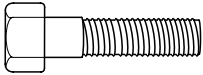
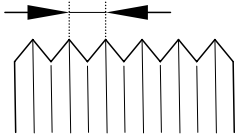
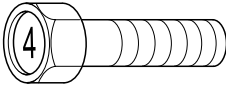
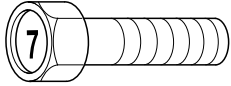


CONTENTS

1. GENERAL	1-1
2. ENGINE MECHANICAL SYSTEM	2-1
3. ENGINE ELECTRICAL SYSTEM	3-1
4. FUEL SYSTEM	4-1

TIGHTENING TORQUE TABLE OF STANDARD PARTS

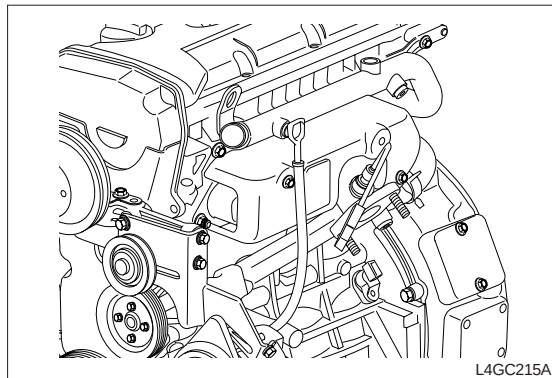
Bolt nominal diameter (mm)	Pitch (mm)	Torque (kg·m)	
		Head mark 4	Head mark 7
 L4GC205A	 L4GC206A	 L4GC207A	 L4GC208A
M5	0.8	0.3 ~ 0.4	0.5 ~ 0.6
M6	1.0	0.5 ~ 0.6	0.9 ~ 1.1
M8	1.25	1.2 ~ 1.5	2.0 ~ 2.5
M10	1.25	2.5 ~ 3.0	4.0 ~ 5.0
M12	1.25	3.5 ~ 4.5	6 ~ 8
M14	1.2	7.5 ~ 8.5	12 ~ 14
M16	1.5	11 ~ 13	18 ~ 21
M18	1.5	16 ~ 18	26 ~ 30
M20	1.5	22 ~ 25	36 ~ 42
M22	1.5	29 ~ 33	48 ~ 55
M24	1.5	37 ~ 42	61 ~ 70

 NOTE

- The torques shown in the table are standard values under the following conditions.
 1. Nuts and bolt are made of steel bar and galvanized.
 2. Galvanized plain steel washers are inserted.
 3. All nuts, bolts, plain washers are dry.
- The torques shown in the table are not applicable,
 1. When spring washers, toothed washers and the like are inserted.
 2. If plastic parts are fastened.
 3. If oil is applied to threads and surfaces.
- If you reduce the torques in the table to the percentage indicated below under the following conditions, it will be the standard value.
 1. If spring washers are used : 85%
 2. If threads and bearing surfaces are stained with oil: 85%

REPLACING OXYGEN SENSOR

Oxygen sensor is as a fuel mixture control unit, if it is damaged, exhaust gas will be bad as well as engine performance. So, if the oxygen sensor is defected, necessarily replace it.



COOLING SYSTEM

Check the cooling system hoses for damage and looseness or inspect the joints for coolant leaks.

COOLANT

When the engine is delivered, the engine cooling system contains mixture of antifreeze(40%) and water(60%).

Because the cylinder head and the water pump are made of aluminum alloy, the mixture should contain antifreeze (ethylene glycol) of 30~60% to prevent those from corrosion, freezing and bursting.

NOTE

- ***If the coolant contains less than 30% of antifreeze, anticorrosion is decreased.***
- ***If the coolant contains more than 60% of antifreeze, the engine will be fatally affected, resulting from decreased anti-freezing and engine cooling. Use only the recommended antifreeze and do not mix with other production.***

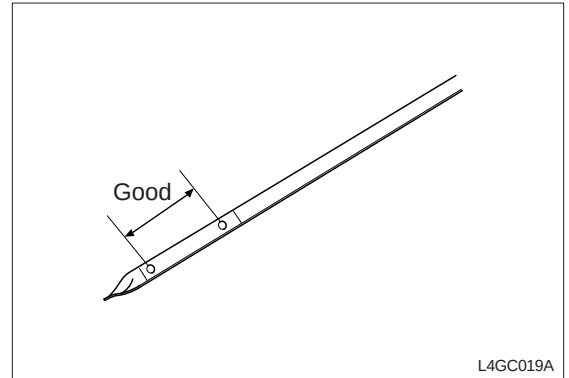
Recommended antifreeze	Ethylene glycol
------------------------	-----------------

Description	Specification	Limit
VALVE Stem O.D Intake Exhaust Thickness of valve head (Margin) Intake Exhaust Valve stem to guide clearance Intake Exhaust	5.965 ~ 5.980 mm 5.950 ~ 5.965 mm 1.15 mm 1.35 mm 0.02 ~ 0.05 mm 0.035 ~ 0.065 mm	0.8 mm 1.0 mm 0.1 mm 0.13 mm
VALVE GUIDE Length Installed size Over size	Intake : 46, Exhaust : 54.5 0.05, 0.25, 0.50	
VALVE SEAT Seat angle Over size	45° 0.3, 0.6	
VALVE SPRING Free length Load Installed height Out-of squareness	48.86 mm 18.3kg/39 mm 40.0kg/30.5 mm 39 mm 1.5 mm or less	3°
CYLINDER BLOCK Cylinder I.D Out-of cylindricity of cylinder I.D Cylinder block-to-piston clearance	82.00 ~ 82.03 mm Less than 0.01 mm 0.02 ~ 0.04	
PISTON O.D Over size	81.97 ~ 82.00 mm 0.25, 0.50, 0.75, 1.00	
PISTON RING Side clearance No.1 No.2 End gap No.1 No.2 Oil ring side rail Over size	0.04 ~ 0.08 mm 0.03 ~ 0.07mm 0.23 ~ 0.38 mm 0.33 ~ 0.48 mm 0.2 ~ 0.6 mm 0.25, 0.50, 0.75, 1.00	0.1 mm 0.1 mm 1.0 mm 1.0 mm 1.0 mm
CONNECTING ROD Bend Twist Side clearance	0.05 mm or less 0.10 mm or less 0.100 ~ 0.250 mm	0.4 mm

SERVICE AND ADJUSTING PROCEDURE

CHECKING ENGINE OIL

1. Be sure that the oil is between “F” and “L” marks of the dipstick.



2. If the oil level is below “L” mark, add about 1L of oil.
3. Check contamination and viscosity of the engine oil and replace it if necessary.

CHECKING COMPRESSED PRESSURE

1. Prior to inspection, check that the engine oil, starter motor and battery are normal.
2. Start the engine and run it until the engine coolant temperature reaches 80 ~ 95°C).
3. Stop the engine and disconnect the spark plug cable and air cleaner element.
4. Remove the spark plug.
5. After opening the throttle valve completely, crank the engine to remove foreign material from the cylinder.

 CAUTION

- ***At this time, necessarily screen the spark plug hole with a rag. Because hot coolant, oil, fuel, and other foreign material, being penetrated in the cylinder through cracks can come into the spark hole during checking compressed pressure.***
- ***When cranking the engine to test compressed pressure, necessarily open the throttle valve before cranking.***

6. Install the compression gauge to the spark plug hole.

INSPECTION

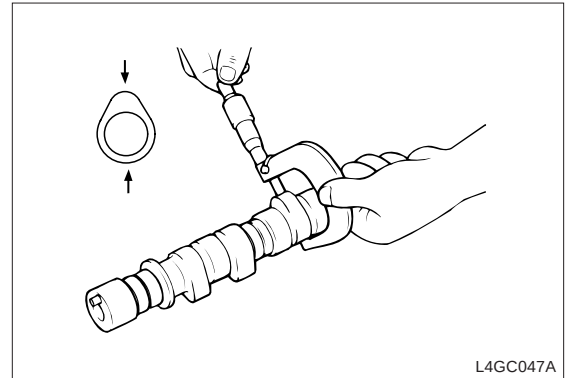
CAMSHAFT

1. Check the camshaft journal for wear and if the journal is seriously worn, replace the camshaft.
2. Check the cam lobe for damage and if the lobe is severely damaged or worn, replace the camshaft.

Items		Standard	Limit
Cam height	Intake	43	42.9
	Exhaust	43	42.9

3. Check the cam surface for abnormal wear and damage and replace it if necessary.
4. Check the cylinder head camshaft journal for damage and if the surface is severely damaged, replace the cylinder head assembly.
5. Lightly put the camshaft on the cylinder head as shown in the illustration and after installing a dial gauge towards shaft, check the endplay.

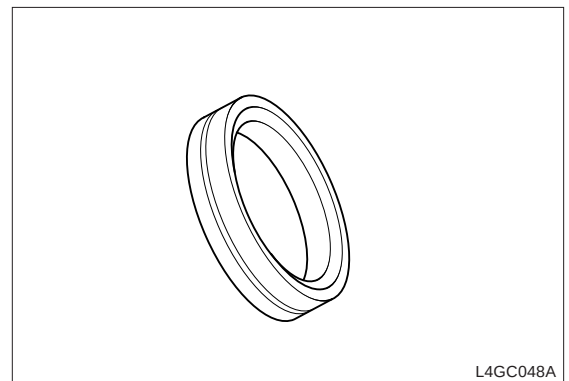
Camshaft endplay	0.1 ~ 0.2mm
------------------	-------------



L4GC047A

OIL SEAL

1. Check the oil seal surface for wear and if the seal lip portion is worn, replace it.
2. Check the camshaft oil seal lip contact surface for partial wear and replace it if necessary.



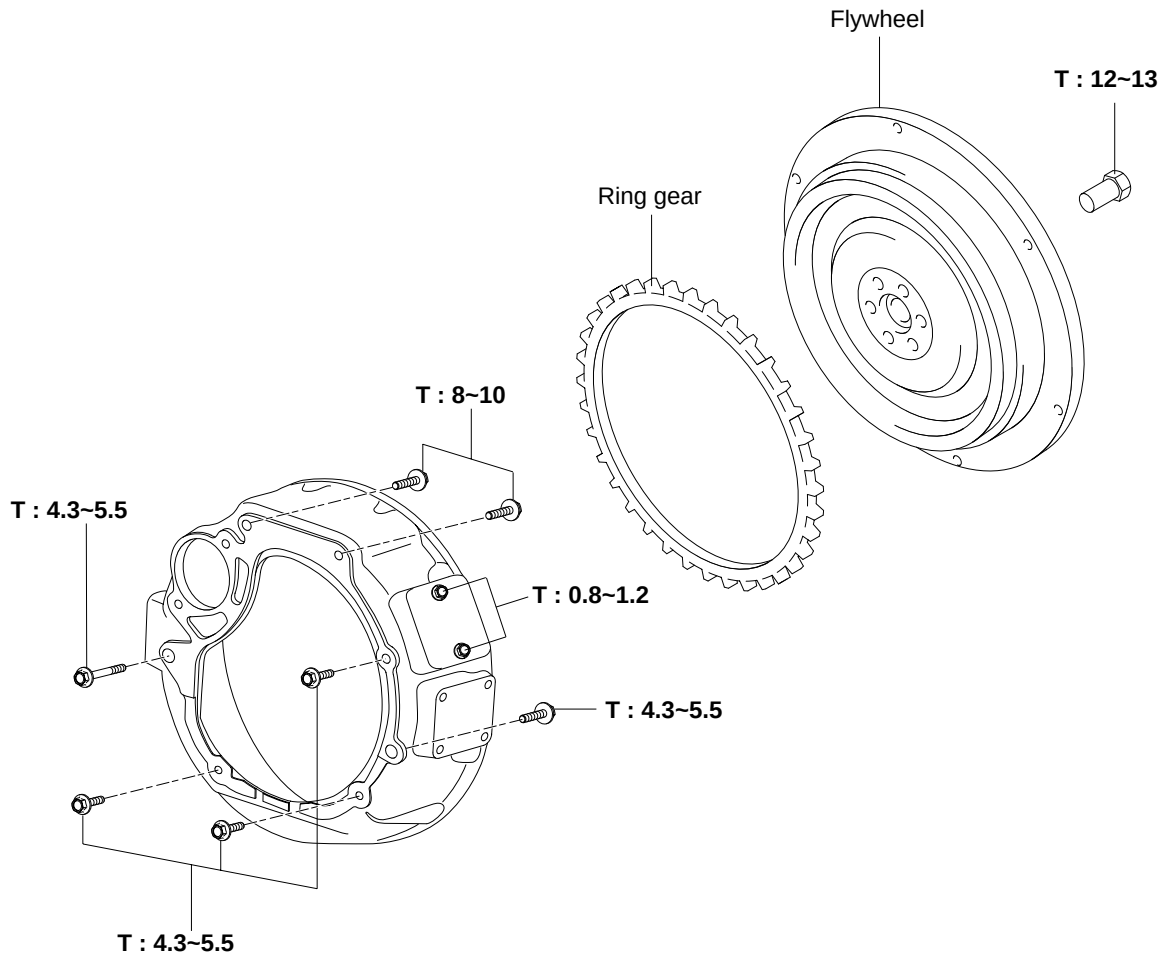
L4GC048A

HLA(Hydraulic Lash Adjuster)

1. HLA I.D : $\varnothing 33(-0.025/-0.041)$
2. How to remove noise when it heard from valve
 - 1) Prior to engine warm-up, check that the engine oil level is normal.
 - 2) Warm-up the engine.
 - 3) If the valve noise is heard at engine warm-up, air-bleed the system.
 - 4) How to air-bleed
 - a) During remaining it for 10 minutes at 3,000 rpm and over 5 minutes at idle, check that the valve noise is heard.
 - b) Repeat the above step(a) only once or twice.

FLYWHEEL & HOUSING

COMPONENTS



Tightening torque : kg·m

L4GC077A

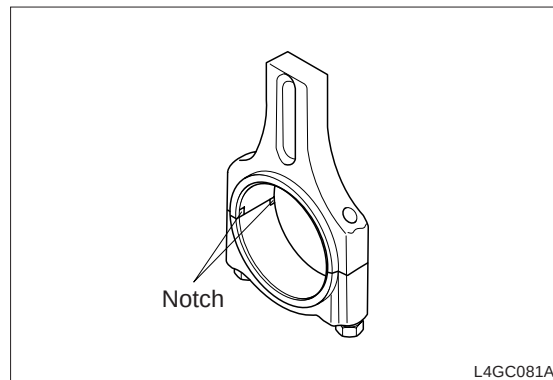
REMOVAL

1. Remove the flywheel.
2. Remove the flywheel housing.

3. Using a connecting rod aligner, measure bending and torsion of rod and if the measured value is around the limit, correct the rod with a press.

But when the rod is severely bended or damaged, necessarily replace it.

Bending of connecting rod	0.05mm
Torsion of connecting rod	0.1mm

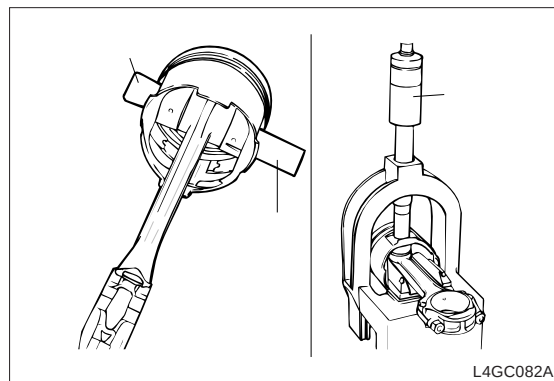


L4GC081A

ASSEMBLY

1. Using the special tool “piston pin setting tool (09234-33001)”, assemble the piston and connecting rod as below.

- 1) Apply engine oil to the outer surface of the piston pin and small end bore of the connecting rod.



L4GC082A

- 2) With the front mark faced upward, fix the connecting rod and piston and insert it into the piston pin assembly.

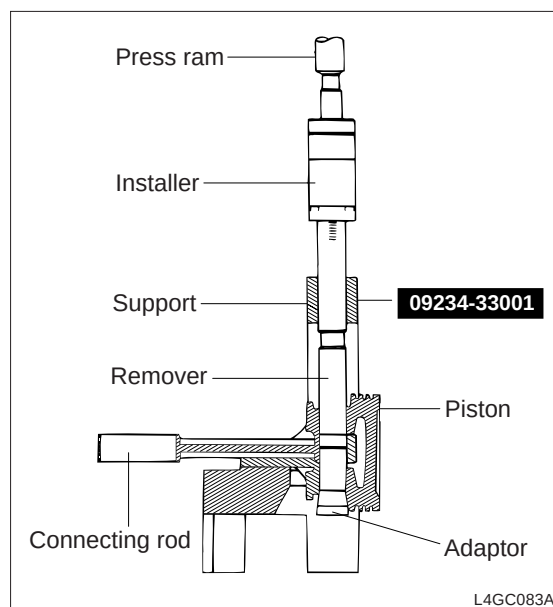
Front mark

Piston side	0 (engraved)
Connecting rod side	Number (embossed)

- 3) Using a press, press-fit the piston pin into the pin hole with the specified pressure on the pin end through the push rod.

If the pressure is required more than the specified value, follow the next step.

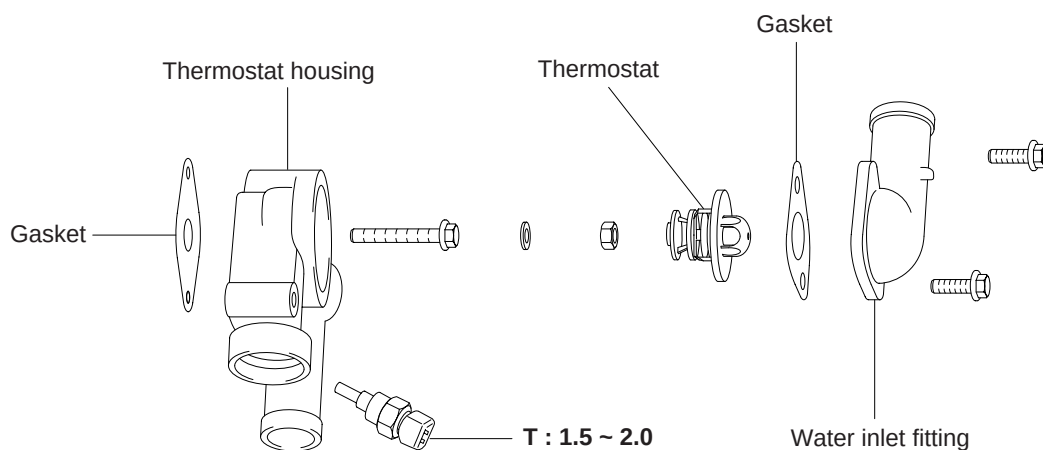
Press-fit pressure of piston pin	350 ~ 1350kg
----------------------------------	--------------



L4GC083A

THERMOSTAT

COMPONENTS



Tightening torque : kg·m

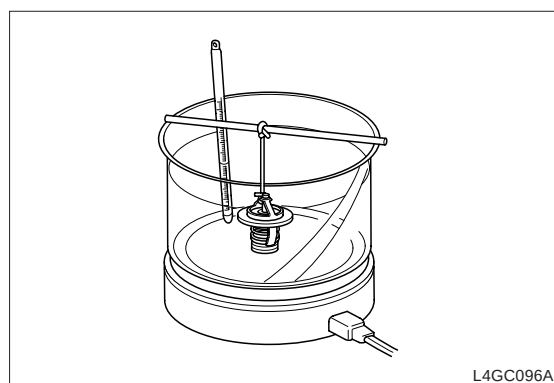
L4GC095A

INSPECTION

1. Check the valve closed at room temperature.
2. Check for defect or damage.
3. Heat the thermostat as shown in the illustration and measure the valve open temperature and full open temperature.

Valve open temperature

Open	82°C
Full open	95°C



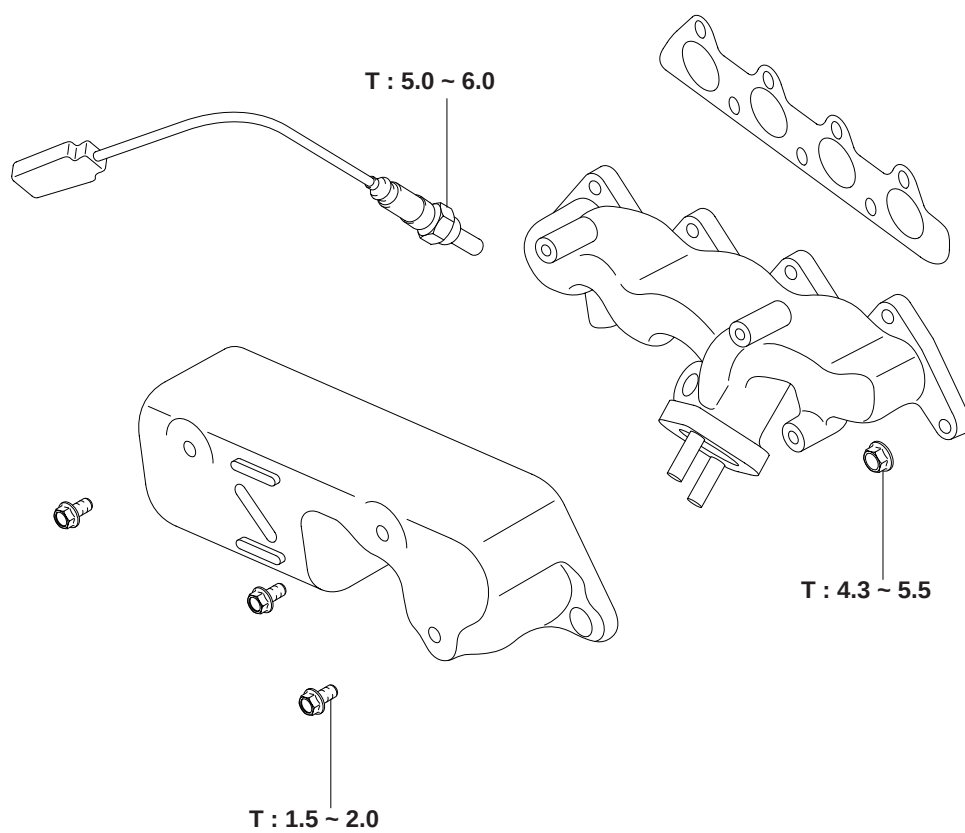
L4GC096A

INSTALLATION

1. Check that the thermostat flange is correctly inserted to the thermostat housing socket.
2. Install a new gasket and water inlet fitting.
3. Add coolant.

INTAKE MANIFOLD

COMPONENTS



Tightening torque : kg·m

L4GC103A

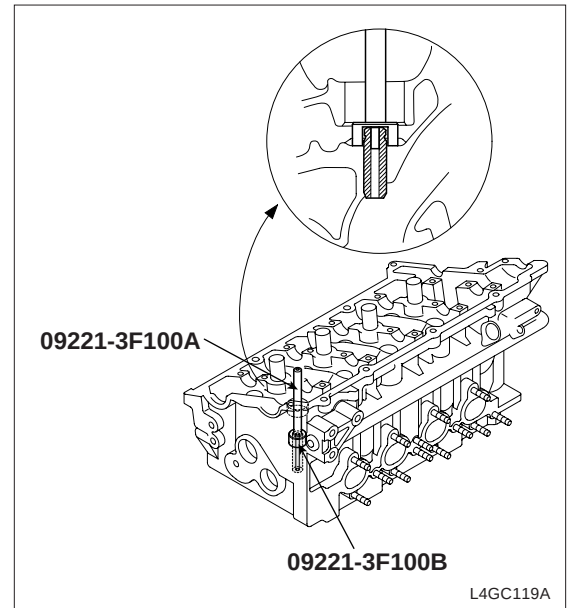
**CAUTION**

Do not tighten parts excessively, observe the specified torque.

VALVE GUIDE REPLACEMENT

Because the valve guide is press-fitted, replace the valve guide as the following procedures using a valve guide installer or proper tool.

1. Remove the valve guide pressed toward cylinder block using a push rod of valve guide installer.
2. Cut the valve guide insert bore of the cylinder head to the valve guide oversize.
3. Press-fit the valve guide using a valve guide installer or proper tool. When using a valve guide installer, Use a valve guide installer to press-fit the valve guide to the specified height.



4. When installing, start from top of valve guide cylinder head. Be sure that the intake valve guide is not same size with the exhaust valve guide. (Intake valve guide : 46.0mm, exhaust valve guide : 54.5mm)
5. After installing the valve guide, insert a new valve and check for perturbation.
6. When replacing the valve guide, check the valve for contact and correct the valve seat if necessary.

Valve guide oversize

Size	Size mark	Cylinder head bore size
0.05 OS	5	11.05 ~ 11.068mm
0.25 OS	25	11.25 ~ 11.268mm
0.50 OS	50	11.50 ~ 11.518mm

IGNITION SYSTEM

GENERAL

1. If the ignition switch is ON, the battery voltage is supplied to 1st coil of ignition coil.
2. By rotation of the crank position sensor wheel, ignition signal in ECU is actuated the power transistor and repeat ground or shut off of 1st current of ignition coil.
3. This causes high pressure in 2nd coil, the induced current from ignition coil to 2nd, coil is grounded through the spark plug and each cylinder is ignited.

TROUBLESHOOTING

When it is hard to start engine, there can be problem with fuel system or engine itself as well as ignition system.

Because main function of ignition system is to supply sufficient electronic spark at a proper timing, when inspecting this system, necessarily contains spark checking and ignition timing measurement. When inspecting ignition system installed to the vehicle, check for possible trouble symptoms from faulty circuit, power, 1st low voltage circuit, high voltage circuit, etc..

1. ENGINE IS NOT STARTED OR HARD TO START.
(CRANKING O.K.)

A spark of spark plug is weak or not at all

- 1) Check Ignition coil
- 2) Crankshaft position sensor
- 3) Spark plug

A spark is normal

Check ignition timing (Ignition timing is automatically controlled by ECU)

2. IDLING IS UNSTABLE
 - **Spark plug**
 - **Ignition timing**
 - **Ignition coil**
3. ACCELERATION IS INSUFFICIENT.
 - **Check Ignition timing**
4. ENGINE IS OVERHEATED AND FUEL CONSUMPTION IS EXCESSIVE.
 - **Check Ignition timing**

TROUBLESHOOTING

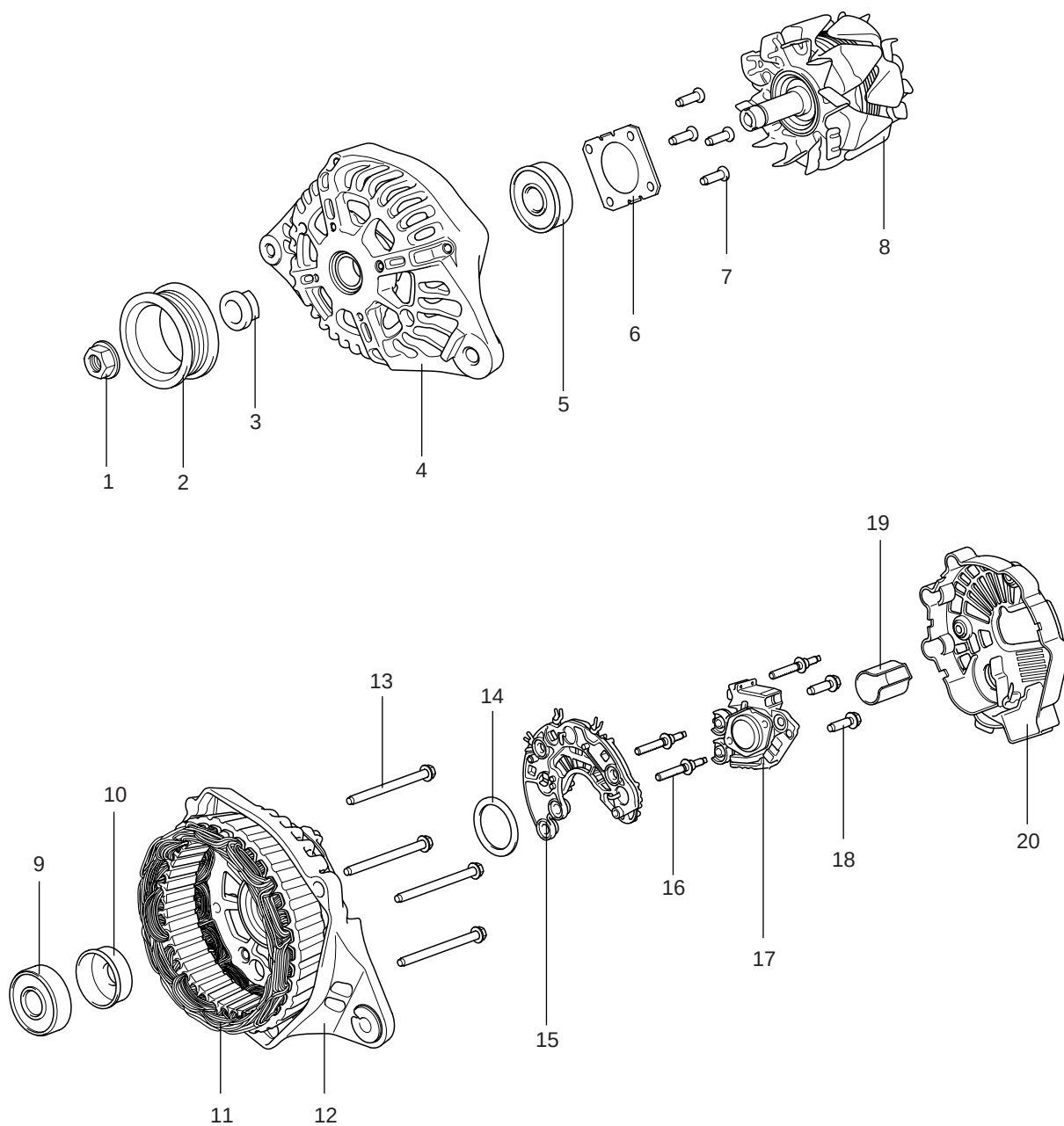
Charging system defect is almost caused by lack of pan belt tension and faulty function of wiring, connector, and voltage regulator.

One of most important thing during troubleshooting of charging system is determining the reason between overcharging and lack of charging. So, prior to inspection of alternator, check the battery for charging. Faulty alternator causes the following symptoms.

1. Faulty battery charging
 - 1) IC regulator fault(Short circuit)
 - 2) Field coil fault
 - 3) Main diode fault
 - 4) Auxiliary diode fault
 - 5) Stator coil fault
 - 6) Brush contact fault
2. Overcharging : IC regulator fault(Short circuit)
 Other faults such as voltage adjusting problem except above symptoms rarely happen.
 Refer to the following troubleshooting table.

Symptom	Possible cause	Remedy
With ignition switch ON, charging warning lamp does not illuminate	Fuse cut off	Replace
	Bulb burnt out	Replace
	Loose wiring connection	Retighten
	Bad connection of L-S terminals	Inspect and replace wiring, Replace voltage regulator
With the engine started, warning lamp is not turned off (Battery needs often charging)	Loose or worn drive belt	Correct or replace
	Fuse cut off	Replace
	Fuse link cut off	Replace
	Faulty voltage regulator or alternator	Inspect alternator
	Faulty wiring	Repair
	Corrosion or wear of battery cable	Repair or replace
Overcharged	Faulty voltage regulator (Charging warning lamp illuminates)	Replace
	Voltage detection wiring fault	Replace
Battery is discharged	Loose or worn drive belt	Correct or replace
	Loose wiring connection	Retighten
	Short circuit	Repair
	Fusible link cut off	Replace
	Ground fault	Repair
	Faulty voltage regulator (Charging warning lamp illuminates)	Inspect alternator
	Battery out	Replace

DISASSEMBLY AND INSTALLATION

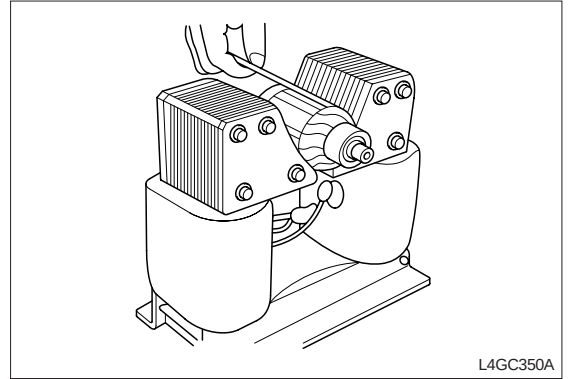


L4GC322A

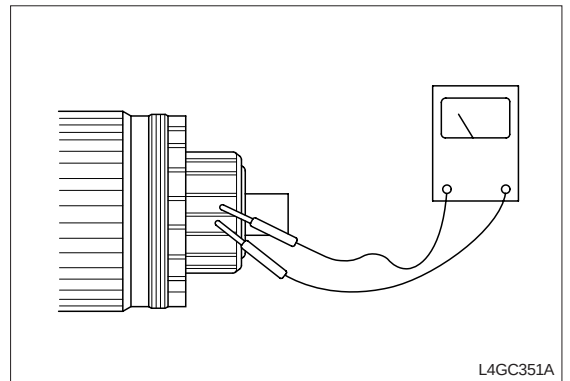
- | | | |
|-------------------------|-------------------|---------------------------|
| 1. Nut | 8. Rotor coil | 15. Rectifier assembly |
| 2. Pulley | 9. Rear bearing | 16. Stud bolt |
| 3. Bushing | 10. Bearing cover | 17. Brush holder assembly |
| 4. Front cover assembly | 11. Stator coil | 18. Brush holder bolt |
| 5. Front bearing | 12. Rear cover | 19. Slip ring guide |
| 6. Bearing cover | 13. Through bolt | 20. Cover |
| 7. Bearing cover bolt | 14. Seal | |

2. SHORT CIRCUIT TEST OF AMARTURE COIL

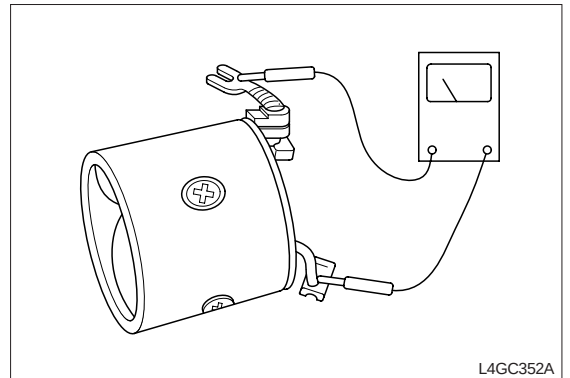
Inspect the armature coil in the growler and if there is short circuit, replace the coil. During core rotation, if the blade attached in the core is vibrated, the armature is short.

**3. OPEN CIRCUIT TEST OF ARMATURE COIL**

Check continuity between the commutator segments using a circuit tester. If there is no continuity, replace the armature assembly owing to open circuit of commutator segment.

**4. OPEN CIRCUIT TEST OF FIELD COIL**

Check continuity of the field coil using a circuit tester. If there is no continuity, replace the field coil assembly owing to open circuit of the field coil.

**5. GROUND TEST OF FIELD COIL**

With the yoke field coil installed, inspect continuity between the field coil and the yoke, if there is continuity, replace the field coil.

