Vehicle Model	BJ1027V2MD5-5	BJ1027V2MW5-3	BJ1027V2MD5-8	BJ1027V2MB5-4
Bore×stroke（mm）	93×102	91×86	93×102	83×100
Compression ratio	18．2	8．8	17．2	17．5
Rated power（kw/rpm）	57/3600	76/4300～4600	68/3600	46/3300
Rated torque（N.m/rpm）	172/2200	193/(2000～2600)	202/2200	150/(2100～2300)
Displacement（L）	2.771	2.237	2.771	2.164
Lubricant volume（L）	4.5			
Coolant volume （L）	10			
Fuel tank （L）	53	64	53	53
Fuel consumption（L/100km）（average speed 50km/h）	≤7	≤9	≤7	≤7

Table 1-3 Main specifications

Vehicle Model		BJ1027V2MD5-5	BJ1027V2MW5-3	BJ1027V2MD5-8	BJ1027V2MB5-4
Transmission		JC530T	5DYA	JC530T	5DYH
Transmission Type		Mechanical 5+1,with synchronizer			
Clutch type		Single disk dry diaphragm spring			
Rear axle type		Rear axle assembly: punch & weld integrated axle housing, single stage final drive (hypoid bevel gear), half-floating half shaft			
Rear axle（L）		2.2			
Steering gear type		Re-circulation ball power steering			
Service brake		Front disk / rear drum, hydraulic vacuum boosting ,dual circuits,			
Front wheel alignment data (unladen) Note: adjust lower steering arm ground clearance to 300mm before alignment	King pin inclination	10° ±20′			
	Caster	2.5° ±20′			
	Camber	30′ ±20′			
	Toe-in	0～3mm			

Table 1-4 Main specifications

Vehicle Model	BJ1027V2MD5-5	BJ1027V2MW5-3	BJ1027V2MD5-8	BJ1027V2MB5-4
Max wheel turning angle（Left /Right）	34°			
Free travel of clutch pedal（mm）	10～15			

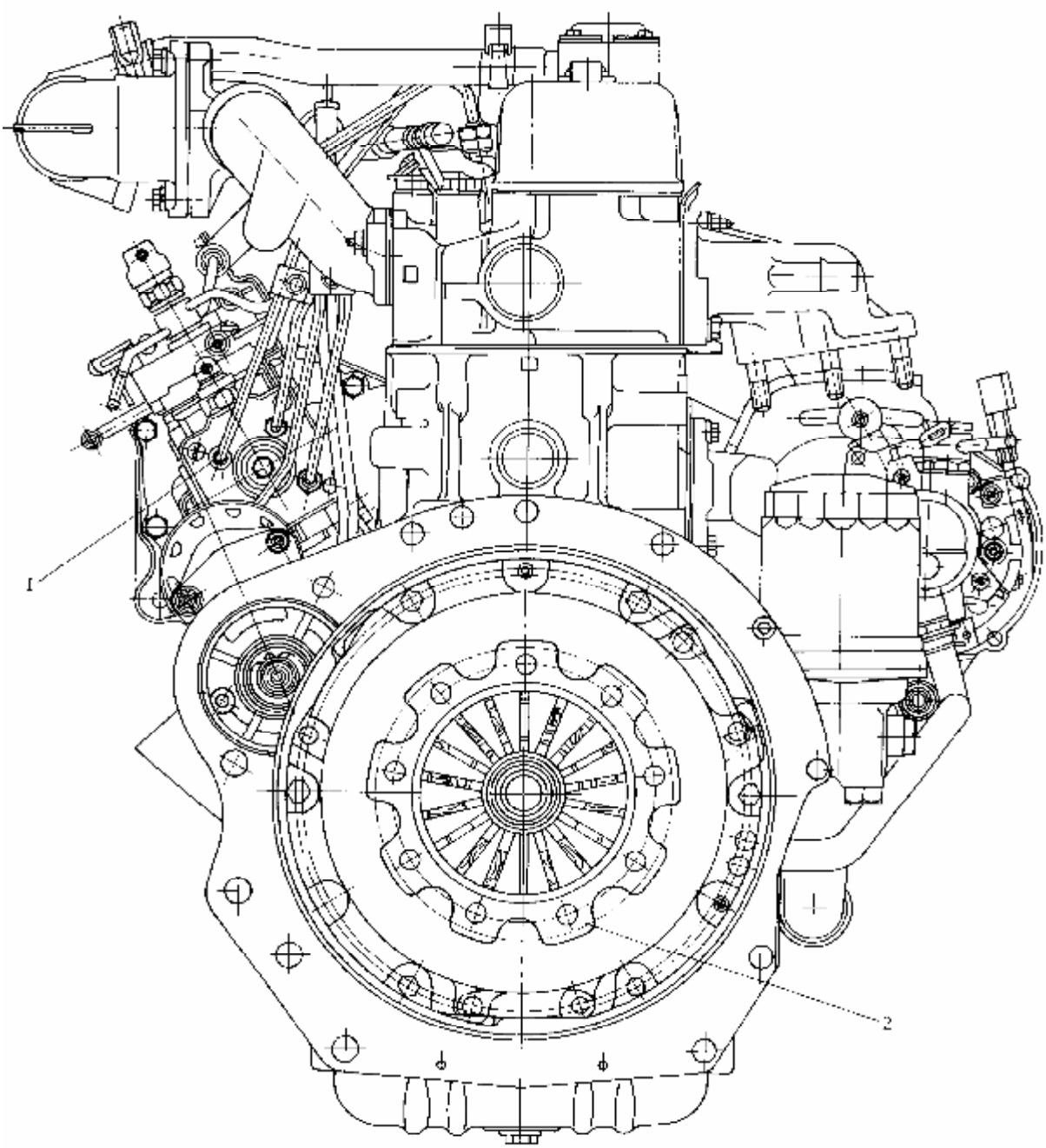

Fig 1-7 BJ493Q Diesel engine assembly rear view

1-VE injection pump ； 2-clutch assembly

Description	Unit	Technical parameter			
Cylinder No.	Cylinder	4			
Cylinder bore	mm	93			
Piston stroke	mm	102			
Compression ratio		18.2：1			
Displacement	L	2.771			
Operation sequence		1—3—4—2			
Rated power / Rpm	kW/r/min	57/3600	68/3600	68/3600	80/3600
Max torque / Rpm	N．m/rmin	172/≤2300	202/≤2300	230/≤2300	245/≤2300
Min fuel consumption rate	g/kW・h	≤230	≤225	≤225	≤210
Rpm at idle	r/min	750±40			
Crankshaft rotation direction （facing flywheel end）		Counter-clockwise			
Lubrication		Pressure / Splashing combination			
Net mass	kg	241			
Dimension	mm	758.5×590×742	775×635×702		775×633×715

See table 1-8 for electrical system parameters of BJ493Q diesel engine

Table 1-8 Electrical system parameters of BJ493Q diesel engine

Description		Unit	Technical parameter
Alternator	Nominal voltage	V	12
	Rated current	A	80
	Power	W	960
	Rated Rpm	r/min	5000
	Operation Rpm	r/min	900~11000
	Rotating direction		Clockwise (viewing from FR to RR)
	Polarity		Negative ground
	Working method		Rated and continuously
	Regulator type		IC regulator
	Regulated voltage	V	14.5±0.15

1.8 DJX491Q 汽油机技术资料

1.8 Technical specifications for BJ491Q Gasoline engine

1.8.1 General Technical Requirement

NO	Description		Specification
1	Fuel		90# gasoline
2	Exhaust gas temperature		≤740℃
3	Oil pressure（kpa）	In idle	≥29.4
		2000±50r/min	≥170
		3000±50r/min	245.2～490.3
4	Highest temperature of the oil		＜110℃
5	Coolant outlet temperature		85～105℃(≤115℃in heavy load)
6	Coolant type		Ethylene glycol group coolant
7	Opening pressure of radiator（kpa）		73.6～103
8	Vacuum of air inlet manifold（kpa）		In idle speed ≥60
9	Fast idle speed（r/min）		2600^{+100}_{-300}
10	Idle speed （r/min）		750±50
11	Rated speed（r/min）		4200～4600
12	Exhaust in idling speed	CO	≤3.5%
		HC	≤700ppm
13	Valve clearance (Hydraulic tappet)		0
14	Spark-plug electrode clearance（mm）		0.9～1.1
15	Timing chain deflection（mm）		Under force of 98N ≤13.5
16	Flywheel diameter run-out（mm）		≤0.1

1.8.2 Main Data and Tightening Torque

NO	Description		Specification
1	Water pump driving belt deflection （under force 98N）（mm）	New belt	5～7
		Used belt	7～8
2	Mass difference of each piston and connecting rod（g）		≤6
3	Crankshaft rotary torque（N.m）		≤30
4	Tightening torque	Rocker arm shaft –cylinder head	23.5
		Cylinder head –cylinder block	88
		Inlet and outlet manifold –cylinder head	49

sleeve, one can only replace sleeve during service, not necessarily discard the whole block.

There are 5 main bearings in cylinder block. Bearing caps are made of cast iron. Each main bearing cap is fixed on body by 2 M14 bolts with a fastening torque of 160～180 N-m. Cap is fastened by 3 steps (40～50 N-m, 90～100 N-m and 160～180 N-m), the sequences see figure 3-1. Main bearing cap is finely processed together with cylinder block, therefore, caps are not interchangeable or mounted reversibly. To avoid this from happening, each cap is tapped with number "1, 2" with arrow toward engine front as indicated in figure 3-1.

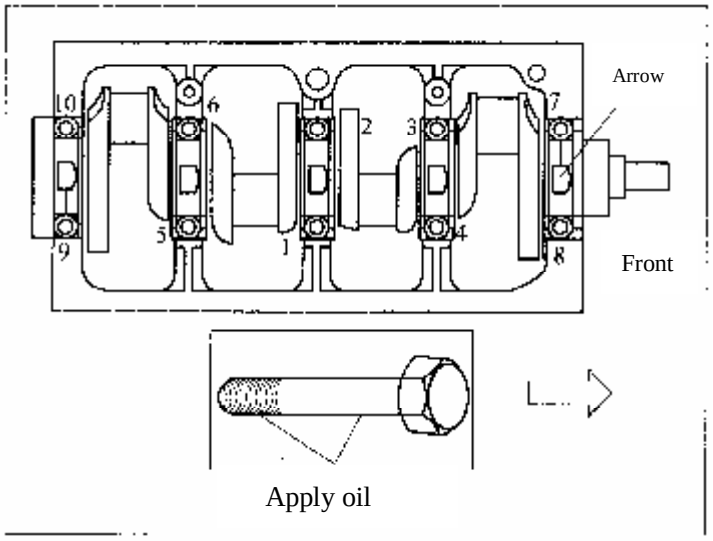

Figure 3-1 Fastening sequence – main bearing bolts

The 3rd bearing under axial load from crankshaft is locked by two half-circle thrust bearings on two sides. Thrust bearing is made of aluminum alloy with steel back. When thrust bearing is mounted, its oil duct should direct to rotating face of crankshaft. See figure 3-2.

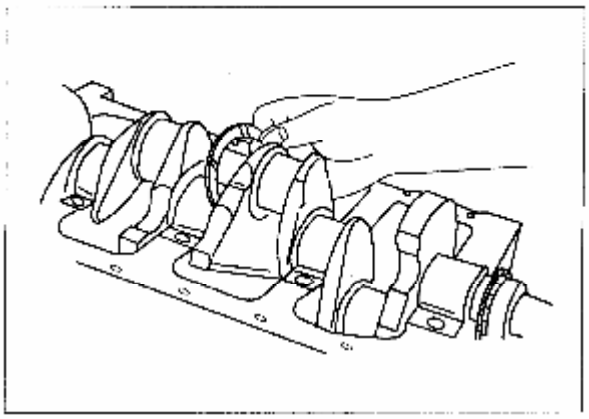

Figure 3-2　Mount crankshaft thrust bearing

The axial clearance of crankshaft is 0.05-0.20 mm.

There are aluminum alloy materials on the steel back. During mounting, be sure oil ducts and holes are seen on all bearing, see figure 3-3.

Crankshaft upper bearings are mounted on cylinder block, and lower bearing on main bearing cap.

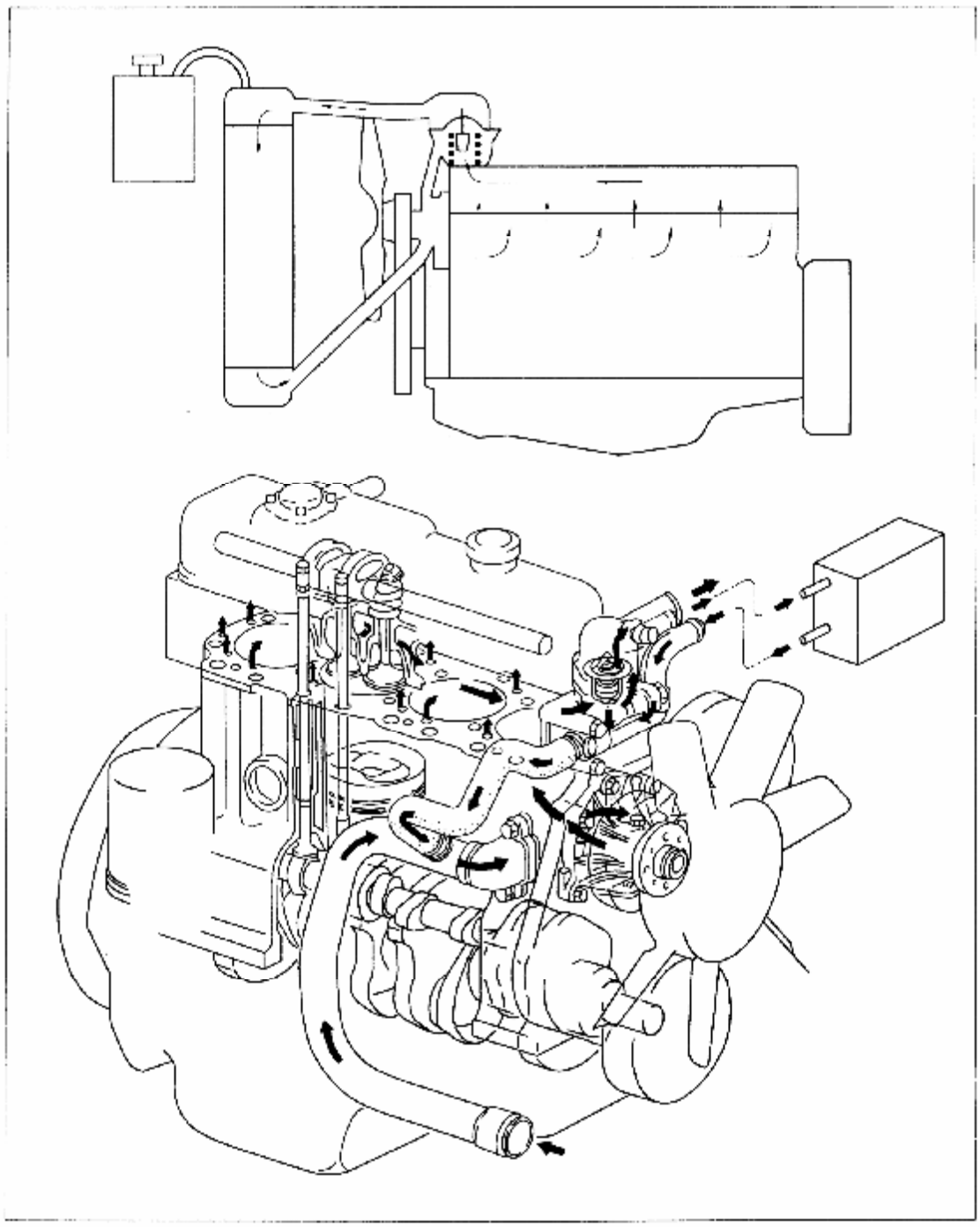

Figure 3-36 Diesel engine cooling system

When coolant temperature is under 82℃, thermostat valve keeps closed. Water flows into water pump via bypass passage to perform small circulation (does not flow through radiator). When coolant temperature goes up over 82℃, thermostat valve opens. Water cycles to flow inside radiator, while the bypass valve under thermostat cuts off bypass passage. All cooling water flows to radiator to perform larger circulation.

● **Warning:** In cold season, if a diesel engine that does not use antifreeze needs to be stalled for longer time, one should drain all cooling water inside diesel engine and radiator. Ice may hurt cylinder block or radiator.

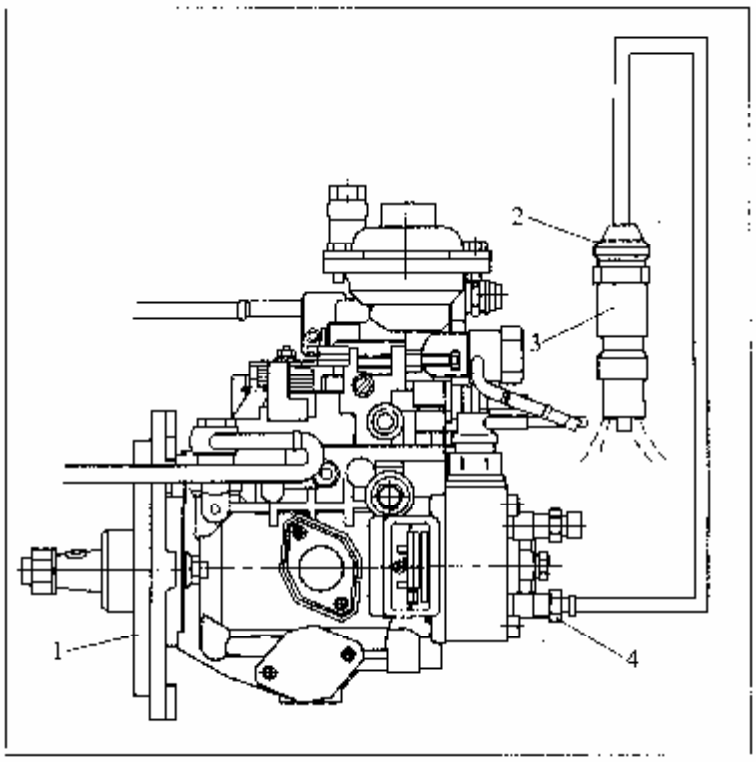

Fig.4-6 Bleed high-pressure fuel pipe

1.injection pump 2.injector end pipe nut 3.fuel injector 4.injection pump end pipe nut

● **Note:**

(1)Don't forget to retighten all loose screws, nuts and hand pump in oil-water separator after bleeding.

(2)Do not let fuel to contaminate diesel engine compartment. Put a collecting pan under engine during bleeding. Dispose used oil according to local laws.

4.4 起动步骤

4.4 Diesel engine start-up procedures

4.4.1 Start-up when environment temperature is over -5°C

● **Note:** Never crank an engine without proper pre-starting preparations. Before starting-up, check if there are any objects around that hamper engine operation.

4.4.1.1 Set transmission to N gear.

4.4.1.2 Depress clutch pedal to reduce load on engine during cranking.

4.4.1.3 Turn ignition switch to "START", quickly press down start button to start up engine. If starter gear cannot mesh with flywheel gear ring, driver should release start button. Re-crank engine after starter has stopped.

● **Note**: Each cranking should not last more than 30 seconds. This is to protect starter and battery. There should be at least 2 minutes interval between a fail start-up to second cranking. If 3 attempts cannot start up engine, one has to turn to find the cause before next cranking.

4.4.1.4 After engine has started up, keep it running at idle while check oil pressure (should not be less than 0.1Mpa), and check any abnormal noise and vibration on supercharger. For supercharged or inter-cooled engine, idle running should not last more than 5 minutes.

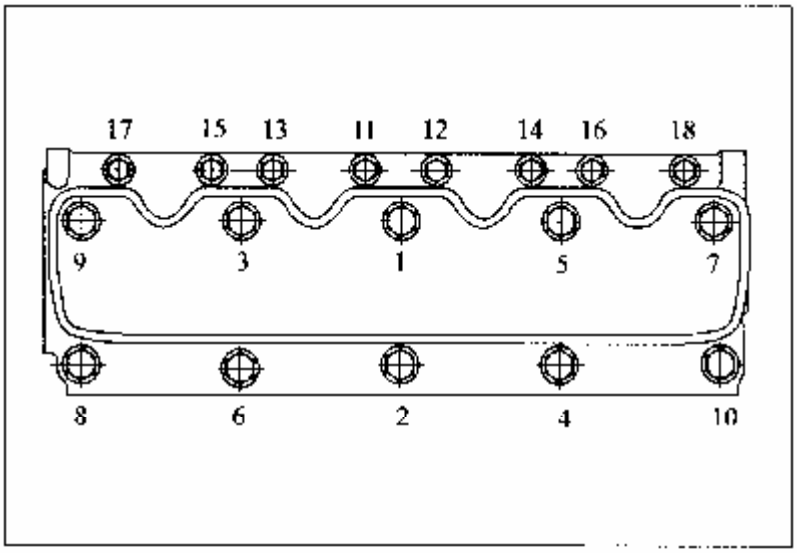

Figure 6-1 Tightening sequence of cylinder head bolts

● **Notes:**

(1) Supercharged diesel engine uses integrated cylinder head gasket. During mounting, there should be no foreign object presence outside the retaining ring to prevent combustible gas leaking.

(2) Check cylinder bolts tightening torques with torque wrench in the case a cylinder head gasket is leaking. Tighten up cylinder head bolts only after diesel engine has cooled down.

(3) Cylinder head bolts are high strength special bolts. It is not allowed to use ordinary bolts to replace.

6.2.2 Cylinder sleeve assembling

Cylinder sleeve is of dry type. A pin helps to locate block and center locating main bearing cap, they flush with front / rear main bearing caps and are connected with main bearing bolts.

Replace sleeve if wear on its inner surface exceeds 0.35mm.

Clean sleeve outer surface and cylinder bore wall before assembling a sleeve. Do not apply oil, that would impair they contacting and heat radiation. Press sleeve into cylinder block with even force.

6.2.3 Tighten main bearing cap bolts

The tightening torque of main bearing cap is 60～170N-m, it is required to tighten them with even force in three steps : first step ; 40～50N-m; second step: 90～100N-m; and third step: 160～170N-m.

6.2.4 Assemble a piston

The oval cone piston (see fig. 6-2, 6-3) head has 2 compression ring grooves and 1 oil ring groove. And an arrow mark is on piston top plane which points to engine front during assembling. Besides, piston has been carved with outer diameter grouping mark that guides to select piston of relevant size to match the cylinder sleeve.

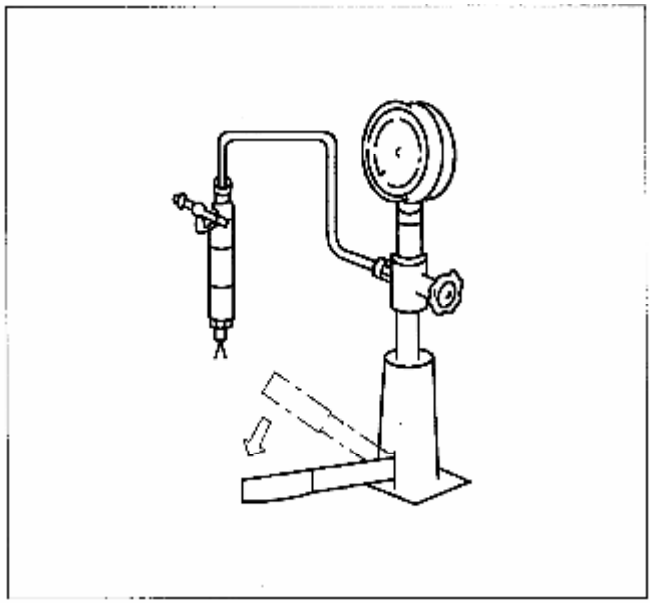

Figure 6-14 Check the Injection Quality of an Injector Using a Test Bench

6.2.22 Check injector opening pressure

Increasing and decreasing the thickness of the pressure regulating shim to injector body to regulate the opening pressure of an injector in supercharged diesel engine. Increase the thickness of shim to raise the opening pressure; and decrease the shim thickness to reduce the opening pressure.

If it is required to regulate the injection pressure, operator should clean the outside of injector and unscrew the tightening nuts. Note that the coupling parts, tappet, springs and original washer should not be discarded. Keep all part and component clean.

6.2.23 Check thermostat

Thermostat automatically changes coolant flow in radiator according to engine temperature to maintain engine in a proper operation temperature. (See figure 6-15)

The temperature-sensing element of the thermostat is a paraffin-type one. The thermostat is installed in the thermostat casing at the water outlet on the cylinder head.

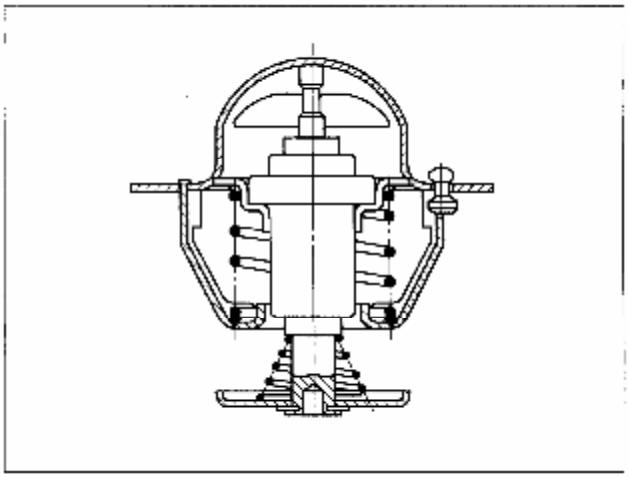

Fig. 6-15 Thermostat

Symptoms and causes		Removing procedures
	(4) Poor contacting at circuit connections,too much oxide on terminals. Insufficient charging.	(4) Make the connection firm, remove oxide and apply Vaseline on terminals.
Larger battery self-discharging	(1) Impurities in battery fluid.	(1) Add battery fluid formulated with pure sulfuric acid and distilled water as specified.
	(2) Short circuit on battery outside lead.	(2) Locate short circuit and remove.
	(3) Fluid overflowing from battery, connect positive / negative poles to short circuit.	(3) Clean battery surface and terminals with soda water or warm water, be sure no water is entering battery.
	(4) Heavy shedding, damaged separator plates and warped plates make short circuit.	(4) Repair or replace battery.

● **Cautions:**

(1) The gas released from battery is easy to be ignited by sparks, so there should be no lighted fire presenting during battery's check and service. Do not let battery fluid contact skin and cloth. Wear goggles while servicing a battery.

(2) Never short circuit two battery terminals, or it may lead to battery overheating even explosion.

(3) While dismounting or mounting electrical equipments, remove first the negative (ground) cable from terminal. But for replacing light bulbs, cutting off relating switch would be ok.

(4) When removing a battery, remove negative cable first then positive cable. Untie battery bracket to life out battery. Operate in reverse sequence to mount a battery.

7.12 冷起动预热系统故障

7.12 Failure cold-start preheating system

Symptoms and causes	Removing procedures
Turn ignition key to "START", engine stalls after flash indicator has blinked 30 seconds at a frequency of 4 times per second. The cause may be burnt fuse or short circuit on glow plug "P" (normal glow plug resistance is about 2Ω), or solenoid "D" fuse is burnt. Fuse damage or loose wire connection may also be the causes.	Check circuit of cold start device or replace damaged parts.
Turn ignition key to "START", engine stalls after flash indicator has blinked 60 seconds at a frequency of 4 times per second. This may be caused by relay contacts inside controller that control FGK output haves not closed due to damaged controller or lower battery voltage (lower than 9V).	Replace controller or charge battery to specification.
Glow plug does not ignite during normal preheating. The cause may be blocked fuel pipe / plug fuel feeder or damaged solenoid parts.	Check fuel pipe, replace damaged parts.

Fifth journal: Φ45.459~Φ45.475mm.

If the dimension of journal is not within the specified scope, follow items in 8.3.7 of this chapter to inspect the fit clearance between camshaft bearing hole and journal.

8.4.4 Install the thrust plate and sprocket of camshaft onto camshaft, tighten the fixing bolts of camshaft sprocket with a 90N-M tightening torque, and then measure axial clearance between thrust plate and first journal thrust surface of camshaft with a plug gauge (see Figure 8-39). The normal axial clearance is 0.07~0.22mm. The maximum axial clearance is 0.30mm. If the clearance exceeds the maximum value, replace the camshaft bearing and if necessary, replace the camshaft, if necessary, replace the camshaft.

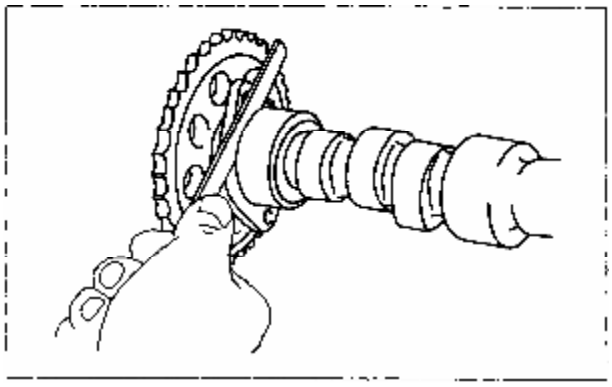

Figure 8-39 Measurement of Axial Clearance of Camshaft

8.4.5 Inspect length of timing chain. Using a spring balance, follow the measurement method in Figure 8-40 to, pull the chain with a 49N tensile force, and the maximum length of chain is 291.4mm. Select 3~4 measurement points at random to measure. If length of chain exceeds the maximum value, replace the chain.

8.4.6 Using a caliper, follow Figure 8-41 to measure diameters of timing sprocket of crankshaft and camshaft timing sprocket with chain. Minimum diameter is:

Sprocket of crankshaft: Φ59mm;

Camshaft sprocket: Φ114mm;

If diameter of sprocket is less than the minimum value, replace the chain and two sprockets.

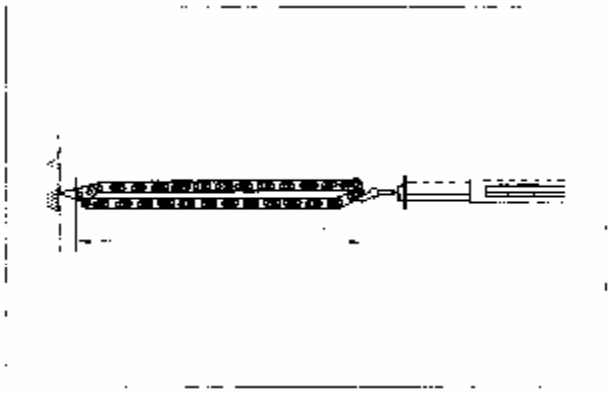

Figure 8-40 Inspection of Length of Timing Chain

●**Caution**: It is forbidden to fill gasoline with lead into BT491EQ1 multi point injection gasoline engine, since lead will restrain the platinum, and the gasoline with lead will make the oxygen sensor invalid very fast so as to worsen the emission.

Oxygen sensor is heated type (see Figure 9-9). The pin of joint, lead color and wire connection of oxygen sensor are shown on Table 9-2. Oxygen sensor output signal is shown on Figure 9-10.

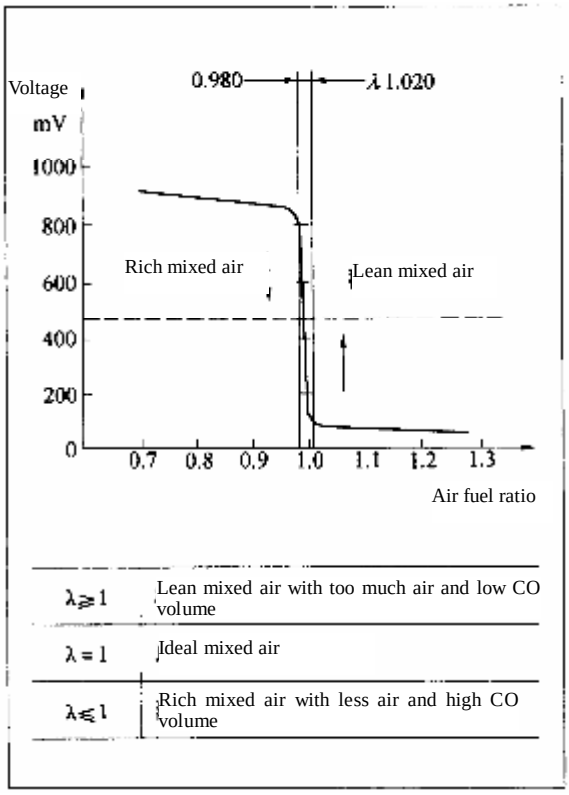

Figure 9-10 Working Characteristic Chart of Oxygen Sensor

Table 9-2 Pin of Joint, Lead Color and Wire Connection of Oxygen Sensor (see Figure 9-9)

Pin	Lead color	Needle and lean connection
A	Dark brown	Oxygen sensor (grounding)
B	Purple	Oxygen sensor (output)
C	Brown	Heater
D	Brown	Heater

9.2.6 Electronic Control Module (ECM)

Gasoline engine ECM is a microprocessor taking the single chip as core (see Figure 9-11), and ECM is composed of hardware circuit board and control software. Its function is to deal with all the signals from the sensors, judge the gasoline engine working conditions, and send actuator with control signals about optimal injection parameter and ignition parameter etc. to drive the engine always in the optimal operations.

necessary check and adjustment.

！Caution: You should often hear if there is abnormal noise while gasoline engine running, check if there is leakage from fuel pipes, cooling pipes or air pipes. If there is leakage, please correct them immediately, otherwise it may occur serious troubles.

10.7 停车

10.7 Stopping

If the engine is to be stopped when it is operating with maximum load, first slow down it for 2~3min and then turn off ignition key, to stop it. The purpose is to cool down the gasoline engine gradually in an equably style, to avoid distortion of some parts arising from abrupt cooling.

10.8 零件保护

10.8 Component Protection

ECM, sensors and actors must be protected from water, static and strong electromagnet disturbing. When repair the vehicle, please do no fall them to grand or kowtow them.

10.9 跛行回家

10.9 Limp in

If the EFI system parts of gasoline engine are in trouble, EMS could turn into safety mode, guarantee vehicle to service station.

10.10 使用注意事项

10.10 Application notices

10.10.1 The gasoline engine shall be used as per application and maintenance methods, and be operated in conformity with all stipulations described in this manual.

10.10.2 Perform running-in as per stipulation for use of new gasoline engine or gasoline engine after heavy repaired, and don’t speed up abruptly and load too early.

10.10.3 A normal temperature of 80~95℃ for coolant shall be maintained during operation of gasoline engine. The normal pressure of engine oil at medium speed should be 245~392kPa, and the warning lamp for oil pressure should be off (this lamp to be on before gasoline engine is ignited).

10.10.4 ECM must be provided with constant-on power. Once the power is cut, failures in memory and self-taught results will be lost. Initialization operation must be performed prior to normal starting for newly assembled vehicles or gasoline engines with ECM disassembled.

10.10.4.1 Connect anode and cathode of battery.

10.10.4.2 Initialize the electronic control fuel injection system:

——Turn the ignition key to On position;

——Turn off ignition key in about 3s;

——Open the ignition key again to ON position in about 5s;

——Control system initialization is finished.

10.10.4.3 Check that the “Lamp for Checking Failures of Gasoline engine” should be able to turn on automatically.

Table 13-1-3 Fitting standard -- master cylinder and piston (mm)

Description	Standard	Limit
Cylinder inner dia.	$\varphi 15.87^{0}_{-0.03}$	
Fitting clearance	0.02～0.06	0.12

2. Check master cylinder return spring for rupture, damage and elastic force. Replace it if necessary.

(3) Check slave cylinder. Check tube and piston for wear. If cylinder tube cylindricality discrepancy exceeds 0.025mm, repair it till the value is not more than 0.01mm. Replace part if wear or damage become serious. Fitting standard (cylinder tube and piston) see table 13-1-4.

Table 13-1-4 Fitting standard -- slave cylinder and piston (mm)

Description	Standard	Limit
Slave cylinder piston diameters	$\varphi 20.64^{0}_{-0.04}$	
Fitting clearance	0.02～0.06	0.12

13.1.4 Reassembly and Adjustment

After having checked and repaired clutch parts as per specification, reassemble the clutch and make adjustment again.

1. Locate spline hole on clutch disk hub, check run out tolerance of driven plate assembly (Figure 13-1-5). Measure at the spot 2.5mm from driven plate edge, if results exceed 0.8mm, driven plate should be corrected.

2. Dynamic unbalance of clutch cover assembly should not exceed 28 gram-cm; dynamic unbalance of driven plate assembly should not exceed 15 gram-cm.

3. Before mounting clutch assembly on engine, clean flywheel friction face, there should be no oil dirt on fitting surface of clutch friction plate. Meanwhile, apply a thin layer of lubricant oil on fitting surfaces of release bearing sleeve, release fork, ball support of release fork and ball nut of push rod.

4. When to reassemble clutch, operator should first mount adjusted clutch driven plate assembly and then cover assembly on flywheel face (be sure to set the short end of clutch plate hub in driven plate assembly to the front). In order to make these two assemblies and flywheel concentric, one should insert a piece of spline bar (may use transmission input shaft as a tool) into flywheel pilot bearing to locate driven plate assembly, and put pressure plate and cover assembly in place by flywheel locating pin. Fix them with bolts.

5. Reassemble and adjust of clutch controls

Reassembly:

⑴ Reassemble and check master cylinder. Thoroughly clean parts before reassembly, and bath sealing cups and rings in brake fluid. Be sure not to block oil holes on master cylinder inner wall and piston.

① Reassembly of master cylinder. Proceed in reverse order to disassembling.

②Check after reassembly.

▲Piston cup of master cylinder should seal well. There should be no brake fluid weeping on it when piston goes back and forth.

▲Perform sealing test under an oil pressure of 13Mpa. Ensure no leakage occurs in 5 seconds.

⑵ Reassemble and check slave cylinder. Thoroughly clean parts before reassembly, and bath sealing ring and cup in brake fluid.

① Reassemble slave cylinder. Proceed in reverse order to disassembly.

② Check after reassembly.

▲After reassembling, devices should operate freely without any restriction or grabbing.

▲Perform sealing test under an fluid pressure of 13Mpa. Ensure no leakage occurs in 5 seconds.

Table 13-4-4 Abnormal Sound from Rear Axle

Cause		Solution	
1	Incorrect gear contact patch -- higher or lower	1	Adjust contact patch and tooth side clearance
2	Insufficient gear fluid	2	Add fluid to standard
3	Excessive play or worn — drive gear bearing, differential bearing and wheel hub bearing	3	Readjust bearing pre-tension or replace bearing
4	Excessive play — driven gear bolt	4	Fastening
5	Excessive clearance — halfshaft spline	5	Replace halfshaft or halfshaft gear
6	Foreign matter in axle housing	6	Remove foreign matter
7	Foreign matter in brake drum	7	Check and remove foreign matter
8	Worn-out differential gear or gasket	8	Replace worn-out parts
9	Tooth peeled or damaged	9	Replace drive/driven gears
10	Gears meshing is too tight or loose	10	Readjust meshing clearance

2. Oil leak, see table 13-4-5.

After vehicle has stopped, fluid trace or fluid weeping from connecting spots is found.

Table 13-4-5 Oil Leak

Cause		Solution	
1	Excessive gear fluid	1	Reduce to standard level
2	Oil seal damaged — drive conical gear shaft	2	Replace
3	Vent hole clogged	3	Clean or replace
4	Bolts loosened or gasket damaged — axle case to final drive case	4	Fasten bolt or replace parts
5	Crack or sand inclusion — rear axle case/ final drive case	5	Repair sand inclusion or replace
6	Worn-out rear wheel hub oil seal, grease enters brake drum	6	Replace oil seal, clean brake drum

3. Rear axle overheating, see table 13-4-6.

After a serviced or new vehicle has driven for a period of time during break-in period, its rear axle case, differential case, wheel hubs and brake drums become scalding (drums normal operating temperature should not be 70℃ more than ambient temperature, and operating temperature on rear axle, differential case and wheel hubs should not exceed 65℃).

Table 13-4-6 Rear Axle Overheating

Cause		Solution	
1	Bearing is adjusted too tight	1	Re-adjust
2	Oil seal is too tight	2	Lubricate lip and let break in at low speed
3	Short gear fluid	3	Add fluid to standard
4	Smaller gear meshing clearance	4	Re-adjust gear meshing clearance
5	Brake shoe contacts drum	5	Adjust pad clearance
6	Rear axle case is bend or distort	6	Adjust bend/distort parts or replace