

# **Dongfeng Sokon Mini Automobile Repair & Maintenance Handbook**

**K Series**



# Chapter 1 Use and Maintenance

## Unit 1 Main technical Parameter

### 1.1 Basic Parameter

#### 1.1.1 Basic dimension & Weight Parameter (Form 1-1)

Form 1-1 Basic dimension & Weight Parameter

Items	Parameters			
<b>1. Dimension (mm)</b>				
Total Length	<b>K01</b>	<b>K01 (long version)</b>	<b>K01L</b>	<b>K01H</b>
	3910	4150	4390	4280
Total Width	1560			
Total Height (empty)	<b>K01</b>	<b>K01 (long version)</b>	<b>K01L</b>	<b>K01H</b>
	1810	1810	1810	1850
Wheelbase (mm)	<b>K01</b>	<b>K01 (long version)</b>	<b>K01L</b>	<b>K01H</b>
	2515	2515	2760	2760
Fr.Tread (mm)	1310			
Rr.Tread (mm)	1310			
<b>2. Weight</b>				
Mass of the vehicle with bodywork in running order	<b>K01</b>	<b>K01 (long version)</b>	<b>K01L</b>	<b>K01H</b>
	948 ~ 980	948 ~ 980	948 ~ 980	948 ~ 980

#### 2、Performance Parameter (Form 1-2)

Form 1-2 Performance Parameters

Items	Parameters	
<b>Optional Model of Engine</b>	<b>BG13-20</b>	<b>AF10-06</b>
(km/h) Max speed	135	105
Max Climbing Capacity	32	30
Time-Needed from Start and then with continuous gear-swift to accelerate 90km/h	40	48
Economical Fuel Consumption Under Limited Condition like 50Km/h, etc	≤6.5	≤6
(50km/h) Brake Distance	≤20	
Outside Noise While Speeding up (dB)	≤74	

### 1.2 Structure parameter

#### 1、Main Technical Parameter of Engines (Form 1-3 )

Form 1-3 Main Technical Parameters of Engines

<b>Model</b> <b>Items</b>	<b>BG13-20</b>	<b>AF10-06</b>
Types	Four Stroke, Water Cooling, Single Top camshaft, Petrol engine with electric control fuel jet,16vavles	Four Stroke, Water Cooling, Single Top camshaft, Petrol engine with electric control fuel jet
Cylinder Dimension	74	65.5
Piston Stroke	76	72
Exhaust	1310	970
Compression Ratio	9.5:1	8.8:1
Rating Power	60.5	38.5
Max Torque	102	74
Weight	98	97
Fuel Consumption	93	93
( r/min ) Idle Emission	750 ± 50	900 ± 50
( r/min ) Max/Mini Swerving Speed	6000/750 ± 50	5200/900 ± 50

2、Transmission Technical Parameter (Form 1-4)

**Form 1-4 Transmission Technical Parameter**

<b>Model</b> <b>Item</b>	<b>BG13-20</b>	<b>AF10-06</b>	
<b>Diving Ratio</b>	Gear I	4.425	3.652
	Gear II	2.722	1.948
	Gear III	1.792	1.423
	Gear IV	1.226	1
	Gear V	1.000	0.795
	Gear R	4.722	3.466

## Unit 2 Use and Notices

### 2.1 Basic Knowledge for New Car Use

#### 2.1.1 Checking the new car

In order to ensure safe driving, before using the car, it must be checked as follows:

(1) Check the connection and strength of the key and essential parts to see whether they accord with requirements, especially on steering devices and braking system. For example, universal joint boot, bed plate, brake system, wheels, steering tie rod boot, steering boot, transmission and so on.

(2) Check the specification, models and quantity of all the oil and liquid to see whether they accord with requirements, such as gasoline, lube, cooling liquid, electrolyte, air window washer fluid, brake liquid, transmission oil, brake oil, steering oil and so on. And also check the car leaks oil and water or not.

(3) Check the working condition of battery voltage, electrical system, lamplight, horn, instrument, pilot lamp and so on. And also check the installment of fuse wire in driver's cab.

(4) Check the types, specifications and tread of the tyres to see whether they comply with requirements; check the tightening torque of the bolt to see whether it comply with the demanding requirement; check each tyre's air inflating pressure to see whether it is normal (including spare tyre) and check the installment of inner valve and the coverings of wheel.

(5) Check the connection and strength of each part, especially the parts of driving, steering, braking, suspension, wheels and so on.

(6) Check clutch, and free stroke of pedal to see whether they accord with the specified value; check the brake system and free stroke of braking pedal to ensure that air in the pipeline is exhausted.

(7) Check the cleanliness of the exterior, including: paint, decorating parts and glass; check the cleanliness of the interior, including: seats, inner decoration parts; check the state of windscreen cleaning device.

(8) Start the engine, warm it up till it reaches the normal temperature, then check it to see whether there is any leakage of oil, gas, water and electricity.

(9) After running with the gearshift lever in gear, check the working condition of clutch, transmission, hand braking, foot braking, steering system and so on.

1) Clutch: whether there is a stuck noise or disordering noise.

2) Speeding-up pedal: flexible as well as non-loosening.

3) Transmission: freely changing gear without difficulty or out-of-gear.

4) Odometer: the odometer index is not chattering while running; when speed changes, the index should waggle stably.

5) Steering control mechanism: we should check whether free stroke of steering wheel is normal, and whether it can automatically back to its position after turning.

6) Foot braking: when braking at speed of 40km/h, we can feel the braking impact, and stop without deflection.

7) Hand braking: when we are lifting the handle of hand braking, and driving at low speed of 20km/h, we can feel the braking impact while transmission getting into neutral position.

8) Air condition: operate buttons and check whether they are in normal working.

9) Judge each part to see whether the sound is normal: when the car is running, especially speeding up or slowing down, please pay much attention to whether there is obviously disordering sound.

10) Check the car to see whether the tools and required technical materials are complete along with it.

11) The air in the water tank and engine must be brought out first.

#### 2.1.2 Breaking in of the new car

Because of the oversight of processing and assembling, friction resistance between moving parts, at the beginning of working, is stronger than at the normal occasions. The effect of breaking in during early period of

using car will affect much on its using length of life, its working fiduciary level and economical efficiency. Therefore, the new car must strictly execute the rules when used.

(1) The rules of breaking in when driving less than 1000km

- 1) Driving at full speed is absolutely not allowed
- 2) Drive generally less than 100km/h
- 3) Avoid driving at high speed in each gear.

(2) The rules of breaking in when driving between 1000km-15000km: gradually drive to the highest speed or the highest rotation rate which engine allows.

(3) Notices after the period of breaking in.

1) Drive the car with speed indicator. When you get into the accessing high speed gear, no later than the finger reaches the red indicating area, the highest rotation speed is 5500r/min which engine allows in the short time. The highest speed which each gear allows is respectively: 20km/h in 1 gear, 30km/h in 2 gear, 50km/h in 3 gear, 70km/h in 4 gear, 80km/h in 5 gear.

2) Avoid engine rotating with unnecessary high speed, and early getting into high speed gear is favorable to save fuel and reduce noise.

3) When we are driving, the rotation rate can not be too low. Only if engine works hard can low gear be used.

4) The speed and rotation rate listed in the explanation book is only applicable to engines with normal temperature. When cooling the car, we should not make engine work with high rotation in neutral position or in each gear.

5) The new tyre doesn't have the strongest adhesion at the beginning of use, so it also needs breaking in. Driving the first 100km should be slow and careful.

6) The new friction wafer of brake also needs breaking in. When we drive the first 200km, there is no appropriate friction. If the braking works not well during this period, we can properly add pressure on the pedal.

## **2.2 Driving**

Proper driving not only shows the good technical performances of the car, but also ensures safety driving. Therefore, as a driver, we must do the daily maintenance work before driving, and during driving, we should drive the car properly according to different roads.

### **2.2.1. Checking preparation before driving**

(1) Check the fuel gauge and judge whether it needs to add fuel.

(2) Check the lube level and examine whether the track on the vemier is between upper limit and lower limit. If the fuel is not enough, we should add fuel on time; when the fuel is excessive, on most occasions, lubricating system of engine will be in trouble. Therefore, we should analyze the reasons immediately and solve the troubles.

(3) Check the cooling liquid level to see whether it accords with requirements. If it is not enough, we should add cooling liquid on time.

(4) Check the braking liquid level to see whether it accords with requirements. If it is not enough, we should add braking liquid on time.

(5) Check the electrolyte level of battery to see whether it accords with requirements. If it is not enough, we should add distilled water on time.

(6) Check the tyre's inflating pressure to see whether it accords with requirements and whether there are enough spare tyres.

(7) Check whether the lamplight, steering signal lamp and braking signal lamp are in good condition.

(8) Check whether the front and back air window are clean, the angle of back mirror inside and outside of the car is proper, and whether wiper is in normal work.

(9) Whether the steering wheel height is adjusted to a proper position, and whether the seat and safe belt are adjusted to a proper position.

(10) Check the performance of tyre's braking system to see whether it is reliable.

(11) Check whether the moving of each pedal is flexible, whether the free stroke is within the demanding scope, whether position shift is free, and whether there is stuck.

(12) Check whether tools along with the car are complete, and whether there is an amount of fusing wires and bulbs.

(13) When driving in a long-distance, we should prepare an amount of lube and cooling liquid.

The key notices of safe driving:

(1) Before each driving, we should wear safe belt and adjust the headrest according to our statures.

(2) We should pay attention that the control of pedal cannot be foreclosed, and things put on the luggage and rear shelf should be accurately placed.

(3) Do not drive when you are tired. Usually we should have a short rest after two hours' driving.

(4) Alcohol, narcotics and druggery will reflect the reaction of the driver. So do not keep driving in drank or distractingly situation. The latest research shows, if driver uses mobile communication equipments during driving, the result will be worse than in over drank situation. Thus, never use mobile communication equipments while driving.

(5) At anytime, the speed of the car should fit the road. For example, low down the speed of the car while driving on the ice or on wet road, or in the crowd road.

(6) For the safe of the driver, do comply with the traffic rules.

2. Start the engine

(1) Manual shifting car

1) Move the gearlever at zero gear, and pull up grip brake.

2) Starts of manual shifting car, step clutch pedal to the bottom, in this way, while the starter work, idle the engine.

3) Open the switch, start the starter, no need to step the accelerograph.

**Remark: Loosen the switch key the moment the starter working, in order to prevent the starter from passively working.**

4) After the engine starting to work, you can drive at once, and there is no need to warm-up.

**Remark: Before the temperature of the engine reach the normal level, do not let the engine work fast or step the accelerograph to the end.**

(2) Notices when start the engine.

1) When the engine coldstarts, because the engine of this car is equipped with continual injection equipment, it can provide oil-gas mixed fuel at any situation. This start-up procedure can not be affected by any outside environment, before the start-up, please do not trample the accelerograph, if the engine can not be started immediately, please wait for around 10 seconds, then re-start it again.

2) If the engine is very hot, you can step the accelerograph lightly after starting the engine. If can not be started immediately, maybe there's problem with the fuse of the electric fuel pump or the fuse of the engine operation system (maybe fusing).

3. Driving notice:

In order to exert the technical performance of the car, reduce the fuel consumption as much as possible, and reduce the blight of exhaust gas and noise, we should pay attention to the followings:

(1) We should avoid trample the speeding-up pedal fiercely, but moderately, this can not only reduce the fuel consumption, but also reduce the abrasion between pollution and inner spare parts.

(2) Change the gear when it is necessary, we should often drive it with economical gear, and avoid the engine running at a too high or too low speed.

(3) Try to drive stably, the operation should be prospective, the unnecessary speed-up, brake, start and stop all increase the fuel consumption rapidly, and avoid sharp curve and urgent brake.

(4) When running into a traffic jam, we should switch off the engine.

(5) Check the tyre's inflating pressure terminally, when the pressure of the tyre is too low, it will increase the rolling resistance, speed up tyre wear and distort steel ring.

(6) Clean up the unnecessary things in the luggage on time.

(7) The accessorial electronic apparatus such as warming, air condition, heating device in rear window, front lamp and so on should only be used when it is necessary.

(8) Do not switch off engine immediately after a long time driving; we should let the engine running two more minutes at a speed higher than idle speed to cool it.

(9) Check the car and follow the rules of safe driving notice before a long journey.

If we know that the oil change and some other maintenance items are at term beforehand during this long journey, we should move them up; especially the change of brake liquid is significant to security of driving.

(10) If the car often drives under the conditions such as with full weight, the outside temperature is too high or too low, full of dust and the poor quality of the fuel; we should adopt some special technical measures accordingly, for example: we should adopt the lube whose viscosity is tally with the outside temperature (we can choose the viscosity grade of the lube according to the outside temperature), install air cleaner with specific function, and the maintenance cycle should be changed accordingly, for example, if the burthen of the engine is heavy, the cycle of changing the lube should be shorten.

(11) Pay attention to the instrument and pilot lamp when we are driving. In order to make drivers more convenient, the car adds various alarm units and fault diagnosis pilot lamp of engine which can reflect the working condition accurately. If there has some hidden trouble, they will warn us as soon as possible and require the driver to pay attention to it immediately to avoid accident with mechanical failure, there are some important alarm units we should especial pay attention to:

1) The pilot lamp alarms when the temperature of the cooling liquid is too high.

2) The pilot lamp alarms when the pressure of the oil is too low.

3) The pilot lamp alarms when the oil liquid level is too low.

4) The pilot lamp alarms when the level of fuel box is too low.

5) The pilot lamp of brake system.

6) The pilot lamp of generator.

(12) When driving through water, we have to move at a crawl and be conscious in case that the water flood into the engine or soak some electrical system, and consequently lead to some malfunction, so we should resume the brake system immediately. When the surface gathers water, we cannot go through it by force.

(13) Do not refit the car without permission, or it will affect the car's normal technical status and the guarantee.

(14) Strictly follow the rules of the manufacturer to maintain and repair the car.

#### 4. Accurate use of draw gear

There is a towing hook in both the front and rear bumpers, which can tow the other cars and be towed by the other cars.

(1) When the car tows the other cars or be towed by the other cars, the dragrope and towing handle can only be put in this towing hook. we should especially avoid forced towing or fierce pulling, or it will be dangerous because of heavy burden.

(2) Follow the traffic rules about tow, the car is towing and the car is towed both have to light the pilot lamp.

(3) The driver of the towed car should pay attention to the dragrope to keep it taut.

(4) The towed car must open the switch to make the redirector turning freely, and the turning lamp, horn, windscreen wiper working normally.

(5) The towed car should get into 3 gear or 2 gear before starting.

(6) Once the towed car starts the engine, we should step the clutch and get to neutral position to avoid bumping to the front car.

## **2.3 Right Use of Fuel, lubricant & Various Fat Liquid**

### **1. Add fuel correctly**

The quality of the fuel influence the performance of driving, engine and its life use, and fuel additive can ameliorate the performance above, so it is necessary to adopt the fuel with high quality additive. If we cannot buy the fuel with high quality additive or when the engine meets something in trouble, such as starting with difficulty, idle speed is not stable or the power drops, we should add fuel with proper additive. The fuel additive can prevent the engine from tarnishing and fouling and has the function of clean oil supply system, which can avoid throttle valve casing freezing at the temperature between 0 and 15. Each service station has fuel additive with the permission of the company, and workers in the station master the method of its use and of dealing with the fouling of the engine.

When we add the fuel, we should pay attention that the oil filling port lies on the little cover board behind the front door and above the side plate, with the capacity of the standard fuel box is 40L. After opening the cover of the fuel box, we can hang it on the cover board, and when we adding fuel, please use the fuel gun accurately.

Explanation; when taking spare fuel with the car, we must follow the rules of local statute.

For the case of safe, do not take spare fuel with the car to avoid accidents, such as breakage of fuel box, overflow of petrol, which lead to fire.

### **2. Accurate use of engine lube**

Before leaving the factory, the car had been filled with engine lube with high quality. Except under extraordinary cold weather, it can be used through the whole year. The engine lube with high quality is the precondition of engine running without failure and long use. Therefore when we add lube or change lube, we must use the proper lube with high quality.

(1) When we check the lube level and engine working, the consumption of lube is natural; the consumption can reach to 0.138L/1000km. So we must check the lube level terminally, and had better check it when adding fuel every time.

When check the lube level, the car must be held in a horizontal position. After the engine stops, wait for a few minutes to let the lube back to the lube plate. Then take out the dipstick, clean it with cloth, and put it back to the bottom, and again take it out to read the number, the fuel level should be between the superscript X and the subscript X.

The difference of highest fuel level and the lowest fuel level of the engine in the car is about 1.0L.

(2) Fill the engine lube. We should open the filling up cap on the cover of the cylinder, fill with lube, and check the fuel level with the dipstick.

Notice: the fuel level is not allowed to exceed the highest level; otherwise the lube may be absorbed through the vent-pipe in crankcase.

After fill the lube, the cover of the fueller should be put away. The dipstick must be put into the bottom, or the lube may flow out when the engine is running.

(3) Change the engine lube. The burden and aging of the lube during working will change the performance of engine lube. So the time of changing lube depends on both the using burden and the using time.

Usually when the car has driven 5000km, it needs to change the engine lube.

If the car is always driving on the special road or in the area with capricious weather, we should shorten the driving mileages of the engine lube to make sure reliable and safe driving during the long journey.

Notice: the engine lube should not be mixed with other materials. The used lube must be disposed strictly according to the rules, and we must forbid the children to touch it. We cannot let the lube flow into the drainpipe or the soil under any circumstance.



### 3. Accurate use of cooling liquid

The cooling system is not need maintenance normally.

When the car left the factory, the cooling system had been put with permanent cooling liquid. This kind of cooling liquid is unnecessary to change.

The cooling liquid is mixed with half glycol and half water, its anti-freeze capacity is

-35°C and it has an excellent performance of antiseptis. Besides, the additive can prevent scaling, and increase the boil point of the cooling liquid.

Based on the excellent performance above, this kind of cooling liquid should be used in the cooling system perennially. Do not add pure water at any time (especially in summer or in some hot area) to avoid decreasing the consistency of the cooling liquid. In order to make sure the normal function of the cooling liquid, the consistency of the cooling liquid can not below 40%( volume proportion)

If it is necessary to improve the anti-freeze capacity of the cooling liquid, we can enhance the proportion of the glycol properly, but the consistency of the cooling liquid can not beyond 60%(volume proportion). At that time the engine can run normally under -48°C. Otherwise it will reduce the anti-freeze capacity and weaken the cooling effect.

Extremely cold area(under -50°C), we should make out cold weather protection.

(1) Check the height of the cooling liquid level. The tank of the cooling liquid is located in front clapboard.

The level of the cooling liquid should accord with the rules to fulfill the level when adding the fuel.

In order to check the cooling level accurately, we should closedown the engine and wait until it stops running before checking. The tank of the cooling liquid is a translucently plastic pot, on which labels max and min, and it is no need to open the tank to check the level.

When the engine is under cold condition, the cooling liquid level must be between the highest and the lowest mark. Once it reaches to thermal state, the level may be higher than the highest mark.

Notice: if the cooling liquid appears exceptional loss, it may mean that the cooling system appears the breakage of leaking, at this period of time, merely depending on adding cooling liquid cannot solve the problem completely. So do not waste any time, come to the service station of the company right away to check the cooling system.

(2) Add the cooling liquid. Close down the engine, wait until it becomes cool and lay over the cover of the cooling liquid tank with a cloth, turn it counter-clock wisely and wait the inside pressure fell down to take out the cooling liquid tank, then add the cooling liquid.

Notice: when the engine is under thermal state, and when the cooling system is still under thermal and high pressure state, do not open the cover of the cooling liquid tank in case of being scalded.

Under emergency, if we have to add pure water, we must add cooling additive afterwards as soon as possible to make the consistency of the cooling liquid back to its normal state.

If the cooling liquid loses a lot, we have to add cooling liquid when the engine is under cold condition to avoid the breakage of the engine.

When add the cooling liquid, do not add it beyond the highest mark of the cooling liquid tank! Because once the engine reaches to the thermal state, the excessive cooling liquid will flow out through the limiting valve of the tank cover under great pressure. After adding the cooling liquid, do screw down the cover tightly.

Notice: both of the cooling liquid and the cooling additive are poisonous! So the additive must be put into the original container, and strictly forbid the children to touch it. If we have to release the cooling liquid in the system, we should collect it properly and put it in a safe place. The ejective cooling should not be used again; we must follow the rules of environment protection law to deal with the used cooling liquid.

### 4. Accurate use of brake liquid

(1) Check the brake liquid level. The brake liquid tank is on the left of the front clapboard. The brake liquid level must accord with the rules to meet the need of the brake system.

The level should be between the max and min mark of the tank.

There is a friction facing in the brake system of the car. So when we drive the car, the brake liquid level may decrease a bit, this phenomenon is natural, do not worry about it. However, if the level of the liquid is apparently decreased a lot or below the lowest mark, which means that the brake system is in trouble, at this time we should drive to the service station of the company to repair the brake system immediately.

(2) Change the brake liquid. The brake liquid has the performance of accessibility, which can absorb moisture in the air when it is used. If the water content of the brake liquid is too heavy, it will rust the brake system. Moreover, the boiling point of the brake liquid will decrease obviously, which will affect the impact of brake and safety. Because of these reasons, the brake system must be changed every year.

Notice: if the brake liquid has been used for a long time or it is often been braked, the brake system will produce steam bubbles, which influence the brake impact and safe driving.

In order to ensure the brake impact and safe driving, please choose the original brake liquid of our company, and do not use the new brake liquid which have never been used before.

Notice: the brake liquid is poisonous! So do not put it in the original sealed container, and do not let the children to touch it! The brake liquid is also mordant to the paint of the car!

Dealing with the used brake liquid is a professional job; we have to equip special tools, so we had better go to the service station of the company to change the brake liquid.

#### 5. Check the power steering liquid heights

Whether the power steering liquid heights is right or not, influence the power steering accommodate directly, so, do check the liquid height regulate. After the engine working 2min, put the front wheel right ahead, stop the engine, check the liquid level.

Open the cover of the oil ruler, check the liquid level, keep it between the maximum and minimum mark. If under the minimum mark, add power steering hydraulic oil according the regulations.

Remark:

(1) Do not mix braking liquid and power steering hydraulic oil. Otherwise, the braking system would not work.

(2) Power steering hydraulic oil is a kind of lube lubricant, if there is no power steering hydraulic oil in the system, oil pump will break. So, in the situation, add it immediately, or unload the V belt of the power steering, drive the vehicle to the maintenance station to add hydraulic oil.

(3) If the power steering component does not work, the vehicle can still turn, but need put more power on the steering wheel, and examine the power steering system as soon as possible.

#### 6. Right use the shift gear oil

In order to keep the shift working normally, do pay attention to add gear oil properly according to the stipulation.

(1) The two types of gear oil of the manual shift are GL-4, SAE80W-90 AND GL-4, SAE75W-90. and the type of GL-4, SAE75W-90 applicable for south and north areas, and for winter & summer. In order to maintenance the transmission better, change the gear oil annually or drove 50000km.

Notice: after a high speed driving or long time bearing, check the level of oil after a 30 minutes packing at least. If the level of oil is not enough, add oil or escape oil (the oil bolt is at the lower part of the oil sump of transmission). The color of the shift oil should be bright red. If it changes to brown or black, which means that there is quantity of friction material or other impurity in the oil. If it changes to pink or white, which means that the cooler of the engine radiator leaks the cooling liquid. If this happens, change the shift oil at once.

Under normal situation, we should change the shift gear oil every 50000km. if the condition of the road is not well, we should shorten the interval of changing the driving miles of shift gear oil to ensure the security and reliability of the car.

## 2.4 Use of Body Establishment & Accessory

### 1. Open and close of the vehicle door

(1) Outside the car, when we open the vehicle door, we should pull the door handle. Both of the front doors can be opened or locked by keys outside the car.

(2) Inside the car, all the vehicle doors (the left front door must be locked) can be locked through safe cage knob. Once we press the safe lock, we can not open the door no matter inside or outside the car.

Notice: do not lock the door when the car is driving in order to open the door easily to get help from outside when we come across emergency.

### 2. Close the window

(1) Regulator. The inside window can be opened or closed by the handle on the door. When we turn the handle clockwise to the left, the window will lower. On the contrary, if we turn the handle clockwise to the right, the result will be contrarily.

### 3. Adjust the angle of back mirror

In order to ensure the best effect, we should adjust the angle of back mirror before driving.

(1) Adjust the angle of back mirror outside the car by hand. The angle of back mirror outside the car should be adjusted rightly. This position can not only ensure the largest view, but also ensure profound check at anytime.

### 4. The use and adjustment of safe belt

A lot of facts prove that when the accident happens, the safe belt can provide better protect. So we must wear safe belt before each driving.

#### (1) The use of safe belt

- 1) Three point safe belt. When the car is driving under common condition, the safe belt can be flexed freely according to the need of the passenger, but if the speed of the car (or some other facts, such as rapid pull or urgent brake) changed suddenly, the buckle of the safe belt will be locked and maintain proper contraction force. The safe belt in the car is the kind of combined safe belt.

Notice: the rightly use of safe belt is important to its function.

2) Method of tying the safe belt across the waist. Pull the head of the safe belt from one side to the other side across the waist, and connect it to the other side until hearing the sound, then pull the belt to see whether the belt is already locked.

3) Method of tying the safe belt across the shoulder. The safe belt should be pulled across the center of our shoulder and cling to our body.

(3) The adjustment of the safe belt. The shoulder safe belt can be adjusted according to passengers' height.

When we adjust the safe belt, we should move the knob up and down to make the safe belt going across the center of the shoulder. After adjusting the safe belt, we should check it to see whether it is locked.

The method of adjusting the height of safe belt in front row

1) Press the guiding ring on the fixed point of the safe belt by hand, and move up and down, adjust the safe belt through shoulder and abut against the neck.

2) After adjusting it, we should to check whether the fixed point on the safe belt is firm.

### 5. Adjustment of seat

(1) Adjust the front seats back and forth. In order to ensure safe driving, the adjustment of driver's seat can only be done when the car stops. The back and forth adjustment of the front seats is: pull the tie bar of the seat to move the seat back and forth.

(2) Adjust the backrest of the front seats, we only have to pitch ourselves and pluck the rod next to the backrest. Do not make the backrest pitched behind too much when we are driving, otherwise, it will influence the effect of the safe belt.

(3) Rear row seats. The backrest and the cushion of the rear row is detached, both of which have the function of turning ahead to enlarge the volume of the luggage. The method of turning

the backrest: we should adjust the front seats to a proper position in case that the front seat will hit the rear ones. And pull the plastic rod which is on the top of the backrest, then we can turn the backrest ahead. The method of turning the cushion: firstly pull the plastic drawstring lightly, and then we can turn it freely.

## Unit 3 Maintenance of the car

### 3.1 Repairing and Maintenance Form

#### 3.1.1 Repairing and Maintenance Form under normal condition

The interval of repairing and maintenance: The interval should be fixed according to the odometer or the using months	This form lists the repairing and maintenance demand of the car which had been driven for 80,000km. For the car of driving miles beyond 80,000km should be repaired and maintained according to the same interval.								
	(×1, 000) Kilometer	10	20	30	40	50	60	70	80
	(×1, 000) mile	6	12	18	24	30	36	42	48
	month	6	12	18	24	30	36	42	48
1. engine									
1—1. driving belt	—	—	—		—	—	—	—	R
1—2. Top camshaft timing belt	Change it per 100,000kms								
1—3. valve clearance	—		—		—		—		
1—4. (SE / SF / SG / SH / SJ) engine oil and engine oil filter	R	R	R	R	R	R	R	R	R
1—5. Cooling system tube and junction	—	—	—		—	—	—	—	
1—6. Cooling liquid of the engine	—	—	—	R	—	—	—	—	R
1—7. exhaust pipe and fabricated section(not include pipe filter)	—	—	—		—	—	—	—	I&(R)
2. Exhaust control system									
2—1. Air hose and junction of crankcase	—		—		—		—		
2—2. Air flow controller of crankcase	—	—	—		—	—	—	—	
2—3. Exhaust system of fuel evaporation	—		—		—		—		
2—4. Fuel cut system	—	—	—		—	—	—	—	
3. electrical system									
3—1. wiring harness and junction	—	—	—		—	—	—	—	
4. Switch system									
4—1. spark plug	Using unleaded gasoline	—	R	—	R	—	R	—	R
	If using leaded gasoline, we should consult the form” driving under severe condition”								
4—2. Subordinate electronical cover and head	—	—	—		—	—	—	—	
4—3. Switch line	—	—	—		—	—	—	—	R

4—4. Timing switch	—	—	—		—	—	—		
4—5. The device of subordinate electronic adjustment	—	—	—		—	—	—		
5. fuel									
5—1.	—	—	—		—	—	—		
5—2. The proportion of idle speed and rotate speed of the engine	( )		—		—		—		
5—3. Fuel tank cover	—	—	—		—	—	—	R	
5—4. Chip of air cleaner				R				R	
5—5. oil filler	Change it per100,000kms								
5—6. Fuel tube and junction/fuel box	—	—	—		—	—	—		
6. brake									
6—1.	Brake wheel and gasket(front)		—		—		—		—
	Brake drum and block		—		—		—		—
6—2. Brake tube and pipe		—		—		—		—	
6—3. Brake liquid	—		—	R	—		—	R	
6-4. Braked pedal	—		—		—		—		
6—5. brake staff and cable		—		—		—		—	
7. batholiths and body									
7—1. clutch									
7—2. tyre									
7—3. tyre turntable									
7—4. impending shelf setting									
7—5. transmission shaft	—		—		—		—		
7—6. manual transmission oil				R				R	
7—7. differential gear oil				R				R	
7—8. redirector system									
7—9. gemel and lock									
7—10. shift control staff and axis									

### Remark

“R”: Replacing

“| ”: Inspecting, replacing when needed

1—7 (R) is used only for installing rubber stuff on exhausting system.

Advice when the car drove under bad condition.

Obey the maintain schedule

### 2. Codes for bad conditions

A—Repeated short distance running.

B—Driving on uneven or muddy road

C—Driving on dusty roads

D—Driving on cold weather and salty roads

E—Repeat short distance traveling under cold weather

F—using lead oil

Bad condition code	Maintenance	Operation	Intermittent time for maintenance
-BC---	transmission strap		every 20,000km or 12 months
		R	every 40,000km or 24 months
A-CDE-	generator oil and oil cleaner	R	every 5,000kms or 3 months
AB-D--	releasing pipe and installing stuff		every 10,000km or 6 months
--C---	Air cleaner core * 1	R	every 2,500kms
			every 20,000kms or 12 months
ABC-EF	Spark plug	R	every 10,000km or 6 months
AB-D--	Transmission shaft		every 10,000km or 6 months
-B--E-	Manual transmission and differential gear oil	R	every 20,000km or 12 months
-B----	Bolts & nuts on Chassis	T	every 10,000kms or 6 months
ABC---	Brake set and front pad Brake drum and brake shoe(rear)		every 10,000kms or 6 months

“R”: Replacing

“|”: Inspecting when needed

“T”: Screw down

\* 1: More frequently checking or replacing is needed when traveling on dusty roads.

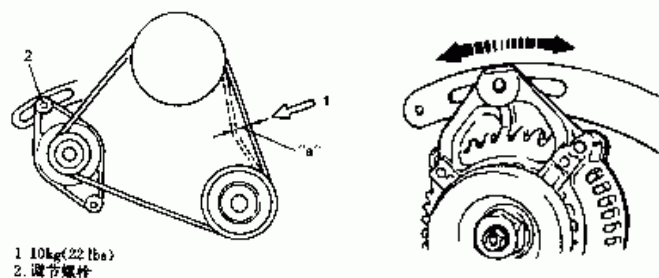
## 二、Maintenance

### 1、engine

#### Transmission strap

Warning: cut off the cathode of the battery before checking strap's condition

Water pump strap checking



1) Checking the crack, cut, distortion, wearing as well as its cleanliness, replacing when needed.

2) Check the tensility of the strap. There should be 7-10mm sink when is pressed by 10kg force.

**Tensility of the strap “a”: Sink value 7-10mm.**

**Attention:**

The tensility regulation is, when replacing a new strap: press at the middle, a 7-10mm sink

**Water pump strap replacing**

- 1) Cutting off the cathode of the battery.
- 2) Remove the compressor transmission strap, if air conditioner is available(details please as per driving strap of air conditioner compressor)
- 3) Replacing water pump strap with a new one.
- 4) Regulating the strap tensility according to instruction.
- 5) Turning on the battery cathode.

**Check air conditioner compressing transmission strap.**

Check wearing, scathe and tensility of the strap. Replacing or adjusting when needed.

**Check air conditioner compressing transmission strap.**

Check wearing, scathe and tensility of the strap. Replacing or adjusting when needed.

**The tensility of air conditioner’s transmission strap:**

**Pressing at the middle with a 10kg force, there will be a 8-11mm sink.**

Replacing air conditioner’s compressing transmission strap

- 1) Cut the cathode of the battery.
- 2) Release the strain of the old belt, and change the new one instead.
- 3) Change the pump belt by the new belt.
- 4) Adjust the strain of the belt according to the demand of technology.
- 5) Connect the cathode of the accumulator.

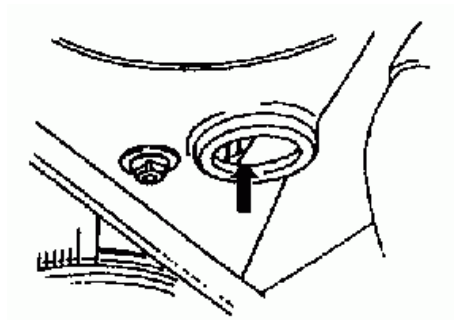
Notice:

When we change the new belt, the strain should be adjusted to: press the middle heavily, there will be a 8-9mm sink.

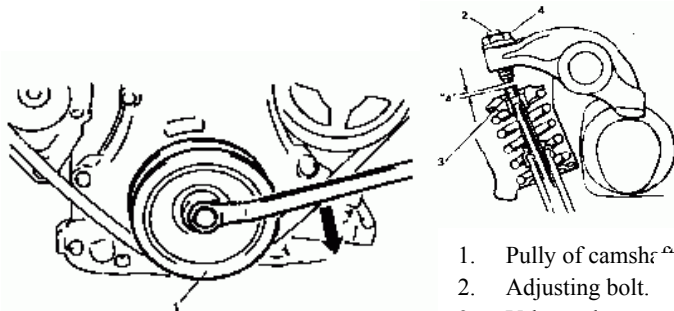
The timing belt of camshaft

**Check**

- 1) Put off the inspection port plug from the timing belt.
- 2) Examine the abrasion, crack, hurt, oil stain of the timing belt with lamp and appropriative mirror according stipulation.
- 3) Install the inspection port plug.



**The gap of valve**



1. Pully of camshaft
2. Adjusting bolt.
3. Valve rod
4. Locking nut for

**Check**

- 1) Unload the crankcase soft pipe on the cover of the cylinder, and the warmer soft pipe
- 2) Unload the cover of the cylinder head.
- 3) Check the gap of the intake and exhaust valve, and if need, adjust it.

See the second chapter to check it.

The gap of the valve (gap "a") Required tech		Cold engine Coolant temperature 15—25°C	Hot Engine Coolant temperature 60—68°C
		Intake	0.13—0.17mm
	Exhaust	0.15—0.18mm	0.25—0.28mm

- 4) Install the cover of the cylinder head, screw down bolt according the technical requirement.
- 5) Link the ventilative soft pipe to crankcase.

Oil of engine and cleaner of engine oil

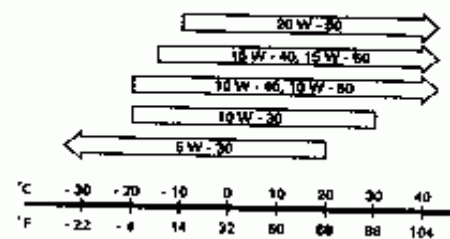
### Change

Suggest using engine oil of SE, SF, SG, SH OR SJ grade.

Choose right engine oil viscosity according to the picture on the left.

It is better to change the oil and the oil cleaner after driving on dusty road. Details please as per the user manual.

Table of Engine oil viscosity



a

Before drain out the engine oil, please check the leakage of engine oil. If leaked, change the bad part before falling to working.

- 1) Remove the oil plug, drain out the engine oil.
- 2) After draining out the oil, clean the drain out plug. Then install it, and screw tight as per the following requirements.

### Tightening torque:

(a): 35N·m

- 3) Loosen the oil filter with appropriate spanner.

### Appropriate tools

(A):09915-47340

- 4) Put engine oil on the "o" ring of new oil filter
- 5) Screw the new oil filter on the holder of it by hand, screw it until the surface contacted the "o" ring

### Attention

In order to screw the oil filter properly, please find the exactitude joint place of the "o" ring and the surface.

- 6) After contacting the surface of holder, screw the oil filter with spanner (turn 3~4 circles).

### Appropriate tools

(A):09915-47340

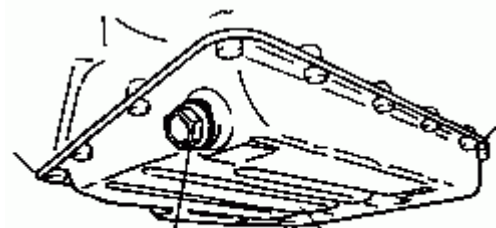
### Tightening torque:

(a): 35N·m

- 7) Filling up oil to the full mark on the fuel level gauge (dipstick).
- 8) Before checking the level of the oil, idle running the engine for 3mins. Then stop it, check the oil level after 5mins. If necessary, add oil to the maximum mark on the fuel level gauge.

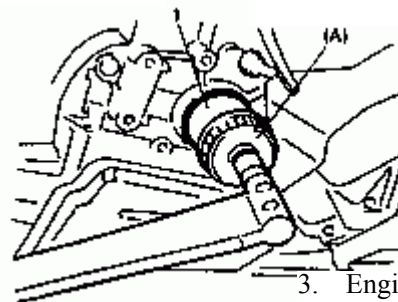
### Notice:

The stipulation of the oil level please refer to the following table.



the

1. Oil sump.
2. Drain out plug.
1. Engine oil filter



3. Engine oil filter



However, according to different situations (temperature, viscosity, etc.), please be noted that the real oil level may be not the same as the figures showed in the right form.

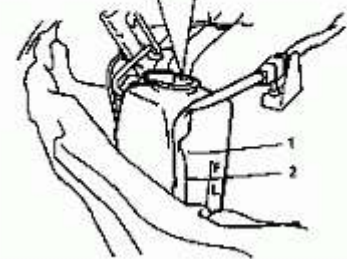
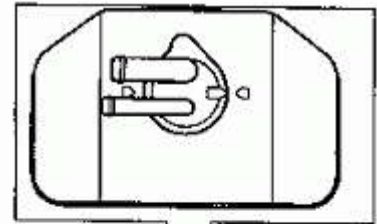
9) Check whether the oil filter and drain out plug leak oil.

**Oil level of the engine**

Oil mass of the oil sump	About 3.0L
Oil mass of the oil cleaner	About 0.2L
Other	About 0.3L
Total oil mass	About 3.5L

**Soft pipe of cooling system and the tie-in Check**

- 1) Eye-evaluating whether there are leaks, cracks on the cooling system, check whether the soft pipe is broken, whether the pipe clamp screwed tight.
- 2) Change any soft pipes with leaks, cracks, or other defects. Change all the pipe clamps which can not keep proper tight
- 3) Clean the front part of the radiator core.
- 4) Text the cooling system and the radiator head, the pressure should be 110kPa. If necessary, change the radiator produced for this vehicle.
- 5)Check the level and concentration of the cooling liquid. See the processes from the second chapter.



1. Full liquid level mark  
2. Low liquid level mark

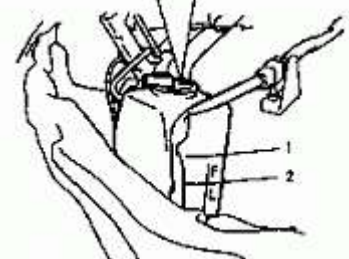
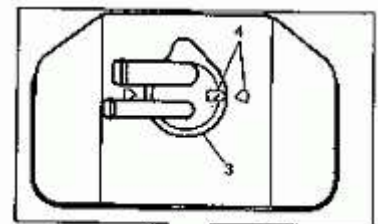
**Cooling liquid of engine**

Warning:

When the engine and the radiator are still thermal, we can not put the cover of the radiator down to avoid danger. If we put the cover of the radiator down at once, the hot water and steam will spurt out by pressure. change

Notice: never put down the cover of thermostat.

- 1) Don't remove the radiator cover, until the engine cool down.
- 2) Screw out radiator drain-out plug to drain out the coolant.
- 3) Remove the liquid storing kettle, and drain out coolant.
- 4) Screw on the drain-out plug, install the liquid storing kettle.
- 5) Add a certain amount of coolant to radiator (refer to chapter 2 VI) exhaust air from cooling system, idle running the engine for 2-3 minutes, then stop. Re-inject coolant till the level rose to radiator fluid mouth. Install radiator cover.
- 6) Inject coolant into liquid storing kettle, till the level up to the mark "Full" (Full Level), then install tank cap, make markers on tank and cover align.



1. Full mark; 2. Low mark is  
3. Cap 4. align mark

Notice:

When change coolant of engine, you should use coolant which is mixed with 50% water and 50% glycol while the temperature is lower than -16°C, and use coolant which is mixed with 70% of water and 30% glycol higher than -16°C.

Even temperature is above freezing, in the purpose of lubricating and anticorrosion water and 30% of glycol is required.

Refer to chapter 2 VI- coolant quantity

**Exhaust pipe and install components**

## Warning:

**Don't touch exhaust system when it is still hot, to avoid scalding. Any maintenance work should be done after the exhaust system has cooled down.**

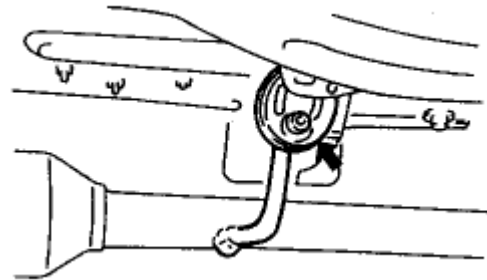
### Inspection

When repair or other regular maintenance as following steps, inspect exhaust system firstly.

- Check whether there are damages or wears on rubber components.
- Check whether there are leakages, joints loose, dimple and damage in exhaust system.

If the bolt or nut is loose, it should be tightened enough under technical requirements.

- Check that if there are any damage or dislocation with bad elements near the exhaust system, or something may result in the emission of smoke into the slit vehicles, holes, loose joints or other damage.
- Ensure there are enough space between exhaust system components and body soleplate, to avoid floor carpeting because of overheating.
- If there are any damage in components, should be repaired immediately.



## 2、 Exhaust pollution control systems

### Crankcase ventilation tube and joints

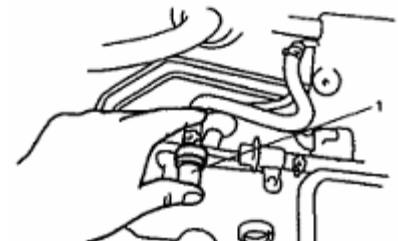
#### Check

Check whether crankcase ventilation tubes contain leak and cracks, any damages should be repaired or replaced.

Check and ensure the hose joints remain fastened.

#### Crankcase ventilation valve

- 1) Continued to cast cylinder head of the crankcase ventilation valve, and then plug the hole and stuffed it into his cast cylinder head.
- 2) Idle running engine
- 3) Put hand on the end of the crankcase ventilation valve control switch to check whether there are any vacuum. If there is no vacuum, it should check valve plug. If necessary, change it.
- 4) Checking the vacuum, stop running the engine, removed the crankcase ventilation valve. Shake this valve, listen if there's any "Ka Ta" voice from the valve needle.
- 5) After the inspection, remove the stopper, and then install the crankcase ventilation valve.



1. Crankcase ventilation valve

### Fuel evaporation pollutant control system

1) Check hoses whether there any defects, cracks or excessive bending. Check whether the tube is damaged and the location is appropriate.

2) Any damage should be repaired or replaced.

3) Check evaporation containers, as per chapter 3 section 6. Inspect evaporation containers in vehicle maintenance steps.

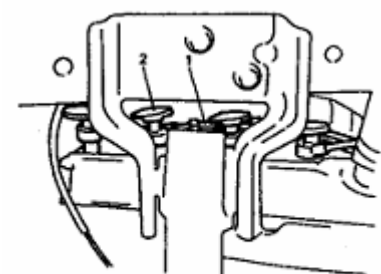
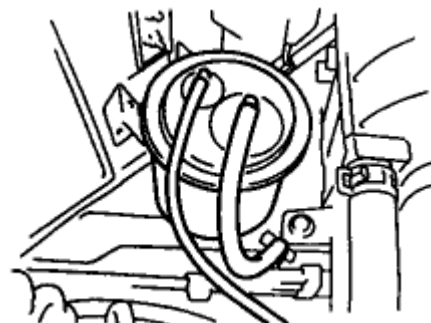
## 3、 Electrical system

### Harness and joints

#### Check

- 1) Visually check all engine components whether there are any signs of damage. Check the insulation (crank), all clamps should be tightened.
- 2) Replace all damaged and bad harness.

## 4、 Ignition system



1. 压阻力 2. 盖

## Spark plug

### Replacement

- 1) Remove the dust on the cylinder head around spark plug.
- 2) Cut the high damping line of spark plugs. Note you only can pull the spark plugs cover.
- 3) Use spark plug wrench, loosen spark plugs and then remove it.
- 4) Install new spark plugs

1. Pressure resistance; 2: Cap

### Notes:

Ensure the new spark plugs comply with the required heating degree and size.

- 6) Tighten torque spark plugs.

### Tighten the spark plug with the rated tightening torque:

**Tightening torque: 15N·m (465) 23—28N·m (474)**

- 7) While connecting the spark plug high damping lines, please don't push the high-voltage wire, just push the shield.

### Ignition system circuit (high damping line)

#### Check

Check whether there're cracks of the high damping line and the resistance of the joints; Resistance data and the measurement steps as per section 7 in chapter 3.

Changed when it's damaged.

#### Notice:

Do inspection to ensure that every high damping line and resistance are already firmly connected, and insert into the complementary components totally. Change every burnout joint.

- 1) Disconnect the damping line and the ignition coil.
- 2) Link with new damping line and clip it tightly. Don't pull the damping line joint but only pull the cover.

### Ignition time

#### Check

Use fault decoder to check and be sure whether the ignition time is appropriate while it is rotating. If it can not meet the requirement, please check the valve timing or electronic control system.

## 5. Fuel

### Engine idle speed and exhaust gas mixture

#### Check

Check engine idle speed and exhaust gas mixture. Adjust it when it's necessary. Detail requirements for checking idle speed/ gas mixture please as per chapter 3.

### Fuel tank cover

#### Inspection

Measure the gasket of fuel case, please change it if damaged.

#### Caution:

**The new cover should be the same in order to avoid working inappropriately.**

### Air filter core

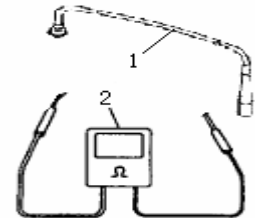
#### Replacement

#### Caution:

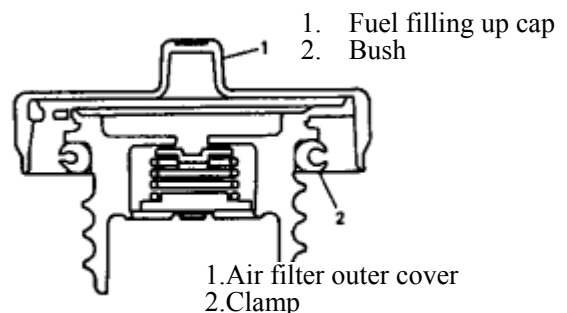
**Under dusty conditions, change it more frequently. Ask the local service providers for more details about the change of the core. Please as per section 5 in chapter 3 for the steps of the changing the air cleaner core.**

#### Check and cleanness

- 1) Visually check air filter whether it is over dirty, damaged or contains too much oil.
- 2) Clean filter core through the air filter by compressing the air.



1. High voltage damping line;
2. OHMmeter

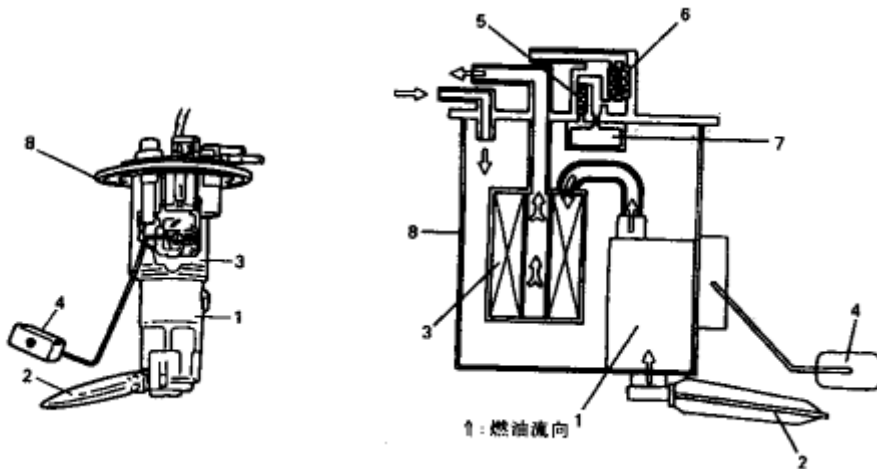
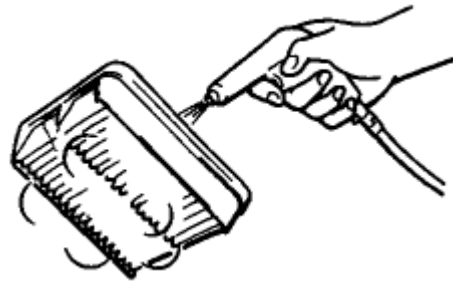


1. Air filter outer cover
2. Clamp

**Notice:**

If the car is driving on dusty road very often, clean or replace the filter every 2,500 kms.

**Fuel filter**



- 1. Fuel pump;
- 2. Fuel pump filter;
- 3. Fuel filter;
- 4. Fuel ruler
- 5. Drain out valve
- 6. Two-way single valve
- 7. Fuel disconnecting valve
- 8. Fuel pump assy

**Replacement**

**Warning:**

**Keep off from fire when changing the fuel filter and in a place with good ventilation.**

Fuel filter is above the fuel tank, including the fuel pump assembly.

Change fuel filter interval. Refer to chapter three for detail knock down and installment.

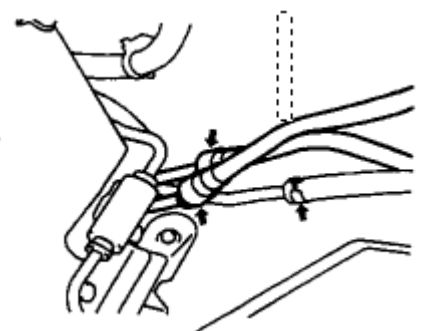
**Fuel pipe and fuel case**

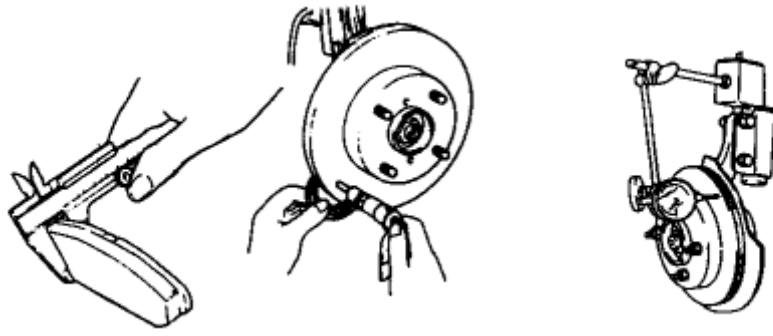
**Check**

Check if there's any leakage, crack, or damage of the fuel tank, fuel pipes, and connectors, make sure that all clips are tightly fixed.

Replace the connectors when it's leaking. Also change when there're cracks or damages.

**6. Arrester**





### Brake disc and pad (front)

#### Check

- 1) Discharge the wheel and caliper, but do not take away brake pipe from the caliper.
- 2) Change the brake disc and its gasket when it is over damaged (details please as per chapter 6). Tightening torque of caliper's bolt should meet the technical requirements.

#### Notice:

**When tramp the brake pedal, check the brake pad friction spacer if there's noise with the arrester. If over damaged and worn, should change the right and the left brake pad together.**

### Brake drum and brake shoe(rear)

#### Check

- 1) Remove tire and brake drum.
- 2) Check rear brake drum whether it is over damaged and worn. And check the leaking problem of brake cylinder while removing the tire and brake drum. Change it when it's necessary (as per chapter 6).

### Brake tube and oil tube

#### Check

**Do the checking under the enough bright light. Use checking mirror necessarily. Check the brake tube and oil tube whether appropriate or not. Change it when it is leaking, cracking, blocking, wearing, eroding, bending, torturing and some other damage. Please change it when necessary.**

#### Caution:

**After changing the brake tube and oil tube, please exhaust the air.**

### Brake liquid

#### Inspection

- 1) Repair brake pump and oil tank when they are found leaking.
- 2) Inspect the oil level

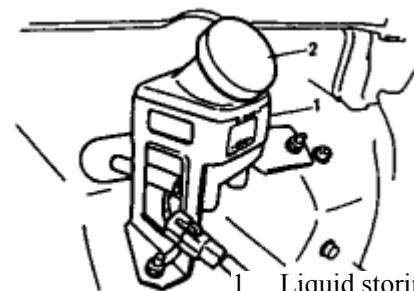
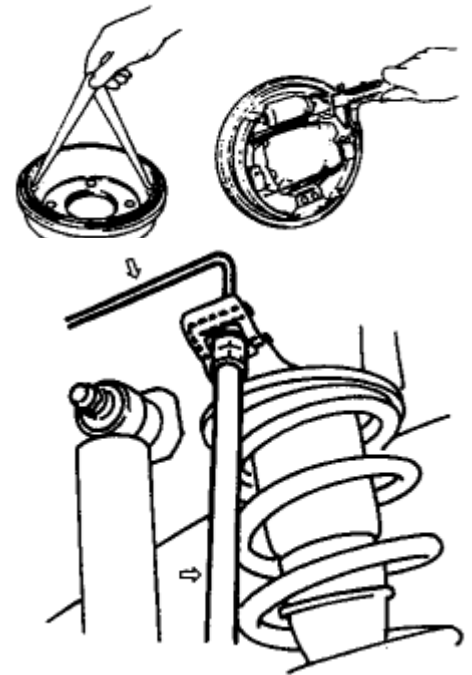
If the oil level is below the minimum storage mark, it should be re-added with required brake liquid.

Brake liquid: Refer to the liquid kettle cover.

Details please as per chapter 6 "cars maintenance"

#### Caution:

Since the car has been added with brake oil before delivered, and marked on the liquid storing kettle cover, when you add again, please use the same kind of brake oil, or it may arouse seriously damage.



1. Liquid storing kettle
2. Cap of the kettle

The oil which is out of date, used or not served in the unsealed container is not allowed.

### Replacement

Change the oil as per the following requirements.

Drain out all the oil of the brake system and add the oil recommended above, then exhaust the air.

The air exhaust process refers to chapter 6.

### Brake pedal

#### Inspection

Check the stroke of the brake pedal.

Checking process refers to chapter 6 “brake pedal stroke inspection”.

### Brake handle and cable

#### Inspection

. Check the teeth top of the brake handle is whether injured or abraded. If it is, you should change the stop brake handle.

. Check the operation and stroke of stop brake handle is correct or not. Adjust it if it needs.

The processes of checking and adjusting refer to chapter 5 “stop brake check and adjust”.

“a”: the stroke of stop brake handle.

4-7 teeth(under 20kg pull power).



## 7. Chassis and body

### Clutch

#### Inspection

Check the free stroke of the clutch pedal. The processes of checking and adjusting refer to unit 2 of chapter 6.

“a” free stroke of pedal

10—15mm

### Tire

#### Inspection

1) Check whether the tire is worn or damaged too much. If it is, change it.

2) Check the inflating pressure and adjust the pressure according to the technical requirement when it is needed.

#### Caution:

. The tire inflating pressure checking should be after the tire is cooled down.

. Find out the specified tire inflating pressure in the complementary logo of tire inflating pressure or operation handbook.

### Change tires in turn

Details please refer to section 3 of chapter 4.

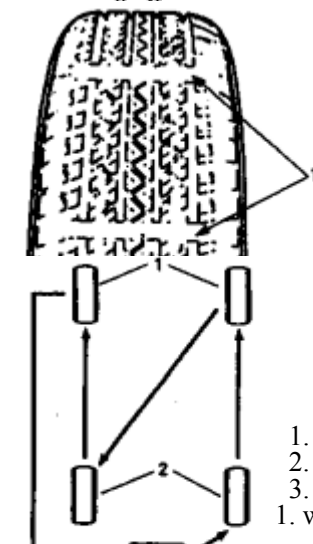
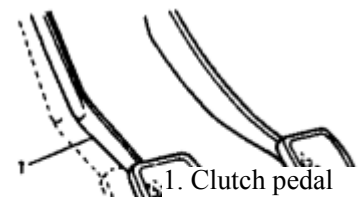
### Tire

#### Check the spoke of wheel rim

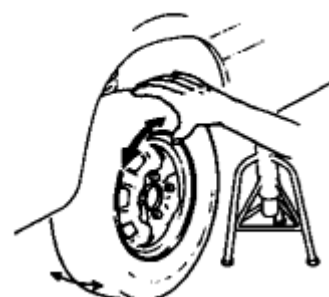
Check whether there is pressed mark, distortion and crackle on the wheel. If the rotary table seriously destroyed, it needs to change.

#### Inspection of wheel bearing

1) Check the front wheel bearing to see whether it is abraded, damaged or has abnormal noise or Kata noise. Details as per section 1 in



1. Front tire
2. Rear tire
3. Spare tire
1. worn sign



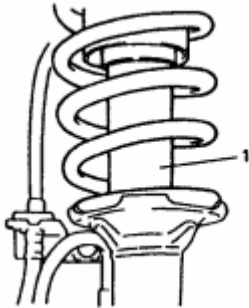
## Chapter 4 “front suspension inspection”.

2) Check the rear wheel bearing to see whether it is abraded, damaged or has abnormal noise or Kata noise. Detail as per section 1 in Chapter 4 “rear suspension inspection”.

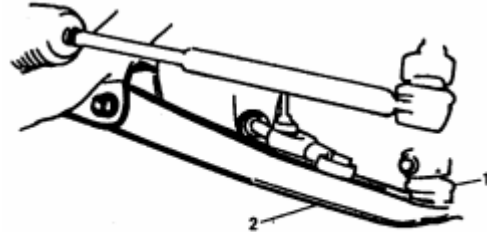
### Wheel nut

Check the wheel nut is tight or not. If not, tighten it according to the specified torque.

### Suspension



1. Supporting pole



1. Dust-proof sealing gasket  
2. Suspending arm

### Inspection

- . Check the front/rear shocker absorber to see whether it has leakage of oil, pressed marks or other damages of the bush. And check it to see whether it has damages, if yes, change them.
- . Check the front/rear suspension to see whether it has damages, loosed or missing parts and check whether the parts is abraded or not well lubricated. If yes, maintain or change it.
- . Check the front boll end sealing washer to see whether it leaks, looses, cracks or has other damages. If it has, change it.
- . Check the front suspension nut and bolt to see whether they are tight. If needed, tight them again, and if there is damaged parts, maintain or change it.

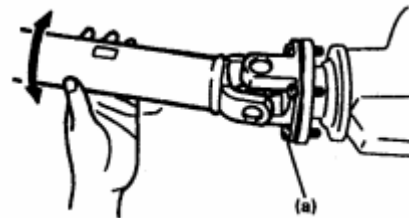
### Propeller shaft

#### Inspection

- 1) Check the propeller shaft and universal joint and the spline to see whether they have Kata noise. If there is, change the damaged parts.
- 2) Check the propeller shaft flange nut and bolt is tight or not. If needed, tighten again.

Tightening torque

(a): 50N.m



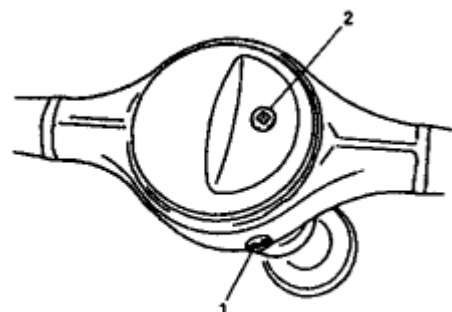
#### Replacement

- 1) Balance the car. Take away the oil drain-out plug, drain out the oil.
- 2) Smear the oil drainer with sealing mucilage then tighten the oil drainer according to the specified torque.
- 3) Add the specified oil to the oil hole.
- 4) Tighten the oil filler plug. The recommended oil, oil quantity, and tighten torque refer to unit 1 “cars maintenance” of chapter 3.

### Check

- 1) Check differential gear shell whether there's leaking information, if yes, please repair it.
- 2) When inspecting the oil level, the vehicle should be laid down in smooth place.
- 3) While removing the oil level line plug of differential gear, you can check the oil level through the plug hole.

When removing the fuel level line plug , if oil outflows from the hole or the oil level is equal to the hole, the oil level is ok.



If found the oil level is not enough, filling up with the stipulate oil to the hole.

Oil requirements, see Chapter V "car maintenance", which shows the replacement.

3) Tighten the oil Cypriot as regulated.

1. Oil drain-out plug
2. Oil filter/oil level line plug

### Replacement

1) Balance the car. Take away the oil drain-out plug, drain out the oil.

2) Smear the oil drainer with sealing mucilage then tighten the oil drainer according to the specified torque.

3) Add the specified oil to the oil hole.

4) Tighten the oil filler plug. The recommended oil, oil quantity, and tighten torque refer to unit 1 "cars maintenance" of chapter 3.

### Steering system

#### Check

1) The vehicle should be drove in a straight line. Then check whether the clearance of the steering wheel is proper, and whether there's Kata noise. Clearance of the steering wheel "a":  
0-30mm



2) Check whether the bolts and nuts are tightened. When necessary, re-tighten it. For damage parts, repair or replacement is needed.

3) Check whether the steering pole is loosen or damaged, for damaged parts, repair or replacement is needed.

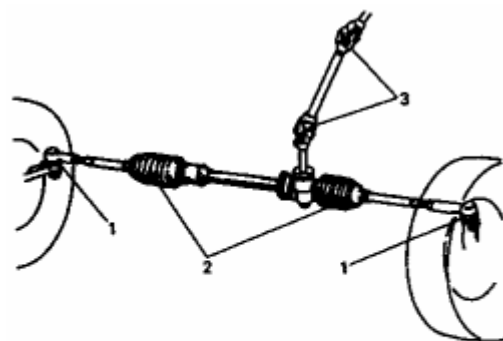
4) Examine whether the steering pole shield and gear box cover are damaged, (leakage, tear, etc.). If defects are found, new cover replacement is required.

5) Check the universal joints for the sound card, if there is kata sound and damages, replacement is required

6) Check whether the steering wheel can turn around easily. If turning badly, repair or replacement is needed.

7) Check whether the bolts and nuts are tightened. When necessary, it should be tightened enough. For damages, repair or replacement is needed; see Chapter V "Tightening torque technical requirements."

8) Check whether the steering wheel has been calibrated.



1. Dust cover of steering cover
2. Steering gear box cover
3. Universal joint

#### Notice:

A detailed description of calibration of the steering wheel is in the Chapter V "makes calibration."

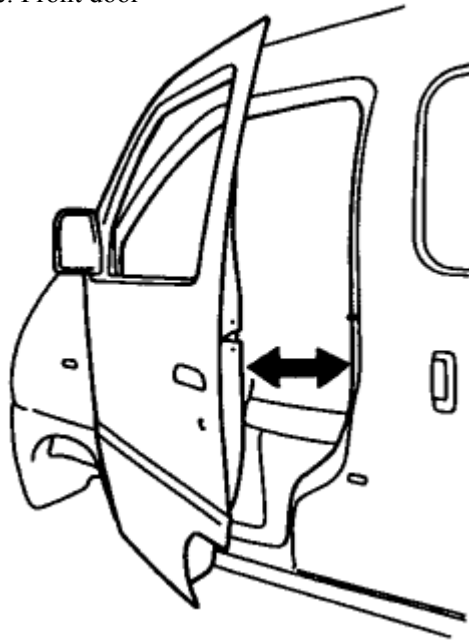
All latches, locks and hinges

#### Check

Check whether the front doors and back doors can be opened and closed easily or not, whether the lock can be locked solidly. See Chapter 9. Sliding doors' lubrication.



For example: Front door



Gearshift lever and axial

**Check**

Check whether the rod gearshift control lever is flexible, and noise.

If the operation of the lever is difficult, please lubricate it according to the following requirements.

Use chassis control rod with waterproof grease for lubrication of bearings and shaft sleeve.

**8. Final check**

**Warning**

For road tests, in order to avoid any incidents, please choose road with no passerby and vehicles.

**Doors**

Check whether all the doors can be opened and closed easily or not, whether the lock can be locked solidly.

**Seats**

Checks whether the seat backrest adjustment devices could be locked at any angle.

**Safety belt**

Check the safety belt (include reinforced plate, agraffe and fixing device) to see whether it is broken or tore.

Check the safe belt to see whether it can be locked tightly.

Check the level of electrolyte in battery.

Check whether all units' electrolyte level in battery is between the highest and lowest mark. If the battery have inside indicators, we can check the state of the battery through indicators.

**Operation of the accelerating pedal**

Check whether the accelerating pedal is flexible, and make sure it is not locked or interfered with other parts.

**Start-up the engine**

Check the condition of starting the engine

**Warning:**

Before checking the following items, there must be enough room to ensure stopping braking and pedal braking. Do not trample the accelerating pedal. If the engine started, should switch off the ignition devices immediately. Adopting these preventive measures is to avoid injury or property damage.

Shift gearlever to “N” gear; trample the clutch half to get ready to start. Only when the clutch is trampled to the bottom can we start the engine.

Check the exhaust system

Check whether the exhaust system is leaking, cracking or loosening.

Clutch

Check the following conditions:

- When we step the clutch pedal, the clutch must be set free completely.
- When we loosen the pedal and speed up, the clutch will not slide.
- The clutch do not exist any abnormal phenomenon.

Gear shift or selecting lever (transmission)

Check whether the gear shift or selecting lever is flexible in all position, and the shift is working well in any position.

Arrester

Foot brake

Check the following items:

Whether the stroke of braking pedal is properly

Whether the brake is working well

Whether there is noise

Whether the brake power of the wheels is symmetrically

Whether the brake can be re-posed.

Parking brake

Check whether the driving miles of braking pole is proper.

**Warning:**

When the car stops on the steep road, should ensure that there is nothing in front of the car in case of injury or property damage. Even if the car starts moving, the car still can realize braking immediately.

When the car stops at a safe steep road, and if the brake pole is pulled completely, we should ensure that the braking is effective.

Steering

- Check the stability of the steering wheel and make sure that there is no instability or the feeling of abnormal heavy.
- Check the car to see whether it swings or slants.

Engine

- Check the engine to see whether it runs normally at any circumstance.
- Check the engine to make sure that there is no abnormal noise or shaking.

Body, wheel and power transmission system

Check the body, wheel and power transmission system to ensure that there is no abnormal noise, shaking or any other circumstance.

Measuring instrument

Check whether the odometer, speed meter, fuel gauge and temperature meter work well.

Lamps

Check whether all the lamps are working well.

Windscreen defogger

When the air condition is working, we should check the exhausted air from the defogger terminally.

When checking, we should turn the switch of the fan to “HI” position.

# Chapter 3 Engine Fuel Injection System

## Section I Brief Introduction of Development of Engine Fuel Injection and Electronic Control System

### Question appeared

With the quick development of the automobile industry, the crisis of energy sources and exhaust pollution become serious day by day. Now the countries all over the world pay much attention to this, especially in the United States where the autos is widely used, the United States parliament has passed a decision of 'Zero Pollution of Automobile Exhaust' though they knew it is very difficult and even impossible, and if they don't do so, the human cannot survive on the earth as the quantity of the autos is greatly increasing which enable the great transformation on the structure of the autos on the existing basis and to manufacture the 'green' autos without pollution, and so the fuel injection electronic control autos, the solar energy autos and electric autos appear.

### Shortcomings of Carburetor Engine

(1) The adjustment of the mixture concentration is not precise, and it lags in the demand of the engine. The adjustment of thickness inside the carburetor is that when the working condition changes, adjust it by manually control mechanical type which cause the precision being limited and lagged in the actual demand.

(2) The quality of the mixture is not good, especially when the rotating speed varies or is at low speed, the mixture is in disproportion which causes the inadequacy combustion.

(3) The pollution of the exhaust is badly serious. The exhaust pollution is badly serious under the condition that the idle speed and the working condition changes, this is the deadly shortcoming of carburetor and also the important reason that it is limited to use.

(4) The vibration is intense and it is easy to be flameout.

(5) The working condition is affected by the posture of engine.

### Advantages of Fuel Injection Electronic Control

(1) The metering is precise, spot-injection uniformly, keep the air-fuel ratio in a good state.

(2) Three "NO" bring three "GOOD": No throat resistance and intake preheating influence, but charging efficiency is good; No flow loss and influence of reverse and air change, but burning condition is good; No influence of poor atomization and misdistribution, but the thermal efficiency is good.

(3) Get a good power performance, economic performance and decontamination effect. The power can improve by 15%~20%, fuel consumption can reduce by 1% to 5%, exhaust pollution decrease obviously,  $CO < 1\%$ ,  $HC < 100 \times 10^{-6}$ , peak torque improve by 5%~7%, accelerating time can decrease by 20%.

(4) Improve the operational performance: it will improve the cold starting performance, heating start performance, transition performance, the anxious acceleration anti-pollution performance, the load self-modulation performance and prevent the extinguishment characteristics and so on.

(5) Expand the control function, increase the diagnosis function. Because the computer (ECU) is used to control, can cover the ignition, the fuel injection, the automatic transmission, ABS braking system, the cruise system, the air-conditioning system, the automobile body highly self-modulation system, the suspension fork rigidity non-linear self-modulation system, the security alarm system and so on, because having the storage and memory ability, it has self-examined function and the fault assurance function..

(6) Reduce the failure rate of pipeline and circuit. As the important component is the computer, the failure rate of 100000km is only 1/1000; and also more control parts, little move parts, so the wearing parts is little and failure ratio decreases obviously.

### Brief History for Development of Fuel Injection Electronic Control

The gasoline jet type engine appeared in 1930, and was installed on the military airplane engine. At that time the main purpose was to prevent the carburetor from icing up while in the upper air or in cold season, and it was easy to affect the normal working of the carburetor when flying position changes.

In 1950, the gasoline jet type engine was installed on the racing car by Benz Company German.

In 1952, Germany Benz company pushed out the 300BL gasoline jet type engine, which adopts direct injection system inside the combustion chamber produced by 'Bosch Company' that is similar to diesel injection system.

In 1958, Germany Benz Company developed 220SE gasoline jet type engine, which changed the injection inside the combustion chamber into spray in the air tube, greatly extended the air mixing time of gasoline and air.

In 1961, American BENDIX company have firstly invented the gasoline injection system controlled by computer (change the machinery control of gasoline injection into electronic control to make it be more precise and energy conservation, less pollution), this patent has been bought by the German Bosch company once it was invented and to be improved and developed by Bosch gradually. .

Year 1967, pushed out D type fuel injection system, namely intake manifold pressure measure type fuel injection system, it sends absolute pressure of intake manifold and rotate speed of engine signals into computer, computer calculate inflation capacity, produce corresponding fuel injection pulse width, control the fuel injector injecting precise quantity of fuel. Continue improving and developing ,pushed out L type fuel injection system, directly calculate out air capacity which entered intake manifold based on air fule capacity, and transfer the air capacity into electrical signal ,sending to computer, computer get the relevant fuel injection capacity , in order to control air-fuel delivery ratio in a best value.

When entering the period of 1,980 -1990, the European countries, American, Japan and other countries started to fully develop the single-point injection technology, multiple-point injection technology and digital injection technology, and the intelligentization and the electric control of the autos have become the inevitable trend for the development of the autos. There will be ae significant technological breakthrough and leap in this aspect.

## **Section II Fuel Injection Electronic System of Engine**

### **Makeup**

The electric injection system of engine for 'Dongfeng Star' series mini vans adopts the digital electric computer control system of BOSCH Company & DELPH Company from Germany, which can control the ignition system and injection system at the same time.

The injection system for this engine is a system of multiple-point injection system, and every cylinder has its separate nozzle to supply oil, the ignition and oil supply are matched precisely which are influenced by each other but work together to guarantee the engine to well operate under any situation and also the exhaust has been strictly controlled not to exceed the regulated standard.

The injection and the ignition share one computer, every sensor signal collected by the computer is used by injection and ignition simultaneously which can help to lessen the complexity of the structure while making the date precise.

This computer is equipped with the breakdown insurance function, namely in lacks certain sensor information time, this system may use in advance in the procedure reserve value to replace, causes the engine not to send in the engine off.

The layout of the fuel injection electric control system is shown as the chart below:

### **General Instruction for the Performance of BOSCH electric Injection System**

The control functions of BOSCH electric injection system include: starting control, heat control of warm-up & three-way catalyze, idle speed control, evaporation exhaust control, knock control and  $\lambda$  closed loop control etc.

## **Section III Structure, Working Principle and Failure Analysis of Spare Parts**

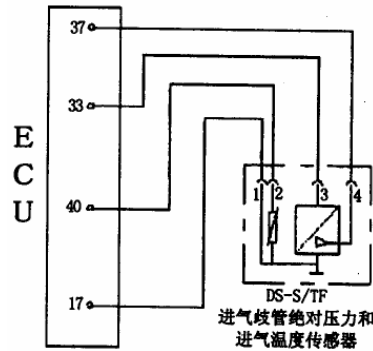
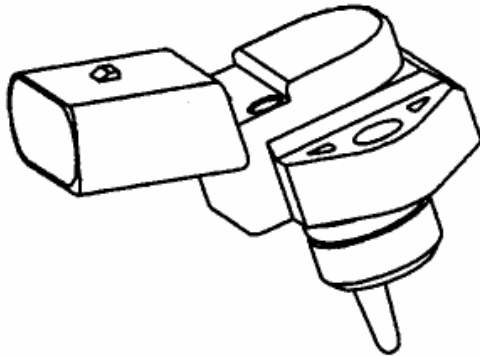
### **Note:**

#### **1. Intake Pressure & Temperature Sensor**

### 1) Brief Chart & Stitch

Function: The intake manifold pressure is related to the opening of the throttle, which reflects the size of the engine loading, so it can be considered as information of

Since the intake temperature has some effect on the quality of the intake air, the intake air temperature should be measured so as to correct the air intake volume.



Stitch: No.1 Grounding

No 2 Output Temperature Signal

No 3 connected to 5V

No 4 Output Pressure Signal

### 2) Working Principle

The absolute pressure sensing element of intake manifold is made up of a piece of silicon chip. And a piece

Scope	Value			Unit
	Min	Model	Max	
Pressure Measuring Scope	20		115	kPa
Operational Temperature	-40		125	°C
Operational Power Supply Voltage	4.5	5.0	5.5	V
Electric Current while $U_s=5.0V$	6.0	9.0	12.5	mA
Load Current of Output Circuit	-0.1		0.1	mA
Load Resistance	50			kΩ

of pressure film was etched from the silicon chip. There are four piezoelectricity resistance on the pressure film, which will compose a Wheatstone bridge as strain element. Except the pressure film, there is also an integrated signal processing circuit on the silicon chip. Silicon chip and metal shell buildup a close reference space, absolute pressure inside the reference space is close to zero. This forms a micro electricity machine system. Activity surface of silicon chip endure a pressure close to zero, its back endure a intake manifold absolute pressure(not test yet) which pulled into by a hose. Thickness of silicon chip only few microns, the change of absolute pressure of intake manifold will make silicon chip get mechanical deformation, 4 voltage resistance units also change shape, its resistances change. After process of signal processing circuit of silicon chip ,get the pressure signal with a linear relation to pressure.

The inlet temperature sensing element is a resistance of negative temperature coefficient (NTC), and the resistance varies with the inlet temperature, the sensor will feed the controller a voltage shown the change of the inlet temperature.

### 3) Technical Specification

## Technical Specification of Intake Pressure Sensor

Operational Temperature:  $-40 / +125^{\circ}\text{C}$

### 4) Reason for General Failure:

- 1、 There is abnormal high voltage or reverse big electric current in the course of working.
- 2、 The vacuum component is damaged in the course of maintaining.

### Maintenance Notice:

- 1、 It is prohibited to use high voltage gas to impact the vacuum component while maintaining.
- 2、 Attention on whether output pressure and electricity is normal when replacing sensor after finding failure.
- 3、 Do not damage the O seal ring.

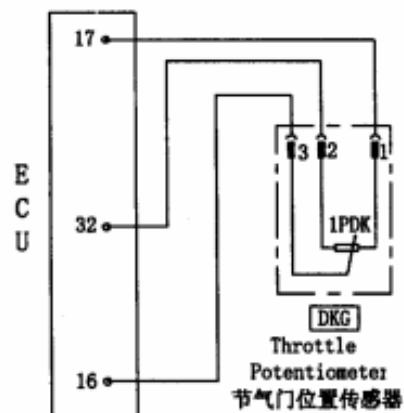
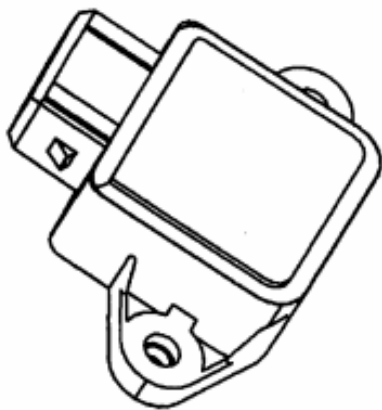
### Brief Measure Method:

**Temperature Sensor Part:** (Discharge the tie-in) Make the digital multimeter on the ohm gear, and the two meter pen meet the stitch of sensor 1# and 2# separately, and rating resistance at  $20^{\circ}\text{C}$  is  $2.5\text{k}\Omega \pm 5\%$ . The simulation method can also be adopted while measuring, the detail process is: blow the wind to the sensor by electric drier (Note: Do not keep them too close with each other), observe the change of the sensor resistance, and this time the resistance value will drop.

**Pressure Sensor Part:** Make the digital multimeter on the direct current voltage gear, the black meter pen earths, and the red meter pen connects with No 3# & 4# separately. The referring voltage on the 3# stitch should be 5v and the voltage on the 4# stitch should be 1.3v while at idle speed (the exact value is related to the vehicle model.); open the throttle slowly while with zero load, the voltage on the pliers stitch will not change a lot, then open the throttle quickly and the voltage on the 4# stitch will immediately reach to 4v and then fall to 1.5v.

## 2. Throttle Position Sensor

### 1) Brief Chart & Stitch



Stitch: The form when the air throttle opens anticlockwise: No 1 earth, No 2 connected to power supply 5v, and No 3 outputs the signal.

The form when the air throttle opens clockwise: No 1 connects power supply 5v, No 2 earth, and No 3 outputs the signal.

### 2) Working Principle

This sensor has the linear output angle sensor, which is made up of two arc slide resistances and two slide arms. The revolve shaft of slide arm is connect with the throttle axle in the same axes. Both ends of slide resistance will connect with 5V electrical source. When the throttle valve rotate, the slide arm will turning along with it and move on the slide resistance meanwhile, and educe the UP at the contact point as output voltage, therefore, it works as corner potentionmeter, and a voltage signal by the proportion of protentionmeter output and throttle position.

### 3) Technical Specification

## Fault Symptom & Judgment Method

Scope	Value			Unit
	least	typical	most	
resistance(stitch 1-2)	1.6	2.0	2.4	kΩ
slide arm protect resistance (slide arm in the zero, stitch 2-3)	710		1380	Ω
running temperature	-40		130	°C
voltage of power		5		V
the voltage ratio of right electrode end position	0.04		0.093	$U_p/U_s$
the voltage ratio of left electrode end position	0.873		0.960	$U_p/U_s$

Fault Symptom: Poor Acceleration

General Reason: Human-made fault

维修注意事项: Maintenance Notice: Pay attention to the installation position.

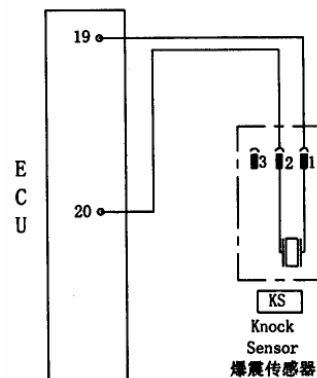
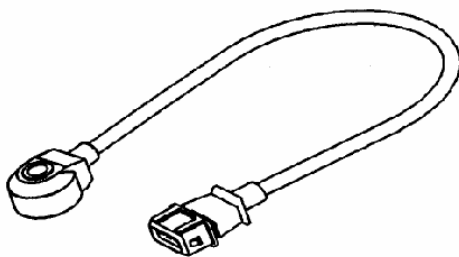
### Brief Measurement Method:

(Demount the tie-in) make the digital multimeter on the ohm gear, two tips connect with stitch 1#,2# of sensor separately, under normal temperature the resistance is  $2k\Omega \pm 20\%$ . Two tips connect with stitch 1#,3# separately, rotate throttle, its resistance change in a linear relation way while opening throttle, but the stitch 2#,3# in a opposite situation.

Note: pay attention to the resistance value to see if there is a bigger leap while observing the change of resistance value.

## 3. Knock meter

### 1) Brief Charge & Stitch



### 2) Working Principle

The knock sensor is an accelerator sensor by vibration, which is installed on the cylinder body of the engine. One knock sensor or more than one knock sensor can be installed on the cylinder block. The sensitive element of the sensor is a piezoelectricity element. The vibration will pass to the piezoelectric crystal through the *quality block* inside the sensor. Because of the pressure caused by the vibration of the quality block, the piezoelectric crystal will produce voltage on the two polar faces and convert the vibration signal into alternating voltage signal to output. Because the frequency of the vibration signal caused by the engine knock is much higher than the normal vibration signal, the ECU can distinguish the knock signal or no-knock signal after processing.

### 3) Technical Specification

### 4) Fault Symptom & Judgment

Scope		value	unit
sensitivity of new sensor to the 5kHz signal		26±8	mV / g
the linearity between 3 to 15kHz		5kHz±15%	
the linearity of resonance		15-39	mV / g
impedance	resistance	>1	MΩ
	capacitance	1200±400	pF
	cable capacitance	280±60	pF / m
resistance leakage the resistance between two output stitches of sensor)		4.8+15%	MΩ
the sensitivity change aroused by temperature		≤-0.06	mV / g°K

Fault Symptom: poor acceleration etc.

General Reason: The liquid, like engine oil, coolant, brake liquid, water and so on will erode the sensor when contacting the sensor for a long time.

Maintenance Notice:

There is one hole in the knock sensor, which is screwed down to the cylinder body by a M8 bolt. Bolt of 30mm is needed for aluminum alloy cylinder body and that of 25mm is for cast iron cylinder body and the tightening torque is 20±5N·m. The installation position should make the sensor easily receive the knock signal from all cylinders. The best installation position should be got by analyzing the engine body mode. Usually, the knock sensor is fitted between the second cylinder and the third cylinder for four cylinder engines and fitted in the centre of the second cylinder for three cylinder engines. Be noted that don't make the liquid like engine oil, coolant, brake liquid and water etc get to the sensor. Any type of gasket is not allowable while fitting. The metal side of the sensor should be clung to the cylinder body. Don't make the signal cables resonate while layout them to prevent break. And avoid high pressure electricity being got through between stitch 1 and stitch 2 which may cause the electric component broken.

Brief Measure Method:

(Remove the tie-in) make the digital multimeter in ohm gear, the two should be connected to stitch 1,2 and stitch 3,4, the resistance value under normal temperature should be more than 1MΩ; and make the digital multimeter to millivolt gear, and slightly knock around the knock sensor by hammer and there should be voltage sending off.

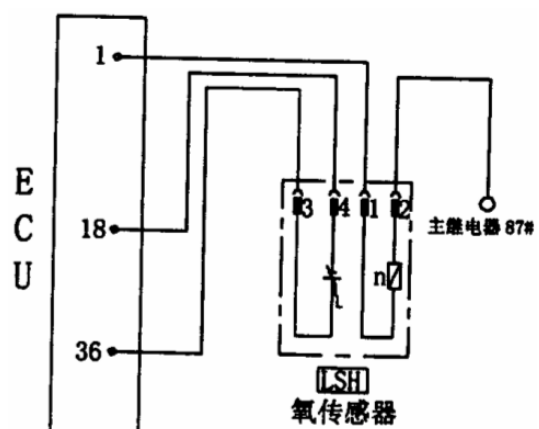
#### 4. Oxygen Sensor

Function: test consistency of mixed air. Keep the mixed air working at  $\lambda=1$  area when  $\lambda$  closed-loop control. It has two types: one is titanium dioxide type( resistance type); one is zirconium dioxide type( generate power type). Two kind of engine in this book both are the second type.

**Function: Test the concentration of the mixed gas.**

##### 1) Brief Drawing& Stitches

**Stitches :** 1,2—heating resistance input  
3,4 oxygen sensor output.





## 2) Working Principle

The sensing head of oxygen sensor is a kind of earthenware conduit with hole, outside conduit surrounded by emission air, inside circulate atmosphere . the wall of earthenware conduit is zirconium dioxide, electrical heating pipe inside.

The work of oxygen sensor is to transfer the difference of oxygen ion concentration between inside and outside of earthenware. When the temperature of earthenware conduit reach 350°C, it will the characteristic of solid state electrolyte, let the oxygen ion concentration get through earthenware freely. Using this characteristic, transfer concentration difference into electric potential difference, get the electrical signal output. If the mix air concentration is high, then the between inside and outside of earthenware conduit, oxygen ion concentration difference is high, electric potential difference is high, quantity oxygen ion concentration move out from inside, output voltage is high( close to 800mV-1000mV);,if the mixed air concentration is low, just little oxygen ion concentration move out, output voltage is low (close to 100mV). Signal voltage occur mutation at the theory air/fuel ration( $\lambda=1$ )

## 3)Technical Specification

Scope		Value	Unit
The insulation resistance between the heating component of new oxygen sensor and sensor tie-in	Room Temperature,	$\geq 30$	M $\Omega$
	Exhaust Temperature	$\geq 10$	M $\Omega$
	850°C Exhaust Temperature	$\geq 100$	k $\Omega$
Electric source & Voltage on plug	Rating Voltage	12	V
	Continuous Working Voltage	12-14	V
	Maintain 1% of total life working voltage most(emission temperature $\leq 850^{\circ}\text{C}$ )	15	V
	Maintain working voltage for 75 seconds most(emission temperature $\leq 350^{\circ}\text{C}$ )	24	V
	Test voltage	13	V
13V,reach heat power of heat balance (emission temperature 350°C, emission flue speed 0.7m/s)		12	W
working voltage 13V,reach heat power of heat balance (emission temperature 350°C .emission fule speed 0.7m/s)		5	A
blown fuse of heating circuit		8	A

#### 4) Fault Symptom & Judgment

**Fault Symptom:** Poor idle speed, off gas over standard and big fuel consumption etc

**Reasons:**

1、 Steam into sensor causing abrupt change of temperature and the probe breaks.

2、 (Pb, S, Br, Si)

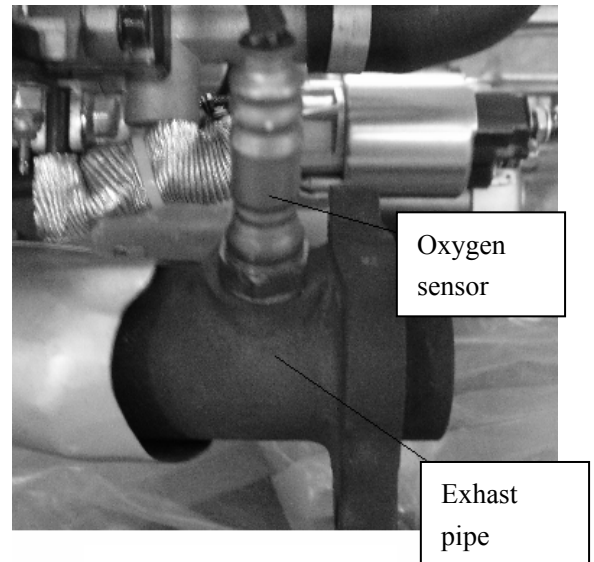
Oxygen sensor "poisoning" (Pb,S,Br,Si)

Notice: Do not use cleaning liquid, nctuous liquid and volatile solid on the oxygen sensor.

**Brief Measure Method:**

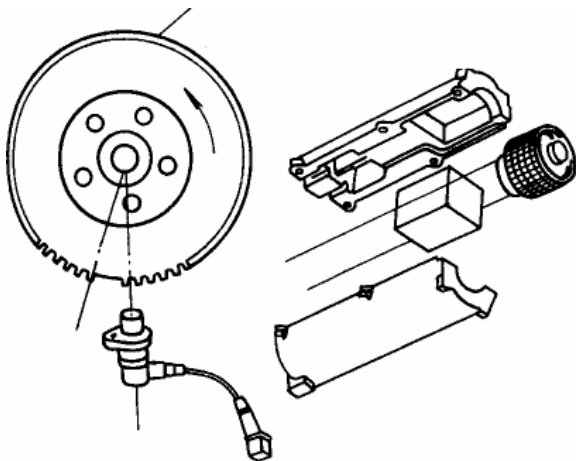
1、 (Remove the tie-in) make the digital multimeter in ohm gear, the two should be connected to stitch 1,2 and stitch 3,4, the resistance value under normal temperature should be 1~6Ω;

2、 (Connect the tie-in)make the digital multimeter in DC volt gear under idle speed when the working temperature of oxygen sensor is 350°C, the two connect stitches of sensor 3#(grey) & 4#(black), then the voltage should quickly fluctuate between 0.1-0.9V.



#### 5. Rotating Speed & Crankshaft Position Sensor

##### 1) Brief Drawing & Stitch



##### 2) Working Principle

The inductive rotate speed sensor works in with the oscillator to offer the information of the engine rotate speed and top dead center of crankshaft. The inductive type of rotate speed sensor is composed of a permanent magnet and its outside loop. The oscillator is a kind of fluted disc, it should have 58 teeth but two of which is vacant. The oscillator is fitted on the crankshaft and moving around along with the crankshaft. When tooth cusp pass the ends of induction type rotate speed sensor closely, pulse wheel made of ferromagnetic material is cutting magnetic line of force of permanent magnet

inside the induction type rotate speed sensor. Produce induced voltage in the coil, as the rotate speed signal be output.

##### 3) Technical Specification

##### 4) Notice

The inductive type of rotate speed sensor is fitted by pressing down not by hammer. Should use partly sealed bolt M6×12 fasten induction type rotate speed sensor. Screw down torsional moment 8±2N·m.

Air gap between induction type rotate speed sensor and pulse wheel tooth cusp: 0.8 to 1.2m . size d(see the following picture): 4.7mm.

##### 5) Fault Symptom & Judgment

Fault Symptom

**Reasons:** 1. Human-made Fault

2. The alnico demagnetized by working long time under high temperature.

Notice: It is by pressing not by hitting while maintaining.

**Easily Measure Method:**

1、 (Discharge the tie-in) make the digital multimeter in ohm gear, the two meter pens should be connected

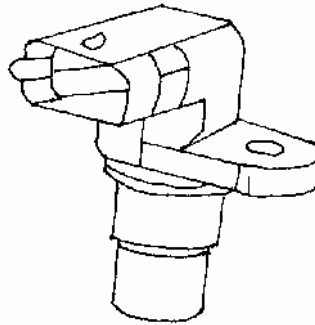
to stitch 2 and stitch 3, the resistance value under 20°C should be  $860\Omega \pm 10\%$ .

2、(Contact tie-in) make the digital multimeter in A/C voltage gear, the two needles should be connected to stitch 2 0and stitch 30, then start the engine, there will be voltage output. (Advice: check by oscillograph)

**6. Phase Sensor**

The phase sensor is to check the sensor of engine timing phase which is usually got by checking the turning angle of the position of the camshaft.

**1) Brief Drawing & Stitch**



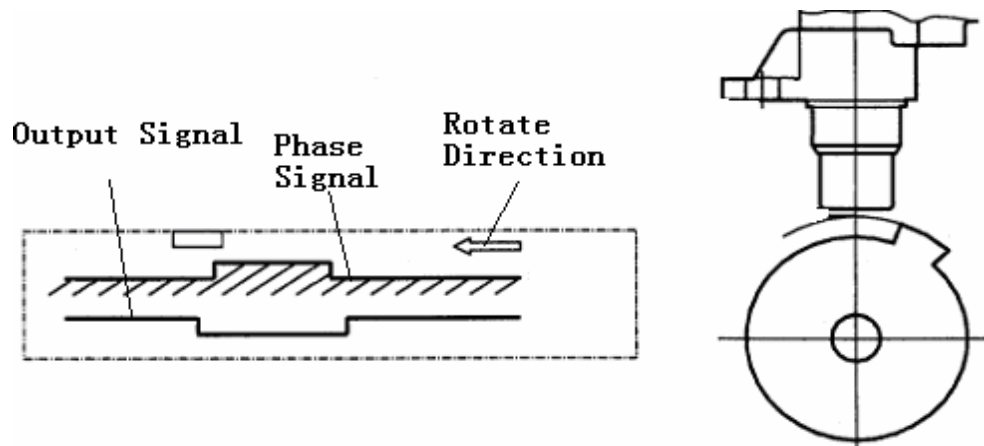
Phase Sensor Sketch

**Stitch: mark”1” as connect earth; mark”2” as signal output; mark “3” as connect power positive.**

**2) Working Principle**

The sensor takes advantage of the Hall Principle, and the Hall Voltage is influenced by the changed magnetic

Scope	Value			Unit
	Min	typical	Max	
Resistance under 20°C	774	860	946	$\Omega$
Inductance	310	370	430	mH
Output voltage while crankshaft 416rpm	>1650			mV



Hall Unit Working Sketch I

Hall Unit Working Sketch II

induction intensity.

**Hall Sensor Principle**

When the electricity current  $I_s$  pass through a semiconductor flake, on the way of voltaic dextral will produce Hall voltage  $U_H$ , its value with magnetic field induction  $B$ (vertical to current  $I_s$ ) and current  $I_s$  is directly

proportional.

**3) Technical Specification**

**4) Fault Symptom & Judgment**

Fault Symptom: the exhaust is beyond the standard and the fuel consumption increases etc.

Reason: man-made malfunction

**Easy Measure Method: (Connect the tie-in) Start the ignition switch but not the engine, put the digital multi meter to the direct voltage gear, two tips connect with stitch 3#,1# of sensor, insure it has reference voltage 12V. Start the engine, the signal of stitch 2# can be tested by vehicle oscilloscope, whether it work in normal.**

**7. Electron control unit**

**1) outline picture and disposal position**

**2) ·multiple points injection**

- Control Ignition
- Idle speed control
- Knock control
- 5V / 100mA supply power for sensor : 5v/100mA
- closed-loop control, with self-adapting.
- Control the control valve of canister
- A/C switch

Scope	Value			Unit
	Min	typical	Max	
Setting Clearance	0.5		1.8	mm
Voltage Supplied	4.5		24	V

- Engine fault indicator lamp
- fuel fixed amount correction
- Output of the engine rotating speed signal
- Input of the speed signal
- Fault self-Diagnosis
- Receive the engine load signal

**3)**

Stitch	Connecting Point	Type	Stitch	Connecting Point	Type
1 (J1-D5)	Oxygen Sensor Heating	output	42(J1-D6)	AC temperature sensor	input
2(J1-D14)	Ignition Coil 2	output	43		
3(J1-C7)	Power earth 2	earth	44	not continuing power	input
4			45		input
5(J1-C14)	Ignition Coil 1	output	46(J2-A13)	canister solenoid valve	out put
6(J1-C6)	Oil Nozzle 4 (2 <sup>nd</sup> cylinder)	output	47(J1-C4)	oil injection nozzle 3( the forth cylinder)	output
7(J1-C6)	Oil Nozzle 4	output	48		

	(3 <sup>rd</sup> cylinder)				
8			49		
9(J2-B8)	to guard against theft	output	50(J1-A11)	fan control 1	output
10			51(J2-B1)	electrical 2	earth
11			52		
12(J1-C5)	continuing power	input	53(J1-D16)	electrical 1	earth
13(J1-C16)	ignition switch	input	54		
14	main relay	output	55		
15(J2-B14)	rotate speed sensor of engine A	input	56		
16(J1-D5)	throttle position sensor	input	57	switch of air condition compressor	input
17(J1-D15)	sensor 1	earth	58		
18(J1-C9)	oxygen sensor	input	59(J1-D10)	signal of vehicle speed	input
19	shock sensor A	input	60		
20	shock sensor B	input	61(J1-D7)	power earth 1	earth
21			62		
22			63	not continuing power	input
23			64(J2-A1)	phase of step motor D	output
24			65(J2-A3)	phase of step motor A	output
25			66(J2-A4)	phase of step motor B	output
26			67(J2-A2)	phase of step C	output
27(J1-C4)	oil injection nozzle 1 (the first cylinder)	out put	68		
28			69(J2-A12)	fuel pump relay	output
29	test lamp	output	70		output
30			71(J1-D11)	diagnosis K line	output, input
31			72		
32(J2-B3)	5V power 2	output	73		
33(J1-D8)	5v power 1	output	74		
34(J2-B13)	rotate speed sensor of engine	input	75(J2-A8)	AC switch	input

35	Sensor earth 3	earth	76(J2-A8)	blower switch	input
36	sensor earth 2	earth	77	headlight switch	input
37	Intake air pressure Sensor	input	78		
38			79	phase sensor	input
39 (J2-B3)	Engine Coolant Sensor	input	80		
40(J2-B4)	Intake air temperature sensor	input	81		

#### 4) Technical Specification

Scope		value			unit
		least	typical	most	
voltage of battery	normal running	9.0		16.0	V
	finity funtion	6.0-9.0		16.0-18.0	V
endure storage battery over voltage and time	26.0V	keep part of functions, can do failure diagnosis		60	S
	13.0V	insure start function, can do failure diagnosis		60	S
working temperature		- 40		+70	°C
storage temperature		-40		+90	°C

#### 5) Notice

Attention on static defend during installing, don't touch interface of ECU by hands.

**Attention on the protection of plug and stitch.**

#### 6) Fault Symptom & Judgment

Failure symptom: idle speed not steady, acceleration not good, idle speed over high, tail gas over proof, start difficult, air condition failure, fuel injector lose control, flameout and so on.

##### Reasons:

- 1、 Because of the overload of external connection apparatus lead the burning of parts inside ECU , and failure.
- 2、 Circuit board tarnishing because of ECU get water inside.

##### Notice:

- 1、 Do not discharge the ECU randomly while maintaining.
- 2、 First discharge the battery power supply, one minute later, discharge the ECU.
- 3、 Store the ECU discharged.
- 4、 Don't install any circuit on the connection line of ECU

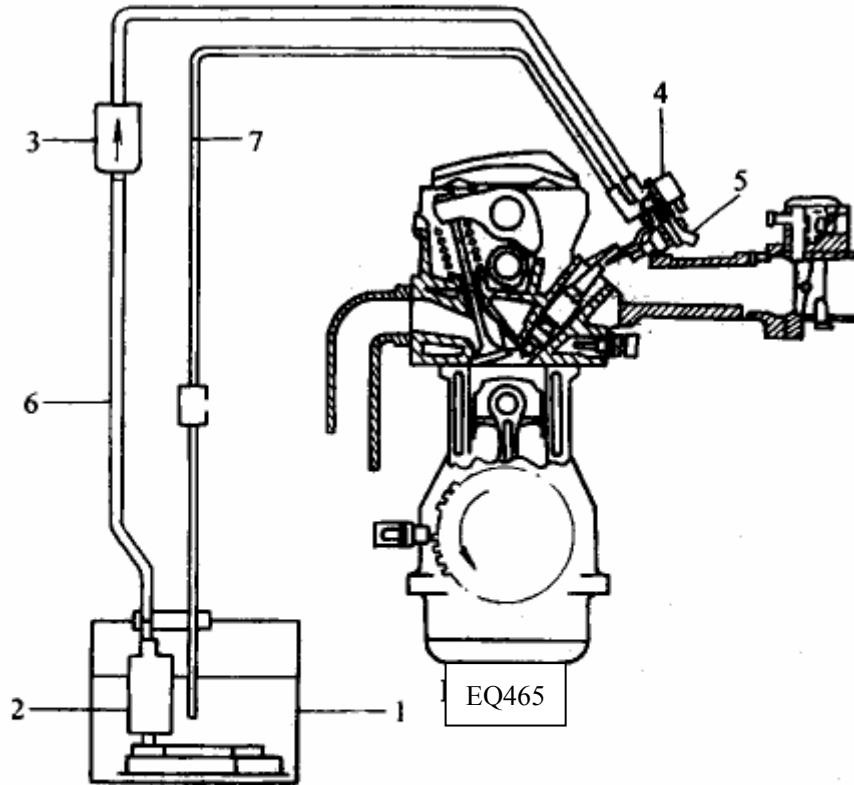
##### Brief Measure Method:

- 1、 (Plug the tie-in) Read the fault record of the engine by engine data K.

- 2、 (Discharge the tie-in) Check if the ECU connecting wire is good; especially check the power supply of the ECU and the earthing wire.
- 3、 Check if the outer sensor works well, the output signal is reliable and the wire is ok.
- 4、 Check if the actuator works well and the wire is ok?
- 5、 Finally, replace the ECU to test.

### Section III Fuel Supply System & Injection Mechanism

The structure of fuel supply system is as follows:



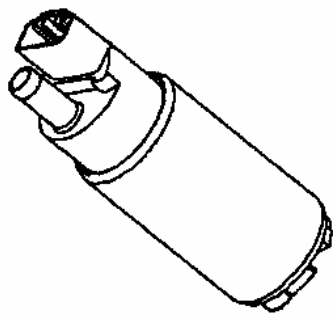
#### Fuel Supply System Layout

- |                  |              |                    |                      |
|------------------|--------------|--------------------|----------------------|
| 1. Fuel Tank     | 2. Fuel Pump | 3. Fuel Filter     | 4. Pressure Adjuster |
| 5. Fuel Injector | 6. Oil Pipe  | 7. Oil Return Pipe |                      |

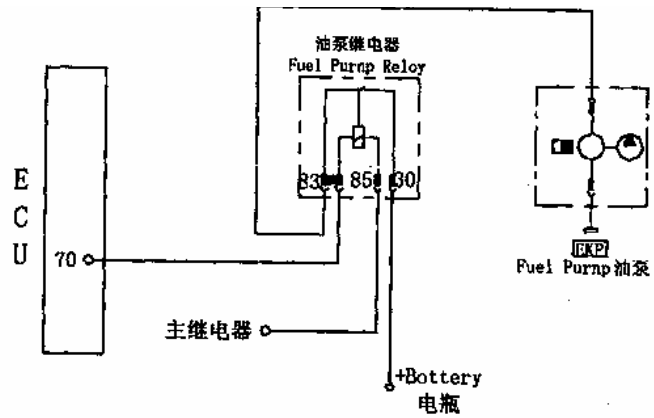
The electric fuel pump that dipped into the fuel tank supplies fuel to the main fuel tube and fuel flows to the distributor and pressure adjuster which guarantee the stable fuel pressure after passing through the fuel filter to make sure the fuel injection mass will not be affected by the pressure and the fuel pump will supply fuel to the injector consecutively and the surplus fuel will return to the fuel tank through return tube.

#### Electric Fuel Pump

##### 1. Brief Figure & Stitch



Electric Fuel Pump

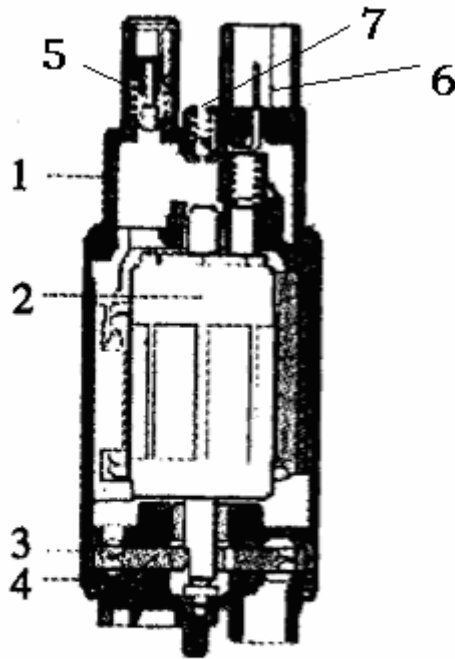


Circuit Diagram of EF

Stitch: The electric fuel pump has two stitches to connecting the fuel pump relay and there are “+” and “-” carved on the fuel pump beside the two stitches showing to connect anode and cathode.

## 2. Working Principle

The electric fuel pump is composed of DC electromotor; vane pump & end cover (integration of check valve, relief valve & anti-electromagnetic interference unit) etc:



1. End Cover, Fuel Pump
2. Motor
3. Fuel Way
4. Leaf
5. One-way Valve
6. Connection-peg, Electric Valve
7. Overflow Valve

Section Drawing, Electric Fuel Pump

The electric fuel pump has different flow according to demand of the engine.

**Note:** The electric fuel pumps of same structure adjust the rotate speed of engine by changing the turns of the coil so as to rectify the flow. So don't use one model of electric fuel pump to another model of vehicle.

## 3. Fault Symptom & Judgment Method

Fault Symptom: running with big noise, poor acceleration, incapable of start (hard start) etc.

General Reasons: usage of poor quality fuel which causing

- 1、 the colloidal substance accumulated forming insulating layer



- 2、 the bushing of fuel pump and the armature locking
- 3、 The abrasion of component of the oil face sensor

**Notice for Maintenance:**

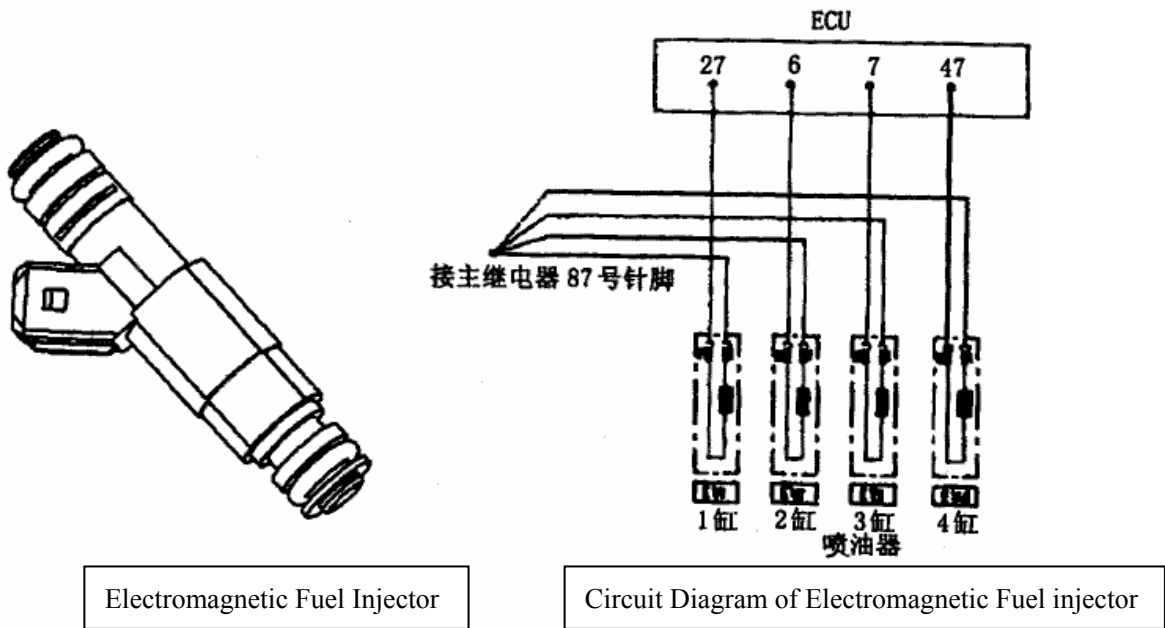
- 1、 The electric fuel pump has different flow according to the demand of the engine. The fuel pump with same shape and which can fit well will not be the right one. The spare part number should be the same as the original when maintaining, wrong one shall not be allowed.
- 2、 Do not operate the fuel pump in dry state for protecting the fuel pump from being damaged accidentally.
- 3、 When it is necessary to change the fuel pump, please pay attention to the clean of uel tank and the pipeline and the replacement of fuel filter.

**Brief Measurement Method:**

- 1、 (Discharge the tie-in) Put the digital multimeter to ohm gear and the two pens connect with two stitiches of fuel pump separately, measure internal resistance, if the internal resistance not zero or infinite , namely its in a short circuit or turnoff state.
- 2、 (Contact tie-in) Contact the fuel pressure meter to the inlet pipe, start the engine to check if the fuel pump works, if not, check the stitch “+”to see if there is voltage, or check the if the fuel pump relay is good; if the fuel pump runs, check the fuel pressure to see if it is around 260kPa at idle speed; pull out the vacuum pipe of fuel pressure adjustor and check if the fuel pressure is around 300kPa.

**Injector**

**1. Brief Figure and Stitch**



Stitch: every injector has two stitches, and the one beside the case marked “+” will contact the No 87 stitch of main relay output end and the other one will contact No 26、 6、 7、 47 stitch separately.

**2. Working Principle**

The ECU sends out electrical pulse to the coil of injector forming the magnetic field force, when the force rises to overcome the composite force of pressure of the return spring, gravity of needle valve and friction force, the needle valve arises, and the fuel injection starts. When the injection pulse closes, the pressure of the return spring will make the needle valve close. Cause pressure difference between diameter of spray hole, fuel pressure and pressure of intake manifold is invariableness. So fuel spout capacity only rest with fuel spout pulse width.(namely the electrify time of coil).

### 3. Technical Specification

#### Special fuel

The fuel injector can only use the fuel which meets the national standard of people republic of china GB17930-1999<<lead-free petrol for vehicle>> and national standard of environment protect GWKBI—1999 <<control standard of motor petrol hazardous substance>> stated fuel.

#### 4. Fault Symptom & Judgment Method

##### **Fault Symptom: poor idle speed, poor acceleration, incapable of start (hard start) etc**

General Reasons: Due to lack of maintenance, the colloidal substance accumulated in the inner side of the injector causes the injector cannot work any more.

##### **Notice for Maintenance:**

1. For easy installing, recommend paint non-silicic clean engine oil on the surface of “O” shaped circle which is connected with fuel distribution pipeline. And be careful for not making the oil contaminated the fuel injector and its finestra.

2. Put the oil atomizer into oil atomizer base in a vertical way, fix it by clip.

**Note: a) oil atomizer clip has axial direction clip and diameter of axle clip, don't use a wrong clip.**

**b) For the installing of axial direction oil atomizer clip, it must make sure the bayonet in the middle of clip should be put in the neck totally, the neck both sides of clip should be clipped into the outer margin roll of the oil atomizer base.**

**c) Meanwhile, axial direction and diameter of axle require using the axial/diameter direction clip during install the oil atomizer, also let the oil atomizer locating block and locating plunger ,locate in the corresponding part of locating clip.**

3. oil atomizer installing by hands, using hammer such tools punch oil atomizer is not allowed.

4. When unloading and reinstall oil atomizer, must change “O” shaped circle. ,don't damage the oil atomizer sealing face at the same time.

5. Don't put out “O” circle supporting bead from the oil atomizer. Don't damage oil atomizer parts like: oil inlet, “o” circle, supporting bead, jet board ,plug .If any damage, stop using.

6. Doing fuel distribution assembled leakage test after oil atomizer installed.,no leakage is qualified.

7. Non-effectiveness part unloading by hands. First unload the oil atomizer clip,then pull out the oil atomizer from the base. Keep the base clean ,avoid pollution.

**Note: While the ignition switched on, whether the engine running or not, never pull out the oil atomizer main connections.**

#### 5. Simple measurement:

Switch off the ignition switch, unload terminal, put on ohm gear of DMM, measure the coil resistance. the two pens connect with oil atomizer two stitches separately. 20°C rated value of resistance is 11—17Ω.

**Suggestion: use special oil atomizer clean analytical instrument clean and analysis oil atomizer every 20000km.**

#### Fuel filter

Fuel filter function is to filter the water and impurity in the fuel.

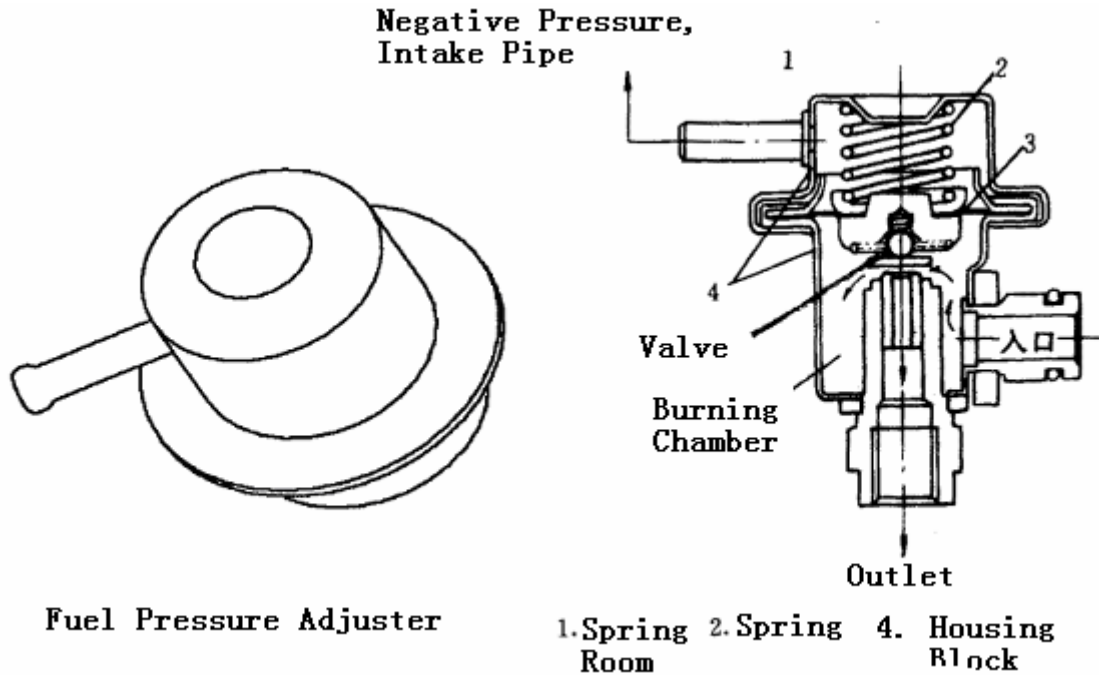
Fuel filter is made up of filter element and shell, see picture on the right side. It belongs to consumptive part, and it can't be overhauled. When the fuel supply is found not enough and the fuel filter is confirmed not work, the fuel filter should be change. Also change it when the car running about 20000km.

The fuel filter is fitted under the fuel tank, pay attention to the fuel flow direction is same as the arrowhead in the picture.

#### Pressure regulator

Function: since the oil atomizer installing in the suction manifold, even the supplying oil pressure, oil spout aperture and time is invariableness, the oil spout mass is influenced by suction manifold. Fuel pressure regulator

function is to keep the pressure difference between oil distribution and suction manifold in a constant number. So the fuel mass from oil atomizer is only determined by oil atomizer opening time, in order to control the consistency of flammable mixture accurately.



2. Like above picture showing, one flexible film which made of rubber and fiber make the oil regulator into upper,down two chambers.Upper chamber trough the soft pipe lateral side connect with suction manifold, upper chamer get spring inside.The down chamber is full of fuel which is throughed the fuel distribution outing from pressure regulator bottom oil-in .Film bottom under the fuel pressure of fuel distribution pipe.,upper under the the pressure of suction manifold and spring..Film can drive clack seat by twist ,let the valve open or close,because the film deformation is small ,the acting force of spring can be considered no change. So the valve open and close is mainly decided by the pressure difference between down chamber fuel pressure and upper chamber suction manifold pressure.Assumption the valve is closed at the beginning,because of the reduction load of engine,suction manifold pressure decrease; or fuel pressure goes up making the above pressure difference increase,ultimately the film is jack-uped by fuel pressure, valve open,

Fuel through pressure regulator centre oil returen hole, comes back fuel tank,fuel pressure decrease,until valve close. In this way, when engine working condiction change,the difference between fuel distribution pipe pressure and suction manifold pressure may keep no change generally.

### 3. technical parameter

#### Fuel demands:

Fuel pressure regulator suits for the fuel which accord with People Republiic Of China Standard GB17930-1999<<motor lead-free petrol>> and National environment protect standard GWKBI—1999<<motor petrol noxious substance control standard>>.

### 4. SYMPTOM AND JUDGEMENT

**Symptom:** fuel pressure hypotony or hypertension, difficult to start.

Cause of Ordinary Symptom: Long term using without maintenance.:

1. filter clog;
2. Impurity particles to cause big leakage.
3. Machine damage artificially.

**MAINTENANCE NOTE:** During the maintenance

- 1 Using high pressure gas shock the diaphragm component is forbidden.
2. Using strongly corrosion liquid for washing is forbidden.
3. Distortion by external force is forbidden.

**Simple measure:**

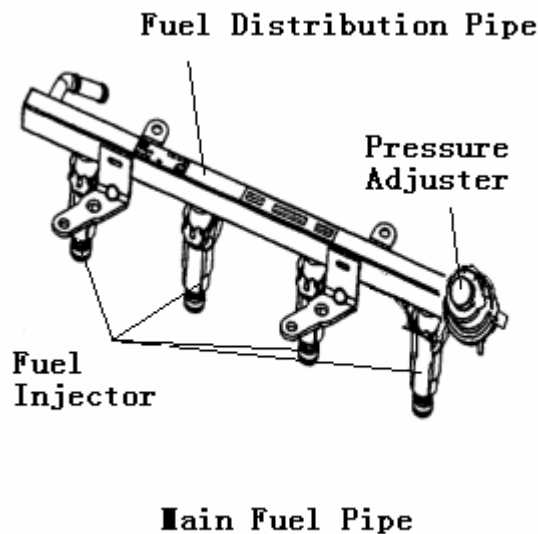
The sucker connect with fuel pressure gauge,start engine,under the idle speed condiction, check the fuel pressure whether around 260kPa; pull out fuel pressure regulator vacuum tube, at this moment whether fuel pressure up to about 300kPa.

SCOPE	VALUE			Unit
	Least	Typical	Most	
Flow Q = 80L / h rating pressure difference		300		kPa
Flow between 15~140L/h ,the changing value of working pressure			17.5	KPa
Flow range	10		220	L / h
The slope of characteristic			0.14	kPa / L / h

**Fuel main pipe assembele**

**1. Working Principle**

Fuel distribution is made up of fuel distribution(KVS-S,fuel injector and fuel pressure regulator(DR)Used for storage and distribute fuel.



**Main Fuel Pipe**

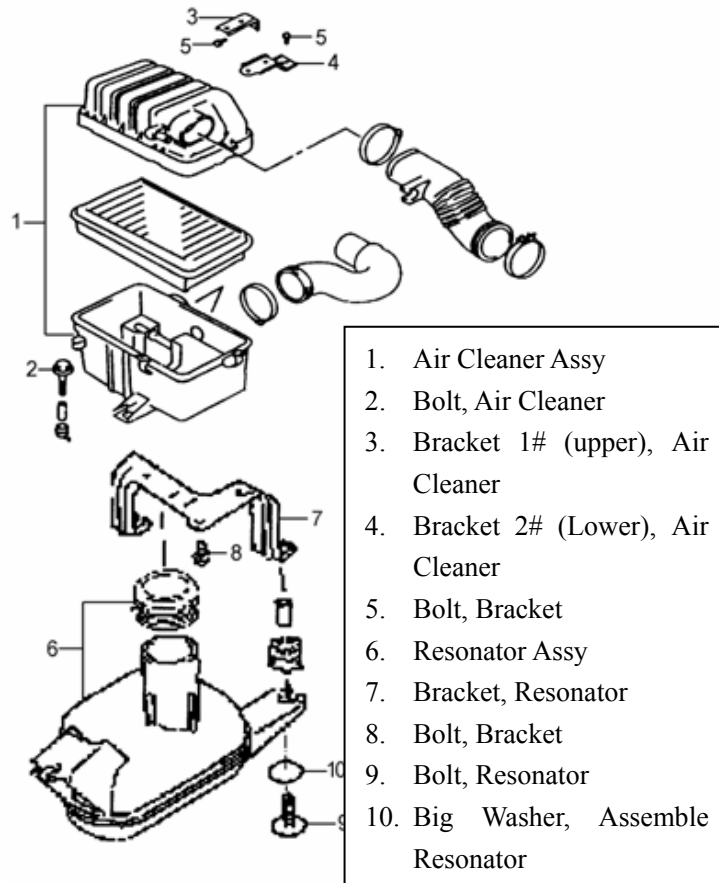
**2. malfunction malfunction and judgement.**

Fuel distribution pipe's sealing is test can be check by decrease testing Test the "O" circle, at the 4.5bar test's largew5 ,=1.5cm/min.

**Section IV enter and exhaust system**

The quantity of air which come into cylinder after through air cleaner is controlled by monomer valve, the air idle speed needing is supplied by addition system which is paralleling with monomer valve.

**Air Cleaner**



Air Cleaner Illustration

**2, maintenance**

This engine air cleaner filter is kind of dry type filter.

**Notice: Pls cleaning follow the order:**

- a. after removing the pipe clip, remove the air cleaner's case cover.
- b. remove the air cleaner filter element.

**check**

Check the air cleaner filter dirty situation.

**clean**

Using the compressed air blow out dust from the side of filter.

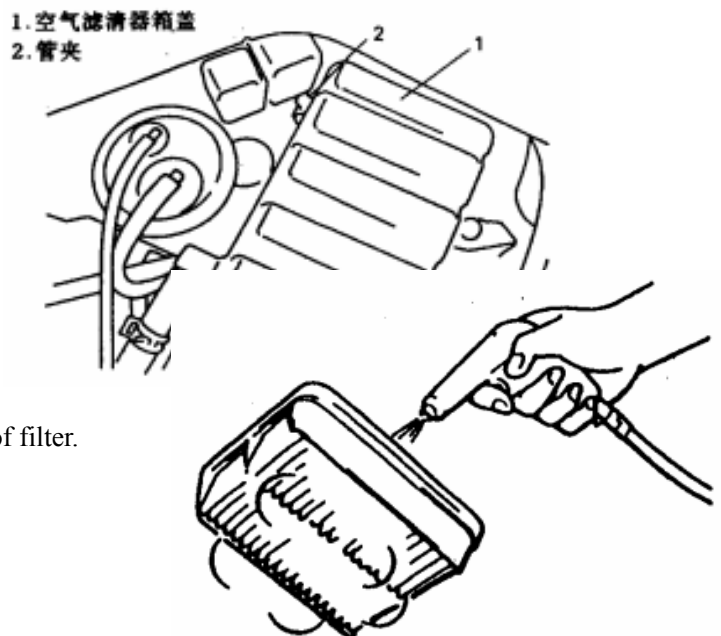
**install**

- 1)Install the air cleaner filter into the air cleaner shell.
- 2)Install the air cleaner shell case.

**Entering air temperature control system**

**1. working principle**

This system through control entering air temperature to improve the fuel steam generation. It is not influenced by drive condiction and outside temperature, keep the eternal state, distribute every cylinder symmetrical mixed air, and keep the air/fuel mixing ratio steady. Inside the air cleaner case,there is a 热蜡 sensor, used for transducing entering air temperature. The connecting with hot wax sensor is a toggle and baffle.When the entering air temperature is low, hot wax sensor move the baffle by toggle, open the fresh air access ,suck more



warm air.when wax sensor feels the entering air temperature is going up ,it will let the baffle moving, in order to close the warm air access

## 2. maintenance

### Check step

a.remove the air cleaner upper cover.

b.blowing the cold air into the hot wax sensor ,like the picture showing,check the baffle opening warm air pipen and closing cold air pipe situation.

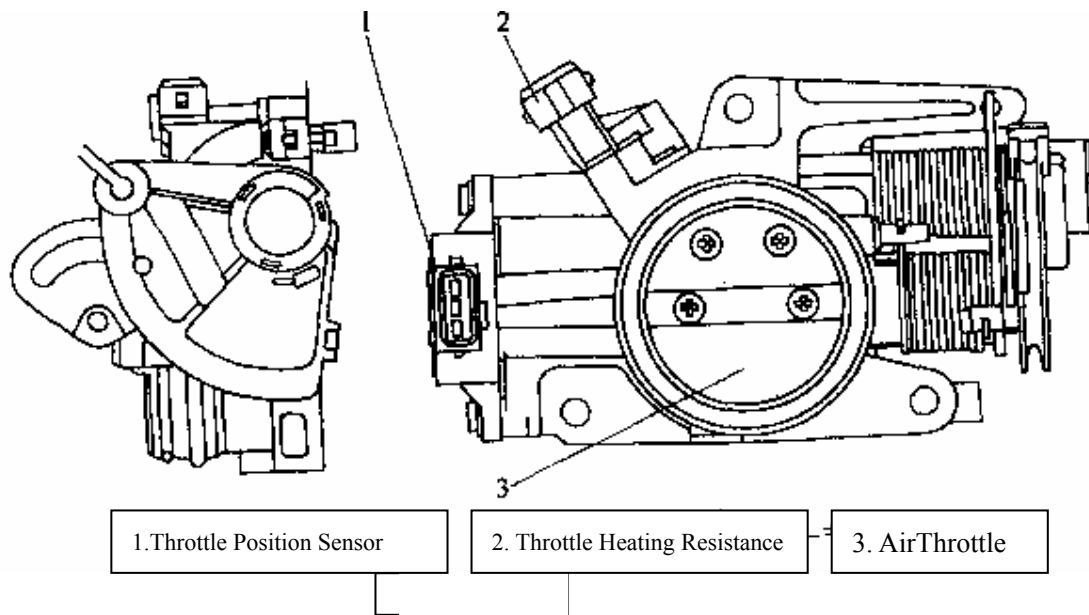
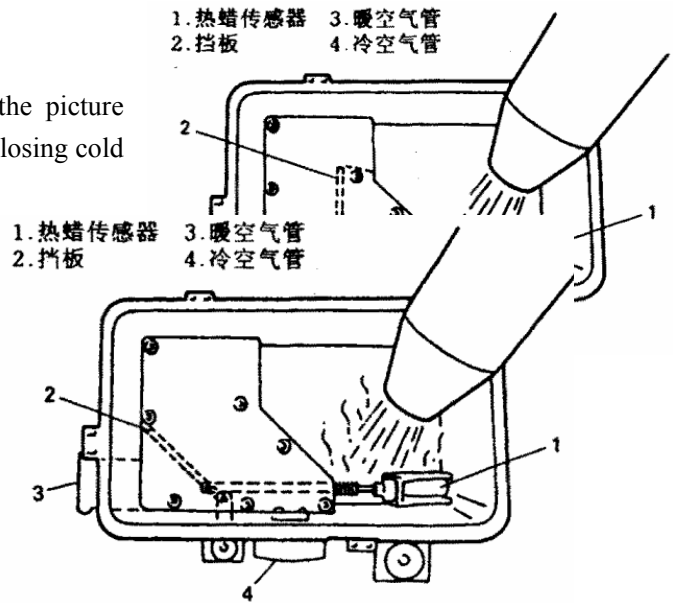
c.next, blowing the warm air into the hot wax sensor,like the picture showing,check the baffle closing warm air pipe and opening cold air pipe situation.

d.If operate the 2) and 3) step finding the baffle is not working well,can't removing the hot wax sensor and baffle, the whole air cleaner assemble should be changed.

ee. re-install the air cleaner upper cover.

### Throttle body

Throttle is one valve for air supplying control。 Operator control it by accelerator pedal. Air throttle and air throttle body's structure as the following pics:



There is a assistant path which parallels air throttle, on the Air throttle body. It is controlled by the idle speed valve which is installed on the throttle body. And there is a activated carbon jar blowhole which can make the fuel steam recycle.

Besides, there are some fixed parts on the air throttle body:

(1) Heating resistance: For heating entering air temperature, get convenience for cold start the engine in cold season

- (2) entering air temperature sensor: inspect the entering air temperature。
- (3) air throttle position sensor: inspect air throttle open degree.
- (4) idle speed valve: control engine idle speed.

**Idle speed controlling valve**

**1. Idle speed controlling valve function**

- a. can keep the idle speed in the previous decided rotate speed;
- b. can auto improving the idle speed under the accelerator pedal relaxing situation, in order to use A/C.
- c. can compensating when urgent acceleration ,deceleration in order to transit rotation speed smoothly.

**2. idle speed control valve structure**

Like picture showing on the right side, make up of servomotor and rotary valve.

**3. idle speed control valve working principle**

Step motor is a minisize motor, which is made up of circuited steel stators and one rotor. Each steel stator wrapped by coil: rotor is a permanent magnet; the centre of it is a nut. All the stator coils always electrify. If only change one coil electricity direction, rotor will change a angle. When each stator coil change electricity in a proper order, then the rotation direction of rotor will be reversed. The nut connecting with the rotator centre drives one screw mandrel. Because screw rod is designed for not running, so its only can move on the axes direction, also be called straight shaft. The head of screw rod is choke plug, so the choke plug can retract and hang out so that increase or decrease the induction trunk section surface which besides the idle speed actuator until block it.

- stitch A connect with stitch NO.ECU65**
- stitch B connect with stitch NO>ECU66**
- Stitch C connect with stitch NO>ECU67.**

**4. Technique characteristic parameters**

SCOPE	值			unit
	least	typical	most	
Resistance of every coil at 25 degree	47.7	53	58.3	Ω
Resistance of every coil in the range of working temperature	35(-40°C)		95(+125 °C)	Ω
Inductance of every coil to the 1000HZ at 25 degree	26.8	33. 5	40.2	mH
normal working voltage	7.5		12.0	V
possibility working voltage	3.5		14.0	V
stepsize of step motor rotor		15		
Pressure of bypass passage opening		60		kPa
The most axial force made by air pressure difference		6.28		N

**5. Symptom and judgments**

Symptom: idle speed too high, idle speed flame out.

Minor failure causation: bypass air access blocked by dust ,fuel steam accumulate, let the step motor idle speed adjust abnormally.

### **Maintenance principle:**

1. Never exert any force on axial direction to try to get the axes in or out.
2. Before the idle speed regulator the one with step motor install in the air damper, its axes must in a total retractive position.
3. Attention on the bypass air flue cleanness.
4. After taking down battery or ECU, attention on the self-learning about step-motor in time.

**Self-learning method:switch on the ignition but don't start the engine at once,do it after 5 seconds. If find the engine idle speed not well this time,then must repeat the steps above.**

### **Simple measure method:**

(take down joint) put the DMM gear to ohm position,the two pins connect with regulator AD stitch and BC stitch separately , at the 25℃,the rating resistance is  $53\pm 5.3\Omega$ .

### **Exhaust system**

The exhaust system of this car is made up of exhaust collector, vent-pipe, muffler,three unique catalyst, sealing elements and so on. Like the pic showing on the right side.

### **maintenance**

#### **Warning:**

**In order to avoid burning, don't touch it when the exhaust system is still hot. Whatever the maintenance, all should be taken after cooling.**

When take Maintenance, or other service, check the exhaust system in a way as follow:

- Check the rubber pad whether still fine, without damage, aging, displacement.
- Check the exhaust system whether leakage, joint loose, impress and damage. If the bolt and nut already loose, screw them down according to the torsion moment.
- Check the whether around exhaust has been damaged, or has any leakage, parts displacement, whether has outseam, pore space, joint loose or any other fault, otherwise the exhaust gas will enter into the carriage.
- Make sure the place between exhaust system parts and car bottom is enough so as to avoid the over heating damage the carpet in the car.
- Any fault should be resolved immediately.

### **maintenance**

- Exhaust manifold discharge and loading steps refer to the chapter of engine discharge.
- In order to change the vent-pipe, muffle or any other installing connected with them ,the car should be jacked up and abide the "warning" in this chapter.
- When discharge the exhaust manifold , check the pad and seal ring whether get aging or damaged. Changing when it needs.
- When reassemble ,screw the bolt and nut to the stated torquemomentt.

### **Screw torquemoment tight**

**(a): 35—50 N•m**



## Section V fuel vapor gathering system

### The function of fuel vapor gathering system

A great lot fuel will evaporate when the fuel heat up by running circumstance( hot summer) or fulsome surge(running on a long rough road) or be heated up during the fuel injector circulation .if vent these steam out, not only waste fuel but also easy to arose fire, also the car will get stagnation of movement by vent exhaust gas over the environmental protection prescribed value.. For this reason, fuel vapor gathering system be installed on the electronic spurt eco-friendly car. This system suck the fuel steam into cylinder over again, avoid occurring bad phenomena.

### Fuel vapor gathering system struction

when the oil tank produce fuel steam, and the steam pressure over the atmospheric pressure, fuel steam will enter into the activated carbon jar which connected with atmosphere.3, fuel molecule will be absorbed by activated carbon. When the engine running , computer control emission valve open, because the air inlet pipe vacuum suction ,atmosphere from activated carbon jar 3 enter into air inlet pipe by through the emission control valve 4, fresh air takes away the absorbed fuel molecule entering into the cylinder for burning after through activated carbon jar 3.

Fuel vapor gathering system is a supplement to the gas handing system, when the carbon jar emission valve open, computer will control decreasing the air input of the main air intake.

Fuel vapor gathering system also is a supplement to the fuel feeding system, when the emission valve open, computer will control decreasing the oil spout of the oil spout machine.

Corresponding to the one operating condition of the engine, mixed consistence and air input is changeless.

### parts constitution and working principle

This system is used for prohibiting exhaust oil of car oil system to the atmosphere.. when the engine stop working, this system save the fuel steam in a jar fulling of activated carbon, when the engine work, the fuel steam which inside the carbon jar enter into the engine burning with the atmosphere from outside.

#### 1. Canister

Picture showing on the right side.

#### 2. Control valve actuator

##### 1) diagram and stitch

Stitch: There are two stitches, one is to contact No 87 stitch of output end of main relay, and the other is to contact No 46 stitch of ECU.

##### 2) Working Principle

Canister is made up of magnet coil, armature and valve. There is a filter at the entrance. The air flow rate which transfluxes carbon jar control valve is related to the duty ratio of the electrical pulse which ECU output to the carbon jar control valve on one side; and on the other side, it is related to the pressure difference between carbon jar control valve entrance and exit.

##### 3) Technical characteristic parameter

Item	Value			Unit
	Min	Typical	Max	
Rating Voltage		13.5		V
+20°C resistance		26		Ω
Current under Rating Voltage		0.5		A
Frequency of impulse Control			30	Hz
Width of Impulse Control		7		Ms

Flow Rate while the pressure Difference is 200mbar and take up 100% air ratio	2.7	3.0	3.3	m <sup>3</sup> /h
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### 3. Examine and Maintenance

#### 1) Canister

aa). The connection between rubber tube and carbon jar, throttle body, fuel tank shall be checked frequently, whether fastness, loose. falloff. rubber tube broken is not allowed.

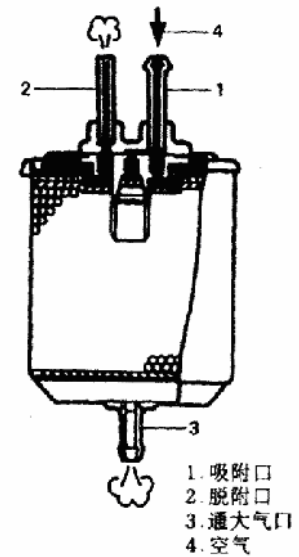
b. examine the system whether working fine ,when running 10,000KM every time.

(1) Pull out the rubber tube from the CANISTER, and then take out the canister.

(2) When blow air to the carbon jar from the absorb hole, there is obvious air flow out at the desorption hole and vent hole.

(3) If there is no air flow out from atmosphere hole and desorption , check the hole inside if there is foreign body, then examine according to the (2), still no air flow, should change the carbon jar.

(4) Finish checking , recovery carbon jar connection, and assure the connection with rubber tube is deep-set.



#### WARNING:

**Don't suck the connection interface on the carbon jar, the fuel steam inside the carbon jar is harmful to people's body.**

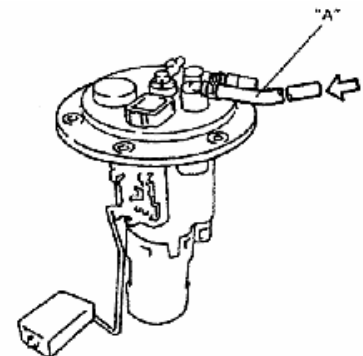
**Attention: change the carbon jar after running 50,000 miles every time.**

#### 2) Fuel tank pressure control valve check

a. Take down the fuel pump assembly which installed on the fuel tank. Refer to chapter 6C.

b. Blow in air by through the vaporize soft tube , air should waltz through the valve.

c. At the same time, when the vacuum pump connect with vaporize soft tube and loading gradually ,air should through the soft tube" A".



#### Special purpose tools

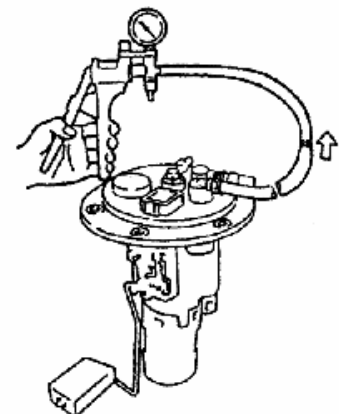
(A): 09917—47910

d. If carry out the step b or c, when the air can't through the valve , then should change the fuel pump assembly.

#### Warning:

**Don't suck in the air through the vaporize tube, cause the fuel inside the valve is harmful.**

e. Install the fuel pump assembly on the fuel tank.



#### 3) Control valve operating motor

Symptom: disabler

Common source of trouble: foreign body enter into the valve inside, conduce rust and sealing weak.

#### Maintenance attention:

1. Make sure the direction of air flow accord with the regulation when installing.
2. When find the black grain(inside the valve) conduce the control valve disabler , needs change the valve, pls

check the carbon jar state.

3. Avoid the water ,fuel and other liquid enter into valve during the maintenance.
4. For avoiding the solid-borne sound, suggest hanging the carbon jar in the air, installing on the soft tube.

#### **Simple measure method:**

(Take down the stitches) put the DMM gear to ohm, two instrument pens connect with the carbon jar control valve stitches separately, at the 20°C ,the rating resistance is  $26\pm 4\Omega$ .

### **Section VI ignition system**

This type engine electric ignition system adopts two ignition coils, not distributor ignition system. The high tension electricity ignition coil produced is sent to every spark plug, ignition coil exterior like the left picture showing, its circuit like the right picture showing.

Ignition system is made up of ignition coil , spark plug and its circuit.

#### **Ignition working principle**

Two ignition coils were controlled by computer, produce high tension by turns, each ignition coil connect with two cylinder spark plug (1. 3. cylinder connect one ignition coil, 2.3. cylinder connect with the other one). So, every time both two cylinder spark plug flashover at the same time, the cylinder which at the end of pressure stroke can ignite the mixing air and break out for working, it's a "effective ignition"; conjugated cylinder is at the instroke, belongs to "inefficacy ignition". This high tension power distribution , though lost a little power because of inefficacy ignition, however this let the ignition system cancelled the distributor block, improved the ignition reliability ,decreased fault.

Spark plug

**AF10-06 electroject engine spark plug type: F6RTC(4C7T) screw thread M14×1.25**

Useful time: run 30,000km ,change

**BG13-20 electroject engine spark plug type: K7RTC**

Useful time: run 10,000 km change

Electrode clearance: 0.7—0.8mm

#### **Check**

- Electrode abrasion state
- Carbon deposition
- Insulant damage state

**Attention: hold rubber tube tightly , pull out high voltage damper, then take down spark plug.**

- a. If find abnormal , adjust air clearance, use spark plug cleaner cleaning or change new spark plug accord with the regulation.
- b. install spark plug and screw down torsional moment accord with the regulation.

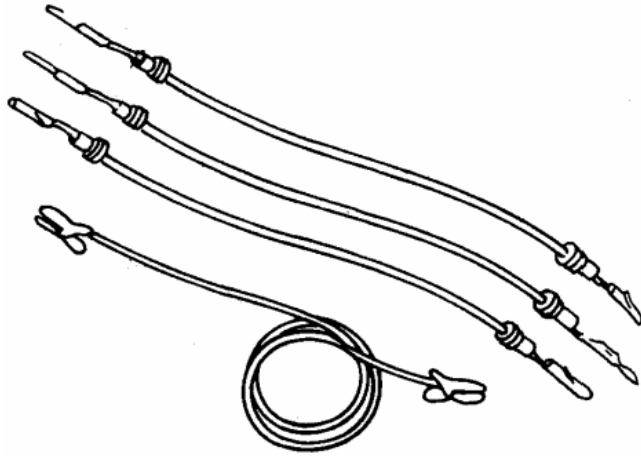
**Spark plug prescribe screw down torsional moment: 25N·m**

- c. Hold the rubber tube, install and fasten the high voltage damper.

### **Section VII fuel injection and electric control system notice**

#### **Normal tools and special tester**

Some tools and meters are needed when diagnosis and checking the malfunction. Before using these tools and meters, we must know its structure, performance, and notice to decide which electric system metering can be suitable. The electric control system of engine is very sensitive about the voltage, so when check and fix it should be very careful, don't test and fix optionally. Now we introduce several normal tools and special tester.



## 1. Jumper Wire

Simple jumper wire is one passage stranded conductor, at its ends connect with crocodile clips or different type plugs, it has different types. In the tool box, there must have different type jumper wire, for the specific place test, like the picture showing rightside.

Jumper Wire is simple, however it's also a very practical tool, its effect like a pass-by circuit. If one electric component not work, first connect jumper wire at terminal "-" and ground strap connection. here if parts work, means ground strap connection is open circuit; if the ground strap connection circuit good, then connect jumper wire between storage battery "+" and power-line terminal of be tested parts, if the parts work, means power supply circuit with failure (turnoff or circuit short) otherwise, parts with failure.

### Note:

**(1) Make sure whether the voltage of the parts which is going to be test, should be 12V before using jumper wire test the parts. For example, if the fuel injector power voltage is 4V, plus 12V it may damage the fuel injector.**

**(2) Don't connect jumper wire between "+" of parts and ground strap connection.**

## 2. Test lamp

1) 12v test lamp is made up of 12v lamp, conductor; different type tips, like the picture showed rightside. It mainly used for testing power supply circuit whether supply power to electronic parts.

Put one tip with ground strap, the other one connect with electronic parts power tip. If it's light, means the power circuit of electric parts no failure; if it's not light, move on the way of power source, connect the second terminal, if it's light, the circuit between the first and second terminal has the failure of turnoff. If still no light, then connect the third terminal..., until its light and the failure is in the circuit between the last terminal and first one, mostly its turn off failure.

### 2) Test lamp with power resource

Test lamp with power resource is similar with 12V test lamp, it just plus two 1.5V dry battery in handle, like rightside picture showed. Its used for testing electric circuit turnoff and short circuit.

a. **Turnoff test** break the power circuit connected with electric parts, take one tip of test lamp connect with ground strap, the other tip connect each tip (start from the head end of circuit). if its no light, turnoff is between point be tested and ground strap, if its light, turnoff point is between this be tested point now and last tested point.

b. **Short circuit test** first, break the power circuit connected with electric parts, one tip with ground strap, the other tip connect with circuit of electric parts, if its light, means short circuit failure exist, then unlatch linkers gradually, switch on, back out parts and so on, until go out. Then, the short circuit is in the place between last open circuit part and prior open circuit part.

**Attention: don't use test lamp to test micro computer control system of engine, unless there is special instruction in the maintenance book.**

## 2. multimeter

Multimeter can be used for testing alternating voltage, direct voltage, electric current, conductor resistance. Test resistance, voltage, voltage drop is in common use during vehicle repairing.

### 1) Resistance measure method

Direct voltage measure method

Put the switch to the direct voltage gear proper position (select the range). Attention on watch hand "+", "-", should according to the circuit ends with right positive and negative. By testing voltage, can check

out whether exist source voltage on the circuit somewhere, and get the electric drop after circuit through electric part.

**Attention: Only use high-impedance (above10MΩ) DMM; don't measure resistance in a hot-line work way, otherwise easy to burn DMM out.**

### 3. Hand-held vacuum air pump

There are many vacuum control system be used on modern vehicles, for diagnose , clearing vacuum control system fault, can use hand-held vacuum pump to test.

Hand-held vacuum pump has many types like the following picture showing. Its made up of a vacuum meter and a aspiration column. Being tested part no need taking down, can do the test on the car ,by push and pull the handle of vacuum pump, throw a proper vacuum degree on parts, can get the vacuum degree when control valve of parts open and close.

When engine running, induction manifold produce vacuum, vacuum source of vacuum control system mostly use the induction manifold vacuum, can use vacuum meter test vacuum source.

### 4. Pressure gauge

Pressure gauge can test pipeline, vessel and liquid inside equipment or air pressure. Because of using convenience, price cheap, be used broadly in vehicle workshop.

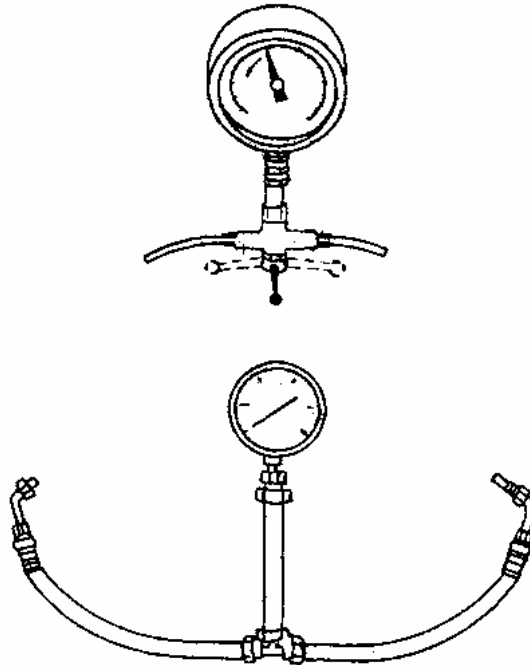
#### 1) 气缸压力表

Cylinder pressure gauge

Cylinder pressure gauge is for testing cylinder pressure when compress finish, it use spark plug holes measure the cylinder pressure.

#### 2) Fuel pressure gauge

Fuel pressure gauge for testing fuel supply and eject system whether work normal. Detection hole on the fuel supple pipe of electronic gasoline injection system is used for connecting with fuel gauge.



### 5. Fuel injector cleaner

Fuel injector blockage, will make mixed air become thin, spray configuration become weak, engine capability become bad. So, must check it , clean it regularly.

**Fuel injector cleaner has many types, generally separate into two types: under vehicle and in the vehicle.**

## 1) Cleaning instrument of cleaning under vehicle

## 2) Cleaning instrument of cleaning inside vehicle

### 7. Special tester

When check the engine control system, use diagnose tester to help finding source of fault is effective. Currently, in the vehicle repairing market most diagnose tester are table type engine fault analysis meter. Also on the market distributed portable type engine computer tester is applied. These tester usually has diagnose interface, take the interface connect with engine inner cabin or the fault diagnose socket which under panel, then operate key-indicate on the tester control panel, can test micro computer control system's sensor, actuator and its circuit. These testers' advantage is, carry easy, operation simple, though price is high, about one engine control computer's average price, however it can avoid changing no damaged parts while maintenance, also can improve the speed and efficiency, so to the buyer, economy benefit is obvious.

Portable engine computer tester has these function as following::

- (1) Take dynamic testing on engine micro computer control system while engine running or car running.
- (2) Read fault code from the engine computer's memorizer.
- (3) After checking, clear the engine computer saved fault code according to the operator's order.

Now, some engine computer testers imported from America have already been sold in civil, different testers suits for different engine microcomputer control system testing, also there is one suits for multi type engine computer control system, called all-purpose computer tester. For example, Owatonna Tool Company sells the computer tester called OTC monitor.

This monitor is a LCD, showing in a way of menu type, operate control key by select menu item when testing, simple and convenient for using, showing in simplicity, diagnosis data transmission cable which connecting with diagnosis socket with multi-interface; used for plug diagnosis socket of multi-type vehicles. At the end of monitor with PROM socket, use relevant PROM magnetic card when testing different vehicle.

### Basic principles and attention items of failure diagnosis

#### 1. Operation principle

- 1) Only digital multi meter (usually above 10M $\Omega$ ) permit to check electric inject system.
- 2) Repairing work pls use quality goods parts, otherwise can't guarantee electric inject system normal operation.
- 3) During the maintenance, only can use lead-free petrol.
- 4) Please abide normative repair and diagnose flow, to do the maintenance.
- 5) During the maintenance disassemble electric eject system parts is prohibited.
- 6) During repairing, take the electronic components ( electronic control unit, sensor and so on), should be careful, don't let them fall down on the floor..

#### 2. Judgment principle

Engine microcomputer control system is a complex system, grasp systemic examine steps and methods when diagnose the faults. From the principle of view, if diagnose and fix one engine fault which may referred to microcomputer system, first, check the fault whether has relation with microcomputer system. When engine get fault, but warning light not show light ( no display code) in the most time, this fault may has relation with the engine micro control system. At this time, should take it like engine machine part, checking as basic diagnose process. otherwise, may take lots of time to check microcomputer sensor, actuator, circuit for a fault no relation with microcomputer, however the not get the real fault.

#### The cause of typical faults which no relation with microcomputer :

- a. idle speed not steady (even flameout)
  - (1) Idle speed too low.
  - (2) Idle speed mixed air ration not correct or not average (vacuum leakage)
  - (3) Ignition time postpone.

- (4) Crank case force ventilation or pipe blocked up.
- (5) Spark plug high voltage wire has defects.
- (6) Spark plug ablate or crase.
- (7) Activated carbon jar system's wash water valve has crack or other defects.
- (8) Exhaust gas recycle valve keep opening because its locked.

b. misfiring when speed up

- (1) Spark plug high voltage wire has defect.
- (2) Spark plug high voltage wire plug wrongly.
- (3) Ignition circuit short or crack.
- (4) Capacitor get loose.
- (5) Wire head of primary coil loose.
- (6) Fuel filter stuck.
- (7) Fuel pump pressure not enough.
- (8) Fuel pipe crack or become soft.

c. fuel consumption ratio high.

- (1) Ignition time too late.
- (2) Exhaust pipe stuck.
- (3) Air filter stuck.
- (4) Constant temperature air filter has defect, let the hot air enter.
- (5) Exhaust air recycle valve keep opening because of clamping stagnation.
- (6) Cooling system thermostat failure or control temperature too low.

d. knock when speed up.

- (1) Ignition time too early.
- (2) Fuel grades too low.
- (3) Exhaust air recycle valve can't open correctly.
- (4) Knock sensor lapsed.

### 3. Matters needattention

(1) whatever engine is running or not , when the ignition switch on , don't cut any 12V electrical equipment. Because when cut these equipments, by self-inductance , any coil can produce high instantaneous voltage even over 7000V, let the microcomputer and sensor damaged heavily. List parts of some equipments can't be cut: any cable of storage cell, gas mixture control electromagnetic valve, idle speed control equipment(step motor). Electromagnetic fuel atomizer, secondary air injection electromagnetic valve, the wire of ignition , prom of microcomputer, any wire of microcomputer, conductor jointer of blower motor , A/C clutch wire and so on.

(2) Start other vehicle by cross-over or other vehicle start the car by cross-over, should switch off ignition first, then can load, discharge cross-over cable.

(3) The speakers of stereo can't be installed close the microcomputer, because magnet of speakers will damage the circuits and parts inside the microcomputer.

(4) When using arc welding on the car body, should cut off microcomputer power. When doing repair work close to the microcomputer or sensor should be very careful.

(5) When install or take off PROM , operator should touch body first, otherwise, people body's static will damage microcomputer circuit.

(6) If wiper leakage , must repair it soon, avoid microcomputer( on the board under the engine cabin) damaged by affected damp.

(7) Except point out in the test program , can't use pointer type ohm meter to test microcomputer sensor, should use high impedance digital tester( usually over 10MΩ)

(8) Don't use test lamp to test any electric equipment which connect with microcomputer, for prevent

microcomputer or sensor get damage , except any instruction. Usually should use high impedance digital tester.

(9) When people enter carriage, body's static discharge may produce very high voltage , so when operate digital tester for repairing or close to this type meter, should take metal tape , one head coil on wrist ,the other one clip on the car body.

(10) Don't take down any electric ejection system parts or plug-in from its installing position, for avoiding any damage or water,oil dirty into the plug-in , influence the electric ejection system 's normal work.

(11) When cut off or turn on the plug-in , must switch off the ignition , otherwise will damage electric parts.

(12) When doing fault hot condition simulated and other repairing work make heat up, don't let the electric control unit over 80°C

(13) Electric ejection system's fuel supplying pressure is high( around 300kPa), all the fuel pipes use bear-high pressure fuel pipe. Even engine not running, oilchannel keeps a high fuel pressure. So, don't take down fuel pipe easily, do pressure relief to fuel system before take down fuel pipe when needs repair the fuel system, pressure relief method: take down fuel pump relay, start engine let it running on idle speed, until extinguish itself. Fuel pipe taking-down and fuel filter changing should be done by pro mechanics in a well ventilated place.

(14) When take electromotion fuel pump from fuel tank, don't electrify it, for avoiding produce spark ,cause fire.

(15) Do the running test under dry state or in the water for the fuel pump is not permitted , otherwise will reduce its useful time, it must be doing in water. And to the fuel pump, the polarity should not be reversed.

(16) When check the ignition system , only do the jump spark test when necessary, and control the time as short as possible. Don't open air damper or take down fuel ejector plug , it will induce a great lot unburned fuel enter into exhaust pipe , damage the three unique catalyst.

(17) Idle speed system with self-adjust function, so the adjust of idle speed is auto finished by electric eject system, no need manual adjust. The set screw of air damper already be adjusted well when it was produced, user change its initial position freely is not allowed.

(18) Don't connect anode and cathode wrongly when connecting storage cell , for avoiding damage electric circuit , this system use cathode bonding.

(19) Don't take down storage cell cable or plug in, out electric joint, otherwise easy damage ECU and circuit.

(20) Before electric welding , should take down storage cell anode, cathode, cable, and electric control unit .

(21) Don't use the way cut through the wire skin for check the parts in-out electric signals.

If driver already see the engine fault indicating lamp is shinning, he should check step by step according to engine microcomputer control system fault finding program. There are usually four steps for finding faults: client idea, eyeballing check, self diagnose test, examine and repair.

## **Section VIII electric eject system fault diagnose and repair**

### **summary**

Computer is the corn of electric eject engine control system, its installed inside the computer box, computer input and output is through one connector with 55 channels.

Computer is made up of central process unit, random memory, erasable programmable read only memory (EPROM) and input output interface circuit.

Control program and parameters of read only memory is a important guarantee for the computer can control target accord to the set. It can edit ,supply or rebuild control program and parameters by through a diagnose faucet connecting with a special diagnose tool (ELIT). Its computer input, output relation like the picture following:

### **Cause of fault and most possible occur parts**

Electronic ejection system fault means : when computer its function or get information not correct, arouse relevant control order not correct , result in engine can't start, start difficult, no high speed, fuel consumption increase, idle speed not steady and so son.



### 1. Failure of fuel injector

Fuel injector is one of main execute components of injection system, when fuel quality fall short of request, easy blind and seizure. Failure usually performance like : magnet coil work bad, fuel injector seizure, wear, water-clock and atomization not good so on. Fuel injector perform above failures will cause some cylinder not working or not working fine.

### 2. Sensor failure

There are many sensors in electronic injection system, they take working state information of important parts of engine into the computer directly, as the basis of sending control order. If sensors failure, it will make orders not correct or even cause engine out of control . Main styles of sensor's failure : elastic parts loose elastic, vacuum diaphragm disrepair, connect part wear or peripheral line failure.

### 3. Connecting fitting failure

Electric injection system has many splicing connecting fittings, because of bad working condition, easy get failure. It performance as: aging failure, tie-in loose or connecting bad and so on. When splicing connecting fitting failure, engine work unsteady, fluctuation.

### 4. Vacuum tube and other pipeline failures.

Most of vacuum soft tubes are made of rubber in electric injection system, also some other parts used rubber. These rubber goods after be heated, stained with oil, alternative be stressed, overtime working, will happen rubber tube aging, nozzle broken, interface loose, clip distortion, sealing element leakage and other failures , it will influence engine's capability.

### 5. The failure of fuel pressure regulator

Fuel pressure regulator easy get the failure : blockage of regulator and membrane damage. This will easy make engine supply fuel unsteady, start difficult, accelerate powerless and so on.

### Failure alarm

System with the function of failure alarm.

Alarm function of system expressed by detect lamp lighten (picture right side) which on the panel.

Normally, after turn on the ignition switch, detect lamp will be lighted, and it will extinguished itself after 3seconds. When start engine, once the rotation of engine reach 24r/min, detect lamp also extinguish at once, this means work find, no failure.



The following situation means system has failure.

(1) Ignition switch turned on , detect lamp lighten , but not extinguish after 3s, and that keep light, no change even after startjng the engine

(2) When engine running, detect lamp lighten, not extinguish.

**Above two situations remind driver that there has failure in electric injection system, should stop car , examine and repair at once. If the failure no necessary repair at once, the detect light would not lighten, however the failure as a failure code will be saved in the computer.**

### Failure record and storage

Failure saved as failure code inside the computer, and its showing orderly, computer can save maximum 15 failures at one time.

#### 1) Failure can be divided into eternal failure and temporary failure.

Eternal failure--- the failure saved in the computer before resolving ,called eternal failure.

Temporary failure----detected failure be resolved or some failures auto-eliminated after instantaneous appeared.

#### 2) Failure can be divided into major failure and minor failure

Major failure——When one failure shows up, alarm lamp lighten, failure be recorded in a failure code way, this type failure called major failure.

Minor failure——when a failure shows up, failure code be recorded, but the alarm lamp no light, this type called minor failure.

In the computer's failure storage, usually major failure has the priority compare to the minor failure. When already stored 15 failures, if one major failure appear, then this major failure will instead of one saved minor failure.

In the system, if appear temporary failure, computer start save the failure code, because detect lamp no light or it will be extinguished , sometimes driver would not notice , if this failure after engine start 50 times, the appeared temporary failure not appear again, computer will delete its failure code from memory.

### **Failure running**

The function of failure running means when system get failure, in order to drive car back home or to the vehicle repair plant , computer invoke back up value parameter order the running.

For example, when cooling water temperature sensor failure , computer take the value parameter of engine temperature at 80°C as fuel inject and ignition control parameter, let the engine keep running. The thing should notice: when failure running, all relevant system not working in a best state, engine power performance and economy performance decrease, exhaust pollution may become bad. So, should examine and repair engine as soon as possible.

After failure eliminated, computer will auto-select actual information parameter, so auto-out of the back up value , finish the failure running function.

### **Client opinions**

When failure car enter into the maintenance depot , depot people should inquire opinions from client, in order to find the failure source fast. First should get know the situation, condition, how and whether be examined ,something about failure when failure happened. So, must give audience to client's description about failure , though the description may not integrity or be misconstrued , or maybe self-contradiction, but it often get the key of the problem. The best way is : after listen client's first opinion , think for a moment, do a first step diagnosis, then ask some relevant questions for helping make sure or deny first diagnosis' conclusion. Meanwhile let client fill “ client questionnaire” . This blank content is about failure record of engine microcomputer control system , with diagnose test result together institute the basis of failure source.

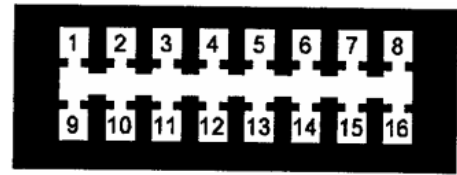
### **Visual measurement**

The purpose of visual measurement is for eliminate general failure element before the further careful test and diagnosis. The content of visual measurement includes:

- (1) Take down air cleaner, check filter element and whether has dirty, impurity or other pollutants around , must change it in time.
- (2) Check the vacuum tube whether broken, aging, or squeeze damaged; check the tube passed path and tie-in whether correct.
- (3) Check the connection situation of wire bundle of microcomputer control system.
  - a. electric coupler of sensor or actuator is fine.
  - b. coupler of wiring hamesh whether loose or disconnect.
  - c. electrical wire whether has rupture or disconnection situation.
  - d. electrical coupler whether splicing in a proper position.
  - e. Whether wires has frazzle or line to line short circuit situation.
  - f. Whether electrical coupler's plug and socket has corrosion.
- (4) Check every sensor and actuator whether has obvious damage.
- (5) Run engine and check enter/exhaust manifold lambda sensor whether has leakage.
- (6) Do the necessary elimination to the failure, and reinstall new air cleaner.

**Failure code read and deletes method**

EQ474Ibg13-20 engine system used standard diagnose tie-in(like picture right side), failure diagnose interface is installed under the panel. Engine manage system EMS using stitches 4.7.16 of standard diagnose tie-in. NO.4 stitch connects with groundwire, No.7 stitch connects with No.71 stitch of ECU, namely engine data line “K”, No.16 stitch connects with the storage cell anode.



Diagnose joint AF10-06 engine system used is showed on the picture rightside, the failure diagnose interface is installed under the driver panel. Engine manage system EMS use stitches 1.4.7.16 of the diagnose joint. Stitch NO.4 is connected with the groundwire, stitch No.7 is connected with stitch J1-D11 of ECU, namely engine data line”K”, stitch No.16 is connected with anode of accumulator, stitch No.1 is connected with stitch J2-B9 of ECU, namely diagnose request stitch of ECU.

16	1
7	2
1	3
5	4
4	

Diagnose instrument can communicate with ECU by through “K” line, and do the following operations(details according to the diagnose instrument instruction book):

1. Engine parameters display

(1) Rotate speed ,cooling fluid temperature, the opening of throttle, ignition advance angle, pulse width of oil spout, intake pressure, intake temperature,vehicle speed , system voltage, oil spout amend,scour rate of canister, idle speed air control, waveform of oxygen sensor.

(2) Target rotates speed, relative load of engine, ambient temperature, ignition closing time, evaporator temperature, intake flux, fuel consumption.

(3) Signal voltage of sensor of throttle position, signal voltage of sensor of cooling fluid, signal voltage of sensor of intake temperature, sensor signal voltage of intake pressure, 1# stitch signal voltage of shock sensor, 2# stitch signal voltage of shock sensor.

2. Electric injection state display:

Guard against theft system state( if there is), cooling system state, stable operating condition, dynamic operating condition, exhaust control state, oxygen sensor state, idle speed state, trouble lamp state, emergency operating condition state, air condition system state.

3. Function of actuator test

Trouble lamp, fuel pump, air condition relay, fans, ignition, fuel spout (single-cylinder oil current break).

4. Speedometer display:

Running mileage, running time.

5. Version information display:

VIN, hardware code of ECU, software code of ECU.

6. Failure display

Intake pressure sensor, intake temperature sensor, engine cooling fluid temperature sensor, throttle position sensor, oxygen sensor, the heat circuit of oxygen sensor, amend of air/fuel, apiece of cylinders fuel injector,fuel pump, shock sensor, revolution speed transducer, phase sensor, canister control valve, cooling fan delay, vehicle peed signal , rotate speed of idle speed, idle speed adjuster, system voltage, ECU, air condition compressor relay, evaporator temperature sensor, trouble lamp.

**Failure code read:**

1. Read code by using failure diagnose lamp

Put ignition switch to “M” position, namely the position of all indicator lights shine on the panel, after breaking the ground strap connection No.7 of diagnose plug in 3-4s, detection lamps of panel will start flicker, and can read self-diagnose code. The code of flicker is two numeral code, flicker ten numeral code first, then flicker

unit code after 1s.

For example, the flicker way of the No.27 failure code is:

Flicker twice continuously (showing 20), then flicker seven times in a successive way after holding a second, which refers to No.27.

The flicker way of the No.55 self-diagnose code for failure is:

Flicker five times continuously (showing 50), then flicker five times in a successive way after holding a second, which refers to No.55.

Every ground strap of the 783 diagnose joint---retaining a flickering process of the diagnose lamps once it is disconnected, which means to read a failure code. Ground strap connection repeatedly, if the number of the stored 15 failure codes is to be checked---cutting for 15 times. After reading the number of the failure code, the parts which have failures can be found out according to the failure code book.

Reading the self-diagnose code of failure, finding out the failure parts, then delete the failure code after removing the failure in order to guarantee the stored failure truly ones.

2. read through the special diagnose tester

Insert the diagnose interface of the tester into the ECU failure diagnose interface to read the failure code.

**Ways of deleting failure code:**

Normally, disconnecting the power cord or the fuse linking to the engine microcomputer control system can delete or clear out the stored failure code in the microcomputer control system. Disconnecting the battery's negative electrode or the microcomputer control system's fuse of the automobile for 30 seconds also works.

Press one key of the special tester to clear out the failure code.

Attention: clearing out the failure code in the way of dismantling the battery's negative electrode will remove the EMS memory of the equipments such as quartz pin and the sound. Therefore, the battery's negative electrode can't be discharged casually. It's better to clear the failure code as the ways introduced in the maintaining manual.

Start engine after clearing out the failure code to check whether the indicate light of the failure code is flickering or not. If it is, there must be some failures in the system which needs further diagnoses.

**Denotative meaning of the failure code shown in the list (AF10-06):**

Index	PCODE	DFP_Bosch	Description of PCODE
1	P0030	HSVE_SI_CDC	O2 Sensor Heater Contr. Circ.(Bank1(1)Sensor 1)
2	P0031	HSVE_MN_CDC	O2 Sensor Heater Contr. Circ.(Bank1(1)Sensor 1) Low
3	P0032	HSVE_MX_CDC	O2 Sensor Heater Contr. Circ.(Bank1(1)Sensor 1) High
4	P0036	HSHE_SI_CDC	O2 Sensor Heater Contr. Circ.(Bank1(1)Sensor 2)
5	P0037	HSHE_MN_CDC	O2 Sensor Heater Contr. Circ.(Bank1(1)Sensor 2) Low
6	P0038	HSHE_MX_CDC	O2 Sensor Heater Contr. Circ.(Bank1(1)Sensor 2) High
7	P0053	HSV_NP_CDC	O2 Sensor Heater Resistance(Bank1(1)Sensor 1)
8	P0054	HSH_NP_CDC	O2 Sensor Heater Resistance(Bank1(1)Sensor 2)
9	P0105	LM_SI_CDC	Manifolt Absolut Pressure/Barometric Pressure Circuit
10	P0106	LM_NP_CDC	Manifold Abs.Pressure or Bar.Pressure Range/Performance
11	P0107	LM_MN_CDC	Manifold Abs.Pressure or Bar.Pressure Low Input
12	P0108	LM_MX_CDC	Manifold Abs.Pressure or Bar.Pressure High Input
13	P0112	TA_MX_CDC	Intake Air Temp.Circ. Low

			Input
14	P0113	TA_MN_CDC	Intake Air Temp.Circ. High Input
15	P0116	TM_NP_CDC	Engine Coolant Temp.Circ. Range/Performance
16	P0117	TM_MX_CDC	Engine Coolant Temp.Circ. Low Input
17	P0118	TM_MN_CDC	Engine Coolant Temp.Circ. High Input
18	P0122	DK_MN_CDC	Throttle/Pedal Pos.Sensor A Circ. Low Input
19	P0123	DK_MX_CDC	Throttle/Pedal Pos.Sensor A Circ. High Input
20	P0130	LSV_NP_CDC	O2 Sensor Circ.,Bank1-Sensor1 Malfunction
21	P0132	LSV_MX_CDC	O2 Sensor Circ.,Bank1-Sensor1 High Voltage
22	P0133	LATP_MX_CDC	O2 Sensor Circ.,Bank1-Sensor1 Slow Response
23	P0134	LSV_SI_CDC	O2 Sensor Circ.,Bank1-Sensor1 No Activity Detected
24	P0136	LSH_NP_CDC	O2 Sensor Circ.,Bank1-Sensor2 Malfunction
25	P0138	LSH_MX_CDC	O2 Sensor Circ.,Bank1-Sensor2 High Voltage
26	P0140	LSH_SI_CDC	O2 Sensor Circ.,Bank1-Sensor2 No Activity Detected
27	P0170	FRST_NP_CDC	Fuel Trim,Bank1 Malfunction
28	P0171	FRST_MX_CDC	Fuel Trim,Bank1 System too Lean
29	P0172	FRST_MN_CDC	Fuel Trim,Bank1 System too Rich
30	P0201	EV1_SI_CDC	Cylinder 1- Injector Circuit
31	P0202	EV4_SI_CDC	Cylinder 2- Injector Circuit
32	P0203	EV2_SI_CDC	Cylinder 3- Injector Circuit
33	P0204	EV3_SI_CDC	Cylinder 4- Injector Circuit
34	P0261	EV1_MN_CDC	Cylinder 1- Injector Circuit Low
35	P0262	EV1_MX_CDC	Cylinder 1- Injector Circuit High
36	P0264	EV4_MN_CDC	Cylinder 2- Injector Circuit Low
37	P0265	EV4_MX_CDC	Cylinder 2- Injector Circuit High
38	P0267	EV2_MN_CDC	Cylinder 3- Injector Circuit Low

Index	PCODE	DFP_Bosch	Description of PCODE
39	P0268	EV2_MX_CDC	Cylinder 3- Injector Circuit High
40	P0270	EV3_MN_CDC	Cylinder 4- Injector Circuit Low
41	P0271	EV3_MX_CDC	Cylinder 4- Injector Circuit High
42	P0300	MD_MN_CDC	Random/Multiple Cylinder Misfire Detected
43	P0300	MD_MX_CDC	Random/Multiple Cylinder Misfire Detected
44	P0300	MD_NP_CDC	Random/Multiple Cylinder Misfire Detected
45	P0301	MD00_MN_CDC	Cyl.1 Misfire Detected
46	P0301	MD00_MX_CDC	Cyl.1 Misfire Detected
47	P0301	MD00_NP_CDC	Cyl.1 Misfire Detected
48	P0302	MD03_MN_CDC	Cyl.2 Misfire Detected
49	P0302	MD03_MX_CDC	Cyl.2 Misfire Detected
50	P0302	MD03_NP_CDC	Cyl.2 Misfire Detected
51	P0303	MD01_MN_CDC	Cyl.3 Misfire Detected
52	P0303	MD01_MX_CDC	Cyl.3 Misfire Detected
53	P0303	MD01_NP_CDC	Cyl.3 Misfire Detected
54	P0304	MD02_MN_CDC	Cyl.4 Misfire Detected
55	P0304	MD02_MX_CDC	Cyl.4 Misfire Detected
56	P0304	MD02_NP_CDC	Cyl.4 Misfire Detected
57	P0318	SWE_MN_CDC	Rough Road Sensor ""A"" Signal Circuit
58	P0318	SWE_MX_CDC	Rough Road Sensor ""A"" Signal Circuit
59	P0318	SWE_NP_CDC	Rough Road Sensor ""A"" Signal Circuit
60	P0321	BM_MN_CDC	Ign./Distributor Eng.Speed Inp.Circ. Range/Performance
61	P0321	BM_MX_CDC	Ign./Distributor Eng.Speed Inp.Circ. Range/Performance
62	P0321	BM_NP_CDC	Ign./Distributor Eng.Speed Inp.Circ. Range/Performance
63	P0321	BM_SI_CDC	Ign./Distributor Eng.Speed Inp.Circ. Range/Performance
64	P0322	N_SI_CDC	Ign./Distributor Eng.Speed Inp.Circ. No Signal
65	P0324	KRNT_NP_CDC	Knock Control System Error
66	P0324	KROF_NP_CDC	Knock Control System

			Error
67	P0324	KRTP_NP_CDC	Knock Control System Error
68	P0327	KS1_MN_CDC	Knock Sensor 1 Circ. Low Input
69	P0328	KS1_MX_CDC	Knock Sensor 1 Circ. High Input
70	P0340	PH_SI_CDC	Camshaft Position Sensor Circuit
71	P0341	PH_NP_CDC	Camshaft Pos.Sensor Circ. Range/Performance
72	P0342	PH_MN_CDC	Camshaft Pos.Sensor Circ. Low Input
73	P0343	PH_MX_CDC	Camshaft Pos.Sensor Circ. High Input
74	P0420	KAT_MX_CDC	Catalyst System,Bank1 Efficiency Below Threshold
75	P0444	TEVE_SI_CDC	Evaporativ Emiss.System Purge Control Valve Circ. Open
76	P0458	TEVE_MN_CDC	Evaporative Emission System Purge Control Valve Circuit Low
77	P0459	TEVE_MX_CDC	Evaporative Emission System Purge Control Valve Circuit High
78	P0480	LUEA_SI_CDC	Cooling Fan 1 Control Circuit

<b>Index</b>	<b>PCODE</b>	<b>DFP_Bosch</b>	<b>Description of PCODE</b>
79	P0501	VFZ_SI_CDC	Vehicle Speed Sensor Range/Performance
80	P0506	LLR_MN_CDC	Idle Control System RPM Lower than Expected
81	P0507	LLR_MX_CDC	Idle Control System RPM Higher than Expected
82	P0508	STPE_MN_CDC	Idle Air Control System Circuit Low
83	P0509	STPE_MX_CDC	Idle Air Control System Circuit High
84	P0511	STPE_NP_CDC	Idle Air Control Circuit
85	P0511	STPE_SI_CDC	Idle Air Control Circuit
86	P0537	TVERD_MX_CDC	A/C Evaporator Temperature Sensor Circuit Low
87	P0538	TVERD_MN_CDC	A/C Evaporator Temperature Sensor Circuit High
88	P0560	UB_NP_CDC	System Voltage Malfunction
89	P0562	UB_MN_CDC	System Voltage Low Voltage
90	P0563	UB_MX_CDC	System Voltage High Voltage
91	P0602	SGPP_NP_CDC	Control Modul Programming Error
92	P0627	KPE_SI_CDC	Fuel Pump "A" Control Circuit /Open

93	P0628	KPE_MN_CDC	Fuel Pump "A" Control Circuit Low
94	P0629	KPE_MX_CDC	Fuel Pump "A" Control Circuit High
95	P0645	KOSE_SI_CDC	AC clutch relais circuit
96	P0646	KOSE_MN_CDC	A/C Clutch Relay Control Circuit Low
97	P0647	KOSE_MX_CDC	A/C Clutch Relay Control Circuit High
98	P0650	MILE_MN_CDC	Malfunction Indicator Lamp Control Circ.
99	P0650	MILE_MX_CDC	Malfunction Indicator Lamp Control Circ.
100	P0650	MILE_SI_CDC	Malfunction Indicator Lamp Control Circ.
101	P0691	LUEA_MN_CDC	Cooling Fan 1 Control Circuit Low
102	P0692	LUEA_MX_CDC	Cooling Fan 1 Control Circuit High
103	P1651	SVSE_CDC	Data Bus Powertrain missing messages
104	P2177	FRAU_MX_CDC	System Too Lean Off Idle
105	P2178	FRAU_MN_CDC	System Too Rich Off Idle
106	P2187	RKAZ_MX_CDC	System Too Lean at Idle
107	P2188	RKAZ_MN_CDC	System Too Rich at Idle
108	P2195	LATV_MX_CDC	O2 Sensor Signal Stuck Lean; Bank 1 Sensor 1
109	P2196	LATV_MN_CDC	O2 Sensor Signal Stuck Rich; Bank 1 Sensor 1
110	P2270	LASH_MX_CDC	O2 Sensor Signal Stuck Lean; Bank 1 Sensor 2
111	P2271	LASH_MN_CDC	O2 Sensor Signal Stuck Rich; Bank 1 Sensor 2

**Additional OBD information used for the original type approval of the vehicle**

Component	fault code	Monitoring strategy	Fault detection criteria	MI activation criteria	Secondary parameters	Pre conditioning	Demonstration test
Catalyst	P0420	The amplitude max limit of sensor signal behind catalyst exceeds	The amplitude mean value of sensor signal behind catalyst : (>0.6992)	3 <sup>rd</sup> cycle	Active monitoring time for catalyst diagnosis : (>70s)	Two Type I cycles	Type I
Engine misfire	P0300 to P0304	Misfire rate that damaged catalyst (max fault)	The counter of misfiring of all cylinders that damaging catalyst.	3 <sup>rd</sup> cycle	Rough road detection, fuel cut off, torque intervention, engine speed, engine load, intake air temp.	Two Type I cycles	Type I
Oxygen sensor	P0134	O2 sensor 2 circuits voltage	O2 sensor 2 circuits voltage : (<0.06V)	3 <sup>rd</sup> cycle	Battery voltage, engine speed, target lambda, catalyst temp.	Two Type I cycles	Type I
Canister plug off	P0444	Circuit check	Open circuit	3 <sup>rd</sup> cycle	Ignition switch on	Two Type I cycles	Type I



- 1、 After confirm steady state failure currently, then can do the following examine and repair, otherwise will make mistake in diagnose.
- 2、 Not allowed use finger type multimeter to check circuit of electric injection system.
- 3、 During check vehicle with guard against theft system ,if there is a replacing ECU situation in the blank of “after steps”, then do the programming after replacing ECU.
- 4、 If failure code shows some circuit voltage below level, it means the circuit may short to the earth; if failure code shows some circuit voltage up level, it means the circuit may turnoff to the power source; if failure code shows some circuit failure, it means there is turnoff or manifold circuit failures in this circuit.
- 5、 About the HH474QE typical failure diagnosis ,readers diagnose based on specific failure please, the diagnosis process is similar with HH465QE.

**Diagnosis help:**

- 1、 Failure code can't be cleaned, the failure is belong to steady failure; if it is chance fault ,the key point is check the joints of wiring harness whether loose.
- 2、 Check following the above steps without abnormal situation.
- 3、 Don't ignore the influence of car maintenance , cylinder pressure, air cleaner and so on to the system during the checking process.
- 4、 Replacing ECU and test.

If the failure code can be cleaned, the failure position is at ECU, if the failure code still can't be cleaned, then replace the previous ECU, repeat process, do the examine work again.

**Diagnosis flow of examine and repair of electric injection system based on failure phenomena**

**Primary check before diagnosis based on engine failure phenomena**

- 1、 Confirm engine failure indicate lamp works well.
- 2、 Using failure diagnosis meter check, confirm no failure information record.
- 3、 Confirm the failure car owner reported is exist, and confirm the conditions when the failure happened.

**Then do the appearance check:**

- Check fuel pipes whether leakage.
- Check vacuum pipes whether break,twist, and connection whether good.
- Check intake pipes whether jam,leakage, be staved or dmaged.
- Check the high voltage line of ignition whether break, aging, and ignition order whether correct.
- Check the place of wiring harness connect to the earth whether clean, fasness.
- Check joints of every sensor, actuator whether loose or connect not good.

**Key point: if above situations exits, should do maintenance work for fixing the failure phenomena, otherwise will influence the failure diagnosis ,repairing work after.**

**Diagnosis help:**

- 1、 Confirm engine no any failure record.
- 2、 Confirm reported failure exist.
- 3、 Already do the check following above steps, and no abnormal situation.
- 3、 Replacing ECU, do the test.

If the failure code can be cleared, the failure part is in the ECU, if it can not be cleared, replace it with the original ECU, repeat this procedure, and test again.

- 4、 4、 Don't ignore the influence of car maintenance , cylinder pressure, air cleaner and so on to the system during the checking process.

**Engine not running or running slow when starting.****General failure position:**

- 1、 Battery cell;
- 2、 Start electric machine;
- 3、 Switch of wiring harness or ignition;
- 4、 Machine part of engine.

**General diagnosis process:**

No.	Operation Step	Test Result	Follow-up step
1	Using multimeter check the voltage between the two pillars of battery cell, whether get 8-12V when the engine start.	Yes	Next step
		No	Replace battery cell
2	Keeping the ignition switch in the start position, check if the voltage of anode in the pillar is more than 8v with multimeter.	Yes	Next step
		No	Repair or replace wire harness
3	Dismantle starting engine, check the starting engine working condition.the focus is on breaking or blocking due to bad lubrication.	Yes	Repair or replace start electric machine
		No	Next step
4	if the failure only occurred in winter, then check whether the engine machine resistance is caused by the improper use of engine lubrication and the gear box oil.	Yes	Proper lubrication
		no	Next step
5	Check whether the unworking and the slow running of engine machine is caused by the great inner engine resistance.	Yes	Test and repair the inner resistance of engine
		no	Repeat above steps

**1. When starting, the engine can run but not work.****General failure parts:**

- 1、 No oil in the oil tank;
- 2、 Fuel pump;
- 3、 Revolution speed transducer;
- 4、 Ignition loop;
- 5、 Machine part of engine.

General diagnose procedure:

**2. Start difficulty**

**General failure parts**

1. Fuel with water
2. Fuel pump
3. Cooling temperature sensor
4. Vacuum hose of fuel pressure regulator
5. Ignition loop

**General diagnose procedure:**

**Start difficulty.**

No.	Operation Step	Test Result	Follow-up step
1	Connecting fuel pressure gauge(point is the forepart of inlet pipe of fuel distribution assembly), starting engine, check whether the fuel pressure is about 260kpa under the idling mode; disconnect vacuum hose of the fuel pressure regulator, check whether the fuel pressure is about 300kpa.	Yes	Next step
		No	Check and repair oil supply system
2	Pull out the wire of one cylinder, connecting with the spark plug, make the distance between the spark plug electrode and the engine body 5mm, and then check whether there is high voltage or not.	Yes	Next step
		No	Check and repair ignition system
3	Pull out the joint of cooling temperature sensor, start engine to check whether the engine can work or not. (or connect a 300 ohmic resistance to replace the cooling temperature sensor, and see if the engine can start successfully.)	Yes	Check and repair revolution speed transducer circuit
		No	Next step
4	Check whether the fuel pressure regulator vacuum pipe is loose or gas leaking.	Yes	Examine and repair or replace
		No	Next step
5	Checking fuel condition to see if this failure is caused by the oil charging.	Yes	Change fuel
		No	Next step
6	Connecting injection system communicator, turning on the ignition switch, check whether stitch power like the relay power, ignition switch, uncontinuous power is normal or not;	Yes	Diagnose help
		No	Check and repair coincident circuit

**General failure parts:**

Fuel with water; fuel pump; cooling temperature sensor; fuel injector; ignition loop; throttle and idle speed bypass inlet pipe, mechanical part of engine.

**General diagnose procedure:**

**3. Normal running speed, difficult to start at any time.**

**Position of general failure**

- 1.fuel contain water;2.fuel pump;3.temperature sensor of cooling fluid;4.fuel injector;5.ignition coil;6.throttle and idle speed bypass inlet pipe 7.intake duct; 8. ignition timing 9.spark plug. 10. Machine parts of engine.

# Chapter 4 Transmission System

## Section 1 Transmission

### Structure

5TH Transmission is a synchronous transmission. It has five onward gears and one reverse gear. It shifts gears through three synchronous sits and four shafts (input shaft, main shaft, centre shaft and reversing gear shaft). All of the onward gears are joggle style and reverse gears are gild or annulus structure.

Low speed synchronous sits are equipped in the centre shaft, and it fits with the 1<sup>ST</sup> gear or 2ed gear in the centre shaft. High speed synchronous sits are in the input shaft, and it fits with the 3ed gear or the 4<sup>th</sup> gear in the input shaft.

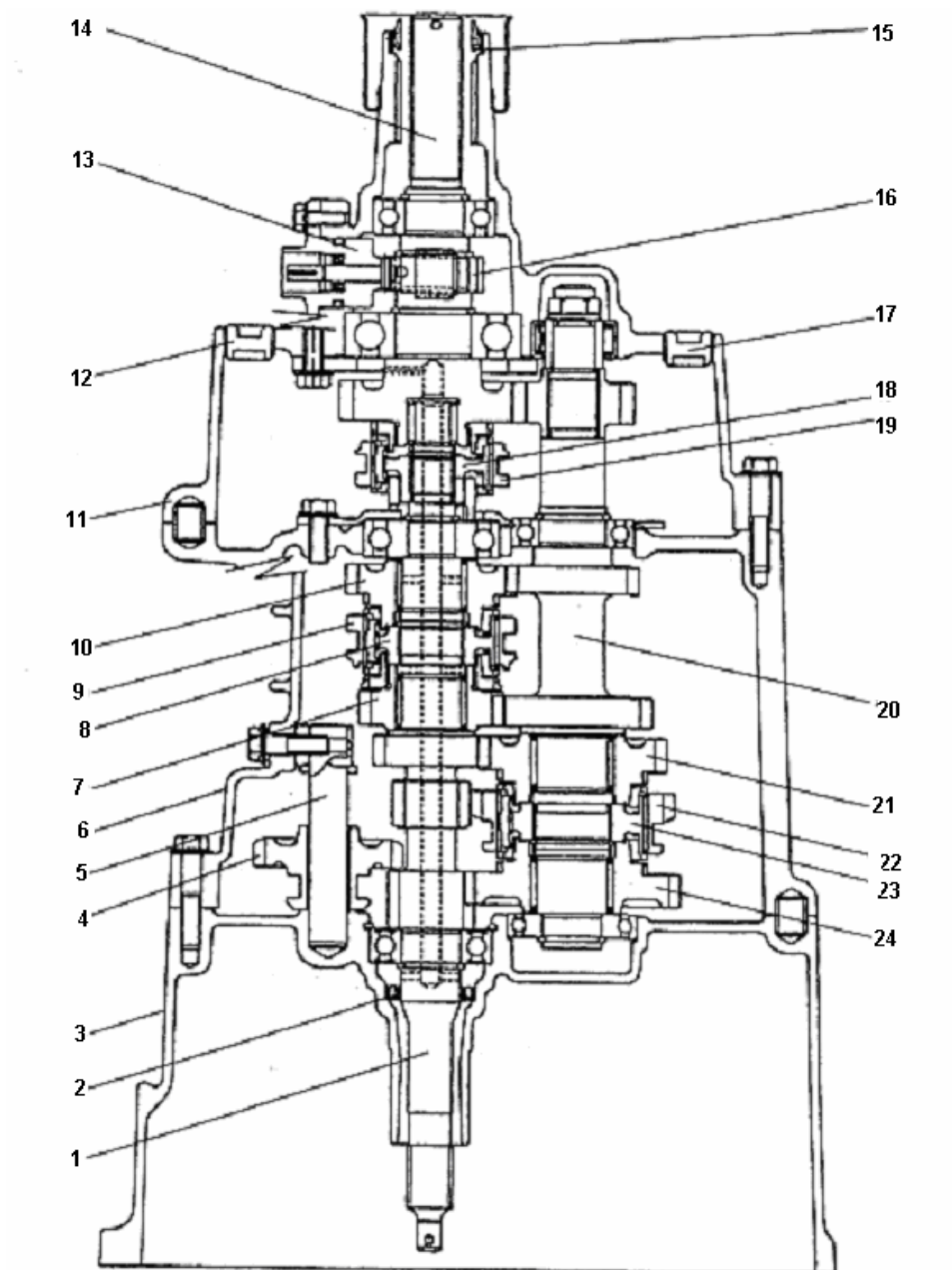
5TH synchronization in the input shaft joggles the gear of the 5 TH in the main shaft.

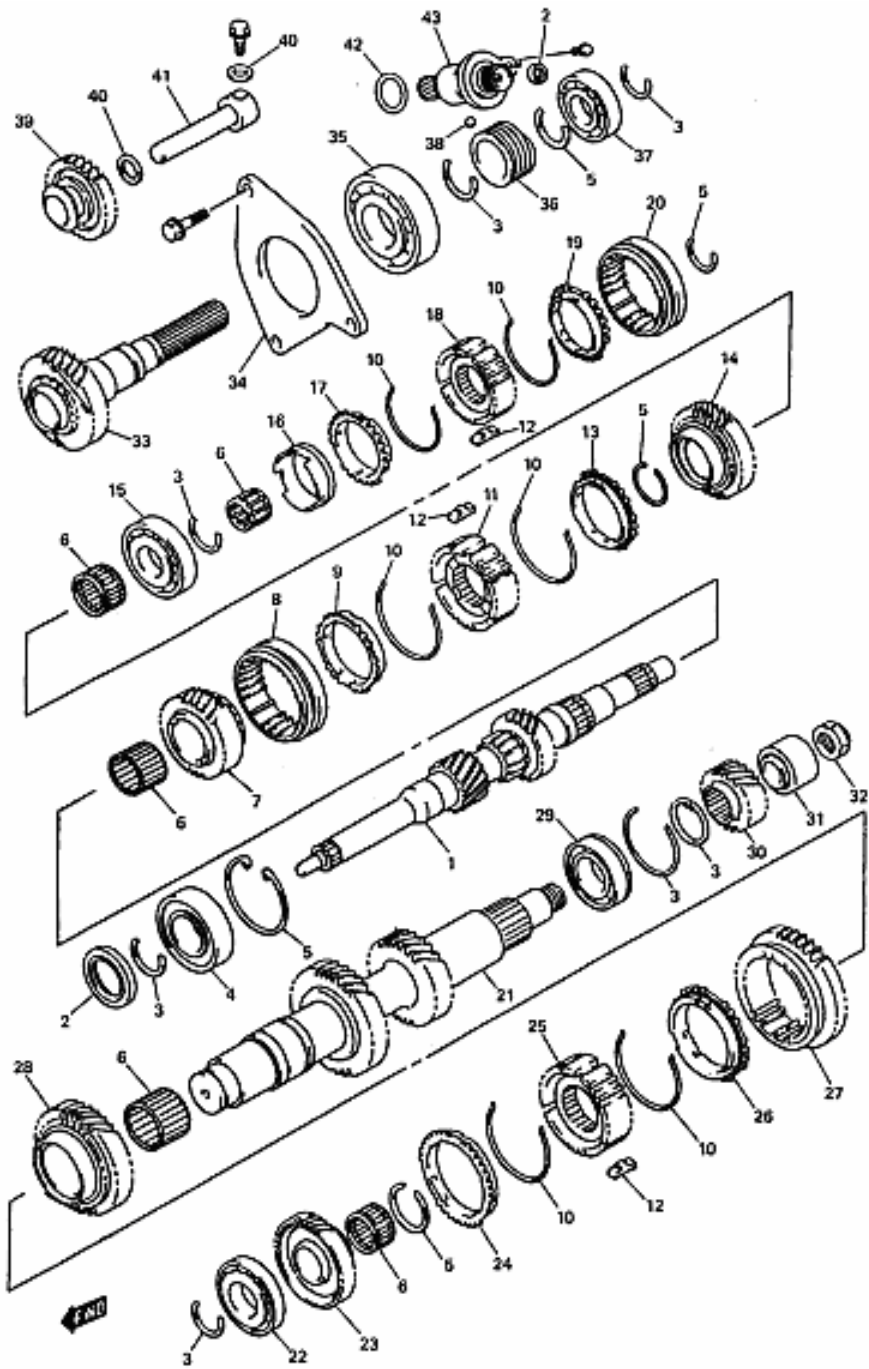
Shift setup and the optional shaft are fixed in the above of the transmission shell, with Cam to avoid shifting from the 5 TH gear straight to the stall of reverse. Maintenance must be used in the material of sealant manufacturer or equivalent with the sealant in the jointed surface of the aluminum gearbox. Tightening bolts with torque wrench to the required torque. Thoroughly cleaning all the parts and then assembling after they are dry.

### Trouble Diagnosis

Trouble	Trouble Analysis	The Way To Deal With
	<ul style="list-style-type: none"> <li>• Gear Shift Fork Wear</li> <li>• Gear Shift Fork or synchronizer Wear</li> <li>• The Flexibility of Spring decrease or damage</li> <li>• Bearing on the Input Shaft or the Main Shaft Wear</li> <li>• Chamfering Gear on the Gear cover and the Gear wheel wear</li> <li>• open spring circle</li> </ul>	replace replace replace replace replace the Gear Cover and Gear install
gear shift improper or	<ul style="list-style-type: none"> <li>• the flexibility of the synchronous spring weaken or break</li> <li>• the gear shift shaft or the gear shift fork distorted</li> </ul>	replace replace
gear shift improper	<ul style="list-style-type: none"> <li>• cultch pedal improper</li> <li>• clutch frication distorted or break</li> <li>• press board of the clutch damaged</li> <li>• synchronous gear wear</li> <li>• ridge gear of the gear cover and the gear wear</li> <li>• reversing shaft distorted</li> </ul>	adjust replace replace the cultch platen replace replace the gear cover and the gear replace

noise	<ul style="list-style-type: none"> <li>• the quantity of the lubricant oil inadequate or the kind of the oil improper</li> <li>• bearing wear or damaged</li> <li>• gear damaged or wear</li> <li>• synchronous gear ring damaged or wear</li> <li>• Inverse gear in the gear cover or gear damaged or wear</li> </ul>	<ul style="list-style-type: none"> <li>makeup or replace</li> <li>replace</li> <li>replace</li> <li>replace</li> <li>replace</li> </ul>
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## On board maintenance

### 1. Replacing the oil

- 1) Before changing or examine the oil, be sure of turning off the engine and uprising the automobile levelly.
- 2) After uprising the automobile, examine the amount of the oil and make sure whether the oil leaks. If it does leak, then make maintenance.
- 3) After discharging the waste oil, apply the airproof lubrication to the whorl part of the tuck

discharging oil and tighten it to the required torsion.

4) Adding required band oil according required quantity of oil. (until the level of the oil hole)

5) In accordance with the following provisions, tighten the tuck discharging oil and the tuck adding oil.

## Section 2 Four-speed Transmission

### Composition

Both the low-speed synchronizer and high-speed synchronizer are installed on the input shaft. low-speed synchronizer is meshed with the first or second gear wheel of the input shaft ,while high-speed synchronizer is meshed with the third or fourth gear wheel of the input shaft.

Gear change device and shaft are fixed on the speed aviator housing.

Maintenance should be adopted with the sealant of the same factory on the surface of the aluminum speed change device. Twist the screw to the ruled torque. Clean all the components, and assemble them after they are dried.

### Malfunction diagnose

Problem	Analysis	solution
Out of the gear	<ul style="list-style-type: none"> <li>• Gear change fork axes fretted</li> <li>• Gear change fork or synchromesh gear cover fretted</li> <li>• The elasticity of the stable spring has been weaken or damaged</li> <li>• The bearing on the input bearing or the main bearing fretted</li> <li>• The reverse gear on the gear cover and the gear fretted</li> <li>• Open spring ring dispatched or fall off</li> </ul>	<ul style="list-style-type: none"> <li>replace</li> <li>replace</li> <li>replace</li> <li>replace</li> <li>replace the gear cover and the gear ring</li> <li>install</li> </ul>
Can't change the gear or can't quit from the current gear	<ul style="list-style-type: none"> <li>• The elasticity of the synchromesh spring has been weaken or broken</li> <li>• The gear change bearing or gear change fork has been bent</li> </ul>	<ul style="list-style-type: none"> <li>replace</li> <li>replace</li> </ul>
noise	<ul style="list-style-type: none"> <li>• Not enough lubrication or not the right type</li> <li>• The bearing damaged or fretted</li> <li>• The gear damaged or fretted</li> <li>•</li> <li>The synchromesh ring damaged or fretted</li> <li>• The reverse gear on the gear cover or the gear damaged or fretted</li> </ul>	<ul style="list-style-type: none"> <li>supply or replace</li> <li>replace</li> <li>replace</li> <li>replace</li> <li>replace</li> </ul>

Examine the joggle of the gear according to the following method

- 1) After cleaning the gear surface of the driven gear, apply equally it with pigmentation (red lead) by brush or sponge.
- 2) Circumrotate the driven gear, making painted parts and the initiative gear joggle right, then circumgyrate the gear by hand, making it joggle repeatedly.
- 3) Examine the joggle way, consulting the up table. If the joggle way is abnormal, readjust or

change it according to the table shows.

**Notes:**

Don't circumrotate the driven gear more than one circle, because it will violate the exact of the examination.

**3. Assembly**

Assemble steps are opposite to the disassembly steps. Pay attention to the following requirements:

**Notes:**

Supply the initiative gear and the driven gear as a set of groupware. Even if there only needs to change the initiative gear or the driven gear, both parts should be changed as a groupware.

Transmission bolts of the driven gear

Fix the driven gear in the bolts of the differential Shell, which would bear cut stress, because the power in the driven gear is transmitted to the differential shell through bolts. Therefore, those specialized bolts should be made in chrome steel, not be replaced by normal bolts.

**"A": 99000—32020**

**(a): 80~90 N·m**

**Gear bearing**

Two roller bearings should be installed in the gear bearing, outer seat circle installed in the final differential shell and the inside seat circle installed in the gear bearing.

- 1) the outside seat circle of the front bearing (fork) should be installed by special implements:

**Special Implements**

**(A): 09913-75520**

- 1) the implements for installing the rear bearing ( gear side) **outside seat circle.**

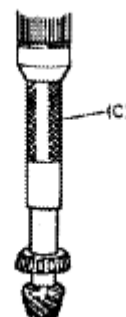
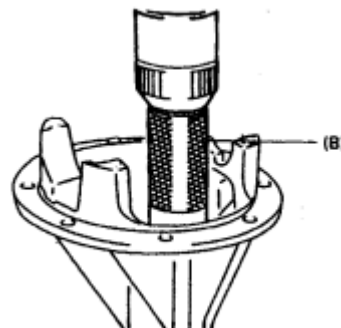
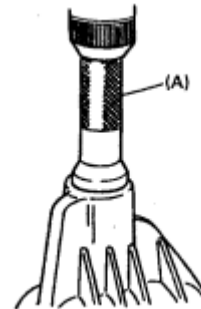
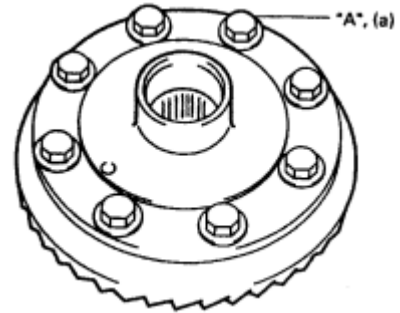
**Special implements**

**(B): 09915—75510**

- 3) The special implements for installing the **inner seat circle.**

**Special Implements**

**(C): 09940—51710**



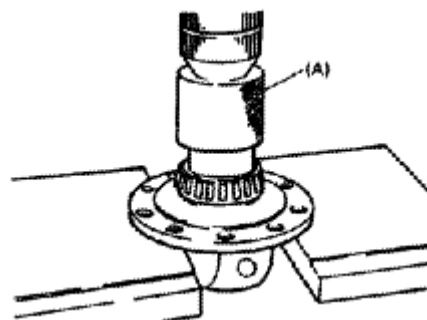


**Differential bearing**

Suppress the bearings to the inner of the differential Shell correctly with special implements, not allowing to knock the bearing into the inner of the shell.

**Special implements**

**(A): 09940—53111**



Special Implements

# Chapter 5 Suspension System

## Section 1 Front Suspension

### I. Components

The front suspension is Macpherson strut suspension as shown below. The top of strut is mounted to the vehicle body through a rubber mounting. The strut and the rubber mounting are connected through a rubber bracing. And a supporting bearing is fixed at the bottom of the rubber bracing.

The bottom of the strut is connected to the top of the steering knuckle. And the bottom of the steering knuckle is connected to the ballpin. The ballpin and the swing-bar are one set. The end of the tie rod is connected with steering knuckle.

So the act of the steering is transmitted to the tie rod before transmitting to the knuckle.

At last, they are transmitted to the wheels to make the wheels turn. During the whole courses, with the movement of the knuckle, the struts are turned through strut bearings and ballpins.

### II. Check And Adjustment

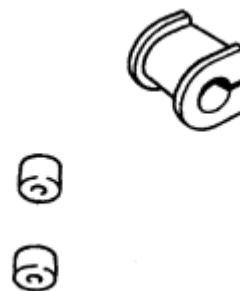
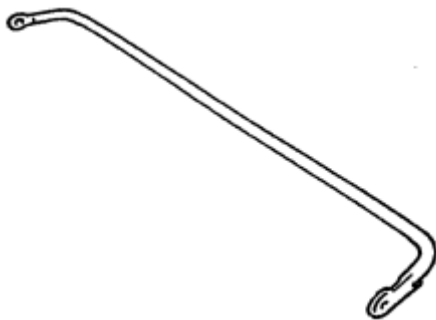
#### 1. Stabilizer Bar And Bushing

##### Stabilizer Bar

If it is spoiled or distorted, you should replace it.

##### Bushing

Check whether it is spoiled or worn, you should change it if it is.



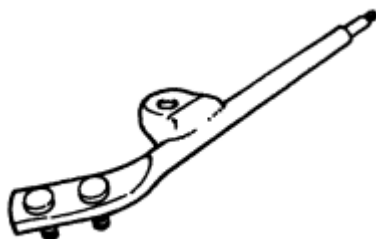
#### 2. Reinforcer And Bushing

##### Reinforcer

If it is spoiled or distorted, you should replace it.

##### Bushing

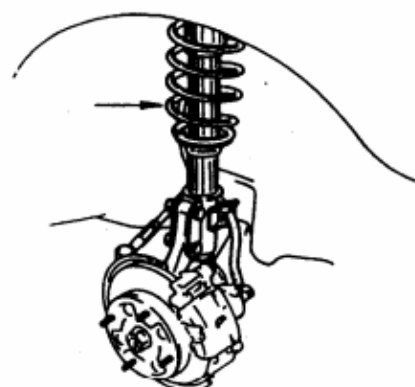
Check whether it is spoiled or worn. If it is not working fine, you should change it.



#### 3. Check The Front Struts

1) Check whether there is leakage from shock absorbers, there is, you should change it as they are not detachable

2). Check the pressure of the tyres according to the manual. Push the side-front to make the vehicle sway three to four



if

times continuously. Try and control the pushing at the same power and pay attention to the performance of the shock-absorber. you should count the times the vehicle sways as you stop pushing. To check shock-absorber of the other side, just repeat the act above. Compare the performances and the times the shock absorbers rebound. The performances should be the same. If the shock-absorbers are normal, the vehicle may stop swaying when you stop pushing. You can compare the performances with other vehicles whose shock-absorbers are good as well.

- 3). Check the shock-absorbers whether they are spoiled or distorted.
  - 4.) Check the bearings whether they are worn, making abnormal noise or blocked.
  - 5). Check the bracket if there are cracks or distortion.
  - 6). Check the bafflers if they are spoiled
  - 7). Check the bafflers and strut fixing units if they are worn, distorted or there are cracks.
- During the step 2)-7), you should change the parts if they are abnormal.

#### 4. Check The sway Bars And Knuckles

Check if there are cracks, distortion or spoilages.

#### 5. Check the bushings of the sway bar.

Check whether they are spoiled or worn.

#### 6. Check ballpin of the sway bar

- 1). Whether they are turning smoothly.
- 2). Whether the kingpin ball joint if they are good
- 3). Check whether the dust-proof covers are spoiled.
- 3) Check whether the dust-proof covers are spoiled.
- 4). Check the windage of the ball joint, if it is abnormal, you should change it.

#### Attention:

The sway bar and the kingpin are not detachable

Either the sway bar or the ball joint is spoiled, The whole sway bar assembly should be changed as a set.

#### 7. Check the tyres, nuts and bearings.

- 1). Check all the tyres if there are indentions, distortion, cracks. Any seriously-spoiled tyres should be changed.
- 2). Check if all the nuts are fixed well. Fix them according to the manual if necessary.

#### Torque

(a): 85N·m

- 3). Check the wear degree of the wheel bearing. When checking the clearance, loose the axle-cover from the axle before measuring it with a vernier caliper .

#### Max. Clearence " a " :0.1mm

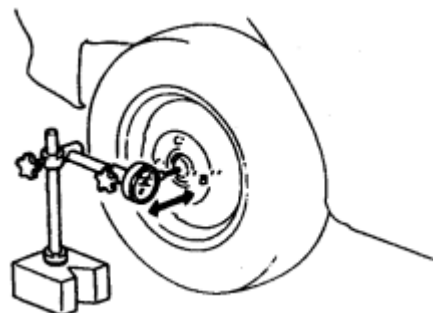
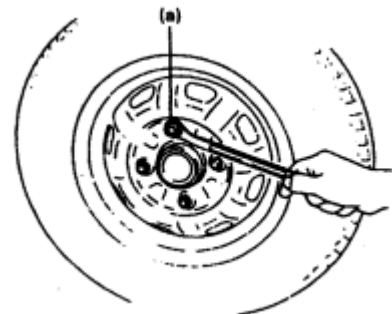
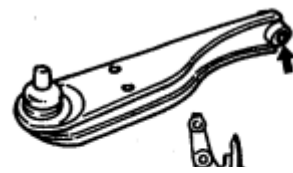
If the measured value is out of the maximum value, should change the hub assembly.

- 4). Rotate the wheels to check whether it makes noise rotates smoothly. Change the hub assembly if it is abnormal.

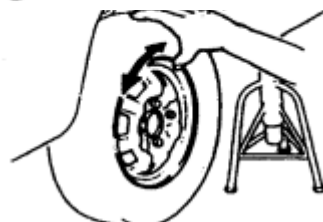
### III. Maintenance

#### 1. Stabilizer Bar and Bushing.

Disassembly



you  
or  
4)



- 1) Jack up the vehicle.
- 2) Loose the nuts and washers.
- 3). Loose the bolts from bushing bracket.
- 4). Loose stabilizer bar and tie-in.
- 5). Loose the tie-in from the stabilization bar. When loosing the tie-in nut, nip the bolt with spanner.

**Fixing**

Fix all the parts loosely so that you can assure the right position of the stabilizer bar.

**Attention:**

Make sure the paint-mark and the busing are in line to ensure thr right fixing of the stabilizer bar as shown left.

Tighten the bolts and the nuts according to prescribed torque

**Attention:**

Pay high attention when tightening the stabilizer bar to make sure the underlay and the washer are well fixed.

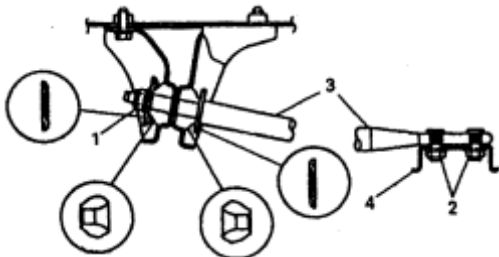
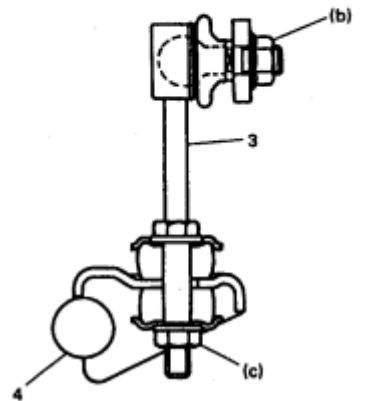
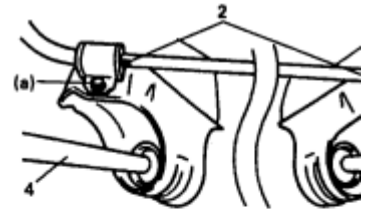
**Torque**

- (a); 25 N·m
- (b); 50 N·m
- (c); 23N·m

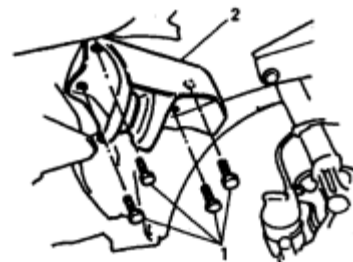
**2. Reinforcer And Bushing**

**Disassembly**

- 1) Jack up the vehiecle.
- 2) Loose the stabilization bar (Refer to “loose down stabilization bar bushing
- 3) Loose the front and the back screws.
- 4) Loose the stabilizer bar.
- 5) Loose the bracket.



**1. Front screw 2 Back Screw 3. stabilization Bar 4. Swing Bar**



**1. Bolt 2. Bracket**

**Fixing**

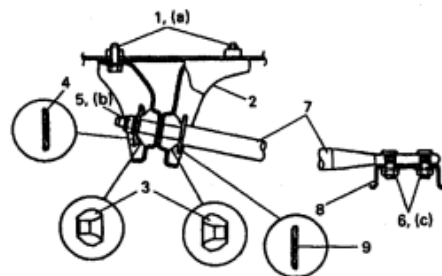
It is reverse order of disassembly, pay attention to issues mention below:

Take reference from the let illustration.

Use new rear screw.

Tighten all the bolts and screws according to described torque.

**Toruqe**



(a); 55 N·m

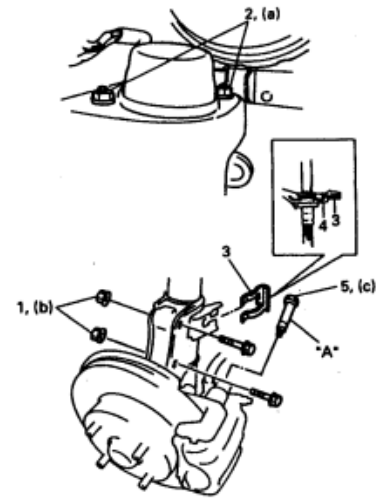
(b): 65 N·m

(c): 95N·m

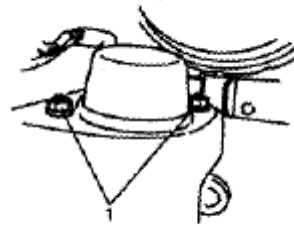
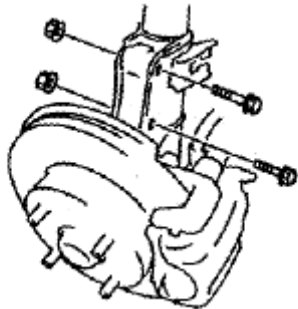
### 3. Front Strut Assy

Disassemble it as follows :

- 1). Remove the negative from the battery.
- 2) Jack the vehicle.
- 3) Remove the tyres.
- 4) Remove the E-ring which is used to fix the brake pipe, loose down the pipe from the bracket as shown from the illustration.
- 5) Loose the bolt of caliper and slant the caliper as shown the illustration.
- 6) Remove the bolt of wiring harness for the speed sensor.
- 7) Loose the bolt of bracket.
- 8) Loose the bolt of support unit, and hold it with care in case of damage.
- 9) Remove the strut assy.



in



1. 螺母

### Fixing

- 1) It is reverse order of disassembly 1)–9). Fix a screw in the position shown from the illustration.
- 2) Tighten all the bolts and screws according to the described torque.

### Torque

(a); 73 N·m

(b): 95 N·m

(c): 35 N·m

### 4. Hub And Spiaral Pole

#### Disassembly

- 1) Lift the vehicle and remove the wheels.
- 2) Remove the axis cover as shown from the illustration ( Knock the cover properly for three times. Don' t spoil or distort the seat of the cover).
- 3) Loose the nuts of the axis.
- 4) Remove them.
- 5) Loose down the nuts of caliper bracker.
- 6) Remove the caliper together with the bracket.

#### Attention:

Hang the removed caliper with metal hook to avoid damage against the brake pipe.

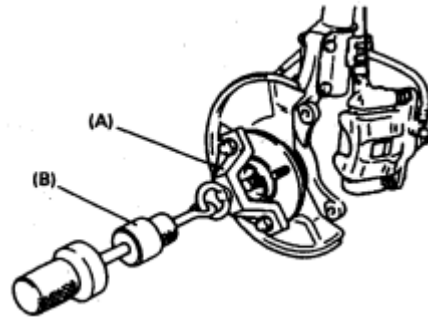
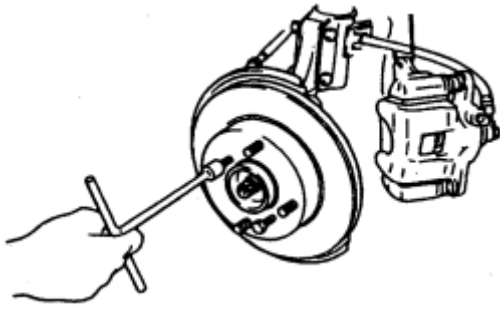
Don' t match the brake pedal when the brake pads are removed.

- 7) Remove the brake disk with two bolts of 8mm.
- 8) Remove the wheel-hub with special tools.

## Special Tools

(A): 09943—17912

(B): 09942—15510



9) Remove the bolts of the wheel-hub.

### Attention:

Don't lose the bolts except for changing new parts. Be sure of using new bolts when changing parts.

### Fixing

#### Fixing Of bolts Of Wheel-Hub

Insert the new bolts into the slot of wheel-hub. Turn Properly to make sure the tiny-teeth accord with the former ones.

1) Fix the axis cover and tighten the bolts as described below.

### Torque

(a): 175 N·m

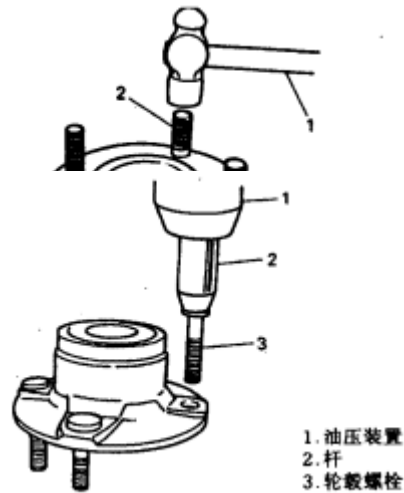
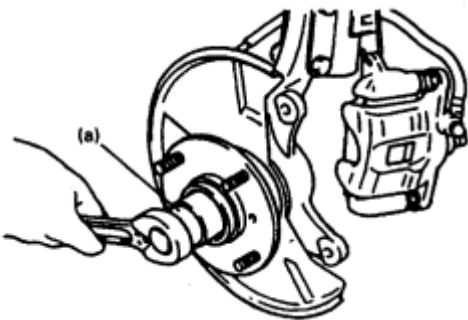
2) Fix the brake pads.

3) Fix the caliper and it's bracket.

4) Tighten the bolts to the described torque below.

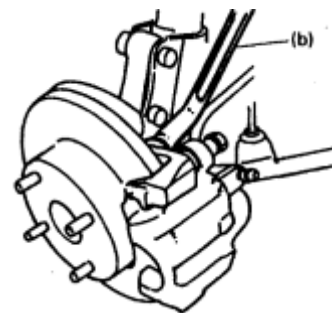
### Torque

(b): 95N·m



除

it



5) Tighten the nuts of the wheel-axis as shown in illustration.

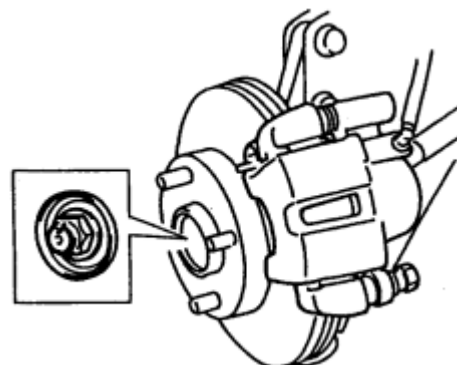
### Warning:

Tighten the nuts properly to avoid cracks. Any cracked nuts must be changed.

6) Fix the axis cover.

7). Fix the tyres and lower the vehicle.

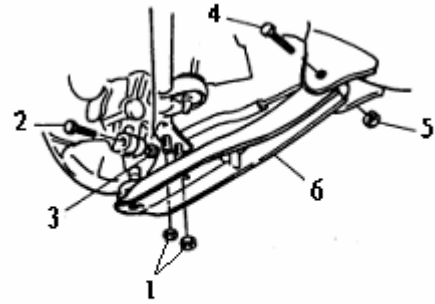
## 5. Swing Bar and Bushing



the

**Disassembly**

- 1) Lift the vehicle and remove the wheels.
- 2) Remove the front screw of reinforcer from the swing bar.
- 3) Remove ballpin and the nuts.
- 4) Remove the bolts and nuts of swing bar.
- 5) Remove the swing bar.
- 6) Removal of bushing



- |          |         |
|----------|---------|
| 1. 压杆前螺母 | 2. 球头销  |
| 3. 球头销螺母 | 4. 摆臂螺栓 |
| 5. 摆臂螺母  | 6. 摆臂   |

**Special Tool**

**(A): 09943—77910**

**Fixing**

- 1) Fixing of bushing

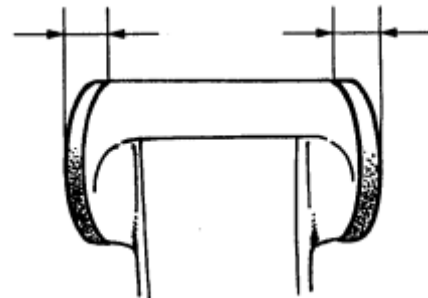
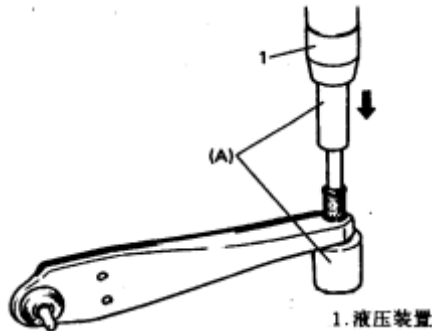
**Special Tool**

**(A): 09943—77910**

**Attention**

Wipe suds around the bushing to get easier fixing.

Finished fixing should be upsides as shown from the illustration.



- 2) Fix the strut to the sway bar. Refer to the illustration to make sure the direction of the nuts and bolts is right.

**Attention:**

The nuts should be loose.

- 3) Fix the ball joint to the knuckle. Set the slots of the ball joint and the bolts of knuckle well as show from the illustration. And tighten the bolts according to the described torque below.

**Torque:**

**(a): 55 N·m**

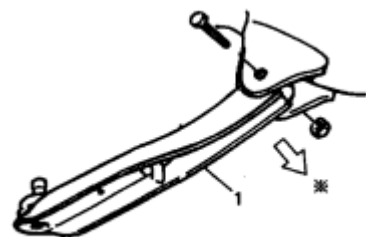
- 4) Tighten the front bolt of reinforcer according to the described torque below.

**Torque**

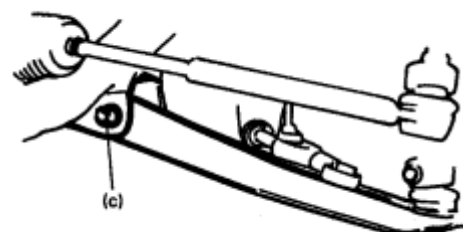
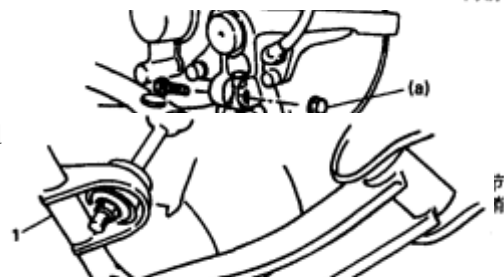
**(b): 95 N·m**

- 5) Fix on the tyre and tighten the screw according to the desciebed torque. Refer to “ Torque technical standard” of section.

- 6) Lower the vehiecle to the ground. And tighten the



1. 摆臂  
※: 向前



this

butts of the sway bar according to the described torque under the condition of non-loading.

**Torque:**

**(c): 73N • m**

7) Check and adjust the toe-in according to the manul.

**6. Knuckle**

**Disassembly**

- 1) Lift the vehiecle and remove the tyres.
- 2) Remove the wheel-hub. Refer to “Disassembly” of “Hub/ tyre bolt” order 2)-8) from this section.
- 3) Remove the knuckle from the tie-rod.
- 4) remove the sppd-sensor from the knuckle (If there is).
- 5) Remove the ball joint from knuckle. And then loose down the bolts of the bracket.
- 6) Remove the knuckle.

**Fixing:**

- 1) Fix the knuckle to the sway-ar and the stut. Match the slots and the bolts well, and fix the bolts of ball joint. Tighten the bolts and the nuts according to the described torque below.

**Torque**

**(a); 95N-m**

**(b): 55N-m**

- 2) Fix the speed-sensor (If there is).
- 3) Cnnect the tie rod with the knuckle, and tighten the nuts of the tie rod to the described torque below. 3)

**Torque**

**(c): 45 N-m**

**Attention**

When tightening the nuts of tie-rod. Boost up the end of tie rod with jack to stop the rotation of the knuckle.

- 4) Follow the fixing order above. Take reference from “wheel hub/wheel bolts” 1)-7)

**7. Bracket Of Strut**

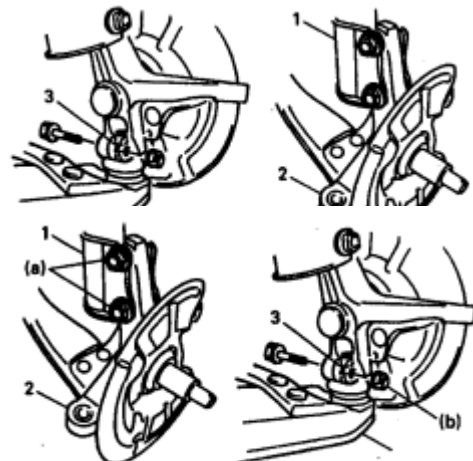
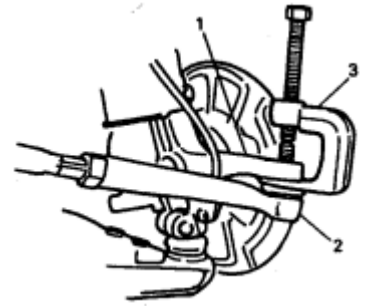
**Disassembly**

- 1) Jack up the vehiecle and remove the tyres.
- 2) Remove the swar-bar (L&R). Refer to “Disassembly Of Sway Bar” of this section
- 3) Remove the fixing-bolts of turning-gear box.
- 4) Remove the wire-harness of speed-sensor. (If there is)
- 5) Remove the bracket of the strut.

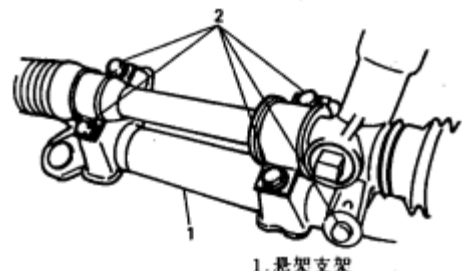
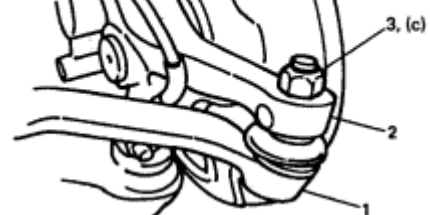
- 1) Fix the bracket of the strut and tighten the bolts to the described torque.

**Torque**

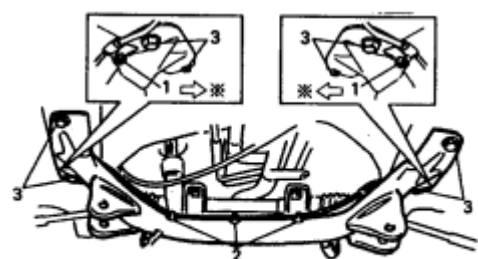
**(a): 95 N-m**



1. 支柱  
1. 横拉杆端  
2. 转向节  
3. 螺母



1. 悬架支架



1. 车轮转速传感器线束夹  
2. 车轮转速传感器线束夹子  
3. 悬架支架螺栓  
※: 车轮侧



2) Fix the wire harness.

3) Fix the bolts of the turning-gear box. And tighten the bolts according to the described torque

**Torque**

**(b): 25 N·m**

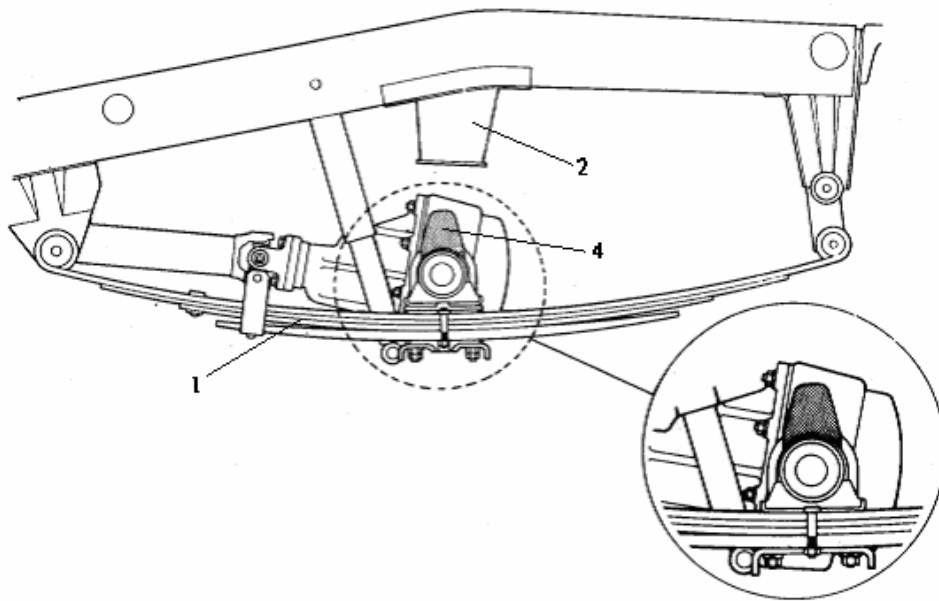
4) Fix the sway bar (L&R), refer to “Fixing of the sway bar” of the section 2)-6).

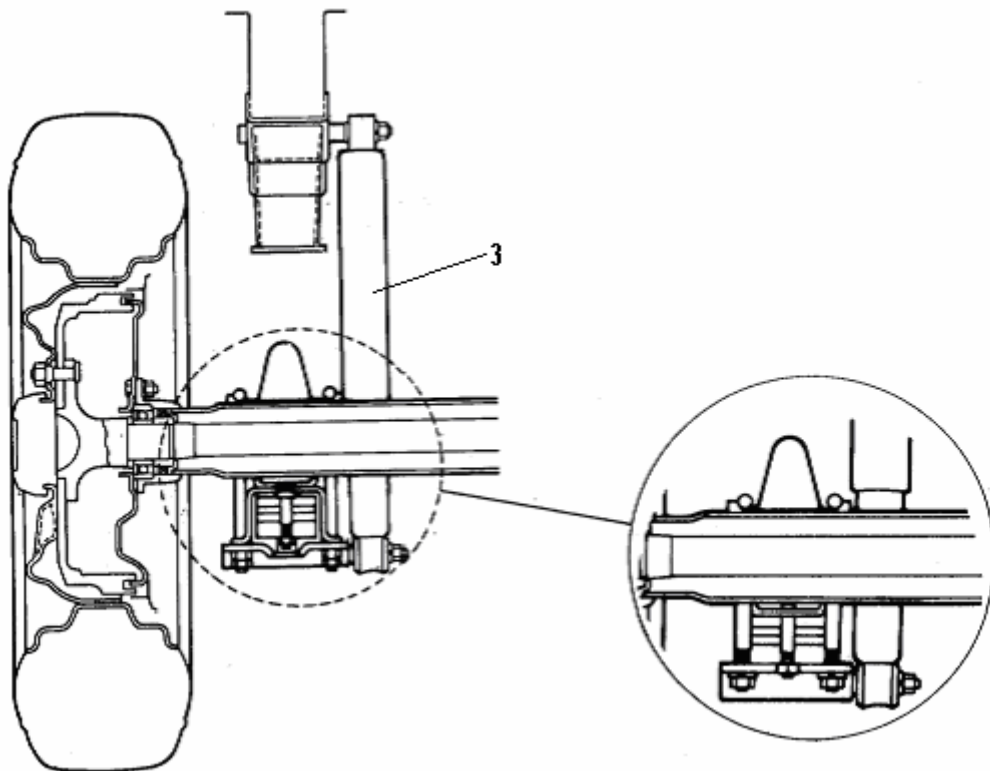
5) Check the alignment of the tyres.

## Section 2 Rear Suspension

### I. Components

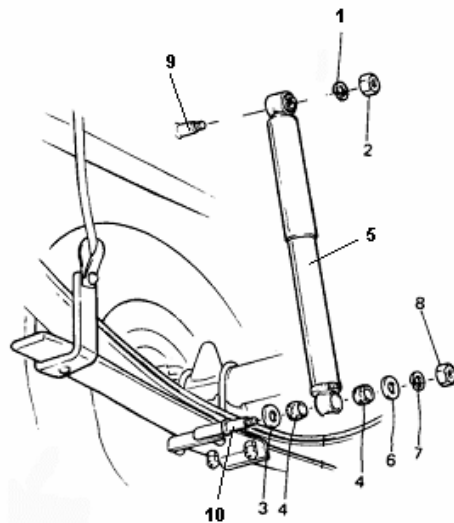
The rear suspension is unit frame beam axle type which uses leaf springs as shown from illustration below.





1. Leaf Spring 2. Limit Stop 3. Telescopic Shock Absorber 4. Bumper

**II. Disassembly And Fixing**



1. Lock Washer 2. Bolt (Top Mounting) 3. Washer 4. Bushing, Shock absorber 5. Shock Absorber  
6. Washer 7. Lock Washer 8. Bolt (Bottom Mounting) 9. Bolt, Top Mounting 10. Bolt, Bottom Mounting

2. 1. Shock absorber

**Disassembly.**

- 1) Jack up the vehicle.
- 2) Remove the bolts of bottom bracket.
- 3) Remove the shock absorber.

**Fixing.**

- 1) Refer to the illustration below and fix the shock absorber.
- 2) Tighten the bolts.
- 3) Lay down the jack

## 2. Leaf Spring2.

### Disassembly

#### Leaf Spring

1) Lift the vehicle. When operating, don't touch the rear suspension or suspension-related elements with jack or lift. When using jack, put a security platform under the chassis to support the lifted vehicle.

#### Attention:

Don't hang the rear axle housing on the brake pipe. Otherwise, the brake pipe may be torn.

To avoid it, make use of safty block to support the rear axle housing.

2) Remove the rear tyres and release the catch hoop.

4) Remove the lifting eye and front nut of spring leaf.

5) Draw out the bolt and remove the leaf spring.

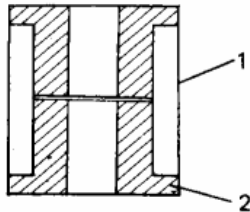
#### Fixing.

Bushing of lifting-eye pin.

Press the bushing into the mate-member. Wipe some suds on the bushing to make it easier.

#### Attention:

Don't wipe any oil on the bushing.



### 1. Leaf spring 2. Bushing

#### Leaf Spring

1) Fix the pin of the lifting-eye from the center of the vehicle outward.

2) Fix the front bolt of the leaf spring inward.

3) Fix the central bolt and nut of the leaf spring. Then tighten the bolt according to the torque.

4) Tighten the screw and bolt of the lifting eye according to the torque when it is no load.

5) Connect the hand brake by catch hoop.

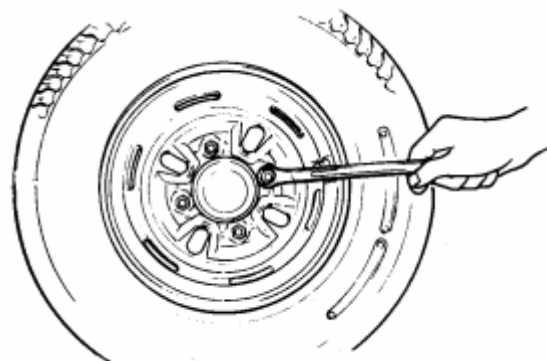
6) Fix the wheel and tighten it according to the torque.

## 3. Wheel bearing and shaft.

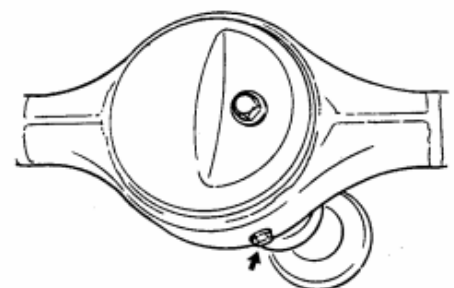
### Disassembly

1) Check wheather the hand brake is released.

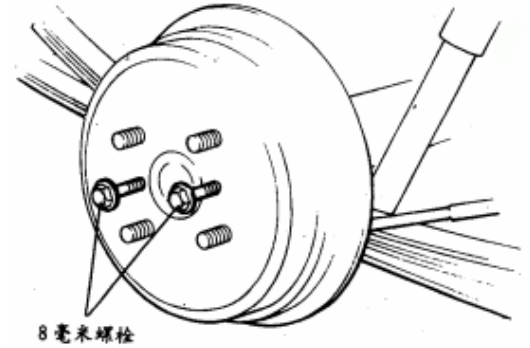
2) Jack up the vehicle and remove the rear tyres.



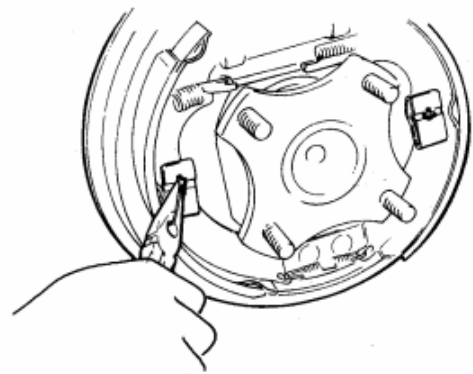
3) loose the oil drain cover and leak the oil from the rear axle housing.



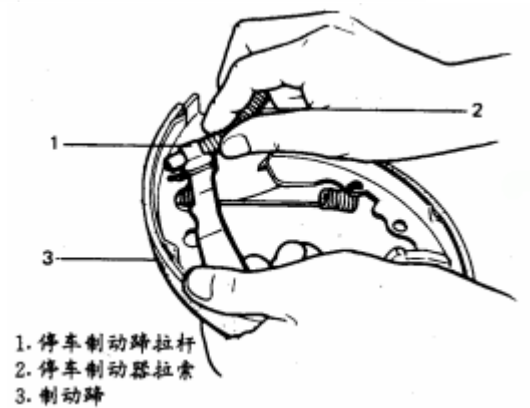
- 4)Loose the hand brake.
- 5)Draw out the brake drum with 8mm bolt.



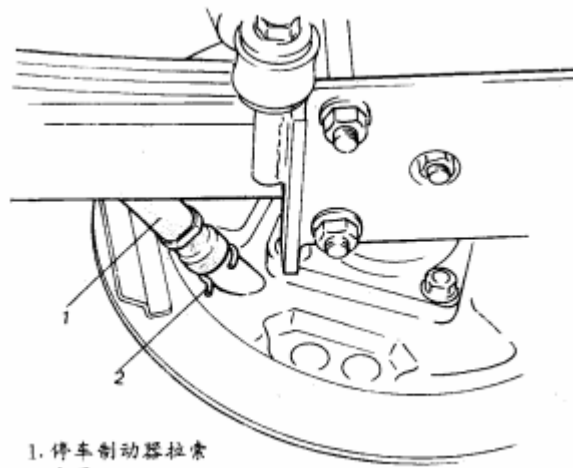
- 6) Rotate the lock pin of brake disk and remove the lock spring as shown from the illustration.



- 7)Release the hand brake and remove brae shoe.



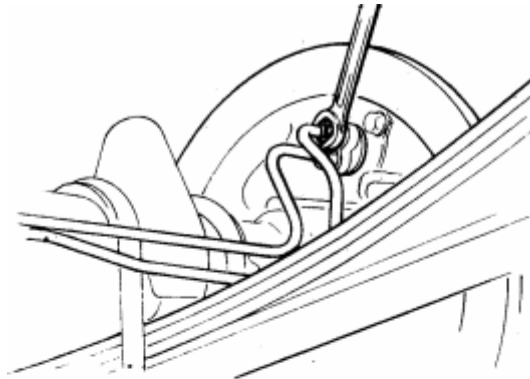
- 8)Remove the hand brake cable from the chasis.



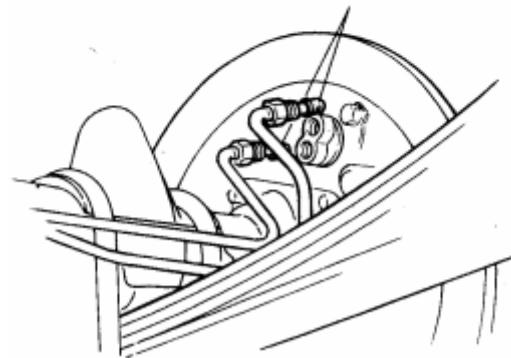
1. 停车制动器拉索  
2. 夹子

1. Hand-brake cable      2. Clip

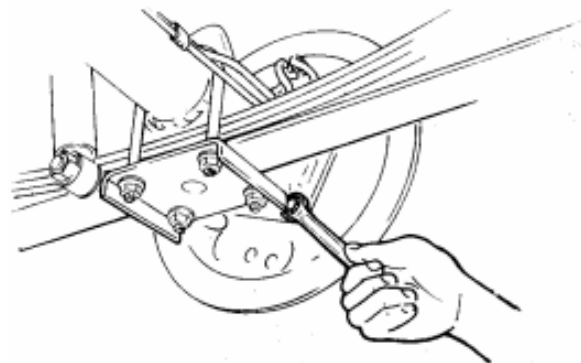
9) Draw out the brake oil. Then detach brake pipe from brake cylinder. Cover the head of the pipe to avoid the leakage of the brake oil.



↓ 通气螺塞盖



10) Detach the nuts of base-plate of brake from the rear axle housing.



11) Use special tools (A&B) to draw out the differential axle with brake base plate.

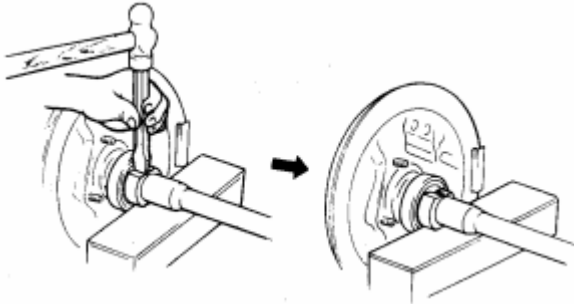
12) Draw out the wheel axle.

13). In order to loose closing ring from the wheel axle, make use of muller to rub the parts of the closing ring until it is thin enough.

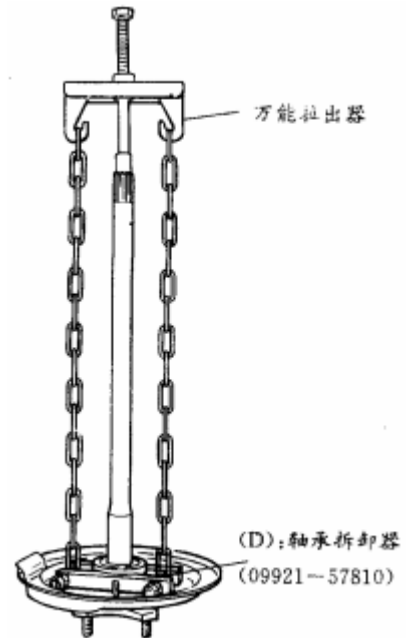
Attention: 小心:

Be careful with the rubbing to avoid injury against axle.

Open the rubbed place with chisel and remove the closing ring .



14) Use special tools (C&D) to loose bearing from axle , then detach the brake base-plate.



Fixing.

1) Fix the parts below to the wheel axle.

Attention:

. Pay attention to the fixing of the bearing spacer.

. Pay attention to the fixing of wheel bearing.

Bolts of the Hub.

When fixing, make sure the head is tightly fixed within step of the wheel axle.

2) use oil press to press down the new bearing and closing ring.

Attention:

Protect the surface of closing ring from spoilage.

Otherwise, oil may leak from differential carrier housing to the brake pad.

When pressing down the closing circle, use 3-5 tons of power.

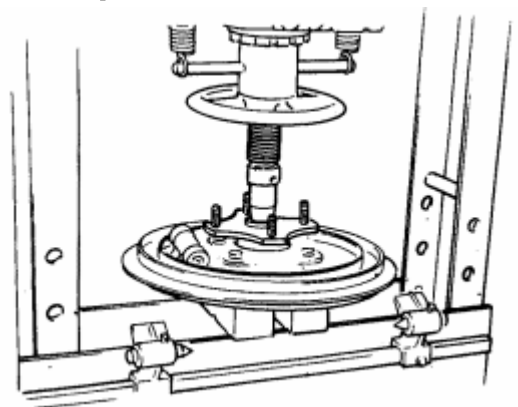
3) When the closing circle is well contacted with the bearing, clean the bearing and wipe enough grease on the closing circle.

4) Check and make sure oil-seal and oil-seat enter the rear axle correctly.

Attention:

Use new oil-seal when fixing even if the old oil-seal does' t leak.

Take reference from right illustration. Wipe super grease A(99000-25010) on the oil seal retainer.



5) Wipe water-proof seal-glue between rear axle and base-plate of brake.

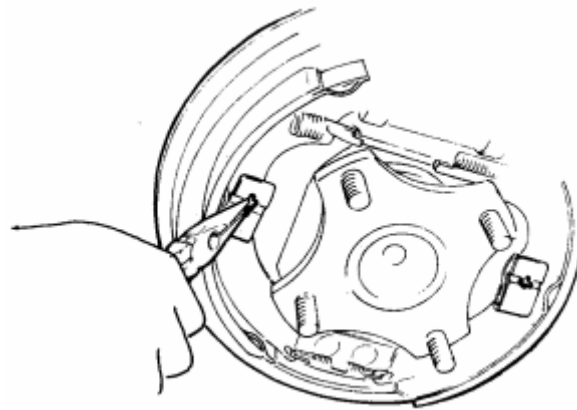
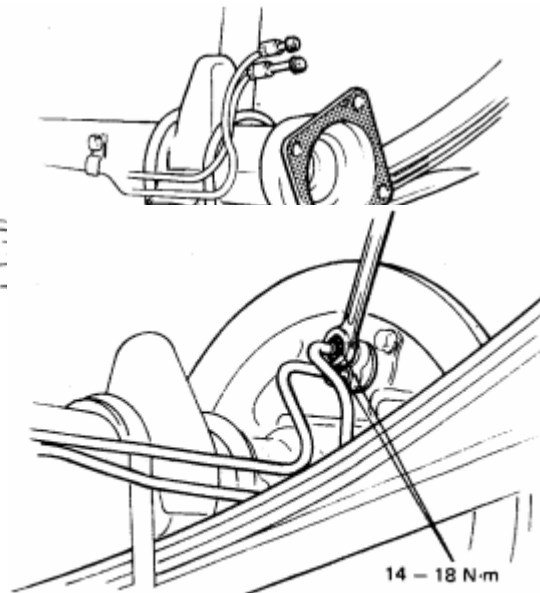
6) Fix the rear axle into rear axle housing before tightening the brake base plate according to the described torque.

7) Connect the brake pipes with sub-cylinder and tighten the nuts according to the described torque.

8) Wipe water-proof seal glue at the joint of the iron board and the steel wire. And clip the brake cable under chassis.

9) Connect the cable with the brake arm and fix the brake pads.

**Attention:**



10) Before fixing the brake drum, in order to maximize the clearance between brake shoe and brake drum, use screw driver to remove the ratchet wheel as shown from the illustration.

11) Fix the brake drum.

12) Top on enough oil for the rear axle housing and tighten the filler screw and drain screw according to the described torque.

13) Discharge the air from the brake pipe. And refill brake fluid.

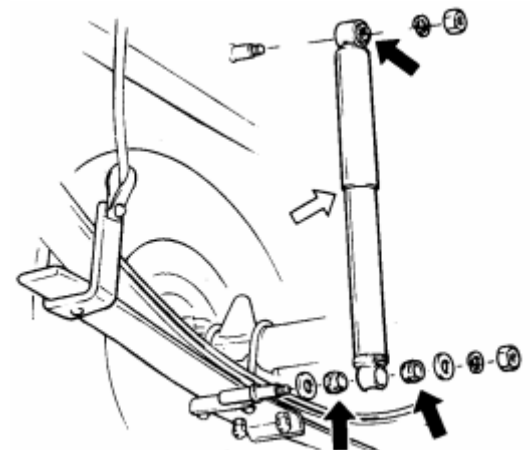
14) Fix wheels and tighten the screws according to the described torque.

**Torque: 50-80N. m**

15) When the job is complete, match the brake pedal 2-3 times with power of 20-30kg to get proper clearance between brake drum and brake shoe.

16) Check the brake drum whether there is disturbance or not to get proper brake effect. Then do brake experiment.

17) Check whether there is leakage from differential or brake cylinder.



### III. Repair

### Rear Shock-Absorber

- 1) Distortion and spoilage.
- 2) Check the bushing.
- 3) Check whether there is leakage.

Change the parts which are abnormal.

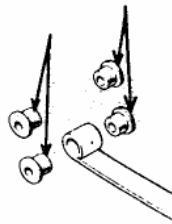
### Leaf spring and cushioned stop

Check whether there are cracks or spoilages. Change the abnormal ones. Meanwhile, the cushioned stop should be fixed in the proper position. Otherwise, it should be replaced.

Bushing of leaf spring.

Check whether it is worn or spoiled. Change the abnormal ones.

If the bushing is normal while it is making noise when running. Detach the bushing and wipe grease at the position shown below.



### Disc, nuts and bearing.

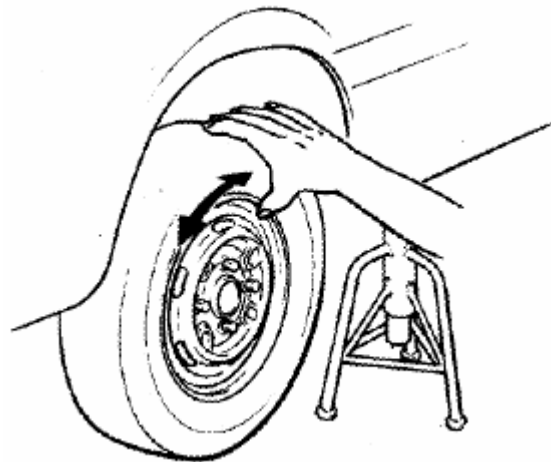
- 1) Check whether it is concave, distorted or cracked. Change the seriously spoiled disc.
- 2) Check the nuts and tighten them if necessary.
- 3) Check the wear degree of the bearing. When checking the axial clearance, remove the central cover of the disc and set an indicating-gauge on the hub.

**Torque of wheel nuts: 50–80 N · m**

**Max axial clearance: rear wheel 0.8mm.**

Change the bearing if the measured value exceeds the max value.

- 4) Rotate the wheel to check whether it is making noise or working smoothly. Change the abnormal bearings.

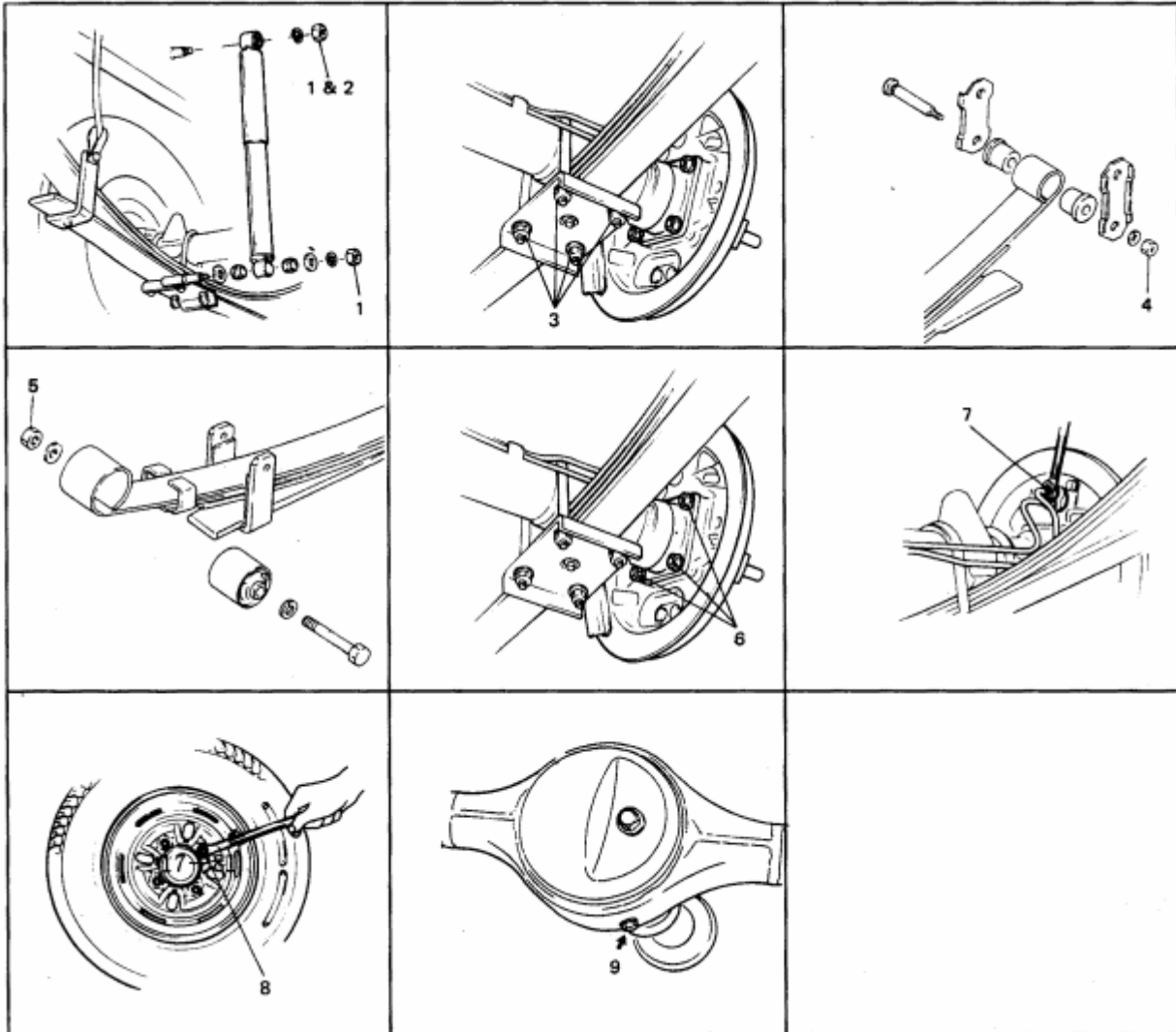


### IV、Torques of fastening elements

Fastening Elements	Torque (N · m)
1. Bolts of shock absorber.	10—16
2. Top bolts of shock-absorber (Mini-van and Npv only.)	22—35
3. Nuts of u-shaped bolt.	30—45
4. Bolts of lifting eye.	30—55
5. Front nuts of leaf spring.	45—70
6. Nuts of rear brake.	18—28



7.Connecting nuts of brake pipe.	14—18
8.Nuts of rear wheel.	50—80
9,Drain screw of rear axle housing.	40—70
10. Filler screw of rear axle housing.	35—50



## Section 2 Wheels and Tyres

### I.Components

#### Attention:

All the closing elements are very important to the vehicle. They even affect the performance of some key parts. It can cause high upkeep. If it is time to change them, you should replace them by the same and equivalent parts instead of inferior ones. Also it is important to tighten them according to the torque described in the manual.

Don't weld these elements to avoid spoilage or reduce the intensity of the metal.

#### 1. Tyre. 1

Tyre type of the vehicle:165/70R14.

It is tubeless tyre. When inflated according to the described pressure, it can work normally at the maximum loading.

Appropriate pressure and driving habit affects the life-span of the tyres awfully. Sudden turn, sudden acceleration and unnecessary sudden brake may increase the wear degree.

**2. Wheel2.**

The hub of wheel is either stealiness or aluminum: 13\*41/2J.

**3. 3. Tyres For Replacement**

Use the same tyres as old ones. Refer to the tyre schedule. The size, structure and the load-range of the new tyres should accord with the old tyres. Otherwise, the tyre may affect operation, speedometer, odometer, tyre chain ,ground learence and the clearance of body and chasis.

**Attention:**

Don't use different tyres in one vehiecle except an emergency. Just as radial-tyre or belted-bias-tyre. Otherwise, it will seriously affect the operation of the vehiecle. More seriously, the vehiecle would be out of control.

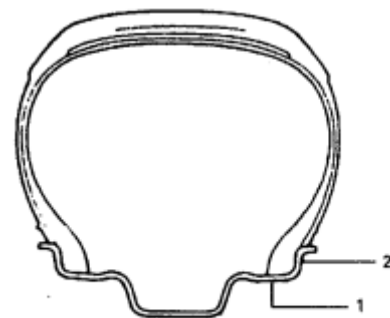
We advise to fix a pair of new tyres for the same axle. If you just change one tyre, you should match the new tyre with the newer one of them as a pair to get a better traction. The metric unit of tyre-pressure is Kpa.

The meter ofc tyre pressure is available from tool distributors. The conversion between Kpa, Kgf/ cm<sup>2</sup> and psi is listed from right for reference.

kPa	kgf / cm <sup>2</sup>	psi
160	1.6	23
180	1.8	26
200	2.0	29
220	2.2	32
240	2.4	35
260	2.6	38
280	2.8	41
300	3.0	44

**4.Chage The Tyre**

If the tyre is bent, hollow, the lateral misalignment or the radial motion is too much, there is leakage from weld line, the screw is elonged, or eyescrew cap is loose or badly rusted, the tyre must be changed. If the jerking-motion -value of the lateral misalignment or the radial motion is higher than the one below, the tyre may cause harmful boboing.



The new tyre should accord with the old ones in Loading capacity, radius, off-set of the rim and the fixing structure.

Unproper tyre in size and type may affect the life-span of the wheels and axles, cooling system, speedometer, odometer, ground learence and the clearance of body and chasis.

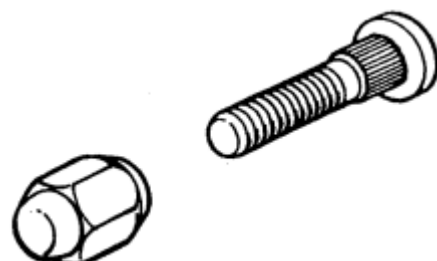
It is necessary to make use of an exact indicating gauge to check the value of jerking-motion. The tyre can be either looed or fixed. Tyres should be fix on the dynamic wheel balancer to get an exact result.

To measure the vzlue of jerking-motion inside and outside rim. Place the indicating gauge well and roatate the wheel round then note down the reading.

Change the tyre when the value is over the prescribed and no way of adjustment through dynamic wheel balancer. Reaing caused weld-line, coating or cruise can be neglected.

	(Max. radial motion)	(Max. lateral misalignment)
(Steeliness Wheel)	1.14mm	1.40mm

**5. Metric eye-screws and wheel bolts5.**



All the vehicles use metric eye-screws and wheel bolts (Model: M12\*12.5).

## II. Trouble Diagnosis

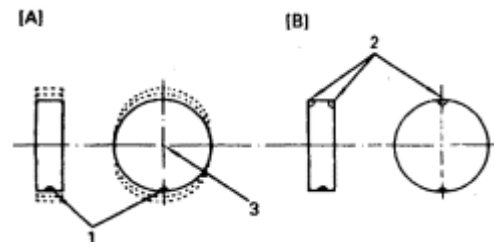
### 1. Trouble Diagnosis Table.

Refer to Section one Chapter five

### 2. Balance

[A]: Before Balancing

[B]: After Balancing

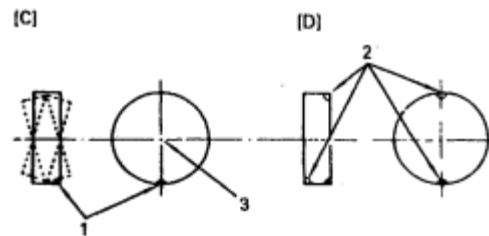


1. Jerking caused by faulty tyres.
2. Location of balance plate.
3. Central line of axle

There are two types of balances for tyres and wheels: static-balance and dynamic-balance.

Static-balance, as shown from the right illustration: it distributes the weight equally around the tyre. Non-static-balance can cause wheel houncing called wheel hop. And it also wears the tyre unequally.

Danamic balance as shown from the right illustration. It distributes the weight eaully two sides of the wheel central line. When the wheel rotates, it does not swing. Non-danamic-balance can cause the wheels swing. Not all the static balance wheels are danamic balance.



### Balance Examinatin Procedure

Clean the inside of the rim.

### Warning:

Remove stones from the groove to avoid injury of the operator and obtain a better balance of the vehicle.

**Check wheather there is damnification with the tyre. And do the balance examination according to the rules of equipment manufacturer.**

Adjust the balance from balancer.

Most of the electronic balancer are more accurate than rotary balancer. With easier operation, it offers dynamic (two planes) balance. Althoufh it doesn' t amend the brake drum and brake disk, the accuracy can overcome the limitation. It' s accuracy is always whin 0.044kg.

### Balance-Adjustment.

Methods of balance-adjustment differs among the different tools and manufacturers. Follow the instructions of the manufacturers.

### Warning:

Limit the speed within 55km/h. Because of the functions of differentia and planetary gears, it is necessary to limit the speed. The speedometer can only indicates half of the real speed when power wheels rotating one side.

Pay special attention when setting the rotating speed of the power wheels. If the spped is too high, the tyres or the differentia may be spoiled, furthermore, it may cause serious human-injury or spoilage of the vehicle.

## III. Maintenance And Small-Range Adjustment.

## 1. Wheel and Tyre.

Don't use weld, heating or blast to repair any wheels. All the spoiled wheels should rereplaced.

### Bolts.

Any spoiled bolts should be replaced.

### Build-up Wheel and Tyre

Tyres and wheels are built-up from factory. Tyre and wheel are fixed as a unit when doing balance examination. The tyre and the wheel are marked with paint to avoid the spoilage of the dynamic balance. Align the tyre well with paint mark when fixing the tyre.

Before removing the tyre, draw a line on the tyre and the wheel in case of uncertainty about the paint mark. And it is necessary for insuring the right position.

### Tyre-Pressure.

For all types of tyres, their advised pressures are fixed through accurate calculation in order to obtain satisfied operation, stability, steering, tread wear, life span and cracks.

Tyre pressure, when the tyre is cool (three hours after parking or less than 1.6km driving). They are supposed to be checked once in a month or before any long journey. Adjust the tyre pressure according to the tag in the vehiecl-door 8kpa when the tyre is hot.

After parking, don't deflate the tyre or reduce the tyre.

### Higher pressure than advised may cause:

1. Hard-driving and reduced comfort.
2. Tyre crack, spoilage of tyre case or even burst of the tyre.
3. Accelerate the wear of the central tread of the tyre.

### Different tyre pressure in the same axle can cause:

1. Odds in brake.
2. Steering deviation.
3. Reduction in operation.
4. Deviation when accelerating.

Cover the valve to avoid dust and water.

### Lower pressure than the advised pressure can cause:

1. Tyres make noise as turning.
2. Hard to turn.
3. Accelerate the wear degree of the tread unequally.
4. It may crack te rim.
5. Spoilage of the tyre cord.
6. High temperature of the tyre.
7. Reduction in operation.
8. Increase in petrol consumption.

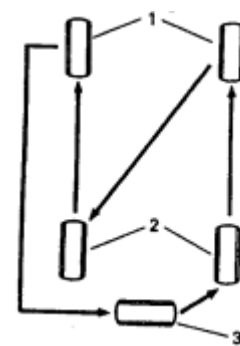
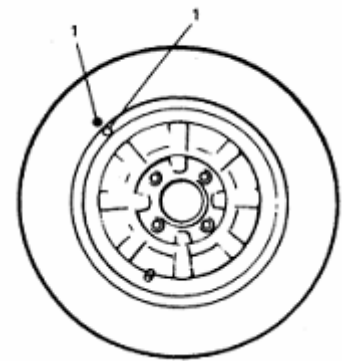
### Tyre Introduction.

Refer to the instructions which is in the right door of the vehiecle.

It listed the maximum loading, size and pressure of the tyre.

### Transposition of the tyres.

In order to make the tyres similar wear degree, transpose the tyres following the right illustration. Transposition the tyres after the first mileage of 10.000kms. Then transpose the tyres for every



10,000kms and adjust the pressure.

1. Front tyres
2. Rear tyres
3. Spare tyre

#### IV. Repair

##### 1. Wheels

###### Disassembly

- 1). Loose the screws 180 degrees. (half circle)
- 2) Jack up the vehicle.
- 3) Remove the tyres.

**Torque of bolts:50-80N.M**

###### Attention:

Don't follow the way of heating to loose the over-tight wheels because heating can reduce the life-span of the wheels and harm to the bearing of the wheels.

###### Fixing.

The bolts of the wheel should be tighten in turn to avoid spoilage of the wheels or brake disk as shown from the right illustration.

##### 2. Tyre

###### Disassembly & Fixing.

Follow the equipments' instructions when disassembling or fixing the tyre. Don't use manual tools only because they may spoil flange or the rim.

###### Attention

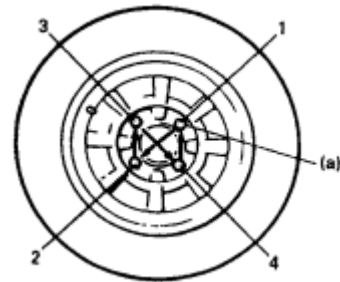
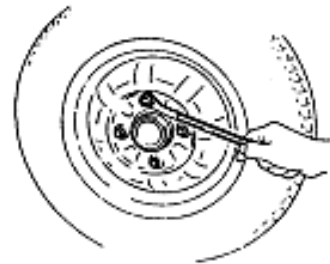
**Don't stand on the tyres when inflating the tyres. Otherwise, the tyres may be spoiled and cause injuries. Otherwise, the flange may be broken and cause serious injury.**

Inflate the tyre according to the described pressure in the manual. If the flange isn't set well, the tyres should be re-lubricated before re-inflating.

Over-inflating may spoil the tyres and cause injury.

###### Repair

There are various type of materials and ways of tyre-repair. Not all the materials or the ways fit all tyres, so the manufacturers publish detailed instruction on how to maintain tyres in time. All the instructions are available from the manufacturers.



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