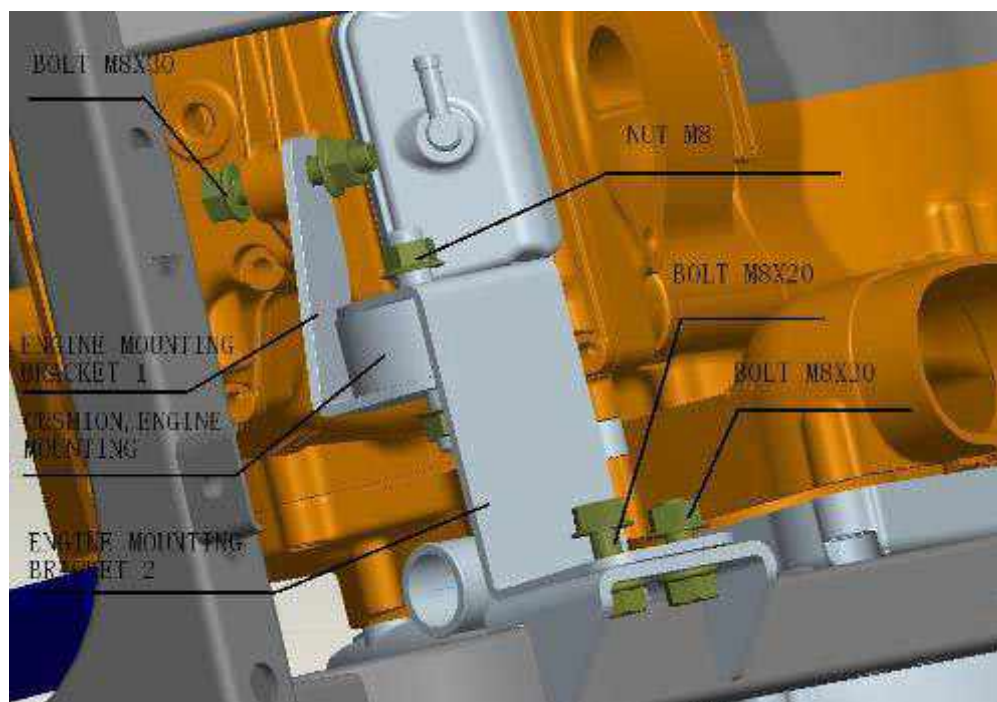


Cette revue technique est à compléter avec la revue technique disponible sur notre site :  
This repair manual needs to be completed with the repair manual (see download area) below :  
« Revue\_Technique\_Quads\_HYTRACK\_50\_a\_550cc »

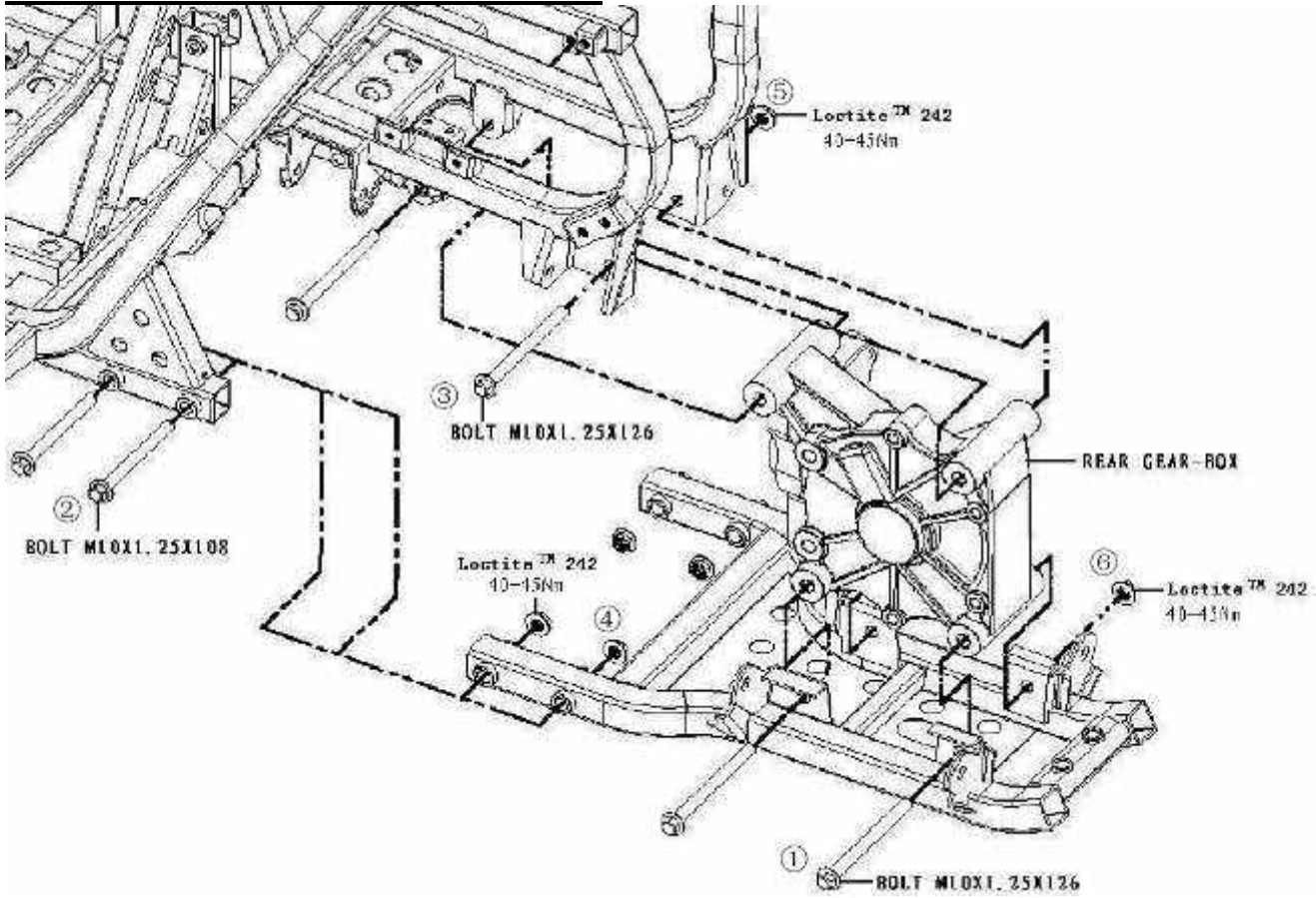
**10.1 FRAME INSTALLATION**  
**ENGINE INSTALLATION**



1 Installation the engine assembly to the frame by the bolt.  
 The torque of the nut M10X1.25 is 60Nm.  
 Apply Loctite™ 242.



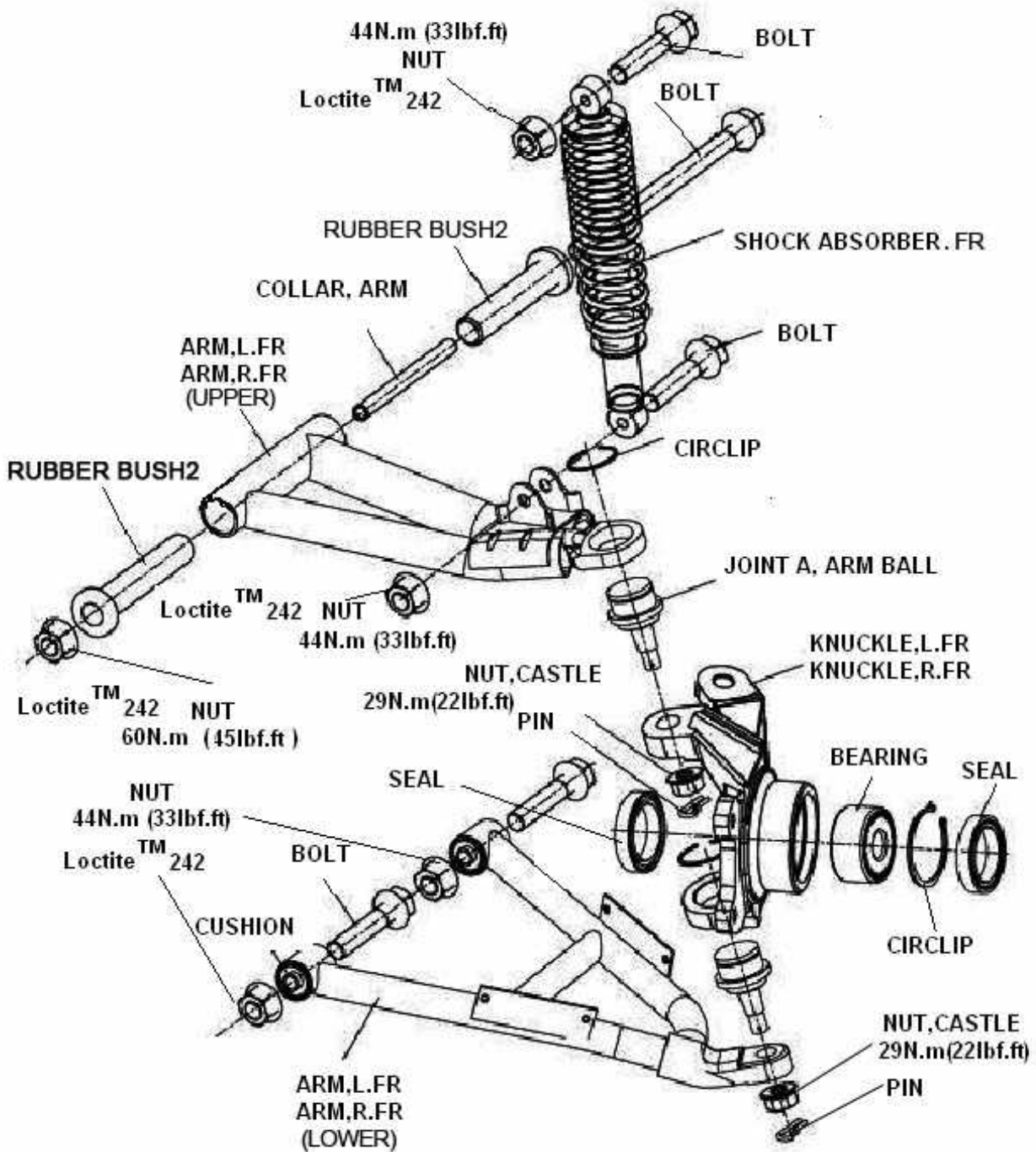
2. Installation the engine assembly to the frame with the engine mounting bracket 1 and 2 and cushion engine mounting .

**REAR GEAR-BOX INSTALLATION**

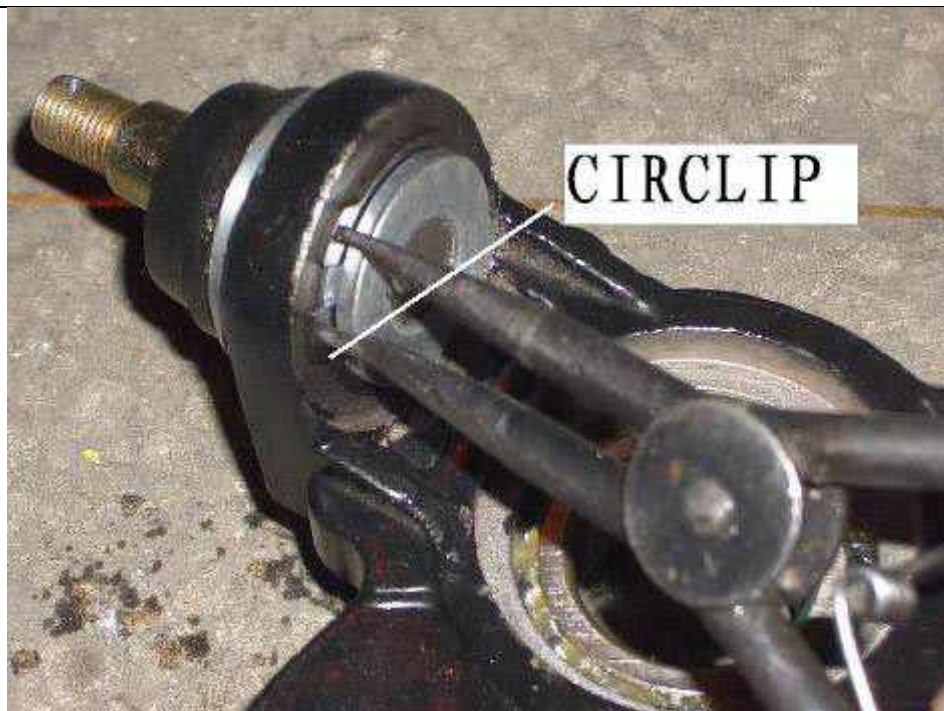
1. Fix the rear gear-box to the rear holder by the bolt M10X1.25X126①(attention don't tighten the nut)
2. Connect the rear holder and the rear gear-box to the frame by the bolt M10X1.25X108② and the bolt M10X1.25X126③.
3. Tighten the nut④⑤⑥, Torque of the nut is 40-45Nm. Apply Loctite™ 242. Reverse the installation procedure for removal.

**10.2 FRONT A-ARM REPLACEMENT**

**MAINTENANCE-FREE PIVOT DESIGN**



1. Elevate and safely support vehicle, removal of front wheel.
2. Remove the cotter pin on the front wheel driving shaft nut, than remove the nut.
3. Remove the front disc brake caliper.
4. Remove the tie-rod ball joint.
5. Remove the mounting bolt of front shock absorber and A-arm. Takedown the A-arm components.
6. Remove the cotter pin, nut, snap spring of the knuckle, FR and joint A-arm ball.



7. Examine the joint A-arm ball. Replace if ball stud excessive gap. Replace new one as required.
8. Using hub extractor to disassembly the front hub.



9. Remove seal.
10. Remove the snap spring of the bearing hub.
11. Using bearing extractor to disassembly the hub bearing.



12. **Notice: when reassembling hub bearing that were removed and rear hub, which are need replaced.**

12. Remove rubber cushion, ARM, and collar. Replace if worn. Discard hardware.



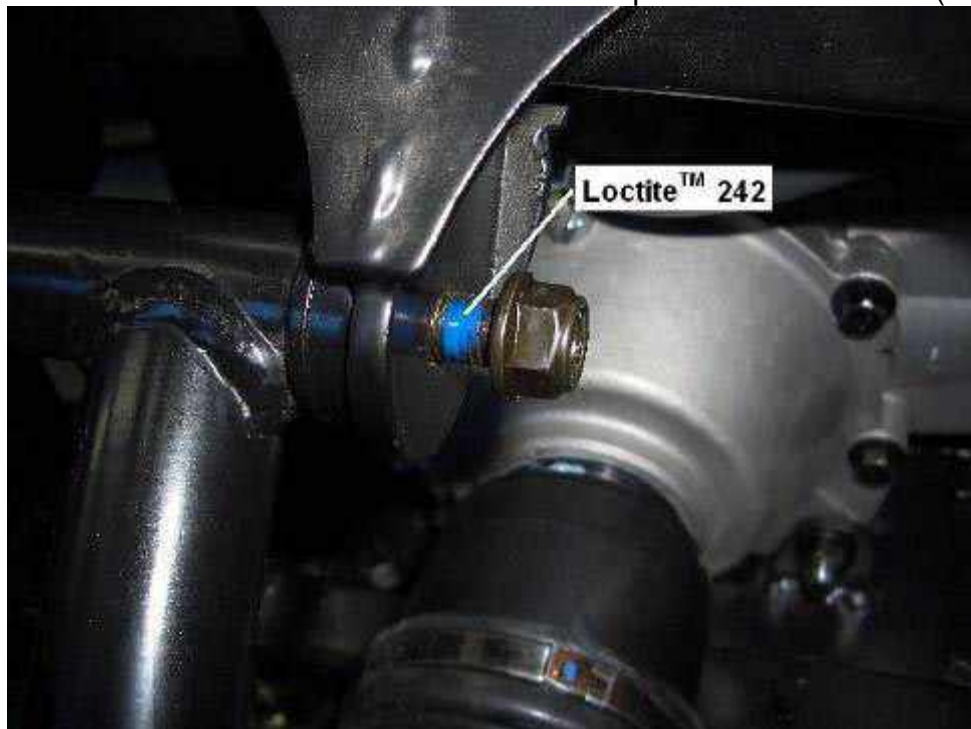
13 Install new A-arm assembly onto vehicle frame from step 12 to step 1. Install new bolts and new nuts.

**NOTE.** Tighten the nuts only finger-tighten at this time. They will be tightened to the final torque after the front wheels are installed and the vehicle is on the ground.

**WARNING**

DO NOT reuse old bolts. Serious injury or death could result if fasteners come loose during operation.

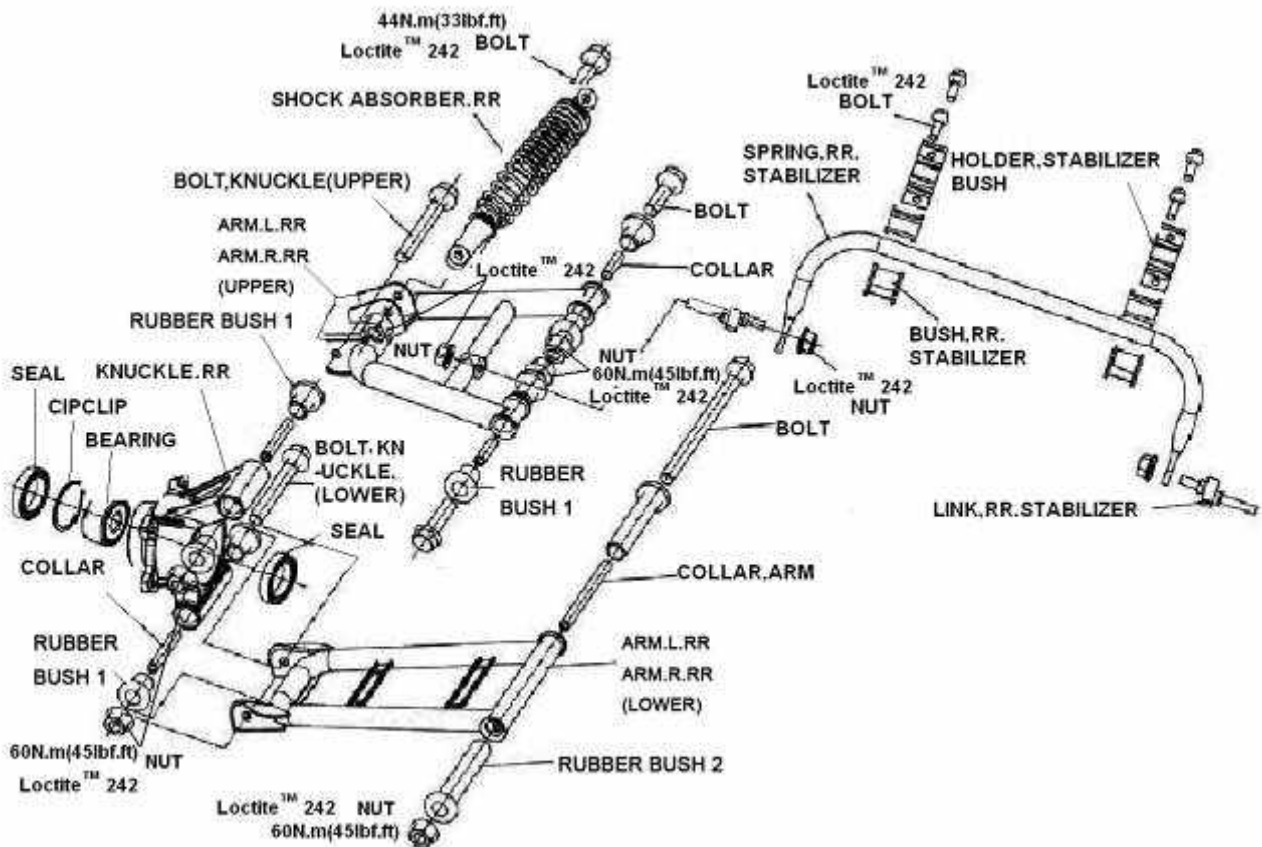
14. Install hubs, calipers and wheels, lower the vehicle to the ground. Apply Loctite™ 242 to screw threads of the A arm bolts and torque bolts to 44 ft. lbs. (60 Nm ).

**WARNING**

Upon A-arm installation completion, test vehicle at low speeds before putting into regular service.

**10.3 REAR A-ARM REMOVE/INSTALLATION**

**MAINTENANCE-FREE PIVOT DESIGN**



1. Remove rear wheel.
2. Remove the cotter pin on the rear wheel driving shaft nut, than remove the nut.
3. Remove the rear disc brake caliper.
4. Remove the link, RR. Stabilizer.
5. Remove the mounting bolt of rear shock absorber and upper and lower A-arm. Takedown the A-arm components.
6. Remove the mounting bolt of the rear hub, after that inspect bushes, A-arms and collar. Replace if worn. Discard hardware.





7. Using hub extractor to take down the rear hub.
8. Remove oil seal.
9. Remove the snap spring of the rear hub.
10. Using bearing extractor to take down the hub bearing.

Notice: when reassembling hub bearing that were removed and rear hub, which are need replaced. (The method is in accordance with removing steering knuckle.)

11. Remove transverse stabilizer bar.



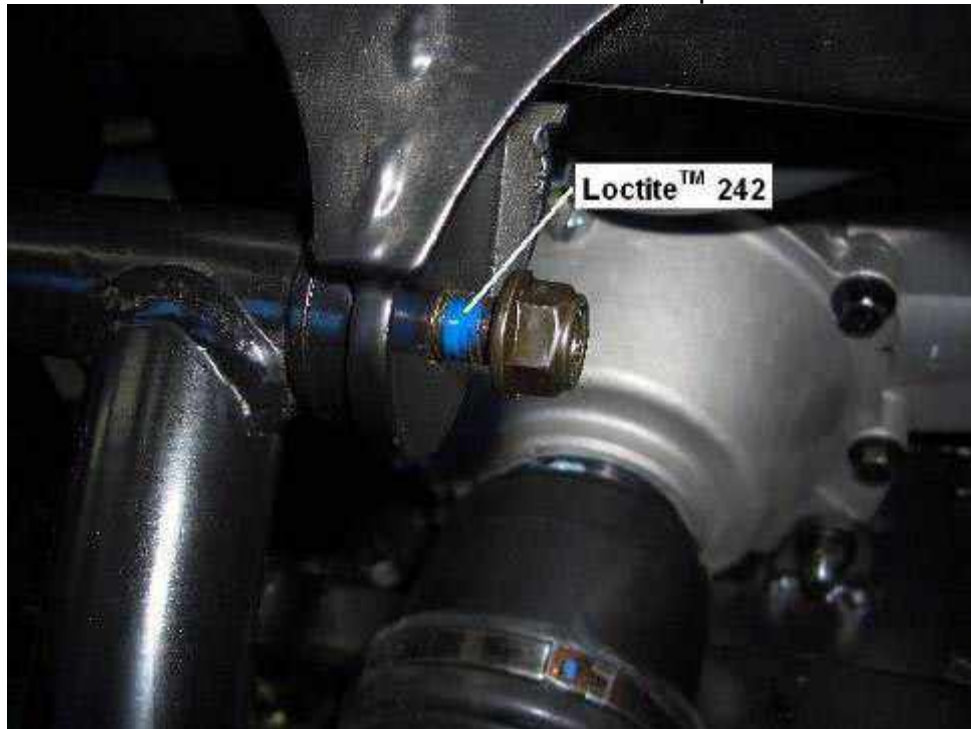
12. Install new A-arm assembly onto vehicle frame , from step11 to step 1 .Install new bolts and new nuts.

**NOTE.** Tighten the nuts only finger-tighten at this time. They will be tightened to the final torque after the front wheels are installed and the vehicle is on the ground.

**WARNING**

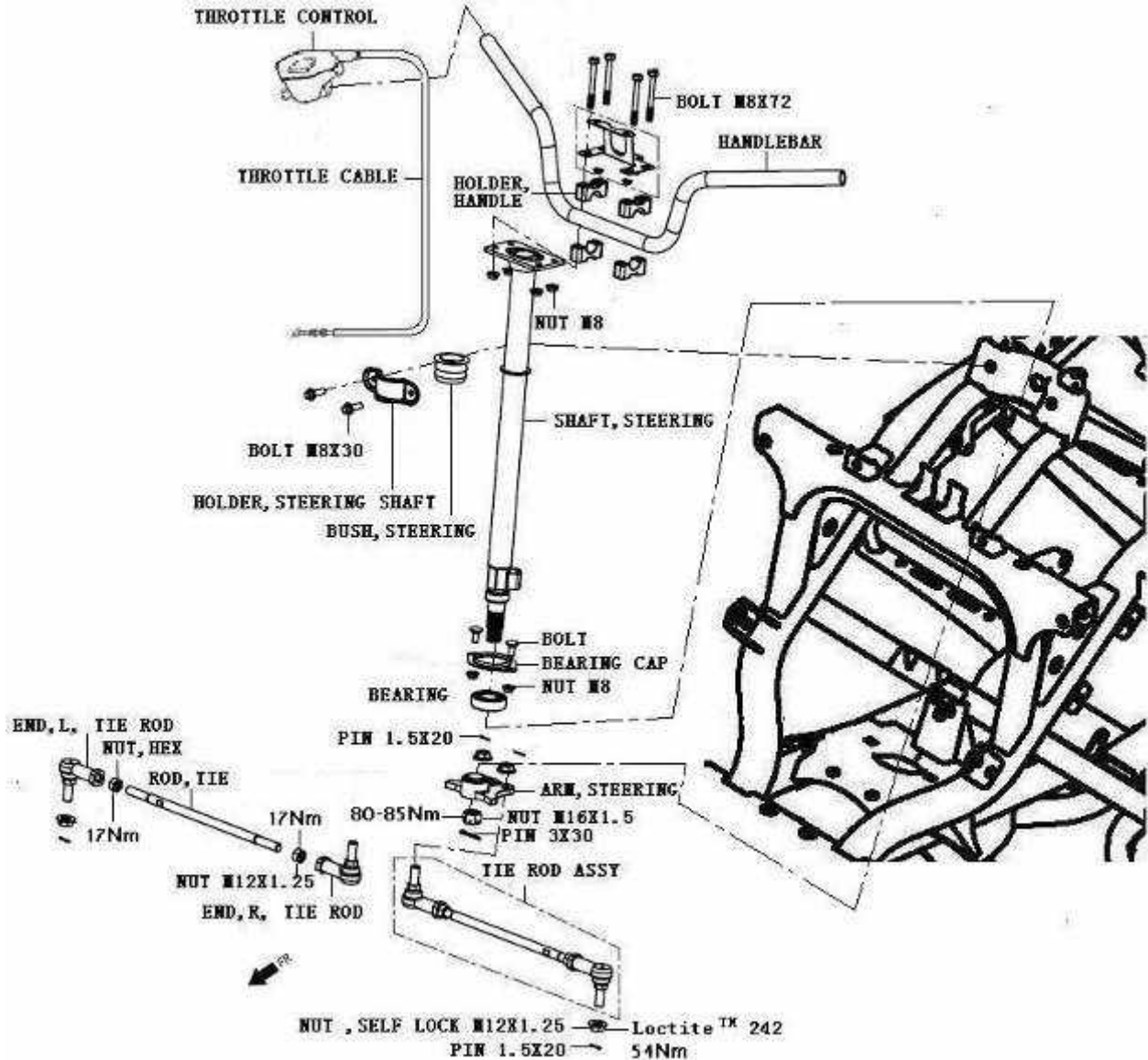
DO NOT reuse old bolts. Serious injury or death could result if fasteners come loose during operation.

13. Install hubs, calipers and wheels, lower the vehicle to the ground. Apply Loctite™ 242 to screw threads of the A arm bolts and torque bolts to 44 ft. lbs. (60 Nm ).

**WARNING**

Upon A-arm installation completion, test vehicle at low speeds before putting into regular service.

**10.4 STEERING SHAFT INSTALLATION**



Non- indicated torque above drawing :

1. BOLT M8X30 Torque : 25Nm
2. NUT M8 Torque : 25Nm

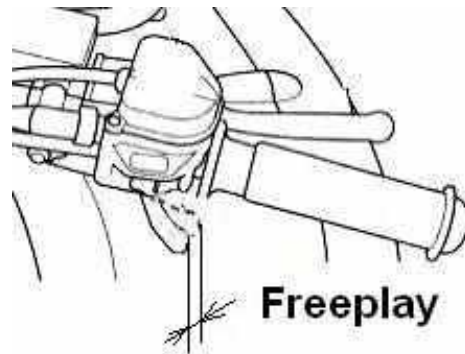
**NOTE :**

1. Use grease M between steering bush and steering shaft.
2. If assembling the nut (M16X1.5) by the torque 80-85Nm and the pin can not be pointed at the hole, you can tighten the torque until the pin is pointed at it. But the max torque is 108Nm.

THROTTLE CABLE FREEPLAY

ADJUSTMENT

1. Throttle cable free play is adjusted at the handlebar.
2. Side the bolts off inline cable adjuster, Loosen adjuster locknut.
3. Turn adjuster until 1/8" to 5/16" (3 to 8 mm) free play is achieved at thumb lever. NOTE: While adjusting freeplay, it is important you flip the throttle lever back and forth.
4. Tighten locknut and slide boots over cable adjuster.



TOE ALIGNMENT

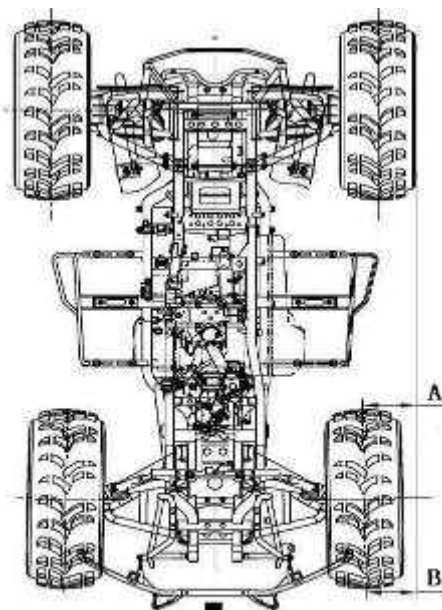
METHOD: STRAIGHTEDGE OR STRING

Be sure to keep handlebars centered

**NOTE:** String should just touch side surface of rear tire on each side of the ATV. Measure from string to rim at front and rear of rim.

Rear rim measurement (A) should be 1/10" to 11/40"(5 to 7mm) more than front rim measurement (B).

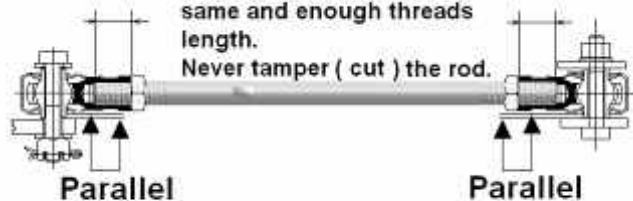
**NOTE:** The steering post arm (frog) can be used as an indicator of whether the handlebars are straight. The frog should always point straight back from the steering post when handlebars are straight.



FRONT

Both ends must screw in same and enough threads length.

Never tamper ( cut ) the rod.



**WARNING:** Always pay attention to tie rods assembly, Both ends must screw in same and enough threads length.

**10.5 WHEELS**

Inspect all wheels for run out of damage.  
Check wheel nuts and ensure they are tight.  
Do not over tighten the wheel nuts.

**WHEEL REMOVAL**

1. Stop the engine, place the transmission in gear and lock the parking brake.
2. Loosen the wheel nuts slightly.
3. Elevate the side of the vehicle by placing a suitable stand under the footrest frame.
4. Remove the wheel nuts and remove the wheel.

**WHEEL INSTALLATION**

1. With the transmission in gear and the parking Brake locked, place the wheel in the correct Position on the wheel hub. Be sure the valve stem is toward the outside and rotation arrows on the tire point toward rotation.
2. Attach the wheel nuts and finger tighten them.  
Install as shown at left for front or rear wheels.
3. Lower the vehicle to the ground.
4. Securely tighten the wheel nuts to the proper Torque listed in the table. On wheel nuts, Make sure tapered end of nut goes into taper on wheel.

**CAUTION:**

If wheels are improperly installed it could affect Vehicle handling and tire wear.

**TIRE PRESSURE**

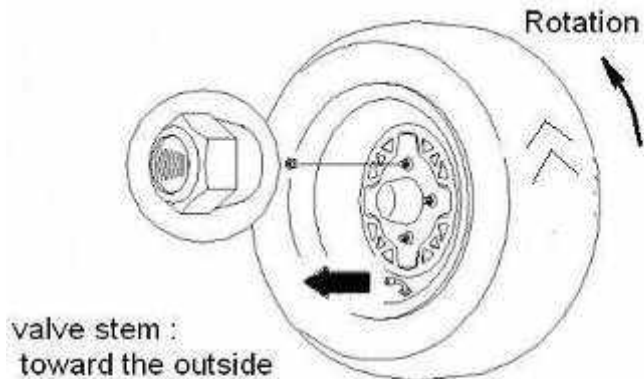
**TIRE INSPECTION**

**CAUTION :**

- Maintain proper tire pressure. Refer to the warning tire pressure decal applied to the vehicle.
- Improper tire inflation may affect ATV maneuverability.
- When replacing a tire always use original equipment size and type and replace in pairs, especially in 4X4 model.
- The use of non- standard size or type tires may affect ATV handling and cause machine damage, especially in 4X4 model.

**TIRE TREAD DEPTH**

Always replace tires when tread depth is worn to 1/8" (3m m ) or less.



Front and rear

Tapered nuts: install with tapered side against wheel

**Wheel Nut Torque Specifications**

Bolt Size		Specification	
Front	M12X1.25	69Ft.Lbs	95N.m
Rear	M12X1.25	69Ft.Lbs	95N.m

**Tire Pressure Inspection**

	Front	Rear
<b>700</b>	14PSI (100±0.5KPa)	14PSI (100±0.5KPa)

**WARNING** Operating an ATV with worn tires will increase the possibility of the vehicle skidding easily with possible loss of control.

Worn tires can cause an accident. Always replace tires when the tread depth measures 1/8" (3 mm ) or less.



## Fuel strainer screen cleaning:

1. Remove the fuel tank ( four bolt ) .
2. Drain the gasoline into an approved fuel container. Remove the two mounting bolts, collars and the fuel fitting.
3. Remove fuel pumpfender.
4. Remove cable.
5. Remove pipe 1 and 2.
6. Remove fuel pump.
7. The assembly sequence is in turn.

### NOTE

After installing the fuel valve and connecting the fuel line, refill the fuel tank and turn the fuel valve ON and check that there is no fuel leaking.

### WARNING

Always pay attention to the fittings of the plastic gas tank during fuel lines service. Don't pull the line from the tank directly for removal. Inspect fittings and tank body for looseness, nicks, and scratches. Replace gas tank if necessary.

### VENT LINES AND ROLL OVER VALVE\*

1. Check fuel tank, oil tank, carburetor, battery, and transmission vent lines for signs of wear, deterioration, damage or leakage. Replace every two years.
2. Be sure vent lines and drain lines are routed properly toward the ground and secured with cable ties. **CAUTION:** Make sure lines are not kinked or pinched

**\*NOTE. There is a Roll-Over Valve on the end of the gas tank vent line. Make sure the ↑ mark on the R-O Valve is upwards.**

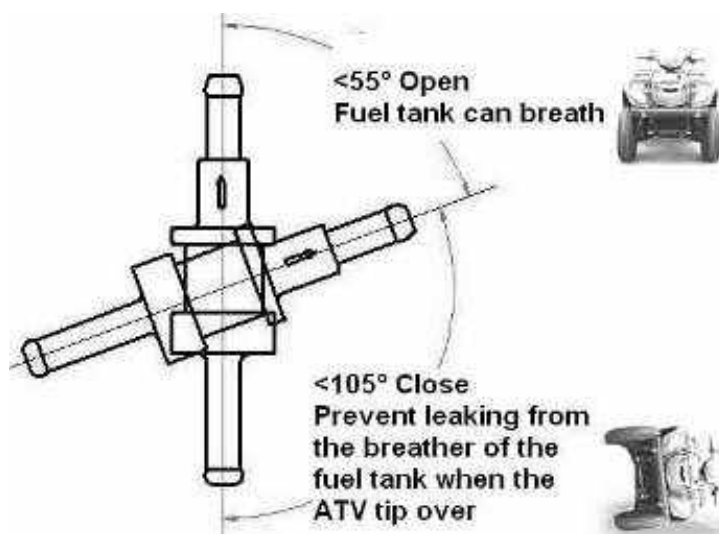
### WARNING

Gasoline is extremely flammable and explosive under certain conditions.

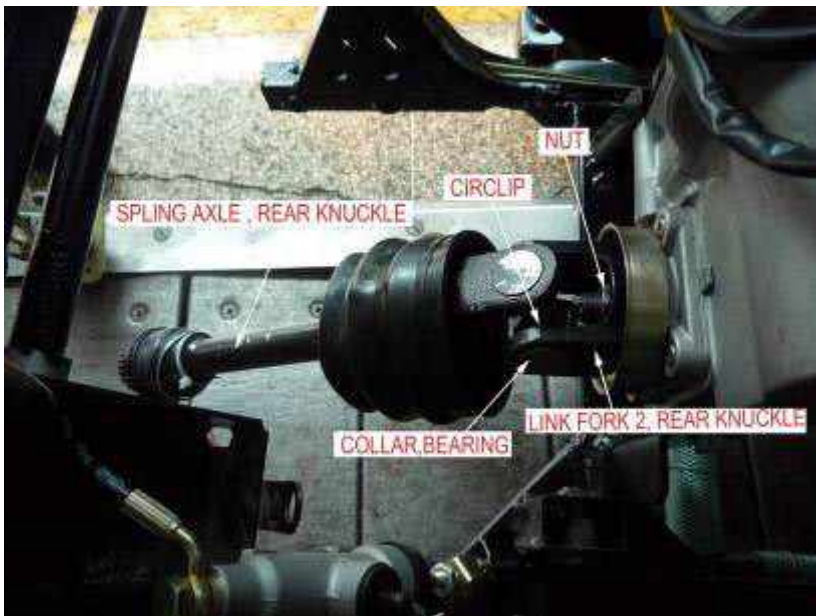
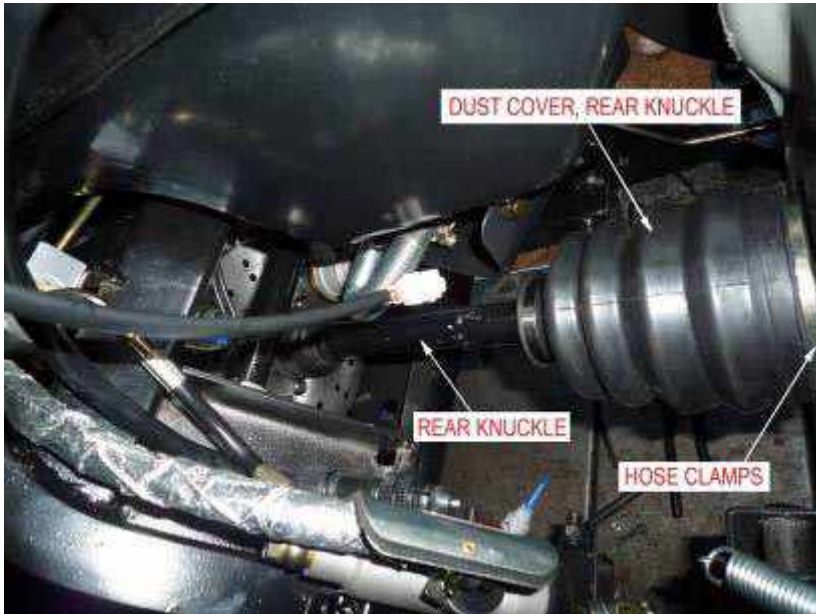
Always stop the engine and refuel outdoors or in a well ventilated area.

- ⚠ Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.
- ⚠ Do not overfill the tank. Do not fill the tank neck.
- ⚠ If you get gasoline in your eyes or if you swallow gasoline, see your doctor immediately.
- ⚠ If you spill gasoline on your skin or clothing, immediately wash it off with soap and water and change clothing.
- ⚠ Never start the engine or let it run in an enclosed area. Gasoline powered engine exhaust fumes are poisonous and can cause loss of consciousness and death in a short time.
- ⚠ Never drain the float bowl when the engine is hot. Severe burns may result.

Item	Specification
CLIP	4 N.m
Nut	6 N.m



**10.7 Rear drive shaft**



1. Remove the hose clamps.
2. Remove the dust cover of the rear drive shaft.





3. Remove circlip.

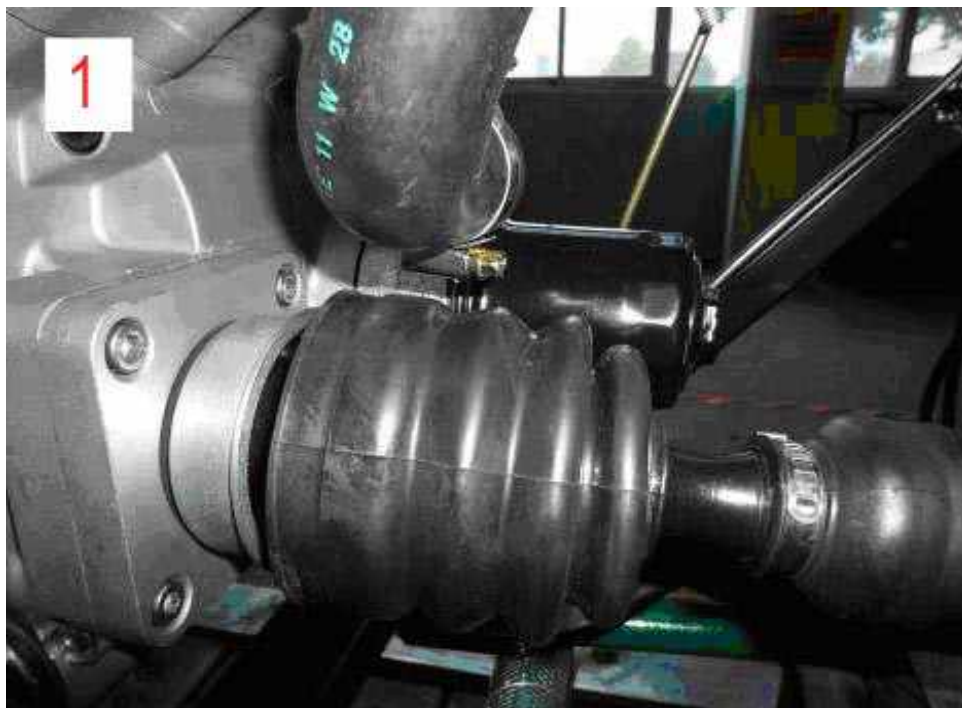


4. Figure on side of the bearing sleeve bearing sleeve, so that the other side of the fell, then remove a bearing sleeve;



5. Remove rear drive shaft spline shaft.
6. Remove rear drive shaft spline shaft.
7. In turn the assembly sequence.

## 10.8 Front drive shaft



1. Remove the hose clamps to connect the engine side, remove the dust cover (as shown in Figure 1);



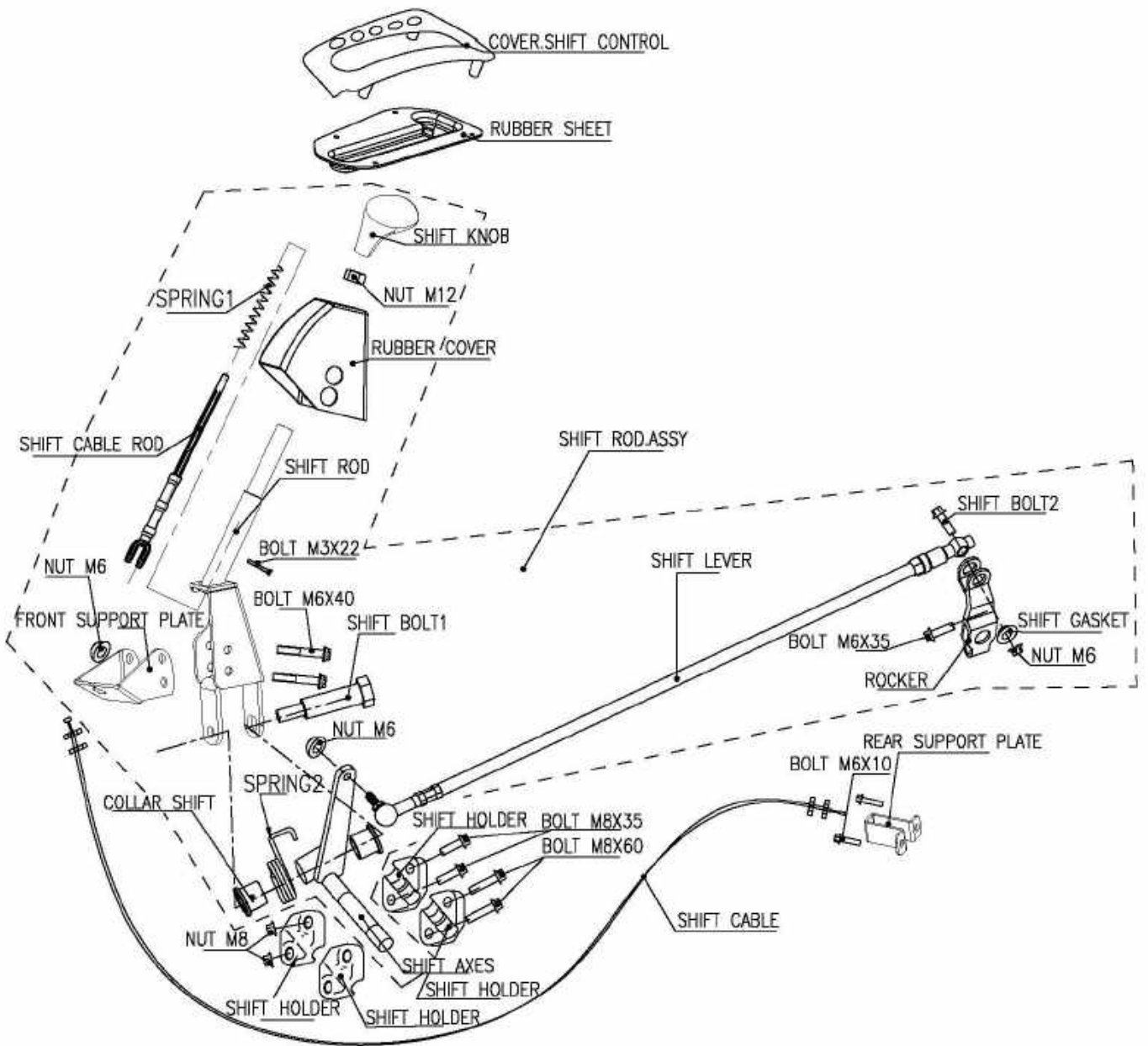
2. Clamp front drive shaft by using a special tool and tighten nut at the right end with a wrench to constrict the drive shaft till it can be removed (as shown in Figure 2).



3. Pull out the front drive shaft (as shown in Figure 3);

4. In turn the assembly sequence.

**10.9 SHIFT ROD SYSTEM**



## SHIFT LINKAGE ADJUSTMENT

Linkage rod adjustment is necessary when symptoms include:

- Noise on deceleration
- Inability to engage a gear
- Excessive gear clash(noise)
- Shift moving out of desired range

**NOTE:** When adjusting shift linkage, always adjust linkage rods. Remove necessary components to gain access to shift linkage rod ends.

1. Inspect shift linkage both tie rod ends, and shift collar and replace if worn or damaged. Lubricate the tie rod ends with a light aerosol lubricant or grease.
2. Loosen all rod end adjuster jam nuts.
3. Note orientation of tie rod end studs with stud up or down. Remove rod end studs from transmission rocker.
4. Be sure idle speed is adjusted properly.
5. Place gear selector in neutral. Make sure the transmission rocker are engaged in the neutral position detents.
6. Be sure the shift linkage rod ends are firmly attached to the gear selector slides. Adjust the linkage rod so the rod end is centered on the transmission rocker. Install the lock nut to the rod end and torque to 35 in.lbs ( 4 Nm).
7. Loosen the clamp nut of gear shift. Clockwise rotation. Lengthening the distance between handlebar and shift swimming arm, conversely the distance shorten. Make gear shift handle smooth limit to L(slot of low gear).then tighten nut of handle.
8. Do not turn shift knob casually after it is assembled and secured.
9. Be sure to remove shift cable rod before removing shift knob while disassembling.

**Mark for counter**

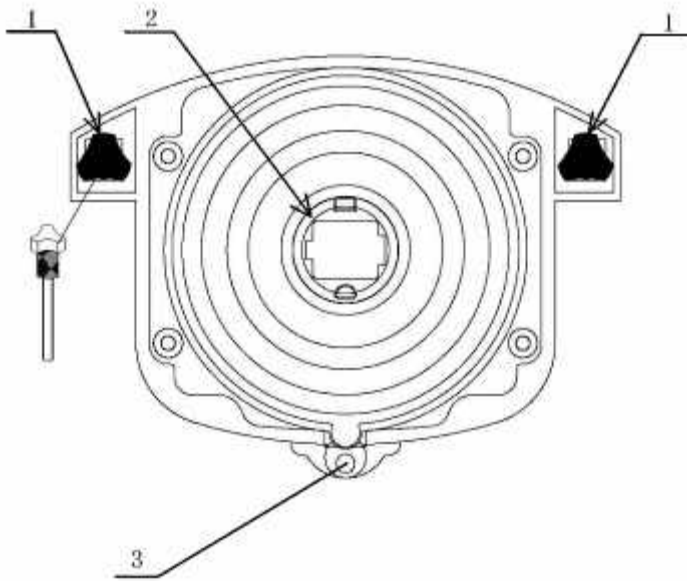


**10.10 ELECTRICAL**

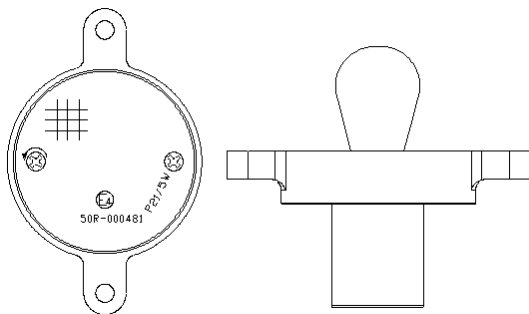
- 10.10.1 LIGHTS INSPECTION AND SERVICE
- 10.10.2 BATTERY
- 10.10.3 IGNITION SYSTEM
- 10.10.4 CHARGING SYSTEM
- 10.10.5 ELECTRICS STARTING SYSTEM
- 10.10.6 COOLING SYSTEM
- 10.10.7 LIGHTING SYSTEM
- 10.10.8 GEAR POSITION INDICATOR SWITCH TEST
- 10.10.9 SPEEDOMETER SYSTEM
- 10.10.10 MAIN SWITCH AND HANDLE SWITCH
- 10.10.11 FUEL GAUGE/ FUEL LEVEL SENSOR
- 10.10.12 THE OPERATION PRINCIPLE OF THE ELECTRIC 4WD SHIFT
- 10.10.13 SINGLE CYLINDER UNWORKING WARNING SYSTEM





**10.10.1 LIGHTS INSPECTION AND SERVICE****A. HEADLIGHT LAMP REPLACEMENT AND ADJUST**

1. To lower headlight brightness cut-off line, turn adjusting bolt (1) counterclockwise. And to raise brightness cut-off line, turn the bolt clockwise.
2. Take rubber cap (2) out from holder. Remove rebound clip to take the worn bulb out from socket. Align the semicircle on a new bulb with that in the socket before mounting the bulb. Install rebound clip just removed to fasten the bulb and then plug in wires.
3. Remove position lamp socket out of top cover. Remove the worn bulb by taking a hold of it and pulling it out. Insert a new bulb into socket before inserting the socket in its mounting hole.

**B. TAILLIGHT LAMP REPLACEMENT**

4. To remove screws used to fasten lampshade, turn the screws counterclockwise with a Phillips screwdriver.
5. Remove lampshade.
6. Keeping a firm grasp on holder, hold bulb to remove it by pressing it down and turning it counterclockwise.
7. To install bulb, align high locating stud on bulb with that in brass socket and low locating stud on bulb with that in brass socket, and bulb will be locked after being pressed down and turned clockwise simultaneously.

### **10.10.2 BATTERY**

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing Antidote:

**External:** Flush with water.

**Internal:** Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.

**Eyes:** Flush with water for 15 minutes and get prompt medical attention.

Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries.

**KEEP OUT OF REACH OF CHILDREN**

**WARNING:** The gases given off by a battery are explosive. Any spark or open flame near a battery can cause an explosion which will spray battery acid on anyone close to it. If battery acid gets on anyone, wash the affected area with large quantities of cool water and seek immediate medical attention.

To ensure maximum service life and performance from a new battery, perform the following steps.

**NOTE:** Do not service the battery unless it will be put into regular service within 30 days. After initial service, add only distilled water to the battery. Never add electrolyte after a battery has been in service.

**NOTE:** New Battery must be fully charged before use.

1. Remove vent plug from vent fitting.
2. Fill battery with electrolyte to upper level marks on case.
3. Set battery aside and allow it to cool and stabilize for 30 minutes.
4. Add electrolyte to bring level back to upper level mark on case.

**NOTE:** This is the last time that electrolyte should be added. If the level becomes low after this point, add only distilled water.

5. Charge battery at 1 /10 of its amp /hour rating. Examples: 1 /10 of 14 amp battery = 1.4 amp; 1/10 of 7 amp battery = 0.7 amp (recommended charging rates).
6. Check specific gravity of each cell with a hydrometer to assure each has a reading of 1.270 or higher.

#### **BATTERY INSPECTION / REMOVAL**

The battery is located under the left rear fender. Inspect the battery fluid level. When the battery fluid nears the lower level, the battery should be removed and distilled water should be added to the upper level line. To remove the battery:

1. Disconnect holder strap and remove cover.
2. Disconnect battery negative (-) (black) cable first, followed by the positive (+) (red) cable.

**CAUTION**

Whenever removing or reinstalling the battery, disconnect the negative (black) cable first and reinstall the negative cable last!

3. Remove the battery. Remove the filler caps and add *distilled water only* as needed to bring each cell to the proper level.

Do not overfill the battery.

To refill use only distilled water. Tap water contains minerals which are harmful to a battery.

Do not allow cleaning solution or tap water to enter the battery. It will shorten the life of the battery.

4. Reinstall the battery caps.

**BATTERY INSTALLATION**

1. Clean battery cables and terminals with a stiff wire brush. Corrosion can be removed using a solution of one cup water and one tablespoon baking soda. Rinse with clean water and dry thoroughly.

2. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable.

3. Install clear battery vent tube from vehicle to battery vent.

**WARNING:** Vent tube must be free from obstructions and kinks and securely installed. If not, battery gases could accumulate and cause an explosion. Vent should be routed away from frame and body to prevent contact with electrolyte. Avoid frame, corrosion will occur.

4. Route cables so they are tucked away in front and behind battery.

5. Reinstall battery cover and holder strap.

Do not start the engine with the battery disconnected. Vehicle lamps will burn out if battery is disconnected during vehicle operation. Also, the reverse speed limiter can be damaged.

**BATTERY TESTING**

Whenever a service complaint is related to either the starting or charging systems, the battery should be checked first.

Following are three tests which can easily be made on a battery to determine its condition: OCV Test, Specific Gravity Test and Load Test.

**MF (Maintenance Free) battery does not require the Specific Gravity Test and Refill****Open Circuit Voltage Test**

Battery voltage should be checked with a digital multimeter. Readings of 12.6 or less require further battery testing and charging.

**NOTE:** Lead acid batteries should be kept at or near a full charge as possible.

**Load test**

**CAUTION:** Remove spark plug high tension leads and connect securely to engine ground before proceeding.

**NOTE:** This test can only be performed on machines with electric starters. This test cannot be performed with an engine or starting system that is not working properly.

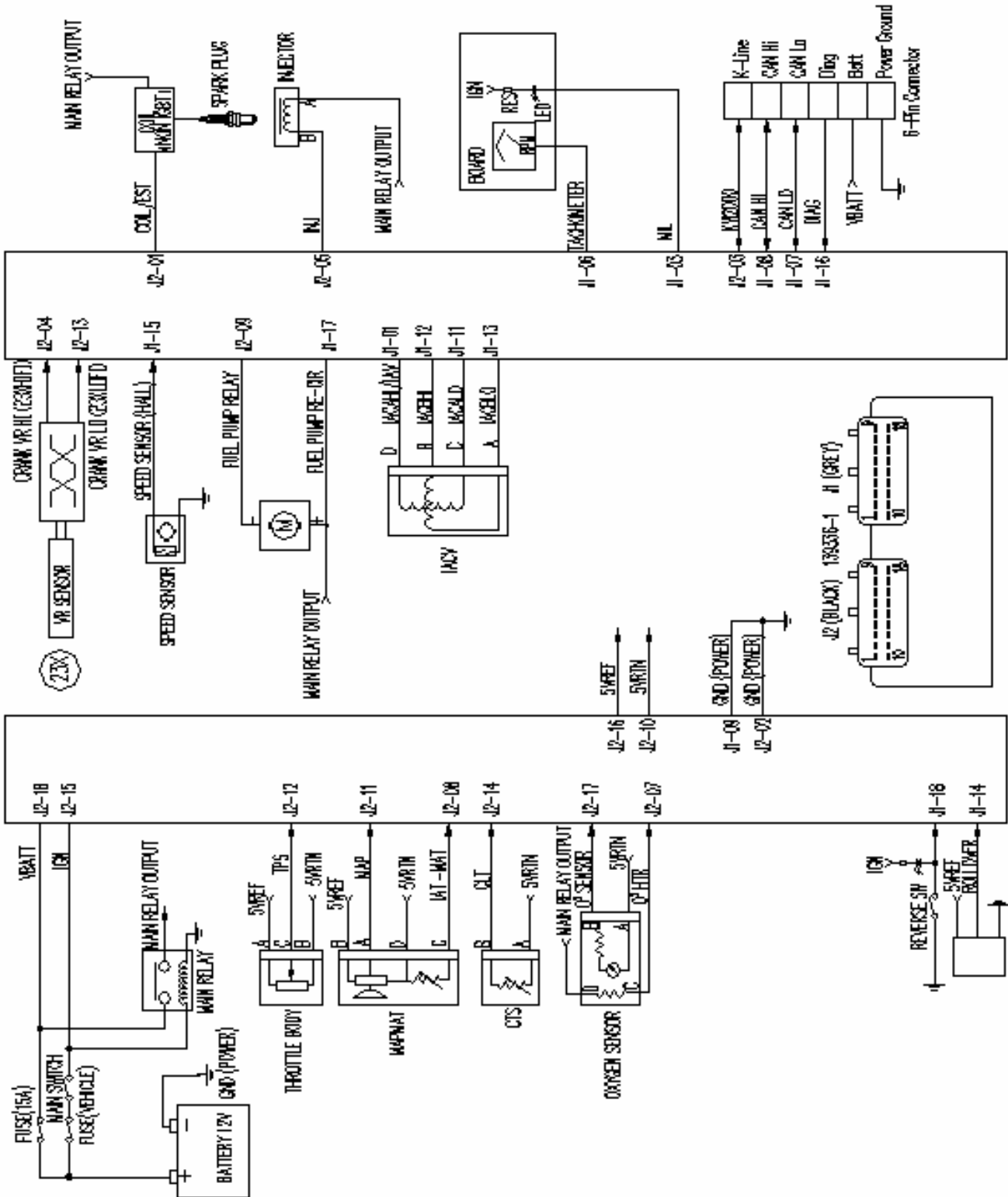
A battery may indicate a full charge condition in the OCV test and the specific gravity test, but still may not have the storage capacity necessary to properly function in the electrical system. For this reason, a battery capacity or load test should be conducted whenever poor battery performance is encountered. To perform this test, hook a multimeter to the battery in the same manner as was done in the OCV test. The reading should be 12.6 volts or greater. Engage the electric starter and view the registered battery voltage while cranking the engine. Continue the test for 15 seconds. During this cranking period, the observed voltage should not drop below 9.5 volts. If the beginning voltage is 12.6 or higher and the cranking voltage drops below 9.5 volts during the test, replace the battery.

---

**10.10.3 IGNITION SYSTEM**

**IGNITION SYSTEM TROUBLESHOOTING****No Spark, Weak or Intermittent Spark**

- Spark plug gap incorrect
- Fouled spark plug
- Faulty spark plug cap or poor connection to high tension lead
- Related wiring loose, disconnected, shorted, or corroded
- Engine stop switch or ignition switch faulty
- Terminal board or connections wet, corroded
- Poor ignition coil ground (e.g. coil mount loose or corroded)
- Faulty stator (measure resistance of all ignition related windings)
- Incorrect wiring (inspect color coding in connectors etc. )
- Faulty ignition coil winding (measure resistance of primary and secondary)
- Worn magneto (RH) end crankshaft bearings
- Sheared flywheel key
- Flywheel loose or damaged
- Trigger coil air gap too wide (where applicable) should be 0.030-0.050" (0.75-1.25 mm)
- Excessive crankshaft run out on magneto (RH) end should not exceed 0.005" (0.13mm)
- Faulty ECU



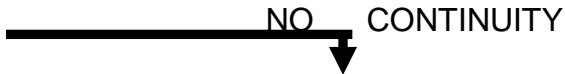
**IF THE IGNITION SYSTEM FAILS TO OPERATE**

**Procedure**

Check:

- |                              |                           |
|------------------------------|---------------------------|
| 1. Fuse (Main)               | 7. Pickup coil resistance |
| 2. Battery                   | 8. Main switch            |
| 3. Spark plug                | 9. Engine stop switch     |
| 4. Ignition spark gap        | 10. Wiring connection     |
| 5. Spark plug cap resistance | (entire ignition system)  |
| 6. Ignition coil             |                           |

1. Fuse



Check switches

Replace the fuse.



2. Battery

- Check the battery condition.

Refer to "BATTERY INSPECTION"

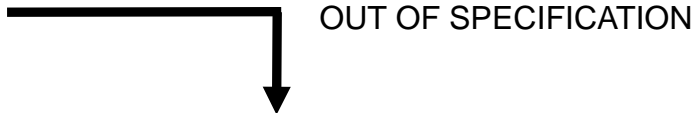


- Clean battery terminals.
- Recharge or replace the battery.



3. Spark plug

- Check the spark plug condition.
- Check the spark plug type.
- Check the spark plug gap.



Repair or replace the spark plug  
**Standard spark plug:FR8DCX/  
BOSCH**



Spark plug gap: 0.6 ~ 0.7mm



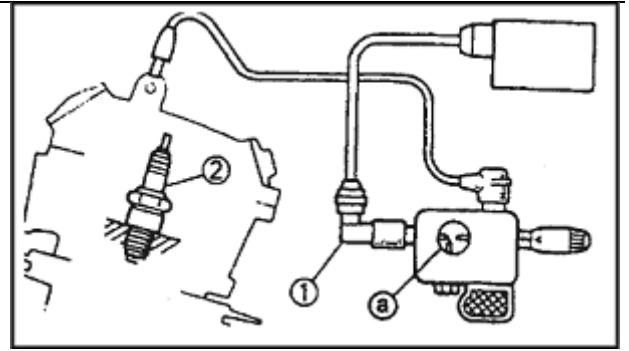
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4. Ignition spark gap

- Disconnect the spark plug cap from the spark plug
- Connect the ignition tester 1 as shown.
- 2 Spark plug
- Turn the main switch to "ON".
- Check the ignition spark gap .
- Check the spark by pushing the starter switch, and increase the spark gap until a misfire occurs.



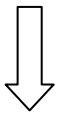
MEETS SPECIFICATION



The ignition system is not faulty.



**Minimum spark gap:  
6mm (0.24 in)**



OUT OF SPECIFICATION  
OR  
NO SPARK

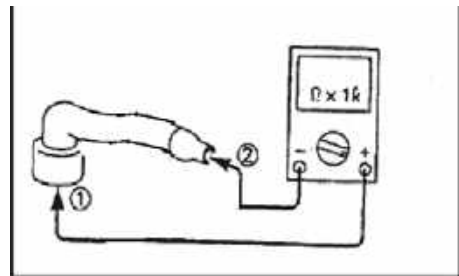
5. Resistive cable with Spark plug cap resistance

- Remove the spark plug cap.
- Remove the resistive cable from the ignition coil
- Connect the pocket tester ( $\Omega \times 1 \text{ k}$ ) to the spark plug cap and the resistive cable terminal.

NOTE:

- When removing the spark plug cap, do not pull the spark plug cap from the resistive cable.
- Remove → Pulling
- Connect → Pushing.
- Check the resistive cable with spark plug cap

Tester (+) lead →  
Spark plug side ①  
Tester (—) lead →  
High tension cord side ②



OUT OF SPECIFICATION



Replace the resistive cable



**Resistive cable  
resistance:**

**$3.68 \pm 0.73 \text{ K}\Omega$  (20  $\square$ )**



CORRECT

\*





6. Ignition coil resistance

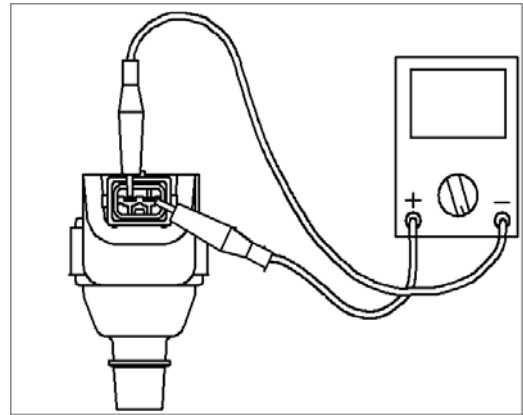
Disconnect the ignition coil connector from the wire harness.

- Connect the pocket tester to the ignition coil.
- Check if the primary coil has the specified resistance.

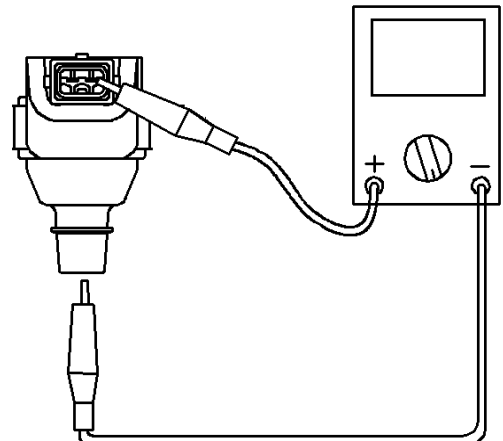


**Primary coil resistance:**  
 $0.58 \pm 0.058 \Omega (20\text{ }^\circ\text{C})$

**Tester (+) lead**  
**Right Terminal**  
**Tester (-) lead**  
**Left Terminal**



**Tester (+) lead:**  
**Connector side (Right)**  
**Tester (-) lead**  
**Resistive cable side**



- Remove the resistive cable from the ignition coil
- Connect the pocket tester ( $\Omega \times 1k$ ) to the ignition coil.
- Check the secondary has the specified resistance

**Secondary coil resistance:**  
 $9.6 \pm 0.96\text{ K}\Omega (20\text{ }^\circ\text{C})$



**BOTH MEET SPECIFICATION**

**OUT OF SPECIFICATION**



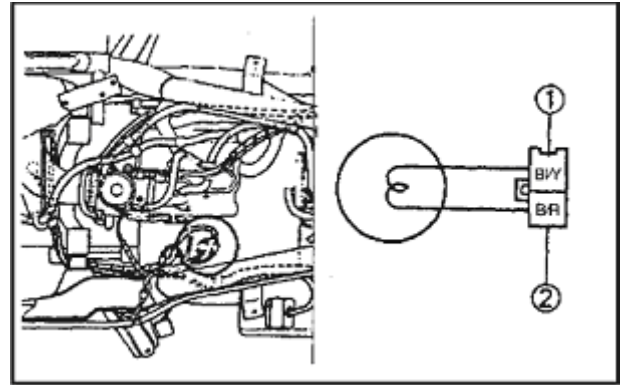
**Replace the ignition coil.**

\*



7. Pickup coil resistance

- Disconnect the pickup coil coupler from the wire harness.
- Connect the pocket tester ( $\Omega$  100) to the pickup coil coupler.



Tester (+) lead →

B/Y Terminal ①

Tester (-) lead →

B/R Terminal ②

- Check the pickup coil has the specified resistance.



Primary coil resistance:  
168 -252 $\Omega$  (20 $\square$ )

MEETS  
SPECIFICATION

8. Main switch

CHECK SWITCHES

CONTINIUTY

9. Engine stop switch ( for USA model)

CONTINIUTY

10. Wiring connection

- Check the connection of the entire ignition system
- Refer to "CIRCUIT DIAGRAM".

CORRECT

Replace the ECU.



OUT OF SPECIFICATION

Replace the pickup coil.

NO CONTINUITY

Replace the main switch

NO CONTINUITY

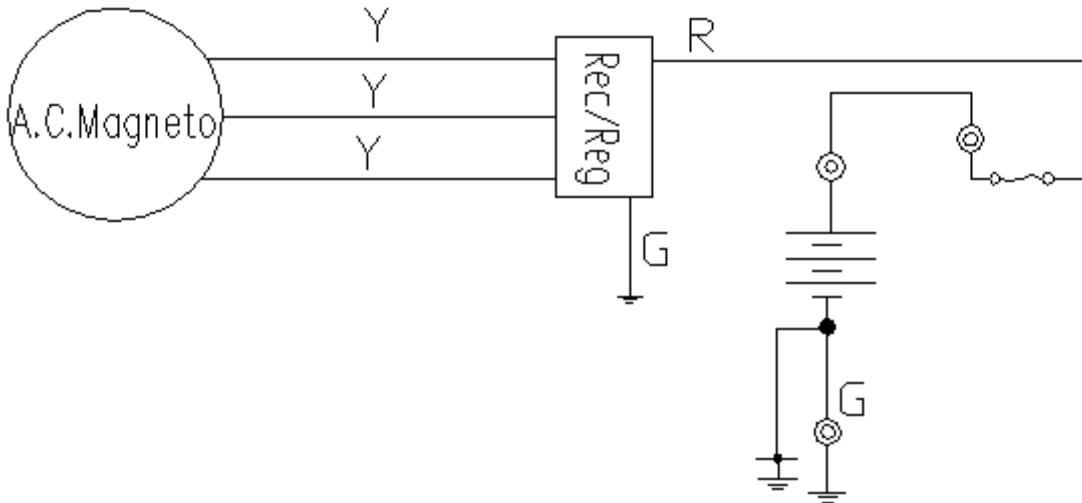
Replace the handlebar switch.

POOR CONNECTIONS

Correct

**10.10.4 CHARGING SYSTEM**

**CHARGING SYSTEM CIRCUIT DIAGRAM**

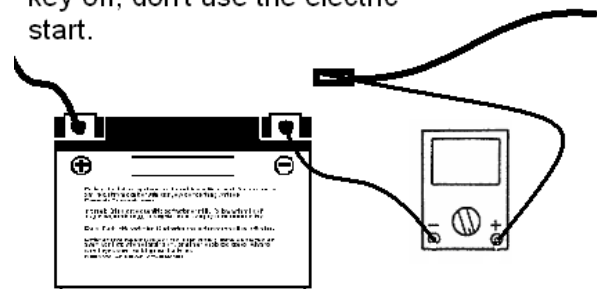


**CURRENT DRAW - KEY OFF**

**CAUTION:** Do not connect or disconnect the battery cable or ammeter with the engine running. Damage will occur to light bulbs and speed limiter. Connect an ammeter in series with the negative battery cable. Check for current draw with the key off, if the draw is excessive, loads should be disconnected from the system one by one until the draw is eliminated. Check component wiring as well as the component for partial shorts to ground to eliminate the draw.

<p><b>Current draw key off:</b>  <b>Maximum of 0.01DCA(10mA)</b></p>
--

key off, don't use the electric start.



**CHARGING SYSTEM**

**Procedure**

Check:

1. Fuse (Main)
2. Battery
3. Charging voltage
4. Stator coil resistance
5. Wiring system (entire charging system)

1. fuse

NO CONTINUITY



Replace the fuse

2. Battery

Check the battery condition.  
Refer to "BATTERY INSPECTION"

INCORRECT



Clean battery terminals  
Recharge or replace the battery

3. Charging voltage

Connect the engine tachometer to the spark plug lead.

●Connect the pocket tester (DC20V) to the battery

**Test (+) lead**→

**Battery (+) terminal ①**

**Tester (-) lead**→

**Battery (-) terminal ②**

Measure the battery terminal voltage.

start the engine and accelerate to about 5,000rpm

●check the terminal voltage

**Measured voltage-terminal Voltage:**

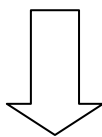
**0.2-2.5V up**

**NOTE:** Use a fully charged battery.

MEETS SPECIFICATION



The charging circuit is not faulty  
Replace the battery



OUT OF SPECIFICATION

4. Starter coil resistance

Remove the A.C. magneto coupler from wire harness

Connect the pocket tester ( $\Omega X1$ ) to the stator coil

Tester (+) lead –yellow terminal

Tester (-) lead –yellow terminal

Measure the stator coil resistance

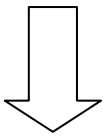
Stator coil resistance 0.5-0.8 $\Omega$  ( 20 $\square$  )

OUT OF SPECITICATION



Replace the stator coil

MEETS SPECIFICATION



5. Wiring connection

check the entire charging system for connections

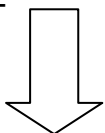
Refer to "CIRCUIT DIAGRAM"

POOR CONNECTION



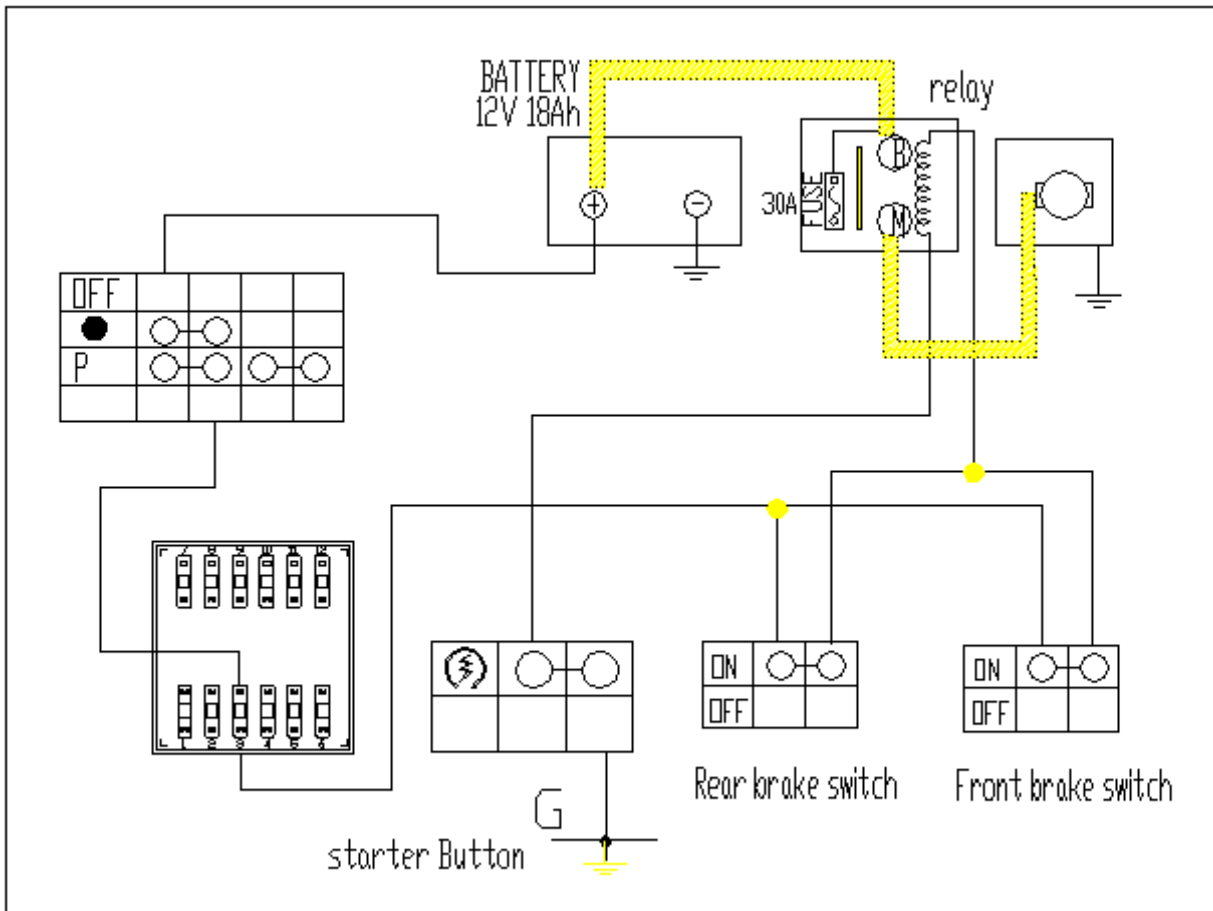
correct

CORRECT



Replace the rectifier/regulator

**10.10.5 ELECTRICS STARTING SYSTEM  
DIAGRAM**



TROUBLESHOOTING

IF THE STARTER MOTOR FAILS TO OPERATE

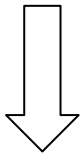
Procedure

Check:

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Fuse (Main)</li> <li>2. Battery</li> <li>3. starter motor</li> <li>4. starter relay</li> <li>5. starting circuit cut-off relay</li> </ol> | <ol style="list-style-type: none"> <li>7. Engine stop switch</li> <li>8. front/rear brake switch</li> <li>9. starter switch</li> <li>10. wiring connection (entire starting system)</li> </ol> |
|---|--|

6. main switch

1. fuse  
refer to "CHECKING SWITCHES" section



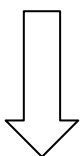
NO CONTINUITY



Replace the fuse

2. Battery

Check the battery condition.  
Refer to "BATTERY INSPECTION" section in CHAPTER 3



INCORRECT



Clean battery terminals  
Recharge or replace the battery

3. Starter motor

Connect the battery positive terminal and starter motor cable using a jumper lead.

Check the starter motor operation

DOES NOT MOVE



Repair or replace the starter motor

4. Starter relay

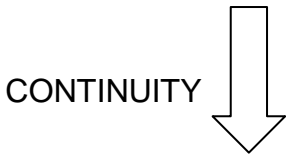
●Disconnect the relay unit coupler from the wire harness.

●Connect the pocket tester ( $\Omega \times 1$ ) and battery (12V) to the relay unit coupler terminals.

- Battery (+) lead →  
Green/Yellow terminal ①
- Battery (-) lead →  
Yellow/Red terminal ②

●Check the starter relay for continuity.

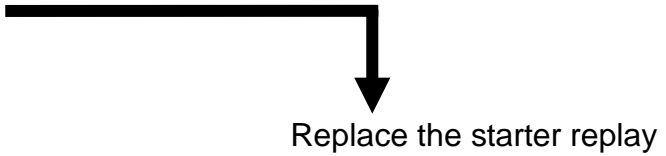
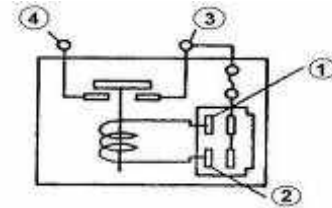
- Test (+) lead → ③ terminal
- Test (-) lead → ④ terminal



**WARNING**

A wire used as a jumper lead must have the equivalent capacity as that of the battery lead or more, otherwise it may burn.

This check is likely to produce sparks, so be sure that no flammable gas or fluid is in the vicinity



5. Starting circuit cut-off relay

●Disconnect the starting circuit cut-off relay coupler from the wireharness.

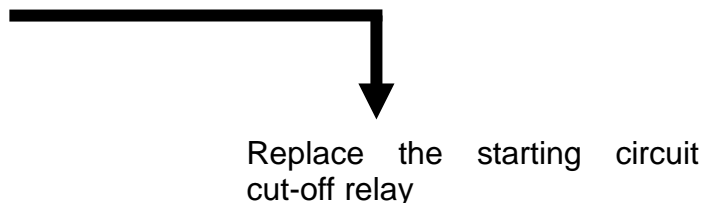
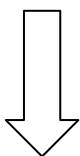
●Connect the pocket tester ( $\Omega \times 1$ ) and battery (12V) to the starting circuit cut-off relay coupler terminals.

- Battery (+) lead → terminal ②**
- Battery (-) lead → terminal ④**

●Check the starting circuit cut-off relay for continuity.

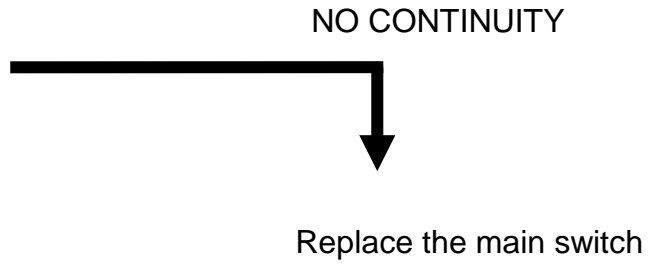
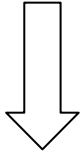
- Test (+) lead → ① terminal**
- Test (-) lead → ③ terminal**

① and ② coil resistance  $4\Omega \pm 10\%$  (  $20\Omega$  )

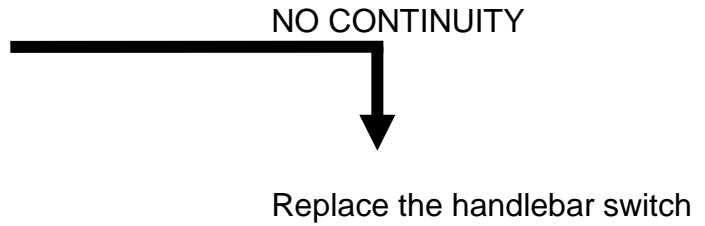
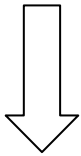




6. Main switch  
CHECK SWITCHES

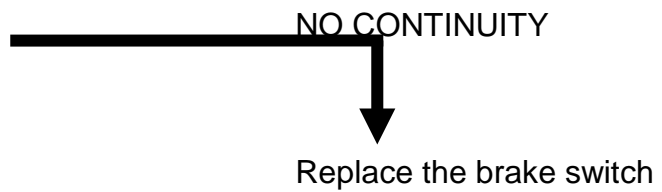
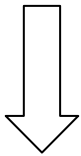


7. Engine stop switch



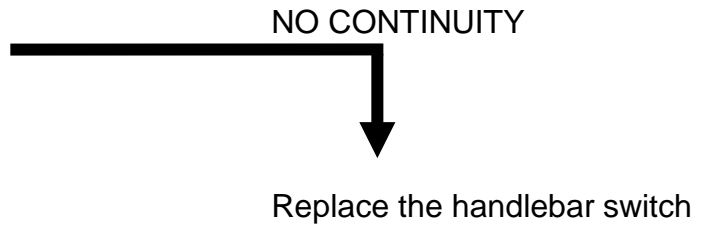
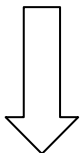
8 Front /rear brake switch

CHECKING SWITCHES



9. Starter switch

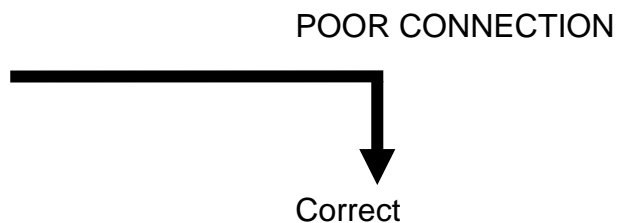
CHECKING SWITCHES



10. Wiring connection

Check the connections of the entire starting system.

Refer to "CIRCUIT DIAGRAM



**10.10.6 COOLING SYSTEM**

**IF THE FAN MOTOR FAILS TO TURN**

Procedure

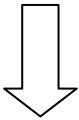
Check:

- 1. Fuse (Main, Fan)
- 2. Battery
- 3. Relay

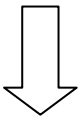
- 4. Main switch
- 5. Fan motor (inspection)
- 6. Thermo switch
- 7. Wiring connection (entire cooling system)

system)

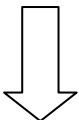
1. fuse  
CHECK SWITCHES



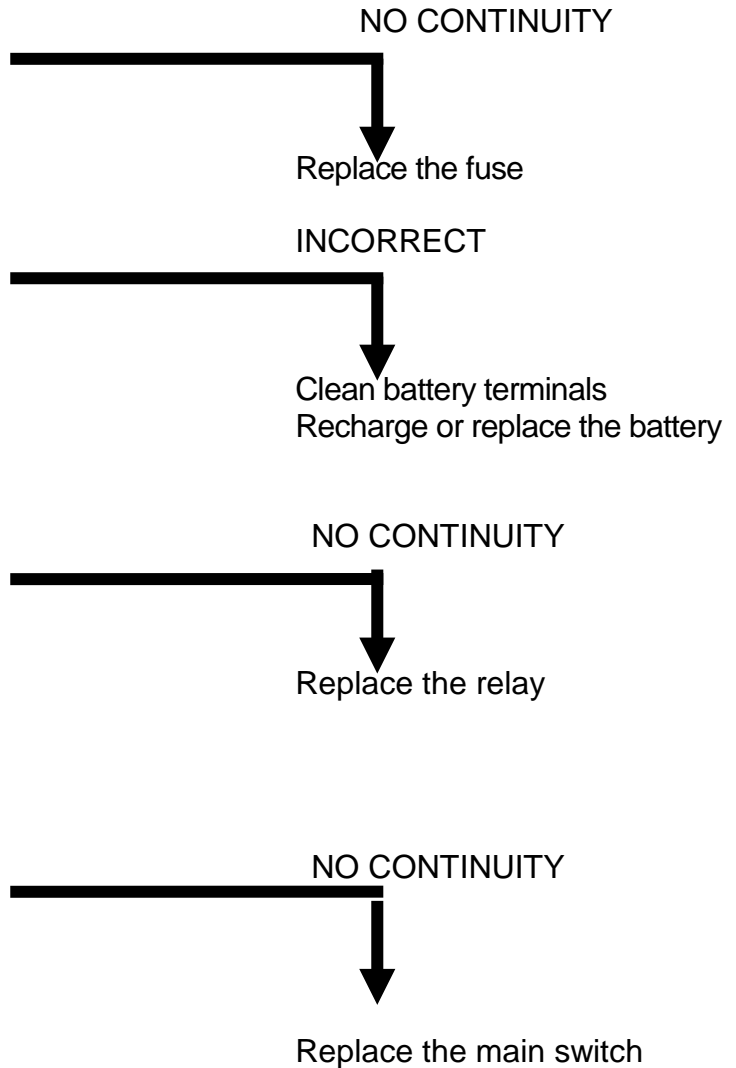
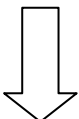
2. Battery  
Check the battery condition..  
Refer to "BATTERY INSPECTION" section



3 RELAY  
CHECK REALY



4 Main switch  
CHECK SWITCHES



5. Fan motor(inspection 1)

Connect the battery to the fan motor.

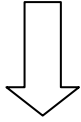
**Battery (+) lead**→**Green/Blue terminal**

①

**Battery (-) lead**→**Green ground** ②

Check the fan motor operation

DOES NOT MOVE



Replace fan motor

Fan motor (inspection 2)

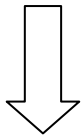
Turn the main switch to off.

●Remove the thermo switch lead from thermo switch.

●Connect jumper lead to thermo switch leads.

●Turn the main switch to on

DOES NOT MOVE



The wiring circuit from battery to fan motor is faulty. Repair

6. Thermo switch

Remove the thermo switch from the radiator.

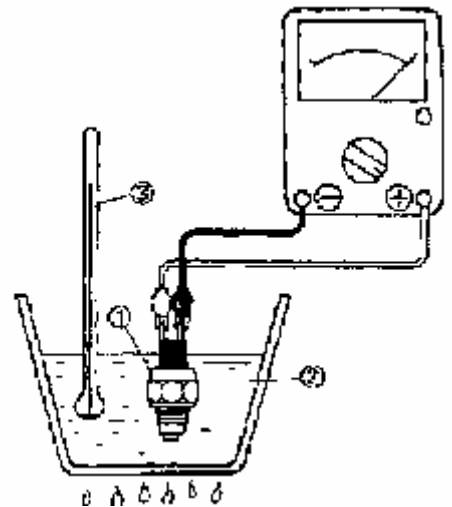
●Connect the pocket tester ( $\Omega X1$ ) to the thermo switch ①.

●Immerse the thermo switch in the water ②

●Check the thermo switch for continuity.

**NOTE:**

Measure temperatures while heating the coolant with the temperature gauge



**WARNING**

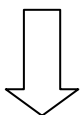
●Handle the thermo switch with special care.

Never subject it to strong shocks or allow it to be dropped. Should it be dropped, it must be replaced.

●Do not touch the thermo switch to the bottom of the heated vessel.

88±3 □ Thermo switch "ON"

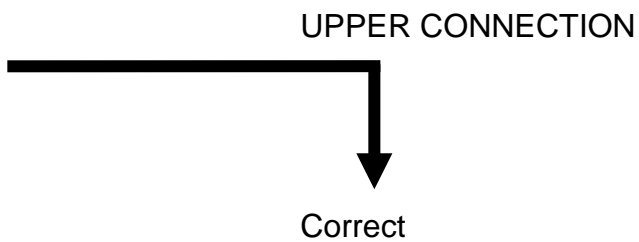
80 □ Thermo switch "OFF"



OUT OF SPECIFICATION

Replace the thermo switch

7. Wiring connection
- Check the connection of the entire cooling system.  
Refer to "CIRCUIT DIAGRAM"



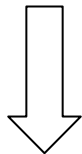


**TROUBLESHOOTING  
Procedure**

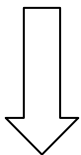
Check:

- 1. Fuse (Main)
- 2. Battery
- 3. Main switch
- 4. Lights switch
- 5. Dimmer switch
- 6. Wiring connection (entire lighting system)

1. fuse  
refer to "CHECKING SWITCHES"  
section

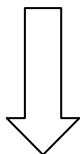


2. Battery  
Check the battery condition.  
Refer to "BATTERY INSPECTION" section  
in CHAPTER 3



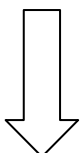
3. Main switch

CHECK SWITCHES



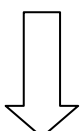
4. Light switch

CHECK SWITCHES



5. Dimmer switch

CHECK SWITCHES



NO CONTINUITY



Replace the fuse

INCORRECT



Clean battery terminals  
Recharge or replace the battery

NO CONTINUITY



Replace the main switch

NO CONTINUITY



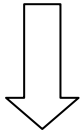
Replace the right handlebar  
switch

NO CONTINUITY



5. Wiring connection

Check the connection of the entire lighting system



Replace the left handlebar switch

POOR CONNECTIONS



correct

6. check the condition of each of the lighting system's circuits

Refer to "LIGHTING SYSTEM CHECK"

**LIGHT SYSTEM CHECK**

**1. If the headlight and the high beam indicator light fail to come on**

1. Bulb and bulb socket

**CHECK SWITCHES**



NO CONTINUITY



Replace the bulb and/ or bulb socket

2. Voltage

Connect the pocket tester (DC20V) to the headlight and high beam indicator light couplers.

**A** When the dimmer switch is on low beam.

**B** When dimmer switch is on high beam

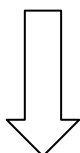
Headlight::

Tester (+) lead → White ① or Blue ② lead

Tester negative (-) lead → Green ③ lead

Turn the main switch to on.  
Turn the light switch to on position.  
Turn the dimmer switch to low beam or high beam.

Check for voltage (12V) on the lead at bulb socket connectors



OUT OF SPECIFICATION

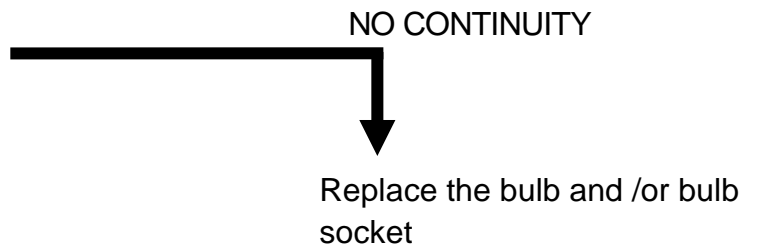
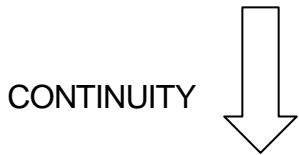
This circuit is not faulty

The wiring circuit from the main switch to bulb socket connector is faulty. Repair

**2. the taillight fails to come on**

- 1. Bulb and bulb socket

CHECK SWITCHES



- 2. Voltage

Connect the pocket tester (DC20V) to the bulb socket connector.

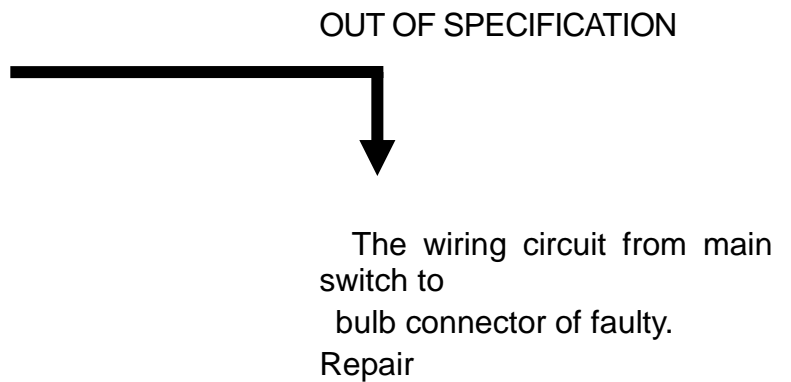
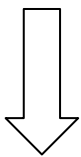
**Tester (+) lead** →  
**Black terminal ①**

**Tester (-) lead** →  
**Green terminal ②**

Turn the main switch to on.

Turn the lights switch to on pilot position.

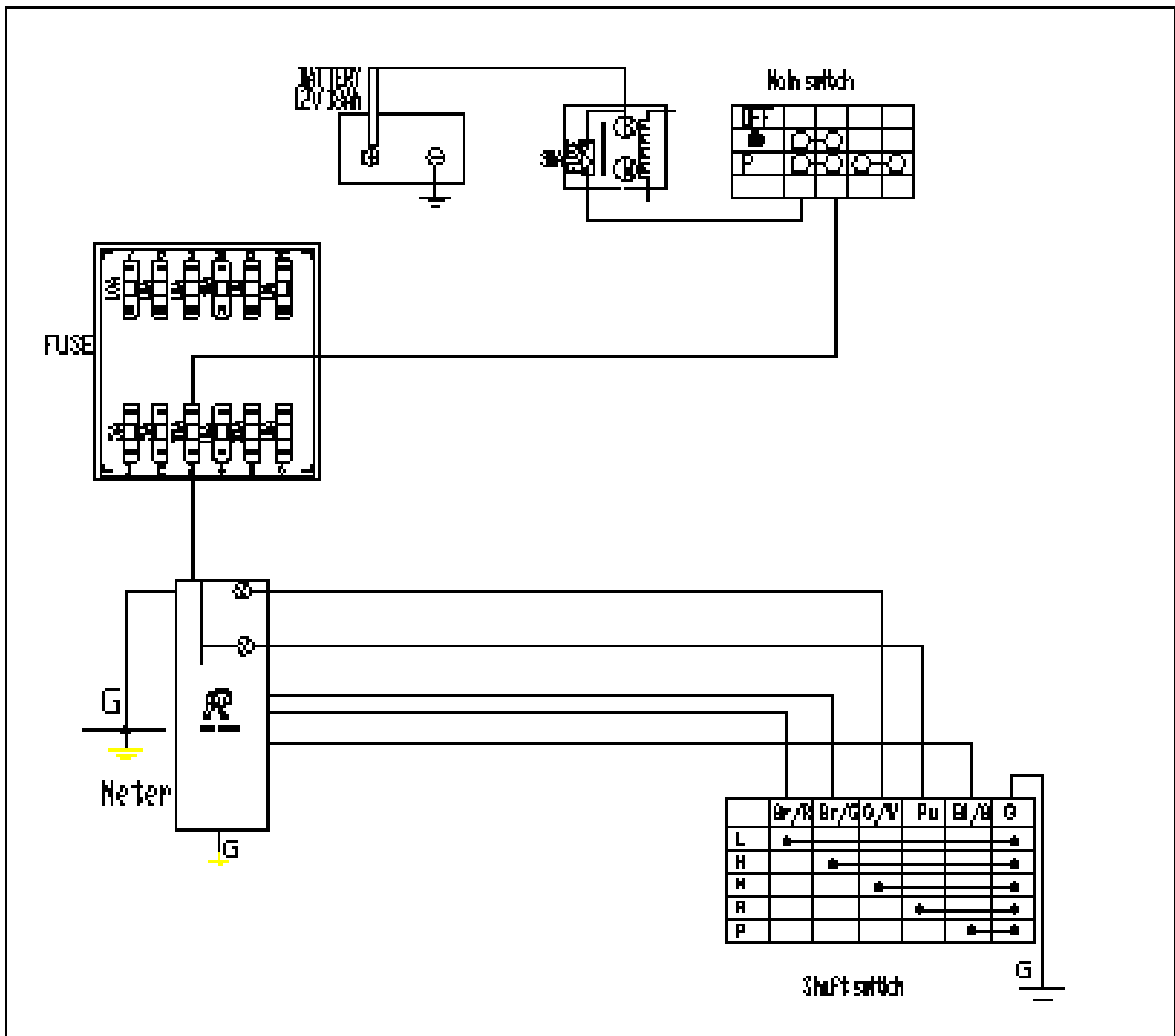
Check the voltage (12V) on the bulb socket connector

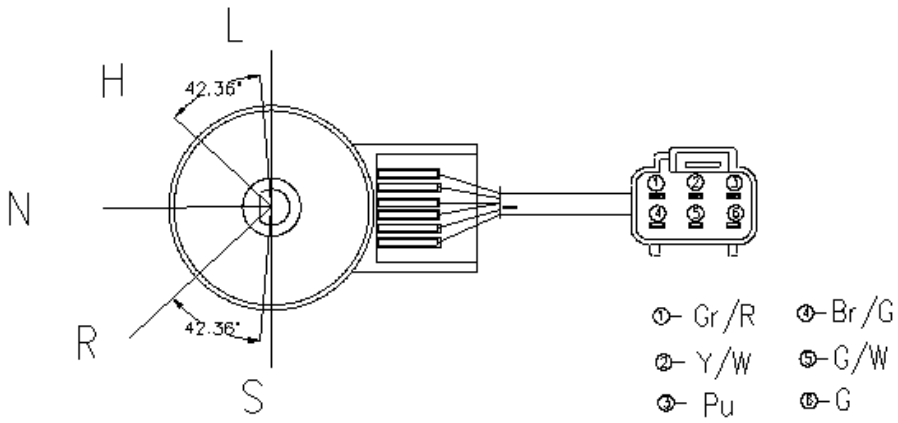


This circuit is not faulty



**10.10.8 GEAR POSITION INDICATOR SWITCH TEST  
DIAGRAM**





	Gr/R	Br/G	G/W	Pu	Y/W	G
L	●					●
H		●				●
N			●			●
R				●		●
S					●	●

**10.10.9 SPEEDMETER SYSTEM**

**OPERATION OF SPPEED SENSOR**

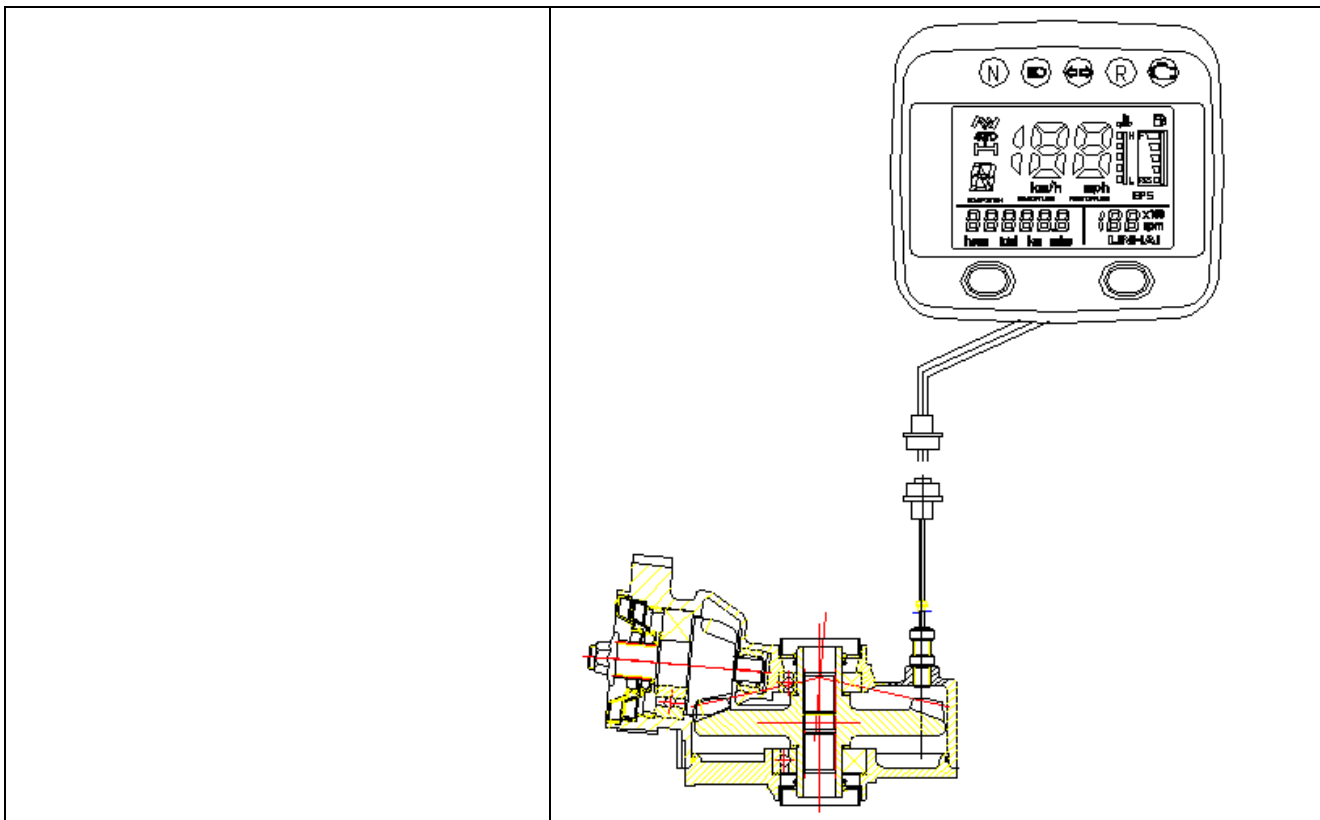
**Speed Sensor on the Transmission Out Put Shaft.**

Operation Instructions of LCD Meter and Speed Sensor

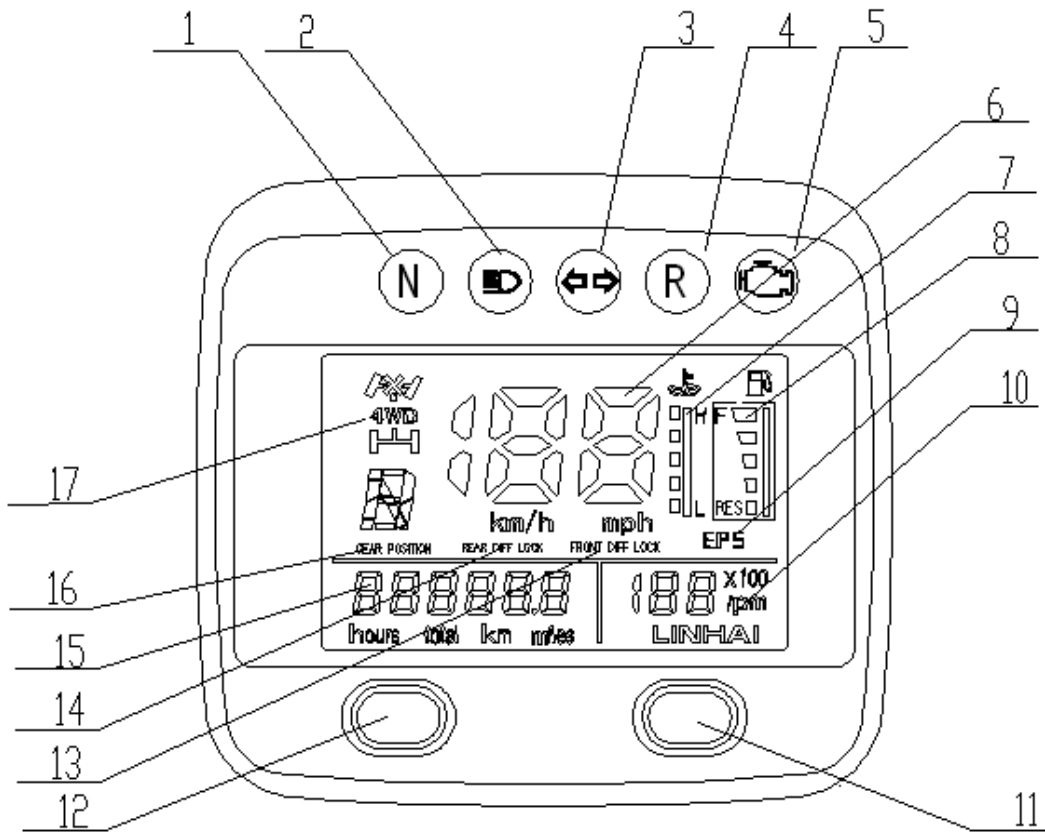
Main Technical Parameter :

Item	Code	Vol value	Unit
Operating voltage	Vcc	5-20	V
Operating current	Icc	≤15	mA
Operating distance	D	1mm≤D≤8mm	mm

The following is the graphic illustration for sensor installation。

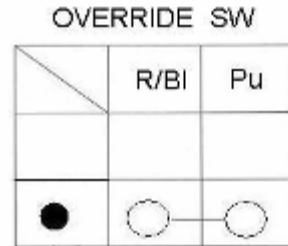
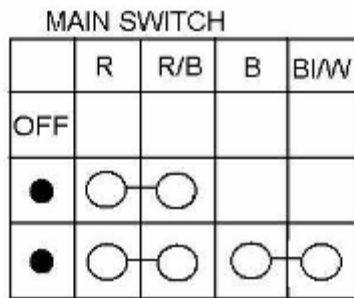


LCD Meter



- |                              |                                    |
|------------------------------|------------------------------------|
| 1. Neutral indicator light   | 9 . Engine rpm meter               |
| 2. High beam indicator light | 10. hour / distance selector       |
| 3. Turn indicator light      | 11. km/ mile selector              |
| 4. Reverse indicator light   | 12: Front diff lock                |
| 5. SVS light                 | 13. Rear diff lock                 |
| 6. Speedometer               | 14. Engine working hour counter    |
| 7. Coolant temperature meter | 15. Gear position                  |
| 8. Fuel gauge Indicator      | 16. 2WD/4WD or DIFF LOCK indicator |

**10.10.10 MAIN SWITCH AND HANDLE SWITCH**



**HANDLE SWITCH SCHEMATIC FOR USA MODEL**

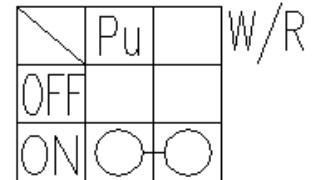
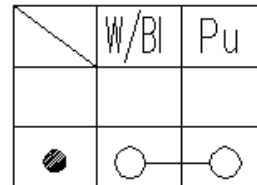
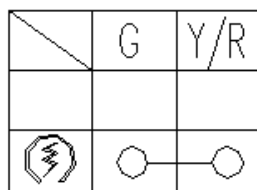
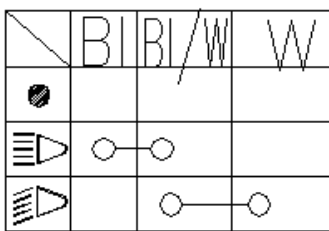
USA. model

HIGH/LOW BEAM SWITCH

START SWITCH

OVERRIDE SWITCH

IGNITION SWITCH



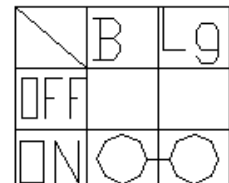
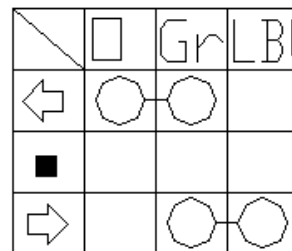
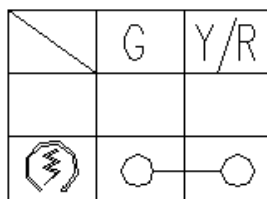
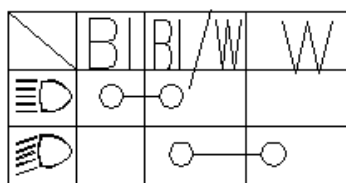
**HANDLE SWITCH SCHEMATIC FOR EUROPE MODEL**

HIGH/LOW BEAM SWITCH

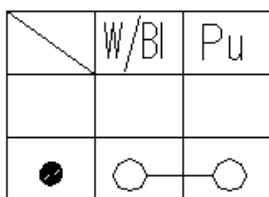
START SWITCH

TURN INDICATORS SWITCH

HORN SWITCH



OVERRIDE SWITCH



**10.10.11 FUEL GAUGE/ FUEL LEVEL SENSOR**

Remove seat, and then remove fuel sensor attached to fuel tank



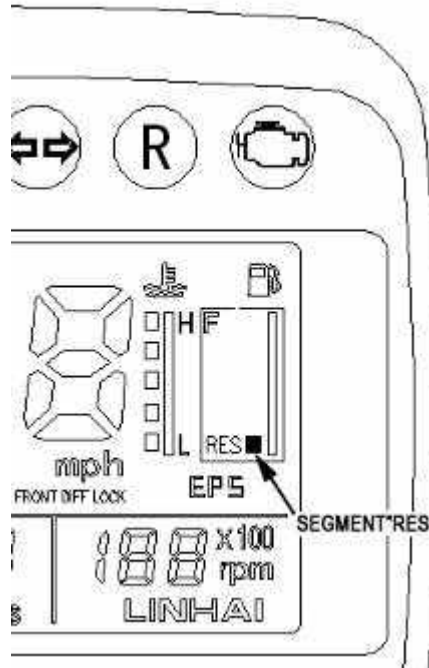
Hold fuel sensor in an upright position after removing it. It is normal if indicator shows "E", otherwise, circuitry connection, fuel sensor or instrument should be inspected



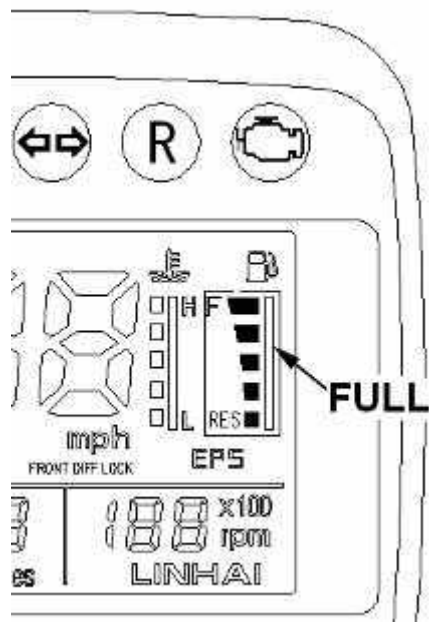
Turn fuel sensor upside down. It is normal if indicator shows "F", otherwise, circuitry connection, fuel sensor or instrument should be inspected



What displays on instrument while fuel sensor is in its upright position



What displays on instrument while fuel sensor is in its upside-down position:



Fuel sensor resistance range

FLOAT POSITION	RESISTANCE(20°C/ 68°)
TOP(FULL)	4-10Ω
BOTTOM(RESERVE)	100-110Ω

**10.10.12 THE OPERATION PRINCIPLE OF THE ELECTRIC 4WD /DIFF LOCK SHIFT**



Push down: 4WD ;  
Push again: 2WD



Push down: 4WD ;  
Push again: 4WD + Diff lock

(Fig 1)

- 1, The rider shifts by the Switch on handlebar.
  2. The Switch gives signal to Controller.
  - 3, The controller gives power to the solenoid.
- During this time, the 4WD/Diff lock indicator is not on, this requires the rider to back or move (ride) the ATV a little to allow the Dog change position for engagement. ( See owner’s manual or decal).

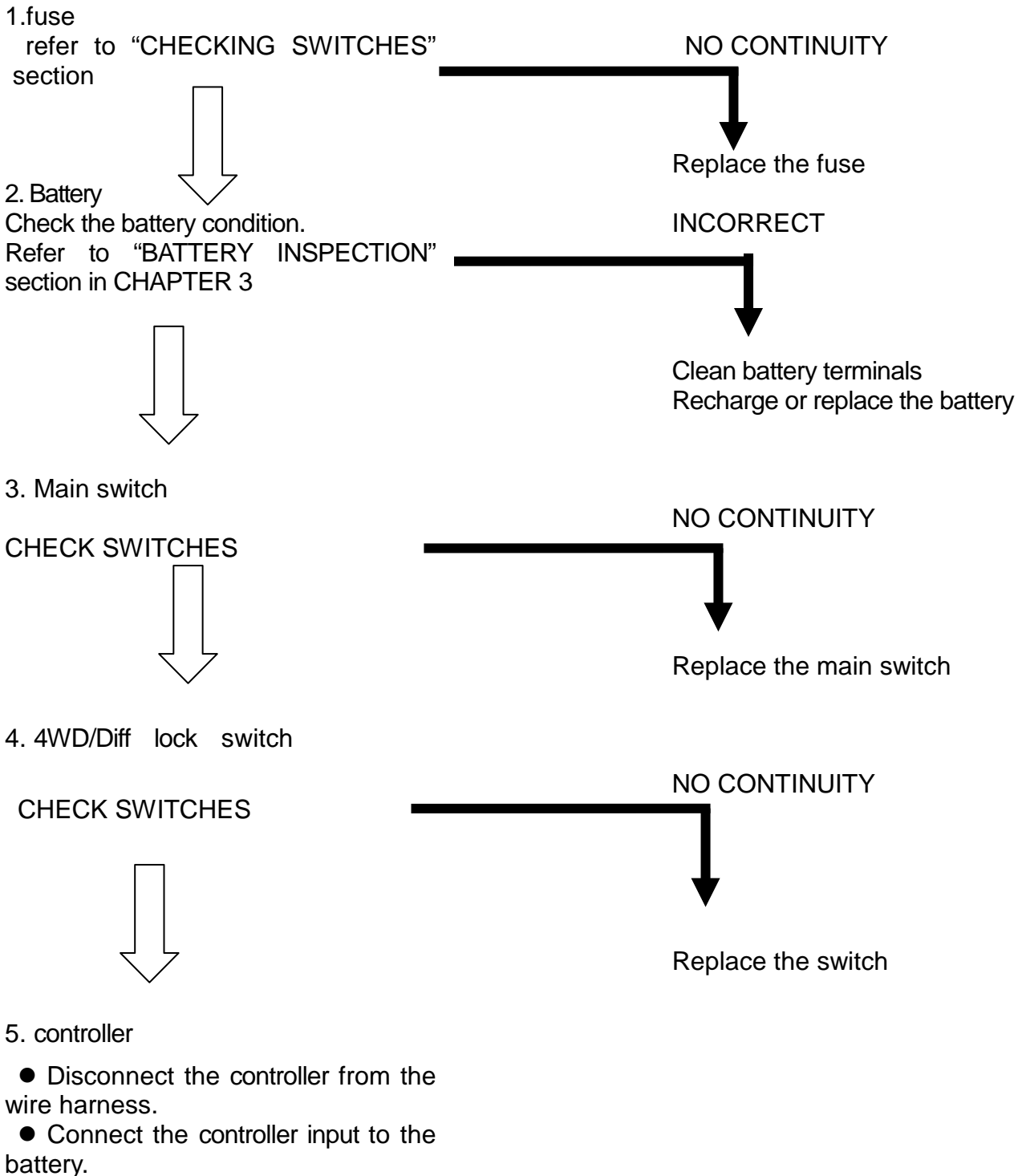


**TROUBLESHOOTING**

**Procedure**

Check:

- |                         |                      |
|-------------------------|----------------------|
| 1. Fuse                 | 5. controller        |
| 2. Battery              | 6. solenoid          |
| 3. Main switch          | 7. Wiring connection |
| 4. 4WD/Diff lock switch |                      |



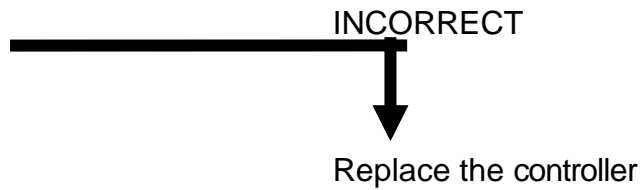
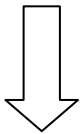
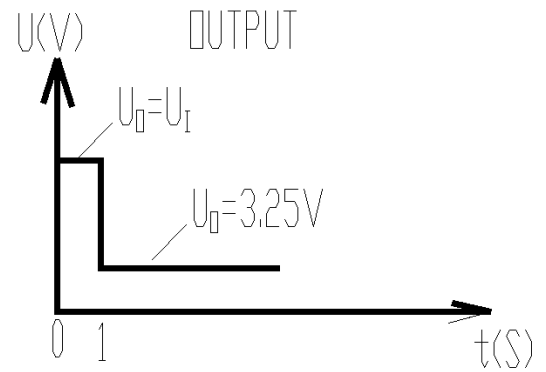
**Battery (+) lead**→**Brown/Black terminal**

**Battery (-) lead**→**Green ground**

Check the controller output::

**(+):Dark Brown terminal**

**(-):Green/Orange terminal**



6. solenoid

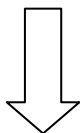
- Disconnect the solenoid from the wire harness.

- Connect the solenoid to the battery.

**Battery (+) lead**→**Dark Brown terminal**

**Battery (-) lead**→**Green ground**

DOES NOT MOVE



Replace the solenoid

7. Wiring connection

Check the connection of the entire lighting system

POOR CONNECTIONS

correct

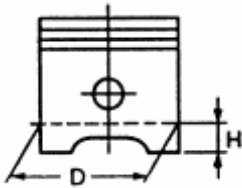
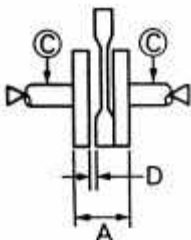
**10.11 ENGINE**

- 10.11.1 MAINTENANCE SPECIFICATIONS
  - 10.11.1.1 SPECIFICATIONS
  - 10.11.1.2 TIGHTENING TORQUES
- 10.11.2 PARTS INSPECTION AND SERVICE
  - 10.11.2.1 VALVE CLEARANCE ADJUSTMENT
  - 10.11.2.2 IDLING SPEED CHECK
  - 10.11.2.3 SPARK PLUG INSPECTION
  - 10.11.2.4 COMPRESSION PRESSURE
  - 10.11.2.5 ENGINE OIL LEVEL INSPECTION
  - 10.11.2.6 COOLANT LEVEL INSPECTION
- 10.11.3 CYLINDER HEAD COVER
- 10.11.4 CYLINDER HEAD
- 10.11.5 CAMSHAFT AND ROCKER ARMS
- 10.11.6 VALVES AND VALVE SPRINGS
- 10.11.7 CYLINDER AND PISTON
- 10.11.8 V-BELT, CLUTCH AND SECONDARY/PRIMARY SHEAVE
- 10.11.9 A.C. MAGNETO AND STARTER CLUTCH
- 10.11.10 CRANKCASE
- 10.11.11 CRANKSHAFT AND BALANCE SHAFT
- 10.11.12 OIL PUMP
- 10.11.13 SHIFT SYSTEM
- 10.11.14 TRANSMISSION SYSTEM
- 10.11.15 REAR OUTPUT SHAFT ASSY.
- 10.11.16 FRONT OUTPUT SHAFT ASSY.
- 10.11.17 COOLING SYSTEM
  - 10.11.17.1 RADIATOR
  - 10.11.17.2 WATER PUMP
  - 10.11.17.3 THERMOSTAT
  - 10.11.17.4 OIL COOLING PARTS
- 10.11.18 FUEL INJECTION SYSTEM
- 10.12 FRONT GEAR-BOX
- 10.13 REAR GEAR-BOX

**10.11.1 MAINTENANCE SPECIFICATIONS**

**10.11.1.1 SPECIFICATIONS**

Item	Standard	Limit	
Cylinder head : Warp limit		0.05 mm	
Cylinder: Bore size Out of round limit	102.000- 102.015 mm	102.05 mm 0.03 mm	
Camshaft: Cam height Intake: Exhaust: Camshaft runout limit:	33.945-34.045 mm 33 .547- 33 .647 mm .....	33.745 mm 33 .35 mm 0.1m m	
Cam chain: Cam chain type/No. of links	92RH2010-128		
Rocker arm /rocker arm shaft: Rocker arm inside diameter Rocker shaft outside diameter Rocker arm - to- rocker arm shaft clearance	14.000- 14.018 mm 13.981- 13.991 mm 0.009- 0.037 mm	14 .05 mm 13.94 mm 0.08	
Valve, Valve seat, Valve guide: Valve clearance (cold)  Valve dimensions	IN EX 0.08-0.1 mm 0.1-0.12 mm		
<p>Valve dimensions</p> <p>"A" head diameter</p> <p>"B" face width</p> <p>"C " seat width</p> <p>"D" margin thickness</p>	<p>Face Width</p> <p>Seat Width</p> <p>Margin Thickness</p>		
"A" head diameter	IN EX	36.9-37.1mm 31.9-32.1mm	
"B" face width	IN EX	2.121-2.97mm 2.121-2.97mm	
"C " seat width	IN EX	0.9-1.1mm 0.9-1.1 mm	
"D" margin thickness	IN EX	0.85-1.15 mm 0.85-1.15 mm	
Stem outside diameter	IN EX	6.57- 6.585 mm 6.555-6.57 mm	6.545mm 6.53 mm
Guide inside diameter	IN EX	6.6- 6.615 mm 6.6- 6.615 mm	6.63mm 6.63 mm

Item	Standard	Limit
Stem-to-guide clearance    IN EX Stem run out limit Valve seat width                IN EX	0.015- 0.045 mm 0.03-0.06mm 0.9-1.1 mm 0.9-1.1 mm	0.08 mm 0.1 mm 0.05 mm 1.6 mm 1.6 mm
Valve spring : Free length (Inner)            IN/EX IN/EX (Outer)	44 mm 45.25 mm	43.1 mm 44.15 mm
Piston: Piston to cylinder clearance Piston size "D" Measuring point "H" Piston pin bore inside diameter  Piston pin outside diameter	0.03 - 0.062 mm 101.95-101.97 mm 10mm 23.002-23.008 mm 22.99-23.0 mm	0.15m m 101.87 23.03 mm 22.98 mm
Piston rings : Top ring : Type End gap (installed) Side clearance (installed ) 2nd ring : Type End gap (installed) Side clearance Oil ring : End gap (installed)	Barrel 0.2- 0.4 mm Taper 0.2- 0.4 mm 0.02- 0.06 mm 0.2- 0.7 mm	... 0.55 mm 0.18mm 0.55 mm 0.15 mm 0.9 mm
Crankshaft:  Crank width "A" Run out limit "C " Big end side clearance "D"	73.95-74.05 mm 0.03 mm 0.35- 0.8 mm	

V-belt: V-belt width	29.2 mm	27.6 mm
Oil pump: Type Tip clearance Side clearance Housing and rotor clearance	Trochoid type 0.1- 0.34 mm 0.1- 0.14 mm 0 .04- 0.10 mm	0 .4 mm 0.2 mm 0.15 mm

Item	Standard	Limit
Radiator: Type Width/height/thickness Radiator cap opening pressure  Radiator capacity Reservoir tank capacity	Cooling fin with electric fan 400/434/62 mm 110-140kPa (1.1-1.4kg/cm <sup>2</sup> , 1.1-1.4bar) 3.8 L 0.35 L	
Thermostatic valve: Valve opening temperature Valve full open temperature Valve full open lift	63- 67°C  78°C 8mm	

10.11.1.2 TIGHTENING TORQUES

Part to be tightened	Part name	Thread size	Q'ty	Tightening Torque		Remarks
				N.m	m.kg	
	Bolt	M6		10	1.0	
Crankcase	Bolt	M8	2	25		
Rocker shaft	Bolt	M8	2	15		
Valve adjuster locknut	Nut	M6	4	14		
Sprocket	Bolt	M10	1	50		Left-hand thread
Decompression	Bolt	M5	2	5		Loctite 263
camshaft baffle	Bolt	M6	1	10		Loctite 243
Cylinder head	Stud	M8	4	13		
Spark plug	Plug	M14	1	28		
Crank balancer drive gear	Nut	M35	1	150		Loctite 243
Crank balancer driven gear	Bolt	M10	2	55		Loctite 243
Oil passage	Bolt	M10	2	20		
Crankcase	Stud	M10	4	18		
Oil filter block	Bolt	M20	1	36		
Oil filter		M18	1	20		
Drain bolt	Bolt	M12	1	25		
Cylinder head	Nut	M10	4	53		
Timing check plug	Plug	M16	1	8		
Magnetic motor	Nut	M16	1	100		
One way clutch	Bolt	M8	6	30		Loctite 243
Trigger coil	Bolt	M5	2	7		Loctite 243
Mounting bolt, driving wheel	Bolt	M10	1	55		
Mounting bolt, driven wheel	Bolt	M12	1	75		
Parking brake disc	Screw	M5	4	5		Loctite 243
Gearshift cam stopper plate	Bolt	M4	2	4		
Gearshift cam stopper	Bolt	M6	1	10		Loctite 243
Drive bevel gear	Nut	M20	1	100		
Bearing plate	Screw	M6	3	6		Loctite 243
Rear output shaft	Nut	M22	1	100		
Bearing bracket	Stud	M8	4	12		
Bearing bracket	Nut	M8	4	30		
Cam chain tensioner	Bolt	M8	1	23		Loctite 243

**10.11.2 PARTS INSPECTION AND SERVICE**

**10.11.2.1 VALVE CLEARANCE ADJUSTMENT**

**NOTE:**

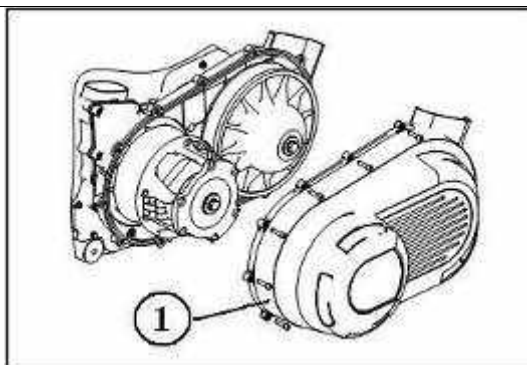
Valve clearance adjustment should be made with the engine cool, at room temperature. When the valve clearance is to be measured or adjusted, the piston must be at Top Dead Center (T.D.C.) on the compression.

1. Remove :

- Spark plug

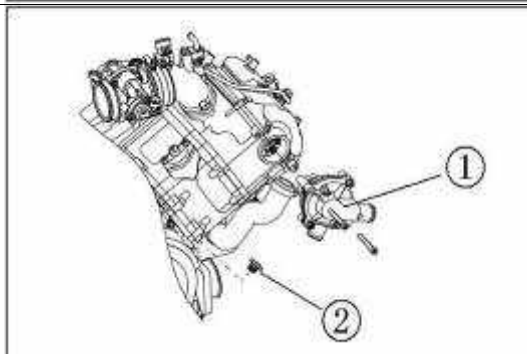
2. Remove :

- CVT cover ①



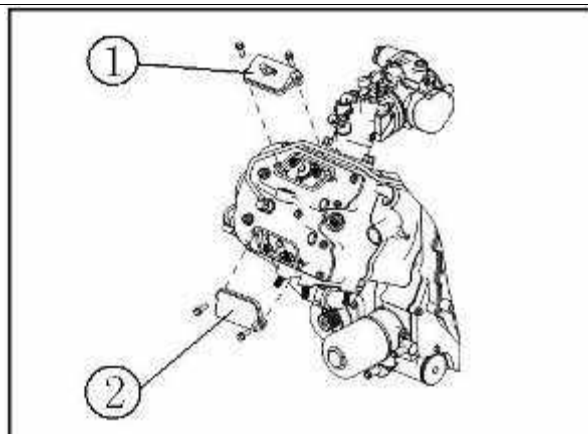
3. Remove :

- Water Pump ①
- Observed Cover ②



4. Remove :

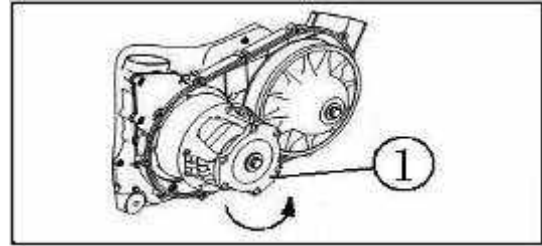
- Valve cover (intake side) ①
- Valve cover (exhaust side) ②





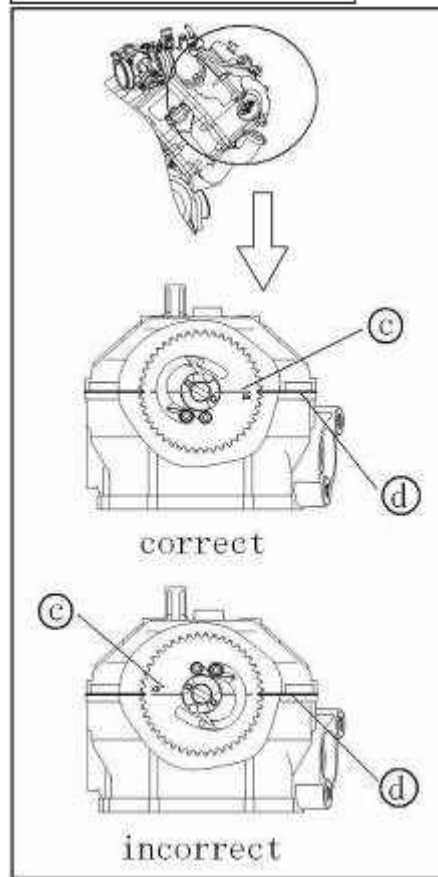
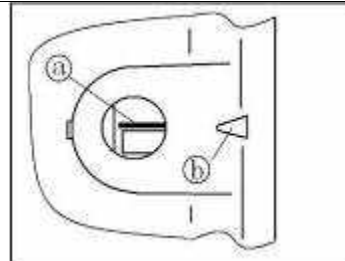
5. Adjust :

●Rotate the CVT primary sheave assembly① anti-clockwise to align the slit○,a on the rotor with the stationary pointer○,b on the right crankcase cover when the piston is Top Dead Center (TDC).



**NOTE :**

●Check the slit○,c (have “EX”) on the cam chain sprocket and the up plane○,d of the cylinder head alignment When the piston is Top Dead Center (TDC).  
If not, rotate the CVT primary sheave assembly① anti-clockwise again.



6.Measure:

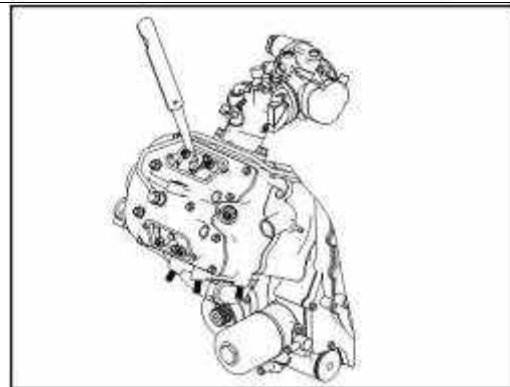
●Valve clearance

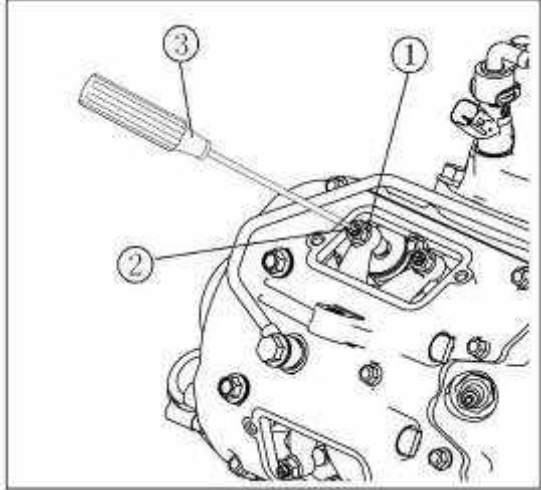
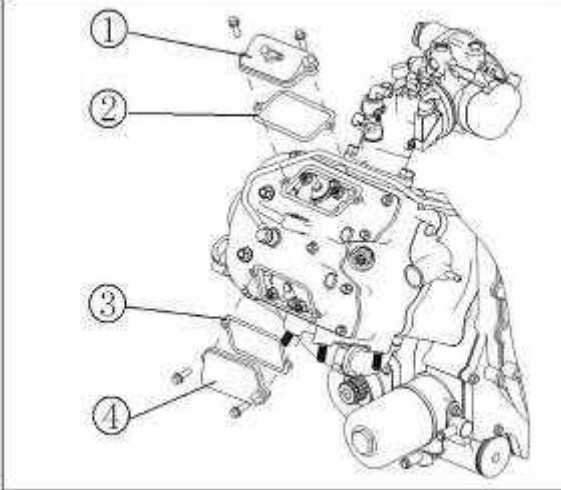
Out of specification → Adjust.


**Valve clearance (cold):**


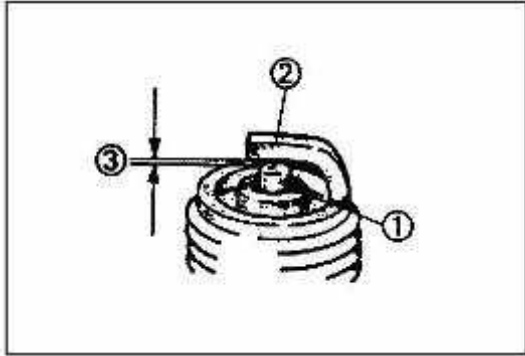


**Intake valve 0.10- 0.12mm**


**Exhaust valve 0.14- 0.16mm**

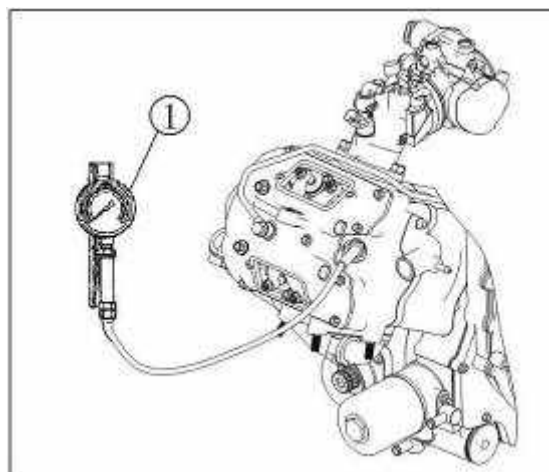



<p>7. Adjust ● Valve clearance</p>	
<p><b>Adjustment steps:</b> ● Loosen the locknut ① ● Turn the adjuster ② in or out with a flat tip screwdriver ③ until specified clearance is obtained. Turning in → Valve clearance is decreased Turning out → Valve clearance is increased ● Hold the adjuster to prevent it from moving and tighten the locknut. <b>14Nm(1.4m·kg)</b></p>	
<p>● Measure the valve clearance. ● If the clearance is incorrect, repeat above steps until specified clearance is obtained.</p>	
<p>8. Install: ● Valve cover (intake side) ① <b>10Nm(10m·kg)</b> ● Valve cover gasket ② <b>NEW</b></p>	
<p>9. Install: ● Valve cover (exhaust side) ③, ④ <b>10Nm(10m·kg)</b> ● Valve cover gasket ③, ④ <b>NEW</b></p>	
<p>10. Install: ● Water Pump <b>10Nm(1.0m·kg)</b> ● Observed Cover <b>10Nm(1.0m·kg)</b> ● CVT cover <b>10Nm(1.0m·kg)</b> ● Spark plug <b>28Nm(2.8m·kg)</b></p>	
<p><b>10.11.2.2 IDLING SPEED CHECK</b></p>	
<p>1. Start the engine and let it warm up for several minutes. The temperature is lower, the engine warm up time is longer.</p>	
<p>2. Attach: ● Inductive tachometer to the spark plug lead.</p>	

<p>3. Check:                  ● Engine idling speed</p>	
	<p><b>Engine idling speed:                  1,300-1,500 r/min</b></p>
<p>4. Repair                  If the engine idling speed is out of normal range too much, you need to do the following:</p> <ul style="list-style-type: none"> <li>● Check the battery voltage. When the engine is stopped, the battery voltage should be greater than 12 volts(<math>\geq 12V</math>).</li> <li>● If the battery voltage is normal, you may turn off the engine. Wait several minutes and check again. (At the time, please don't remove the battery.)</li> </ul>	

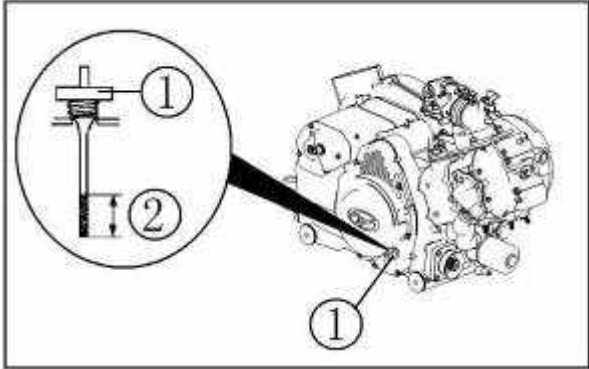
<b>10.11.2.3 SPARK PLUG INSPECTION</b>	
<p>1.Remove :</p> <ul style="list-style-type: none"> <li>● Spark plug cap</li> <li>● Spark plug</li> </ul>	
<p><b>CAUTION:</b>                  Before removing the spark plug, use compressed air to blow away any dirt accumulated in the spark plug wells to prevent it from falling into the cylinder.</p>	
<p>1. Check:</p> <ul style="list-style-type: none"> <li>●Spark plug type</li> </ul> Incorrect → Replace.	
 <p><b>Standard spark plug: FR8DCX (BOSCH)</b></p>	
<p>2.Inspect:</p> <ul style="list-style-type: none"> <li>●Electrode ① Wear/ damage → Replace.</li> <li>●Insulator ② Abnormal color → Replace. Normal color is a medium - to- light tan color.</li> </ul>	
<p>3.Clean:</p> <ul style="list-style-type: none"> <li>●Spark plug (with spark plug cleaner or wire brush)</li> </ul>	
<p>4.Measure:</p> <ul style="list-style-type: none"> <li>●Spark plug gap ③ (with a wire gauge)</li> </ul> Out of specification → Adjust gap.	
 <p>Spark plug gap : 1.1 mm</p>	
<p>5. Install:</p> <ul style="list-style-type: none"> <li>●Spark plug</li> </ul> <p> 28Nm(2.8m·kg)</p>	
<p><b>NOTE:</b>                  Before installing a spark plug, clean the Gasket surface and plug surface.</p>	
<p> </p>	


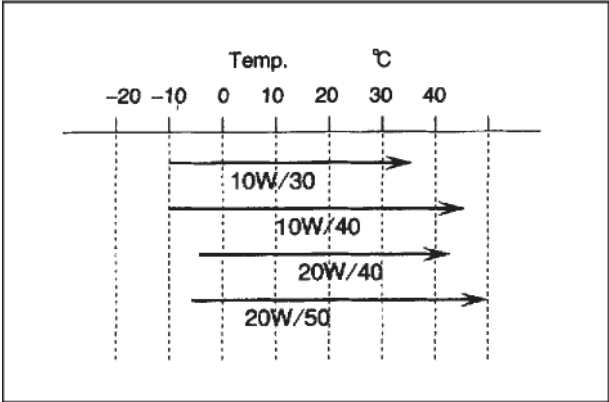
<b>10.9.2.4 COMPRESSION PRESSURE MEASUREMENT</b>	
<b>NOTE :</b> Insufficient compression pressure will result in performance loss.	
1. Check: ●Valve clearance Out of specification → Adjust. Refer to “ <b>VALVE CLEARANCE ADJUSTMENT</b> ” section.	
2. Start the engine and let it warm up for several minutes.	
3. Turn off the engine.	
4. Remove: ●Spark plug	
<b>CAUTION:</b> Before removing the spark plug, use compressed air to blow away any dirt accumulated in the spark plug well to prevent it from falling into the cylinder.	
5. Attach: ● Compression gauge①	
6. Measure: ● Compression pressure	
If it exceeds the maximum pressure allowed → Inspect the cylinder head, valve surfaces and piston crown for carbon deposits.	
If it is below the minimum pressure → Squirt a few drops of oil into the affected cylinder and measure again. Follow the table below.	
Compression pressure (With oil applied into cylinder)	
Reading	Diagnosis
Higher than without oil	Worn or damaged pistons
Same as without oil	Possible defective ring (s), valves, cylinder head gasket or Piston →Repair.
	Compression pressure(at sea level): Standard: 1100±50 kPa (11.2±0.5Kg/cm <sup>2</sup> , 11±0.5 bar)


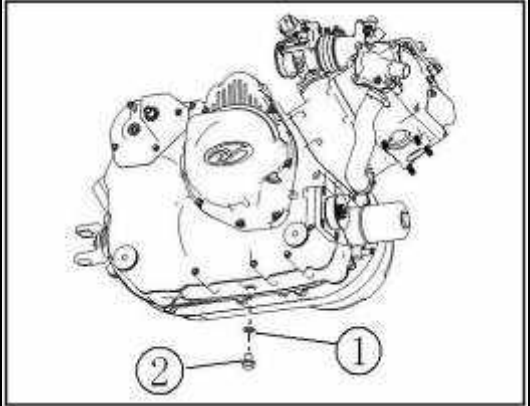


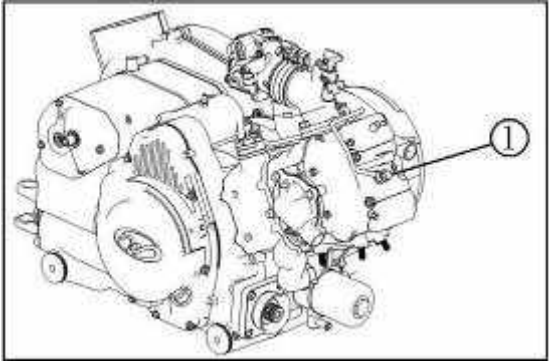


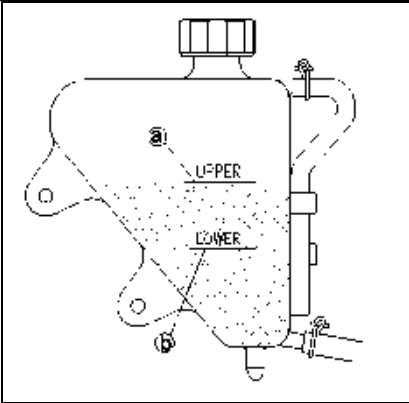
Measurement steps : ●Crank the engine with the throttle wide open until reading on the compression gauge stabilizes.	
<b>WARNING :</b> Before cranking the engine, ground all spark plug leads to prevent sparking.	
8. Install: ● Spark plug  28Nm(2.8m·kg)	

**10.11.2.5 ENGINE OIL LEVEL INSPECTION**

1. Start the engine and let it warm up for a few minutes.	
2. Turn off the engine.	
3. Remove: ●Oil Plug <sup>○,1</sup>	
4. Inspect: (Do not Oil Plug <sup>○,1</sup> in) ●Engine oil level Oil level should be between maximum and minimum marks <sup>②</sup> . If oil level is below the minimum mark, then add oil up to the proper level.	

<b>RECOMMENDED ENGINE OIL</b>	
Refer to the chart for selection of the oils suited to the atmospheric temperature.	
 <b>API STANDARD:</b> <b>API SE or higher grade</b>	
<b>CAUTION:</b> ●Do not put in any chemical additives or use oils with a grade of CD or higher. ●Be sure not to use oils labeled "ENERGY CONSERVING I" or higher. Engine oil also lubricates the clutch and additives could cause clutch slippage. ●Be sure no foreign material enters the crankcase.	
5. Start the engine and let it warm up for a few minutes.	
6. Turn off the engine.	

<p><b>NOTE:</b> Wait a few minutes until the oil settles before inspecting the oil level.</p>	
<p><b>ENGINE OIL REPLACEMENT</b></p> <p>1. Start the engine and let it warm up for several minutes.</p> <p>2. Turn off the engine and place an oil pan under the engine.</p> <p>3. Remove :</p> <ul style="list-style-type: none"> <li>● Bolt plug ②</li> </ul> <p> 26Nm(2.6m·kg)</p> <ul style="list-style-type: none"> <li>● Gasket ①</li> <li>● Drain the crankcase of its oil.</li> </ul>	
<p>4. Install:</p> <ul style="list-style-type: none"> <li>● Gasket</li> <li>● Bolt plug</li> </ul>	
<p>5. Fill:</p> <ul style="list-style-type: none"> <li>● Crankcase</li> </ul>	
<p> Oil quantity: 3L</p>	
<p>6. Check:</p> <ul style="list-style-type: none"> <li>● Engine oil level</li> </ul> <p>Refer to "ENGINE OIL LEVEL INSPECTION" section</p>	
<p><b>ENGINE OIL PRESSURE INSPECTION</b></p>	
<p>Inspection steps:</p> <ul style="list-style-type: none"> <li>● Slightly loosen the Drain Plug ①</li> <li>● Start the engine and keep it idling until the oil begins to seep from the Drain Plug. If no oil comes out after one minute, turn the engine off so it will not seize.</li> <li>● Check oil passages and oil pump for damage or leakage.</li> <li>● Start the engine after solving the problem (s), and recheck the oil pressure.</li> <li>● Tighten the Drain Plug to specification.</li> </ul> <p> 20Nm(2.0m·kg)</p>	
<p><b>CAUTION:</b></p> <ul style="list-style-type: none"> <li>● Start the engine and check the oil pressure with the Drain Plug loosened.</li> <li>● Do not apply at high speeds more than specified when checking the pressure.</li> </ul>	

<p><b>NOTE:</b> Wipe any spilled oil off the engine.</p>	
<p><b>10.11.2.6 COOLANT LEVEL INSPECTION</b></p>	
<p>Inspect:</p> <ul style="list-style-type: none"> <li>●Coolant level</li> </ul> <p>Coolant level should be between the maximum<sup>○,a</sup> and minimum<sup>○,b</sup> marks.</p> <p>When coolant level is below the "LOWER" level line, Add coolant up to the proper level.</p>	 <p>The diagram shows a coolant reservoir with a dipstick on top. Two horizontal lines indicate the coolant level: an upper line labeled 'UPPER' and a lower line labeled 'LOWER'. The reservoir is partially filled with a dotted pattern representing coolant. There are also some small circles and lines indicating other parts of the reservoir or engine connections.</p>
<p><b>CAUTION:</b> Hard water or salt water is harmful to engine parts. Use only soft water if coolant is not available. Use only distilled water if soft water is not available. If you use tap water, make sure it is soft water.</p>	
<p>1. Start the engine and let it warm up for several minutes.</p>	
<p>2. Turn off the engine and inspect the coolant level again.</p>	



**NOTE:**

Wait a few minutes until the coolant settles before inspecting the coolant level.

**COOLANT REPLACEMENT**

1. Remove:

- Front cover of ATV plastic body work.

2. Loosen:

- Clamp ①

3. Remove:

- Hose<sup>○,2</sup> (reservoir tank)

Drain the reservoir tank of its coolant.

4. Remove:

- Clamp ①
- Hose<sup>○,2</sup>
- Radiator cap

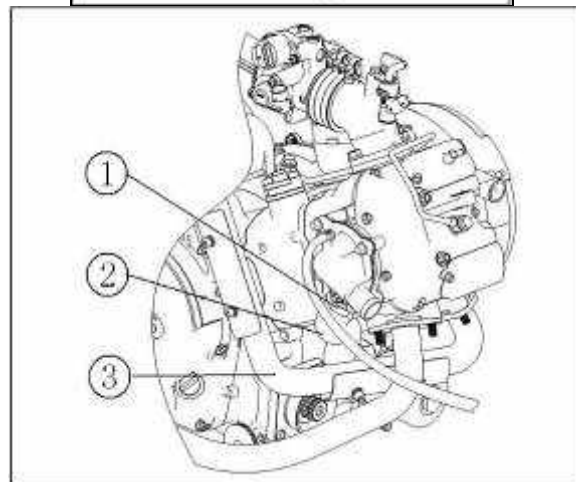
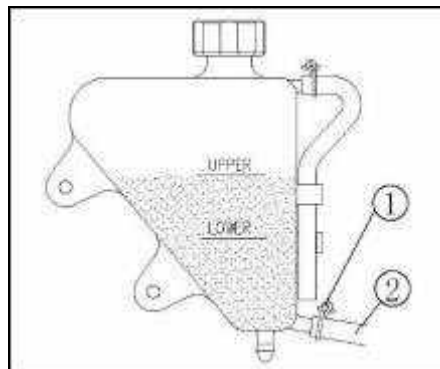
**WARNING:**

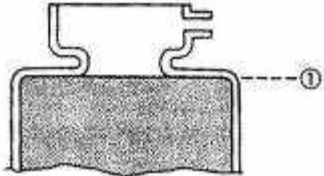






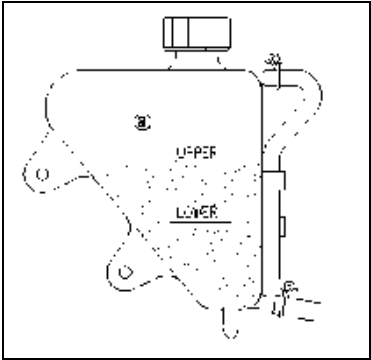
**Do not remove the hose<sup>○,2</sup> when the engine and radiator are hot. Scalding hot fluid and steam may be blown out under pressure, which could cause serious injury. When the engine has cooled, remove the hose.**

**When you remove the hose, please make sure the exhaust pipe<sup>○,3</sup> is not hot. The hot exhaust pipe may cause burns.**

**Do not remove the radiator cap when the engine and radiator are hot. Scalding hot fluid and steam may be blown out under pressure, which could cause serious injury. When the engine has cooled, open the radiator cap as follows:**

**Place a thick rag or a towel over the radiator cap. Slowly rotate the cap counterclockwise toward the detent. This allows any residual pressure to escape. When the hissing sound has stopped, press down on the cap while turning counterclockwise and remove it.**



<p>5. Drain: ●When you remove the hose, the coolant will flow out.</p>			
<p><b>WARNING:</b> <b>When the coolant flows out, place a basin under the hose.</b> <b>The coolant may be for environmental harm, please don't be arbitrarily discarded.</b></p>			
<p>6. Install: ● Hose ② ● Clamp ①</p>			
<p>7. Connect: ●Hose (reservoir tank)</p>			
<p>8. Tighten: ●Clamp (hose of the reservoir tank)</p>			
<p>9. Fill: ●Radiator ( to specified level① ) Fill the coolant slowly, until the coolant comes to specified level. ●Reservoir tank ( to maximum level○,a )</p>			
<table border="1"> <tr> <td data-bbox="103 1178 225 1256">  </td> <td data-bbox="225 1178 790 1323"> <p>Recommended coolant: High quality ethylene glycol anti-freeze containing corrosion inhibitors for aluminum engine.</p> </td> </tr> </table>			<p>Recommended coolant: High quality ethylene glycol anti-freeze containing corrosion inhibitors for aluminum engine.</p>
		<p>Recommended coolant: High quality ethylene glycol anti-freeze containing corrosion inhibitors for aluminum engine.</p>	
<table border="1"> <tr> <td data-bbox="103 1357 225 1435">  </td> <td data-bbox="225 1357 790 1469"> <p>Total amount: 3.8L Reservoir tank capacity: 0.35L</p> </td> </tr> </table>		<p>Total amount: 3.8L Reservoir tank capacity: 0.35L</p>	
	<p>Total amount: 3.8L Reservoir tank capacity: 0.35L</p>		
<p><b>Handling notes for coolant:</b> Coolant is potentially harmful and should be handled with special care.</p>			
<p><b>WARNING:</b> splashes in your eyes: Thoroughly wash your eyes with water and consult a doctor. If coolant splashes on your clothes: Quickly wash it away with water and then with soap and water. If coolant is swallowed: Vomit immediately and see a physician.</p>			

**CAUTION:**

- Do not use coolant containing impurities or oil.
- Take care that no coolant splashes onto painted surfaces. If it does, wash them immediately with water.
- Do not mix different types of ethylene glycol antifreeze containing corrosion inhibitors for aluminum engines.

10. Install:

- Radiator cap

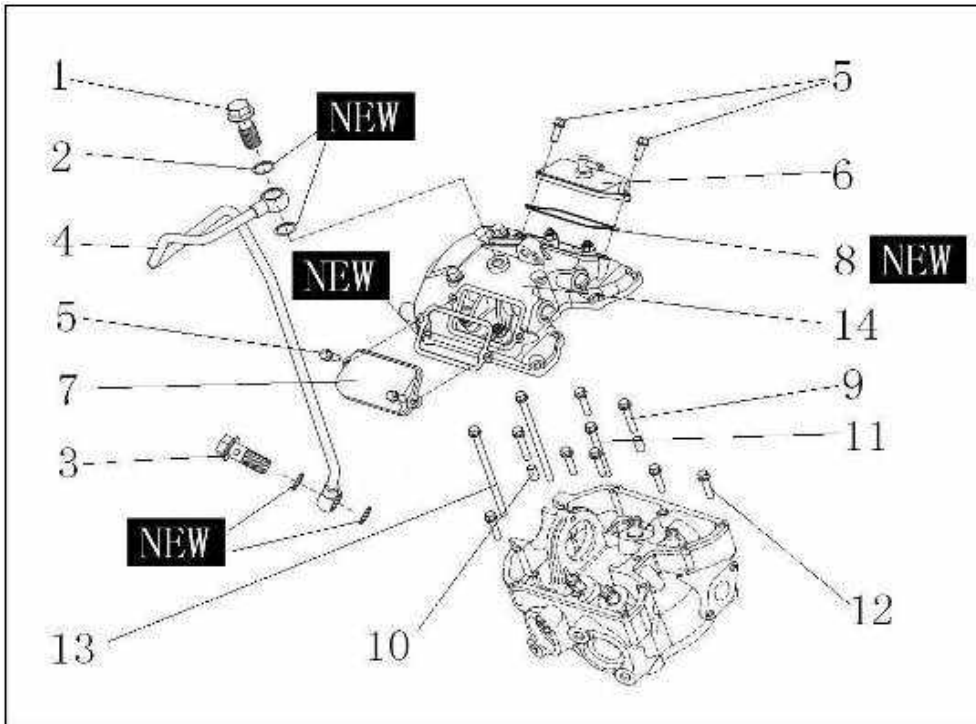
11. Start the engine and let it warm up for several minutes.

12. Stop the engine and inspect the level.

**NOTE:**

Wait a few minutes until the coolant settles before inspecting the coolant level.

**10.11.3 CYLINDER HEAD COVER**



Order	Job name / Part name	Q 'ty	Remarks
	Cylinder head cover removal		Remove the parts in order.
	Water Pump	1	
1	Drain Plug B	1	20Nm(2.0m·kg)
2	Composite gasket	4	
3	Drain Plug A	1	20Nm(2.0m·kg)
4	Tubing Components 2	1	
5	Bolt M6×16	4	10Nm(1.0m·kg)
6	Valve cover (intake side)	1	Apply bond to the mating surface of the valve cover. <b>CAUTION: If this is not done, oil may leak.</b>
7	Valve cover (exhaust side)	1	Apply bond to the mating surface of the valve cover. <b>CAUTION: If this is not done, oil may leak.</b>
8	Valve cover gasket	2	
9	Bolt M6×32	2	10Nm(1.0m·kg)
10	Pin 8×9	2	
11	Bolt M6×60	1	10Nm(1.0m·kg)
12	Bolt M6×25	6	10Nm(1.0m·kg)
13	Bolt M6×105	2	10Nm(1.0m·kg)
14	Cylinder Head Cover	1	

● Refer to "CYLINDER HEAD COVER REMOVAL AND INSTALLATION" section. Reverse the removal procedure for installation.

**CYLINDER HEAD COVER REMOVAL**

1. Remove :

- Water Pump ○,1

2. Remove :

- Drain Plug B ○,2
- Composite gasket
- Drain Plug A
- Tubing Components 2 ○,3

3. Remove :

- Valve cover (intake side)
- Valve cover (exhaust side)

4. Loosen:

- Bolt

**NOTE:**

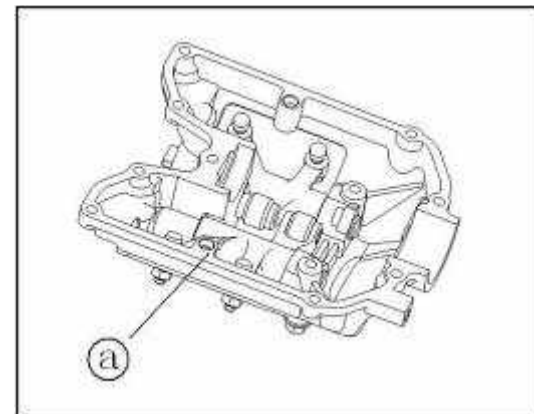
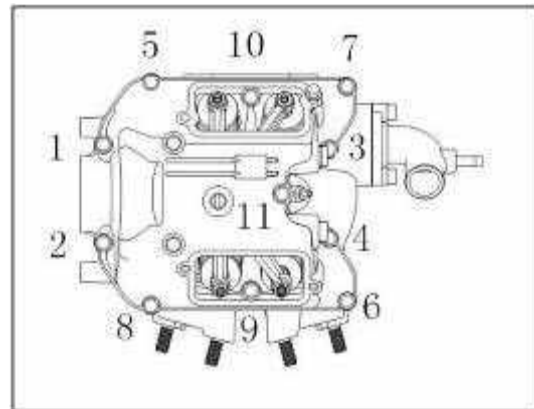
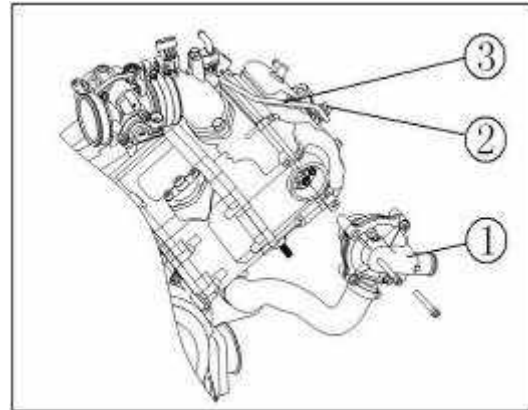
- Loosen the nuts in their proper loosening sequence (number order).
- Start by loosening each nut 1/2 turn until all are loose.

5. Remove:

- Bolt

6. Remove:

- Cylinder head Cover



**CYLINDER HEAD COVER INSPECTION:**

1. Eliminate:

- Sealant (from the surface○,a) use a rounded scraper.

**NOTE:**

Do not use a sharp instrument to avoid scratching the plane○,a.

2. Inspect:


- Cylinder head cover

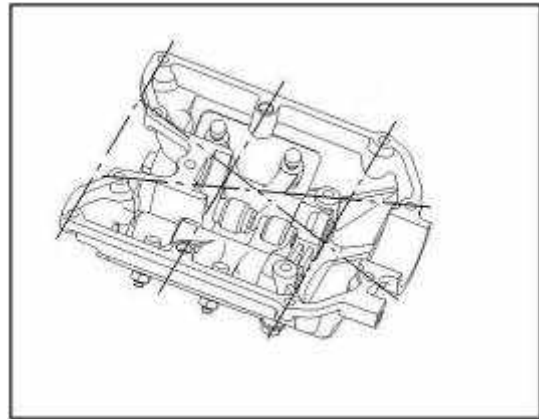
Scratches/damage → Replace

3. Measure:

- Cylinder head cover warpage

Out of specification → Resurface .

	Cylinder head cover warpage :
	Less than 0.06 mm



**Warpage measurement and resurfacement steps:**

- Place a straight edge and a feeler gauge across the cylinder head cover.

- Measure the warpage.

If the warpage is out of specification, resurface the cylinder head cover.

- Place a 400 ~ 600 grit wet abrasive paper on the surface plate, and resurface the head cover using a figure eight sanding patten.

**NOTE:**

Rotate the cylinder head cover several times for an even resurfacement.

**CYLINDER HEAD COVER INSTALLATION**

1. Install:


- Dowel pins
- Cylinder head cover

**NOTE:**

- Apply the sealant onto the surface○,a.
- Tighten the nuts in a crisscross pattern (number order).

2. Tighten:

- Bolts (cylinder head cover)

 10Nm(1.0m·kg)

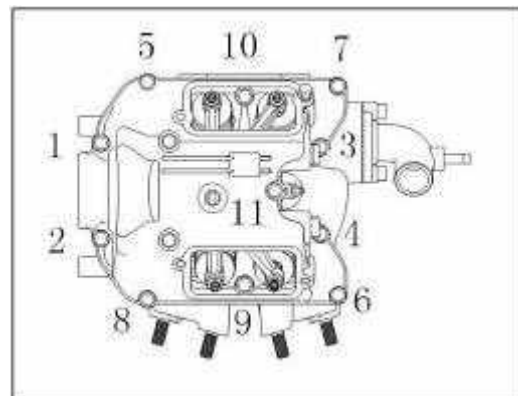
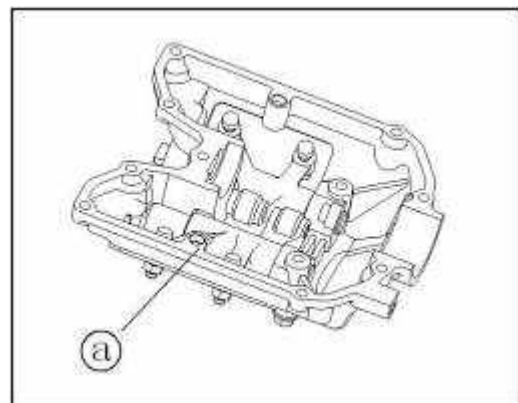
3. Check

- Valve clearance

Out of specification → Adjust.


**NOTE:**

Refer to “VALVE CLEARANCE ADJUSTMENT” section.




## 4. Install:

- Valve cover gasket **NEW**
- Valve cover (intake side)
- Bolts (Valve cover)

 10Nm(1.0m·kg)


## 5. Install:

- Valve cover gasket **NEW**
- Valve cover (exhaust side)
- Bolts (Valve cover)

 10Nm(1.0m·kg)

## 6. Install:

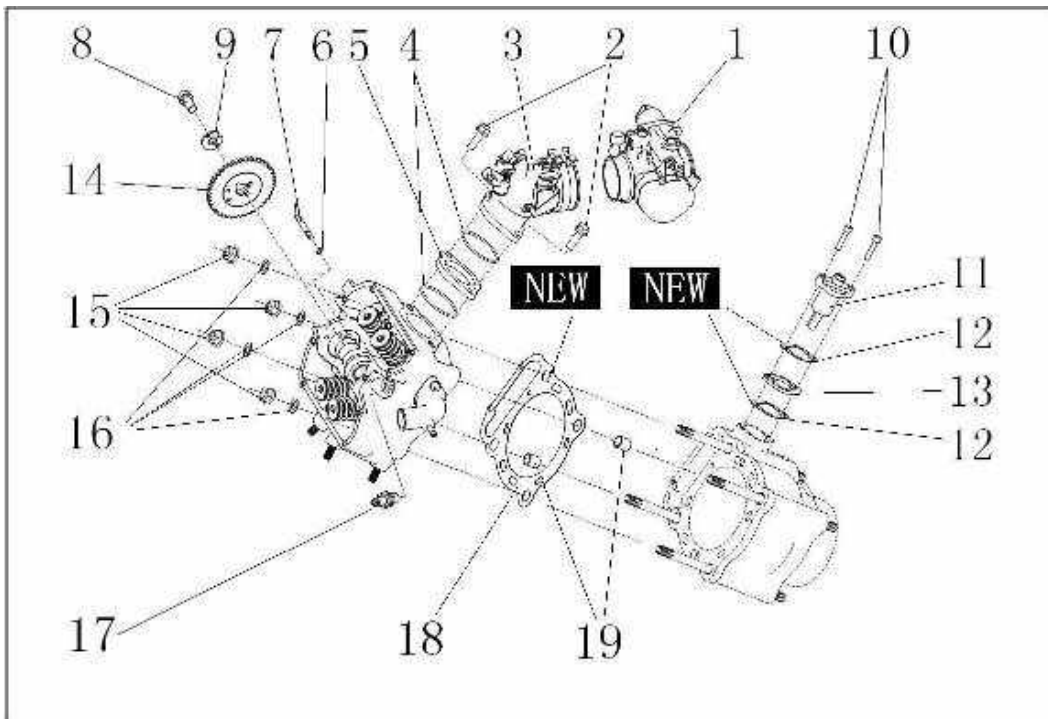
- Composite gasket **NEW**
- Tubing Components 2
- Composite gasket **NEW**
- Drain Plug B and Drain Plug A

 20Nm(2.0m·kg)

## 7. Install:

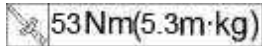
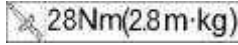
- Water Pump

**10.11.4 CYLINDER HEAD**



Order	Job name / Part name	Q 'ty	Remarks
	Cylinder Head Cover removal		Remove the parts in order.
	Pipe A, Exhaust	1	
	Pipe B, Exhaust	1	
	Water Pump	1	
	Drain the coolant		
	Air Cleaner	1	
	Cylinder head cover	1	
	Spark Plug cap	1	
1	TB D46 (Throttle Body Assembly D46)	1	
2	Bolt M8×25	2	26Nm(2.6m·kg)
3	Feed Hose Assy.	1	
4	O-Ring 51.5×2	2	
5	Joint, TB	1	
6	Split Washer d5	1	
7	Decompression Centrifugal Shaft	1	
8	Tighten Bolt (Cam Chain Sprocket)	1	50Nm(5.0m·kg)
9	Sprocket Washer	1	
10	Bolt M6×30	2	10Nm(1.0m·kg)





Order	Job name / Part name	Q 'ty	Remarks
11	Cam Chain Tensioner Assy.	1	
12	Gasket, Tensioner Case	2	
13	Joint, Tensioner Assy.	1	
14	Cam Chain Sprocket	1	
15	Nut M10×1.25	4	
16	Washer 10	4	
17	Spark Plug	1	
18	Gasket 1, Cylinder Head	1	
19	Dowel Pin 14×16	1	

● Refer to "CYLINDER HEAD REMOVAL AND INSTALLATION" section. Reverse the removal procedure for installation.

**CYLINDER HEAD REMOVAL**



1. Align:

"I" mark  on the rotor with the stationary pointer  on the right crankcase cover.

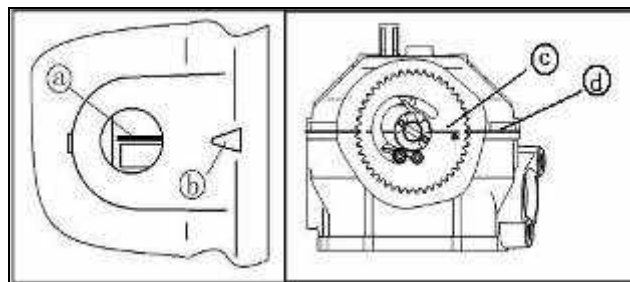
**NOTE:**

If any special mark found, contact the ATV manufacture via the agent for the parts and special instruction.



**NOTE:**

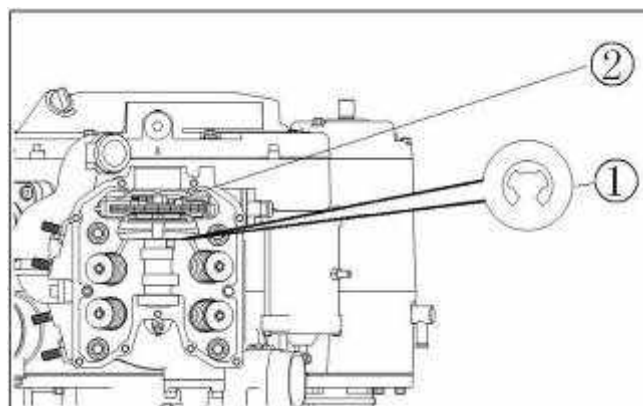
Turn the CVT primary sheave assembly counterclockwise with a wrench and align the "I" mark  (have "EX") on the cam chain sprocket with the up plane  of the cylinder head when the piston is Top Dead Center (TDC).

Refer to "VALVE CLEARANCE ADJUSTMENT" section, part 5 "Adjust".



2. Remove:

- Split Washer <sub>1</sub>
- Decompression Centrifugal Shaft <sub>2</sub>

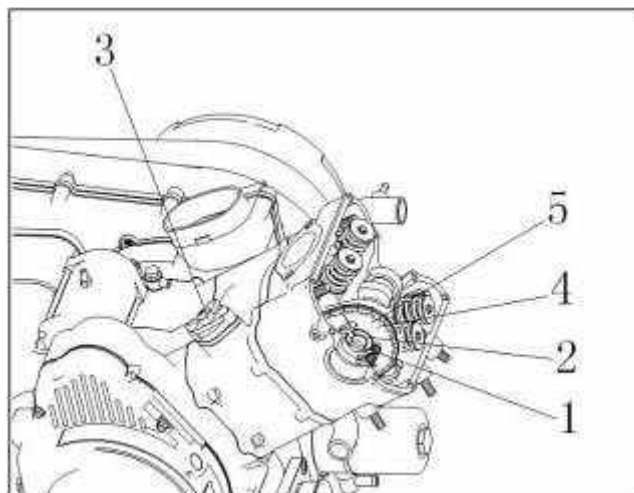


3. Loosen:

- Tighten Bolt (Cam Chain Sprocket) ①

4. Remove:

- Sprocket Washer ②
- Cam Chain Tensioner Assy. ③
- Gasket, Tensioner Case
- Joint, Tensioner Assy.
- Cam Chain Sprocket ④
- Timing chain ⑤



**NOTE:**

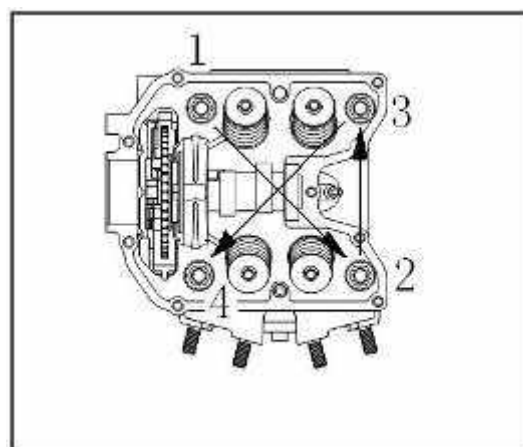
- Fasten a safety wire to the timing chain to prevent it from falling into the crankcase.
- Remove the Tighten Bolt ① while holding the rotor mounting bolt with a wrench.

5. Remove:

- Cylinder head

**NOTE:**

- Loosen the nuts in their proper loosening sequence.
- Start by loosening each nut 1/2 turn until all are loose.



**CYLINDER HEAD INSPECTION:**

1. Eliminate:

- Carbon deposits (from combustion chambers)
- Use a rounded scraper.

**NOTE:**

Do not use a sharp instrument to avoid damaging or scratching:

- Spark plug threads
- Valve seats

2. Inspect:

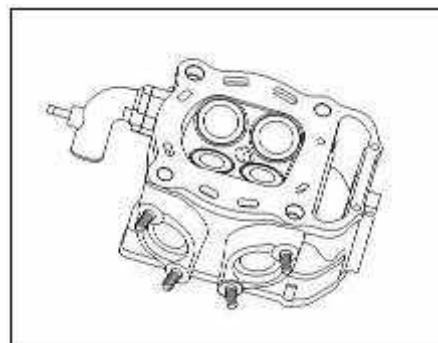
- Cylinder head


Scratches/damage → Replace.

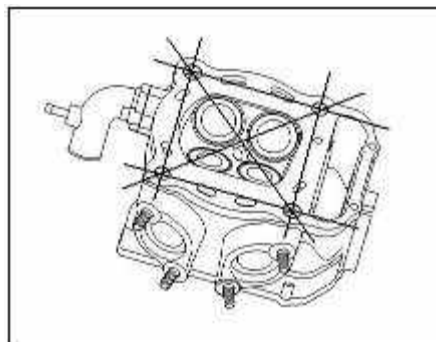
3. Measure:

- Cylinder head warpage

Out of specification → Resurface .



	Cylinder head warpage :
	Less than 0.03 mm



**Warpage measurement and resurfacement steps:**

- Place a straight edge and a feeler gauge across the cylinder head.
- Measure the warpage.

If the warpage is out of specification, resurface the cylinder head.

- Place a 400 ~ 600 grit wet abrasive paper on the surface plate, and resurface the head using a figure eight sanding paten.

**NOTE:**

Rotate the cylinder head several times for an even resurfacement.

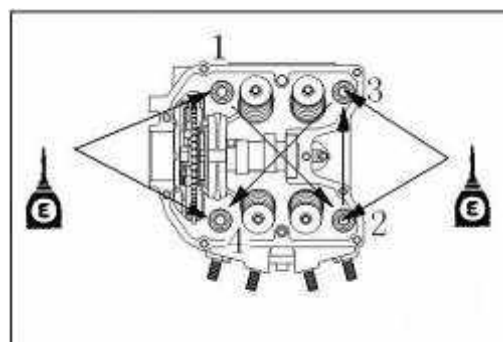
**CYINDER HEAD INSTALLATION**

1. Install:

- Gasket (cylinder head) **NEW**
- Dowel Pin 14×16
- Cylinder head


**NOTE:**

- Apply engine oil onto the nut threads.
- Tighten the nuts in a crisscross pattern.



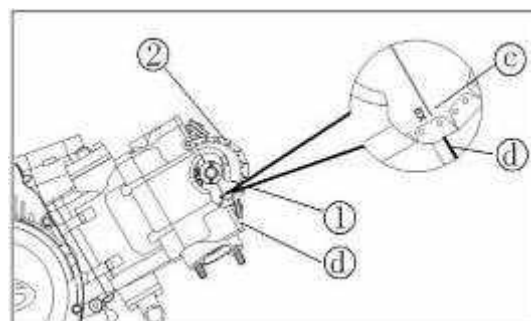
2. Tighten:

- Nuts (cylinder head)

 53Nm(5.3m·kg)

3. Install:

- Cam Chain Sprocket ①
- Timing chain ②



**Installing steps :**

- Turn the CVT primary sheave assembly ( or the primary sheave ) counterclockwise until the TDC mark ○,a matches the stationary pointer ○,b.

●Align the "I" mark<sup>○,c</sup> (have "EX") on the cam chain sprocket with the up plane<sup>○,d</sup> of the cylinder head.

**NOTE:**

If any special mark found, contact the ATV manufacture via the agent for the parts and special instruction.

**Refer to "VALVE CLEARANCE ADJUSTMENT" section, part 5 "Adjust".**

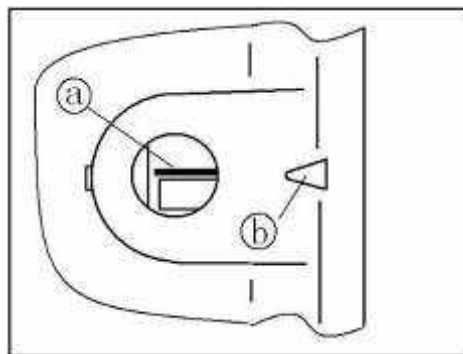
●Fit the timing chain onto the cam sprocket and install the cam chain sprocket on the camshaft.

**NOTE:**

●When installing the cam sprocket, keep the timing chain as tense as possible on the exhaust side.

●Align the "I" mark<sup>○,c</sup> (have "EX") on the cam chain sprocket with the up plane<sup>○,d</sup> of the cylinder head.

●Align the pin on the cam shaft with the slot in the cam chain sprocket.

**CAUTION:**

Do not turn the crankshaft during installation of the cam shaft. Dam age or improper valve timing will result.

●While holding the camshaft, temporarily tighten the bolts.

●Remove the safety wire from the timing chain.

## 4. Install:

● Sprocket Washer

## 5. Tighten:

● Tighten Bolt (Cam Chain Sprocket)

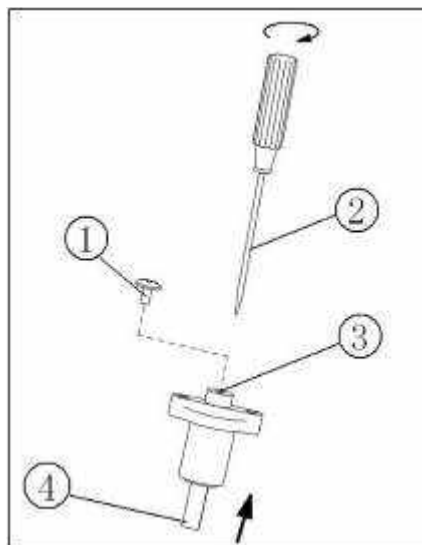
50Nm(5.0m·kg)

## 6. Install:

- Cam Chain Tensioner Assy.

**Installing steps:**

- Remove the tensioner cap bolt ①.
- Turn a small flat tip screwdriver ② clockwise in the hole ③ of the Cam Chain Tensioner Assy until the tensioner rod ④ all the way in.



## 7. Install:

- Gasket, Tensioner Case **NEW**
- Joint, Tensioner Assy.
- Gasket, Tensioner Case **NEW**

## 8. Tighten:

- Bolt M6×30

10Nm(1.0m·kg)

## 9. Tighten :

- Tighten the tensioner cap bolt ①. Please in the thread place daub a little sealant.

8Nm(0.8m·kg)

## 10. Install:

- Split Washer d5
- Decompression Centrifugal Shaft

## 11. Check:

- Valve timing

Out of alignment → Adjust.

**Repeat installing sequence 3 ~ 5**

## 12. Check:

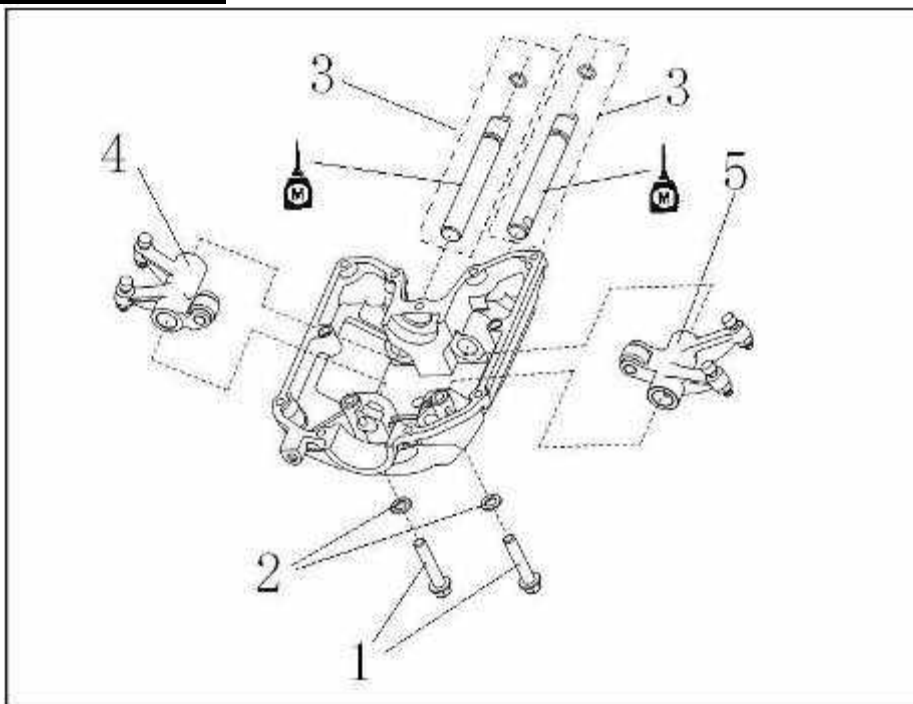
- Valve clearance


Out of specification → Adjust.

**Refer to “VALVE CLEARANCE ADJUSTMENT” section,**

**10.11.5 CAMSHAFT AND ROCKER ARMS**

**10.11.5.1 ROCKER ARMS**



Order	Job name / Part name	Q 'ty	Remarks
	Rocker Arms removal		Remove the parts in order.
	Cylinder Head Cover	1	
1	Lock Rocker Arm Bolt	2	 15 Nm(1.5m·kg)
2	Washer d8 (aluminum)	2	
3	Rocker Arm Shaft & O-Ring 9.8×2.4	2	
4	Rocker Arm (exhaust)	1	
5	Rocker Arm (intake)	1	

● Refer to "ROCKER ARMS INSTALLATION" section. Reverse the removal procedure for installation.

**ROCKER ARMS REMOVAL**

1. Remove:

- Lock Rocker Arm Bolt
- Washer d8 (aluminum)

2. Remove:

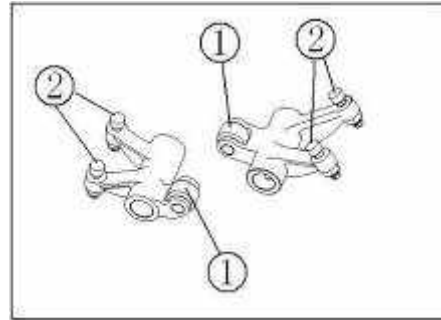
- Rocker Arm Shaft & O-Ring 9.8×2.4

**ROCKER ARMS AND ROCKER ARM SHAFTS INSPECTION**

1. Inspect:

- Cam lobe contact surface ①
- Adjuster surface ②

Wear/Pitting/Scratches/Blue/Non-rotation discoloration→Replace.



**Inspection steps:**

- Inspect the two contact areas on the rocker arms for signs of unusual wear.
- Rocker arm shaft hole.
- Cam-lobe contact surface.

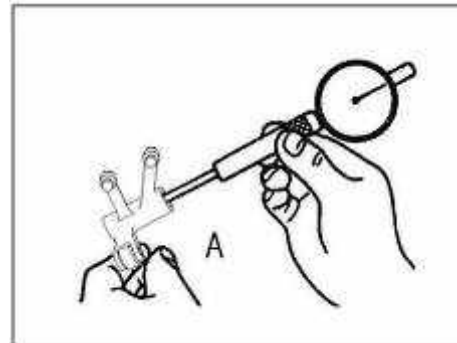
Excessive wear → Replace.


- Inspect the surface condition of the rocker arm shafts.

Pitting/scratches/blue discoloration → Replace or check lubrication.

- Measure the inside diameter A of the rocker arm holes.

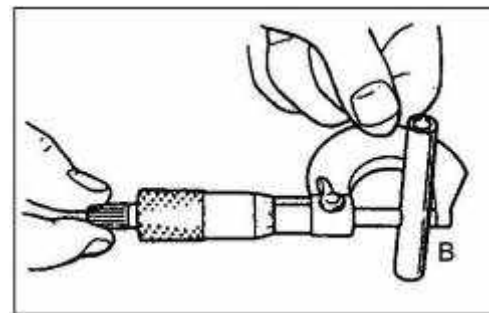
Out of specification → Replace.




	<p><b>Inside diameter (rocker arm ):</b>  <b>14.000- 14.018 mm</b>  <b>&lt; Limit: 14.05 mm &gt;</b></p>
---	--

- Measure the outside diameter B of the rocker arm shafts.

Out of specification → Replace.



	<p><b>Outside diameter(rocker arm shaft):</b>  <b>13.981- 13.991 mm</b>  <b>&lt; Limit: 13.94 mm &gt;</b></p>
---	---

**ROCKER ARM INSTALLATION**

6. Lubricate:

- Molybdenum disulfide oil onto the rocker arm and rocker arm shaft.

7. Install:

- Rocker Arm (exhaust)
- Rocker Arm Shaft & O-Ring 9.8×2.4

8. Install:

- Rocker Arm (intake)
- Rocker Arm Shaft & O-Ring 9.8×2.4

**NOTE:**

Before installing the Rocker Arm Shaft & O-Ring 9.8×2.4, check the O-Ring 9.8×2.4. If the O-Ring is damaged, replace it.

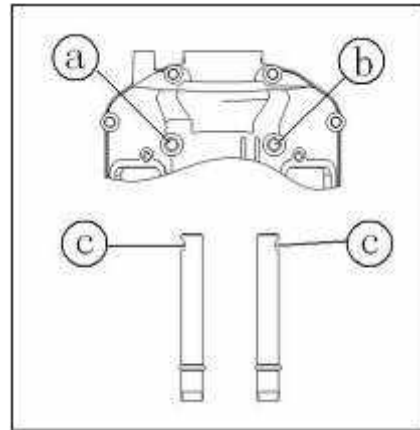
9. Install:

- Washer d8 (aluminum)
- Lock Rocker Arm Bolt

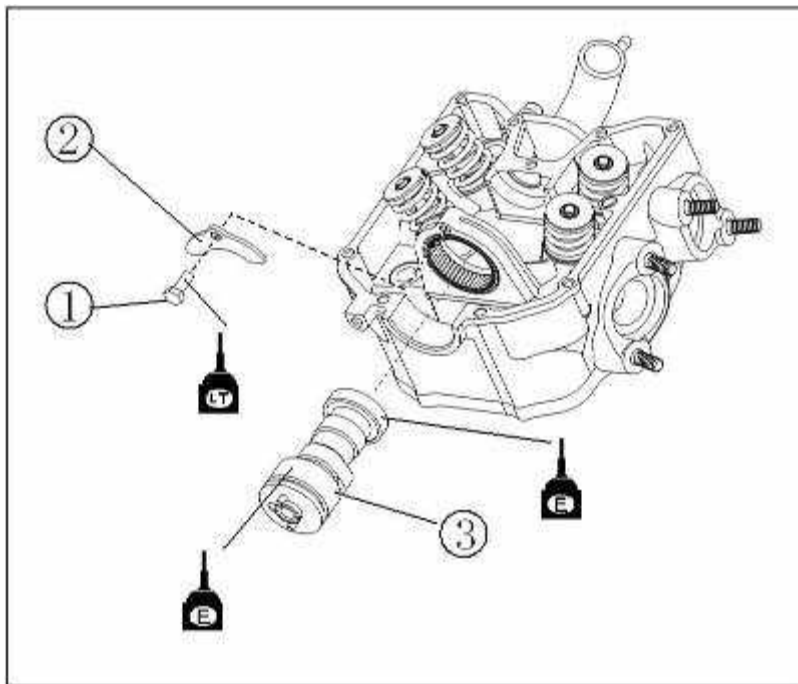
**15 Nm(1.5m·kg)**

**NOTE:**

When installs the Lock Rocker Arm Bolt, the groove<sup>○,c</sup> on the Rocker Arm Shaft should match with the hole(○,a/○,d) in the Cylinder head cover. If not, the Lock Rocker Arm Bolt maybe damage.



**10.11.5.2 CAMSHAFT**



Order	Job name / Part name	Q 'ty	Remarks
	Camshaft removal		Remove the parts in order.
	Cylinder Head	1	
1	Bolt 6×12	1	<b>5 Nm(0.5m·kg)</b>
2	Plate, Locate	1	
3	Camshaft	1	



- Refer to "CAMSHAFT INSTALLATION" section. Reverse the removal procedure for installation.

**CAMSHAFT REMOVAL**

- Remove:
  - Bolt 6×12
  - Plate, Locate

**CAMSHAFT INSPECTION**


- Inspect:
  - Cam lobes<sup>o,a</sup>

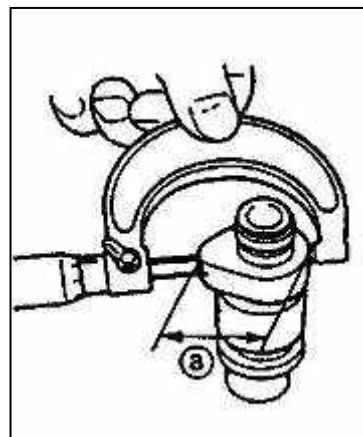
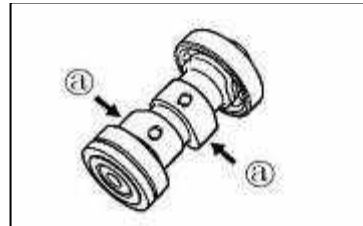
Pitting/Scratches/Blue discoloration → Re-place

- Measure:
  - Cam lobes length <sup>o,a</sup>

Out

of

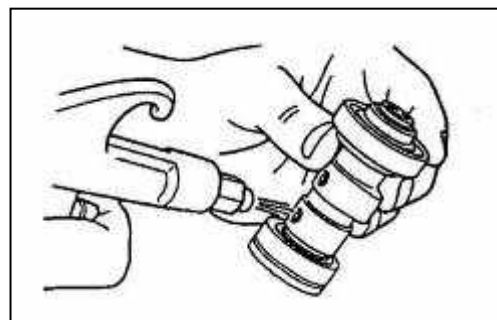
	<b>Cam lobes length:</b>
	<b>Intake:</b> 33.945-34.045 mm <Limit: 33.745 mm>
	<b>Exhaust:</b> 33.547- 33.647 mm <Limit: 33.35 mm>



specification → Replace.


- Inspect:
  - Cam shaft oil passage

Stuffed → Blow out oil passage with compressed air.



**CAMSHAFT INSTALLATION**

- Lubricate:
  - Camshaft

	<b>Camshaft:</b>
	<b>Molybdenum disulfide oil</b>
	<b>Camshaft bearing:</b>
	<b>Engine oil</b>


2. Install:

- Camshaft

3. Install:

- Plate, Locate

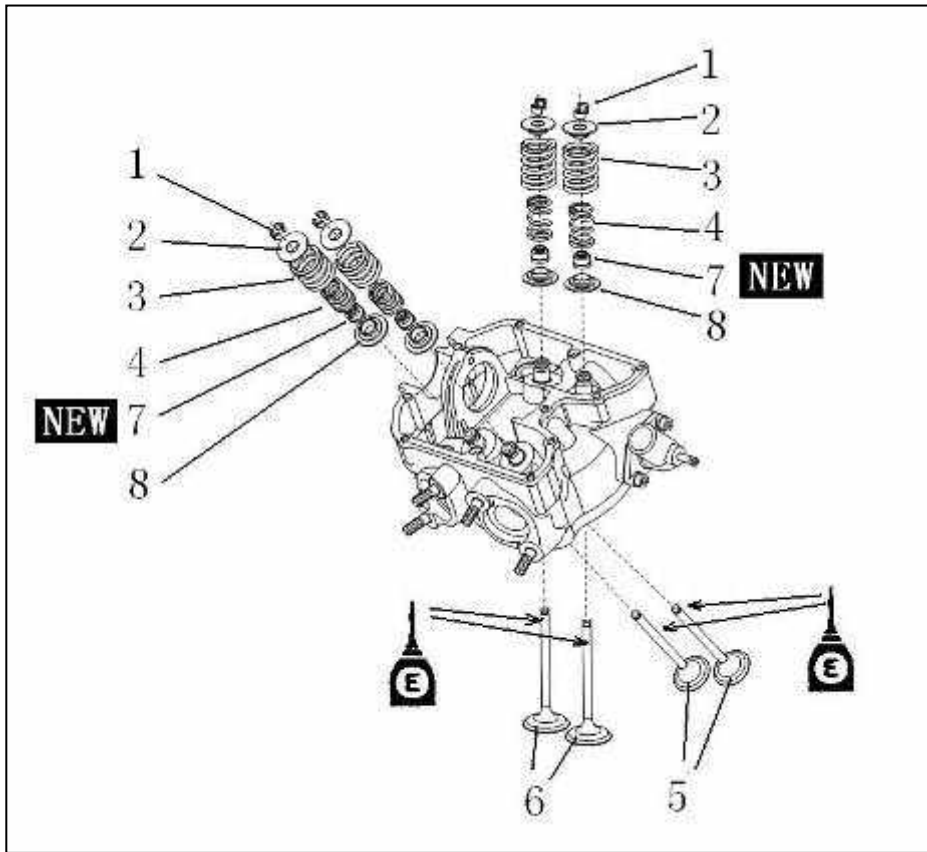
- Bolt 6×12

 5Nm(0.5m·kg)

**NOTE:**

Apply Loctite 243(Blue) to screw threads

**10.11.6 VALVES AND VALVE SPRINGS**



Order	Job name / Part name	Q 'ty	Remarks
	Valves and valve springs removal		Remove the parts in order.
	Cylinder head	1	Refer to "CYLINDER HEAD " section .
	Camshaft	1	Refer to "CAMSHAFT" section.
1	Valve cotters	8	
2	Spring retainer	4	
3	Valve spring (inner)	4	
4	Valve spring (Outer)	4	
5	Valve (intake)	2	
6	Valve (exhaust)	2	
7	Seal Valve Stem	4	
8	Spring seat	4	

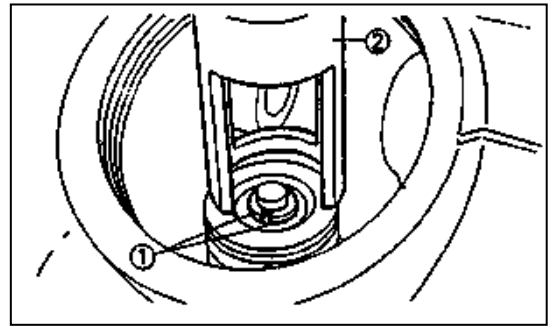
●Refer to "VALVES AND VALVE SPRINGS INSTALLATION" section. Reverse the removal procedure for installation.

**VALVES AND VALVE SPRINGS REMOVAL**

- 1. Remove:
  - Valve cotters ①

**NOTE:**

Attach a valve spring compressor and attachment ② between the valve spring retainer and cylinder head to remove the valve cotters.




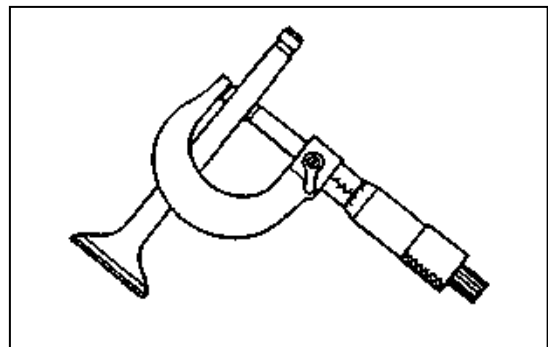
**CAUTION:**

Do not compress so much as to avoid damage to the valve spring.


**VALVE AND VALVE SPRINGS INSPECTION**

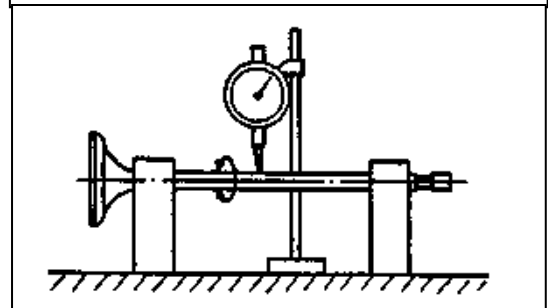
- 1. Measure:
  - Valve stem diameter
 Out of specification → Replace.

	<b>Valve stem diameter:</b> <b>Intake:</b> 6.57-6.585mm <Limit: 6.545mm>
	<b>Exhaust:</b> 6.555-6.57mm <Limit: 6.53mm>




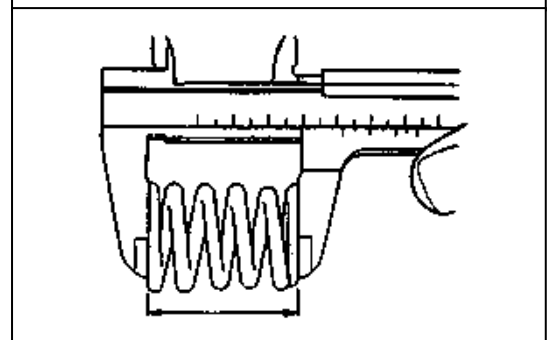
- 2. Measure:
  - Runout (valve stem)
 Out of specification → Replace.

	<b>Runout limit:</b>
	<b>0.05 mm</b>



- 3. Measure:
  - Free length (valve spring)
 Out of specification → Replace.


	<b>Valve spring free length:</b> <b>Inner spring:</b> 44 mm <Limit: 43.1mm>
	<b>Outer spring:</b> 45.25 mm <Limit: 44.14mm>

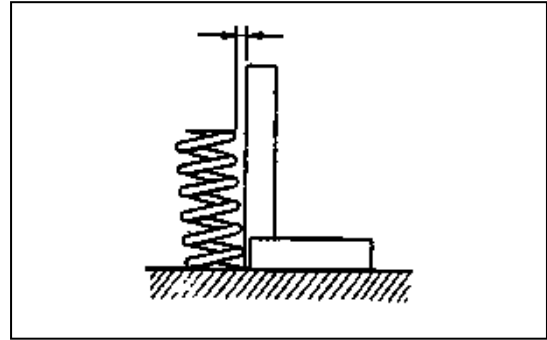


4. Measure:

- Spring tilt

Out of specification → Replace.

	<b>Spring tilt limit:</b>
	<b>1.7mm (2.5°)</b>



5. Inspect:


- Spring contact face

Wear/Pitting/Scratches → Replace.

6. Measure:


- Valve guide inside diameter

Out of specification → Replace.

	<b>Valve guide inside diameter:</b>
	<b>Intake:</b> 6.6-6.615 mm <Limit: 6.63mm> <b>Exhaust:</b> 6.6-6.615 mm <Limit: 6.63 mm>

7. Measure:

**Stem-to-guide clearance=**  
**Valve guide inside diameter-**  
**Valve stem diameter**

	<b>Stem-to-guide clearance:</b>
	<b>Intake:</b> 0.015-0.045mm <Limit:0.08 mm> <b>Exhaust:</b> 0.03-0.06mm <Limit:0.10 mm>

Out of specification → Replace the valve guide.

**VALVE SEATS INSPECTION**

1. Eliminate:

- Carbon deposits  
(from the valve face and valve seat)

2. Inspect:


- Valve seats

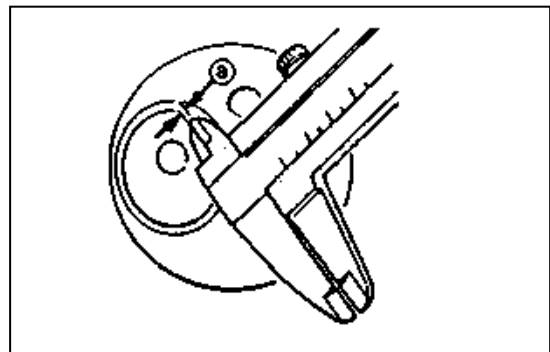
Pitting/wear → Reface the valve seat.

3. Measure:

- Valve seat width <sup>o,a</sup>

Out of specification → Reface the valve seat.

	<p><b>Valve seat width:</b>  <b>Intake:</b>  <b>0.9-1.1mm</b>  <b>&lt;Limit:1.6mm&gt;</b>  <b>Exhaust:</b>  <b>0.9-1.1mm</b>  <b>&lt;Limit:1.6mm&gt;</b></p>
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**Measurement step:**

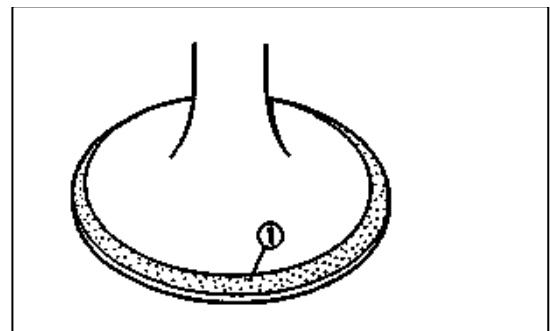
- Apply Mechanic's blueing dye (Dykem)<sup>①</sup> to the valve face.

- Install the valve into the cylinder head.

Press the valve through the valve guide and onto the valve seat to make a clear pattern.

- Measure the valve seat width. Where the valve seat and valve face made contact, blueing will have been removed.

- If the valve seat is too wide, too narrow, or the seat is not centered, the valve seat must be replaced.

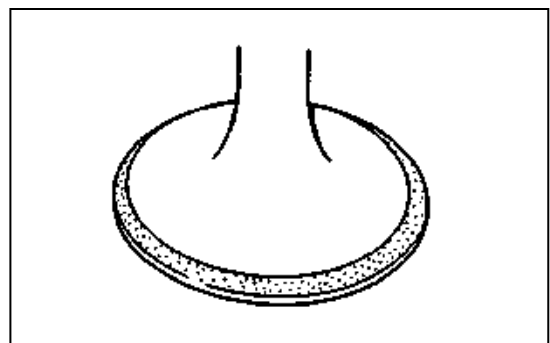


4. Lap:

- Valve face
- Valve seat

**NOTE:**

After replacing the valve seat, valve and valve guide, the valve seat and valve face should be lapped.



**Lapping steps:**

- Apply a coarse lapping compound<sup>o,a</sup> to the valve face.

**CAUTION:**

Do not let compound enter the gap between the valve stem and the guide.

- Apply molybdenum disulfide oil to the valve stem.
- Install the valve into the cylinder head.
- Turn the valve until the valve face and valve seat are evenly polished, then clean off all compound.

**NOTE:**

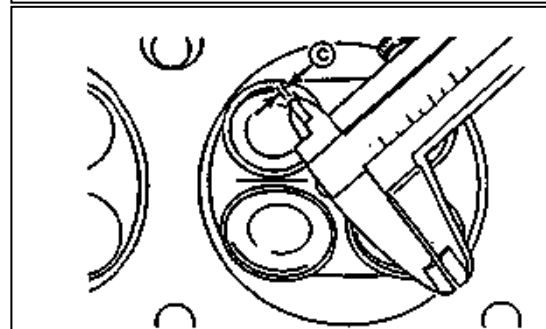
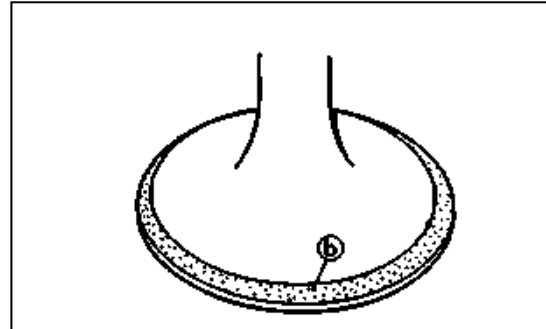
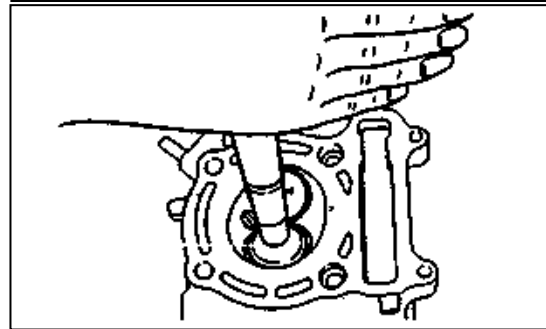
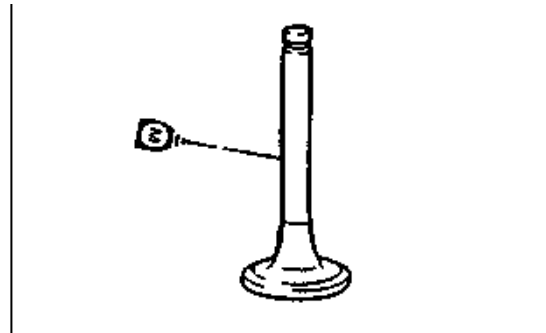
For best lapping results, lightly tap the valve seat while rotating the valve back and forth between your hand.

- Apply a fine lapping compound to the valve face and repeat the above steps.

**NOTE:**

Make sure to clean off all compound from the valve face and valve seat after every lapping operation.

- Apply Mechanic's blueing dye (Dykem) <sup>ⓐ</sup>, <sup>ⓑ</sup> to the valve face.
- Install the valve into the cylinder head.
- Press the valve through the valve guide and onto the valve seat to make a clear pattern.
- Measure the valve seat with <sup>ⓒ</sup> again.



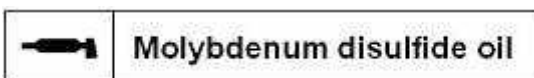
**VALVES AND VALVE SPRINGS INSTALLATION**

1. Deburr:

- Valve stem end
- Use an oilstone to smooth the stem end.

2. Apply:

- Molybdenum disulfide oil (onto the valve stem<sup>③</sup> and oil seal <sup>②</sup> )



3. Install:

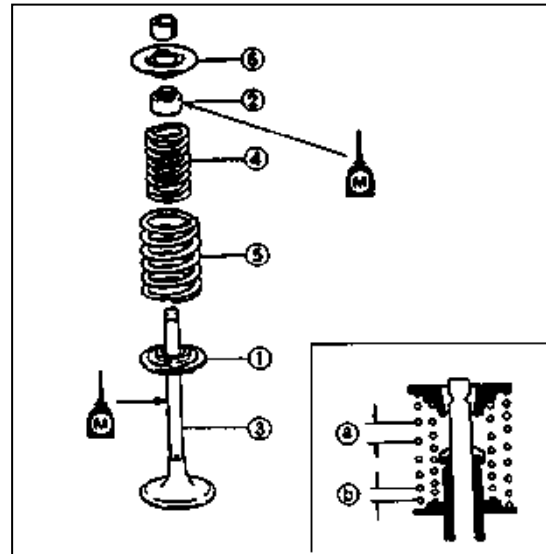
- Valve spring seat ①
- Valve stem seal ② **NEW**
- Valve ③ (into the cylinder head)
- Valve spring (under) ④
- Valve spring (outer) ⑤
- Spring retainer ⑥

**NOTE:**

Install the valve spring with the larger pitch

○,a facing upwards.

○,b Smaller pitch



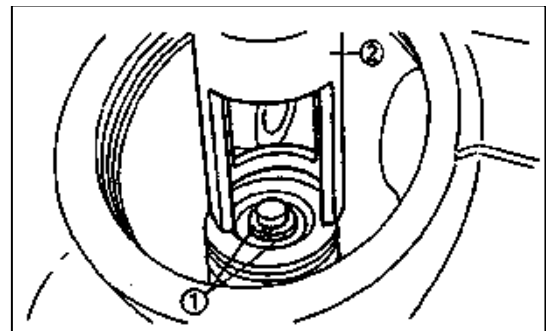
4. Instal:

- Valve cotters ①

**NOTE:**

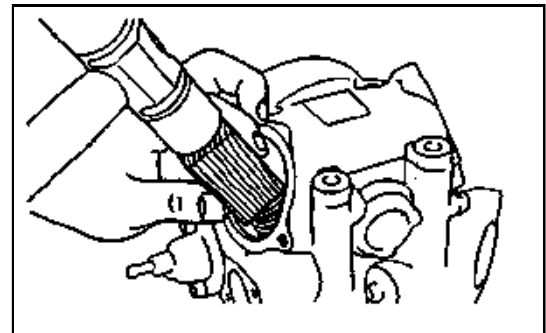
Install the valve cotters while com pressing the valve spring with a valve spring compressor and attachment ②.

5. Secure the valve cotters onto the valve stem by tapping lightly with a piece of wood.



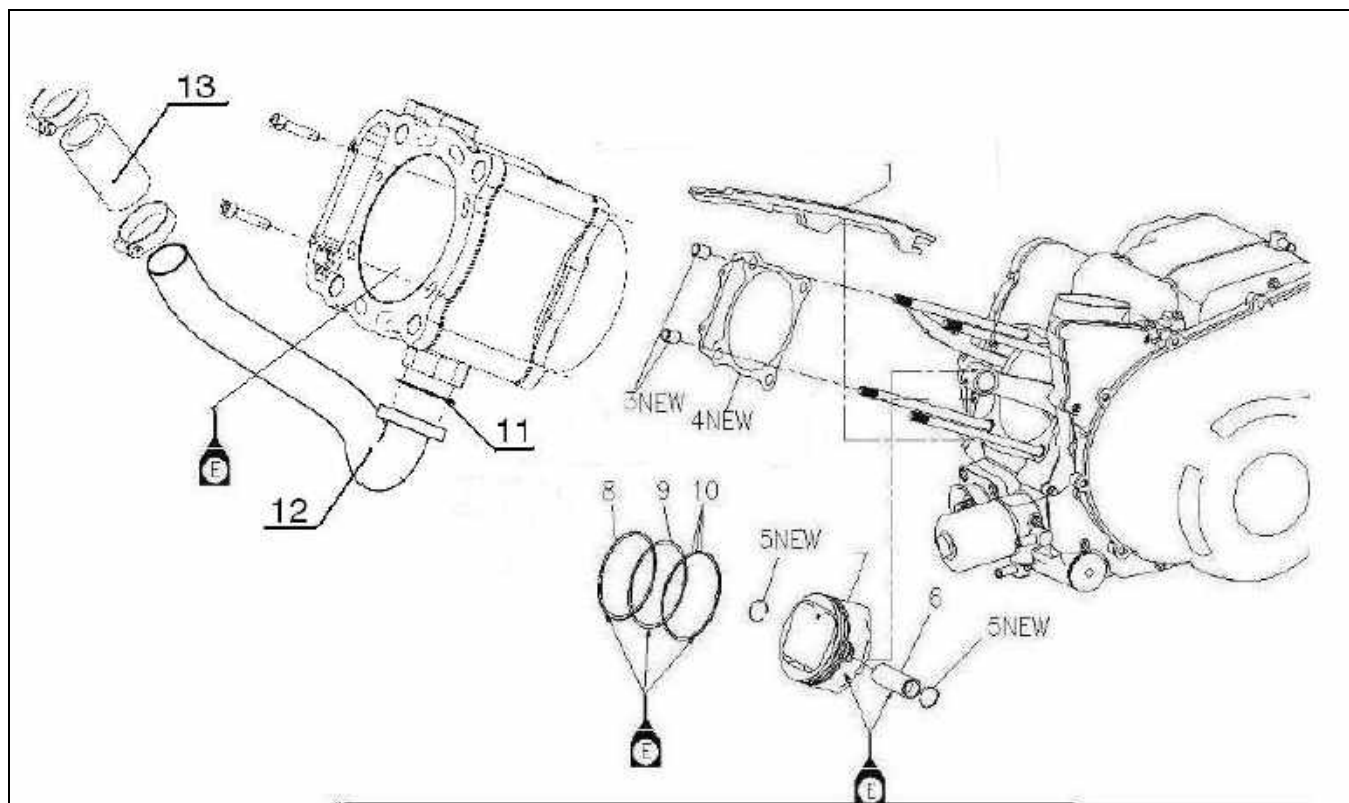
**CAUTION:**

Do not hit so much as to damage the valve.





**10.11.7 CYLINDER AND PISTON**



Order	Job name / Part name	Q 'ty	Remarks
	Cylinder and piston removal		Remove the parts in order.
	Cylinder head		Refer to " CYLINDER HEAD "
1	Timing chain guide	1	section .
2	Cylinder	1	
3	Dowel pin	2	
4	Cylinder gasket	1	
5	Piston pin clip	2	
6	Piston pin	1	
7	Piston	1	
8	Piston ring 1 set (top ring)	1	
9	Piston ring 2 set (2 <sup>nd</sup> ring)	1	
10	Side rail/Spacer	3	
11	Gasket , cylinder	1	
12	Inlet pipe, cylinder	1	
13	Hose , water pump	1	

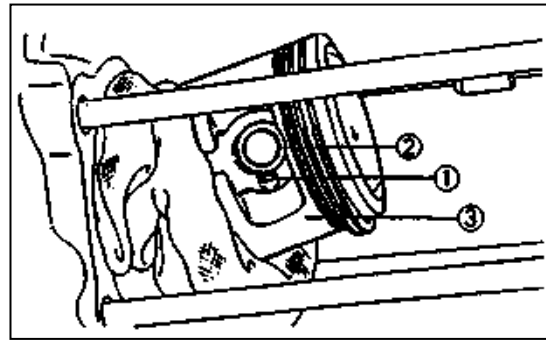
**PISTON AND PISTON RINGS REMOVAL**

1. Remove:

- Piston pin clip ①
- Piston pin ②
- Piston ③

**NOTE:**

Before removing the piston pin clip, cover the crankcase opening with a clean towel or rag to prevent the clip from falling into the crankcase cavity.

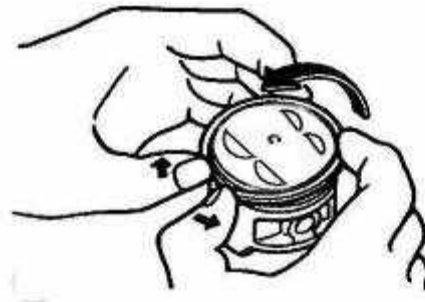


2. Remove:

- Top ring
- 2nd ring
- Oil ring

**NOTE:**

When removing the piston ring, open the end gap of the ring by fingers, and push up the other side of the ring.



**CYLINDER INSPECTION**

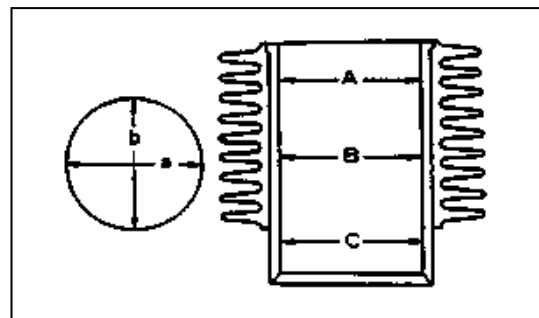
1. Measure:


- Cylinder bore

Out of specification → Rebore or replace.

**NOTE:**

- Measure the cylinder bore with a cylinder bore gauge.
- Measure the cylinder bore in parallel to and a right angle to the crankshaft. Then, find the average of the measurements.

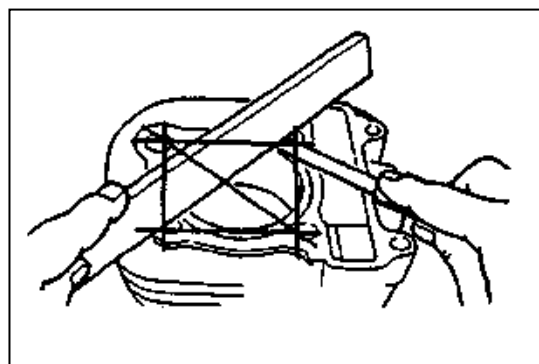



	<p><b>Cylinder bore:</b>  <b>102.000- 102.015 mm</b>                  &lt; Limit: 102.05 mm &gt;                  &lt; Difference limit between A,B and C :0.03m m &gt;</p>
---	---

2. Measure:

- Warpage

Out of specification → Replace.



	<p>Cylinder warpage limit:                  0.03mm</p>
---	--

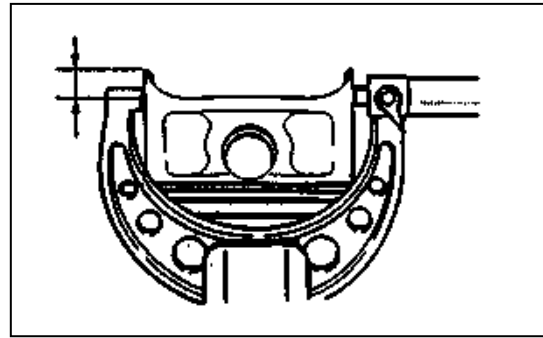
**PISTON AND PISTON PIN INSPECTION**


1. Measure:

- Piston skirt diameter

Out of specification → Replace .

○,a 10.0mm from the piston bottom edge.



	<p><b>Valve skirt diameter:</b>  <b>101.95-101.97 mm</b>  <b>&lt; Limit: 101.87 mm &gt;</b></p>
---	---


2. Calculate:

- Piston-to-cylinder clearance

<p><b>Piston-to-cylinder clearance=</b>  <b>Cylinder bore-Piston skirt diameter</b></p>
---

Refer to “CYLINDER” section for cylinder bore measurement.

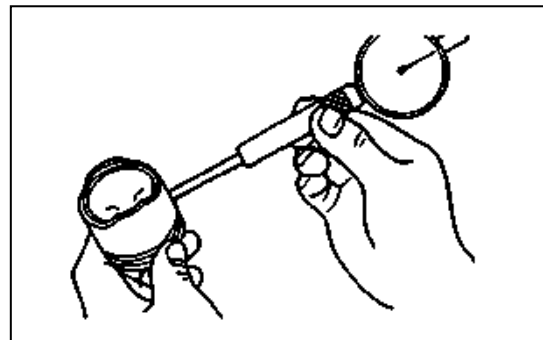
Out of specification → Replace the piston and piston rings as a set.


	<p><b>Piston-to-cylinder clearance:</b>  <b>0.03 - 0.062 mm</b>  <b>&lt;Limit:0.15mm&gt;</b></p>
---	--

3. Measure:

- Piston pin bore diameter

Out of specification → Replace.



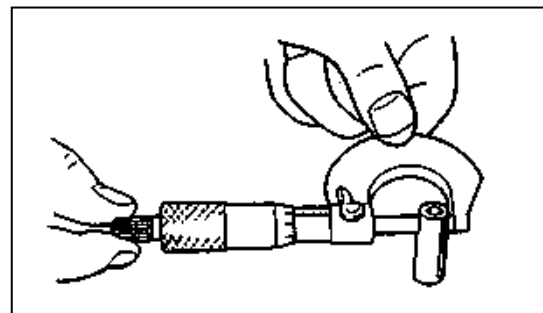
	<p><b>Piston pin bore diameter:</b>  <b>23.002-23.008mm</b>  <b>&lt;Limit: 23.03mm&gt;</b></p>
---	--

4. Measure:

- Piston pin outside diameter

Out of specification → Replace.

	<p><b>Piston pin bore diameter:</b>  <b>22.99-23.0mm</b>  <b>&lt;Limit: 22.98mm&gt;</b></p>
---	---



5. Inspect:

- Piston pin

Blue discoloration/groove → Clean or replace.

**PISTON RINGS INSPECTION**

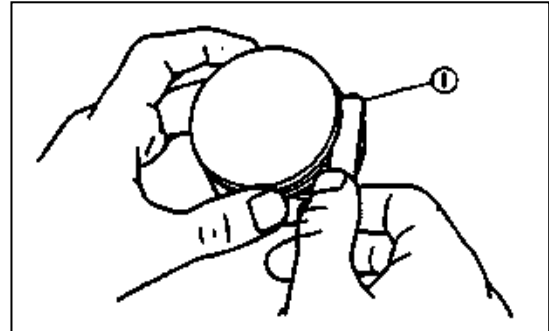
1. Measure:


- Side clearance  $\varnothing_{,1}$

Out of specification → Replace the piston and the piston rings as a set.

**NOTE:**

Eliminate the carbon deposits from the piston ring grooves and rings before measuring the side clearance.



	<p><b>Side clearance (piston ring):</b>  <b>Top ring:</b></p> <p style="padding-left: 40px;">&lt;Limit: 0.18mm&gt;</p> <p><b>2nd ring:</b></p> <p style="padding-left: 40px;">0.02 - 0.06mm</p> <p style="padding-left: 40px;">&lt;Limit: 0.15mm&gt;</p>
---	--

2.Position:

- Piston ring into the cylinder

**NOTE :**

Push the ring with the piston crown so that the ring will be at a right angle to the cylinder bore.

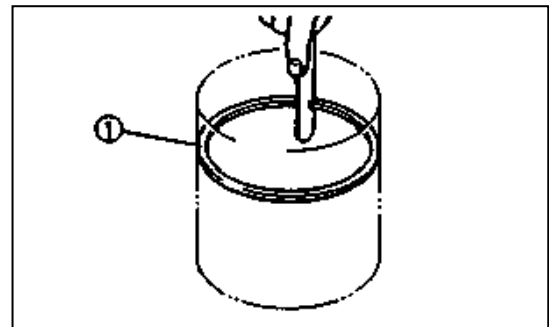
$\varnothing_{,1}$  5.0mm


3. Measure:

- End gap
- Out of specification → Replace.

**NOTE:**

You cannot measure the end gap on the expander spacer of the oil ring. If the oil ring rails show excessive gap, replace all three rings.

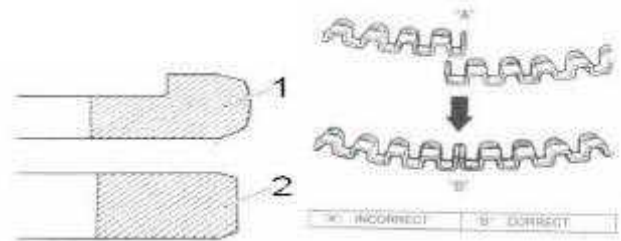


	<p><b>End gap:</b></p> <p><b>Top ring:</b></p> <p style="padding-left: 40px;">0.20-0.40mm</p> <p style="padding-left: 40px;">&lt;Limit:0.55mm&gt;</p> <p><b>2nd ring:</b></p> <p style="padding-left: 40px;">0.20-0.40mm</p> <p style="padding-left: 40px;">&lt;Limit:0.55m m&gt;</p> <p><b>Oil ring:</b></p> <p style="padding-left: 40px;">0.20-0.70mm</p> <p style="padding-left: 40px;">&lt;Limit:0.90m m&gt;</p>
---	---

**PISTON RINGS, PISTON AND CYLINDER INSTALLATION**

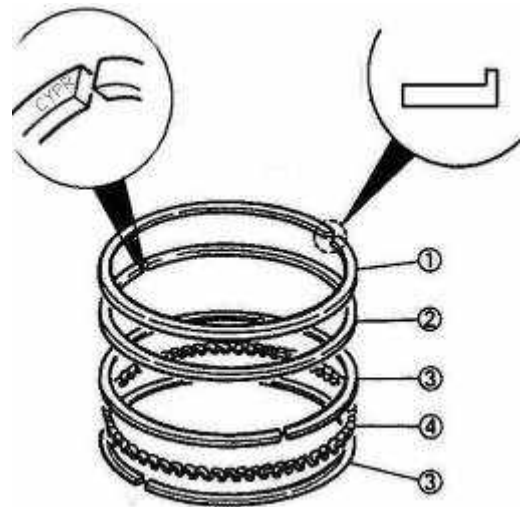
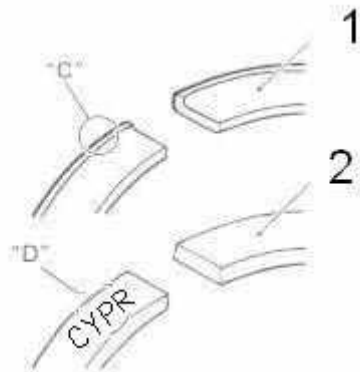
1. Install:

- Top ring ①
- 2nd ring ②
- Side rails (oil ring) ③
- Expander spacer (oil ring) ④



**NOTE:**

- 1<sup>st</sup> ring (1) and 2<sup>nd</sup> ring (2) differ in shape.
- Face the side with the edge "C" and stamped mark "D" when assembling.
- When installing the spacer, be careful so that the both edges are not overlapped.
- Lubricate the pistons and piston rings liberally with engine oil

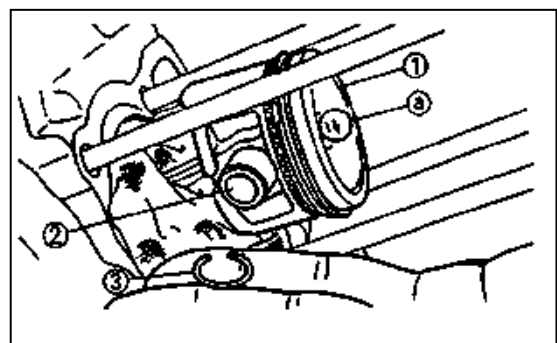


2. Install:

- Piston ①
- Piston pin ②
- Piston pin clip ③ **NEW**

**NOTE:**

- Apply engine oil to the piston pins.
- make sure to install the piston so that the intake valve are located above of the exhaust valve (the intake valve is bigger than the exhaust valve)



● Before installing the piston pin clip, cover the crankcase opening with a clean rag to prevent the piston pin clip from falling into the crankcase.

3. Install:

- Gasket (cylinder) **NEW**
- Dowel pins

4. Position:

- Piston rings

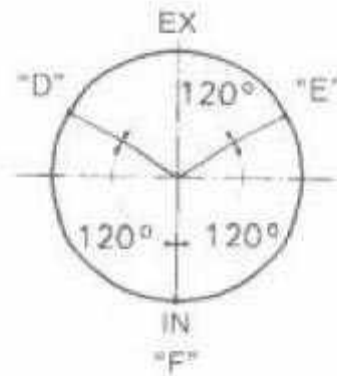
**NOTE:**

Position the gaps of three rings and side rails as shown. Before inserting piston into the cylinder, check that the gaps are so located.

“D”: 2<sup>nd</sup> ring and lower side rail

“E” upper side rail

“F” 1<sup>st</sup> ring and spacer



5. Lubricate:

- Piston outer surface
- Piston ring
- Cylinder inner surface

	<b>Engine oil</b>
---	-------------------

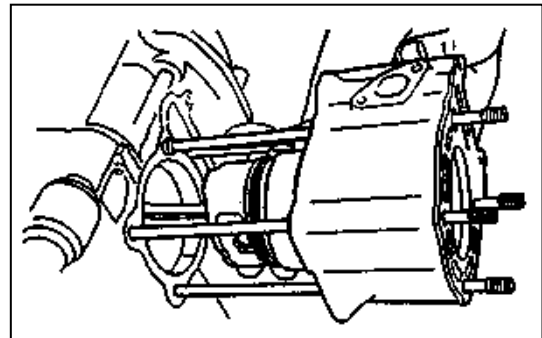
6. Install:

- Cylinder

**NOTE:**

● Install the cylinder with one hand while compressing the piston rings with the other hand.

● Pass the timing chain and timing chain guide (exhaust side) through the timing chain cavity.



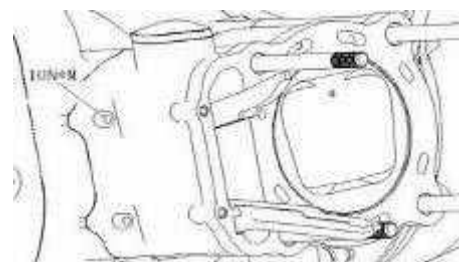
7. Install:

- socket head bolt

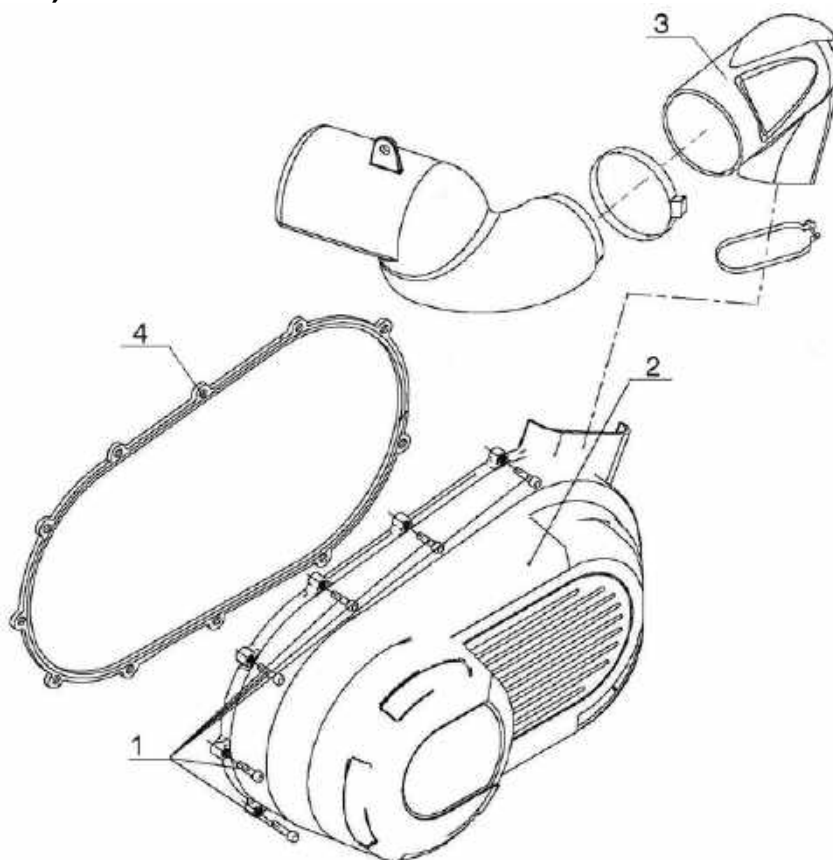
**NOTE:**



● Apply Loctite 243(Blue) to screw threads and torque screws to 10N.m

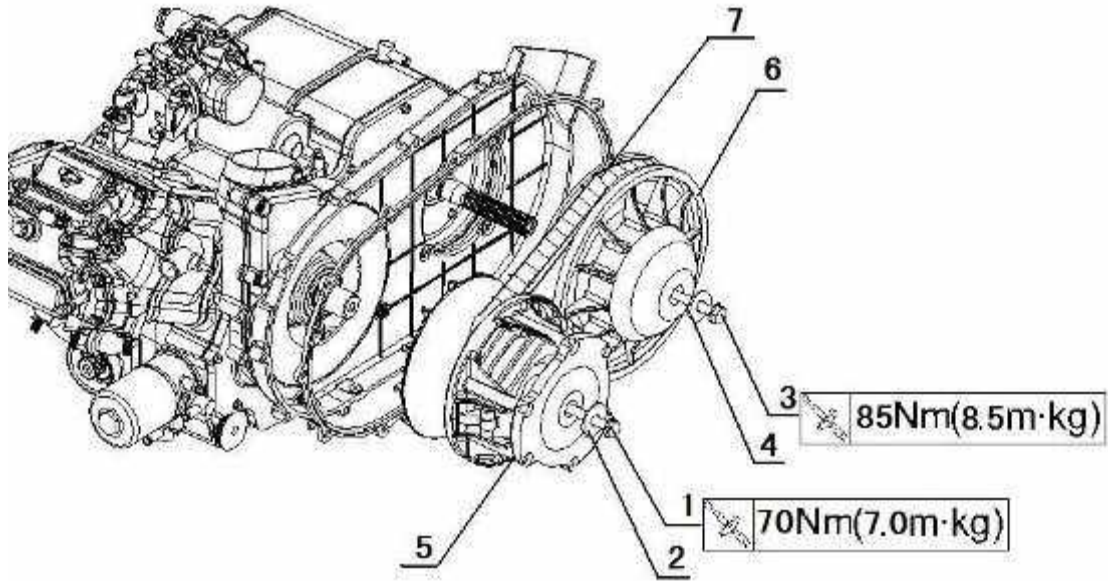


**10.11.8 V-BELT,CLUTCH AND SECONDARY/PRIMARY SHEAVE COVER (LEFT)**



Order	Job name / Part name	Q 'ty	Remarks
	cover (left) removal		<b>Remove the parts in order.</b>
1	socket head cap screws	8	Tightening torque:10N.m
2	cvt big cover componets	1	
3	out pipe	1	
4	washer,cvt big cover	1	
			Reverse the removal procedure for installation .

V-BELT, DRIVEN ASSY COMPLETE&PRIMARY SHEAVE



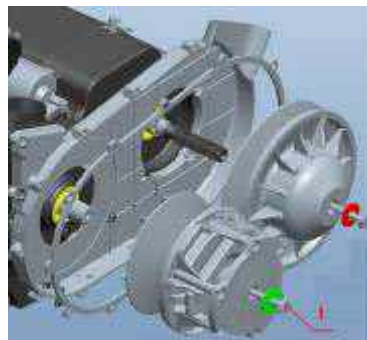
Order	Job name / Part name	Q 'ty	Remarks
	V-belt, driven assy complete/ primary sheave removal		Remove the parts in order
1	mounting bolt,driving wheel	1/1	
2	installation sleeve,driving sheel	1/1	
3	mounting bolt,driven wheel	1	
4	installation sleeve,driven sheel	4	
5	driving wheel sub-assy.	8	
6	driven sheel sub-assy.	1	Reverse the removal
7	belt	1	procedure for installation.



**DRIVING WHEEL REMOVAL**

1. Remove:

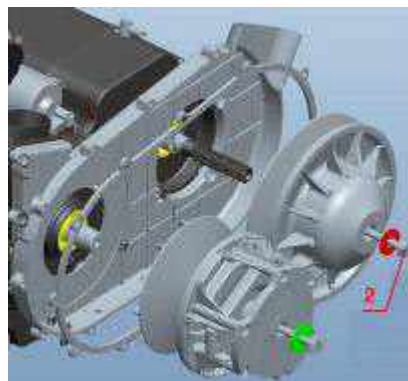
- Bolt ①(primary sheave)
- Plate washer
- Use the driving clutch puller remove the driving wheel



**DRIVEN ASSY AND V-BELT REMOVAL**

1. Remove:

- Bolt ② (driven assembly)
- Plate washer
- Driven assembly
- V-belt ③



**CLUTCH CARRIER INSPECTION**

1. Inspect:

- Scratches → Glaze using coarse sandpaper.
- Wear /Damage → Replace

**V-BELT INSPECTION**

1. Inspect:

- V-belt ①

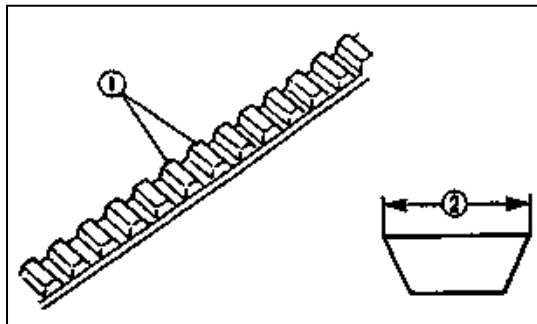
Cracks/Wear /Scaling /Chipping → Replace.

Oil/Grease → Check primary sheave and secondary sheave.

2. Measure:

- V-belt width ②

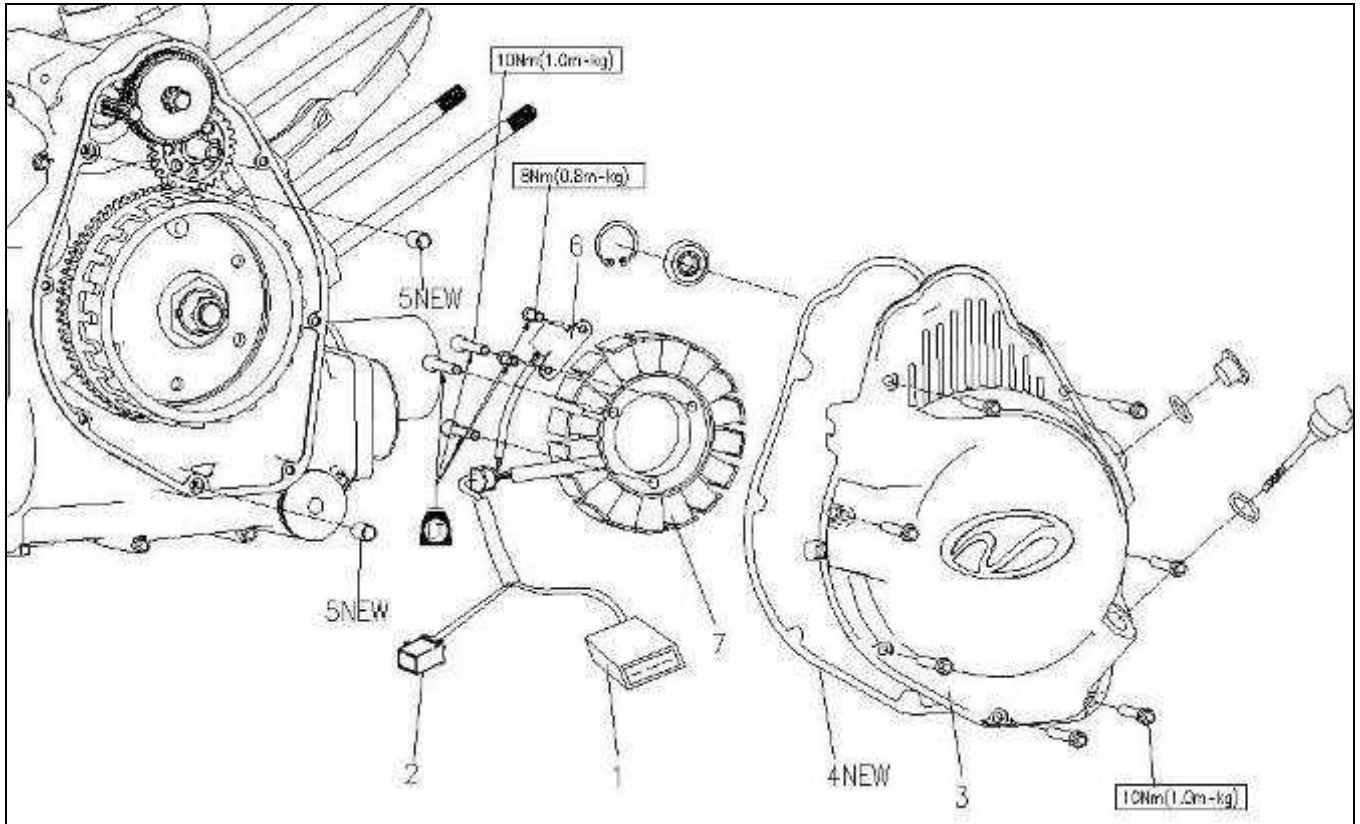
Out of specification → Replace




**V-belt width:  
29.2mm  
(Limit:27.6 mm)**

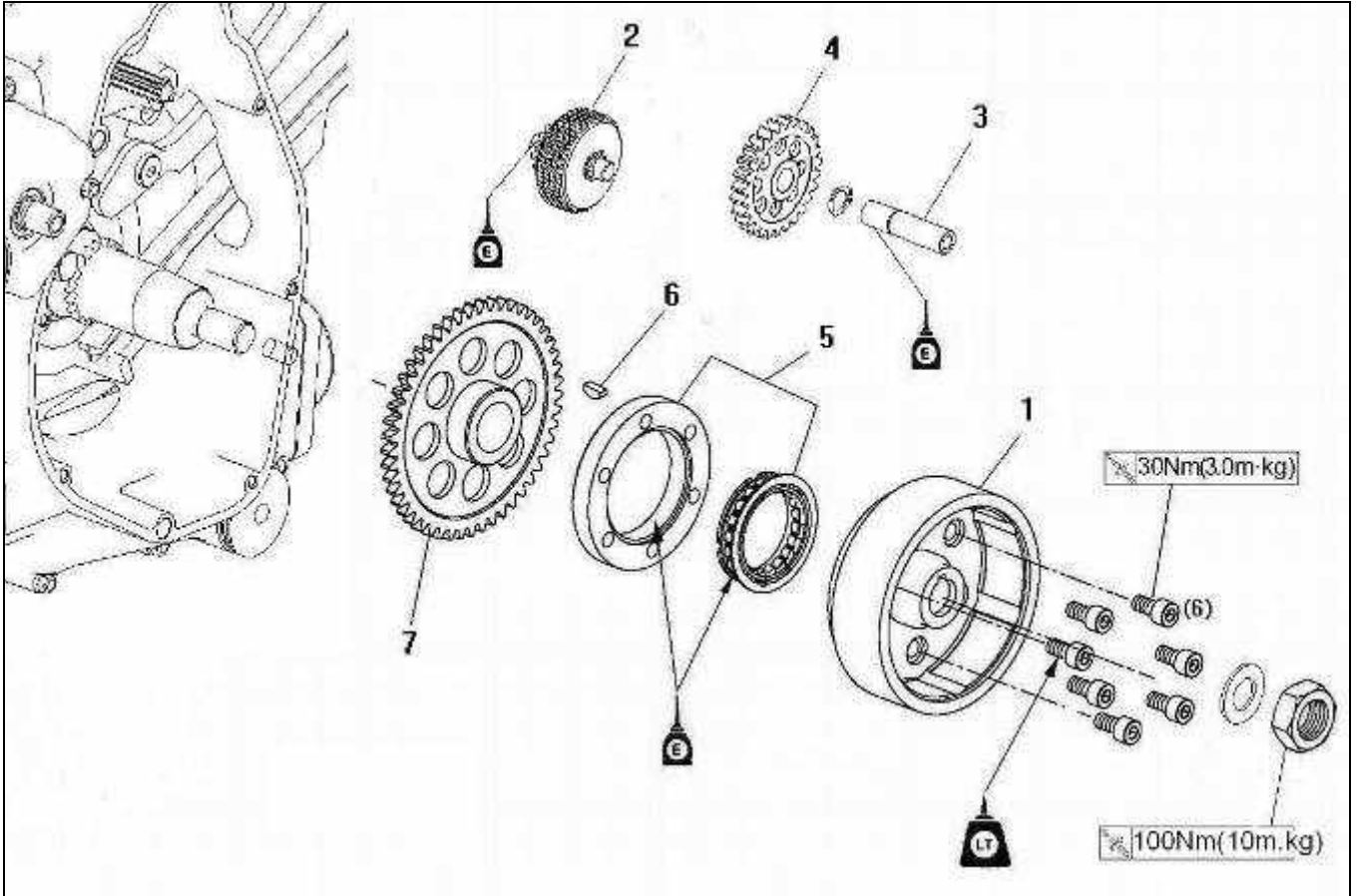
**10.11.9 A.C. MAGNETO AND STARTER CLUTCH**

**MAGNETO COVER AND STATOR COIL**



Order	Job name / Part name	Q 'ty	Remarks
	<b>Magneto cover and stator coil removal</b> Drain the engine oil.		Remove the parts in order. Refer to "ENGINE OIL REPLACEMENT" section.
1	Couplers (A.C. magneto lead)	1	<b>NOTE:</b> Disconnect the couplers  Reverse the removal procedure for installation.  <b>NOTE:</b>  Apply Loctite 243(Blue) to screw threads and torque screws to 8N.m and 10N.m
2	Couplers ( Pick up coil )	1	
3	Magneto cover	1	
4	Gasket (magneto cover)	1	
5	Dowel pins	2	
6	Pick up coil	1	
7	Stator coil	1	

A. C. MAGNETO AND STARTER CLUTCH

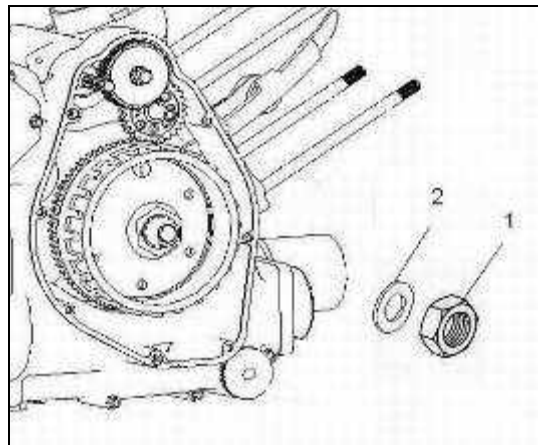


Order	Job name / Part name	Q 'ty	Remarks
	<b>A.C. magneto and starter clutch removal</b>		Remove the parts in order.
1	Rotor	1	Refer to "A.C. MAGNETO ROTOR REMOVAL /INSTALLATION" section
2	Starter torque limiter	1	
3	idle gear shaft	1	
4	idle gear	1	
5	Starter one way clutch assembly	1	
6	Woodruff key	1	
7	Starter driven gear	1	

**A.C. MAGNETO ROTOR REMOVAL**

1. Remove:

- Nut ① (rotor)
- washer② (rotor)



2. Remove:

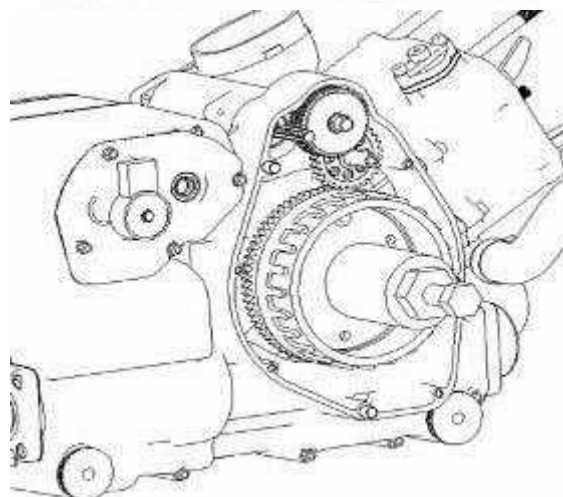
- Rotor
- Woodruff key

**NOTE:**

- special tools and equipment  
flywheel puller



- Remove the rotor with the flywheel puller.
  - Screw the flywheel puller in the rotor.
- Make sure the threaded connections of the flywheel puller and rotor tightening, then screwing in the special bolt.



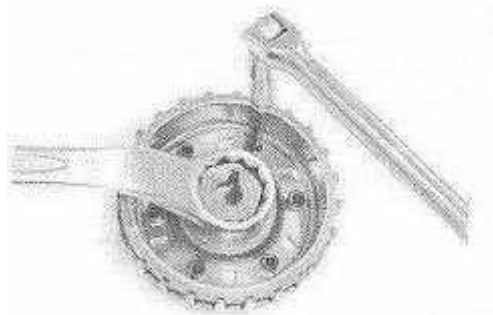
3. Remove:

- Starter torque limiter
- idle gear shaft
- idle gear

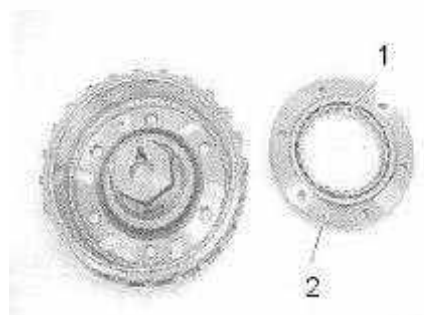
4. Remove:

● Starter one way clutch assembly

1) Hold the generator rotor with a 41mm offset wrench and remove the starter clutch bolts



2) Remove the one way clutch(1) from the guide(2).



**CAUTION:**

Cover the crankshaft end with the box wrench for protection.

**STARTER DRIVE GEAR INSPECTION**

1. Inspect:

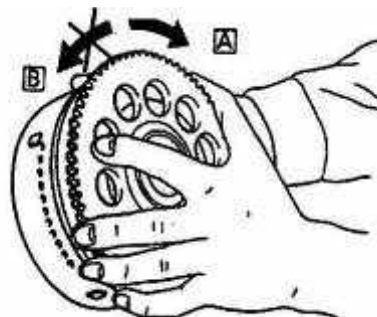
- Starter idle gear teeth
- Starter drive gear teeth
- Starter torque limiter teeth

Burrs /chips /roughness /wear → Replace.

2. Check:

● Starter clutch operation

- 1) Install the starter driven gear onto the starter clutch.
- 2) Turn the starter driven gear by hand to inspect the starter clutch for smooth movement. The gear turns in one direction only ( A ). If a large resistance is felt for rotation, inspect the starter clutch or the starter clutch contacting surface on the starter driven gear for wear or damage.
- 3) If they are found to be damaged, replace the one way clutch with a new one.



● Starter torque limiter.

**CAUTION:**

**Do not attempt to disassemble the starter torque limiter. The starter torque limiter is available only as an assembly.**

- 1 ) Set the starter torque limiter to the special tools and vise.
- 2 ) Turn the starter torque limiter and check the slip torque.

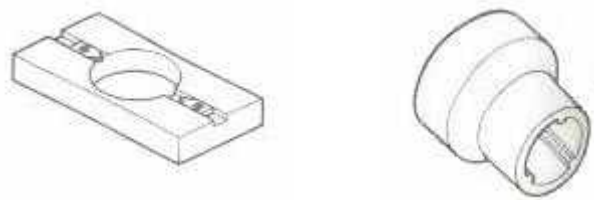
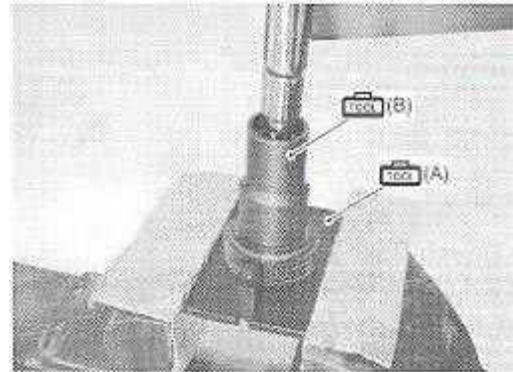
**Special tool**

Starter torque limiter holder(A)

Starter torque limiter socket(B)

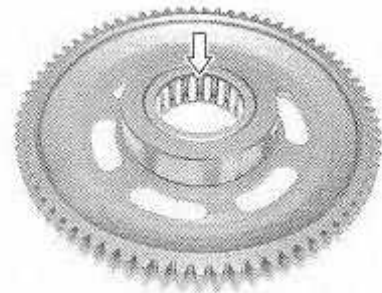
**Starter torque limiter slip torque**

**Standard : 41.2-62.8N.m(4.2-6.4kgf-m)**



● Starter driven gear bearing

Inspect the starter driven gear bearing for wear or damage. If necessary, replace it with a new one.



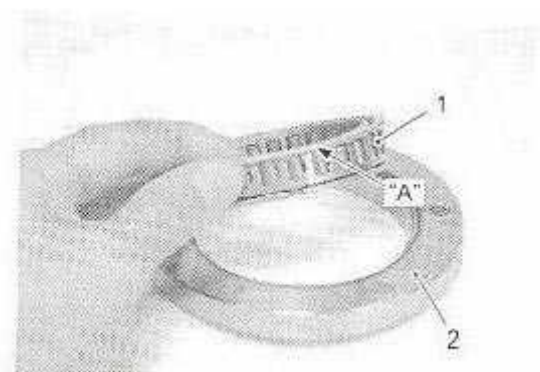
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**A.C. MAGNETO ROTOR INSTALLATION**

1. Install:

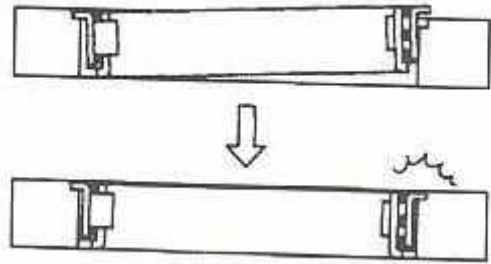
● Starter clutch

- 1) When inserting the one way clutch(1) into the guide(2), fit the flange "A" in the step of the guide(2).



**Note:**

Be sure to seat the flange "A" of the one way clutch (1) to the guide (2).



2) Install the guide to the generator rotor.

**Note :**

The arrow mark "B" must face the generator rotor side



3) Apply Loctite 243(Blue) to the bolts, and then tighten them to the specified torque.(30N.m)

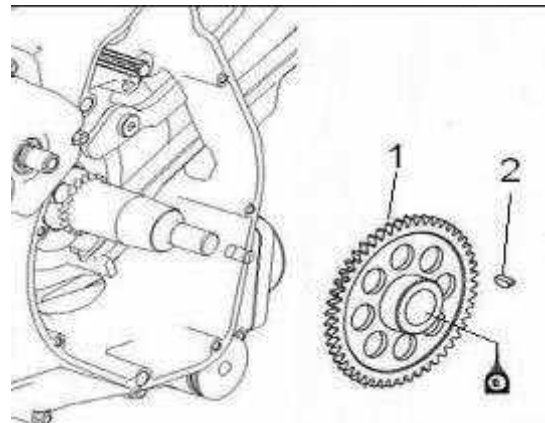
2. Install

- Starter driven gear①.
- Woodruff key ②

**NOTE:**

Install the starter wheel gear①, then install the woodruff key②.

	<b>Engine oil</b>
--	-------------------



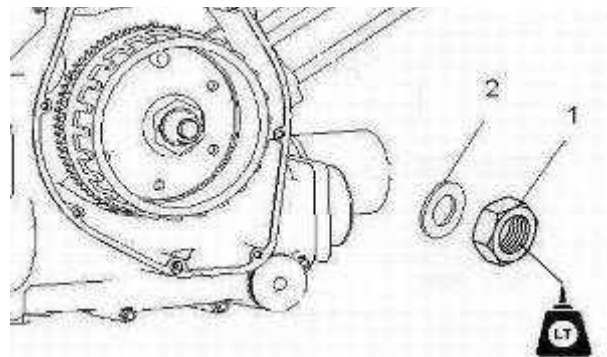
3. Install:

Rotor

- Plain washer② (rotor)
- Nut ① (rotor)

**NOTE:**

- Clean the tapered portion of the crankshaft and the rotor hub.
- When installing the magneto rotor, make sure the woodruff key is properly seated in the key way of the crankshaft.



4. Tighten:

- Nut(rotor)① 100N.m



**NOTE:**

Apply Loctite 243(Blue) to screw threads and torque screws to 100N.m

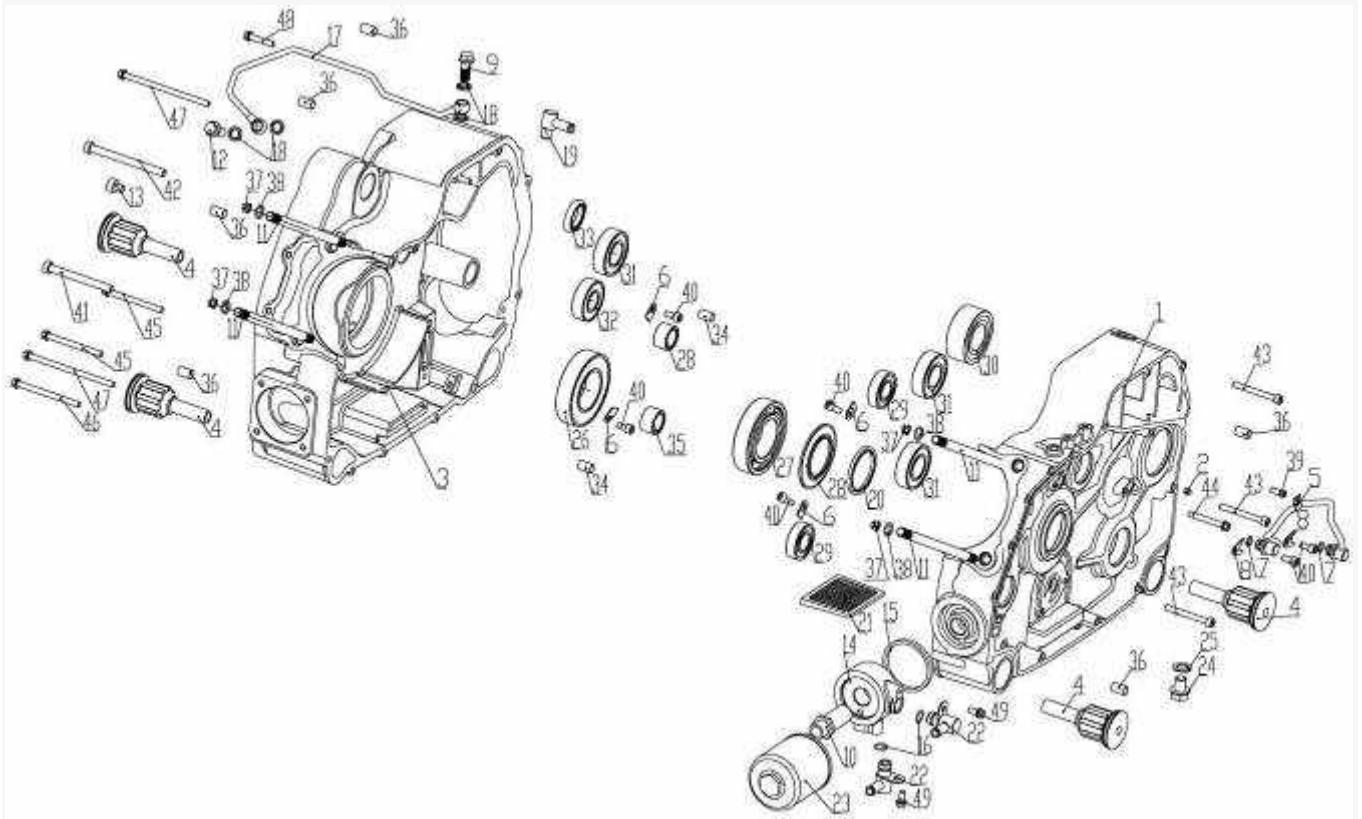
5. Install:

- idle gear& idle gear shaft

- Starter torque limiter

	<b>Engine oil</b>
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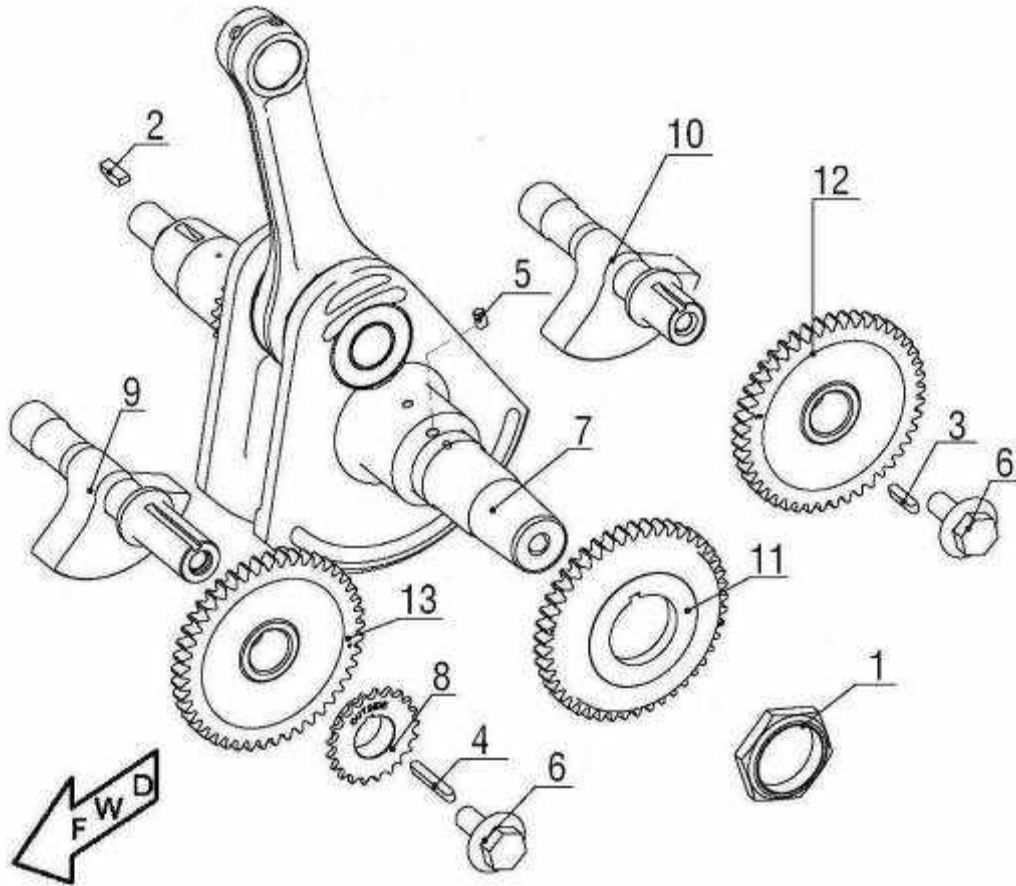
**10.11.10CRANKCASE**




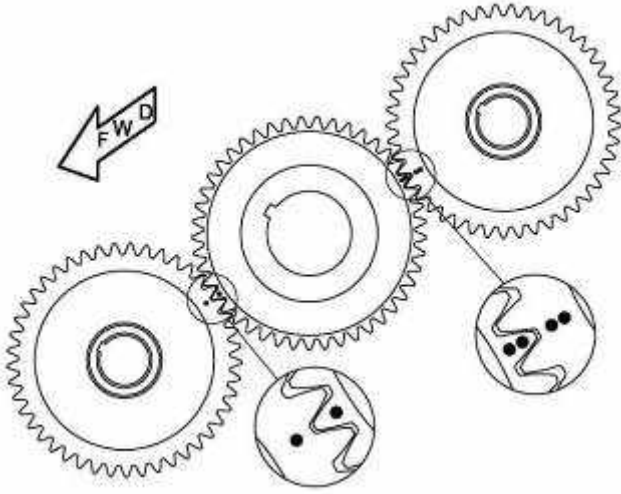
Order	Job name/ Part name	Q'ty	Remarks
1	Left crankcase	1	<ul style="list-style-type: none"> <li>· Wipe the crankcase mating surface (both surfaces)</li> <li>· Insert the locating pin(34) onto the crankcase</li> <li>·Apply bond to the mating surface of the left crankcase</li> </ul>
2	Oil road plug	1	
3	Right crankcase	1	
4	Engine mount bushing	4	
5	Tubing components 1	1	
6	Needle roller bearing baffle	4	
7	O- ring 8.8X1.9	2	Apply grease
8	Tubing baffle	2	
9	Oil passage bolt A	1	Tightening torque:20N.m
10	Oil filter block	1	Tightening torque:36N.m
11	Double end studs	4	Tightening torque:23N.m
12	Oil passage bolt B	1	Tightening torque:20N.m
13	Limit axis	1	

Order	Job name/ Part name	Q'ty	Remarks
14	Oil-cooling connector	1	
15	Ring	1	
16	O -ring 11.2X1.8	2	Apply grease
17	Tubing components 2	1	
18	Combinatorial gasket	4	
19	Ventilation mouth components	1	
20	Oil seal 45X55X4	1	Apply grease
21	Oil strainer	1	
22	Cold oil connector tube assembly	2	
23	Oil filter	1	Tightening torque:20N.m
24	Drain bolt	1	Tightening torque:26N.m
25	Washer	1	
26	Bearing 6209	1	
27	Bearing 6209-2U	1	First installation the seal to bearing 6209-2U, then installation the bearing 6209-2U to left crankcase
28	Seal	1	
29	Bearing 6004	2	
30	Bearing 5206	1	
31	Bearing 6205	3	
32	Bearing 6204	1	
33	Bearing 61805	1	
34	Locating pin 10X16	2	
35	Needle roller bearings NK20/16	2	
36	Locating pin 8X14	6	
37	Nut M10X1.25	4	Tightening torque:45N.m
38	Washer 10	4	
39	Socket head cap screws M5X12	1	Apply Loctite 243(Blue) Tightening torque:7N.m
40	Socket head cap screws M6X12	6	Apply Loctite 243(Blue) Tightening torque:10N.m
41	Socket head cap screws M8X80	1	Tightening torque:25N.m
42	Socket head cap screws M8X95	1	Tightening torque:25N.m
43	Socket head cap screws M6X55	3	
44	Bolt M6X45	1	
45	Bolt M6X70	2	
46	Bolt M6X80	1	Tightening torque:10N.m
47	Bolt M6X110	2	
48	Bolt M6X30	1	
49	Bolt M6X12	2	

**10.11.11 CRANKSHAFT AND BALANCE SHAFT**



Order	Job name/ Part name	Q'ty	Remarks
1	Locknut M35x1.5	1	Apply Loctite 243(Blue) Tightening torque:150N.m Lock the crank balancer drive gear nut with a center punch.  <b>CAUTION:</b> the removed nut must be replaced with a new one.
2	key	1	
3	Flat key A4x20	1	
4	Flat key A4x30	1	
5	Cylindrical pin 5x8	1	

Order	Job name/ Part name	Q'ty	Remarks
6	Bolt M10x1.25x25	2	Apply Loctite 243(Blue) Tightening torque:55N.m
7	Crankshaft assy.	1	
8	Initiative sprocket oil pump	1	
9	Front balance shaft	1	
10	Rear balance shaft	1	
11	Crank balancer drive gear	1	Align the punch mark as shown in the figure. 
12	Crank balancer driven gear B	1	
13	Crank balancer driven gear A	1	

**CRANKSHAFT INSPECTION**

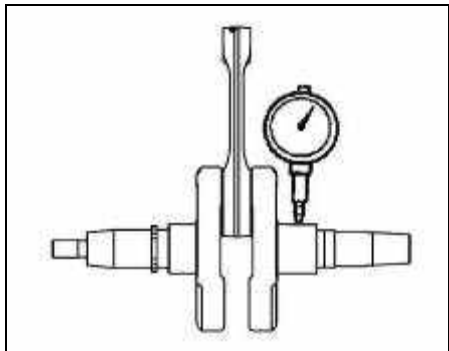
1. Measure:


- Crankshaft runout

Out of specification → Replace crankshaft and/or bearing.

**NOTE:**

Measure the crankshaft runout with the crankshaft assembly running slowly.

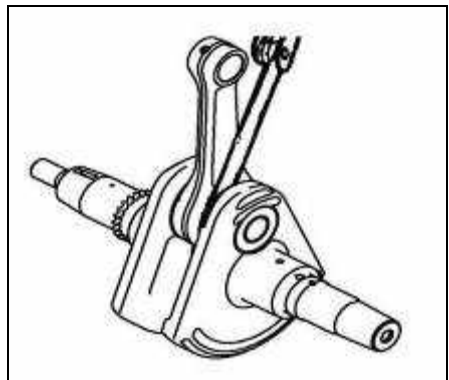



	<b>Runout limit: 0.03 mm</b>
---	----------------------------------

2. Measure:

- Big end side clearance

Out of specification → Replace big end bearing, crank pin and/or connecting rod.



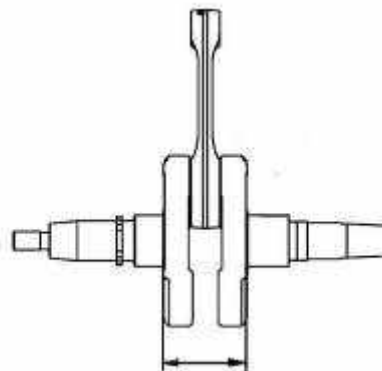
	<b>Big end side clearance: 0.35-0.80 mm</b>
---	---

3. Measure:

- Crank width

Out of specification → Replace crankshaft.

	<p><b>Crank width:</b> <b>73.95-74.05 mm</b></p>
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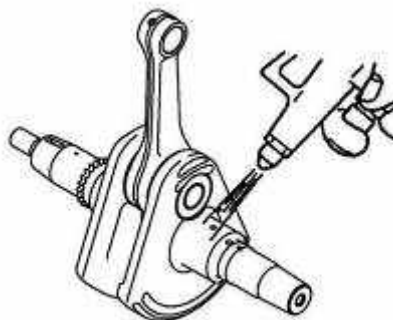
4. Inspect:

- Crankshaft sprocket

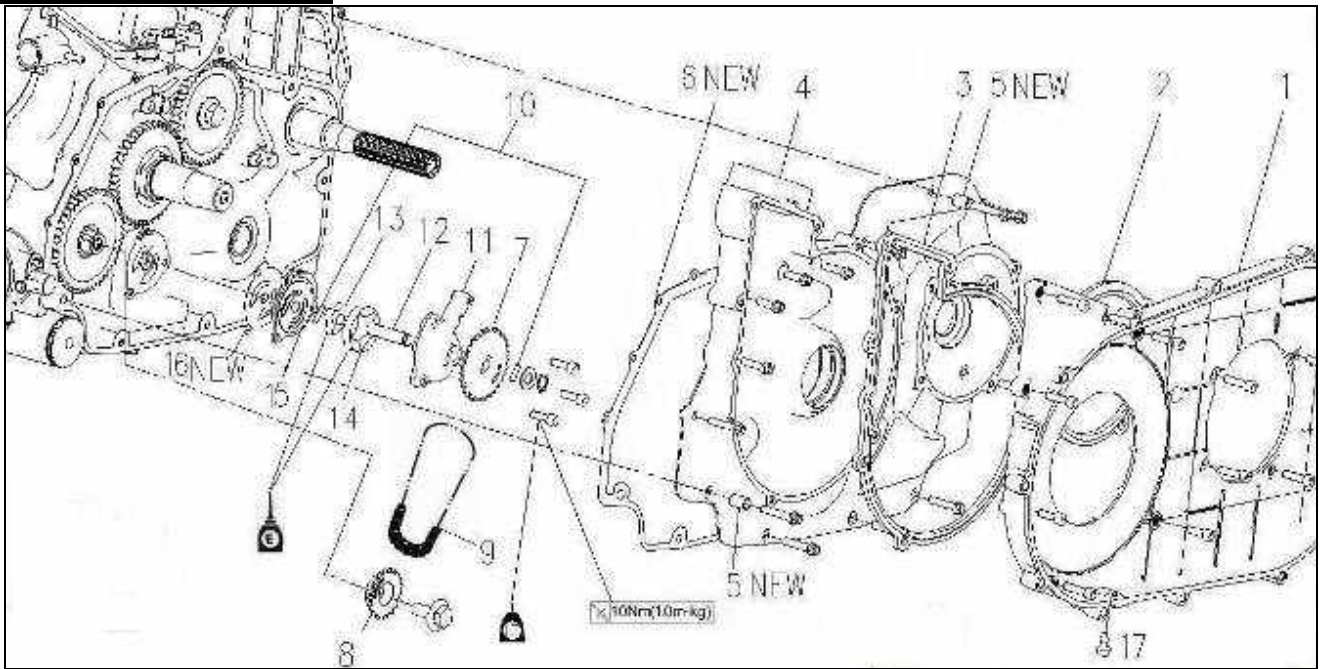
Wear/ Damage → Replace crankshaft.

- Crankshaft journal

Clogged → Blow out the journal with compressed air.



10.11.12 OIL PUMP



Order	Job name/ Part name	Q'ty	Remarks
	<b>Oil pump removal</b> Drain the engine oil.		Remove the parts in the order. Refer to "ENGINE OIL REPLACEMENT" section.
	V-belt, clutch, secondary/ primary sheave		Refer to "V BELT, CLUTCH AND SECONDARY/ PRIMARY SHEAVE" section.
1	Cvt small cover componets	1	
2	Wash B , small cover	1	
3	Wash A , small cover	1	
4	Left cover	1	
5	Dowel pins	1	
6	Gasket , left cover	1	
7	Oil pump driven gear	1	
8	Oil pump drive gear	1	
9	chain	1	
10	Cylindrical pin 4 X 16	2	
11	Pump housing	1	
12	Oil pump shaft	1	
13	Inner rotor	1	
14	Outer rotor	1	
15	Pump housing cover	1	
16	Gasket , oil pump	1	
17	Drain plug	1	
			Reverse the removal procedure for installation.

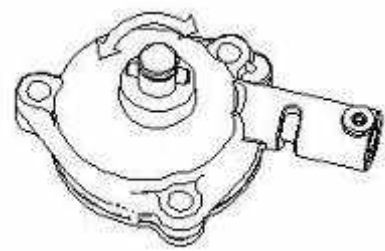
**OIL PUMP INSPECTION**

1. Inspect:

- Oil pump driven gear
- Pump housing
- Pump housing cover
- Oil pump drive gear

Wear /cracks/ damage → Replace.

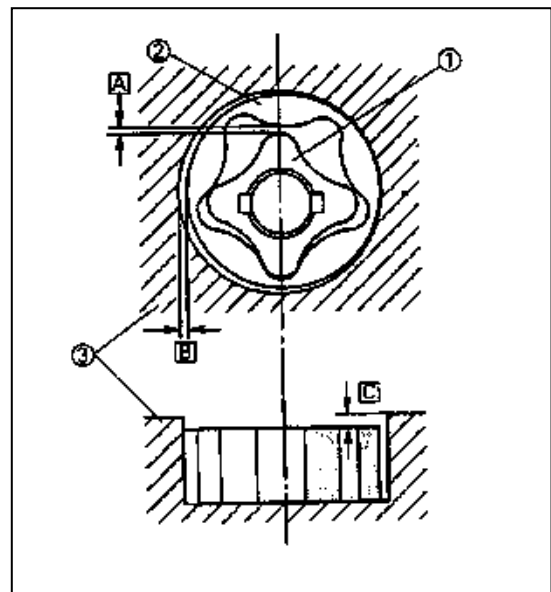
Rotate the oil pump by hand and check that it moves smoothly. If it does not move smoothly, Replace the oil pump assembly.



2. Measure:

- Tip clearance  
(between the inner rotor ① and the outer rotor ②)
- Side clearance  
(between the outer rotor ② and the pump housing ③)
- Housing and rotor clearance  
(between the pump housing ③ and the rotors ① ②)

Out of specification → Replace the oil pump assembly.



	<p><b>Tip clearance</b> □,A:  <b>0.10-0.34 mm &lt;Limit: 0.40mm&gt;</b></p>
	<p><b>Side clearance</b> □,B:  <b>0.1- 0.14mm &lt;Limit:0.20mm&gt;</b></p>
	<p><b>Housing and rotor clearance</b> □,C:  <b>0.04-0.10 mm &lt;Limit: 0.15mm&gt;</b></p>

**OIL PUMP INSTALLATION**

1. Install:



● Oil pump

Install the oil pump in the reverse of removal. pay attention to the following points.

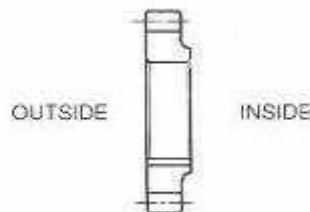
- 1) Apply Loctite 243(Blue) to the oil pump bolts
- 2) Install the new snap ring

2. Install

● Oil pump drive gear and chain

**NOTE:**

- 1) Install the oil pump drive gear with chain.
- 2) The flange side of the oil pump drive gear inside.

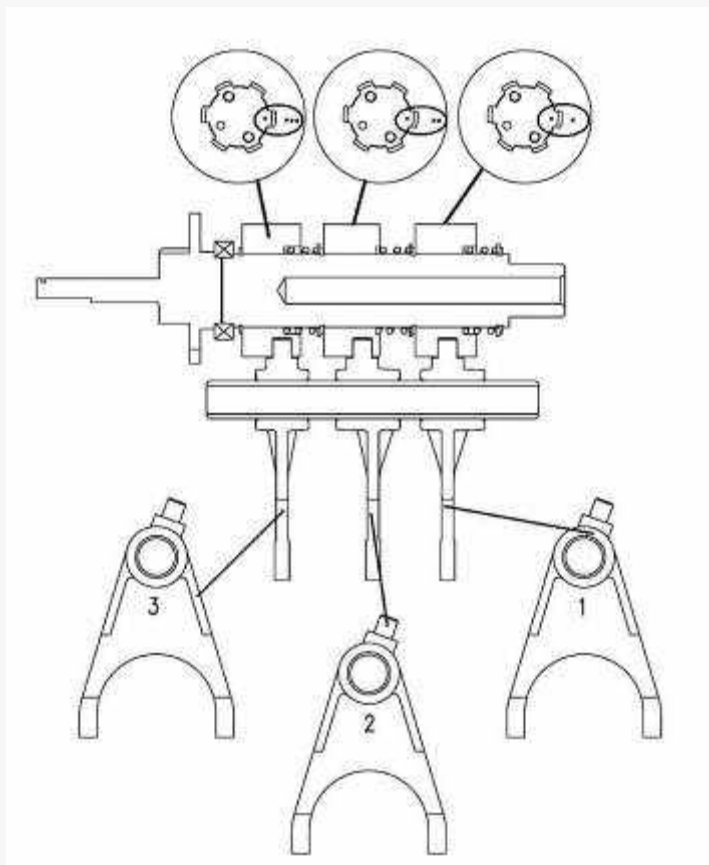
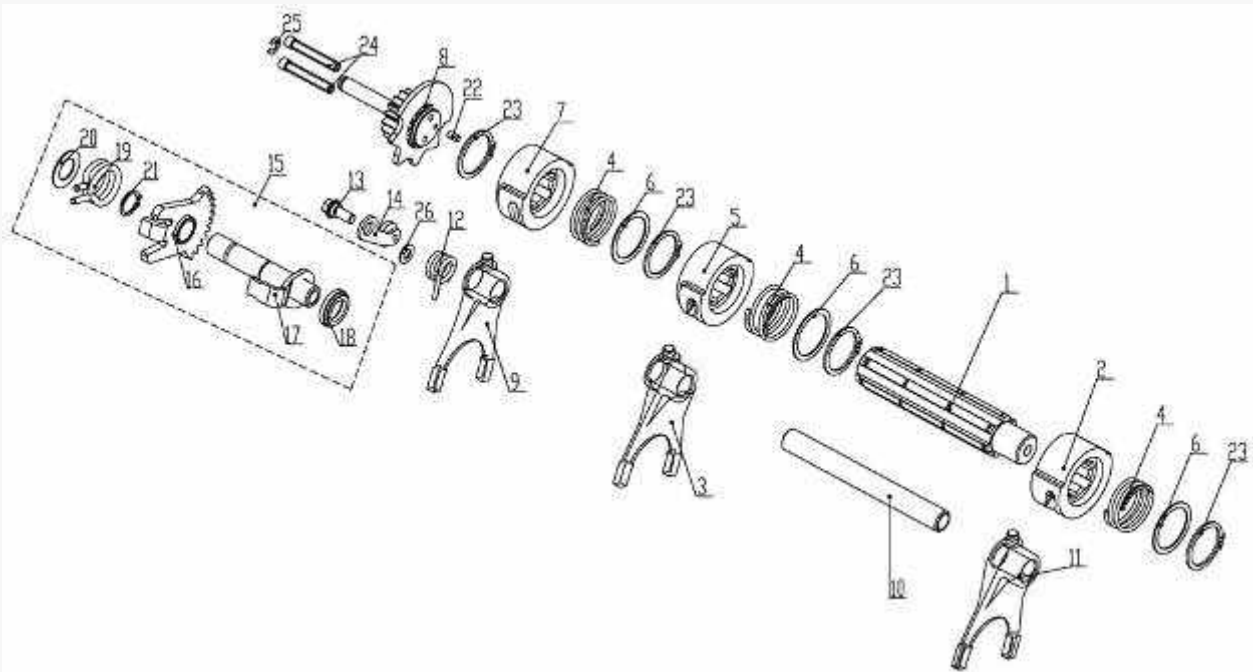


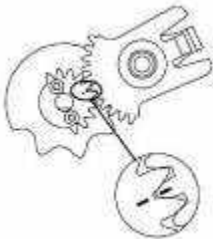
3)Apply Loctite 243(Blue) to the oil pump drive gear bolt.

4) Hold the crank balancer driven gear and tighten the oil pump drive gear bolts to 60N.m.

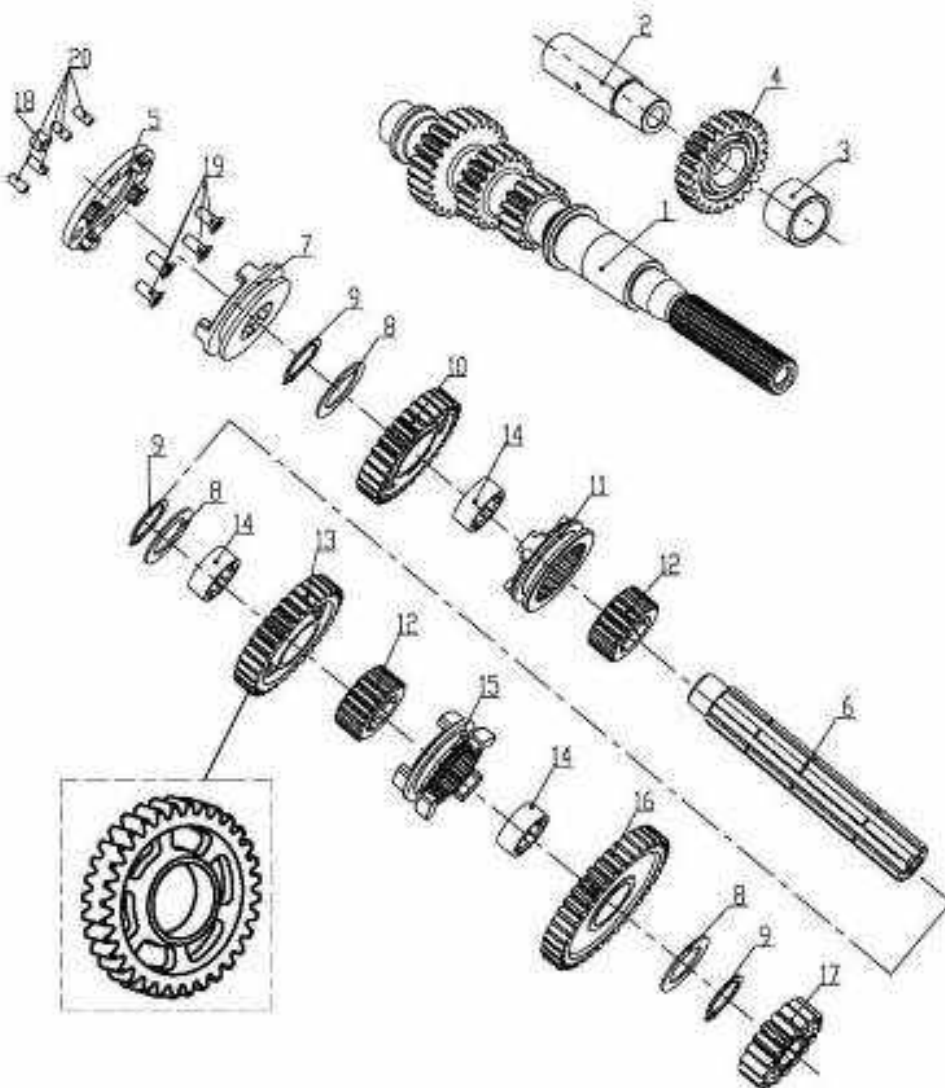
Refer to " CRANKCASE AND CRANKSHAFT " section

**10.11.13 SHIFT SYSTEM**

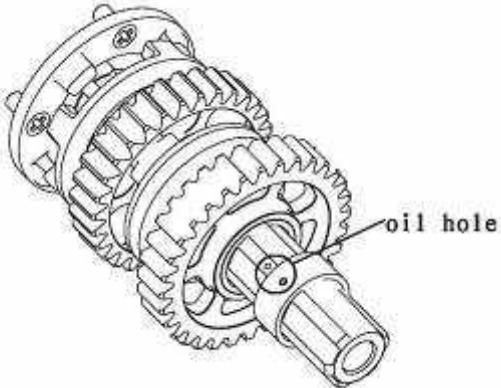


Order	Job name/ Part name	Q'ty	Remarks
1	Shift drum shaft	1	Align the punch mark as shown in the figure
2	Low speed-reverse shift drum	1	Align the punch mark as shown in the figure
3	High Gearshift Fork	1	
4	Shift compression spring	3	
5	High gearshift drum	1	Align the punch mark as shown in the figure
6	Washer 28.2	3	
7	Parking stalls shift drum	1	Align the punch mark as shown in the figure
8	Gearshift cam stopper plate	1	
9	In the car stalls plectrum	1	
10	Gearshift fork shaft	1	
11	Low/reverse gearshift fork	1	
12	Return spring	1	
13	Gearshift cam stopper bolt	1	
14	Gearshift cam stopper	1	
15	Shift shaft assy.	1	
16	Shift gear assy.	1	Align the punch mark as shown in the figure ( order 8 and order 16 ) 
17	Gearshift shaft	1	
18	Sleeve	1	
19	Gearshift return spring	1	
20	Washer 14	1	
21	Ring 14	1	
22	B-type cylindrical pin	1	
23	Ring 28	4	
24	Socket head cap screws M4X35	2	
25	Open retaining ring 6	1	
26	Washer 6	1	

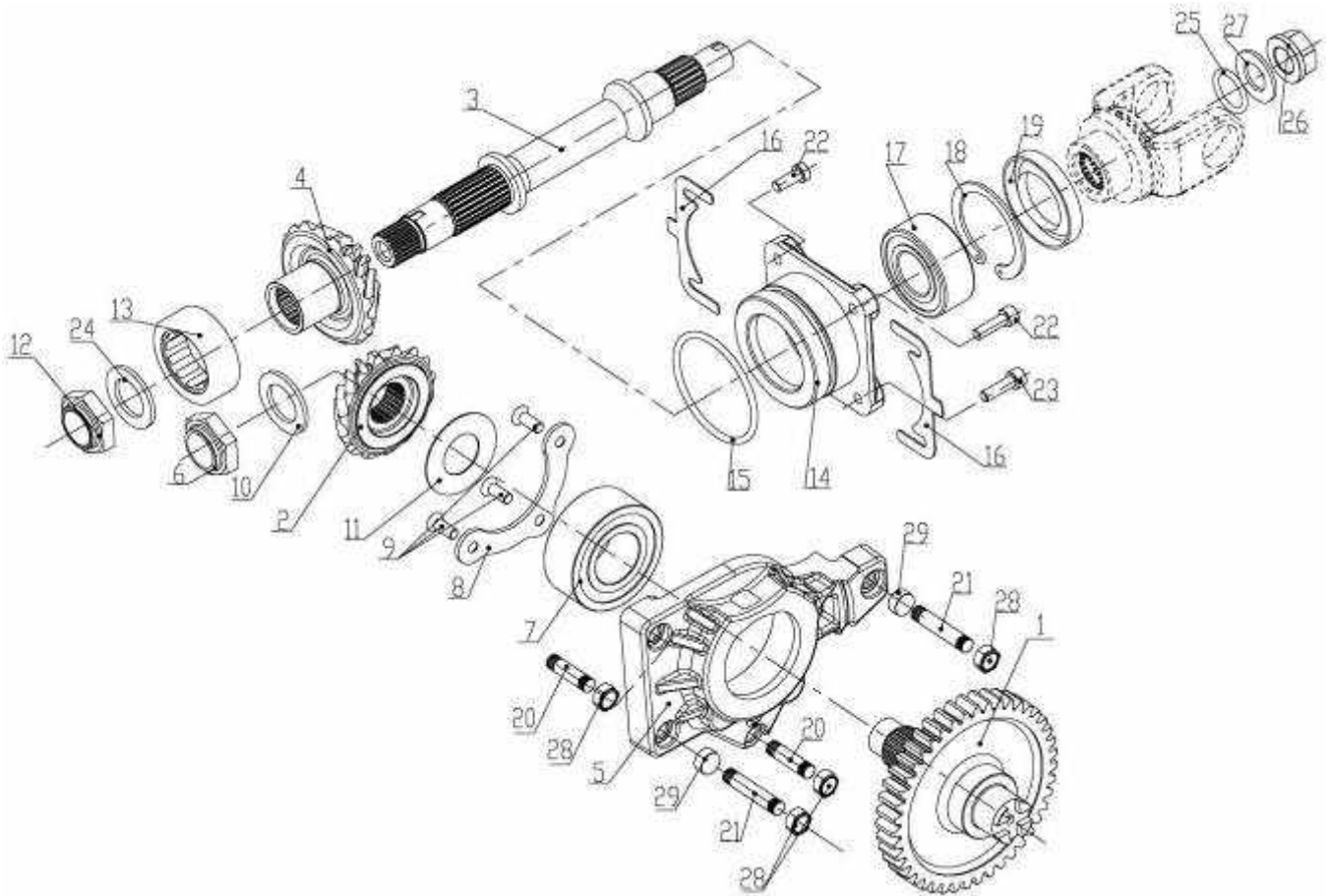
**10.11.14 TRANSMISSION SYSTEM**





Order	Job name/ Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Reverse idle gear shaft	1	
3	Reverse sleeve	1	
4	Reverse idle gear	1	
5	Parking brake disc	1	
6	Counter shaft	1	
7	Parking switch plate	1	
8	Washer 25.2	3	
9	Ring 25	3	
10	High driven gear	1	
11	High gearshift dog	1	
12	Vice shaft spline housing	2	
13	Reverse driven gear	1	

Order	Job name/ Part name	Q'ty	Remarks
14	Gear bushing	3	<p><b>CAUTION:</b> the surface of gear bushing must be applied oil before installing.                      When installing the gear bushing onto the counter shaft( order 6 ), align the shaft oil hole with the bushing oil hole as shown in the figure.</p> 
15	Low-reverse gearshift dog	1	
16	Low driven gear	1	
17	Intermediate gear 1	1	
18	Counter shaft plug	1	
19	Slotted head screws M5x14	4	Apply Loctite 243(Blue) to screw threads and torque screws to 5N.m
20	Cylindrical pin 5x12	4	

**10.11.15 REAR OUTPUT SHAFT ASSY.**



Order	Job name/ Part name	Q'ty	Remarks
1	Idler wheel 2	1	
2	Drive bevel gear	1	
3	Rear output shaft	1	
4	Driven bevel gear	1	
5	Bearing braket	1	
6	locking nut M20x1.5	1	<p>Tightening torque:100N.m Lock the drive bevel gear nut with a center punch.</p>  <p><b>CAUTION:</b> the removed drive bevel gear nut must be replaced with a new one.</p>

Order	Job name/ Part name	Q'ty	Remarks
7	Bearing 5206	1	
8	Bearing plate	1	
9	Phillips head screws M6x14	3	Apply Loctite 243(Blue) to screw threads and torque screws to 5N.m
10	Washer 1	1	
11	Shim 2 ( optional)	1	
12	Locking nut M22x1.5	1	<p>Tightening torque:100N.m Lock the driven bevel gear nut with a center punch.</p>  <p><b>CAUTION:</b> the removed drive bevel gear nut must be replaced with a new one.</p>
13	Needle bearing 32NQ5419	1	
14	Bearing braket, rear output shaft	1	
15	O-ring 59.6x3.5	1	Apply grease
16	Shim ( optional)	2	
17	Bearing 5205	1	
18	Washer 52	1	
19	Seal 35x54x8	1	Apply grease
20	Stud bolts M8x38	2	Apply Loctite243(Blue) to screw threads and torque screws to 13N.m
21	Stud bolts M8x45	2	Apply Loctite243(Blue) to screw threads and torque screws to 13N.m
22	Socket head screw M6x20	3	Tightening torque:10N.m
23	Socket head screw M6x16	1	Tightening torque:10N.m
24	Washer 22	1	
25	O-ring 20x3	1	Apply grease
26	Nut M16x1.5	1	Tightening torque:100N.m
27	Washer 16.5	1	
28	Nut M8	4	Tightening torque:32N.m
29	Pin dowel 12x14	2	

10.11.15.1 Rear output shaft drive bevel gear shim inspection and adjustment

Feel the backlash by turning the drive bevel gear shaft in each direction, If the backlash is not within specification, the shim must be changed and backlash should be re-checked until correct.	<b>Rear output shaft bevel gear backlash Standard:0.03-0.15mm</b>	
	<b>backlash</b>	<b>Shim (order 16) adjustment</b>
	Under 0.03mm	Increase shim thickness
	0.03-0.15mm	correct
	Over 0.15mm	Decrease thickness

**Note:** Adjust the backlash by referring to the table at the using the thickness of the removed shims as a guide.

10.9.15.2 Check the tooth contact

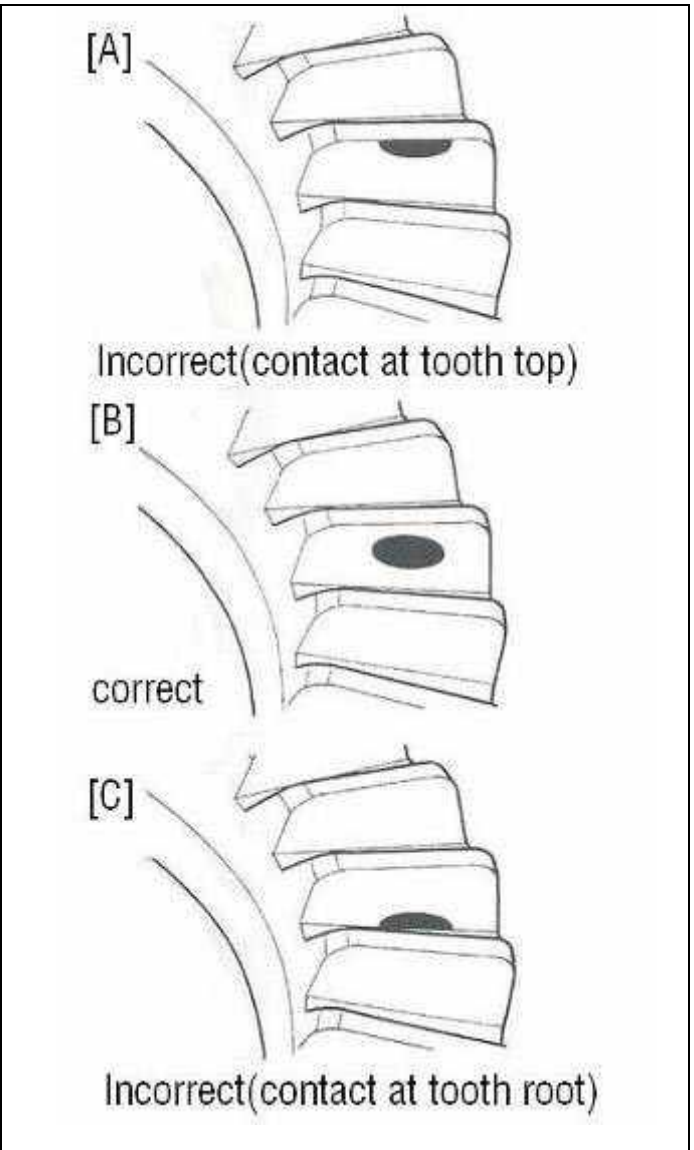
**CAUTION:** Make sure to check the backlash after the tooth contact has been adjusted, since it may have changed. Adjust the tooth contact and backlash until they are both within specification. If the correct tooth contact cannot be maintained when adjusting the backlash, replace the rear output shaft drive and driven bevel gears.

Clean and degrease several teeth of the drive and driven bevel gears, and then apply a coating of machinist's layout dye or paste to several teeth of the rear output shaft driven bevel gear.

Rotate the rear output shaft driven bevel gear several turns in both directions.

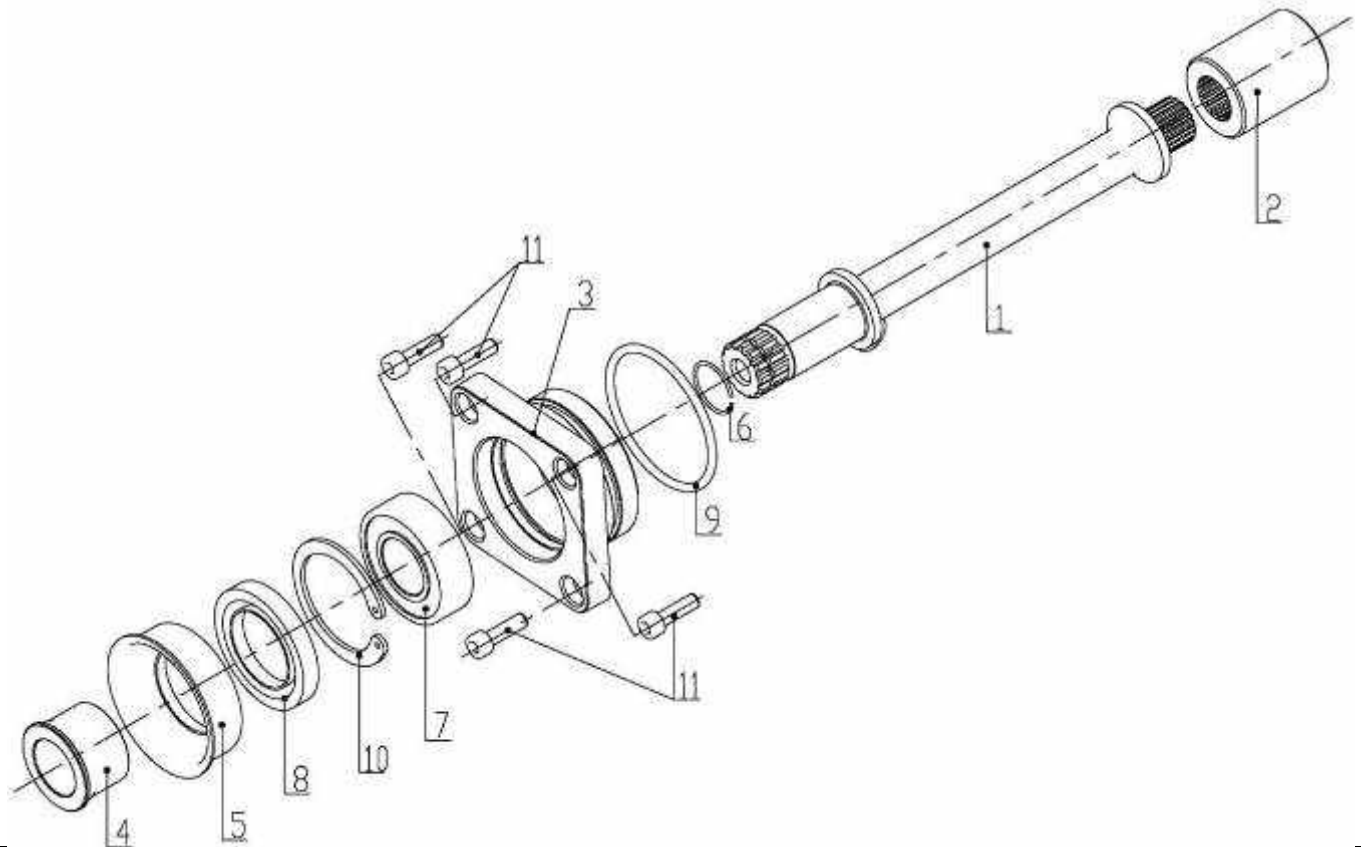
Remove the Bearing braket and inspect the coated teeth of the rear output shaft bevel gear. The tooth contact pattern should be as shown in [A],[B] and [C]. if tooth contact is found to be incorrect (example [A] and [C]), the shim thickness between the rear output shaft drive bevel gear and bearing must be changed and the tooth contact re-checked until correct (example [B]).

<b>tooth contact</b>	<b>shim (order 11) adjustment</b>
Contact at tooth top [A]	Increase shim thickness
Contact at tooth top [C]	Decrease shim thickness





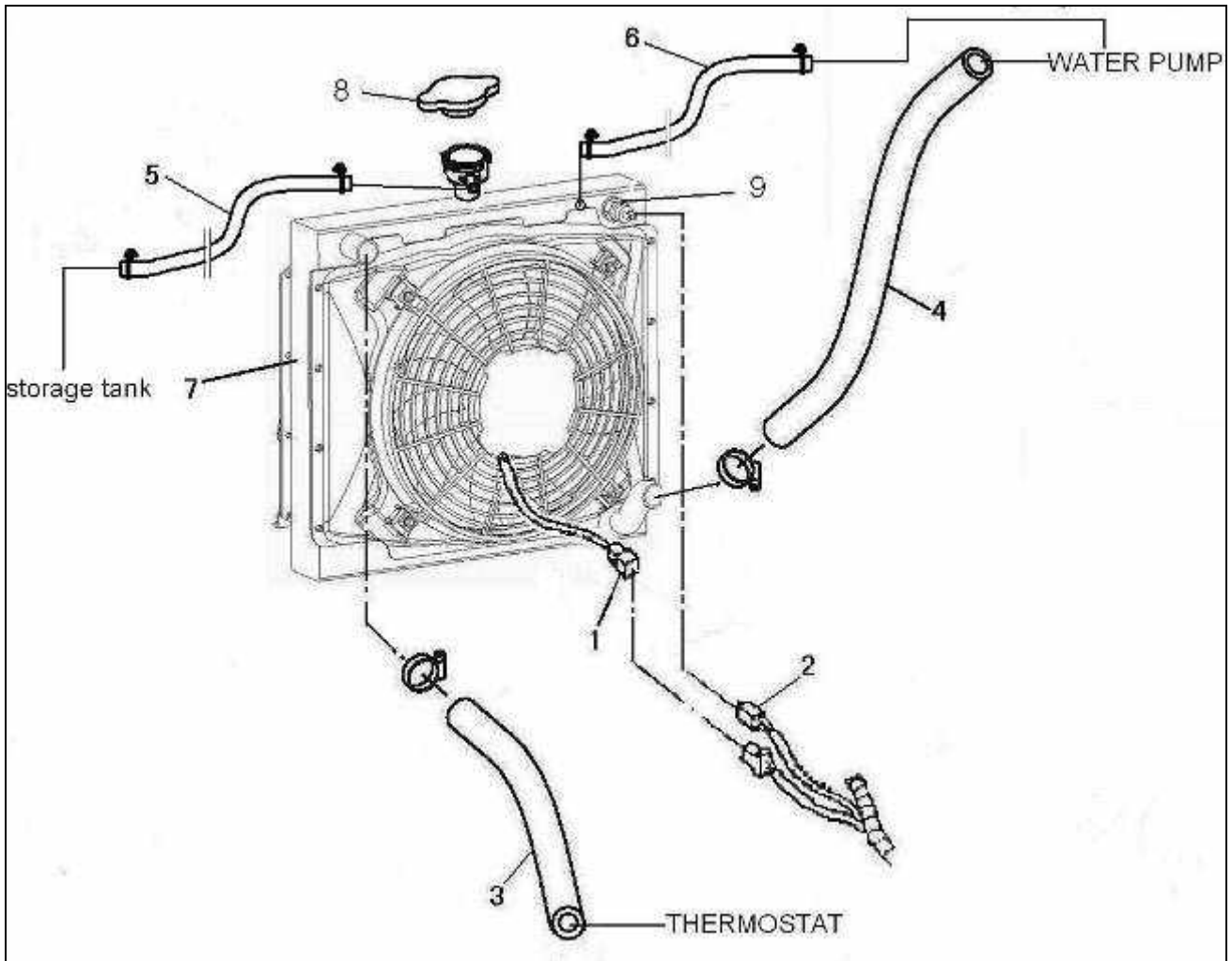
**10.11.16FRONT OUTPUT SHAFT ASSY.**



Order	Job name/ Part name	Qty	Remarks
	Front drive assembly removal		Remove the parts in order. Socket head screws m6x20(order 11) Bearing seat, front drive shaft(order 3) Wire ring $\Phi 21 \times 1.3$ (order 6) Front drive shaft(order 1) Sleeve, front drive shaft(order 4)
1	Front drive shaft	1	
2	Spline sets	1	
3	Bearing braket, front drive shaft	1	
4	Sleeve, front drive shaft	1	
5	Sheath holder	1	
6	Wire ring $\Phi 21 \times 1.3$	1	
7	Bearing 6205	1	
8	Seal 35x54x8	1	Apply grease
9	O-ring 59.6x3.5	1	Apply grease
10	Ring 52	1	
11	Socket head screws m6x20	4	Torque screws to 10N.m

**10.11.17 COOLING SYSTEM**

**10.11.17.1 RADIATOR**



Order	Job name/ Part name	Q'ty	Remarks
	<b>Radiator removal</b> Drain the coolant.		Remove the parts in order. Refer to "COOLANT REPLACEMENT" section.
1	Fan motor leads	1	
2	Cool fan thermo-switch leads	1	
3	Inlet hose , radiator	1	
4	Outlet hose , radiator	1	
5	Pipe , storage tank	1	
6	Pipe , water pump	1	
7	Radiator	1	
8	Safety valve	1	
9	Cool fan thermo-switch	1	Apply silica gel and a new O-ring when installing. Reverse the removal procedure for installation.

**INSPECTION**

1. Inspect:

- Radiator ①

Obstruction → Blow out with compressed air through the rear of the radiator.

Flattened fins → Repair or replace.

If flattened over the 20% of radiator fin, repair or replace the radiator.

**CAUTION:**

Use only specified adhesive to repair the radiator.

- Cooling fan ②

- 1) Disconnect the cooling fan motor coupler
- 2) Test the cooling fan motor for load current with an ammeter connected as show in the figure. If the fan motor does not turn, replace the cooling fan assembly with a new one.

**NOTE:**

- 1) When making this test, it is not necessary to remove the cooling fan.
- 2) The voltmeter is for making sure that the battery applies 12 V to the motor. With the fan motor with electric motor fan running at full speed, the ammeter should be indicating not more than 8 A.

Refer to "COOLING SYSTEM".


2. Inspect:

- Water tank feed hose
- Water tank outlet hose

Cracks/damage → Replace.

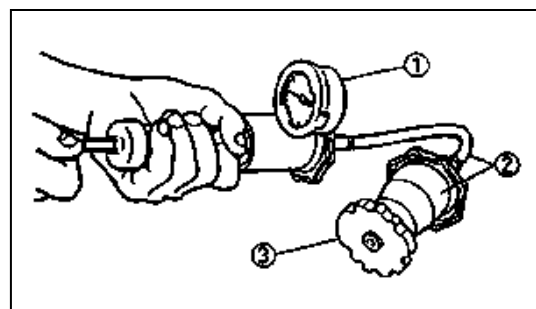
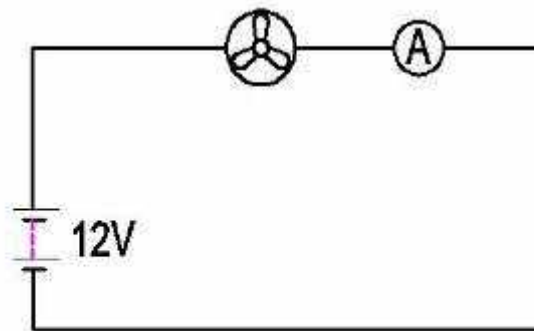
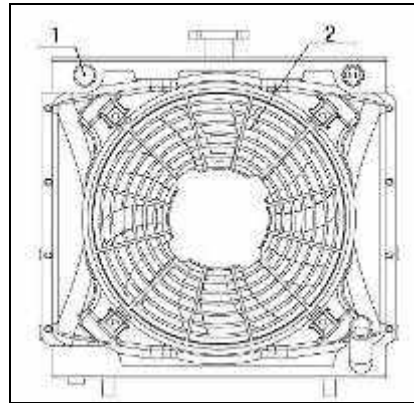
3. Measure:

- Safety valve opening pressure
- Safety valve opens at a pressure below the specified pressure → Replace.

	<p><b>Safety valve opening pressure:</b>  <b>110-140kPa</b>  <b>(1.1-1.4kg/cm<sup>2</sup> , 1.1-1.4 bar)</b></p>
---	--

Measurement steps:

- Attach the safety valve tester ① and adapter ② to the safety valve ③.



●Apply the specified pressure for 10 seconds, and make sure there is no pressure drop.

4. Inspect:

●Pipes

Cracks/damage → Replace.

5. Inspect

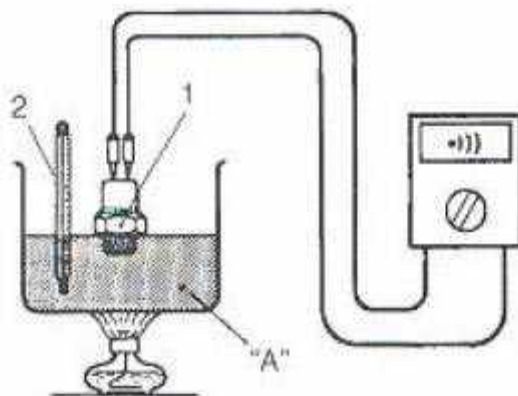
● Cool fan thermo-switch

1) Remove the cooling fan thermo-switch.

2) Check the thermo-switch closing or opening temperatures by testing it at the bench as shown in the figure.

3) Connect the thermo-switch (1) to a circuit tester and place it in the water "A" contained in a pan, which is placed on the stove.

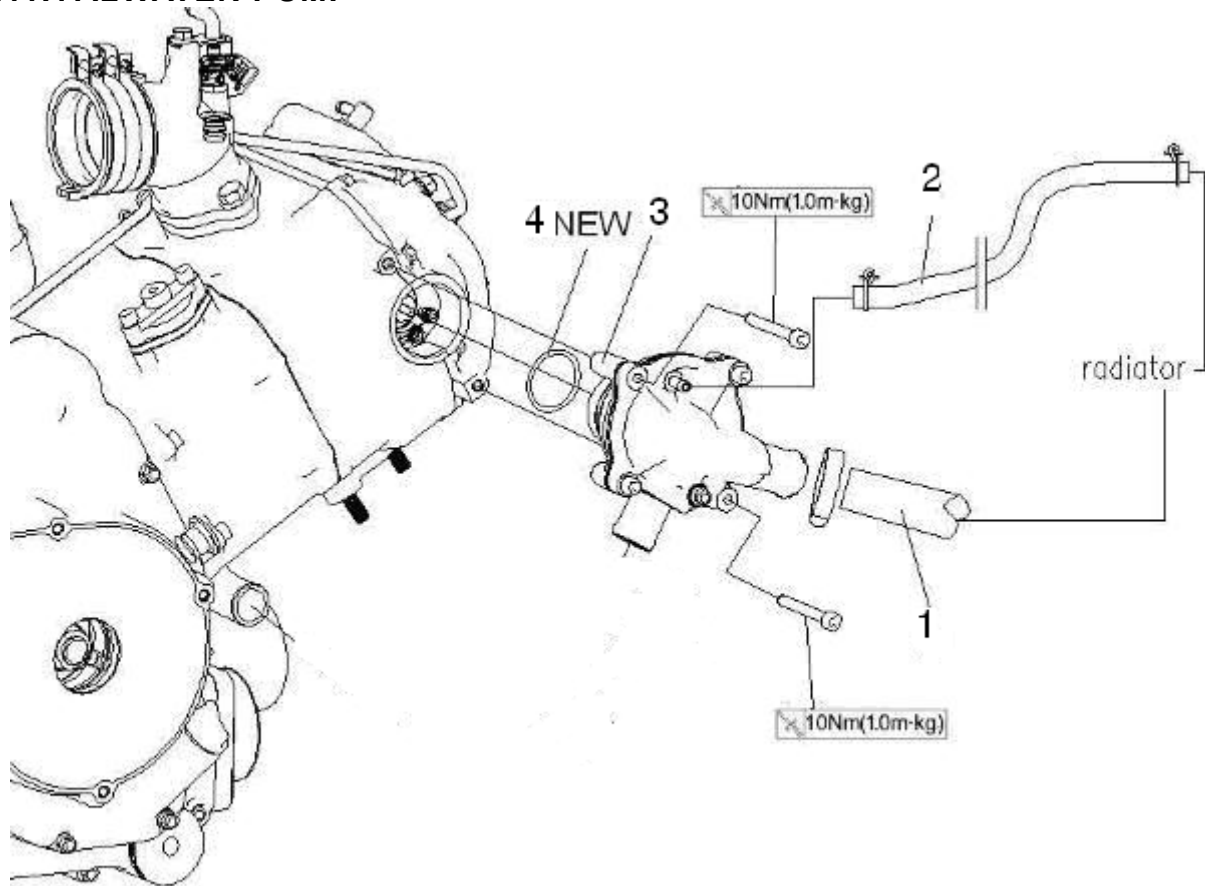
4) Heat the water to raise its temperature slowly and read the column thermometer (2) when the switch closes or opens. If any abnormality is found, replace the cooling fan thermo-switch with a new one.



#### CAUTION

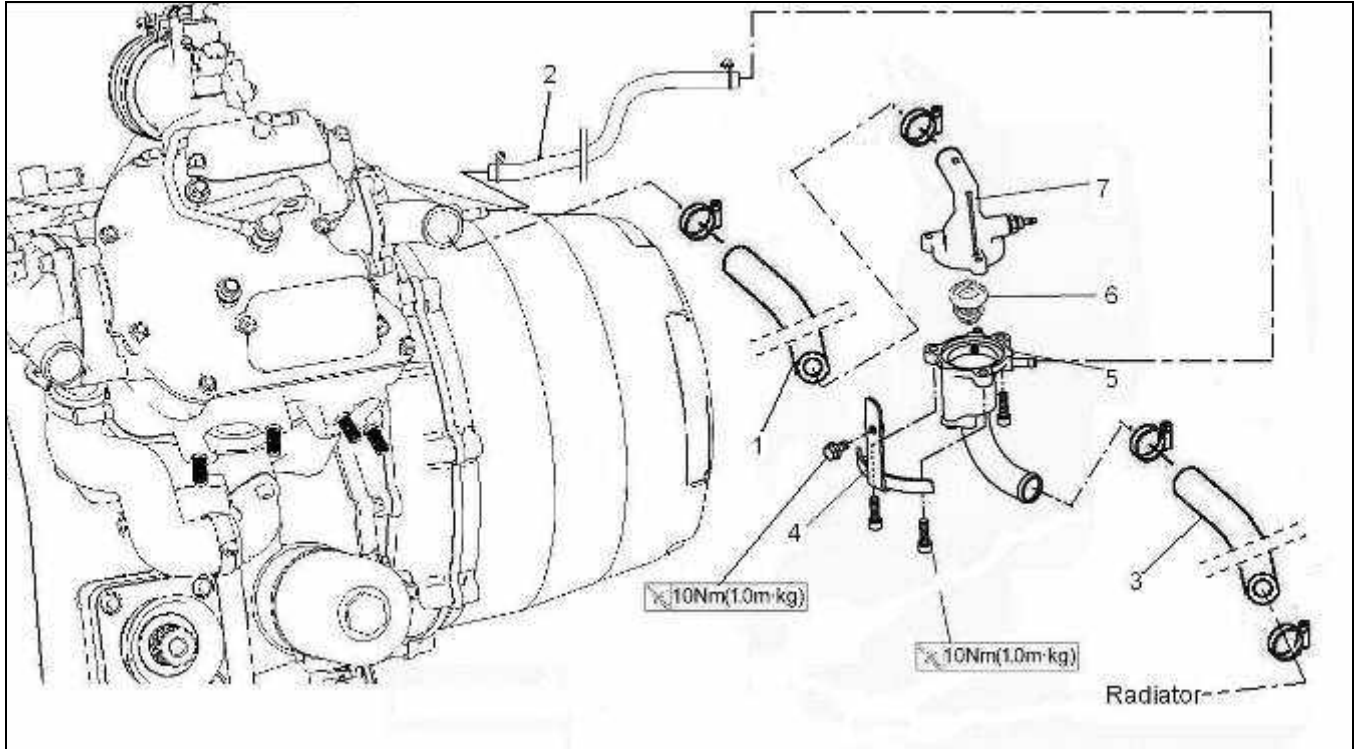
- 1) Take special care when handling the cooling fan thermo-switch. Do not subject it to strong blows or allow it to be dropped.
- 2) Do not contact the cooling fan thermo-switch and the column thermometer(2) with a pan.

10.11.17.2 WATER PUMP



Order	Job name/ Part name	Q'ty	Remarks
	Water pump removal Drain the coolant.		Remove the parts in order. Refer to "COOLANT REPLACEMENT" section.
1	Hose , water pump	1	
2	Ventilation tube radiator		
3	Water pump	1	
4	O-ring 36X3.2	1	
			Reverse the removal procedure for installation.

10.11.17.3 THERMOSTAT



Order	Job name/ Part name	Q'ty	Remarks
	<b>Thermostat removal</b> Drain the coolant		Remove the parts in order. Refer to "COOLANT REPLACEMENT" section.
1	Outlet hose , Cylinder head	1	
2	Minor cycle conduit	1	
3	Inlet hose , radiator	1	
4	Thermostatic holder	1	
5	Thermostatic cover	1	
6	Thermostatic valve	1	
7	Thermostatic shell	1	
			Reverse the removal procedure for installation.

**INSTALLATION**

1. Inspect:

- Thermostatic valve

Valve does not open at 63-67°C → Replace.

**Inspection steps:**

- Suspend the thermostatic valve in a vessel.
- Place a reliable thermometer in water.
- Observe the thermometer, while continually stirring the water.

- ① Thermostatic valve
- ② Vessel
- ③ Thermometer
- ④ Water

- A** CLOSE
- B** OPEN

**NOTE:**

The thermostatic valve is sealed and its setting requires specialized work. If its accuracy is in doubt, replace. A faulty unit could cause serious over-heating or over cooling.

2. Inspect:

- Thermostatic cover

Cracks /damage → Replace.

3. Inspect

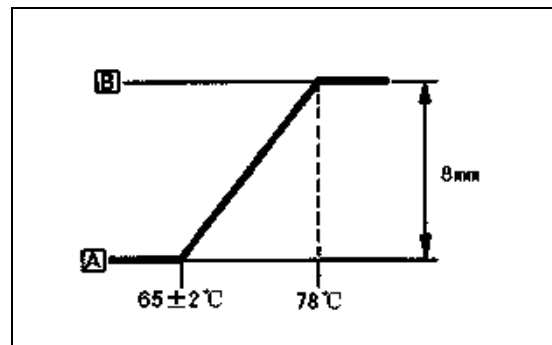
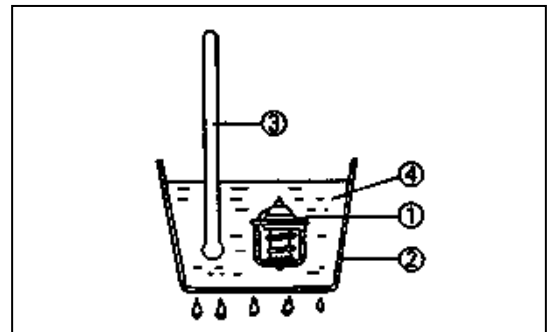
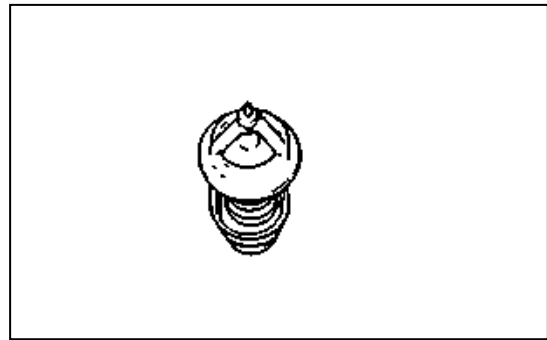
- Outlet hose , Cylinder head
- Minor cycle conduit
- Inlet hose , radiator

Cracks /damage → Replace

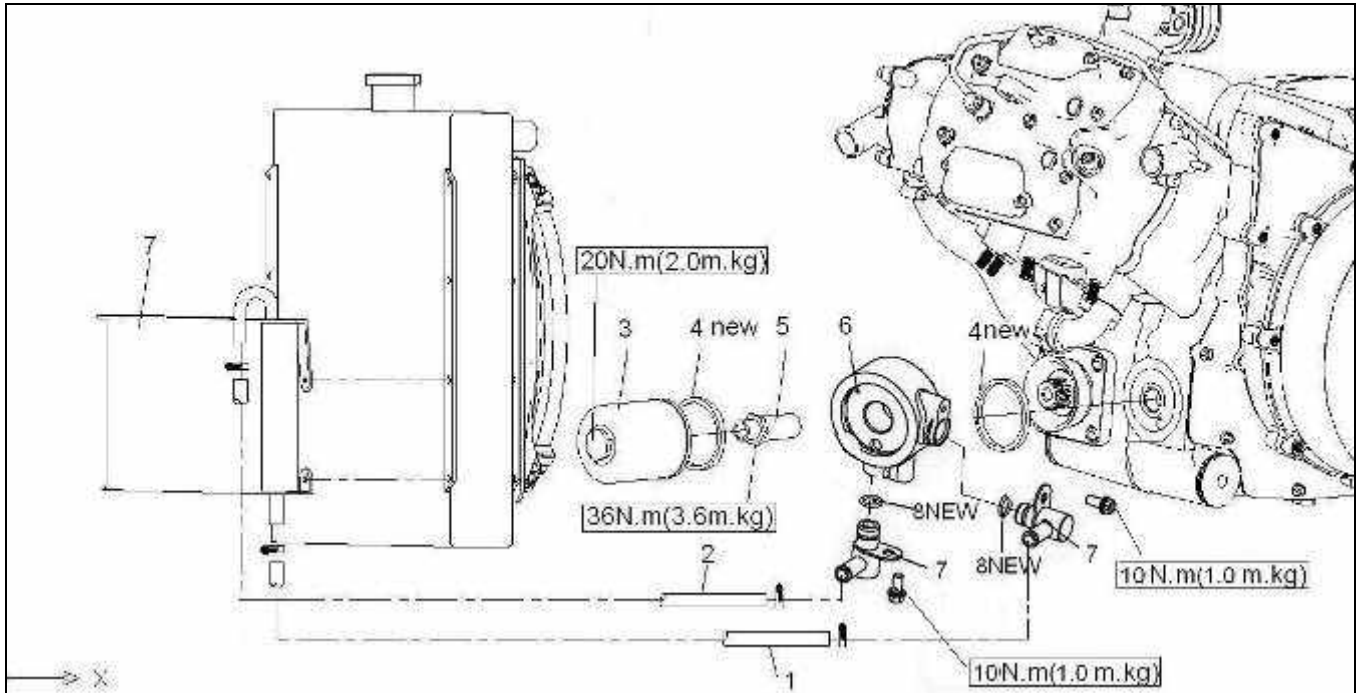
**INSTALLATION**

1. Install:

- Thermostatic valve
- Thermostatic cover



10.11.17.4 OIL COOLING PARTS



Order	Job name/ Part name	Q'ty	Remarks
	<b>Oil cooling parts removal</b> Drain the engine oil		Remove the parts in order. Refer to " ENGINE OIL LEVEL INSPECTION " section.
1	Oil cooling hose A	1	
2	Oil cooling hose B	1	
3	Oil filter	1	
4	O-ring	2	
5	Oil filter mount	1	
6	Oil-cooling connector	1	
7	Connecting tube assembly , oil cooling	2	
8	O-ring ,11.2X1.8	2	
			Reverse the removal procedure for installation.



### INSPECTION

1. Inspect:

- Oil filter

Cracks/damage/oil spilling → Replace

#### NOTE:

Replace oil filter and engine oil initially at 200Km (1month) and every 2000Km (6month) thereafter. Oil filter replacement at the above intervals, should be done together with the engine oil change.

Engine oil change refer to " ENGINE OIL LEVEL INSPECTION " section.

2. Inspect:

- Oil cooling hose A
- Oil cooling hose B

Cracks/damage → Replace.

### INSTALLATION

Reverse the removal procedure for installation.

#### CAUTION:

**The oil cooling hoses and the oil cooling connector must be keeping away from the muffler when installing.**

**10.11.18 FUEL INJECTION SYSTEM**

## 10.11.18.1 ECU

10.11.18.1 .1 Description &amp; Working Principle

10.11.18.1 .2 Appearance

10.11.18.1 .3 Handling – DOs &amp; DONTs

10.11.18.1 .4 Installation requirements

10.11.18.1 .5 Power Requirements

10.11.18.1 .6 Temperature Requirements

10.11.18.1 .7 Maintenance service and Repair

## 10.11.18.2 INJECTOR

10.11.18.2.1 Appearance

10.11.18.2.2 Sealrings

10.11.18.2.3 Sealrings replacement

10.11.18.2.4 Lubricant Recommendation

10.11.18.2.5 Over -Voltage

10.11.18.2.6 Temperature Requirements :

10.11.18.2.7 Fuel Contamination

10.11.18.2.8 Wire Routing

10.11.18.2.9 Handling - DOs &amp; DONTs

10.11.18.2.10 Installation guide lines

10.11.18.2.11 Replacement Techniques

10.11.18.2.12 Interchange ability

10.11.18.2.13 Plugging

10.11.18.2.14 Cleaning Procedure

## 10.11.18.3 Throttle Body Assembly (with stepper motor )

10.11.18.3.1 Description and Working Principle

10.11.18.3.2 Appearance

10.11.18.3.3 Technical Parameters

10.11.18.3.4 Operating Conditions

10.11.18.3.5 Throttle Body Removal

10.11.18.3.6 Cleaning Procedure

10.11.18.3.7 Throttle Body Installation

10.11.18.3.8 Precautions

10.11.18.3.9 Handling - DOs &amp; DONTs

## 10.11.18.4 Engine Coolant Temperature Sensor

10.11.18.4.1 Description and Working Principle

10.11.18.4.2 Appearance

10.11.18.4.3 Installation Requirements

10.11.18.4.4 Operating Environment

10.11.18.4.5 Storage Environment

10.11.18.4.6 Sample Cleaning

## 10.11.18.5 Intake Air Pressure and Temperature Sensor(MAP&amp;MAT)

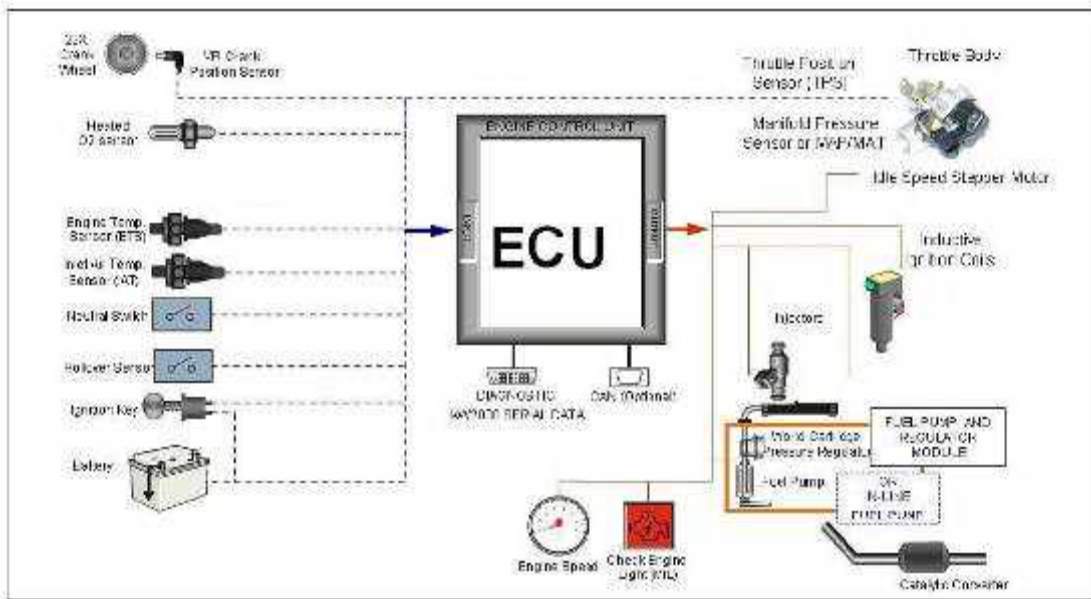
10.11.18.5.1 Description and Working Principle

10.11.18.5.2 Appearance

10.11.18.5.3 Operating Environment

- 10.11.18.5.4 Storage Environment
- 10.11.18.5.5 Electrical Environment
- 10.11.18.5.6 Sample Cleaning
- 10.11.18.6 Oxygen Sensor
  - 10.11.18.6.1 Description and Working Principle
  - 10.11.18.6.2 Appearance
  - 10.11.18.6.3 Technical Parameters
  - 10.11.18.6.4 Fuel Quality Requirements
- 10.11.18.7 Ignition Coil
  - 10.11.18.7.1 Description and Working Principle
  - 10.11.18.7.2 Appearance
  - 10.11.18.7.3 Technical Parameters
  - 10.11.18.7.4 Installation requirements
  - 10.11.18.7.5 DOs and DONTs
- 10.11.18.8 Fuel Pump Module
  - 10.11.18.8.1 Description and Working Principle
  - 10.11.18.8.2 Appearance & Components of Fuel Module
  - 10.11.18.8.3 Dimensions
  - 10.11.18.8.4 Identification and Markings
  - 10.11.18.8.5 Operating Conditions
  - 10.11.18.8.6 Service Procedure
  - 10.11.18.8.7 Fuel Module Diagnosis:
  - 10.11.18.8.8 Fuel Module Removal:
  - 10.11.18.8.9 Fuel Module Installation:
  - 10.11.18.8.10 Pressure Regulator Assembly Replacement:
  - 10.11.18.8.11 Fuel Pressure Relief Procedure:
  - 10.11.18.8.12 Fuel Leakage Check Procedure:
  - 10.11.18.8.13 Handling – DOs and DONTs :
- 10.11.18.9 Diagnostic Tools
  - 10.11.18.9.1 Motor Scanner ( for MT05 EMS)
    - 10.11.18.9.1.1 Precautions
    - 10.11.18.9.1.4 . Functions

Below shows the layout of typical EMS for engine. The solid lines in the figure 1 below indicate the output signals from the Engine Controller and the dotted lines indicate the input signals to the controller from various sensors and switches.



10.11.18.1 ECU

10.11.18.1 .1 Description & Working Principle

The ECU continuously monitors the operating conditions of the engine through the system sensors. It also provides the necessary computation, adaptability, and output control in order to minimize the tailpipe emissions and fuel consumption, while optimizing vehicle drivability for all operating conditions. The ECU also provides diagnosis when system malfunctions occur.

10.11.18.1 .2 Appearance

The MT05 ECU has a polyester header, with an aluminum base plate. below shows the top and bottom view of the MT05 ECU.



10.11.18.1 .3 Handling – DOs & DONTs

ACTION	REASON
<b>DO NOT:</b> Place the ECU close to the exhaust pipe or Engine when removed	High temperature might reduce the life of the ECU and also can damage the ECU
<b>DO NOT:</b> Place the ECU close to or pour water, oil or any other liquids.	ECU is susceptible to water and liquids

<b>DO NOT:</b> Allow mud or other debris to accumulate on the surface of the ECU	Having mud or debris accumulated on the ECU casing reduces its heat dissipation efficiency.
<b>DO NOT:</b> Apply any voltage relative to any point to the ECU	Drastically affects the performance of the ECU and may lead to ECU damage
<b>DO NOT:</b> Clean ECU with any solvent or any corrosive liquid	Can damage the housing of the ECU
<b>DO:</b> Take extreme care that water droplets or excess moisture should not fall on ECU connectors	ECU connectors can get short and may lead to ECU damage
<b>DO:</b> Clean the ECU with a moist cloth and keep it dry	Prevents ECU damage

**10.11.18.1 .4 Installation requirements**

The ECU shall be mounted using M5 machined screws with a torque of 3.9Nm ±10%. The mounting surface should also be flat to avoid subjecting the base plate to unnecessary force and warping the PCB.

**10.11.18.1 .5 Power Requirements**

**Power Supply:** The controller’s power supply module will power up the microprocessor if the battery voltage is greater than 6.3 Volts. The power on is controlled by the controller hardware only.

**Operating Range:** All planned functions are executed in this range. Battery and/or Ignition voltage: 9.0 to 16V DC

**Power Off:** The controller will turn its power off when the ignition voltage: < 6.2 V DC. The controller prepares for entry into Power Down mode. The preparation involves storing important information into EEPROM.

**Reset:** During reset, all outputs shall be set to a predefined state. The controller shall monitor itself for proper operation and enter reset should any internal errors be detected. The controller shall then restart normal operations after the computer has properly reset

**Over Voltage:** the controller will survive no permanent damage if the ignition voltage do not exceed 26V for more than 1 minute

**Reverse Voltage:** The controller will survive with no permanent damage: Battery and/or Ignition voltage < -13V DC for 1 minute

**10.11.18.1 .6 Temperature Requirements**

**Storage:** The controller shall suffer no damage as a result of being stored at temperatures of -40 °C or +105 °C continuously for 168 hours. If the storage temperature is not as extremely high as +105 °C or as extremely low as -40 °C, the ECU could be stored for longer time without damage.

**Operating:** The controller shall operate in the ambient temperature from -20 °C to +85 °C.

**10.11.18.1 .7 Maintenance service and Repair**

ECU is a non-serviceable part. Once there are problems, it’s important to first determine if the problem is caused by software/calibration. If it is caused by software/calibration, please refer to software/calibration reflashing procedure. In the event of ECU hardware failure or malfunction (during warranty period only) the ECU should be sent back to the vehicle manufacturer giving complete details of the ECU Part No, Serial number, Vehicle Model & Make, manufacturing Date, Total kms run on the vehicle, Location of use, Vehicle No, Date of return.

### 10.11.18.2 INJECTOR

#### 10.11.18.2.1 Appearance

The figure below shows the standard Multec 3 Fuel Injector appearance



#### 10.11.18.2.2 Sealrings

Seal rings for injectors (refer to Figure 12) are made to withstand temperatures ranging from  $-40^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  ( $-40$  to  $302^{\circ}\text{F}$ ) without leakage or seeping. They must also be resistant to varying amounts of fuel additives to fuel (i.e., ethanol, etc.). The following are currently available seal rings designs. Please contact a Delphi representative if the specific sealing requirements are not met by these designs:

##### Injector to fuel rail seal ring

- Dimensions:
- ID. : 6.35 mm
- OD. : 14.85 mm
- Cross-section: 4.25 mm
- Materials
- Viton $\square$  GLT (blue color). For low temperature applications
- Viton $\square$  A (black). All other applications.

##### Injector to manifold

- Dimensions:
- ID: 9.61 mm
- OD: 14.49 mm
- Cross-section: 2.44 mm
- Materials:
- Viton A (black or brown other applications.)

#### 10.11.18.2.3 Sealrings replacement

- Lubricate the seal rings with an approved lubricant or equivalent. The lubricant application process must prevent lubricant from contacting the director plate, which could possibly restrict the injector flow.
- It is preferred to not reuse the seal rings when re-installing an injector. If re-use is necessary, carefully inspect each seal ring for any signs of damage, as even minor defects can lead to fuel / vacuum leakage. Always install injectors and seal rings using the recommended service procedures to avoid the possibility of a safety hazard.
- When installing seal rings to the injector inlet, take extra care not to damage the seal on the injector top flange.

**10.11.18.2.4 Lubricant Recommendation**

Lubrication should be applied to the O-rings only for ease of injector installation. The table 4 is a list of lubricant oils that were tested and approved for O-ring lubrication. These lubricants have shown to have no effect on injector performance (plugging, sticking).

Lubrication Recommendation		Table: 6
Lubricant Name	Supplier	Viscosity (cSt) @ 40 °C
Spindura 10	Equilon	10
Spindura 22	Equilon	21
DTE-24	Mobil	32
DTE-25	Mobil	46
DTE-26	Mobil	68
Norpar 15	Exxon / Mobil	<1
Drawsol 60	DA Stewart	1-2
NocoLube AW 46	NOCO Energy	46
NocoLube AW 32	NOCO Energy	32
Advantage Spindle Oil	Advantage Lubrication Specialties	10

**10.11.18.2.5 Over -Voltage**

The Multec 3 injectors and the Multec 3.5 injectors can withstand a voltage of 26v for a maximum of one minute at a duty cycle of 100 ms pulse width and 200 ms period. The injector will be pressurized with calibration test fluid at normal operating pressure during the test. This will not result in any permanent physical damage to the injector or coil assembly, or any degradation in electrical performance.

**10.11.18.2.6 Temperature Requirements :**

Typical injector temperature environments are defined below. The Multec 3 injectors and the Multec 3.5 injectors will not experience any loss of the ability to comply with the flow tolerance requirements after exposure to the following temperature environments. Also, they will not experience unacceptable external leakage, any type of physical degradation, or loss of service life during or after being exposed to these ambient conditions.

Normal Operating Temperature Range: - 30 to 125°C

Extreme Operating Temperature Range (some performance degradation): - 40 to 150°C

Storage Temperature Range: -60 to 60°C

**10.11.18.2.7 Fuel Contamination**

The injector fuel inlet filter protects the fuel injector from initial build fuel contamination as well as from fuel system assembly contamination. Filtration is extremely important because particle contaminants can cause an injector to stick open, flow shift or tip leak.

The injector inlet filter is not a serviceable component and is designed only to trap potential built-in contamination between the chassis fuel filter and injector.

**10.11.18.2.8 Wire Routing**

Electrical wiring to the injector should be routed so that conductors are protected from excessive heat, damage, and wear.

Avoid unnecessary handling (disconnecting and connecting) of the electrical connector.

**10.11.18.2.9 Handling - DOs & DONTs**

<b>ACTION</b>	<b>REASON</b>
<b>DO NOT:</b> Re-use injector seal rings if at all possible. If no other choice exists, take extra care in inspecting the seal rings for damage.	Leakage.
<b>DO NOT:</b> Dip injector tips into lubricants.	Can plug injector spray orifices.
<b>DO NOT:</b> Cycle injector repeatedly without fuel pressure.	Damage to internal mechanical components.
<b>DO NOT:</b> Pulse (actuate) a suspected high leak rate injector (leak >50 sccm air)	Can dislodge internal contamination if
<b>DO NOT:</b> Allow water to enter fuel system from air lines, etc. during leak checks.	Can damage injectors.
<b>DO NOT:</b> Contact or apply load to the injector tip for installation.	Apply load to 45 deg angle on nylon over mold see
<b>DO NOT:</b> Pound injectors into manifold during assembly to engine.	Can damage injectors or seal rings.
<b>DO NOT:</b> Apply excessive side loads to electrical connectors.	May cause loss of electrical continuity.
<b>DO NOT:</b> Use any dropped unit.	Internal damage may have occurred.
<b>DO NOT:</b> Store injectors, rails, or subassemblies including engines on which the injectors have been installed in an unprotected environment.	External contamination can damage the injector electrically and/or mechanically.
<b>DO NOT:</b> Use the injector as a handle.	Do not use the injector to lift assemblies
<b>DO NOT:</b> Rack, stage, or handle parts in a manner that allows contact between parts.	Damage will occur.
<b>DO NOT:</b> Remove packing in a way that allows contact between parts.	Damage could occur due ton contact between parts
<b>DO NOT:</b> Tap on fuel injectors to correct any malfunction..	Can damage injector.
<b>DO NOT:</b> Replace the injector with other part number not recommended for this application	Will severely affect the performance of the injector
<b>DO:</b> Take extra care when installing new fuel seal ring over injector inlet flange.	Prevent tearing seal ring during installation
<b>DO:</b> Use proper lubricants on seal ring surfaces to install injector in engine. Minimize time between applying lubricant and inserting injector /rail.	Avoid damage to seal ring during installation. Avoid contamination at seal.
<b>DO:</b> Pulse (actuate) stuck closed or tip-leak suspected injector (Actuate consists of one pulse<5 sec duration at 9 to 15V).	To verify the injector failure
<b>DO:</b> Pulse (actuate) injectors prior to a dry fuel system leak test at engine/vehicle assembly to reseal injector valves.	Injector valves may not reseal without fuel after shipping and handling resulting in false leakage.
<b>DO:</b> Avoid any liquid contamination in the injector area.	Coil could short circuit.
<b>DO:</b> Use care during connection of harness to injector.	Avoid terminal damage.
<b>DO:</b> Use recommended terminal lubricant on mating connector.	Minimize potential for terminal fretting corrosion.
<b>DO:</b> Return any dropped, damaged, or suspect material with a tag that describes the problem.	Ensure fast and correct diagnosis of root cause.



### 10.11.18.2.10 Installation guide lines

Follow these guidelines to prevent damage to the injector and its electrical interface during the replacement or re-installation process.

- .. Lubrication: Apply a light coating of lubricant to the lower injector seal ring. ISO 10 light mineral oil or equivalent is recommended.
- .. The preferred technique is to apply the lubricant to the sockets the injectors are being installed into, rather than directly to the seal ring itself. This will help minimize the possibility of injector contamination.
- .. Avoid applying lubricant over the director plate holes – this may restrict injector flow. Do not dip the injector tip in lubricant.
- .. All Multec 3 and Multec 3.5 injectors come from the factory with the seal rings attached. The re-use of seal rings is not preferred when replacing an injector. If an injector is to be re-used, and no new seal rings are available, take care to inspect each seal ring for signs of damage. Even minor defects in the seal ring can lead to leakage. Take extra care in installing seal ring over flange of injector inlet.
- .. Carefully installing the harness connector will prevent terminal damage. Listen for a positive audible click from the connector retention device — this ensures that it is fully engaged.
- .. Avoid unnecessarily disconnecting/reconnecting the harness connector.
- .. Wires routed in a manner that can allow them to become pinched between components can result in a short circuit and a stuck open injector.
- .. For injectors that require orientation for spray pattern, do not rotate the injector in the fuel rail assembly to install the injector electrical connector. This may dislodge the retaining clip, and result in improper spray orientation

### 10.11.18.2.11 Replacement Techniques

The following procedure outlines standard Multec 3 and Multec 3.5 Fuel Injectors removal and replacement.

**Warning: The injector and all associated hardware may be extremely hot.**

- .. Shut off ignition.
- .. Disconnect negative battery cable to avoid possible fuel discharge if an accidental attempt is made to start the engine.
- .. Disconnect the electrical connector from the injector wiring harness.
- .. Relieve fuel pressure
- .. Remove the retaining clip from the fuel injector.
- .. Remove the fuel line connection from the injector
- .. Carefully clean debris from the interface surfaces. Do not damage seal mating surfaces.
- .. Remove the injector from the manifold
- .. Apply a light coating of a lubricant to both the upper and lower injector seal ring of the replacement injector.
- .. Install the new injector into the manifold. Check that the injector is installed in the original orientation to maintain proper spray targeting, and that the retaining clip is properly seated on the injector and the fuel line
- .. Install the retaining clip after connecting the fuel line
- .. Tighten the injector mounting to the desired torque as mentioned in the manufacturer manual
- .. Tighten the fuel line
- .. Re-install the injector electrical connector
- .. Check for fuel leaks with the key “on” and the engine “off”

..Start engine and verify proper operation

#### 10.11.18.2.12 **Interchange ability**

The injector should be replaced in service only with an equivalent injector of the same part number. On occasion, a new part number may supersede part numbers. Consult the appropriate vehicle service manual and part number guide for the latest replacement injector part number information.

#### 10.11.18.2.13 **Plugging**

Fuel deposits cause plugging resulting in flow shifts over the life of the injector. Fuel varnish or gumming, a type of injector deposit, is created when certain types of fuel are heated by high injector tip temperatures at soak (no fuel flow). Deposit build up in the director holes causes the flow shifts

..Plugging can cause flow restrictions, frictional changes and the collection of other particles attracted by the tacky surface. The flow restrictions can degrade emissions and drivability.

..Other fuel and environmental conditions may cause crystal or corrosion growth in the injector and cause a flow shift.

..Oxidation stability of the gasoline affects the potential for deposit formation and must be controlled by the fuel supplier.

..Increased levels of detergent additives reduce the rate of injector plugging.

..Incase of plugging of injector follow the injector cleaning procedure mentioned in the section below

#### 10.11.18.2.14 **Cleaning Procedure**

..Electrically disable the fuel pump by removing the fuel pump connection.

..Relieve the fuel pressure in the system and disconnect the fuel connection at the injector. Plug the fuel feed line.

..Injector cleaner with the specific ratio of the cleaner and gasoline to be mixed in the Injector cleaning tank.

..Connect the injector-cleaning tank to injector in the vehicle.

..Pressurize the injector-cleaning tank to system pressure.

..Start and idle the engine for 15- 20 minutes.

..Disconnect the injector-cleaning tank from the system and install the fuel pump connections. Connect the fuel feed line to injector.

..Start and idle the vehicle for an additional 2 minutes to ensure the residual injector cleaner is flushed from system.

### 10.11.18.3 **Throttle Body As sembly (with stepper motor )**

#### 10.11.18.3.1 **Description and Working Principle**

The Throttle Body Assembly is an interactive system comprised of the following subsystems: the main casting body, bearing system, shaft and valve system, return spring system, cable interface system, throttle position sensing system, and the bypass air control system. The subsystems interact and support each other to provide all the functional requirements, which are mentioned below -

..Control intake air flow

..Control idle air flow

..Sense throttle position - Provide position feedback to Engine Controller

..Provide reactionary force to the throttle

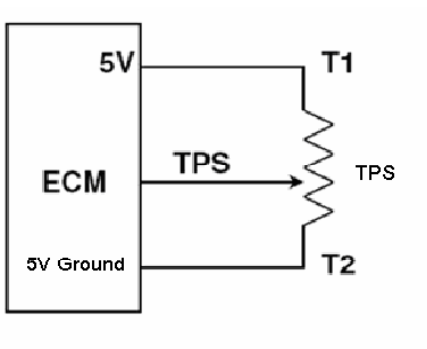
10.11.18.3.2 Appearance



10.11.18.3.3 Technical Parameters

Throttle Position Sensor:

- ..Reference voltage:  $5 \pm 0.1$  VDC
- ..Resistance between T1 and T2: 3k~12k $\Omega$



Idle Air Control Valve:

- ..Operating voltage: 7.5~14.2 VDC
- ..Solenoid resistance:  $53 \Omega \pm 10\%$
- ..Solenoid inductance: 33mH $\pm 20\%$

10.11.18.3.4 Operating Conditions

Normal Operating Temperature: -30~120°C

10.11.18.3.5 Throttle Body Removal

- ..Disconnect negative terminal of the battery
- ..Disconnect electric lead wire of throttle position sensor coupler, stepper motor coupler and MAP/MAT sensor coupler ( if this sensor is mounted on the throttle body)
- ..Disconnect accelerator cable from throttle body
- ..Remove air cleaner outlet hose and throttle body outlet hose

10.11.18.3.6 Cleaning Procedure

If there is cover on the bottom, it may be removed and cleaned using carburetor cleaner (3M make recommended). Once the throttle body cover is removed, spray the throttle-body cleaner inside the shipping air passage, and use the brushes to gently dislodge the dirt, gum and varnish that are present. Do not let the bye pass holes be blocked by dirt or foreign particles.

**10.11.18.3.7 Throttle Body Installation**

Reverse the procedure for installation noting the following:

- . Adjust accelerator cable play
- . Check to ensure that all removed parts are back in place.
- . Reinstall any necessary part which have not been reinstalled

**10.11.18.3.8 Precautions**

- . Do not submerge TPS in any cleaning fluid.
- . Always open the throttle valve using the throttle cable or lever.
- . Do not hold the valve at opening position by inserting tools or any sticks into the bore. The valve may be warped and the bore may be scratched. This type of damage may keep the throttle from opening easily or fully closing.

**10.11.18.3.9 Handling - DOs & DONTs**

<b>ACTION</b>	<b>REASON</b>
<b>DO:</b> Use care during assembly of harness to throttle body.	Avoid terminal damage.
<b>DO:</b> Avoid any liquid contamination in the throttle body area.	Ensure proper operation.
<b>DO:</b> Unload and install units one at a time from packing trays.	Damage may be done to critical components.
<b>DO:</b> Return any dropped, damaged, or suspect material with a tag that describes the problem. (Only warranty cases)	Ensure fast and correct diagnosis of root cause.
<b>DO:</b> Remove and discard protective caps just before assembling mating components.	Protects system from contamination, which can prevent proper operation.
<b>DO:</b> clean the by pass passage after removing bottom cover	To ensure good idle stability
<b>DO NOT:</b> Use any dropped or impacted unit.	Internal damage may have occurred or emissions settings may have been upset.
<b>DO NOT:</b> Store units without protective caps in place.	Contamination may impair correct operation.
<b>DO NOT:</b> Ship or store near saltwater without protection.	Corrosion buildup may impact proper operation.
<b>DO NOT:</b> Exposed to environmental conditions (Moisture) prior to complete vehicle installation.	Corrosion buildup may impact proper operation.
<b>DO NOT:</b> Apply any voltage other than system voltage for testing.	Damage could occur
<b>DO NOT:</b> Apply excessive band clamp loading	Damage could occur.
<b>DO NOT:</b> Remove packing in a way that allows contact between parts.	Minimum air leakage could be affected and/or other damage could occur.
<b>DO NOT:</b> Release the throttle cam abruptly from any position without the throttle linkage attached.	Damage could occur.
<b>DO NOT:</b> Let the by pass holes be blocked by dirt or foreign particles.	This could effect idle stability
<b>DO NOT:</b> Rake, stage, or handle parts in a manner that allows contact between parts.	Damage will occur.

**10.11.18.4 Engine Cool ant Temper ature Sensor**

**10.11.18.4.1 Description and Working Principle**

This sensor is used in water cooled engines. It provides a resistance that varies as a function of temperature within prescribed tolerance limits. The sensor has a negative temperature coefficient of resistance. This is a non-serviceable part.

#### 10.11.18.4.2 Appearance



#### 10.11.18.4.3 Installation Requirements

Dynamic Torque Requirement: The sensor shall be hand into the application and then driven by a driver with a maximum no load speed of 400 rpm or installed to the desired torque by a hand torque wrench (5/8" hex). The recommended installation torque is:

Minimum: 20 N·m

Maximum: 25 N·m

Static Torque Requirement: The torque required to remove the sensor from the mating hole shall be within 200% of the installation torque mentioned above.

#### 10.11.18.4.4 Operating Environment

This device is intended for use in engine coolant and air cooled applications and shall withstand such an under hood environment.

Normal Operating Temperature: -40°C ~ 135°C (continuously).

Relative Humidity: 0 to 100% RH.

Typical Pressure: When installed at the minimum torque the sensor shall be capable of sealing engine coolant with a positive pressure of 206.8 kPa (30 psi) at 135°C applied to the probe tip end of the sensor.

Extreme Operating Environment: Maximum temperature excursion to 150°C for 1 hour.

#### 10.11.18.4.5 Storage Environment

Storage temperature: -40°C to 120°C for an indefinite duration

Transport at altitudes to: 13,700 m for an indefinite duration

#### Electrical Environment

Typical Voltage: The sensor circuit operates with a DC voltage reference of  $5 \pm 0.1$  VDC.

Maximum Excitation Current: The sensor calibration shall not be affected by a current source of less than 1 mA at all temperatures.

#### 10.11.18.4.6 Sample Cleaning

When necessary the samples may be cleaned in isopropyl alcohol for one minute with mating connectors in place and then air-dried

### 10.11.18.5 Intake Air Pressure and Temperature Sensor(MAP&MAT)

### 10.11.18.5.1 Description and Working Principle

This sensor has two functions. The first is the intake manifold air temperature, it provides a resistance that varies as a function of temperature within prescribed tolerance limits. The second is the intake manifold air pressure; it provides a voltage varies as the intake air pressure.

### 10.11.18.5.2 Appearance



The appearance of the MAP&MAT Sensor is shown as above.

### 10.11.18.5.3 Operating Environment

- ..This device is intended for use in inlet manifold for sensing air temperature and pressure which shall withstand such an under hood environment.
- ..Pressure Range: 20~102kPa
- ..Temperature Range: -40~105°C
- ..Relative Humidity: 0 to 100% RH.
- ..Extreme Operating Environment: Maximum temperature excursion to 125°C for 2 hours.

### 10.11.18.5.4 Storage Environment

- ..Storage temperature: -50°C to 150°C for an indefinite duration

### 10.11.18.5.5 Electrical Environment

- ..Typical Voltage: The sensor circuit operates with a DC voltage reference of  $5 \pm 0.1$  VDC.

### 10.11.18.5.6 Sample Cleaning

- ..When necessary the samples may be cleaned in isopropyl alcohol or gasoline for one minute with mating connectors in place and then air-dried

## 10.11.18.6 Oxygen Sensor

### 10.11.18.6.1 Description and Working Principle

This sensor is a device for monitoring the residual oxygen in the exhaust of an internal combustion engine. It consists of the wide range sensor and stoichiometric sensor. Usually we use stoichiometric sensor on the small engine. It is the feedback element for engine closed loop control.

### 10.11.18.6.2 Appearance

The appearance of the Engine Oxygen Sensor is shown as below



### 10.11.18.6.3 Technical Parameters

- ..A/F ratio rich threshold: > 750 mVDC
- ..A/F ratio lean threshold: < 120 mVDC
- ..Heater power: 7.0W  
(These parameters as above are measured basing on 450°C (engine dyno), typically on 70% duty at 10Hz and under 13.5V)
- ..Heater part resistance:  $9.6 \pm 1.5 \Omega$   
(This parameter is measured basing on 21°C)
- ..Operating temperature range: 260-850 °C

### 10.11.18.6.4 Fuel Quality Requirements

- ..Pb $\leq$ 0.005g/L
- ..P $\leq$ 0.0002g/L
- ..S $\leq$ 0.04% (weight proportion)x
- ..MMT $\leq$ 0.0085g/L
- ..Si $\leq$ 4ppm

### 10.11.18.7 Ignition Coil

#### 10.11.18.7.1 Description and Working Principle

This coil provides energy to the spark plug in the combustion chamber. The coil itself doesn't have a driver. The high voltage tower of the coil is connected to the spark plug using a high voltage cable assembly. This is a non-serviceable component.

10.11.18.7.2 **Appearance**

The appearance of the Ignition coil is shown as below.



10.11.18.7.3 **Technical Parameters**

- ..Input voltage: 9~14VDC
- ..Output voltage: ~25~30KV
- ..Operating temperature: -30 ~110 °C
- ..Storage temperature: -40~155°C
- ..Mounting Torque: 8.8~11.8Nm

10.11.18.7.4 **Installation requirements**

- ..The vehicle frame provides the mounting surface and mounting holes.
- ..Mount coil close to the spark plug and keep the plug wire length very short (less than 6 “).
- ..Mount coil away from any pick coil device. Especially, a VR type Crank / Cam sensor. Keep a Min distance of 150 mm (around 6”) between coil and any VR sensor device.
- ..Never route the coil C- wire with the same bundle as the Crank sensor wires. There is around 200 V peak potential between C- wire and engine ground. This voltage potential could cause a noise on sensor cables.

10.11.18.7.5 **DOs and DONTs**

ACTION	REASON
<b>DO NOT:</b> Install the low voltage connectors with the power applied	This might cause an unwanted secondary firing, possibly leading to personal injury
<b>DO NOT:</b> Use a screw driver to asset in removing secondary boots from the secondary tower. Use tools designed for secondary removal.	It is possible to damage a secondary lead in such a manner that creates an electrical path to outside the system permitting improper system operation misfire, or even possible personal injury if arcing occurs.
<b>DO NOT:</b> Use parts that have been dropped or display physical damage	Damaged components can lead to premature failure.
<b>DO NOT:</b> Scratch or apply any non approved material to the surface of the high voltage tower which mates with the high voltage secondary leads.	This can jeopardize the seal integrity of the mating surfaces which in turn can create a secondary high voltage leak path.
<b>DO NOT:</b> Strike any part of the ignition system with a tool or other object.	This can lead to physical damage which can cause a system malfunction or failure.
<b>DO NOT:</b> Permit paint or other sprayed materials to be sprayed onto the electrical connectors.	Insulating type sprays can create a high resistance or open connection. And, a conductive type spray can create an electrical short condition.



<b>ACTION</b>	<b>REASON</b>
<b>DO NOT:</b> Support the ignition system by the wiring harness or plug wire.	These leads are not designed to support the weight of the ignition system. It can create a poor electrical connection Or become disconnected allowing the system to fall and be subjected to physical damage
<b>DO NOT:</b> Pierce or probe the secondary leads.	This creates an electrical path to outside the system permitting improper system operation, misfire, or even possible personal injury if arcing occurs.
<b>DO NOT:</b> Operate without the spark plug attached	If a technician or mechanic comes in contact with the high voltage generated during operation, personal injury may occur. Or, if the engine is operated under this condition, unburned fuel may fill the converter area creating a potential hazard
<b>DO NOT:</b> Share ignition component wiring with other components, Dedicated wiring is required.	This prevents electrical cross talking between components which can lead to component malfunction.
<b>DO NOT:</b> Apply voltage to the ignition system other than vehicle system voltage for testing purposes.	This can cause reduced performance or an electrical malfunction of the ignition system
<b>DO NOT:</b> Use high impact tools to apply the spark plug boot to the ignition secondary towers. Installation of the high voltage secondary leads by hand is preferred.	Damage to the coil tower, secondary boot, or mating connection surfaces might occur.
<b>DO:</b> Install the secondary leads before connecting the primary leads.	In the event the low voltage connection has been made and the power applied, unwanted secondary output might occur possibly resulting in injury, damage the ignition component, and test equipment
<b>DO:</b> Take care when working around the ignition system.	The high voltage produced by the coil secondary circuit can cause personal injury and/or damage test equipment
<b>DO:</b> Proper handling and shipping methods need to be in place to reduce the risk of damage due to impact, moisture, or contamination	Damaged components can lead to premature failure.
<b>DO:</b> Avoid unnecessary disconnecting and connecting of the electrical components.	The electrical connections are not designed for repeated connection and disconnection.
<b>DO:</b> Insure the low voltage connectors are entirely seated and the locking mechanism is engaged.	This prevents intermittent electrical connections leading to an improper ignition system operation.
<b>DO:</b> Use approved connector breakouts when testing the ignition system.	Connector and/or component damage may occur.
<b>DO:</b> Insure the appropriate seals are included in the connector system.	Liquid intrusion into the terminal connection area might occur causing an electrical intermittent or short condition. In the event of severe terminal corrosion, an open condition might occur.
<b>DO:</b> Operate with gasoline based internal combustion engines.	Other fuels or combustion designs may require additional design considerations
<b>DO:</b> The power feed line should be fused.	This could protect the system in the event of an electrical short
<b>DO:</b> The module heat sink and back plate must not be used as a connection point when jump starting the engine	The high level of voltage and current which the module could be subjected to, could cause module performance degradation or failure.
<b>DO:</b> Connection of the module back plate to vehicle ground is desirable whenever possible	This greatly reduce potential ground loops and acts as a heat transfer source from the module.
<b>DO:</b> The ignition system ground wire should be kept as short as possible. And, when permissible, should be grounded at the same engine block position as the engine controller	This would greatly reduce the possible of unwanted electrical ground loops.

ACTION	REASON
<p><b>DO:</b> The electrical wiring to the ignition system should be routed so that the conductors are protected from excessive heat, damage, and wear.</p>	<p>Helps prevent electrical intermittent, open or shorted operating conditions.</p>
<p><b>DO:</b> Ignition secondary leads should not be routed with the ignition primary harness or any other electrical harness.</p>	<p>Voltage spikes can be transmitted from the secondary cables into other leads which are in close. This could create a component performance degradation or failure condition</p>
<p><b>DO:</b> Spark plug wires(secondary leads) &amp; primary wiring:                      - must not contact sharp surface                      - must not be under tension between fixed points                      - must be clear of moving parts (belts, fan, etc...)                      - must be protected from or kept at least 125 mm away from radiant heat source exceeding 400 F.                      - must be protected from environmental damage (dirt, splash, oils, fluids, etc....)                      - must be retained, secured or insulated to prevent pinching, mis-routing, rattles, and squeaks</p>	<p>- Spark plug wires carry very high voltage (30,000 volt). If the secondary lead loses its dielectric characteristics thru being nicked, cut , chaffed, then an arc thru to a near by ground could take place. This kind of condition could lead to misfire, no start, or premature failure of ignition system.</p>
<p><b>DO:</b> Not all fasteners are designed for repeat use. Beware of fastener specifications. All harnesses should be supported within 6" of a mating connection.</p>	<p>Adequate retention force might not be achieved if the fastener is not designed to be reused. Mating connections are not designed to support the weight of the harness assembly</p>
<p><b>DO:</b> For removing spark plugs follow the following steps:                      1- Grasp the spark plug boot and gently rotate 90°; and then pull the spark plug boot and cable away from the spark plug                      2- Before removing spark plug, brush or air blast dirt away from the well areas                      3- Use correct size deep socket wrench to loosen each spark plug one or two turns</p>	<p>To remove spark plugs from Aluminum heads, allow the engine to cool. The heat of the engine, in combination with a spark plug that is still hot, may cause the spark plug threads to strip the cylinder head upon removal                      Use goggles to protect eyes from dirt when applying compressed air to spark plug wells</p>
<p><b>DO:</b> Cleaning a spark plug could be done as follow:                      1- wipe all spark plug surfaces clean....remove oil, water, dirt and moist residues.                      2- If the firing end of spark plug has oily or wet deposit, brush the spark plug in an approved, non-flammable and non-toxic solvent. Then dry the spark plug thoroughly with compressed air                      3- Use a propane torch to dry wet-fuel fouled plugs. Allow the torch flame to enter up the center electrode insulator. Allow plug to cool down                      4- If the spark plug threads have carbon &amp; scale deposits, clean with wire brush, taking care not to injure the electrode or the insulator tip</p>	<p>- Cleaning a spark plug will reduce the voltage required for an electrical arc(spark) across the electrodes                      - Cleaning &amp; re-gapping will not restore a used spark plug to a new condition. It may be more economical and efficient to replace used spark plugs with new plugs instead of cleaning.                      - Sooted plugs should be replaced                      - Do not cool by using water or any liquid                      - Clean threads permit easier installation and proper seating which will maximize transfer heat away from the plug</p>
<p><b>DO:</b> Regap spark plugs to the exact measurement specified by the engine manufacturer to keep the best fuel economy and proper engine performance                      - Use round wire-type gauge for an accurate measure of gap on all used spark plugs                      - when gapping a spark plug only the side electrode is moved. The center electrode must not be moved</p>	<p>- Too wide a gap could cause the plug to misfire(higher required ignition voltage).                      - Too narrow of a gap could affect idle stability                      - A flat gauge can't accurately measure the spark plug on used plugs</p>
<p><b>DO:</b> When replacing spark plugs with new ones, always use equivalent plugs with same heat range, thread, size, etc....</p>	<p>- Higher heat range plug(hotter plug) could lead to pre-ignition &amp; possible piston damage                      - Lower heat range (colder plug) could lead to cold fouling &amp; emission problem</p>

<b>ACTION</b>	<b>REASON</b>
<p><b>DO:</b> For installing spark plugs follow the following steps:</p> <p>1- make sure the cylinder head threads and spark plug threads are clean. Make sure the spark plug thread is free of dings and burrs. If necessary, use a thread chaser and seat cleaning tool.</p> <p>2- Make sure the spark plug gasket seat is clean, then thread the gasket to fit flush against the gasket seat. Tapered seat plugs do not require gaskets</p> <p>3- Screw the spark plugs finger-tight into the cylinder head. Then, use a torque wrench to tighten spark plugs following manufacturer's recommendation).</p> <p>Torque is different for various plug type &amp; cylinder head material</p>	<p>- If the thread is damage, it prevents a good heat transform from the shell to the cylinder head</p> <p>- Do not use any type of anti-seize compound on spark plug threads. Doing this will decrease the amount of friction between the threads. The result of the lowered friction is that when the spark plug is torqued to the proper specification, the spark plug is turned too far into the cylinder head. This increases the likelihood of pulling or stripping the threads in the cylinder head</p> <p>- Over-tightening of a spark plug can cause stretching of the spark plug shell and could allow blowby to pass thru the gasket seal between the shell and insulator. Over-tightening also results in extremely difficult removal</p>

**10.11.18.8 Fuel Pump Module**

**10.11.18.8.1 Description and Working Principle**

Fuel Pump Module supplies fuel to engine at system pressure. Fuel Pump Module is mounted to fuel tank at bottom and supplies fuel to engine through hoses.

Fuel Pump module consists of Fuel Pump to generate the fuel flow and pressure regulator to regulate the fuel pressure.

**Fuel Pump**

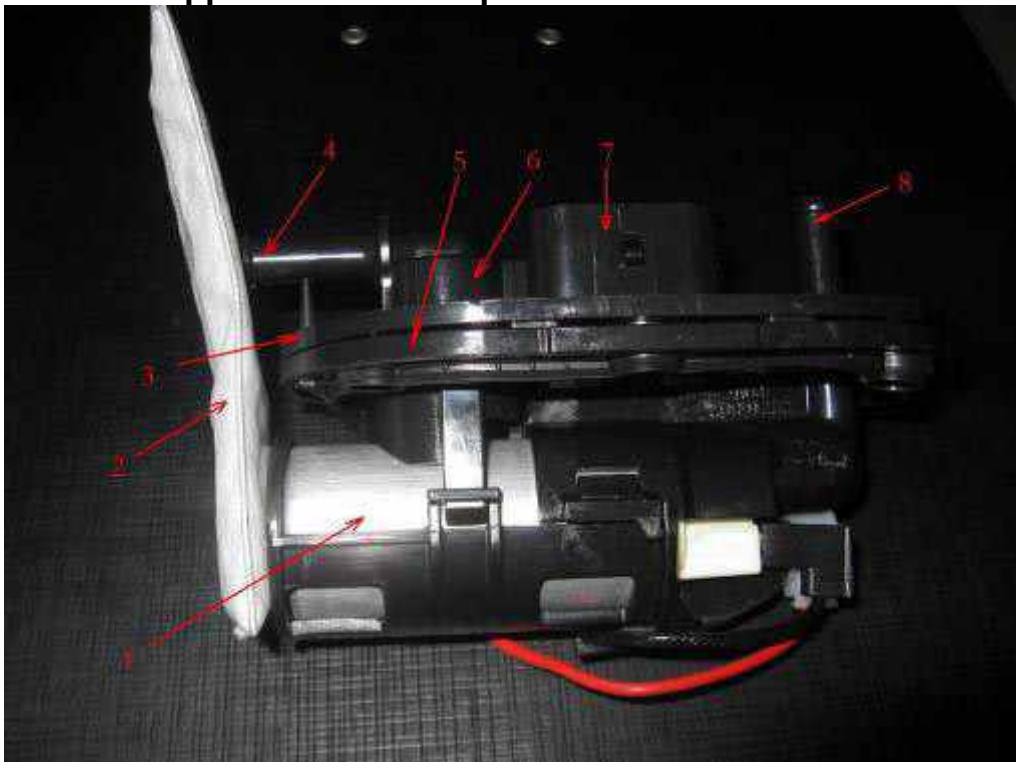
When power is supplied to fuel pump, motor in pump assembly rotates the impeller.

Impeller in turn draws the fuel from strainer and pumps the flow to generate the system pressure.

**Pressure Regulator**

Pressure Regulator is a diaphragm type mechanical device. Fuel flow from filter enters in the inlet of pressure regulator. Pressure regulator regulates the fuel pressure at a set pressure by releasing the excessive fuel flow to fuel tank.

## 10.11.18.8.2 Appearance &amp; Components of Fuel Module



1. Fuel Pump
2. Strainer
3. Gasket, Fuel Module
4. Fuel Tube (in pump)
5. Module Bracket
6. Pressure Regulator
7. Module Harness
8. Fuel Tube (out pump)

## 10.11.18.8.3 Dimensions

Fuel Module Cover in elliptical shape with outer edge dimensions as 115mm x 70mm.

## 10.11.18.8.4 Identification and Markings

Fuel Module, Fuel Pump and Regulator are marked with batch code in Julian Date Code.

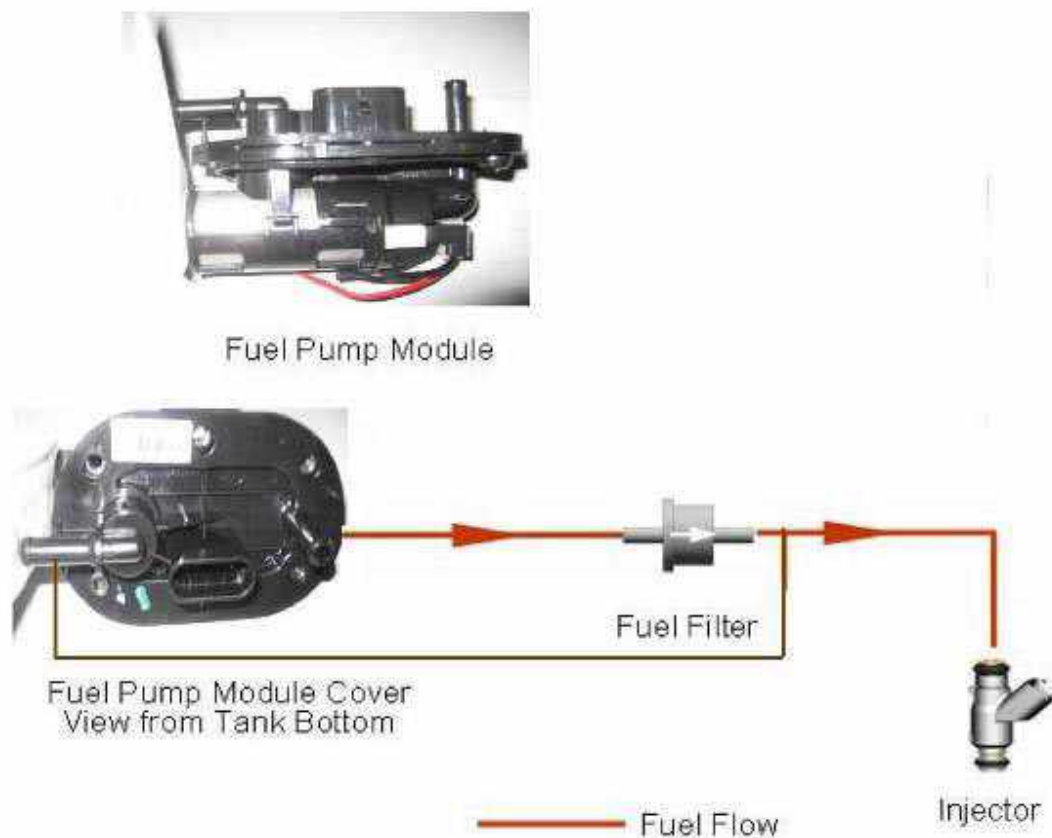
On Fuel Module, batch code is mentioned on the label available on fuel module cover.

On Fuel Pump Batch code is engraved on pump body (shell).

On Fuel Pressure Regulator, batch code is engraved on regulator dome area.

## 10.11.18.8.5 Operating Conditions

- ..Fuel Pump Module needs to be mounted on Fuel Tank Bottom according to the installation instructions.
- ..Fuel Pump Module is intended to use with gasoline. However if the fuel contains ethanol, please contact vehicle manufacture to check whether the fuel pump module itself can survive or not.
- ..Make sure there is at least 3 liters of gasoline in the fuel tank before priming for first time (do not run the pump dry)
- ..Fuel Hose connections needs to be installed according to the fuel flow diagram shown



Fuel Flow Description in vehicle fuel system

#### 10.11.18.8.6 **Service Procedure**

##### Precautions:

Before attempting any service on fuel system, following cautions should be always followed for personal safety and to avoid system damages.

- .. Disconnect negative cable at battery.
- .. DO NOT smoke, and place "No SMOKING" sign near work area
- .. Make sure to have fire extinguisher handy.
- .. Make sure to perform work in well ventilated area and away from any open fire/flames.
- .. Wear Safety glasses
- .. To relieve fuel vapor pressure in fuel tank, remove fuel filler cap fuel filler neck and then reinstall it.
- .. As fuel lines are at high pressures when the engine is stopped, loosening or disconnecting fuel line will cause dangerous spout of fuel. Before loosening/ disconnecting fuel lines, please follow the "Fuel Pressure Relief Procedure" described in this section.
- .. Small amount of fuel may drip after the fuel lines are disconnected. In order to reduce the risk of personal injury, cover the pipe/ hose ends with suitable blind with no rust or contamination.
- .. After servicing, make sure that the fuel hoses and clamps are connected according to the hose fitment instructions given in vehicle instruction manual.
- .. After servicing, please follow the 'Fuel Leakage Check Procedure' described in this section.
- .. After servicing make sure to fill at least 3 liters gasoline before pump is primed (ignition key should be turned on only after ensuring there is minimum 3 liters of fuel in the fuel tank)

**10.11.18.8.7 Fuel Module Diagnosis:**

Step	Action	Yes	No
1	Switch on Ignition key. Fuel Pump primes for 3 seconds when the ignition key is ON. Check for fuel pump running noise for 3 seconds after ignition key is ON.	If fuel pump running noise can be heard, go to step 4.	If fuel pump running noise can not be heard, go to step 2.
2	Disconnect fuel module coupler. Check voltage at harness coupler. Is the voltage within 10-14V?	Go to step 3	Check the electrical circuit from Ignition to fuel module.
3	Connect 12V DC power supply (battery) to fuel module. Make sure that enough fuel available in fuel tank to avoid fuel pump running dry. Is the fuel pump running?	1. Check electrical circuit from fuel module to ECU 2. Check ECU	1. Check Fuel Pump Harness integrity 2. Check Fuel Pump
4	Check fuel system pressure at Injector inlet (with a T-joint) while engine is running in idle condition. Is the pressure between 220 ~ 270kPa?	Fuel Module Operation Normal	Go to Step 5
5	Is the Pressure below 220kPa?	1. Check for leakages from hoses, hose joints 2. Check Fuel Pump 3. Check Pressure Regulator	1. Clogged Filter 2. Kink/ Blockage in Fuel Hoses 3. Check Re

**10.11.18.8.8 Fuel Module Removal:**

- ..Relieve fuel pressure in fuel lines referring to the 'Fuel Pressure Relief Procedure' provided in this section.
- ..Disconnect negative cable at battery.
- ..Disconnect fuel module wire coupler.
- ..Drain the fuel in fuel tank thru fuel filler with help of hand pump (siphon). Collect the fuel in approved container for contamination and safety.
- ..Disconnect the fuel hoses from fuel module by using standard tools
- ..Remove the fuel tank from vehicle.
- ..Place the fuel tank with bottom up condition. Care to be taken not to cause any scratches/ damages on fuel tank.
- ..Open the fuel module mounting bolts.
- ..Take out fuel module assembly from fuel tank with care
- ..Care to be taken not to damage the strainer while removing fuel module from tank.

**10.11.18.8.9 Fuel Module Installation:**

- ..Replace the fuel module gasket in fuel module assembly with a new one. Old/ used gaskets can cause leakages.
  - ..Fold strainer towards fuel pump and insert fuel module in tank opening with care. Care should be taken not to cause any damages on strainer.
- Fuel Module Orientation: Fuel module bolts not symmetrical and can be mounted only in the intended direction. Regulator side should be facing the Fuel Tank rear side.
- Make sure that the fuel tank surface at module mounting area is clean and free of surface defects.
- ..Place the bolts on module cover and tighten the bolts gradually in star pattern sequence to apply equal compression on gasket. It is shown as below.



Bolt Tightening Torque: 3~4 Nm.

Fuel module is installed with special bolts (step bolts). Use designated bolts only. Follow the tightening torque and tightening sequence instruction. Over torque and miss-sequence can cause unequal compression of gasket and leakage.

- ..Install the fuel tank to vehicle.
- ..Connect for fuel hoses with suitable hose clamps.
- ..Connect fuel module coupler
- ..Follow "Fuel Leakage Check Procedure" to check any leakage before the engine is started.

#### 10.11.18.8.10 Pressure Regulator Assembly Replacement:

- ..Remove the regulator retainer from module.
- ..Apply gradual pull force on retainer to avoid any personal injury due to spring action of retainer.
- ..Take out the pressure regulator assembly from module.
- ..Do not hit/ damage on the regulator dome and crimping portion.
- ..Lubricate the O-rings in new pressure regulator assembly with recommended lubrication oils as mentioned in Table no: 3. Lubrication oil is applied only for ease of regulator assembly.
- ..Make sure that 2 O-rings (one is bigger diameter the other is smaller diameter) are assembled in pressure regulator.
- ..Place the pressure regulator on module at regulator pod. Push the regulator gently in the pod.
- ..Do not hit/ damage on the regulator dome and crimping portion. This will disturb the pressure setting.
- ..Assemble the retainer on the regulator pod
- ..Replace the gasket, module with new gasket provided in the kit.

#### 10.11.18.8.11 Fuel Pressure Relief Procedure:

Caution: This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst (if equipped)

After making sure that engine is cold, relieve fuel pressure as follows.

- ..Place vehicle gear in 'Neutral'.
- ..Disconnect fuel module electrical coupler from vehicle harness.
- ..Start engine and run till it stops due to lack of fuel. Repeat ignition key ON and OFF for 2 ~ 3 times of about 3 seconds each time to relieve fuel pressure in lines. Fuel Connections are now safe for servicing.
- ..Upon the completion of servicing, Connect Fuel Module Connector to Vehicle Harness

**10.11.18.8.12 Fuel Leakage Check Procedure:**

After performing any service on fuel system, check to make sure that there are no fuel leakages as below.

- ..Fill about 3 ~ 5 liters of fuel in tank.
- ..Turn Ignition key to ON position for 3 seconds (to operate fuel pump) and then turn to OFF position. Repeat this for 3 ~ 4 times to apply fuel pressure in fuel lines.
- ..In this state, check to see that there are no fuel leakage from any part of fuel system (Fuel Tank, Hoses, Hose Joints, etc)

Handling – DOs and DONTs :

<b>ACTION</b>	<b>REASON</b>
<b>DO NOT:</b> Drop Fuel Module on Floor	Could cause internal damage to Fuel Pump.
<b>DO NOT:</b> Run Fuel Pump Dry (without fuel at pump inlet/ strainer) ensure atleast 3 litres of gasoline is present in the fuel tank	Caused internal damage to Fuel Pump
<b>DO NOT:</b> Damage the strainer during servicing, insertion of fuel module in fuel tank	Contamination enters fuel pump thru damaged strainer damages the Fuel Pump
<b>DO NOT:</b> Disassemble Fuel Pump and regulator internal parts out side Delphi premises. <b>DO NOT:</b> Do any adjustments on pressure regulator and pump except for replacement.	Warranty void.
<b>DO NOT:</b> Use module harness for hold/ carry fuel module. <b>DO NOT:</b> Pull Wiring Harness in vertical direction to module cover	Wiring Harness Breakage/ Fuel Pump Power disconnection
<b>DO NOT:</b> Use damaged/ distorted hose clamps	Can cause fuel seepage/ leakage.
<b>DO NOT:</b> Use Fuel Module if the strainer with excessive damage/ cut.	Contamination enters fuel pump thru damaged strainer damages the Fuel Pump
<b>DO NOT:</b> Use Fuel Pump for draining fuel in fuel tank.	Not intended function of fuel module
<b>DO NOT:</b> Use module mounting bolts for mounting other components.	Affects fuel module sealing.
<b>DO NOT:</b> Damage fuel pump harness while servicing fuel module.	Damaged terminals will cause intermittent/ No contact for power supply.
<b>DO NOT:</b> Force hand pump towards fuel module while draining fuel from tank.	To avoid any damages on fuel module
<b>DO :</b> Ensure that there are no damages to fuel pipes while servicing fuel module	Can cause fuel seepage/ leakage.
<b>DO:</b> Use genuine module gasket only.	Spurious gaskets can cause leakages
<b>DO:</b> Use designated hose clamps.	To ensure no leakages/ seepages thru hose joint.
<b>DO:</b> Clamp fuel module harness to vehicle chassis	Clamp provides mechanical support for wiring harness in vibrations.
<b>DO:</b> Use only standard gasoline for operating vehicle/ module	Fuel Module is intended to run in standard gasoline. Adulterated fuel can cause fuel module premature failures which are not covered under warranty.
<b>DO:</b> Change the fuel filter at recommended intervals.	Clogged fuel filter will cause restriction in fuel flow and can cause flow reduction.
<b>DO:</b> Use fuel filters supplied/ recommended fuel filters only.	Spurious fuel filters causes damages to injector, regulator and fuel pump performance.
<b>DO:</b> Ensure that the hoses are routed properly and there are no kinks / rubbing with other components.	Improper routing, kinks and fouling of hoses with other components causes hose damage
<b>DO :</b> Ensure that always sufficient fuel till the strainer height	Avoids Pump running in dry



ACTION	REASON
<b>DO:</b> Replace two O-rings along with replacement/re-installation of pressure regulator.	For proper functioning of regulator
<b>DO:</b> Use care during connection of harness to module coupler.	Avoid terminal damage.
<b>DO:</b> Return any dropped, damaged, or suspect material with a tag that describes the problem.	Ensure fast and correct diagnosis of root cause.

10.11.18.9 Diagnostic Tools

10.11.18.9.1 Mot or Scanner ( for MT05 EMS)

10.11.18.9.1.1 P r e c a u t i o n s

- .. Motor-Scanner is a precision instrument and should be protected from vibration and impact.
- .. If the unit does not run correctly or the screen is unstable when first turned on, disconnect it from the main lead and try again.
- .. Make sure the DLC is always firmly inserted into the diagnostic socket.
- .. Never test electrical signals that exceed the limit of specifications.
- .. Test cannot be performed by the person who is driving the car.
- .. This unit should be used and stored in the following conditions:

Ambient temperature: 0~50□

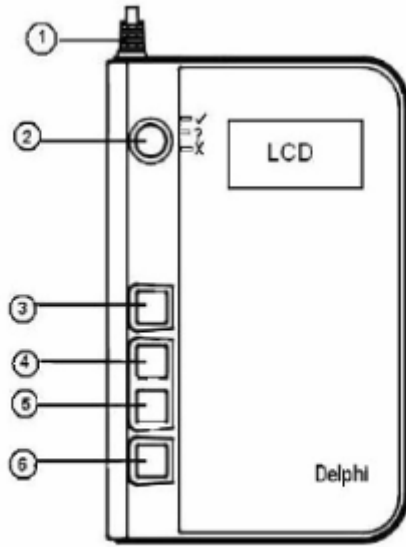
Relative humidity: <90%

10.11.18.9.1.2 .C o n f i g u r a t i o n s

Delphi Motor scanner consists of 2 main part: the main units (with diagnostic main cable) and diagnostic connector link (one end is 6PIN connector; the other is the interface for connecting diagnostic main cable). They are shown in figure 34 as below.



Outline of Main Unit



Main Unit

The 6 PIN diagnostic connector link cable and USB type main unit's software update cable are in the delivered package.

1	Diagnostic Cable	To connect the unit and vehicle socket for diagnosis
2	reserved Key	The Key is reserved for future
3	[←] Key	To return to the previous interface.
4	[↑] Key	To move the cursor to upper item in the menu
5	[↓] Key	To move the cursor to down item in the menu
6	[↵] Key	To confirm and execute this operation.

Screen:

128×64 array high definition screen with back light for displaying all the information during testing.

Keyboard:

There are 5 keys (one is reserved) on the main unit for selecting and controlling test steps.

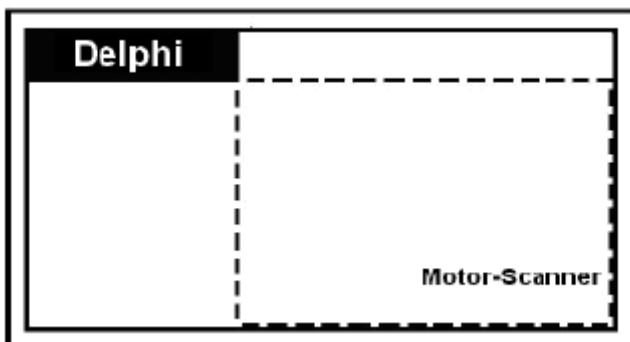
10.11.18.9.1.3 . Preparations Connection

Find the 6PIN diagnostic socket on the motor.

Connect one end of the diagnostic main cable to the main unit, and the other end to diagnostic socket on the motor, tighten the screws.

Normal Power – on Display

When power is on normally, the unit will display:



Seconds later, the unit will display:



10.11.18.9.1.4 . **F u n c t i o n s**

Delphi Motor-Scanner can be used to diagnose Delphi Engine Management System with functions: Read DTC, Clear DTC, Data Stream, Status Stream, and Record Data.

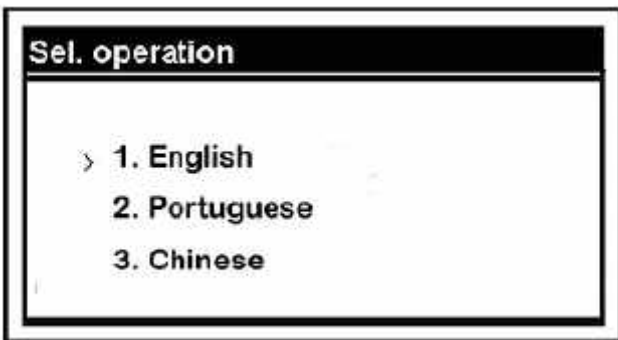
**Op e r a t i o n s**

When the unit is powered up, the screen will display the interface as below.

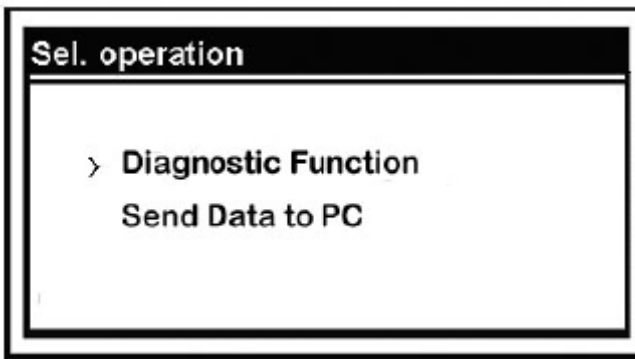


Here, we take diagnostic function for demonstration.

Select 1 and press [↵] key, it will display an interface for language selection, as shown below:



Select 'English' and press [↵] key, it will display information about the diagnostic software version, press [↵] to continue, the interface will display as below:

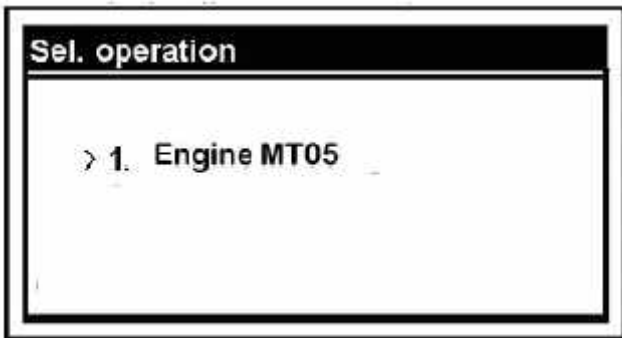


**Diagnostic Function**

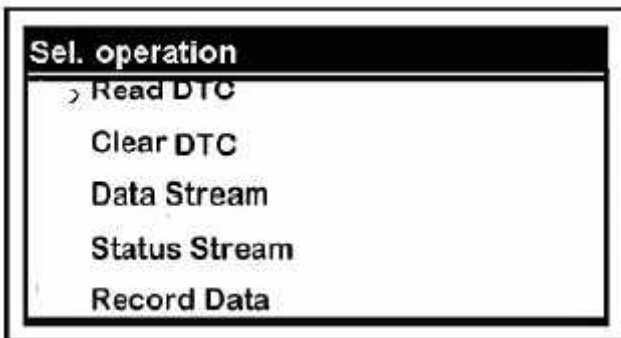
Here, we take 'diagnostic function' for demonstration.

Select 'diagnostic function' and press [↵], the screen will display an interface to indicate 'Delphi-3' diagnostic connector should be used.

Press [↵], the screen will display engine information as below:



Press [↵], with 'accessing system' fleeting on the screen, then, it will display as below:



Available functions are as follows:

- ..Read DTC
- ..Clear DTC
- ..Data Stream
- ..Status Stream
- ..Record Data

Press [↑] or [↓] key to select function you needed.

**1. Read DTC**

Select 'Read DTC', and press [↵], it will display fault code as below:

Power Train System		
● P0118	P0113	P0122
P0201	P0650	P0135
P0351		

Press [Left] or [Down] key to move '●' icon, and select fault code, take 'P0118' for example, it's selected when there is '●' in front of it, press [Right], the screen will display detailed information of the code, as below:

Temperature of engine oil sensor short V / Open
Code: P0118 <span style="float: right;">01 01</span>

2. Clear DTC  
 Select 'Clear DTC' and press [Right], it will display as below:

```

Erase fault memory.
Trouble code has been
erased.

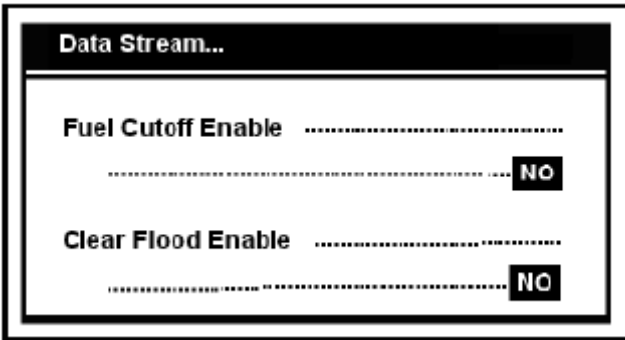
.Press [Esc] key
    
```

3. Data Stream  
 Select 'Data Stream' and press [Right], it will display as below:

Data Stream...	
MAP.....	fac
Command AFR. ....	afr

Press [Up] or [Down] key for page up/down to view more. Press [Left] key to exit.

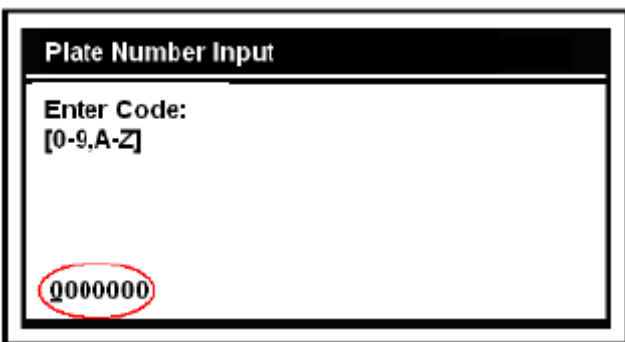
4. Status Stream  
 Select 'Status Stream' and press [Right], the interface will display as below:



Press [Up] or [Down] key for page up/down to view more. Press [Left] key to exit.

5. Record Data

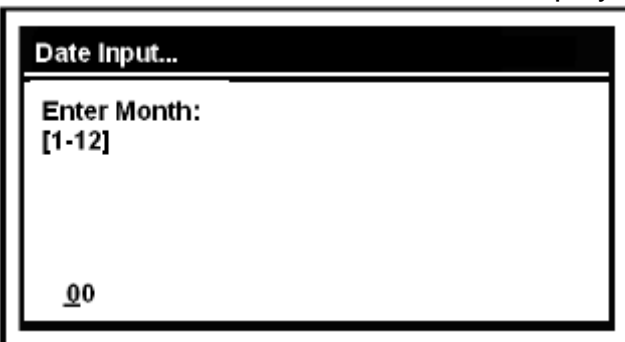
Select 'Record Data' and press [Enter], it will display:



Press [Up] or [Down] key to enter code, when the first number of the code was set, press [Enter] to confirm and continue to input the sequent numbers, till all the 7 numbers were input.

When all the 7 numbers were set, press [Enter], the screen will display a message for confirmation of the Plate Number input. Press [Left] to return to the previous interface to input the code again or press [Enter] to confirm the code.

Press [Enter], another interface will be displayed for you to input date, as below:



It's the same way to enter month as vehicle code input. Month was input, then enter date, as below:

The screenshot shows a rectangular window with a black header bar containing the text "Date Input...". Below the header, the text "Enter Date:" is followed by "[1-31]" on the next line. At the bottom left of the window, the number "00" is displayed.

Then, 'Enter Year' continues, as below:

The screenshot shows a rectangular window with a black header bar containing the text "Date Input...". Below the header, the text "Enter Year:" is followed by "[00-99]" on the next line. At the bottom left of the window, the number "00" is displayed.

After that, 'Enter Week' follows, as below:

The screenshot shows a rectangular window with a black header bar containing the text "Date Input...". Below the header, the text "Enter Week:" is followed by "[0-6]" on the next line. At the bottom left of the window, the number "0" is displayed.

Till now, the 'date input' was completed, and it starts to record data, press [⏪] to stop recording.

..Check malf code meaning by reading the below table.

Malf code in MT05	Description
<b>P0107</b>	MAP Circuit Low Voltage or Open
<b>P0108</b>	MAP Circuit High Voltage
<b>P0112</b>	IAT Circuit Low Voltage
<b>P0113</b>	IAT Circuit High Voltage or Open
<b>P0117</b>	Coolant/Oil Temperature Sensor Circuit Low Voltage
<b>P0118</b>	Coolant/Oil Temperature Sensor Circuit High Voltage or Open
<b>P0122</b>	TPS Circuit Low Voltage or Open
<b>P0123</b>	TPS Circuit High Voltage
<b>P0131</b>	O2A Circuit Low Voltage
<b>P0132</b>	O2A Circuit High Voltage
<b>P0031</b>	O2A Heater Circuit High Voltage
<b>P0032</b>	O2A Heater Circuit Low Voltage
<b>P0201</b>	Injector 1 Circuit Malfunction
<b>P0202</b>	Injector 2 Circuit Malfunction
<b>P0230</b>	FPR Coil Circuit Low Voltage or Open
<b>P0232</b>	FPR Coil Circuit High Voltage
<b>P0336</b>	CKP Sensor Noisy Signal
<b>P0337</b>	CKP Sensor No Signal
<b>P0351</b>	Cylinder 1 Ignition Coil Malfunction
<b>P0352</b>	Cylinder 2 Ignition Coil Malfunction
<b>P0505</b>	Idle Speed Control Error
<b>P0562</b>	System Voltage Low
<b>P0563</b>	System Voltage High
<b>P0650</b>	MIL Circuit Malfunction
<b>P1693</b>	Tachometer Circuit Low Voltage
<b>P1694</b>	Tachometer Circuit High Voltage

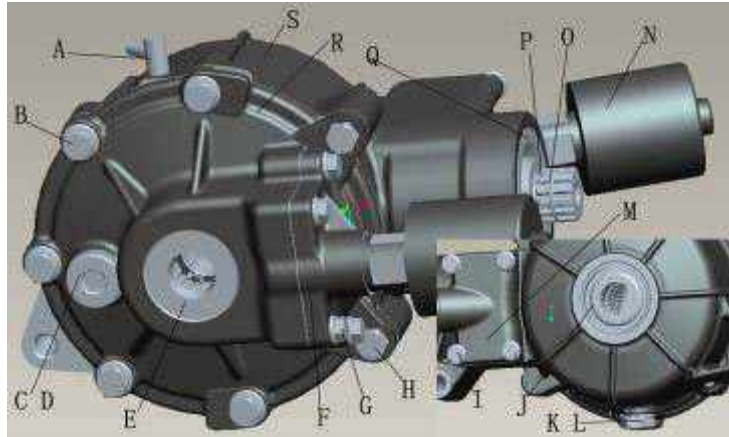


**10.12 FRONT GEARCASE**

**10.12.1 FRONT GEARCASE COMPONENT IDENTIFICATION**

External Components

- A Jointor
- B Bolt M8X25
- C Diff filler plug
- D Washer 16
- E Oil-seal 27x42x7
- F Diff lock cover
- G Bolt M6X22
- H Bolt M8X25
- I Bolt M6X40
- J Oil-seal 22X48X11
- K Oil drain plug
- L Washer 12
- M Diff 4WD cover
- N Electromagnetic valve
- O Bead flange
- P Input shaft
- Q Oil-seal 35X62X7
- R Housing cover
- S Housing



**10.12.2 FRONT GEARCASE DISASSEMBLY**

1 Remove the oil drain plug **A** and let the oil drain from the gearcase.



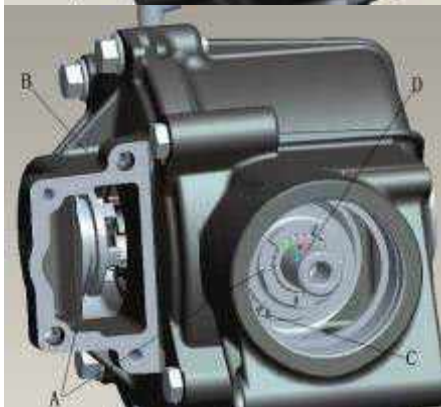
2. Remove the electromagnetic valves **A** and the oil-seal **B**, then remove the diff lock cover assy. **C** and the diff 4WD cover assy. **D**.



3. Remove the D62 lock snap ring **A** and remove the input shaft with the bearing 6007 **B**.



4. Remove the splined dog **A**, then remove the housing cover **B**. Remove the D52 lock snap ring **C**, then remove the pinion with the bearing 6205 **D**.



5. Remove the differential **A**.

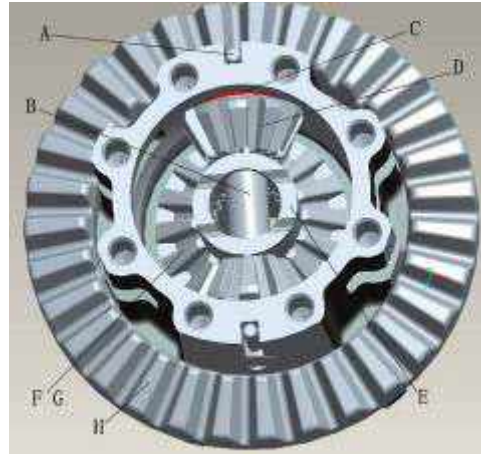


**10.12.2.1 FRONT DIFFERENTIAL DISASSEMBLY**

1. Remove the diff carrier cover **A**.



2. Remove the roll pin **A**, remove center pin **B**, bevel pinion washers **C**, bevel pinions **D**, center spacer **E** bevel gear **F** and washer **G** from differential housing. Remove the bevel crownwheel **H**.

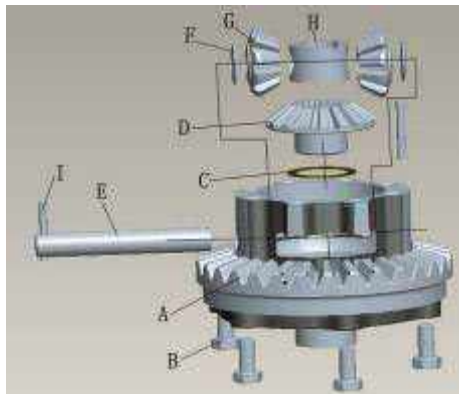


Note: Clean all components and inspect for wear. Inspect gears for wear, cracks, chips or broken teeth. Inspect engagement dogs and detent ball housing, replace if edges are rounded. Inspect casting for crack. Inspect bearings for smooth operation. Check for excessive play between inner and outer race. Inspect detent spring and finger spring for wear, cracks, relaxation. Replace part with any defects.

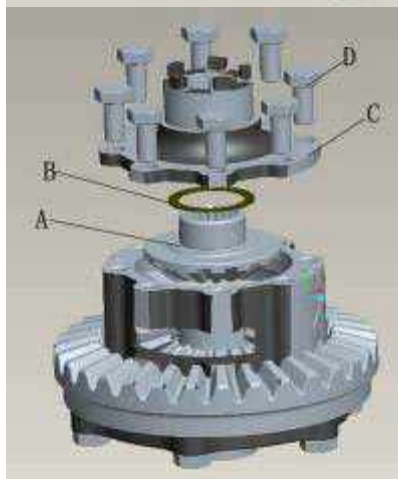
**IMPORTANT:** New seals should be installed after the transmission is completely assembled.

### 10.12.3 FRONT GEARCASE ASSEMBLY

1. Install the bevel crownwheel **A**, tighten the screws **B** with screw threads glue. and torque bolts to 24ft.lbs. (32Nm). Install washer **C**, bevel gear **D** into differential housing. Install center pin **E**, bevel pinion washers **F**, bevel pinions **G**, center spacer **H**, then install the roll pins **I**.



2. Install bevel gear **A**, washer **B** and the diff carrier cover **C**, tighten the screws **D** with screw threads glue. and torque bolts to 16ft.lbs. (22Nm).



3. Install the bearing 6006 **A** into the housing **B**, install the bearing 6007 **C** into the housing cover **D**.



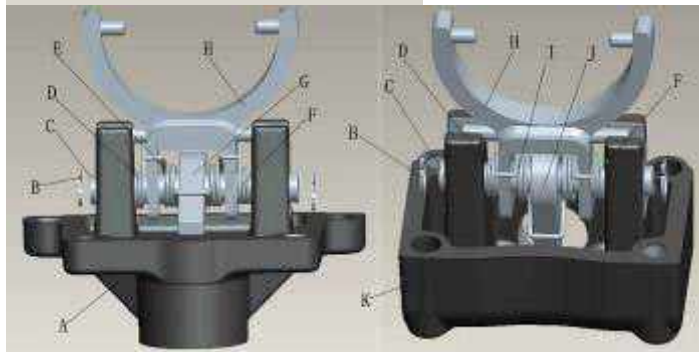
4. Install the bearing 6205 **B** to the pinion **A** with the D25 lock snap ring **C**. Install the bearing 6007 **E** to the input shaft **D** with the D35 lock snap ring **F**, install the bead flange **G** to the input shaft **D**.



Components

- A Diff lock cover
- B D8 lock snap ring
- C Diff fork pivot
- D Return spring 1
- E Diff lock pawl spring
- F Return spring 2
- G Diff lock fork pawl
- H Diff dog selr fork
- I Diff 4WD pawl spring
- J Diff 4WD fork pawl
- K Diff 4WD cover

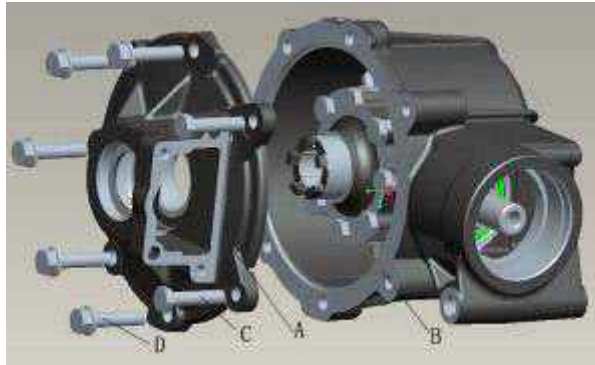
5. Assemble components as shown in figure.



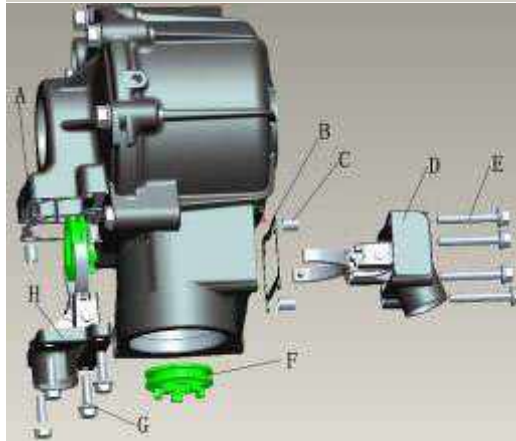
6. Install the differential **A** into the housing **B** and install the pinion assy. **C** with the D52 lock snap ring **D**.



7. Apply Loctite sealant evenly on the surface **A** or **B**, then assemble the two semi-housings. Tighten the screws **C** and **D**, torque bolts to 14ft.lbs. (20Nm)



8. Put the splined dog **F** into the housing, install Diff 4WD cover assy. **D** with paper washer **B**, locating pin **C**, tighten the screws **E**, torque bolts to 8ft.lbs. (12Nm).



.Put the splined dog **F** into the housing cover, install diff lock cover assy. **H** with paper washer **A**, locating pin **C**, tighten the screws **G**, torque bolts to 8ft.lbs. (12Nm).

NOTE: the splined dog should glide smooth on the diff dog self fork.

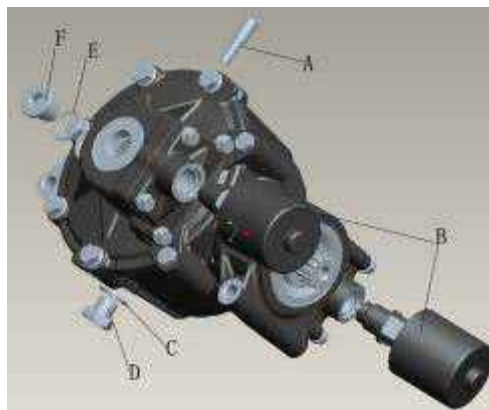
9. Install the input shaft assy. **A** with the D62 lock snap ring **B**.



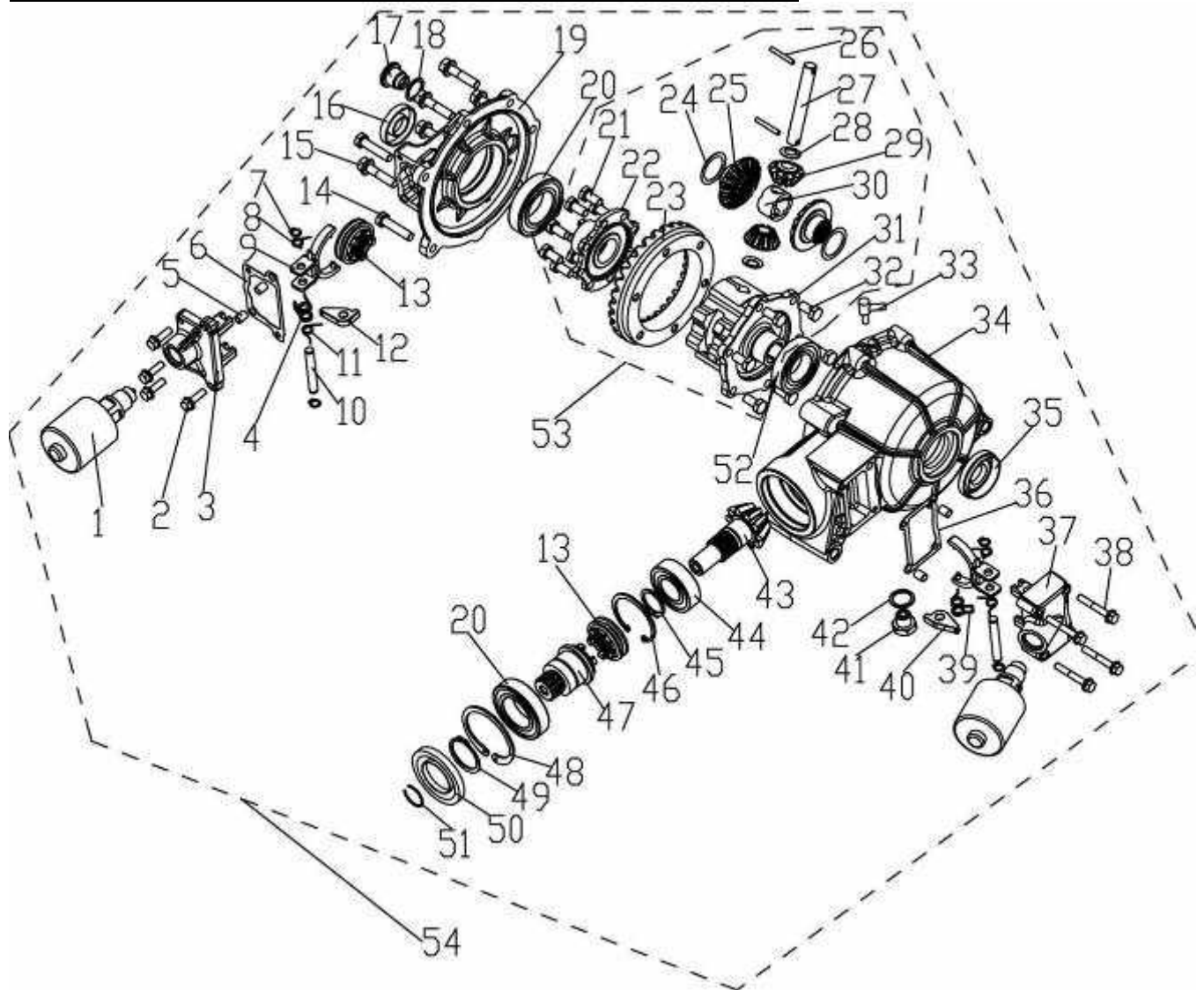
10. Install oil-seal 35X62X7 **A**, oil-seal 27x42x7 **B**, oil-seal 22X48X11.



11. Install the jointor **A** into the housing. Install the electromagnetic valves **B**, torque bolts to 40ft.lbs (54Nm). Install oil drain plug **D** and washer **C**, torque bolt to 21ft.lbs (28Nm). Add 450 ml gear oil, then install diff filler plug **F** and washer **E**, torque bolt to 24ft.lbs. (32Nm).



**10.12.4 FRONT GEARCASE EXPLODED VIEW**



- |                          |                        |                          |                          |
|--------------------------|------------------------|--------------------------|--------------------------|
| 1. Electromagnetic valve | 2. Bolt M6X22          | 3. Diff lock cover       | 4. Diff lock pawl spring |
| 5. Locating pin          | 6. Paper washer A      | 7. D8 lock snap ring     | 8. Return spring 2       |
| 9. Diff dog self fork    | 10. Diff fork pivot    | 11. Return spring 1      | 12. Diff lock fork pawl  |
| 13. Splined dog          | 14. Bolt M8X25         | 15. Bolt M8X25           | 16. Oil-seal 27x42x7     |
| 17. Diff filler plug     | 18. Washer 16          | 19. Housing cover        | 20. Bearing 6007         |
| 21. Bolt M8X15           | 22. Diff carrier cover | 23. Bevel crownwheel     | 24. Washer               |
| 25. Bevel gear           | 26. Roll pin           | 27. Center pin           | 28. Bevel pinion washer  |
| 29. Bevel pinion         | 30. Center spacer      | 31. Differential housing | 32. Bolt M8X18           |
| 33. Jointor              | 34. Housing            | 35. Oil-seal 22X48X11    | 36. Paper washer B       |
| 37. Diff 4WD cover       | 38. Bolt M6X40         | 39. Diff 4WD pawl spring | 40. Diff 4WD fork pawl   |
| 41. Oil drain plug       | 42. Washer 12          | 43. Pinion               | 44. Bearing 6205         |
| 45. D25 lock snap ring   | 46. D52 lock snap ring | 47. Input shaft          | 48. D62 lock snap ring   |
| 49. D35 lock snap ring   | 50. Oil-seal 35X62X7   | 51. Bead flange          | 52. Bearing 6006         |
| 53. Differential         | 54. Front gearcase     |                          |                          |

**10.13 REAR GEAR-BOX****10.13.1 REAR GEAR CASE DISASSEMBLY**

1. Drain and properly dispose of used oil.
2. Loosen the cover bolts in a crisscross pattern in several steps and remove them.
3. Pry the cover at the prying points using a screw-driver and remove the output cover. Remove the o-ring.
4. Remove the ring gear and bearing assembly.
5. Remove the oil seals and o-ring.
6. Unstake the pinion bearing lock nut with a drill or grinder. Remove the lock nut using the special tool.
7. Remove the pinion bearing assembly.

**10.13.2 REAR GEAR CASE ASSEMBLY**

1. Drive the pinion gear assembly into the drive housing.
2. Install a new lock nut and tighten it using the special tool.
3. Stake the lock into the case groove.
4. Coat a new O-ring with grease and install it onto the pinion gear shaft.
5. Apply grease to the lips of new oil seals. Install the inner oil seal into the drive housing until it is flush with the stepped edge.
6. Install the outer oil seal into the drive housing until with the drive housing outer surface.
7. Coat a new O-ring with grease and install it into the cover groove.
8. Install the outer cover onto the drive housing.





9. Install the cover bolts and tighten them in several steps until the cover evenly touches the drive housing. Then while rotating the pinion gear, tighten the bolts to the specified torque in a crisscross pattern in several steps.

TORQUE:

10mm bolt:45N.m

8mm bolt: 25N.m

10. Check that the gear assembly turns smoothly without binding.



### 10.13.3 BACKLASH INSPECTION

Remove the oil filler cap.

Install the special tool into the pinion joint, and set the final drive assembly and tool in a vise.

Install the drive shaft into the final drive assembly and hold it.

Set a horizontal type dial indicator on the ring gear through the filler hole.

Turn the ring gear back and forth with the drive shaft to read backlash.

**STANDARD:0.05-0.25mm**

**SERVICE LIMIT:0.4mm**

Remove the dial indicator. Turn the ring gear 120° and measure backlash.

Repeat this procedure once more.

Compare the difference of the three measurements.

**SERVICE LIMIT:0.2mm**

If the difference in measurements exceeds the service limit, it indicates that the bearing is not installed squarely, or the case is deformed.

Inspect the bearings and case.

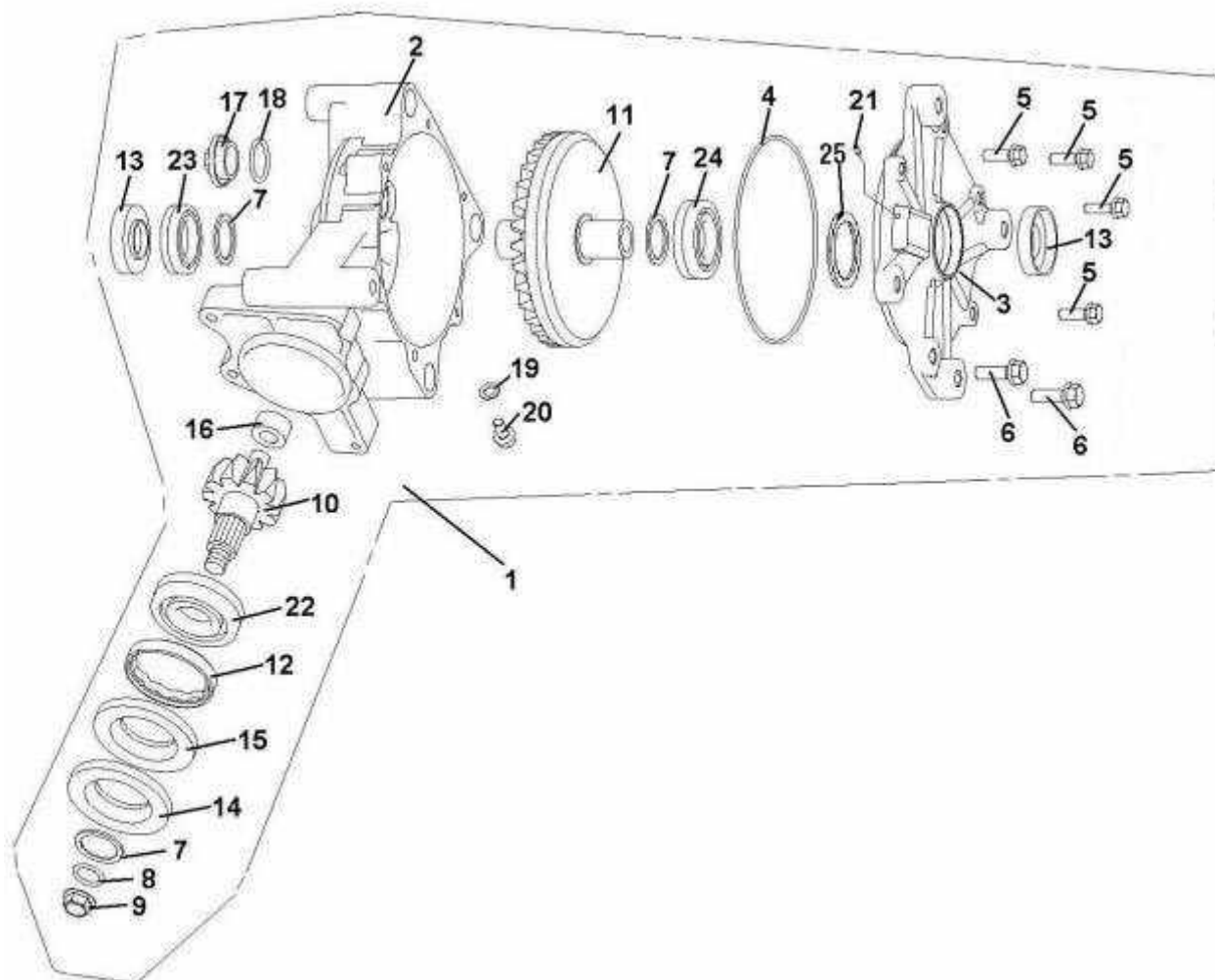
If the backlash is excessive, replace the ring gear right shim with a thinner one.

If the backlash is small, replace the ring gear right shim with a thicker one.

Backlash is changed by about 0.06mm when thickness of the spacer is changed by 0.12mm.



REAR GEARCASE EXPLODED VIEW



- 1. REAR GEAR-BOX ASSY    2. DRIVE HOUSING    3. OUTPUT COVER    4. O-RING 160X2.65
- 5. BOLT M8X28    6. BOLT M10X1.25X28    7. WASHER 35.5    8. O-RING 20X3    9. NUT M16X1.5
- 10. OUTPUT AXLE, RING REAR GEAR-BOX    11. INPUT AXLE, RING REAR GEAR-BOX    12. LOCK NUT
- 13. SEAL 35X55X11    14. SEAL 38X85X8    15. SEAL 38X80X8    16. BEARING 15NQ2815
- 17. OIL SCREEN CAP    18. O-RING    19. WASHER    20. OIL PLUG    21. tube, REAR GEAR-BOX BREATHER
- 22. BEARING 6306    23. BEARING 6007    24. BEARING 6207
- 25. WASHER 60