Play different

TGB 1000 UTV

SERVICE MANUAL

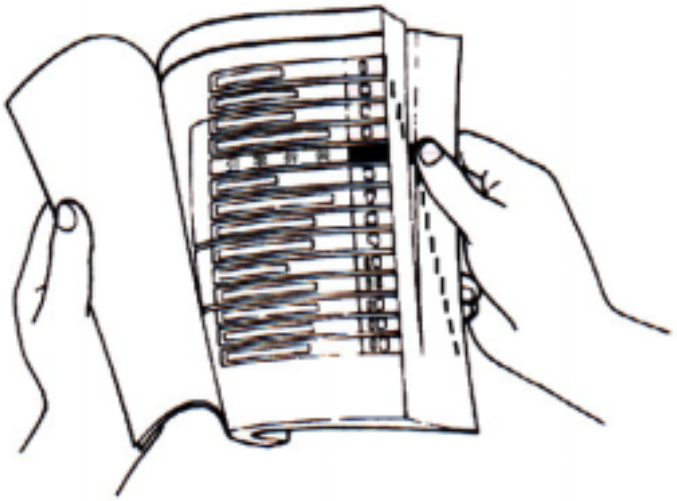
TAIWAN GOLDEN BEE CO.,LTD.

This service manual contains the technical data of each component inspection and repairs for the TGB UTV 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 UTV 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.

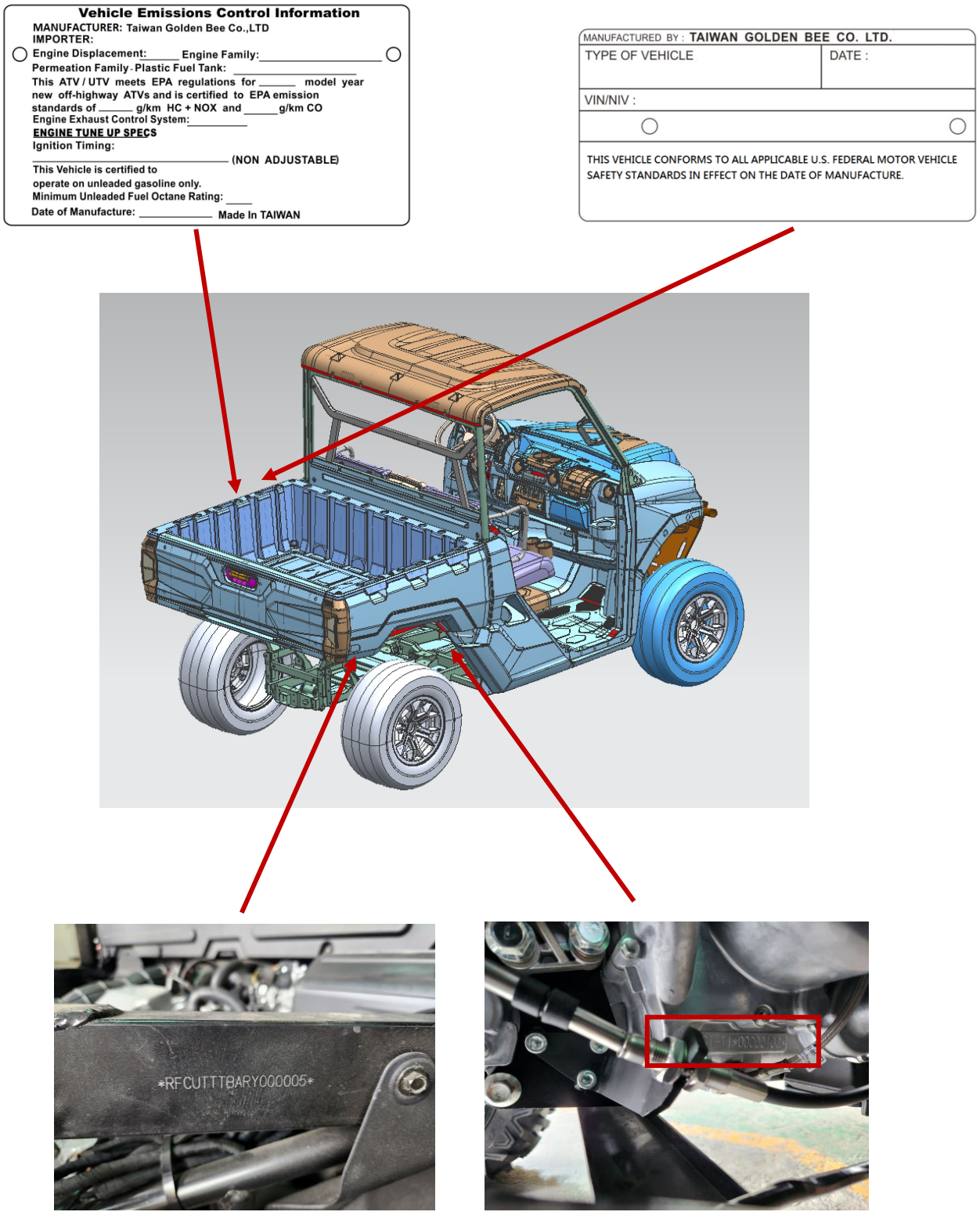
This service manual describes basic information of different system parts and system inspection & service for TGB UTV 1000. In addition, please refer to the manual contents in detailed for the model you serviced in inspection and adjustment.

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



SERIAL NUMBER

Frame Number and Engine Number



Symbols and Marks

Symbols and marks are used in this manual to indicate what and where the special service are needed, in case supplemental information is procedures needed for these symbols and marks, explanations will be added to the text instead of using the symbols or marks.

 Warning	Means that serious injury or even death may result if procedures are not followed.
 Caution	Means that equipment damages may result if procedures are not followed.
 Engine oil	Limits to use SAE 10W-40 API SG class oil.Warranty will not cover the damage that caused by not apply with the limited engine oil.
 Grease	King Mate G-3 is recommended.
 Oil seal	Apply with lubricant.
 Renew	Replace with a new part before installation.
 Brake fluid	Use recommended brake fluid DOT4 or WELLRUN brake fluid.
 Special tools	Special tools
Indication	Indication of components.
 Directions	Indicates position and operation directions

General Safety

Carbon monoxide

If you must run your engine, ensure the place is well ventilated. Never run your engine in a closed area. Run your engine in an open area, if you have to run your engine in a closed area, be sure to use an extractor.

Caution

Exhaust contains toxic gas, which may cause one to lose consciousness and even result in death.

Gasoline

Gasoline is a low ignition point and explosive material. Work in a well-ventilated place, no flame or spark should be allowed in the work place or where gasoline is being stored.

Caution

Gasoline is highly flammable, and may explode under some conditions, keep it away from children.

Used engine oil

Caution

Prolonged contact with used engine oil (or transmission oil) may cause skin cancer although it might not be verified.
We recommend that you wash your hands with soap and water right after contacting. Keep the used oil beyond reach of children.

Hot components

Caution

Components of the engine and exhaust system can become extremely hot after engine running. They remain very hot even after the engine has been stopped for some time. When performing service work on these parts, wear insulated gloves and wait until cooling off.

Battery

Caution

- Battery emits explosive gases; flame is strictly prohibited. Keeps the place well ventilated when charging the battery.
- Battery contains sulfuric acid (electrolyte) which can cause serious burns so be careful do not be spray on your eyes or skin. If you get battery acid on your skin, flush it off immediately with water. If you get battery acid in your eyes, flush it off immediately with water and then go to hospital to see an ophthalmologist.
- If you swallow it by mistake, drink a lot of water or milk, and take some laxative such as castor oil or vegetable oil and then go to see a doctor.
- Keep electrolyte beyond reach of children.

Brake shoe

Do not use an air hose or a dry brush to clean components of the brake system; use a vacuum cleaner or the equivalent to avoid dust flying.

Caution

Inhaling brake shoe or pad ash may cause disorders and cancer of the breathing system.

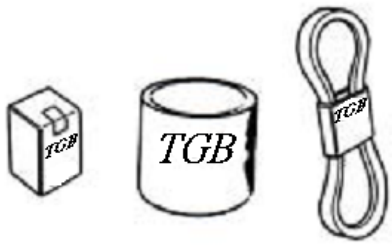
Brake fluid

Caution

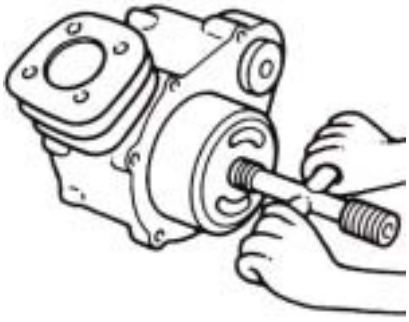
Spilling brake fluid on painted, plastic, or rubber parts may cause damage to the parts. Place a clean towel on the above-mentioned parts for protection when servicing the brake system. Keep the brake fluid beyond reach of children.

Service Precaution

● Always use with TGB genuine parts and recommended oils. Using non-designed parts for TGB UTV may damage the UTV.



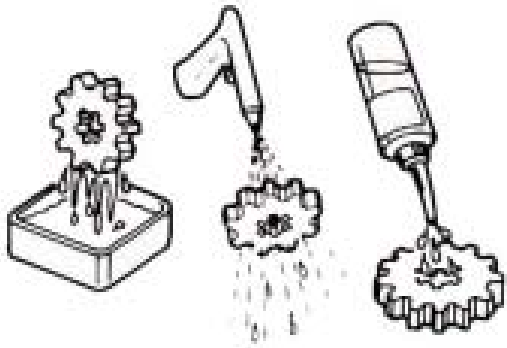
● Special tools are designed for remove and install of components without damaging the parts being worked on. Using wrong tools may result in parts damaged.



● When servicing this UTV, use only metric tools. Metric bolts, nuts, and screws are not interchangeable with the English system, using wrong tools and fasteners may damage this vehicle.

● Clean the outside of the parts or the cover before removing it from the UTV. Otherwise, dirt and deposit accumulated on the part's surface may fall into the engine, chassis, or brake system to cause damage.

● Wash and clean parts with high ignition point solvent, and blow-dry with compressed air. Pay special attention to O-rings or oil seals because most cleaning agents have an adverse effect on them.

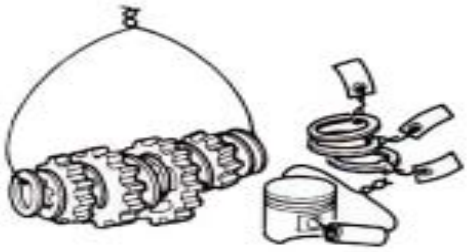


● Never bend or twist a control cable to prevent unsmooth control and premature worn out.

● Rubber parts may become deteriorated when old, and prone to be damaged by solvent and oil. Check these parts before installation to make sure that they are in good condition, replace if necessary.

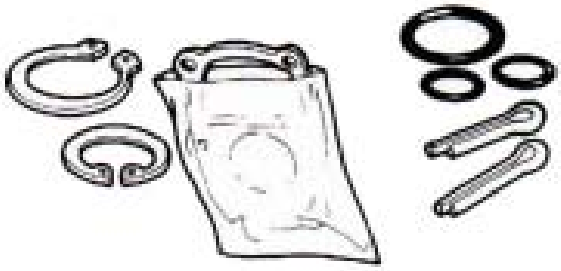
● When loosening a component, which has different sized fasteners, operate with a diagonal pattern and work from inside out. Loosen the small fasteners first. If the bigger ones are loosen first, small fasteners may receive too much stress.

● Store complex components such as transmission parts in the proper assemble order and tie them together with a wire for ease of installation later.

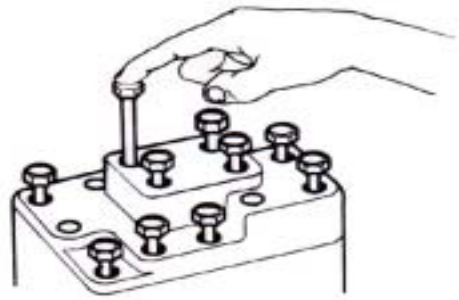


● Note the reassemble position of the important components before disassembling them to ensure they will be reassembled in correct dimensions (depth, distance or position).

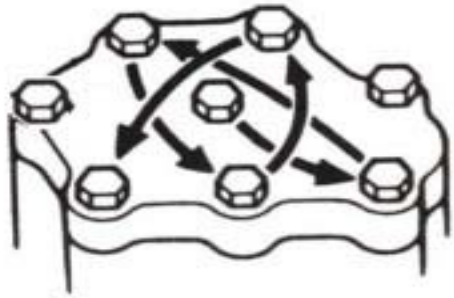
● Components not to be reused should be replaced when disassembled including gaskets metal seal rings, O-rings, oil seals, snap rings, and split pins.



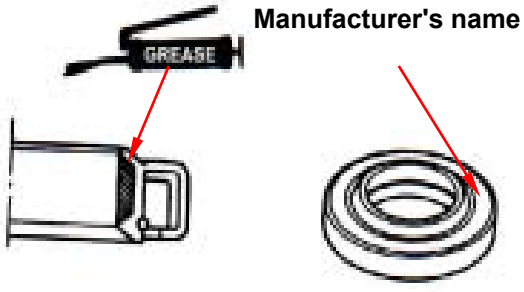
- The length of bolts and screws for assemblies, cover plates or boxes is different from one another, be sure they are correctly installed. In case of confusion, Insert the bolt into the hole to compare its length with other bolts, if its length out side the hole is the same with other bolts, it is a correct bolt. Bolts for the same assembly should have the same length.



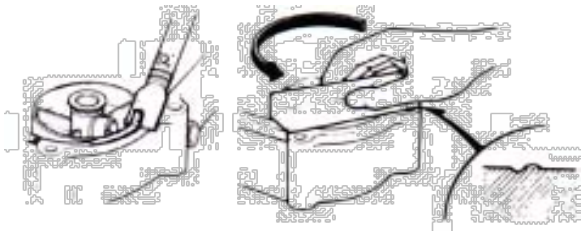
- Tighten assemblies with different dimension fasteners as follows: Tighten all the fasteners with fingers, then tighten the big ones with special tool first diagonally from inside toward outside, important components should be tightened 2 to 3 times with appropriate increments to avoid warp unless otherwise indicated. Bolts and fasteners should be kept clean and dry. Do not apply oil to the threads.



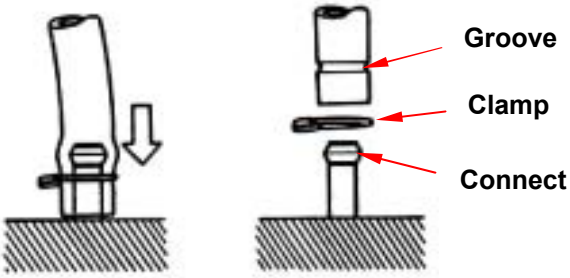
- When oil seal is installed, fill the groove with grease, install the oil seal with the name of the manufacturer facing outside, and check the shaft on which the oil seal is to be installed for smoothness and for burrs that may damage the oil seal.



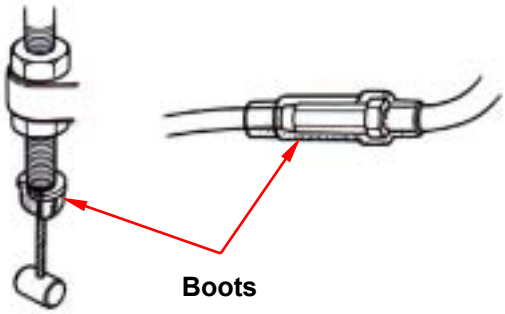
- Remove residues of the old gasket or sealant before re-installation grind with a grindstone if the contact surface has any damage.



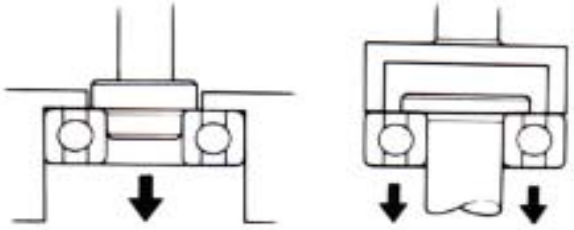
- The ends of rubber hoses (for fuel, vacuum, or coolant) should be pushed as far as they can go to their connections so that there is enough room below the enlarged ends for tightening the clamps.



- Rubber and plastic boots should be properly reinstalled to the original correct positions as designed.

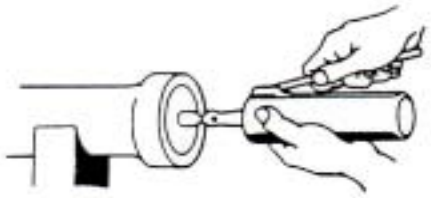


- The tool should be pressed against two (inner and outer) bearing races when removing a ball bearing. Damage may result if the tool is pressed against only one race (either inner race or outer race). In this case, the bearing should be replaced. To avoid damaging the bearing, use equal force on both races.



Both of these examples can result in bearing damage.

● Lubricate the rotation face with specified lubricant on the lubrication points before assembling.



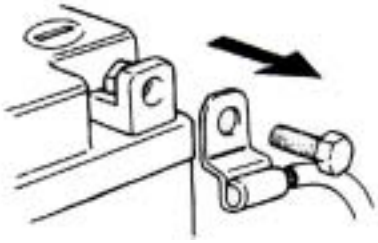
● Check if positions and operation for installed parts is in correct and properly.

● Make sure service safety each other when conducting by two persons.

OK

● Note th

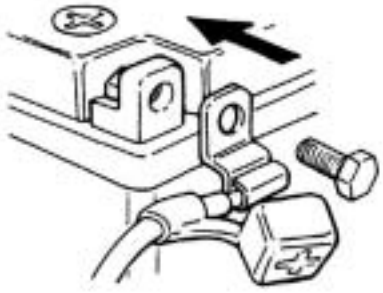
● Before battery removal operation, it has to remove the battery negative (-) cable firstly. Notre tools like open-end wrench do not contact with body to prevent from circuit short and create spark.



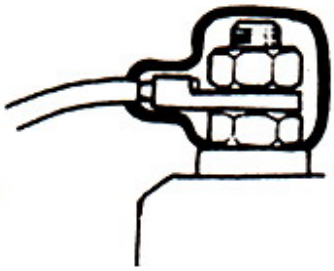
● After service completed, make sure all connection points is secured.

Battery positive (+) cable should be connected firstly.

● And the two posts of battery have to be greased after connected the cables.

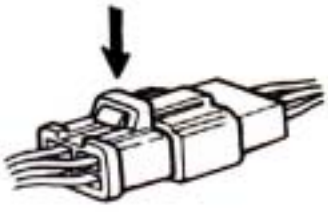


● Make sure that the battery post caps are located in properly after the battery posts had been serviced.



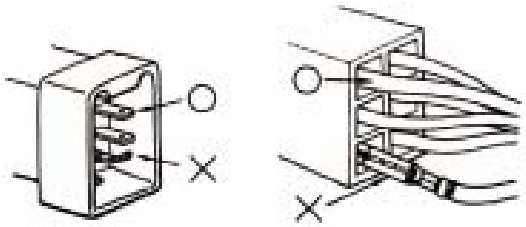
● If fuse burned, it has to find out the cause and solved it. And then replace with specified capacity fuse.

● When separating a connector, it locker has to be unlocked firstly. Then, conduct the service operation.

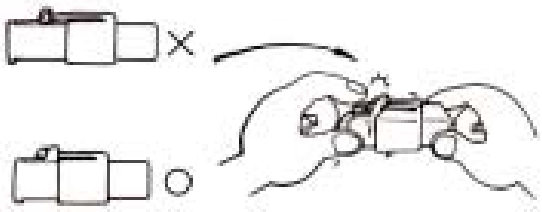


- Do not pull the wires as removing a connector or wires. Hold the connector body.

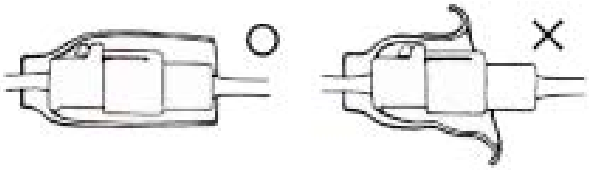
- Make sure if the connector pins are bent, extruded or loosen.



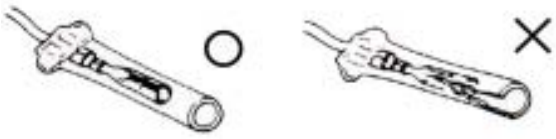
- Insert the connector completely. If there are two lockers on two connector sides, make sure the lockers are locked in properly. Check if any wire loose.



- Check if the connector is covered by the twin connector boot completely and secured properly.

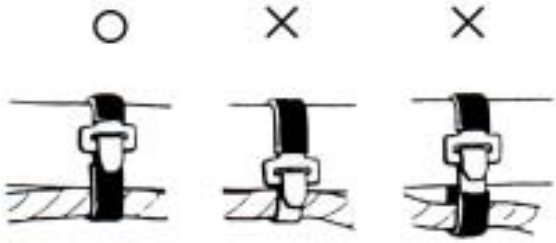


- Before terminal connection, check if the boot is crack or the terminal is loose.

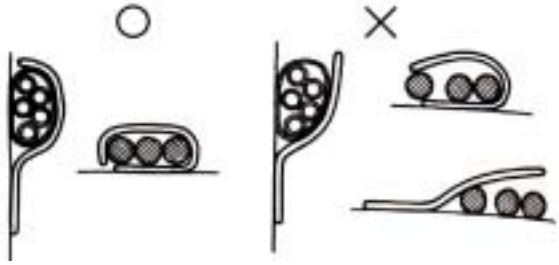


- Insert the terminal completely.
  Check if the terminal is covered by the boot.
  Do not let boot open facing up.

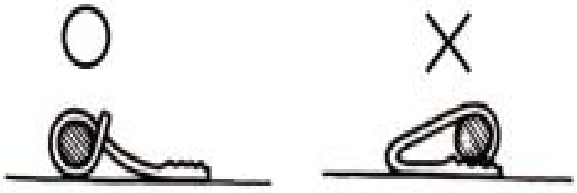
- Secure wires and wire harnesses to the frame with respective wire bands at the designated locations. Tighten the bands so that only the insulated surfaces contact the wires or wire harnesses.



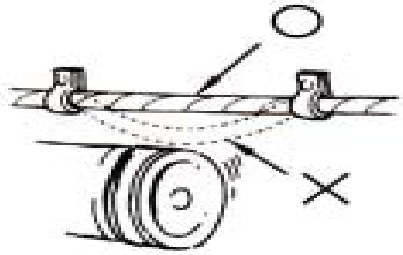
- Wire band and wire harness have to be clamped secured properly.



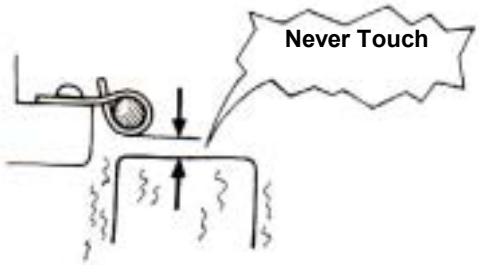
- Do not squeeze wires against the weld or its clamp.



- Do not let the wire harness contact with rotating, moving or vibrating components as routing the harness.

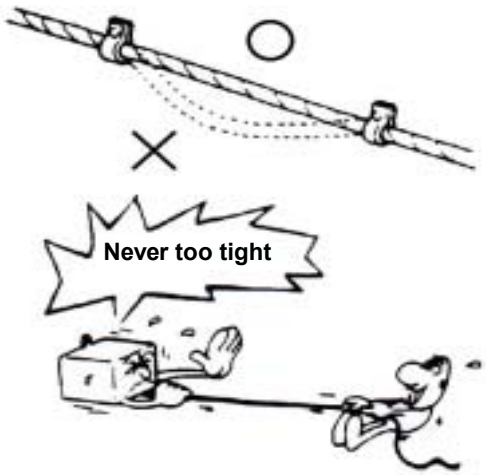


- Keep wire harnesses far away from the hot parts.

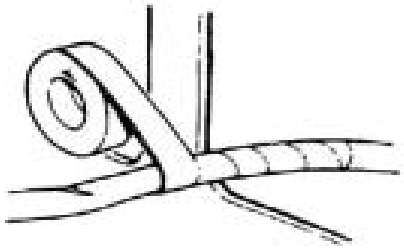


- Route wire harnesses to avoid sharp edges or corners and also avoid the projected ends of bolts and screws.

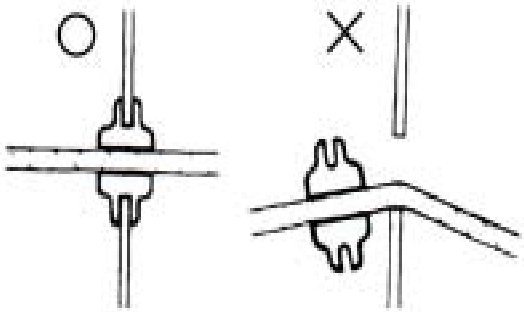
- Route harnesses so that they neither pull too tight nor have excessive slack.



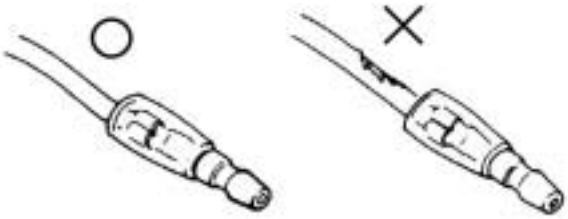
- Protect wires or wire harnesses with electrical tape or tube if they contact a sharp edge or corner. Thoroughly clean the surface where tape is to be applied.



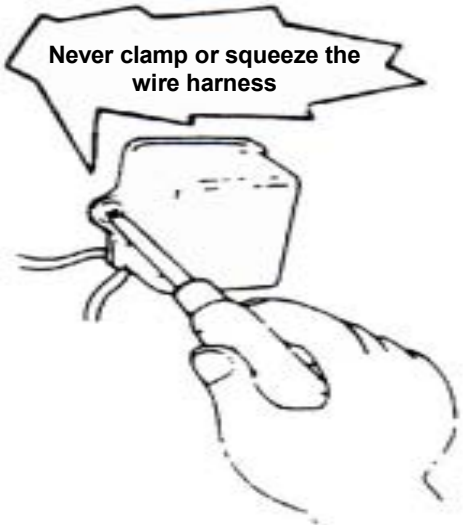
- Secure the rubber boot firmly as applying it on wire harness.



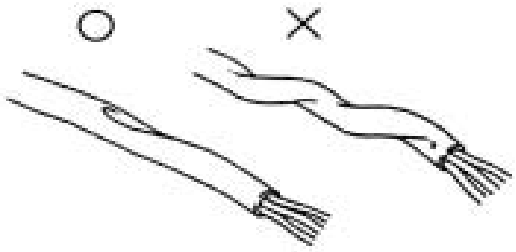
- Never use wires or harnesses which insulation has been broken. Wrap electrical tape around the damaged parts or replace them.



- Never clamp or squeeze the wire harness as installing other components.

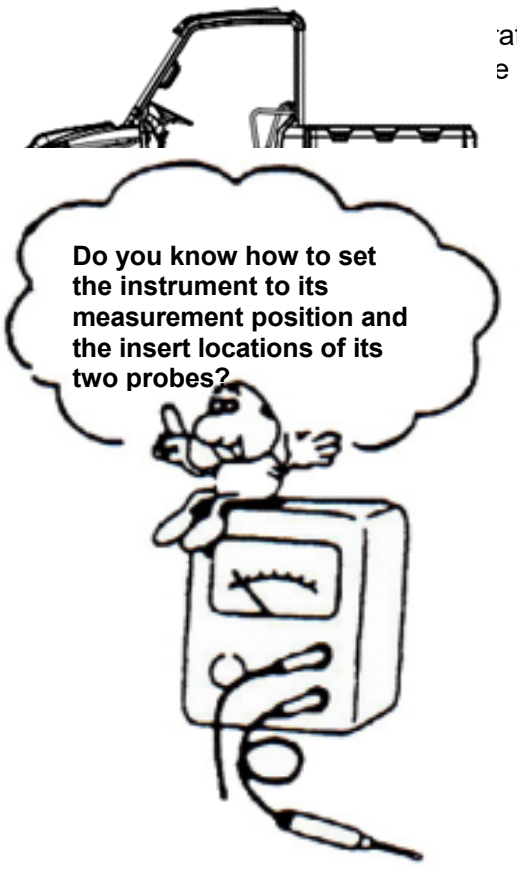


- Do not let the wire harness been twisted as installation.



- Wire harnesses routed along the handlebar should not be pulled too tight or have excessive slack, be rubbed against or interfere with adjacent or surrounding parts in all steering positions.

- With sand paper to clean rust on connector pins/terminals if found and then conduct connection operation later.



Specifications

		1000 UST-U	
Overall Length		3122	[mm]
Overall Width		1625	[mm]
Overall Height		2065	[mm]
Wheel Base		2120	[mm]
Type		4-Stroke Engine, V-Twin	
Installation and arrangement		Vertical, below center, incline	
Fuel Used		87 Octane	
Cycle/Cooling		4-stroke/Water cooled	
Cylinder	Bore	Ø92	[mm]
	Stroke	75	[mm]
	Number/ Arrangement	Two Cylinder, V-type	
Displacement		997.1	[cc]
Compression Ratio		10.2:1	
Max. HP		62kw/ 7000rpm	[kw/rpm]
Max. Torque		89.8Nm /5500rpm	[Nm/rpm]
Ignition		ECU	
Starting System		Electrical starter	
Air filtration		Spoon	
Suspension System	Front	Double A-Arm	
	Rear	Double A-Arm	
Tire Specifications	Front	27X9-14、29X9-14	
	Rear	27X11-14、29X11-14	
Rim		Aluminum	
Brake System		Disk (Ø 232)	[mm]
		Disk (Ø 220)	[mm]
Performance	Climb Ability	＜25	°
	Max Speed	100	
Reduction	Primary Reduction	Belt	
	Secondary Reduction	Gear / Shaft	

	Transmission	C.V.T., auto speed change	
Fuel capacity		42	[l]
Lubrication System		Forced circulation & splashing	
Engine oil	Engine oil	SAE 10 W/ 40	
	Capacity	2.5	[l]
Gear lubrication	Spec.	SAE 75W/140	
	Transmission	750	[ml]
	Spec.	SAE 85W/90	
	Front Diff.	700	[ml]
	Rear Diff.	600	[ml]
Spark Plug		NGK DCPR8E	
Battery		12/32	V/AH
Lamps	Front Lamps (HI/LO)	T(19/18)、M(60/60)、A(25.9/16.8)	[W]
	Rear Lamps	T(4X2)、M(0.1X2)、A(0.1X2)	[W]
	Daytime Running lamp	15x2	[W]
	Brake Lamps	T(2.2X 2)、M(2.2X2)、A(1.72)	[W]
	Turn Lamps	T(4.3 ×4)、M(3.5X4)、A(1.2X4)	[W]

Torque Values

The torque values listed in above table are for more important tighten torque values. Please see standard values for not listed in the table.

Standard Torque Values for Reference

Type	Tighten	Type	Tighten
5 mm bolt、nut	0.45~0.6kgf-m	5 mm screw	0.35~0.5kgf-m
6 mm bolt、nut	0.8~1.2kgf-m	6 mm screw、SH nut	0.7~ 1.1kgf-m
8 mm bolt、nut	1.8~2.5kgf-m	6 mm bolt、nut	1.0 ~1.4kgf-m
10 mm bolt、nut	3.0~4.0kgf-m	8 mm bolt、nut	2.4 ~3.0kgf-m
12 mm bolt、nut	5.0~6.0kgf-m	10 mm bolt、nut	3.5~4.5kgf-m

Engine Torque Values

Item	Q'ty	Thread Dia. (mm)	Torque Values (kgf-m)	Remarks
Cylinder stud nut	4	6	1.0~1.2	
Cylinder head bolt	8	10	2.0 & 180° +/-5°	
Cylinder head cover bolt	8	7	1.3~1.5	
Intake inject pipe bolt	4	8	1.6~1.8	
Intake inject bolt	2	6	0.9~1.0	
Tappet adjustment screw nut	8	6	1.0~1.2	Apply oil to thread

Spark plug	1	12	1.8~2.2	
Tensioner lifter bolt	2	6	1.0~1.2	
Oil pump bolt	3	6	1.0~1.2	
Water pump impeller	1	8	2.2~2.5	
Oil radiator bolt	2	8	2.4~2.6	
ACG. Flywheel nut	1	18	16~18	
Crankcase bolts	7	6	0.8~1.2	
Mission case bolt	7	8	2.6~3.0	

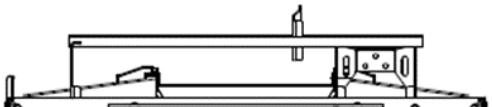
Frame Torque Values

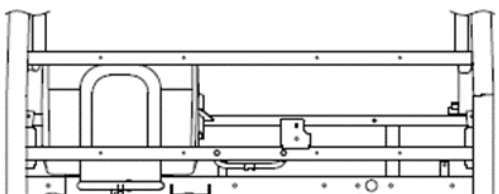
Item	Q'ty	Thread Dia. (mm)	Torque Values (kgf-m)	Remarks
Handlebar upper holder bolt	4	6	3.5	
Steering shaft nut	1	10	8.0	
Steering tie-rod nut	4	10	3.5	
Knuckle nut	2	10	5.5	
Steering shaft holder bolt	2	8	3.5	
Tie rod lock nut	4	10	3.6	
Handlebar under holder nut	2	8	4.0	
Front wheel nut	8	10	7.2	
Front axle castle nut	2	14	5.5	
Rear axle castle nut	2	14	5.5	
Rear wheel nut	8	10	7.2	
Engine hanger nut	4	12	8.5	
Rear axle holder bolt	4	12	9.2	
Drive gear bolt	2	10	4.6	
Driven gear nut	4	10	4.6	
Swing arm pivot bolt	1	14	9.2	
Front suspension arm nut	4	10	5.0	
Front / Rear cushion mounting bolt	6	10	4.6	
Brake lever nut	2	6	1.0	
Brake hose bolt	13	10	3.5	
Brake caliper bolt	6	6	3.2	
Brake disk mounting bolt	11	8	3.5	
Air-bleed valve	3	5	0.5	
Exhaust muffler mounting bolt	2	8	2.5	
Exhaust muffler connection nut	4	8	1.5~2.0	

Oil and Lubrication Points

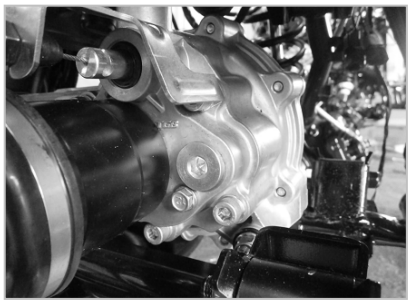
Brake Fluid

GREASE POINT

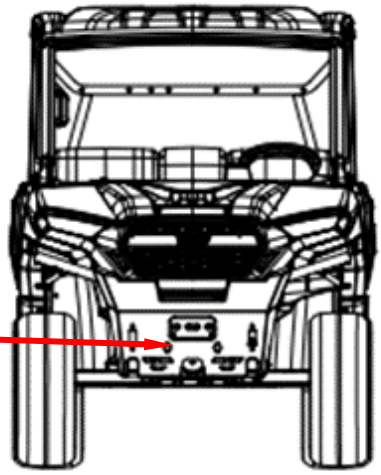


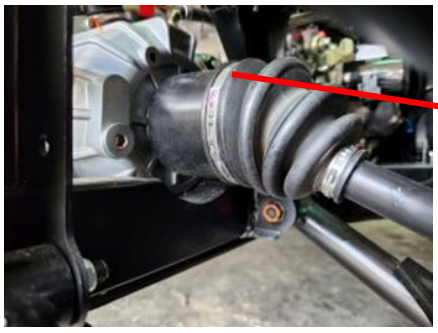


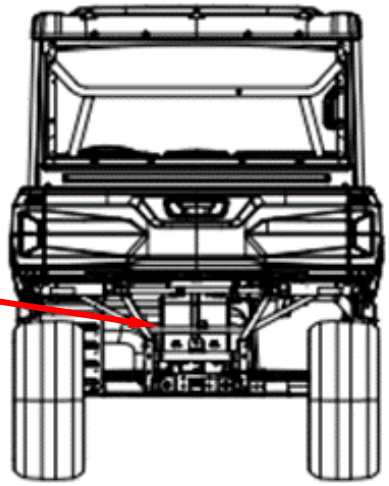
Gear Oil

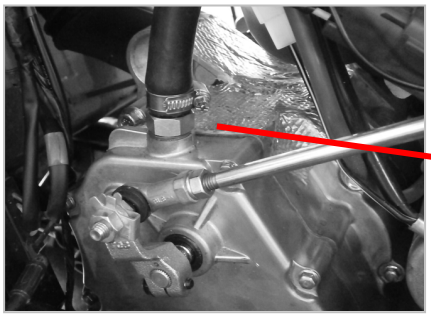


Front Diff.

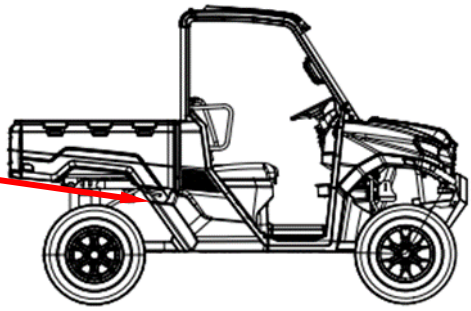




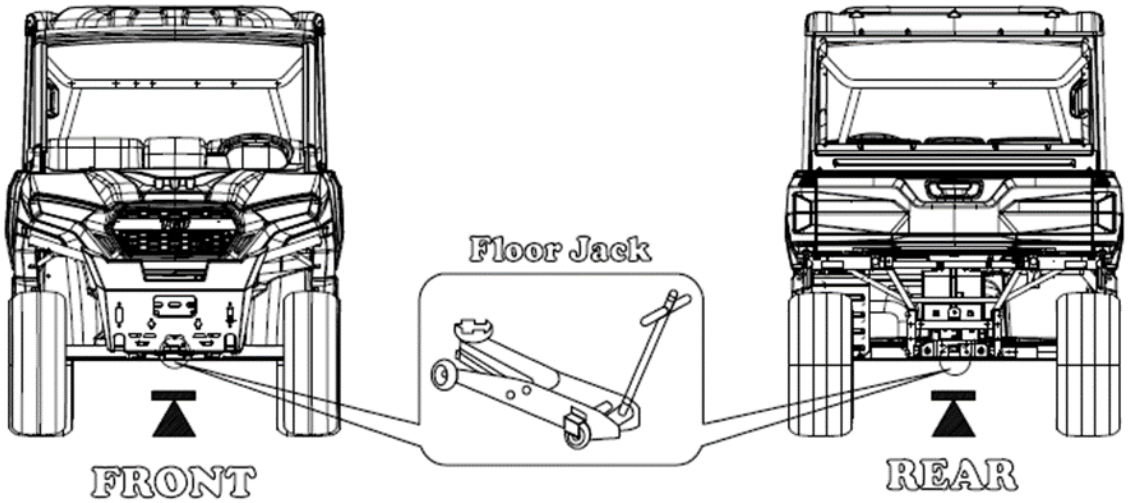




Transmission



Jacking Point



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Specification

Fuel Tank Capacity			42 Liter	
Engine Oil	Oil & Filter Change		2200 c.c.	
	Oil change		2000 c.c.	
	New Engine		2500 c.c.	
Transmission Gear oil	Bear Box	Capacity	750 cc	
	Front	Capacity	700 c.c.	
	Rear	Capacity	600 c.c.	
Capacity of coolant	Engine + Radiator		4900 c.c.	
	Reservoir upper		650 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 ± 2 bar	
Valve clearance			IN:0.10 ± 0.02 mm EX:0.15 ± 0.02 mm	
Tire dimension	Front		27X9-14	29X9-14
	Rear		27X11-14	29X11-14
Tire pressure			16/18 psi	
Battery			12V32Ah (type : MF battery)	

Periodical Maintenance Schedule

NO.	ITEM	Check or maintenance job	Whichever comes first	INITIAL	EVERY		
				MONTH	1	3	6	12
				Km	200	1000	2000	4000
				Mi	120	600	1200	2400
1	Exhaust system	◆Check for leakage and replace gasket if necessary			T	T	T	T
		◆Check for looseness and tighten all screw clamps and joints if necessary						
2	Valves	◆Check valve clearance and adjust if necessary			I		I	I
3	Air filter element	◆Clean and replace if necessary				I	I	I
4	Vent Tube	◆Clean				I	I	I
5	Spark plug	◆Check condition and clean, re-gap or replace if necessary					I	I
6	Engine oil	◆Change ◆Check UTV for oil leakage and correct if necessary			R		R	R
7	Engine oil filter	◆Replace			R		R	R
8	Engine oil strainer	◆Clean			I		I	I
9	Gear Box Oil	◆Replace			R		R	R
10	Front Differential gear oil	◆Change			R		R	R
		◆Check UTV for oil leakage and correct if necessary			Replace every 4 years			
11	Rear Differential gear oil	◆Change			R		R	R
		◆Check UTV for oil leakage and correct if necessary			Replace every 4 years			
12	Fuel line	◆Check fuel hoses for cracks or other damage and replace if necessary					I	I
13	Fuel filter	◆Replace			Every 2 years			
14	Front brake	◆Check operation and correct if necessary ◆Check fluid level and UTV for fluid leakage and correct if necessary			I	I	I	I
		◆Replace brake pads			Whenever worn to the limit			
15	Rear brake	◆Check operation and correct if necessary ◆Check the brake lever and pedal free play and adjust if necessary			I	I	I	I

16	Brake hoses	◆Check for cracks or other damage and replace if necessary		I	I	I
		◆Replace	Every 4 years			
17	Wheels	◆Check run out and for damage and replace if necessary	I		I	I
18	Tires	◆Check tread depth and for damage and replace if necessary ◆Check air pressure and balance and correct it if necessary		I	I	I
19	Wheel hub bearings	◆Check for looseness or damage and replace if necessary	I		I	I
20	V-belt	◆Check for wear, cracks or other damage and replace if necessary			I	I
21	Drive shaft universal joint	◆Lubricate with grease			L	L
22	Chassis fasteners	◆Make sure that all nuts, bolts and screw are properly tightened	T	T	T	T
23	Shock absorber assemblies	◆Check operation and correct if necessary ◆Check for oil leakage and replace if necessary			I	I
24	Grease Nipple	◆Lubricate with grease			L	L
25	Steering shaft	◆Lubricate with grease			L	L
26	Steering system	◆Check operation and repair or replace if damaged ◆Check toe-in and adjust if necessary	I	I	I	I
27	Engine mount	◆Check for the cracks or other damage and replace if necessary			I	I
28	Transmission boots	◆Check for the cracks or other damage and replace if necessary	I	I	I	I
29	Spark Arrester	◆Clean	C	Every 1000km/600 miles		

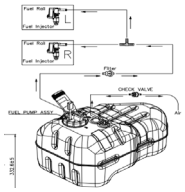
L: Lubricate **C**: Clean **R**: Replace **T**: Tighten **I**: Inspect, correct If necessary

*** For UTVs subjected to sever riding conditions, shorten the period of inspecting oil level, CVT and drive belt condition to at least once every 1000km.**

- Have the UTV serviced and checked by an authorized TGB dealer, make sure the service book is stamped and signed. Failure to do so could invalidate your warranty.
- The maintenance schedule is established by taking month and kilometer as a reference, whichever comes first.
- Proper periodic inspection and maintenance can keep your vehicle in a safe and efficient condition. Safety is an obligation of the vehicle owner/operator.

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.

THROTTLE PEDA

Push the throttle pedal down to increase engine speed. Spring pressure returns the pedal to the rest position when released. Always check that the throttle pedal returns normally before starting the engine.

Air Cleaner

1.Lift and Open the access cover.
2.Loosen and remove the air filter.
3.Clean and replace if necessary
4.Insert the filter carefully.
5.Inspect and carefully clean gasket in the groove of the cover. Replace if damaged.
6.Secure air filter cover with latches

Caution

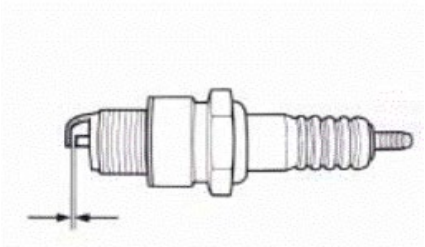
When riding in dusty conditions or sand, the air filter needs to be cleaned before every ride.

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**



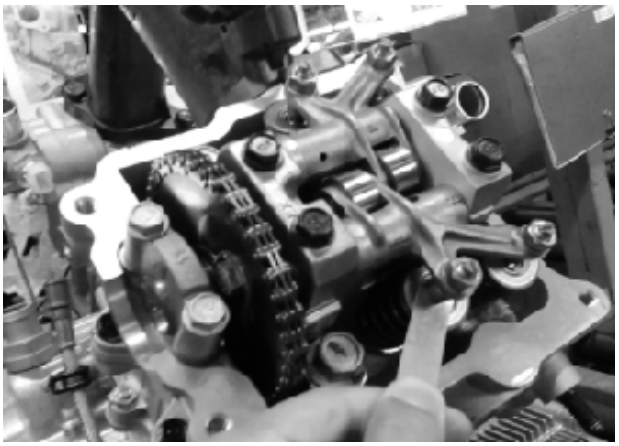
Carefully bend ground electrode of the plug to adjust the gap if necessary.
Hold spark plug washer and install the spark plug by screwing it.
Tighten the plug by turning 1/2 turn more with plug socket after installed.

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.

Drive Belt

Tilt the cargo box.

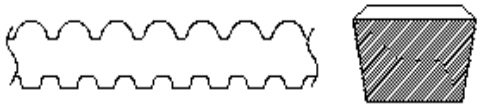
Remove nuts and LH rear wheel.

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.

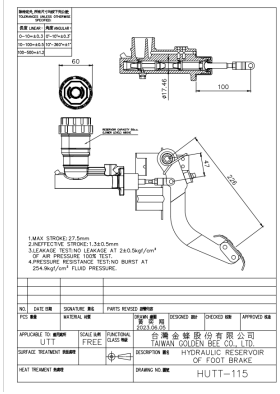
Width limit: 31.0 mm or above

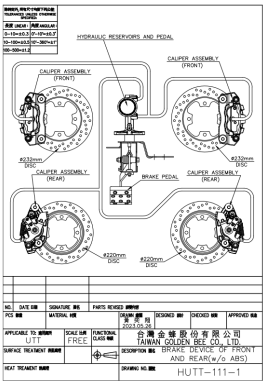


Brake System

Brake System Hose

Make sure the brake hoses for corrosion or leaking oil.





Brake Fluid

Inspect the brake system routinely. Inspect the level of the brake fluid before each operation.

Caution

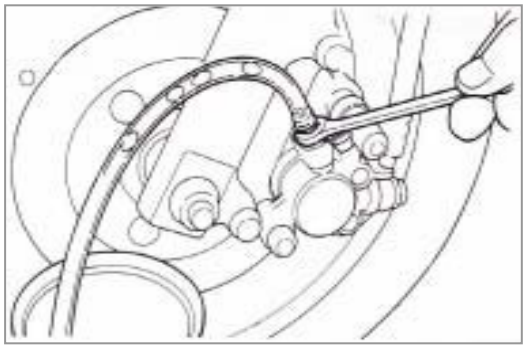
After opening a bottle of brake fluid, always discard any unused portion. Never store or use a partial bottle. Brake fluid is hygroscopic, meaning it rapidly absorbs moisture from the air. The moisture causes the boiling temperature of the brake fluid to drop, which can lead to early brake fade and the possibility of accident or severe injury

Change the brake fluid every two years and any time the fluid becomes contaminated, the fluid level is below the minimum, or if the type and brand of the fluid in the reservoir are unknown.

1. Position the vehicle on a level surface and turn off the engine.

2. View the brake fluid level at the reservoir in the driver's side wheel well. The level should be between the upper (MAX) and lower (MIN) level lines.

3. If the fluid level is lower than the upper level line, remove the master cylinder cap and add brake fluid to the upper (MAX) line.

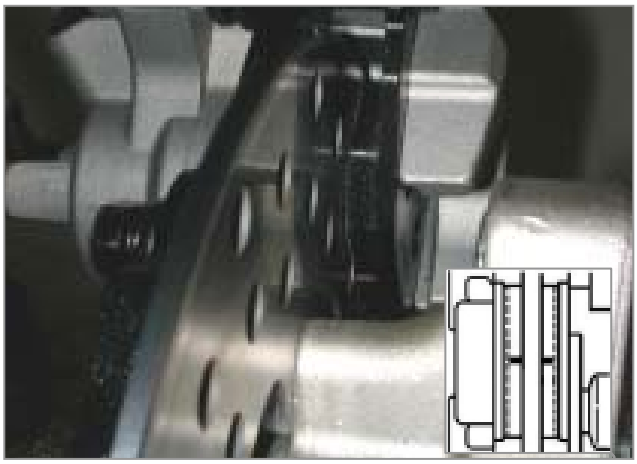


4. Apply the brake forcefully for a few seconds and check for fluid leakage around the fittings

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 apply WD-40®or any petroleum product to brake discs. These types of products are flammable and may also reduce the friction between the brake pad and caliper

Brake Light Switch/Starting Inhibitor Switch

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

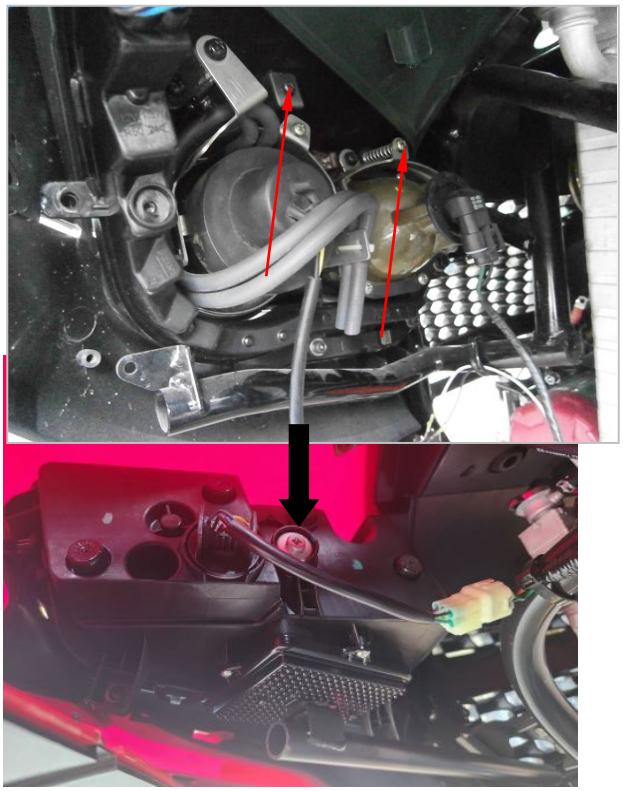
Make sure that electrical starter can be operated only under brake applying.

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.

The LED Headlight and taillights are built with LEDs (light emitting diode) and this technology proved to be reliable. In the unlikely event they do not work, have them checked by an authorized TGB dealer, a repair shop or person of your choosing.

Steering Wheel

The steering wheel is located in front of the driver's seat.

The steering wheel steers the vehicle to the left or right.

Turn the steering wheel in the direction you want to go.

Grip the steering wheel with both hands, without having thumbs rolled around the steering wheel.

Caution

Under rough trail conditions or when crossing an obstacle, the steering wheel could suddenly jerk on one side, causing hand or wrist injuries if the thumbs are rolled around the steering wheel.

Wheel/Tire

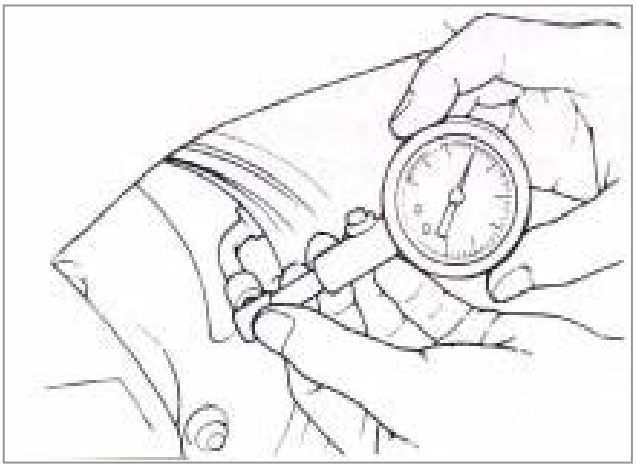
Caution

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	16 psi	18 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

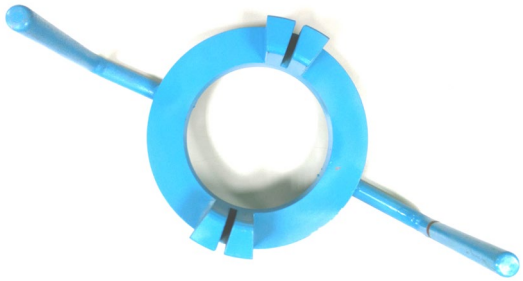
PARTS NO. : 440667
PARTS NAME : CYLINDER HEAD VALVE AND SPRING INSTALLER/REMOVER

PARTS NO. : 560001
PARTS NAME : FLYWHEELREMOVER

PARTS NO. : 560002
PARTS NAME : FLYWHEEL INSTALLER

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

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



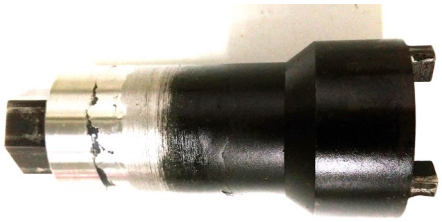
PARTS NO. : 560005
PARTS NAME : DRIVEN PULLEY FIXING TOOL

PARTS NO. : 560006
PARTS NAME : DRIVE PULLEY REMOVER

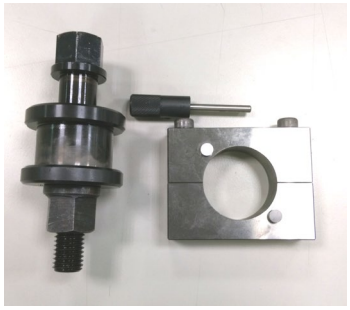
PARTS NO. : 560007
PARTS NAME : DRIVEN PULLEY EXTEND TOOL FOR REMOVE BELT

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

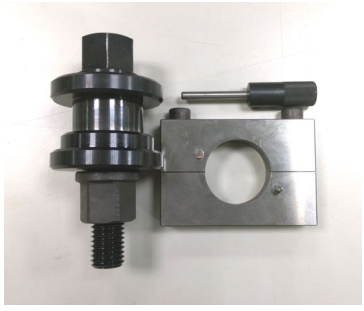


PARTS NO. : 560011
PARTS NAME : PLAIN BEARING INSTALLER (LEFT CRANKCASE)

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

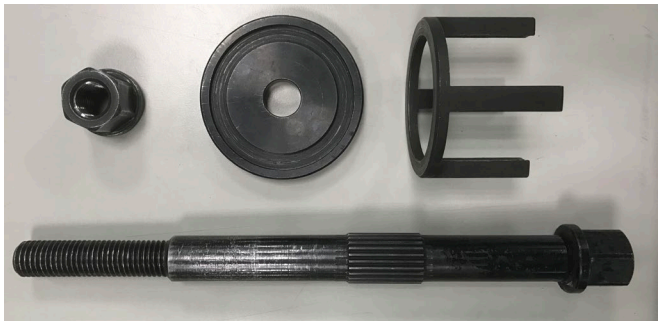
PARTS NO. : 560013
PARTS NAME : PLAIN BEARING INSTALLER (RIGHT CRANKCASE)

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

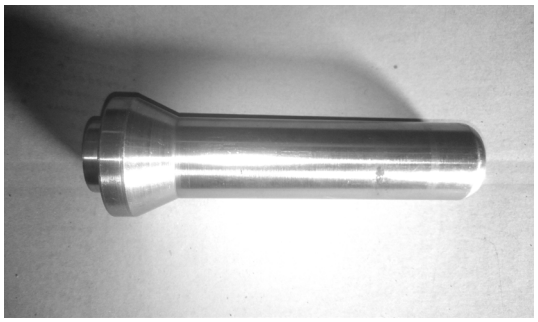


PARTS NO. : 560015
PARTS NAME : CRANKCASE COVER LH PLAIN BEARING INSTALLER (LEFT CRANKCASE)

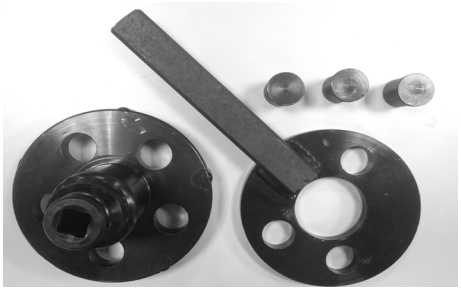
PARTS NO. : 560016
PARTS NAME : CRANKCASE COVER LH PLAIN BEARING REMOVER (LEFT CRANKCASE



PARTS NO. : 560017
PARTS NAME : DRIVEN PULLEY REMOVER/
INSTALLER OFF ENGINE



PARTS NO. : 560018
PARTS NAME : TRANSMISSION BEARING
INSTALLER

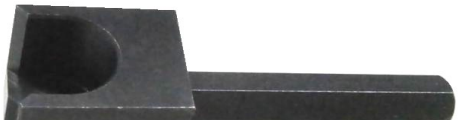


PARTS NO. : 560019
PARTS NAME : GOVERNOR CUP
INSTALLER/REMOVER KIT
(DRIVE PULLEY)

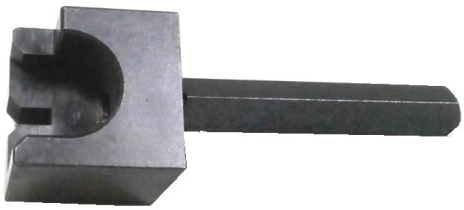
PARTS NO. : 560020A
PARTS NAME : DRIVE PULLEY FIXING SEAT
FOR INSTALL AND REMOVE

PARTS NO. : 560023
PARTS NAME : REAR DIFFERENTIAL CABLE
ADJUSTING TOOL

PARTS NO. : 560024
PARTS NAME : RIGHT CRANKCASE
MECHNICAL SEAL REMOVER

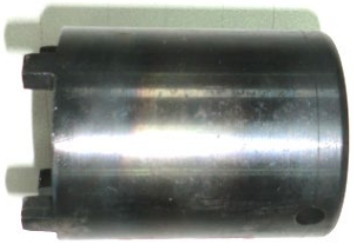


PARTS NO. : 552309-1
PARTS NAME : FRONT DIFFERENTIAL CABLE 2W/4W ADJUSTING TOOL

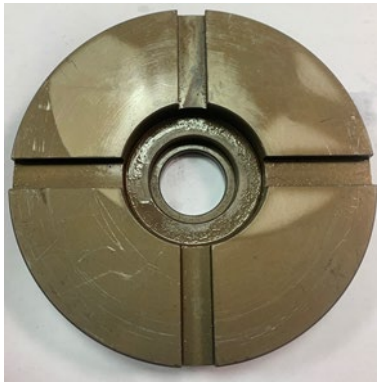


PARTS NO. : 552309-2
PARTS NAME : FRONT DIFFERENTIAL CABLE LOCK ADJUSTING TOOL

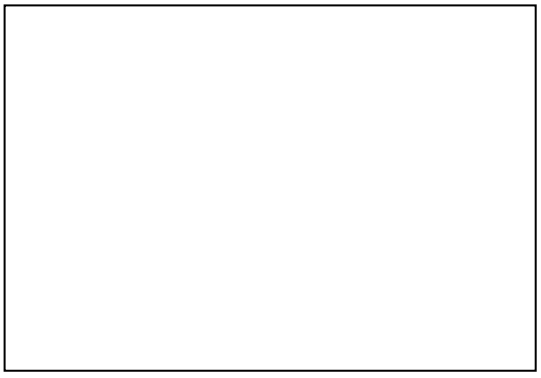
PARTS NO. : 552303
PARTS NAME : PISTON & ROD CONNECTING HOLDER



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



PARTS NO. : 560027
PARTS NAME : OUTPUT SECONDARY SHAFT REMOVAL/INSTALLATION BASE JIG



PARTS NO. : 560028
PARTS NAME : DRIVEN PULLEY REMOVER/ INSTALLER ON THE ENGINE

NOTE: should use together with 560006.

Precautions in Operation

General Information

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

Specifications

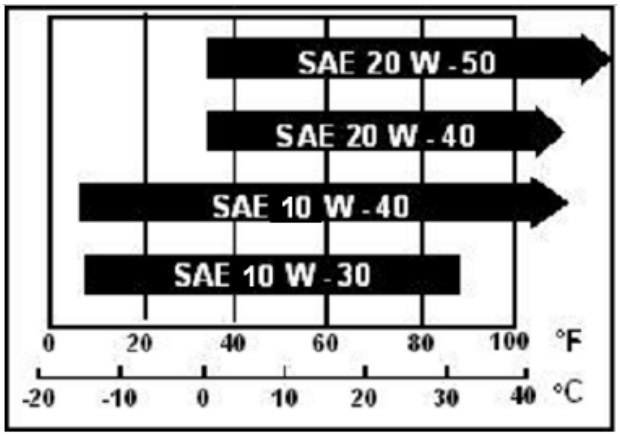
Engine oil quantity

Overhaul: 2500 c.c.

Filter change: 2200 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 — Turn by hand until filter O-ring contacts sealing surface, then turn an additional 3/4 turn

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.*

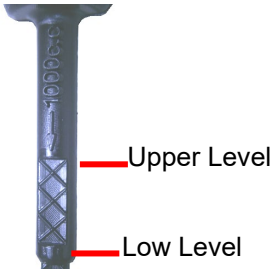
- Ensure vehicle is on a level surface.
- Start engine and let idle for a few minutes.
- Stop engine, wait a few minutes to allow oil to flow down to crankcase then check oil level.
- Fully screw in dipstick to check oil level.
- Remove dipstick and read the oil level.
- Oil level must be between minimum 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.

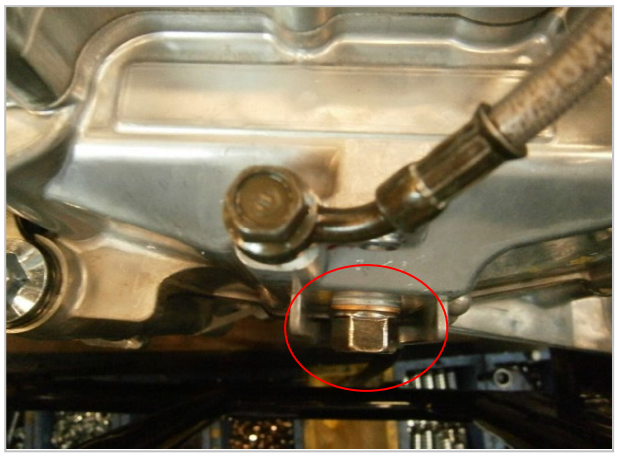
WARNING

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

Do not re-use oil filter.
Always replace by a new one.

▪Using the oil filter wrench and a ratchet handle (or a socket or box-end wrench), remove the old oil filter

▪ Replace oil filter. Pour the recommended oil into the filler hole.

▪ Refill engine with recommended engine oil.

▪ Oil change capacity with filter: 2.2 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

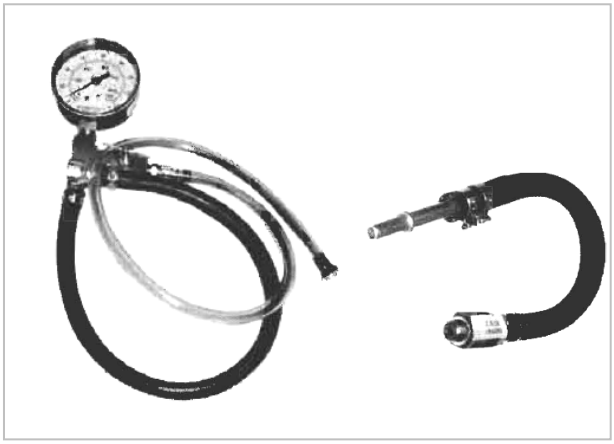
NOTE: *The engine oil pressure test should be done with a warm engine 90℃ and the recommended oil.*

▪ 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 the drain plug from the bottom of the engine and drain the oil into a drain pan.
- Using the oil filter wrench and a ratchet handle (or a socket or box-end wrench), remove the old oil filter and dispose of properly. Capture oil in a suitable pan or absorbent material. Do not re-use oil filter.
-

Oil Filter Inspection

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

Oil Filter Installation

▪ Apply oil to the new filter O-ring and check to make sure it is positioned correctly; then install the new oil filter. Tighten securely.

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.

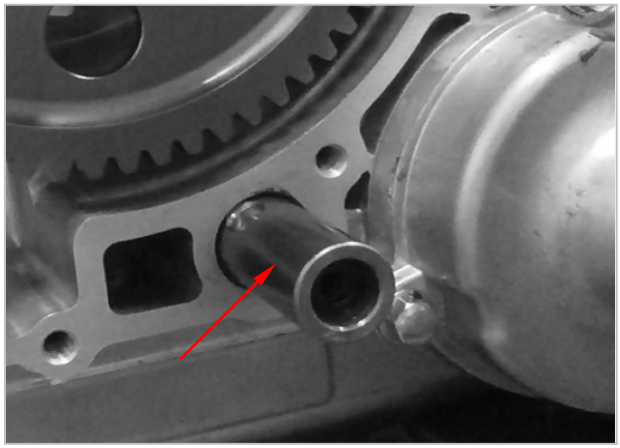
ENGINE OIL PRESSURE VALVE

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.



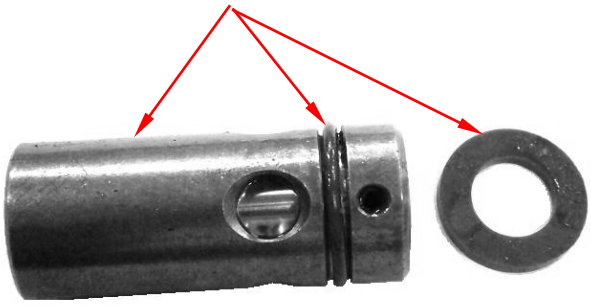
Inspection

- 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.

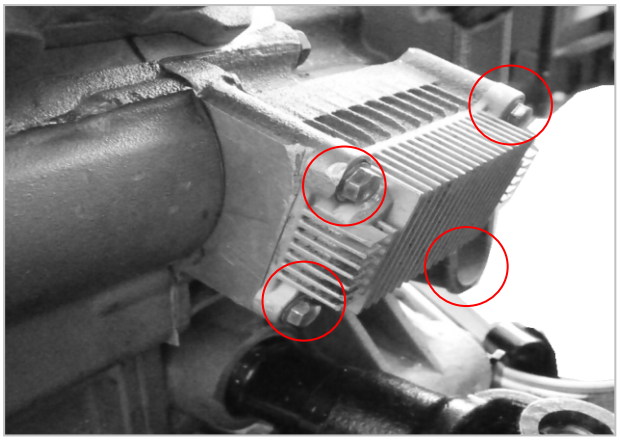
NOTE: *At installation, always replace the gasket ring.*



OIL RADIATOR

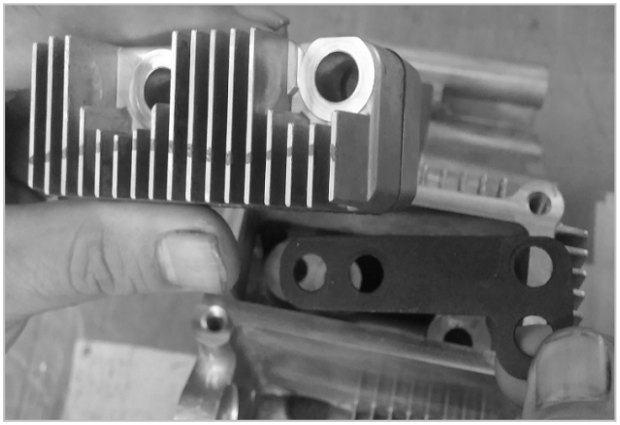
Oil Radiator Removal

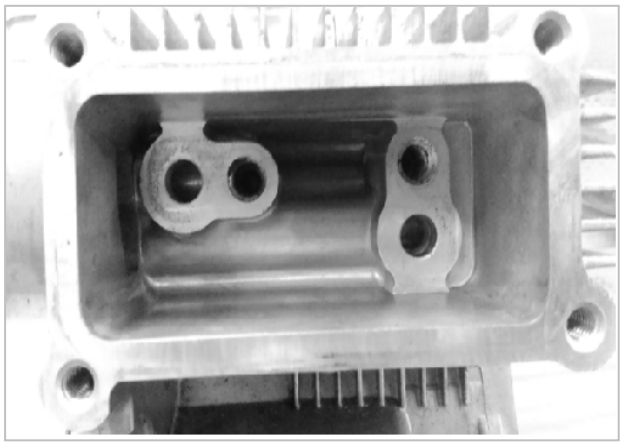
- Drain engine oil.
- Drain coolant.
- Remove oil radiator cap retaining bolts.
- Place rags or towels under oil cooler to catch remaining oil and coolant.
- Remove oil radiator and discard gasket.



Oil Radiator Inspection

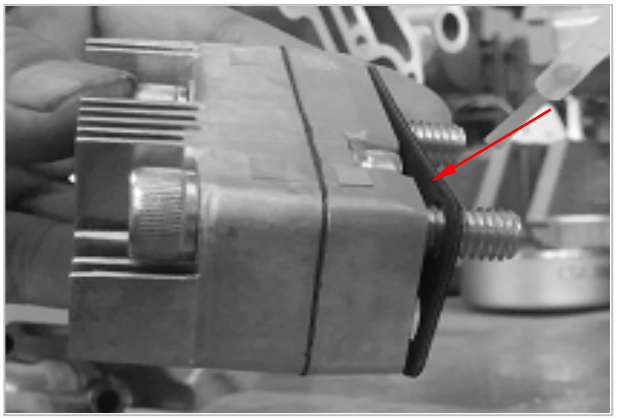
- Check oil radiator for cracks or other damage.
- Replace if necessary.





Oil Radiator Installation

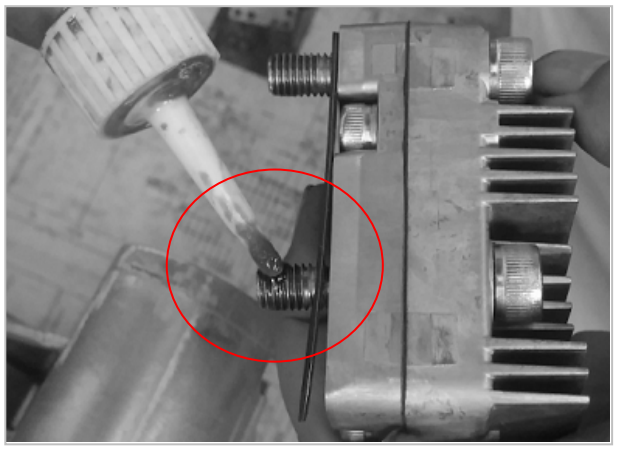
- For installation, reverse the removal procedure.
- Wipe off any oil and coolant spillage.
- Install a **new gasket** as shown.



NOTE：Apply LOCTITE 263 on the thread.

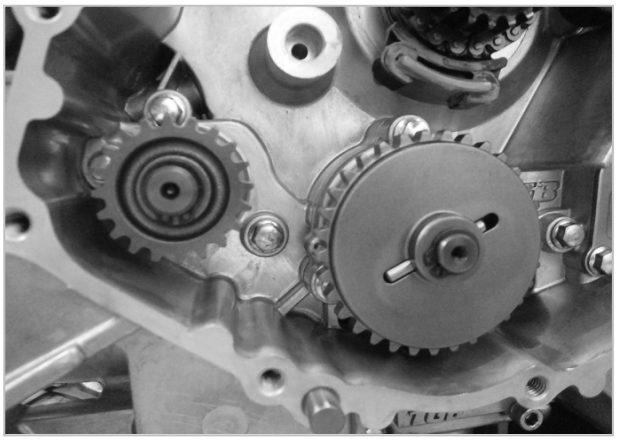
- Refill engine oil with recommended oil and at the proper oil level.
- Refill and bleeding cooling system.

TORQUE: 2.4~2.5 kgf-m.



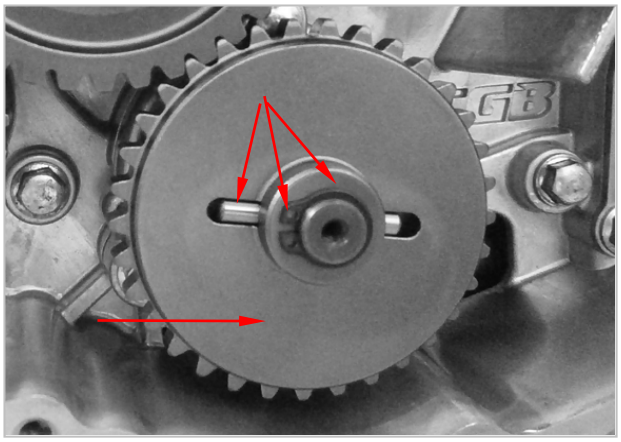
OIL PUMP

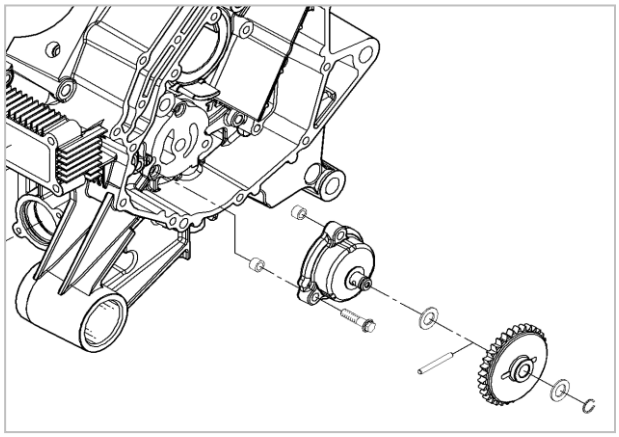
The oil pump is located on the engine CVT side (behind cover).



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

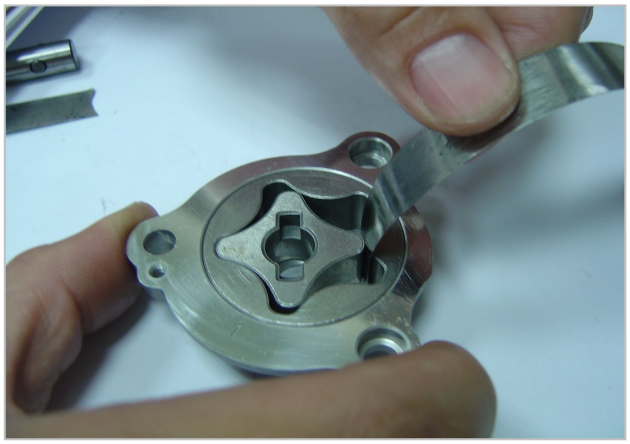
For installation, reverse the removal procedure.

NOTE：Apply LOCTITE 263 on the thread.

TORQUE: 1.0~1.2 kgf-m.

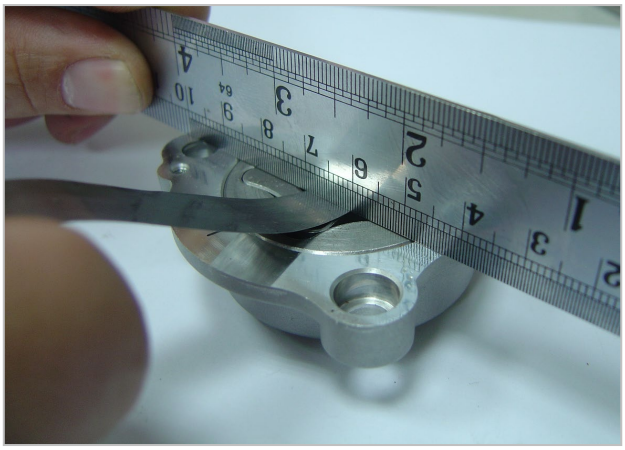
NOTE: *The outer rotor and inner rotor are marked. When installing, make sure both markings are on the upper side.*

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

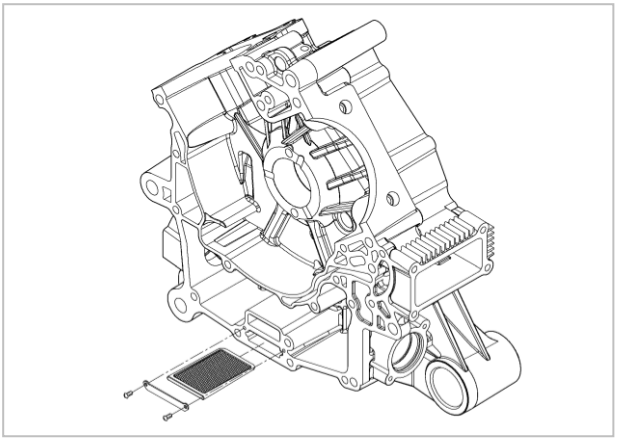


Oil Pump Final Test

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.

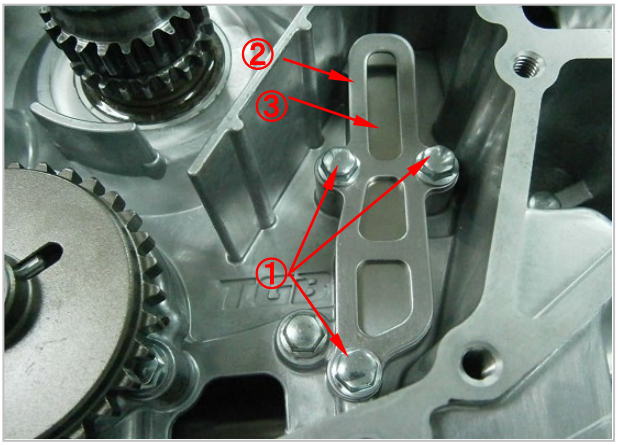
TORQUE:0.15~0.20 kgf-m.

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.

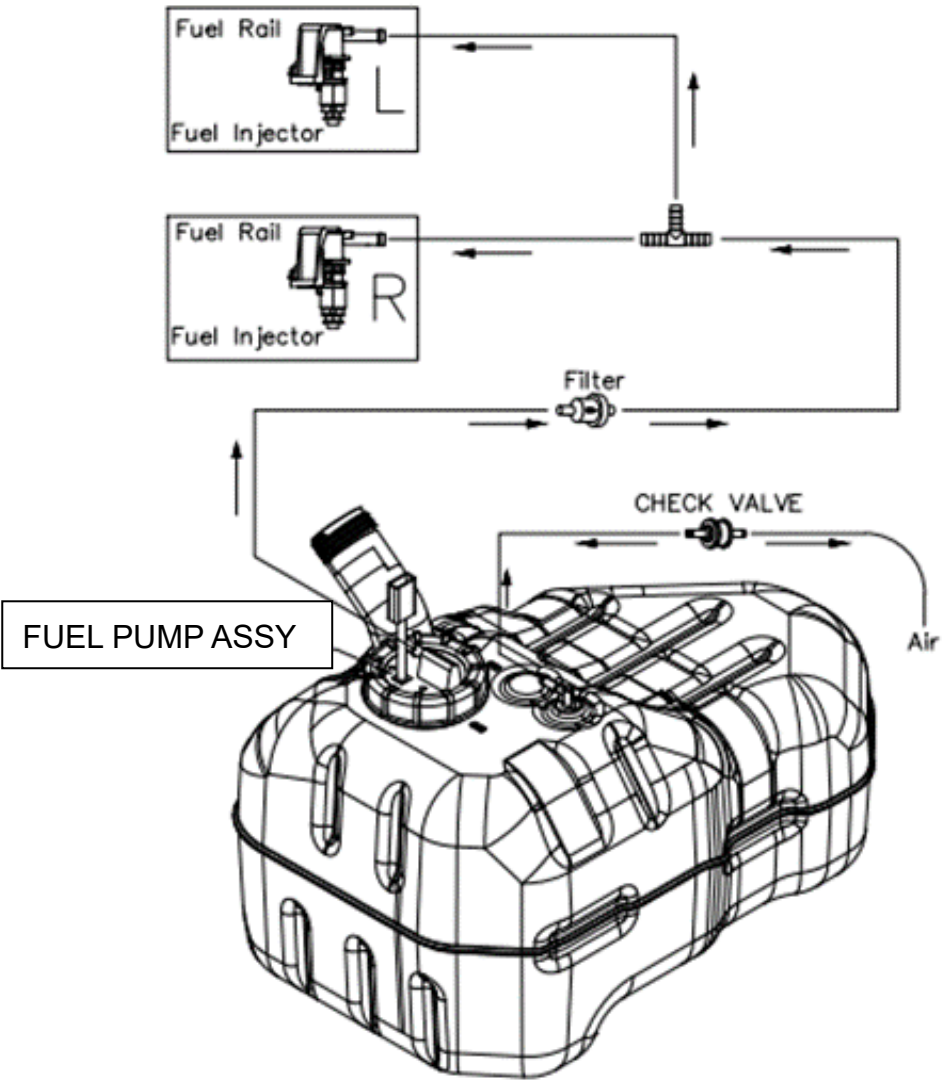
NOTE: *Replace reed valve if damaged.*

Valve installation

For installation, reverse the removal procedure.

TORQUE:1.0~1.2 kgf-m.

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

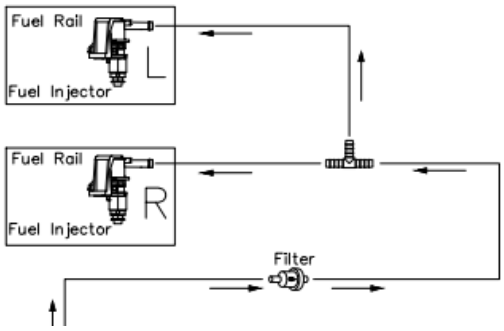
Do not allow fuel to spill on hot engine parts and/or on electrical connectors.

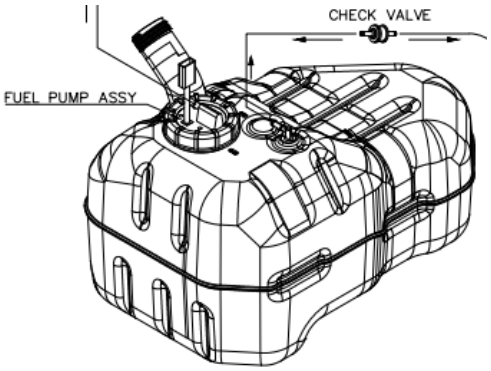
- When the repair is completed, ensure that all hoses are connected and secured.
- Fuel lines remain under pressure at all times.
- Proceed with care when removing/installing high pressures test equipment.
- Disconnect the fuel pump electrical connector to disable fuel pump and crank engine to release 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

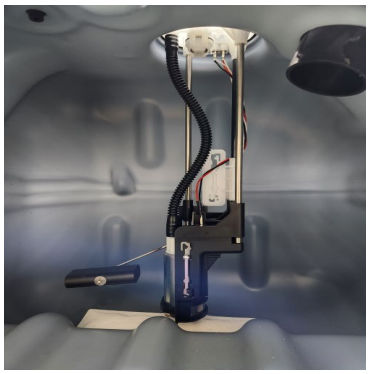
- The fuel pump assembly is inserted in the fuel tank.
- It provides fuel delivery for EFI system and encompasses the following components:
  - Electric fuel pump.
  - Fuel pre-filter.
  - Fuel pressure regulator.
  - Fuel level sender.

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.

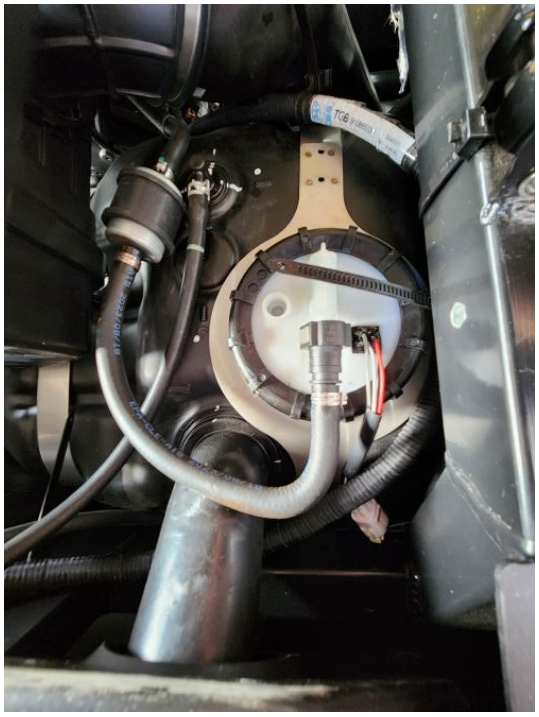
FUEL TANK

Fuel Tank Draining

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

Remove the fuel tank

1. Disconnect battery.
2. Drain fuel tank.
3. Disconnect the fuel pump connector.
4. Remove the vent hose and the refuel pipe from the fuel tank valve.
5. Disconnect the high-pressure fuel hose.
6. Remove fuel tank retaining bolts.
7. Unscrew fuel tank retaining nuts and unhook straps.
8. Loosen fuel filter neck hose clamp.
9. Remove fuel tank.



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. Disconnect the fuel pump connector.
2. Turn ignition key ON.
3. Use multimeter measure and read:

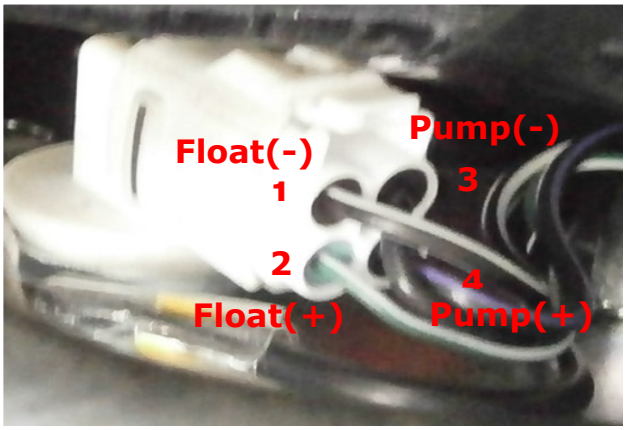
Fuel pump connector:

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.

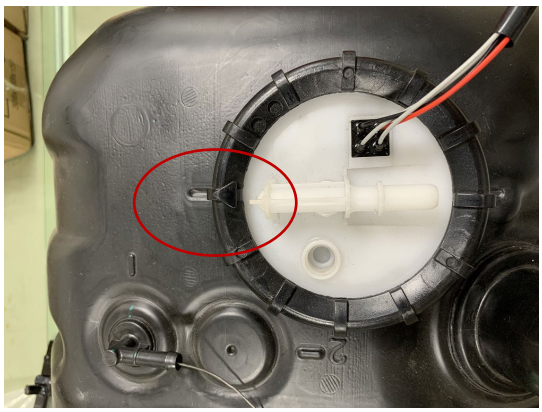
Fuel Pump Resistance Test

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.

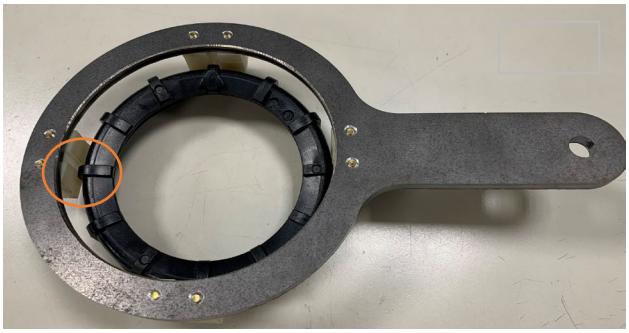
Fuel Pump removal



1. Remove the air filter housing.
2. Disconnect fuel pressure hose from the fuel pump.
3. Disconnect fuel pump electric connector.
4. Remove the fuel pump retaining nut.

WARNING

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



5. Carefully pull out and rotate fuel pump as required.

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.

6. Discard gasket ring.
7. Wipe off any fuel spilage.

Fuel Pump Installation

For installation, reverse the removal procedure.

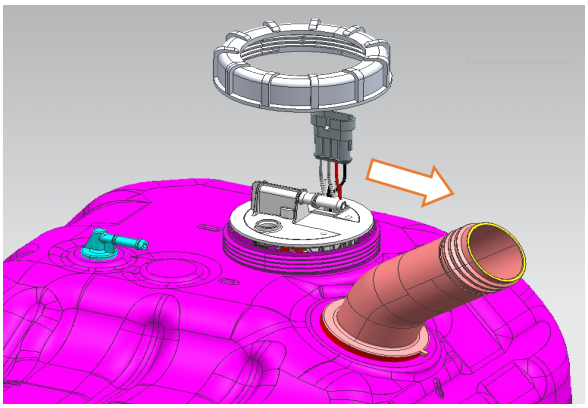
CAUTION

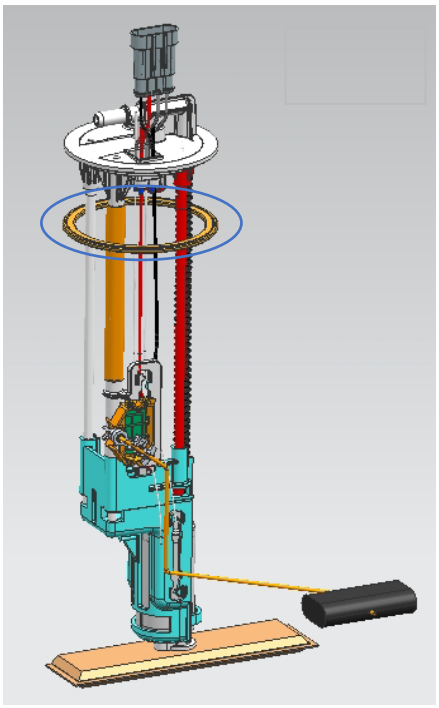
Manipulate fuel pump with care.

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.





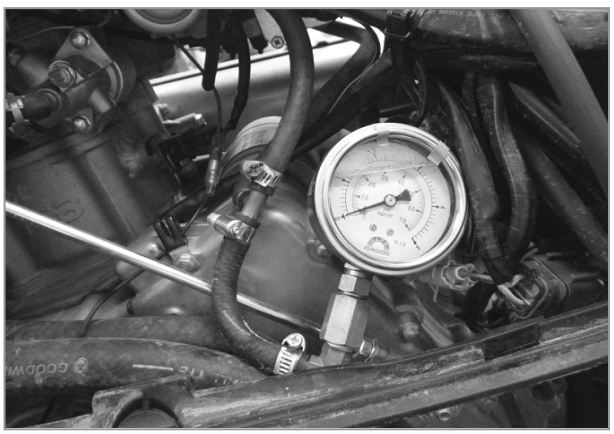
FUEL PRESSURE INSPECTION

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.

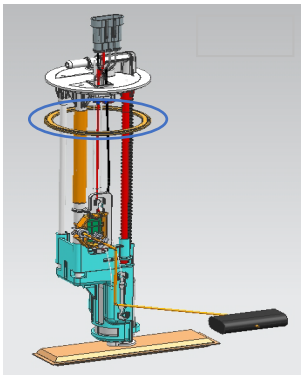
IDLE SPEED: 1250+/-100 RPM

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

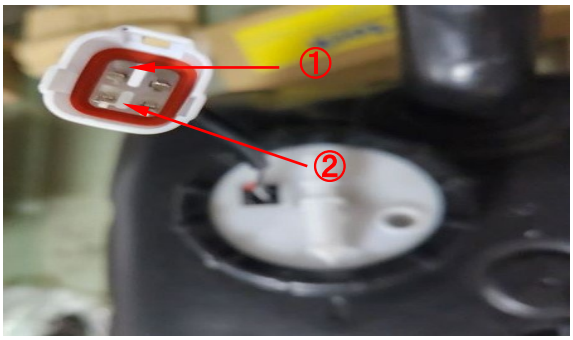
1. Disconnect the fuel pump connector.
2. Use multimeter measure the resistance of the gauge meter..

   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.

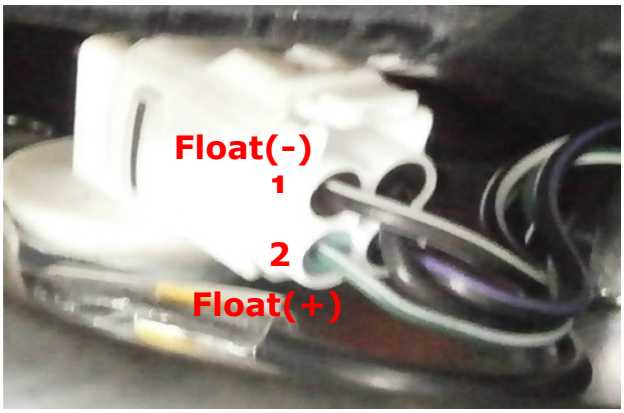


Fuel Gauge Meter Input Voltage Test

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 : gray

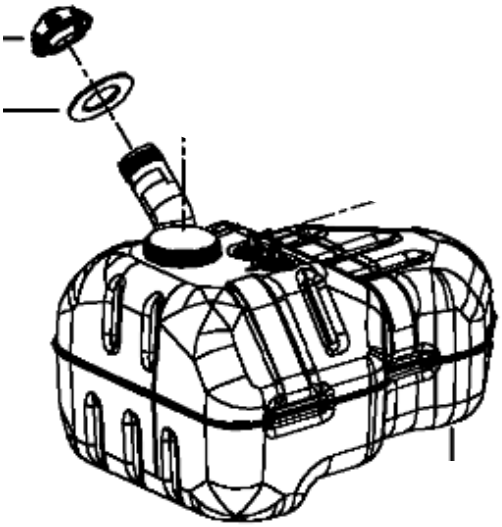
Pin 2 : gray

FUEL TANK VENT VALVE

Fuel tank Vent Valve Test

Test for Normal Operation

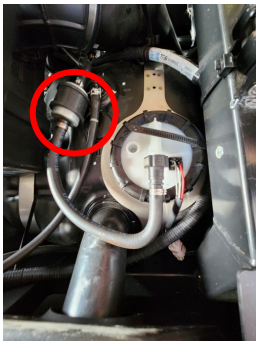
1. Disconnect vent hose from fuel tank vent valve.
2. Connect the VACCUM /PRESSURE PUMP and a short piece of hose to the fuel tank vent valve.
3. Remove fuel tank cap.
4. Set vacuum/pressure pump to PRESSURE and activated pump. The gauge on the pump should not change in reading; air should flow through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

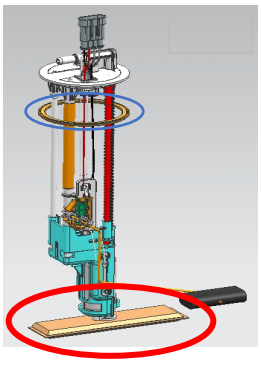


Fuel Filters

The system comprises two levels of filtration.

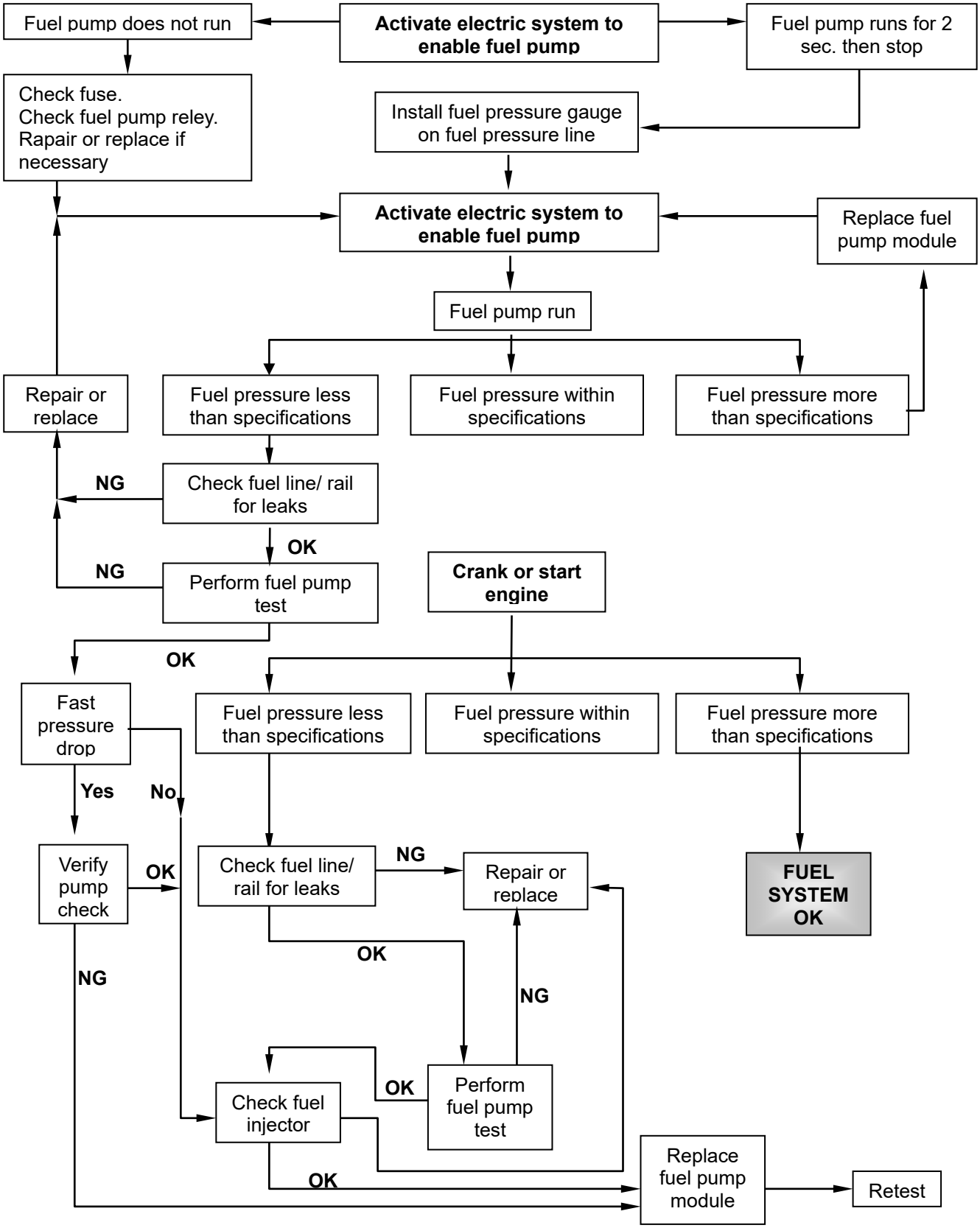
A lower inlet filter (Prefilter) attached to the bottom of the pump, and a upper outlet filter that is integral to the fuel pump module.



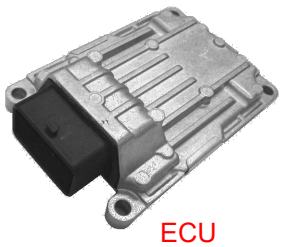


TROUBLESHOOTING

FUEL SYSTEM DIAGNOSTIC FLOW CHART



Fuel Injection System Components

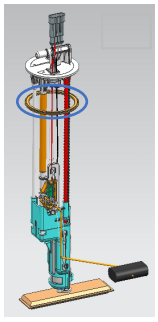

ECU

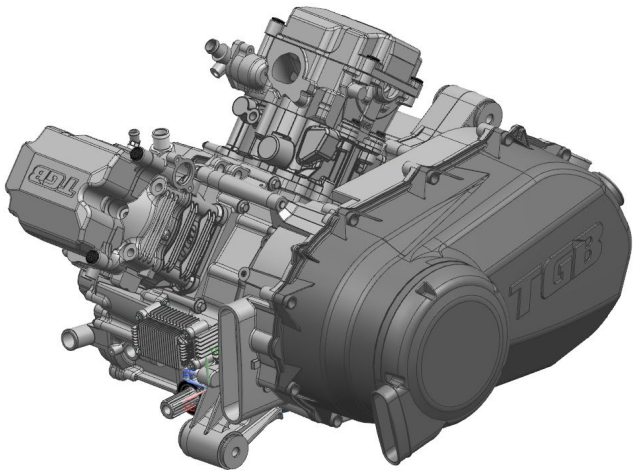

O2 sensor


Throttle Body

Idle Speed Controller


Temperature Manifold Air Pressure


Fuel Pump




Throttle Position Sensor


Injector

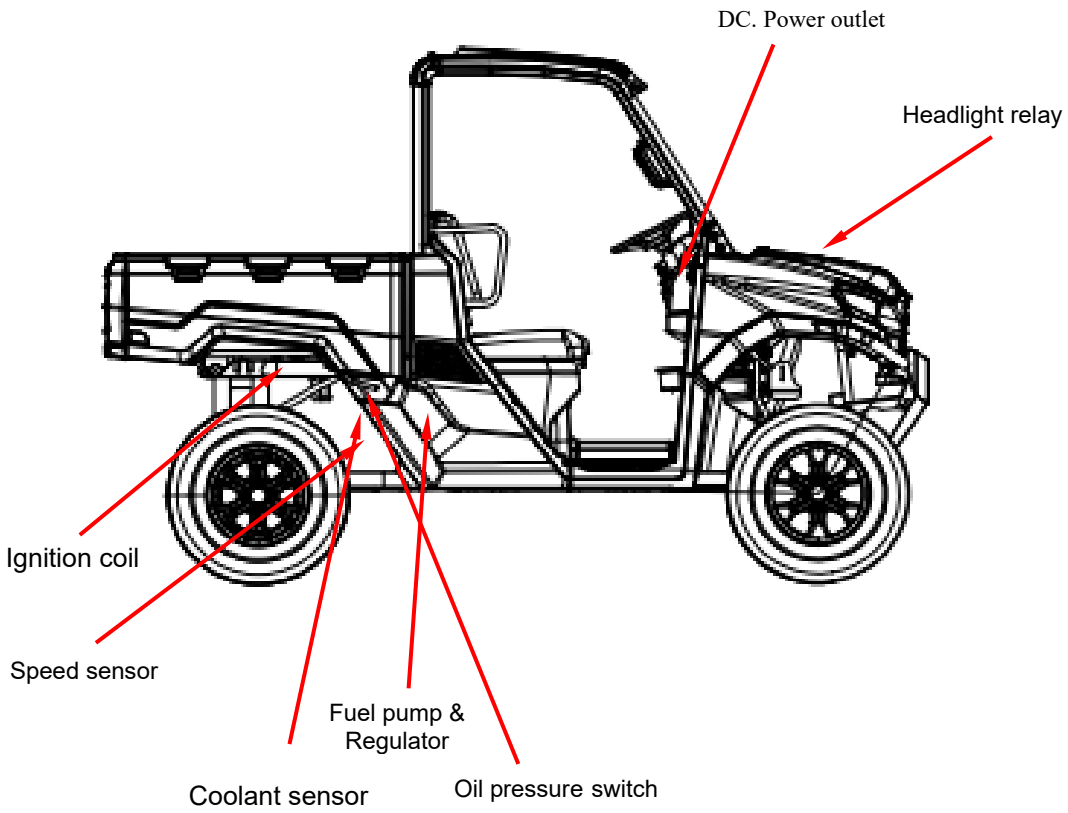

Ignition Coil

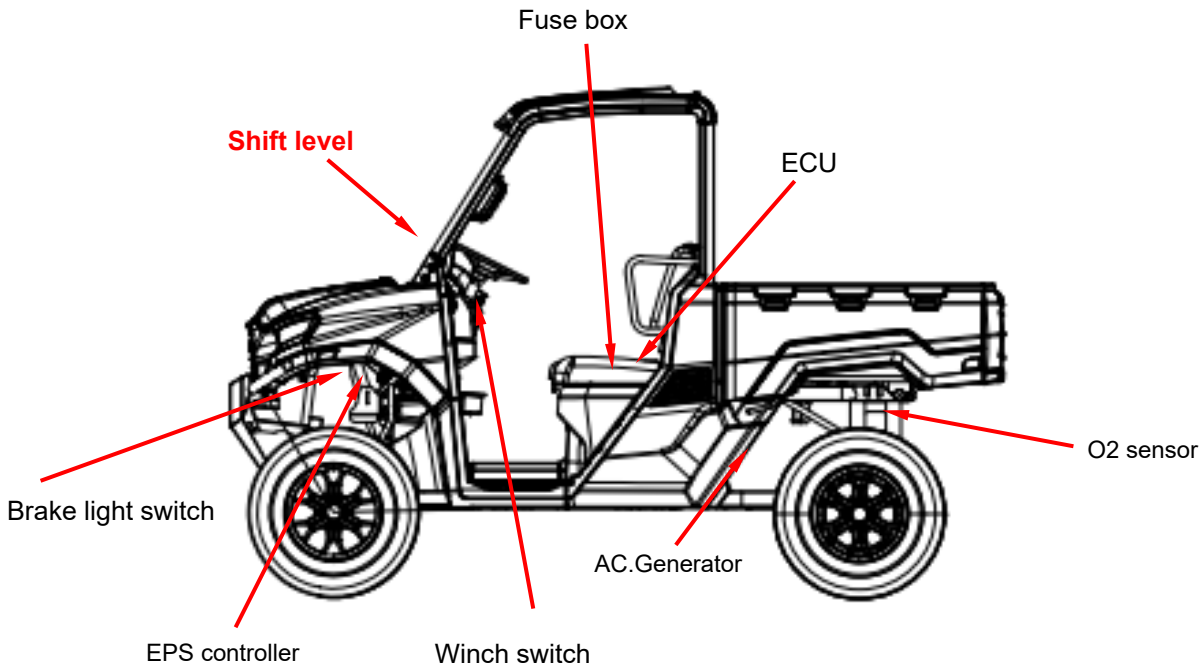

Crank Position Sensor


Roll Over Switch


Engine Coolant Temperature Sensor

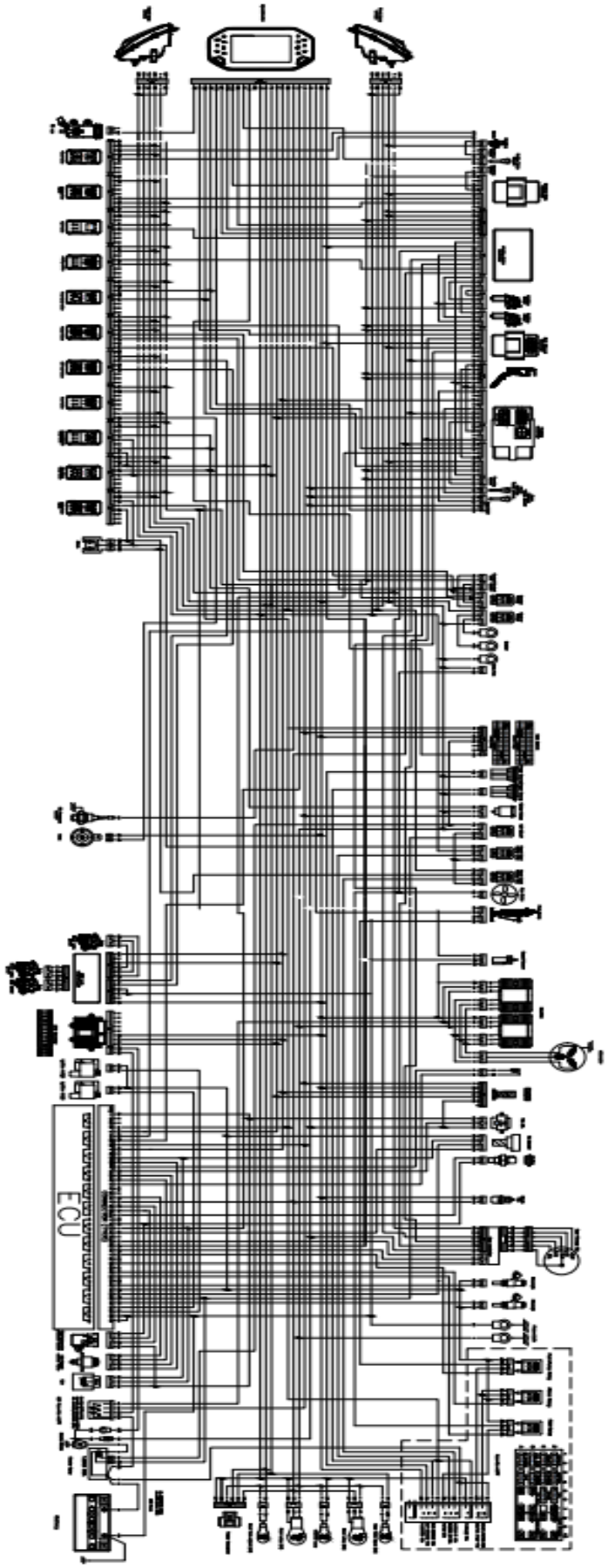
PARTS LOCATION





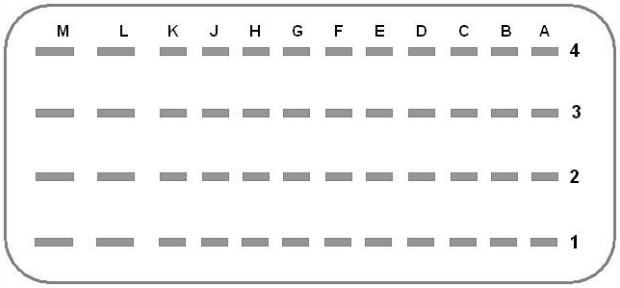
WIRING DIAGRAM

With EPS



ECU TERMINAL

HARNESS



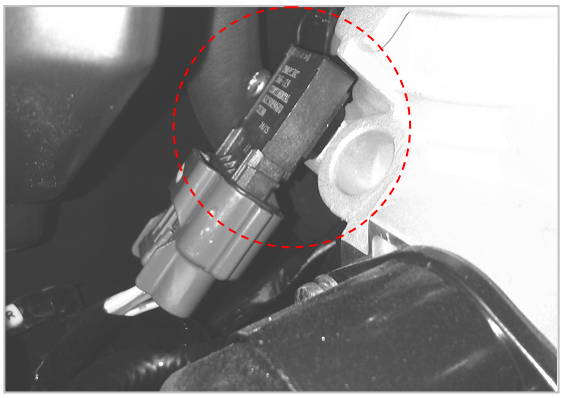
ECU PLUG

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	Blank	Stop SW
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	B	Blank	O2 sensor
B1	2	P/W	CAN_H	Diagnosis Tool	H1	8	-	Blank	
B2	14	W/G	Blank	RPM Limit	H2	20	W	Gear B	H/L signal
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	Neutral signal
C1	3	P/G	CAN_L	Diagnosis Tool	J1	9	B	Blank	Fuel Pump relay
C2	15	B/Y	Temp.	Temperature LED	J2	21	Gr/R	Blank	Front DiffLock SW
C3	27	Gr/R	SGND1	Signal Ground	J3	33	R	Gear A	Reverse signal
C4	39	Br/B	Stepper B	stepper /B	J4	45	R/Gr	Blank	Override switch
D1	4	LG/R	CPS-	Crank position sensor (-)	K1	10	O/W	Blank	Main relay
D2	16	Pu/B	Blank	TILT SW	K2	22	B/W	Blank	Fan relay
D3	28	G/B	Stepper D	stepper /D	K3	34	Blank	Blank	4WD SW
D4	40	L/B	Stepper A	stepper /A	K4	46	L/W	INJ2	Injector#2
E1	5	L/Y	CPS+	Crank position sensor (+)	L1	11	R	VBR	Start relay voltage
E2	17	Gr/L	Blank	Rear DiffLock SW	L2	23	W	Blank	O2 heater
E3	29	-	Blank		L3	35	B/W	Blank	Starter
E4	41	B/Y	Stepper C	stepper /C	L4	47	L/G	INJ1	Injector#1
F1	6	G/Y	Blank	Brake SW	M1	12	B/Y	IGN1	Ignition#1
F2	18	W/Y	MAP	Manifold Air Pressure	M2	24	B/L	IGN2	Ignition#2
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

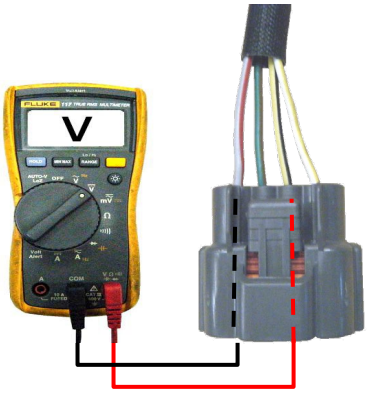
- Turn the ignition OFF.
- Disconnect the T-MAP sensor 4P connector.
- Check for loose or poor contact on the MAP sensor connector.



- 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

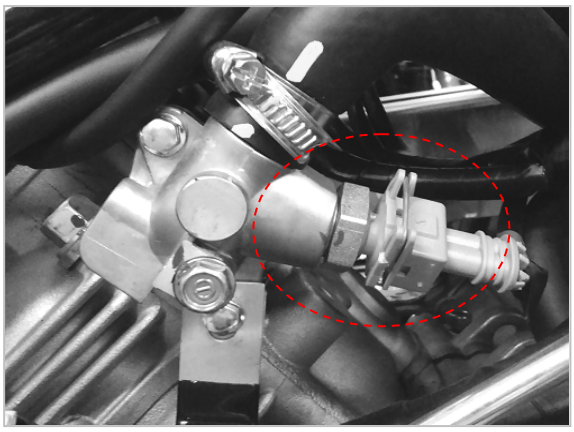


- Turn the ignition switch OFF.
- Connect the TMAP sensor 4P connector.

ECT SENSOR

INSPECTION

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

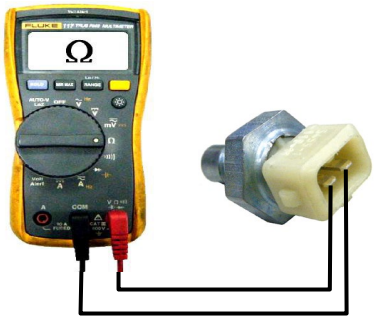


- Connect the ECT sensor connector.
- Turn the ignition switch ON.
- Check the MIL light.

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

  Connection:

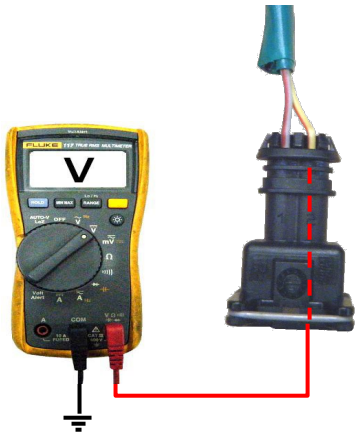
  Standard:2.3~2.6 kΩ (at 20℃)



- 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(-)

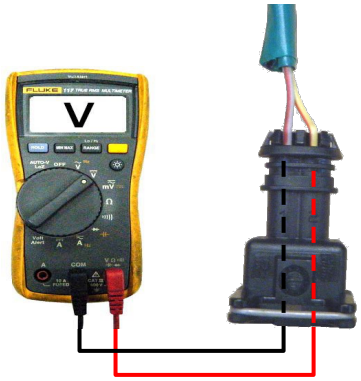
  Standard: 5.0 +/- 0.1V



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

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

  Standard: 5.0 +/- 0.1V

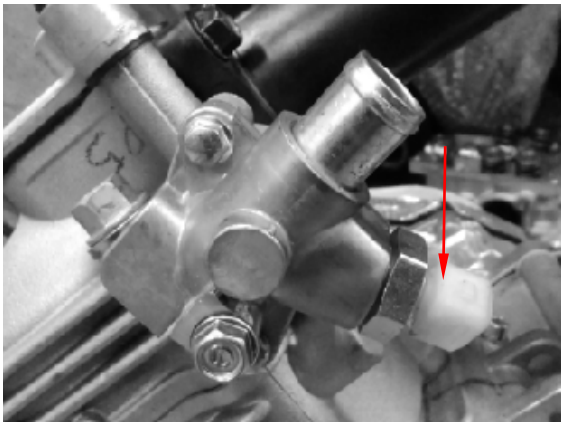


REMOVAL / INSTALLATION

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

TORQUE: 1.6~1.8 kgf/m

- Connect the ECT sensor 2P connector.

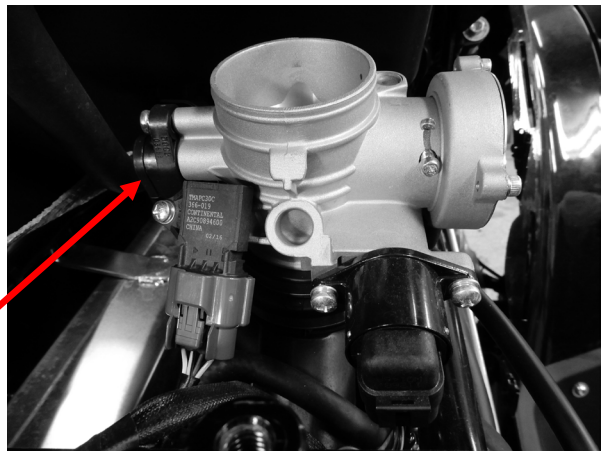


Standard:

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

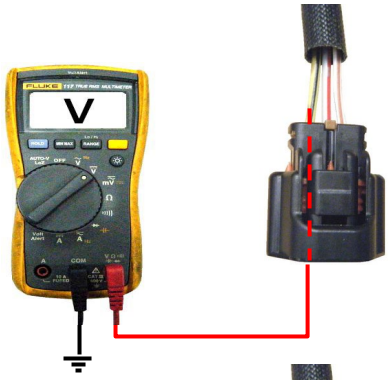
TP SENSOR

INSPECTION

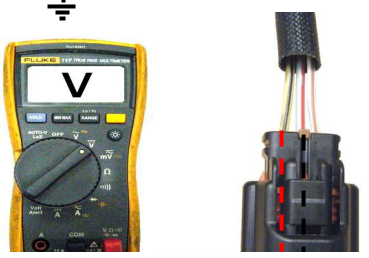


- Turn the ignition switch OFF.
- Disconnect the TP sensor 3P connector.
- Check for loose or poor contact on the TP sensor connector.

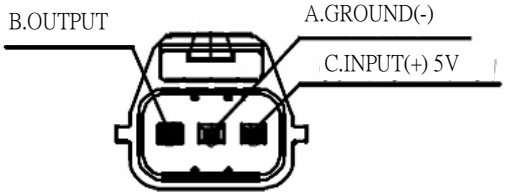
- Connect the TP sensor connector.
- Start the engine and check the MIL light.

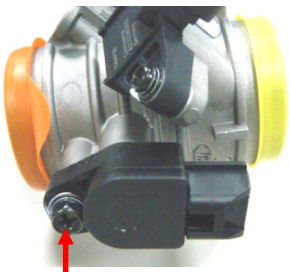


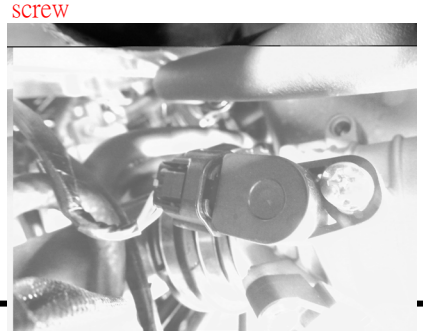
- Turn the ignition switch OFF.
- Disconnect the TP sensor 3P connector.
- Turn the ignition switch ON.
- Measure the voltage between the wire harness side connector terminal and ground.
  Connection: Yellow/Black (+)－Ground(-)
  Standard: 5.0 +/- 0.1V



- 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.



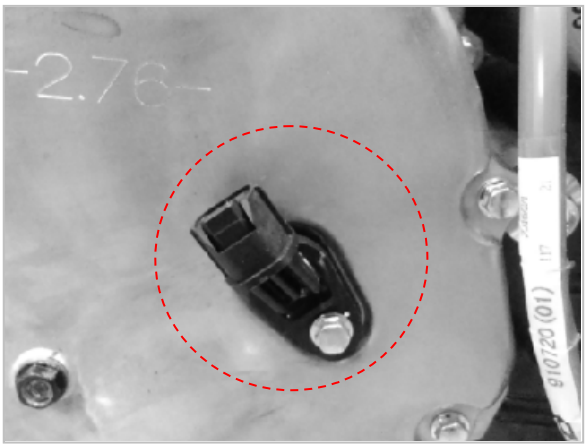




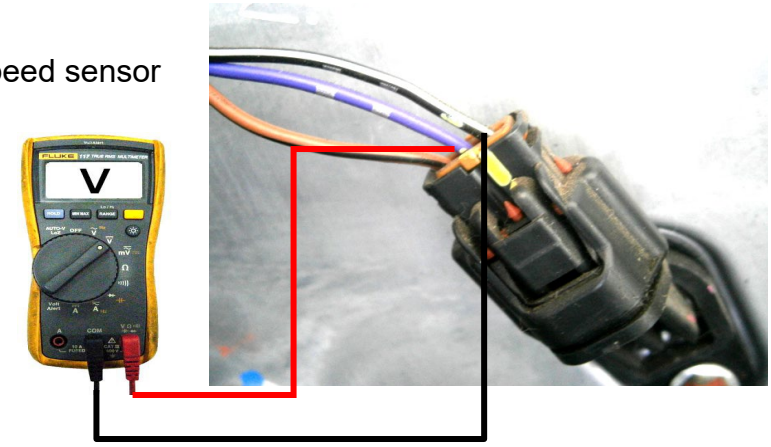
- Using diagnosis tool to confirm the throttle output signal.
  1. Connected to the "diagnosis tool", and open the main switch, but not to start engine.
  2. "Diagnosis tool" selects to a "Live Data" screen.
  3. Rotations throttle and check voltages.

VEHICLE SPEED SENSOR

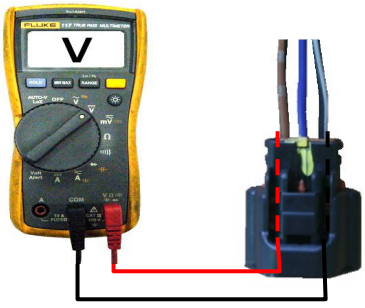
- Turn the ignition switch OFF.
- Disconnect the vehicle speed sensor 3P connector.
- Check for loose or poor contact on the vehicle speed sensor connector.



- Raise the rear wheel of the vehicle and supported by jack.
- Measure the voltage at the vehicle speed sensor connector as shown.
- Turn the rear wheel.
- Check the output voltage:
  High：12 V.
  Low：0 V.

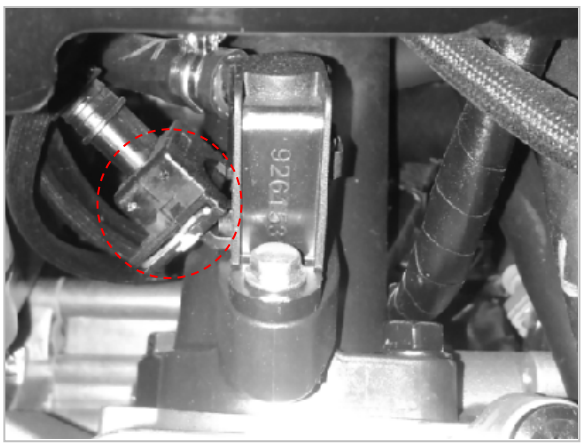


- Turn the ignition switch OFF.
- Disconnect the vehicle speed sensor 3P connector.
- Turn the ignition switch ON.
- Measure the voltage at the wire harness side connector.
  Connection: Red (+)—Black/White(-)
  Standard: 12 V



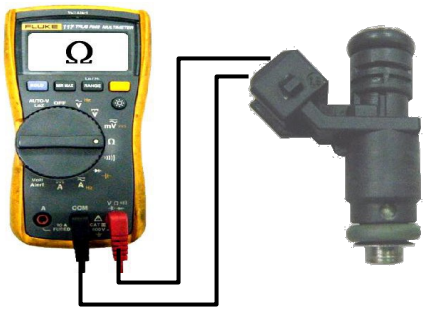
INJECTOR

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

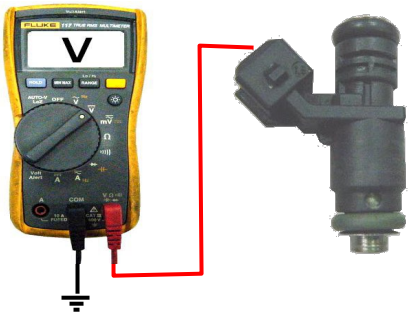


• Connect the injector 2P connector.
• Turn the ignition switch ON.
• Check the MIL light.

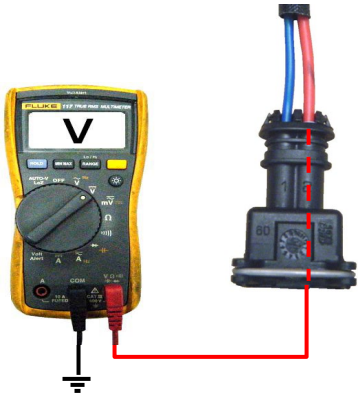
• Turn the ignition switch OFF.
• Disconnect the injector 2P connector and measure the resistance of the injector.
Connection: Red (+) — Blue/Green(-)
Standard:12.0+/-0.6Ω



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

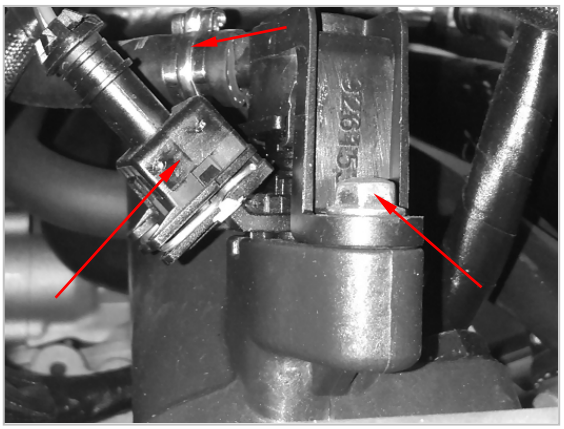


• Turn the ignition switch ON.
• Measure the voltage between the injector connector of the wire harness side and ground.
Connection: Red (+) — Ground(-)
Standard: battery voltage



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

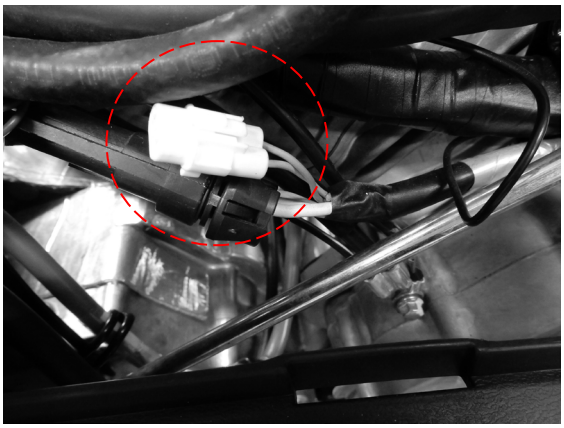
- Install injector on the intake pipe.
- Being careful not to damage the O-ring of injector.
- Install fuel rail assembly and tighten the bolt.

TORQUE: 0.9~1.0 kgf-m

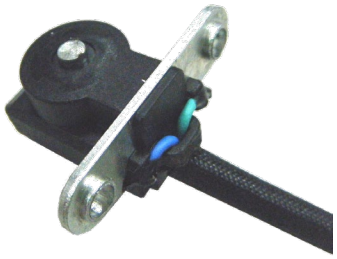
- Connect the injector 2P connector.

CRANK POSITION SENSOR

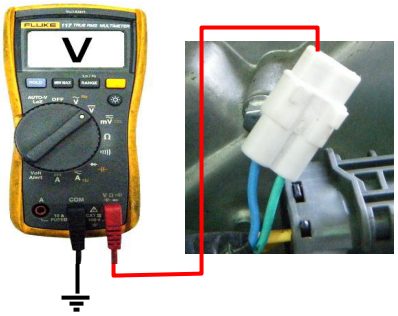
- Turn the ignition switch OFF.
- Disconnect the crank position sensor 2P connector.
- Check for loose or poor contact on the crank position sensor 2P connector.



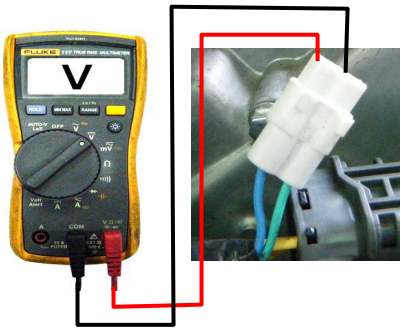
- Connect the crank position sensor 2P connector.
- Turn the starter motor more than 10 seconds and then check that the MIL light.



- 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

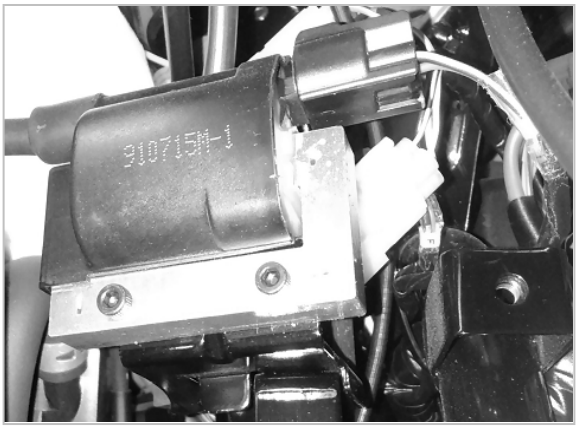


- Crank the engine with the starter motor, and measure the crank position sensor peak voltage at the crank position sensor 2P connector.
  Connection: Blue (+) — Sky Blue(-)
  Standard: **1.6~2.2V (AC)**



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.

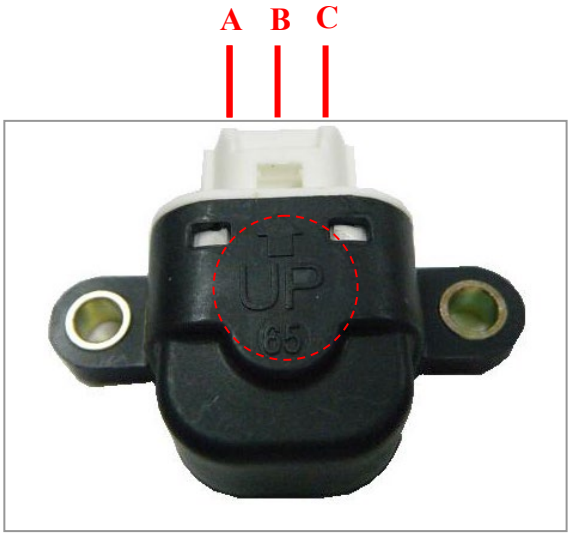
ROLL OVER SENSOR

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 (65º)	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.

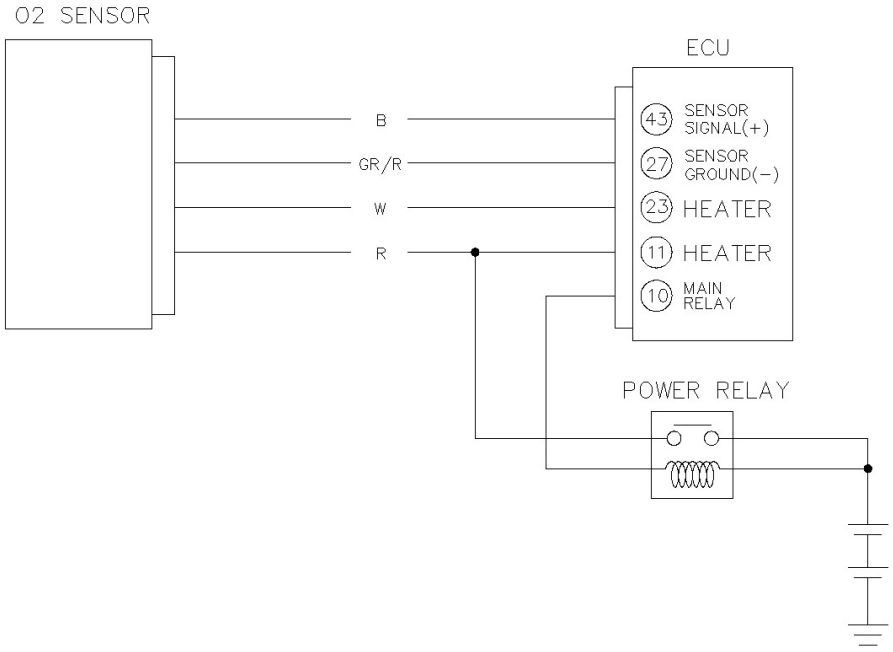


REMOVAL / INSTALLATION

- 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.***

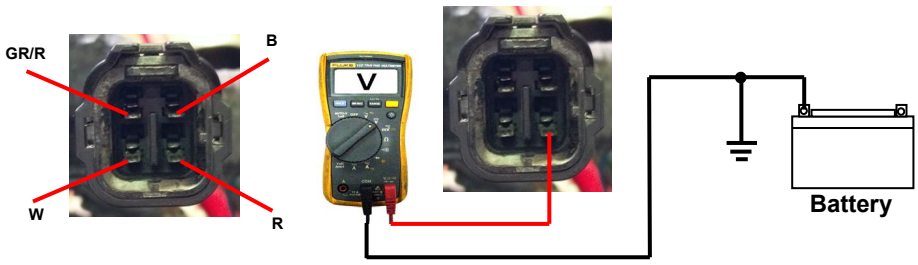
O_2 Sensor Circuit Inspection



Voltage check: (wiring harness):

- Disconnect the coupler of O_2 Sensor.
- Turn the ignition switch ON but not to star engine.
- Using voltage meter (DCV) measure the terminal of wiring harness as shown.

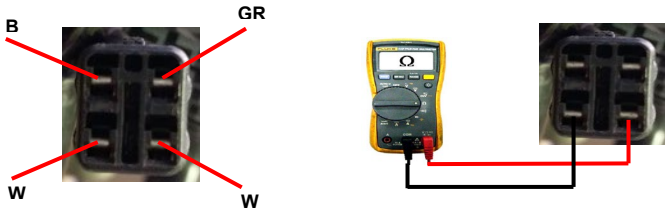
Voltage > 12 VDC.



Resistance check: (O2 sensor coupler):

Using voltage meter (Ω) measure the terminal of O2 sensor coupler as shown.

Resistance: 13～17.5Ω



ECU

REMOVAL / INSTALLATION

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

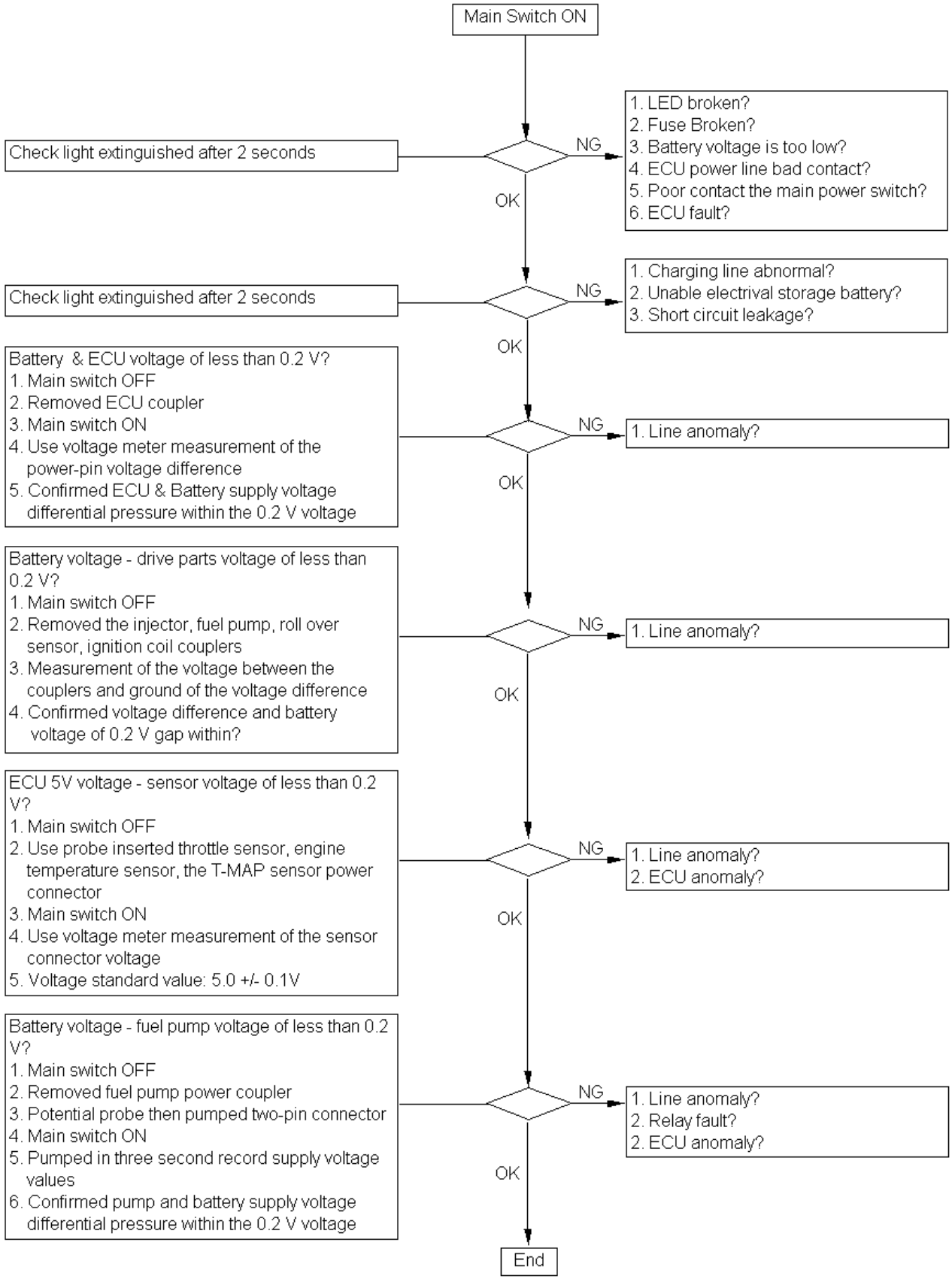
POWER INPUT LINE

- 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.

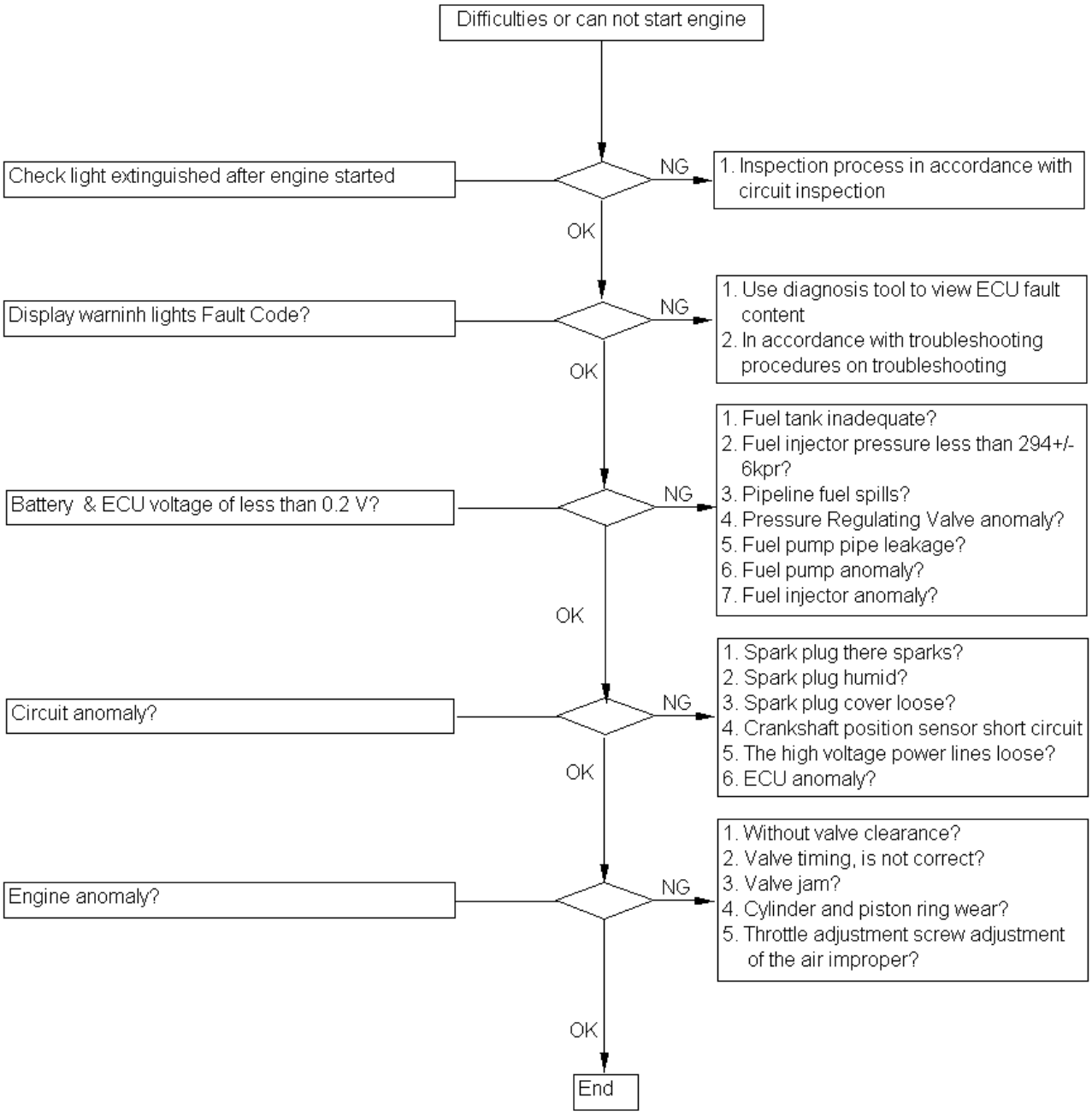
• If the wire is OK, check for the roll over sensor/relay.

Fault Diagnosis

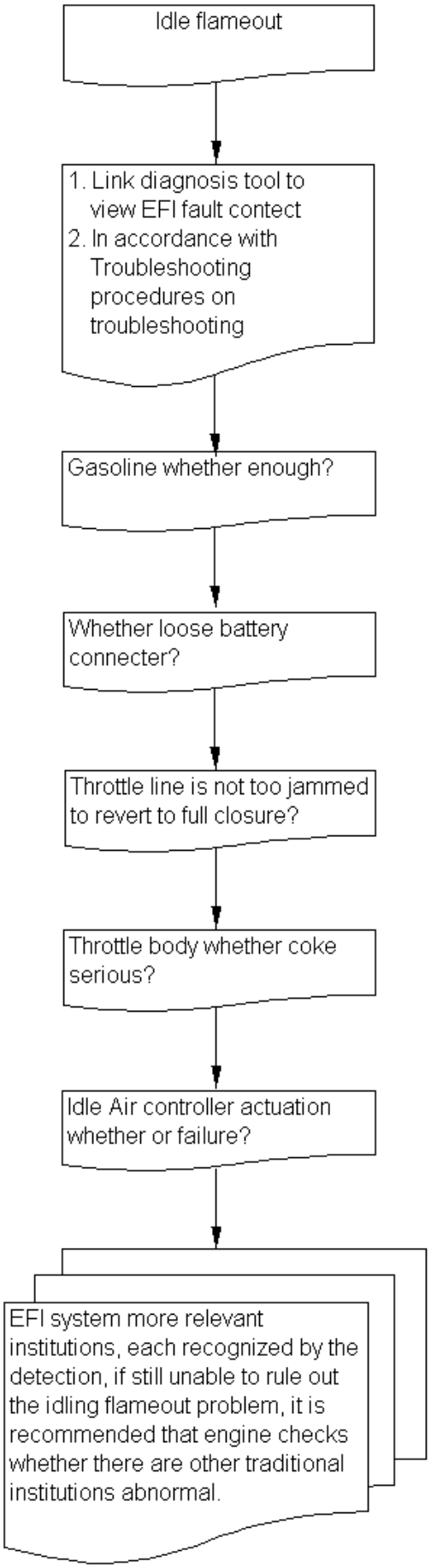
EFI Circuit inspection



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 Battery)
3	B2226	Tilt switch diagnosis (Short Circuit Ground/Open Circuit)
4	P0000	No DTC
5	P0031	Sensor heater diagnosis #0 (Short Circuit Ground/Open Circuit)
6	P0032	Sensor heater diagnosis #0 (Short Circuit Battery)
7	P0107	MAP sensor diagnosis (Short Circuit Ground/Open Circuit)
8	P0108	MAP sensor diagnosis (Short Circuit Battery)
9	P0112	Intake air temperature sensor diagnosis (Short Circuit Ground)
10	P0113	Intake air temperature sensor diagnosis (Short Circuit Battery/Open Circuit)
11	P0114	Electrical intake air temperature intermittent diagnosis (failure)
12	P0117	Coolant Temperature Sensor (Short Circuit Ground)
13	P0118	Coolant Temperature Sensor (Short Circuit Battery/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 Ground/Open Circuit)
17	P0123	Throttle Position Sensor 1 (Short Circuit Battery)
18	P0131	Lambda sensor #0 diagnosis (Short Circuit Ground)
19	P0132	Lambda sensor #0 diagnosis (Short Circuit Battery)
20	P0133	Lambda sensor #0 diagnosis (Open Circuit)
21	P0171	Lambda control diagnosis #0 (too high)
22	P0172	Lambda control diagnosis #0 (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 Ground/Open Circuit)
26	P0232	Electric fuel pump diagnosis (Short Circuit Battery)
27	P0261	Injection valve diagnosis #0 (Short Circuit Ground/Open Circuit)
28	P0262	Injection valve diagnosis #0 (Short Circuit Battery)
29	P0264	Injection valve diagnosis #1 (Short Circuit Ground/Open Circuit)
30	P0265	Injection valve diagnosis #1 (Short Circuit Battery)
31	P0351	Ignition diagnosis #0 (Short Circuit Battery)
32	P0352	Ignition diagnosis #1 (Short Circuit Battery)
33	P0370	Loss of synchronization diagnosis
34	P0371	Crankshaft sensor diagnosis

35	P0373	Crankshaft sensor diagnosis
36	P0462	FUEL sensor diagnosis (Short Circuit Ground)
37	P0463	FUEL sensor diagnosis (Short Circuit Battery/Open Circuit)
38	P0484	Cooling fan diagnosis (Short Circuit Battery)
39	P0485	Cooling fan diagnosis (Short Circuit Ground/Open Circuit)
40	P0560	Battery voltage diagnosis (too low)_VBR
41	P0561	Battery voltage diagnosis (too high)_VBR
42	P0562	Battery voltage diagnosis (too low)_VBK
43	P0563	Battery voltage diagnosis (too high)_VBK
44	P0608	Reference voltage diagnosis (Short Circuit Battery)
45	P0609	Reference voltage diagnosis (Short Circuit Ground/Open Circuit)
46	P0615	Starter 1 diagnosis (Open Circuit)
47	P0616	Starter 1 diagnosis (Short Circuit Ground)
48	P0617	Starter 1 diagnosis (Short Circuit Battery)
49	P0630	VIN coherence
50	P0651	MIL diagnosis (Short Circuit Ground/Open Circuit)
51	P0652	MIL diagnosis (Short Circuit Battery)
52	P1352	Ignition diagnosis #0 (Short Circuit Ground/Open Circuit)
53	P1353	Ignition diagnosis #1 (Short Circuit Ground/Open Circuit)
54	P1508	Stepper motor diagnosis (Short Circuit Ground/Open Circuit)
55	P1509	Stepper motor diagnosis (Short Circuit Battery)
56	P1615	Starter 2 diagnosis (Open Circuit)
57	P1616	Starter 2 diagnosis (Short Circuit Ground)
58	P1617	Starter 2 diagnosis (Short Circuit Battery)

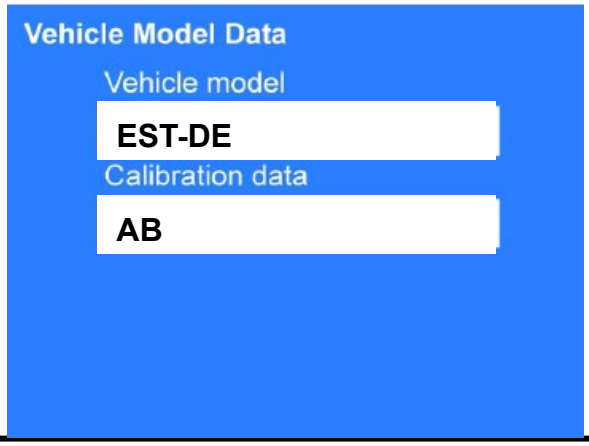
Use diagnosis tool

Note:

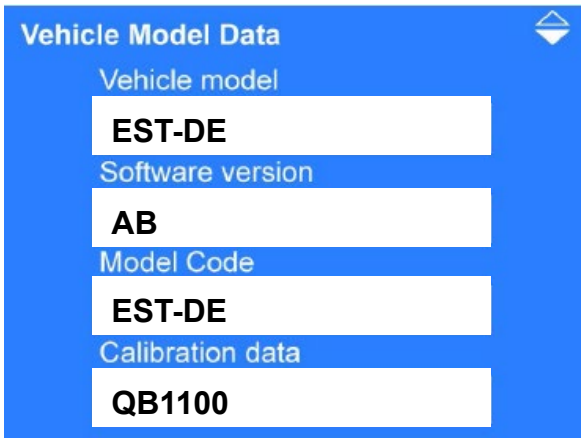
- When problems arise, can be used for diagnosis tool of the fault is detected, and exclusion.
- In addition to testing, troubleshooting, another of the operation can be carried out data analysis-type monitor.

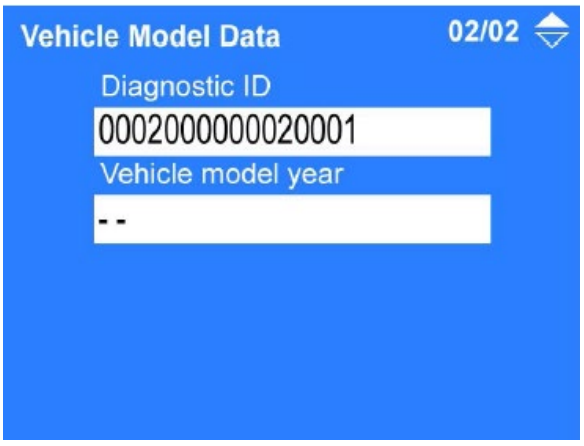
Method of Use:

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



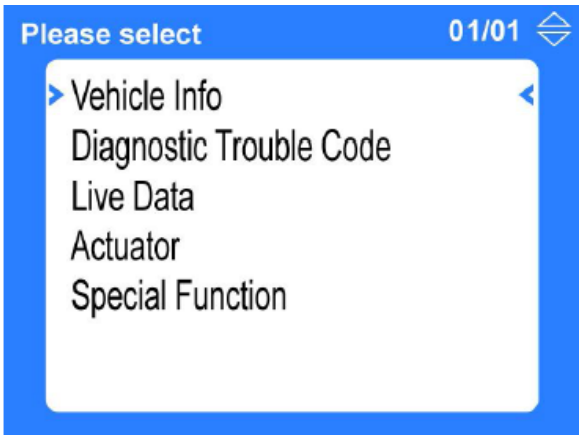
5. Press “ENTER” button again for more detailed vehicle information. Press ▲▼ button to view all information.





Diagnosis Use Note

Press ”ENTER” button to the function menu.



Options main functional areas:

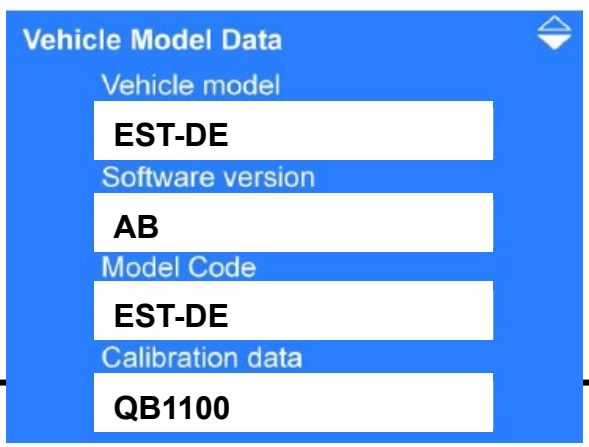
1. **Vehicle Info**
2. **Diagnostic Trouble Code**
3. **Live Data**
4. **Actuator**
5. **Special Function**

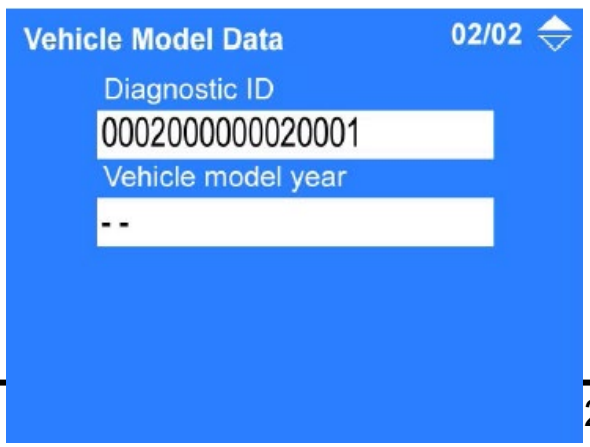
Press ▲▼ button to choose one function.

1. Vehicle Info

Move the cursor to ”**Vehicle Info**” and press **ENTER** to see the content

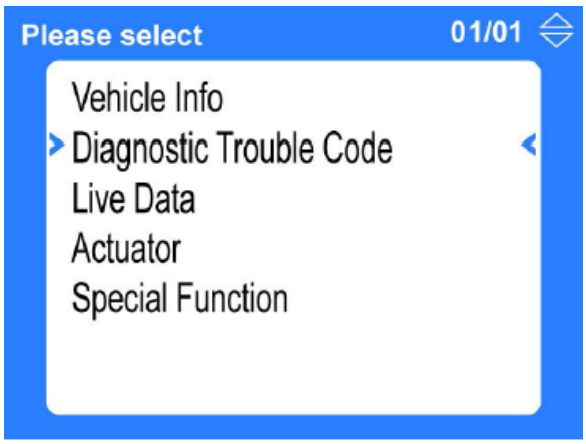
This is the page of “**Vehicle Info**”, press ▲▼ button to view all vehicle info.

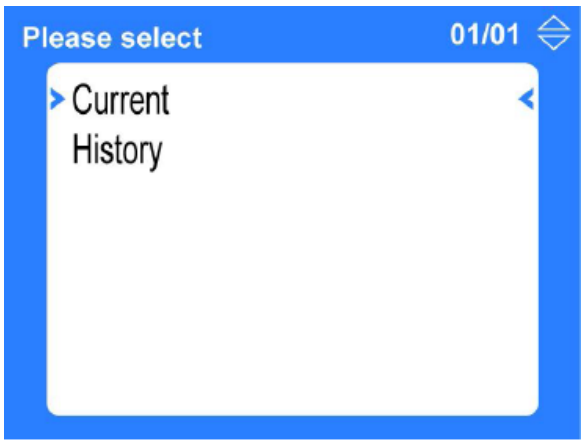




2. Diagnostic Trouble Code

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



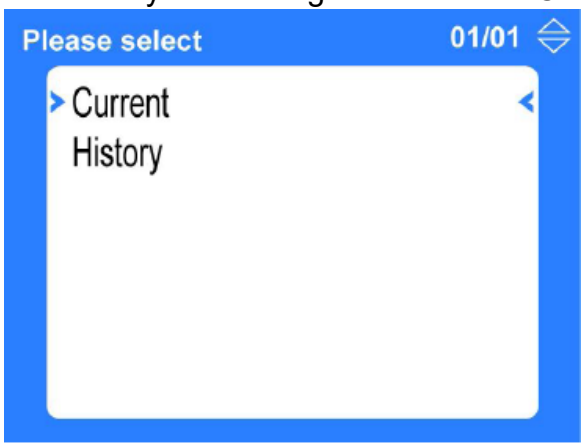


2-1. Current

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

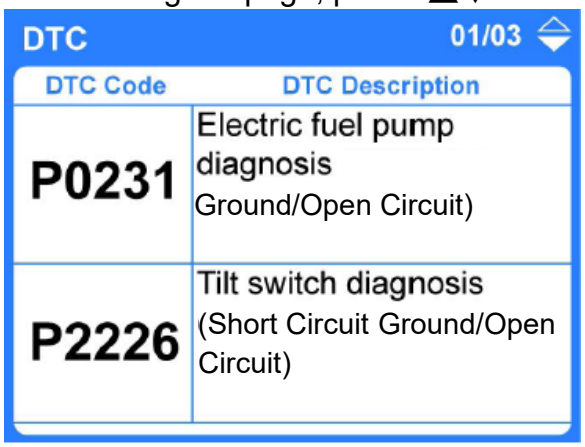
2-2. History

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



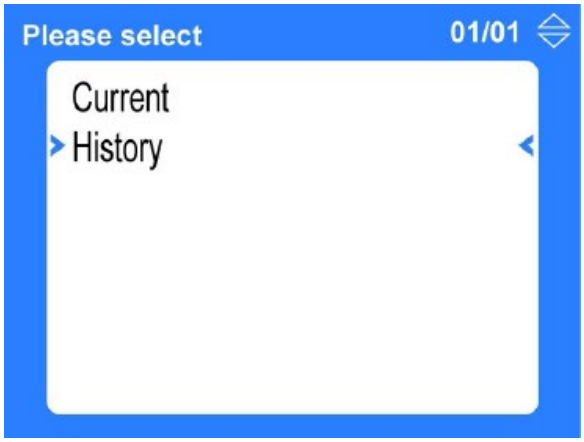
Move the cursor to "**Current**" and press "**ENTER**" to continue

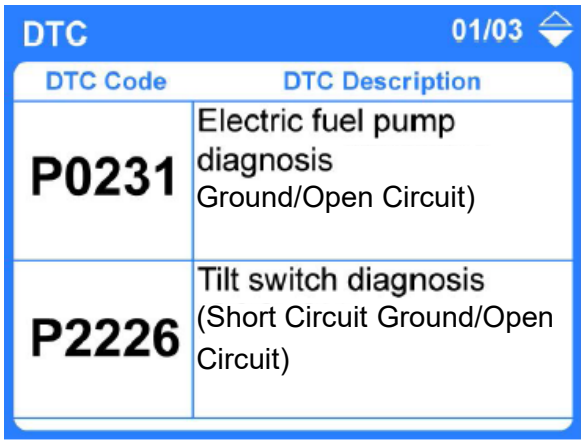
After entering the page, press ▲▼ to view all the Diagnostic Trouble Code.



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

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

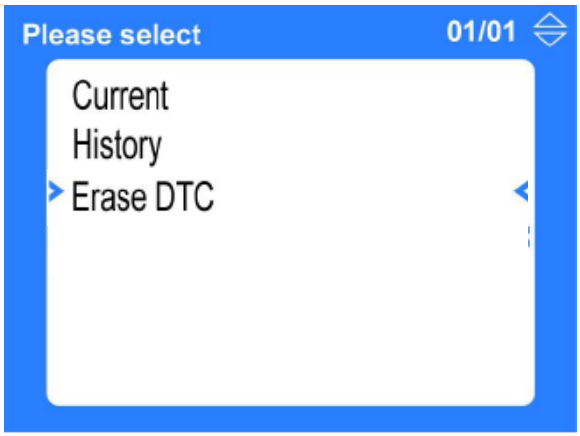


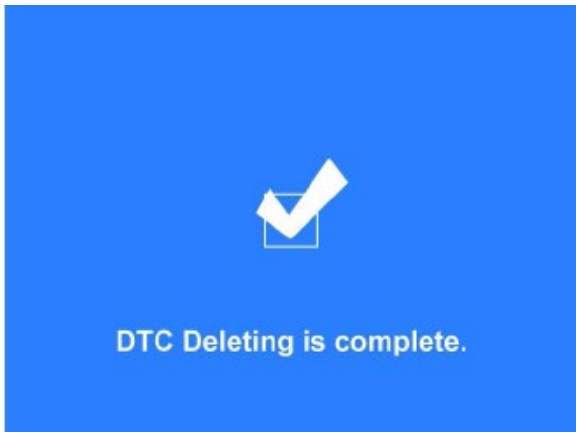


After entering the page, press ▲▼ to view all the Diagnostic Trouble Code occurred in the past.
After viewing the Diagnostic Trouble Code, press ESC to return to the previous page.

※
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”.
“**Erase DTC**” is the function to erase all Diagnostic Trouble Code in both “Current” and “History”.

2-3. Erase DTC
Move the cursor to “Erase DTC” item and press ENTER to EARSE ALL DIAGNOSTIC TROUBLE CODE DIRECTLY!

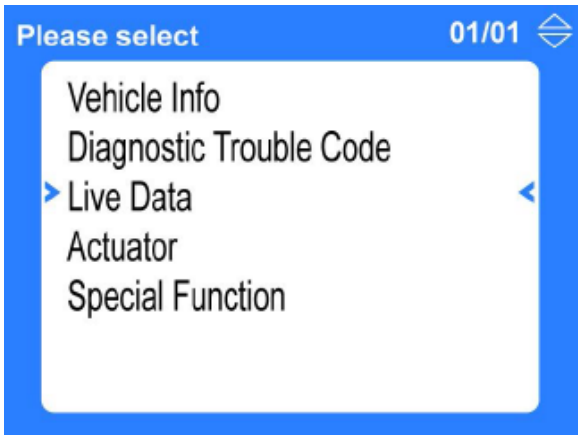




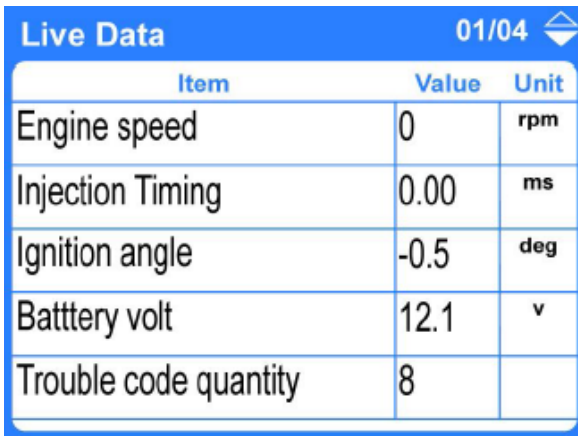
When you see the following picture on the screen, the Diagnostic Trouble Code erasure is completed. Press ESC button back to the main menu.

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



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 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	Open the main switch but did not start engine the injection situation Injector state when start	Not started, Injector not leaking fuel In started, the injection state must show fan shape	Fuel pump relay fault Fuel pump fault Injector fault 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 front and rear drive shafts.
5. Remove the cargo box.
6. Remove air cleaner assembly with the throttle body.
7. 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 the air intake below.
10. Remove the front and rear exhaust head pipes and muffler.
11. Remove the shift connecting rod.
12. Disconnect the CVT inlet and outlet ducts.
13. Disconnect the engine coolant hose
14. Disconnect the crankcase vent hose.
15. Disconnect the gearbox vent hose.
16. Unplug and remove the ETS (engine temperature sensor).
17. 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.
18. Remove the bolts of the front and rear universal joint.
19. Remove front and rear engine support nut.
20. Remove the L/H fan and the black plastic cover.

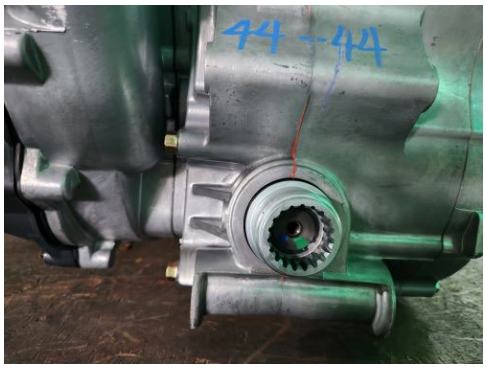
Lifting and Remove the Engine

1. Install a hook and strap through the rear engine lifting holes and route a second lifting strap under the front cylinder.
2. Remove retaining screws on front and rear propeller shaft.
3. Slightly lift engine to easy remove of front engine support bolt.
4. Remove the front engine support bolt
5. Raise the front of engine to separate front propeller shaft from engine

ENGINE INSTALLATION

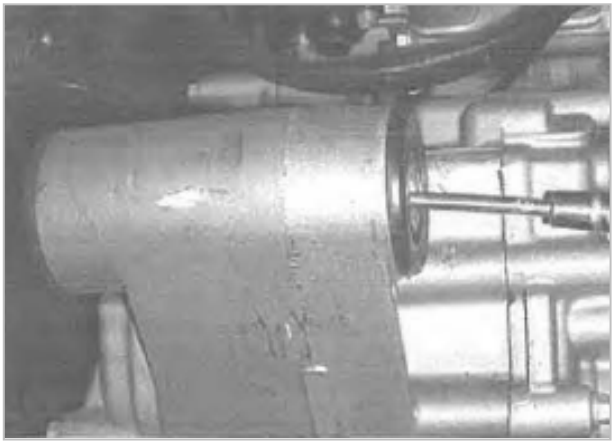
For installation, reverse the removal procedure. However, pay attention to the following.

- 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 cargo box, seat, cooling fan and the black plastic cover.
5. Test drive vehicle to confirm proper operation.



ENGINE MOUNTS

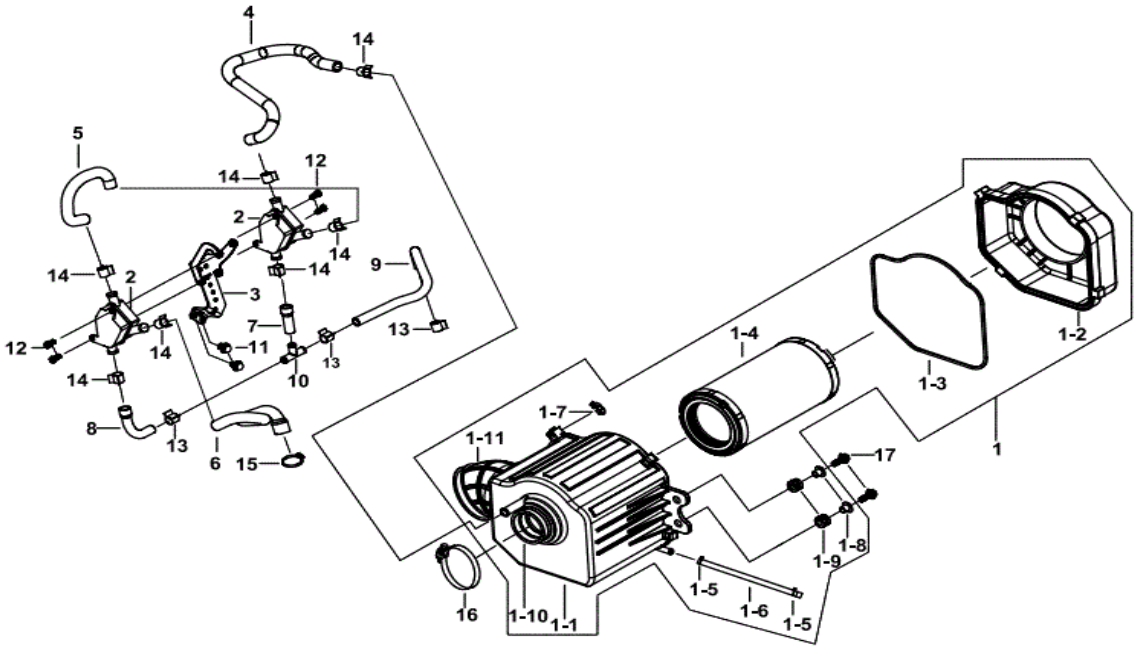
NOTE: *Use the same procedure for the front and rear engine mounts.*

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.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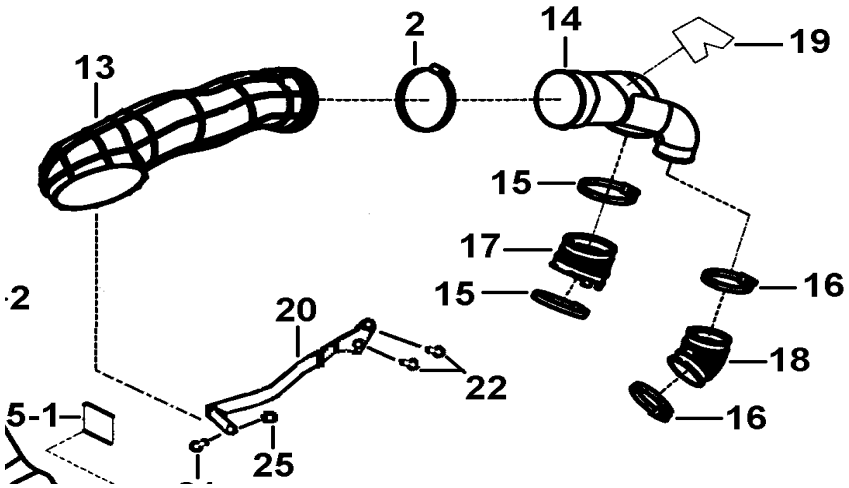
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GENERAL

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. Lift and Open the access cover.
2. Loosen and remove the air filter.
3. Clean and replace if necessary
4. Insert the filter carefully.
5. Inspect and carefully clean gasket in the groove of the cover. Replace if damaged.
6. Secure air filter cover with latches.

AIR CLEANER

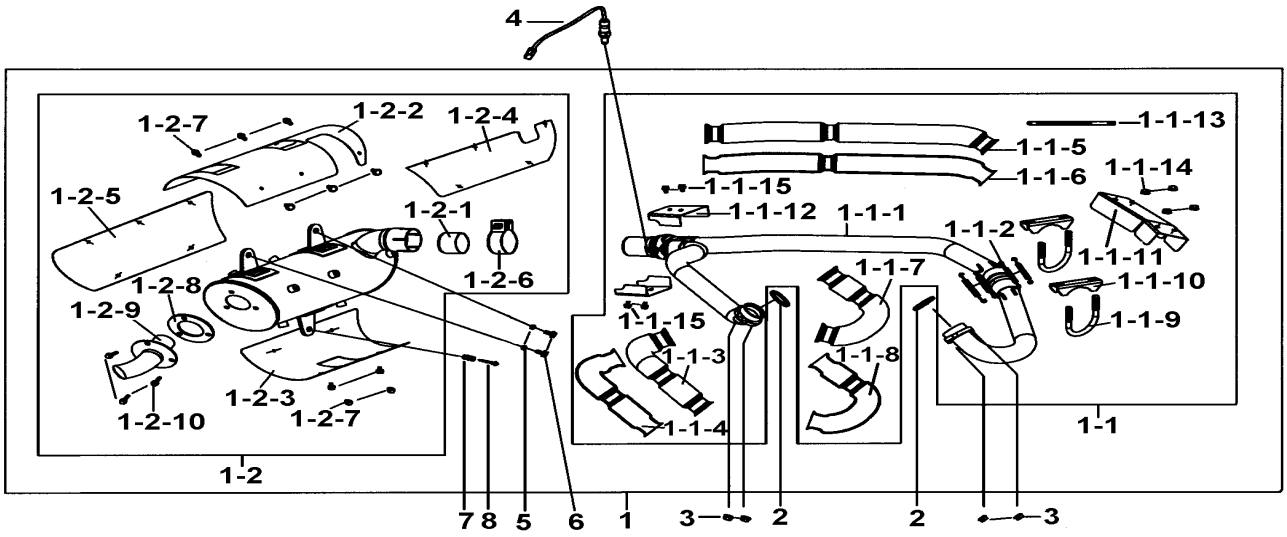
Air Cleaner Removal

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.

WARNING

When riding in dusty conditions or sand, the air filter needs to be cleaned before every ride.

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.

Cleaning and inspecting the muffler spark arrester

The muffler must be periodically purged of accumulated carbon.

1. Remove and discard the tail retaining screws.
2. Remove exhaust tail pipe, gasket (discard) and spark arrester.
3. Remove carbon deposits from the spark arrester using a brush.
4 Use a soft brush and be careful to avoid damaging spark arrester mesh.
5.Inspect mesh of spark arrester for any damage. Replace as required.

For installation, reverse the removal procedure.

MUFFLER

Muffler Inspection

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

EXHAUST PIPE

Exhaust Pipe (Front Cylinder)

Removal

1. Remove muffler.
2. Remove heat shields covering front head pipe by removing the gear clamps
3. Remove springs securing rear head pipe to front head pipe. Discard gasket.
4. Remove springs securing rear head pipe to front head pipe. Discard gasket.
5. Remove front cylinder head pipe.

Installing Front Head Pipe

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

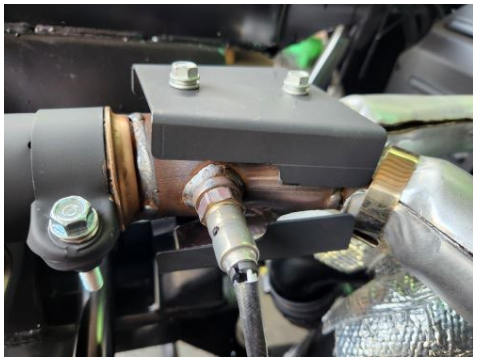
1. Install NEW exhaust gaskets and nuts.
2. Check the front head pipe spring
3. If spring length exceeds specification, replace spring.
4. Install muffler.
5. Reinstall heat shields of front head pipe, tighten gear clamps following the tightening sequence and specification.

Exhaust Pipe (Rear Cylinder)

Removal

1. Remove muffler.
2. Remove heat shield covering front head pipe by removing the gear clamps.
3. Remove both retaining nuts from rear cylinder head pipe flange. Discard nuts
5. Remove rear head pipe with “Y” exhaust pipe, and heat shields. Discard gasket and nuts.

“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：2.5 kgf-m

Nut Torque: 2-2.5 kgf-m

O2 Sensor：2.5 kgf-m

Installing Rear Head Pipe

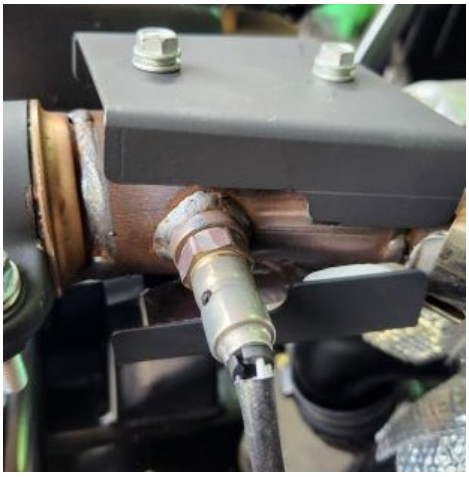
The installation is the reverse of the removal procedure. However, pay attention to the following.

1. Do not tighten yet. Strictly adhere to tightening sequence.
2. Install NEW exhaust gasket.
3. Install muffler

WARNING

Never touch exhaust system components immediately after the engine has been running.

Heated Oxygen Sensor



Oxygen Sensor General Precautions

Take the following precautions to avoid sensor malfunction:

– Do not use any product on sensor probe.

– Do not expose sensor to water, oil, windshield cleaner, anticorrosion oil, grease, terminal cleaner, etc.

– Do not drop or use an oxygen sensor that has been dropped.

– Do not use any compound on sensor threads unless labeled as compatible with oxygen sensor.

– Do not use impact wrench or conventional socket type wrench to install sensor.

– Do not allow sensor or wire to touch exhaust system or any other hot component.

– Do not route sensor wires to create tension in the wires. This could cause faults or sensor malfunction.

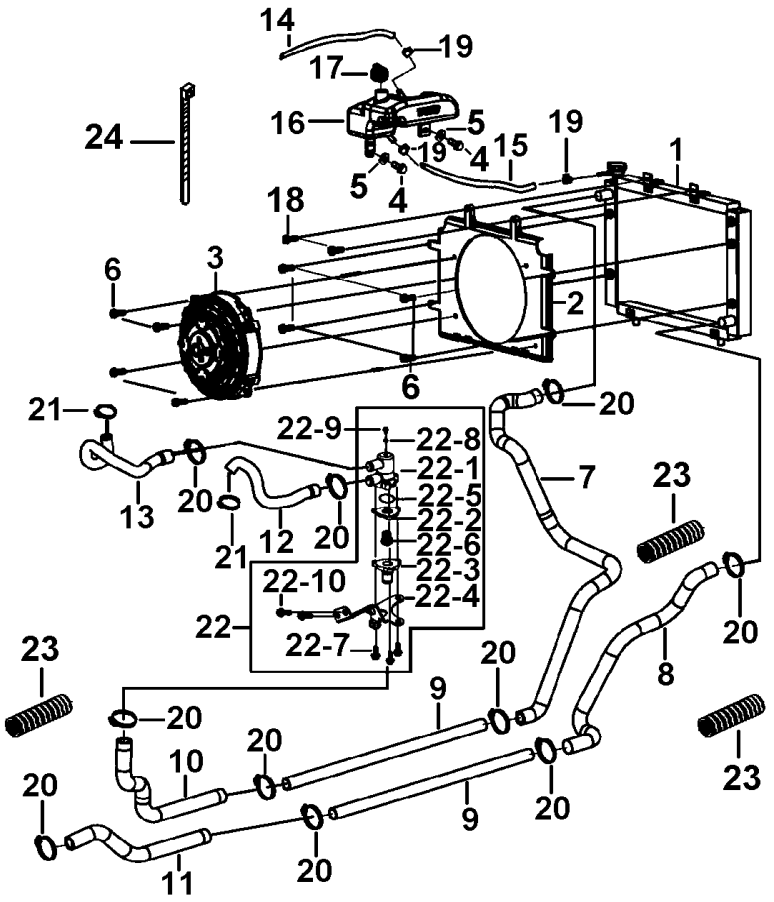
Oxygen Sensor Location

This vehicle is equipped with a heated oxygen Sensor.

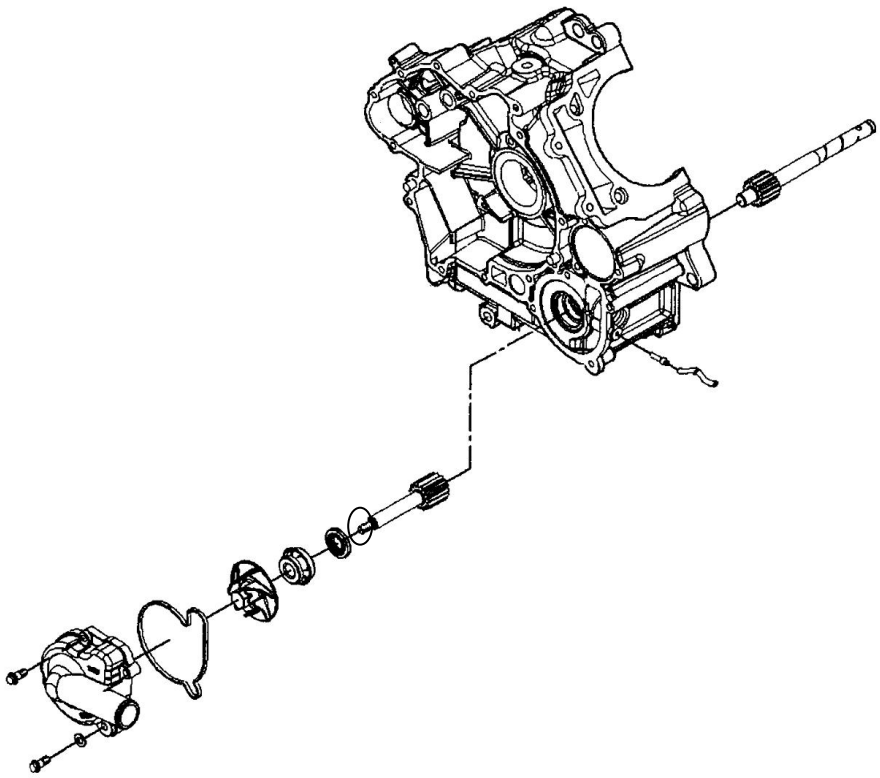
The sensor is located on the exhaust pipe.

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.

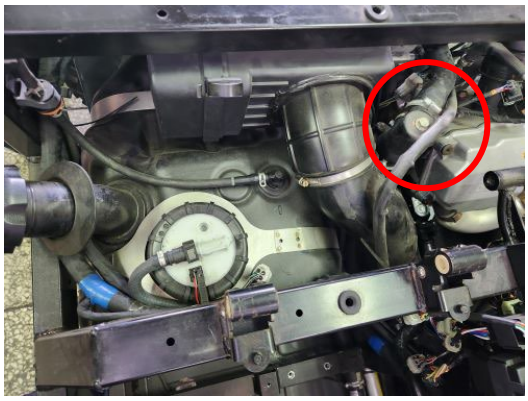
WARNING

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

1. The thermostat is mounted in-line in the cooling system circuit.
2. The thermostat is located in front of the vehicle, near the air cleaner housing.

Thermostat Removal

1. Drain the cooling system.
2. Remove the clamps that secure hoses to thermostat.
3. Remove the thermostat housing.

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.

Torque:0.6~0.8 kgf-m

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. Refer to Body and remove the following parts to reach radiator:

– Front fenders
– Service center tray with service cover
– Front fascia and head lights

3. Remove the following parts from the radiator:
   - Radiator inlet hose (LH upper)
   - Radiator outlet hose (RH lower).
   - Reservoir hose.
   - 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 the radiator.

Radiator Installation

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

1. Install new hoses clamps if necessary.
2. Fill radiator with the recommended coolant.
3. Bleed the cooling system.
4. Check for coolant leaks from radiator and hoses.

BOLT ,BLEED TORQUE: 0.6 kgf-m.

COOLANT TEMPERATURE SENSOR

Refer to EFI section.

RADIATOR COOLING FAN RELAY

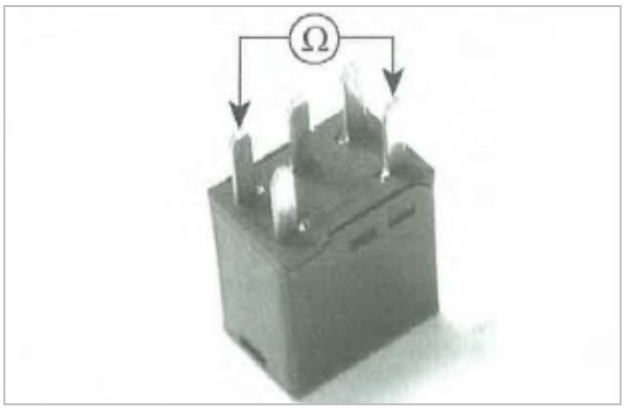
Relay Installation (Radiator Cooling Fan)

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).

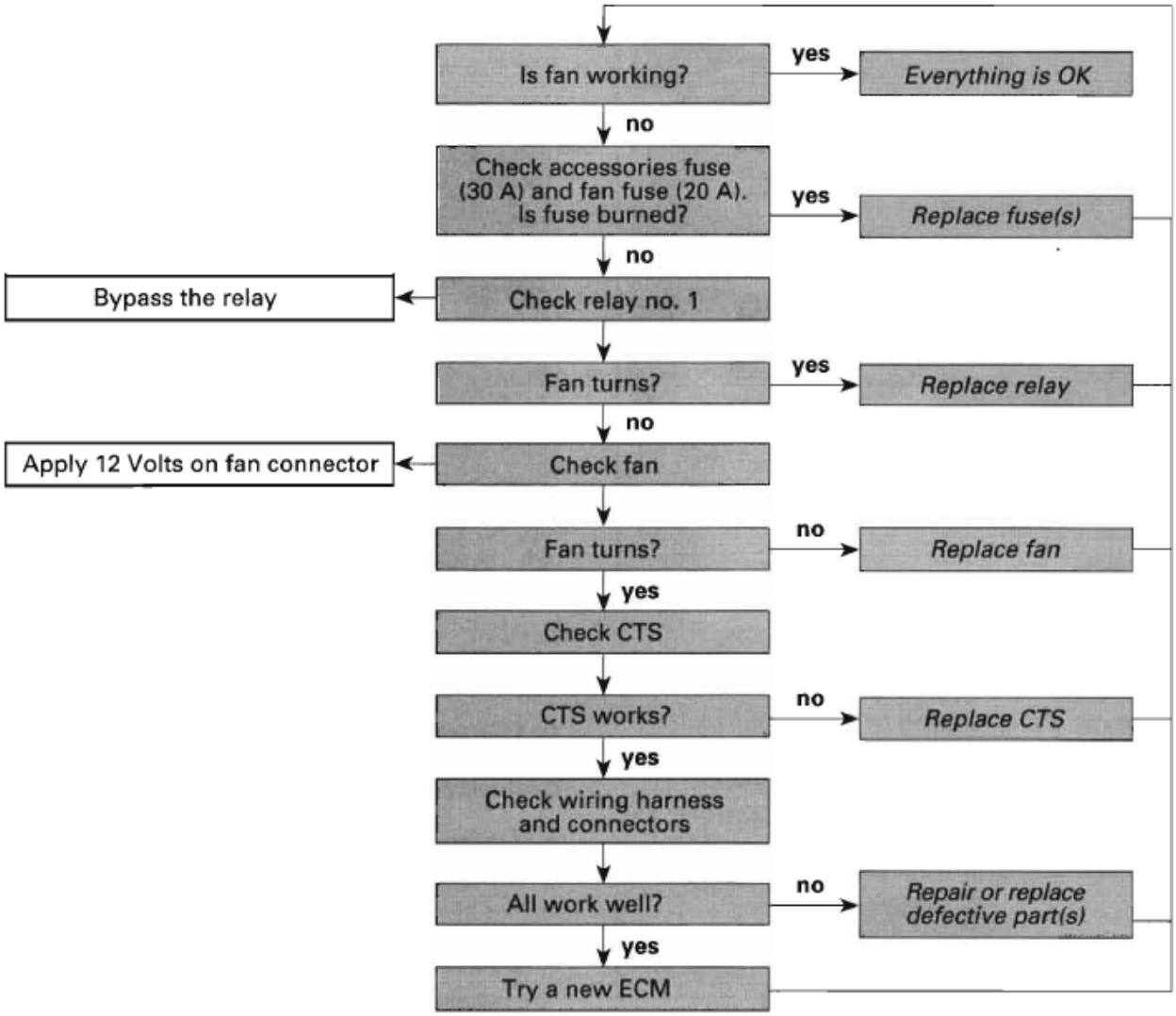
The radiator cooling fan should turn on when coolant temperature reaches 98℃ and should turn off when the coolant cools down at 95℃.

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 the radiator
3. Remove 4 fan retaining screws.
4. Remove the radiator fan.

Radiator Cooling Fan Installation

For the installation, reverse the removal procedure.

WATER PUMP HOUSING

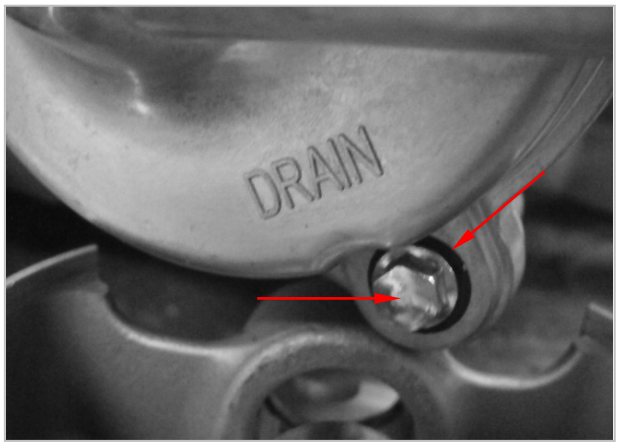
It is located on the engine ACG side.

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

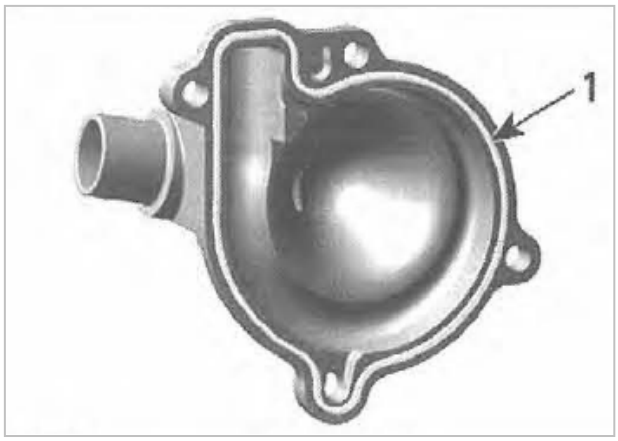
Check if gasket is brittle, hard or damaged and replace as necessary.

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.



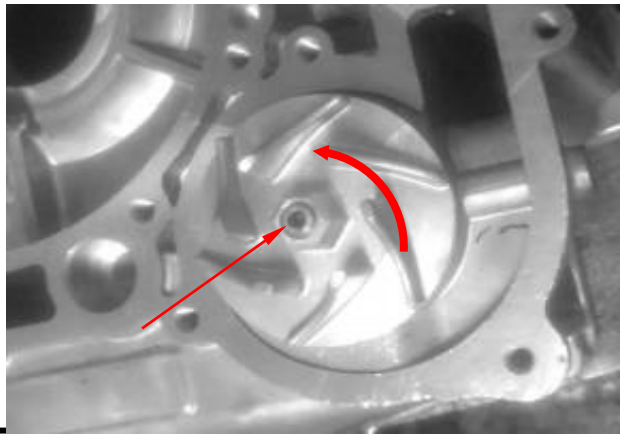
WATER PUMP IMPELLER

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: 240~260 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:

1.Be careful not to damage impeller fins during installation.

2.Check the rotary seal spring function normally.

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.

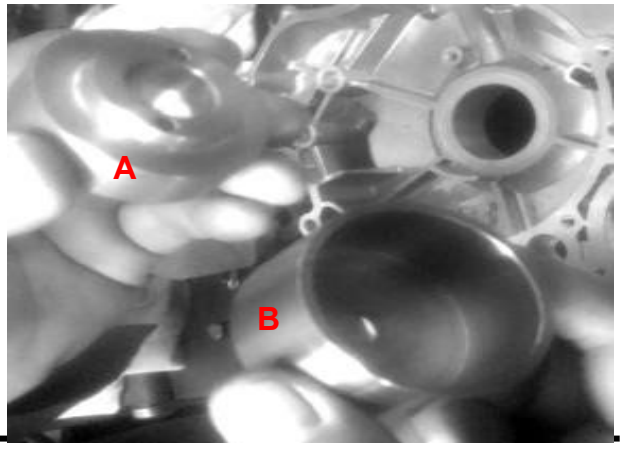
NOTICE: *Be careful not to damage the crankcase while removing outer part of the rotary seal.*

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

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

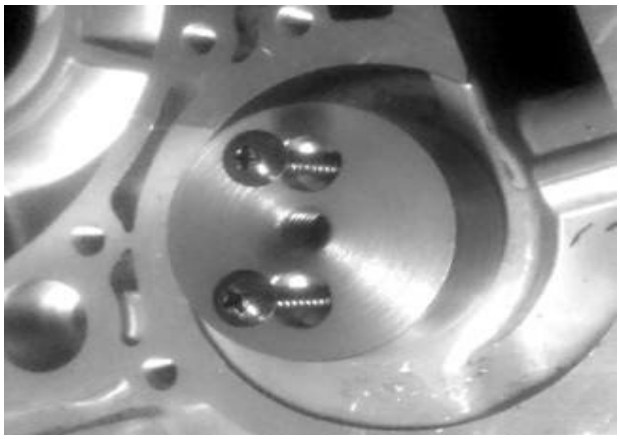
5. Lightly push back the water pump shaft and install special tool A #560024 as shown.

Special tool A



6. Install 2 screws on the tool A.

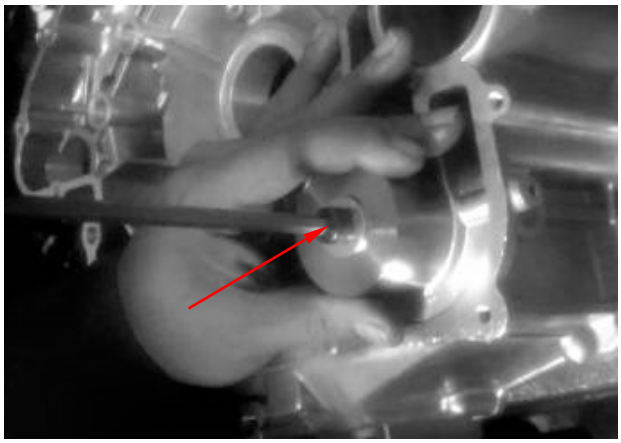
Special tool B



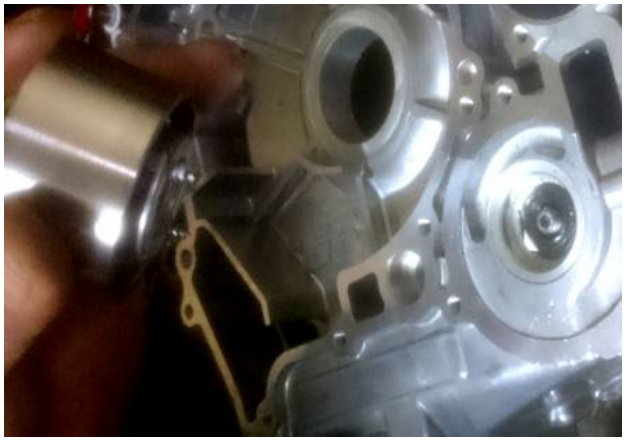
7. Install special tool B on the top of tool A then install a bolt with M8x1.25P shown.

Special tool B

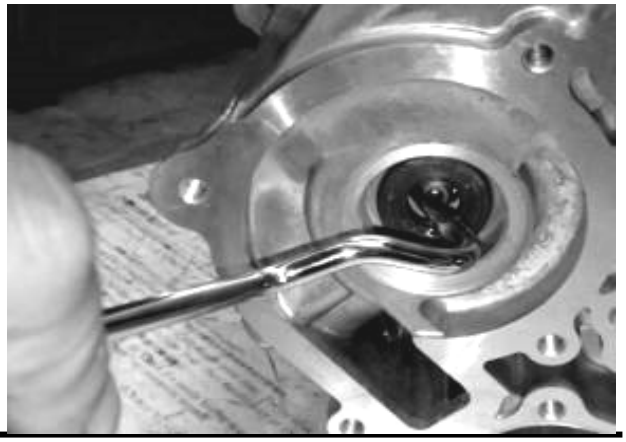
Special tool A



8. Screw in the bolt to the end until the seal remove from the crankcase.



9. Using special tool #440650 to remove the oil seal from crankcase.
10. Check water pump shaft axial play. If not adequate, engine must be disassembled to replace the water pump shaft.
11. Clean oil seal seat.

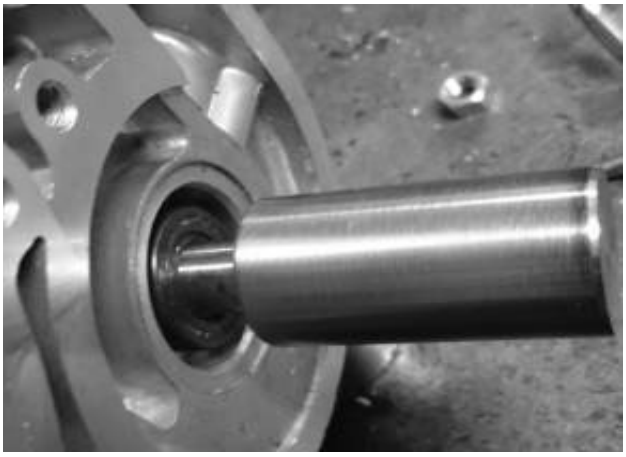


Rotary Seal and Oil Seal Installation

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 special tool # as shown.
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. Apply Silicon glue #5699 on the seal bore and outer portion as shown.

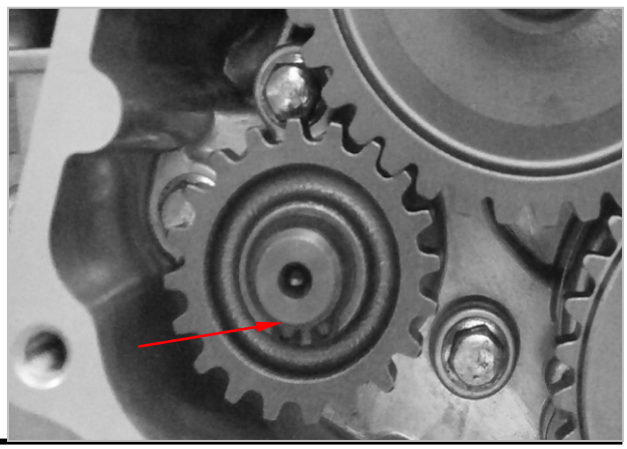
3.Install special tool with rotary seal on the water pump shaft and screw in by hand.
4. Then thread the tool install rotary.
5. Ensure that the rotary seal is going straight into crankcase.
6. Remove tools from crankcase.

TORQUE: 100kgf-cm

NOTICE: *After installed, Clean and remove the overflow of glue to prevent block the shaft motion.*

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



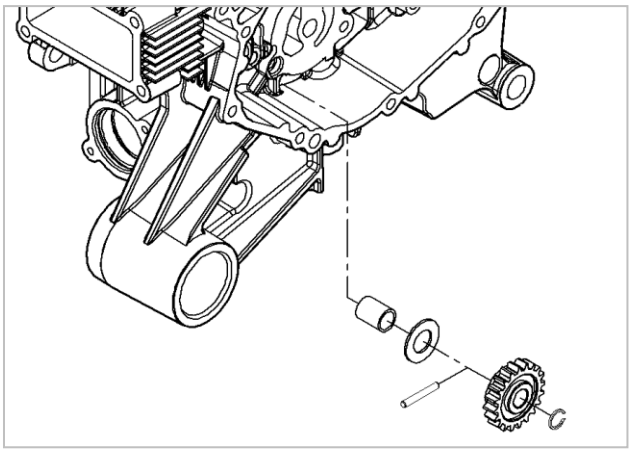
shaft with inner portion of rotary seal from inside of crankcase ACG side.

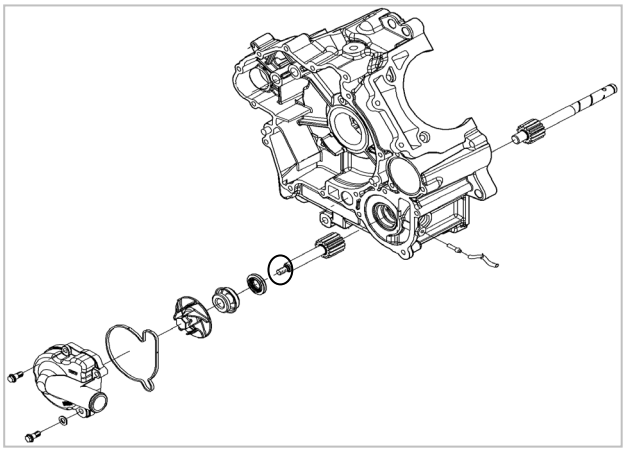
5. To remove outer part of rotary seal, use an expander special tool.
6. Install expander against outer part of rotary seal and pull seal out.

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.*

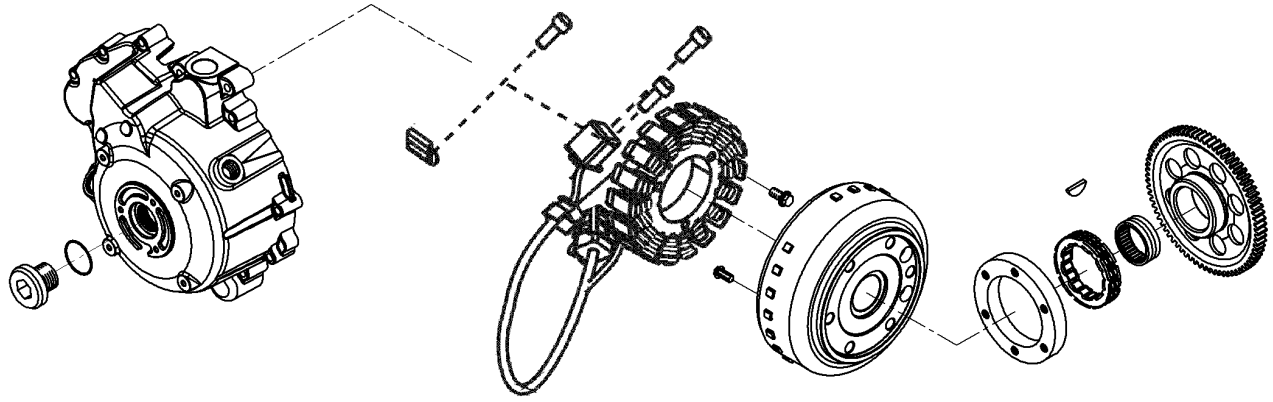
- Ensure water pump intermediate driven gear snaps properly onto needle pin, then install the circlip to retain the gear onto shaft.

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.

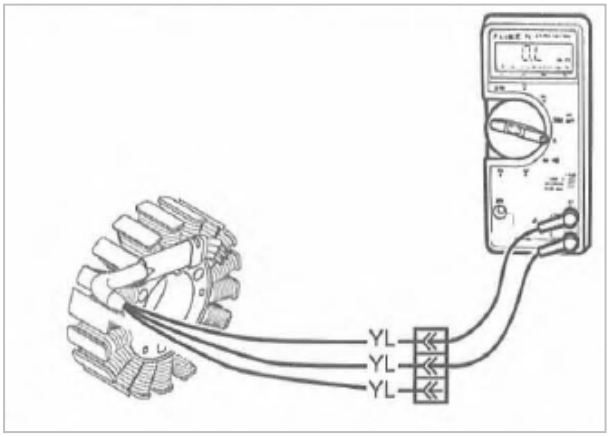
STATOR

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.

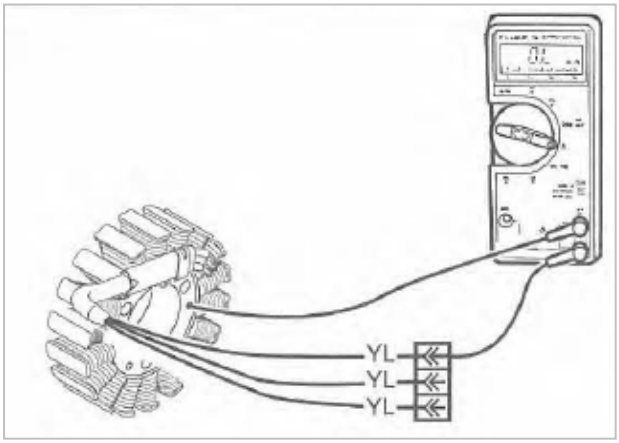


Stator Static Test: Insulation

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 FLYWHEEL REMOVER 560001 then remove rotor.

NOTE: *Use grease to place protector on crankshaft end prior to screw on the FLYWHEEL REMOVER.*
Screw FLYWHEEL REMOVER 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

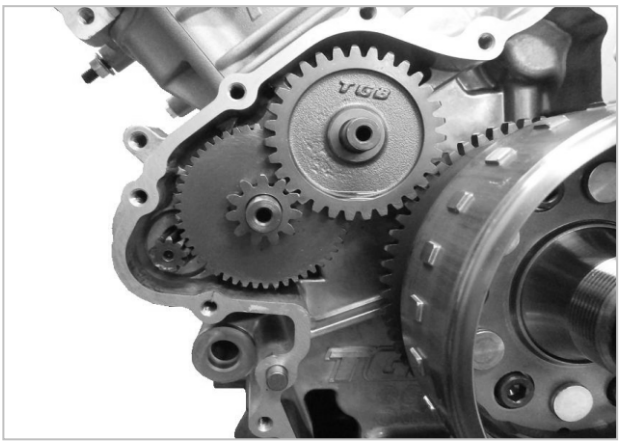
For installation, reverse the removal procedure.

- 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.

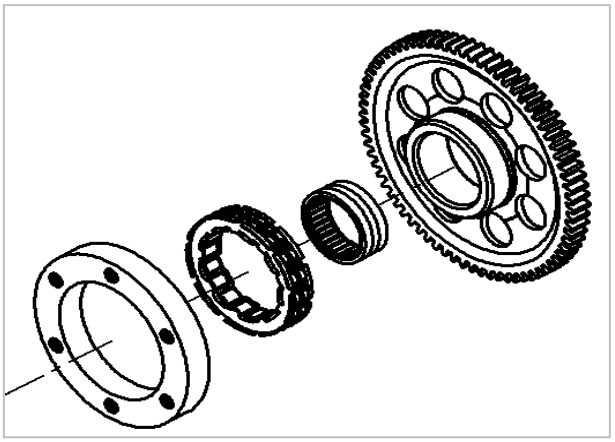
- Slide rotor onto crankshaft. The woodruff key and the keyway must be aligned.
- Rotate idle gear counterclockwise to align idle gear teeth with starting clutch gear.



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.*

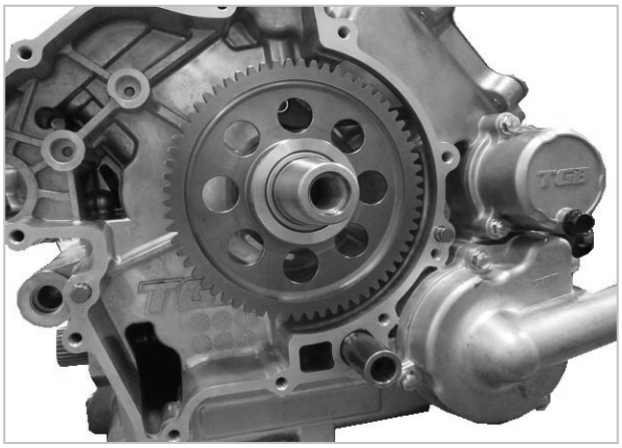
NOTE: *Unidirectional clutch, thrust plate and gear must be replaced at the same time, if damaged.*

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.

SINGLE CYLINDER IGNITION.

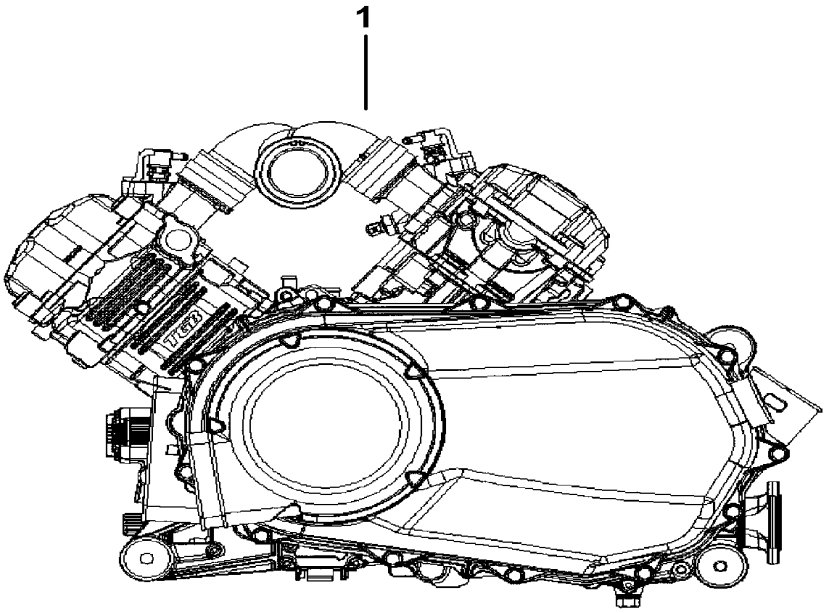
Check the following:

- If spark plug cap loose, firm the spark plug cap (see chapter 4-2).
- Check the spark plug gap (see chapter 4-2).
- Ignition coil (see chapter 4-2).

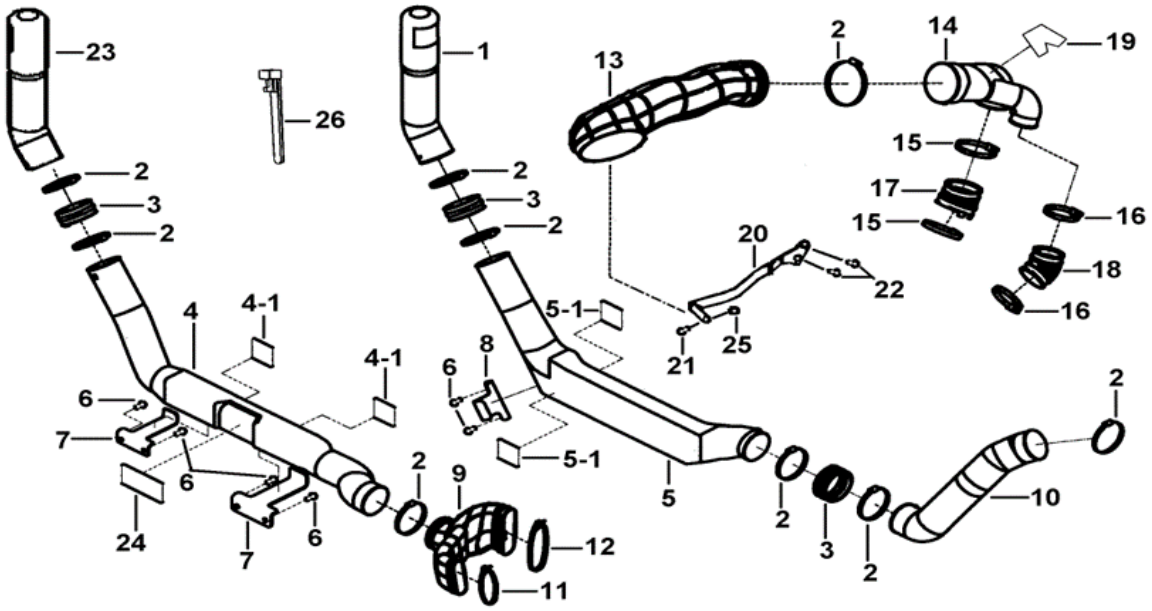
COOLING FAN IS NOT WORKING.
(RADIATOR COOLING FAN AND COOLING FAN UNDER DRIVER'S SEAT)

– Ensure cooling fan is not jammed and working properly.
– Check fan fuse. See Fuses and Fusible Links in the Maintenance Procedures.

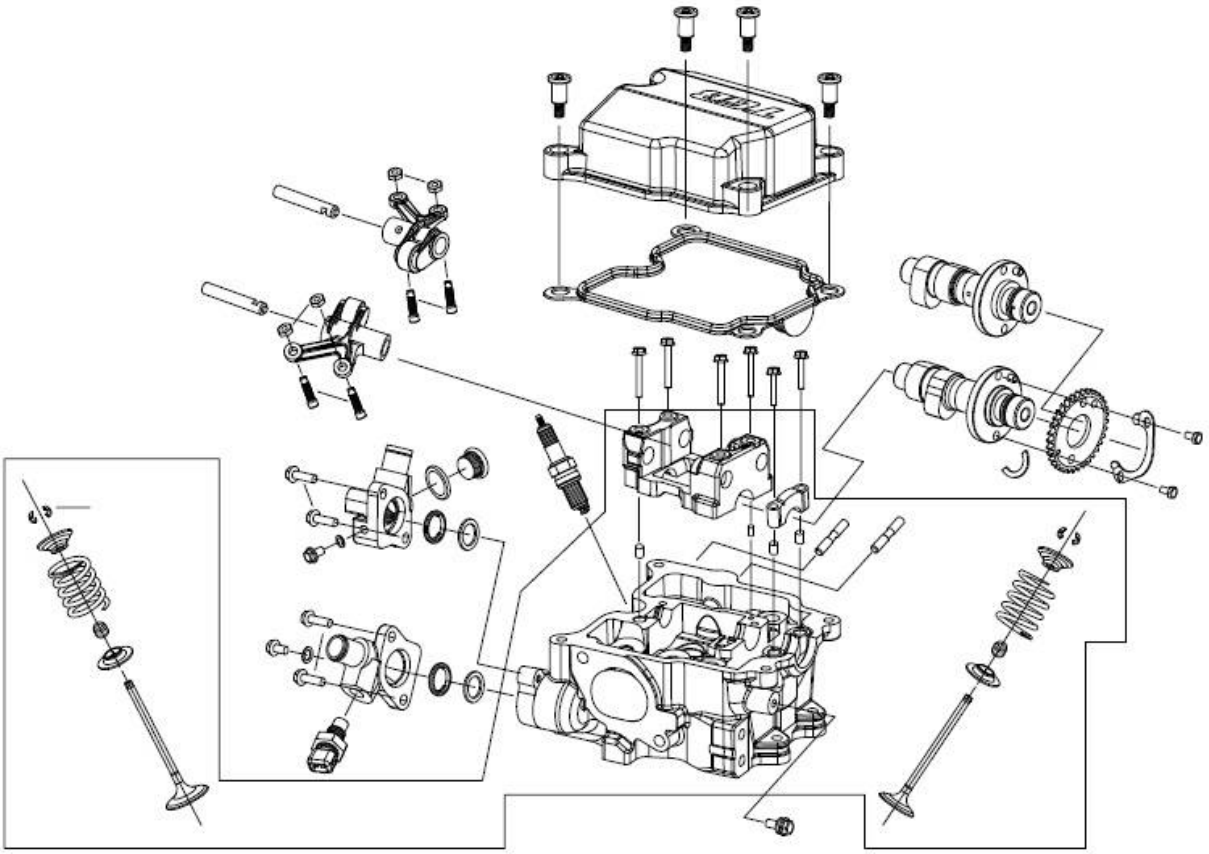
－TOP END



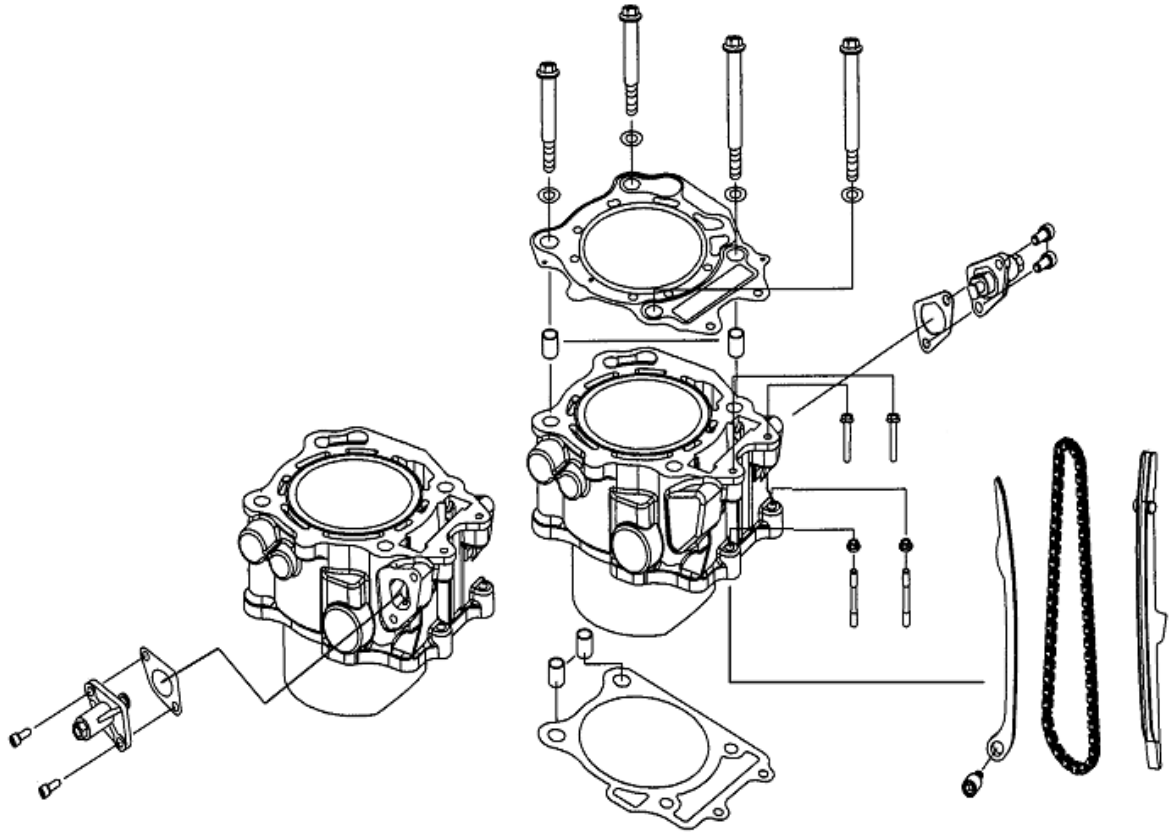
INTAKE MANIFOLD

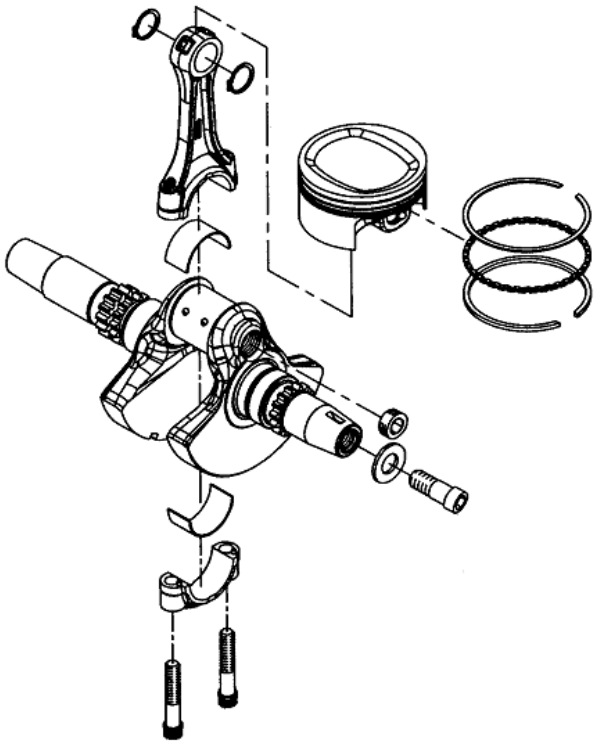


CYLINDER HEAD



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

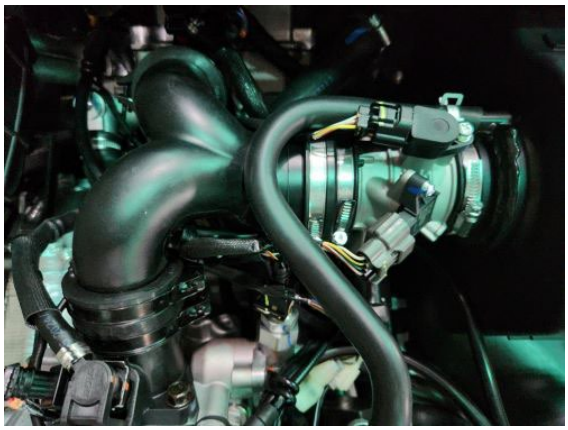
Intake Manifold Removal

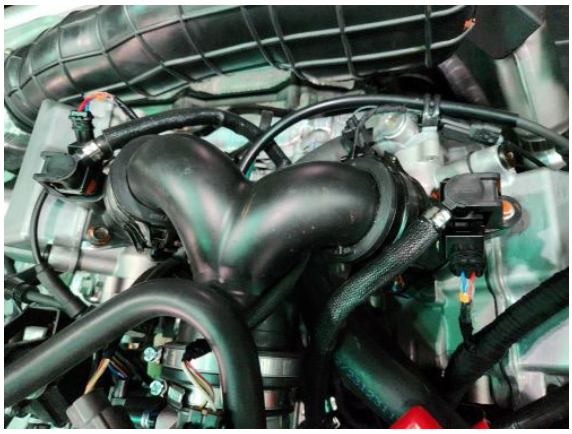
1. Remove the cargo box.
2. Remove two mounting bolts of air cleaner.
3. Loosen clamp of intake adapter
4. Raise air cleaner and using needle-nose pliers loosen and disconnect two air hoses, then pull up and remove the air cleaner.
5. Release fuel pressure by running engine until it run out of fuel.
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 and seal for cracks, warping at flanges or any other damage. Replace if necessary.

Intake manifold Installation

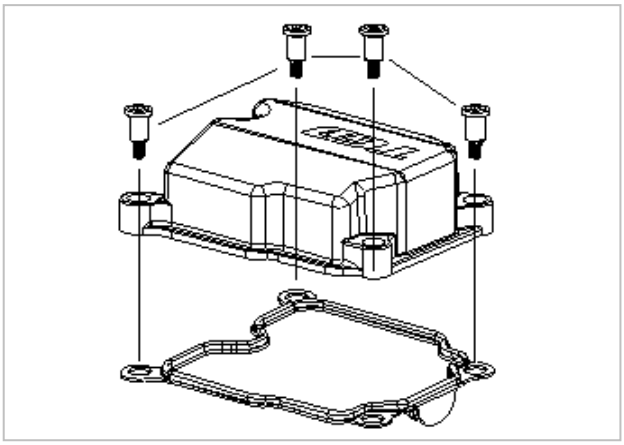
- The installation is the reverse of the removal procedure.
- Tighten intake manifold retaining bolts to specified torque one cylinder at time.

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

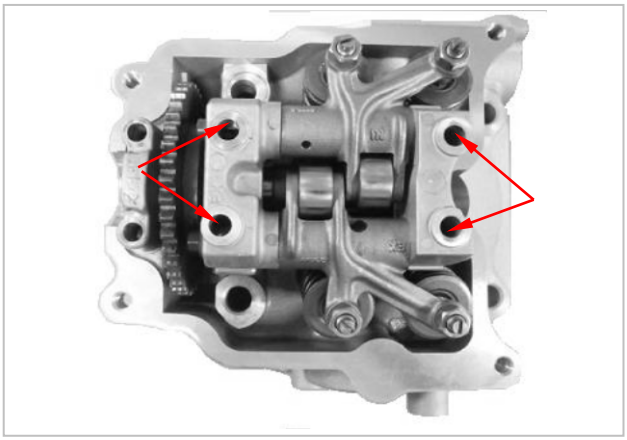
- For installation, reverse the removal procedure.
- Tighten cylinder head cover retaining bolts to specified torque in a criss-cross sequence.

TORQUE: 1.3~1.5 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.

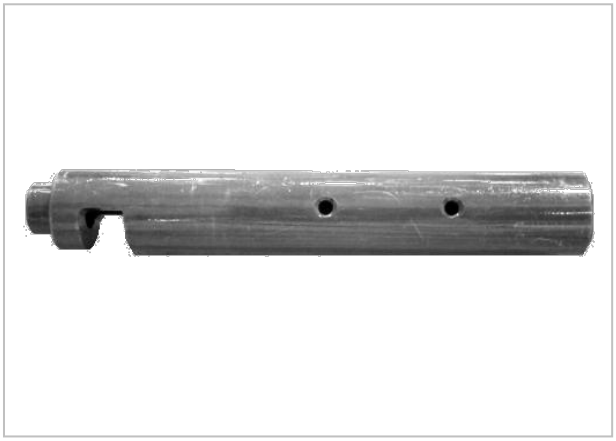


Rocker Arm Inspection

- 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.

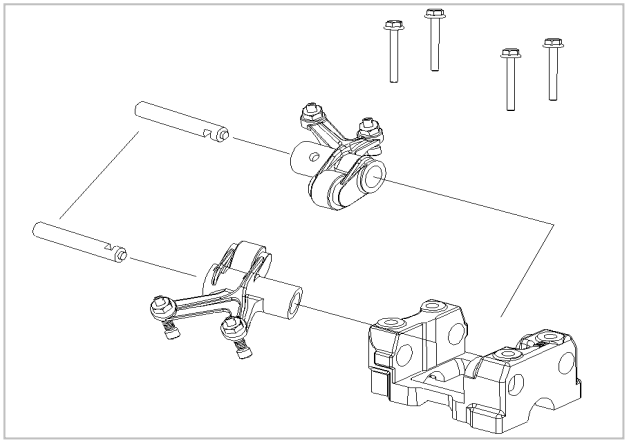


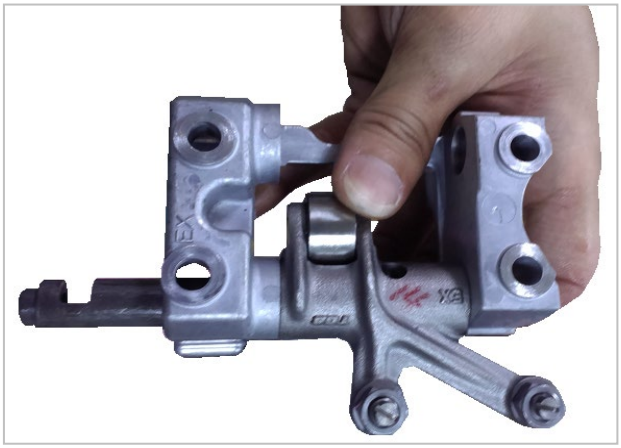
Rocker Arm Installation

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 kgf-m





CYLINDER HEAD

Cylinder Head Removal

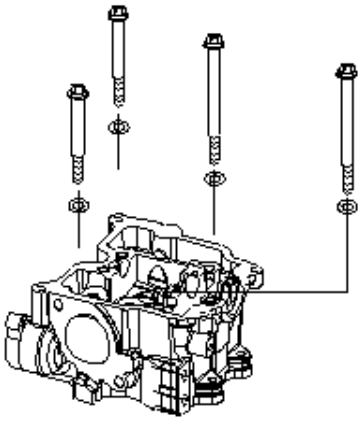
- The removal procedure is the same for both cylinder heads.
- Drain coolant and remove the hoses..

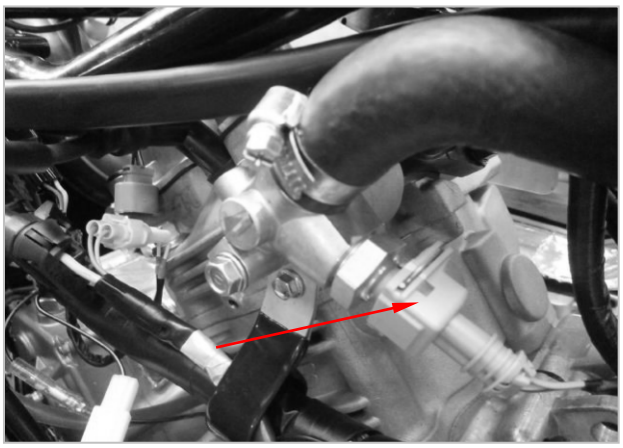
NOTE: *Before removing cylinder head, blow out remaining coolant by air pressure. During cylinder head removal, the remaining coolant in cylinder head could overflow into engine and a little quantity of coolant could drop into the engine. In this case, the engine oil will be contaminated.*

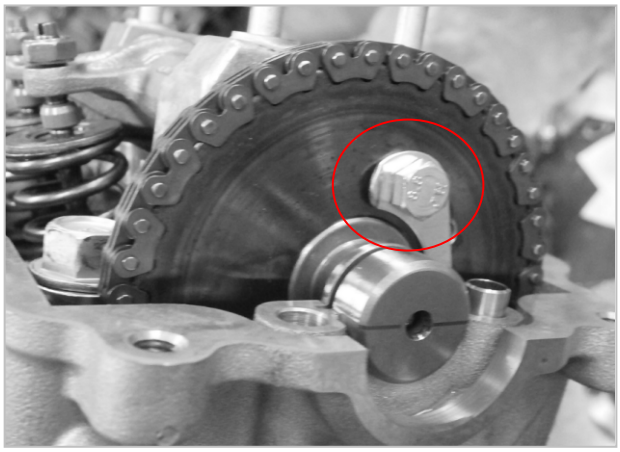
- Disconnect spark plug wire.
- Disconnect coolant temperature sensor connector, located at rear cylinder head.
- Remove air cleaner.
- Remove the intake manifold and exhaust pipe.
- Remove the chain tensioner.
- Remove the cylinder head cover and its gasket.
- Remove the camshaft holder.
- Remove the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

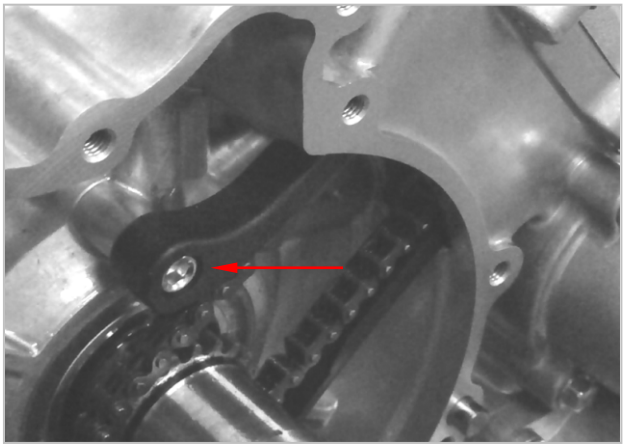
Cylinder Head Inspection

- 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.





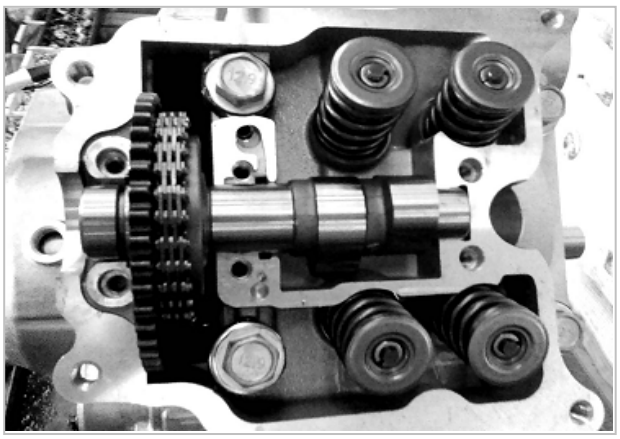




Cylinder head Installation

For installation, reverse the removal procedure.

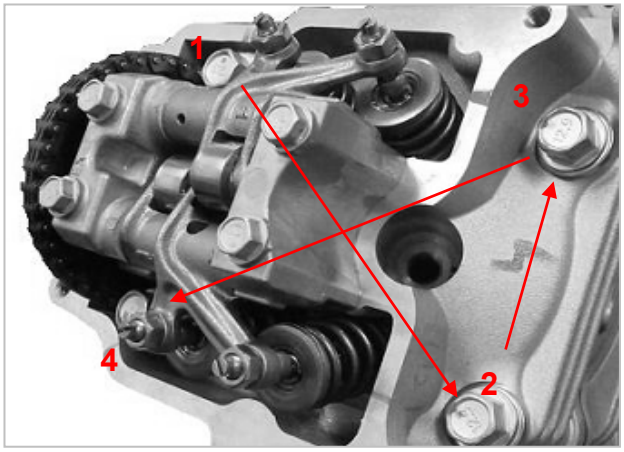
NOTE: *Never invert front and rear cylinder heads.*



▪ Ensure dowel pins and key are in place.

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

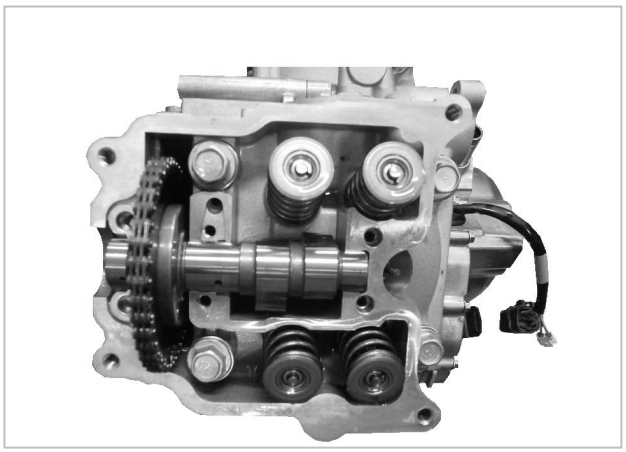
▪ Install a NEW cylinder head gasket.
▪ First torque M10 cylinder head bolts with LOCTITLE in cross sequence to 20 Nm+/- 1 Nm two times then finish by tightening to 180° +/- 5°.
▪ Install cylinder head M6 bolts.
▪ Check timing chain guide (tensioner side) for movement.



CAMSHAFT

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

Mark "A" to front cylinder.
Mark "B" to rear cylinder



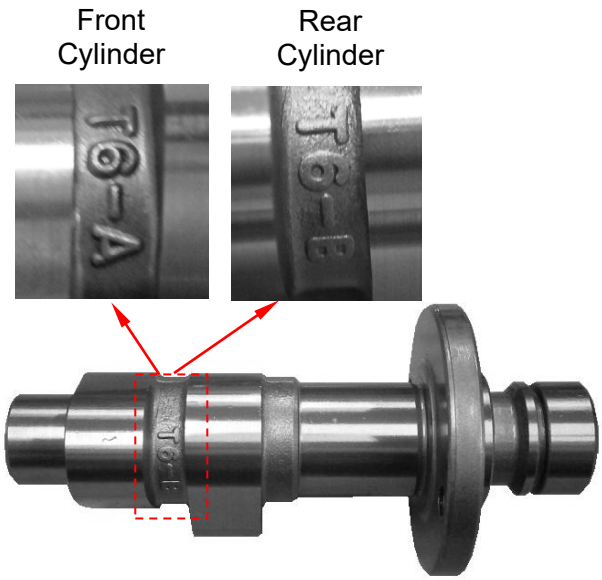
Camshaft Removal

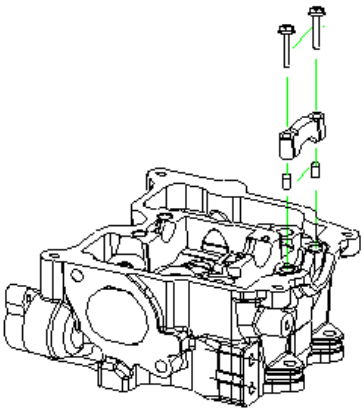
▪ The removal procedure is the same for both camshafts.
▪ Remove cylinder head cover.
▪ Remove the chain tensioner.
▪ Remove the rocker arm assembly.
▪ Remove the camshaft two retaining bolts.
▪ Remove the camshaft timing gear.
▪ Remove the camshaft.

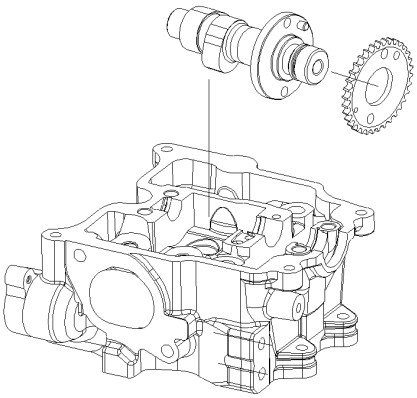
NOTICE: *During removal, pay attention to avoid key fall into engine via chain hole.*

Camshaft Inspection

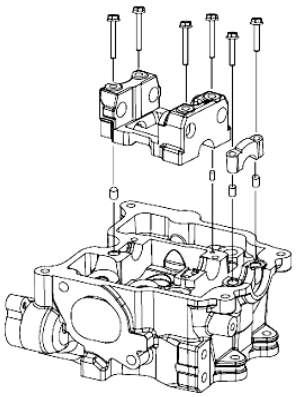
- Check each lobe and bearing journal of camshaft for scoring, scuffing, cracks or other signs of wear.
- Using a micrometer measure camshaft journal diameter and lobe height.
- Replace parts that are not within specifications.







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.*

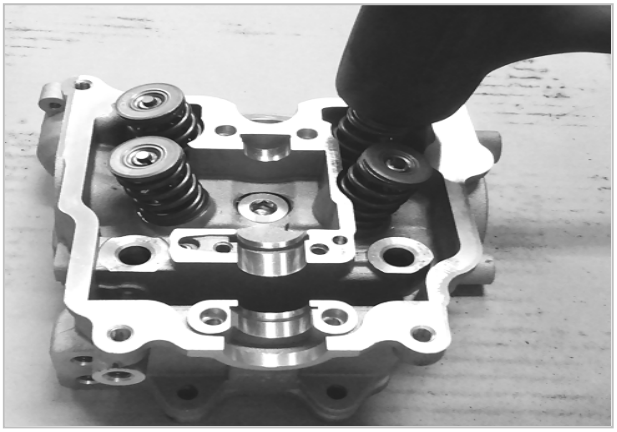
- Tighten the camshaft retaining bolts with specified torque.

TORQUE: 1.0 kgf-m

VALVE SPRING

Valve Spring Removal

- Remove rocker arms.
- Remove cylinder head.



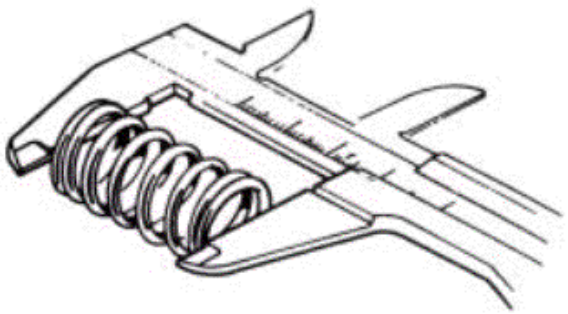
WARNING

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.

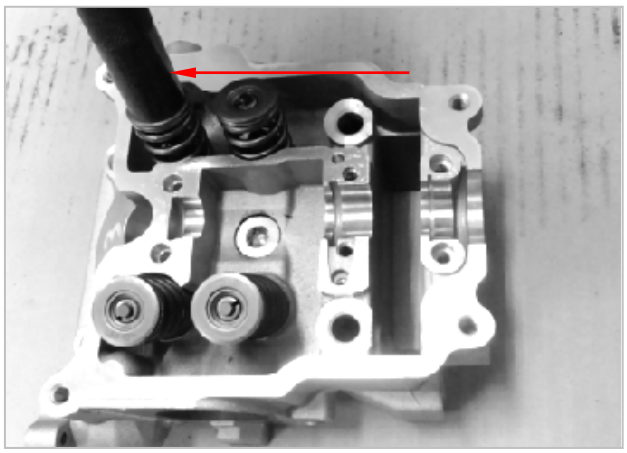
Valve Spring Inspection

- 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.
- Compress valve spring using VALVE SPRING COMPRESSOR special tool #440609.

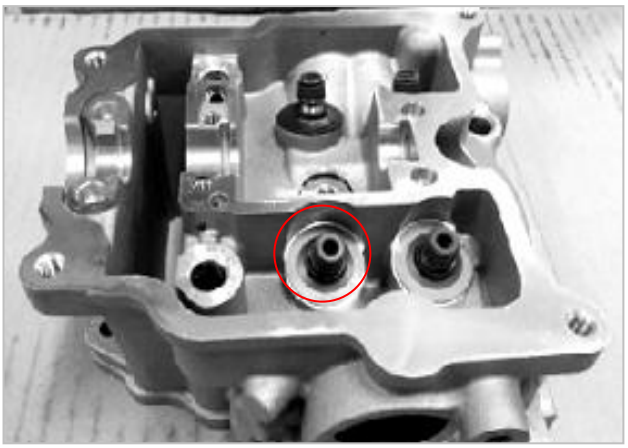
NOTE: *Valve cotter must be properly engaged in valve stem grooves.*

- 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

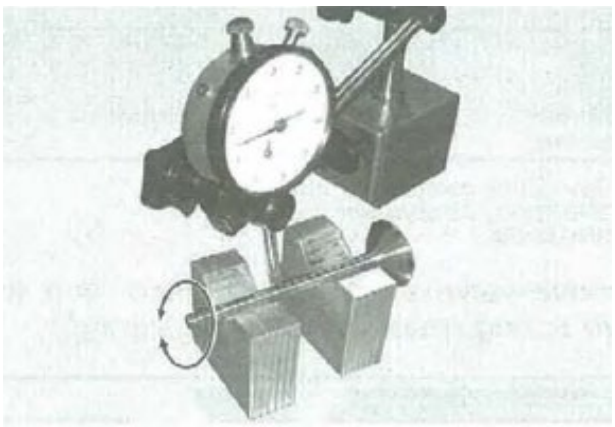


- Remove valve spring.
- Push valve stem, then pull valves (intake and exhaust) out of valve guide.
- Remove valve stem seal with SNAP-ON PLIERS and discard it.

Valve Inspection

Valve Stem Seal

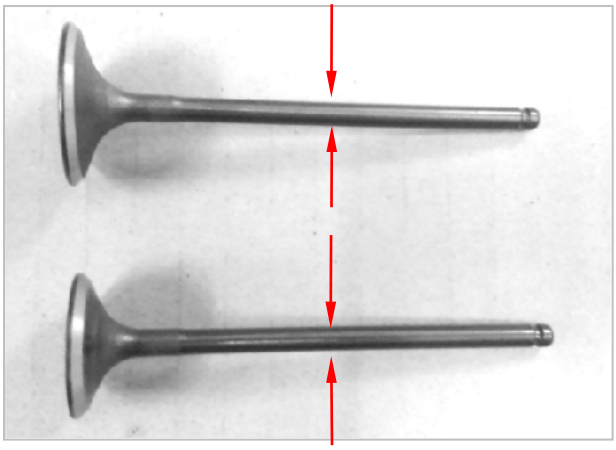
- Always install new seals whenever valves are removed.



Valve

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

VALVE OUT OF ROUND

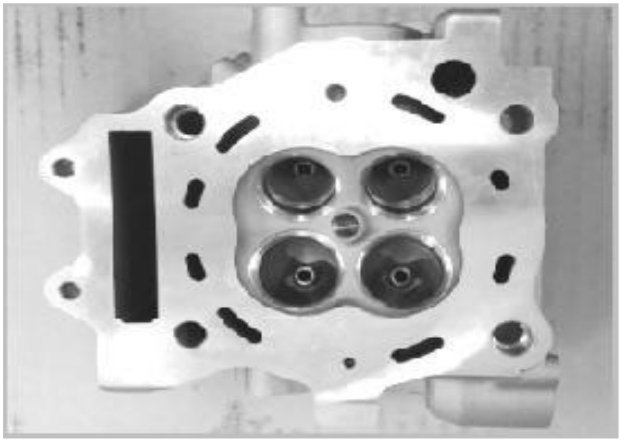


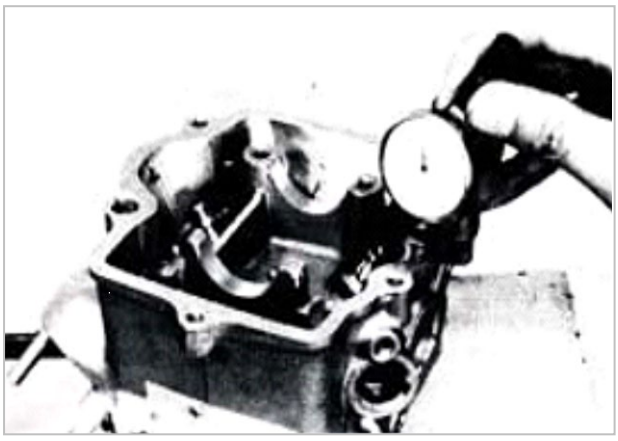
Valve Stem and Valve Guide Clearance

- 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.

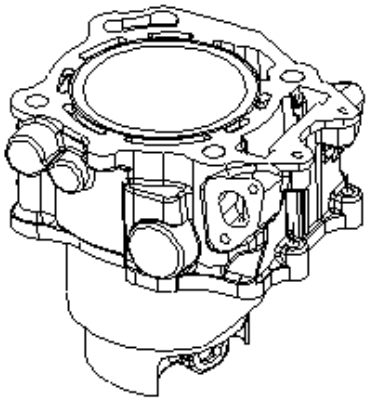
NOTICE: *Be careful when valve stem is passed through sealing lips of valve stem seal.*

- 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 and gasket.
- 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

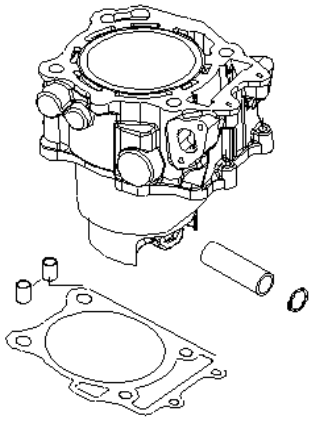
- Measure cylinder bore and if it is out of specifications, replace cylinder and piston rings.
- Measure cylinder bore at three recommended positions.
- Distance between measurement should not exceed the service limit mentioned above.

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.*

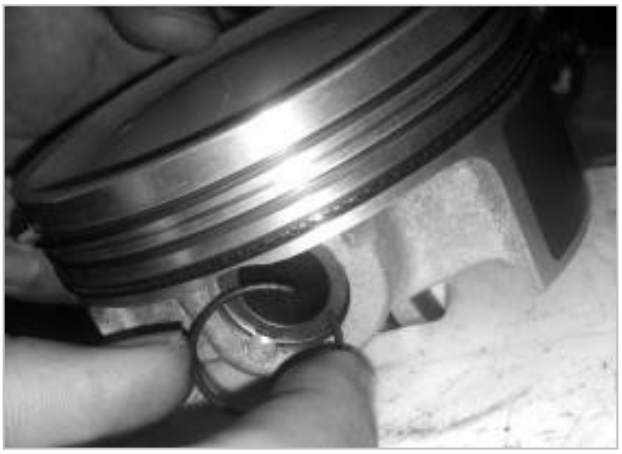
Cylinder Installation



- 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 SPECIAL TOOL 552303 under piston and in the area of timing chain compartment.

WARNING

Piston circlip are spring loaded.

- Remove one piston circlip and discard it.

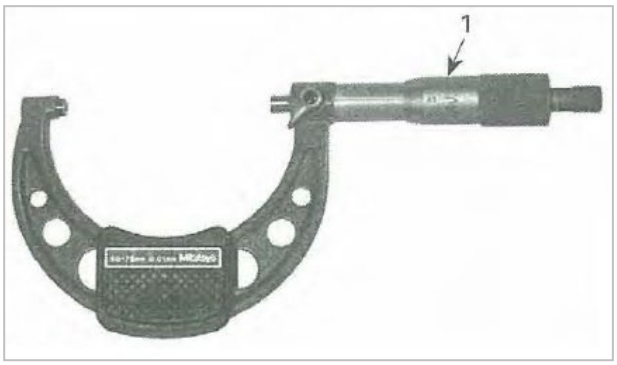
NOTE: *The removal of both piston circlip is not necessary to remove piston pin.*

- 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 22 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.*

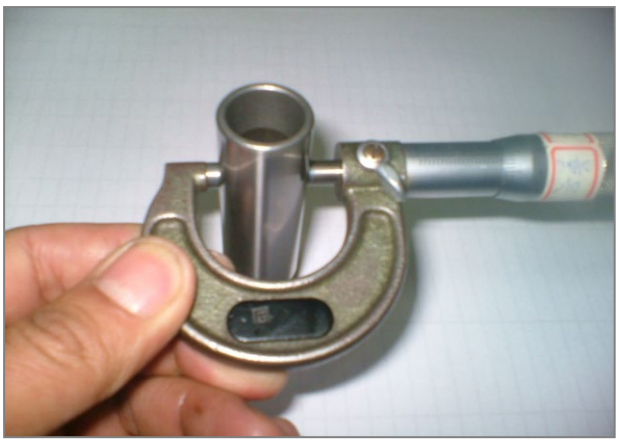
- If clearance exceeds specified tolerance, replace piston by a new one and measure piston/cylinder clearance again.

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.
- Place SPECIAL TOOL 552303 under piston.
- 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

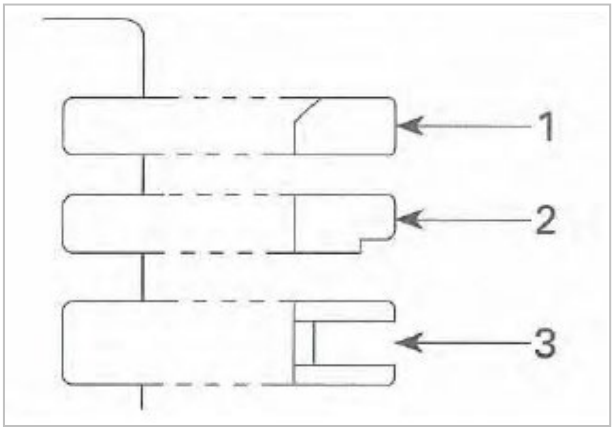
▪ Using a feeler gauge measure each ring/piston groove clearance. If the clearance is too large, the piston and the piston rings should be replaced.

▪ 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.

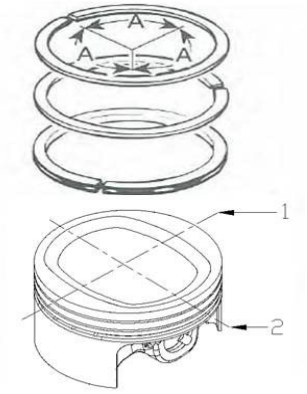
NOTE: *In order to correctly position the ring in the cylinder, use piston as a pusher.*

▪ 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.*

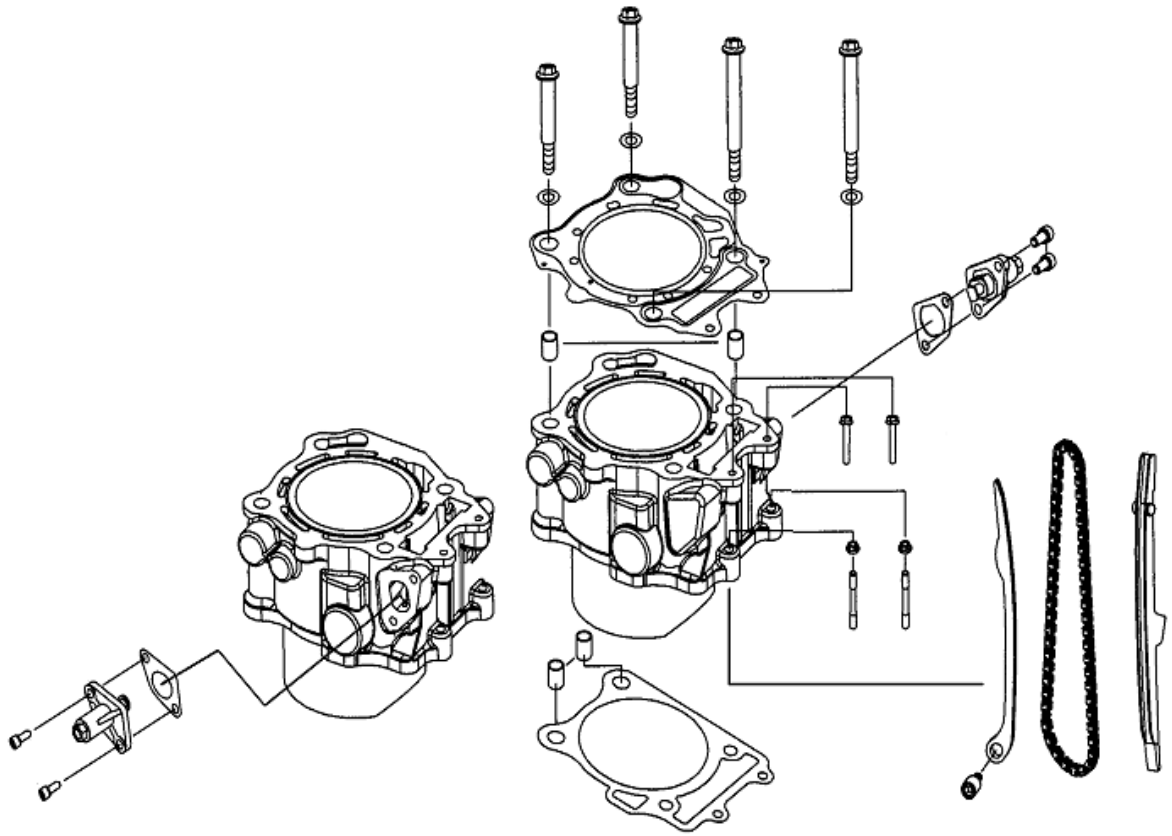
- Install the oil scraper ring first, then the lower compression ring with the open edge facing up, then the upper compression ring with the word “R” facing up.

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.

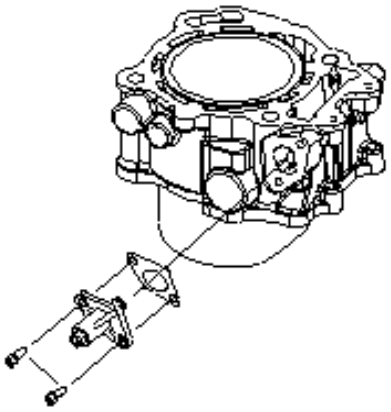
Timing Chain Tensioner Inspection

- 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.

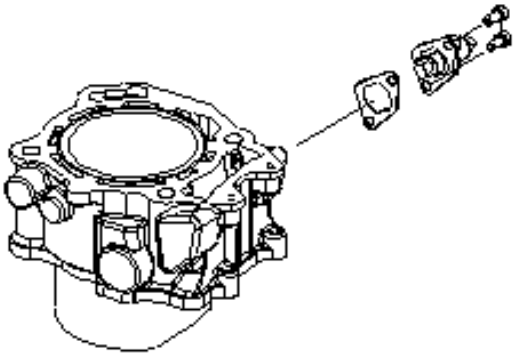
Timing Chain Tensioner Installation

- 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.*

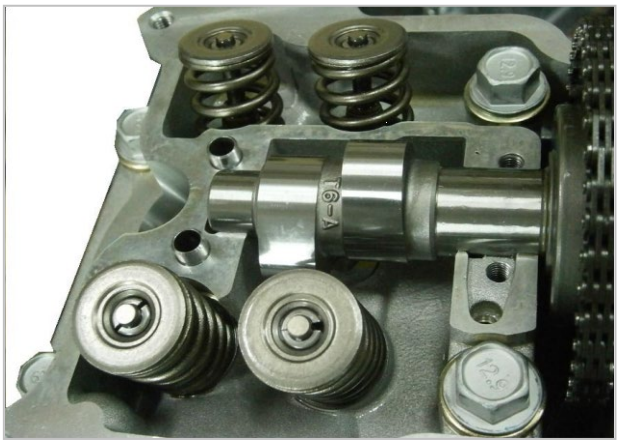
- Place timing gear along with the timing chain on the camshaft.

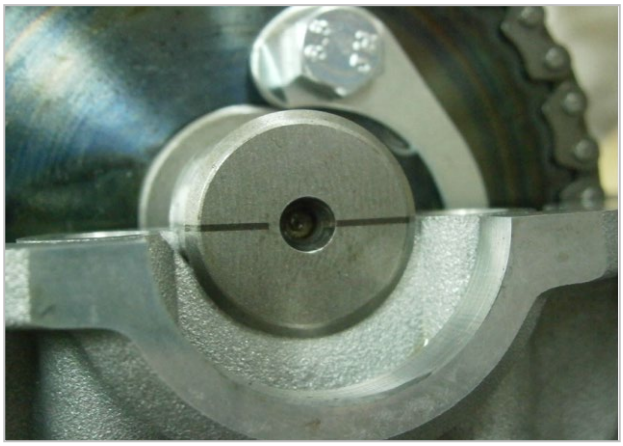
NOTE: *The printed marks on the camshaft must be parallel to the cylinder head base.*

- 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: 1.0~1.2 kgf-m

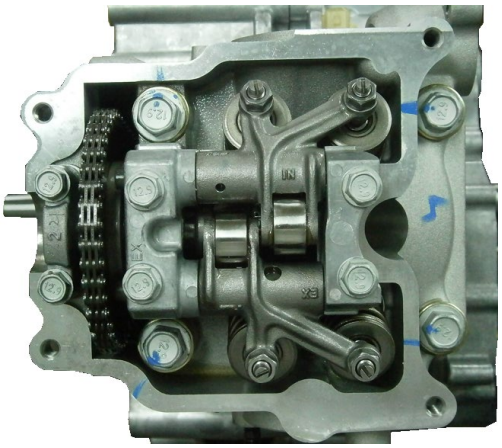


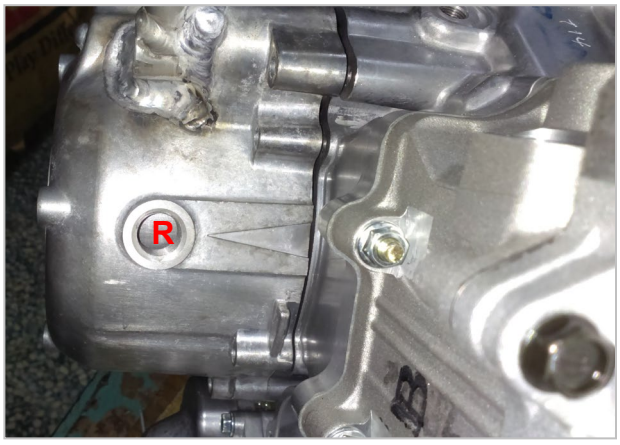


NOTE: *If a piston (front or rear cylinder) is set to TDC ignition, the timing gear of the opposite cylinder must be in the following position.*

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.

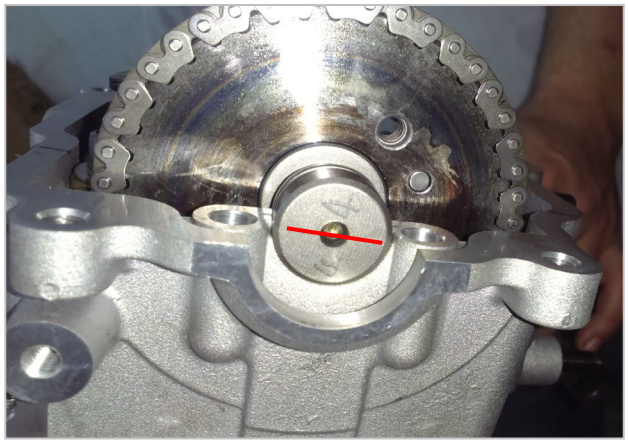




Camshaft Timing Cylinder (front)

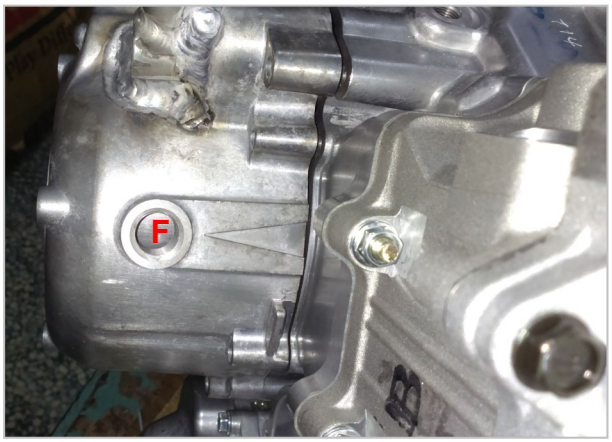
- Turn cylinder to TDC ignition.
- Using a 14 mm Allen key, turn crankshaft 450° clockwise, until marks on magneto flywheel and magneto cover are aligned.

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



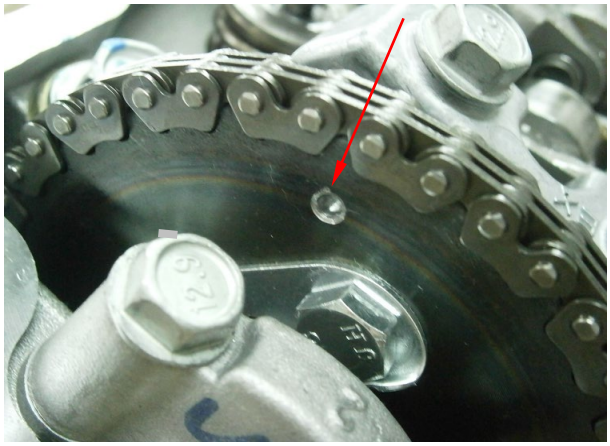
NOTE: *Before installing camshaft of rear cylinder, it should be confirm mark "B" on the camshaft.*

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.*

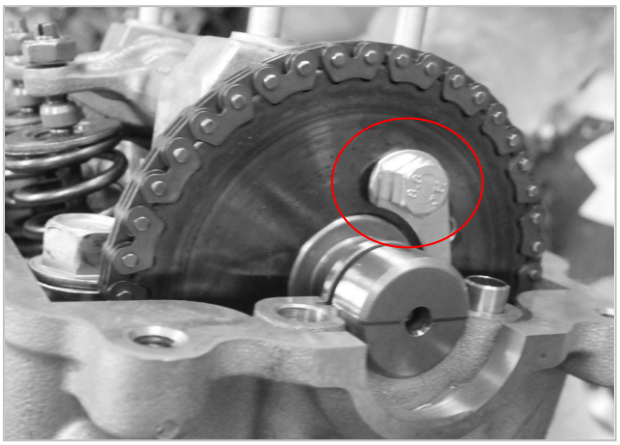
NOTE: *Check the timing chain identification hole, during assemble, when one cylinder camshaft on the TDC position, the other cylinder timing chain sprocket left up corner will shown the hole, If not, please re-adjust and re-assemble.*



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.

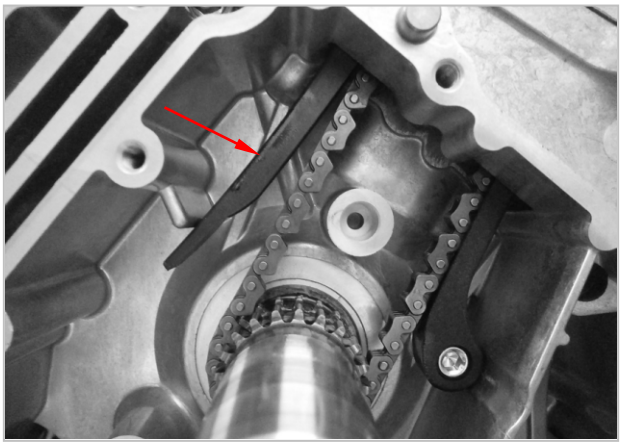


Timing Chain Removal (ACG Side)

▪ 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.

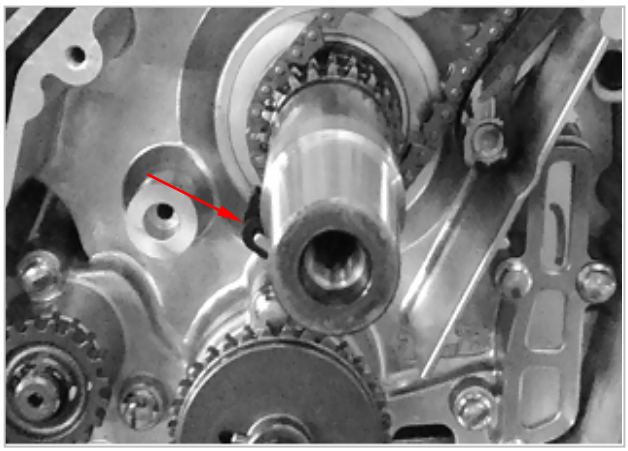
Timing Chain Removal (CVT Side)

▪ 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.

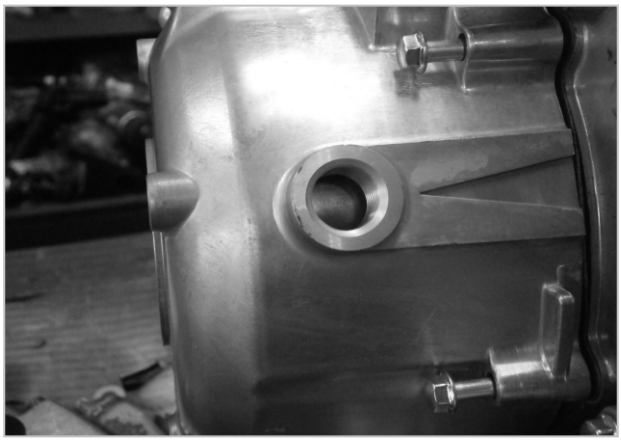
NOTE: *Mark the operating direction of the timing chain before removal.*

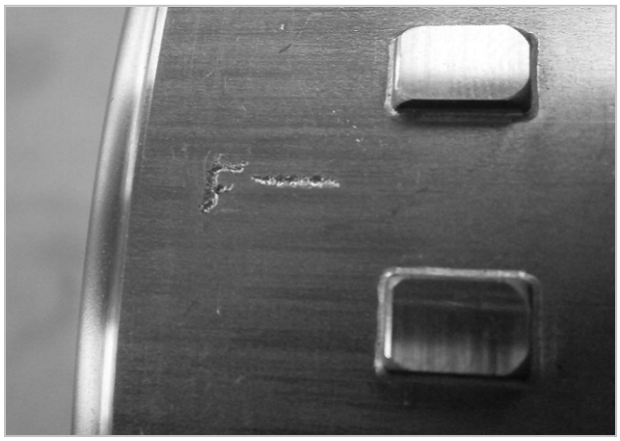


Timing Chain Inspection

- 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

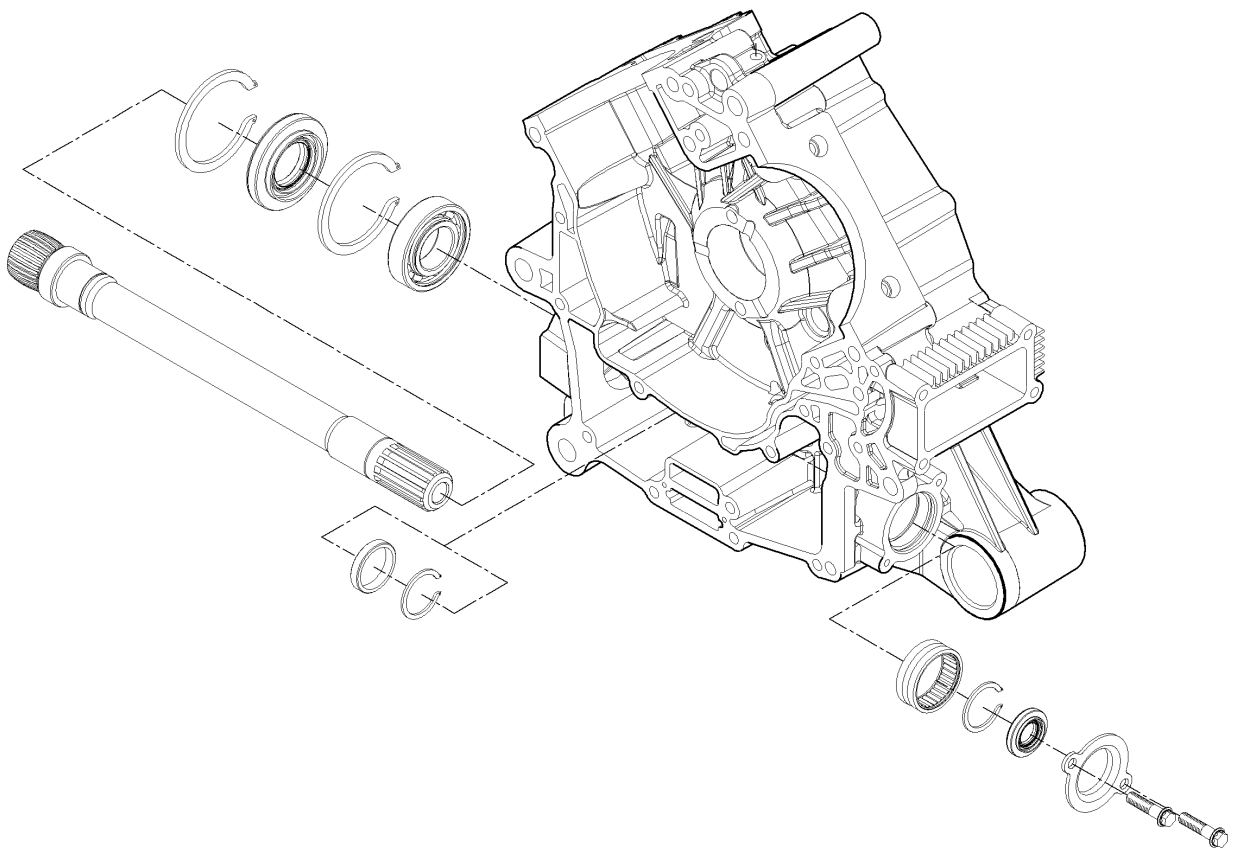
- Check timing chain guide for wear, cracks or deforming. Replace if necessary.

Timing Chain Guide Installation

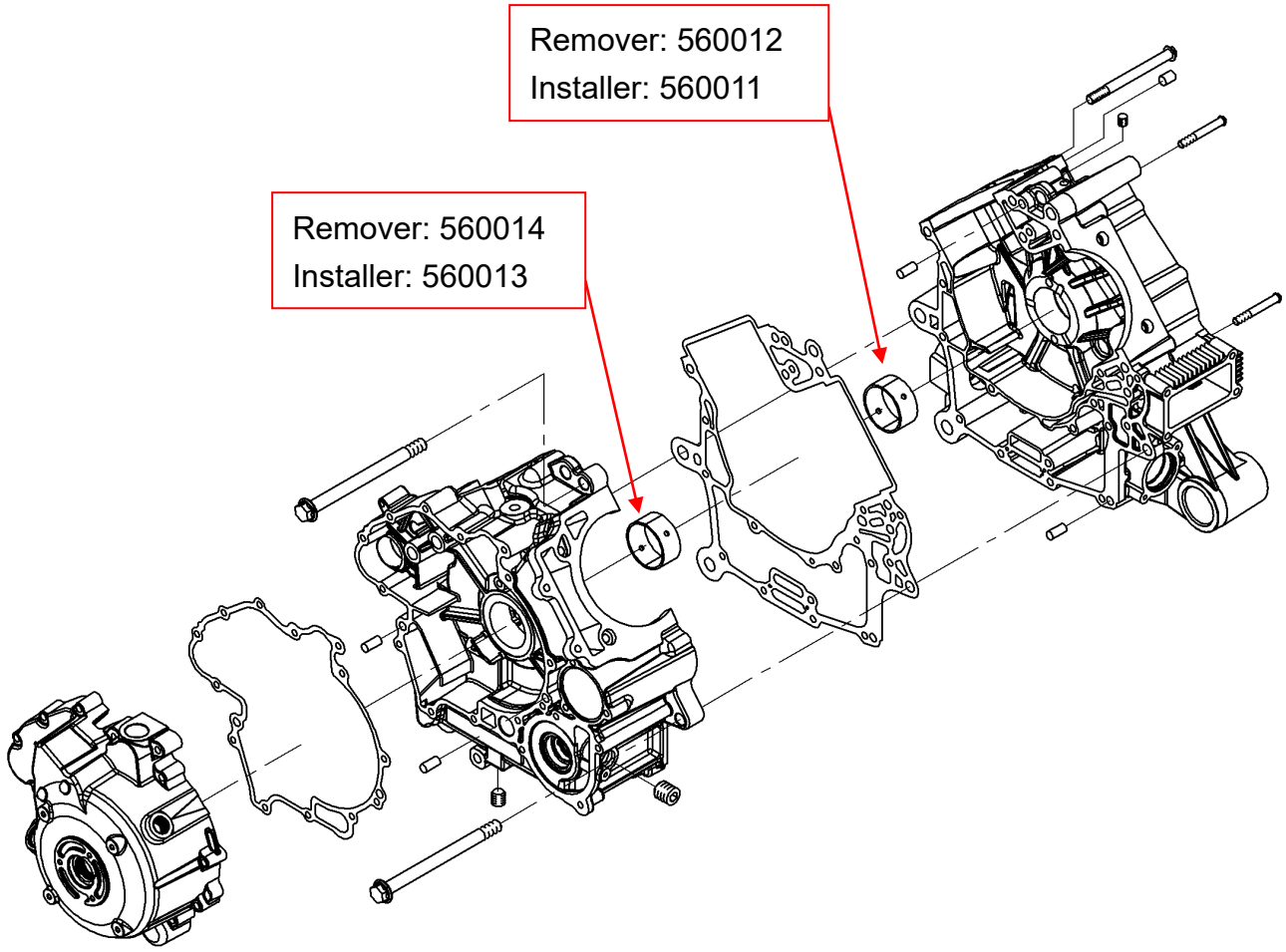
- For installation, reverse the removal procedure.

BOTTOM END

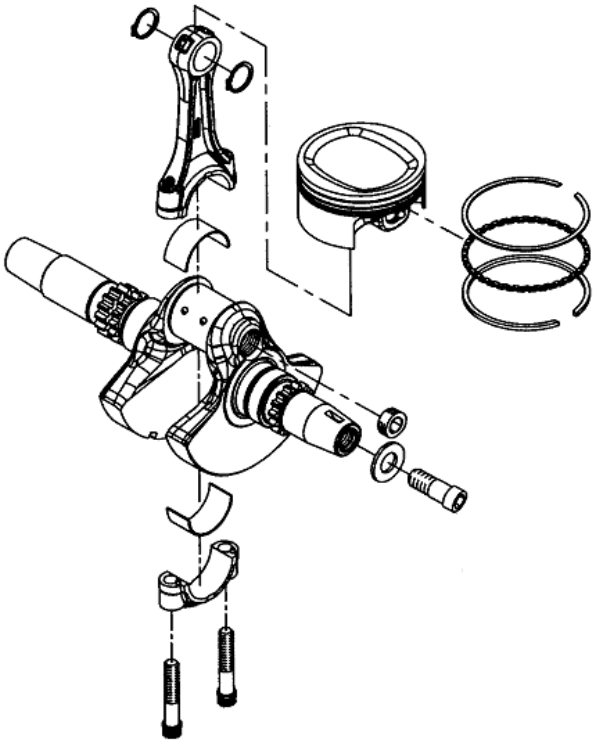
ENGINE DRIVE SHAFT

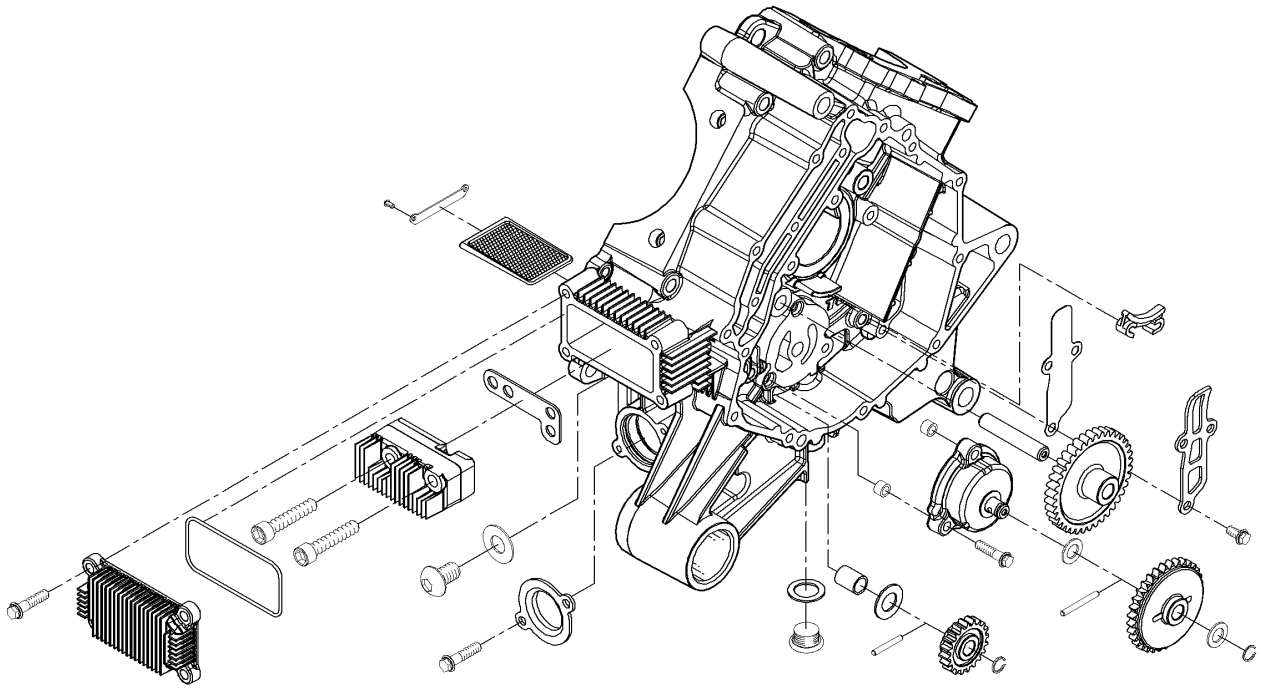


CRANKCASE

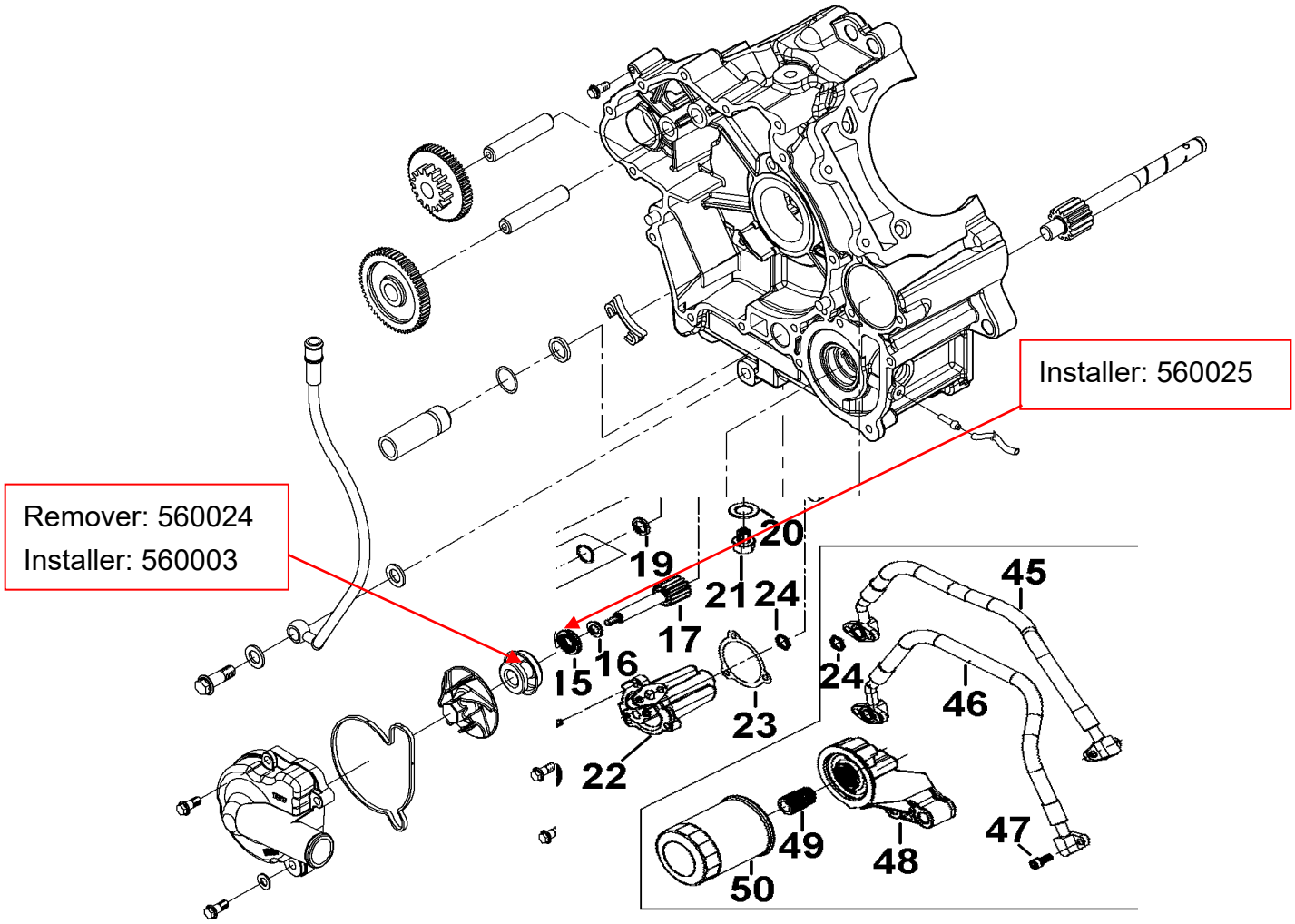


CRANKSHAFT

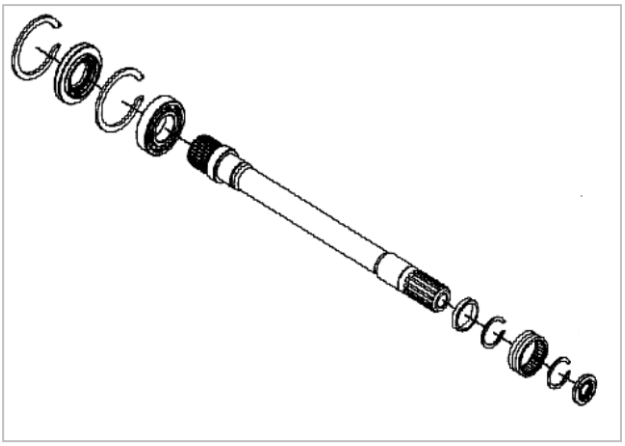




WATER PUMP, OIL PUMP



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.

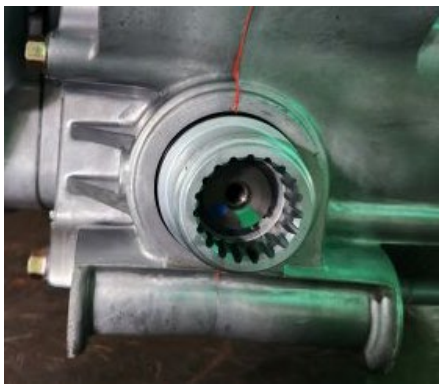
WARNING

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.

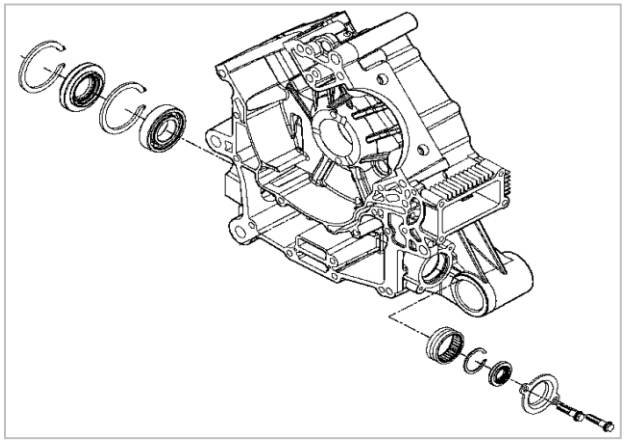
Engine Drive Shaft Removal

- Remove the engine.

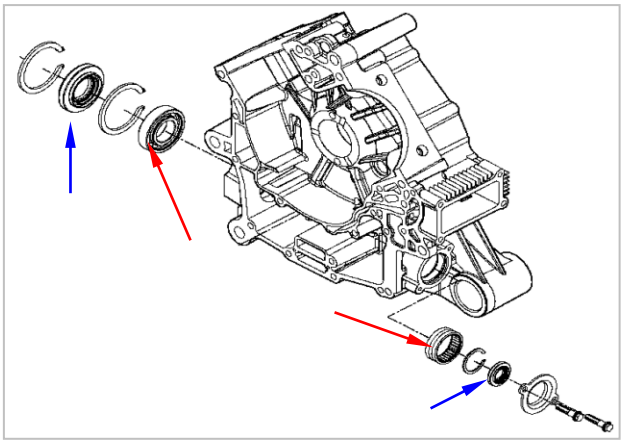
At rear of engine, remove the O-ring.

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

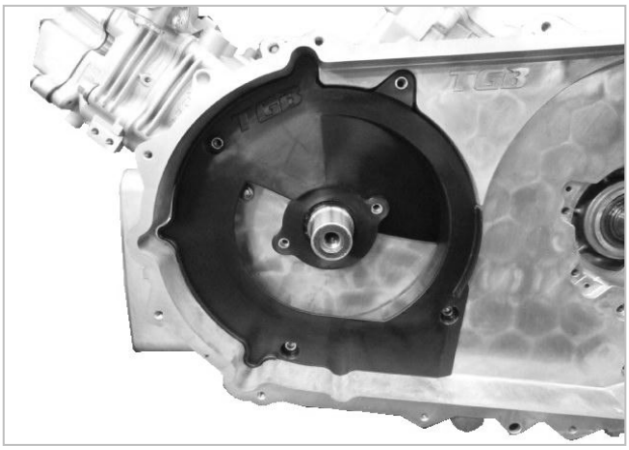


- Replace oil seals and/or O-ring if they are brittle, hard or damaged.
- Check drive shaft bearings for contamination and/or metal shavings. Check if bearing turn freely and smoothly. Replace if necessary.
- Check drive shaft for cracks, bend, pitting or other visible damages.
- Check drive shaft splines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

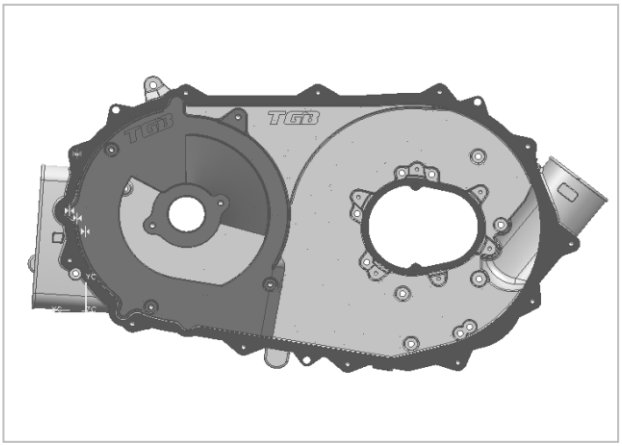


- Use a suitable installer for install bearing.
- Use LOCTITE 5910 on mating surfaces.

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.

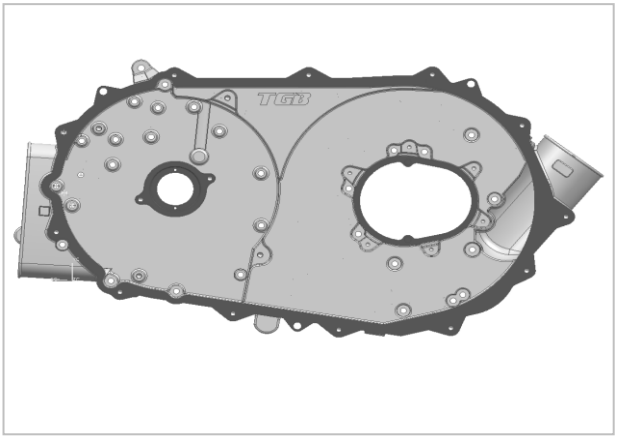


CVT Vent Backboard Oil Seal Removal

- 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.

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.

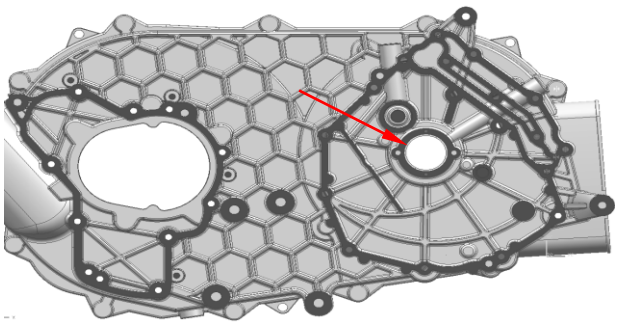
▪ Check surface of sealing sleeve for wear or other damages. Replace CVT vent backboard if damaged.

▪ 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)

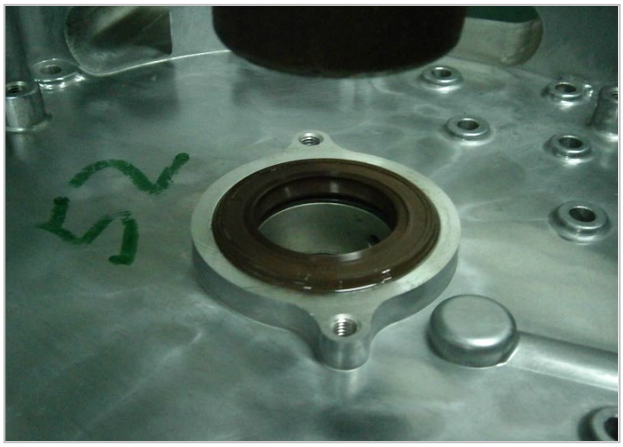


Plain Bearing Replacement (CVT Vent Backboard Cover)

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 560016.
- The CVT cover has to be supported from below with suitable support with straight surface, in order to prevent damage of the sealing surface.



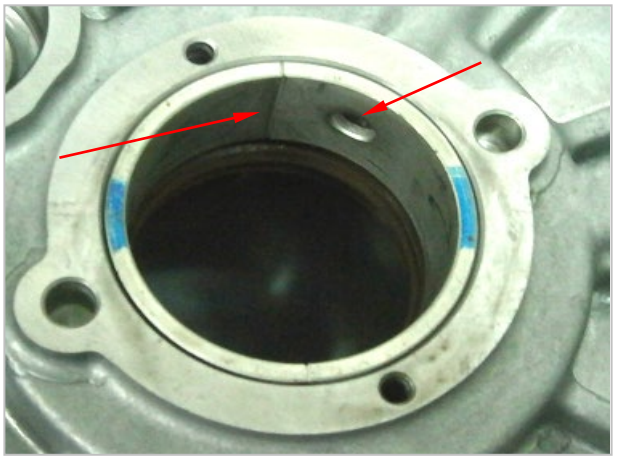
Plain Bearing Installation

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

- Install plain bearings with the proper PLAIN BEARING REMOVER/INSTALLER 560015 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.*

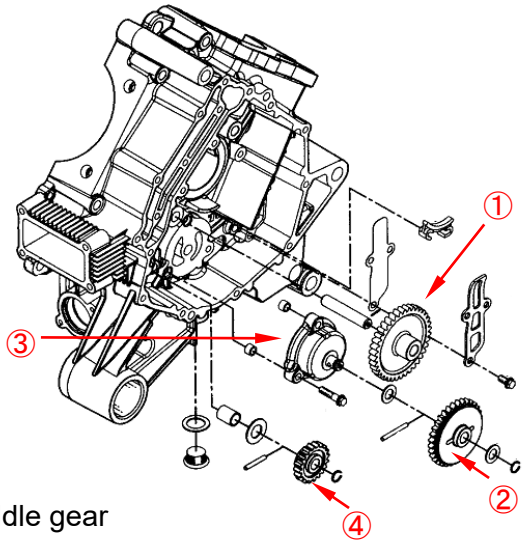
- Tighten CVT cover bolts following the illustrated sequence.

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.

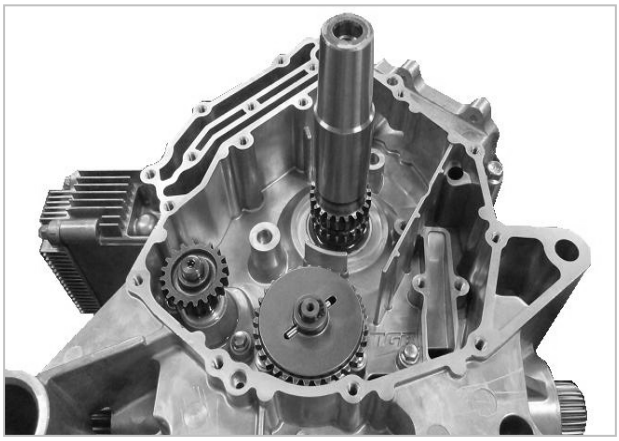


1. Idle gear
2. Oil pump gear
3. Oil pump
4. Water pump drive gear

Drive Gears Inspection

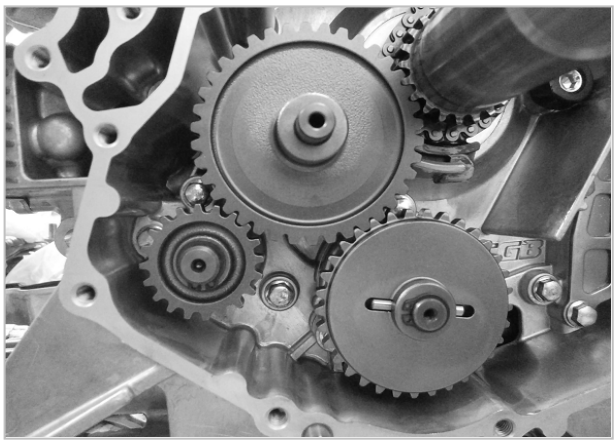
Idle Gear/Oil Pump Drive Gear/Water Pump Drive Gear

- 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

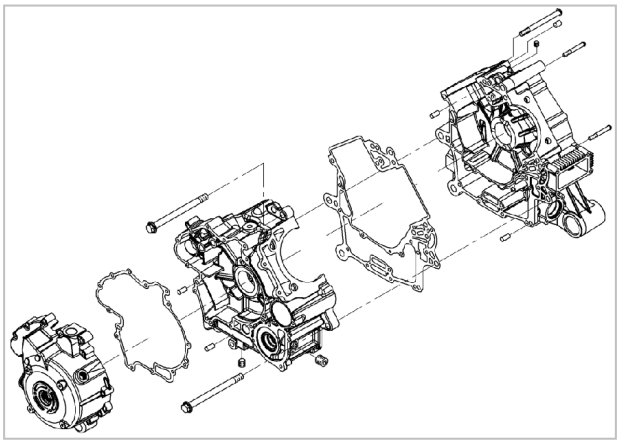
- For installation, reverse the removal procedure.
- Adequately oil the ball bearing of the breather gear.



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

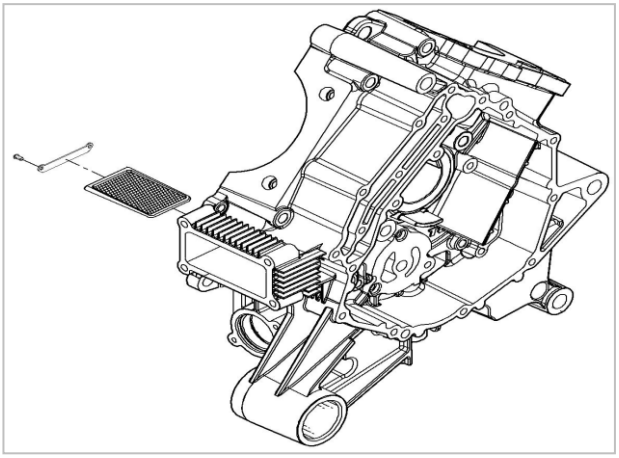
WARNING

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)

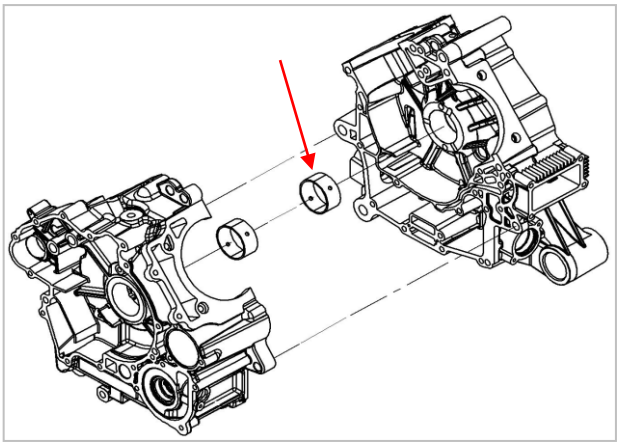
Plain Bearing Removal

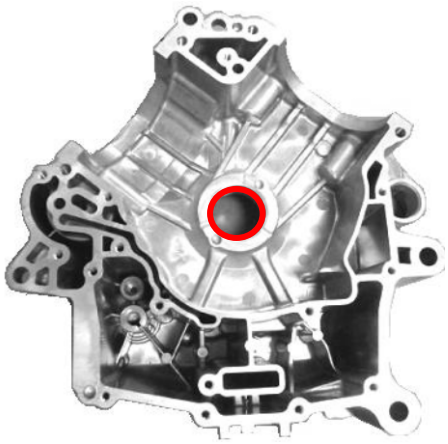
NOTICE: *Always use a press for removal of plain bearings.*

- Remove plain bearings with the PLAIN BEARING REMOVER 560012 (LH)/ 560014 (RH)
- 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 INSTALLER 560011 (LH) /560013 (RH) 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.*

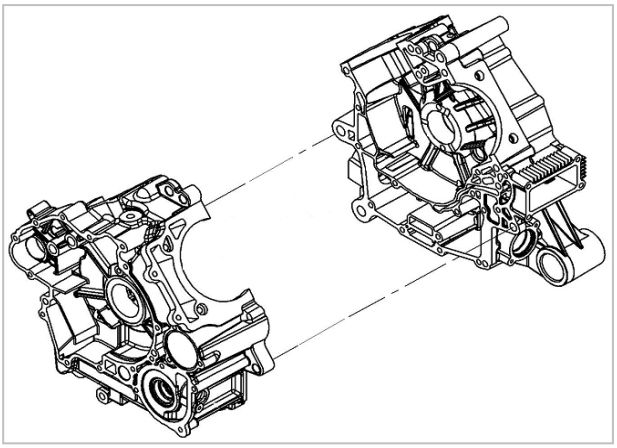
NOTICE: *Mark position of plain bearing oil bore on plain bearing remover/installer.*

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.*

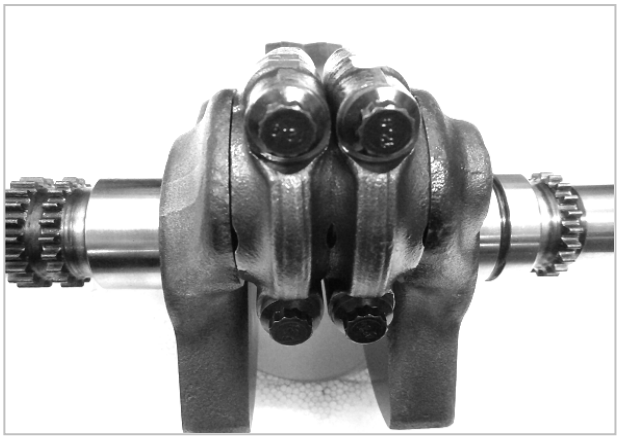
- Properly reinstall engine oil strainer and bolts.
- Reinstall water pump shafts/gears.
- Tightening sequence for bolts on crankcase is as per following illustration.

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).*

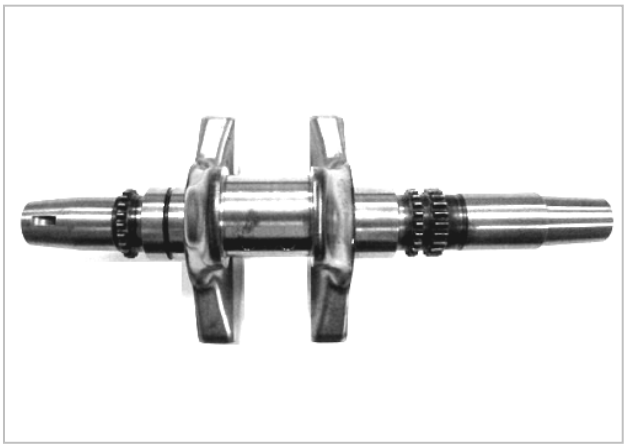
- Remove connecting rods from crankshaft.

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.

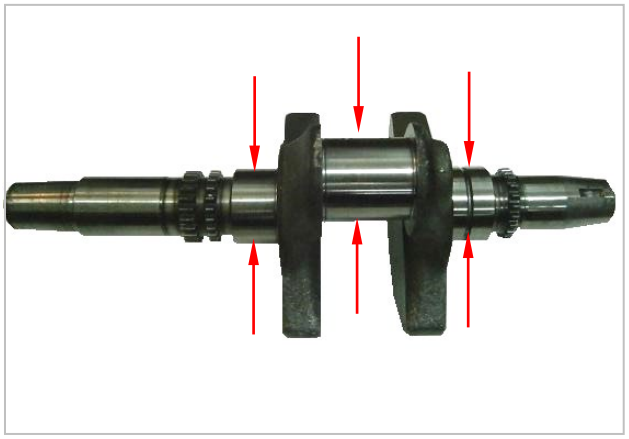
Connecting rod big end radial clearance

- 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.



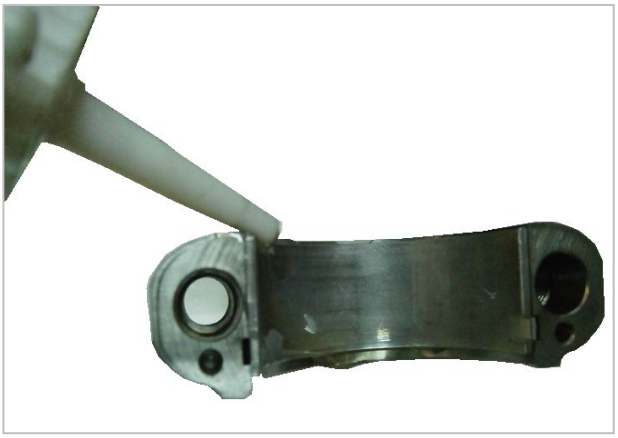
Crankshaft Assembly

- 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.*

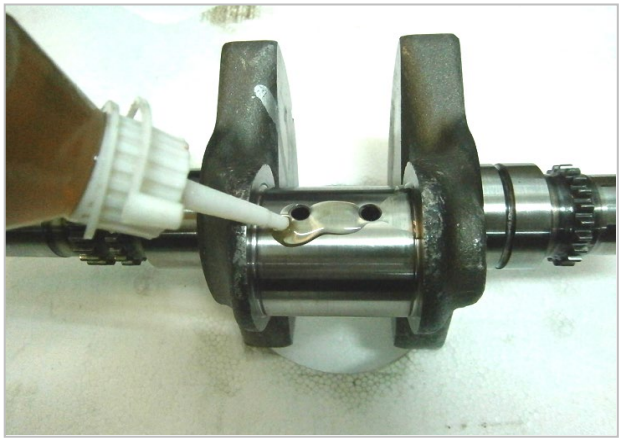


- Thread bolts in the connecting rods, tighten bolts in the following sequence:

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.*

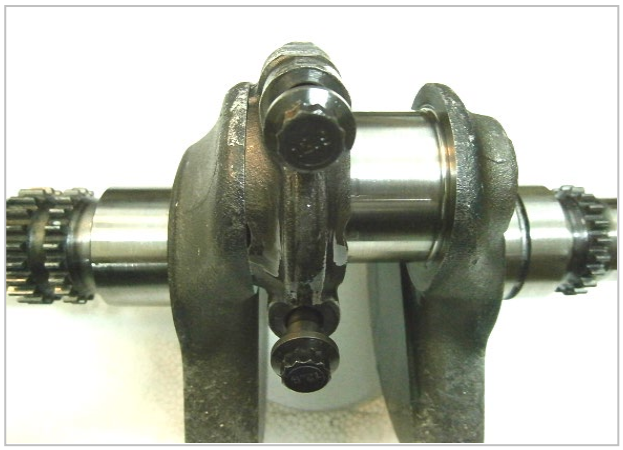
NOTICE: *Failure to strictly follow this procedure may cause bolts to loosen and lead to severe engine damage.*

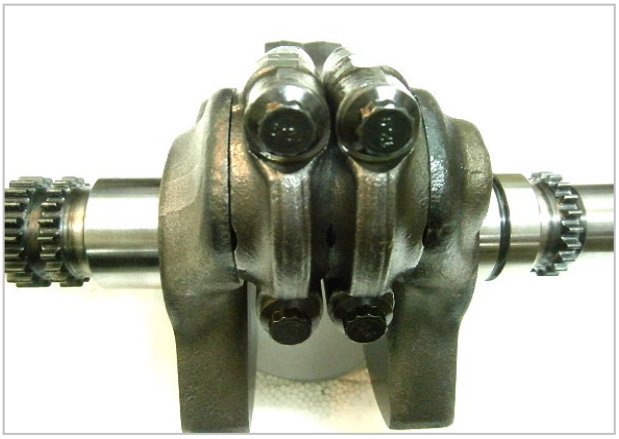


Crankshaft Installation

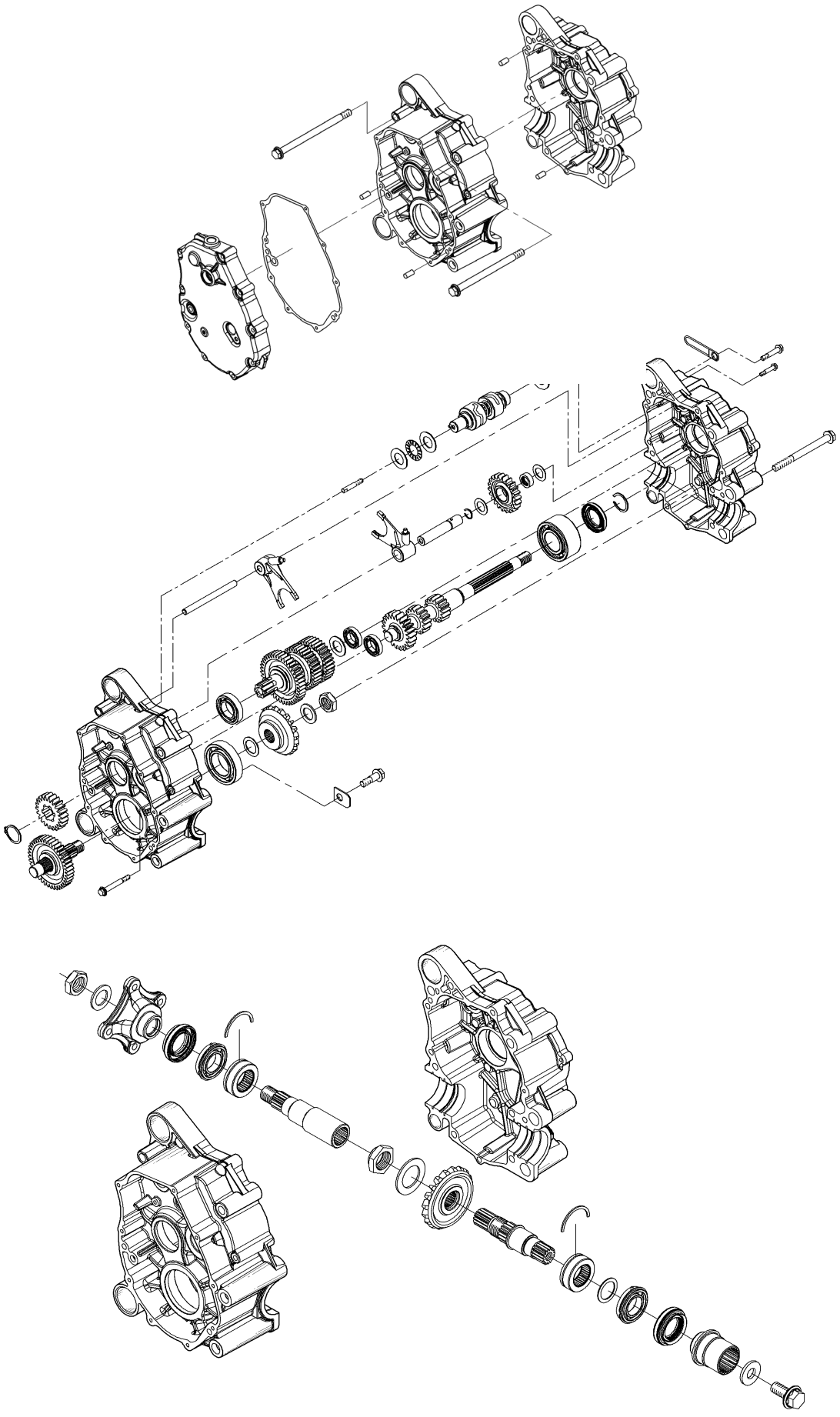
- For installation, reverse the removal procedure.
- Pay attention to the following details.
- Do not mix up the connecting rods of each cylinder during installation.

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.

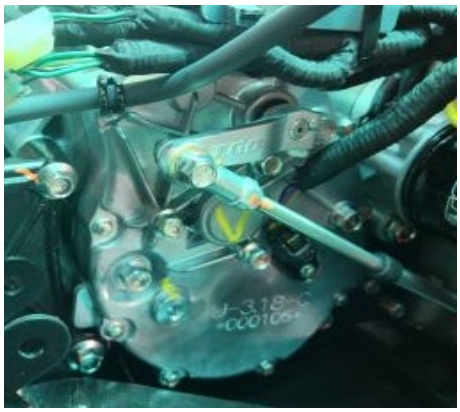
GEAR IS HRAD TO SHIFT

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

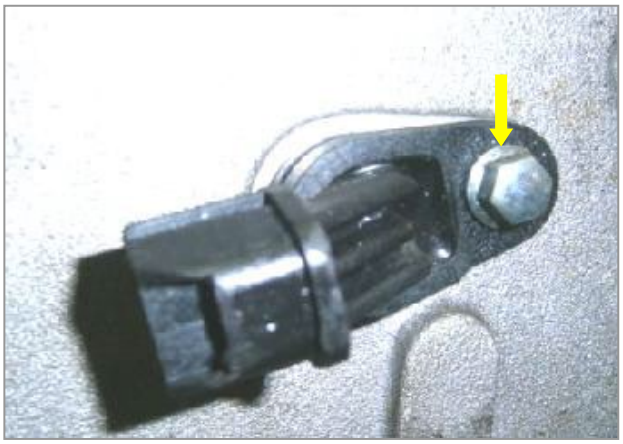
1. Lift rear of vehicle so that rear wheels are off the ground.
2. Set transmission to Neutral.
3. Turn ignition switch ON.
4. Set multimeter to VDC.
5. Measure voltage while slowly rotating rear wheels by hand.

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.

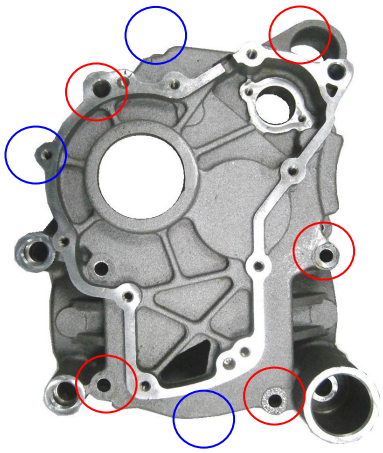
GEARBOX

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

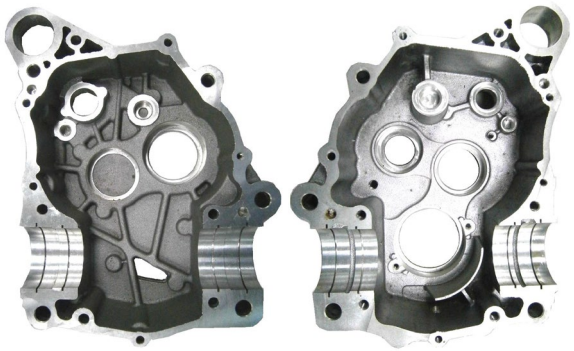
To replace the output drive shaft oil seal, processed as follows:

- 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.*

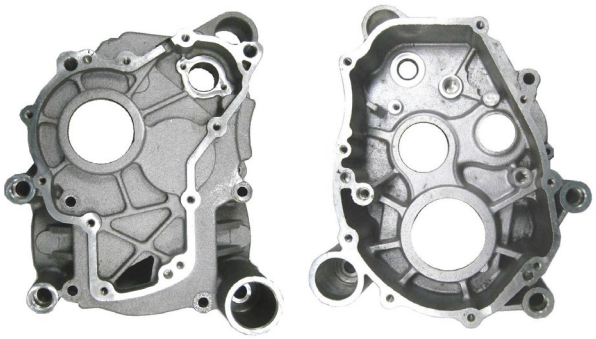
- Check if ball bearings turn freely and smoothly.
- Check all bearings, bearing points, tooth flanks and taper grooves.



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

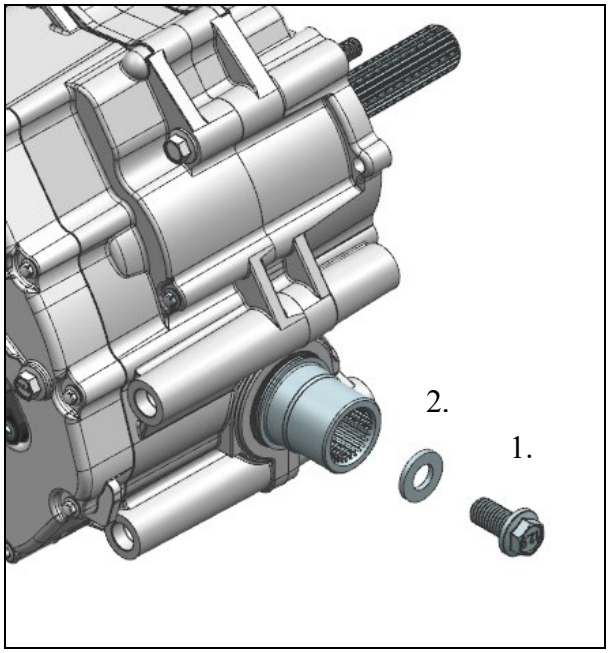
For installation, reverse the removal procedure.

- 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 box oil : 75W-140, 0.75L

Torque: 330 kgf/cm

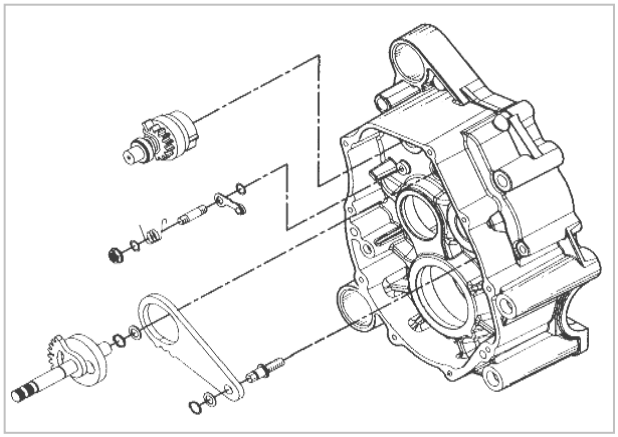
The torque setting for the secondary drive shaft bolts:



Version		Old	New
Parts	1	S20225 BOLT, HEX. HEAD M12	S03402 BOLT, HEX. HEAD M14
	2	W99230 *1 PCS WASHER	W99441 *1 PCS WASHER
Torque		1000kgf-cm	1800kgf-cm

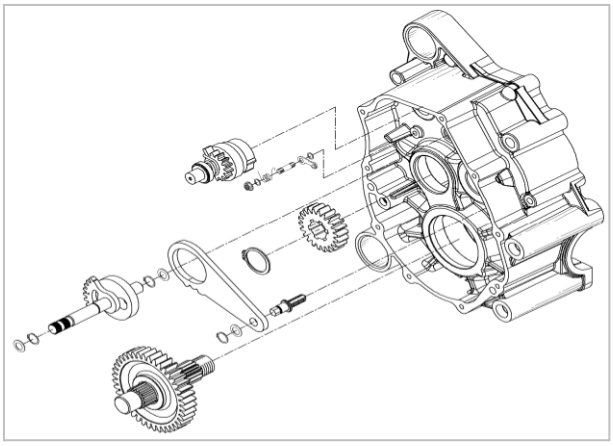
Gear Camshaft Comp.

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



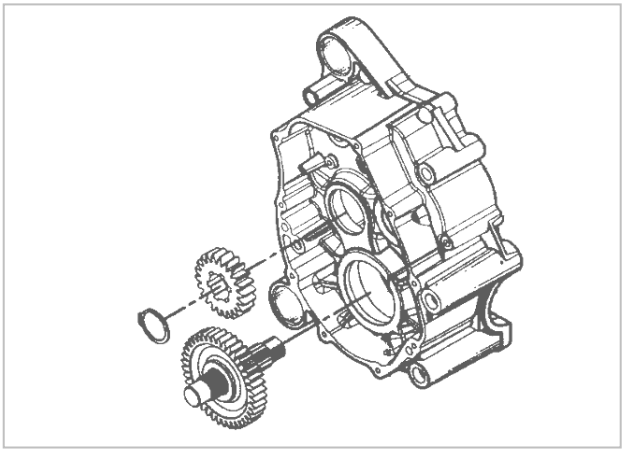
Parking Gear

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



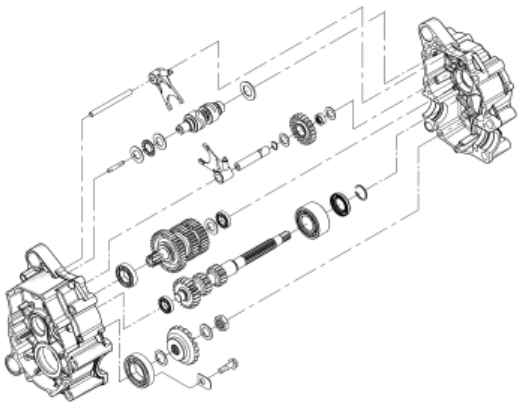
Output Secondary gear shaft and 17 tooth Gear

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

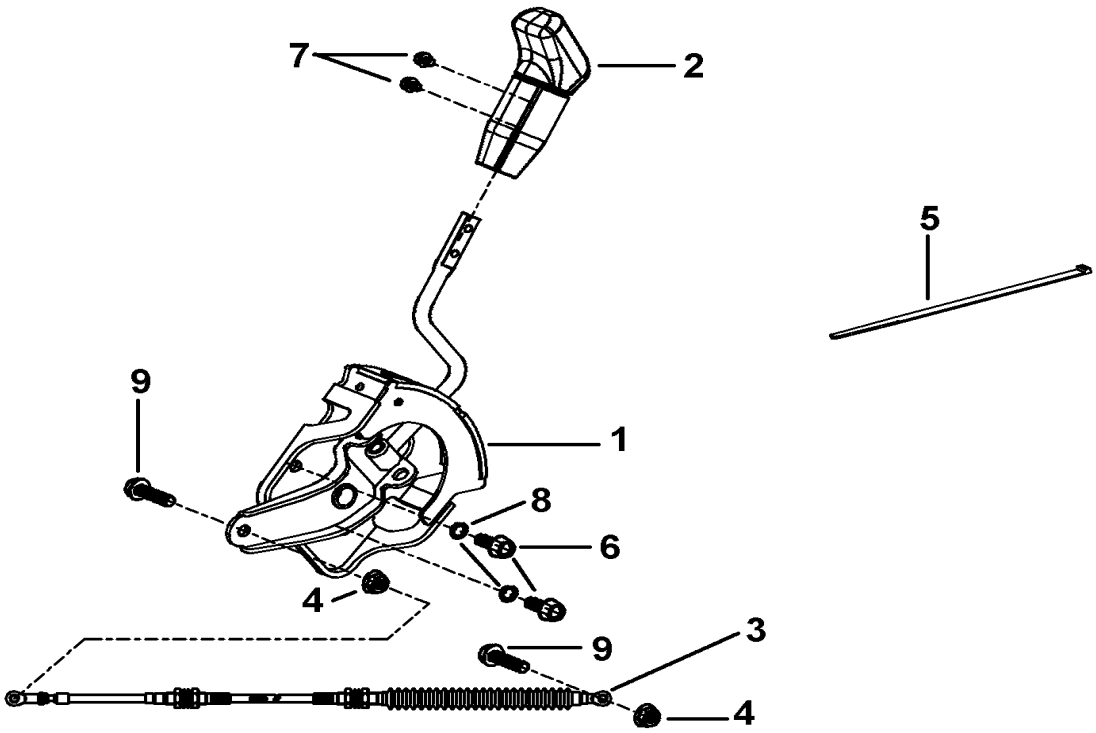


Transmission Gear

- 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

Removing the Shift Lever

1. Place shift lever in NEUTRAL position.
2. Secure vehicle using wheel blocks.
3. Remove the shift lever handle.
4. Remove shift lever trim
5. Detach shifter cable from shift lever by removing nut and washer.
6. Remove shift lever pivot bolt and nut.
7. 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.

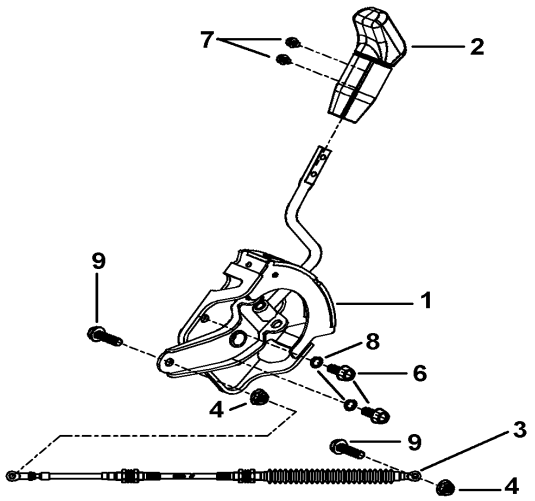
Shift Lever Installation

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

1. Ensure shift lever is tilting toward the center of vehicle
2. Tighten shift lever handle nut to specification. Tightening Torque Shift lever handle nut 15.5 ± 1.5 Nm (137 ± 13 lbf-in)
3. Adjust shifter cable, refer to Adjusting the Shifter Cable.
4. Check if shift lever works properly in all positions.

▪ 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.



Shifter Cable

Adjusting the Shifter Cable

1. Place shift lever in **NEUTRAL** position.

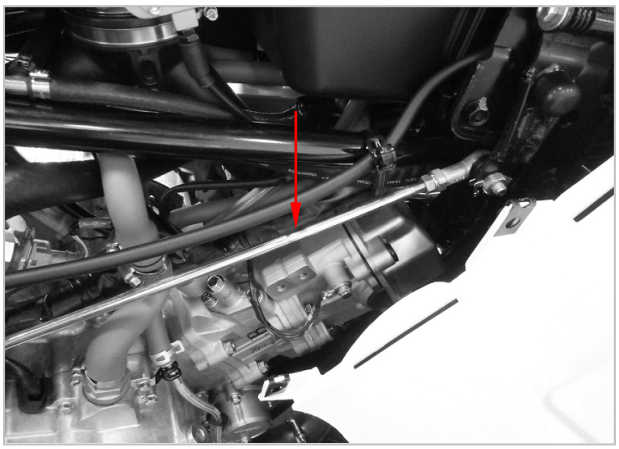
NOTE: Move vehicle back and forth to ensure gearbox is set in neutral position.

2. Secure vehicle using wheel blocks.
3. Loosen cable adjustment nuts at engine end of cable.
4. Adjust cable nuts in order to center shift lever with neutral notch.

NOTE: UP and DOWN shifter arm free play must be symmetrical about the center line of neutral notch.

5. Tighten cable adjustment nuts to specification.
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 with neutral notch. Readjust as required.

NOTE: To properly check shift lever alignment with notch, move shift lever toward the LH side then let it return to position.



9. Test the shifter to confirm that the system works properly in all positions.

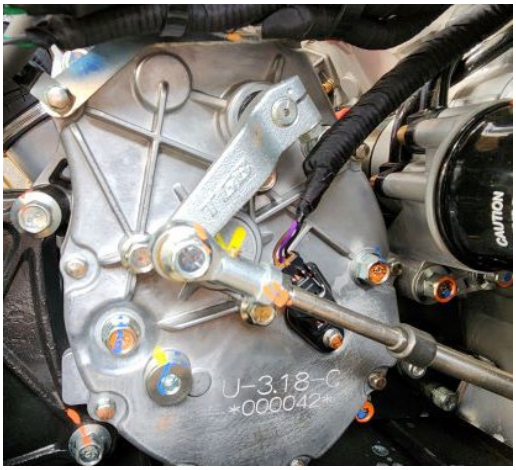
WARNING : After adjustment, make sure that PARK position works properly.

SHIFT PLATE

Shift Plate Removal

NOTE *: Do not remove shift plate needlessly.*

1. Place gearbox in NEUTRAL position.
2. If the engine is still in the vehicle, detach shifter cable from shift plate.
3. Mark the shift plate position on the shift shaft end and on the housing
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

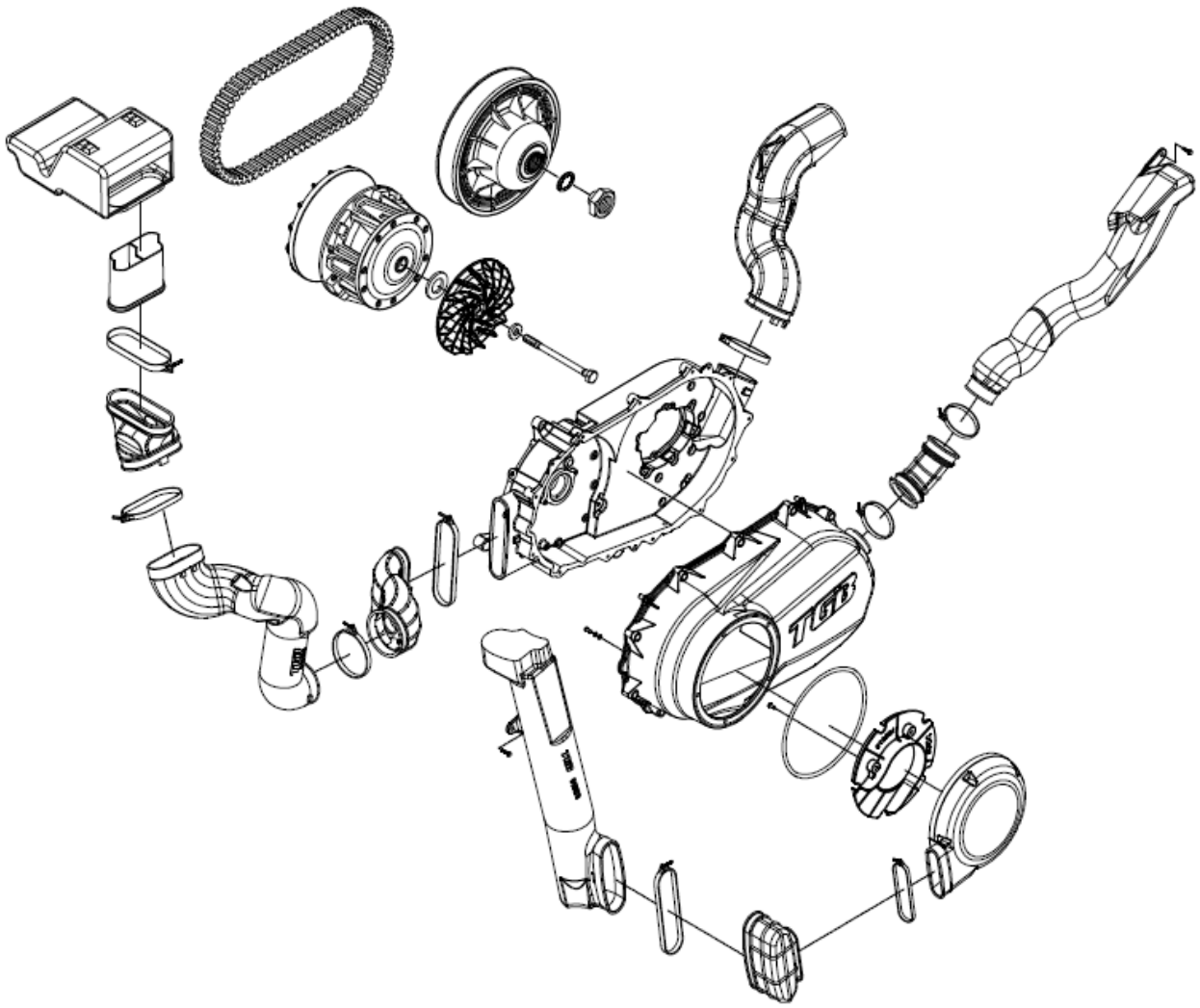
- The installation is the reverse of the removal procedure. However, pay attention to the following.
- Place gearbox in NEUTRAL position before shift plate installation.
- Align shift plate using marks previously traced.
- Tighten shift plate nut to specification

TORQUE： 9NM+/- 1 Nm.

T**esting Shifter System**

1. Move shift lever in R position then in H position.
2. Place shift lever in NEUTRAL position.
3. Make sure that shift lever is properly centered with neutral notch. Readjust if necessary.
4. Verify proper operation of shift lever in every position.

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.

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

WARNING

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

WARNING

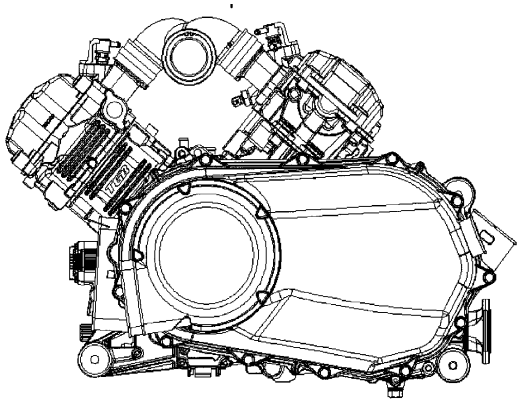
Any drive pulley repairs must be performed by an authorized TGB dealer. Subcomponent installation and assembly tolerance require strict adherence to procedure detailed.

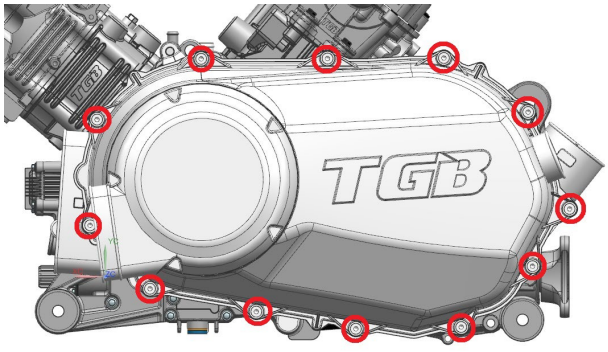
NOTICE: *Never use any type of impact wrench at drive pulley removal and installation.*

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.*





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 560007 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.

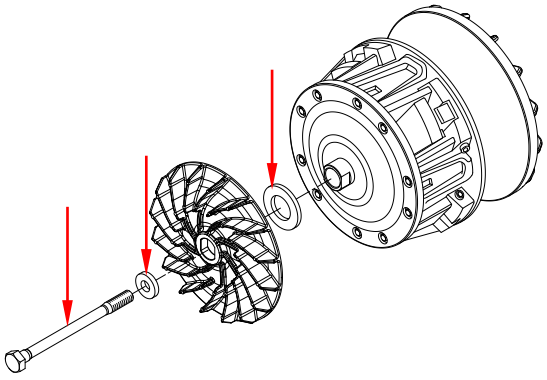
Drive belt Installation

- 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 560006to 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.

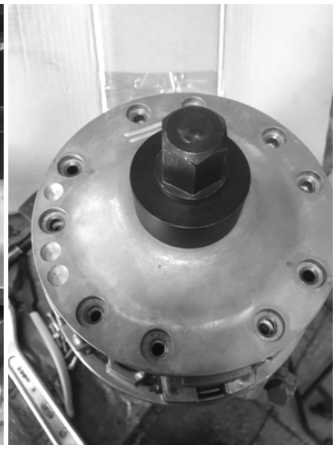
NOTICE: *Do not lean the tool hook on the slider shoe guides.*

TUNER HAFT COVER REMOVAL

- Install the drive pulley on the special tool fixing seat #560020A as shown.
- Screw in the nut to the end.
- Mark the align line used for installation.

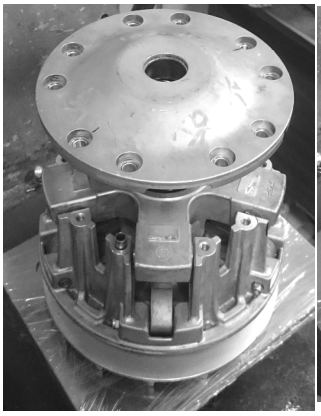
- Loosen ten bolts on the tuner cover.

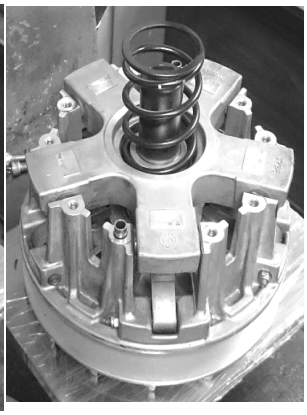
NOTE: the bolts discard after reinstall for twice. Always use new bolts after disassemble twice.



- remove tuner cover.
- Remove the spring.

NOTICE: *Make sure to use the specified tool. Using another tool will damage the crankshaft threads.*

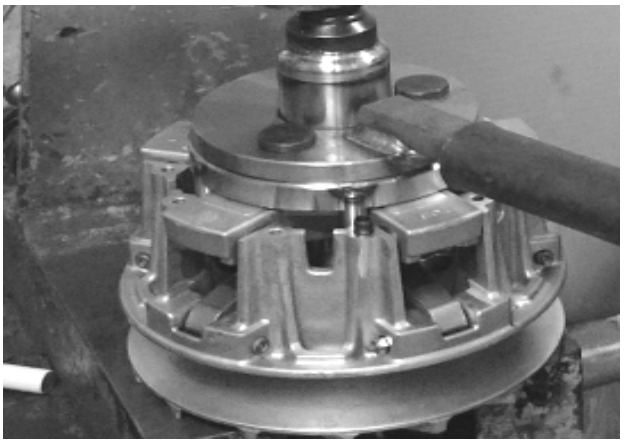




GOVERNOR CUP REMOVEAL

▪ Using special tool #560019 loose and remove the governor cup.

NOTICE: *During removal, press and hold the governor cup.*



Centrifugal lever Replacement

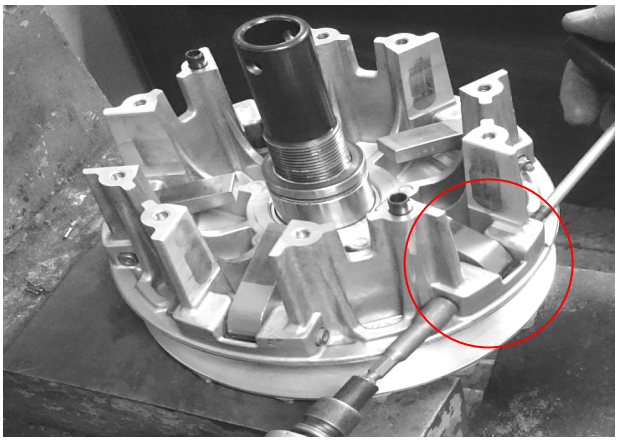
Removal

▪ 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.



ONE-WAY BEARING REMOVAL

▪ Remove the outer half assy.

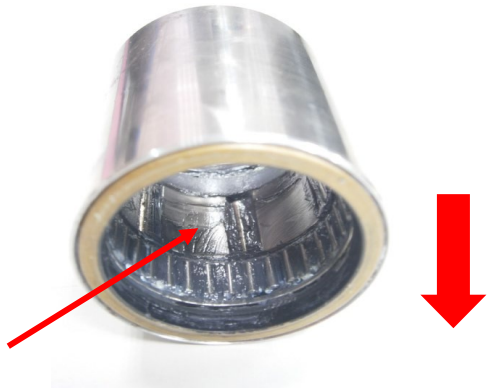
▪ Remove the bearing and spacer.

▪ Inspection, replace the bearing if damage.

ONE-WAY BEARING INSTALLATION

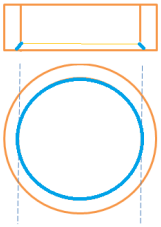
▪ Apply Molybdenum Disulfide grease on the needle bearing before install.

NOTE: With needle bearing face down follow the direction install the ONE-WAY Bearing..



① Washer
② ONE-WAY Bearing
③ Washer
④ Spacer

Note: the round inner edge of washer should face down during installation.



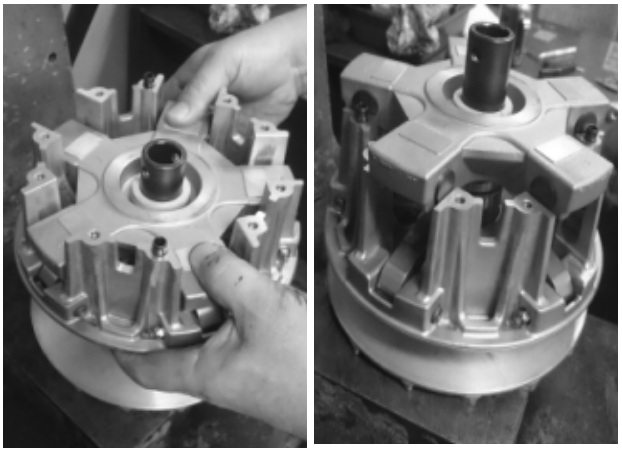
GOVERNOR CUP INSTALLATION

▪ For installation, reverse the removal order.

▪ Using hand lift up the sliding sheave and install the governor cup.

:

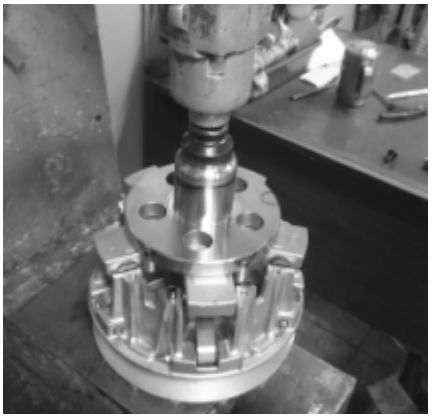
NOTE : *Apply 3~5 cc Molybdenum disulfide grease inside the bearing before installation.*



▪ Install the special tool #560019 on the top of centrifugal cop.

▪ Tighten the centrifugal cup.

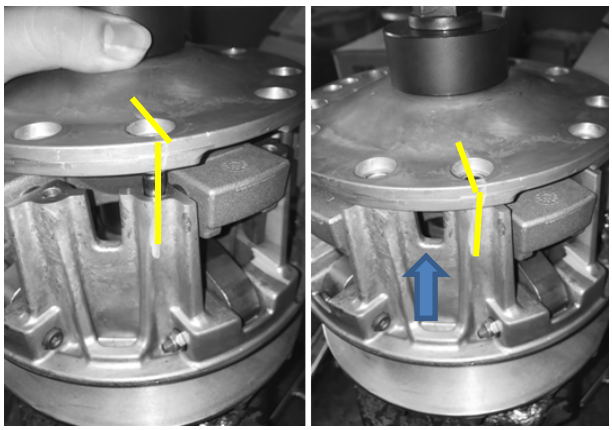
TORQUE: 2000~2500kgf-cm.



TUNER HAFT COVER INSTALLATION

- For installation, reverse the removal order.
- Install the spring.
- Install the special tool and using wrench press the tuner cover to the end.

- Check the mounting area should align.
- Raise up the bottom and guide the pin and cover at right position as shown.
- Tighten the bolts on the tuner cover, follow the cross sequence.



TORQUE: 80~120kgf-cm.

NOTE: the bolts discard after reinstall for twice. Always use new bolts after disassemble twice.

DRIVE PULLEY INSTALLATION

- For installation, reverse the removal procedure.
- Apply **LOCTITE 263** on the end of thread.
- 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 560004 lock the drive pulley.

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

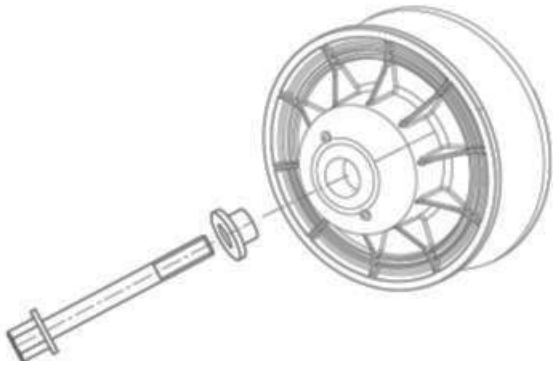
- Install the cooling fan and washers.
- Tighten drive pulley screw to specified torque.

TORQUE: **700 ~750 kgf.cm**

DRIVEN PULLEY

Driven Pulley Removal

- Remove DRIVE BELT.(refer to CVT belt removel procedure.
- Using the DRIVEN CLUTCH HOLDER, hold the driven pulley and loosen the driven pulley retaining bolt.
- Remove driven pulley retaining bolt and flange washer.
- Remove the driven pulley with the spring and the cam.



Driven Pulley Installation

- For installation, reverse the removal procedure.
- Apply **LOCTITE 243** on the end of thread.

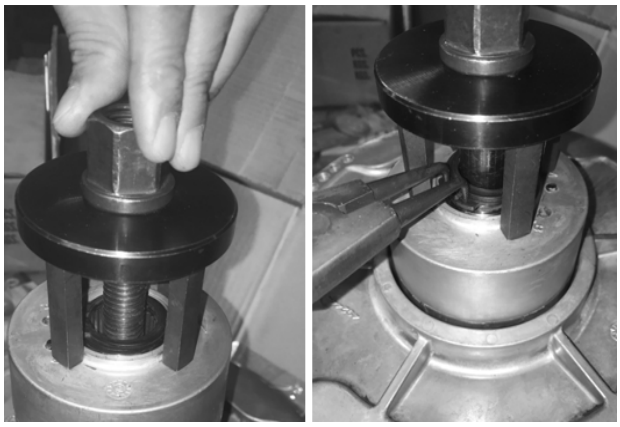
TORQUE: 850~900 kgf.cm

DRIVEN PULLEY DISASSEMBLY

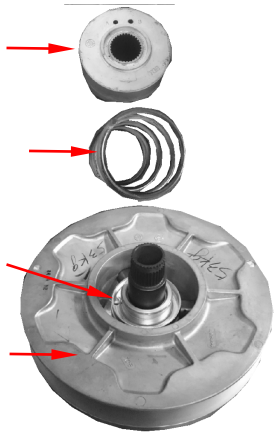
- Install the special #560017 on the top of cam.

▪ Screw in the special tool #560017 down and remove the two C-clips.

▪



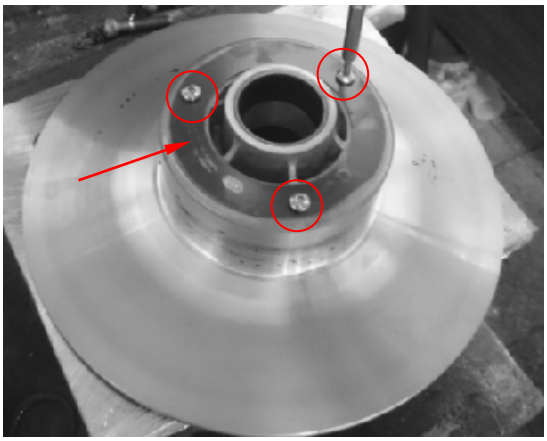
▪ Disassemble the cam, spring, spring seat and outer haft sheave.



Slider Shoe Replacement

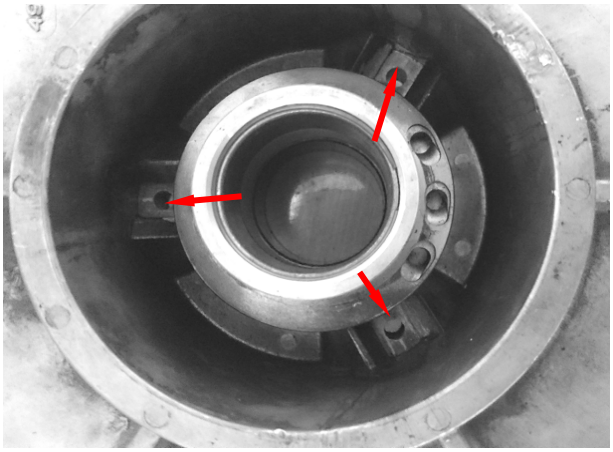
▪ Remove three screws and washer from the back side of outer haft sheave.

NOTE: Replace Every 6000KM.



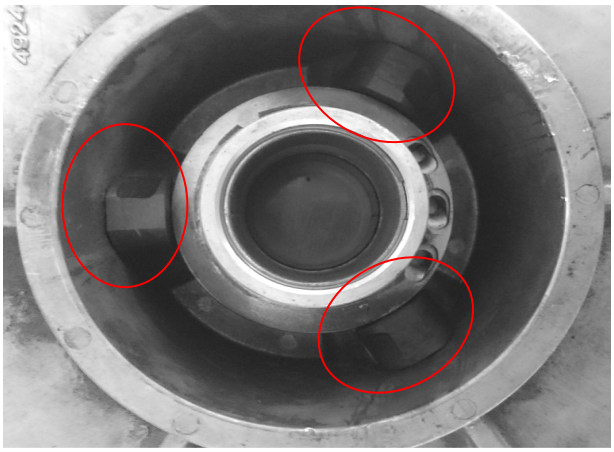
▪ Using rubber hammer push out the slider shoe.

▪ 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.

NOTE: Apply **LOCTIE 263** on the end of thread before install.

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.

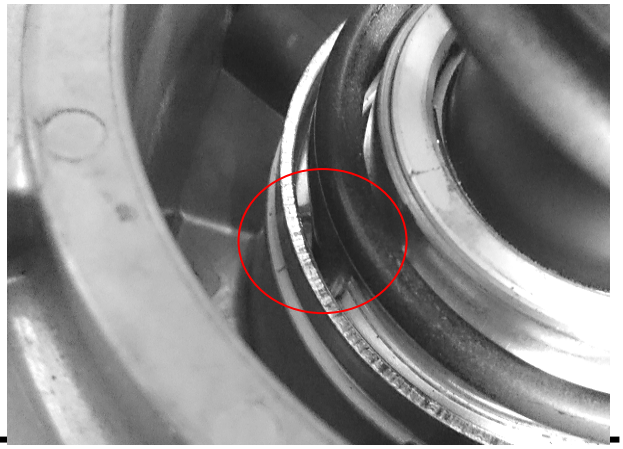
NOTE: *The hole of spring seat should align the hole of outer haft sheave.*

Before **VIN** :004372

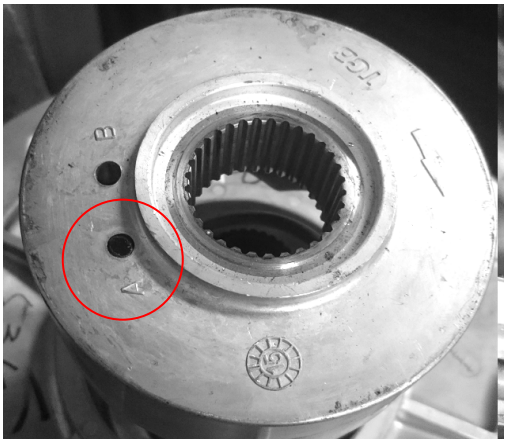
After **VIN**:004373

▪ 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".**

▪ Install two "C-clip" ① and special tool #560017 ②.

▪ Using special tool #560017 screw-in push down.

NOTE: The flat surface of should face outward.

CAUTION

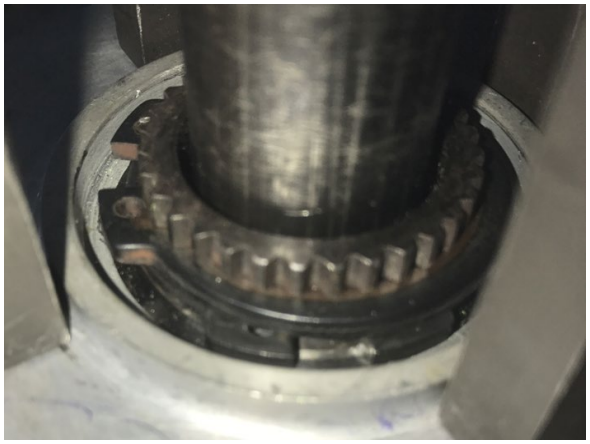
During push down, you should counter-clockwise turn the outer haft sheave to let the spline of cam align to the shaft around 60 degree.

NOTE: If the spline not aligns the shaft, the cam cannot push down.

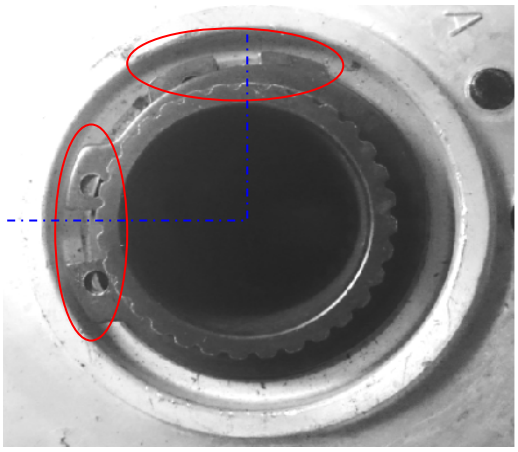
▪ When the cam on the position, the haft sheave cannot turn clockwise. Only can turn counter-clockwise.

▪ Install two C-clips.

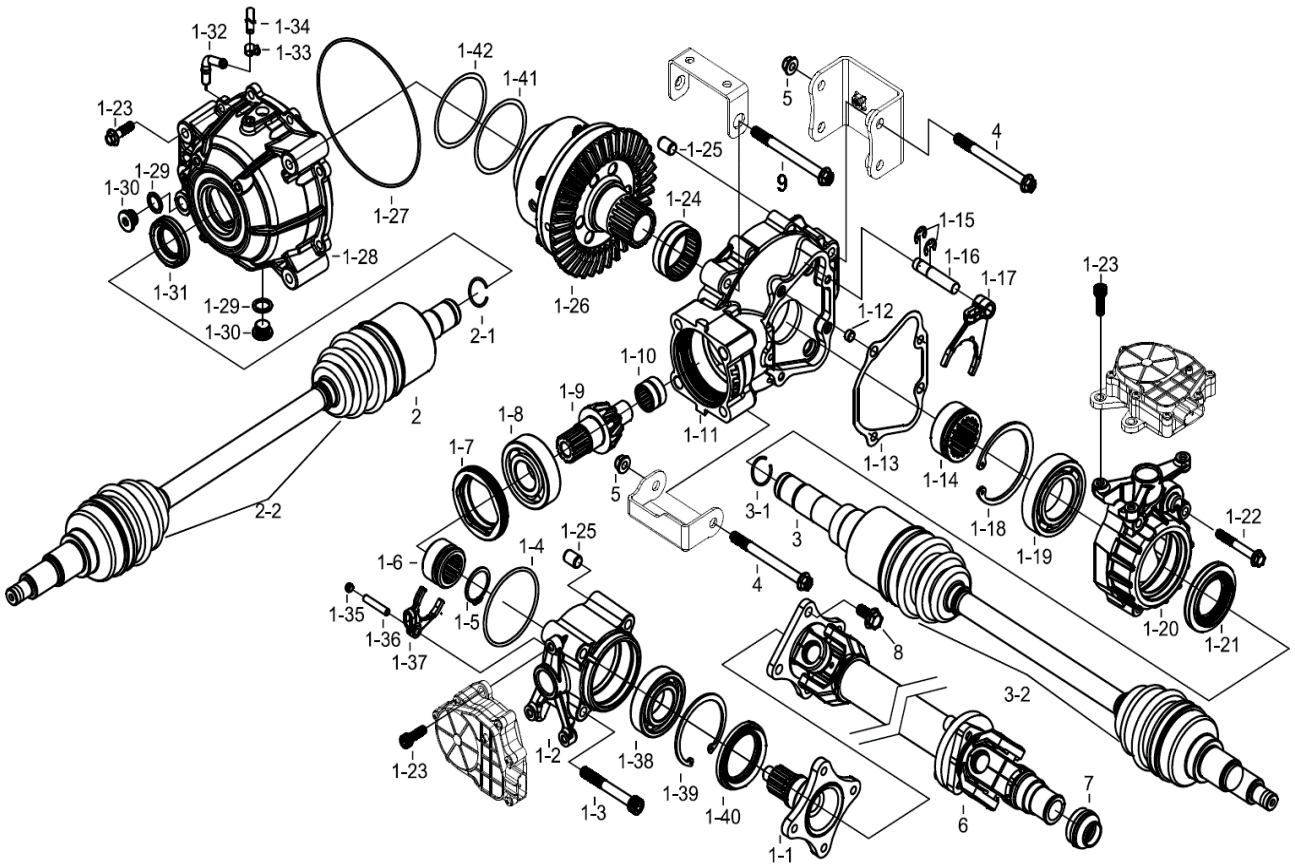
▪ Adjust the open area of two C-clips to perpendicular direction as shown.



- Ensure the open area of two C-clips to perpendicular direction and same distance 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.

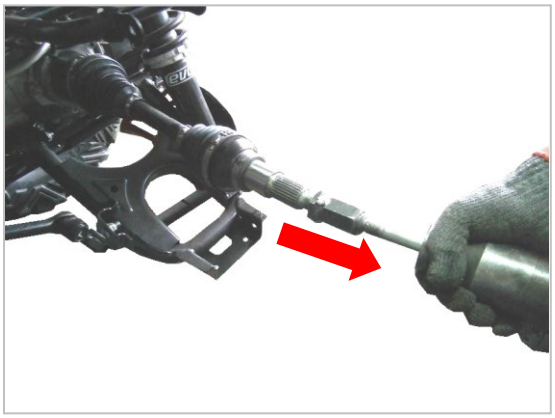
TORQUE: 225 Nm.

NOTE: *Tighten further castellated nut if* required *to align grooves with drive shaft hole.*

- 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.

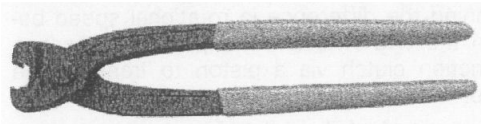
NOTE: *If the splines on plunging joint are worn, a check of differential inner splines should be done.*

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.

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.

Central Propeller Shaft

Removing the Central Propeller Shaft

1. Remove the central propeller shaft screw and nut on front differential end.
2. Remove all the bottom plate.
3. Dislodge the propeller shaft from the front differential side first by pushing it towards the engine. When it is disengaged from the front differential, pull it out towards front the rear differential to disengage from the engine.
4. Remove the central propeller shaft through bottom plate opening.

FRONT DIFFERENTIAL

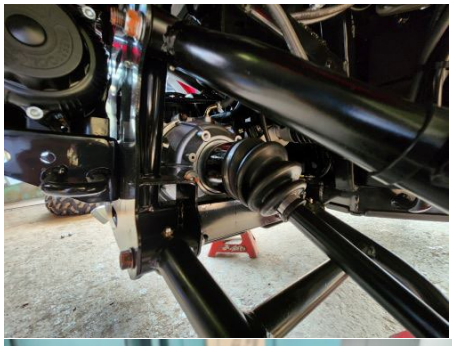
Front differential Removal

Caution

Be sure the differential set temperature below 35℃

- Drain the differential oil.
- Remove both drive shafts.
- Detach vent hose from front differential.
- Remove the front bottom plate.

- Remove bolts and nuts securing the differential.
- Remove the central propeller shaft if required.
- Disconnect the actuator connector.
- Remove the differential from the under of vehicle.



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 Installation

For installation, reverse the removal procedure.
Fill the gear oil and tighten the bolt.

Caution

Oil standard:SAE85W90 hypoid gear oil Oil capacity: 700c.c.

Bolt Torque : 33N-m

Differential Motor

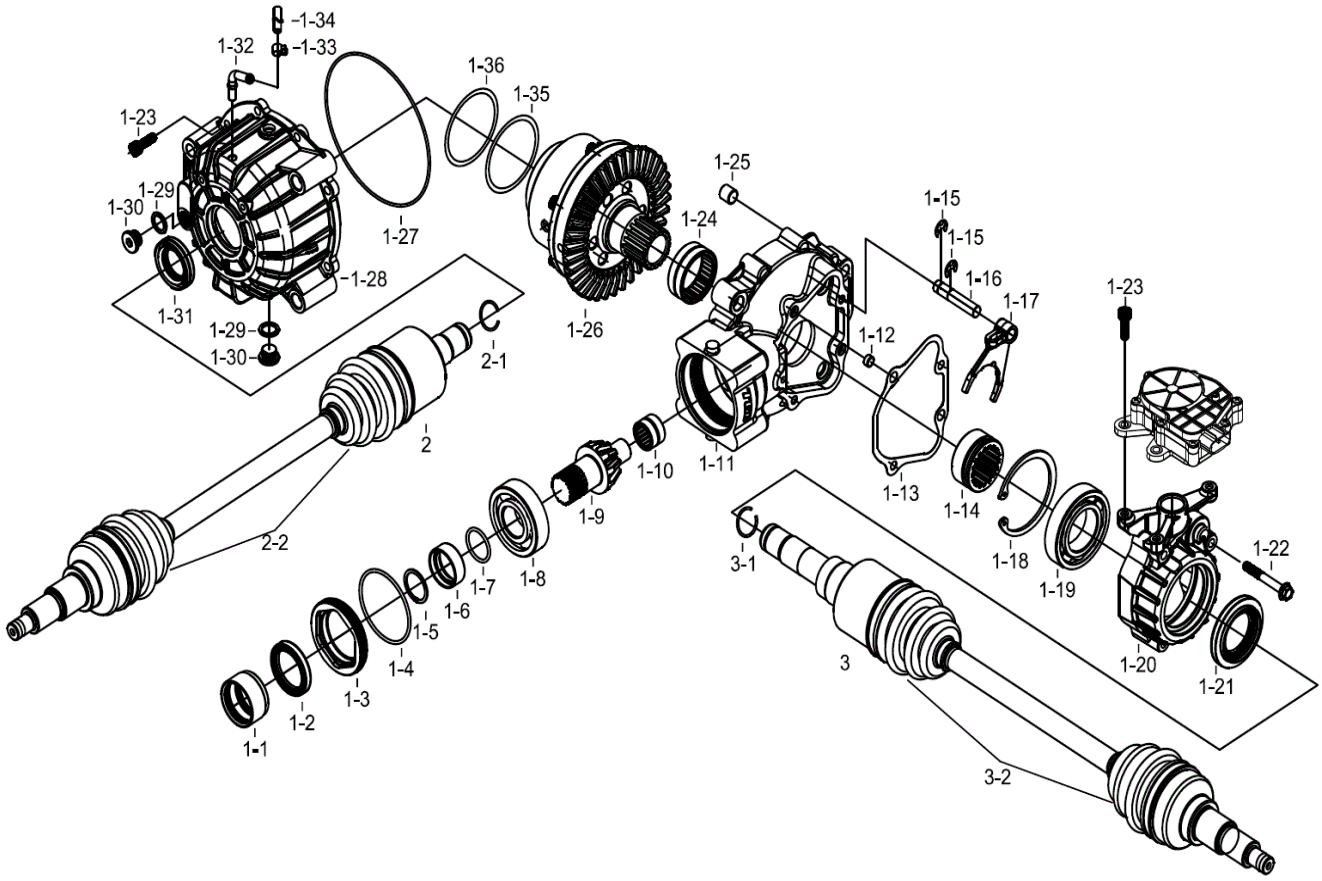
Disconnected the wiring connector.

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.

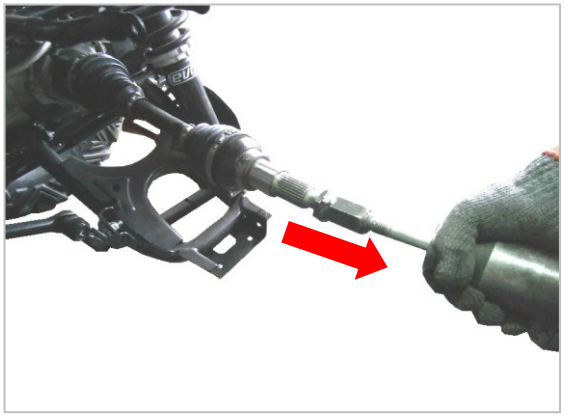
TORQUE: 225 Nm.

NOTE: *Tighten further castellated nut if* required *to align grooves with drive shaft hole.*

- 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.

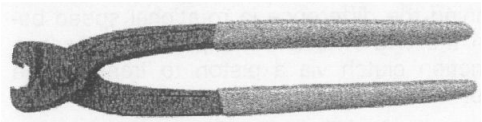
NOTE: *If the splines on plunging joint are worn, a check of differential inner splines should be done.*

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 rear bottom plate
- Remove bolts and nuts securing the differential.
- Remove the central propeller shaft if required.
- Disconnect the actuator connector.
- Remove the differential from the under of vehicle.

Rear Differential Disassembly

Unscrew the differential housing bolts then separate half housings.

Rear Differential Installation

For installation, reverse the removal procedure.
Fill the gear oil and tighten the bolt.

Caution

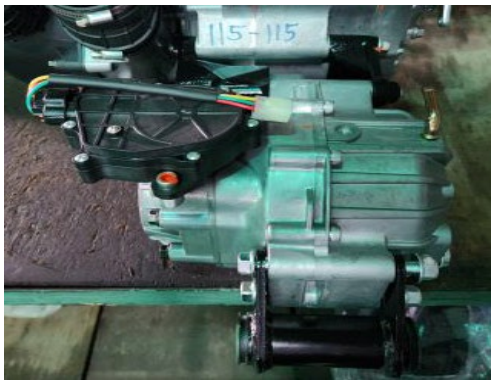
Oil standard: :SAE85W90 hypoid gear oil Oil capacity: 600 c.c.

Bolt Torque : 330N-m

Differential Motor

Disconnected the wiring connector.

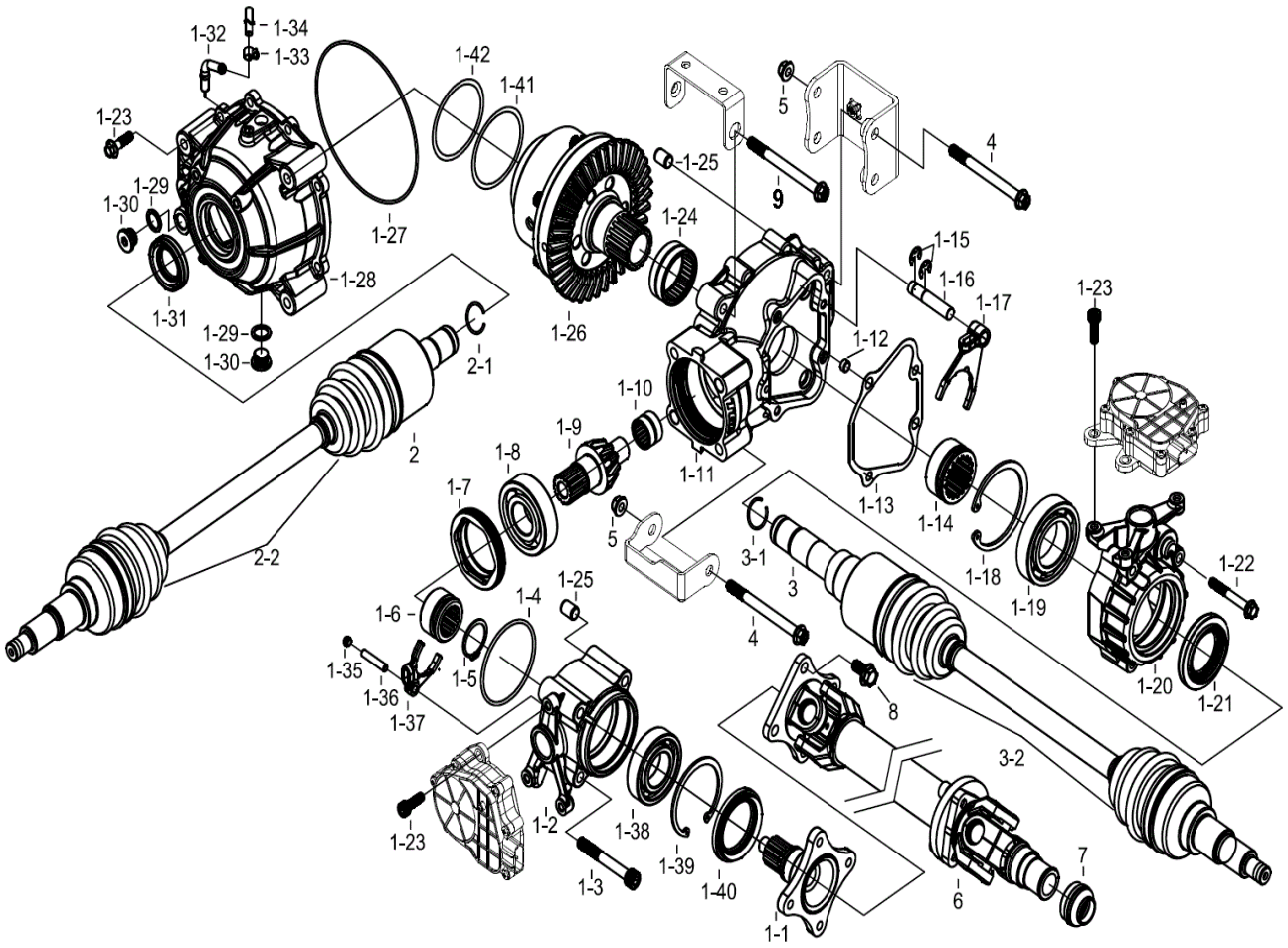
Unscrew three differential motor bolts.



Installation

For installation, reverse the removal procedure.

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: 225 Nm.

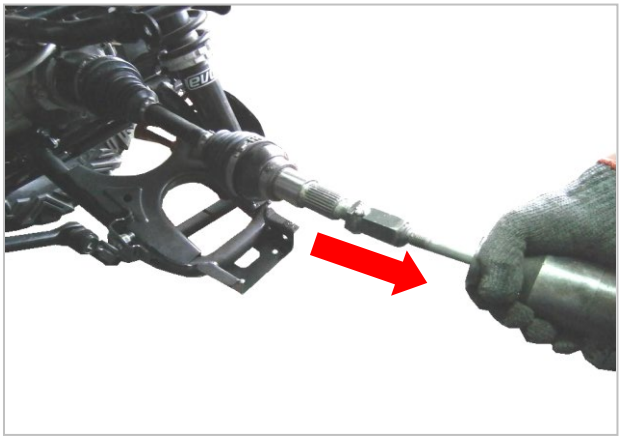
NOTE: *Tighten further castellated nut if* required *to align grooves with drive shaft hole.*

- Install a NEW cotter pin.

DRIVE SHAFT

REMOVAL

- Lift and support vehicle.
- Remove the wheel hub.
- Remove the knuckle.
- Apply special tool # 440649 strongly pull drive shaft out of differential.
- Discard the stop ring at the end of the 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.*

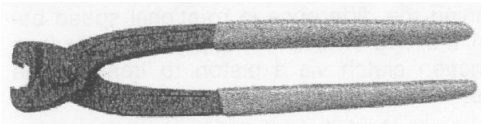
INSTALLATION

- 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

REMOVAL

- Remove the drive shaft from the vehicle.
- Remove drive shaft boot clamps using clamp plier as shown to loose and remove.
- Dislodge the large boot end.
- Separate the joint from the shaft.
- Remove boot from drive shaft.
- Remove and discard the circlip.



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.

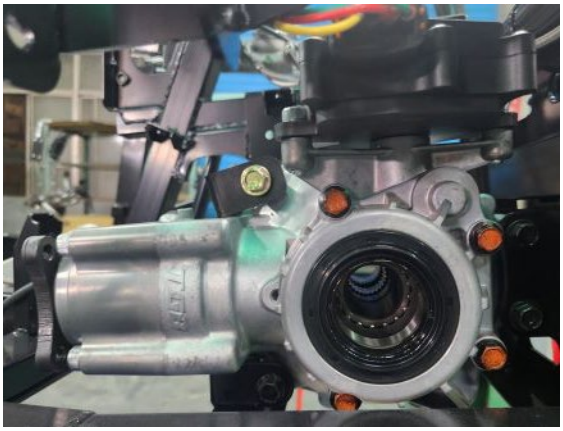
Central Propeller Shaft

Removing the Central Propeller Shaft

1. Remove the central propeller shaft screw and nut on front differential end.
2. Remove all the bottom plate.
3. Dislodge the propeller shaft from the front differential side first by pushing it towards the engine. When it is disengaged from the front differential, pull it out towards front the rear differential to disengage from the engine.
4. Remove the central propeller shaft through bottom plate opening.

FRONT DIFFERENTIAL

REMOVAL



Caution

Be sure the differential set temperature below 35℃ and Do not use another type of oil when servicing.

- Drain the differential oil.
- Remove both drive shafts.
- Detach vent hose from front differential.
- Remove the front bottom plate.

- Remove bolts and nuts securing the differential.
- Remove the central propeller shaft if required.
- Disconnect the differential motor connector.
- Remove the differential from the under of vehicle.

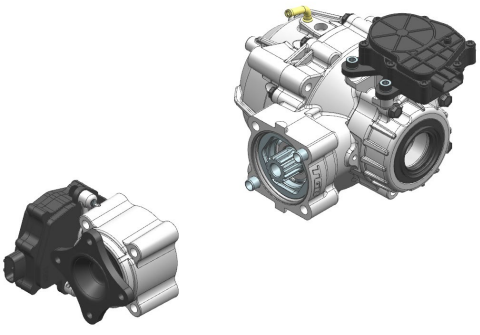
- Remove securing the differential bolts and nuts.

- Lift up the differential and slide forward to detach from the propeller shaft.
- Remove the front differential by pulling it from the RH side.

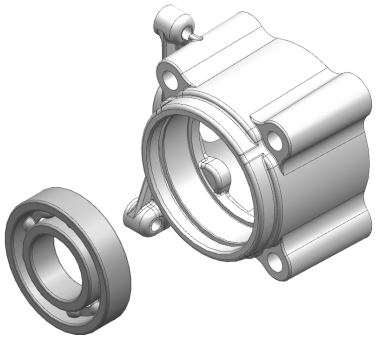
NOTICE: *Be careful not to knock or to bend vent hose fitting while removing front differential.*

- Loose and remove bolts on the LOCK cover.

- Check the shift fork oil seal, replace if damage.

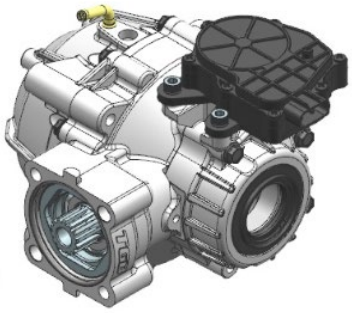


▪ Check the LOCK cover bearing, replace if necessary.



FRONT DIFFERENTIAL DISASSEMBLY

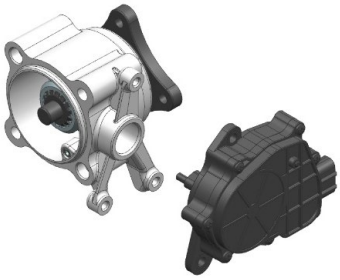
▪ Loose and remove differential housing bolts then separate half housings.



Differential Motor

▪ Disconnected the wiring connector.

▪ Unscrew three differential motor bolts.



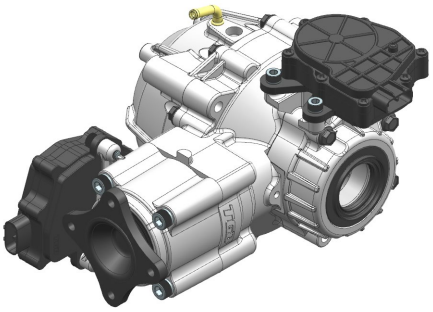
Installation

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

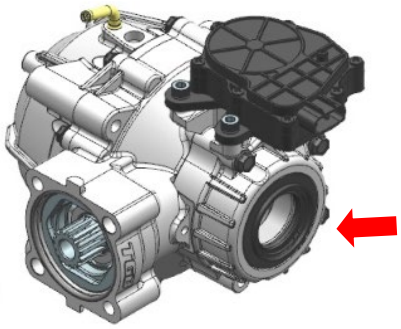
1. Apply grease to the new Differential Motor
2. Carefully push the Differential Motor into it's bore until seated. Ensure the O-ring is not pinched or rolled.

Install Differential Motor mounting screws

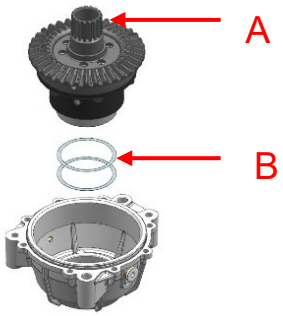
Tighten to specification



▪ Check the oil seal, replace if necessary.

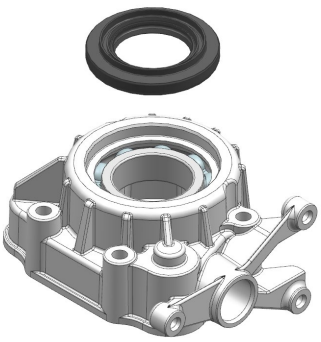


▪ Remove the anti-slip gear set (A) and shim (B), check the bearing, replace if necessary.



▪ Remove the “C” clip.

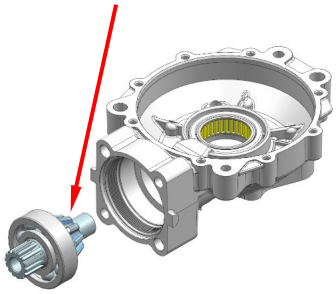
▪ Remove the oil seal and discard, replace new one when reassemble.



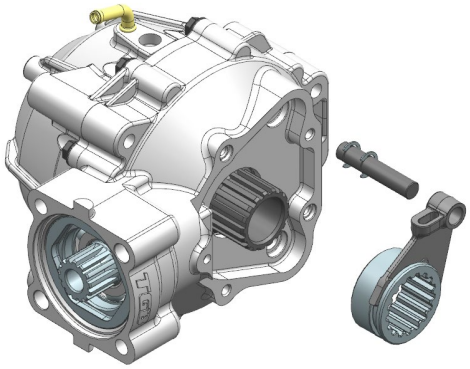
▪ Using tool 552306-14 pull out the bearing. Check the bearing replace if necessary.

▪ Using plier remove the “C” clip.

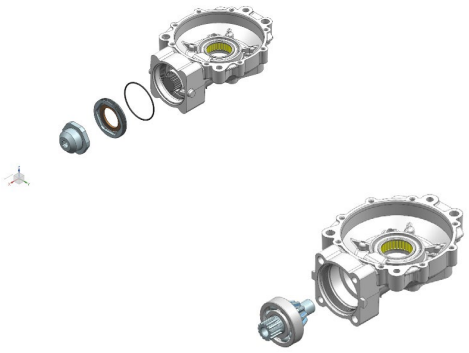
▪ Using rubber hammer lightly knock out the pivot gear.
▪ Using special tool 560008 to remove the needle bearing.



▪ Remove pinion nut.
▪ Apply rubber hammer from the inside of case lightly knock out the gear to remove the shaft from the case.



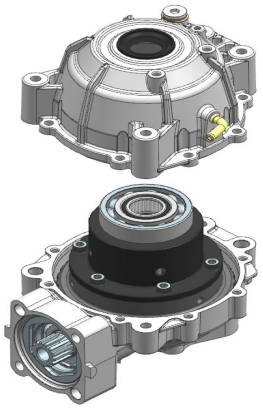
NOTE: Beware the knocking might damage the bearing.
▪Using special tool 560009 remove the needle bearing.
▪ Check the bearing replace if necessary.
▪ Before install new bearing, apply some lubricate oil inside the bearing.



ASSEMBLY

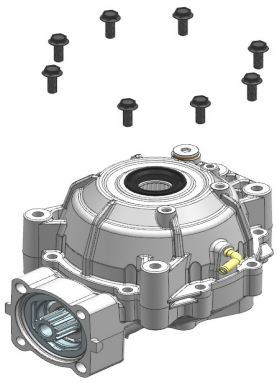
▪ Apply the Loctite #510 on the contact surface of half case.

NOTE: Before apply Loctite, clean the old glue.



▪ Cross tighten the bolts.

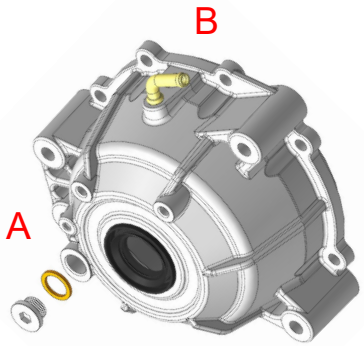
Torque : 120~150kgf-cm)



Torque :

A : gear oil level check bolt 70~90kgf-cm)

B : Gear oil filling bolt 300~350kgf-cm



INSTALLATION

- For installation, reverse the removal procedure.

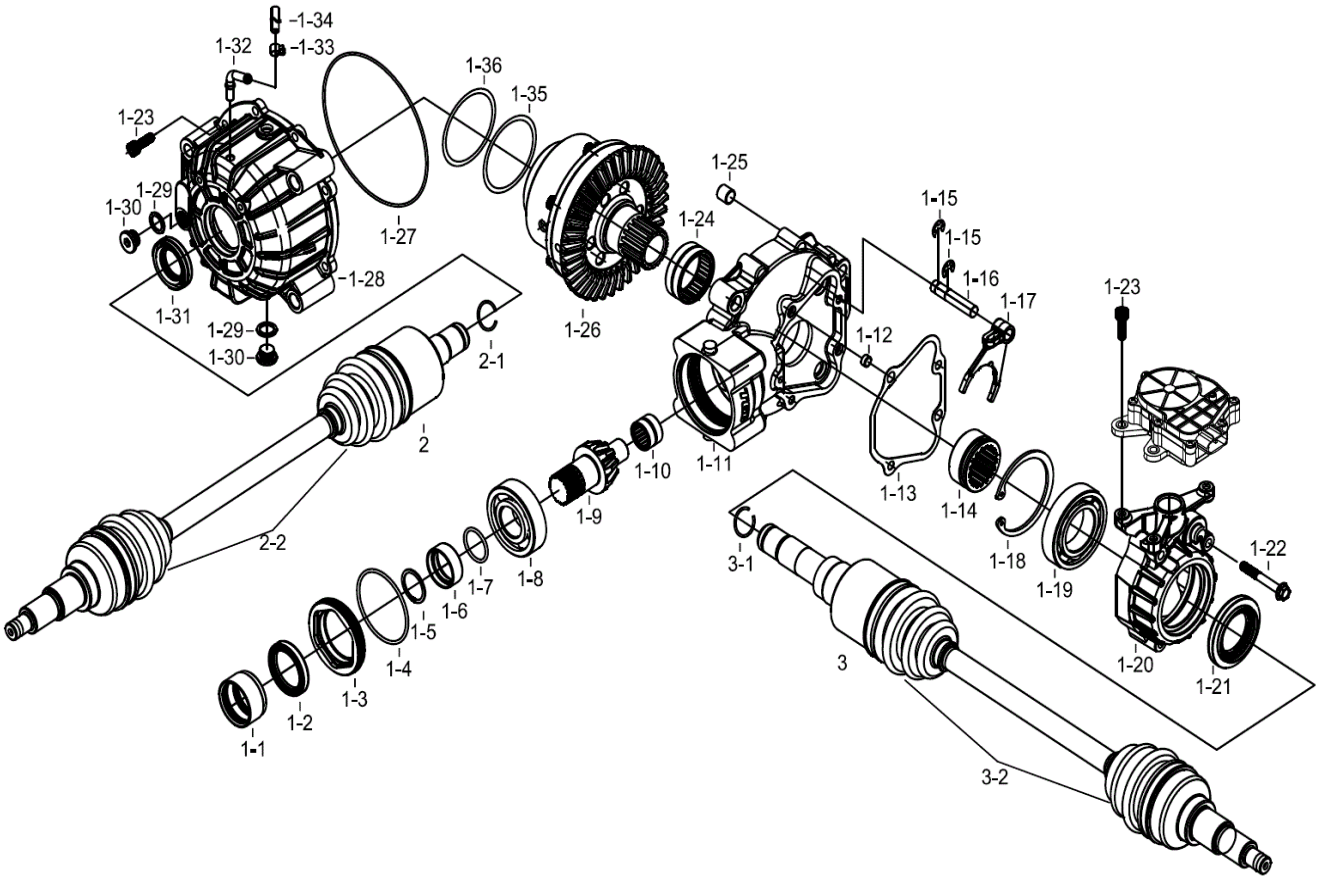
- Fill the gear oil and tighten the bolt.

Caution

Oil standard:SAE85W90 hypoid gear oil Oil capacity: 7000c.c.

Bolt Torque : 33N-m

REAR DRIVE (REAR DIFFERENTIAL)



REAR DIFFERENTIAL

REMOVAL

Caution

Be sure the differential set temperature below 35℃, and Do not use another type of oil when servicing.

- Drain the differential oil.
- Remove both drive shafts.
- Detach vent hose from rear differential.
- Remove the rear bottom plate
- Remove bolts and nuts securing the differential.
- Remove the central propeller shaft if required.
- Disconnect the differential motor connector.
- Remove the differential from the under of vehicle.

- Remove front end upper and bottom bolts .
- 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 Installation

For installation, reverse the removal procedure.
Fill the gear oil and tighten the bolt.

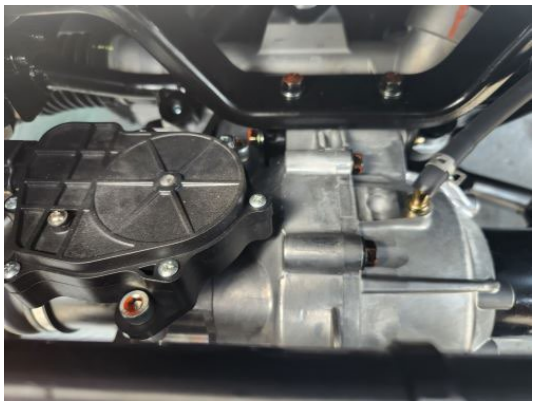
- Apply grease into the propeller shaft end.

- Install the rear differential and insert the differential shaft into the connecting shaft, put and the boot on the position.

- Install rear brackets and tighten with bolts, washers and nuts.

Torque : 4.5~5.5kgf-m

▪ Assemble the upper bracket and tighten with bolts on the front top of rear differential as shown.



Torque : 2.2~2.5kgf-m.

▪ Tighten the upper and bottom front end bolt .

Torque : 4.5~5.5kgf-m.

▪ Install and fixed the vent hose as shown.

NOTE: keep the vent hose away from the exhaust.

▪ Reverse the removal procedure; install the relative parts.

▪ Refill the gear oil to 600 cc and tighten the bolt and washer.

Caution

Oil standard:SAE85W90 hypoid gear oil
Oil capacity: 600 c.c.

Torque: 3.0~3.5 kgf-m

Differential Motor

▪ Disconnected the wiring connector.

▪ Unscrew three differential motor bolts.

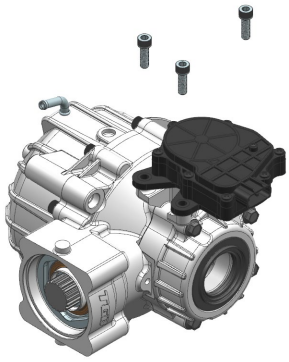
Installation

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

1. Apply grease to the new Differential Motor
2. Carefully push the Differential Motor into it's bore until seated. Ensure the O-ring is not pinched or rolled.

Install Differential Motor mounting screws

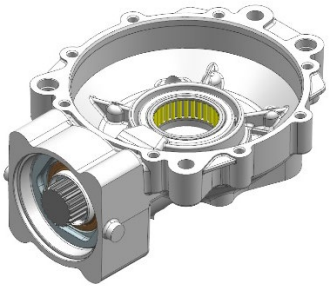
Tighten to specification



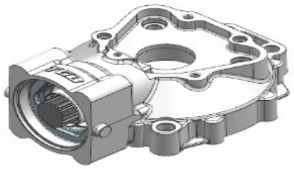
REAR DIFFERENTIAL DISASSEMBLY

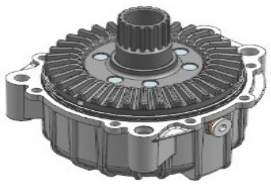
▪ Remove the differential housing eight bolts..

▪ Apply rubber hammer lightly knock the case to separate the half case.

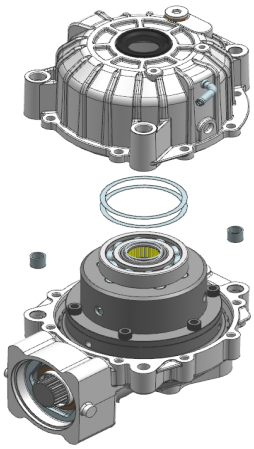


▪ Check “O” ring, replace if necessary.



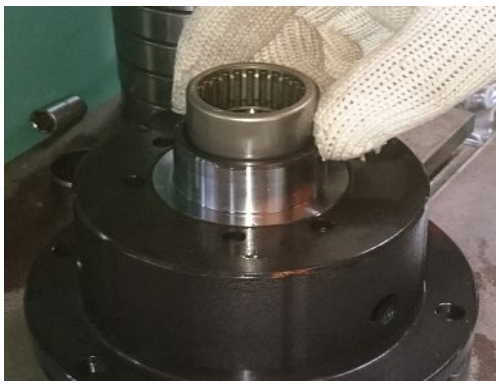


▪ Remove the anti-slip limited gear assy. and the shims.

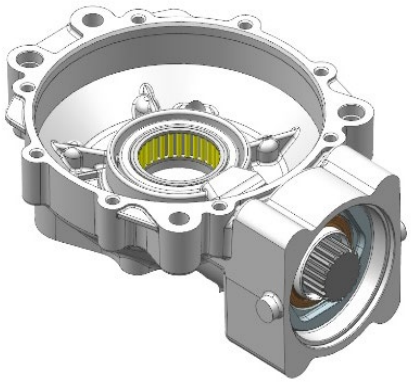


▪ Check the bearing, replace if necessary.

NOTE: beware the foreign object falling into the slip limited gear assy.

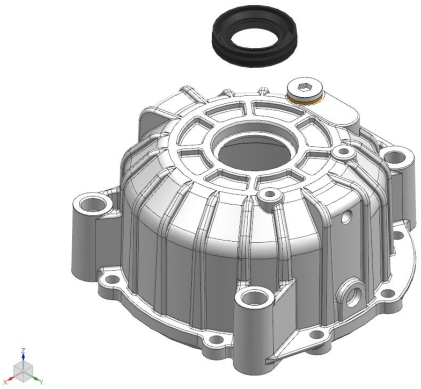


▪ Check the bearing on the left half case, replace if necessary.



▪ Check oil seal, replace if necessary.

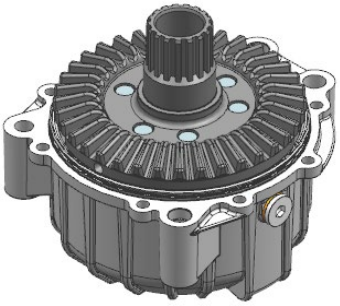
NOTE: Apply grease on rear area as shown before install oil seal.



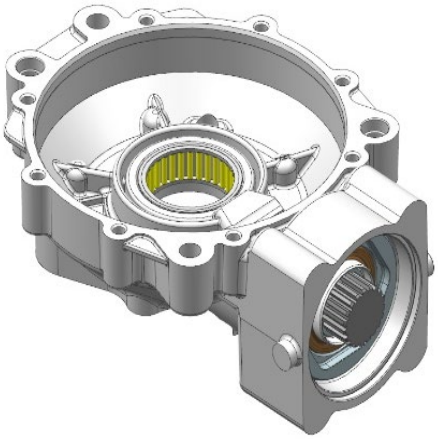
REAR DIFFERENTIAL ASSEMBLE

▪ Install shim into the case as shown.

▪ Install anti slip limited gear assy. into the case and apply rubber hammer lightly knock to the position.



▪ Install dowel pin on the left half case.



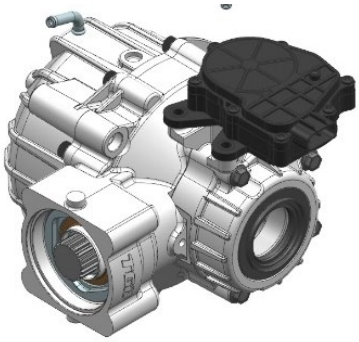
▪ Apply Loctite #263 on the eight bolts and cross tighten.

NOTE: Ensure the O-ring install properly.

Torque: 2.0~2.2kgf-m.

LOCK MODE ASSY. DISASSEMBLE

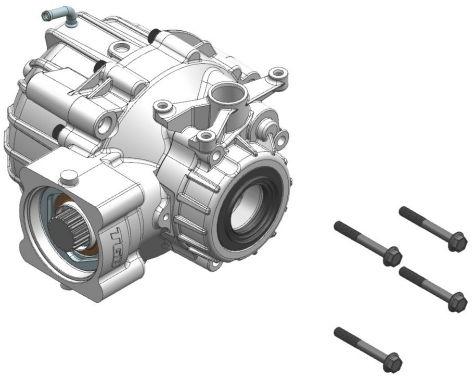
▪ Remove the bolts.



▪ Apply rubber hammer light knock to separate the case.

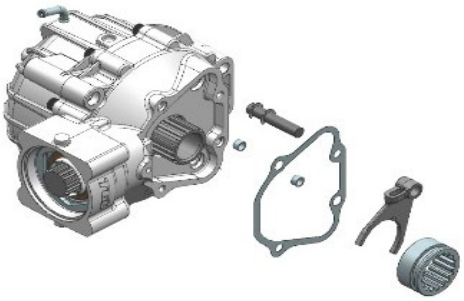
▪ Check the oil seal, replace if necessary.

NOTE: shift shaft seal recommend replace after assemble.



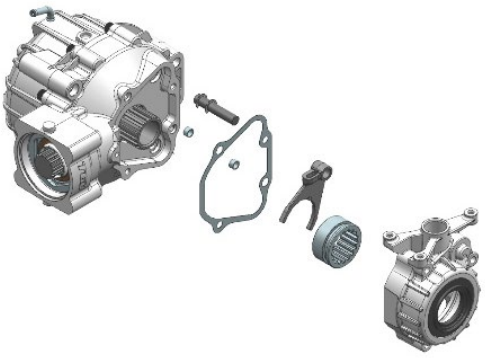
▪ Check bearing, replace if necessary.

▪ Remove shift rod assy. and other parts.



LOCK MODE ASSY. ASSEMBLE

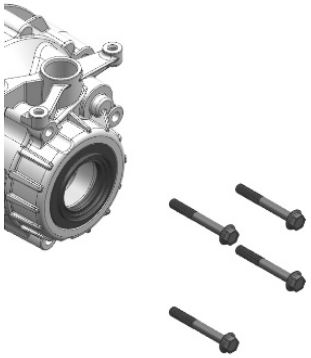
▪ Install the dowel pin as shown.



▪ Install the lock sleeve and shift rod.

▪ Clean the old glue and apply Loctite #510 on the contact surface.

▪ Assemble the case.

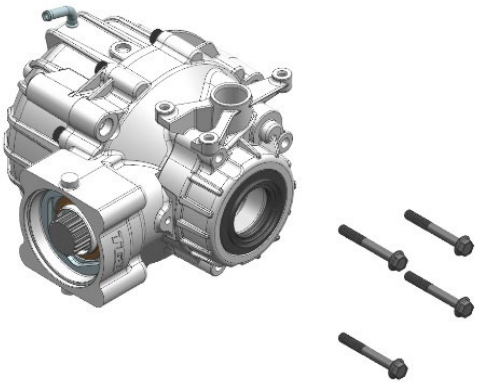


▪ Apply Loctite #263 on the bolts and cross tighten as shown.

Torque : 1.2~1.5kgf-m。

▪ Install bracket and tighten the bolts.

▪ Install the differential motor.



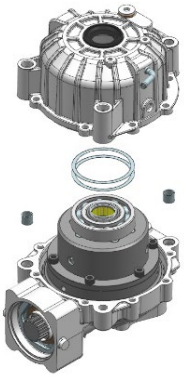
PIVOT GEAR DISASSEMBLE

▪ Remove the bolts and lightly knock out the housing.

▪ Check the oil seal and O ring, replace if necessary.

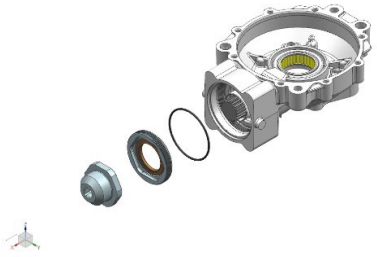
▪ Using special tool #560010 to remove the ring snap.

▪ Remove pinion nut.
▪ Apply rubber hammer from the inside of case lightly knock out the gear to remove the shaft from the case.



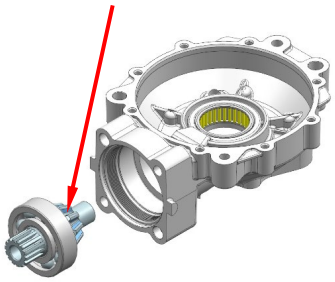
NOTE: Beware the knocking might damage the bearing.
▪Using special tool 560009 remove the needle bearing.

▪ Check the bearing, replace if necessary.
▪ Before install new bearing, apply some lubricate oil inside the bearing.



▪ Using plier remove the “C” clip.

▪ Using rubber hammer lightly knock out the pivot gear.
▪ Using special tool 560008 to remove the needle bearing.



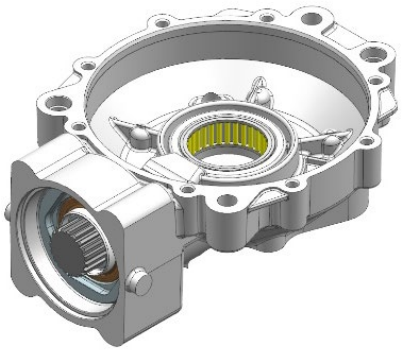
PIVOT GEAR ASSEMBLE

▪ Reverse the disassemble procedure install the shaft and bearing into case.
▪ Apply Loctite #263 on the ring snap, and Apply special tool #560010 to install.

Torque : 11~12kgf-m

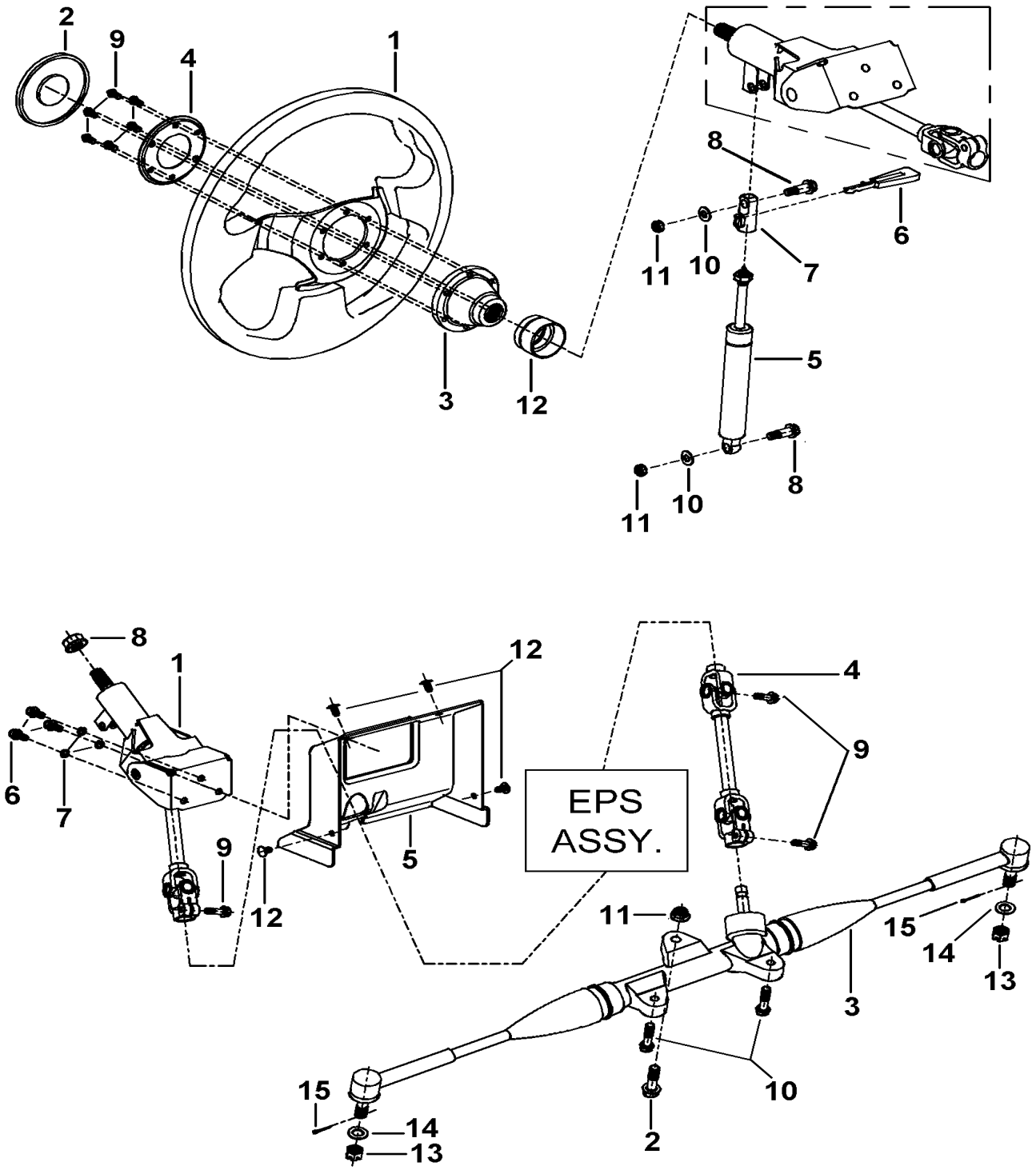
▪ Apply Loctite #263 on the four bolts, and install the housing and tighten.

Torque : 4.2~4.4kgf-m



STEERING SYSTEM

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.

EQUIPMENT

For information concerning the safety labels, refer to Important On-Product Labels.

Tilt Steering

The steering wheel height is adjustable.

Adjust the steering wheel height to face your chest, not your head. To adjust steering wheel height:

1. Unlock steering by pulling the tilt lever toward you.
2. Move steering wheel to the desired position.
3. Release tilt lever to lock steering wheel in position.

WARNING

Never adjust the steering wheel height while riding. You may lose control

PROCEDURES

Inspecting the Steering System

Steering Column

Turn and move steering column to detect any play.

Rack and Pinion

Check rack and pinion bellows for cracks or damages.

Replace if necessary

Tie-Rod End

Check tie-rod end ball joint for:

- Damage
- Pitting
- Play.

Replace if necessary.

Steering Wheel

Removing the Steering Wheel

1. Remove steering wheel center cap and nut.
2. Use a suitable wheel extractor that sits on the steering wheel shoulder, around the pivot tube, to remove the steering wheel.

Installing the Steering Wheel

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

Install a new nut and tighten to specification.

Tightening Torque

Steering wheel nut 60 ± 5 Nm

(44 ± 4 lbf-ft)

Steering Column

Removing the Steering Column

1. Remove the upper bolt of the steering column.
2. From inside of the vehicle, remove the steering column
3. Remove the lower bolt of the steering column.

4. Loosen the bolts securing rack and pinion to frame.
5. Remove the steering column

Installing the Steering Column

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

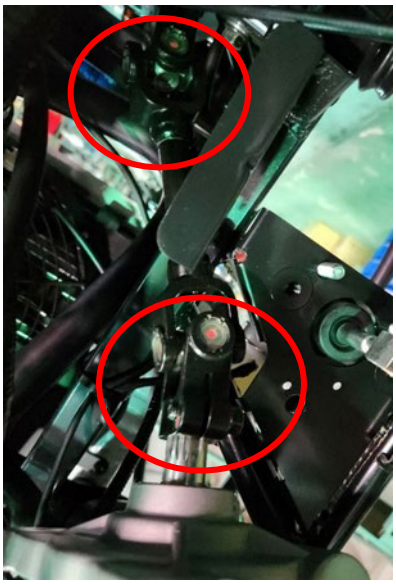
1. Prior to installing the steering column, position front wheels parallel with the vehicle.
2. Apply antiseize on splines.
3. Position steering column in vehicle and insert upper U-joint on EPS output shaft.
4. Loosely install the pinch bolt with a new nut to secure the upper U-joint.
5. Engage the pinion shaft of the rack and pinion in the lower steering column U-joint. Make sure steering wheel remains centered.
6. Loosely install rack and pinion retaining bolts.
7. Loosely reinstall the pinch bolt with a new nut to secure the lower U-joint.
8. Tighten all fasteners as outlined in Steering System Tightening Sequence.
9. Check front wheel alignment.
10. Install all other removed parts.

Removing the Rack and Pinion

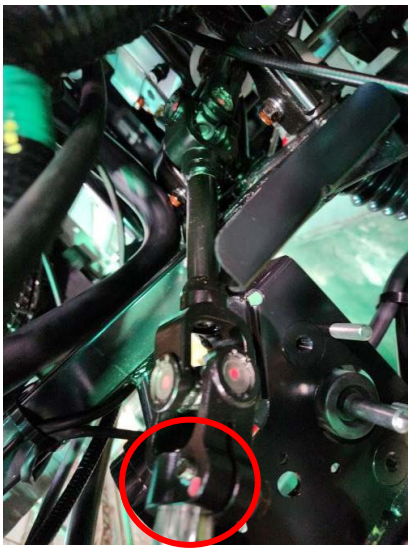
1. Remove both front wheels.
2. Detach tie-rod ends from knuckles. Refer to Replacing the Tie Rod end in this subsection.
3. Remove the lower yoke pinch bolt and nut. TYPICAL
4. Remove the bolts and nuts securing rack and pinion to frame.
5. Disengage the rack and pinion shaft from the lower yoke.
6. Remove rack and pinion from vehicle.

Installing the Rack and Pinion

1. The installation is the reverse of the removal procedure. However, pay attention to the following.
2. Find rack and pinion center as follows:
- Calculate the total pinion shaft rotations from side to side
- Position the pinion shaft at half the total rotations
- Using a paint marker, make an alignment mark on pinion and on the rack housing.



3. Ensure steering wheel is centered (horizontal).
4. Apply antiseize on pinion shaft.
5. Position rack and pinion in frame and engage pinion in lower yoke. Make sure steering wheel remains centered.
6. Install rack and pinion retaining bolts and nuts.
7. Install lower yoke pinch bolt and nut.
8. Check steering alignment.



Inspecting the Steering Components

1. Before removing any components:
   1. Raise front wheels off the ground.
   2. Turn steering wheel from stop to stop.
   3. Ensure steering wheel turns smoothly.
2.

– Rack and pinion shaft must not be loose.
– Rack and pinion mounting bracket must not be cracked or deformed.
– Rack and pinion steering support must not be cracked or deformed.

Installing the Tie Rod

The installation is the reverse of the removal procedure.

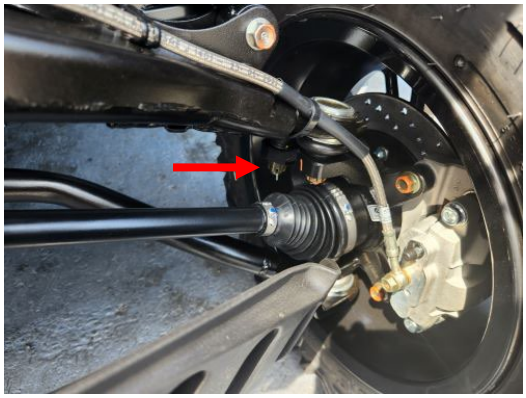
However, pay attention to the following.

Adjust outer tie rods to the nominal engagement length.

Tie-Rod Ends

Replacing the Tie-Rod End

1. Remove front wheel.
2. Loosen tie rod locking nut
3. Detach tie-rod end.
4. Install new tie-rod end.
5. Adjust tie-rod end to the nominal engagement length.
6. Attach tie-rod end to steering knuckle.
7. Install a new tie-rod end retaining nut and tighten to specification.
8. Install a new cotter pin. Both ends of cotter pins must be folded.
9. Install front wheel.
10. Check steering alignment, refer to Aligning the Wheels.



Knuckles

Removing the Knuckle

Remove front wheel.

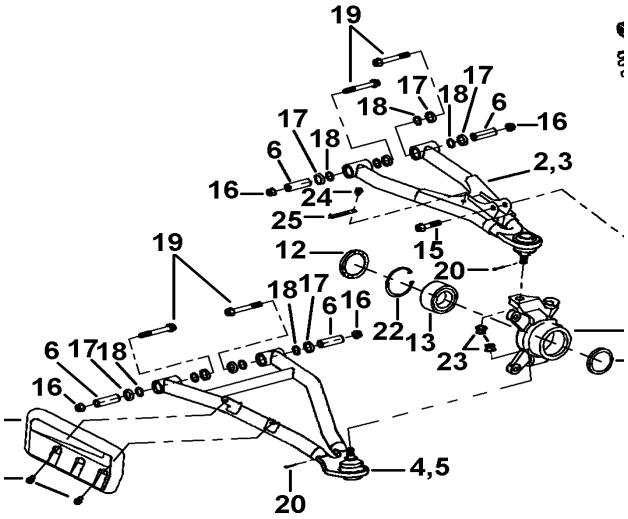
1. Remove caliper.
2. Remove wheel hub.
3. Detach tie-rod end from knuckle.
4. Detach upper and lower suspension arm from knuckle.
5. Remove knuckle from vehicle.

Inspecting the Knuckle

Check knuckle for cracks or other damages**.** Replace if necessary.

Installing the Knuckle

The installation is the reverse of the removal procedure.



Wheel Bearings

Inspecting the Wheel Bearing

1. Safely lift and support the front of vehicle.
2. Hold wheel by the top and the bottom and move it. Check for any play.
3. If there is any loose, replace wheel bearing.

NOTE: To properly locate play during this inspection,
be sure to check other components for wear or loose (ball joints, suspension pivots, etc). If necessary repair or replace all defective parts before checking the wheel bearing condition. Be careful not to misjudge loose in the ball joint and loose in the wheel bearing.

Inspecting the Wheel Bearing (During Component Removal)

Whenever the drive axle or knuckle is removed, check if wheel bearing turns freely and smoothly. Replace if necessary.

Removing the Wheel Bearing

1. Remove knuckle from vehicle,
2. Remove and discard circlip.
3. Install knuckle on a press.
4. Remove bearing from knuckle with an appropriate bearing remover.

Installing the Wheel Bearing

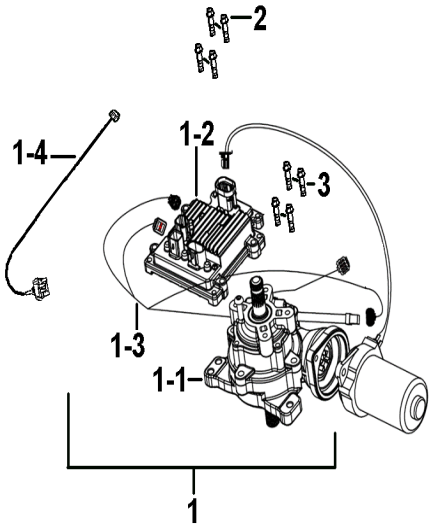
1. The installation is the reverse of the removal procedure. However, pay attention to the following.
2. To ease wheel bearing installation:

– Place bearing in a freezer for 10 minutes.

– Place knuckle in oven to 100°C (212°F) for 30 minutes maximum.

3. When knuckle is cooled down, install new circlip.

EPS remove and install



1. Remove the steering wheel cap.
2. Loosen the nut and back it half way off the steering shaft.
3. Place the assembly in a vise.
4. Using a large bronze drift and hammer, strike the steering shaft nut to pop the steering wheel off the shaft taper.
5. Once the steering wheel pops loose, completely remove the nut and lift the steering wheel off the shaft.

POWER STEERING UNIT REMOVAL

1. Remove the upper steering shaft, pivot tube and steering wheel from the vehicle as an assembly.

2. Disconnect the two electrical harnesses from the power steering unit .
3. Remove the pinch bolt w retaining the lower steering shaft to the power steering unit .
4. While supporting the power steering unit, remove the four nuts from the mount bracket.
5. Carefully remove the power steering unit and mount bracket from the vehicle as an assembly.
6. If replacing the power steering unit, remove the four bolts that retain the power steering unit to the mount bracket.

LOWER STEERING SHAFT REMOVAL

1. Use the steering wheel to position the front wheels so they point straight ahead.
2. Locate the lower steering shaft through the left front wheel well. Mark the lower steering shaft, gear box stub shaft and gear box to aid installation.
3. Remove the power steering unit.
4. Remove the pinch bolt q retaining the lower steering shaft wto the steering gear box assembly.
5. Lift up on the shaft and remove it through the floor panel.

LOWER STEERING SHAFT INSTALLATION

1. Install the lower steering shaft onto the gear box and align the marks made during step 2 of the “Lower Steering Shaft Removal (EPS Models)” procedure.
2. Install the pinch bolt that retains the lower steering shaft to the steering rack assembly and torque to specification.
3. Install the power steering unit and reassemble the vehicle

POWER STEERING UNIT INSTALLATION

1. If the power steering unit was removed from the mount bracket, reinstall it prior to vehicle installation. Torque the mounting bolts to specification.

NOTE

Power Steering Unit Fasteners:

30 ft-lb (41 Nm)

2. Install the power steering unit into the vehicle and align the skip-tooth spline on the power steering stub shaft with the opening in the lower steering shaft.

3. Place the power steering mount bracket over the top of the brake pedal mount studs and finger tighten the four nuts.

4. Position the lower steering shaft on the power steering unit stub shaft and install the pinch bolt. Torque to specification.

TORQUE

Lower Steering Shaft to EPS Unit Pinch Bolt: 15 ft-lbs (20 Nm)

5. Torque the four mount bracket nuts to specification.

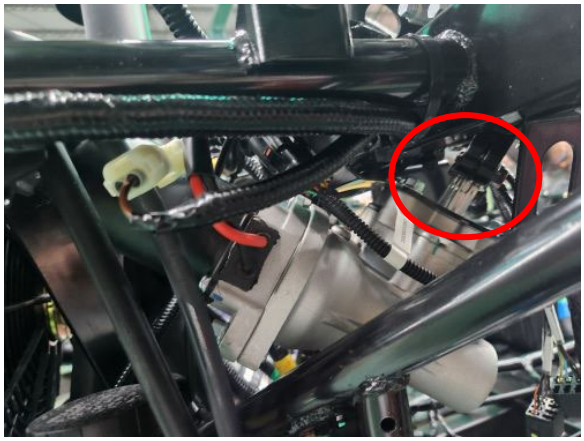
TORQUE

Power Steering Unit Mount Bracket Nuts:

16 ft-lb (22 Nm)

6. Proceed to Upper Steering Shaft Installation to complete the installation procedure.

UPPER STEERING SHAFT INSTALLATION



1. Install the upper steering shaft and align the skiptooth spline on the power steering stub shaft with the opening in the upper steering shaft

2. Install the pivot tube and torque fasteners to specification.

TORQUE

Pivot Tube Fasteners:

8 ft-lb (11 Nm)

3. Install the tilt shock and torque fastener to specification.

4. Be sure the front wheels are pointing straight ahead and install the steering wheel and retaining nut. Torque the nut to specification and reinstall the plastic wheel cover.

TORQUE

Steering Wheel Nut:

65 ft-lbs (88 Nm)

5. Install a new upper steering shaft pinch bolt and nut.

Torque pinch bolt to specification.

TORQUE

Upper Steering Shaft Pinch Bolt:

15 ft-lbs (20 Nm)

6. Reconnect both electrical harnesses onto the power steering unit. Be sure the connectors snap into place.

7. Turn the key switch on and test EPS operation.

WHEEL AND TIRE

GENERAL

WARNING

Torque wrench tightening specifications must strictly be adhered to.

Castle Nut

Torque: 1600-1800 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: 16 psi

REAR: 18 psi

Tire Inspection

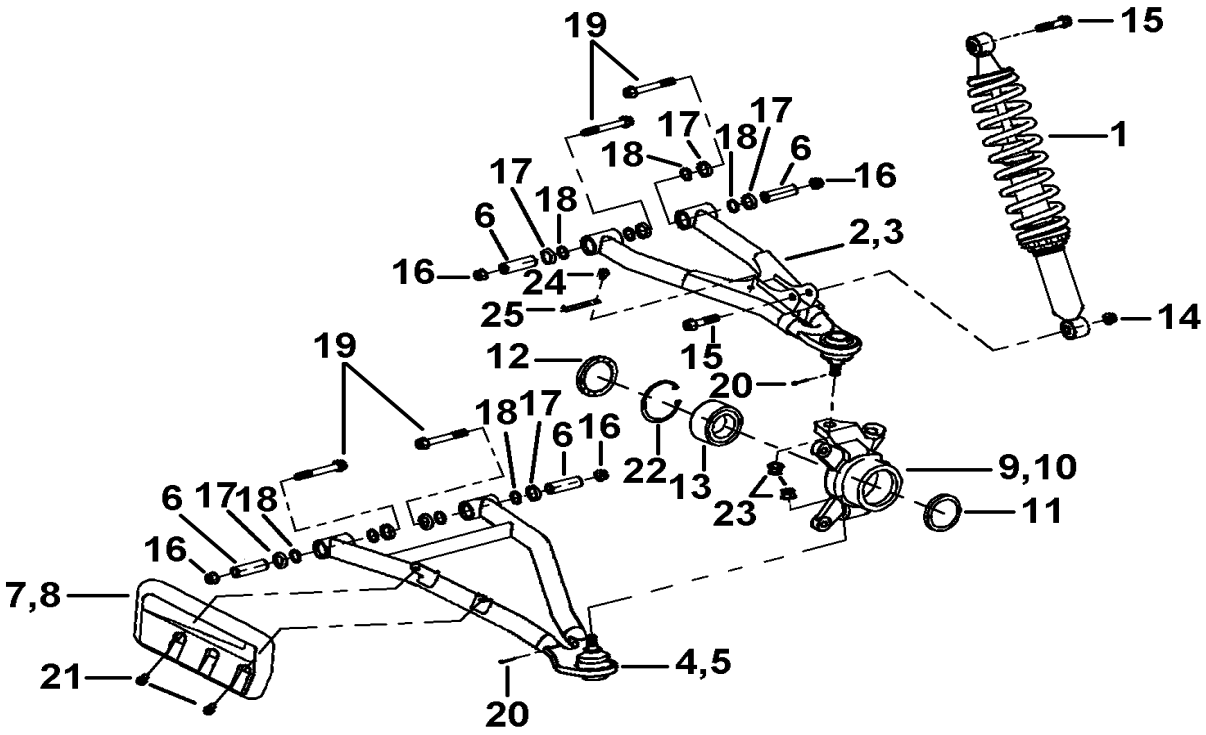
Check tire for presence of slits, bulges, wear or other damage. Replace if necessary.

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

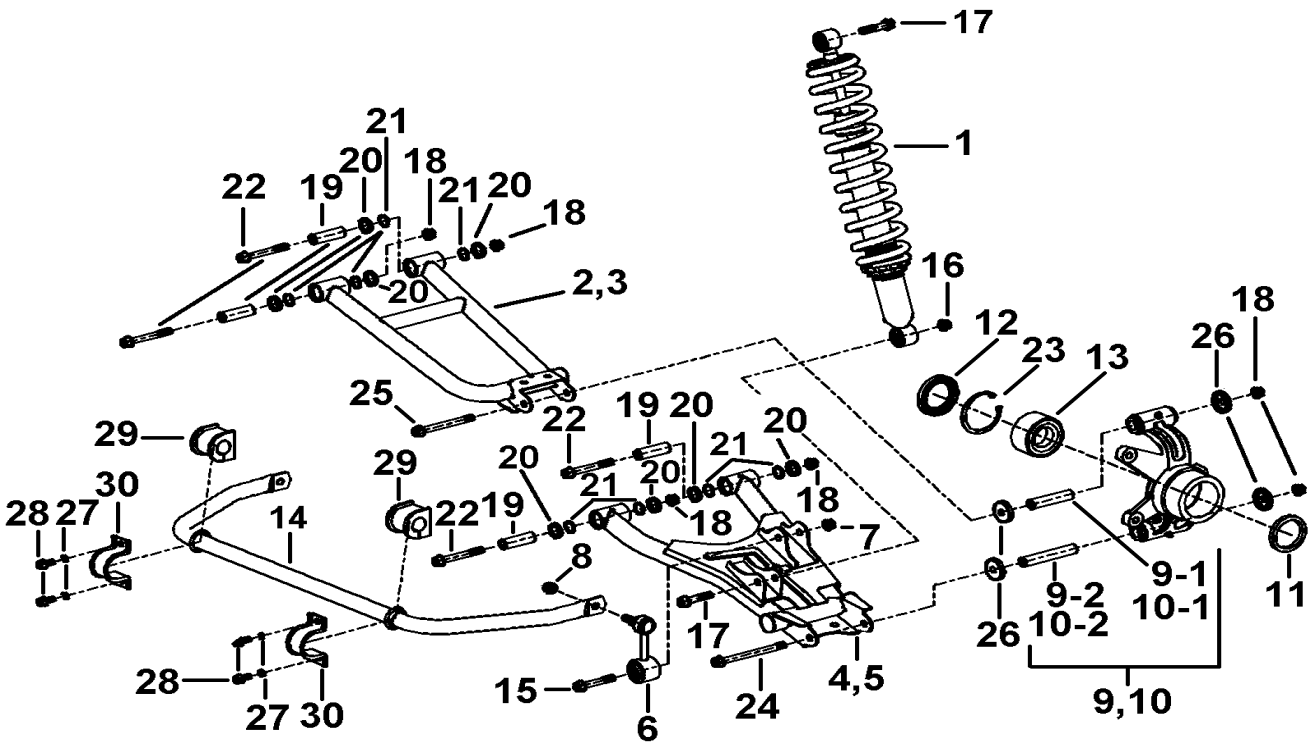
For installation, reverse the removal procedure.

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.

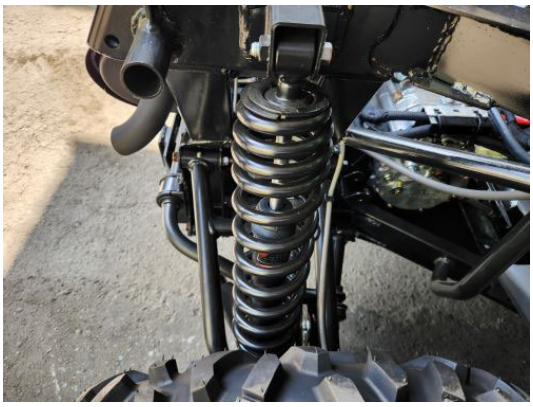
During assembly/installation, use the torque values and service products as in the exploded view.

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.

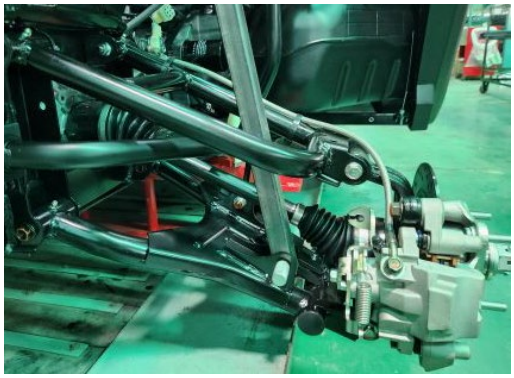
TORQUE: 280-300 kgf-cm.

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.

LOWER A ARM

Lower A Arm Removal

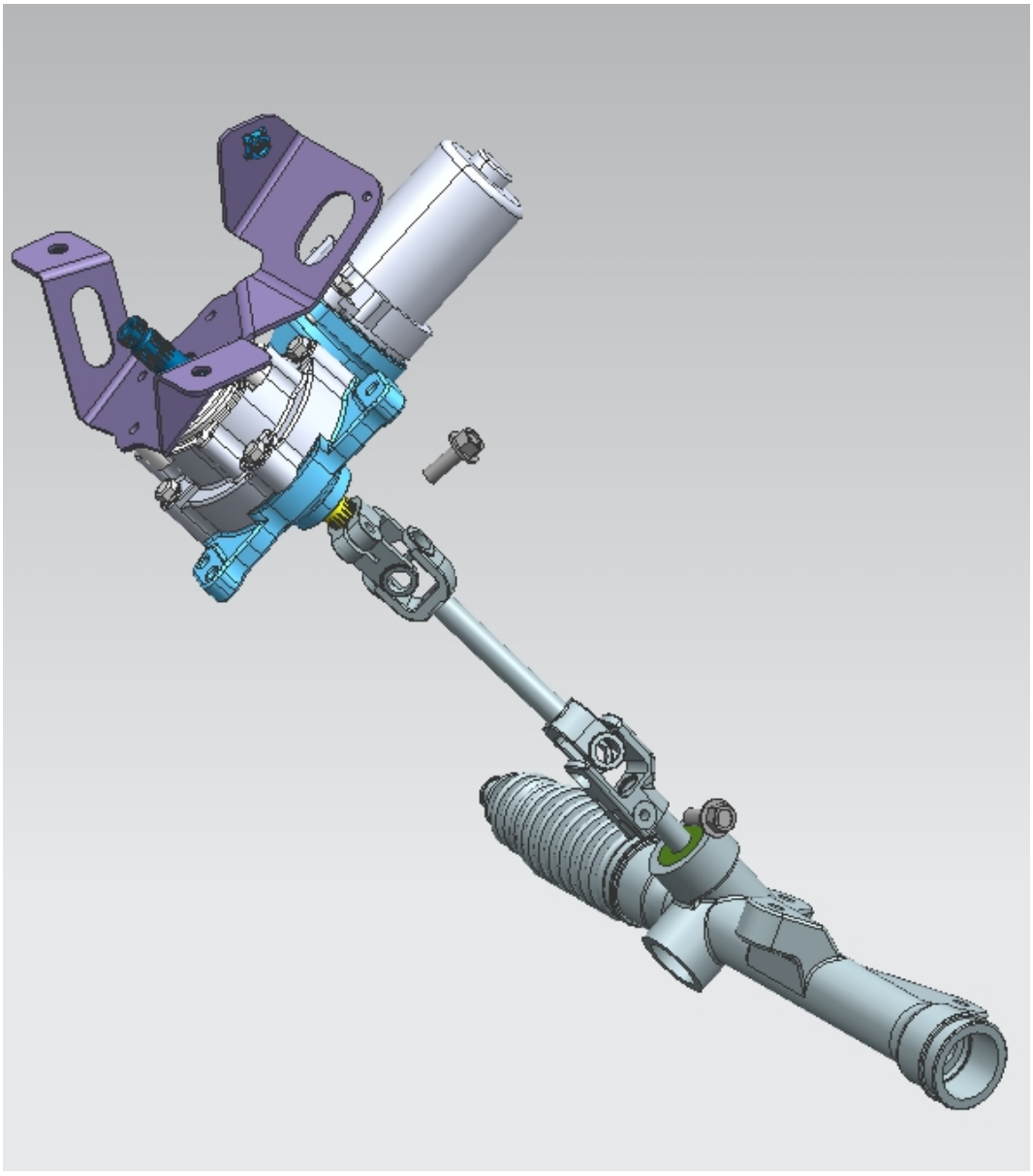
1. Safety lifts and supports the vehicle off the ground.
2. Remove wheel.
3. Remove bolts and nuts securing A arm to frame.
4. Remove bolts and nut securing lower knuckle.
5. Remove ball joint nut to tension bar rod.
6. Remove shock absorber lower bolt.
7. Remove A arm.

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 steering wheel effort (steering torque), electrical power available, and vehicle speed.

When the steering wheel 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.*

EPS Assist Mode

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.

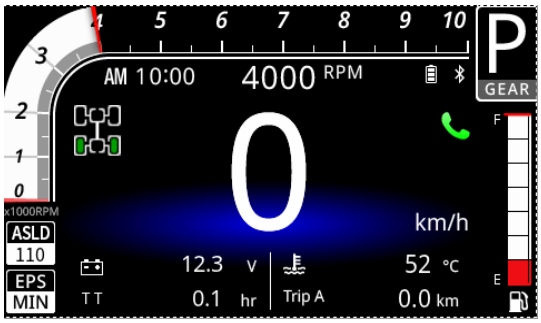
When the steering wheel is turned, torque is applied to the shaft, which tends to twist the shaft slightly, deforming the magnetic field in the shaft. The sensor detects the torque by measuring the deviation of the magnetic field. The torque sensor is very sensitive and can detect very small changes in the magnetic field. The harder the steering wheel 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.

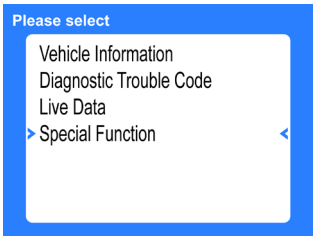
ADJUSTMENT

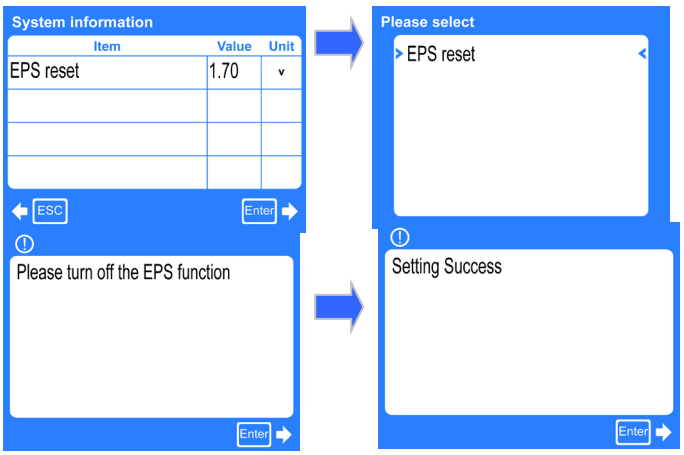
TORQUE OFFSET RESET

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 column
- 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 steering wheel 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)

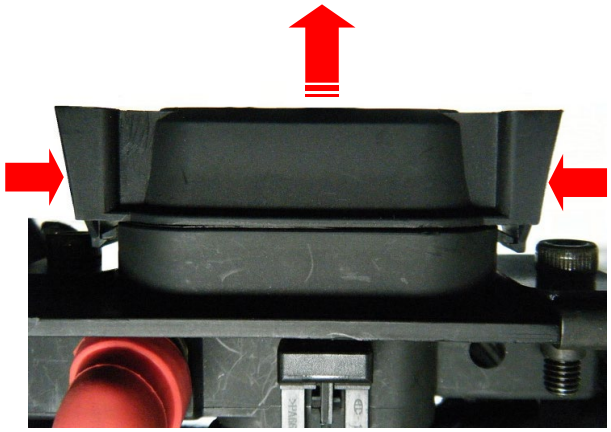
1. Torque sensor not reset to zero.

- Ensure steering alignment is within specification and carry out the TORQUE OFFSET RESET procedure detailed in this subsection.

EPS unit Power Fuse Test

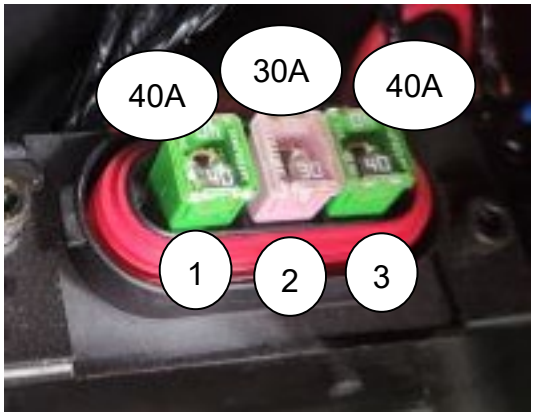
A 40 A EPS fuse located at the right side under the passenger seat in the EPS fuse box provides power for the EPS motor.

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 (Green 40A).

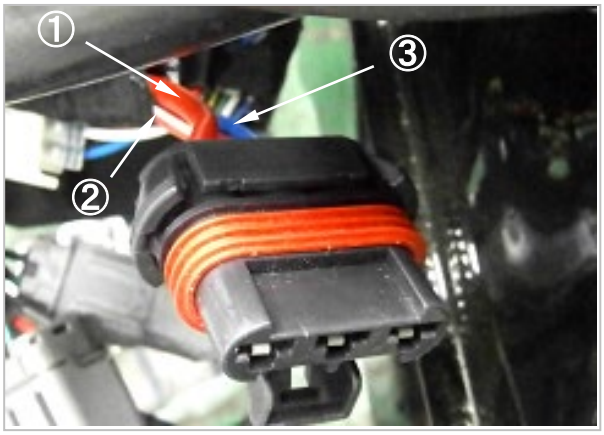
EPS unit Input Voltage Test (Power Side)

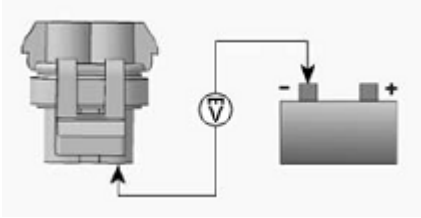
1. Disconnect the EPS power connector.
2. Test for 12 VDC EPS motor power at pin as per following table.

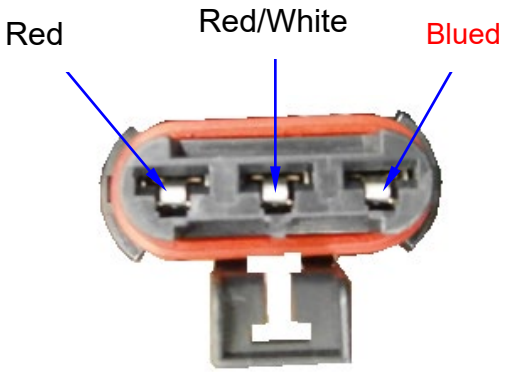
EPS power connector pin 1 + Battery GND

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).







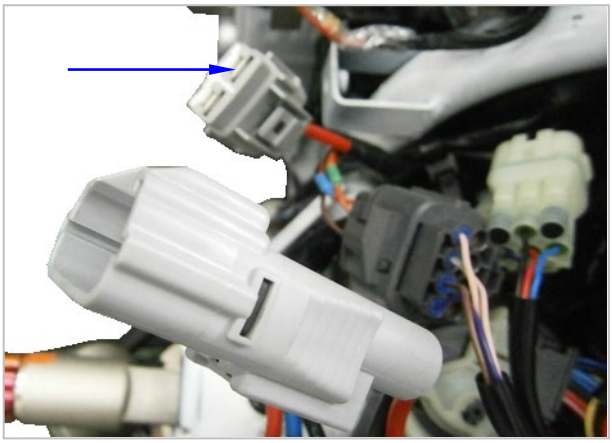
EPS Unit Input Voltage Test (Control Side)

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)***

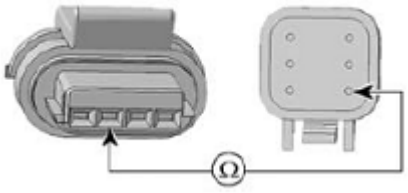
- If there is NO continuity or a high resistance is measured, check wires and connector pins from EPS unit to chassis ground post. Replace or repair defective parts and reset faulty codes.
- If there is good continuity, carry out the following EPS UNIT COMMUNICATION LINK (CAN) CONTINUITY TEST.

EPS Unit Communication Link (CAN) Continuity Test

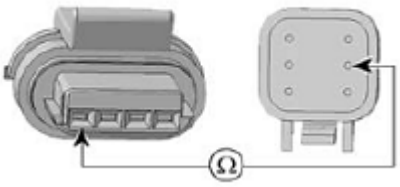
NOTE: *EPS unit must receive an RPM signal to provide power steering assist.*

- 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 steering wheel momentarily against the steering frame stops to each side.

NOTE: *Do not hold steering against frame stops for and extended period of time.*

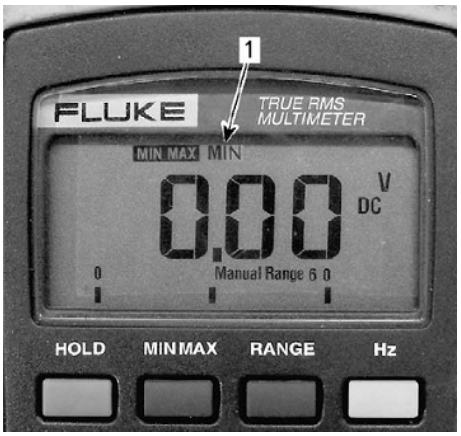
10. Read the MIN charging system voltage recorded while the steering wheel was turned against each stop.

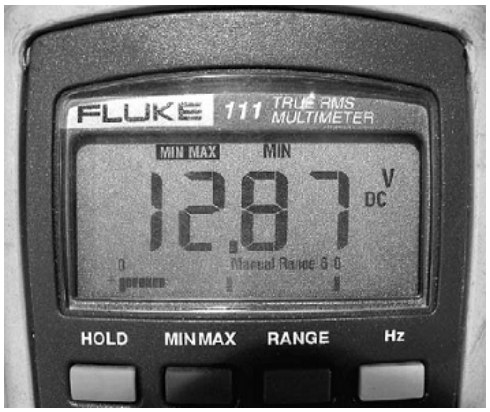
Battery (-) terminal + fuse box battery terminal = at least 12 VDC (Steering position LH stop/ RH stop)

NOTE: *Turning the steering wheel 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 steering wheel 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 steering wheel.
▪ 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

•Position the front wheels parallel to the rear wheels.

•Remove both front wheels.

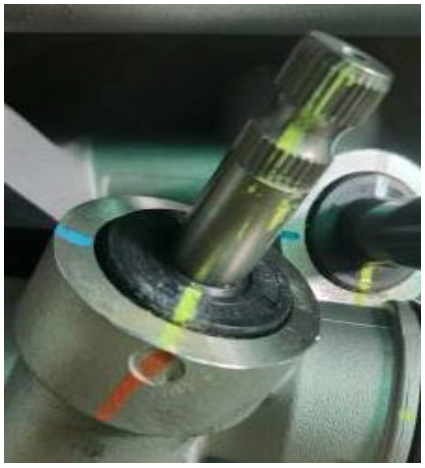
•Mark the alignment of the lower steering shaft with the input shaft and the rack and pinion housing.

・Disconnect the electrical connector from the EPS unit.

•Remove steering column.

・Remove the lower steering shaft pinch bolt and nut.

▪ Remove the shifter module support retaining nuts and screw.



▪ Slightly lift the dash board to remove the shifter support.

▪Remove all EPS unit support retaining screws

▪Pull up on DPS unit and support to disengage from the rack and pinion shaft and remove it from the vehicle.

EPS Unit Install

If Replacing EPS Unit

▪ Install the support on the new EPS unit.

▪. Install locking bolt and nut.

IMPORTANT: : Make sure to engage bolt in the input shaft groove.

▪Continue with If Installing Same EPS Unit.

If Installing Same EPS Unit

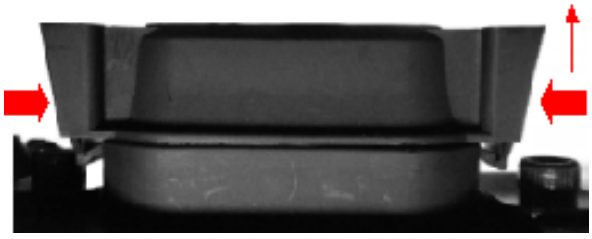
▪While lowering the EPS unit with its support and the lower steering shaft in place, a second technician engage the lower yoke on the rack and pinion shaft. Make sure to align marks previously made on lower yoke, rack and pinion input shaft and housing.

▪Install and tighten locking bolt and nut.

IMPORTANT: : Make sure to engage bolt in the input shaft groove.

▪ Install the steering column.
▪. Apply grease on harness connector terminals.
▪ Connect DPS connector to EPS unit.
▪. If installing a replacement EPS unit, refer to Replacing the EPS.
▪.Align wheels.
▪.Verify EPS system

Fuse Removal
Simultaneously squeeze tabs inwards on each end of fuse box cover as you pull downward on the cover.
Replace the damage fuse.



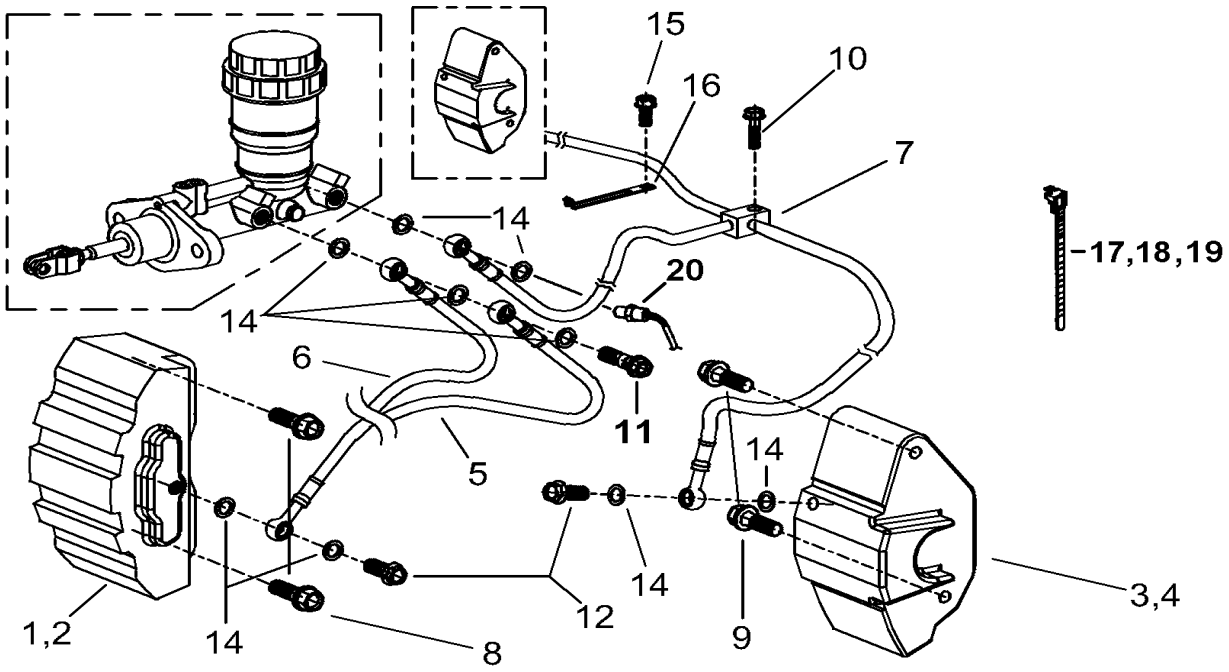
Installation
Install the control in the reverse order of removal.

 # 928706Y

EPS Troubleshooting and replacement

When EPS encounter noise or hard to steering or vibration, please contact authority TGB dealer.

BRAKE SYSTEM



BRAKE SPECIFICATIONS

FRONT BRAKES

Item	Standard	Service Limit
Bake Pad Thickness		1.5 mm
Brake Disc Thickness	4.75 mm	4.24 mm
Brake Disc Run out		0.25 mm
Caliper Piston Diameter 14” tire	25.3 mm	25.25 mm
Caliper Bore Diameter 14” tire	25.4 mm	25.45 mm

REAR BRAKES

Item	Standard	Service Limit
Bake Pad Thickness		1.5 mm
Brake Disc Thickness	3.75 mm	3.24 mm
Brake Disc Run out		0.25 mm
Caliper Piston Diameter	33.86 mm	33.81 mm
Caliper Bore Diameter	33.96 mm	34.01 mm

TORQUE SPECIFICATIONS

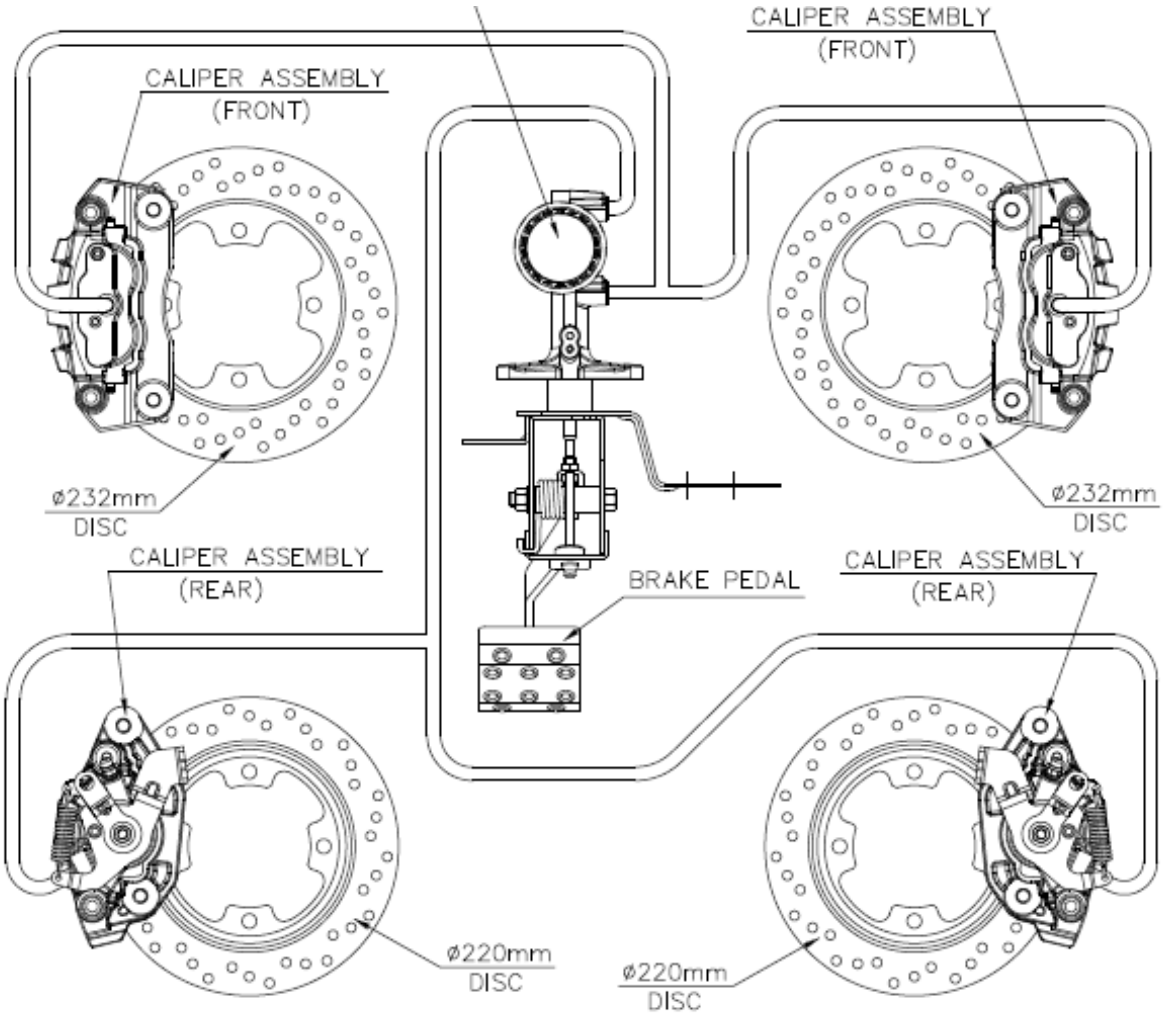
Item	Torque kgf-cm
Front Caliper Mounting Bolts	280-320
Rear Caliper Mounting Bolts	500~600
Handlebar Master Cylinder Clamp Bolts	70-90
Hand Master Cylinder Reservoir Cover	8
Brake Line Flare Fitting	160-200
Brake Line Banjo Bolt Fitting	320
Bleeder Screw	40-70
Caliper bracket Bolts 14” tire only	300
Caliper bracket Nuts 14” tire only	220-250

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.

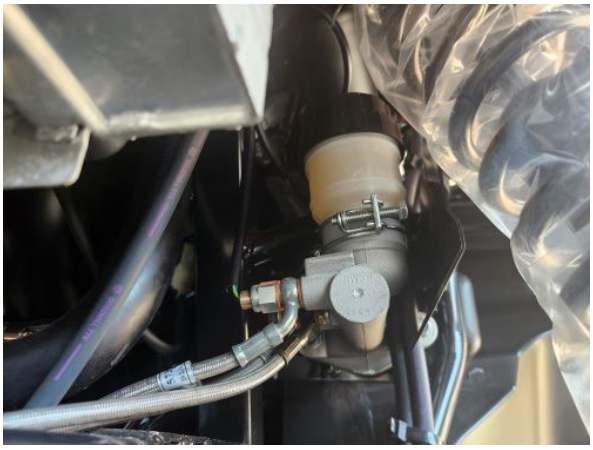
- Do not overfill the master cylinder fluid reservoir.
- Make sure the brake lever/pedal returns freely and completely.
- Adjust stop pin on caliper after pad service.
- Check and adjust master cylinder reservoir fluid level after pad service.
- Make sure atmospheric vent on reservoir is unobstructed.
- 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

Brake light switch is located underneath LH front fender on master cylinder.



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 front brake line.
3. Remove brake light switch from master cylinder.

NOTE: *Use shop rag to catch any spilled brake fluid.*

4. Install new sealing washers.
5. Install brake light switch on master cylinder.

TORQUE: 300~350kgf-cm

6. Connect brake light switch connector.
7. Refill and bleed brake system.

MASTER CYLINDER

Master Cylinder Removal

1. Drain brake system.
2. Remove master cylinder.
3. Remove or disconnect:

– Master cylinder push rod clip

– Brake light switch connector

– Brake light switch and rear brake hose screw.

4. Remove or disconnect:

– Master cylinder push rod

– Brake oil reservoir hoses

– Master cylinder screws.

5. Remove master cylinder from vehicle.

Master Cylinder Inspection

▪. Check boot for crack.

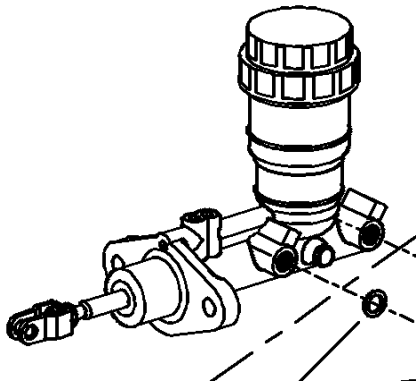
▪. Check rod for wear and scratch.

▪. 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.



▪. 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.

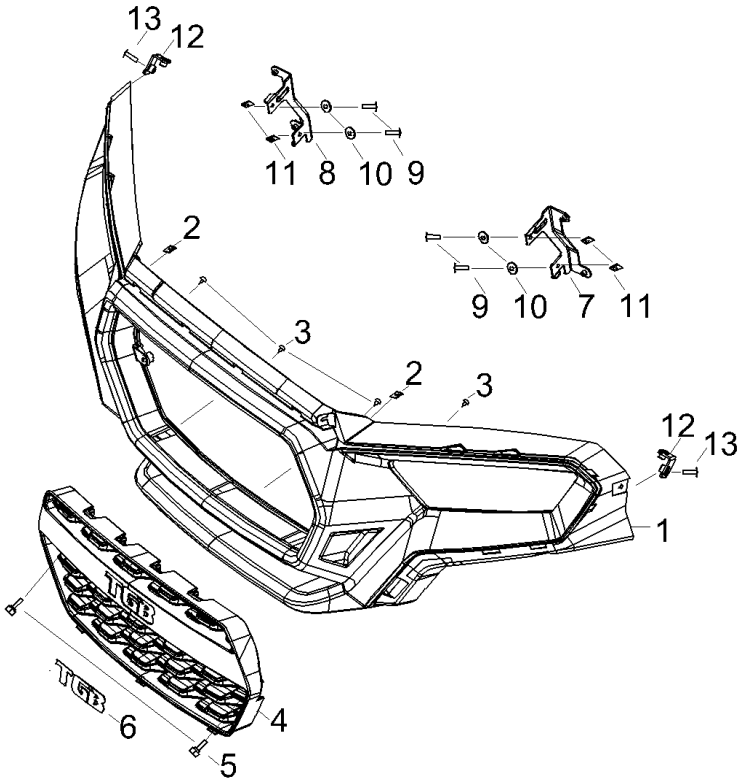
TORQUE:

Brake Disc:250-300 kgf-cm.

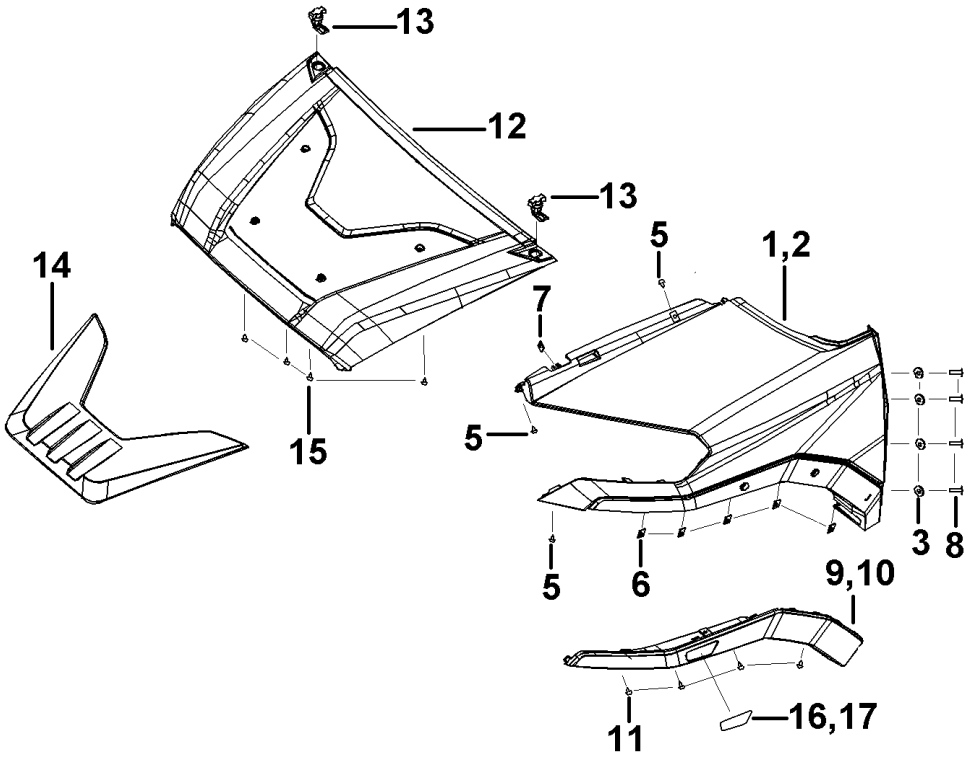
Castle Nut:1600-1800 kgf-cm

BODY

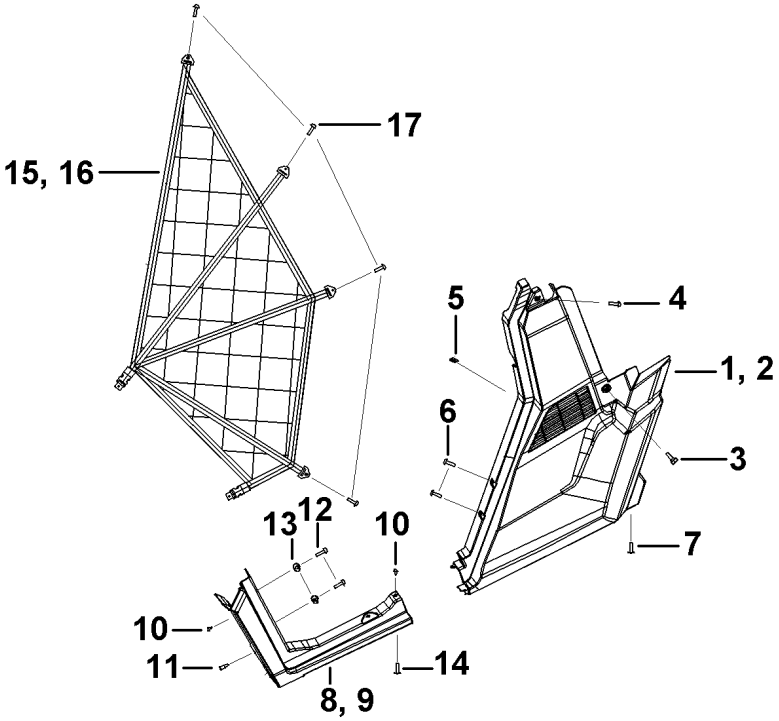
FRONT BUMPER



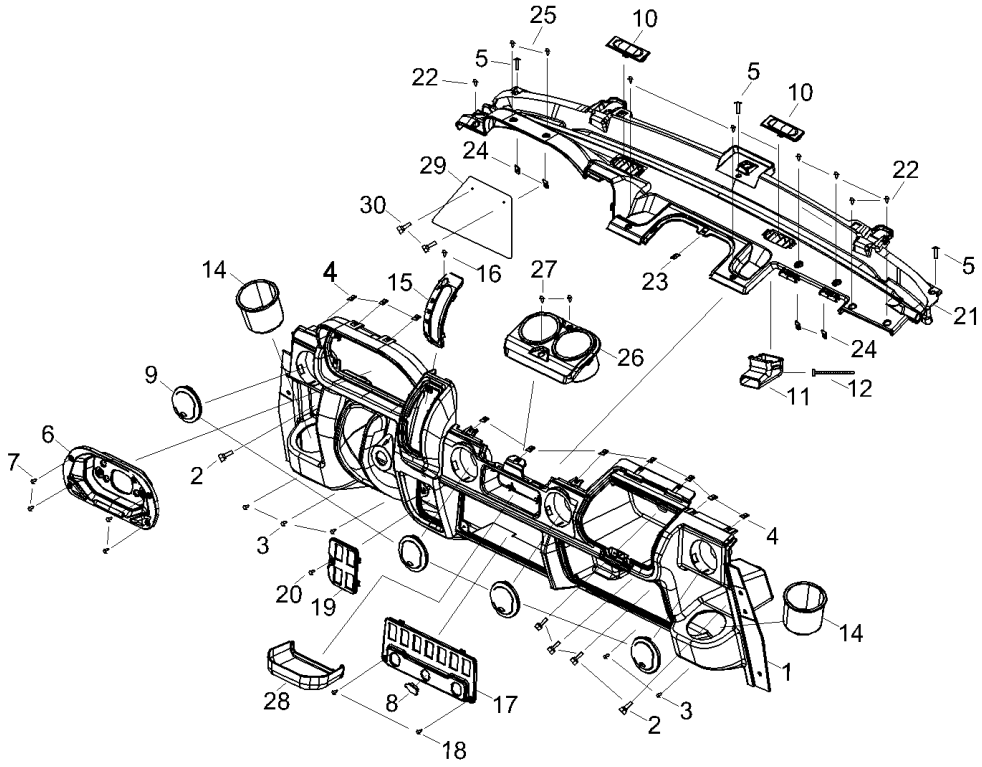
FRONT HOOD



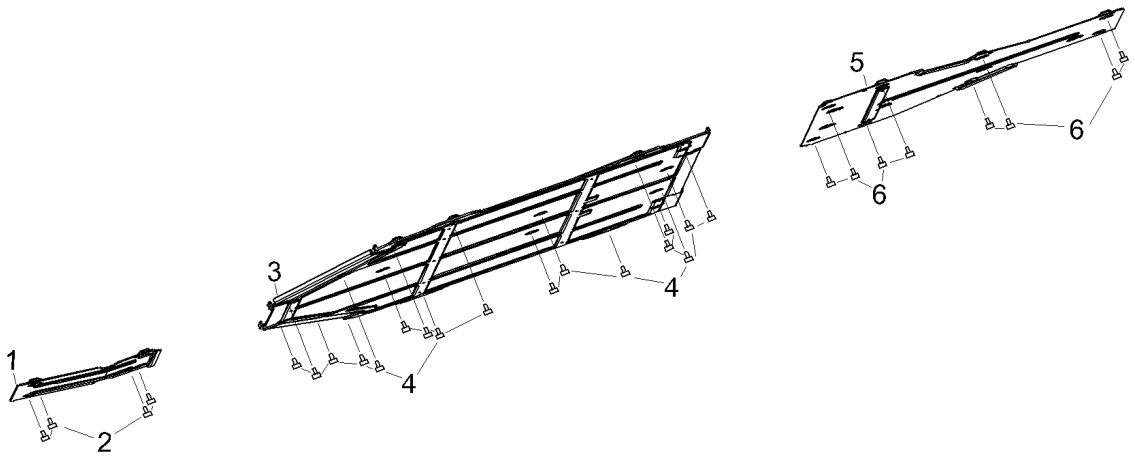
REAR SIDE PLATE



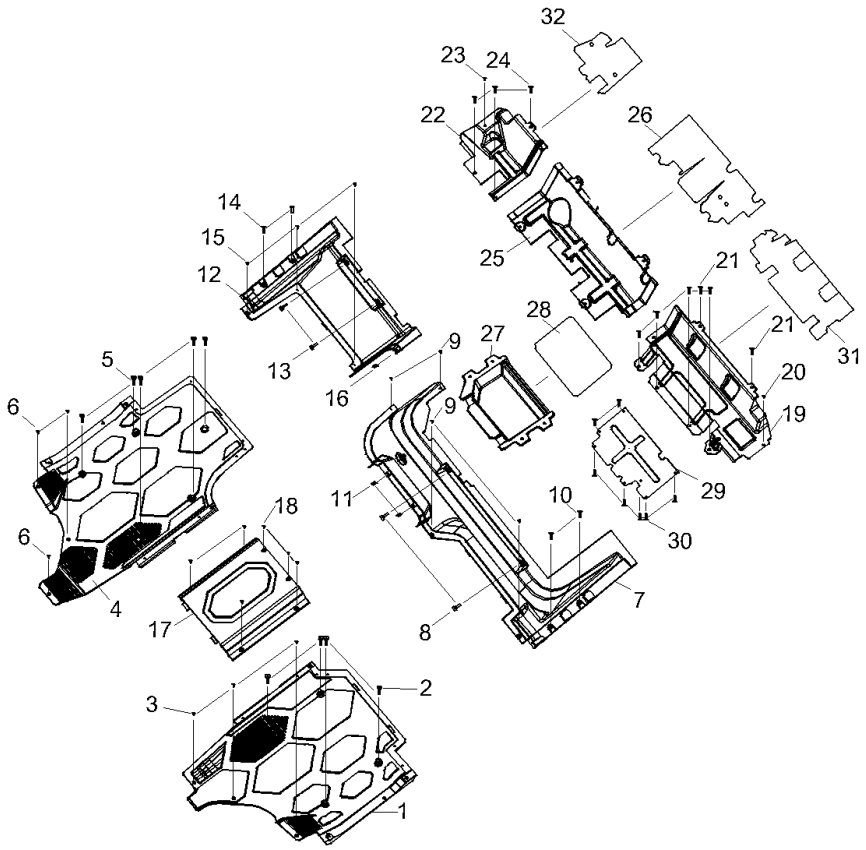
INTERIOR (TOP SIDE)



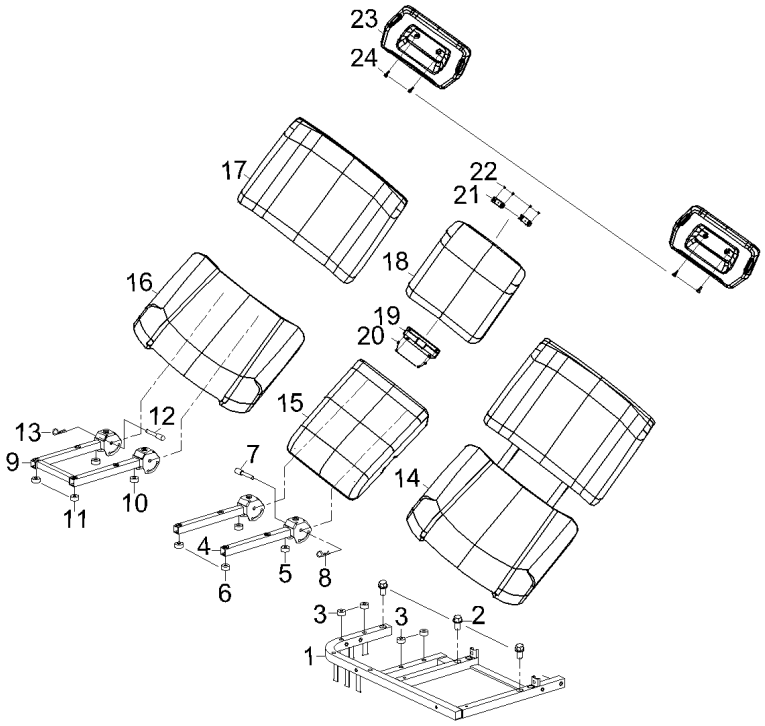
BOTTOM PLATE(PLASTIC)



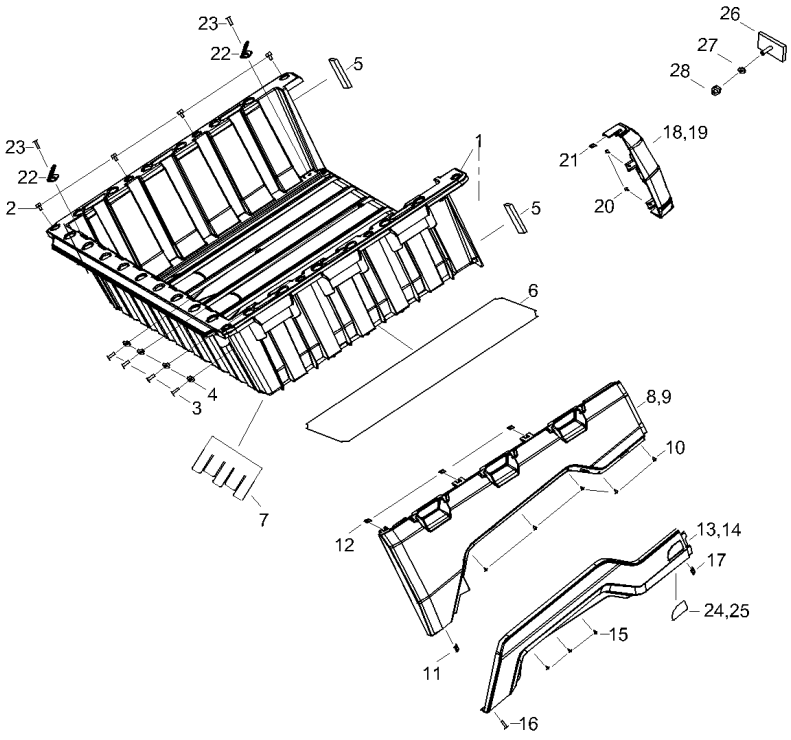
LEG SHIELD



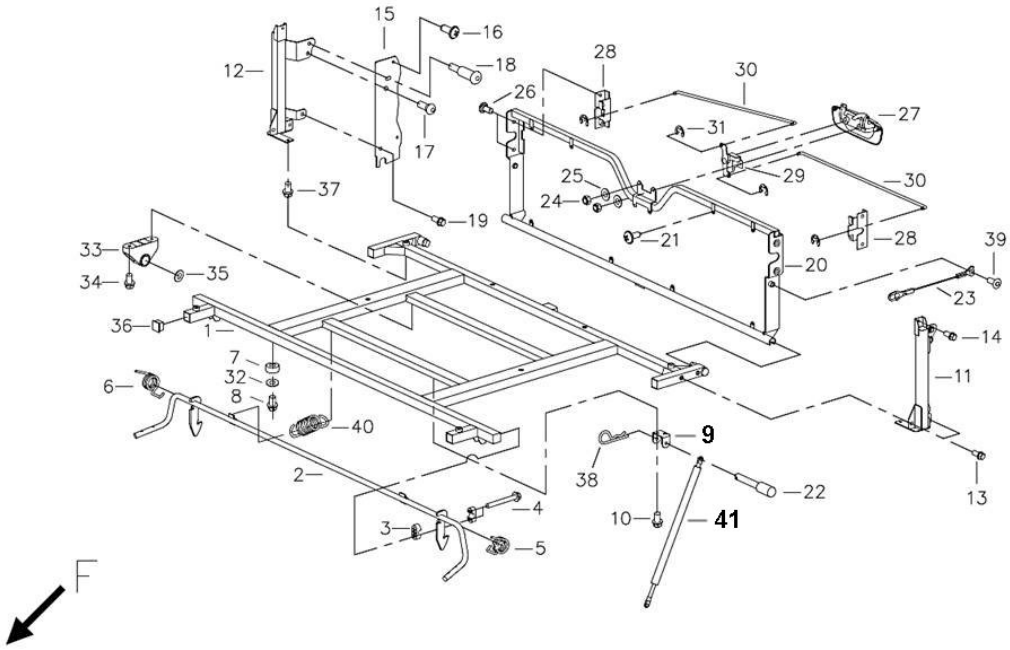
SEAT



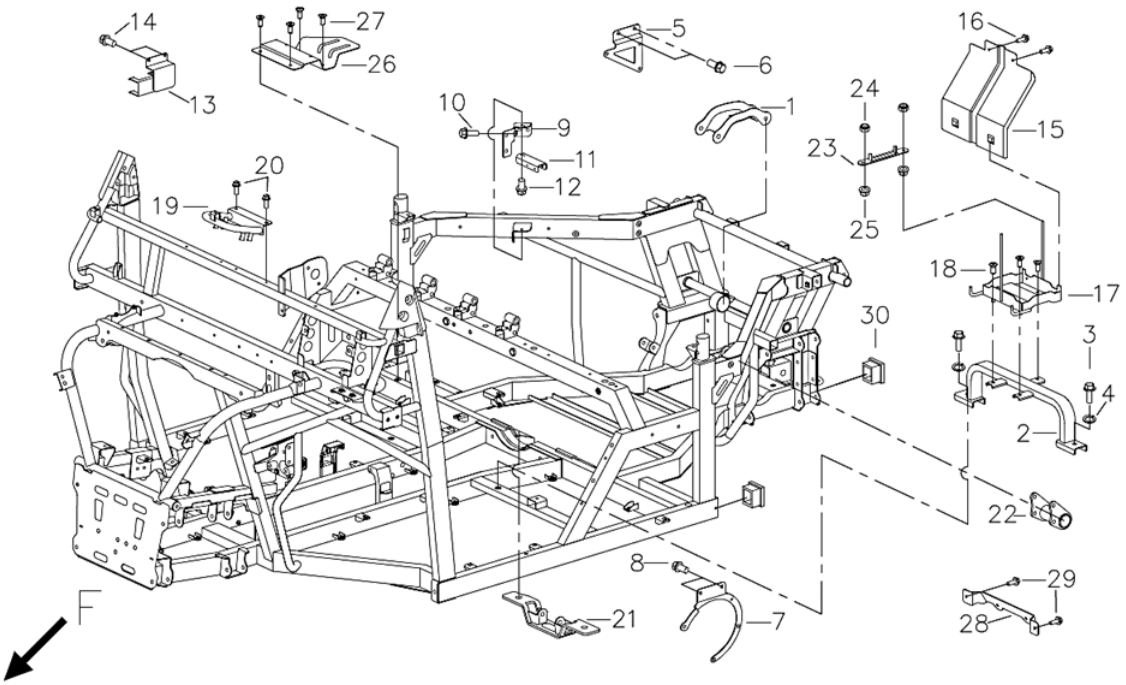
TRUCK BED



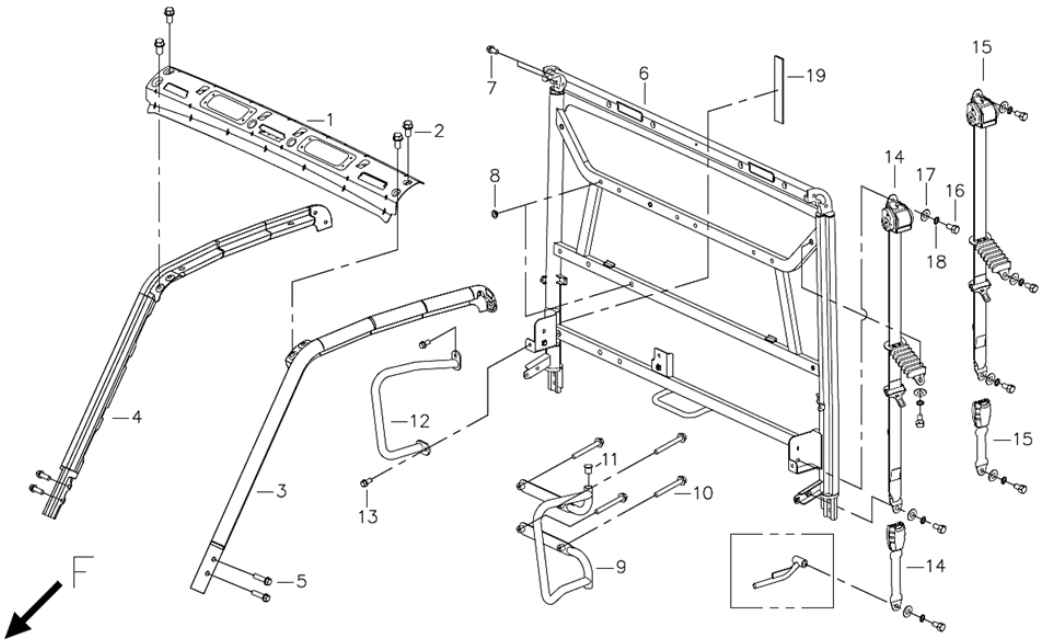
TRUCK BED PARTS (1)



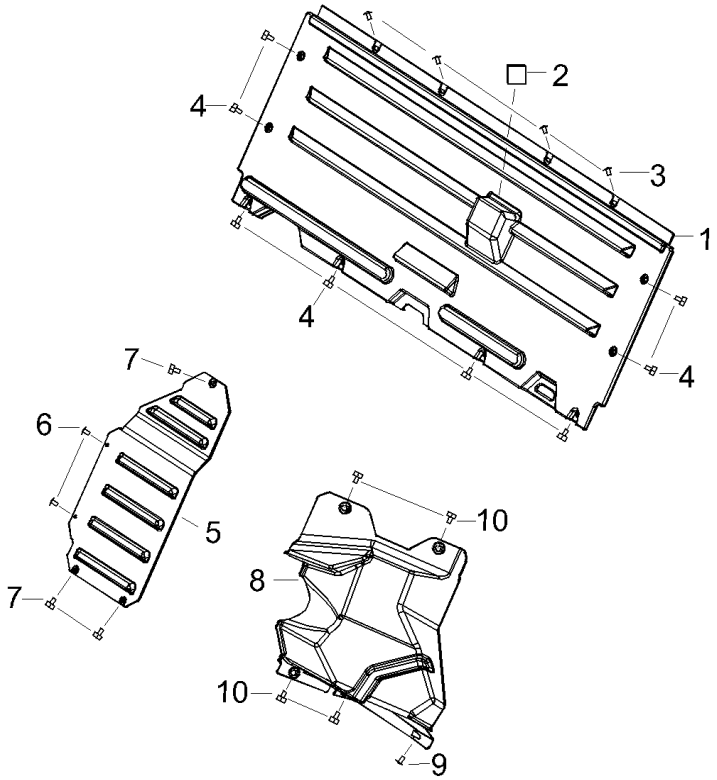
FRAME(2)



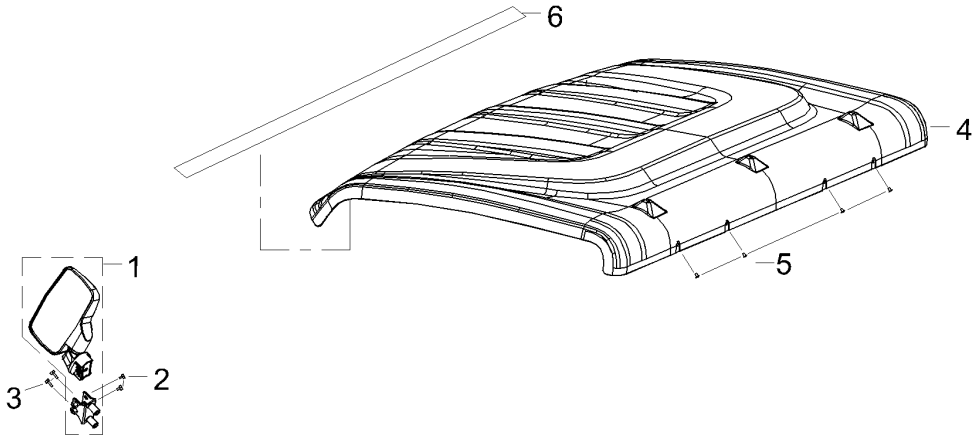
ANTI-ROLL CAGE (1)



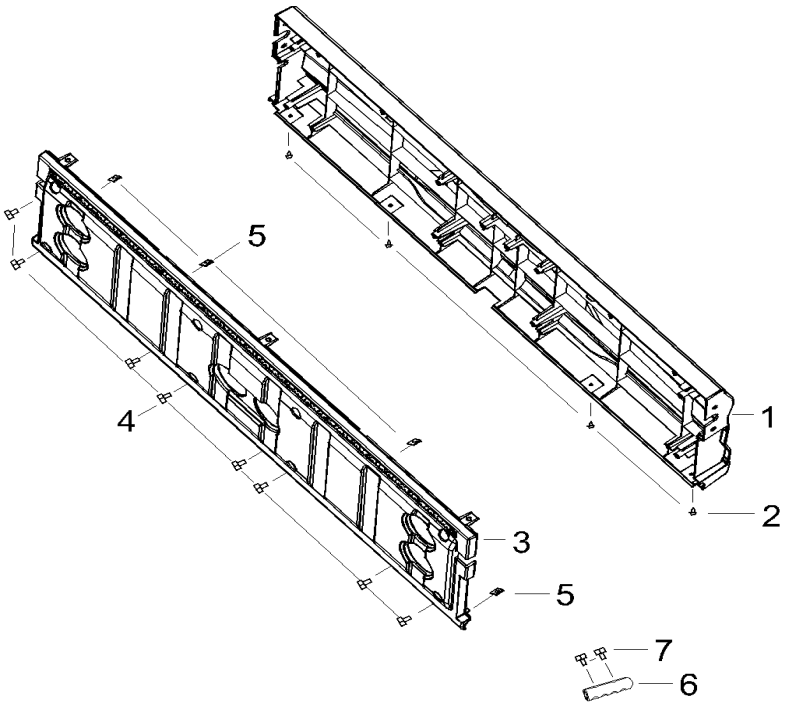
ANTI-ROLL CAGE (2)



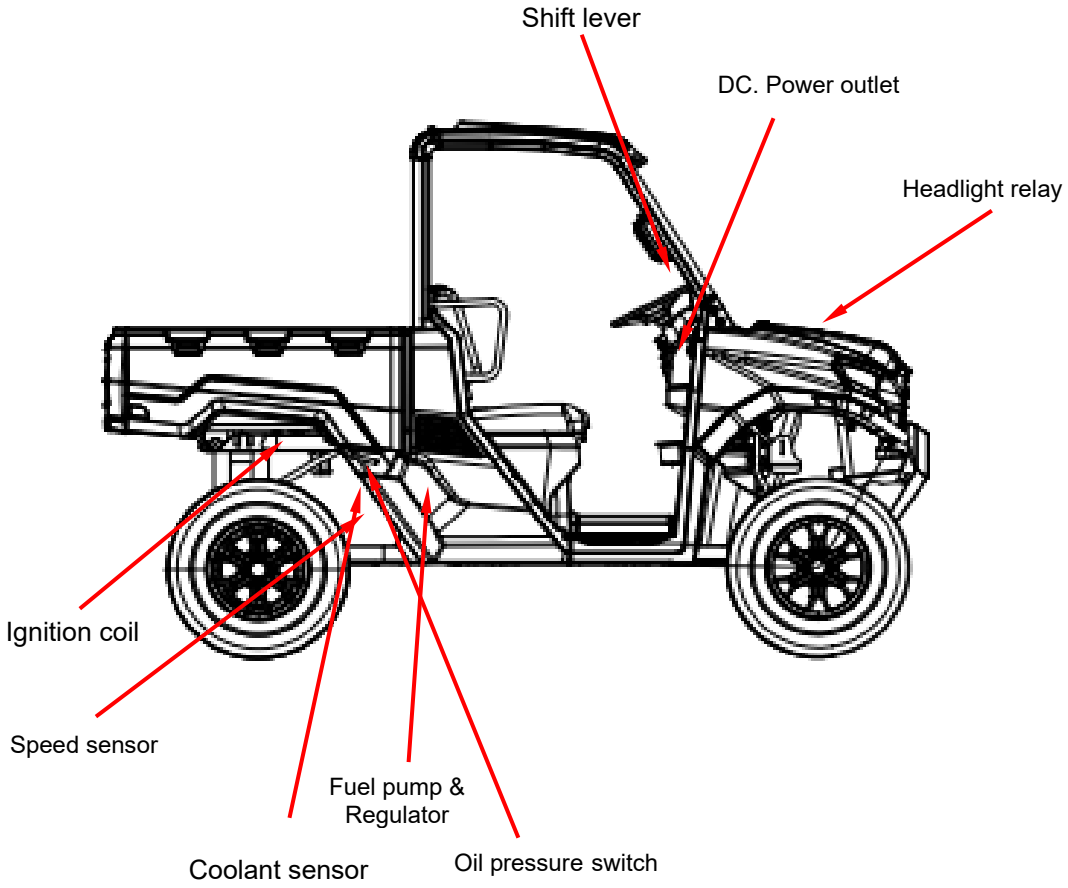
ROOF (OPTION)

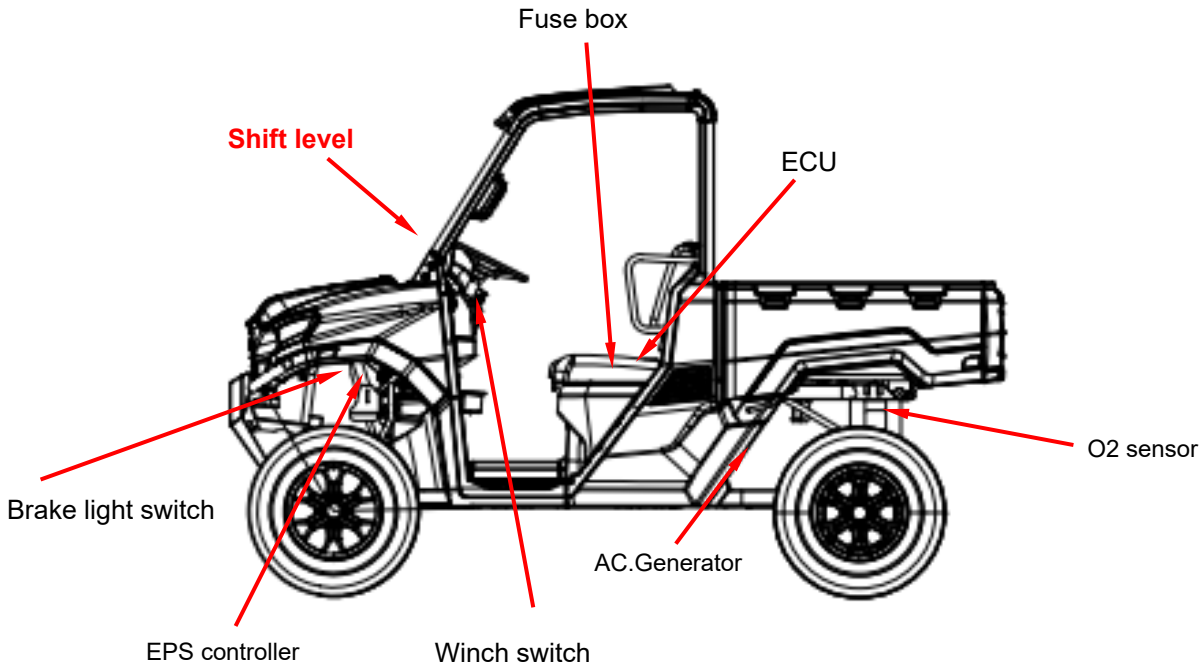


TRUCK BED PARTS (2)



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

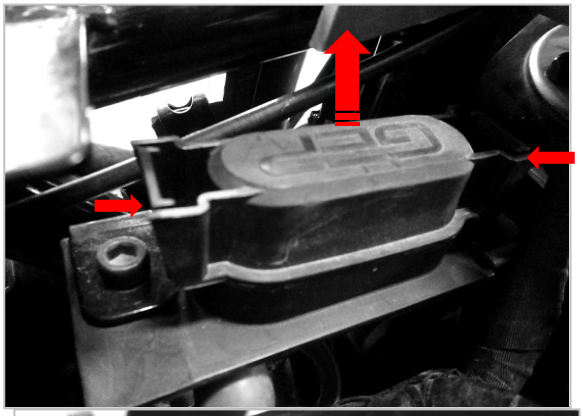
1. Fouled, defective spark plus.
   - Check/replace.
2. Damaged trigger wheel/defective or loose CPS. - Check.

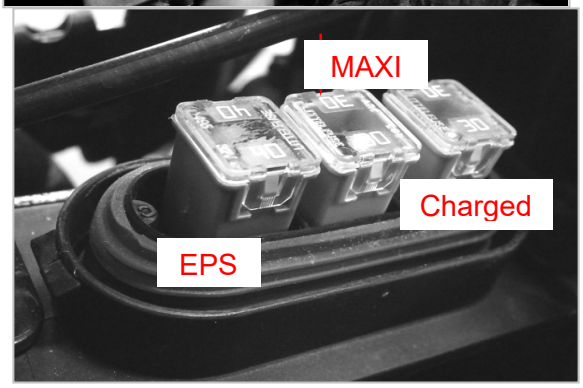
FUSE

MAXI FUSE

EPS Model

- Remove the seat.
- Remove the isolate shield.
- Push inward from the both side and lift up the cap.

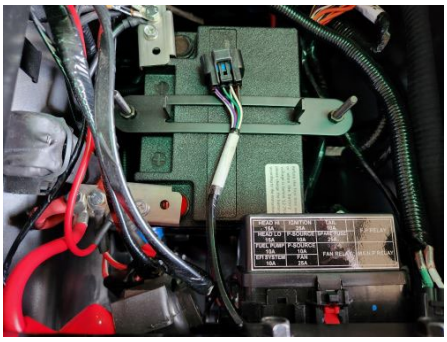




- Check the fuse condition, replace if necessary.

ESP：40 A, Green
MAXI FUSE：30 A, Pink
Charged：40 A, Green

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

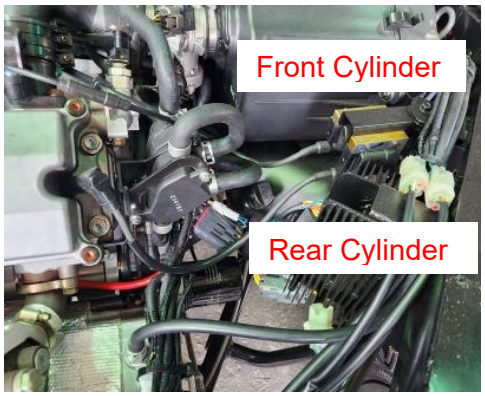
PIN A = 12 Vdc output

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.

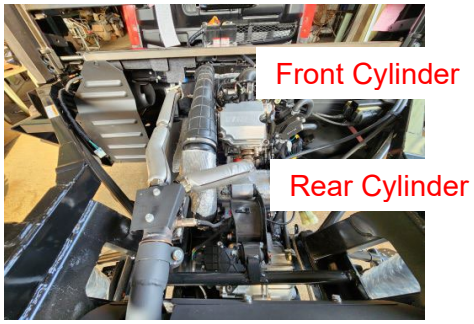
TORQUE: 8 Nm+/- 1

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

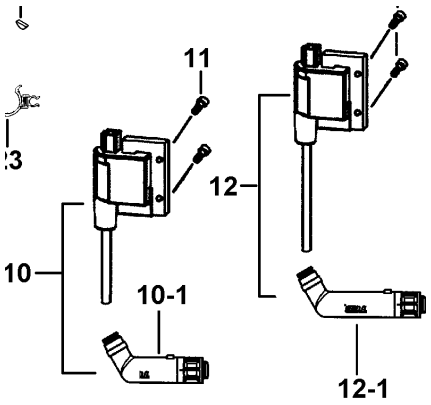
Pin 1 and ECM

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.

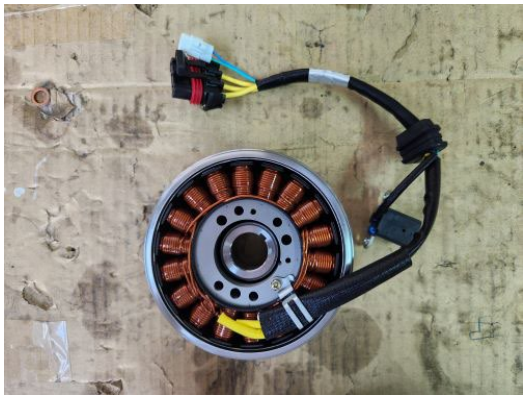
The plug face of a fouled spark plug has either a wet black deposit or a black carbon fouling. Such coatings form a conductive connection between the center electrode and ground.

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

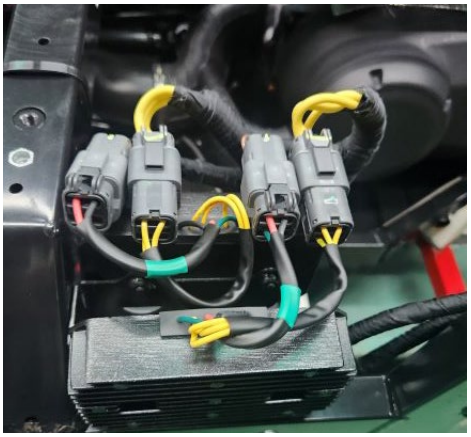
The purpose of the charging system is to keep the battery at a fuel state of charge and to provide the electrical system with the required electrical power for normal vehicle operation.

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 strap retaining nut to the specified torque.

TORQUE: 3.4 Nm+/- 0.3.

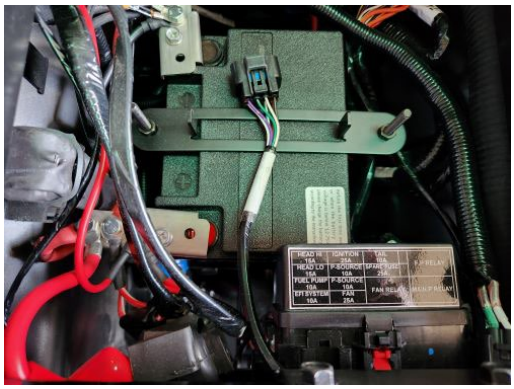
STARTING SYSTEM

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

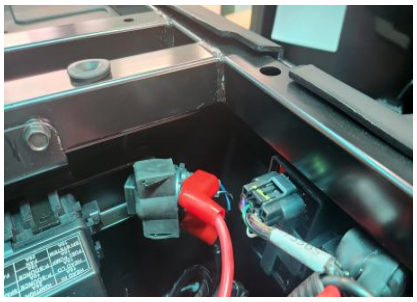
1. Disconnect connector with Black/Yellow wire.
2. Turn ignition switch ON.
3. Measure voltage:

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

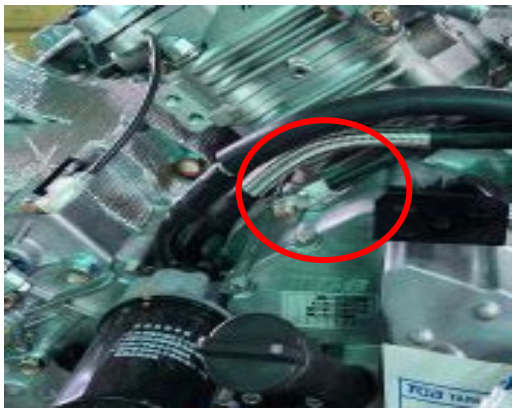
Using booster cables, carefully supply current from a 12 volt battery directly to the starter.
Connect the Black (-) cable first, then connect the remaining jumper cable from the battery then to the starter.
If starter turns, test other starting system components.

Starter Removal

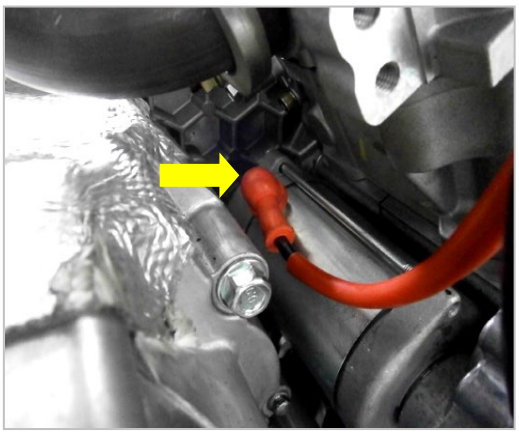
Turn OFF ignition switch.
Disconnect BLACK (-) cable from battery.

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.

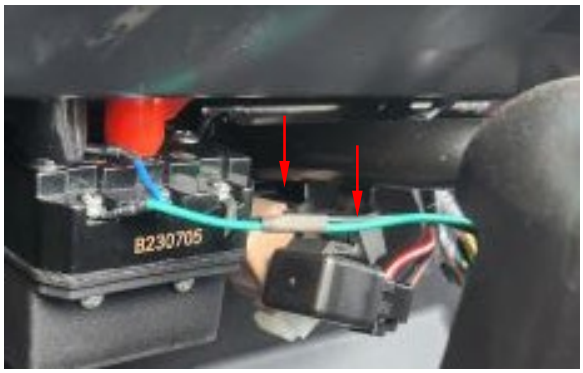
12 volt output to headlights low beam and low/high beam switch = Green.

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.

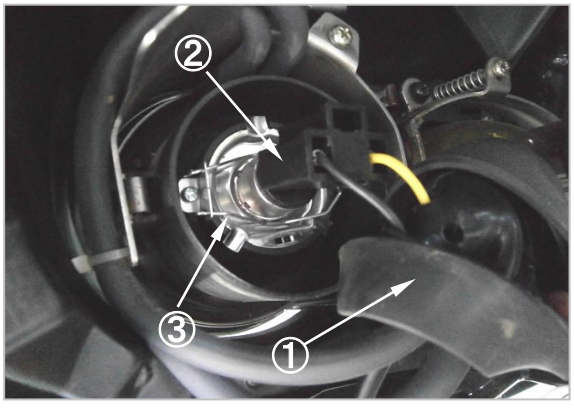
Unplug connector from bulb.

Lift and release the fixing spring.

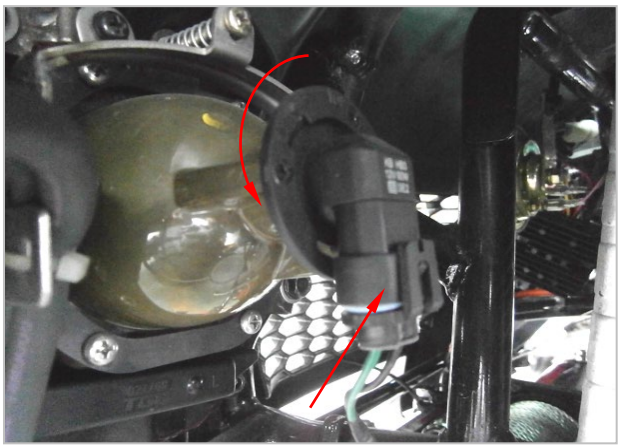
Pull the bulb out.

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.

LED Headlight Beam Aiming

Turn adjustment screw to adjust beam height to your convenience.

NOTE: Adjust headlights evenly.

LED Headlight and Taillight Bulbs Replacement (TURN SIGNAL LAMP)

The LED Headlight and taillights are built with LEDs (light emitting diode) and this technology proved to be reliable. In the unlikely event they do not work, have them checked by an authorized TGB dealer, a repair shop or person of your choosing.

TAILLIGHTS/BRAKE LIGHTS

Brake Light Switch

- Disconnect the brake light switch connector.
- Drain front brake line.
- Remove brake light switch from master cylinder.

OVERHEAT MONITORING CONTROL DEVICE

When overheat warning light is blanking, the troubleshooting procedure as follow:

1. Check the cooling fan fault?
   Disconnect the connector of cooling fan and check the two pin of connector.
   Replace cooling fan if necessary.

2. Check Spark plug cover of Cylinder #1 or #2 is any crack, loose or current leaking (refer to this section for spark plug troubleshooting).
   Replace if necessary.

3. Check the spark plug of Cylinder #1 or #2 (refer to this section for spark plug troubleshooting).
   Replace if necessary

4. Check ignition coil of Cylinder #1 or #2 (refer to this section for ignition coil troubleshooting).
   Replace if necessary

5. Check the connection of exhaust pipe and muffler is any leakage due to poor connection or graphite gasket damage.