TGB

Play different

EST 1000

SERVICE MANUAL

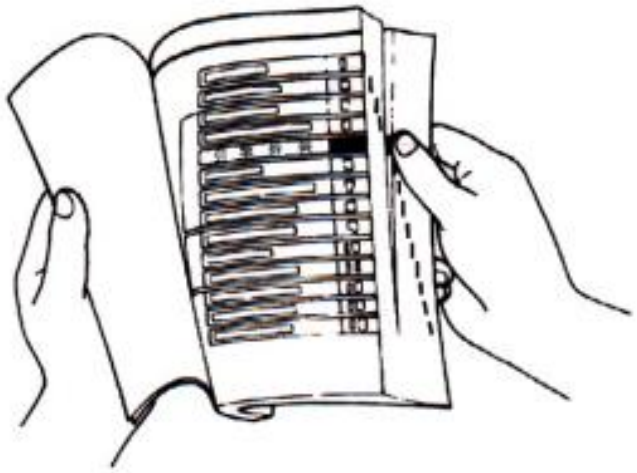
TAIWAN GOLDEN BEE CO.,LTD.

This service manual contains the technical data of each component inspection and repairs for the TGB Blade 1000. The manual is shown with illustrations and focused on "Service Procedures", "Operation Key Points", and "Inspection Adjustment" so that provides technician with service guidelines.

If the style and construction of the TGB Blade 1000 are different from that of the photos, pictures shown in this manual, the actual vehicle shall prevail. Specifications are subject to change without notice.

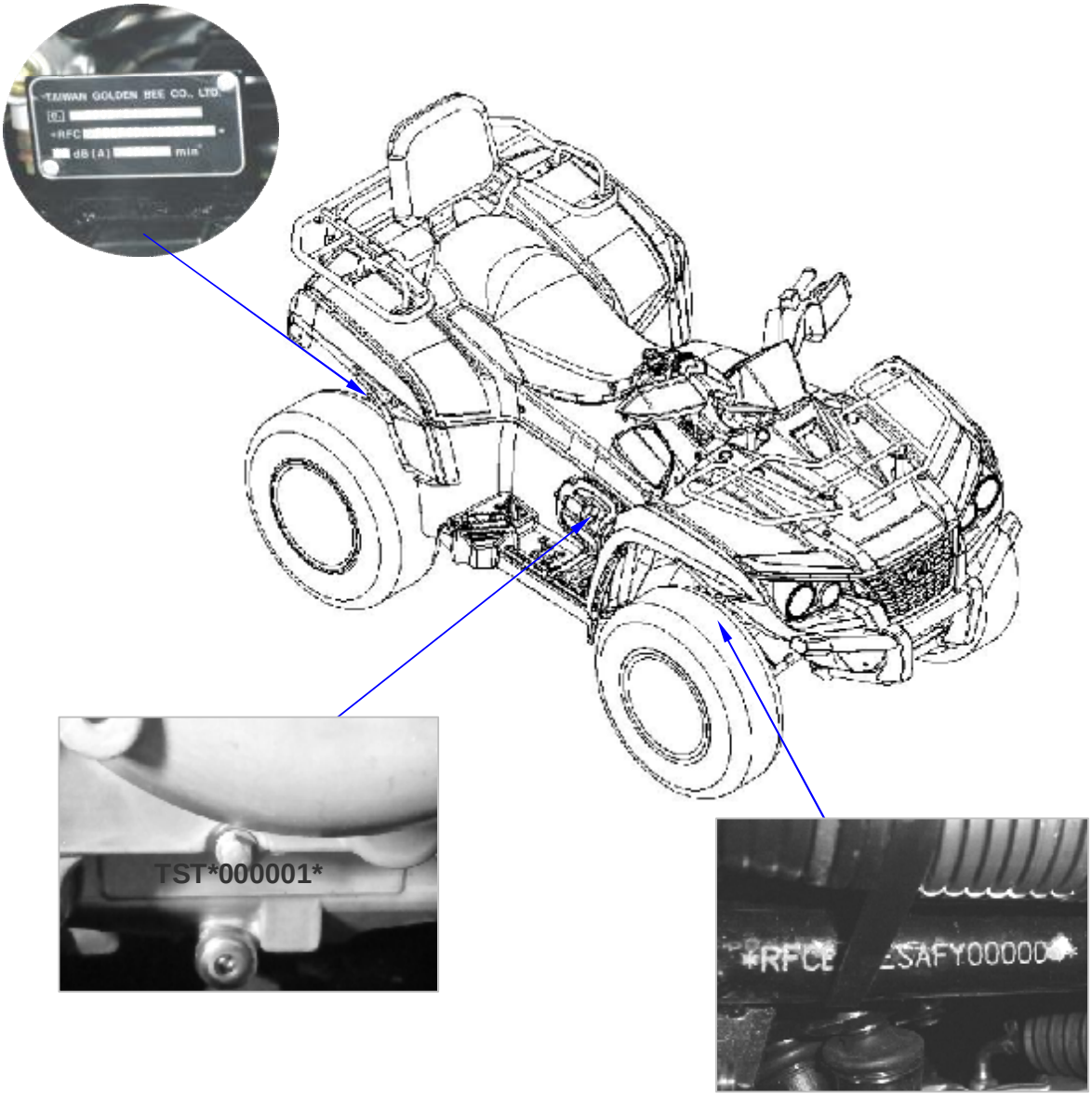
This service manual describes basic information of different system parts and system inspection & service for TGB Blade 1000. In addition, please refer to the manual contents in detailed for the model you serviced in inspection and adjustment.

Please see the content for quick having the special parts and system information.



SERIAL NUMBER

Frame Number and Engine Number



Specification

Fuel Tank Capacity			2300 c.c.	
Engine Oil	Oil & Filter Change		2000 c.c.	
	Oil change		1800 c.c.	
	New Engine		2300 c.c.	
Transmission Gear oil	Bear Box	Capacity	900 cc	
	Front	Capacity	350 c.c.	
	Rear	Capacity	500 c.c.	
Capacity of coolant	Engine + Radiator		2600 c.c.	
	Reservoir upper		1100 c.c.	
Clearance of throttle valve			1~3 mm	
Spark Plug	Type		NGK DCPR8E	
	Gap		0.7~0.8 mm	
Idling speed			1250±100 rpm	
Cylinder compression pressure			9 ±1 kgf/cm²	
Valve clearance			IN:0.10 ± 0.02 mm EX:0.15 ± 0.02 mm	
Tire dimension	Front		AT25x8-12	AT26x8-14
	Rear		AT25x10-12	AT26x10-14
Tire pressure			7 psi	
Battery			12V18Ah (type : MF battery)	

Periodical Maintenance Schedule

INTERVAL / ITEM	MONTHS	1	3	6	12
	Kms	INITIAL 200	EVERY 1000	EVERY 2000	EVERY 4000
	MILES	INITIAL 120	EVERY 600	EVERY 1200	EVERY 2400
Muffler Bolts and Exhaust Pipe Nuts		T	T	T	T
Valve Clearance		I	-	I	I
Air Cleaner		-	C	C	R
Air Cleaner Vent Tube			I	I	I
Engine Idle RPM		I	I	I	I
Spark Plus		-	-	I	I
		Replace Every 6000KM (4000 MILES)			
Engine Oil		R	-	R	R
Oil Filter		R	-	R	R
Front Differential Set Oil		R	-	R	R
		Replace Every 6000KM or Every 6 Months			
Final Gear Oil		R	-	R	R
		Replace Every 6000KM or Every 6 Months			
C.V.T Belt		-	-	I	I
Fuel Tube		-	I	I	I
		Replace Every 4 Years			
Throttle Cable Play		I	I	I	I
Brakes		I	I	I	I
Brake Hose		-	-	I	I
		Replace Every 4 Years			
Brake Fluid		-	I	I	I
		Replace Every 2 Years			
Tires		-	I	I	I
Suspensions		-	-	I	I
Steering System		I	I	I	I
Chassis Bolts and Nuts		T	T	T	T
General Lubrications		-	L	L	L
Grease nipple		-	-	L	L

Code: C ~ Cleaning (replaced if necessary) I ~ Inspection, cleaning, and adjustment
L ~ Lubrication R ~ Replacement T ~ Tighten

Have your ATV checked, adjusted, and recorded maintenance data periodically by your TGB Authorized Dealer to maintain the ATV at the optimum condition.
The above maintenance schedule is established by taking the monthly 1000 kilometers as a reference which ever comes first.

Remarks:

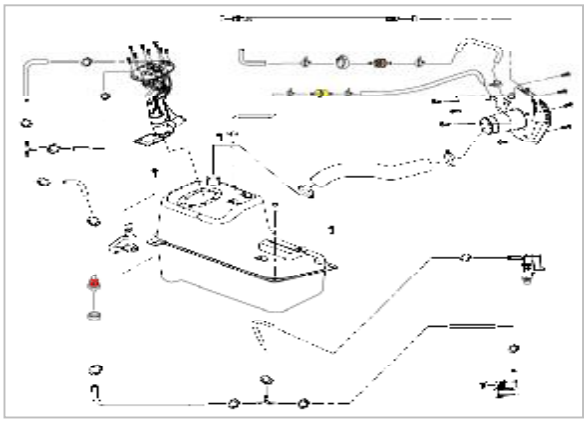
1. Clean or replace the air cleaner element more often when the ATV is operated on dusty roads or in the Heavily- polluted environment.
2. Maintenance should be performed more often if the ATV is frequently operated in high speed and after the ATV has accumulated a higher mileage.
3. Preventive maintenance
   a. Ignition system – Perform maintenance and check when continuous abnormal ignition, misfire, after-burn, overheating occur.
   b. Carbon deposit removal – Remove carbon deposits in cylinder head, piston heads, exhaust system when power is obviously lower than normal.

Fuel Lines

Check all lines, and replace it when they are deterioration, damage or leaking.
For removal, refer to chapter 4 Fuel Pump.

Warning

Gasoline is a low ignition material so any kind of fire is strictly prohibited as dealing it.



Acceleration Operation

Have a wide open of throttle valve as handle in any position and release it to let back original (full closed) position.
Check handle if its operation is smooth.
Check acceleration cable and replace it if deteriorated, twisted or damaged.
Lubricate the cable if operation is not smooth.
Measure the throttle lever free play in its flange part.
Remove rubber boot, loosen fixing nut, and then adjust it by turning the adjustment screw.
Tighten the fixing nut, and check acceleration operation condition.

Free play: 1~3 mm.

Air Cleaner

Open access cover.
Counterclockwise turn the lid and pull out the element
Loosen the screw and separate the element.
Clean the sponge with non-flammable or high-flash point solvent and then squeeze it for dry.

Caution

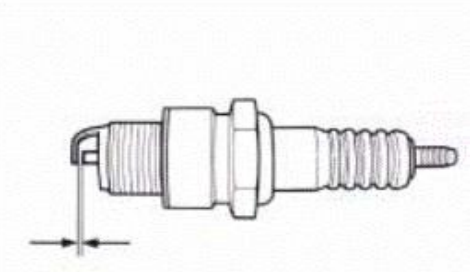
Never use gasoline or acid organized solvent to clean the element.

For installation, reverse the removal procedure.

Spark Plug

Recommended spark plug:
NGK / DCPR8E

Remove spark plug cap.
Clean dirt around the spark plug hole. Remove spark plug.
Measure spark plug gap.
Spark plug gap：**0.7~0.8 mm**



Carefully bend ground electrode of the plug to adjust the gap if necessary.
Hold spark plug washer and install the spark plug by screwing it.
Tighten the plug by turning 1/2 turn more with plug socket after installed.

Tighten torque: 2.0~0.2kgf-m

Valve Clearance

Caution

Checks and adjustment must be performed when the engine temperature is below 35℃.

Remove front fender, top cover and air cleaner.
Remove cylinder head cover.
Turn camshaft bolt in C.W. direction and let the Printing mark on the camshaft sprocket align with cylinder head mark so that piston is placed at TDC position in compression stroke.

Caution

Do not turn the bolt in C.C.W. direction to prevent from camshaft bolt looseness.

Valve clearance inspection and adjustment.
Check & adjust valve clearance with feeler gauge.

Standard Value: IN 0.10 ± 0.02 mm
EX 0.15 ± 0.02 mm

Loosen fixing nut and turn the adjustment nut for adjustment.

Caution

Re-check the valve clearance after tightened the fixing nut.

Ignition System

For ignition system, refer to chapter 5 electric system.

Cylinder Compression Pressure

Warm up engine.

Turn off the engine.

Remove the top cover.

Remove the side cover.

Remove any one of the spark plug cap and spark plug.

Install compression gauge.

Full open the throttle valve, and rotate the engine by means of starter motor.

Caution

- Rotate the engine until the reading in the gauge no more increasing.
- Usually, the highest pressure reading will be obtained in 4~7 seconds.

Compression pressure: 9.0 ± 2 bar

Check following items if the pressure is too low:

- Incorrect valve clearance.
- Valve leaking.
- Cylinder head leaking, piston, piston ring and cylinder worn out.

If the pressure is too high, it means carbon deposits in combustion chamber or piston head.

Drive Belt

Remove side cover.

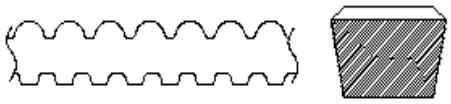
Remove footrest.

Remove bolts of the clutch cover.

Check if the belt is crack or worn out.

Replace the belt if necessary or in accord with the periodical maintenance schedule to replace it.

Width limit: 31.0 mm or above



Brake System

Brake System Hose

Make sure the brake hoses for corrosion or leaking oil.

Brake Fluid

Check brake fluid level in the brake fluid reservoir.

If the level is lower than the LOWER limit, add brake fluid to UPPER limit. Also check brake system for leaking if low brake level found.

Caution

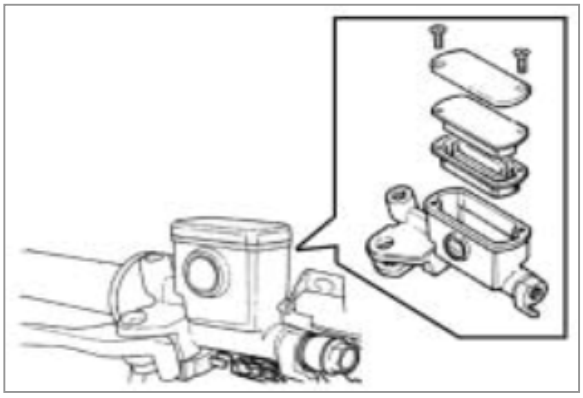
- In order to maintain brake fluid in the reservoir in horizontal position, do not remove the cap until handle stop.
- Do not operate the brake lever after the cap had been removed. Otherwise, the brake fluid will spread out if operated the lever.
- Do not mix non-compatible brake fluid together.

Filling Out Brake Fluid

Tighten the drain valve, and add brake fluid. Operate the brake lever so that brake fluid contents inside the brake system hoses.

Air Bleed Operation

Connect a transparent hose to draining valve. Hold the brake lever and open air bleeding valve. Perform this operation alternative until there is no air inside the brake system hoses.

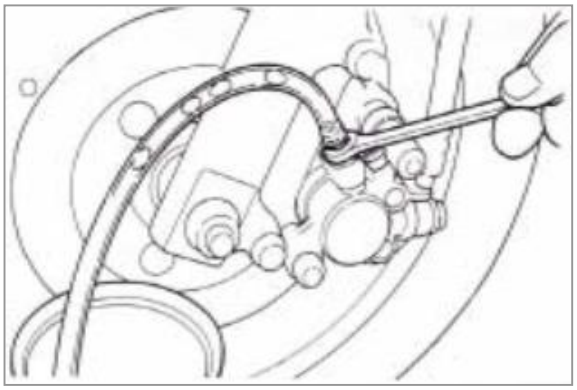


Caution

Before closing the air bleed valve, do not release the brake lever.

Added Brake Fluid

Add brake fluid to UPPER limit lever. Recommended brake fluid: DOT3 or DOT4 WELL RUN brake fluid.



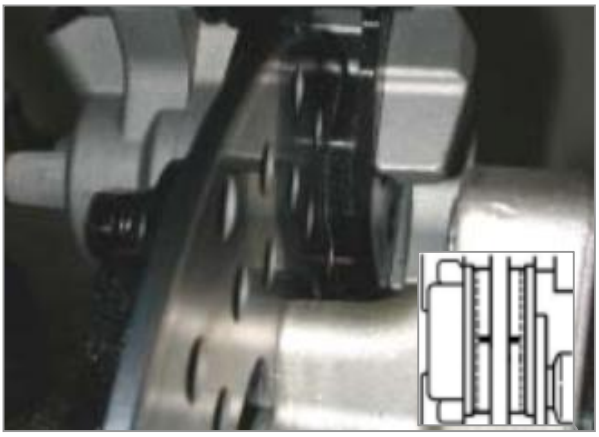
Caution

Never mix or use dirty brake fluid to prevent from damage brake system or reducing brake performance.

Brake Lining Wear

The indent mark on brake lining is the wear limitation.

Replace the brake lining if the wear limit mark closed to the edge of brake disc.



Caution

- To check front brake lining must be remove front wheel first.
- It is not necessary to remove brake hose when replacing the brake lining.

Brake Lining Replacement (refer chapter 7-3)

Make sure the brake lining condition. Replace the lining if the brake lining wear limitation groove close to the brake disc.

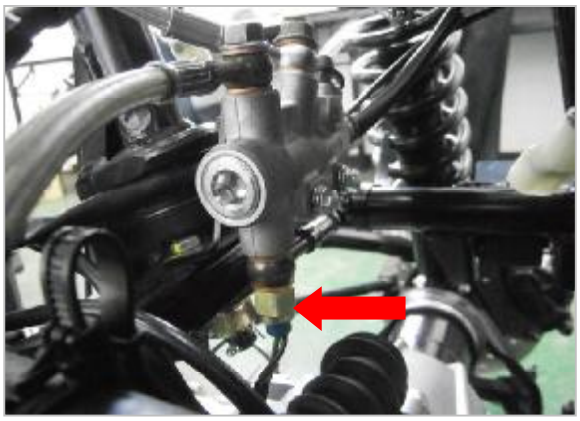
Caution

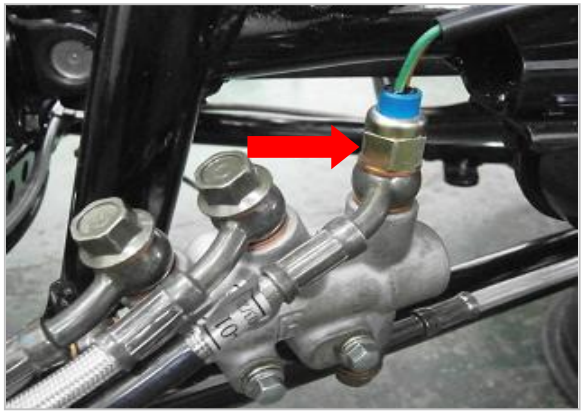
- Do not operate the brake lever after the clipper removed to avoid clipping the brake lining.
- In order to maintain brake power balance, the brake lining must be replaced with one set.

Brake Light Switch/Starting Inhibitor Switch

The brake light switch is to light up brake light as brake applied.

Make sure that electrical starter can be operated only under brake applying.





Headlight Beam Distance

Turn on main switch.

Headlight beam adjustment.

Turn the headlight adjustment screw to adjust headlight beam high.

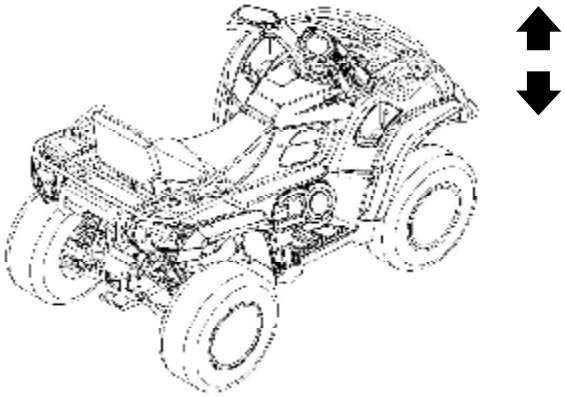
Caution

- To adjust the headlight beam follows related regulations.
- Improper headlight beam adjustment will make in coming driver dazzled or insufficient lighting.

Cushion

Warning

- Do not ride the ATV with poor cushion.
- Looseness, wear or damage cushion will make poor stability and drive-ability.



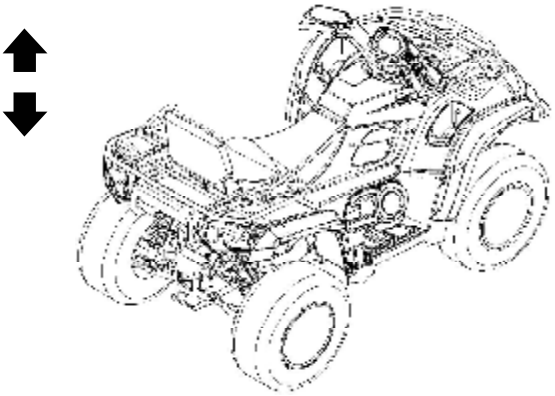
Front cushion

Press down the front cushion for several times to check it operation.

Check if it is damage

Replace relative parts if damage found.

Tighten all nuts and bolts.



Rear Cushion

Press down the rear cushion for several times to check it operation.

Check if it is damage

Replace relative parts if damage found.

Steering Handle

Caution

Check all wires and cables if they are interfered with the rotation of steering handle bar.

Lift the front wheel out of ground.

Turn handle from right to left alternative and check if turning is smoothly.

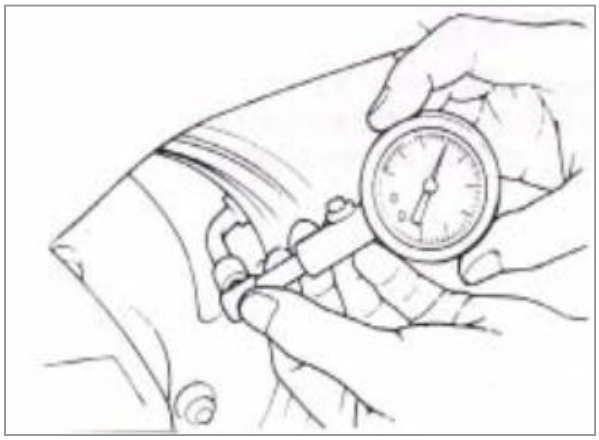
If handle turning is uneven and bending, or the handle can be operated in vertical direction, then check the handle top bearing.

Wheel/Tire

Caution

Tire pressure check should be done as cold engine.

Check if tire surface is ticked with nails, stones or other materials.



Appointed tire pressure

Tire size	Front Tire	Rear Tire
Tire pressure as cold	7 psi	7 psi

Check if front and rear tires' pressure is in normal. Measure tire thread depth from tire central surface. Replace the tire if the depth is not come with following specification:

Front tire: 1.5 mm
Rear tire: 2.0 mm

Nuts, Bolts Tightness

Perform periodical maintenance in accord with the Periodical Maintenance Schedule

Check if all bolts and nuts on the frame are tightened securely.

Check all fixing pins, snap rings, hose clamp,

and wire holders for security.

Special Tools List

PARTS NO. : 440649
PARTS NAME : EXTENSION PULLER / REMOVER

PARTS NO. : 440650
PARTS NAME : BUSHING(924739) REMOVER

PARTS NO. : 440651
PARTS NAME : BEARING(924384) REMOVER φ15

PARTS NO. : 440652
PARTS NAME : BEARING(924384) REMOVER φ20

PARTS NO. : 440653
PARTS NAME : BEARING(924384) REMOVER φ45

PARTS NO. : 440656
PARTS NAME : L CRANK CASE OIL SEAL REMOVER

PARTS NO. : 552303
PARTS NAME : PISTON & ROD CONNECTING HOLDER

PARTS NO. : 440662
PARTS NAME : CYLINDER HEAD VALVE GAP ADJUSTER

PARTS NO. : 440667
PARTS NAME : CYLINDER HEAD VALVE AND SPRING INSTALLER/REMOVER

PARTS NO. : 440671
PARTS NAME : WET CLUTCH SCREW NUT FIXER

PARTS NO. : 560001
PARTS NAME : FLYWHEELREMOVER

PARTS NO. : 560002
PARTS NAME : FLYWHEEL INSTALLER

PARTS NO. : 560003
PARTS NAME : RIGHT CRANKCASE MECHNICAL SEAL INSTALLER/REMOVER

PARTS NO. : 560004
PARTS NAME : DRIVE PULLEY FIXING ROD

PARTS NO. : 560005
PARTS NAME : DRIVEN PULLEY FIXING TOOL

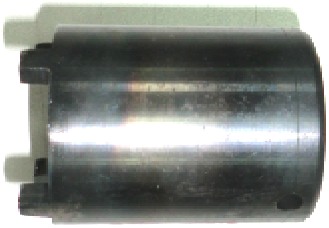
PARTS NO. : 560006
PARTS NAME : DRIVE PULLEY REMOVER

PARTS NO. : 560007
PARTS NAME : DRIVEN PULLEY EXTEND TOOL FOR REMOVE BELT

PARTS NO. : 560008
PARTS NAME : BEARING REMOVER (W/ 440649 Ø20 mm)

PARTS NO. : 560009
PARTS NAME : DEAR DIFF. NEEDLE BEARING REMOVER (W/ 440649 Ø20 mm)

PARTS NO. : 560010
PARTS NAME : REAR DIFF. BEARING SPACER INSTALLER



PARTS NO. : 552312
PARTS NAME : EPS STEERING BEARING SEAT SOCKET

PARTS NO. : 560011
PARTS NAME : PLAIN BEARING INSTALLER (LEFT CRANKCASE)

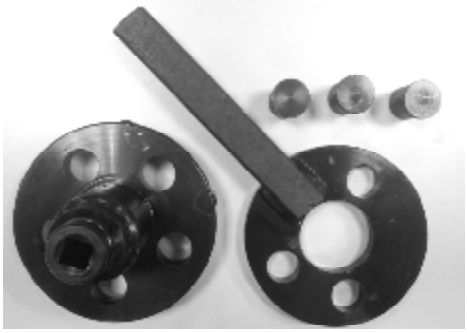
PARTS NO. : 560012
PARTS NAME : PLAIN BEARING REMOVER (LEFT CRANKCASE

PARTS NO. : 560013
PARTS NAME : PLAIN BEARING INSTALLER (RIGHT CRANKCASE)

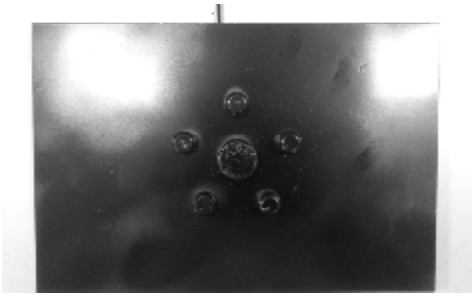
PARTS NO. : 560014
PARTS NAME : PLAIN BEARING REMOVER (RIGHT CRANKCASE

PARTS NO. : 560015
PARTS NAME : CRANKCASE COVER LH PLAIN BEARING INSTALLER (LEFT CRANKCASE)

PARTS NO. : 560016
PARTS NAME : CRANKCASE COVER LH PLAIN BEARING REMOVER (LEFT CRANKCASE

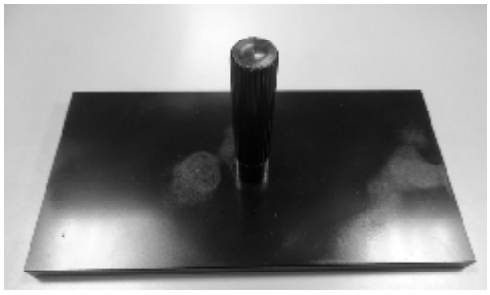


PARTS NO. : 560017
PARTS NAME : GOVERNOR CUP INSTALLER/REMOVER KIT (DRIVE PULLEY)



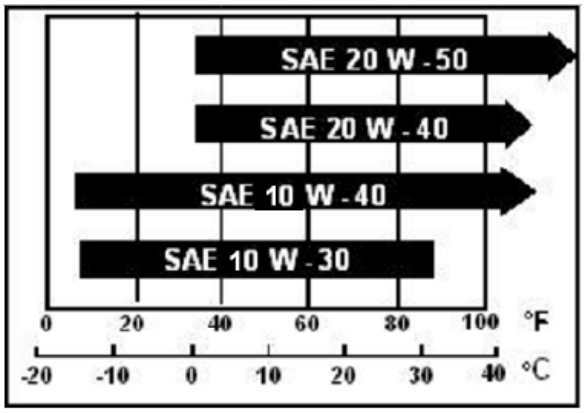
PARTS NO. : 560018
PARTS NAME : DRIVE PULLEY FIXING SEAT FOR INSTALL AND REMOVE

PARTS NO. : 560019
PARTS NAME : HAFT SHEAVE PRESSING TOOL



PARTS NO. : 560020
PARTS NAME : DRIVEN PULLEY FIXING SEAT FOR INSTALL AND REMOVE

Precautions in Operation



General Information

This chapter contains maintenance operation for the engine oil pump and gear oil replacement.

Specifications

Engine oil quantity

Overhaul: 2300 c.c.

Filter change: 1800 c.c.

Change: 2000 c.c.

Oil viscosity SAE 10W-40

Items		Standard (mm)	Limit (mm)
Oil pump	Inner rotor clearance	0.15	0.20
	Clearance between outer rotor and body	0.15~0.20	0.25
	Clearance between rotor side and body	0.04~0.09	0.12

Torque value

Torque value oil filter cover 1.2 kgf-m

Engine oil drain bolt 2.4 kgf-m

Troubleshooting

Low engine oil level

- Oil leaking
- Valve guide or seat worn out
- Piston ring worn out
- Camshaft worn out
- Camshaft main bearing worn out

Low oil pressure

- Low engine oil level
- Clogged in oil strainer, circuits or pipe, oil radiator gasket
- Oil pump damage
- Oil pressure valve, oil filter

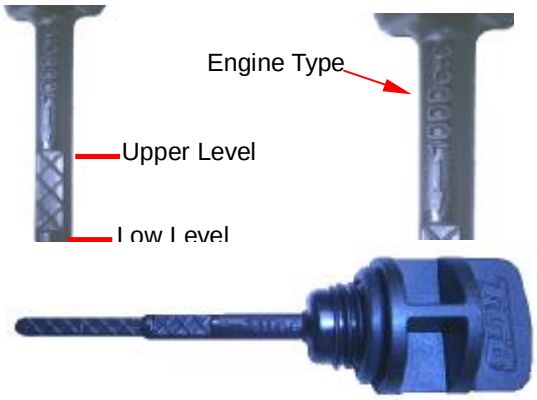
Dirty oil

- No oil change in periodical
- Cylinder head gasket damage
- Piston ring worn out
- Camshaft worn out
- Camshaft main bearing worn out

Oil Level Verification

NOTE: *Strictly follow this procedure, otherwise wrong oil level may be indicated.*

- Ensure vehicle is on a level surface.
- Start engine and let idle for a few minutes.
- Stop engine, wait a few minutes to allow oil to flow down to crankcase then check oil level.
- Fully screw in dipstick to check oil level.
- Remove dipstick and read the oil level.
- Oil level must be between minimum and maximum marks on dipstick.
- Refill oil as necessary. Do not overfill.
- Reinstall dipstick.



Oil Filter Change

- Ensure the vehicle is on a level surface.
- Oil and oil filter must be replaced at the same time. Oil change and oil filter replacement should be done with a warm engine.

WARNING

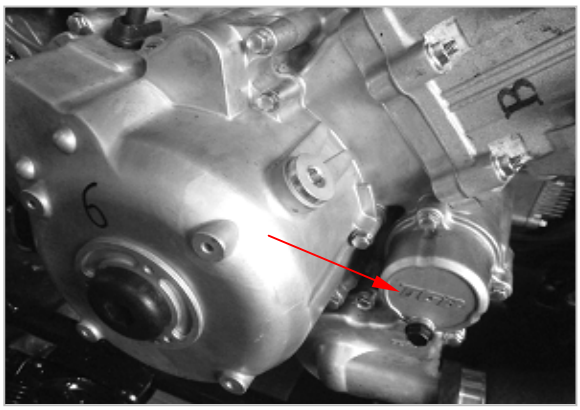
Engine oil can be very hot. Wait until engine oil is warm

- Place a drain pan under the engine drain plug area.
- Clean the drain plug area.
- Unscrew drain plug and discard the gasket ring.
- Remove dipstick.
- Allow oil to drain completely from crankcase.

NOTE: *Oil condition gives information about the engine condition.*

- clean the magnetic drain plug from metal shavings and residue. Presence of debris gives an indication of failure inside the engine. Check engine to correct the problem.
- Install a NEW gasket ring on drain plug.

TORQUE: 2.4 kgf-m



CAUTION

Never use the gasket ring a second time. Always replace by a new one.

- Replace oil filter.
- Refill engine with recommended engine oil.
- Oil change capacity with filter: 2.0 L.
- After filling, check the oil level with dipstick.
- Run engine to ensure oil filter and drain plug areas are not leaking.
- Dispose oil and filter as per your local environmental regulation.

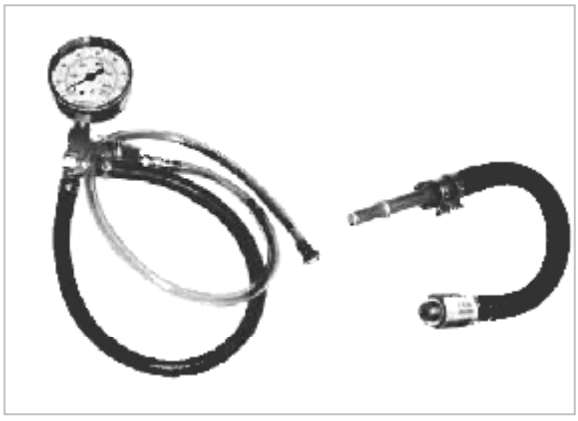
INSPECTION

ENGINE OIL PRESSURE

NOTE: *The engine oil pressure test should be done with a warm engine 90℃ and the recommended oil.*

- Remove the oil pressure switch.
- Install *PRESSURE GAUGE* and *ADAPTER HOSE*.

The engine oil pressure should be within the following values.

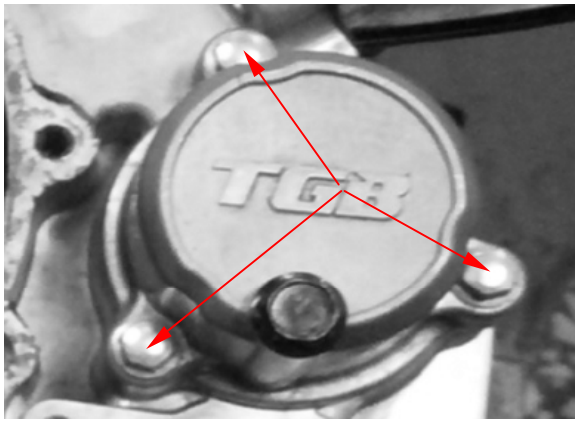


OIL PRESSURE	1250 RPM	6000 RPM
MINIMAL	10 psi	39 psi
NORMIAL	22 psi	46 psi
MAXIMAL	36 psi	70 psi

- If the engine oil pressure is out of specifications, check the points described in troubleshooting section.
- Removal oil pressure gauge and adapter hose.

NOTE: *To remove adapter hose from oil pressure gauge, use the disconnect tool.*

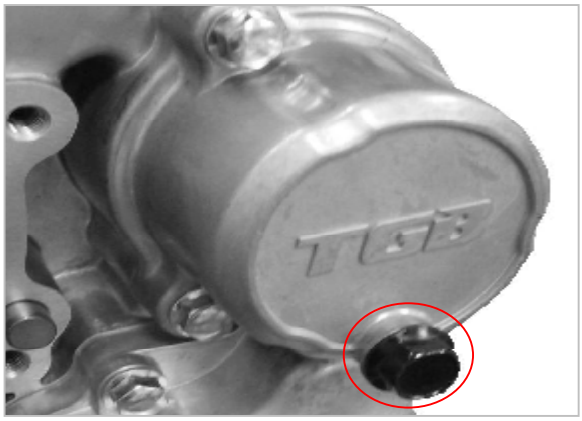
- Reinstall the oil pressure switch.



OIL FILTER

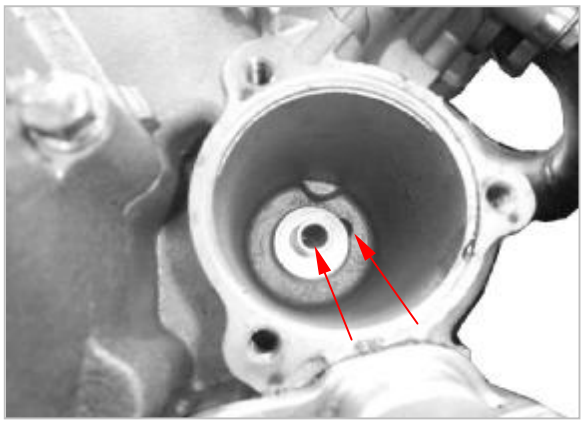
Oil Filter Removal

- Remove oil filter drain screw and washer.
- Drain out the oil inside the filter housing
- Remove three retaining screws and cover.
- Remove oil filter.



Oil Filter Inspection

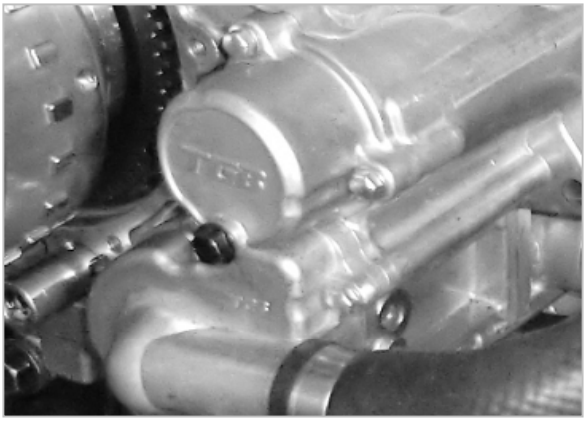
Check and clean the oil filter inlet and outlet area for dirt and other contaminations.



Oil Filter Installation

- Install a new O-ring on oil filter.
- Install the filter into the cover.
- Apply engine oil on O-ring and grease on the end of filter.
- Install the cover on the engine.

TORQUE: 1.2 kgf-m



OIL PRESSURE SWITCH

Oil Pressure Switch Activation

- Oil pressure switch works when engine oil pressure is between 20 and 40 kPa.
- To check the function of the oil pressure switch, an oil pressure test has to be performed. If the engine oil pressure is good, check the resistance of the oil pressure switch while engine is off and while engine is running.

Oil Pressure Switch Test

- Disconnect the connector from oil pressure switch.
- Use multimeter to check the continuity.
- Replace the oil pressure switch if necessary.
- If OK, check the continuity of the wiring harness.

Oil Pressure Switch Removal

Unplug then unscrew the oil pressure switch.

Oil Pressure Switch Installation

NOTE: *Install oil pressure switch with LOCTITE 243.*

TORQUE: 1.7 kgf-m.

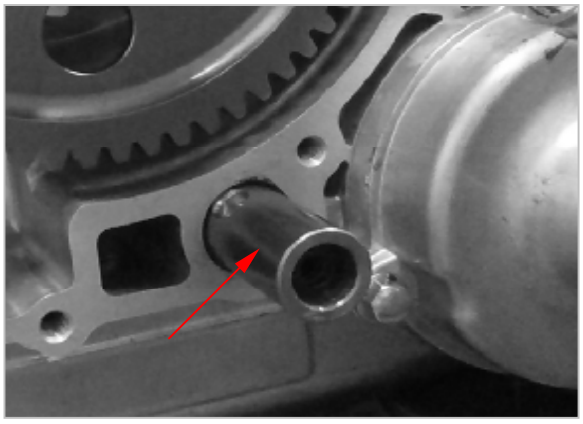
ENGINE OIL PRESSURE VALVE

The oil pressure valve is located on the engine magneto side (inside magneto cover).

NOTE: *The oil pressure valve system works when oil pressure exceeds 70 psi.*

Removal

- Remove the bolts and the ACG cover.
- Pull out the oil pressure valve and washer.



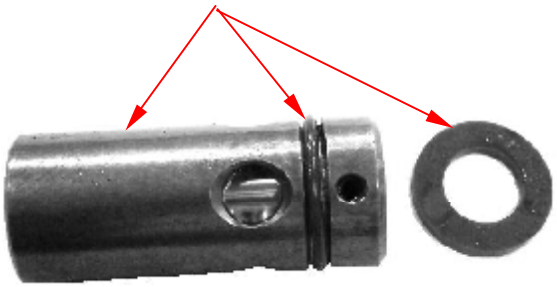
Inspection

- Inspect pressure valve housing, O-ring and valve for scoring or other damages.
- Clean bore and thread in the magneto housing from metal shavings and other contamination.

Installation

For installation, reverse the removal procedure.

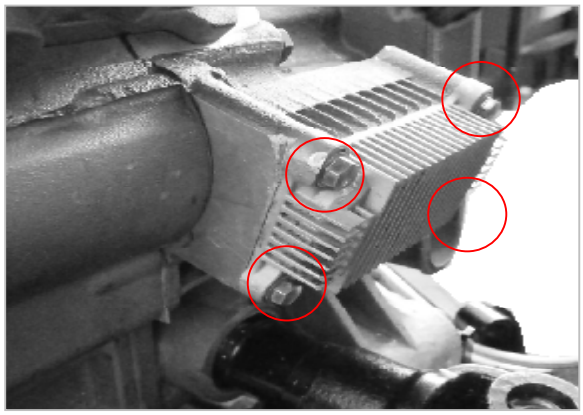
NOTE: *At installation, always replace the gasket ring.*



OIL RADIATOR

Oil Radiator Removal

- Drain engine oil.
- Drain coolant.
- Remove oil radiator cap retaining bolts.
- Place rags or towels under oil cooler to catch remaining oil and coolant.
- Remove oil radiator and discard gasket.

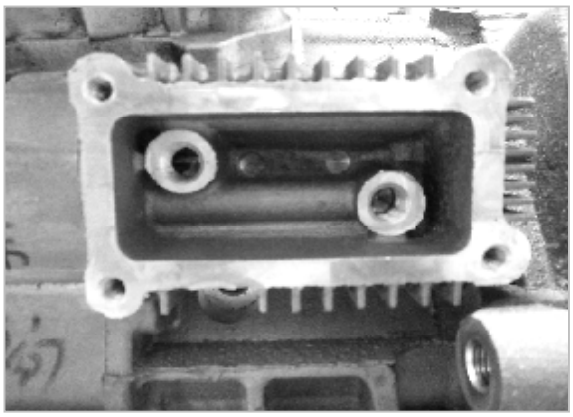


Oil Radiator Inspection

- Check oil radiator for cracks or other damage.
- Replace if necessary.

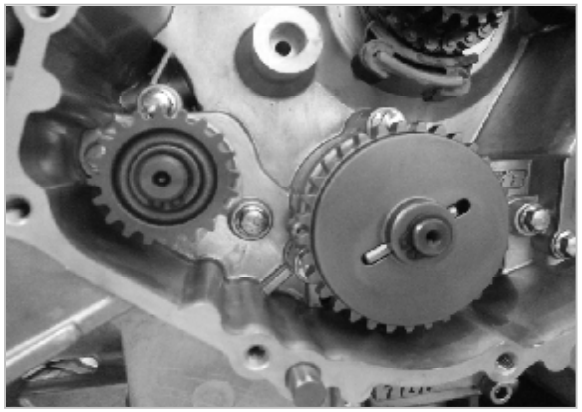
Oil Radiator Installation

- For installation, reverse the removal procedure.
- Wipe off any oil and coolant spillage.
- Install a new gasket.
- Refill engine oil with recommended oil and at the proper oil level.
- Refill and bleeding cooling system.



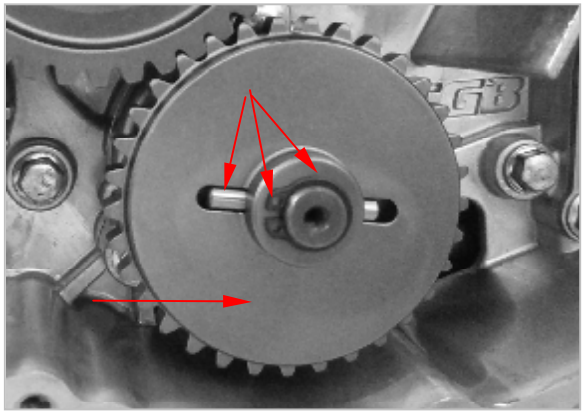
OIL PUMP

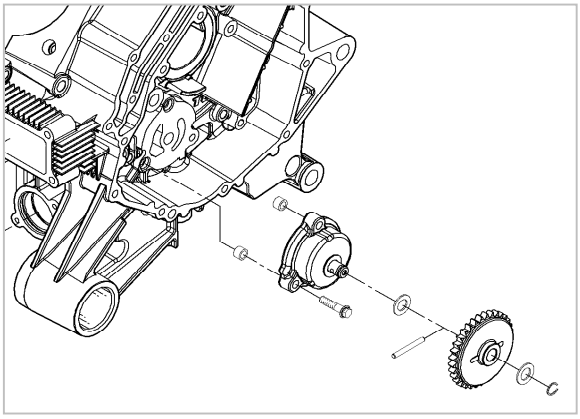
The oil pump is located on the engine CVT side (behind cover).



Removal

- Drain engine oil.
- Remove parts to access the CVT cover.
- Remove the CVT cover.
- Remove CVT assembly.
- Remove crankcase cover LH.
- Remove:
  - retaining ring.
  - oil pump gear.
  - needle pin
  - thrust washer.
  - oil pump flange bolts.
  - oil pump cover screws and pull oil pump cover.
  - oil pump shaft with inner rotor and outer rotor.





Inspection

- Inspect oil pump for marks or other damages.
- Check for scratches din crankcase between outer rotor and oil pump bore. If so, replace damaged parts.
- Check inner rotor for corrosion pinholes or other damages. If so, replace oil pump shaft assembly.

- Using a feeler gauge, measure the clearance of inner and outer rotors as shown.
- If clearance of inner and outer rotors exceeds the tolerance, replace oil pump shaft assembly. Ensure to also check oil pump cover. If damaged, replace the complete oil pump assembly.
- If clearance between outer rotor and its bore in crankcase exceeds the tolerance, replace the complete oil pump assembly and/or the crankcase.
- Using a depth gauge, measure the axial clearance of the oil pump as shown.
- Difference between measurements should not exceed 0.2 mm. If so, replace the complete oil pump assembly.

NOTE: *When the axial clearance of the oil pump shaft assembly increases, the oil pressure decreases.*

Installation

For installation, reverse the removal procedure.

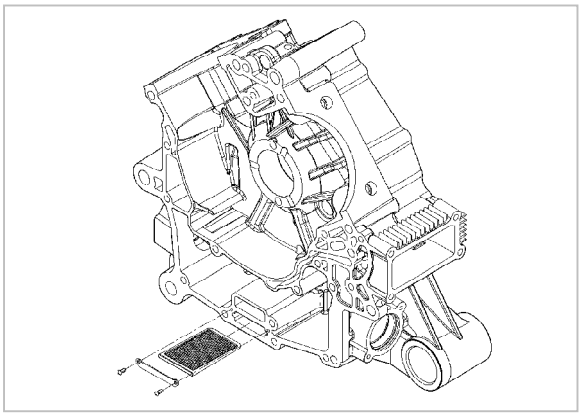
NOTE: *The outer rotor and inner rotor are marked. When installing, make sure both markings are on the upper side.*

After reinstallation of remaining parts, check for smooth operation of the oil pump assembly.

Oil Pump Final Test

After engine is completely reassembled, start engine and make sure oil pressure is within specifications.

ENGINE OIL STRAINER



- The engine oil strainer is located between both crankcase halves.
- Usually the strainer no needs to clean.
- During engine over hall, it will clean after separate the crankcase half.
- Remove the retaining bolts and pull the oil strainer out.

Cleaning and Inspection

- Clean engine oil strainer with a part cleaner then use airgun to dry it.

WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

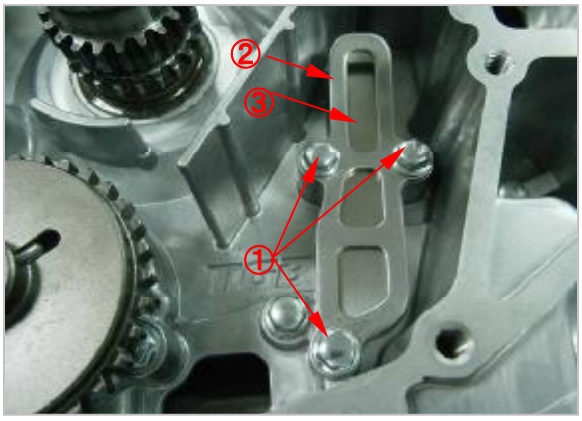
- Check engine oil strainer for cracks or other damage. Replace if damaged.

Installation

For installation, reverse the removal procedure.

REED VALVE

The engine is equipped with reed valve, which prevents accumulation of large oil quantities in the crankcase. The reed valve is fitted into the crankcase.



Valve Removal

Remove

- Reed valve three retaining bolts.
- Stopper plate.
- Reed valve.

Valve Inspection

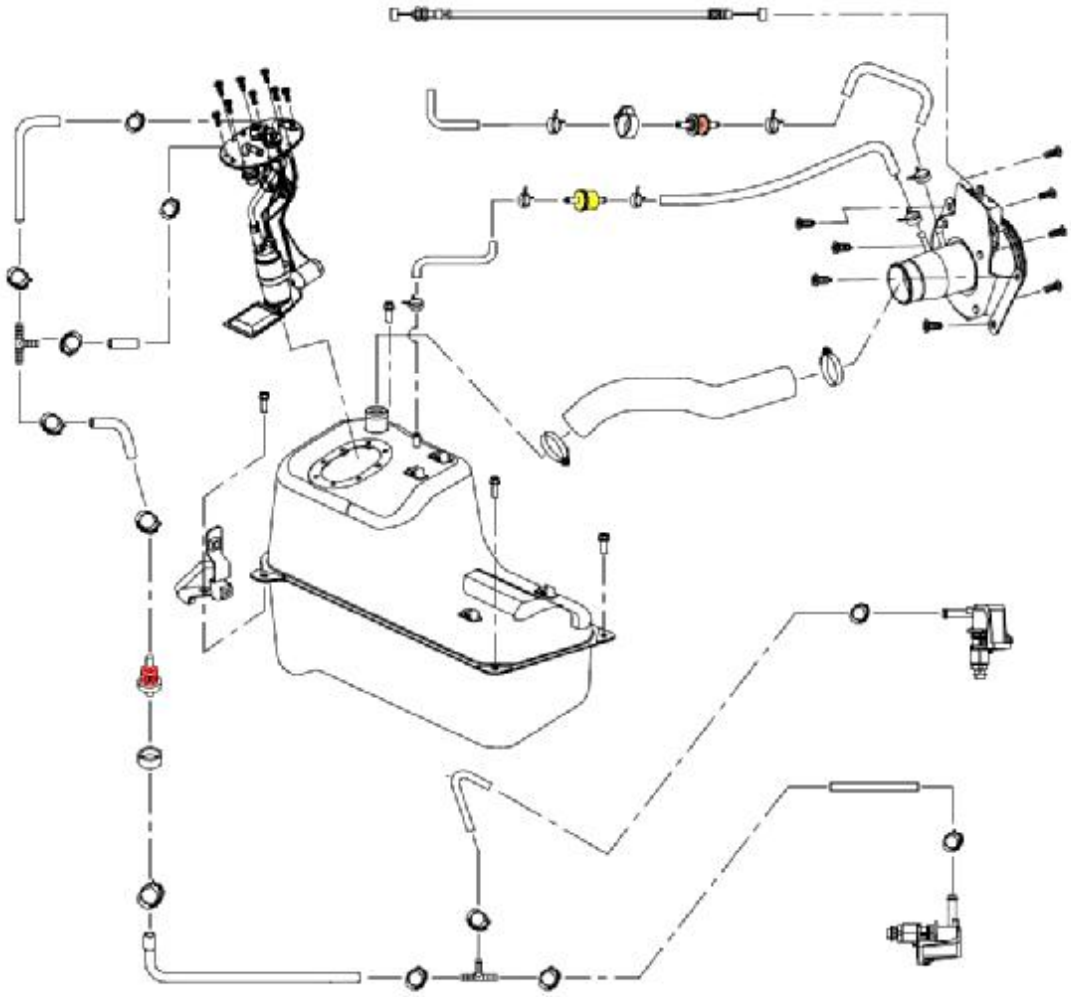
Check reed valve for cracks or other damage.

NOTE: *Replace reed valve if damaged.*

Valve installation

For installation, reverse the removal procedure.

FUEL TANK AND FUEL PUMP



FUEL TANK AND FUEL PUMP

GENERAL

WARNING

Fuel is flammable and explosive under certain conditions. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

WARNING

Always disconnect battery prior to working on the fuel system.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

WARNING

Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses.

WARNING

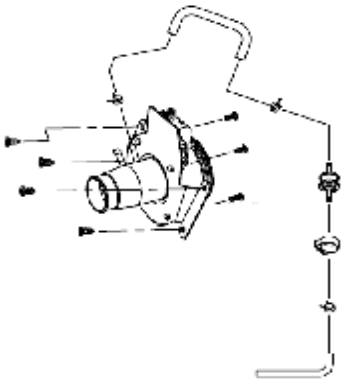
Do not allow fuel to spill on hot engine parts and/or on electrical connectors.

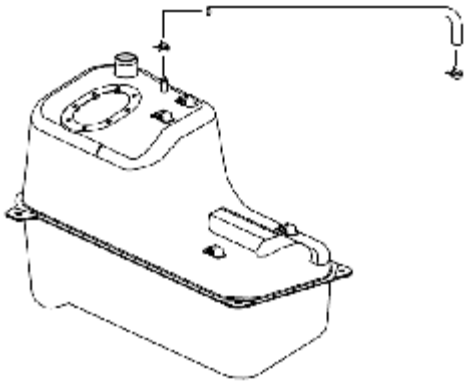
- When the repair is completed, ensure that all hoses are connected and secured.
- Fuel lines remain under pressure at all times.
- Proceed with care when removing/installing high pressures test equipment.
- Disconnect the fuel pump electrical connector to disable fuel pump and crank engine to release fuel pressure prior to disconnecting any fuel hose.
- Cover the fuel hose connections with an absorbent shop rag and carefully disconnect them to minimize spilling.
- Wipe off any fuel spillage.
- Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

SYSTEM DESCRIPTION

Fuel Tank Vent System

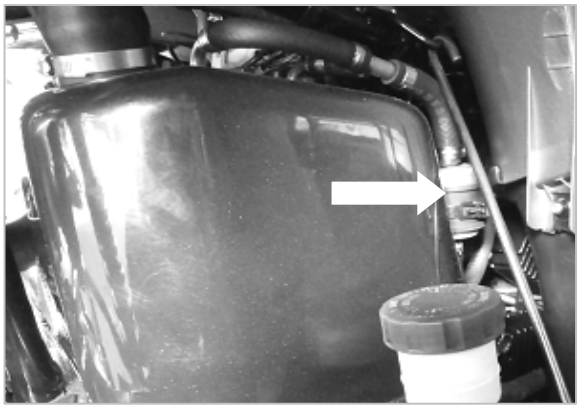
- The fuel tank is equipped with a vent system that ensures the fuel tank remains at ambient pressure.
- Air can enter the fuel tank at all times through the fuel tank vent valve. This prevents negative pressure within the fuel tank, which could cause fuel starvation.
- The vent valve also prevents fuel from flowing out through the inlet of the vent system should the vehicle be overturned.





Fuel Pump Assembly

- The fuel pump assembly is inserted in the fuel tank.
- It provides fuel delivery for EFI system and encompasses the following components:
  - Electric fuel pump.
  - Fuel pre-filter.
  - Fuel pressure regulator.
  - Fuel level sender.



Fuel Filters

- The fuel filter is located on the right of the fuel tank, which connected fuel line before go into the fuel injector nozzle.
- For replace, please using Oetiker pliers to remove the clamp..

Fuel Pump Pressure Regulator

- The fuel pressure is integral to the fuel pump assembly. The pressure regulator maintains proper fuel pressure for the EFI system.

INSPECTION

FUEL PUMP PRESSURE TEST

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and tests for leaks in the system.

NOTE: *Diagnose a fuel system problem.*

1. Ensure there are no leaks from hoses and fittings. Repair any leak.
2. Ensure the fuel level in the tank is sufficient.
3. Before proceeding with the pressure test ensure the battery is fully charged. Battery voltage must be over 12 volts.
4. Release fuel pressure by running engine until it runs out of gas.
5. Carefully disconnect the fuel filter outlet hose.
6. Install fuel PRESSURE GAUGE and FUEL ADAPETR between disconnected hose and fuel rail.
7. Turn ignition key ON and observe fuel pressure.

FUEL PRESSURE: 300 kPa.

8. Start engine and observe fuel pressure.
9. Stop engine.
10. Release fuel pressure by running engine until it runs out of gas.
11. Remove tool and connect hose on fuel rail.

Test Conclusion

The fuel pressure should be within specification in static or dynamic tests.

Rapid fuel pressure drop

A rapid pressure drop after the engine is stopped indicates leakage either from a fuel hose, fuel rail, or from the fuel pump check valve.

- Check fuel hoses, fuel rail and fittings for leaks. If not leaking, replace fuel pump.

Slow fuel pressure drop

A slow pressure drop after the engine is stopped indicates leakage either from a fuel indicator or from the fuel pressure regulator.

- Check fuel injectors for leaks. If not leaking, replace fuel pump.

FUEL HOSE AND CLAMP

Fuel Hose Replacement

When replacing fuel hoses, be sure to use hoses and clamps from TGB parts department. This will ensure continued proper and safe operation.

WARNING

Use of fuel lines other than those recommended by TGB may compromise fuel system integrity.

WARNING

Whenever removing a hose in the fuel system, always use new clamps at assembly. Then validate fuel system tightness by performing a fuel pressure test.

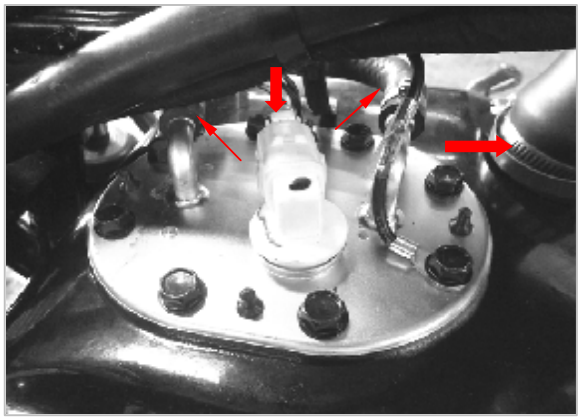
Oetiker Clamp Replacement

To secure or cut clamp on fuel lines, use Oetiker pliers.

FUEL TANK

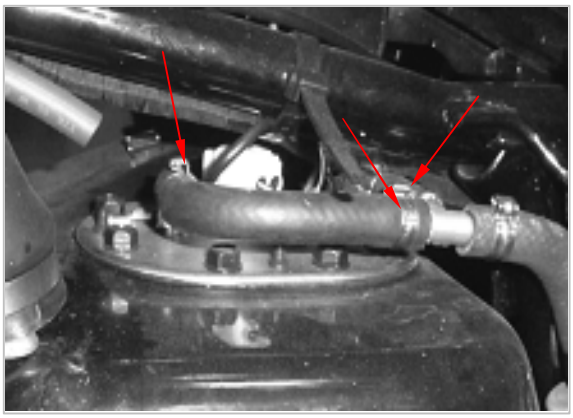
Fuel Tank Draining

Remove the fuel tank cap and siphon gas into an approved fuel container.



Fuel Tank Removal

1. Drain fuel tank.
2. Release fuel pressure by running engine until it runs out of gas.
3. Disconnect battery.
4. Remove rear cover, RH side cover, footrest and RH rear tire.
5. Disconnect the fuel pump connector and ground wire.
6. Remove the vent hose and the refuel pipe from the fuel tank valve.
7. Disconnect the high-pressure fuel hose.
8. Remove fuel tank retaining bolts.
9. Slide the fuel tank to the right side then pull out from the vehicle.



Fuel Tank Inspection

- Inspect fuel tank for nay damages or cracks which may result in fuel leaks.
- Inspect tank and protector attachment points for damages.
- Inspect protector for damages.
- If cracks, gouges or other damages, which may lead to a fuel, leak, or damages to attachment points that could prevent the tank from being secure are found, replace fuel tank.

Fuel Tank Installation

- For installation, reverse the removal procedure.
- Be sure to reinstall the rubber washers between the fuel tank and the frame.
- Be sure properly connect and route:
  - Fuel tank vent hose.
  - Fuel pup pressure hose.
  - Electrical connector.
- Refuel tank and ensure there are no leaks by performing FUEL TANK LEAK AND PRESSURE TEST.

FUEL PUMP

Fuel Pump Quick Test

1. Turn ignition key to ON.
2. Listen the fuel pump operation.
3. Fuel pump should runs for a few seconds then stop.

If fuel pump does not runs, carry out the following step:

- Check fuel pump fuse.
- Check fuel pump relay.
- Carry out a fuel pump input voltage test.

Fuel Pump Input Voltage Test

1. Remove body cover.
2. Disconnect the fuel pump connector.
3. Turn ignition key ON.
4. Use multimeter measure and read:

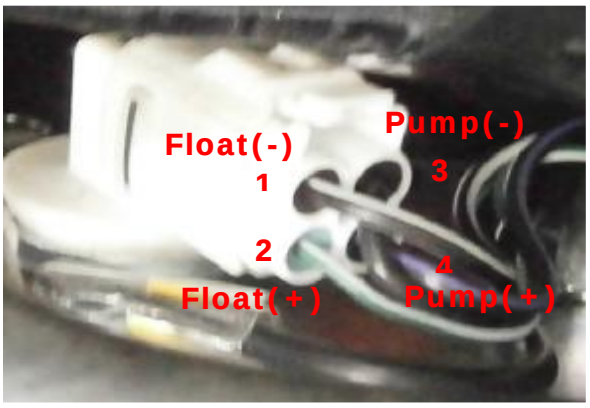
Fuel pump connector:

Pin 3 and Pin 4 = battery voltage.

If battery voltage is read, carry out a fuel pump resistance test.

If battery voltage is not read, test fuel pump power input as follow:

Fuel pump connector Pin 4 and Battery ground = Battery voltage.



Pin 1：Black/White

Pin 2：Green/White

Pin 3：Black

Pin 4：Black/ Purple

- If battery voltage is now read, check fuel pump ground circuit between fuel pump connector and ECU connector.
- If battery voltage is still not read, check fuel pump:
  - Fuse.
  - Power circuit.
  - Wiring and connectors.

Fuel Pump Resistance Test

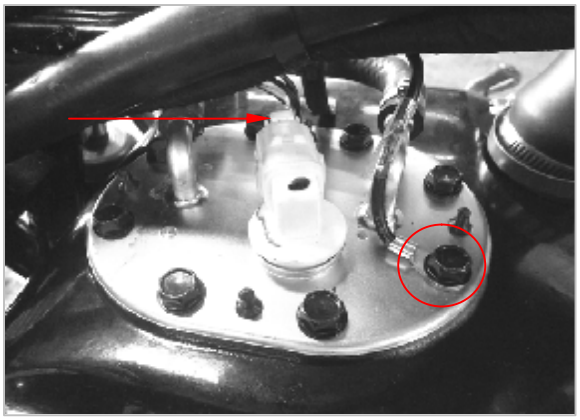
1. Remove the fuel pump connector.
2. Remove connector
3. Measure fuel pump resistance:

Pin 1 and Pin2 = 2 Ω

- If test failed at fuel pump connector, replace fuel pump.
- If test succeeded at connector, check wiring and connector from fuse box to ECU connector. Repair or replace as necessary.

Fuel Pump removal

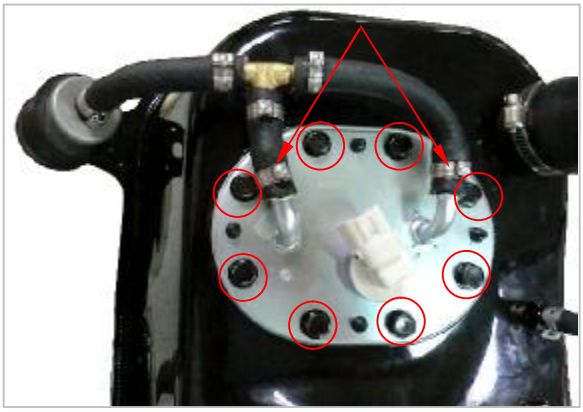
1. Release fuel pressure by running engine until it runs out of gas.
2. Remove the body cover.
3. Disconnect fuel pump electric connector.
4. Disconnect high-pressure hose at fuel pump using special tool as shown.
5. Remove eight fuel pump retaining bolts.



WARNING

Fuel vapors are flammable and explosive under certain conditions. Use only non-sparking tools.

6. Carefully pull out fuel pump.



CAUTION

While pulling out the fule pump, pay attention to fuel sender float arm. Float arm can get stuck and bend reducing fuel sender accuracy.

7. Discard gasket ring.

Fuel Pump Installation

For installation, reverse the removal procedure.

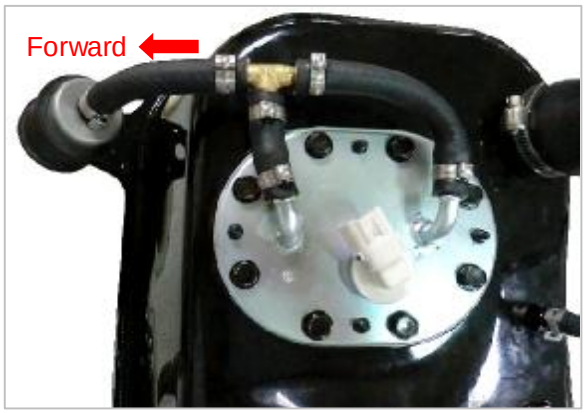
CAUTION

Manipulate fuel pump with care.

1. Install a NEW gasket ring.
2. Place gasket ring so that it is located between pump and tank mounting surface.
3. Pay attention to pump orientation as shown.
4. Tighten the fuel pump retaining bolts with specified torque.

TORQUE: 80-100 kgf-cm

5. Refuel tank and ensure there are no leaks.
6. Check fuel level sender operation.



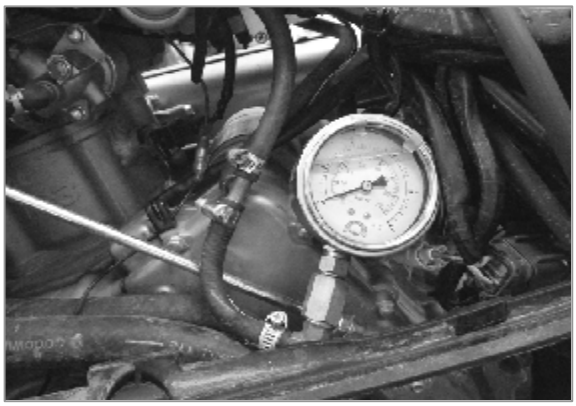
FUEL PRESSURE INSPECTION

NOTE:

- Before disconnecting fuel hose, release the fuel pressure by loosening the pressure regulator fuel hose clamp on the injector hose.
- Always replace the clamp when the hose is removed or loosened.
- Disconnect the battery negative cable from the battery terminal.
- Disconnect the pressure regulator output hose and plug the hose.
- Slowly catch the remaining fuel using an approved gasoline container.
- Install the 3-way connector and attach the fuel pressure gauge as shown.
- Connect the battery negative cable.
- Start the engine.
- Read the fuel pressure at idle speed.

IDLE SPEED: 1250+/-100 RPM

STANDARD:300 kPa



FUEL GAUGE METER

The fuel gauge meter is a float actuated variable resistance type that is part of the fuel pump.

Fuel Gauge Meter Resistance Test

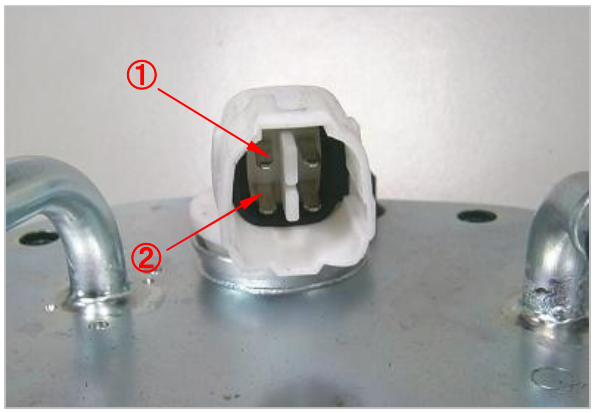
1. Disconnect the fuel pump connector.
2. Use multimeter measure the resistance of the gauge meter..

   Pin 1 and Pin 2 =.

   Full = *1100 Ω+/- 10*

   Empty =*100Ω +/- 5*

- If reading are out of specification, repeat test at fuel pump connector. If resistance at fuel pump connector is not good, replace fuel gauge meter.
- If readings are specified, carry out a FUEL GAUGE METER INPUT voltage test.

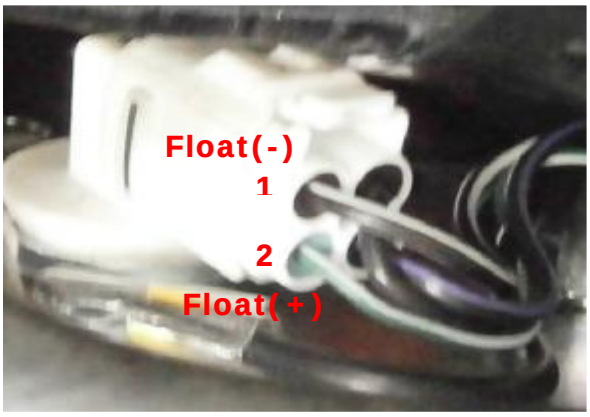


Fuel Gauge Meter Input Voltage Test

1. Set ignition switch to ON.
2. Disconnect fuel pump connector.
3. Use a multimeter and measure the input voltage:

   Pin 2 and Battery (-) = Battery Voltage

- If battery voltage is not read, test wiring continuity between gauge meter and speedometer.
- If wiring continuity is good, replace speedometer.
- If continuity is not obtained, repair or replace wiring.



Pin 1：Black/White

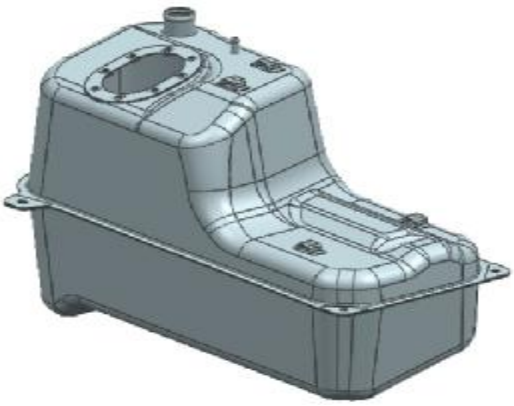
Pin 2：Green/White

FUEL TANK VENT VALVE

Fuel tank Vent Valve Test

Test for Normal Operation

1. Disconnect vent hose from fuel tank vent valve.
2. Connect the VACCUM /PRESSURE PUMP and a short piece of hose to the fuel tank vent valve.
3. Remove fuel tank cap.
4. Set vacuum/pressure pump to PRESSURE and activated pump. The gauge on the pump should not change in reading; air should flow through the vent valve and fuel tank freely.
5. Set vacuum/pressure pump to VACCUM and activate pump. The gauge should not change in reading; air should flow through the vent valve and fuel tank freely.

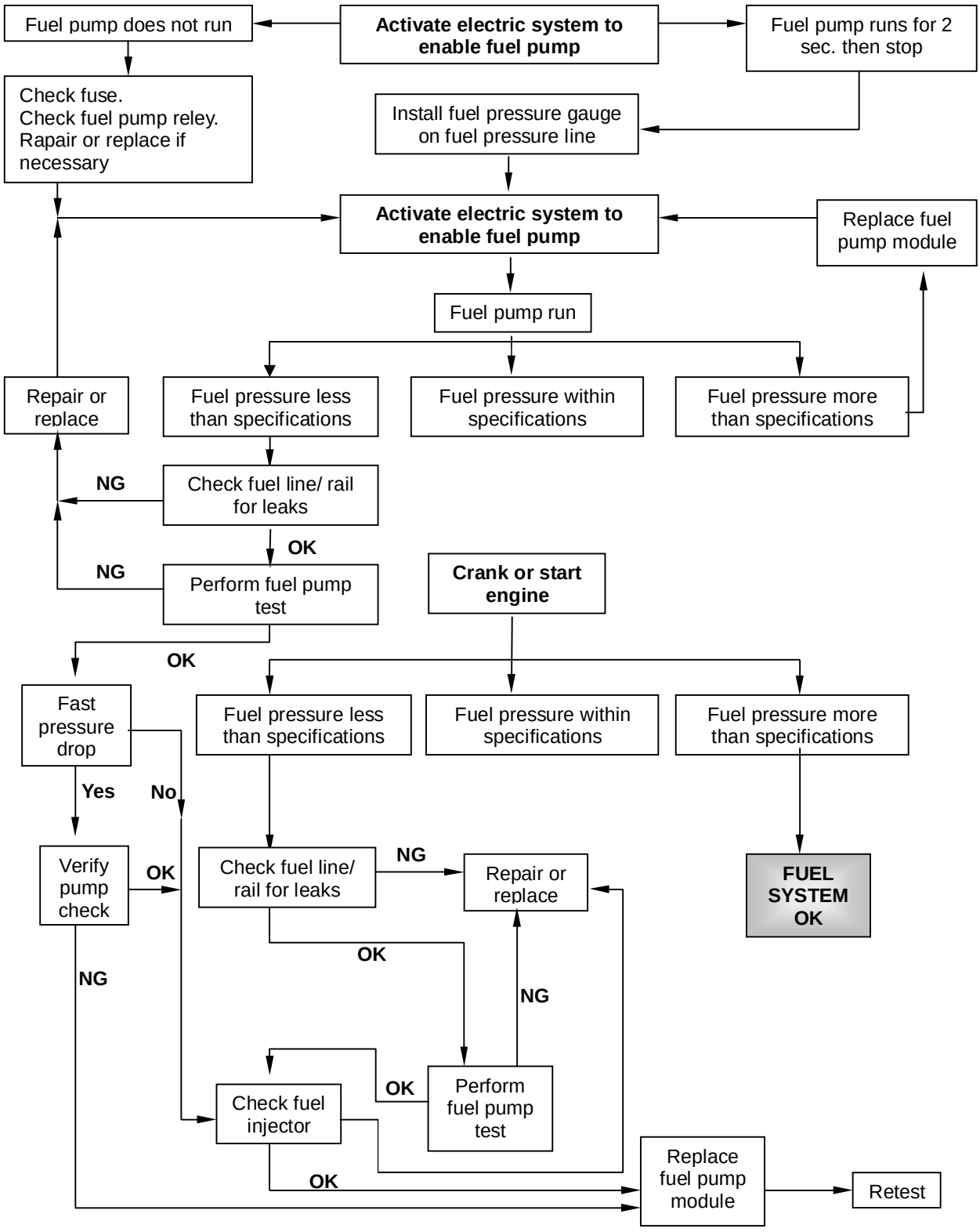


Observe Cup

There is clear cup connected with the vent hose, it can check the fuel over the tank during refilling.

TROUBLESHOOTING

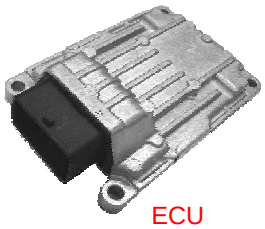
FUEL SYSTEM DIAGNOSTIC FLOW CHART



Fuel Injection System Components

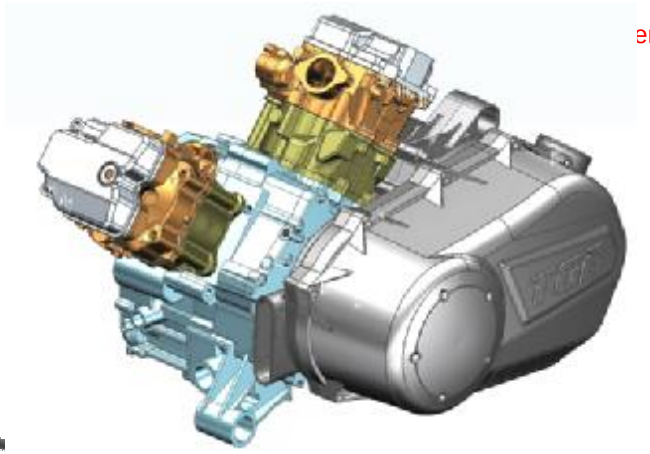
Throttle Body

Idle Speed Controller



ECU

emperature Manifold Air Pressure



Fuel Pump

Throttle Position Sensor

Injector

Ignition Coil

Crank Position Sensor

Roll Over Switch

Engine Coolant Temperature Sensor

PRECAUTIONS IN SERVICING

When handling the Fuel Injection component parts or servicing the Fuel Injection system, observe the following points for the safety of the system.

GENERAL

Be sure to relieve the fuel pressure while the engine is OFF.

Bending or twisting the control cables will impair smooth operation and could cause the cables to stick or bind, resulting in loss of vehicle control.

Work in a well-ventilated area. Smoking or allowing flames or sparks in the work area or where gasoline is stored can cause a fire or explosion.

FUEL SYSTEM

- Do not apply commercially available carburetor cleaners to the inside of the throttle bore, which is coated with molybdenum.
- Do not snap the throttle valve from full open to full close after the throttle cable has been removed. It may cause incorrect idle operation.
- Seal the cylinder head intake ports with tape or a clean cloth to keep dirt and debris from entering the intake ports after the throttle body has been removed.
- Do not apply excessive force to the fuel pipe on the throttle body while removing or installing the throttle body.
- Do not damage the throttle body. It may cause incorrect throttle and idle valve synchronization.
- Prevent dirt and debris from entering the throttle bore, fuel tube and return tube, clean them using compressed air.
- The throttle body is factory pre-set. Do not disassemble in a way other than shown in this manual.
- Do not loosen or tighten the white painted bolts and screws of the throttle body. Loosening or tightening them can cause throttle and idle valve synchronization failure.
- Do not push the fuel pump base under the fuel tank when the fuel tank is stored.
- Always replace the packing when the fuel pump is removed.
- Fuel injection system location, see page 8.
- A faulty EFI system is often related to poorly connected or corroded connectors. Check those connections before proceeding.
- When disassembling the EFI parts, note the location of the O-rings. Replace them with new ones upon reassembly.
- Before disconnecting the fuel hose, release the fuel pressure.
- Always replace the clamp when the fuel hose is removed or loosened.
- Use a diagnosis tool for EFI system inspection.

CONNECTOR/COUPLER

- When connecting a connector, be sure to push it in until a click is felt.
- With a lock type coupler, be sure to release the lock when disconnecting, and push in fully to engage the lock when connecting.
- When disconnecting the coupler, be sure to hold the coupler body and do not pull the lead wires.
- Inspect each terminal on the connector/coupler for looseness or bending.
- Inspect each terminal for corrosion and contamination. The terminals must be clean and free of any foreign material, which could impede proper terminal contact.
- Inspect each lead wire circuit for poor connection by shaking it by hand lightly. If any abnormal condition is found, repair or replace.
- When taking measurements at electrical connectors using a tester probe, be sure to insert the probe from the wire harness side (backside) of the connector/coupler.
- When connecting meter probe from the terminal side of the coupler where (connection from harness side not being possible), use extra care not to force and cause the male terminal to bend or the female terminal to open. Connect the probe as shown to avoid opening of female terminal. Never push in the probe where male terminal is supposed to fit.
- Check the male connector for bend and female connector for excessive opening. Also check the coupler for locking (looseness), corrosion, dust, etc.

FUSE

- When a fuse blows, always investigate the cause to correct it and then replace the fuse.
- Do not use a fuse of a different capacity.
- Do not use wire or any other substitute for the fuse.

ECU/VARIOUS SENSORS

- Since each component is a high-precision part, great care should be taken not to apply any sharp impacts during removal and installation.
- Be careful not to touch the electrical terminals of the ECU. The static electricity from your body may damage this part.
- When disconnecting and connecting the ECU couplers, make sure to turn OFF the ignition switch, or electronic parts may get damaged.
- Battery connection in reverse polarity is strictly prohibited. Such a wrong connection will damage the components of the FI system instantly when reverse power is applied.
- Removing any battery terminal of a running engine is strictly prohibited. The moment such removal is made, damaging counter electromotive force will be applied to the ECU, which may result in serious damage.
- Before measuring voltage at each terminal, check to make sure that battery voltage is 11 V or higher. Terminal voltage check with a low voltage battery will lead to erroneous diagnosis.
- Never connect any tester (voltmeter, ohmmeter, or whatever) to the ECU when its coupler is disconnected. Otherwise, damage to the ECU may result.

• Never connect an ohmmeter to the ECU with its coupler connected. If attempted, damage to the ECU or sensors may result.
• Be sure to use a specified voltmeter/ohmmeter. Otherwise, accurate measurements may not be obtained and personal injury may result.

ELECTRICAL CIRCUIT INSPECTION PROCEDURE

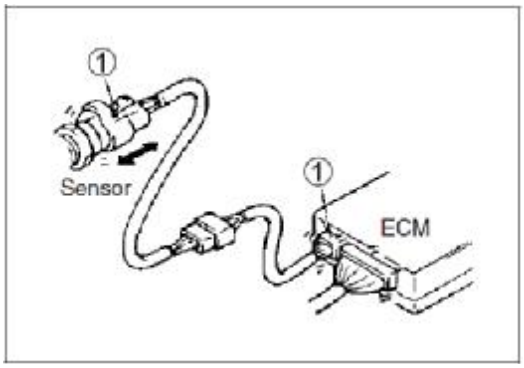
While there are various methods for electrical circuit inspection, described here is a general method to check for open and short circuit using an ohmmeter and a voltmeter.

OPEN CIRCUIT CHECK

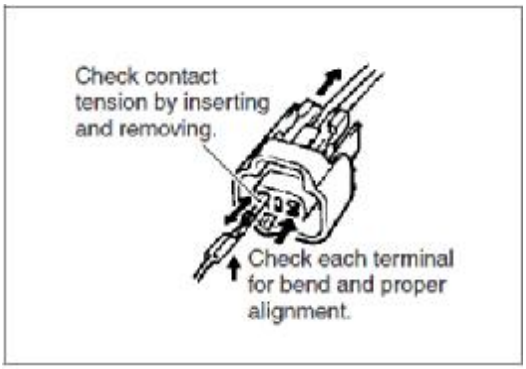
Possible causes for the open circuit are as follows. As the cause can exist in the connector/coupler or terminal, they need to be checked carefully.

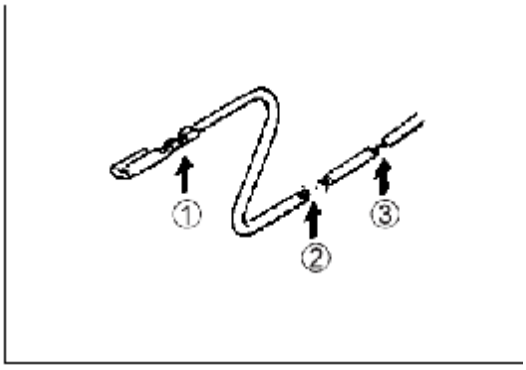
• Loose connection of connector/coupler.
• Poor contact of terminal (due to dirt, corrosion or rust, poor contact tension, entry of foreign object etc.)
• Wire harness being open
• Poor terminal-to-wire connection
• Disconnect the negative cable from the battery.
• Check each connector/coupler at both ends of the circuit being checked for loose connection. Also check for condition of the coupler lock if equipped.
• Using a test male terminal, check the female terminals of the circuit being checked for contact tension.
  Check each terminal visually for poor contact (possibly caused by dirt, corrosion, rust, entry of foreign object, etc.). At the same time, check to make sure that each terminal is fully inserted in the coupler and locked.
  If contact tension is not enough, rectify the contact to increase tension or replace.
  The terminals must be clean and free of any foreign material, which could impede proper terminal contact.

• Using continuity inspect or voltage check procedure as described below, inspect the wire harness terminals for open circuit and poor connection. Locate abnormality, if any.



1. Check for loose connection

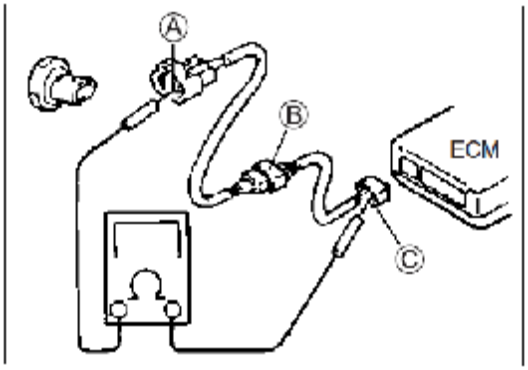




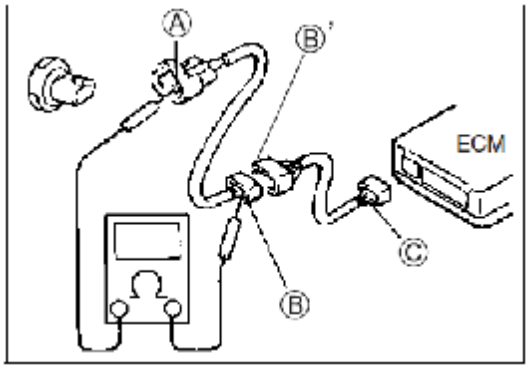
1. Looseness of crimping
2. Open
3. Thin wire (a few strands left)

CONTINUITY CHECK

- Measure resistance across coupler B (between A and C in the figure).
- If no continuity is indicated (infinity or over limit), the circuit is open between terminals A and C.

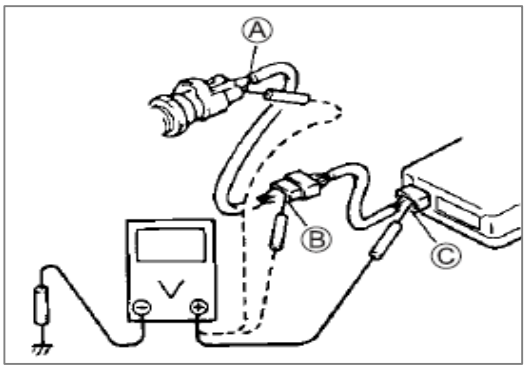


- Disconnect the coupler B and measure resistance between couplers A and B.
- If no continuity is indicated, the circuit is open between couplers A and B. If continuity is indicated, there is an open circuit between couplers B' and C or an abnormality in coupler B' or coupler C.



VOLTAGE CHECK

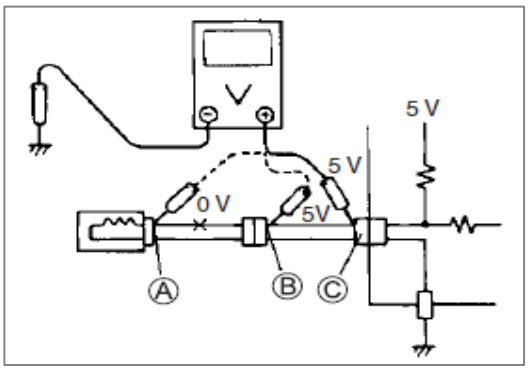
- If voltage is supplied to the circuit being checked, voltage check can be used as circuit check.
- With all connectors/couplers connected and voltage applied to the circuit being checked, measure voltage between each terminal and body ground.
- If measurements were taken as shown in the figure at the right and results are as listed below, it means that the circuit is open between terminals A and B.



Voltage Between:

C and body ground: Approx. 5 V
B and body ground: Approx. 5 V
A and body ground: 0 V

- Also, if measured values are as listed below, a resistance (abnormality) exists which causes the voltage drop in the circuit between terminals A and B.



Voltage Between:

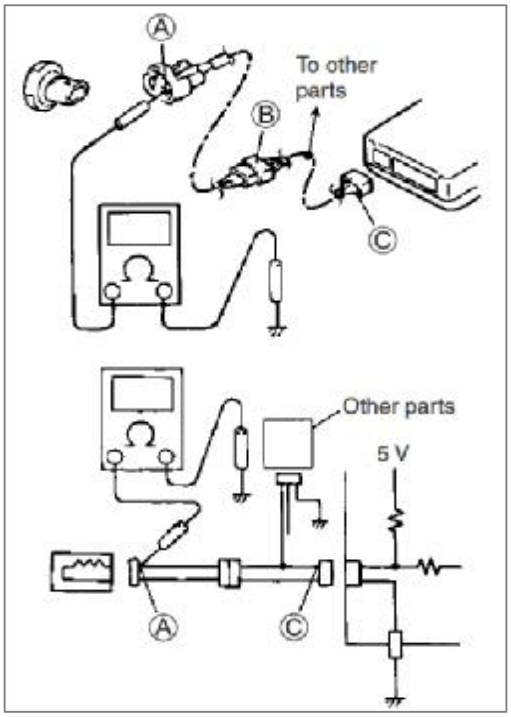
C and body ground: Approx. 5 V
B and body ground: Approx. 5 V
A and body ground: 3 V (2 V voltage drop)

SHORT CIRCUIT CHECK (WIRE HARNESS TO GROUND)

• Disconnect the negative cable from the battery.
• Disconnect the connectors/couplers at both ends of the circuit to be checked.

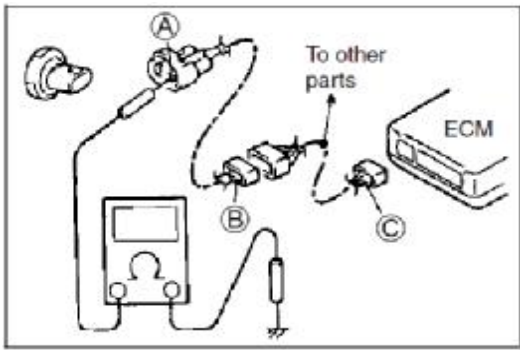
NOTE:

If the circuit to be checked branches to other parts as shown, disconnect all connectors/couplers of those parts. Otherwise, diagnosis will be misled.



• Measure resistance between terminal at one end of circuit (A terminal in figure) and body ground. If continuity is indicated, there is a short circuit to ground between terminals A and C.

• Disconnect the connector/coupler included in circuit (coupler B) and measure resistance between terminal A and body ground.
If continuity is indicated, the circuit is shorted to the ground between terminals A and B.



SPECIFICATIONS

ITEM	SPECIFICATIONS
Throttle body identification number	
Starter valve vacuum difference	
Idle speed	1250+/- 100 rpm
Throttle grip free play	2~4 mm
Fuel injector resistance	Ω
Manifold absolute pressure at idle	420 +/- 30 mm Hg
Fuel pressure at idle	300 kPa

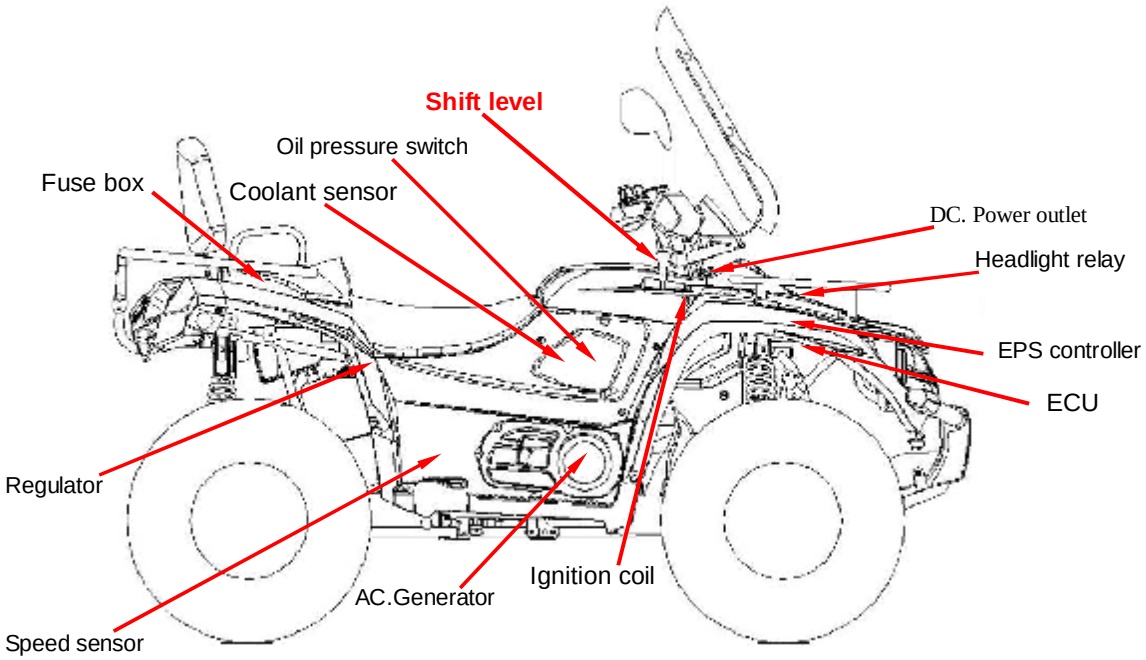
TORQUE VALUES

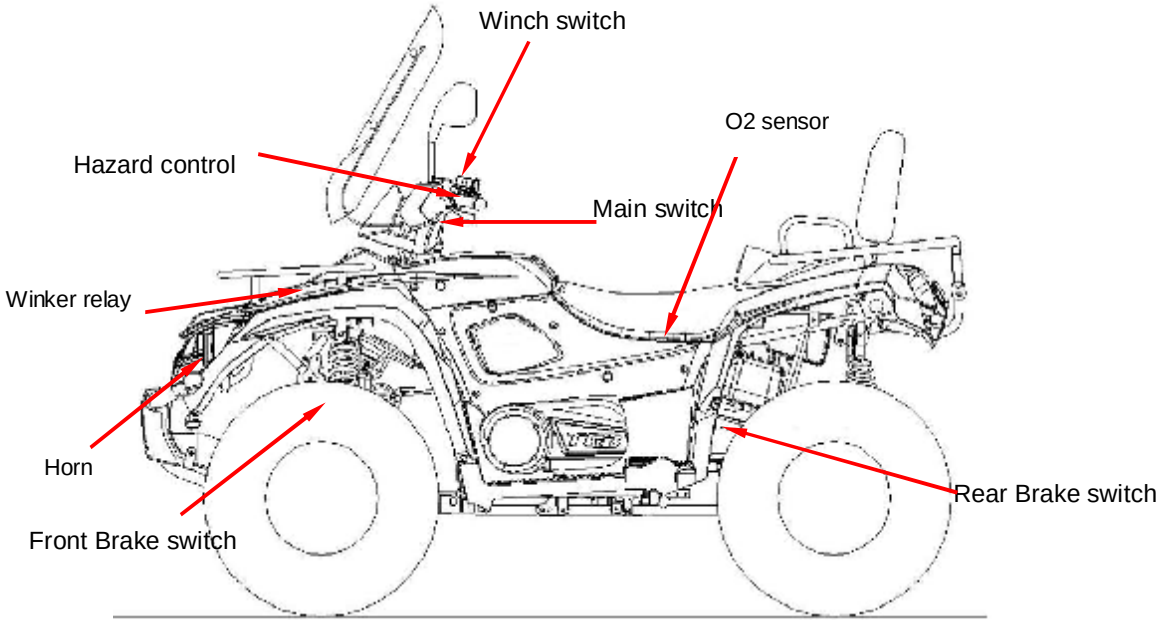
ECT sensor

Pressure regulator mounting bolt

Fuel pump mounting nut

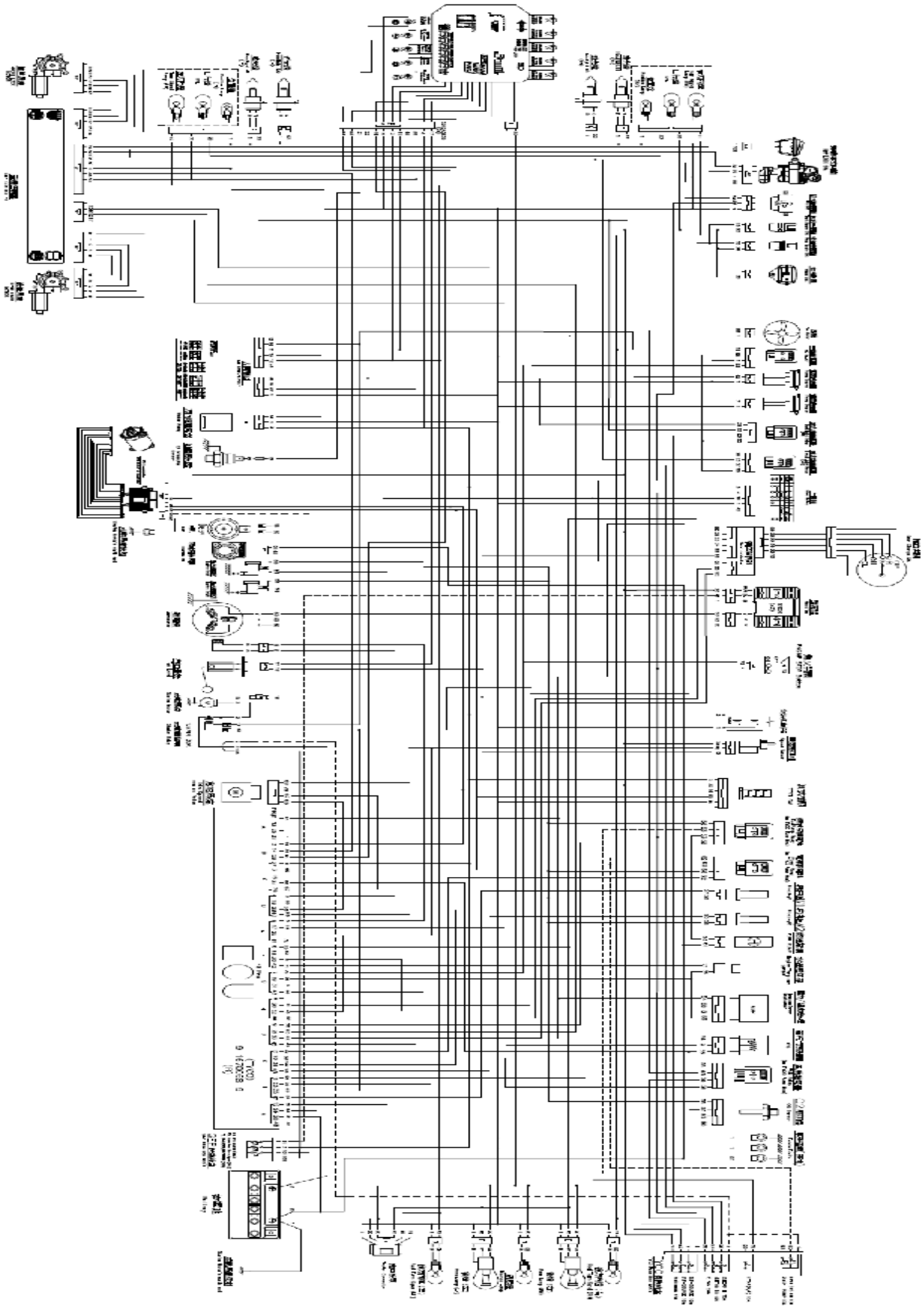
PARTS LOCATION



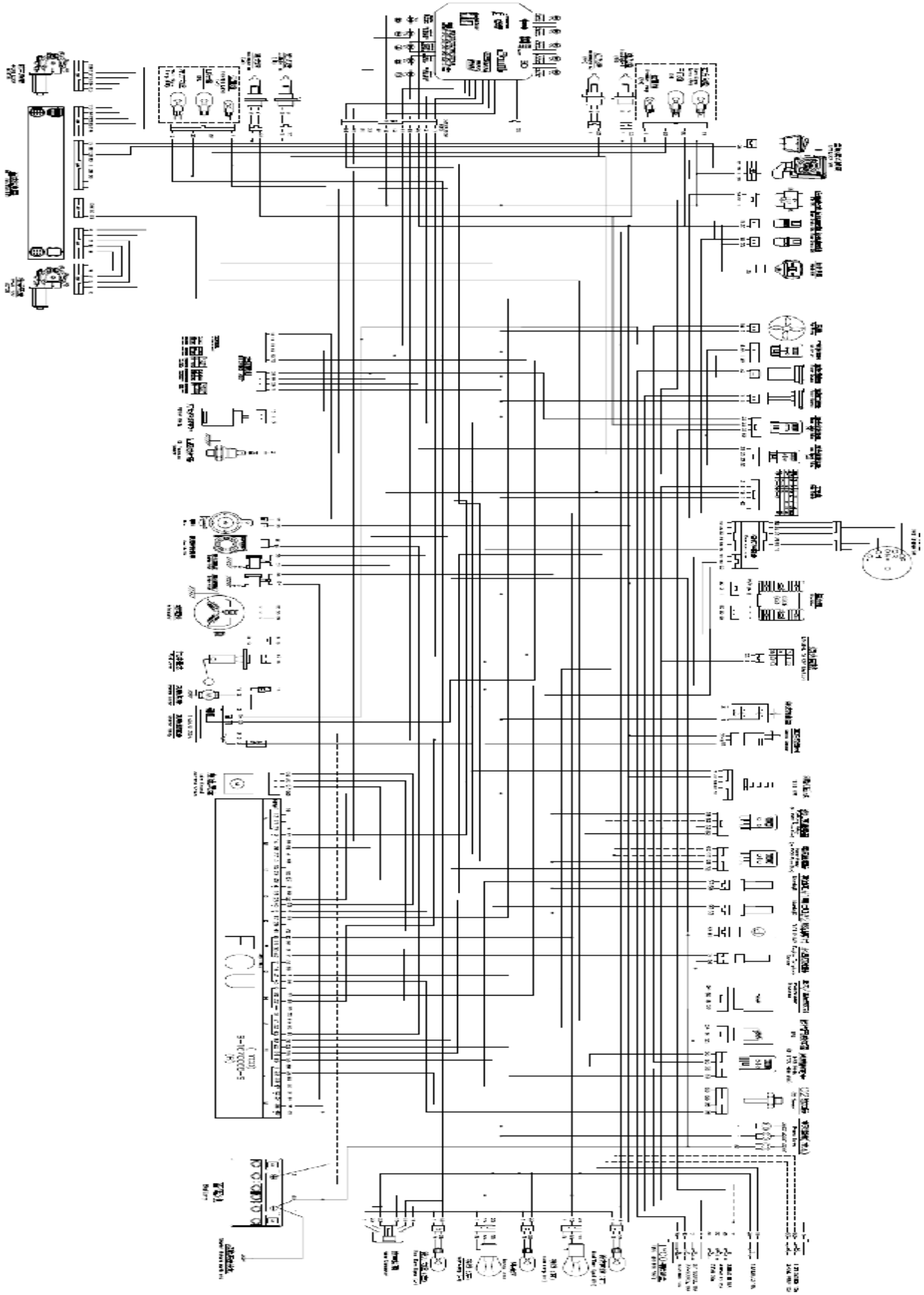


WIRING DIAGRAM

With EPS



Without EPS



ECU TERMINAL

HARNESS

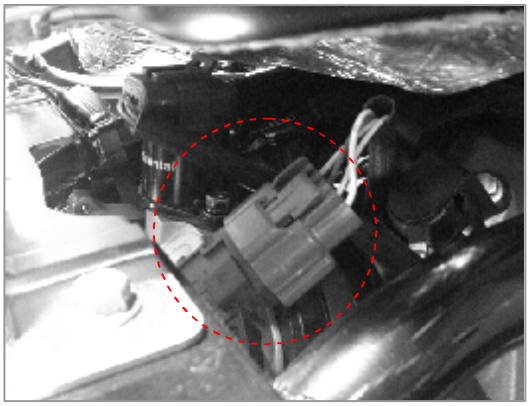
ECU PLUG

Pin No.	Pin Code	Wire Color	Circuit	Note	Pin No.	Pin Code	Wire Color	Circuit	Note
A1	1	Y/B	VSENS	Sensor voltage	G1	7	Br/W		
A2	13		Blank		G2	19	Gr/R	SGND2	Signal ground
A3	25		Blank		G3	31	W/Br	TPS	Throttle position sensor
A4	37	Br/L	VBK	Key SW voltage	G4	43		Blank	
B1	2	P/W	CAN_H	Diagnosis Tool	H1	8		Blank	
B2	14	W/G	RPM		H2	20	W	Gear B	
B3	26	Y/G	MIL	Engine Check	H3	32	Pu	VEH	Speed sensor
B4	38	R/W	VBD	Battery Voltage	H4	44	L	Gear C	
C1	3	P/G	CAN_L	Diagnosis Tool	J1	9	B		Fuel Pump relay
C2	15	B/Y	Temp.	Temperature LED	J2	21		Blank	
C3	27	Gr/R	SGND1	Signal Ground	J3	33	R	Gear A	
C4	39	Br/B	Stepper B		J4	45	R/Gr		Override switch
D1	4	LG/R	CPS-	Crank position sensor (-)	K1	10	O/W		Main relay
D2	16	Pu/B			K2	22	B/W		Fan relay
D3	28	G/B	Stepper D		K3	34		Blank	
D4	40	L/B	Stepper A		K4	46		Blank	
E1	5	L/Y	CPS+	Crank position sensor (+)	L1	11	R	VBR	Start relay voltage
E2	17		Blank		L2	23		Blank	
E3	29		Blank		L3	35	B/W		Starter
E4	41	B/Y	Stepper C		L4	47	L/G		Injector
F1	6	G/Y		Brake SW	M1	12	B/Y		Ignition
F2	18	W/Y	MAP	Manifold Air Pressure	M2	24		Blank	
F3	30	G/Br	TIA	Temperature Intake Air	M3	36	Gr	PGND	Ground
F4	42	Y/R	ECT	E/G Temperature sensor	M4	48	Gr	PGND	Ground

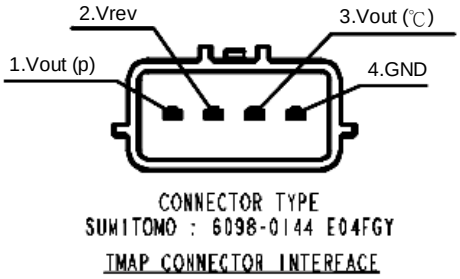
EFI SYSTEM COMPONENTS INSPECTION

T-MAP SENSOR

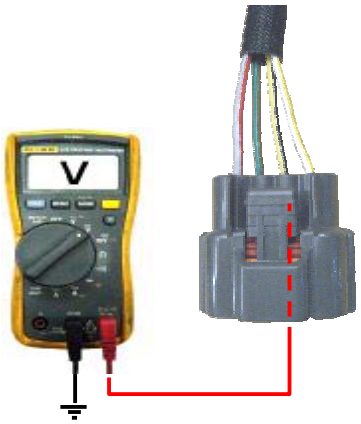
- Turn the ignition OFF.
- Disconnect the T-MAP sensor 4P connector.
- Check for loose or poor contact on the MAP sensor connector.



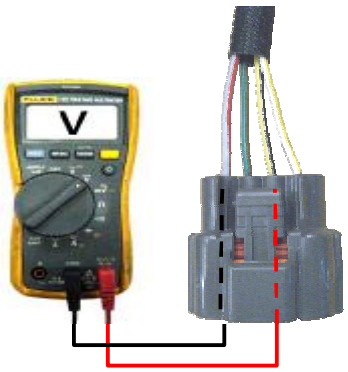
- Connect the T-MAP sensor connector.
- Start the engine and check that the MIL light.



- Turn the ignition switch OFF.
- Disconnect the MAP sensor 4P connector.
- Turn the ignition switch ON.
- Measure the voltage at the wire harness side connector.
  Connection: Yellow/Black (+)－Ground(-)
  Standard: 5.0 +/- 0.1V



- Measure the voltage between the connector terminals of wire harness side.
  Connection: Yellow/Black (+)－Gray/Red(-)
  Standard: 5.0 +/- 0.1V

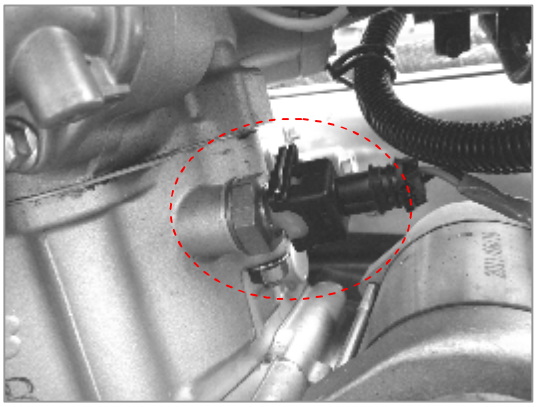


- Turn the ignition switch OFF.
- Connect the TMAP sensor 4P connector.

ECT SENSOR

INSPECTION

- Turn the ignition switch OFF.
- Disconnect ECT sensor 2P connector.
- Check for loose or poor contact on the ECT sensor connector.



- Connect the ECT sensor connector.
- Turn the ignition switch ON.
- Check the MIL light.

- Turn the ignition switch OFF.
- Disconnect the ECT sensor connector.
- Measure the resistance at ECT sensor terminals.

  Connection:

  Standard:2.3~2.6 kΩ (at 20℃)

- Turn the ignition switch ON.
- Measure the voltage between the ECT sensor connector terminal of the wire harness side and ground.

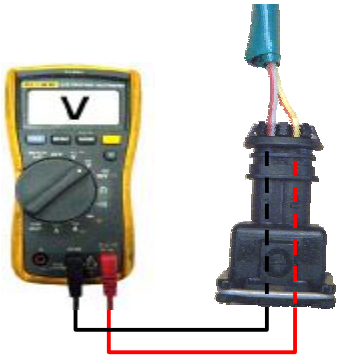
  Connection: Yellow/Red (+)－Ground(-)

  Standard: 5.0 +/- 0.1V

- Measure the voltage at ECT sensor connector of the wire harness side.

  Connection: Yellow/Red (+)－Gray/Red(-)

  Standard: 5.0 +/- 0.1V

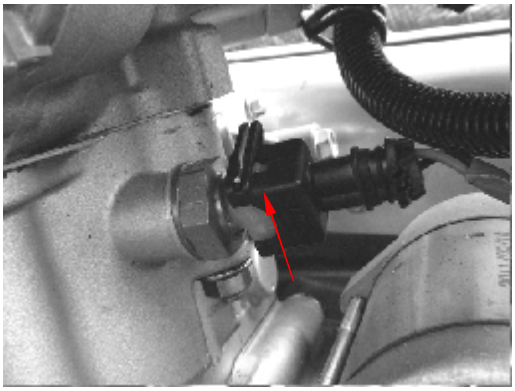


REMOVAL / INSTALLATION

- Disconnect the ECT sensor 2P connector from the sensor
- Remove the ECT sensor.
- Install the new ECT sensor.

TORQUE: 120 kgf/cm

- Connect the ECT sensor 2P connector.

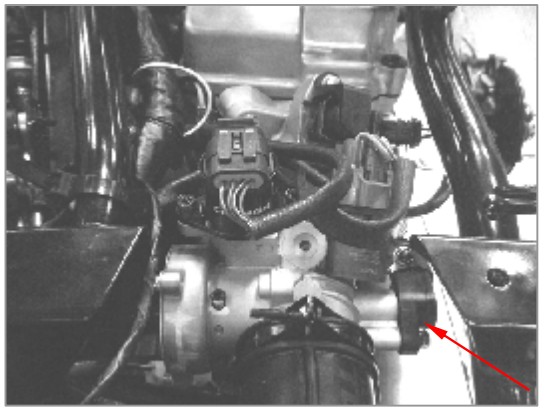


Standard:

TEMPERATURE(℃)	RESISTANCE VALUES(OHM)	TOL. (OHM)
20	3500	±250
60	704	±45
90	260	±20

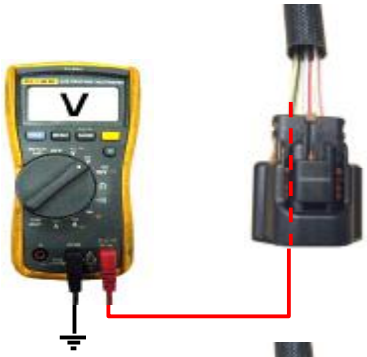
TP SENSOR

INSPECTION

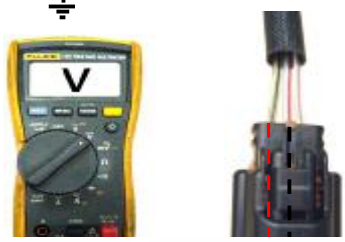


- Turn the ignition switch OFF.
- Disconnect the TP sensor 3P connector.
- Check for loose or poor contact on the TP sensor connector.

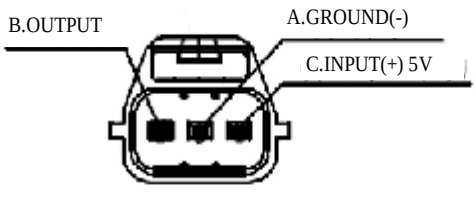
- Connect the TP sensor connector.
- Start the engine and check the MIL light.



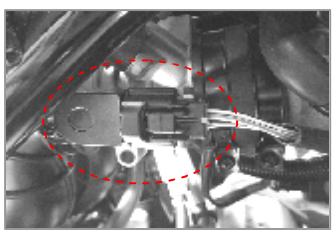
- Turn the ignition switch OFF.
- Disconnect the TP sensor 3P connector.
- Turn the ignition switch ON.
- Measure the voltage between the wire harness side connector terminal and ground.
  Connection: Yellow/Black (+)－Ground(-)
  Standard: 5.0 +/- 0.1V



- Measure the voltage at TP sensor terminals of the wire harness side.
  Connection: Yellow/Black (+)－Gray/Red(-)
  Standard: 5.0 +/- 0.1V
- Working voltage value: 5.0±0.1V
- Full throttle open voltage: **3.9±0.2V**
- Full throttle closed voltage: **0.5±0.05V**
- WARNING!
  Never loosen the screw of TPS, result the unsteady idle.

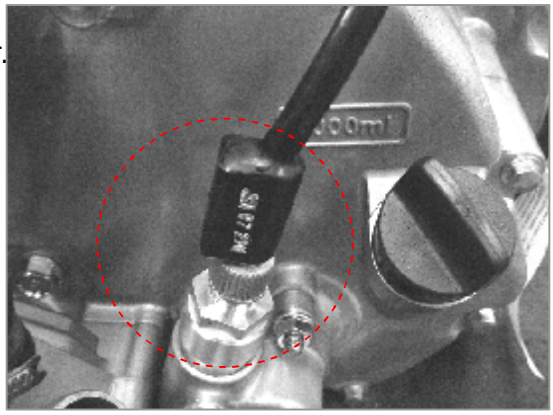


- Using diagnosis tool to confirm the throttle output signal.
  1. Connected to the "diagnosis tool", and open the main switch, but not to start engine.
  2. "Diagnosis tool" selects to a "Live Data" screen.
  3. Rotations throttle and check voltages.

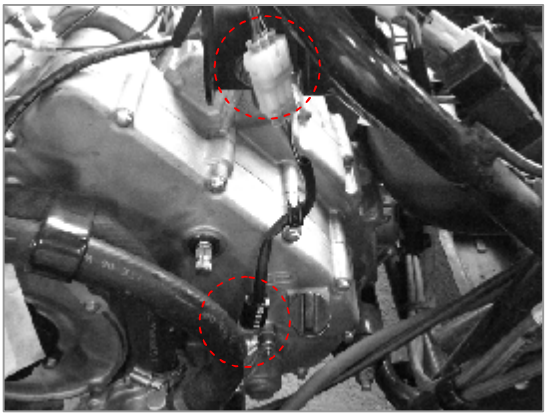


VEHICLE SPEED SENSOR

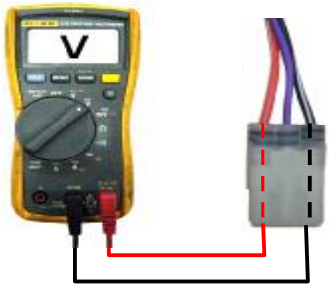
- Turn the ignition switch OFF.
- Disconnect the vehicle speed sensor 3P connector.
- Check for loose or poor contact on the vehicle speed sensor connector.



- Connect the vehicle speed sensor 3P connector.
- Start the engine.
- Ride the vehicle and keep the engine more than 5,000 RPM about 20 seconds or more.
- Check the MIL light.

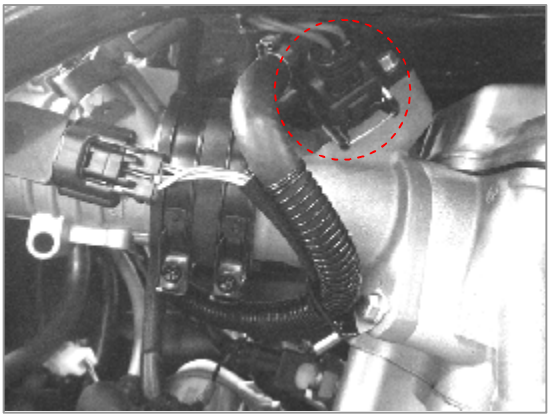


- Turn the ignition switch OFF.
- Disconnect the vehicle speed sensor 3P connector.
- Turn the ignition switch ON.
- Measure the voltage at the wire harness side connector.
  Connection: Red (+)－Black/White(-)
  Standard: 12 V



INJECTOR

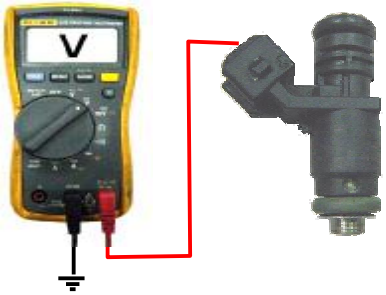
• Turn the ignition switch OFF.
• Disconnect the injector 2P connector.
• Check for loose or poor contact on the injector 2P connector.



• Connect the injector 2P connector.
• Turn the ignition switch ON.
• Check the MIL light.

• Turn the ignition switch OFF.
• Disconnect the injector 2P connector and measure the resistance of the injector.
Connection: Red (+) — Blue/Green(-)
Standard:12.0+/-0.6Ω

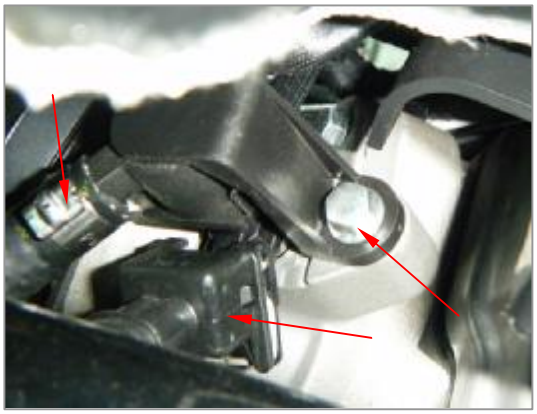
• Check for continuity between the injector and ground.
Connection: Red (+) — Ground(-)
Standard: continuity



• Turn the ignition switch ON.
• Measure the voltage between the injector connector of the wire harness side and ground.
Connection: Red (+) — Ground(-)
Standard: battery voltage

INSPECTION

- Start the engine and let it idle.
- Confirm the injector operating sounds with a sounding rod or stethoscope.
- If the injector does not operate, replace the injector.



REMOVAL

- Disconnect the injector 2P connector.
- Remove the bolts and fuel rail assembly.
- Remove the injector from the intake pipe.

INSTALLATION

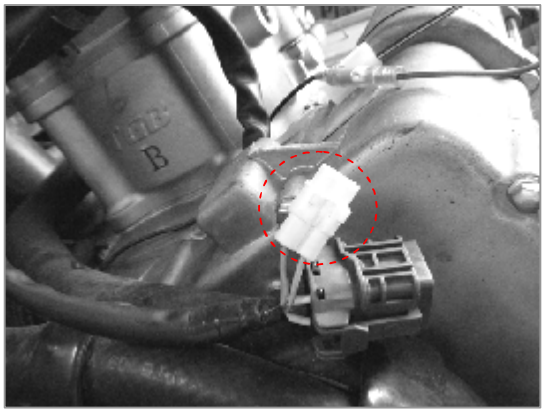
- Install injector on the intake pipe.
- Being careful not to damage the O-ring of injector.
- Install fuel rail assembly and tighten the bolt.

TORQUE: 120 kgf-cm

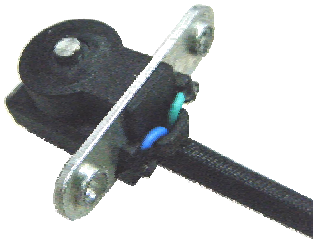
- Connect the injector 2P connector.

CRANK POSITION SENSOR

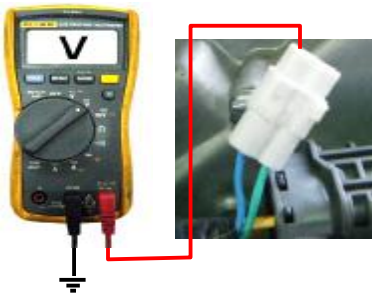
• Turn the ignition switch OFF.
• Disconnect the crank position sensor 2P connector.
• Check for loose or poor contact on the crank position sensor 2P connector.



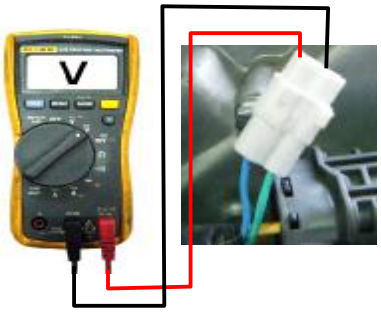
• Connect the crank position sensor 2P connector.
• Turn the starter motor more than 10 seconds and then check that the MIL light.



• Turn the ignition switch OFF.
• Disconnect the crank position sensor 2P connector.
• Check for continuity between the crank position sensor connector terminal and ground.
  Connection: Blue (+) — Ground(-)
  Standard: No continuity

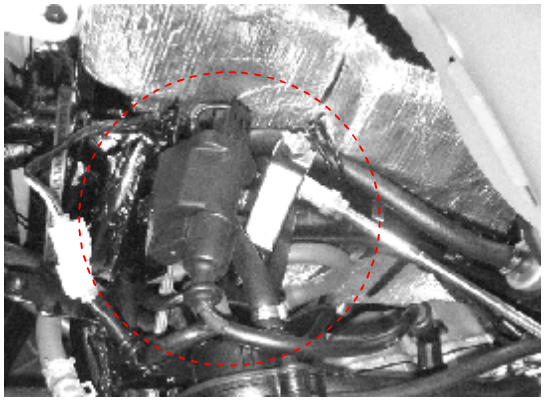


• Crank the engine with the starter motor, and measure the crank position sensor peak voltage at the crank position sensor 2P connector.
  Connection: Blue (+) — Sky Blue(-)
  Standard: **1.6~2.2V (AC)**



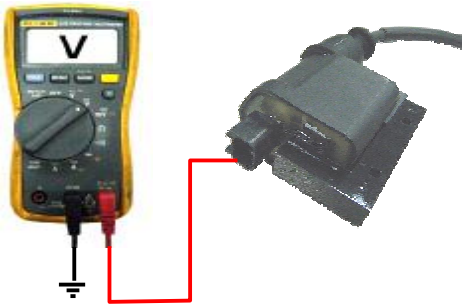
IGNITION COIL

• Turn the ignition switch OFF.
• Disconnect the ignition coil 2P connector.
• Check for loose or poor contact on the ignition coil 2P connector.



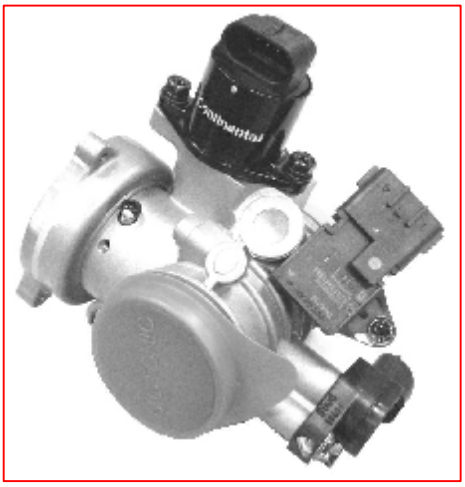
• Connect the ignition coil 2P connector.
• Turn the starter motor more than 10 seconds and then check that the MIL light.

• Turn the ignition switch OFF.
• Disconnect the ignition coil 2P connector.
• Check for continuity between the ignition coil connector terminal and ground.
Connection: Red (+) — Ground(-)
Standard: No continuity



• Check for resistance between the ignition coil connector terminal and ground.
Standard: **0.6±0.05Ω**

THROTTLE BODY



REMOVAL

NOTE:

- *Before disconnecting the fuel hose, release the fuel pressure by loosening the clamp.*
- *Always replace the clamp when the fuel hose is removed or loosened.*

DISASSEMBLY

- Disconnect the TP sensor, T-MAP sensor and ISC sensor connector from the throttle
- Disconnect intake pipe rubber tube from the throttle body.
- Disconnect the throttle body from the air cleaner case.

NOTE:

- *Do not damage the throttle body. It may cause incorrect throttle and idle valve.*
- ***The throttle body is factory pre-set. Do not disassemble in a way other than shown in this manual.***
- ***Do not loosen or tighten the white painted bolts and screws of the throttle body. Loosening or tightening them can cause throttle and idle valve failure.***

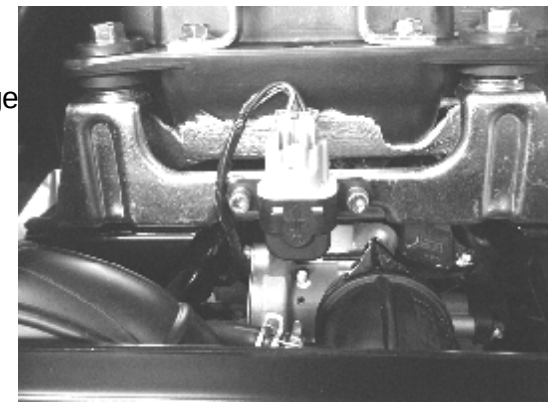
- Disconnect the throttle cable end from the throttle drum.

ASSEMBLY

- Connect the throttle cable end to the throttle drum.
- Connect the TP, T-MAP and ISC sensor connector on the throttle body.
- Install and tighten the intake pipe rubber tube on the throttle body.
- Install the throttle body to the air cleaner case.

ROLL OVER SENSOR

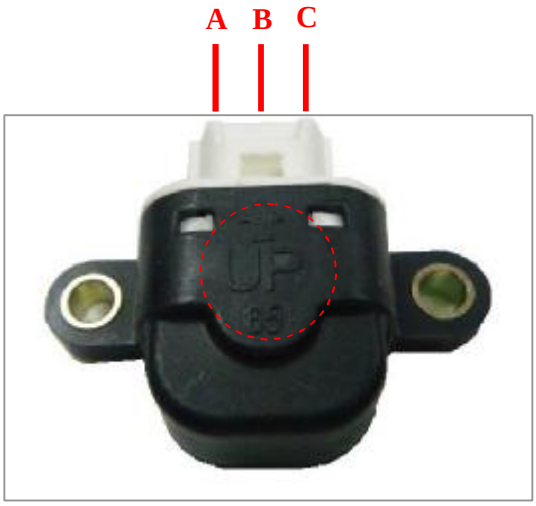
INSPECTION



- Remove the seat set.
- Turn the ignition switch ON and measure the voltage between the following terminals of the Roll Over sensor connector with the connector connected.

TERMINAL	STANDARD
A-C	**4~5V**
B-C	**1~1.5V**
B-C (65°)	**3.9V~4.3V**

- Turn the ignition switch OFF.
- Remove the screws, washers, nuts and roll over sensor.
- Place roll over sensor horizontal as shown and turn the ignition switch ON.
- The roll over sensor is normal if the power supply is closed.
- Incline the roll over sensor approximately 65 degrees to the left or right with the ignition switch ON.
- The roll over sensor is normal if the power supply is open.
- If you repeat this test, first turn the ignition switch OFF then turn the ignition switch ON.

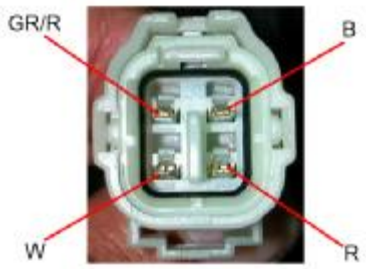


REMOVAL / INSTALLATION

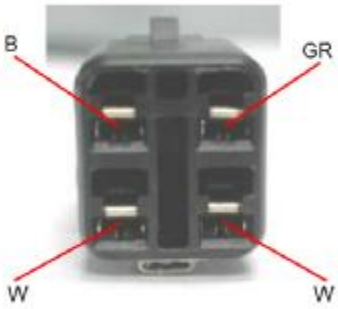
- Disconnect the roll over sensor 2P connector.
- Remove the two screws, nuts and roll over sensor.
- Installation is in the reverse order of removal.
- Tighten the mounting screws securely.

NOTE: ***Install the roll over sensor with its "UP" mark facing up.***

O2 Sensor



Confirmed working voltage



Resistance Confirmation

Functional Description:

- Use 8 ~ 16V DC power supply, has the 4-pin coupler, a power supply pins for heater; for a heater control pin; signal for a grounding pin; O2 for a signal pin.
- O2 Sensor output feedback signal to the ECU fuel ratio control in the vicinity of 14.5 ~ 14.7, a closed-loop fuel control.
- When the air-fuel ratio control in the near equivalent, CO / HC / Nox to have the highest conversion efficiency.

Testing Procedures:

1. Voltage confirmed:

- Removed O2 Sensor and the wire harness between the coupler.
- Open the main switch, but not to start engine.
- Use "volteg meter" DC stalls (DCV) to check inlet pressure sensor voltage.
- Confirmed working voltage:

  Volteg meter negative access to the wire harness sensor coupler 2nd pin (Gray/Red).

  Voltage meter positive access to the wire harness sensor coupler first pin (Red).

2. Resistance Confirmation:

- Removed O2 Sensor and the wire harness between the coupler.
- Use of the "meter" Ohm stalls, Measurement O2 Sensor heater resistance.
- Measurement resistance value

  Ohm meter negative access to the O2 sensor coupler 2nd pin (White).

  Ohm meter negative access to the O2 sensor coupler first pin (White).

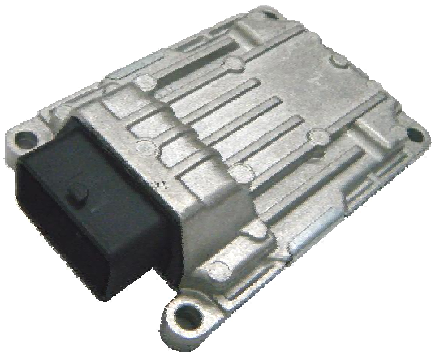
Detection judge:

- Working voltage value: above 10V
- Resistance value:15±2Ω

Treatment of abnormal phenomena:

- O2 sensor damage, heater damaged or couplers to poor contact.
- Check whether the abnormal wire harness lines.
- O2 Sensor anomaly, the proposed replacement of the O2 Sensor，and measurements again.

ECU



REMOVAL / INSTALLATION

- Remove the seat set.
- Disconnect the ECU 48P connectors.

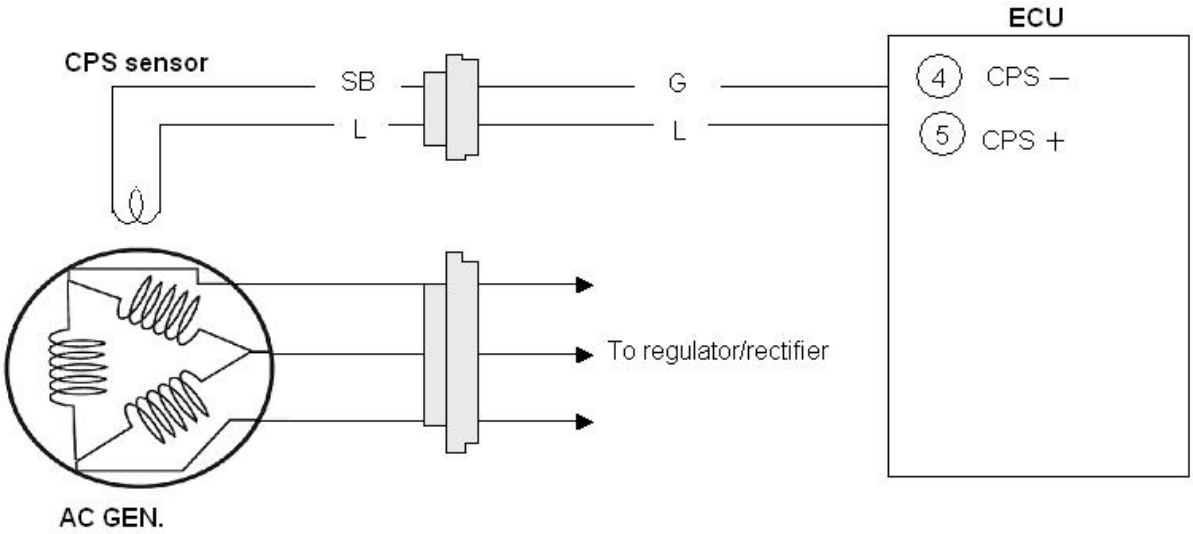
POWER INPUT LINE

- Turn the ignition switch ON.
- Measure the voltage between the ECU and ground.
- There should be battery voltage.
- If there is no voltage, check for an open circuit in Black/White wire between the ECU and roll over sensor/relay.
- If the wire is OK, check for the roll over sensor/relay.

SENSOR CIRCUIT TROUBLESHOOTING

CPS SENSOR CIRCUIT MALFUNCTION

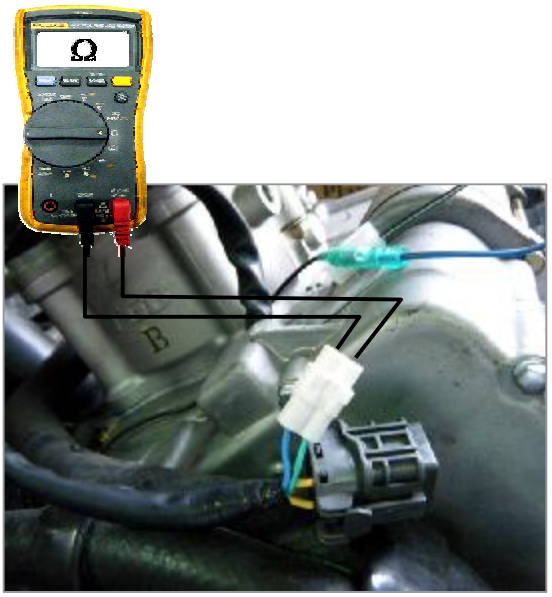
DETECTED CONDITION	POSSIBLE CAUSE
The signal does not reach ECU for 3 sec. or more, after receiving the starter signal.	• Metal particles or foreign material being stuck on the CPS sensor and rotor tip • CPS sensor circuit open or short • CPS sensor malfunction • ECU malfunction



INSPECTION

Step 1

1) Remove the seat set.
2) Remove the left side cover.
3) Turn the ignition switch OFF.
4) Check the CPS sensor coupler for loose or poor contacts.
   If OK, then measure the CPS sensor resistance.
5) Disconnect the CPS sensor coupler and measure the resistance.
   CPS sensor resistance: **50±5 Ω**
   (Blue –Sky Blue)
6) If OK, then check the continuity between each terminal and ground.
   CPS sensor continuity: ∞ Ω (Infinity)
   (Blue – Ground)
   (Green – Ground)



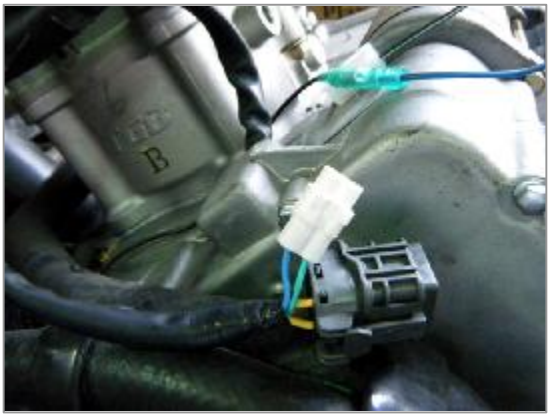
Are the resistance and continuity OK?

YES	Go to next step 2
NO	Replace CPS sensor with new one

7) After repairing the trouble, clear the DTC using Diagnosis Tool.

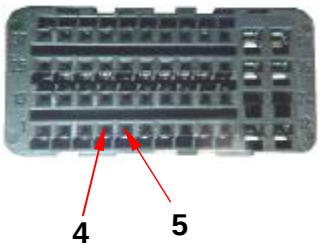
Step 2

1) Crank the engine a few seconds with the starter motor, and measure the CPS sensor peak voltage at the coupler.
2) Repeat the above test procedure a few times and measure the highest peak voltage.
CPS sensor peak voltage: 4.0 V and more
(+ Blue – - Sky-Blue)



Is the voltage OK?

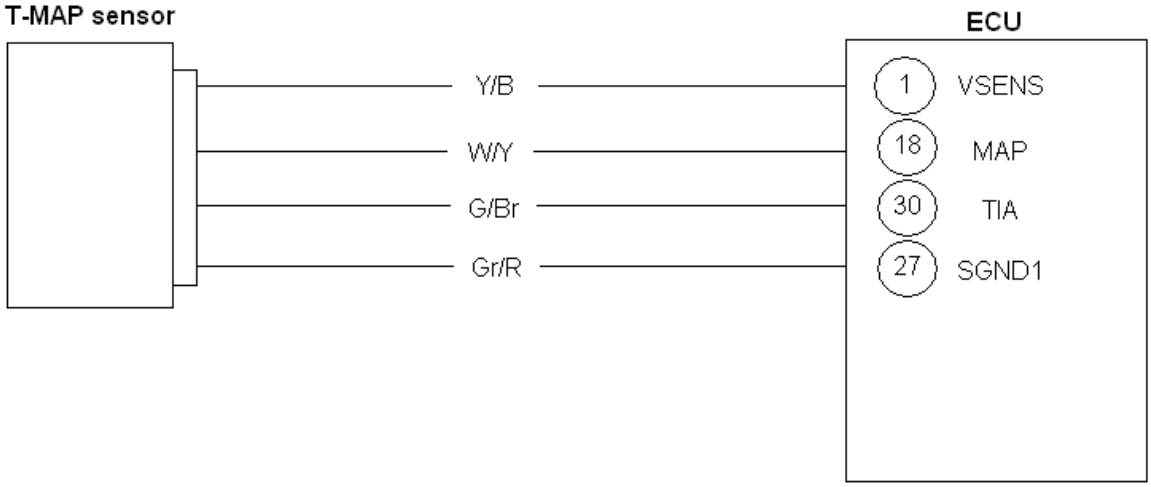
YES	•Blue or Sky-Blue wire open or shorted to ground • Loose or poor contacts on the CPS sensor coupler or ECU coupler (terminal 4 or 5) • If wire and connection are OK, intermittent trouble or faulty ECU. • Recheck each terminal and wire harness for open circuit and poor connection. • Replace the ECU with a known good one, and inspect it again.
NO	• Inspect that metal particles or foreign material stuck on the CPS sensor and rotor tip. • If there are no metal particles and foreign material, then replace the CPS sensor with a new one.



3) After repairing the trouble, clear the DTC using Diagnosis tool.

TMAP SENSOR CIRCUIT MALFUNCTION

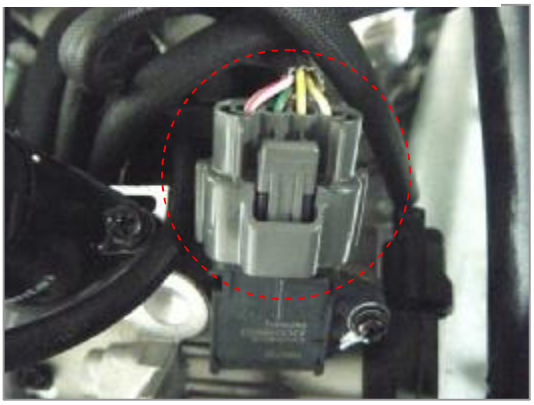
DETECTED CONDITION	POSSIBLE CAUSE
T-MAP sensor voltage low or high (0.1 V Sensor voltage < 4.8 V) NOTE: *Note that atmospheric pressure varies depending on weather conditions as well as altitude.* *Take that into consideration when inspecting voltage.*	• Clogged vacuum passage between throttle body and T-MAP sensor • Air being drawn from vacuum passage between throttle body and T-MAP sensor • T-MAP sensor circuit open or shorted to ground • T-MAP sensor malfunction • ECM malfunction

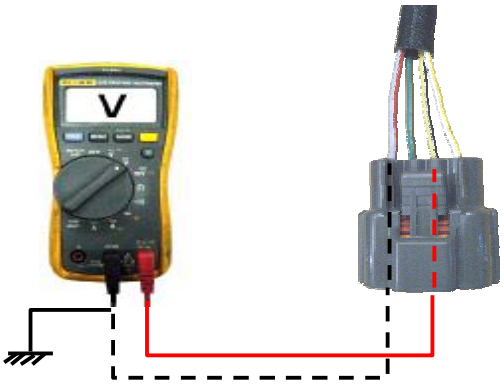


INSPECTION

Step 1

1) Loosen and lift up the fuel tank.
2) Turn the ignition switch OFF.
3) Check the T-MAP sensor couple for loose or poor contacts.
   If OK, then measure the T-MAP sensor input voltage.
4) Disconnect the T-MAP sensor coupler.
5) Turn the ignition switch ON.
6) Measure the voltage at the Yellow/Black wire and ground.
7) Also, measure the voltage at the Yellow/Black wire and Gray/Red wire.
   T-MAP sensor input voltage: 4.5 – 5.5 V
   (+Yellow/Black – - Ground)
   (+Yellow/Black – - Gray/Red)

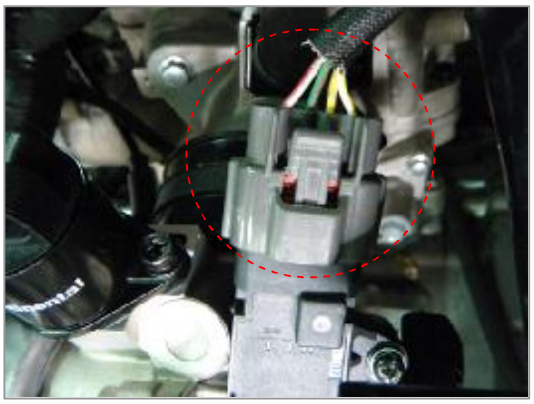




Is the voltage OK?

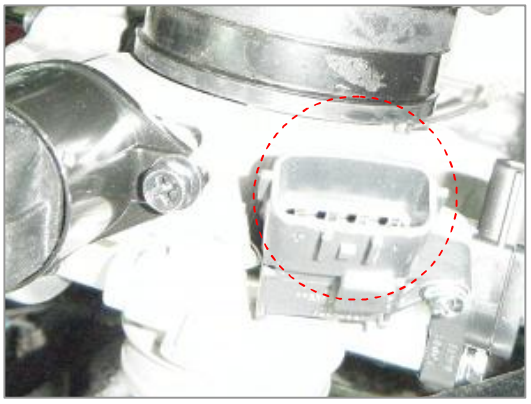
YES	Go to next step 2
NO	• Loose or poor contacts on the ECU coupler terminal 1 or 27 • Open or short circuit in the Yellow/Black wire or Gray/Red wire

8) After repairing the trouble, clear the DTC using Diagnosis tool.



Step 2

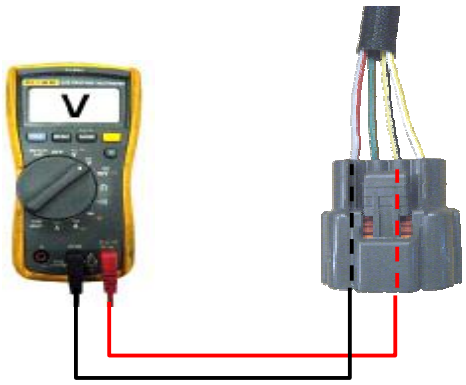
1) Connect the T-MAP sensor coupler.
2) Insert the needle pointed probes to the lead wire coupler.
3) Start the engine at idle speed and measure the T-MAP sensor output voltage at the wire side coupler.
   T-MAP sensor output voltage: Approx. 2.6 V at idle speed
   (**+White/Yellow**– - Gray/Red)



Is the voltage OK?

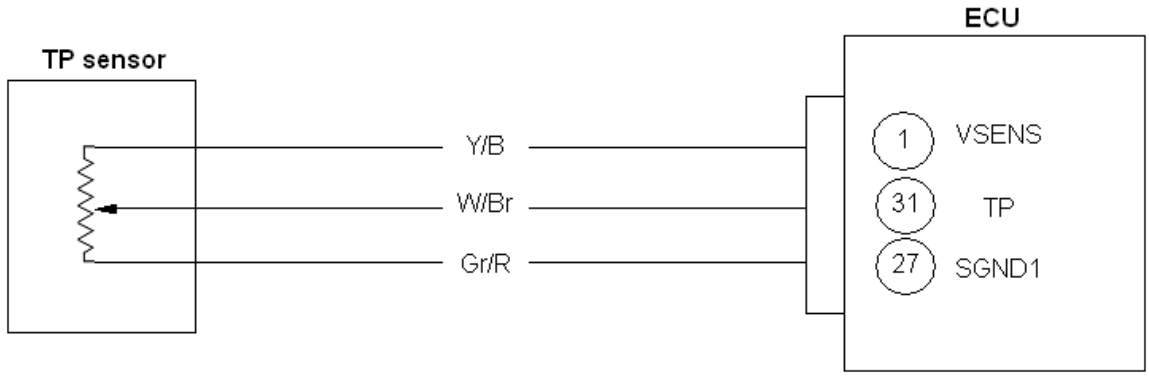
YES	•Yellow/Black or Gray/Red wire open or shorted to ground, or poor 18, 30 or 1 connection. • If wire and connection are OK, intermittent trouble or faulty ECU. • Recheck each terminal and wire harness for open circuit and poor connection. • Replace the ECU with a known good one, and inspect it again.
NO	• If check result is not satisfactory, replace new T-MAP (throttle body).

5) After repairing the trouble, clear the DTC using Diagnosis tool.



TP SENSOR CIRCUIT MALFUNCTION

DETECTED CONDITION	POSSIBLE CAUSE
Output voltage is not within the following range. Difference between actual throttle opening and opening calculated by ECU is larger than specified value. 0.1 V Sensor voltage < 4.8 V	• TP sensor maladjusted • TP sensor circuit open or short • TP sensor malfunction • ECU malfunction
Sensor voltage is higher than specified value.	• TP sensor circuit shorted to VSENS or ground circuit open
Sensor voltage is lower than specified value.	• TP sensor circuit open or shorted to ground or VSENS circuit open

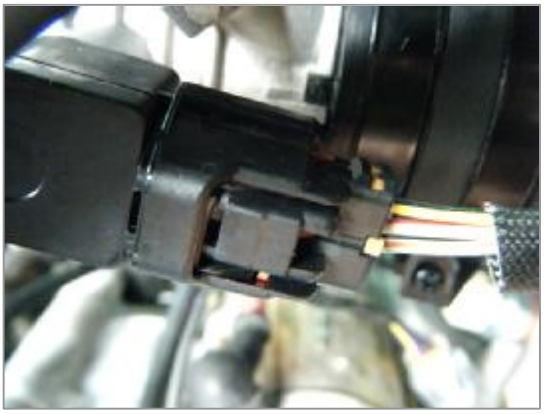


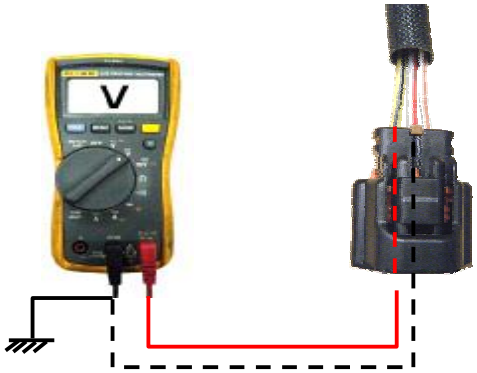
INSPECTION

Step 1

(When output voltage is out of specified)

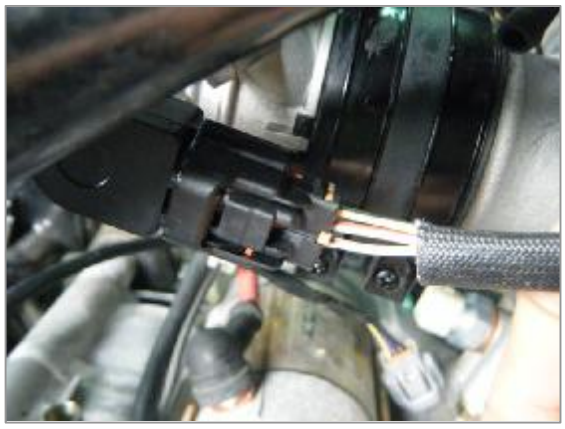
1) Loosen and lift up the fuel tank.
2) Turn the ignition switch OFF.
3) Check the TP sensor coupler for loose or poor contacts.
   If OK, then measure the TP sensor input voltage.
4) Disconnect the TP sensor coupler.
5) Turn the ignition switch ON.
6) Measure the voltage at the Red wire B and ground.
7) Also, measure the voltage at the Yellow/Black wire and Gray/Red wire.
   TP sensor input voltage: 4.5 – 5.5 V
   (+Yellow/Black – - Ground)
   (+Yellow/Black – - Gray/Red)





Is the voltage OK?

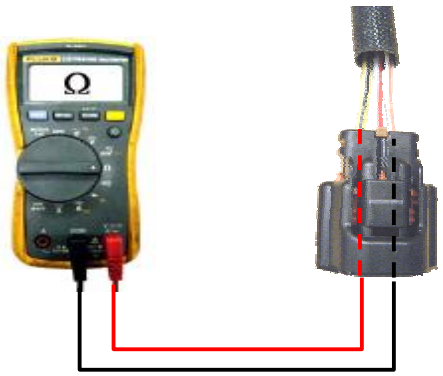
YES	Go to next step 2
NO	• Loose or poor contacts on the ECU coupler (terminal 1 or 27) • Open or short circuit in the Yellow/Black wire or Gray/Red wire



Step 1

(When sensor voltage is higher than specified)

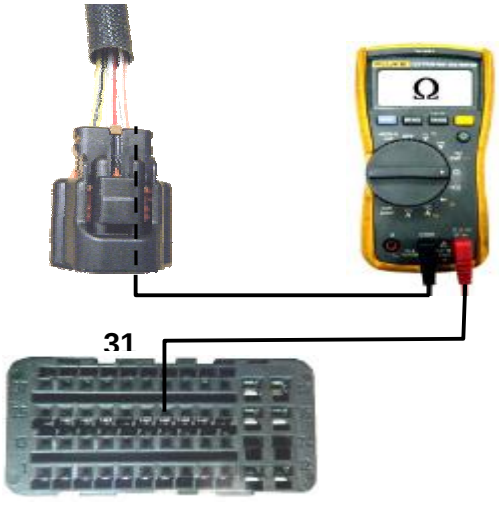
1) Loosen and lift up the fuel tank.
2) Turn the ignition switch OFF.
3) Check the TP sensor coupler for loose or poor contacts.
   If OK, then check the TP sensor lead wire continuity.
4) Disconnect the TP sensor coupler.
5) Check the continuity between W/Br wire and Y/B wire.
   If the sound is not heard from the tester, the circuit condition is OK.
6) Disconnect the ECU coupler.
7) Check the continuity between W/Br wire and terminal 31.
8) Also, check the continuity between Gr/R wire and terminal 27.
   TPS lead wire continuity: Continuity (sound)



Is the continuity OK?

YES	Go to next step 2
NO	W/Br wire shorted to VSENS or SGND1 wire open

9) After repairing the trouble, clear the DTC using Diagnosis tool.



Step 1

(When sensor voltage is lower than specified)

1) Loosen and lift up the fuel tank.
2) Turn the ignition switch OFF.
3) Check the TP sensor coupler for loose or poor contacts.
   If OK, then measure the TP sensor lead wire continuity.

4) Disconnect the TP sensor coupler.
5) Check the continuity between W/Br wire and ground.
6) Also, check the continuity between W/Br wire and Gr/R wire

C. If the sound is not heard from the tester, the circuit condition is OK.

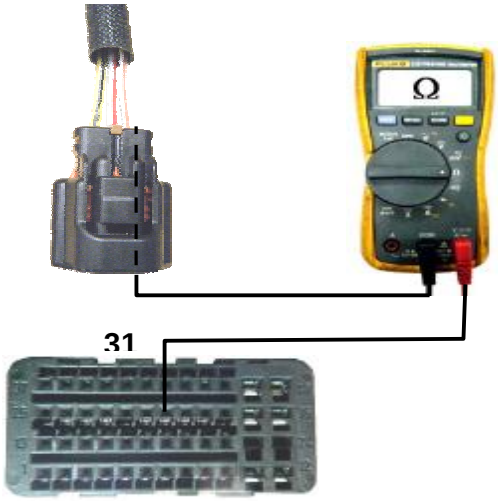
7) Disconnect the ECU coupler.
8) Check the continuity between W/Br wire and terminal 31.
9) Also, check the continuity between Y/B wire and terminal .

TPS lead wire continuity: Continuity (sound)

Is the continuity OK?

YES	Go to step 1 and step 2
NO	Y/B wire or Gr/R wire open, or Gr/R wire shorted to ground

10) After repairing the trouble, clear the DTC using Diagnosis tool.



Step 2

1) Turn the ignition switch OFF.
2) Disconnect the TP sensor coupler.
3) Check the continuity between W/Br wire and ground.

TP sensor continuity: ∞ Ω (Infinity)

(White/Brown – Ground)

4) If OK, then measure the TP sensor resistance at the terminals (between Bottom and Center pin).
5) Turn the throttle grip and measure the resistance.

TP sensor resistance

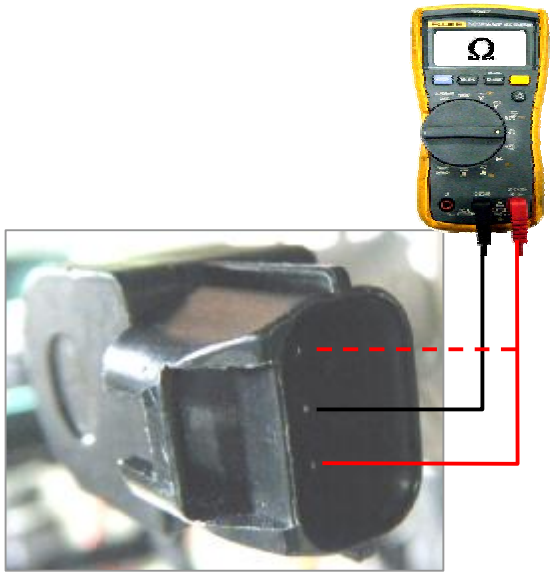
Throttle valve is closed: Approx. **1.2±0.2 kΩ**

Throttle valve is opened: Approx. **4.3±0.2 kΩ**

6) If OK, then measure the TP sensor resistance at the terminals (between Upper and Center pin).

TP sensor resistance: Approx. **4.6±0.2kΩ**

(Upper pin – Center pin)



Are the continuity and resistance OK?

YES	Go to step 3
NO	• Reset the TP sensor position correctly. • Replace the new TP sensor (throttle body).

7) After repairing the trouble, clear the DTC using Diagnosis tool.

Step 3

1) Connect the TP sensor coupler.
2) Insert the needle pointed probes to the lead wire coupler.
3) Turn the ignition switch ON.
4) Measure the TP sensor output voltage at the coupler (between W/Br wire and Gr/R wire) by turning the throttle grip.

TP sensor output voltage

Throttle valve is closed: Approx. **0.5±0.05 V**

Throttle valve is opened: Approx. **3.8±0.05 V**

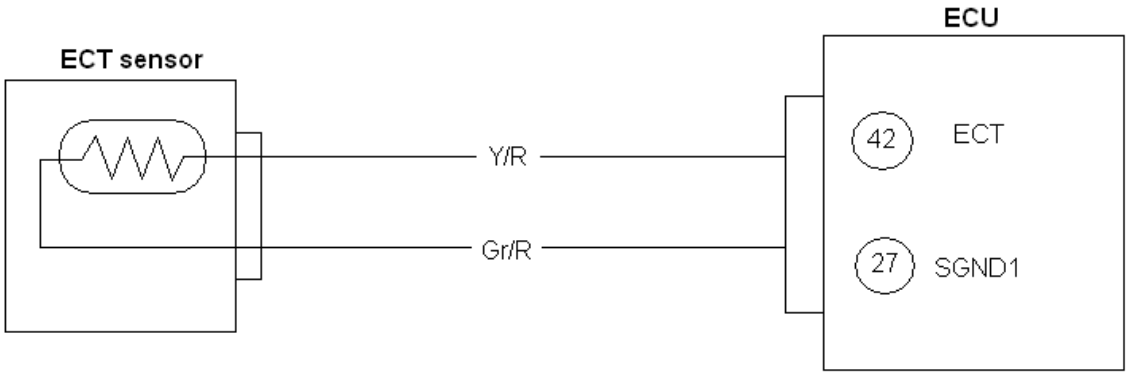
Is the voltage OK?

YES	• Y/B, W/Br or Gr/R wire open or shorted to ground, or poor 1, 31 or 27 connection • If wire and connection are OK, intermittent trouble or faulty ECU. • Recheck each terminal and wire harness for open circuit and poor connection. • Replace the ECU with a known good one, and inspect it again.
NO	If check result is not satisfactory, replace new TP sensor (throttle body).

5) After repairing the trouble, clear the DTC using Diagnosis tool.

ECT SENSOR CIRCUIT MALFUNCTION

DETECTED CONDITION	POSSIBLE CAUSE
Output voltage is not within the following range. 0.1 Sensor voltage < 4.6 V	• ECT sensor circuit open or short • ECT sensor malfunction • ECU malfunction
Sensor voltage is higher than specified value.	• ECT sensor circuit open or ground circuit open
Sensor voltage is lower than specified value.	• ECT sensor circuit shorted to ground



INSPECTION

Step 1

(When output voltage is out of specified)

1) Turn the ignition switch OFF.
2) Check the ECT sensor coupler for loose or poor contacts.
   If OK, then measure the ECT sensor voltage at the wire side coupler.
3) Disconnect the ECT sensor coupler and turn the ignition switch ON.
4) Measure the voltage between Y/R wire terminal and ground.
5) Also, measure the voltage between Y/R wire terminal and Gr/R wire terminal.
   ECT sensor input voltage: 4.5 – 5.5 V
   (+Y/R – - Ground)
   (+Y/R – - Gr/R)

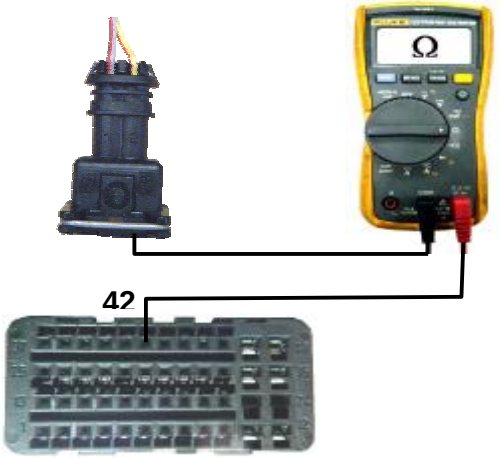
Is the voltage OK?

YES	Go to step 2
NO	• Loose or poor contacts on the ECU coupler (terminal 42 or 27) • Open or short circuit in the Y/R wire or Gr/R wire

Step 1

(When sensor voltage is higher than specified)

1) Turn the ignition switch OFF.
2) Check the ECT sensor coupler for loose or poor contacts.
   If OK, then check the ECT sensor lead wire continuity.
3) Remove the left side cover.
4) Disconnect the ECT sensor coupler.
5) Remove the ECU coupler.
6) Check the continuity between Y/R wire and terminal 42.
7) Also, check the continuity between Gr/R wire and terminal 27.
   ECTS lead wire continuity: Continuity (sound)



Is the continuity OK?

YES	Go to step 2
NO	Y/R or Gr/R wire open

8) After repairing the trouble, clear the DTC using Diagnosis tool.

Step 1

(When sensor voltage is lower than specified)

1) Turn the ignition switch OFF.
2) Check the ECT sensor coupler for loose or poor contacts.
   If OK, then check the ECT sensor lead wire continuity.
3) Disconnect the ECT sensor coupler.
4) Check the continuity between Y/R wire and ground.
5) If the sound is not heard from the tester, the circuit condition is OK.
   Tester knob indication: Continuity (sound)

6) Connect the ECT sensor coupler.
7) Turn the ignition switch ON.
8) Measure the voltage between Y/R wire and ground.
Output voltage: 0.1 – 4.6 V
(+ Y/R – - Ground)

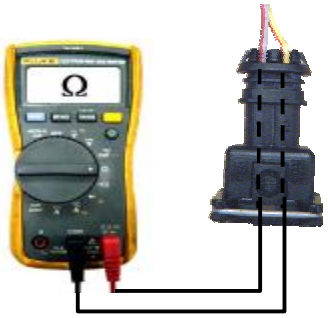
Are the continuity and voltage OK?

YES	Go to step 2
NO	Y/R wire shorted to ground.

9) After repairing the trouble, clear the DTC using Diagnosis tool.

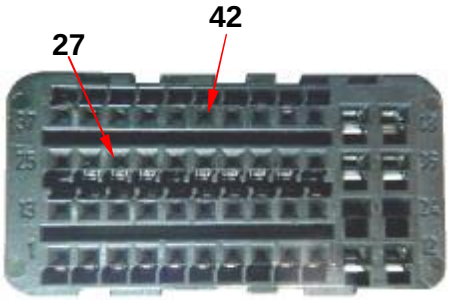
Step 2

1) Turn the ignition switch OFF.
2) Disconnect the ECT sensor coupler.
3) Measure the ECT sensor resistance.
ECT sensor resistance:
Approx. 2.3 – 2.6 kΩ at 20 °C (68 °F)
(Terminal – Terminal)

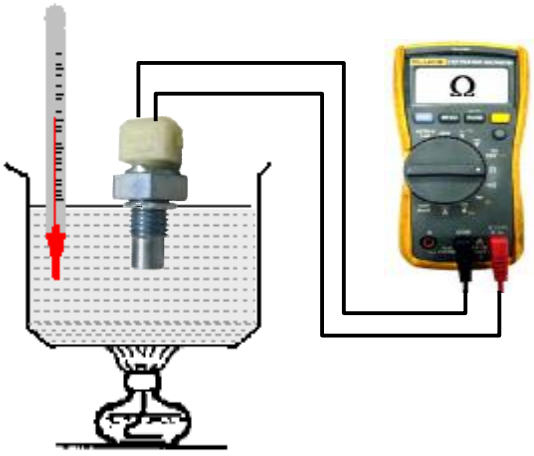


Is the resistance OK?

YES	• Y/R or Gr/R wire open or shorted to ground, or poor 42 or 27 connection • If wire and connection are OK, intermittent trouble or faulty ECU. • Recheck each terminal and wire harness for open circuit and poor connection. • Replace the ECU with a known good one, and inspect it again.
NO	Replace ECT sensor with a new one.



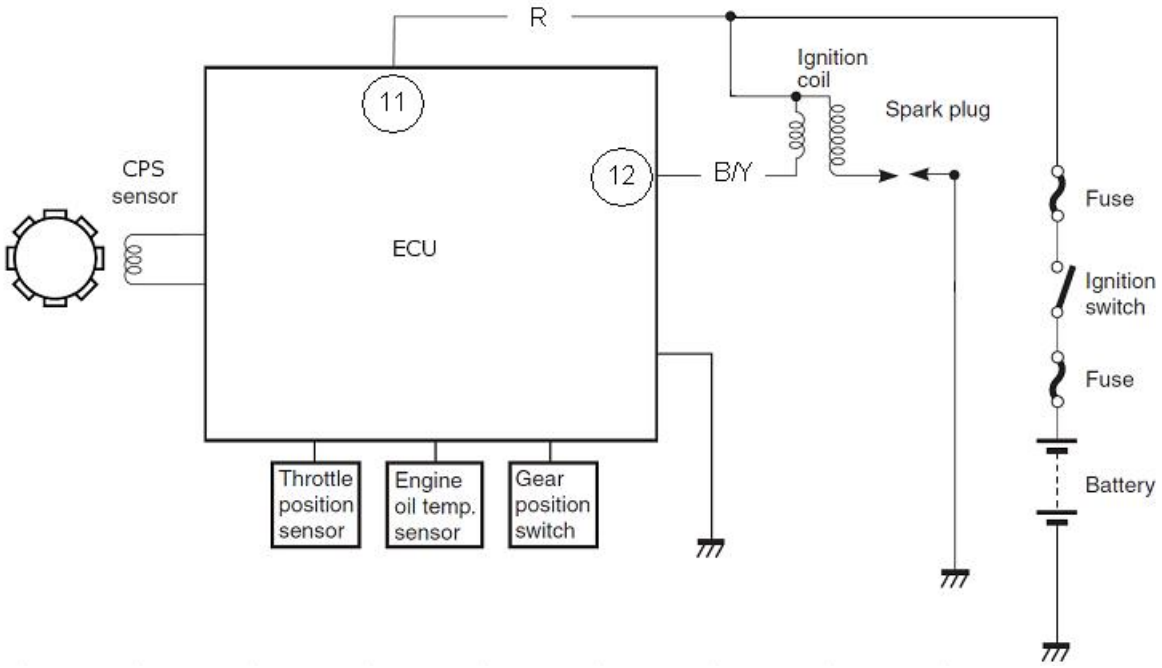
4) After repairing the trouble, clear the DTC using Diagnosis tool.



ECT sensor specification

Engine Coolant Temperature	Resistance
20 °C (68 °F)	Approx. 2.45 kΩ
40 °C (104 °F)	Approx. 1.148 kΩ
60 °C (140 °F)	Approx. 0.587 kΩ
80 °C (176 °F)	Approx. 0.322 kΩ

IGNITION SYSTEM MALFUNCTION



TROUBLESHOOTING

No spark or poor spark

NOTE:

Check that the transmission is in neutral and check that the fuse is not blown and the battery is fully charged before diagnosing.

Step 1

1) Check the ignition system couplers for poor connections.

Is there connection in the ignition switch couplers?

YES	Go to step 2
NO	Poor connection of couplers

Step 2

1) Measure the battery voltage between input lead wires at the ECU with the ignition switch in the "ON" position.

Is the voltage OK?

YES	Go to step 3
NO	• Faulty ignition switch • Broken wire harness or poor connection of related circuit couplers

Step 3

1) Measure the ignition coil primary peak voltage.

NOTE:

This inspection method is applicable only with the multi circuit tester and the peak volt adaptor.

Is the peak voltage OK?

YES	Go to step 4
NO	Go to step 5

Step 4

1) Check the plug caps for poor contacts.
2) If OK, then inspect the spark plugs.

Are the spark plugs OK?

YES	Go to step 5
NO	Faulty spark plug (-s)

Step 5

1) Inspect the ignition coils.

Are the ignition coils OK?

YES	Go to step 6
NO	Faulty ignition coil (-s)

Step 6

1) Measure the CPS sensor peak voltage and its resistance.

NOTE:

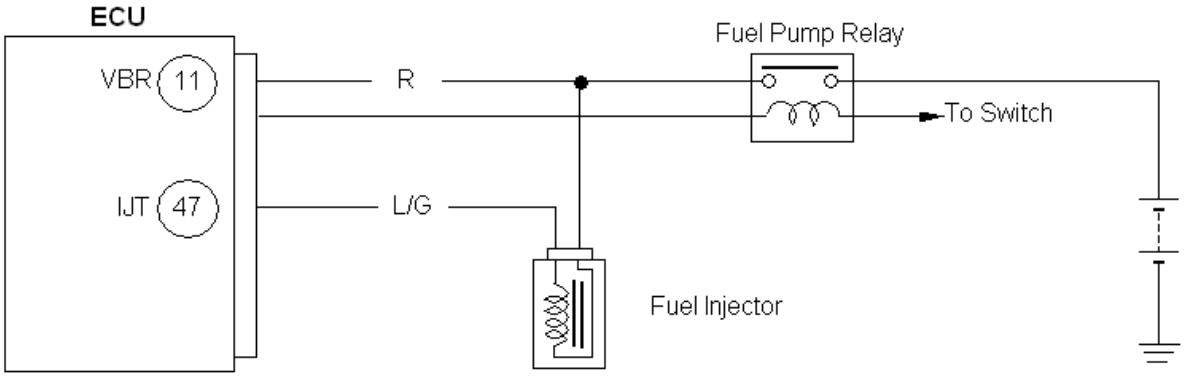
The CPS peak voltage inspection is applicable only with the multi-circuit tester and peak volt adaptor.

Are the peak voltage and its resistance OK?

YES	• Faulty ECU • Open or short circuit in wire harness • Poor connection of ignition couplers
NO	• Faulty CPS sensor • Metal particles or foreign material being stuck on the CPS sensor and rotor tip

FUEL INJECTOR CIRCUIT MALFUNCTION

DETECTED CONDITION	POSSIBLE CAUSE
CPS signals produced but fuel injector signal is interrupted continuous by 4 times or more.	• Injector circuit open or short • Injector malfunction • ECU malfunction



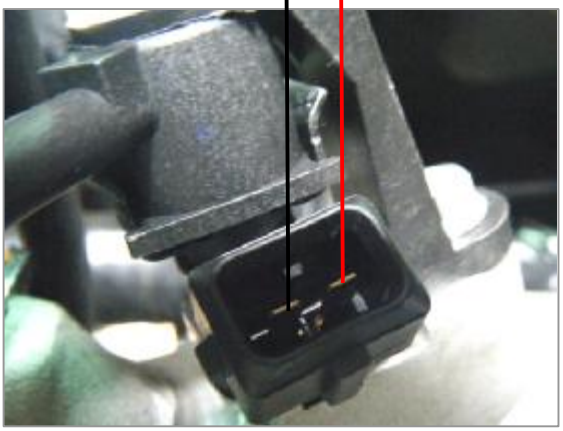
Step 1

1) Turn the ignition switch OFF.
2) Check the injector coupler for loose or poor contacts.
   If OK, then measure the injector resistance.
3) Disconnect the injector coupler and measure the resistance between terminals.
   Injector resistance:
   Approx. 11.7 Ω at 20 °C (68 °F)
   (Terminal – Terminal)
4) If OK, then check the continuity between each terminal and ground.
   STP sensor continuity: ∞ Ω (Infinity)

Are the resistance and continuity OK?

YES	Go to step 2
NO	Replace the injector with a new one.

5) After repairing the trouble, clear the DTC using Diagnosis tool.



Step 2

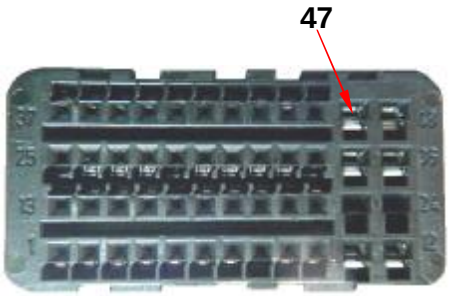
1) Turn the ignition switch ON.
2) Measure the injector voltage between R wire and ground.
   Injector voltage: Battery voltage
   (+ R – - Ground)

NOTE:

Injector voltage can be detected only 3 seconds after ignition switch is turned ON.

Is the voltage OK?

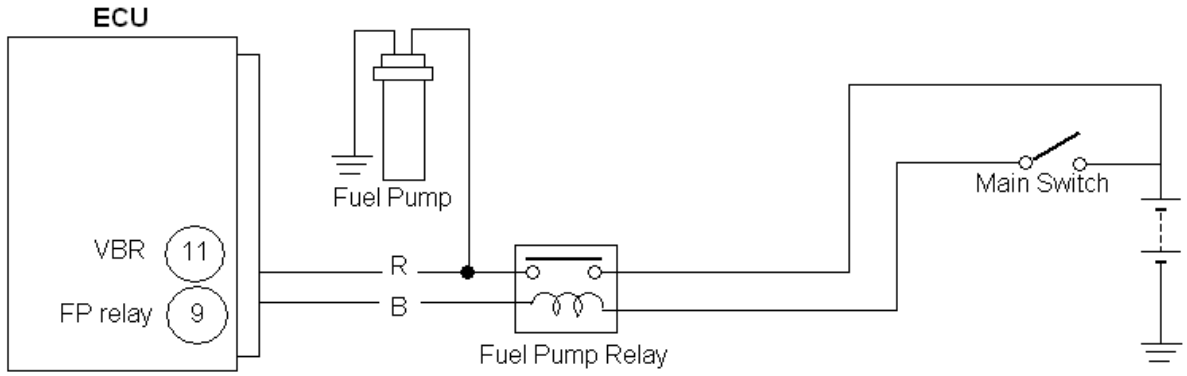
YES	• L/G wire open or shorted to ground, or poor 47 connection (cylinder side) • If wire and connection are OK, intermittent trouble or faulty ECU. • Recheck each terminal and wire harness for open circuit and poor connection. • Replace the ECU with a known good one, and inspect it again.
NO	Open circuit in the R wire



3) After repairing the trouble, clear the DTC using Diagnosis tool.

Fuel Pump RELAY CIRCUIT MALFUNCTION

DETECTED CONDITION	POSSIBLE CAUSE
No voltage is applied to fuel pump although fuel pump relay is turned ON, or voltage is applied to fuel pump, although fuel pump relay is turned OFF.	• Fuel pump relay circuit open or short • Fuel pump relay malfunction • ECU malfunction



INSPECTION

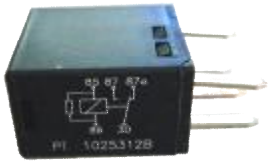
Step 1

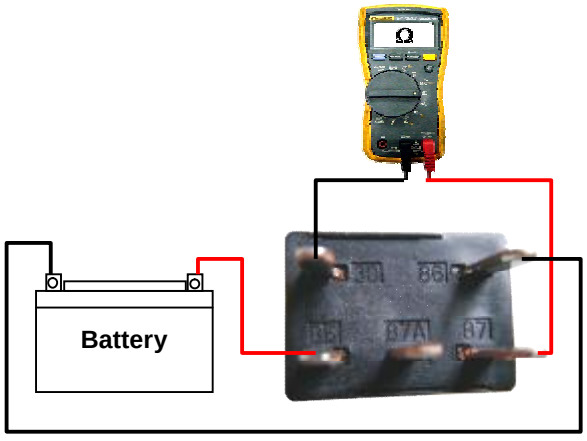
1) Remove the seat.
2) Turn the main switch OFF.
3) Check the FP relay coupler for loose or poor contacts.
   If OK, then check the FP relay.

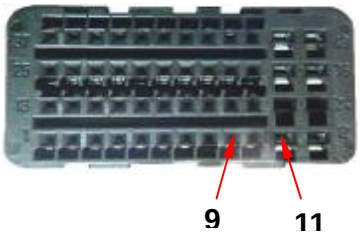
Is the FP relay OK?

YES	• Blue wire open or shorted to ground, or poor 9 connection • Red wire open or poor 11 connection • If wire and connection are OK, intermittent trouble or faulty ECU. • Recheck each terminal and wire harness for open circuit and poor connection. • Replace the ECU with a known good one, and inspect it again.
NO	Replace the FP relay with a new one.

4) After repairing the trouble, clear the DTC using Diagnosis tool.

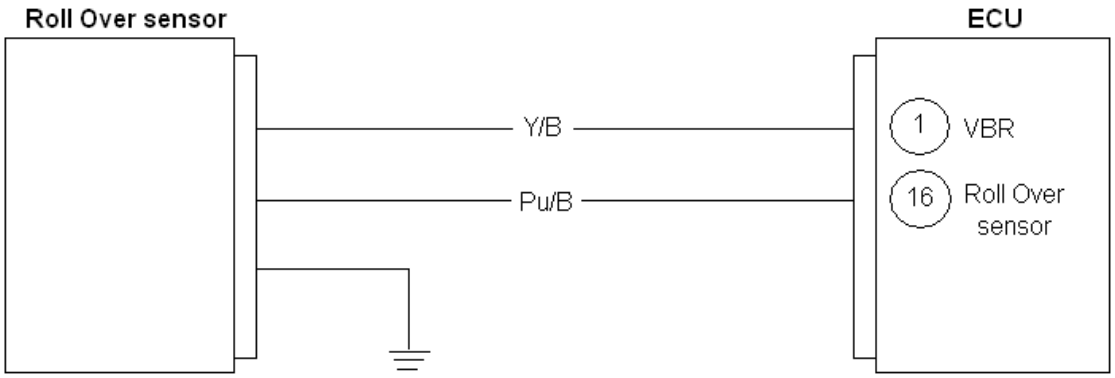






ROLL OVEWR SENSOR CIRCUIT MALFUNCTION

DETECTED CONDITION	POSSIBLE CAUSE
The sensor voltage should be the following for 2 sec. and more, after ignition switch is turned ON. 0.2 Sensor voltage < 4.6 V	• TO sensor circuit open or short • TO sensor malfunction • ECU malfunction
Sensor voltage is higher than specified value.	•TO sensor circuit open or shorted to VSENS or ground circuit open
Sensor voltage is lower than specified value.	•TO sensor circuit shorted to ground or VSENS circuit open

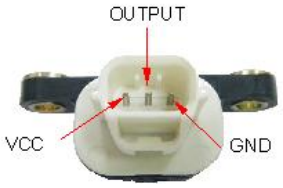


INSPECTION

Step 1

(When output voltage is out of specified)

1) Remove the seat set.
2) Turn the ignition switch OFF.
3) Check the Roll over sensor coupler for loose or poor contacts.
   If OK, then measure the Roll over sensor resistance.
4) Disconnect the Roll over sensor coupler.
5) Measure the resistance between terminal A and terminal C.
   Roll over sensor resistance: **1.6±0.2kΩ**
   (Terminal A – Terminal C)



Is the resistance OK?

YES	Go to step 2
NO	Replace the Roll over sensor with a new one.

Step 1

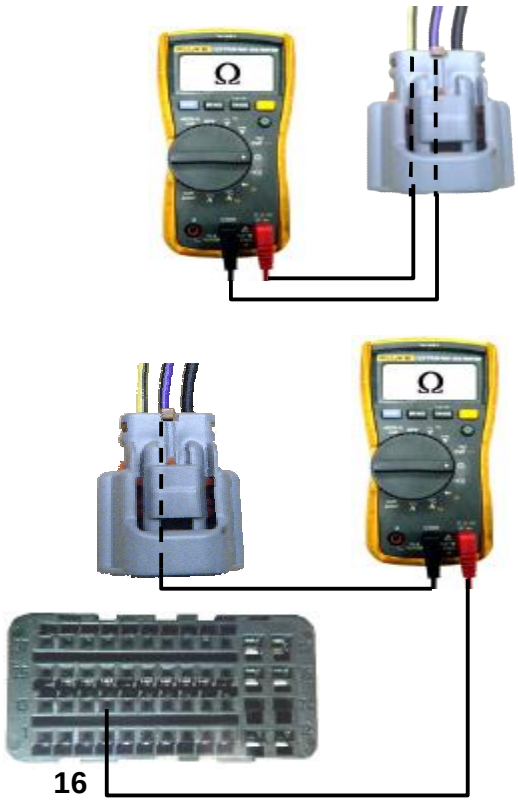
(When sensor voltage is higher than specified)

1) Remove the seat set.
2) Turn the ignition switch OFF.
3) Check the Roll over sensor coupler for loose or poor contacts.
   If OK, then check the Roll over sensor lead wire continuity.
4) Disconnect the Roll over sensor coupler.
5) Check the continuity between Y/B wire and Pu/B wire.
   If the sound is not heard from the tester, the circuit condition is OK.
6) Disconnect the ECU coupler.
7) Check the continuity between Pu/B wire and terminal 16.

Is the continuity OK?

YES	Go to step 2
NO	Pu/B wire shorted to VBR

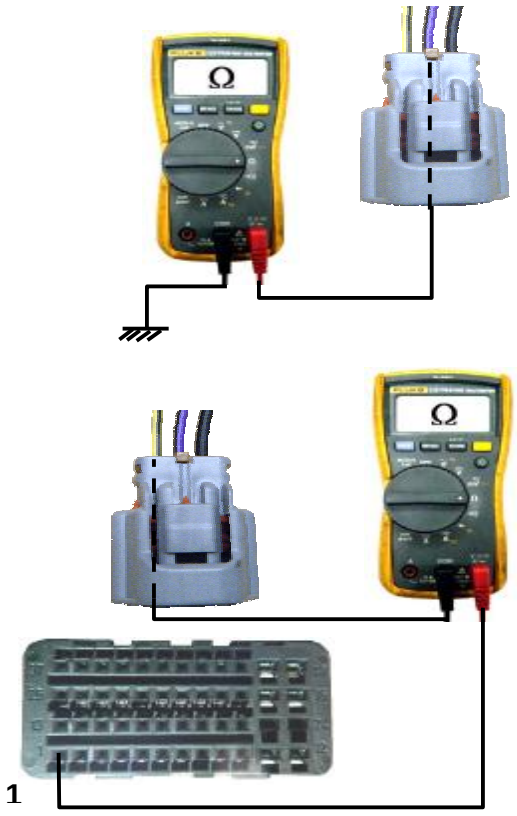
8) After repairing the trouble, clear the DTC using Diagnosis tool.



Step 1

(When sensor voltage is lower than specified)

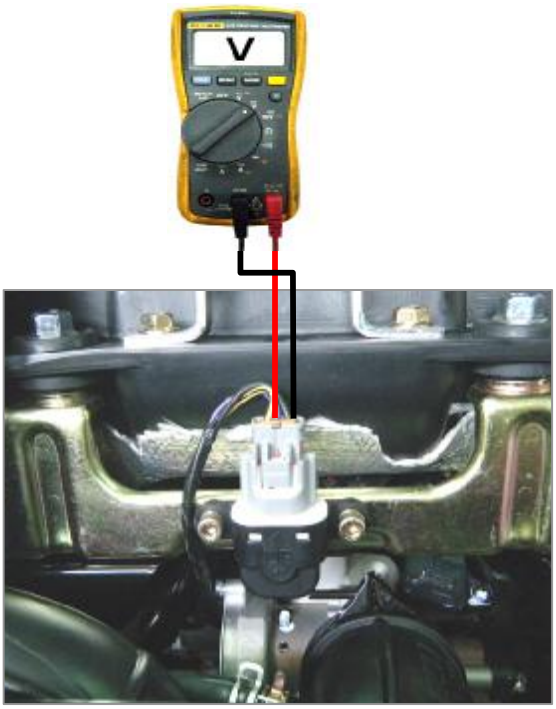
1) Remove the seat set.
2) Turn the ignition switch OFF.
3) Check the Roll over sensor coupler for loose or poor contacts.
   If OK, then check the Roll over sensor lead wire continuity.
4) Disconnect the Roll over sensor coupler.
5) Check the continuity between Pu/B wire and ground. If the sound is not heard from the tester, the circuit condition is OK.
7) Disconnect the ECU coupler.
8) Check the continuity between Y/B wire and terminal 1.
9) Also, then check the continuity between Pu/B wire B and terminal 16.
   Roll over sensor lead wire continuity:
   Continuity (sound)



Is the continuity OK?

YES	Go to step 2
NO	Y/B or Pu/B wire open or Pu/B wire shorted to ground

10) After repairing the trouble, clear the DTC using Diagnosis tool.



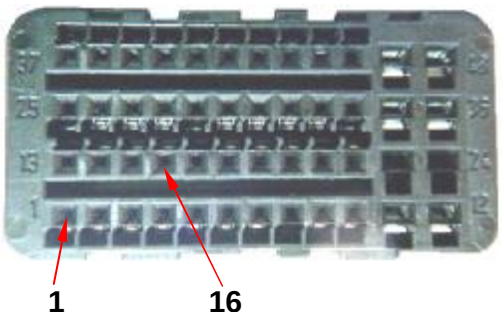
Step 2

1) Connect the Roll over sensor coupler.
2) Insert the needle pointed probes to the lead wire coupler.
3) Turn the ignition switch ON.
4) Measure the voltage at the wire side coupler between Pu/B and B wires.
   Also, measure the voltage when leaning the vehicle.
   Roll over sensor voltage (Normal):**1.1±0.2 V**
   (+ Pu/B – - B)
5) Dismount the Roll over sensor from its bracket and measure the voltage when it is leaned 65° and more, left and right, from the horizontal level.
   Roll over sensor voltage (Leaning): **4.1±0.2 V**
   (+ Pu/B – - B)

Is the voltage OK?

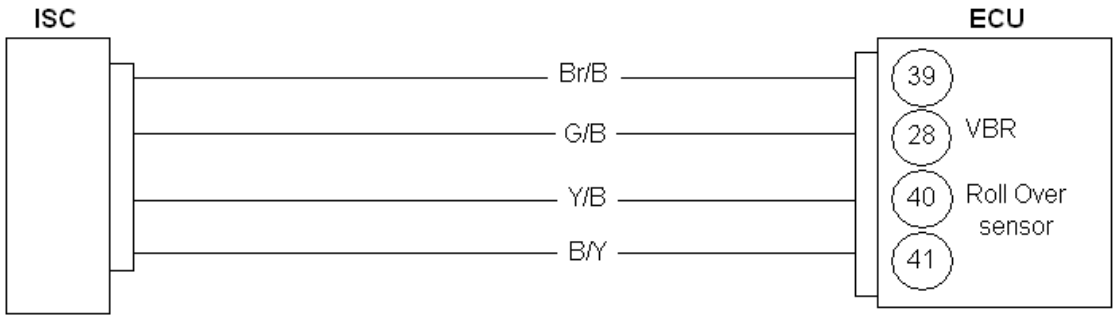
YES	• Y/B or Pu/B wire open or shorted to ground, or poor 1 or 16 connection • If wire and connection are OK, intermittent trouble or faulty ECU. • Recheck each terminal and wire harness for open circuit and poor connection. • Replace the ECU with a known good one, and inspect it again.
NO	• Loose or poor contacts on the ECU coupler • Open or short circuit • Replace the Roll over sensor with a new one.

6) After repairing the trouble, clear the DTC using Diagnosis tool.



IDLE SPEED CONTROLLER CIRCUIT MALFUNCTION

DETECTED CONDITION	POSSIBLE CAUSE
The operation voltage does not reach the ISC. ECU does not receive communication signal from the ISC.	• ISC malfunction • ISC circuit open or short • ISC motor malfunction



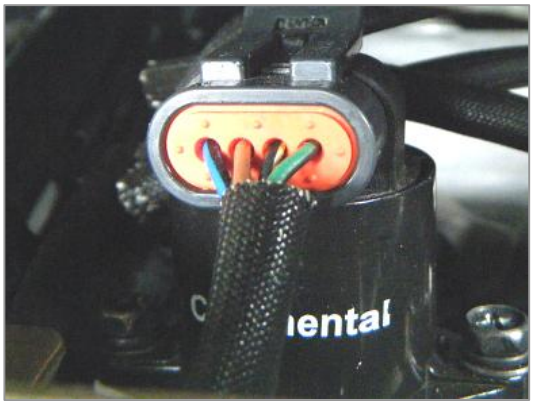
INSPECTION

Step 1

1) Remove the fuel tank.
2) Turn the ignition switch OFF.
3) Check the ISC lead wire coupler for loose or poor contacts.
4) Remove the air cleaner rubber tube.
5) Turn the ignition switch ON to check the ISC operation.
   (ISC operating order: 95% open → full open → 95% open)

Is the operating OK?

YES	Go to step 2.
NO	• Loose or poor contacts on the ISC coupler • Open or short circuit in the Br/B, G/B, Y/B or B/Y wires • If wire and connection are OK, go to Step 2.



6) After repairing the trouble, clear the DTC using Diagnosis tool.

Step 2

1) Turn the ignition switch OFF.
2) Disconnect the ISC lead wire coupler.
3) Check the continuity between each terminal and ground.

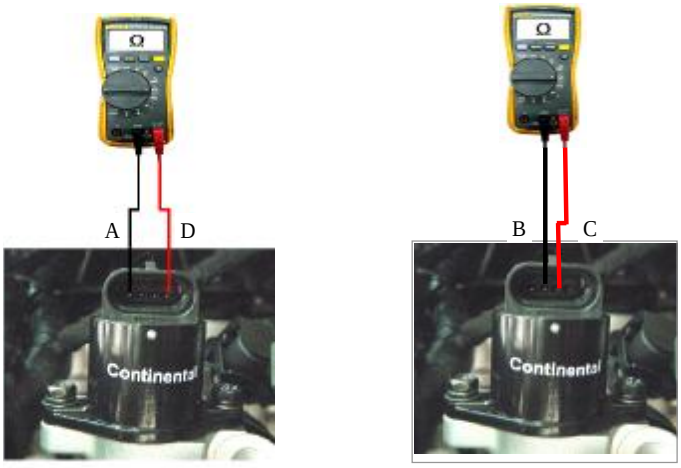
ISC continuity: ∞ Ω (Infinity)

(Terminal – Ground)

4)

• Measure the resistance between A-D and B-C as below

• The standard are all follow 50±5Ω.



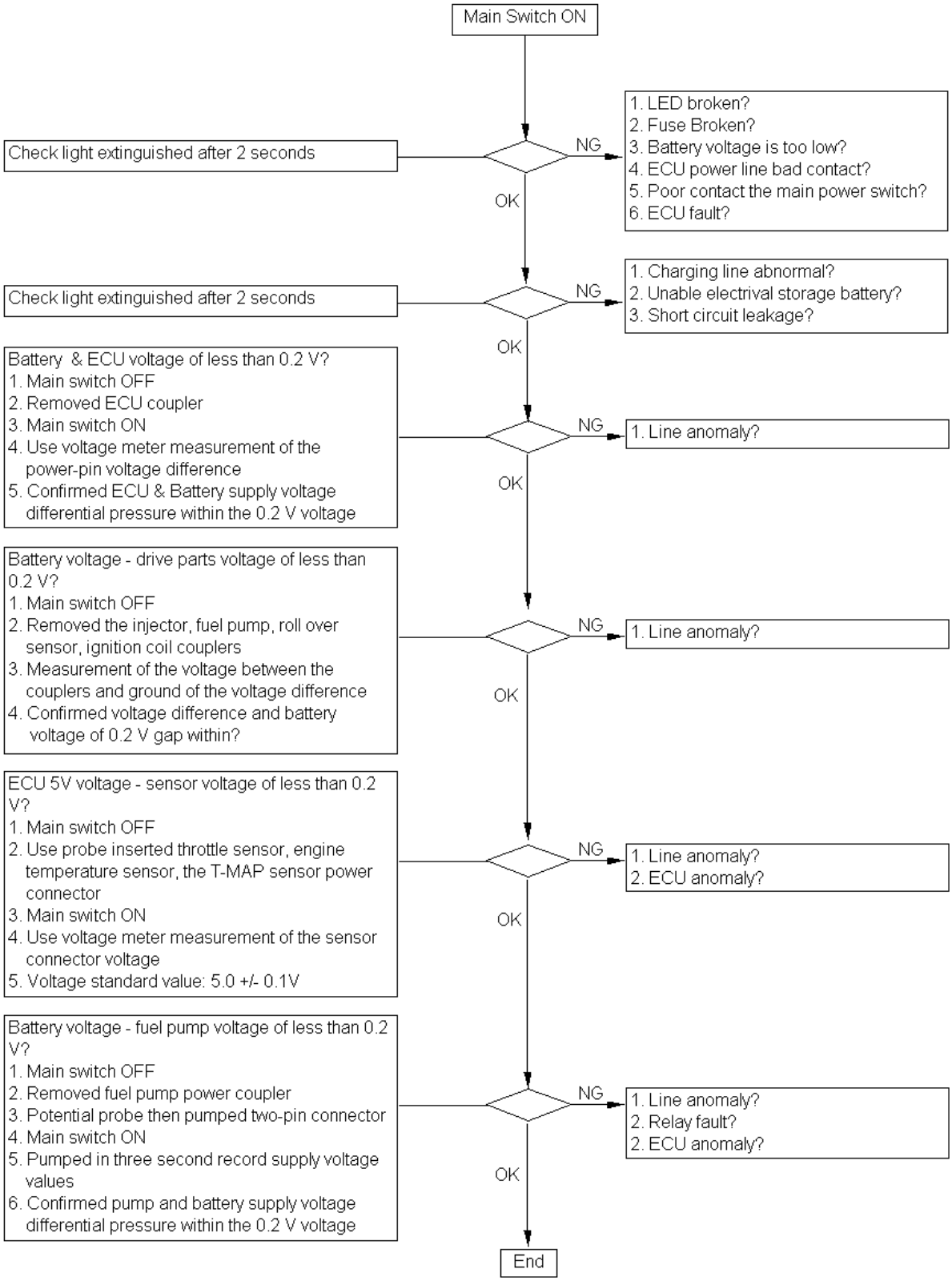
Is the resistance OK?

YES	•Br/B, G/B, Y/B and B/Y wire open or shorted to ground, or poor 28, 39, 40 and 41 connection • If wire and connection are OK, intermittent trouble or faulty ECU. • Recheck each terminal and wire harness for open circuit and poor connection. • Replace the ECU with a known good one, and inspect it again.
NO	• Loose or poor contacts on the ECU coupler • Replace new ISC (throttle body).

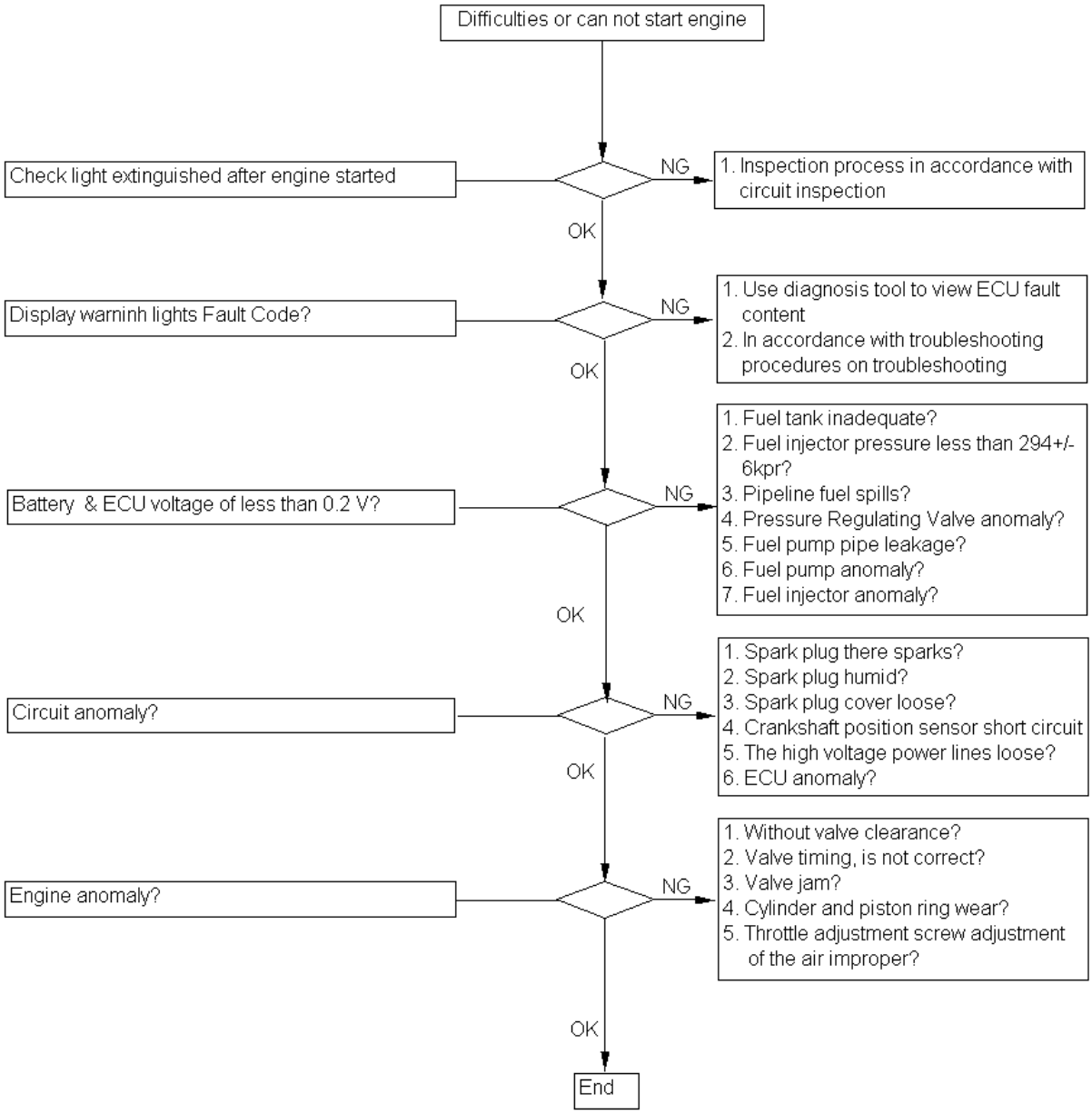
5) After repairing the trouble, clear the DTC using Diagnosis tool.

Fault Diagnosis

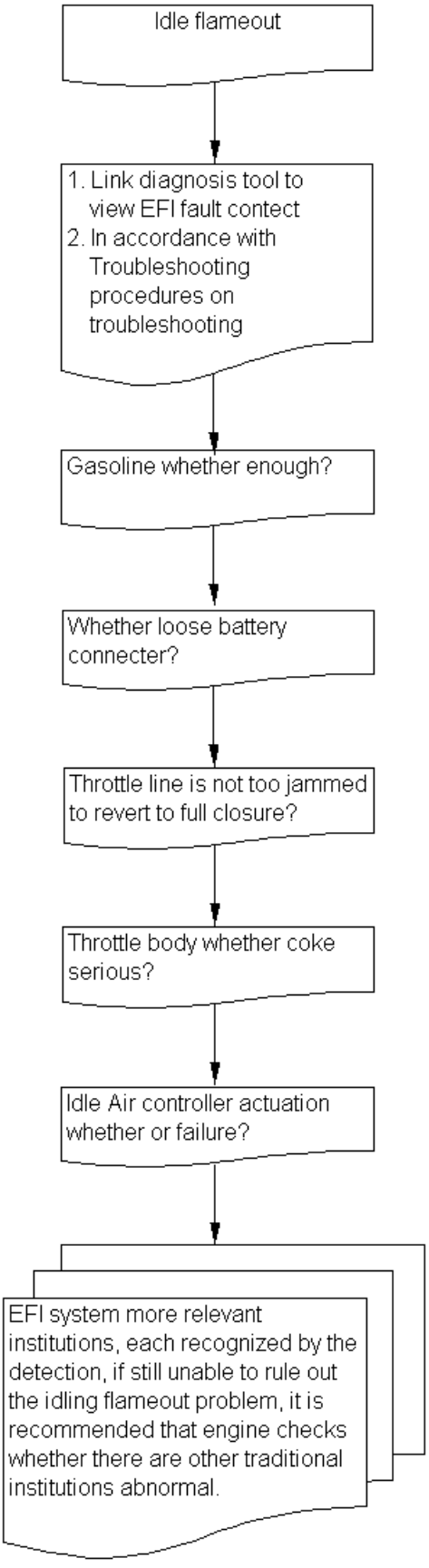
EFI Circuit inspection



Can not Start the engine or difficult to start inspection



Idle flameout diagnosis



Integrated Fault Diagnosis Program

Checking adjusting project	Detection of maintenance projects and steps	Fault status determination		Fault reasons	Parts specifications
Battery Voltage	· Use meter direct measurement battery voltage · Use diagnosis tool detection battery voltage	· Battery voltage is 10 V above? · Diagnosis tool show whether the voltage of 10 V above?	NO	· Battery electricity · Battery connector loose · Harness circuit opening · ECU coupler not connected properly	· Diagnosis tool display voltage required to achieve more than 10 V
		YES			
Diagnosis fault code inspection	· Use of the diagnosis tool detection fault code · Elimination of fault codes and then start engine	· Diagnostic tool show whether or not a fault code? · Fault Code cleared after show again?	YES	· TPS fault · ETS fault · CPS fault · T-MAP fault · Tilt fault · ECU fault	· The sensor detection methods and specifications, please refer to repair manual
		NO			
Fuel quantity and fuel pressure	· Removed the injector on the intake manifold but not removal of harness coupler. (Injector and cap tightly by hands, fuel spills should not be the case) · Start the engine · Examine whether injector fuel injection · Between the tank and injector, Installation the pressure gauge · Check fuel pressure adequancy	· Injector whether injection? · Injector spray angle is normal? · Fuel pressure enough?	NO	· Less than fuel tank · Injector fault · Fuel pump relay fault · Fuel pump fault · ECU fault · Fuel pump filter obstructive	· Pressure fuel specifications: Open the main switch ten seconds after but not start engine->more than 250 kPa Idle->294+/- 6kPa · Injecetor resistance specifications: 11.7+/- 0.6Ω
		YES			
Ignition situation	· Removed the spark plug from the cylinder head, but then power lines still ring · Start the engine · Check spark plug sparks	· Examine whether the spark plug ignition? · Check spark plug sparks strength is normal?	NO	· Spark plug fault · Roll over sensor fault · ECU fault · Ignition coil fault · Crankshaft position sensor fault	· Dspark plug specifications: NGK-CR7E
		YES			
Engine Vaccum	· Use diagnosis tool to detect of the manifold pressure	· Diagnosis tool manifold pressure for compliance with specifications?	NO	· Valve clearance is not normal · Intake system leak	· Manifold pressure Specifications: 32~38 kPa

YES

Normal starting → Finish

Can not starting or starting difficulties → In traditional engine overhaul way to maintenance

Fault Diagnosis Note

When the motorcycle injection system in the wrong signal, causing abnormal functioning of the engine or can not start engine, MIL light at the dashboard will be lighting, to inform drivers to carry out maintenance.

Overhaul, the diagnosis tool can be used for troubleshooting. If the fault has been ruled out or repair after the MIL light will be extinguished, but ECU fault code will be recorded, so the need to get rid of fault codes.

Diagnosis tool for overhaul

Diagnosis tool will connect to the motorcycle for coupler diagnosis, according to the use of diagnostic tool testing methods, when belong fuel injection system fault or parts fault, according to the diagnosis tool of the fault code display messages do describe parts of the inspection testing maintenance and replacement parts. When after the maintenance, the need to get rid of fault codes.

Fault Code And The Sensors Of The Table

No.	Fault codes	Fault Description
1	XXXXX	Un define
2	B2225	Tilt switch diagnosis (short circuit to battery)
3	B2226	Tilt switch diagnosis (short circuit to ground _Open circuit)
4	P0000	No DTC
5	P0031	Sensor heater diagnosis #0 (short circuit to ground _Open circuit)
6	P0032	Sensor heater diagnosis #0 (short circuit to battery)
7	P0107	MAP sensor diagnosis (short circuit to ground _Open circuit)
8	P0108	MAP sensor diagnosis (short circuit to battery)
9	P0112	Intake air temperature sensor diagnosis (short circuit to ground)
10	P0113	Intake air temperature sensor diagnosis (short circuit to ground _Open circuic)
11	P0114	Electrical intake air temperature intermittent diagnosis (failure)
12	P0117	Coolant Temperature Sensor (short circuit to ground)
13	P0118	Coolant Temperature Sensor (short circuit to ground _Open circuit)
14	P0119	Coolant temperature intermittent diagnosis (failure)
15	P0121	TPS position sensor adaptation diagnosis (out of range)
16	P0122	Throttle Position Sensor 1 (short circuit to ground _Open circuit)
17	P0123	Throttle Position Sensor 1 (short circuit to battery)
18	P0131	Lambda sensor #0 diagnosis (short circuit to ground)
19	P0132	Lambda sensor #0 diagnosis (short circuit to battery)
20	P0133	Lambda sensor #0 diagnosis (Open circuit)
21	P0171	Lambda control diagnosis (O2 correction too high)
22	P0172	Lambda control diagnosis (O2 correction too low)
23	P0217	Engine coolant over temperature protection diagnosis
24	P0219	Engine over speed detection diagnosis
25	P0231	Electric fuel pump diagnosis (short circuit to ground _Open circuit)
26	P0232	Electric fuel pump diagnosis (short circuit to battery)
27	P0261	Injection valve diagnosis #1 (short circuit to ground _Open circuit)
28	P0262	Injection valve diagnosis #1 (short circuit to battery)
29	P0264	Injection valve diagnosis #2 (short circuit to ground _Open circuit)
30	P0265	Injection valve diagnosis #2 (short circuit to battery)
31	P0351	Ignition diagnosis #1 (short circuit to battery)
32	P0352	Ignition diagnosis #2 (short circuit to battery)
33	P0370	Loss of synchronization diagnosis
34	P0373	Crankshaft sensor diagnosis
35	P0484	Cooling fan diagnosis (short circuit to battery)

36	P0485	Cooling fan diagnosis (short circuit to ground _Open circuit)
37	P0562	Battery voltage diagnosis (Voltage too low)
38	P0563	Battery voltage diagnosis (Voltage too high)
39	P0608	Reference voltage diagnosis (short circuit to battery)
40	P0609	Reference voltage diagnosis (short circuit to ground _Open circuit)
41	P0615	Starter 1 diagnosis (Open circuit)
42	P0616	Starter 1 diagnosis (short circuit to ground)
43	P0617	Starter 1 diagnosis (short circuit to battery)
44	P0651	MIL diagnosis (short circuit to ground _Open circuit)
45	P0652	MIL diagnosis (short circuit to battery)
46	P1352	Ignition diagnosis #1 (short circuit to ground _Open circuit)
47	P1353	Ignition diagnosis #2 (short circuit to battery)
48	P1508	Stepper motor diagnosis (short circuit to ground _Open circuit)
49	P1509	Stepper motor diagnosis (short circuit to battery)

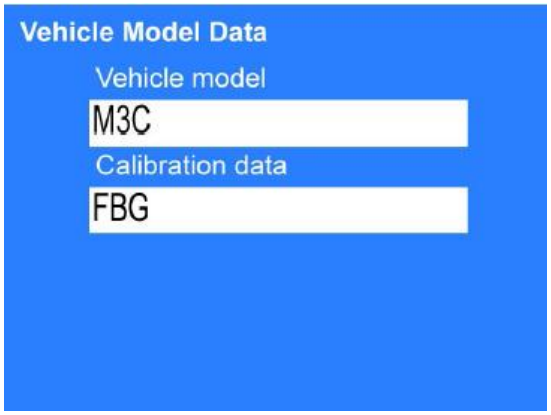
Use diagnosis tool

Note:

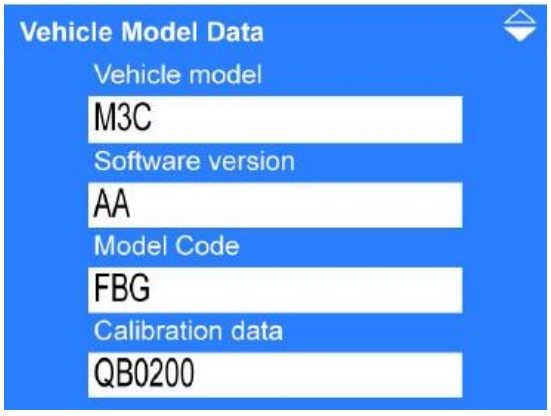
- When problems arise, can be used for diagnosis tool of the fault is detected, and exclusion.
- In addition to testing, troubleshooting, another of the operation can be carried out data analysis-type monitor.

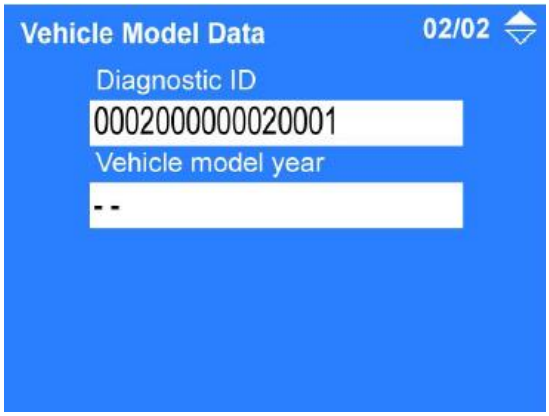
Method of Use:

1. Connected to the diagnostic connector for diagnosis tool.
   NACS→TGB interface→Transfer Cable→TGB 3 pin/6 pin Diagnosis Cable→Vehicle.
2. When the IG of the motorcycle is on, the system starts to run, entering into boot screen.
3. Key ON and the diagnosis display screen appeared the words connection.
4. Press the “ENTER” button and the system will identify the vehicle model automatically and display the vehicle info on the screen, as following picture



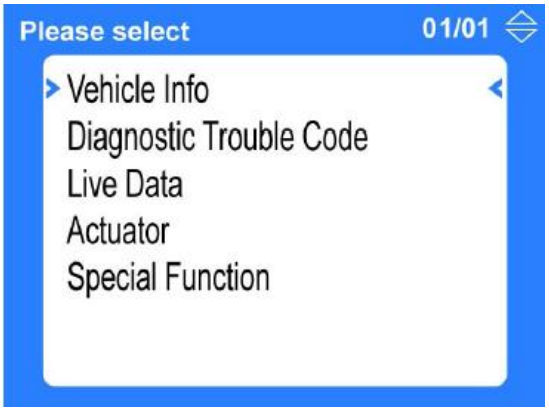
5. Press “ENTER” button again for more detailed vehicle information. Press ▲▼ button to view all information.





Diagnosis Use Note

Press ”ENTER” button to the function menu.



Options main functional areas:

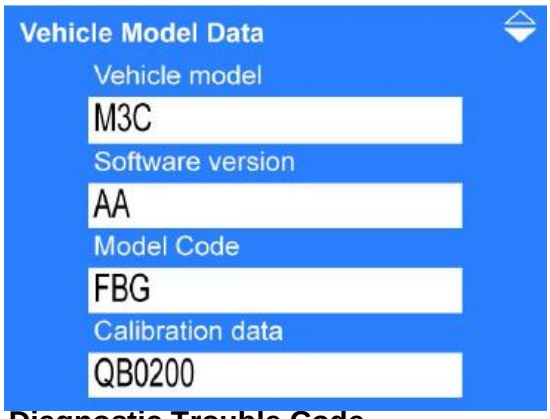
1. Vehicle Info

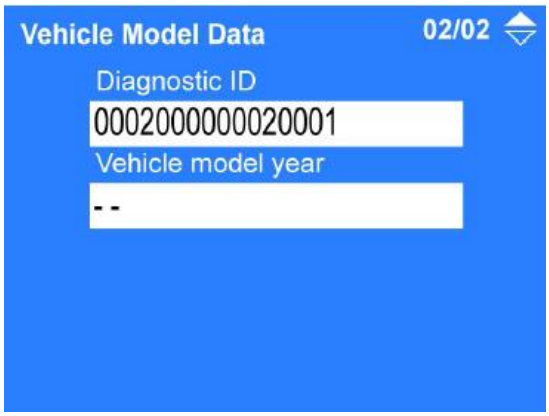
2. Diagnostic Trouble Code
3. Live Data
4. Actuator
5. Special Function

Press ▲▼ button to choose one function.

1. Vehicle Info

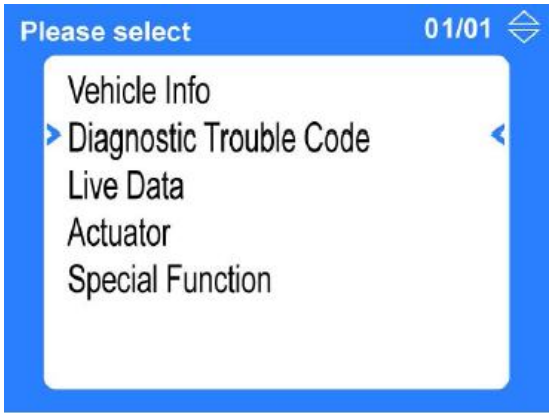
Move the cursor to "**Vehicle Info**" and press **ENTER** to see the content
This is the page of "**Vehicle Info**", press ▲▼ button to view all vehicle info.

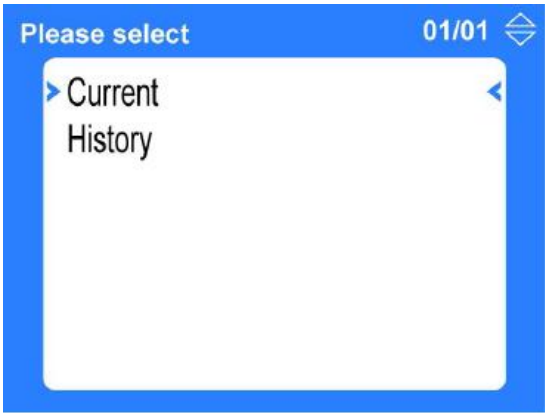




2. Diagnostic Trouble Code

Move the cursor to "**Diagnostic Trouble Code**" and press **ENTER** to see the content.



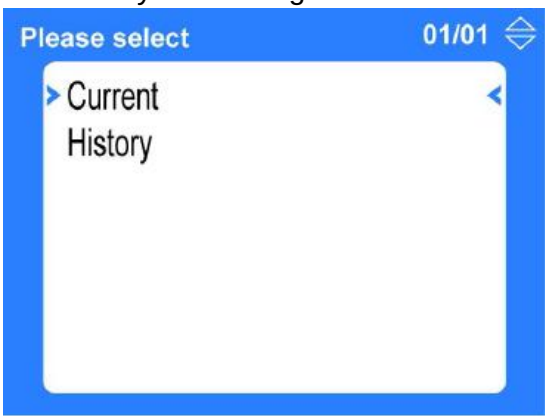


2-1. Current

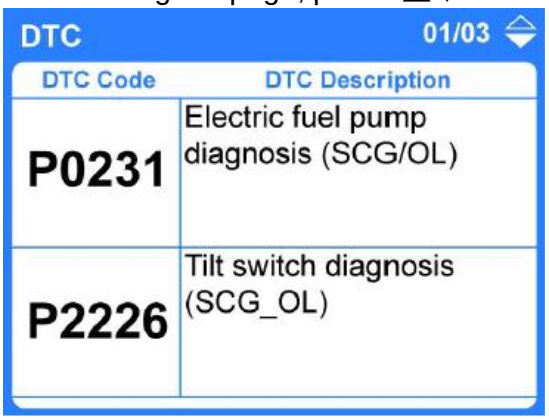
Current" is for the Diagnostic Trouble Code occurred at the time

2-2. History

"History" is for Diagnostic Trouble Code occurred in the past.

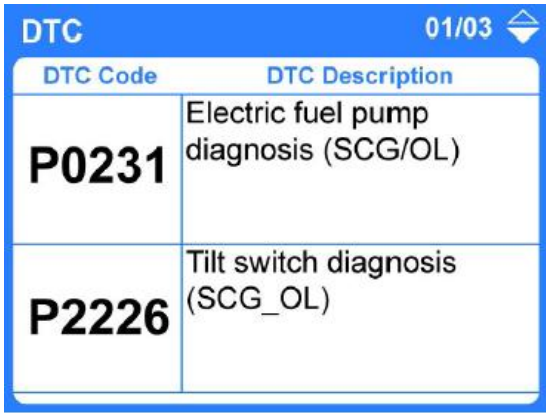


Move the cursor to ”**Current**” and press “**ENTER**” to continue
After entering the page, press ▲▼ to view all the Diagnostic Trouble Code.



After viewing the Diagnostic Trouble Code, press ESC to return to the previous page.

Move the cursor to “**History**” and press “**ENTER**” to continue



After entering the page, press ▲▼ to view all the Diagnostic Trouble Code occurred in the past.
After viewing the Diagnostic Trouble Code, press ESC to return to the previous page.

※
After viewing the content of “Current” or “History” Diagnostic Trouble Code, press **ESC** to return to the previous page, you will see two more items on the screen - “Freeze Data” and “Erase DTC”.
“**Freeze Data**” is the data recorded when FIRST Diagnostic Trouble Code occurred, and one time only record one Diagnostic Trouble Code freeze data, it’s for saving the engine dynamic data for further analysis.
“**Erase DTC**” is the function to erase all Diagnostic Trouble Code in both “Current” and “History”.

2-3. Freeze Data
This is the content you will see when entering into the “Freeze Data”. Press ▲▼ to view the Freeze Data.

★ NOTE: not all ECU support this function.

Numerical analysis of images (1 / 3), the waveform can be displayed as shown in the following items:

Freeze Data (01/03)

Number of data
DTC
Engine speed
Throttle valve volt
Intake pressure MAP

Freez Data 01/03

Item	Value	Unit
Number of data	9	
DTC	P0351	
Engine speed	0	rpm
Throttle valve volt	0.00	v
Intake pressure MAP	4.99	v

Freeze Data (02/03)

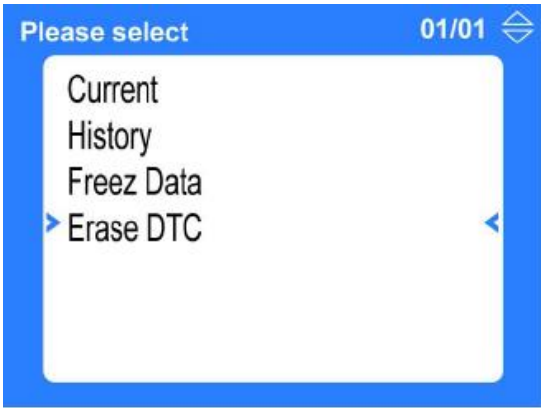
Engine temp
Lambda Control volt
Battery volt
Atmospheric pressure
Intake air temp

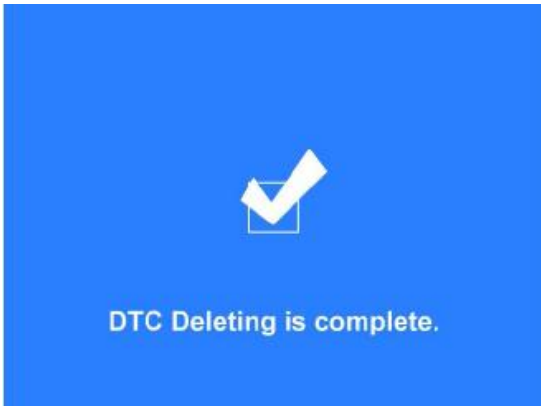
Freez Data 02/03

Item	Value	Unit
Engine temp	4.99	v
Lambda Control volt	4.99	v
Battery volt	12.0	v
Atmospheric pressure	0.00	v
Intake air temp	4.99	v

2-4. Erase DTC

Move the cursor to “Erase DTC” item and press ENTER to EARSE ALL DIAGNOSTIC TROUBLE CODE DIRECTLY!

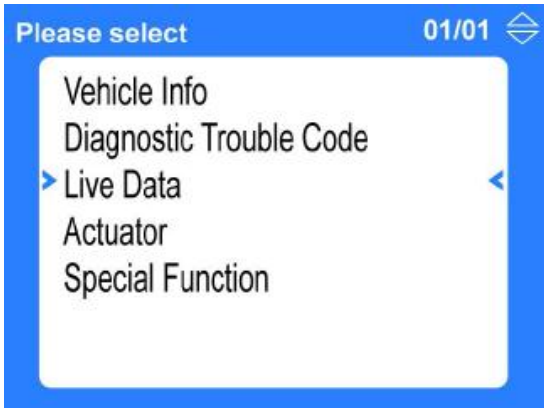




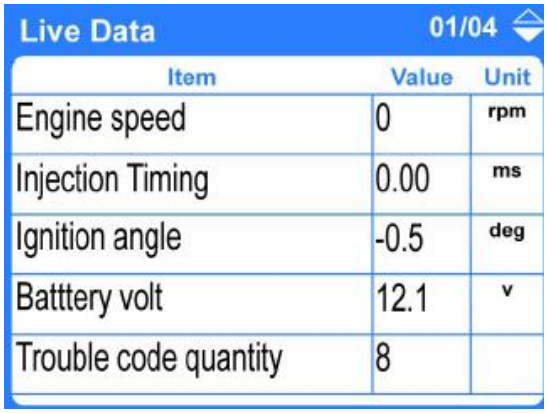
When you see the following picture on the screen, the Diagnostic Trouble Code erasure is completed. Press ESC button back to the main menu.

3. Live Data

Back to the main menu, move the cursor to “**Live Data**” and press ENTER to view the content.

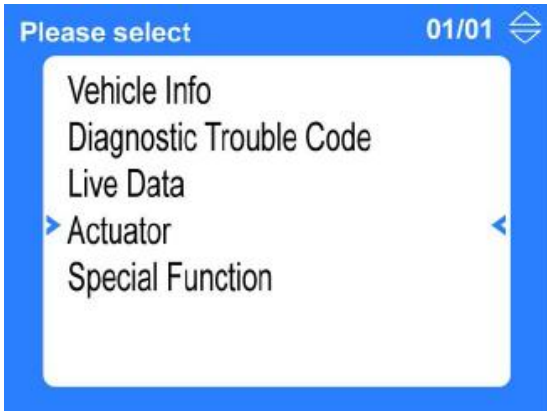


Press ▲▼ button to view all Live Data

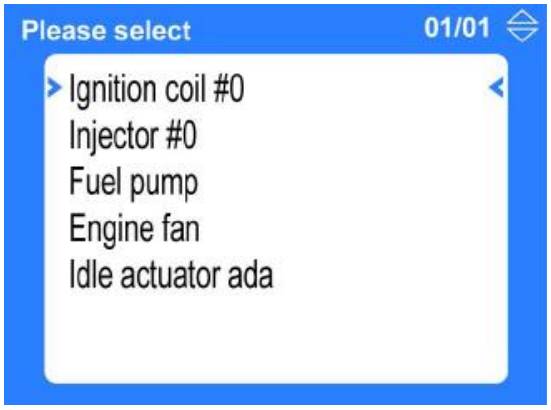


4. Actuator

Move the cursor to “Activator” and press ENTER to see the content (To perform this function, IG must be **ON** and engine stop running.)



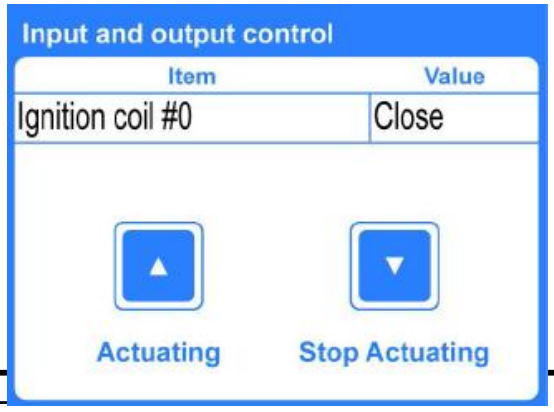
This is the page after entering the “Activator” function



Take one activation function for example: move the cursor to “Ignition coil” item and press ENTER to continue.

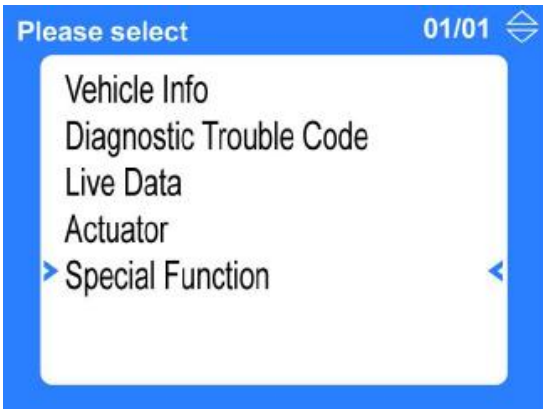
When pressing “Actuating “▲ button, the test is activated and the “Value” column shows Open.

When pressing “Stop Actuating” ▼ button, the test is de-activated and the “Value” column shows close.

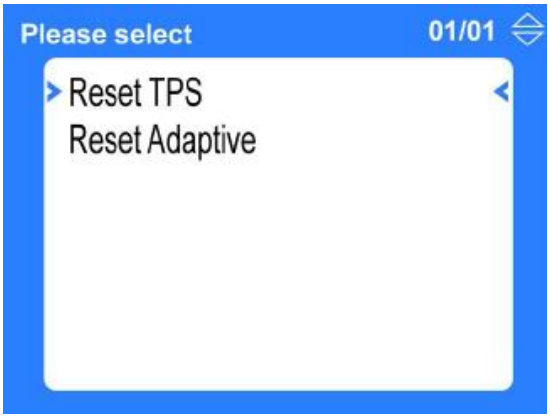


5. Special Function

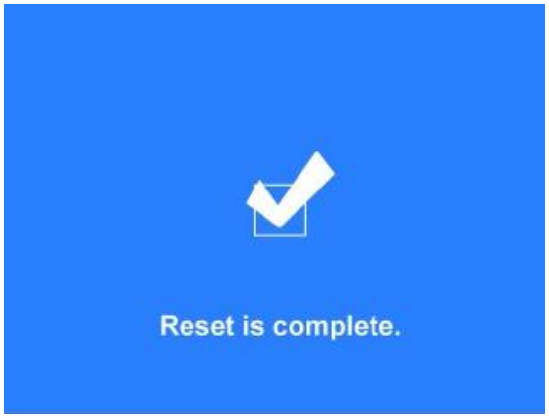
Move the cursor to “Special Function” and press ENTER to view the content



There are two items under “Special Function”: “Reset TPS” and “Reset Adaptive”.



Move the cursor to “Reset TPS” and press ENTER. Then you will see the following picture, which means the RESET is completed. Press ESC button to return to the previous page.



Troubleshooting Table

Test Items / Abnormal phenomena		Comprehensive Testing Program						Parts		
		Power voltage	Fuel press.	Ignition state	Engine vacuum	Injection state	Fault code detection	ECU	Throttle position sensor	Engine temp. sensor
Start state	Can't start	※	※	※	※	※	※	※		
	Difficult to start	※	※		※		※		※	※
Idle state	Without Idle			※	※	※	※		※	※
	Idle not smooth					※	※	※	※	
	RPM NG						※	※		
	CO NG		※			※	※	※		
Acceleration	Not smooth		※	※	※	※	※	※	※	※
	Inability and slow		※	※	※	※	※	※	※	※
Flameout	Idle flameout				※		※			
	Acceleration flameout						※	※		
Related spare parts		Roll over sensor	Fuel pump	Ignition coil	Inlet pipe	Injector				
		Power relay	Fuel pressure adjustment valve	Spark plug	Cylinder head	Fuel pump				
			Fuel pump relay		Inlet pressure sensor	Fuel pressure adjustment valve				
		Main switch	Fuel filter							
		Battery								

Notes: 1. Integrated test motorcycle, according to the "Comprehensive Maintenance list" implementation.
2. Spare parts, according to the "EFI System components description" implementation.

Comprehensive Maintenance List

No.	Maintenance Project	Testing Procedures	Test items	Determine benchmarks	Fault reasons
1	**Power and voltage**	Use meter direct measurement battery voltage Use diagnosis tool detection of battery voltage	Battery	Battery voltage = 10 V above	Battery electricity Battery connector loose Harness circuit opening ECU coupler not connected properly
2	**Fuel pressure**	Use fuel pressure gauge connected in series between the injector and the pressure regulating valve Main switch ON but not start engine Check fuel pressure Start engine (Idle) Check change of fuel pressure Throttle several rotation Check to the change of fuel pressure again	Open the main switch but not to start the engine of pressure Pressure in Idle Rotating throttle, situation of pressure changes	Open main switch but not start: Pressure = 250 kPa (stable value) Idle state: Pressure = 300+/-6 kPa (Beating situation from top to bottom) Rotating throttle moment: Pressure=300+/-6kPa(slightly beating)	Fuel not enough Fuel pump relay fault Fuel pump fault Injector fault ECU fault
3	**Ignition state**	The spark plug removed from the cylinder head but the power lines still ring Start engines or use for the diagnosis tool of output view spark plug ignition conditions	Spark plug specifications Whether the spark plug ignition Spark plug sparks whether it is normal strength	Specifications: NGK-CR7H Ignition conditions: With traditional engines found ways	Spark plug fault Roll over sensor fault ECU No. 12 pin fault Ignition coil fault Crankshaft position sensor fault
4	**Engine vacuum**	Diagnosis tool to detect the use of	Manifold pressure of diagnosis tool	Manifold pressure = 32~38 kPa	Valve clearance abnormal Intake system leak
5	**Injection state**	The injector removed from the throttle body but not dismantle pipeline	Open the main switch but did not start engine the injection situation	Not started, Injector not leaking fuel In started, the injection state must show fan shape	Fuel pump relay fault Fuel pump fault Injector fault

		Main switch ON but not start engine Investigation the injector it's leaking fuel? Start engines again or use for the diagnosis tool of output function Check injector fuel injection and the injection situation	Injector state when start		ECU fault
6	**Fault Code Detection**	Use of diagnosis tool existing fault detection code or historical Fault Code Eliminated of the implementation of fault codes, check can be eliminated Start engine again Check fault is it happen again	Diagnosis toll of the fault code is it can be eliminated Start engine, the fault is it will happen again	Without any residual Fault Code If residual Fault Code, according to the "Fault Code Maintenance Form" implementation of troubleshooting	Throttle position sensor fault Engine temperature sensor fault Intake temperature sensor fault Manifold pressure sensor fault CPS fault ECU fault Tilt sensor fault

Notes: 1. Fuel pressure gauge connected between the fuel tank and injector, open the main switch to repeatedly shut down, fuel system makes pressure stability.

2.Injector and injector cap tightly by hands, fuel spills should not be the case.

ENGINE REMOVAL AND INSTALLATION

WARNING

To avoid potential burns, let engine and exhaust system cool down before servicing.

During assembly/installation, use the torque Values and service products as in the exploded view. Clean thread before applying a thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new one where specified. If the efficiency of a locking device is impaired, it must be renewed.

ENGINE REMOVAL

Preparation

1. Place vehicle on a workstation that will have access to an engine-lifting hoist.
2. Safely lift and support the vehicle.
3. Disconnect BLACK (-) cable from battery, then the RED (+) cable.

WARNING

Always disconnect battery cables exactly in the specified order, the BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

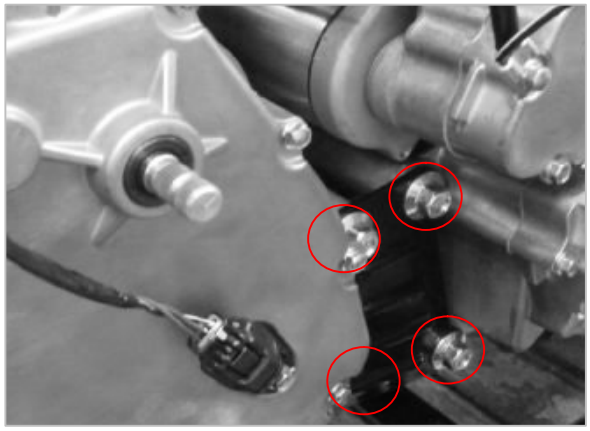
4. Remove seat and seat steady.
5. Remove the following plastic parts:
   - Upper cover.
   - LH and RH side covers and footrest.
   - Heat isolation.
6. Remove air cleaner and the rear bracket.
7. Remove the throttle body,air intake manifold.
8. Drain engine oil.

NOTE: *Drain engine oil and gearbox oil only if engine overhaul and gearbox need to repair is necessary.*

8. Drain engine coolant.
9. Remove footrest bracket.
10. Remove the front and rear exhaust head pipes and muffler.
11. Remove the shift connecting rod.
12. Disconnect the CVT inlet duct from the CVT cover.
13. Remove the CVT outlet duct.
14. Disconnect the coolant hose at water pump and thermostat cover.
15. Disconnect the crankcase vent hose.
16. Disconnect the gearbox vent hose.
17. Unplug and remove the ETS (engine temperature sensor).
18. Unplug all remaining connectors and remove cables from engine. Cut all necessary locking ties.
    - Spark plug cables.
    - Starter cable (retaining nut on starter body).
    - Gear Position Switch.
    - Vehicle speed sensor.
    - Oil Pressure Sensor.
    - Crankshaft Position Sensor.
    - Engine ground cable.
    - ACG connector.
19. Remove the bolts of the front and rear universal joint.
20. Remove CVT assy. and crankcase cover LH.
21. Remove bracket and cushion bush at cylinder head.

Lifting and Remove the Engine

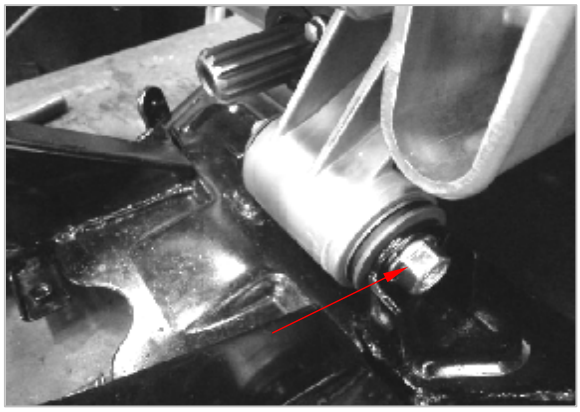
1. Remove four bolts on the rear output drive shafts connecting plate.
2. Remove the front and rear engine support bolts. Remove front output drive shaft bolts.
3. Carefully backward the engine and gearbox then raise the front of engine to separate front output drive shaft from engine.
4. Raise and slide the engine to left side and remove engine from vehicle.



ENGINE INSTALLATION

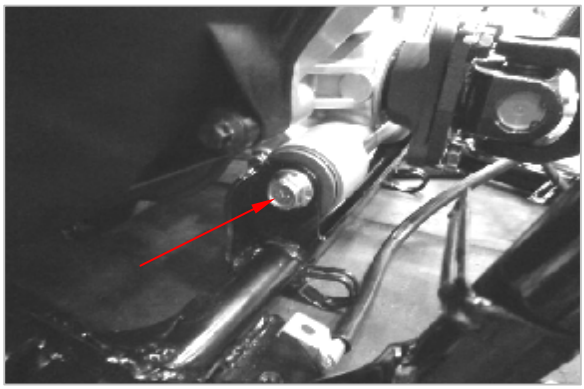
For installation, reverse the removal procedure. However, pay attention to the following.

- Before install the engine, inspect condition of engine mounts.
- Install the rear output drive shaft onto engine output shaft.
- Connect the front output drive shaft to the engine output shaft while lowing engine.
- Install connecting plate bolts, rear and front mounting bolts then torque all mounting bolts.



Final Assembly Procedure

1. Fill engine with the recommended oil and quantity.
2. Fill and bleed cooling system.
3. Check for any leaks.
4. Reinstall plastic parts, seat and body cover.
5. Test drive vehicle to confirm proper operation.

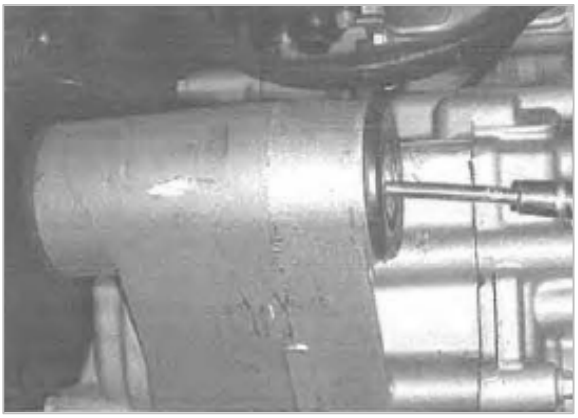


ENGINE MOUNTS

NOTE: *Use the same procedure for the front and rear engine mounts.*

Engine Mount Removal

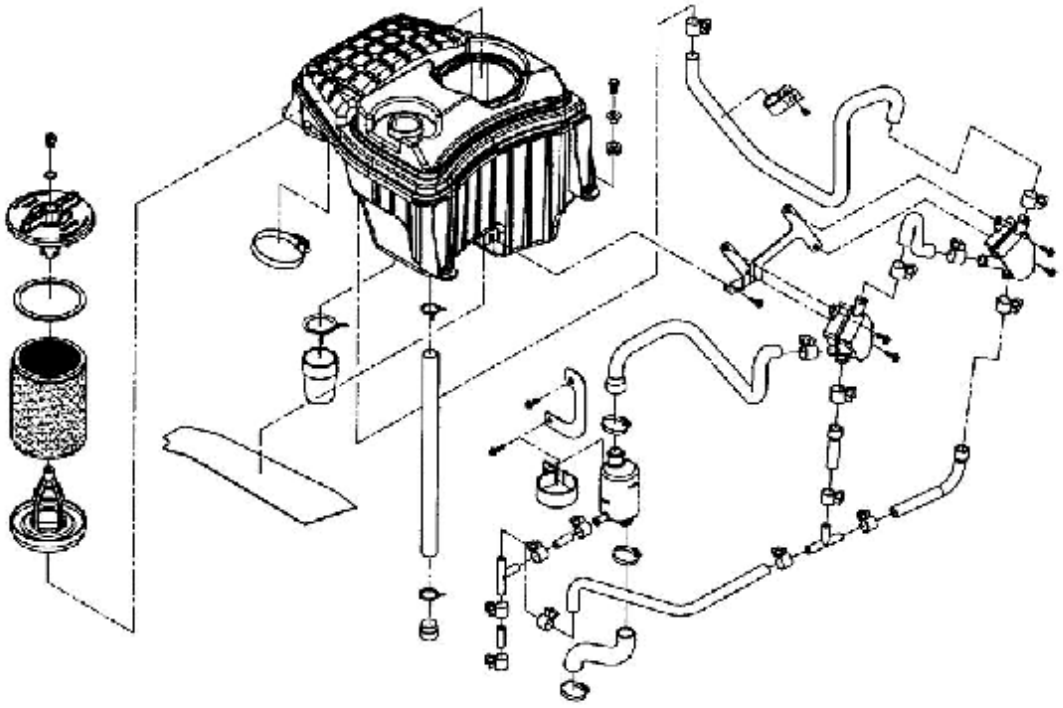
Insert a punch into engine mount busing and push the opposite engine mount out.

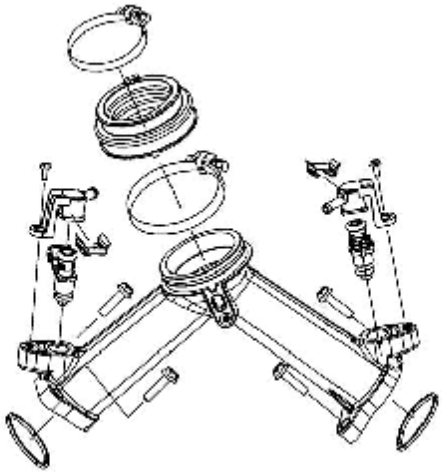


Engine Mount Installation

For installation, reverse the removal procedure.

AIR INTAKE SYSTEM





GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean thread before applying a thread locker.

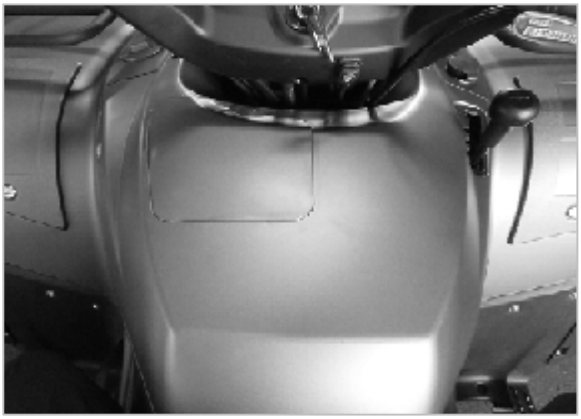
WARNING

Never modify the air intake system. Otherwise, engine performance degradation or damage can occur. The engine is calibrated to operate specifically with these components.

AIR CLEANER ELEMENT

Air Filter Element Replacement

1. Open the service cover.
2. Counter clockwise open the filter element lid and pull out the element.
3. Remove the screw and separate the lid and element.
4. Replace if necessary.
5. For the installation, reverse the removal procedure.

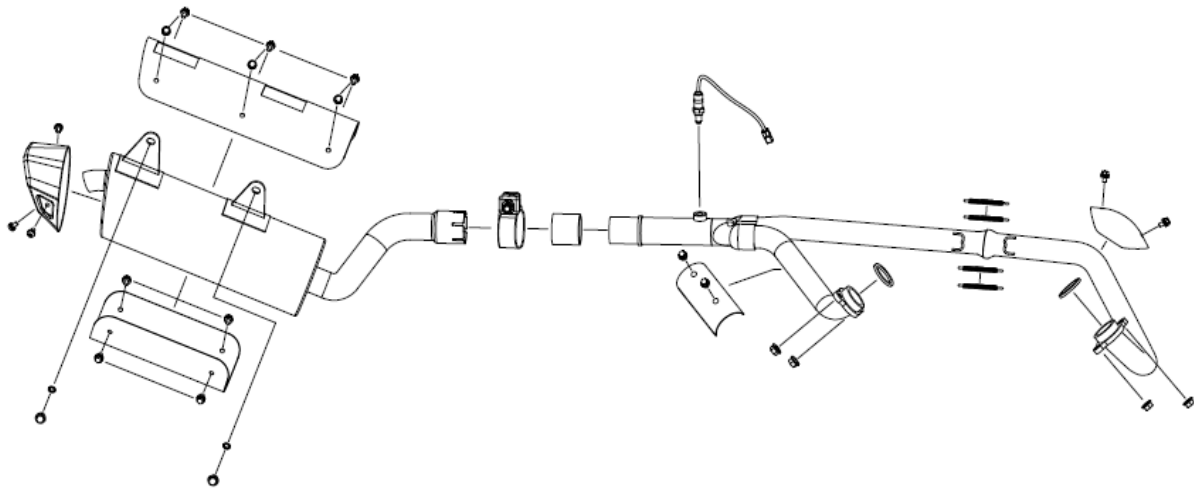


AIR CLEANER

Air Cleaner Removal

1. Remove both side covers and upper cover.
2. Remove the four retaining bolts.
3. Remove air intake adapter from the intake manifold.
4. For the installation, reverse the removal procedure.

EXHAUST SYSTEM



GENERAL

WARNING

To avoid potential burns, never touch exhaust system components immediately after the engine has been run because these components are very hot. Let engine and exhaust system cool down before performing any servicing.

During assembly/installation, use the torque values and service products as in the exploded view. Clean thread before applying a thread locker.

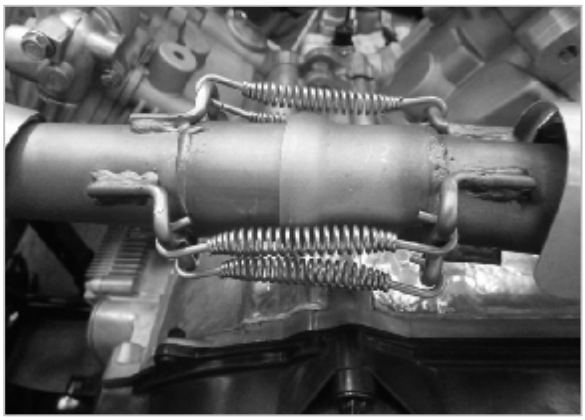
WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

MUFFLER

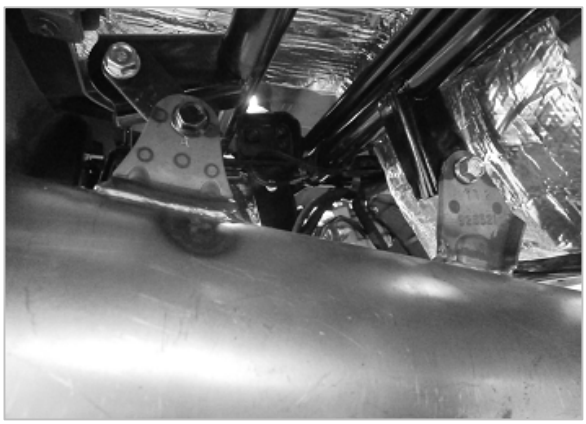
Muffler Removal

1. Remove seat.
2. Remove LH side cover.
3. Detach spring from the “Y” exhaust pipe.
4. Remove muffler retaining bolts.
5. Loose the clamp of muffler.
6. Discard the gasket at the end of “Y” exhaust pipe.



Muffler Inspection

Check muffler for cracks or other damages. Replace if necessary.



Muffler Installation

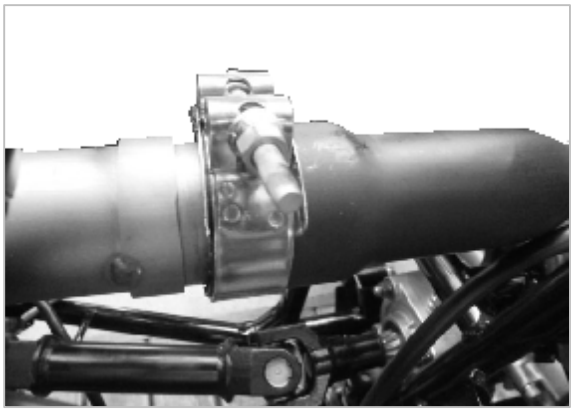
For the installation, reverse the removal procedure.

NOTE：Always install new plumbago gasket after muffler disassemble.

EXHAUST PIPE

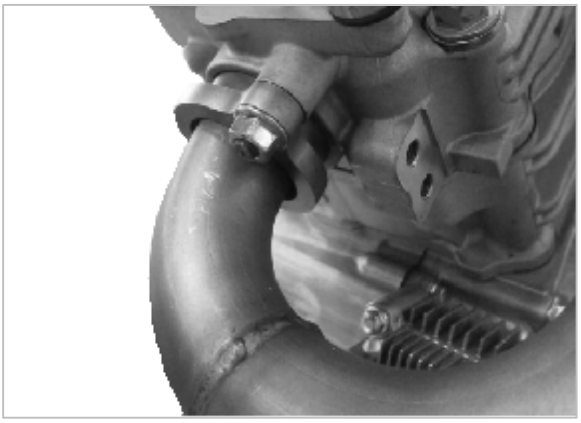
Exhaust Pipe Removal

1. Remove seat and seat steady.
2. Remove LH side cover, inner fender and the heat isolation.
3. Remove O2 sensor and exhaust pipe from vehicle.
4. Remove the Muffler.



CAUTION:

Do not damage the O2 sensor connecting wire.



"Y" Exhaust Pipe Inspection

Check "Y" exhaust pipe for cracks, bending or other damages. Replace if need.

"Y" Exhaust Pipe Installation

The installation is the reverse of the removal procedure.

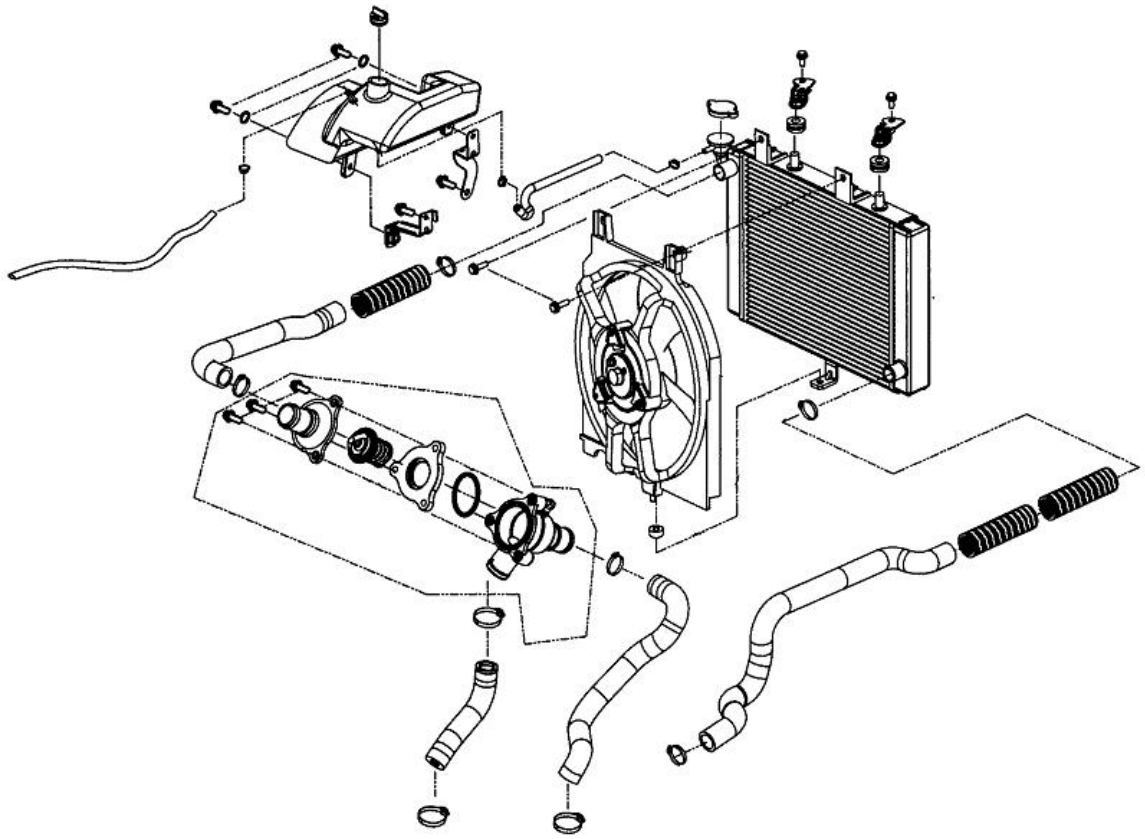
Install new exhaust gasket.

Clamp Torque：250 kgf-cm

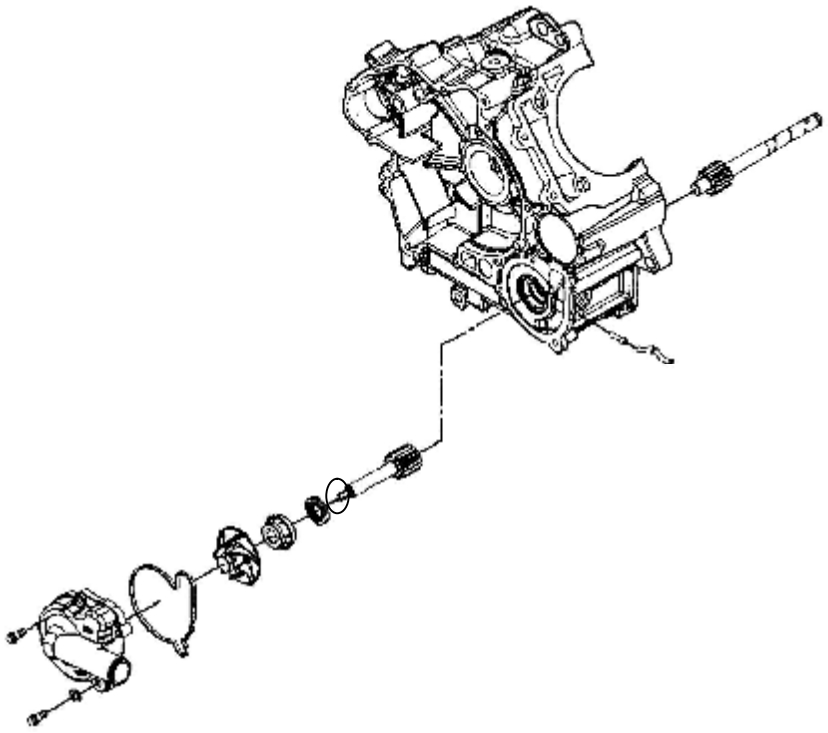
Nut Torque: 150-200 kgf-cm

COOLING SYSTEM

RADIATOR



WATER PUMP



COOLING SYSTEM

GENERAL

WARNING

Never start engine without coolant. Some engine parts such as the rotary seal on the water pump shaft can be damaged.

During assembly/installation, use the torque values and service products as in the exploded view.

Clean thread before applying a thread locker.

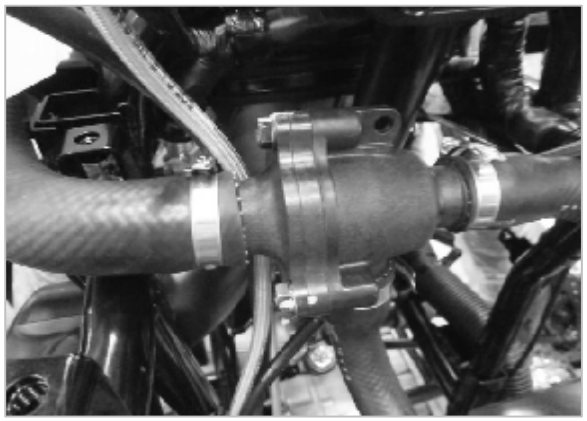
WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

PROCEDURE

THERMOSTAT

The thermostat is a single action type.

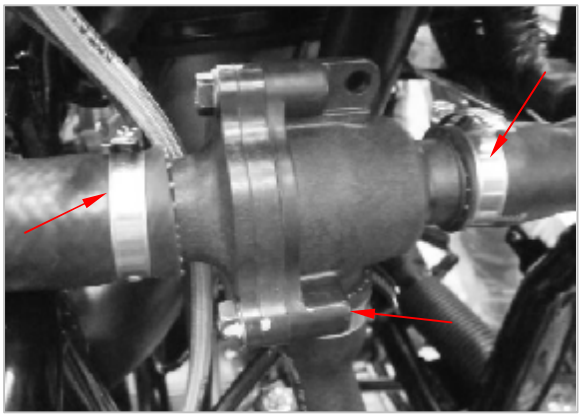


Thermostat Location

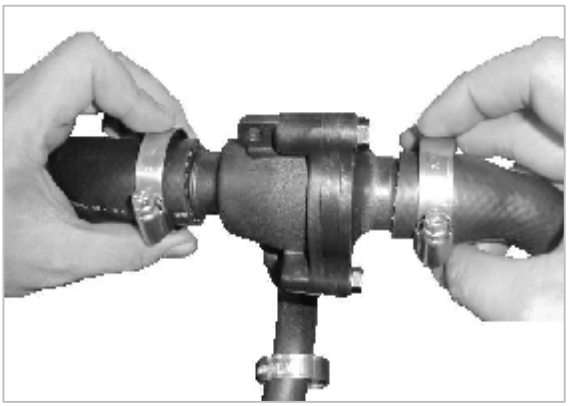
The thermostat is mounted in-line in the cooling system circuit.

Thermostat Removal

1. Remove service cover.
2. Remove air filter housing.
3. Remove clamp that secures thermostat housing to frame.
4. Install large hose pincher on both radiator hoses.
5. Drain remaining coolant.
6. Pull hoses from thermostat housing to remove thermostat.
7. Remove clamps that secure hose to thermostat.



8. Pull hoses from thermostat housing to remove thermostat.



Thermostat Test

- To check thermostat, put it in water and heat the water.

THERMOSTAT OPENING TEMPERATURE	
STARTS TO OPEN	FULLY OPEN
65 ℃	88 ℃

- Replace thermostat if it does not begin to open at specified temperature.
- Check if gasket is brittle, hard or damaged. If so, replace gasket.

Thermostat Installation

- Reverse removal procedures.
- Refill cooling system.
- Bleed cooling system.
- Check for coolant leaks.

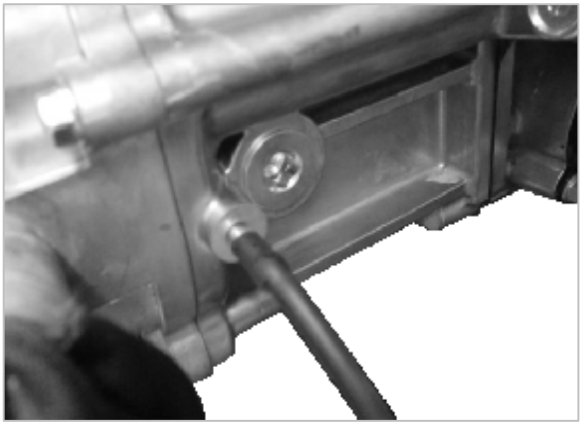
RADIATOR

Radiator Inspection

Check radiating fins for clogging or damage. Remove insects, mud or other obstructions with compressed air or low pressure water.

Radiator Removal

1. Install a large hose pincher on both radiator hoses.
2. Lift front of vehicle to extend suspension.
3. Remove the following parts from the radiator:
   - Radiator inlet hose (LH upper)
   - Radiator outlet hose (RH lower).
   - Radiator mounting screws (2 at top of radiator).
4. Disconnect cooling fan electrical connector.
5. Remove the retaining bolts.
6. Lift radiator and tilt its lower end towards the front of the vehicle.
7. Carefully remove radiator through LH wheel well.



Radiator Installation

1. For installation, reverse the removal procedure. However, pay attention to the following details
2. Install the rubber bushings between bottom of radiator and radiator support.
3. Fill radiator with recommended coolant.
4. Bleed the cooling system.
5. Check for coolant leaks from radiator and hoses.

COOLANT TEMPERATURE SENSOR

Refer to EFI section.

RADIATOR COOLING FAN RELAY

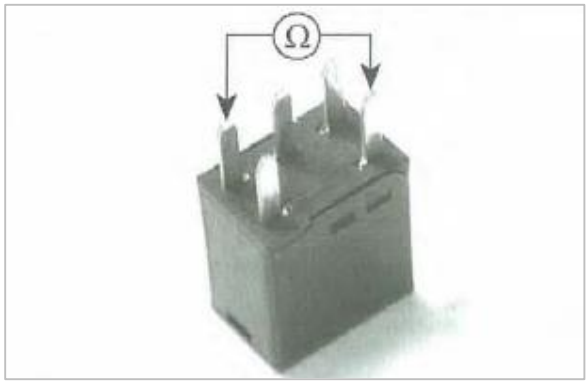
Relay Installation (Radiator Cooling Fan)

NOTE: Ensure to align tabs of relay with terminals of fuse holder at installation.

Relay Operation test (Radiator Cooling Fan)

The easiest way to check the relay is to remove it and bypass it using a jumper. If the radiator-cooling fan is activated, replace the relay. See illustration to find where to bypass the relay.

Relay Continuity Test (Radiator Cooling Fan)



1. Remove relay.
2. Use the MULTIMETER and select the Ω position.
3. Probe relay as follows.

TERMINAL		RESISTANCE
30	87	Open Circuit (OL)

4. Connect battery as shown and probe relay again as follows.

TERMINAL		RESISTANCE
30	87	0.5Ω max. (continuity)

If relay failed any test, replace it.

RADIATOR COOLING FAN

Radiator Cooling Fan Operation

The ECU controls the radiator-cooling fan via the input of the coolant temperature sensor (CTS) and the manifold air pressure and temperature sensor (MAP).

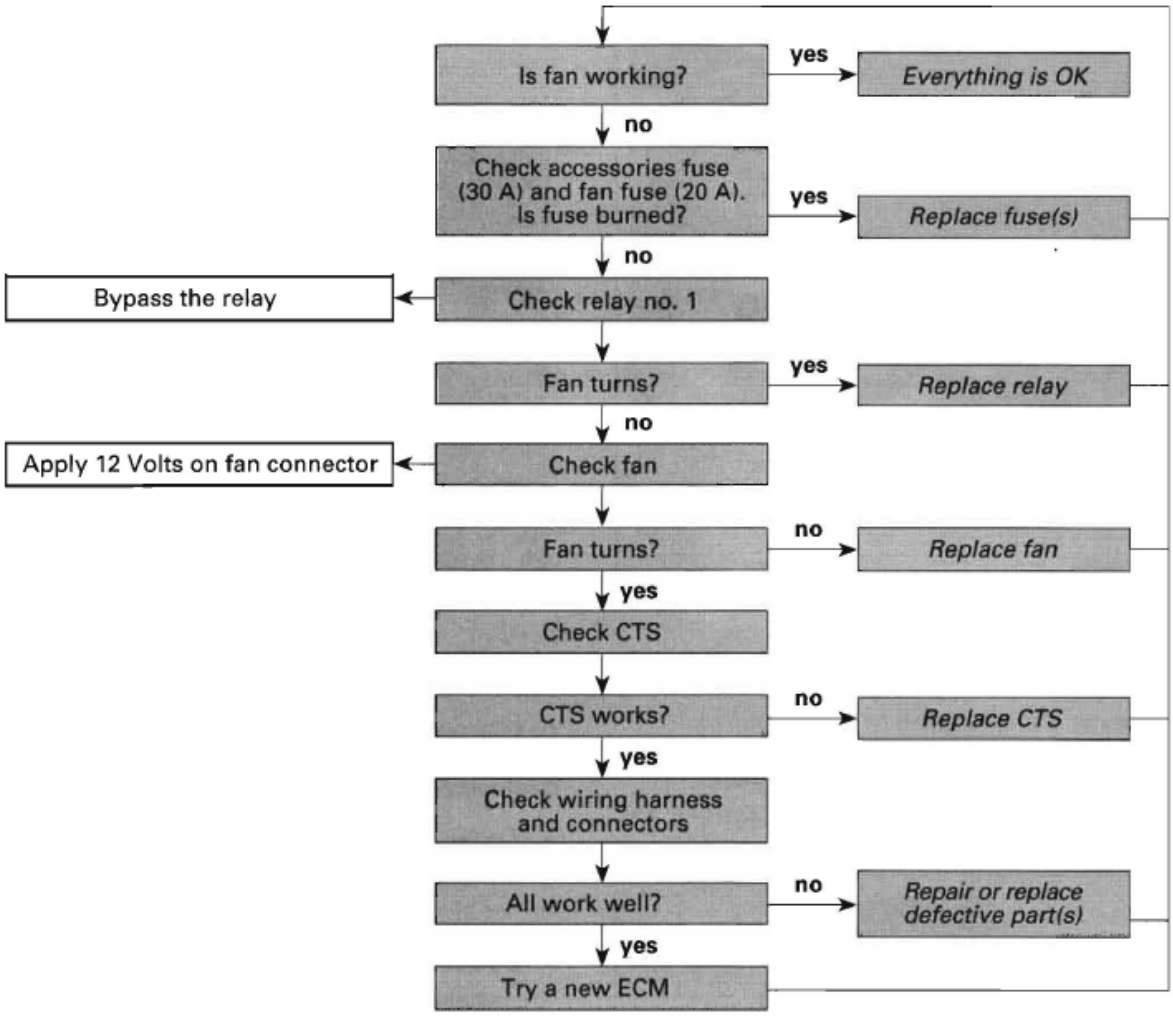
The radiator cooling fan should turn on when coolant temperature reaches 98℃ and should turn off when the coolant cools down at 95℃.

Radiator Cooling Fan Fuse Location

The fuse is located in the fuse box under the seat set.

Radiator Cooling Fan Test

Connect the 12VDC to cooling fan connector, if fan turns on; check CTS, wiring harness and connectors. If all parts are good, replace ECU. If fan does not turn on, refer to the following troubleshooting chart.



Radiator Cooling Fan Removal

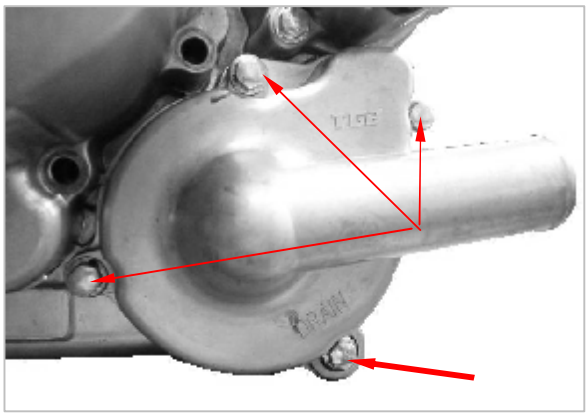
1. Disconnect fan motor electrical connector.
2. Remove 4 fan retaining screws.
3. Remove the radiator fan.

Radiator Cooling Fan Installation

For the installation, reverse the removal procedure.

WATER PUMP HOUSING

It is located on the engine ACG side.

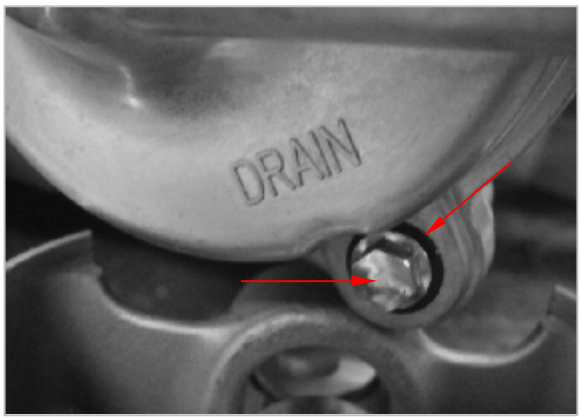


Water Pump Housing Removal

WARNING

To avoid potential burns, do not remove the radiator cap or loosen the coolant drain plug if the engine is hot.

1. Drain cooling system.
2. Remove radiator outlet hose from water pump housing.
3. Remove screws retaining water pump housing and pull water pump housing to remove it.



Water Pump Housing Inspection

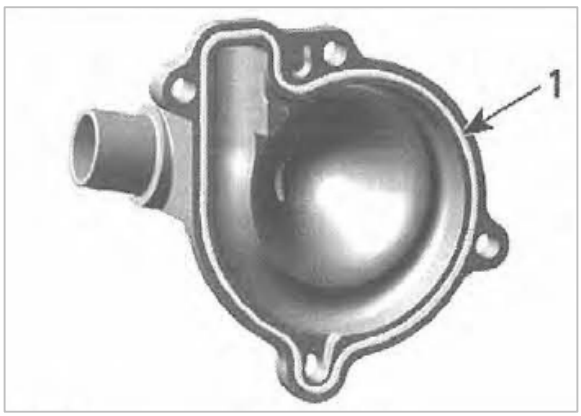
Check if gasket is brittle, hard or damaged and replace as necessary.

Water Pump Housing Installation

1. The installation is reverse of the removal procedure.
2. Install and tighten the drain screw and washer.

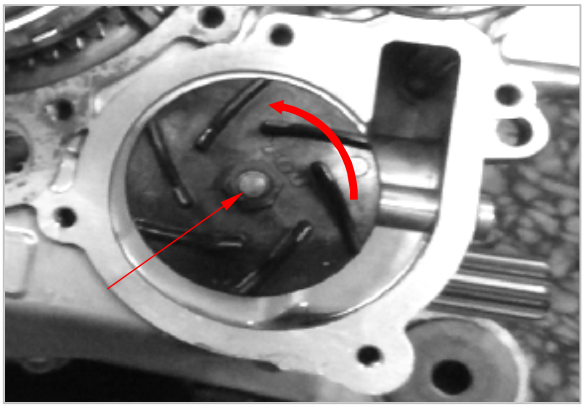
NOTICE: *To prevent leaking, take care that the gasket is exactly in groove when you reinstall the water pump housing.*

3. Tighten screws of water pump housing in a criss cross sequence.



WATER PUMP IMPELLER

Water Pump Impeller removal



1. Remove water housing.
2. Unscrew impeller.

NOTICE: *Water pump shaft and impeller have right hand threads. Remove by turning counterclockwise and install by turning clockwise.*

TORQUE: 220~250 kgf.cm

Water Pump Impeller Inspection

Check impeller for cracks or other damage. Replace impeller if damaged.

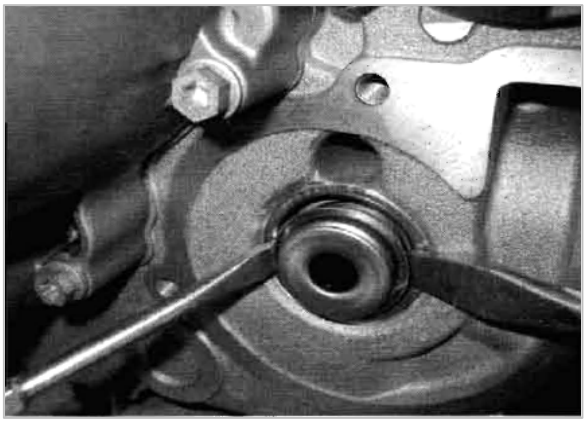
Water Pump Impeller Installation

The installation is reverse of the removal procedure.

NOTICE: *Be careful not to damage impeller fins during installation.*

WATER PUMP SHAFT AND SEALS

Rotary Seal and Oil Seal Removal (Assembled Engine)



Remove water pump housing.

1. Using special tool onto the rotary seal and insert the small chisel pin strong punch with hammer on the seal plate.
2. Install three screws through the tool hole.
3. Screw the special tool and pull out the rotary seal.

NOTICE: *Be careful not to damage the crankcase while removing outer part of the rotary seal.*

4. Thoroughly remove carefully sealing residue and burr of rotary seal using a scraper.

NOTICE: *Be careful not to damage water pump shaft.*

5. Install 2 wooden screws in the seal.

6. Remove oil seal from crankcase by pulling screws with pliers.
7. Check water pump shaft axial play. If not adequate, engine must be disassembled to replace the water pump shaft.
8. Clean oil seal seat.

Rotary Seal and Oil Seal Installation

Oil Seal

Apply engine oil on water pump shaft.

1. Apply grease to the lips of the oil seal.
2. Carefully install the oil seal over the water pump shaft.
3. Push the oil seal into the water pump cavity using a 24 mm deep socket.
4. Ensure that the oil seal is properly seated in water pump cavity.

Rotary Seal

NOTICE: *Read and thoroughly understand the entire procedure of installing the rotary seal before starting it.*

1. Apply engine oil on water pump shaft.
2. Place rotary seal inside the special tool socket.

NOTICE: *Do not install the rotary seal completely into crankcase to prevent the water pump shaft plastic gear from breaking. Push it partially in, then pull the shaft.*

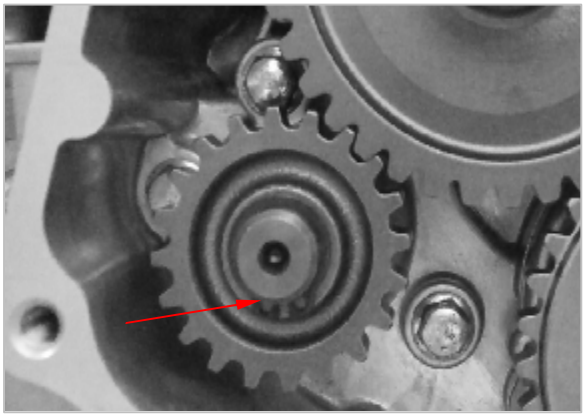
3. Install special tool with rotary seal on the water pump shaft and screw in by hand.
4. Then thread the tool install rotary.
5. Ensure that the rotary seal is going straight into crankcase.
6. Remove tools from crankcase.

7. Pull water pump shaft in proper position until the rotary seal is flush with the end of water pump shaft threads.

NOTICE: *Ensure that the water pump shaft is properly adjusted with rotary seal.*

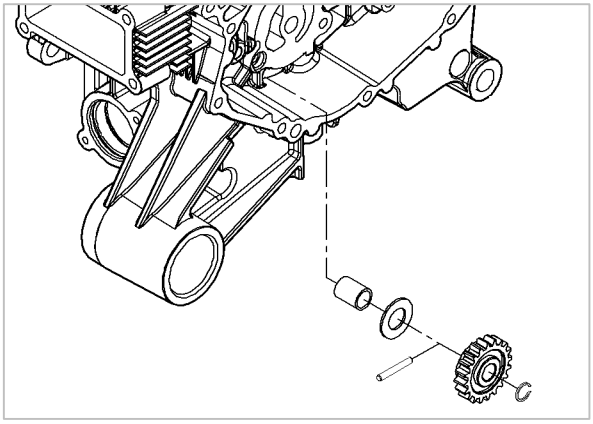
NOTICE: *Ensure that the water pump shaft moves freely while pushing it toward the crankcase.*

Water Pump Shaft / Seal Removal (Disassembled Engine)



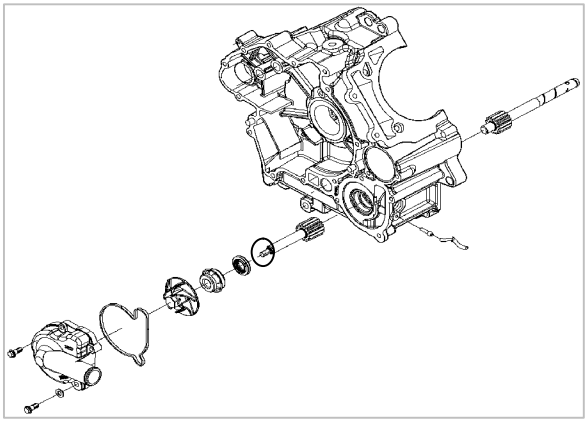
1. Remove the water pump housing and impeller.
2. Remove the circlip retaining the driven gear on water pump shaft.
3. Remove water pump driven gear, needle pin and thrust washer.
4. Using soft hammer; push out water pump shaft with inner portion of rotary seal from inside of crankcase ACG side.
5. To remove outer part of rotary seal, use an expander special tool.
6. Install expander against outer part of rotary seal and pull seal out.

NOTICE: *When removing water pump shaft, always replace rotary seal with water pump shaft. Also replace oil in crankcase.*



7. Remove oil seal from inside of crankcase ACG side using a pusher tool.

NOTICE: *Be careful not to damage the rotary seal surface in crankcase.*



Water Pump Shaft / Seal Inspection (Disassembled Engine)

- Inspect water pump gear for wear and damage on the snap mechanism to the needle pin. Replace if damaged.
- Check water pump intermediate drive gear for wear or broken teeth. Replace if damaged.

NOTICE: *Never use the circlip a second time. Always install a NEW one.*

Water Pump Shaft / Seal Installation (Disassembled Engine)

For installation, reverse the removal procedure.

NOTE: *For installation use the torque values specified in the exploded view.*

NOTICE: *Always replace rotary seal and water pump shaft together. Also install a NEW oil seal (behind rotary seal) at the same time.*

NOTE: *Never use oil in the press fit area of the oil seal and rotary seal.*

- Clean rotary seal surface of any old sealant.
  1. Use the OIL SEAL PUSHER and the HANDLE to install oil seal.
  2. When installing the oil seal on the pusher, make sure the sealing lip points outwards.
  3. Push NEW oil seal in place.
- Apply engine oil on sealing lip of the oil seal.
- Apply engine oil on the water pump shaft and intermediate shaft.
- Slide water pump shaft with new rotary seal into crankcase.
- To properly install water pump shaft with rotary seal, use SEAL PUSHER.

NOTICE: *Never use a hammer for rotary seal installation. Only use a press to avoid damaging the ceramic component.*

- Install thrust washer and needle pin on water pump shaft.

NOTICE: *A missing thrust washer will cause a leaking rotary seal.*

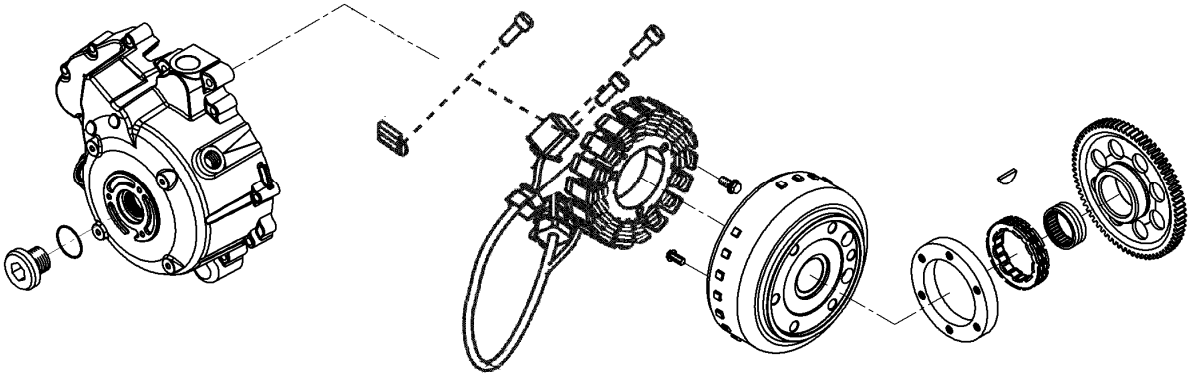
- Ensure water pump intermediate driven gear snaps properly onto needle pin, then install the circlip to retain the gear onto shaft.

NOTICE: *Never use the circlip a second time. Always install a NEW one.*

NOTICE: *After installation, water pump shaft with rotary seal must rotate freely.*

- Tighten screws of the water pump housing crosswise.

AC GENERATOR SYSTEM



GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean thread before applying a thread locker.

W ARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

PROCEDURE

ACG COVER

ACG Cover Removal

- Drain engine oil.
- Disconnect ACG connector.
- Remove the vent hose.
- Remove ACG cover retaining screws.
- Pull out ACG cover.

ACG Cover Inspection and Cleaning

- Check ACG cover for cracks or other damage.
- Replace if necessary.

NOTE: *Clean all metal components in a nonferrous metal cleaner.*

WARNING

Wear safety glasses and work in a well-ventilated area when working with strong chemical products. Also wear suitable non-absorbent gloves to protect your hands.

ACG Cover Installation

For installation, reverse the removal procedure.

NOTE: *At installation replace ACG cover gasket.*

- Apply SEALING COMPOUND on stator cable grommet as shown in next illustration.
- Tighten screws using the following sequence.
- Refill engine with recommended oil.

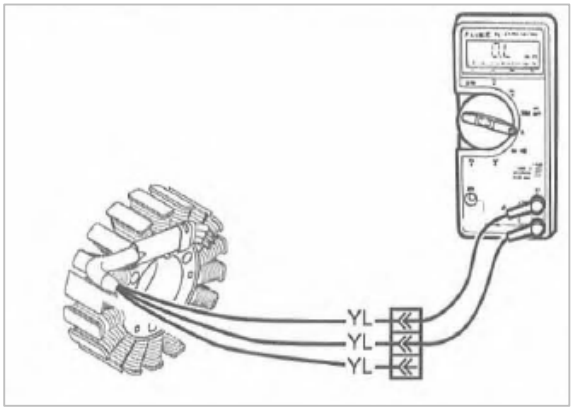
STATOR

Stator Static test: Continuity

1. Disconnect the ACG connector.
2. Install the ACG DIAGNOSTIC HARNESS on ACG connector.
3. Set multimeter to Ω.
4. Connect multimeter between YELLOW wires.
5. Read resistance.

TERMIINAL	RESISTANCE 20 ℃
1 and 2	0.15 – 0.30 Ω
1 and 3	
2 and 3	

6. If any reading is out of specification, replace stator.
7. Re-plug connector properly.

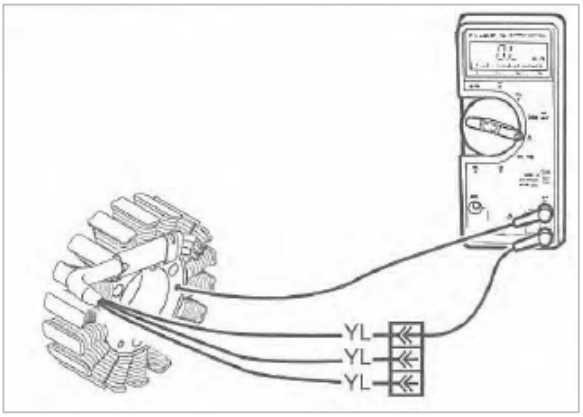


Stator Static Test: Insulation

1. Install the MAGNETO DIAGNOSTIC HARNESS on ACG connector.
2. Set multimeter to Ω.
3. Connect multimeter between any YELLOW wire and engine ground.
4. Read resistance.

TEST PROBES	RESISTANCE 20 ℃
Any YELLOW wire and engine GND	Infinite (open circuit)

5. If there is a resistance or continuity, the stator coils and/or the wiring is shorted to ground and needs to be repaired or replaced.
6. Re-plug connectors properly.



Stator Dynamic Test: AC Voltage

1. Unplug magneto wiring harness connector.
2. Install the ACG DIAGNOSTIC HARNESS between unplugged connectors.

NOTE: Both connectors must be plugged.

3. Set multimeter to VAC.
4. Start engine.
5. Connect multimeter between YELLOW wires.

6. Read voltage as per following table.

TEST ENGINE SPEED	TERMINAL	VOLTAGE
4000 RPM	1 and 2	10 – 25 VAC
	1 and 3	
	2 and 3	

7. If voltage is lower than specification, replace stator.
8. Re-plug connectors properly.

Stator Removal

- Remove ACG cover.
- Remove screws securing the wiring holding strip.
- Remove stator retaining screws then stator.

Stator Inspection

- Check stator windings and insulation for cracks or other damages. If damaged replace it.
- Check if stator wires are brittle, hard or otherwise damaged.

Stator Insulation

For installation, reverse the removal procedure.

NOTICE: *When installing the stator take care to route wires properly and install retaining strip.*

NOTE: *There is only one position for the stator (notch in the ACG housing cover).*

ROTOR

Rotor Removal

- Remove ACG cover.
- Remove screw and washer securing rotor to crankshaft.
- Install ACG PULLER and CRANKSHAFT PROTECTOR then remove rotor.

NOTE: *Use grease to place protector on crankshaft end prior to screw on the ACG puller. Screw ACG puller bolt to remove rotor.*

Rotor Inspection

- Check inner side of rotor for scratches or other damage.
- Check keyway of the rotor for wear or damages.
- Check if trigger wheel teeth are bent or otherwise damaged.
- Check woodruff key and keyway on the crankshaft for wear or damages.
- Replace parts as necessary.

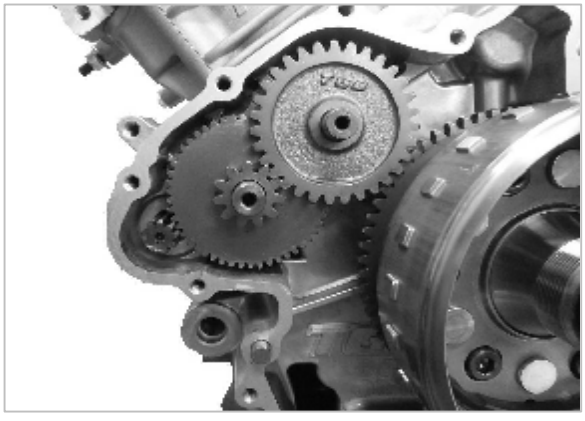
Rotor Installation

For installation, reverse the removal procedure.

- Clean crankshaft taper and rotor with PULLY FLANGE CLEANER.

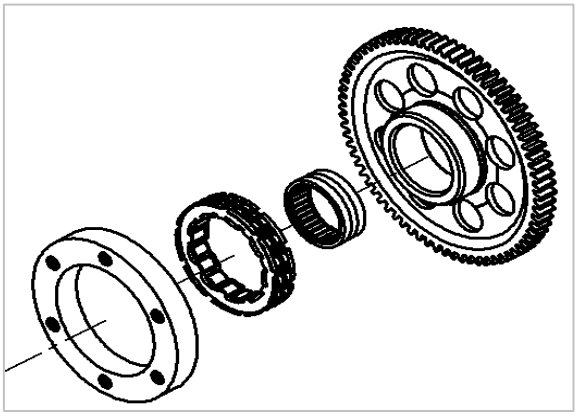
NOTICE: *Taper on crankshaft and rotor must be free of grease.*

- Clean the crankshaft oil passage and threads using PULLY FLANGE CLEANER.
- Oil starting unidirectional clutch and install starting clutch gear.
- Slide rotor onto crankshaft. The woodruff key and the keyway must be aligned.
- Rotate idle gear counterclockwise to align idle gear teeth with starting clutch gear.



UNIDIRECTIONAL CLUTCH

Unidirectional Clutch Removal



- Remove ACG cover.
- Loosen thrust plate screws located inside rotor.
- Remove rotor (refer to ROTOR above).
- Remove starting clutch gear.
- Remove thrust plate screws and thrust plate.

Unidirectional clutch inspection

- Inspect unidirectional clutch and thrust plate for wear and damage.
- Check the collar of the starting clutch gear.
- Perform a functional test of the starting clutch gear. To do so, rotate starting clutch gear in unidirectional clutch.

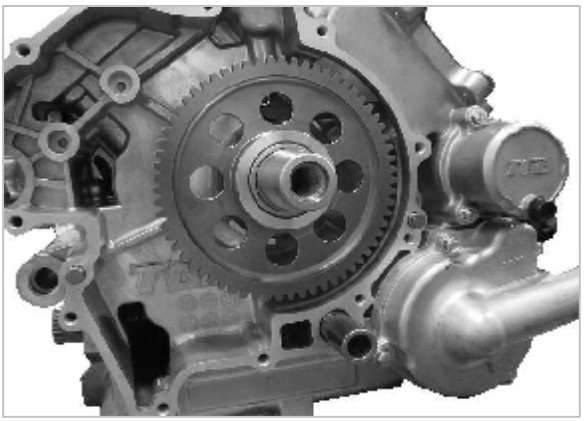
NOTE: *Unidirectional clutch must lock in counterclockwise direction.*

NOTE: *Unidirectional clutch, thrust plate and gear must be replaced at the same time, if damaged.*

Unidirectional Clutch Installation

For installation, reverse the removal procedure.

- Apply LOCTITE 648 (GREEN) on threads of thrust plate screws.
- Install screws but do not torque yet.
- Apply engine oil on unidirectional clutch and inside starting clutch gear hole.
- Install rotor then torque thrust plate screws to 30 Nm.



STARTING CLUTCH GEAR

Starting clutch Gear Removal

- Remove ROTOR.
- Pull starting clutch gear out of the rotor.

Starting Clutch Gear Inspection

- Inspect gear, especially teeth and unidirectional collar, for wear and other damage.
- Check needle bearing condition. Replace starting clutch gear if necessary.

Starting Clutch Gear Installation

The installation is the reverse of the removal procedure.

NOTE: *apply engine oil on needle bearing and collar of starting clutch gear.*

STARTER DRIVE GEARS

The starter drive gears are located on the engine ACG side behind the ACG cover.

Starter Drive Gear Removal

- Remove ACG cover. See procedure in this subsection.
- Remove location pins, starter double gear and idle gear.

Starter Drive Gear Inspection

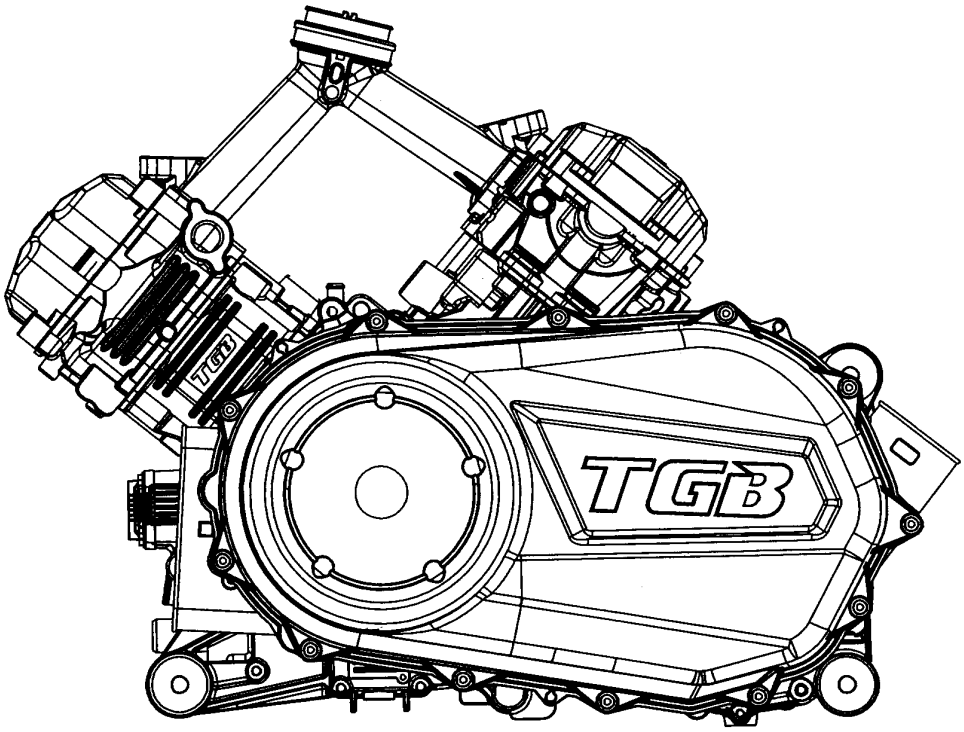
- Inspect gears and location pins for wear and damage.
- Replace parts as necessary.

Starter Drive gear Installation

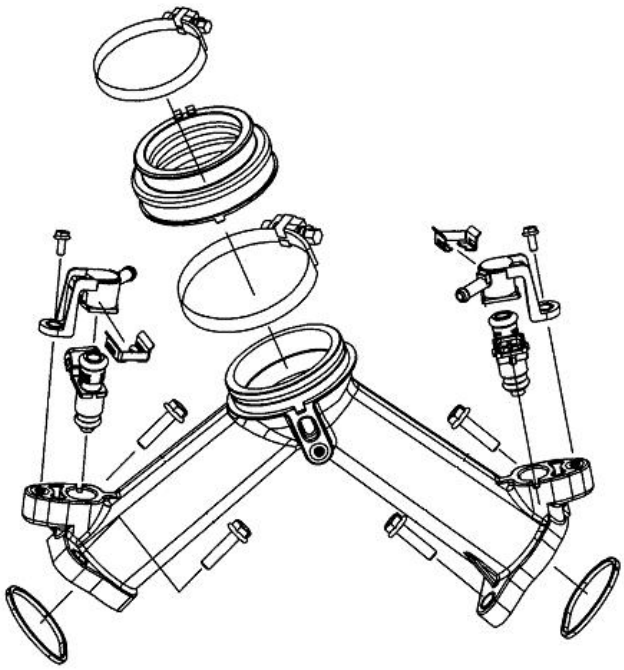
The installation is the reverse of the removal

- Apply LOCTITE 767 (ANTISEIZE LUBRICANT) on starter gear before installing the starter idle gear.
- Apply engine oil on location pins.

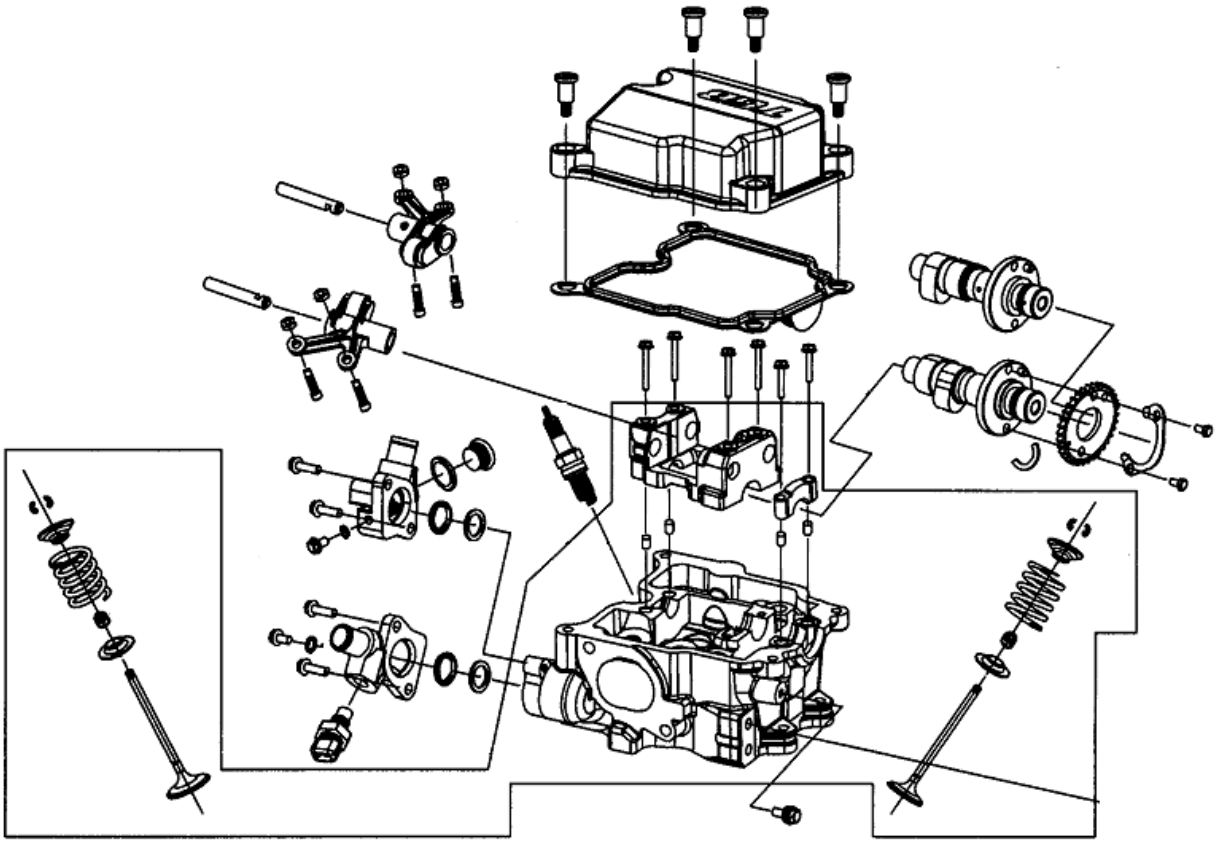
TOP END



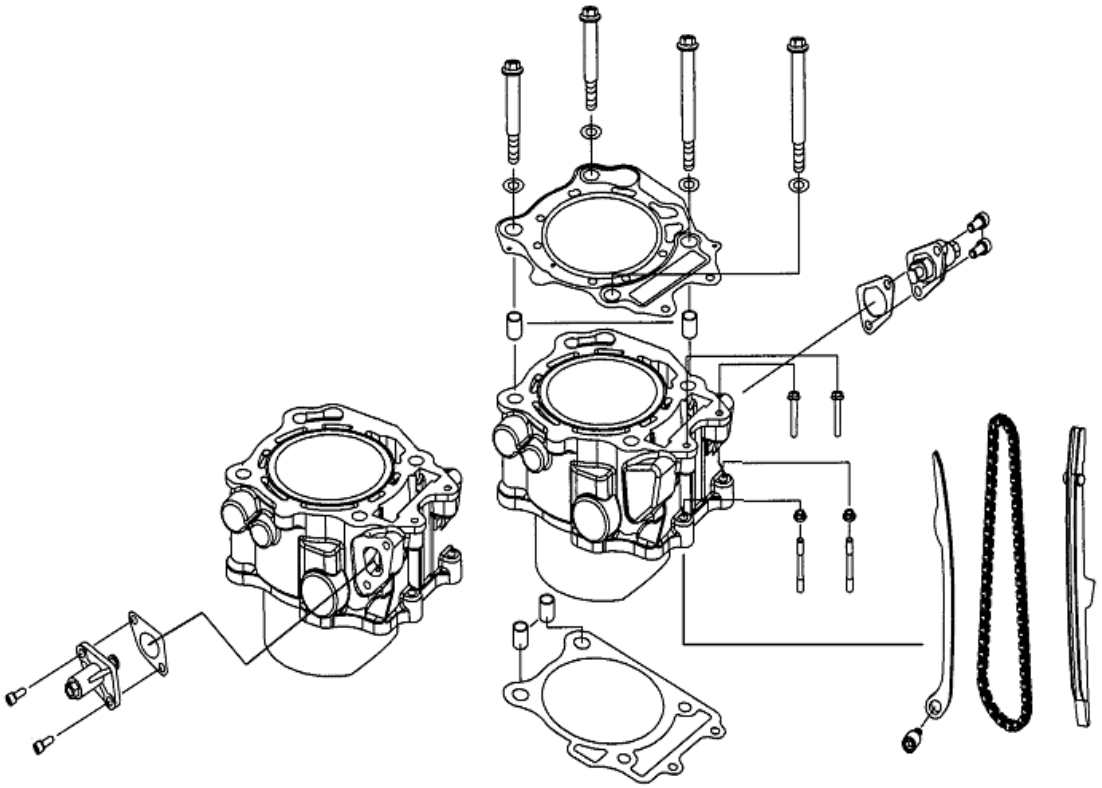
INTAKE MANIFOLD

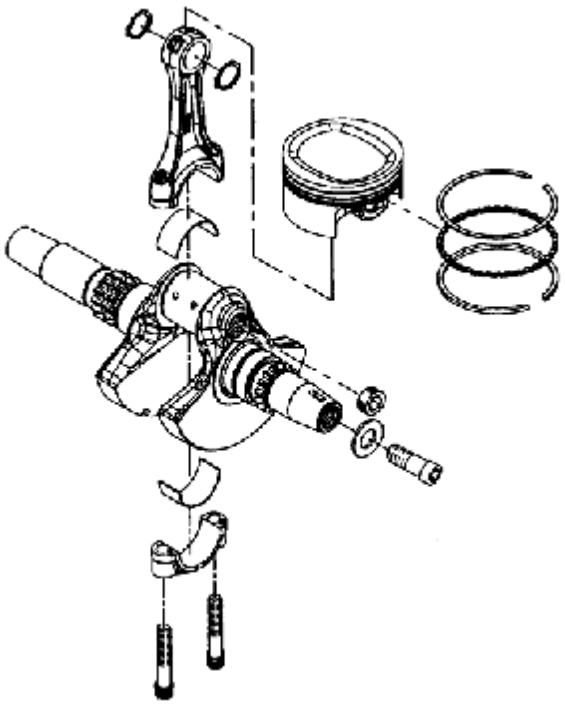


CYLINDER HEAD



CYLINDERS AND PISTONS





GENERAL

- Special references are made in the text for procedures, which are different for front cylinder and rear cylinder.
- When diagnosing an engine problem, always perform a cylinder leak test.
- Always place the vehicle on level surface.

NOTE: *Even though the following procedures do not require the engine removal. Many Illustrations show the engine out of the vehicle for more clarity.*

- Always disconnect BLACK (-) cable from the battery, then RED (+) cable before working on the engine.
- Even if the removal of many parts is not necessary to reach another part, it is recommended to remove these parts in order to check them.
- During assembly/installation, use the torque values and service products as in the exploded views.
- Clean threads before applying a thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

- When disassembling parts that are duplicated in the engine, (e.g.: valves), it is a strongly recommended to note their position and keep them as a “group”. If you find a defective component, it would be much easier to find the cause of failure among its group of parts (e.g.: you found a worn valve guide.
- A bent spring could be the cause and it will be easy to know which one among the springs is the cause to replace it if you grouped them at disassembly). Also since used parts have matched together during the engine operation, they will keep their matched fit when you reassemble them together within their “group”.

MAINTENANCE

VALVE ADJUSTMENT

NOTE: *Check and adjust valve clearance only when engine is cold.*

- Remove valve covers.
- Before checking or adjusting the valve clearance, turn crankshaft to TDC ignition of respective cylinder.
- Using feeler gauge check the valve clearance.

  INTAKE: 0.10 ± 0.02 mm

  EXHAUST: 0.15 ± 0.02 mm

- If valve clearance is out of specification, adjust valves as follow:

NOTE: *Use mean value of intake/exhaust to ensure a proper valve adjustment.*

- Hold the adjustment screw at proper position and torque the locking nut.
- Repeat the procedure for each valve.
- Before installing valve covers, recheck valve clearance.

PROCEDURES

INTAKE MANIFOLD

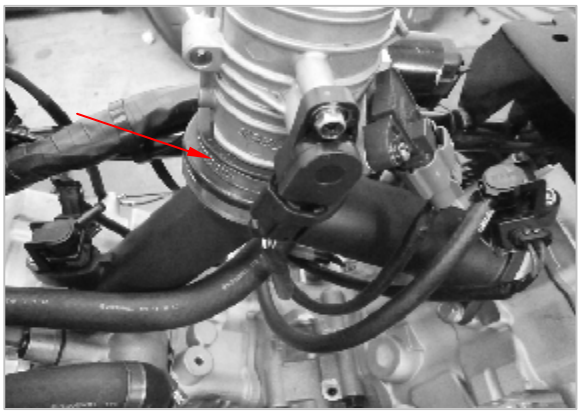
Intake Manifold Removal

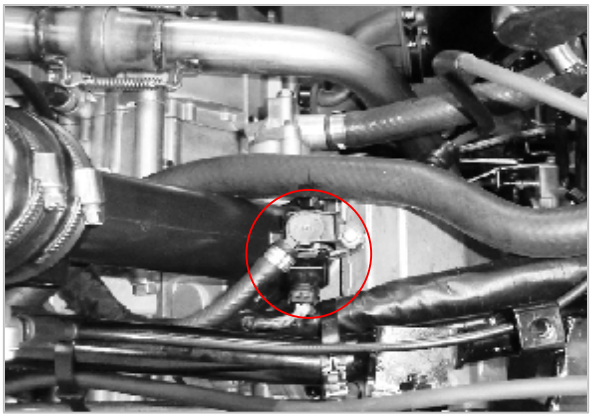
1. Remove upper and both side covers.
2. Remove four mounting bolts of air cleaner.
3. Loosen clamp of intake adapter
4. Raise air cleaner and using needle-nose pliers loosen and disconnect two air hoses, then pull up and remove the air cleaner.
5. Release fuel pressure by running engine until it run out of fuel.
6. Disconnect the fuel hoses at the fuel rails.

CAUTION

The fuel hose may still be under pressure.

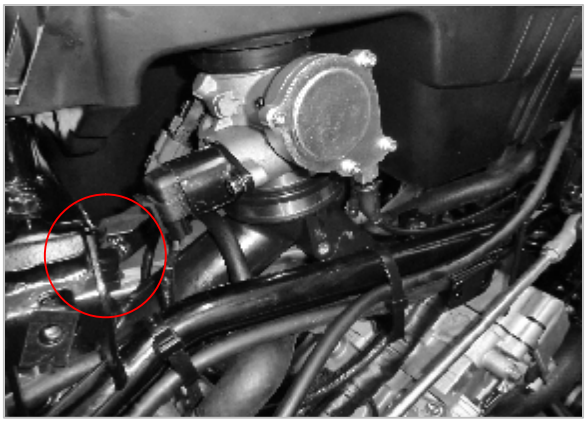
7. Disconnect fuel injectors wire connectors.
8. Remove intake manifold to cylinder head retaining bolts, then remove intake manifold.





Intake manifold Inspection

Check intake manifold for cracks, warping at flanges or any other damage. Replace if necessary.



Intake manifold Installation

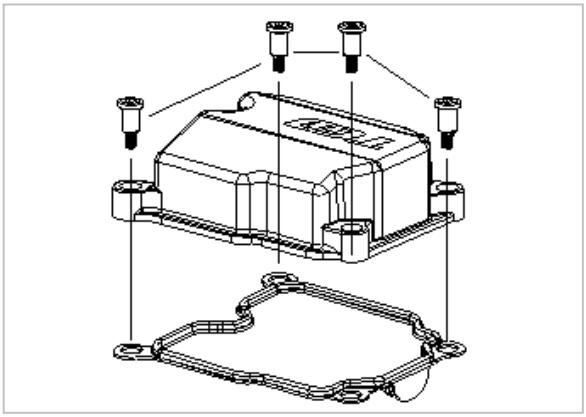
- The installation is the reverse of the removal procedure.
- Tighten intake manifold retaining bolts to specified torque one cylinder at time.

TORQUE: 1.6~1.8 kgf.m

CYLINDER HEAD COVER

Cylinder Head Cover Removal

- Remove the bolts of cylinder head cover.
- Remove cover and gasket.
- Repeat at the procedure for the other cylinder head cover if required.



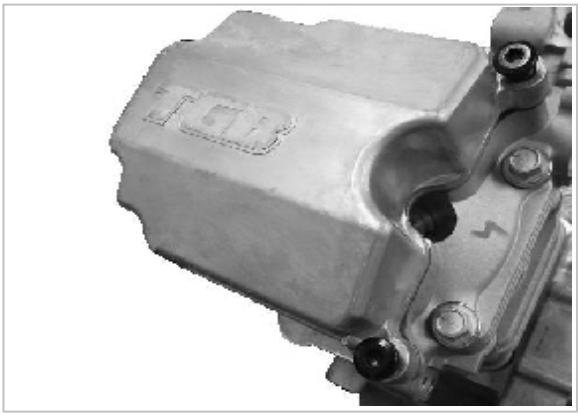
Cylinder Head Cover Inspection

Check the gasket on the cover if it is brittle, cracked or hard. If so, replace the gasket.

Cylinder Head Cover Installation

- For installation, reverse the removal procedure.
- Tighten cylinder head cover retaining bolts to specified torque in a criss-cross sequence.

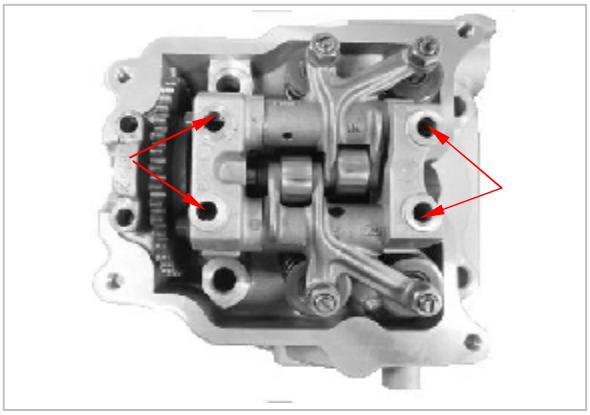
TORQUE: 1.0~1.2 kgf.m



ROCKER ARM

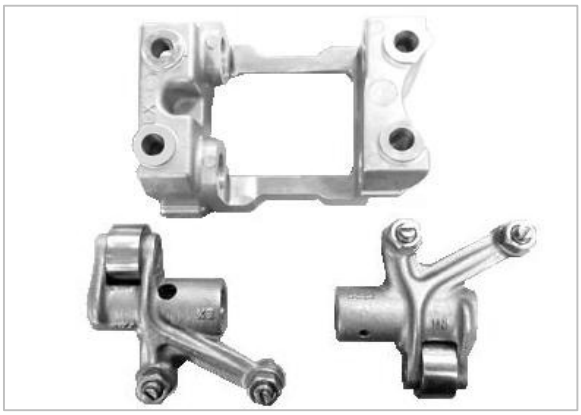
Rocker Arm Removal

- Remove cylinder head cover.
- Place the cylinder at TDC ignition.
- Remove four bolts of the camshaft holder and remove rocker arm shafts
- Remove rocker arm assembly.



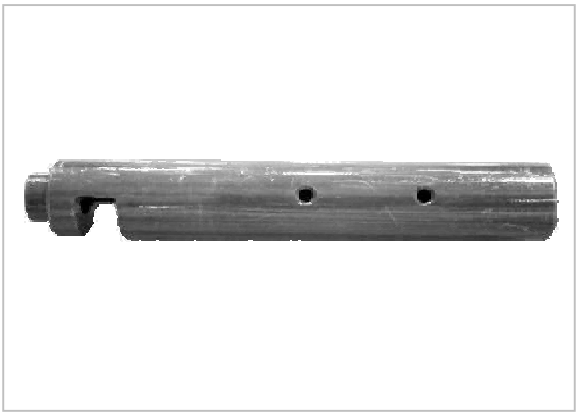
Rocker Arm Inspection

- Inspect each rocker arm for cracks and scored friction surfaces. If so, replace rocker arm assembly.
- Check the rocker arm rollers for free movement, wear and excessive radial play. Replace rocker arm assembly if necessary.
- Measure rocker arm bore diameter. If diameter is out of specification, change the rocker arm assembly.
- Check adjustment screws for free movement, cracks and/or excessive play.



Rocker Arm Shaft

- Clean the oil hole of rocker arm shaft.
- Check for scored friction surface; if so, replace parts.

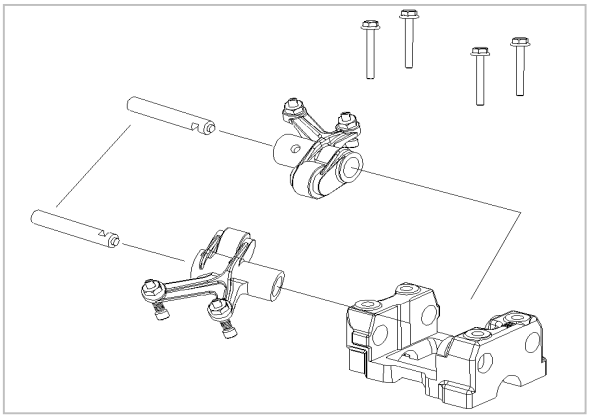


Rocker Arm Installation

NOTE: *Use the same procedure for exhaust and intake rocker arm.*

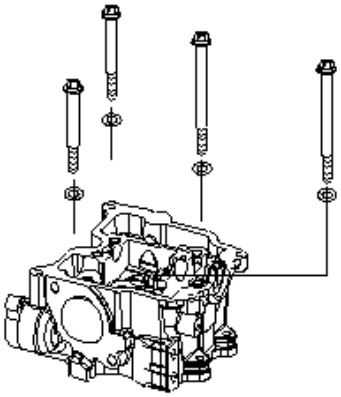
- Apply engine oil on rocker arm shaft.
- Install the rocker arm shafts with flat end first.
- Install four bolts of the camshaft holder according to the order, as shown.

TORQUE: 1.0~1.2 kgf.cm



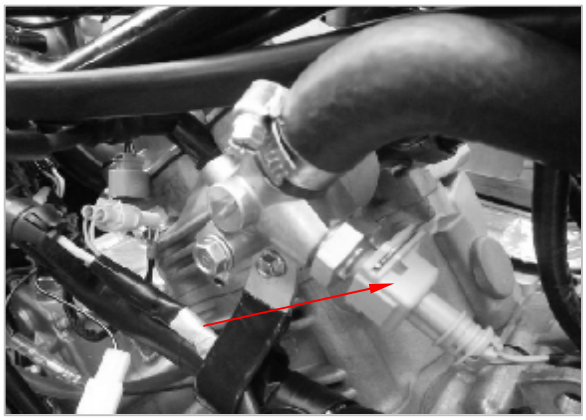
CYLINDER HEAD

Cylinder Head Removal

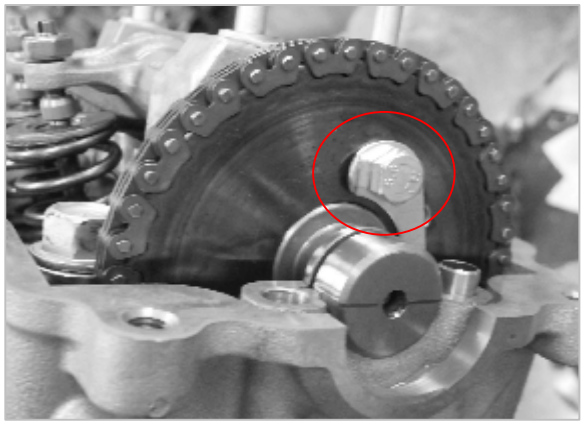


- The removal procedure is the same for both cylinder heads.
- Drain coolant and remove the hoses..

NOTE: *Before removing cylinder head, blow out remaining coolant by air pressure. During cylinder head removal, the remaining coolant in cylinder head could overflow into engine and a little quantity of coolant could drop into the engine. In this case, the engine oil will be contaminated.*

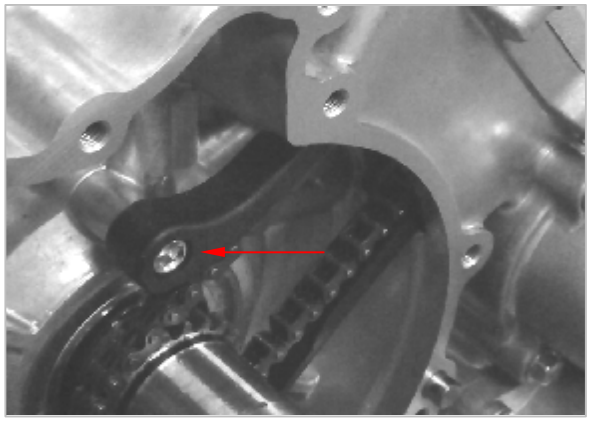


- Disconnect spark plug wire.
- Disconnect coolant temperature sensor connector, located at rear cylinder head.
- Remove air cleaner.
- Remove the intake manifold.
- Remove the chain tensioner.
- Remove the cylinder head cover and its gasket.
- Remove the camshaft holder.
- Remove the camshaft timing gear.
- Remove the camshaft.



- Unscrew cylinder head M6 and M10 bolts retaining cylinder head and cylinder to cylinder base.
- Pull out cylinder head.
- Remove timing chain guide (fixed).
- Remove and discard the cylinder head gasket.

Cylinder Head Inspection

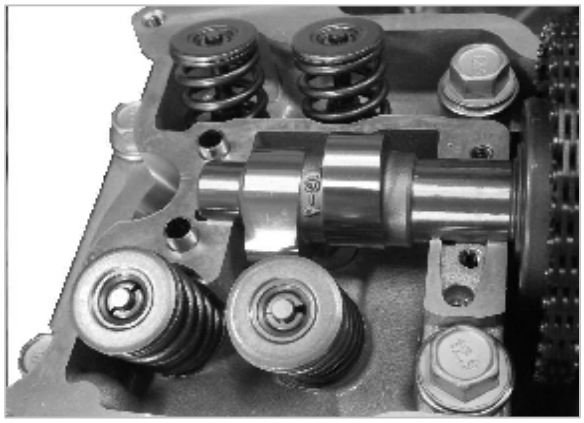


- Inspect timing chain guide (fixed) for wear, cracks or other damages. Replace if necessary.
- Check for cracks between valve seats, if so, replace cylinder head.
- Check mating surface between cylinder and cylinder head for contamination. If so, clean both surfaces.
- Clean oil supply through the cylinder head from contamination.

Cylinder head Installation

For installation, reverse the removal procedure.

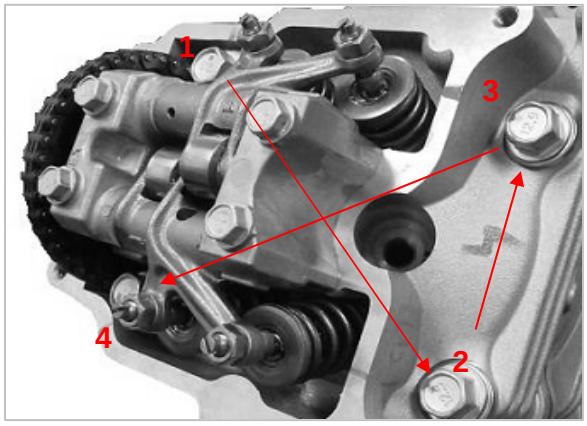
NOTE: *Never invert front and rear cylinder heads.*



▪ Ensure dowel pins and key are in place.

NOTICE: *Timing chain guide (fixed) has to be fixed between cylinder and cylinder head.*

▪ Install a NEW cylinder head gasket.
▪ First torque M10 cylinder head bolts with LOCTITLE in cross sequence to 20 Nm+/- 1 Nm two times then finish by tightening to 180° +/- 5°.
▪ Install cylinder head M6 bolts.
▪ Check timing chain guide (tensioner side) for movement.



CAMSHAFT

NOTE: *The engine is equipped with two different camshaft.*

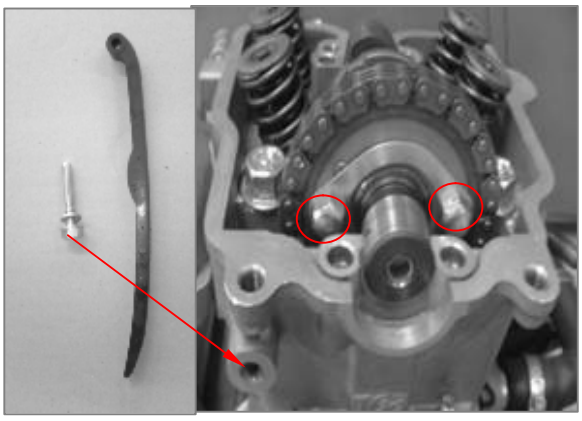
Mark "A" to front cylinder.

Mark "B" to rear cylinder

Camshaft Removal

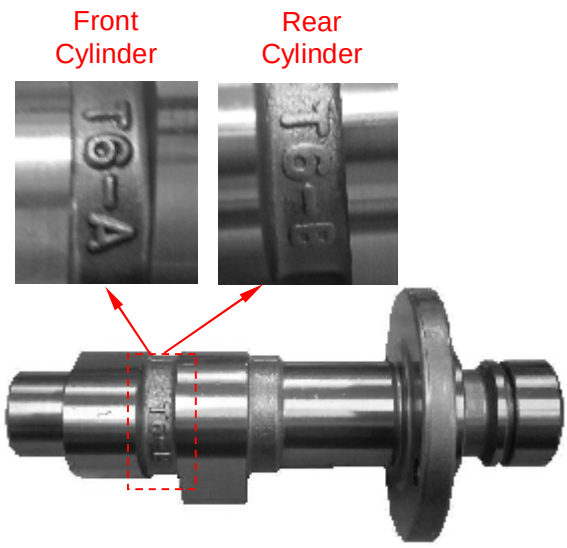
▪ The removal procedure is the same for both camshafts.
▪ Remove cylinder head cover.
▪ Remove the chain tensioner.
▪ Remove the rocker arm assembly.
▪ Remove the camshaft two retaining bolts.
▪ Remove the camshaft timing gear.
▪ Remove the camshaft.

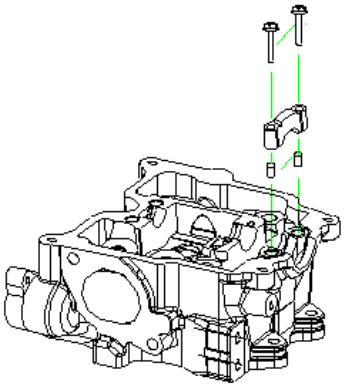
NOTICE: *During removal, pay attention to avoid key fall into engine via chain hole.*

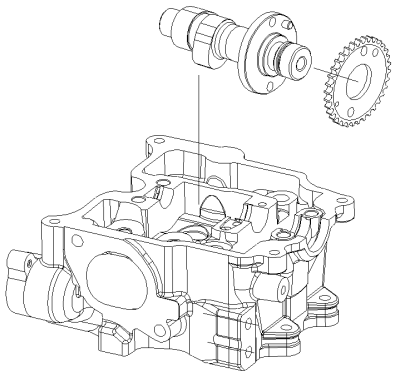


Camshaft Inspection

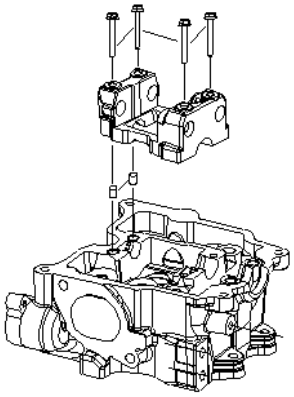
- Check each lobe and bearing journal of camshaft for scoring, scuffing, cracks or other signs of wear.
- Using a micrometer measure camshaft journal diameter and lobe height.
- Replace parts that are not within specifications.







Camshaft Installation



- For installation, reverse the removal procedure.

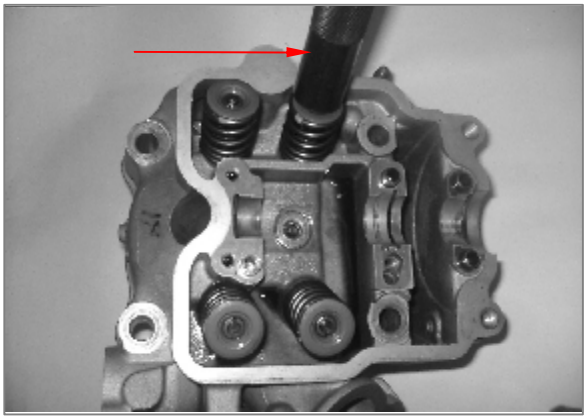
NOTICE: *Do not invert the camshaft during assembly. Any mix-up of the components will lead to engine damage.*

- Tighten the camshaft retaining bolts with specified torque.

TORQUE: 1.0~1.2 kgf.m

VALVE SPRING

Valve Spring Removal



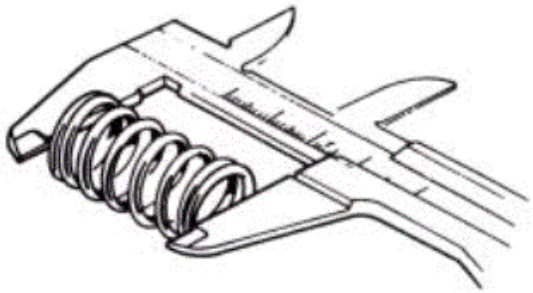
- Remove rocker arms.
- Remove cylinder head.
- Compress valve spring using VALVE SPRING
- COMPRESSOR special tool.

WARNING

Always wear safety glasses when disassembling valve springs. Be careful when unlocking valves. Components could fly away because of the strong spring preload.

- Remove valve cotters.
- Remove valve spring compressor and withdraw valve spring retainer and valve spring.

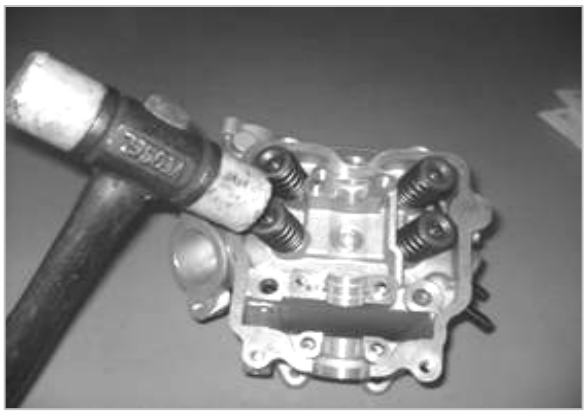
Valve Spring Inspection



- Check valve spring for visible damage. If so, replace valve spring.
- Check valve spring for free length and straightness.

- Replace valves springs if not within specifications.

Valve Spring Installation



- For installation, reverse the removal procedure.
- To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

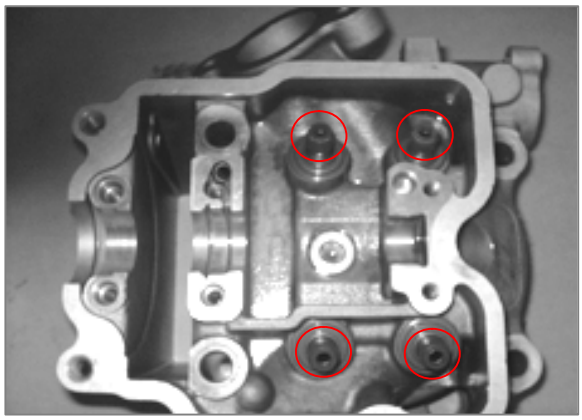
NOTE: *Valve cotter must be properly engaged in valve stem grooves.*

- After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

NOTICE: *An improperly locked valve spring will cause engine damage.*

VALVES

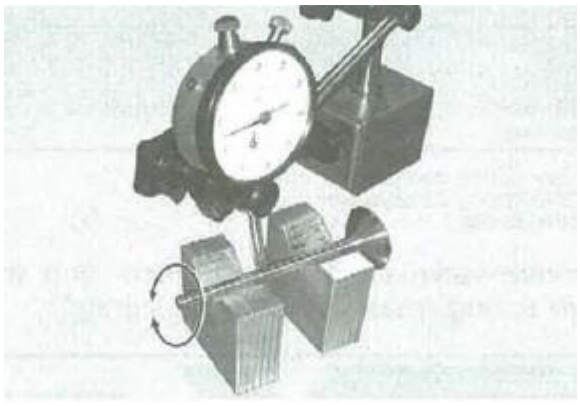
Valve Removal



- Remove valve spring.
- Push valve stem, then pull valves (intake and exhaust) out of valve guide.
- Remove valve stem seal with SNAP-ON PLIERS and discard it.

Valve Inspection

Valve Stem Seal

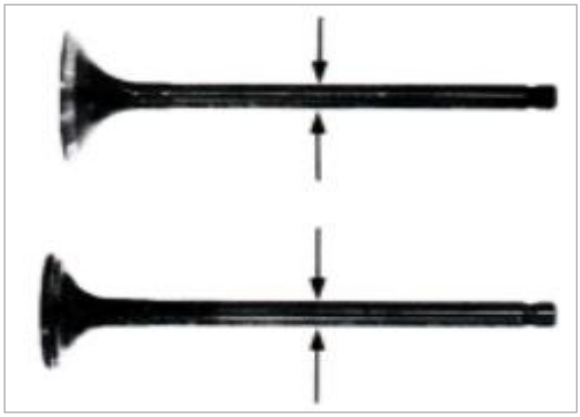


- Always install new seals whenever valves are removed.

Valve

- Inspect valve surface, check for abnormal stem wear and bending. If out of specification, replace by a new one.

VALVE OUT OF ROUND

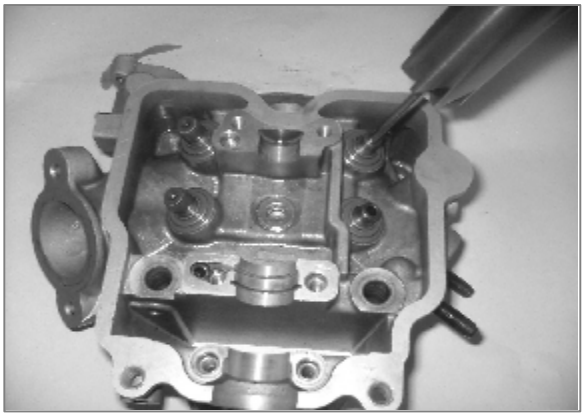


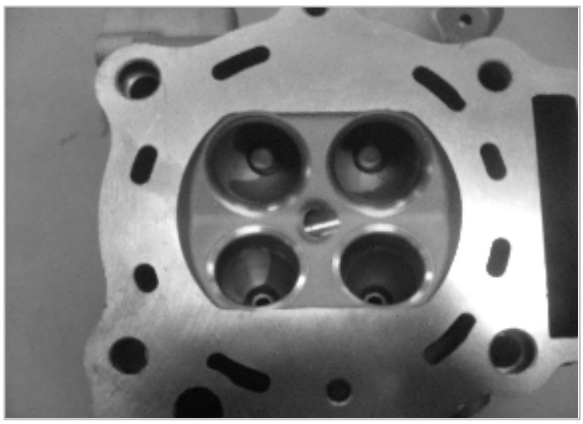
Valve Stem and Valve Guide Clearance

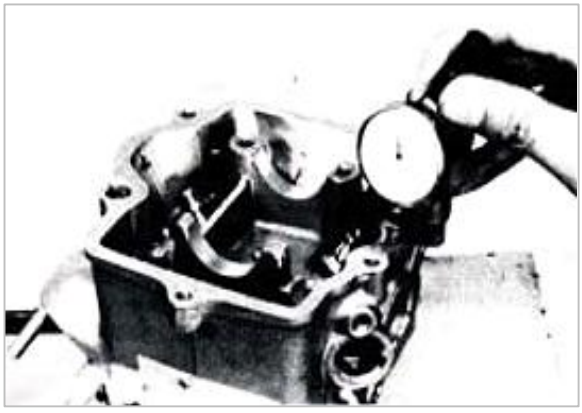
- Using a micrometer and a small gauge measure valve stem and valve guide in three places.

NOTE: *Clean valve guide to remove carbon deposits before measuring.*

- Change valve if valve stem is out of specification or has other damages such as wear or friction surface.
- Replace valve guide out of cylinder head if valve guide is out of specification or has other damages such as wear or friction surface.







Valve Face and Seat

- Check valve face and seat for burning or pittings and replace valve or cylinder head if there are signs of damage.
- Ensure to seat valves properly. Apply some lapping compound to valve face and work valve on its seat with a lapping tool.
- Measure valve face contact width.

NOTE: *The location of contact area should be in center of valve seat.*

- Using a caliper measure valve seat width.
- If valve seat contact width is too wide or has dark spots, replace the cylinder head.

Valve Installation

- For installation, reverse the removal procedure.
- Install a NEW valve stem seal. Make sure thrust washer is installed before installing seal.
- Apply engine oil on valve stem and install it.

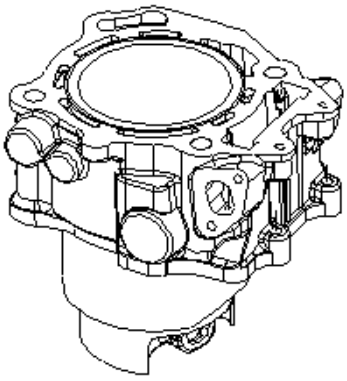
NOTICE: *Be careful when valve stem is passed through sealing lips of valve stem seal.*

- To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.
- After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

NOTICE: *An improperly locked valve spring will cause engine damage.*

CYLINDER

Cylinder Removal



- Remove chain tensioner.
- Remove timing gear.
- Remove the camshaft
- Remove the nuts at cylinder
- Remove the cylinder head.
- Pull out the cylinder
- Discard cylinder base gaskets.

Cylinder Inspection

- Check cylinder for cracks, scoring and wear ridges on the top and bottom of the cylinder. If so, replace cylinder.

Cylinder Taper

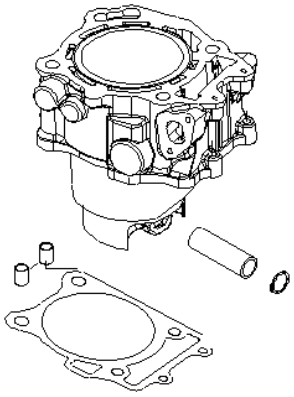
- Measure cylinder bore and if it is out of specifications, replace cylinder and piston rings.
- Measure cylinder bore at three recommended positions.
- Distance between measurement should not exceed the service limit mentioned above.

Cylinder Out of Round

- Measure cylinder diameter in piston axis direction from top of cylinder. Take another measurement 90° from first one and compare.

NOTE: *Take the same measuring points like described in CYLINDER TAPER above.*

Cylinder Installation



- For installation, reverse the removal procedure.

NOTICE: *Always replace cylinder base gasket before installing the cylinder.*

NOTE: *Ensure the front and rear cylinder installation correct, the timing chain adjuster should face to the backside of cylinder. Wrong install direction will lose the function of chain adjuster and cause timing chain damage.*

PISTON

Piston Removal

- Remove cylinder head.
- Remove the cylinder.
- Place a rag under piston and in the area of timing chain compartment.

WARNING

Piston circlip are spring loaded.

- Remove one piston circlip and discard it.

NOTE: *The removal of both piston circlip is not necessary to remove piston pin.*

- Push piston pin out of piston.
- Remove the piston from connecting rod.

Piston Inspection

- Inspect piston for scoring, cracking or other damages. Replace piston and piston rings if necessary.
- Using a micrometer. Measure piston pin.
- The measured dimension should be as described in the following tables. If not, replace piston.

Piston / Cylinder Clearance

- Adjust and lock a micrometer to the piston dimension.
- With the micrometer set to the dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to zero.
- Position the dial bore gauge 20 mm above cylinder base, measuring the piston pin axis.
- Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

NOTE: *Make sure used piston is not worn.*

- If clearance exceeds specified tolerance, replace piston by a new one and measure piston/cylinder clearance again.

NOTE: *Make sure the cylinder bore gauge indicator is set exactly at the same position as with micrometer, otherwise the reading will be false.*

Connecting Rod / Piston Pin Clearance

- Using synthetic abrasive woven, clean piston pin from deposits.
- Inspect piston pin for scoring, cracking or other damages.

- Measure piston pun. See the following illustration for the proper measurement positions.
- Replace piton pin if diameter is out of specifications.
- Measure inside diameter of connecting rod small end bushing.
- Replace connecting rod if diameter of connecting rod small end is out of specifications.
- Compare measurements to obtain the connecting rod/piston pin clearance.

Piston Installation

- For installation, reverse the removal procedure.
- Apply engine oil on the piston pin.
- Insert piston pin into piston and connecting rod.
- For each cylinder, install piston with punched arrow on piston dome is pointing toward the exhaust side of the engine.

CAUTION

Mark on top of position must show to both cylinders exhaust side.

- Install NEW piston circlip, and double check the C-clip is seating at the groove..

NOTICE: *Always replace disassembled piston circlip(s) by new ones. Place a rag on cylinder base to avoid dropping the circlip inside the engine.*

PISTON RINGS

Ring Removal

▪ Remove the piston.

Ring Inspection

Ring / Piston Groove Clearance

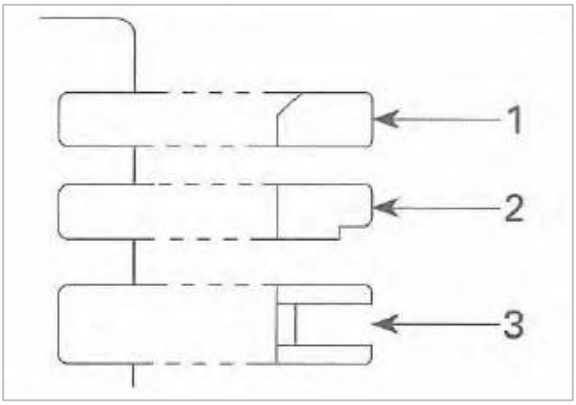
▪ Using a feeler gauge measure each ring/piston groove clearance. If the clearance is too large, the piston and the piston rings should be replaced.

▪ To measure the ring end gap place the ring in the cylinder in the area of 8 mm to 16 mm from top of cylinder.

NOTE: *In order to correctly position the ring in the cylinder, use piston as a pusher.*

▪ Using a feeler gauge, check ring end gap.

▪ Replace ring if gap exceeds above described specified tolerance.



Ring Installation

- For installation, reverse the removal procedure.

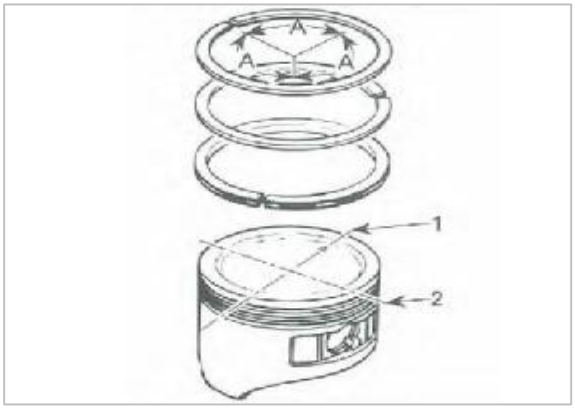
NOTE: *First install spring and then ring of oil scraper ring.*

- Install the oil scraper ring first, then the lower compression ring with the open edge facing up, then the upper compression ring with the word “R” facing up.

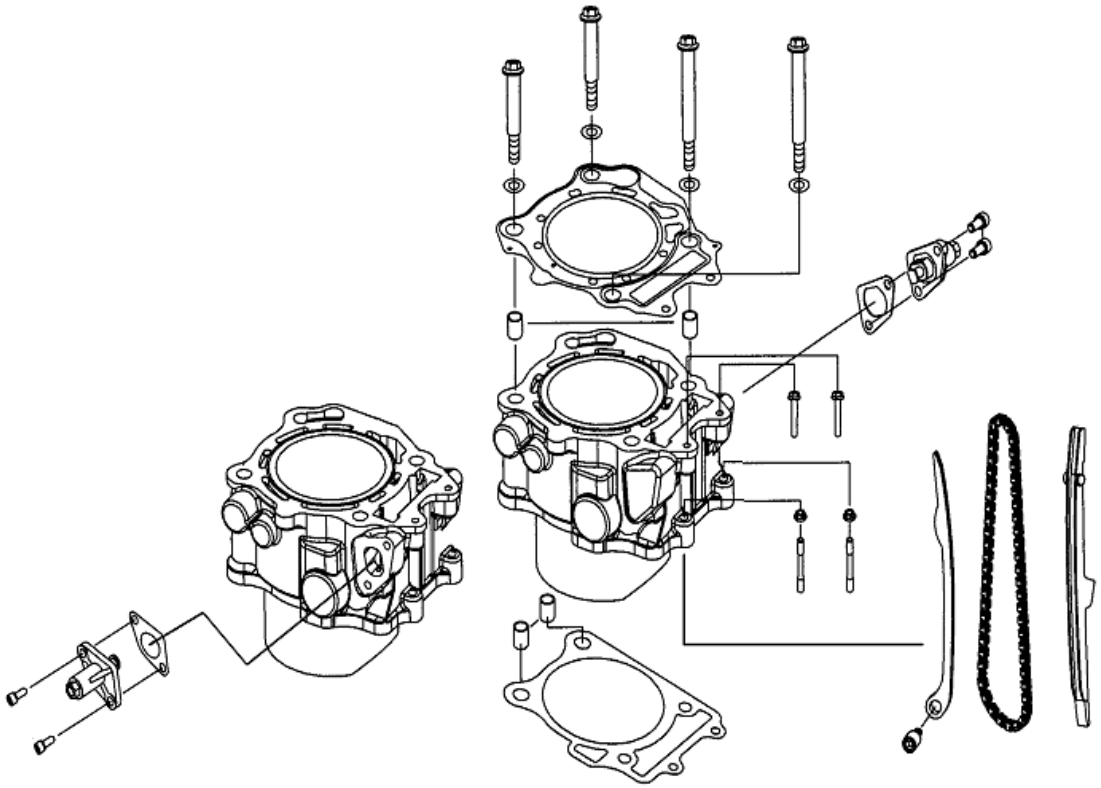
NOTICE: *Ensure that top and second rings are not interchanged..*

NOTE: *Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.*

- Check that rings rotate smoothly after installation.
- Space the piston ring end gap 120° apart and do not align the gaps with the piston pin bore.



TIMING CHAIN



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

TROUBLESHOOTING

USUALL ENGINE NOISE OR VIBRATION

1. Improper valve clearance adjustment and/or worn out rocker arm(s)

Re-adjust valve clearance and/or replace defective parts.

2. Defective chain tensioner

Replace chain tensioner.

3. Worn out timing chain guide(s)

Replace timing chain guide(s)

4. Stretched timing chain or worn out timing gears

Replace timing chain and timing gears.

5. Loose timing gear retaining bolts

Retighten bolts to recommended torque.

6. Incorrect camshaft timing

Replace damaged components and readjust camshaft timing.

ENGINE LACKS ACCELERATION OR POWER

1. Incorrect camshaft timing

Replace damaged components and readjust camshaft timing.

TIMING CHAIN TENSIONERS

Timing Chain Tensioner Removal

- Make sure the respective cylinder is set to TDC ignition.
- Carefully unscrew chain tensioner plug and release spring tension.

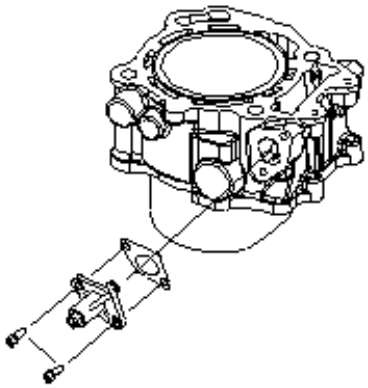
CAUTION

Tensioner is spring loaded.

- Remove O-ring, spring and chain tensioner plunger.
- Remove chain tensioner housing retaining bolts.
- Remove chain tensioner housing and O-ring.

Timing Chain Tensioner Inspection

- Check the chain tensioner housing and plug for cracks or other damages. Replace if necessary.
- Check chain tensioner plunger for free movement and/or scoring.
- Check if O-ring are brittle, cracked or hard.
- Replace if necessary.
- Check spring condition. Replace if damage.



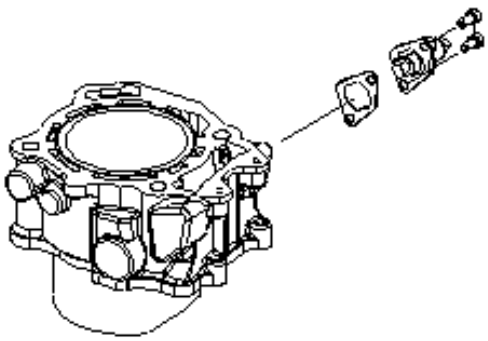
Timing Chain Tensioner Installation

- For installation, reverse the removal procedure.

NOTE: *Before installing the chain tensioner make sure, that the camshaft timing gear can be moved back and forth.*

- Slightly turn the camshaft timing gear in order to get the timing chain play on the tensioner side.
- Slightly screw the plunger in until the timing chain allows no more back and forth movement of the camshaft timing gear.
- Screw the plunder in an additional 1/8 turn to reach the required specified torque.

TORQUE: 1.0 kgf.m.



NOTE: *Install the new gasket of chain tensioner.*

NOTICE: *Improper adjustment of the timing chain will lead to severe engine damage.*

- Fit the spring on one side into the slot of the plug and on the other side into the plunger.

NOTE: *Turn spring only clockwise in order to fit the spring end into the notch of the plunger and to avoid loosening the plunger during spring installation. Do not reload the spring.*

NOTE: *Do not forget to replace the O-ring on chain tensioner plug.*

- Then compress the spring and screw the plug in.

NOTE: *To avoid overstressed timing chain, the plug must engage into threads within the first full turn.*

- Install all other removed parts.
- Finally, tighten the plug.

CAMSHAFT TIMING GEARS

Camshaft Timing Gears Removal

- Remove the cylinder head cover.
- Turn crankshaft to TDC ignition of the respective cylinder and lock magneto flywheel.
- Unscrew timing chain tensioner.
- Remove timing gear retaining bolts.
- Remove the timing gear.

NOTE: *Secure timing chain with a piece of wire.*

Timing gear Inspection

- Check timing gear for wear or deterioration.
- If gear worn or damaged, replace it as a set (camshaft timing and timing chain).

Timing Gear Installation

- For installation, reverse the removal procedure.
- Clean mating surface and threads of camshaft prior installing timing gear.
- Crankshaft must be set to TDC position before install the timing chain.

NOTICE: *Crankshaft and camshaft must be locked at TDC ignition position to place timing gear and timing chain in the proper position.*

- Place timing gear along with the timing chain on the camshaft.

NOTE: *The printed marks on the camshaft must be parallel to the cylinder head base.*

- Install and adjust timing chain tensioner.
- Install and tighten timing gear retaining bolts to specified torque.

NOTE: *The hole on the timing gear sprocket should at the exhaust side.*

TORQUE: 10 Nm

NOTE: *If a piston (front or rear cylinder) is set to TDC ignition, the timing gear of the opposite cylinder must be in the following position.*

Camshaft Timing Cylinder (rear)

- Turn crankshaft until piston is at TDC ignition as follow:
- Remove spark plug of both cylinders.
- Remove both cylinder head covers.
- Remove the plug and O-ring of magneto cover.
- Use 14 mm Allen key to turn crankshaft until rear piston is at TDC ignition.
- When rear piston is at TDC ignition, marks on magneto flywheel **"R"** and on the magneto cover are aligned.
- At TDC ignition, the printed marks on the camshaft have to be parallel to cylinder head base.

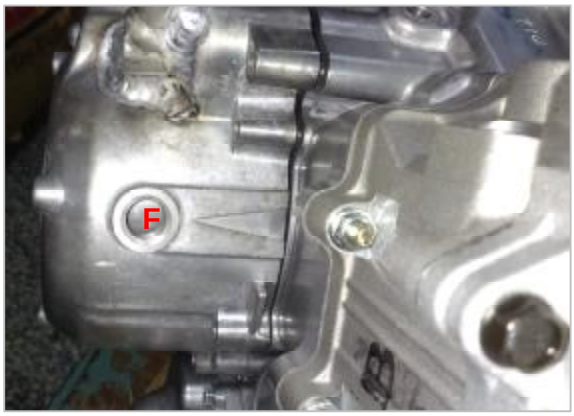
Camshaft Timing Cylinder (front)

- Turn rear cylinder to TDC ignition.
- Using a 14 mm Allen key, turn crankshaft 450° clockwise, until marks on magneto flywheel and magneto cover are aligned.

NOTE: *At TDC ignition, the printed marks on the camshaft have to be parallel to cylinder head base as per following illustration.*

NOTE: *Before installing camshaft of rear cylinder, it should be confirm mark "B" on the camshaft.*

NOTE: *Before installing camshaft of front cylinder, it should be confirm mark "A" on the camshaft.*



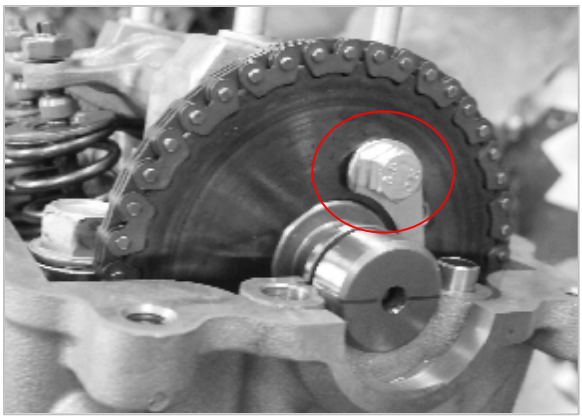
NOTE: *Reconfirm the TDC ignition of front cylinder, at this time, the rear cylinder timing chain sprocket will show up an hole at up-left corner on the intake side.*

NOTE: *Check the timing chain identification hole, during assemble, when one cylinder camshaft on the TDC position, the other cylinder timing chain sprocket left up corner will shown the hole, If not, please re-adjust and re-assemble.*

NOTE: *It will show one hole only, if shows two hole or no hole, it mean the installation incorrect.*

TIMING CHAIN

The engine is equipped two timing chains. One of timing chain is located on engine ACG side behind the magneto cover. The second timing chain is located on engine PTO side behind the PTO cover.



Timing Chain Removal (ACG Side)

- Remove the following parts:
  - ACG cover.
  - Starting idle gear
  - Rotor.
  - Starting clutch gear.
  - Cylinder head cover.
    Chain tensioner.
  - Timing gear.
- Remove timing chain guide (tensioner side) and lower timing chain guide.

NOTE: *Mark the operating direction of the timing chain before removal.*

- Carefully pull the timing chain downwards and sideways, then out of the crankcase.

Timing Chain Removal (CVT Side)

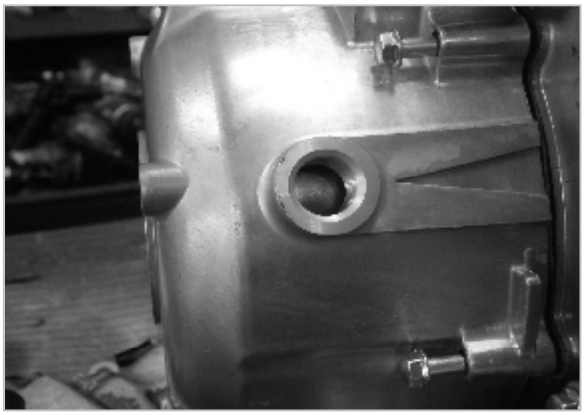
- Remove the following parts:
  - CVT cover.
  - Idle gear.
  - Cylinder head cover.
    Chain tensioner.
  - Timing gear.
- Remove timing chain guide (tensioner side) and lower timing chain guide.
- Carefully pull the timing chain downwards and down from the crankcase.

NOTE: *Mark the operating direction of the timing chain before removal.*

Timing Chain Inspection

- Inspection is the same for both timing chains.
- Check timing chain on timing gear for excessive radial play.
- Check chain condition for wear and teeth condition.
- If chain is excessively worn or damaged, replace it as a set (timing gear and timing chain).
- Check timing chain guides for wear, cracks or deforming. Replace as required.

NOTE: *Check also the timing chain guide (tensioner side).*



Timing Chain Installation

- The installation is essentially the reverse of the removal procedure, but pay attention to the following details.

NOTE: *Installation is the same for both timing chains.*

TIMING CHAIN GUIDE SOCKET SCREW

TIGHTENING TORQUE: 1.0~1.2 kgf.m

- Install timing chain with camshaft timing gear.

NOTE: *Ensure to carry out proper valve timing.*

NOTICE: *Improper valve timing will damage engine components.*

TIMING CHAIN GUIDE (TENSIONER SIDE)

Timing Chain Guide Removal

- Refer to TIMING CHAIN in this subsection.

Timing Chain Guide Inspection

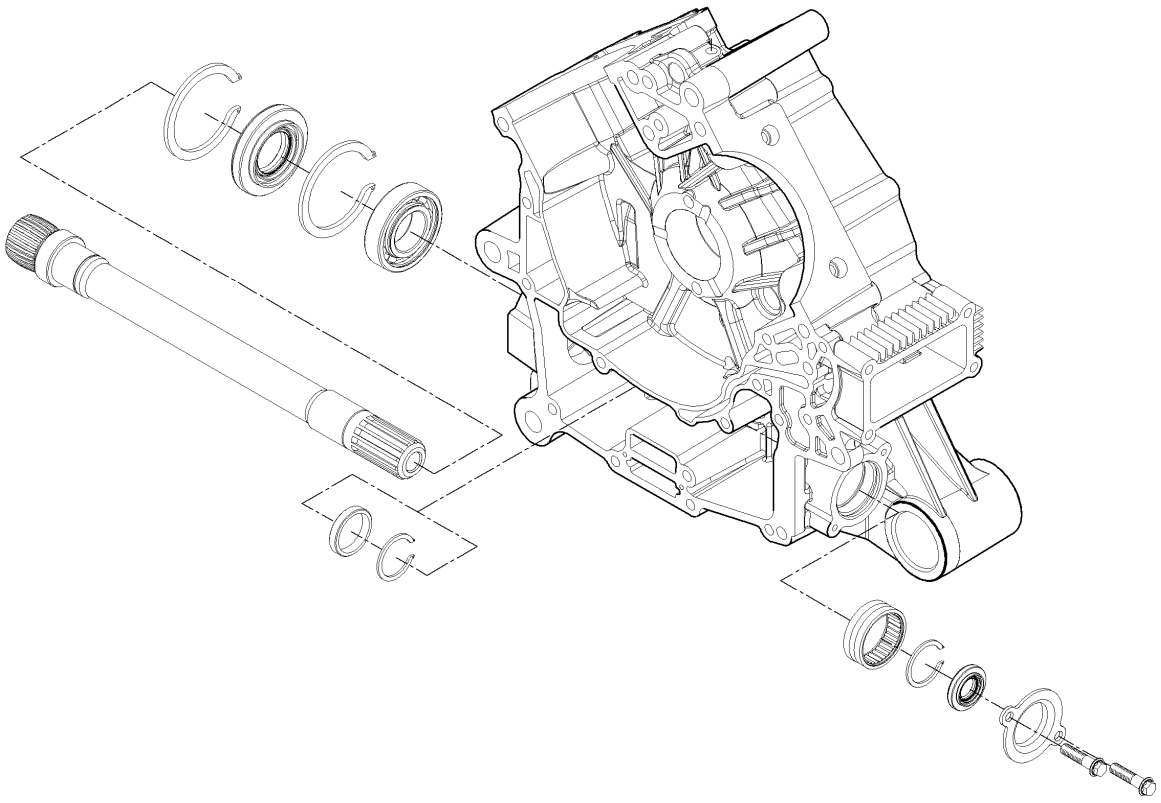
- Check timing chain guide for wear, cracks or deforming. Replace if necessary.

Timing Chain Guide Installation

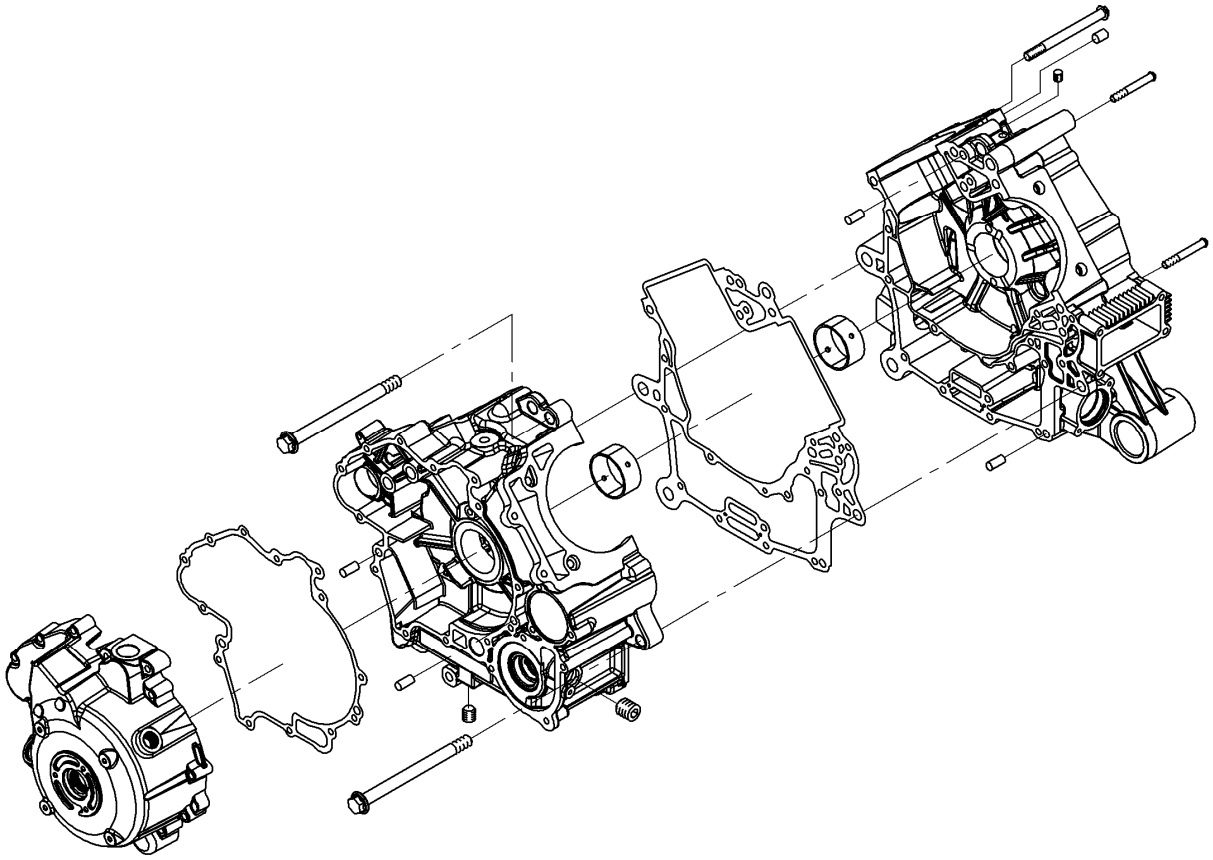
- For installation, reverse the removal procedure.

BOTTOM END

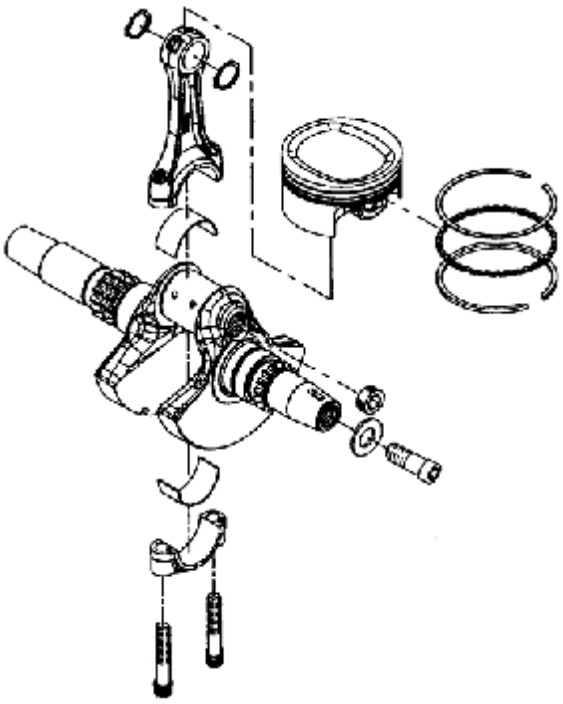
ENGINE DRIVE SHAFT



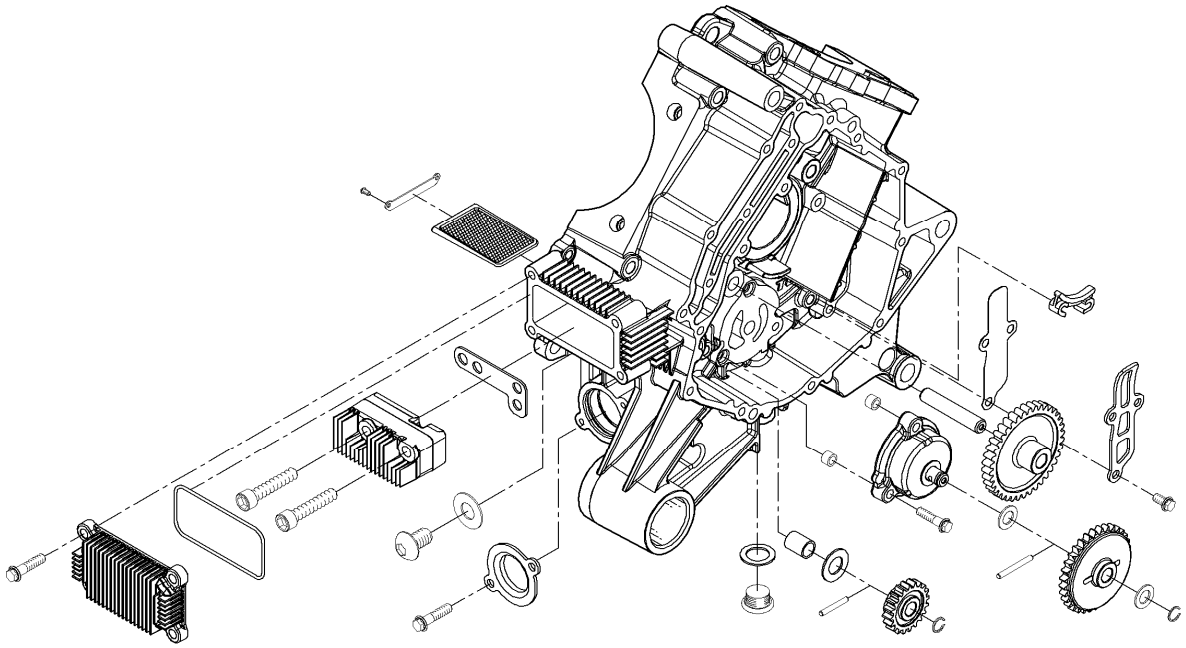
CRANKCASE

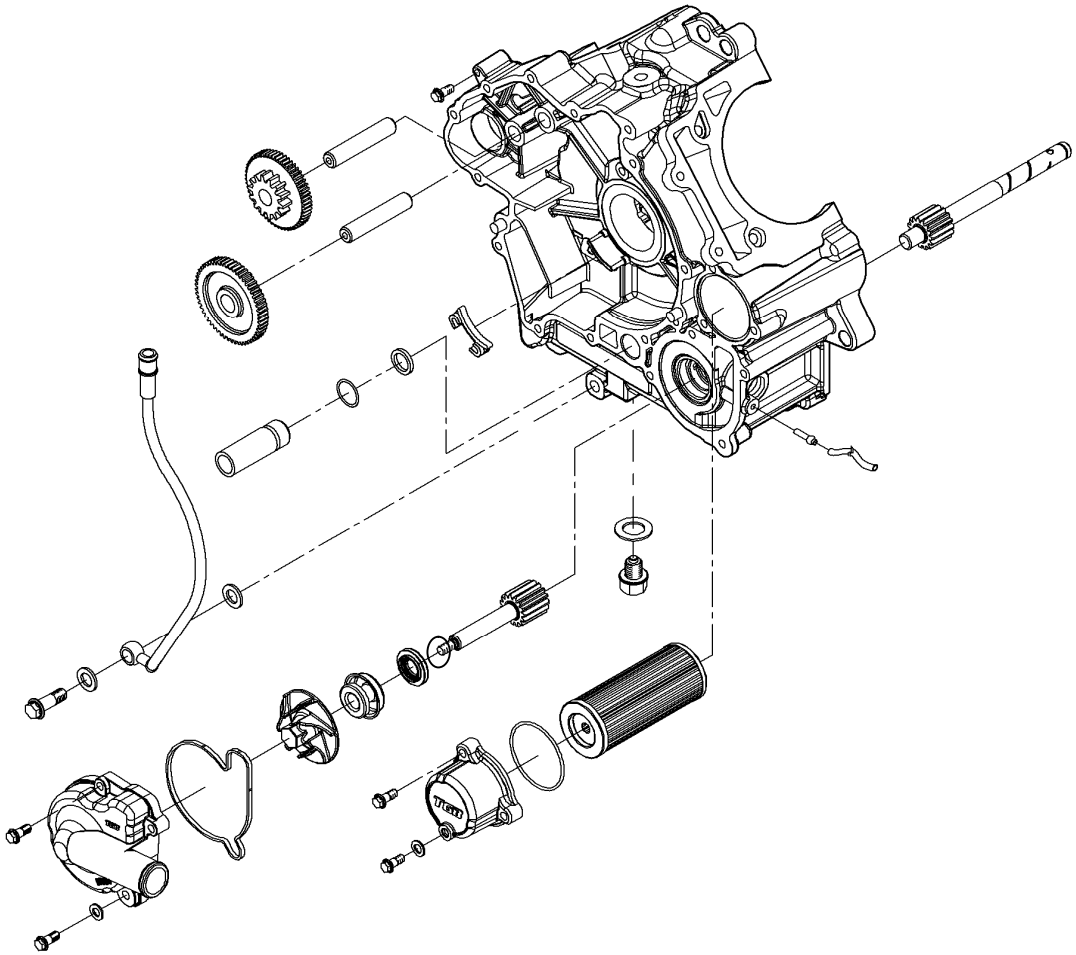


CRANKSHAFT

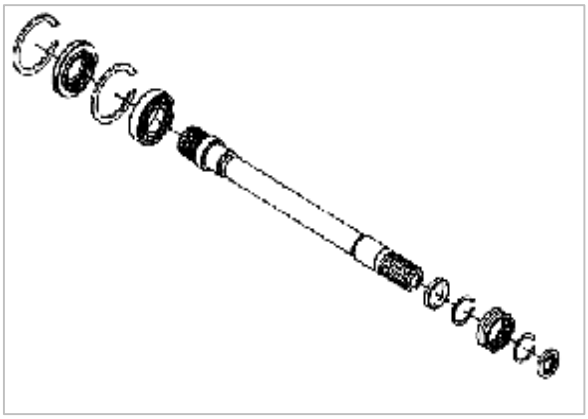


WATER PUMP, OIL PUMP





BOTTOM END



GENERAL

- During assembly/installation, use the torque values and service products as in the exploded views.
- Clean threads before applying a thread locker.

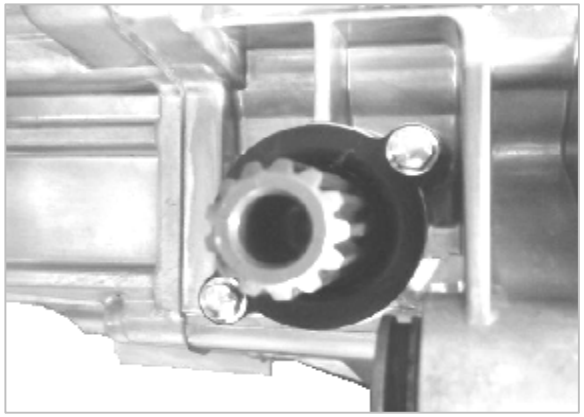
WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced with new ones where specified.

PROCEDURE

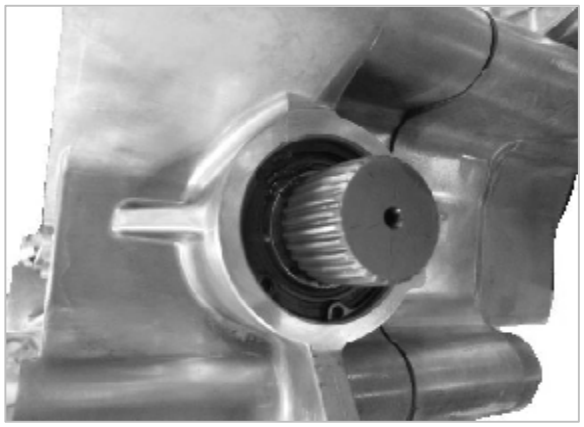
ENGINE DRIVE SHAFT

NOTE: *The engine drive shaft transmits the power from gearbox to the front differential and is located inside the crankcase.*



Oil Seal Replacement (Engine Drive Shaft)

- Remove the engine.
- To remove the rear oil seal, the gearbox has to be removed from the engine.
- To replace drive shaft oil seals, refer to drive shaft removal.



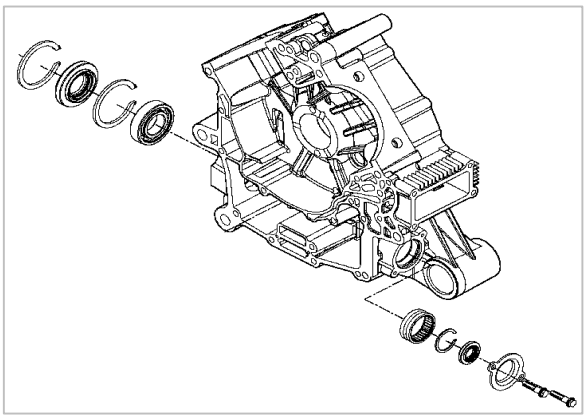
Engine Drive Shaft Removal

- Remove the engine.

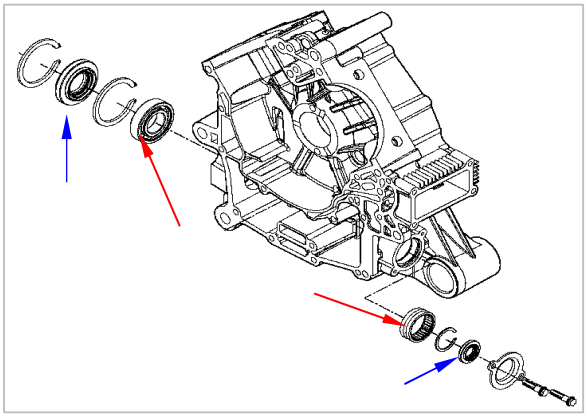
At rear of engine, remove the O-ring.

NOTE: *Check ends of the circlip for sharp edges or burr before removing the drive shaft, to avoid damaging the oil seal.*

- Split the crankcase.
- Remove engine drive shaft from the crankcase.



Engine Drive Inspection

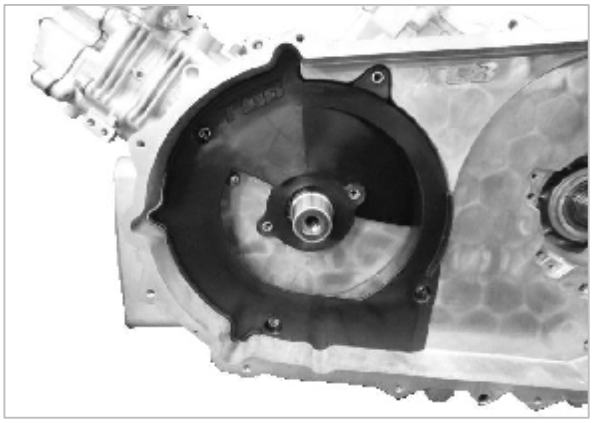


- Replace oil seals and/or O-ring if they are brittle, hard or damaged.
- Check drive shaft bearings for contamination and/or metal shavings. Check if bearing turn freely and smoothly. Replace if necessary.
- Check drive shaft for cracks, bend, pitting or other visible damages.
- Check drive shaft splines for wear or damages.
- Check oil seal running surface of the drive shaft for scratches. Replace if necessary.

Engine Drive Shaft Installation

- For installation, reverse the removal procedure.
- Pay attention to the following details.
- Clean all metal components in solvent.
- Crankcase surface is best cleaned using a combination of LOCTITE CHISEL (gasket remover) and a brass brush. Brushes a first pass in one direction then makes the final brushing perpendicularly to the first pass.

NOTICE: *Do not wipe with rag. Use a new clean hand tower only.*

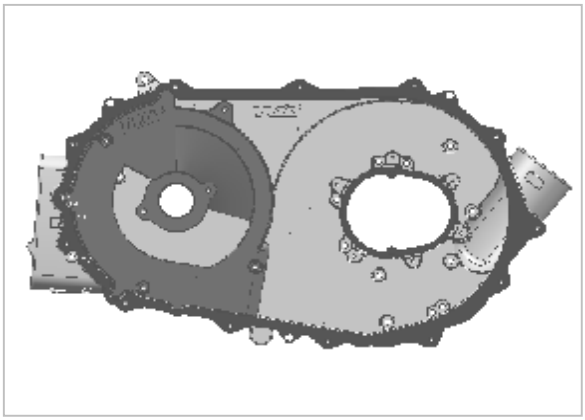


- Use a suitable installer for install bearing.
- Use LOCTITE 5910 on mating surfaces.

IMPORTANT: *When beginning the application of the sealant, the assembly and the first torquing should be done within 10 minutes. It is suggested to have all you need on hand to save time.*

CVT VENT BACKBOARD OIL SEAL

To replace oil seal it is not necessary to remove engine from vehicle.

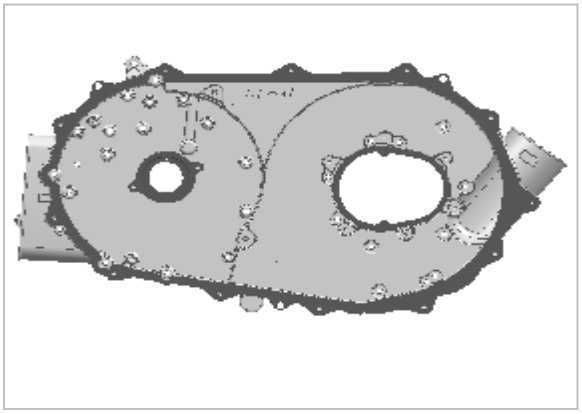


CVT Vent Backboard Oil Seal Removal

- Drain engine oil and remove the following parts:
  - CVT cover.
  - Drive Pulley.
  - Driven Pulley.
  - CVT air ducting guide.

▪ Remove oil seal with a small flat screwdriver.

NOTICE: *Avoid scoring surface with tool.*



Vent Backboard Oil Seal Inspection

Check oil seal running surface of crankshaft CVT side for grooves. Replace if necessary.

CVT Vent Backboard Oil Seal Installation

▪ For installation, reverse the removal procedure.

▪ Pay attention to the following details.

NOTICE: *Oil Seal must be installed with sealing lip toward engine.*

▪ Push oil seal in place by using the CVT COVER OIL SEAL INSTALLER.

CVT Vent Backboard

CVT Vent Backboard Removal

▪ Remove the following parts:

- CVT cover.
- Drive Pulley.
- Driven Pulley.
- CVT air ducting guide.

▪ Disconnect vent hose.

▪ Remove CVT cover bolts and pull CVT cover.

CVT Vent Backboard Inspection

▪ Check the CVT vent backboard for cracks or other damage.

▪ Replace CVT vent backboard if damaged.

▪ Clean oil breather bore in CVT vent backboard from contaminations with part cleaner then use pressurized air to dry it.

WARNING

Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.

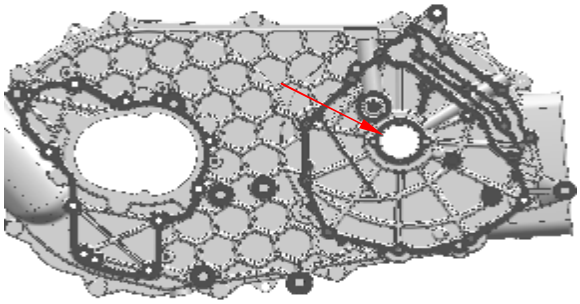
▪ Check surface of sealing sleeve for wear or other damages. Replace CVT vent backboard if damaged.

▪ Check plain bearings for scoring or other damages.

NOTE: *Measure plain bearing inside diameter and compare to crankshaft journal diameter.*

- Replace if the measurement is out of specification.

PLAIN BEARING INSDIE DIAMETER (CVT BACKBOARD)

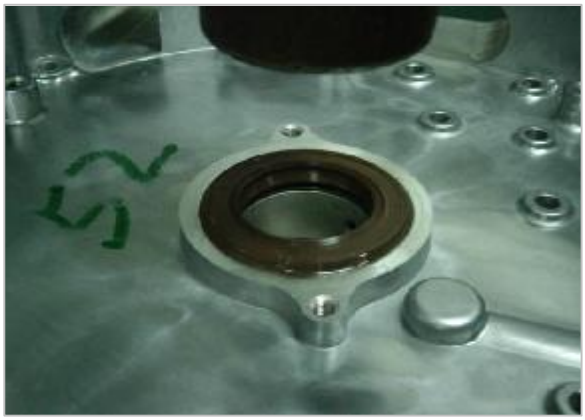


Plain Bearing Replacement (CVT Vent Backboard Cover)

Plain Bearing Removal

NOICTE: *Unless otherwise instructed. Never use a hammer to install plain bearing. Use a press only.*

- Carefully remove the CVT oil seal with a screwdriver, without damaging the CVT cover.
- Push out the plain bearings from the outside towards the inside using the PLAIN BEARING REMOVER/INSTALLER.
- The CVT cover has to be supported from below with suitable support with straight surface, in order to prevent damage of the sealing surface.



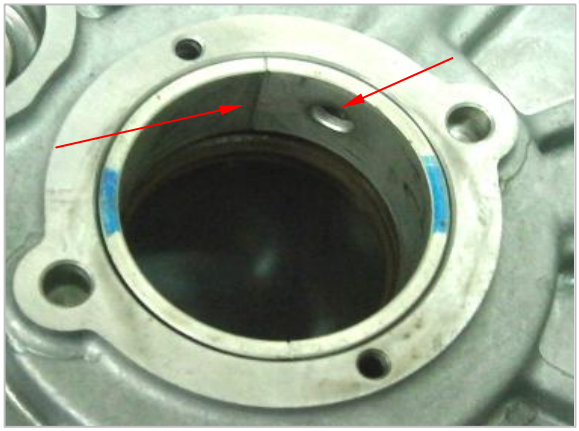
Plain Bearing Installation

NOTE: *Do not lubricate plain bearing and/or CVT cover for installation.*

- Install plain bearings with the proper PLAIN BEARING REMOVER/INSTALLER in a cool PTO cover.

NOTICE: *Mark position of oil bore on CVT cover and on plain bearing remover/installer. Align mark on plain bearing remover/installer with mark on CVT cover.*

- Carefully press-in the plain bearings in the same direction as during disassembly, from the outside towards the inside. Support CVT cover with suitable support with straight surface, in order to prevent damage of sealing surface.



NOTE: *Wrong oil bore position will stop oil supply to plain bearings and will damage the engine.*

NOTICE: *The partition of the plain bearings must be positioned near to oil bore in counterclockwise direction.*

CVT Vent Backboard Installation

- For installation, reverse the removal procedure.
- Pay attention to the following details.

NOTE: *At installation, replace CVT cover gasket and oil seal.*

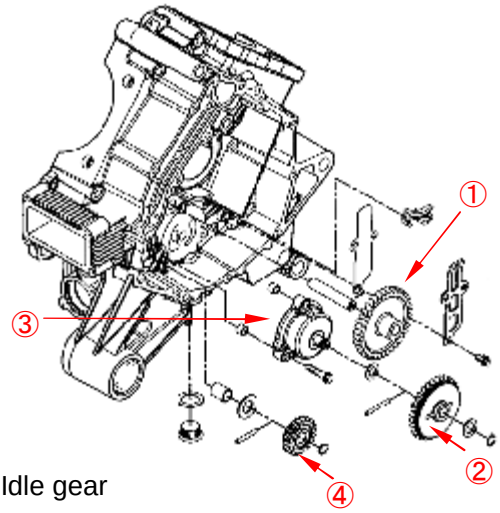
- Tighten CVT cover bolts following the illustrated sequence.

DRIVE GEARS

The drive gears are located on the engine CVT side behind the CVT vent backboard cover.

Drive Gear Removal

- Remove CVT cover.
- Withdraw idle gear.
- Remove oil pump gear c-clip and washer.
- Remove the bolts and pull out water pump.
- Remove c-clip and pull out the water pump gear.

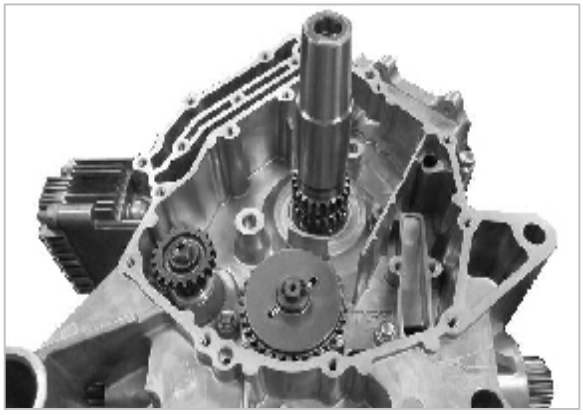


1. Idle gear
2. Oil pump gear
3. Oil pump
4. Water pump drive gear

Drive Gears Inspection

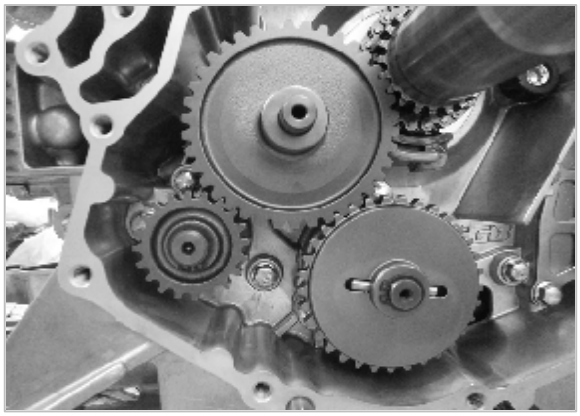
Idle Gear / Oil Pump Drive Gear / Water Pump Drive Gear

- Inspect gears for wear or other damage.
- Replace if damaged.
- Check if oil seal is brittle, hard or damaged. Replace if necessary.
- Inspect gear for wear or other damage.
- Check ball bearing for excessive play and smooth operation. Replace breather gear assembly if necessary.



Drive Gear Installation

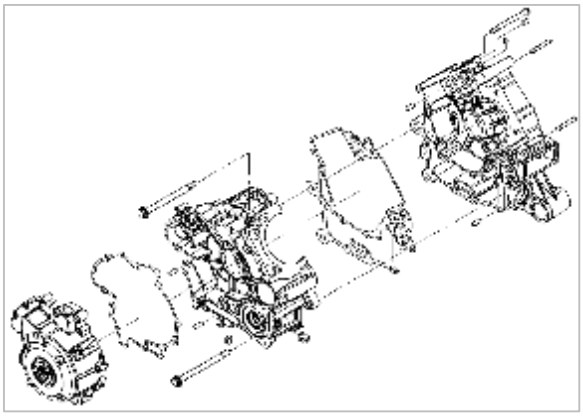
- For installation, reverse the removal procedure.
- Adequately oil the ball bearing of the breather gear.



CRANKCASE

Crankcase Disassembly

1. Drain the following system:
   1.1 Cooling system
   1.2 Engine oil.
   1.3 Gearbox oil.
2. Lock crankshaft.
3. Remove the following parts:
   - CVT cover.
   - Drive Pulley.
   - Driven Pulley.
   - CVT air guide.
4. Remove the engine from vehicle.
5. Disconnect gearbox from engine.
6. Remove the following parts:
   - ACG cover.
   - Rotor with starting clutch gear.
   - Starter drive gears.
7. Remove the following parts:
   - CVT vent backboard cover.
   - Drive gears.
8. Remove the following parts:
   - Chain tensioners.
   - Camshaft timing gears.
   - Timing chains.
   - Timing chain guides.
9. Remove the following parts:
   - Front cylinder head.
   - Rear cylinder head.
   - Both cylinders.
10. Remove the following parts:
    - Water pump housing.



11. Remove the following parts:
- Oil filter.
- Oil cooler.
- Oil pump drive gear.

NOTE: *Oil pump removal from crankcase is not necessary, but recommended to see condition of oil pump.*

12. Remove electric starter.

NOTE: *Before splitting the crankcase, measure crankshaft axial play.*

▪ Remove retaining bolts of crankcase.
▪ Carefully split crankcase halves by using a screwdriver and a soft hammer.

NOTE: *During disassembly, do not damage the sealing surface of the crankcase halves.*

▪ Pull crankshaft out of crankcase.
▪ Remove the water pump idle shaft and the water pump gear.
▪ Remove engine oil strainer.

Crankcase Cleaning

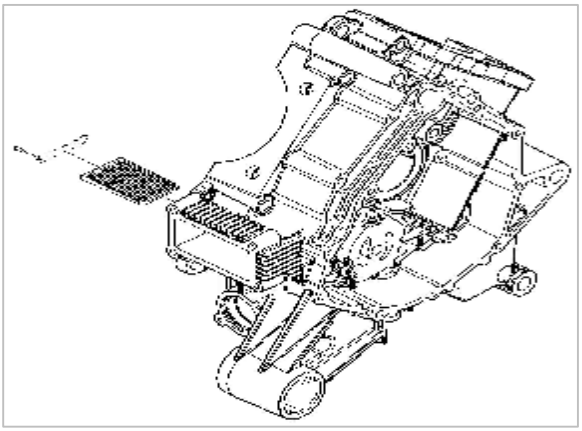
WARNING

Use safety goggles to avoid eye injuries.

▪ Clean crankcase using a part cleaner.
▪ Dry crankcase using compressed air.
▪ Below the oil supply lines.

Oil Strainer

▪ Clean the engine oil strainer (same procedure as for the crankcase)

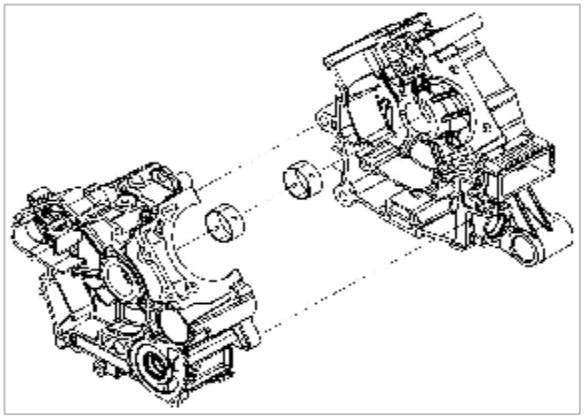


Crankcase Inspection

▪ Check crankcase halves for cracks or other damage. Replace if damaged.
▪ Check main bearings in ACG and CVT crankcase half for scorings or other damages.

NOTE: *Measure plain bearing inside diameter and compare to CVT/ACG main journal diameters of crankshaft. Replace if the measurement are out of specification.*

MAIN BEARING INSIDE DIAMETER (CVT / ACG)



Plain Bearing Replacement (Main)

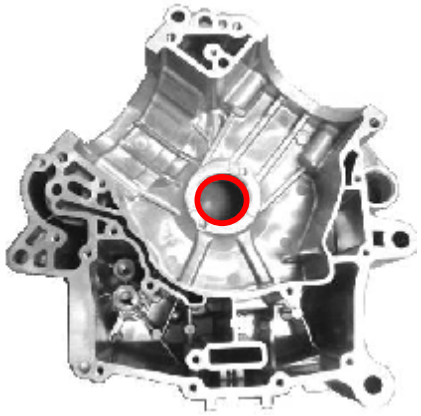
Plain Bearing Removal

NOTICE: *Always use a press for removal of plain bearings.*

- Remove plain bearings with the PLAIN BEARING REMOVER/INSTALLER
- Carefully push the plain bearings out, from the crankcase half inside towards the outside.

NOTE: *Place the proper CRANKCASE SUPPORT ACG/CVT under crankcase halves before removing plain bearings.*

NOTE: *During disassembly, make sure not to damage the sealing surfaces of the crankcase halves.*



Plain Bearing Installation

NOTICE: *Unless otherwise instructed, never use hammer to install plain bearings. Use press only.*

- Install plain bearing with the proper PLAIN BEARING REMOVER/INSTALLER in a cool crankcase. Do not lubricate plain bearings and/or crankcase for installation.

NOTE: *Place the proper crankcase support sleeve under crankcase halves before installing the plain bearing.*

- Carefully press in the plain bearings in the same direction as during disassembly, from the crankcase inside towards the outside.
- During reassembly, make sure not to damage the sealing surface of the crankcase halves.

NOTE: *Use O-rings to hold plain bearings in place during installation. The O-ring will disappear in the groove of the plain bearing remover/installer.*

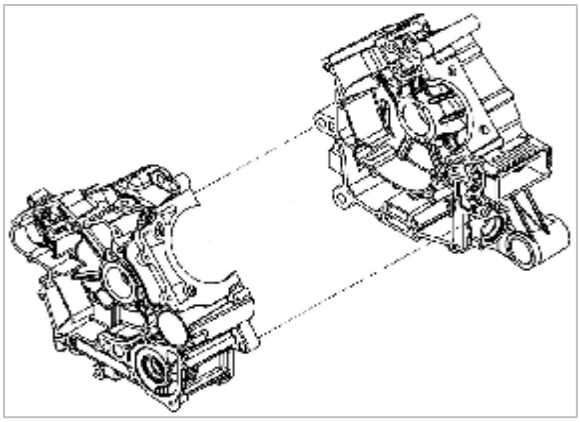
NOTICE: *Mark position of plain bearing oil bore on plain bearing remover/installer.*

NOTE: *Mark position of oil bore on crankcase half. Align mark on plain bearing remover/installer with mark on crankcase half.*

NOTE: *Wrong oil bore position will stop oil supply to plain bearings and will cause engine damage.*

NOTICE: *The partition of the plain bearing in crankcase half ACG side must be positioned near to oil bore in clockwise direction.*

NOTICE: *The partition of the plain bearing in crankcase half CVT side must be positioned near to oil bore in counterclockwise direction.*



Crankcase Assembly

- The assembly of crankcase is essentially the reverse of removal procedure. However, pay attention to the following details.
- Clean oil passages and make sure they are not clogged.
- Clean all metal components in a solvent.
- Install a new crankcase gasket.
- Oil the plain bearings before mounting the crankshaft.

NOTICE: *Correctly reinstall crankshaft.*

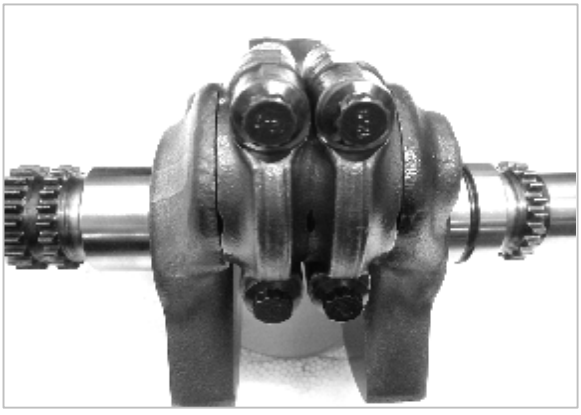
- Properly reinstall engine oil strainer and bolts.
- Reinstall water pump shafts/gears.
- Tightening sequence for bolts on crankcase is as per following illustration.

Crankshaft Inspection

NOTE: *Check each bearing journal of crankshaft for scoring, scuffing, cracks or other signs of wear.*

NOTE: *Replace crankshaft if the gears are worn or otherwise damaged..*

NOTICE: *Components out of specifications always have to be replaced. If this is not observed, severe damage may be caused to the engine.*



Connecting Rod Big End Axial Play

- Using a feeler gauge, measure distance between butting face of connecting rods and crankshaft counterweight.

Connecting Rod Big End Radial Play

NOTE: *Prior to remove connecting rod from the crankshaft, mark big end halves together to ensure a correct reinstallation (cranked surface fits in only one position).*

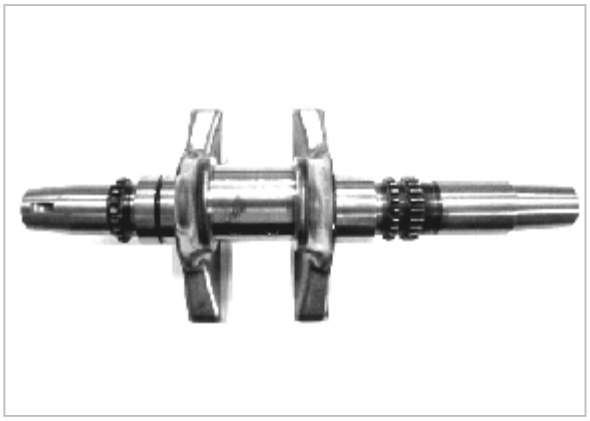
- Remove connecting rods from crankshaft.

NOTICE: *Connecting rod bolts are not reusable. Always discard bolts and replace by new ones. It is recommended to install new plain bearings when reinstalling connecting rods.*

- Measure crankpin. Compare to inside diameter of connecting rod big end.
- Carry out the tightening procedure described in this subsection.

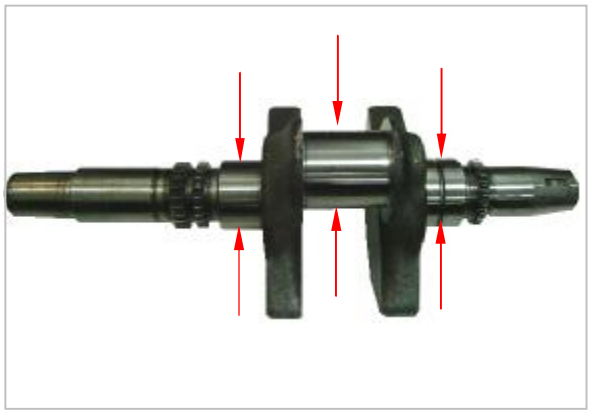
Connecting rod big end radial clearance

- If crankshaft pin diameter is out of specification, replace crankshaft.
- If connecting rod big end diameter or radial clearance is out of specification, replace plain bearings and recheck.



Crankshaft Radial Play ACG / CVT Side

- Measure crankshaft on ACG/CVT side. Compare to inside diameter of ACG/CVT plain bearing.
- Measure crankshaft journal diameter Compare to plain bearing inside diameter.
- If crankshaft journal diameter is out of specification, replace crankshaft.
- If crankshaft radial play (CVT cover bearing) out of specification, replace plain bearings and recheck.



Crankshaft Assembly

- For assembly, reverse the disassembly procedure. Pay attention to following details.
- Put plain bearings correctly in place and clean the split surface on both sides (cracked area) carefully with compressed air.

NOTE: *Oil the plain bearing surface of the connecting rod and crank pin before installation.*

- Oil NEW connecting rod bolts.

NOTICE: *Always use NEW connecting rod bolts at final assembly. They are not reusable.*

- Thread bolts in the connecting rods, tighten bolts in the following sequence:

1. Tighten to 1/2 of specified torque.
2. Tighten to 30 NM+/- 2 NM.
3. Torque by an additional 90 +/- 5° turn using an angle torque wrench.

NOTE: *Do not apply any thread locker.*

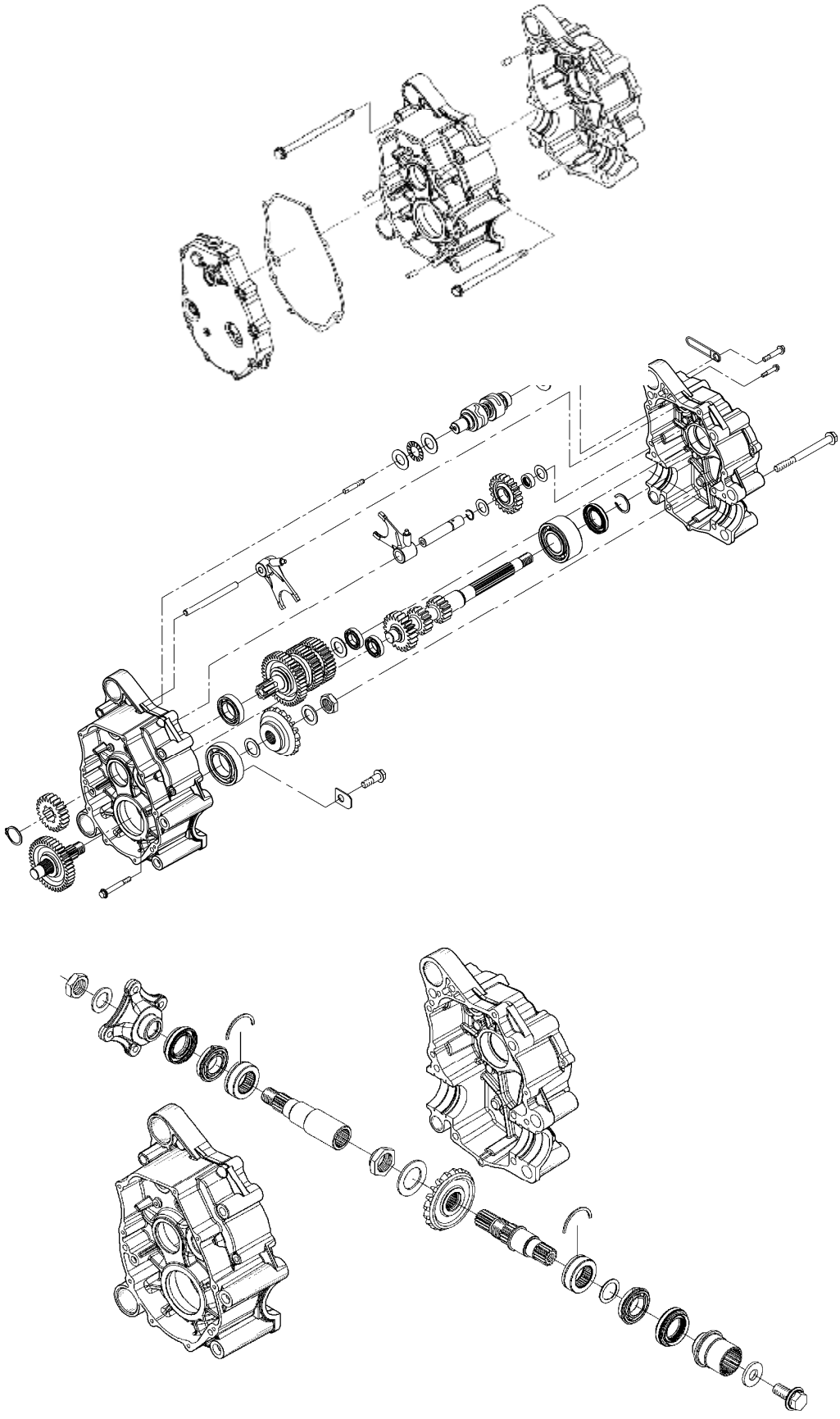
NOTICE: *Failure to strictly follow this procedure may cause bolts to loosen and lead to severe engine damage.*

Crankshaft Installation

- For installation, reverse the removal procedure.
- Pay attention to the following details.
- Do not mix up the connecting rods of each cylinder during installation.

NOTICE: *Observe the correct installation position when fitting the crankshaft with the connecting rods. The connecting rod ACG side has to face rear cylinder.*

TRANSMISSION GEARBOX



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

NOTICE: *Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.*

TROUBLESHOOTING

UNUSUAL GEARBOX NOISE AND/OR VIBRATIONS

1. Low oil level in gearbox.
   - Oil leakage from gearbox. Replace damaged gasket and/or oil seal.
2. Defective bearings.
   - Bearings do not turn smoothly. Replace bearing.
3. Damaged or worn gears.
   - Inspect gears for damages or missing teeth. Replace respective gears.

GEAR INDICATION FAILS

1. Defective gear switch.
   - Perform a gear switch test.
   - Damaged wires. Repair as required.

GEAR IS HRAD TO SHIFT

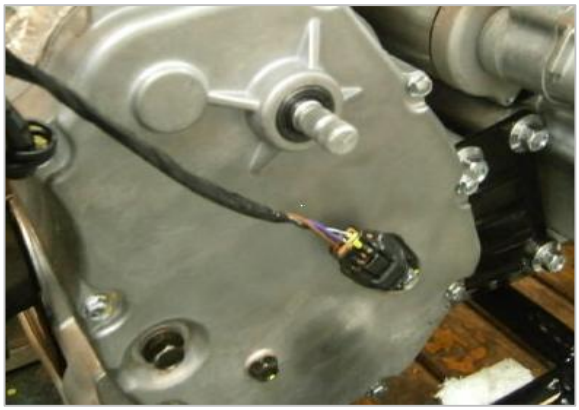
1. Incorrect shifter connecting rod adjustment.
   - Adjust shifter connecting rod.

PROCEDURES

VSS (VEHICLE SPEED SENSOR)

VSS Location

- The vehicle speed sensor is located on the right housing of the gearbox.
- To reach the VSS, remove the following parts:
  - Passenger seat.
  - RH side cover.



VSS Wire identification

PIN	COLOR	FUNCTION
A	BN/BK	12 Volt
B	PU	Speed signal
C	Black	Ground

VSS Input Voltage Test

1. Use the multimeter and select VDC.
2. Turn ignition switch ON.
3. Measure voltage as per following table.
   PIN A and PIN B = Battery Voltage

If voltage is not as specified. Test positive and ground separately.

VSS Signal Test

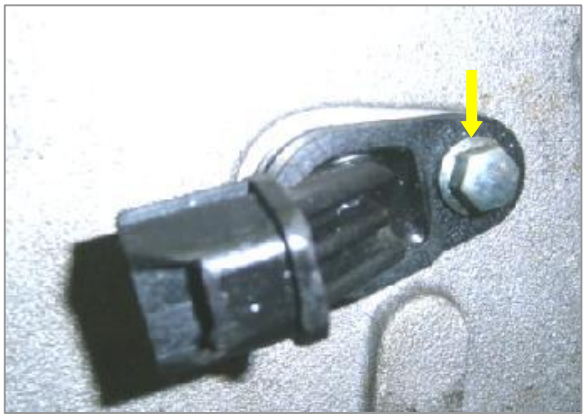
1. Lift rear of vehicle so that rear wheels are off the ground.
2. Set transmission to Neutral.
3. Turn ignition switch ON.
4. Set multimeter to VDC.
5. Measure voltage while slowly rotating rear wheels by hand.

PIN B and PIN C = Alternate reading between battery voltage and 0 VDC.

NOTE: *Since we measure pulsating voltage, the numeric display will continuously change. The analog display may be easier to follow.*

VSS Removal

- Remove RH side cover
- Remove VSS retaining bolts.
- Turn sensor and pull it out of the gearbox right cover.



VSS Installation

- For installation, reverse the removal procedure. Apply GREASE on VSS O-ring.

GEAR SWITCH

To reach the VSS, remove the following parts:

- Passenger seat.
- LH side cover.
- Drain engine oil.
- Drain gearbox oil.
- Remove CVT assembly

Gear Switch Input Test

- Set shift lever in NEUTRAL position.
- Unplug the gear switch connector.
- Connect the ground (Black) cable and other cable (ex: Red, reverse gear), there should indicate the relative gear position on the dashboard.
- Repair or replace if necessary.

If there is indication, conducting the continuity test for each gear switch as follows.

- Connect the connector to multimeter, negative probe to ground (Black) and positive prove to gear position cable to be tested.
- Using a piece of wire connect the Ground point and each gear position point.
- They should be continuity when each gear position is OK.
- Replace if necessary.

Gear Switch Removal

- Disconnect the gear switch connector.
- Remove LH side cover.
- Drain the engine oil and gearbox oil.
- Remove the CVT assembly.
- Remove two bolts and replace gear switch.

Gear Switch Installation

For installation, reverse the removal procedure.

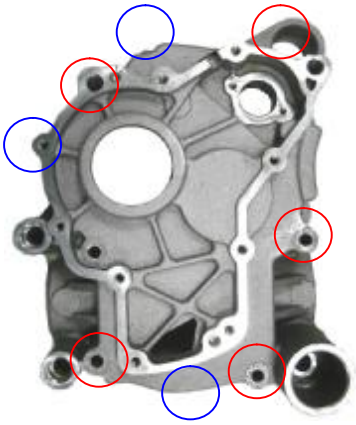
GEARBOX

Gearbox Removal

- Drain engine and gear box oil.
- Disconnect VSS and Gear switch connector.
- Remove the CVT assembly.
- Unscrew the bolts on the CVT air guide that retaining the gearbox.
- Detach the gearbox from the engine.
- Pull gearbox to separate it from engine.

Gearbox Disassembly

NOTE: *During gearbox disassembly, inspect the condition of each part closely.*



Gearbox Case

- Remove the bolts (M8x5, M6 x3) as shown.
- Using a big flat screwdriver and a soft hammer to split the gearbox case.
- Remove the bolts and right cover.

Output Drive Shaft Oil Seal Replacement

To replace the output drive shaft oil seal, processed as follows:

- Remove output drive shaft from gearbox.
- Remove keys.
- Replace the front and rear oil seal.
- Install the new oil seal using special tool.

Gearbox Bearings

NOTE: *Always support gearbox housings properly when ball bearings are removed. Housing damages mat occur if this procedure is not performed correctly.*

- Check if ball bearings turn freely and smoothly.
- Check all bearings, bearing points, tooth flanks and taper grooves.

Gearbox Inspection

Always verify for the following when inspecting gearbox components:

- Gear teeth damage.
- Worn or scoured bearing surfaces.
- Rounded engagement dogs and slots.
- Worn shift fork engagement groove.
- Worn splines on shafts and shifting sleeves.

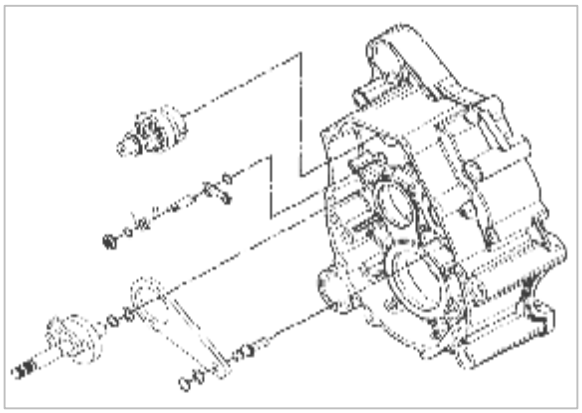
Gearbox Installation

For installation, reverse the removal procedure.

- Before gearbox installation check O-ring in bearing cover if brittle, hard or damaged. Replace if necessary.
- Install the keys on the output shaft.
- After installation refill gearbox oil.

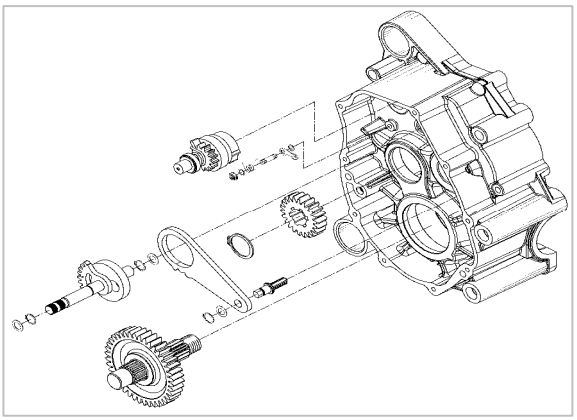
Gear Camshaft Comp.

- Check all the gear tooth wear, cracks or other damage.
- Replace if necessary



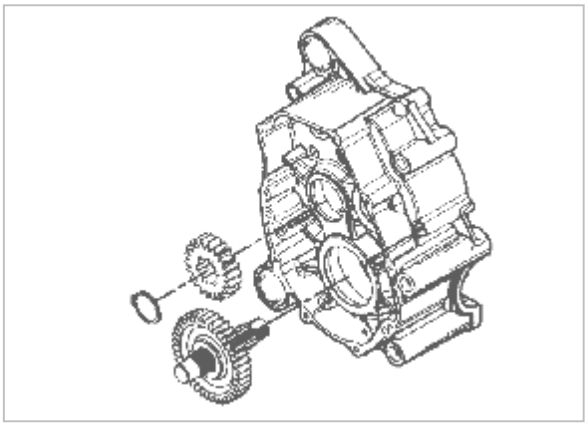
Parking Gear

- Check the gear tooth wear, cracks or other damage.
- Replace if necessary.



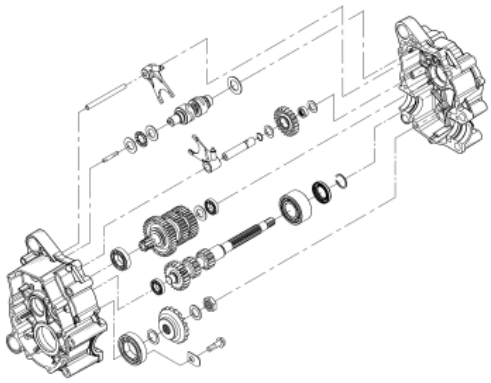
Output Secondary gear shaft and 17 tooth Gear

- Check all the gear tooth wear, cracks or other damage.
- Replace if necessary

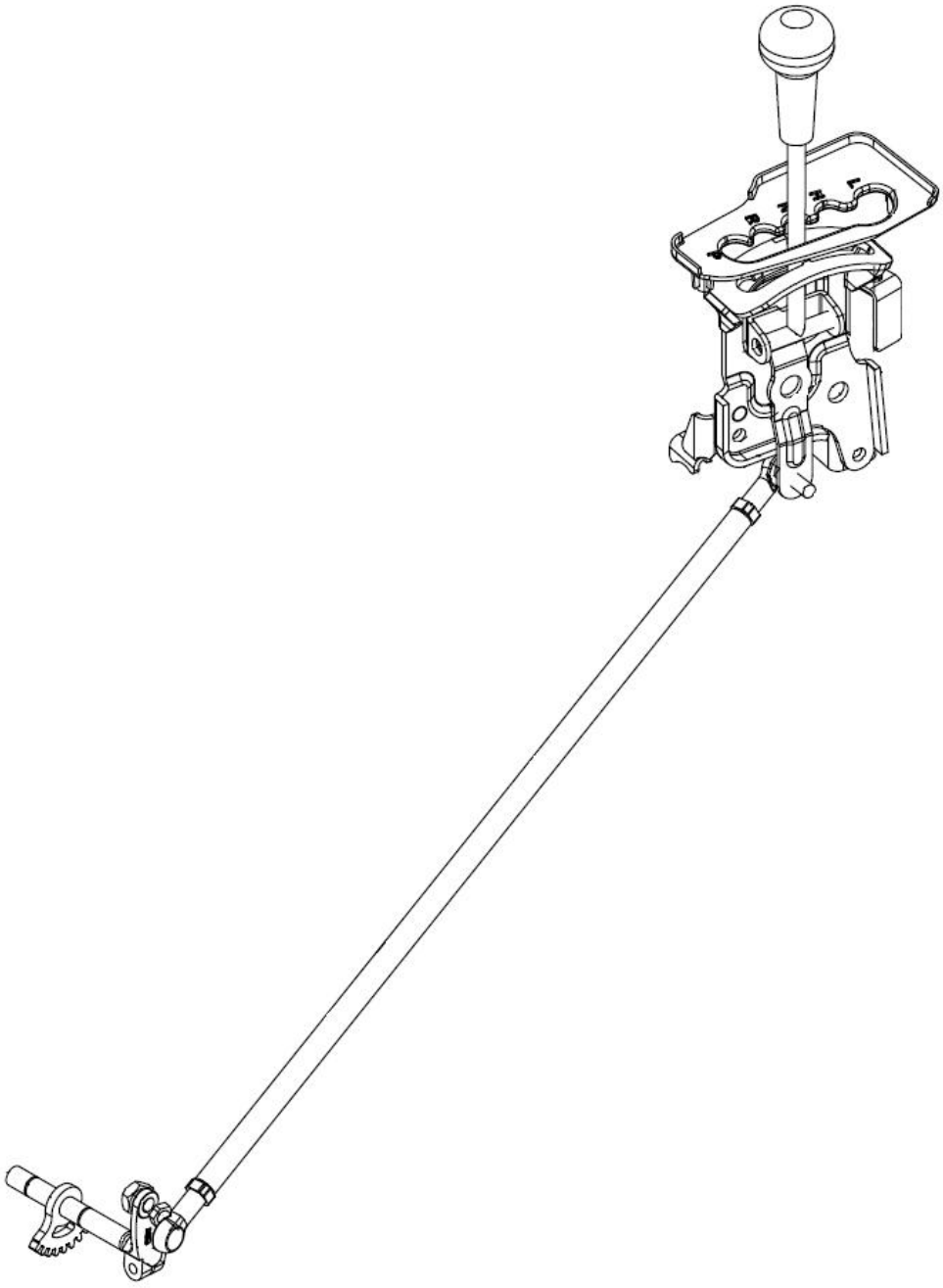


Transmission Gear

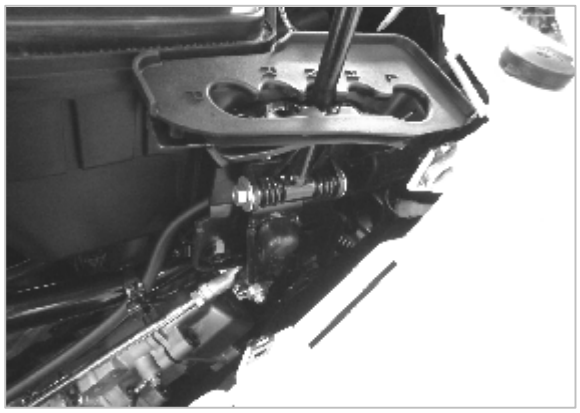
- Check all the gear tooth wear, cracks or other damage.
- Replace if necessary



SHIFT LEVER



SHIFT LEVER



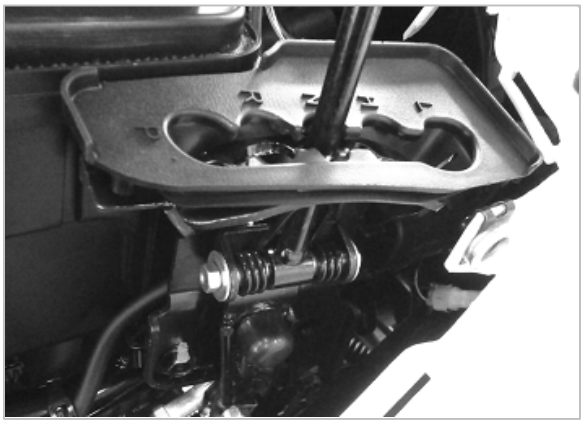
▪.before performing any servicing on the transmission linkage system, be sure the transmission lever is on **NEUTRAL** position and the parking brake is applied.

▪ During assembly/installation, use the torque values and services products as in the exploded view.

▪.Clean threads before applying a thread locker.

PROCEDURES

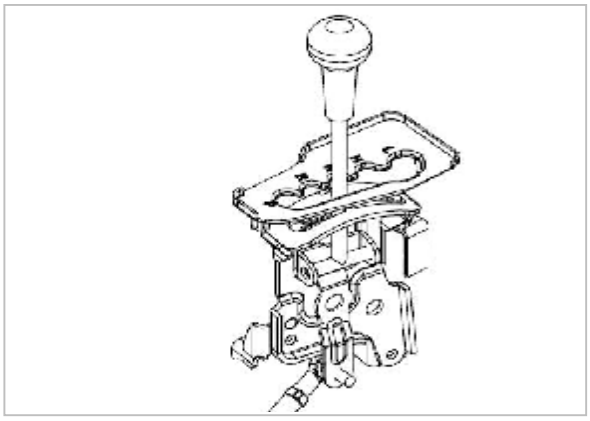
TRANSMISSION LEVER



Shifter Lever Removal

To remove the transmission lever, do the following:

- Place shift lever in NEUTRAL position.
- Apply parking brake.
- Unscrew the shift lever handle.
- Remove the RH side cover and the top cover.
- Detach shift rod from shift lever..
- Detach shift lever support.
- Remove shift lever.



Shift Lever Inspection

▪ Check shift lever for bending or cracks.

▪ Check spring and bushing condition.

▪ Check ball joint condition.

▪ Replace all damaged parts.

Shift Lever Installation

▪ The installation is the reverse of the removal procedure. However, pay attention to the following.

▪ Adjust shift lever handle as per the following illustration.

▪ Check if shift lever works properly in all positions. IF not, please follow below adjustment procedure.

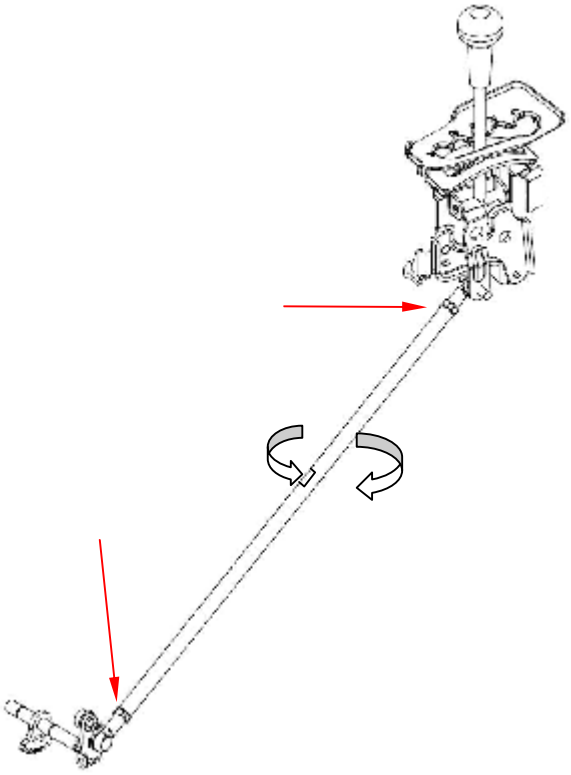
SHIFT ROD

Shift Rod Adjustment

1. Place shift lever in NEUTRAL position.

NOTICE *: Move vehicle back and forth to ensure gearbox is seat in neutral position.*

2. Secure vehicle using parking brake.
3. Remove side cover.
4. Loosen shift rod adjustment nuts.
5. Turn rod adjuster to center shift lever in neutral notch.

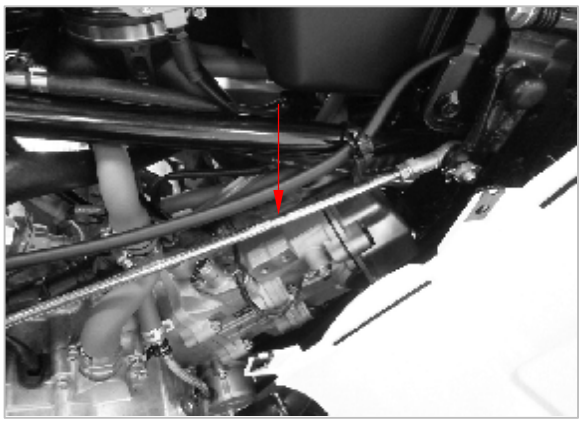


NOTE *: Ensure there is the same threaded length each side of rod adjuster.*

NOTE *: Be aware that a nut has LH threads.*

6. Move shift lever in R position then in H position.
7. Place shift lever in NEUTRAL position.
8. Check if shift lever is properly centered in neutral notch. Readjust as required.
9. Test the shifter to confirm that the system works properly in all positions.

NOTE *: It may be necessary to realign shift rod ball joints to allow easy movement.*

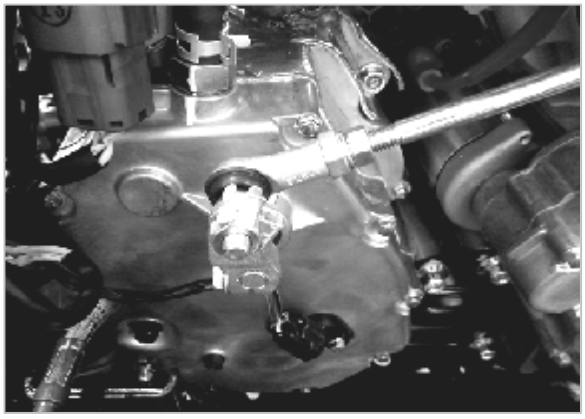


SHIFT PLATE

Shift Plate Removal

NOTE *: Do not remove shift plate needlessly.*

1. Remove the following parts:
   - Seat.
   - RH side cover.
   - RH footrest.
2. Remove shift rod from shift plate.
3. Trace an index mark on shift plate and shaft.



4. Remove shift plate nut and bolt.
5. Remove shift plate.

Shift Plate Inspection

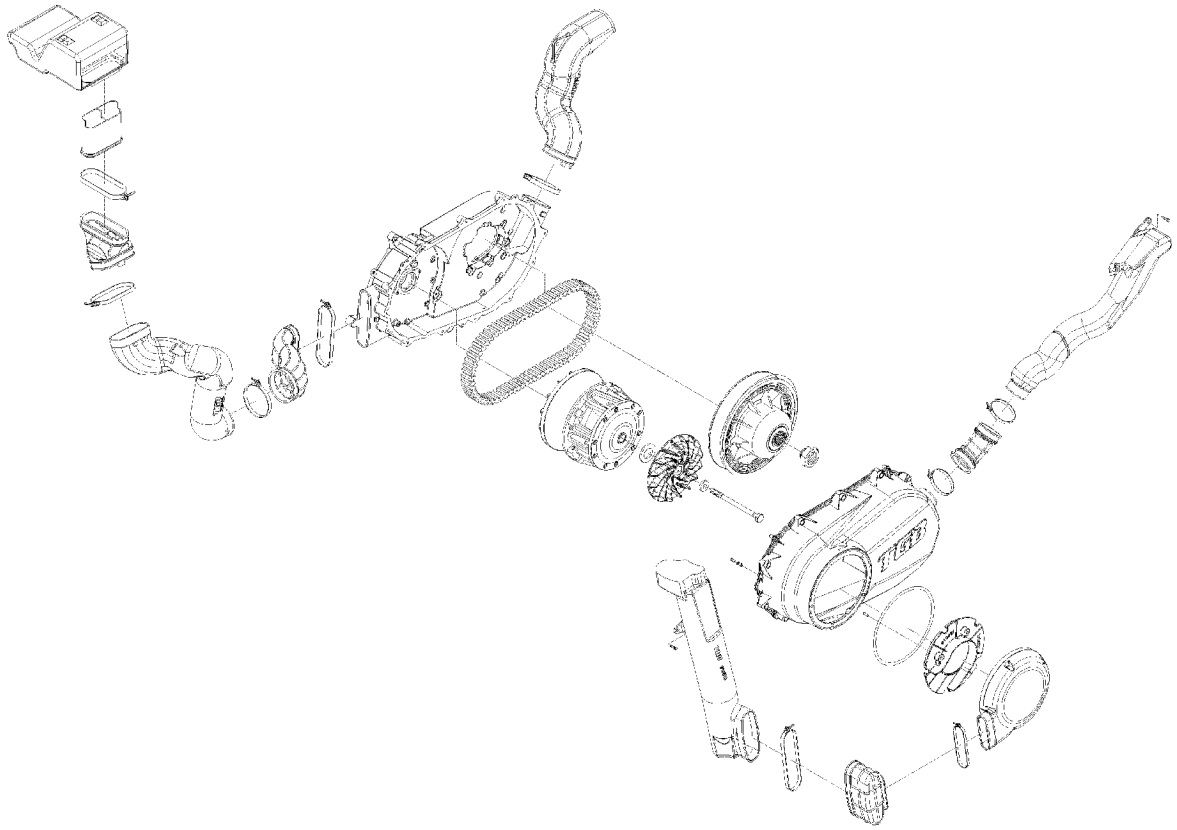
- Check shift plate for:
- Cracks.
- Bending.
- Spline condition.

Shift Plate Installation

▪ The installation is the reverse of the removal procedure. However, pay attention to the following.
▪ Place gearbox in NEUTRAL position before shift plate installation.
▪ Align shift plate using marks previously traced.
▪ Tighten shift plate nut to specification

TORQUE： 9NM+/- 1 Nm.

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)



CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

GENERAL

NOTE: *For a better understanding, the following illustrations are taken with engine out of vehicle. To perform the following instructions, it is not necessary to remove engine.*

- This CVT is lubrication free. Never lubricate any components except drive pulley one-way clutch.
- During assembly/installation, use the torque values and service products as in the exploded views.
- Clean threads before applying a thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

WARNING

Never touch CVT while engine is running. Never drive vehicle when CVT cover is removed.

WARNING

Any drive pulley repairs must be performed by an authorized TGB dealer. Subcomponent installation and assembly tolerance require strict adherence to procedure detailed.

NOTICE: *Never use any type of impact wrench at drive pulley removal and installation.*

WARNING

The clutch assembly is a precisely balanced unit. Never replace parts with used parts from another clutch assembly.

NOTICE: *Always tighten puller by hand to ensure that the drive pulley has the same type of threads prior to fully tightening.*

PROCEDURE

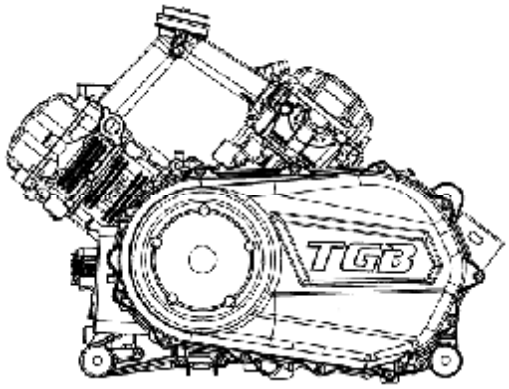
CVT COVER

CVT Cover Removal

1. Remove LH side cover.
2. Remove the bolts of CVT cover.

NOTE: *Remove the center top bolt last. These bolts allow to support the cover during removal.*

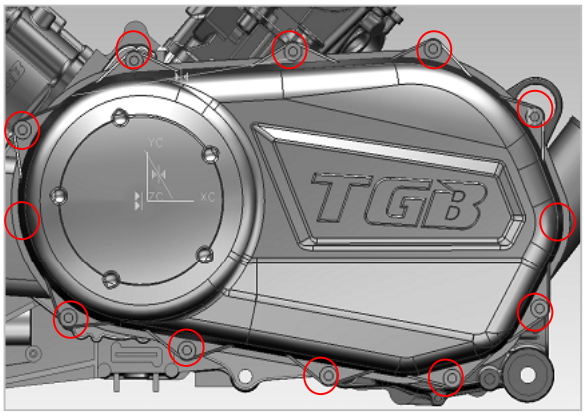
3. Remove the CVT cover and its gasket.



CVT Cover Installation

- Install the center top bolt first.
- Tighten the CVT cover bolts as criss-cross sequence.

TORQUE: 70 kgf.cm



CVT Draining

If water is present in CVT, it can be drained as follows:

1. Remove drain bolt.
2. Let water drain from CVT.
3. Reinstall drain bolt.

NOTICE: *If any debris entered the CVT, CVT must be cleaned and inspected.*

DRIVE BELT

Drive Belt Removal

NOTICE: *In case of a drive belt failure, the CVT, cover and air outlet must be cleaned.*

- Remove CVT COVER.
- Open driven pulley with GEAR LOCK PIN.
- Screw tool in the threaded hole of driven pulley and tighten to open the pulley.
- To remove belt, slip the belt over the top edge of fixed sheave, as shown.

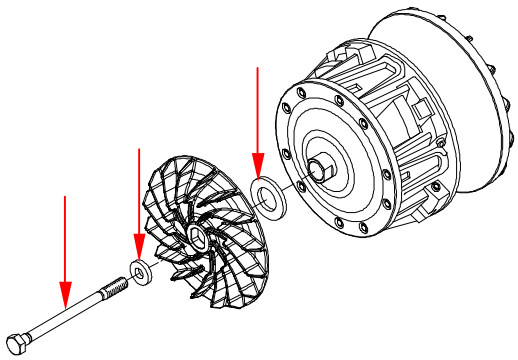
Drive belt Installation

- For installation, reverse the removal procedure.
- Pay attention to following details.
- The maximum drive belt life span is obtained when the drive belt has the proper rotation direction. Install it so that the arrow printed on belt is pointing towards front of the vehicle, viewed from top.

DRIVE PULLEY

DRIVE PULLEY REMOVAL

- Remove DRIVE BELT.
- Remove the colling fan bolt 、washers and colling fan as shown.



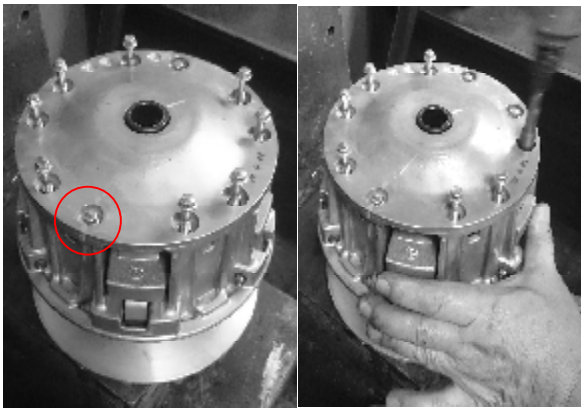
- Using special tool to loose and remove the drive pulley assembly.
- Prior to removing the drive pulley., mark sliding sheave and governor cup to ensure correct indexation at reinstallation.

NOTICE: *Do not lean the tool hook on the slider shoe guides.*

TUNER HAFT COVER REMOVAL

- Install the drive pulley on the special tool fixing seat #561018.
- Loosen the tuner cover screw.

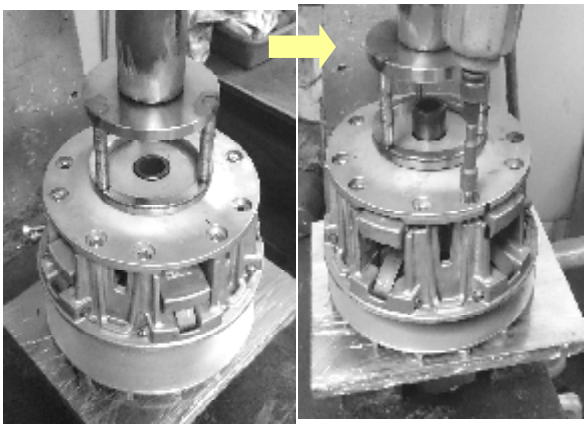
NOTE: *Do not unscrew the tuner cover screw completely.*



- Using special tool #560019 and compress machine on the tuner cover.
- Press the tuner cover and remove cover screws.

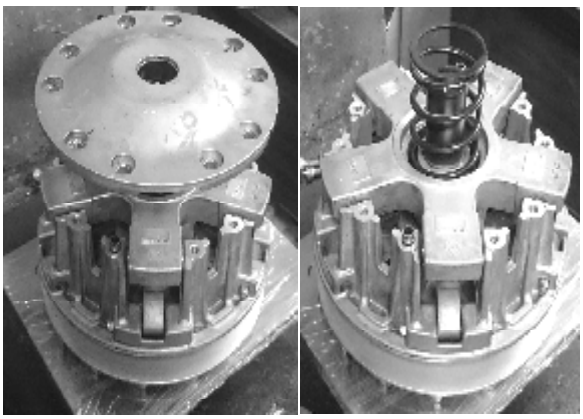
CAUTION

Sliding sheave of drive pulley is spring loaded.



- Slowly release compress machine and special tool, remove tuner cover.
- Remove the spring.

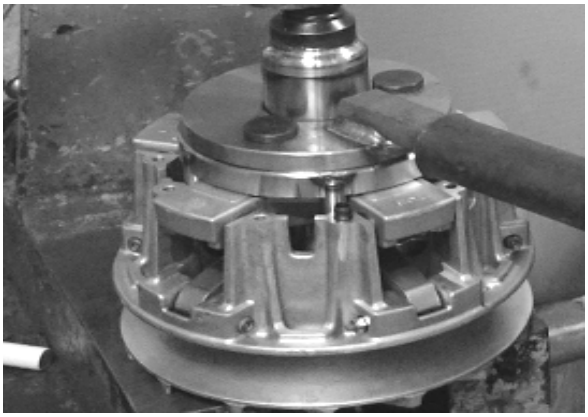
NOTICE: *Make sure to use the specified tool. Using another tool will damage the crankshaft threads.*



GOVERNOR CUP REMOVEAL

- Using special tool #560017 loose and remove the governor cup.

NOTICE: *During removal, press and hold the governor cup.*

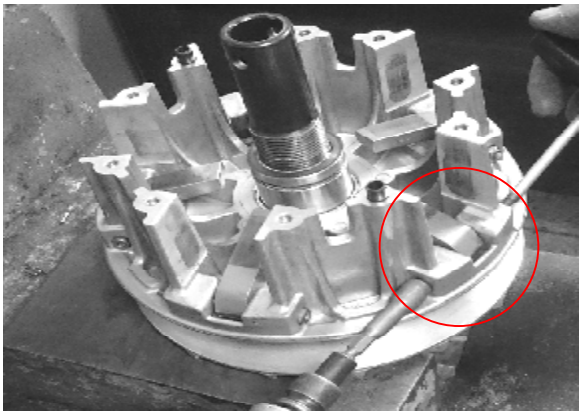


Centrifugal lever Replacement

Removal

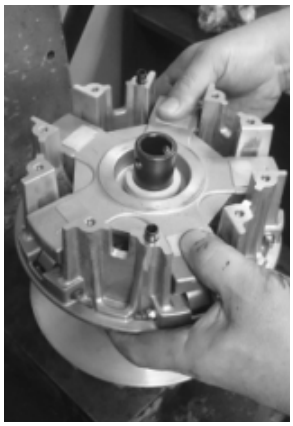
- Loosen and remove the bolts and nuts on the centrifugal lever.
- Replace new centrifugal lever.
- For installation, reverse the removal order.

TORQUE:44~56kgf-cm.



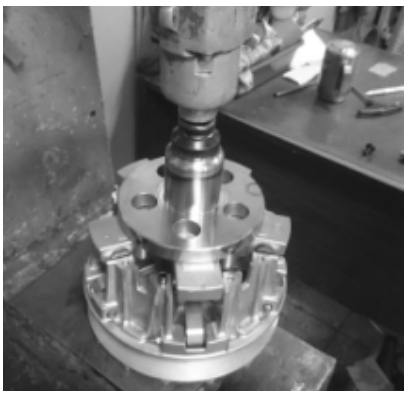
GOVERNOR CUP INSTALLATION

- For installation, reverse the removal order.
- Using hand lift up the sliding sheave and install the governor cup.



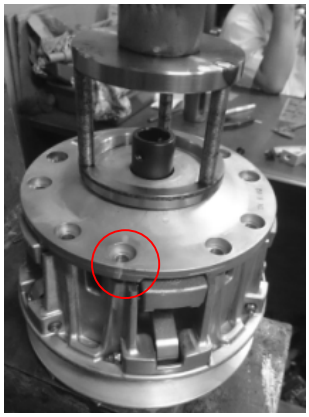
- Install the special tool #560017 on the top of centrifugal cop.
- Tighten the centrifugal cup.

TORQUE: 2000~2500kgf-cm.

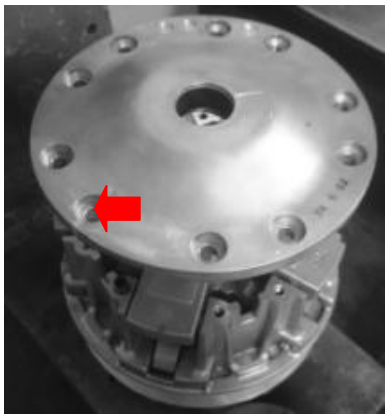


TUNER HAFT COVER INSTALLATION

- For installation, reverse the removal order.
- Install the spring.
- Align the mark at the mounting area as shown.
- Install the special tool and using compress machine press the tuner cover to the position.



- Tighten the bolts on the tuner cover, follow the cross sequence as shown.



TORQUE: 80~120kgf-cm.

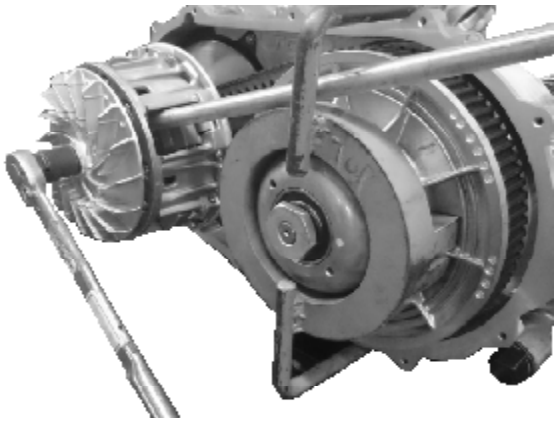
DRIVE PULLEY INSTALLATION

- For installation, reverse the removal procedure.
- Pay attention to the following details.

WARNING

Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

NOTICE: *Never use any type of impact wrench at drive pulley removal and installation.*



- Using mounting special tool lock the drive pulley.

NOTICE: *Do not lean the tool hook on the slider shoe guides.*

- Install the cooling fan and washers.
- Tighten drive pulley screw to specified torque.

TORQUE: 700 ~750 kgf.cm

DRIVEN PULLEY

Driven Pulley Removal

- Remove DRIVE BELT.
- Using the DRIVEN CLUTCH HOLDER, hold the driven pulley and loosen the driven pulley screw.

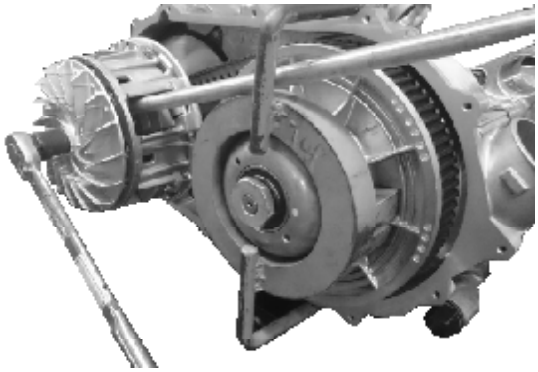
NOTE: *Do not unscrew the driven pulley screw completely.*

- Apply axial pressure with your hand on driven pulley and maintain during screw removal.
- Remove driven pulley screw, locking washer and washer.
- Discard locking washer.

CAUTION

Driven pulley is spring loaded. Hold driven pulley tight and slowly remove the driven pulley screw to release spring tension.

- Remove the driven pulley with the spring and the cam.



Driven Pulley Installation

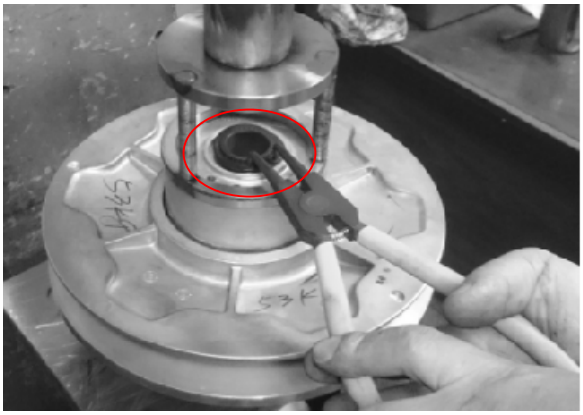
- For installation, reverse the removal procedure.

TORQUE: 1000 kgf.cm

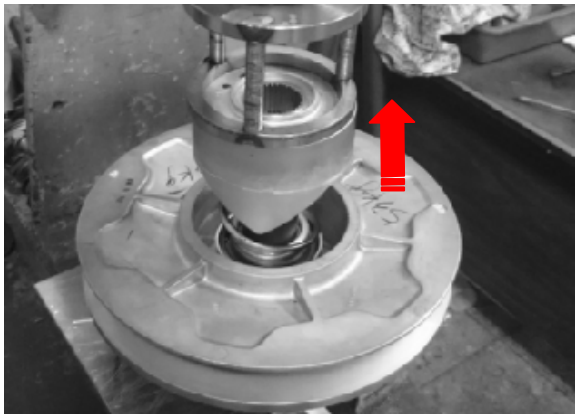
DRIVEN PULLEY DISASSEMBLY

- Install the special #560019 and compress machine on the top of cam.

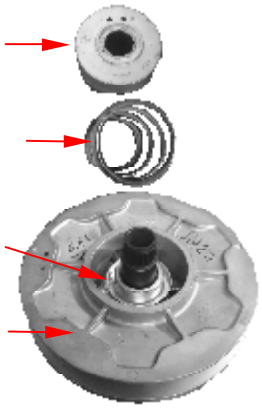
- Press the special tool #560019 down and remove the two C-clips.
-



- Lightly lift up the compress machine and remove the cam.

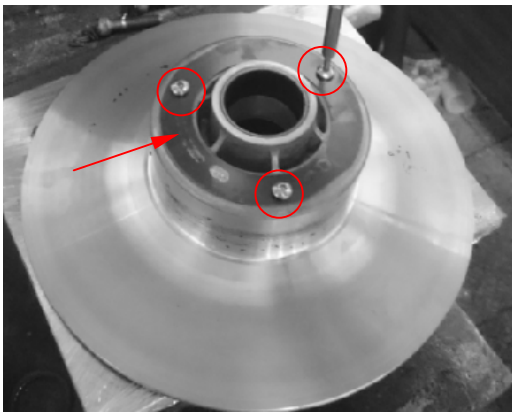


- Disassemble the cam, spring, spring seat and outer haft sheave.



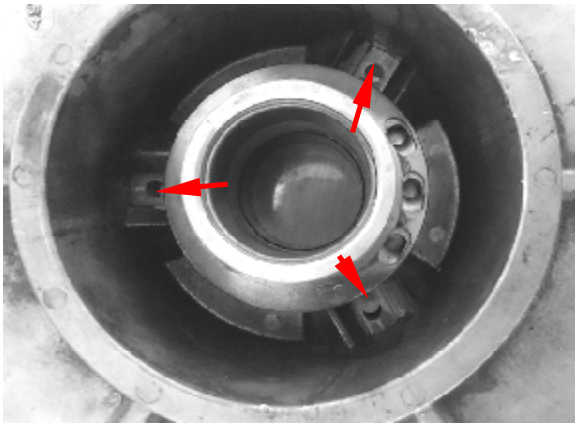
Slider Shoe Replacement

- Remove three screws and washer from the back side of outer haft sheave.



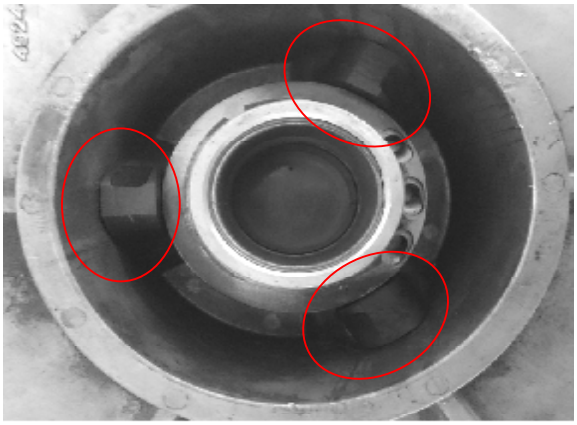
▪ Using rubber hammer push out the slider shoe.

▪ Replace and install new slider shoe.



CAUTION

The slider shoe have two side, the flat side should toward the center.



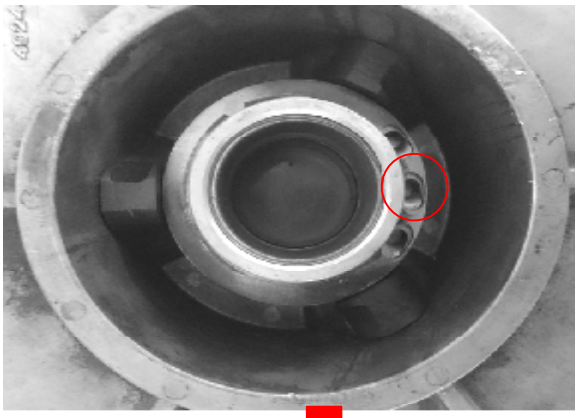
▪ Tighten the screws and washer.

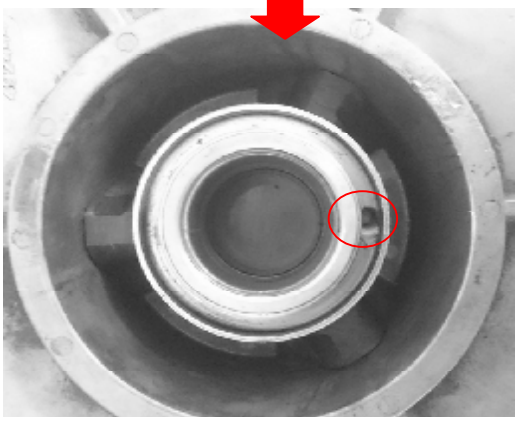
TORQUE: 25~35 kgf.cm

DRIVEN PULLEY ASSEMBLY

For assemble the driven pulley, the sequence as follow:

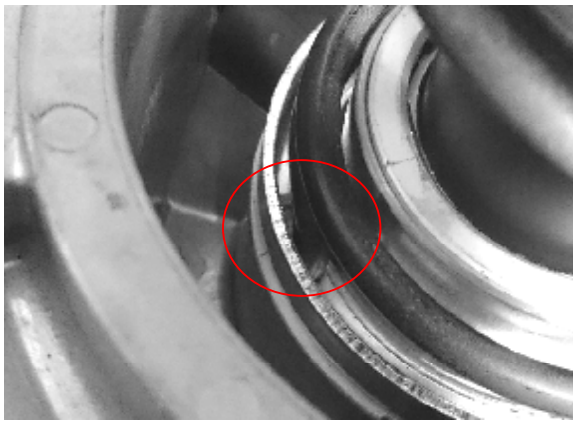
▪ Install the spring seat into the outer haft sheave.





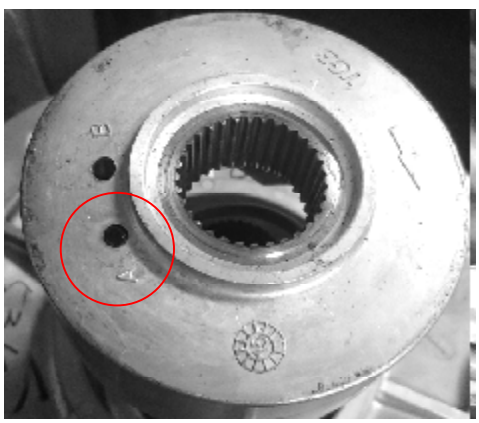
NOTE: *The hole of spring seat should align the center hole of outer haft sheave.*

▪ Install the spring on the spring seat.



NOTE: the bottom end of spring should insert into the hole of spring seat.

▪ Install the cam on the spring.



NOTE: the upper end of spring should insert into the hole of cam with mark **"A"**.

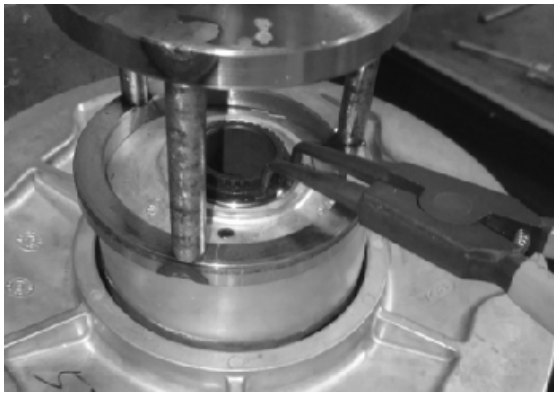
▪ Using special tool #560019 and compress machine on the cam and push down.

CAUTION

During push down, you should counter-clockwise turn the outer haft sheave to let the spline of cam align to the shaft.

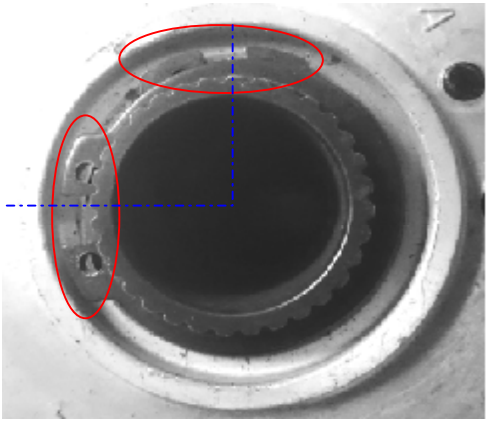
NOTE: If the spline not aligns the shaft, the cam can not push down.

▪ Install two C-clips.

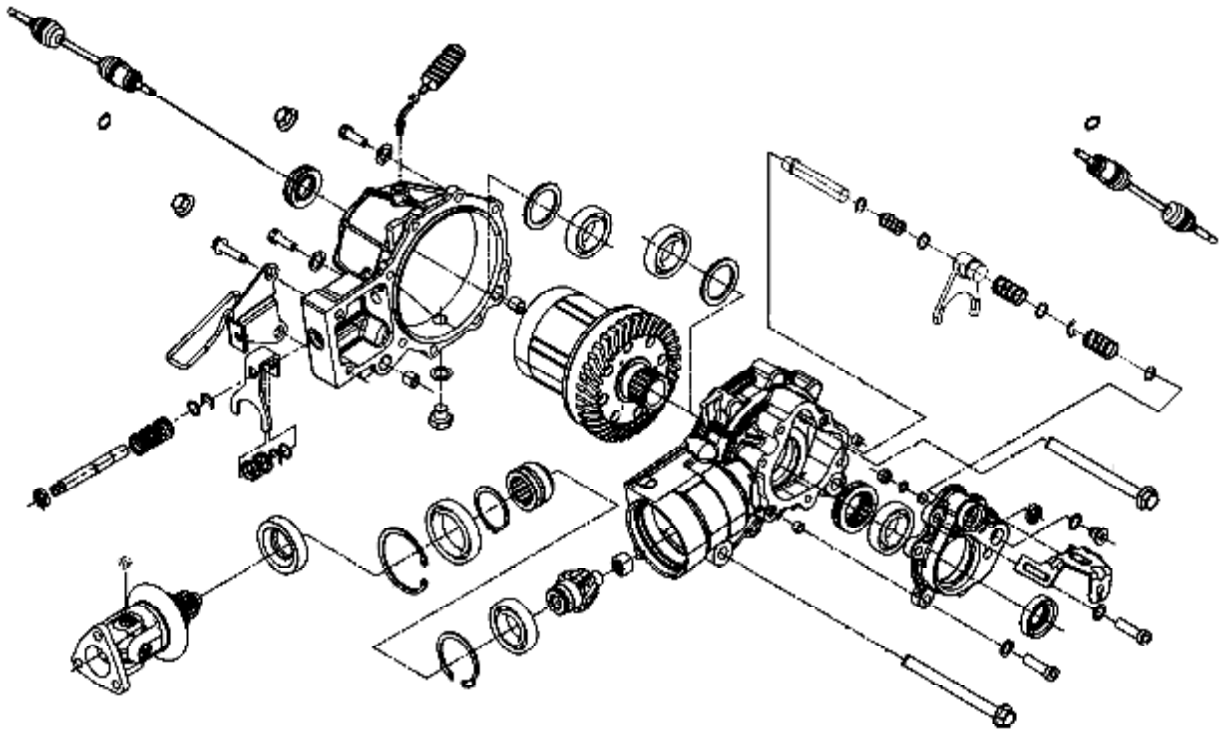


NOTE: The flat surface of should face outward.

▪ Adjust the open area of two C-clips to perpendicular direction as shown.



FRONT DRIVE (FRONT DIFFERENTIAL)



DRIVE SYSTEM

FRONT DRIVE

GENERAL

During assemble/installation, use torque values and service products as in the exploded views.

Clean threads before applying thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

WHEEL HUB

Wheel Hub Removal

- Lift and support vehicle.
- Place the transmission lever on “P”.
- Remove caliper from knuckle.
- Remove the following parts:
  - Wheel
  - Cotter pin.
  - Castellated nut.
  - Washer.
- Remove wheel hub.

Wheel Hub Inspection

- Check wheel hub for cracks or other damages.
- Check inner splines for wear or other damages.
- If any damage is detected on wheel hub, replace it with a new one.

Wheel Hub Installation

- For installation, reverse the removal procedure.
- Install washer with its concave side towards outward.

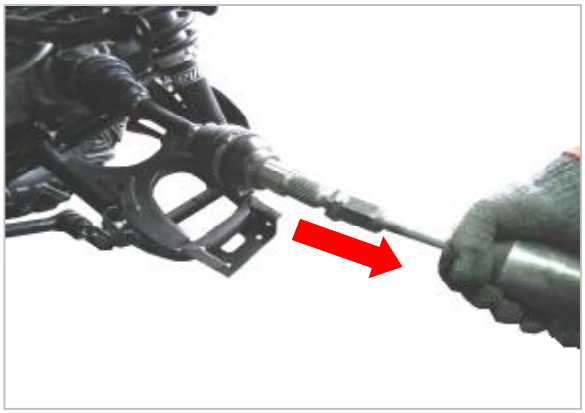
TORQUE: 1600 kgf-cm (160 Nm).

NOTE: *Tighten further castellated nut if* required *to align grooves with drive shaft hole.*

- Install a **NEW** *castellated nut*.
- Install a **NEW** cotter pin.

FRONT DRIVE SHAFT

Front Drive Shaft Removal



- Lift and support vehicle.
- Remove the wheel hub.
- Remove the knuckle.
- Strongly pull drive shaft out of differential.
- Discard the stop ring at the end of the shaft.

Front Drive Shaft Inspection

- Inspect the condition of boots. If there is any damage or evidence of leaking lubricant, replace them.
- Check splines for excessive wear. Replace if necessary.

NOTE: *If the splines on plunging joint are worn, a check of differential inner splines should be done.*

Front Drive Shaft Installation

- For installation, reverse the removal procedure.
- Install a NEW stop ring.
- Apply SYNTHETIC GREASE to the splines.
- The wear ring should be closed to the differential.
- Reinstall all removed parts.

DRIVE SHAFT BOOT

Drive Shaft Boot Removal

- Remove the drive shaft from the vehicle.
- Remove drive shaft boot clamps using special tools.
- Dislodge the large boot end.
- Separate the joint from the shaft.
- Remove boot from drive shaft.
- Remove and discard the circlip.

Drive Shaft Boot Installation

- For installation, reverse the removal procedure.
- Install new circlip.
- Pack bearing area with grease.

NOTE: *Do not use or add other grease.*

- Install new drive shaft clamps.

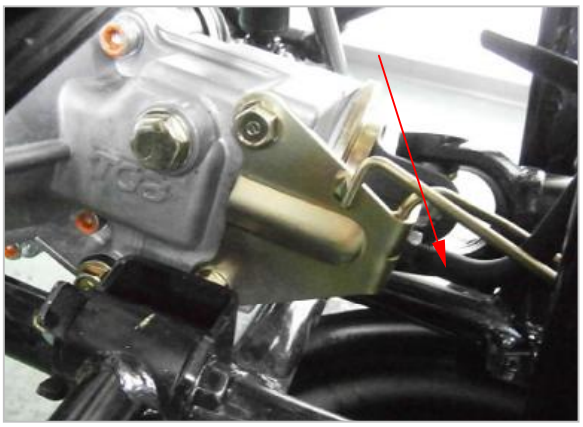
FRONT DIFFERENTIAL

Front differential Removal

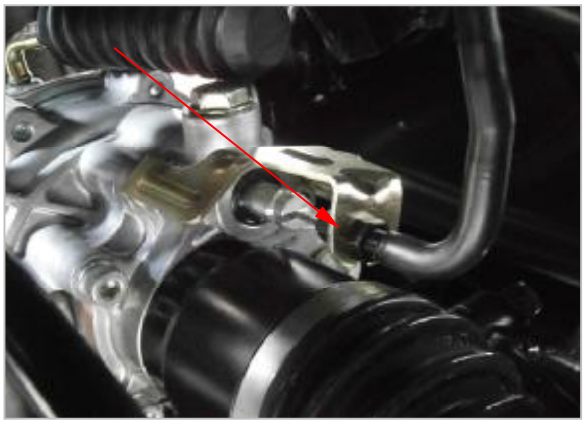
Caution

Be sure the differential set temperature below 35℃

- Drain the differential oil.
- Remove both drive shafts.
- Detach vent hose from front differential.
- Remove two drive mode select cables.



- Remove bolts and nuts securing the differential.



- Lift up the differential and slide forward to detach from the propeller shaft.
- Remove the front differential by pulling it from the RH side.

NOTICE: *Be careful not to knock or to bend vent hose fitting while removing front differential.*

Front Differential Disassembly

Unscrew the differential housing bolts then separate half housings.

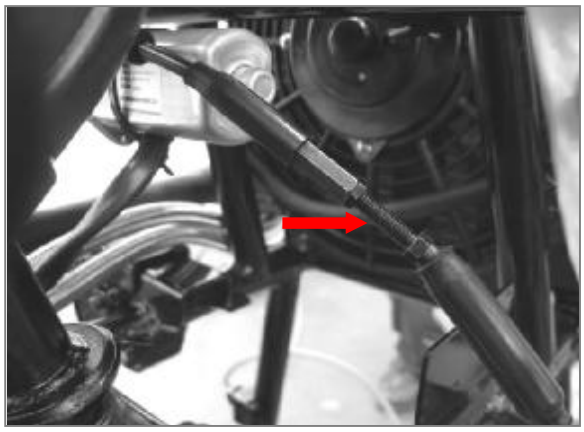
Pinion Gear

- Remove and discard oil seal.
- Unscrew the pinion nut.

Front Differential Adjustment

Using special tool to adjust the cable.

Adjust the suitable length by the rotate the nuts



Front Differential Installation

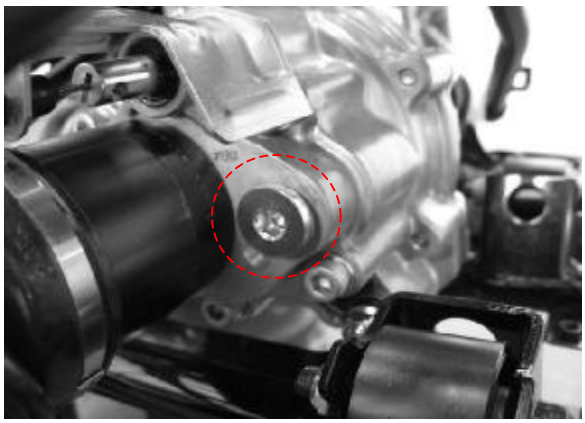
For installation, reverse the removal procedure.

Fill the gear oil and tighten the bolt.

Caution

Oil standard:SAE#90 hypoid gear oil Oil capacity: 350c.c.

Bolt Torque : 33N-m



Differential Motor

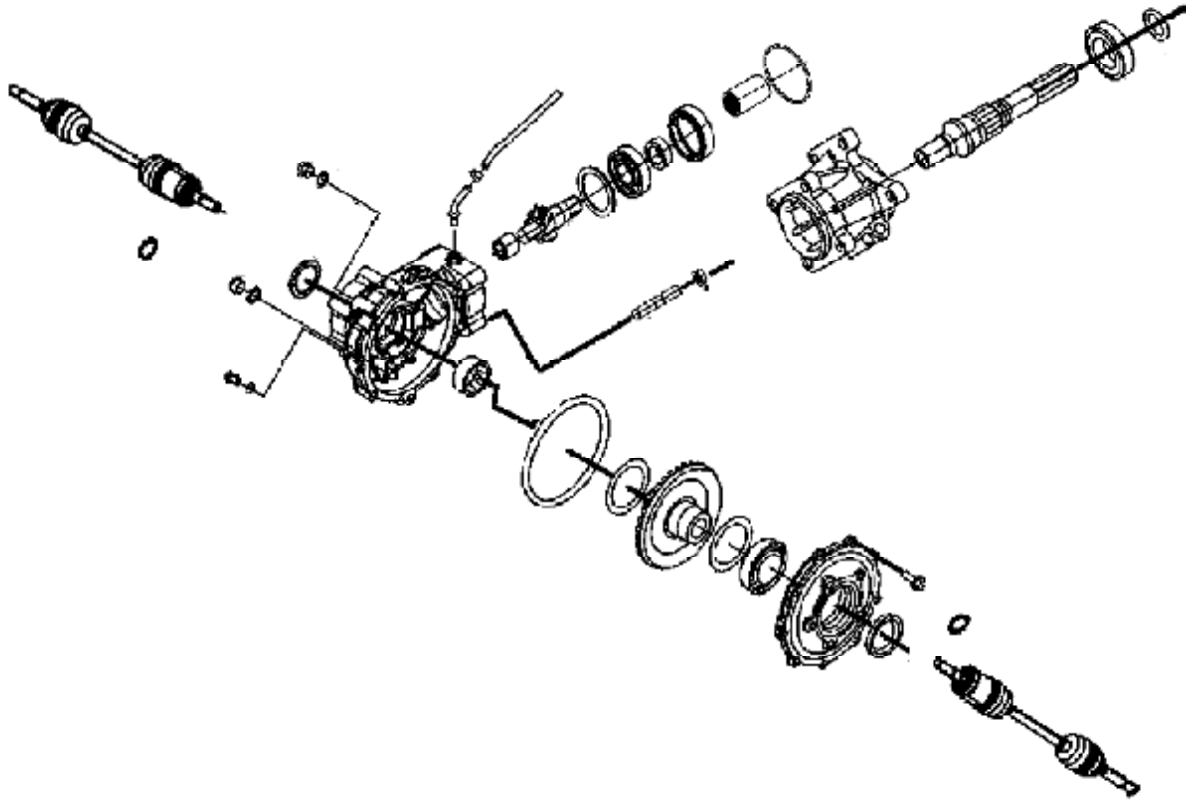
Disconnected the wiring connector.

Unscrew three differential motor bolts.

Installation

For installation, reverse the removal procedure.

REAR DRIVE (REAR DIFFERENTIAL)



REAR DRIVE

GENERAL

During assemble/installation, use torque values and service products as in the exploded views.

Clean threads before applying thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

PROCEDURE

WHEEL HUB

Wheel Hub Removal

- Lift and support vehicle.
- Place the transmission lever on “P”.
- Remove caliper from knuckle.
- Remove the following parts:
  - Wheel
  - Cotter pin.
  - Castellated nut.
  - Washer.
- Remove wheel hub.

Wheel Hub Inspection

- Check wheel hub for cracks or other damages.
- Check inner splines for wear or other damages.
- If any damage is detected on wheel hub, replace it with a new one.

Wheel Hub Installation

- For installation, reverse the removal procedure.
- Install washer with its concave side towards outward.

TORQUE: 1600 kgf-cm (160 Nm).

NOTE: *Tighten further castellated nut if* required *to align grooves with drive shaft hole.*

- Install a **NEW** *castellated nut*.
- Install a **NEW** cotter pin.

REAR DRIVE SHAFT

Rear Drive Shaft Removal

- Lift and support vehicle.
- Remove the wheel hub.
- Remove the knuckle.
- Strongly pull drive shaft out of differential.
- Discard the stop ring at the end of the shaft.

Rear Drive Shaft Inspection

- Inspect the condition of boots. If there is any damage or evidence of leaking lubricant, replace them.
- Check splines for excessive wear. Replace if necessary.

NOTE: *If the splines on plunging joint are worn, a check of differential inner splines should be done.*

Rear Drive Shaft Installation

- For installation, reverse the removal procedure.
- Install a NEW stop ring.
- Apply SYNTHETIC GREASE to the splines.
- The wear ring should be closed to the differential.
- Reinstall all removed parts.

DRIVE SHAFT BOOT

Drive Shaft Boot Removal

- Remove the drive shaft from the vehicle.
- Remove drive shaft boot clamps using special tools.
- Dislodge the large boot end.
- Separate the joint from the shaft.
- Remove boot from drive shaft.
- Remove and discard the circlip.

Drive Shaft Boot Installation

- For installation, reverse the removal procedure.
- Install new circlip.
- Pack bearing area with grease.

NOTE: *Do not use or add other grease.*

- Install new drive shaft clamps.

REAR DIFFERENTIAL

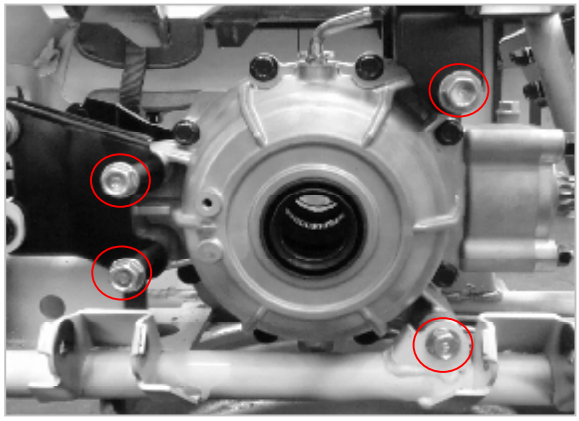
Rear differential Removal

Caution

Be sure the differential set temperature below 35℃

- Drain the differential oil.
- Remove both drive shafts.
- Detach vent hose from rear differential.
- Remove the lock mode cables.

- Remove bolts and nuts securing the differential.



- Lift up the differential and slide backward to detach from the propeller shaft.
- Remove the rear differential by pulling it from the RH side.

NOTICE: *Be careful not to knock or to bend vent hose fitting while removing front differential.*

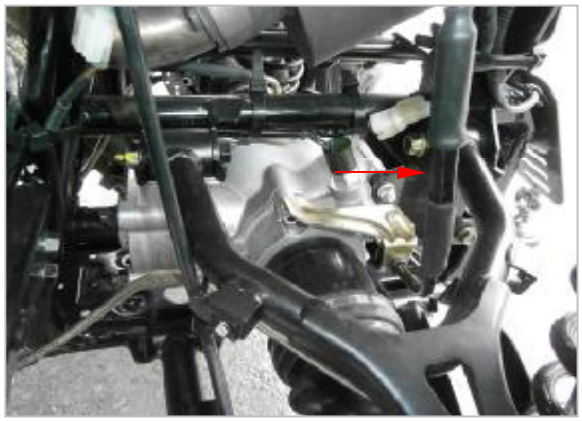
Rear Differential Disassembly

Unscrew the differential housing bolts then separate half housings.

Rear Differential Adjustment

Using special tool to adjust the cable.

Adjust the suitable length by the rotate the nuts



Rear Differential Installation

For installation, reverse the removal procedure.

Fill the gear oil and tighten the bolt.

Caution

Oil standard:SAE#90 hypoid gear oil Oil capacity: 500 c.c.

Bolt Torque : 330N-m

Differential Motor

Disconnected the wiring connector.

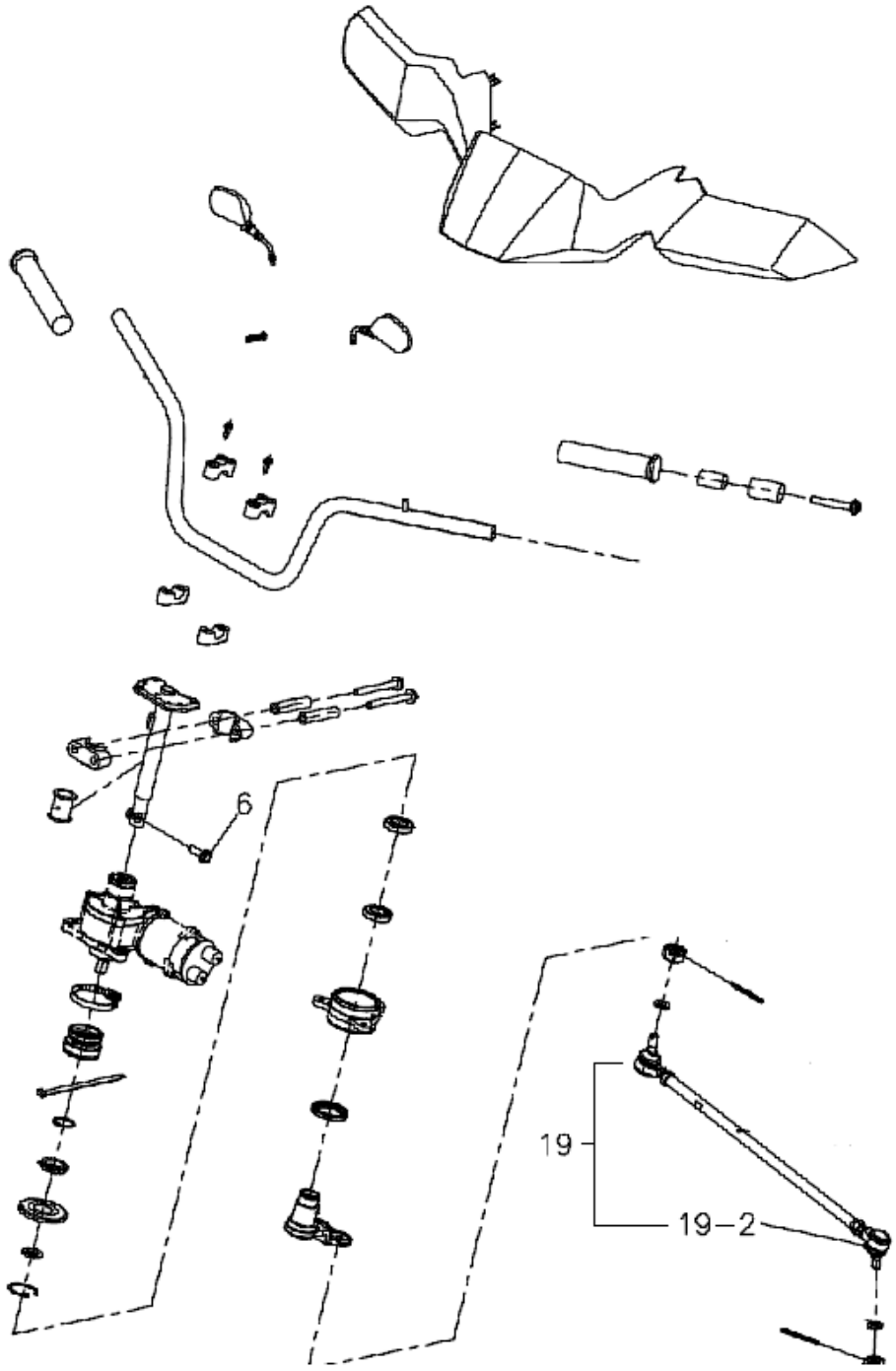
Unscrew three differential motor bolts.

Installation

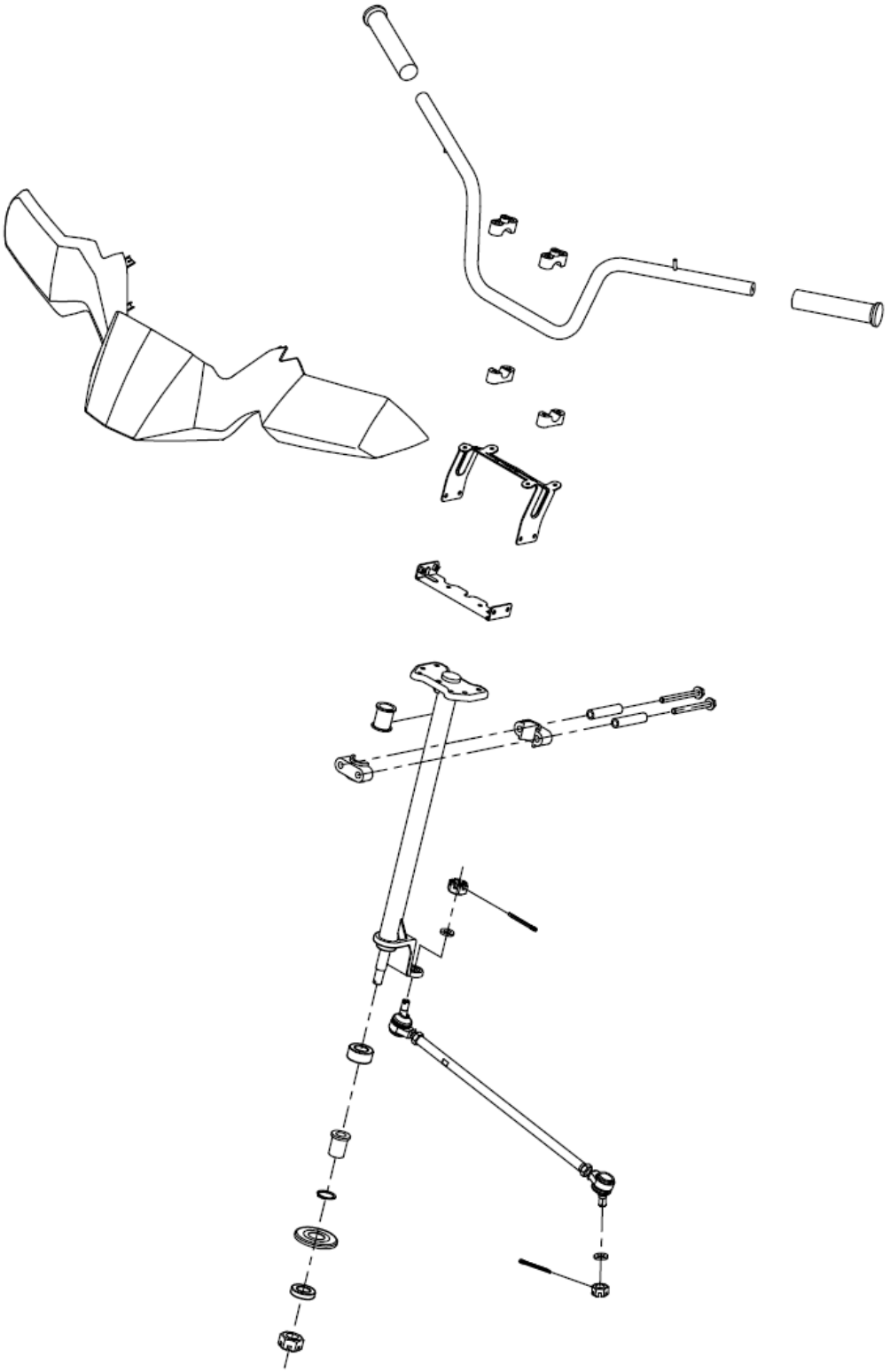
For installation, reverse the removal procedure.

STEERING SYSTEM

EPS MODEL



NON EPS MODEL



STEERING SYSTEM

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

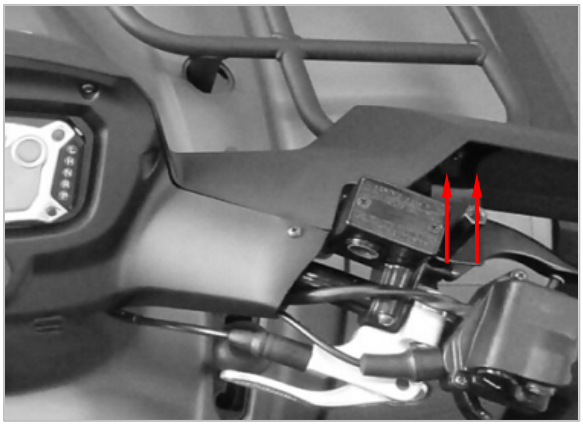
PROCEDURES

HANDLEBAR COVER

Handlebar Cover Removal

1. Loosen six screws on the dashboard cover.

2. Remove the two screws on the both rear mirror bracket.



3. Remove the top cover screws and pull out the cover from the handlebar.

Handlebar Cover Inspection

Check covers for cracks or other damages. Replace if necessary.

Handlebar Cover Installation

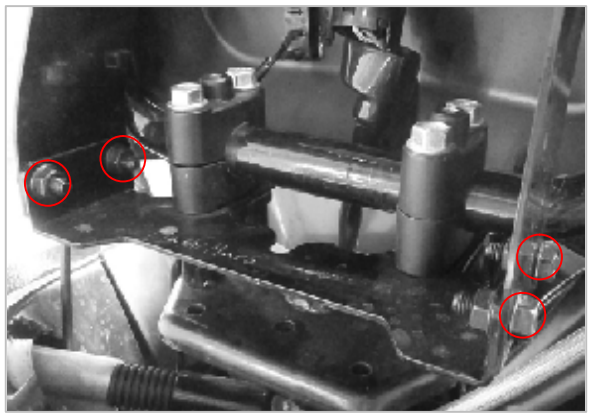
The installation is the reverse of removal procedure.

Handlebar Removal

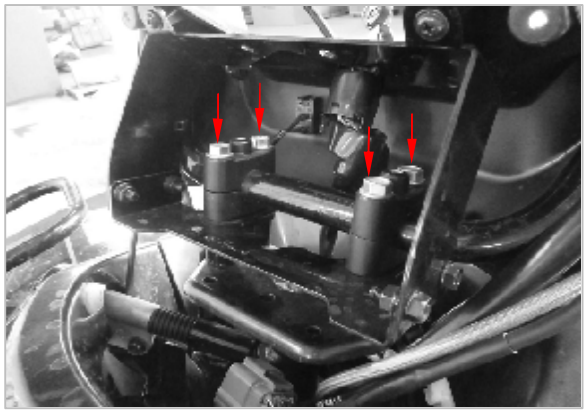
1. Remove handlebar cover.

NOTE: *Remove handlebar grips, throttle lever, brake lever and switch only if the handlebar is defective and requires replacement.*

2. Remove four bolts from the dashboard bracket.
3. Remove the dashboard.



4. Remove four handlebar mounting bolts.
5. Remove handlebar



Handlebar Inspection

Inspect the handlebar for damage, cracks or bending. Replace if any of these problems is detected.

Handlebar Installation

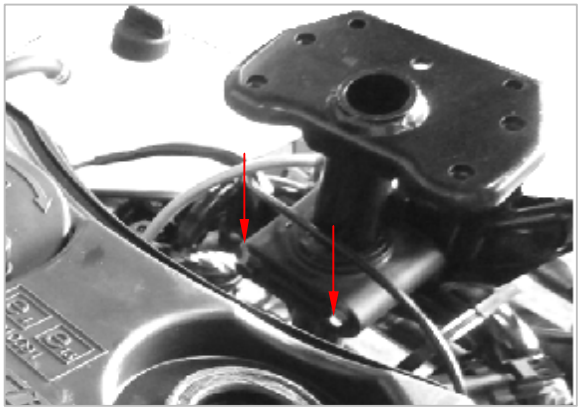
For the installation, reverse the removal procedure.

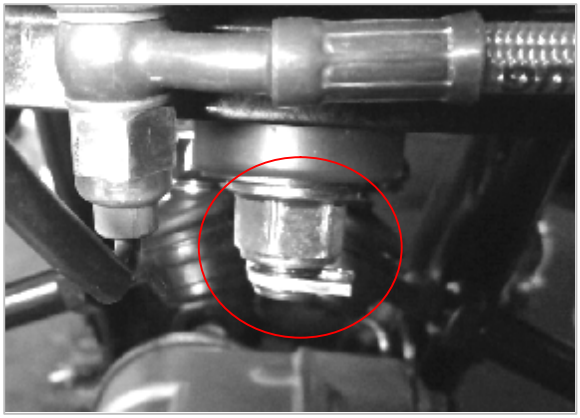
Steering Shaft Removal (without EPS)

1. Remove handlebar cover.
2. Remove dashboard support.
3. Loosen handlebar mounting bolts and remove handlebar.
4. Remove the body top cover.
5. Remove steering shaft bracket and bolts.
6. Remove the inner fender.
7. Remove the cotter pin and castle nut at the arm plate. Discard the cotter pin.
8. Disconnect the tie-rods from the arm plate.
9. Remove the steering shaft cotter low end pin, washer and castle nut. Discard the cotter pin.

NOTE: *Always install new cotter pin after removal.*

10. Pull off the steering shaft from the vehicle.





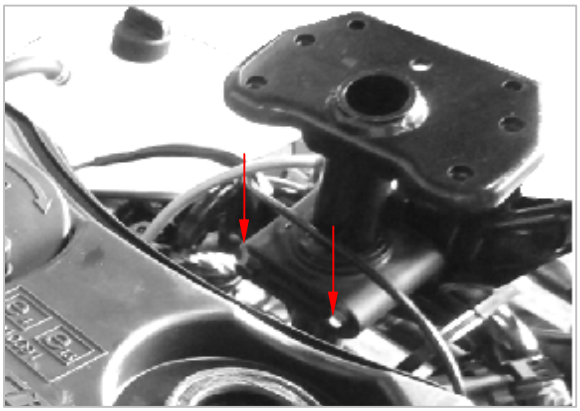
Steering Shaft

Steering Shaft Removal (with EPS)

1. Remove handlebar cover.
2. Remove dashboard support.
3. Loosen handlebar mounting bolts and remove handlebar.
4. Remove the body top cover.
5. Remove steering shaft bracket and bolts.
6. Remove the inner fender.
7. Remove steering shaft secure bolt and pull out the shaft.

Torque: 280~320 kgf-cm

NOTE: For detail of the EPS system please refer to chapter EPS.



WHEEL AND TIRE

GENERAL

WARNING

Torque wrench tightening specifications must strictly be adhered to.

Castle Nut

Torque: 950-1200 kgf-cm

Wheel Nut

Torque: 680-720 kgf-cm

WHEELS

Removal

1. Position the vehicles on a level surface.
2. Stop the engine, place the transmission in PARK and lock the parking brake.
3. Loosen the wheel nuts slightly.
4. Elevate the appropriate side of the vehicle by placing a suitable stand or jack under the frame.
5. Remove the wheel nuts and remove the wheels.

Installation

1. Verify the transmission is still in PARK and the parking brake is locked.
2. 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 forward rotation.
3. Install the wheel nuts and finger tighten them to align center of the wheel holes with the center of the tapered nuts.
4. Carefully lower the vehicle to the ground.
5. Torque the wheel nuts to the proper torque specification.

WARNING

Do not rotate tires. The front and rear tires have a different size. Respect direction of rotation when applicable.

TIRES

WARNING

Do not rotate tires. The front and rear tires have a different size. Respect direction of rotation when applicable.

TIRE PRESSURE

WARNING

Tire pressure greatly affects vehicle handling and stability. Insufficient pressure may cause tire to deflate and rotate on wheel. Excessive pressure may burst the tire. Always follow recommended pressure.

Checks pressure when tires are cold before using the vehicle. Tire pressure changes with temperature and altitude. Recheck pressure if one of these condition has changed.

TIRE PRESSURE

FRONT: 7 psi

REAR: 7 psi

Tire Inspection

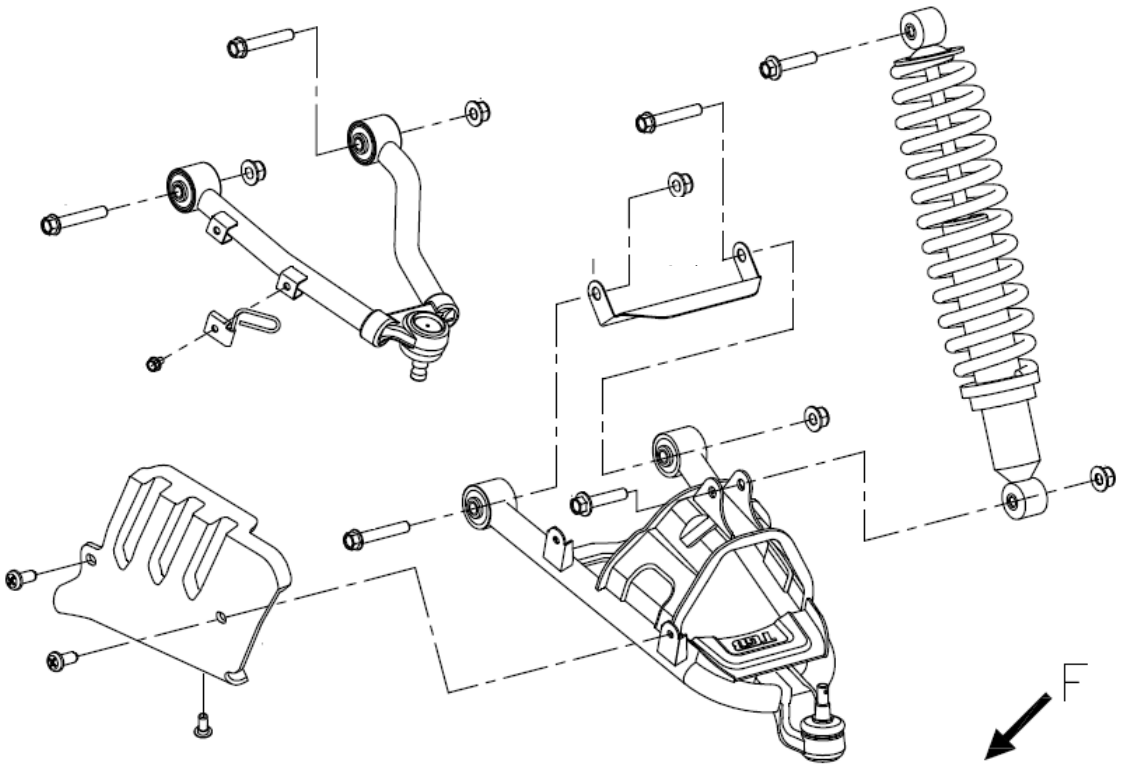
Check tire for presence of slits, bulges, wear or other damage. Replace if necessary.

Tire Replacement

WARNING

- Replace tires only with the same type and size as original tires.
- For unidirectional thread pattern, ensure that the tires are installed in the correct direction of rotation.

FRONT SUSPENSION



FRONT SUSPENSION

GENERAL

- The procedure explained below is the same for the RH and LH sides unless otherwise noted.
- During assembly/installation, use the torque values and service products as in the exploded view.
- Clean threads before applying a thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices when removed (e.g.: locking tabs, cotter pins, etc.) must be replaced.

NOTICE: *hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.*

PROCEDURES

SHOCK ABSORBER

Shock Absorber Removal

1. Safety lifts and supports the vehicle of the ground.
2. Remove bolts and nuts retaining shock absorber.
3. Remove shock absorber.

Shock Absorber Inspection

- Remove spring from shock absorber.
- Secure the end of shock body in a vise with its rod upward.

NOTICE: *Do not clamp directly on shock body.*

- Extend and compress the piston several times over its entire stoke. Check that it moves smoothly and with uniform resistance with its rod upward.
- Check the following conditions that will denote a defective shock:
  - A skip or a hang back when reversing stroke at mid travel.

- Seizing or binding condition except at extreme end of either stroke.
- Oil leakage.
- A gurgling noise, after completing one full compression and extension stroke.

▪ Replace if any faults are present.

Shock Absorber Installation

For installation, reverse the removal procedure.

▪ Make sure to install the proper type of shock absorber on vehicle.

TORQUE: 48 Nm +/- 6.

LOWER A ARM

Lower A Arm Removal

1. Safety lifts and supports the vehicle off the ground.
2. Remove wheel.
3. Remove bolts and nut securing lower ball joint to knuckle.
4. Remove bolts and nuts securing A arm to frame.
5. Remove A arm.

Lower A arm installation

For installation, reverse the removal procedure.

TORQUE: 48 Nm +/- 6.

UPPER A ARM

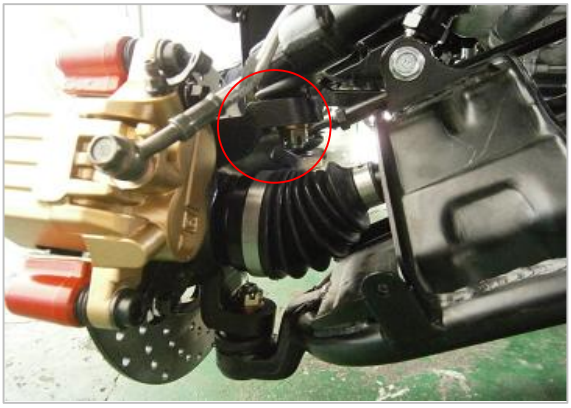
Upper A Arm Removal

1. Safety lifts and supports the vehicle off the ground.
2. Remove wheel.
3. Remove fasteners retaining brake hose to vehicle.
4. Remove and discard cotter pin retaining ball joint.
5. Remove ball joint nut and washer.
6. Carefully move brake hose aside.
7. Using a plastic hammer, carefully hit on the knuckle side to separate ball joint from knuckle.

NOTE: *A ball joint remover can be used if the ball joint is jammed into knuckle.*

NOTICE: *Never hit on A arm to avoid to damage it permanently.*

8. Remove bolt and nut securing A arm to shock absorber.
9. Remove fasteners securing A arm to frame.
10. Remove A arm.



Upper A Arm Installation

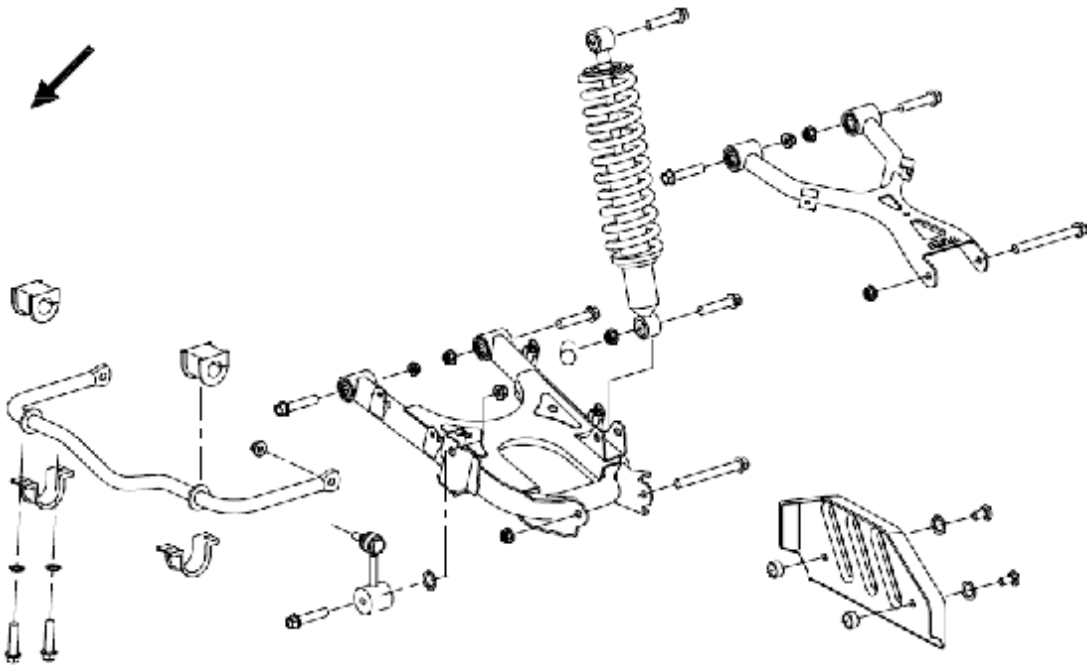
For installation, reverse the removal procedure.

Install a new cotter pin to secure ball joint nut.

Both end of cotter pin must be folded.

TORQUE: 48 Nm +/- 6.

REAR SUSPENSION



REAR SUSPENSION

GENERAL

The procedure explained below is the same for the RH and LH sides unless otherwise noted.

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices when removed (e.g.: locking tabs, cotter pins, etc.) must be replaced.

NOTICE: *hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.*

PROCEDURES

SHOCK ABSORBER

Shock Absorber Removal

1. Safety lifts and supports the vehicle of the ground.
2. Remove bolts and nuts retaining shock absorber.
3. Remove shock absorber.

Shock Absorber Inspection

- Remove spring from shock absorber.
- Secure the end of shock body in a vise with its rod upward.

NOTICE: *Do not clamp directly on shock body.*

- Extend and compress the piston several times over its entire stoke. Check that it moves smoothly and with uniform resistance with its rod upward.
- Check the following conditions that will denote a defective shock:
  - A skip or a hang back when reversing stroke at mid travel.

- Seizing or binding condition except at extreme end of either stroke.
- Oil leakage.
- A gurgling noise, after completing one full compression and extension stroke.

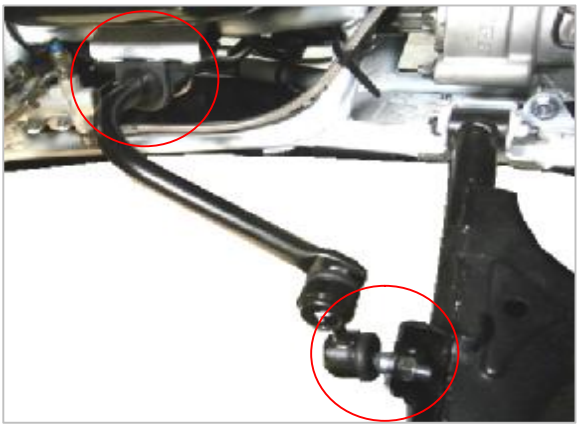
▪ Replace if any faults are present.

Shock Absorber Installation

For installation, reverse the removal procedure.

▪ Make sure to install the proper type of shock absorber on vehicle.

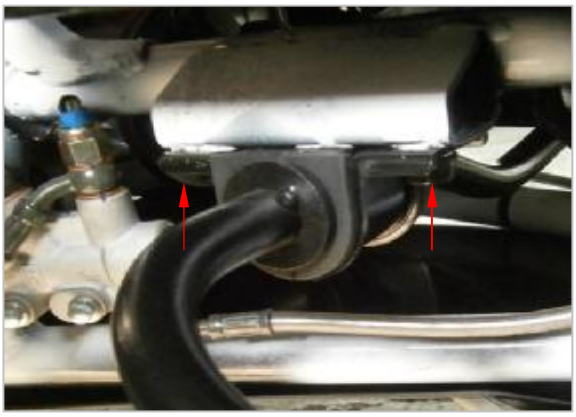
TORQUE: 48 Nm +/- 6.



TENSION BAR

Tension Bar Removal

1. Safety lifts and supports the vehicle off the ground.
2. Loosen and remove the bolts, washer and bushing from the frame.
3. Remove ball joint nut from the A arm or tension bar.

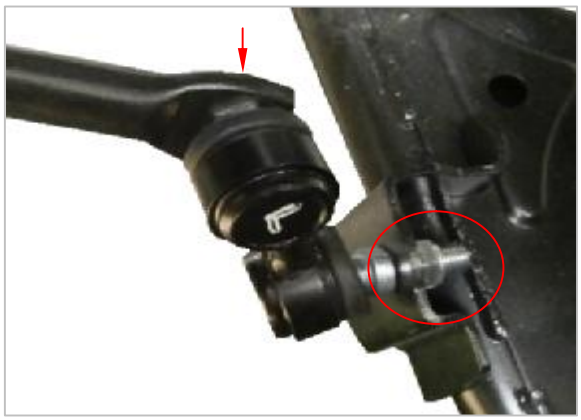


Tension Bar Installation

For installation, reverse the removal procedure.

TORQUE: 280-300 kgf-cm.

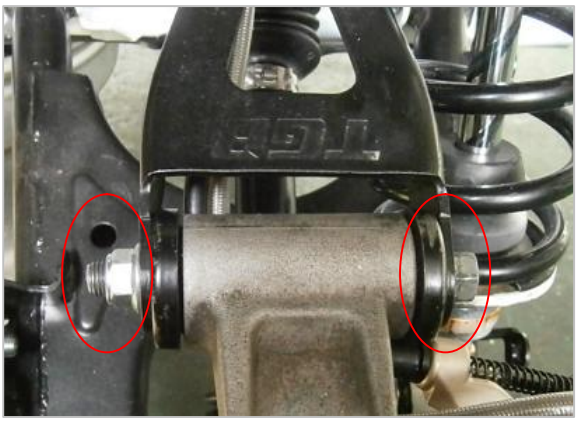
TORQUE: 450-500 kgf-cm



UPPER A ARM

Upper A Arm Removal

1. Safety lifts and supports the vehicle off the ground.
2. Remove wheel.
3. Remove bolts and nuts securing A arm to frame.
4. Remove bolts and nut securing upper knuckle.
5. Carefully move brake hose aside.
6.. Remove A arm.



Upper A Arm Installation

For installation, reverse the removal procedure.

Install a new cotter pin to secure ball joint nut.

Both end of cotter pin must be folded.

TORQUE: 48 Nm +/- 6.

TORQUE: 48 Nm +/- 6.

LOWER A ARM

Lower A Arm Removal

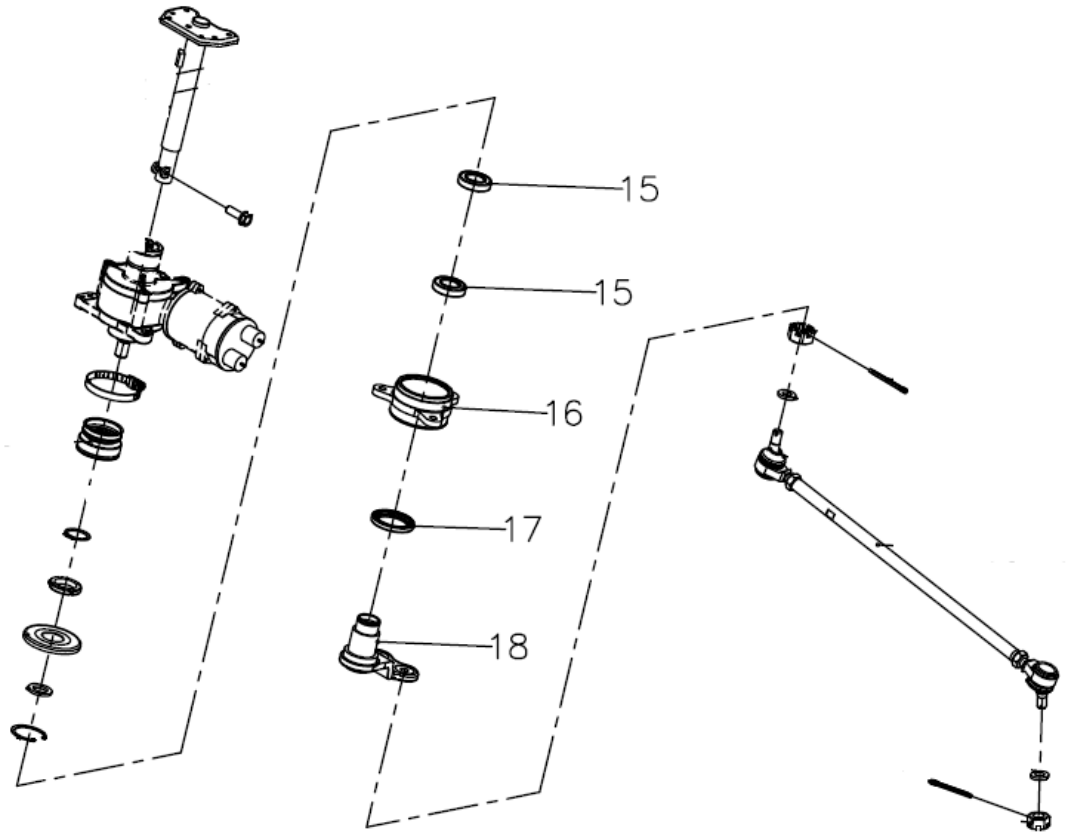
1. Safety lifts and supports the vehicle off the ground.
2. Remove wheel.
3. Remove bolts and nuts securing A arm to frame.
4. Remove bolts and nut securing lower knuckle.
5. Remove ball joint nut to tension bar rod.
6. Remove shock absorber lower bolt.
7. Remove A arm.

Lower A arm installation

For installation, reverse the removal procedure.

TORQUE: 48 Nm +/- 6.

EPS (Electric Power Steering)



(EPS) Electric Power Steering

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying thread locker.

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

SYSTEM DESCRIPTION

The Electric Power Steering (EPS) provides a computer controlled, variable power assist, achieved by an electric motor to optimize the amount of steering input required by the rider.

The EPS system uses the following parameters to determine how much steering assist it provides:

- Electrical system voltage.
- Vehicle speed.
- EPS shaft torque sensor input.

The amount of steering assist provided is dependent on the handlebar effort (steering torque), electrical power available, and vehicle speed.

When handlebar is in the straight ahead position, there is no steering assist.

Steering torque may also come from the wheels due to rough terrain. Steering kickback is reduced while providing feedback to the driver.

The greater the power steering assist, the greater the load on the electrical system.

When electrical system is under high load (battery not at full charge, operating the vehicle for prolonged periods of time at slow speed and low RPM which, requires higher power steering assist), the battery power reserve will gradually decrease. This further increase the load on the charging system and the electrical system voltage will drop. As system voltage drops, so does power steering assist.

NOTE: *It is important to maintain the battery at a full state of charge to ensure proper EPS operation. The magneto output is 650 watts to minimize battery drain and system voltage drop.*

EPS Assist Mode

The EPS system provides two rider selectable modes of operation.

ESP MAX provides maximum steering assist for technical low speed riding in rough or muddy terrain or for touring.

EPS MIN provides less steering assist for increased feedback and trail riding.

De-rating Explanation

De-rating is an internal protection system integrated in the EPS electrical module.

This system protects the electrical components when EPS works too hard and internal temperature reaches a critical level.

It also protects electronics when current ripples in the system are too high. These current ripples can be caused by:

- Bad grounds.
- Defective stator or bad stator output wires connection.
- Failed regulator.
- High electrical loads.

The internal protection system decreases the assistance level available to protect its electronic board. The normal assistance level will return when riding conditions are back to normal and the internal temperature decrease and/or when the ripples in the electric circuit decrease.

NOTE: *This reaction is a normal protective behavior of the unit and it does not necessary raise a fault in the cluster.*

EPS SYSTEM DESCRIPTION

EPS Unit

The EPS unit is a self contained unit that includes the steering gear, the EPS module, the EPS motor and the torque sensor.

The EPS module provides DC power to the motor. The amount and duration of that DC power is determined by the inputs to the EPS module. The direction in which the motor turns is changed by reversing the polarity of the circuit current.

The EPS motor does not “spin”, but rather turns in very small increments based on the amount, duration, and direction of DC power delivered by the EPS module.

EPS Unit protection

When the EPS unit temperature is above 100 ℃, all the EPS function will stop but the steering can operate without power assist, when the EPS internal board temperature decrease below 90℃, the power steering will back to normal and steering assist should resume normal operation.

Steering Torque Sensor

The steering column is connected to the shaft on the EPS unit. A small area of the EPS shaft is magnetized. Inside the EPS unit, a torque sensor surrounds the magnetized area of the EPS shaft.

When the handlebar is turned, torque is applied to the shaft, which tends to twist the shaft slightly, deforming the magnetic field in the shaft. The sensor detects the torque by measuring the deviation of the magnetic field. The torque sensor is very sensitive and can detect very small changes in the magnetic field. The harder the handlebar is turned, the greater the magnetic deviation, the greater the power steering assist.

EPS Mode

The EPS system normally provides two rider selectable modes of operation.

MAX provides maximum steering assist for technical low speed riding in rough or muddy terrain or for touring.

MIN provides less steering assist for increased feedback and aggressive trail riding.

How to View EPS Mode Selection

1. To view the active EPS assist mode, press MODE button from the dashboard and move to EPS select page, the EPS page will blinking then press the RESET button to engage the EPS assist.
2. The active EPS mode will display in the middle right portion of speedometer.

How to Change EPS Mode

To change EPS mode, press the RESET button on the EPS function page, The EPS system will engage or disengage and display **"MIN"**, **"MAX"** and blank (**OFF**).

When EPS system is malfunction, the function block will displayed **"FAIL"**. And the bottom of dashboard will show DTC code with "Cxxxx".

Code	Problem Caused
C1511	Torque sensor connector poor contact
C1512	Torque sensor abnormal
C1513	
C1514	
C1515	
C1521	Motor connector poor contact
C1522	Motor abnormal
C1523	
C1524	
C1525	
C1526	
C1532	Controller current sensor abnormal
C1531	Controller abnormal
C1533	
C1536	Controller voltage too high
C1538	Controller overheat

SYSTEM DESCRIPTION (COMPONENTS)

EPS Unit

- The EPS unit is a self-contained unit that includes the steering gear, the EPS module, the EPS motor and the torque sensor.
- The EPS module provides DC power to the motor. The amount and duration of that DC power is determined by the inputs to the EPS module. Reversing the polarity of the circuit current changes the direction in which the motor turns.
- The EPS motor does not “spin”, but rather turns in very small increments based on the amount, duration and direction of DC power delivered by the EPS module.

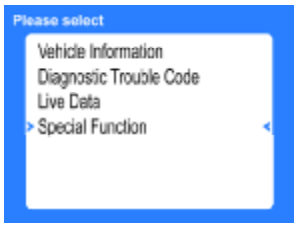
ADJUSTMENT

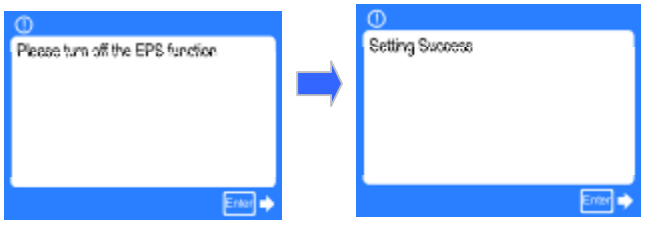
TORQUE OFFSET RESET

When replacing the following parts or adjusting steering alignment, the sensor torque offset must be reset to zero for proper system operation.

- EPS unit
- Steering shaft bearing
- Tie Rod
- Knuckle
- Ball joint
- Front suspension A-arm
- Steering alignment

1. Connect vehicle to the Diagnostic tool.
2. Select ‘Special Function” →”ESP reset”→
3. Follow the instruction and procedure of the screen till “setting success” the reset is completely.





NOTICE: *Ensure handlebar is free and centered position. There MUST NOT be any effort applied to the steering shaft.*

TROUBLESHOOTING

NO POWER STEERING

1. EPS malfunction.

- If the CHECK ENGINE light is on and a EPS FAULT message is visible in the dashboard, check for fault code at the bottom of dashboard.

2. No power to EPS unit.

- Carry out an EPS unit FUSE test. Replace as required.
- Carry out an EPS unit INPUT VOLTAGE test (POWER SIDE). Repair or replace wiring/connectors as required.
- Carry out an EPS unit INPUT VOLTAGE test (CONTROL SIDE). Repair or replace wiring/connectors as required.

3. NO ground to EPS unit.

- Carry out an EPS unit GROUND CIRCUIT test. Repair or replace wiring/connectors as required.

4. No engine RPM signal from ECU.

- If engine RPM can be displayed in the dashboard when the engine is running, carry out an EPS unit COMMUNICATION LINK (can) CONTINUITY test. Repair or replace wiring/connectors as required.
- If engine RPM cannot be displayed in the dashboard, use diagnostic tool to check for applicable fault codes. Carry out service actions.

LOW POWER STEERING ASSIST

1. Low battery voltage.

- Check battery terminals. Clean, repair, replace or tighten as required.
- Test battery voltage. Recharge or replace battery as required.
- Carry out an EPS unit INPUT VOLTAGE test (POWER SIDE) as detailed in this subsection. Ensure power connector pins are clean, corrosion free, tight and make good contact. Repair or replace wiring/connectors as required.
- Carry out an EPS SYSTEM LOAD TEST as detailed in this subsection.

2. Low input voltage to EPS unit.

- Carry out an EPS unit INPUT VOLTAGE test (POWER SIDE) as detailed in this subsection. Ensure power connector pins are clean, corrosion free, tight and make good contact. Repair or replace wiring/connectors as required.

3. Faulty EPS ground circuit.

- Carry out an EPS GROUND CIRCUIT test. Ensure EPS ground connector pins and frame ground post are clean, corrosion free, tight and make good contact. Repair or replace wiring/connector as required.

ASYMMETRICAL POWERT STEERING ASSIST (SIDE TO SIDE)

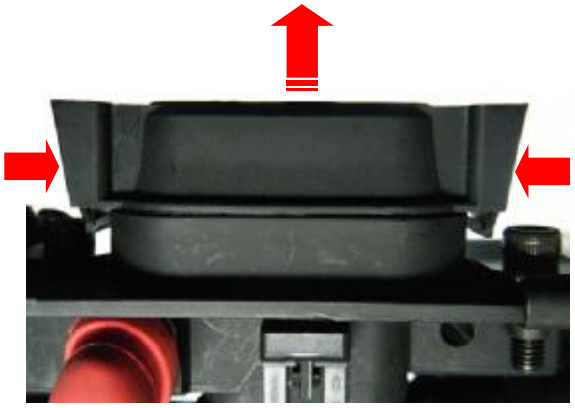
1. Torque sensor not reset to zero.

- Ensure steering alignment is within specification and carry out the TORQUE OFFSET RESET procedure detailed in this subsection.

EPS unit Power Fuse Test

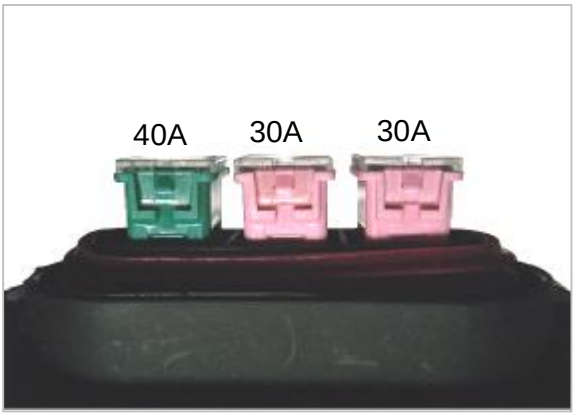
A 40 A EPS fuse located at the right side under the passenger seat in the EPS fuse box provides power for the EPS motor.

1. To remove fuse box cover, simultaneously squeeze tabs inwards on each end of fuse box cover as you pull upward on the cover.



2. Using voltmeter set to Ω selection, remove and test the EPS fuse.

3. Replace fuse as required.

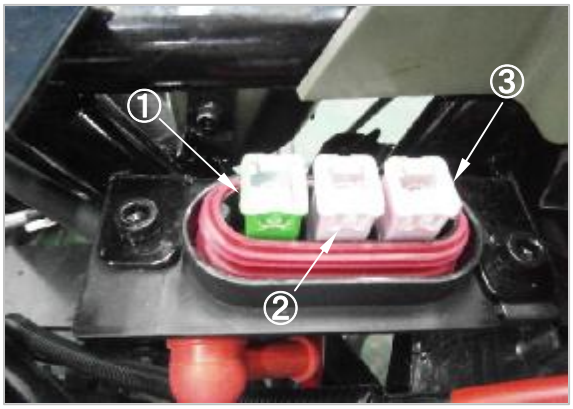


NOTE *: The color and function of fuse.*

① EPS power fuse (Green 40A).

② MAXI fuse (Pink 30 A).

③ Charger fuse (Pink 30A).



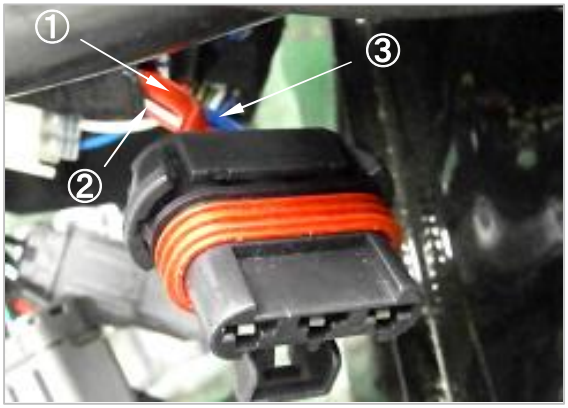
EPS unit Input Voltage Test (Power Side)

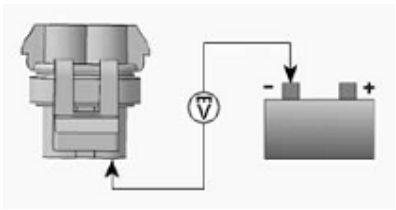
1. Disconnect the EPS power connector.
2. Test for 12 VDC EPS motor power at pin as per following table.

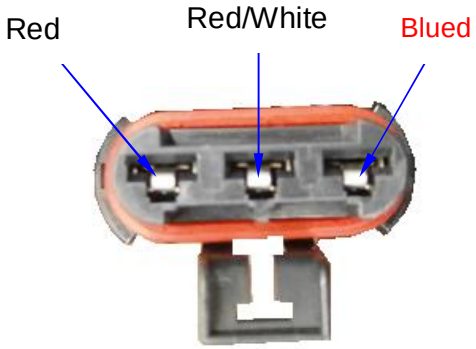
EPS power connector pin 1 + Battery GND

The voltage should be ***battery voltage***

- If NO voltage is measured, test the 40 A EPS fuse. If good, check wires and connector pins. Replace or repair defective parts and reset faulty codes.
- If battery voltage is measured, carry out the following EPS UNIT INPUT VOLTAGE TEST (CONTROL SIDE).







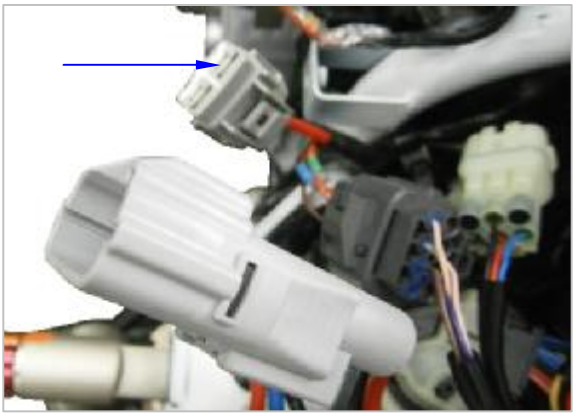
EPS Unit Input Voltage Test (Control Side)

1. Disconnect EPS control connector and turn ignition switch ON.
2. Set the ignition switch to ON.
3. Test for 12 VDC power to the EPS module pin as per following table.

EPS control connector (pin A) + battery GND

The voltage should be ***battery voltage***

- If NO voltage is measured, check wires and connector pins from EPS unit to the Relays/Speedo fuse in front fuse box. Replace or repair defective parts and reset faulty codes.
- If battery voltage is measured, carry out the following EPS UNIT GROUND CIRCUIT TEST.



EPS Unit Ground Circuit Test

1. Disconnect the EPS ground connector (GDN)
2. Test for continuity between PINS to battery ground.

EPS GND connector pin A + Battery GND

EPS GND connector pin B+ Battery GND

The voltage should be ***Continuity (close to 0 Ω)***

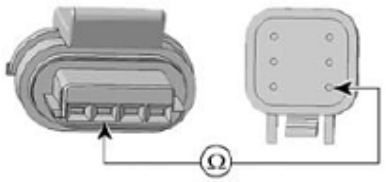
- If there is NO continuity or a high resistance is measured, check wires and connector pins from EPS unit to chassis ground post. Replace or repair defective parts and reset faulty codes.
- If there is good continuity, carry out the following EPS UNIT COMMUNICATION LINK (CAN) CONTINUITY TEST.

EPS Unit Communication Link (CAN) Continuity Test

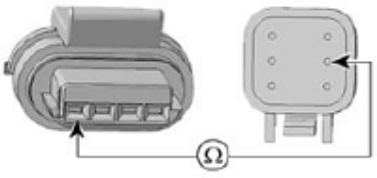
NOTE: *EPS unit must receive an RPM signal to provide power steering assist.*

- Disconnect the EPS control connector and the diagnostic connector.
- Test continuity of CAN Bus Wires at PINS.

EPS control connector (pin C) + diagnostic connector (pin 1) = Below 1 Ω



EPS control connector (pin D) + diagnostic connector (pin 2) = Below 1 Ω



- If resistance measured is out of specification, check wires and connector pins. Carry out repairs as required and reset faulty codes.
- If resistance measured is good, replace the EPS unit and reset faulty codes.

EPS System Load Test

If the charging system cannot sustain normal voltage when the EPS is operating, EPS may be greatly reduced or nonexistent. Carry out the following steps.

1. Connect the red lead of voltmeter set to VDC to the EPS fuse box battery terminal.
2. Connect the black voltmeter lead to the battery ground.
3. Measure the battery voltage.

NOTE: *If battery voltage is low, recharge battery.*

4. Ensure the vehicle transmission is set to N.
5. Start the engine.
6. Note the voltage on the voltmeter with the engine running (charging system voltage).
7. Press the RANGE button repeatedly to select Manual Range 60.
8. Press the MIN MAX button on the voltmeter to engage the MIN function.
9. Turn the handlebar momentarily against the steering frame stops to each side.

NOTE: *Do not hold steering against frame stops for and extended period of time.*

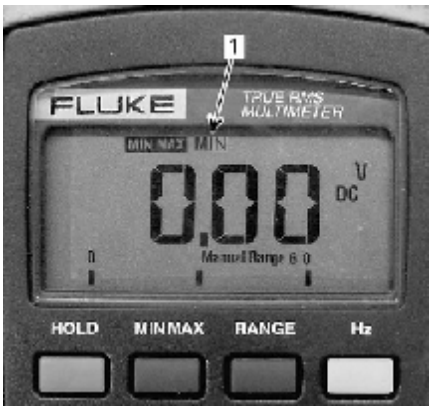
10. Read the MIN charging system voltage recorded while the handlebar was turned against each stop.

Battery (-) terminal + fuse box battery terminal = at least 12 VDC (Steering position LH stop/ RH stop)

NOTE: *Turning the handlebar momentarily against the frame stops generates maximum EPS load (maximum current draw on electrical system). Electrical system must sustain at least 12 VDC for proper EPS operation.*

▪ If the electrical system cannot sustain at least 12 VDC, check the following:

- Battery.
- Battery connections.



- EPS unit power and ground connections.
- Charging system.
- Frame and engine ground studs.

▪ If the previously listed items, carry out the following EPS UNIT CURRENT TEST.

EPS Unit Current Test

1. Connect vehicle to the latest BUS software.
2. Click on the Rear Data button.
3. Choose the Monitoring page tab.
4. At the bottom of the Monitoring page, choose the EPS tab.
5. With the vehicle engine running in N, turn the handlebar side to side, momentarily against each stop and observe the indications on the BUS EPS Monitoring page.

▪ The EPS Torque Sensor Nm increase with torque applied to the handlebar.
▪ The EPS Current ammeter should increase proportionately to the torque applied and decrease with the torque as steering assist is provided.

NOTE: *Increase and decrease in torque and current readings is very brief as steering assist is quickly provided. Current draw should remain within green scale but may momentarily peak to 60 amps, then drop off close to 0 amps as torque applied is nulled out by steering assist. A residual torque of 2 NM with a corresponding current draw is acceptable.*

▪ If current draw tends to remain high, carry out the following:
- Steering alignment check.
- Steering column shim adjustment at half bushings as described in the EPS UNIT INSTALLATION procedure detailed in this section.
- TORQUE OFFSET RESET procedure detailed in this section.
- Replace EPS unit.

EPS Unit Removal

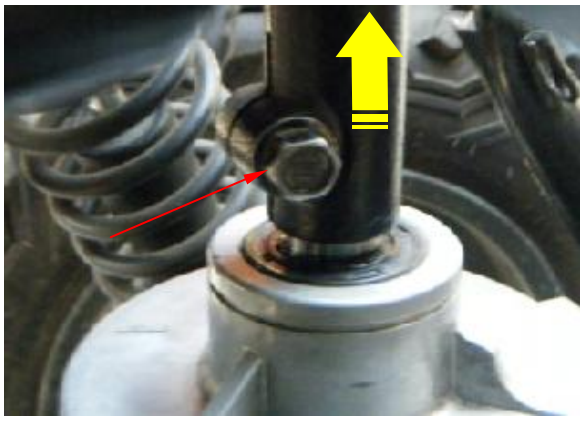
Remove the following items:

- Both internal fender.
- The front bumper.
- Disconnect the wiring of headlamp and power source.
- The front cover.
- The inlet tube.

▪ Loose the handle steering lock nut.

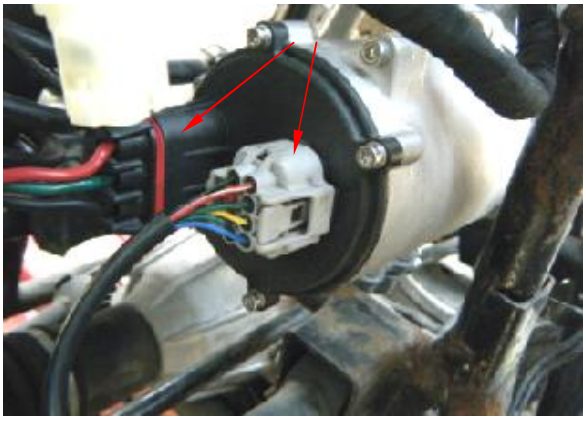
▪ Lift up and dismounting the steering shaft.

Torque: 280~320 kgf-cm



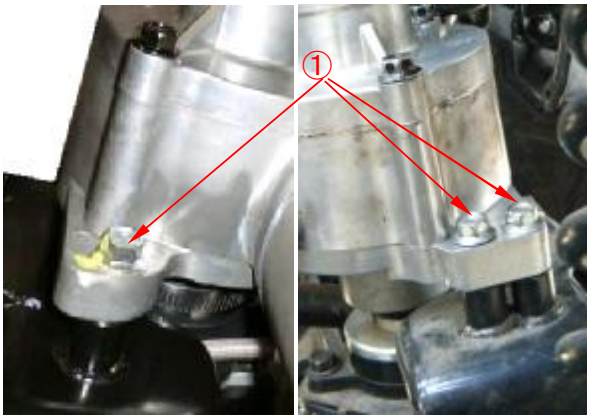
▪ Disconnect the wiring on the motor.

▪ Disconnect the wiring on the controller.

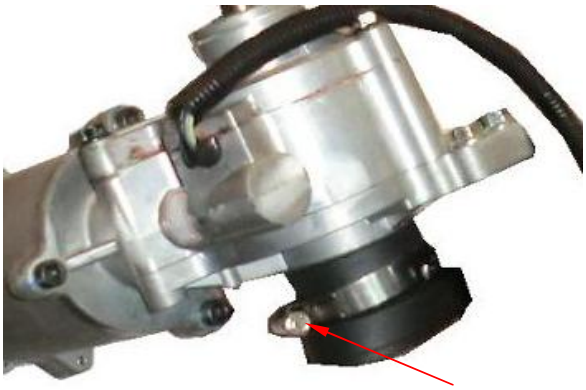


Remove the three mounting bolts ① of EPS body.

Torque: 250~300 kgf-cm

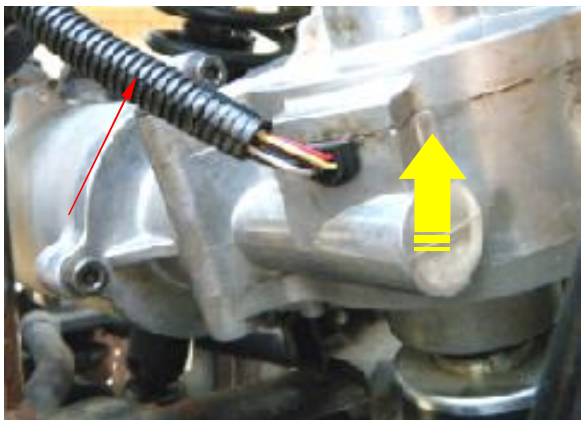


Loose the clamp of anti-dust rubber.



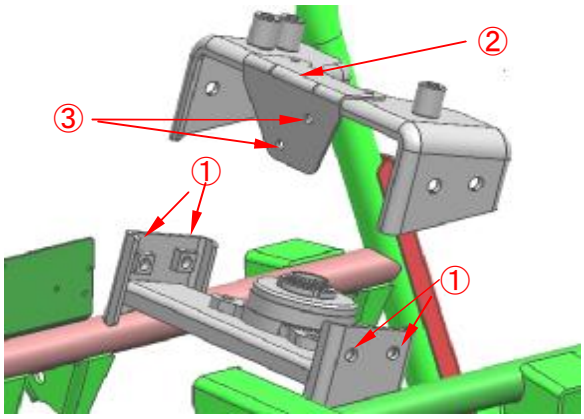
Lift up and dismounting the EPS unit.
Take out the EPS unit from the left side of vehicle.

NOTE: Be careful do not damage the cable of torque sensor.



Remove the four bolts ① and the bracket ②.
Remove the two bolts ③ and dismounting the brake distributor.

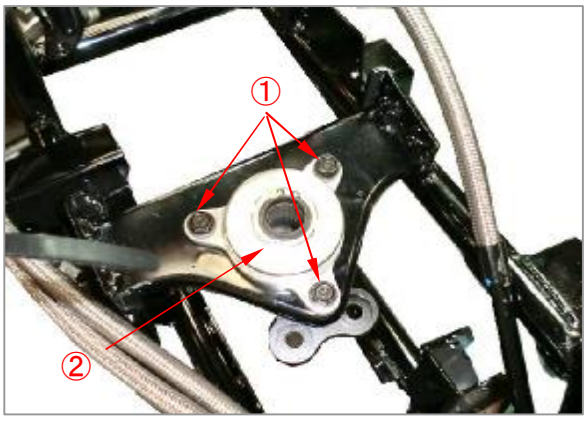
Torque: 280~320 kgf-cm



Remove the three bolts ①.
Lift up and remove the steering lower bearing seat ②.

Torque: 280~320 kgf-cm

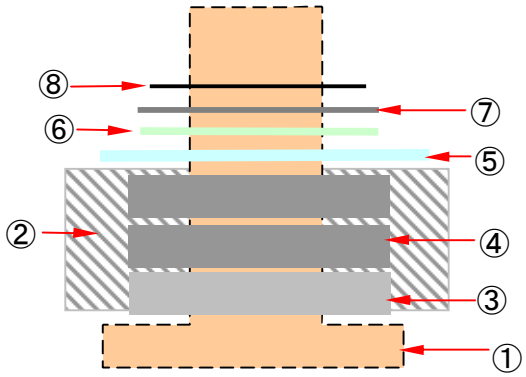
Installation
Install the EPS in the reverse order of removal.



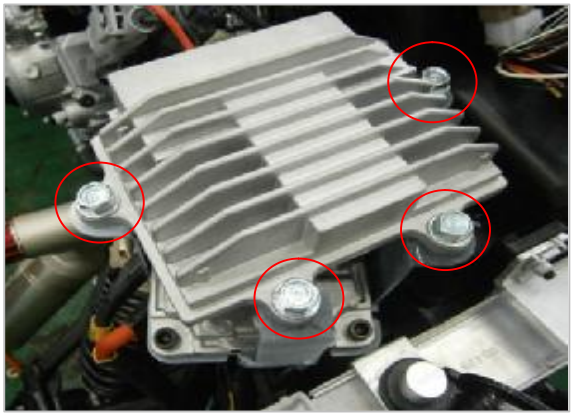
Steering lower Bearing Seat

Refer to the picture for install new bearing and seal into the bearing seat then assemble the bearing seat assembly.

① Steering Pad.
② Bearing Seat
③ Oil Seal
④ Bearing x 2
⑤ Cap
⑥ Washer
⑦ Plate Nut
⑧ Circlip

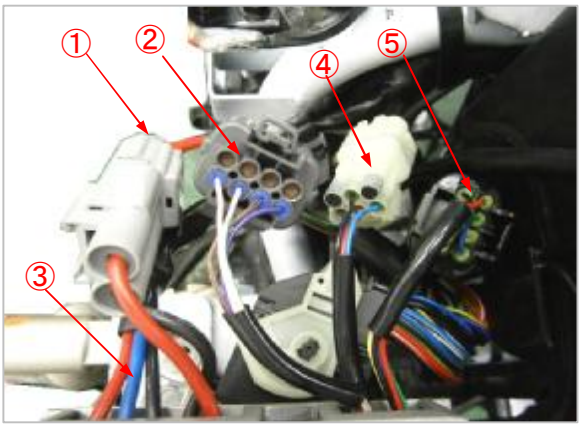


Control Unit Removal
Remove four mounting bolts.



Disconnect the wiring as follow:.

1. To fuse box.
2. To ECU, Speed Sensor and Ignition.
3. To Motor Power.
4. To Torque Sensor.
5. To Motor Control.



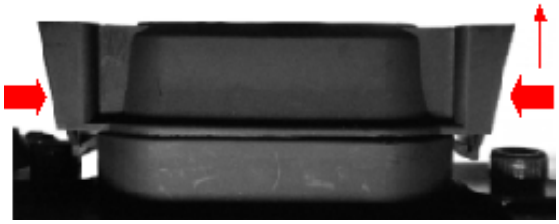
Remove the control unit.

Installation
Install the control in the reverse order of removal.

Fuse Removal

Simultaneously squeeze tabs inwards on each end of fuse box cover as you pull downward on the cover.

Replace the damage fuse.

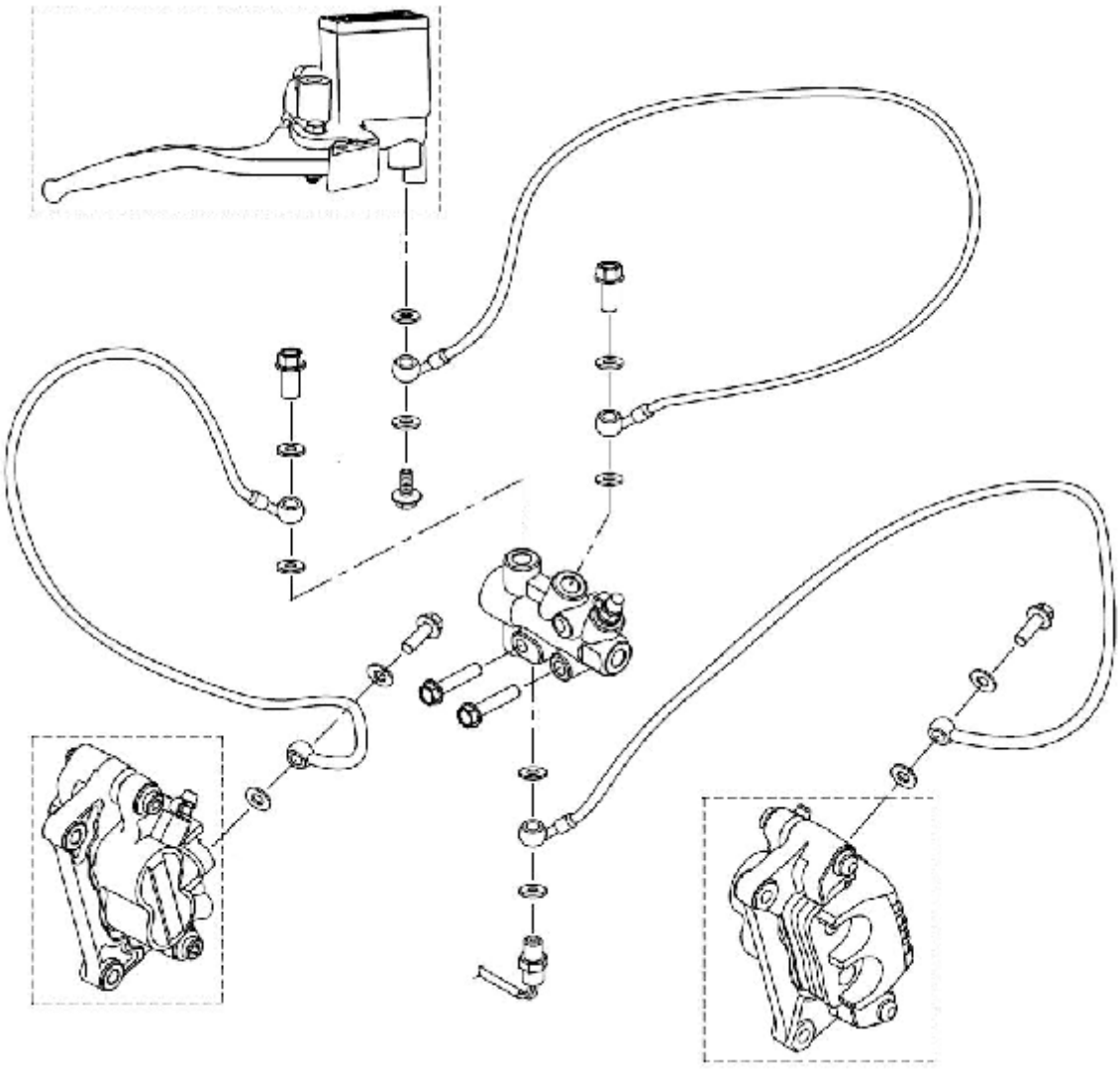


Installation

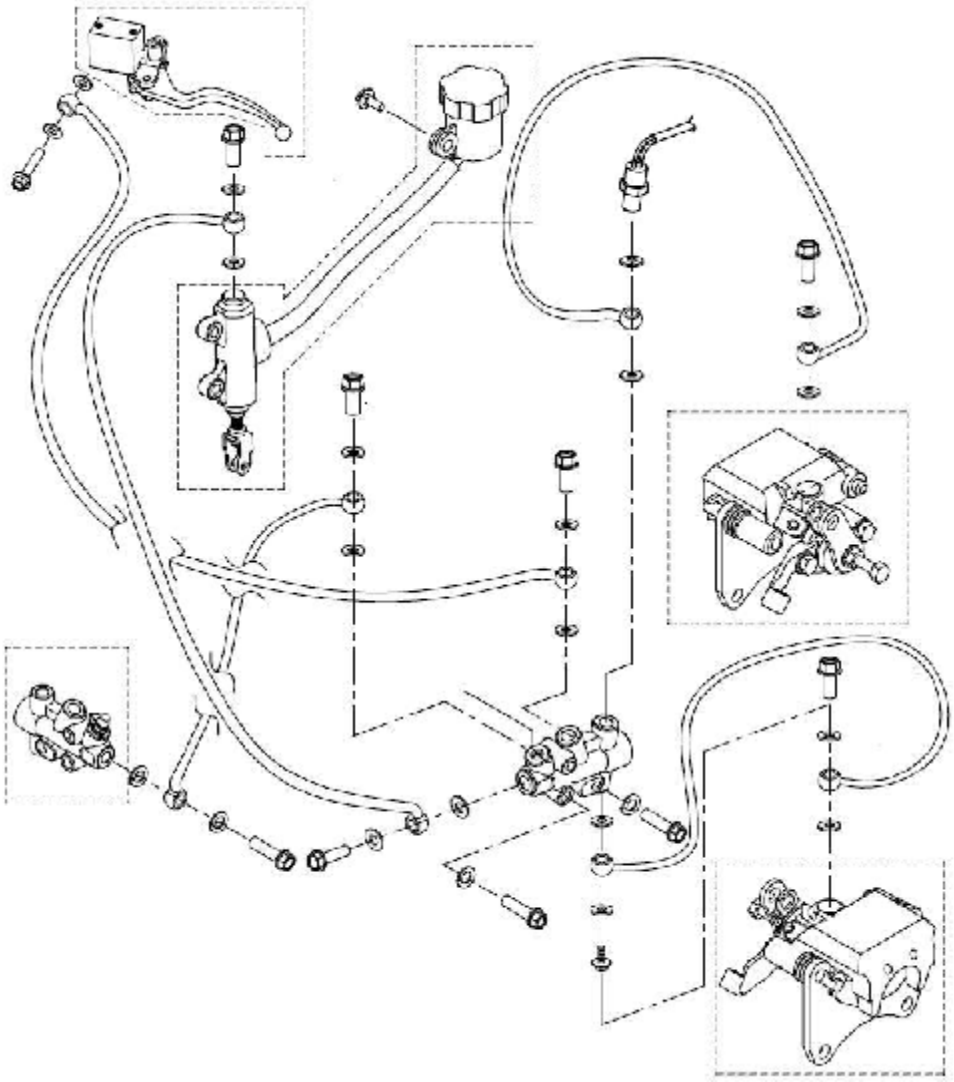
Install the control in the reverse order of removal.

BRAKE

FRONT BRAKE



REAR BRAKE



BRAKE SPECIFICATIONS

FRONT BRAKES

Item	Standard	Service Limit
Bake Pad Thickness		1 mm
Brake Disc Thickness	4.75 mm	4.24 mm
Brake Disc Run out		0.254 mm
Caliper Piston Diameter	30.12 mm	30.07 mm
Caliper Bore Diameter	30.28 mm	30.33 mm

REAR BRAKES

Item	Standard	Service Limit
Bake Pad Thickness		1 mm
Brake Disc Thickness	4.75 mm	4.24 mm
Brake Disc Run out		0.254 mm
Caliper Piston Diameter	31.75 mm	31.65 mm
Caliper Bore Diameter	31.85 mm	31.90 mm

TORQUE SPECIFICATIONS

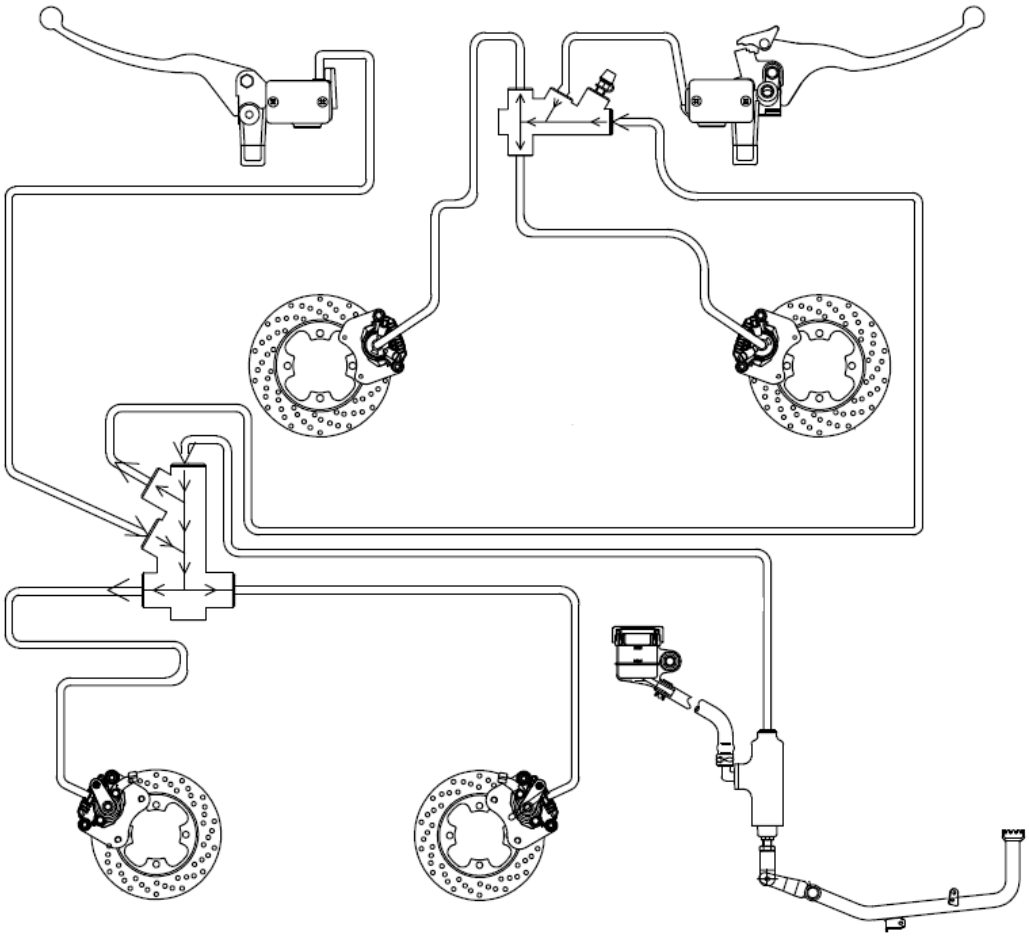
Item	Torque kgf-cm
Caliper Mounting Bolts	500
Handlebar Master Cylinder Clamp Bolts	70-90
Hand Master Cylinder Reservoir Cover	8
Brake Line Flare Fitting	160-200
Brake Line Banjo Bolt Fitting	200
Bleeder Screw	53

BRAKE FLUID：DOT4

BRAKE SYSTEM SERVICE NOTES

Disc brake systems are lightweight, low maintenance and perform well in the conditions this vehicle will routinely encounter. There are a few things to remember when replacing disc brake pads or performing brake system service to ensure proper system function and maximum pad service life.

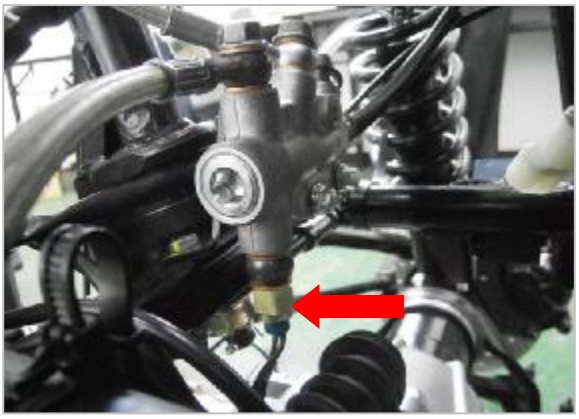
- Do not overfill the master cylinder fluid reservoir.
- Make sure the brake lever/pedal returns freely and completely.
- Adjust stop pin on caliper after pad service.
- Check and adjust master cylinder reservoir fluid level after pad service.
- Make sure atmospheric vent on reservoir is unobstructed.
- Test for brake drag after any brake system service and investigate cause if brake drag is evident.
- Make sure caliper moves freely on guide pins (where applicable).
- Inspect caliper piston seals for foreign material that could prevent caliper piston from returning freely.
- Perform a brake burnishing procedure after installing new pads to maximum service life.
- . DO NOT lubricate or clean the brake components with aerosol or petroleum products. Use only approved brake cleaning products..
- .DO NOT allow brake-cleaning products to contact painted surfaces. Painting damage will occur as a result.

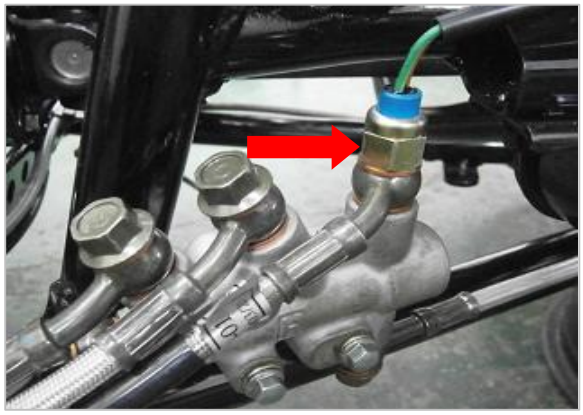


BRAKE LIGHT SWITCH

Brake Light Switch Location

There are two brake light switches, which located on the brake liquid distributor, one at front and other at LH rear.





Brake Light Switch Continuity Test

1. Disconnect brake light switch connector.
2. Using multimeter check switch operation:

Firmly pushed switch = continuity.

Release switch = Open.

- If switch is defective, replace with a new one.
- If the switch is good, verify wire continuity between harness connector and ECU connector.

Brake Light Switch Replacement

1. Disconnect brake light switch connector.
2. Drain rear brake line.
3. Remove brake light switch from distributor.

NOTE: *Use shop rag to catch any spilled brake fluid.*

4. Install new sealing washers.
5. Install brake light switch on distributor.

TORQUE: 19 Nm

6. Connect brake light switch connector.
7. Refill and bleed brake system.

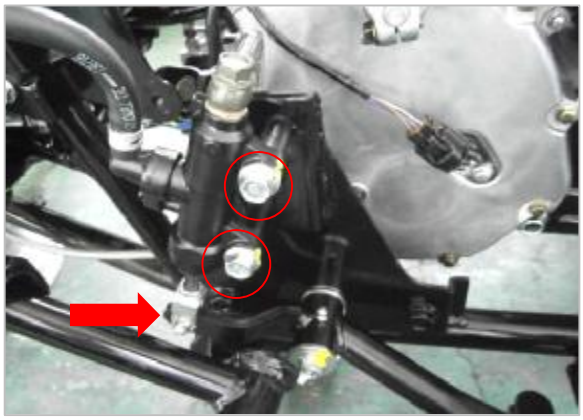
MASTER CYLINDER

Master Cylinder Removal (Hand Brake)

1. Drain brake system.
2. Remove master cylinder.
3. Unscrew brake hose from master cylinder.

Master Cylinder Removal (Pedal Brake)

4. Disconnect master cylinder rod from brake pedal.
5. Remove master cylinder rod from master cylinder.
6. Remove master cylinder retaining bolts and nuts.
7. Remove master cylinder from vehicle.

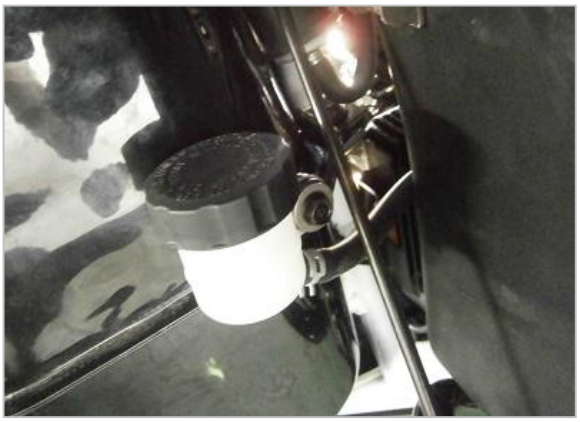


Master Cylinder Inspection

- ▪. Check boot for crack.
- ▪. Check rod for wear and scratch.
- ▪. Check master cylinder housing for leak or damage.

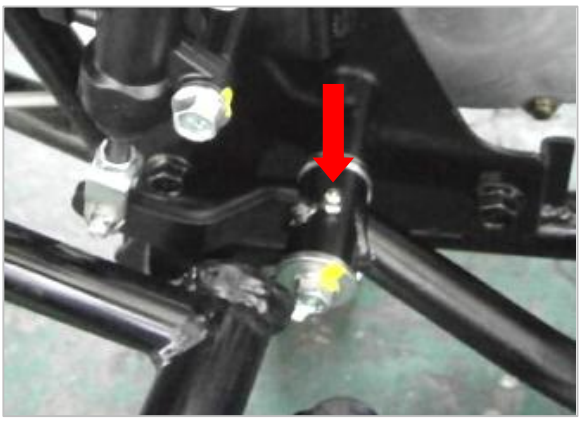
Master Cylinder Installation

- ▪. For installation, reverse the removal procedure.
- ▪. Tighten brake light switch and front brake hoses to specification.



TORQUE:

Pedal Master Cylinder bolts:208-320kgf-cm.
Break hose = 300-350 kgf-cm.
Brake light switch = 300-350 kgf-cm.
Pedal reservoir bolt: 100-120 kgf-cm.



- ▪. Lubricate push rod end and inside master cylinder boot.
- ▪. Install new sealing washers.
- ▪. Refill and bleed brake system.
- ▪. Adjust master cylinder rod.

CALIPER

Caliper Removal

1. Safety lift and support the vehicle.
2. Remove wheels.
3. If caliper is removed from vehicle for replacement:
   3.1 Drain brake system.
   3.2Unscrew brake hose from caliper.
4. Remove fasteners retaining brake hose to knuckle.
5. Remove screws securing caliper support knuckle.
6. Place caliper assembly onto a support.

NOTICE: *Do not let caliper hangs the hose and do not stretch or twist hose.*

Caliper Installation

For installation, reverse the removal procedure.

If caliper was removed for replacement:

- Refill and bleed brake system.
- Install new sealing washers.

Apply thread locker (LOCTITE 243)on caliper retaining screws.

Tighten caliper retaining screws to specification.

TORQUE: 300-320 kgf-cm.

BRAKE PADS

Brake Pads Replacement

1. Remove caliper from knuckle.
2. Remove brake pad pins from caliper.
3. Remove brake pads.
4. Clean pistons end using brake cleaner.
5. Push caliper pistons inward.

NOTE: *To avoid damaging pistons, use an old pad to push it into the caliper using a C-clamp.*

6. Ensure brake pad spring is properly positioned onto caliper.
7. Install new brake pads.
8. Clean then lubricate brake pad pins using grease.
9. Install brake pad pins on caliper.
10. Install caliper on knuckle.

BRAKE DISC

Brake Disc Inspection

1. Check disc surfaces for scratch or grooves on both sides.
2. Measure thickness of the disc.

   THICKNESS: 4.1 mm.

NOTICE: *Brake discs must never be machined*

3. Check warpage of disc.

   Maximum disc warpage : 0.2 mm.

Brake Disc Replacement

1. Remove caliper.
2. Remove brake disc mounting bolts.
3. Replace brake disc.
4. Install new brake disc.
5. Apply thread locker (LOCTITE 243) on disc retaining bolts and tighten with torque.
6. Install caliper and install **NEW** cotter pin to secure wheel hub castle nut.

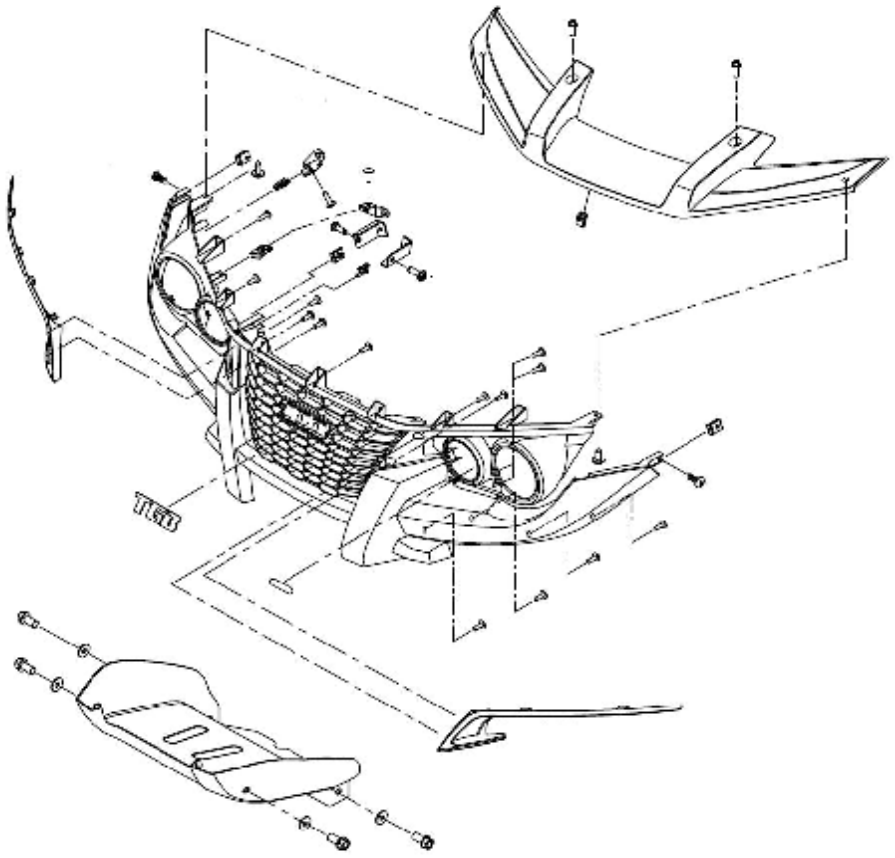
TORQUE:

Brake Disc:320-350 kgf-cm.

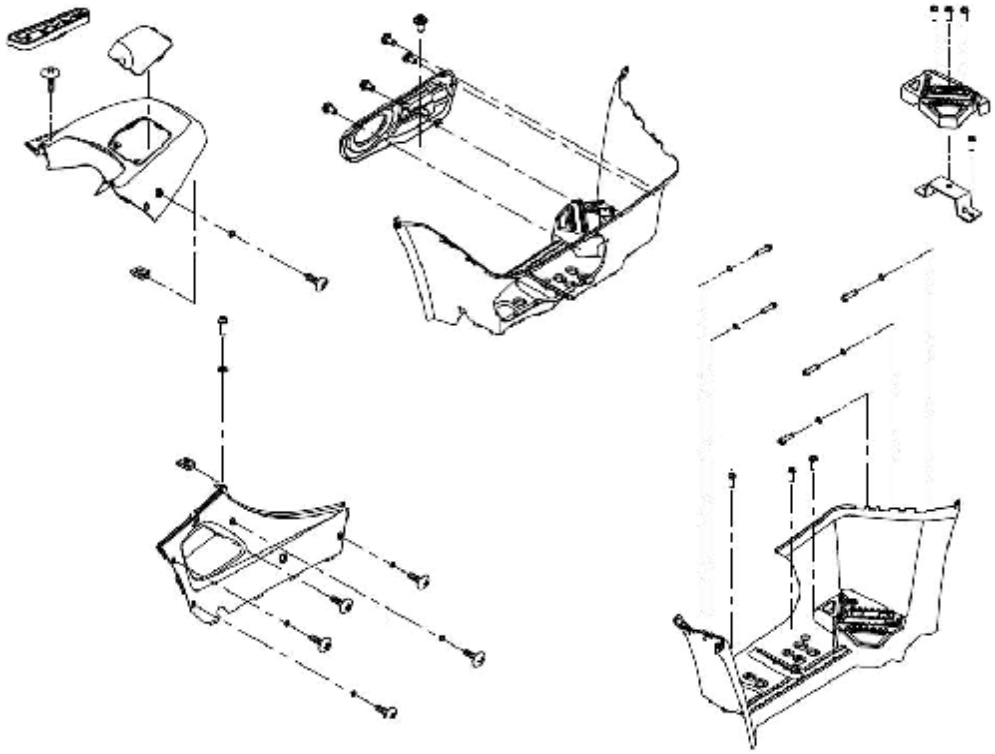
Castle Nut:950-1200 kgf-cm

BODY

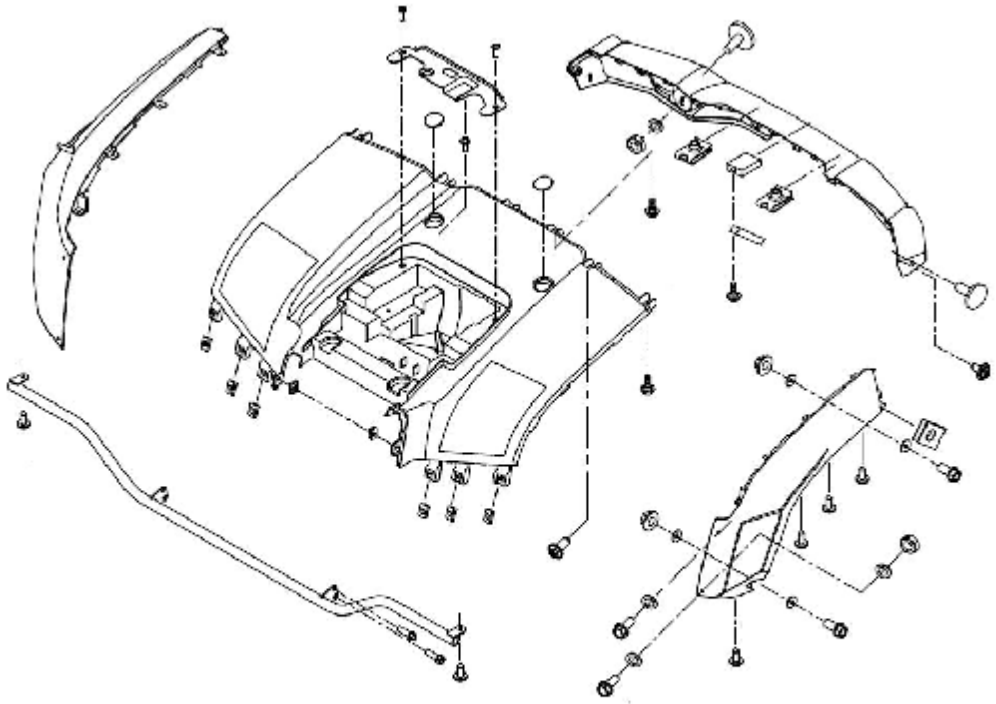
FRONT BUMPER



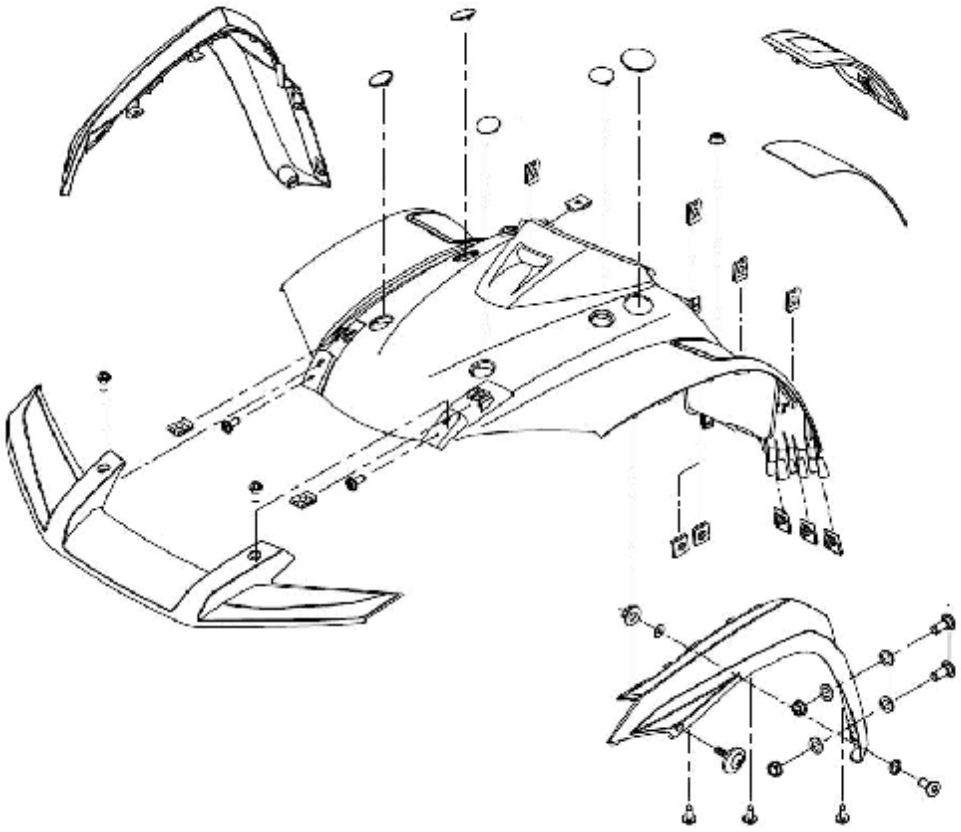
TOP COVER, SIDE COVER, FOOTREST



FRONT COVER



REAR COVER



REMOVAL

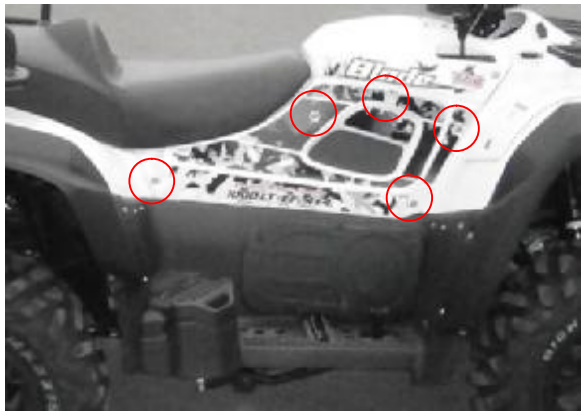
Top Cover

- Unscrew the jam nut.
- Unscrew and remove the shift gear lever holder.

- Remove the four bolts at front and two bolts at rear of the top cover as shown.

Side Cover

- Remove both side five bolts and the side covers as shown.



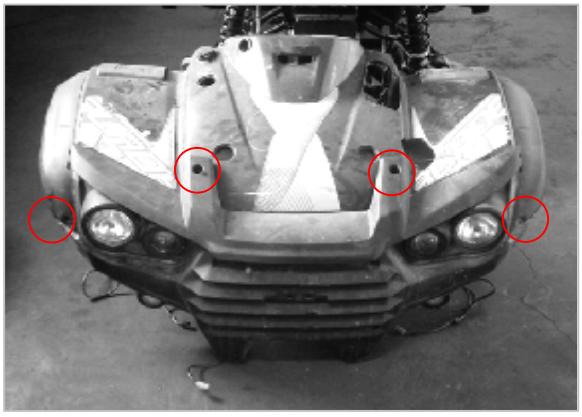
Front Bumper Steel

- Remove both side retaining bolts.
- Remove the front bumper steel.

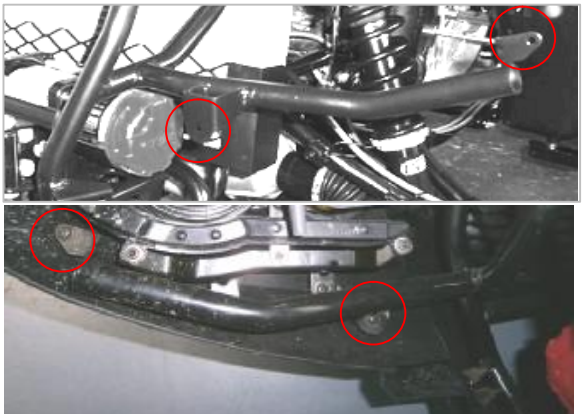
NOTE: *After remove the front bumper steel, the front lower shield detach at same time.*

Front Bumper Comp.

- Disconnect front lamp connector.
- Remove the four retaining bolts on the front side.



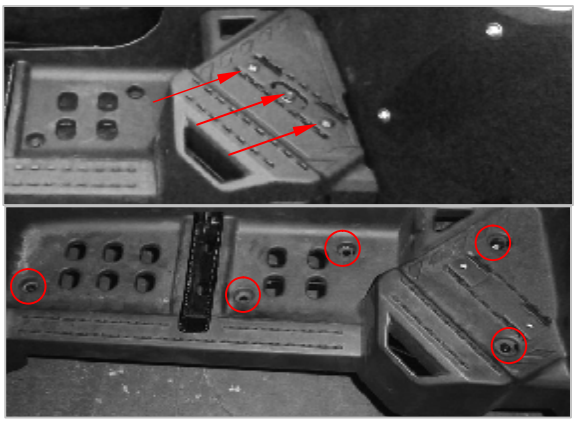
- Remove the four retaining bolts on the backside.



Footrest

- Remove both side footrest-connecting bolts as shown.

- Remove passenger footboard mounting bolts.
- Remove footrest bracket mounting bolts.



Inner Fender

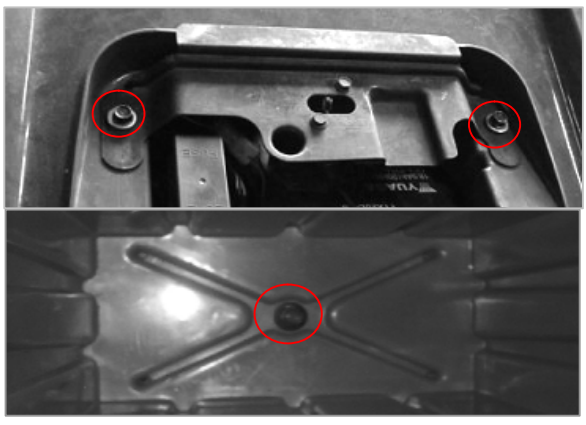
- Remove the five retaining screws and inner fender as shown.

Front Cover

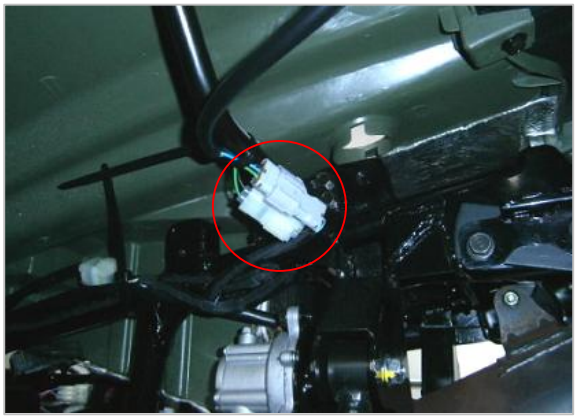
- Disconnect DC supply connector.
- Remove two front cover retaining bolts and take out the front cover.

Rear Cover

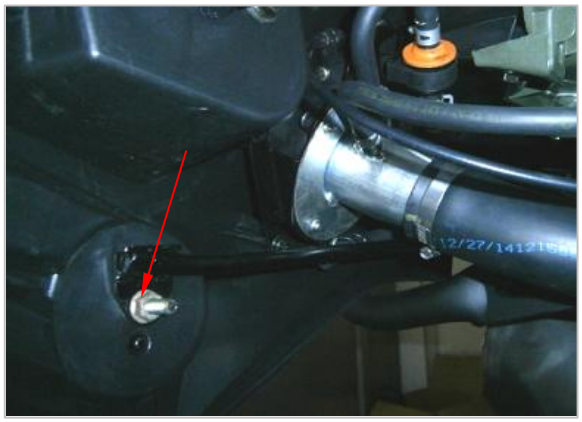
- Remove the seat.
- Remove the fixing plate two bolts.
- Remove the battery and disconnect the electric parts connectors.
- Remove rear cover retaining bolts.



▪ Disconnect rear light lamp connector.

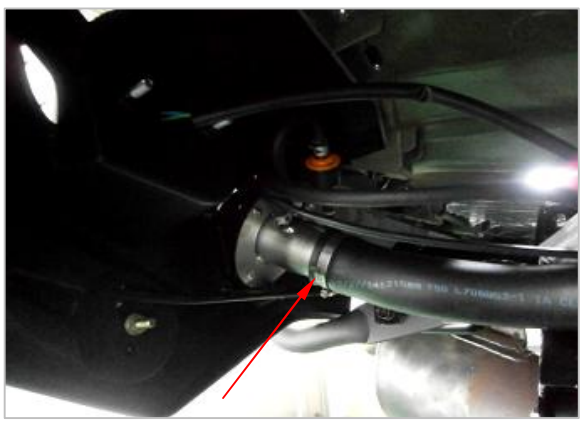


▪ Remove both side reflector retaining nuts.



▪ Remove two retaining screws on the inside of rear cover.

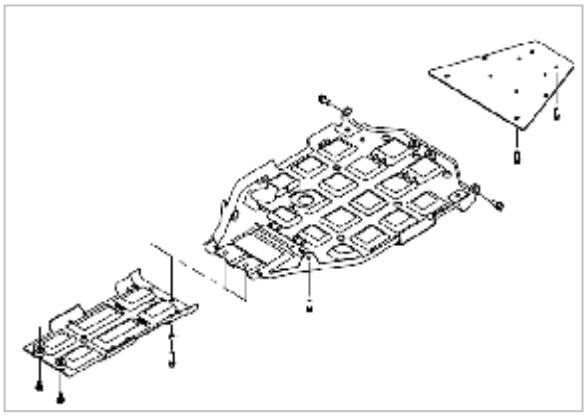
▪ Remove the fuel hose clamp from the fuel filler assembly and detach the hose.



- Loosen the fuel tank breath hose retaining clip and remove the hose.
- Remove the rear cover together with rear bumper and fender side rail.

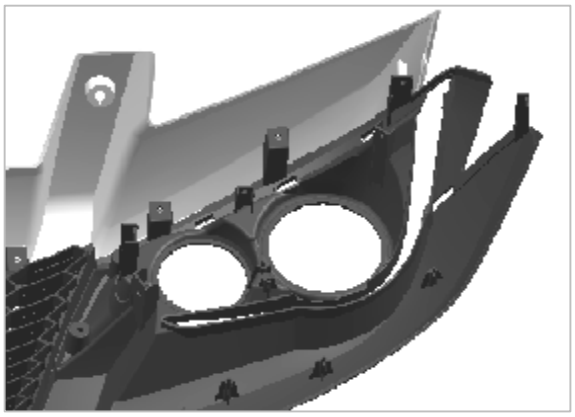
Skid Plate

- Remove retaining bolts and plate from the bottom of the frame.

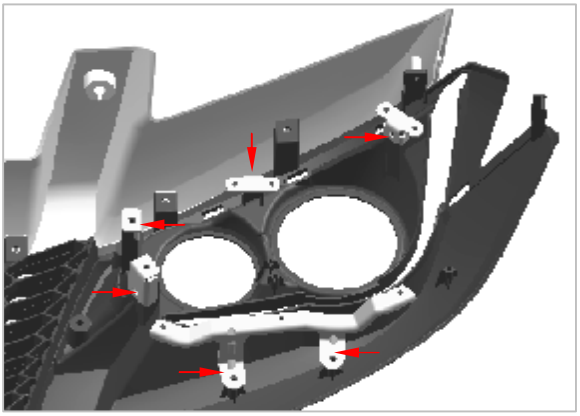


INSTALLATION

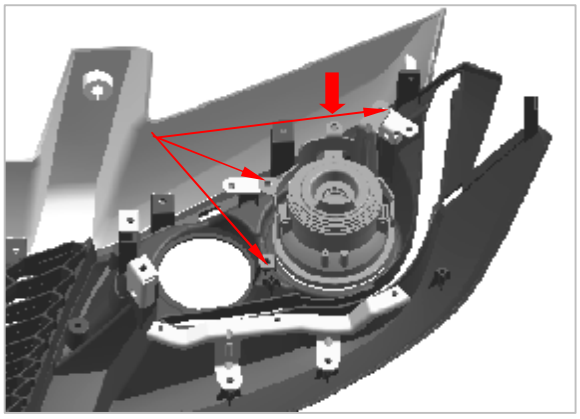
- . For installation, reverse the removal procedure.



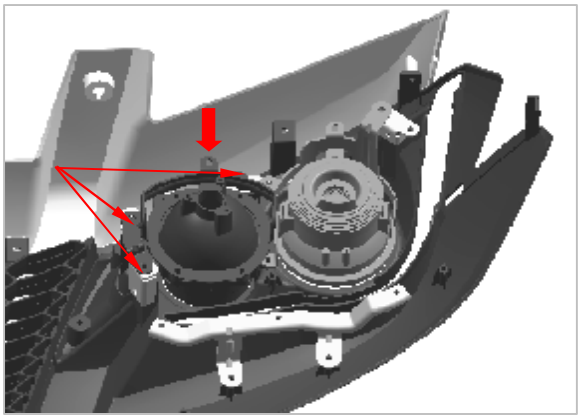
- Install the bracket set of lamp.



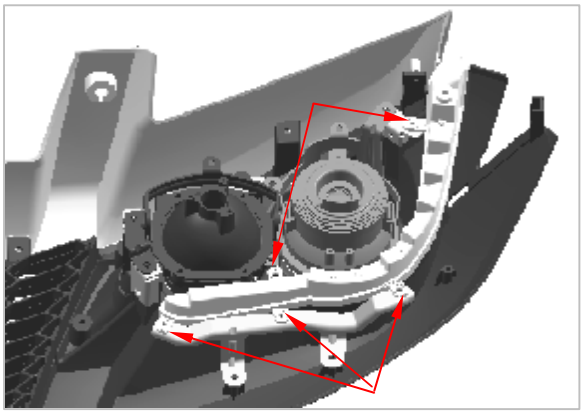
- Install passing beam headlight three mounting screws.
- Adjust the suitable aiming height of lamp.

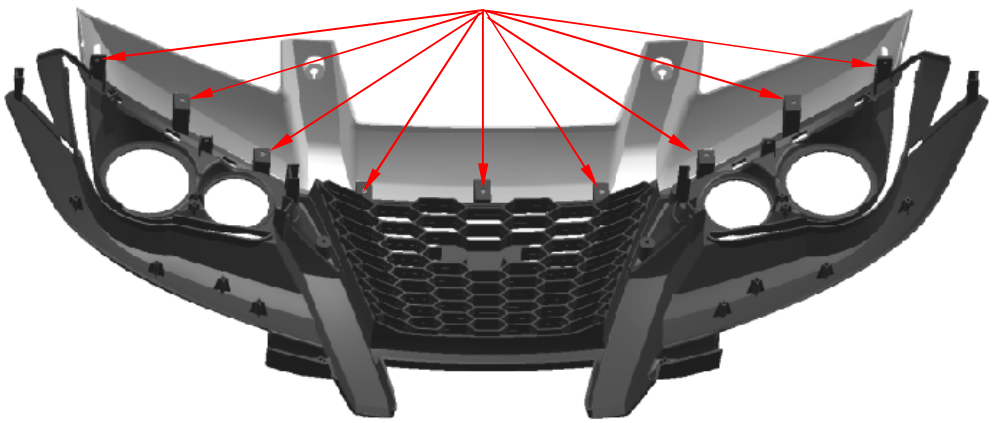


- Install driving beam headlight three mounting screws.
- Adjust the suitable aiming height of lamp.

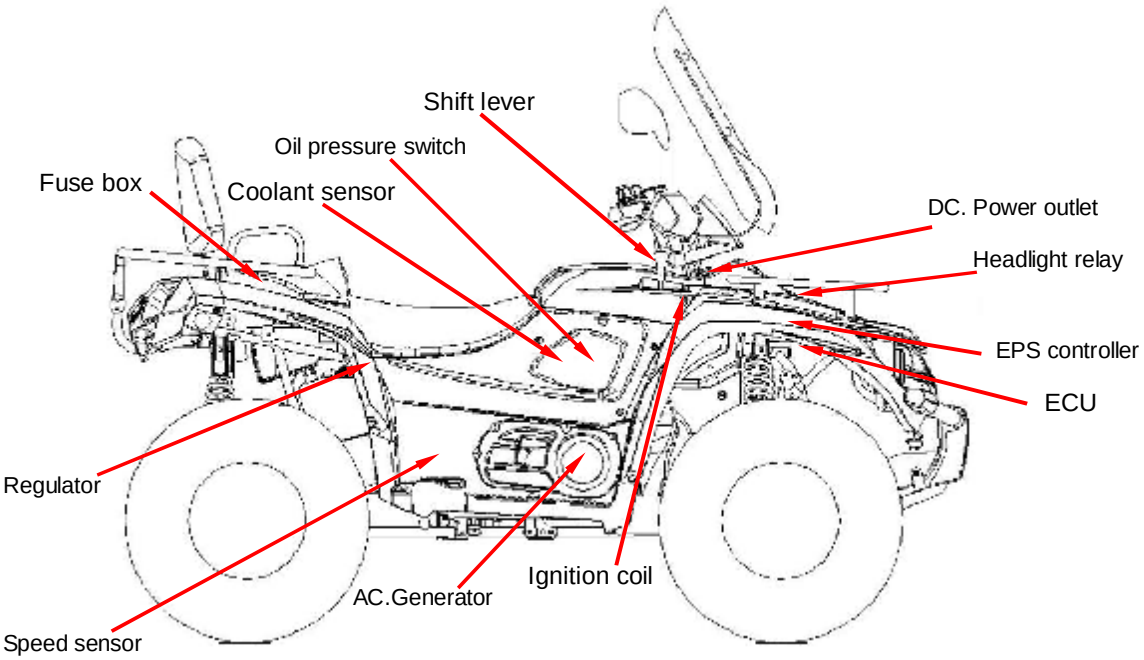


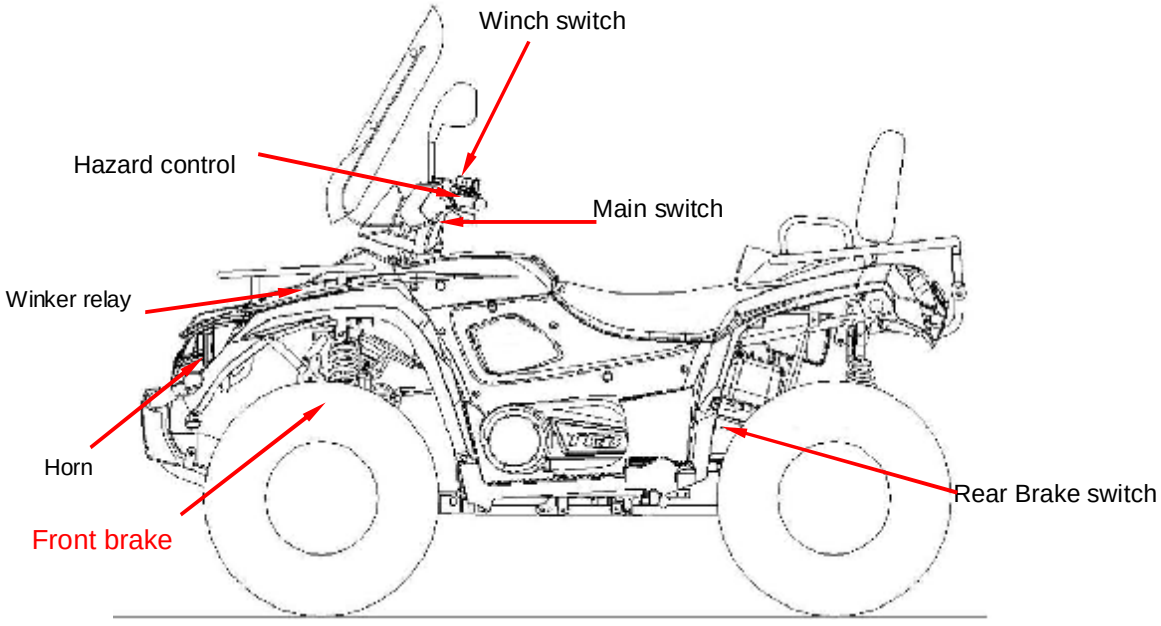
- Install the winker/position/daytime running lamp five mounting screws.





Mechanism Diagram





ELECTRIC SYSTEM

IGNITION SYSTEM

GENERAL

WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be replaced.

Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

SYSTEM DESCRIPTION

The battery suppliers the primary side of ignition coil through the main relay while ECU completes the circuit for each cylinder by switching it to the ground at the right moment. The ECU can direct open and short circuit in the primary winding but it does not check the secondary winding.

Ignition Timing

Ignition timing is not adjustable.

TROUBLESHOOTING

- It is good practice to check for fault codes using the diagnostic tool.
- Always refer to the WIRING DIAGRAM when troubleshooting an electrical circuit.

DIAGNOSTIC GUIDELINES

The following is provided to help in diagnosing the probable cause of a problem. It is a guideline and should not be assumed to list all possible causes.

ENGINE WILL NOT START (ENGINE TURNS OVER)

1. Fouled or defective spark plug.
   - Replace.
2. Defective CPS.
   - Check operation of CPS and replace if necessary..
3. Defective trigger wheel.
   - Check.
4. Defective ignition circuit.
   - Check fuse of fuse box, ignition coil and wiring condition.
5. Defective fuel pump.
   - Check fuel pump.
6. Defective fuel injectors or circuit.
   - Check fuel injectors.

ENGINE HARD TO START

1. spark plug faulty, fouled or worn out.
   - Check spark plug condition, replace if necessary.
2. Low fuel pressure.
   - Test fuel pressure.

ENGINE MISFIRES, RUNS IRREGULARLY

1. Fouled or defective, worn spark plugs.
   - Check/verify heat range/gap/replace.
2. Damaged trigger wheel/loose CPS.
   - Check.
3. Defective ignition circuit.
   - Check ignition coil, fuse, and wiring condition.
4. Poor engine grounds.
   - Check/clean/repair.

ENGINE CONTINUALLY BACKFIRES

1. Fouled, defective spark plus.
   - Check/replace.
2. Damaged trigger wheel/defective or loose CPS. - Check.

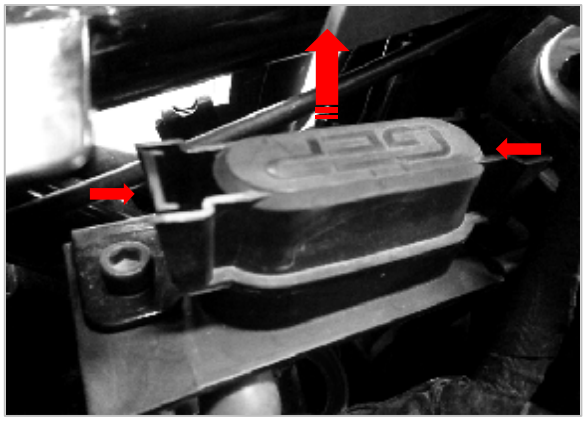
IGNITION SYSTEM

FUSE

MAXI FUSE

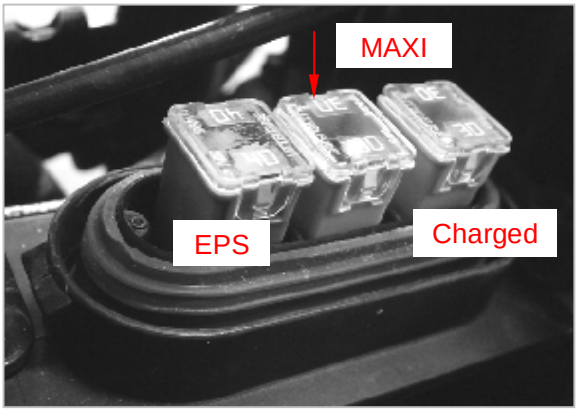
EPS Model

- Remove the seat.
- Remove the isolate shield.
- Push inward from the both side and lift up the cap.



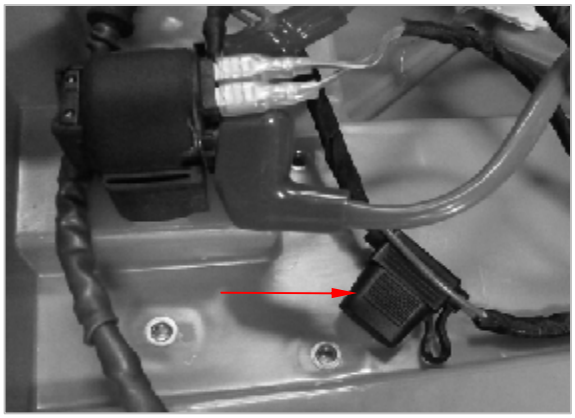
- Check the fuse condition, replace if necessary.

ESP：40 A, Green
MAXI FUSE：30 A, Pink
Charged：30 A, Pink



MAXI FUSE

Non EPS Model



Fuse Box

IGNITION SWITCH

Ignition Switch Quick Test

- Turn ignition switch to ON position.
- If dashboard turns on (assuming it works), the ignition switch is good.
- If dashboard does not turn on, check the following:
  - Battery.
  - Fuses (main fuse, fan, headlight, brake light)
  - ECU is properly powered.
  - Ignition switch.

Ignition Switch Wire Identification

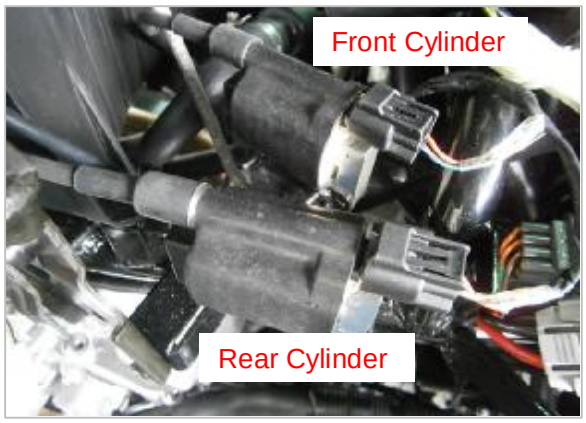
PIN A = 12 Vdc output

PIN B = 12 Vdc input

PIN C = Ground through ECU.

PIN D = Ground signal to ECU in OFF position.

PIN E = 12 Vdc output (ECU, starter and start switch).



Ignition Coil location

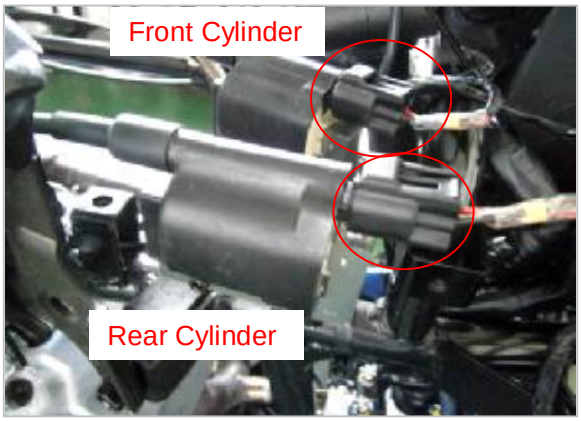
Cylinder 1 (rear): R/BK-Y

Cylinder 2 (front): R/BK-Bu

Ignition Coil Installation

Install two bolts on the bracket and tighten to the specified torque.

TORQUE: 8 Nm+/- 1

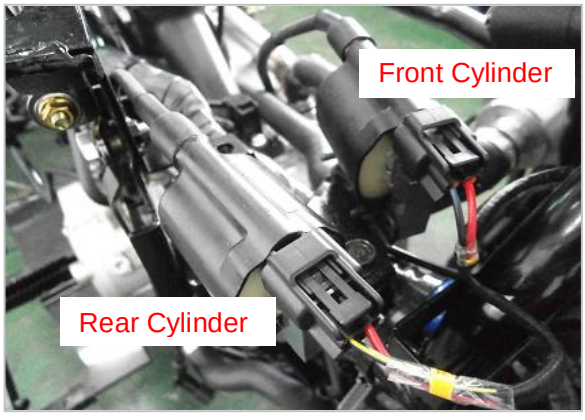


Ignition Coil Input Voltage Test

- Disconnect the 2-pin connector from the ignition coil.
- Turn ignition switch ON.
- Using multimeter read the voltage.

Pin 2 and battery ground = battery voltage

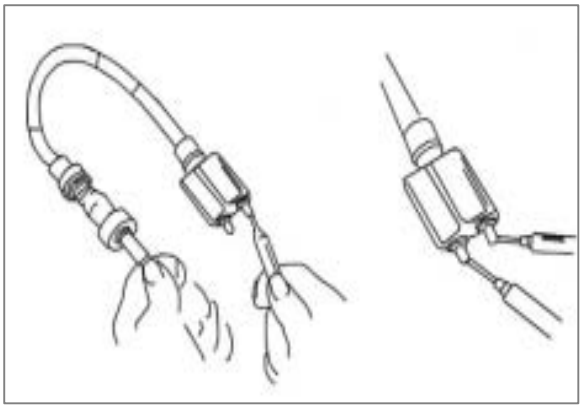
- Battery voltage should be read.
- If battery voltage is NOT read, check continuity of ignition coil supply circuit.



Ignition Coil Ground Circuit Continuity Test

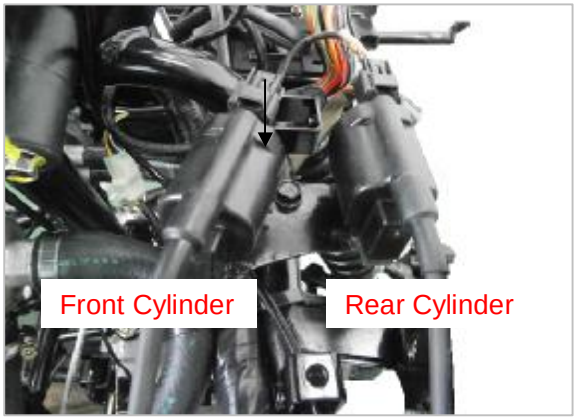
Pin 1 and ECM

Pin 1 and ECM



Ignition Coil Resistance Test

An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level that is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test. Disconnect ignition cables from spark plugs.



Inspection on Ignition Coil

Disengage the connector of the ignition coil and the spark plug cap.

Measure the resistance between the terminals of the primary winding.

Standard resistance: 2.9Ω ± 10%

Remove the cap from the spark plug and measure the resistance between the spark plug and the primary winding.

Standard resistance:

With no cap: 15.0Ω ± 10%

With cap: 20.0±10%KΩ

SPARK PLUG

Troubleshooting Fouled Spark Plug

Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is due to a loss of compression. Other possible cause are : prolonged idling or low speed riding, a clogged air filter, incorrect fuel, defective ignition system, incorrect spark plug gap, lubricating oil entering the combustion chamber, or too cold spark plug.

The plug face of a fouled spark plug has either a wet black deposit or a black carbon fouling. Such coatings form a conductive connection between the center electrode and ground.

Spark Plug Analysis

The plug face reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at regular intervals, examining the plug face.

CHARGING SYSTEM

GENERAL

SYSTEM DESCRIPTION

The purpose of the charging system is to keep the battery at a fuel state of charge and to provide the electrical system with the required electrical power for normal vehicle operation.

AC Generator

The AC generator is the primary source of electrical energy. It transforms magnetic field into electric current (AC).
The ACG has a 3 phase series stator.

Voltage Regulator/Rectifier

The rectifier receives AC current from the magneto and transforms it into direct current (DC).
The voltage regulator, included in the same unit, limits voltage to prevent any damage to electrical components.

Battery

The battery supplies DC power to the electric starter for cranking the engine. During engine starting, it also supplies DC power to the entire electrical system.
At low engine RPM operation and high current load conditions, it supplements the magneto output and helps to maintain a steady system voltage.

INSPECTION

CHARGING SYSTEM OUTPUT

First ensure that battery is in good condition prior to performing the following tests.

Output Voltage Test

1. Start engine.

2. Increase engine RPM and read voltage.
   If voltage is above specification, replace voltage rectifier.
   If voltage is below specification, check stator output and wiring harness prior to concluding that voltage rectifier is defective.

Output Voltage Test

1. Connect multimeter to battery posts.
2. Start engine.
3. Increase engine RPM and read voltage with multimeter.

Test engine speed 4000 RPM = 14.8 +/- 0.4 Vdc

If voltage is above specification, replace voltage rectifier.
If voltage is below specification, check stator and wiring harness prior to concluding that voltage rectifier is defective.

TROUBLESHOOTING

BATTERY REGULARLY DISCHARGED OR WEAK

1. Loose or corroded battery cables connections.
   - Tighten or repair battery cables connections.
2. Worn or defective battery.
   - Change and test battery.
3. Defective magneto stator.
   - Test stator.
4. Defective rectifier.
   - Test system voltage.
5. Damaged magneto rotor or Woodruff key.
   - Replace magneto rotor or Woodruff key.

PROCEDURE

VOLTAGE RECTIFIER

The rectifier is located on the RH, underneath the rear cover beside the RH side cover.

BATTERY

Battery Voltage Test (No Load Applied)

NOTE: *A voltage test is carried out on a battery without discharging current. It is the simplest and most commonly used. However, be aware that the voltage test can be good; while the battery does not have enough power to crank the engine .A load test gives a more accurate condition of the battery.*

A voltage reading provides an instant indication of the state of charge of the battery, not of it's current output capacity. A load test gives a more accurate indication of the battery's condition.

If the battery has just received a charge, allow it to rest for 1-2 hours before taking a voltage reading.

FULLY CHARGED BATTERY VOLTAGE: 12.6 Vdc minimum.

NOTE: *A battery that shows a voltage of 12.0 Vdc is considered completely discharged and need to be recharged.*

Battery Load Test

This is the best test to indicate a battery condition. Use a load testing device and has a 500 Amp adjustable load.

Apply a load of 3 times the ampere-hour rating of the battery. At 14 seconds into the test, check battery voltage.

14 seconds = Min. 10.5 Vdc @ 20℃

Battery Removal

1. Disconnect BLACK (-) cable first, then the RED (+) cable.

NOTICE: *Always respect this order for removal; disconnect BLACK (-) cable first.*

2. Remove battery strap retaining nut.
3. Unhook the top of battery strap.
4. Remove battery.

Battery Cleaning

Clean the battery rack, cables and battery posts using a solution of baking soda and water.
Remove corrosion (if so) from battery cable terminals and battery posts using a firm wire brush. Rinse with clear water and dry well.

Battery Storage

If the battery is in storage or used infrequently, disconnect the battery cables to eliminate drain from electrical equipment.
For extended storage, remove the battery from vehicle.
Clean battery terminals and cable connections using a wire brush. Apply light coat of ELECTRIC GREASE on terminals.
Clean battery casing using a solution of baking soda and water. Rinse battery with clear water and dry well using a clean cloth.
Regularly charge battery as per manufacturer's recommendations.

WARNING

Ensure to store battery in a safe place, out of reach for children.

Battery Installation

NOTICE: *Always connect RED (+) cable first then BLACK (-) cable.*
For installation, reverse the removal procedure.
- Install the battery with the positive post down.
- Tighten battery strao retaining nut to the specified torque.

TORQUE: 3.4 Nm+/- 0.3.

STARTING SYSTEM

GENERAL

WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices when removed (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced.

Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

SYSTEM DESCRIPTION

The starting system is composed of an electric starter supplier in current by the battery through a solenoid.
The starter solenoid receives a 12 volt input from ignition switch and the ground signal is provided by the ECU when the engine cranking conditions are met:
- Ignition switch ON.
- Transmission in Park or neutral position and/or brake lever or pedal held.
- Start button held.

NOTE: If the ignition switch is left ON for more than 15 minutes, engine will not start unless ignition switch is turned OFF, then ON again.

TROUBLESHOOTING

Always refer to the WIRING DIAGRAM when troubleshooting an electrical circuit.
Check all connections, cables and wires.
Tighten any loose connections. Replace any chafed or corroded wires/cables.

ENGINE DOES NOT CRANK AND GAUGE DOES NOT TURN ON

1. Burnt main fuse.
   - Check fuse.
2. Burnt ignition fuse
   - Check fuse.
3. Defective or discharged battery
   - Test battery.
4. Defective ignition switch or circuit.
   - Check ignition switch.

ENGINE DOES NOT CRANK BUT GAUGE TURN ON

1. Defective brake switch.
   - Check brake switch.
2. Defective gearbox position sensor.
   - Check gearbox position sensor.
3. Defective start button or circuit.
   - Test start button.
4. Defective starter solenoid or circuit.
   - Check starter solenoid.
5. Defective starter motor.
   - Check starter motor.

PROCEDURES

Start Button Wire Identification

12 V input from ignition switch = Black/Yellow.

12 V output to ECU pin = Yellow/Red.

Start Button Resistance Test

Disconnect start button connector.

Using multimeter measure resistance:

Switch released = infinite

Switch depressed and held = 0.6 Ωmax.

Replace start button if defective.

STARTER RELAY

Start Relay Wire Identification

12 V input from ignition switch = Black/Yellow.

Ground from ECU pin = Orange/Brown.

Starter Relay Operational Test

1. Disconnect both terminals from the starter relay.
2. Connect pin 1 to the positive battery terminal.
3. Momentarily connect pin 2 to the chassis ground.

If starter runs, carry out the STARTER RELAY INPUT VOLTAGE TEST.

If starter does not run, carry out the SATRTER RELAY WINDING RESISTANCE TEST.

Starter Relay Input Voltage Test

1. Disconnect connector with Black/Yellow wire.
2. Turn ignition switch ON.
3. Measure voltage:

Black/Yellow wire and *Battery ground = battery voltage*.

Starter Relay Ground Signal Test

1. Disconnect pin 2 (Orange/Brown) from relay.
2. Turn ignition switch ON.
3. Measure voltage:

Orange/Brown wire and Battery positive post = Battery voltage.

Starter Relay Winding Resistance Test

Disconnect terminals from relay.

With a multimeter, check primary winding resistance:

Starter Relay pin 1 and *pin 2 = Approximately 5* Ω.

If measurement is out of specification, replace relay.

Starter Relay Voltage Drop Test

Turn ignition key ON.

Measure voltage while cranking engine:

Post from battery and post going to starter = 0.2 Vdc max.

If voltage is out of specification, replace relay.

ELECTRIC STARTER

Starter Operation Test

Using booster cables, carefully supply current from a 12 volt battery directly to the starter.
Connect the Black (-) cable first, then connect the remaining jumper cable from the battery then to the starter.
If starter turns, test other starting system components.

Starter Removal

Turn OFF ignition switch.
Disconnect BLACK (-) cable from battery.

WARNING

Always disconnect BLACK (-) cable first and reconnect last.

Disconnect RED (+) cable from starter.
Clean starter area.
Remove starter-retaining screw.
Carefully pry starter out of the engine crankcase.

Starter Installation

Installation is the reverse of removal procedure.
Make sure that starter and engine mating surface are free of debris. Serious problem may arise if the starter is not properly aligned.
Bring starter close to its location. Rotate it so that its mounting ear allows installation in engine crankcase.
Push starter in place and align mounting ear to install screw. Tighten to the specified torque.
TORQUE: 25 Nm.
Connect the RED (+) cable to the starter and tighten nut and apply specified product.

CAUTION

When connecting the RED (=) cable to the starter motor, make sure the battery cables are disconnected.

TORQUE: 6 Nm.

First connect RED(=) cable to battery then connect BLACK(-) cable.

Connect battery cables.

WARNING

Always connect RED (+) cable first and BLACK (-) cable last.

Test starter operation.

LIGHTS, SPEEODEMETER AND ACCESSORIES

GENERAL

NOTICE: *it is recommended to always disconnect the battery when replacing any electric or electronic parts. Always disconnect battery exactly in the specified order, black (-) cable first.*

TROUBLESHOOTING

DIAGNOSTIC

IMPORTANT: When troubleshooting an electronic system fault, check battery condition, cables and connections first.

Circuit Testing

Check the related-circuit fuse condition with a fuse tester or test lamp.

NOTE: *If the ignition switch is left ON for more than 30 minutes, the accessory relay will shut down.*

Electronic Connection Inspection

When replacing an electric or electronic component, always check electronic connections. Make sure they are tight, make good contact, and are corrosion-free. Dirty, loose or corroded contacts are poor conductors and are often the source of a system or component malfunction.

Ensure all wire terminals are properly crimped on wires, and connector housings are properly fastened.

Check for signs of moisture, corrosion or dullness.

Clean pins properly and coat them with DIELECTRIC GREASE or other appropriate lubricant when reassembling them, except if otherwise specified such as for the ECU connectors.

HEADLIGHTS

Headlight Wire Identification

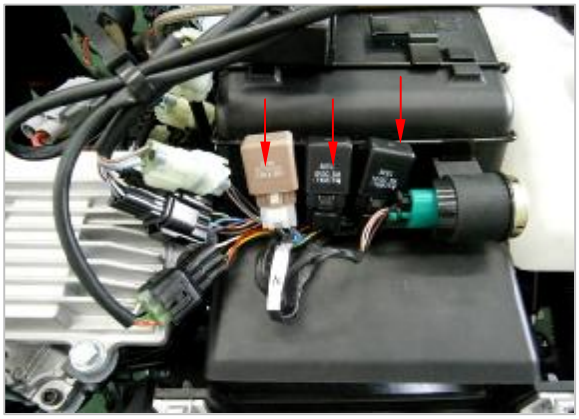
Headlight Relay

12 volt input from fuse (headlight power) = Yellow/Black.

12 volt input from ignition switch (relay winding input) = Yellow/Blue.

12 volt output to headlights low beam and low/high beam switch = Green.

Relay winding ground (from ECU) = Orange/Black.



Headlight Low/High Beam Switch

12 volt input from headlights relay = Green.

12 volt output to high beam headlights = Blue.

Headlight Test

Disconnect headlight connector.

Using multimeter measure the voltage:

SWITCH POSITION	***WIRE COLOR***		***VOLTAGE***
LO beam/ HI beam	*Green*	*Black*	*Battery voltage*
HI beam	*Blue*	*Black*	

Headlight Bulb Replacement

NOTICE: *Never touch glass portion of an halogen bulb with bare fingers, it shortens its operating life. If glass is touched, clean it with isopropyl alcohol which will not leave a film on the bulb.*

NOTE: *The same bulb type is used for LO and HI beams on both sides of vehicle.*

Open the rubber cover.

Unplug connector from bulb.

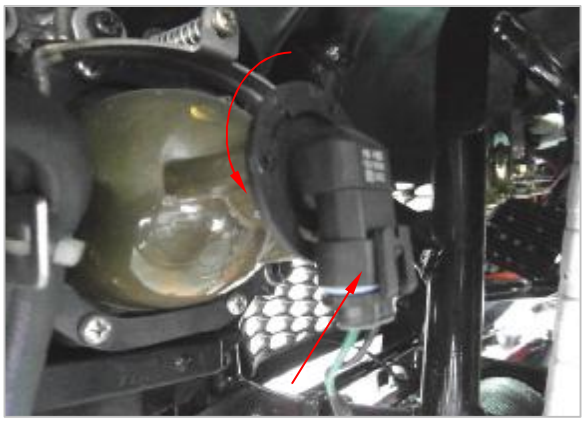
Lift and release the fixing spring.

Pull the bulb out.

Properly reinstall removed parts in the reverse order of their removal.

Validate headlight operation.

- Disconnect the wiring connector.
- Counter clockwise then remove the bulb.



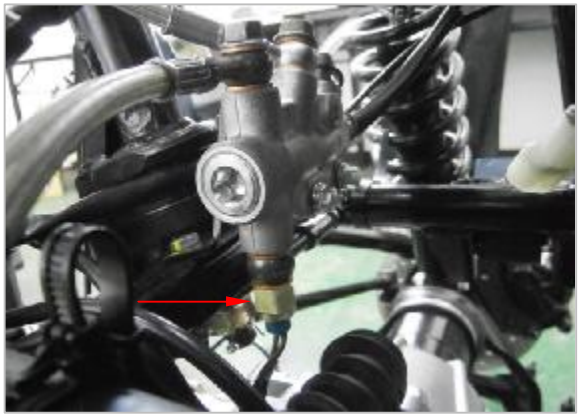
Installation

- For installation, reverse the removal procedure.

TAILLIGHTS/BRAKE LIGHTS

Brake Light Switch

- Disconnect the front brake switch connector.
- Press the right brake lever and check continuity of brake switch connector.
- Replace if necessary.



Torque:

- Disconnect the rear brake switch connector.
- Press the left brake lever or pedal then check continuity of brake switch connector.
- Replace if necessary.

Torque:

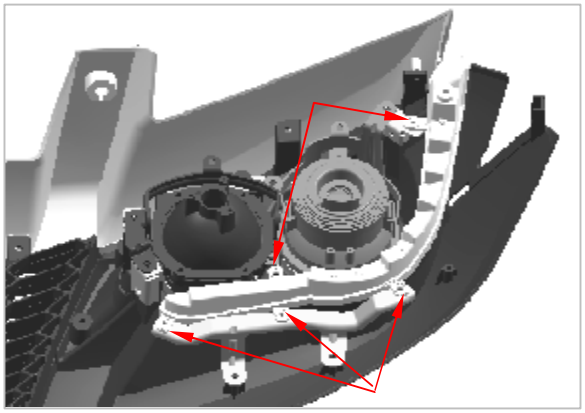
Taillight/Brake Light Replacement

- Disconnect the taillight wiring connector.
- Loosen and remove two nuts and washers.
- Pull taillight out through the rear bumper.
- For installation, reverse the removal procedure.

TURN SIGNAL LAMP

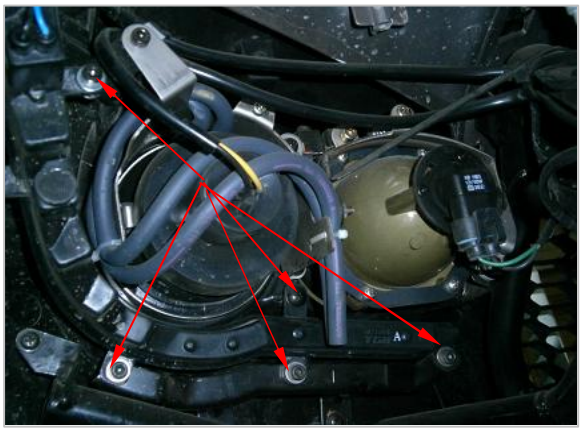
Turn Signal

- Disconnect the wiring of turn signal connector.
- Press the left brake lever or pedal then check continuity of brake switch connector.
- Replace if necessary.



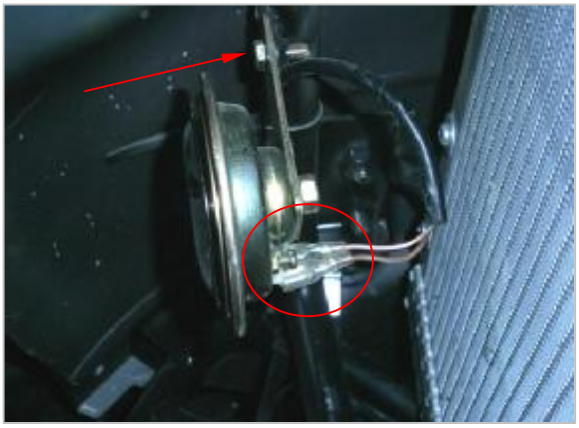
Replacement

- Remove five screws of turn signal lamp.
- For installation, reverse the procedure of removal.



HORN

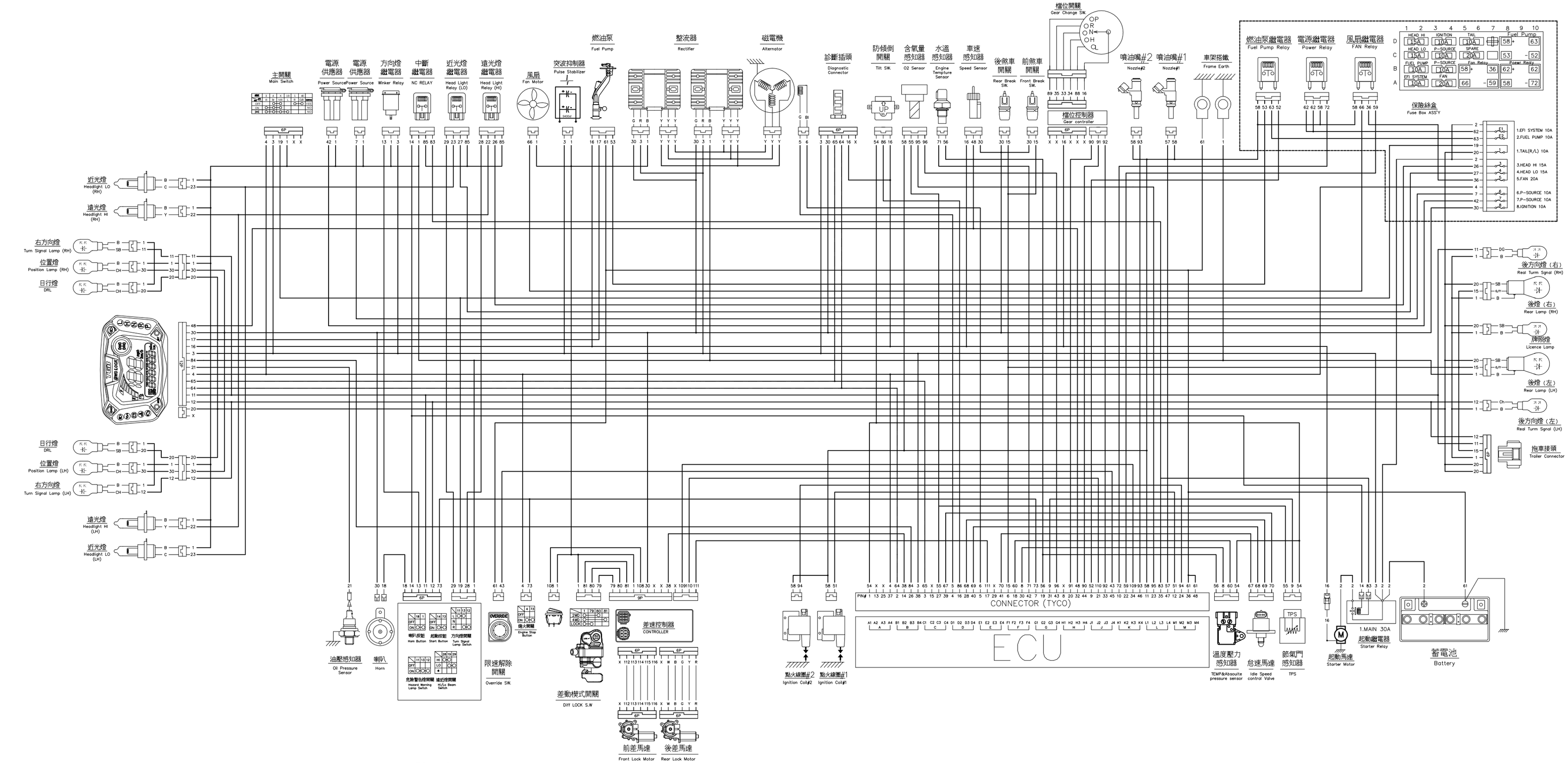
- Disconnect the wiring of horn connector.
- Press the horn switch and check continuity.
- Replace if necessary.

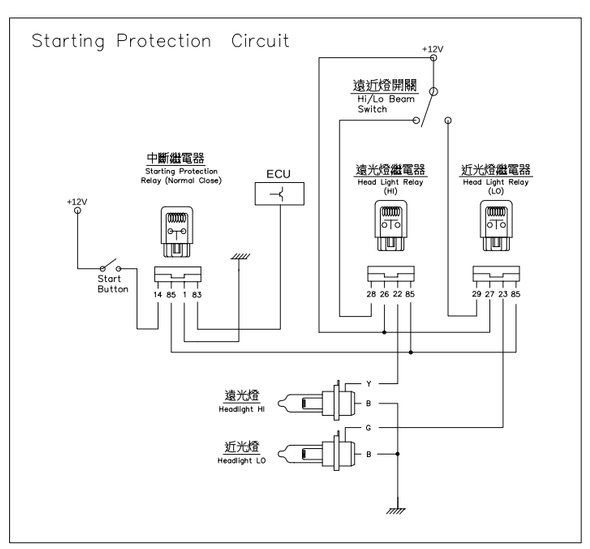


Horn

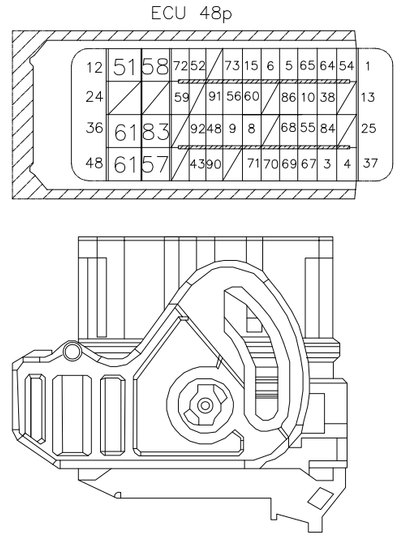
Replacement

- Remove bolt of horn.
- For installation, reverse the procedure of removal.





ECU 48p



代號	顏色	COLOR
1	黑	BLACK
2	紅	RED
3	紅／白	RED/WHITE
4	棕／藍	BROWN/BLUE
5	淺綠／紅	LIGHT GREEN/RED
6	藍／黃	BLUE/YELLOW
7	白／紅	WHITE/RED
8	綠／棕	GREEN/BROWN
9	白／棕	WHITE/BROWN
10		
11	深綠	DEEP GREEN
12	赤褐	CHOCOLATE
13	棕／白	BROWN/WHITE
14	藍／白	BLUE/WHITE
15	綠／黃	GREEN/YELLOW

代號	顏色	COLOR
16	黑／白	BLACK/WHITE
17	綠／白	GREEN/WHITE
18	粉紅	PINK
19	藍／紅	BLUE/RED
20	淺藍	SKY BLUE
21	藍／黑	BLUE/BLACK
22	黃	YELLOW
23	綠	GREEN
24		
25		
26	紅／黃	RED/YELLOW
27	紅／綠	RED/GREEN
28	黃／藍	YELLOW/BLUE
29	綠／藍	GREEN/BLUE
30	棕／黑	BROWN/BLACK

代號	顏色	COLOR
31		
32		
33		
34		
35		
36		
37		
38	白／綠	WHITE/GREEN
39		
40		
41	藍	BLUE (AVX2.0)
42	白／黑	WHITE/BLACK
43	紅／灰	RED/GRAY
44		
45		

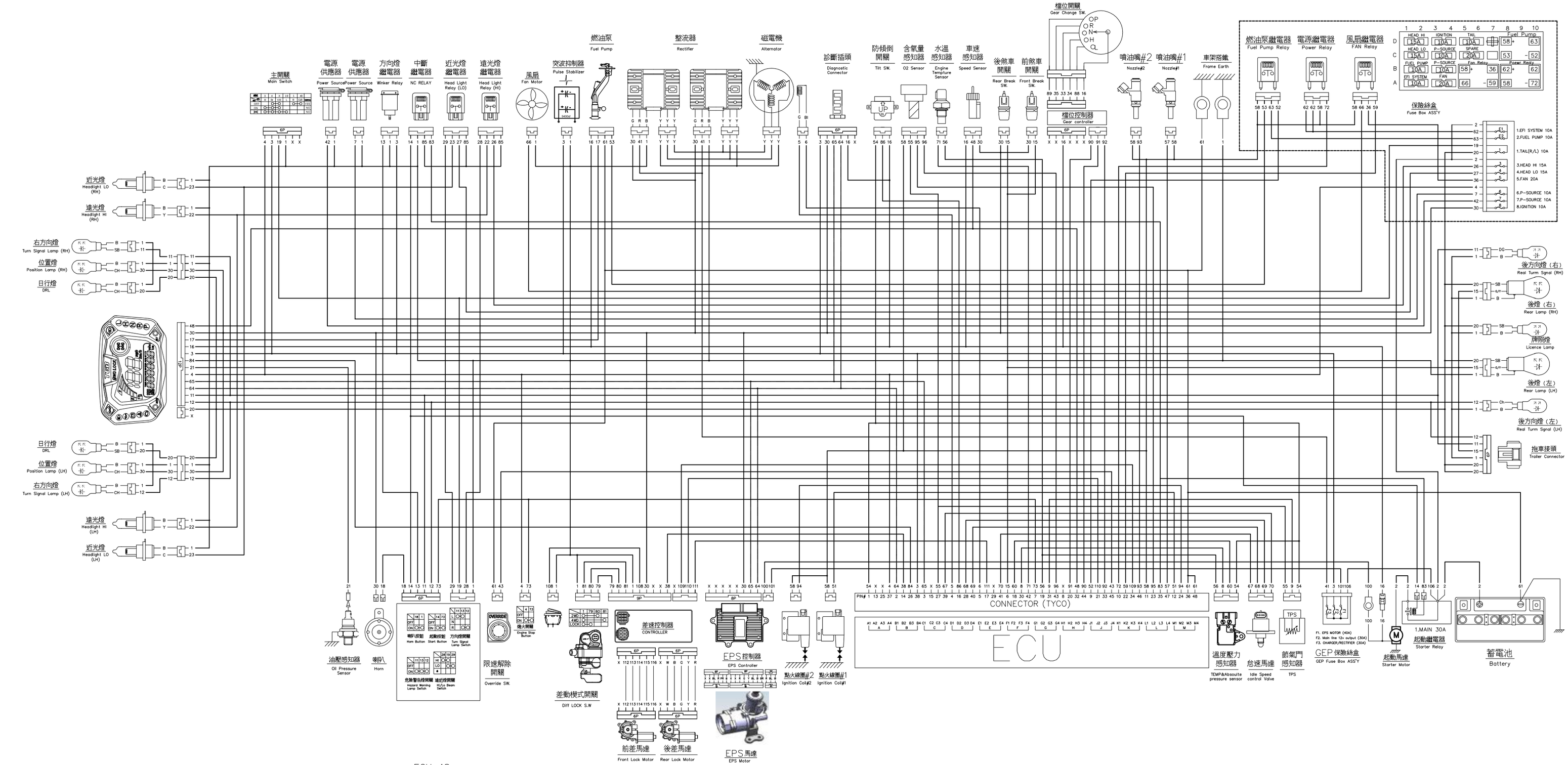
代號	顏色	COLOR
46		
47		
48	紫	PURPLE
49		
50		
51	黑／黃	BLACK/YELLOW
52	黑	BLACK
53	黑／紫	BLACK/PURPLE
54	黃／黑	YELLOW/BLACK
55	灰／紅	GRAY/RED
56	灰／紅	GRAY/RED
57	藍／綠	BLUE/GREEN
58	紅	RED
59	黑／白	BLACK/WHITE
60	白／黃	WHITE/YELLOW

代號	顏色	COLOR
61	黑	BLACK
62		
63		
64	粉紅／白	PINK/WHITE
65	粉紅／綠	PINK/GREEN
66	藍	BLUE
67	棕／黑	BROWN/BLACK
68	綠／黑	GREEN/BLACK
69	藍／黑	BLUE/BLACK
70	黑／黃	BLACK/YELLOW
71	黃／紅	YELLOW/RED
72	橙／白	ORANGE/WHITE
73	棕／白	BROWN/WHITE
74	黑／淺藍	BLACK/SKYBLUE
75	黑／淺藍	BLACK/SKYBLUE

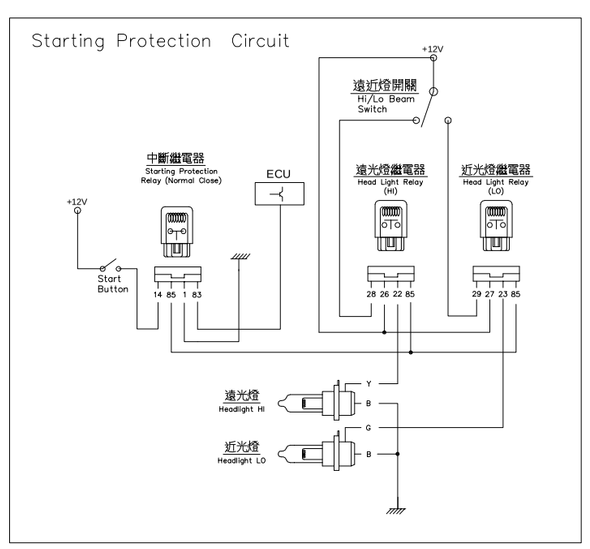
代號	顏色	COLOR
76		
77		
78		
79	白／藍	WHITE/BLUE
80	白／橙	WHITE/ORANGE
81	紫／白	PURPLE/WHITE
82		
83	黑／白	PURPLE/WHITE
84	黃／綠	YELLOW/GREEN
85	黑／白	BLACK/WHITE
86	紫／黑	PURPLE/BLACK
87		
88		
89		
90	藍	BLUE

代號	顏色	COLOR
91	白	WHITE
92	紅	RED
93	藍／白	BLUE/WHITE
94	黑／藍	BLACK/BLUE
95	淺綠／紅	LIGHT GREEN/RED
96	白	WHITE
108	茶／白	BROW/WHITE
109	灰／黑	GREY/BLACK
110	灰／紅	GREY/RED
111	灰／藍	GREY/BLUE
112		
113		
114		
115		
116		

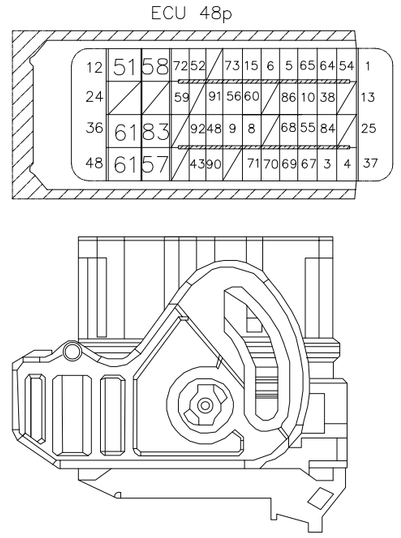
NO.	DATE 日期	SIGNATURE 簽名	PARTS REVISED 設變內容			
PCS 數量 1		MATERIAL 材質		DRAWN 繪圖	DESIGNED 設計	CHECKED 核對	APPROVED 核准
APPLICABLE TO: 適用處所 T6		SCALE 比例	FUNCTIONAL CLASS 等級	台灣金蜂股份有限公司 TAIWAN GOLDEN BEE CO., LTD.			
SURFACE TREATMENT 表面處理				DESCRIPTION 圖名 T6 迴路圖			
HEAT TREAMENT 熱處理				DRAWING NO. 圖號 00			



Starting Protection Circuit



ECU 48p



代號	顏色	COLOR
1	黑	BLACK
2	紅	RED
3	紅／白	RED/WHITE
4	棕／藍	BROWN/BLUE
5	淺綠／紅	LIGHT GREEN/RED
6	藍／黃	BLUE/YELLOW
7	白／紅	WHITE/RED
8	綠／棕	GREEN/BROWN
9	白／棕	WHITE/BROWN
10		
11	深綠	DEEP GREEN
12	赤褐	CHOCOLATE
13	棕／白	BROWN/WHITE
14	藍／白	BLUE/WHITE
15	綠／黃	GREEN/YELLOW
16	黑／白	BLACK/WHITE
17	綠／白	GREEN/WHITE
18	粉紅	PINK
19	藍／紅	BLUE/RED
20	淺藍	SKY BLUE
21	藍／黑	BLUE/BLACK
22	黃	YELLOW
23	綠	GREEN
24		
25		
26	紅／黃	RED/YELLOW
27	紅／綠	RED/GREEN
28	黃／藍	YELLOW/BLUE
29	綠／藍	GREEN/BLUE
30	棕／黑	BROWN/BLACK
31		
32		
33		
34		
35		
36		
37		
38	白／綠	WHITE/GREEN
39		
40		
41	藍	BLUE (AVX2.0)
42	白／黑	WHITE/BLACK
43	紅／灰	RED/GRAY
44		
45		
46		
47		
48	紫	PURPLE
49		
50		
51	黑／黃	BLACK/YELLOW
52	黑	BLACK
53	黑／紫	BLACK/PURPLE
54	黃／黑	YELLOW/BLACK
55	灰／紅	GRAY/RED
56	灰／紅	GRAY/RED
57	藍／綠	BLUE/GREEN
58	紅	RED
59	黑／白	BLACK/WHITE
60	白／黃	WHITE/YELLOW
61	黑	BLACK
62		
63		
64	粉紅／白	PINK/WHITE
65	粉紅／綠	PINK/GREEN
66	藍	BLUE
67	棕／黑	BROWN/BLACK
68	綠／黑	GREEN/BLACK
69	藍／黑	BLUE/BLACK
70	黑／黃	BLACK/YELLOW
71	黃／紅	YELLOW/RED
72	橙／白	ORANGE/WHITE
73	棕／白	BROWN/WHITE
74	黑／淺藍	BLACK/SKYBLUE
75	黑／淺藍	BLACK/SKYBLUE
76		
77		
78		
79	白／藍	WHITE/BLUE
80	白／橙	WHITE/ORANGE
81	紫／白	PURPLE/WHITE
82		
83	黑／白	PURPLE/WHITE
84	黃／綠	YELLOW/GREEN
85	黑／白	BLACK/WHITE
86	紫／黑	PURPLE/BLACK
90	藍	BLUE
91	白	WHITE
92	紅	RED
93	藍／白	BLUE/WHITE
94	黑／藍	BLACK/BLUE
95	淺綠／紅	LIGHT GREEN/RED
96	白	WHITE
100	黑	BLACK
101	紅	RED
106	紅	RED
108	茶／白	BROW/WHITE
109	灰／黑	GREY/BLACK
110	灰／紅	GREY/RED
111	灰／藍	GREY/BLUE
112	綠	GREEN
113	紅	RED
114	黃	YELLOW
115	黑	BLACK
116	白	WHITE

NO.	DATE 日期	SIGNATURE 簽名	PARTS REVISED 設變內容			
PCS 數量 1		MATERIAL 材質		DRAWN 繪圖	DESIGNED 設計	CHECKED 核對	APPROVED 核准
APPLICABLE TO: 適用處所 T6/EPS		SCALE 比例	FUNCTIONAL CLASS 等級	台灣金蜂股份有限公司 TAIWAN GOLDEN BEE CO., LTD.			
SURFACE TREATMENT 表面處理				DESCRIPTION 圖名 T6/EPS 迴路圖			
HEAT TREAMENT 熱處理				DRAWING NO. 圖號 00			