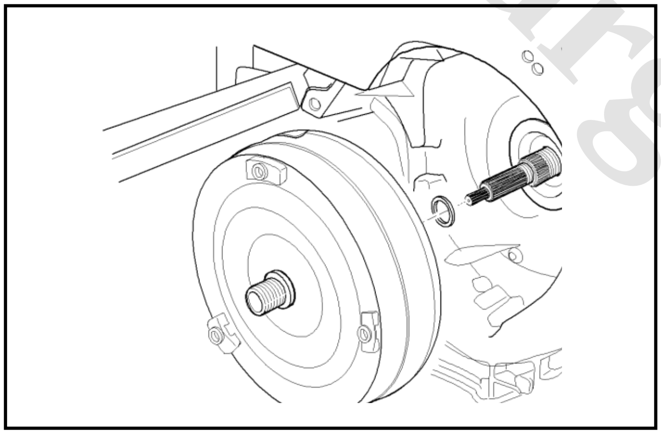
Tools Required

260-20 Transaxle Support Fixture

CAUTION : To reduce the possibility of personal injury or transaxle damage, make sure, when doing the next step, that all of the bolts for the support fixture are installed as shown, and that the bolts are tightened to 11 N.m

Disassembly and Assembly Procedure

1. Install the transaxle support fixture 260-20 onto the transaxle.
2. Torque the support fixture bolts to 11 N.m
3. Position the transaxle with the rear cover facing up.



VALVE BODY

Disassembly and Assembly Procedure

1. Remove the oil pan bolts and oil pan.
2. Remove the oil pan gasket.
3. Remove valve body fixing bolts and transaxle input speed sensor bolt on the valve body.
4. Remove the holder for the transaxle input speed sensor.

Installation Notice

Tighten the bolts to 8 N.m

5. Tilt the valve body.

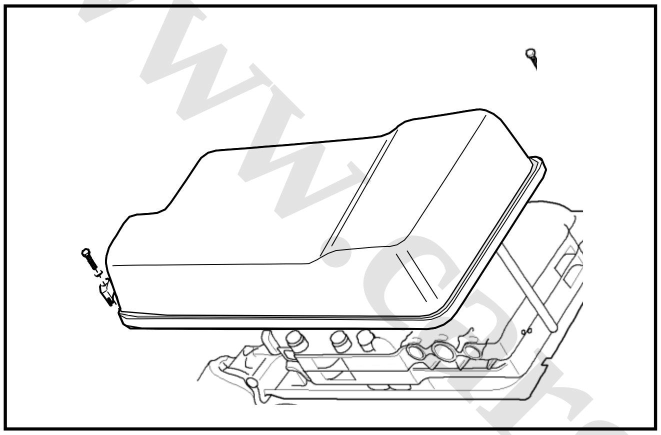
6. Remove the fastening screw for the output speed sensor under the valve body assembly.

7. Lever the cable out of the retaining clip and pull out the output speed sensor.

8. Installation should follow the removal procedure in the reverse order.

Installation Notice

Tighten the screw to 6



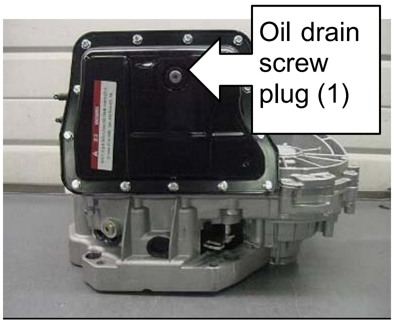
Section III Continuously Variable Transmission (CVT)

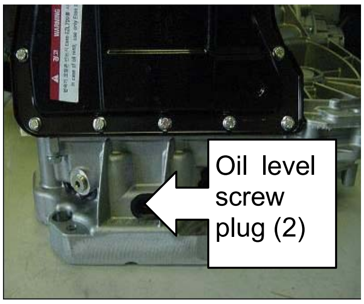
1. Use regulations

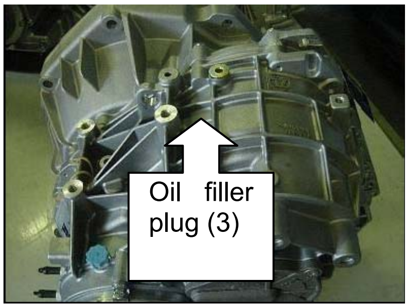
1.1. Refill oil /oil level check description

This means whenever the transmission discharges oil or is replaced; the following oil level check shall be made. As the service part, the transmission is not filled with oil. It is necessary to fill X.xx L ESSO EZL799 (A) into the transmission after it is installed in the vehicle. After filling oil, check oil level according to the following method:

- Start the engine and run idly for at least 10 seconds (Note: when the engine starts, it is normal to hear airflow noise of internal cycle in the system.)
- Switch to different gears by shift lever (P – R – N - D) and stay at each gear for 5 seconds before switching to the next gear.
- Shift the gear to “D” (driving gear).
- Loosen brake pedal.
- The accelerator exceeds 60 km/h (engine speed shall not be more than 2500 rpm).
- Release the accelerator until the vehicle stops (Noise caused by airflow circulation will disappear).
- Oil temperature increases; drive carefully for at least 5 minutes or the transmission temperature is about 60°C.
- Park the vehicle on a flat ground.
- Step on brake pedal.
- Wait for 2s.
- Shift the gear to “R” (reverse gear).
- Wait for 10s.
- Shift the gear to “P” (parking gear).
- The engine runs idly.
- Loosen oil level screw plug.
- Make sure 0.2L oil comes out of oil pipe after oil level screw plug is loosened. (Otherwise, it means initial oil is insufficient) If it is less than 0.2L, fill 0.5L oil and then repeat the steps above.
- Until oil drips from oil level screw plug.
- Retighten new oil level screw plug with gasket (Torque: 18-24Nm)
- Shut down the engine







1.2. Oil level check

If initial oil filling is correct, oil level shall be at correct position (oil level bolt position); normal tolerance (like residual oil in new transmission and production line oil filling tolerance) shall be the position of oil level bolt. Oil level can be ±0.165L. If it is necessary to check oil level, the procedure as follows:

- Remove oil filling bolt (3) on upper end of the transmission.
- Fill 0.5L oil into the transmission
- Install oil screw plug (3) and tighten it by torque (18-24Nm)
- The transmission temperature increases; drive carefully for at least 5 minutes or oil temperature is about 60°C.
- Park the vehicle on a flat ground
- Step on the brake
- Wait for 2s
- Shift the gear to P
- Keep the engine idle
- When the engine runs idly, remove oil level check bolt (2)
- Discharge oil correctly (at least 0.335L and at most 0.665L)
- At least 0.335L (0.5ADDED OIL - 0.165 tolerances = 0.335L) oil comes out of the transmission; if it is less than this value: original oil level is too low.
- At most 0.665L (0.5ADDED OIL + 0.165 tolerances = 0.665 L) oil comes out of the transmission; if it is more than this value: original oil level is too high. All data shall be calculated at 60 degree.
- Put new gasket on oil level bolt (2) and tighten it by (18-24Nm)
- Shut down the engine

1.3. Gear shift cable adjustment

This procedure describes how to connect shift lever correctly. If you do not follow this description, the transmission gears may be confused. Wherever shift lever is, instrument panel always displays the gear state of the transmission. Gear shift cable shall be installed accurately so that instrument panel and shift lever indicate the same gear state (PRND). - Put shift lever to P – make sure the transmission is at P gear, and outer position of shift lever shall conform to the following diagram:

Shift lever state in P gear

- If shift lever is not this position, push it to the right position by hand:

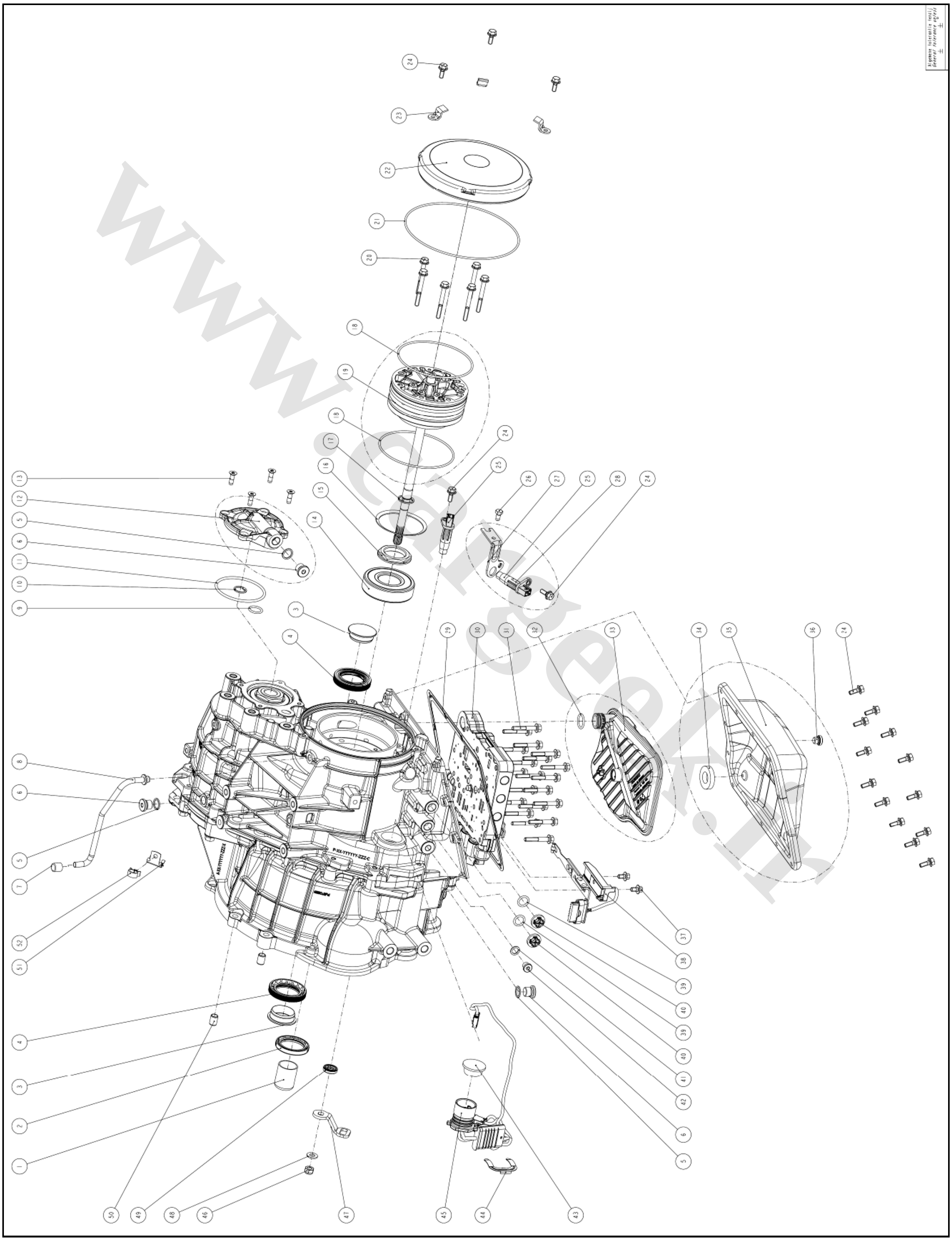
When shift lever is not at P gear, gear shift cable shall not be installed at this position.

- P gear can be confirmed through gear indication of instrument panel.
- Rotate front wheels until wheels are locked. Now the transmission is fixed on P gear. You can rotate shift lever out of P gear. But, never do this.
- If there is cable fixed for the bracket, first connect the cable to the bracket.

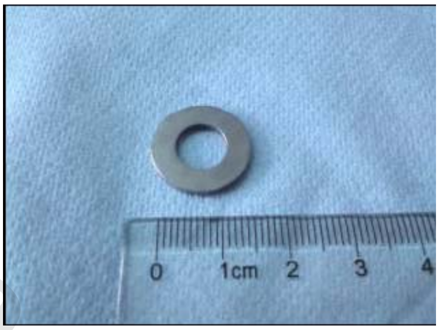
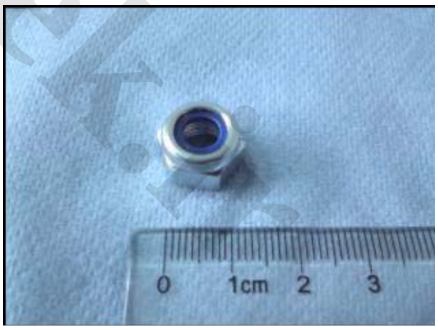
- Connect cable to shift lever by bolts and nuts.
- When tightening the nut, do not bend cable or shift lever!!

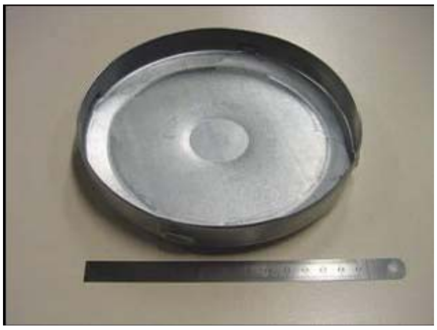
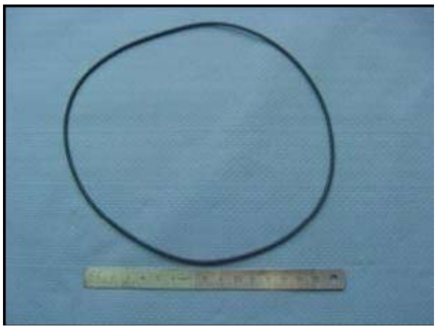
Now the shifter is fixed with the transmission, therefore, instrument panel will display the same position as the shifter.

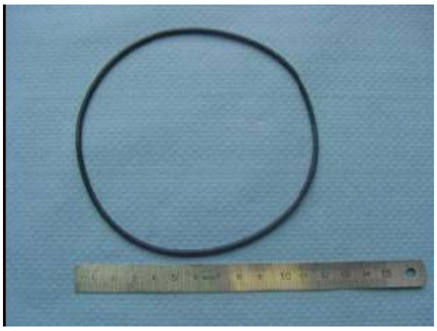
1.4. Exploded view of the transmission

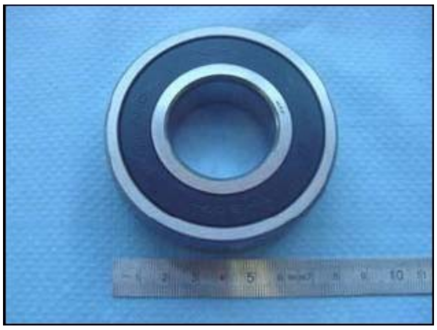


1.5. Service accessory list and torque requirement

482871 No. 4	Differential oil seal	
481274 No. 2	Input shaft oil seal	
482584 No. 48	Selector lever nut gasket	
481329 No. 46	Selector lever nut 14,5 +/-1,5 Nm	

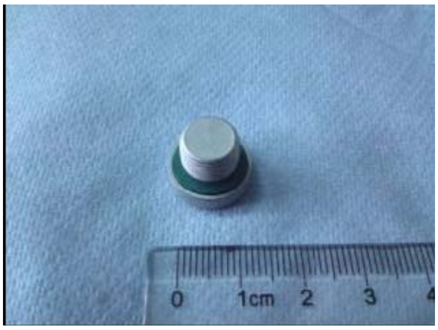
482099 No. 49	Oil seal (selector shaft)	
48XXXX No. 47	Selector lever	
481173 No. 22	Drive cone wheel shaft end cover	
481189 No. 23	Drive cone wheel shaft end cover fastener	
481253 No. 21	O-ring of drive cone wheel shaft end cover	

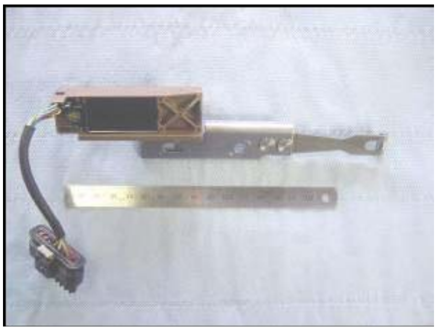
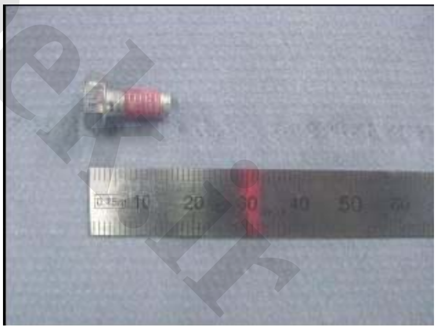
481283 No. 24	M6x16 drive cone wheel shaft end cover bolt 9,5 +/-2,5 Nm	
481259 No. 18	Oil pump O-ring	
481284 No. 20	Oil pump bolt 10 +/-1 Nm	
481293 No. 15	Drive cone wheel shaft nut 197,5 +/-17,5 Nm	
481826 No. 17	Oil pump seal ring	

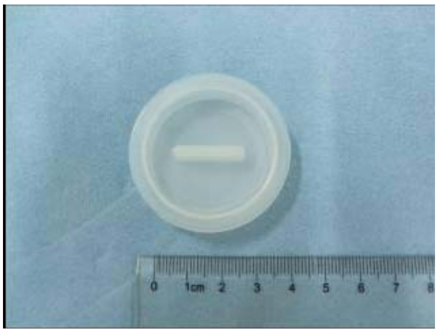
481856 No. 16	Cone spring gasket	
483323 No. 19	Oil pump (including O-ring)	
482294 No. 14	Drive cone wheel shaft ball bearing	
481247 No. 5	Oil filling screw gasket	
481248 No. 6	Oil filling screw plug 21 +/-3 Nm	

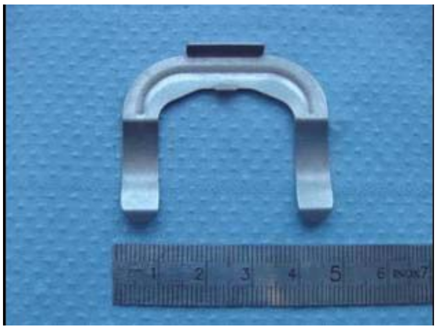
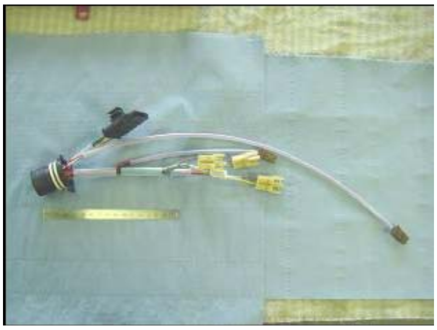
481249 No. 41	Oil level screw plug gasket	
481250 No. 42	Oil level screw plug 15 +/-2,25 Nm	
483616 No. 12	Driven cone wheel shaft end cover	
481254 No. 9	Driven cone wheel shaft end cover O-ring (small)	
481255 No. 11	Driven cone wheel shaft end cover O-ring (large)	

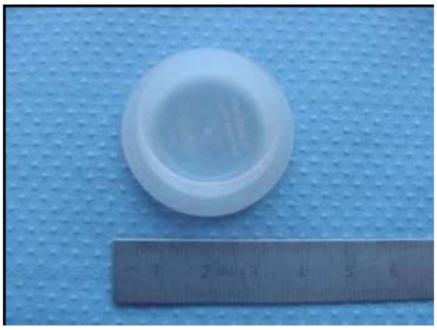
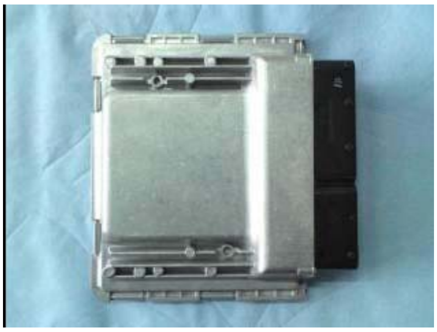
481877 No. 10	Seal ring of driven cone wheel shaft end cover	
482208 No. 13	Countersunk screw of driven cone wheel shaft end cover 9,5 +/-0,95 Nm	
482456 No. 33	Oil filter assembly (including O-ring)	
481283 No. 24	Oil pan bolt 9 +/-1 Nm	
482504 No. 29	Oil pan gasket	

481870 No. 34	Oil pan magnet	
482442 No. 36	Oil drain screw plug 11 +/-1 Nm	
482489 No. 35	Oil pan assembly	
482589 No. 30	Valve body assembly	
481311 No. 31	Valve body bolt 11 +/-1 Nm	

483444 No. 38	Driving mode sensor	
481090 No. 37	Fixed screw for driving mode sensor 9,5 +/-0,95 Nm	
482468 No. 27	Speed sensor bracket at differential	
481289 No. 26	Fixed screw for speed sensor bracket at differential 9,5 +/-0,95 Nm	
483516 No. 25	Speed sensor	

481283 No. 24	Fixed bolt of speed sensor 8,5 +/- 2 Nm	
481258 No. 39	Oil cooler screw plug O-ring	
482121 No. 40	Oil cooler screw plug	
482235 No. 1	Input shaft rubber protection sleeve	
481296 No. 3	Differential oil seal cover	

482105 No. 44	Main joint fastener	
482475 No. 45	Main joint and internal wire harness	
483114 No. 8	Vent pipe assembly	
483420 No. 7	Vent pipe cap	
481456 No. 51	Metal fastener	

482253 No. 32	Plastic fastener	
482104 No. 43	Main joint seal cover	
483XXX	TCU	
483XXX	New transmission (excluding TCU)	
483XXX	Reinstall transmission (excluding TCU)	

1.6. Special tool and replacement of service and accessories

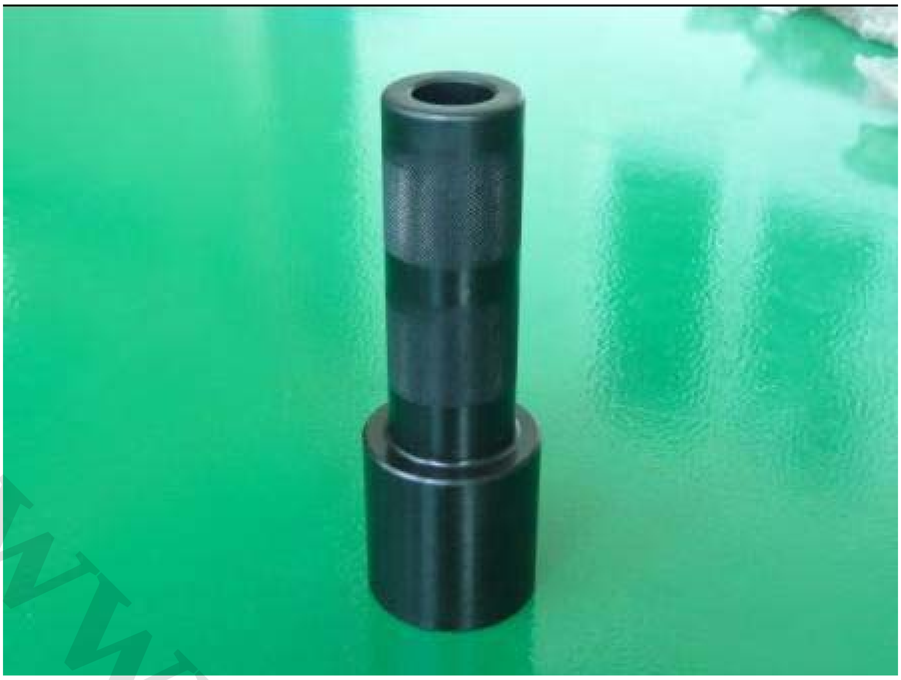
1.6.1. Special tool

Drive cone wheel bearing plug (drawing 480139)

Selector shaft oil seal punch (drawing 480125)

Drive cone wheel bearing punch (drawing 480137 + 480126)

Dismantling tool for drive cone wheel bearing (drawing 480136)



Input shaft oil seal punch (drawing 480130)

Input shaft oil seal location bushing (drawing 480129)

Dismantling tool of selector shaft oil seal (drawing 480127)

Hydraulic control block locating pin (drawing 480142)

Differential oil seal punch (drawing 480143)

Special tool for dismantling oil pump (drawing 480141)

Installation tool – vent pipe (Fig. 480140)

Auxiliary tool for axle shaft installation (Fig. 480154)

1.6.2. Replace service accessories

1.6.2.1. Axle shaft installation

When axle shaft is installed on the transmission, we strongly suggest Bangqi tool 480145, to protect differential oil seal. If the differential of axle shaft is damaged, the transmission will leak oil inevitably. Use special tool to reduce oil seal damage possibility obviously.

- Remove oil seal protection cover:

Fig. 1-1: Transmission oil seal protection cover

- Install the tool 480145 on axle shaft oil seal:

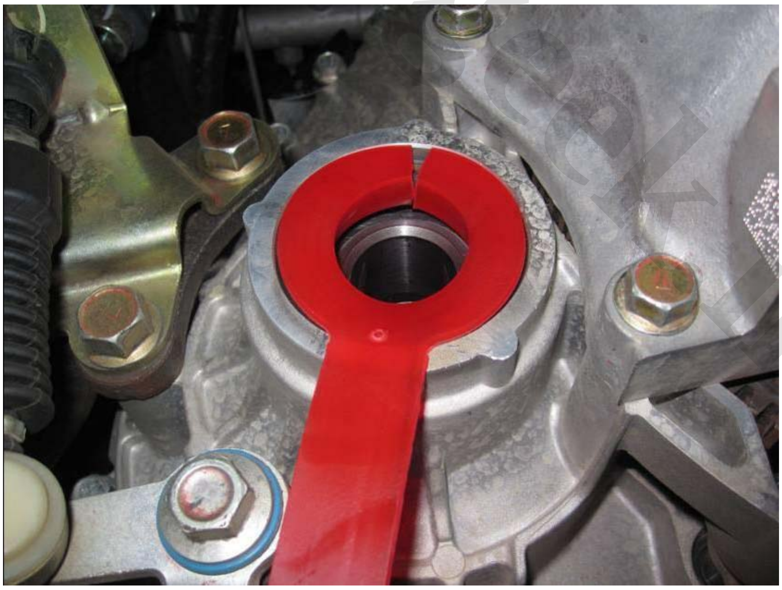


Fig. 1-2: Install axle shaft tool 480145

- Put axle shaft into the transmission, with 4cm depth at most:

Fig. 1-3: Axle shaft is 4cm deep in the transmission

- Stop and keep 2cm distance between the tool and axle shaft:

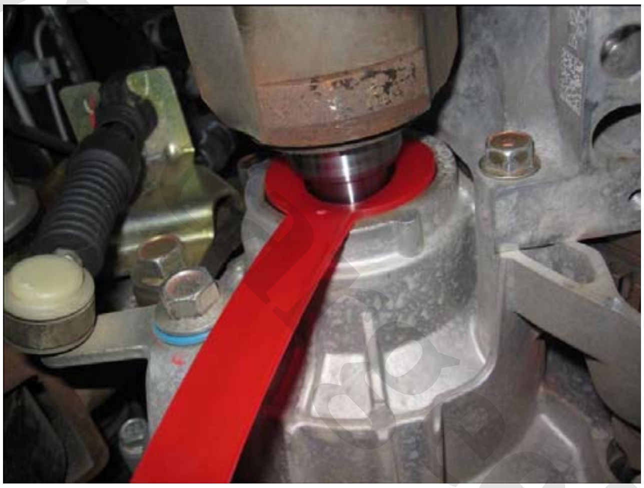


Fig. 1-4: 2cm between axle shaft and tool 480145

- Take down the tool 480145

Fig. 1-5: Take down tool 480145

- Put axle shaft into the transmission:

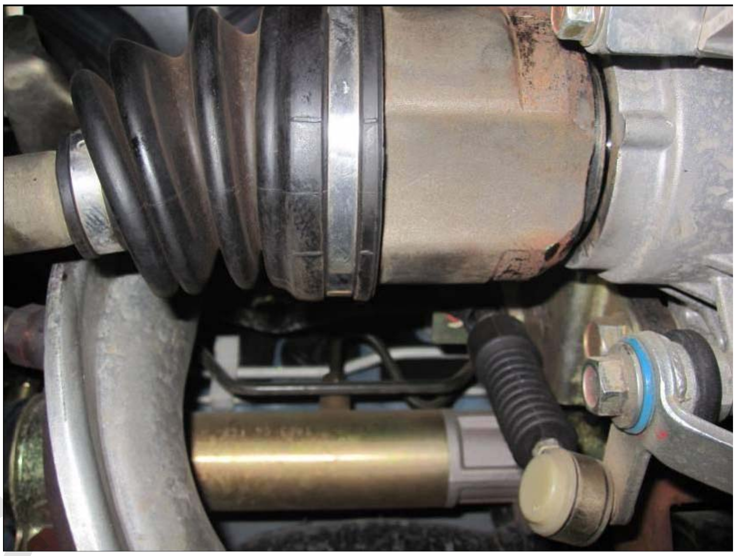


Fig. 1-6: Axle shaft is installed completely

1.6.2.2. Replace differential oil seal

Fault descriptions: If oil seal is damaged or leaks oil, or haft shaft is damaged or leaks oil

Maintenance method: - Discharge oil in the transmission (see How to Replace Oil Filter)

- Remove axle shaft
- Pry oil seal out by large straight screwdriver. Do not put the straight screwdriver too deeply to protect the housing (Fig. 2-1)
- Throw away removed oil seal
- Take a new oil seal and put it on the housing (Fig. 2-2)
- Put special tool (480143) on oil seal and knock it into the housing by rubber hammer to keep it in the right position
- The depth of oil seal is 3mm ± 0.3mm from the housing edge – If necessary, install axle shaft
- Fill new oil into the transmission according to instructions (see 3.2)

Fig. 2-1: Remove oil seal

Fig. 2-2 Install oil seal with special tool

1.6.2.3. Replace input shaft oil seal

Fault descriptions: Input shaft oil seal is damaged or leaks oil

Maintenance method:

- Discharge oil from the transmission (see How to Replace Oil Filter)
- Remove the transmission from the vehicle
- Take out oil seal from the housing by large straight screwdriver (Fig. 3-1). Pry it along hollow section of oil seal. Be careful! Do not damage transmission input shaft - take out oil seal and throw it away.

Fig. 3-1: Remove input shaft oil seal

- Put location bushing (480129) of oil seal on input shaft (Fig. 3-2)
- Take a new oil seal and put it on the location bushing (Fig. 3-3)

Fig. 3-2: Install special tool on input shaft (480129)

Fig. 3-3: Press oil seal down

- Put special tool (480130) on input shaft (Fig. 3-4)
- Knock special tool by rubber hammer and install it in the right position.
- Remove special tool and reinstall the transmission into the vehicle
- Fill new oil into the transmission according to instructions (see 3.2)

Fig. 3-4: Install oil seal by special tool (480130)

1.6.2.4. Replace selector shaft oil seal

Fault descriptions: Selector shaft oil seal oil leakage

Maintenance method:

- Discharge oil from the transmission (see How to Replace Oil Filter)
- Remove the transmission from the vehicle
- Remove shift lever

- Install special tool (480127) on selector shaft (see Fig. 4-1)
- Screw special tool into oil seal by wrench. Press top end of the wrench down to screw special tool into oil seal (see Fig. 4-2)
- Rotate the bolt on special tool to pull out selector shaft oil seal of the housing (see Fig. 4-3)
- Throw oil seal away (see Fig. 4-4)

Fig. 4-1: Put special tool (480127) on selector shaft

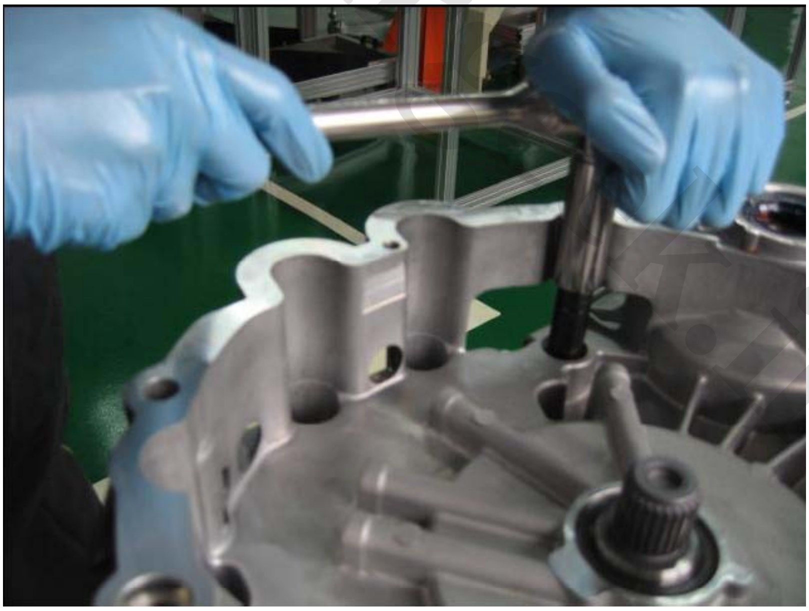


Fig. 4-2: Press and rotate special tool

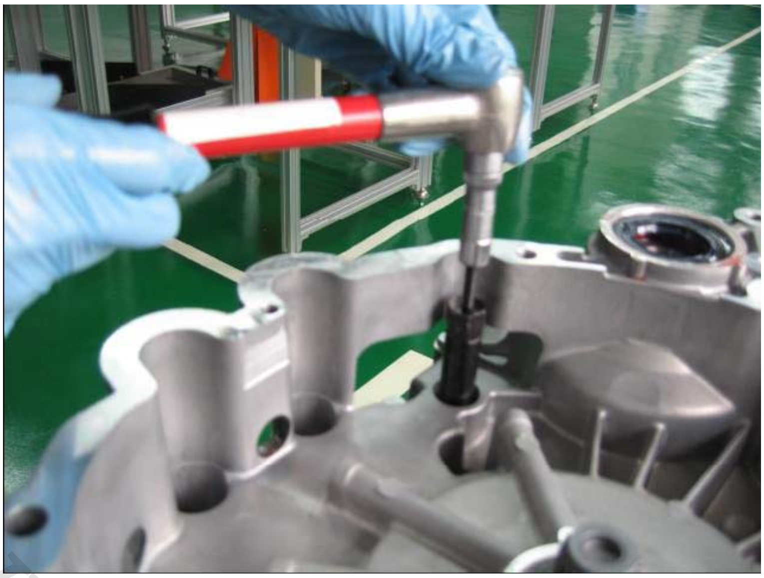


Fig. 4-3: Screw out small bolt to pull out oil seal

Fig. 4-4: Take out oil seal

- Apply Vaseline or lubricating grease on top end of oil seal punch (480125) (see Fig.4-5)
- Take a new oil seal and install oil seal on the punch (480125)
- Install special punch (480125) with oil seal on selector shaft and knock it with a hammer in place (see Fig.4-6, 4-7)
- Take out the punch (480125)

Fig. 4-5: Install oil seal on the punch (480125)

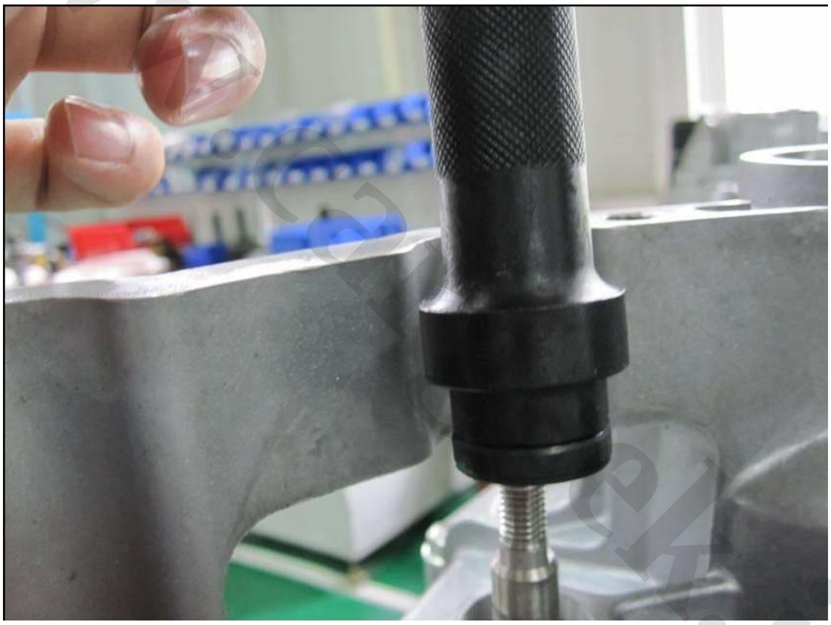


Fig. 4-6: Place the punch with oil seal on selector shaft

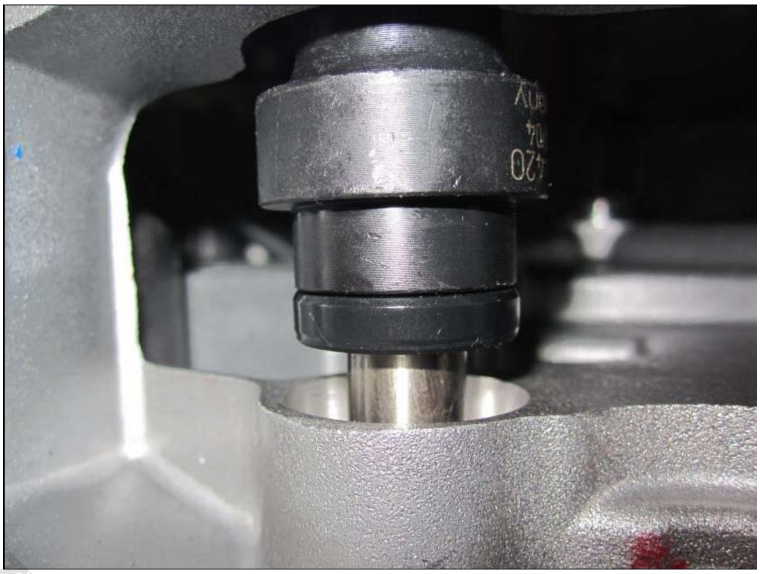


Fig. 4-7: Knock the punch (480125) in place by hammer

- Pull out the punch. Otherwise, oil seal and the punch may be pulled out together.
- Install shift lever, with new gasket (482584) and nut (481329).
- Tighten the nut with the torque 14.5Nm±1.5Nm – reinstall the transmission on the vehicle
- Refill transmission oil (see Section 3.1)

1.6.2.5. Replace drive cone wheel shaft end cover

Fault descriptions: Drive cone wheel shaft end cover leaks oil

Maintenance method:

- Discharge 1L oil from the transmission (see Oil Filter of Replacement)
- The transmission is not removed from the vehicle. If the engine and transmission fall down together, it is easy for replacement.
- Remove three bolts and take the fastener down. Remove end cover by large straight screwdriver; put a cloth under it to prevent the transmission housing from being damaged.
- Remove end cover by large straight screwdriver and use a cloth under it to prevent transmission housing from being damaged (see Fig. 5-1) – take down larger O-ring and throw it away together with end cover.
- Install one new O-ring – replace with a new end cover and tighten bolts and fastener; the torque is 9.5Nm +/- 2.5Nm – fill 1L oil into the transmission.

Fig. 5-1: Dismantle drive cone wheel shaft end cover

1.6.2.6. Replace oil pump

Fault descriptions: If the transmission pressure is too low or vibration or abnormal phenomenon occurs, there are two key parts that may lead to this problem: oil pump and hydraulic control block. Determine which one is required to be replaced by fault code. In many cases, it is impossible to determine the problem reason. Check the problems one by one.

Maintenance method:

- According to replacement procedure of drive cone wheel shaft end cover, remove end cover.
- Remove six bolts of oil pump and put special tool on oil pump shaft (see Fig. 6-1)
- Pull out oil pump by special tool (23K002-099-84295) (see Fig. 6-2).
- Replace with a new oil pump and make sure two new O-rings are placed on oil pump. Do not take out cone return spring, and confirm one end with large diameter towards oil pump (see Fig. 6-3)
- Install 6 bolts and tighten them by 10Nm +/- 1Nm
- According to the procedure, reinstall end cover, do not replace O-ring and end cover

Fig. 6-1: Remove six bolts and install special tool

Fig. 6-2: Pull out oil pump

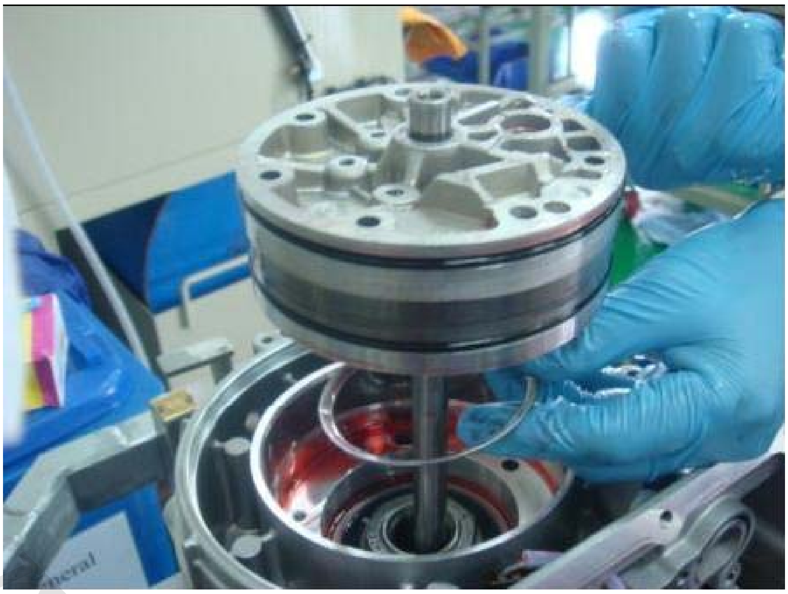


Fig. 6-3: Cone spring gasket

1.6.2.7. Replace drive cone wheel shaft ball bearing

Fault descriptions: If drive cone wheel bearing is worn, replace the bearing. Once drive cone wheel ball bearing is worn, high noise will occur and change with engine speed. Therefore, if D gear is changed to manual mode at constant speed, and the noise increases suddenly, it means the bearing may be damaged. After switching to manual mode, the vehicle speed remains unchanged and the engine speed increases.

Maintenance method:

- According to the steps, remove oil pump
- Take out cone return spring
- Make marks on shaft and nut (see Fig. 7-1)
- Remove the nut by +/-300Nm pneumatic wrench
- Remove dust cover from the bearing by small straight screwdriver (see Fig. 7-2)
- Put special plug on the shaft (T00222) (see Fig. 7-3)
- Assemble bearing puller (480136), and hook outer ring of the bearing (see Fig. 7-4)
- Tighten middle bolt to pull out the bearing (see Fig. 7-5)
- Throw away old bearing, clean drive cone wheel shaft and remove oil pump drive shaft lock sealant, and clean oil pump cavity (see Fig. 7-6) – install new bearing in place and use special punch (480137 + 480126). Knock the punch by rubber hammer and install it in place (see Fig.7-7)
- Tighten the nut by pneumatic tool until the mark on the shaft and that on the nut are coincided (+/-5°)
- Reinstall cone return spring, with larger diameter end towards oil pump

- According to the steps, install oil pump to the transmission

Fig. 7-1: Make marks on the shaft and nut

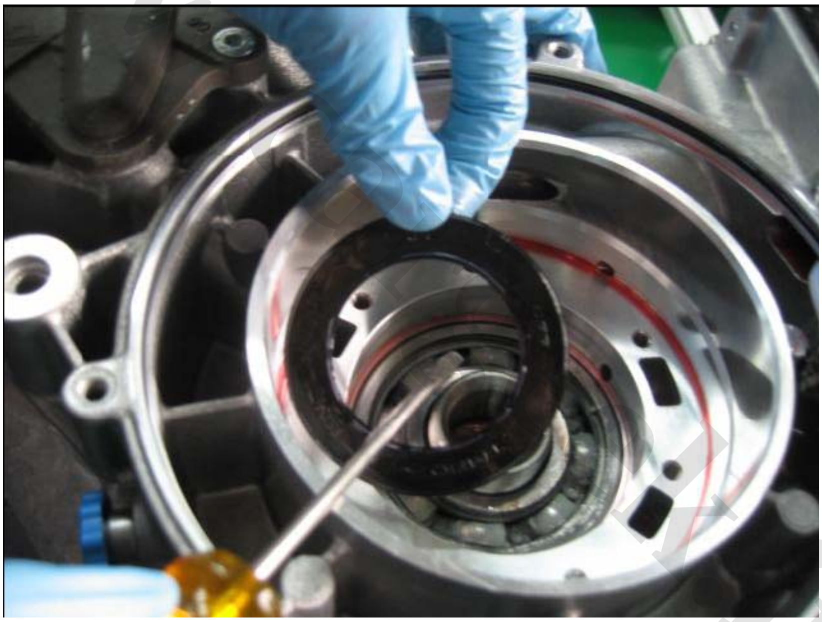


Fig. 7-2: Take out dust cover of drive cone wheel bearing

Fig. 7-3: Put special tool on the shaft (drive cone wheel plug T00222)

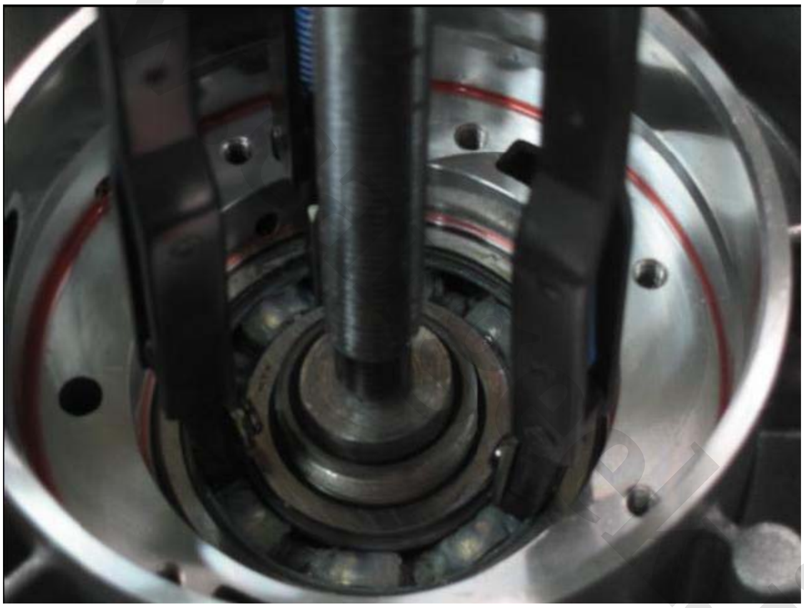


Fig. 7-4: Assemble bearing dismantler (480136)

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Fig. 7-5: Screw out middle bolt to pull out the bearing

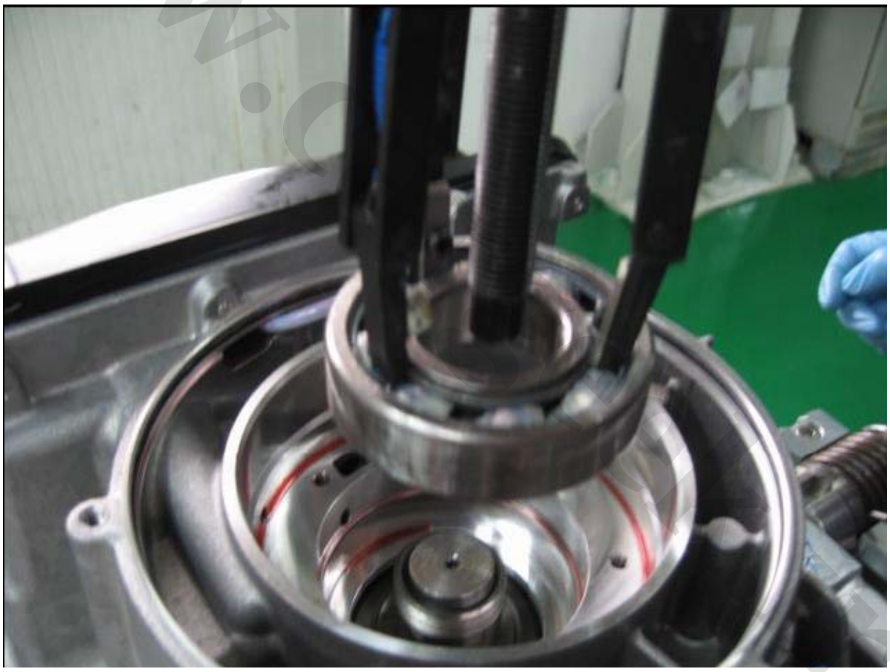


Fig. 7-6: Remove drive cone wheel shaft bearing

Fig. 7-7: Install a new bearing

1.6.2.8. Replace driven cone wheel shaft end cover

Fault descriptions: Driven cone wheel shaft end cover damaged or oil leakage

Maintenance method:

- The transmission is not removed from the vehicle. If the engine and transmission fall down together, it is easy for replacement.
- Remove four countersunk screws
- Remove one of two O-rings on end cover completely
- If end cover is damaged, replace it with new end cover
- Reinstall two O-rings and one seal ring on end cover
- Remove thread glue in four screw holes on the housing
- Tighten four screws with the torque 9.5Nm +/- 0.95Nm

1.6.2.9. Replace oil pan

Fault descriptions: Oil pan is damaged or leaks oil

Maintenance method:

- Remove oil drain screw plug and discharge oil (see Fig. 9-1)
- Until no oil drips and throw away oil drain screw plug
- Remove 13 bolts of oil pan (see Fig. 9-2)
- Throw away old oil pan and gasket
- Take a new oil pan and gasket
- Install oil pan with new gasket as shown in Fig. 9-3; the torque is 9.5Nm +/- 1Nm

- Fill new oil into the transmission according to instructions (see 3.2).

Fig. 9-1 Remove oil drain screw plug

Fig. 9-2 Remove oil pan

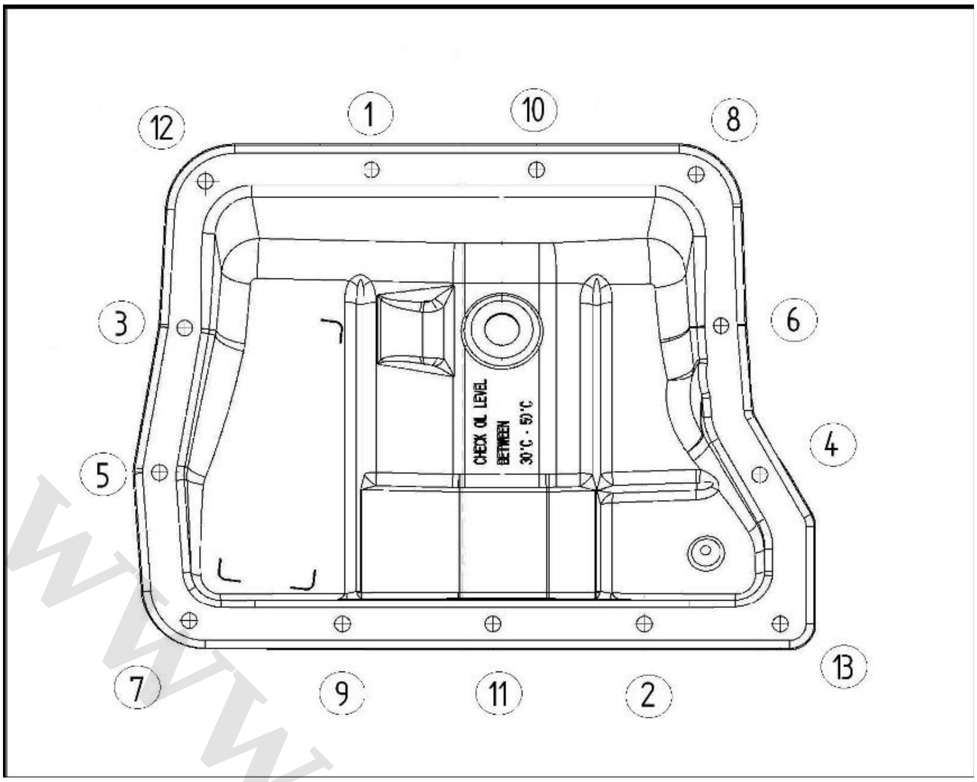


Fig. 9-3: Bolt sequence

Replace oil filter

Fault descriptions: Oil filter shall be replaced at least every 60000 km; reduce the interval according to manufacturer's standard.

Maintenance method:

- Open oil drain screw plug and discharge oil (see Fig. 9-1)
- Until no oil drips and throw away oil drain screw plug
- Take a new oil drain screw plug and tighten it, and the torque is 11Nm +/-1Nm
- Remove 13 bolts of oil pan (see Fig. 9-2)
- Throw away oil pan gasket
- Take oil filter out slightly and throw it away.
- Take one filter with O-ring and lubricated by ESSO EZL799 (A) (see Fig. 10-1)
- Press the filter into the right position slightly (the hole in the middle of the filter matches with middle bolts of hydraulic control block) (see Fig. 10-2)
- Clean magnet and oil pan
- Install new gasket and oil pan, and tighten 13 bolts. The torque is 9.5Nm +/- 1Nm
- According to description, refill oil (see 3.2)

Fig. 10-1: Lubricate O-ring

Fig. 10-2: Install the filter in place

1.6.2.11. Replace driving mode sensor

Fault descriptions: Driving mode sensor fault. Fault code shall be the fault of driving mode sensor. Replace driving mode sensor.

Maintenance method:

- According to the steps, remove oil filter
- Remove two screws from driving mode sensor (see Fig. 11-1)
- Remove driving mode sensor from hydraulic control block, because the rear of sensor is connected with metal slipping sheet on hydraulic control block by a

small pin. Press the sensor down to disengage the pin from slipping sheet (see Fig. 11-2)

- Open the lock on sensor joint by small straight screwdriver and press white fastener down to disengage the joint (see Fig. 11-3)
- Take a new sensor and connect the joint, press white fastener inside
- Put the pin behind the sensor onto metal slip sheet and install it (see Fig. 11-4)
- Move the sensor to expose the bolts
- Tighten two screws by 9.5Nm +/- 0.95Nm
- According to the steps, install oil filter

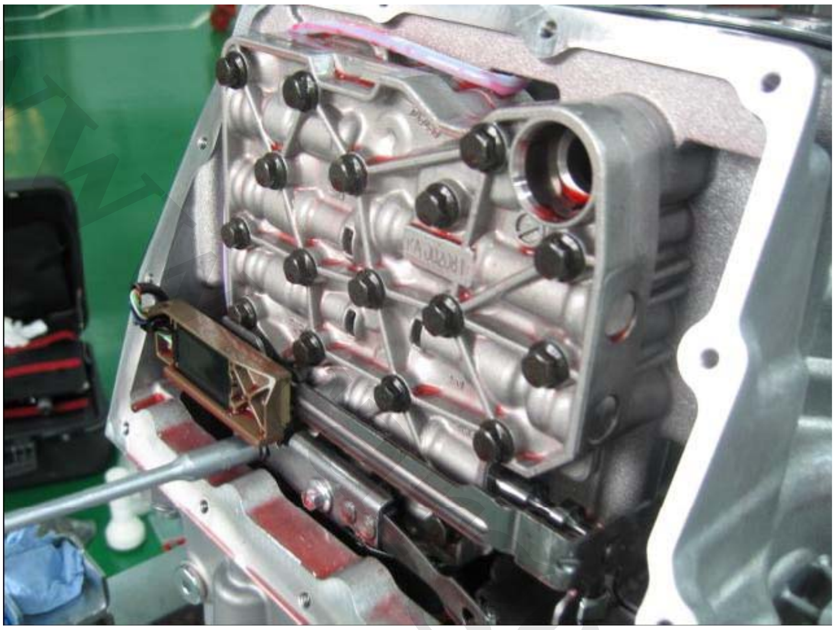


Fig. 11-1: Remove driving mode sensor bolt

Fig. 11-2: Press down the sensor and take it out

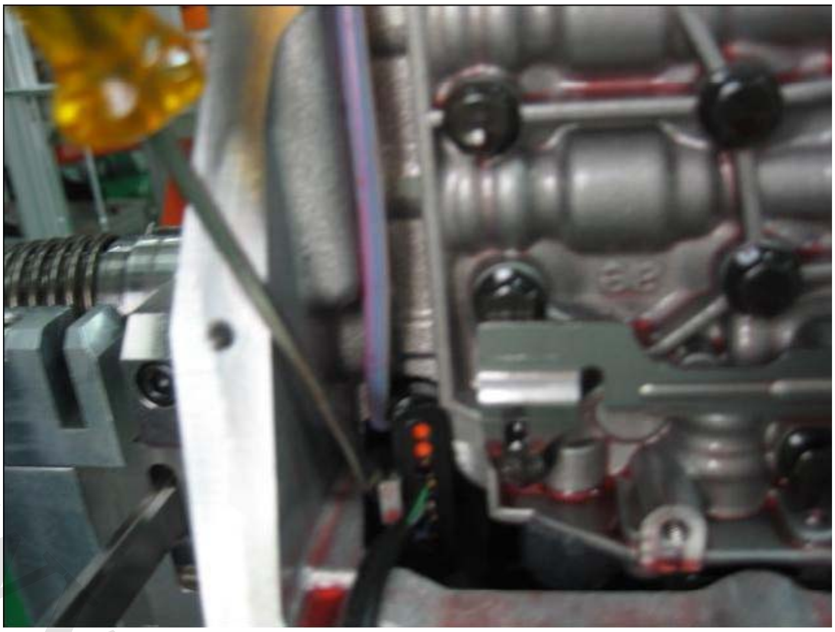


Fig. 11-3: Remove driving mode sensor

Fig. 11-4: The pin is installed in correct position of metal sliding sheet.

1.6.2.12. Replace hydraulic control block

Fault descriptions: If the transmission pressure is too low or vibration or abnormal phenomenon occurs, there are two key parts that may lead to this problem: oil pump and hydraulic control block. Determine which one is required to be replaced by fault code. In many cases, it is impossible to determine the problem reason. Check the problems one by one.

Maintenance method:

- According to the steps, remove driving mode sensor
- As shown in Fig. 12-1, remove bolts according to 20 - 19 - 18 - 17 - 16 - 15 - 14 - 13 - 12 - 11 - 10 - 9 - 8 - 7 - 6 - 5 - 4 - 3 - 2 - 1

- Take out hydraulic control block and separate four joints, remove the joint by straight screwdriver carefully and easily. (see Fig. 12-2 and 12-3)
- Take a new hydraulic control block and four joints; install four joints according to cable length.
- Install hydraulic control block, put the pin behind hydraulic control block into the right position (see Fig. 12-4)
- Make sure metal slip sheet and pin on gear shift cam are matched well. (see Fig. 12-5)
- Install middle bolts and tighten it by hand.
- Install special tool (23K002-099-84312) in bolt hole on upper left corner (see Fig. 12-6)
- Press drive cone wheel speed sensor wire on the left corner of hydraulic control block (see Fig. 12-6)
- Install all bolts of hydraulic control block, as shown in Fig. 11-1, tighten bolts according to the sequence 1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20 by 11Nm torque
- According to the procedure, install driving mode sensor

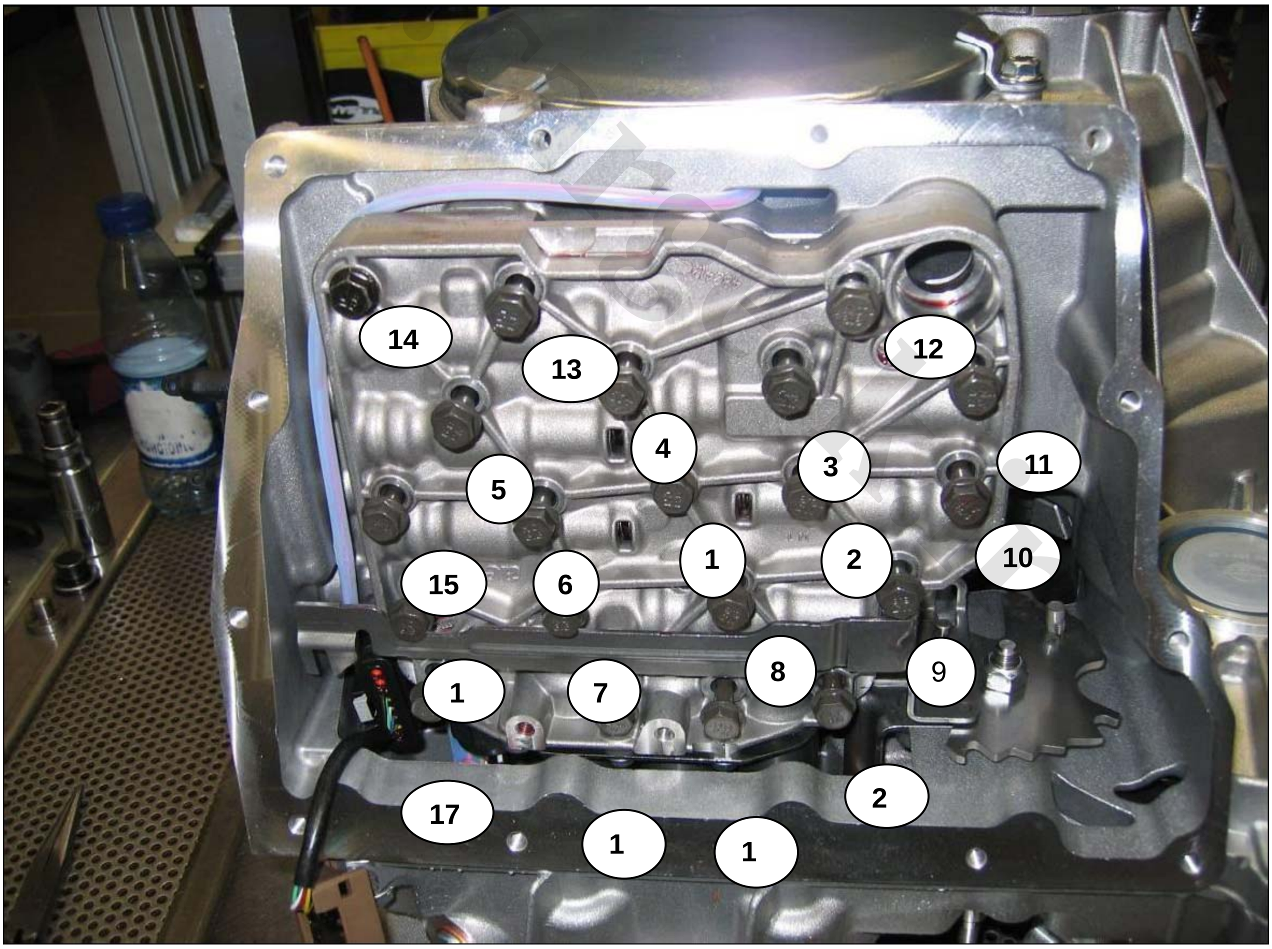


Fig. 12-1: Bolt sequence

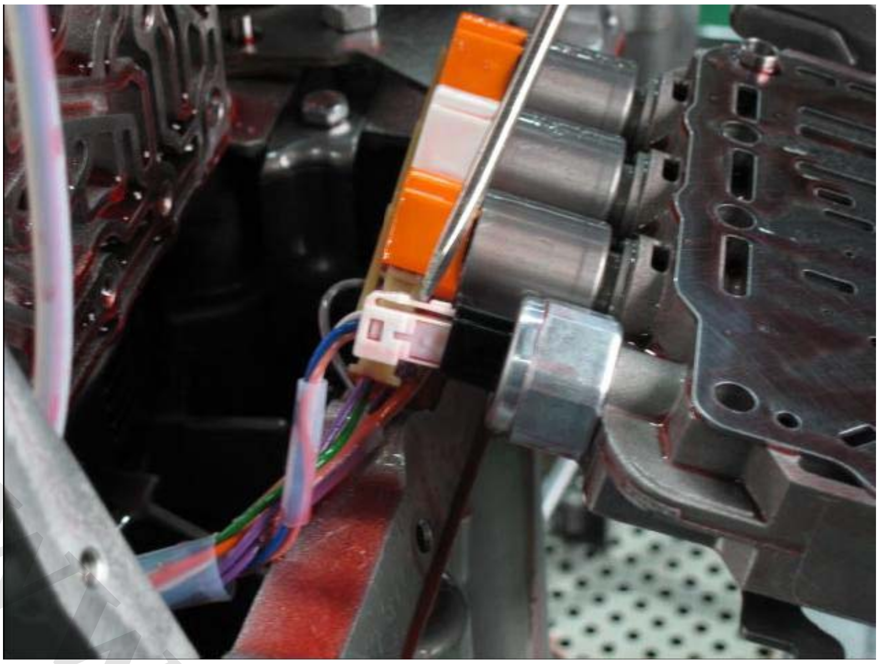


Fig. 12-2: Remove four joints by small straight screwdriver

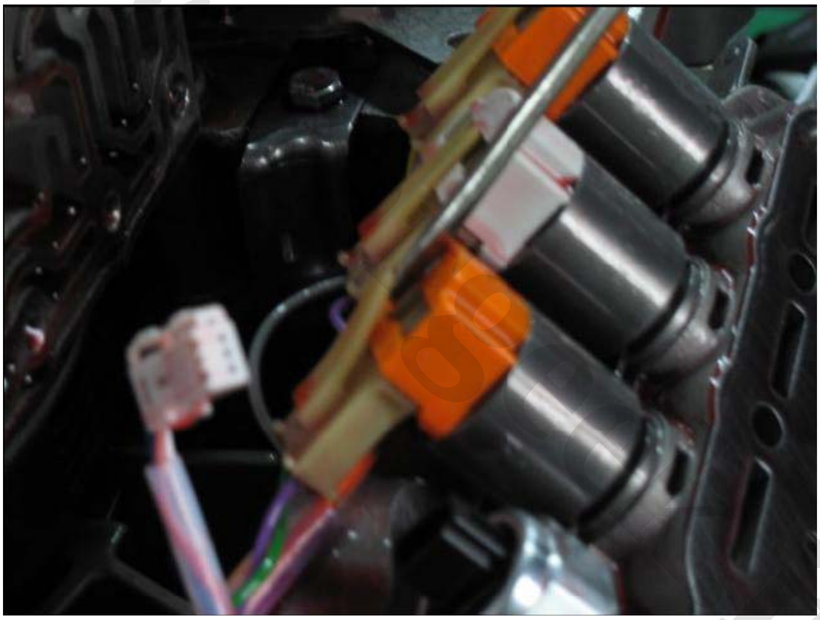


Fig. 12-3: Remove four joints by small straight screwdriver

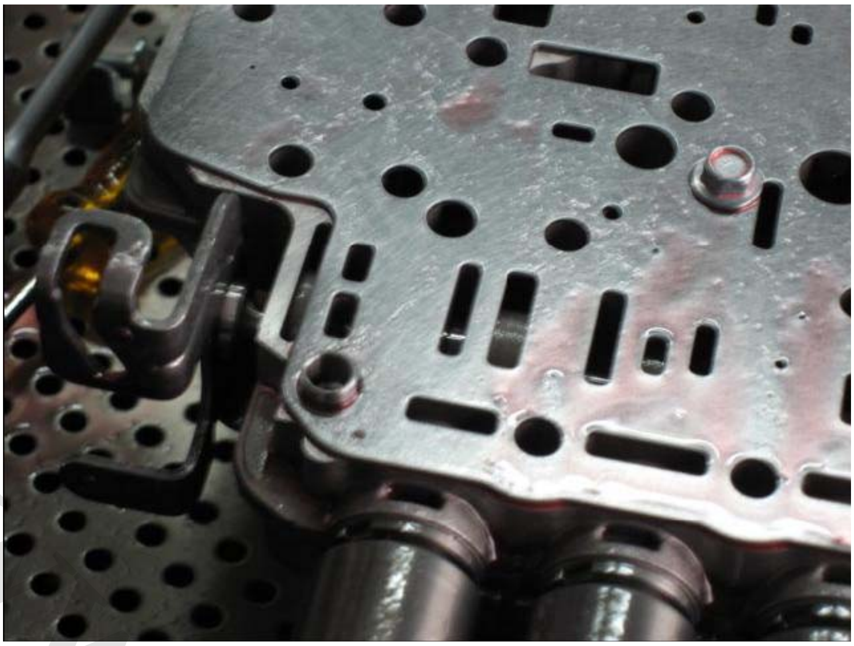


Fig. 12-4: Location pin behind hydraulic control block

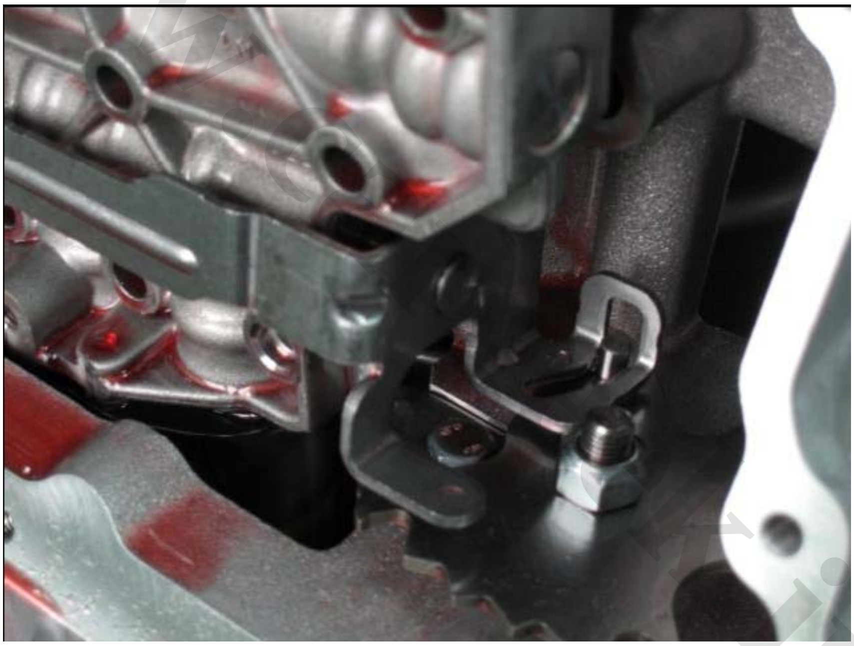


Fig. 12-5: Fix clutch control valve pull rod and locating pin on shifting cam in place

Fig. 12-6: Special tool (23K002-099-84312) fixes hydraulic control block

1.6.2.13. Replace driven cone wheel speed sensor and bracket

Fault descriptions: Determine part fault by fault code

Maintenance method:

- According to the procedure, remove hydraulic control block
- Loosen sensor bracket bolt and throw away the bolt (see Fig. 13-1)
- Draw the bracket out of selector shaft. (see Fig. 13-2)
- Remove the sensor and joint by long flat nose pliers (see Fig. 13-3)
- Loosen bracket bolt and remove speed sensor
- Throw away the sensor or the bracket
- Take a new sensor or bracket, and tighten both by bolts (torque 8.5Nm +/- 2Nm)
- Wire and clamp the bracket on selector shaft in the right position.
- Take a new bolt and tighten the bracket; the torque is 9.5Nm +/- 0.95Nm
- According to the procedure, install hydraulic control block

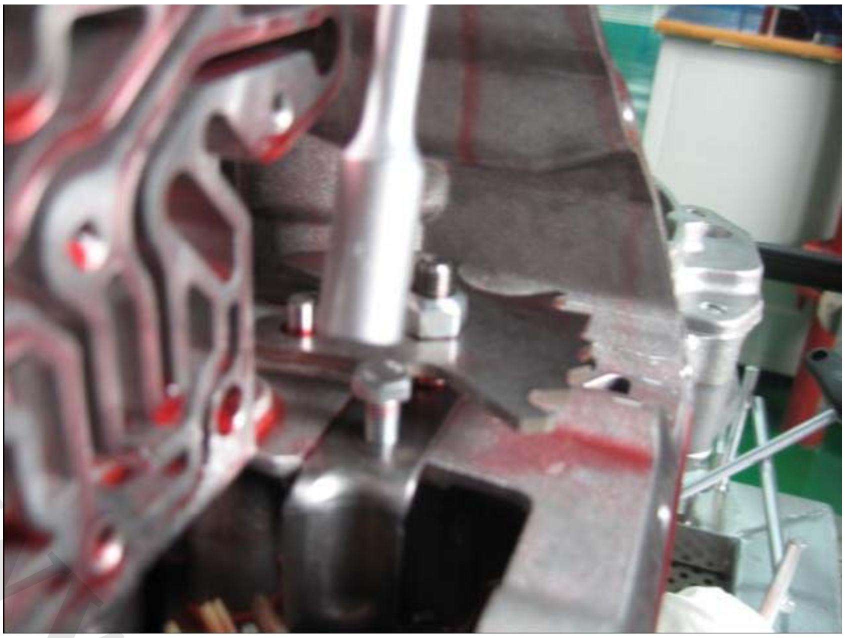


Fig. 13-1: Remove speed sensor bracket bolt

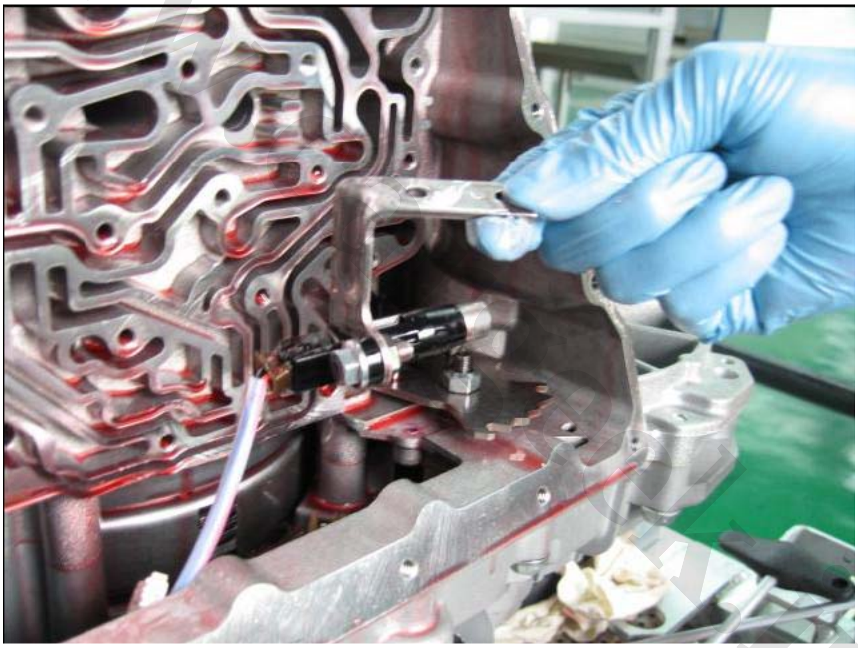


Fig. 13-2: Speed sensor bracket

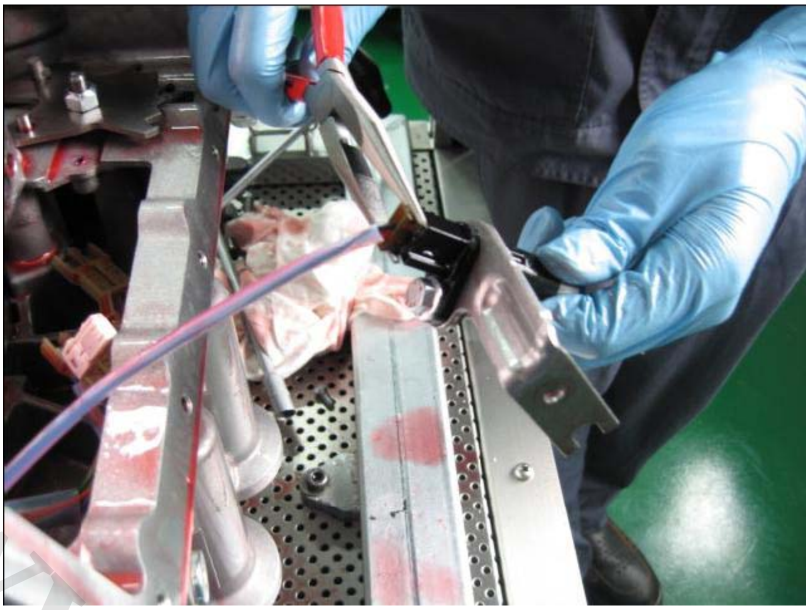


Fig. 13-3: Separate the joint by long flat nose pliers

1.6.2.14. Replace drive cone wheel speed sensor

Fault descriptions: Determine part fault by fault code

Maintenance method:

- According to the procedure, remove drive cone wheel end cover
- Loosen the bolt and take out the sensor (see Fig. 14-1)
- Separate the wire and throw away the sensor removed
- Take a new sensor and tighten bolts. The torque is 8.5Nm +/- 2Nm
- Connect the wire to the sensor
- According to the procedure, install drive cone wheel end cover

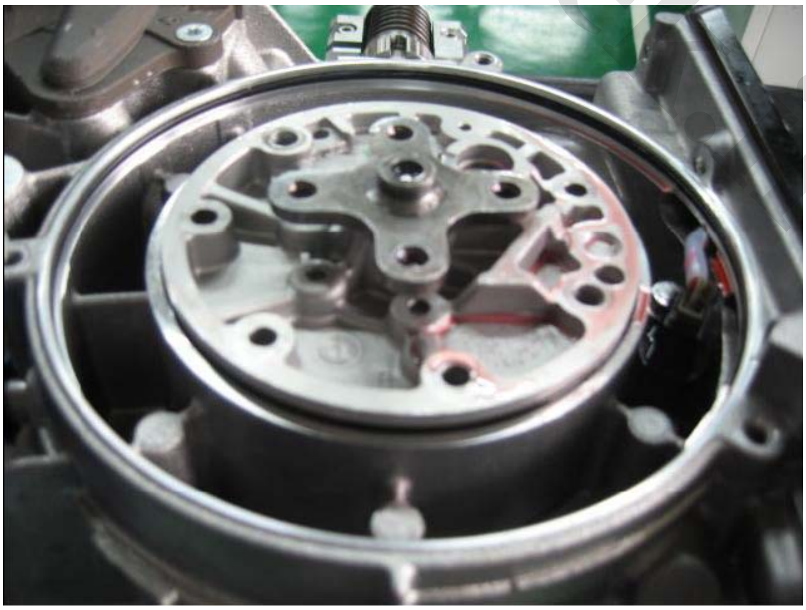


Fig. 14-1: Drive cone wheel speed sensor

1.6.2.15. Replace main joint and internal wire harness

Fault descriptions: Determine part fault by fault code

Maintenance method: - According to the sequence, take out hydraulic control block

- Separate two speed sensor joints
- Remove the cable connected with main joint on the vehicle
- Remove the fastener on main joint, and press main joint into the transmission (see Fig. 15-1, 15-2)
- The joint of driving mode sensor is clamped on the housing. First remove the joint (see Fig. 15-3)
- Take main joint out of the transmission and throw it away
- Take a new main joint and put it into the transmission
- Main joint is connected with the housing by one spline, as shown in Fig. 15-4 and 15-5.
- If 45-degree long flat nose pliers are used, it is easy to keep it upright and press it upwards
- Reinstall the fastener
- Install driving mode sensor joint onto the housing (see Fig. 15-6)
- Connect speed sensor with the joint
- According to the steps, install hydraulic control block in the transmission

Fig. 15-1: Remove the fastener from main joint

Fig. 15-2: Press main joint into the transmission

Fig. 15-3: Remove driving mode sensor joint from the transmission

Fig. 15-4: Locating pin

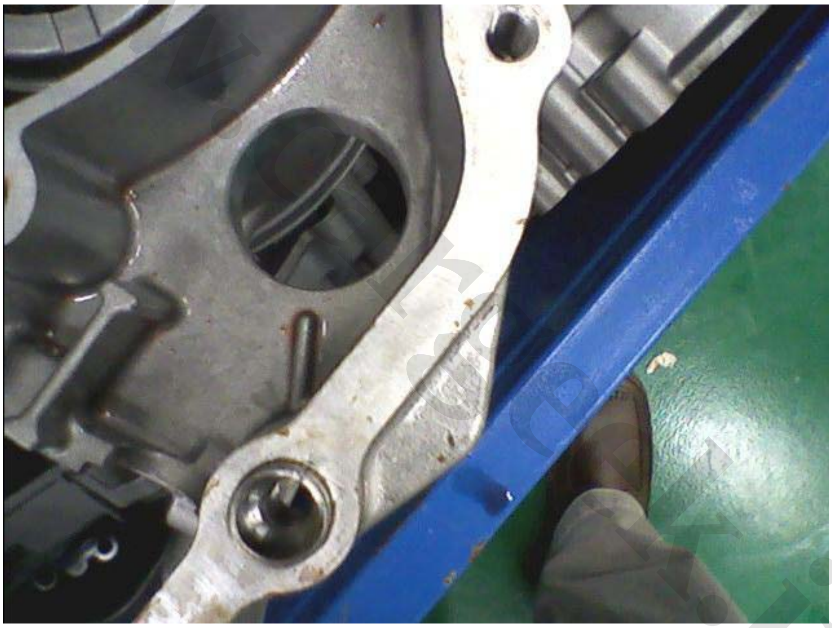


Fig. 15-5: Locating pin

Fig. 15-6: Press driving mode sensor joint on the housing

1.6.2.16. Replace vent pipe

When to be replaced:

When vent pipe is damaged, water or dust may go into the transmission. Now vent pipe shall be replaced.

How to replace:

- Engine intake pipe, battery and upper bracket may be removed so that enough space is provided for vent pipe.
- Remove the fastener between the top of vent pipe and transmission.
- Remove vent pipe by pliers. The pliers are placed between the housing and vent pipe, and take down vent pipe.
- Put a new vent pipe (483114) into a special tool (480140), see Fig. 16-1. Apply a small amount of vaseline on aluminum pipe on the bottom of vent pipe.
- Put the tool and vent pipe on the housing to keep them parallel, see Fig.16-2, knock the tool by rubber hammer vertically to make vent pipe go into the housing.
- Put plastic fastener (482253) on vent pipe
- Insert the pin on plastic fastener into metal fastener (481456) hole.
- Install metal fastener on reinforced rib of transmission housing.
- Install vent pipe cap (483117) on the pipe, make sure it is in the correct position, see Fig.16-3
- If necessary, reinstall the battery and intake pipe.

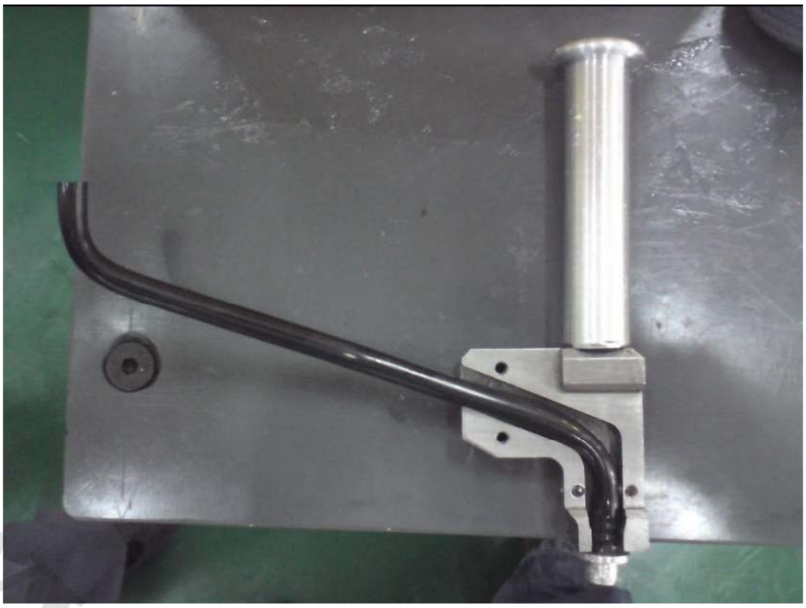


Fig. 16-1 Put vent pipe into the special tool.

Fig. 16-2: Knock the tool with vent pipe into the transmission

Fig. 16-3 Install the fastener and vent pipe cap

1.7. Electronic component check list

Transmission electronic component check list:

Driving mode sensor

Check the resistance between different pins and check if driving mode sensor is good

DMS_GND = pin 6

DMS_A = pin 13

DMS_B = pin 14

DMS_C = pin 15

DMS_D = pin 16

DMS_Supply= pin 9

	DMS_Supply	DMS_A	DMS_B	DMS_C	DMS_D
DMS_Supply	X	17.2 megohms	17.2 megohms	17.2 megohms	17.2 megohms
DMS_A	17.2 megohms	X	9 kΩ	9 kΩ	9 kΩ
DMS_B	17.2 megohms	9 kΩ	X	9 kΩ	9 kΩ
DMS_C	17.2 megohms	9 kΩ	9 kΩ	X	9 kΩ
DMS_D	17.2 megohms	9 kΩ	9 kΩ	9 kΩ	X
DMS_GND		4.5 kΩ	4.5 kΩ	4.5 kΩ	4.5 kΩ

Oil temperature sensor

Internal resistance of measure oil temperature sensor

Measure the resistance between the pins 5 and 7

When the temperature is between 20°C and 40°C, the resistance is between 942Ω and 1121Ω

Speed sensor

This is a complicated two-line component. There is no simple method to measure it.

The resistance measured between the pins 9 and 11 is about 24.3 megohms

The resistance measured between the pins 9 and 12 is about 24.3 megohms

Note: this means does not ensure speed sensor is good

4. The resistance between the pins 7 and 10, which is measured by oil pressure sensor, is 44.3 kΩ
5. The resistance between the pins 1 and 4, which is measured by clutch pressure regulator, is about 5.2Ω
6. The resistance between the pins 1 and 3, which is measured by drive cone wheel pressure regulator, is 5.2Ω.
7. The pressure between the pins 1 and 2, which is measured by driven cone wheel pressure regulator, is about 5.2Ω
8. TCU cannot detect

Note: If measured accuracy of the instrument is different, measured resistance range is different

Common questions and answers

Oil leakage

Faults	Troubleshooting
Transmission oil pan washer oil leakage	Confirm if oil pan bolt is fixed Replace oil pan washer Replace oil drain hole Replace the oil pan assembly
Transmission oil drain plug oil leakage	Confirm if screw plug is fixed Replace oil drain plug Replace the oil pan assembly
Drive cone wheel end cover leaks oil	Confirm if seal cover is fixed Replace O-ring Replace drive cone wheel shaft end

Faults	Troubleshooting
Driven cone wheel end cover oil leakage	Confirm if seal cover is fixed Replace seal cover O-ring Replace driven cone wheel shaft cover assembly
Selector lever oil leakage	Replace selector lever gasket
Input bar leaks oil	Replace input shaft gasket
Differential oil seal oil leakage	Replace oil seal
Oil cooling pipe joint leaks oil	Confirm if the pipe is fixed Replace oil cooling pipe joint seal ring Replace the pipe

2.2. Noise problem check and maintenance

2.2.1. Driven cone wheel gear has noise

Sound description:

When accelerating from 60kph to 90kph, there is an obvious whistle. Release accelerator pedal, the noise reduces. Step accelerator pedal, the noise restores immediately. The noise is similar to whistle. The noise increases with the speed. This noise is normal. The noise comes from engagement of driven cone wheel gear and intermediate shaft gear.

2.2.2. R gear noise

Sound description:

Put into reverse gear, keep the vehicle static, and you can hear low whistle. This is normal sound when planetary wheel in the transmission works.

2.2.3. Low-speed noise

Sound description:

When vehicle speed is 40km/hour, release the accelerator pedal. When vehicle speed is reduced slowly, a whistle is heard. This whistle is lower than noise in 4.2.1 and is not easy to be heard. This is normal sound between small pinion and differential.

2.2.4. Drive cone wheel ball bearing noise and noise in the bearing

Drive cone wheel ball bearing noise:

Sound description:

At D gear, the noise occurs during driving. The noise is buzzing. The noise and frequency will increase with engine speed but with vehicle speed.

Check method:

1. When it drives at constant speed at D gear (constant accelerator openness and the speed is about 60km/h), then it is in S mode, engine speed will increase to 500 rpm within 1 and 2 seconds. Vehicle speed does not change. If the noise

goes up with engine speed, it means ball bearing of drive cone wheel is damaged. Refer to 3.6.2.7, replace drive cone wheel bearing.

2. At 4th gear of manual transmission, keep some accelerator opening constant, and keep the vehicle speed 60km/h, then shift to 3rd gear of manual transmission, and now the engine speed will go up to 800rpm; then shift from 3rd gear to 4th gear, engine speed will reduce to 800rpm; the vehicle speed remains unchanged during the course; if noise goes up with engine speed, it means noise comes from damaged drive cone wheel ball bearing. Refer to 3.6.2.7, replace drive cone wheel bearing.

Noise from the bearing in the transmission:

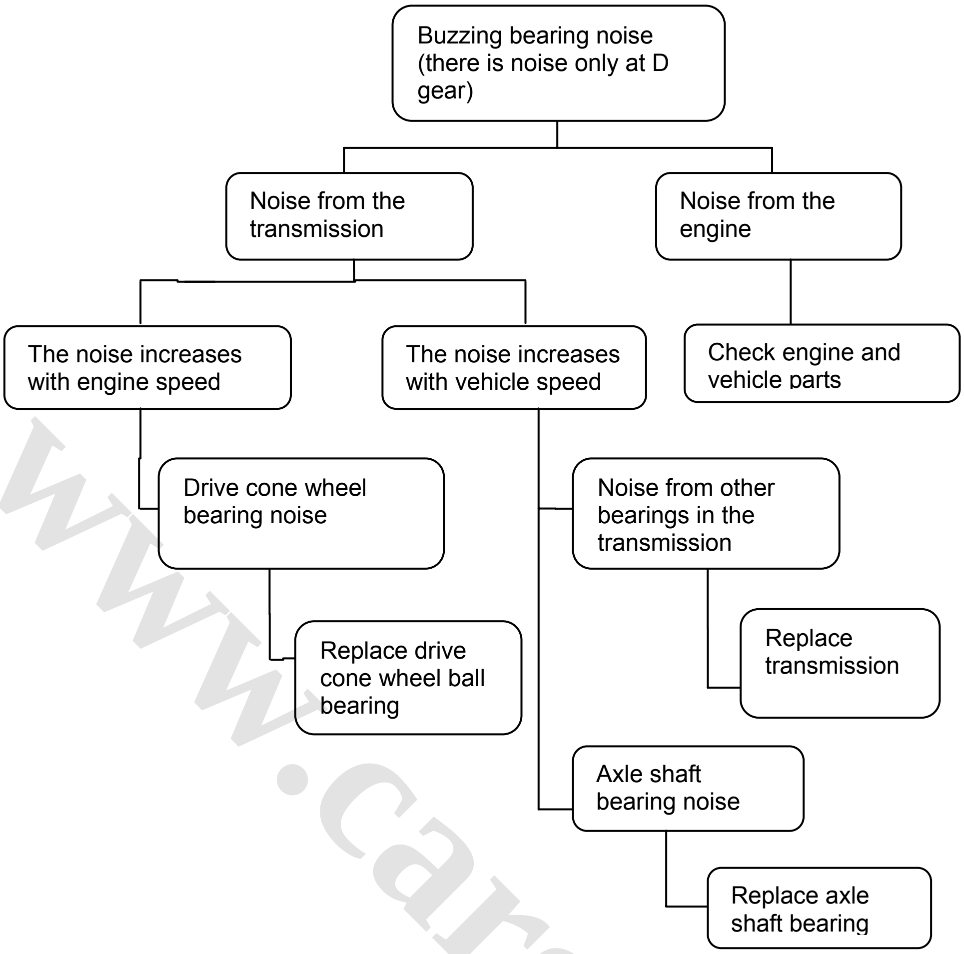
Sound description:

At D gear, noise occurs during driving. The noise is buzzing. The noise and frequency will increase with vehicle speed. Check method:

According to check method of drive cone wheel ball bearing noise, if the noise does not increase with the engine speed, but with vehicle speed, it may come from wheel axle shaft bearing noise. If axle shaft bearing fault is eliminated, the noise comes from the bearing in the transmission.

Note: It is very difficult to determine noise problem. Therefore, before it is to replace the transmission parts or the transmission, it is necessary to determine that the noise comes from the transmission. Replace parts that are easily to be replaced to determine noise source.

Detection flow diagram:



2.2.5. Water noise in the transmission or noise from other oil in the transmission

Sound description:

Put into D or R gear, release the brake slowly; as long as wheels move, crackle noise will occur. If the accelerator is depressed, crackle noise will occur continuously from 10km/h to 40km/h. After the speed exceeds 40km/h, the noise disappears.

At the stage of water inlet, you may hear "cackle" noise. But when you accelerate, you do not hear "crackle-----"noise.

Some vehicles may run out at the time of starting. It depends on water level inside.

How to check and maintain:

Discharge oil and open oil pan and drive cone wheel end cover:

If there is white object in drive cone wheel end cover and oil pan, it means there is water or other oil or liquid in the transmission.

Discharge oil in the transmission as far as possible and throw the filter away.

Replace new filter and refill oil into the transmission according to 3.1.

The vehicle drives at each speed and accelerates and decelerates about five minutes.

Discharge oil in the transmission and refill new oil into the transmission. (do 2-3 times until noise disappears)

“Crackle” noise shall disappear; “creak-------” noise shall be reduced.

“Creak-------” noise can be solved by stall test to increase the clutch temperature. Put into D gear, step on brake and the accelerator.

If fault code P2787 occurs during this course and clutch is disengaged due to high temperature, it is only self-protection function of the transmission, not a fault. When the fault indicator lamp goes out automatically, stall test can go on until the noise disappears.

If excessive water or other oil goes in the transmission, noise and runout cannot be solved. Therefore, the transmission shall be replaced.

2.2.6. Noise at N or P gear

1. This noise goes up with the engine speed (accelerate at neutral gear, the noise is larger)

First, check if the noise comes from the engine or the transmission

If it is located in the engine, check the engine

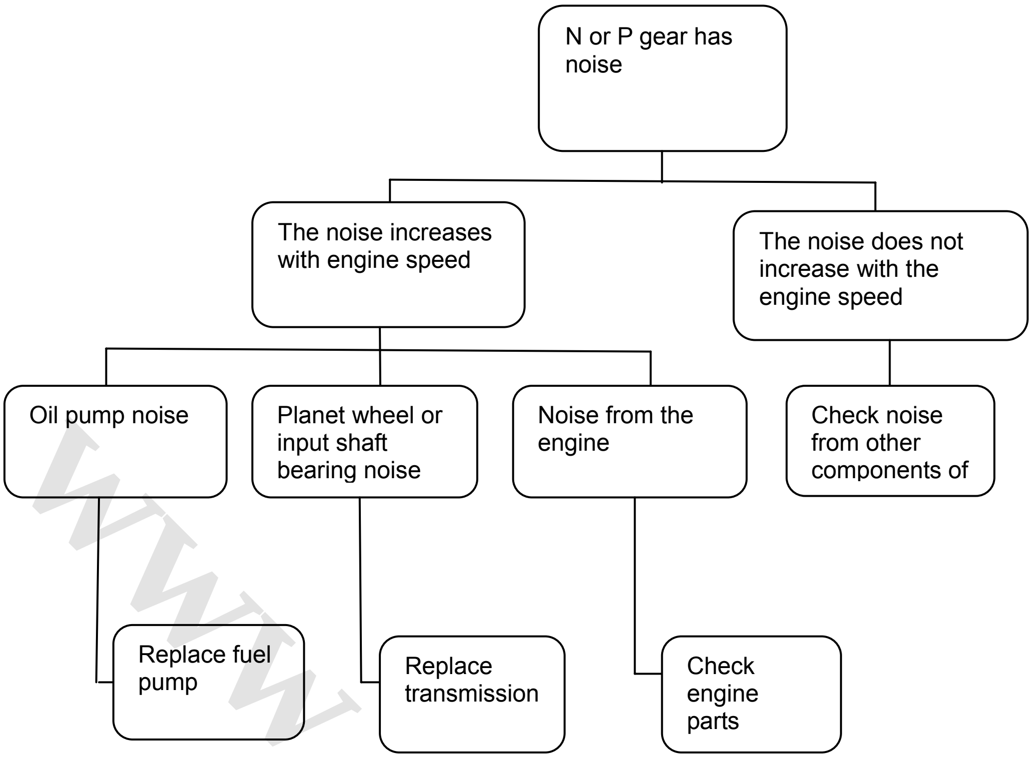
If it is located in the transmission, check if oil pump has abnormal noise

If the noise comes from the transmission, but not from oil pump, it may be noise of input shaft bearing or planetary gear set, it is necessary to replace the transmission.

2. The noise does not go up with the engine speed

This noise comes from other parts of the vehicle. Check vehicle components

Detection flow diagram:



Note: It is very difficult to determine noise problem. Therefore, before replacing the transmission parts or the transmission, it is necessary to determine that the noise comes from the transmission. Replace parts that are easy to be replaced to determine noise source.

2.3. Check and maintenance for runout

2.3.1. The vehicle runs out during driving (run out)

Fault description: when driving at D gear, the vehicle runs out or runs out at quick acceleration.

Detection and maintenance: the vehicle runs out. There are the following possibilities:

1. Self-learning is not completely done, refer to 2.5
2. Oil filled is wrong or water goes into the transmission, so oil in the transmission is deteriorated, refer to 4.2.5
3. Replace drive cone wheel speed sensor, refer to 3.6.2.14
4. Replace hydraulic control block (valve body), refer to 3.6.2.12; and make self-learning again, refer to 2.5
5. Replace driven cone wheel speed sensor, refer to 3.6.2.13
6. If you have any question, please contact after-sales service station of the manufacturer

2.3.2. The vehicle cannot start driving (do not accelerate)

Fault description: put into D gear, release the brake, and the vehicle is completely static, then step on the accelerator; when engine speed is 2000rpm, the vehicle rushes out suddenly, with large impact.

Inspection and repair:

1. First check if there is fault code, refer to 4.4
2. Check if there is fault; if yes, check self-learning, and refer to 2.5
3. Brake signal has a problem. When braking is not done, brake signal is actually in braking state. The problem may occur. Check brake signal and wire harness
4. If no problem is found, valve body may have a problem. Please replace valve body, refer to 3.6.2.12, and for self-learning, refer to 2.5
5. If the problem still occurs, please contact after-sales service station of the manufacturer.

2.4. Fault code and measures taken

General description:

Once there is fault code in transmission control unit, the fault indicator lamp on instrument lamp will be lit.

Whenever you read DTC and find fault code by detecting tool, first check if this fault is historical fault and make sure it does not occur in the last driving cycle (the detector shall display “error path of H stored in FCM, history fault); if yes, delete fault code and check if this fault code occurs again. If it is not history fault, but current fault (the detector shall display “error path of C stored in FCM, current fault”); solve it according to the following fault codes.

Check if it is the latest software every time. If not, refresh the latest software and then check if fault code still exists.

General description: when fault code occurs or the transmission has a problem, first check three basic items:

a. Check if it is special oil for CVT
b. Check oil level
c. Make self-learning again

- Do not complete the following procedures. After the problems are solved, it is not necessary to go on with it.

- **P0604 RAM internal data check fault**
- TCU takes measures:
- Three pressure regulators are all off*, fault indicator lamp is lit.
- Maintenance guide:
- 1. Refresh software, and use MLT or tools provided by automobile manufacturer.
- 2. Replace with a new TCU.

- **P0605 ROM internal data checksum**
- TCU takes measures:

- Three pressure regulators are all off*, fault indicator lamp is lit.
- Maintenance guide:
- 1. Refresh software, and use MLT or tools provided by automobile manufacturer.
- 2. Replace with a new TCU.
- **P0602 ROM internal code checksum**
- TCU takes measures:
- Three pressure regulators are all off*, fault indicator lamp is lit.
- Maintenance guide:
- 1. Refresh software, and use MLT or tools provided by automobile manufacturer.
- 2. Replace with a new TCU.
- **P0603 EEPROM fault (checksum)**
- TCU takes measures:
- Three pressure regulators are all off*, fault indicator lamp is lit.
- Maintenance guide:
- 1. Refresh software, and use MLT or tools provided by automobile manufacturer.
- 2. Replace with a new TCU.

P0710 oil temperature sensor fault

TCU takes measures:

Fault indicator lamp is lit, and the system sets transmission oil temperature

Maintenance guide:

1. Measure oil temperature of the transmission by detector; if signal data is appropriate, clear fault code and check if it will occur again
2. Check the wire (short circuit, open circuit and grounding)
3. Measure the resistance between two pins of main joint of the transmission (at 20°C, the resistance shall be 980-1000Ω) to determine if oil temperature sensor is damaged. If it is damaged, go to the next step and directly replace main joint
4. Replace with a good TCU
5. Replace the transmission

P2765 drive cone wheel speed sensor fault

TCU takes measures:

Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure oil temperature of the transmission by detector; if signal data is appropriate, clear fault code and check if it will occur again

2. Check the wire (short circuit, open circuit and grounding)
3. Replace with a good TCU 4 and replace speed sensor

P0720 driven cone wheel speed sensor fault

TCU takes measures:

Fault indicator lamp is lit, and the system sets driven cone wheel speed

Maintenance guide:

1. Measure oil temperature of the transmission by detector; if signal data is appropriate, clear fault code and check if it will occur again
2. Check the wire (short circuit, open circuit and grounding)
3. Replace with one good TCU
4. Replace the speed sensor

P0840 driven cone wheel pressure sensor

TCU takes measures:

Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure actual pressure of driven cone wheel by detector and compare it with target value; if signal data is appropriate, clear fault code and check if it will occur again.
2. Check the circuit according to the value in step 1 (earthing: 0 bar (actual pressure), short circuit: 60 bar, open circuit: 60 bar)
3. Replace with one good TCU
4. Replace valve body

P0641 pressure sensor power supply fault

TCU takes measures:

Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check if input voltage is 5v by detector; if input voltage is 5v and data is correct, clear fault code and check if it will occur again.
2. Measure the voltage between pressure sensor power wire and ground wire; it is based on the result of first step
3. Check the wire (short circuit, open circuit and grounding)
4. Replace with one good TCU
5. Replace hydraulic control block (valve body)

P0651 driving mode sensor and speed sensor power supply fault

TCU takes measures:

Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check if input voltage measured by the tester is 8.4v or not; if the data is correct, clear fault code and check if it exist again.
2. Measure the voltage between pressure sensor power wire and ground wire; it is based on the result of first step
3. Check the wire (short circuit, open circuit and grounding)
4. Replace with one good TCU

P0659 pressure regulator is short circuit

TCU takes measures:

Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

Measure the HS voltage: Compare it with the battery voltage. If they are the same, check the circuit (check if there is short circuit between the battery positive electrode and VHA and transmission port) and repair wire harness. If they are different and higher than 3.4V, replace TCU.

P0658 pressure regulator is open circuit or grounding

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

Measure the HS voltage: Compare it with the battery voltage. If the battery voltage is normal and high end voltage is less than 3.4V, it means there is wire grounded. If the battery voltage is normal, high end voltage is higher than 3.4 V, it means open circuit. According to actual details, check pin wire; if the wire is good, replace TCU; if the battery voltage is abnormal, check the battery.

P0702 TCU internal detection system fault (during the course of ignition)

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

Replace TCU

P0962 EDS1drive cone wheel pressure regulator is grounding

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of drive cone wheel pressure regulator – it shall be 5.05Ω +- 6%.
2. Check the wire (grounding), according to check result, replace wire harness in the transmission or engine wire harness.

3. Replace hydraulic control block

P0963 EDS1 drive cone wheel pressure regulator is short circuit

TCU takes measures:

Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of drive cone wheel pressure regulator
2. Check the wire (short circuit, open circuit and grounding), according to check result, replace wire harness in the transmission or engine wire harness.
3. Replace hydraulic control block

P0960 EDS1 drive cone wheel pressure regulator is open circuit

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of drive cone wheel pressure regulator
2. Check the wire (open circuit), according to check result, replace wire harness in the transmission or engine wire harness.
3. Replace hydraulic control block

P0966 EDS2 driven cone wheel pressure regulator is grounding

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of driven cone wheel pressure regulator
2. Check the wire (grounding), according to check result, replace wire harness in the transmission or engine wire harness.
3. Replace hydraulic control block

P0967 EDS2 driven cone wheel pressure regulator is short circuit

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of driven cone wheel pressure regulator
2. Check the wire (short circuit), according to check result, replace wire harness in the transmission or engine wire harness.
3. Replace hydraulic control block

P0964 EDS2 driven cone wheel pressure regulator is open circuit

TCU takes measures:

Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of driven cone wheel pressure regulator
2. Check the wire (open circuit), according to check result, replace wire harness in the transmission or engine wire harness.
3. Replace hydraulic control block

P0902 EDS3 clutch pressure regulator is grounding

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of clutch pressure regulator
2. Check the wire (grounding), according to check result, replace wire harness in the transmission or engine wire harness.
3. Replace hydraulic control block

P0903 EDS3 clutch pressure regulator is short circuit

TCU takes measures:

Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of clutch pressure regulator
2. Check the wire (short circuit), according to check result, replace wire harness in the transmission or engine wire harness.
3. Replace hydraulic control block

P0900 EDS3 clutch pressure regulator is open circuit

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure the resistance of clutch pressure regulator
2. Check the wire (open circuit), according to check result, replace wire harness in the transmission or engine wire harness.
3. Replace hydraulic control block

P0930 gear shift lock is grounding

TCU takes measures: fault indicator lamp is lit

Maintenance guide:

1. Check gear shift lock relay wire harness

P0931 gear shift lock is grounding or open circuit

TCU takes measures: fault indicator lamp is lit

Maintenance guide:

1. Check gear shift lock relay wire harness

P1763 start lock is grounding or open circuit

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check the wire; if the gear sensor has a problem, fault code is sometimes reported.
2. Replace TCU

P1764 start lock is short circuit

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check the wire
2. Replace TCU

P1768 reverse lamp is grounding

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check the wire
2. Replace TCU

P1769 reverse lamp is short circuit or open circuit

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check the wire
2. Replace TCU

P0868 pressure pre-tightening adjustment fault

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check oil level and oil product
2. Replace oil pump
3. Replace hydraulic control block
4. Replace the transmission

P0811 clutch (forward or backward) slipping

TCU takes measures: fault indicator lamp is lit, the clutch is disengaged

Maintenance guide:

1. Do self-learning again; this fault code may occur in cold state, therefore, do self-learning in cold state.

2. Check oil level and oil type
3. Replace hydraulic control block
4. Replace the transmission

P0730 drive ratio control fault

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check signals given by speed sensor and check input current and feedback current of drive cone wheel pressure regulator
2. Take corresponding measures according to the fault, for example, if speed sensor has a problem, check speed sensor; if the pressure has a problem, check pressure sensor etc.
3. Check oil level and oil produce
4. Replace oil pump
5. Replace hydraulic control block
6. Replace the transmission

P1765 driven cone wheel pressure is too low

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Measure actual pressure in dynamic driving (like manual transmission), compare it with target value
2. Check oil level and oil type
3. Complete self-learning (fault code may occur when self-learning is not completed)
4. Check the reason when engine torque reduction is caused by engine end: spark plug, throttle valve, three-way catalytic converter (the longer the engine is used, the more likely this problem occurs)
5. Replace hydraulic control block
6. Replace oil pump
7. Replace the transmission

P1766 driven cone wheel pressure is too high

TCU takes measures: fault indicator lamp is lit

Maintenance guide:

1. Measure actual pressure in dynamic driving (like manual transmission), compare it with target value
2. Check oil level and oil type

3. Replace hydraulic control block
4. Replace oil pump
5. Replace the transmission

P0701 two faults occur at the same time, which requires pressure regulator power off

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

Check other fault codes

P0218 transmission oil temperature is too high

TCU takes measures: fault indicator lamp is lit

Maintenance guide:

1. Check oil cooler
2. Try to create this fault again in common driving conditions; if not, inquire the customer in what driving conditions this fault occurs.
3. Under driving conditions of step 2, measure transmission oil temperature, check if transmission oil temperature is greater than or equal to 120°C by detector (it is wrong that fault code is shorter than 30 minutes of the filter), and take measures to prevent the transmission temperature from being too high

P1767 transmission oil temperature exceeds the range

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Try to create this fault again in common driving conditions; if not, inquire the customer in what driving conditions this fault occurs. (Climbing driving or high-speed driving).
2. Check oil cooler
3. Check oil level
4. Replace valve body
5. Replace the transmission

P0219 power system speed exceeds the range

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. In principle, it will not occur
2. Check engine if the speed is within 6000rpm

P2766 drive cone wheel speed does not conform to actual speed

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check if other speed information (engine speed, output shaft speed and vehicle speed) by detector is lost; if yes, first solve these problems and then check if the fault occurs again.
2. Check drive cone wheel speed signal by detector, compare it with engine speed when the clutch is engaged. The difference shall be within 200 rpm. Compare thoroughly within low and high speed range of the engine (until 6,000 rpm)
3. Check the circuit
4. Replace with one good TCU
5. Check the sensor position, angle and speed sensor. Check if there is an object (steel strip debris etc.) in front of the sensor – Remark: this is a mechanical fault. Electrical fault has other fault codes.
6. Replace drive cone wheel speed sensor
7. Replace wire harness in the transmission
8. Replace engine wire harness
9. Replace the transmission

P0721 driven cone wheel speed does not conform to real speed

TCU takes measures: fault indicator lamp is lit, clamping force is increased to 0* level, the system sets driven cone wheel speed.

Maintenance guide:

1. Check if other speed information (engine speed, output shaft speed and vehicle speed) by detector is lost; if yes, first solve these problems and then check if the fault occurs again.
2. Check drive cone wheel speed signal by detector, compare it with engine speed when the clutch is engaged. The difference shall be within 200 rpm. Compare thoroughly within low and high speed range of the engine (until 6000 rpm)
3. Check the circuit
4. Replace with one good TCU
5. Check or replace speed sensor
6. Replace driven cone wheel speed sensor
7. Replace wire harness in the transmission
8. Replace engine wire harness
9. Replace the transmission

P0944 clamping force is insufficient (VSM)

TCU takes measures: Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

When engine torque is too large, fault code is activated. ECU does not follow TCU torque reduction requirement.

1. Check ECU fault code
2. Replace ECU
3. Check oil level and oil product
4. Complete self-learning (this fault code may occur when self-learning is not completely fulfilled)
5. Check the reason when engine torque reduction is caused by engine end: spark plug, throttle valve, three-way catalytic converter (the longer the engine is used, the more likely this problem occurs)
6. Replace valve body
7. Replace oil pump
8. Replace transmission

P0782 winter driving mode fault

TCU takes measures: fault indicator lamp is lit, the system winter mode is closed

Maintenance guide: Window mode switch circuit problem

1. Check the circuit
2. Replace TCU

P0783 cruise control fault

TCU takes measures: Fault indicator lamp is lit, the system cruise control function is closed

Maintenance guide:

There is no cruise control signal on CAN bus or ECU sends error fault:

1. Check the circuit
2. Replace ECU
3. Replace TCU

P0810 off-line self-adaption updating is not completed

TCU takes measures: fault indicator lamp is flashing

Maintenance guide:

According to 2.5, self-adaption is updated.

P1762 current value is fixed, which cannot be changed

TCU takes measures: Three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check fault codes, including P0962 P0963 P0960 P0966 P0967 P0964 P0902

P0903 P0900 P1763 P1764 and make troubleshooting until no fault code exists.

2. Replace with one good TCU

P0882 the battery or high-end voltage is too low

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. When this fault occurs, the battery voltage is recorded at that time (therefore, you can recognize the fault caused by the battery or high end voltage): if it is not history record, go on with next step.
2. Check high end voltage or battery voltage by detector – the temperature has great effect on the value: for details, see the software
3. Check the circuit from the battery to TCU (fuse, main relay),
4. Replace /check the battery
5. If high end voltage problem: high-end voltage problem: Check the circuit from transmission to TCU
6. Replace TCU

P0883 the battery or high-end voltage is too high

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. When this fault occurs, the battery voltage is recorded at that time (therefore, you can recognize the fault caused by the battery or high end voltage): if it is not history record, go on with next step.
2. Check high end voltage or battery voltage by detector – the temperature has great effect on the value
3. Ask the customer if other batteries are used to keep lamps on (now, power supply is 24V). If the battery has a problem, check the circuit between the battery and TCU (fuse, main relay)
4. Check and replace the battery or generator
5. If high end voltage problem: high-end voltage problem: Check the circuit from transmission to TCU
6. Replace TCU

P2787 clutch temperature is too high

TCU takes measures: fault indicator lamp is lit, the clutch is disengaged

Maintenance guide:

1. Check how many times this fault occurs; if only once or several times, please check data in TCU and inquire the customer about special driving environment at that time, like uphill driving, then delete fault code.
2. Check oil level and oil product

3. Complete self-learning (if self-learning is not completed, this fault code may occur)
4. Only when stall test is made, this fault code may occur; delete fault code and check if there is still fault code.
5. Replace TCU
6. If throttle valve may be stuck, replace it

P0727 hardwired engine speed signal from ECU to TCU does not conform to real speed

TCU takes measures: fault indicator lamp is lit

Maintenance guide:

1. Check if engine has a fault on the engine detection report; if yes, maintain the engine
2. Check TCU input signal – this is a frequency signal (900 rpm is 30Hz, 3000 rpm is 100Hz)
3. Replace TCU
4. Replace the engine speed sensor

P1761 pressure regulator current fault

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check pressure drop inside pressure regulator by detector and compare the current specified by each pressure regulator.
2. Check pressure regulator current by detector and compare with specified current; if one of them is different from the specified current, check pressure regulator wire (also check the inside of transmission)
3. Replace TCU
4. Replace hydraulic control block
5. Replace wire harness in the transmission
6. Replace engine wire harness

U0301 vehicle configuration error (such as ECU on other vehicles)

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check if TCU hardware and software combination is correct and efficient.
2. If it is updated EMS or TCU software: Software on new controller must be wrong (incompatibility between the transmission controller and engine controller)

P0706 driving mode sensor single wire error

TCU takes measures: fault indicator lamp is lit, and the system sets the sensor position

Maintenance guide:

1. Check which wire has a problem by detector and what it is, like B wire short circuit (if this fault indicates one of wire has a fault)
2. Check the wire between the transmission and TCU
3. Replace with one good TCU
4. Replace driving mode sensor
5. Replace wire harness in the transmission
6. Replace engine wire harness

P0705 driving mode sensor multi-wire error

TCU takes measures: three pressure regulators are off*, fault indicator lamp is lit

Maintenance guide:

1. Check which wire has a problem by detector and what it is, like B wire short circuit (if this fault indicates one of wire has a fault)
2. Check the wire between the transmission and TCU
3. Replace with one good TCU
4. Replace driving mode sensor
5. Replace wire harness in the transmission
6. Replace engine wire harness

P0571 brake signal fault

TCU takes measures: fault indicator lamp is lit, brake signal is engaged

Maintenance guide:

1. Check brake signal state by detector
2. Check brake signal wire
3. Check brake switch
4. Replace TCU

P0955 manual gear shift signal fault

TCU takes measures: fault indicator lamp is lit, there is no manual mode

Maintenance guide:

1. Check the circuit between TCU and shifter
2. Replace gearshift
3. Replace with one good TCU

U0001 CAN bus fault

TCU takes measures:

Fault indicator lamp is lit, and emergency mode is activated*, there is no increase clamping force level 1* (maximum) in manual mode, the system sets locking and rotating conditions; internal driving strategy is activated; the system sets engine speed and the system sets engine torque; the system sets engine cooling water temperature, brake signal is engaged, accelerator pedal value is fixed, the system sets front left wheel speed, front right wheel speed, rear left wheel speed and rear right wheel speed.

Maintenance guide:

1. If this fault occurs in all controllers, it means wire harness has a problem (CAN high speed and CAN low speed short circuit): check vehicle wire harness
2. If the fault only exists in TCU: replace with a good TCU

U0121 ABS CAN communication fault

TCU takes measures:

Increase clamping force level 0*, the system sets locking and rotating conditions, front left wheel speed, front right wheel speed, rear left wheel speed and rear right speed.

Maintenance guide: Check ABS controller and CAN communication interface on it (maybe this fault occur to other controllers)

U0100 ECU CAN communication fault

TCU takes measures:

Fault indicator lamp is lit, and emergency mode is activated*, there is no increase clamping force level 0* in manual mode, internal driving strategy is activated; the system sets engine torque and the system sets engine cooling water temperature, accelerator pedal value is fixed and data stopping at CAN transfers

Maintenance guide: Check engine controller and CAN interface on engine controller (maybe this fault occur to other controllers)

Engine speed signal error on the U1012 CAN bus

TCU takes measures: the system sets engine speed

Maintenance guide: Check engine speed sensor and sensor wire

U1013 CAN bus accelerator pedal signal error

TCU takes measures: fault indicator lamp is lit, accelerator pedal value is fixed

Maintenance guide: Check accelerator pedal sensor and sensor wire

U1014 CAN bus engine torque signal error

TCU takes measures: fault indicator lamp is lit, emergency mode is activated*, no manual mode activates inside driving strategy. The system sets engine torque.

Maintenance guide: Check ECU

Note:

- Three pressure regulators are off*: when fault code is displayed and pressure regulator disconnects, the clutch is disengaged, the vehicle cannot move even the transmission is put into gear; only when the engine is shut down, key position returns to zero, then start the engine again; now the vehicle can start driving.
- Increase clamping force level 0*: driven cone wheel pressure is fixed, this pressure is higher than normal value and lower than the maximum
- Increase clamping force level 1*: driven cone wheel pressure is fixed at the maximum
- EDS1*: drive cone wheel pressure regulator
- EDS2*: driven cone wheel pressure regulator
- EDS3*: clutch pressure regulator
- Emergency mode*: it can be called “limp home mode”; when the following conditions occur, it shall be activated:
- CAN wire falling off
- CAN ECU communication fault
- CAN engine torque signal are error, all signals related to engine and ABS will be replaced (safety measures taken):
- Throttle percentage is fixed -engine map replaces engine torque
- Cooling temperature of the engine is fixed
- Wheel speed is replaced by transmission output shaft
- Speed signal of engine speed sent by hard wire
- Clutch disengagement or engagement compares rigidity. It seems that no calibration data exist.
- The maximum rotate speed of the engine is 3200rpm
- The maximum speed is 98km/h.
- The transmission only allows gear shift in one driving strategy.

CVT will work only in basic conditions, which provides enough drivability and make the vehicle drive to near service station.

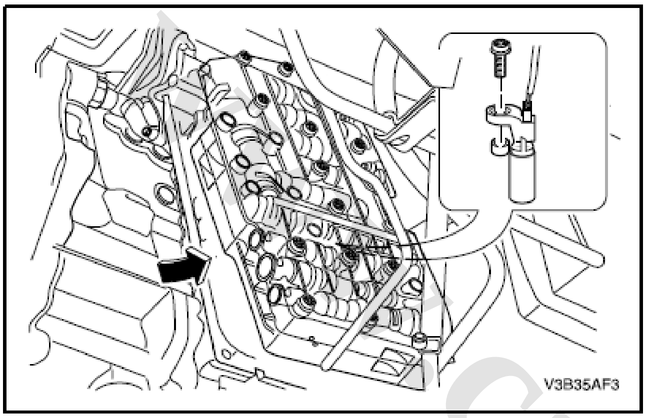
- After 2 seconds, manual shift or sport shift cannot be used, and fault indicator lamp is lit

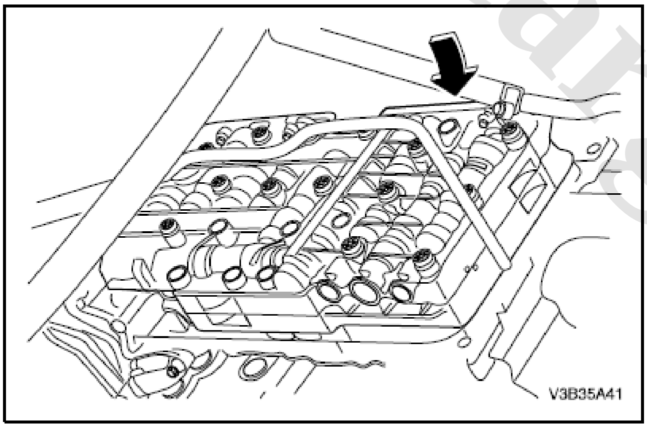
Section 3 Suspension System

Troubleshooting

Check and confirm

Confirm the customers' problems.





Visually check the following devices for obvious mechanical fault.

Tire pressure, wheel and tire, steering knuckle, tie rod end, front suspension lower arm ball joint, front suspension lower arm bush.

Front pillar and spring assembly, front/rear stabilizer bar, rear spring, rear damper, rear suspension lower arm.

Solve the observed or complaint problems before moving forward (if possible).

If failing to check the cause visually, confirm the fault phenomenon and refer to the fault phenomenon table.

Problem Symptoms Table

Condition	Possible reasons	Measures
Deflect toward one side	Incorrect height of the vehicle (front or back is too high or low).	Check if the load is abnormal, the coil-shaped spring is snagging or the spring isn't standard.

	Abrasion or damage of the steering gear or connecting rod.	Check the steering system，refer to general information of the steering system.
	Brake system.	Refer to general information of the brake system.
	Improper wheel alignment	Adjust the wheel alignment.
	Abrasion of front wheel bearing.	Check the front wheel bearing. Refer to the wheel bearing part of this chapter.
	Wheel and tire.	Steering wheel misalignment
Deflection test towards one side.	Incorrect height of the vehicle (front or back is too high or low).	Check if the load is abnormal, the coil-shaped spring is snagging or the spring isn’t standard. or the spring isn’t standard.
	Steering gear and connecting rod.	Check the steering system, refer to wheel and tire
	Suspension lower arm ball joint	Test the ball joint in this chapter.
	Improper wheel alignment	Adjust the wheel alignment.
Incorrect track	Incorrect caster angle	Test for incorrect track
	Damage of rear suspension	Test for incorrect track
Uncomfortable	Front or rear stabilizer	Check or install new suspension component

ride	connecting rod- joint or bush	as required. Refer to front and rear suspension.
Deflect towards one side	Incorrect height of the vehicle (front or back is too high or low).	Check if the load is abnormal, the coil-shaped spring is snagging or the spring isn't standard. or the spring isn't standard.
Deflect towards one side	Abrasion or damage of the steering gear or connecting rod.	Check the steering system, refer to general information of the steering system.
	Brake system.	Refer to general information of the brake system.
	Improper wheel alignment	Adjust the wheel alignment.
	Abrasion of front wheel bearing.	Check the front wheel bearing. Refer to the wheel bearing part of this chapter.
	Wheel and tire.	Steering wheel misalignment
Deflection test towards one side.	Incorrect height of the vehicle (front or back is too high or low).	Check if the load is abnormal, the coil-shaped spring is snagging or the spring isn't standard. or the spring isn't standard.
	Steering gear and connecting rod.	Check the steering system. Refer to wheel and tire
	Suspension lower arm ball joint	Test the ball joint in this chapter.

	Improper wheel alignment	Adjust the wheel alignment.
Incorrect track	Incorrect caster angle	Test for incorrect track
	Damage of rear suspension	Test for incorrect track
Uncomfortable ride	Front or rear stabilizer connecting rod- joint or bush	Check or install new suspension component as required. Refer to front and rear suspension.

Pinpoint test

Pinpoint test A: deflect towards one side

Warning: To avoid personal injury due to out of control. Two persons do the check together to maintain safe driving. Suitably control the steering wheel. Otherwise, it may cause personal injury.

Note: Evaluate the vehicle as per the following conditions.

Note: Tire exchange procedure is only suitable for two-way rotating tire.

Condition	Contents/Results/Measures
A1: Exchange front wheel and tire assembly	Lift and support the vehicle. - Exchange the left/right front wheel - Do road test. Whether the vehicle is drifting? →Yes To A2 →No

	The problem has been corrected.
A2: Exchange rear wheel and tire assembly	Lift and support the vehicle. - Exchange the left/rear front wheel - Do road test. Whether the vehicle is drifting? →Yes To A3 →No The problem has been corrected.
A3: Exchange left wheel and tire assembly	Lift and support the vehicle. - Exchange left front/rear wheel assembly. - Do road test. Whether the vehicle is drifting? →Yes To A4 →No The problem has been corrected.
A4: Exchange right wheel and tire assembly	Lift and support the vehicle. - Exchange left front/rear wheel assembly. - Do road test. Whether the vehicle is drifting?

	→Yes To A5 →No The problem has been corrected.
A5: Exchange left front wheel and tire assembly	Lift and support the vehicle. - Exchange left front wheel and right rear wheel assembly. - Do road test. Whether the vehicle is drifting? →Yes To A6 →No The problem has been corrected.
A6: Exchange right front wheel and tire assembly	Lift and support the vehicle. - Exchange right front wheel and left rear wheel
A6: Exchange right front wheel and tire assembly	- Do road test. Whether the vehicle is drifting? →Yes To A6 →No The problem has been corrected.
A7: Install new tire	Install new tires for 4 wheels. Check the system for normal

Note: New tire can be installed only once.	operation. Whether the vehicle is drifting? →Yes Confirm possible reason and refer to fault phenomenon table. →No The problem has been corrected.

Pinpoint test B: incorrect track

Condition	Contents/Results/Measures
B1: Check the caster angle	Check the vehicle wheel alignment. Whether the caster angle meets the requirement? →Yes To B2 →No Install new suspension component as required. Adjust the corrected value to the specified range. Check the system for normal operation.
B2: Check the rear suspension	Measure the left/right shaft distance of the vehicle. - Compare the measured value. Are the measured values the same? →Yes

	Confirm the customers' problems. →No Check the rear suspension component for abrasion or damage. Install new component as required. Refer to rear suspension part. Check the system for normal operation.

Pinpoint test C: uncomfortable ride

Condition	Contents/Results/Measures
C1: Check the front pillar and spring assembly	Lift and support the vehicle. - Check the front pillar and spring assembly for oil leakage or damage. Check the front pillar and spring assembly for oil leakage or damage →Yes Install new component as required. Refer to rear suspension. Check the system for normal operation. →No To C2
C2: Check the rear shock absorber	Lift and support the vehicle. - Check the rear shock absorber for oil leakage or damage. Check the rear shock absorber for oil leakage or damage. →Yes Install new component as required. Refer to rear

	suspension part. Check the system for normal operation. →No Confirm the customers' problems.

Pinpoint test D: too loud noise

Condition	Contents/Results/Measures
D1: Check the suspension	Lift and support the vehicle. - Check the suspension retaining bolt. Whether the retaining bolt is loosed or cracked →Yes Lock and install new suspension retaining bolt. Refer to suspension (front and rear). Check the system for normal operation. →No To D2
D2: Check the spring	Check the spring for damage. Whether the spring is damaged? →Yes Install a new spring. Refer to suspension (front). Refer to suspension (rear). Check the system for normal operation. →No To D3

D3: Check the front suspension lower arm	Check the front suspension lower arm bushing for excessive abrasion or damage. Whether the front suspension lower arm bushing is abraded or damaged? →Yes Install new lower arm. Refer to suspension. Check the system for normal operation. →No To D4
D4: Check the tire	Check the wheel for uneven abrasion. Uneven abrasion? →Yes Install a new tire. Adjust it to the specified value. Check the system for normal operation. →No Confirm the customers' problems.

Pinpoint test E: vibration

Condition	Contents/Results/Measures
E1: Check the tire	Lift and support the vehicle. - Check the tire for damage or excessive abrasion. Whether the tire is damaged or abraded?

	→Yes Install a new tire. Check the system for normal operation. →No To E2
E2: Measure the wheel and tire for deflection on the vehicle.	Measure the wheel and tire for deflection on the vehicle with a proper equipment. Whether the measured value is qualified? →Yes To E8 →No To E3
E3: Measure the wheel and tire for deflection under the vehicle.	Measure the wheel and tire. Before removing the wheel, mark the wheel bolt and corresponding bolt hole to ensure that the wheel would be installed at the original position. Place the removed wheel on the balancer. Whether the measured value is qualified? →Yes To E6 →No To E4
E4: Suitable mounting position	Mark the high deflection of the tire and the wheel. Evacuate the air in the tire and rotate it 180 degree. Inflate the tire and measure the deflection.

	Whether the wheel and the tire are balanced? →Yes Install the wheel into the vehicle Check the system for normal operation. →No To E5
E5: Measure the wheel deflection	Remove the tire and place the vehicle on the wheel balancer. Measure the 2nd flange deflection. Whether the deflection is qualified? →Yes Find out and mark the low point on the wheel and install the wheel suitable for the high point of the wheel. Balance the wheel and tire assembly. Check the system for normal operation. →No Install a new wheel and check the new wheel deflection. If the new wheel is within the limit, find out and mark the low point on the wheel. Install the tire and adjust the high point and low point of the wheel. Balance the wheel and tire assembly. Check the system for normal operation. Check the system for normal operation.
E6: Rear wheel hub and bolt circle diameter deflection	Remove the rear wheel, the brake drum or the brake disc. - If the measured value is correct? →Yes

	To E7 →No Install a new wheel hub.
E7: Front wheel hub and bolt circle diameter deflection	Remove the front wheel and the brake disc. - Measure the deflection of the bolt circle. If the measured value is correct? →Yes To E8 →No Install a new wheel hub. Refer to front suspension.
E8: Wheel balance	Balance all wheels. Perform road test. If there is vibration? →Yes Refer to noise, vibration and unflatness. →No Confirm the customers' problems.

Specification

Master pin caster angle	2°44′±30′
Front wheel Camber angle	-1°12±30′
Toe-in angle of front wheel	-0°43±30′

Master pin inner caster angle	11°2′±30′

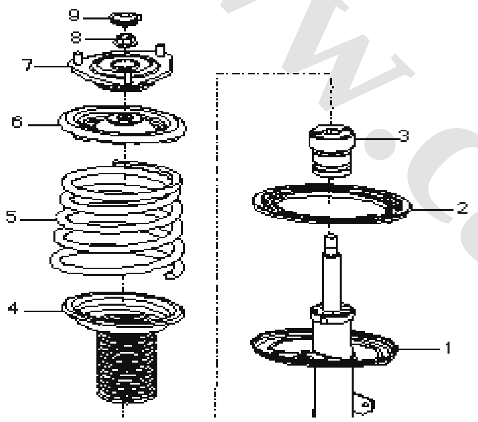
Tightening torque

Tie rod end locking nut	40 N•m

Removal and Installation of Front Shock Absorber

Appearance

Breakdown drawing



Shock absorber assembly

Removal and installation of front shock absorber

Removal procedure:

Lift the vehicle with a jack and remove the front wheel.

Remove the hose and ABS speed sensor lead from the shock absorber (with ABS system).

Remove the steering knuckle with brake disc assembly from the shock absorber

Dismantle 2 nuts and bolts of the shock absorber and the steering knuckle with brake disc assembly.

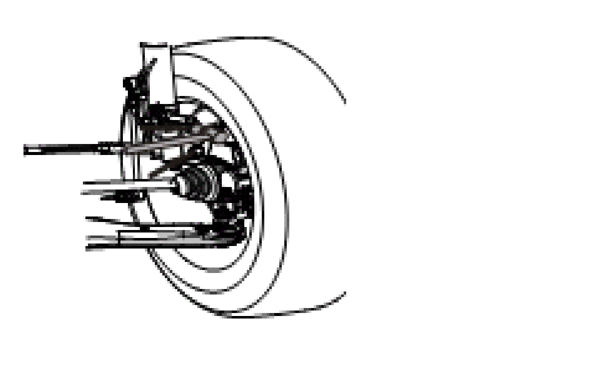


Fig. 301

Remove the bolt connecting the tie rod ball joint pin and the steering knuckle with brake disc assembly and loosen the ball joint pin

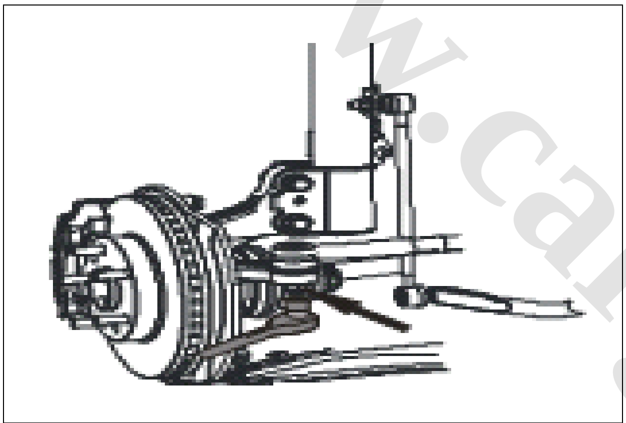


Fig. 302

Remove the bolt connecting the front connecting rod and the shock absorber and loosen the connecting rod (see Fig. 303);

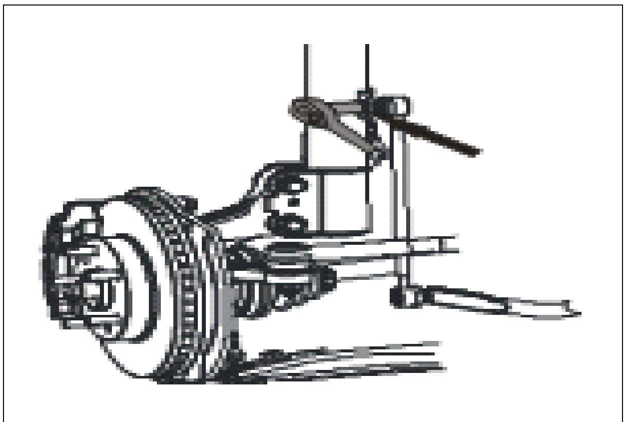


Fig. 303

Remove the bolt connecting the steering knuckle (with brake disc assembly) and the control arm ball joint. Remove the drive shaft bolt of the front wheel (304)。

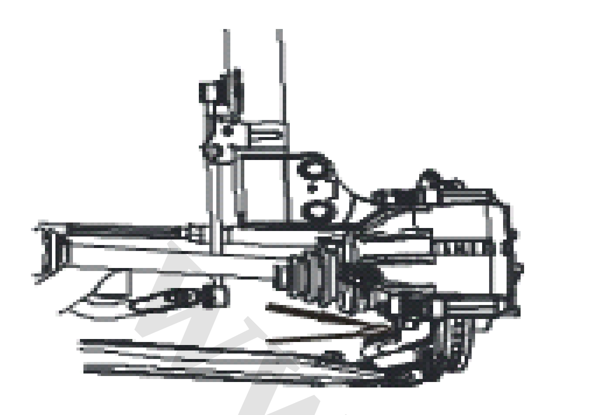


Fig. 304

Remove the steering knuckle with brake disc assembly from the shock absorber.Installation hints: apply engine oil to the thread of the nut.

4-Remove the shock absorber and the spiral spring together

Remove 3 bolts connecting the shock absorber and the vehicle body (see Fig. 305).

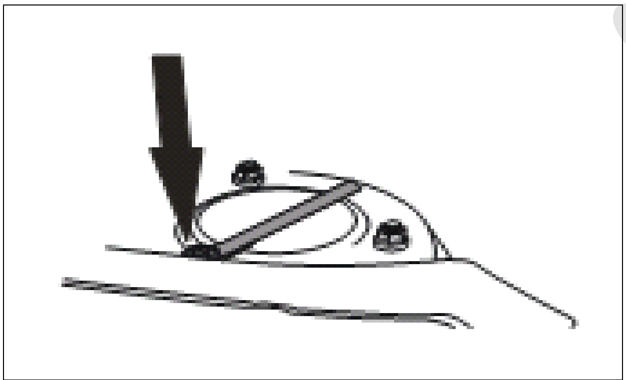


Fig. 305

Remove the shock absorber and the spiral spring together.

Installation should comply with the removal procedure.

Notes: The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it’s loosed each time.

Fasten each bolt to the specified torque after installation.

Please check the four-wheel alignment after installation.

Removal and installation of the shock damping pillar component and/or spring

Removal procedures:

If the assembly fixture couldn't be fixed on the work bench, fix it in the standing vice. (See Fig. 306)

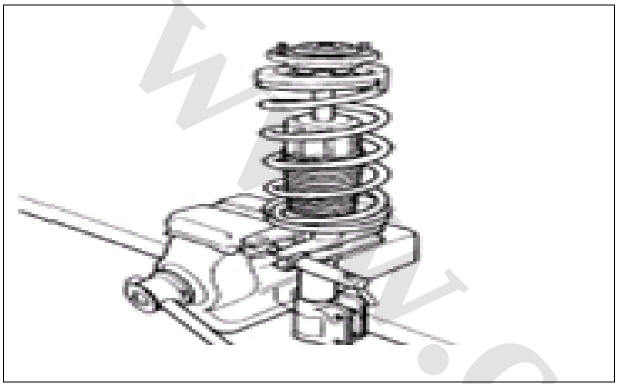


Fig. 306

Install a pair of claws corresponding to the spring diameter into the spring compressor.

Loosen the spring compressor and the claw is between the top and the bottom of the spring (as shown by arrow). (See Fig. 307)

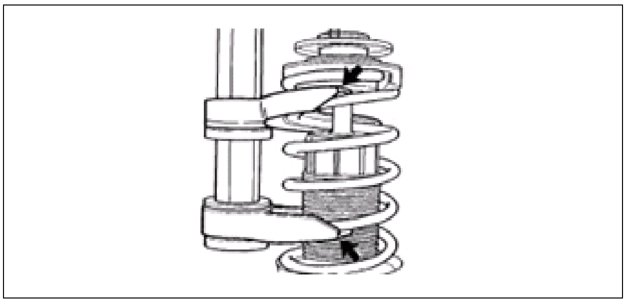


Fig. 307

Use a locknut ratchet wrench (as shown in Fig. 308) to remove the shock damping pillar bracket with limiter and the washer from the piston connecting rod.

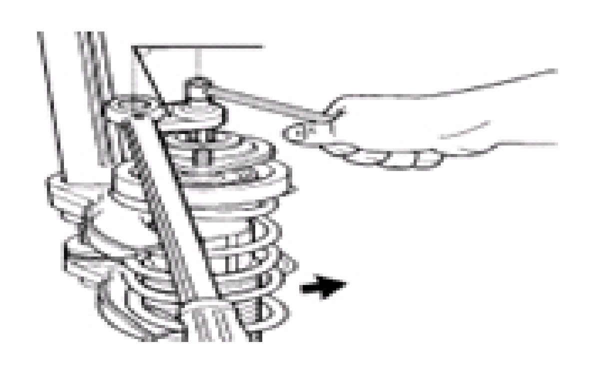
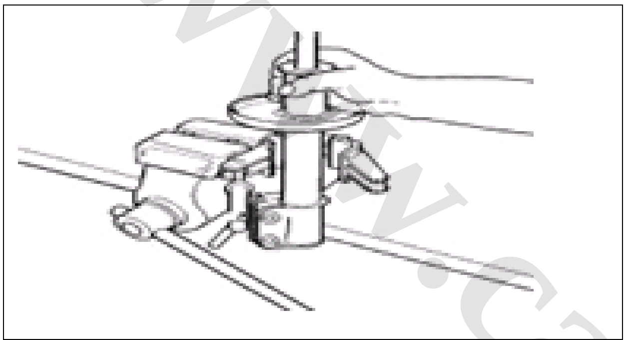


Fig. 308

Remove the upper spring seat with a shock damping block. (See Fig. 309)



See Fig. 309

Remove the spring compressor with spring and dustproof cover. (See Fig. 310)

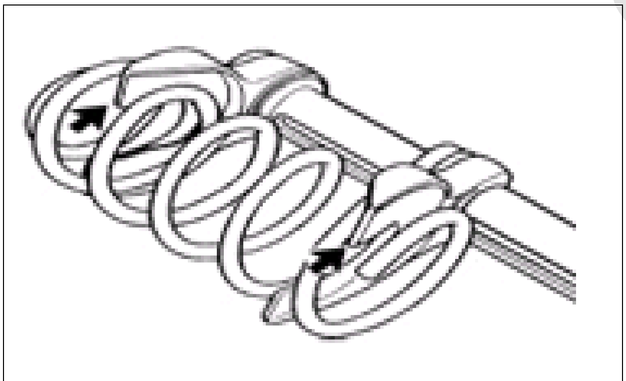


Fig. 39

Remove the buffer stopper

Check the following components as per the damage and abrasion degree.

Buffer stopper

Dustproof cover

Vibration stopper

Shock damping pillar seat

Upper spring seat with bearing and limiter

If the old shock absorber requires changing, remove the shock absorber, remove the wheel speed sensor speed limit bracket from the shock absorber and install it on the new shock absorber. (Directly replace the shock absorber if there is no wheel speed sensor harness bracket.)

Installation procedure

Install a new shock absorber into the assembly fixture.

Loosen the spring and take out the old spring from the spring compressor to replace the old spring.

Insert a new spring in the spring compressor. Leave a circle at the upper part of the spring and a circle and half at the lower part

(As shown by arrow in Fig. 311)

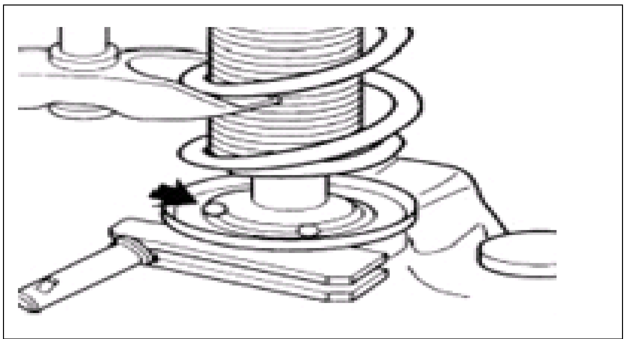


Fig. 310

Compress the spring to keep the distance between two claws ≤120 mm.

Confirm the position of the buffer stopper limiter. (See 1 in Fig. 312)

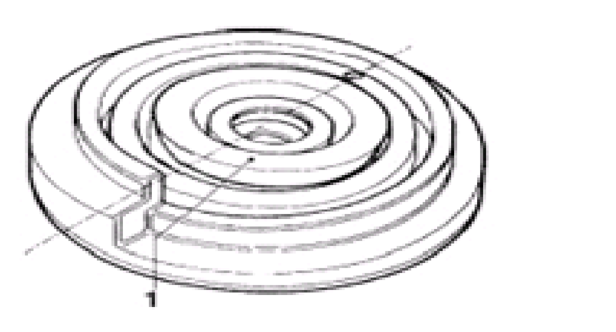


Fig. 311

Install the buffer stopper and pull the piston rod to the end

Place the spring on the spring seat.

It's very important that the spring end should be in the limit hole.

Install the upper spring seat with shock damping block and keep the hole deflects 180° from the lower spring pillar fastening position. (As shown by arrow)

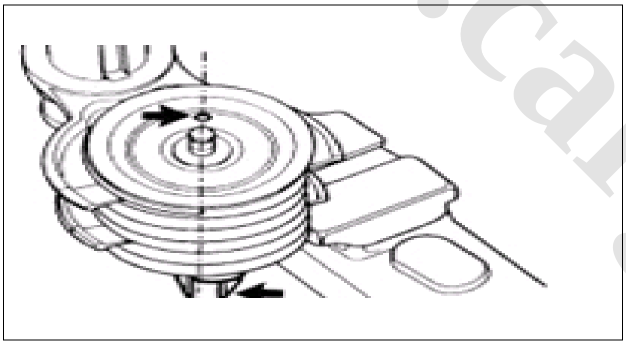


Fig. 312

Install the spacer bush bearing and the aligner

Fasten it with a new lock nut

Fasten the new lock nut

Important notes

Vertically use the torque wrench (see Fig. 314)

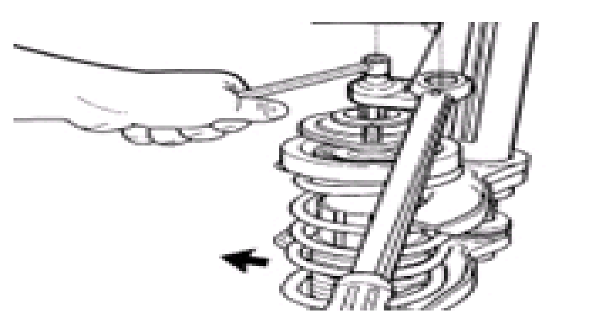


Fig. 313

Check of the shock absorber

Check of the shock absorber

Check the shock absorber for oil leakage, if so, replace it. Check the damping force of the shock absorber, if disqualified, replace it. Check the thrust bearing for excessive abrasion, abnormal noise and blockage. Check the spring lower seat for crack or deformation. Check the limitation stop for damage. Check the suspension spring limitation pad for abrasion, crack or deformation. Replace all defective parts.

Note: Discard the shock absorber as per the following procedures.

Discard the front shock absorber

Stretch the shock absorber rod as long as possible. (See Fig. 315)

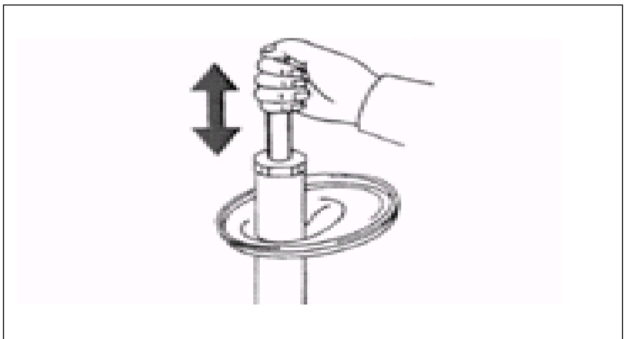


Figure 314

Use a drill to drill a hole on the cylinder as shown in the figure to evacuate the air in the shock absorber cylinder.

(See Fig. 316)

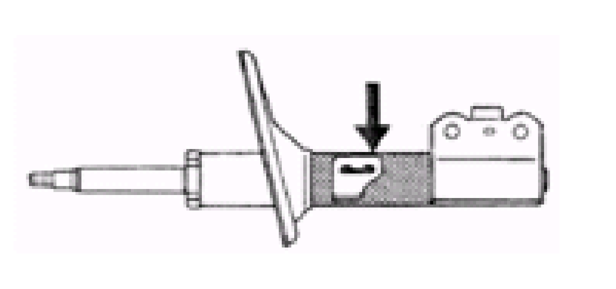
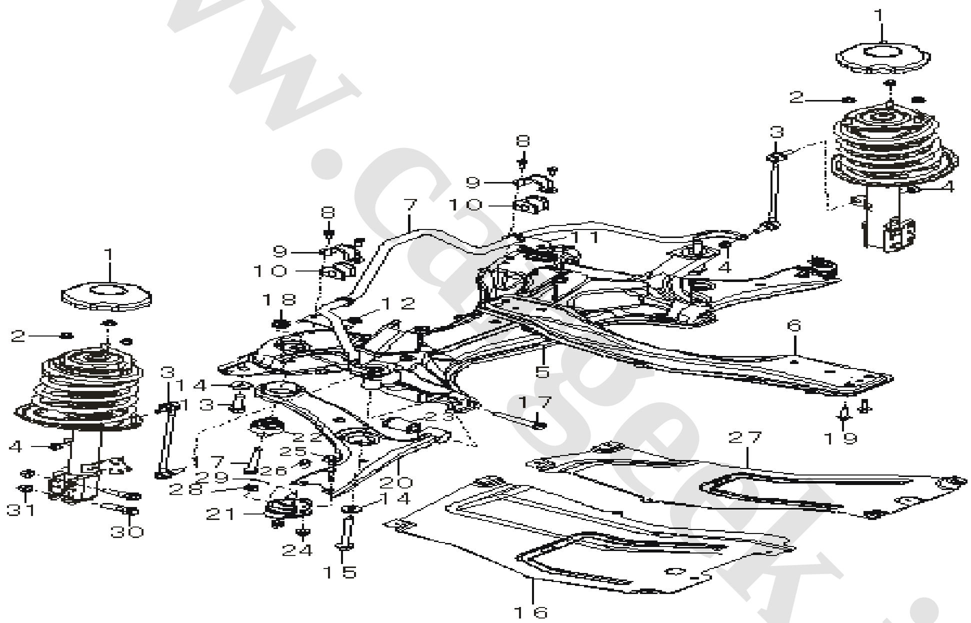


Figure 315

Front axle and front suspension

Appearance



1-Front pillar upper dustproof cover	17-Hexagon flange bolt
2-Metal hexagon flange face lock nut	18-Hexagon flange bolt
3-Front lateral stabilizer bar right connecting	19-Hexagon flange bolt

rod assembly	
4-Metal hexagon flange face lock nut	20-Left and right front swing arm component
5-front bracket component	21-Ball pin component
6-Front bracket corbel	22-Left front swing arm bushing component
7-Front lateral stabilizer bar component	23-Left front swing arm bushing component II
8-Hexagon-headed bolt and taper spring washer component	24-nut
9-Front lateral stabilizer bar fixed block	25-Hexagon flange bolt
10.Front lateral stabilizer bar clamp insulator	26.Ball pin mounting bolt
11.Left fixed block washer	27.Engine left lower steel plate guard panel
12.Right fixed block washer	28. Hexagon flange bolt
13. Hexagon flange bolt	29. Split pin
14. Flat washer	30. Hexagon flange bolt
15. Hexagon flange bolt	31. Hexagon flange nut
16.Engine right lower steel plate guard panel	

Removal and installation of the control arm assembly

Removal procedure:

Remove the connecting bolt of the control arm and the sub-frame. (See Fig. 317)

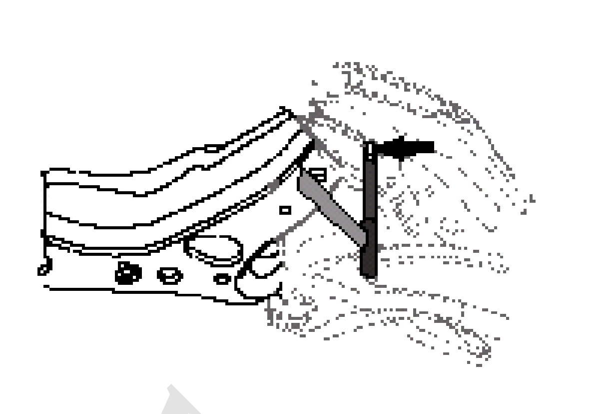


Figure 316

Remove the connecting bolt of the control arm ball pin and the steering knuckle with brake disc assembly.

Remove the connecting bolt of the control arm rear rubber sleeve and the sub-frame.

Remove the control arm from the vehicle.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt should be replaced once it's loosened.

Fasten each bolt to the specified torque after installation.

Removal and installation of the control arm ball pin

Removal procedure:

Remove the control arm assembly. (Refer to the removal and installation of the control arm assembly.)

Remove the connecting bolt of the control arm and the control arm ball pin. (See Fig. 318)

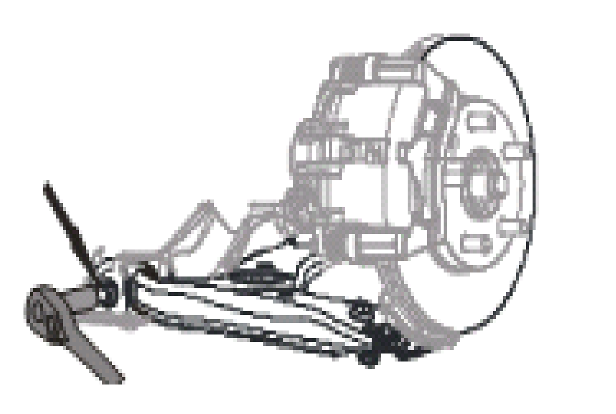


Figure 317

Take down the control arm ball pin.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt should be replaced once it's loosened.

Fasten each bolt to the specified torque after installation.

Removal and installation of the front connecting rod

Removal procedure:

Remove the connecting bolt of the front connecting rod and the shock absorber. (See 321)

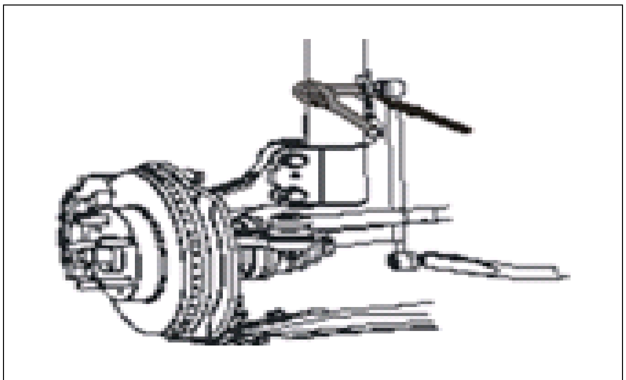


Figure 321

Remove the connecting bolt of the front connecting rod and the front stabilizer bar. (See Fig. 319)

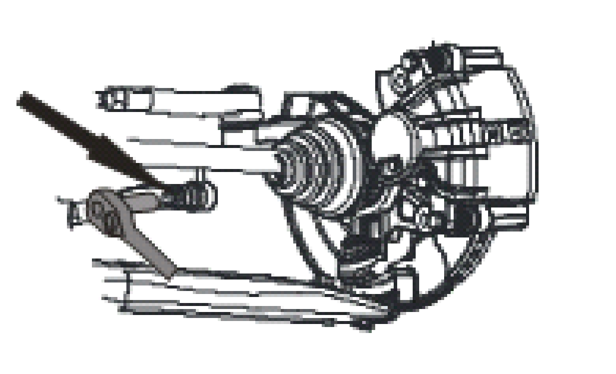


Fig. 318

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the front stabilizer bar bushing

Removal procedure:

Remove the retaining bolt of the left and right connecting rod bushing. (See Fig. 320)

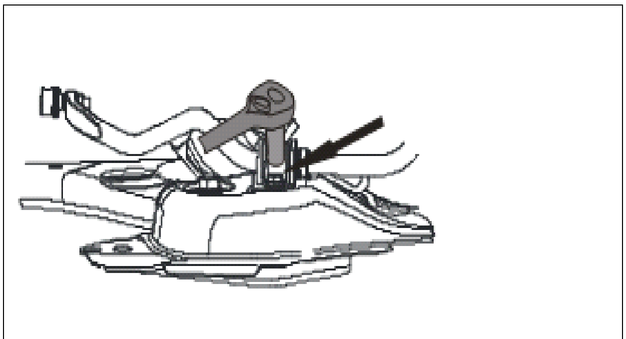


Fig. 319

Fasten each bolt to the specified torque after installation.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the sub-frame assembly

Removal procedure:

Remove the left and right control arm. (See the removal and installation of the control arm.)

Remove the connecting bolt of the connecting bar and the stabilizer bar. (See the removal and installation of the connecting rod.)

Remove 2 connecting bolts of the steering gear box and the sub-frame.

Remove the connecting bolt and nut of the sub-frame assembly and the girder welding assembly.

Remove 4 connecting bolts of the sub-frame and the vehicle body.

Remove the connecting bolt of the sub-frame and the vehicle body.

Take down the sub-frame assembly.

Note: Hang the engine in the front engine room to avoid dropping before removing the sub-frame.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the front stabilizer bar

Removal procedure:

Remove the sub-frame assembly (Refer to the removal and installation of the sub-frame.)

Remove the front stabilizer bar bushing (Refer to the removal and installation of the front stabilizer bar bushing.)

Remove the stabilizer bar.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the girder welding assembly:

Removal procedure:

Remove the connecting bolt of the engine front suspension and the front suspension bracket.

Remove 2 connecting bolts of the girder welding assembly and the vehicle body.

Remove the connecting bolt of the engine rear suspension and the rear suspension bracket.

Remove the connecting bolt of the girder welding assembly and the sub-frame.

Remove the girder welding assembly.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of rear shock absorber

Exploded view of rear shock absorber:

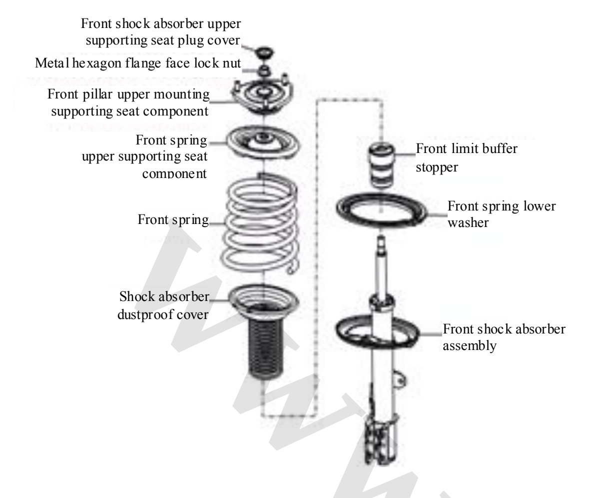


Fig. 320

Removal and installation of rear shock absorber

Removal procedure:

Remove the shock absorber protection cover on the C pillar lower guard panel.

Remove the retaining bolt of the rear shock absorber and the vehicle body.

Remove the retaining bolt of the rear shock absorber and the rear trailing arm.

Take down the rear shock absorber.

Remove the shock absorber spiral spring:

Take down the rear shock absorber;

Remove the rear connecting rod. (Refer to the removal and installation of the rear connecting rod.);

Press the rear trailing arm with a hand to take out the spiral spring.

Installation procedure:

Installation should obey the reverse order of the removal.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Please check the four-wheel alignment after installation.

In the assembly, install the spiral spring firstly, and the shock absorber. (Lift up the trailing arm in the installation of the shock absorber and the rear trailing arm.)

Check of the shock absorber

Check of the shock absorber

Check the shock absorber for oil leakage, if so, replace it. Check the damping force of the shock absorber, if disqualified, replace it.

Check the thrust bearing for excessive abrasion, abnormal noise and blockage. Check the spring lower seat for crack or deformation. Check the limitation stop for damage. Check the suspension spring limitation pad for abrasion, crack or deformation. Replace all defective parts.

Note: Discard the shock absorber as per the following procedures.

Disposal

Stretch the shock absorber rod as long as possible.

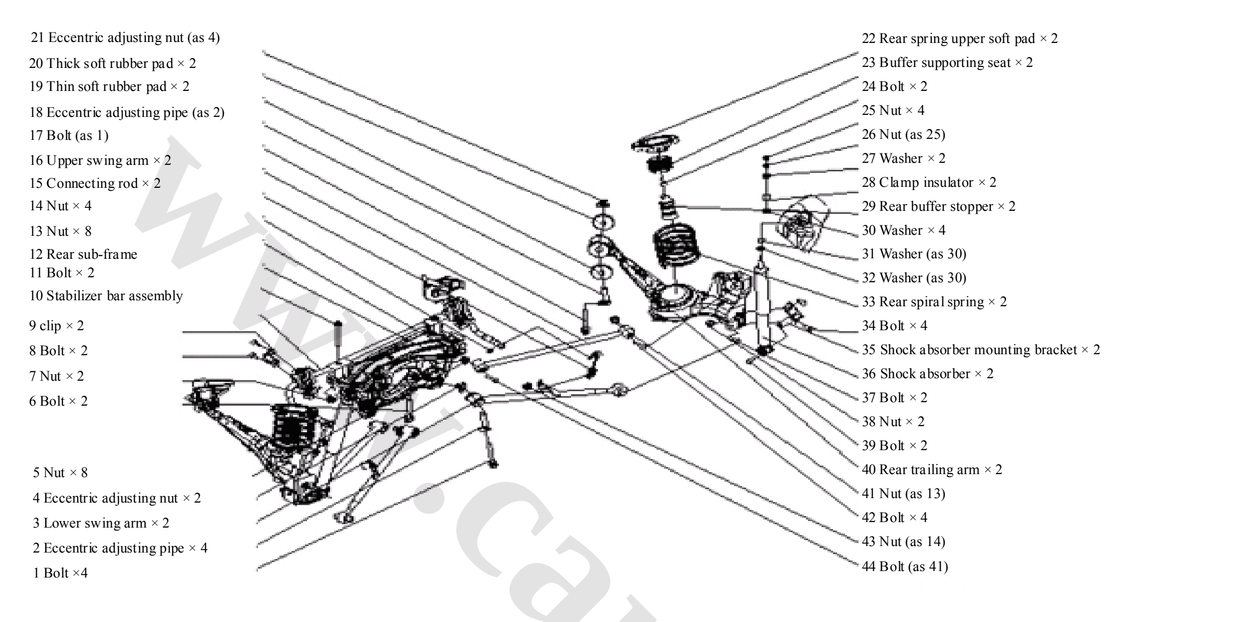
Use a drill to drill a hole on the cylinder as shown in the figure to evacuate the air in the shock absorber cylinder. (See Fig. 316)

Note: The exhausted air is no harmful but with scrap iron in the drilling.

Removal and installation of the rear axle and rear suspension

Appearance

Breakdown drawing



Use bolt 44 and nut 14 to connect the upper swing arm assembly 16 with the upper part of the rear sub-frame assembly 12. It's the same for right and left. Don't screw it down.

Use bolt 1, eccentric adjusting pipe 2 and eccentric adjusting nut 4 to connect the lower swing arm assembly with the rear sub-frame assembly 12 lower part. Don't screw it down. It's the same for right and left. Use bolt 8 and clip 9 to connect the stabilizer bar assembly 10 with the vehicle body. It's the same for right and left.

Use bolt 23 to connect the shock absorber mounting bracket 24 and the rear trailing arm assembly 40. It's the same for right and left.

Use bolt 42 and nut 41 to connect the upper swing arm assembly 16 with the rear trailing arm assembly 40. It's the same for right and left. Don't screw it down. Don't screw it down.

Use bolt 37 and nut 38 to connect the lower swing arm assembly 3 with the rear trailing arm assembly 40. It's the same for right and left. Don't screw it down;

Use washer 32 (keep opening upward), buffer sleeve 31, washer 30 (keep opening upward and place it above the vehicle body), buffer sleeve 28 (upper and lower end with gear), washer 27 (keep opening downward), nut 26 and nut 25 to connect with the vehicle body. It's the same for right and left. Don't screw it down.

Use bolt 24 to fix the rear spring upper soft pad 22 and the buffer stopper supporting seat 23 on the vehicle body rear spring mounting seat. It's the same for right and left. Screw the rear buffer stopper 29 into the buffer stopper supporting seat 23.

Use bolt 11 (front, anti-rotation, insert it in the vehicle body), nut 7 (front, 120±1 ONm) and bolt 6 to connect the rear sub-frame and the vehicle body to the specified torque.

Use bolt 14 and nut 43 to connect the connecting rod upper and lower end, stabilizer bar 1O and lower swing arm. It's the same for right and left. Don't screw it down;

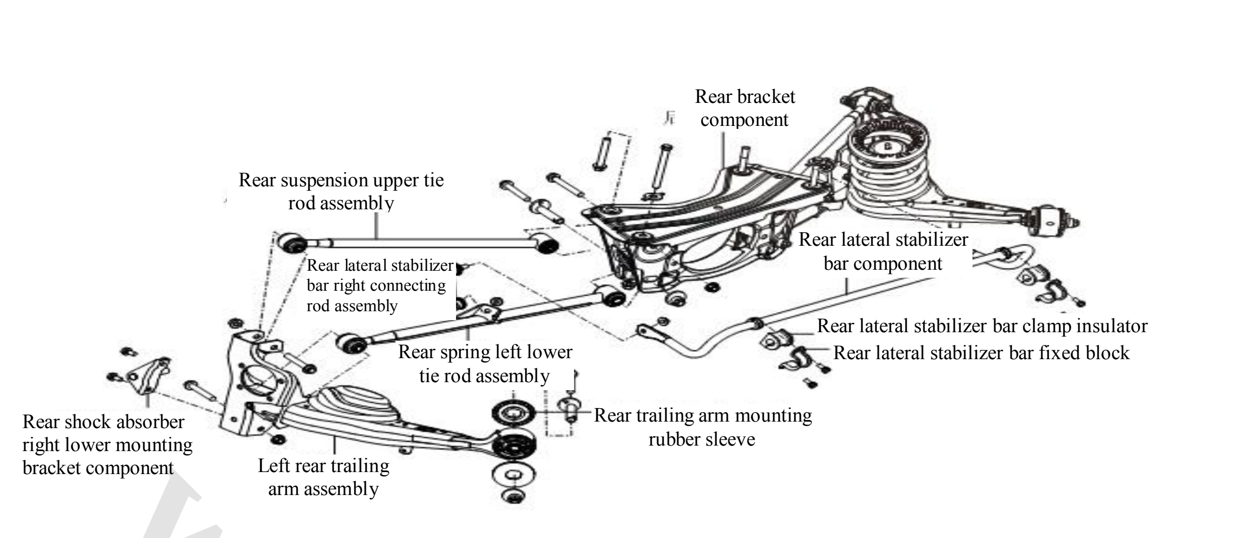
Use bolt 39 to connect the rear shock absorber 36 with the shock absorber mounting bracket 35. It's the same for right and left. Don't screw it down. Don't screw it down;

Place the rear spiral spring 33 on the mounting seat of the rear trailing arm 40. Use bolt 17, eccentric adjusting pipe 18, thin and thick soft rubber pad 1 9/20 and adjusting nut 21 to connect the rear trailing arm assembly with the vehicle body. Screw down the torque. Tightening torque;

Screw down the above unscrewed bolts and nuts orderly to the specified torque.

Structure of the rear axle

Disassembly view:



Removal and installation of the rear connecting rod assembly

Removal procedure:

Remove the connecting bolt of the rear connecting rod and the rear suspension lower swing arm.

Remove the connecting bolt of the rear connecting rod and the rear stabilizer bar.

Take down the rear connecting rod.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it’s loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the rear suspension lower swing arm assembly

Removal procedure:

Remove the connecting bolt of the rear suspension lower swing arm and the rear trailing arm.

Remove the connecting bolt of the rear suspension lower swing arm and the connecting rod.

Remove the connecting rod of the rear suspension lower swing arm and the rear sub-frame welding assembly.

Take down the rear suspension lower swing arm.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the rear suspension upper swing arm assembly

Removal procedure:

Remove the connecting bolt of the rear suspension upper swing arm and the rear trailing arm.

Remove the connecting bolt of the rear suspension upper swing arm and the rear sub-frame welding assembly.

Take down the rear suspension upper swing arm.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the rear trailing arm assembly

Removal procedure:

Remove the connecting bolt of the rear trailing arm and the shock absorber rubber chain bracket.

Remove the connecting bolt of the rear trailing arm and the upper swing arm.

Remove the connecting bolt of the rear trailing arm and the lower swing arm.

Remove the connecting bolt of the rear trailing arm and the hand brake cable bracket.

Remove the connecting bolt of the rear trailing arm and the brake pipe bracket.

Remove the connecting bolt of the rear trailing arm and the vehicle body.

Take down the rear trailing arm.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it’s loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the rear sub-frame

Removal procedure:

Remove the connecting pipe

Remove the rear suspension lower swing arm. (Refer to the removal and installation of the rear suspension lower swing arm.)

Remove the rear suspension upper swing arm. (Refer to the removal and installation of the rear suspension upper swing arm.)

Remove 4 bolts of the rear sub-frame and the vehicle body.

Take down the sub-frame.

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

Removal and installation of the rear stabilizer bar

Removal procedure:

Remove the connecting pipe

Remove the fuel tank assembly. (Refer to the removal and installation of the fuel tank)

Remove the bolt of the rear stabilizer bar and the rear connecting rod. (Refer to the removal and installation of the rear connecting rod)

Remove the bolt of the rear brake pipe and the bracket and take down the rear brake pipe. (One for right and one for left)

Remove the bolt of the rear stabilizer bar and the vehicle body. (One for right and one for left)

Installation procedure:

Installation should comply with the removal procedure.

Precautions:

The retaining bolt under the torque and the angle controlled by yield strength must be replaced after it's loosed each time.

Fasten each bolt to the specified torque after installation

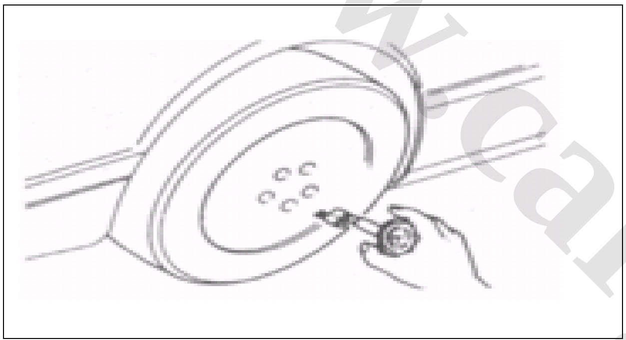
Four-wheel alignment

Adjustment before check

Check before wheel alignment

Check the tire pressure and adjust it to specified value: standard inflation pressure of the tire of 250 kpa.

Item	215 / 65R16 102H	Spare tire
Front wheel	250 Kpa	250 Kpa
Rear wheel	250 Kpa	



Check the height of the vehicle body

Measure the height of the vehicle. Firstly add tire pressure to standard value. (Note: keep the same tire pressure at both sides.)

Front measurement point (see Fig. 322)

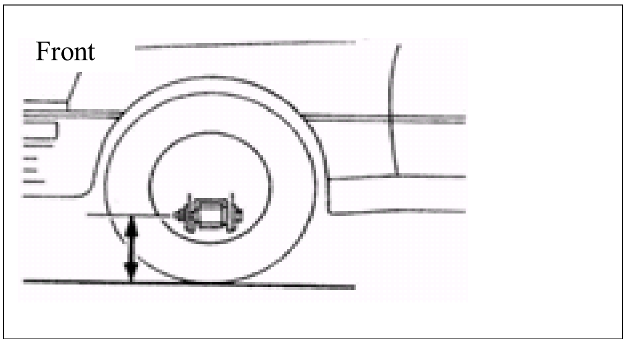


Fig. 321

Measure the center height from the ground to the connecting bolt of the lower control arm and front steering knuckle. Keep the same height at both sides.

Rear measurement point (see Fig. 323).

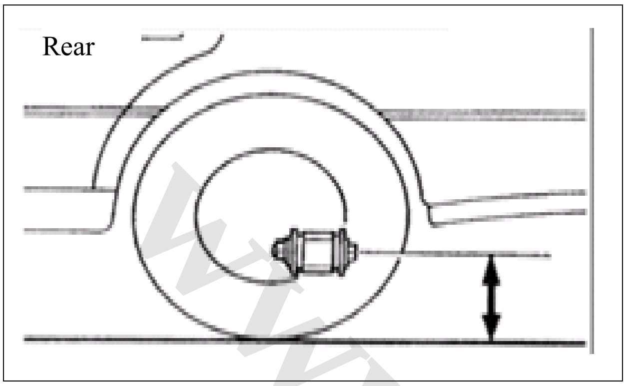


Fig. 322

Check the center height from the ground to the connecting bolt of the rear axle and the shock absorber. Keep the same height at both sides.

Note: Adjust the vehicle to the specified height before measuring the wheel alignment. If the vehicle height fails to meet the requirement:

Check the front and rear suspension for damage or deformation.

Check the wheel bearing clearance, if necessary, replace the front wheel bearing.

Check the wheel hub and the tire condition.

Check the looseness degree of the steering linkage and the ball joint.

Place the vehicle on the flat ground without luggage or personnel.

Shake the wheel to check the looseness degree of the front suspension.

Check the shock absorber for normal operation.

Check it for oil leakage.

Check the assembly bushing for abrasion.

Check the damping force of the shock absorber, if disqualified, replace it.

Note: The oil tank is half full and the water tank cooling water and the engine oil are within the specified height. The tire jack and the basic hand tool are at the specified position.

Rim and tire

Visual inspection

Check the tire and the rim.

If the rim or the tire is cracked, damaged, deformed or with other problems, replace them. See Fig. 324.

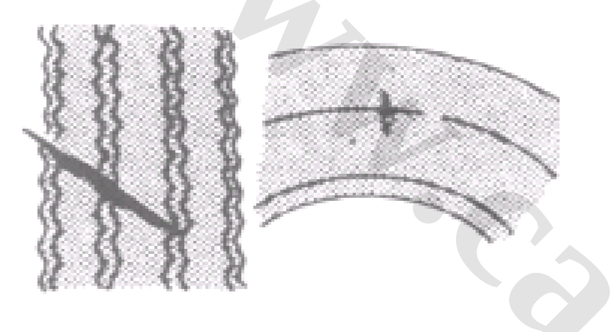


Fig. 323

Tire abrasion

(1) Check the depth of the rest tread. See Fig. 325 for standard tread.

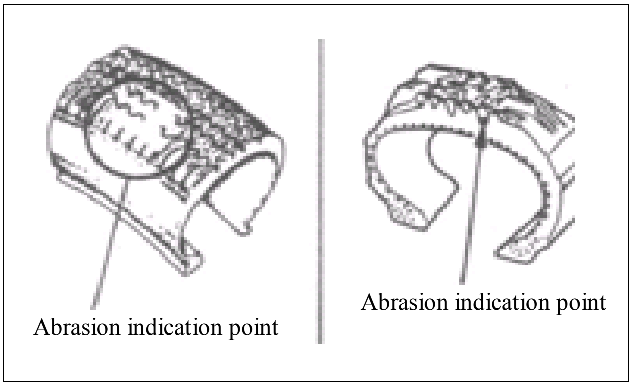


Fig. 324

At least： 1.6mm Tire for snow place: 50% tread

(2) If the abrasion indication area emerges, replace the tire. (See Fig. 326)

Abnormal abrasion of tire

In case of abnormal abrasion of tire as shown in the right figure, refer to the following possible reasons and measures.

Symptoms	Possible reasons	Measures
(a)	Insufficient tire pressure (dual abrasion)	Measure and adjust the tire pressure
	High speed turn	Reduce the speed
	Improper tire position	Adjust the tire position
(b)	Too high tire pressure (central abrasion)	Measure and adjust the tire pressure
	Improper tire position	Adjust the tire position
(c)	Incorrect toe-in	Adjust the toe-in
(d)	Incorrect camber angle and caster angle	Adjust, repair or replace the vehicle shaft and suspension system part.
	Suspension system fault	Repair or replace
	Tire unbalance	Do dynamic balance of the tire or replace it.
	Brake drum or disc out-of-roundness	Correct or replace
	Other mechanical problems	Correct or replace
	Improper tire position	Adjust the tire position

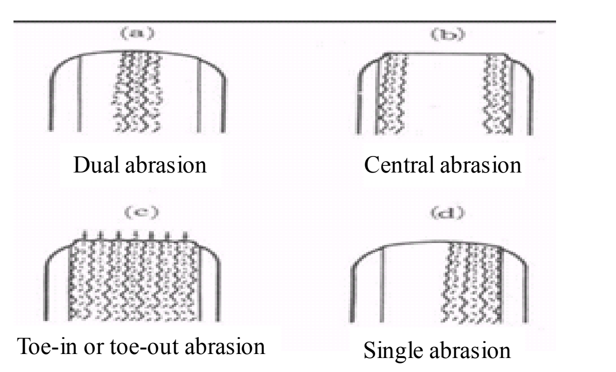


Fig.325 Tire abrasion

Notes for rim and tire

Never use disqualified rim and tire.

Clean the aluminum alloy steering rim with soft cloth rather than steel brush. In case of using steam to wash the vehicle, the rim shouldn't contact with the boiled water.

If corrosive compound (such as muddy water and road mud) are attached to the aluminum alloy steel rim, clean it with neutral cleaner as quick as possible to avoid damaging the rim.

Replace the tire

Check the valve hole on the wheel for smoothness without burr before assembling the valve cork. And then apply glycerol to the valve cork rubber body surface or dip the valve cork in the glycerol. Install the locating ring on the valve cork through the wheel hole with a special tool with 24N force. (The glycerol can be replaced by soap suds.)

Apply glycerol or soap stud to the edge of the rim before assembling the tire. If there is a dub mark on the rim, align the mark of the tire evenness test with the dub mark of the rim. If there isn't a dub mark, align the mark of the tire dynamic balance test with the valve cork position. If there isn't a dub mark or dynamic balance test mark, but a static balance test mark, align the valve cork with the static balance test mark.

Tire pressure.

Check the pressure of all tires (including spare tires) with an air gauge, if necessary, adjust them. Strictly comply with the specified pressure to inflate the tire. The pressure shouldn't exceed 10% of the rated value. In the disassembly of the spare tire assembly, the rated pressure is 2.5bar. Before the four-wheel alignment, check the pressure of the four wheels and adjust them. Front wheel: 2.5bar and rear wheel: 2.5 bar.

See Fig. 327.

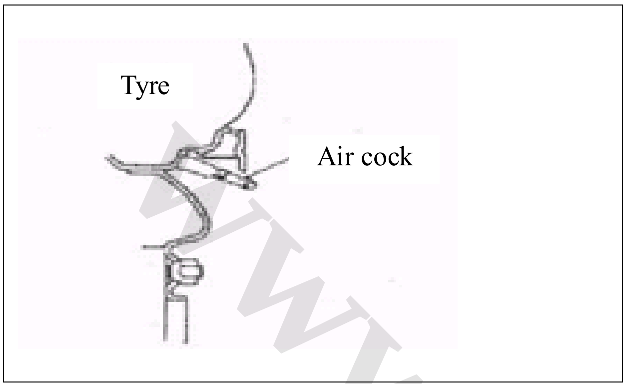


Fig. 326

Air leakage

Check the valve for air leakage. See **Fig. 329**

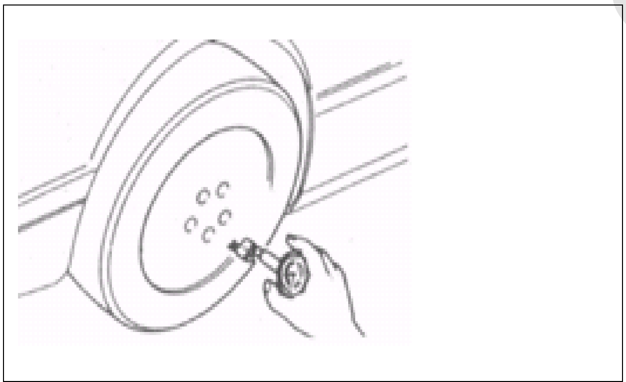


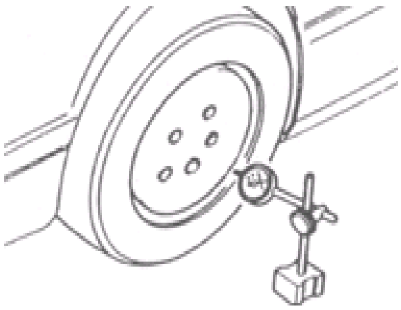
Figure 327

Check of tyre unevenness

Jack and support the vehicle.

Fix a multimeter with a cylindrical contact on the rim edge to measure the unevenness depth.

See Fig.330



End face run-out check

Figure 328

If necessary, replace the rim.

Note: Allowable deformation of rim:

Within the maximum allowable mean of the unevenness depth on both edges of the rim:

Steel rim: 5mm

Aluminum alloy rim: 3 mm

Tyre positioning (see Fig. 331)

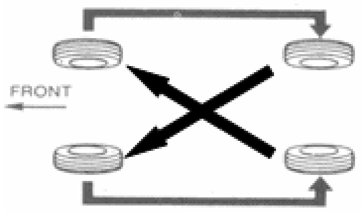


Figure 329

Position the tyres every 5000km in order to extend tyre life and check tyre wear (see Fig. 331), but the most suitable time to replace tyres shall depend on the driver's driving habits and the road conditions.

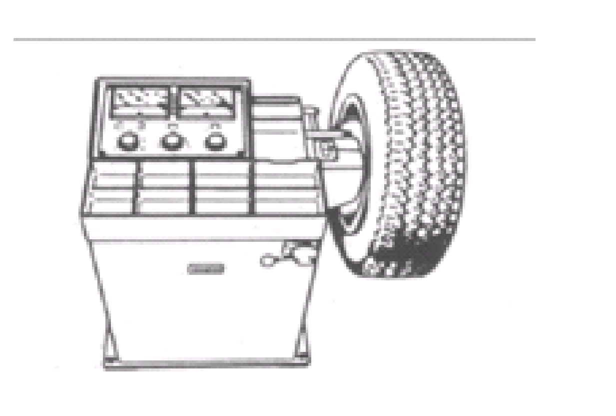


Figure 330

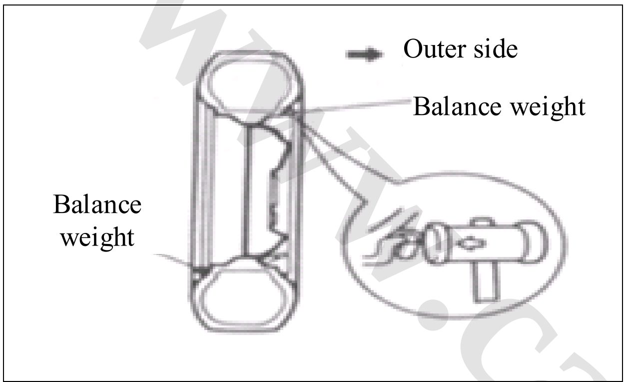


Figure 331

Note:

* Use best tyre for front wheels.

* Adjust the tyre pressure to specified value after changing the tyre position.

Wheel balance adjustment

After the tyre inflation, screw on the valve mouth protection cover to test the motion balance. Paste proper weight balancing weight on the rim as required. The dynamic imbalance quality at both sides should be lower than 10g and the quality at single side should be lower than 75g. In the assembly, try to avoid heavy attack on the balancing weight, otherwise, replace the balancing weight. The removed balancing weight couldn't be used again.

Removal and installation of the wheel

Removal procedure:

Remove the wheel ornamental cap. (See Fig. 334)

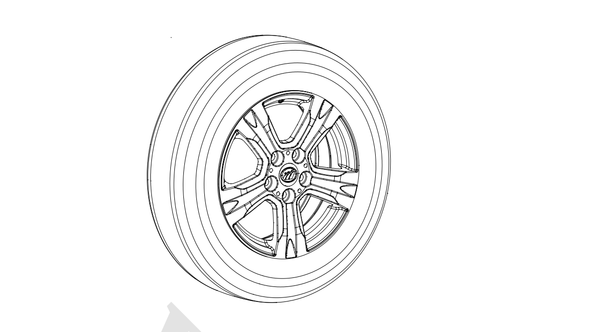


Figure 332

Remove the wheel retaining bolt. (See Fig. 335)

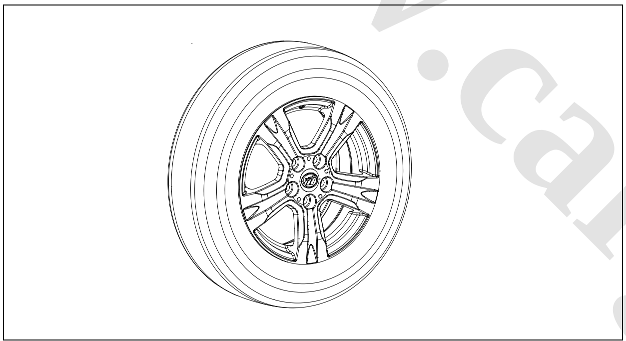


Figure 333

Take down the wheel

Installation procedure:

In the installation of wheel and tyre assembly, screw down the wheel bolt into the hub with hand to pre-tighten it, and then diagonally screw it down with a special tool. The tightening torque is 120±20N.m. Never use a impact wrench to avoid damaging the wheel or screw it down too loosely or tightly. it is prohibited to apply lubricating grease to wheel bolt. (After the installation of the wheel and the tyre assembly, fasten the wheel bolt to ensure the tightening torque after initial driving for 800km.)

One of the daily maintenance contents is to check the wheel bolt tightening torque.

Crossly screw down the bolt with similar tightening degree. Freely turn the wheel. Place the wheel on the road surface to tighten it.

Install the ornamental cap or place it as per the requirement. Tap the clip-type ornamental cap with hand or knock it with a rubber tool.

Rear wheel alignment

Install the wheel aligner and alignment tester into the wheel. (See Fig. 336)

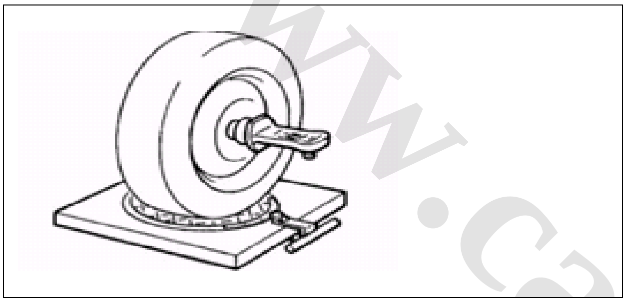


Figure 334

Installation should obey the specific instructions of the manufacturer.

Check and adjust the vehicle as per the equipment requirement. The wheel alignment requirements are as follows:

Rear wheel toe-in	0°6′±30′
Rear wheel outer caster angle	-0°57′±30′

Rear wheel toe-in adjustment:

If the rear wheel toe-in fails to meet the requirement, adjust it with eccentric adjusting pipe 4 and eccentric adjusting nut 6. Loosen bolt 3 and prevent eccentric adjusting pipe 4 and eccentric adjusting nut 6 releasing from the groove. Turn eccentric adjusting pipe 4 and eccentric adjusting nut 6 to change rear wheel toe-in till meeting the requirement. Screw down bolt 3 to the specified torque. (Right and left are the same.) (See Fig. 338)

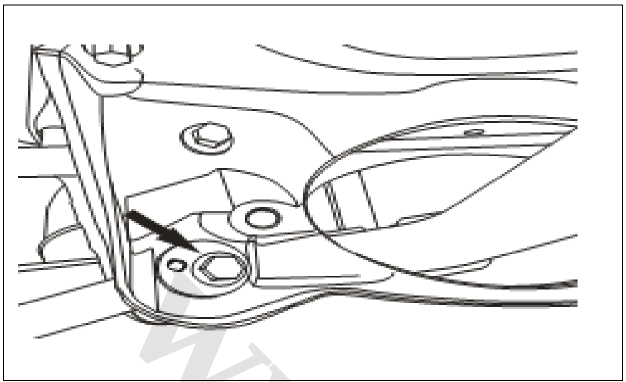


Figure 335

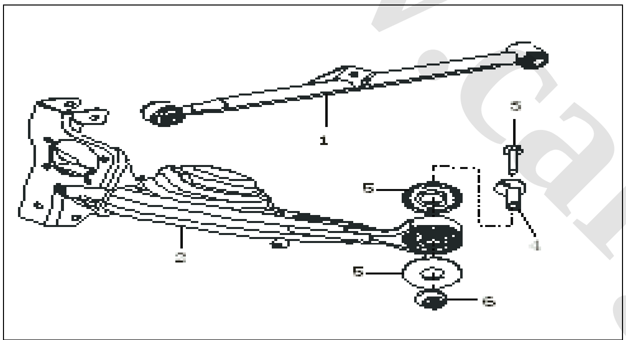


Figure 336

1-Rear spring left lower tie rod assembly	4-Rear wheel toe-in adjusting eccentric wheel
2-Left rear trailing arm assembly	5-Rear trailing arm mounting rubber sleeve
3-Hexagon flange bolt	6-Rear wheel toe-in adjusting nut

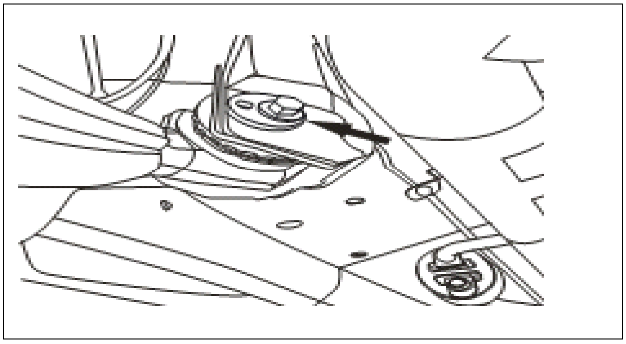


Figure 337

Adjustment of the rear wheel extraversion:

It's the same as the rear wheel toe-in adjustment

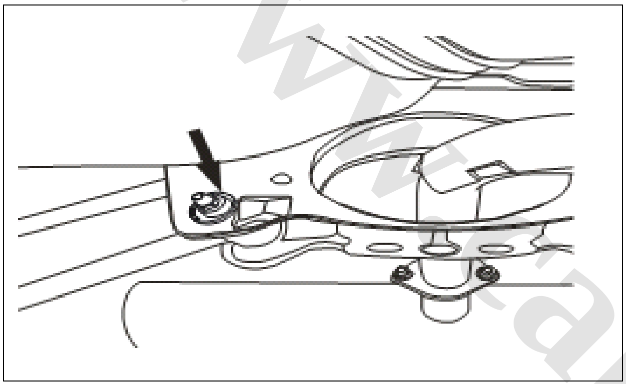


Figure 338

Front wheel alignment

Install the wheel aligner or alignment tester into the wheel.

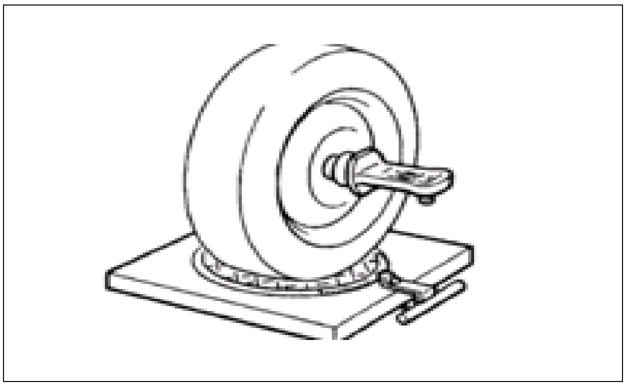


Figure 339

Installation should obey the specific instructions of the manufacturer

Measure and adjust the front wheel Master pin caster angle, the front wheel caster angle, and the front wheel toe-in angle and steering angle.

Specification: Requirements for the front wheel alignment are as follows:

Table 340

Master pin caster angle	2°44′±30′
Front wheel Camber angle	-1°12±30′
Front wheel toe-in	0°43′±30′
Master pin inner caster angle	11°2′±30′

Master pin caster angle

Master pin rear angle is designed to ensure the structure and doesn't require adjusting.

Influence of the caster angle

The caster angle is mainly to keep the vehicle drive right forward. If the caster angle is right, the vehicle inside may drop and the chassis may rise when the front wheels are rotating, which may increase load to the steering knuckle. If the caster angles of two wheels are the same, the vehicle may return to the right front after steering. Increasing the right caster angle may increase the stability of the steering wheel. But the force may rise in the steering. Decreasing the right caster angle may decrease the stability of the steering wheel, but the steering force may drop. The caster angle may not influence the tyre abrasion, but stabilize the driving direction of the vehicle and automatically return after steering. If the vehicle is equipped with traditional mechanical steering, the caster angle is very small and near to minus, which facilities the steering. If the vehicle is equipped with power steering, the caster angle is usually set as larger one, which facilities the steering. The caster angle increasing may increase the steering force and improve the stability of the straight driving.

Camber angle

In normal condition, it's not necessary to adjust the caster angle after independent suspension and wheel steering knuckle assembly. If the Camber angle defects over the tolerance due to other reasons, rectify it with independent suspension and the steering knuckle connecting bolt.

Check (visually) the driving components for damage and replace the damaged components before correction.

If the front wheel camber angle exceeds the tolerance, loosen the connecting bolt ① of the front shock absorber and the steering knuckle and move the wheel to rectify it.

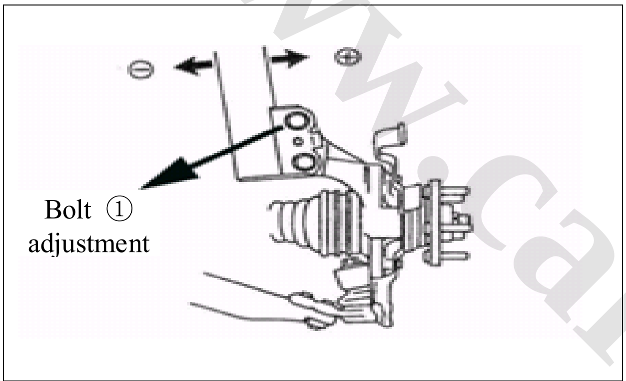


Figure 340

Front wheel toe-in

Check and adjust the toe-in with a special four-wheel alignment tester.

Make good preparation for adjusting the wheel alignment as per the requirement of the tester. Fix the steering wheel at straight forward position with a steering wheel limiter available in the market. (The steering wheel must be at the central position ±5. And the steering shaft lower clamping flange bolt must be horizontal.)

Loosen the steering tie rod lock nut.

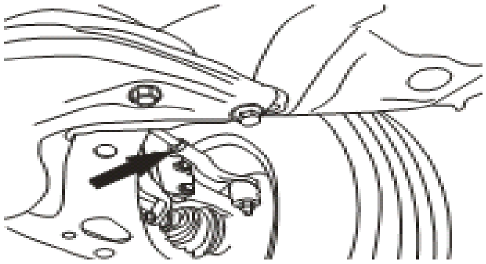


Figure 341

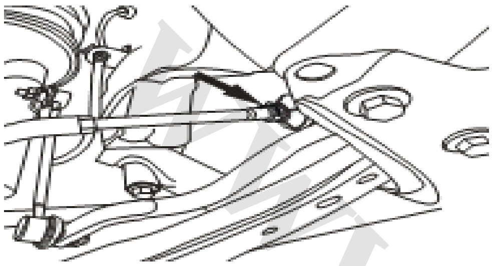


Figure 342

Remove the elastic protection sleeve snap ring with a clamp.

Note: Replace the snap spring with insufficient spring force.

Adjust the length of the toe-in adjusting rod to specified value if necessary.

Fasten the lock nut, re-install the protection sleeve elastic snap ring, and check the lock nut for tightness and the protection sleeve at correct position.

After adjusting the front wheel toe-in, check (the steering wheel for level. Otherwise loosen the steering wheel lock nut, adjust the steering wheel to level position, screw down the steering wheel lock nut to torque requirement (30±3) Nm.

Check of the front wheel steering angle

After replacing the tie rod joint and adjusting the toe-in, check the steering angle. If the front wheel steering angle fails to meet the standard, check and adjust the right and left tie rod length.

Instructions for fault elimination

Problems	Possible reasons	Measures
Excessive abrasion or uneven abrasion of tyre	As shown below.	
Early abrasion of tyre	Incorrect tyre pressure	Adjust
	Incorrect wheel alignment parameter	Adjust
Tyre noise	Incorrect tyre pressure	Adjust
	Tyre abrasion	Inspect and adjust-replace
Road noise or vehicle body vibration	Insufficient tyre pressure	Adjust
	Tyre unevenness	Adjust
Road noise or vehicle body vibration	Deformation of rim or tyre	Repair or replace
	Uneven abrasion of tyre	Inspect and adjust-replace
Steering wheel vibrates upward and downward	Excessive deflection of tyre and rim	Replace
	Looseness of wheel nut or shaft head	Lock
	Tyre unbalance	Adjust
	Engine suspension rubber breakage or abrasion	Replace

	Rubber breakage or damage of transmission bracket	Replace
Steering wheel circumference vibration	Excessive deflection of tyre and rim	Replace
	Looseness of wheel nut or shaft head	Lock
	Tyre unbalance	Adjust
	Uneven abrasion of tyre	Check
	Insufficient tyre pressure	Adjust
	Damage or abrasion of front wheel bearing	Replace
	Steering system fault	Check
	Suspension system fault	Check
Steering wheel deflects toward one side	Incorrect tyre pressure	Adjust
	Excessive abrasion or uneven abrasion of tyre	Check
	Steering system fault.	Check
	Brake system fault	Check
	Suspension system fault	Check

Unstable driving.	Uneven tyre pressure at both sides	Adjust
	Deformation of rim or tyre	Repair or replace
Unstable driving.	Looseness of wheel nut	Lock
	Steering system fault	Check
	Suspension system fault	Check

Brake deflects toward one side	Uneven tyre pressure at both sides	Adjust
	Brake system fault	Check
Heavy steering wheel	Insufficient tyre pressure	Adjust
	Steering system fault	Check
	Suspension system fault	Adjust
	Incorrect wheel alignment parameter	Adjust
Poor returnability of the steering wheel	Insufficient tyre pressure	Adjust
	Steering system fault	Check
	Suspension system fault	Check
	Incorrect front wheel Master pin rear caster	Adjust

Section 4 Steering System

Introduction

The power steering system for LIFAN X60 is hydraulic power steering system, consisting of steering pump, steering mechanism, steering pipeline, steering reservoir, etc.

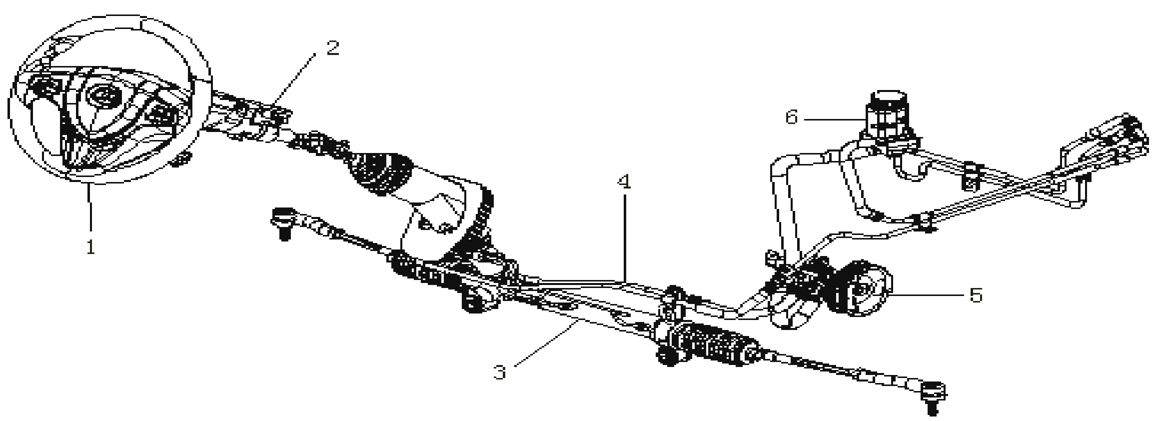
The steering mechanism is gear rack power steering gear, with shift valve structure and two-end output. There is a dustproof cover on the connection of the rod and the rack. The piston rod and the rack are integrated. Properly adjust the rod length to match with the toe-in. Connect the steering mechanism rod outer ball joint and the steering knuckle with a self-locking nut, without nut anti-loose pin.

The rotating pump is constant flow lamella pump, with maximum working pressure of 8Mpa. The flow declines between 1,250 rpm and 3,000 rpm. No apparent flow increases when exceeded 3,000 rpm. To ensure smooth road condition in high speed It improves the safety at high speed driving. Not try to turn the steering wheel to the end for over 10s in the operation.

The steering oil pipe is to transport the steering fluid. As per the distances among assembly components and different characteristics, the steering oil pipe for LIFAN X60 is made from steel pipe and hose. Connect the steel pipe and the hose with cutting sleeve for high pressure oil pipe assembly to ensure reliable tightness. Connect the oil pipe and the steering mechanism with bolt and O-ring to ensure reliable tightness.

Main functions of the steering reservoir: store the oil, supply oil to the oil pump and the system, radiate the heat, lower the oil temperature, filtrate the impurities, and clean the oil. Oil type: ATF220。

Layout



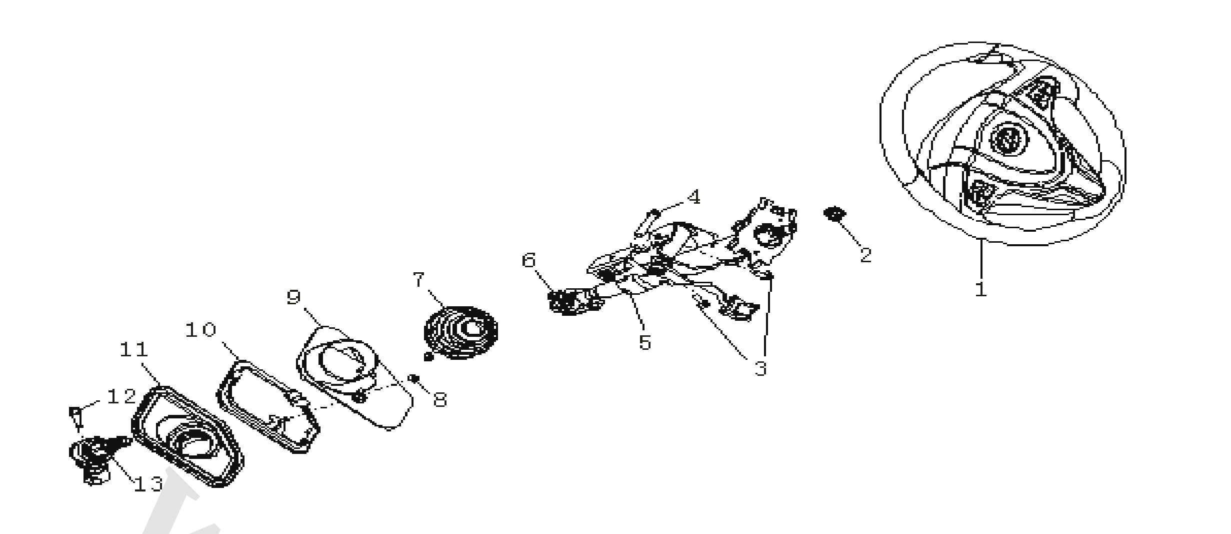
1-Steering wheel	4-Steering pipe
2-Steering column	5-Steering oil pump
3-Steering gear	6steering oil reservoir

Tightening specification for fasteners

Application	Tightening torque
Steering wheel retaining nut	45～55 N•m
Steering column upper bracket retaining bolt	20～26 N•m
Steering column lower bracket retaining bolt	20～26 N•m
Steering column mandrel and universal joint retaining bolt	20～26 N•m
Middle steering universal joint spline retaining bolt	20～26 N•m
Middle and lower universal joint retaining	20～26 N•m

bolt	
Steering mechanism input shaft retaining bolt	20～26 N•m
Power steering mechanism mounting bolt	80～100 N•m
Steering mechanism tie rod and rack retaining nut	70～80 N•m
Steering mechanism tie rod and steering joint retaining nut	80～100 N•m
Steering pump and bracket	20～26 N•m
Steering pump and engine cylinder body	70～80 N•m
Tension wheel lock nut	55～65 N•m
Joint of the power steering high pressure hard tube and the steering mechanism	40～50 N•m
Power steering high-pressure oil pipe and steering pump	40～50 N•m
Steering mechanism and oil pipe joint	40～50 N•m

Breakdown drawing



1-Steering wheel	8-Dustproof cover mounting nut
2-Steering wheel nut	9-Steering column dustproof cover II
3、4-installation bolts	10-dustproof cover mounting nut
5-upper steering shaft assembly	11-Steering column dustproof cover I
6-Universal joint	12-Fixing bolts.
7-Steering column dustproof coverIII	13-Lower steering shaft assembly

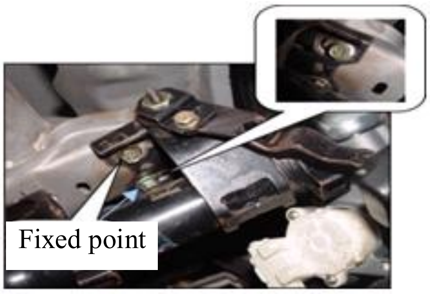
Removal and installation of the steering system

Steering column

Remove the steering wheel(refer to removal and installation of accessories).

Remove lower left panel of the dashboard (refer to removal and installation of accessories).

Loosen the upper retaining bolt of the steering column.



Loosen the upper retaining bolt of the steering column.

Loosen the lock nut connecting the middle shaft and the steering mechanism.

Remove the upper and the lower guard panels on the steering mechanism.

Take down the steering column assembly.

To install, reverse the removal procedure.

Torque:

Steering wheel nut	45-55N•m
upper retaining bolt	20-26N•m

Middle shaft and the steering mechanism input shaft: 20～26Nm

Steering mechanism

Drain the power steering fluid

Lift the vehicle and the wheel from the ground.

Remove the power steering oil return hose from the power steering reservoir tank.

Place the oil return hose in a big container that is available to contain the drained steering fluid.

Start the engine and run it idly.

Turn the steering wheel to the right end and the left end.

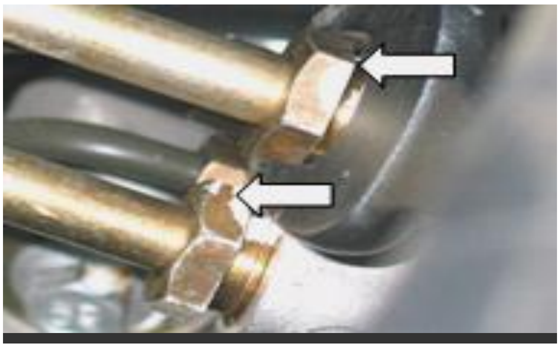
Note: Never keep still while turning the steering wheel to the end; otherwise, the hydraulic system may be damaged.

Ensure that the engine stops after the steering fluid is drained out.

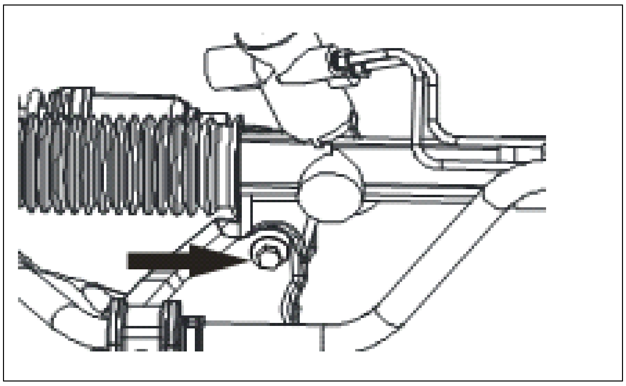
Lift the vehicle.

Loosen the upper and the lower protection sleeve of the steering mechanism.

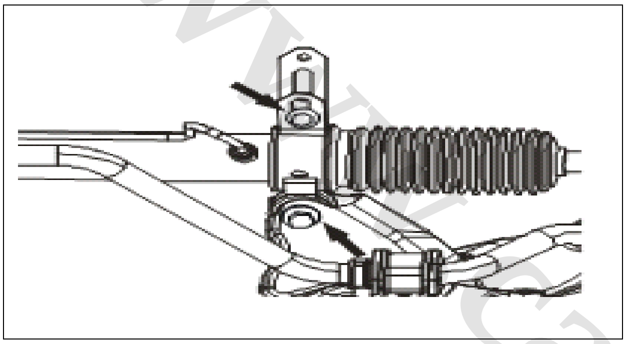
Loosen the high-voltage oil pipe.



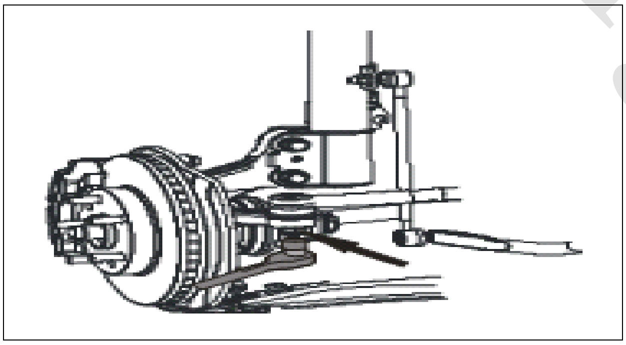
Loosen the left retaining bolt of the steering mechanism.



Loosen the left retaining bolt of the steering mechanism.



Loosen the right and the left tie rod connection steering knuckle.



Take down the steering mechanism assembly.

To install, reverse the removal procedure.

Torque:

Power steering mechanism mounting bolt: 70-80 Nm

Steering tie rod connection steering knuckle: 45 N•m

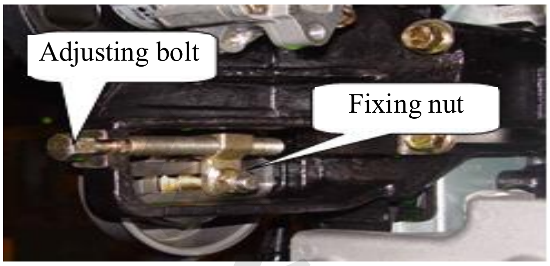
Steering oil pump

Drain the power steering fluid

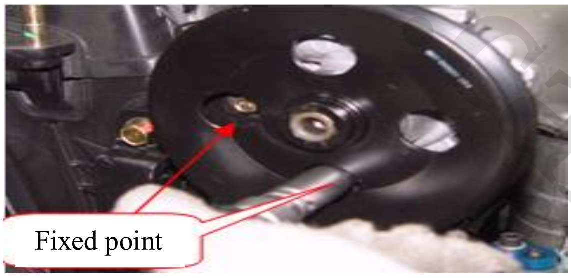
Loosen the oil pump belt.

Loosen the tension wheel retaining bolt.

Rotate the adjusting bolt anticlockwise to loosen the belt.



Loosen two retaining bolts under the belt pulley.



Loosen the retaining bolt at the other side.

Take down the oil pump.

To install, reverse the removal procedure.

Torque:

Fixed steering oil pump 20～26N•m

Tension wheel lock nut 55～65N•m

Steering oil pump and high voltage oil pipe: 40-50 Nm

Maintenance instructions

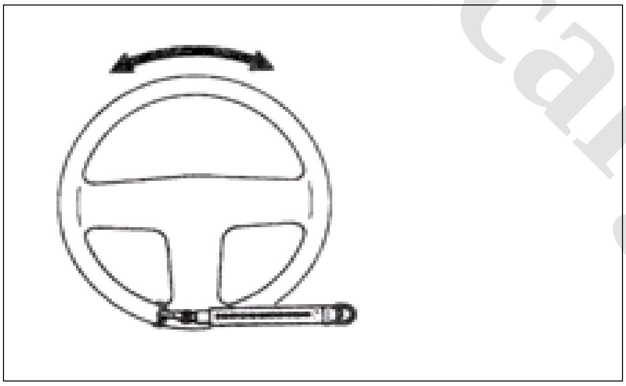
Check of the steering wheel clearance

(1) When the engine (the hydraulic system) is running, keep the front wheels straightly forward.

(2) Before slightly rotating the steering wheel leftward and right forward and the steering wheel starts rotating, measure the circumference clearance of the steering wheel.

Limit: 30mm.

(3) When the clearance exceeds the limit, check the clearance between the steering shaft joint and the steering linkage, and adjust or replace relevant spare parts accordingly. If the clearance exceeds the limit, keep the steering wheel right forward when the engine stops, apply 5N load to the steering wheel circumference and check the clearance. Standard value (the clearance when engine stops): less than 15mm. If the clearance exceeds the standard, remove the steering gear housing and check the total torque of the pinions.



Check of the steering angle

Place the front wheels on the radius testing device of the turning to measure the steering angle.

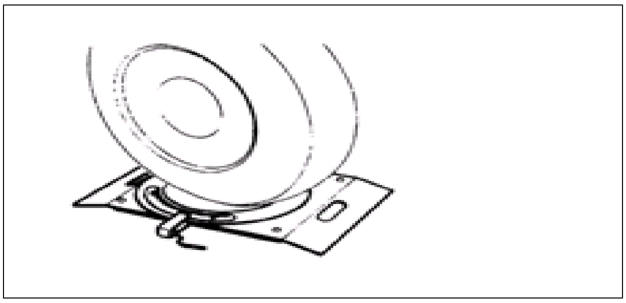
Standard Value

Left steering angle for left wheels:(+35°31′)～(+39°31′)

Left steering angle for right wheels:(+29°18′)～+33°18′)

Right steering angle for left wheels:(-29°18′)～(-33°18′)

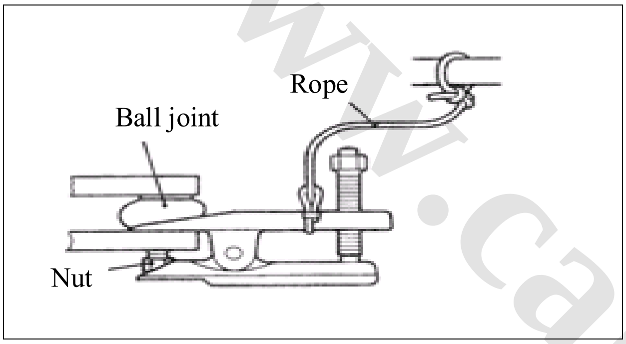
Right steering angle for right wheels: (-35°31′)～(-39°31′)



The steering angle fails to meet the standard range, which may be caused by incorrect toe-in. Adjust the toe-in and re-check the steering angle.

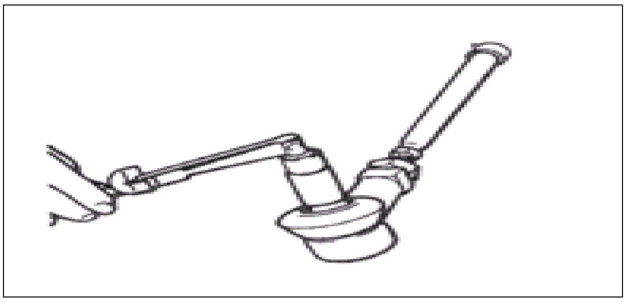
Check of the start-up torque of the steering tie rod end ball joint

(1) Disconnect the steering tie rod from the steering knuckle with a special tool.



(2) When the start-up torque exceeds the standard, replace the steering tie rod end.

(3) When the start-up torque is lower than the standard, check the ball joint for axial clearance or mesh. If there isn't abnormal, the ball joint is OK.



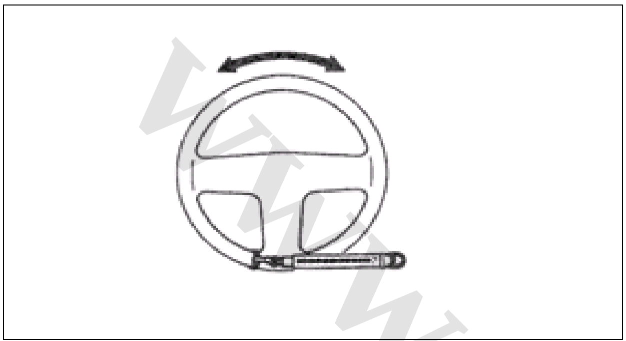
Check of the static steering force

(1) Park the vehicle on the flat road and rotate the steering wheel to up front position. Start the engine and adjust the rotation speed to 1,000±100r/min.

Note: After checking the rotation speed of the engine, make it return to the standard idle value.

(2) Connect the spring balance with the outer circumference of the steering wheel to measure the steering force required for the steering wheel facing right forward to turn leftward and rightward (within 1.5 rings). In addition, check if there is obvious fluctuation of the required steering force.

Standard value: steering force: below 34N, allowed fluctuation below 5.9N.



(3) If the measured force exceeds the standard, please refer to the fault elimination for check and adjustment.

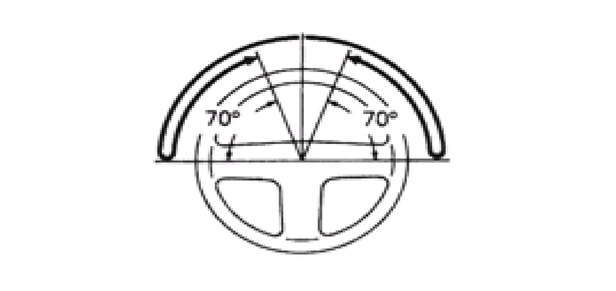
Check of the returnability of the steering wheel

Do this test in the driving test on the road and check the following items.

Take a gentle turn and a sudden turn to check the driving and ensure that there is no difference between the steering force required for turning left and turning right and the steering wheel returning to the center.

When the vehicle is running at 20-30Km/h, rotate the steering wheel 90° and release it after 1 or 2 seconds. If the steering wheel returns above 70°, it enjoys sound returnability.

Remark: There is temporary heaviness while rapidly rotating the steering wheel, which isn’t abnormal (but oil shortage of the oil pump in the idling).

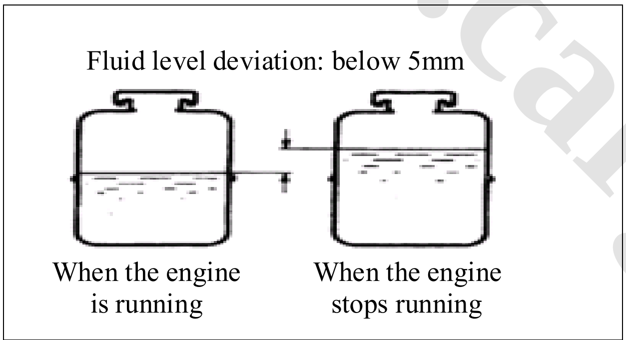


Check of the fluid level

Park the vehicle on the flat road, start the engine, and rotate the steering wheel for several times to heat the oil temperature to nearly 50°C-60 °C.

1-When the engine is running, repeatedly turn the steering wheel to the right end and the left end for several times.

2-Check the oil in the oil chamber for bubble or milkiness. Check the fluid level difference when the engine stops running and is running. If it’s above 5mm, exhaust the air.

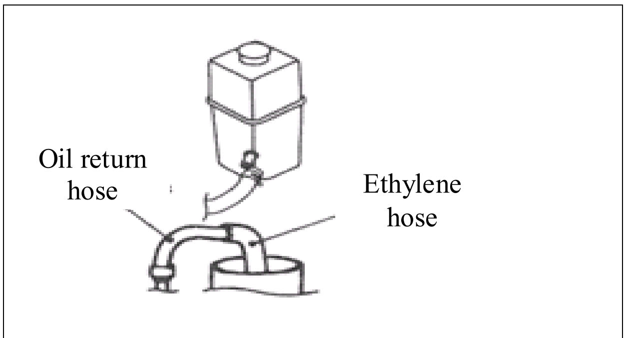


Replacement of the steering gear oil

(1) Lift the front wheels with a jack and support them with a rigid frame.

(2) Disconnect the joint of the oil return hose.

(3) Connect the ethylene hose with the oil return hose and drain the oil to a container.



(4). Disconnect the high-voltage cable, discontinuously operate the start-up motor, and rotate the steering wheel to the right end and the left end. Repeatedly do it for several times to drain all the steering gear oil.

Note: Never place the high-voltage cable near the carburetor or the oil outlet pipe.

(5). Firmly connect the oil return hose and fasten it with a toggle clamp.

(6) Fill the oil chamber with specified steering gear oil till the low fluid level position of the filter and then evacuate the air.

Specified steering gear oil：ATF220.

Section 5 Brake System

Technical parameters

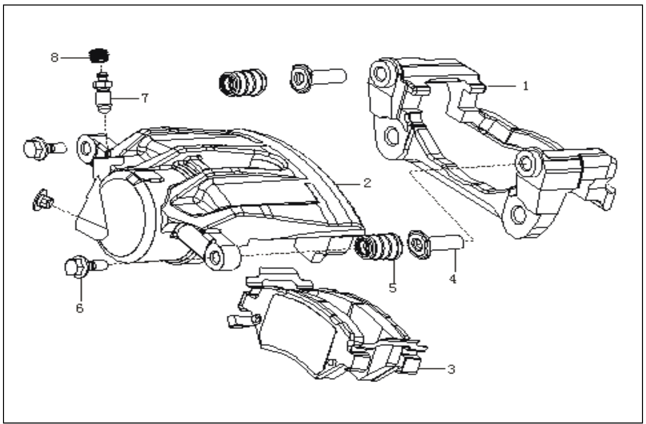
Front brake assembly

Specification of the front brake

Application	Specification
Diameter of the brake caliper piston	57mm
Diameter of the brake disc	300mm
Minimum used thickness of the brake disc	23mm
Thickness of the brake disc	25mm
Max. runout	0.1mm
Thickness of the front brake lining	11mm
Min. used thickness of front brake pads	2mm

Inspection, disassembly and assembly of the front wheel brake

Structure of the brake caliper



1-brake caliper bracket	5-Dustproof cover
2-brake caliper body	6-brake caliper connecting bolt
3-brake lining assembly	7-Vent screw
4-positioning guide bar	8-Dustproof cover

Replace the brake caliper

Removal procedures:

Note: Never move the vehicle in case of no stable brake pedal travel to avoid personal injury.

1-Discharge a little brake fluid in the master pump

2-Jack and suitable support the vehicle

3-Mark relative positions of the wheel and the wheel hub

4-Refer to the removal and install the tyre and the wheel to remove the front wheel tyre and the wheel assembly

5-Remove the brake caliper retaining bolt

6-Install a big C-clamp on the top of the brake caliper supporting the back of the outer brake liner

7-Fasten the C-clamp till the caliper piston reaching a certain depth in the caliper cylinder sleeve to make the brake caliper roll out from the brake disc

8-Refer to the replacement of the brake liner

9-Remove the dustproof cap from the oil cylinder with a screw driver

10-Remove the piston

(1) Prepare a wood board to ward off the piston, place the wood plate between the pistons and insert the liner from one side.

(2) Press out the piston with compressed air through the connecting hole. Place a guard board (hard wood, etc.) at the notch of the brake caliper to protect the piston.

Warning---Never hold the piston with fingers!

11-Inspection of guide bearing

Push the guide sleeve with a hand flexibly; replace the guide sleeve in case of any blockage or inflexibility.

Note: Apply lubricating grease to the guide sleeve in the assembly.

12-Carefully take down the sealing ring with a plastic needle.

Clean the brake cylinder and component with alcohol and dry them with compressed air. Carefully check the brake cylinder, the piston and the flange faces. Never machine the brake cylinder and the piston.

13-Installation instruction

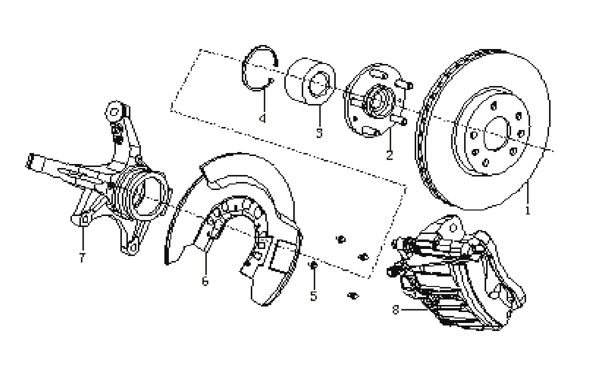
Apply a thin layer of the brake cylinder grease to the cylinder, the piston and the seal sleeve and install a seal ring in the ring groove at the back of the brake cylinder. Install the dustproof seal ring into the front ring groove and completely press it into the ring groove. Keep the dustproof seal ring and the brake caliper housing areas dry. Never touch the brake cylinder grease or the brake fluid to keep the dustproof seal ring at the proper position.

14-Fix the brake piston with an elongthening part sold in the market, slightly press it in the dustproof seal ring and blow the dustproof ring with compressed air (maximum 3bar). Cover the brake piston with a piston ring.

Installation instruction:

Soak the dustproof seal ring and the brake piston with the brake fluid to facilitate the pass of the dustproof seal ring.

Assembly drawing of the rear wheel brake

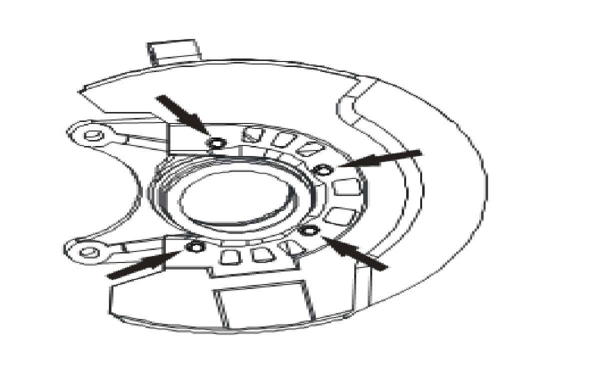


1-front brake discs	5-left front brake bottom plate mounting bolt
2-front wheel hub assembly	6-left front brake bottom plate
3-wheel hub bearing	7-left front steering knuckle
4-bearing retainer ring	

Brake caliper guide bolt	31～38 N•m
Brake caliper positioning bolt	120～128 N•m
Vent screw	9～11 N•m
Dustproof plate bolt	7.5～1 N•m
Brake disc positioning bolt	9±3 N•m

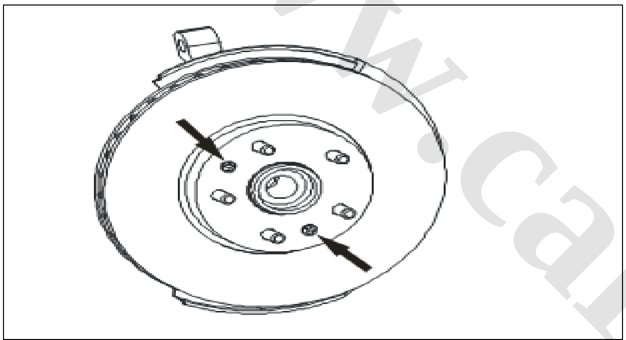
Installation of the front brake assembly

(1)Install the front brake bottom plate on the steering knuckle and screw it down with a bolt. The tightening torque is 9-11N•m.

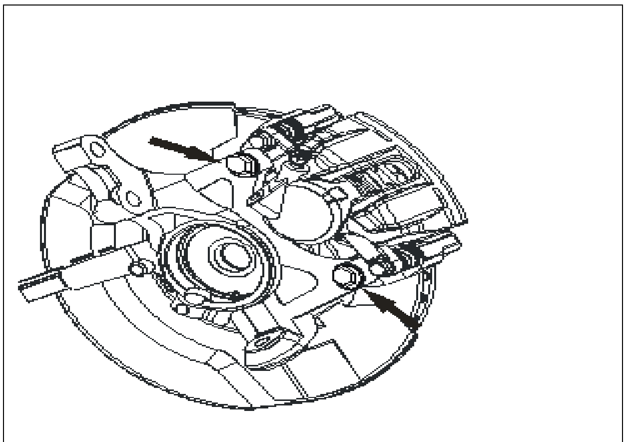


(2) Press the wheel hub bearing and the wheel hub in the steering knuckle and install the bearing retainer ring.

(3) Fasten the brake disc on the front wheel hub bearing unit with a screw. The tightening torque is 7-9N•m.



(4) Use two bolts to connect the brake caliper assembly with the steering knuckle. The tightening torque is 85±5N•m.



Note: The brake disc and the brake lining should be free of grease.

Diagnostic information of the brake liner

1-Check the brake liner once after driving 5,000km.

2-Check the brake liner once the wheel tyre is removed and replaced.

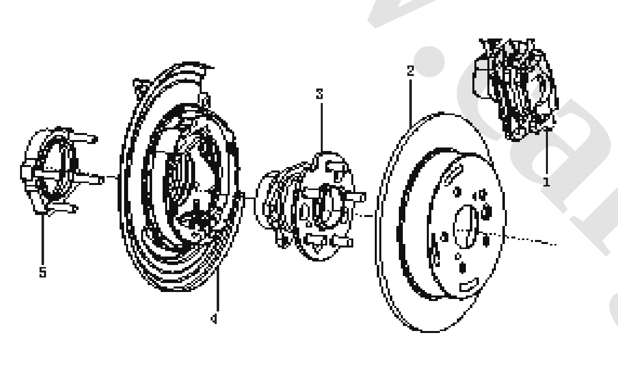
3-Check the brake caliper at both ends of the caliper for abrasion.

4-Check the thickness of the inner brake liner to ensure that the brake liner isn't abraded. Check the brake liner through the caliper sightglass.

5-When the thickness of the brake liner is less than 7mm after abrasion, replace the brake liner. If the brake liner is fixed by a rivet, replace the brake liner when the thickness of the rivet head is less than 5mm after abrasion.

Rear wheel brake

Assembly drawing of the rear wheel brake



1-rear brake caliper assembly	4-rear brake bottom plate assembly
2-rear brake disc	5-connecting plate
3-rear wheel hub	

Check and replace the brake liner

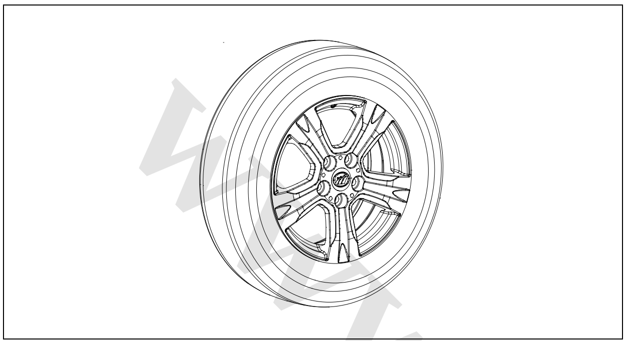
Replace the brake lining of the vehicles of Lifan Motor Company with that of the original company to avoid that the brake lining may change the brake performance of the vehicle.

(1)Jack and suitably support the vehicle to remove the decorative plate

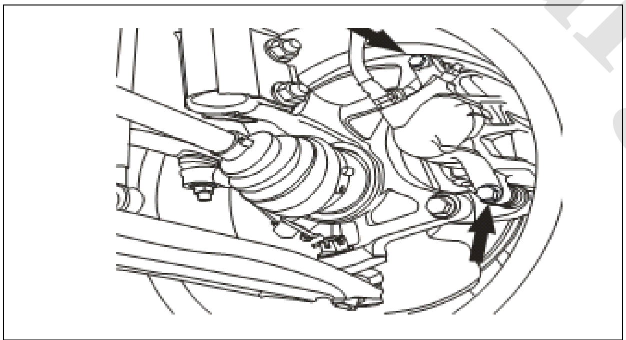
Note: After removal, pay attention that the front side of the decorative plate never abrades with the floor to avoid scratch.

(2) Take down 5 retaining bolts from the wheel and remove the wheel

The torque is 120N•m



Loosen the guide bolt on the brake caliper and the guide bolt below the brake caliper, and take out the brake caliper. Take out the brake caliper The brake caliper shouldn’t connect with the brake hose to avoid damaging the brake hose.



Installation instruction:

Only clean the guide bolt, but never apply grease to it.

Check the thread to ensure the guide bolt is sound. Swing the brake caliper from the top to the bottom to remove it. Remove the brake lining thickness sensor harness bracket and the brake caliper bracket.

4-Remove the brake lining

Note: Mark the lining which has experienced running in. Do not replace the brake plate if the lining at one side is worn.

Replace the lining with a new one only when the thickness of the brake disc is ≤ the minimum thickness. Pay attention to the minimum thickness of the lining and clean the lining. Do not apply grease to the backup plate of the lining.

5-Inspect if the dustproof sealing ring is worn and replace it if necessary. Clean the contact surface of the brake piston.

Note: The dustproof seal ring never contacts the noise damping grease to avoid the expansion of the dustproof seal ring.

6-Clean the contact surface of the brake caliper.

7-Clean the hammer head-shaped guide parts of the brake caliper.

Installation procedure

Installation should obey the reverse order of the removal.

Notes for the above operations:

1-Grind the new brake surface after changing the brake liner.

2-Grind the new brake surface after polishing the surface or changing the brake disc.

3-Keep the vehicle speed below 40-60 Km/t and brake for 15 times to grind the new brake plate.

4-Step on the brake pedal with medium or heavier force to avoid over-heating of the brake.

Diagnostic information of the brake disc

1-Check the thickness deviation of the brake disc

Randomly choose 4 or above points on the brake disc and measure their thicknesses with a micrometer. Measure all the values at the same distance to the edge of the brake disc. If the thickness deviation of the brake disc exceeds 0.013mm, which causes the pulse or front vibration of the brake pedal, replace the above-mentioned disqualified brake disc.

2-Check the lateral run-out of the brake disc

Remark: Once the brake disc is separated from the bearing flange, clean the rust or foreign objects on the mating face of the brake disc and the flange, otherwise, it may cause lateral run-out and brake vibration of the brake disc.

Keep the wheels on the vehicle to check the lateral run-out, thus to get more precise general indicating run-out in the actual brake. If the wheel inspection isn't made on the vehicle, remove the wheel and maintain the caliper's position to get more accurate reading.

Removal procedure

(1) Jack and suitably support the vehicle. Refer to the vehicle lifting in the general information.

(2) Mark the relative positions of the wheel and the wheel hub.

(3) Remove the tyre and the wheel. Refer to the removal and the installation of the tyre and the wheel.

(4) Clean the surface of the brake disc.

(5) Re-install the wheel nut to fasten the brake disc.

(6) Fasten the micrometer component on the steering knuckle to ensure that the contact surface of the indicator button and the brake disc is about 13mm to the edge.

(7) Zero the micrometer.

(8) Rotate the wheel around to check the run-out of the micrometer. If the TIR general indicating run-out exceeds 0.08mm, precisely adjust or replace the brake disc.

In some cases, mark the position of the brake disc on the wheel hub to leave one to two bolts' distance and improve the excessive lateral run-out of the brake disc. If marking the brake disc fails to adjust the lateral run-out, check if the lateral run-out of the wheel hub is too big or too loose. If the lateral run-out of the wheel hub exceeds 0.04mm, replace the wheel hub. If the lateral run-out is qualified, finish the surface or replace the brake disc as necessary.

3-Tolerance of the brake disc

Strictly keep the brake surface tolerance in manufacturing the brake disc

Flatness

Parallelism

Lateral run-out

Keep the shape tolerance of the brake surface to avoid abrasion or pulse of the brake. The surface precision must be below the regulated radius 60 degrees' roughness. New brake discs meet the above specification. The brake discs which are subject to surface finishing adjustment also meet the above specification. Adjust the brake disc to control the precision of the brake surface to eliminate the following faults.

The pedal is too hard.

The brake performance is degraded.

Driving deviation

Abnormal performance

Control the precision of the brake surface to extend the lifetime of the liner. Slight scratch (no more than 1.5mm) of the brake disc may not cause adverse influence on the brake performance. Normal operation may also cause slight scratch.

Install or replace 2 front brake discs

1-Remove the wheel

If necessary, remove and clean the brake lining.

Note: If it's less than the minimum thickness of the brake disc, replace the brake disc. (For the same axle), the brake disc should be replaced in pairs. In case of replacing the brake disc, re-install the brake lining!

2-Loosen the retaining bolts of the brake caliper assembly, remove the brake caliper and tie it to one side.

Hint: Keep the brake pipelines connected.

3-Loosen the positioning screw to remove the brake disc

Note: Loosen the brake disc. In any cases, never knock the friction ring with a hammer or similar objects. If necessary, carefully knock the disc body of the brake disc with a rubber hammer.

Installation instruction: Replace the retaining bolt of the brake disc and thoroughly clean the contact surface of the wheel hub. If necessary, clean the corrosion marks. The unevenness of the contact surface may cause the deformation of the brake disc. See the technical data for the tightening torque. Installation should obey the reverse order of the removal.

Parts of the rear brake

Inspection and maintenance

Measure the thickness of the brake pad.

Measure the thickness of the brake pad with a ruler. If the thickness of the pad is ≤ the minimum, or the abrasion is severely uneven, replace the pad.

Measure the thickness of the brake disc.

If the thickness of the brake disc is ≤ the minimum, replace the brake disc. If there is scratch or uneven abrasion on the brake disc, polish and grand the machine or replace it.

Screw down the brake disc with 2 hub nuts.

Hint: Clamp the brake disc with a special tool in the measurement. The torque is 120N.m. The torque is 120N.m.

Measure the deflection value of the brake disc with a dialgage at the position 10mm to the outer edge of the brake disc. If the deflection value ≥ the maximum, check the axial clearance of the bearing and the deflection of the axle hub. If the end play of the bearing and the deflection of the axle hub are normal, adjust the deflection of the brake disc.

Specification of the front brake

Diameter of the brake disc	305 mm
Thickness of the brake disc	10 mm
Minimum used thickness of the brake disc	8 mm
Max. runout	0.1mm
Thickness of the brake lining	10.2 mm
Minimum thickness of the brake lining	2 mm
Thickness of the brake lining	2.5 mm
Minimum thickness of the brake lining	1.5 mm

Specification of the rear brake fasteners

Brake caliper alignment long bolt	(63±3) N•m
Brake caliper alignment short bolt	(63±3) N•m
Brake caliper guide bolt	80～110 N•m
Vent screw	9～11 N•m
Bearing retaining bolt	(78±5) N•m
Hand brake cable retaining bolt	(9±3) N•m

Removal and installation of rear brake lining

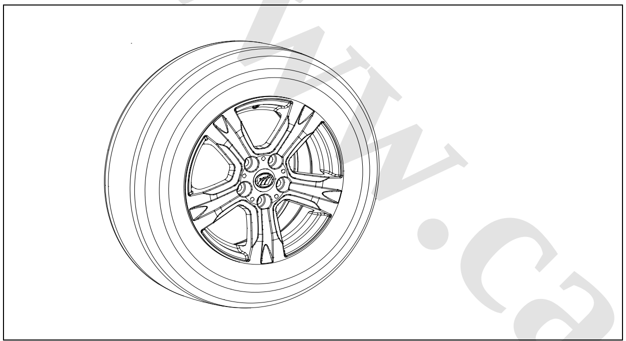
Hint: After the operation, step on the brake for several times to make the brake lining run in the brake disc. Make sure the safety!

After replacing the rear axle brake lining, check if the brake fluid level is between MIN and MAX.

1-Remove the decorative plate.

Note: After removal, pay attention that the front side of the decorative plate never abrades with the floor to avoid scratch.

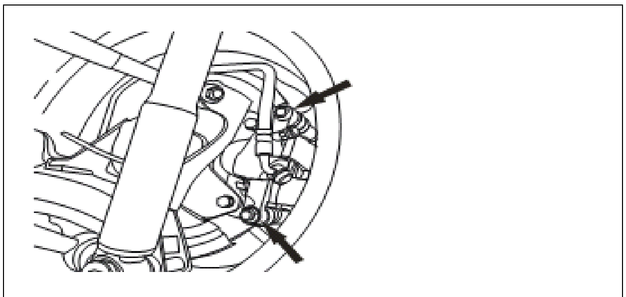
2-Remove five retaining bolts of the wheel and take down the tyre. The torque is 120N.m.



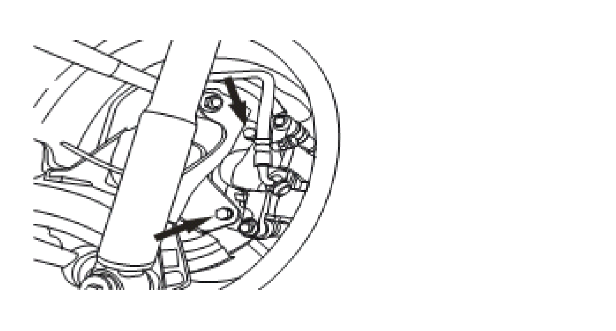
3-Loosen the retaining bolt of the guide bolt and the brake hose.

Installation instruction: Only clean the guide bolt, but never apply any grease.

Check the thread and renew the not intact guide bolt. Swing the brake caliper from the bottom to the top, remove it and hang it with metal wire.



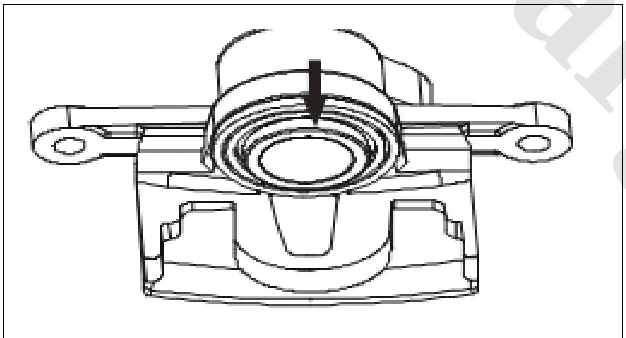
4-Remove the retaining bolt of the brake caliper and pull outward the brake caliper.



5-Remove the brake lining.

Note: Mark the lining which has experienced running in. Do not replace the brake plate if the lining at one side is worn. Replace the lining with a new one only when the thickness of the brake disc is equal to or less than the minimum thickness. Pay attention to the minimum thickness of the lining and clean the lining. Do not apply grease to the backup plate of the lining.

6-Inspect if the dustproof sealing ring is worn and replace it if necessary. Clean the contact surface of the brake piston.



Note: Do not try to seize or protect the piston of the caliper with fingers when using compressed air, to keep the piston flying by force from damaging the vehicle body.

7-Remove the piston and blow the compressed air into the inlet of the caliper to get rid of the piston from its protector.

8-Replace the piston if there is scratch, crack, or corrosion on the piston or the piston coating is worn or damaged.

Note:

The installation procedure of the lining is opposite to the removal procedure!

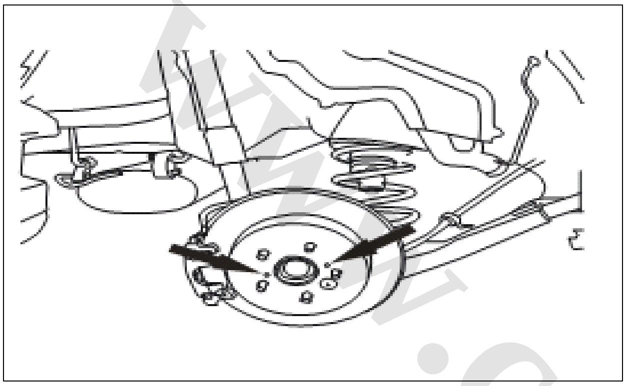
Replacement of Rear Brake Disc

1-Lift the vehicle, choose suitable pivots and remove tyres.

2-Loosen the retaining bolts of the brake caliper assembly, remove the brake caliper and tie it to one side.

Hint: Keep the brake pipelines connected.

Fasten two bolts into the two technical holes on the brake disc and remove the brake disc.



Note: Do not hit the friction ring with a hammer or similar thing when removing the brake disc.

Installation instruction:

Replace the retaining bolts of the brake disc with new ones. Completely clean the contact surface of the wheel hubs and get rid of the corrosion marks if necessary. Uneven contact surface may distort the brake disc!

Note: Do not finish the brake disc surface only for the following:

1-Noise of the brake, such as boom and scream;

2-Early wear of the brake lining;

3-Corrosion on the brake disc surface;

4-Color fading of the brake disc.

Only finish the brake disc surface for one or more conditions below:

1-Serious scratch on the brake surface of the brake disc exceeding the prescribed;

2-Run-out of the brake may be caused by:

(1) Lateral run-out beyond the range;

(2) The brake disc thickness tolerance exceeding the specified;

(3) Corrosion or pitting depth exceeding the brake surface of the brake disc.

Remarks: Follow the examination and repair for the front-wheel brake disc to examine and repair the brake disc.

Specification of parking brake

Braking diameter of drum brake	190 mm
Min. used diameter of drum brake	192 mm
Thickness of brake pads	3 mm
Min. thickness of brake pads	2 mm

Installation of Parking Brake

Replacement of Parking Brake Shoe

Removal procedure

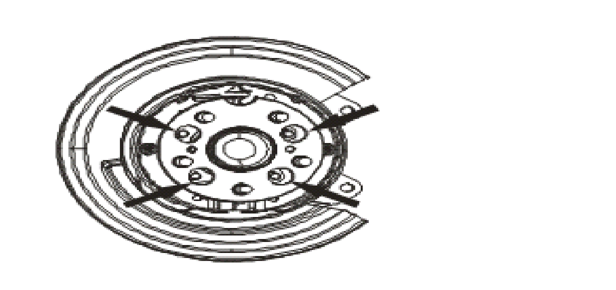
1-Lift the vehicle, choose suitable pivots and remove tyres.

2-Refer to the replacement of the brake caliper bracket in “Disc Brake” and remove the brake caliper.

3-Refer to the replacement of the brake disc in “Disc Brake” and remove the rear brake disc.

4-Remove the rear wheel hub unit.

Remarks: Align the four technical holes on the brake hub unit with the corresponding retaining bolts of the brake unit.



5-Remove the parking brake actuator.

6-Remove the brake shoe.

Installation procedure

1-Install the brake shoe and lining.

Note: Make sure the brake shoe and the parking brake are engaged.

2-Install the parking brake actuator.

3-Refer to the replacement of the wheel bearing/hub in “Rear Suspension” and install the rear wheel hub.

4-Regulate the parking brake shoe.

5-Refer to the replacement of the brake disc in “Disc Brake” and install the rear brake disc.

6-Refer to the replacement of the brake caliper bracket in “Disc Brake” and install the rear caliper bracket.

7-Regulate the parking brake.

Regulation of Parking Brake Shoe

1-Refer to the replacement of the brake caliper bracket in “Disc Brake” and remove the brake caliper bracket.

2-Remove the brake disc.

Pull the brake disc out of the wheel hub and slowly rotate the brake disc.

3-Loosen the parking brake cable adjustment nuts and make the rod at “Stop”.

4-Make the inner diameter measuring tool contact the inner diameter of the brake disc.

5-Place the inner diameter measuring tool at the widest gap between the brake shoe and the lining.

6-Rotate the regulator bolts until the brake shoe and lining 1 exactly contact the inner diameter measuring tool.

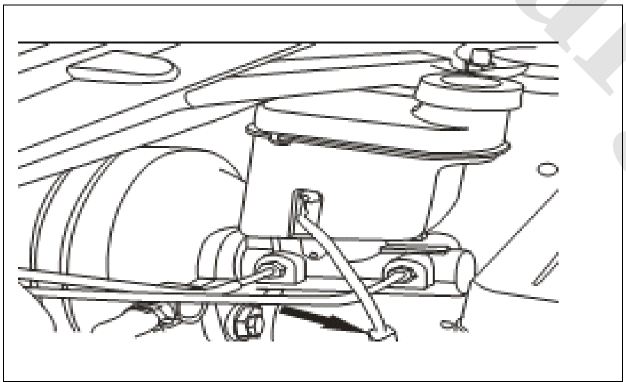
7-Repeat step 2-5 for the brake disc at the other side.

8-Regulate the rear parking brake cable adjustment nuts and install the brake disc and the brake caliper.

Removal of Brake Master Cylinder

Removal of Brake Master Cylinder

1-Disconnect the electrical connector of the fluid level sensor.



2-Use a suction tube to draw the brake fluid.

Remarks: Take care! Do not spatter corrosive brake fluid on skin or paintwork!

3-Loosen the brake pipeline on the brake master pump.

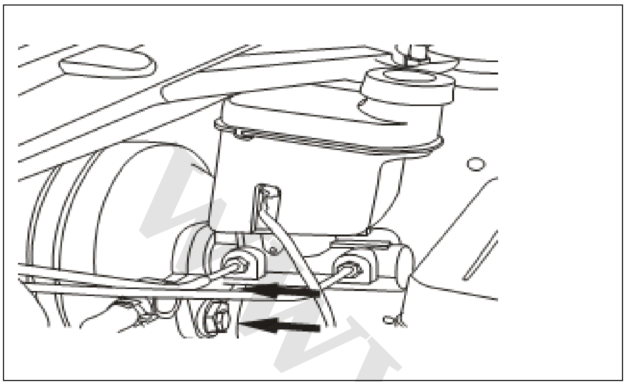
4-Remove the reservoir.

Remarks: Push up the reservoir body vertically to get it down from the master pump and remove the O-ring seal from the groove of the reservoir. Replace the reservoir if it cracks or is distorted and clean it with denatured alcohol. Use compressed air without lubricant to dry the reservoir.

5-Remove the retaining nuts of the brake master pump.

Disassembly of Brake Master Cylinder

1- Removal of Brake Master Cylinder



2-Clean the reservoir cover

3-Remove the reservoir cover and the diaphragm

4-Replace the reservoir cover and the diaphragm if one or more of the following happens:

a. Cut

b Crack

c. Scratch

d. Distortion

5-Remove the master pump reservoir

6-Remove the holder, press down the primary piston and avoid damaging:

a. Piston

b Cylinder liner

c. Holder groove

7-Send the unlubricated low-pressure compressed air into the upper outlet of the closed end when other external connectors are blocked and follow the above operation when replacing

a. Primary piston

b Accessory piston

c. Spring

d. Spring retainer

8-Remove the seal and the spring retainer from the secondary piston

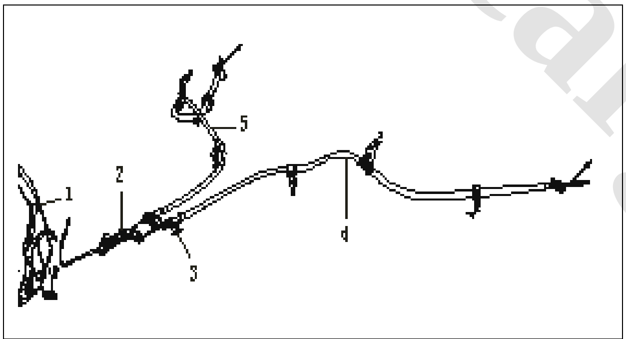
9-Replace the master pump if there is scratch, corrosion or damage. Do not apply abrasive to the hole

10-Use clean denatured alcohol to clean all the components

11-Use compressed air without lubricant to dry the components

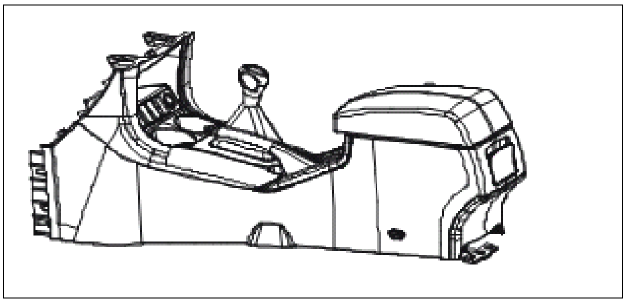
Remarks: The installation procedure is opposite to the removal procedure!

Replacement of Parking Brake Cable

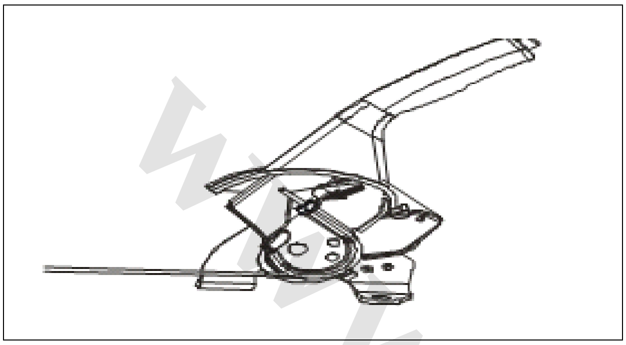


1-Brake control lever assembly	4-Left parking brake cable rear section
2-Parking brake cable front section assembly	5-Right parking brake cable rear section
3-Fastener	

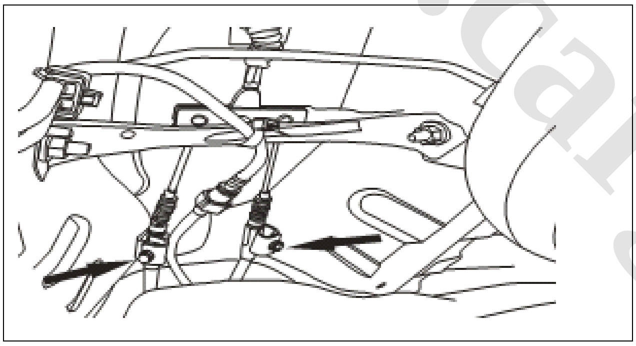
1. Remove the auxiliary dashboard



2-Loosen the retaining bolts of the handbrake



◎ Loosen the retaining bolts of the left and right cables



2-Loosen the handbrake cable

3-Remove the retaining bolts of the left and right handbrake cables

4-Remove the hand cable from the brake actuator

Hint: The installation procedure is opposite to the removal procedure!

Remarks: It is necessary to regulate the parking brake when the brake shoe or the handbrake cable is being replaced:

1-Let go the parking brake lever

2-Press down the brake pedal forcibly once

3-Pull up the parking brake lever and go by four teeth

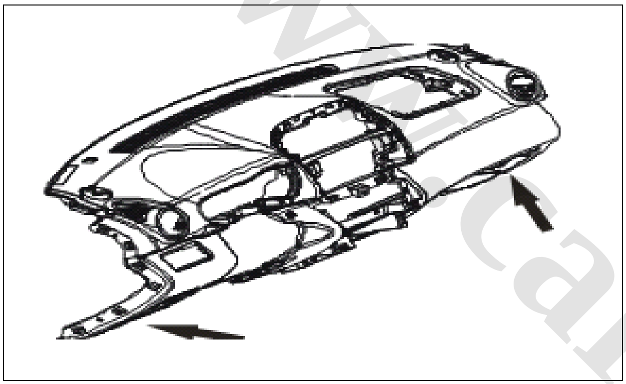
4-Tighten the adjustment nuts until the two wheels can not be rotated by hand

5-After the above steps, let go the parking brake and check if the two rear wheels can turn freely. Or repeat the above steps.

Brake Booster and Brake Pedal

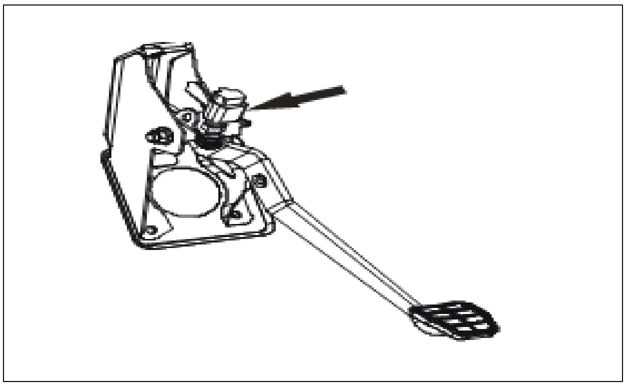
I. Removal of Brake Pedal and Vacuum Booster

1- Remove the two retaining bolts on the left lower shield of the dashboard.

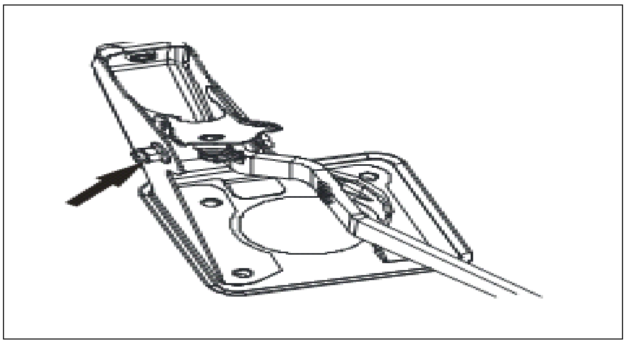


2-Remove the front engine hood handle assembly, disconnect the 4 switch plugs and remove the dash board shield.

3-Disconnect the stoplamp switch plug and remove the stoplamp switch.



4-Remove the connecting pin between the vacuum booster pump and the brake pedal.

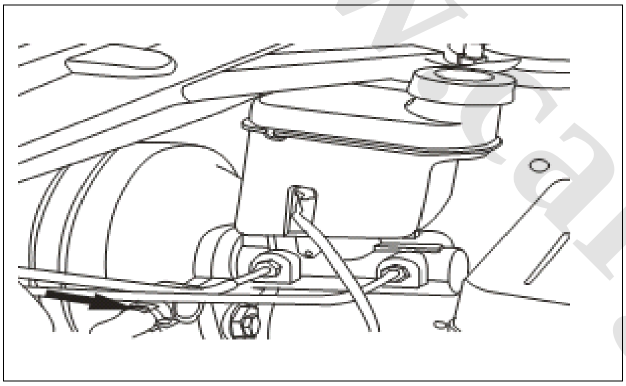


5-Remove the 4 retaining bolts of the brake pedal bracket

6-Remove the brake pedal bracket

Remarks: Do not repair the inner components of the booster or disassemble the housing. Disassembling the housing may cause permanent distortion and improper force application.

7-Remove the vacuum tube



8-Replace the vacuum booster check valve

Note: It is unnecessary to remove the booster from the vehicle for checking the vacuum check valve and the sealing ring.

(1) Disconnect the brake booster vacuum hose at the vacuum check valve

(2) Disconnect the brake booster vacuum check valve from the booster

(3) Remove the sealing ring of the brake booster vacuum check valve from the booster

9-Loosen the adjustment bolts and regulate the brake pedal to the standard height

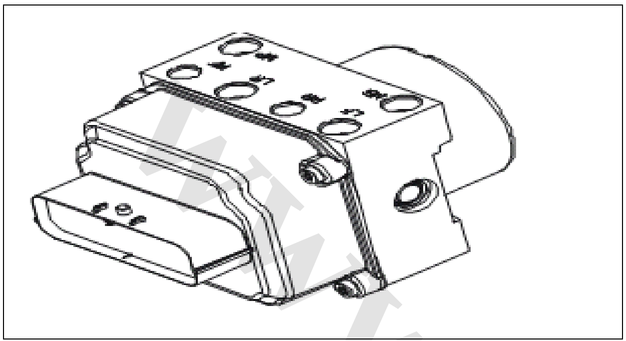
Remarks: The installation procedure of the vacuum booster and the brake pedal is opposite to the removal procedure.

Installation and Removal of Brake Pipelines

Replace the brake pipe and fix the new brake pipe at the original position.

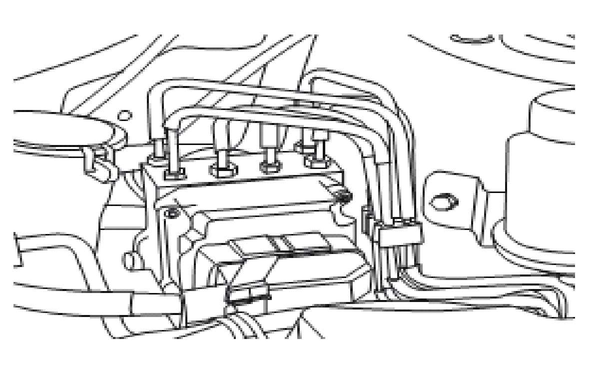
Note: The brake pipelines must be two-wall steel brake pipelines to avoid causing the fault of the brake system. Improper arrangement may lead to bad brake effects or faults.

Remove the pipeline from the brake master pump to the ABS controller assembly



Pipeline definition:

MS：	1st cavity
MP：	2nd cavity
LF：	Left front
RR：	Right rear
LR：	Left rear
RF：	Right front



2-Remove the brake pipelines

(1) Loosen the connecting bolts to the ABS hydraulic unit

(2) Remove the retaining bolts of the fixing clip and the brake pipelines connected to the vehicle body.

3-Remove the brake hose

(1) Lift the vehicle and remove tyres

(2) Use a supporting wrench to clip the hose joint and remove the pipeline from the brake hose bracket. Do not bend the brake pipeline or the bracket.

(3) Remove the holder clip from the hose assembly bracket

(4) Remove the hose from the bracket

(5) Remove the following components from the caliper:

Brake hose bolts

Hose

Two washers (remarks: replace them with new ones during the installation)

Note: Do not move the vehicle before getting the reliable brake pedal travel. Air in the pipelines may result in bad brake effects or faults.

Remarks: Do not suspend components on the flexible brake hose because such an action may damage the hose. Do not bend any part of the brake hose to keep the brake fluid from flowing away from any component.

Remarks: No pipelines can intervene in the vehicle body and the brake joint bolts are respectively provided with the following tightening torque:

The tightening torque of M12×1 shall be 18±2N•m.

The tightening torque of M10×1 shall be 12±2N•m.

Brake Fluid Filling and Exhaust

Hint: If air enters the brake system during the repair or the replacement of the brake components, the exhaust procedure shall be carried out completely. Before the exhaust of the brake, the front and rear exhaust cylinder pistons shall return to the highest positions. The best method is to use a diagnostic scanner to carry out the return procedure. Without any diagnostic scanner, a second procedure can be adopted and the operation shall be done strictly following the specified steps.

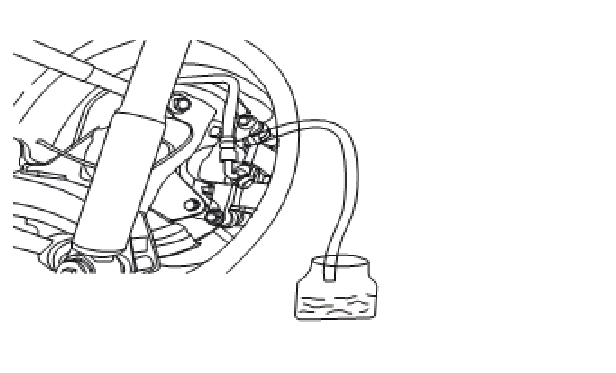
Exhaust all the 4 brake hydraulic systems if air enters because the fluid level is too low or the master pump brake pipelines are disconnected. If the brake hose or the brake is disconnected at a certain wheel, only exhaust the caliper of this wheel. If the brake pipe or hose is disconnected at any joint between the master pump and the brake, only exhaust the brake system related to the disconnected pipeline or hose.

1-Exhaust the brake system

(1) Lift and support the vehicle suitably

(2) Attach the transparent plastic exhaust hose to the exhaust valve of the brake caliper

(3) Dip the other end of the transparent plastic exhaust hose into the clean container with clean brake fluid



(4) Slowly open the exhaust vale to make the brake fluid flow

(5) Close the exhaust valve when there are no bubbles in the brake fluid

(6) Remove the transparent plastic exhaust hose from the exhaust valve

Remarks: The above steps apply to the exhaust of each brake pipeline.

2-The exhaust order of the brake system is Rear Left---Front Right---Rear Right---Front Left. If there is an ABS, connect a diagnostic scanner and start the fluid filling and exhaust procedure to exhaust the air in the ABS.

3-Exhaust the brake circuit

Connect the exhaust hose with a container to the fluid discharge & exhaust valve of the rear left brake caliper. Open the fluid discharge & exhaust valve and press down the brake pedal to the end several times. The brake fluid flowing out must be clean and without bubbles. Keep the brake pedal at the end, close the fluid discharge & exhaust valve. And then release the brake pedal, and similar operation can be carried out for the brakes of other wheels.

4-Fill brake fluid

To ensure the reliable brake of a driving vehicle, check the brake fluid level after the exhaust of the brake system. Fill brake fluid when it is insufficient.

Note:

(1) The brake fluid shall conform to the standards set by the Ministry of Transport (only DOT4) and the brake fluid can not be mixed with brake fluid of other types.

(2) The brake fluid has strong water absorbability so it must be kept in the original sealed

container when recycled.

(3) The brake fluid has strong causticity. Immediately wipe the brake fluid spattered on skin with wet cloth and wash the skin with soap and water completely. Wash the vehicle body immediately if the brake fluid is spattered on the body paintwork.

(4) Observe the fluid level in the brake fluid reservoir during the exhaust and fill some brake fluid if the level is too low.

(5) Repeat manual exhaust again and again until the air in the brake system is exhausted completely.

(6) Check if there is leakage at the brake system after fluid filling and exhaust end. Repair the leakage in time to ensure driving safety.

Anti-lock Brake System

The ABS of LIFAN X60 is a dry product with four-passage control. The electronic control unit of the ABS collects the rotation speed information of each wheel and independently controls the brake pressure of each wheel. Then fault diagnosis and repair can be done via a diagnostic scanner when the warning lamp of the ABS is on.

ABS Working Principles

The rotation speed sensor installed on a wheel collects the rotation speed signal of each wheel and sends the signal to the electronic control unit where the rotation speed can be calculated and then the deceleration of the vehicle and the slip rate of wheels can be calculated. Based on the calculated parameters, the electronic control unit of the ABS can lock the vehicle via the hydraulic control unit regulating the brake pressure during brake. When the ABS doesn't work, the electronic brake force distribution system can still regulate the brake force of the rear wheels and then the rear wheels will not be locked earlier than the front wheels, to ensure driving safety. Each time when the ignition switch is turned on, ABS may conduct self-test;

Each time when the ignition switch is turned on, ABS may conduct self-test; if any fault is found, ECU may automatically interrupt the ABS function and illuminate the ABS warning light. Now the brake system will work as if no ABS system is equipped.

ABS Regulation

The wheel brake pressure is regulated as follows:

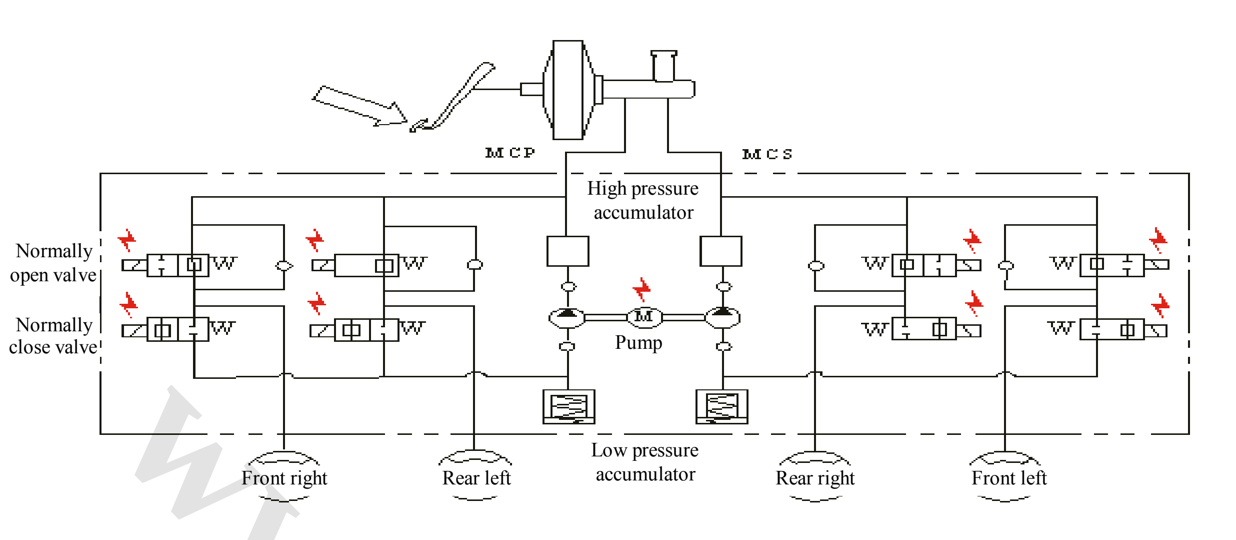
1-Pressure build-up: Pressure is built up via the vacuum booster and the master pump during brake. At this moment, the normally-open valve is open and the normally-closed valve is closed. Then the brake pressure enters into the wheel brake and the wheel speed decreases quickly until the electronic control unit of the ABS gets a signal via the rotation speed sensor and recognizes that the wheels are going to be locked.

2-Pressure maintaining: The electronic control unit of the ABS gets a signal via the rotation speed sensor and recognizes that the wheels are going to be locked. Then the normally-open valve is closed by the ABS control unit and the normally-closed valve is still closed.

3-Depressurization: If the wheels are still going to be locked during the pressure maintaining, the ABS will go to the depressurization stage. As required by the electronic control unit, the normally-open valve is open and the normally-closed valve is closed. Then the hydraulic pump begins to work and the brake fluid is returned from the wheel cylinder to the brake master pump, passing by the low pressure accumulator. After that, the brake pressure decreases and the brake pedal shakes. Then the wheel lock degree drops and the wheel rotation speed starts to increase.

4-Pressure boosting: To achieve the best brake effect, the electronic control unit of the ABS opens the normally-open valve and closes the normally-closed valve again when the wheel rotation speed reaches a certain level. As the pressure is boosted, the wheels brake again and the wheel speed decreases. The anti-lock brake system regulates the pressure at 2-4 cycles/second.

ABS Brake Principles



Removal of ABS Assembly

1-Turn off the ignition switch and disconnect the negative cable of the battery;

2-Remove the harness plug from the ABS control unit assembly;

3-Press down the pedal (>60mm) and fix it with the pedal bracket, which can make the center valve of the master pump closed. Therefore the brake fluid will not flow out from the outlet;

4-Remove the brake hard pipe from the HCU, mark it and block the outlet with a plug at once;

5-Loosen the bolts of the ABS control unit bracket.

Installation of ABS Assembly

Note: Remove the plug of the hydraulic opening on the ABS assembly only when the brake hard pipe is installed, to prevent foreign material entering the brake system.

1-Install the ABS assembly on the bracket and tighten it with the torque of 20±4Nm;

2-Remove the plug of the hydraulic opening, install the brake hard pipe and confirm that the hard pipe connection is correct.

3-tighten the brake hard pipe with the torque of 12±4Nm and 15±3Nm; 3. Install the brake hard pipe to the master pump and

4-Fill the fluid reservoir with new brake fluid until the level reaches the maximum and exhaust the air as required;

5-Turn the ignition switch to ON. The ABS warning lamp will be on for 3.7 seconds and then go off;

Exhaust and Fluid Filling After HECU Replacement

1-Replace the HECU with a HECU (wet-type) for after-sales service, place the ignition switch at ON and use a diagnostic scanner to detect if there are DTCs.

If there are DTCs, eliminate them with a diagnostic scanner.

If a DTC can not be eliminated, refer to "Badness Maintenance".

2-Step on the brake pedal and do exhaust operation for all the wheels through loosening the brake caliper or the exhaust bolts on the drum brake.

Connect the fluid reservoir of the master pump to the device which can continuously supplies brake fluid to keep the fluid reservoir full.

The exhaust operation shall not be completed until the air in the brake fluid is exhausted through loosening the exhaust bolts and the brake pedal is suitably hard. (It is similar to the exhaust/fluid filling of the brake system without ABS)

3-Measure the travel of the pedal and repeat the operations in the above Clause 2 if the travel does not meet the requirement.

If the brake pedal travel still does not meet the requirement after the operations in the above Clause 2 are repeated more than 10 times, do the operations again after the HECU is replaced with a HECU (wet-type) for after-sales service.

Exhaust and fluid filling shall be completed when the brake pedal travel meets the requirement.

4-Instructions for exhaust and fluid filling

If a sponge phenomenon happens to the brake pedal during ABS operation, use a diagnostic scanner to do operations in exhaust mode;

If there is no reacting force after the brake pedal is stepped on, step on/release the brake pedal repeatedly until the exhaust mode ends.

Exhaust mode: Within one minute, start/stop the normally-closed solenoid valve of the HECU repeatedly with the interval of 2S and then continuously drive the motor.

Carry out the operations in the above Clause 2 and Clause -3 after the operations of the exhaust mode.

Instructions on Disassembly

1-Use a diagnostic scanner to find out fault causes before repair;

2-Open the package of spare parts only before installation;

3-Only use OEM parts;

4-Only use non-plush cloth to do cleaning during repair;

5-Use cleanser without mineral oil to clean the surface before repair;

6-Do not use compressed air or move the vehicle when the system is opened;

7-Block each hydraulic outlet with a plug as soon as possible after the removal of the ABS assembly;

8-Remove other components which may hinder work;

9-Please use DOT4 brake fluid but not mineral oil;

10-Use brake fluid to wet the seal and the O-ring and do not use oil or brake factice;

11-Check if the general brake functions of the brake system and the ABS are normal after repair;

12-Check if there is leakage at any joint of the hydraulic pipes.

Notes for Service

1-Disconnect the harness plug from the electronic brake control module before electric welding.

2-Pay attention to locations, installations, orientations, wirings, joints, clamps, and brackets of all the ABS components and parts because they are quite sensitive to EMI (electromagnetic interference).

3-Do not use a quick charger to charge up the battery starting the engine or being connected, to avoid battery failure or damaging ABS parts and components.

4-Turn off the ignition switch and disconnect the battery.

5-Disconnect the harness plug from the electronic brake control module.

6-Do not repair but only replace the ABS parts and components.

7-Do not hang the suspension parts and components on the wheel speed sensor harness to prevent the harness being damaged.

8-Do not put the electronic brake control module in a place where the temperature is higher than 85°C (184℉)。

9-Do not use oil-based fluid in the brake master cylinder or a container which has been used to hold oil-based fluid before, because oil may make the rubber parts and components in the hydraulic brake system swell and be distorted, and then water will enter the system and the fluid boiling point will be lowered.

Fault diagnosis flow of anti-lock braking system

Preparation

1. Special tool

S/N	Tools	Contour Drawing	No.	Description
1	Diagnostic scanner			ABS fault diagnosis system

Repair Specifications

1. Technical Specifications

Brake fluid model	DOT4
Fixing bolt of ABS assembly	20—25N.m

Precautions

1. ABS shall be repaired by the skilled, well-trained technicians and replaced with the genuine parts.

2. If the basic brake system has faults, these faults should be eliminated firstly before diagnosis of the ABS system, such as:

(a). Brake system noise.

(b). Tough operation of brake pedal.

(c). Brake pedal or the vehicle vibrates in normal braking operation.

(d). Braking deviation

(e). Parking brake system malfunctions.

3. The ABS assembly (referring to the ABS electronic control unit and hydraulic pressure regulator assembly, excluding braking lines, sensors and other accessory devices) can be replaced only as a whole. Disassembling or partial /mutual replacement is absolutely prohibited. Lifan does not provide individual part.

The ABS assembly, if disassembled, shall be excluded from our warranty. Meanwhile, we shall be held irresponsible for any adverse consequence arising from disassembling or partial /mutual replacement.

4. The following two cases indicate that ABS system faults have been detected:

(a). Turn on the ignition switch, system self-test is completed, the ABS warning light illuminates.

(b). ABS warning light remains lit in driving the car.

Warning:

The driver may conduct normal braking operation now, but should minimize braking force to avoid locking up the wheels. After the warning light illuminates, you should drive carefully and immediately go to a service station authorized by LIFAN for the check and repair to avoid more failures and traffic accidents.

5. For the harness connecting ABS sensors, please note:

(a) To turn OFF the ignition switch and disconnect the negative pole of accumulator before removing the harness of both ABS and sensors.

(b). Confirm that connectors are dry and clean; prevent any foreign matter from entering.

(c). ABS wiring harness connectors must be mounted vertically and horizontally to avoid damaging connectors.

6. Ensure correct connection when connecting ABS braking pipes. The ABS ECU cannot judge whether the brake line is connected correctly or not. Wrong connection might cause serious accident. Always conform to marks on the ABS assembly when connecting the brake line:

(a). MC1: Connect brake line 1 of the brake master cylinder.

(b). MC2: Connect brake line 2 of the brake master cylinder.

(c). FL: Connect brake line of the front left wheel brake wheel cylinder

(d). FR: Connect brake line of the front right wheel brake wheel cylinder

(e). RL: Connect brake line of the rear left wheel brake wheel cylinder

(f). RR: Connect brake line of the rear right wheel brake wheel cylinder

7. ABS may generate noise in the following cases:

(a). When the vehicle is being electrified or the engine is being started, it may emit short time noise "buzz", which is sound of the ABS in self-test and is a normal phenomenon.

(b). When ABS is working normally, sound comes from the following sources:

• Sound generates when the motor, solenoid valve and the reflux pump are operating.

• The brake pedal may generate sound in rebounding.

• Sound of impacting between the suspension and the vehicle body due to emergency brake.

System Description

1. ABS system is used to avoid off-tracking of wheels when braking on wet and sliding road.

This helps to ensure stability and steering performance of vehicle under above conditions.

2. When ABS is functioning, you'll feel the impulse of brake pedal impulse and hear some noise.

In this case, ABS can be made to work only by treading the brake pedal more powerfully.

3. With car speed above 15km/h, the ABS is in the working status; with car speed below 15km/h, the ABS is deactivated.

4. When the ABS is working, the following conditions may occur, which does not mean fault:

(a). When you hear the operation sound of the ABS and feel the vibration of the brake pedal, the vehicle body and the steering wheel. You still may hear motor sound from the engine compartment even if the car stops.

(b). When the ABS operation is completed, the brake pedal might move forward a little.

Preliminary inspection items

△ Hint:

Before diagnosing ABS system, first inspect parts which are easy to cause ABS system fault.

Appearance inspect procedures can quickly determine fault. Hence it is unnecessary to conduct further diagnosis.

1. Make sure that only tyres and wheel hubs with recommended sizes are installed on the vehicle. Pattern and depth of the tyres with the same shaft must be the same.

2. Check ABS hydraulic regulator and brake lines and connectors for leakage

3. Check the ABS system fuses, and ensure that the fuse is not burned and its model is correct

The ABS system has three kinds of fuses, as following:

Pump motor fuse: 30A

Solenoid valve fuse: 40A

Electronic control unit fuse: 10A

4. Check if the battery is fully charged, and check the battery connection for corrosion and the terminals for looseness. The normal voltage of ABS ranges from 9.3V~16.8V.

5. Check if the ABS ground wire's earthing point is loose, and that earthing location is

changed.

6. The ground wire of ABS shall be excellent in tightness in order to prevent functions from being out of service for the reason that water or humidity penetrates the joint of ABS ECU via the pores of harness due to the capillary (siphon) effect.

7. Check the following electrical parts visually and their appearance:

(a). Check if ABS parts harness and terminals are properly connected and damaged due to clamping or cutting.

(b). Check if the wiring harness is arranged close to any device with high voltage or big current, such as high voltage power supply or parts, generator, electric motor, or additionally-installed stereo amplifier after purchasing the car.

Note:

Devices with high voltage or big current might cause circuit to generate induced noise, consequently interfering with the normal working of the circuit.

(c) ABS parts are sensitive to electromagnetic interference (EMI). If an intermittent fault is in doubt, inspect whether after-sale optional anti-theft device, lamps and mobile telephone are improperly installed.

8. As an active safety system, ABS works to keep the car operable and stable to the greatest extent by virtue of road holding. However, ABS can't prevent the car from slipping either when exceeding the physical limits or speeding on a slippery road.

9. If ABS noise is too loud, it may be caused by the following reasons:

(a). The bracket between the ABS assembly and the ABS is loose.

(b). Connection between the ABS bracket and the vehicle body is loose.

(c). Plastic washers in the ABS bracket are missed or damaged.

Troubleshooting

Diagnostic Steps

1. Read the DTC

(a) If any DTC exists, go to step 3.

(b) If there is no DTC, go to step 4.

2. Record the DTC, and then clear the DTC

3. Confirm and reproduce the fault: with car speed above 15km/h, simulate the fault

occurrence state and read the DTC again.

(a) If any DTC exists, go to step 5.

(b) If there is no DTC, go to step 6.

4. Carry out fault maintainence in no DTC condition, and then go to step 7.
5. Conduct the troubleshooting according to DTCs table, and then go to step 7.
6. Eliminate fault according to fault symptom, and then go to step 7.
7. Confirm that the fault is eliminated, and then the system works again.
8. The diagnosis ends.

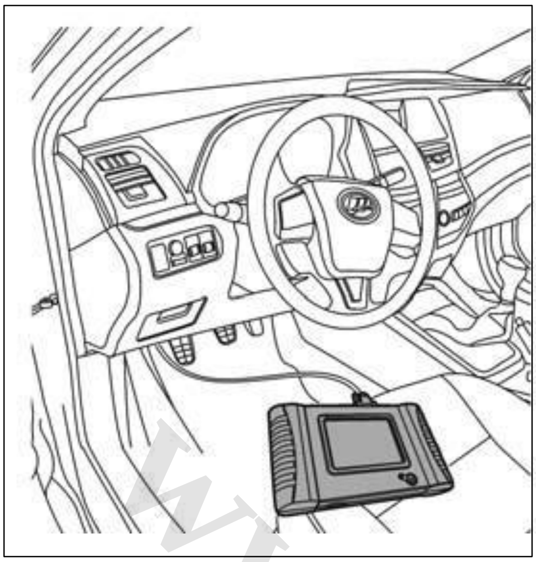
ABS diagnostic description

The wheel speed sensor mounted on the wheels collects wheel speed signal and sends it to the ECU to calculate the wheel speed and further calculate the car deceleration speed and the sliding rate of wheels. ABS electric control unit based on calculated parameters and through hydraulic control unit, adjust brake pressure during braking, to achieve ABS function. Each time when the ignition switch is turned on, ABS may conduct self-test; if any fault is found, ECU may automatically interrupt the ABS function and illuminate the ABS warning light. Now the brake system will work as if no ABS system is equipped.

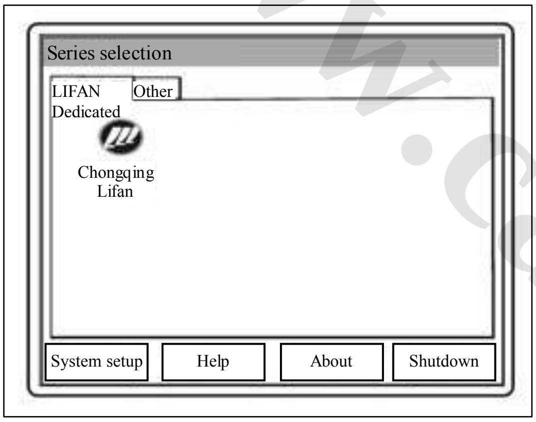
Read and clear DTCs

1. Use the diagnostic scanner to read the diagnostic DTC (DTC)

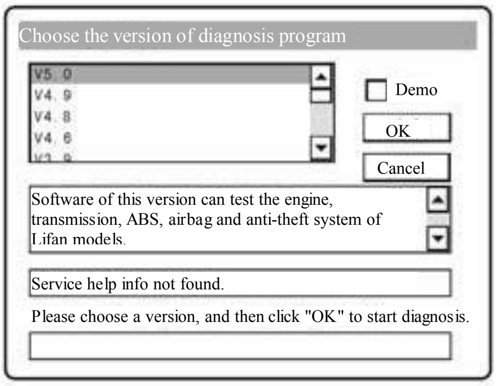
(a). Connect Lifan V30 diagnostic scanner to the diagnostic connector.



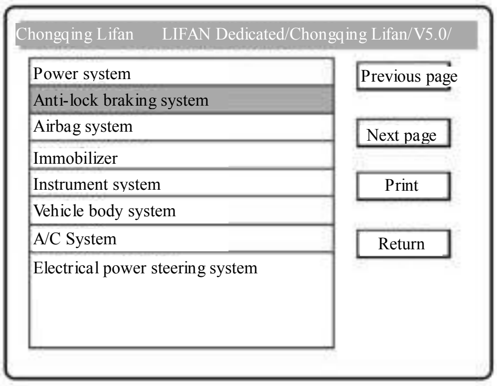
(b). Turn on the diagnostic scanner, and enter into "Chongqing Lifan" diagnosis system.



(c). Select Diagnostic Program version "V5.0", and then click "OK."



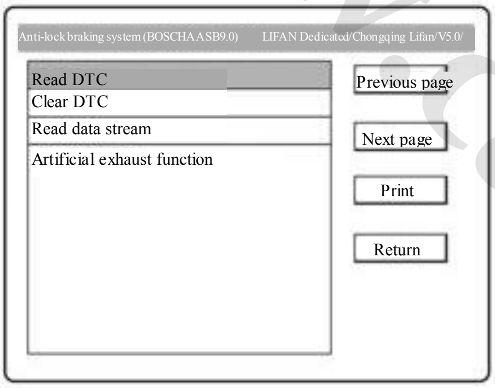
(d). Select and enter into "Anti-lock braking system".



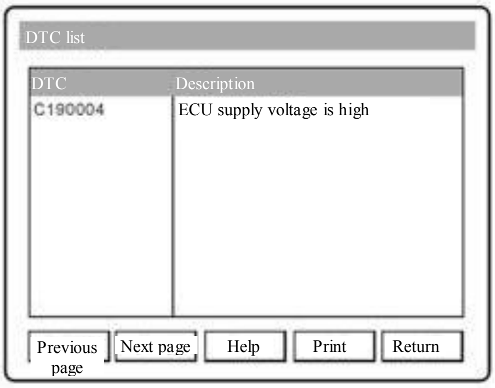
(e). Click to choose "Read DTC".

△ Hint:

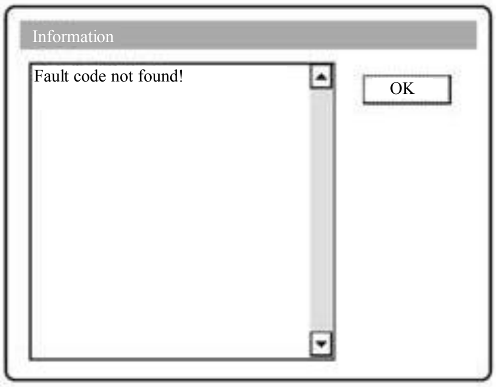
If any previous DTC exists in the diagnostic scanner, firstly you should clear off it before reading.



(f). Read and record the fault code as shown.

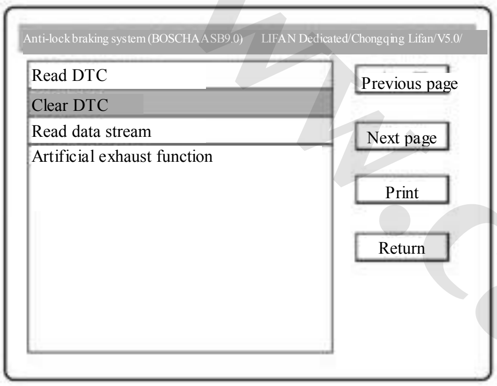


(g). If no DTC is found, select "OK" to return.



2. Clearing of DTCs

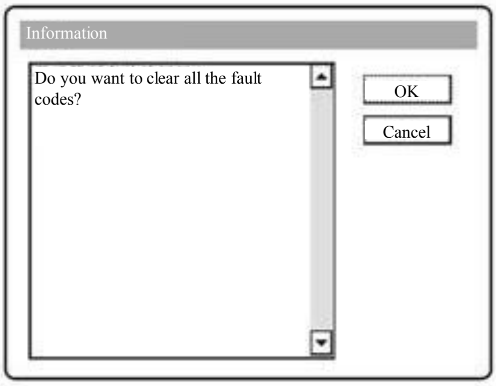
(h). Click "Clear DTC" to clear off DTC.



(m). Select “OK” to clear DTC.

△ Hint:

If the DTC cannot be removed, it is an indication that the fault has not been troubleshooted. You should remove the fault based on the DTC before trying to remove the DTC again.



List of ABS Fault Codes and Diagnosis Codes

BCNC fault code	Diagnosis code	Chinese expression
C1011	11	ABS warning light fault
C1012	12	Brake warning light fault
C1014	14	Relay open-circuit or grounding short-circuit
C1017	17	Input open-circuit of ECU pump motor battery
C1018	18	High grounding resistance of pump
C1021	21	F/L wheel speed =0km/h (active sensor)
C1022	22	F/R wheel speed =0km/h (active sensor)
C1023	23	R/L wheel speed =0km/h (active sensor)
C1024	24	RR wheel speed =0km/h (active sensor)
C1025	25	Intermittent fault of RR wheel (active sensor)
C1026	26	Intermittent fault of RR wheel (active sensor)
C1027	27	Intermittent fault of RR wheel (active sensor)
C1028	28	Intermittent fault of RR wheel (active sensor)
C1032	32	Hardware fault of RR wheel speed (active sensor)
C1033	33	Hardware fault of RR wheel speed (active sensor)
C1034	34	Hardware fault of RR wheel speed (active sensor)
C1035	35	Hardware fault of RR wheel speed (active sensor)
C1036	36	System voltage is low
C1037	37	System voltage is high
C1042	42	Pump motor open-circuit
C1055	55	ECU internal fault
C1056	56	System breaker switched on continuously
C1091	91	Brake pedal out of service when slowing down
C1093	93	Brake pedal out of service when slowing down during the previous ignition cycle
C1094	94	Brake pedal always in service when not slowing down
C1095	95	Brake switch/lamp open-circuit
C1121	121	Control fault of LF or RF, LR or RR pressurizing solenoid
C1122	122	Control fault of LF or RF, LR or RR ECU depressurizing solenoid
C1127	127	Brake pedal out of service when not slowing down during the previous ignition cycle
C1134	134	High ECU grounding resistance
C1151	151	F/L wheel depressurized too long in time
C1152	152	F/R wheel depressurized too long in time
C1153	153	R/L wheel depressurized too long in time
C1154	154	RR wheel depressurized too long in time
C1191	191	Starting current of pump-free motor
C1192	192	Current overload of pump motor
C1194	194	Pump motor current short-circuit

C1205	205	Low circuit or battery voltage
C1206	206	F/L wheel speed frequency beyond the range (passive sensor)
C1207	207	F/R wheel speed frequency beyond the range (active sensor)
C1208	208	R/R wheel speed frequency beyond the range (active sensor)
C1211	211	R/R wheel speed frequency beyond the range (active sensor)
C1217	217	Motor temperature beyond the range
C1218	218	Motor temperature beyond the limits
1221	221	Abnormal working temperature of motor driver

EBD Working Process

When part of wheels brakes, the electronic brake force distribution (EBD) will function especially at the turning. Based on the rotation speed signals of the four wheels sent by the speed sensor, the electronic control unit calculates the rotation speed and the slip rate of the wheels. If the slip rate of the rear wheels is higher than some set value, the hydraulic control unit will regulate the brake pressure of the rear wheels to ensure the rear wheels will not be locked earlier than the front wheels.

Compared with the traditional proportional valve brakeforce distribution, the electronic brakeforce distribution ensures a strong adhesion of wheels and a reasonable brakeforce distribution. When the ABS functions, the electronic control distribution will stop working. The pressure boosting and maintaining of the EBD is the same as that of the ABS while its depressurization is different from that of the ABS. When the rear wheels are likely to be locked, the normally-open valve of the rear wheels will be closed and the normally-closed valve will be opened. Then the wheel brake pressure will decrease. At this moment, the hydraulic pump will not work and the brake fluid discharged via depressurization will be kept in the low pressure accumulator temporarily, which differs from the ABS. After brake ends and the brake pressure inside the pedal master cylinder is released, the normally-open valve and the normally-closed valve will be opened again, through which, the brake fluid in the low pressure accumulator will return to the master cylinder. The low pressure accumulator will be exhausted for the next ABS or EDS.

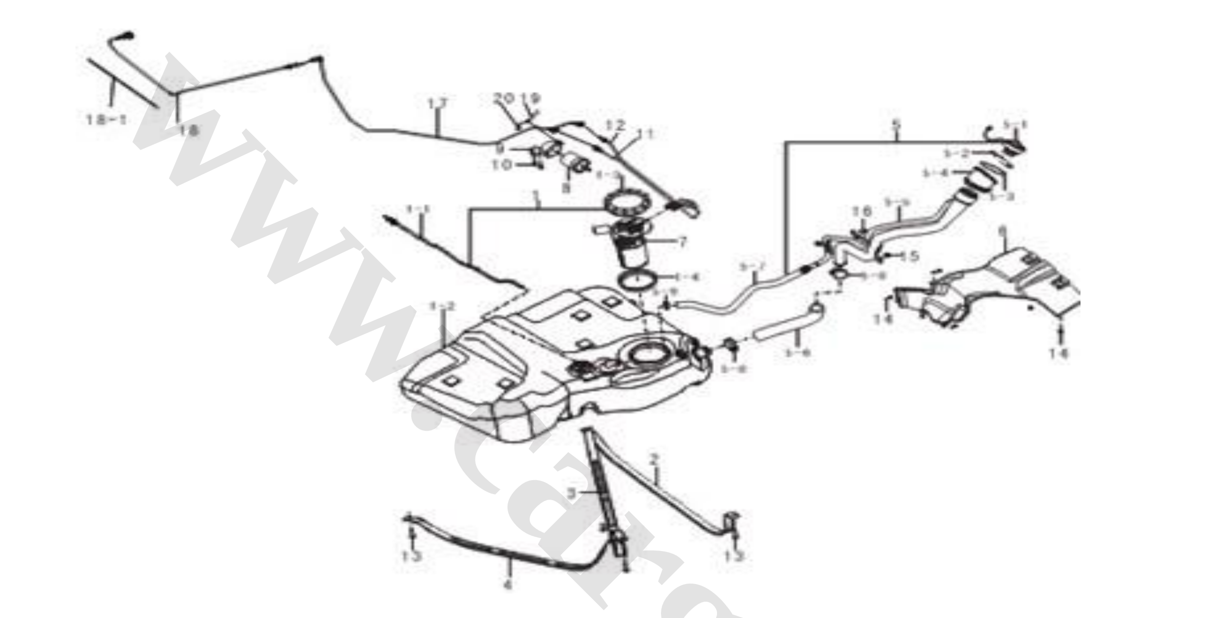
Section 6 Fuel Supply System

Removal and Installation

1. Before removal：① Pump fuel ② Prevent fuel from flowing to the ground

2. After installation：① Fill fuel ② Confirm there is no leakage

3 Removal steps (see Fig. 1)



Fuel tank assembly

1-Fuel tank assembly (Rated capacity: 55L)	8-Fuel filter assembly
1-1 fuel vaporization connecting pipe	9-Filter support
1-3-fuel pump cover	10-support bolt
2--Right bracket of fuel tank	11-Outlet pipe assembly of fuel tank
3-Bracket inside fuel tank	12-outlet pipe assembly of filter
4-Left bracket of fuel tank	13-Bracket bolts

5-Fuel filler pipe assembly	14-Filler pipe shroud bolts
5-6-Lower section assembly of filler pipe	15-Filler pipe support nuts
5-7-Air return pipe	16-Filler pipe support bolts
5-8-A-type worm-driven hose hoop	17-Engine inlet pipe Ⅰ
5-9-A-type worm-driven hose hoop	18-Engine inlet pipe Ⅱ
6-Filler pipe shroud	19-Soft clip of short wire harness Ⅱ
7Fuel pump assembly	20-support bolt

(1) Remove 14-filler pipe shroud bolts and 27-filler pipe shroud.

(2) Loosen A-type worm-driven hose hoop 5-8 and A-type worm-driven hose hoop 5-9 and remove -lower section assembly of filler pipe 5-6 and 5-7 air return pipe from fuel tank.

(3) Remove 11-outlet pipe assembly of fuel tank and 12-outlet pipe assembly of filter from 7-fuel pump assembly.

(4) Pull out plug connector of fuel pump, unscrew 1-3 fuel pump cover and take out 7-fuel pump assembly.

(5) Pull out 1-1 fuel vaporization connecting pipe.

(6) Unscrew 13-bracket bolts and remove 2-right bracket of fuel tank, 3-bracket inside fuel tank and 4-left bracket of fuel tank. .

(7) Remove 1-fuel tank assembly

4. When removing the fuel tank,

(1) Support the vehicle with a lift and jack the fuel tank with auxiliaries to prevent the fuel tank from turning over.

(2) Do not repair a certain section of a rubber or nylon pipe but replace the entire pipe.

(3) Cover accessories and block holes during the operation of the fuel system to prevent dust and others entering the fuel system through open pipelines or other passages.

(4) Keep the components of the fuel system clean.

Note:

(1) Re-install the four M8 fixing bolts of the fuel tank and tighten them with the torque of 23N•m.

(2) Tighten the clamp and replace them when necessary.

(3) Check and confirm each hose is not wound or damaged during removal and installation.

(4) Make the ignition switch be on for 2s and off for 10s. Then turn on the ignition switch again and check if there is leakage.

Fuel filter

1. Replace the fuel filter

Remove the fuel filter

(1) Release the pressure of the fuel system.

(2) Discharge superfluous fuel into a suitable container.

(3) Remove the fuel hoses on the two ends of the fuel filter. See the fuel filter after removal in the Fig. below.

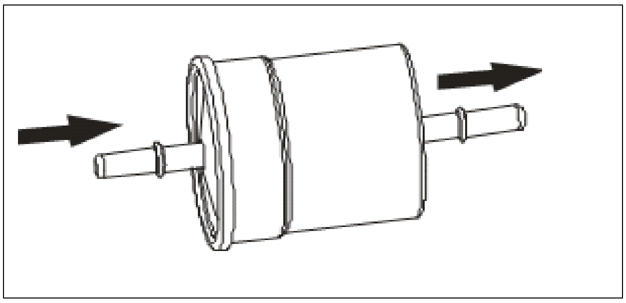


Fig. X—2 Fuel filter

2. Install a new fuel filter

(1) Remove the protective cap of the new fuel filter.

(2) Connect the fuel hoses at the two ends of the fuel filter.

(3) Tighten the filler pipe cover of the fuel tank.

(4) Connect the negative cable of the battery again.

(5) Make the ignition switch be on for 2s and off for 10s. Then turn on the ignition switch again and check if there is leakage.

Note:

Pull the high pressure pipe connected to check if it has been mounted. Make sure there is a clearance about 3mm.

Electric Fuel Pump

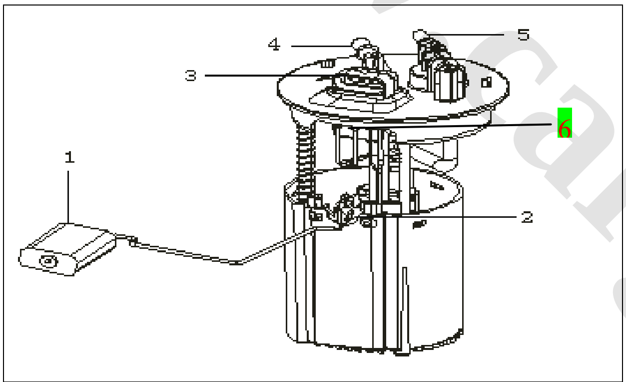


Figure Fuel Pump

1-Fuel float	4-Outlet pipe joint
2-the fluid level sensor	5-Return pipe joint
3-Fuel pump socket	6- Pressure regulating valve

Table of Technical Specifications

Normal pressure of fuel	（0.34～0.36）MPa

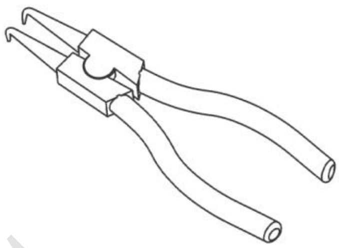
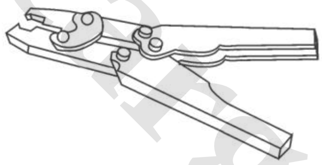
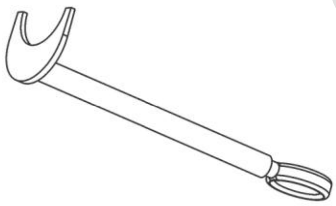
Oil level sensor resistance value (the highest point)	（36±3）Ω
Resistance of oil level sensor (min.)	（300±5）Ω

Section 7 Drive System

Drive shaft

Preparation

1. Special tool

S/N	Tools	Contour Drawing	No.	Description
1	Nose pliers			Dismantle snap ring and retainer ring
2	Clamp tightening tool			Tighten the seal cover clamp
3	Drive shaft remover			Dismantle drive shaft

Repair Specifications

1. Table of Technical Specifications

Left drive shaft	Total length	654±3mm
	Maximum compression	30mm
	Maximum extension	22.6mm
Right drive shaft	Total length	988±3mm
	Maximum compression	30mm
	Maximum extension	22.6mm

2. Tightening Torque Specifications

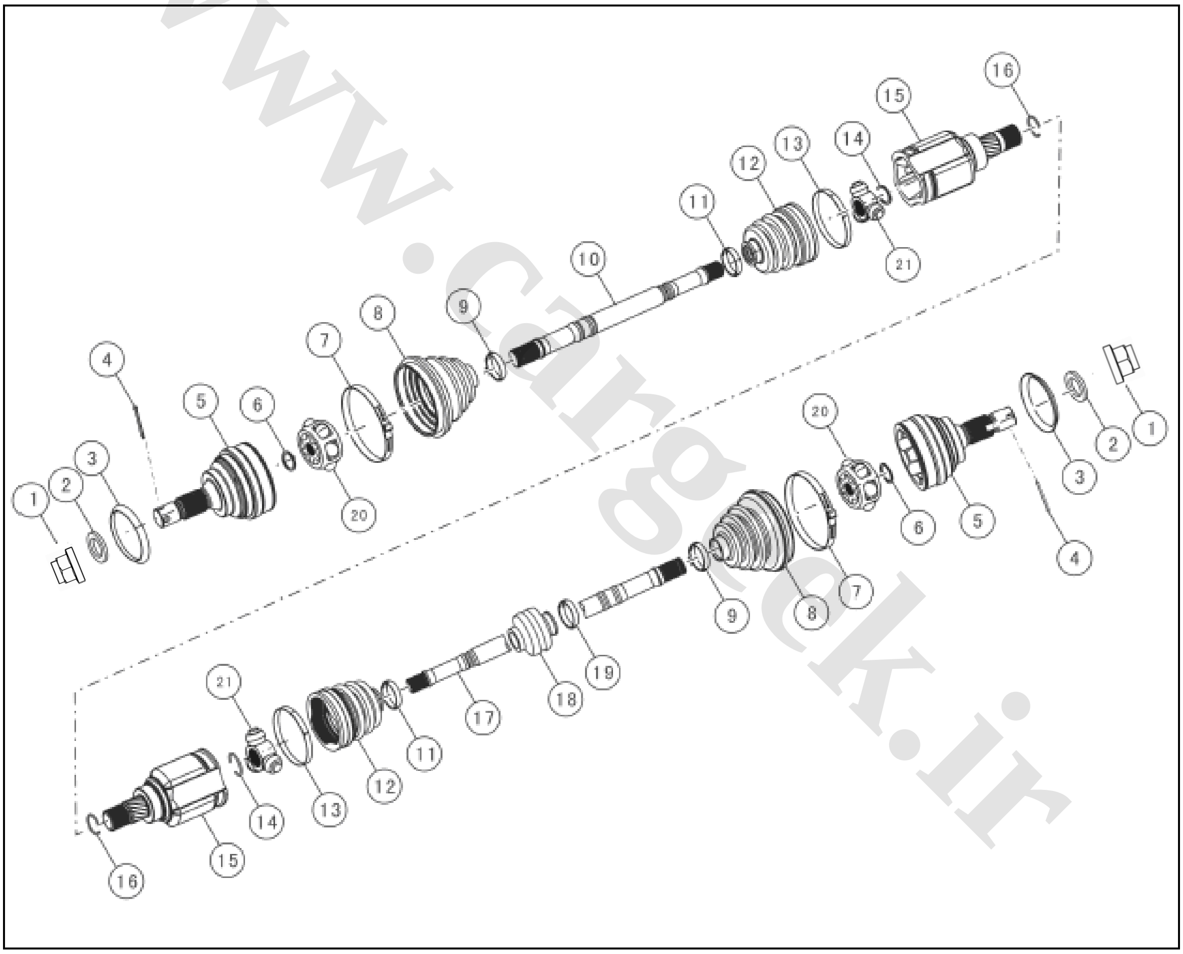
Item	N·m
Steering knuckle and front column	195225
Drive shaft hub nut	250~300
Fixing bracket bolts for oil pipes and ABS leads	20~25

Precautions

1. Do not have seal parts (shield) of drive shaft rub with or bump on sharp objects when seal parts are rotating or removed with a car running. Otherwise seals parts will be damaged.
2. Disposable parts cannot be reused.

3. Do not contaminate parts in the process of repair. Do not have any foreign matter enter.
4. Clean the external surfaces of the components before dismantling or assembling them.
5. Decomposed parts (except for rubber parts) should be cleaned by kerosene and then dried by air, or wiped by paper towel or cloth.
6. Conduct necessary alignment inspection after installation of system.

Components diagram



1	Drive shaft hub nut	12	Sealing cover on sliding end

2	Flat washer	13	No ear and no step clamp
3	Dustproof ring	14	Shaft-used snap ring and retainer ring
4	Wedge-shaped groove	15	T J87 constant speed universal joint
5	BT87 constant velocity cardan joint (CVJ)	16	Differential spring retainer ring
6	Steel wire retainer ring on fixed end	17	Long shaft
7	Single ear and no step clamp	18	Shock absorber
8	Sealing cover on fixed end	19	No ear and no step clamp
9	Single ear and no step clamp	20	Ball cage assembly
10	Short shaft	21	Three-fork pin assembly
11	No ear and no step clamp		

System Description

The Lifan X60SUV uses front-wheel drive, and its drive shafts mean the axle shafts which are used for the transmission’s differential to be connected to the left/right steering and drive wheels. Inner end of left and right drive shafts are connected with spline and axle shaft gear and fixed by snap ring. External fine spline inserts into spline hole of wheel hub and shaft end is locked by nut.

On-Vehicle Check

1. Check for obvious damage.

(a). Check if the drive shaft and the universal joint are loose and have other damages.

(b). Check if seal cover is cracked or has other damages.

2. You can hear a click when rotating

(a). When rotation of constant speed universal of worn or damaged front wheel drive shaft, it may produce the sound of click.

(b). If there is the sound of click, inspect whether sealing cover of constant speed universal of front wheel drive shaft has abrasion or damage.

3. When accelerating speed in sliding traveling condition, there is dull metal sound. If there is the sound of click while rotating, inspect the following conditions:

(a). Check if seal cover is damaged or broken.

(b). External universal joint is worn out or damaged.

4. Jerk or vibration in acceleration

(a). Starting jerking is vibration felt on steering wheel or from the car front when the car goes to intermediate speed from start or is rapidly accelerating. During acceleration, starting jerking might be forward and rearward vibration. In front wheel drive cars, starting jerking might be resulted from the following conditions:

- TJ87 constant speed universal joint has abrasion or damage.
- The BJ87 CVJ is badly worn or horned.

(b). Universal joint has serious angle shape, which is generally caused by too high height of front shock absorber spring. The following faults may occur when mounting seat of power system has abrasion or misalignment:

• Universal joint angle is too large.

• Starting jerking.

(c). During rapid acceleration, the front suspension height may increase due to high torque of the powertrain. When suspension height rises, angle of TJ87 constant universal joint becomes bigger. The following conditions may also cause vibration when starting:

Universal joint wear.

Angle is too big before acceleration.

Troubleshooting

Problem Symptoms Table

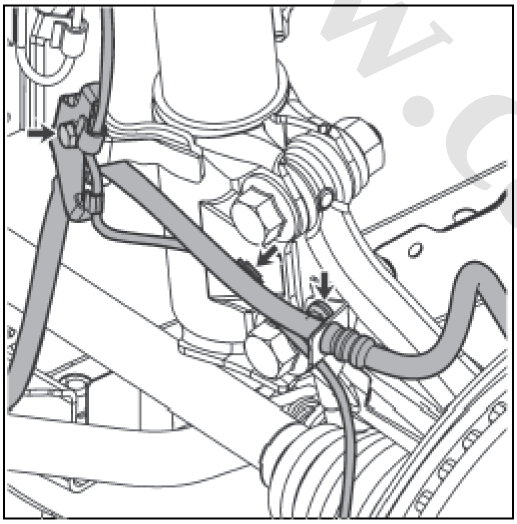
Use the table below to help you find the cause of the problem. Check each part in order. If necessary, repair or replace these parts.

Symptom	Suspicious part	Recommended Action
Vibration	1. Drive shaft (wear, damaged or bent)	Replace
	2. Drive shaft and hub spline (abnormal sound)	Replace
Jerk in acceleration	1. Improper adjustment of car height cause poor performance of universal joint	Adjust vehicle body height
	2. Angle (too high)	Replace
	3. Universal joint (wear)	Replace
Loud noise	1. Drive shaft (wear, damaged or bent)	Replace
	2. Front hub spline (wear)	Replace

	3. Drive shaft hub spline (wear)	Replace
	4. Drive shaft (poor lubrication)	Add grease
	5. Hub nut (loose)	Adjustment or replacement
	6. Front suspension and steering (defective)	Adjustment or replacement

Drive Shaft Assembly

Replace



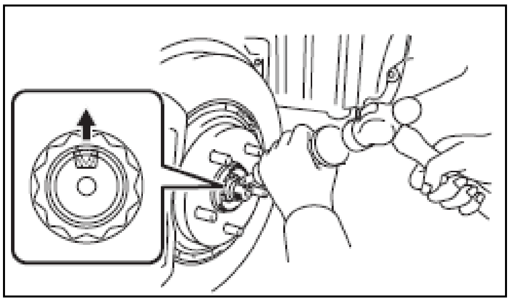
1. Drainage of transmission gear oil

2. Lift up the vehicle, and remove front wheels

3. Removing the brake hose and wheel-speed sensor as well as the lead

△ Note:

Just remove the brake hose and wheel-speed sensor as well as the lead from the front suspension and steering knuckle instead of disconnecting.



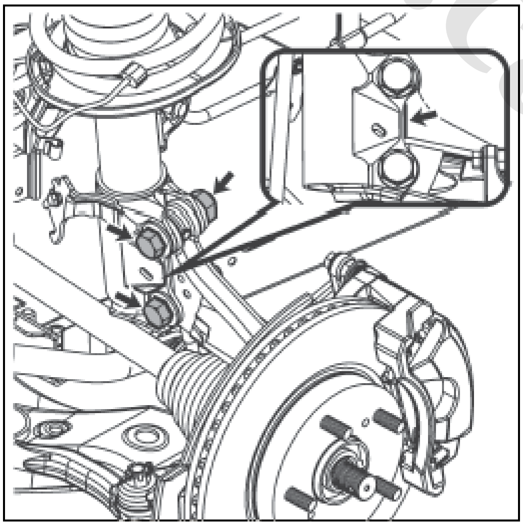
4. Remove the front brake with steering knuckle assembly

(1) Restore the deformation of the top of hub nut at the wedge-shaped groove with a hammer and thimble.

(2) Unscrew the hub nut with the hexagon socket and airgun.

△ Hint:

Step and hold the brake pedal to prevent the drive shaft from rotating while turning the hub nut.



(3) Make marks on the shock absorbers.

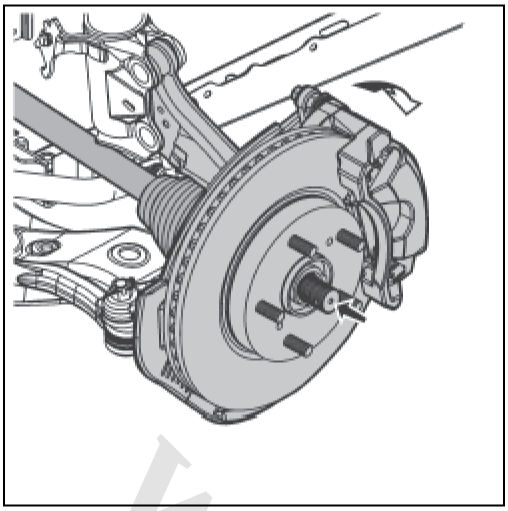
△ Note:

Be sure to mark the bolts when removing them so that you can re-install them based on the marks without four-wheel alignment. Without the marks, you must do four-wheel alignment after installation in place.

(4)Remove the front shock absorbers and steering knuckle bolts.

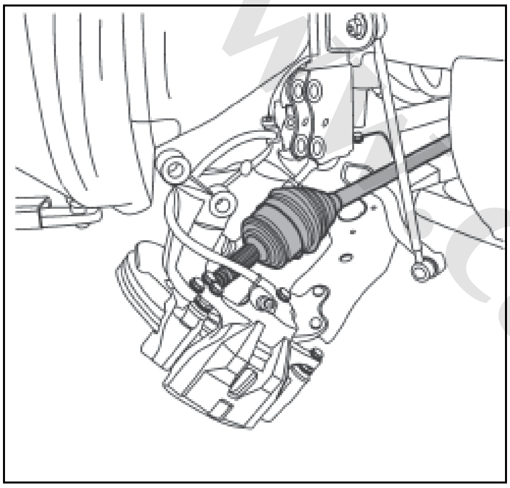
△ Note:

After dismantling lower locknut, slightly rise up front brake with steering knuckle assembly and unplug bolts.

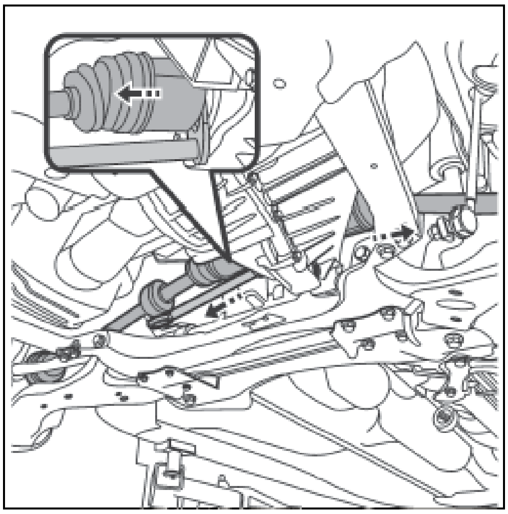


5. Removal of drive shaft assembly

(1). Turn the front brake with the steering knuckle assembly to a proper angle.



(2). Pull out the drive shaft on the wheel side from the knuckle hub.



(3). Pull the drive shaft assembly on the right/left side from the transmission's differential.

△ Note:

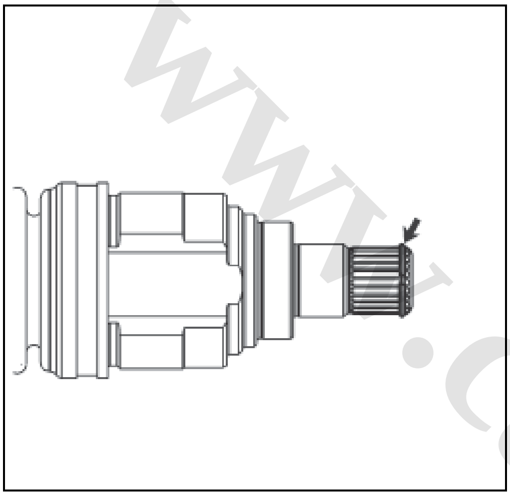
Drive shaft detacher or equivalent tool must be used to remove the drive shaft assembly; do not use heavy-duty tool to knock directly the drive assembly. Otherwise the drive shaft will be damaged.

Note:

Pay attention not to damage boot and oil seal.

Pay attention not to fall drive shaft assembly.

Do not directly pull drive shaft assembly, because this may cause loosening of TJ87 constant speed universal joint of drive shaft, and even cause damage of dustproof rubber sleeve.



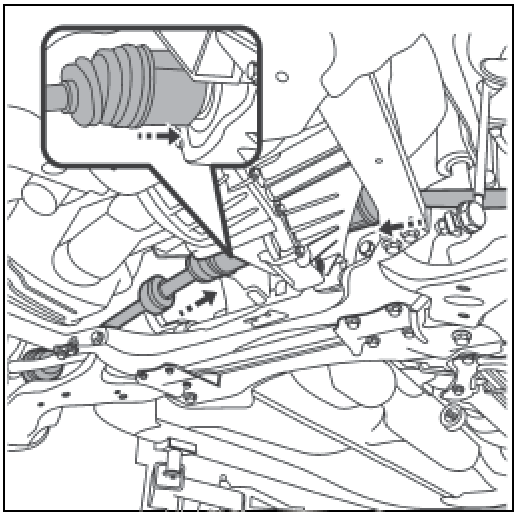
6. Installation of drive shaft assembly

(1). Inspect whether retainer ring of differential spring on transmission side of drive shaft assembly is installed to proper position.

△ Note:

Try to replace the snap ring after each removal and installation.

(2). Apply gear oil to the universal-joint spline shaft of the drive shaft on the transmission side.



(3). Align inner end of drive shaft (T J87 universal end) with center hole of differential, and slightly rotate drive shaft to align spline teeth and push it with hard force to install transmission of drive shaft into differential.

△ Hint:

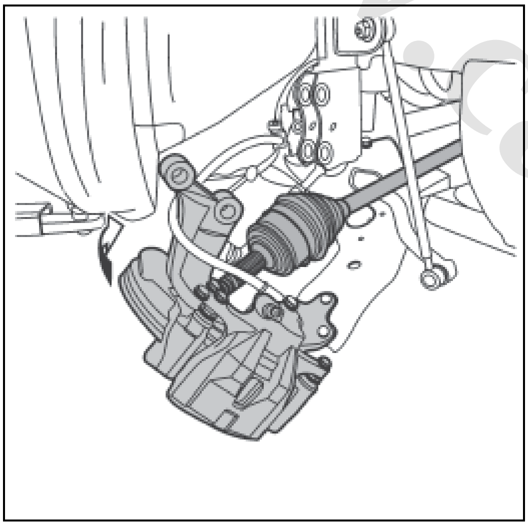
Through rotation of drive shaft assembly, by hearing sound and feeling, you can know whether spine shaft of universal on transmission side is installed to proper position.

Use rubber hammer to punch spline shaft of universal joint of drive shaft assembly into differential.

Note:

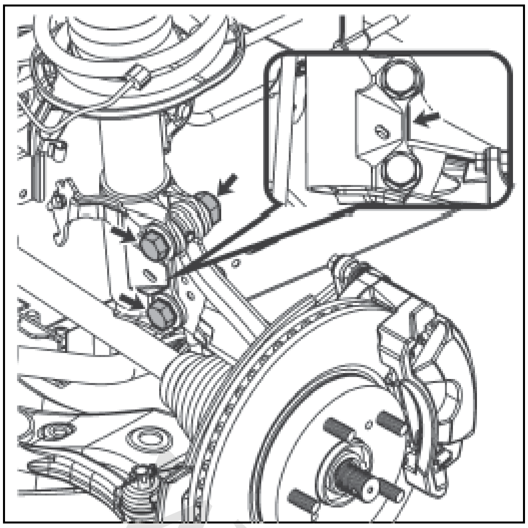
While installing, opening of retainer ring of differential spring should be placed downwards.

Pay attention not to damage boot and oil seal.



7. Mount the front brake with steering knuckle assembly

(1). Turn the front steering knuckle and then mount the drive shaft steering knuckle laterally onto the steering knuckle wheel hub.

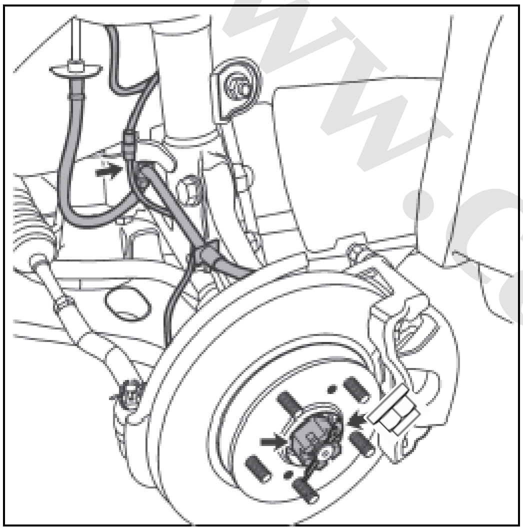


⑵ Rise front steering knock and install connecting bolts of steering knuckle and front column assembly, and install bolts and nuts, and tighten them.

Torque: 195~225 N m

Note:

Pay attention to align marks made in removal during installation.



⑶. Install the flat washer and hub nut.

Torque: 250~300 N m

△ Hint:

Step and hold the brake pedal to prevent the drive shaft from rotating when tightening the hub nut.

After tightening, be sure to align the top of hub nut to the wedge-shaped groove and strike the deformation into the groove to avoid looseness of the hub nut during the vehicle driving.

8. Re-fix the brake hose and wheel speed sensor, as well as lead to the front shock absorber bracket.

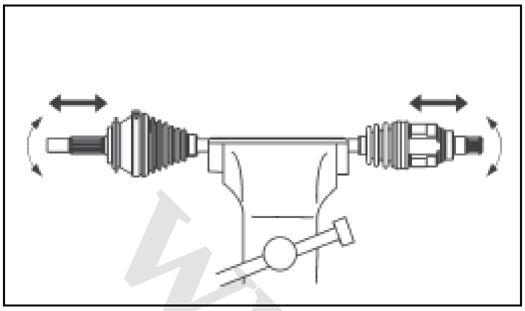
△ Hint:

Be sure to wind the oil pipe and the lead in order. No mutual interference between parts is permitted.

9. Installation of front wheels

10. Fill the transmission gear oil.

Check



1. Inspection of drive shaft

△ Hint:

If any of abnormalities below is detected, always decompose the drive shaft and then repair or replace damaged parts.

(1). Check the ball joint on the wheel side for looseness.

(2). Check the axial sliding of the ball joint on the transmission side for smoothness or seizure.

(3). Check the ball joint on the transmission side for oversized radial clearance.

(4). Check the dust boot for damage.

Note:

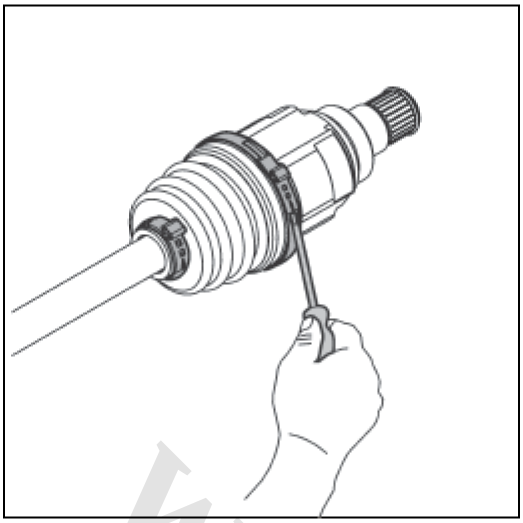
Keep the drive shaft assembly in level in the process of inspection.

Inspection of drive shaft length

Length of left drive shaft: 654±3mm

Length of right drive shaft: 988±3mm

Decompose and assemble

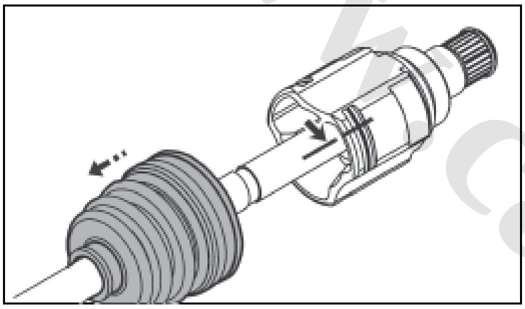


1. Detach TJ87 constant speed universal joint assembly on transmission side.

(1). Use screwdriver to pry no ear and no step clamp on 2 sides of sealing cover on sliding side of drive shaft.

Note:

After the clamps are removed, they must be replaced; do not damage seal cover in the process of removal.



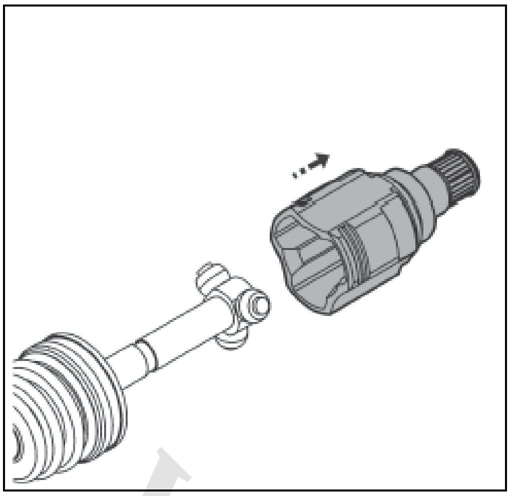
(2). Pull out the sealing cover from the TJ87 CVJ housing and move it towards the middle of the drive shaft.

(3) Wipe off the grease inside the TJ87 CVJ with cloth or paper towel.

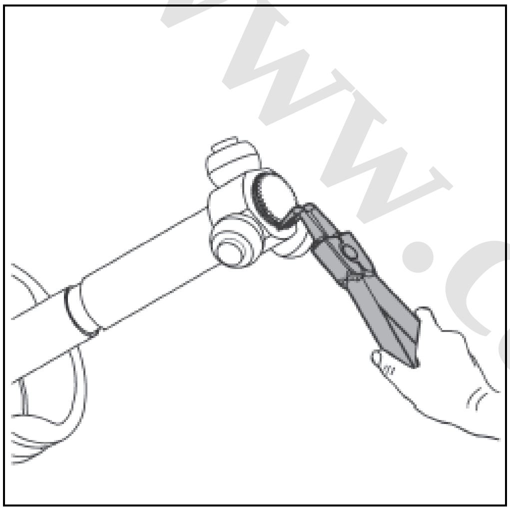
(4). Make an assembly mark on TJ87 constant speed universal joint housing on transmission side and drive shaft.

Note:

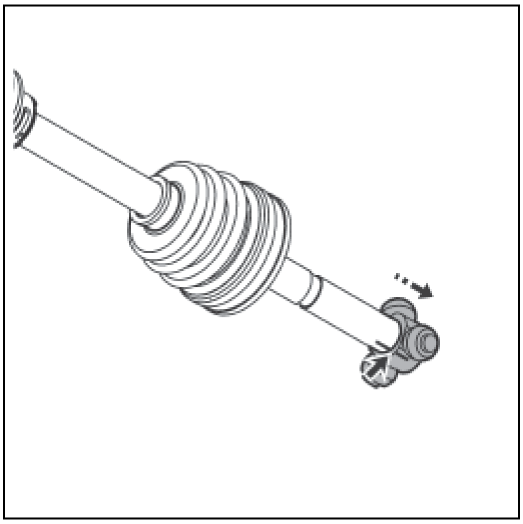
Do not use a punching pin or engraving tool to make the mark. Marking pen can be used to make a mark.



⑸. Remove the TJ87 CVJ from the inside ball joint assembly.



⑹. Remove the retainer ring for shaft from the inside ball joint of the drive shaft with the circlip pliers.



⑺. Mark the trigonocephalia ball joint assembly to provide ease of installation.

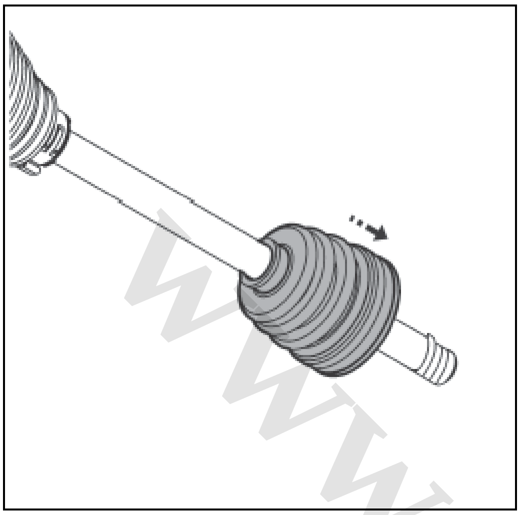
Note:

Do not use a punching pin or engraving tool to make the mark. Marking pen can be used to make a mark.

⑻. Knock off the trigonocephalia ball joint assembly from the drive shaft with the copper bar or the rubber hammer.

Note:

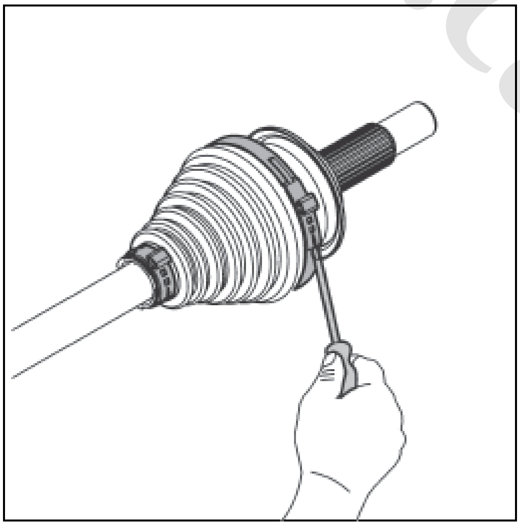
Do not tap the roller in the process of removal.



⑼. Remove the TJ87 CVJ sealing cover from the drive shaft.

Note:

When removing, wrap the spline with the rubber tape to prevent the sealing cover from being damaged.

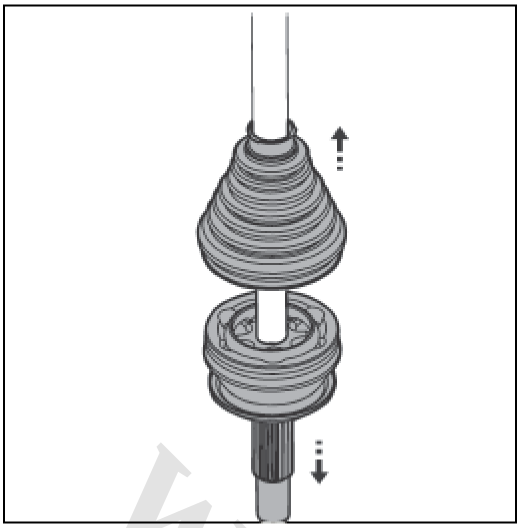


2. Disassembling the BJ87 CVJ assembly on the wheel side.

⑴. Loosen the single-ear stepless clamps on both sides of the sealing cover of the fixed end with the screwdriver.

Note:

After the clamps are removed, they must be replaced; do not damage seal cover in the process of removal.

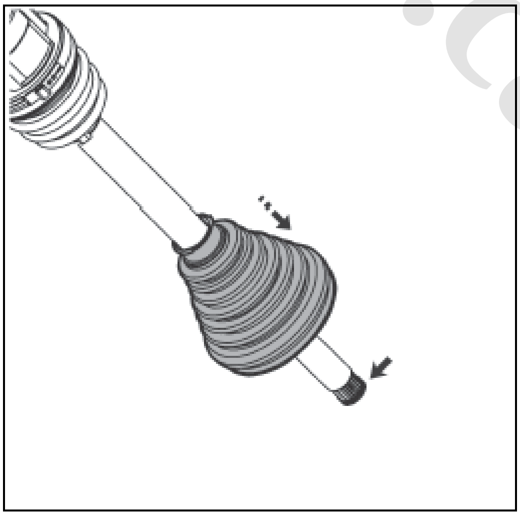


(2). Pull out the sealing cover from the BJ87 CVJ assembly and move the sealing cover towards the middle of the drive shaft.

(3). Pull out the BJ87 velocity universal joint assembly from the drive shaft on the wheel side.

△ Hint:

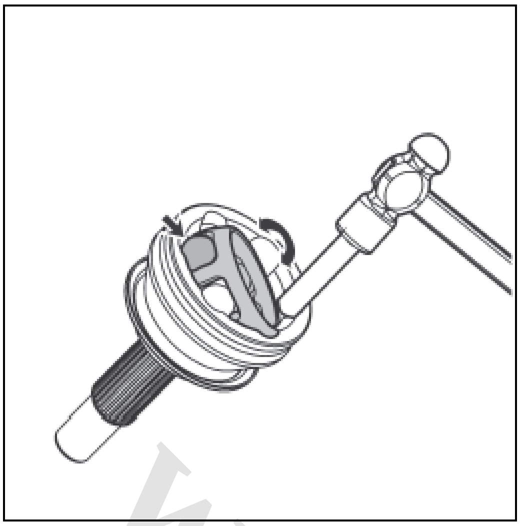
Use a table vice to fix drive shaft, and use rubber hammer or copper bar to strike BJ87 constant speed universal joint assembly out vertically.



(4). Remove the steel retainer ring and the sealing cover on the fixed end of the drive shaft.

Note:

When removing, wrap the spline with the rubber tape to prevent the sealing cover from being damaged.

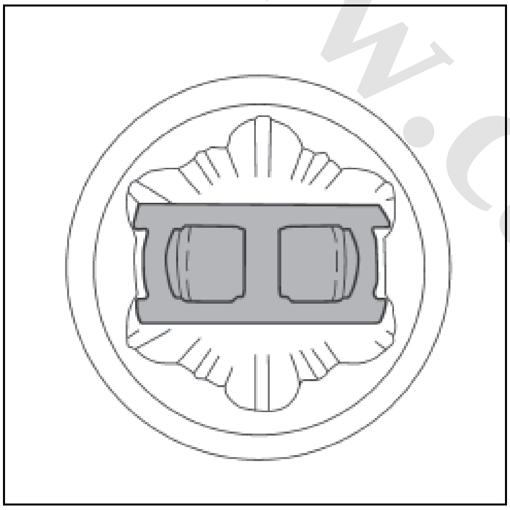


⑸. Tap the CVJ rolling bearing spacer to tilt it with the copper bar and hammer.

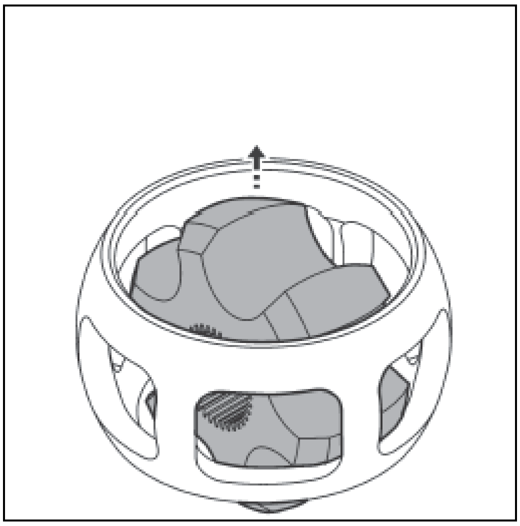
⑹. When spacer of roller bearing of constant speed universal it tilt, take the first steel ball.

⑺. Tilt spacer of roller bearing of constant speed universal in reversing direction, and take out corresponding steel ball.

⑻. Remove each ball bearing one by one according to this method.



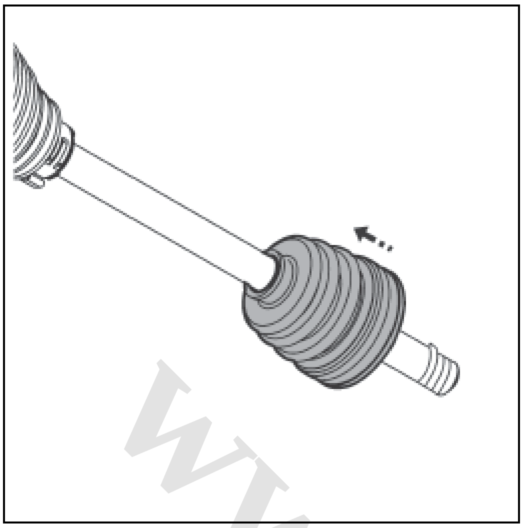
⑼. Rotate the CVJ rolling bearing spacer and inner race ball track to a certain angle to remove it.



⑽. Remove the inner race ball track from the CVJ rolling bearing spacer.

⑾. Clean the disassembled parts. Clean the traces of used grease and contaminants and dry all the parts.

⑿. Inspect whether each part of constant speed universal joint assembly has abnormal abrasion, breaking or damage. If any, replace the parts.



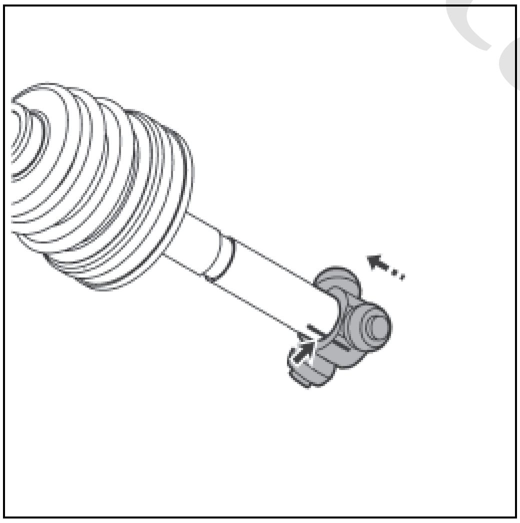
3. Assembly T J87 constant speed universal joint assembly on transmission side.

(1). Wrap the splines on the drive shaft with adhesive tape to avoid damage to the dust boot. Install the sealing cover on the sliding end onto the shaft.

Note:

Do not reuse seal cover clamps.

After installation, remove rubber adhesive around the spline of drive shaft.

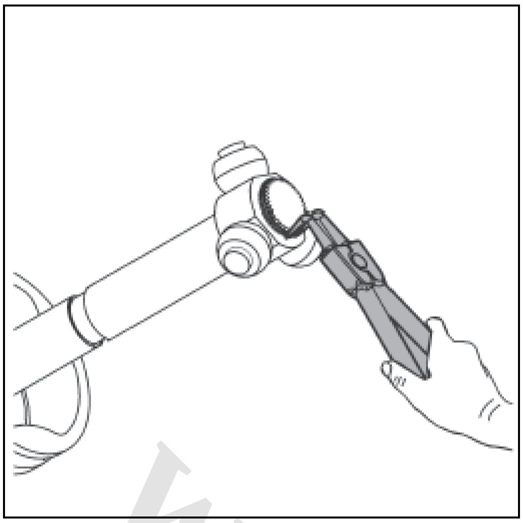


(2). Install the trigonocephalia ball joint assembly by aligning its mark.

Note:

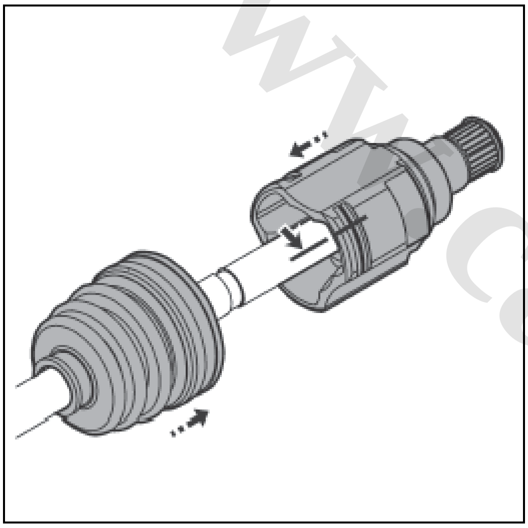
Use copper bar or rubber hammer to install three-pin ball joint assembly.

Make sure that three-pin ball joint is installed to proper position.



(3). Install the retainer ring for shaft onto the inside ball joint of the drive shaft.

(4). Coat the ball joint assembly with grease.



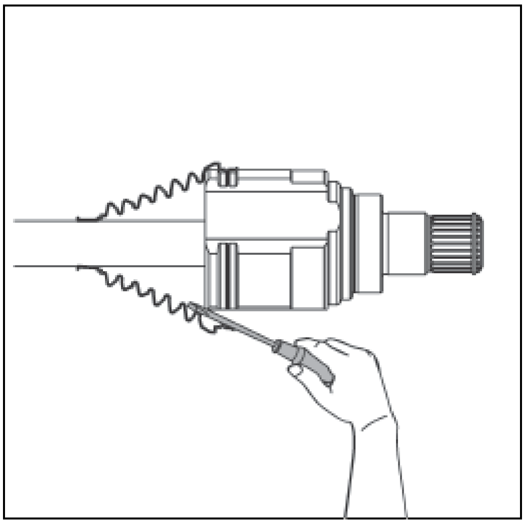
(5). Install the TJ87 CVJ of the drive shaft on the transmission side by aligning its mark.

(6). Fill the right amount of grease.

(7). Install the sealing cover on the sliding end on the CVJ.

Note:

If grease sticks to the seal cover fitting surface, the seal cover might fall off and therefore all grease should be cleaned off.

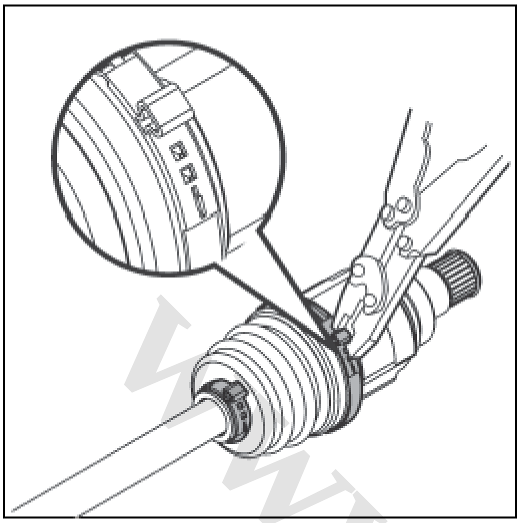


(8). Insert the flat end screwdriver from the side with large diameter of the sliding end seal cover and release air inside; adjust mounting length of seal cover and avoid deformation of seal cover.

Note:

If sealing cover is too long, it may cause damage of sealing cover.

Take care to use the screwdriver to avoid damage to the sealing cover.

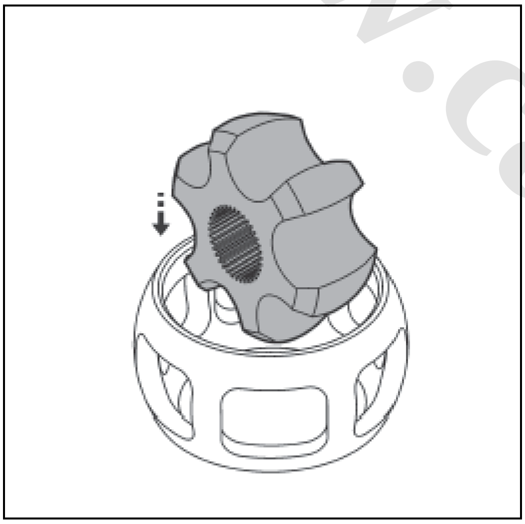


⑼. Install the new sealing cover clamp.

⑽. Tighten the new sealing cover clamp with the special tools.

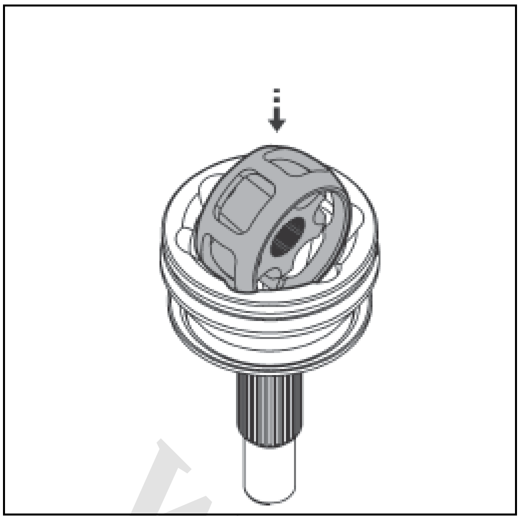
Note:

Do not reuse seal cover clamps.



4. Wheel-side BJ87 CVJ assembly

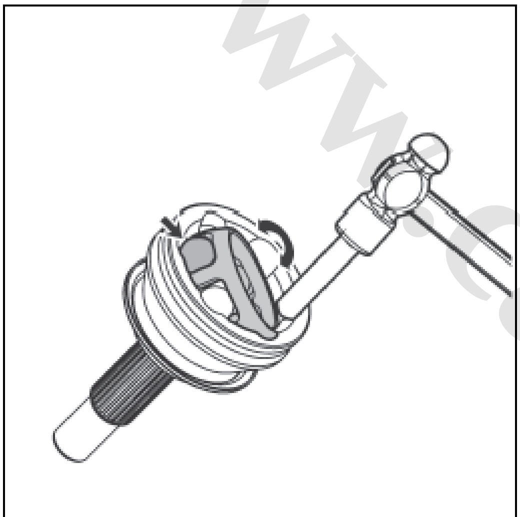
⑴. Install the inner race rolling track into the rolling bearing spacer by making a proper angle of the inner race rolling track with the rolling bearing spacer.



⑵. Rotate the rolling bearing spacer and the inner race rolling track to a proper angle to install them into the CVJ.

Note:

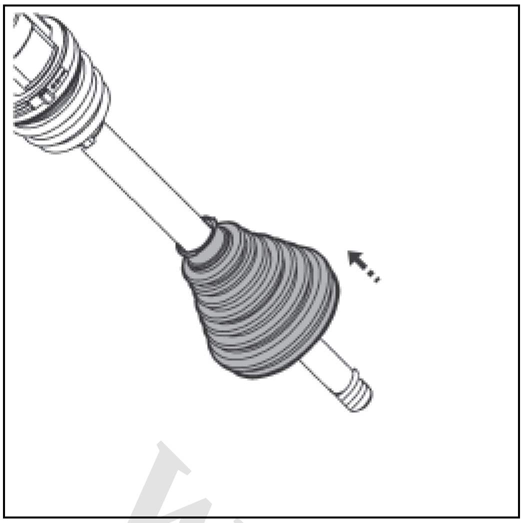
Make sure that fixed ring of inner seat ring rail points to drive shaft rod.



⑶ Install the first steel ball, and then tilt spacer of roller bearing of universal joint in reversing direction, and install pairly steel balls.

⑷. Install each ball bearing one by one by following this method.

⑸. Smear a proper amount of grease on the jagged holes of universal joint subassembly until grease starts flowing out from the circular groove and the jagged holes. After smearing grease, clean off overflowing grease by a cloth.

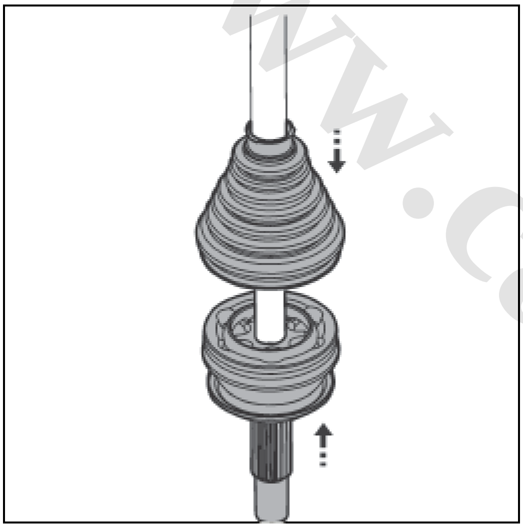


(6). Wrap the splines on the drive shaft with adhesive tape to avoid damage to the sealing cover. Install the sealing cover on the fixed end onto the shaft.

Note:

Do not reuse seal cover clamps.

After installation, remove rubber adhesive around the spline of drive shaft.



(7). Install the steel retainer ring on the fixed end onto the drive shaft to place the BJ87 CVJ vertically. Insert the shaft into the BJ87 CVJ center hole until up to the extreme position.

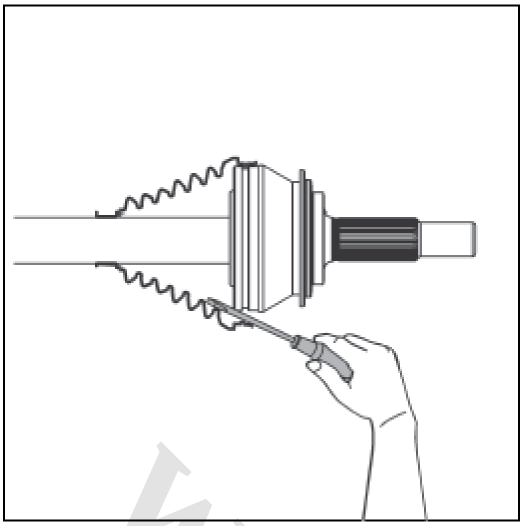
△ Hint:

Confirm that the universal joint subassembly is correctly engaged in rotating the driver shaft.

(8). Add a proper amount of lubricant into the sealing cover evenly from the side of large diameter of the sealing cover on the fixed end.

Note:

If grease sticks to the seal cover fitting surface, the seal cover might fall off and therefore all grease should be cleaned off.

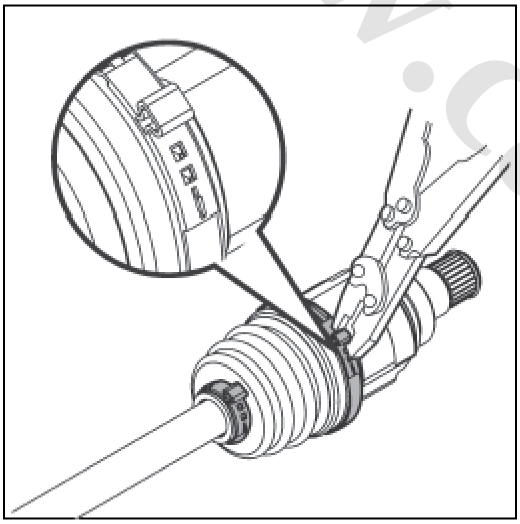


⑼. Insert the flat end screwdriver from the side with large diameter of the sliding end seal cover and release air inside; adjust mounting length of seal cover and avoid deformation of seal cover.

Note:

If sealing cover is too long, it may cause damage of sealing cover.

Take care to use the screwdriver to avoid damage to the sealing cover.



⑽. Install the new sealing cover clamp.

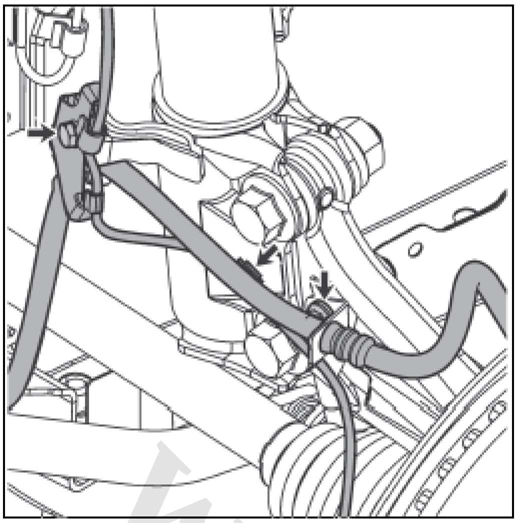
⑾. Tighten the new sealing cover clamp with the special tools.

Note:

Do not reuse seal cover clamps.

Sealing Cover of Drive Shaft

Replace



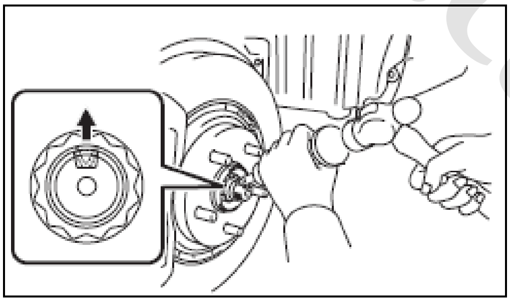
1. Replacement of sealing cover on the fixed end of the drive shaft

(1). Lift the vehicle and remove the front wheels.

(2). Remove the brake oil pipe and wheel speed sensor, lead bolts.

△ Note:

Just remove the brake hose and wheel-speed sensor as well as the lead from the front suspension and steering knuckle instead of disconnecting.

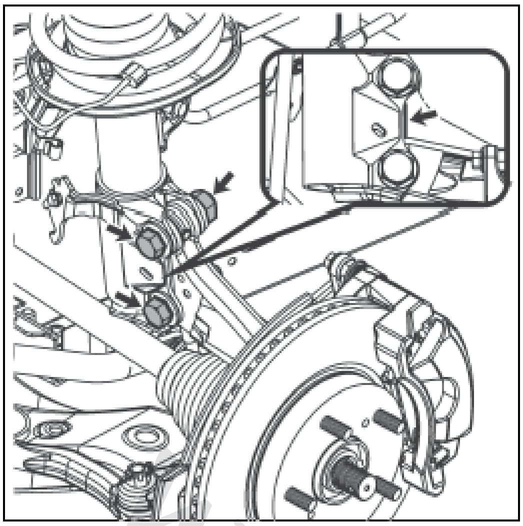


(3) Restore the deformation of the top of hub nut at the wedge-shaped groove with a hammer and thimble .

(4) Unscrew the hub nut with the hexagon socket and airgun.

△ Hint:

Step and hold the brake pedal to prevent the drive shaft from rotating while turning the hub nut.



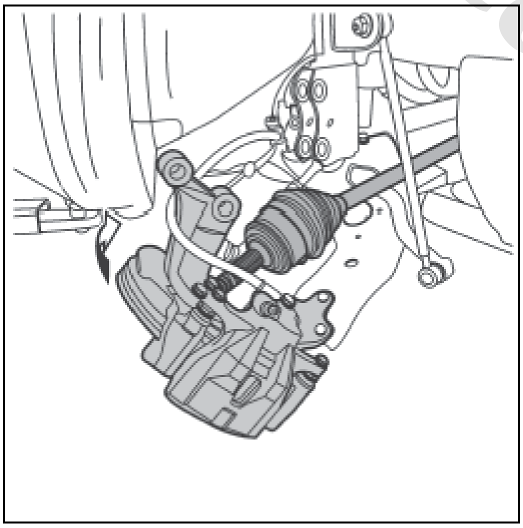
(5) Make marks on the shock absorbers.

△ Hint:

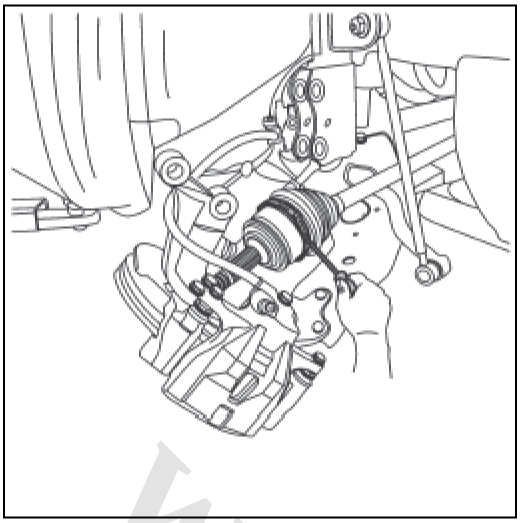
Be sure to mark the bolts when removing them so that you can re-install them based on the marks without four-wheel alignment. Without the marks, you must do four-wheel alignment after installation in place.

(6) Remove the front shock absorbers and steering knuckle bolts.

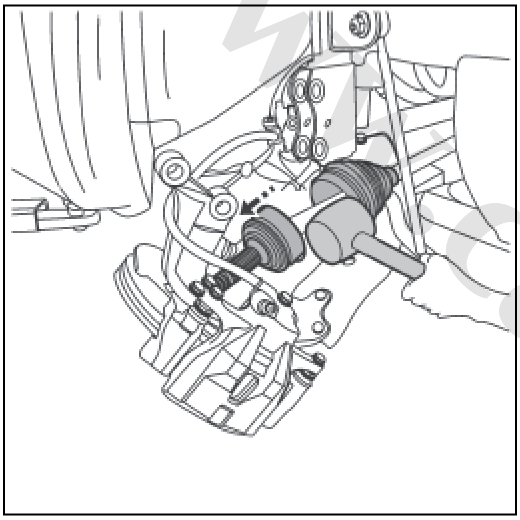
After dismantling lower locknut, slightly rise up front brake with steering knuckle assembly and unplug bolts.



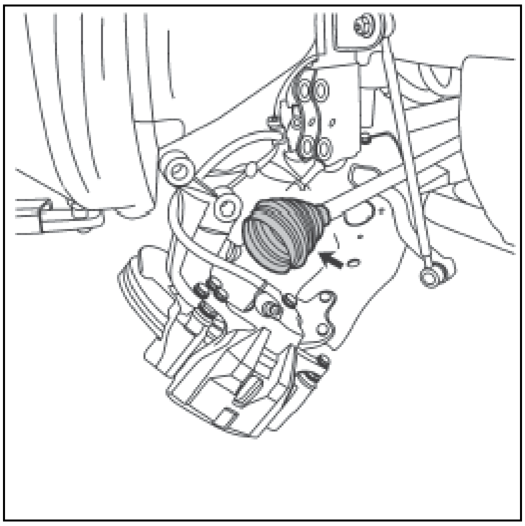
(7). Turn the front brake with steering knuckle assembly to a certain angle to pull out the drive shaft from the knuckle hub.



⑻. Loosen the single-ear stepless clamps on both sides of the sealing cover of the fixed end with the screwdriver.



⑼. Remove the wheel-side BJ87 CVJ assembly.



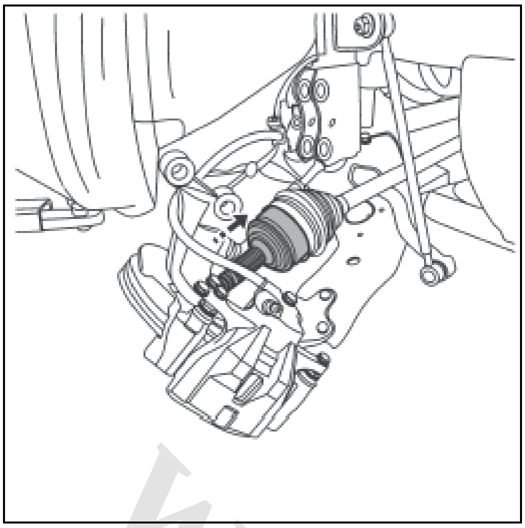
⑽. Remove the sealing cover on the fixed end of the drive shaft.

⑾. Wrap the shaft splines with adhesive tape to avoid damage to the sealing cover.

⑿. Install the new sealing cover onto the drive shaft.

Note:

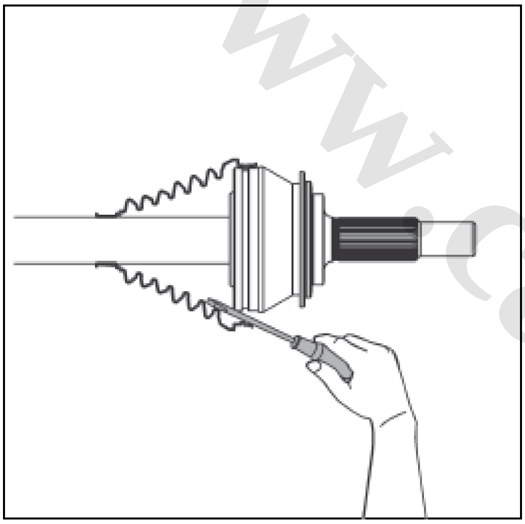
After installation, remove rubber adhesive around the spline of drive shaft.



⒀. Install the steel retainer ring on the fixed end onto the drive shaft. Insert the shaft into the BJ87 CVJ center hole until up to the extreme position.

△ Hint:

Confirm that the universal joint subassembly is correctly engaged in rotating the driver shaft.



⒁. Fix the sealing cover on the fixed end on the small diameter side with the new clamp.

⒂. Apply a proper amount of grease into the sealing cover from big diameter side of sealing cover.

Note:

If the grease sticks to the fixed face of sealing cover, the sealing cover may fall off.

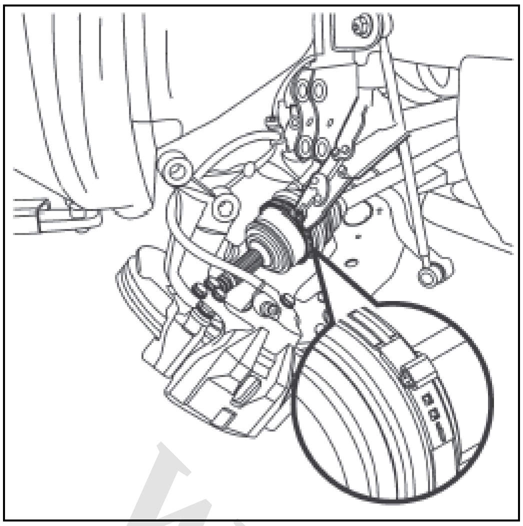
Clean all the grease from the surface of sealing cover.

⒃. Insert flat-blade screwdrivers from big diameter side of sealing cover, exhaust air, and adjust mounting length of sealing cover to avoid deformation of sealing cover.

Note:

If sealing cover is too long, it may cause damage of sealing cover.

Take care to use the screwdriver to avoid damage to the sealing cover.

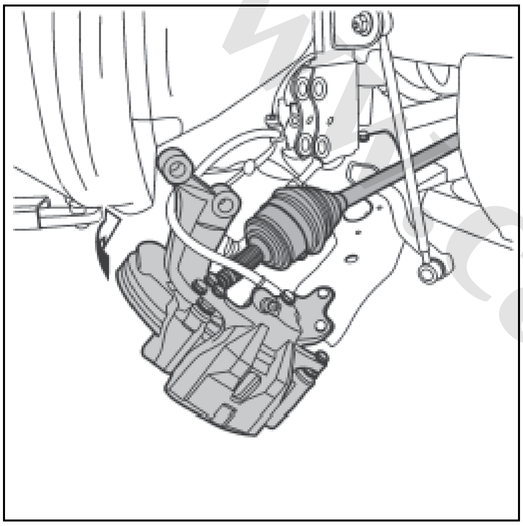


⒄. Install the new sealing cover clamp on the fixed end.

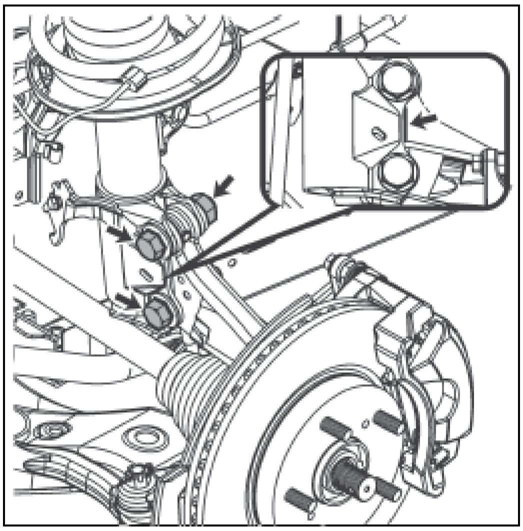
⒅. Fix the new sealing cover clamp with the special tools.

Note:

Do not reuse seal cover clamps.



⒆. Turn front steering knuckle, and install the drive shaft on the knuckle side to the steering knuckle hub.

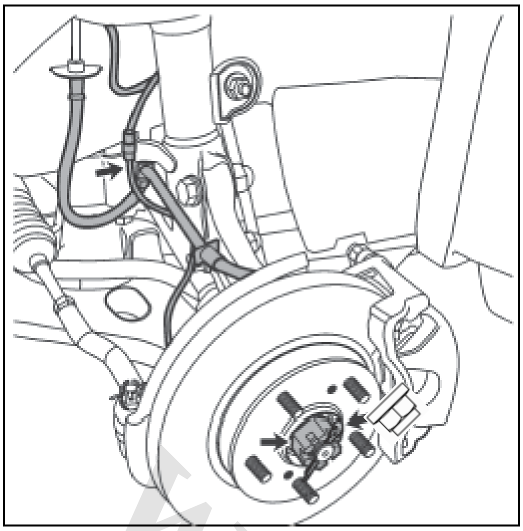


⒇ Rise front steering knock and install connecting bolts of steering knuckle and front column assembly, and install bolts and nuts, and tighten them.

Torque：195~225N·m

Note:

When installing, be sure to allow the marks made during removing to be aligned.



2. Installation of flat washer and hub nut

Torque：250~300 N·m

△ Hint:

Step and hold the brake pedal to prevent the drive shaft from rotating when tightening the hub nut.

After tightening, be sure to align the top of hub nut to the wedge-shaped groove and strike the deformation into the groove to avoid looseness of the hub nut during the vehicle driving.

3. Re-fix the brake hose and wheel speed sensor, as well as lead to the front shock absorber bracket.

△ Hint:

Be sure to wind the oil pipe and the lead in order. No mutual interference between parts is permitted.

4. Installation of front wheels

5. Replace sealing cover at sliding end of drive shaft.

△ Hint:

Replace boot at sliding end of drive shaft. It is necessary to dismantle drive shaft with its sealing cover to be replaced. Detach TJ87 constant speed universal joint assembly on transmission side of drive shaft. Replace with a new sealing cover and sealing cover clamp.

(1). Remove the drive shaft to replace the sealing cover on the sliding end. (See the Drive Shaft Assembly, Replacement)

(2). Remove the TJ87 CVJ of the drive shaft on the transmission side. (See the Drive Shaft Assembly, Disassembly and Assembly)

(3). Replace with the sealing cover and its clamp.

Note:

Do not reuse seal cover clamps.

(4). Assemble the TJ87 CVJ of the drive shaft on the transmission side. (See the Drive Shaft Assembly, Disassembly and Assembly)

(5). Installation of drive shaft assembly

Chapter V Electrical Part

Section 1 Starting System

Inspection on the vehicle

Note: Check the following items once again before operating the starter:

(1) Conditions of connectors

(2) Installation of accessories, such as anti-theft system.

A. Dismantling of the starter

(1) Remove the magnetic switch;

(2) Remove the nut and disconnect the wire of the magnetic switch terminal;

(3) Unscrew the 2 nuts used to fix the magnetic switch on the starter housing;

(4) Pull up the magnetic switch and release the plunger hook of the drive shaft while lifting the front of the magnetic switch, and then release the magnetic switch;

(5) Remove the plunger cover.

B. Removal of magnetic pole frame and armature

(1) Remove the connecting wires between the solenoid switch and the motor. Remove the nut and disconnect the wires from the terminal, with a torque of 5.9Nm;

(2) Remove the two pass-through bolts. For the 1.2kW model, with a torque of 5.9N.m;

(3) Removing the magnetic pole frame and the armature from the solenoid switch assembly;

(4) Remove the O-ring.

Assembly notes:

- Be sure to use a new O-ring;
- Be sure to align the lug of the magnetic pole frame with the concave of the solenoid switch.

C. Removal of starter housing, clutch assemble and gears

(1) Remove the two screws. Torque: 1.5N • m for 1.2kW model

1.4kW model： 5.9N•m

2.0kW model： 9.3N•m

(2) Remove the following components from the solenoid switch assembly:

Starter housing, return spring, bearing, idler pulley, clutch assembly

(3) Remove the steel balls, using the magnetic needle suck out the balls from the clutch shaft hole.

D. Removal of electric brush carrier

(1) Remove the two screws and the end cover from the pole frame.

Torque: 1.5N • m for 1.2kW model

1.4kW model： 1.5N•m

2.0kW model： 3.8N•m

(2) Remove the O-ring from the pole frame. Notes on Assembly: Be sure to use a new O-ring.

(3) Press the return spring with the screwdriver to remove the brushes from the brush carrier. Disconnect the 4 brushes and remove the brush carrier.

E. Removal of armature from pole frame

F. Armature coils

(1) Checking the commutator for continuity

Use an ohmmeter to check the two commutator segments which shall be conducted.

Replace the armature winding if either commutator segment is not conducted (see Fig. 401).

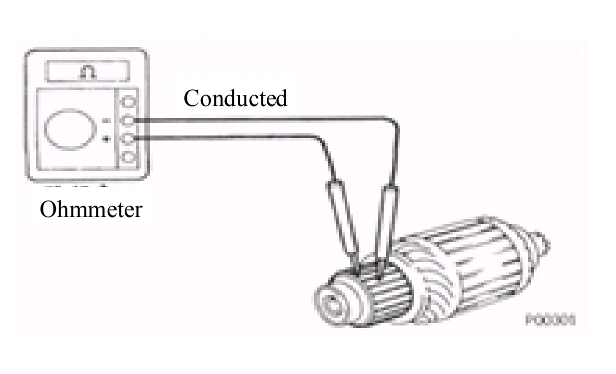


Figure 401

(2) Checking the commutator for grounding

Use an ohmmeter to check the commutator and the armature solenoid, between which there shall be no passage. Replace the armature winding if there is a passage (see Fig. 402).

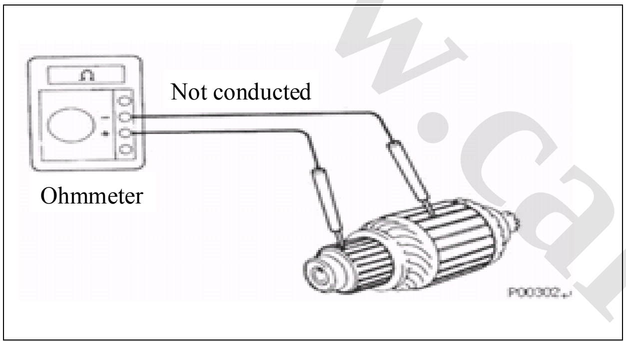


Figure 402

G. Commutator

(a) Checking the commutator for contamination and surface scorch

If any, treat the commutator with sand paper or on a lathe.

(b) Checking the commutator for tooth runout difference

(1) Place the commutator on a wooden V-shaped wedge mat.

(2) Measure the tooth runout difference with a dial gauge.

Maximum run-out of commutator ring gear: 0.05mm

Correct the run-out difference of the ring gear on a lathe if it is higher than the maximum.

c) Checking the commutator diameter

Use a dial caliper to measure the diameter of the commutator (see Fig. 403).

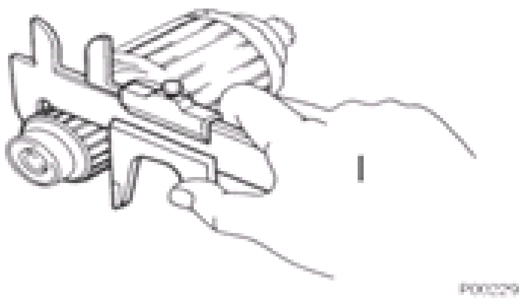


Figure 403

Minimum diameter: 30mm for 1.2kW model

30mm for 1.4kW model

35mm for 2.0kW model

Minimum diameter: 29mm for 1.2kW model

29mm for 1.4kW model

34mm for 2.0kW model

If the measured diameter less than the minimum one, replace the armature.

(d) Checking undercut depth (see figure**Figure**)

Make sure that the undercut area is clean and free of impurities and its edges are smooth.

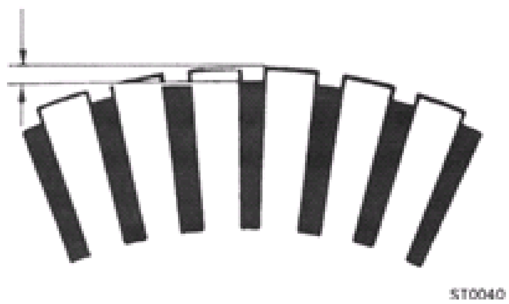


Figure 403

Standard undercut depth: 1.2kW model：0.6mm

0.6mm for 1.4kW model

0.7mm for 2.0kW model

Minimum undercut depth: 0.2mm

If the measured undercut depth less than the minimum value, correct it with a hacksaw blade.

H. Brush

Checking the brush length

1) Use a dial caliper to measure the length of the brush (see Fig. 404).

Standard length:

15.5mm for 1.2kW model

15.5mm for 1.4kW model

15.0mm for 2.0kW model

Minimum length:

10.0mm for 1.2kW model

10.0mm for 1.4kW model

9.0mm for 2.0kW model

If the measured length less than the minimum, replace the brush carrier and pole frame.

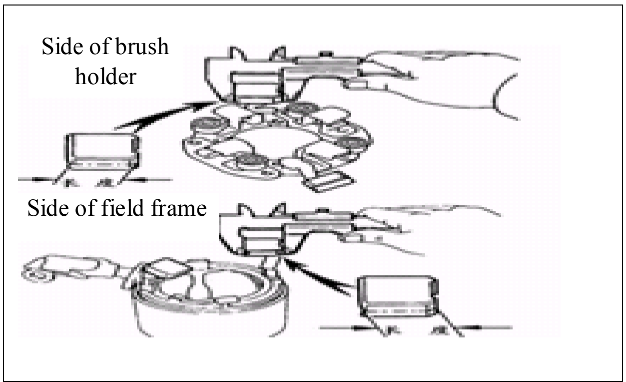


Figure 404

I. Brush spring

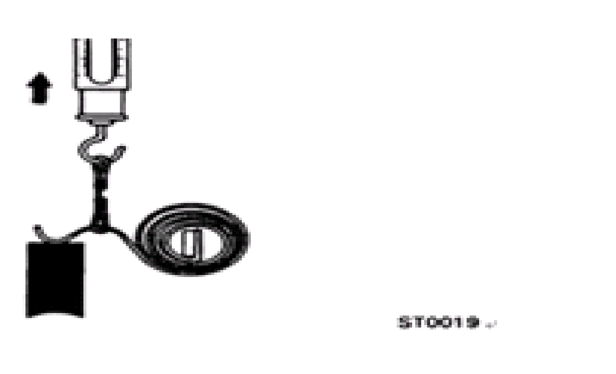


Figure 405

K. Brush carrier

Checking the brush carrier for insulation

Use an ohmmeter to check the positive pole and the negative pole of the brush holder, which shall not be conducted. Repair or replace the brush holder if the positive pole and the negative pole are conducted (see Fig. 406).

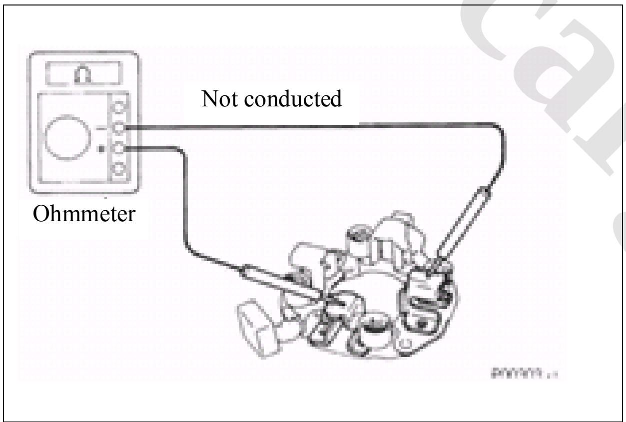


Figure 406

Clutch and gears

J. Clutch and gears

(a) Checking the gear teeth

Check the gear teeth of the planetary pinion and idler gear and the clutch assembly for wear or damage. If any damage, replace the gear or the clutch assembly. Check if the ring gear of the flywheel is damaged as well.

(b) Checking the clutch planetary pinion

Hold the starter clutch and turn the pinion clockwise to check the pinion can be free to rotate. Then try to turn the pinion counterclockwise to make sure that it cannot be rotated.

Replace the clutch assembly if necessary (see Fig. 47).

It is suggested that the whole motor assembly shall be replaced in the after-sales market.

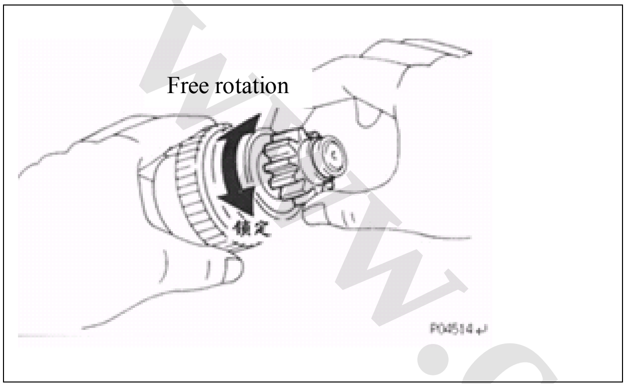


Figure 47

(c) Checking the clutch planetary pinion

Hold the starter clutch and turn the pinion clockwise to check the pinion can be free to rotate. Then try to turn the pinion counterclockwise to make sure that it cannot be rotated. Replace the clutch assembly if necessary.

Section 2 Power Supply System

Disassembly and Assembly of AC Alternator Components

Removal of AC Alternator

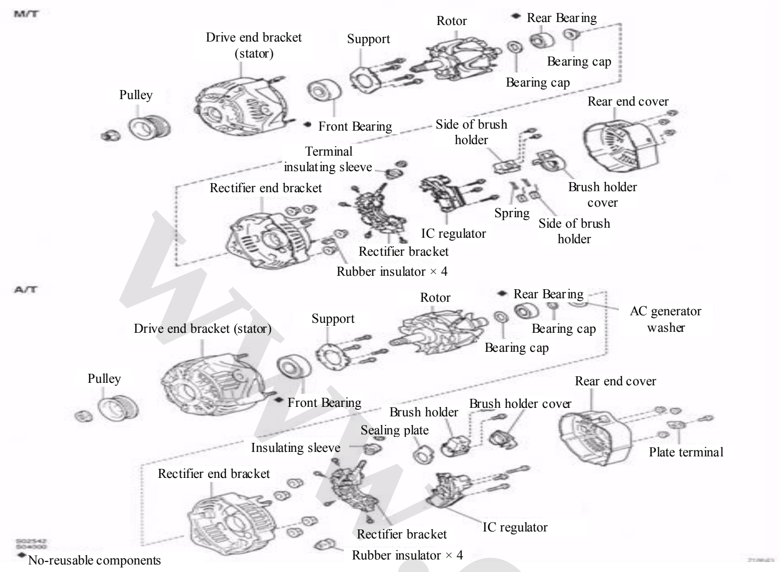


Figure 48

Removal of Rear End Cover

Remove the nuts and the terminal insulating sleeve.

M/T：Remove 3 nuts and the end cap (see Fig. 49).

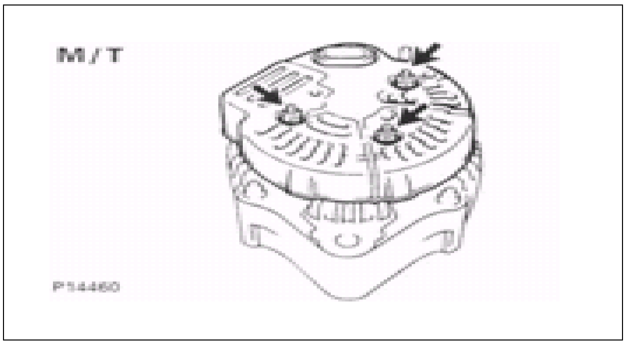


Figure 49

Removal of Brush Holder

M/T：

Remove 2 screws and the brush holder (see Fig. 410).

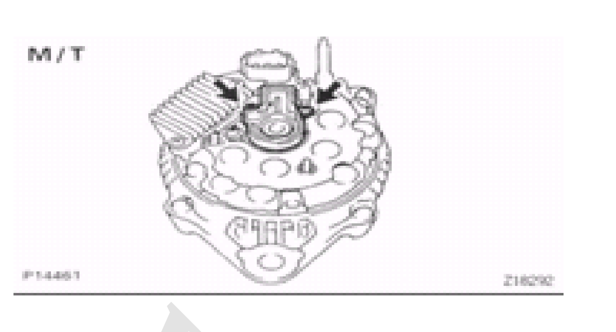


Figure 410

Remove the brush holder cover from the brush holder (see Fig. 411).

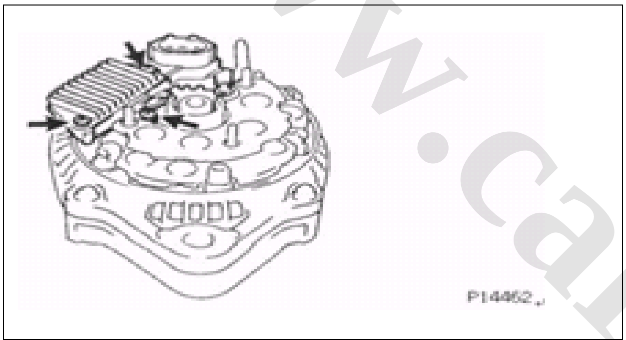


Figure 411

Removal of IC Regulator

Remove3 screws and the IC regulator (see. Fig. 412）.

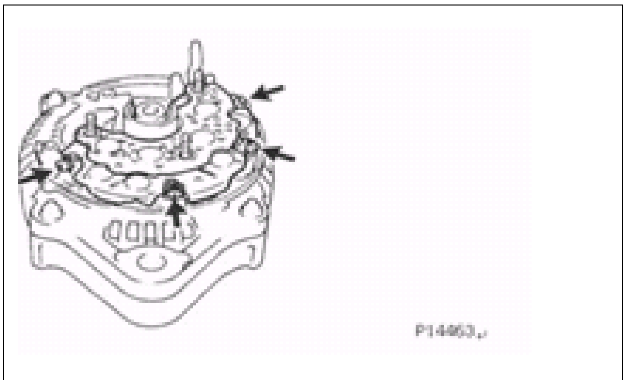


Figure 412

Removal of Rectifier Bracket

Remove 4 screws and the rectifier holder.

Remove 4 rubber insulators

Use a torque wrench to hold special tool (A) and tighten special tool (B) in a clockwise direction to the required torque (see Fig. 413).

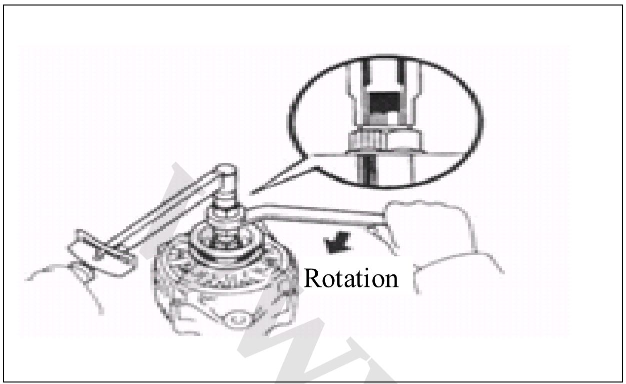


Figure 413

Torque: 39N.m

Check special tool (A) which shall be fixed on the rotor shaft tightly.

Put special tool (C) in a vise (see Fig. 414).

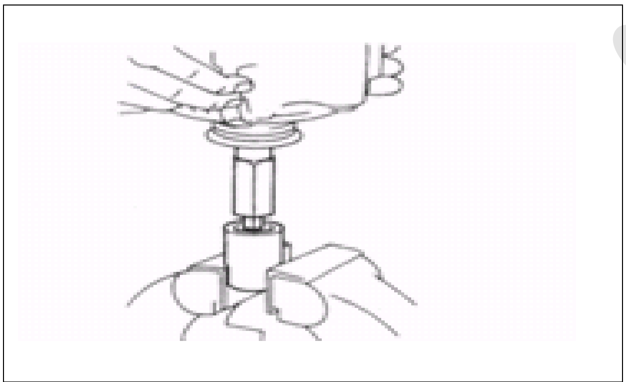


Figure 414

Install the generator to special tool (C).

Loosen the pulley nut and rotate special tool (A) as shown in the figure. (See Fig. 415)

Note: Do not loosen the pulley nut more than half a circle to avoid damaging the rotor shaft.

Remove the generator from special tool (C).

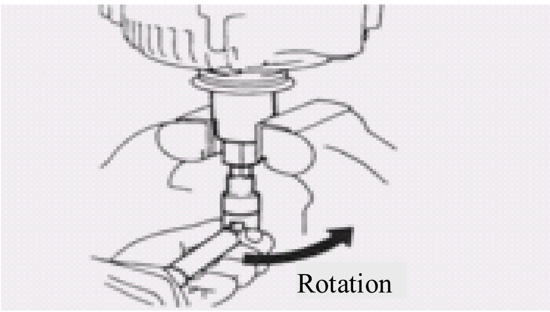


Figure 415

Rotate special tool (B) and remove special tool (A and B). (See Fig. 418-1)

Remove the pulley nut and the pulley.

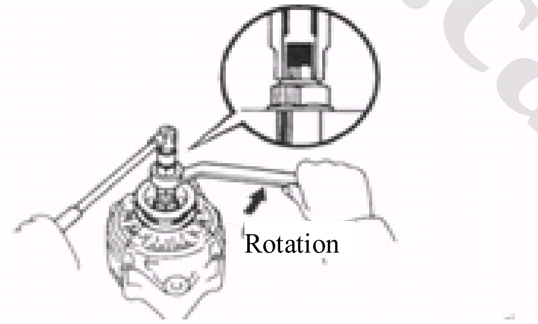


Fig. 418-1

Removal of Rectifier End Bracket

Remove 4 nuts (see Fig. 416).

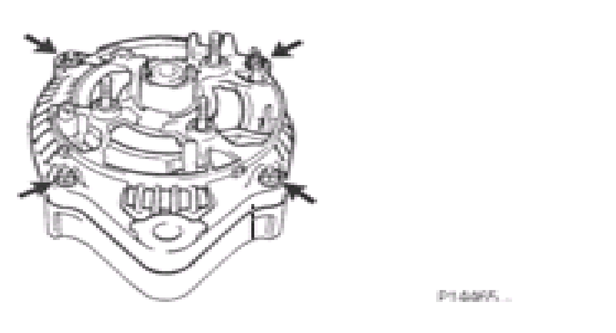


Figure 416

Remove the rectifier end bracket with a special tool (see Fig. 417).

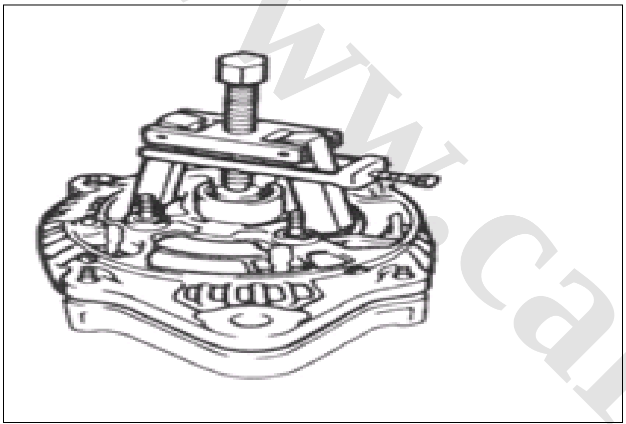


Figure 417

Remove rotor from drive end bracket.

Check and Repair of AC Alternator

Check and Repair of Rotor

Check the rotor is conducted or disconnected (see Fig 418).

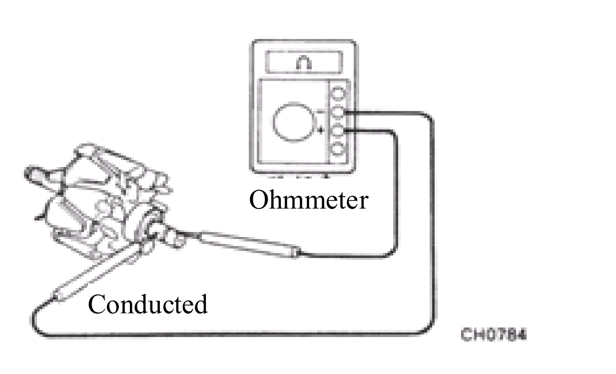


Figure 418

Use an ohmmeter to check if the slip ring is conducted.

Standard resistance (cold): 2.1-2.5Ω (M/T)

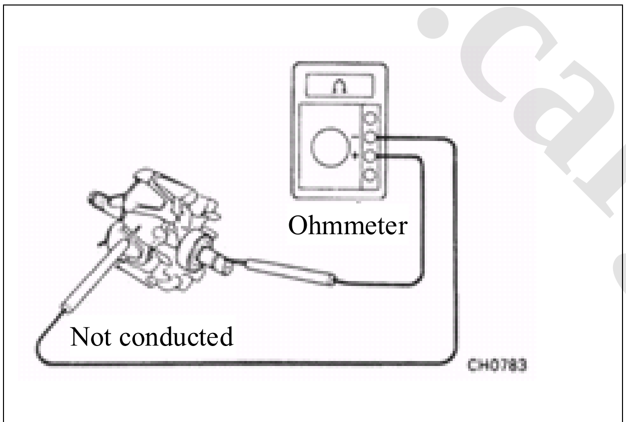


Figure 419

Replace the rotor if it is not conducted (see Fig. 419).

Check the grounding of the rotor.

Use an ohmmeter to check the slip ring and the rotor which shall not be conducted (see Fig 420).

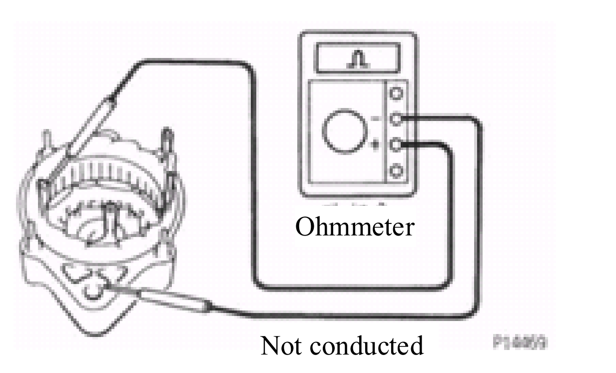


Figure 420

Replace the rotor if it is not conducted (see Fig. 421).

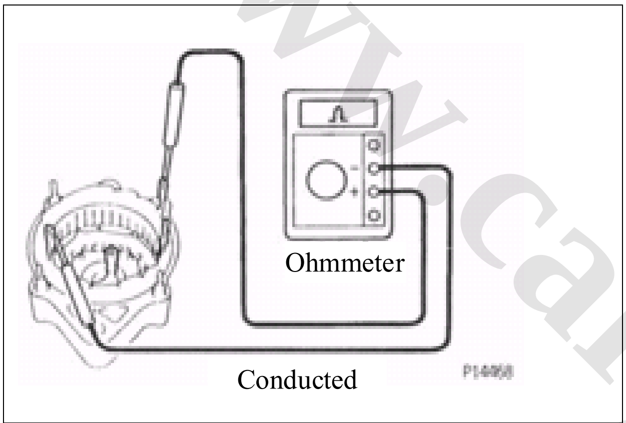


Figure 421

Check the slip ring

Check if the slip ring is rough or if there is scratch on the slip ring.

Replace the rotor if the slip ring is rough or there is scratch.

b. Measure the diameter of the slip ring with a dial caliper (see Fig. 422).

Standard diameter: 14.2-14.4mm

Minimum diameter: 14.2mm

Replace the rotor if the diameter measured is smaller than the minimum.

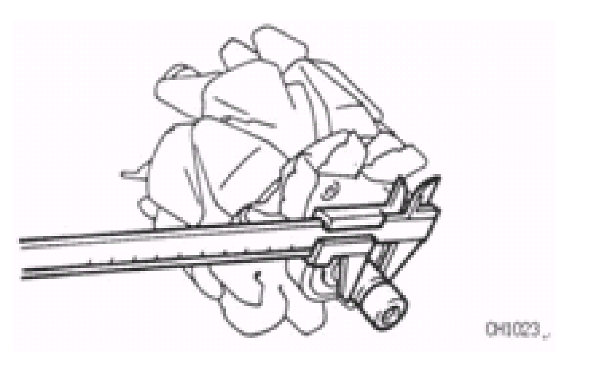


Figure 422

Check and Repair of Stator (Drive end bracket)

Check the disconnection of the stator

Use an ohmmeter to check the coil lead which shall be conducted.

Replace the drive end bracket assembly if the lead is not conducted.

Check the grounding of the rotor.

Use an ohmmeter to check the coil lead which shall be conducted.

Replace the drive end bracket assembly if the lead is not conducted.

Check and Repair of Rotor

Check the exposed length of the brush

Use a dial caliper to measure the exposed length of the brush.

Standard exposed length: 10.5mm

Minimum exposed length: 1.5mm

Replace the brush if the exposed length is smaller than the minimum (M/T).

M/T: Replace the brush if necessary.

Unsolder and remove the brush and the spring.

Pull a new brush harness through the hole of the brush holder and insert the spring and the brush.

Weld the brush on the brush holder, with the exposed length as stipulated (see Fig. 423)

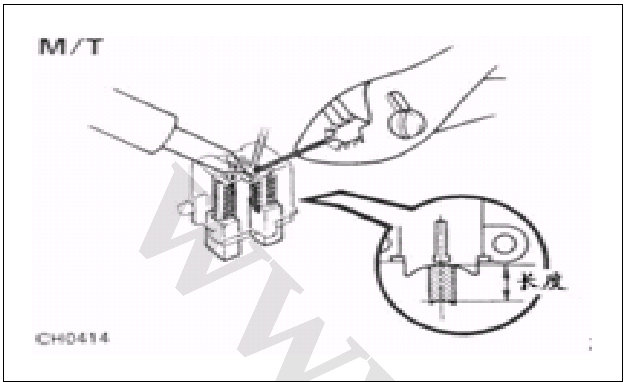


Figure 423

Harness. Exposed length: 10.5mm

Check if the brush can slide smoothly at the brush holder (see Fig. 424).

Cut unwanted harness, and apply insulating paint to the welding area.

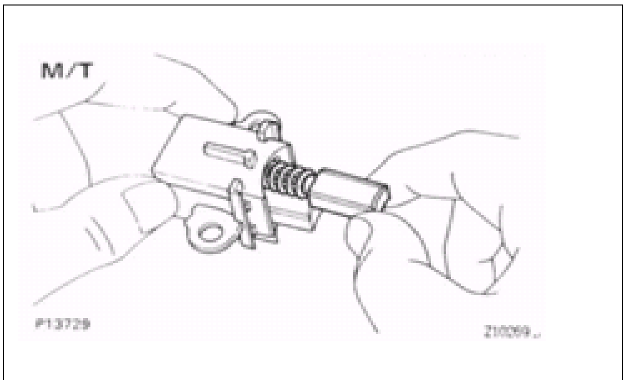


Figure 424

Check and Repair of Rectifier (Rectifier bracket)

Check the forward rectified current (see Fig. 425)

• Connect one probe of the detector of an ohmmeter to the positive pole (+) and the other probe to the terminal of each rectifier.

• Exchange the poles of the detector probes and repeat the above (a) step.

• Check the two probes of the ohmmeter, one of which shall be conducted and the other of which shall not be conducted. Replace the rectifier bracket if the conduction is not the same as the afore-mentioned.

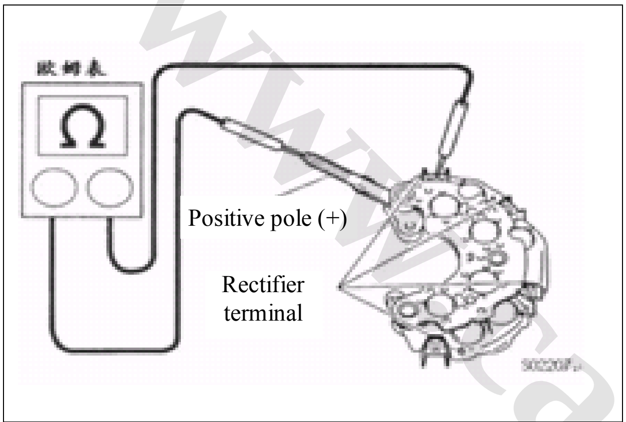


Figure 425

Check the negative pole of the rectifier (see Fig. 426).

• Connect one probe of the detector of an ohmmeter to each negative pole (-) and the other probe to the terminal of each rectifier.

• Exchange the poles of the detector probes and repeat the above (1) step.

• Check the two probes of the ohmmeter, one of which shall be conducted and the other of which shall not be conducted. Replace the rectifier if the conduction is not the same as the afore-mentioned.

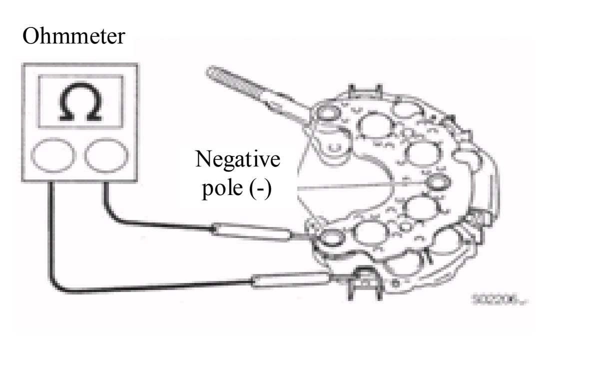


Figure 426

Check and Repair of Bearings

Check the front bearing

Check roughness or abrasion of the bearing.

Replace the front bearing if necessary.

Remove 4 screws, the bearing support and the bearing (see Fig. 427).

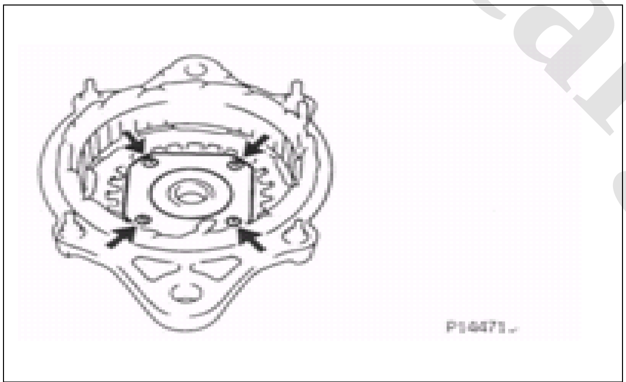


Figure 427

Use a special tool and a pressing device to force out the bearing (see Fig. 428).

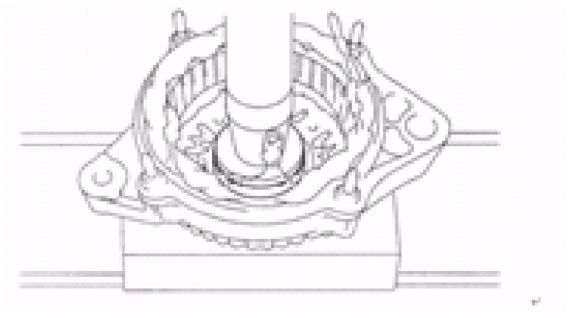


Figure 428

Use a special tool and a pressing device to press in a new bearing (see Fig. 431-1).

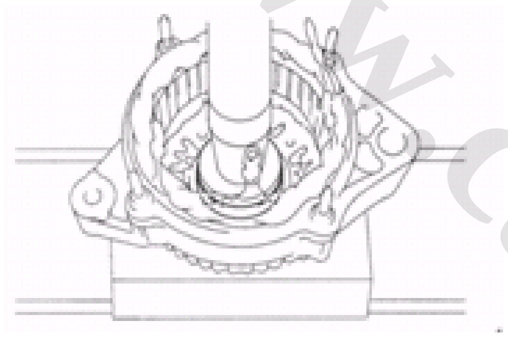


Fig. 431-1

Install the bearing support and 4 screws (see Fig. 429).

Torque: M/T: 2.6N.m

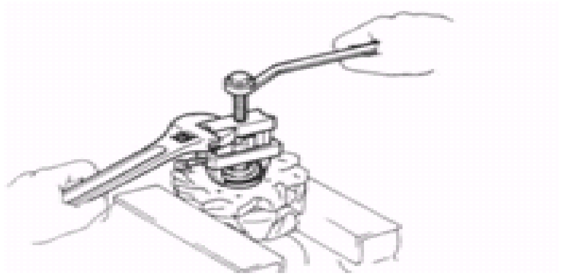


Figure 429

(3) Install the rear bearing

Check roughness or abrasion of the bearing.

Replace the rear bearing if necessary.

Remove the bearing cap and the bearing with a special tool (see Fig. 430)

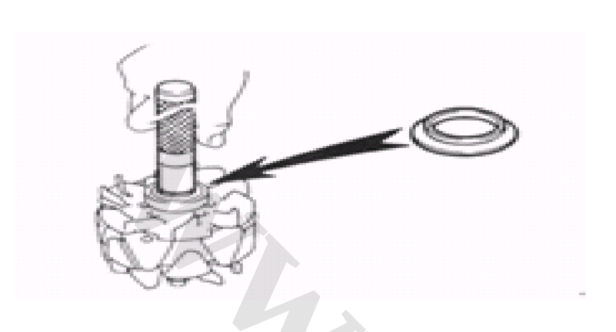


Figure 430

Note: Do not damage the fan.

• Place the bearing cap on the rotor.

• Use a special tool and a pressing device to press in a new bearing (see Fig. 431).

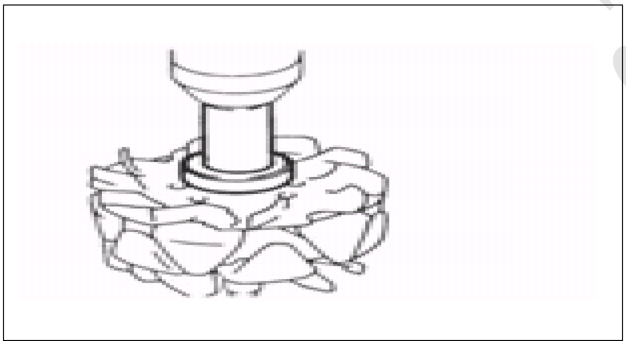


Figure 431

• Push in the bearing cap with a special tool (see Fig. 432).

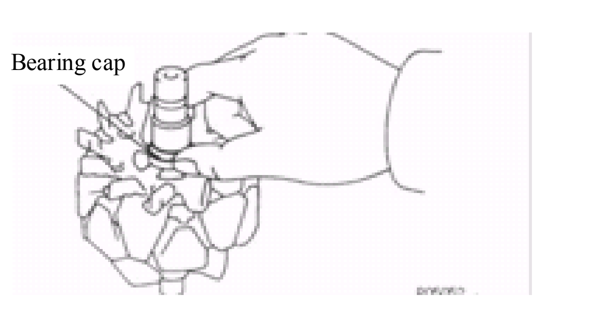


Figure 432

AC Alternator Assembly

Place the drive end bracket on the pulley (see Fig. 433)

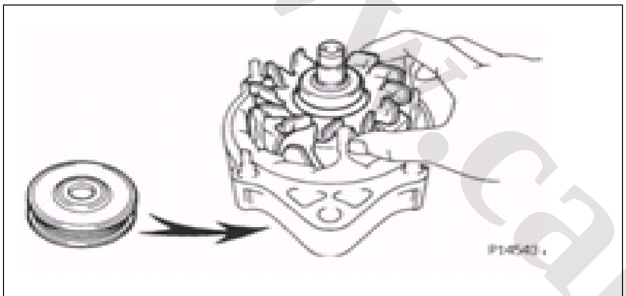


Figure 433

Install the rotor to the drive end bracket (see Fig. 434).

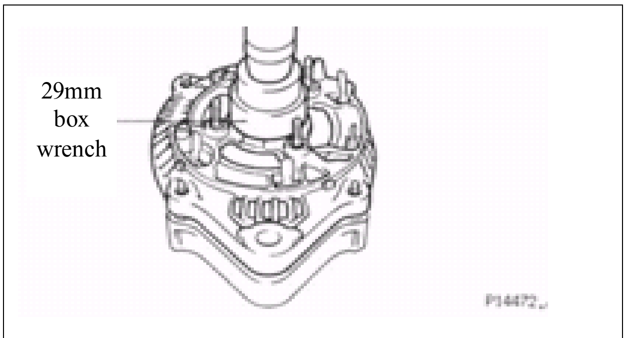


Figure 434

Install rectifier end bracket

• Use a 29-mm box wrench and a pressing device to press in the rectifier end bracket (see Fig. 435).

• Install 4 nuts.

Torque: 4.5N.m

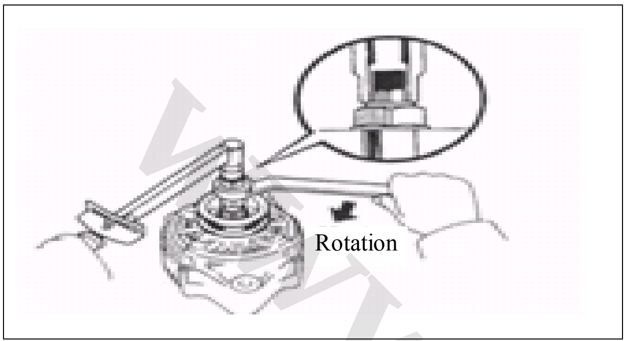


Figure 435

Install the pulley

• Manually tighten the pulley nuts and install the pulley to the stator shaft.

• Use a torque wrench to hold special tool (A) and tighten special tool (B) in a clockwise direction to the required torque (see Fig. 436).

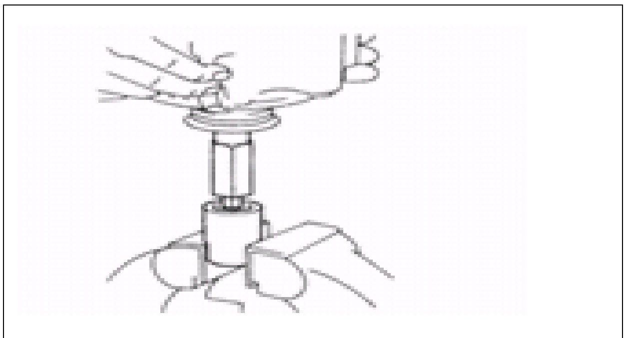


Figure 436

Torque: 39N.m

• Check special tool (A) which shall be fixed on the pulley shaft (see Fig. 437).

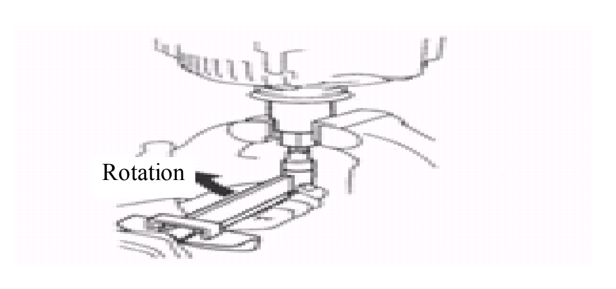


Figure 437

• Put special tool (C) in a vise

• Install the AC alternator to special tool (C).

• Rotate special tool (A) as shown in the figure and make the pulley nut turn.

Torque: 110.5N.m

Remove the AC alternator from special tool (C).

Rotate special tool (B) and remove special tool (A) with special tool (B). (See Fig. 438)

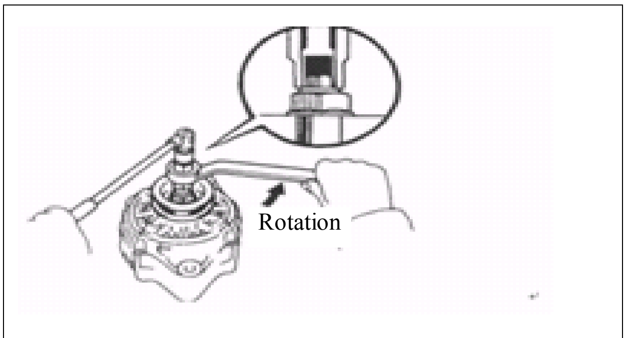


Figure 438

Install rectifier end bracket

Install 4 rubber insulators on the lead (see Fig. 439).

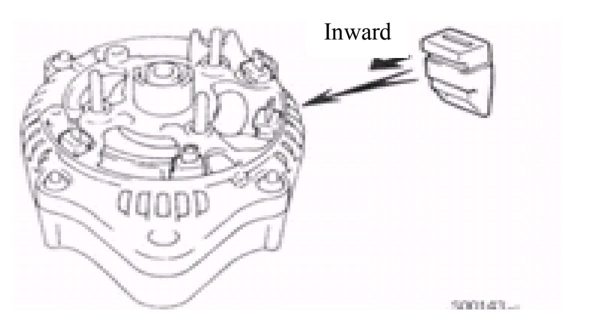


Figure 439

Note: Pay attention to the installation direction of the rubber insulators.

Install the rectifier bracket and 4 screws (see Fig. 440).

Torque: M/T: 2.0N.m

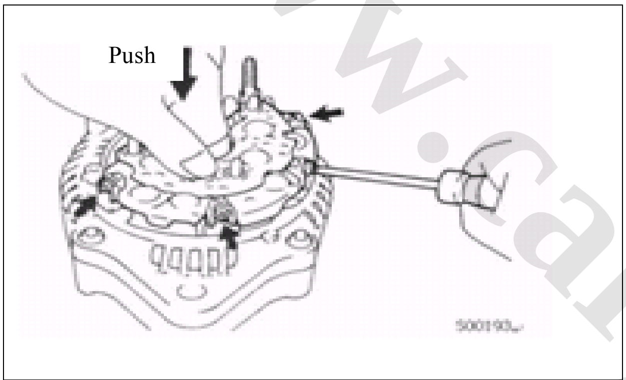


Figure 440

Install IC regulator and brush bracket.

M/T：

• Install the brush holder cover on the brush holder.

Note: Pay attention to the installation direction of the the brush holder.

• Put the IC regulator and the brush holder together horizontally (see Fig. 441).

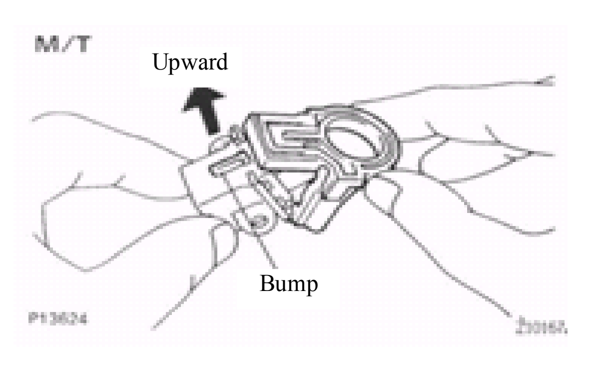


Figure 441

• Install 5 screws and make the clearance between the brush holder and the connector about 1mm (0.04in). (see Fig.442**Figure 442**)

Torque: 2.0N.m

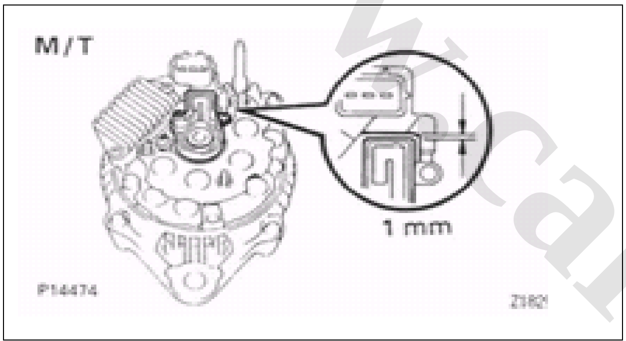


Figure 442

• Install the brush holder cover. (see Fig. 443**Figure 443**)

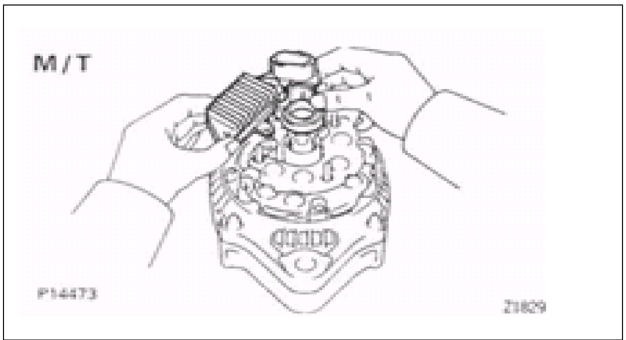


Figure 443

Install the rear end cover.

A. M/T：

Install the end cover and 3 nuts.

Torque: 4.4N.m

B. Install the terminal insulating sleeve and nuts.

Torque: 4.1N.m

Repair Specification

Repair Data

Battery	Specific gravity when at 20℃		1.25-1.29
Drive belt	Skewness	New	5-7mm
		Old	7-8mm
	Tensity	New	685-785N
		Old	295-440N
AC alternator	Rated output	M/T	12 V 7A
	Rotor coil resistance	M/T	2.1-2.5Ω
	Slip ring diameter	STD	14.2-14.4mm
		Min	12.8mm
	Exposed length of brush	STD	10.5mm
		Min	1.5mm

IC regulator	Regulating voltage	13.2-14.8V

Torque Specification

Components to be tightened	N•m
Bearing support × Drive end bracket M/T	2.6
Rectifier end bracket × Drive end bracket	4.5
AC alternator belt × Rotor	110.5
Rectifier end bracket × Brush holder — IC regulator	2.0
Rectifier bracket × Coil lead on the rectifier end bracket M/T	2.0
Rear end cover × Rectifier bracket	4.4
Plate terminal × Rectifier bracket Bolt	3.8
Terminal insulator × Rectifier bracket	4.1

Battery

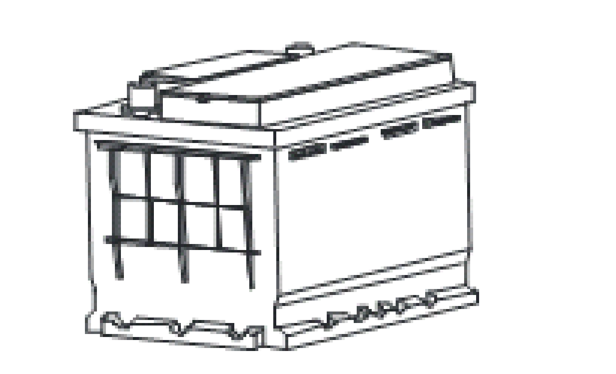


Fig. 4-59

Note:

Please use a 12V auxiliary accumulator if an auxiliary accumulator and a jumper cable are needed to start the generator.

Make sure that the battery cable is clamped to the battery electrode for good contact after the cable is connected.

How to use the battery

①: Keep the surface (especially the top) of the battery clean and dry. Electrolysis or wetness will cause the discharging of the battery.

②: Pick off the negative wire harness of the battery if the vehicle is not used during a certain period.

Note: Do not let electrolyte contact skin, eyes, textile or paintwork. Immediately wash what is contacted by electrolyte for 15 minutes and then go to see a doctor.

③: If the battery is not used for a long time and the proportion of its electrolyte is less than 1.1, there will be discharging which may result in sulfating of a single battery plate. In the primary charging process, the voltage of the sulfated battery is higher and its current is unstable, compared with those of an ordinary battery.

The battery is maintenance-free, which shall be kept in a good charging status. Note: Do battery maintenance following "Instructions" on the battery.

Power Distribution System

Replace the blown fuse with a new one only after the blowing causes are excluded.

Do use a fuse with specified specifications. Do not use the one exceed the specifications.

Do not install the fuse at a tilt and install it into the fuse box correctly.

Relay: There are normally-open, normally-closed and mixed relays.

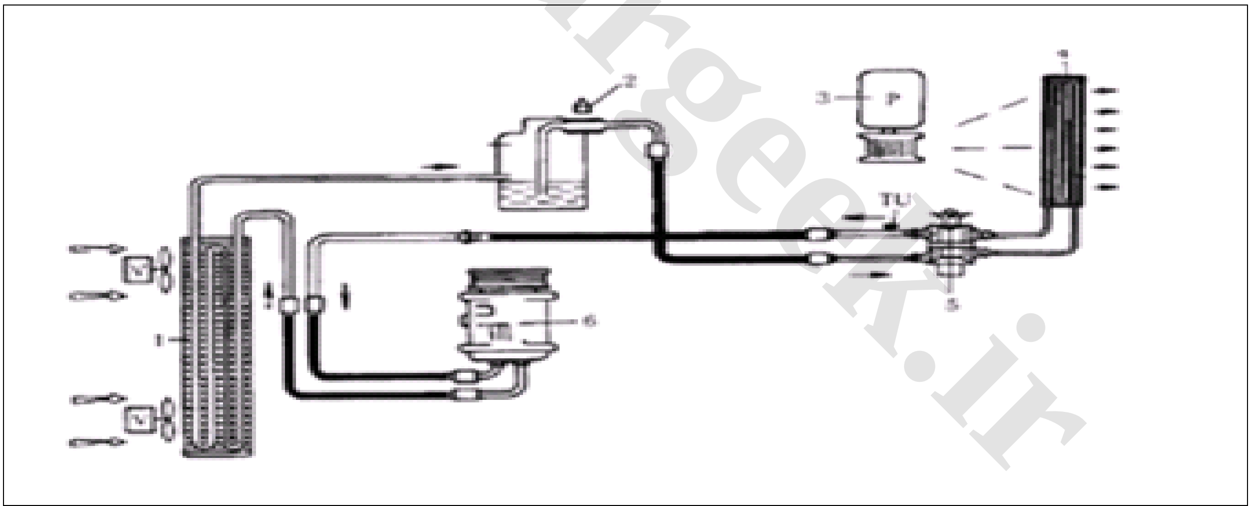
Section 3 Air Conditioning

Overview

Sedans of this series are provided with air conditioning systems with refrigeration, heating, and ventilation. The air conditioning can be used to lower the temperature inside the vehicle in summer and for heating and defrosting & demisting of windshields in winter. For the frigid-zone market, the configuration of the air conditioning system has been simplified by canceling its refrigeration system (optional). This system of a compact structure can be easily operated and equipped with complete functions.

Refrigeration Principle

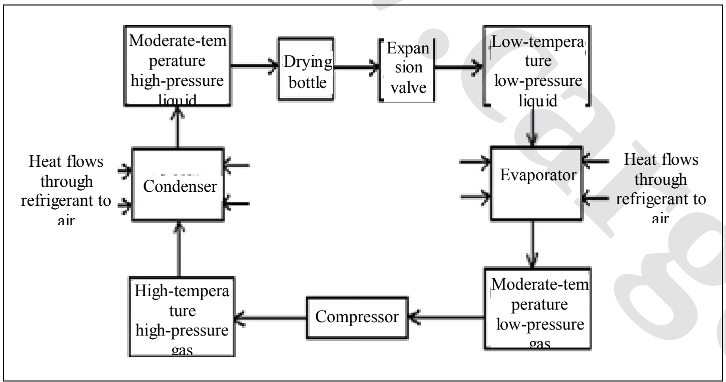
The refrigeration system consists of a compressor, evaporator, and condenser with a dry reservoir, expansion valve, blower, and control mechanism.



1-Condenser with a dry reservoir	4-Evaporator
2-Pressure switch	5-Expansion valve

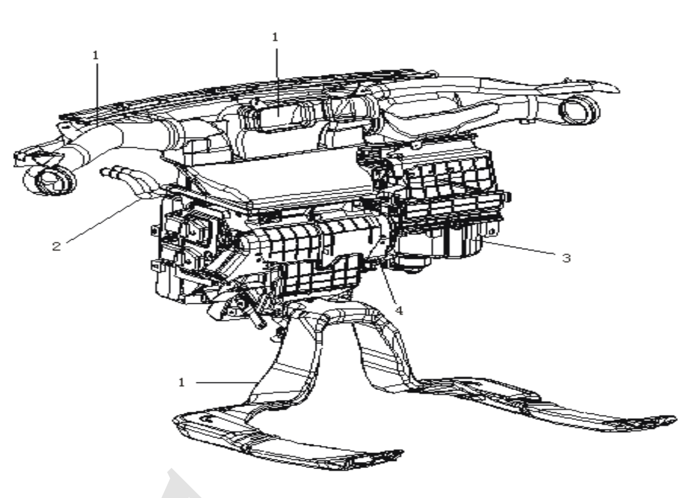
3-Blower	6-Compressor

The engine-driven compressor draws the gaseous refrigerant from the evaporator and presses it into the condenser, through which, the high-pressure gaseous refrigerant is liquefied for heat exchange (releasing heat taken away by air outside the vehicle). The high-pressure liquid refrigerant will be depressurized via the throttling of the expansion valve and then the low-pressure liquid refrigerant is gasified in the evaporator for heat exchange (absorbing heat), The cooled air nearby the evaporator is blown into the inner vehicle by the blower. and the gaseous refrigerant is carried away by the compressor and pumped into the condenser, In such a way, the refrigerant flowing in a closed circle discharges the heat inside the vehicle into the outside and lowers the temperature inside the vehicle to a suitable one.

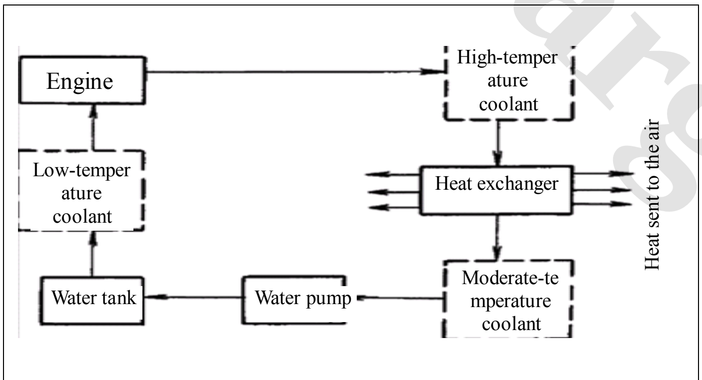


Heating Principle

The heating system adopts a water-heated method with heat source from the coolant of the engine. It mainly consists of heat exchanger, coolant pipeline, blower, air-guide duct, air duct, and control mechanism. The heater unit adopts the housing which is integrated with that of the evaporator while the blower and the air duct use the very housing of the refrigeration system.



1-Air conduit	3-Blower
2-The coolant pipeline	4--Heat exchanger



A/C Control System

The A/C control system includes power control circuit, compressor clutch control circuit, safety protection control circuit, and data communication circuit. Its components are A/C controller (electric A/C system), coolant temperature sensor, pressure switch, magnetic valve, and temperature controller. This system functions to ensure the efficient work of the A/C system in any case and the safe operation of the A/C system and the engine.

1. Refrigeration temperature control

The refrigeration temperature control is realized by the circuits related to the evaporator temperature sensor and the A/C controller. The resistance of the sensor changes with the temperature inside the evaporator, which provides the A/C controller with a voltage signal corresponding to the temperature. This signal to be amplified by the amplifying circuit inside the controller is used to control the relay of the electromagnetic clutch: along with the connection of the relay of the electromagnetic clutch, the electromagnetic clutch of the compressor is engaged, the compressor works and then the temperature drops; with the disconnection of the relay of the electromagnetic clutch, the electromagnetic clutch of the compressor is released, the compressor stops and then the temperature rises. The A/C control system controls the compressor to keep the refrigeration temperature within the pre-set scope.

2. To reduce the load under some special working conditions, the electronic injection engine also controls the compressor: the A/C compressor can stop working at the start, urgent acceleration and overspeed rotation of the engine.

3. Safety protection control

To ensure the normal operation of the system, the pressure and the temperature of the system is monitored via the pressure switch installed on the high-pressure hard pipe, which realizes the safety protection control. The safety protection control functions are as follows:

(1) Low-pressure protection: When the pressure is lower than 0.196±0.02 MPa, the pressure switch will be disconnected, the compressor clutch will be powered off and the compressor will stop.

(2) Low-pressure protection: When the pressure is lower than 3.14±0.2 MPa, the pressure switch will be disconnected, the compressor clutch will be powered off and the compressor will stop.

(3) High-pressure control: When the pressure is higher than or equals to 1.77±0.08 MPa, the pressure switch (between 2-A4 and 4-A4) will be connected to send the engine ECM a triggering signal to rotate the electronic fans at a high speed.

(4) Low-temperature protection: When the temperature sensed by the evaporator temperature sensor is lower than 3.5°C, the compressor clutch will be powered off and the compressor will stop.

(5) High-temperature protection: When the temperature sensed by the coolant temperature sensor is higher than 104℃, for overheating protection, the compressor clutch will be powered off and the compressor will stop.

4. Control for the cooling system of the engine (electronic fans) will be realized by the coolant temperature sensor, engine ECM and fan control relays-cooling fan-condensation fan, and relevant circuits. Via the relevant temperature sensors and switch signals, the engine ECM can control the circuits of the relevant fan control relays as follows:

(1) When the coolant temperature is 94℃, the engine ECM will make the 1# and 3# relays powered on and the two fan motors in series turn at a low speed simultaneously.

(2) When the coolant temperature is 98℃, the engine ECM will make the K05 and K06 relay powered on and the two electronic fans turn at a low speed.

(3) When the coolant temperature reaches 110°C, the water temperature warning lamp on the instrument cluster will light.

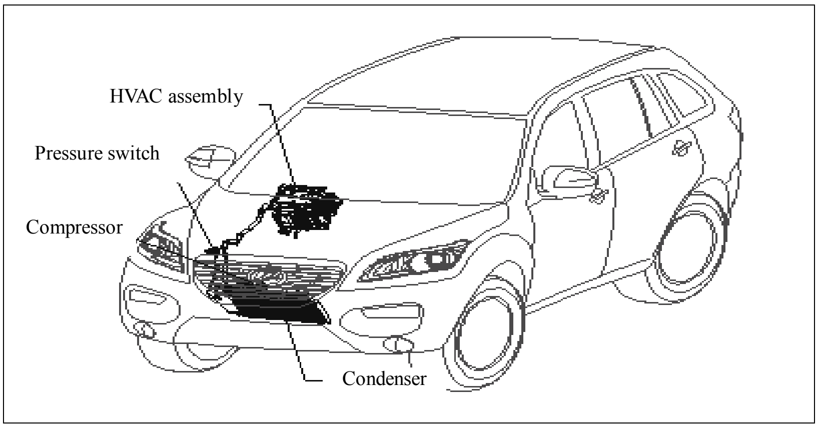
(4) After the compressor begins to work, the electronic fans will turn at a low speed no matter when the coolant temperature is high or low.

(5) When the pressure of the A/C refrigeration system is higher than or equals to 1.77±0.08MPa, the electronic fans will turn at a high speed.

(6) If the signal of the coolant temperature sensor is abnormal (the coolant temperature sensor is broken), the engine ECM will consider the engine is provided with a heavy load and make the electronic fans turn at a high speed.

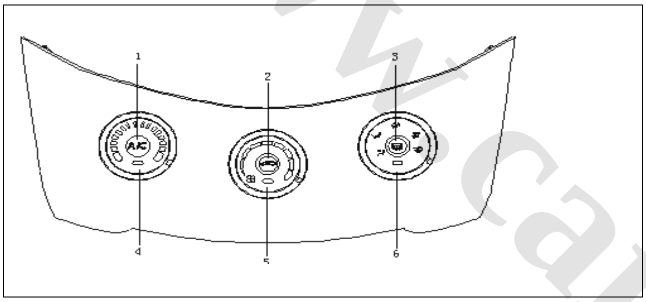
A/C System Layout

Heater - A/C electronic control system layout 1



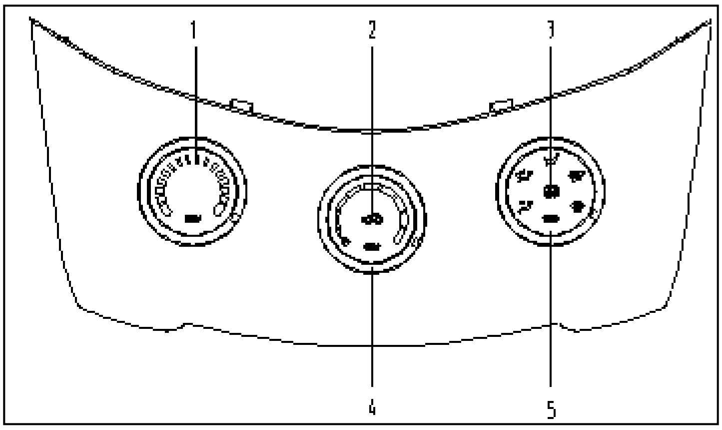
Heater - A/C electronic control system layout 2

Electronic A/C control plate



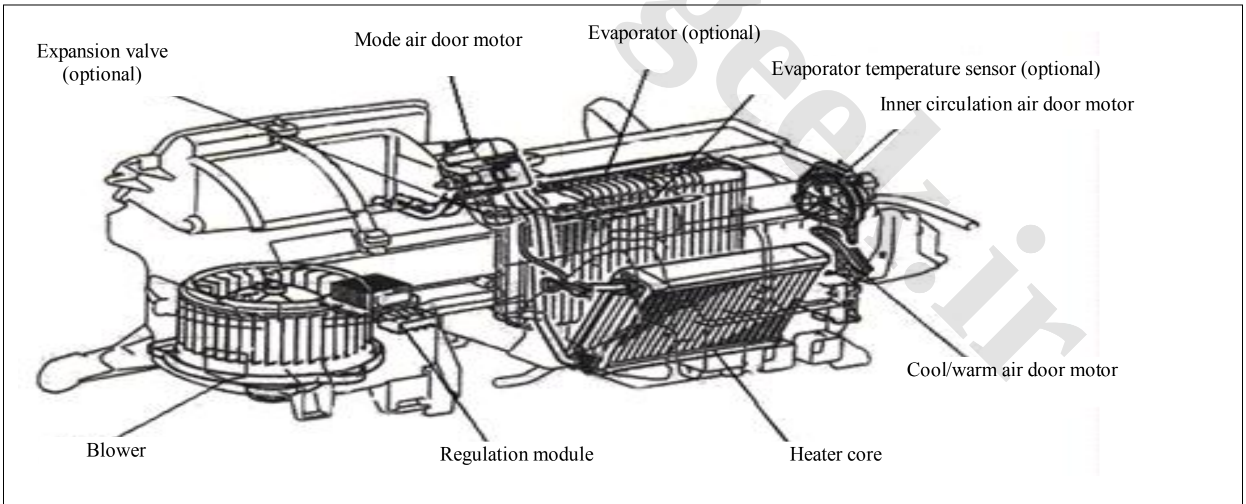
1- "A / C" switch	4-Temperature regulation knob
2 –Selector button for internal/external circulation mode	5- Air volume adjustment knob
3 - Defrosting / defogging button	6 –Selector button for air-out mode

Air conditioning control panel (optional)

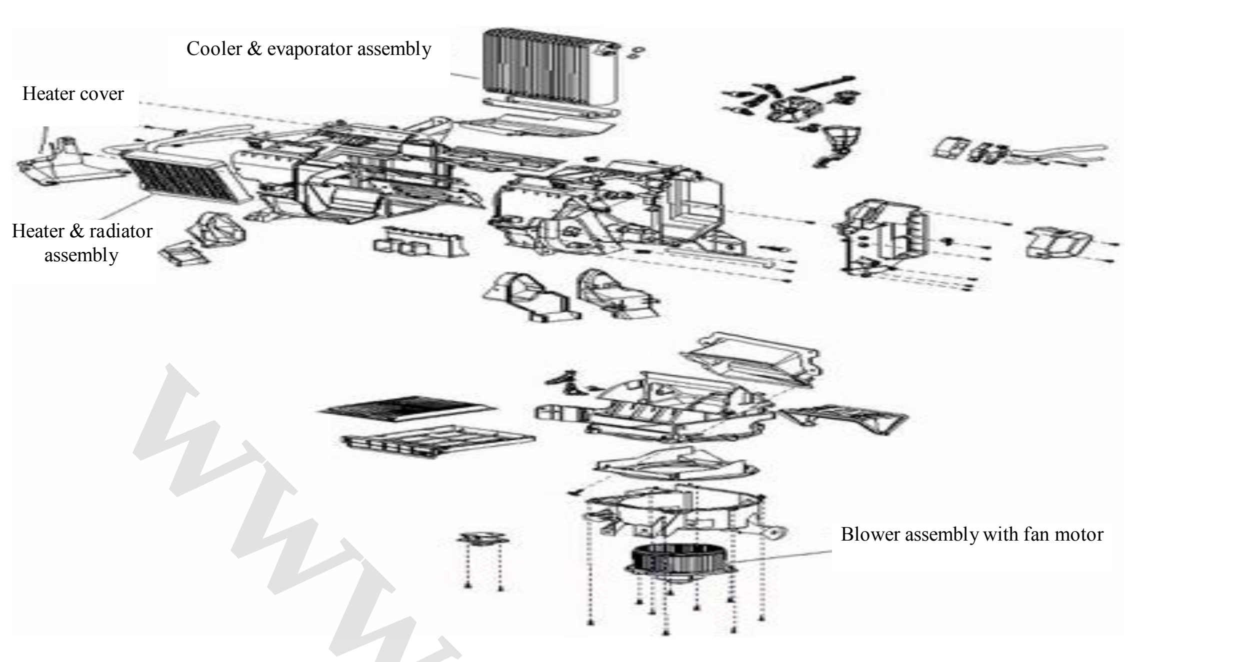


1 - Heating temperature control knob	4- Air volume adjustment knob
2 –Selector button for internal/external circulation mode	5 –Selector button for air-out mode
3 - Defrosting / defogging button	

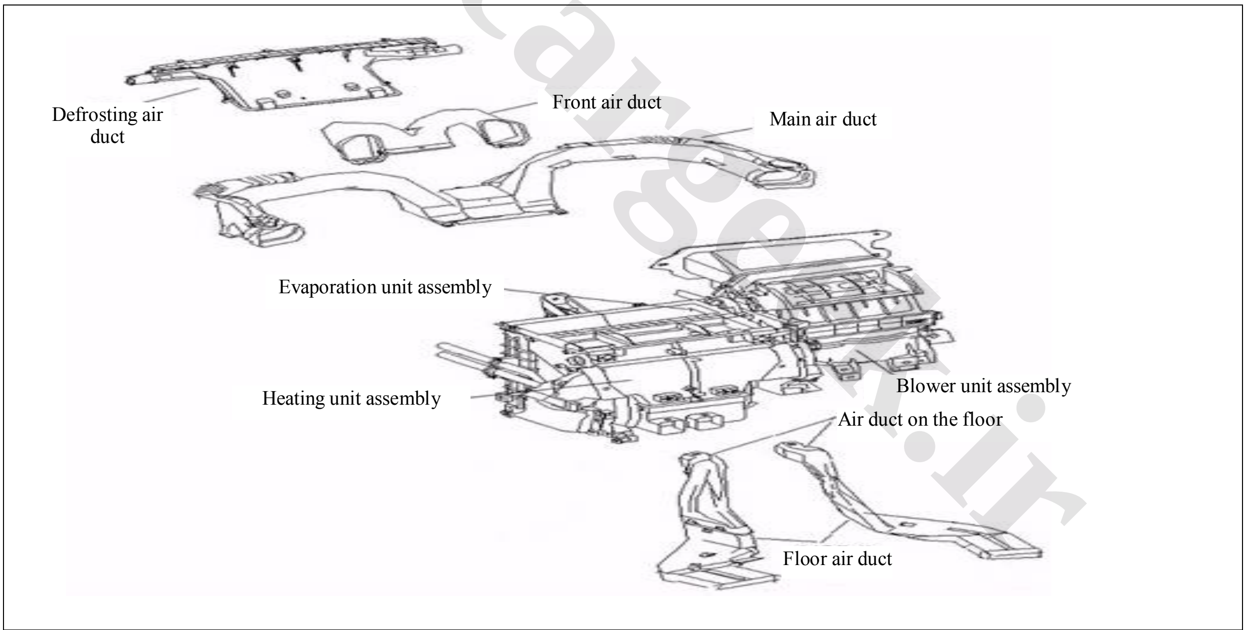
Heater & A/C electronic control system layout 2



A/C parts diagram



A/C parts diagram



Repair of A/C System Parts and Components

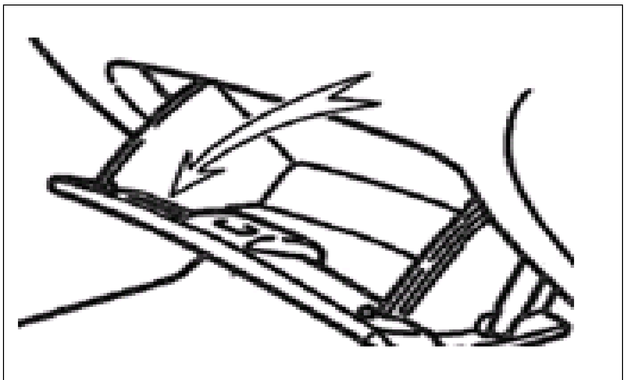
A/C System Performance Parameters

<table>
<tr><td>Compressor</td><td colspan="2">Model</td><td>WXH-106-AP</td></tr>
<tr><td rowspan="3">Condenser assembly</td><td colspan="2">Model</td><td>Parallel flow</td></tr>
<tr><td colspan="2">Specifications L×W×D mm</td><td>625×397×16mm</td></tr>
<tr><td colspan="2">Heat exchanged</td><td>≥4.5m/s; face velocity: 13.1KW</td></tr>
<tr><td rowspan="5">HVAC assembly</td><td rowspan="3">Evaporation core</td><td>Model</td><td>Cascading</td></tr>
<tr><td>Specifications D×H×W mm</td><td>58×255×255</td></tr>
<tr><td>Refrigerating output</td><td>Inlet air amount 423 m³/h; refrigerating output ≥4.2Kw</td></tr>
<tr><td rowspan="2">Radiator core</td><td>Model</td><td>Cascading</td></tr>
<tr><td>Specifications D×H×W mm</td><td>27×220×180</td></tr>
</table>

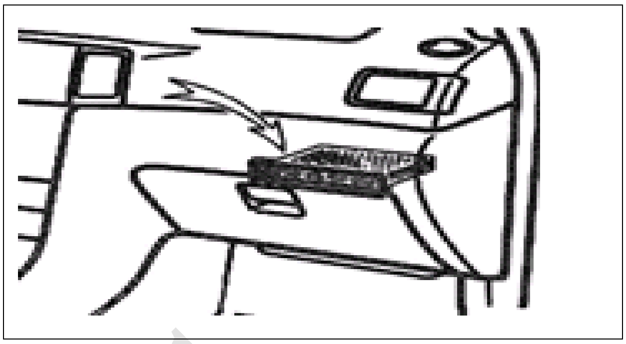
HVAC assembly	Radiator core	Heating output	6L/h flow and 350 m³/h air, collection ≥4.5Kw
	Air regulation		8 gear
	Maximum air		Refrigeration for face ≥423m³/h
			Heating for feet ≥300 m³/h
Refrigerant	Type		R134a
	Filling amount		520g±20g
Lubricant	Type		PAG56
	Filling amount		120ml
A/C system	Maximum refrigeration output		≥4.8Kw when compressor completes 1,800 revolutions
	Temperature regulation scope		18℃～32℃

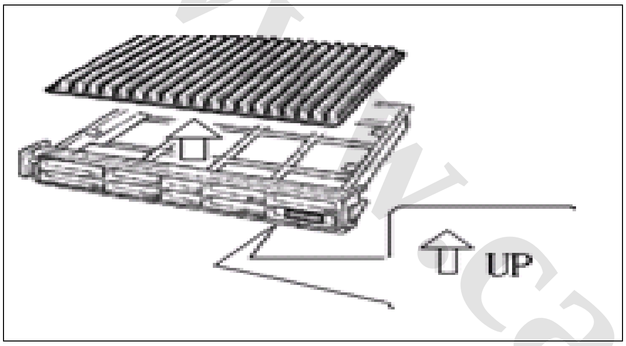
Check and Repair of Air Filter

Remove the sundries box and see details in the removal procedure of the sundries box.



Take out the filter element upward and check the breathability. Replace the filter element if the breathability is bad.





Check and Repair of Evaporator Case

1. Remove the air ducts

(1) Remove the upper air ducts of the case

① Remove the steering wheel, combination switch, instrument cluster, A/C control plate, center air distribution vent assembly, CD player, and sundries box.

② Remove the retaining bolts of the case and the duct beams.

③ Remove the dash board (see the removal procedure of the dash board) and the left and right pillar trims of the A/C.

④ Remove the middle transitional air duct assembly

⑤ Remove the new air duct

(2) Remove the lower ducts of the case

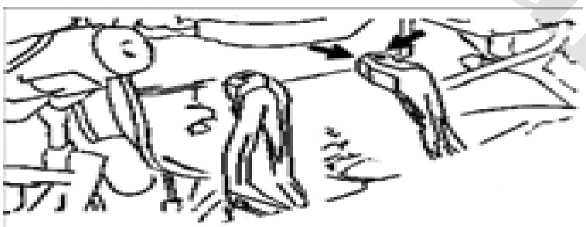
① Move the seats backwards

② Lift the carpet, remove the rear left and right air nozzles and the lower center ventilation pipe, and take all the air ducts.

Disconnect the lower center ventilation pipe on the left floor. Loosen the air duct on the left floor by shaking it left and right as shown in the figure.

Arrow means the removal position

Disconnect the lower center ventilation pipe on the right floor. Disconnect the lower center ventilation pipe. Loosen the air duct by shaking it left and right as shown by the arrow. Disconnect the lower center ventilation pipe. Loosen the air duct by shaking it left and right as shown by the arrow.

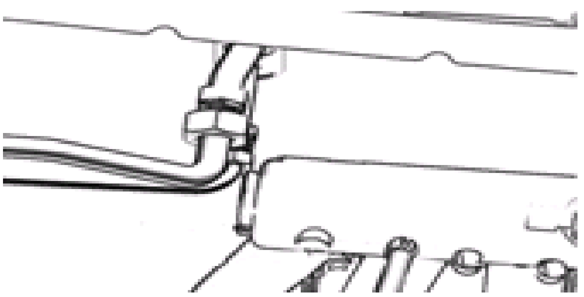


Arrow means the removal position

2. Remove the case

(1) Discharge the refrigerant.

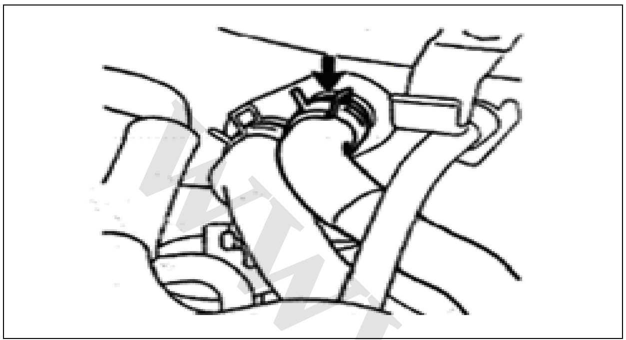
(2) Disconnect the A/C pipeline assembly.



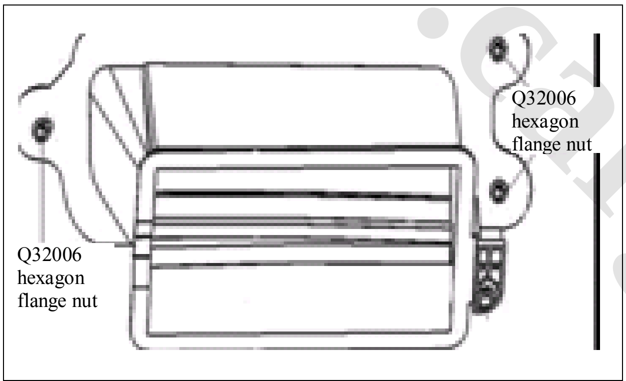
Use two wrenches respectively with opening of 24 and 27 to clip the two ends of the M16 pipe and two respectively with opening of 17 and 19 to clip the two ends of the M18 pipe, remove the nuts and disconnect the A/C pipeline assembly.

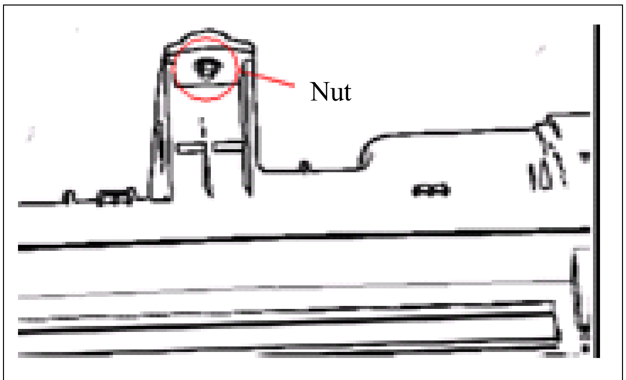
(3) Remove the clamps from the A/C pipeline assembly.

Remove the ring clamps of the heater inlet and outlet pipes from the heater unit.



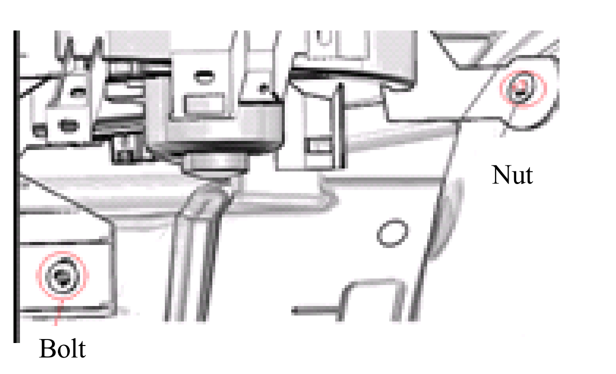
(10) Remove the 3 nuts in the figure.





(11) Remove the nut in Fig. 4-61.

(12) Remove the bolt and the nut in the following figure and then take out the A/C case.



(13) Remove the A/C evaporator unit assembly.

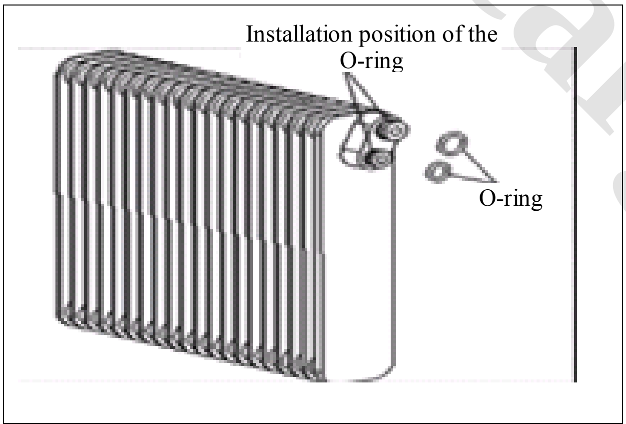
1) Remove the evaporator inlet/outlet cover

2) Pull off the inlet/outlet pipes, the fixing clamp and the expansion valve.

3) Remove the right pipe plate of the evaporator.

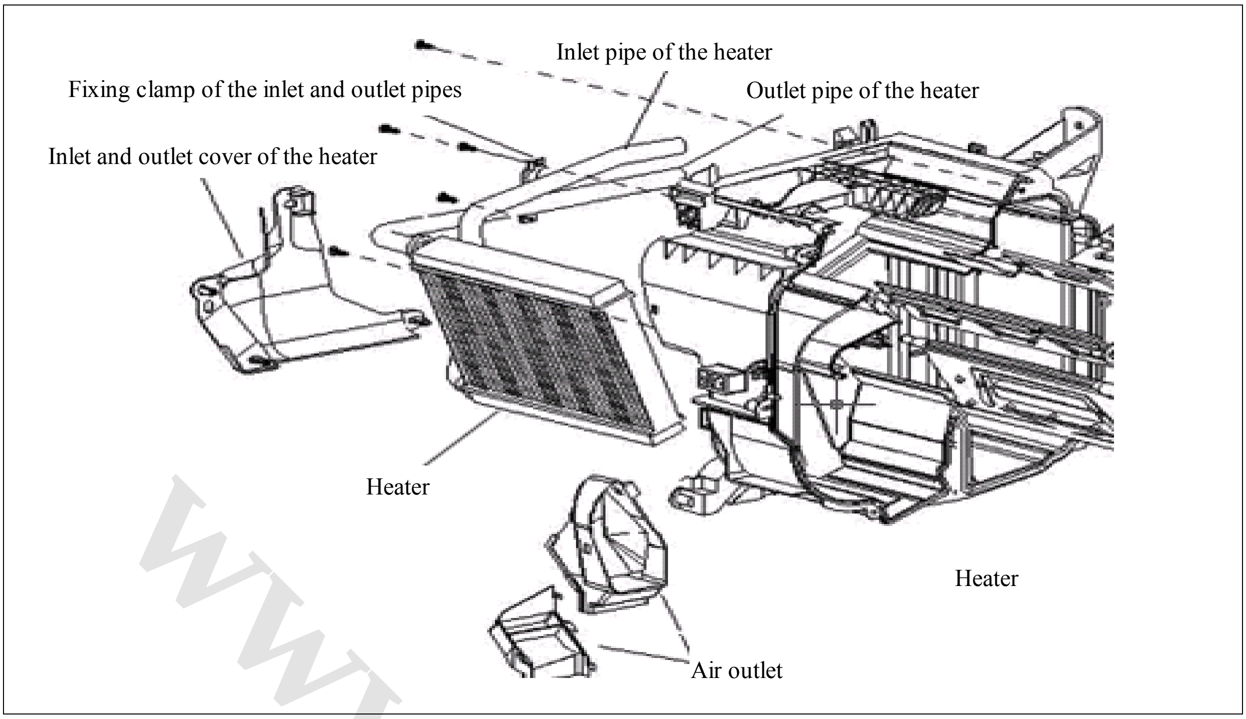
4) Remove the evaporator

5) Remove the two O-rings from the evaporator core.



(14) Remove the heater unit.

1) Remove the cover of the heater inlet/outlet pipes and the lower air distributor of the main cab.



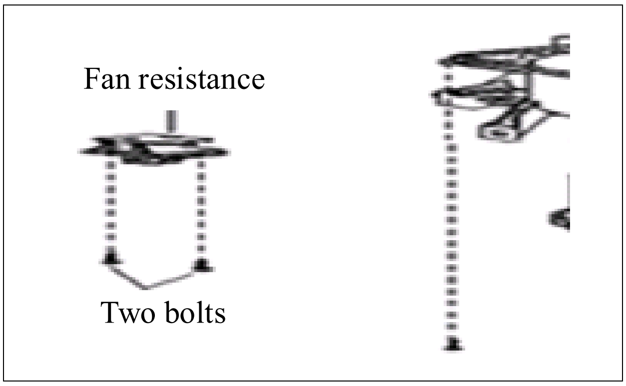
2) Remove the two bolts on the fixing clamp of the heater core and then take down the fixing clamp.

(15) Remove the cooler connection and disconnect the joint.

(16) Remove the fan resistor. Remove the two screws and the blower resistor.

(17) Remove the blower assembly with a fan resistor and remove the 3 screws and the blower assembly with a motor, as shown in Fig. 6-62.

(18) Remove the evaporator temperature sensor.



(1) Draw out the evaporator, as shown in Fig. 4-62.

(2) Remove the evaporator temperature sensor from the plunger of the right case of the evaporator.

3. Note for installation

(1) Install the evaporator assembly.

1) Apply sufficient compressor oil to the surface of the two new O-rings and the interface of the expansion valve; compressor oil: PAG56

2) Install the two new O-rings on the evaporator assembly.

(2) Install the inlet/outlet pipes, the fixing clamp and the expansion valve. Use a 5.0mm hexagon wrench to install the 2 hexagon bolts.

Tightening torque: 3.5N•m

Check and Repair of Compressor Assembly

1. Removal and installation

Discharge the refrigerant before removing the compressor. Check the tensity of the compressor drive belt after filling refrigerant.

(1) Remove the A/C pipeline

A plunger shall be used to seal the removed joint between the pipeline and the evaporator, to prevent dust and foreign material from entering pipes, or the compressor lubricant and the receiver drier will absorb vapor.

(2) Remove the compressor drive belt.

Loosen the fixing bolts of the steering pump (refer to the removal procedure of the steering pump) and the regulating bolts. Remove the drive belt.

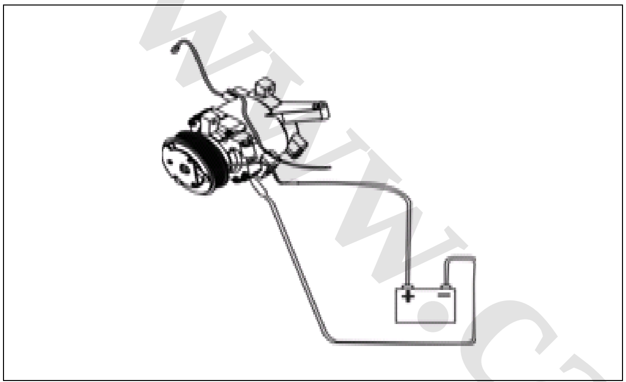
(3) Remove the compressor

Do not spill compressor lubricant.

Check:

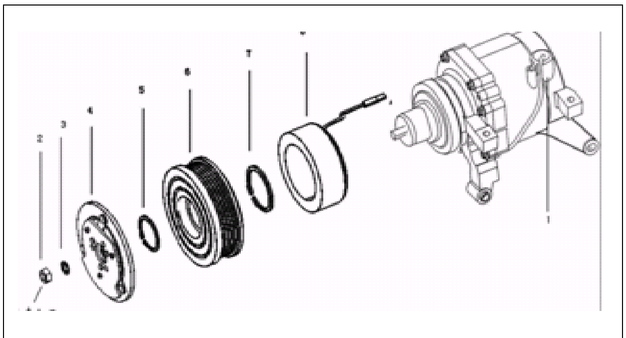
Check the action of the electromagnetic clutch.

Directly connect the positive terminal of the battery to the plug connector of the electromagnetic clutch and the negative terminal to the compressor. If the electromagnetic clutch is normal, the armature plate will pick up the clutch. If it does not happen, there may be a fault.



2. Disassembly and assembly:

Do disassembly as shown in the following figure.

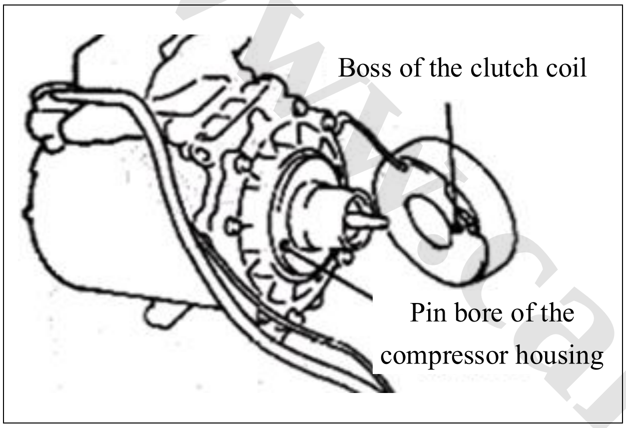


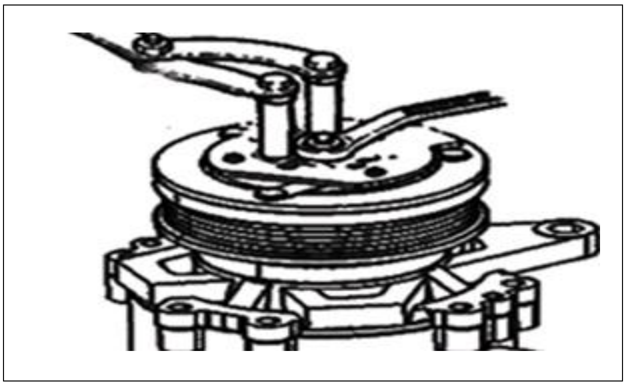
1-Check the compressor overheating protection switch.	5-Snap ring

2- Self-locking nut	6-Rotor
3-Washer	7-Snap ring
4-Armature plate	8-the clutch coil

Boss of the clutch coil

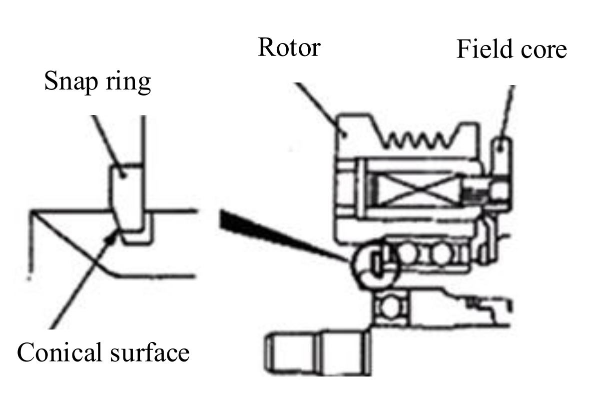
See the figure below:





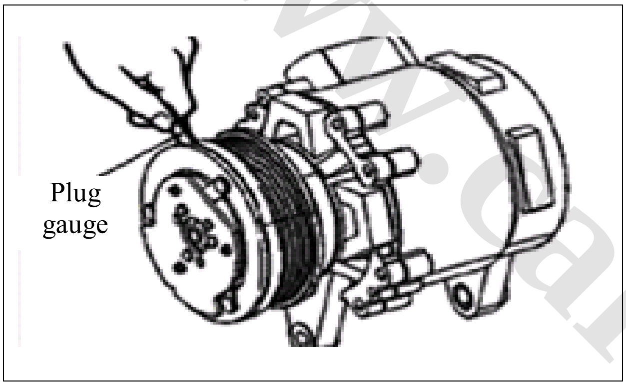
Align the pin bore of the compressor housing with the boss of the clutch coil when installing the clutch coil to the compressor housing.

Assemble the snap ring.

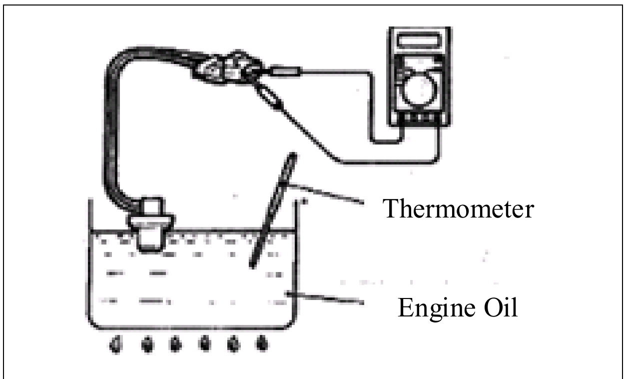


Note: Install the snap ring and make its conical surface outside.

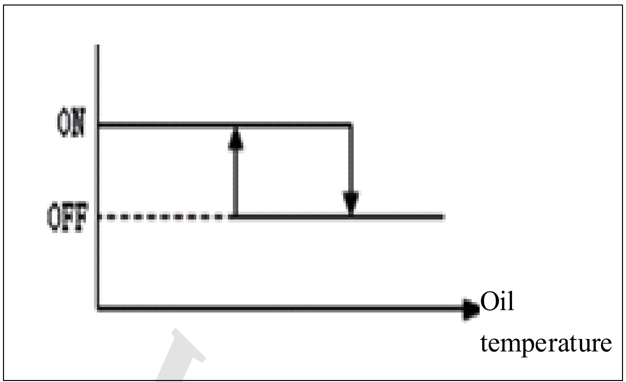
Use a special tool to clamp the electromagnetic clutch and run down the self-locking nuts in the same way as removal. Regulate the clutch clearance as shown in the figure.



Check if the clearance deviation of the electromagnetic clutch is within the standard valve scope. If not, use a washer to regulate the clearance. Standard value: 0.3-0.5mm. Check the compressor overheating protection switch.



Put the metal part of the engine overheating protection switch into engine oil, use a gas-fired furnace to make the temperature standard valve and check if the switch terminals are conducted (see Fig. 4-63).



Compressor overheating protection switch

Conducted: ＜105℃

Disconnected: ＞130℃ (in OFF status, the minimum is 125℃)

Note: The temperature can not exceed the ignition temperature of the engine oil brand during the heating.

Check and Repair of Condenser Assembly with Fluid Reservoir

1. Check the condenser of a vehicle

(1) Check the condenser assembly

1) Check if the cooling fin of the condenser is dirty. If it is dirty, use a soft bristled brush to clean it. Do not use a hydraulic giant to wash the cooling fin, to prevent damage. Note: The damaged cooling fin of the condenser assembly may influence the refrigeration effect.

2) Use a screwdriver or a pair of pinchers to correct the bent cooling fin of the condenser.

(2) Check if there is leakage of the condenser refrigerant.

1) Use a halogen leak detector to check if there is leakage at the pipeline joints.

2) If there is leakage at a joint, check if the O-ring seal is broken. During the assembly, tighten

the joints as required.

2. Remove the condenser from the vehicle

(1) Refer to the removal procedure of the water tank and remove the water tank.

(2) Remove the two pipelines connected with the condenser, remove the two screws and take out the condenser.

(3) Apply sufficient compressor oil to the joint between the cover and the O-ring. Compressor oil: PAG56.

(4) Install the cover and the filter on the condenser assembly with a Φ10 hexagon wrench. Tightening torque: 12N•m.

(5) Install the condenser assembly with a fluid reservoir.

(6) Install the A/C pipeline assembly.

1) Open the plug on the pipeline and connect each part of the condenser assembly;

2) Install a new O-ring seal at the pipeline joint and apply sufficient compressor oil to the pipeline joint; compressor oil: PAG56

3) Use bolts to connect the A/C pipeline assembly and the condenser assembly with a fluid reservoir. Note: Tighten the bolts as required.

4) Fill refrigerant. Specified amount： 520±20g

5) Warm up the engine.

6) Check if there is refrigerant leakage.

Removal and Repair of Refrigeration Pipeline

Common fault of the pipeline of the refrigeration system: blocking or leakage of the pipeline of the refrigeration system results in insufficient refrigeration or no refrigeration.

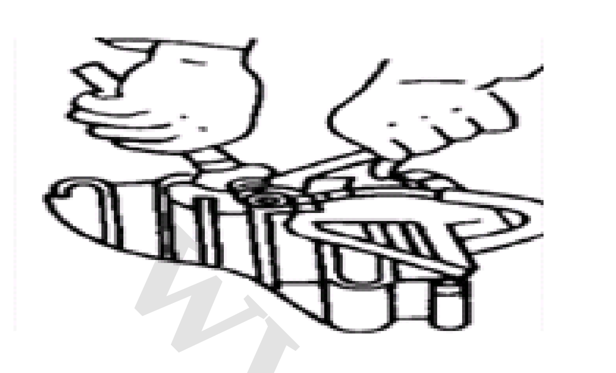
(1) Bent or distorted pipes may partly or completely block the refrigerant.

(2) Damaged or loose pipe joints may cause leakage.

2. Remove the pipeline of the refrigeration system

Note:

Use two wrenches to loosen the pipeline in case of damage.



Immediately use a plug or clean cloth to seal any pipe joint removed, to prevent contamination from entering the pipeline.

Check and repair the pipeline of the refrigeration system:

(1) Check if any pipeline joint is loose or leaks. If a joint leaks, please tighten it; if it still leaks after tightened as required, please check whether the O-ring seal or the pipe is broken.

(2) Check any sunken, bent, distorted, or cracked pipe or pipe with damaged screw thread at the joint. If any, replace that pipe.

(3) Wash the dirty pipeline with absolute alcohol and install the pipeline after it becomes dry.

Note: Do not use compressed air to clean pipes.

4. Install the pipeline of the refrigeration system: use two wrenches to install the pipeline of the refrigeration system and tighten the pipe joints as required. If the joints are too loose, the pipeline will not be sealed well; if they are too tight, the screw thread at the pipe joints may be easily damaged.

Other installation instructions:

(1) Use a suitable O-ring seal and take care not to drop the O-ring or damage it;

(2) Apply some compressor oil to the O-ring seal during installation;

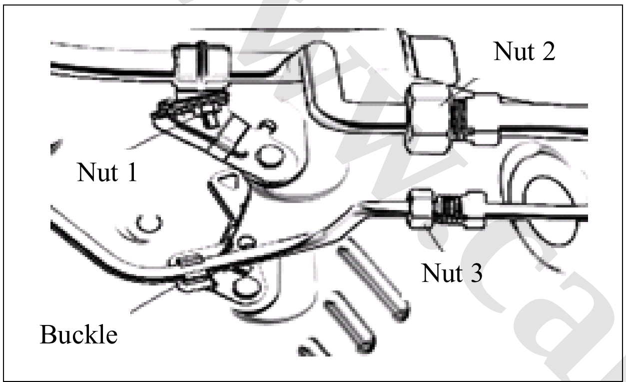
(3) Apply some compressor oil to the pipe joints before connecting the pipes.

(4) Check if the pipeline is correctly installed and if other components and parts will hit the pipeline. Vacuumize the pipeline after it is installed and no leakage is confirmed. Then fill refrigerant and detect the performance of the A/C system.

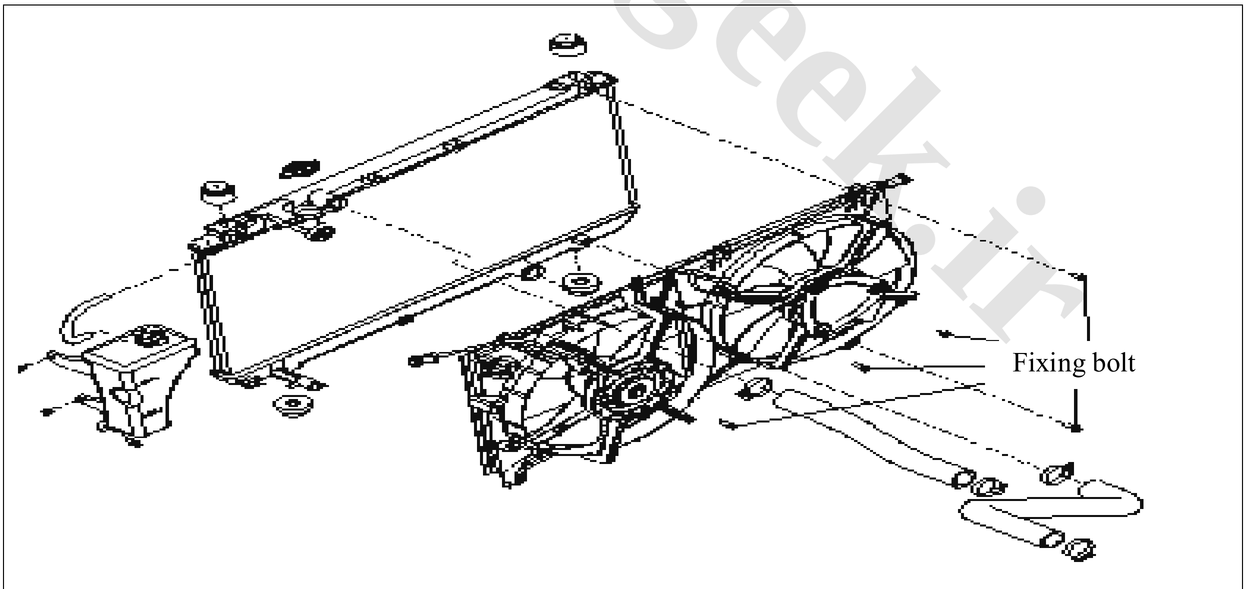
Note:

(1) Seal the two ends of a joint when disconnecting the pipeline. Do not use R134a corrosive sealing material to prevent water and impurity from entering the pipeline.

(2) Install snap-fits and clips in place when installing the pipeline.



Removal and Repair of Condenser Fan



1. Remove the connecting pipe between the swelling water kettle and the water tank.

2. Remove the 5 retaining bolts shown in the figure and then remove the fan assembly.

3. The installation sequence is opposite to the removal sequence.

Diagnosis of A/C System Faults

Diagnosis of System Faults

I. Direct observation and check

1. If the A/C system does not operate or operate abnormally, there may be some appearance abnormalities. Faults can be judged and eliminated accurately and easily by direct check of eyes, hands and/or ears.

(1) Carefully observe if the pipeline is broken and if there is crack or oil stain on the appearance of the condenser and the evaporator. If there is oil stain at the condenser, evaporator or pipeline, soap bubble can be used to check whether there is leakage. The following parts shall be checked:

① The joints of the pipeline and the connections of the valve;

② Hose and its joints;

③ Compressor oil seal, front and rear covers, and gasket;

④ Scratch and distortion on the surface of the condenser and the evaporator;

(2) Check the refrigerant through the inspection window. Before observation, start the engine, turn on the A/C system and operate the engine at a high idle speed (1500~2000r/min) for 5 min. And then observe the circulatory flow of the refrigerant through the inspection window:

① The refrigerant is normal if the fluid flows normally and sometimes a bubble appears.

② No bubble means the refrigerant is full or there is no refrigerant. If the air outlet is cold, the refrigerant is normal; if the air outlet is not cold, the refrigerant may leak out.

③ Many bubbles mean the refrigerant is not enough.

(3) Carefully check if there is bad contact or disconnection of the relevant electrical circuits.

2. Check faults by hand

(1) Check the high-pressure end of the A/C refrigeration system, press down the A/C switch and touch the pipeline and the components of the high-pressure end of the A/C system by hand after the compressor works for 10~20 min. Along the line compressor outlet → condenser → drier → expansion valve inlet, the hand-feel shall be hot-warm. If a certain part in the middle is too hot, this part may be blocked;

If some components are cool, the A/C refrigeration system may be blocked or has no refrigerant or may not operate well.

(2) Check the low-pressure end of the A/C refrigeration system, press down the A/C switch and touch the pipeline and the components of the low-pressure end of the A/C system by hand after the compressor works for 10~20 min. From the evaporator to the compressor inlet, the hand-feel shall be cold-cool. If some part is not cool or frosted, the refrigeration system may be abnormal.

(3) Check the temperature difference between the inlet and the outlet of the compressor, press down the A/C switch and touch the inlet and the outlet of the compressor by hand after the compressor works for 10~20 min. The temperature difference between the high-pressure and the low-pressure ends of the compressor shall be obvious. Unobvious or no temperature difference means insufficient or no refrigerant.

(4) Check the line and if the plug connector of the lead is connected well and the plug connector on each line of the A/C system is loose or hot. If the plug connector is loose or hot, the contact inside the plug connector may be poor.

3. Check faults by ear

Listen carefully, check if the compressor has abnormal sound and if it operates and judge whether no refrigeration or poor refrigeration of the A/C system is caused by faults of the compressor or the control circuit of the compressor.

4. Common faults and measures

(1) The A/C system does not do refrigeration and the compressor and the blower do not operate.

1) The fuse of the control circuit is blown---replace it with a new fuse of the same specifications after finding out the cause;

2) The control line or earth line is disconnected---check if each terminal or earth is loose and fix the loose;

3) The blower relay is damaged---check if the blower relay coil and the contact are damaged and repair/replace the damaged;

4) The electromagnetic clutch coil burns out---check if there is current flowing through the clutch coil and repair/replace the coil without current;

5) The electronic temperature control is damaged---check if the thermistor temperature sensor is damaged and if the characteristic of the thermistor is normal, check the amplified part and repair/replace the damaged temperature control;

6) A fault happens to the pressure switch---fill the refrigeration system with 300KPa (G) refrigerant. If the refrigeration system resumes work, the low-pressure switch shall be in a normal status; if it doesn't, some fault may happen to the low-pressure switch, which may be caused by the short circuit of the pressure switch. Short circuit can be also used to judge whether the high-pressure switch is good or not. The pressure switch with a fault shall be replaced;

7) The blower doesn't rotate---check if the blower circuit is normal, if the blower blade gets stuck and if the blower motor burns out.

(2) The A/C refrigerant is insufficient.

1) Refrigerant is too little---both high pressure and low pressure are on the low side. Do leakage detecting and repair and fill refrigerant until the pressure becomes normal;

2) Refrigerant is too much---both high pressure and low pressure are on the high side and the manometer shakes sharply. Discharge the refrigerant, create vacuum and fill refrigerant of a fixed amount;

3) There is moisture in the system---after the A/C works for a certain time, the low-pressure

side is in a vacuum status, the expansion valve is frosted, ice appears and the air-out is not cold. Stop the A/C for a moment and then start it again. The A/C can work normally but it repeats the above fault before long. This may be caused by damp air or too much moisture in the refrigerant/refrigerant oil. Replace the drier, extend vacuumizing time, fill drying refrigerant and lubricant;

4) There is filth in the system---the low-pressure side is in a vacuum status, the pressure of the high-pressure side is on the low side and the front and rear pipes of the drier or the expansion valve are frosted or congealed and the air out is not cold. Turn off the system, which can not improve this condition. There must be filth blockage. Then replace the drier and the components of filth blockage.

5) The compressor is damaged, with internal leakage ---the low pressure is too high while the high pressure is too low; sometimes there may be abnormal knock of the compressor. Then the compressor shall be replaced;

6) The drive belt of the compressor is too loose---the rotation speed of the compressor is too low, the air-out is not cold and there is belt slipping sound. The drive belt shall be tensioned or replaced;

7) The compressor clutch slips---the compressor can not operate normally. The clutch shall be removed and repaired/replaced;

8) The cooling air of the condenser is a little---the high pressure and the low pressure are both too high. Check if the rotation speed of the blower is normal;

9) The fin of the condenser is blocked by dust---the high pressure is too high and the cooling effect is not good. The dust on the condenser shall be cleaned;

10) The fin of the evaporator is blocked by dust---air output decreases. The dust on the evaporator shall be blown away by nitrogen or compressed air;

11) The air filter of the evaporator is blocked by dust or others---air output decreases. The air filter shall be cleaned or replaced;

12) The opening of the expansion valve is too big---the high pressure and the low pressure are

both too high and too much refrigerant flowing through the evaporator can not be vaporized completely. Then the expansion valve shall be replaced.

13) The power head of the expansion valve leaks---the expansion valve is completely blocked and the high pressure and the low pressure are both low. Then the expansion valve shall be replaced.

14) The thermostat is regulated improperly---frequent startup is caused, which influences the effect of the A/C. The thermostat shall be replaced or regulated again;

15) The lubricant in the system is too much---the high pressure and the low pressure are both too high and there is muddy stripe in the level glass. Surplus lubricant shall be discharged;

16) The fresh air door of the A/C is not closed tightly---much high-temperature air outside the vehicle enters. The fresh air door shall be closed tightly;

17) The cold/warm air door of the HVAC is not closed tightly---air is heated. The cold/warm air door shall be closed tightly;

18) The air supply pipe of the A/C is blocked---air output decreases and noise increases. The obstruction in the pipe shall be removed;

3. The temperature of the A/C intermittently drops.

It is mainly caused by ice barrier of the system, faults of the temperature control and the relay, slipping of the compressor clutch, and bad contact of the coil:

1) There are the faults of the control and the relay, the slipping of the compressor clutch, the bad contact of the coil, etc.

2) Poor contact, bad earth and loose connection happen to the compressor clutch coil---the clutch is separated too early during the operation. The joints shall be tightened.

3) The temperature control operates abnormally---the surface of the evaporator is frosted heavily and no cold air is supplied. The temperature control shall be replaced.

4. Noise of the A/C is too loud.

1) Noise of the blower, the compressor, the drive belt, the collision of the parts and the components;

2) Noisy operation of the expansion valve.

5. The warm air of the A/C is insufficient.

1) The blower motor is damaged---the blower motor shall be checked and repaired/replaced.

2) Air leakage happens to the heater---the sealing washer shall be replaced;

3) The opening of the cold/warm air door is abnormal---check the working mode of the cold/warm air door;

4) Fouling or distortion happens to the fin of the heater and ventilation is poor----the heater shall be cleaned or replaced;

5) The hot water pipe of the heater is blocked by fouling---the heater shall be replaced;

6) The coolant of the engine is insufficient---check if there is leakage inside the cooling system, repair the leakage and fill coolant;

7) The thermostat of the engine does not work---replace the thermostat;

8) There is air inside the core pipe of the heater, which shall be exhausted.

Diagnosis of A/C System Faults

Phenomenon & status	Causes	Measures
The high pressure and the low pressure are	1. Air enters the system.	Create vacuum and re-fill refrigerant.
	2. Refrigerant is too much.	Discharge surplus refrigerant.
	3. Lubricant is too much.	Discharge surplus lubricant or replace

too high		lubricant.
	4. Cooling effect of the condenser is bad.	Clean the fouling on the condenser surface or replace the condenser.
	5. The cooling fan shared by the condenser and the water tank can not work normally.	Repair or replace the condenser fan.
The low pressure and the low pressure are too low	1. Refrigerant is insufficient.	Fill refrigerant.
	2. Refrigerant leaks.	Check and replace the leaking components.
	3. The O-ring is damaged.	Replace the O-ring.
The high pressure is normal while the low pressure is too high.	1. The opening of the expansion valve is too big or the expansion valve is damaged.	Regulate the opening of the expansion valve or replace the expansion valve.
	2. Refrigerant is too much.	Discharge surplus refrigerant.
	3. There is something wrong with the compressor.	Then the compressor shall be replaced;
Normal voltage The low pressure is too low	1. Refrigerant is insufficient.	Fill refrigerant.

Normal voltage The low pressure is too low		2. There is ice barrier at the expansion valve	Replace the drying bottle
		3. There is dust on the surface of the evaporator or blockage inside the evaporator.	Clean the surface of the evaporator or replace the evaporator.
The low pressure		1. The efficiency of the compressor decreases.	Repair or replace the compressor.
The low pressure is high		2. The air duct is blocked.	Regulate the opening of the expansion valve or replace the expansion valve.
		1. The low pressure increases quickly after the A/C stops working---ice barrier appears in the system.	Replace the drying bottle
The high pressure and the low pressure are too low		2. The low pressure increases slowly after the A/C stops working---ice barrier appears in the system.	Clean the system.
Air is insufficient.	Normal voltage	1. The inlet filter is blocked.	Replace the inlet filter element.
		2. The air duct is blocked.	Clean the air duct.
		3. There is dust on the	Clean the surface of the

		surface of the evaporator.	evaporator.
		4. The operation of the blower motor is hindered.	Repair or replace the blower motor.
	Under voltage	1. The power voltage of the complete vehicle is unstable.	Do check and repair.
		2. There is something wrong with the power grounding.	
The high pressure only reaches a certain value.	The clutch or the belt slips.		Repair or replace the clutch or the belt.
The evaporator is frozen.	1. Something happens to the evaporator temperature sensor.		Replace the sensing head or check if it is located correctly.
	2. There is something wrong with the evaporator temperature sensor harness and insert.		Do check and repair.
	3. Refrigerant is too much.		Discharge some refrigerant.
	4. The air flowing through the evaporator is insufficient.		Check if the rotation speed of the blower is normal;
	5. There is ice barrier at the expansion		Replace

	valve.	

Check the Refrigerant

1. Check the refrigerant and observe the inspection window on the A/C pipe.

Note: If the refrigerant is enough and the ambient temperature is higher than the normal, the bubbles seen from the inspection window can be considered to be normal.

Test results:

① Engine rotation speed: 1,500r/min;

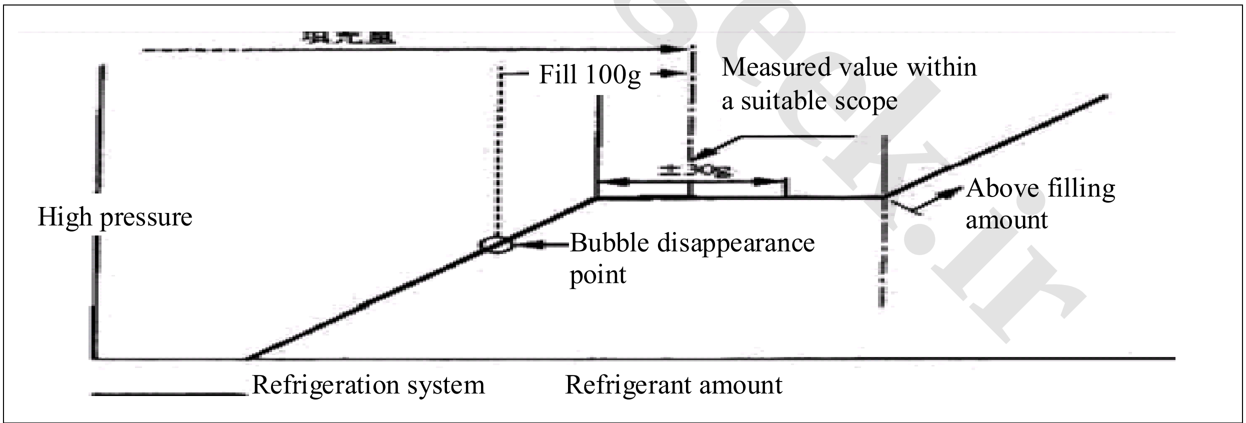
② Blower rotation control switch: HI "HIGH";

③ A/C switch: ON;

④ Temperature control panel: MAX COLD "MAX REFRIGERATION";

⑤ Vehicle doors are all closed.

Fill refrigerant, as shown in Fig. 4-49.



1. Discharge the refrigerant in the system.

① Turn on the A/C switch.

② Make the engine operate at the speed of about 1000r/min and the A/C compressor work for 5-6 min, circulate the refrigerant and draw the residual oil in each part as much as possible to the compressor.

③ The engine stops.

④ Discharge the refrigerant.

Note: Gently press down the check valve of the filler and slowly release it when discharging the refrigerant to avoid bringing out the compressor oil.

2. Fill refrigerant.

① Use a vacuum pump to do vacuumizing.

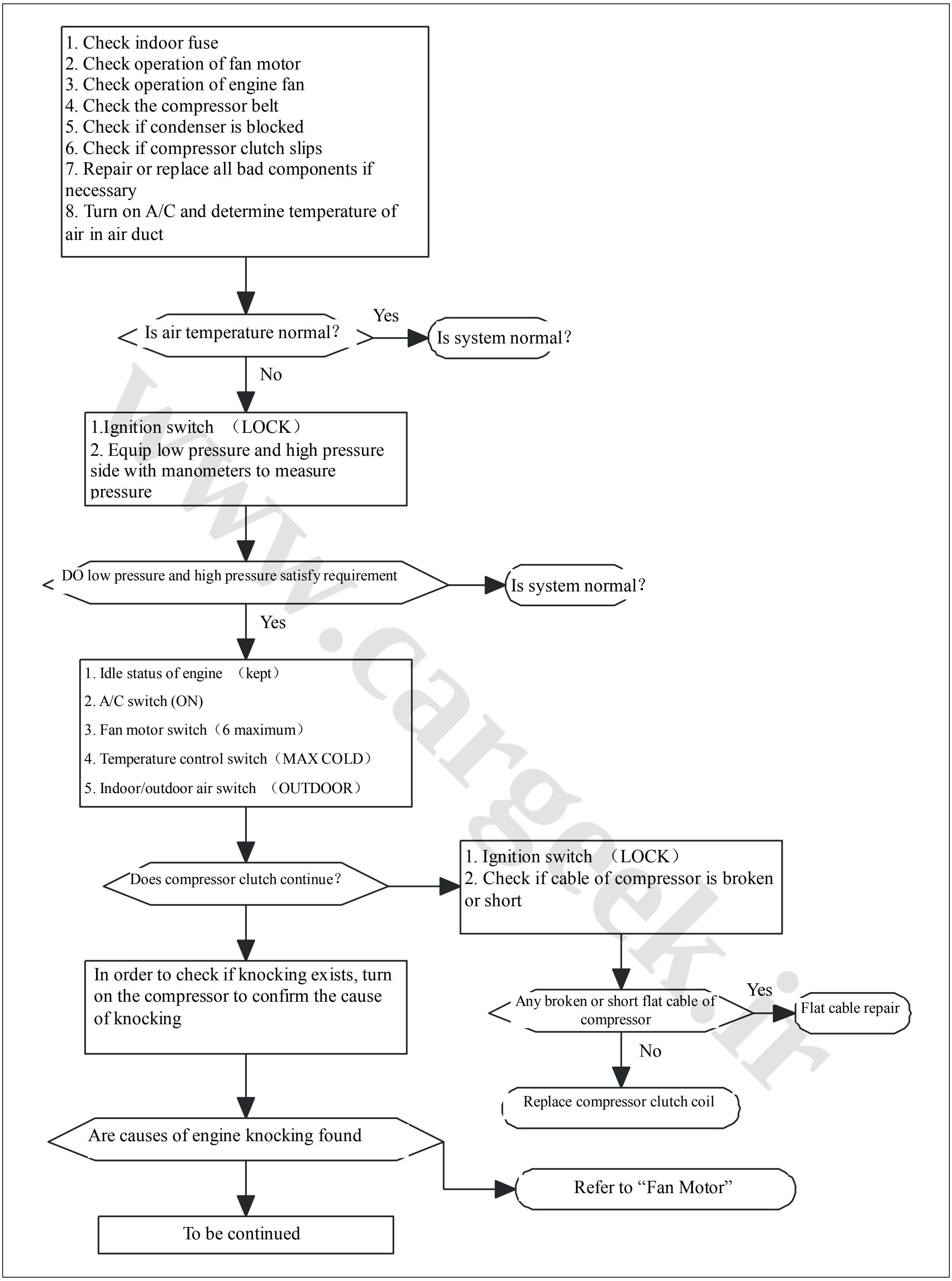
② Fill R134a, Standard: 520g±20g.

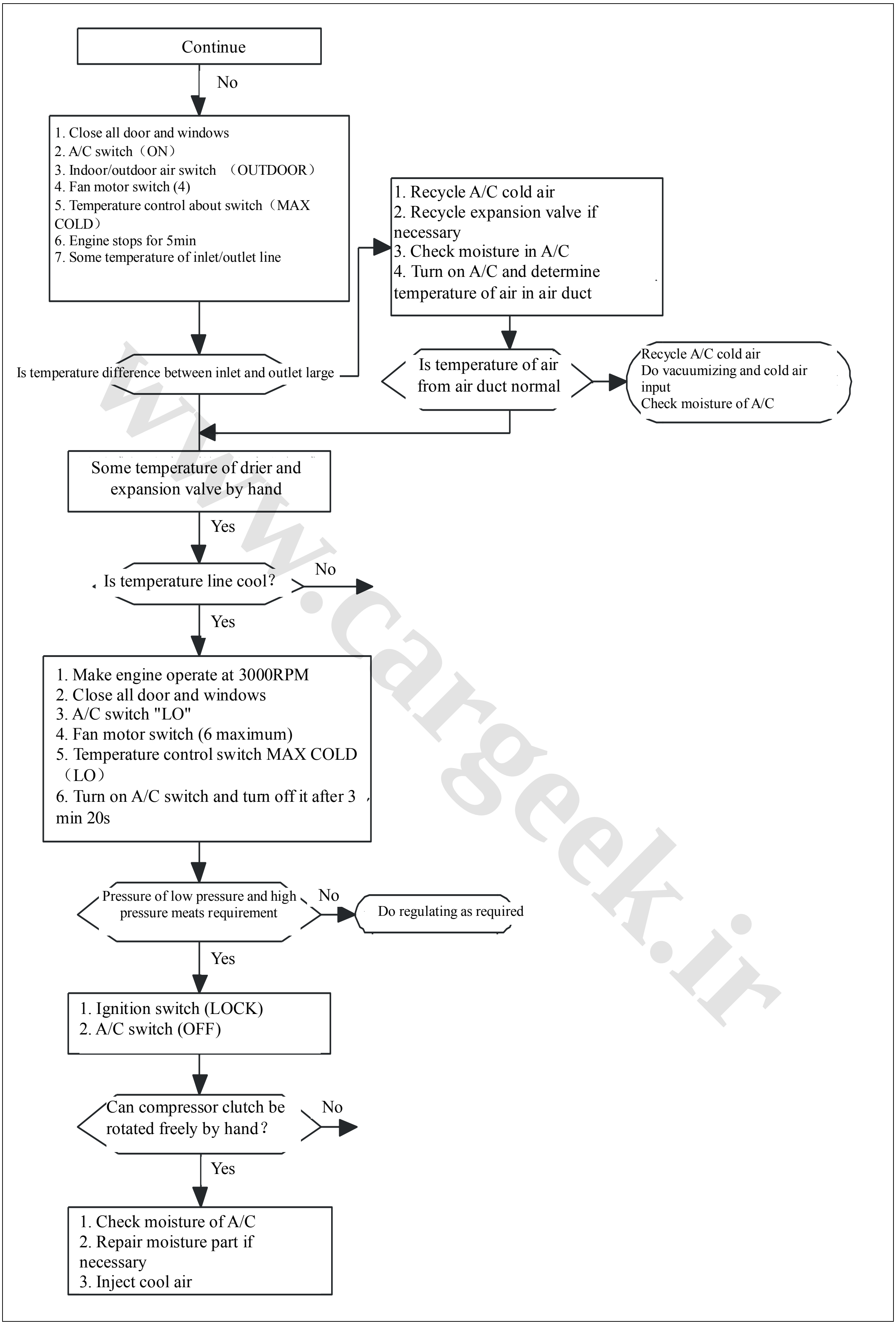
3 Warm up the engine.

4 Check if there is refrigerant leakage. Use an air leak detector to check if the refrigerant leaks.

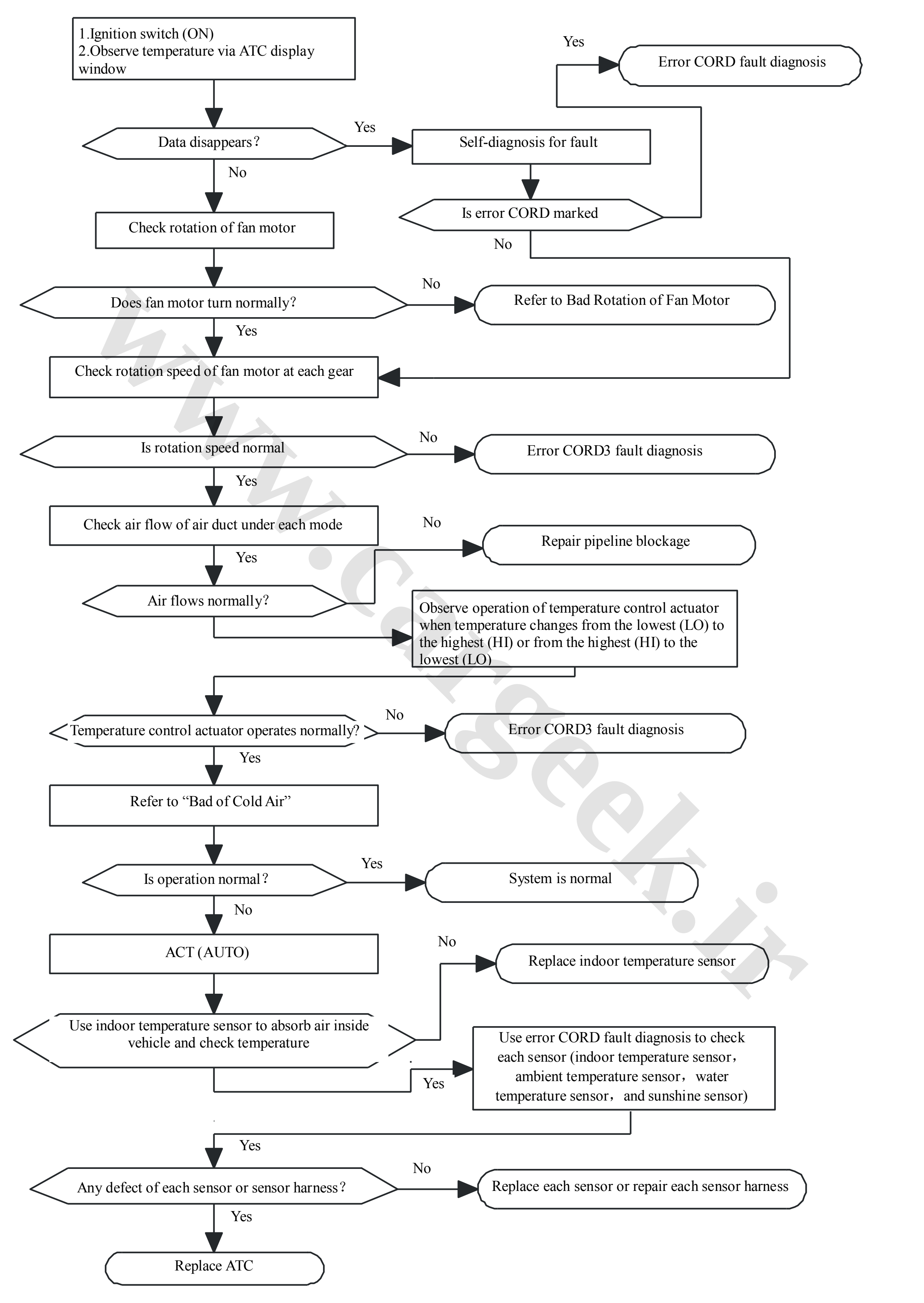
Diagnosis Procedure of A/C Faults

Bad refrigeration effect (see the following figure)

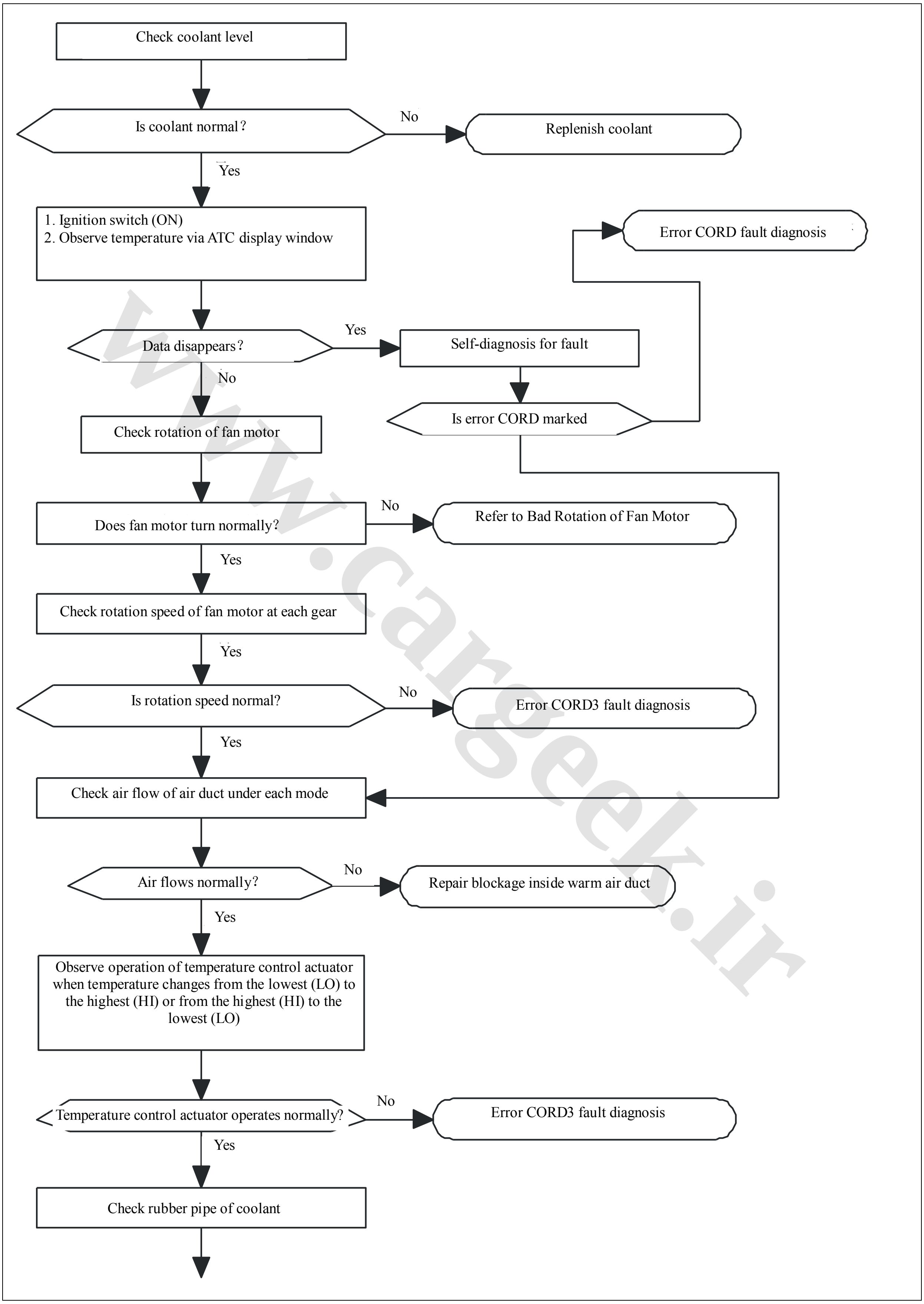

1. Check indoor fuse
2. Check operation of fan motor
3. Check operation of engine fan
4. Check the compressor belt
5. Check if condenser is blocked
6. Check if compressor clutch slips
7. Repair or replace all bad components if necessary
8. Turn on A/C and determine temperature of air in air duct
Is air temperature normal?
Yes
Is system normal?
No
1.Ignition switch （LOCK）
2. Equip low pressure and high pressure side with manometers to measure pressure
DO low pressure and high pressure satisfy requirement
Is system normal?
Yes
1. Idle status of engine （kept）
2. A/C switch (ON)
3. Fan motor switch（6 maximum）
4. Temperature control switch（MAX COLD）
5. Indoor/outdoor air switch （OUTDOOR）
Does compressor clutch continue?
1. Ignition switch （LOCK）
2. Check if cable of compressor is broken or short
Any broken or short flat cable of compressor
Yes
Flat cable repair
No
Replace compressor clutch coil
In order to check if knocking exists, turn on the compressor to confirm the cause of knocking
Are causes of engine knocking found
Refer to “Fan Motor”
To be continued

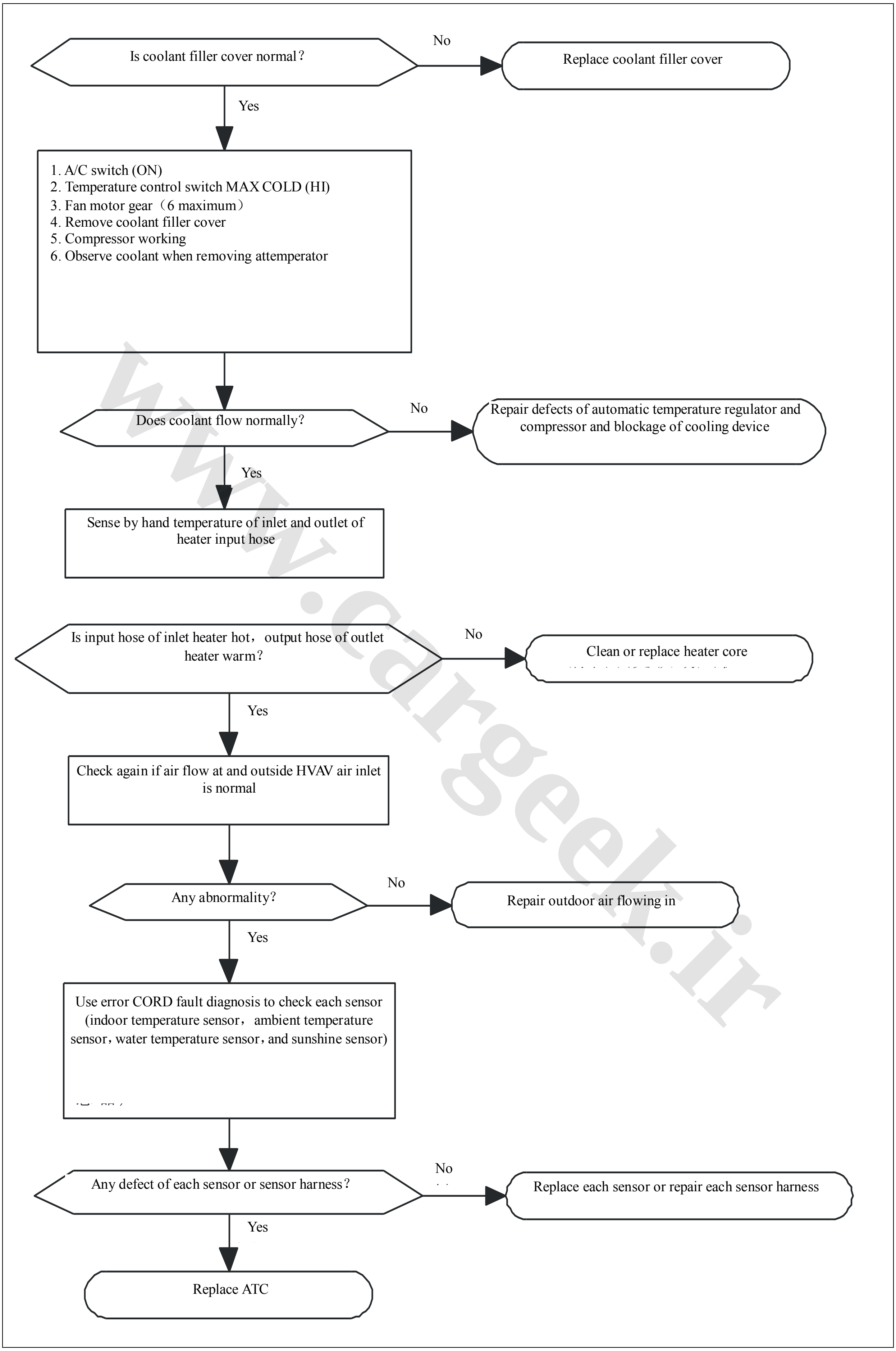

Continue
No
1. Close all door and windows
2. A/C switch（ON）
3. Indoor/outdoor air switch （OUTDOOR）
4. Fan motor switch (4)
5. Temperature control about switch（MAX COLD）
6. Engine stops for 5min
7. Some temperature of inlet/outlet line
1. Recycle A/C cold air
2. Recycle expansion valve if necessary
3. Check moisture in A/C
4. Turn on A/C and determine temperature of air in air duct
Is temperature difference between inlet and outlet large
Is temperature of air from air duct normal
Recycle A/C cold air
Do vacuumizing and cold air input
Check moisture of A/C
Some temperature of drier and expansion valve by hand
Yes
Is temperature line cool?
No
Yes
1. Make engine operate at 3000RPM
2. Close all door and windows
3. A/C switch "LO"
4. Fan motor switch (6 maximum)
5. Temperature control switch MAX COLD（LO）
6. Turn on A/C switch and turn off it after 3 min 20s
Pressure of low pressure and high pressure meats requirement
No
Do regulating as required
Yes
1. Ignition switch (LOCK)
2. A/C switch (OFF)
Can compressor clutch be rotated freely by hand?
No
Yes
1. Check moisture of A/C
2. Repair moisture part if necessary
3. Inject cool air

Abnormal ATC (see the figure below)



Bad heating effect




Is coolant filler cover normal?
No
Replace coolant filler cover
Yes
1. A/C switch (ON)
2. Temperature control switch MAX COLD (HI)
3. Fan motor gear（6 maximum）
4. Remove coolant filler cover
5. Compressor working
6. Observe coolant when removing attemperator
Does coolant flow normally?
No
Repair defects of automatic temperature regulator and compressor and blockage of cooling device
Yes
Sense by hand temperature of inlet and outlet of heater input hose
Is input hose of inlet heater hot，output hose of outlet heater warm?
No
Clean or replace heater core
Yes
Check again if air flow at and outside HVAV air inlet is normal
Any abnormality?
No
Repair outdoor air flowing in
Yes
Use error CORD fault diagnosis to check each sensor (indoor temperature sensor，ambient temperature sensor，water temperature sensor，and sunshine sensor)
Any defect of each sensor or sensor harness?
No
Replace each sensor or repair each sensor harness
Yes
Replace ATC

Notes about A/C System

Usage of Pure R134a Refrigerant

(1) R-134a refrigerant which meets the requirements for all the indexes of composition, water content, impurity, and non-condensable air must be used. The service stations shall use 13.6-kg canned refrigerant;

(2) Refrigerant must be filled as required by the complete vehicle factories. Too much or too little refrigerant may affect the refrigeration of the A/C.

(3) Check if the sealing ring of each pipe joint is in good condition and if there is leakage of each component before filling refrigerant;

(4) Refrigerant shall be filled at the low pressure and the high pressure sides simultaneously before the compressor works; if the compressor begins to work, refrigerant shall be only filled at the low pressure side (see Fig. 4-65).

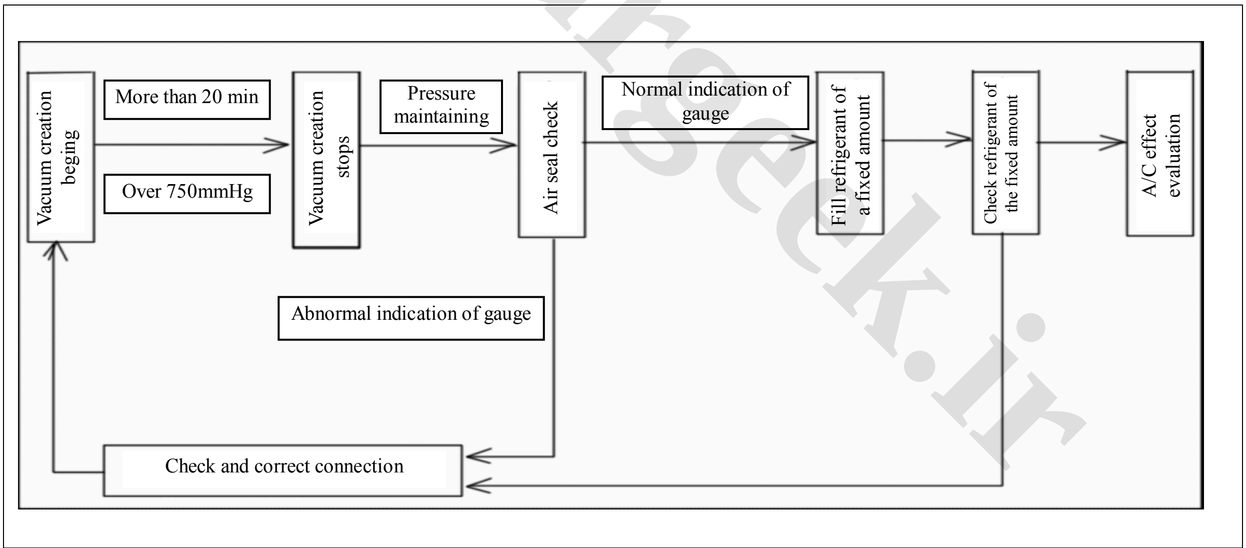


Figure 465

(5) Use an electronic leak detector to check if leakage exists after filling R-134a refrigerant.

Correct Filling of Lubricant

1. Use the lubricant of the type and the brand as required by the compressor manufacturer.

Lubricant of different types and brands can not be mixed, or the compressor may be damaged.

2. Lubricant shall be filled as required. As lubricant hinders heat exchanging, too much will seriously affect the A/C effect; generally speaking, it is unnecessary to fill lubricant which is filled by the compressor manufacturer; lubricant of the same type shall be added suitably when components are replaced; condenser (20ml); drying bottle (30ml); evaporator (30ml); pipeline (10ml/m).

3. Lubricant shall be kept from air because it absorbs water easily.

4. Check the quality of the lubricant in the pipe before filling. Completely clean the whole A/C system and replace all the lubricant if lubricant is blackened or carbon article is separated out. Note: Water, corrosive solvent or flammable & combustible solvent are prohibited and cleaning agents like R-141b and methane are recommended.

5. Lubricant shall be filled at the air outlet of the compressor before vacuum is created.

Enough Vacuum Creation Time and Vacuum

1. Use a powerful vacuum pump to create vacuum for more than 20min;

2. Keep the absolute pressure of the system below 1000Pa;

3. Maintain the pressure for at least 5min and check air tightness before filling refrigerant. Create vacuum for 5min if air tightness is qualified.

Section 4 Lamps

Bulb Standards

Type	Specification
Headlight	12V 55W
Turn signal lamp, Rear fog light, Reverse light.	12V 21W
License plate lamp, Side steering light, High-mounted brake lamp	12V 5W
Brake lamp	12V 21W
Width lamp	12V 5W
Front fog lamps (optional)	12V 55W
Front and rear ceiling lights	12V 8W

Removal and Installation of Headlight

Removal and Installation of Assembly

1. Open the hood of engine compartment.

2. Take down high/low beam insert.

3. Unscrew the three retaining bolts of the headlight.

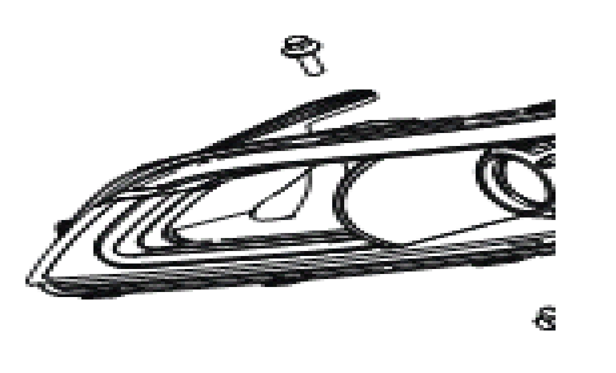


Figure 466

4. Carefully pull out the headlight assembly.

5. The installation procedure is opposite to the removal procedure.

Torque: 6±1N•m for fixing the headlight (3) Replace bulbs.

Replacement of High/Low Beam Bulb

1. Remove the headlight plug.

2. Loosen the bulb clip.

3. Take out high/low beam bulb.

4. Install a new bulb.

Replace the bulb of the front turn signal lamp

Anticlockwise screw the front steering light bulb holder from the headlight assembly.

Screw off the bulb.

Install a new bulb to the holder.

Install the holder to its original place.

Removal and installation of front fog lamps (optional)

1. Remove the front bumper

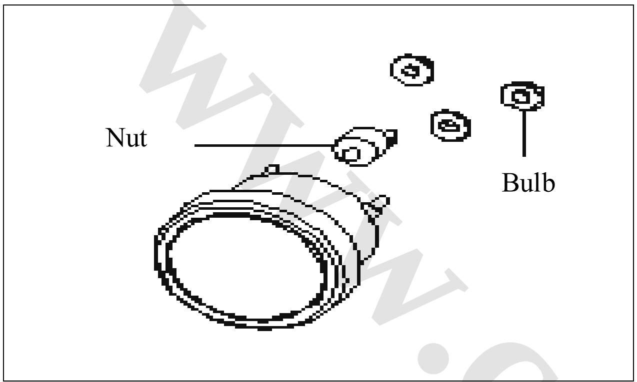
A. Remove the retaining bolts under the front bumper.

B. Remove the retaining bolts at the sides of the front bumper.

C. Remove the connecting screws of the front wheel covers at the two sides.

D. Remove the three retaining bolts on the front bumper.

E. Pay attention to the clips at the upper left and right sides and then take down the bumper. Pull out the harnesses and the inserts of the two front fog lights.



Note: Pay attention not to damage the harnesses and the inserts of the front fog lights.

2. Remove the front fog lights from the bumper.

Use an open-end wrench to remove the three nuts shown in the figure and take the fog light assembly out of the front bumper.

3. To install, reverse the removal procedure.

Torque: 2.0±0.2 N•m for fixing front fog lights (3)

Replace the bulbs

1. Hold the bulb holder by hand and anticlockwise screw off the bulb.

2. Screw in a new bulb clockwise.

3. Screw in the new fog light bulb.

Removal and installation of Tail Lamp

1. Open the rear door.

2. Remove the lower guard panel of pillar C.

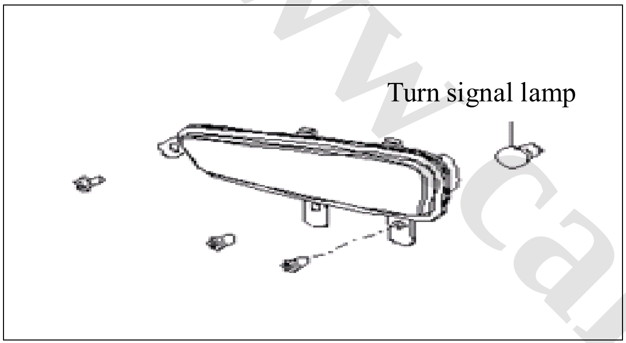
a. Remove the self-tapping screws under the lower guard panel.

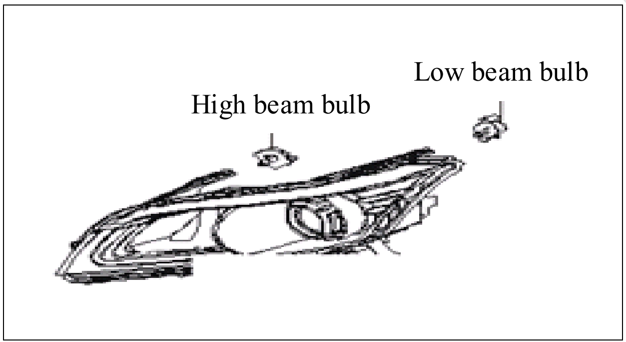
b. Remove the self-tapping screws in the cover stem of the sundries box.

c. Take down the tail door sill plate and remove the screws below.

d. Take down the lower guard panel of pillar C.

3. Remove the three retaining nuts from the reserved bores in the vehicle body.





4. Unplug the tail lamp insert.

5. Pull out the tail lamp gently.

6. To install, reverse the removal procedure.

Torque:

Retaining nuts of the tail lamp: 5±1N•m (3)

Replace the bulbs

1. Open the cover stem of the sundries box in the rear luggage boot.

2. Use a screwdriver to unclench the inner protective cover. And stretch a hand through the cover gap to anticlockwise screw off the width lamp bulb, the turn signal lamp bulb, the steering light bulb and the brake lamp bulb.

3. Install new bulbs.

License Plate Light

Removal and installation

1. The license plate light is fixed on the rear bumper by the flexible clamps at its two ends.

2. During removal, use a flared tip screwdriver to hold the clamps, take down the license plate lamp slowly and pull out the insert.

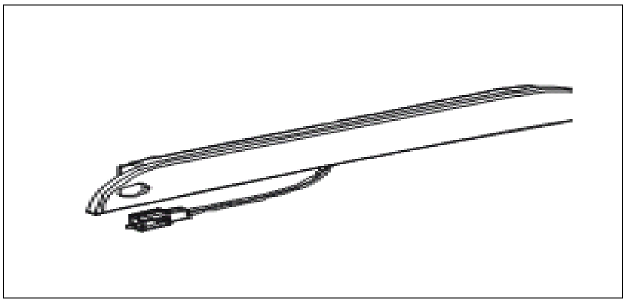
3. During installation, locate the insert well and press the license plate lamp in.

Removal and Installation of High-mounted Brake Lamp

1. Remove the lampshade of the high-mounted brake lamp.

2. Remove the retaining screws.

3. Take down the high-mounted brake lamp.



4. To install, reverse the removal procedure.

Torque: 3±0.5N•m for tightening self-tapping bolts

Indoor Front Ceiling Light

Figure 467

Removal and installation

1. Open the glasses case.

2. Use a cross screwdriver to loosen the self-tapping bolts.

3. Slowly take down the indoor front ceiling light assembly and the harness and the insert.

4. To install, reverse the removal procedure.

Torque: 3±0.5N•m for tightening self-tapping bolts

Replace the bulbs

1. Use a flat-blade screwdriver to unclench the housing.

2. Take down the old bulb and install a new one.

Indoor Middle Ceiling Light

Removal and installation

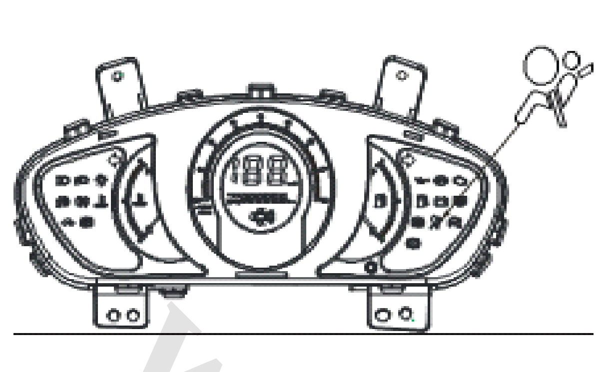
1. Insert the flat-blade screwdriver into a place between the lamp housing and the lampshade to gently unclench the lampshade.

2. Loosen the retaining bolts.

3. Take down the ceiling light.

4. To install, reverse the removal procedure.

Torque: 3±0.5N•m for tightening self-tapping bolts

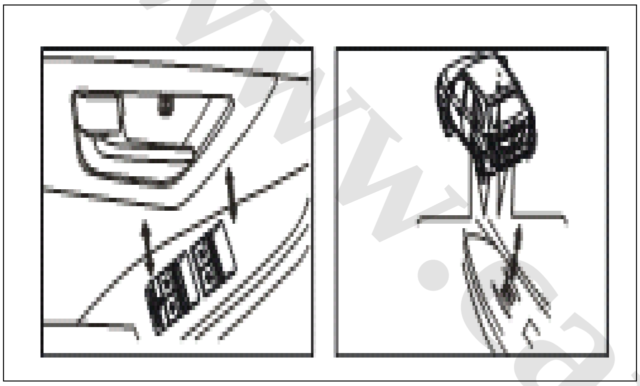


Indoor rear ceiling light refers to "Indoor Middle Ceiling Light".

Section 5 Electric Window

Overview

The electric windows can be controlled by the switches on the door trim panels (see the following figure) while these switches can be controlled by the master switch on the front door trim panel of the driver side. The safety switch of the electric windows is located on the front door trim panel of the driver side. The driver can forbid all the passengers to use the window switches via key A. the electric window system can not work until the ignition switch is placed at “ON”.



(1) Electric rise

EX type: Lift a window switch for no less than 300ms to make the corresponding window rise. Release the switch to stop the rising of the window.

LX/DX type: Lift a window switch to make the corresponding window rise. Release the switch to stop the rising of the window.

(2) Electric fall.

EX/LX/DX type: Press down a window switch for no less than 300ms to make the corresponding window fall. Release the switch to stop the falling of the window.

(3) Automatic rise

EX type: Lift a window switch for no more than 300ms to make the corresponding window rise automatically. After the window rises to the end, the regulator will be powered off. If the signal is lost after the window rises to the end. If the signal is lost after the window falls to the end, the regulator will work for 8 seconds and then stop to protect the motor. If the window is made to rise or fall again during its rising, the rising of the window shall be stopped. After the window rises to the end, the regulator will be powered off.

If the window meets some foreign material during its rise, stop the rising of the window and make it fall automatically. All the operations will be of no effect. If the window falls to the end, the regulator will be powered off.

(4) Automatic fall

EX/LX/DX type: Press down a window switch for no more than 300ms to make the corresponding window fall automatically. After the window falls to the end, the regulator will be powered off. If the signal is lost after the window falls to the end, the regulator will work for 8 seconds and then stop to protect the motor. If the window is made to rise or fall again during its falling, the falling of the window shall be stopped.

The electric window system has some functions controlled by its electronic modules which are integrated in the left front door window regulator switch assembly and the BCM.

Components of the electric window system:

(1) Electric window switch

(2) Electric window motor

(3) Body control module (BCM)

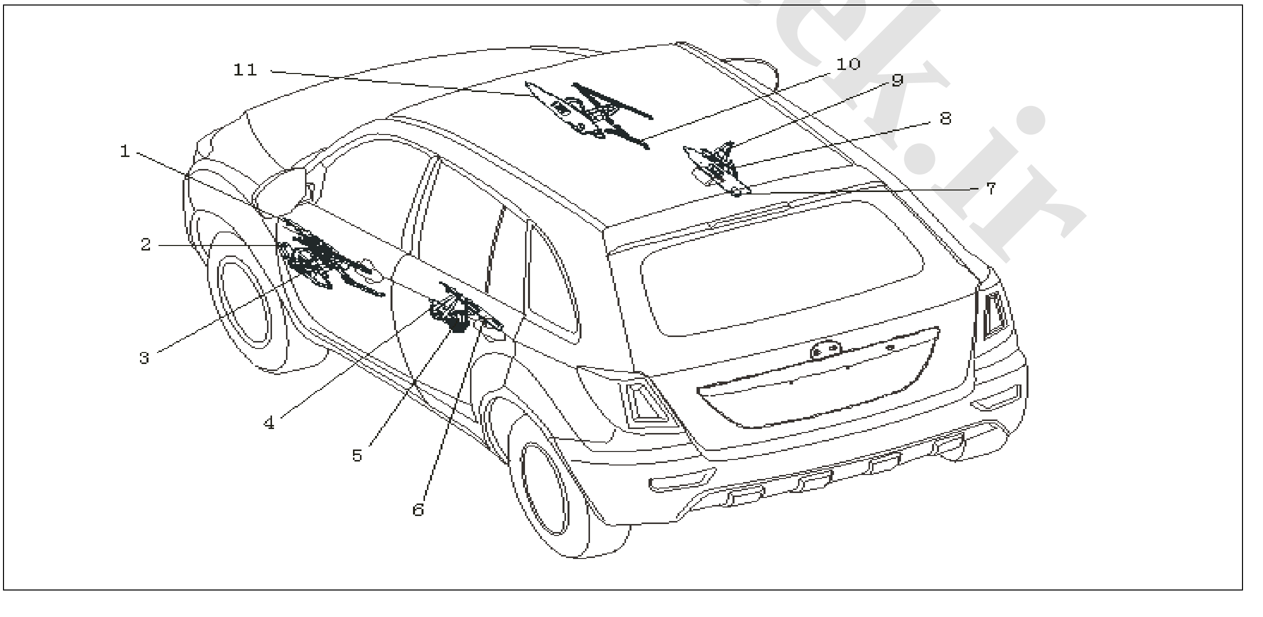
The electric window motor adopts new technologies and materials, e.g., for watertightness, the complete sealing design and the breathable film are used (the motor produces temperature rise during its operation, which may create pressure difference inside and outside the motor, as a result, the thinnest seal will be broken. Then the motor needs a respiratory organ to balance the pressure difference inside and outside and prevent impact on the thinnest seal. The breathable film can not only balance the pressure difference inside and outside via air but also prevent water from flowing into the motor to realize the complete sealing and waterproof design);

For overheating protection, the polymer PTC over-current protector is used to quickly and efficiently protect the motor from being burnt by external faults (like switch fault);

For motor noise handling, wear-resistant damping material is adopted at the rotation axis of the motor to ensure that the motor will not produce metal impact and noise during its high-speed rotation. For motor power connection, the terminal interface is directly applied to avoid poor contact caused by power lead wire;

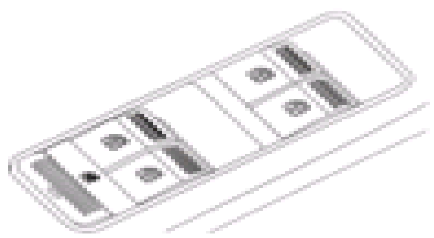
Adopting DC double-pole permanent magnet and bidirectional rotation, the motor is provided with inner overheating protector to avoid outer protection; after the motor is powered on, because of the magnetic field force, the motor will revolve and then be slowed down by a big turbine reducing mechanism and then a large low-speed torque will be gained at the output gear. When the motor is stuck or the circuit has some problem, the overheating protector can cut off the power immediately to protect the motor. To keep the motor from being damaged by the overheating caused by continuous operations of electric windows, the circuit will do self-protection to stop the operations for 5 minutes and will return to the normal automatically.

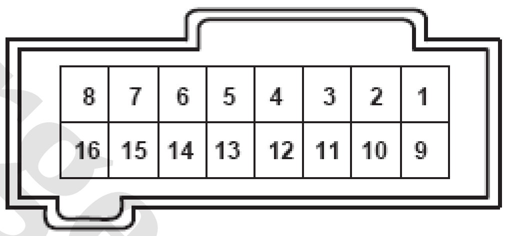
Layout of Windows



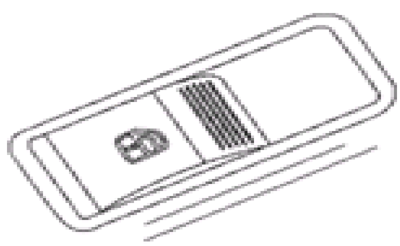
1 - Left front door armrest plate switch	7 - Right rear door armrest plate switch
2 - Left front door window regulator motor	8 - Right rear door window regulator support
3 - Left front door window regulator support	9 - Right rear door window regulator motor
4 - Left rear door window regulator support	10 - Right front door window regulator support
5 - Left rear door window regulator motor	11 - Right front door armrest plate switch
6 - Left rear door armrest plate switch	

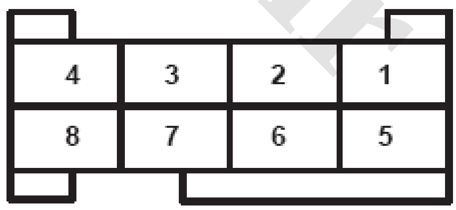
1. Left front door window regulator switch



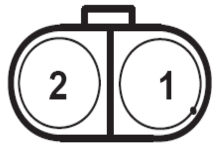


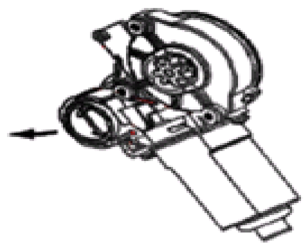
2. Definition of right front, left rear and right rear door armrest panel switches



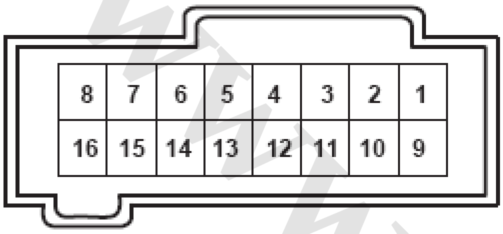


3. Definition of window regulator interface





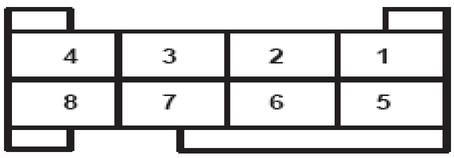
4. Left front door window regulator switch



D4

Pin	diameter of line	line color	Function
1	0.50	Y/P	Left front window falling signal
2	0.50	Y/R	Left front window rising signal
3	0.50	R/G	12 V power
4	--		
5	--		
6	0.50	Y/B	Safety lock signal
7	0.50	Y/G	Left rear window falling signal

8	0.50	Y/Bl	Left rear window rising signal
9	0.50	Y/V	Right front window falling signal
10	0.50	Y/W	Right front window rising signal
11	0.50	G/Y	Power of background light
12	--		
13	0.50	B	Grounding
14	--		
15	0.50	Y/Br	Right rear door window falling signal
16	0.50	Y/P	Right front door window rising signal

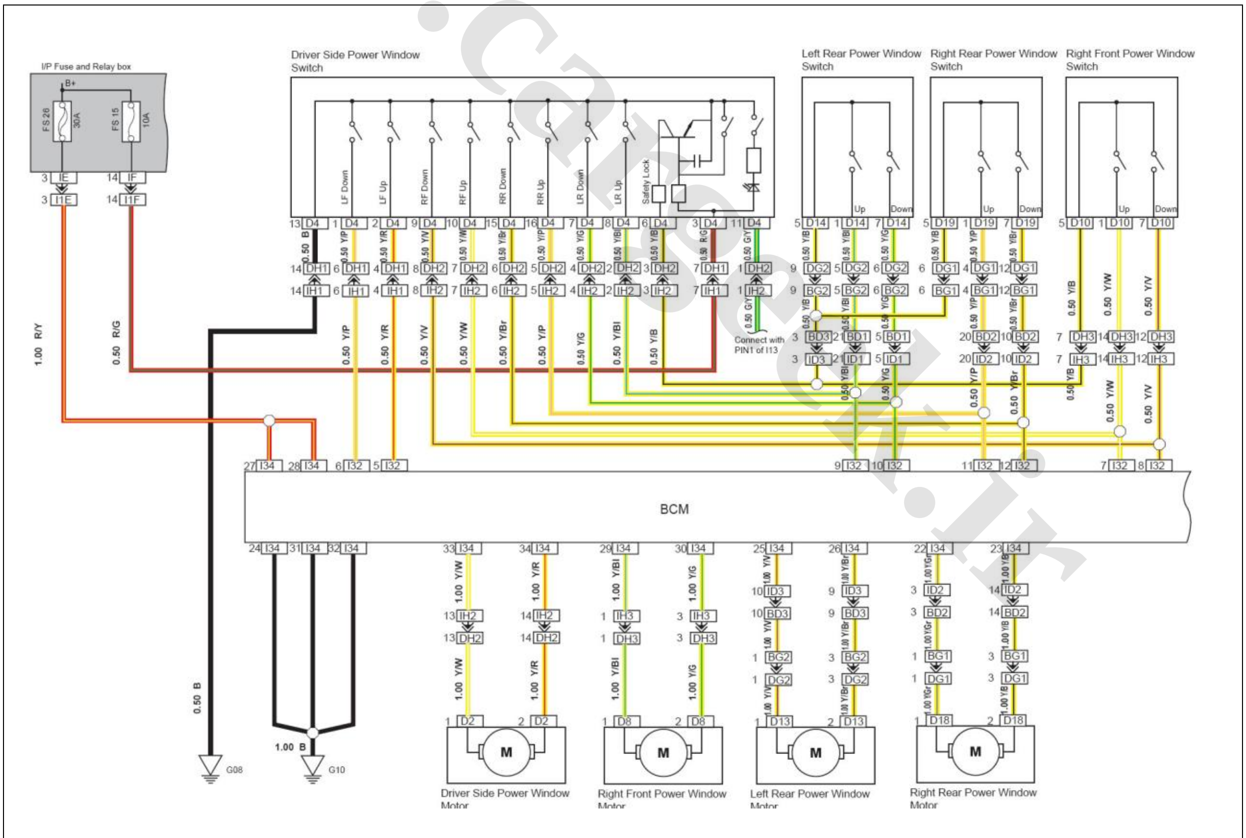


D10

Pin	diameter of line	line color	Function
1	0.50	Y/W	Right front window rising signal
2	--		

3	--		
4	--		
5	0.50	Y/B	Safety lock signal
6	0.50	B	
7	0.50	Y/V	Right front window falling signal
8	0.50	Br/P	Power

5. Electric window circuit



6. Faults of electric windows

Fault Symptom	Fault Reason
All the electric windows do not work	BCM fault Fault of window regulator power fuse The wiring is faulty.
A single electric window system does not work	Fault of this door window regulator switch Fault of window regulator motor The wiring is faulty.
The locking system of the windows does not work	1. Fault of the safety switch in the left front door power window master switch 2. Wiring fault

Check of Electric Window Components

1 - Check the left front door armrest panel switch and the left front door power window master switch (see the above table). Other doors: Check the conductivity among each terminal of the window regulator switch connectors.

(1) Check if the window regulator switch is normal.

Place the left front door window regulator switch at "UP". Then terminal 2 and terminal 13 shall be conducted and so shall terminal 7 and terminal 12. If it is placed at "DOWN", terminal 1 and terminal 13 shall be conducted. Other window regulator switches shall be checked in the same way as the above. If conductivity does not meet the requirement, window regulator switches shall be replaced.

(2) Check if the backlight of the left front door armrest panel switch is normal

Make terminal 11 connected with power (10-14V) and terminal 13 grounded and observe if the backlight is on. If it is on, it shall be qualified; if not, the backlight shall be disqualified.

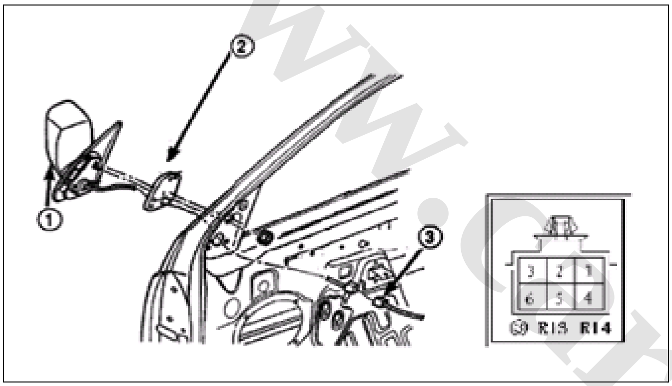
2 - Check the window regulator motor

If the positive pole of the battery is connected with terminal 1 of the window regulator motor and the negative pole with terminal 2, the left front window will rise; If the positive pole of the battery is connected with terminal 2 of the window regulator motor and the negative pole with terminal 1, the left front window will fall;

Section 6 Exterior Electric Rearview Mirror

Overview

The electric rearview mirrors can be regulated up and down or left and right (the regulating angle at each direction can reach 7 degrees) by the electric switch on the left dash board of the driver side. When parking the vehicle, the driver can fold the rearview mirrors (the maximum folding angle is higher than 85 degrees) to prevent the mirrors from being damaged. If a rearview mirror is hit by something, its case will be folded outwards. To avoid damage, the maximum folding angle outwards shall be 105 degrees. If the mirror is broken, the fragments will stay in the mirror carrier, which may be much safer.



1 - Exterior electric rearview mirrors;	3 - Electric interface
2 - Gasket	

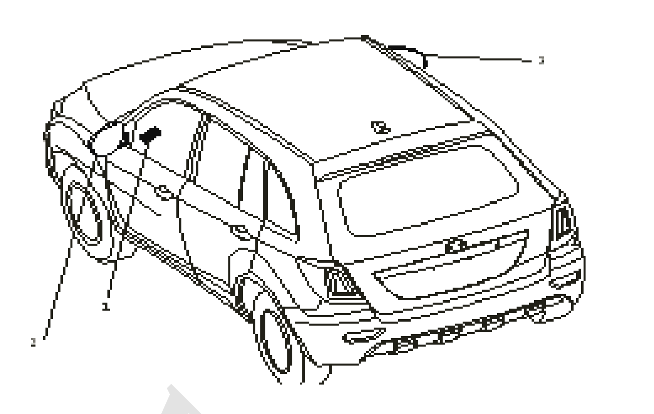
The electric rearview mirror system includes:

(1) Left and right exterior electric rearview mirrors;

(2) Exterior electric rearview mirror switch assembly

Layout of Exterior Electric Rearview Mirrors

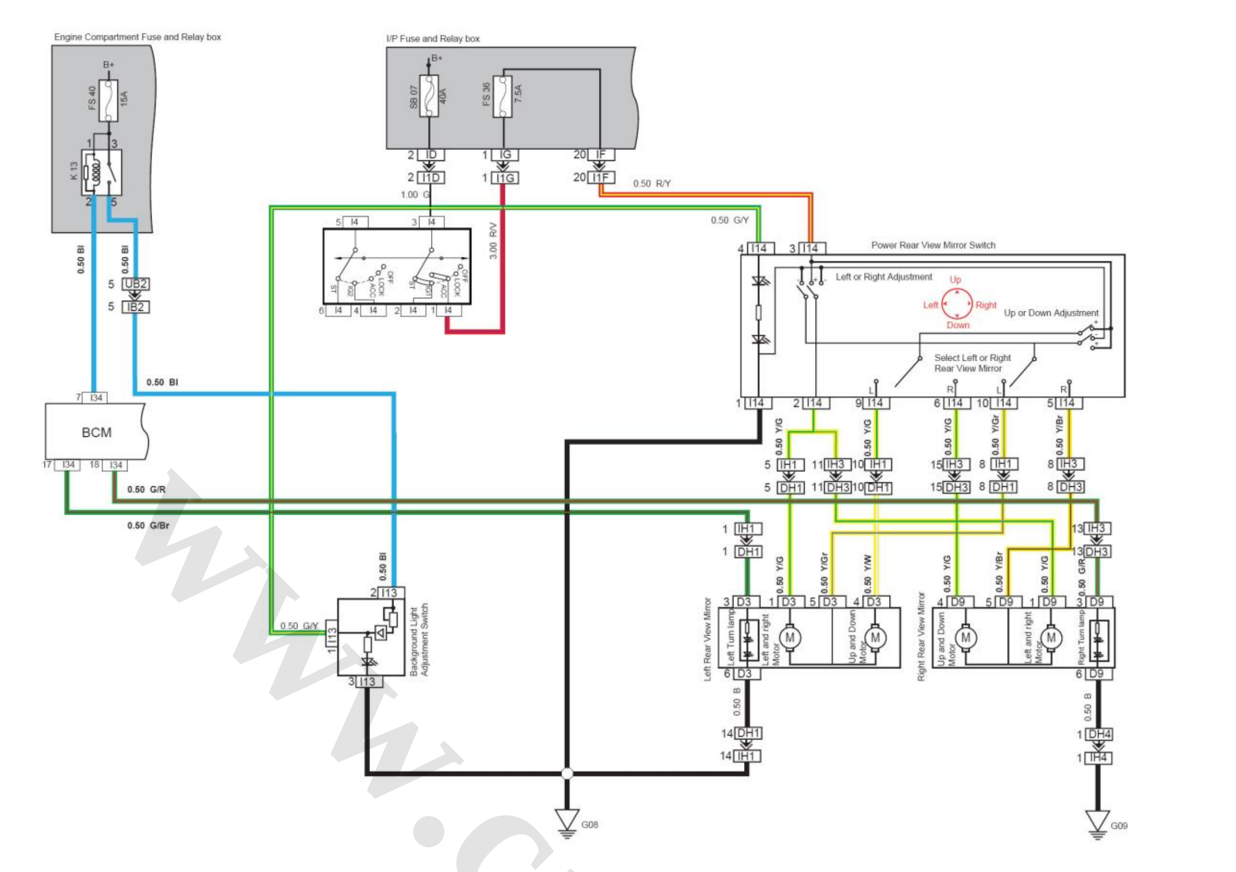
Layout of Exterior Electric Rearview Mirrors

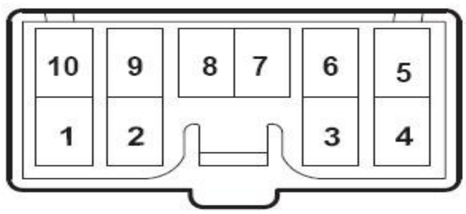


1 - Exterior electric rearview mirrors switch;	3 - Right exterior electric rearview mirror
2 - Left exterior electric rearview mirror	

Terminal Voltage of Exterior Electric Rearview Mirrors

1. Exterior electric rearview mirror switch (see the following figure)





I14

Electric rearview mirrors switch terminal view

Pin	diameter of line	line color	Function
1	0.50	B	Grounding
2	0.50	Y/G	12V motor power

3	0.50	R/Y	12 V power
4	0.50	G/Y	Power of background light
5	0.50	Y/Br	Right signal
6	0.50	Y/G	Right signal
7	--		
8	--		
9	0.50	Y/W	Left signal
10	0.50	Y/Gr	Left signal

Fault Symptoms of Exterior Electric Rearview Mirrors

Table 4-68

Fault Symptom	Fault Reason
The exterior rearview mirrors do not work	1. Fuse fault 2. Fault of the rearview mirror switch 3. Fault of the rearview mirror motor 4 Wiring fault
The exterior rearview mirrors work abnormally	1. Fault of the rearview mirror switch 2. Fault of the rearview mirror motor 3 Wiring fault

Check of Exterior Electric Rearview Mirrors

1 Check the electric rearview mirror switch following the above items. If the conductivity does not meet the requirement, the electric rearview mirror switch shall be replaced.

2 Check the electric rearview mirrors following the above items. If the requirements are not satisfied, the electric rearview mirror motor and the motor wiring connector ③ shall be replaced.

Section 7 Wiper and Washer

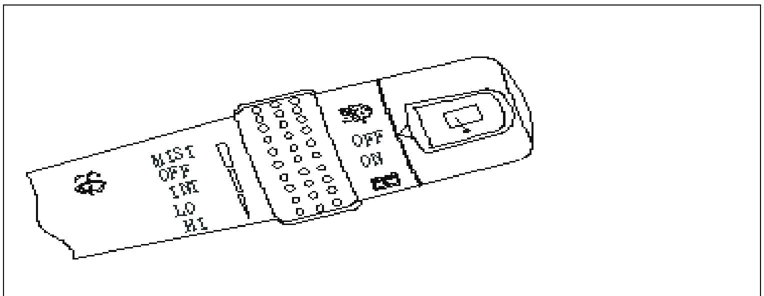
Overview

The wiper system, consisting of wiper arm assembly, connecting rod mechanism, and wiper motor, is provided with functions of single wipe, intermittent wipe, slow wipe, and fast wipe.

The washer system is mainly composed of washing pump, reservoir, filler pipe, and nozzle. The wiper and washer system aims to provide a convenient, safe and reliable method for the driver to ensure the view of the windshield. Each component of this system transforms the energy produced by the circuit system of the vehicle into the mechanical movement of the wiper blade to wipe out water drops on the surface of the glass and also into the liquid movement of the washer to inject the washer fluid in the fluid reservoir onto the glass which needs to be washed.

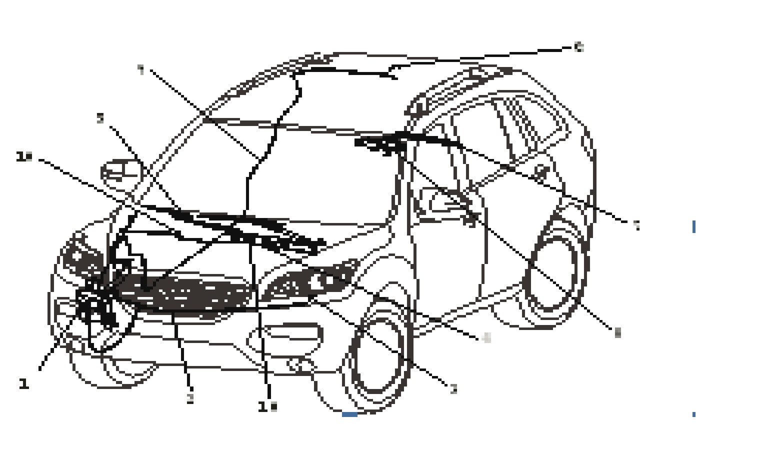
Under the integrated application of these functions, these components can wipe out rain, snow, bugs, mud, and other small materials to provide a clear view for the driver in a hostile environment.

The driver can start all the functions of the wiper and washer system via the combination switch at the right side of the steering column under the steering wheel.

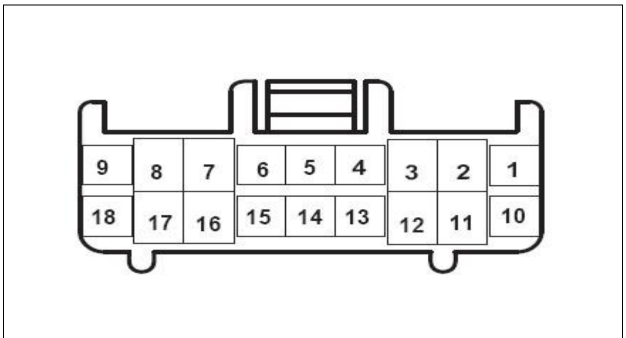


Layout o f Wiper and Washer System

1. Harness interface, see the following figure.



1 - Headlight washer hose assembly	7 - Tail door windshield wiper
3 - Headlight washer nozzle	8 - Rear wiper motor assembly
4 - Wiper connecting rod mechanism and motor assembly	9 - Front section of rear windshield hose
5 - Wiper assembly	10 - Front windshield washer nozzle
6 - Rear windshield washer nozzle	

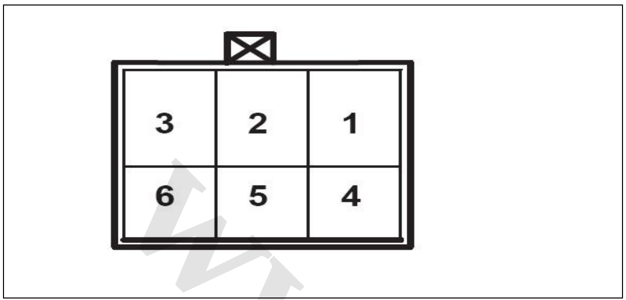


I3

Combination switch terminal view

Pin	diameter of line	line color	Function
1	--		
2	2.00	P/L	Rear wiper motor power 12V (high speed)
3	2.00	P/G	Rear wiper motor power 12V (low speed)
4	--		
5	--		
6	--		
7	--		
8	0.50	Y/Bl	Signal
9	--		
10	--		
11	1.0	B	Grounding
12	0.50	P/G	Signal (rear wiper)
13	--		
14	0.50	B	Grounding
15	0.50	P/W	
16	0.50	P/Y	12 V power

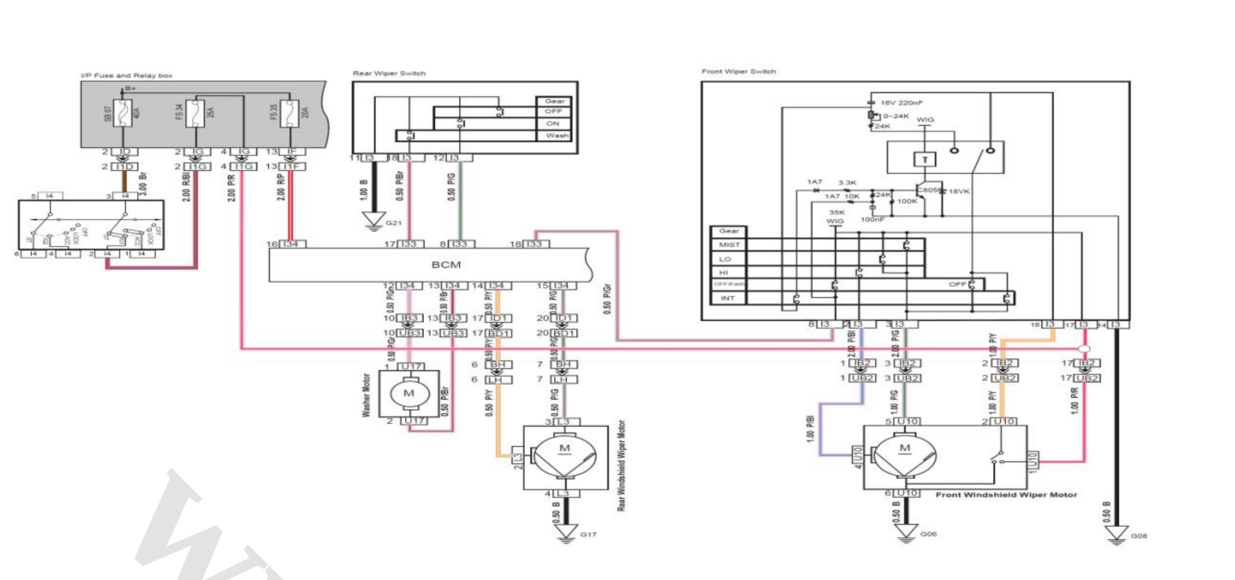
17	0.50	P/R	MIST gear signal
18	0.50	P/Br	Signal (rear wiper)



Wiper motor terminal view

Pin	diameter of line	line color	Function
1	1.00	P/R	MIST gear signal
2	0.50	P/Y	Front wiper motor power 12V (high speed)
3	--		Front wiper motor power 12V (low speed)
4	0.50	P/Bl	High speed power
5	0.50	PG	Low speed power
6	0.50	B	Grounding

2 Check and repair the circuit



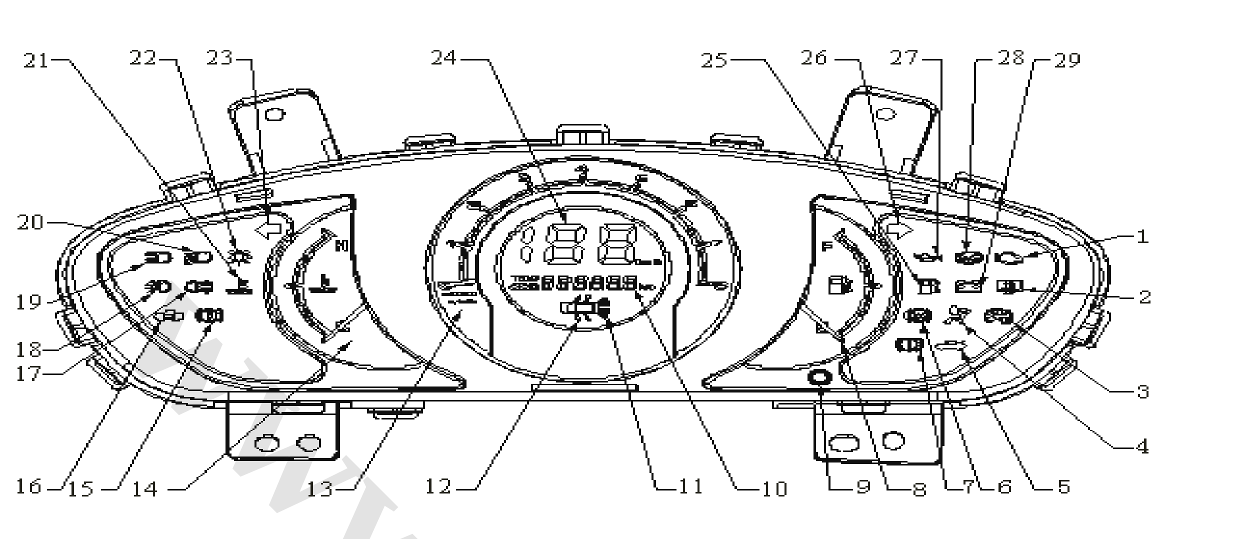
3 Fault Symptoms of Wiper and Washer System

Fault Symptom	Fault Reason
Wiper and washer do not work	1 Fault of accessory relay 2 Fault of wiper fuse 3 Fault of wiper combination switch assembly 4 Wiring fault
At INT, the wiper does not work	1 Fault of wiper combination switch assembly 2 Fault of wiper motor 3 Wiring fault
When the combination switch assembly is placed at MIST, the wiper does not work	1 Fault of wiper combination switch assembly 2 Fault of wiper motor 3 Wiring fault
When the right combination switch is at OFF, the wiper blade does not return or returns to the wrong	1 Fault of wiper combination switch assembly 2 Fault of wiper motor

position	3 Wiring fault
At LO or HI, the wiper does not work	1 Fault of wiper combination switch assembly 2 Fault of wiper motor 3 Wiring fault
The washer motor does not work	1 Fault of wiper combination switch assembly 2 Fault of washer motor 3 Wiring fault
The washer does not inject fluid	1 Fault of washer hose 2 Fault of washer nozzle
When the wiper combination switch assembly is at OFF, the Wiper blade will go down and then up and stop.	The crank on the wiper motor is not at the RESET.

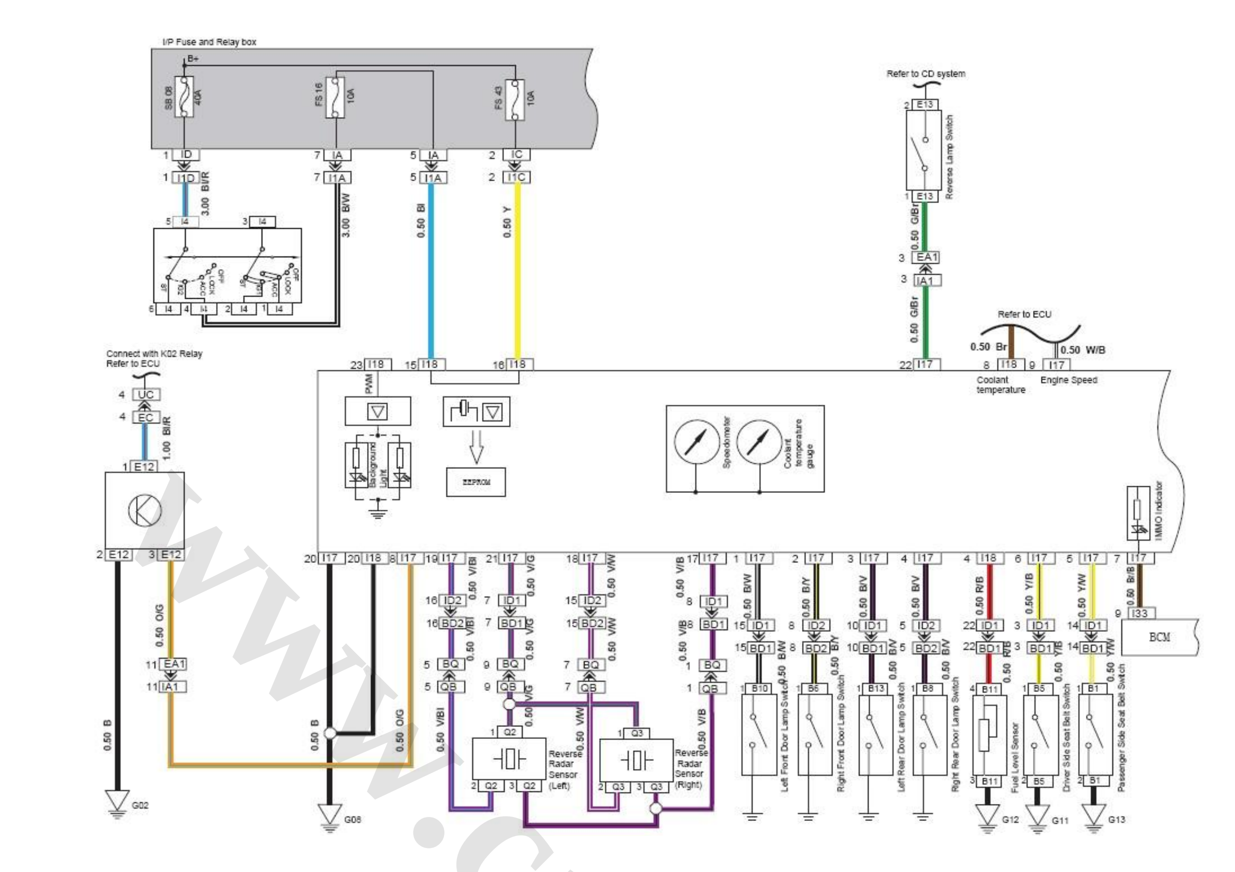
Section 8 Instrument Cluster

Overview of instrument of X60 models (MT)



1 - Engine emissions and monitoring indicator lamp	16 - Anti-theft alarm indicator lamp
2 - Rear window defroster indicator lamp	17 - Rear fog lamp indicator lamp
3 - 120 ㎞/h overspeed alarm indicator lamp	18 - Front fog lamp indicator lamp
4 - Airbag fault alarm indicator lamp	19 - Headlight high beam indicator lamp
5 – Unclosed luggage compartment door alarm indicator lamp	20 - Headlight low beam indicator lamp
6 - ABS fault indicator lamp	21 – Excessive water-temperature warning indicator lamp
7 - Brake system fault indicator lamp	22 – Lighting master switch indicator lamp
8- Fuel gauge	23 - Left turn indicator lamp

9 - Subtotal mileage / total mileage switch - zero reset lever	24- Speedometer
10 - Subtotal / Total odometer	25 - Fuel warning indicator lamp
11 - Reversing radar indicator lamp	26 - Right turn indicator lamp
12 – Unclosed door alarm indicator lamp	27 - Low engine oil pressure warning indicator lamp
13 - Engine tachometer	28 - Fault(beyond engine OBD) alarm indicator lamp
14- Water temperature gauge	29 - Battery charging indicator lamp
15 - Parking brake indicator lamp	



As shown above, the circuits of instrument cluster constitute a single wire harness, which is connected with a connector at the back of the instrument cluster housing. All gauges and indicator lamps of the instrument meter are protected behind a whole piece of transparent plastic lens, which can be seen clearly from the front of the instrument shield. Behind the transparent plastic mirror are the cover and the panel of the instrument cluster. The shield is made of a sun-visor plate to allow the surface of the instrument cluster to avoid environmental illumination and reflection, resulting in reduction of glare.

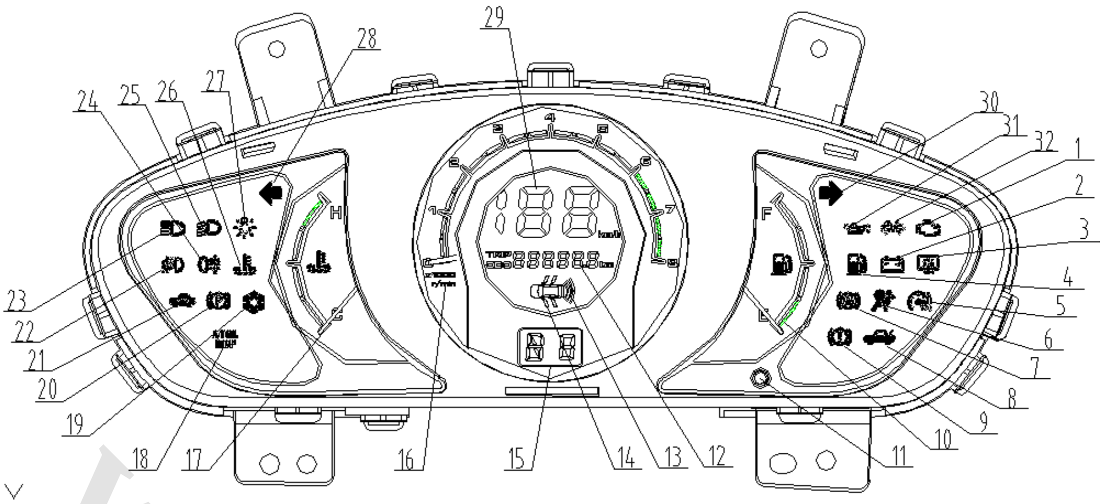
This instrument cluster is also provided with a sound warning function. The visible dark surface of the panel and the surface of the instrument dial are surface layers or covering layers of multilayer structure. The surface layer is subtransparent and dark to avoid unorderly situation of the unlit indicators packaged in the instrument cluster. Translucence makes the lit indicators and icons visible. Under the covering layer is a non-transparent layer, behind which, the indicators send light to the panel and the instrument dial surface through the reserved opening. Then the panel and the dial become visible.

Both graphics-scale and digits on the surface of the instrument are translucent, which can be lit from behind. However, the white meter pointers are lit inside. There is a little plastic button switch for odometer/ taximeter in the center of the lower edge of the instrument cluster lens, protruding the mirror surface through a special small hole in the lens. This vehicle model’s instrument cluster uses the integrated circuit, through the PCI data bus, to control the information from the network of part gauges and indicator lamps. There are also a number of gauges and indicator lamps directly connected to input to achieve some functions of their own.

Fuel level low warning indicator	Water temperature too high warning indicator	Battery charging warning indicator	Engine oil pressure too low warning indicator	Brake system fault indicator
Parking brake indicator	Engine OBF indicator	Anti-lock brake system fault indicator	Safety belt unbuckled warning indicator	Air bag fault warning indicator
Rear defrosting indicator	Left turn signal lamp indicator	Right turn signal lamp indicator	Hazard warning indicator	Headlamp high-beam indicator
Headlamp low-beam indicator	Width lamp indicator	Front fog lamp indicator	Rear fog lamp indicator	Warning indicator for faults outside engine OBD
120Km/h overspeed warning indicator	Luggage boot ajar warning indicator	Door ajar warning indicator	Hint of reversing radar distance display	... ...

The illumination of the instrument cluster is realized by the adjustable LED at its back, which can make the instruments visible. Each indicator of the instrument cluster is also lit by a special LED. And each LED is welded integrally on the circuit board behind the instrument cluster housing. The instrument cluster is connected to the electric system of the complete vehicle by connecting circuits which are integrated in the harness of the vehicle in different routings, fixed in different ways.

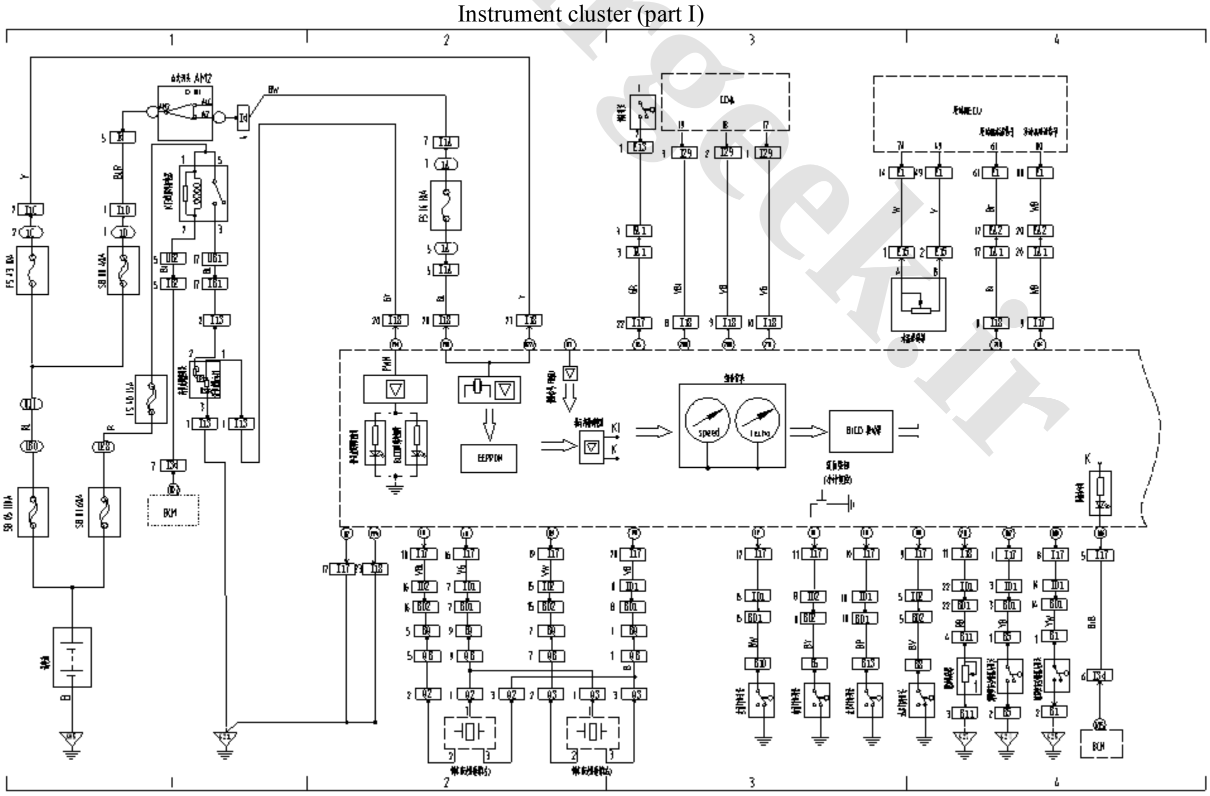
Overview of Instrument of X60 Models (AT)



1 - Engine emissions and monitoring indicator lamp	17 - Water temperature gauge
2 - Battery charging indicator lamp	18 - Transmission oil temperature alarm indicator lamp
3 - Rear window defroster indicator lamp	19 -Snow mode indicator lamp
4 - Fuel warning indicator lamp	20 - Parking brake indicator lamp
5 - 120 km/h overspeed alarm indicator lamp	21 - Anti-theft alarm indicator lamp
6 - Airbag fault alarm indicator lamp	22 - Rear fog lamp indicator lamp
7 - ABS fault indicator lamp	23 - Headlight high beam indicator lamp
8 – Unclosed luggage compartment door alarm indicator lamp	24 - Front fog lamp indicator lamp
9 - Brake system fault indicator lamp	25 - Headlight low beam indicator lamp
10- Fuel gauge	26 – Excessive water-temperature warning indicator lamp

11 - Subtotal mileage / total mileage switch - zero reset lever	27 – Lighting master switch indicator lamp
12 - Subtotal / Total odometer	28 - Left turn indicator lamp
13 - Reversing radar indicator lamp	29- Speedometer
14 – Unclosed door alarm indicator lamp	30 - Right turn indicator lamp
15 - Gear indicator display	31 - Low engine oil pressure warning indicator lamp
16 - Engine tachometer	32 - Fault(beyond engine OBD) alarm indicator lamp

Instrument cluster (part I)



As shown above, the circuits of instrument cluster constitute a single wire harness, which is connected with a connector at the back of the instrument cluster housing. All gauges and indicator lamps of the instrument meter are protected behind a whole piece of transparent plastic lens, which can be seen clearly from the front of the instrument shield. Behind the transparent plastic mirror are the cover and the panel of the instrument cluster. The shield is made of a sun-visor plate to allow the surface of the instrument cluster to avoid environmental illumination and reflection, resulting in reduction of glare.

This instrument cluster is also provided with a sound warning function. The visible dark surface of the panel and the surface of the instrument dial are surface layers or covering layers of multilayer structure. The surface layer is subtransparent and dark to avoid unorderly situation of the unlit indicators packaged in the instrument cluster. Translucence makes the lit indicators and icons visible. Under the covering layer is a non-transparent layer, behind which, the indicators send light to the panel and the instrument dial surface through the reserved opening. Then the panel and the dial become visible.

Both graphics-scale and digits on the surface of the instrument are translucent, which can be lit from behind. However, the white meter pointers are lit inside. There is a little plastic button switch for odometer/ taximeter in the center of the lower edge of the instrument cluster lens, protruding the mirror surface through a special small hole in the lens. This vehicle model’s instrument cluster uses the integrated circuit, through the PCI data bus, to control the information from the network of part gauges and indicator lamps. There are also a number of gauges and indicator lamps directly connected to input to achieve some functions of their own.

Layout of Instrument Cluster

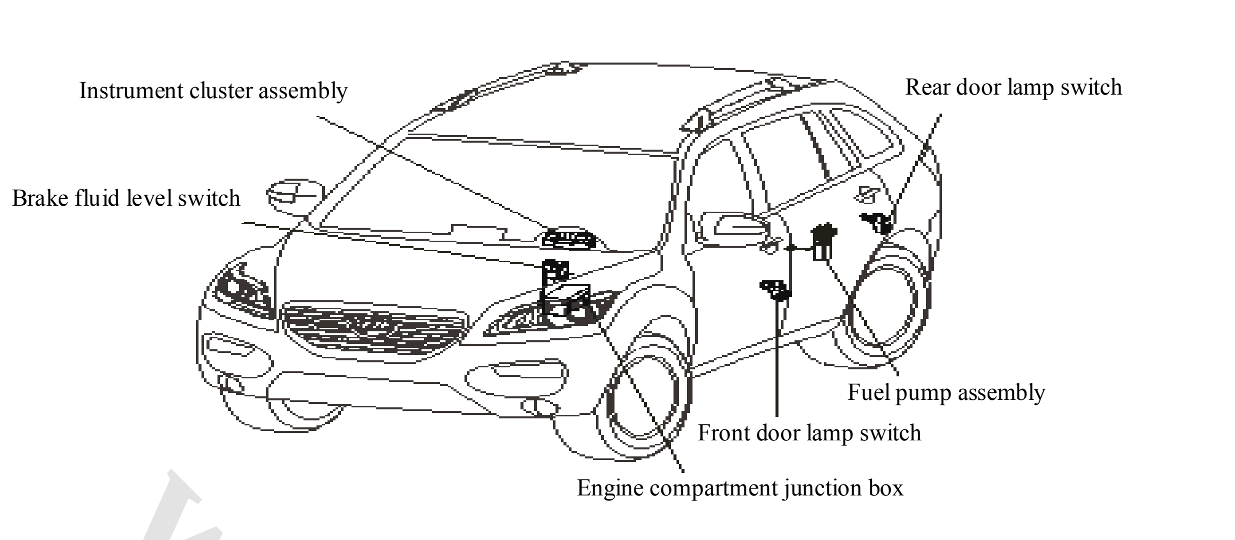
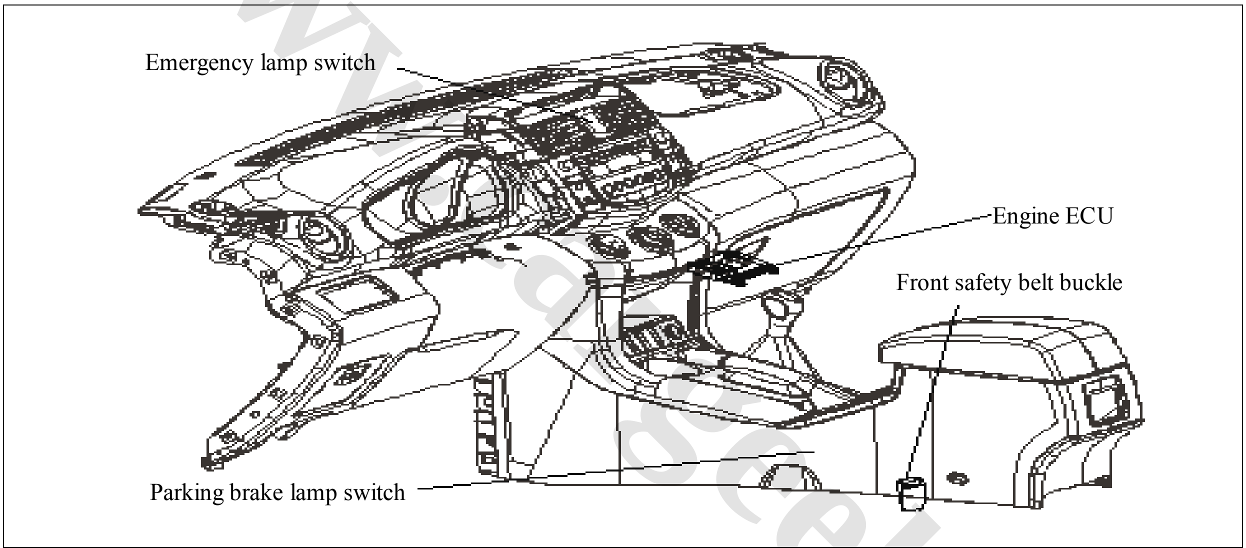
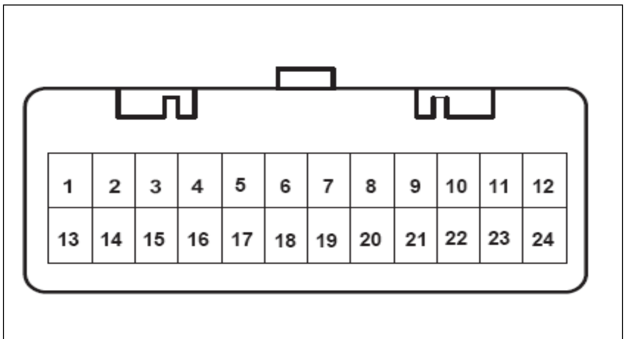


Fig. 4-69



Instrument Cluster Terminal Voltage

See the following figure

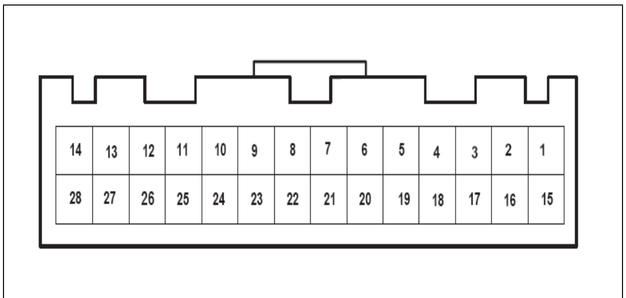


I17

See the following table for the definition of terminal

Pin	diameter of line	line color	Function
1	0.50	B/W	Left front step lamp signal
2	0.50	B/Y	Right front step lamp signal
3	0.50	B/V	Left rear step lamp signal
4	0.50	B/V	Right rear step lamp signal
5	0.50	Y/W	Co-driver's safety belt switch signal
6	0.50	Y/B	Driver safety belt switch signal
7	0.50	Br/B	IMMO Indicator Light
8	0.50	O/G	Vehicle speed sensor signal (MT)
9	0.50	W/B	Engine rotation speed signal
10	--		
11	0.50	Bl/W	CAN-L(AT)
12	0.50	Bl/B	CAN-H(AT)
13	0.50	Bl	Width indicator light
14	--		

15	0.50	Bl/W	High beam indicator
16	0.50	Bl/B	Brake indicator
17	0.50	V/B	Reverse radar signal-
18	0.50	V/W	Reverse radar sensor (right) signal
19	0.50	V/Bl	Reverse radar sensor (left) signal
20	0.50	B	Grounding
21	0.50	V/G	Reverse radar signal+
22	0.50	G/Br	Reverse switch signal
23	0.50	G/Br	Left turn signal lamp signal
24	--		



I18

Pin	diameter of line	line color	Function

1	0.50	O/W	Vehicle speed sensor signal (12V)
2	0.50	O/G	Vehicle speed sensor signal (5V)
3	--		
4	0.50	R/B	Oil level signal
5	0.50	V/G	Sound enabling signal
6	0.50	V/B	Sound control signal
7	0.50	V/Bl	Sound selection signal
8	0.50	Br	Coolant temperature signal
9	--		
10	0.50	R/G	ABS Indicator Light
11	0.50	V	Charge indicator
12	0.50	O/B	SRS Indicator Light
13	0.50	Y/B	Low engine oil pressure indicator
14	0.50	G/P	Right turn indicator lamp
15	0.50	Bl	Instrument B+ power
16	0.50	Y	Instrument IGN power
17	0.50	Bl/Y	Low beam

18	0.50	Bl/B	Front fog light indicator
19	0.50	G/Br	Rear fog light indicator
20	0.50	B	Grounding
21	--		
22	--		
23	0.50	G/Y	Adjustment input of background light
24	0.50	W/Bl	SVS Indicator Light
25	0.50	Bl/Br	Low brake fluid level indicator light
26	0.50	B/Br	Luggage boot ajar
27	0.50	P	Rear defrosting indicator
28	0.50	G	OBD Indicator Light

Table 4-70

Fault Symptoms of Instrument Cluster

Fault Symptom	Fault Reason
The instrument cluster does not work	1 Fuse fault 2 Wiring and connector fault 3 Fault of instrument cluster

Fault of the tachometer	1 Engine/ECM fault 2 Wiring and connector fault 3 Fault of instrument cluster
Fault of the coolant temperature gauge	1 Fault of coolant temperature sensor 2 Wiring and connector fault 3 Fault of instrument cluster
The safety belt unbuckled buzzer works abnormally	1 Fault of four-step lamp switches 2 Fault of SRS ECU 3 Wiring and connector fault 4 Fault of instrument cluster
Fault of the speedometer	1 Fault of vehicle speed sensor 2 Wiring and connector fault 3 Fault of instrument cluster
Fault of fuel gauge	1 Fault of fuel level sensor 2 Wiring and connector fault 3 Fault of instrument cluster
The reverse radar alarm buzzer works abnormally	1 Fault of instrument cluster 2 Fault of ECM controller 3 Fault of reverse radar probe 3. Fault of reverse switch

	4 Fault of key unlocked warning switch 5 Wiring and connector fault
The door ajar buzzer works abnormally	1 Fault of four-step lamp switches 2 Wiring and connector fault 3 Fault of instrument cluster
No display of gear indicator	1 Instrument cluster fault 2 Trouble in wiring and connectors 3 Trouble in selector switch
Incorrect display of gear indicator	1 Trouble in selector switch 2 Trouble in shifting bearing

Check of Instrument Cluster Circuits

1 - The instrument cluster does not work.

(1) Check steps

1) Check the instrument cluster power 10A fuse (located in the indoor fuse box). If it is normal, the next step can be carried out; if it is abnormal, the instrument fuse shall be replaced.

2) Check the fuse FS16-10A (located in the indoor fuse box). If it is normal, the next step can be carried out; if it is abnormal, the instrument fuse shall be replaced.

3). Check the instrument cluster.

Remove the instrument cluster and place the ignition switch at “ON”. Detect the voltage between No. 15 terminal and No. 16 terminal of terminal I18 of the instrument cluster connector and the vehicle body, which shall be 10~14V.

② Detect the resistance between No. 20 terminal of terminal I17 and No. 20 terminal of terminal I18 of the instrument cluster connector and the vehicle body, which shall be less than 1Ω. If it is normal, the instrument cluster shall be replaced; if it is abnormal, the wiring and the connector shall be repaired or replaced.

2 - Speedometer fault

2.1 Inspection procedures for X60 models (MT)

1) Check the input terminal of the power supply of the speed sensor.

With the ignition switch ON, measure the voltage between No. 1 terminal of E12 and the body. Make sure that it is between 10 ~ 14V.

If so, go to next step; if not, repair or replace the fuse-wiring or connector.

2) Check the ground terminal of the speed sensor. See Figure 4-20.

Measure the resistance between No. 2 terminal of E12 and the body. Make sure that it is always less than 1Ω. If so, go to next step; if not, repair or replace the wiring or connector.

3) Checking the instrument cluster

Move the shift lever into the N position. Lift the front wheels with a lift, and turn the ignition switch to the ON position. When the wheels rotate slowly, measure the voltage between No. 8 pin of the instrument cluster harness terminal I17 and the body. Make sure that the peak of pulse voltage to be generated is between 5 ~ 14V.

If so, replace the instrument cluster; if not, repair or replace the wiring and connector as well as speed sensor.

2.2 Inspection procedures for X60 models (MT)

1) Checking the vehicle speed signal circuit

Check the continuity from the U32connector 15 PIN of the front harness to the I38 connector

96 PIN of the dashboard harness, from the U32 connector 16 PIN of the front harness to the I38 connector 97 PIN of the dashboard harness, from the I38 connector 19 PIN of the dashboard harness to the I17 connector 1 PIN of the dashboard harness and from the I38 connector 20 PIN of the dashboard harness to the I17 connector 2 PIN of the dashboard harness.

2) Checking the instrument cluster

You can do it by replacing the instrument cluster.

3) Checking the TCU

You can do it by replacing the TCU.

3 - Fault of the tachometer

(1) Check steps

1) Check the rotation speed signal output of the engine ECM.

During the operation of the engine, check the voltage between terminal No. 9 of terminal I17 and the body, which shall be the pulse voltage with the wave crest of about 5V.

If it is normal, the instrument cluster shall be replaced; if it is abnormal, the wiring/connector/electronic injection system shall be repaired or replaced.

4 - Fault of fuel gauge

(1) Check steps

1). Check the resistance of the fuel level sensor.

Disconnect the fuel pump harness connector B11. Detect the resistance between terminal 3-B11 and terminal 4-B11 of the fuel level sensor connector when the fuel level sensor float is at E and F. When it is at F, the resistance shall be 1-5Ω; when it is at E, the resistance shall be 112~116Ω.

If it is normal, the next step shall be carried out; if it is abnormal, the fuel level sensor shall be replaced and installed to the fuel pump.

2). Check the wiring and the connector between the instrument cluster and the fuel pump.

① Disconnect the instrument cluster harness connector and terminal B11 of the fuel pump harness connector.

② Measure the resistance between No. 4 pin of I18 and 4-B11 should less than 1Ω.

③ Measure terminal No. 20 of the harness I17 and the vehicle body grounding, which shall be less than 1Ω.

④ Measure terminal No. 4 of the instrument cluster and the vehicle body, which shall be more than 100KΩ.

If it is normal, the instrument cluster shall be replaced; if it is abnormal, the wiring and the connector shall be repaired or replaced.

5 - Fault of the coolant temperature gauge

(1) Check steps

1). Check the coolant temperature sensor

Disconnect the engine coolant temperature sensor harness connector. When the coolant temperature is 90°C, the resistance between the signal wire terminal of the coolant sensor and the vehicle body shall be 75-98Ω.

If it is normal, the next step shall be carried out; if it is abnormal, the coolant temperature sensor shall be replaced.

2). Check the wiring and the connector between the instrument cluster and the coolant temperature sensor.

① Disconnect the instrument cluster harness connector and the engine coolant temperature sensor harness connector.

② Detect the resistance between No. 8 terminal of the instrument cluster I18 and the No. 61

terminal of E1 of engine ECM, which shall be less than 1Ω.

③ Measure the resistance between terminal No. 8 of the instrument cluster I18 and the vehicle body, which shall be more than 100KΩ.

If it is normal, the instrument cluster shall be replaced; if it is abnormal, the wiring and the connector shall be repaired or replaced.

6 - The step lamp alarm buzzer works abnormally.

(1) Check steps

1) Check the left front step lamp switch.

Open and then close the left front door and confirm the status between terminal No. 1 of the instrument cluster I17 and the vehicle body shall be connected (the resistance shall be less than 1Ω) and then disconnected (the resistance shall be more than 100KΩ).

If it is normal, the next step shall be carried out; if it is abnormal, the left front step lamp switch shall be replaced.

2) Check the right front step lamp switch

Open and then close the right front door and confirm the status between terminal No. 2 of the instrument cluster I17 and the vehicle body shall be connected (the resistance shall be less than 1Ω) and then disconnected (the resistance shall be more than 100KΩ).

If it is normal, the next step shall be carried out; if it is abnormal, the right front step lamp switch shall be replaced.

3) Check the left rear step lamp switch.

Open and then close the left rear door and confirm the status between terminal No. 3 of the instrument cluster I17 and the vehicle body shall be connected (the resistance shall be less than 1Ω) and then disconnected (the resistance shall be more than 100KΩ).

If it is normal, the next step shall be carried out; if it is abnormal, the left rear step lamp switch shall be replaced.

4) Check the right rear step lamp switch.

Open and then close the left rear door and confirm the status between terminal No. 4 of the instrument cluster I17 and the vehicle body shall be connected (the resistance shall be less than 1Ω) and then disconnected (the resistance shall be more than 100KΩ).

If it is normal, the next step shall be carried out; if it is abnormal, the right rear step lamp switch shall be replaced.

7 - Driver safety belt unbuckled alarm buzzer works abnormally. See the following table.

Fault Symptom	Fault Reason
The driver safety belt unbuckled alarm buzzer works abnormally.	1 Fault of instrument cluster 2 Fault of SRS ECU 3 Wiring and connector fault 4 Fault of safety belt buckle switch

8 - Check the engine oil pressure warning indicator of the instrument cluster

Disconnect the harness connector of the switch of the engine oil pressure warning indicator, place the ignition switch at ON and connect the connector terminal at the switch wiring side of the engine oil pressure warning indicator. The engine oil pressure warning indicator shall be lit.

9 - Check the engine oil pressure warning indicator switch

Disconnect the harness connector of the engine oil pressure sensor switch and check the conductivity between the terminal of the engine oil pressure warning indicator switch and the vehicle body. When the engine stops, the terminal and the vehicle body shall be conducted; when the engine operates, the terminal and the vehicle body shall not be conducted.

10 - Check the step lamp alarm buzzer

(1) Place the ignition switch at ON (IG1). The door ajar alarm buzzer will sound even if only one of the four doors is not closed. The sound will stop as long as all doors are closed.

12 - Check the brake warning indicator of the instrument cluster

(1) Check the parking brake warning indicator: disconnect the parking brake light switch harness connector and connect the connector terminal of the parking brake switch wiring and the vehicle body. Place the ignition switch at ON and check the parking brake warning indicator which shall be lit;

(2) Check the brake fluid level warning indicator: disconnect the brake fluid level warning indicator connector and make the connector terminal of the parking brake switch wiring short-circuited. Place the ignition switch at ON and check the brake fluid level warning indicator which shall be lit.

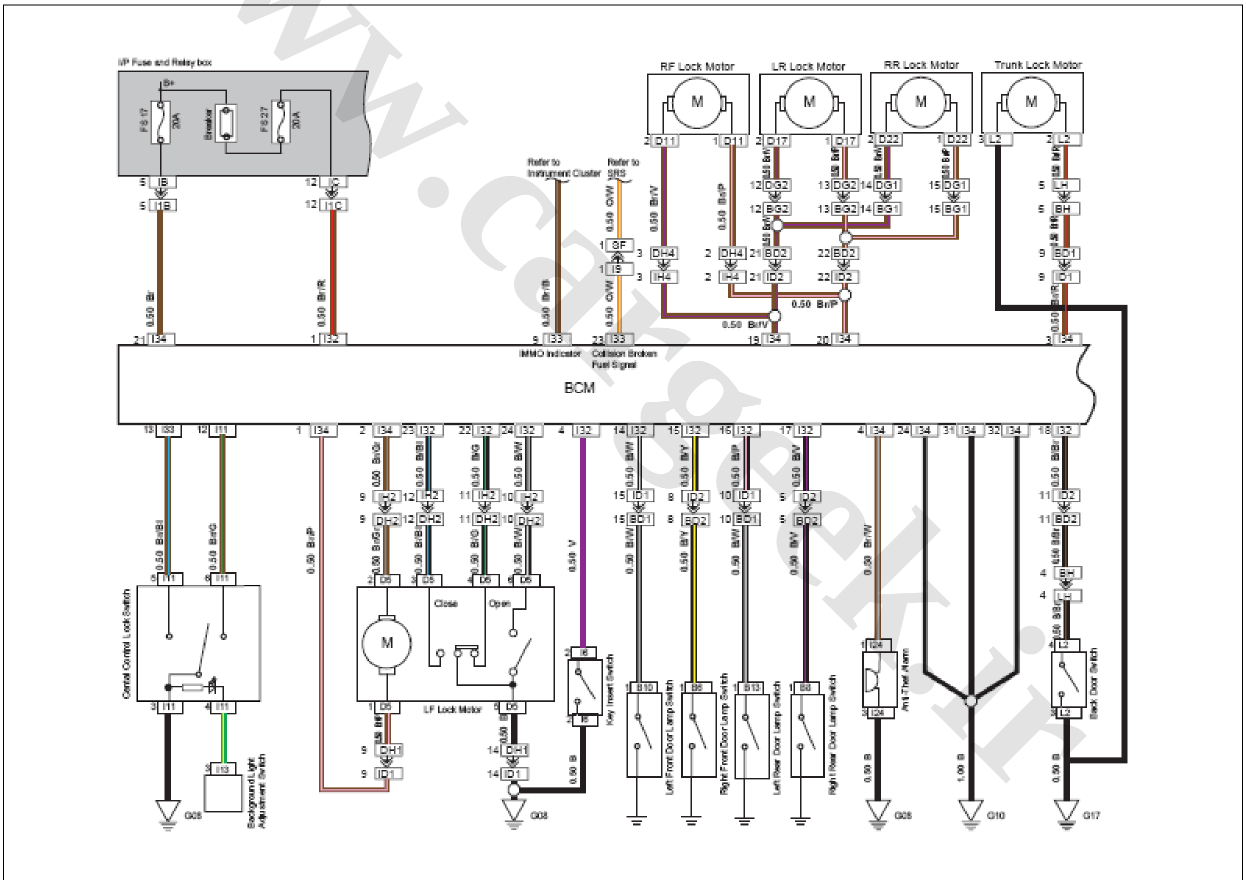
13 - Check the brake fluid level warning indicator: remove the reservoir cover and the filter, disconnect the harness connector of the brake fluid warning indicator switch and check the conductivity between the terminals of the brake fluid level switch. When the float rises, the terminals shall not be conducted. Use a suction tube to draw out the brake fluid in the reservoir and check the conductivity between the terminals of the brake fluid level warning indicator switch. When the float drops, the terminals shall be conducted.

Section 9 BCM Central Lock and Burglar Alarm System

Overview

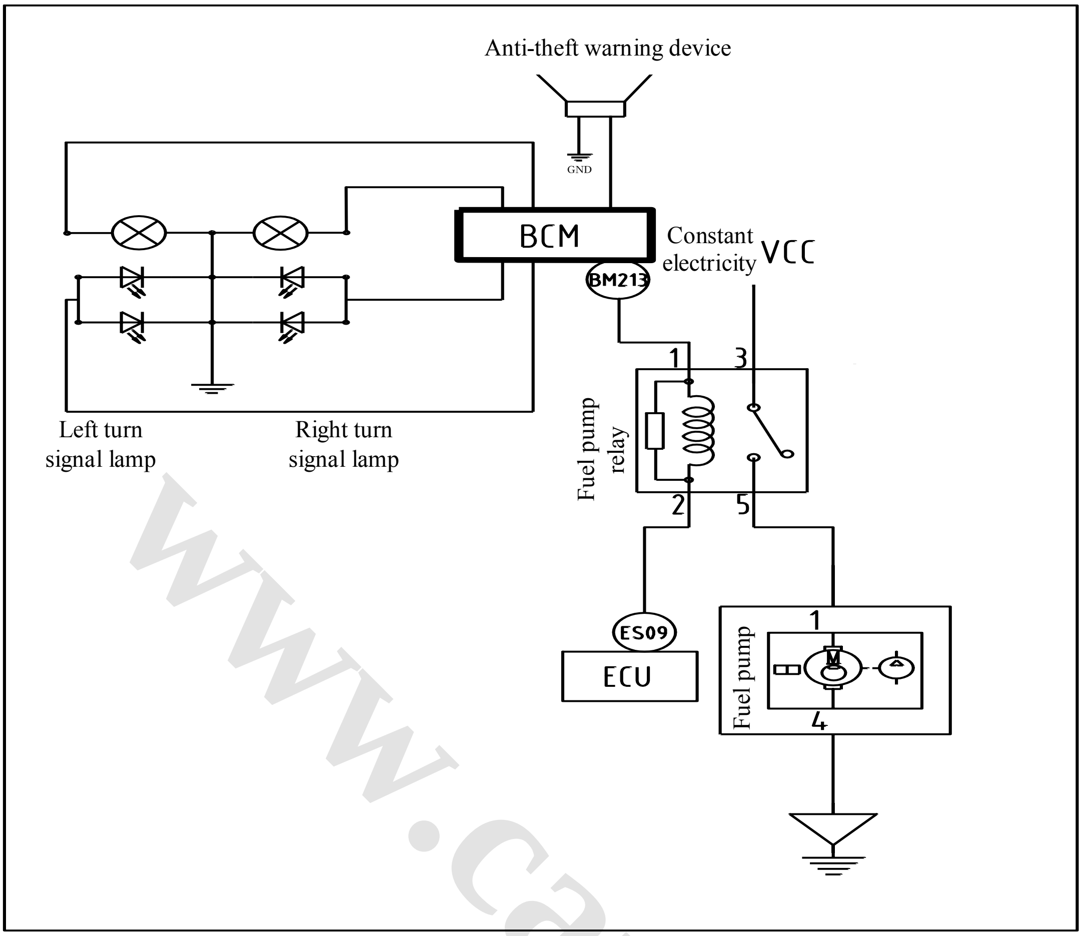
Composition and structure of anti-theft system consists of BCM, remote key, alarm and turn lights.

The central lock system is a part of the Body Control Module (BCM), connected with the burglar alarm system. It is mainly responsible for controlling four-door lock motors, remote locking & unlocking, controlling indoor lights, preventing the vehicle from being started during the security status, and vehicle search. See details in the user’s manual. The control principle is as shown in the following figure.



Operating principle: The LF6430’s anti-theft system achieves its function by controlling the on and off of the fuel pump through the high/ low level signal output by the BCM control module.

Anti-theft system principle diagram:



Alarm conditions: The ignition switch is disconnected, the ignition key is drawn out and the four doors and the rear luggage boot are closed in place.

Remote operation conditions: The remote operation is of no effect when the ignition key is inserted into the ignition lock.

1 Locking operations

Unlocked doors can be locked with many methods. Different methods are provided with different results.

(1) Automatic locking of driving vehicle

When the vehicle drives at the speed of 20km/h during the start, the four doors will be locked automatically. In a driving circle (the vehicle is not stopped but the ignition switch is turned off), when the vehicle speed decreases to less than 20km/h and then increases to 20km/h again, the system will not repeat the locking no matter whether the doors are unlocked or not.

(2) Locking switch on dash board

The four doors can be locked simultaneously via operating the locking switch on the dash board.

(3) Remote locking key

When the remote locking key is pressed (short-time operation), the four doors can be locked simultaneously, the turn signal lamp will flash once to send a vision signal and the alarm will sound once to send an acoustic signal.

(4) Key insertion into door lock

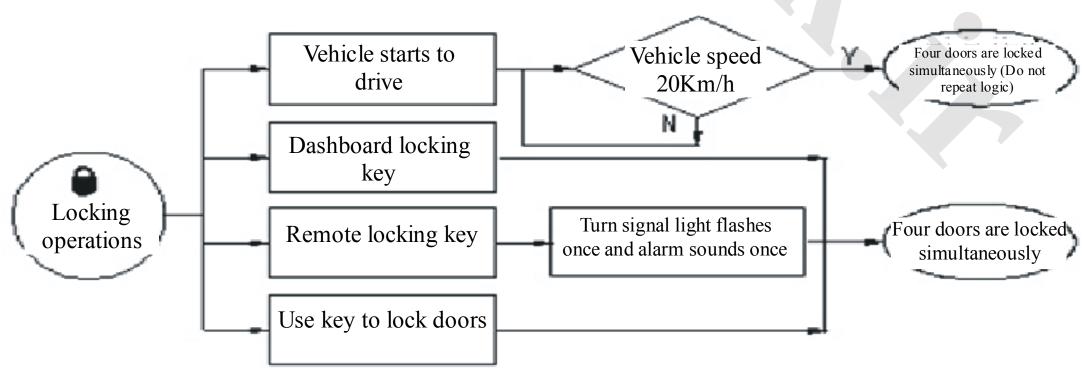
The four doors can be locked simultaneously when the key is inserted into the door keyhole and rotated anticlockwise.

(5) Door lock button

The door lock button can display the status of the vehicle door lock. The outward red mark means unlocking while the inward means locking. When the door lock button is moved from inside vehicle, only the corresponding door will be operated and others will not.

(6) Door locking operation procedure

See the following figure for the door locking operation procedure.



2 Unlocking operations

Locked doors can be unlocked with many methods. Different methods are provided with different results.

(1) Unlocking switch on dash board

The unlocking switch on the dash board can only be used to unlock the vehicle doors. The first operation of the switch is to unlock the driver door while the second operation is to unlock the other 3 doors.

(2) Door key

The four doors can be unlocked simultaneously when the key is inserted into the door keyhole and rotated clockwise.

(3) Key ignition switch

After the driving vehicle stops and the key leaves from ON to ACC, the four doors shall be unlocked simultaneously.

(4) Airbag

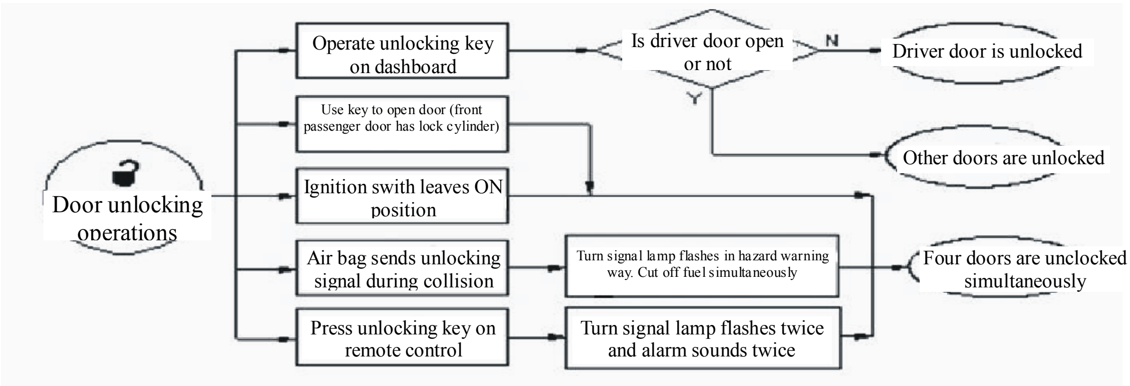
When the vehicle is hit and the airbag is exploded, the airbag SDM will send an unlocking signal. Then the four doors will be unlocked independently at the same time and the turn signal lamp will send a vision signal in hazard warning way (the ignition switch is turned off).

(5) Unlocking key on remote control

When the unlocking switch on the remote control is pressed, the four doors can be independently unlocked at the same time, the turn signal lamp will flash twice to send a vision signal and the alarm will sound twice to send an acoustic signal.

(6) Procedure of door unlocking operations

See the following figure for the procedure of the door unlocking operations.



3 Set alarm conditions

Alarm conditions: The ignition switch is turned off, the key is drawn out and the four doors and the rear luggage boot are closed.

(1) Alarm operations of the locking key on the remote control

1) Under the set alarm conditions, when the locking key on the remote control is pressed (short-time operation), the four doors can be locked simultaneously, the turn signal lamp will flash once to send a vision signal and the alarm will sound once to send an acoustic signal. Then the anti-theft indicator will flicker and the system will cut off the fuel control stop to enter the alarm status.

2) If the alarm conditions for the closed four doors and the rear luggage boot are not satisfied, the turn signal lamp will flash for 10s to point out the doors shall be closed; if the anti-theft indicator flickers after 10s, the system will cut off the fuel control stop to enter the alarm status.

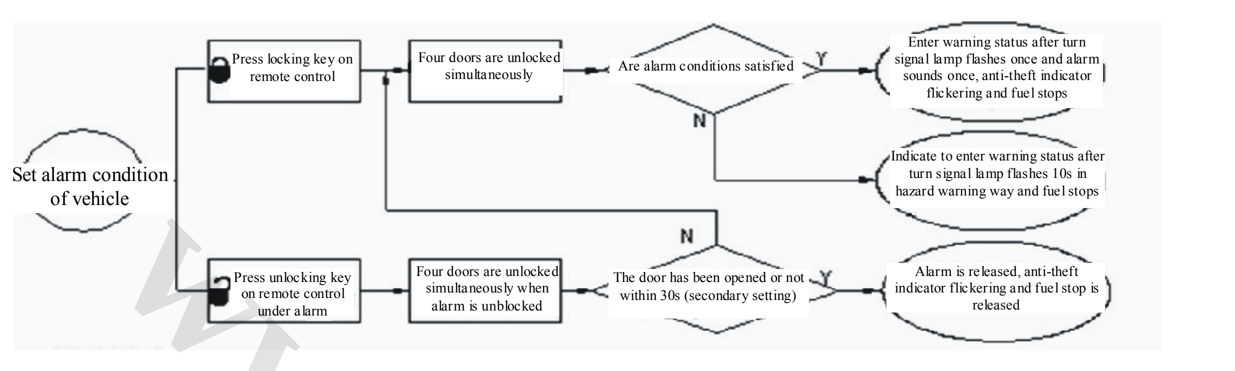
(2) A second setting for the alarm operations of the locking key on the remote control

① Under the set alarm conditions, when the unlocking key on the remote control is pressed, the four doors can be unlocked simultaneously, the turn signal lamp will flash twice to send a vision signal and the alarm will sound twice to send an acoustic signal. Then the anti-theft indicator will go off and the fuel supply control will be recovered.

② If no door has been opened within 30s, the four doors are locked and the anti-theft indicator flickers, the system will cut off the fuel stop to enter the alarm status for a second time.

(3) The procedure of the alarm setting operations

See the following figure for the procedure of the alarm setting operations.



4 Unblock the alarm

Under the set alarm conditions, unlawful entry or theft will be alarmed and the vehicle can be locked. Only the authorized person can unblock the alarm in a correct way and then the vehicle can be used normally.

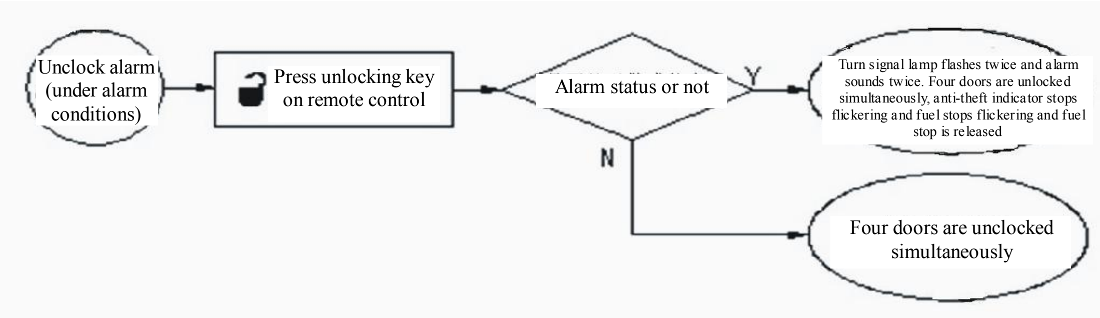
(1) Press the unlocking key on the remote control to unblock the alarm.

When the unlocking key on the remote control is pressed, the four doors can be unlocked simultaneously. If the system enters the alarm status, the turn signal lamp will flash twice to send a vision signal and the alarm will sound twice to send an acoustic signal. Then the anti-theft indicator will stop flickering, the alarm will be unblocked and the fuel supply control will be recovered.

If the alarm is unblocked, the four doors will be unlocked simultaneously.

(2) The procedure of alarm unblocking operations

See the following figure for the procedure of the alarm unblocking operations.



42 See the procedure for the procedure of the alarm unblocking operations

5 Hints for locking vehicle

If the doors are not locked and the alarm conditions are set, the system will judge the situation and give a suggestion.

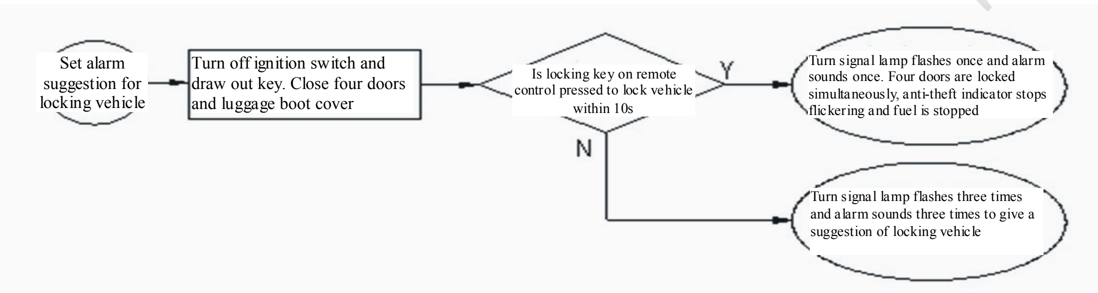
(1) Set the alarm suggestion for locking the vehicle

1) The ignition switch is disconnected, the key is drawn out and the four doors and the rear luggage boot are closed. If the locking key on the remote control is pressed within 10s to set the alarm conditions, the vehicle will enter the alarm status.

2) If the locking key on the remote control is not pressed within 10s, the turn signal lamp will flashes 3 times to send a vision signal and the alarm will sound three times to send an acoustic signal to give a suggestion of locking vehicle and setting alarm.

(2) The procedure of vehicle locking and alarm setting operations

See the following figure for the procedure of vehicle locking and alarm setting operations.



6 Vehicle search

One can use vehicle search function to find his among many vehicles.

(1) Vehicle search operations

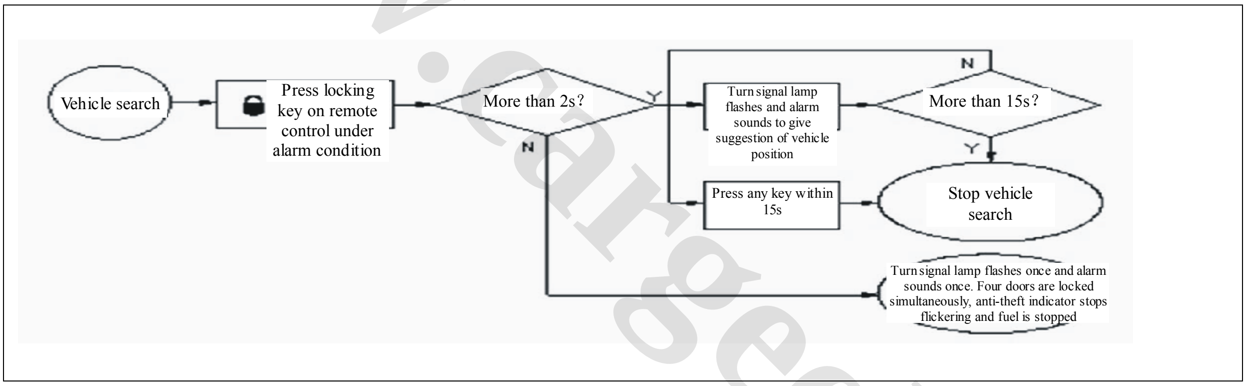
When the vehicle is in alarm status and the unlocking key on the remote control is pressed for no less than 2s, the vehicle search will begin. Then the turn signal lamp will send a vision signal and the alarm an acoustic signal. The vehicle search will end after 15s.

If any key on the remote control is pressed within 15s, the vehicle search will end.

If the unlocking key on the remote control is pressed for less than 2s, the vehicle will be still in alarm status.

(2) The procedure of the vehicle search operations

See the following figure for the procedure of the vehicle search operations.



7. Electrically open the rear luggage boot (EX)

(1) Press the remote control to open the luggage boot under the non-alarm status.

Under the non-alarm status, operate the opening key on the center console. The rear luggage boot cover will open and the signal light (31 in the figure) on the instrument cluster will be lit. Then the rear luggage boot cover can be lifted by hand. For closing, the luggage boot cover shall be pressed down. Then the signal light (31 in the figure) on the instrument cluster will go off and the cover shall be confirmed to be closed. If the cover is not closed within 60s, the turn signal lamp will flash to give a suggestion that the cover is not closed.

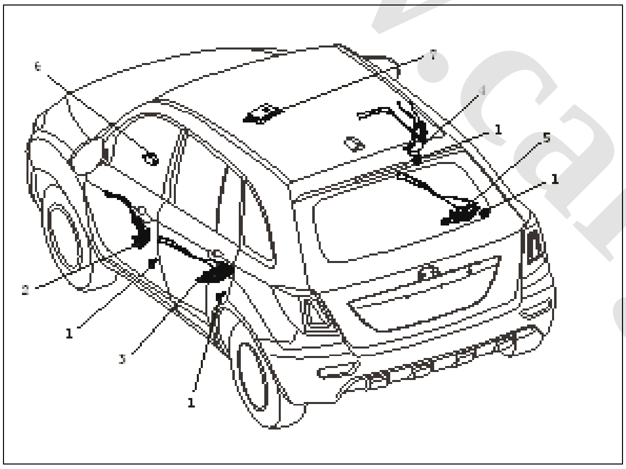
(2) Open the rear luggage boot under the alarm status

1) The rear luggage boot can not be opened by the remote control when the ignition key is

inserted into the ignition lock. The remote operation will be of effect only when the ignition key is drawn out.

2) Under the alarm status, the alarm shall be unblocked first and the remote control shall be pressed to open the rear luggage boot. The rear luggage boot cover will open and the signal light on the instrument cluster will be lit. Then the rear luggage boot cover can be lifted by hand. The luggage boot cover shall be pressed down and be closed. Then the signal light on the instrument cluster will go off and the cover shall be confirmed to be locked. If the cover is not closed within 60s, the turn signal lamp will flash to give a suggestion that the cover is not closed.

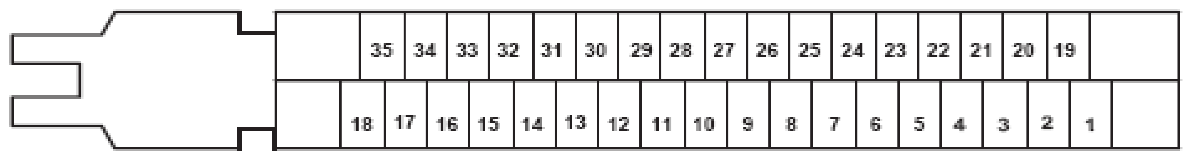
Layout of Central Lock



1 - door lamp switch	5 - Right rear door central actuator
2 - Left front door central actuator	6 - mmobilizer ECU
3 - Left rear door central actuator	7 - Body control module (BCM)
4 - Right front door central actuator	

Terminals of Central Lock

1 Pins’definition of the central lock of the body control module (BCM):

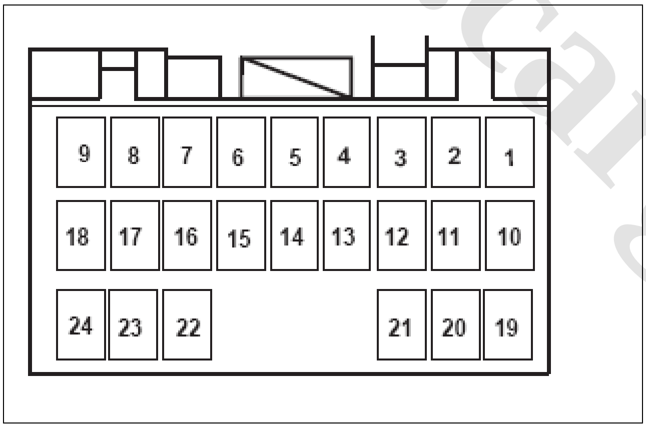


I34

Pin	diameter of line	line color	Function
1	0.50	Br/P	Left front door lock motor power+
2	0.50	Br/Gr	Left front door lock motor power-
3	0.50	Br/R	Tail door lock power
4	0.50	Br/W	Anti-theft warning signal
5	--		
6	0.50	G/Gr	Front / Middle ceiling light signal
7	0.50	Bl	BCM power 12V
8	0.50	Bl/Br	headlight 12 V
9	0.50	G/Br	Left rear turn signal lamp power
10	0.50	G/R	Right rear turn signal lamp power
11	0.50	P/W	

12	0.50	P/Gr	Washer motor power+
13	0.50	P/Br	Washer motor power-
14	0.50	P/Y	Rear wiper motor power (high speed)
15	0.50	P/G	Rear wiper motor power (low speed)
16	0.50	R/P	BCM power 12V
17	0.50	G/Br	Power output
18	0.50	G/R	Power input
19	0.50	Br/V	Door lock power+
20	0.50	Br/P	Door lock power-
21	0.50	Br	BCM power 12V
22	1.00	Y/Gr	Left rear window motor power+
23	0.50	Y/B	Left rear window motor power-
24	1.00	B	Grounding
25	0.50	Y/V	Left rear window motor power+
26	0.50	Y/Br	Left rear window motor power-
27	0.50	R/Y	BCM power 12V
28	0.50	Y/Bl	BCM power 12V

29	0.50	Y/P	Right front window motor power+
30	0.50	Y/G	Right front window motor power-
31	0.50	B	Grounding
32	0.50	B	Grounding
33	0.50	Y/W	Driver side window motor power+
34	0.50	Y/R	Driver side window motor power-
35	0.50	R	BCM power 12 V

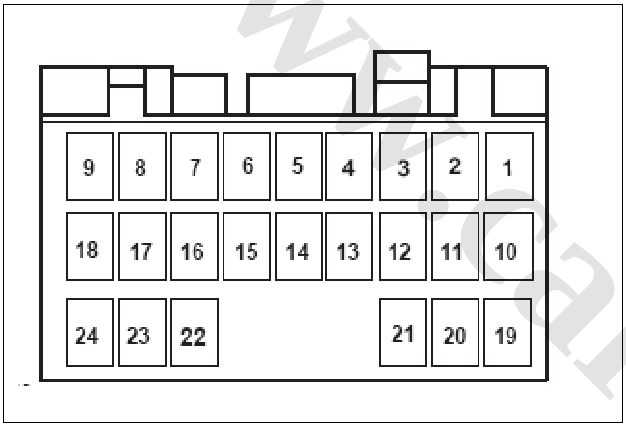


I32

Pin	diameter of line	line color	Function
1	0.50	Br/R	12 V power
2	0.50	Bl	12 V power

3	0.50	Y	Ignition switch aperture light signal
4	0.50	V	Key insertion signal
5	0.50	Y/R	Left front window rising signal
6	0.50	Y/P	Left front window falling signal
7	0.50	Y/W	Right front window rising signal
8	0.50	Y/V	Right front window falling signal
9	0.50	Y/G	Left rear window rising signal
10	0.50	Y/G	Left rear window falling signal
11	0.50	Y/P	Right rear window rising signal
12	0.50	Y/Br	Rear rear window falling signal
13	0.50	G/B	
14	0.50	B/W	Left front step lamp signal
15	0.50	B/Y	Right front step lamp signal
16	0.50	B/P	Left rear step lamp signal
17	0.50	B/V	Right rear step lamp signal
18	0.50	B/Br	Back door switch signal
19	0.50	R/W	

20	--		
21	--		
22	0.50	B/G	Right front door lock locking signal
23	0.50	B/Bl	Left front door lock locking signal
24	0.50	B/W	Signal



I33

Pin	diameter of line	line color	Function
1	0.50	G/B	Emergency light signal
2	0.50	G/Y	Right turn signal lamp signal
3	0.50	G/W	Left turn signal lamp signal
4	0.50	Bl/R	Automatic warning signal
5	0.50	Bl/W	Low beam signal

6	0.50	Bl/Gr	Width lamp signal
7	0.50	G/Br	Light sensor signal
8	0.50	P/Gr	Rear wiper signal
9	0.50	Br/B	IMMO Indicator Light signal
10	--		
11	--		
12	0.50	Br/G	Central lock switch turning off signal
13	0.50	Br/Bl	Central lock switch turning on signal
14	0.50	Br/Y	
15	0.50	R	Signal
16	0.50	P/W	
17	0.50	P/Br	Rear washer signal
18	0.50	P/Gr	Signal
19	--		
20	--		
21	--		
22	--		

23	0.50	P/W	SRS signal
24	0.50	P/Br	

Vehicle Anti-theft Warning

While under anti-theft condition, if the key is at the ignition lock, the ignition switch is shorted, and all the doors are open, then, the oil line output will not be available, the alarm will send out continuous warning and the turn signal lamp will flash. The alarm will stop yet keep flash after 20 seconds. Ten seconds later, the flash will stop. The warning can be released only by pressing the unlocking key and then the oil line can be recontrolled by the ignition key.

Vehicle Body Control Module Central Locking Fault Symptom Table

Fault Symptom	Fault Reason
Door lock control system inoperative	1 Power supply system fuse fault 2 Vehicle body control module fault 3 Wiring fault
Only one door lock inoperative	1 Door lock motor fault 2 Wiring fault
Remote control system failure	1 Step lamp switch fault. 2 Door key locking & unlocking switch fault 3 Vehicle body control module fault (receiving function) 4 Remote controller battery low level or fault (transmitting function)

	5 Wiring fault
Door lock locking/unlocking fault (using central control lock and key)	1 A/C panel fault 2 Vehicle body control module fault 3 Wiring fault 4 Door key locking and unlocking switch fault
Four door locks inoperative	1 Vehicle body control module fault 2 Switch control equipment fault 3 Door lock motor fault 4 Wiring fault
Key mis-locking (the key is at ignition switch and the door can be locked automatically after stopping the vehicle)	1 Locking device fault 2 Vehicle body control module fault 3 Wiring fault

Central Locking Parts Check

1 Central locking basic check

(1) All the doors will be locked if the driver side door is locked. All the doors will be opened if the driver side door is opened.

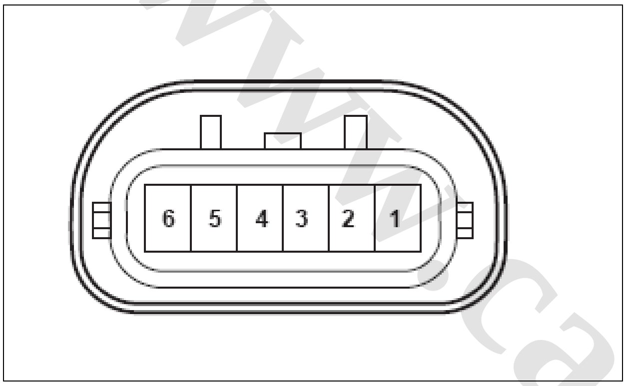
(2) Safety function check

① Only unlocking is performed by pressing the unlocking key on the remote controller if the anti-theft system is closed.

② The steering signal light will flash for two times, the alarm will sound for two times and the anti-theft light will go off by pressing the unlocking key on the remote controller if the anti-theft system has already been started.

③ If the anti-theft system has already been started and the door fails to be opened within 30 seconds after pressing the unlocking key on the remote controller, the door will be locked automatically under anti-theft condition, the turn signal lamp will not flash and the alarm will keep silent.

2 Left front door central locking actuator check



D5

Pin	diameter of line	line color	Function
1	0.50	Br/p	Motor power+
2	0.50	Br/Gr	Motor power+
3	0.50	B/Bl	Turning off signal
4	0.50	B/G	Turning on signal
5	0.50	B	Grounding
6	0.50	B/W	Signal

3 Check the remote control locking system for normal operation

Check steps

(1) Check control function

1) Check basic function

① Press the button on the remote controller for about 1s within 1m from the vehicle to check if all the door locks are unlocked or locked, and at this moment, the ignition key is not at the ignition lock cylinder and all the doors are locked.

② Press the button on the remote controller for 3 times, and check if the light-emitting diode on the remote controller illuminates for 3 times. And the diode will keep illuminating if keep pressing the button. Note: If the diode still can not illuminate after pressing the button for 3 times, the battery may have run down.

2) Check automatic locking function

① While the vehicle is under anti-theft condition, if press the unlocking button on the remote controller and no door is opened within 3Os, then, all the doors will be locked automatically and enter anti-theft condition again, at this moment, the turn signal lamp will not flash and the alarm will keep silent.

② Under the condition mentioned above, if any door is opened within about 3Os, then, all the doors will not be locked automatically.

(3) Check safety protection function

① With the key at the lock cylinder, all the doors will not lock or open while pressing the locking or unlocking button on the remote controller.

② The doors should not lock or open while using a unregistered remote controller. However, the doors should lock or open if using a registered remote controller.

4) While the key is not at the ignition lock cylinder and the door is open or half-open, if press

the button on the remote controller, the door will be locked with warning.

5) Check the flashing function of the steering signal light

① Press the remote control locking button. The system will enter anti-theft condition (anti-theft indicator flashes and fuel is cut off) and the doors will be locked. If proper, the turn signal lamp will flash for 1 time and the alarm will sound for 1 time. If not proper, the turn signal lamp will flash for 10 seconds and the alarm will keep silent, indicating the door should be opened. The flash will stop if proper.

② Press remote-control unlocking button. The anti-theft condition will be released and the 4 doors will be unlocked. And the turn signal lamp will flash for 2 times and the alarm will sound for 2 times. However, only unlocking will be performed while not under anti-theft condition.

③ While under anti-theft condition, if the door is not opened within 30 seconds after pressing the unlocking button on the remote controller, then, the door will be locked automatically and enter anti-theft condition. At this moment, the turn signal lamp will not flash and the alarm will keep silent.

④ Locking indication. If the doors fail to be locked within 10 seconds after taking out the ignition key and closing all the doors, then, the turn signal lamp will flash for 3 times and the alarm will sound for 3 times, indicating the door should be locked.

⑤ Vehicle locating function. Press the locking button on the remote controller for over 2 seconds to perform vehicle locating function. Then, the turn signal lamp will flash for 15 seconds, and the alarm will sound for 0.2 seconds at an interval of 0.6 seconds and stop after 15 seconds. The vehicle locating function can be stopped by pressing any key within the 15 seconds and corresponding function can be performed.

⑥ Vehicle anti-theft warning. While under anti-theft condition, if the key is at the ignition lock, the ignition switch is shorted, and all the doors are open, then, the oil line output will not be available, the alarm will send out continuous warning and the turn signal lamp will flash. The alarm will stop yet keep flash after 20 seconds. Ten seconds later, the flash will stop. The warning can be released only by pressing the unlocking key and then the oil line can be recontroled by the ignition key.

⑦ Bulb damage reminding. The flashing frequency of the turn signal lamp will be doubled if the main bulb is damaged.

⑧ Open luggage boot with remote controller (EX). While under anti-theft condition, release the anti-theft condition at first and then open the luggage boot. If the luggage boot is not opened or closed within 60 seconds, the turn signal lamp will flash. And the flash will not stop until the luggage boot is opened or closed.

If normal, the system is normal. If not normal, go on with the next checking step.

(2) Check the battery of the remote controller

The light-emitting diode on the remote controller will flash for 3 times while pressing the remote controller switch for 3 times.

If normal, go on with next checking step. If not normal, the battery is at low level and replace with specified battery.

(3) Check rear interior lamp

Move the rear interior lamp to position ON and check if the lamp can be illuminated.

Move the rear interior lamp to position DOOR and check if the lamp can be illuminated.

If normal, go on with next checking step. If not normal, repair or replace the rear interior lamp.

(4) Check the area can be controlled by the remote controller

Press the switch button on a new or a same normal remote controller 1m away from the driver side door to check the system for normal operation.

Note: Move the rear interior lamp to position DOOR and the rear interior lamp will keep flashing while pressing the switch button on the remote controller.

If normal, replace remote controller. If not normal, go on with step 5.

(5) Check the warning switch for unlocking of ignition switch

Insert the key into the ignition switch and take it out, then, the switch terminal No. 1 and terminal No. 2 of switch I6 will be connected and disconnected.

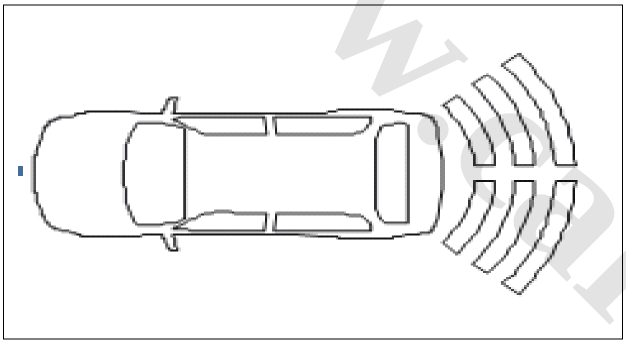
If normal, go on with next checking step. If not normal, replace the warning switch for unlocking of ignition switch.

Section 10 Reversing Radar System (optional)

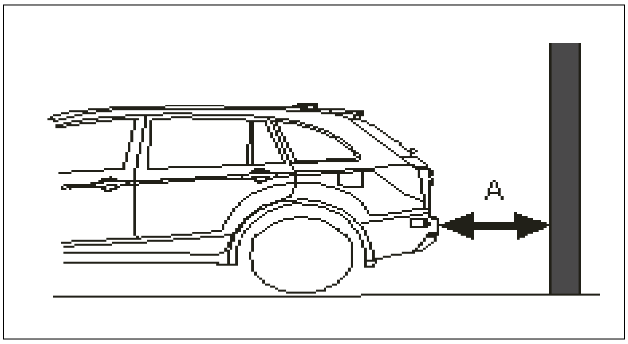
Overview

The reverse radar system is a vehicle monitoring system which is developed as per the detection principle of bat. Several ultrasonic radar probes are installed at the rear to send and receive signal and feed the signal back to the controller. Then, the controller will calculate the distance of the barrier through the signal time and send out different sounds for different distances, then the driver can get the distance between the barrier and the vehicle and the reverse can be more convenient and safer.

1. The alarm signal of the reverse radar system can be shown on the LCD screen of the instrument cluster.



2. Radar-detected distance:



The distance from the reverse radar system will be displayed on the LCD screen section by section, which is controlled by the instrument cluster. The specific distance and display are as follows:

a - While the detected distance A is longer than 1.5m, all the 3 sections will not be illuminated

 (without chime).

b - While the detected distance A is longer than 1m and equal to 1.5m, the outside section will be illuminated  (chime at an interval of 1s).

c - While the detected distance A is longer than 0.5m and equal to 1m, the outside two sections will be illuminated  (chime at an interval of 0.5s).

d - While the detected distance A is shorter than 0.5m, all the 3 sections will be illuminated  (continuous chimes).

3. The system consists of:

(1) Reverse radar

(2) Reverse probe

(3) Reverse indicator (on automatic panel)

Notes for Reverse Radar System

The reverse radar system is a supplementary tool for the driver and it is necessary to use the rear view mirror. LIFAN Company shall not be responsible for any accident due to overspeed reversing and the carelessness of the driver.

1 - The sensor can not check normally in the following situations:

(1) There is soil or snow on the sensor (the function of the sensor can be recovered by washing off the soil or snow on the sensor)

(2) If the sensor is shielded by hand

(3) If the sensor freezes and goes wrong in low temperature

2 - The checking range of the sensor will change in the following situations:

(1) There is soil or snow on the sensor (the function of the sensor can be recovered by washing off the soil or snow on the sensor)

(2) If the vehicle is exposed to extreme sunshine and low temperature

3 - The sensor may mis-check in the following situations:

(1) While the vehicle is on bumpy road, sand road or grassland

(2) If the sensor is disturbed by the horn of other vehicles, the engine noise of motorcycle, the brake noise of oversize vehicle, or the sound wave from other vehicles with probe

(3) While the vehicle is in heavy rain or splashed with water

(4) While the inclination of the vehicle is serious

(5) There is soil or snow on the sensor

(6) With towing eye on the vehicle

(7) While another vehicle with probe is approaching

(8) While the vehicle is driving toward high curb

4 - The sensor can not detect the following barriers:

(1) String-shaped objects, such as wiring or rope

(2) The objects easy to absorb sound wave, such as cotton or snow

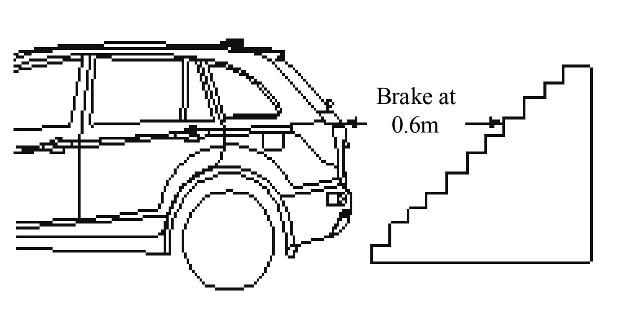
(3) The objects with sharp edge

(4) The objects are too low

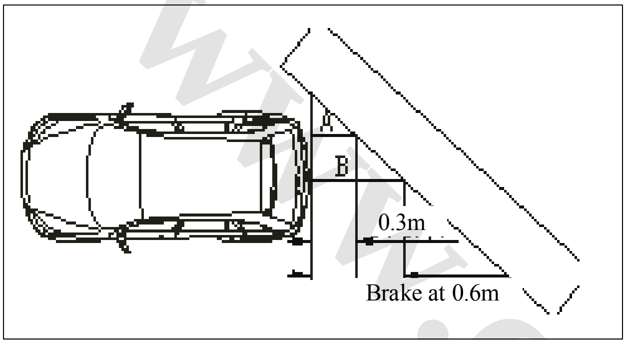
(5) The objects are too high or with a projecting upper part

(6) The sensor is knocked by strong force

(7) The vehicle is too close to the steps and the system can not correctly measure the distance between the vehicle and the bottom step, so the mudguard is damaged (as shown in the following figure)



(8) As shown in Figure 4-71, the vehicle is too close to the wall and the distance is mis-checked by the sensor



Self-diagnosis and fault removal of reverse radar system

1. Pre-check

(1) Move ignition switch to position ON, move shift lever to reverse, apply parking brake to ensure the security of the vehicle, and check reverse radar system

(2) Connect reverse indicator switch

(3) Check the detecting range of the sensor with a column of 60mm diameter moving round the sensor

(4) Check the sound of the indicator and buzzer while a barrier is detected

A - The three sections will not be illuminated while the detected distance S is longer than 1.5 meter

B - While the detected distance S is longer than 1m and equal to 1.5m, the outside section will be illuminated. (Chime at an interval of 1s).

C - While the detected distance S is longer than 0.5m as well as shorter and equal to 1m, both the middle section and the outside section will be illuminated. (chime at an interval of 0.5s) D - While the detected distance A is shorter than 0.5m, all the 3 sections will be illuminated. (Continuous chime)

Test height: 528 + -10MM

2. Self-check function

(1) Test the self-check function of the LCD indicator and buzzer. Check the operation of the indicator and buzzer about 0.4s after moving ignition switch to position ON and keeping the shift lever at reverse location. The operation should last for 0.8±0.2 and the system is under normal checking and operation condition.

(2) If the LCD indicator is not illuminated or the buzzer fails to giver a sound as per requirement, the wiring may be disconnected.

3. See the following fault diagnosis table

Fault Symptom	Fault Reason
Totally out of service (no self-check)	1. Power circuit fault 2 Reverse radar fault
LCD indicator off sometimes (self-check available)	1. Indicator driving circuit fault 2 Reverse radar fault
The system can not work while at reverse position (self-check available)	1. Reverse switch circuit fault 2 Reverse radar fault
Fault Symptom	Fault Reason
Buzzer can not work (self-check available)	1. Buzzer driving circuit fault 2 Reverse radar fault

Open circuit or freezing displayed during self-check	1. Sensor fault or influenced by outside environment 2. Sensor circuit fault
Sound of buzzer too low	1. Buzzer driving circuit fault 2 Reverse radar fault

Reverse Radar System Troubleshooting

1. Totally out of service

(1) Check circuit (as shown in Figure 4-72)

(2) Check steps

(1) Disconnect reverse radar probe wiring connector, check the impedance of pin 3 and vehicle body as shown in above figure, which should be less than 1Ω.

(2) Move the ignition switch to position ON, move the shift lever to reverse position, and check the voltage between pin 1 and vehicle body as shown in above figure, which should be 10-14V. If normal, replace reverse radar. If not normal, go on with next step.

2. Check the buzzer for normal operation and damage

(1) Check circuit

(2) Check steps

1) Check if there is reverse output signal

① Disconnect instrument cluster connector.

② Move the shift lever to reverse position after starting the engine, and square wave signal output should be seen while detecting pin BCM (1-19) with oscilloscope.

If normal, go on with next step. If not normal, check BCM controller and probe for damage.

2) Check wiring harness or connector

① Disconnect BCM vehicle body controller connector

② Disconnect instrument cluster connector

③ Check the impedance of BCM vehicle body controller sleeve BCM and instrument cluster, which should be less than 1Ω.

If normal, go on with next step. If not normal, repair or replace wiring and connector.

3) Check instrument cluster buzzer for normal operation

① Move ignition key to position ON, open any door and the buzzer should sound.

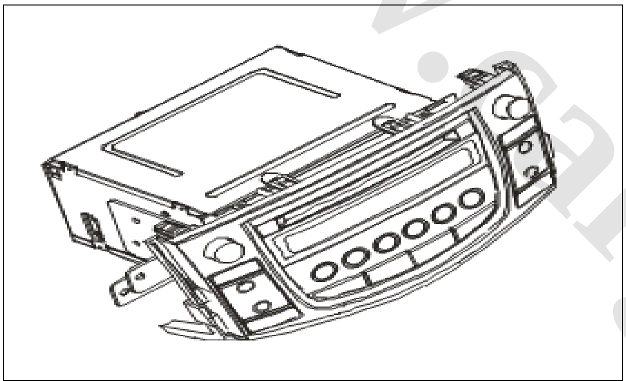
② If the vehicle speed signal can be sent to instrument and the wiring & connector are normal, then, replace instrument cluster.

If normal, go on with other checks. If not normal, replace instrument cluster.

Section 11 Audio System (option)

Overview

The audio system is an integral digital product, and your car with this system will become a mini music theater. All the CD music, USB interface and AM/FM broadcast are excellent. The audio system consists of the following parts: (1) Antenna amplifier, (2) AM/FM printed antenna, (3) CD player assembly, (4) 2-high 4-low amplifier, (5) USB interface. The audio system is an integral digital product, and your car with this system will become a mini music theater. All the CD music, USB interface and AM/FM broadcast are excellent. The audio system consists of the following parts: (1) Antenna amplifier, (2) AM/FM printed antenna, (3) CD player assembly, (4) 2-high 4-low amplifier, (5) USB interface.



Working principle: the audio system can provide information and entertainment by receiving, modulating and amplifying the AM/FM signal from local radio station. The electromagnetic wave signal from radio station will be transformed to weak current modulation signal through printed antenna and then sent to the radio through antenna amplifier and cable. Then, the weak signal received by the radio will be modulated and amplified as strong current signal and sent to amplifier. After that, the strong current signal will be transformed to air vibration by the amplifier and so the radio signal from the radio station can be transformed to sound. The user can select the audio system of other model, which can play cassette & videotape, CD or VCD. Any type you choose can best regulate the sound in your vehicle and meet individual requirements.

The internal circuits of the audio system can suppress the interference from radio frequency and electromagnetic wave.

The outside strategies are as follows:

(1) Antenna amplifier shell grounding

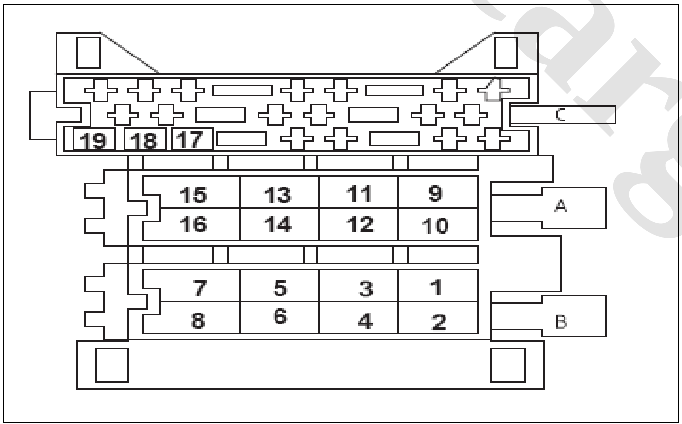
(2) Radio shell grounding

(3) Engine and vehicle body grounding

(4) Adopt resistance type spark plug

(5) Adopt radio noise-suppressing secondary ignition coil

Definition of audio equipment interface



Pin	diameter of line	line color	Function
1	0.50	R/B	Sound volume+
2	0.50	R/W	Sound volume-

3	0.50	Bl/B	Amplifier signal
4	0.50	V/R	ACC power
5	0.50	G/Y	Power of background light
6	0.50	G/Br	Reverse signal
7	0.50	R/V	Power
8	0.50	B	Grounding
9	0.50	V/B	Right rear amplifier power+
10	0.50	V/W	Right rear amplifier power-
11	0.50	V/Br	Right front amplifier power+
12	0.50	V/Gr	Right front amplifier power-
13	0.50	V/R	Left front amplifier power+
14	0.50	V/W	Left front amplifier power-
15	0.50	V/Bl	Left rear amplifier power+
16	0.50	V/G	Left rear amplifier power-
17	0.50	V/G	Sound volume
18	0.50	V/B	Sound volume control
19	0.50	V/Bl	Sound volume selection

Audio System Fault Diagnosis

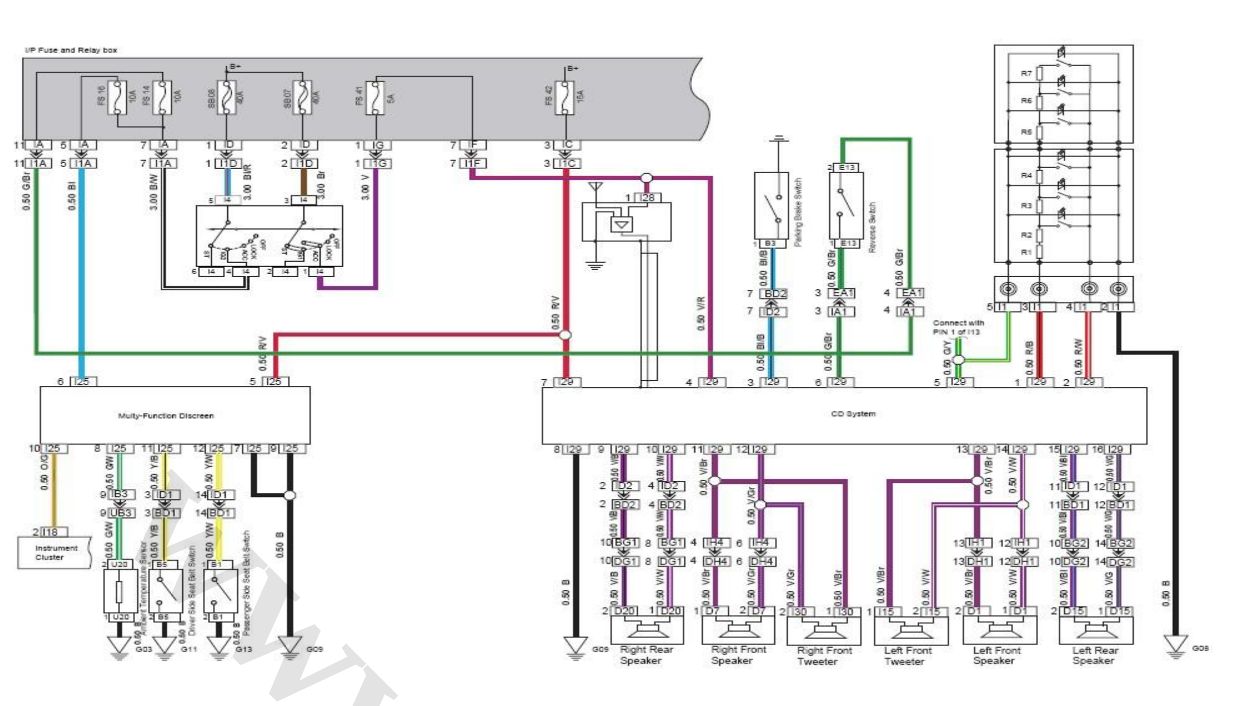
Fault Symptom	Fault Reason
Press down the power switch and the radio system can not be started	1. Audio system power circuit fault 2. CD player assembly fault
The amplifier keeps silent under all modes	1. Amplifier circuit fault 2. Audio system power circuit fault 3. CD player assembly fault
Can not receive radio broadcast (poor performance)	1. Antenna circuit fault 2. CD player assembly fault
CD can not be played even with power	1 CD disc fault 2. Audio system power circuit fault 3 CD disc fault
Poor sound of CD player	1 CD disc fault 2. CD player assembly fault
Touch panel switch can not work	1. Audio system power circuit fault 2. CD player assembly fault 3 Wiring harness connection fault
The night illumination device of the audio system can not work	1. Audio system illumination circuit fault 2. CD player assembly fault
The sound is bad under all modes	1. Amplifier circuit fault

(sound volume too low)	2. Audio system power circuit fault 3. CD player assembly fault
CD can not be inserted or pop out immediately	1 CD disc fault 2. Audio system power circuit fault 3. CD player assembly fault
Can not take out CD/VCD	1 CD disc fault 2. Audio system power circuit fault 3. CD player assembly fault
Jumping sound	1 CD disc fault 2. CD player assembly installation incorrect

Audio System Parts Check

1. Press down power switch and the audio system can not be started:

As per the following wiring diagram: 1) Check the cab and find if there is electrical short circuit and keep good ventilation for the cab. 2) Check the voltage between terminal No. 7 of audio system assembly connector I29 and vehicle body, which should be 10~14V. 3) Check the resistance between audio terminal No. 8 of system assembly connector I29 and vehicle body, which should be less than 1Ω. 4) Turn the ignition switch to ACC, and check the voltage between terminal No.4 of audio system assembly connector I29 and vehicle body, which should be 10～14V. If normal, check and replace audio system assembly. If not normal, repair or replace wiring and connector.



2. The night illumination device of the audio system can not work:

Turn the lighting control lever of the lamp combination switch assembly to clearance lamp position or fog light position, and check the voltage between terminal No.4 of audio system assembly connector I29 and vehicle body, which should be 10～14V. If not normal, repair or replace wiring and connector. If normal, check and replace CD player assembly.

3. The amplifier keeps silent under all modes:

Steps are as follows:

(1) Check display device

Turn ignition switch to ACC and move the audio system to position OPEN, and the display device is illuminated. If normal, go on with next step. If not normal, perform step 5.

(2) Adjust sound volume controller and the balance of the sound

Adjust the sound for balance with the volume knob and find out which amplifier is out of service. If certain amplifier is out of service, go on with next step. If all the amplifiers are out of service, check and replace the audio system.

(3) Check amplifier

Disconnect amplifier connector and check the resistance between the amplifier terminals, which should be 2～9Ω. If normal, go on with next step. If not normal, replace amplifier.

(4) Check the connector between audio system and amplifier

If normal, go on with next step. If not normal, repair or replace wiring and connector.

(5) Check CD player assembly

① Check the voltage between terminal No. 7 of audio system assembly connector I29 and vehicle body, which should be 10~14V.

① Check the resistance between terminal No. 8 of audio system assembly connector I29 and vehicle body, which should be less than 1Ω.

③ Turn the ignition switch to ACC and check the voltage between terminal No. 5 of audio system assembly connector I29 and vehicle body, which should be 10～14V.

If not normal, repair or replace wiring and connector. If normal, check and replace CD player assembly.

4. CD can not be inserted or pop out immediately, and the CD can not be used.

Check as per 4-96 wiring diagram and the specific steps are as follows:

(1) Make sure that the CD disc is normal, without deformation, crack, flaw, burr and other defects.

If normal, go on with next step. If not normal, the CD disc has already been damaged.

(2) Check if the CD disc is placed wrongly. If normal, go on with next step. If not normal, correctly place the CD disc.

(3) Replace the fault CD disc with normal CD disc and check if the same fault occurs again.

If normal, the CD disc is wrong. If not normal, go on with next check.

(4) Check the automatic search of the radio for normal operation.

If normal, repair or replace CD player assembly. If not normal, go on with step 6.

(5) Check if the temperature and humidity in the cab charges sharply.

If so, condensation is caused by the change of temperature and humidity (keep still for a while before use). If not, check and replace CD player assembly.

(6) Check CD player assembly

① Check the voltage between terminal No. 7 of audio system assembly connector I29 and vehicle body, which should be 10~14V.

② Check the resistance between terminal No. 8 of audio system assembly connector I29 and vehicle body, which should be less than 1Ω.

③ Turn the ignition switch to ACC and check the voltage between terminal No. 5 of audio system assembly connector I29 and vehicle body, which should be 10～14V.

If not normal, repair or replace wiring and connector. If normal, repair or replace CD player assembly.

5. Can not take out CD disc:

Check as per the above wiring diagram and the specific steps are as follows:

(1) Check the automatic search of the radio for normal operation.

If normal, repair or replace CD player assembly. If not normal, go on with step 5).

(2) Press down the open/close switch of the CD player for 2s or longer time and check if the CD disc can pop out.

If normal, go on with next step. If not normal, repair or replace CD player assembly.

(3) Check if the sound is stable while driving on a bad road.

If normal, go on with next step. If not normal, the CD disc has already been damaged.

(4) Check the installation of the CD player assembly

If normal, the CD disc is wrong. If not normal, go on with next check.

(5) Check CD player assembly

① Check the voltage between terminal No. 7 of audio system assembly connector I29 and vehicle body, which should be 10~14V.

② Check the resistance between terminal No. 8 of audio system assembly connector I29 and vehicle body, which should be less than 1Ω.

③ Turn the ignition switch to ACC and check the voltage between terminal No. 5 of audio system assembly connector I29 and vehicle body, which should be 10～14V.

If not normal, repair or replace wiring and connector. If normal, repair or replace CD player assembly.

6. Poor sound of CD player (sound volume too low):

Check the CD player for installation, if normal, the CD disc is wrong. If not normal, check and replace the CD player assembly.

7. Can not receive radio broadcast (poor performance)

Check as per the above wiring diagram and the specific steps are as follows:

(1) Check the automatic search of the radio for normal operation.

If normal, repair or replace CD player assembly. If not normal, go on with next step.

(2) Check if the equipment is disturbed by wiper, A/C blower, window regulator or others.

If so, move away such interference. If not, go on with next check.

(3) Carry out noise check for the printed antenna

Turn the ignition switch to ACC, turn on the radio and select AM mode, and check if the noise of the amplifier is caused by placing a screwdriver on the antenna. If normal, repair or replace CD player assembly. If not normal, go on with next step.

(4) Check audio system antenna assembly

Remove the antenna plug from the audio system assembly and turn the ignition switch to ACC while the radio connector is connected, then turn on the radio and select AM mode. Check if the noise of the amplifier is caused by placing such metal objects as screwdriver or wire on the antenna seat. If normal, go on with next step. If not normal, repair or replace CD player assembly.

8. Touch panel switch can not work

Check as per the above wiring diagram and the specific steps are as follows:

(1) Check if there is dirt on the touch screen. If so, remove the surface dirt. If not, go on with next step.

(2) Check if the touch switch can respond correctly. If normal, go on with next step. If not normal, repair or replace CD player assembly.

(3) Check multimedia player assembly

① Check the voltage between terminal No. 7 of audio system assembly connector I29 and vehicle body, which should be 10~14V.

Check the resistance between terminal No. 8 of audio system assembly connector I29 and vehicle body, which should be less than 1Ω.

③ Turn the ignition switch to ACC and check the voltage between terminal No. 5 of audio system assembly connector I29 and vehicle body, which should be 10～14V. If not normal, repair or replace wiring and connector. If normal, go on with next step.

Section 12 Air Bag

Composition and Layout

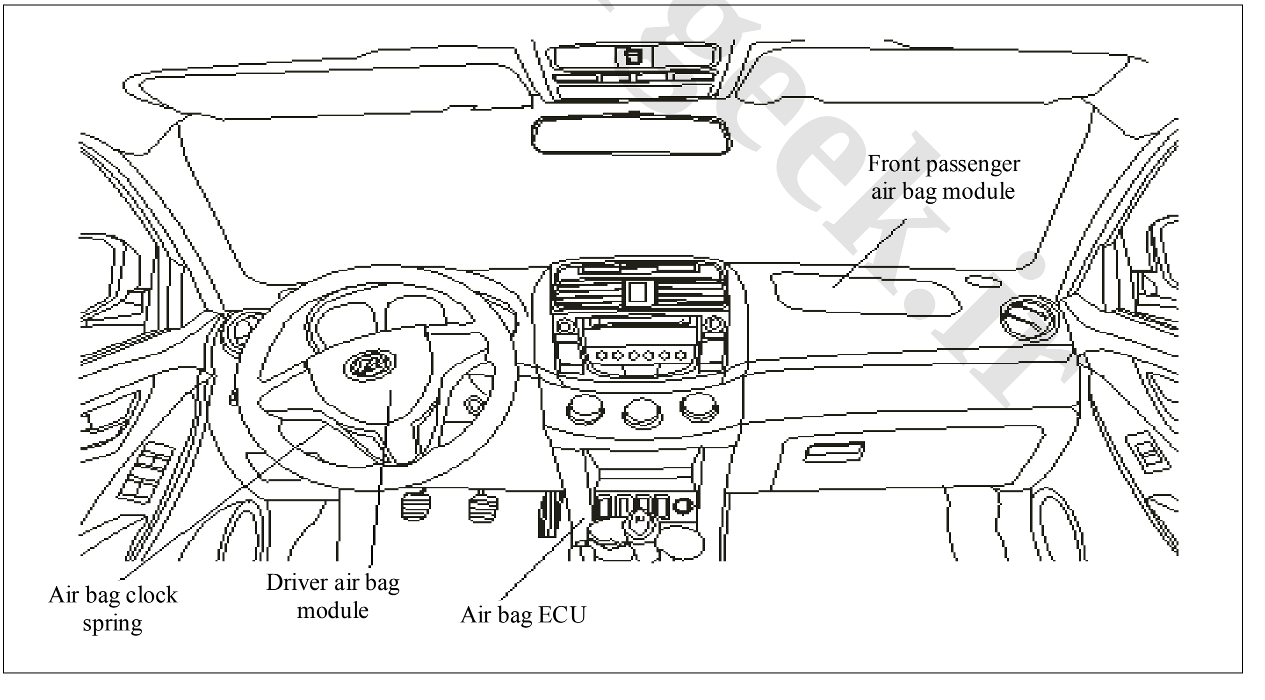
LIFAN X60 adopts an electronic double-air-bag system. One airbag is installed in the central ornamental cap of the steering wheel and the other in the dash board in front of the front passenger seat. The whole airbag system is composed of driver airbag module (DAB), front passenger airbag module (PAB), SRS clock spring (SRS CS), airbag electronic control unit (SRS ECU), safety belt pre-tensioners for driver and front passenger (luxury), and SRS wire harness and warning labels. Refer to the figure below for layout of airbag system.

1. SRS ECU

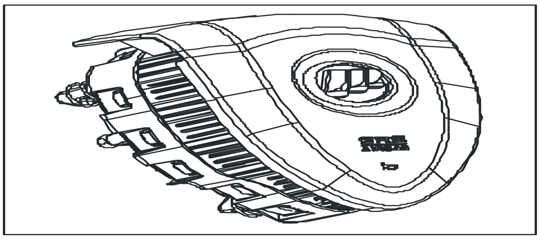
The SRS ECU is installed at the central axis, and below the central control panel. See the following figure.

If the voltage of battery is too low or the power is off due to collision, the SRS ECU will still work for over 100ms.

2. Driver air bag module



The driver airbag module is installed in the central ornamental cap of the steering wheel, so it can not be disassembled. As shown in the figure, it consists of gas generator, air bag, ornamental cap and a series of auxiliary components.



Main function of the driver airbag module: Under normal use, in case of collision at certain strength, the driver airbag module will receive the signal for ignition from SRS ECU (electronic control unit of the airbag), and then trigger the gas generator to rapidly produce lots of gas so as to deploy the air bag and protect the driver.

3. SRS clock spring

The driver airbag module is installed on the steering wheel. It runs with the steering wheel, and communicates with ECU by the SRS clock spring. The clock spring is installed on the combination switch as shown in figureFig. . The clock spring is composed of spiral cable, swivel wheel, housing, harness and auxiliary components.

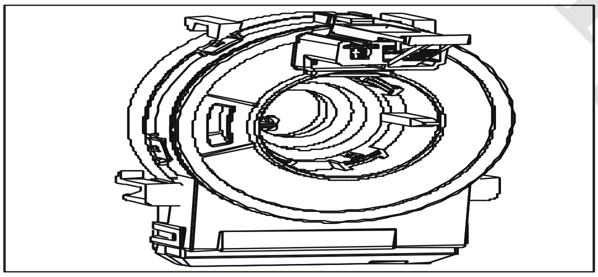


Fig. 4-73

Working principle of SRS clock spring: the installation housing of clock spring is fixed on the steering column, with the upper part of swivel wheel inserted into the steering wheel and spiral cable into the space between the swivel wheel and the housing. When the steering wheel turns left and right, the swivel wheel will turn with the steering wheel and make the output end of the cable turn together, so as to make the spiral cable stretch or be flapped, which can prevent the harness from winding the steering column and ensure the continuity of the harness and the connection of electric signal at any time. Therefore, the clock spring works as a harness bridge used to supply power for related components of the steering wheel.

4. Front passenger airbag module

The front passenger airbag module is installed above the sundries box. It consists of gas generator, air bag and a series of auxiliary components.

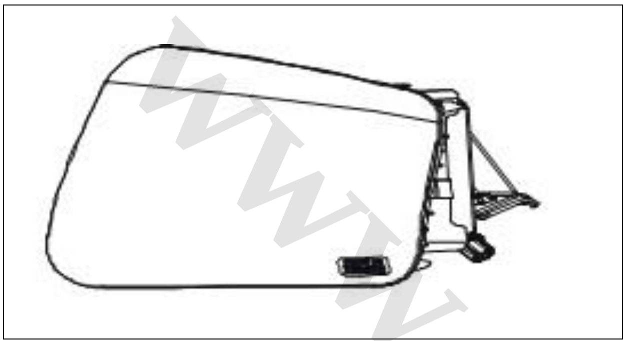


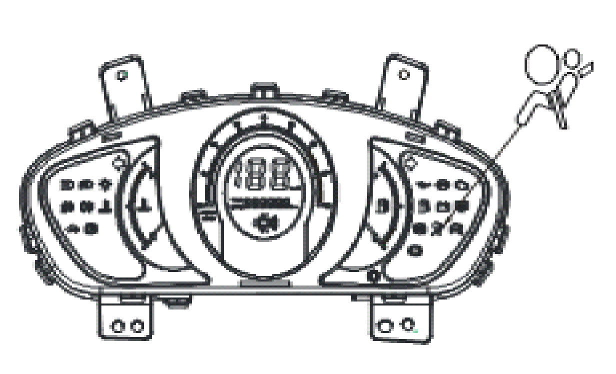
Fig. 4-74

Main function of the front passenger airbag module: Under normal use,

in case of collision at certain strength, the front passenger airbag module will receive the signal for ignition from SRS ECU (electronic control unit of the airbag), and then trigger the gas generator to rapidly produce lots of gas so as to deploy the air bag and protect the front passenger.

5. SRS wire harness

The SRS wire harness is used to connect the SRS ECU, clock spring and dash board wire harness.



6. SRS warning lamp

SRS warning lamp is installed on the instrument cluster.

In case of a fault in the self-diagnostic circuit of the SRS ECU assembly, the SRS warning lamp will illuminate to inform the driver of fault in the airbag system. Under normal circumstance, when the ignition switch turns to ON, the warning lamp will illuminate normally for 5s and then go out automatically. However, in some special cases, if the circuit is bad contacted and the fault exists sometimes, the SRS ECU warning lamp will record 8 faults data. If more than 8 faults data exist, the warning lamp will illuminate normally. Usually, in case of abnormity in the SRS warning lamp, the driver should go to a service station for check in time.

In case of a fault in the self-diagnostic circuit of the SRS ECU assembly, the SRS warning lamp will illuminate to inform the driver of fault in the airbag system. Under normal circumstance, when the ignition switch turns to ON, the warning lamp will illuminate normally for 5s, and then go out.

Working Principle

In case of a frontal collision, the collision sensor will produce a collision signal; then the SRS ECU will detect such a signal and make an analysis and judge if the requirements for ignition have been met. If yes, it will send out ignition pulse to ignite ignition tubes in airbag modules which will then ignite the gas production drug to produce mass of gas and swell the air bag in a short time to burst out the ornamental cap and form a full air bag, so as to buffer the impact from collision on the driver and the front passenger.

Safety Rules for Airbag Maintenance

Failure to implement correct operation procedure during maintenance may cause accidental deployment of the airbag and result in a serious accident. Moreover, for incorrect maintenance, the airbag may not deploy as expected. Therefore, before maintenance, please carefully read the following instructions and abide by the correct operation procedure.

1. Detection, installation and maintenance must be carried out by professionals.

2. For detection, a detecting lamp, general voltmeter and ohm meter should not be used; for measurement of voltage and resistance, a V30 diagnostic scanner should be used.

3. Please do read the flash DTC before dismantling the earthing wire of battery for eliminating the fault in the airbag system.

4. Before specific maintenance, please do disconnect the earthing wire of the battery negative pole, wait for over 3 min, and then carry out maintenance; otherwise, the airbag may deploy unexpectedly. Furthermore, wrap the dismantled negative pole by insulating tape.

Note: After interruption of power supply, continue with the operation for 3 min at least later; otherwise the airbag may deploy unexpectedly and cause a serious accident.

5. The airbag has not deployed after a slight collision, but the driver airbag module and SRS ECU assembly must be checked.

6. If the sensor will be impacted by vibration due to maintenance, please dismantle the SRS ECU assembly before maintenance.

7. Do not use airbag components dismantled from other vehicles. For replacement of components, use a new one.

8. Do not dismantle and repair the driver and front passenger airbag modules and SRS ECU assembly for reuse or other reasons.

9. Replacement is required if the driver airbag module, the front passenger airbag module and SRS ECU assembly fall onto the floor, are impacted by vibration and knock, or there is crack,

indentation or other damage on the housing, bracket or interface.

10. Do not place the driver airbag module, the front passenger airbag model and SRS ECU assembly in hot air or into flame.

11. If affected due to over heat (over 93°C) during painting, please remove the SRS ECU, airbag module and the clock spring and keep them properly.

12. A protecting mechanism to prevent the airbag from accidental deployment is installed in the SRS ECU assembly interface, the interface between the SRS ECU assembly and the clock spring, the interface between the clock spring and the driver airbag module, and the interface between the front passenger airbag module and the SRS ECU assembly. During maintenance of the airbag system, please do carry out operation as required to avoid accidental deployment of airbag and damage to its components.

13. There are warning labels on the components of the airbag system and in the relevant locations within the vehicle. During operation, please follow instruction on the labels.

14. During maintenance of the airbag system, the airbag module must be installed immediately after it is taken out from a transport container. If interruption is needed, put the airbag module back into the container, and do not keep it unwatched. For the storage of the module, place it with the deployed surface upward.

15. After the maintenance is finished, do not connect the airbag module to power supply right now. Do electrical inspection first, and connect it to the power supply if no fault is found.

16. There should be no any person in the vehicle when connecting the airbag system to the power supply. Power should not be connected if the SRS ECU has not been fixed properly.

17. After maintenance, check if the SRS warning lamp is normal.

18. The service life of the airbag is limited (refer to the instruction). For expiration of service life, the airbag module and label must be replaced.

Diagnosis and Fault Elimination

LIFAN X60 airbag system is furnished with self-diagnostic function. The basic diagnosis procedures are described as below.

SRS Warning Lamp Circuit Self-diagnosis

1. Turn the ignition switch to ACC or ON, and check if the SRS warning lamp illuminates.

2. The system is normal if the warning lamp illuminates normally for about 5s and then goes out for over 5s.

3. If the warning lamp keeps illuminating but not goes out, the SRS ECU has detected one or more faults. As per Section 2, read the fault and eliminate it.

4. If the SRS warning lamp illuminates sometimes after the ignition switch is on for 5s, and even illuminates again after the ignition switch is located before LOCK, there may be short circuit in the SRS warning lamp circuit. Do inspection as per Section 2.5.

Fault Reading

Read the fault by a special hand-held diagnostic scanner.

(1) Connect the scanner tool to the fault diagnostic interface on vehicle.

(2) Read fault according to the prompt on the scanner tool. See DTC tableDTC Table

DTC Table 4-76

Fault code	Fault cause	Fault condition
0x9012	ECU internal fault	ECU fault
0x9013	ECU used	ECU has activated the deployment of airbag for several times
0x9014	There is collision record in the register.	The collision record has been latched after the ECU activates the deployment of the airbag

0x9017	Short circuit between a detonator and another one	Short circuit between a detonator and another one
0x9018	No VIN code	No VIN code has been storaged in the nonvolatile storage of ECU
0x9021	The driver front impact airbag resistance is too high	The driver front impact airbag resistance is too high
0x9022	The driver front impact airbag resistance is too low	The driver front impact airbag resistance is too low
0x9023	The driver front impact airbag is shorted to ground	The driver front impact airbag is shorted to ground
0x9024	The driver front impact airbag is shorted to power supply	The driver front impact airbag is shorted to power supply
0x9029	The resistance of driver safety belt pre-tensioner is too high	The resistance of driver safety belt pre-tensioner is too high
0x902A	The resistance of driver safety belt pre-tensioner is too low	The resistance of driver safety belt pre-tensioner is too low
0x902B	The driver safety belt pre-tensioner is shorted to ground	The driver safety belt pre-tensioner is shorted to ground
0x902C	The driver safety belt pre-tensioner is shorted to power supply	The driver safety belt pre-tensioner is shorted to power supply
0x9031	The passenger front impact airbag resistance is too high	The passenger front impact airbag resistance is too high

0x9032	The passenger front impact airbag resistance is too low	The passenger front impact airbag resistance is too low
0x9033	The passenger front impact airbag is shorted to ground	The passenger front impact airbag is shorted to ground
0x9034	The passenger front impact airbag is shorted to power supply	The passenger front impact airbag is shorted to power supply
0x9039	The resistance of front passenger safety belt pre-tensioner is too high	The resistance of front passenger safety belt pre-tensioner is too high
0x903A	The resistance of front passenger safety belt pre-tensioner is too low	The resistance of front passenger safety belt pre-tensioner is too low
0x903B	The resistance of front passenger safety belt pre-tensioner is shorted to ground	The resistance of front passenger safety belt pre-tensioner is shorted to ground
0x903C	The resistance of front passenger safety belt pre-tensioner is shorted to power supply	The resistance of front passenger safety belt pre-tensioner is shorted to power supply
0x9051	The driver side front impact sensor is shorted to ground	The driver side front impact sensor is shorted to ground
0x9053	Internal fault in the driver side front impact sensor	Fault exists during the initialization of the driver side front impact sensor
0x9054	No communication for the driver side front impact sensor	ECU can not receive data from the sensor

0x9055	Incorrect communication for the driver side front impact sensor	Incorrect data stream from the sensor
0x9056	Internal fault 2 in the driver side front impact sensor	Incorrect sensor offset
0x9057	Internal fault 3 in the driver side front impact sensor	Incorrect sensor deflect
0x9061	The passenger side front impact sensor is shorted to ground	The passenger side front impact sensor is shorted to ground
0x9063	Internal fault in the passenger side front impact sensor	Fault exists during the initialization of the passenger side front impact sensor
0x9064	No communication for the passenger side front impact sensor	ECU can not receive data from the sensor
0x9065	Incorrect communication for the passenger side front impact sensor	Incorrect data stream from the sensor
0x9066	Internal fault 2 in the passenger side front impact sensor	Incorrect sensor offset
0x9067	Internal fault 3 in the passenger side front impact sensor	Incorrect sensor deflect
0x9091	Fault warning lamp is shorted to power supply	Fault warning lamp is shorted to power supply
0x9092	Fault warning lamp is shorted to ground	Fault warning lamp is shorted to ground

0x9095	Collision output is shorted to ground	Collision output is shorted to ground
0x9096	Collision output is shorted to power supply	Collision output is shorted to power supply
0x9097	Power voltage is too high	Power voltage is too high
0x9098	Power voltage is too low	Power voltage is too low

Troubleshooting

Table 477

S/N	Possible fault	Fault location	Fault elimination
1	Poor earthing wire	Earthing wire harness	1. Preparation before inspection 2. Check the earthing wire; if normal, turn to step 3; if loose or disconnecting, and connect the earthing harness well. 3. Check the harness; if normal, the component that was faulty before is considered normal now; if abnormal, repair or replace it.
2	Voltage over the high limit	Battery	1. Preparation before inspection 2. Check the battery voltage; if normal, the component that was faulty before is considered normal now; if the voltage is too low, charge the battery or replace it.
3	NO	driver airbag	1. Preparation before inspection

	DAB	module, clock spring, harness and SRS ECU	2. Check the driver airbag circuit; if normal, turn to step 3; if abnormal, turn to step 5. 3. Check the SRS ECU; if normal, turn to step 4; if abnormal, replace the SRS ECU. 4. Check the driver SRS ECU; if normal, the component that was faulty before is considered normal now; if abnormal, replace the driver airbag module. 5. Check the clock spring; if normal, turn to step 6; if abnormal, replace the clock spring. 6. Check the harness between air bag ECU and clock spring; if normal, the component that was faulty before is considered normal now; if abnormal, repair or replace the harness.
4	No PAB	Front passenger air bag module, harness, SRS ECU	1. Preparation before inspection 2. Check the front passenger air bag circuit; if normal, turn to step 3; if abnormal, and repair or replace the harness or interface between SRS ECU and the front passenger air bag module. 3. Check the SRS ECU; if normal, turn to step 4; if abnormal, replace the SRS ECU. 4. Check the front passenger airbag module; if normal, the component that was faulty before is considered normal now; if abnormal, replace the front passenger airbag module.
5	No	1. Driver safety belt	1. Preparation before inspection

	LPSB	pre-tensioner 2. Harness 3. SRS ECU	2. Check the driver safety belt pre-tensioner circuit; if normal, turn to step 3; if abnormal, and repair or replace the harness or interface between SRS ECU and the driver safety belt pre-tensioner module. 3. Check the SRS ECU; if normal, turn to step 4; if abnormal, replace the SRS ECU. 4. Check the driver safety belt pre-tensioner; if normal, the component that was faulty before is considered normal now; if abnormal, replace the driver safety belt pre-tensioner.
6	No RPSB	1. Front passenger safety belt pre-tensioner 2. Harness 3. SRS ECU	1. Preparation before inspection 2. Check the front passenger safety belt pre-tensioner circuit; if normal, turn to step 3; if abnormal, and repair or replace the harness or interface between SRS ECU and the front passenger safety belt pre-tensioner module. 3. Check the SRS ECU; if normal, turn to step 4; if abnormal, replace the SRS ECU. 4. Check the front passenger safety belt pre-tensioner; if normal, the component that was faulty before is considered normal now; if abnormal, replace the front passenger safety belt pre-tensioner.
7	More than 2 faults displayed at the	Related components	Diagnose and eliminate faults one by one according to the flash DTCs.

	same time		

Air Bag Circuit

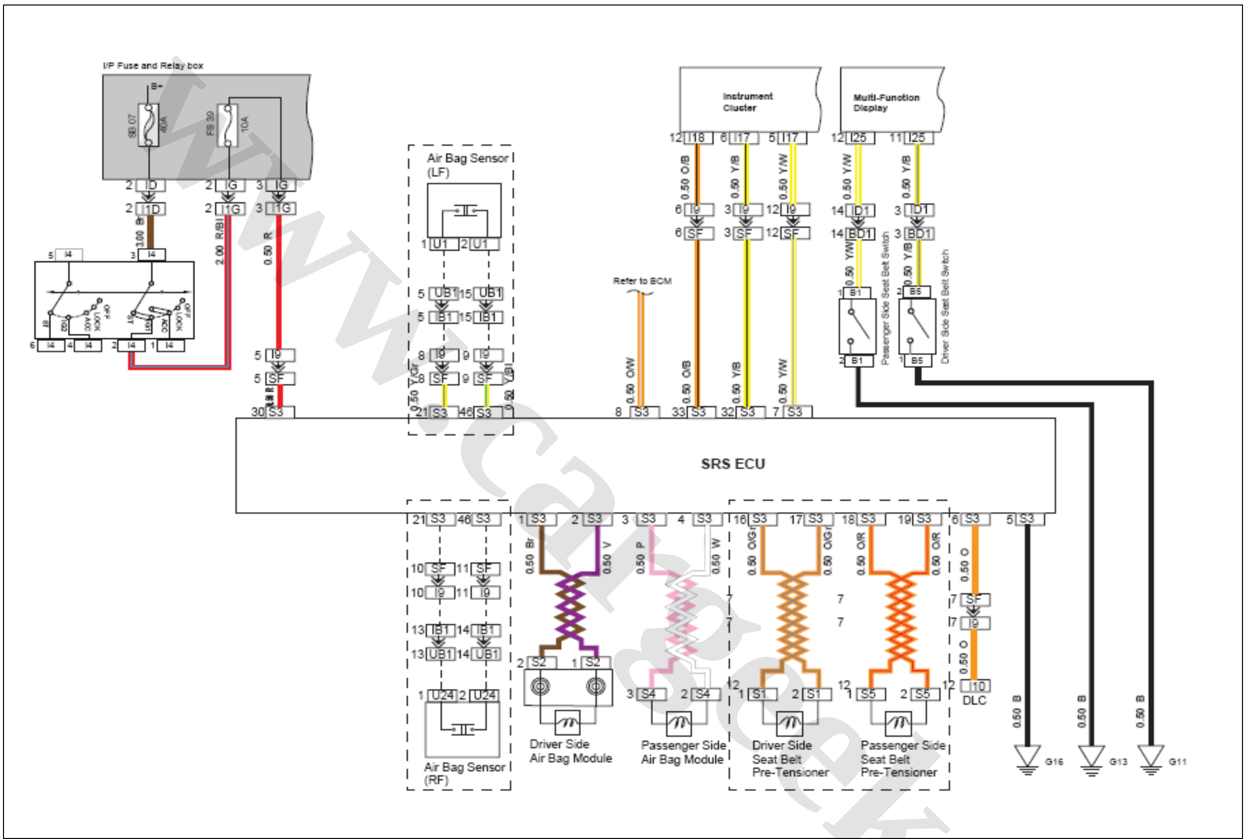


Figure 478

Table 4-79 Feet and terminals of SRS ECU plugs

Pin	diameter of line	line color	Function
1	0.50	Br	Power+
2	0.50	V	Power-

3	0.50	P	Power+
4	0.50	W	Power-
5	0.50	B	Grounding
6	0.50	O	Diagnostic signal
7	0.50	Y/W	Signal
8	0.50	O/W	Signal
21	0.50	Y/Gr	
22	0.50	Y/G	
30	0.50	R	12 V power
32	0.50	Y/B	Signal
33	0.50	O/B	Power signal light
46	0.50	Y/Bl	
47	0.50	Y/R	

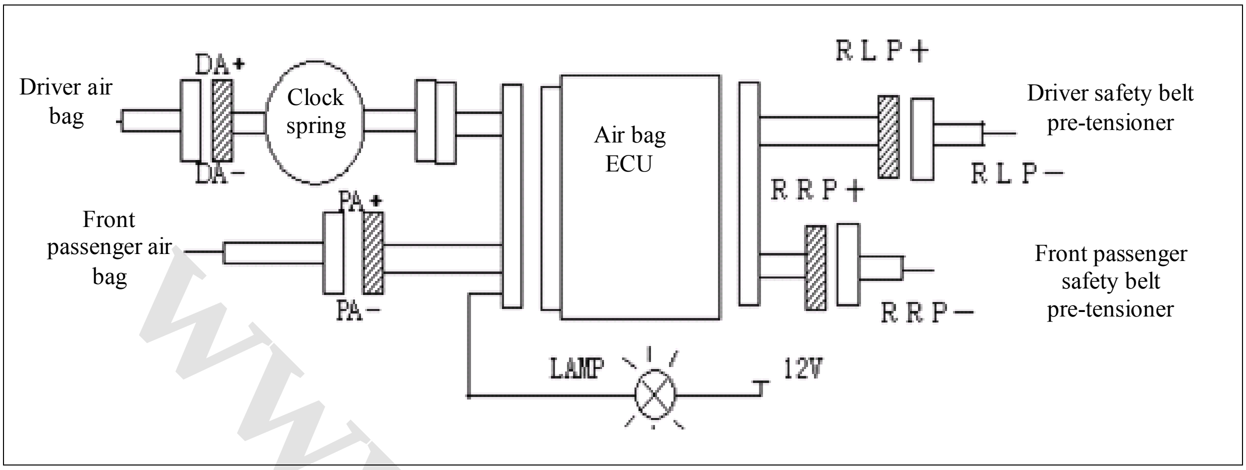
2. Preparation before inspection

Before operation, please carefully read the safety rules for maintenance of airbag. Meanwhile, do the following preparation.

(1) Disconnect the negative pole earthing wire from the battery, and wait for at least 3 min.

(2) Remove the driver and front passenger airbag modules; keep the front facing upward (see Section 4 for removal)

(3) Disconnect the interfaces for the driver and front passenger airbag modules, and interface for SRS ECU. Refer to the following figure.



3. Check if the battery voltage is too low or high

(1) Connect the battery negative pole earthing wire, turn on the ignition switch and it then turns to ON.

(2) Measure the PW voltage at the end of SRS wire harness.

(3) Normal voltage: 10-14V.

4. Check the harness and interface

(1) Check if the SRS wire harness is broken over and harness resistance is below 1Ω.

(2) Check if other harness is well connected to the corresponding terminal of interface.

(3) Check if there is crack in all leads of harness or crack in the insulating layer.

(4) Check there is crack in the harness interface.

5. Check the SRS ECU

(1) Connect the SRS ECU by SRS wire harness. See the above figure.

(2) Connect the negative pole earthing wire to the battery, and wait for at least 3 min.

(3) Turn the ignition switch to ACC or ON, and wait for at least 20s.

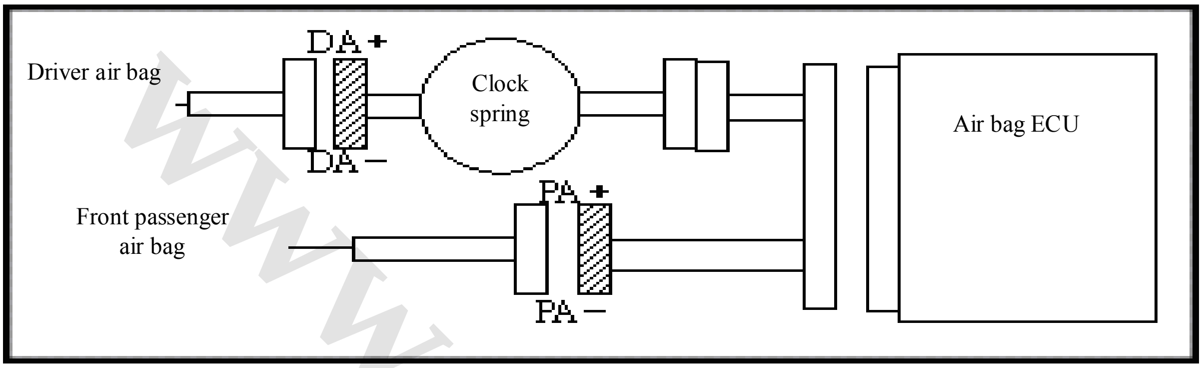
(4) Eliminate and read the flash DTC by a diagnostic scanner.

6. Check the driver airbag module

(1) Turn the ignition switch to LOCK.

(2) Disconnect negative pole earthing wire from the battery, and wait for at least 3 min.

(3) Connect the driver airbag module. See the below figure.



(4) Connect the negative pole earthing wire, and wait for at least 3 min.

(5) Turn the ignition switch to ACC or ON, and wait for at least 20s.

(6) Eliminate the flash DTC and read the fault by a diagnostic scanner.

7. Check the driver airbag circuit

(1) Measure the resistance of the interface between the clock spring and the driver airbag module, and that between DA+ and DA− at side of the clock spring. It should be over 1 MΩ.

(2) Measure the resistance of the interface between the clock spring and the driver airbag module, and that between DA+ beside the clock spring and DA+ beside the SRS ECU interface harness. It should be within 1 ohm.

(3) Measure the resistance of the interface between the clock spring and the driver airbag module, and that between DA− beside the clock spring and DA− beside the SRS ECU interface harness. It should be within 1 ohm.

8. Check the front passenger air bag module

(1) Turn the ignition switch to LOCK.

(2) Disconnect negative pole earthing wire from the battery, and wait for at least 3 min.

(3) Connect the front passenger air bag module interface.

(4) Connect the negative pole earthing wire, and wait for at least 3 min.

(5) Turn the ignition switch to ACC or ON, and wait for at least 20s.

(6) Eliminate the flash DTC and read the fault by a diagnostic scanner.

9. Check the front passenger air bag circuit

(1) Measure the resistance of the interface between the SRS ECU harness and the front passenger air bag module harness, and that between PA＋ and PA－ beside the SRS ECU harness. It should be over 1 megohm.

(2) Measure the resistance of the interface between the SRS ECU harness and the front passenger air bag module harness, and that between PA＋ beside the SRS ECU harness and PA＋ beside the front passenger air bag module harness. It should be within 1 ohm.

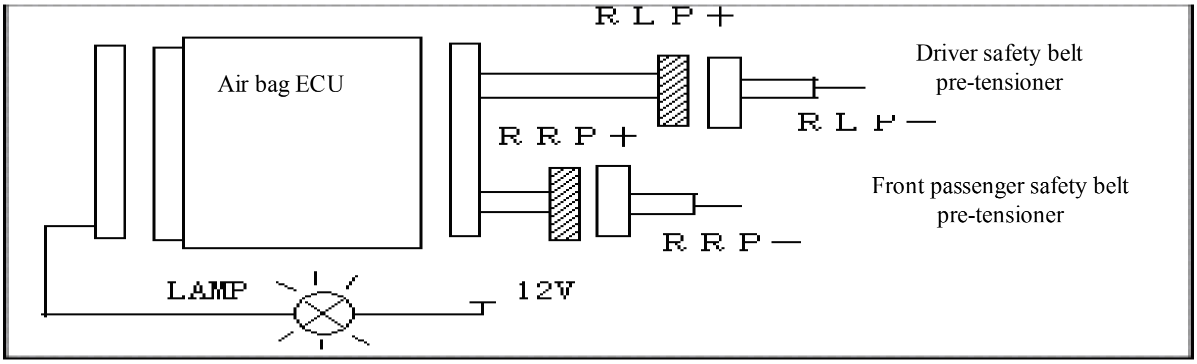
(3) Measure the resistance of the interface between the SRS ECU harness and the front passenger air bag module harness, and that between PA－ beside the SRS ECU harness and PA－ beside the front passenger air bag module harness. It should be within 1 ohm.

10. Check the driver safety belt pre-tensioner

(1) Turn the ignition switch to LOCK.

(2) Disconnect negative pole earthing wire from the battery, and wait for at least 3 min.

(3) Connect the interface of the driver safety belt pre-tensioner. See Fig. 5-10.



(4) Connect the negative pole earthing wire, and wait for at least 3 min.

(5) Turn the ignition switch to ACC or ON, and wait for at least 20s.

(6) Eliminate the flash DTC and read the fault by a diagnostic scanner.

11. Check the driver safety belt pre-tensioner circuit

(1) Measure the resistance of the interface between the SRS ECU harness and the driver safety belt pre-tensioner harness, and that between RLP＋ and RLP－ beside the air bag ECU harness. It should be over 1 megohm.

(2) Measure the resistance of the interface between the SRS ECU harness and the driver safety belt pre-tensioner harness, and that between RLP＋ beside the SRS ECU harness and RLP＋ beside driver safety belt pre-tensioner harness. It should be within 1 ohm.

(3) Measure the resistance of the interface between the SRS ECU harness and the driver safety belt pre-tensioner harness, and that between RLP－ beside the SRS ECU harness and RLP－ beside driver safety belt pre-tensioner harness. It should be within 1 ohm.

12. Check the front passenger safety belt pre-tensioner

(1) Turn the ignition switch to LOCK.

(2) Disconnect negative pole earthing wire from the battery, and wait for at least 3 min.

(3) Connect the interface of the front passenger safety belt pre-tensioner. See the above figure.

(4) Connect the negative pole earthing wire, and wait for at least 3 min.

(5) Turn the ignition switch to ACC or ON, and wait for at least 20s.

(6) Eliminate the flash DTC and read the fault by a diagnostic scanner.

13. Check the front passenger safety belt pre-tensioner circuit

(1) Measure the resistance of the interface between the SRS ECU harness and the front passenger safety belt pre-tensioner harness, and that between RRP＋ and RRP－ beside the SRS ECU harness. It should be over 1 megohm.

(2) Measure the resistance of the interface between the SRS ECU harness and the front passenger safety belt pre-tensioner harness, and that between RRP＋ beside the SRS ECU harness and RRP＋ beside front passenger safety belt pre-tensioner harness. It should be within 1 ohm.

(3) Measure the resistance of the interface between the SRS ECU harness and the front passenger safety belt pre-tensioner harness, and that between RRP－ beside the SRS ECU harness and RRP－ beside front passenger safety belt pre-tensioner harness. It should be within 1 ohm.

14. Check the clock spring

(1) Pull out the interface between the SRS ECU and the clock spring. See the above figure.

(2) Measure the resistance of the interface between the clock spring and the SRS ECU harness, and of two ends of the SRS ECU harness. It should be over 1 ohm.

(3) Measure the resistance of the interface between the clock spring and the SRS ECU harness, and that between A＋ beside the clock spring and A＋ beside the SRS ECU harness. It should be within 1 ohm.

(4) Measure the resistance of the interface between the clock spring and the SRS ECU harness, and that between A－ beside the clock spring and A－ beside the air bag ECU harness. It should be within 1 ohm.

Check of fault in SRS warning lamp circuit

Under normal circumstance, when the ignition switch turns to ACC or ON from LOCK, the

SRS warning lamp should illuminate for 5s and then go out automatically. In case of fault in the air bag system, it will always illuminate but not go out. The flash DTC can be read according to normal procedures.

If, when the ignition switch is at LOCK, the SRS warning lamp always illuminates or, when at ACC or ON, does not illuminate, the circuit of SRS warning lamp can be considered as faulty. Inspection should be carried out according to the following procedure. For inspection, refer to the circuit diagram for the air bag system.

1. Check when SRS warning lamp always illuminates if the ignition switch is at LOCK

(1) Turn the ignition switch to LOCK.

(2) Disconnect negative pole earthing wire from the battery, and wait for at least 3 min.

(3) Pull out the SRS ECU interface.

(4) Connect the earthing wire to the negative pole of battery, and wait for at least 3 min.

(5) Observe if the SRS warning lamp goes out. If it does, replace the SRS ECU; if not, check the SRS warning lamp circuit.

2. Check the SRS warning lamp circuit

Before checking the SRS warning lamp circuit, firstly check the fuse of ECU. If it is burnout, replace it with a new one; if normal, proceed with the next step.

(1) Preparation before check.

(2) Connect the negative pole earthing wire to the battery, and wait for at least 3 min.

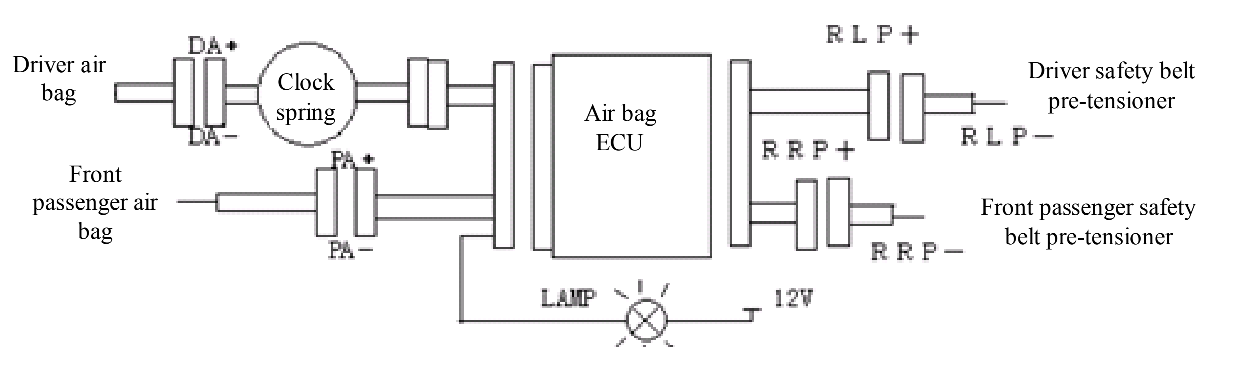
(3) Turn the ignition switch to ACC or ON.

(4) Measure the voltage between the foot LA of SRS ECU and the vehicle body.

(5) Normal voltage: 0～4V. If the voltage is not normal, check the bulb or repair the circuit; if normal, proceed with the next step.

(6) Disconnect the negative pole earthing wire from the battery, and wait for at least 3 min.

(7) Connect the SRS ECU interface. Refer to the following figure.



(8) Connect the negative pole earthing wire to the battery, and wait for at least 3 min.

(9) Turn the ignition switch to ACC or ON.

(10) Observe if the SRS warning lamp illuminates. If yes, the component that was faulty before is considered normal now; if not, check the terminal LA of SRS ECU. If the terminal LA is normal, replace the SRS ECU.

Diagnosis of Vehicle After Collision

No matter whether the air bag has deployed, inspection and maintenance should be carried out on the vehicle after collision. See Section 4 for removal and installation.

Diagnosis when the air bag has deployed

1. If the air bag has deployed after collision, do the fault diagnosis according to methods in Section 2. The following components should be renewed.

(1) SRS ECU

(2) Driver air bag module

(3) Front passenger air bag module

(4) Driver safety belt pre-tensioner module

(5) Front passenger safety belt pre-tensioner module

Note: All replaced components should be recovered, such as SRS ECU, driver air bag module, front passenger air bag module, driver safety belt pre-tensioner module, and front passenger safety belt pre-tensioner module.

2. Check the following components. If abnormal, renew them.

(1) Clock spring. Check if the interface and harness of clock spring are damaged; and check the on-off of the circuit of clock spring as per 2.3.10. In case of damage and abnormity, replace them with new ones.

(2) Steering wheel, steering column, and steering lower shaft assembly. Check if steering wheel, steering column, and steering lower shaft assembly are distorted or abnormal. If yes, repair or replace them.

(3) Harness. Check if the SRS wire harness is fixed, harness and interface damaged, or terminal distorted. If abnormal, replace the harness.

Diagnosis when the air bag has not deployed

If the air bag has not deployed for collision at a lower speed or of other kinds, do the diagnosis according to methods in Section 2 and check the following components.

1. SRS ECU. Check if there is dent, crack and distortion in the SRS ECU body and bracket; check if the interface is damaged, terminal distorted and installation normal. In case of problems concerned, replace them with new ones.

2. Driver air bag module. Check if there is dent, crack and distortion on the ornamental cap; check if harness and interface are damaged, and terminal distorted; check if there is dent, crack and distortion on the gas generator housing; check if the horn button contact of steering wheel is distorted and if installation abnormal. In case of problems concerned, replace them with new ones.

3. Front passenger air bag module. Check if there is dent, crack and distortion on the ornamental cap; check if harness and interface are damaged, and terminal distorted; check if there is dent, crack and distortion on the gas generator housing; check if the horn button contact of steering wheel is distorted and if installation abnormal. In case of problems concerned, replace them with new ones.

4. Driver safety belt pre-tentioner. Check if there is dent, crack and distortion on the driver safety belt pre-tentioner; check if harness and interface are damaged, and terminal distorted; check if installation is abnormal. In case of problems concerned, replace them with new ones.

5. Front passenger safety belt pre-tentioner. Check if there is dent, crack and distortion on the front passenger safety belt pre-tentioner; check if harness and interface are damaged, and terminal distorted; check if installation is abnormal. In case of problems concerned, replace them with new ones.

6. Clock spring. Check if the interface and harness of clock spring are damaged; and check the on-off of the circuit of clock spring as per 2.3.14. In case of damage and abnormity, replace them with new ones.

7. Harness. Check if the SRS wire harness is fixed, harness and interface damaged, or terminal distorted. If abnormal, replace the harness.

Note: If water entering the vehicle makes the air bag system soggy, replace the entire air bag components.

8. Press down the SST execution switch to make the air bag deploy. When the LED lamp of the execution switch illuminates, the air bag will deploy at the same time.

Removal and Installation

Removal and installation of driver air bag module, front passenger air bag module, SRS clock spring, air bag electronic control unit, and SRS wire harness may be needed in the maintenance of LIFAN X60 air bag system. Notes are demonstrated as below.

Make preparation before removal and installation:

1. Turn the ignition switch to ON; encrypt the SRS ECU by a diagnostic scanner.

2. Turn the ignition switch to LOCK.

3. Disconnect the negative pole earthing wire from the battery, and wait for at least 3 min.

Removal and installation of SRS ECU assembly

Note: Unless badly needed, the housing of SRS ECU assembly must not be opened. If it contacts the terminal of the integrated circuit, the integrated circuit will be damaged.

1. Notes for removal of SRS ECU assembly

(1) Pull out the interface. Note: the interface should be pulled out during the installation of ECU assembly.

(2) Remove screws by a wrench, and take out the SRS ECU assembly.

2. Notes for installation of SRS ECU assembly

(1) Install the SRS ECU assembly by a wrench in the correct direction. Note: Tighten the screws at torque of 8N•m.

(2) Connect interface.

3. Inspection after installation

Sway the SRS ECU assembly and check if it is loose.

Notes for removal, maintenance and repair of driver air bag module (DAB)

1. Removal procedure and notes

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative pole of battery for over 3 min.

(3) Remove the two hexagon flange bolts at left and right sides of the steering wheel hub.

(4) Pull up the driver air bag module from the steering wheel, and disconnect the interface of clock spring and the terminal of gas generator.

Note: Stir up the black shrapnel by a small flat-blade screwdriver.

(5) Disconnect the interface of horn wire, and take out the air bag module, and complete the removal.

Note: During removal of the driver air bag module, do not pull the SRS wire harness. During storage, make the ornamental cap facing upward; and do not dismantle the air bag module. Do not knock the air bag module; if it has been knocked, replace it. Do not expose it in environment with temperature of 90°C. Prevent the module from lubricant, grease and water. The replaced air bag module should be put into a sealable bag and returned to LIFAN.

2. Installation procedures and notes

(1) A new driver air bag module is used for installation; well insert the interface between the clock spring and the gas generator.

Note: Clip the snap-fit of the black interface into the gas generator, and then insert the interface of horn wire.

(2) Put the whole module into the steering wheel, adjust the position of the module. Note: the gap at four corners should be even. Screw down 2 hexagon bolts into corresponding position and tighten them by a hexagonal socket wrench at torque of 8 N•m.

(3) Check the middle position of the steering wheel. After installation, turn the steering wheel to left and right, to check if there is abnormity or noise.

3. Notes for maintenance and repair

All components of LIFAN X60 driver air bag module, except the horn mechanism, have no need for maintenance and repair. In case of faults, replace them with new ones.

Note: For component replacement, turn to professionals at designated service stations for help.

Notes for removal, maintenance and repair of front passenger air bag module (DAB)

Removal procedure and notes

Turn the ignition switch to LOCK.

Disconnect the negative pole of battery for over 3 min.

Remove the trim board of sundries box door on the dash board to make a wrench capable of screw off the bolts connecting the front passenger air bag module and tubular beam.

Note: Extra attention should be paid for operation of the air bag interface. No damage is allowed to the SRS wire harness.

Remove the sundries box on the dash board. Slightly put up the dash board, and stir up the interface inserted on the terminal of gas generator of the front passenger air bag module by a small flat-blade screwdriver, and then pull it out.

Remove the front passenger air bag module. Remove the nuts fixing the front passenger air bag module and dash board by a wrench; take out the slope tied on the front passenger air bag module from the gap, and then take out the module from the dash board. The module should be packed in a sealable bag and returned to LIFAN.

Note: The front passenger air bag module should not be dismantled.

Installation procedures and notes

A new front passenger air bag module should be used for installation. Align and insert the corresponding bolts on the mounting base of the front passenger air bag module and the dash board, then tighten the nuts by a wrench at torque of 8N•m.

Screw off bolts on the pulling rope ring first, and then put the pulling rope on the dash board into the pulling rope ring on the air bag module, and screw down the bolts at torque of 8N•m.

When the dash board is installed to corresponding positions, insert the interface of SRS wire harness into the terminal of gas generator of the front passenger air bag module.

Fix the dash board on the vehicle.

Now the installation holes at the lower part of air bag module should align with those on the tubular beam. Fix them by bolts.

Install sundries box.

After installation is completed, visually check if the surface of the dash board is smooth and the clearance normal. If not, readjustment is required.

Note: The installation and adjustment of the module must be carried out by professionals. Any others are not allowed for such operation to avoid danger.

Notes for maintenance and repair

All components of LF6430 front passenger air bag module, except the horn mechanism, have no need for maintenance and repair. In case of faults, replace them with new ones.

Note: For component replacement, turn to professionals at designated service stations for help.

Notes for removal, maintenance and repair of clock spring

Removal procedure and notes

Make the wheels at the position of straight running.

Turn the ignition switch to LOCK.

Disconnect the negative pole of battery, and wait for over 3 min.

Remove the driver air bag module. Then remove the installation nut M12 on the steering wheel by Φ19 sleeve, and take out the steering wheel.

Remove the screws on the combination switch cover by a cross-tip screwdriver, and then gently dismantle the combination lever cover.

Pull out the interface connected to the input socket of the clock spring.

Remove the clock spring from the steering column. Pay attention to the two snap-fits fixed on the steering column. The SRS clock spring replaced should be packed in a sealable bag and returned to LIFAN.

Installation procedures and notes

A new SRS clock spring should be used for installation. Do not pull out the lock piece before installing the steering wheel.

Put the clock spring onto the steering column shaft.

Press down the clock spring by proper pressure to make the two plastic snap-fits and a metal one on the clock spring clipped into the mounting base of the steering column.

Note: Even force should be applied to the buckling of two barbs. In case that the snap-fit is broken, replace the clock spring with a new one.

Check if the snap-fit of the clock spring is buckled into the corresponding position.

Install the front and back covers of the steering column combination switch, and tighten the two screws.

Check if the front wheel is at straight running position (refer to the installation manual of clock spring), and install the steering wheel. Align the marks on the steering wheel and steering main shaft, and screw down the steering installation nuts. For a new steering wheel, adjust the direction and then pull out the lock piece of the clock spring.

Note: The lock piece of the clock spring should be recovered.

Connect the negative pole cable of battery and turn the ignition switch to ON.

Notes for maintenance and repair

The SRS clock spring of LIFAN X6 has no need for maintenance, repair and alignment.

Overview

This section covers the heated front-row seats (optional), rear defrost system - electric horn system - electronic clock - automatic power-off function (configuration for export-oriented vehicles).

Heated front-row seats (optional)

The heated front seats are divided into the heated driver/ co-driver seats. They specifically include the following components: the heating switch for driver's seat, the heating switch for co-driver’s seat and the seat heating pad (built-in seats).

1 The seat heater can heat the front seats in cold seasons.

With the ignition switch at the "ON" position, press the heating switch for driver's seat or co-driver’s seat to heat it.

Whenever the ignition switch is set to the "ON" position, the default value is that the seat heater is in its OFF state.

2 Table of Fault Symptom:

Fault Symptom	Fault Reason
Driver's seat or co-driver’s seat cannot be heated.	Trouble in driver's seat or co-driver’s seat heating fuse Trouble in driver's seat or co-driver’s seat heating switch Electric circuit has fault.

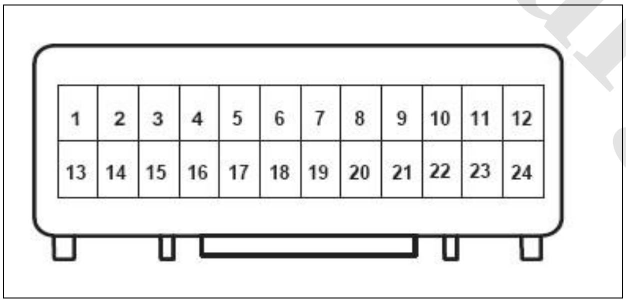
Rear defrosting system

The rear defrosting system includes rear window heating net, rear window defroster relay, and rear window defroster switch. It is integrated with the emergency light and the internal integration is equipped on the A/C panel (equipped for an electric air-conditioning).

1. Fault symptom table

Fault Symptom	Fault Reason
The rear defrosting system does not work	The rear defroster relay is faulty The rear defrosting fuse is faulty. The rear defrosting switch is faulty. The wiring is faulty.

2. Check the rear defrosting switch (equipped for an electric air-conditioning)



Pin	diameter of line	line color	Function
1	0.500.50	W/R	12 V power
2	0.50	W/B	Recirculation valve actuator power+
3	0.50	Gr/Bl	Recirculation valve actuator power-

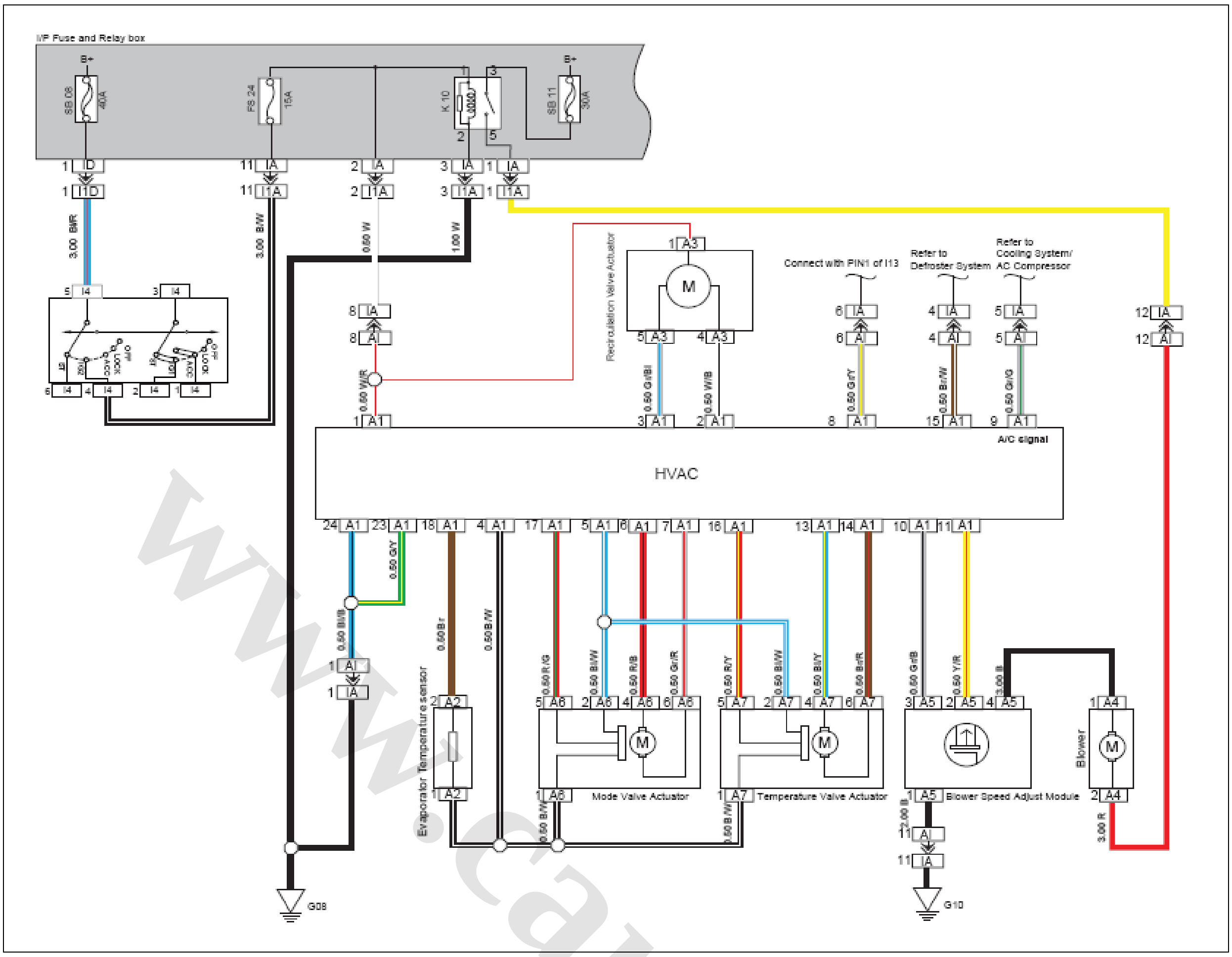
4	0.50	B/W	Grounding
5	0.50	Bl/W	Signal-
6	0.50	R/B	
7	0.50	Gr/R	
8	0.50	Gr/Y	Power of background light 12V
9	0.50	Gr/G	A/C signal
10	0.50	Gr/B	Speed adjustment module signal of blower+
11	0.50	Y/R	Speed adjustment module signal of blower+
12	--		
13	0.50	Bl/Y	
14	0.50	Br/R	
15	0.50	Br/W	
16	0.50	R/Y	
17	0.50	R/G	
18	0.50	Br	Evaporator temperature signal
19	--		
20	--		

21	--		
22	--		
23	0.50	G/Y	Grounding
24	0.50	Bl/B	Grounding

Electric horn system contains the following components.

The horn system is started by the switch under the ornamental cap of the air bag module hidden on the center of the steering wheel.

Press down the horn switch of the ornamental cap of the air bag module to start the horn relay. The horn relay then leads current to the horn.



2. Fault Diagnosis

Fault Symptom	Fault Reason
The two horns do not work	1. Fuse is blowout 2. Horn relay is ineffective 3. Horn switch is ineffective 4. Horn is ineffective 5. Clock spring is faulty 6 Wiring fault

One horn does not work	1. Horn is ineffective 2 Wiring fault
The horn keeps tweeting	1. Horn relay is ineffective 2. Horn switch is ineffective 3. Clock spring is faulty 4 Wiring fault

Automatic power-off function (configuration for export-oriented vehicles)

I. Glossary:

Transport mode: A model specially designed for long transport in order to minimize the loss of electric energy;

Normal mode: That the internal output end of the automatic circuit breaker is closed means the normal open state, with an output of high level of (12V) and a drive (rated) load capacity≥ 30A.

Ⅱ. Description of Control Logics:

1 Under the transport mode, the automatic circuit breaker has two modes, namely, sleeping mode and forced wakefulness mode (to meet the needs of transit shipment in transit).

1.1 Methods for Entering the Sleeping Mode

Method 1:

After the automatic circuit breaker installed in the vehicle and energized (B +) for the first time, after the ignition switch is switched off automatically, the automatic circuit breaker cannot detect the IG1 trigger signal (12V) within successive 72h, the automatic circuit breaker will automatically enter the sleeping mode (see Figure 1);

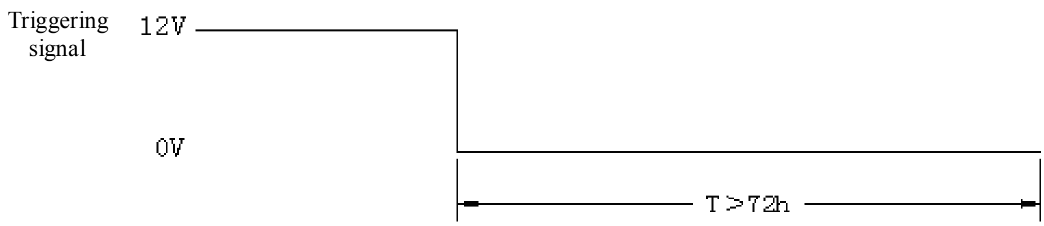


Figure 1

Method 2:

After the automatic circuit breaker installed in the vehicle and energized (B +) for the first time, and even after any period, when the IG1 trigger signal switches for five successive times within 5s, if you stop the OFF position, the automatic circuit breaker will enter the wakefulness mode (see Figure 2);

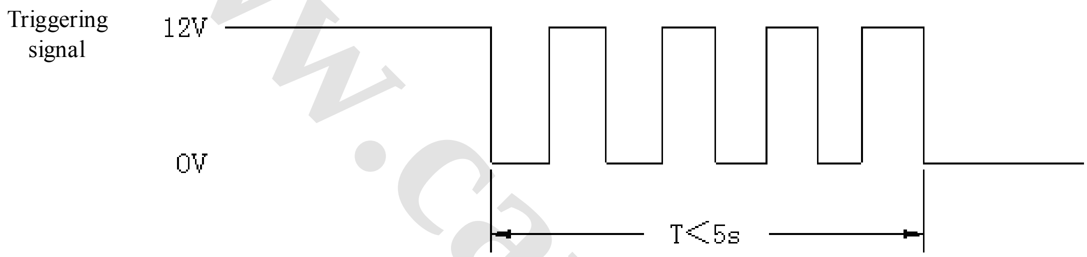


Figure 2

1.2 Conditions for Forced Wakefulness Mode

With the automatic circuit breaker in the sleeping mode, when the IG1 trigger signal is energized (12V), the automatic circuit breaker will be forced to wake up (see Figure 3).

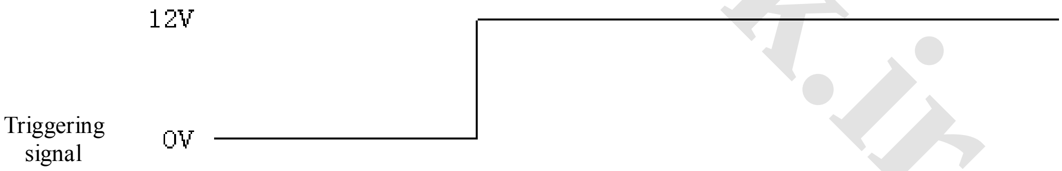


Figure 3

1.3 After taking method one or method two to enter the sleeping mode, with the automatic circuit breaker in the forced wakefulness mode, after the ignition switch is turned off (OFF position), that is, the voltage will drop to 0V from 12V, the automatic circuit breaker will also immediately enter the sleeping mode (see Figure 4).

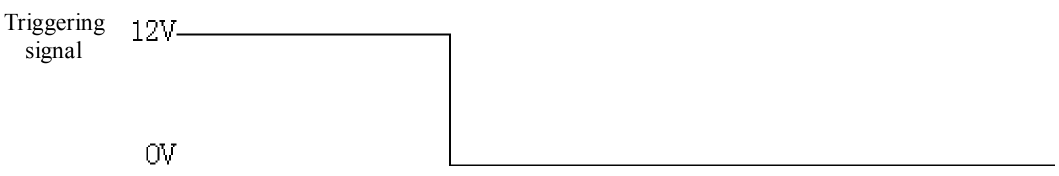
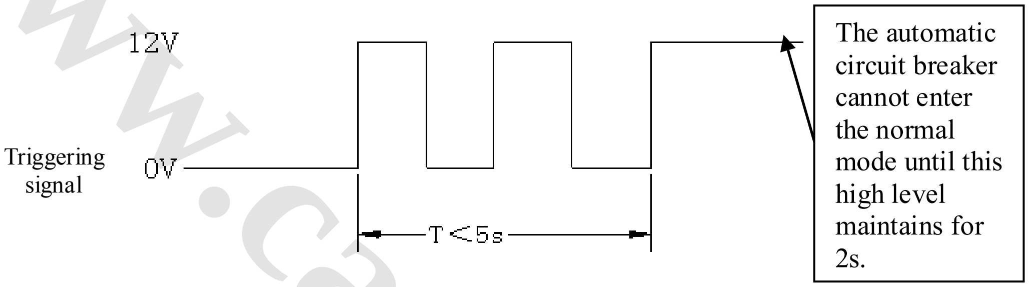


Figure 4

2 Switchover Between Transport Mode and Normal Mode

2.1 From Transport Mode to Normal Mode

When the ignition switch is switched to the IG1 position from the OFF position within 5s for three successive times, and after the third high level maintains for 2s, the automatic circuit breaker will exit the transport mode and enter the normal mode (see Figure 5).



(The automatic circuit breaker cannot enter the normal mode until the third high level maintains for 2s from the transport mode to the normal mode.)

Figure 5

2.2 From Normal Mode to Transport Mode

After the automatic circuit breaker has entered the transport mode, if it is needed to enter the transport mode once more, it is necessary to cut off the B + power supply of the automatic circuit breaker (longer than 3s) and to be energized (B +) again to allow the automatic circuit breaker to enter the transport mode (see Figure 6) .

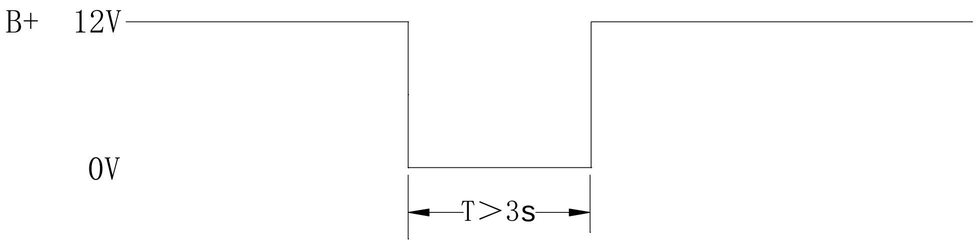


Figure 6

Chapter VI Vehicle Body and Accessories

Section 1 Vehicle Body

Door and Door Lock

Engine room cover

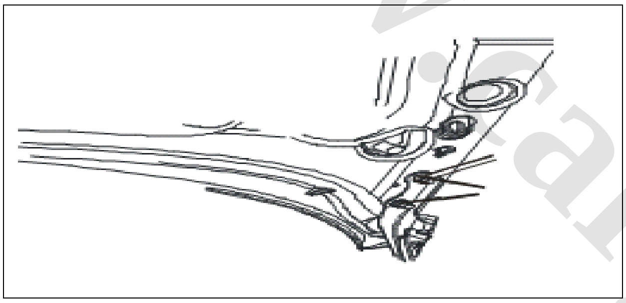
1. Removal of the engine room cover

(1) Release the four bolts that fix the hinges, and lift up the engine room cover.

(2) Take out the engine room cover.

(3) To install, reverse the removal procedure.

Torque: The hinge is connected with the engine room cover at torque of 23±2 N•m (two).



2. Removal of hinge

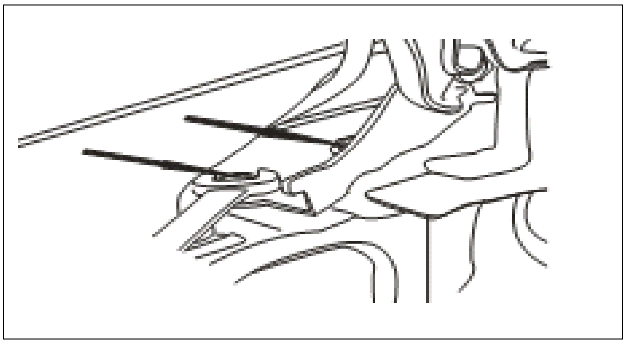
(1) Remove the fender. The fender is fixed by 7 bolts at torque of 10N•m， see the following figure for installation position:

(2) Release the two fixing bolts, and take out the hinge.

(3) During check and repair, adjust the rubber pad at the two sides of the engine room cover to ensure the clearance between the engine room cover and the vehicle body.

(4) To install, reverse the removal procedure.

Torque: The hinge is connected with the vehicle body at torque of 23±210 N•m (two).



Disassembly and assembly of vehicle door

1. Right front door

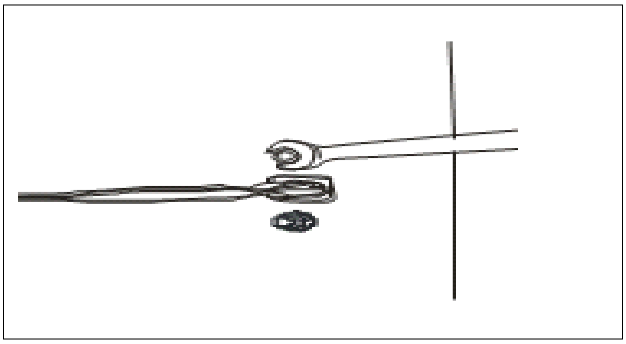
(1) Remove the fixing bolt of the front door hinge.

(2) Remove the fixing bolt of the door limiter.

(3) Detach the front door.

For removal of other doors, refer to that of the right front door.

(4) To install, reverse the removal procedure.



Torque:

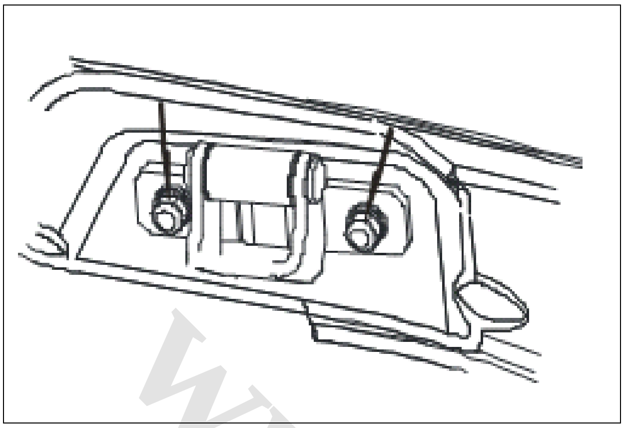
The left/right front door hinge is connected with the vehicle body at torque of 36±4N•m

The left/right front door hinge is connected with the vehicle door at torque of 36±4N•m

The left/right front door limiter is connected with the vehicle body at torque of 11 N•m (two)

2. Removal of tail door

(1) Remove the two nuts on the tail door that are connected with the hinge.



(2) Pull out the interface connecting the rear door harness and vehicle body harness.

(3) Remove the tail door pneumatic supporting rod.

(4) Detach the rear door harness and the tail door together.

(5) To install, reverse the removal procedure.

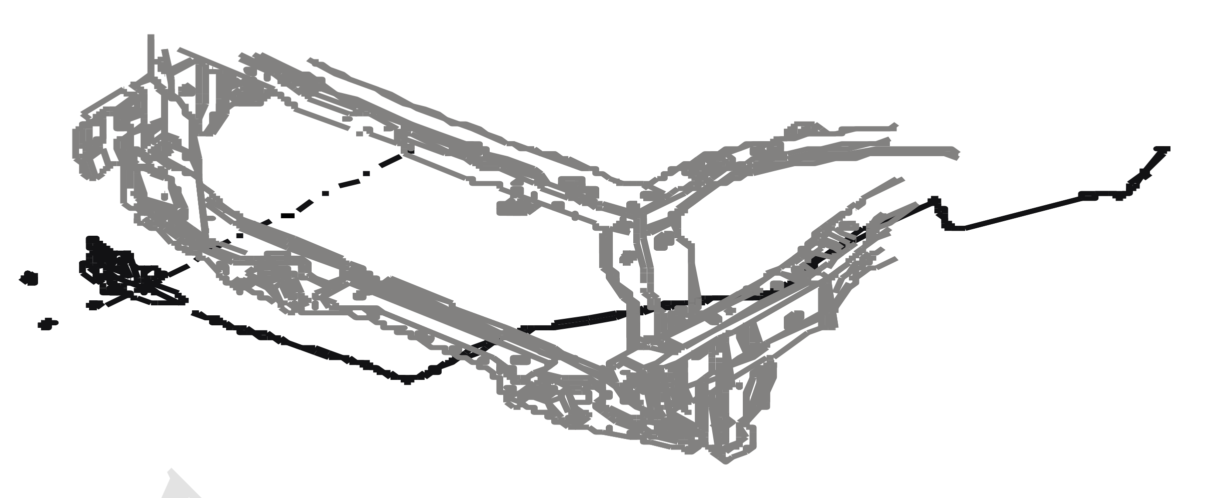
Torque: Hinge is connected with the vehicle body at torque of (36±4)N•m, hinge is connected with the vehicle door at torque of 50±5N•m, Rear door limiter bracket is connected with the vehicle body at torque of 27N•m

Removal of door lock

1. Engine room cover lock

(1) Dismantle the engine room cover lock body.

(2) Removal of engine room lock cable.



(3) To install, reverse the removal procedure.

Torque: The engine room upper lock body is connected with the vehicle body at torque of 11 N•m (3).

2. Tail door lock

(1) Remove the tail door upper shield

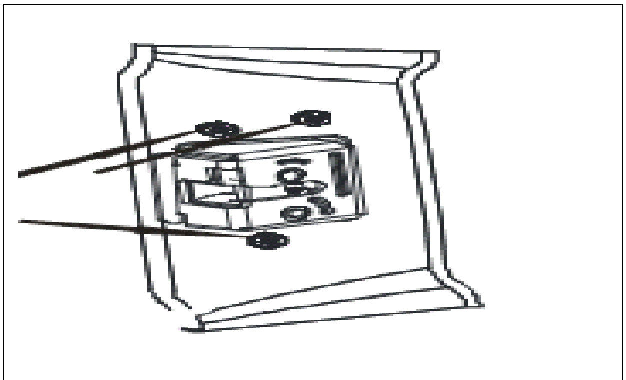
(2) Remove the tail door left/right shields

(3) Remove the tail door lower pillar trim

(4) Remove the opening-out rod from the outside handle

(5) Remove the lock cylinder rod from the lock cylinder

(6) Remove the tail door lock



(7) Pull out the harness interface

(8) To install, reverse the removal procedure.

Torque:

The tail door lock body is connected with the vehicle body at torque of 15N•m (3).

The tail door lock catch is connected with the vehicle body at torque of 12±2N•m (2).

3. Four door locks

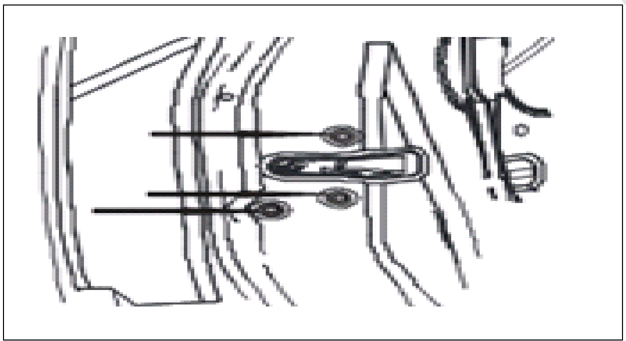
(1) Dismantle the inner shield of left front door.

(2) Detach the triangle shield of the left front door; b. Remove the inlay clip; c. Release the self-tapping screw of inside handle Q2744816 (1); d. Release the self-tapping screw of door handle cover (1); e. Insert the flat-blade screwdriver into the gap at the door bottom, and prize up a corner of the door panel and remove the inside door shield.

Note: For other 3 doors, this process is applicable, too.

Take down the inside-opening cable and lock cable.

(3) Remove the lock body and door panel installation bolts.



(4) Take down the plug.

(5) Remove lock catch by a screwdriver.

(6) To install, reverse the removal procedure.

Torque:

The lock body assembly is connected with door at torque of 9±1N•m (4).

The lock catch is connected with vehicle body at torque of 12±2N•m (2).

Note: For other three doors, this procedure is applicable, too.

Adjustment of door

1. Left/right rear door

Adjust the door clearance by iron (the clearance between the rear door and the triangle window is 8±1.5mm, and the side wall 6±1mm, door sill 6±1mm, and the planeness is 0-0.5mm; marked by arrow) and make it flat by a magnet. Then put nuts (Q32008, 2 up and down respectively) into the sleeve of the pneumatic wrench and tighten them at torque of 35±3N•m.

Check:

(1) If there is bump during assembly; if bolts and nuts are properly assembled and if there is screw loose.

(2) If the planeness of clearance between the rear door and the side wall is within the requirements and the checker line of the rear door is higher than the side wall for 0 - 0.5mm.

2. Left/right front door

Adjust the door clearance by iron (the clearance between the front door and the rear door upper section is 5.5±O.7mm, and door outside panel 5.5±O.7mm, front door and pillar A 6.5±1mm, and front and rear doors and door sill 6±1mm. The planeness is 0-0.5mm; marked by arrow) and make it flat by a magnet. Then put nuts (11—6 1 O 11 03, 2 up and down respectively) into the 2-3 screw teeth and attached to the vehicle body, and tighten them by a pneumatic wrench at torque of 35±3N•m.

Check:

(1) If there is bump during assembly; if bolts and nuts are properly assembled and if there is

screw loose.

(2) If the planeness of clearance between the front door and the rear door is within the requirements and the checker line is 0- 0.5mm high.

3. Tail door lock

Assemble the back door, and adjust the planeness of and clearance between the tail door and the side wall. The average planeness is 0-0.5mm. The clearance is required to be 5.8±1mm between the back door and side wall, 6. 4±1mm between the tail door and the side wall center, and 6.2±1mm between that and the tail lamp (marked by arrow). Adjust the planeness of and clearance between the tail door and the top cover; clearance is required to be 9.3±1.5mm. Check the clearance between the tail door and the side wall and the top cover; the same requirement is applicable. Then tighten the bolts (T 11—630 1 O 11, each 2 up and down respectively) by a pneumatic wrench (at torque of 50±3N•m for top cover, hinge and vehicle body).

Inspection: Check the torque: Use a torque wrench to check if the process torque of the tail door is 50±3N•m.

4. Engine room cover

Assemble the engine hood: adjust the hood and fender.

Clearance and planeness of plate: clearance is 5±0.5mm; and planeness is 0-0.5mm. Attach the engine hood to the hinge through bolts by an angle wrench (at torque of 30±4N•m).

Check:

(1) Check the matching between the engine hood and fender, and check if the engine hood aligns with the fender front section in length (0-0.5mm).

(2) Check if the matching of four doors, front fender, and tail door meets the requirements; if there are loose nuts and bolts. And also check the inner trims,

Section 2 Accessories

Removal of CD assembly

(1) Prize up an end of the ornamental cap of the control panel by a flat-blade screwdriver, and take down the ornamental cap.

(2) Remove the fixing bolts on CD by a cross-tip screwdriver.

(3) Unplug the harness interface.

(4) To install, reverse the removal procedure.

Removal of A/C Control Panel

1. Prize up an end of the ornamental cap of the control panel by a flat-blade screwdriver, and take down the A/C control panel.

2. To install, reverse the removal procedure.

Removal of Steering Wheel

1. Take down the horn cover, and unplug the horn button interface.

2. Remove the fixing nut on the steering wheel.

3. Take down the steering wheel.

4. To install, reverse the removal procedure.

Torque: Fix the steering wheel at torque of 30±3N•m.

Removal of Instrument Console

1. Dismantle the auxiliary fascia console (refer to the removal of auxiliary fascia console).

2. Remove the steering wheel (refer to the removal of steering wheel).

3. Remove the A/C control panel (refer to the removal of control panel).

4. Remove the CD (refer to the removal of CD).

5. Remove the instrument cluster.

a. Remove the dustproof leather assembly of the instrument cluster cover. b. Dismantle the upper and lower shields of steering column. c. Remove the fixing screws of the instrument cluster. d. Remove the instrument cluster.

6. Release the installation bolt (1) at the front section of the tubular beam.

7. Dismantle the sundries box.

8. Release the bolts (2) at left and right lower ends of the dash board.

9. Release the bolts (2) at left and right upper ends of the dash board.

10. Prize up the left and right end cover board of the dash board.

11. Release the fixing bolts under the shield (2 each at left and right; 4 in total).

12. Take down shield of pillar A, 13 and also the instrument console.

Note: To install, reverse the removal procedure

Torque: Fixing bolt at torque of 7±1N•m.

Removal of Auxiliary Instrument Console

1. Take down the A/C panel. (Refer to the removal of A/C panel)

2. Remove the console trim plate assembly of auxiliary fascia console

3. Remove the A/C left/right pillar trim.

a. Prize up the clamps (1 each at left and right; 2 in total) at the front end of the A/C left/right pillar trim. b. Remove the A/C left/right pillar trim.

4. Release the fixing bolts of the auxiliary fascia console and the tubular beam (1 each at left and right; 2 in total).

5. Release the two self-tapping screws at the back of the auxiliary fascia console.

6. Release the two installation bolts in the sundries box of the auxiliary fascia console.

Removal of left front door window regulator

1. Detach the left front door shield. (refer to the removal of lock cylinders of the four doors)

a. Prize up the door handle cover b. Release the fixing screws c. Unplug the harness interface d. Take down the inner board of door

2. Release the door inner handle cable, and put off the protective film.

3. Remove the door glass. Release the bolts fixing the glass by a sleeve wrench.

4. Release the fixing bolts of the regulator.

5. Take out the regulator.

6. To install, reverse the removal procedure.

Torque:

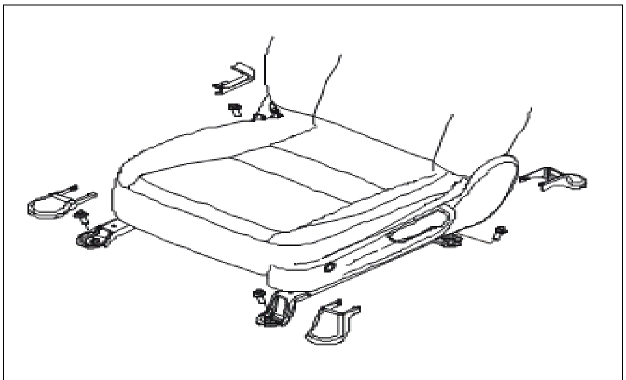
To fix the door glass at torque of 11 N•m (2).

To fix the door regulator at torque of 11 N•m (6).

Note: For other 3 doors, this process is applicable, too.

Dismantling of Seat

Dismantle the left front seat



Move the seat to the forefront, and take down the rear foot cover.

Release the fixing bolt at the rear end of the guide rail.

Move the seat to the tail end, and take down the front foot cover.

Release the fixing bolt at the front end of the guide rail.

Unplug the seat heating interface, and take down the left front seat.

To install, reverse the removal procedure.

Torque: Fix the seat guide rail at torque of 60N•m (4).

Note: For dismantling of the right front seat, refer to that for the left front door.

Remove the right rear seat

Open the rear side door.

Open the cushion and turn it forward. Release the two fixing bolts. Release the two fixing bolts.

Release the two fixing bolts.

Torque: 60 N•m (two)

Now the cushion can be pushed down.

Pull the unlocking switch of the rear seat back, enlarge the back angle backward. Release the four fixing bolts.

Torque: 60 N•m (two)

To install, reverse the removal procedure.

Note: For the removal of the left rear seat, refer to that of the right rear seat.

Removal of Safety Belt

Take down the fixing bolt protective cover of safety belt.

Release the upper fixing bolts.

Take down the fixing bolt protective cover of safety belt.

Take down the lower guard panel of pillar C.

Release the bolts that are used to fix the retractor of the safety belt.

To install, reverse the removal procedure.

Torque:

Fix the head end piece and the lower part of the retractor of the safety belt at torque of 50±5 N•m (1).

Attach the adjusting mechanism to the sliding rail at torque of 50±5 N•m (1).

Removal of Roof

Remove the passenger armrest.

Take down the interior front ceiling light.

Take down the interior middle ceiling light.

Take down the interior rear ceiling light.

Take down the roof safety belt cover.

Remove shields on pillar A, B and C.

Prize up the fixing snap-fit by a flat-blade screwdriver.

Take down the roof.

To install, reverse the removal procedure.

Outerior Trims

Dismantling of the front door outer handle

Remove the shield inside the left front door (refer to the removal of shield inside door), and put off the protective film.

Prize up the screw plug of the outer door handle.

Remove the fixing bolts by an internal spline wrench.

Disconnect the lock cylinder from the lock cylinder rod, and take down the protective cover of the left front door lock cylinder and the lock cylinder.

Take down the outer handle.

To install, reverse the removal procedure.

Torque: Fix the lock cylinder at torque of 11N•m.

Note: For removal of the right front door outer handle, refer to that of the left front door.

Dismantling of the Rear Door Outer Handle

Remove the shield inside the left rear door. (refer to the removal of shield inside door)

Put off the protective film, and remove the fixing bolts at the tailstock of outer door handle by an internal spline wrench from the shield inside the door.

Take down the tailstock of door handle.

Take down the door outer handle.

To install, reverse the removal procedure.

Torque: Fix the tailstock of outer handle at torque of 11N•m. (1).

Note: For removal of the right rear door outer handle, refer to that of the left rear door.

Dismantling of the Tail Door Outer Handle

Open the tail door.

Remove the shield inside the tail door, and put off the protective film.

Release the bolts that are used to fix the tail door outer handle from the door shield.

Dismantle the door handle rod from the lock cylinder, and take off the tail door outer handle.

Note: Fix the lock cylinder and handle by two bolts at the rear left side, take off the handle to disconnect the lock cylinder rod, and remove

the lock cylinder.

To install, reverse the removal procedure.

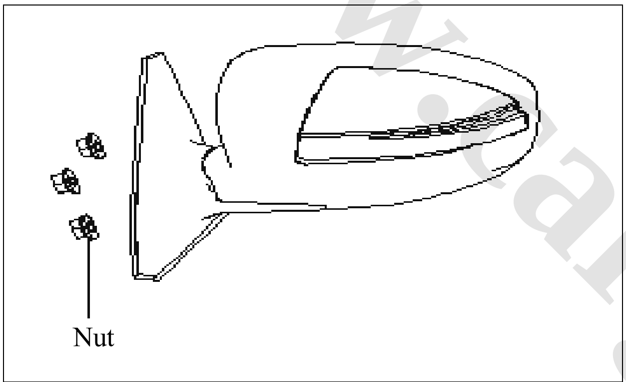
Torque: Fix the tail door outer handle at torque of 11N•m (3).

Dismantling of Exterior Rearview Mirror

Take down the triangular block of the door.

Unplug the interface of the power exterior rearview mirror.

Release the screws that are used to fix the exterior rearview mirror.



Take down the exterior rearview mirror.

To install, reverse the removal procedure.

Torque: Fix the exterior rearview mirror at torque of 11N•m (3).

Dismantling of Front Wiper

Take down the wiper arm.

Release the nuts that fix the wiper arm.

Take out the wiper arm assembly.

Remove the lower decorative plate of the front windshield. Remove the snap-fit to take down the lower decorative plate.

Release the bolts fixing the linkage mechanism.

Unplug the motor interface, and take down the linkage mechanism assembly.

To install, reverse the removal procedure.

Torque:

Fix the wiper arm at torque of 55±3 N•m (1).

Fix the linkage mechanism at torque of 10±1 N•m (3).

Dismantling of Rear Wiper

Prize up the decorative cap of nuts fixing the rear wiper arm.

Release the fixing nut, and take down the wiper arm and rubber ring.

Open the tail door.

Take down the shield inside the tail door.

Unplug the interface of wiper harness, and release the three fixing bolts.

To install, reverse the removal procedure.

Torque: Fix the wiper arm at torque of 2O±3N•m (1).

Fix the wiper motor at torque of 1O±1 N•m (3)

Dismantling of Radiator Grille

Open the engine room cover.

Release the bolts fixing radiator grille.

Take down the radiator grille.

To install, reverse the removal procedure.

Torque: Fix the radiator grille at torque of 6±1N•m (5).

Replacement of Windshield

Replacement of Front Windshield

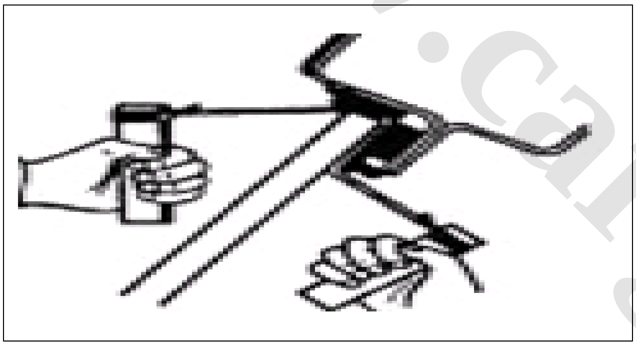
Removal procedures:

Remove the slug of the windshield according to the figure: cut the slug by a knife. Note: Do not damage the vehicle body by a knife.

Remove the windshield

Put the steel piano wire out through the space between the vehicle body and glass.

Bind the two ends of the piano wire by wood block or similar object. Note: Stick the adhesive tape on the outside surface to protect the surface from scratch.



Note: For glass separation, do not damage the paint and inner and outer trims. To prevent scratch on the dash board, a plastic piece can be put between the steel piano wire and the dash board.

Pull the steel piano wire around the glass, cut open the adhesive, and then remove the glass.

Note: For cutting open the glass adhesive area, as much as adhesive should be left on the vehicle body.

Installation procedure

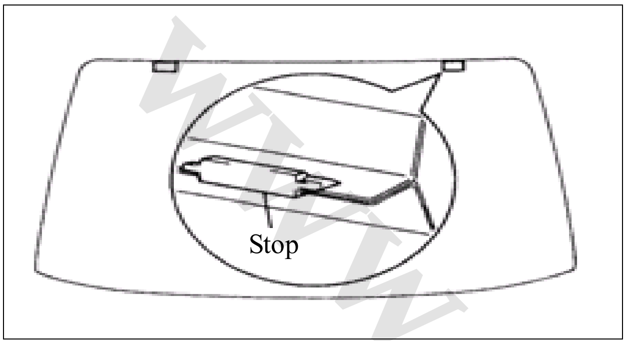
Preparation for installation

Do not touch the glass surface after cleaning.

Cut out the rough section on the vehicle body. Note: Leave as much as adhesive on the vehicle body.

Clean the cut surface of adhesive by cleaning cloth with washer fluid. Note: Even all adhesive has been cleared away, the vehicle body surface should be cleaned.

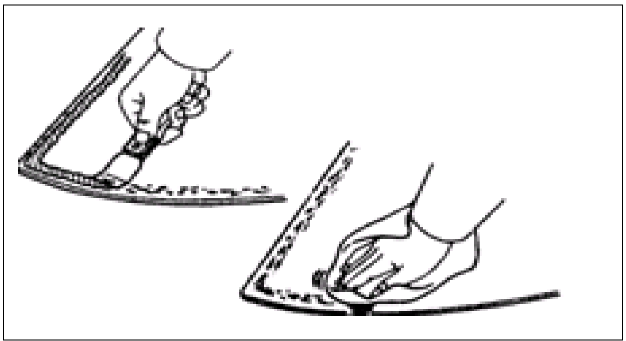
Remove the stop. Cut out the stop by knife.



Clean the detached windshield.

Clear away the adhesive on the glass by a scrapper.

Clean the glass by washer fluid. Note: Do not touch glass after cleaning.

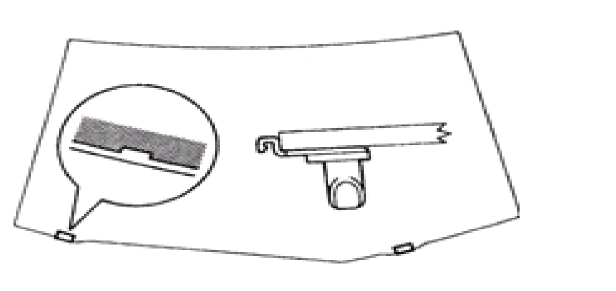


Replace the clip as necessary.

Cut out the stop by knife.

(2) Remove the old clip

(3) Install the new clip

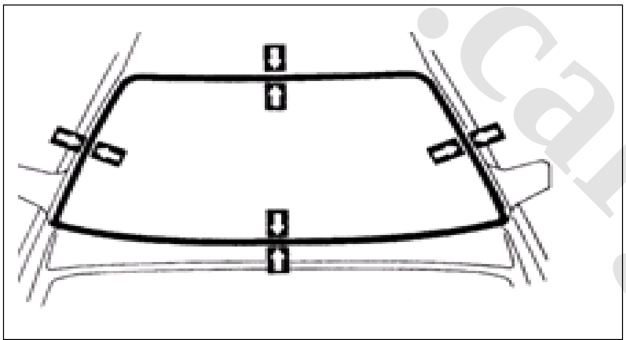


Positioning of glass

Locate the glass at correct position

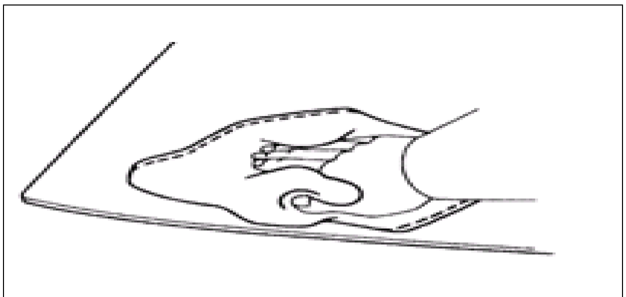
Make reference marks on glass and the vehicle body

Take down the glass

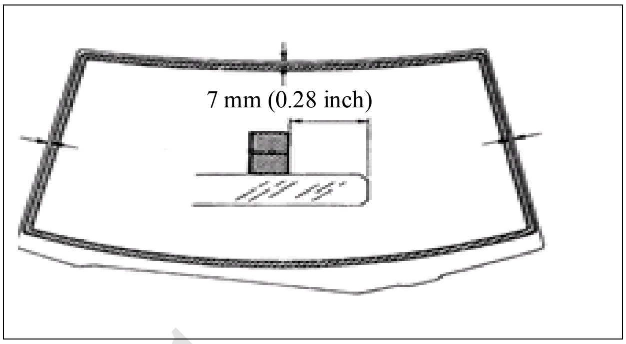


Clean the glass contact surface. Clear away the black dirt around glass contact surface.

Note: Do not touch the glass surface after cleaning.



Install the baffle. Install the baffle by double sticky tape. Note: Do not touch the glass surface after cleaning

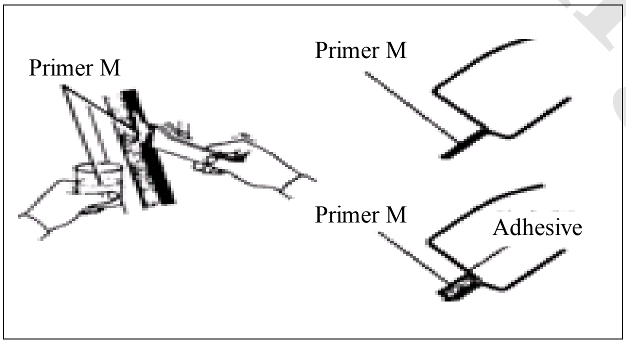


Smear primer M on the vehicle body contact surface. Smear primer M on the vehicle body contact surface by a brush. Note:

* The primer coating should be kept for at least 3 min.

* Do not smear it on the adhesive

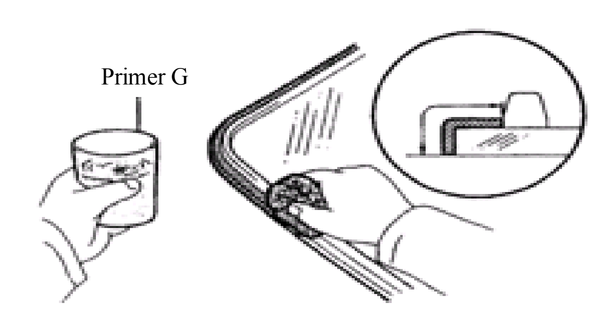
* The primer M that has been opened for use can not be storaged for reuse.



Smear primer G on the glass contact surface.

Smear primer G on the edge of glass and the contact surface by brush or sponge.

Before the drying of primer, wipe it away by clean cloth. Note: (The primer coating should be kept for at least 3 min) Do not smear it on the adhesive. The primer G that has been opened for use can not be storaged for reuse.



Mix adhesive

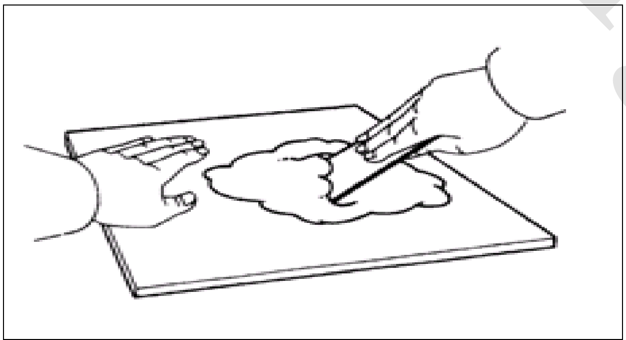
(1) Thoroughly clean the glass plate and putty knife by dissolvent.

(2) Mix the 500g base resin and 75g hardener by a scrapper on the glass plate or similar objects.

Note:

* Make sure that the slug has been installed during the period when the adhesive is applied.

* The adhesive should be mixed within 5 min.

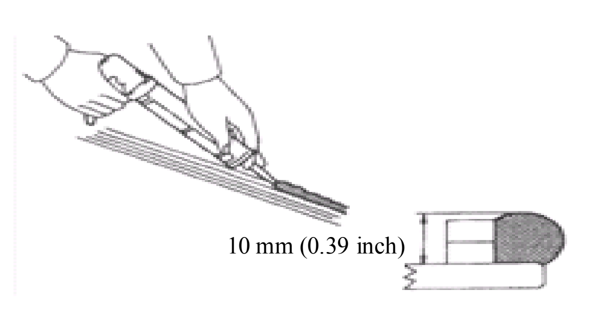


Smear the adhesive

(1) Cut off the mouth point of the pipe pot, and put the adhesive into the pipe pot.

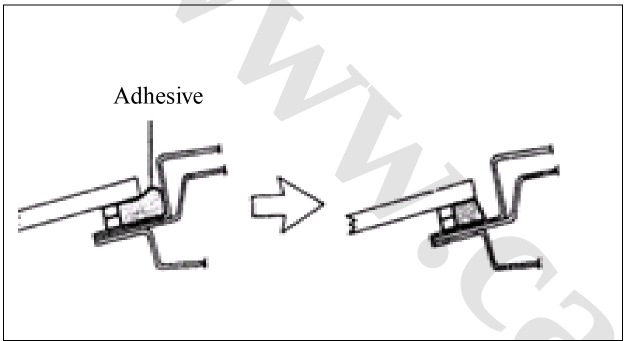
(2) Put the pipe pot into sealing rubber gun.

(3) Smear adhesive on glass as shown in the figure.

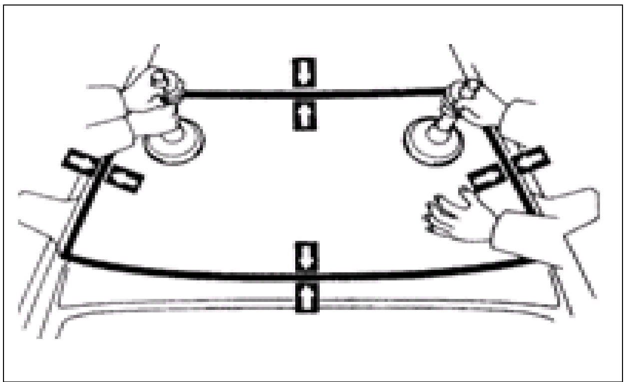


Installation of glass

Note: As shown in the figure, make sure that the baffle has been sticked to the vehicle body panel.

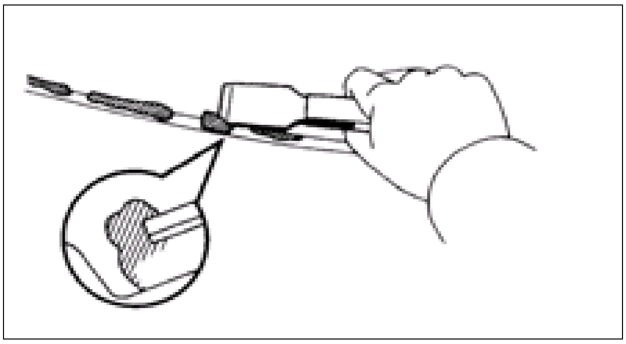


(1) Install glass. Align the reference marks on glass with those on the vehicle body, and then press the glass gently from the edge.



(2) Smear the adhesive on the edge of glass by a scrapper

(3) Remove the excessive or overflown adhesive by a scrapper.



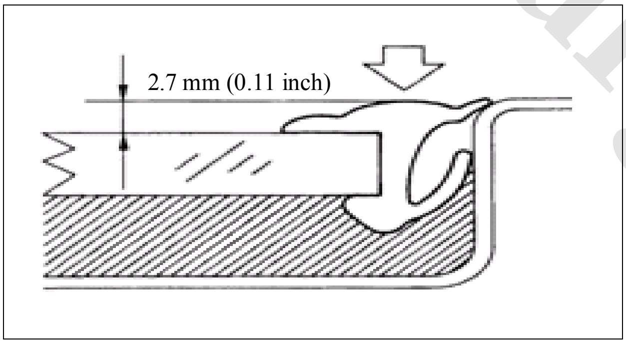
(4) Clamp the glass till the adhesive is hardened.

5. Check

Check if there is water leakage, and repair.

(1) After hardening, do the water leakage test.

(2) Stop the leaking area by adhesive.



1 - Install the windshield upper slug. Install the upper slug on the vehicle body and beat it gently by hand.

2 - Install the outside slug. Install screw and outside slug.

Replacement of Rear Windshield

Removal procedures:

1 - Detach the lower slug. Cut off the double face tape at the two ends of slug by a scrapper.

Note: Wrap the scrapper point by tape before use, and prize up the slug in 6 directions.

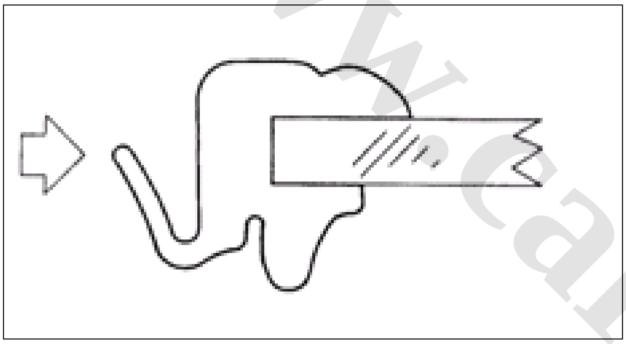
2 - Remove the rear windshield

Pull out the steel piano wire from the vehicle inside through the space between vehicle body and glass; bind the two ends of the piano wire by wood block or similar objects. Note: Do not make the piano wire damaged by the two stops. Take out the glass.

3 - Remove the rear windshield slug.

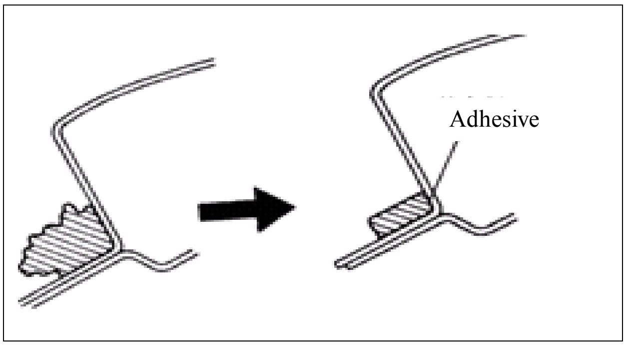
Installation procedure

Install rear windshield slug. Put the slug around the glass and install it by hand. Note: For installation, remove the rear windshield first.

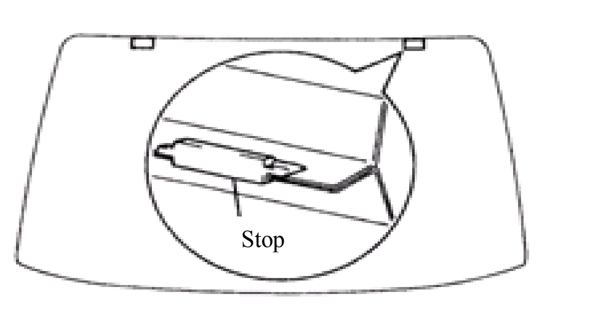


Clean and trim the vehicle body contact surface

Cut out the rough section on the vehicle body. Note: Leave as much as adhesive on the vehicle body. Clean the cut surface of adhesive by cleaning cloth with cleanser. Note: Even all adhesive has been cleared away, the vehicle body surface should be cleaned.



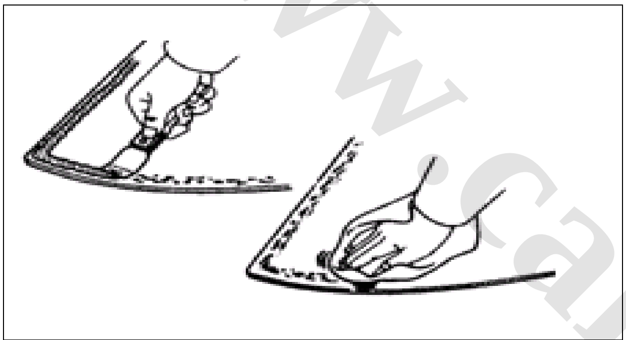
Remove the stop. Cut out the stop by knife.



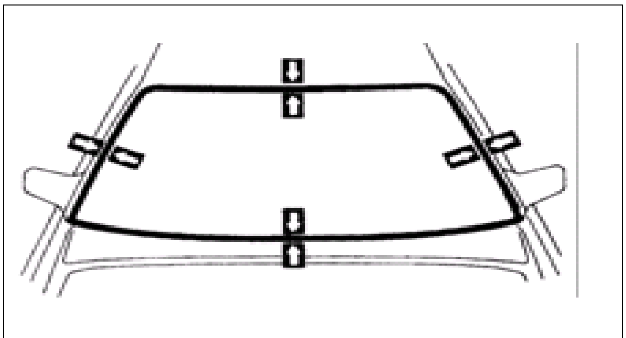
Clean the detached glass

Clear away the adhesive on the glass by a scrapper. Detach the stop by knife and clean the glass by washer fluid.

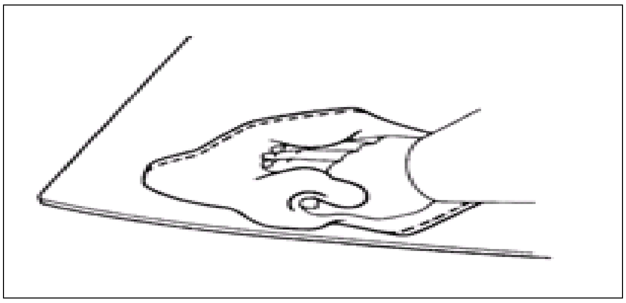
Note: Do not touch glass after cleaning.



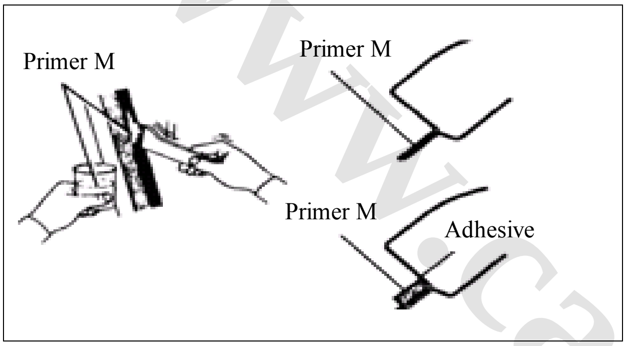
Positioning of glass. Locate the glass at correct position. Make reference marks on glass and the vehicle body. Take down the glass.



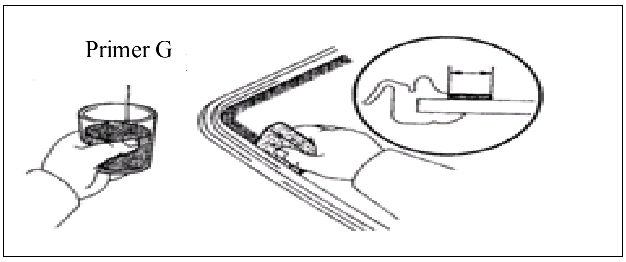
Clean the glass contact surface. Clear away the black dirt around glass contact surface. Note: Do not touch the glass surface after cleaning. Note: Do not touch the glass surface after cleaning.



Smear primer M on the vehicle body contact surface. Smear primer M on the vehicle body contact surface by a brush. Note: The primer coating should be kept for at least 3 min. Do not smear it on the adhesive. The primer M that has been opened for use can not be storaged for reuse.

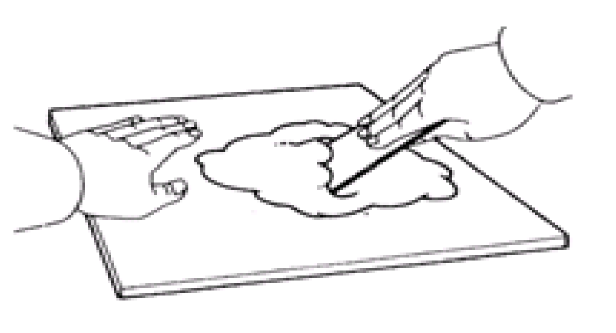


Smear primer G on the vehicle body contact surface. Smear primer G on the vehicle body contact surface by a brush. Note: The primer coating should be kept for at least 3 min. Do not smear it on the adhesive. The primer G that has been opened for use can not be storaged for reuse.



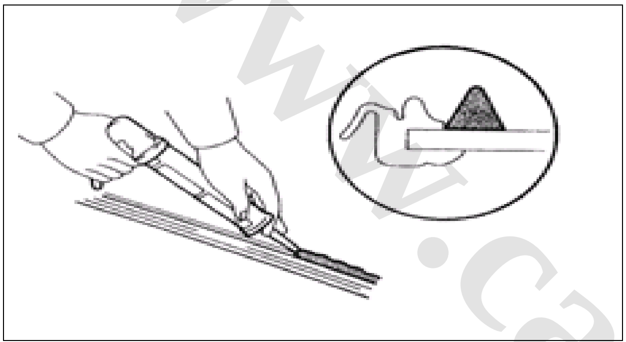
Mix adhesive. Make sure that the slug has been installed during the period when the adhesive is applied.

The adhesive should be mixed within the regulated time. Thoroughly clean the glass plate and putty knife by dissolvent. Mix the 500g base resin and 75g hardener by a scrapper on the glass plate or similar objects.



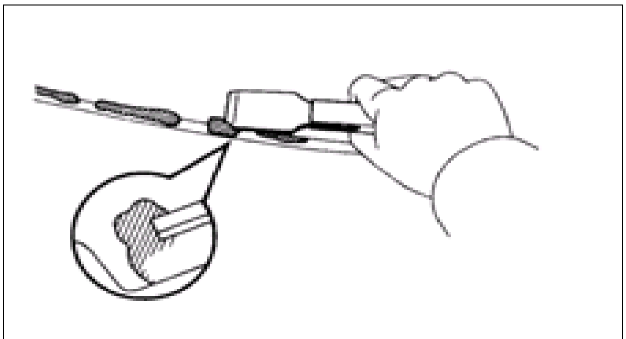
Smear the adhesive

Cut off the mouth point of the pipe pot, and put the adhesive into the pipe pot. Put the pipe pot into sealing rubber gun. Smear adhesive on glass.



Installation of Glass

Install glass. Align the reference marks on glass with those on the vehicle body, and then press the glass gently from the edge. Smear the adhesive on the edge of glass by a scrapper. Remove the excessive or overflown adhesive by a scrapper. Clamp the glass till the adhesive is hardened.



Check if there is water leakage, and repair. After hardening, do the water leakage test. Stop the leaking area by adhesive.

Install the windshield lower slug. Install the upper slug on the vehicle body and beat it gently by hand.

Connect the demister lead connector.

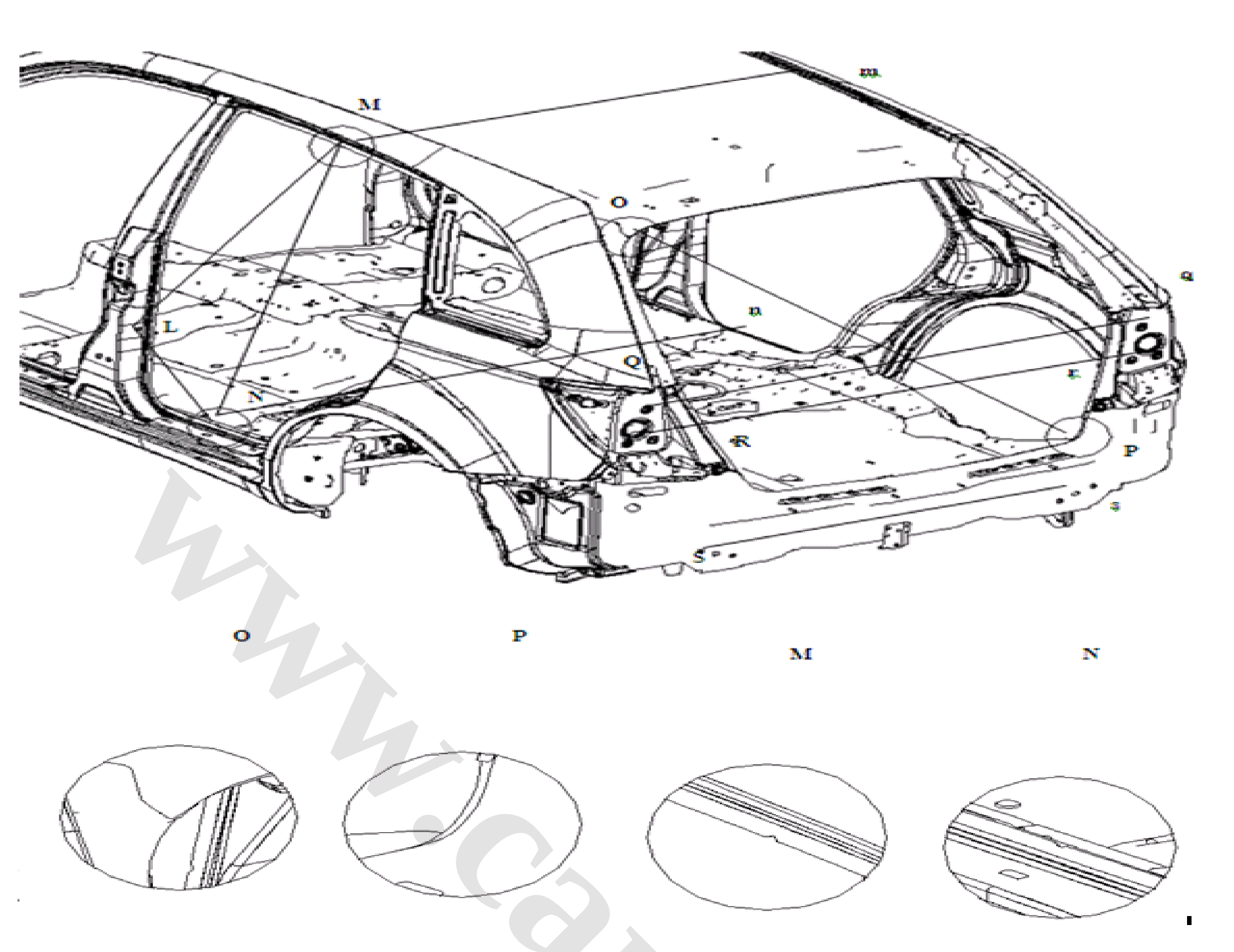
Vehicle Dimensions

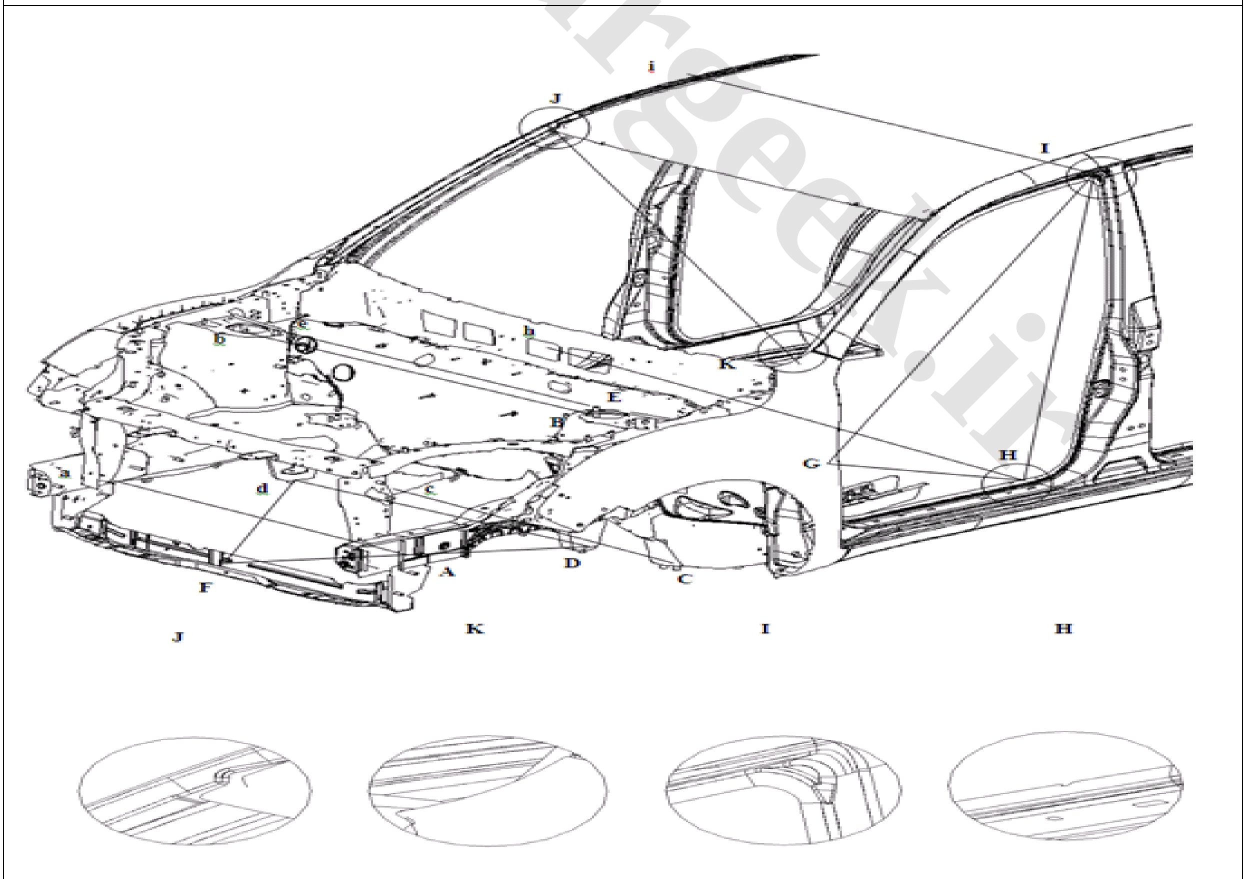
S/N	Measuring location	Dimension parameter (mm)	S/N	Measuring location	Dimension parameter (mm)
1	A-a	984	14	L-M	956
2	B-b	913	15	L-N	390
3	C-c	890	16	M-N	1114
4	D-d	1157	17	M-m	1142
5	E-e	1008	18	N-n	1438
6	F-D	756	19	O-P	1266
7	F-d	814	20	Q-q	1330
8	G-H	696	21	R-r	1286
9	G-L	1285	22	S-s	1012
10	H-h	1434	23		

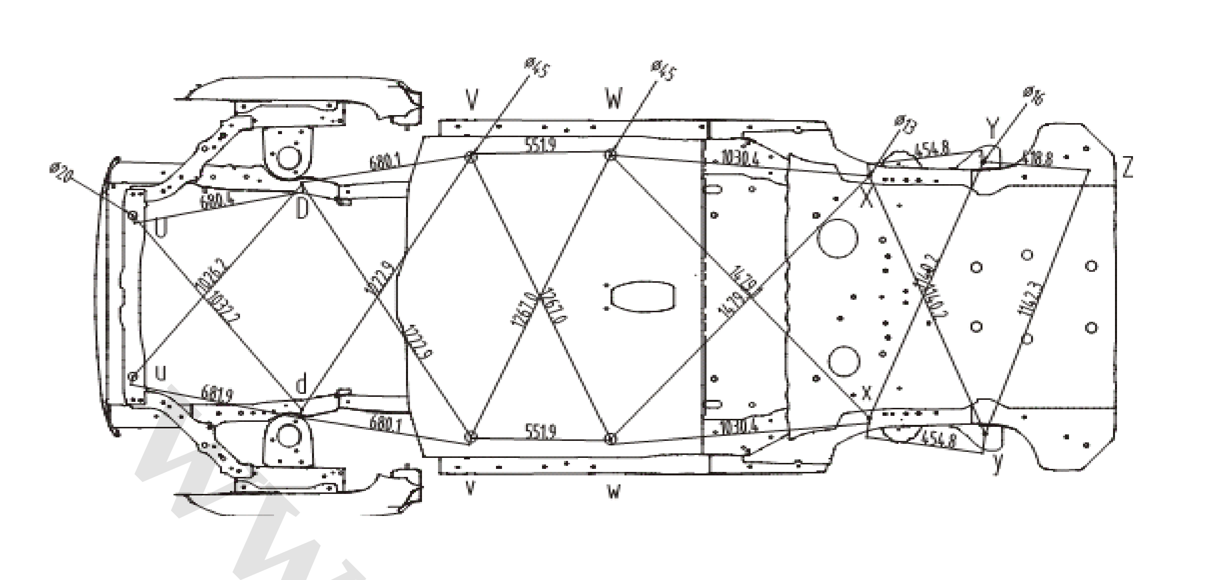
11	H-L	1148	24		
12	I-i	1140	25		
13	J-K	1446	26		

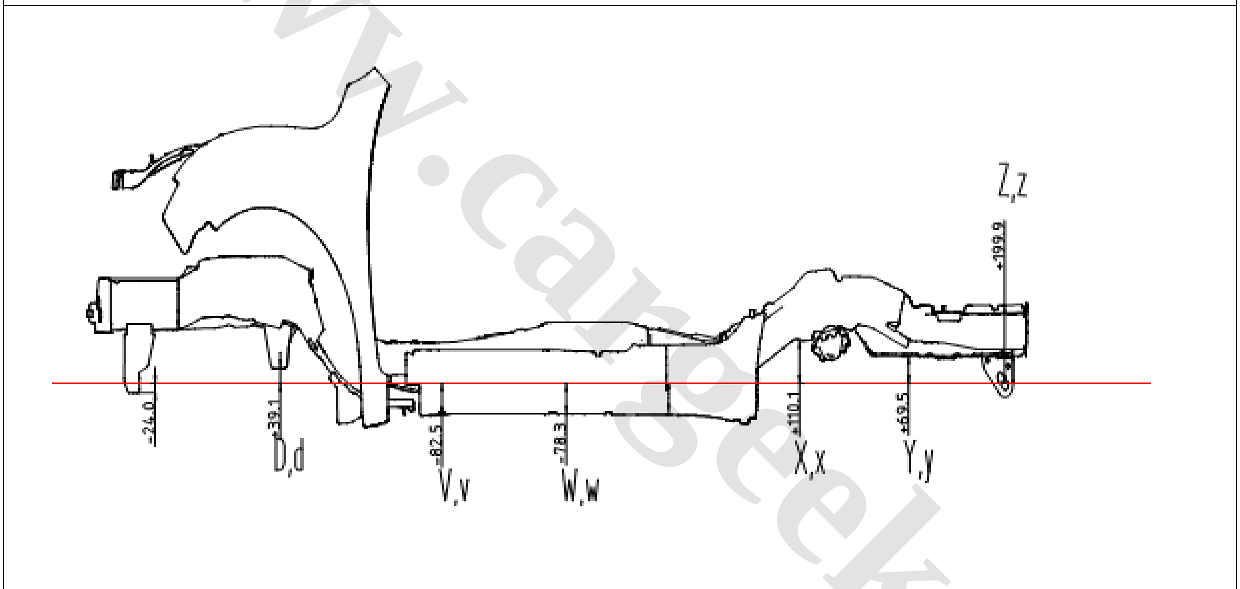
Use of Hole Location Description

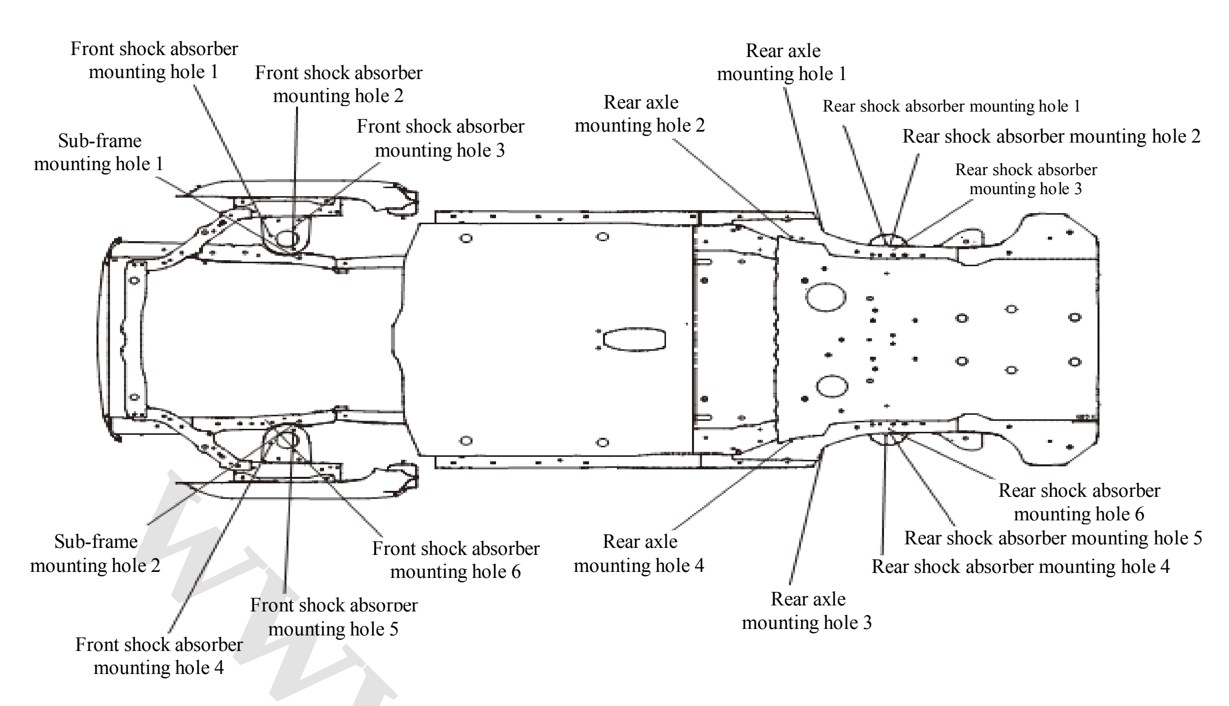
A，a	Main positioning hole of vehicle body	Q,q	Mounting hole of tail lamp
B，b	Mounting hold of suspension assembly	R,r	Mounting hole of tail lamp
C，c	Front sub-frame front mounting hole	S,s	Positioning hole for welding of backpanel
D，d	Front sub-frame front mounting hole	U，u	Positioning hole for welding of water tank lower beam
E，e	Mounting hold of suspension assembly	V,vW,w	Positioning hole for welding of front floor
F	Mounting hole of the lower shield of right engine room	X,x	Mounting hole of rubber plug
G	Mounting hole of front door limiter	Y，y	Mounting hole of rear shock absorber assembly
L	Mounting hole of rear door limiter	Z, z	Mounting hole of rear tow hook


m
M
O
q
L
n
Q
r
N
R
P
s
S
O
P
M
N


i
J
I
b
e
h
K
E
B
G
H
a
d
c
A
D
C
F
J
K
I
H


Ø45
Ø45
V
W
Ø20
Ø13
Ø16
Y
Z
680.1
551.9
1030.4
454.8
518.8
680.5
D
U
X
1026.2
1032.2
1222.9
1222.9
1267.0
1267.0
1478
1479
1440.2
1440.2
1142.3
u
d
x
681.9
680.1
551.9
1030.4
454.8
y
v
w


Z,z
+199.9
-24.0
+39.1
D,d
-82.5
V,v
-78.3
W,w
+110.1
X,x
+69.5
Y,y



Coordinates of the front and rear shock absorbers mounting holes and the front and rear sub-frame mounting holes

Hole location	X(mm)	Y(mm)	Z(mm)
Sub-frame mounting hole 1	76	456.5	39.6
Sub-frame mounting hole 2	76	-456.5	39.6
Front shock absorber mounting hole 1	-39.9	578.7	619.1
Front shock absorber mounting hole 2	52.1	504.2	610.8
Front shock absorber	54.4	622.7	617.4

mounting hole 3			
Front shock absorber mounting hole 4	-39.9	-578.7	619.1
Front shock absorber mounting hole 5	52.1	-504.2	610.8
Front shock absorber mounting hole 6	54.4	-622.7	617.4
Rear axle mounting hole 1	2066.3	592.6	1.9
Rear axle mounting hole 2	2102.6	550	1.9
Rear axle mounting hole 3	2066.3	-592.6	1.9
Rear axle mounting hole 4	2102.6	-550	1.9
Rear shock absorber mounting hole 1	2442.1	536.2	74.3
Rear shock absorber mounting hole 2	2459	521.6	70.9
Rear shock absorber mounting hole 3	2453.3	498.8	62.3

Rear shock absorber mounting hole 4	2442.1	-536.2	74.3
Rear shock absorber mounting hole 5	2459	-521.6	70.9
Rear shock absorber mounting hole 6	2453.3	-498.8	62.3

Origin of vehicle body coordinate: X0 at the center of the front wheel shaft; Y0 at the left and right symmetrical center; Z0 at the upper surface of the middle floor.

No.1539, Jinkai Avenue, NNZ, Chongqing, China.
Http://www.lifanmotors.net
iecauto03@lifan.com
+8602361668042/08602361668043