

Service manual

Z JOYMAX



SERVICE MANUAL

LW30W1

JOYMAX Z

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This service manual contains the technical data of each component inspection and repair for the SYM LW25 / LW30 series scooter. The manual is shown with illustrations and focused on “Service Procedures”, “Operation Key Points”, and “Inspection Adjustment”, providing technicians with service guidelines.

If the style or the mechanical structures of the scooter SYM LW25 / LW30 series scooter are different from those of the photos or pictures shown in this manual, the actual vehicle shall prevail. Specifications are subject to changes without notice.

**Service Department
SANYANG MOTOR CO., LTD.**

How To Use This Manual



This service manual describes the basic information of different system parts and system inspection & service for SYM LW25 / LW30 series scooter. In addition, please refer to the manual contents in detail for the model you serviced in inspection and adjustment.

The first chapter covers the general information and the trouble diagnosis.
The second chapter covers the periodic maintenance information and the special tool models.

The third to the 11th chapters cover the engine and the driving systems.

The 12th chapter is the cooling system.

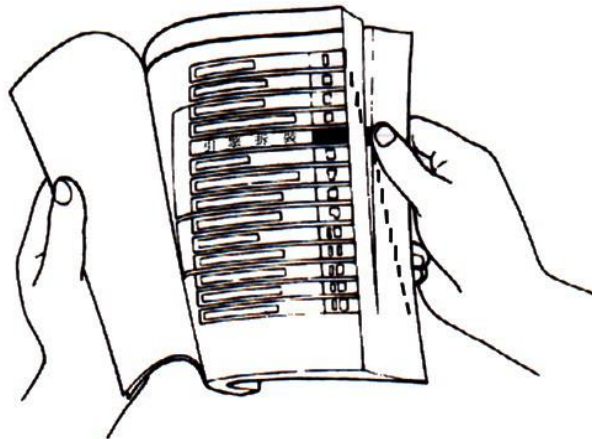
The 13th to the 16th chapter contain the relative parts of the body frame assembly.

The 17th chapter is the electrical system.

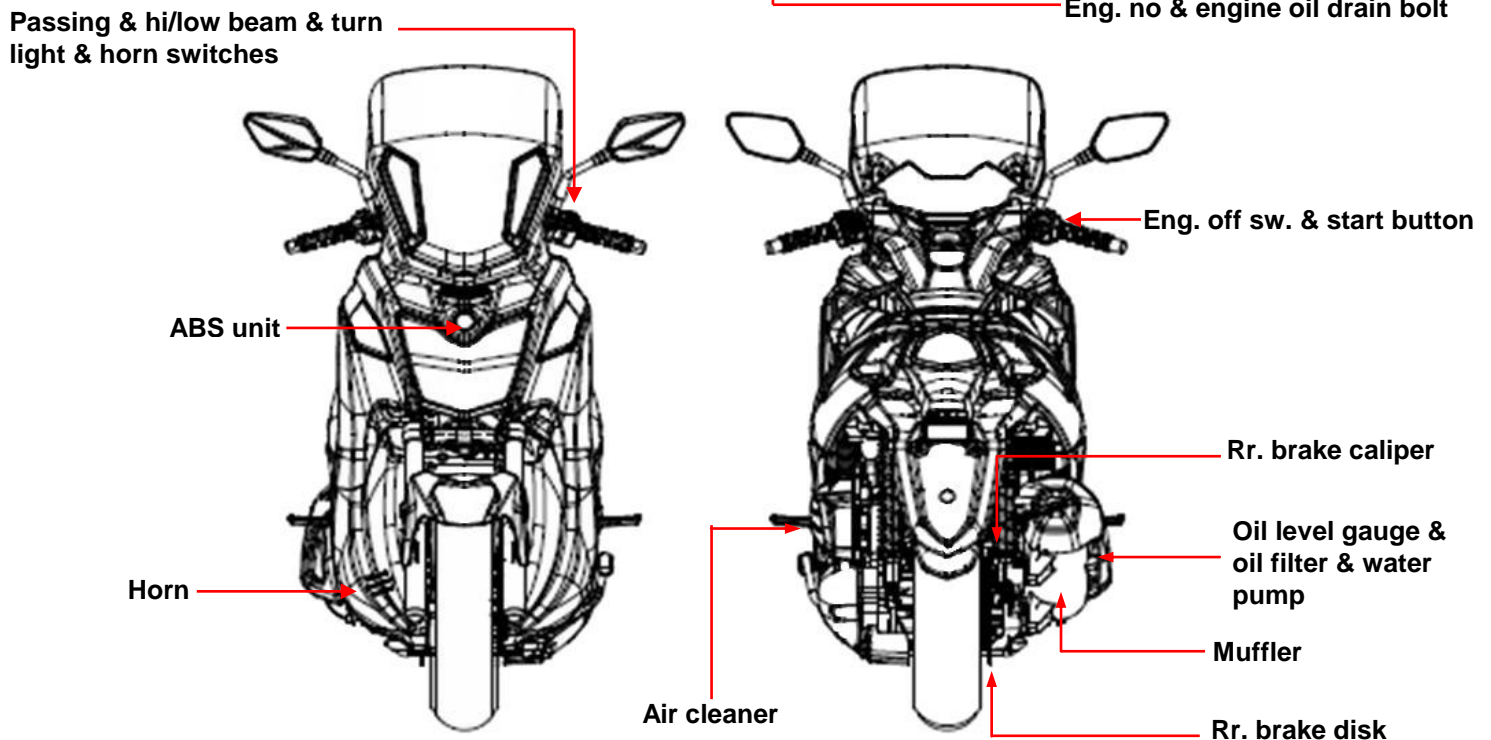
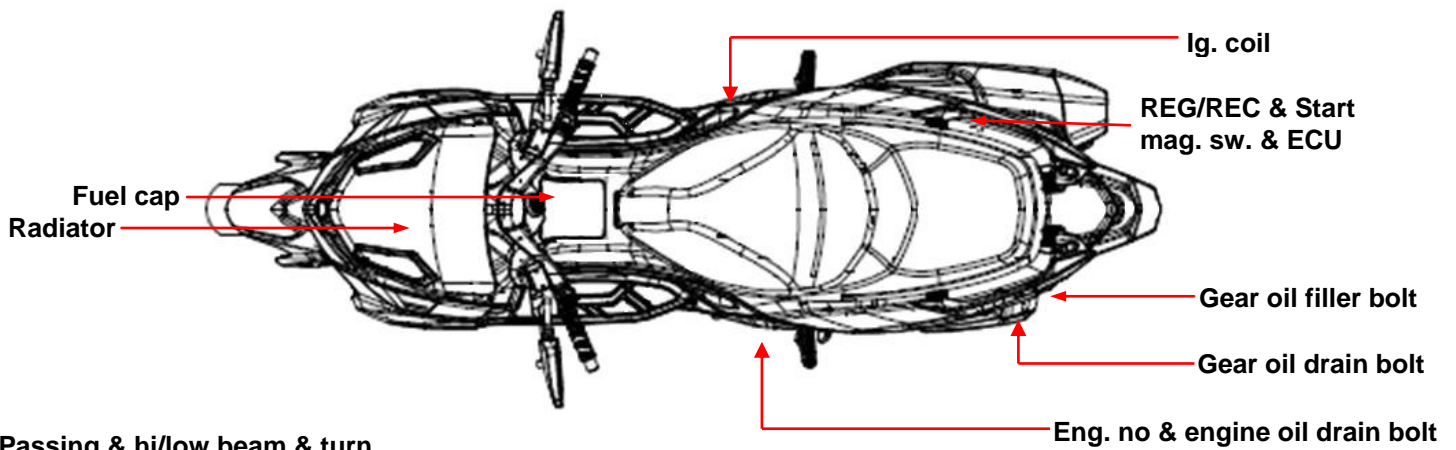
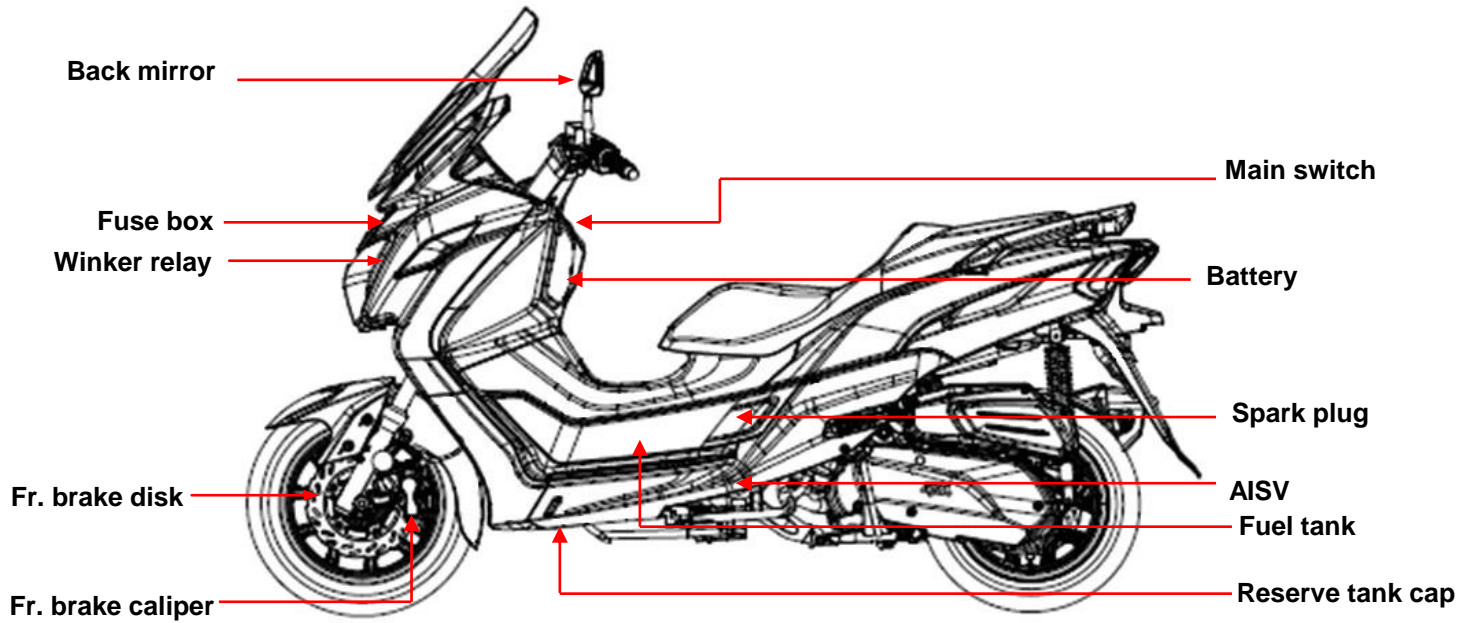
The 18th chapter is the emission control system.

The 19th chapter is the wiring diagram.

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



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Symbols and Marks

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

	Warning	Means that serious injury or loss of life may happen if procedures are not correctly followed.
	Caution	Means that equipment damages may result if procedures are not followed.
	Engine oil	Limits to use SAE 10W-40 API SJ class oil. Warranty will not cover the damage that caused by not apply with the limited engine oil. (Recommended oil: “ SYMOIL ” engine oil serials)
	Grease	High Temperature Lithium Complex E.P. Grease is recommended.
	Gear oil	“ SYMOIL ” gear oil serials are recommended. (GEAR OIL #85W/140 GL-5)
	Locking sealant	Apply sealant; medium strength sealant should be used unless
	Oil seal	Apply with lubricant.
	Renew	Replace with a new part before installation.
	Brake fluid	Use recommended brake fluid DOT3 or DOT4 brake fluid.
	Special tools	Special tools
O	Correct	Meaning correct installation.
X	Wrong	Meaning wrong installation.
	Indication	Indication of components.
	Directions	Indicates position and operation directions
		Components assembly directions each other.
		Indicates where the bolt installation direction, --- means that bolt cross through the component (invisibility).

General Safety

Carbon Monoxide

Before you start the engine, make sure the place is well ventilated. Never start the engine in an unventilated place. If you have to start the engine in an unventilated place, an exhaust fume extractor is needed.

Caution

Exhaust fume contains toxic gas which may cause one to lose consciousness and even result in loss of life.

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 the children.

Used Engine Oil

Caution

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

Hot Components

Caution

Components of the engine and exhaust system can be extremely hot after engine running. They remain very hot even after the engine has been stopped for a period of time. Before performing service work on these parts, wear the heat insulation gloves or wait until the temperature drops.

Battery

Caution

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

Brake Shoes

Do not use compressed air or brush to clean the components of the brake system. Use a vacuum cleaner or the equivalent to avoid dust drifting in the air.

Caution

Inhaling brake shoes dust may cause disease or even cancer of the respiratory system.

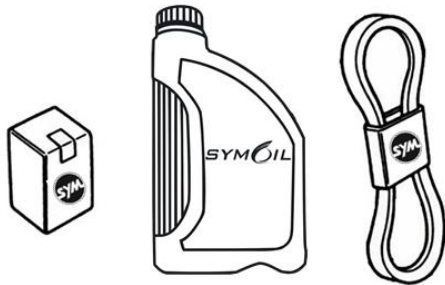
Brake Fluid

Caution

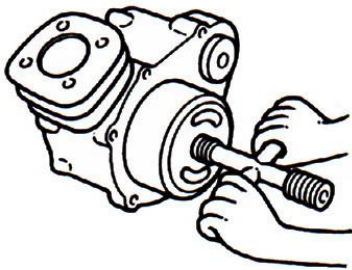
Brake fluid spilled on painted, plastic, or rubber parts may cause damage to the parts. Place a clean towel on the top of the parts for protection when servicing the brake system. Keep the brake fluid beyond reach of the children.

Before Servicing

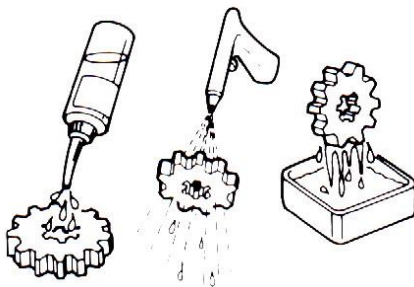
- Always use SANYANG genuine parts and recommended oil. Using improper parts may cause damage to or destruction of the vehicle.



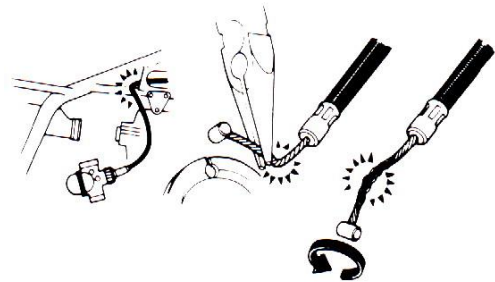
- Special tools are designed for removal and installation of component parts without damaging them. Using wrong tools may result in parts damage.



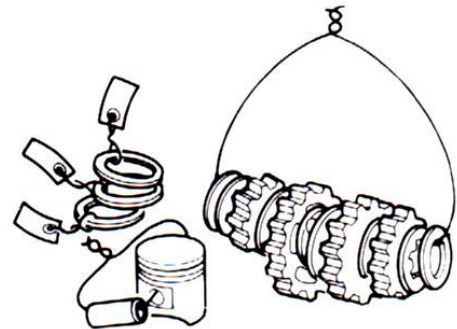
- When servicing this vehicle, use only metric tools. Metric bolts, nuts, and screws are not interchangeable with the Britain system, using wrong tools and fasteners may damage this vehicle.
- Clean the outside of the parts or the cover before removing it from the vehicle. Otherwise, dirt and deposit accumulated on the part's surface may fall into the engine, chassis, or brake system to cause damage.
- Wash and clean parts with high flash point solvent, and then blow dry with compressed air. Pay special attention to O-rings or oil seals because most of the cleaning agents have bad effect on them.



- Never bend or twist control cables to avoid unsmooth control and premature worn out.



- Rubber parts may become deteriorated when old, and be damaged by solvent and oil easily. 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.



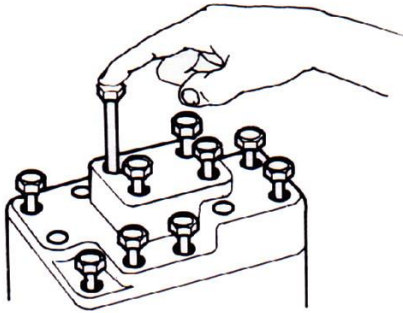
- Note the reassemble position of the important components before disassembling them to ensure they will be reassembled in correct dimensions (depth, distance or position).
- Components not to be reused should be replaced when disassembled including gaskets metal seal rings, O-rings, oil seals, snap rings, and split pins.



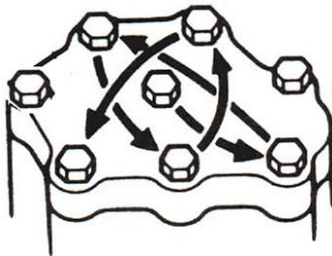
1. General Information



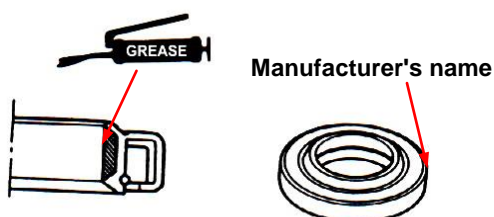
- The length of bolts and screws for assemblies, cover plates or boxes is different from one another, be sure they are correctly installed. In case of confusion, Insert the bolt into the hole to compare its length with other bolts, if its length out side the hole is the same with other bolts, it is a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



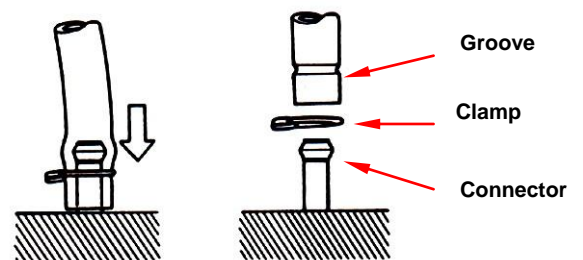
- When oil seal is installed, fill the groove with grease, install the oil seal with the name of the manufacturer facing outside, and check the shaft on which the oil seal is to be installed for smoothness and for burrs that may damage the oil seal.



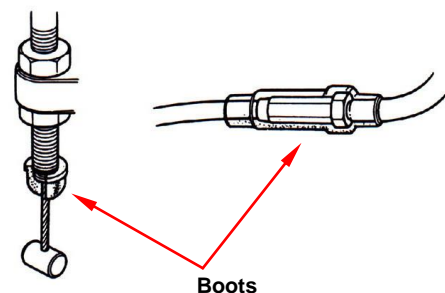
Remove residues of the old gasket or sealant before reinstallation, grind with a grindstone if the contact surface has any damage.



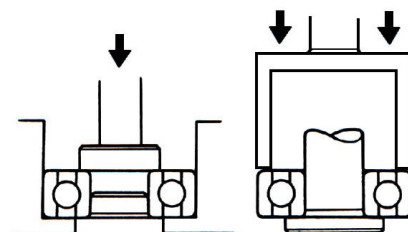
- The ends of rubber hoses (for fuel, vacuum, or coolant) should be pushed as far as they can go to their connections so that there is enough room below the enlarged ends for tightening the clamps.



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



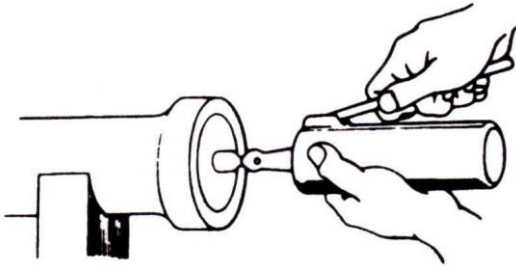
- The tool should be pressed against two (inner and outer) bearing races when removing a ball bearing. Damage may result if the tool is pressed against only one race (either inner race or outer race). In this case, the bearing should be replaced. To avoid damaging the bearing, use equal force on both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



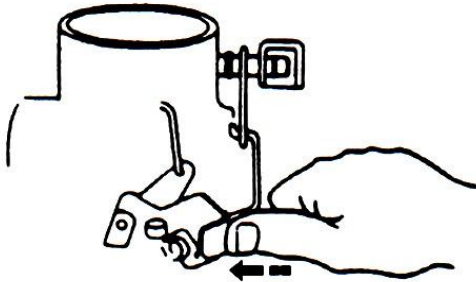
Both of these examples can result in bearing damage.

1. General Information

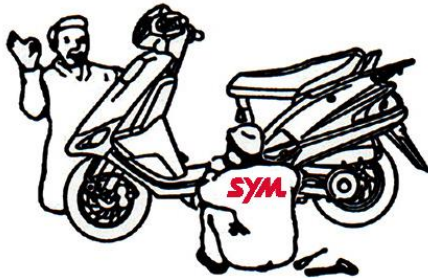
- Lubricate the rotation face with specified lubricant on the lubrication points before assembling.



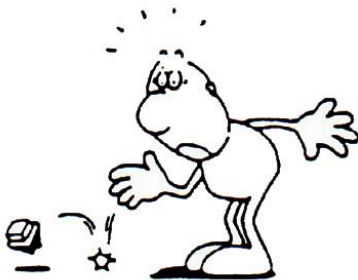
- Check if positions and operation for installed parts is in correct and properly.



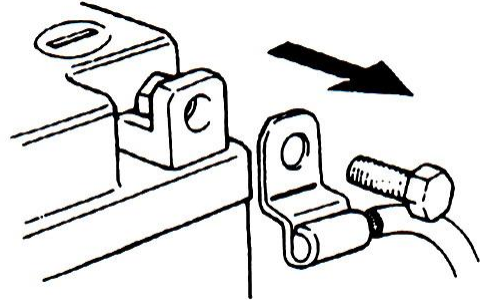
- Make sure service safety each other when conducting by two persons.



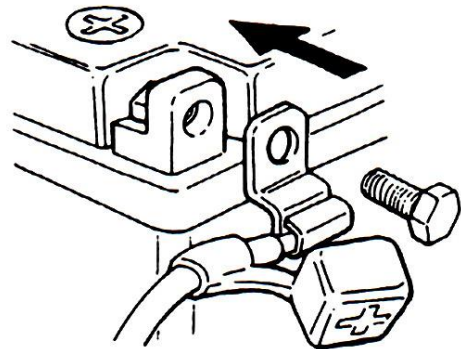
- Note that do not let parts fall down.



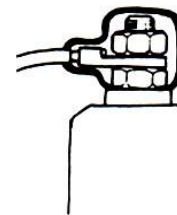
Before battery removal operation, it has to remove the battery negative (-) cable firstly. Note tools like open-end wrench do not contact with body to prevent from circuit short and create spark.



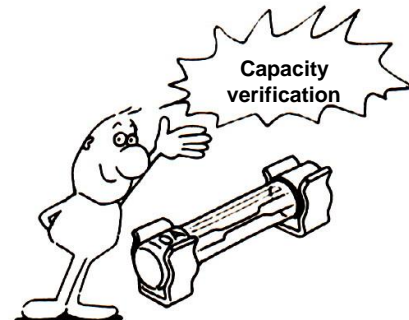
- After service completed, make sure all connection points is secured. Battery positive (+) cable should be connected firstly.
- And the two posts of battery have to be greased after connected the cables.



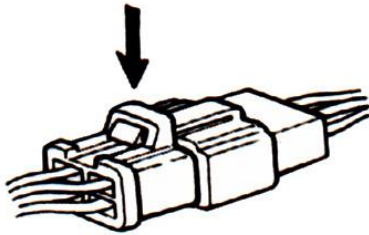
- Make sure that the battery post caps are located in properly after the battery posts had been serviced.



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



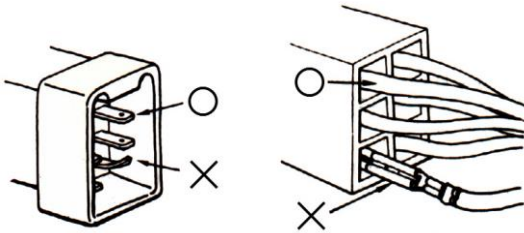
- When separating a connector, it locker has to be unlocked firstly. Then, conduct the service operation.



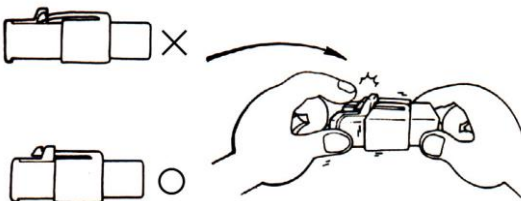
- Do not pull the wires as removing a connector or wires. Hold the connector body.



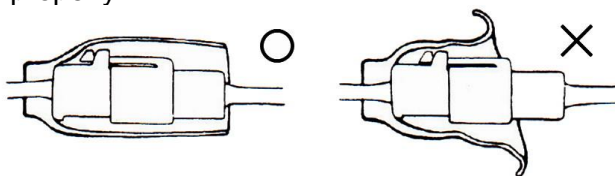
- Make sure if the connector pins are bent, extruded or loosen.



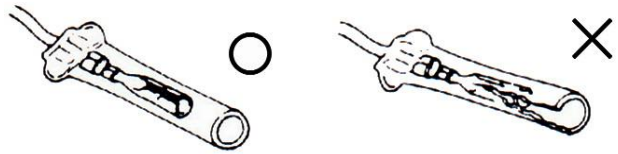
- Insert the connector completely. If there are two lockers on two connector sides, make sure the lockers are locked in properly. Check if any wire loose.



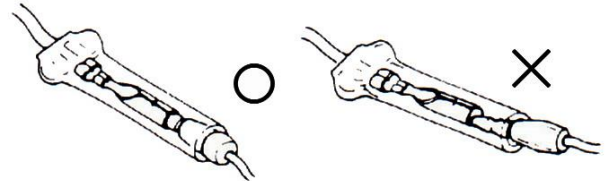
- Check if the connector is covered by the twin connector boot completely and secured properly.



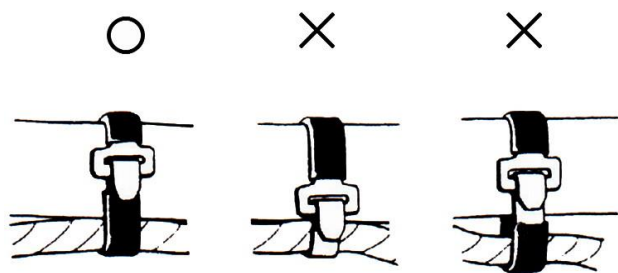
- Before terminal connection, check if the boot is crack or the terminal is loose.



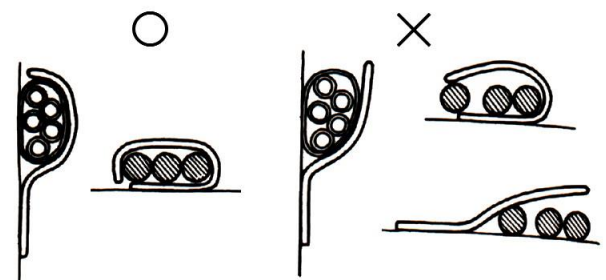
- Insert the terminal completely. Check if the terminal is covered by the boot. Do not let boot open facing up.



- 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.

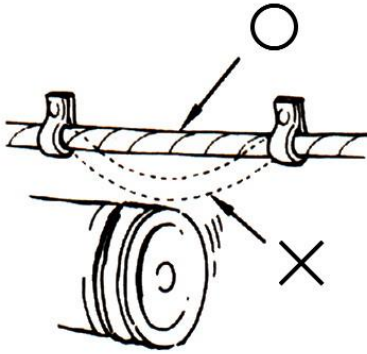


- Do not squeeze wires against the weld or its clamp.

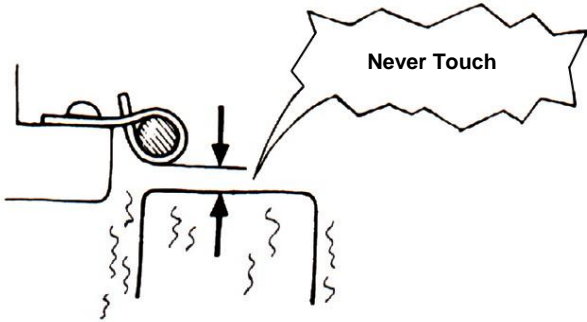


1. General Information

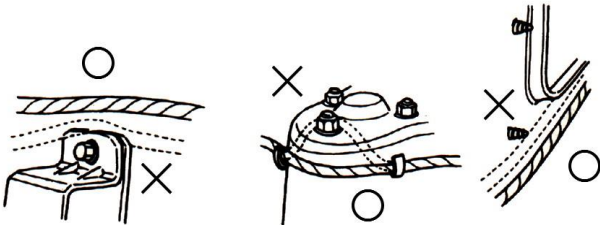
- Do not let the wire harness contact with rotating, moving or vibrating components as routing the harness.



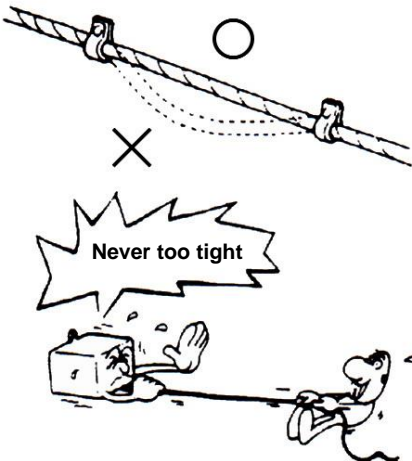
- Keep wire harnesses far away from the hot parts.



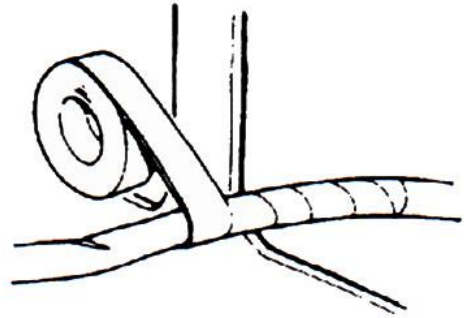
- Route wire harnesses to avoid sharp edges or corners and also avoid the projected ends of bolts and screws.



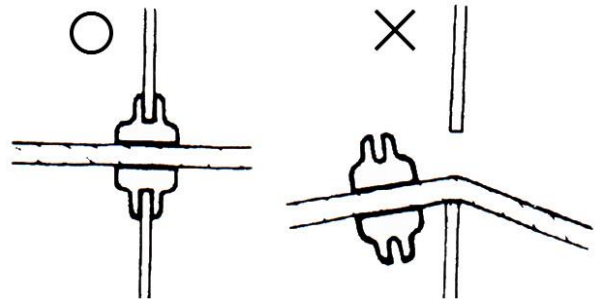
- Route harnesses so that they neither pull too tight nor have excessive slack.



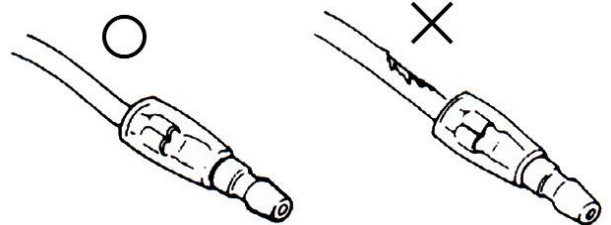
- Protect wires or wire harnesses with electrical tape or tube if they contact a sharp edge or corner. Thoroughly clean the surface where tape is to be applied.



- 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.

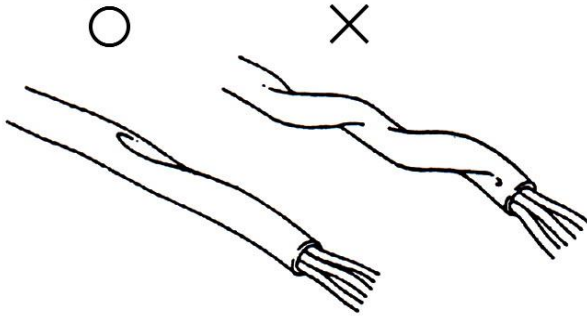


- Never clamp or squeeze the wire harness as installing other components.



1. General Information

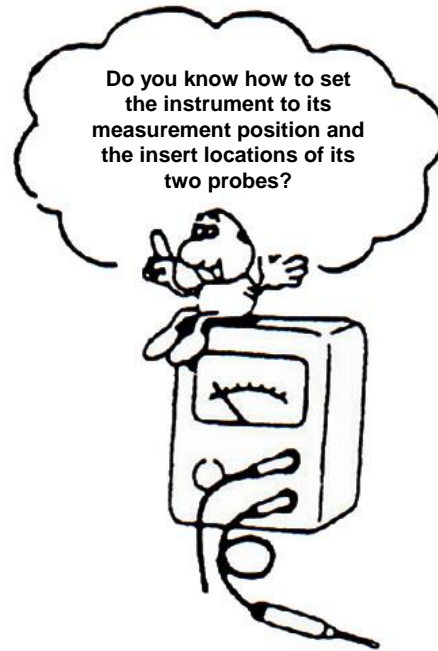
- Do not let the wire harness been twisted as installation.



- 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.



- Before operating a test instrument, operator should read the operation manual of the instrument. And then, conduct test in accordance with the instruction.



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



Specifications

MAKER		SANYANG MOTOR		MODEL		LW30W1		
Dimension	Overall Length	2190 mm		Suspension System	Front	TELESCOPIC FORK		
	Overall Width	750 mm			Rear	UNIT SWING		
	Overall Height	1422 mm		Tire Specifications	Front	120 / 70-14 55P		
	Wheel Base	1550 mm			Rear	140 / 60-13 63P		
Weight	Curb Weight	Front	77 kg	Brake System	Front	DISK (φ 260mm)		
		Rear	107 kg		Rear	DISK (φ 240mm)		
		Total	184 kg					
	Passengers/Weight		2 人/160 kg		Performance	Max. Speed	129 km/hr	
	Total Weight	Front	125 kg			Climb Ability	<27°	
		Rear	219 kg		Reduction	Primary Reduction	Belt	
		Total	344 kg			Secondary Reduction	Gear	
			Clutch	Centrifugal, dry type				
Engine	Type		4-STROKE ENGINE		Transmission	CVT		
	Installation and arrangement		Vertical, below center, incline 80°					
	Fuel		Above 92 octane unleaded			Speedometer	0 ~ 180 km/hr	
	Cycle/ Cooling		4-stroke/ Liquid-cooled		Horn	1		
	Cylinder	Bore	75 mm		Muffler	Expansion & Pulse Type		
		Stroke	63 mm		Exhaust Pipe Position and Direction	Right side, and Backward		
		Number/Arrangement	SINGLE CYLINDER		Lubrication System	Forced circulation & splashing		
	Displacement		278.3 cc		exhaust Concentration			
	Compression Ratio		10.5 : 1			CO	<2.0 %	
	Max. HP		27.3 ps / 8000 rpm			HC	<900 PPM	
	Max. Torque		2.8 kgf-m / 6750 rpm		E.E.C.		√	
	Ignition system		Full transistor ignition (ECU)		P.C.V.		√	
	Starting System		Electrical starter		Catalytic reaction control system		√	

1. General Information



Specifications

MAKER		SANYANG MOTOR		MODEL		LW25W1		
Dimension	Overall Length	2190 mm		Suspension System	Front	TELESCOPIC FORK		
	Overall Width	750 mm			Rear	UNIT SWING		
	Overall Height	1422 mm		Tire Specifications	Front	120 / 70-14 55P		
	Wheel Base	1550 mm			Rear	140 / 60-13 63P		
Weight	Curb Weight	Front	77 kg	Brake System	Front	DISK (φ 260mm)		
		Rear	107 kg		Rear	DISK (φ 240mm)		
		Total	184 kg					
	Passengers/Weight		2 人/160 kg		Performance	Max. Speed	124 km/hr	
	Total Weight	Front	125 kg			Climb Ability	<27°	
		Rear	219 kg		Reduction	Primary Reduction	Belt	
		Total	344 kg			Secondary Reduction	Gear	
Type		4-STROKE ENGINE		Clutch		Centrifugal, dry type		
Installation and arrangement		Vertical, below center, incline 80°		Transmission	CVT			
Fuel		Above 92 octane unleaded		Speedometer		0 ~ 180 km/hr		
Cycle/ Cooling		4-stroke/ Liquid-cooled		Horn		1		
Engine	Cylinder	Bore	71 mm	Muffler		Expansion & Pulse Type		
		Stroke	63 mm	Exhaust Pipe Position and Direction		Right side, and Backward		
		Number/Arrangement	SINGLE CYLINDER		Lubrication System		Forced circulation & splashing	
	Displacement		249.4 cc		exhaust Concentration			
	Compression Ratio		10.5 : 1			CO	<2.5 %	
	Max. HP		21.5 ps / 7500 rpm			HC	<900 PPM	
	Max. Torque		2.4 kgf-m / 5500 rpm		E.E.C.		√	
	Ignition system		Full transistor ignition (ECU)		P.C.V.		√	
	Starting System		Electrical starter		Catalytic reaction control system		√	

Torque Values

Engine Torque Values

Item	Q'ty	Thread Dia. (mm)	Torque Value (kgf-m)	Remarks
Cylinder stud bolt	4	10	1.0~1.4	
Cylinder head nut	4	10	3.6~4.0	
Cylinder head right bolt	2	6	1.0~1.4	
Cylinder head side cover bolt	2	6	1.0~1.4	
Cylinder head cover bolt	4	6	1.0~1.4	
Cylinder head stud bolt (inlet pipe)	2	6	1.0~1.4	
Cylinder head stud bolt (EX. pipe)	2	8	2.4~3.0	
Air inject pipe bolt	4	6	1.0~1.4	
Air inject reed valve bolt	2	3	0.07~0.09	
Tappet adjustment screw nut	4	5	0.7~1.1	Apply oil to thread
Spark plug	1	10	1.0~1.2	
Camshaft Chain Tensioner bolt	2	6	1.0~1.4	
Carburetor insulator bolt	2	6	0.7~1.1	
Oil pump screw	2	3	0.1~0.3	
Water pump impeller	1	7	1.0~1.4	
Engine left cover bolt	9	6	1.1~1.5	
Engine oil draining bolt	1	12	3.5~4.5	
Engine oil strainer cap	1	30	1.3~1.7	
Mission draining bolt	1	8	0.8~1.2	
Mission filling bolt	1	10	1.0~1.4	
Clutch driving plate nut	1	36	8.0~10.0	
Clutch outer nut	1	14	6.0~7.0	
Drive face nut	1	14	8.5~10.5	
ACG. Flywheel nut	1	14	8.5~10.5	
Crankcase bolt	7	6	0.7~1.1	
Mission case bolt	7	8	2.4~3.0	
Muffler mounting bolt	3	10	4.0 ~5.0	
Muffler mounting nut	2	8	2.4 ~3.0	

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

1. General Information



Frame Torque Values

Item	Q'ty	Thread Dia. (mm)	Torque Value (kg-m)	Remarks
Mounting bolt for steering handle post	1	10	4.0~5.0	
Lock nut for steering stem	1	BC1	6.0~8.0	
Steering top cone race	1	BC1	2.0~3.0	
Front wheel axle bolt	1	12	5.0~6.0	
Rear wheel axle nut	1	16	11.0~13.0	
Front cushion mounting bolt	4	10	4.0~4.5	
Rear cushion upper connection bolt	1	10	3.5~4.5	
Rear cushion under connection bolt	1	8	2.4~3.0	
Rear fork mounting bolt	2	10	4.0~5.0	
Brake hose bolt	4	10	3.0~4.0	
Brake air-bleeding valve	2	6	0.8~1.0	
Front brake disc mounting bolt	5	8	4.0~4.5	
Rear brake disc mounting bolt	5	8	4.0~4.5	
Brake clipper mounting bolt	4	8	2.9~3.5	
Engine hanger link bolt	2	12	7.5~9.5	On frame side
Engine hanger link nut	1	12	7.5~9.5	On engine side
Main stand nut	1	10	4.0~5.0	
Air cleaner bolt	2	6	1.0~1.4	

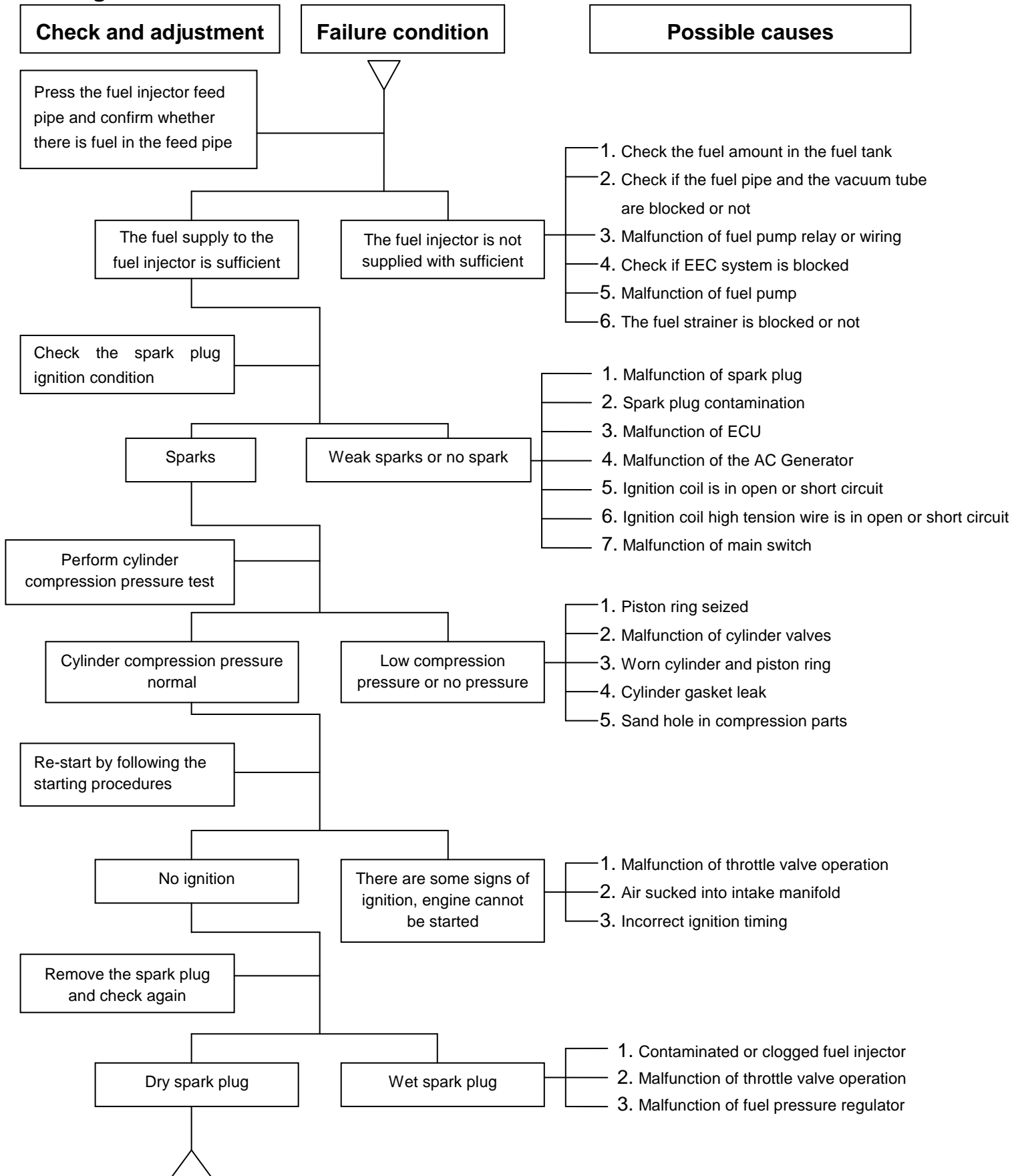
The torque values listed above are for more important tightening torque values. Please see standard values for those not listed in the table.

Standard Torque Values for Reference

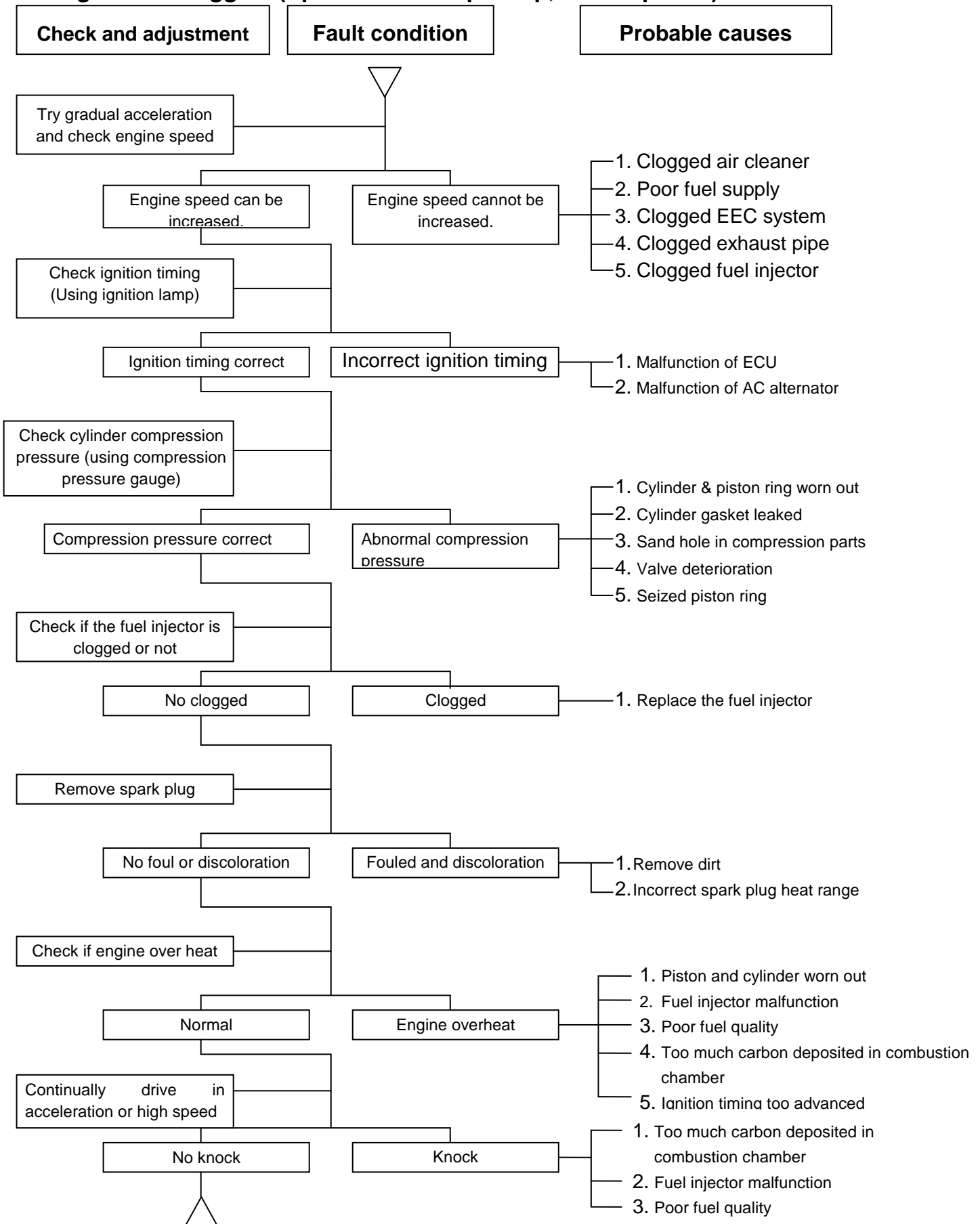
Type	Torque Value	Type	Torque Value
5 mm bolt, nut	0.45~0.6kgf-m	5 mm screw	0.35~0.5 kgf-m
6 mm bolt, nut	0.8~1.2 kgf-m	6 mm bolt, SH nut	0.7~ 1.1 kgf-m
8 mm bolt, nut	1.8~2.5 kgf-m	6 mm flange bolt, nut	1.0 ~1.4 kgf-m
10 mm bolt, nut	3.0~4.0 kgf-m	8 mm flange bolt, nut	2.4 ~3.0 kgf-m
12 mm bolt, nut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

Trouble Diagnosis

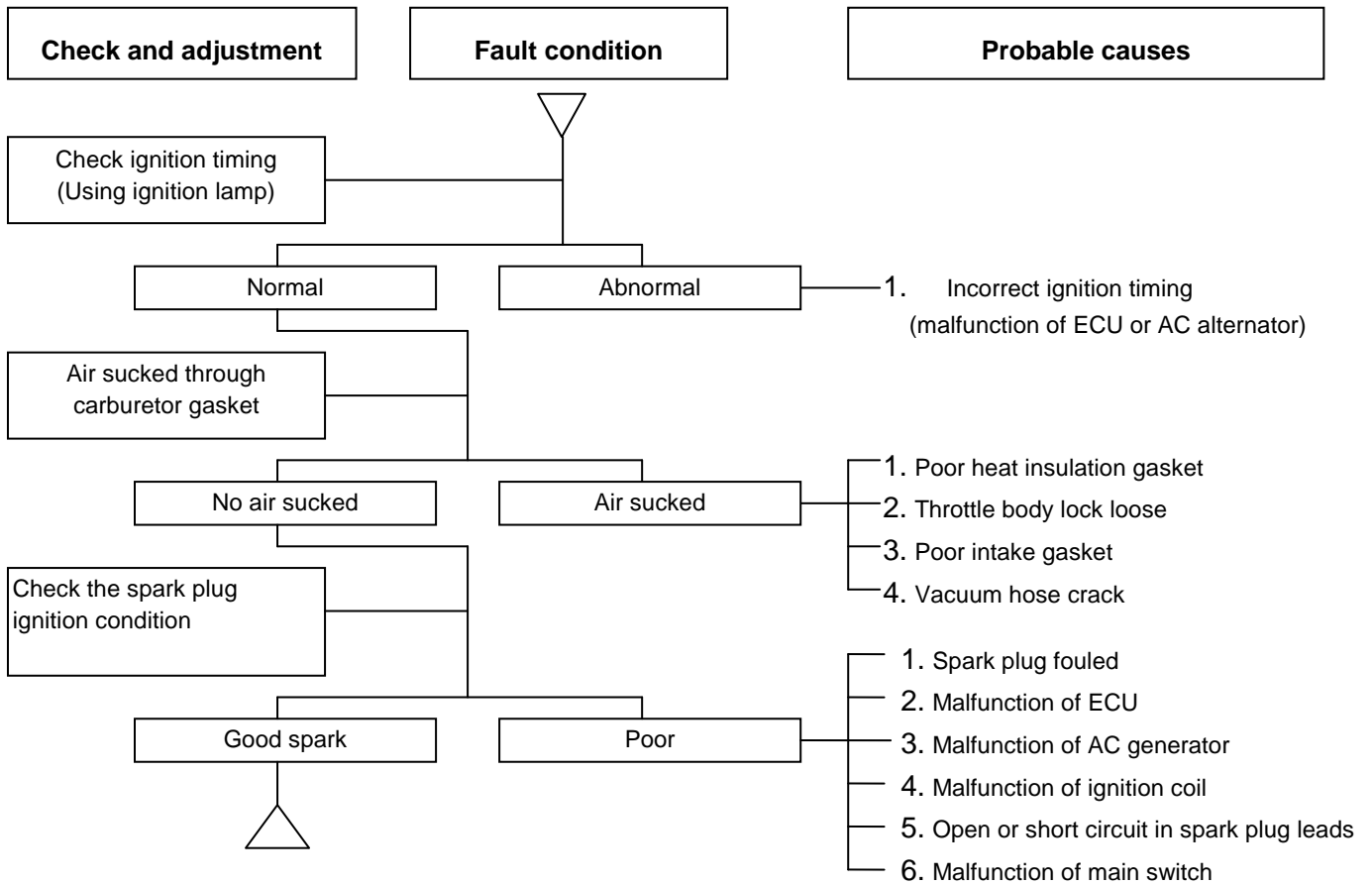
A. Engine hard to start or can not be started



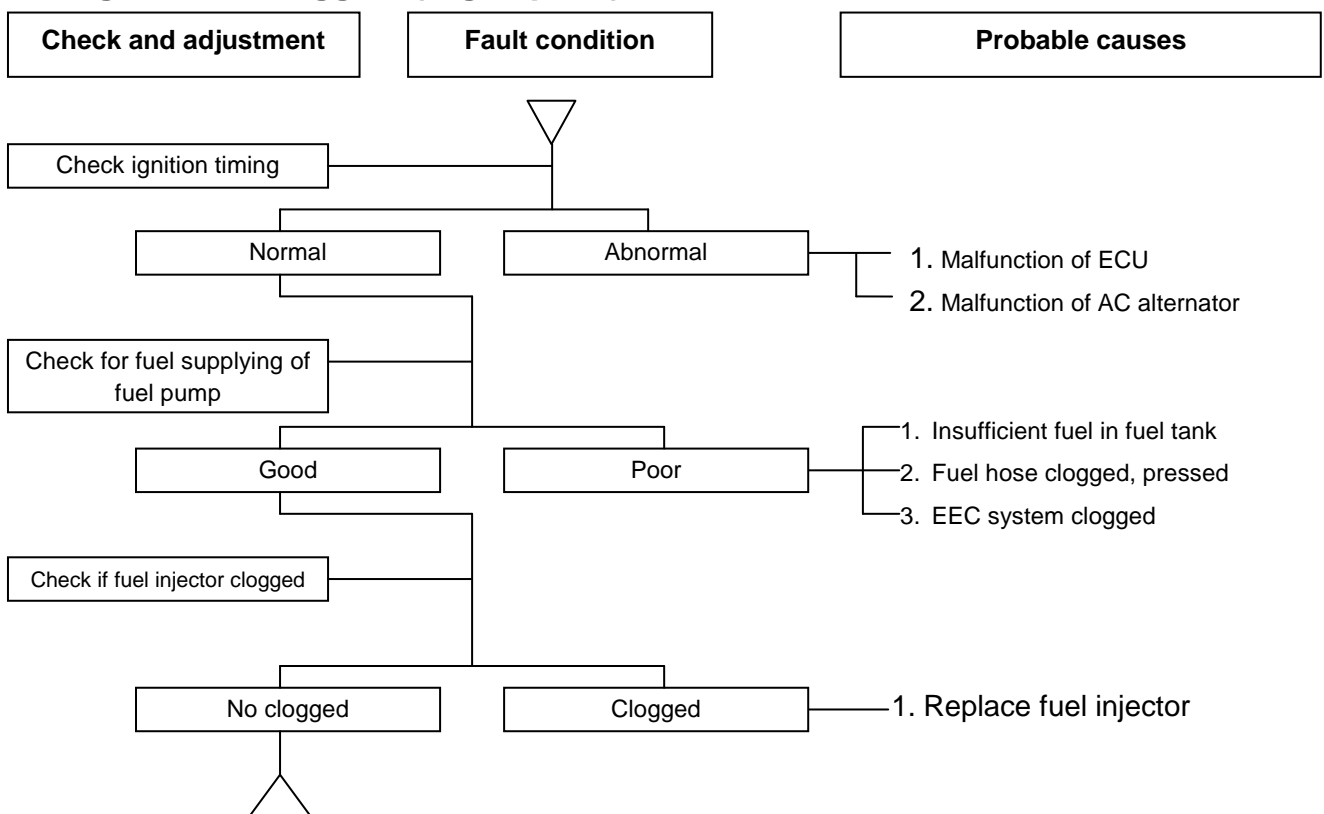
B. Engine run sluggish (Speed does not pick up, lack of power)



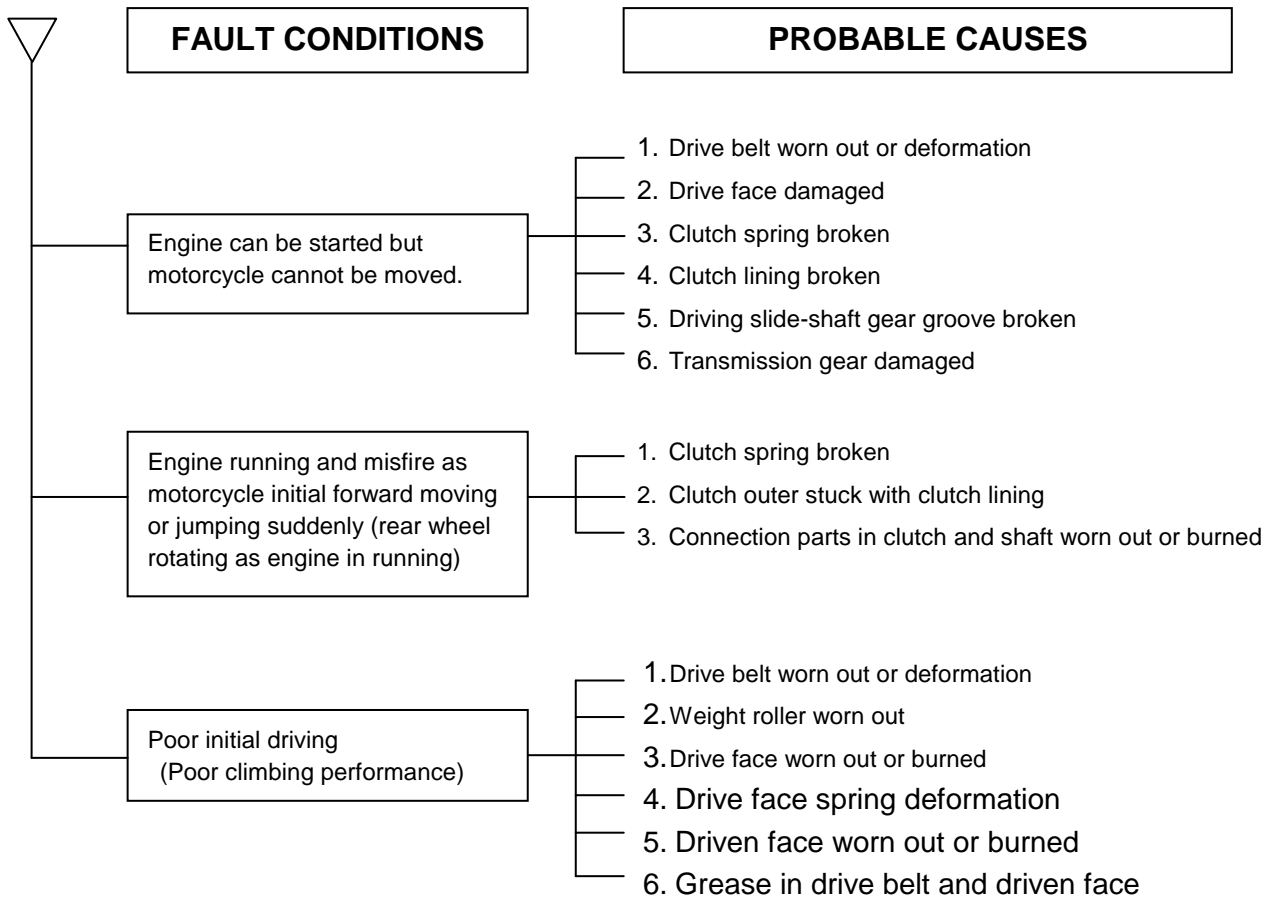
C. Engine runs sluggish (especially in low speed and idling)



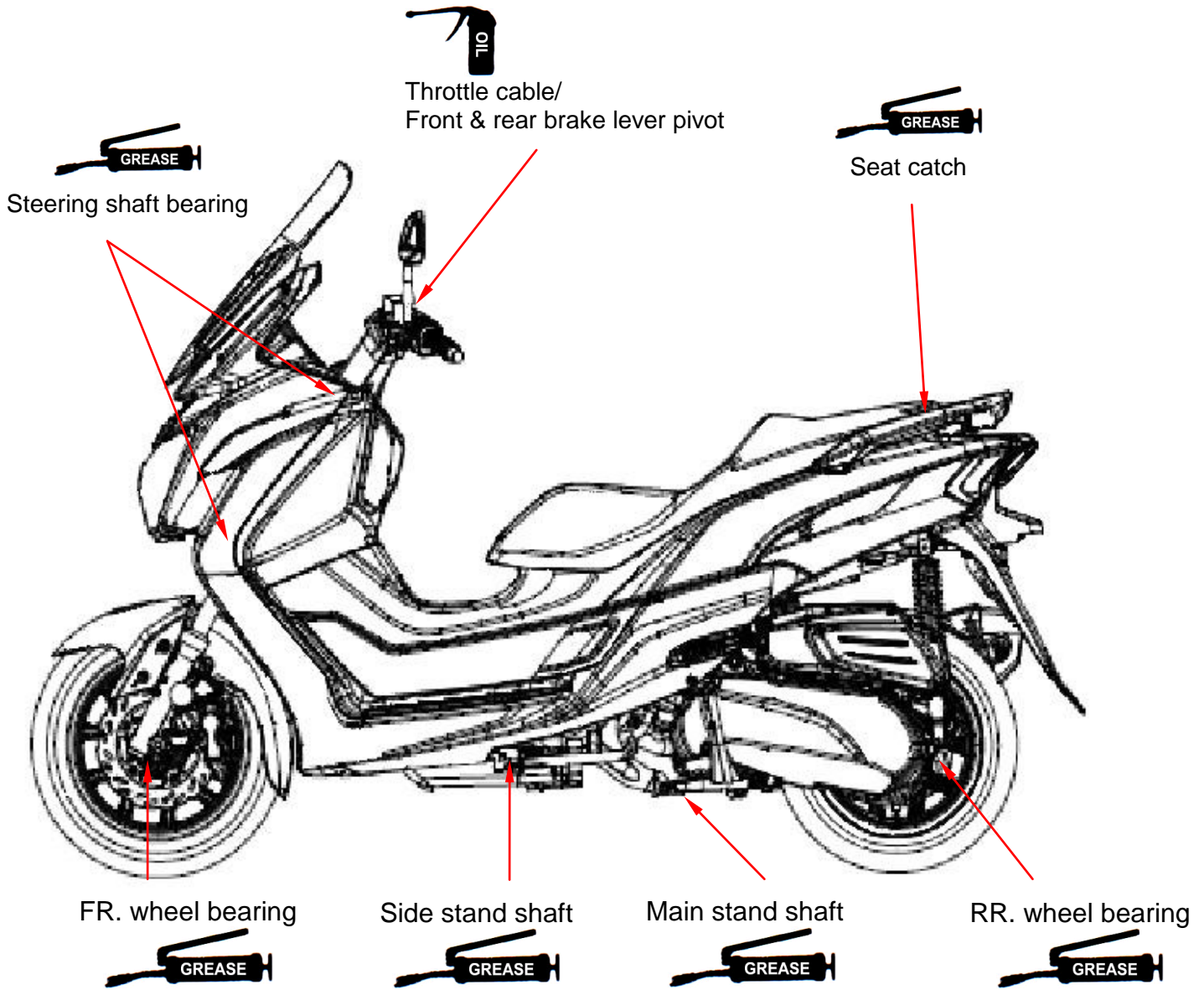
D. Engine runs sluggish (High speed)



E. Clutch, Driving And Driving Pulley



Lubrication Points



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Cylinder Compression Pressure 2-9	Special Tools List 2-15

Precautions in Operation Specification

Item		LW30W1-EU
Fuel Tank	capacity	12000c.c.
Engine Oil	capacity	1400 c.c.
	change	1200 c.c.
Transmission Gear oil	capacity	180 c.c.
	change	160 c.c.
Capacity of coolant	Engine + radiator	1400 c.c.
	Reservoir upper	200 c.c.
Clearance of throttle grip		2~6 mm
Spark plug		NGK CR8E gap: 0.6~0.7 mm
Timing advance idle speed		BTDC 10° / 1550 rpm
Full timing advanced		30°
Idling speed		1550 ± 100 rpm
Cylinder compression pressure		14.0 ± 2 kgf/cm ²
Valve clearance	IN/EX	0.10±0.02 mm / 0.15±0.02 mm
Tire dimension	Front	120 / 70 - 14 55P
	Rear	140 / 60 - 13 63P
Tire pressure	Single	Front: 1.8 kg/cm ² Rear: 2.3 kg/cm ²
	Load 90 KG (full load)	Front: 1.8 kg/cm ² Rear: 2.5 kg/cm ²
Battery		12V10Ah (MF battery) / GT12A-BS

Periodical Maintenance Schedule

No	Check items	First 1,000KM or 1 month	Every 1,000KM or 1 month	Every 5,000KM or 3 months	Every 10,000KM or 6 months	Every 15,000KM or 12 months	
1	☆ Air cleaner	I		C	R		
2	☆ 2nd air jet leaner	I			C	R	
3	☆ Fuel filter	I			R		
4	☆ Oil filter (metal mesh)	I			C		
5	☆ Engine oil change	R		R			
6	Tire pressure	I	I				
7	Battery inspection	I	I				
8	Brake & free play check	I	I				
9	Steering handle check	I			I/L		
10	Cushion operation check	I			I		
11	Every screw tightening check	I	I				
12	Gear oil check for leaking	I	I				
13	☆ Spark plug check or change	I		I	R		
14	☆ Gear oil change	R		R			
15	Frame lubrication				L	L	
16	☆ Exhaust pipe	I	I				
17	☆ Ignition timing	I	I				
18	☆ emission check in Idling	A	I				
19	☆ Throttle operation	I		I			
20	☆ Engine bolt tightening	I	I				
21	☆ CVT driving device(belt)				I	R	
22	☆ CVT driving device(roller)				C	C	
23	Lights/electrical equipment/multi-meters	I	I				
24	Main/side stands & springs	I/L			I/L		
25	Fuel lines	I		I			
26	Shock absorbers			I	I	I	
27	Cam chain	I		I			
28	☆ Valve clearance	I		A			
29	☆ Crankcase evaporative control system	I		C			
30	☆ Crankcase blow-by over-flow pipe	Drain over-flow oil from tube while engine oil change					
31	☆ 2nd air jet system	I		C			
32	☆ Evaporative control system			I			
33	Lines & connections in cooling system	I		I			
34	Coolant reservoir	I		I			
35	Coolant	I	Replace for every 1 year				
36	ECU input voltage				I		
37	EFI sensor coupler	I		I			

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

Have your motorcycle checked, adjusted, and recorded maintenance data periodically by your SYM Authorized Dealer to maintain the motorcycle at the optimum condition

The above maintenance schedule is established by taking the monthly 1,000 kilometers as a reference which ever comes first.

Remarks: 1. **These marks “☆” in the schedule are emission control items. According to EPA regulations, these items must be performed normally periodical maintenance following the user manual instructions. They are prohibited to be adjusted or repaired by unauthorized people. Otherwise, SYM is no responsible for the charge.**

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

Engine Oil Oil Capacity

⚠ Caution

- Turn off engine, and park the motorcycle in flat surface with main stand.
- Start engine and run for 3~5minutes, turn off engine for 3~5 minutes, then check the oil capacity.

Check oil level with oil level gauge (LW12 series) or oil level window (LW25&LW30 series).

Do not screw the level gauge into engine as checking.

If oil level is close to lower level, fill out recommended oil to upper level.

Oil Change

Turn off engine and remove oil level gauge or oil filler cap.

Place an oil pan under the motorcycle, and remove oil drain bolt.

After drained, make sure washer can be re-used. Install oil drain bolt.

Torque value: 3.5~4.5kgf-m

⚠ Caution

- Drain oil as engine warmed up so that make sure oil can be drained smoothly and completely.

Add oil to crankcase (oil viscosity SAE 10W-40) Recommended using “**SYMOIL**” engine oil.

Engine oil capacity:

Disassembly 1400 c.c.

Replacement 1200 c.c.

Install dipstick, start the engine for running several minutes.

Turn off engine, and check oil level again.

Check if engine oil leaks.

Engine Oil Strainer Clean

Drain engine oil out.

Remove oil strainer and spring.

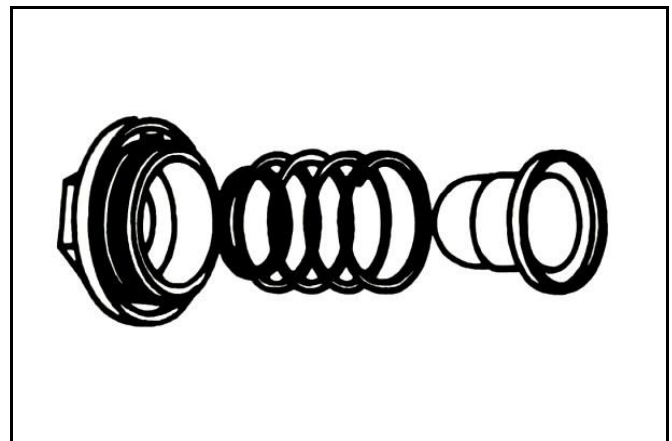
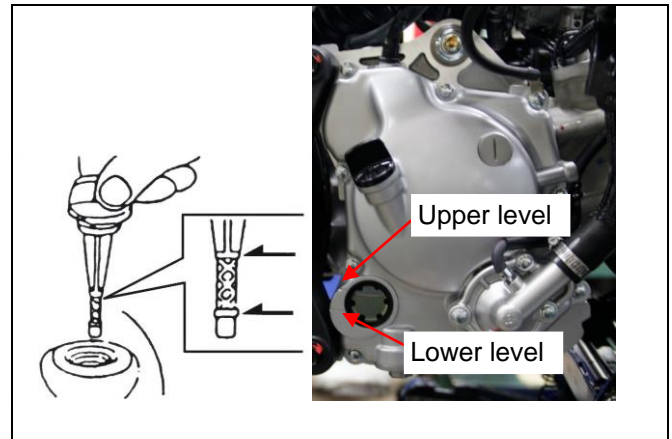
Clean oil strainer.

Check if O-ring can be re-used.

Install oil strainer and spring.

Install oil strainer cap.

Torque value : 1.0~2.0kgf-m



Gear Oil

Oil check

Check if there is leakage.

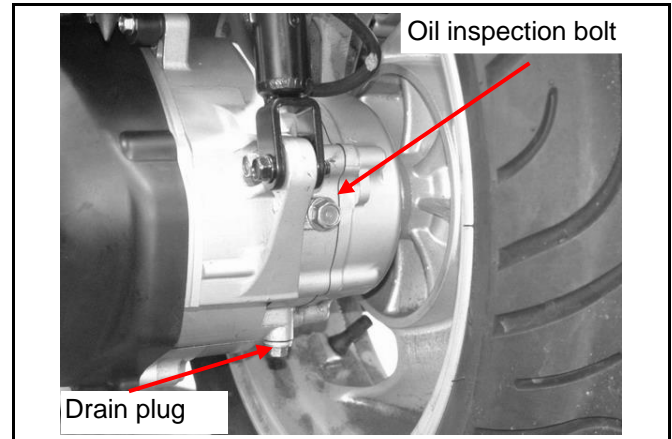
Park the motorcycle on flat surface with main stand.

Turn off the engine and remove oil inspection bolt.

Place a measuring cup under drain hole.

Remove drain plug and drain oil into measuring cup.

Check if there is sufficient oil.



Oil change

Remove drain plug and drain oil out.

Install the drain plug after drained.

Torque value: 0.8~1.2kgf-m

Caution

- Make sure that the bolt washer can be re-used.

Add gear oil to specified quantity from the inspection hole.

Install the inspection bolt.

Torque value: 1.0~1.4kgf-m

Gear Oil Quantity: 160 c.c.

Recommended: "SYMOIL" SAE 85W-140 GL-5

Fuel Lines / Cable

Remove luggage box.

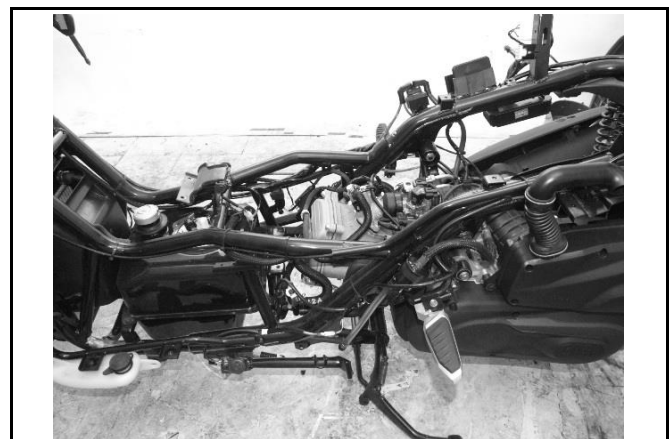
Remove rear carrier.

Remove body covers.

Check all lines, and replace when they are deteriorated, damaged or leaking.

Warning

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



Acceleration Operation

Have a wide open of throttle valve as handle bar in any position and release it to let back original (full closed) position.

Check handle bar if its operation is smooth.

Check acceleration cable and replace it if deteriorated, twisted or damaged.

Lubricate the cable if operation is not smooth.

Measure handle bar free play in its flange part.

Free play: 2~6 mm

Adjustment can be done in either end.

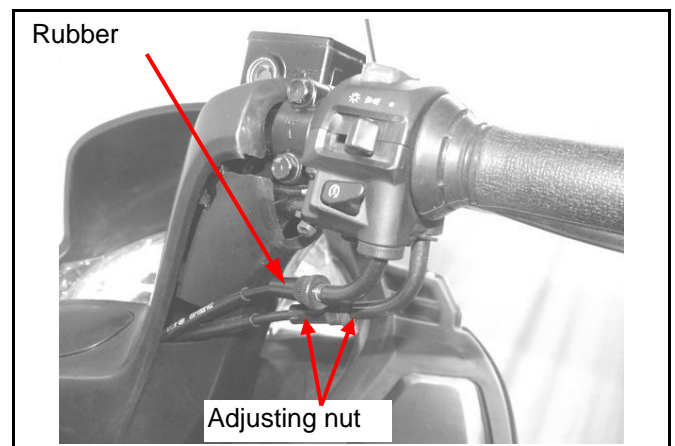
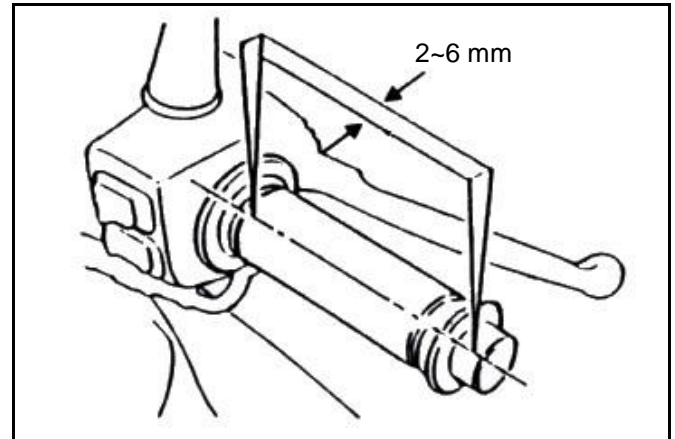
Secondary adjustment is conducted from top side.

Remove rubber boot, loosen fixing nut, and then adjust it by turning the adjustment nut.

Primary adjustment is conducted from bottom side.

Loosen fixing nut, and adjust by turning the adjustment nut.

Tighten the fixing nut, and check acceleration operation condition.



P.C.V. system

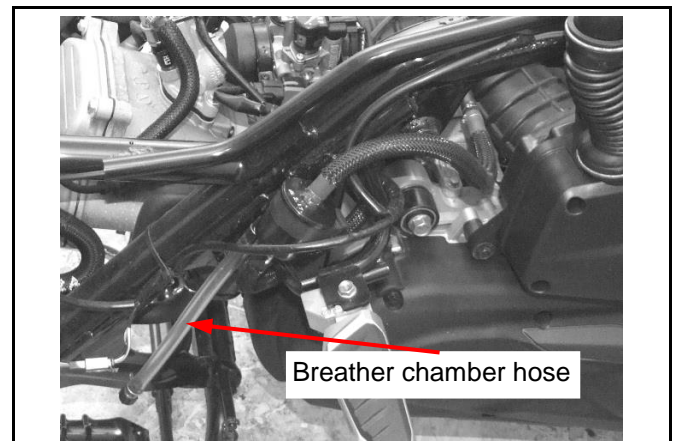
Remove the plug from lower of the breather chamber hose.

Release the dry internal deposit.

Drain every 2,000 KM.

⚠ Caution

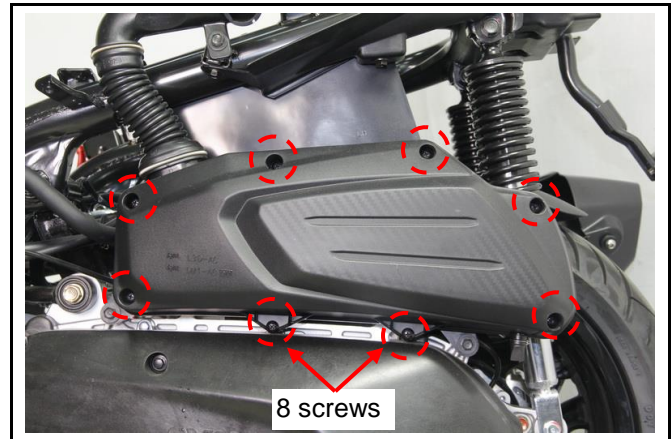
- Under rainy or full throttle riding mode, reduce the maintenance period.
- Deposit can be seen through breather chamber hose.



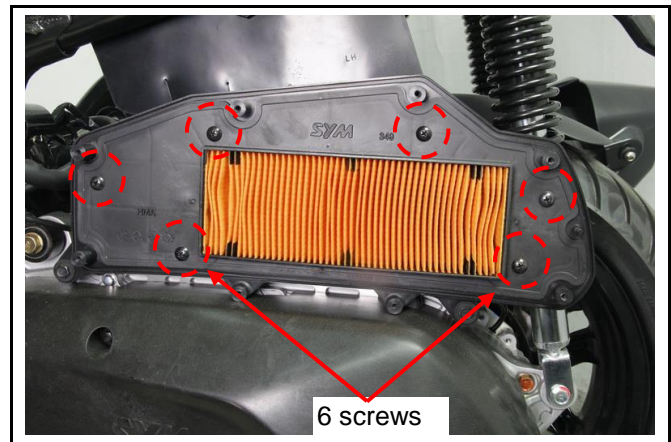
Air Cleaner

Air Cleaner Element

Remove 8 screws from the air cleaner cover and remove the cover.



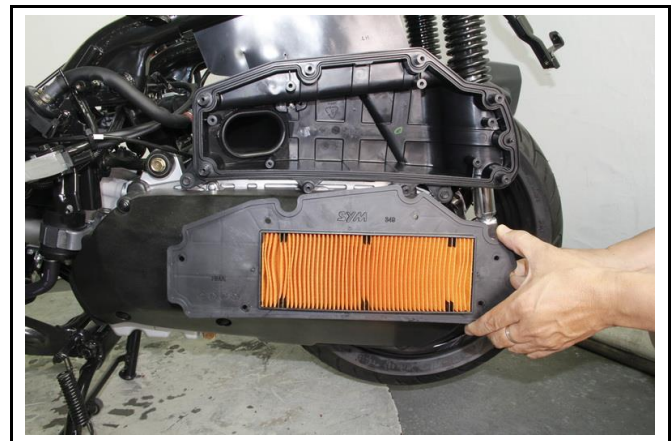
Remove 6 screws from the air cleaner element.



Remove the air cleaner element.
Check if the air cleaner element is contaminated or damaged.
Replace the air cleaner element if necessary.

Caution

- The air cleaner element is made of paper so do not soap it into water or wash it with water.



Valve Clearance

⚠ Caution

- Checks and adjustment must be performed when the engine temperature is below 35°C.

Remove luggage box and body covers.

Remove cylinder head cover & side cover.

Remove ignition timing hole cap located in front upper side of engine right cover.

Turn camshaft bolt in C.W. direction and let the "T" mark on the camshaft sprocket aligns 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.

Loosen fixing nut and turn the adjustment nut for adjustment.

Valve clearance

IN: 0.10 ± 0.02 mm.

EX: 0.15 ± 0.02 mm.

⚠ Caution

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

Special tool: Tappet adjuster

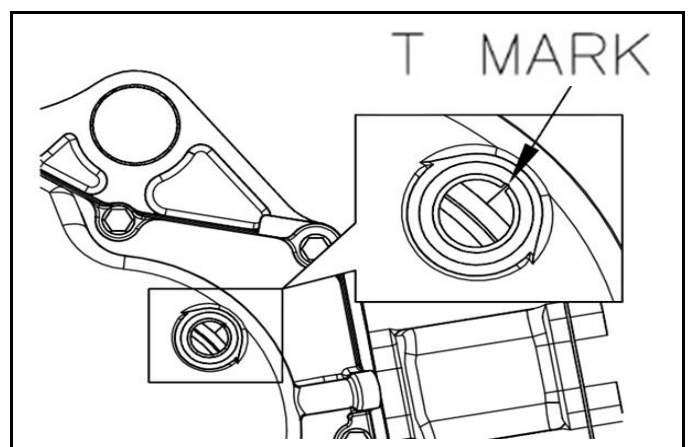
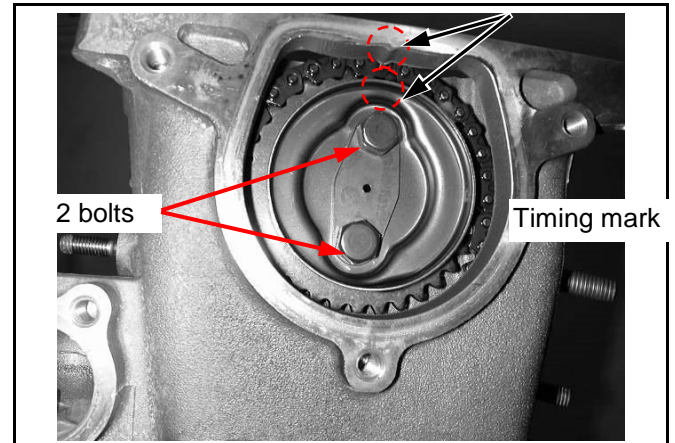
SYM-9001200-08

SYM-9001200-09

SYM-9001200-10

Special tool: Tappet adjuster wrench

SYM-9001200



Ignition system

Ignition timing

⚠ Caution

- Ignition system is set by factory and cannot be adjusted.
- Ignition timing check is to confirm the function of ECU.

Remove right side cover.

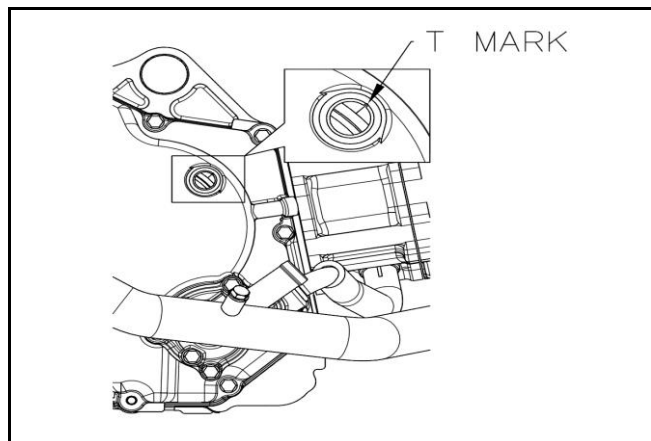
Remove ignition timing check cap on right crankcase cover.

Check ignition timing.

Start engine to idle speed, if the mark is aligned with timing, the ignition timing is correct.

Increase to 6,000 rpm and check mark. If the mark is between “II”, it is correct.

If the ignition timing is not correct, check ECU, flywheel, and CPS. Replace the parts if necessary.



Spark Plug

Recommended spark plug: CR8E

Remove luggage box

Remove central cover.

Remove spark plug cap.

Clean dirt around the spark plug hole.

Remove spark plug.

Measure spark plug gap.

Spark plug gap: 0.6~0.7mm

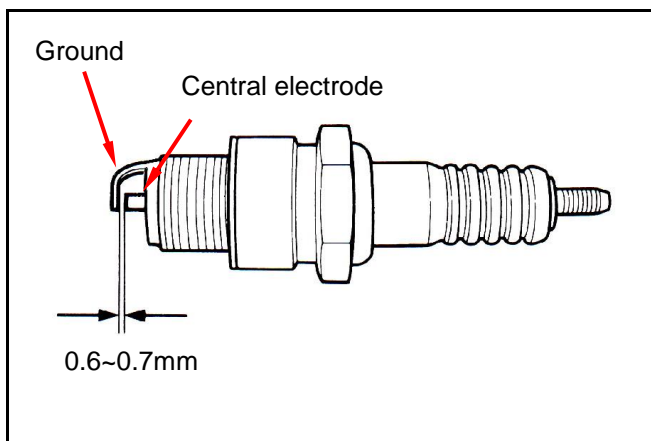
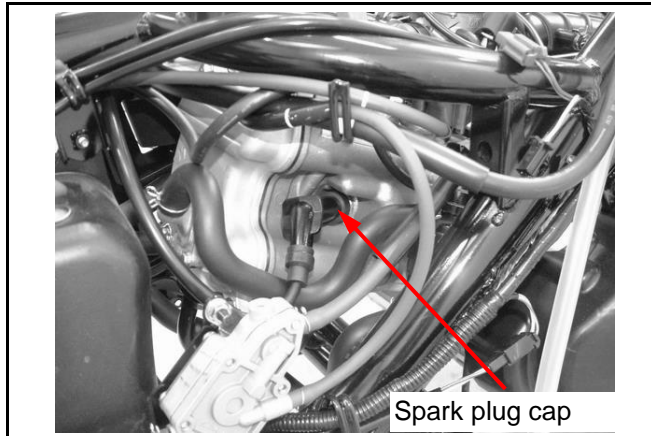
Carefully bend ground electrode of the plug to adjust the gap if necessary.

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: 1.0~1.2kgf-m

Connect spark plug cap.



Cylinder Compression Pressure

Warm up engine. Turn off the engine.

Remove luggage box and central cover

Remove spark plug cap and spark plug.

Install compression gauge.

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

⚠ Caution

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

Compression pressure: $14.0 \pm 2 \text{ Kg/cm}^2$

Check following items if the pressure is too low:

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

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

Drive Belt

Remove mounting bolt located under air cleaner.

Remove the engine left side cover and the cover.

Check if the belt is cracked or worn out.

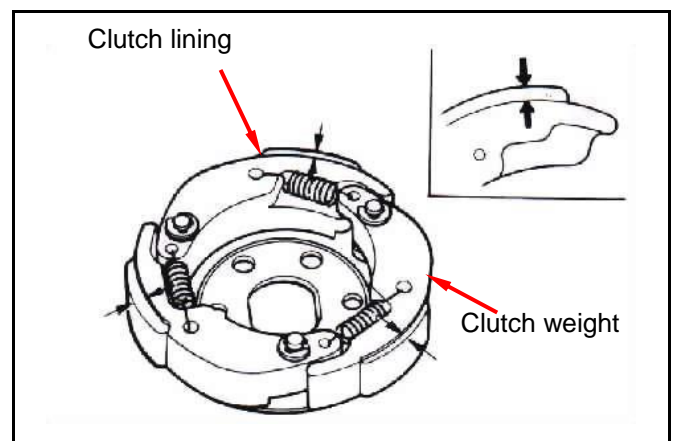
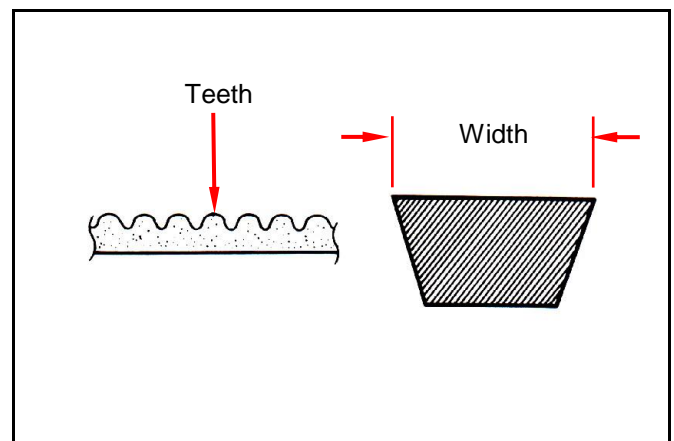
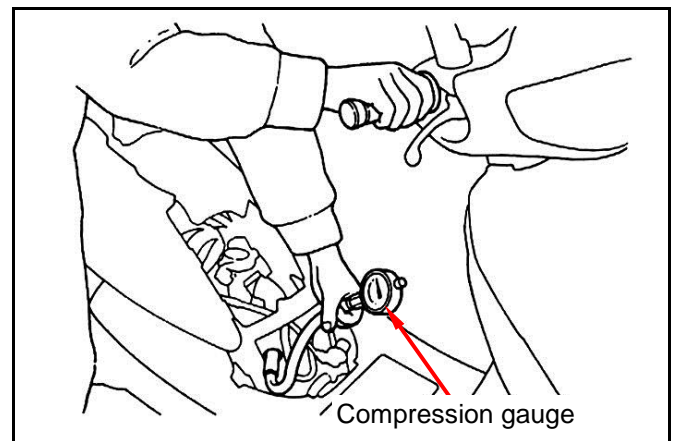
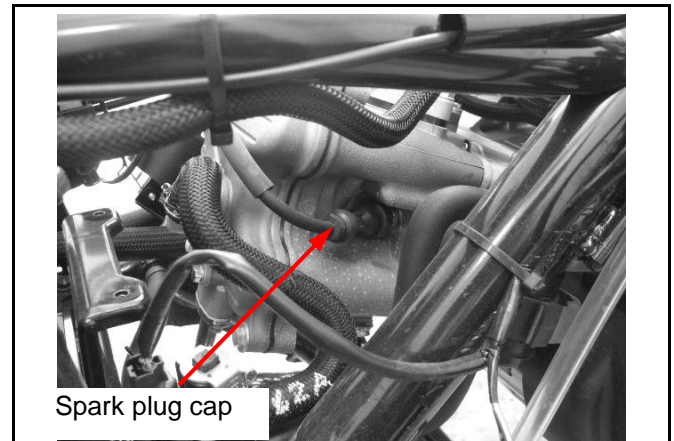
Replace the belt if necessary or in accord with the periodical maintenance schedule.

Width limit: 22.5 mm or above

Clutch Disc Wear

Run the motorcycle and increase throttle valve opening gradually to check clutch operation.

If the motorcycle is in forward moving and shaking, check clutch disc condition. Replace it if necessary.



Steering Handle Top Bearing

⚠ Caution

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

Lift the front wheel out of ground.

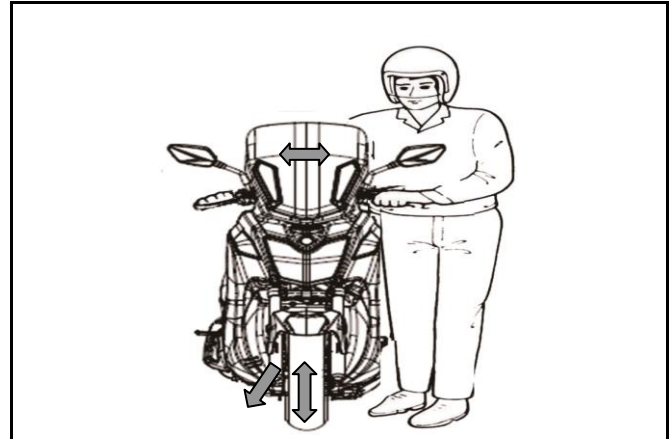
Turn handle from right to left alternative and check if turning is smoothly.

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

Cushion

⚠ Caution

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



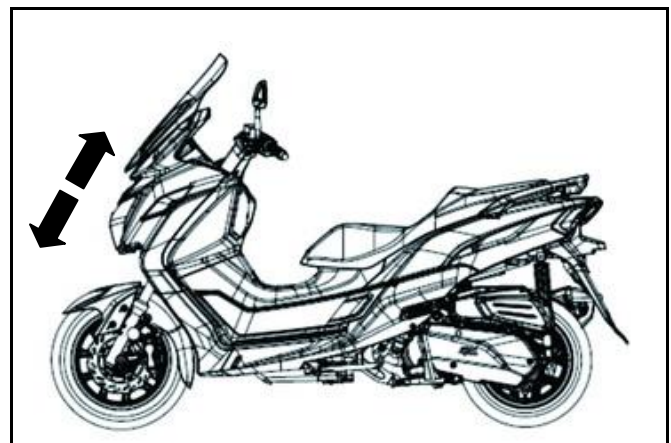
Front cushion

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

Check if there is damage.

Replace relative parts if damage is found.

Tighten all nuts and bolts.



Rear Cushion

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

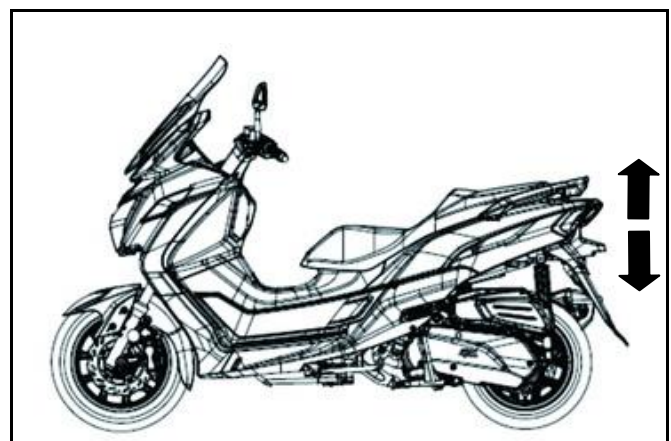
Check if there is damage.

Replace relative parts if damage is found.

Park the scooter with main stand.

Start the engine and accelerate gradually to rotate the rear wheel, check if the engine is loose or vibrating abnormally. Replace the bushing if it is worn.

Tighten all nuts and bolts.



Disk Brake System Brake System Hose

Check if the brake hose is corroded or damaged. And check if the brake system is leaking.

Brake Fluid

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

⚠ Caution

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

Air Bleed Operation

Tighten the drain valve, and add brake fluid to **UPPER** limit.

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

⚠ Caution

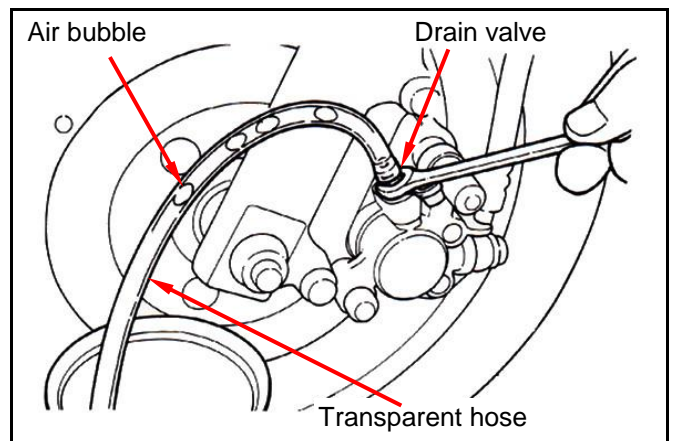
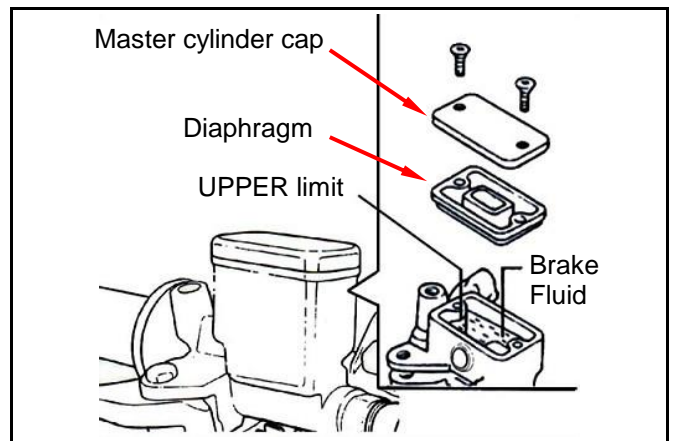
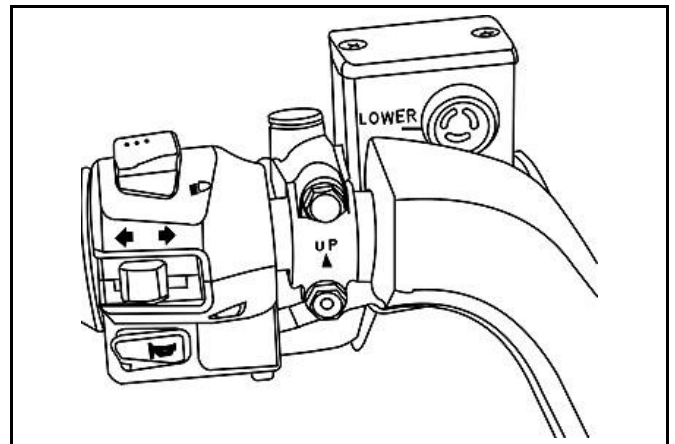
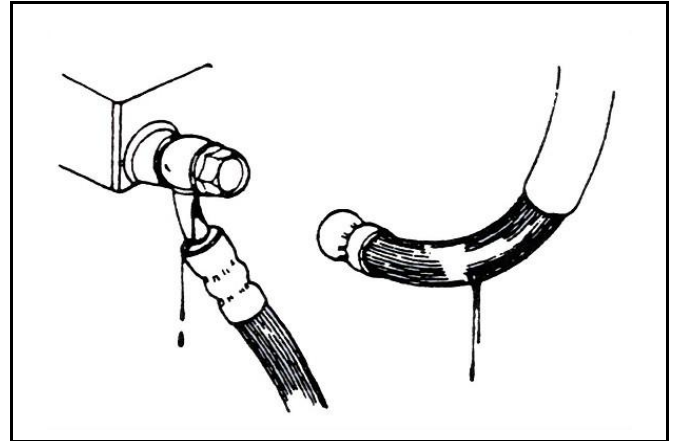
- Before closing the air bleed valve, do not release the brake lever.

Add Brake Fluid

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

⚠ Caution

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



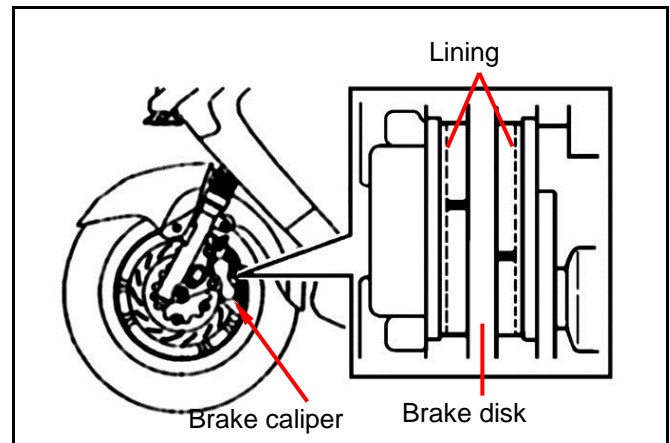
Brake Lining Wear

The indent mark on brake lining is the wear limitation.

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

⚠ Caution

- It is not necessary to remove brake hose when replacing the brake lining.



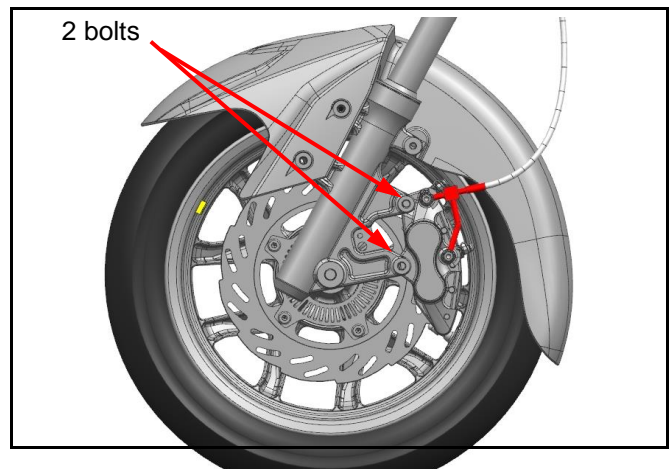
Replace Brake Lining

Remove the brake clipper bolts, and take out the caliper.

⚠ Caution

- Do not operate the brake lever after the clipper removed to avoid clipping the brake lining.

Pry out the brake lining with a flat driver if lining is clipped.

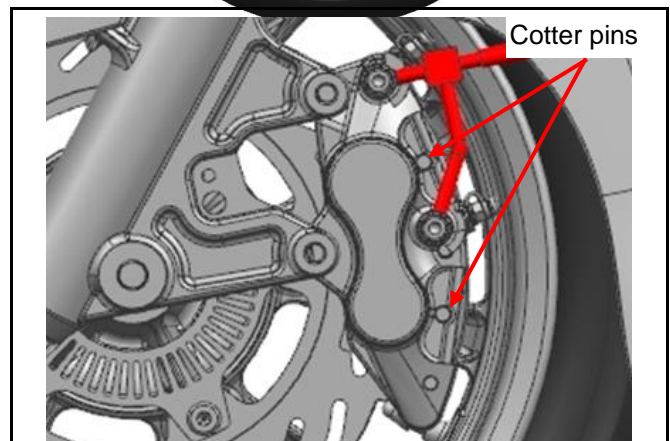


Remove 2 cotter pins

Remove the brake pad shafts and pads.

⚠ Caution

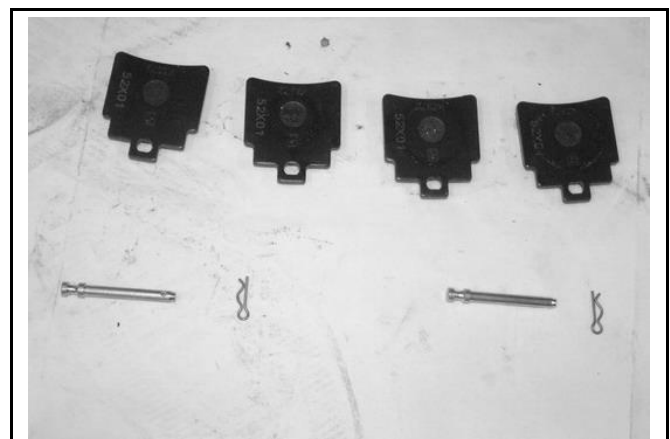
- In order to maintain brake power balance, the brake lining must be replaced with one set.



Brake Performance Check

⚠ Caution

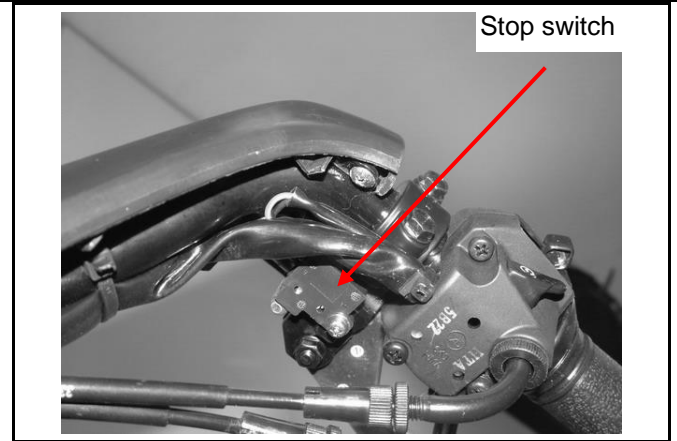
- After replacing the brake lining, check if front and rear brake function normally.



Brake Light Switch / Start Switch

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

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



Wheel / Tire

Check if the front and rear tire pressure is correct.

⚠ Caution

- Tire pressure check should be done as cold.

Standard tire pressure

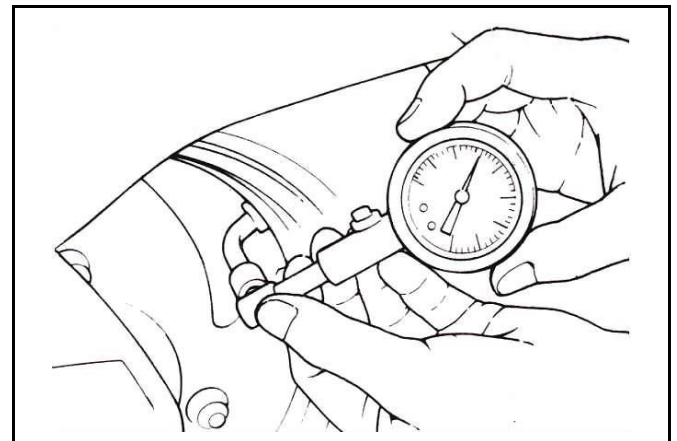
Tire		Front	Rear
Tire pressure as cold (Kg/cm ²)	Single	1.8	2.3
	2 persons with full loaded	1.8	2.5

Standard tire Front: 120/70-14 55P

Rear: 140/60-13 63P

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

Check if tire surface and sidewall is torn or worn, replace the tire if necessary.



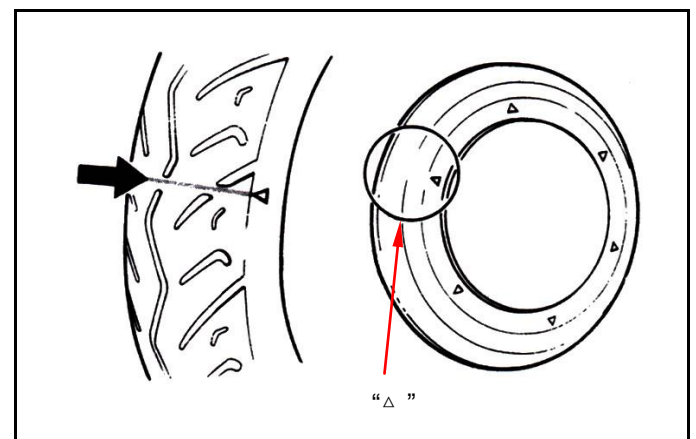
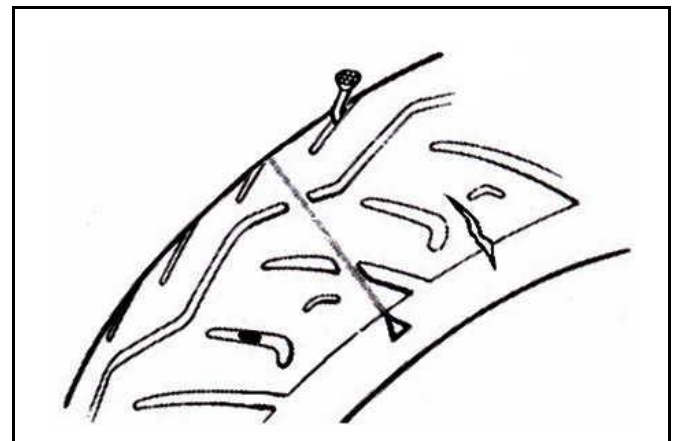
Replace the tire if the tire tread depth is not come with following minimum tire tread depth.

Front tire: 1.5 mm

Rear tire: 2.0 mm

⚠ Caution

- Tread wear indicators "△" are located around the sidewall.



Battery

Battery removal

Open the inner box lid.

Loosen screw & remove the battery cover

Battery cable removal:

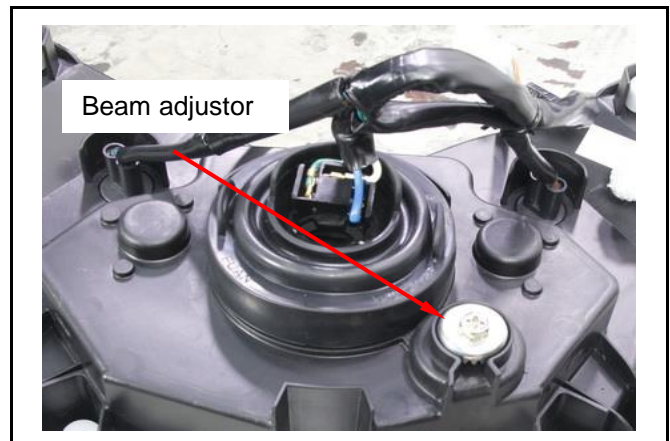
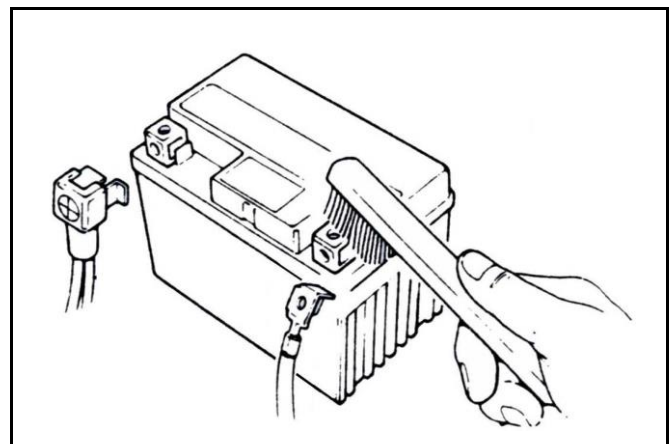
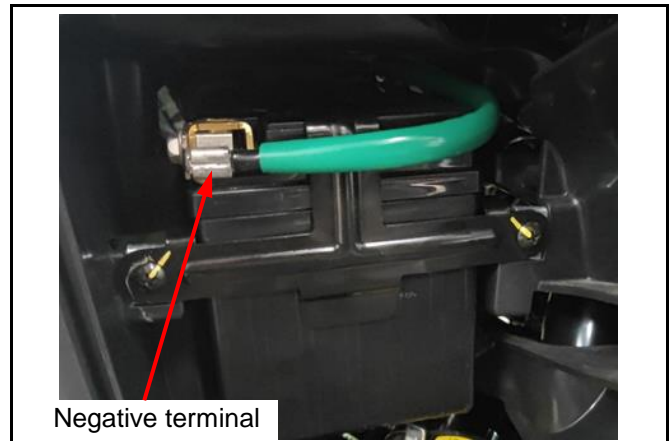
1. Disconnect the cable negative terminal (-),
2. Then the cable positive terminal (+).
3. Remove the battery from the motorcycle.

If there is rust on battery posts, clean it with steel brush.

Install the battery in the reverse procedures of removal.

Caution

- If there is too much rust on the posts, spray some hot water on the posts. Then, clean it with steel brush so that rust can be removed more easily.
- Apply some grease on the posts to prevent from rust again.



Headlight Distance Adjustment

Turn on main switch

Turn the headlight adjustment screw to adjust headlight beam.

Caution

- Adjust the headlight beam by following related regulations.
- Improper headlight beam adjustment will make in coming driver dazzled or insufficient lighting.

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 (pipe) clamps, and wire holders for security.

SPECIAL TOOL LIST



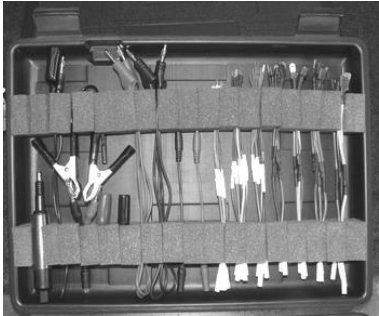



					
NAME	LEFT CRANK BRG PULLER	NAME	R/L CRANKCASE DISSASSEMBLE TOOL	NAME	VALVE COTTER REMOVE & ASSEMBLY TOOL
NO	SYM-9100100	NO	SYM-1120000-HMA H9A	NO	SYM-1471110/20
					
NAME	L CRANK SHAFT PULLER	NAME	TAPPET ADJUSTING WRENCH	NAME	TAPPET ADJUSTING TOOLS
NO	SYM-1130000-HMA H9A	NO	SYM-9001200	NO	SYM-1472100
					
NAME	R CRANKCASE BRG 6201 ASSEMBLE TOOL	NAME	LEFT CRANKSHAFT & OIL SEAL ASSEMBLY SOCKET	NAME	ROCKER ARM SHAFT DISASSEMBLE TOOL
NO	SYM-1130000-HMA H9A	NO	SYM-1332100-HMA	NO	SYM-1445100-ALL
					
NAME	BRG DRIVER 6204	NAME	ASSEMBLY DIRECTS PULLER	NAME	DRIVE SHAFT PULLER
NO	SYM-9110400	NO	SYM-2341110	NO	SYM-2341110-HMA

2. Maintenance Information



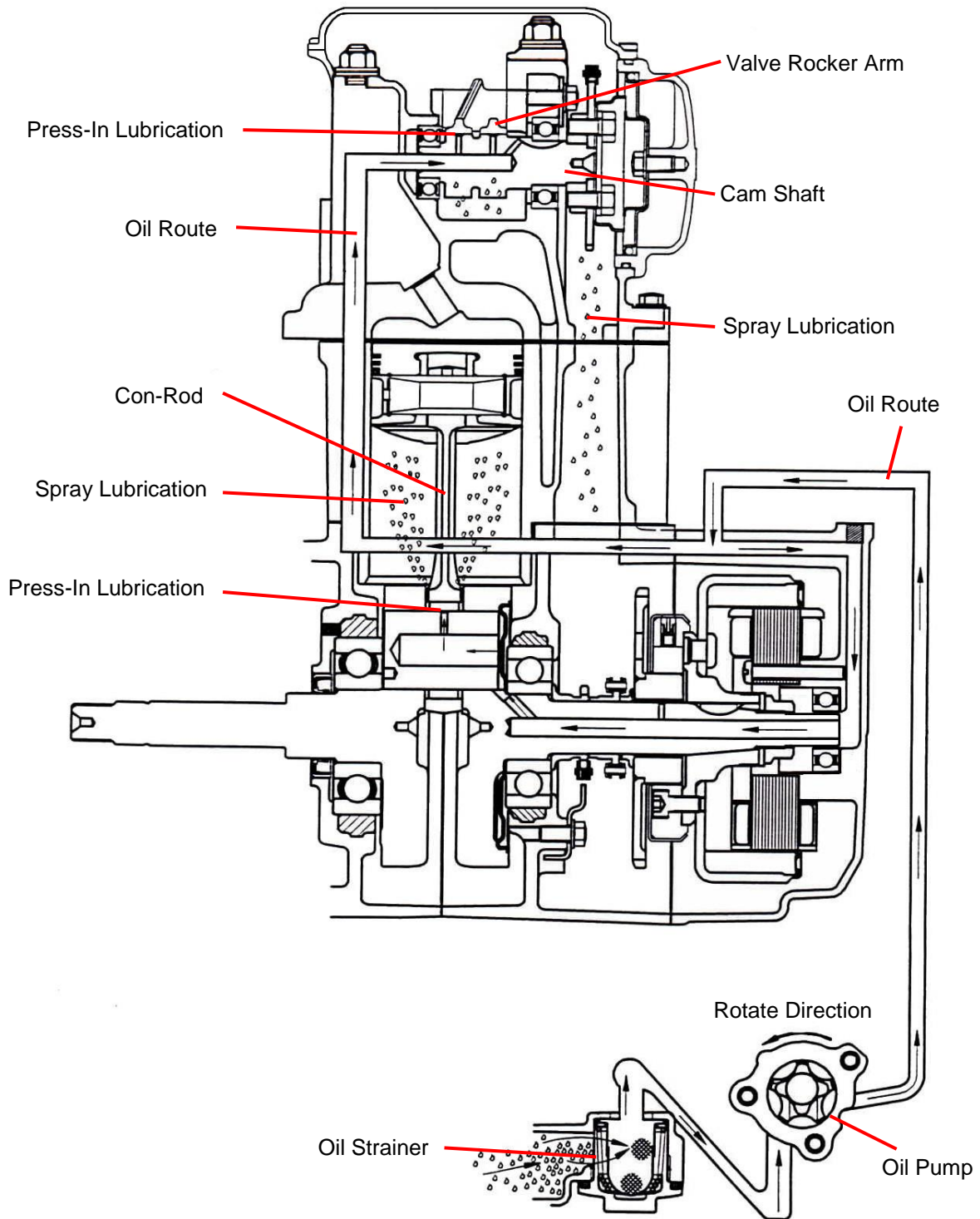
					
NAME	INNER BEARING PULLER	NAME	OUTER BEARING PULLER	NAME	STEERING HEAD TOP THREAD WRENCH
NO	SYM-6204022	NO	SYM-6204010	NO	SYM-5320000
					
NAME	39-46 CLUTCH NUT WRENCH	NAME	UNIVERSAL HOLDER	NAME	ACG FLYWHEEL PULLER
NO	SYM-9020200	NO	SYM-2210100	NO	SYM-3110000-HMA
					
NAME	STEERING HEAD TOP THREAD WRENCH SET	NAME	COUNTER SHAFT BRG DRIVER	NAME	BRG INSTALL PULLER
NO	SYM-5320010	NO	SYM-9100200-HMA HK1516	NO	SYM-9100400 HMA RA1
					
NAME	AIR OPERATED BRG PULLER	NAME	OIL SEAL 34*52*5 DRIVER	NAME	R. CRANKCASE COVER BRG 6201 PULLER
NO	SYM-9100410-400 A6205	NO	SYM-9125500-HMA	NO	SYM-9614000-HMA RBI 6201

					
NAME	BRG 6205 DRIVER	NAME	DRIVE SHAFT & OIL SEAL DRIVER	NAME	BRG 6303 PULLER
NO	SYM-9615000-6205	NO	SYM-9120200-HMA	NO	SYM-6303000-HMA H9A 6303
		 (Ø30mm)		 (Ø22mm)	
NAME	BRG 6201 DRIVER	NAME	CRANKCASE BUSH PULLER 30mm	NAME	CRANKCASE BUSH PULLER 22mm
NO	SYM-9614000-6201	NO	SYM-1120310	NO	SYM-1120320
					
NAME	WATER PUMP MECHANICAL SEAL DRIVER	NAME	WATER PUMP BRG DRIVER 6901	NAME	WATER PUMP OIL SEAL 12*20*5 DRIVER
NO	SYM-1721700-H9A	NO	SYM-9100100	NO	SYM-9120500-H9A
					
NAME	EFI DIAGNOSTIC TOOL	NAME	FUEL PRESSURE GAUGE	NAME	MULTI-METER
NO		NO	SYM-HT07010	NO	SYM-HE07007-01

					
NAME	VACUUM PRESSURE GAUGE	NAME	CLAMP METER	NAME	TESTING WIRE SET
NO	SYM-HT07011	NO	SYM-HE07009	NO	SYM-HE07014
					
NAME	EFI PLIERS SET	NAME	VEHICLE CIRCUIT TEST TOOL KIT	NAME	COMPRESSION GAUGE
NO	SYM-1768100 SYM-1768110 SYM-1950500	NO	SYM-HE170009	NO	SYM-HT07013

Mechanism Diagram	3-1	Engine Oil Strainer Clean	3-3
Precautions in Operation	3-2	Oil Pump	3-4
Troubleshooting	3-2	Gear Oil	3-7
Engine Oil	3-3		

Mechanism Diagram



Precautions in Operation

General Information:

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

Specifications

Engine oil capacity Disassembly 1400 c.c.
Replacement 1200 c.c

Oil viscosity SAE 10W-40

Recommended: "SYMOIL" series

Gear oil capacity

Disassembly 180 c.c.

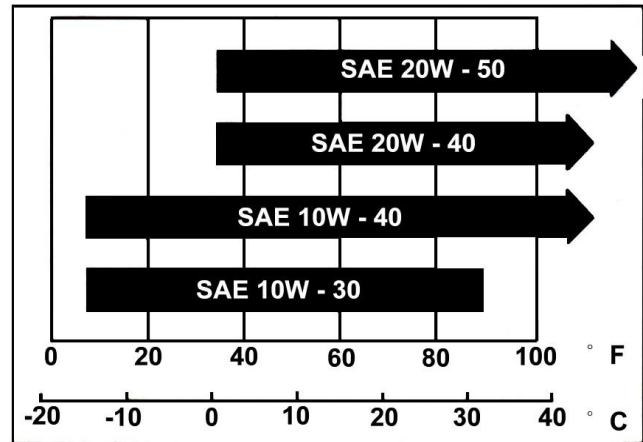
Replacement 160 c.c.

Gear oil viscosity SAE 85W-140

Recommended: "SYMOIL" SAE 85W-140

GL-5

Engine oil viscosity



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

Oil strainer cap	1.0~2.0kgf-m
Engine oil drain plug bolt	3.5~4.5kgf-m
Gear oil drain bolt	0.8~1.2kgf-m
Gear oil inspection bolt	1.0~1.4kgf-m
Oil pump connection screw	0.1~0.3kgf-m

Troubleshooting

Low engine oil level

- Oil leaking
- Valve guide or seat worn out
- Piston ring worn out

Low oil pressure

- Low engine oil level

- Clogged in oil strainer, circuits or pipes
- Oil pump damage

Dirty oil

- No oil change periodically
- Cylinder head gasket damage
- Piston ring worn out

Engine Oil

Turn off engine, and park the scooter in flat surface with main stand.

Check oil level with oil dipstick.

Do not screw the dipstick into engine as checking. If oil level is near low level, fill in recommended oil to upper level.

Oil Change

Caution

Drain oil as engine warmed up so that makes sure oil can be drained smoothly and completely.

Place an oil pan under the scooter, and remove oil drain bolt.

After draining, make sure washer can be re-used.

Install oil drain bolt.

Torque value: 3.5~4.5kgf-m

Engine Oil Strainer Clean

Remove oil strainer cap.

Remove oil strainer and spring.

Clean oil strainer.

Check if O-ring can be re-used.

Install oil strainer and spring.

Install oil strainer cap.

Torque value : 1.0~2.0kgf-m

Add oil to crankcase (oil viscosity SAE 10W-40) ("SYMOIL" recommended).

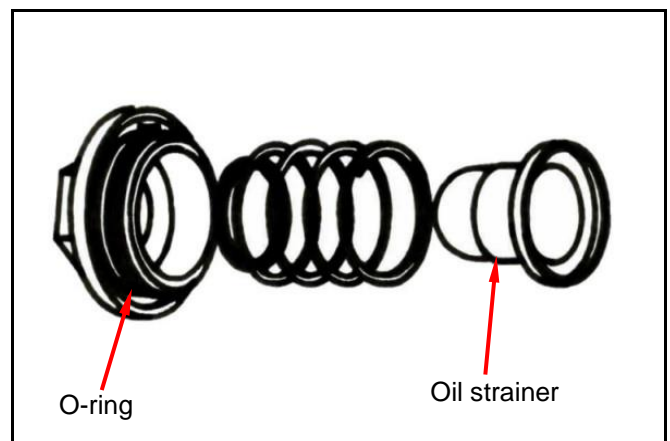
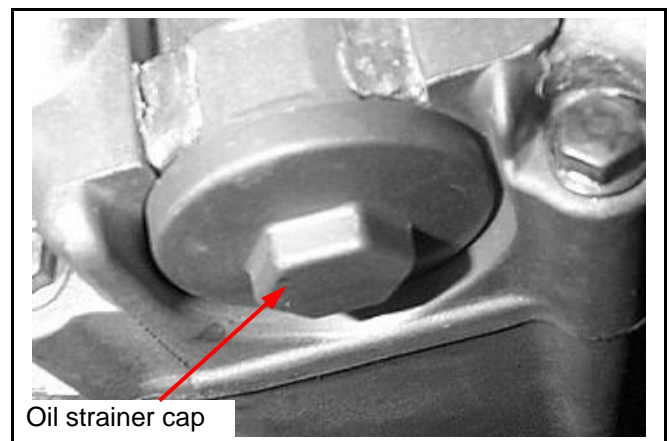
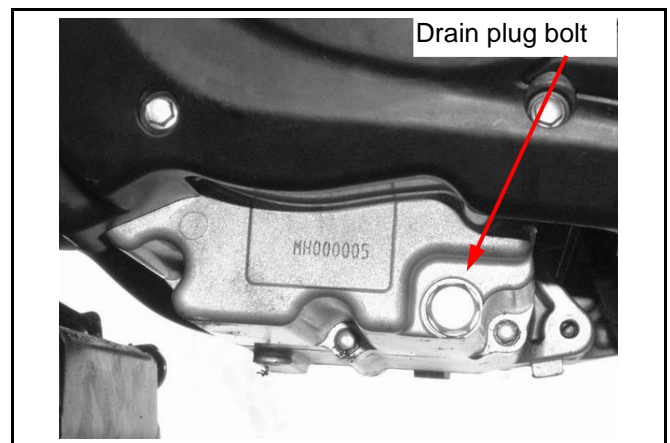
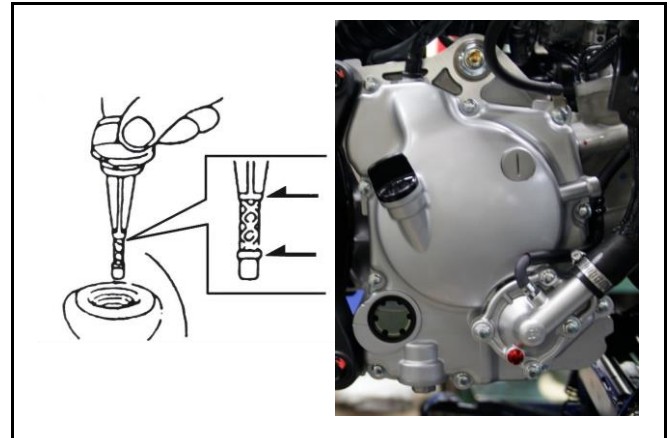
Engine oil capacity: 1200c.c. when replacing

Reset the oil check indicator.

Install dipstick, start the engine for running several minutes.

Turn off engine, and check oil level again.

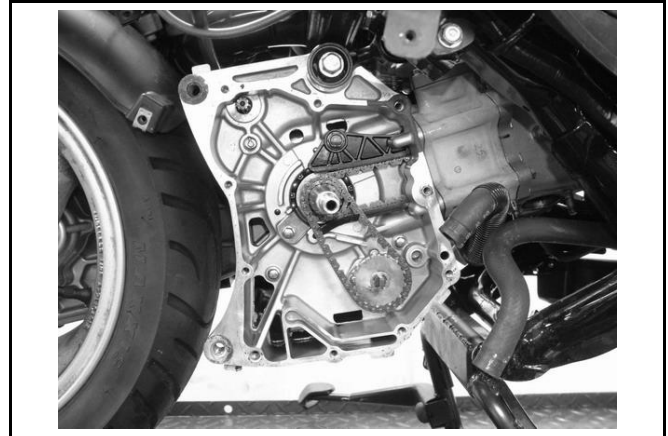
Check if engine oil leaks.



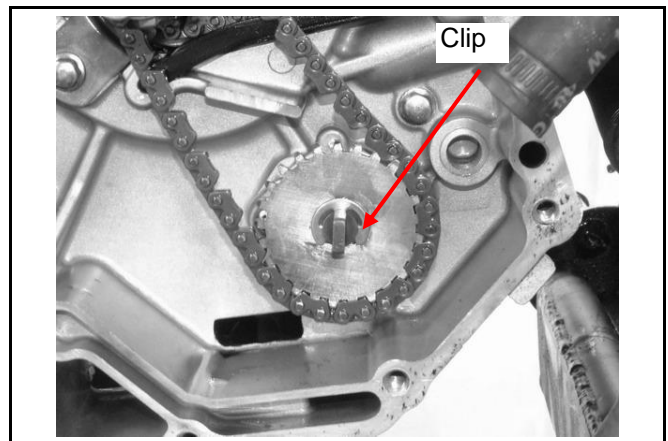
Oil Pump

Oil Pump Removal

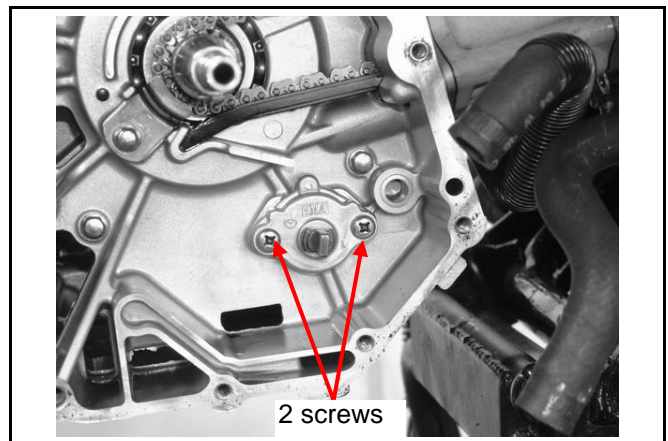
Remove generator and starting gear. (Refer to chapter 10)



Remove circlip and take out oil pump driving chain and sprocket.

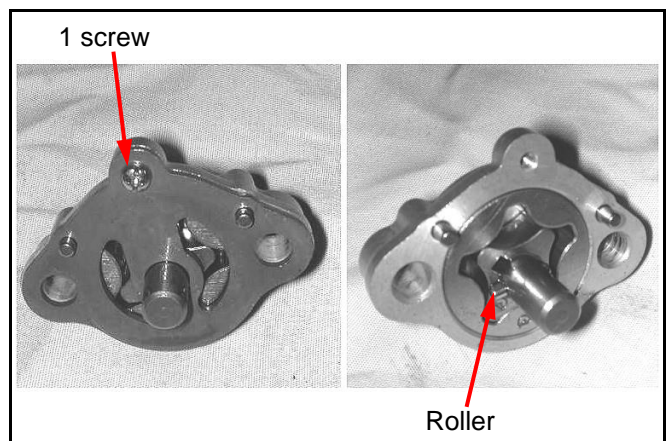


Make sure that pump shaft can be rotated freely. Remove 2 screws on the oil pump, and then remove oil pump.



Oil Pump Disassembly

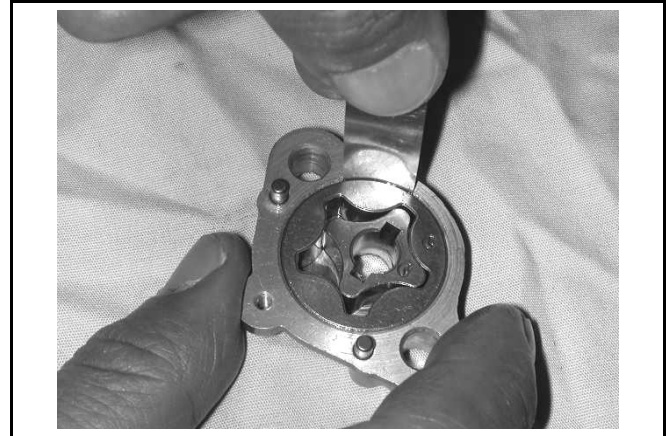
Remove the screw on oil pump cover and remove the cover.
Remove oil pump shaft roller and shaft.



Oil Pump Inspection

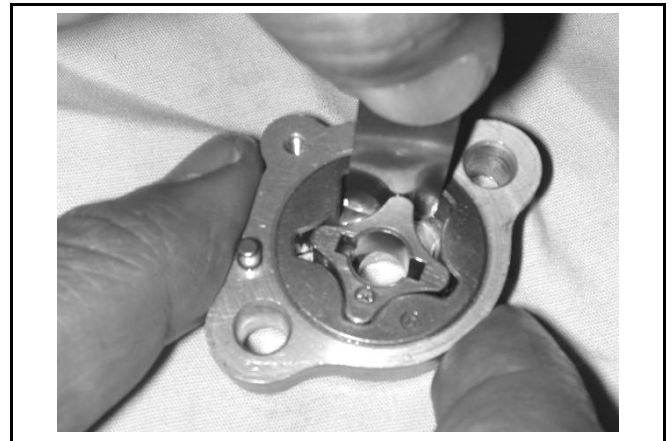
Check the clearance between oil pump body and outer rotor.

Limit: 0.25 mm



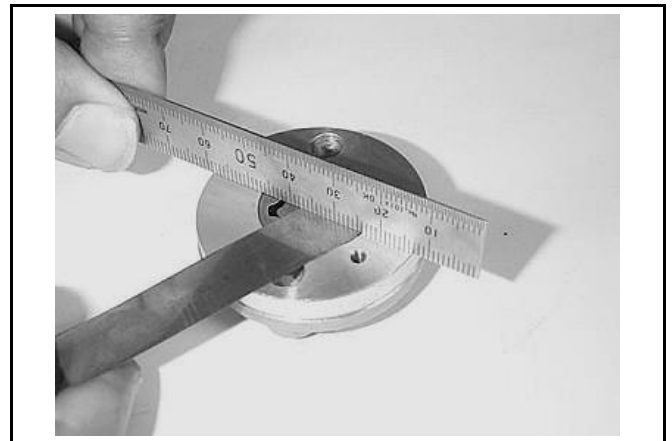
Check clearance between inner and outer rotors.

Limit: 0.20 mm



Check clearance between rotor side face and pump body

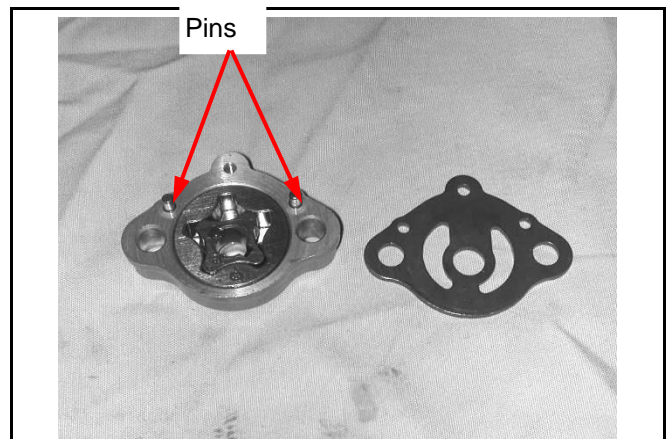
Limit: 0.12 mm

**Oil Pump Re-assembly**

Install inner and outer rotors into the pump body.
Align the indent on driving shaft with that of inner rotor.

Install the oil pump shaft and roller.

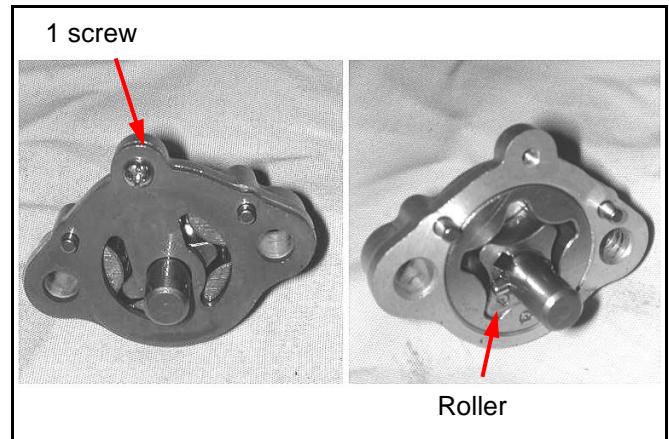
Install the oil pump cover and fixing pins properly.



3. Lubrication System



Tighten the oil pump screw.

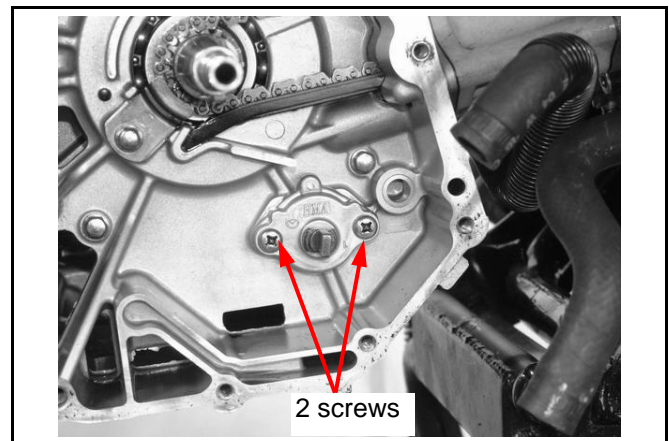


Oil Pump Installation

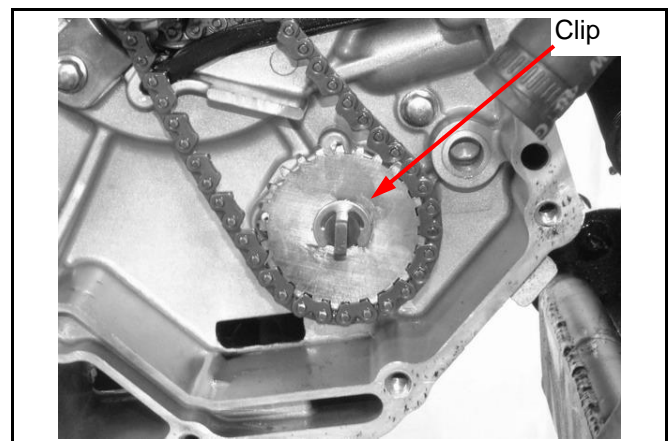
Install the oil pump, and then tighten screws.

Torque value : 0.1~0.3kgf-m

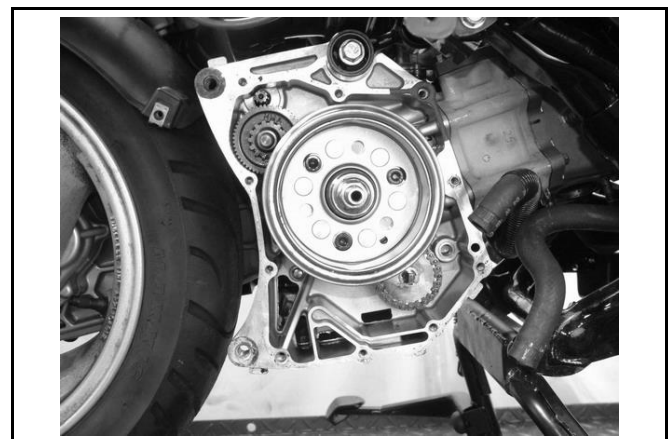
Make sure that oil pump shaft can be rotated freely.



Install oil pump drive chain and sprocket, and then install cir clip onto oil pump shaft.



Install starting gear and generator.
(Refer to chapter 10)



Gear Oil

Gear Oil Change

Park the scooter with main stand.
Turn off engine, place a measuring cup under the gear oil drain bolt.
Remove gear oil check bolt and gear oil drain bolt, drain gear oil into measuring cup.
Check if gear oil meets standard.
Refill gear oil, if the oil is lower than standard.

Standard: 180 c.c.

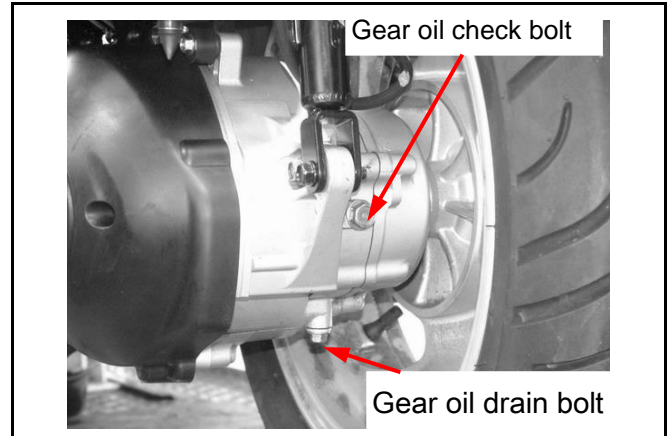
Replacement: 160 c.c.

Torque values:

Gear oil drain bolt 0.8~1.2kgf-m

Gear oil check bolt 1.0~1.4kgf-m

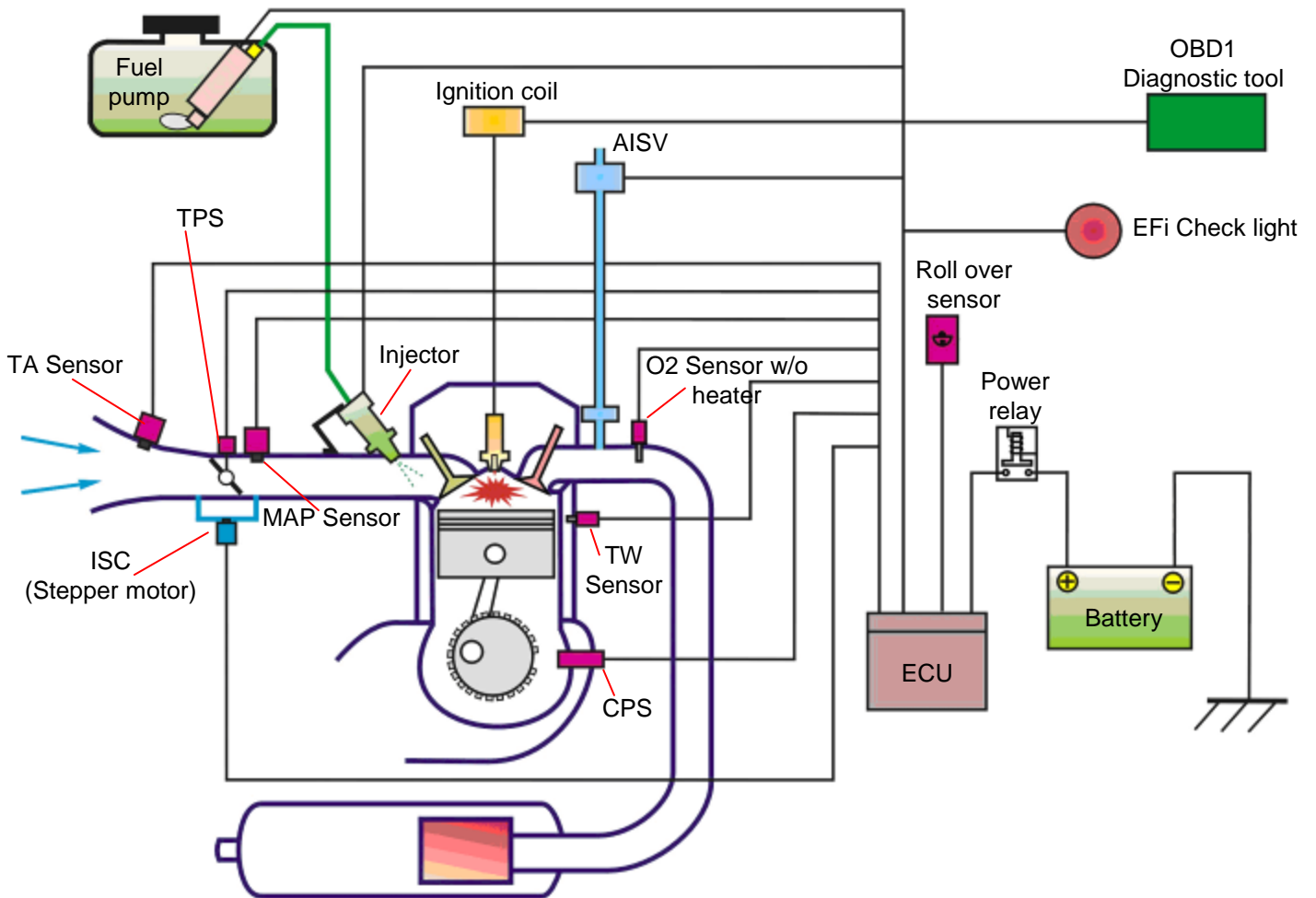
Start engine and run engine for 2-3 minutes.
Turn off engine and make sure that oil level is in correct level. Make sure that no gear oil leaking.



NOTE:

EFi System Components.....	4-1	ECU Pin Configuration	4-31
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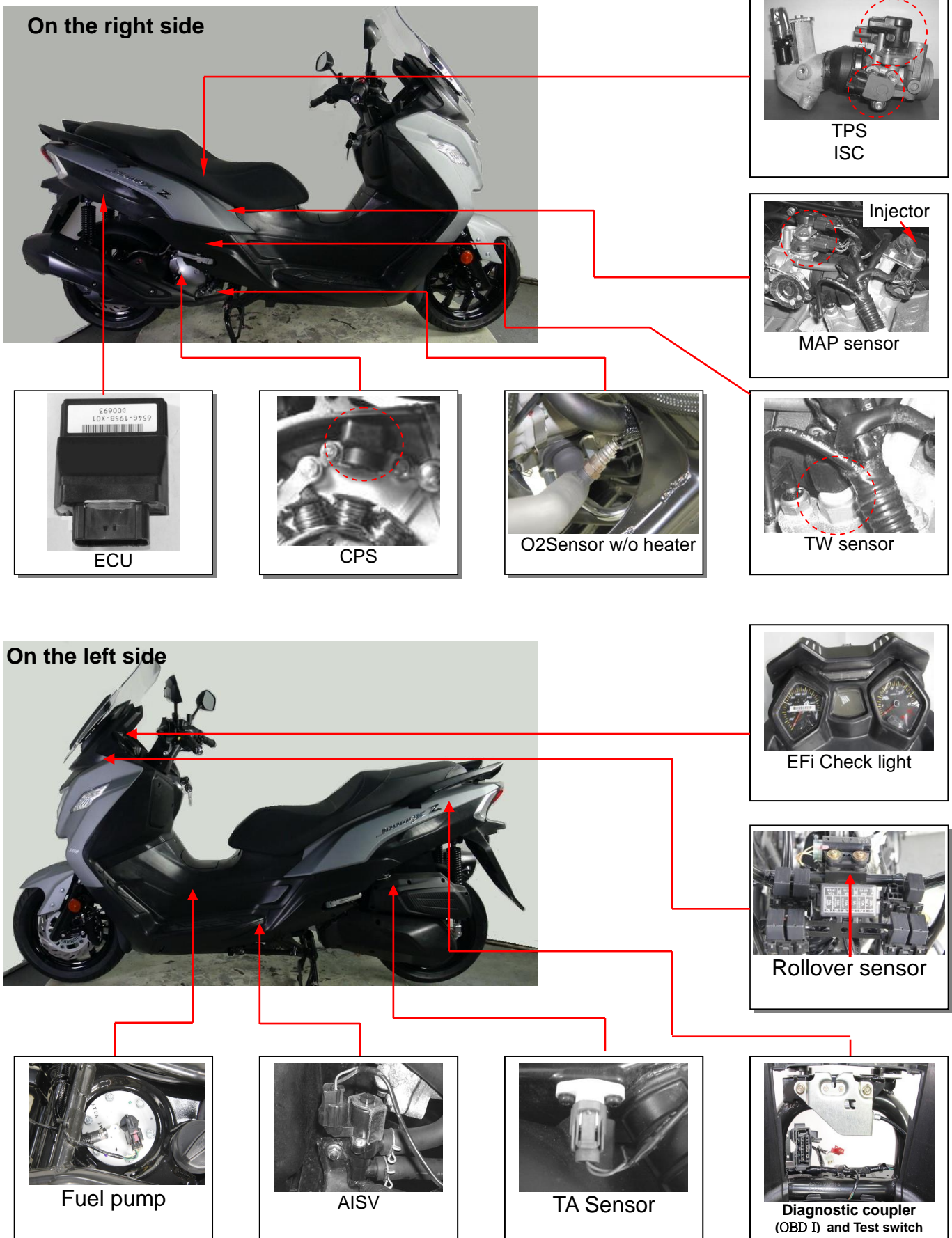
EFi System Components



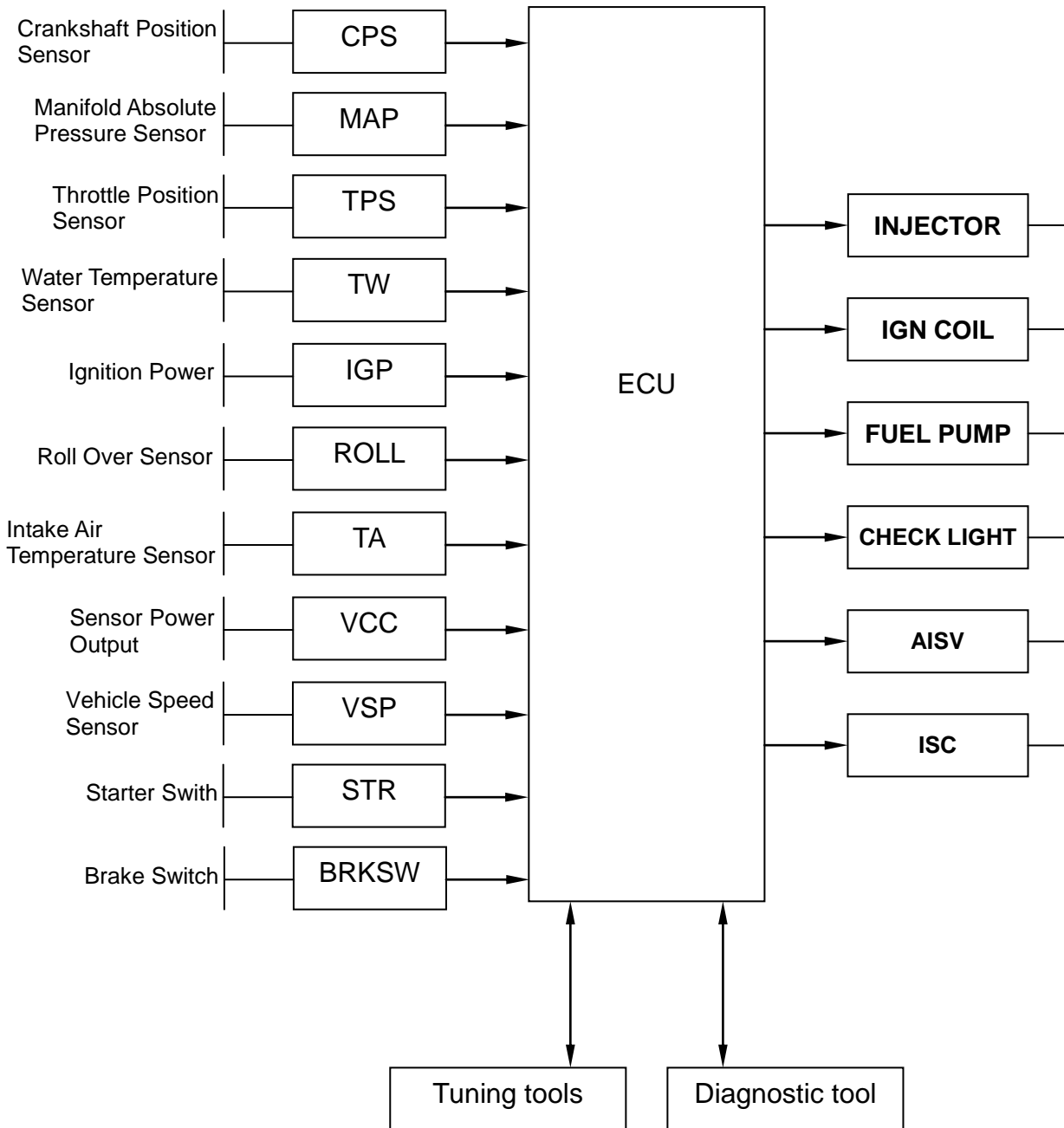
4. Fuel Injection System



EFi System Vehicle Configuration



EFi System Operation



4. Fuel Injection System



EFi System Introduction

Based on 4-stroke SOHC engine, displacement 278c.c. for LW30 or displacement 249c.c. for LW25, electronically controlled fuel injection, fuel vapor absorbed by activated carbon canister. The engine burns off the blow-by fuel-gas in the crankcase through the fuel-air separating device. The O² sensor enhances the efficiency of the catalytic converter, by dynamically controlling the Fuel/Air ratio.

Electronic Fuel Injection Devices

Consist of fuel supply devices: fuel tank, fuel pump, fuel filter and fuel pressure regulator. And fuel control devices: fuel injector and ECU (Engine Control Unit).

The fuel is pumped from electrical fuel pump in the fuel tank, to the injector on the inlet pipe. The fuel pressure regulator keeps the fuel pressure around 294±6kPa. The signals from ECU enable the injector to spray fuel into the combustion chamber once every two crankshaft revolutions. The excessive fuel flows back to the fuel tank through the fuel pressure regulator. Fuel pump is placed within the tank to reduce the working noise, and the complicity of fuel pipes. Electronically controlled ignition and injection system effectively reduce the fuel consumption rate and pollution.

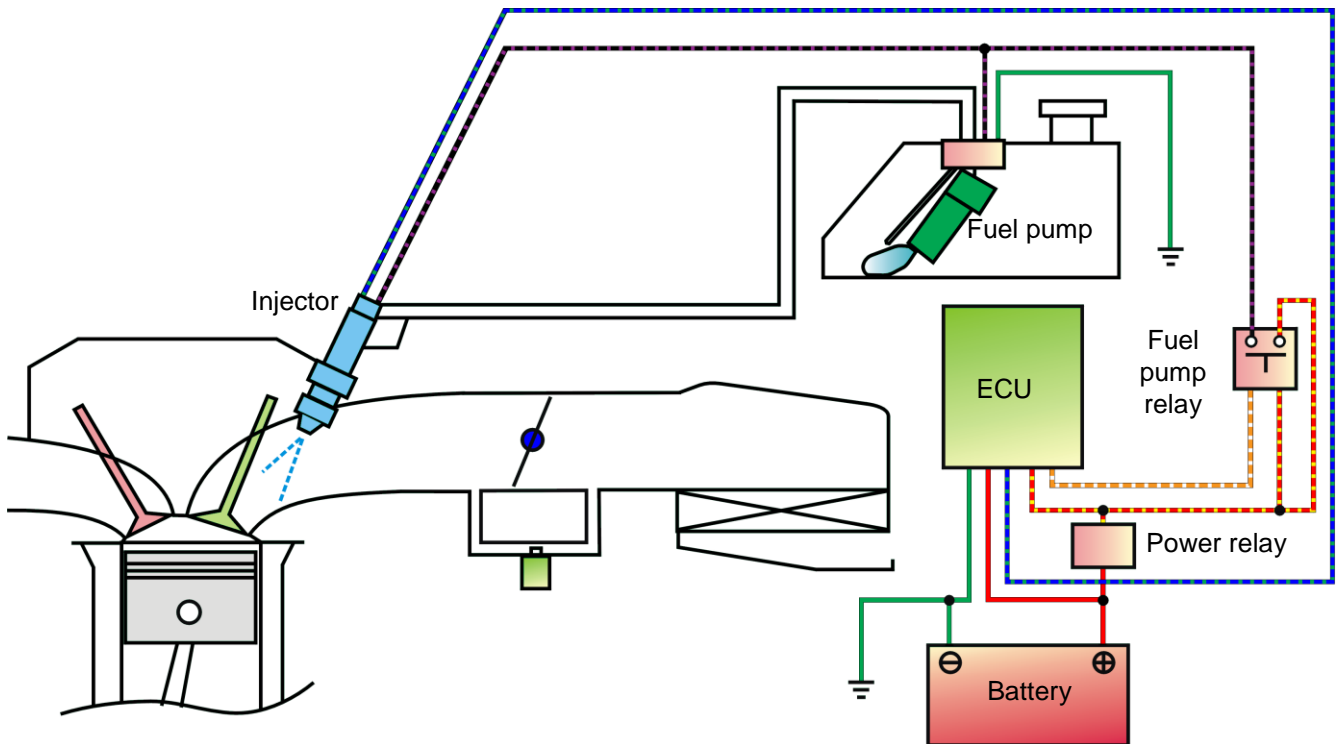
In the traditional gasoline engine, the carburetor supplies the fuel. The process is done by the engine vacuum and the negative pressure in the carburetor by mixing fuel and air. Under this condition, three major processes are done simultaneously in the carburetor: 1. Air quantity measurement. 2. Fuel quantity determination. 3. Mixing of fuel and air.

Electronic Fuel Injection System distributes the three major processes to three different devices: 1. MAP / TA sensor measures the air quantity and temperature and sends the signal to ECU as a reference. 2. ECU determines the amount of fuel to be injected, according to the default A/F rate. 3. ECU enables the injector to spray appropriate fuel amount. The independence of these three functions will raise the accuracy of the whole process.

EFi engine uses computer-programmed fuel injection, the main features are:

1. The quantity of fuel injected is decided according the condition of the engine. The engine RPM, and throttle position determines the fuel quantity and injection time-length. This throttle-controlled fuel injection is better responding and more accurate.
2. The quantity of fuel injection, and the determination of injection time length, are all controlled by 16-bit microcomputer.
3. The fuel pressure regulator maintains a 294±6 kPa pressure difference between intake pipe and fuel pipe, raising the accuracy of fuel injection.
4. By measuring the air pressure of intake pipe, this system gives the vehicle better accommodation to the environment.
5. Idle air by-pass system supplies fuel and air to stabilize the idle running, and cold starting.
6. O₂ sensor feeds back the signal to minimize the exhaust pollution.

Fuel System



System Description

1. After Key-on, the sensors signal to be sent to the ECU. ECU controls the fuel pump relay to make the fuel pump operate. If the engine is not started, the fuel pump will be shut down within 2 to 3 seconds in order to save electricity. Fuel pressure regulator maintains fuel pressure at $294 \pm 6\text{kPa}$ (about 3 kg / cm^2). According to the operating conditions and environmental compensation coefficient, appropriate fuel will be injected. After Key-off or engine stopped operating, the fuel pump stops running.
2. Fuel impurities filtered by the fuel filter should be cleaned regularly.
3. When the engine can not be started, do not keep start motor running continuously which may lead to lack of battery power (less than 10 V) and the fuel pump will not be able to operate. The correct way is to use a new battery.

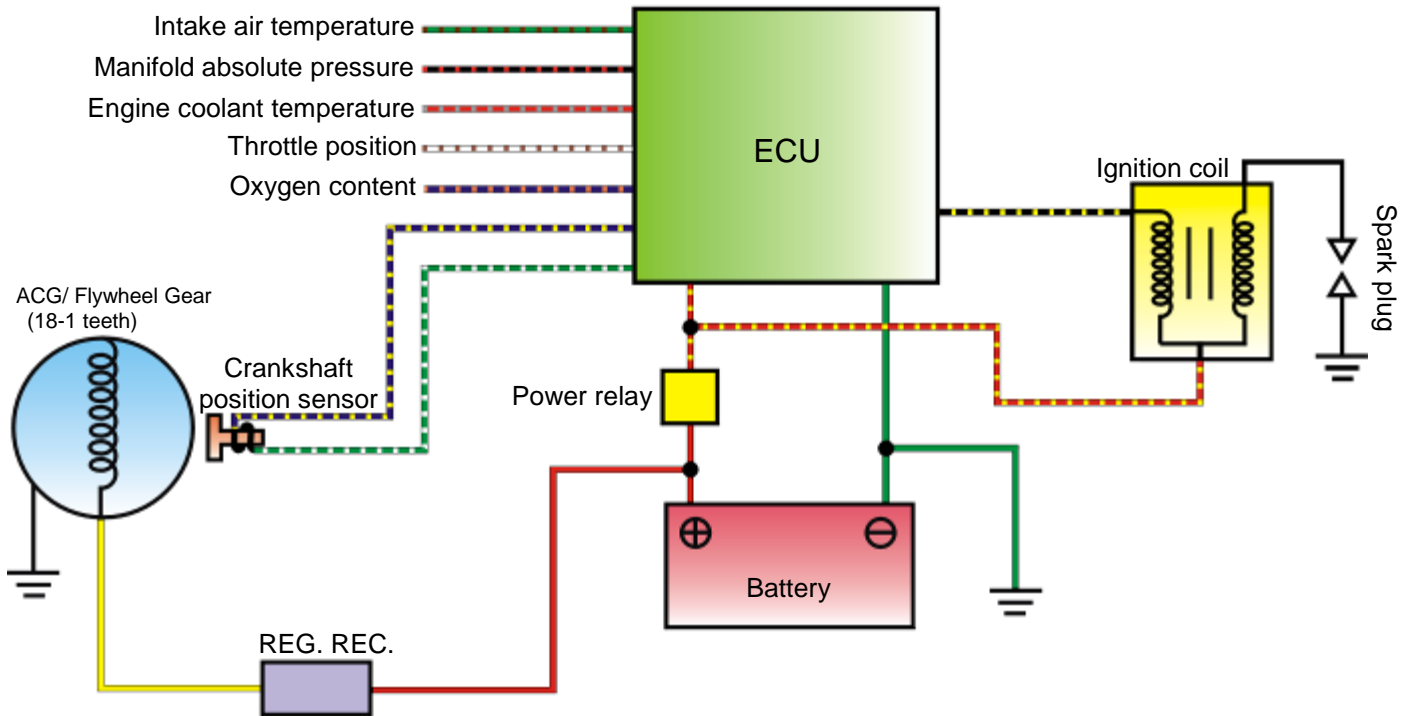
Injector

10-hole type injector provides two intake valves fuel injection quantity, enhances the effect of fuel atomization, and reduces HC emissions. Short-type injector cap can easily fix the injector, receive the fuel from the fuel pump, and limit injector rotation sliding. The signals from ECU control the fuel pressure regulator, using the diaphragm and spring to maintain the fuel pressure in $294 \pm 6\text{kPa}$ (about 3 kg / cm^2), and determine the fuel injection quantity by adjusting injection time width under different engine conditions.

Fuel Pump

Electrical fuel pump is placed inside the fuel tank, powered by the battery and controlled by ECU. Fuel pressure: $294 \pm 6\text{kPa}$ (about 3 kg / cm^2)

Ignition System



Principle

The computer programmed ignition system receives the signals from the Crankshaft position sensor, Throttle position sensor, O₂ Sensor, MAP sensor, Intake air temperature sensor, Engine coolant temperature sensor. Calculating the engine RPM, the 16-bit microcomputer determines the appropriate ignition timing, controls the ignition coil and triggers the spark plug. This way can not only make the engine achieve the maximum power output, but also help improve fuel consumption rate.

Specifications

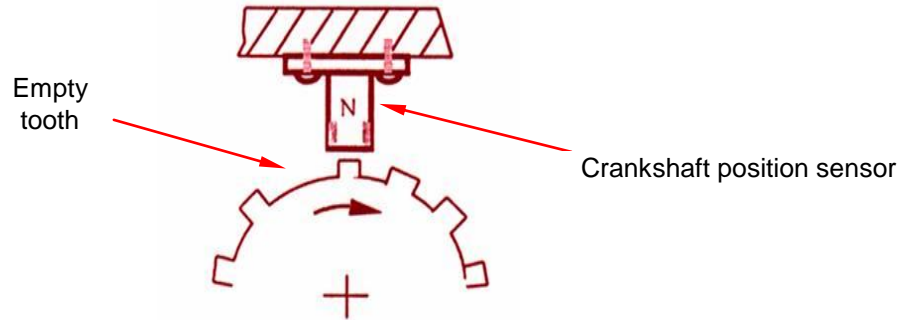
1. Ignition timing: BTDC 10 ° / 1550RPM
2. Spark plug: NGK CR8E Clearance: 0.6 to 0.7 mm
3. ACG crankshaft position sensor coil resistance: **120Ω±20% (20°C)** (Green / White - Blue / Yellow)
4. Ignition coil primary circuit resistance: 2.8 Ω ± 15% (20 ° C) (Red / Yellow - Black / Yellow)
5. Battery Type / Capacity: YT12A-BS or GT12A-BS / 12V 10Ah

Sensors / Drives

Crankshaft Position Sensor (CPS)

Function:

Inducting the teeth sequence on the flywheel, conveying the voltage signals to ECU.



Description

Right after the engine is started; the crankshaft position sensor identifies the TDC position by detecting the empty tooth on the flywheel and ignites at the fixed angle. When the engine RPM reaches the specified speed, the ignition timing will change to the software mode.

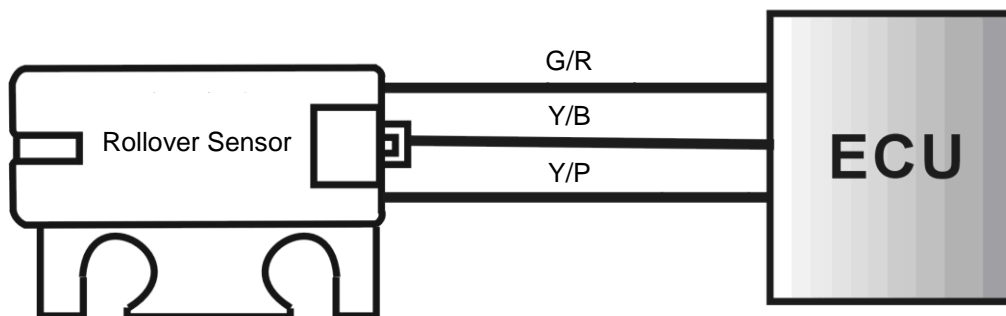
Roll over sensor

Function:

As a safety device, when the motorcycle tips over, it will cut off power supply of ECU and shut down the engine.

Note:

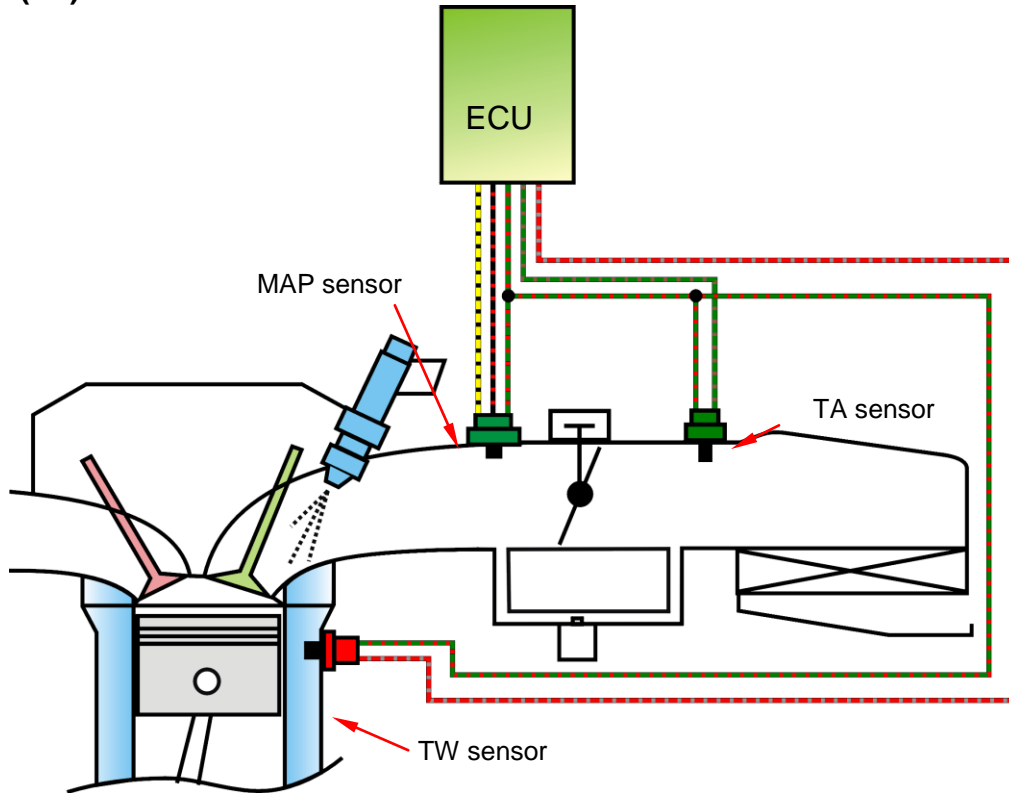
The pendulum-type roll over sensor will cut off the power supply of ECU. Main switch should be turned Key-on again before the engine can be restarted.



4. Fuel Injection System

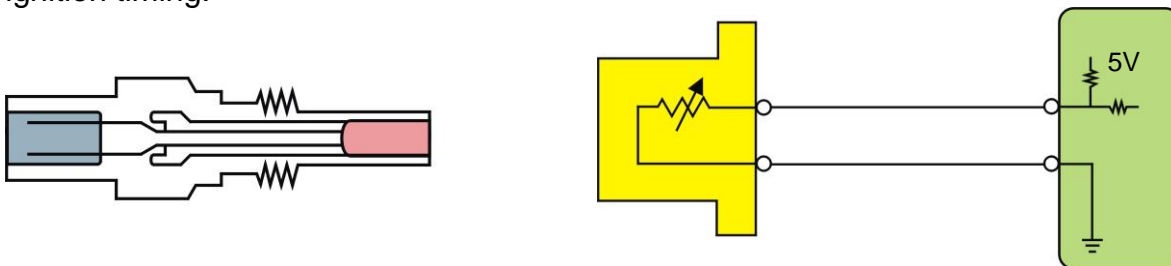


Manifold Absolute Pressure (MAP) / Engine Water Temperature (TW) / Intake Air Temperature (TA) Sensors



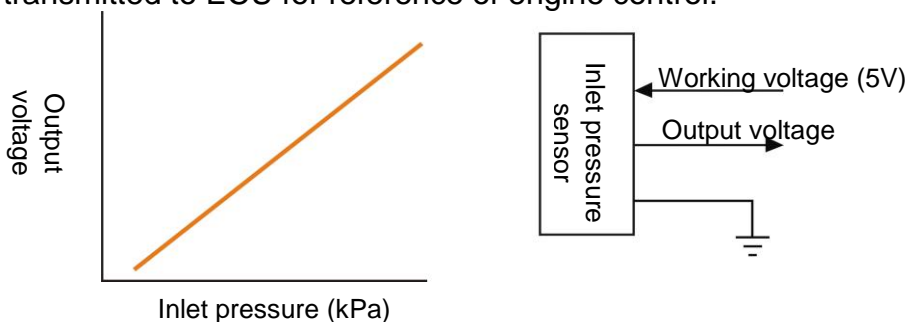
Engine water temperature / Intake air temperature sensor:

Use the variable resistor of negative temperature coefficient (thermistor) to sense the outside temperature. The electrical resistance value goes down when the temperature rises. On the contrary, the electrical resistance value becomes higher when the temperature falls. Sensors provide the temperature of the engine coolant and intake air to ECU to determine the injection and ignition timing.

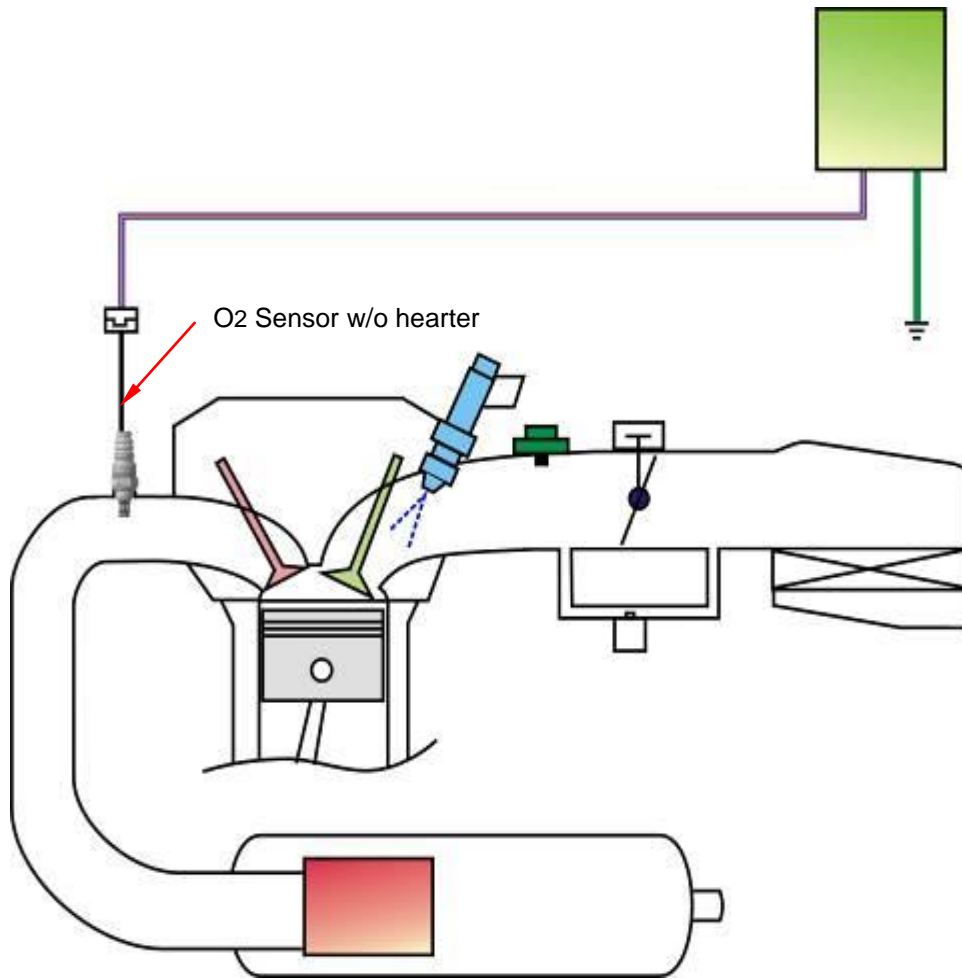


Manifold absolute pressure sensor:

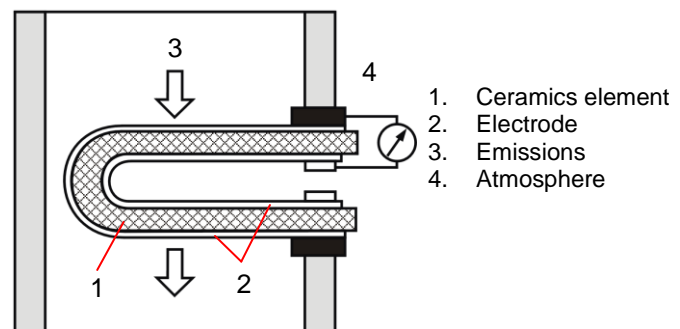
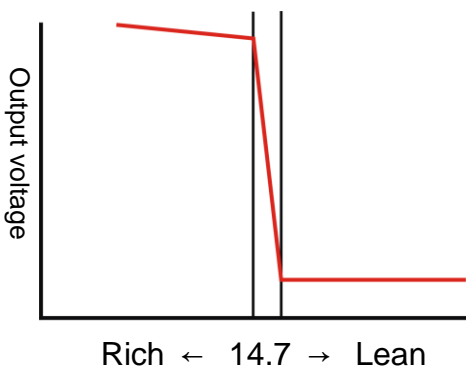
Manifold absolute pressure sensor (MAP Sensor) uses the piezoresistive resistor composed of silicon diaphragm, forming the Wheatstone bridge circuit to measure the atmospheric pressure and the intake manifold pressure, which are both transmitted to ECU for reference of engine control.



O2 Sensor w/o heater (Muffler Earth Type)



O2 Sensor



Function

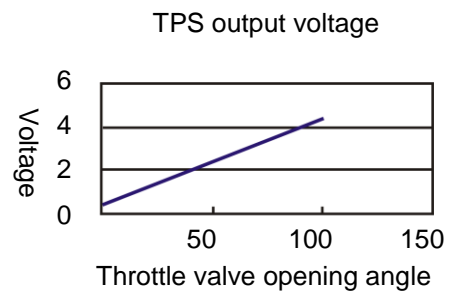
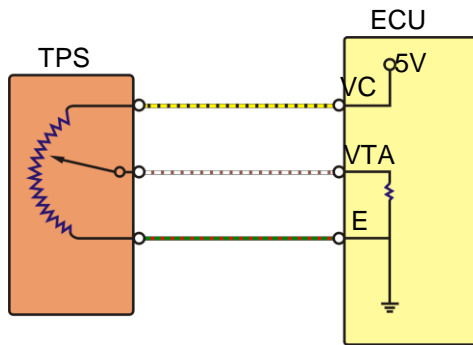
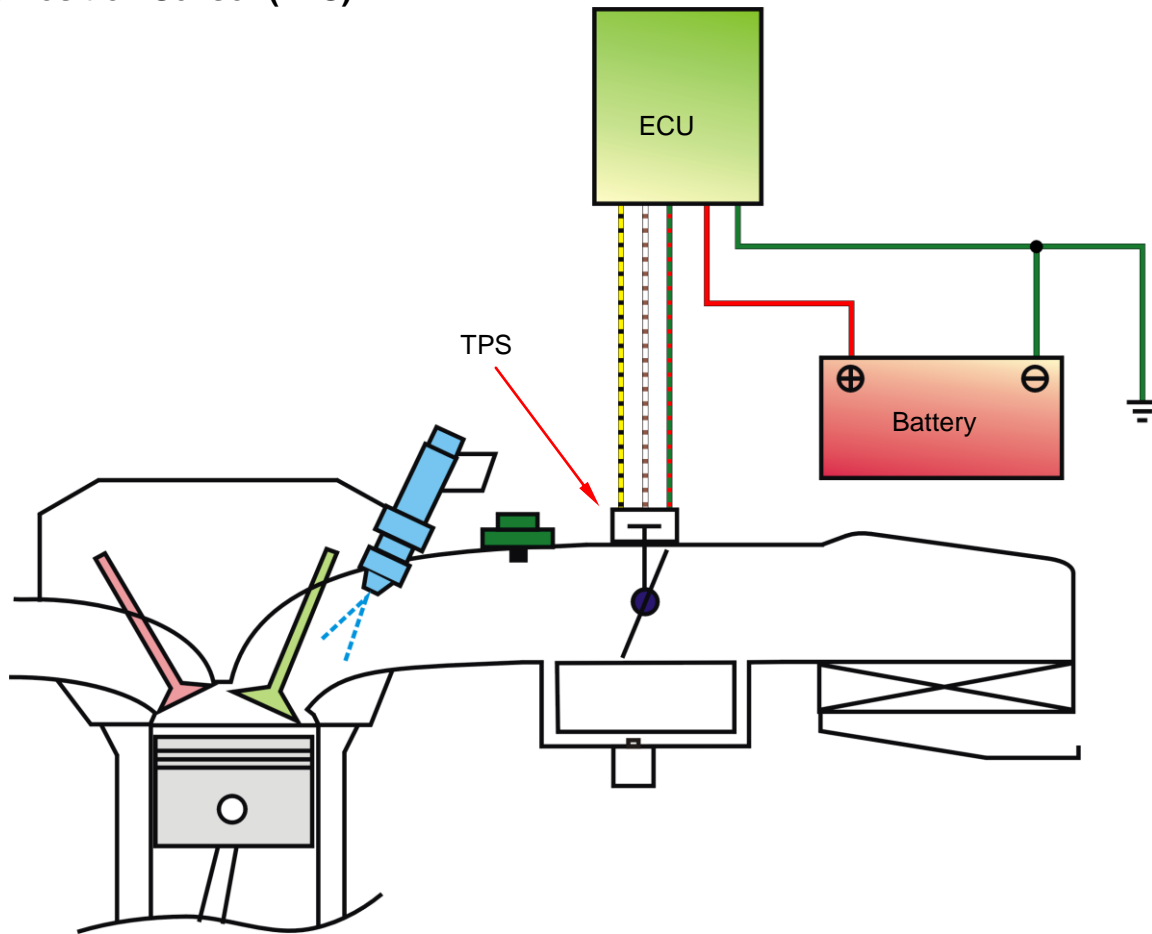
O₂ Sensor measures the proportion of oxygen in the exhaust gas, sending signals to ECU which adjusts the air-fuel ratio by changing the fuel injection time. If the proportion of oxygen is too low, it means the rich air-fuel mixture with higher HC & CO concentration in the exhaust gas. If the proportion of oxygen is too high, it means the lean air-fuel mixture with higher temperature and higher NO_x concentration.

1. O₂ Sensor outputs feedback signal to ECU which keeps the air-fuel mixture near the stoichiometric ratio approximately 14.7 and forms the closed loop control system.
2. When the air-fuel mixture is near the stoichiometric ratio, CO / HC / NO_x are converted most efficiently.
3. O₂ Sensor produces a rapidly fluctuating output voltage between approximately :100 ~ 900 mV

4. Fuel Injection System



Throttle Position Sensor (TPS)



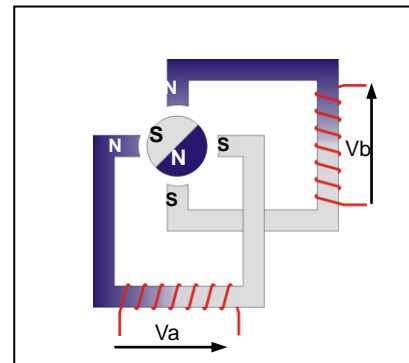
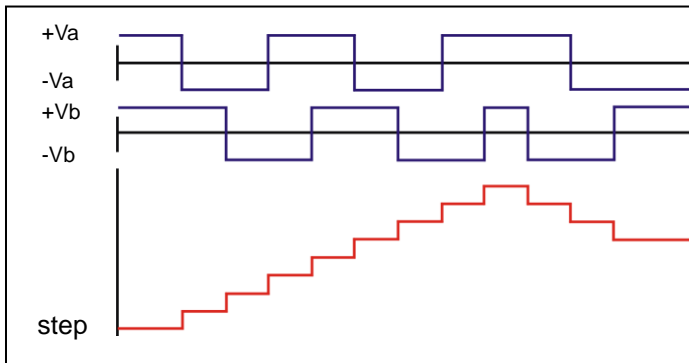
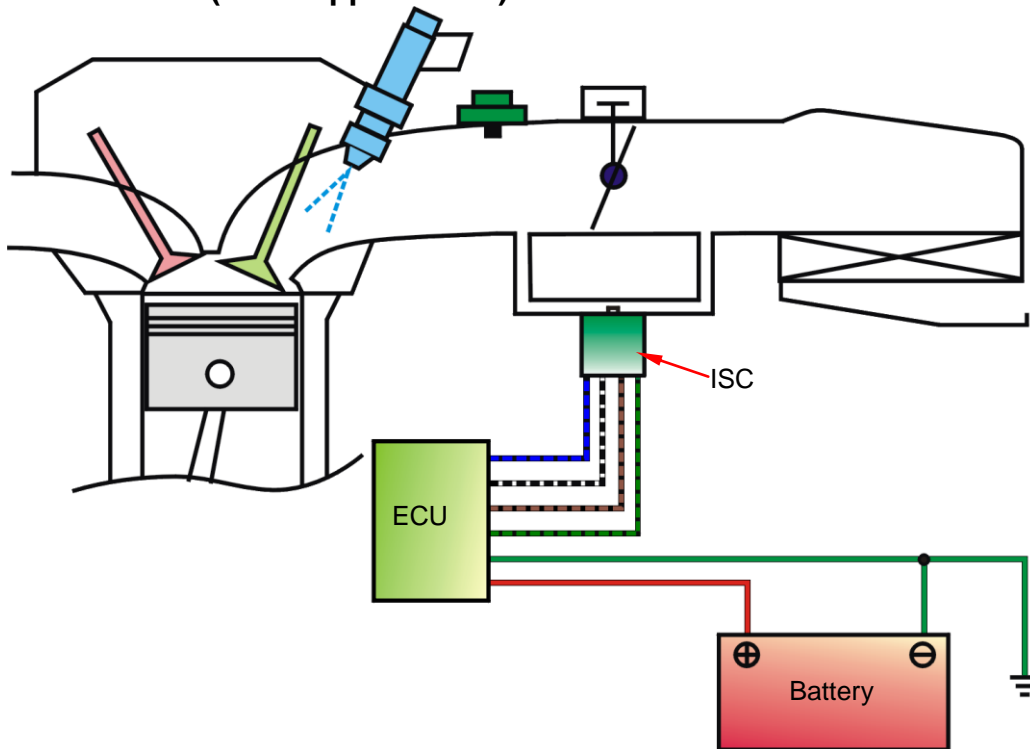
Basic Principle:

TPS is a rotary variable electric resistor. When it is rotated, both electric resistance and voltage value change, determining the throttle position.

Function:

TPS determines the throttle valve position and sends signal to ECU as reference of engine control.

Idle Speed Control Valve (ISC stepper motor)



Function:

ECU controls ISC stepper motor to adjust the bypass intake air quantity and stabilize the idle speed.

4. Fuel Injection System



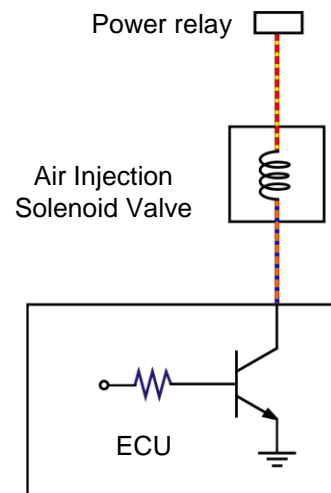
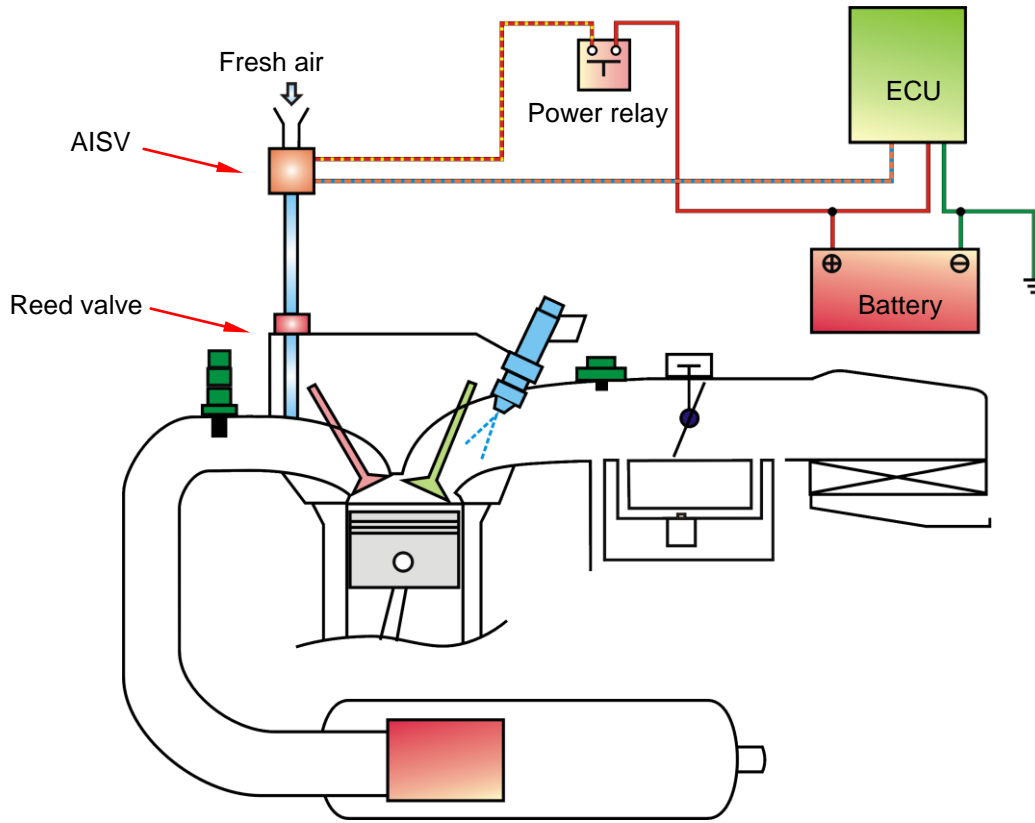
Air Injection Solenoid Valve (AISV)

Function:

AISV introduces appropriate air quantity to reduce pollutant emission.

Basic Principle:

When the engine RPM and throttle opening are higher than the default value, ECU controls AISV opening or closure.



Precautions in Operation

General information

Warning

- Gasoline is a low fire point and explosive material. Always work in a well-ventilated place and flame is strictly prohibited when working with gasoline.
- Before dismantling fuel system parts, leak fuel out first, or grip the fuel pipe by using pliers to prevent fuel from splashing.

Cautions

- Do not bend or twist the throttle cable. Damaged cable will lead to unstable driving.
- When disassembling fuel system parts, pay attention to O-ring position, replace with new one as re-assembly.

Method for releasing pressure in fuel system:

After removing fuel pump relay, key on and press start button until engine off to consume fuel in fuel hose for releasing pressure.

Specification

Item	Specifications
Idle RPM	1550±100 rpm
Throttle handle free play	2~6 mm
Fuel pressure	294±6kpa (about 3.0kg/cm ²)

Torque value

Engine Temperature sensor 0.74~0.88kgf-m
O² Sensor 3.6~4.6kgf-m

Special Tools

Vacuum Gauge
Fuel Pressure Gauge
EFi System Diagnostic Scanner
Fuel Pipe Pliers

EFi System Components Description

ECU (Electronic Control Unit)

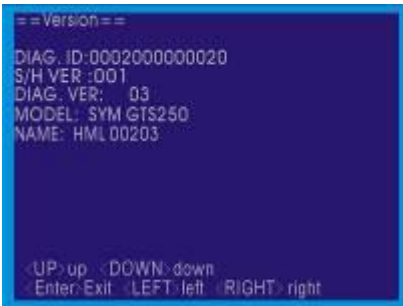


Functional Description:

- Powered by DC 8~16V, and has 33-pin socket on the unit.
- The hardware component consists of a 16-bit microcomputer that is its control center. It contains the functional circuit interface of engine condition sensing and the driving actuator for the fuel injector, fuel pump, as well as ignition coil.
- Its major software is a monitor strategy operation program that includes controlling strategy and self-diagnosis programs.

Testing Procedures:

1. Connect the diagnostic scanner to the diagnostic coupler on the vehicle.
2. Key-on but not to start engine, confirm ECU and the diagnostic scanner can be connected or not.
3. Diagnostic scanner will automatically display Version "certification" of the screen.
4. Confirm the application model, version is correct or not.
5. Check if the fault codes exist.
6. Remove the fault codes.
7. Start engine and check the parameters shown on the diagnostic scanner.



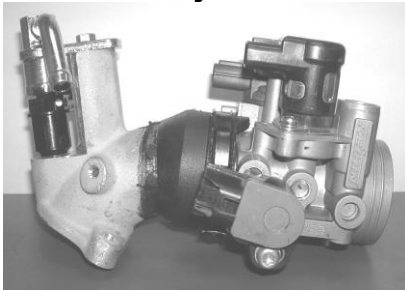
Detection judge:

- Fault codes can be read and cleaned, and the fault codes will not appear again after re-start.

Treatment of abnormal phenomena:

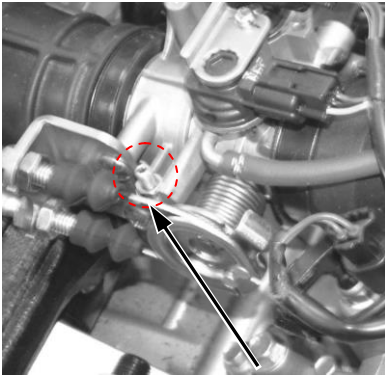
1. Can not connect→ First check whether the cartridge is correct and ECU is normal or not.
2. Unable to start→ ECU or relevant parts abnormal. Re-confirm after the replacement of abnormal parts.
3. Fault codes appear→ ECU or relevant parts abnormal. Troubleshoot and re-confirm.

Throttle Body



Functional Description:

- Throttle body is the inlet air flow regulating device (similar to the carburetor).
- Throttle valve pivot drives the throttle position sensor synchronously and makes ECU detect the throttle opening immediately.
- Throttle valve positioning screw has been adjusted and marked on the production line. Readjustment is not suggested.

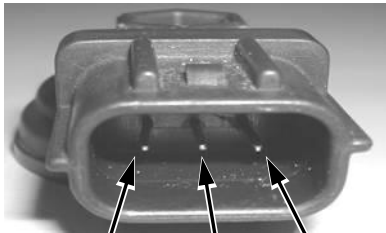
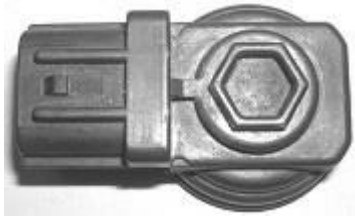


Throttle positioning screw

Treatment of abnormal phenomena:

- If all fuel injection associated components identified no adverse, and other traditional engine components are also normal, the engine is still not smooth, please confirm whether the throttle body coke serious.
- If coke serious, please clean throttle body, and then adjust the injection system.

MAP Sensor



Working voltage measurement



Output voltage measurement plains

Functional Description:

- Powered by 5V DC from ECU. It has 3-pin socket on the sensor. One terminal is for power, and 1 terminal are for signal output. And, the rest one is for ground.
- The major component of the intake pressure sensor is a variable transistor IC. Its reference voltage is DC 5V, and output voltage range is DC 0~5V.
- It is a sensor by sensing pressure, and can measure the absolute pressure in intake process. It also conducts fuel injection quantity correction based on environmental position level.

Pin	Wire color	Function
Left	Yellor / Black	5V voltage input
center	Black / Red	Signal output
Right	Green / Red	Ground

Testing Procedures:

1. Inlet pressure sensor connector to properly (using the probe tool).
2. Open the main switch, but not to start engine.
3. Use "volteg meter" DC stalls (DCV) to check inlet pressure sensor voltage.
4. Confirmed working voltage:
 - Volteg meter negative access to the inlet pressure sensor third pin (Green / Red).
 - Voltage meter positive access to the inlet pressure sensor first pin (Yellow / Black).
5. Confirmed plains output voltage values:
 - Volteg meter negative access to the inlet pressure sensor third pin (Green / Red).
 - Voltage meter positive access to the inlet pressure sensor second pin (Black / Red)

⚠ Caution

- Attentions to the tools required close to the probe wire waterproof apron penetrate skin and internal terminal before measurements to the correct value.

Detection judge:

- Working voltage value: **5.0±0.1V**
- Plains output voltage values: **2.9±0.03V** (Conditions: In the plains 101.3 kPa Measurement)

⚠ Caution

- The higher the altitude, the measurement value to the lower voltage.
- Sea-level atmospheric pressure = 1Atm = 101.3kPa = 760mmHg = 1013mbar

Treatment of abnormal phenomena:

- Inlet pressure sensor damaged, or poor contact couplers.
- Check whether the abnormal wire harness lines.
- Inlet pressure sensor anomaly, the proposed replacement of the sensor to measure the output voltage.
- ECU anomaly, the proposed replacement of the ECU to measure the working voltage.

TA Sensor



Functional Description:

- Use ECU DC 5V power supply provided, has the two-pin coupler, a voltage output pin; another one for a grounding pin.
- Its main component is a negative temperature coefficient (resistance temperature rise smaller) thermistor.
- Installed in the air cleaner on the intake temperature sensor within the resistance, with the induction to the temperature change, and converted into voltage signals sent to the ECU then calculated the temperature and, in accordance with the ECU temperature and state amendments injection time and ignition angle.

Testing Procedures:

Resistance Value Measurement:

- Dismantled inlet temperature sensor connector.
- Use of the "Ohmmeter" Ohm stalls, inspection sensor resistance.

Detection judge:

Resistance value and the temperature between relationships as follows

Temperature (°C)	Resistance value (KΩ)
-20	18.8 ± 2.4
40	1.136 ± 0.1
100	0.1553 ± 0.007

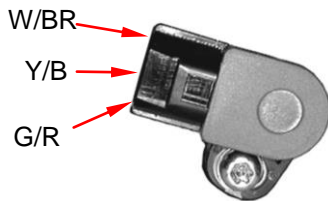
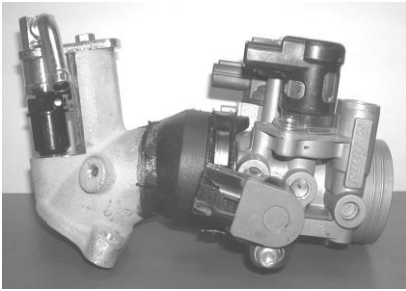


Resistance value measurement

Treatment of abnormal phenomena:

- Temperature sensor damage or connector poor contact.
- Check whether the abnormal wire harness lines.
- Temperature sensor anomaly, the proposed replacement of the temperature sensor.

TPS



Functional Description:

- Use ECU provided DC 5V power supply, has the three-pin coupler, one for the power supply pin; one for a voltage output pin; one for a grounding pin.
- Its main component is a sophisticated type of variable resistor. Installed on the throttle body beside the throttle through (the accelerator) rotates, the output of linear voltage signal provided ECU perception and judgement then throttle position (opening), and in this signal with have the most appropriate fuel injection and ignition timing control.

Pins	Wire color	Function
Upper	White / Brown	Signal output
Center	Yellow / Black	5V voltage input
Under	Green / Red	Ground



Working voltage measurement



Throttle output signal measurement - full closed



Throttle output signal measurement - full open

Testing Procedures:

1. Sensor connected properly (using the probe tool), or can be removed connector to voltage measurements (direct measurement).
2. Opened the main switch, but not to start engine.
3. Use "volteg meter" DC stalls (DCV) to check sensor voltage.
4. Confirmed working voltage:
 - Volteg meter negative access to the inlet pressure sensor third pin (Green / Red).
 - Voltage meter positive access to the inlet pressure sensor first pin (Yellow / Black).
5. Throttle output signal recognition (using the probe tool)
 - Volteg meter negative access to the sensor third pin (Green / Red).
 - Voltage meter positive access to the sensor first pin (white / Brown).
 - Measurements were full throttle at full throttle closed the values of the output voltage.

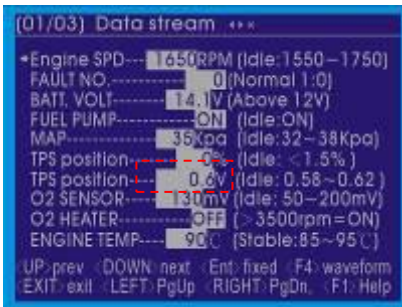


Caution

- Attentions to the tools required close to the probe wire waterproof apron penetrate skin and internal terminal before measurements to the correct value.

Detection judge:

- Working voltage value: **5.0±0.1V**
- Full throttle voltage value: **0.6±0.02V**
- Full throttle closed voltage value: **3.77±0.1V**



Throttle output signal
measurement - full closed

Also, can be used for diagnosis tool confirm to the throttle output signal.

1. Connected to the "diagnosis tool", and open the main switch, but not to start engine.
2. "Diagnosis tool" screen switches to a "data analysis (01 / 03)" screen.
3. Rotations throttle and check voltages.

Treatment of abnormal phenomena:

- Throttle sensor damage or connector poor contact.
- Check whether the abnormal wire harness lines.
- Throttle sensor anomaly, the proposed replacement of the throttle sensor to measure the voltage.

Warning

- Throttle sensor prohibited removed from the throttle body to do any testing.

4. Fuel Injection System



TW Sensor



Resistance measurement

Functional Description:

- Powered by 5V DC from ECU. It has the two-pin socket on the sensor. One terminal is for power output, and 1 terminal are for ground.
- Its main component is a negative temperature coefficient (resistance temperature rise smaller) thermistor.
- Installed in the cylinder head, the engine temperature sensor resistance, with the induction to the temperature change, and converted into voltage signals sent to the ECU was calculated engine temperature, ECU accordance with the engine warm up to amendment the injection time and ignition angle.

Testing Procedures:

Resistance measurement:

- Dismantled engine temperature sensor.
- Use of the "meter" Ohm stalls, inspection sensor resistance.

Detection judge:

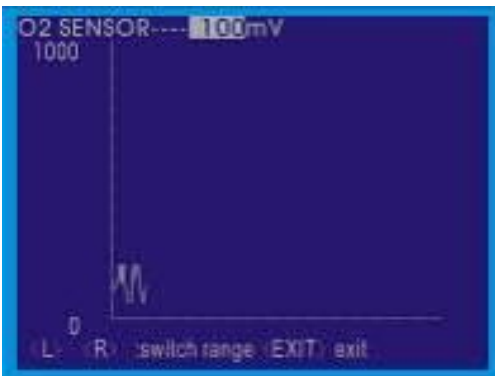
Resistance value and the temperature between relationships as follows:

Temperature (°C)	Resistance value (KΩ)
-20	18.8 ± 2.4
40	1.136 ± 0.1
100	0.1553 ± 0.007

Treatment of abnormal phenomena:

- Temperature sensor damage or couplers to poor contact.
- Check whether the abnormal wire harness lines.
- Temperature sensor anomaly, the proposed replacement of the temperature sensor.

O2 Sensor w/o heater



Functional Description:

The O2 sensor is equipped with 1 pin coupler, as signal output to measure oxygen concentration in exhausted gas, and send signal back to ECU as reference to adjust injection timing of fuel injector so as to adjust air fuel ratio. If the oxygen concentration is low, it means the air fule ratio is too thick, HC and CO concentration in exhausted gas is increased. If the oxygen concentration is high, it means the air fuel ratio is too thin. Thin air fuel ratio will increase combustion temperature and the NOx concentration in exhausted gas.

O2 sensor produces feedback signal to the ECU which keeps the air/fuel mixture ratio control in the vicinity of 14.5 ~ 14.7 to minimize emissions, which is referred to as fuel “ closed loop” control. When the air/fuel mixture ratio control in the near equivalent, CO / HC / NOx to have the highest conversion efficiency.

A good O2 sensor should produce an oscillating waveform at idle that makes voltage transitions from near 100 mV to near 900 mV

Connect diagnostic tool and start engine.

Fully warm up engine.

Switch diagnostic tool to wave analysis and keep RPM at 4,500 to check O2 sensor.

Observe the wave on diagnostic tool.

If the wave is moving between 100~900 mV, it means the closed loop control is normal.

Detection judge:

Treatment of sensor abnormality:

O2 sensor malfunction or coupler poor contact.

Check if the wire harness is normal.

Under possible defect, it is suggested to replace a new O2 sensor to measure again.

Roll over sensor



Functional Description:

- Control power of the power relay coil, has the three-pin socket.
- When vehicles tilt angle greater than 65 degrees, roll over sensor will be the implementation of ECU system power off. At this point once again to restart the engine, the need to re-open a main switch.
- This as a safety device, when the dumping of vehicles, be cut off power supply of ECU, and engine stop.

Testing Procedures:

- Because of the roll over sensor for the electronic control agencies, not against removed after a single measurement.
- Normal state, after power is turned on the main switch, measurement of ECU power relays red / yellow line to the Green Line (ground), the power supply voltage measurement can determine whether it is normal for the roll over sensor.

Detection judge:

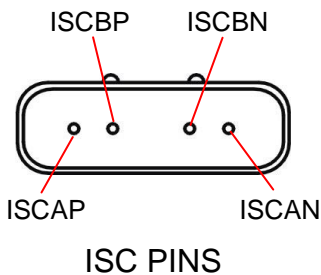
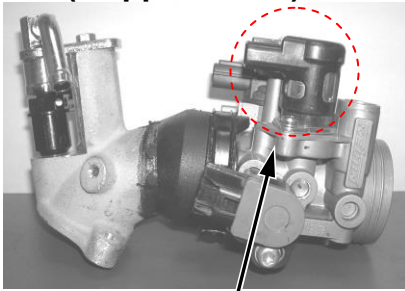
Voltage: **Normal : 0.4~1.4V**
Rollover : 3.7~4.4V

Treatment of abnormal phenomena:

Vehicle state vertical, power relays or ECU without electricity supply.

- Roll over sensor internal short circuit or open circuit, or coupler bad contact.
- Check whether the abnormal wire harness lines.
- Roll over sensor anomaly, the proposed replacement of the roll over sensor.

ISC (stepper motor):



A phase measurement of the resistance value



B phase measurement of the resistance value

Functional Description:

- Use ECU provided power, has the four-pin socket.
- 4-pin coupler for the two motor coils of the power supply and grounding wire, grounding ECU power through the control and management of the stepper motor actuators.
- If it's mainly low-power DC motors, drives idle speed control valve (ISC) of the movement to adjust the idle air flow channel size, control of idle speed of the engine in the cold or hot.

Testing Procedures 1:

Resistance Confirmation:

- Idle Air Control Valve will be demolished down coupler (directly in the body, can also measure).
- Use of the "meter" Ohm stalls (Ω), measurement of the two step motor coil resistance values.
A phase: ISCAP and ISCAN
B phase: ISCBP and ISCBN

Inspection of the actuation (testing can only be on engine, not a single test):

- Closure of the main switch.
- Use hand to touch Idle Air Control Valve body.
- Open the main switch.
- Feeling the Idle Air Control Valve Actuation.

⚠ Caution

- Dynamic checking for Idle Air Control valve, can only be tested on the engine, not a single test.

Detection judge:

1. Resistance value:

A phase: $80 \pm 10\Omega$ (Environmental conditions: 15 ~ 25 °C)

B phase: $80 \pm 10\Omega$ (Environmental conditions: 15 ~ 25 °C)

2. Actuator inspection:

In the above steps Idle Air Control Valve (ISC) Idling motor actuator control of inspection, ISC will be slightly vibration or "... da... da..." continuous voice.

Treatment of abnormal phenomena:

- Idle air control valve damage, or poor coupler contact.
- Check whether the abnormal wire harness lines.
- Idle Air Control Valve anomaly, the proposed replacement of the Idle Air Control Valve, further inspection of its actuator.

4. Fuel Injection System

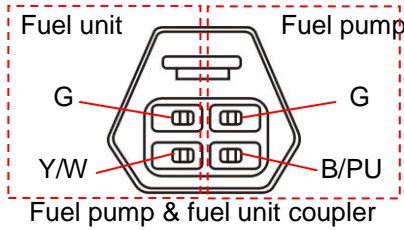


Fuel Pump



Functional Description:

- Powered by DC 8~16V, and has four-pin socket on the pump.
- The two terminals are connected to power source and ground respective. The ECU is to control and manage the operation of fuel pump through electrical power.
- Its major component is a driving fan pump that equipped with a low electrical consuming DC motor. Powered by 12V voltage and keep fuel pressure inside the fuel pump in $294 \pm 6 \text{ kPa}$ (about 3 kg / cm^2).
- The fuel pump is located inside of the fuel tank, and installed a filter in front of its inlet so that can prevent from foreign materials sucking into the fuel pump to damage it and the fuel injector.



Testing Procedures 1:

Fuel pump working voltage confirmed:

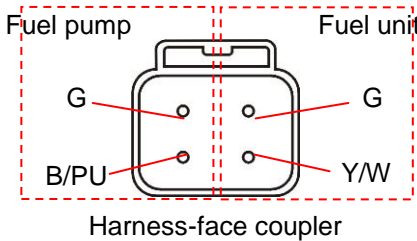
- Fuel pump coupler to properly (using the probe tool), or can be removed coupler working voltage measurements (direct measurement).
- Open the main switch, but not to start engine.
- Use "volteg meter" DC stalls (DCV) to check fuel pump voltage.
- Confirmed working voltage:
Volteg meter negative access to the wire harness fuel pump coupler 2nd pin (Green).
Voltage meter positive access to the wire harness fuel pump coupler first pin (Black / Purple).



Confirmed working voltage

⚠ Caution

- Conducting fuel pump voltage measurement, if the main switch to open three seconds after the engine did not started, the ECU will automatically cut off the fuel pump power supply.



Detection judge 1:

1. Working voltage value: **Above 10V**
2. Resistance value: **$1.5 \pm 0.5 \Omega$**
3. Fuel pressure: **$294 \pm 6 \text{ kPa}$ (about 3 kgf/cm^2)**

Testing Procedures 2:

Resistance Confirmation:

- Removed coupler on the fuel pump.
- Use of the "meter" Ohm stalls, Measurement fuel unit resistance (Yellow / White & Green).

Detection judge 2:

- Fuel unit resistance value: **Empty: $95 \sim 105 \Omega$ Full: $1130 \sim 1170 \Omega$**



Resistance Confirmation



Fuel system pressure measurement

Testing Procedures 3:

Fuel pressure measurement:

- Use fuel pressure gauge, connected in series between the injector and the fuel tank.

Caution

In the implementation of the fuel pressure measurement, will go to the demolition of the fuel hose, such as: injector or fuel pump hose, hydraulic measurements after, be sure to confirm whether there is a leakage of fuel situation in order to avoid danger.



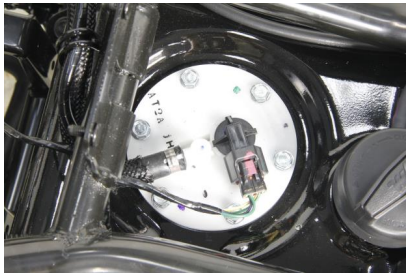
Fuel pressure measurement

Detection judge 3:

Fuel pressure: $294 \pm 6 \text{ kPa}$ (about 3 kgf/cm^2)

Treatment of abnormal phenomena:

1. Fuel pump damage internal coil break, or coupler bad contact.
2. Fuel filter blockage.
3. Fuel pump anomaly, the proposed replacement of the fuel pump.
4. Fuel unit anomaly, the proposed replacement of the fuel unit.



Fuel pressure measurement

Fuel Injector



Functional Description:

- Powered by DC 8~16V, and has two-pin socket on the injector.
- Its major component is the solenoid valve of high resistance driven by electronic current.
- The two terminals are connected to power source and ground respective. It is controlled by ECU to decide the injection timing, and the injector pulse width.

Testing Procedures:

1. Resistance Confirmation:

Use of the "meter" Ohm stalls (Ω), measurement of the injector resistance value.



Injector resistance confirmation

2. Injector injection state examination:

- Removed the injector fixed bolt and removed the injector from intake manifold, but not removal of harness coupler.
- Injector and injector cap tightly by hands, fuel spills should not be the case.
- Key-on and start the engine, injector injection state examination.

Detection judge:

1. Between the two pin resistance values: $10.5 \pm 0.53 \Omega$

2. Injection state:

- Fuel atomizing good, with a clear scattering angle \rightarrow judged as normal.
- Injection-state such as water, no obvious scattering angle \rightarrow found abnormal.



Injection-state atomizing good

Treatment of abnormal phenomena:

1. Injector resistance abnormal, the proposed replacement of the new one injector.

2. Injection-state abnormal, for the following reasons:

- Injector obstructive \rightarrow the proposed replacement of the new one injector.
- Fuel pressure shortage \rightarrow confirmed hydraulic pressure, the proposed replacement fuel pump to confirm.

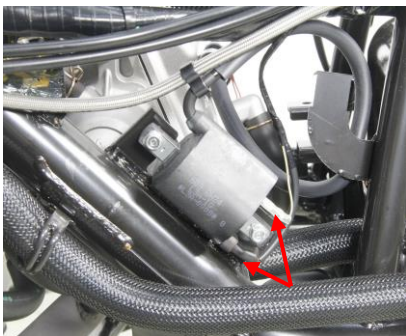


Injection-state unusual

Warning

Gasoline is lower ignited explosive materials, in the ventilation premises operations, and prohibited fire. In the inspection injector fuel injection state, the outflow of gasoline, and the application of appropriate collection containers, so as to avoid danger.

Transistor ignition coil



First circuit coil resistance measurement

Functional Description:

- Use 8 ~ 16V DC power supply, has the two-pin socket.
- Two-pin socket for the power supply and grounding. Its main components for the high conversion ratio transformer.
- Through computer programs when the ignition is controlled, from ignition timing (TDC) / crank position sensor, the throttle valve position sensor, engine temperature sensor, the inlet pressure sensor and O₂ Sensor, issued by the signal, with the engine Speed through the ECU to determine the appropriate ignition is, by the current of a crystal intermittent control, a 25000-30000 volts of secondary hypertension, flashover triggered spark plug, this approach will not only enable the engine to achieve maximum output function, also help to improve the efficiency of fuel consumption and pollution improvements.

Testing Procedures:

Resistance Confirmation:

- Removed coil first circuit plugs on the ignition coil (Red / Yellow & Black / Yellow).
- Use of the "meter" Ohm stalls (Ω), measurement of the ignition coil resistance value.

Detection judge:

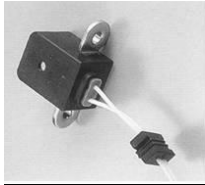
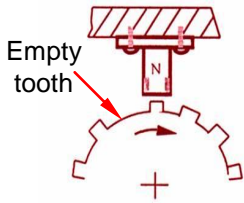
- Ignition coil primary circuit: $2.8\Omega \pm 15\%$ (20°C) secondary circuit: $9.0\text{ K}\Omega \pm 20\%$

Treatment of abnormal phenomena:

1. Ignition coil internal coil disconnection damaged, or plugs bad contact.
2. Ignition coil ignition is not abnormal, proposes to replace the ignition coil.

4. Fuel Injection System

Crankshaft position sensor



Functional Description:

- Do not need for an external power supply, has two-pin of signal plug.
- Constitutes a major change in its reluctance induction coil.
- The spacing of flywheel and sensor should be 0.7 to 1.1 mm.
- Magnetic induction sensor is the use of flywheel on the Gear (18-1 empty tooth) rotary cutting induction coil changes in the magnetic field sensor with the inductive voltage signal for ECU judgement, calculated at the engine speed and crankshaft position, and with a most appropriate time of fuel injection and ignition control.

Testing Procedures:

Resistance Confirmation:

- Removed crankshaft position sensor coupler (Blue / Yellow & Green / White).
- Use of the "meter" Ohm stalls (Ω), measurement of the crankshaft position sensor resistance value.

Detection judge:

- Resistance value: $120\Omega \pm 20\%$ (20°C)

Treatment of abnormal phenomena:

1. Sensor internal coil interrupted damaged, or coupler bad contact.
2. Check whether the abnormal wire harness lines.
3. Sensor coil anomaly, the proposed replacement of the new one.



Measurement resistance value

AISV**Functional Description:**

- Control power, has two-pin socket, one for the power supply pin, one for grounding pin.
- Secondary air injection solenoid valve at the Idle (3500 rpm below) actuator.
- At Idling, ECU control solenoid valve by the grounding circuit to be moving or closing.

Testing Procedures:**Resistance Confirmation:**

- Use of the "meter" Ohm stalls (Ω), measurement of the secondary air injection solenoid valve resistance value.

**Detection judge:**

Resistance value = $25.1 \pm 1.7\Omega$ (20°C)

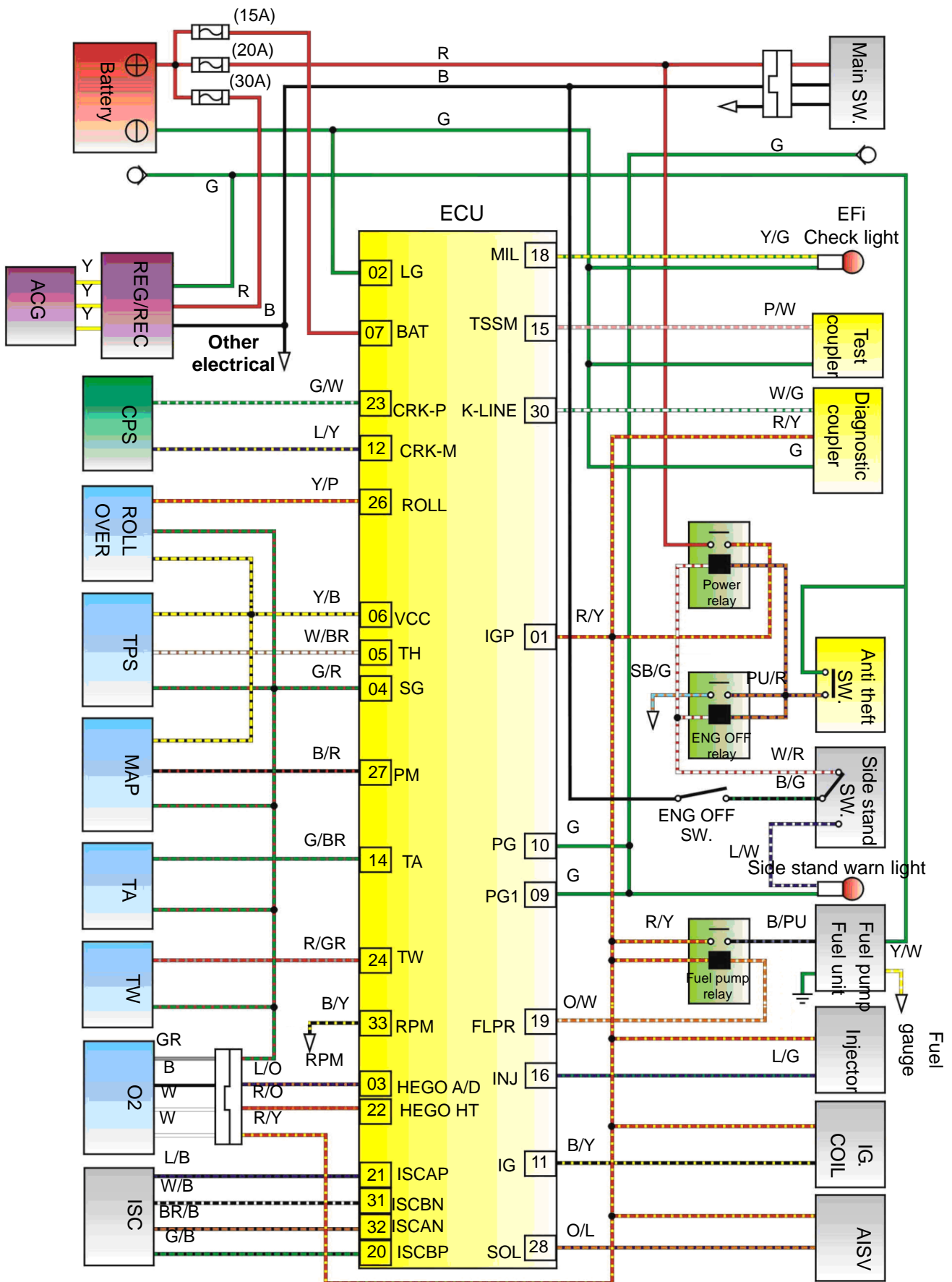
Treatment of abnormal phenomena:

- Secondary air injection solenoid valve internal short circuit or open circuit, or coupler bad contact.
- Check whether the abnormal wire harness lines.
- Secondary air injection solenoid valve anomaly, the proposed replacement of the new one.

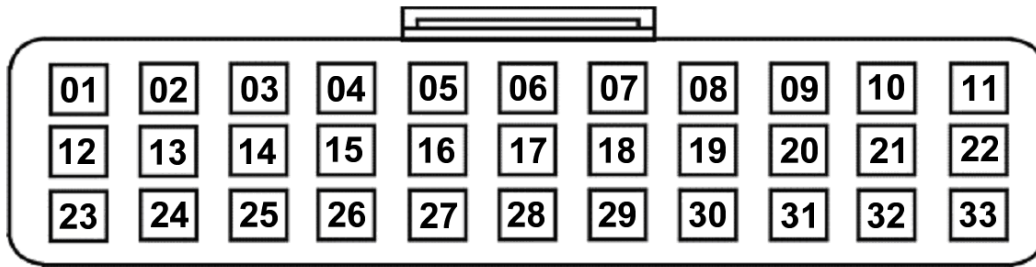
4. Fuel Injection System



EFi System Circuit diagram



ECU Pin Configuration (ON ECU)



ECU Pin Note

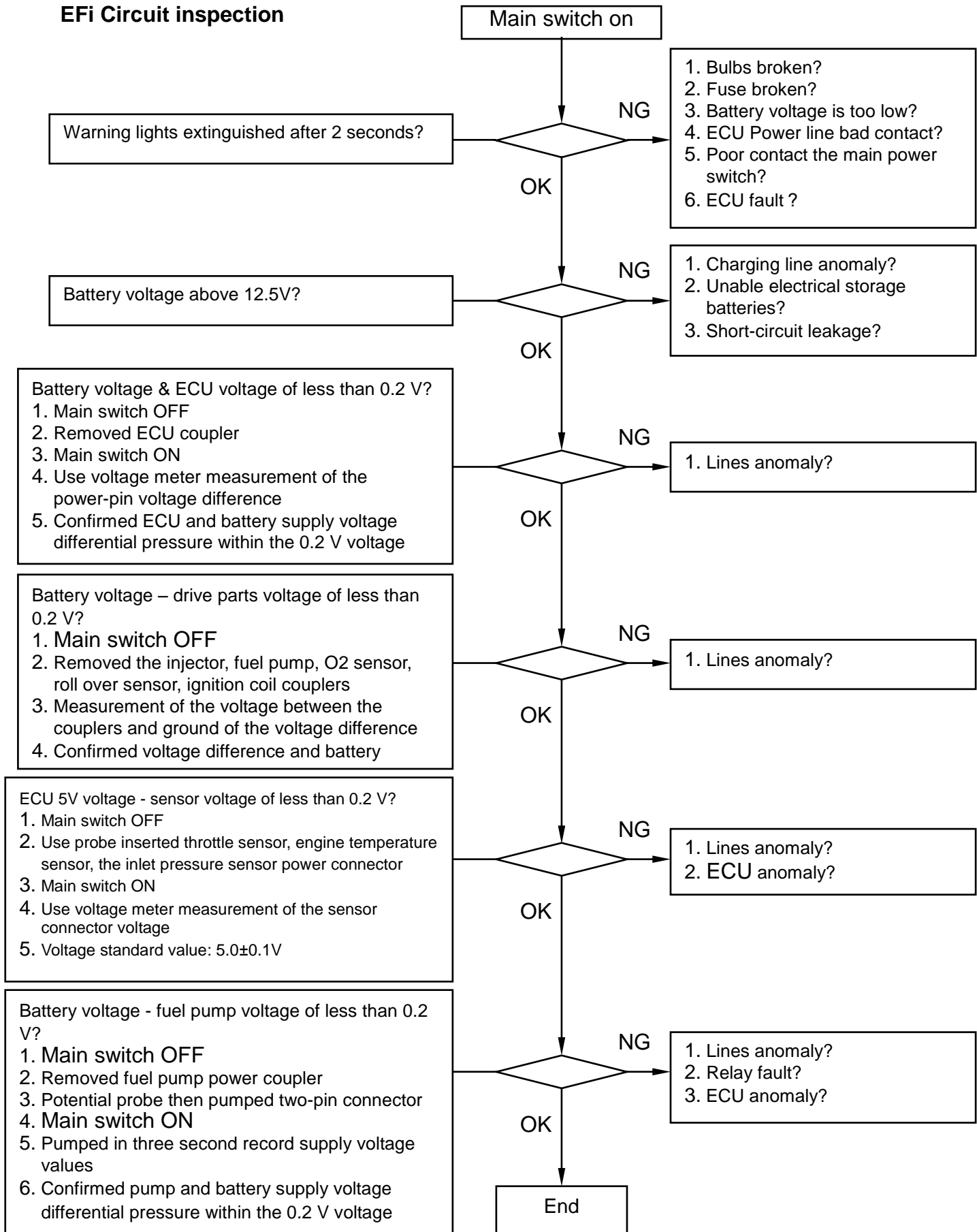
Pin No.	Pin code	Wire color	Note
1	IGP	R/Y	Ignition Power
2	LG	G(4)	Logic Ground
3	HEGO	L/O	Hego Sensor
4	SG	G/R	Sensor ground
5	TH	W/BR	TPS signal
6	VCC	Y/B	Sensor Power Output (+5V)
7	STR		Starter relay
8	FLPR	O/W	Fuel Pump Relay
9	PG1	G(4)	Power Ground 1
10	PG2	G(4)	Power Ground 2
11	IG	B/Y(1)	Ignition Coil
12	CRK-P	L/Y	CPS+
13	BRK-SW	-	Brake Switch
14	TA	G/BR	Air Temp. sensor signal
15	TEST	P/W	Test Switch
16	INJ	L/G	Fuel Injector
17	VSP		Vehicle Speed Sensor
18	IDL		Idle stop light
19	FANR		Cooling fan relay
20	ISCBP	G/B	Idle Speed Control B
21	ISCAP	L/B	Idle Speed Control A
22	MIL		EFi check light
23	CRK-M	G/W	CPS-
24	TW/TH	R/GR	Water temp. sensor signal
25	STSW	-	Starter switch
26	ROLL	Y/P	Rollover sensor
27	PM	B/R	MAP sensor signal
28	SOL	O/L	Solenoid output
29	IDLSSW	-	Idle stop SW.
30	K-LINE	W/G	Diagnostic tool signal
31	ICSBN	W/B	Idle speed control_B
32	ISCAN	BR/B	Idle speed control_A
33	OUTPUT		RPM

4. Fuel Injection System

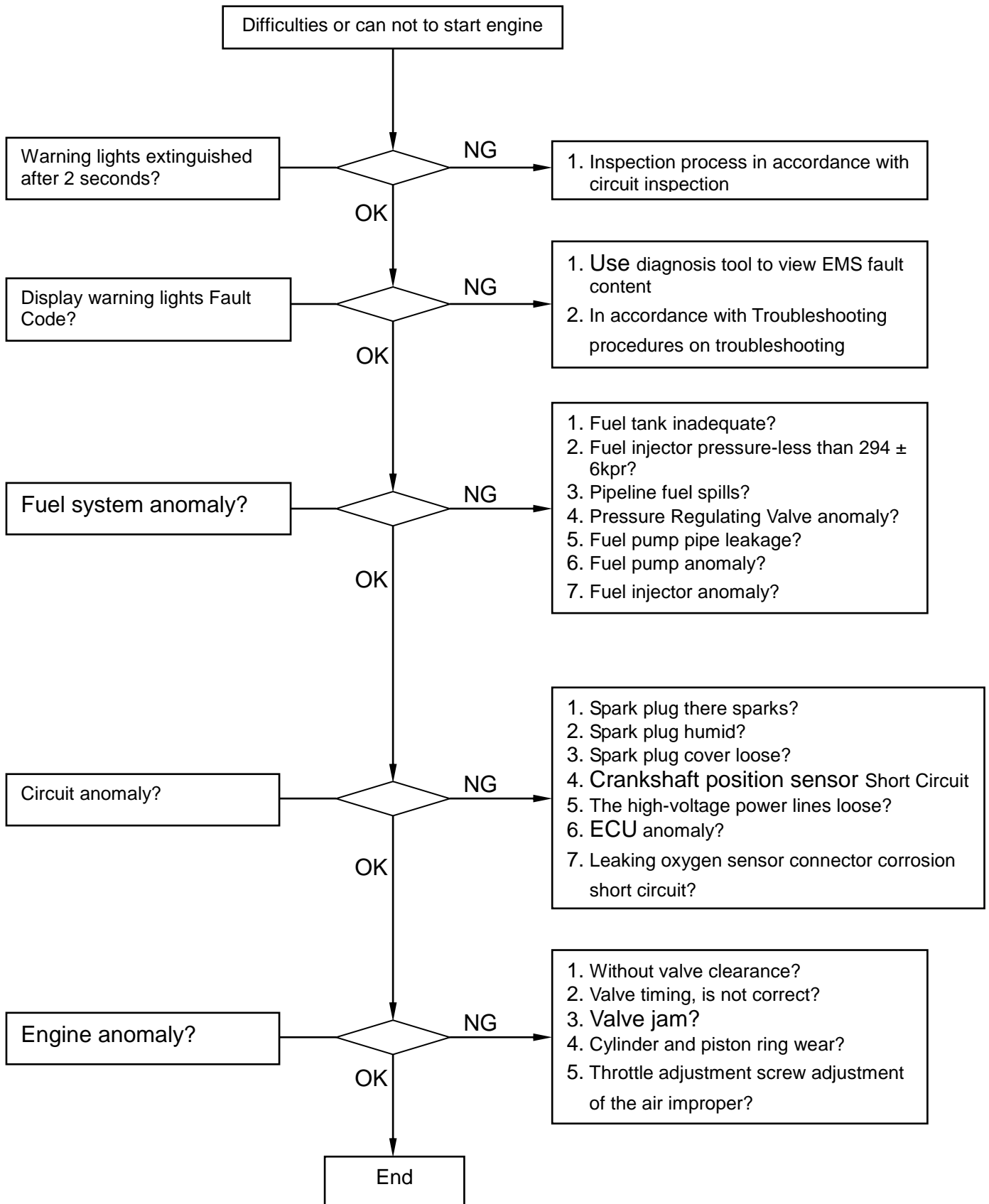


Troubleshooting

EFI Circuit inspection



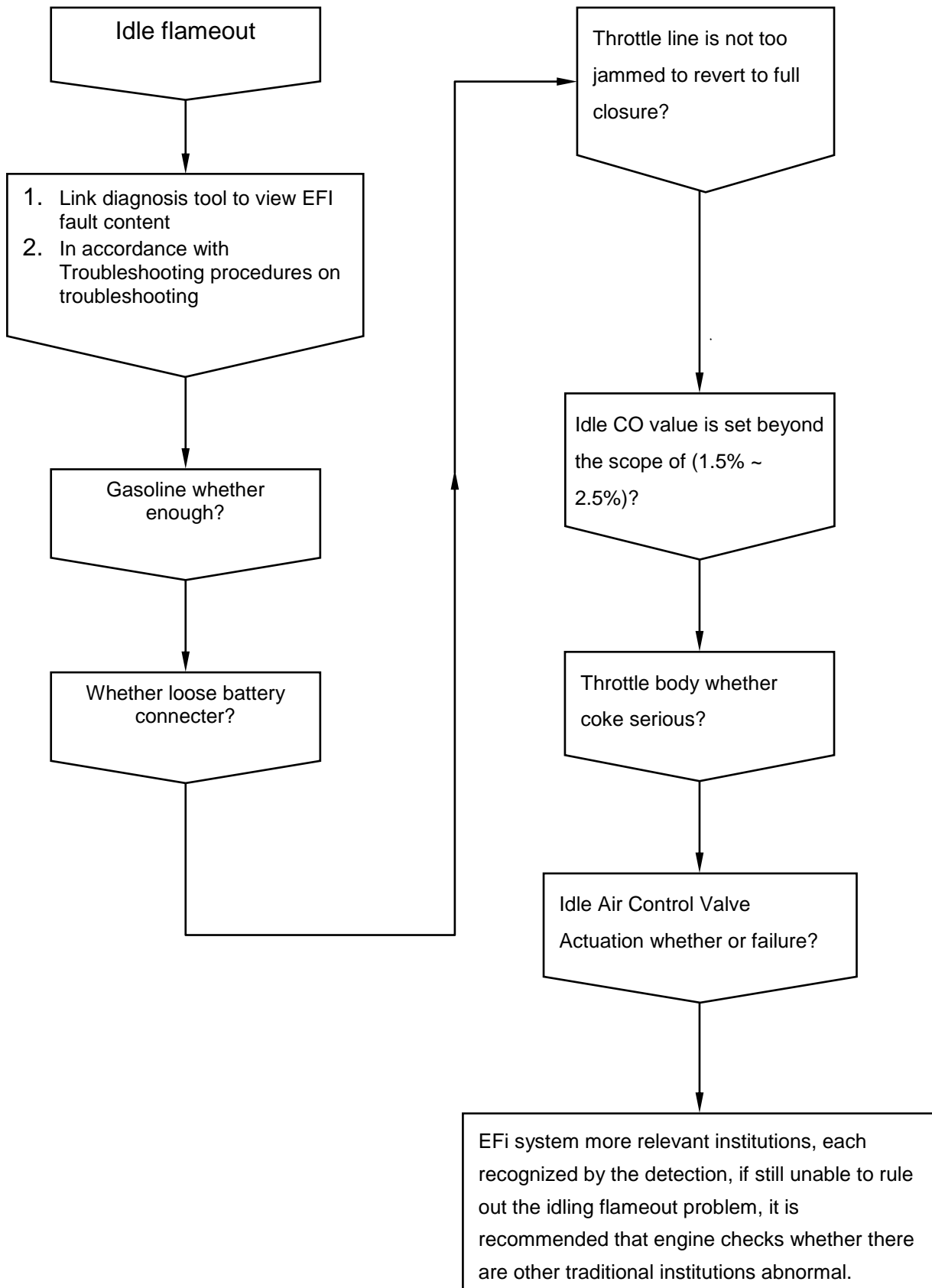
Can not Start the engine or difficult to start inspection



4. Fuel Injection System

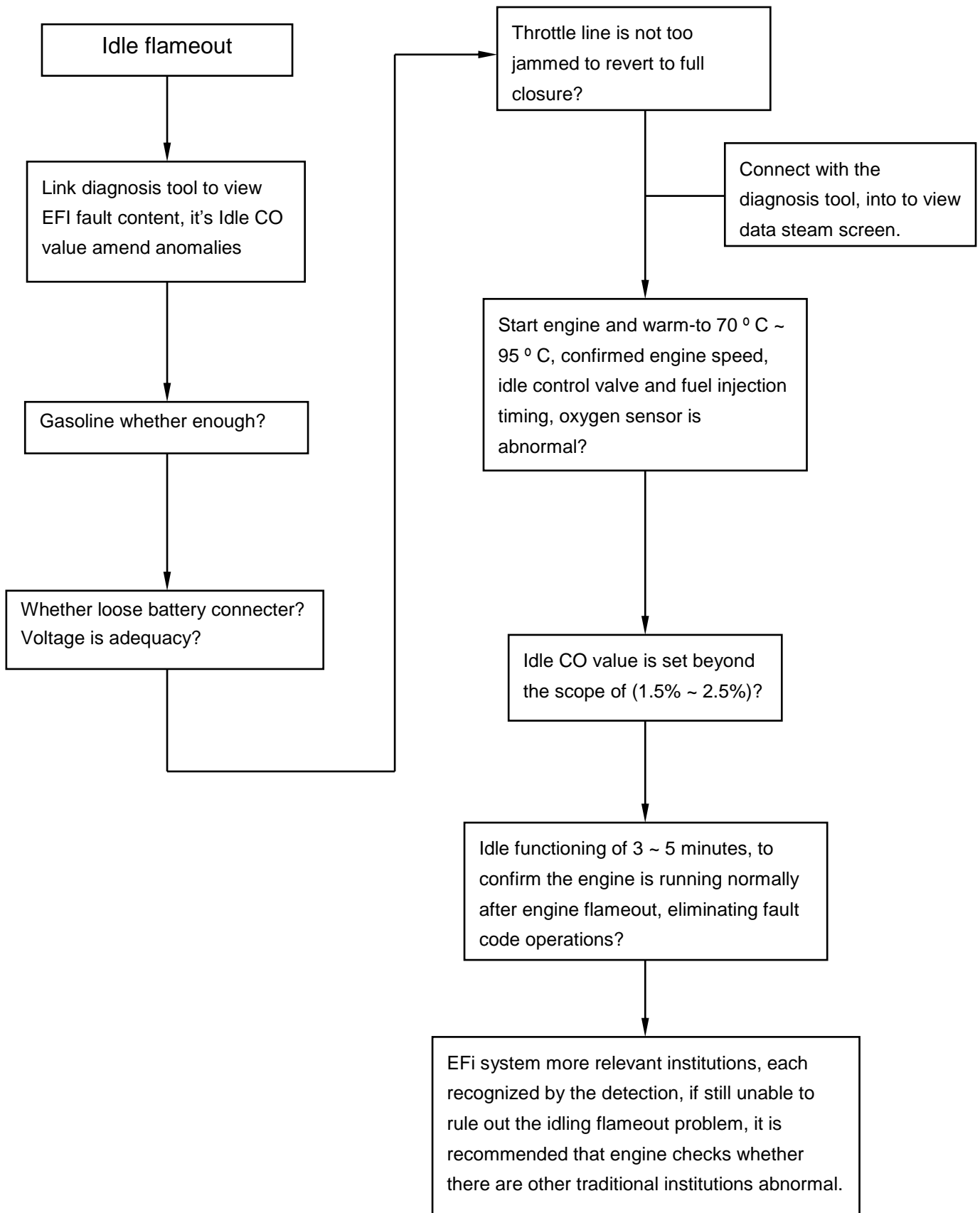


Idle flameout diagnosis



CO value revised anomaly

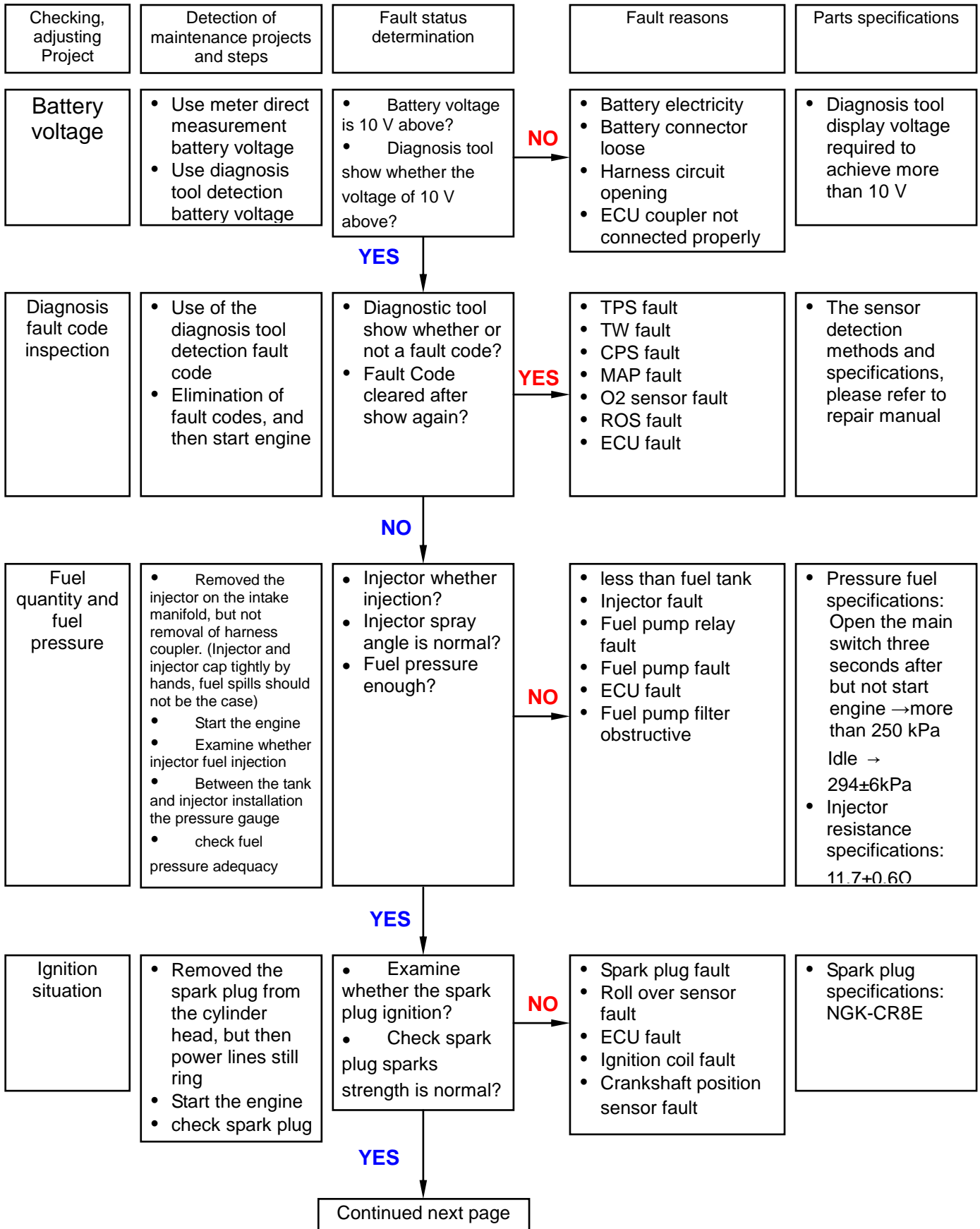
O2 Sensor equipped with the system, in principle, not adjusted CO value, such as CO value deviated from the normal range, check O2 Sensor and other agencies anomaly.

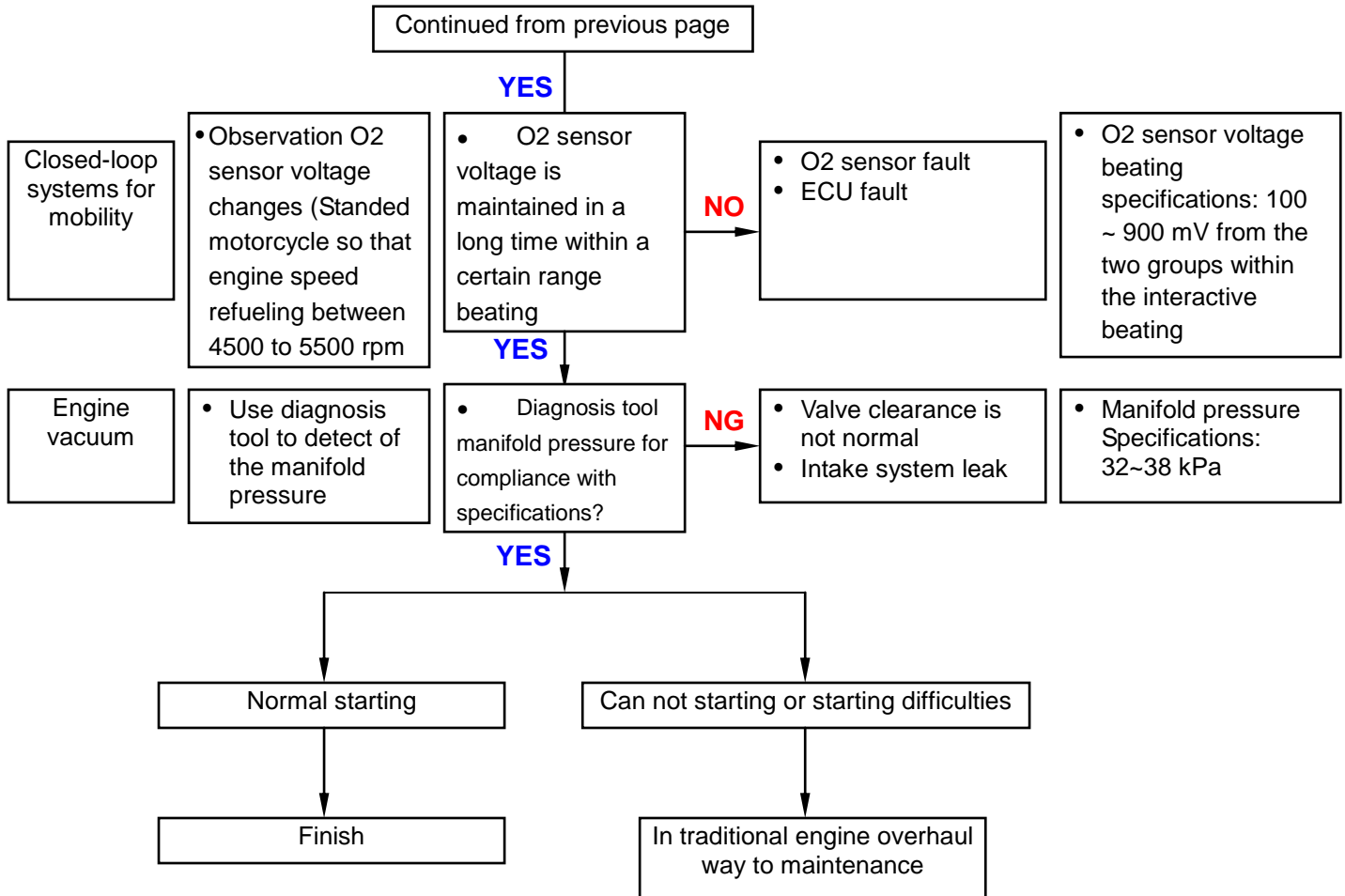


4. Fuel Injection System



Integrated Troubleshooting Procedure





4. Fuel Injection System

Fuel Pump

Remove fuel pump/fuel unit

Remove side cover.

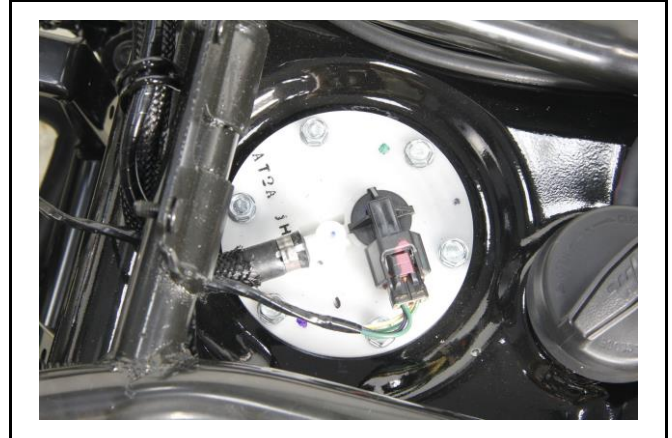
Remove rear carrier

Remove rear bodycover.

Remove floor panel.

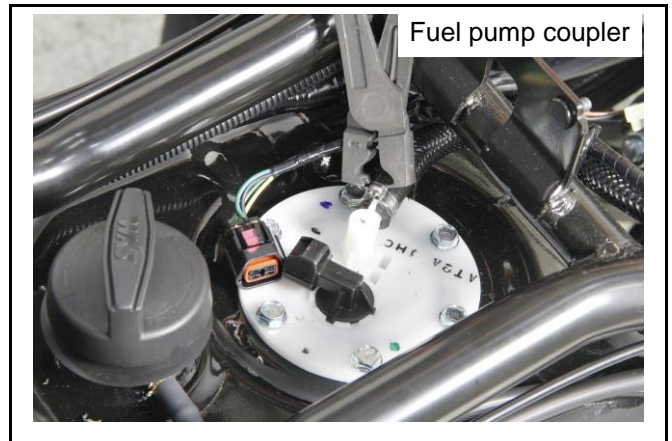
Remove under cover.

(refer to chapter 13)



Remove fuel pump lines coupler.

Release the fuel tube folder, removed the fuel tube.



Remove the fuel tank fixed bolts (Bolt × 3), remove the fuel tank.

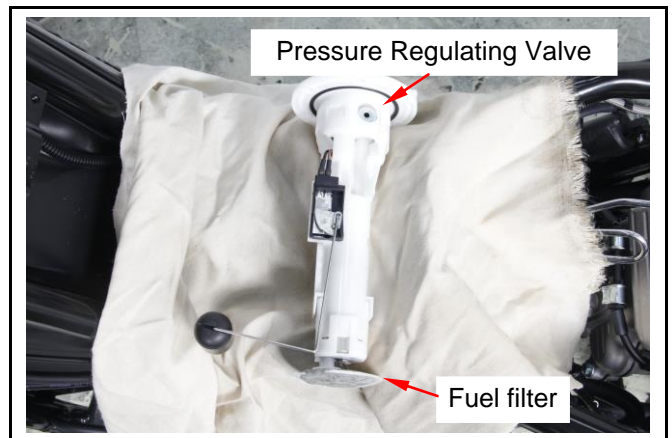
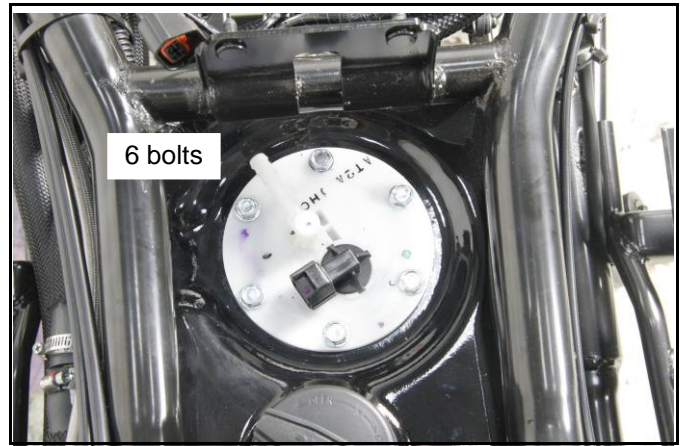
Remove / Install fuel pump and fuel unit

Remove fuel pump fixed bolts (Bolt × 6), remove fuel pump.

Install In the anti-demolition order.

Caution

- Then remove fuel pump, fuel in fuel tank internal to confirm not excessive.
- Then install fuel pump and fuel unit, attention direction.
- Confirm whether the fuel filter dirt, obstructive.
- Fuel pump installation, to confirm whether it is normal to the fuel out (the pressure about 3 kg/cm²).



Air Cleaner

Remove

Remove left side body cover and luggage box.
 Remove rear carrier and body cover.
 Remove fuel gas recover tube.
 Remove waste gas purification system pipes.
 Remove intake temperature sensor coupler.

Remove intake tube fixed bolt (bolt×1).
 Remove air cleaner fixed bolts (bolt×2).
 Remove air cleaner.

Install

Install In the anti-demolition order.

Clean air cleaner element

Remove air cleaner cover (screw×8).
 Remove air cleaner filter (screw×6).
 Use compressed air to remove the adhesion of dirt, if not too much dirt cleared, please new replacement.

Caution

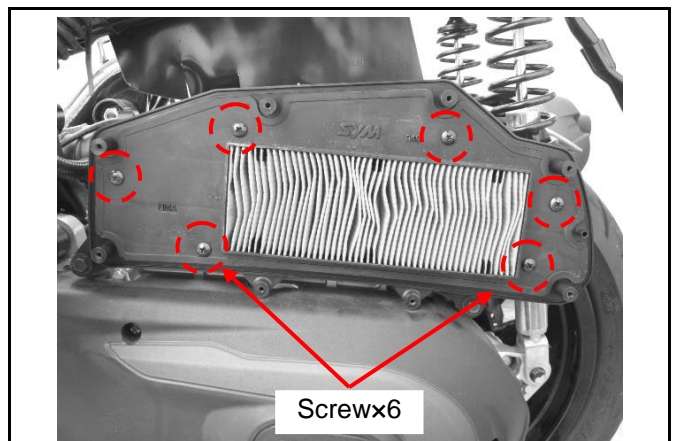
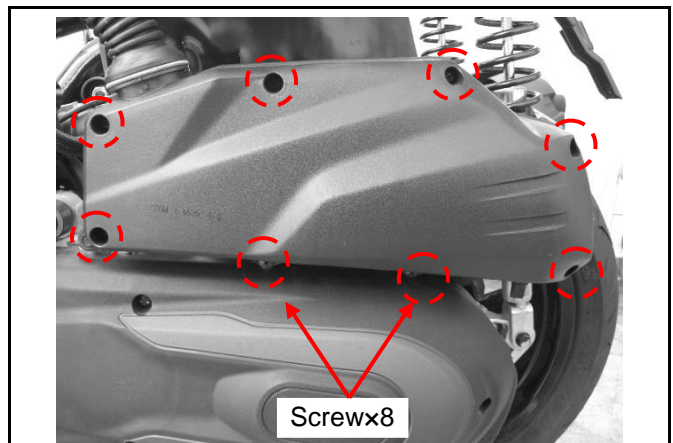
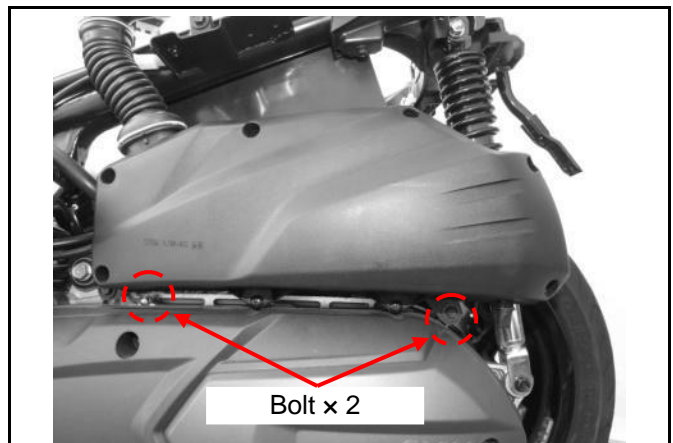
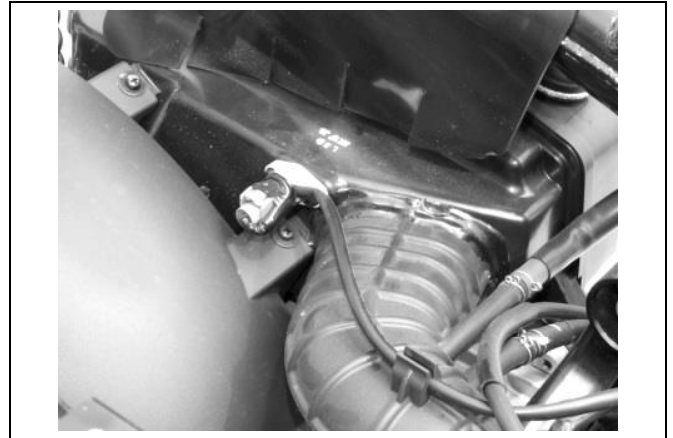
- Air cleaner filter for paper products, must not soak or cleaning by water.

Install air cleaner element

Install In the anti-demolition order.

Caution

- Air cleaner filter and air filter cover should be covered formation is the installation, not to skew a seam, resulting dust, foreign body aspiration in the engine.



4. Fuel Injection System



EFi System Diagnosis Methods

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

Overhaul, the diagnosis tool can be used for troubleshooting (refer to diagnosis tool use guide), or manually by the meter warning light inspection revealed that the fault codes (refer to checking signal fault codes discriminant method), the two methods for maintenance.

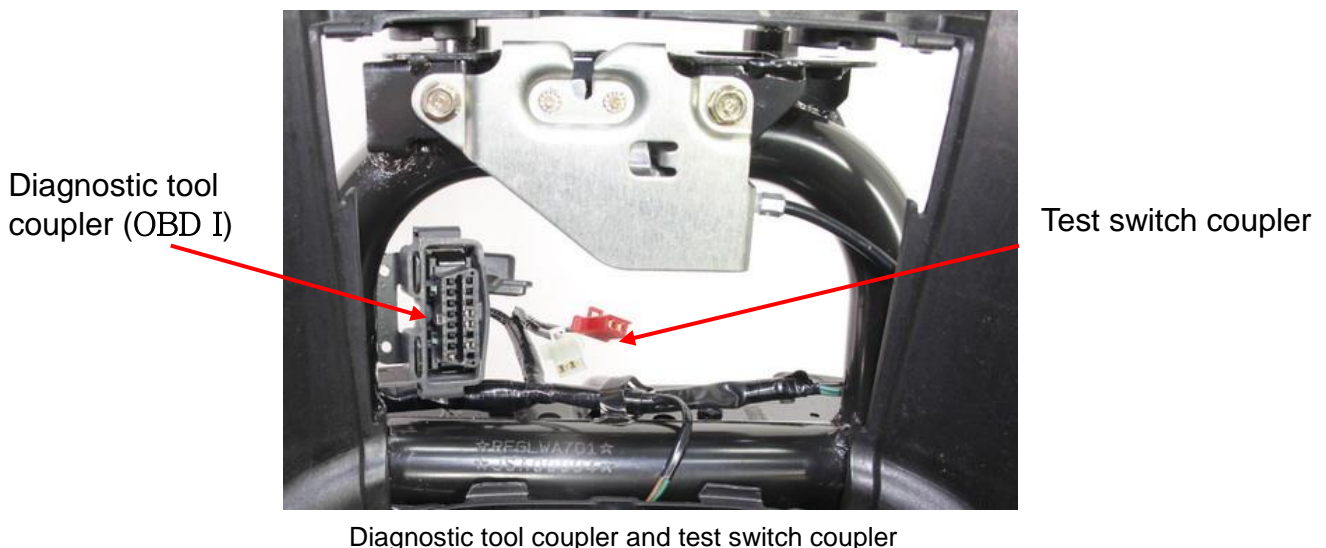
If the fault has been ruled out or repair after the inspection light will be extinguished, but ECU fault code will be recorded, so the need to get rid of fault codes. If a fault exists, this system has two kinds of methods to eliminate fault codes respectively in the diagnosis tool removal and manual removal.

Using diagnostic 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 (Please refer to detailed steps diagnosis tool of instructions), or fault code will always be stored in the ECU.

Manual inspection

Use of cross-wiring (wire or paper clips, etc.) to cross-Joints Test Switch for grounding, in the meter of this check light are flashing, it means that the injection system or parts of abnormal situations, but not in the diagnosis tool can be - for the detection, inspection can enjoy for a long time flashing lights flashing and the short period of time to inform the cause of the malfunction (refer to check light fault information fault code table).



Trouble Code(s) and Sensor(s) Table

List of all active and stored trouble codes in the ECU and their description

NO	Component Inspection	Parameter	Description	Trouble Code
1	Crankshaft position sensor	CRK	The sensor circuit malfunction	P0335
2	Engine coolant temperature sensor	TW	Too low input voltage	P0117
			Too high input voltage or open	P0115
3	Intake air temperature sensor	TA	Too low input voltage	P0112
			Too high input voltage or open	P0110
4	Manifold absolute pressure sensor	PM	Too low input voltage	P0107
			Too high input voltage or open	P0105
5	O2 sensor	HG	Too low input voltage	P0131
			Too high input voltage or open	P0130
6	Throttle position sensor	TH	Too low input voltage or open	P0120
			Too high input voltage	P0123
7	Vehicle speed sensor	VSP	The sensor circuit malfunction	P0500
8	Fuel injector	INJ	Short circuit to ground or open circuit	P201
			Short circuit to battery	
9	Idle Speed Control stepper motor	ISC	Short circuit to ground or open circuit	P0511
			Short circuit to battery	
10	ISC system	ISCNEL	Idling speed is low	P1505
		ISCNEH	Idling speed is high	
11	Ignition coil primary control circuits	IG	Short circuit to ground or open circuit	P0351
			Short circuit to battery	
12	O2 sensor heater	HR	Short circuit to ground or open circuit	P0030
			Short circuit to battery	P0032
13	Secondary air injection system	EXAI	Short circuit to ground or open circuit	P0412
			Short circuit to battery	
14	Rollover sensor	RO	Too low input voltage	P1630
			Too high input voltage or open	
15	Fuel pump relay	FLR	Short circuit to ground or open circuit	P0230
			Short circuit to battery	
16	Cooling fan relay	FAN	Short circuit to ground or open circuit	P0480
			Short circuit to battery	
17	Variable Inlet Port solenoid	VIP	Short circuit to ground or open circuit	P1415
			Short circuit to battery	
18	Starter motor relay	STR	Short circuit to ground or open circuit	P0615
			Short circuit to battery	
19	Keep Alive Memory	KAM	KAM error	P0603
20	SPI communication (INJ & device driver)	SPI	SPI communication	P1600

4. Fuel Injection System

EFi System Diagnostic Tool - V70

Note:

When problems arise, can be used for diagnosis tool of the fault is detected, and exclusion.

Method of Use:

1. Maintain engine flameout state, do not open main switch.
2. Opened the luggage box lighting light cover, connected to the diagnostic connector for diagnosis tool.
3. Then open the main switch and the diagnosis tool power switch after diagnosis display screen appeared the words connection.
4. Press the "ENTER" button into the main screen (there are 6 major functions: ECU ID, DATA STREAM, FREEZED DATA, TROUBLE CODE, ERASE TB CODE and CO ADAPTION)
5. Use ▲, ▼ select button under the function, press the "ENTER" button access into various functions. Example: select "DATA STREAM," by the "ENTER" button, the screen showed that the existing fault codes; indicates no fault "system is OK."
6. Press "EXIT" button to leave of the various functions.
7. Must to close the main switch or power switch of the diagnosis tool after, and then can removal of diagnosis tool coupler.





Diagnostic Tool Use Note

Connect diagnostic tool coupler to vehicle and key on.

Press ENTER to main function.

Use "▲" "▼" button to select.

4. Fuel Injection System



Troubleshooting Table

Test items Abnormal phenomena		Comprehensive testing program							Parts		
		Power voltage	Fuel press.	Ignition state	Engine vacuum	Injection state	closed-loop control system	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	O2 sensor				
		Power relay	Fuel pressure adjustment valve	Spark plug	Cylinder head	Fuel pump	Secondary air injection solenoid valve				
		Main switch	Fuel pump relay		Inlet pressure sensor	Fuel pressure adjustment valve					
		Battery	Fuel filter								

- 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	<ul style="list-style-type: none"> Use meter direct measurement battery voltage Use diagnosis tool detection of battery voltage 	<ul style="list-style-type: none"> Battery voltage 	<ul style="list-style-type: none"> Battery voltage = 10V Above 	<ul style="list-style-type: none"> Battery electricity Battery connector loose Harness circuit opening ECU coupler not connected properly
2	Fuel pressure	<ul style="list-style-type: none"> 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 the fuel pressure throttle several rotation check to the change of fuel pressure again 	<ul style="list-style-type: none"> Open the main switch, but not to start the engine of pressure Pressure in idle Rotating throttle, situation of pressure changes 	<ul style="list-style-type: none"> Open main switch, but not srart: pressure = 250kPa (Stable value) Idle state: pressure = 294±6kPa (Beating situation from top to bottom) rotation throttle moment: pressure = 294±6kPa (Slightly beating) 	<ul style="list-style-type: none"> Fuel not enough Security switch not disarm Ruel pump relay fault Ruel pump fault Injector fault ECU fault
3	Ignition state	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Spark plug specifications Whether the spark plug ignition Spark plug sparks whether it is normal strength 	<ul style="list-style-type: none"> Specifications: NGK-CR8H Ignition conditions: With traditional engines found ways 	<ul style="list-style-type: none"> Spark plug fault Roll over sensor fault ECU No. 5 pin fault Ignition coil fault Crankshaft position sensor fault
4	Engine vacuum	<ul style="list-style-type: none"> Diagnosis tool to detect the engine vacuum 	<ul style="list-style-type: none"> Manifold pressure of diagnosis tool 	<ul style="list-style-type: none"> Manifold pressure =32~38kPa 	<ul style="list-style-type: none"> Valve clearance abnormal Intake system leak
5	Injection state	<ul style="list-style-type: none"> 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? Once again start engines or use for the diagnosis tool of output function Check injector fuel injection and the injection situation 	<ul style="list-style-type: none"> Open the main switch, but did not start engine the injection situation Injector state when start 	<ul style="list-style-type: none"> Not started, injector not leaking fuel In started, the injection state must show fan shape 	<ul style="list-style-type: none"> Security unit is configured not disarm Fuel pump relay fault Fuel pump fault Injector fault ECU fault
6	Closed - loop control system	<ul style="list-style-type: none"> Use of diagnostic tool observation O2 Sensor voltage changes 	<ul style="list-style-type: none"> Stable condition, sensor voltage variation (Idle continued 5 minutes later to measurement) 	<ul style="list-style-type: none"> Idle stable condition: O2 Sensor voltage = 50 ~ 200mV (Show from top to bottom beating phenomenon) 	<ul style="list-style-type: none"> O2 Sensor fault ECU fault
7	Fault Code Detection	<ul style="list-style-type: none"> Use of the diagnosis tool existing fault-detection code or historical Fault Code Elimination of the implementation of fault codes, check can be eliminated Once again start engine Check fault is it happen again 	<ul style="list-style-type: none"> Diagnosis tool of the fault code is it can be eliminated Start again, the fault is it will happen again 	<ul style="list-style-type: none"> Without any residual Fault Code If residual Fault Code, according to the "Fault Code Maintenance Form" implementation of troubleshooting 	<ul style="list-style-type: none"> throttle position sensor fault Engine temperature sensor fault Intake temperature sensor fault Manifold pressure sensor fault O2 Sensor fault Crankshaft position sensor fault ECU fault Roll over 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.

4. Fuel Injection System



NOTE:

Precautions in Operation.....5-1	Rear Fork..... 5-9
Engine Removal5-2	Engine Bush Removal 5-10
Engine Hanger.....5-8	Engine Installation 5-11

Precautions in Operation

General Information

- Engine must be supported by a bracket or adjustable tool in height.
- The following parts can be serviced with the engine installed on the frame.
 1. EFi components
 2. AC. Generator and start clutch
 3. Drive face, drive belt, driven pulley
 4. Final reduction gear mechanism

Specification

Item		Specification
Engine Oil Capacity	Replacement	1,200 c.c.
	Disassemble	1,400 c.c.
Gear Oil Capacity	Replacement	160 c.c.
	Disassemble	180 c.c.
Capacity of coolant	Engine + radiator	950 c.c.
	Reservoir upper	450 c.c.

Torque Values

Engine hanger bolt (frame side)	7.5~9.5kgf-m
Engine hanger nut (engine side)	7.5~9.5kgf-m
Bolt of rear cushion upper connection	3.5~4.5kgf-m
Bolt of rear cushion lower connection	2.4~3.0kgf-m
Rear wheel axle nut	11.0~13.0kgf-m

5. Removal & Installation of Engine



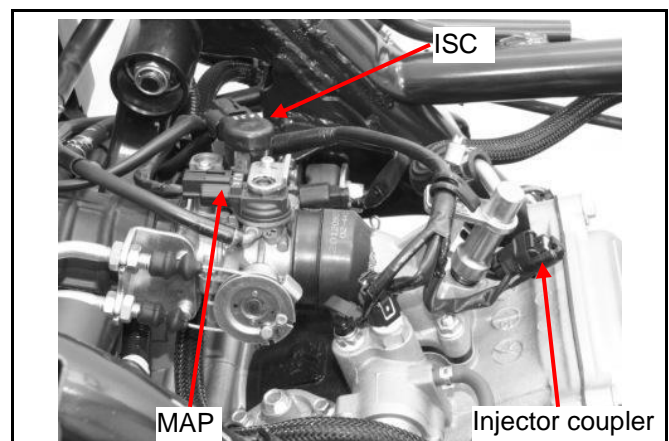
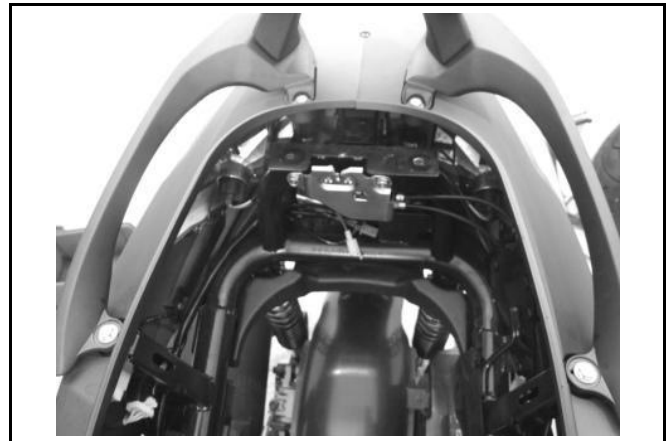
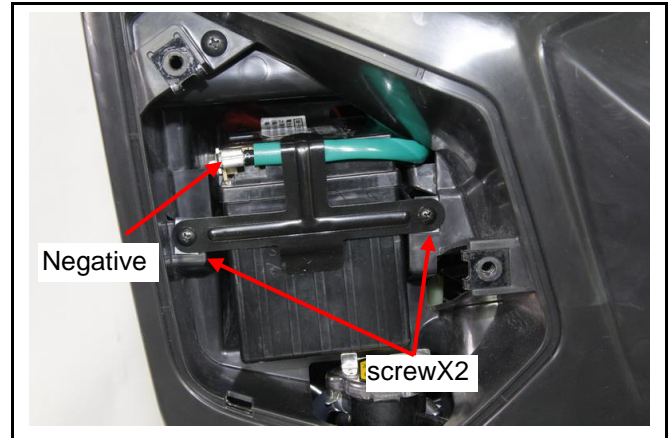
Engine Removal

Open inner box cover.
Remove battery cover (1 screw).
Remove the battery negative (-) cable.
Remove the battery positive (+) cable.

Open the seat.
Remove the luggage box.
(Refer to chapter 13)

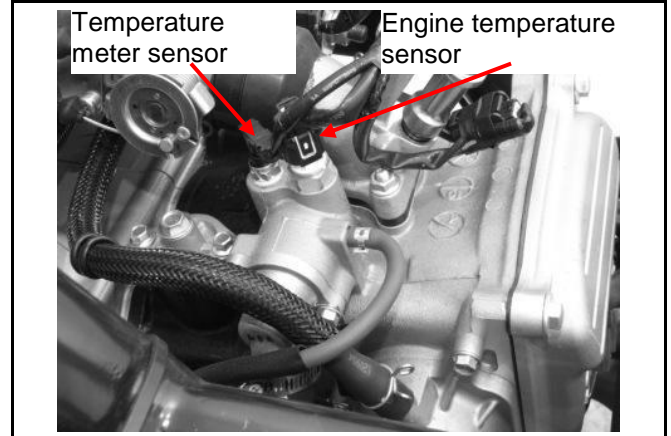
Remove rear carrier.
Disconnect tail light coupler.
Remove right and left body covers.
Remove right and left side covers.
(Refer to chapter 13)

Remove fuel injection system of electrical couplers and fuel hoses
Remove idle speed control valve, inlet pressure sensor, coupler of fuel injector.

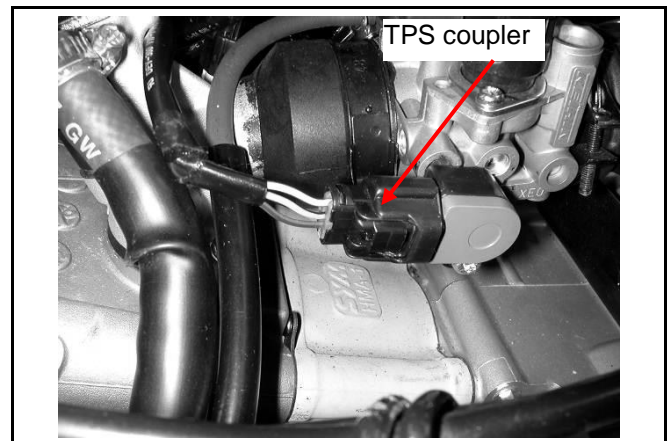


5. Removal & Installation of Engine

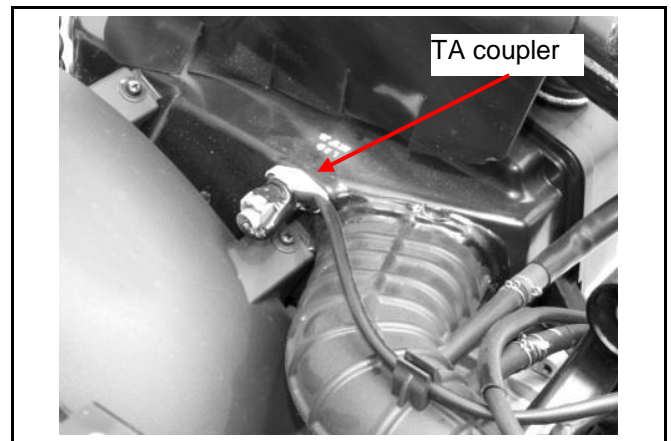
Remove the temperature meter sensor and engine temperature sensor wire couplers.



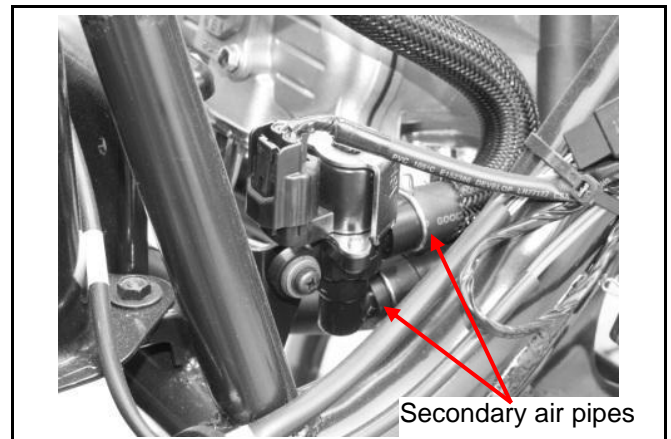
Remove throttle position sensor coupler.



Remove inlet temperature sensor coupler.



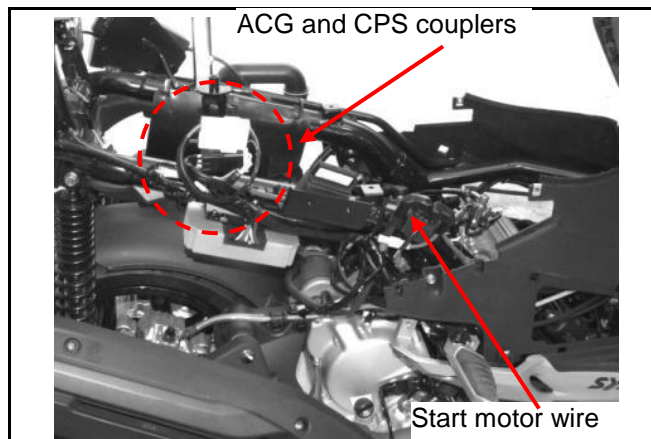
Remove secondary air solenoid valve pipes.



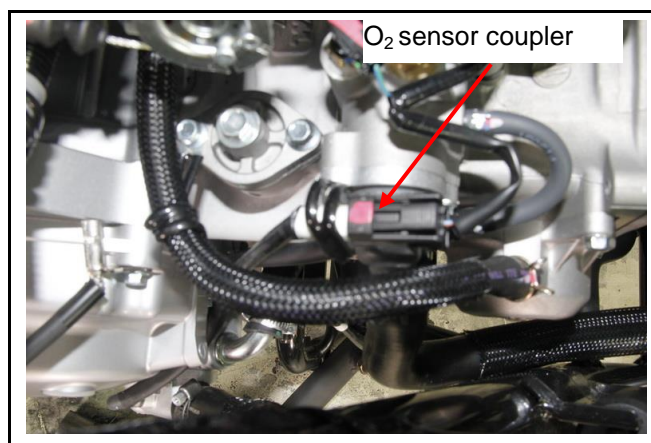
5. Removal & Installation of Engine



Remove AC generator and crankshaft position sensor coupler.
Remove start motor wire from the start relay.



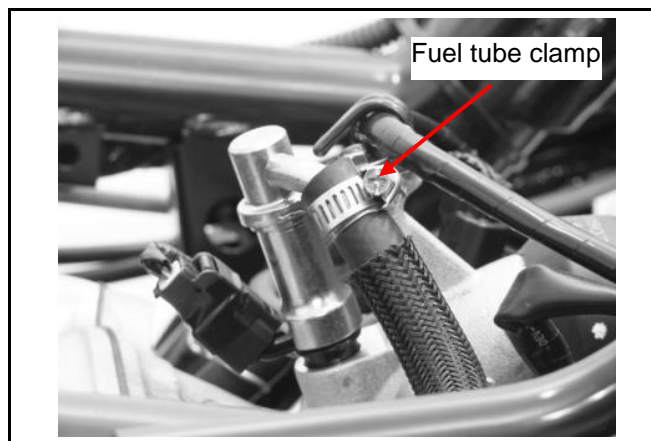
Remove O₂ sensor wire coupler.



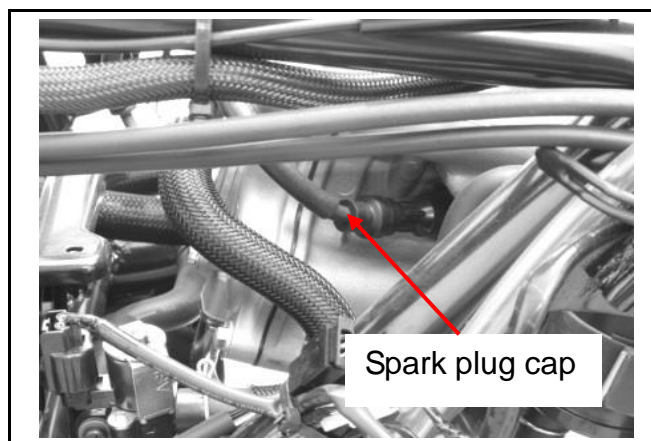
Start engine for the pipeline to be exhausted within the residual pressure, the engine flameout, relaxing fuel tube folder, open for fuel tube.

Caution

- When removing fuel tubes, release the pressure in the tube, or clamp the tubes with tube pliers to avoid fuel from splashing out.

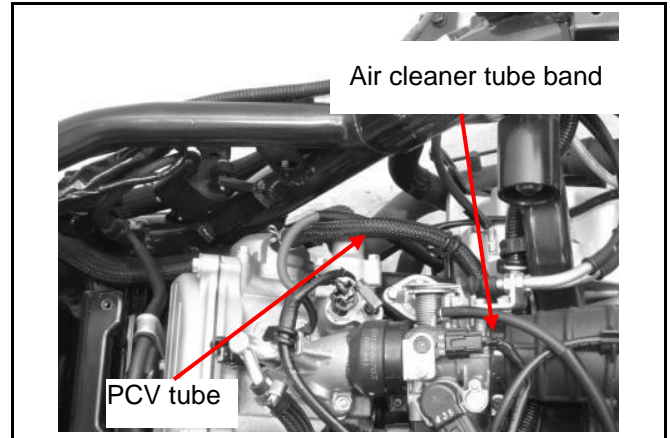


Remove spark plug cap.

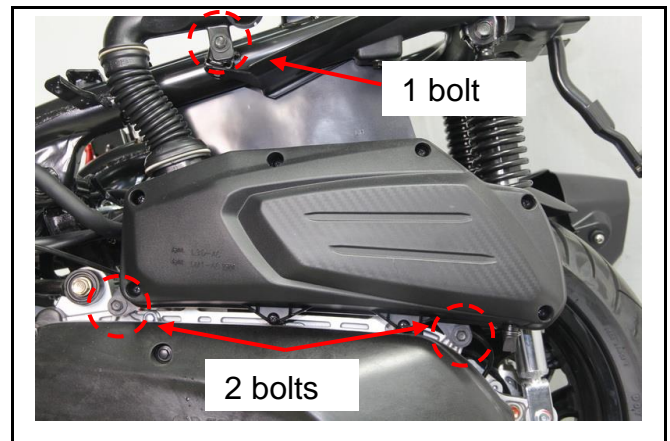


5. Removal & Installation of Engine

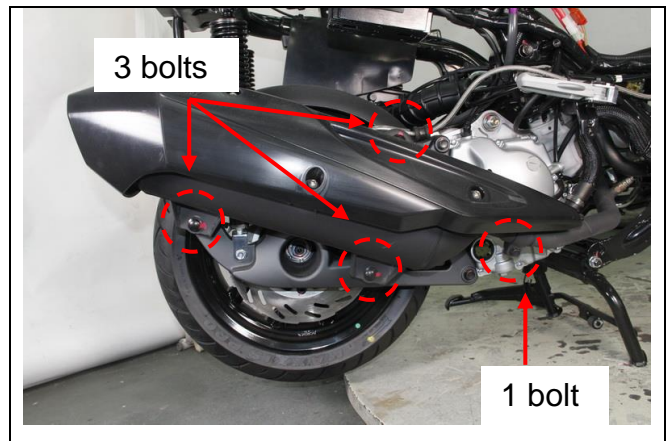
Remove PCV tube.
Remove air cleaner tube band.



Remove the air cleaner inlet pipe connection bolt (1 bolt).
Remove the air cleaner connection bolts (2 bolts).
Remove the air cleaner.



Release muffler connection bolt. (1 bolt)
Remove muffler bolts. (3 bolts)



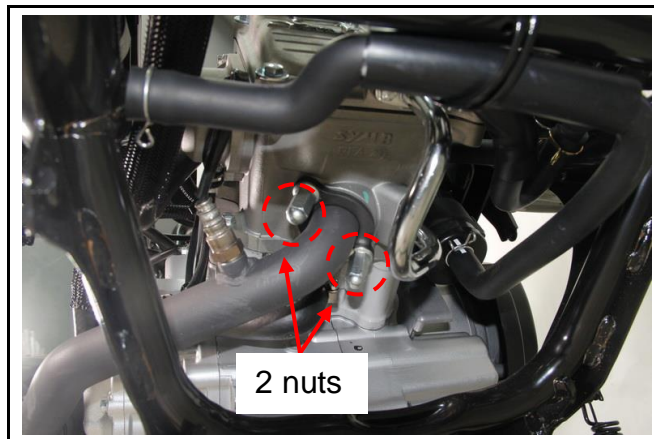
Remove muffler.



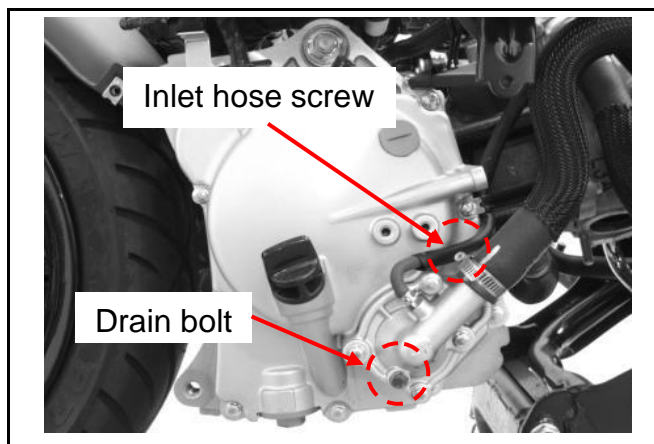
5. Removal & Installation of Engine



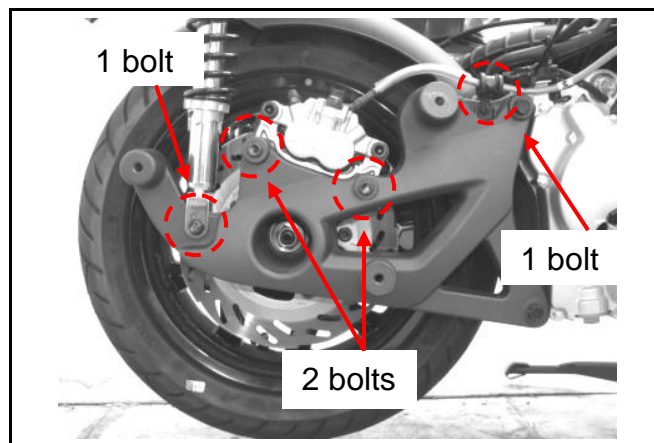
Remove nuts from exhaust pipe. (2 nuts)



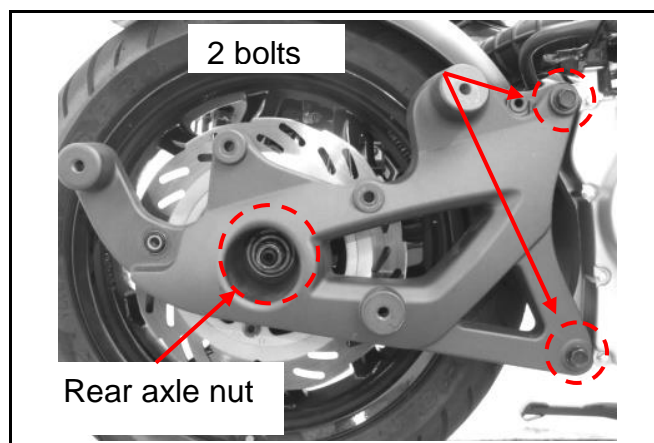
Remove drain bolt and drain out coolant.
Remove inlet hose from water pump.



Remove rear caliper bolts. (2 bolts)
Remove brake hose bolt. (1 bolt)
Remove right rear cushion lower bolt. (1 bolt)



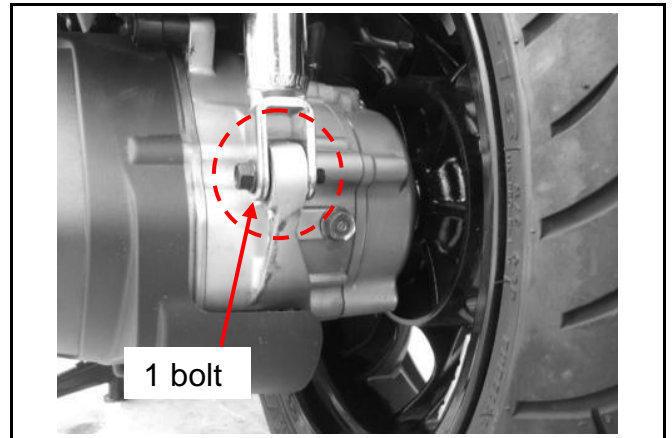
Remove the rear fork bolts. (2 bolts)
Remove the rear wheel axle nut. (1 nut)



Remove rear wheel.



Remove left rear cushion lower bolt. (1 bolt)



Support engine with bracket.
Remove frame side engine hanger bolts.
(each side 1 bolt)
Remove engine and engine hanger.

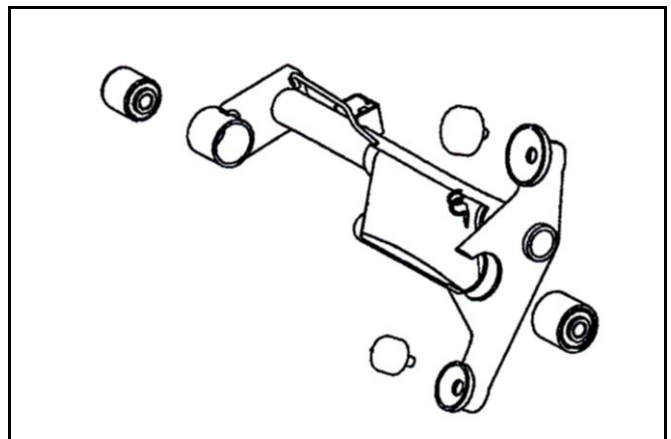
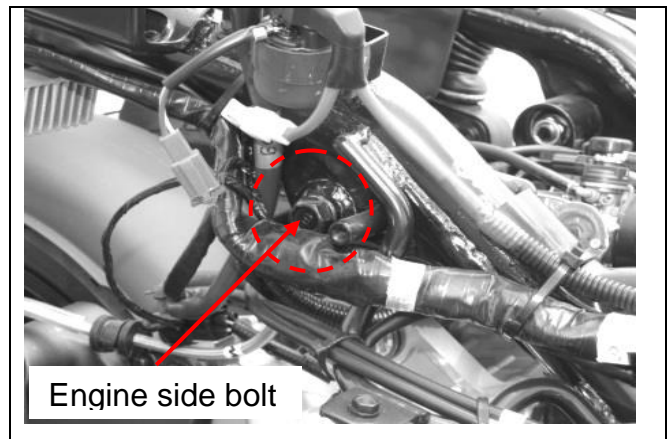
Engine Hanger

Removal

Remove the engine side bolts of engine hanger. (1 bolt on each side)
Remove engine hanger.
Check if the engine hanger bush and cushion rubber is damaged. If yes, replace with new ones.

Installation

Tighten the bolts and nuts of engine hanger.
Torque Value: 7.5~9.5kgf-m



5. Removal & Installation of Engine



Rear Fork

Bearing Inspection

Rotate bearing inner ring with fingers. Check if bearing can be turned smoothly and silently, and also check if bearing outer ring is mounted on rear fork tightly. If bearing rotation is uneven, noising, or loose bearing mounted, then replace it.

Bearing removal

Remove bearing mounting circlip.
Drive the bearing out of the rear fork.

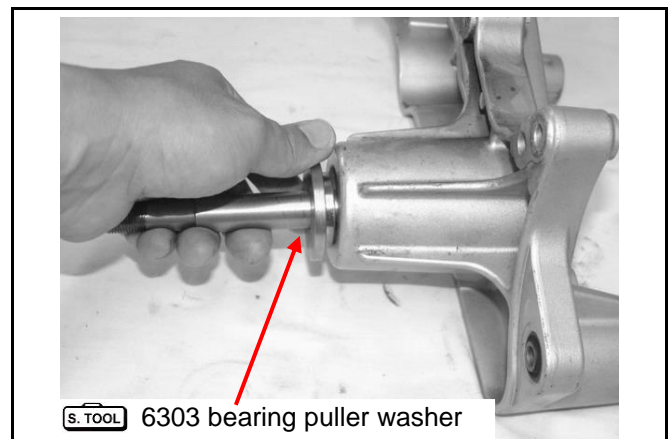
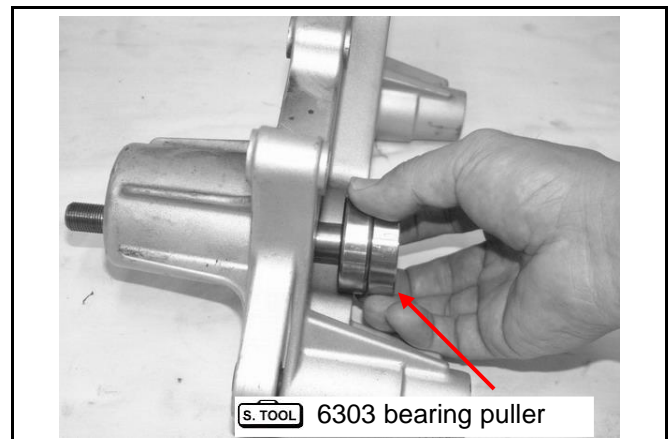
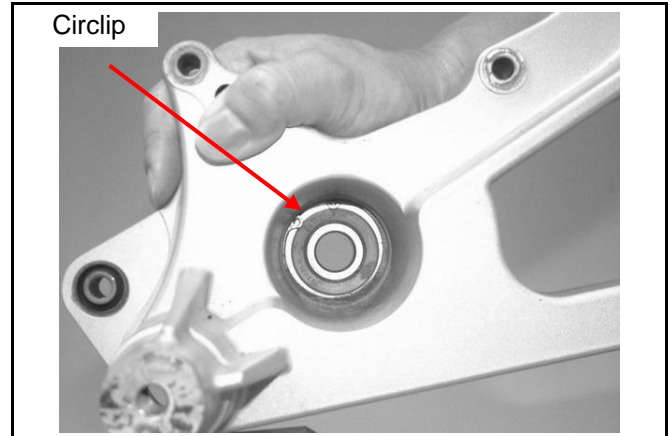
Bearing installation

Install new rear axle bearing and bearing puller into rear fork.

Special Service Tools:

Rear fork bearing puller
SYM-6303000-6303

Install the washer of the 6303 bearing puller.



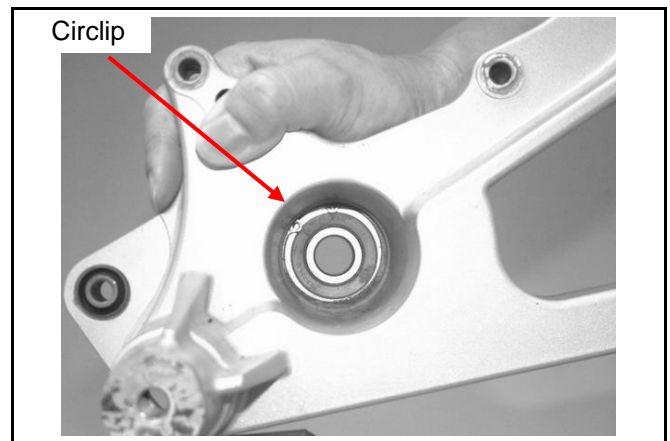
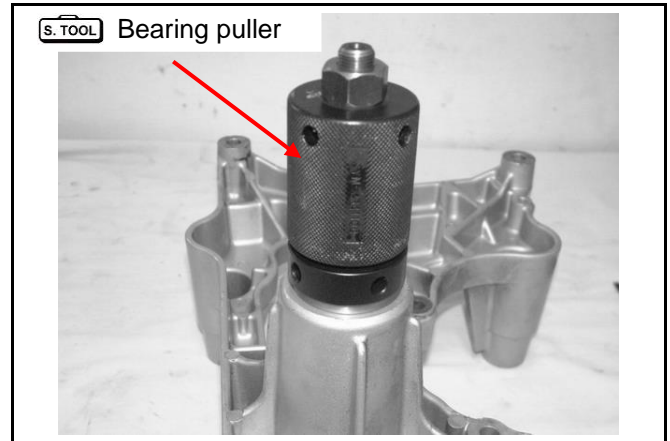
Install assembly directs puller

Special Service Tools:

Assembly directs puller SYM-2341110

Use screw driver to hold bearing puller lower part, and turn the bearing puller upper part to install the rear fork bearing.

Install bearing mounting circlip.



Engine Bush Removal

Check if the engine hanger frame and the cushion rubber of rear cushion bush is damaged. With the bush remover / presser, $\varnothing 28\text{mm}$ & $\varnothing 20\text{mm}$, to press the bush out, and replace it with new one.

Pressing out

Place the detent section of the bush remover toward the bush, and drive both the pressing ring and bolt in to press the bush out.

Special Service Tools:

Crankcase bush remover/presser

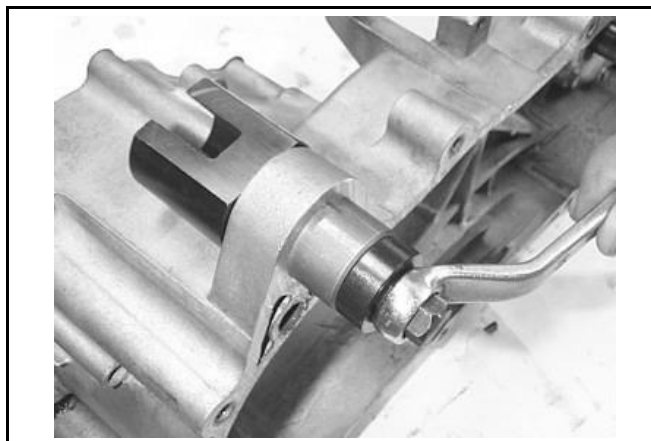
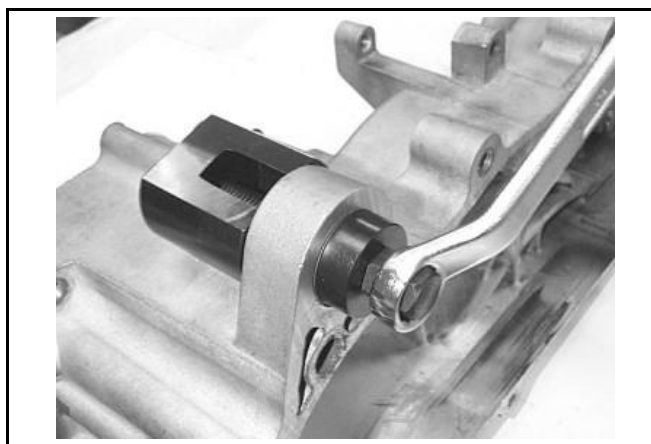
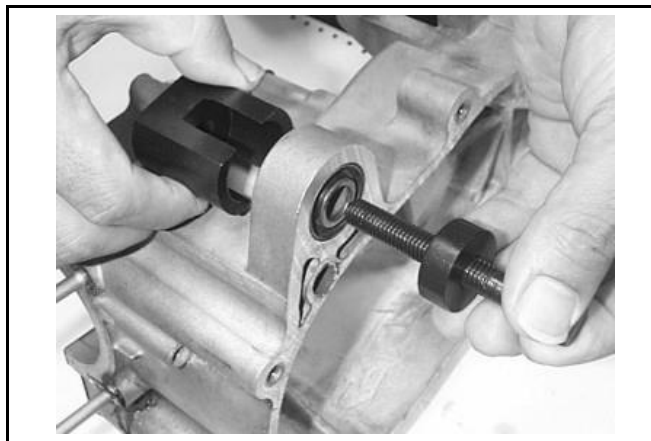
SYM-1120310

Crankcase bush remover/presser

SYM-1120320

Pressing In

Place the flat section of the remover toward the bush, and then drive the bush, pressing ring, and bolt in to install the bush.



Engine Installation

Check if bush of engine hanger and cushion is damaged. If yes, replace with new one.

Install the engine according to the reversing order of removal.

⚠ Caution

- When installing engine, avoid hands and feet from injury.
- Do not bent or squeeze wires and hoses.
- Route all cables and wires in accordance with the routine layout.

Torque values:

Engine hanger nut: 7.5~9.5kgf-m

Rear cushion upper bolt: 3.5~4.5kgf-m

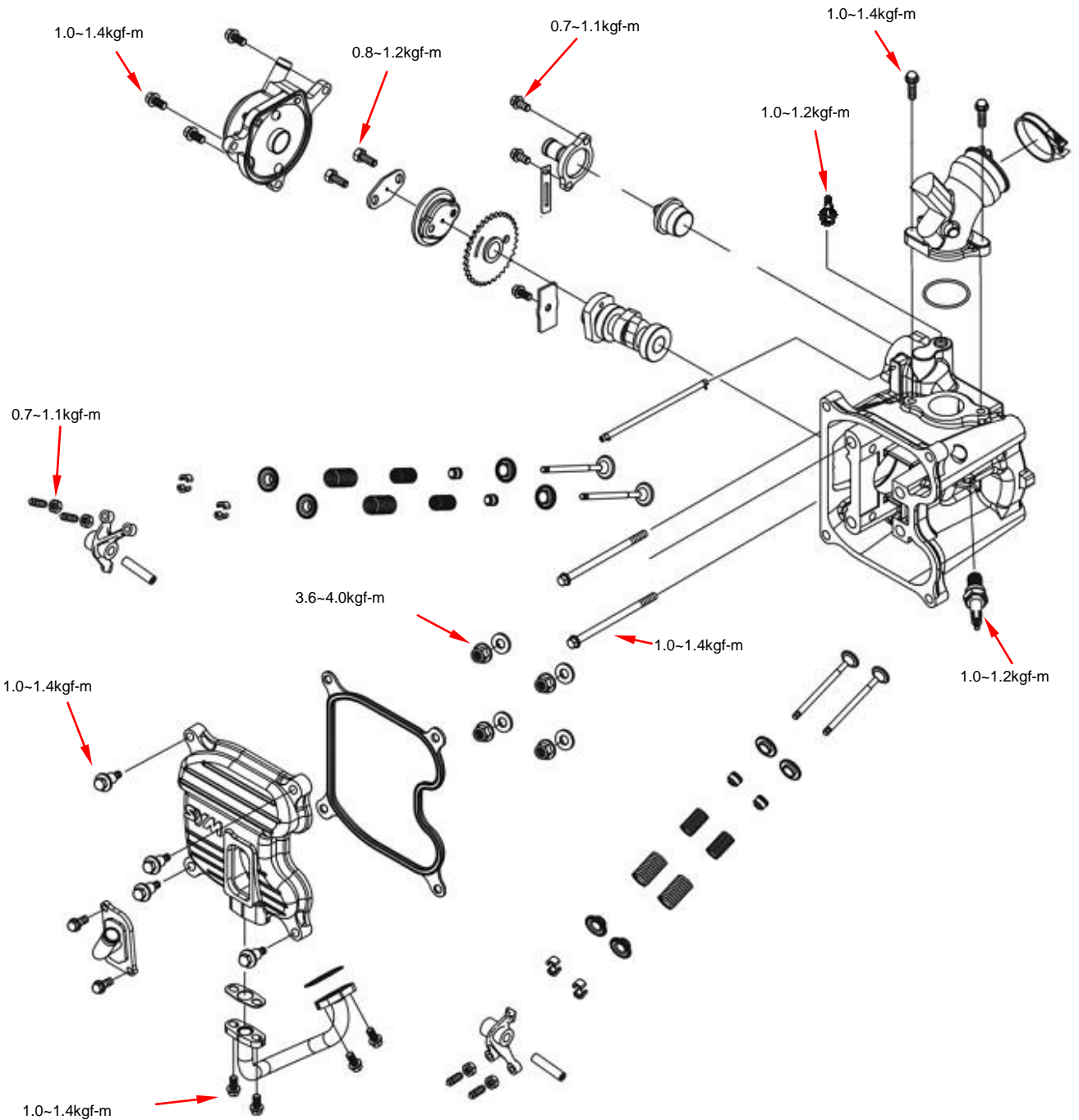
Rear cushion lower bolt: 2.4~3.0kgf-m

Rear wheel axle nut: 11.0~13.0kgf-m



Mechanism Diagram.....	6-1	Valve Stem Replacement	6-10
Precautions in Operation	6-2	Valve Seat Inspection and Service	6-11
Troubleshooting	6-3	Cylinder Head Reassembly	6-13
Cylinder Head Removal	6-4	Cylinder Head Installation	6-14
Cylinder Head Disassembly.....	6-6	Valve Clearance Adjustment.....	6-16
Cylinder Head Inspection.....	6-8		

Mechanism Diagram



Precautions in Operation

General Information

This chapter contains maintenance and service for cylinder head, valve, and camshaft as well as rocker arm.

Cylinder head service cannot be carried out when engine is in frame.

Specification

mm

Item		Standard	Limit	
Compression pressure		14.0±2 kg/cm ²	---	
Camshaft	Height of cam lobe	Intake	34.880	
		Exhaust	34.740	
Rocker arm	ID of valve rocker arm	11.982~12.000	12.080	
	OD of valve rocker arm shaft	11.966~11.984	11.936	
Valve	OD of valve stem	Intake	4.975~4.990	
		Exhaust	4.950~4.975	
	ID of valve guide		5.000~5.012	5.030
	Clearance between valve stem and guide	Intake	0.010~0.037	0.080
		Exhaust	0.025~0.062	0.100
	Free length of valve spring	Inner	38.700	35.200
		outer	40.400	36.900
	Valve seat width		1.000	---
	Valve clearance	Intake	0.10±0.02mm	---
Exhaust		0.15±0.02mm	---	
Tilt angle of cylinder head		---	0.050	

Torque Value

Cylinder head side cover bolt	1.0~1.4kgf-m	Sealing bolt of cam chain auto-tensioner	
Cylinder head side cover bolt	1.0~1.4kgf-m		0.8~1.2kgf-m
Cylinder head bolt	1.0~1.4kgf-m	Bolt of cam chain auto-tensioner	1.2~1.6kgf-m
Cylinder head Nut	3.6~4.0kgf-m	Tappet adjustment screw nut	0.7~1.1kgf-m
Cam sprocket hex bolt	1.0~1.4kgf-m	Exhaust pipe stud bolt	2.4~3.0kgf-m
		Spark plug	1.0~1.2kgf-m

Special service tools

Valve reamer: 5.0mm

Valve guide driver: 5.0mm

Valve spring compressor

Troubleshooting

Engine performance will be affected by troubles on engine top parts. The trouble usually can be determined or by performing cylinder compression test and judging the abnormal noise generated.

Unstable idle speed

- Low compression pressure

Low compression pressure

1. Valve

- Improper valve adjustment
- Burnt or bent valve
- Improper valve timing
- Valve spring damaged
- Valve carbon deposit
- Valve seat pressure leaking
- Improper spark plug installation

2. Cylinder head

- Cylinder head gasket leaking or damaged
- Tilted or cracked cylinder

3. Piston

- Piston ring worn out.

High compression pressure

- Too much carbon deposit on combustion chamber or piston head

Noise

- Improper valve clearance adjustment
- Burnt valve or damaged valve spring
- Camshaft worn out or damaged
- Worn or loose cam chain
- Auto-tensioner worn out or damaged
- Camshaft sprocket worn out
- Rocker arm or rocker arm shaft worn out

White smoke out of muffler

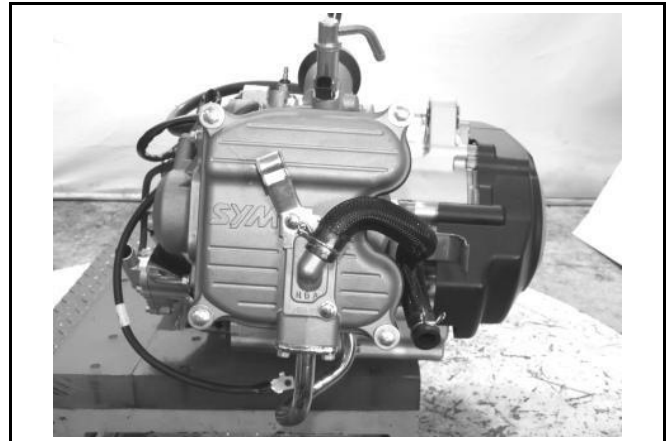
- Valve guide or valve stem worn out
- Valve stem seal worn out

6. Cylinder Head / Valve



Cylinder Head Removal

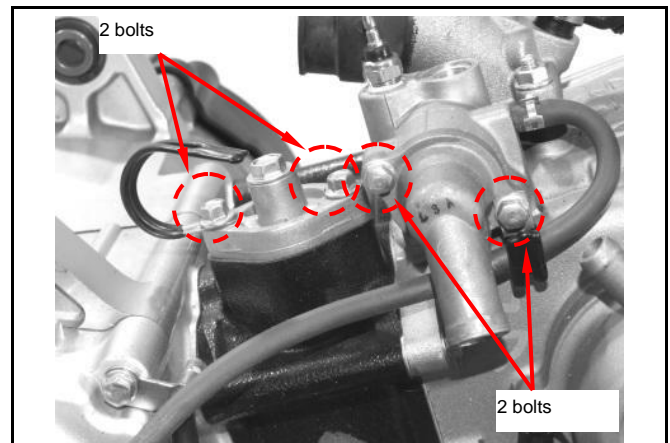
Remove engine. (Refer to chapter 5)



Remove tensioner adjuster bolt. (1 bolt)

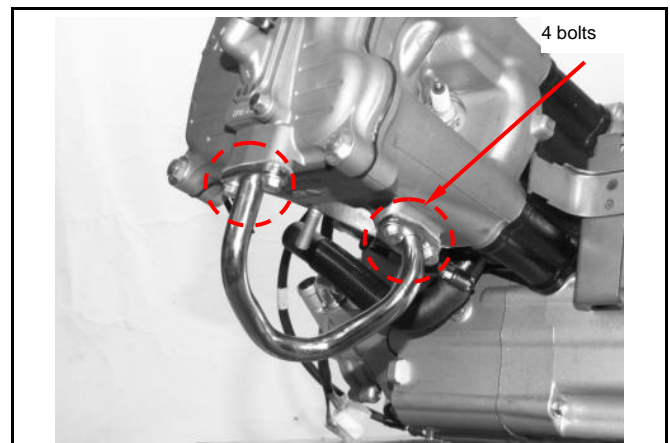
Remove tensioner bolts. (2 bolts)

Remove thermostat bolts. (2 bolts)

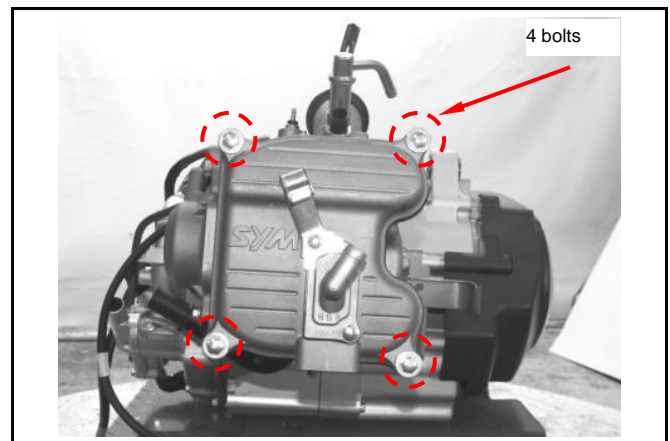


Remove Air Injection system (AI) pipe mounting bolts. (4 bolts)

Remove spark plug.



Remove cylinder head cover bolts. (4 bolts)



Remove the side cover mounting bolts of cylinder head, and then take out the side cover.

Open the timing check cap on right case cover.

Turn the drive face counter clock wise to align the "T" mark on right crankcase; also align timing marks on cam sprocket and cylinder head.

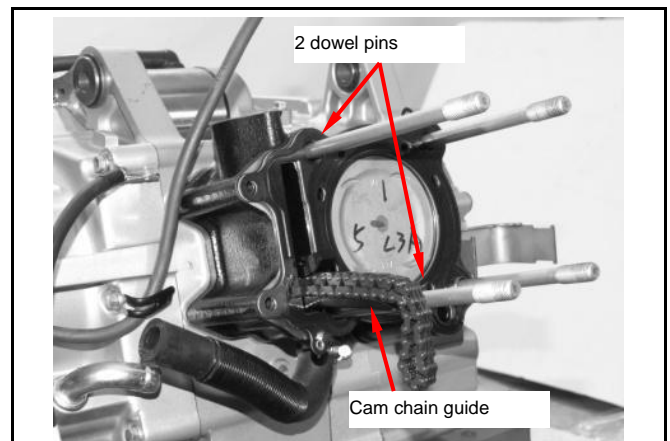
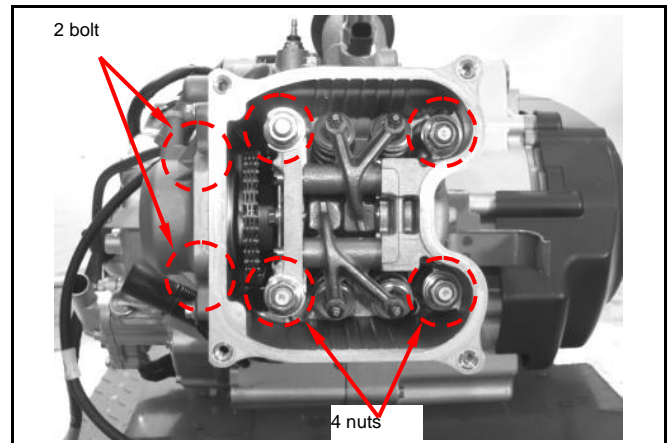
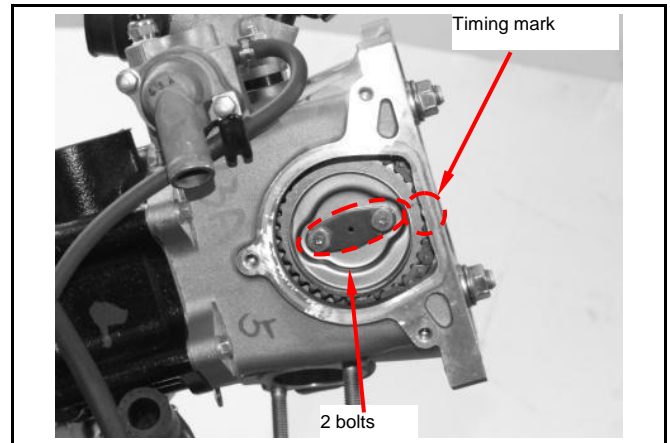
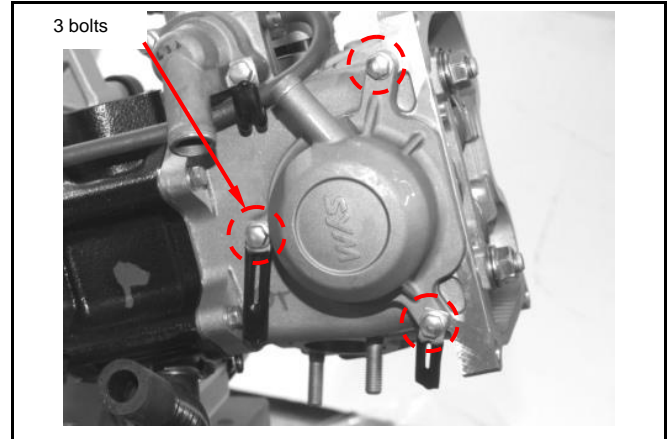
Remove cam sprocket bolts.
Remove cam sprocket.

Remove the 2 cylinder head mounting bolts from cylinder head right side, and then remove 4 nuts and washers from cylinder head upper side.
Remove the cylinder head.

Remove cylinder head gasket and 2 dowel pins.
Remove chain guide.
Clean up residues from cylinder and cylinder head.

Caution

- Do not damage the surfaces of cylinder and cylinder head.
- Avoid residues of gasket or foreign materials from falling into crankcase as cleaning.

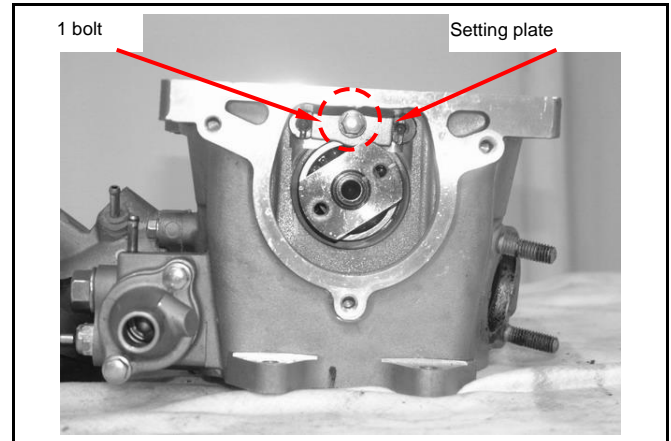


6. Cylinder Head / Valve



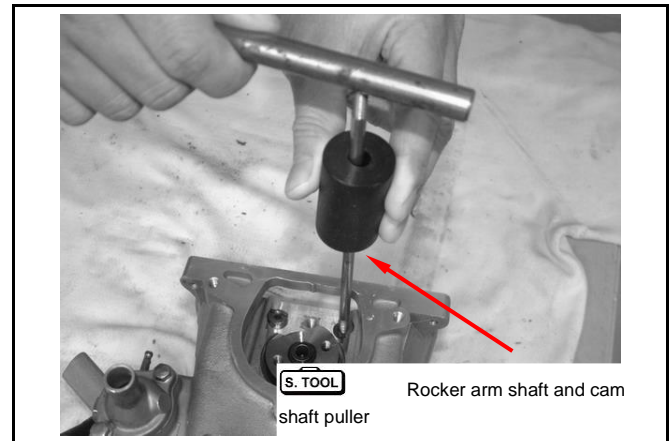
Cylinder Head Disassembly

Remove cam shaft setting plate (1 bolt),
remove cam shaft.



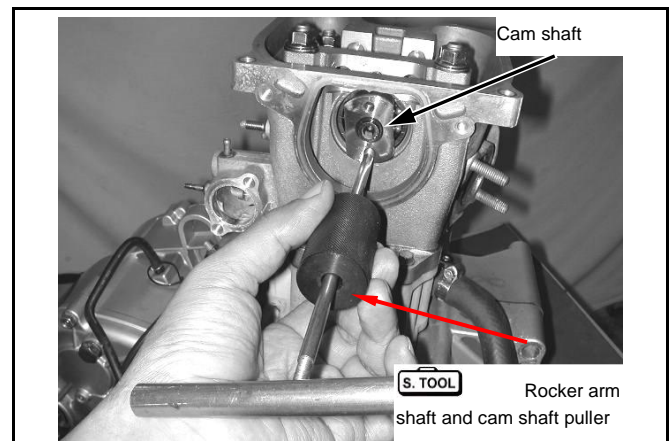
Remove rocker arm shafts and rocker arms.

Special Service Tool:
Rocker arm and cam shaft puller
SYM-1445100



Remove cam shaft.

Special Service Tool:
Rocker arm and cam shaft puller
SYM-1445100

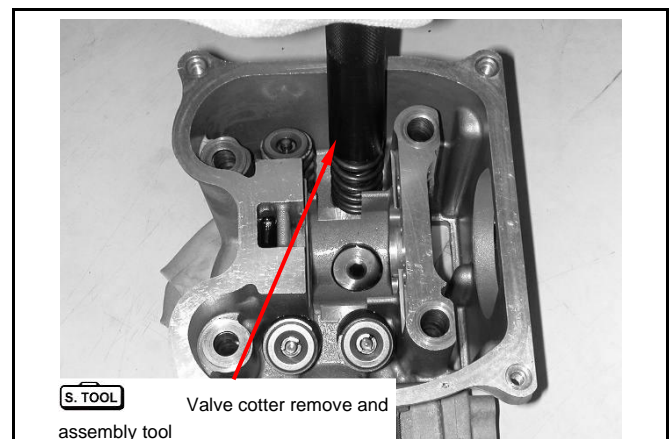


Use a valve cotter remove & assembly tool to
press the valve spring, and then remove
valves.

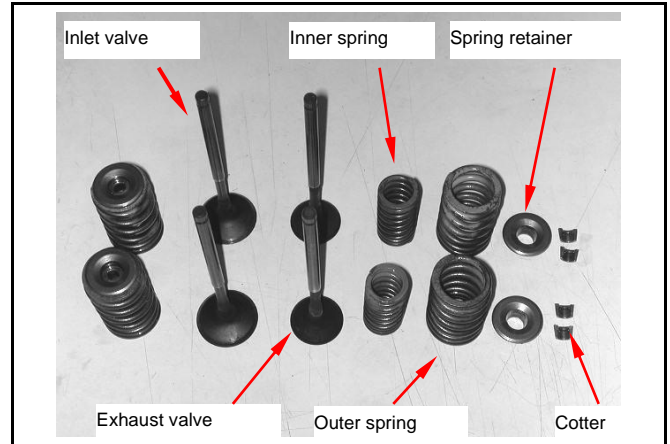
Special Service Tool:
Valve cotter remove & assembly tool
SYM-1471110-SY125

⚠ Caution

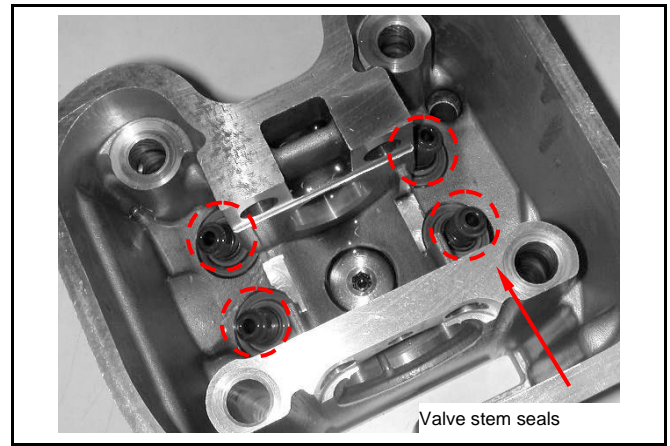
- In order to avoid loosening spring elasticity, do not press the spring too much.
- Place cloth on combustion chamber side when removing/assembling springs to avoid spring from bending.



Remove valve cotters, spring retainers, springs and valves.



Remove valve stem seals.



Clean carbon deposits in combustion chamber.
Clean residues and foreign materials from cylinder head matching surface.

⚠ Caution

- Do not damage the matching surface of cylinder head.



6. Cylinder Head / Valve



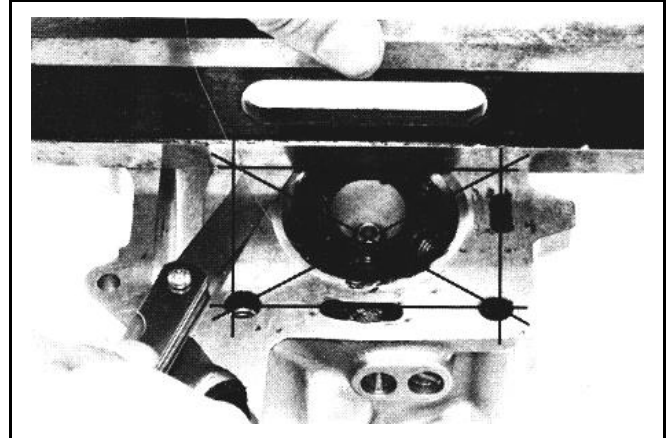
Cylinder Head Inspection

Cylinder surface and holes

Check if spark plug and valve holes are cracked.

Measure cylinder head warp with a straightedge and thickness gauge.

Service limit: 0.05 mm



Camshaft

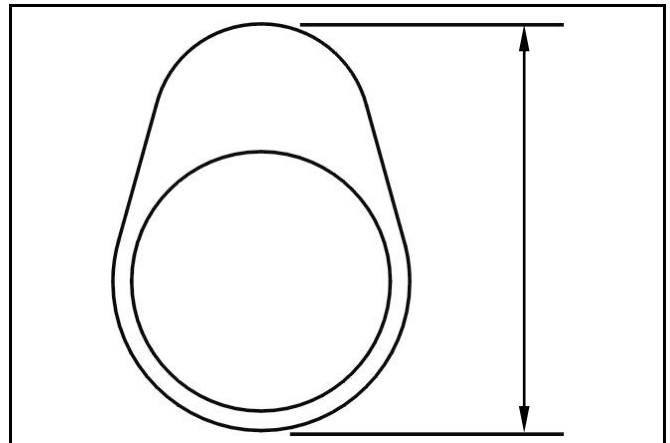
Measure the height of in. and ex. Cam lobe.

Service Limit:

IN: Replacement when less than 34.860mm

EX: Replacement when less than 34.725mm

Inspect if the camshaft bearing is loose or worn out. If yes, replace cam shaft and bearing as a whole set.

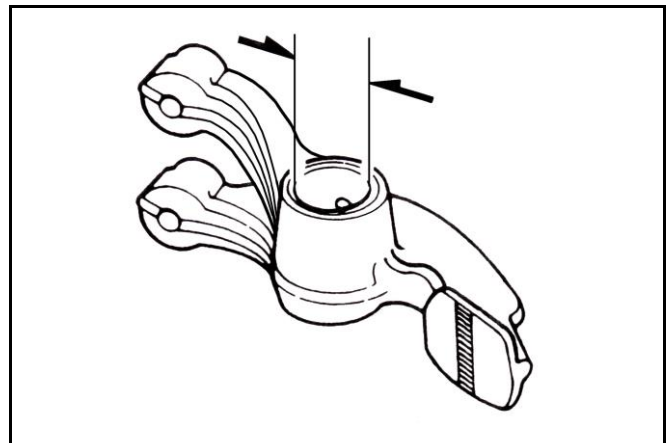


Rocker Arm

Measure the cam rocker arm I.D.

Service Limit: Replace when it is less than 12.080 mm.

Within service limit, inspect if the oil hole is clogged and the surface is worn.



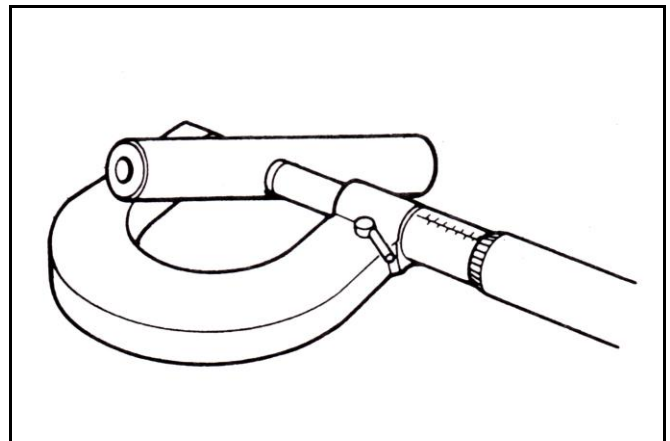
Rocker Arm Shaft

Measure the active O.D. of the cam rocker arm shaft and cam rocker arm.

Service Limit: Replace when it is less than 11.936 mm.

Calculate the clearance between the rocker arm shaft and the rocker arm.

Service Limit: Replace when it is less than 0.10 mm.



Valve spring

Measure the free length of intake and exhaust valve springs.

Service limit:

Inner spring 35.20 mm

Outer spring 36.90 mm

Valve stem

Check if valve stems are bent, cracked or burned.

Check the operation condition of valve stem in valve guide, and measure & record the valve stem outer diameter.

Service Limit: 4.90 mm

Valve guide

Caution

- Before measuring the valve guide, clean carbon deposits with reamer.

Tool: 5.0 mm valve guide reamer

Measure and record each valve guide inner diameters.

Service limit: 5.03 mm

The difference that the inner diameter of valve guide deducts the outer diameter of valve stem is the clearance between the valve stem and valve guide.

Service Limit: IN→ 0.08 mm, EX→ 0.10 mm

Caution

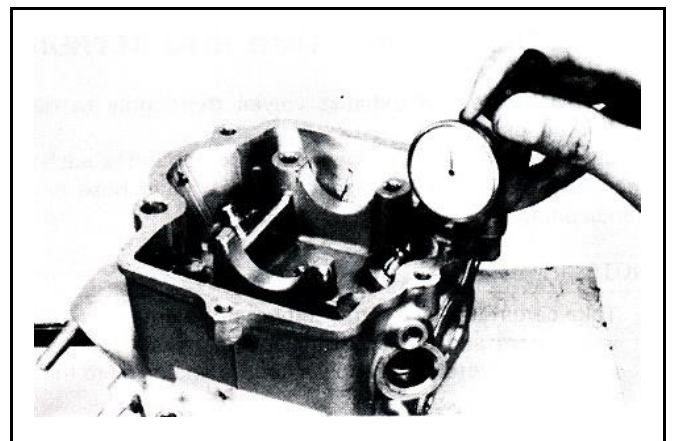
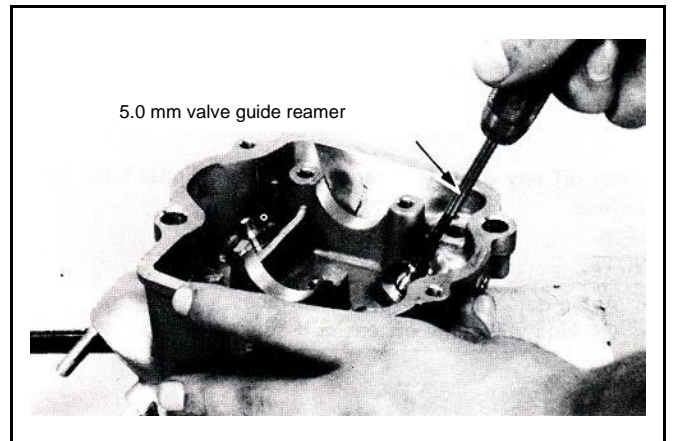
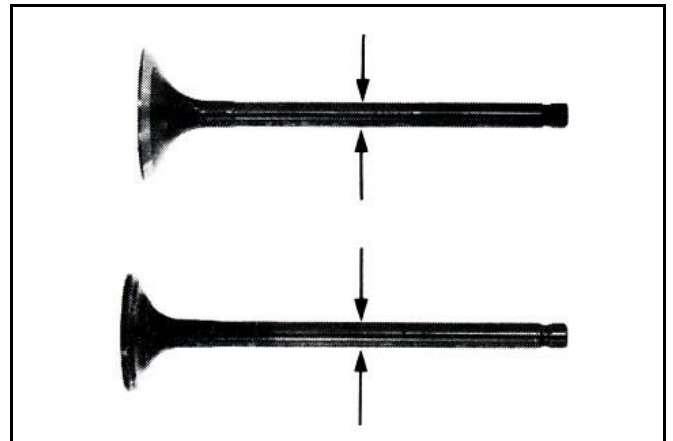
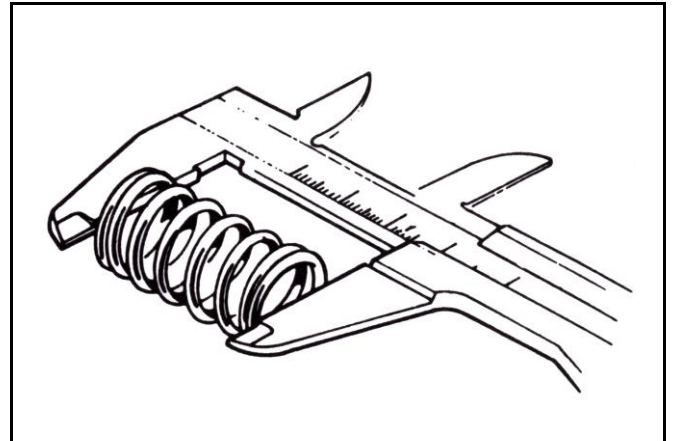
- If clearance between valve stem and valve guide exceeds service limit, check whether the new clearance is within service when only replacing new valve guide. If yes, replace valve guide.

Correct it with reamer after replacement.

If clearance still exceeds service limit after replaced valve guide, replace valve stem too.

Caution

- Correct valve seat when replacing valve guide.



6. Cylinder Head / Valve



Valve Stem Replacement

Heat up cylinder head to 100~150 °C with heating plate or toaster.

⚠ Caution

- Do not let torch heat cylinder head directly. Otherwise, the cylinder head may be deformed as heating.
- Wear gloves to protect your hands when operating.

Hold the cylinder head, and then press out old valve guide from combustion chamber side.

Tool: Valve guide driver: 5.0 mm

⚠ Caution

- Check if new valve guide is deformed after pressing it in.
- When pressing in the new valve guide, cylinder head still have to be kept in 100~150°C.

Adjust the valve guide driver and let valve guide height is in 13 mm.

Press in new valve guide from rocker arm side.

Tool: Valve guide driver: 5.0 mm

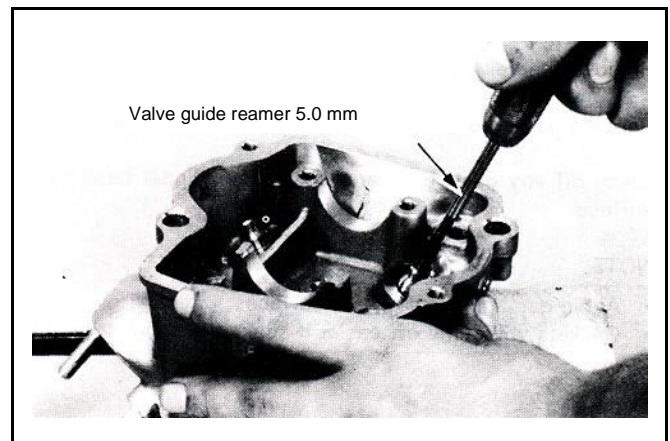
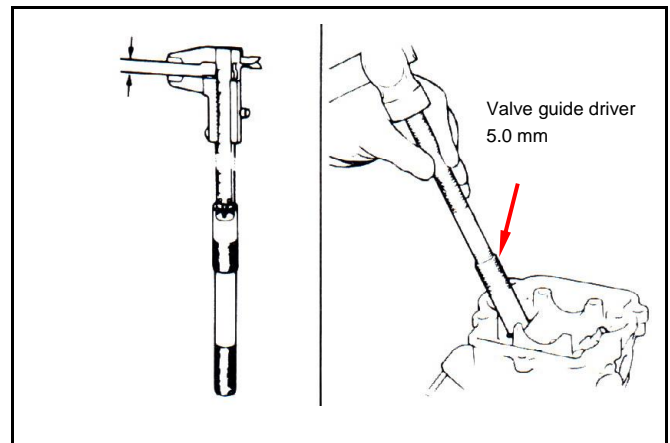
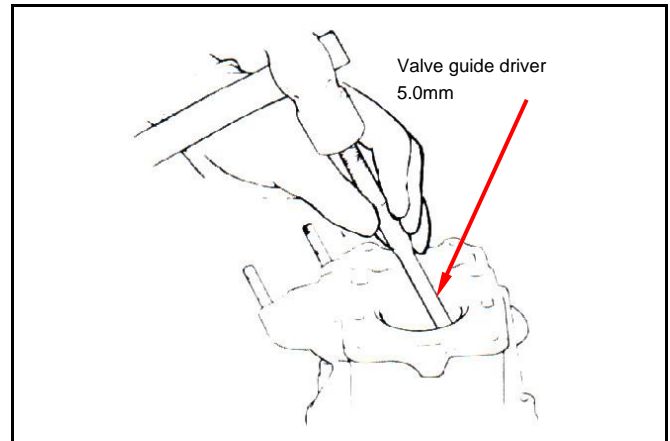
Wait for the cylinder head cooling down to room temperature, and then correct the new valve guide with reamer.

⚠ Caution

- Using cutting oil when correcting valve guide with a reamer.
- Turn the reamer in same direction when it inserting or rotating.

Correct valve seat, and clean up all metal residues from cylinder head.

Tool: Valve guide reamer: 5.0 mm



Valve Seat Inspection and Service

Clean up all carbon deposits on intake and exhaust valves.

Apply with emery slightly onto valve contact face. Grind valve seat with a rubber hose or other manual grinding tool.

Caution

- Do not let emery enter into valve stem and valve guide.
- Clean up the emery after correcting, and apply with engine oil onto contact faces of valve and valve seat.

Remove the valve and check its contact face.

Caution

- Replace the valve with new one if valve seal is rough, worn out, or incompletely contacting with valve seat.
- If valve and valve seat cannot contact closely after correcting, replace with new ones.

Valve seat inspection

If the valve seat is too wide, narrow or rough, correct it.

Valve seat width

Service limit: 1.6mm

Check the contact condition of valve seat.

Valve seat grinding

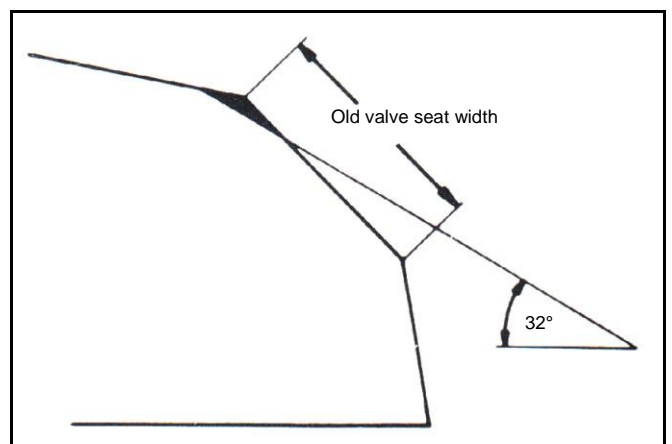
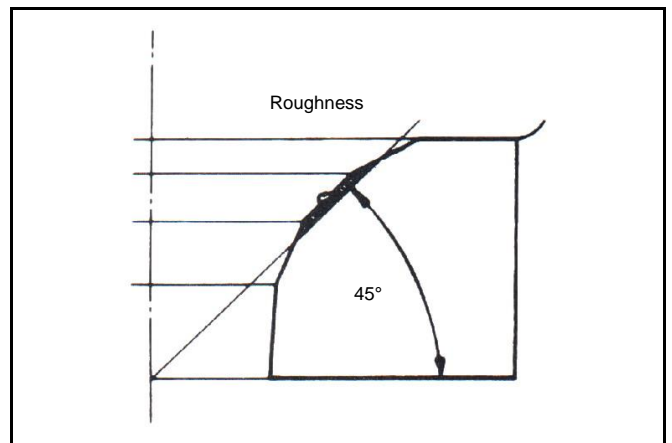
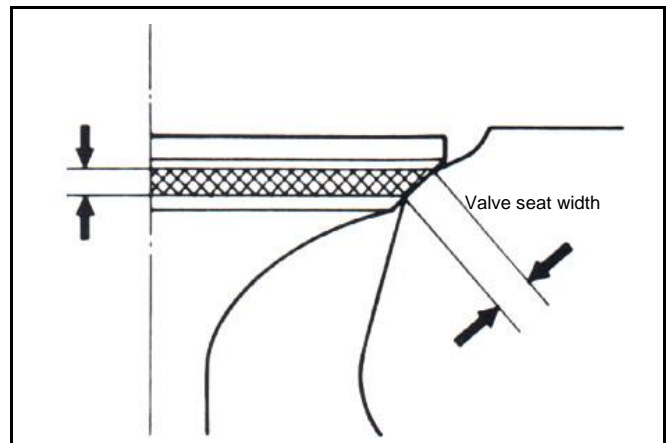
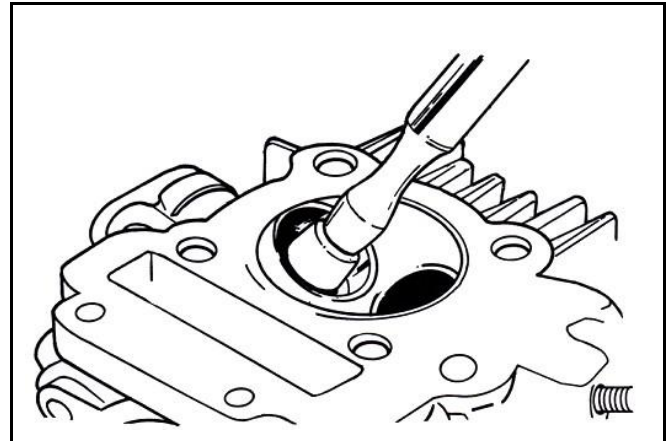
The worn valve seat has to be ground with valve seat chamfer cutter.

Use 45° valve seat chamfer cutter to cut any rough or uneven surface from valve seat.

Caution

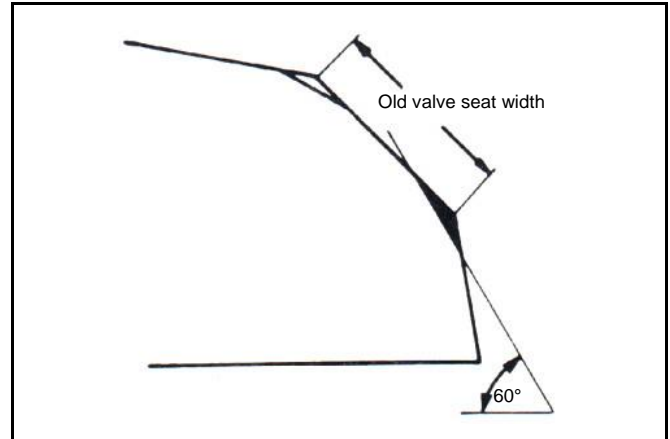
- After replacing valve guide, grind the seat surface with 45° valve seat chamfer cutter.

Use 32° cutter to cut a quarter upper parts out.



6. Cylinder Head / Valve

Use 60° cutter to cut a quarter lower parts out.
Remove the cutter and check new valve seat.

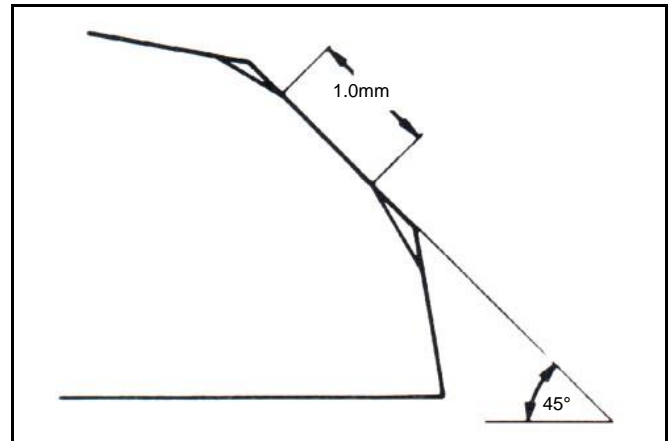


Use 45° cutter to grind the valve seat to specified width.

⚠ Caution

- Make sure that all roughness and uneven faces had been ground.

Grind valve seat again if necessary.



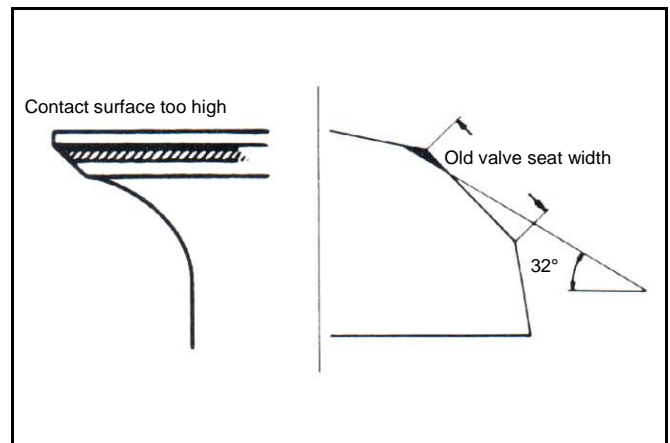
Coat the valve seat surface with rouge.
Install the valve through valve guide until the valve contacting with valve seat, slightly press down the valve but do not rotate it so that a seal track will be created on contact surface.

⚠ Caution

- The contact surfaces of valve and valve seat are very important to the valve sealing capacity.

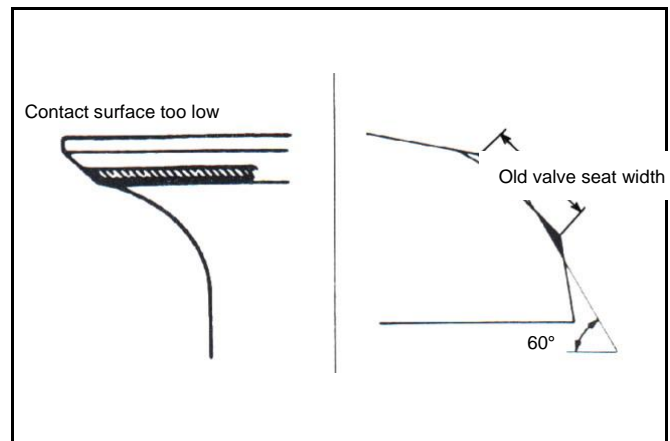
If the contact surface is too high, grind the valve seat with 32° cutter.

Then, grind the valve seat to specified width with 45° cutter.



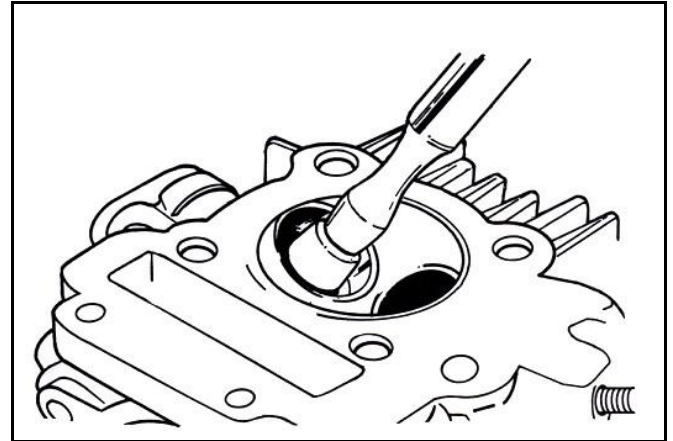
If the contact surface is too low, grind the valve seat with 60° cutter.

Then, grind the valve seat to specified width with 45° cutter.



After the valve seat grinding, coat valve seat surface with emery and then slightly press the grinding surface.

Clean up all emery coated onto cylinder and valve after grinding.



Cylinder Head Reassembly

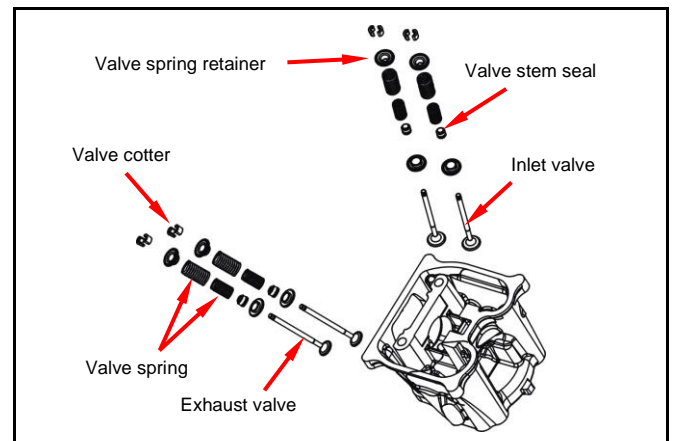
Lubricate valve stem with engine oil, and then insert the valve into valve guide.

Install new valve stem oil seal.

Install valve springs and retainers.

⚠ Caution

- The closed coils of valve spring should face down to combustion chamber.



Put the valve cotters onto valve spring retainer.

Use a valve cotter remove & assembly tool to press the valve springs, and then install valves.

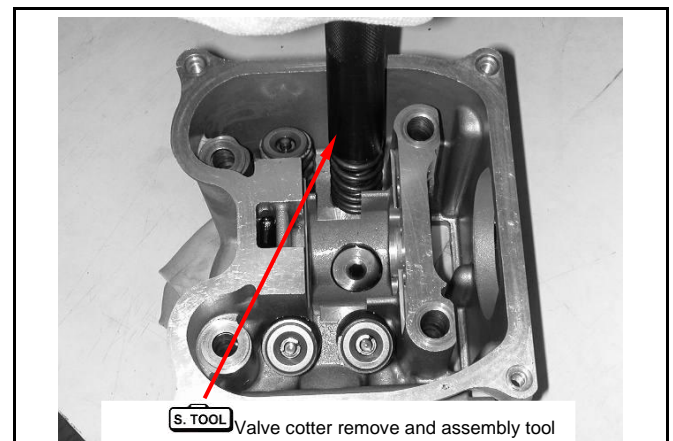
Special Service Tool:

Valve cotter remove & assembly tool

SYM-1471110-SY125

⚠ Caution

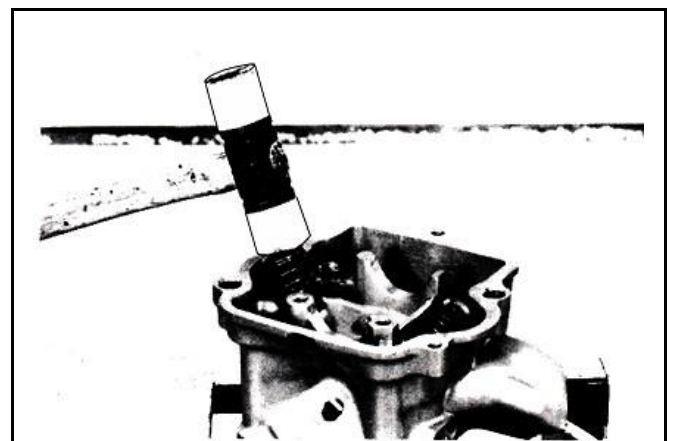
- Place cloth on combustion chamber side when removing/assembling springs to avoid spring from bending.



Tap the valve stems gently with a plastic hammer to make sure valve retainer and valve cotter settled properly.

⚠ Caution

- Place and hold cylinder head on working table to prevent valve from damage.



6. Cylinder Head / Valve

Install camshaft into cylinder head.
Install valve rocker arm, rocker arm shaft and cam shaft setting plate.

Cylinder Head Installation

Clean up all residues and foreign materials on the matching surfaces of both cylinder and cylinder head.

Install chain guide, dowel pins and a new cylinder head gasket onto the cylinder.

⚠ Caution

- Do not damage the matching surfaces of cylinder and cylinder head.
- Avoid residues of gasket or foreign materials from falling into crankcase.

Install cylinder head.

Install 4 washers and tighten 4 nuts on the cylinder head upper side, and then tighten 2 mounting bolts of cylinder head side.

Torque value:

Nut	3.6~4.0kgf-m
Bolt	1.0~1.4kgf-m

⚠ Caution

- Lubricate thread with engine oil, and tighten 2~3 times diagonally.
- Do not tighten with exceeding torque value. Otherwise, the cylinder head could be deformed and resulted in abnormal noise or leakage, and performance loss in the end.

Turn the drive face counter clock wise to align the "T" mark on right crankcase. (Piston on TDC)

Install cam chain on to sprocket and align the timing mark on the sprocket with that of cylinder head.

Tighten cam sprocket bolts. (2 bolts)

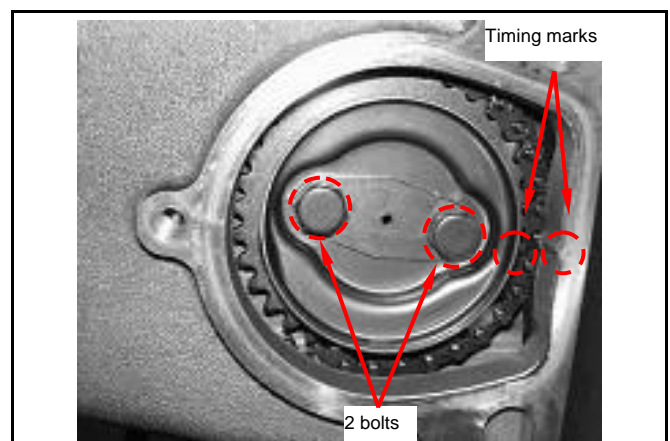
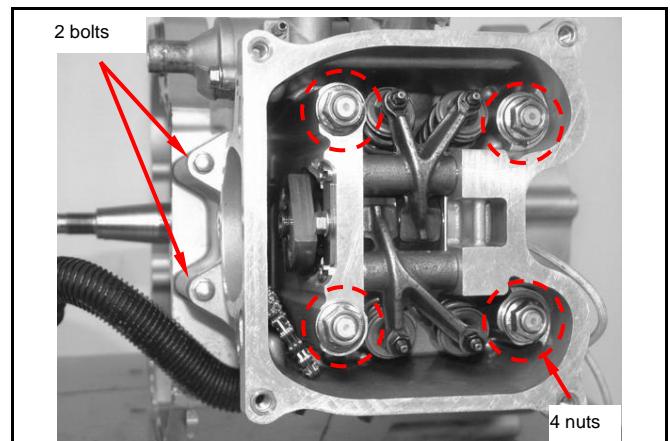
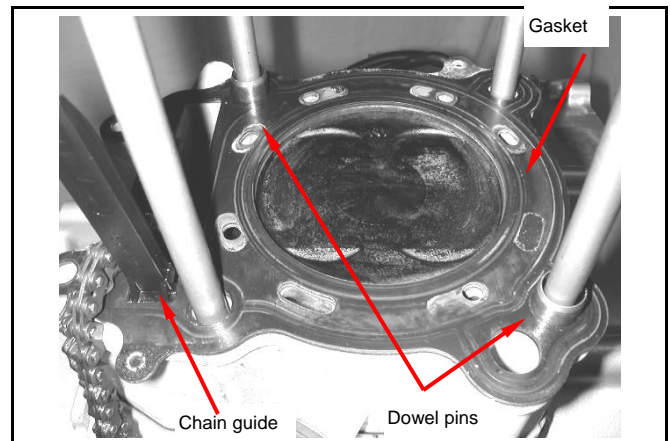
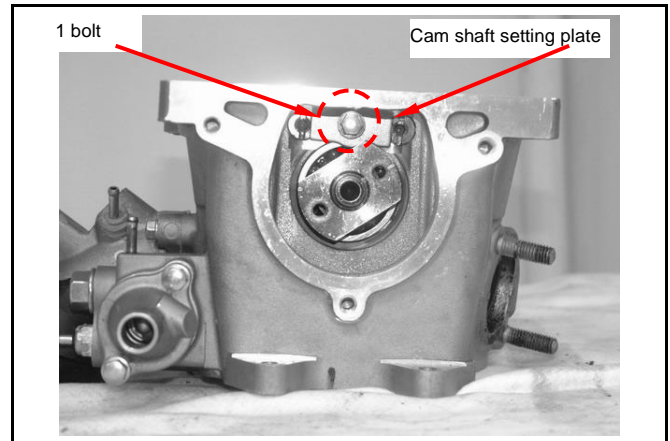
Torque value: 0.8~1.2kgf-m

Install spark plug.

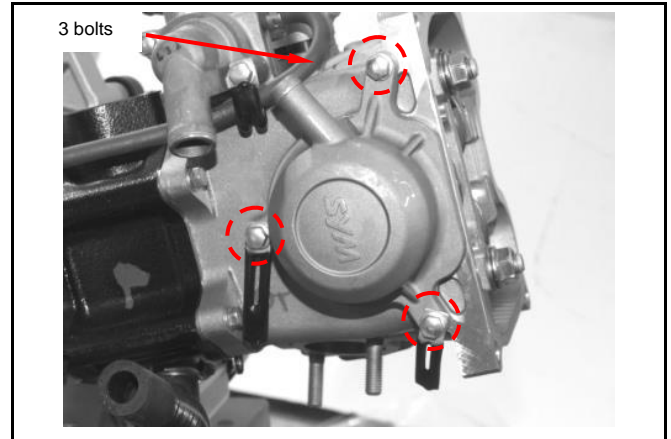
Torque value: 1.0~1.2kgf-m

⚠ Caution

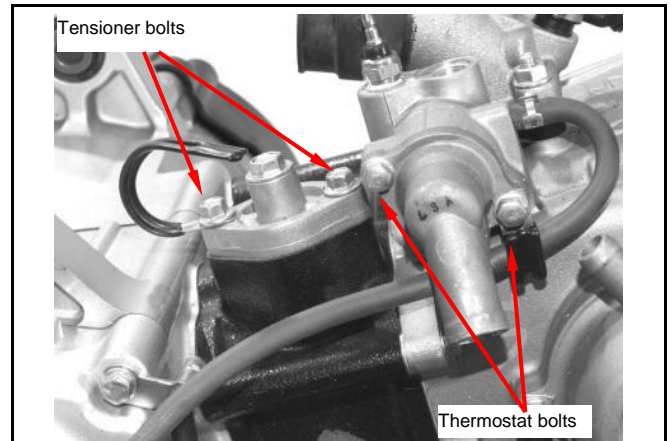
- Make sure timing marks are matched.



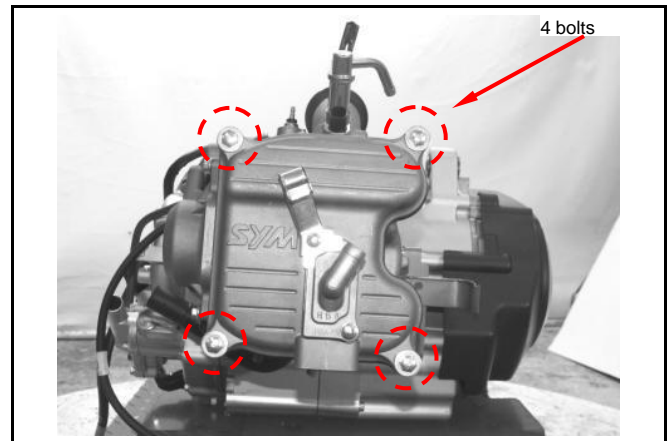
Install cylinder head side cover. (3 bolts)



Install thermostat. (2 bolts)
Loosen auto tensioner adjustment bolt and remove bolt and spring.
Install tensioner and install spring and adjustment bolt.

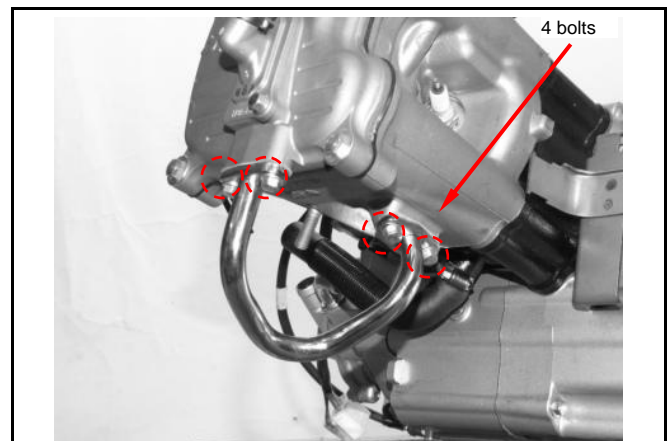


Install cylinder head cover. (4 bolts)



Install Air Injection system (AI) pipe. (4 bolts)

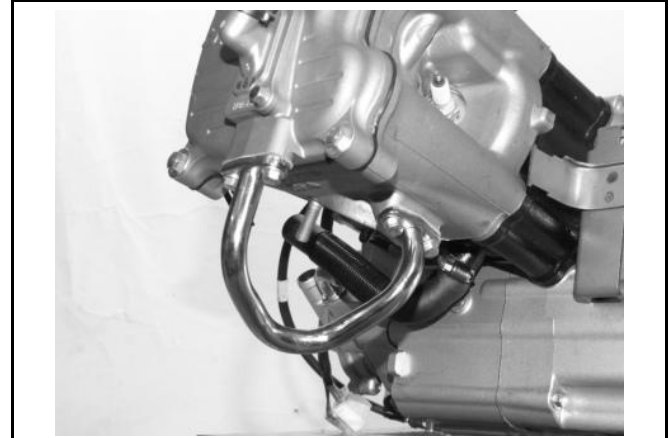
Install the engine onto frame. (refer chapter 5)



Valve Clearance Adjustment

Loosen Air Injection system (AI) pipe upper side bolt. (2 bolts)

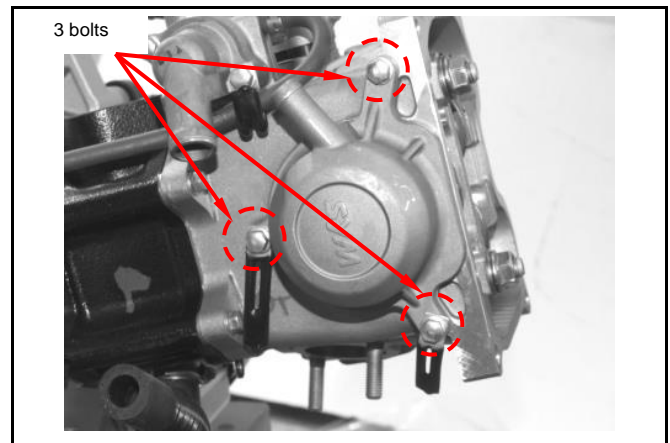
Remove cylinder head cover. (4 bolts)



Remove the cylinder head side cover. (3 bolts)

Open the timing check cap on right case cover.

Open left crankcase cover, turn the drive face counter clock wise to align the "T" mark on right crankcase; also align timing marks on cam sprocket and cylinder head.

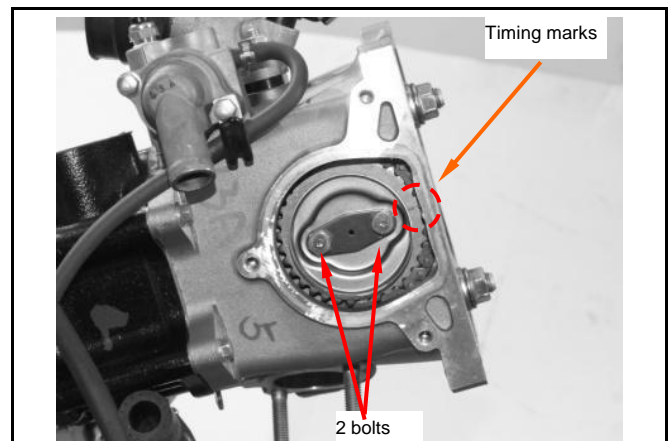


Loosen valve clearance adjustment nuts and bolts located on valve rocker arm.

Measure and adjust valve clearance with feeler gauge.

After adjusting valve clearance to standard value, hold adjustment bolt and then tighten the adjustment nut.

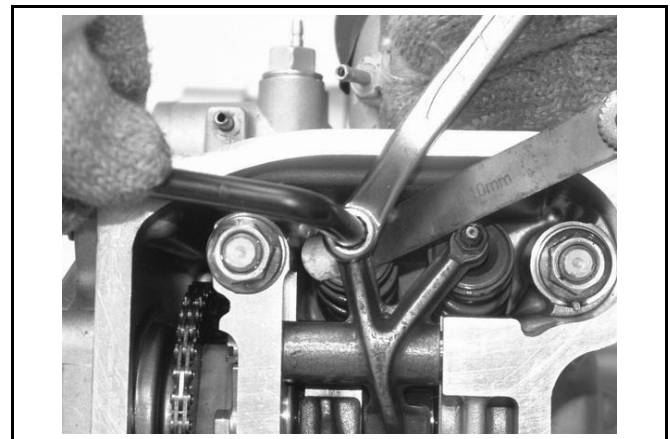
Standard Value: IN 0.10 ± 0.02 mm
EX 0.15 ± 0.02 mm



Install the cylinder head side cover.

Start the engine and make sure that engine oil flows onto the cylinder head.

Stop the engine after confirming, and then install the cylinder head cover and AI pipe.

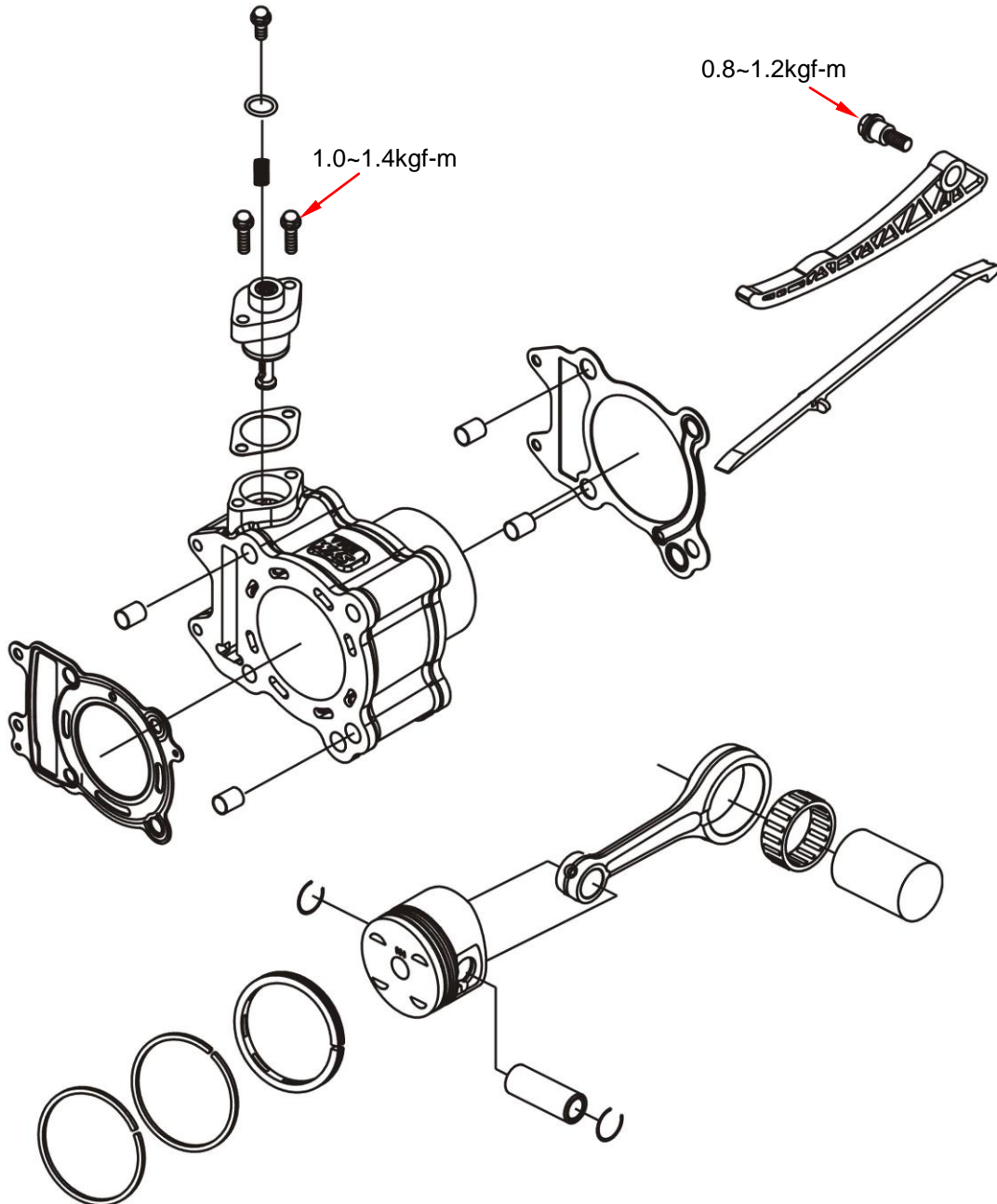


⚠ Caution

- If engine oil does not flow to cylinder head, engine components will be worn out seriously.
- When checking engine oil flowing condition, run the engine in idle speed. Do not accelerate engine speed.

Mechanism Diagram..... 7-1	Cylinder / Piston Removal.....7-3
Precautions in Operation 7-2	Piston Ring Installation7-6
Troubleshooting 7-2	Cylinder / Piston Installation7-7

Mechanism Diagram



7. Cylinder / Piston



Precautions in Operation

General Information

- Both cylinder and piston service cannot be carried out when engine mounted on frame.

Specification

unit: mm

Item		Standard	Limit	
Cylinder	I.D.	74.995~75.015	75.100	
	Warpage	-	0.050	
Piston/ Piston ring	Clearance between piston ring and ring groove	Top	0.015~0.050	0.090
		2 nd	0.015~0.050	0.090
	Piston ring end gap	Top	0.150~0.300	0.500
		2 nd	0.300~0.450	0.650
		Oil (side rail)	0.200~0.700	-
	Piston O.D. (2 nd)		74.236~74.286	74.380
	Clearance between piston and cylinder		0.005~0.015	0.100
ID of piston pin boss		17.002~17.008	17.020	
Piston pin O.D.		16.994~17.000	16.960	
Clearance between piston and piston pin		0.002~0.014	0.020	
Connecting rod small end I.D.		17.016~17.034	17.064	

Troubleshooting

Low or Unstable Compression Pressure

Cylinder or piston ring worn out

Knock or Noise

Cylinder or piston ring worn out
Carbon deposits on cylinder head top side
Piston pin hole and piston pin worn out

Smoking in Exhaust Pipe

Piston or piston ring worn out
Improper piston ring installation
Cylinder or piston damaged

Engine Overheat

Carbon deposits on cylinder head top side
Cooling pipe clogged or insufficient coolant flow

Cylinder / Piston Removal

Removal

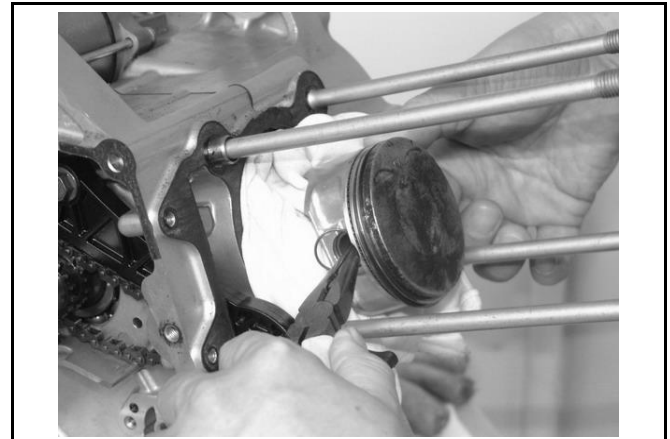
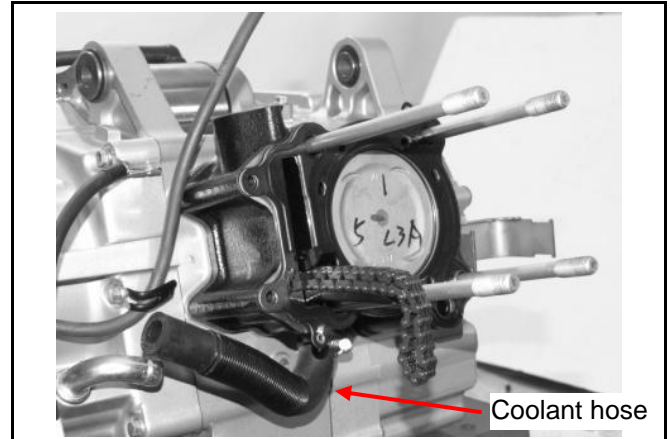
- Remove cylinder head. (refer to chapter 6)
- Remove chain guide.
- Remove coolant hose from cylinder.
- Remove cylinder.

Cover the holes of crankcase and cam chain with a piece of cloth.
Remove piston pin clip, and then remove piston pin and piston.

Remove cylinder gasket and dowel pin.
Clean up all residues or foreign materials from the matching surfaces of cylinder and crankcase.

Caution

- Soak the residues with solvent for easy removal.
- Avoid residues of gasket or foreign materials from falling into crankcase.

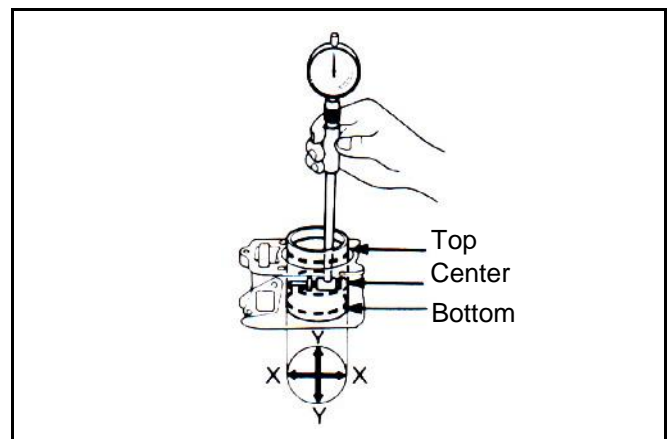


Inspection

Check if the inner diameter of cylinder is worn out or damaged.

In the 3 positions, top, center and bottom, of cylinder, measure the X and Y values respective in the cylinder.

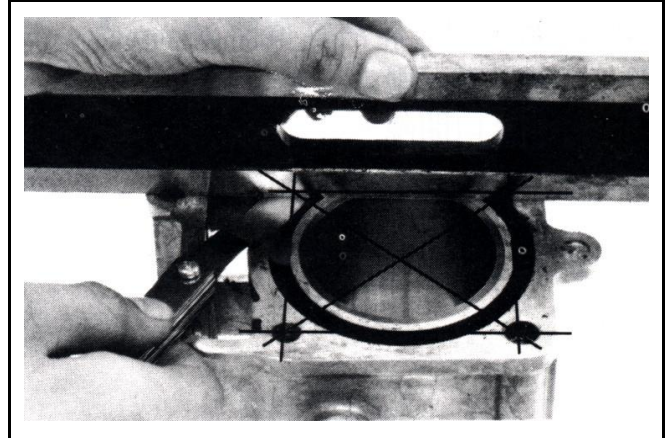
Service limit: 75.100 mm



7. Cylinder / Piston

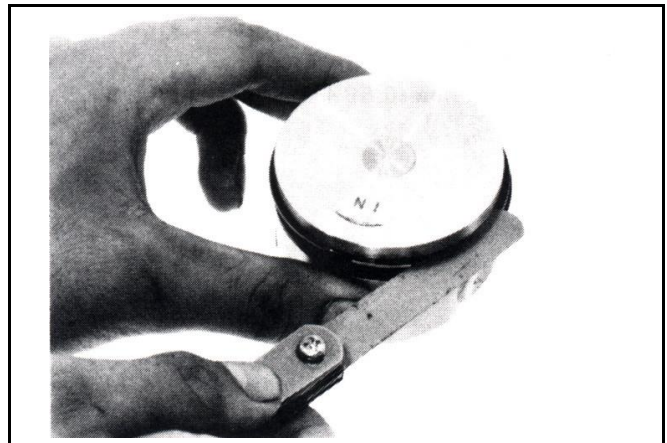
Measure the cylinder upper surface for warpage.

Service limit: 0.05 mm



Measure the clearance between piston rings and ring grooves.

Service Limit: Top ring: 0.09 mm
2nd ring: 0.09 mm



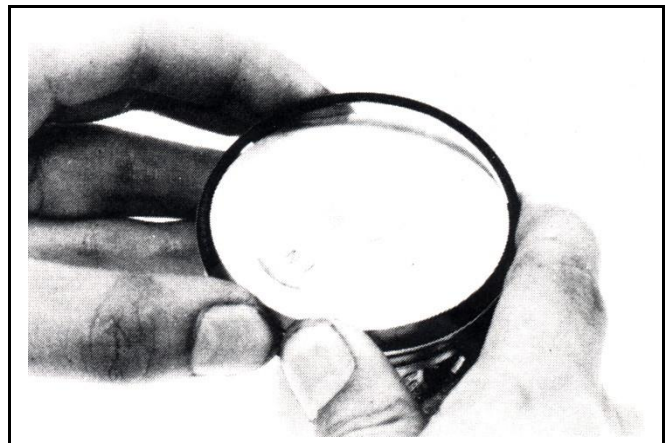
Remove piston rings

Check if the piston ring is damaged or its groove is worn.

Clean carbon deposit on piston ring groove.

Caution

- Piston rings are fragile, remove the piston rings with care.

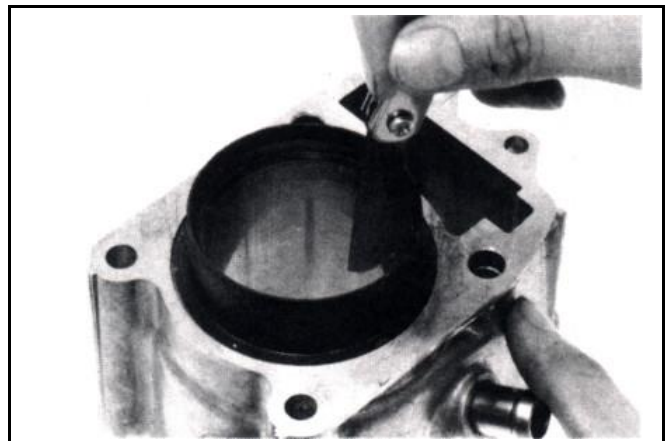


Place piston rings respectively into cylinder below 20 mm of cylinder top.

Measure the piston ring end gap.

Caution

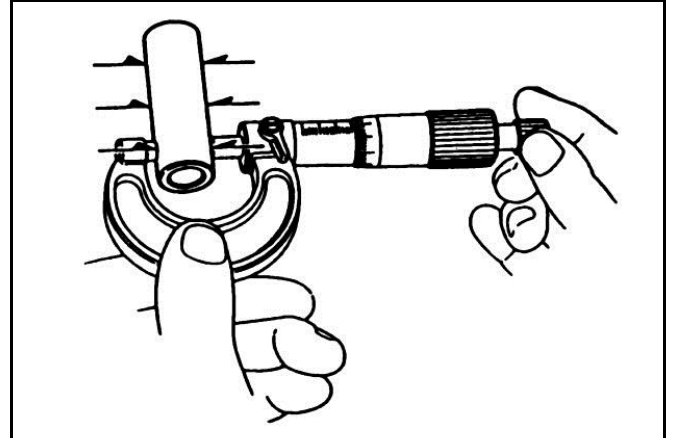
- In order to keep the piston rings in horizontal level in cylinder, push the rings with piston.



Service Limit: Top ring: 0.50 mm
2nd ring: 0.65 mm

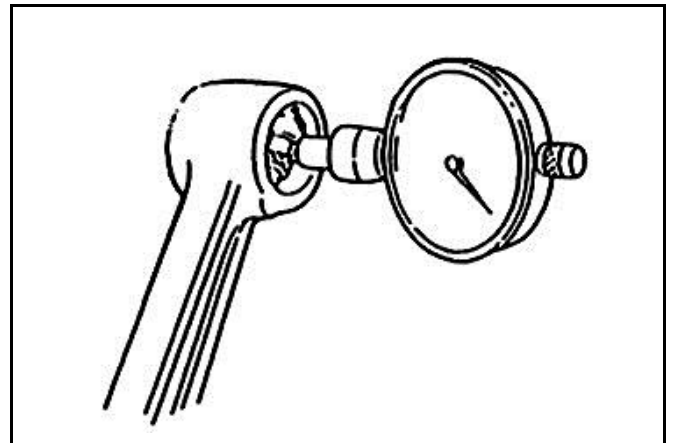
Measure the outer diameter of piston pin.

Service Limit: 16.96 mm



Measure the inner diameter of connecting rod small end.

Service Limit: 17.064 mm

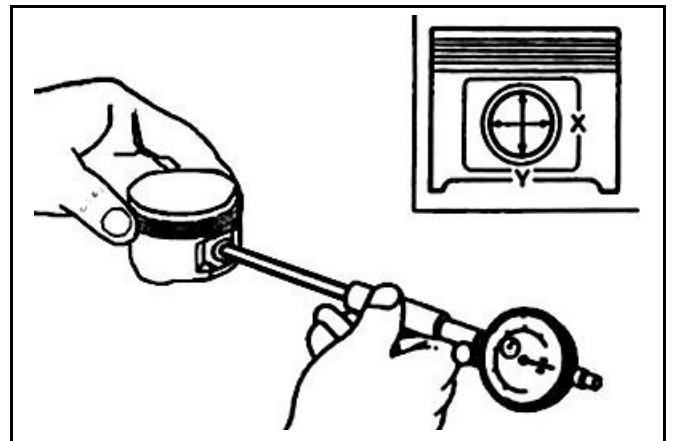


Measure the inner diameter of piston pin hole.

Service Limit: 17.02 mm

Calculate clearance between piston pin and its hole.

Service Limit: 0.02 mm



Measure the piston outer diameter.

Service limit: 74.380 mm

Caution

- The measuring position is on the 2nd ring 90° to piston pin hole.

Compare measured value with service limit to calculate the clearance between piston and cylinder.

Service limit: 0.1 mm



Piston Ring Installation

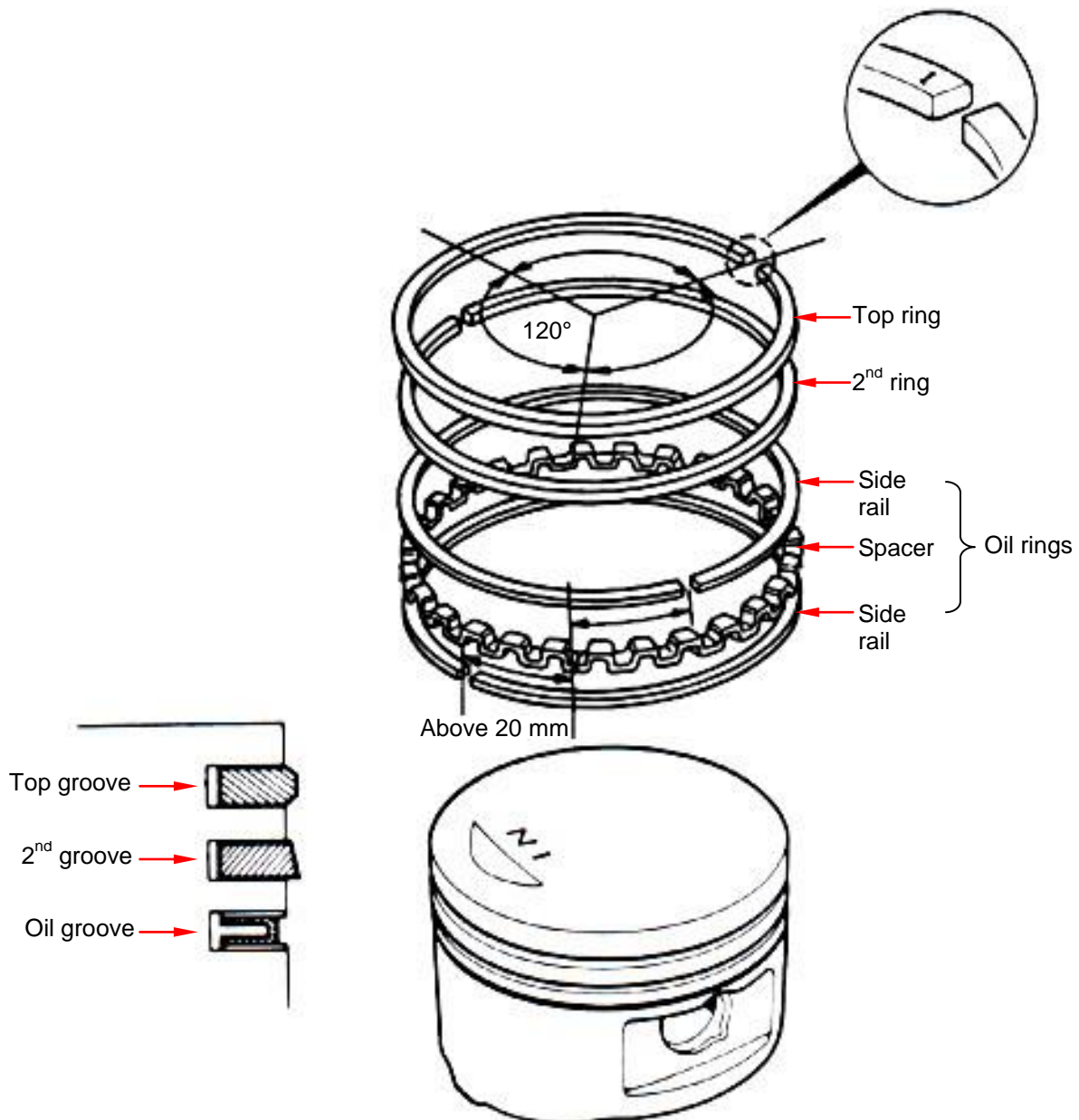
Clean up piston top, ring groove, and piston surface.

Install the piston ring onto piston carefully.

Place the openings of piston ring as diagram shown below.

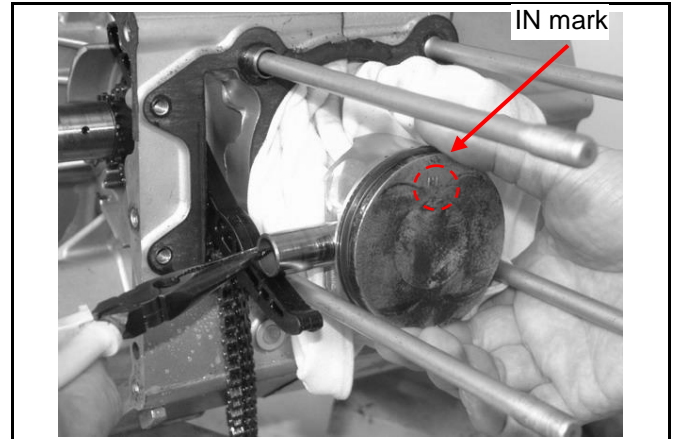
Caution

- Do not damage piston and piston rings as installation.
- All marks on the piston rings must be toward to upside.
- Make sure that all piston rings can be rotated freely after installation.



Cylinder / Piston Installation

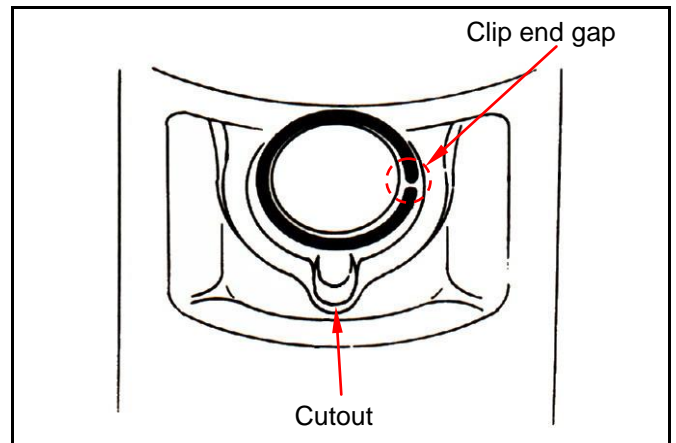
Install piston and piston pin, and place the IN marks on the piston top side forward to inlet valve.



Install new piston pin clip.

Caution

- Do not let the opening of piston pin clip align with the piston cutout.
- Place a piece of cloth between piston and crankcase in order to prevent clip from falling into crankcase as operation.



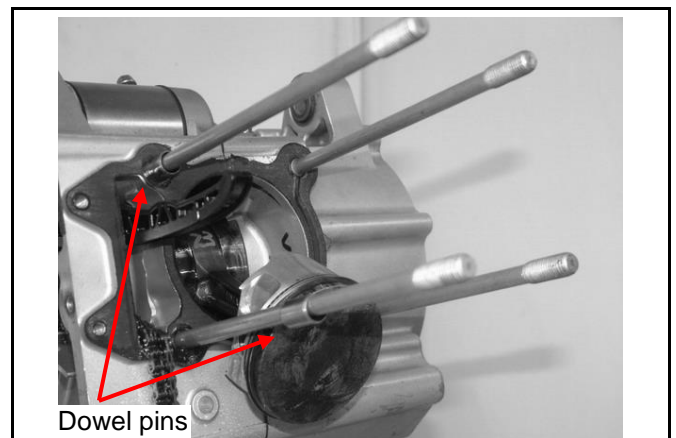
Clean up all residues and foreign materials on the matching surface of crankcase.

Caution

- Soak the residues with solvent for easy removal.



Install dowel pins and new cylinder gasket.



7. Cylinder / Piston

Coat inside of cylinder, piston, and piston rings with engine oil.

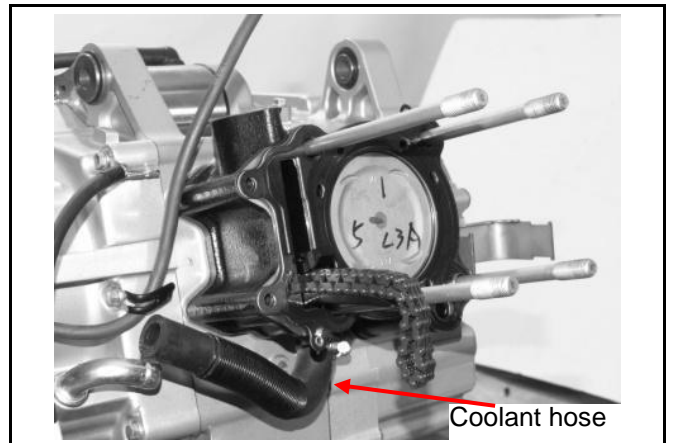
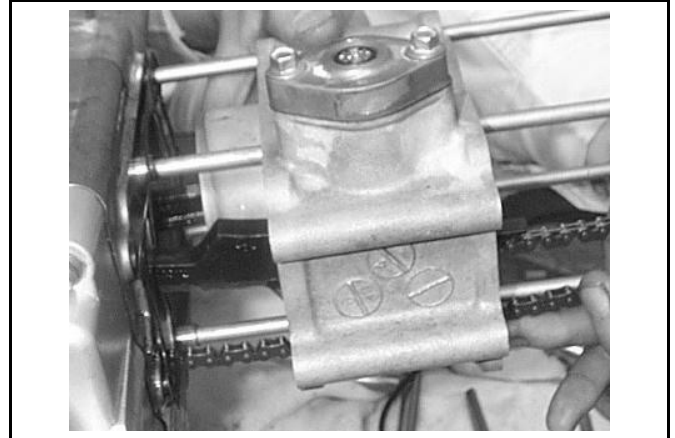
Install piston into cylinder with care. Press piston rings one by one as installation.

Caution

- Do not push piston into cylinder forcefully because piston and piston rings will be damaged.

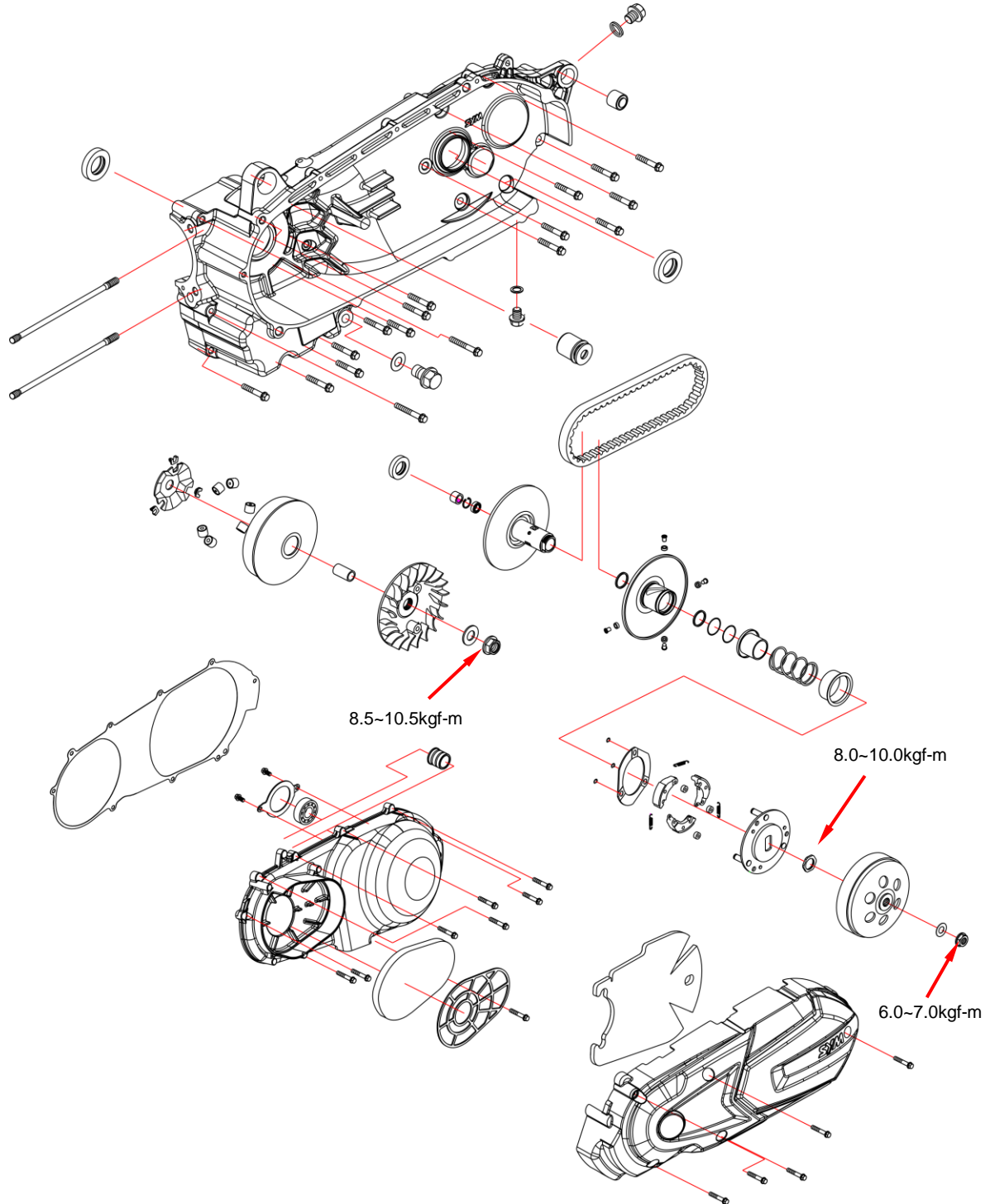
Install coolant hose onto cylinder.

Install cylinder head (refer to Chapter 7).



Mechanism Diagram.....	8-1	Drive Belt	8-5
Precautions in Operation	8-2	Drive Face	8-7
Troubleshooting	8-2	Clutch Outer / Driven Pulley	8-10
Left Crankcase Cover	8-3		

Mechanism Diagram



8. V-Belt Drive System



Precautions in Operation

General Information

- Drive face, clutch outer, and driven pulley can be serviced on the scooter.
- Drive belt and drive pulley must be free of grease.

Specification

Item	Standard value	Limit
Drive belt width	24.000 mm	22.500 mm
OD of movable drive face boss	29.946~29.980 mm	29.926 mm
ID of movable drive face	30.000~30.040 mm	30.060 mm
OD of weight roller	19.500~20.000 mm	19.000 mm
ID of clutch outer	144.850~145.150	145.450 mm
Thickness of clutch weight	6.000 mm	3.000 mm
Free length of driven pulley spring	102.400 mm	97.400 mm
OD of driven pulley boss	40.950~40.990 mm	40.930 mm
ID of driven face	41.000~41.050 mm	41.070 mm
Weight of weight roller	17.700~18.300 g	17.200 g

Torque value

Drive face nut:	8.5~10.5kgf-m
Clutch outer nut:	6.0 ~7.0kgf-m
Drive plate nut:	8.0 ~10.0kgf-m

Special Service Tools

Clutch spring compressor:	SYM-2301000
Inner bearing puller:	SYM-6204002
Clutch nut wrench 39 x 41 mm:	SYM-9020200
Universal holder:	SYM-2210100
Bearing driver:	SYM-9100100

Troubleshooting

Engine can be started but scooter cannot be moved

1. Broken drive belt
2. Worn drive face
3. Worn or damaged clutch weight
4. Broken driven pulley spring

Insufficient horsepower or poor high speed performance

1. Worn drive belt
2. Insufficient spring force of driven pulley
3. Worn roller
4. Unsmooth driven pulley operation

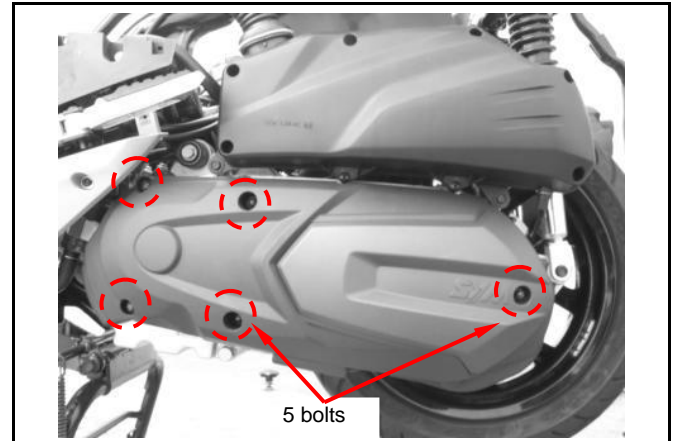
Shudder or misfire when driving

1. Broken driven pulley spring
2. Worn clutch weight

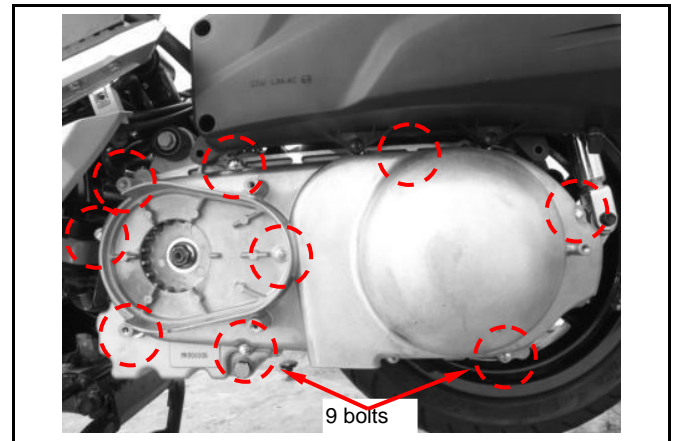
Left Crankcase Cover

Removal

- Remove left outer cover. (5 bolts)
- Remove air cleaner bolts. (2 bolts)

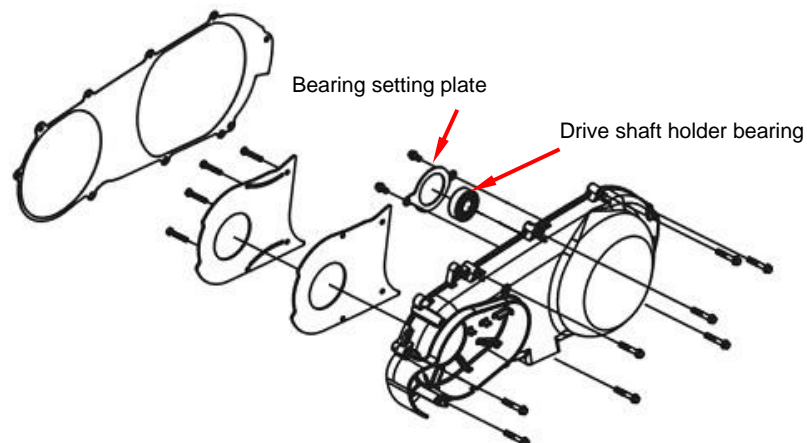
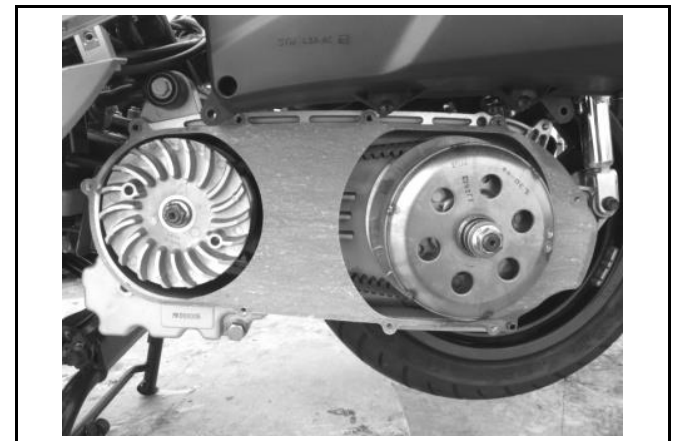


- Remove left side cover element.
- Remove left crankcase cover. (9 bolts)



Left crankcase cover install

- Install left crankcase cover in the reverse procedures of removal.



8. V-Belt Drive System



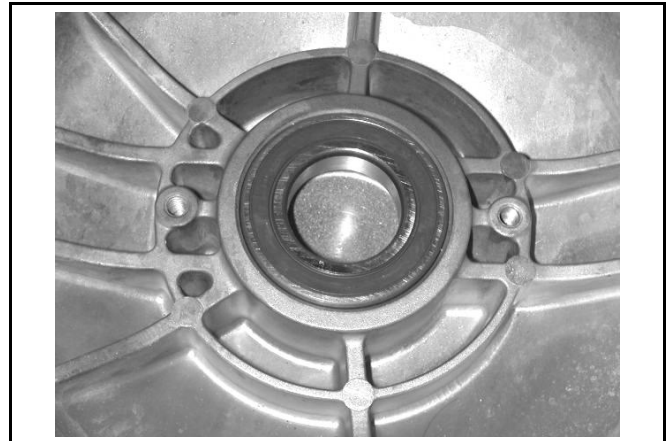
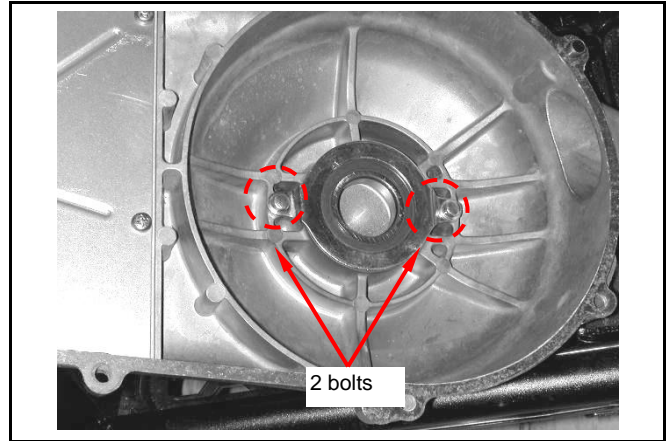
Left crankcase cover inspection

Remove left crankcase cover bearing setting plate. (2 bolts)

Check bearing on left crankcase cover. Rotate bearing's inner ring with fingers. Check if bearings can be turned smoothly and silently, and also check if bearing outer ring is mounted on cover tightly. If bearing rotation is uneven, noisy, or loose bearing mounted, replace it.

Caution

- Do not remove bearing from left crankcase cover, if unnecessary.
- Replace the bearing, if it is removed from left crankcase cover.



Bearing replacement

Caution

- Never use a used bearing. Replace with a new bearing, if the bearing is removed.

Remove bearing with special service tools.

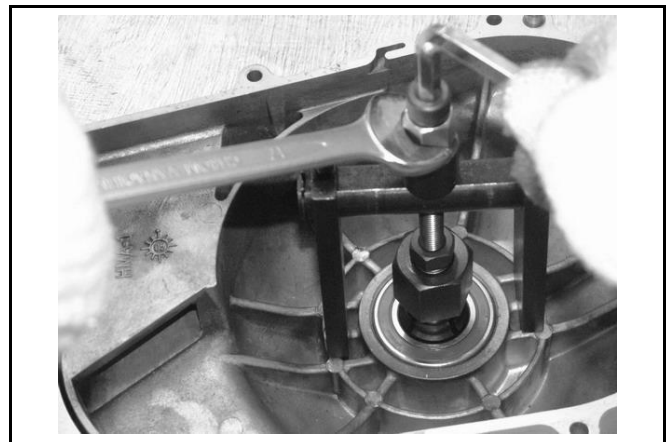
Special tools:

Inner bearing puller **SYM-6204022**
 SYM-6204021

Install new bearing on left crankcase cover.

Special tools:

Right crank case bearing 6201 assemblies tool **SYM-9614000-HMA 6201**



Drive Belt

Removal

Remove left crankcase cover.

Hold drive face with universal holder, and remove nut and drive face.

Special Tool : Universal holder

Hold clutch outer with universal holder, and remove nut, bearing stay collar and clutch outer.

Caution

- Use special service tools for tightening or loosening the nut. If only fix rear wheel or rear brake, the reduction gear system could be damaged.

Special Tool : Universal holder

Push the drive belt into belt groove as diagram shown so that the belt can be loosened, and then remove the driven pulley and belt.

Remove the drive belt from the groove of driven pulley.

Inspection

Check if the drive belt is cracked or worn.

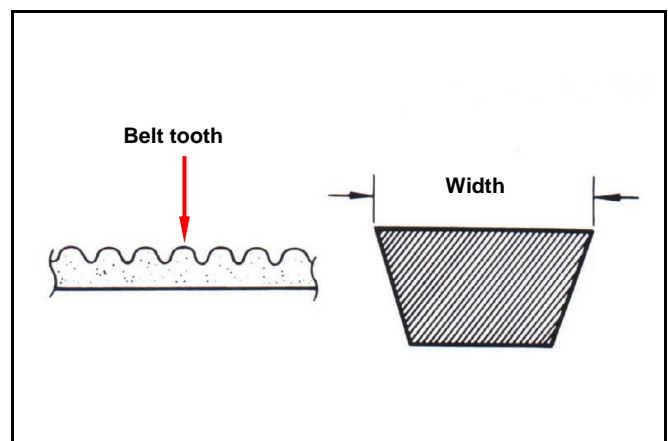
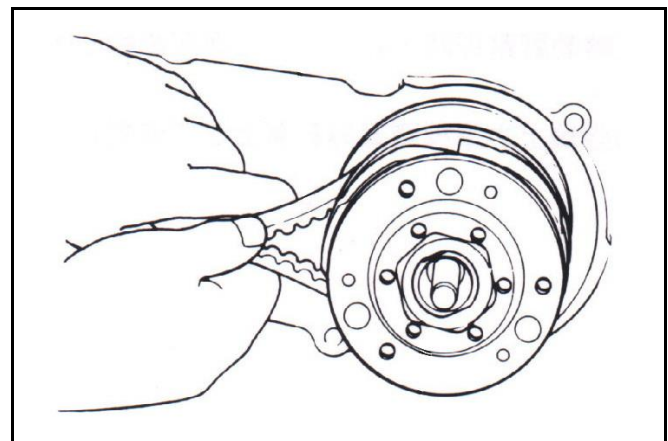
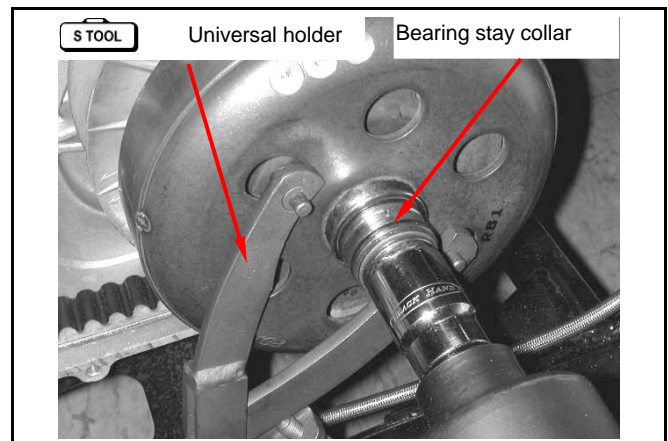
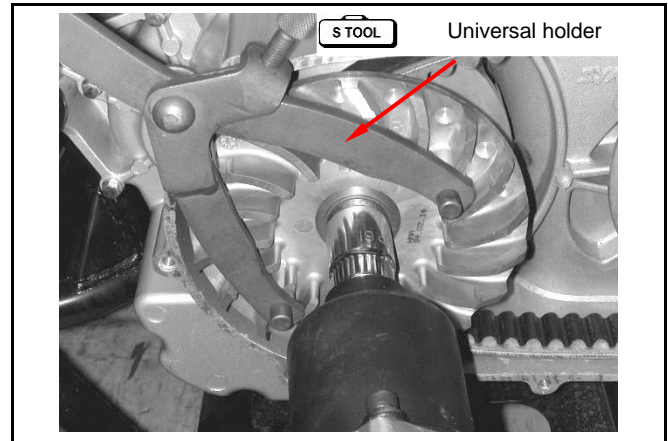
Replace it if necessary.

Measure the width of drive belt as diagram shown. Replace the belt if exceeds the service limit.

Service Limit: **22.5mm.**

Caution

- Use the genuine parts for replacement.
- The surfaces of drive belt or pulley must be free of grease.
- Clean up all grease or dirt before installation.



8. V-Belt Drive System

Installation

Pull open driven pulley and insert belt into driven pulley.

Caution

- Install belt into driven pulley first for easy installation of drive pulley.

Install the driven pulley that has installed the belt onto drive shaft.

Mount the other end of drive belt onto the movable drive face.

Install the clutch outer and bearing stay collar. Hold the clutch outer with universal holder, and then tighten nut to specified torque value.

Torque value: **5.0~6.0kgf-m**.

Install the drive face, washer and drive face nut.

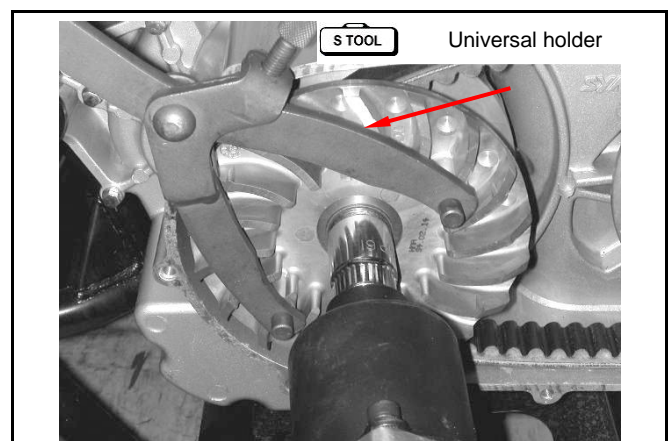
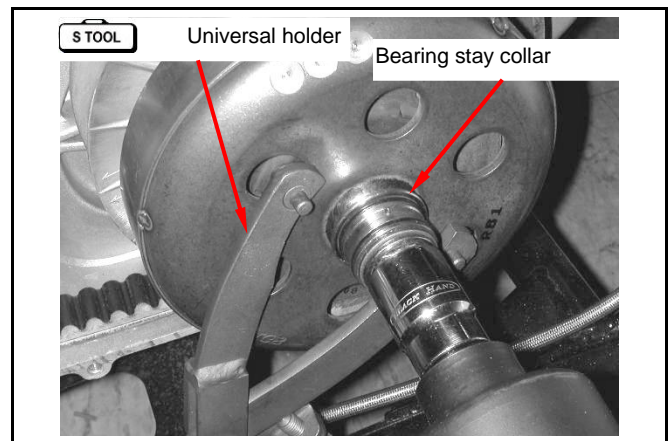
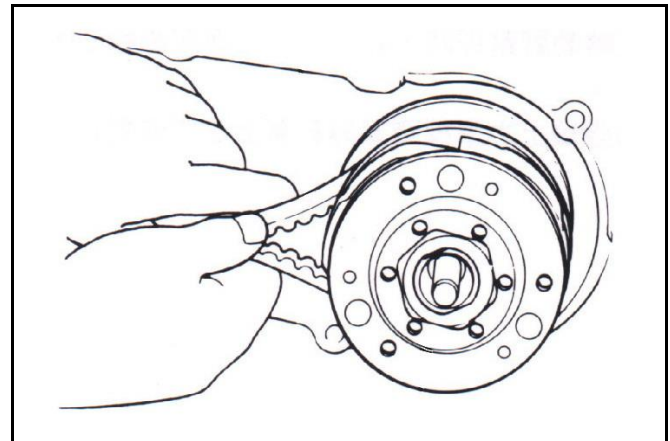
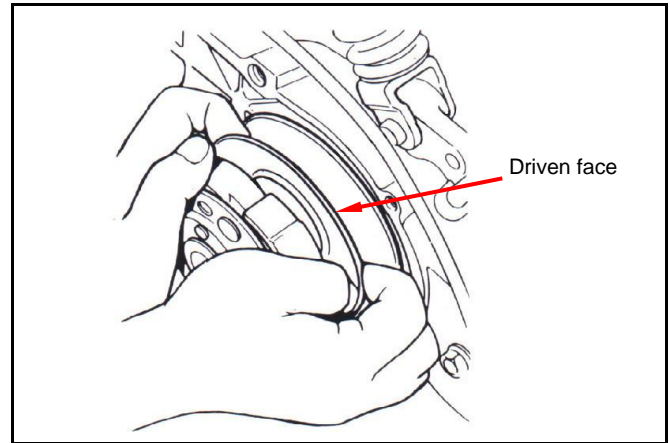
Caution

- Both drive faces must be free of grease. Clean up unnecessary grease.

Hold drive face with universal holder, and then tighten nut to specified torque value.

Torque value: **8.5~10.5kgf-m**

Install left crankcase cover.



Drive Face**Removal**

Remove left crankcase cover.
Hold drive face with universal holder, and then remove drive face nut.

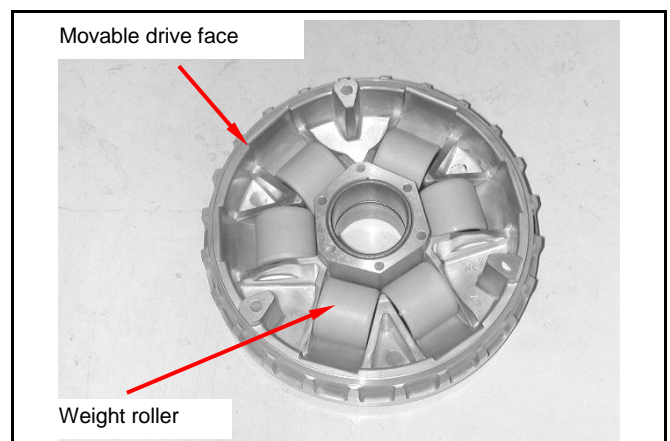
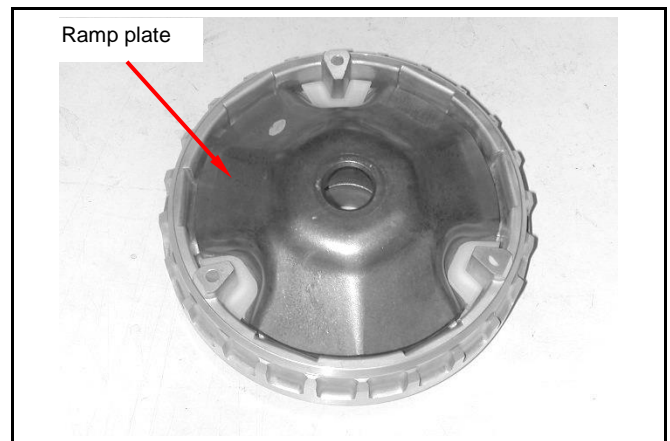
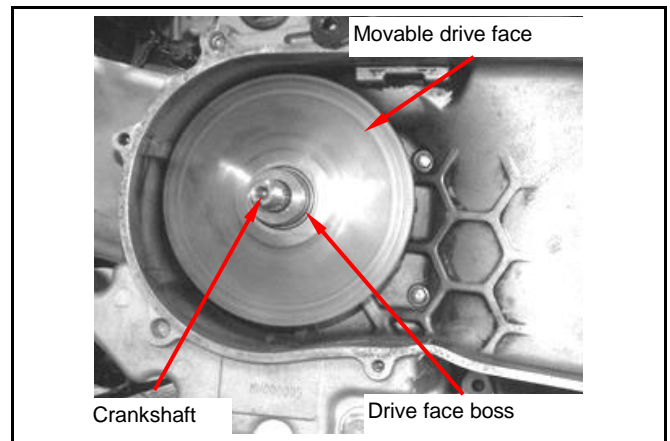
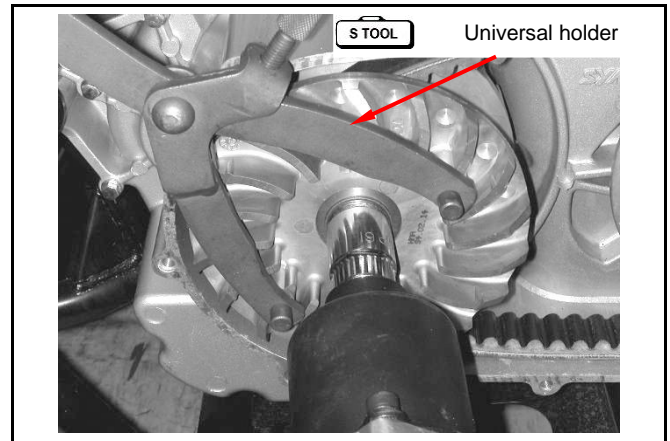
Remove drive face and drive belt.

Special Tool : Universal holder

Remove movable drive face comp and drive face boss from crankshaft.

Remove ramp plate.

Remove weight rollers from movable drive face.



8. V-Belt Drive System



Inspection

The weight rollers are to press movable drive face by means of centrifuge force. Thus, if weight rollers are worn out or damaged, the centrifuge force will be affected. Check if rollers are worn or damaged. Replace it if necessary. Measure each roller's outer diameter. Replace it if exceed the service limit.

Service limit: **19.0mm**。

Weight: **17.2g**

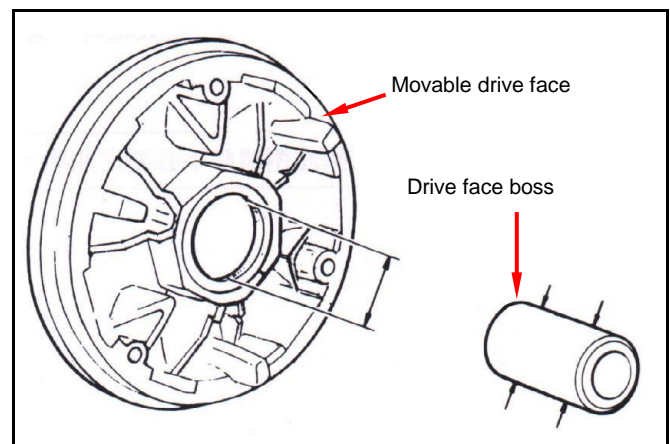
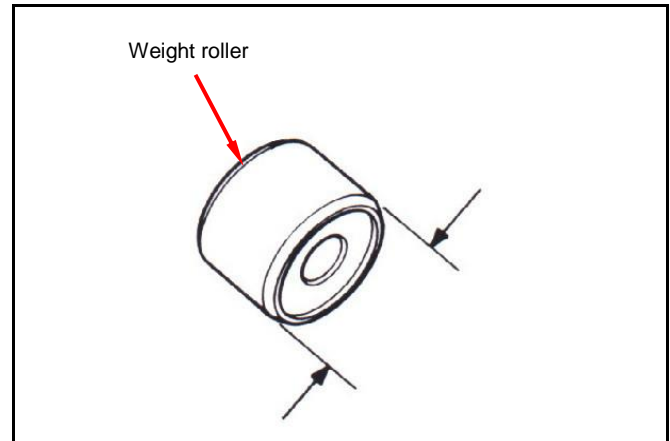
Check if drive face boss is worn or damaged and replace it if necessary.

Measure the outer diameter of movable drive face boss, and replace it if it exceeds service limit.

Service limit: **29.926 mm**。

Measure the inner diameter of movable drive face, and replace it if it exceeds service limit.

Service limit: **30.060 mm**。

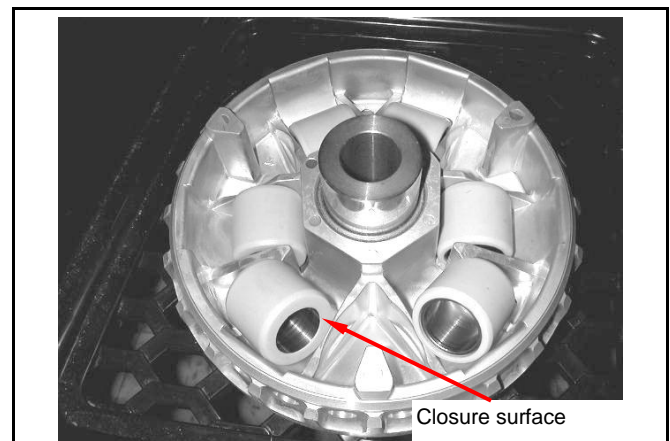


Reassembly/installation

Install weight rollers.

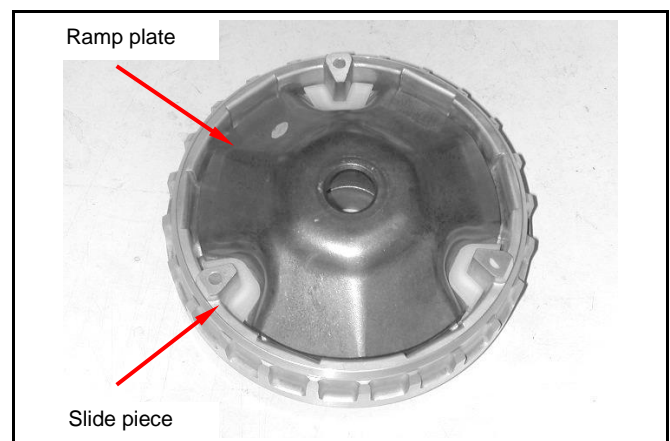
⚠ Caution

- The weight roller two end surfaces are different. To lengthen the roller life and prevent exceptional wear, please install the closure surface onto movable drive face counter clock wise.



Install 3 slide pieces to ramp plate.

Install ramp plate.

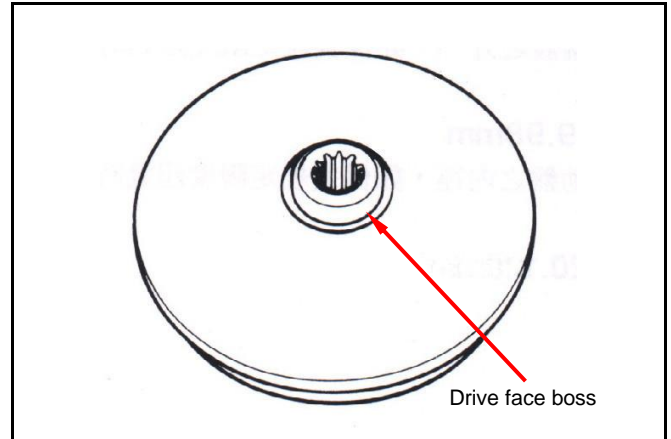


Lubricate movable drive face axis hole with grease.

Install drive face boss.

⚠ Caution

- Both drive faces must be free of grease.
Clean up unnecessary grease.



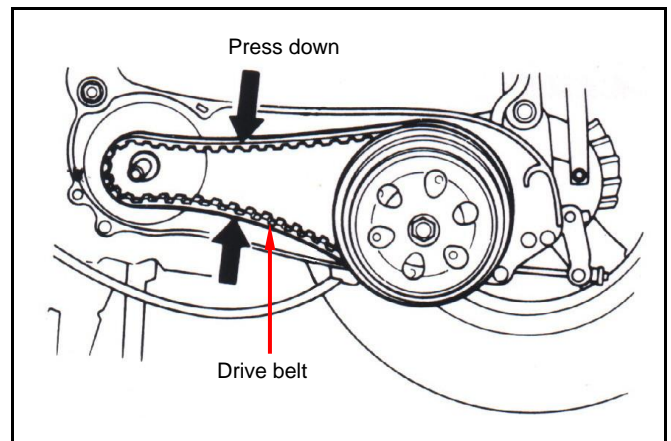
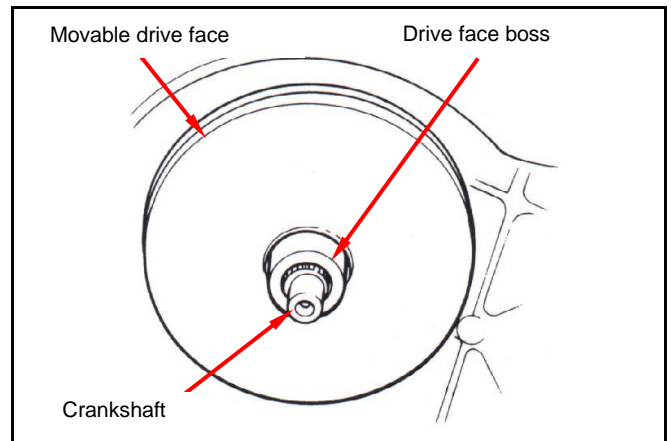
Install movable drive face comp. onto crankshaft.

Driven pulley installation

Press drive belt into pulley groove, and then pull the belt onto drive shaft.

⚠ Caution

- Pressing belt can avoid it from abnormal squeeze when installing drive face and ensure drive face to be tightened properly.



Install drive face, washer and nut.

⚠ Caution

- Both drive faces must be free of grease.
Clean up unnecessary grease.

Hold drive face with universal holder.

Tighten nut to specified torque value.

Torque value: **8.5~10.5kgf-m**

Install left crankcase cover.



8. V-Belt Drive System



Clutch Outer / Driven Pulley

Disassembly

Remove drive belt, clutch outer and driven pulley.

Install clutch spring compressor onto the pulley assembly, and operate the compressor to let the wrench be installed more easily.

⚠ Caution

- Do not press the compressor too much.

Special tool:

Clutch spring compressor **SYM-2301000**

Clutch nut wrench **SYM-9020200**

Hold the clutch spring compressor onto bench vise, and then remove mounting nut with special service tool.

Release the clutch spring compressor and remove friction plate, clutch weight and spring from driven pulley.

Remove seal collar from driven pulley.

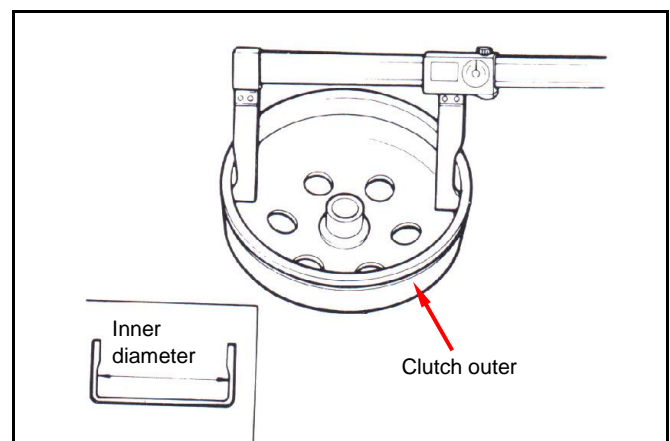
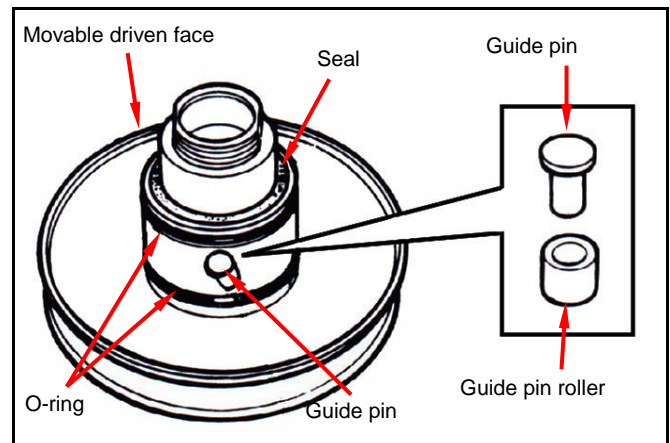
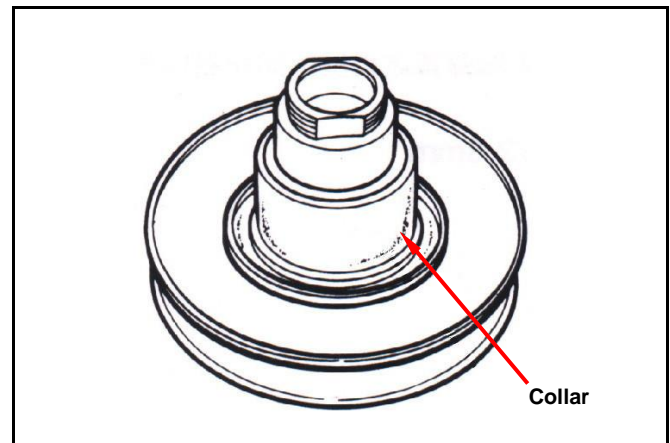
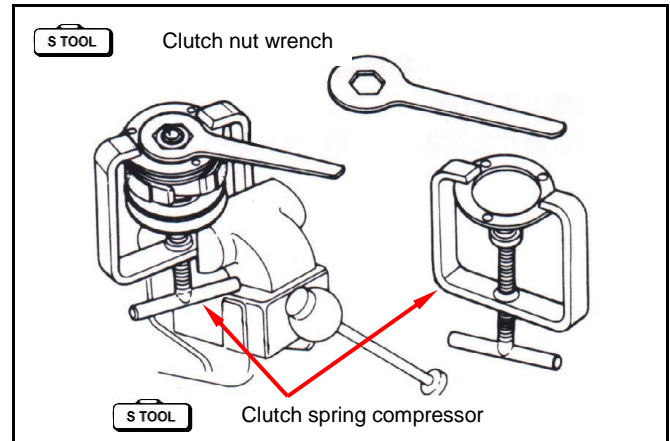
Remove guide pin, guide pin roller, and movable driven face, and then remove O-ring & oil seal seat from movable driven face.

Inspection

Clutch outer

Measure the inner diameter of clutch outer. Replace the clutch outer if it exceeds service limit.

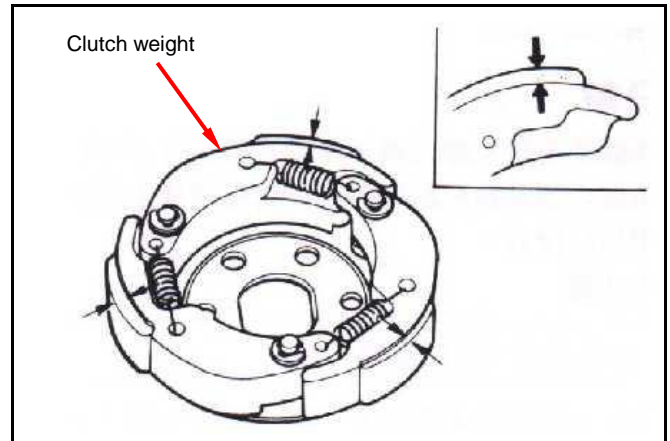
Service limit: **145.450mm**



Clutch weight

Measure each clutch weight thickness.
Replace if it exceeds service limit.

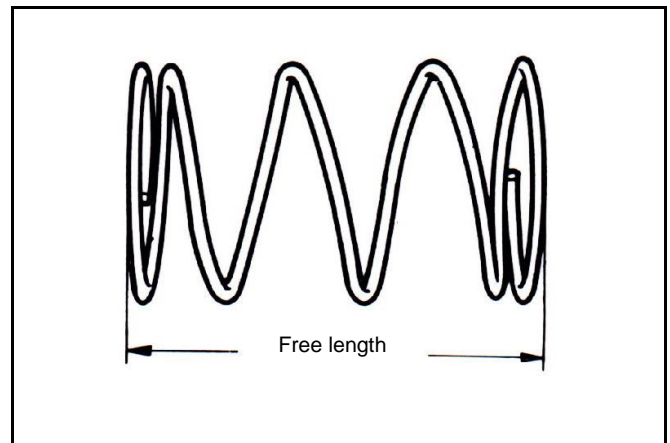
Service limit: **3.0 mm**



Driven pulley spring

Measure the length of driven pulley spring.
Replace if it exceeds service limit.

Service limit: **97.400 mm.**



Driven pulley

Check following items:

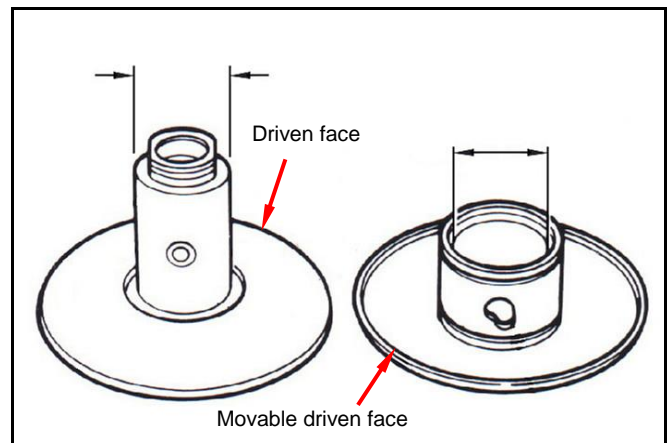
- If both surfaces are damaged or worn.
- If guide pin groove is damaged or worn.

Replace damaged or worn components.
Measure the outer diameter of driven face and the inner diameter of movable driven face.
Replace if it exceeds service limit.

Service limit:

Outer diameter **40.930 mm**

Inner diameter **41.07 mm**

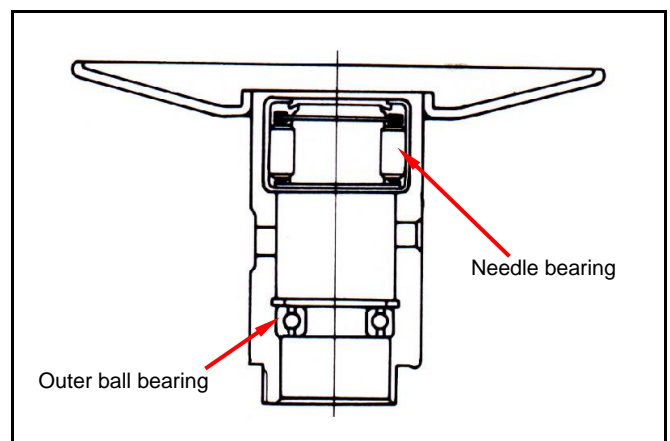


Driven Pulley Bearing Inspection

Check if the inner bearing oil seal is damaged.
Replace it if necessary.

Check if needle bearing is damaged or too big clearance. Replace it if necessary.

Rotate the inside of inner bearing with fingers to check if the bearing rotates smoothly and silently. Check if the bearing outer is fixed properly on driven pulley. Replace it if necessary.

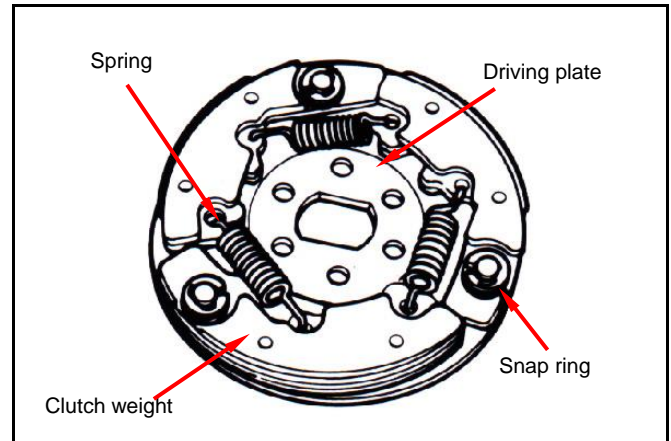


8. V-Belt Drive System

Clutch weight Replacement

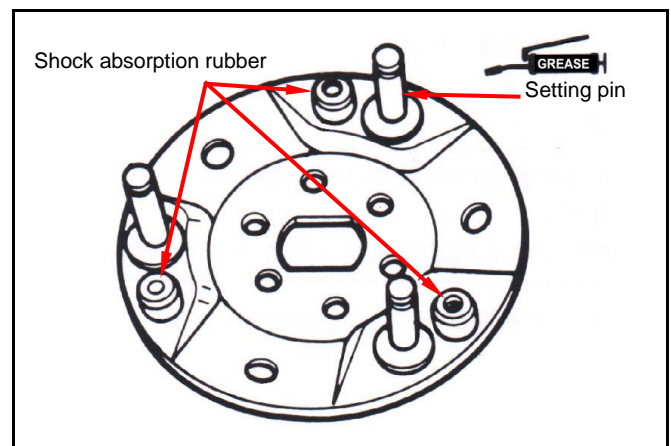
Remove snap ring and washer, and then remove clutch weight and spring from driving plate.

Check if spring is damaged or insufficient elasticity.



Check if shock absorption rubber is damaged or deformed.

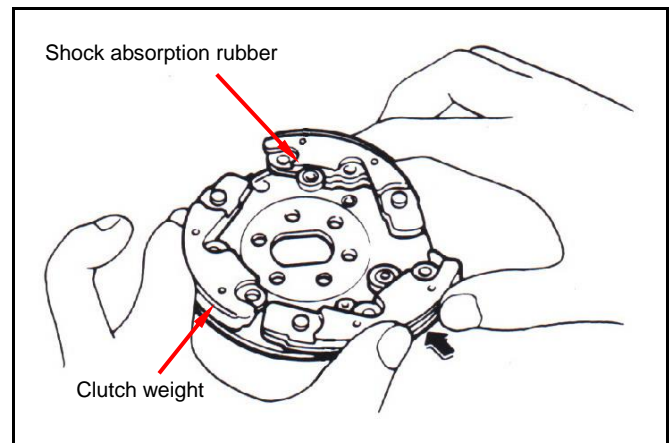
Apply grease onto setting pins.



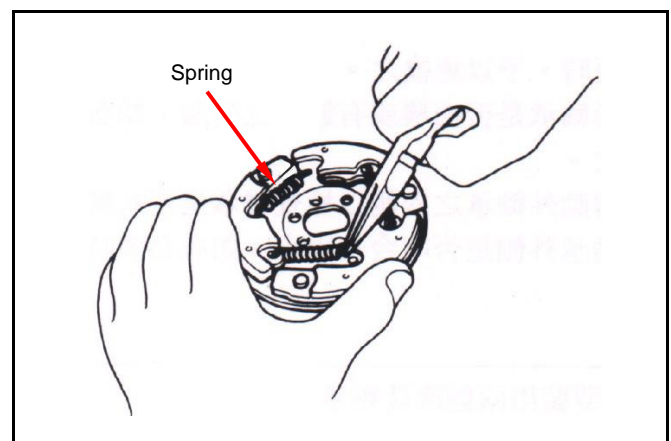
Apply grease onto setting pins. Clutch weight should be free of grease. Replace the clutch weight, if it is contaminated by grease. Install new clutch weight onto setting pin and then push to the specified location.

Caution

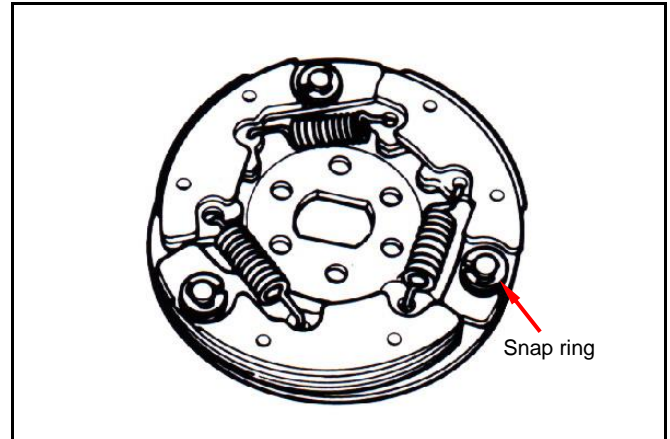
- Grease or lubricant will damage the clutch weight and reduce the friction capacity.



Install the spring into groove with pliers.



Install snap ring and mounting plate onto setting pin.



Replacement of Driven Pulley Bearing

Remove inner bearing.

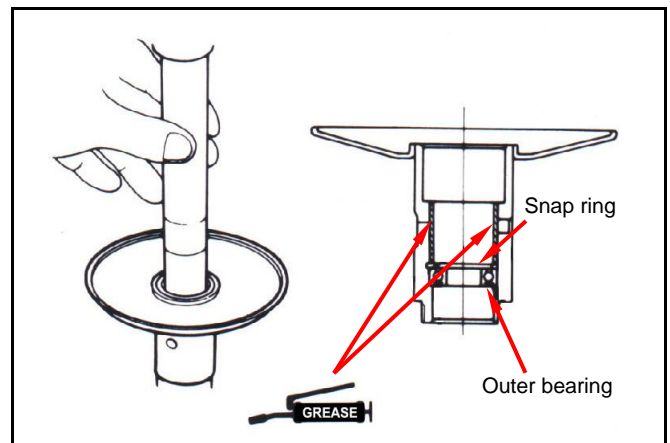
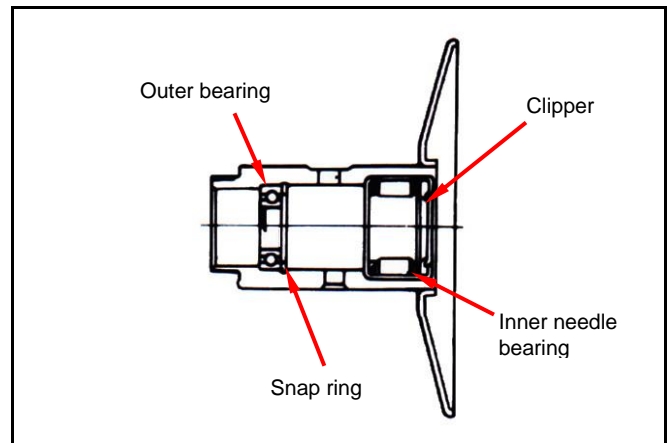
Caution

- If the oil seal is equipped on side of the driven pulley, remove the oil seal first.
- Remove the snap ring first, then the bearing.

Remove snap ring and then push bearing out toward other side of inner bearing.

Place new bearing onto proper position and its sealing end should be toward to outside.

Install snap ring.

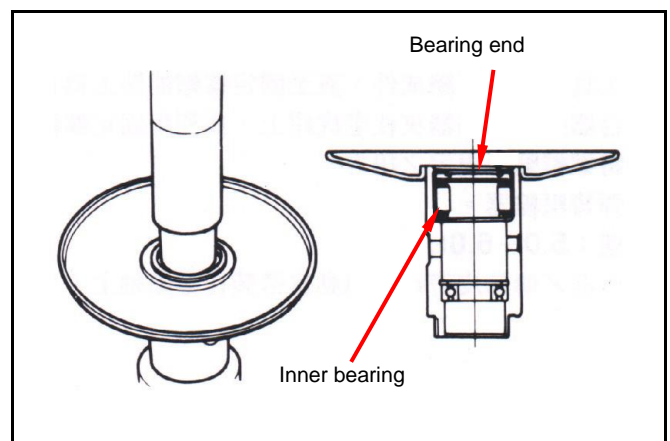


Install new inner bearing.

Caution

- The sealing end should be toward to outside as bearing installation.
- Install needle bearing with hydraulic presser.

Align oil seal lip with bearing, and then install the new oil seal (if necessary).



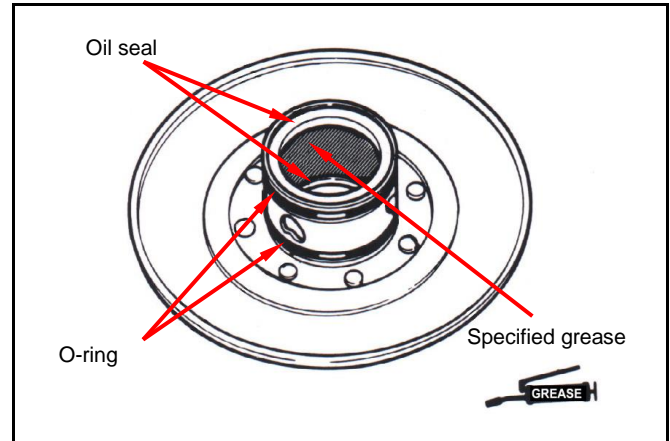
8. V-Belt Drive System



Installation of Clutch Outer/Driven Pulley Assembly

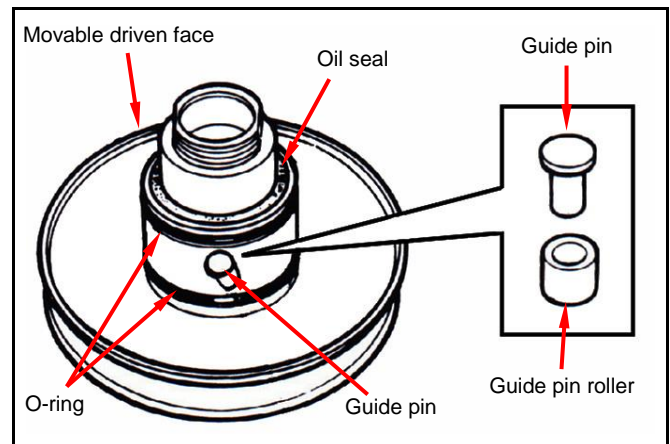
Install new oil seal and O-ring onto movable driven face.

Apply with specified grease to lubricate the inside of movable driven face.

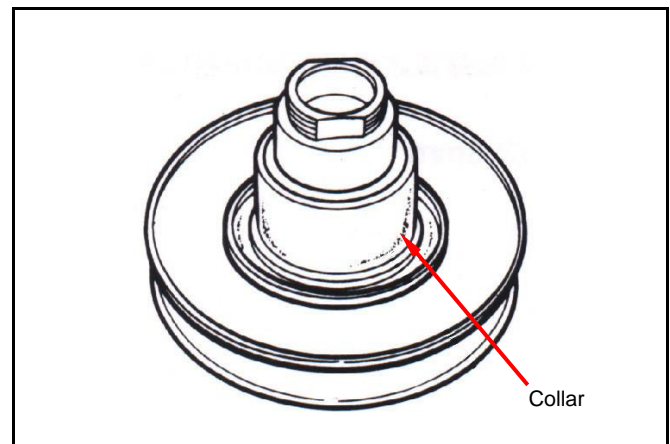


Install the movable driven face onto driven face.

Install the guide pin and guide pin roller.



Install the collar.

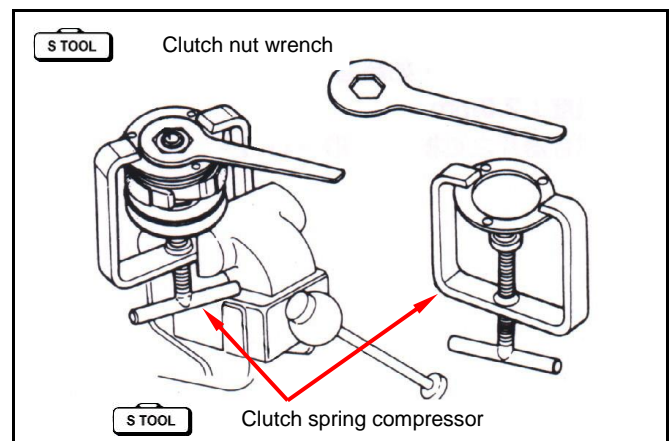


Install friction plate, spring and clutch weight into clutch spring compressor, and press down the assembly by turning manual lever until mounting nut that can be installed. Hold the compressor by bench vise and tighten the mounting nut to specified torque value with clutch nut wrench.

Remove the clutch spring compressor.

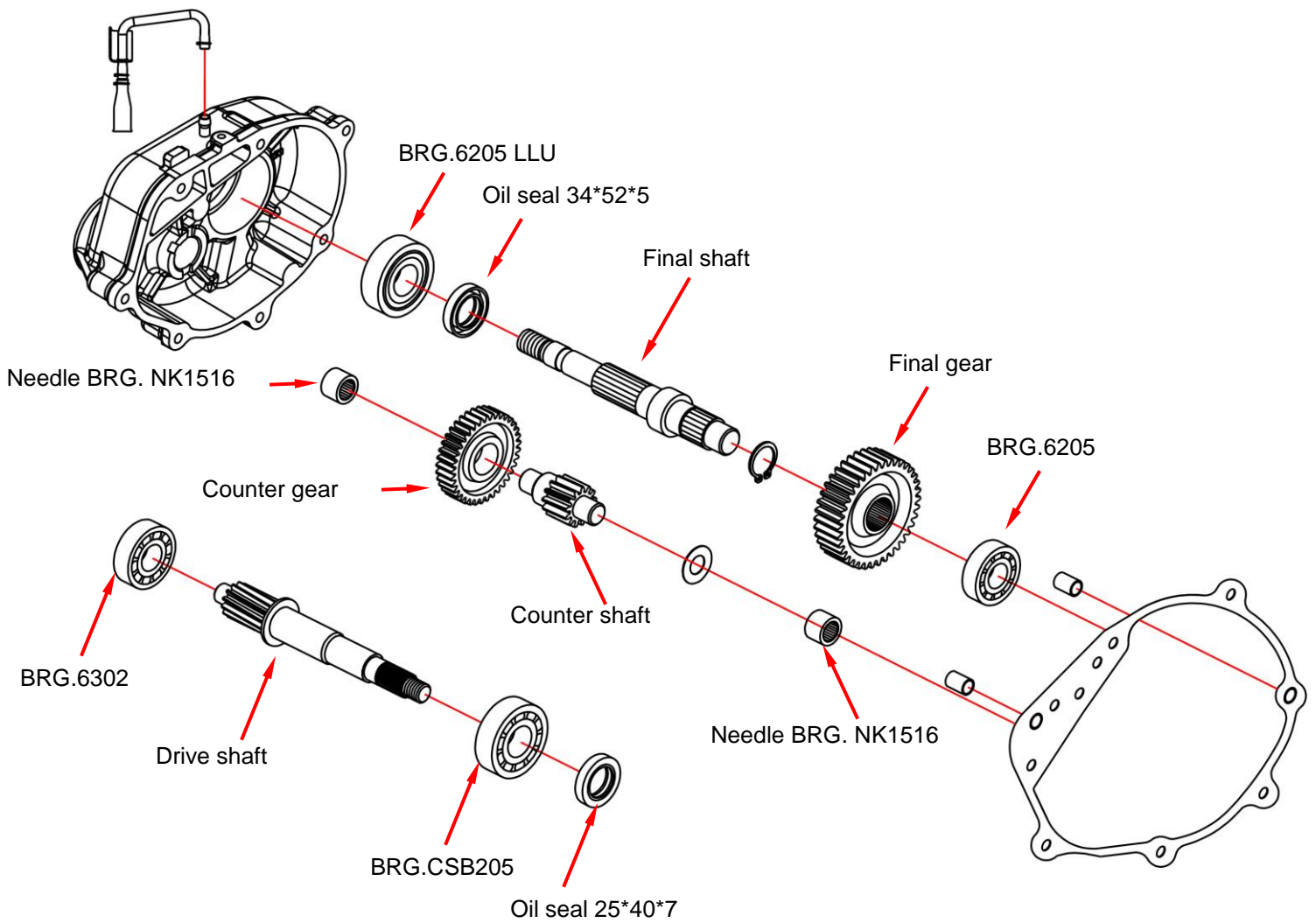
Torque value: **5.0~6.0kgf-m.**

Install clutch outer/driven pulley and drive belt onto drive shaft.



Mechanism Diagram..... 9-1	Final Drive Mechanism Inspection 9-4
Precautions in Operation 9-2	Bearing Replacement 9-5
Troubleshooting 9-2	Final Drive Mechanism Reassembly ... 9-8
Final Drive Mechanism Disassembly .. 9-3	

Mechanism Diagram



Precautions in Operation

Specification

Recommended oil: SYMOIL

Oil quantity: 170cc. (replacement 160 c.c.)

Torque value

Gear box cover 2.4~3.0kgf-m

Special tools

Inner bearing puller	SYM-6204021 or SYM-6204022
Outer bearing puller	SYM-6204001
Bearing (6205) driver	SYM-9615000-6205
Bearing (6205) puller	SYM-9100400 HMA RA1 6205
Drive shaft & oil seal socket	SYM-9120200-HMA
Bearing (NK1516) driver	SYM-9100200-HMA NK1516
Oil seal drive 34*52*5	SYM-9125500-HMA
Drive shaft install puller	SYM-2341110-HMA RB1
Bearing install puller	SYM-2341100
Clutch nut wrench	SYM-9020200

Troubleshooting

Engine can be started but motorcycle cannot be moved.

- Damaged driving gear
- Burned driving gear
- Damaged driving belt.

Noise

- Worn or burned gear
- Worn bearing

Gear oil leakage

- Excessive gear oil
- Worn or damaged oil seal

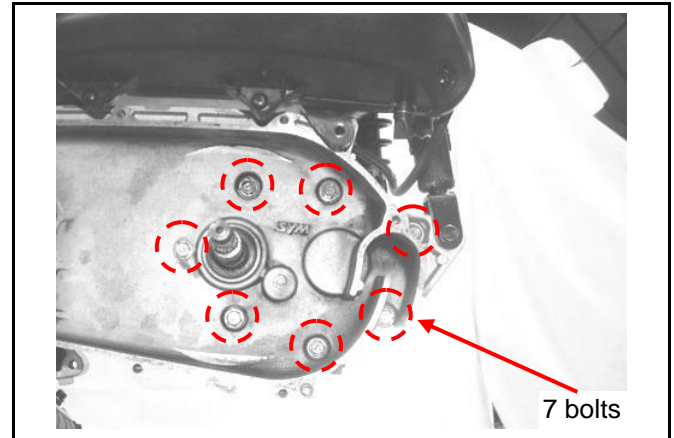
Final Drive Mechanism Disassembly

Remove the rear wheel. (refer to chapter 16)

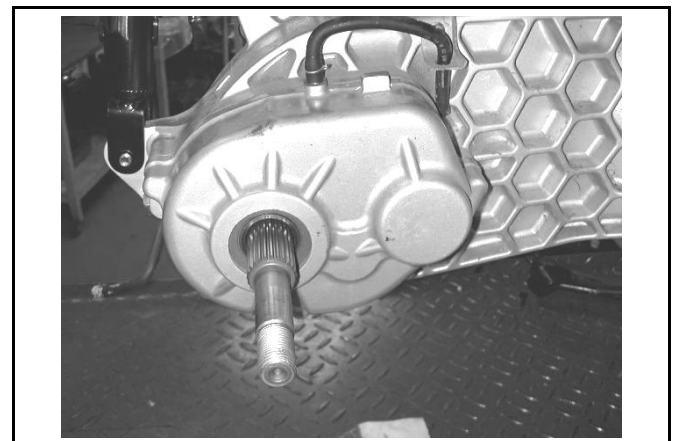
Remove the clutch.

Drain out gear oil from gear box.

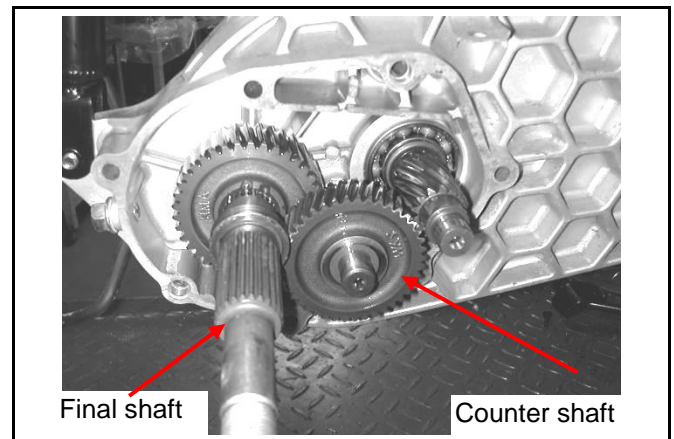
Loosen 7 bolts and remove gear box cover bolts.



Remove the gear box cover.
Remove the gasket & dowel pin.



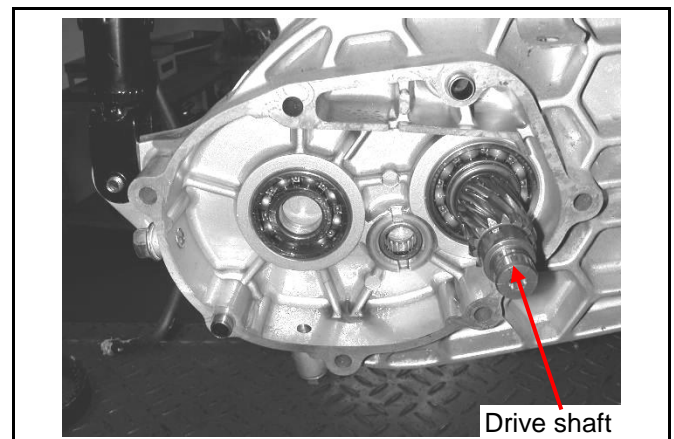
Remove counter shaft, gear, and 2 washers.
Remove final shaft and gear.



Remove the drive shaft.
Special tool: **Shaft protector**

Caution

- Do not remove drive shaft if not necessary.
- Replace the bearing, if drive shaft is removed.

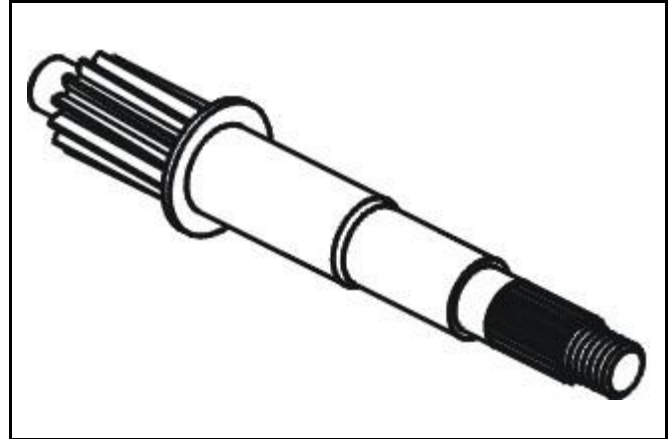


9. Final Drive Mechanism

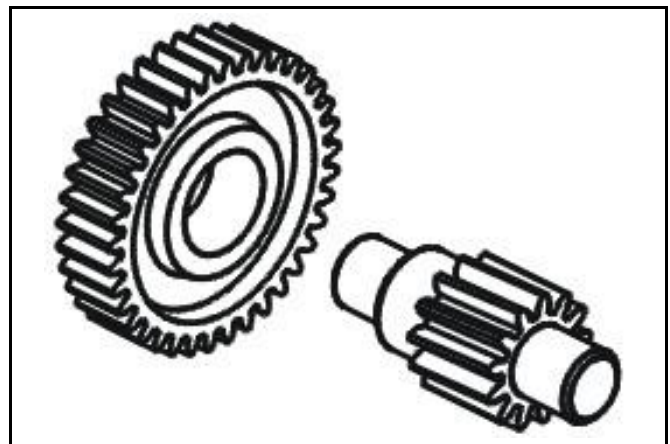


Final Drive Mechanism Inspection

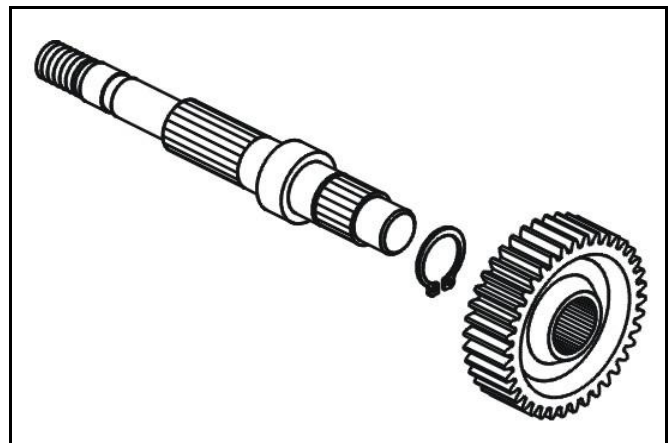
Check if the drive shaft is burned, worn or damaged.



Check if the countershaft and gear are burned, worn, or damaged.



Check if the final shaft and gear are burned, worn, or damaged.

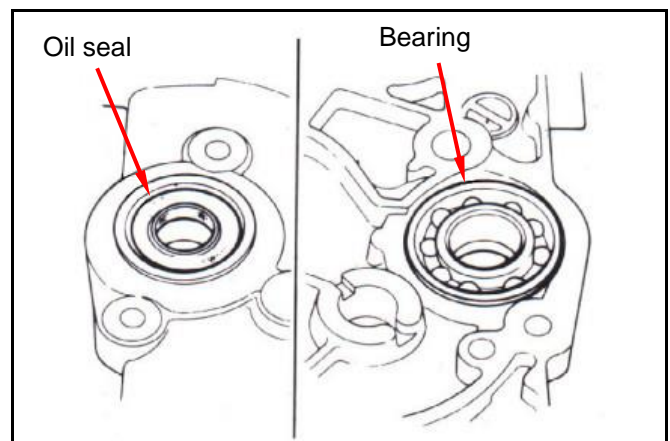


Check bearings on gear box cover.
Rotate each bearing's inner ring with fingers.
Check if bearings can be turned smoothly and silently, and also check if bearing outer ring is mounted tightly.

Replace the bearing, if the rotation is uneven, noisy, or loose bearing mounted

Replace the oil seal, if the oil seal is worn or damaged.

Check gear box bearing as the same way above, and replace if necessary.



Bearing Replacement

Left crankcase side

If the drive shaft is pulled out with its bearing, then remove the bearing with bearing puller and shaft protector.

Special tool:

Outer bearing puller SYM-6204001

Shaft protector SYM-6204010

Remove final shaft bearing and counter shaft bearing from left crankcase by using following tools.

Special tool:

Inner bearing puller SYM-6204020 / SYM-6204021

Caution

- Never use a used bearing. Replace with a new bearing, if the bearing is removed.

Install new final shaft bearing and counter shaft bearing into left crankcase.

Special tool:

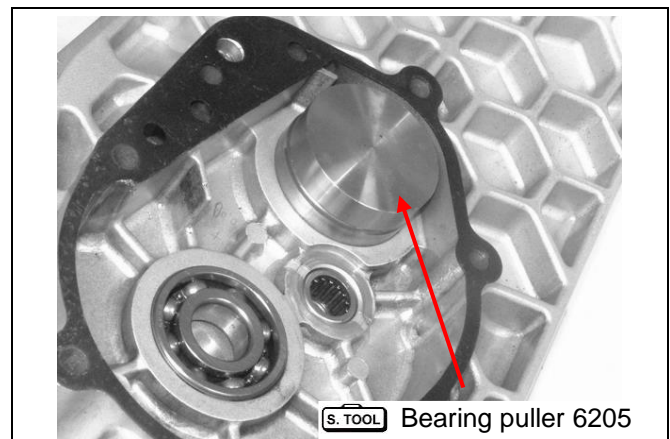
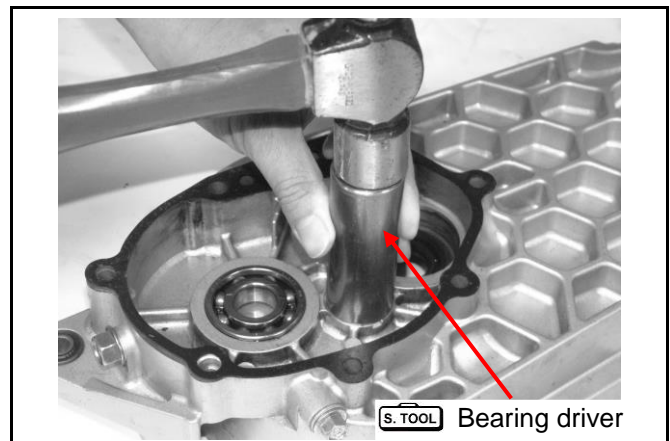
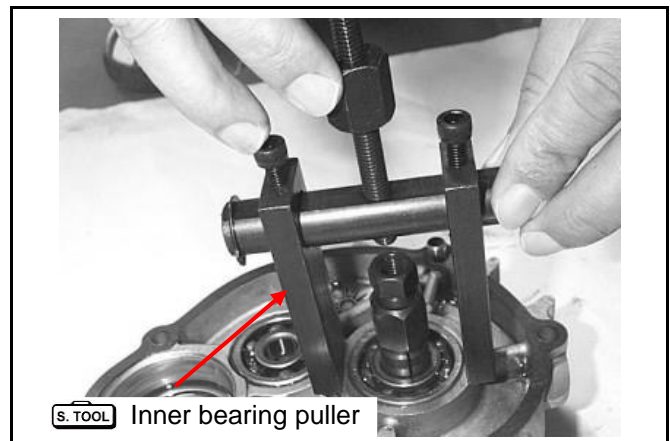
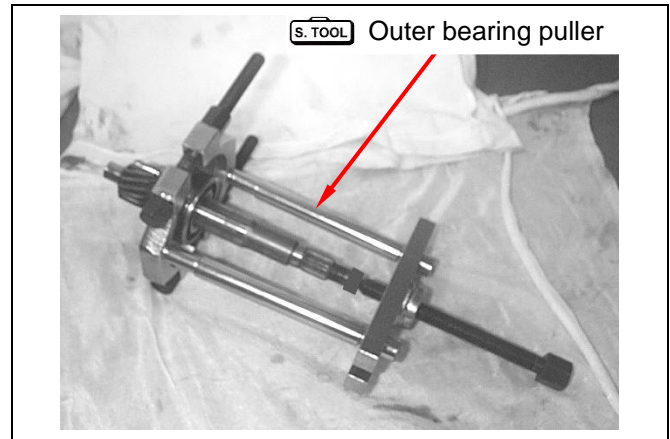
Bearing driver 6205 SYM-9615000-6205

Bearing driver HK1516 SYM-9100200-HK1516

Install new drive shaft bearing and bearing puller onto left crankcase.

Special tool:

Bearing puller 6205 SYM-9100400-6205



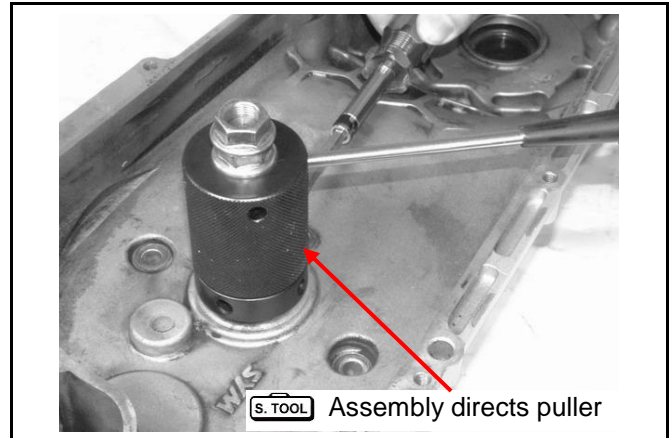
9. Final Drive Mechanism



Install assembly directs puller and the bearing.
Use screw driver to hold bearing puller lower part, and turn the bearing puller upper part to install the drive shaft bearing.

Special Service Tools:

Assembly directs puller SYM-2341110

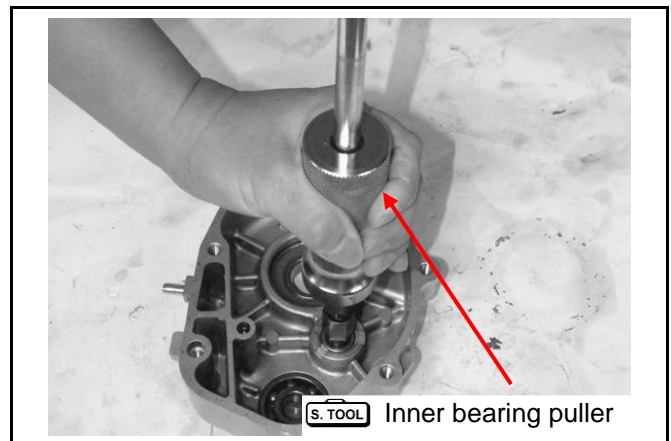


Gear box cover side

Remove drive shaft bearing and counter shaft bearing from gear box cover by using following tools.

Special tool:

Inner bearing puller SYM-6204020 / SYM-6204021

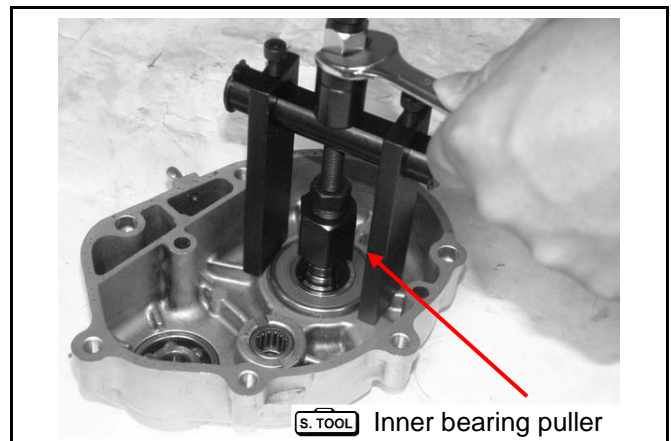


Remove final shaft bearing from gear box cover by using following tools.

Remove oil seal.

Special tool:

Inner bearing puller SYM-6204020 / SYM-6204021



Install a new drive shaft bearing and counter shaft bearing into gear box cover.

Special tool:

Bearing (6205) driver
SYM-9615000-6205

Bearing (NK1516) driver
SYM-9100200-HMA NK1516

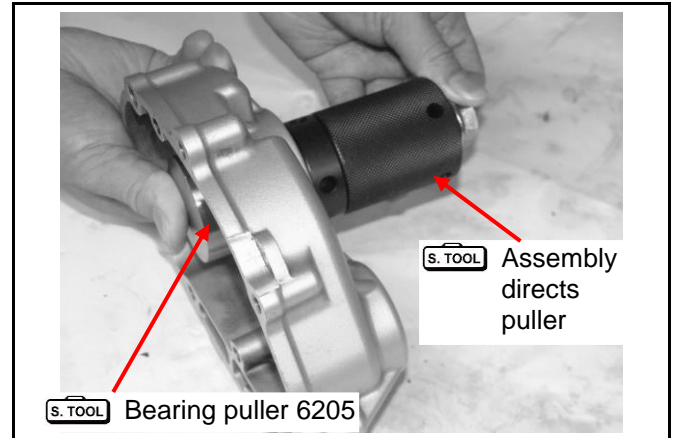


Install new final shaft bearing and bearing puller onto gear box cover.

Special tool:

Bearing (6205) puller

SYM-9100400 HMA RA1 6205

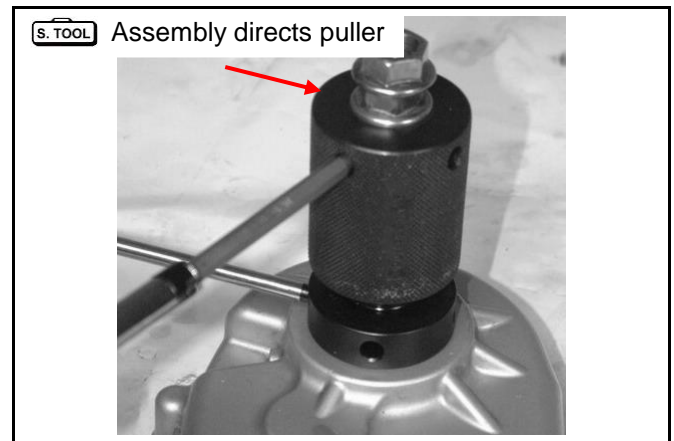


Install assembly directs puller and the bearing. Use screw driver to hold bearing puller lower part, and turn the bearing puller upper part to install the bearing.

Special tool:

Assembly directs puller

SYM-2341110

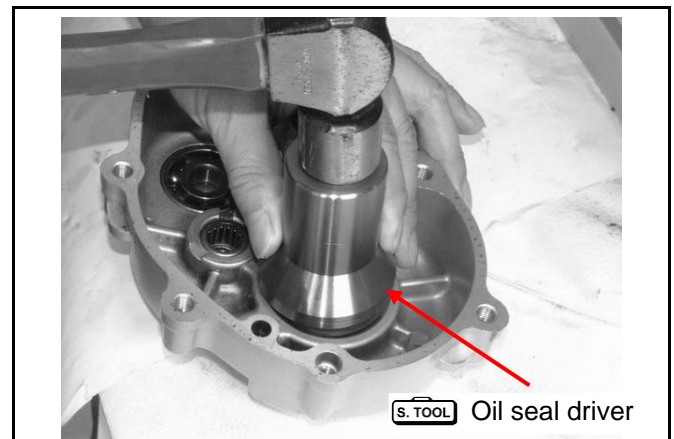


Apply grease onto final shaft oil seal. Install the oil seal into gear box cover.

Special tool:

Oil seal driver 34*52*5

SYM-9125500-HMA



9. Final Drive Mechanism



Final Drive Mechanism Reassembly

Install drive shaft.

Special tool:

Drive shaft puller

SYM-2341110- HMA RB1

Drive shaft socket & oil seal driver (25*40*8)

SYM-9120200-HMA

Clutch nut wrench

SYM-9020200

Apply grease onto drive shaft oil seal.

Install the oil seal to left crankcase.

Special tool:

Drive shaft socket & oil seal driver (25*40*8)

SYM-9120200-HMA

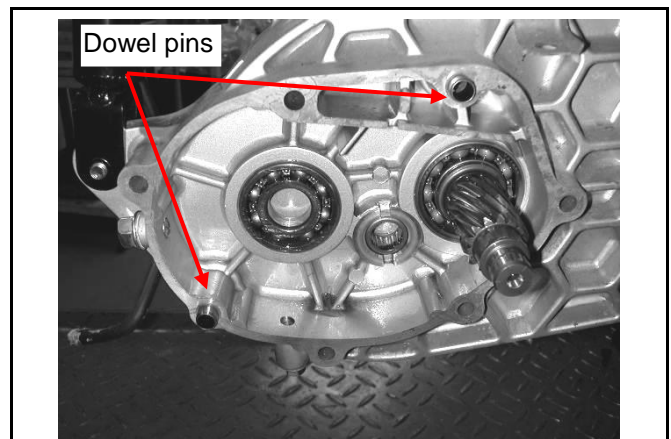
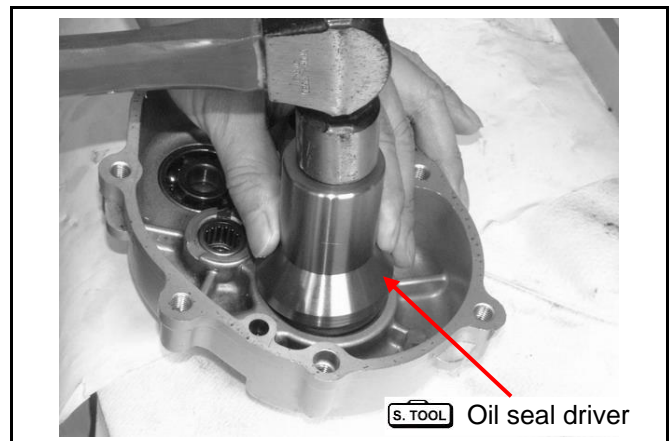
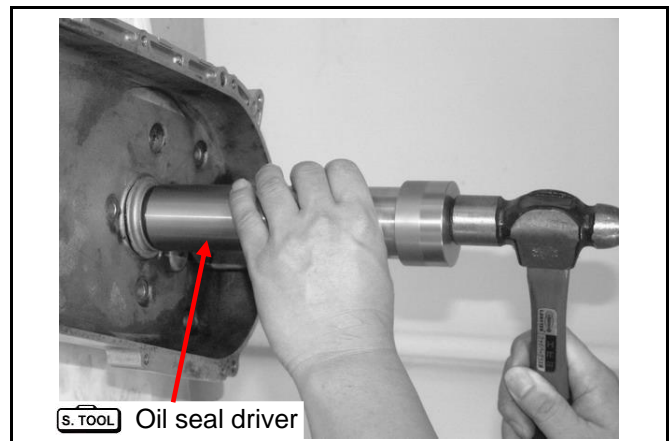
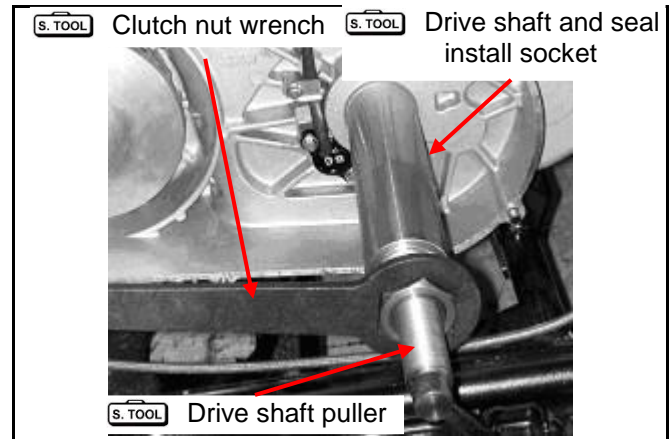
Apply grease onto final shaft oil seal and install the oil seal.

Special tool:

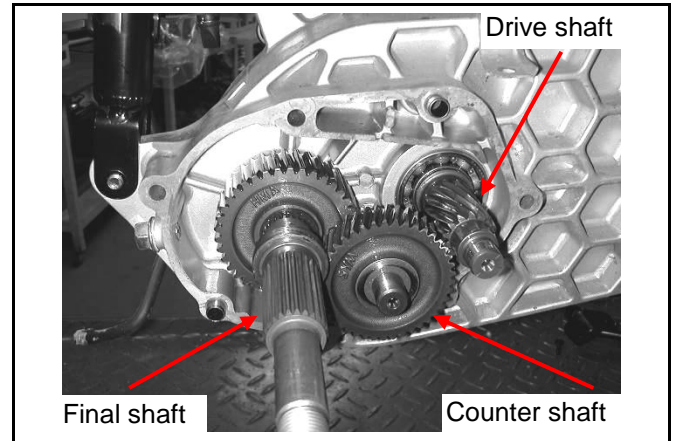
Oil seal drive 34*52*5

SYM-9125500-HMA

Install 2 dowel pins & new gasket.



Install counter gear, 2 washers, final gear, and final shaft onto left crankcase.



Install the gear box and tighten the bolts. (7 bolts)

Torque value: 2.6~3.0kgf-m

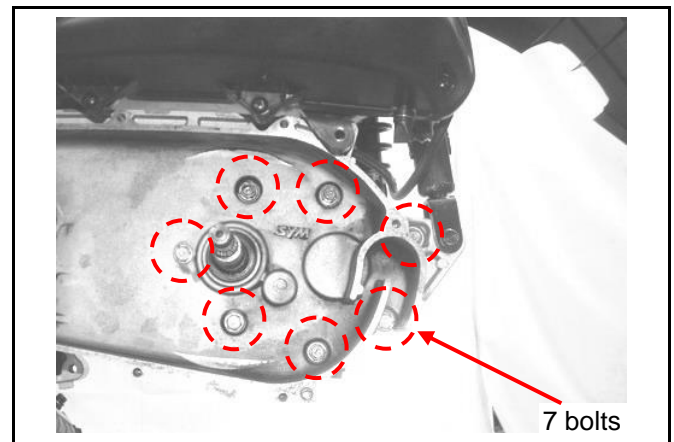
Install driven pulley / clutch outer / belt.

Install movable drive face, drive face and left crankcase cover.

Install rear wheel.

Add gear oil.

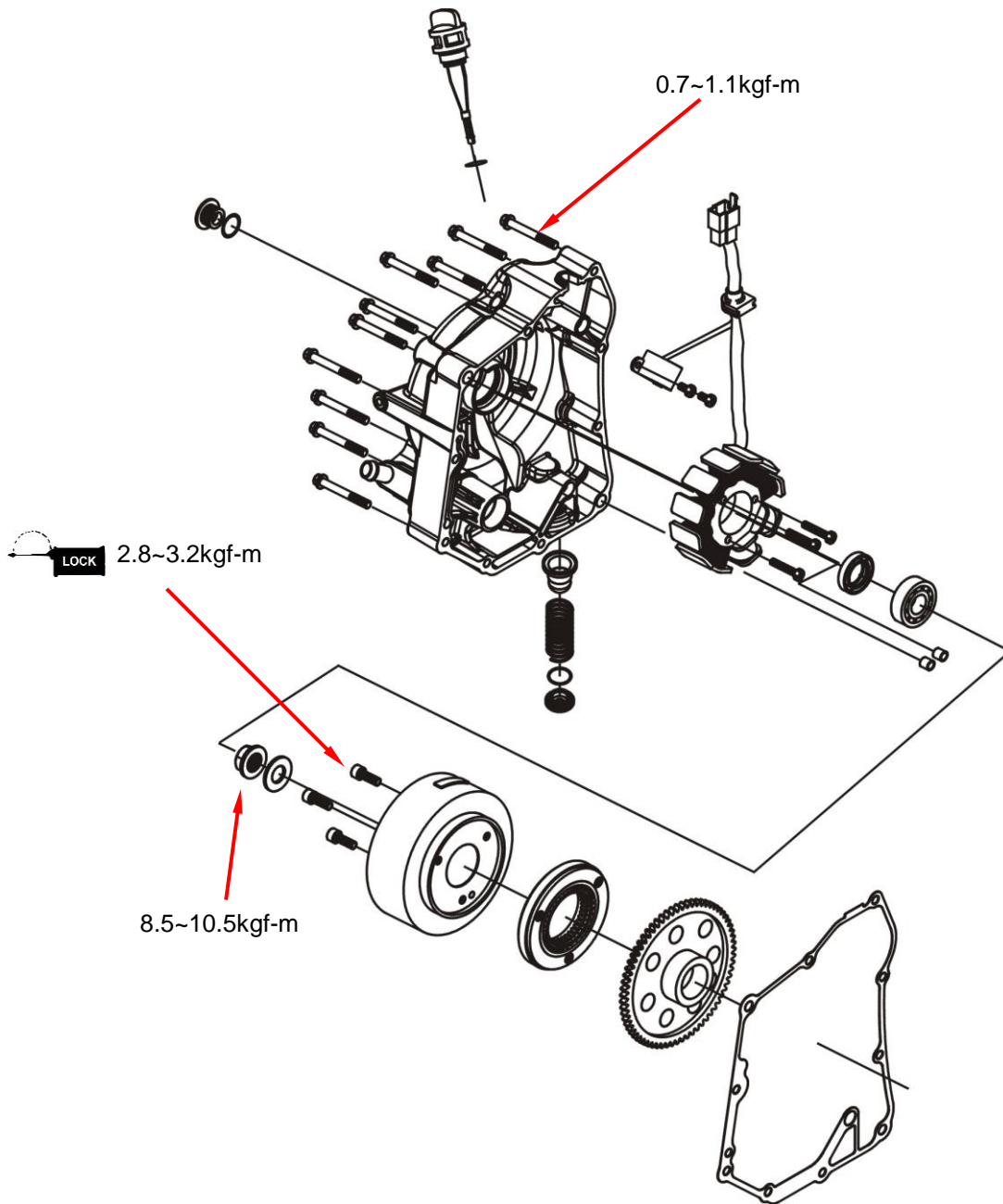
**Gear oil quantity: 180 c.c. / replacement:
160 c.c.**



NOTE:

Mechanism Diagram	10-1	Flywheel Removal	10-5
Precautions in Operation	10-2	Start Clutch	10-6
Right Crankcase Cover Removal	10-3	Flywheel Installation	10-8
AC. Generator Removal	10-4	AC. Generator Installation	10-9
Right Crankcase Cover Bearing	10-4	Right Crankcase Cover Installation	10-9

Mechanism Diagram



Precautions in Operation

- General information
- Refer to chapter 17: The troubleshooting and inspection of alternator.
- Refer to chapter 17: The service procedures and precaution items of starter motor.

Specification

mm

Item	Standard value (mm)	Limit (mm)
ID of starting clutch gear	25.026~25.045	25.050
OD of starting clutch gear	42.192~42.208	42.100

Torque value

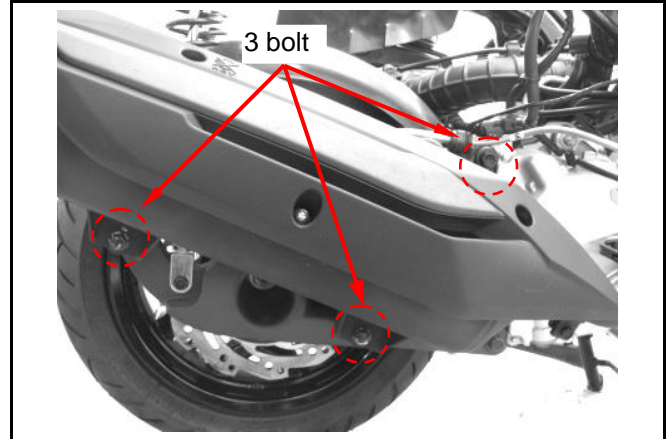
Flywheel nut	5.0~6.0kgf-m
Starting clutch hexagon bolt	2.8~3.2kgf-m with adhesive
7 mm bolt	0.7~1.1kgf-m
12 mm bolt	1.8~2.2kgf-m

Special tools

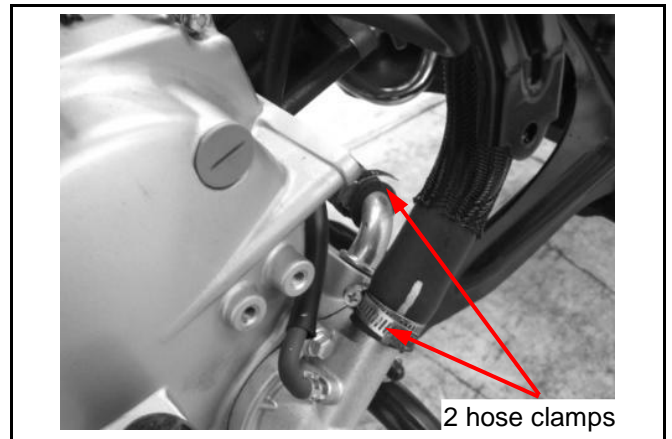
AC.G. flywheel puller	SYM-3110000-HMA
R crank case cover 6201 BRG puller	SYM-9614000-HMA RB1 6201
Inner bearing puller	SYM-6204022
Universal holder	SYM-2210100

Right Crankcase Cover Removal

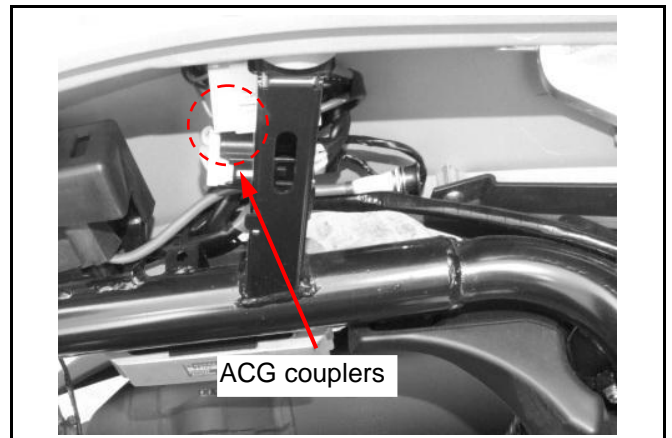
Remove right side cover.
Remove seat and luggage box.
(Refer to chapter 13)
Remove the exhaust muffler. (3 bolts, 2 nuts)



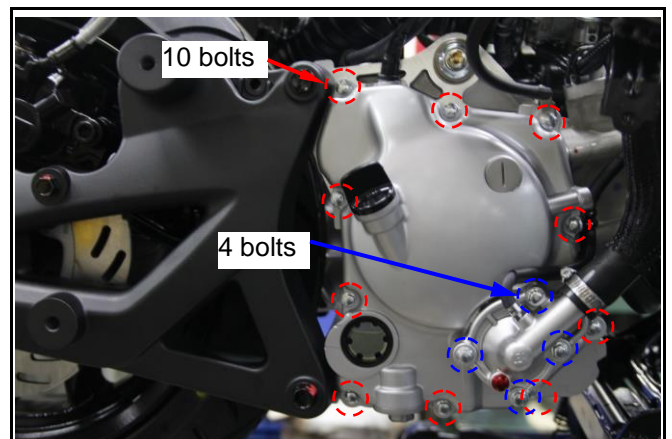
Drain out the engine oil and coolant. (Refer to chapter 5&12)
Remove coolant hoses.



Disconnect the ACG couplers.

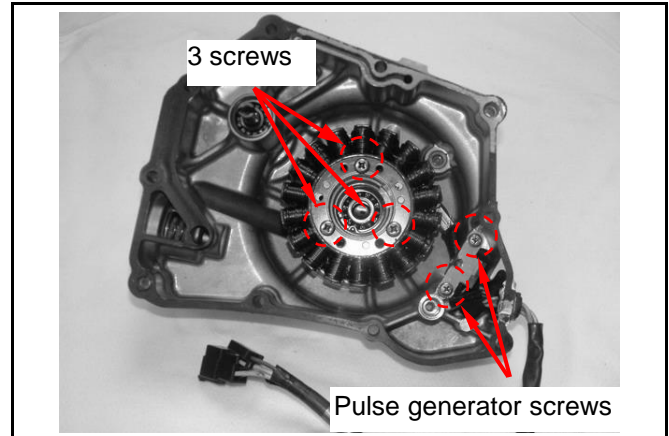


Remove water pump cover. (4 bolts)
Remove 10 bolts from the right crankcase cover.
Remove the right crankcase cover.
Remove dowel pin and gasket.
Clean up all residues or foreign materials from the matching surfaces of cover and crankcase.



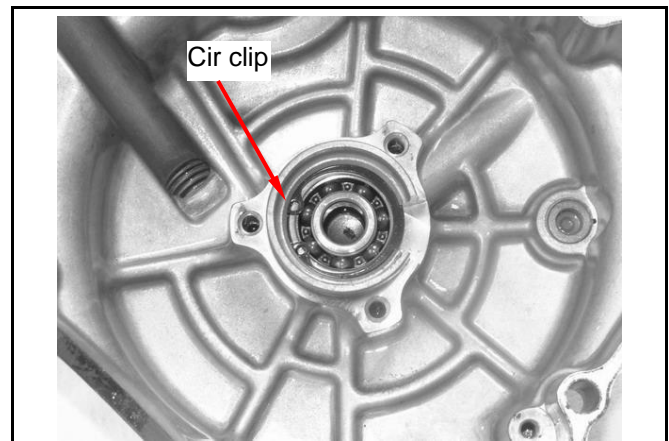
AC. Generator Removal

Remove 2 mounting screws from pulse generator.
Remove 3 screws from right crankcase cover and then remove generator coil set.



Right Crankcase Cover Bearing

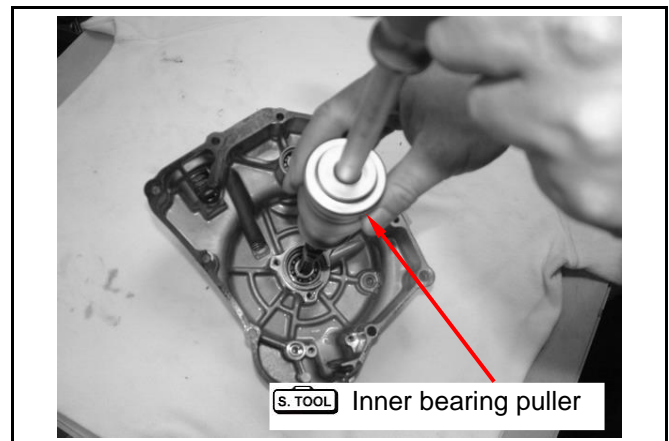
Rotate the bearing with finger to check if the bearing rotates smoothly and silently.
Rotate bearing's inner ring with fingers.
Check if bearings can be turned smoothly and silently, and also check if bearing outer ring is mounted on cover tightly.
If bearing rotation is uneven, noisy, or loose bearing mounted, replace it.
Remove circlip.



Remove the bearing 6201 with inner bearing puller.

Special tool:

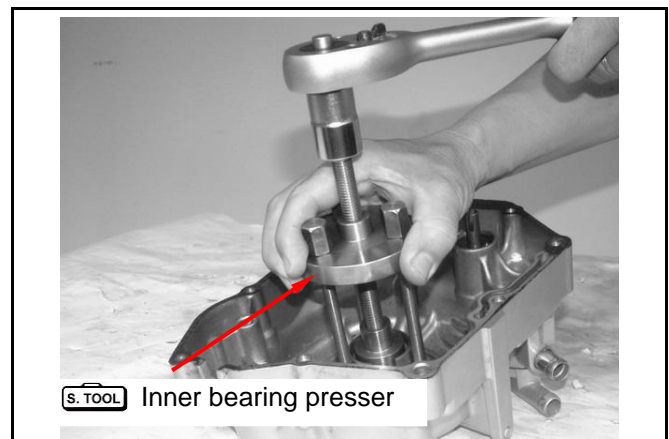
Inner bearing puller SYM-6204020 or SYM-6204021



Install the bearing 6201 bearing with special tool.

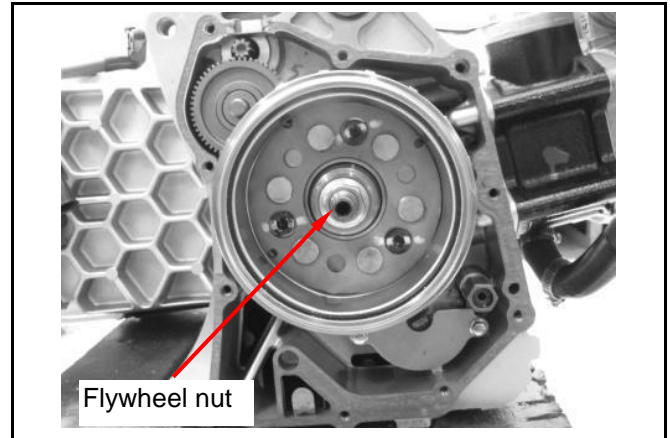
Special tool:

Right crankcase cover bearing 6201 presser
SYM-9614000-HMA RB1 6201

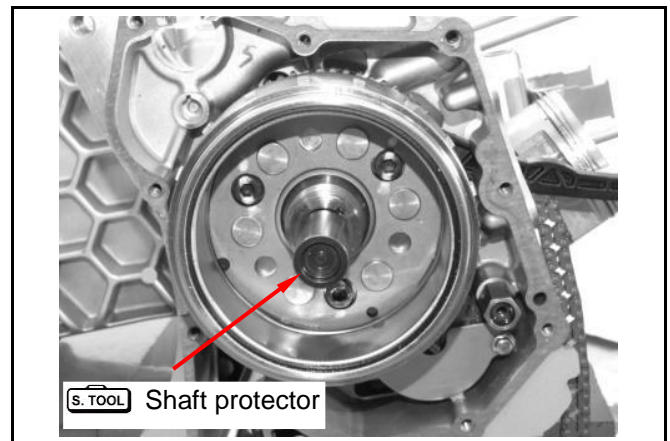


Flywheel Removal

Remove right crankcase cover and generator coil.
Remove flywheel nut.



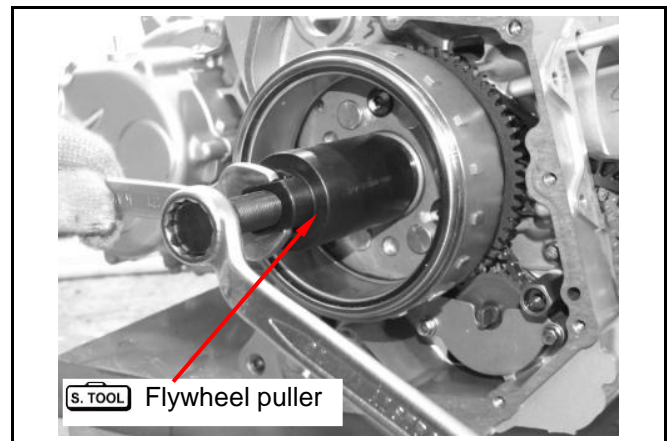
Installs shaft protector onto the crank shaft.



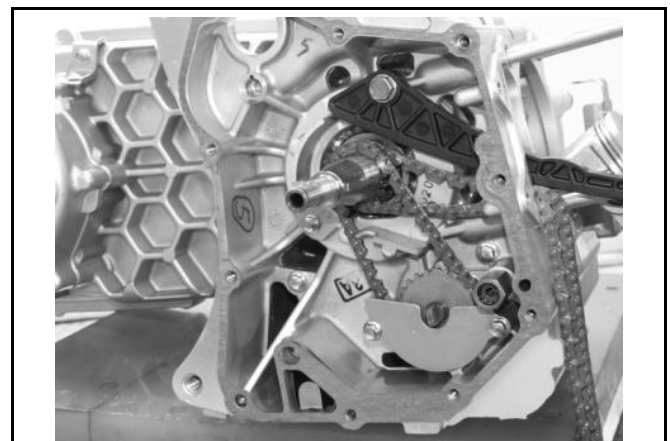
Pull out flywheel with AC.G. flywheel puller.
Special tool:
AC.G. Flywheel puller SYM-3110000-HMA

⚠ Caution

- Install shaft protector before install flywheel puller.



Remove flywheel and starting driven gear.



Start Clutch

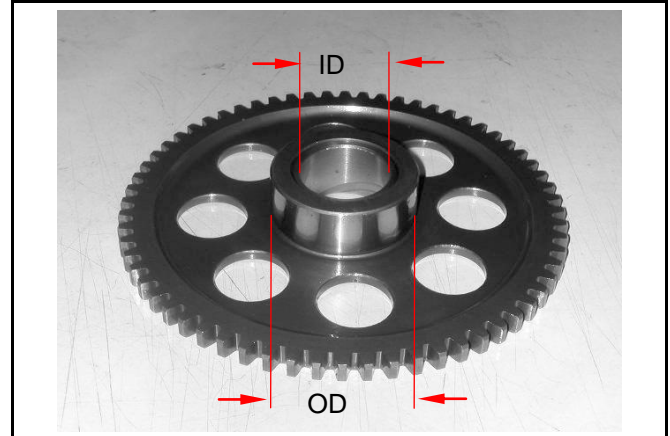
Start Clutch Inspection

Remove start clutch driven gear.
Measure the ID and OD of the start clutch driven gear.

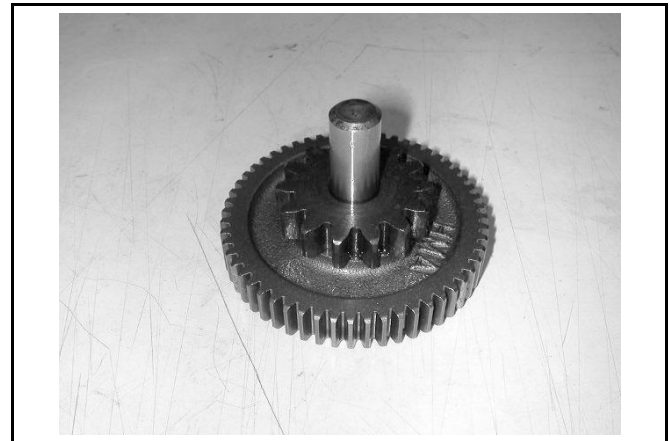
Service Limit:

ID 25.050 mm

OD 42.100 mm



Check if starting reduction gear and shaft is worn or damaged.



Check if each roller is worn or damaged.



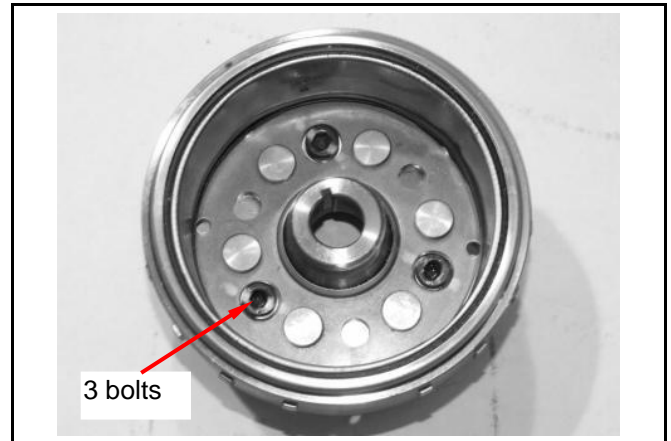
Install start clutch driven gear onto one way clutch.
Hold flywheel and rotate start clutch gear.
The start clutch gear should be rotated in C.W direction freely, but not C.C.W direction.



One way clutch removal

Remove the starting gear

Loosen 3 starting clutch socket bolts from one way clutch and remove one way clutch.



Push out the roller set and check if each roller is worn or damaged.

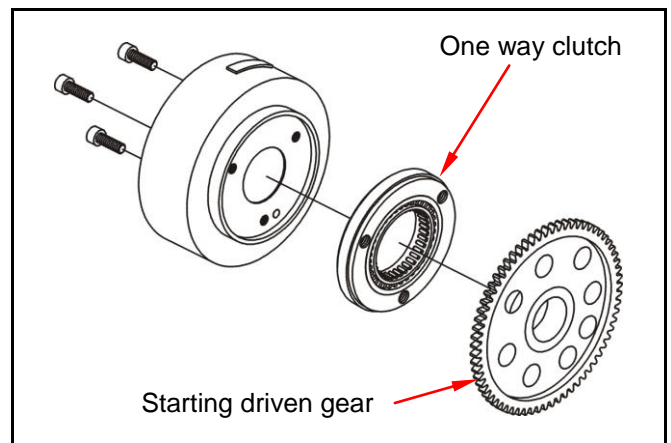
**One way clutch Installation**

Install the components in the reverse procedures of removal.

Torque value: 2.8~3.2kgf-m

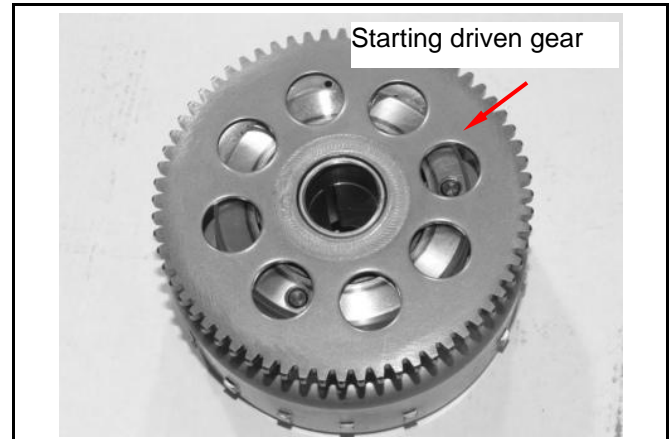
⚠ Caution

Install one way clutch, flywheel, and starter gear onto crankshaft first; then tighten the bolts. Otherwise, there will be concentric deviation and bring damage.

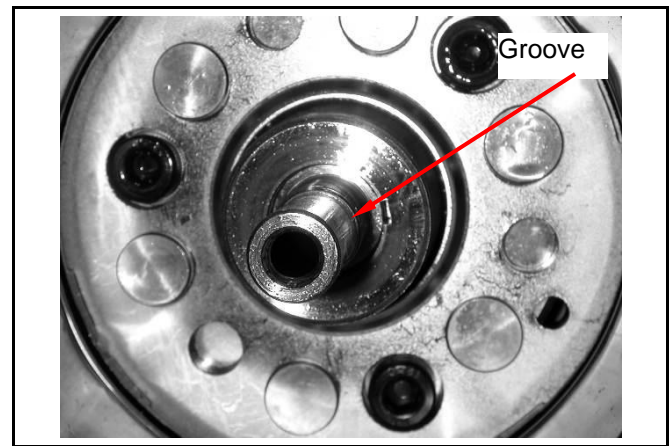


Flywheel Installation

Install starting driven gear onto one way clutch.

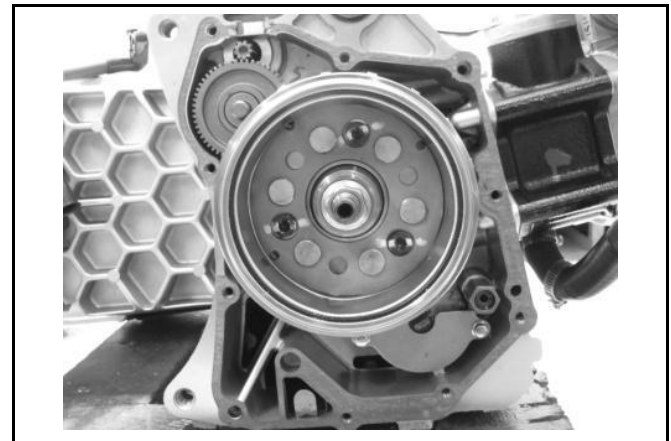


Align the key on crankshaft with the flywheel groove, and then install the flywheel.



Hold the flywheel by drive face with universal holder, and tighten flywheel nut.
Torque value: **8.5~10.5kgf-m**

Special tool:
Universal Holder SYM-2210100



AC. Generator Installation

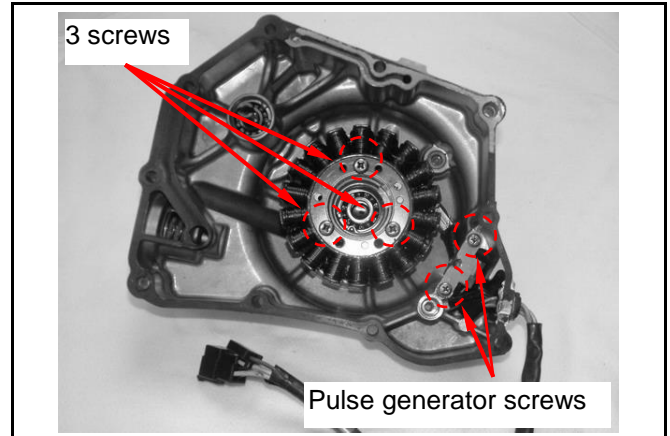
Install the AC.G. coil set onto right crankcase cover. (3 screws)

Install pulse generator. (2 screws)

Tie rubber sleeve securely onto the indent of crankcase cover.

Caution

Make sure that the cable is placed under pulse generator.



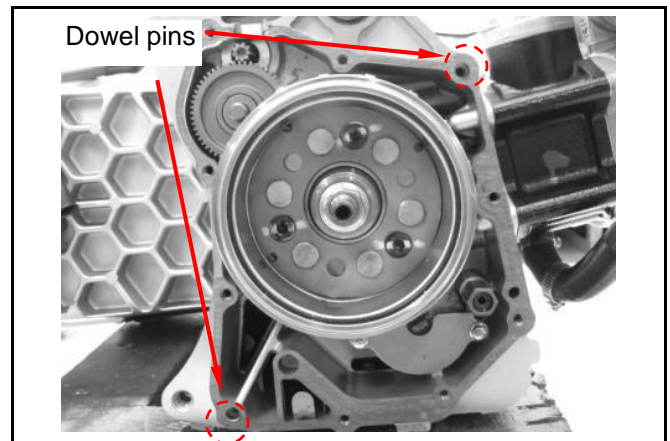
Right Crankcase Cover Installation

Install dowel pins and new gasket.

Remove water pump cover to rotate water pump shaft.

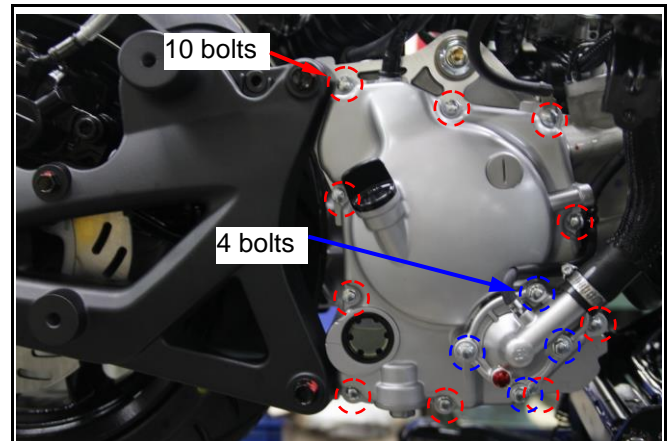
Install right crankcase cover onto the crankcase.

Align the water pump shaft indent with the oil pump shaft.



Install right crankcase cover. (10 screws)

Install the dowel pin, new gasket and water pump cover onto crankcase cover.



Connect coolant hoses onto the right crankcase cover.

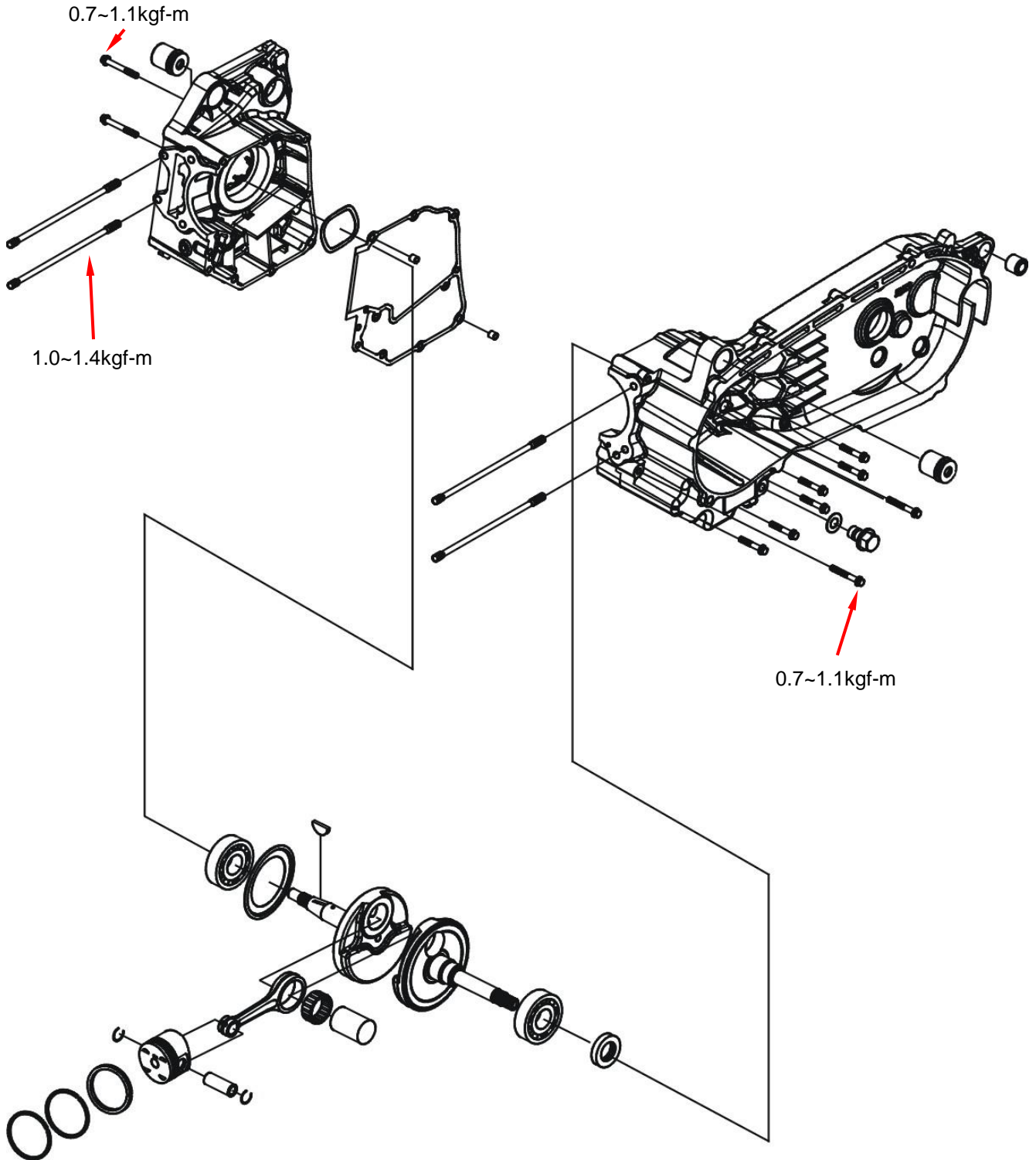
Add engine oil and coolant.



NOTE:

Mechanism Diagram.....	11-1	Crankcase Disassembly.....	11-3
Precautions in Operation	11-2	Crankshaft Inspection	11-4
Troubleshooting	11-2	Crankcase Assembly.....	11-6

Mechanism Diagram



Precautions in Operation

General Information

- This Section concerns disassembly of the crankcase for crankshaft repair purpose.
- Remove following components before disassembling crankcase.
 - - Engine remove Chapter 5
 - - Cylinder head Chapter 6
 - - Cylinder and piston Chapter 7
 - - Drive face and driven pulley Chapter 8
 - - AC generator/Start one way clutch Chapter 10
- In case of replacing right bearing, oil pump sprocket, or timing sprocket, it is necessary to replacing the whole crankshaft as a set.

Specification

mm

Item	Standard	Limit
Connecting rod side clearance of the big end	0.100~0.400	0.600
Vertical clearance of the big end of the connecting rod	0~0.008	0.050
Run-out	-	0.100

Torque value

Bolts for crankcase	0.7~1.1kgf-m
Bolt for cam chain adjuster	0.8~1.2kgf-m
Cylinder stud bolts	1.0~1.4kgf-m

Special tools

R/L. crank disassemble tool	SYM-1120000-HMA H9A
L. crank shaft bearing puller	SYM-9100100
Crank shaft install socket & oil seal driver	SYM-2341110- HMA RB1
Crank shaft puller	SYM-1130000-HMA H9A
Outer bearing puller	SYM-6204001
Inner bearing puller	SYM-6204022
Clutch nut wrench	SYM-9020200

Troubleshooting

Engine noise

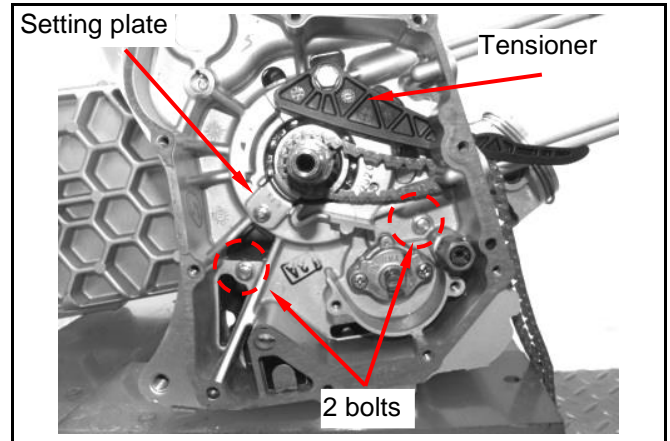
- Loose crankshaft bearing
- Loose crankshaft pin bearing
- Worn out piston pin and pin hole

Crankcase Disassembly

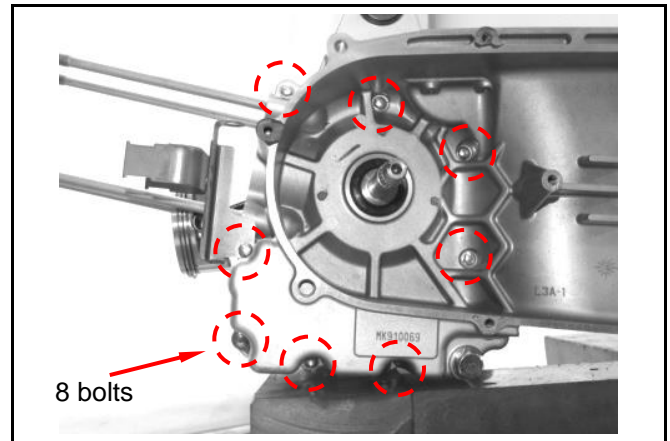
Remove the cam chain setting plate, and then remove cam chain.

Loosen the pivot bolt and remove the tensioner.

Loosen 2 bolts on the right crankcase.



Loosen 8 bolts on the left crankcase.



Place right crankcase downward and left crankcase upward.

Install crank disassemble tool onto left crankcase.

Special tool:

Crank case disassemble tool

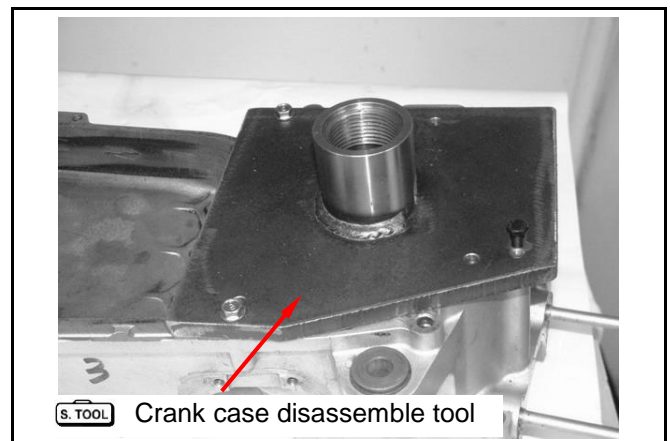
SYM-1120000-HMA H9A

L. Crank shaft puller

SYM-1130000-HMA H9A

Clutch nut wrench

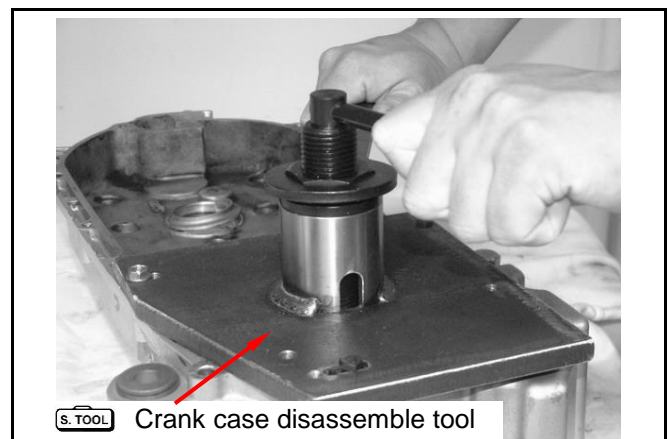
SYM-9020200



Hold left crank shaft puller nut by clutch nut wrench, and turn the shaft puller to press out crank shaft from left crankcase.

⚠ Caution

- Do not pry open on the crankcase matching surface. Otherwise, the matching surface will be damaged and result in oil leak.

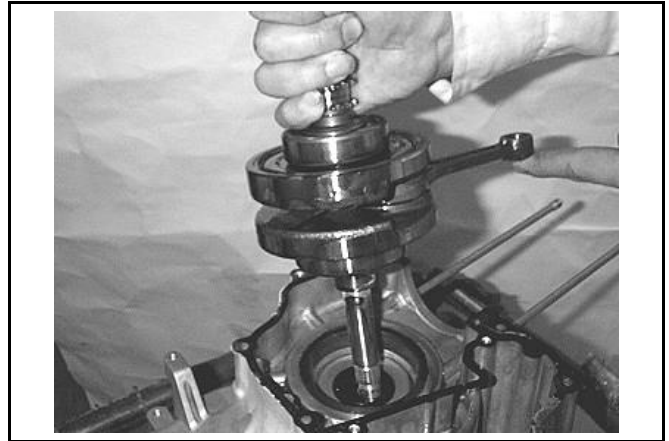


11. Crankshaft / Crankcase

Remove crankshaft and wave washer from right crankcase.

Caution

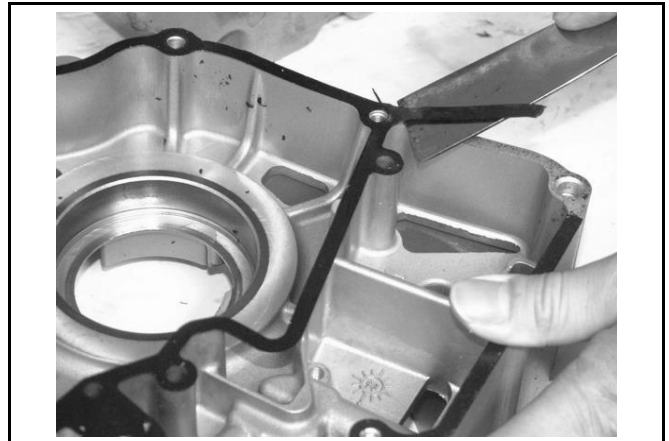
- When assembly, the left bearing is assembled on left crankcase, and the right bearing is assembled on crankshaft.
- When disassembling crankcase, the left bearing could possibly be removed together with crankshaft.



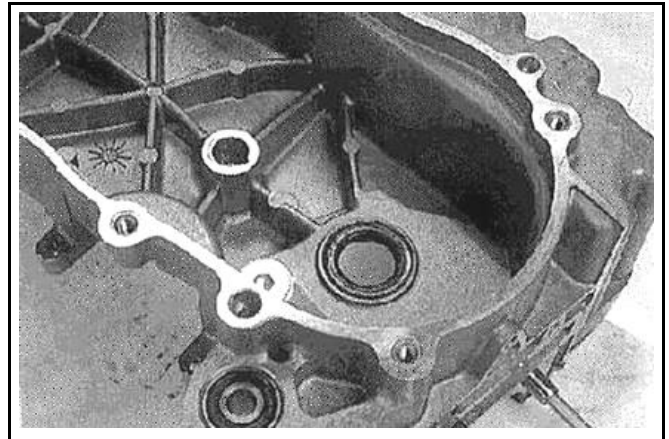
Remove gasket and dowel pins.
Clean up all residues or foreign materials from the matching surfaces of crankcase.

Caution

- Avoid damaging the matching surface of crankcase.
- Soak the residues with solvent for easy removal.



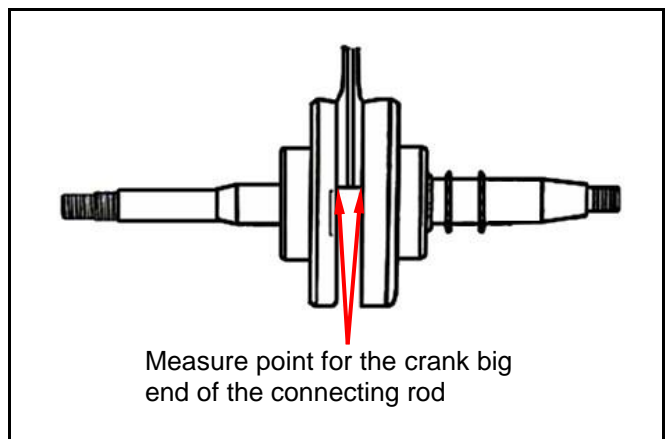
Check if the oil seal on left crankcase is worn or damaged.
Replace the oil seal if necessary.



Crankshaft Inspection

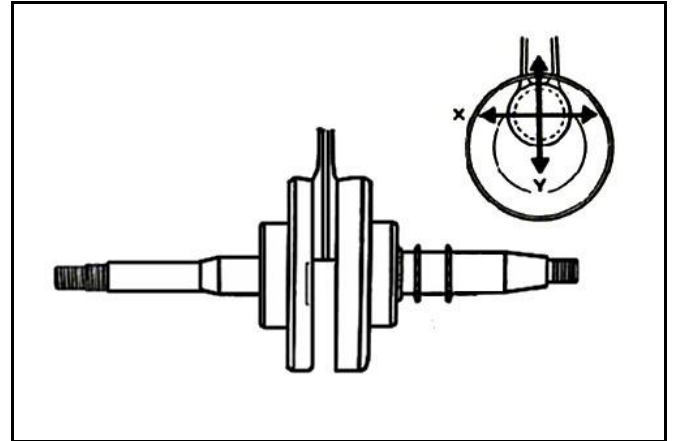
Use a thickness gauge to measure left and right clearance of connecting rod big end.

Service limit: 0.6 mm



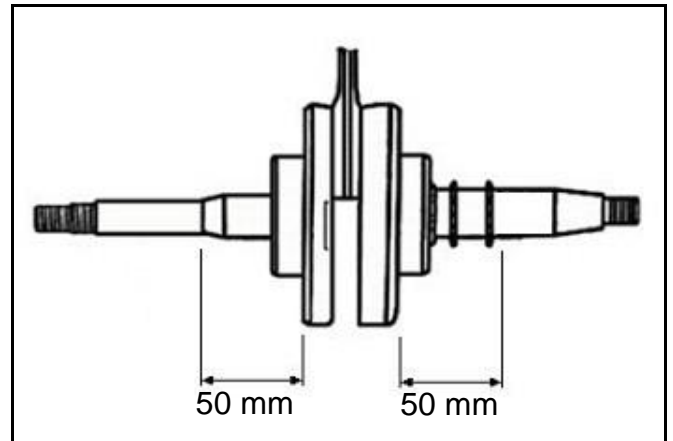
Measure the clearance of the big end at the vertical direction.

Service limit: 0.05 mm



Place the crankshaft on a V-block, measure run-out of the crankshaft.

Service limit: 0.10 mm

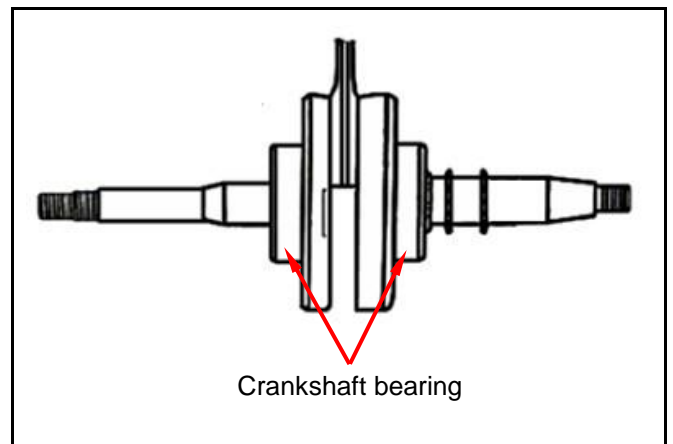


Check crankshaft bearing

Rotate the bearing with finger to check if the bearing rotates smoothly and silently. Check if bearing inner ring is mounted on crankshaft tightly. If bearing rotation is uneven, noisy, or loose bearing mounted, replace it.

Caution

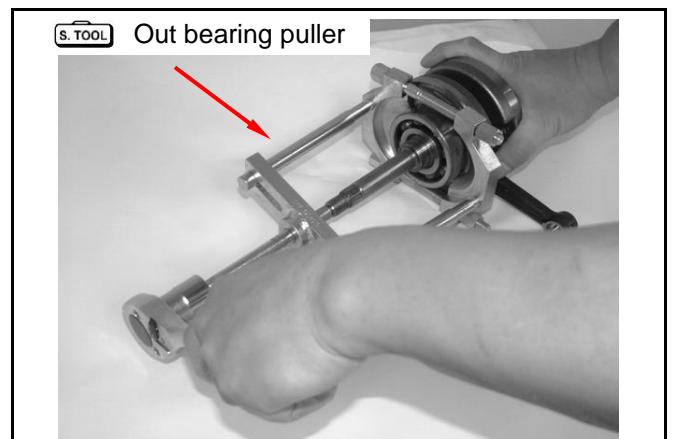
- The bearings shall be replaced in pair.



Remove right and left bearings from crankshaft by out bearing puller.

Special tool:

Outer bearing puller SYM-6204001



11. Crankshaft / Crankcase



Crankcase Assembly

Install new bearing and bearing puller onto left crankcase bearing hole.

Special tool:

- L. crank shaft bearing puller
SYM-9100100-HMA
- Crank case disassemble tool
SYM-1120000-HMA H9A
- L. Crank shaft puller
SYM-1130000-HMA H9A
- Clutch nut wrench
SYM-9020200

Install crank disassemble tool onto left crankcase.
Hold left crank shaft puller nut by clutch nut wrench, and turn the shaft puller to press crankshaft into left crankcase.

Install crank shaft onto the left crankcase and install crank shaft install socket.

Special tool:

- L/CRANKSHAFT & OIL SEAL DRIVER
SYM-1332100-HMA**

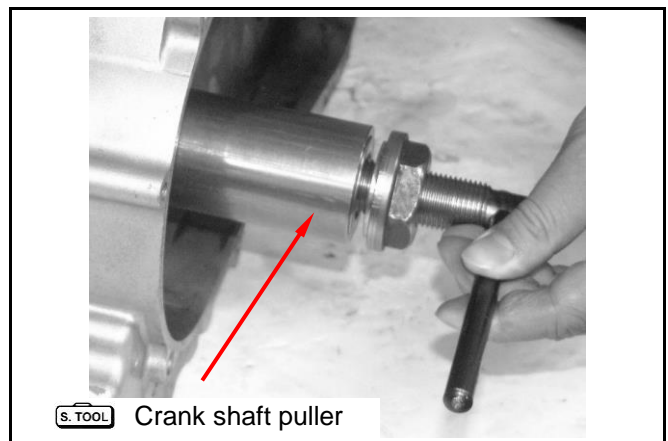
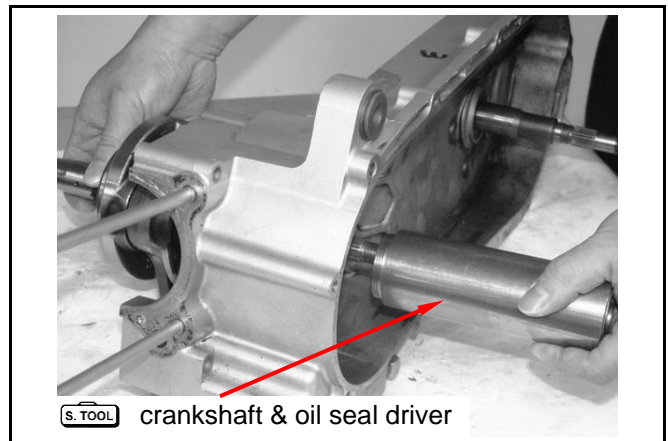
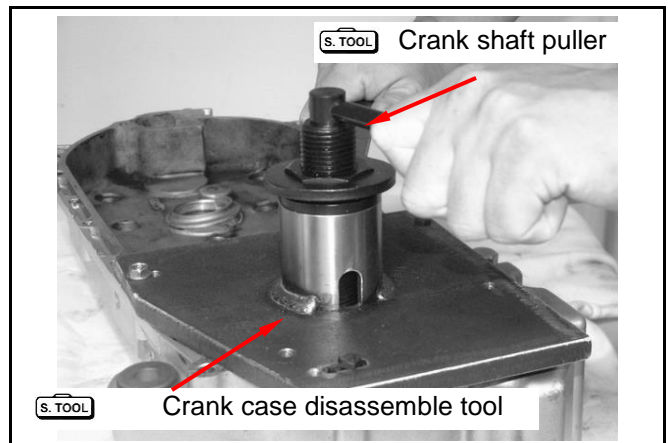
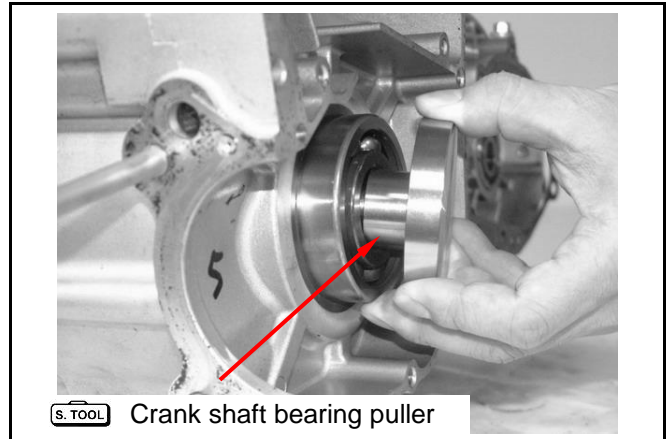
Turn in the crank shaft puller spiral tooth to the left crank shaft.

Special tool:

- L. Crank shaft puller SYM-1130000-HMA H9A

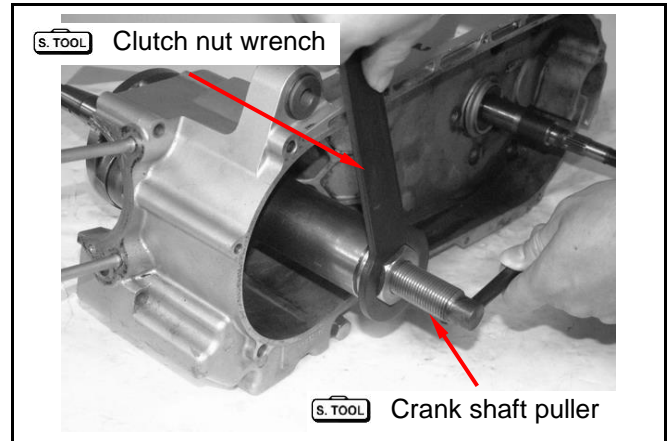
⚠ Caution

- Turn more spiral teeth into crank shaft puller to avoid damaging tooth.



Hold left crank shaft puller, and turn the shaft puller nut by clutch nut wrench to pull in crank shaft into left crankcase.

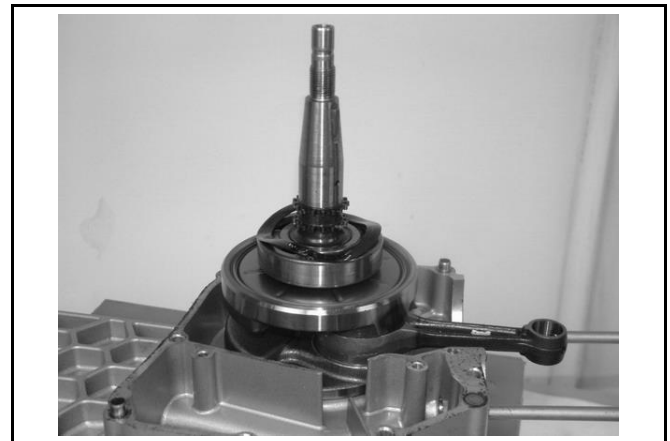
Special tool:
Clutch nut wrench
SYM-9020200



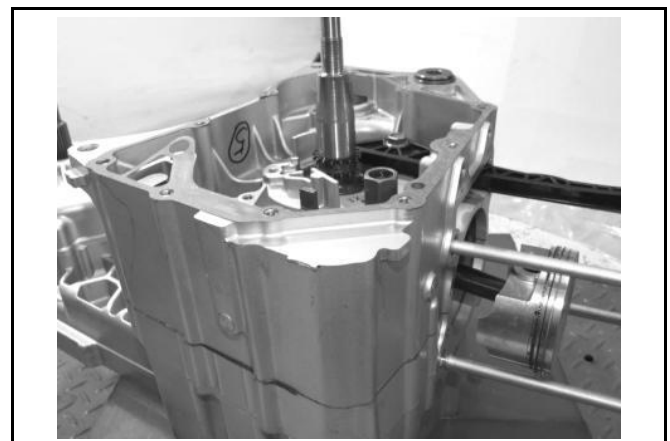
Put wave washer onto right crank bearing.

⚠ Caution

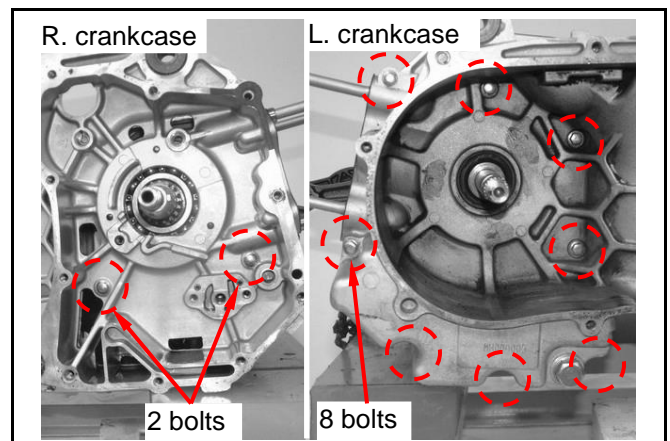
- Wave washer must be place at the right side. Do not miss or place at wrong place. Otherwise, it would possibly cause vibration.



Install 2 dowel pins and new gasket.
 Install the right crankcase onto the left crankcase.



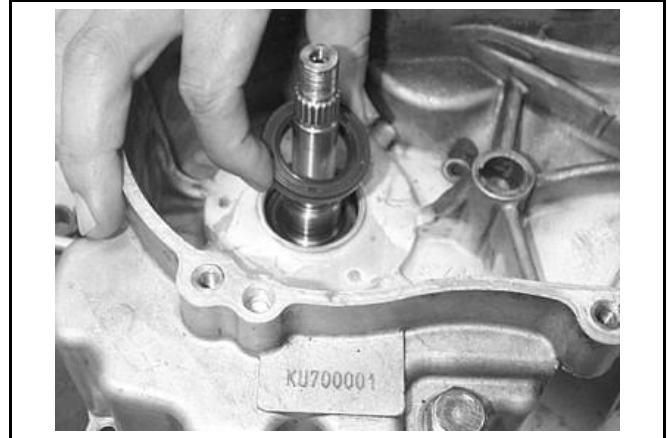
Tighten 2 bolts on the right crankcase.
 Tighten 8 bolts on the left crankcase.
Torque value: 0.7-1.1kgf-m



11. Crankshaft / Crankcase

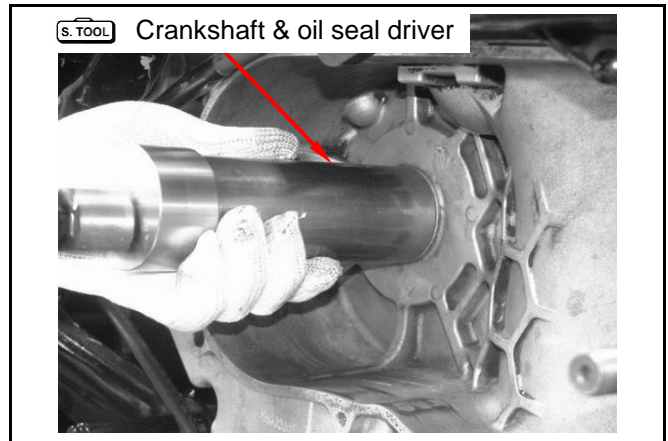


Apply grease on the lip of oil seal and put on left crankcase.



Install the oil seal in the left crankcase with special tool.

Special tool:
L/CRANKSHAFT & OIL SEAL DRIVER
SYM-1332100-HMA

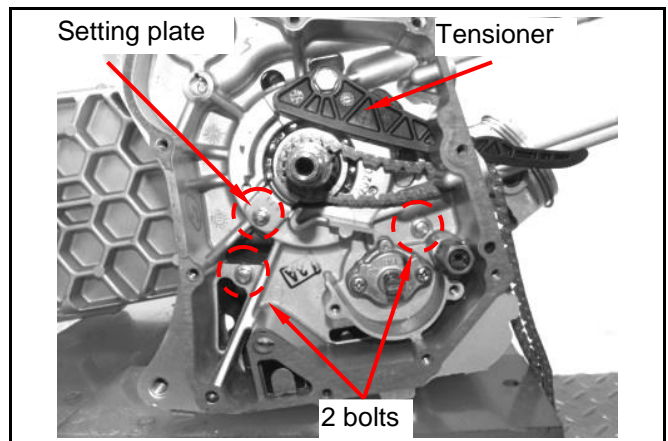


Install the cam chain tensioner & and tighten the bolts.

Torque value: 0.8-1.2kgf-m

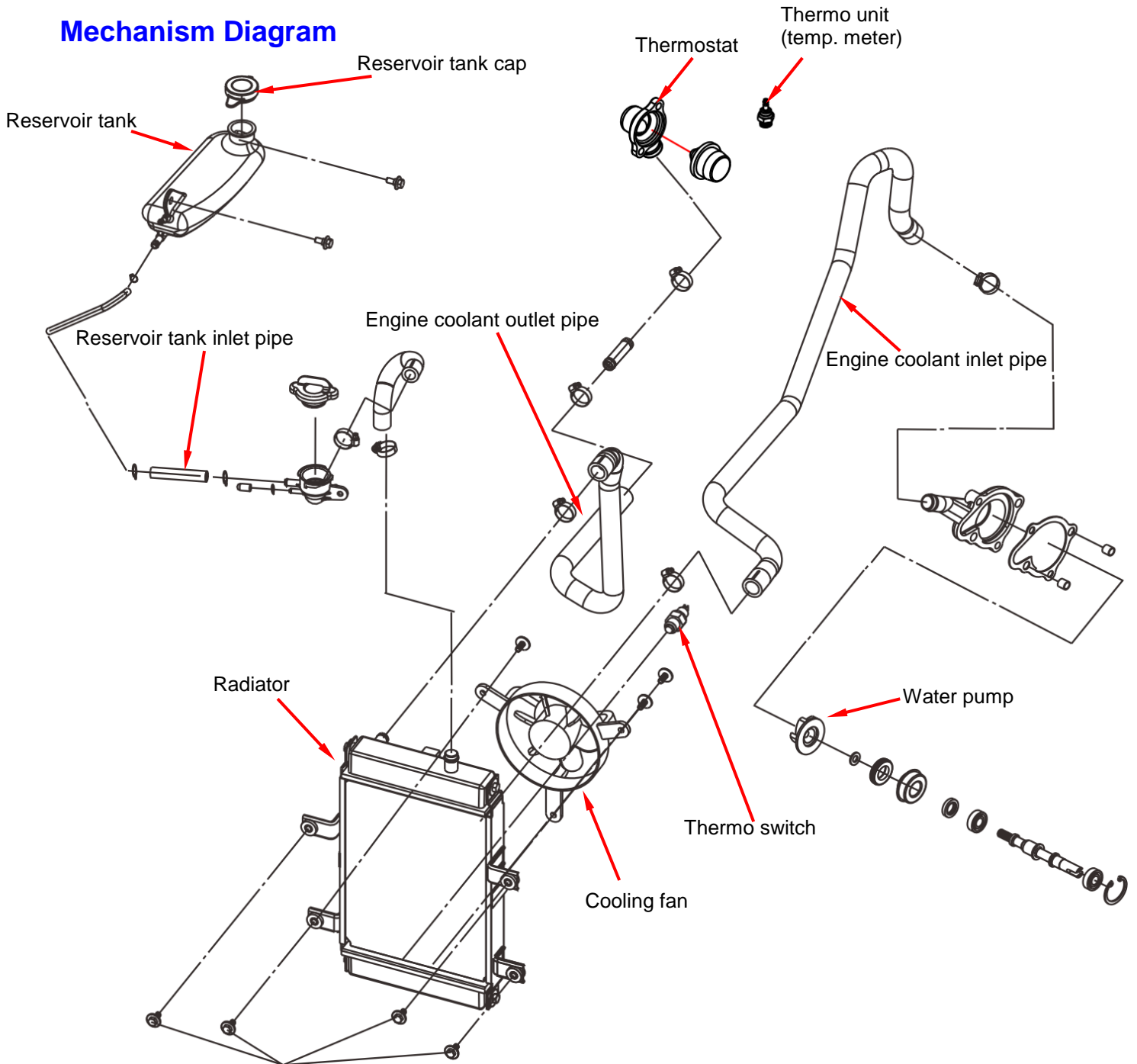
Install the cam chain.

Install the cam chain setting plate.



Mechanism Diagram	12-1	Change of Coolant	12-5
Precautions in Operation	12-2	Radiator	12-6
Troubleshooting	12-2	Water Pump	12-8
Diagnosis for Cooling System	12-3	Thermostat	12-12

Mechanism Diagram



Precautions in Operation

General Information

Caution

- While the engine is running, never attempt to open the radiator filler cap, the pressurized hot coolant may shoot out and cause serious scalding injury. No maintenance work is allowed to perform unless the engine is completely cooled down.
- Refill the radiator with distilled water or specified additives.
- Add coolant to the reservoir.
- The cooling system can be serviced on the motorcycle.
- Never spill the coolant to the painted surface.
- Check if the cooling system leaks after the repair.
- Please refer to Section 17 for inspection of the temperature sensor switch for the fan motor and the water thermometer.

Technical Specification

Item	Specification
Pressure to open filler cap	0.9±0.15 Kg/cm ²
Capacity of coolant: Engine + radiator Reservoir upper	950c.c. 450c.c.
Thermostat	Begins to activate at: 82~92°C Stroke: 0.05~3.0mm/80°C
Boiling point	Not-pressurized: 107.7°C Pressurized: 125.6°C

Torque Value

For water pump rotor 1.0~1.4kgf-m

Special tools

Water pump bearing driver (6901): SYM-9100100

Water pump oil seal driver (Inner): SYM-9120500-H9A

Water pump mechanical seal driver: SYM-1721700-H9A

Inner bearing puller: SYM-6204020

Troubleshooting

The engine temperature is too high

- The water thermometer and the temperature sensor do not work properly.
- The thermostat is clogged.
- Insufficient coolant.
- The water hose and jacket are clogged.
- Water pump malfunction.
- Cooling fan motor malfunction.
- The radiator cap malfunction.

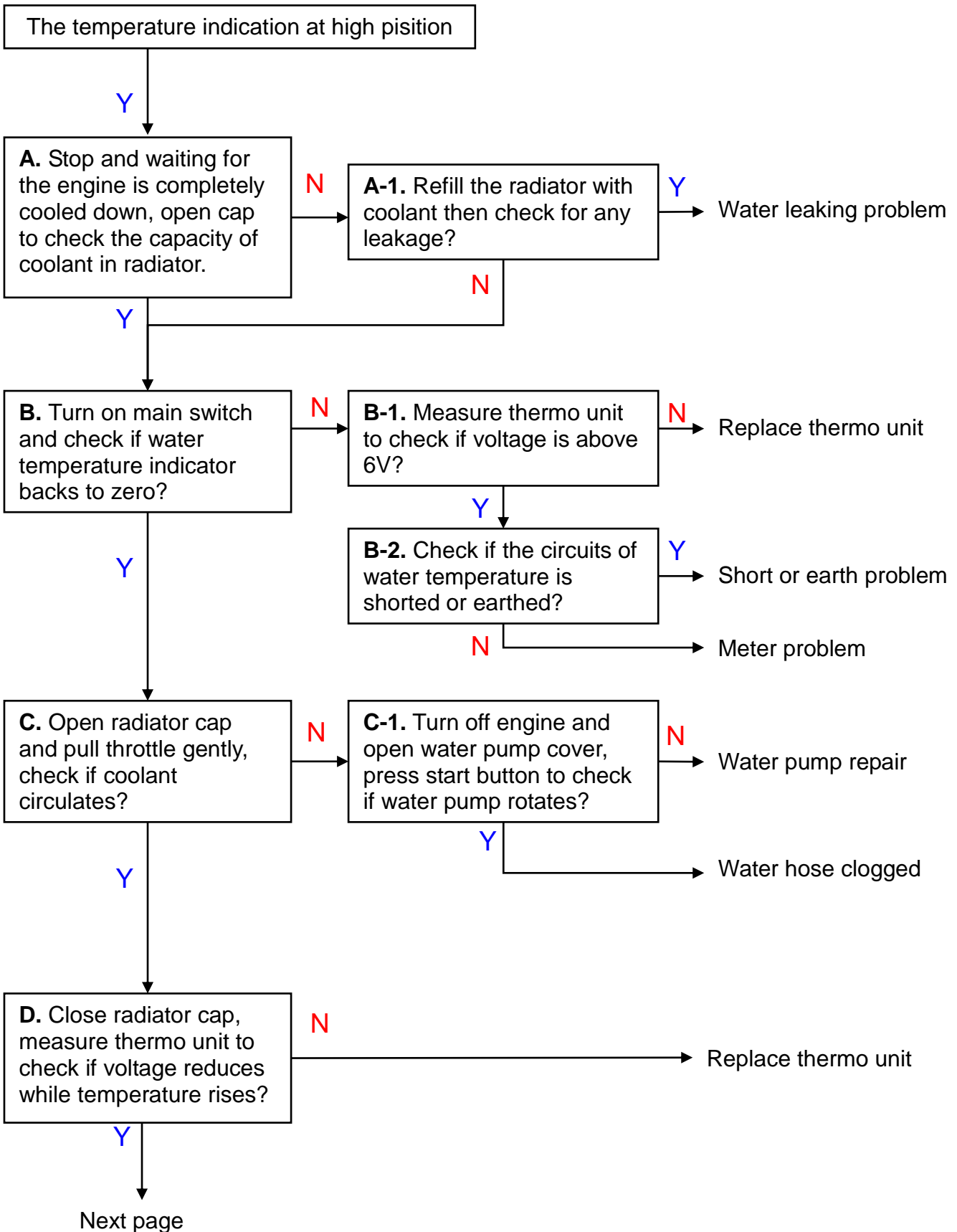
The engine temperature is too low

- The water thermometer and the temperature sensor malfunction.
- The thermostat is stuck to open.

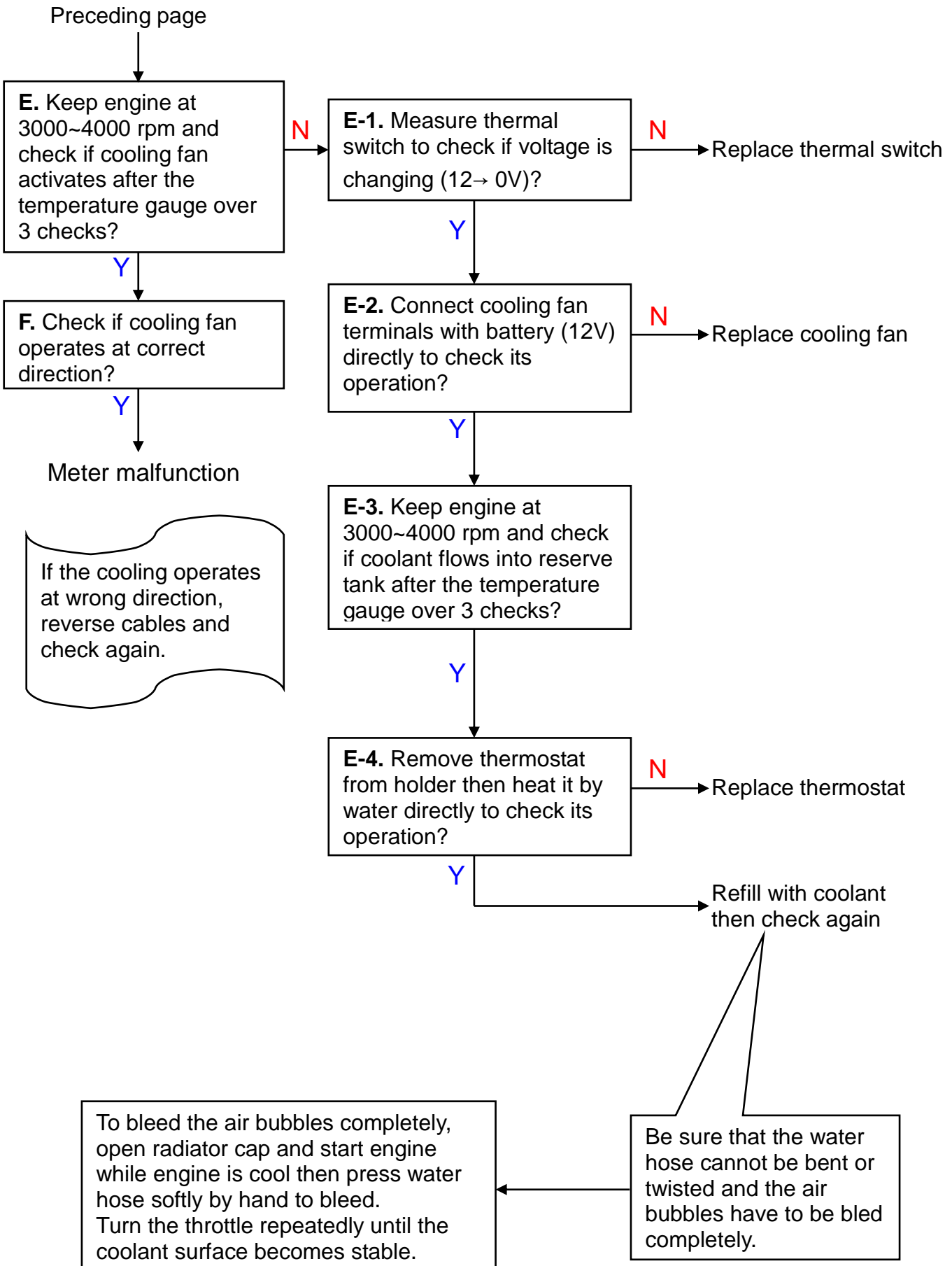
Coolant is leaking

- The water pump mechanical seal does not function properly.
- The O ring is deteriorated.
- The water hose is broken or aged.

Diagnosis for Cooling System



12. Cooling System

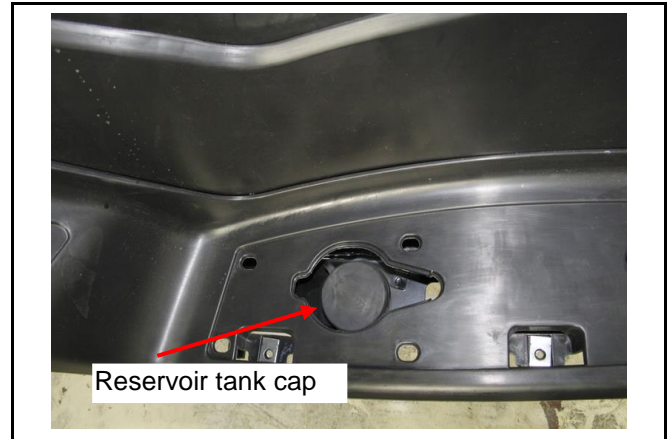


Change of Coolant

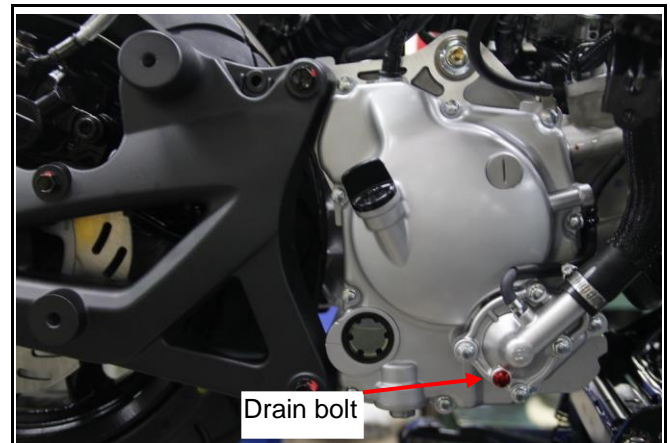
Caution

- Never attempt to carry out service work on the cooling system unless the engine is completely cooled down, otherwise, you may get scalded.

Remove the reservoir tank cap cover, and then remove tank cap.

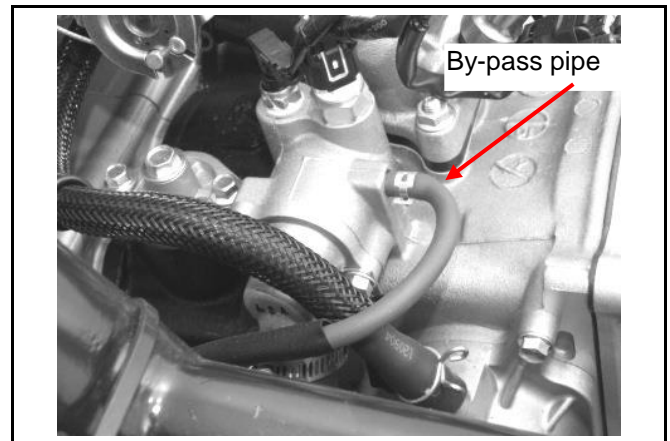


Place a water pan under the water pump; loosen the drain bolt to drain out the coolant. Reinstall the drain bolt.



Refill system with coolant and bleed out the air bubbles.

- Start the engine, and remove by-pass pipe.
- Check if air bubble comes out from by-pass hole.
- If there is no air bubble coming out but only coolant, reinstall by-pass pipe and turn off engine.
- Remove radiator filler cap.
- Start engine to check if there is no air bubble in coolant and the coolant level is stable.
- Turn off engine and add coolant to proper level if necessary.
- Reinstall radiator filler cap.



Caution

- In order to avoid rust, please do not use unknown coolant.

Coolant recommended: SYM radiator agent.
Concentration: 50%

12. Cooling System

Check reservoir

- Check the coolant level in the reservoir.
- Add coolant to proper level if too low.
(Between upper and lower limit)
- Reinstall reservoir cap.

Caution

- Do not add too much coolant to reservoir. Otherwise, coolant will overflow when temperature is warmed up.

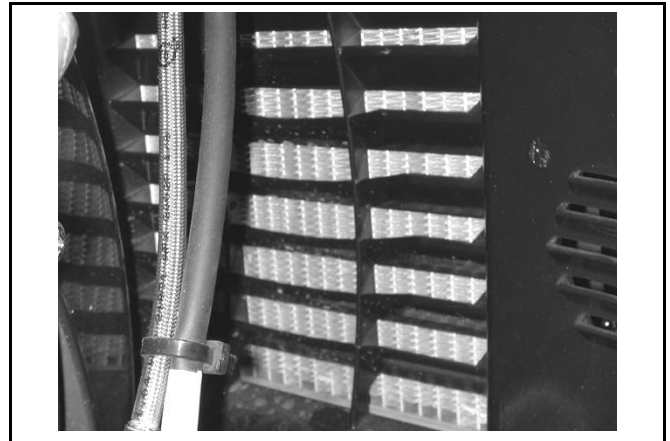


Radiator

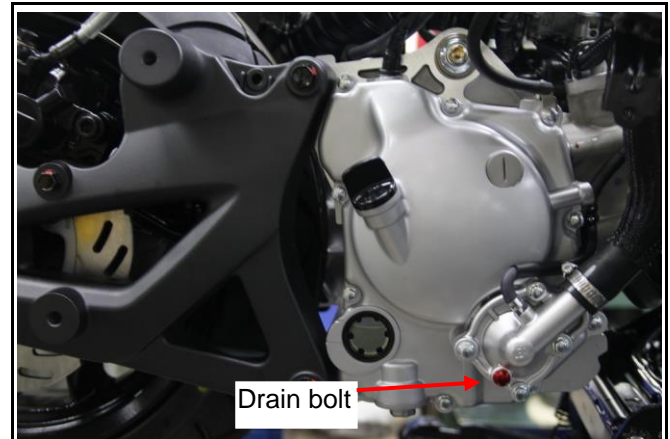
Check/Removal

Clean radiator with compressed air. If the radiator is blocked by dirt, use low pressure water jet to clean it.

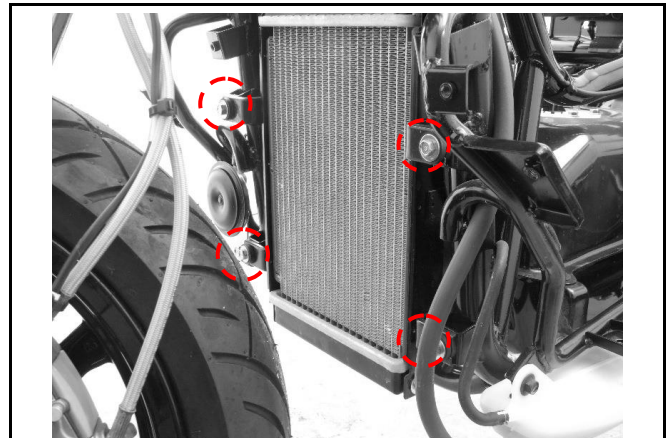
Recover fin back straight with care.



Place a water pan under the water pump; loosen the drain bolt to drain out the coolant. Reinstall the drain bolt.

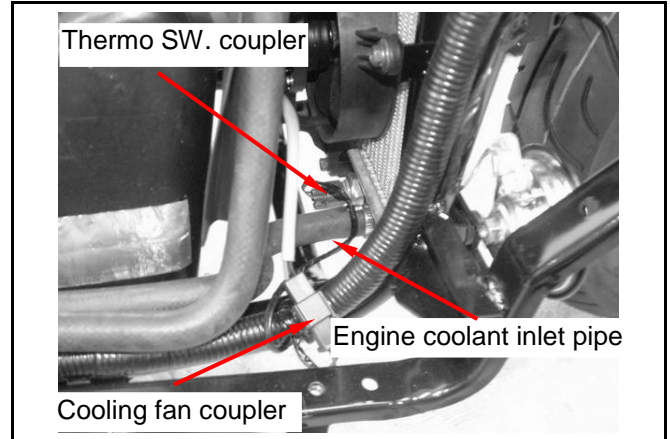


Remove the front cover and under spoiler. Check if there is leakage from welding. Loosen the radiator mounting bolts. (4 bolts)

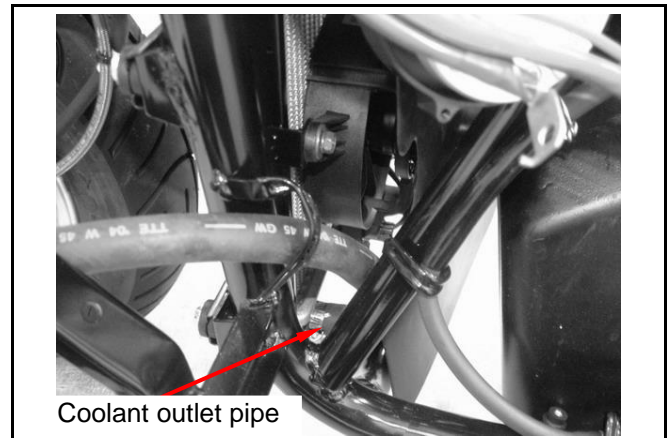


Disconnect the couplers for the thermo switch and fan motor.

Remove engine coolant inlet pipe, reserve tank inlet pipe and radiator inlet pipe.



Remove reserve tank coolant outlet pipe.
Remove the radiator and the cooling fan.



Disassemble

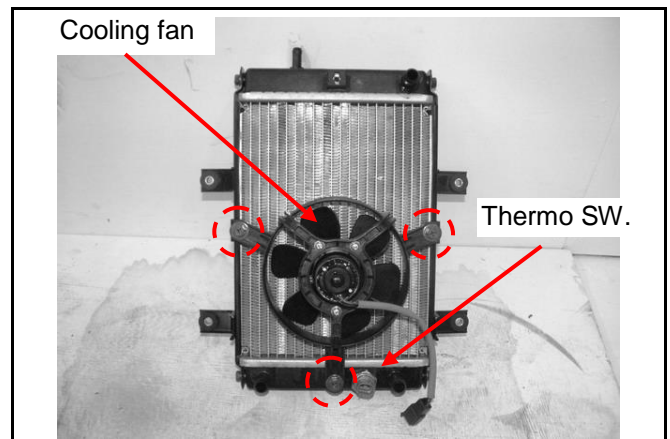
Remove cooling fan. (3 bolts)
Remove thermo switch.

Assemble

Install cooling fan to radiator. (3 bolts)
Install thermo switch.
Refer to chapter 18 for thermos switch inspection.

Caution

- Apply glue on the thread of thermo unit and then install on radiator. Avoid damaging radiator.



Installation

Install the removed parts in the reverse order of removal.
After installation, check if there is leakage.



Water Pump

Water pump seal/cooling system leakage inspection

- Remove drain bolt, drain out some coolant to check if there is oil in coolant.
- Remove oil level gauge to check if engine oil is emulsified.

If there is above mentioned inner leakage phenomenon, the water pump seal, engine cooling system, or cylinder head and cylinder gasket could possibly be damaged. Remove right crankcase cover to check water pump seal first. If there is no problem, then repair the cooling system of cylinder head and cylinder.

Water pump removal

Remove drain bolt to drain out coolant.

Remove the water hose.

Remove 4 bolts and remove pump cover.

Remove gasket and pin.

Remove 10 bolts and remove right crankcase cover.

Remove gasket and pins.

Turn pump rotor clockwise and remove it.

Caution

- The rotor is with left turn thread.

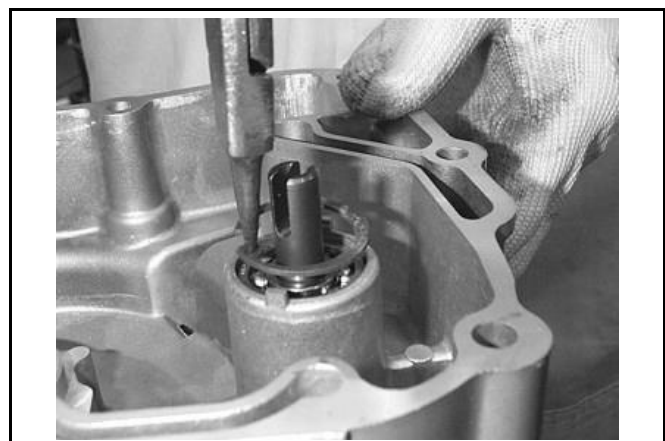
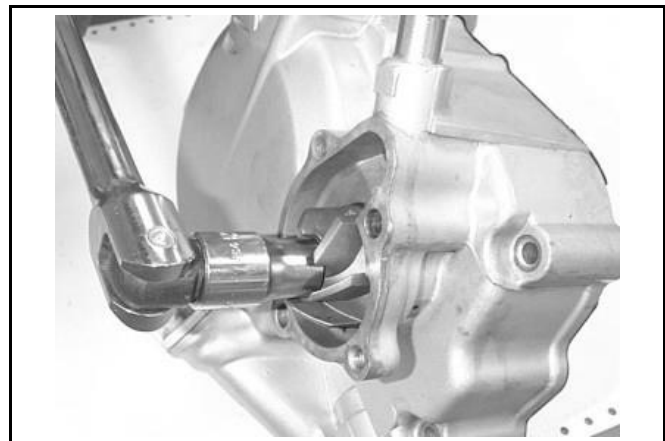
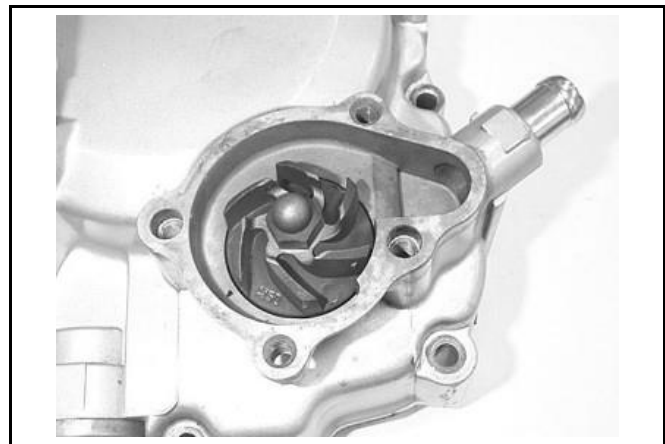
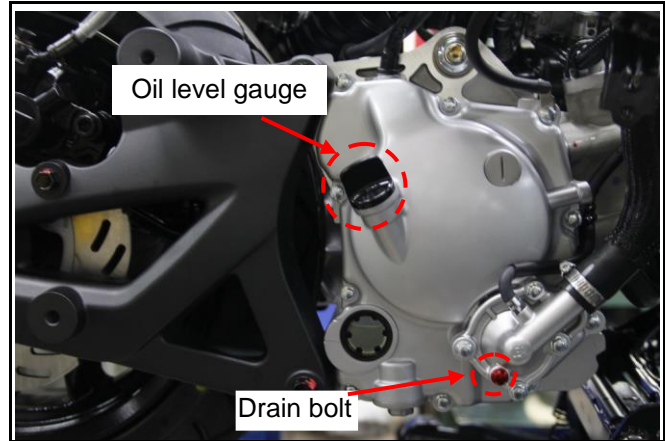
Remove cir clip from right crankcase cover.

Remove water pump shaft and the inner bearing.

Remove the outside bearing by inner bearing puller.

Rotate the bearing with finger to check if the bearing rotates smoothly and silently.

If bearing rotation is uneven, noisy, or loose bearing mounted, replace it.



Check if mechanical seal and the inside seal is worn or damaged.

⚠ Caution

- The mechanical seal and the inside seal must be replaced as a set.

Mechanical Seal Replacement

Remove the bearing by inner bearing puller. Drive the mechanical seal and inside seal out of the right crankcase cover.

Special tools:

Inner bearing puller

Water pump bearing driver

⚠ Caution

- Replace a new mechanical seal after removing it.

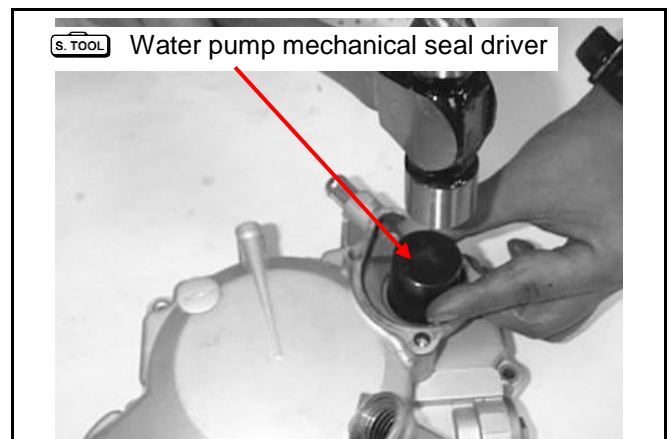
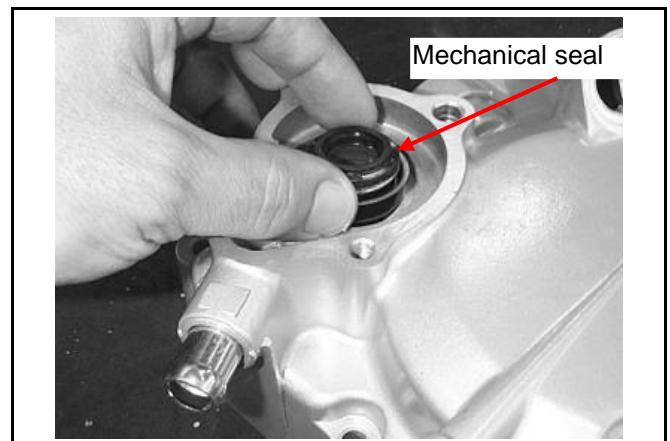
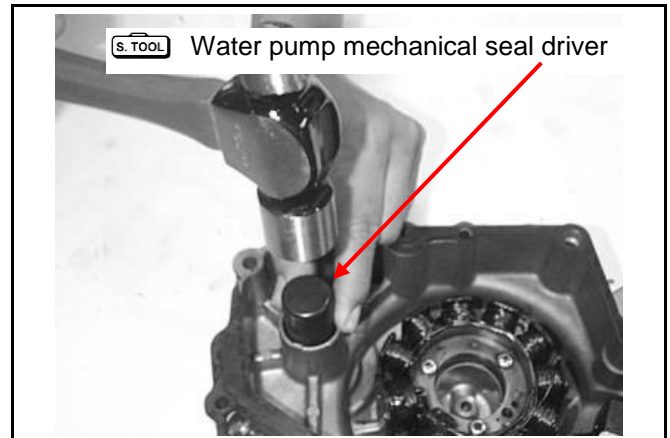
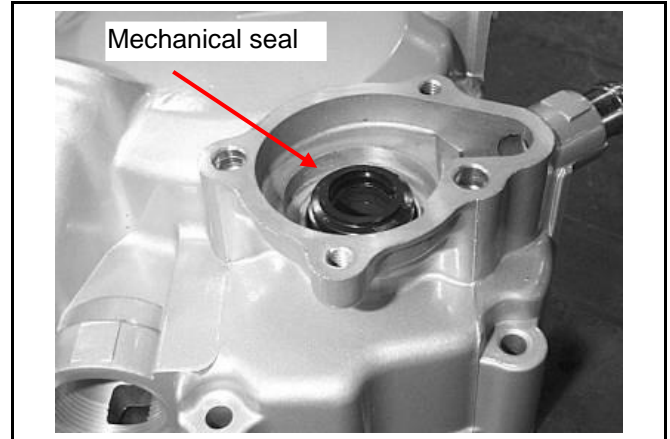
Apply sealant on the matching surface of the right crankcase cover before installing the new mechanical seal.

Install the new mechanical seal onto the right crankcase cover.

Special tools:

Water pump mechanical seal driver

SYM-1721700-H9A



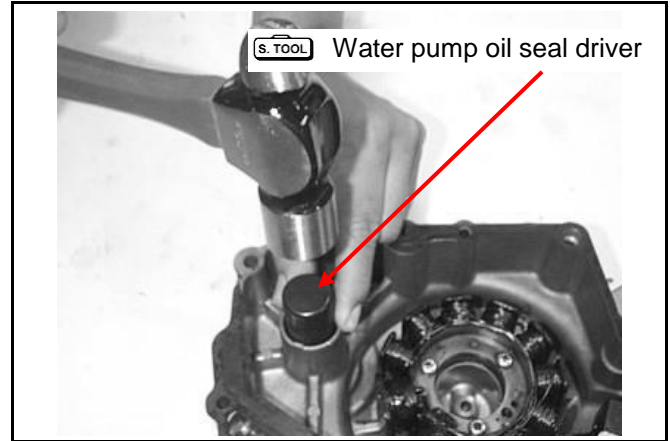
12. Cooling System

Install the new inside seal onto the right crankcase cover.

Special tools:

Water pump oil seal driver

SYM-9120500-H9A



Install a new outside bearing to the right crankcase cover.

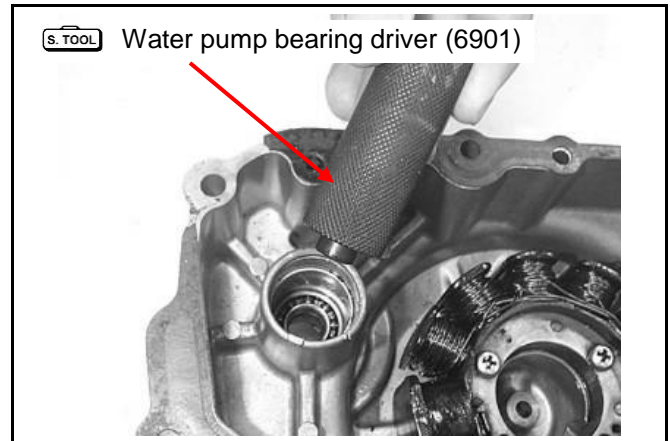
Special tools:

Water pump bearing driver (6901)

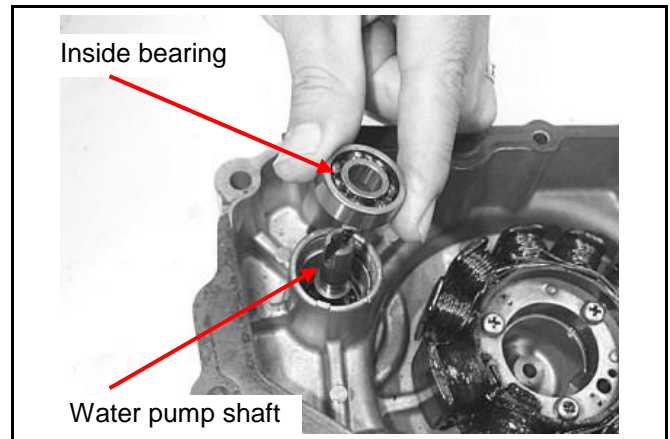
SYM-9100100

⚠ Caution

- Never use a used bearing. Once the bearing is removed, replace with a new one.



Install water pump shaft and the inside bearing to the right crankcase cover.



Install the cir clip to hold the inner bearing.



Water pump rotor install

Install the seal washer into the rotor.

Caution

- Washer must be replaced together with the mechanical seal.

Install the rotor onto the water pump shaft.

Torque Value: 1.0~1.4kgf-m

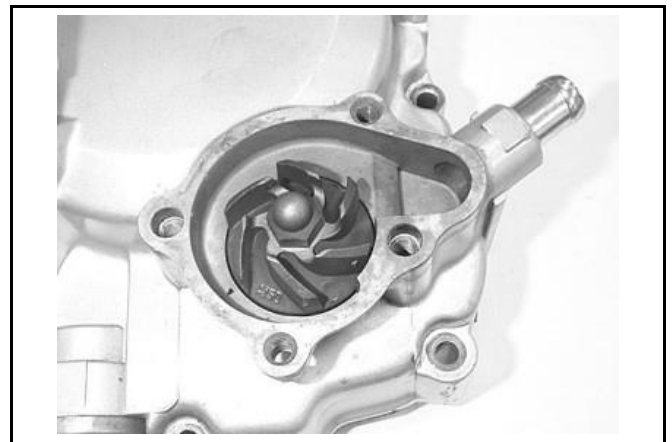
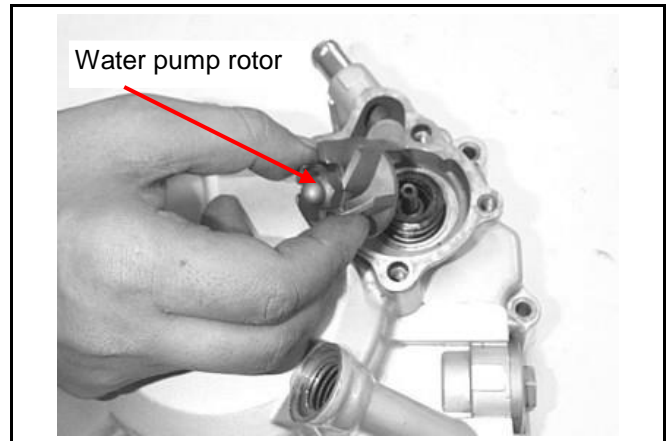
Caution

- The rotor is with left turn thread.

Install the dowel pin and right cover gasket.
Rotate water pump rotor to align water pump shaft with oil pump shaft.

Install right crankcase cover. (10 bolts)
(Refer to chapter 10)

Install the dowel pin and new gasket.
Install the water pump cover. (4 bolts)



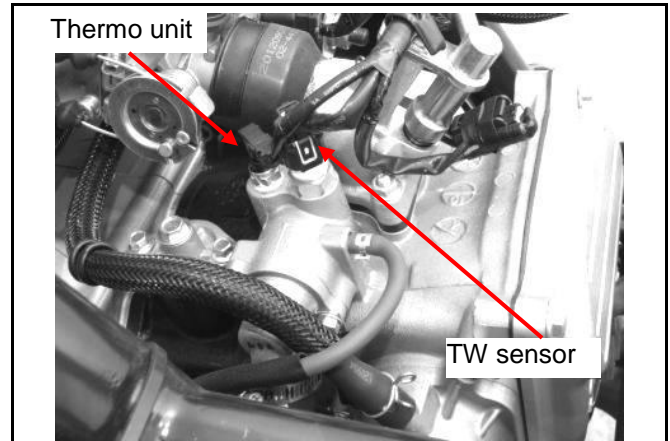
12. Cooling System

Thermostat

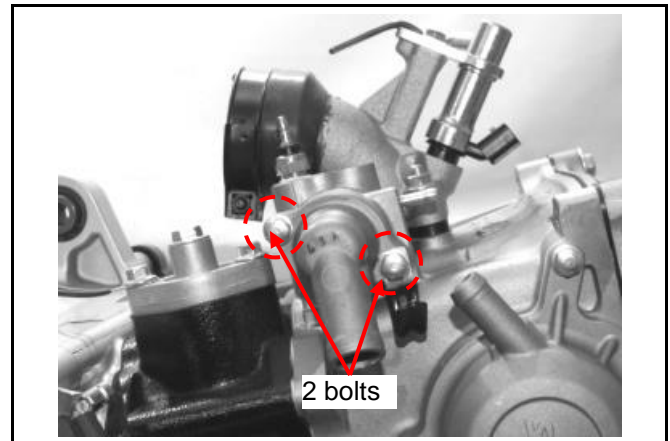
Refer to chapter 17 for inspection of thermostat.

Removal

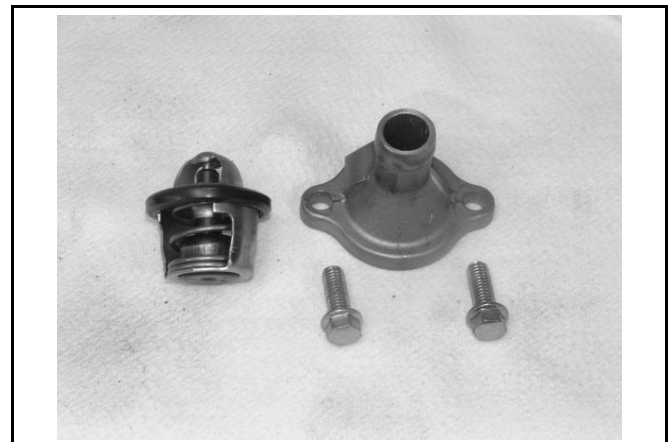
Remove the luggage box and body cover.
Drain out coolant.
Remove couplers.



Remove the thermostat cover. (2 bolts)



Remove thermostat.



Inspection

Inspect if thermostat is damaged.



Place the thermostat into heated water to check its operation.

⚠ Caution

- Whenever the thermostat and the thermometer are in contact to the wall of heated water container, the reading displayed is incorrect. If the valve of the thermostat remains open at room temperature or the valve operation is not corresponding to the temperature change, then it must be replaced.

Technical Data

Valve begins to open	82~95°C
Valve stroke	0.05~3mm at 80°C

Installation

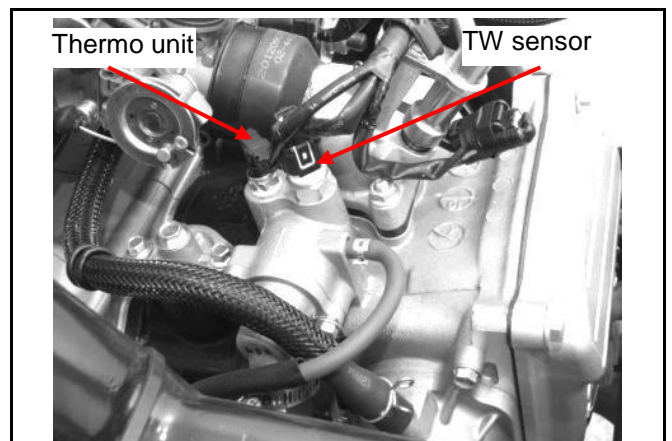
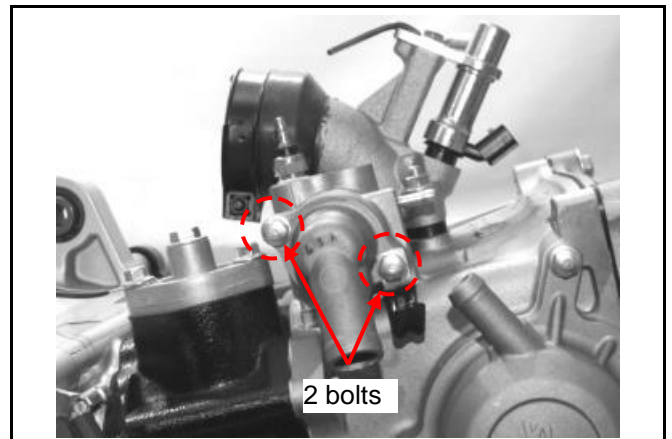
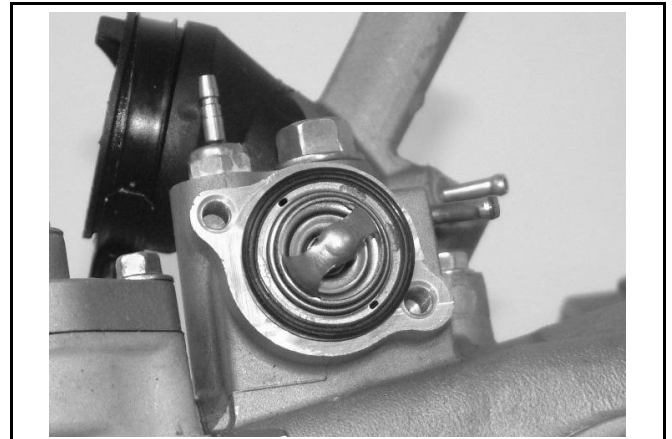
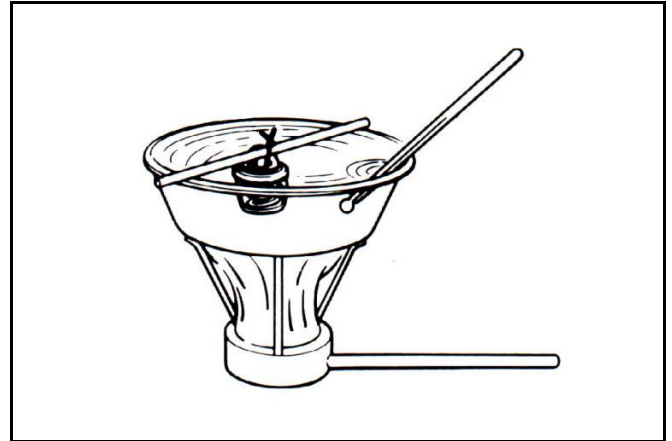
Install the thermostat.

Install the thermostat cover. (2 bolts)

Install couplers.

Install water hose, refill coolant, and bleed out air.

(Page 12-5)



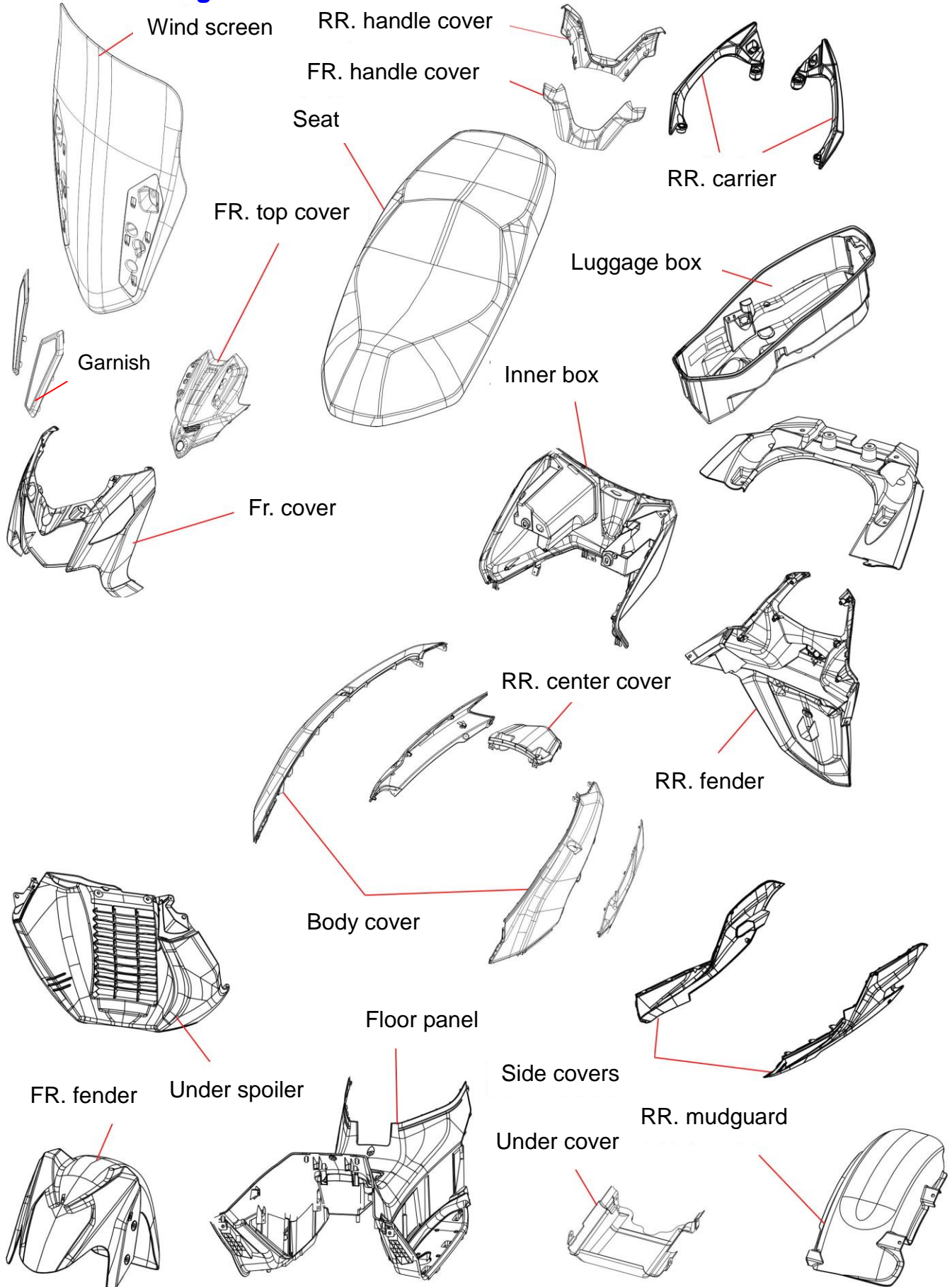
NOTE:

Mechanism Diagram..... 13-2	Front Fender 13-11
Maintenance..... 13-3	Front Under Spoiler..... 13-12
Handle Cover..... 13-4	Double Seat/Luggage Box 13-13
Wind Screen..... 13-6	Rear Carrier 13-14
Front Top Cover..... 13-7	Body Cover 13-15
Front Cover 13-8	Floor Panel 13-17
Meter Panel 13-9	Inner Box 13-20
R/L Side Covers 13-10	

13. Body Cover

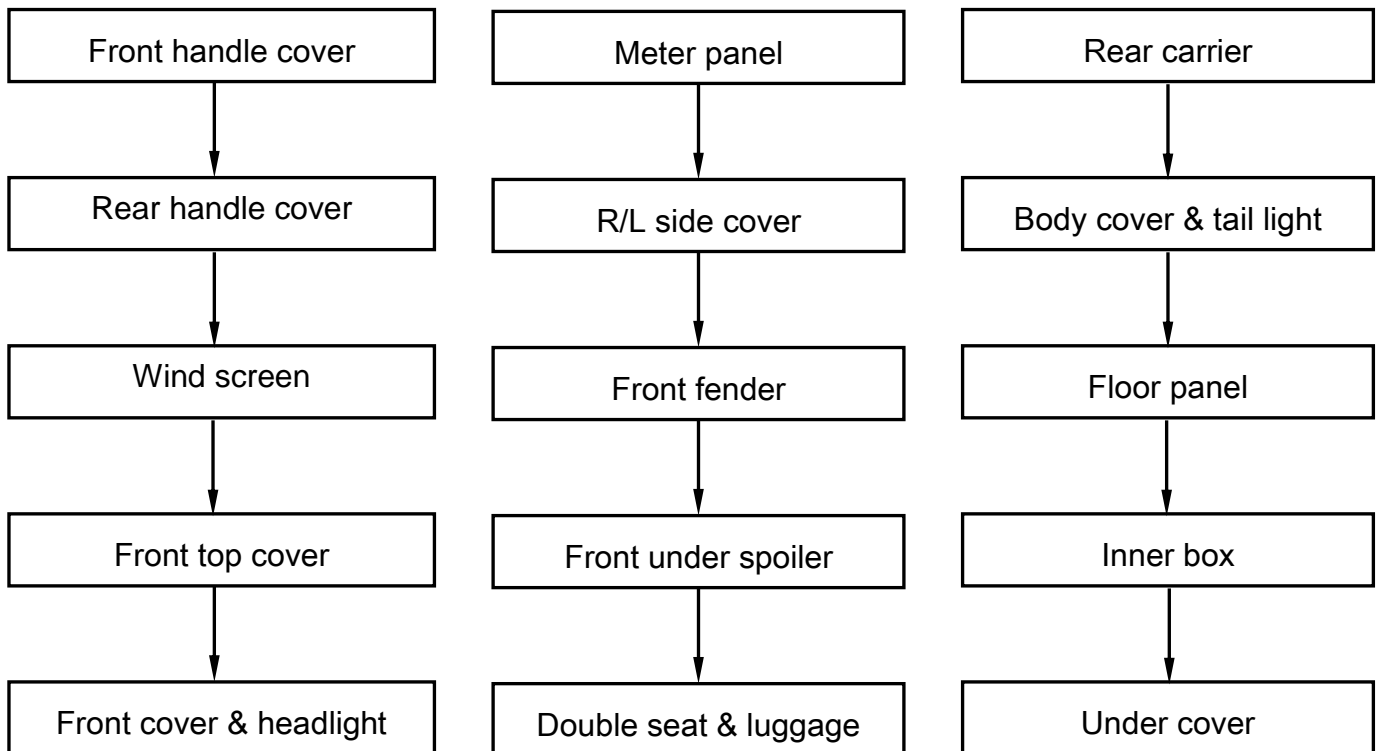


Mechanism Diagram



Maintenance

Body covers disassemble sequence:



- Be careful not to damage various covers in assembly or disassembly operation.
- Never injure hooks molded on the body covers.
- Align the buckles on the guards with slot on the covers.
- Make sure that each hook is properly installed during the assembly.
- Never compact forcefully or hammer the guard and the covers during assembly.

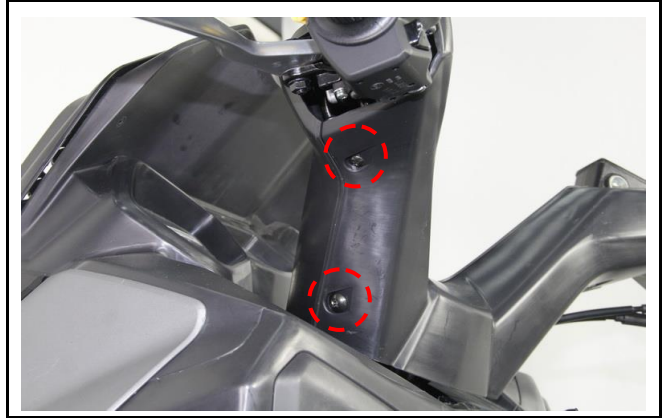
13. Body Cover



Handle Cover

Remove

Remove screws from both sides of handle cover. (2 screws on both right and left)
Remove front handle cover.



Remove screws on rear handle cover. (1 screw on both right and left)



Installation

Install in reverse order of removal procedures.

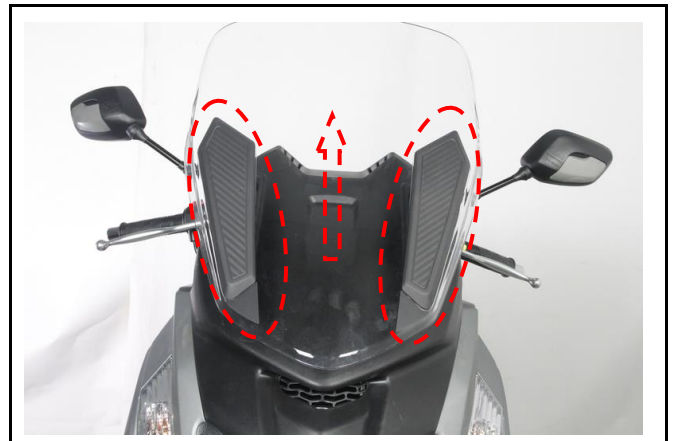


Wind Screen**Remove**

Remove screws on the back of wind screen garnish. (1 screw on both right and left)



Remove wind screen garnish.



Remove 4 flange bolts from wind screen.



13. Body Cover



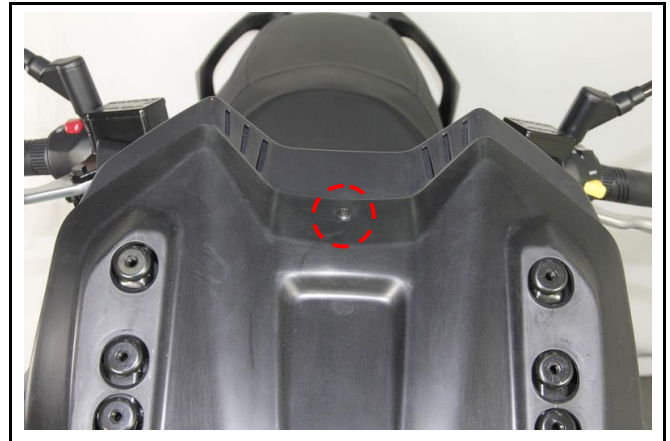
Front Top Cover

Remove

Remove 2 screws on rear.



Remove 1 screw on front.



Pull front top cover forward to detach hooks.

Installation

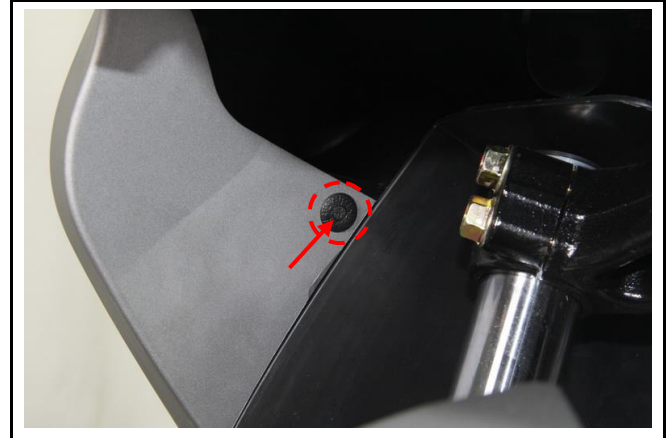
Install in reverse order of removal procedures.



Front Cover

Remove

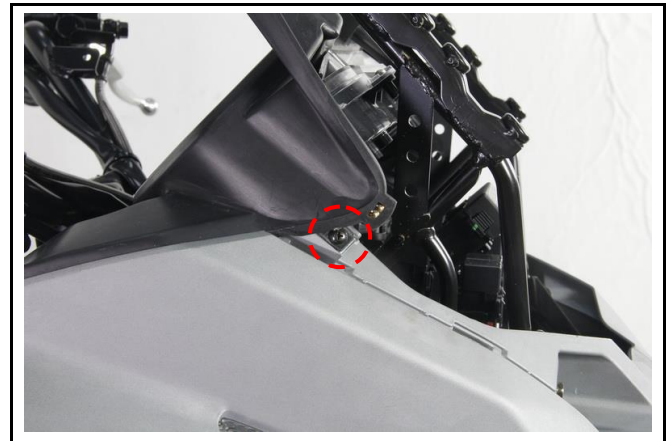
Remove 2 plastic screws on inner/lower side of front cover. (1 screw on both right and left)
(Press center of plastic screw with screw driver.)



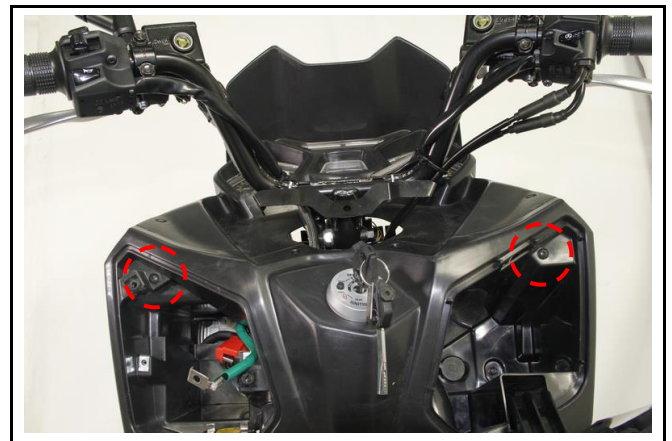
Remove 2 screws on rear of front cover. (1 screw on both right and left)



Remove 2 screws on upper side of front cover.
(1 screw on both right and left)



Remove 2 screws on inner box.



13. Body Cover



Remove 2 screws on meter panel.



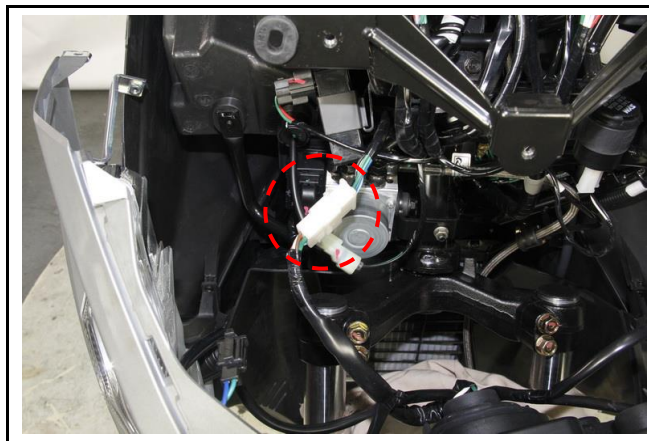
Remove 3 bolts on front cover.



Disconnect headlight and turn signal couplers.
Remove front cover.

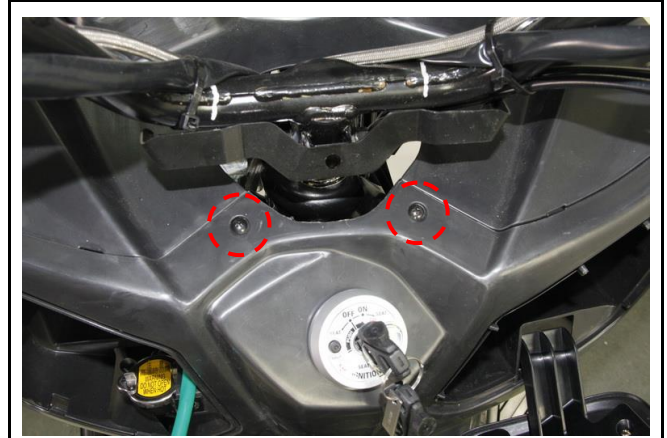
Installation

Install in reverse order of removal procedures.

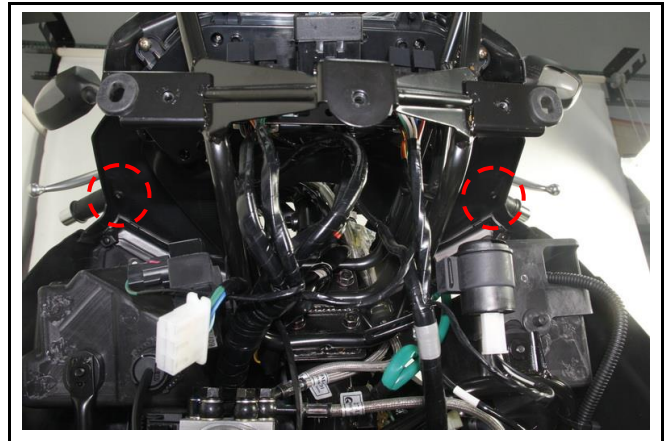


Meter Panel**Remove**

Remove 2 screws.



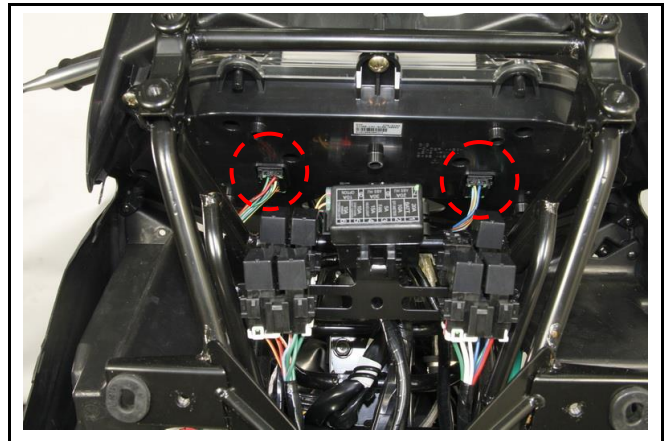
Remove 2 screws from inner side.



Disconnect meter cord couplers.
Remove meter panel.

Installation

Install in reverse order of removal procedures.



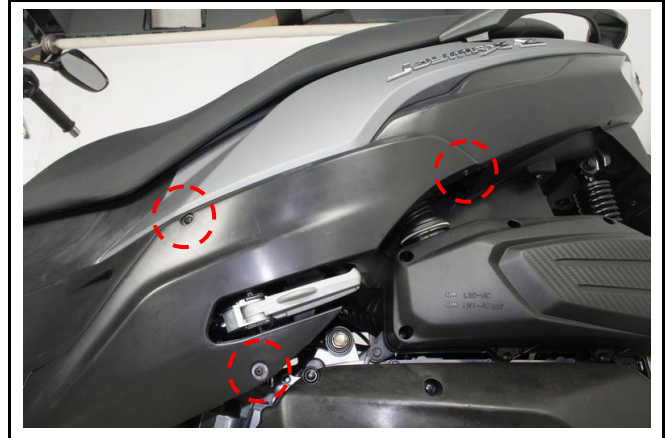
13. Body Cover



R/L Side Covers

Remove

Remove 6 screws on rear of side covers. (3 screws on both right and left)



Remove 2 screws on front of side covers. (1 screw on both right and left)



Remove 4 floor mats. (2 mats on both right and left)



Remove 6 screws on floor panel. (3 screws on both right and left)
Remove right and left side covers.

Installation

Install in reverse order of removal procedures.

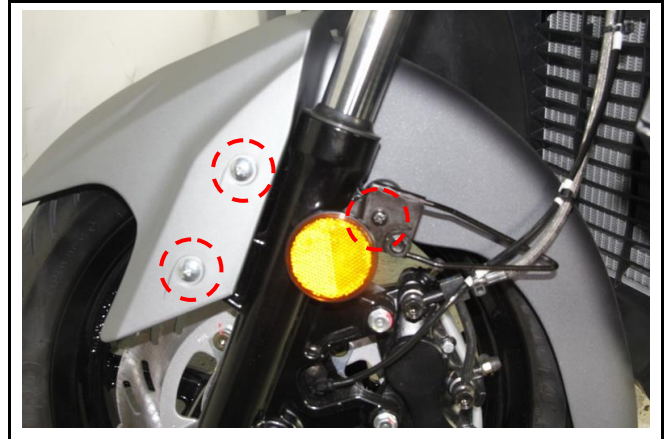


Front Fender**Remove**

Remove 6 screws from front fender and reflector. (3 screws on both right and left)
Remove front fender.

Installation

Install in reverse order of removal procedures.



13. Body Cover

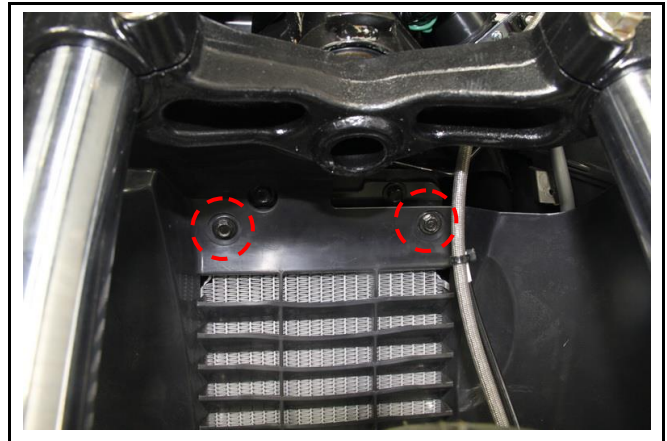
Front Under Spoiler

Remove

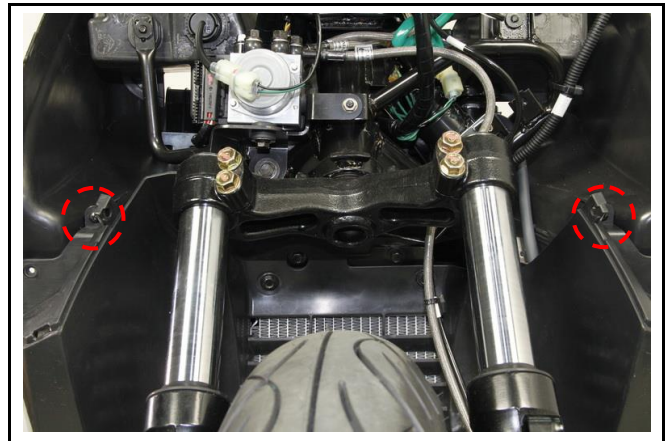
Remove 2 bolts on lower side. (1 bolt on both right and left)



Remove 2 bolts on under spoiler.



Remove 2 screws on front/under side.



Remove front under spoiler.

Installation

Install in reverse order of removal procedures.



Double Seat**Remove**

Remove 2 nuts on open stay.
Remove 2 nuts on double seat.

Installation

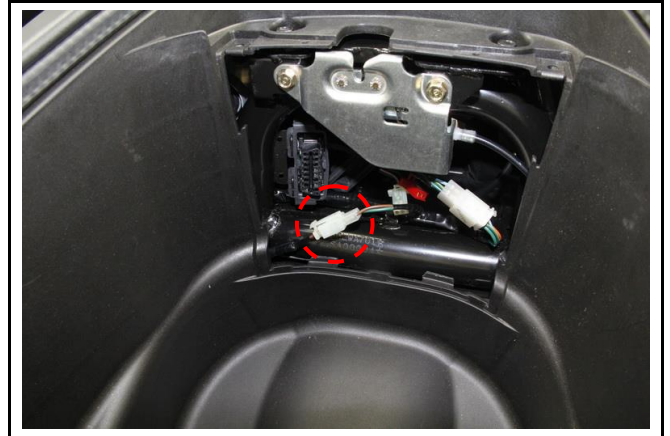
Install in reverse order of removal procedures.

**Luggage Box****Remove**

Remove 2 screws on luggage box rear cover.



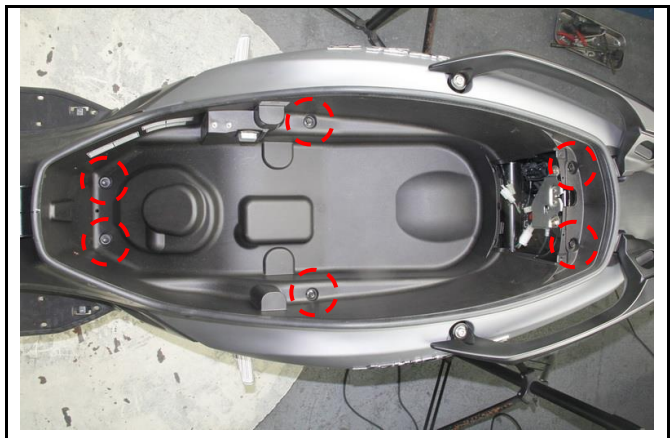
Disconnect luggage box light coupler.



Remove 6 bolts on luggage box.

Installation

Install in reverse order of removal procedures.



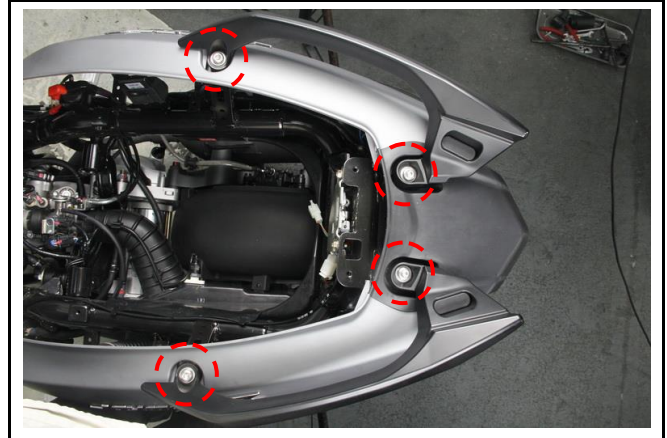
Rear Carrier

Remove

Remove 4 bolts on rear carrier.

Installation

Install in reverse order of removal procedures.

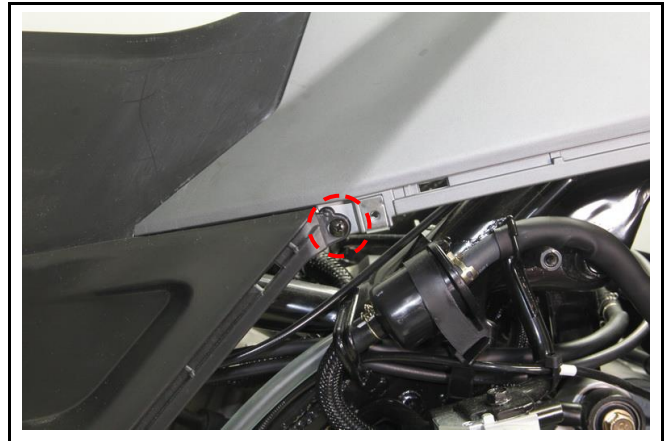


Body Cover**Remove**

Remove 2 screws on inner side of body cover.
(1 screw on both right and left)



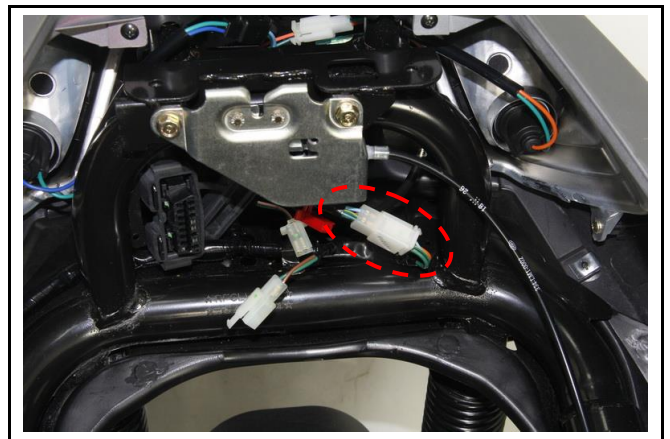
Remove 2 screws on front side of body cover.
(1 screw on both right and left)



Remove bolt on rear fender.



Disconnect tail light coupler.



13. Body Cover



Detach hooks (right and left) from floor panel.
Remove body cover and tail light.

Installation

Install in reverse order of removal procedures.

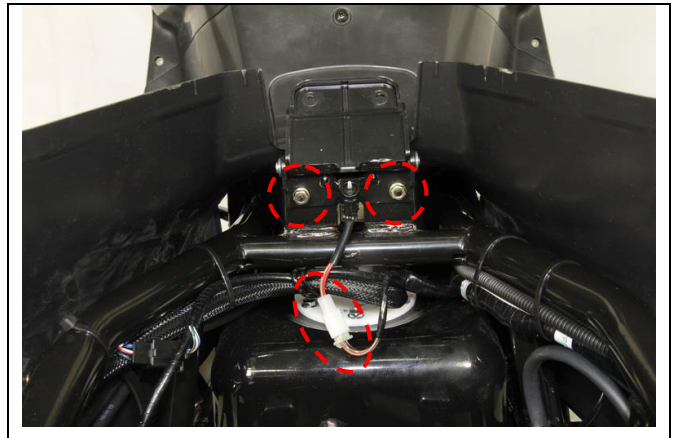


Floor Panel**Remove**

Remove screw behind fuel cap lid.



Disconnect luggage box light switch coupler.
Remove 2 nuts on seat hinge.



Remove screw on front side of floor panel.



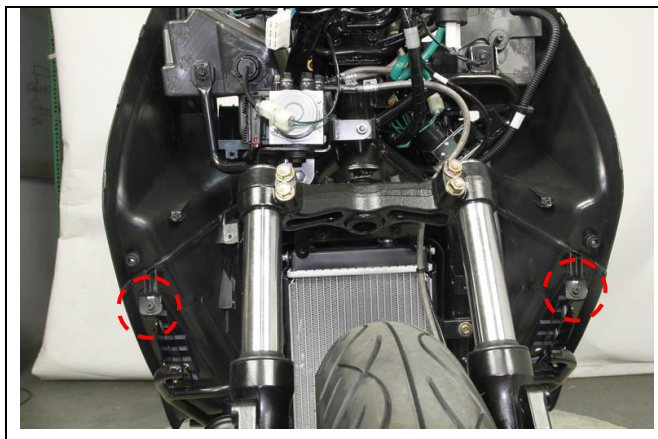
Remove 4 bolts on lower side of floor panel. (2 bolts on both right and left)



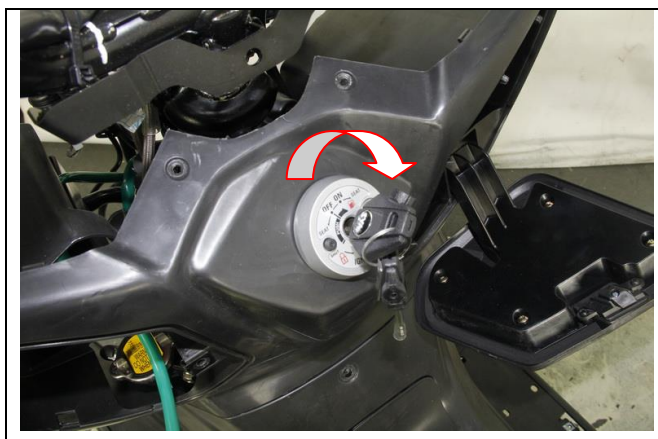
13. Body Cover



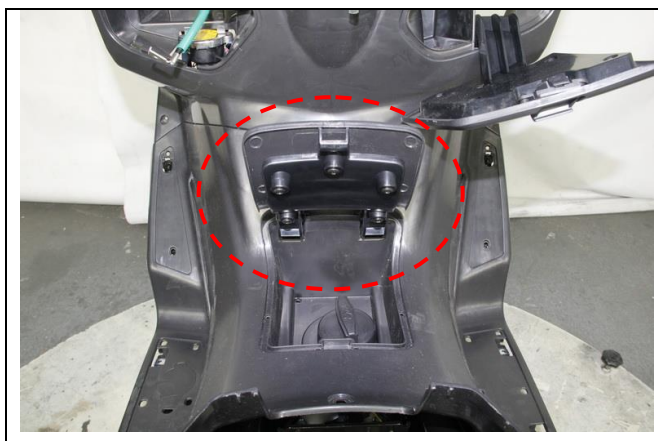
Remove 2 screws on front side of floor panel.



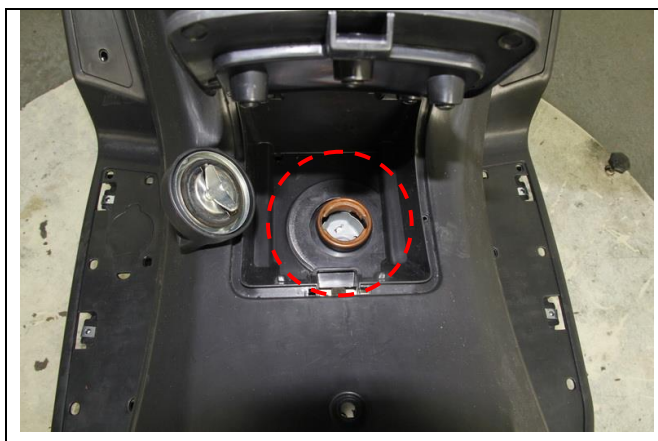
When key off, press key downward and turn right.



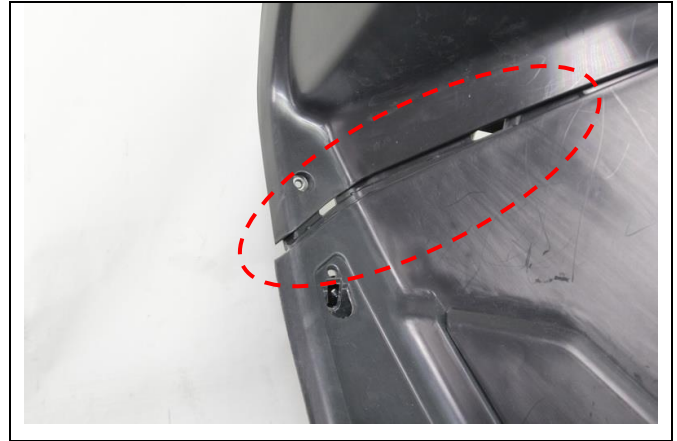
Open fuel cap lid.



Open fuel cap.



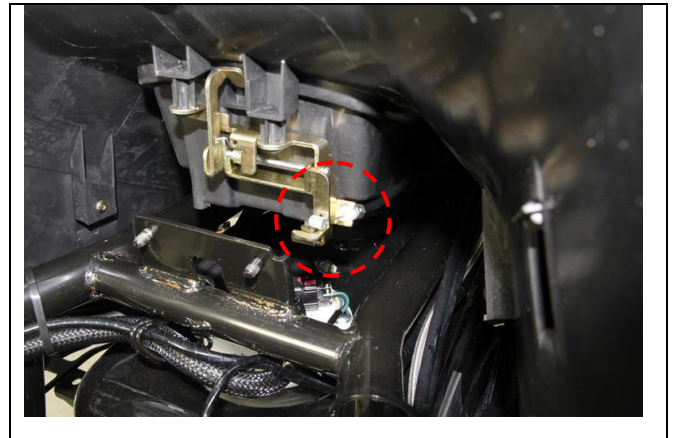
Detach hooks (right and left) from inner box.



Pull up floor panel and remove fuel lid lock cable.
Remove floor panel.

Installation

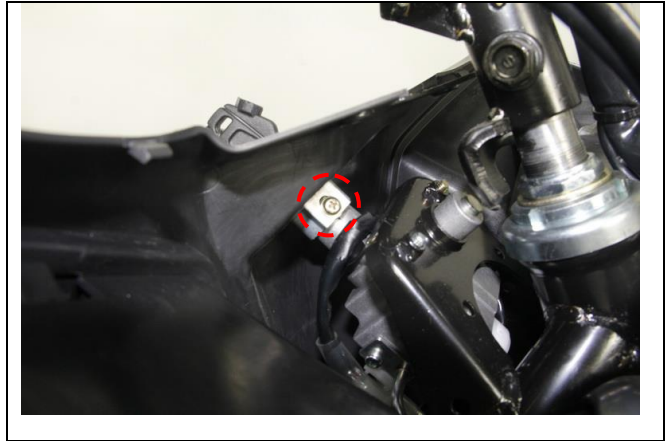
Install in reverse order of removal procedures.



13. Body Cover

Inner Box

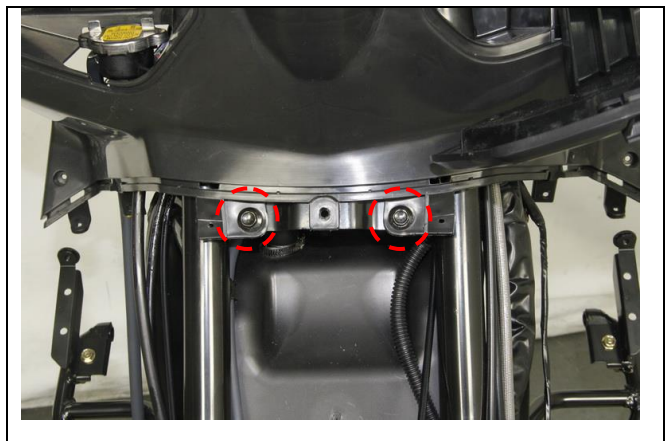
Remove screw on shutter.



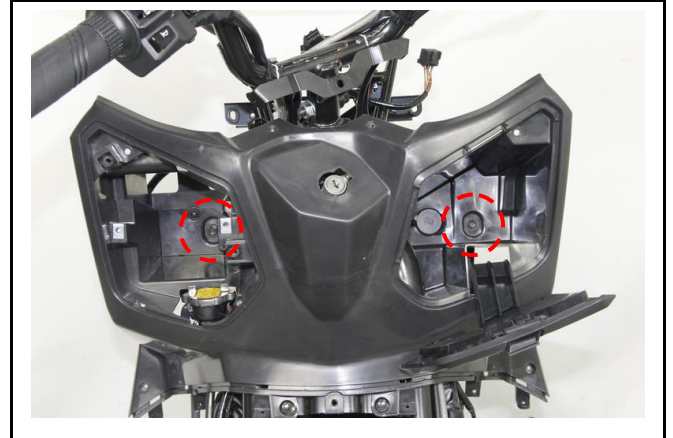
Remove shutter.



Remove 2 bolts.



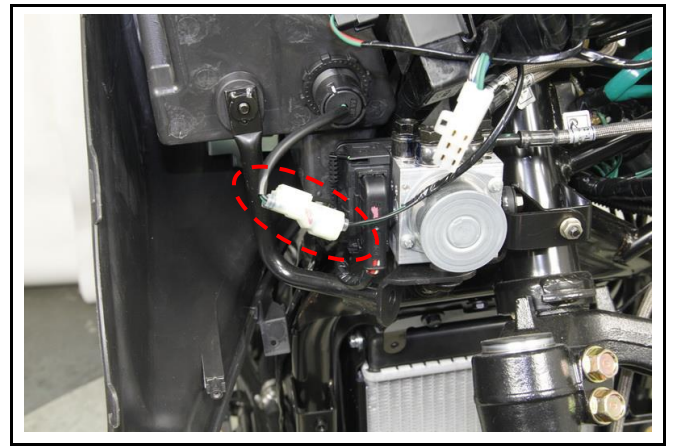
Remove 2 bolts inside of inner box.



Disconnect charge unit coupler.

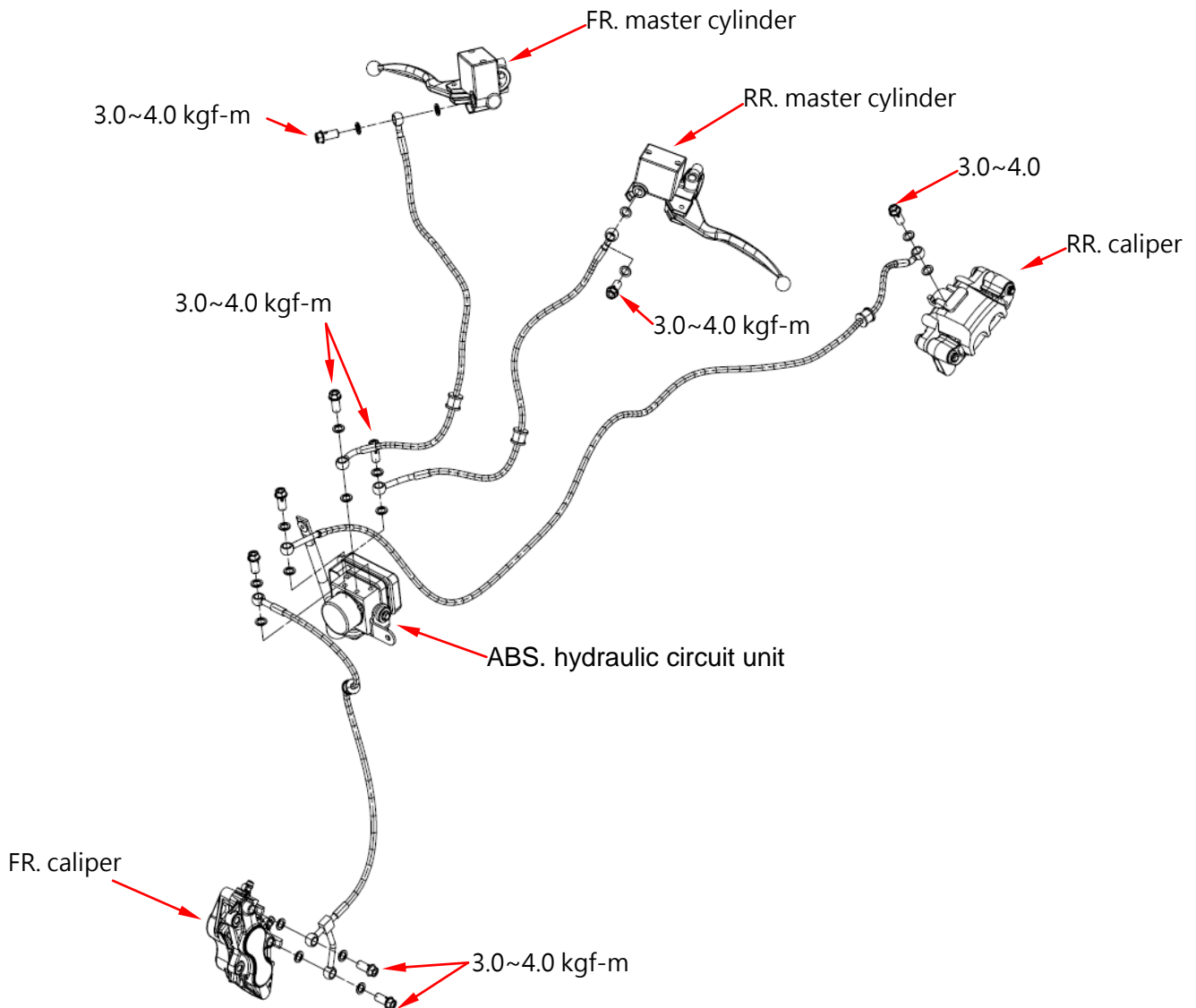
Installation

Install in reverse order of removal procedures.



Mecahnism Diagram	14-1	Rear Brake Caliper	14-10
Precautions in Operation.....	14-3	Speed Sensor / ABS Detective Disk...	14-11
Torque value	14-3	Brake Disk.....	14-12
Troubleshooting.....	14-4	Master Cylinder	14-12
Disk Brake System Inspection	14-5	ABS System.....	14-15
Adding Brake Fluid	14-6	ABS Components Location	14-19
Brake Fluid Replacement/Air-bleed...	14-7	ABS Description.....	14-20
Front Brake Caliper.....	14-8		

Mechanism Diagram (ABS version)



Precautions in Operation

Caution

Inhaling asbestos may cause disorders of respiration system or cancer, therefore, never use compressed air or dry brush to clean brake parts. Use vacuum cleaner or other authorized tool instead.

- The brake caliper can be removed without removing the hydraulic system.
- After the hydraulic system is removed, or the brake system is spongy, bleed the hydraulic system.
- While refilling brake fluid, avoid foreign material from entering the brake system.
- Do not spill brake fluid on the painted surfaces, plastic or rubber parts.
- Check the operation of brake system before riding.

Specifications

mm

Item	Standard	Limit
The thickness of front brake disk	4.000	3.500
The thickness of rear brake disk	5.000	4.500
Front and rear brake disk warpage	<0.100	0.300
Front brake master cylinder inner diameter	12.700~12.743	12.755
Front brake master cylinder piston outer diameter	12.657~12.684	12.645
Rear brake master cylinder inner diameter	12.700~12.743	12.755
Rear brake master cylinder piston outer diameter	12.657~12.684	12.645
Diameter of front disk	260.000	—
Diameter of rear disk	240.000	—
Thickness of front brake lining	5.500	1.800
Thickness of rear brake lining	7.000	2.000

Torque values:

Brake hose bolt	3.0~4.0kgf-m
Brake caliper bolt	2.9~3.5kgf-m
Brake lever nut	1.0~1.4kgf-m
Air-bleed valve	0.8~1.0kgf-m

Troubleshooting**Soft brake lever**

- Air inside the hydraulic system
- Hydraulic system leaking
- Worn master piston seal
- Worn brake pad
- Poor brake caliper
- Worn brake lining/disk
- Low brake fluid
- Blocked brake hose
- Deformed/bent brake disk
- Bent brake lever

Hard operation of brake lever

- Blocked brake system
- Poor brake caliper
- Blocked brake pipe
- Seized/worn master cylinder piston
- Bent brake lever

Uneven brake

- Dirty brake lining/disk
- Poor wheel alignment
- Clogged brake hose
- Deformed/bent brake disk
- Clogged brake hose/joint

Tight brake

- Dirty brake lining/disk
- Poor wheel alignment
- Deformed/bent brake disk

Brake noise

- Dirty lining
- Deformed brake disk
- Poor brake caliper installation
- Imbalance brake disk or wheel

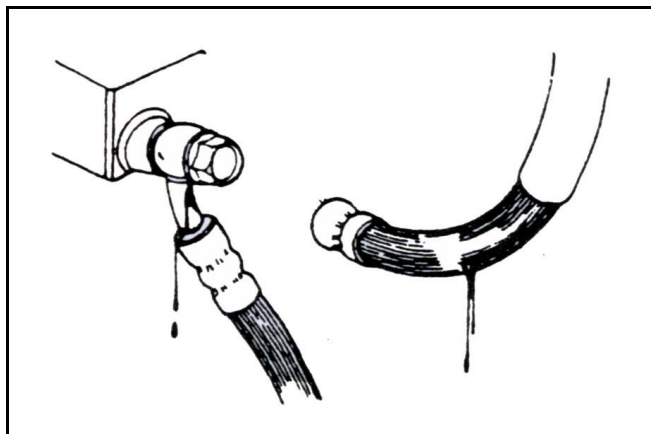
14. Brake System



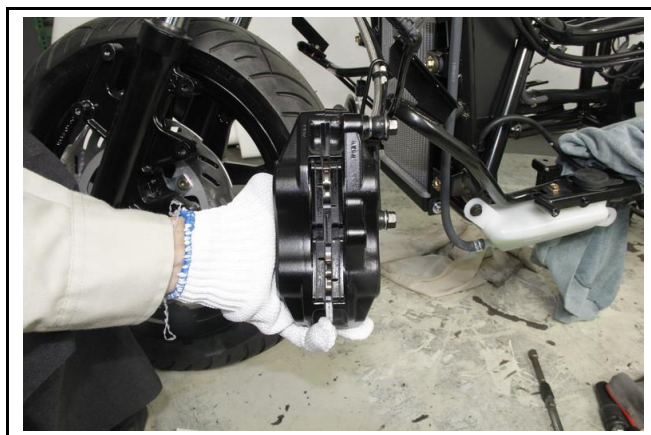
Disk Brake System Inspection

Inspection

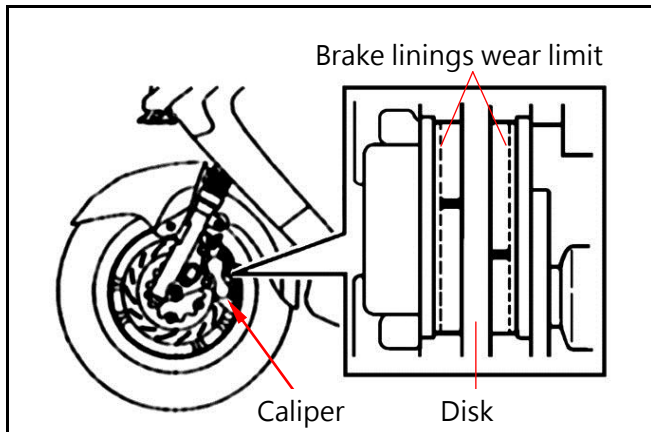
Visually check if there is leak or damage. Check by wrench if joints are loose. Check handle bar operation and suspension operation if there is abnormal interference with other parts.



Check the wear of brake lining.



Check from behind the brake caliper, the brake pad must be replaced with new lining when the brake pad reaches its wear limit.

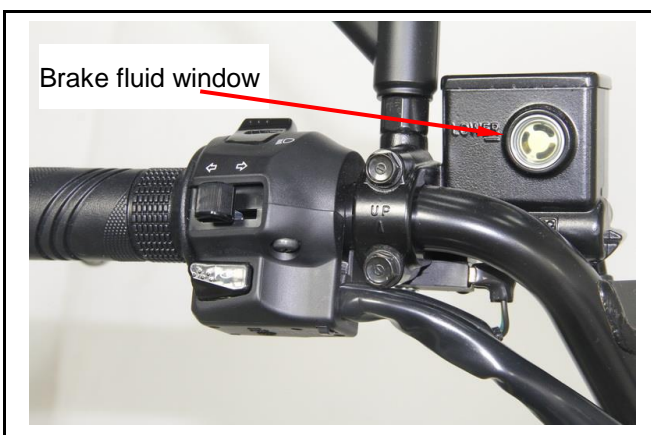


Park the motorcycle on a level ground, and check the fluid level.

Recommended Brake Fluid: **DOT 3 or DOT 4**

Caution

- When the vehicle is tilted or just parked, the fluid level is not correct. Park and wait for 3~5 minutes.
- To avoid chemical reaction, never use unknown brake fluid.
- To ensure brake efficiency, use same brake fluid.



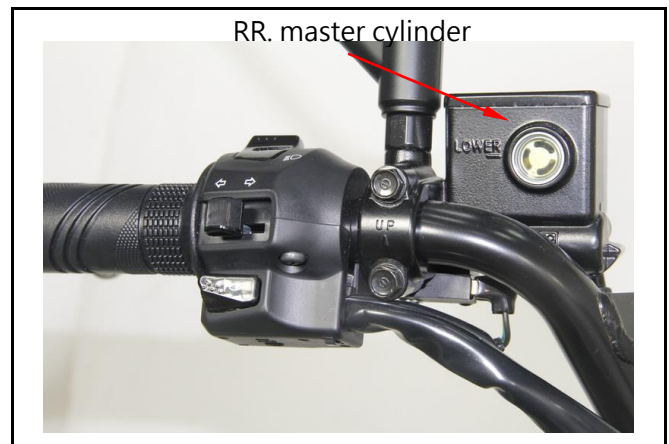
Adding Brake Fluid

Before the master cylinder cap is removed, turn the handle so that the brake fluid becomes horizontal, and then remove the master cylinder cap.

When servicing brake system, cover paint, plastic, and rubber parts with cloth.

Caution

When adding brake fluid, do not exceed upper limit. Avoid brake fluid spill on paint, plastic, and rubber parts.

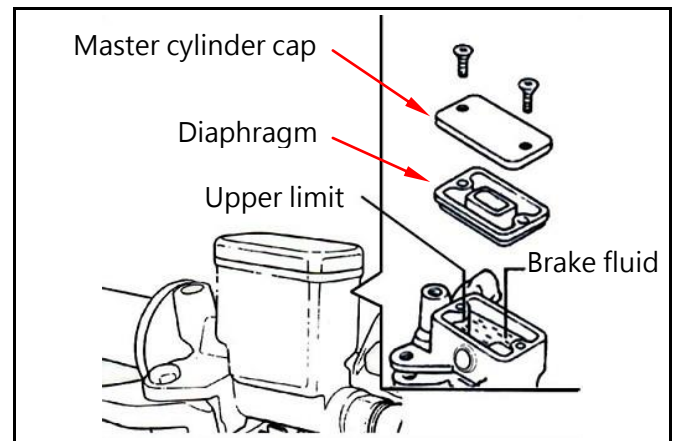


Remove the master cylinder cap and diaphragm. Be sure to use brake fluid from same brands.

Clean the dirty brake disk.

Caution

- Dirty brake lining or disk will reduce the brake performance.
- Mixing non-compatible brake fluid will reduce brake performance.
- Foreign materials will block brake system and cause reduced brake performance or brake force total loss.



Brake Fluid Replacement / Air-bleed

Connect drain hose to air-bleed valve.

Open the air-bleed valve and pull the brake lever until the old brake fluid is entirely drained out.

Close the valve and add specified brake fluid into brake master cylinder.

Recommended brake fluid: DOT 3 or DOT 4 brake fluid

Air bleed

Connect one end of transparent hose to air-bleed valve, and put the other end into a container.

Open the valve around 1/4 turns, and at the same time pull the brake lever until there is no air bubble in the hose and also feeling resistance on the brake lever.

Close the valve when finishing the brake system refilling fluid procedure, and operate the brake lever to check whether air bubble is in brake system or not. If brake is still soft, please bleed the system as following:

1. Press brake lever several times and hold, open air-bleed valve 1/4 turn and then close it.

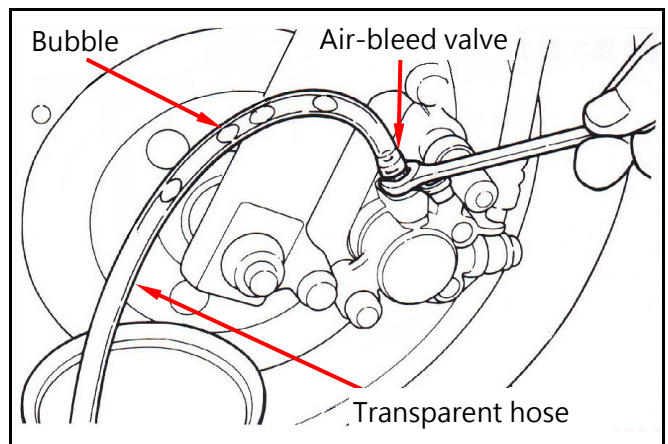
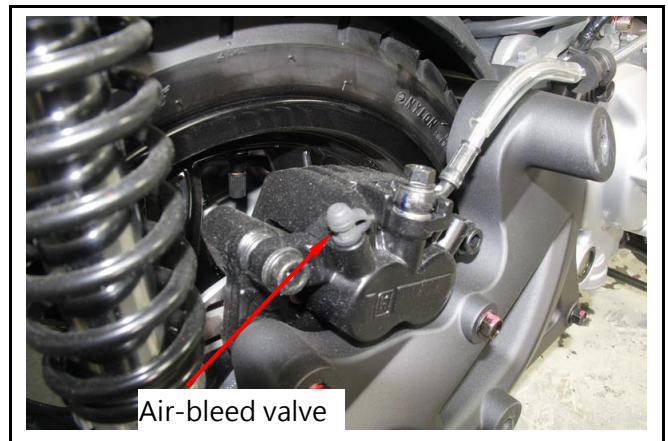
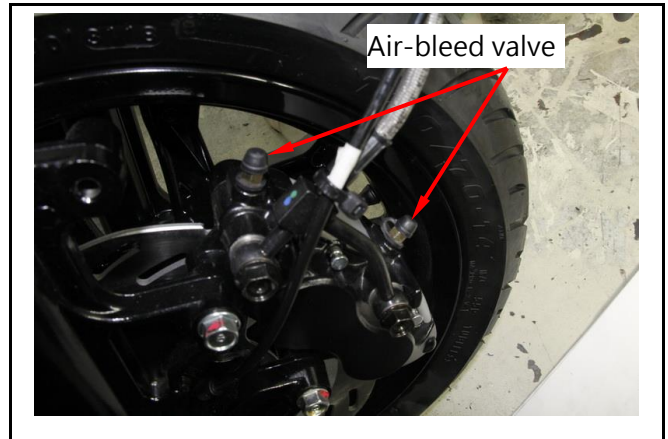
⚠ Caution

- Do not release the brake lever before air-bleed valve is closed.
- Always check the brake fluid level when carrying out air bleeding procedure to avoid air entering the system.

2. Release brake lever slowly, and wait for a few seconds until it reaches its top position.
3. Repeat the step 1 and 2 until there is no air bubble at the end of the hose. Tightly close the valve.
4. Make sure the brake fluid is in the UPPER level of the master cylinder, and refill the fluid if necessary.
5. Cover the cap

⚠ Caution

- Apply fluid replacement machine for shorter replacing time and less air bubble.



Front Brake Caliper

Removal

Place a container under the brake caliper, and loosen the brake hose bolts and remove the brake hoses.

⚠ Caution

Do not spill brake fluid on painted surfaces.

Remove the caliper. (2 bolts)

Installation

Install the brake caliper and tighten the mounting bolts.

Torque: 3.5~4.5kgf-m

⚠ Caution

- Use M8 x 35 mm flange bolt only.
- Long bolt will interfere the operation of brake disk.

Use two seal washers and hose bolts to lock the hoses and brake caliper in place.

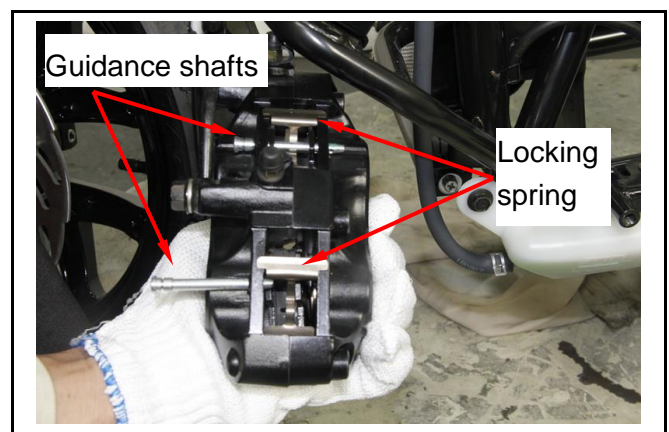
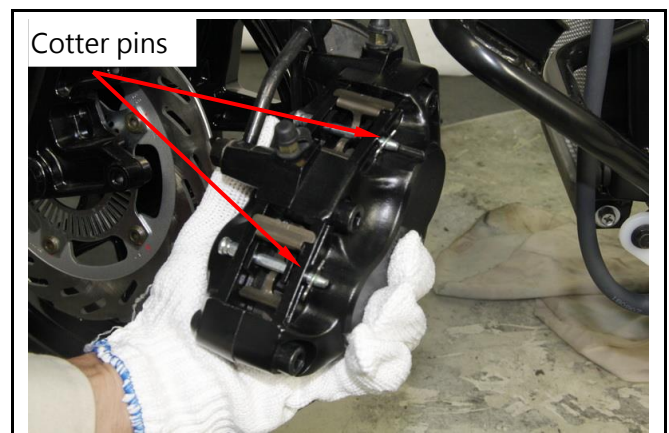
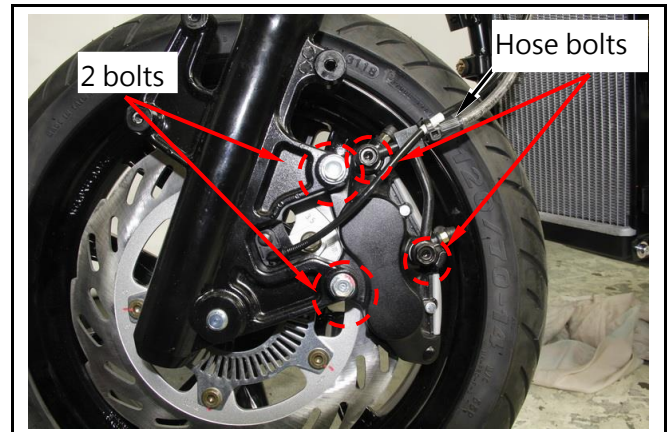
Torque: 3.0~4.0kgf-m

Refill brake fluid to front and rear master cylinder and make necessary air bleeding.

Brake pad replacement

Remove brake caliper.
Remove brake pad caps.
Remove cotter pins.

Remove the brake pad guidance shafts and locking spring, and then remove brake pads.

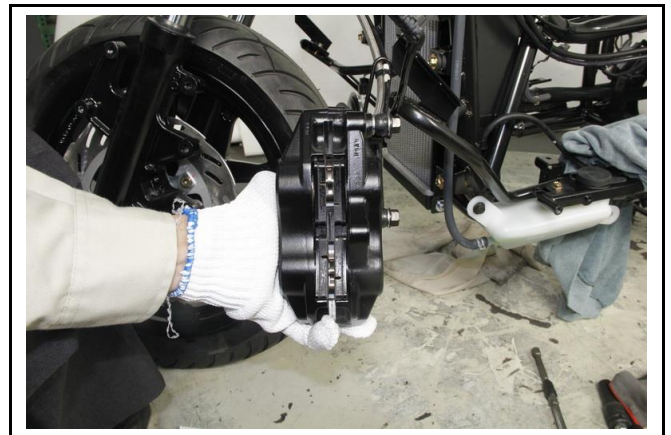
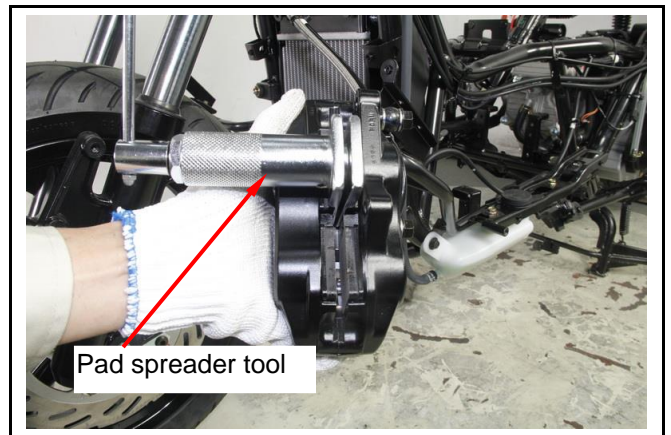


14. Brake System

Install the new brake pads onto brake caliper.
Install the brake pad guidance shafts and locking springs.
Install cotter pins.



Spread brake pads by pad spreader tool.



Install front brake caliper and tighten bolts.



Rear Brake Caliper

Removal

Place a container under the brake caliper, and loosen the brake hose bolt and remove the brake hose.

⚠ Caution

Do not spill brake fluid on painted surfaces.

Remove the caliper. (2 bolts)

Installation

Install the brake caliper and tighten the mounting bolts.

Torque: 3.5~4.5kgf-m

⚠ Caution

- Use M8 x 35 mm flange bolt only.
- Long bolt will interfere the operation of brake disk.

Use two seal washers and hose bolts to lock the hoses and brake caliper in place.

Torque: 3.0~4.0kgf-m

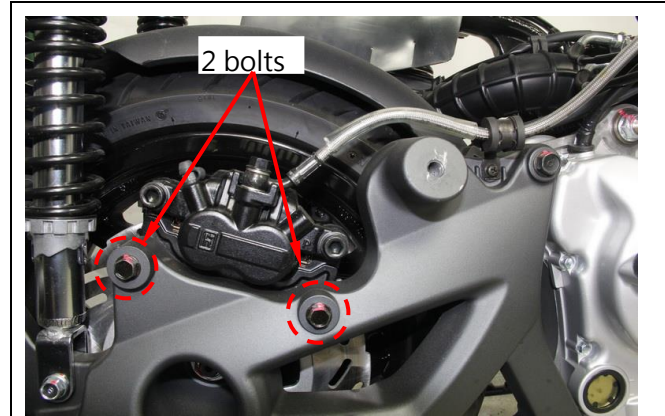
Refill brake fluid to rear master cylinder and make necessary air bleeding.

Brake pad replacement

Remove rear brake caliper.

Spread brake pads by pad spreader tool.

Remove brake pads.

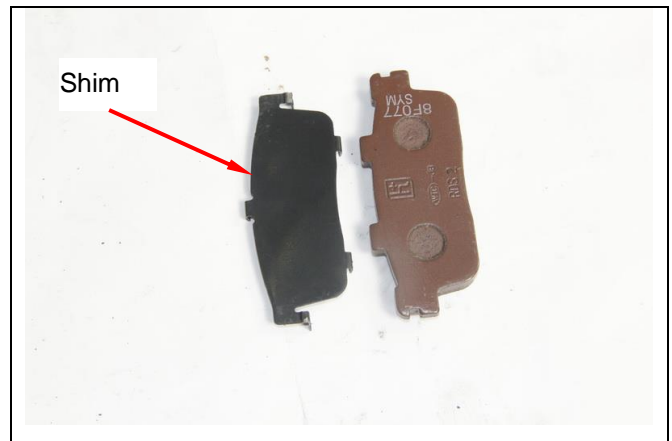


14. Brake System

Install one new brake pad onto caliper piston side.



Remove shim from the other brake pad.



Install shim onto caliper first.

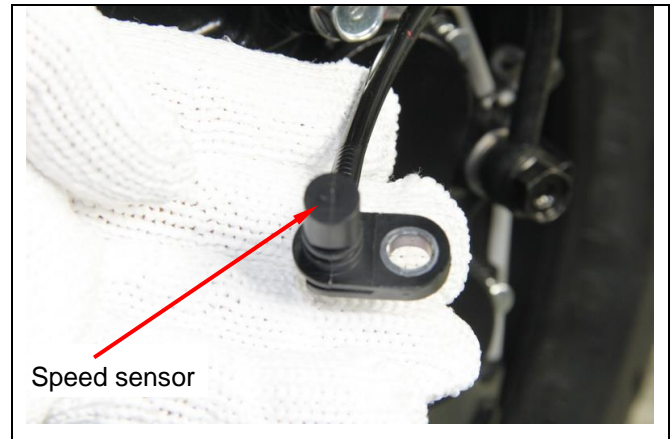


Install brake pad with shim.

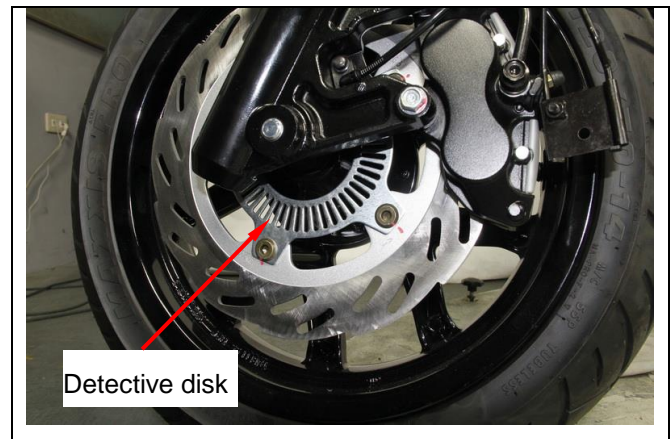


Speed Sensor / ABS Detective Disk

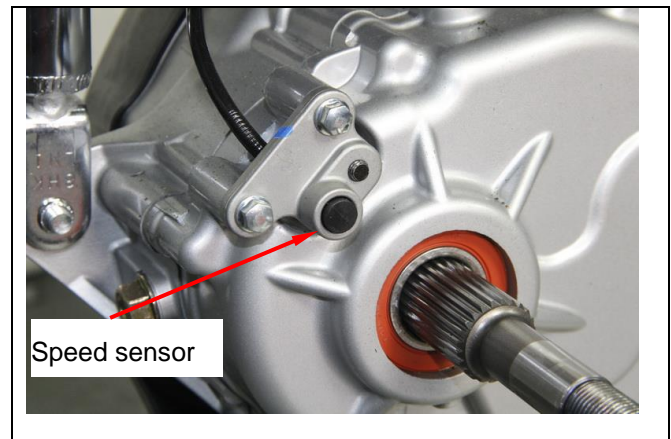
Remove front speed sensor and clean it.



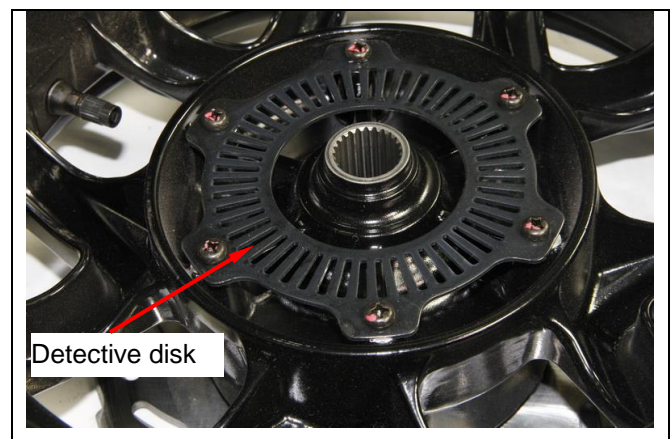
Check and clean detective disk.
Replace if the detective disk is damaged.
Damaged detective disk would probably affect
ABS function.



Remove rear speed sensor and clean it.



Check and clean detective disk.
Replace if the detective disk is damaged.
Damaged detective disk would probably affect
ABS function.



14. Brake System

Brake Disk

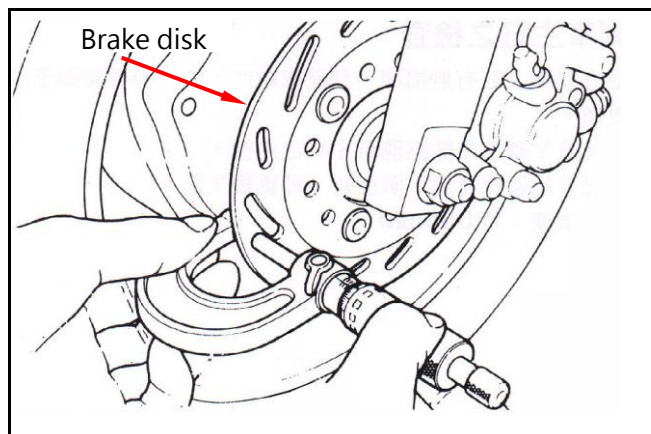
Inspection

Visually check if the brake disk is worn or broken. Measure the thickness of the disk at several places. Replace the disk if it exceeds the service limit.

Allowable limit:

Front brake disk 3.5 mm

Rear brake disk 4.5 mm

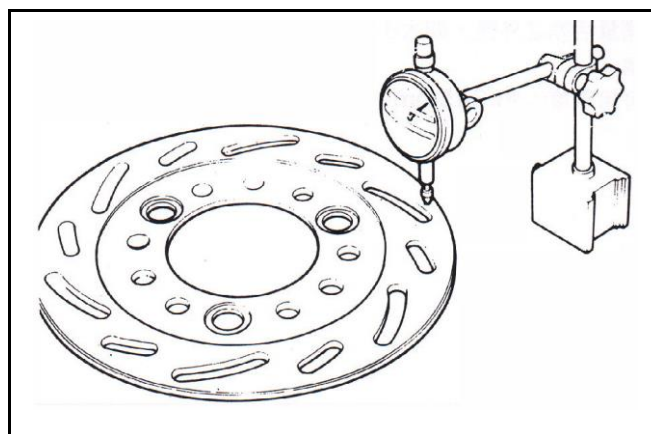


Remove the brake disk from wheel. Check if the disk is deformed or bent.

Allowable limit: 0.30 mm

⚠ Caution

- Dirty brake disk will reduce the brake performance.
- Brake lining contains asbestos ingredient. Do not use compressed air for cleaning. Operator should wear mask and glove, and use vacuum cleaner for cleaning.



Master Cylinder

Removal

⚠ Caution

Avoid foreign materials from entering the master cylinder.

⚠ Caution

The whole set of master cylinder, piston, spring, diaphragm and circlip should be replaced as a set.

Remove the handle covers.

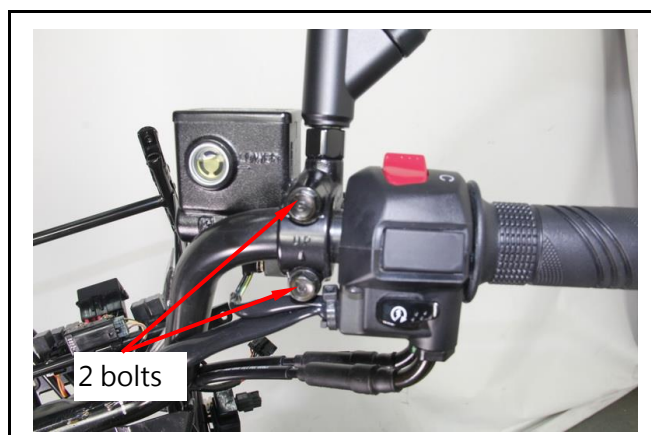
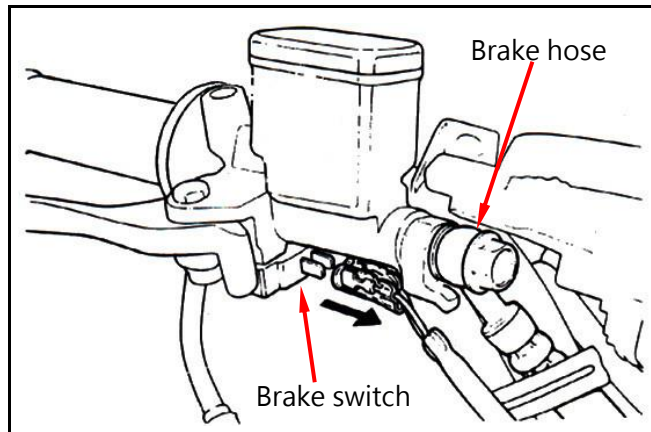
Disconnect brake switch couplers.

Drain out the brake fluid.

Remove the brake lever from the brake master cylinder.

Remove the brake hose.

Remove the master cylinder bolts and the master cylinder.



Remove the rubber boot.
 Remove the circlip.
 Remove the piston and the spring.
 Clean the master cylinder with recommended brake fluid.

Inspection

Check if the master cylinder is damaged or scratched. Replace it if necessary.

Measure the cylinder inner diameter at several points along both X and Y directions.

Replace the cylinder if the measured values exceeds allowable limit.

Allowable limit:

Front brake: 12.755 mm

Rear brake: 12.755 mm

Measure the outer diameter of the piston.

Replace the piston if its measured value exceeds allowable limit.

Allowable limit:

Front brake: 12.645 mm

Rear brake: 12.645 mm

Installation

⚠ Caution

- It is necessary to replace the whole set of piston, spring, piston cup, and circlip.
- Make sure there is no dust on components before assembling.

Apply clean brake fluid to the piston cup, and then install the cup onto the piston.

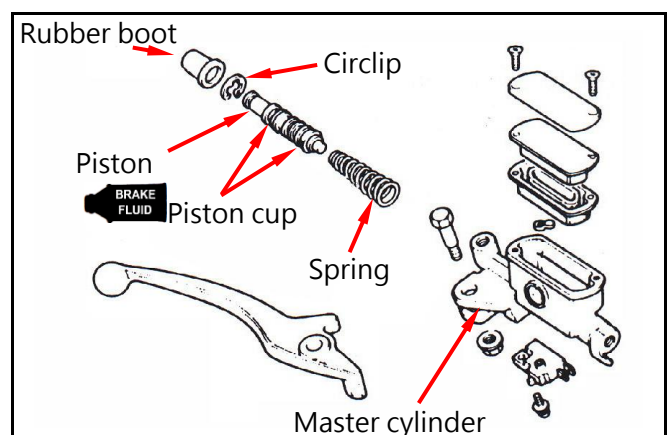
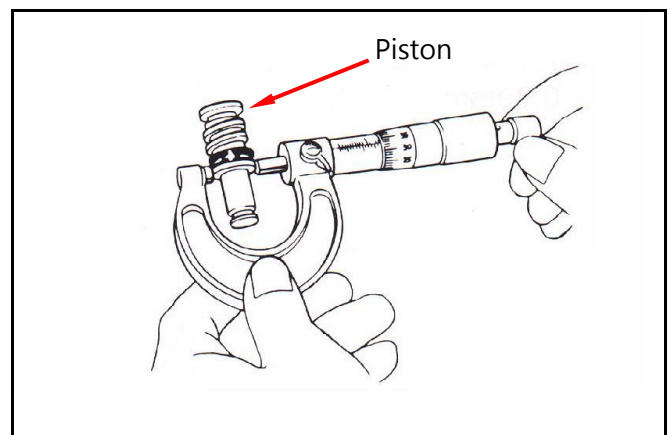
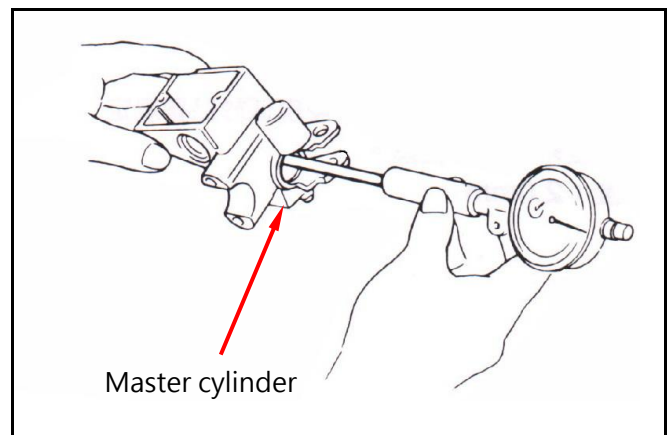
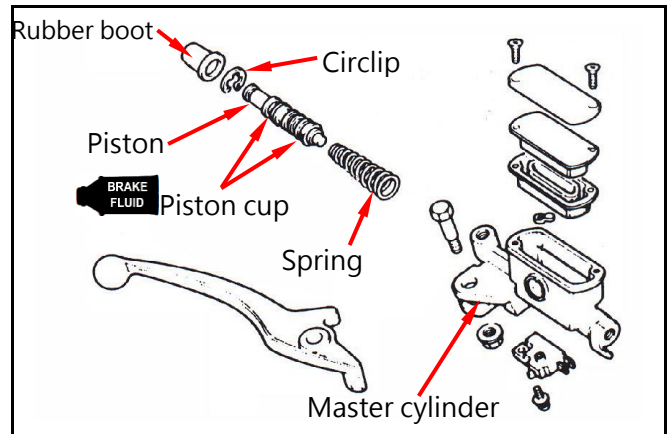
Install the larger end of the spring onto the master cylinder.

The cup's cavity should be facing inside of master cylinder when installing the cup.

⚠ Caution

- Never install cup lip in the opposite direction.
- Be sure the circlip is installed securely in the groove.

Install the rubber boot into groove properly.



14. Brake System



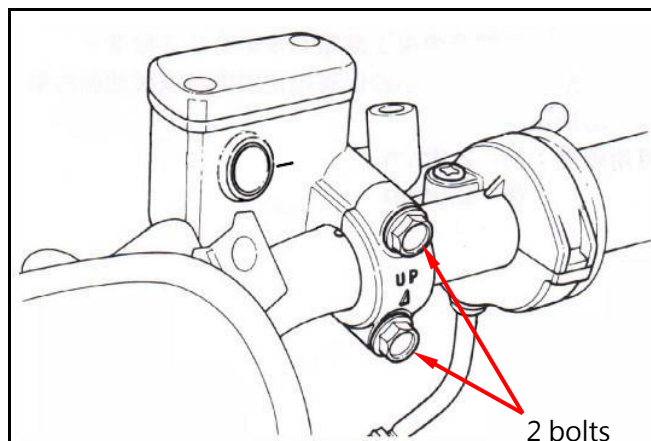
Master Cylinder Installation

Place master cylinder onto handlebar and install holder and bolts. The "UP" mark on holder should be toward upside.

Align the fix marks on master cylinder and holder with handlebar.

Tighten upper bolt first, then lower bolt.

Install brake lever and connect brake switch coupler.



Connect brake hose with 2 new seal washers.

Tighten the brake hose bolt to the specified torque value.

Make sure the hose is installed correctly.

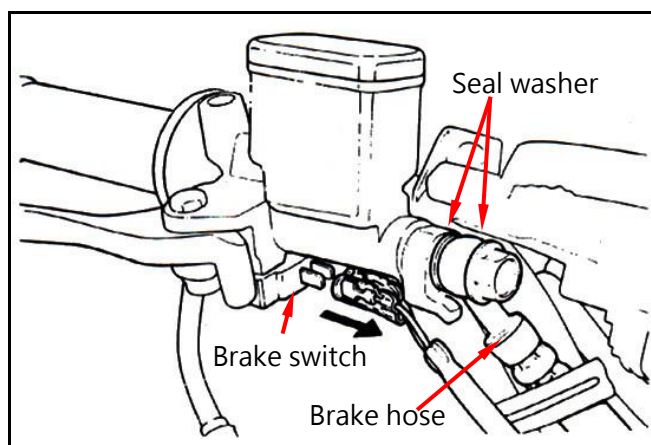
Install all wires, hoses, and components carefully to avoid twisting them together.

⚠ Caution

Improper routing may damage couplers, hoses or pipes.

⚠ Caution

Twisted brake hoses will reduce brake performance.



Add specified brake fluid and bleed the brake system.

ABS (Anti-lock Brake System) System

ABS is designed to help prevent the wheel from locking up when hard brakes are applied while running straight. The ABS automatically regulates the brake force. Intermittently gaining gripping force and braking force helps prevent wheel lock-up and allows stable steering control while stopping. Brake control function is identical to that of a conventional scooter. The right brake lever is used for the front brake and the left brake lever for the rear brake.

Use of non-recommended tires may cause malfunctioning of ABS and can lead to extended braking distance. The rider could have an accident as a result. Always use recommended standard tires for this scooter.

When the ABS is functioning, rider may feel successive pulses in the brake lever. This is normal.

ABS does not function at the speed of approx. 5 km/h or below.

ABS does not function if the battery is discharged.

14. Brake System

ABS indicator light:

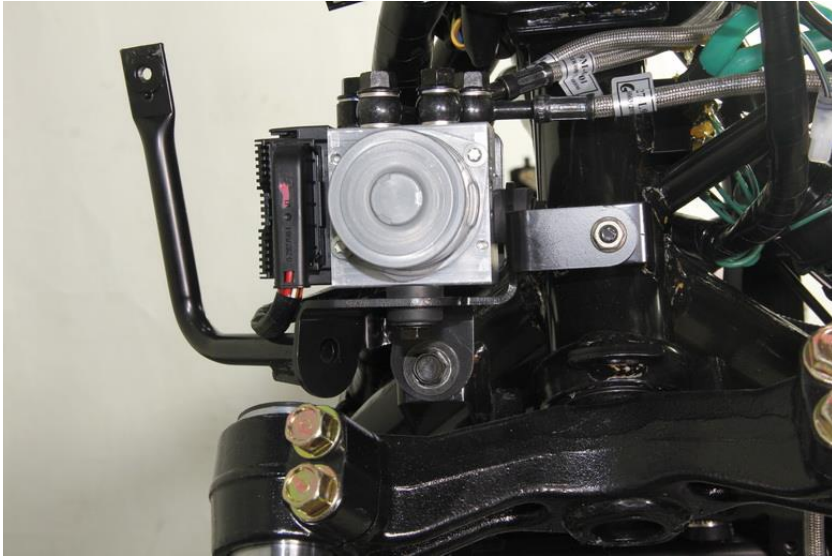
The ABS indicator light goes on when the ignition switch is turned on and goes off shortly after the scooter speed is over 5km/hr.

If the indicator light is on, ABS may be out of function. However, the brake system can still work properly. You should have the ABS checked.

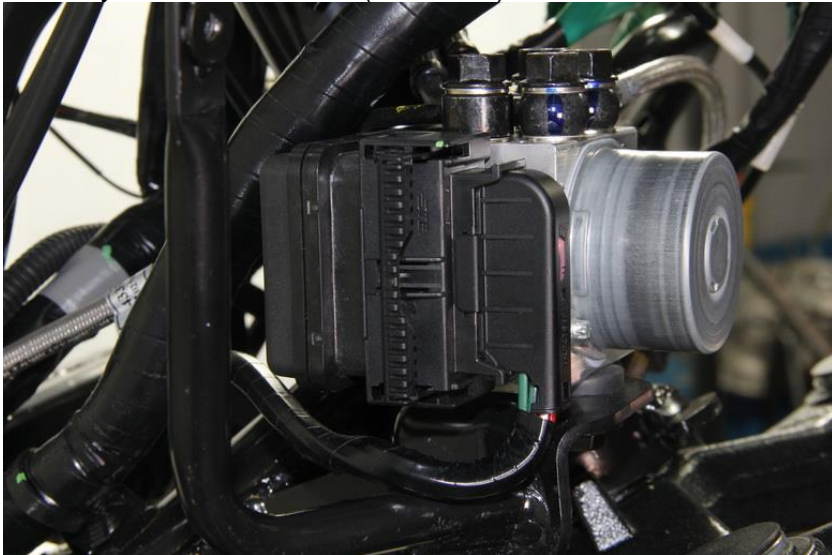


ABS indicator

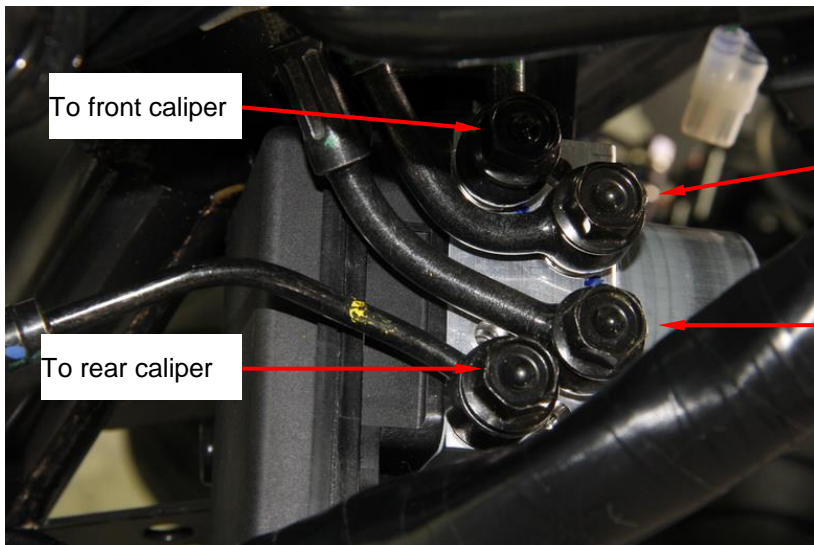
ABS Components



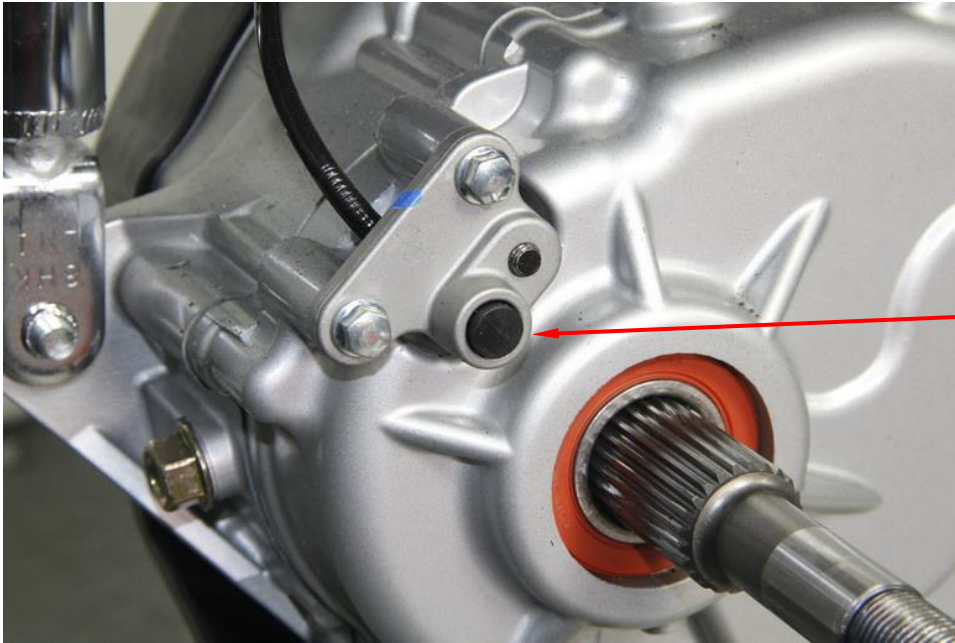
ABS. Hydraulic Circuit Unit (front view)



ABS. Hydraulic Circuit Unit (right view)



ABS. Hydraulic Circuit Unit (top view)



Rear wheel speed sensor

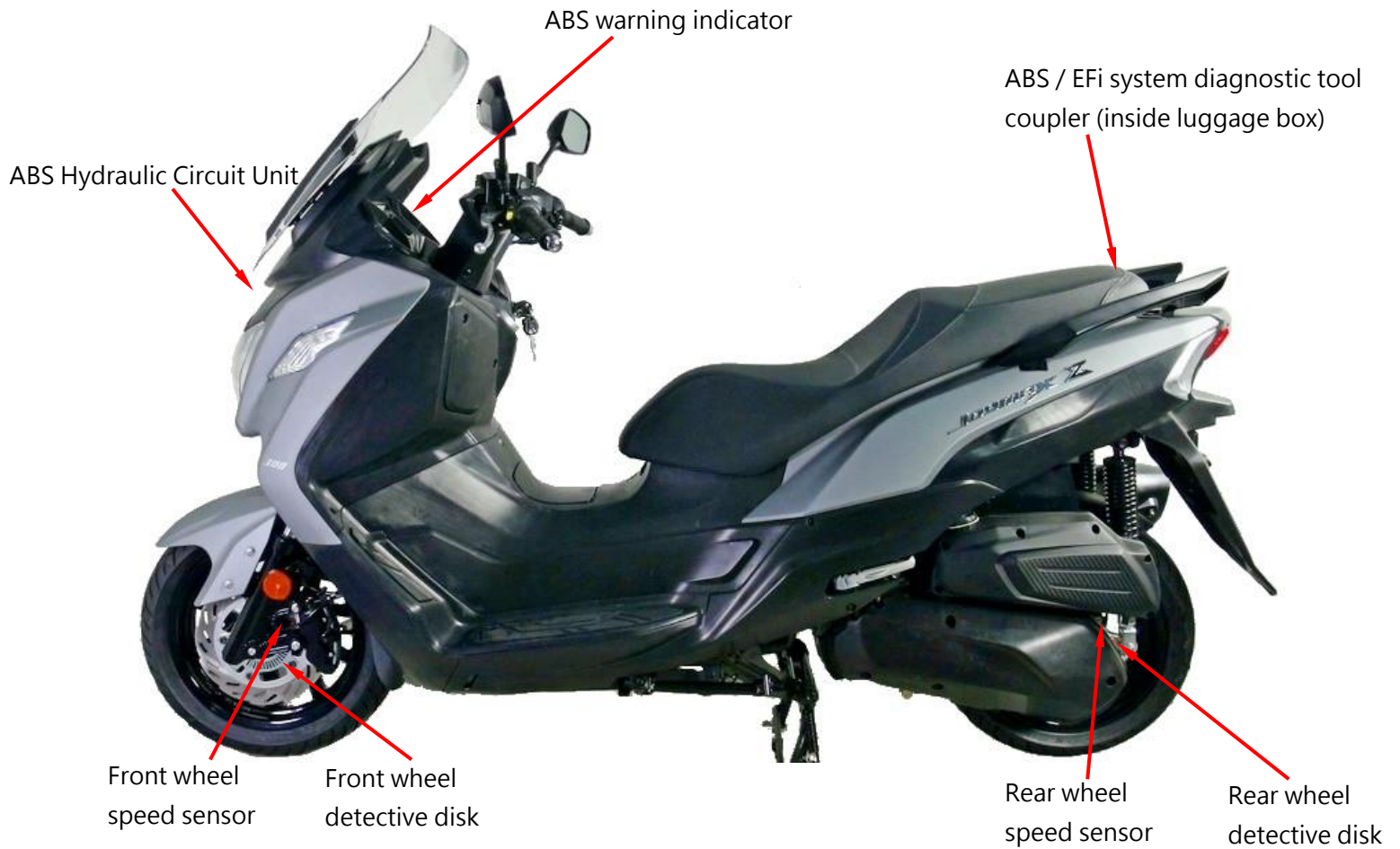


Front wheel speed sensor

Caution

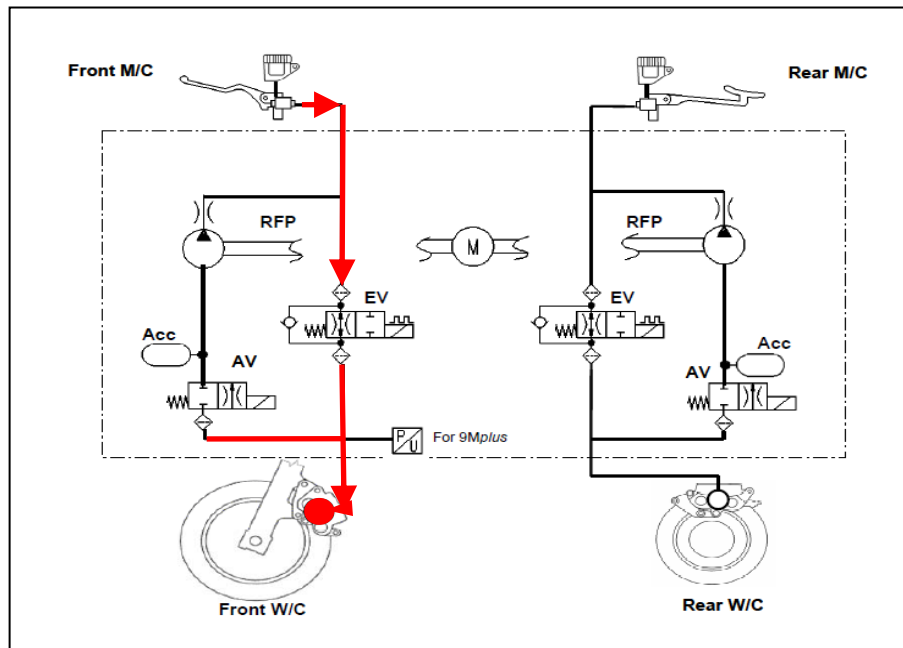
Do not remove the ABS control unit coupler when the main switch is ON, or the ABS control unit will be damaged.

ABS Components Location



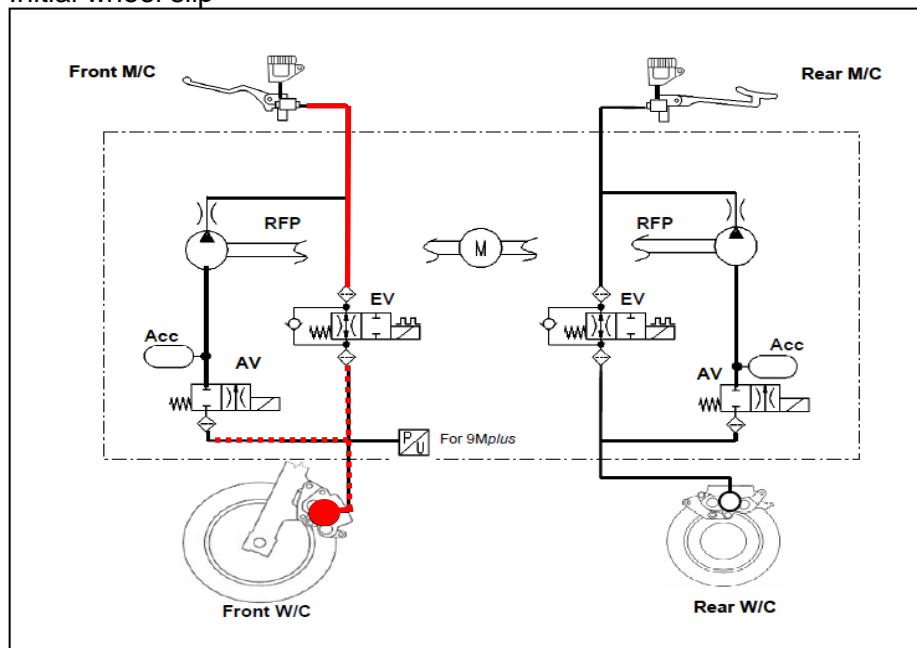
ABS Description

Normal brake



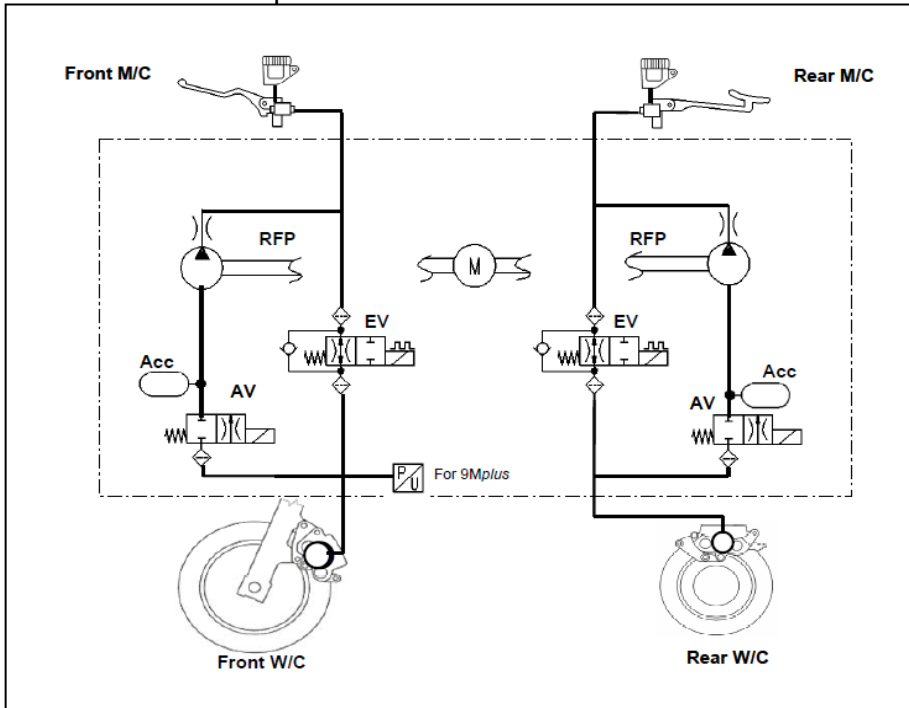
When the brake is applied, speed sensors detect the front and rear wheel speed. When there is no wheel slip, EV (inlet valve for maintaining pressure) keeps open and AV (outlet valve for pressure reduction) is closed. Brake calipers receive pressure for master cylinders and brake normally.

Initial wheel slip



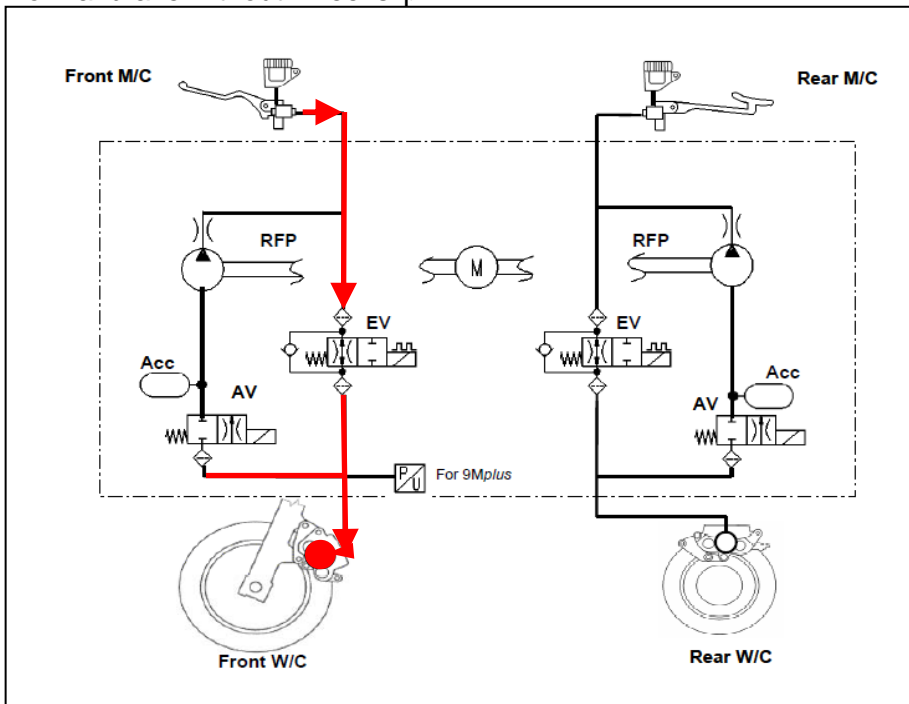
When the initial wheel slip is detected by the wheel speed sensors, EV and AV are both closed. Brake caliper keeps the pressure and brake continues.

Continuous wheel slip



When the wheel speed sensors detect continuous wheel slip, EV keeps closed and AV is open. Brake pressure is reduced (pulsing in the brake lever). Brake caliper lowers the pressure and braking force.

Normal brake without wheel slip



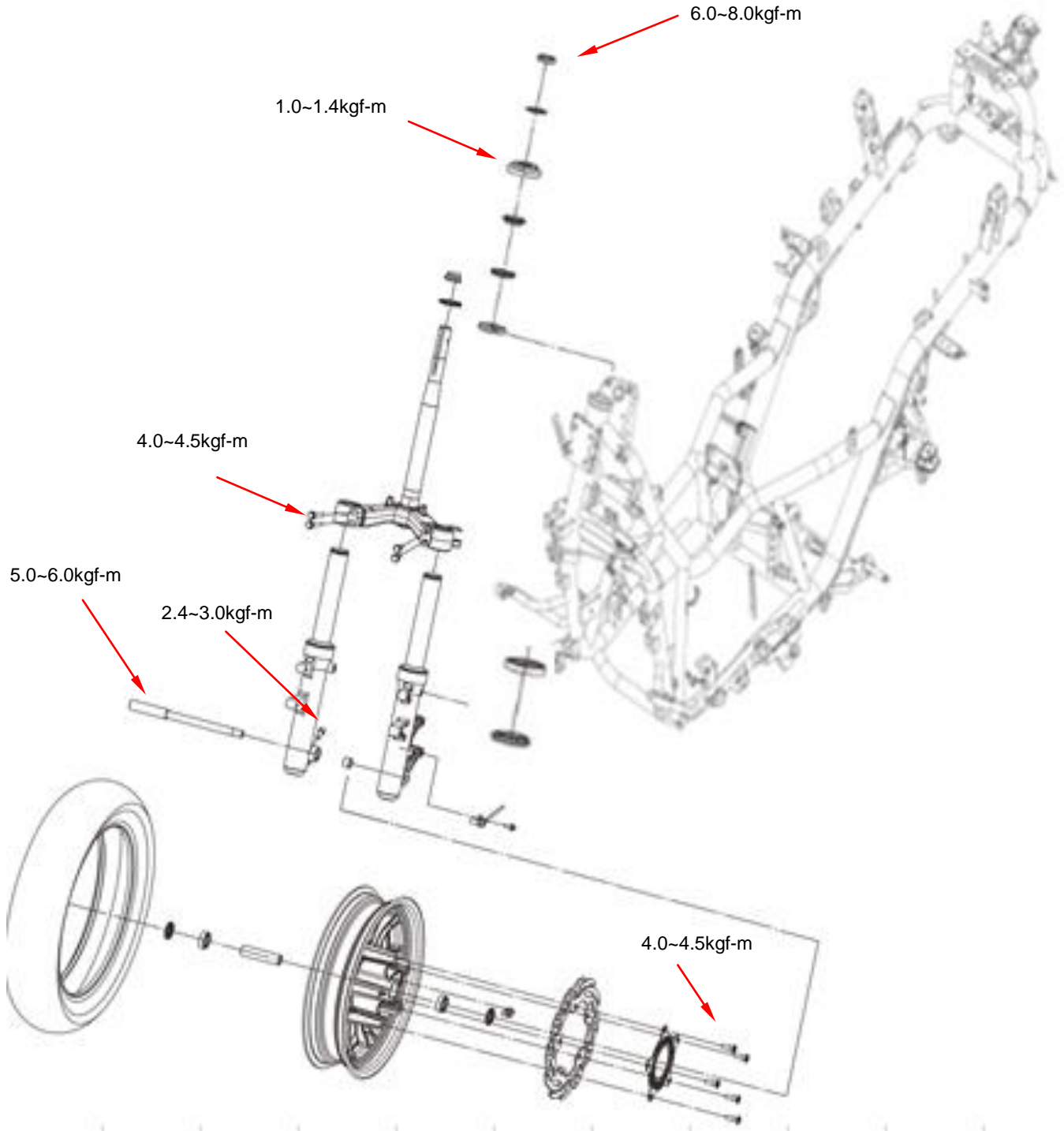
When the pressure reduction continues, the wheel speed sensors detect no wheel slip. EV keeps open and AV is closed. Brake caliper receives pressure from master cylinder and normal brake is applied.

Diagnostic Trouble Codes

(9.0m) version	(9.1m) version	Errors and Description
C1021	C1055	ABS control unit (ECU) fault
C1014	C1019	EV / AV relay fault
C1054	C1017	Front Inlet Valve malfunction (EV)
C1052	C1013	Rear Inlet Valve malfunction (EV)
C1049	C1018	Front Outlet Valve malfunction (AV)
C1048	C1014	Rear Outlet Valve malfunction (AV)
C1059	C1053	Power Supply Malfunction (High Voltage)
C1058	C1052	Power Supply Malfunction (Low Voltage)
C1015	C1035	Pump Motor Malfunction
C1033	C1043	Abnormal front wheel speed sensor (Disconnection/ground Short/Supply Voltage Short)
C1031	C1045	Abnormal rear wheel speed sensor (Disconnection/ground Short/Supply Voltage Short)
C1034	C1042	Abnormal front wheel speed sensor (Plausibility)
C1032	C1044	Abnormal rear wheel speed sensor (Plausibility)
C1024	C1025	Deviation between Wheel speeds (Wheel Speed Sensor)

Mechanism Diagram.....	15-1	Front Wheel.....	15-5
Precautions in Operation	15-2	Front Cushion	15-8
Troubleshooting	15-2	Steering Stem.....	15-9
Steering Handle	15-3		

Mechanism Diagram



Precautions in Operation

General information

Please refer to the Maintenance Manual of tubeless tire in respect to the removal, repair and installation of the tire.

Torque Values

Front wheel axle	5.0~6.0kgf-m
Front wheel axle lock bolt	2.4.0~3.0kgf-m
Nut for the steering handle	4.0~5.0kgf-m
Lock nut for the steering handle stem	6.0~8.0kgf-m
Top crown for the steering handle stem	2.0~ 3.0kgf-m
Locating screw for the speedometer cable	1.0~1.4kgf-m
Front cushion upper lock bolt	4.0~4.5kgf-m
Front brake disk	4.0~4.5kgf-m

Special Tools

Steering handle top thread wrench	SYM-5320000、SYM-5321100
Inner bearing puller	SYM-6204020
Steering nut wrench	SYM-5320010
Driver 32*35mm	
Driver 42*47mm	

Troubleshooting

Hard to steer

- The steering handle stem nut is too tight.
- The ball and the top crown of the steering handle stem are damaged.
- Insufficient tire pressure.

The steering handlebar is tilted

- Uneven arrangement of the front cushion.
- The front fork is bent.
- The front wheel axle is bent

The front wheel rim run-out

- The rim is bent.
- The wheel axle nut is not tightened enough.
- Side-worn or poor tire.
- The bearing clearance of the wheel axle is too large.

Soft front cushion

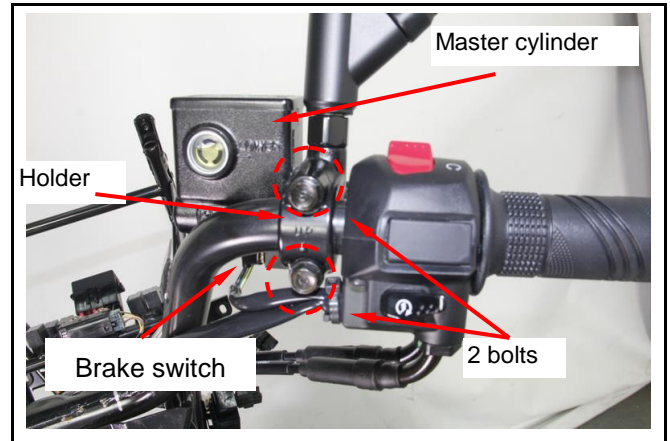
- The front cushion spring is worn out.
- The oil seal of the front cushion is leaking.

Noise in front cushion

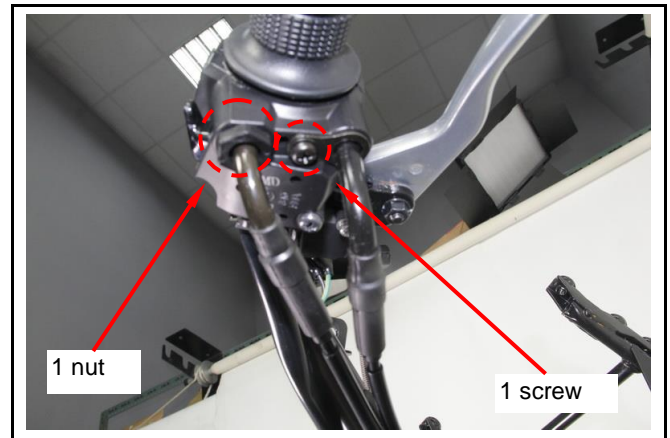
- Front cushion is warped.
- The joint of the front cushion gets loose.

Steering Handle**Removal**

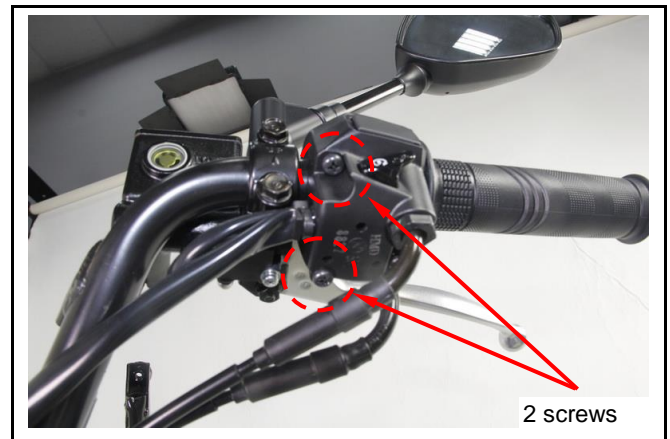
Remove the handle covers.
Loosen the lock bolts for the master cylinder of the front brake.
Remove master cylinder and holder.



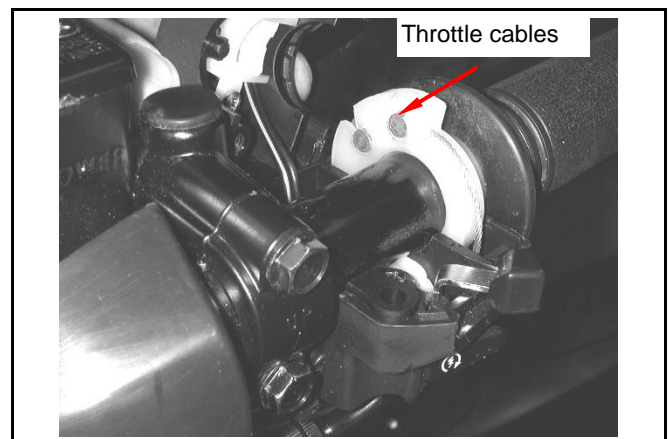
Loosen the deceleration throttle cable fixing nut.
Loosen 1 screw from the acceleration throttle fixing plate.



Loosen 2 screws from the throttle holder.



Remove throttle holder, handle switch, cables and grip.

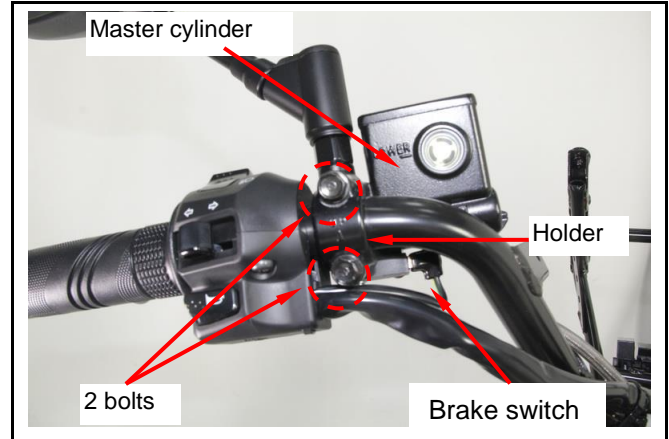


15. Steering / Front Wheel / Front Cushion



Loosen 2 bolts from the master cylinder of the rear brake.

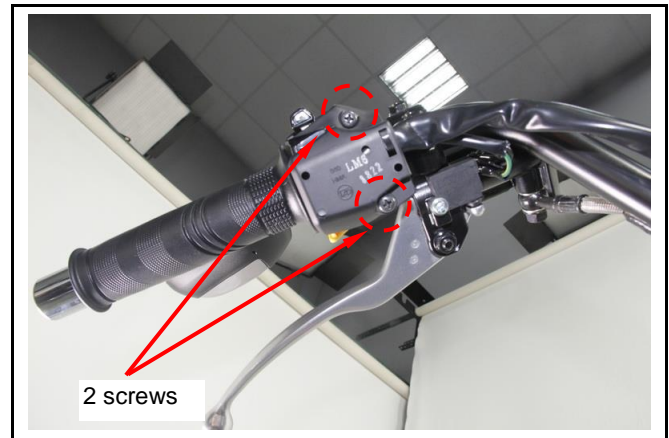
Remove holder and master cylinder.



Loosen left handle switch connector.

Loosen 2 screws from left side handle switch holder.

Remove the left handle switch.



Loosen handle mounting nut.

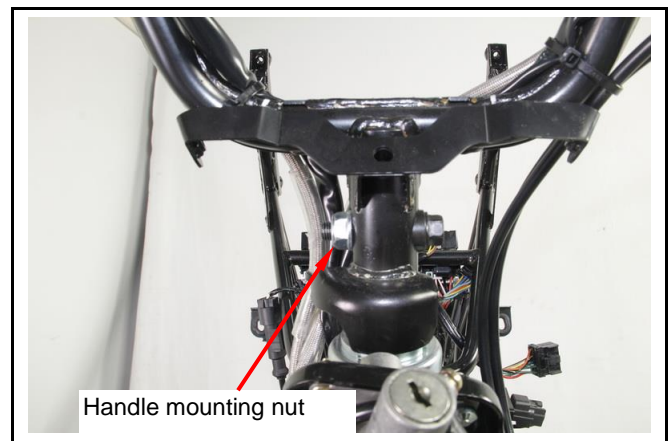
Remove handle mounting bolt, and then remove the handle.

Installation

Install in the reverse order of removal.

Torque value:

Handlebar 4.0~5.0kgf-m



Apply grease onto throttle cable and the sliding surface of handle.

Align the lock pin with the hole on the handle.

After the installation, carry out the following inspection and the adjustment:

- Throttle grip operation.
- All electric appliances, the meter function

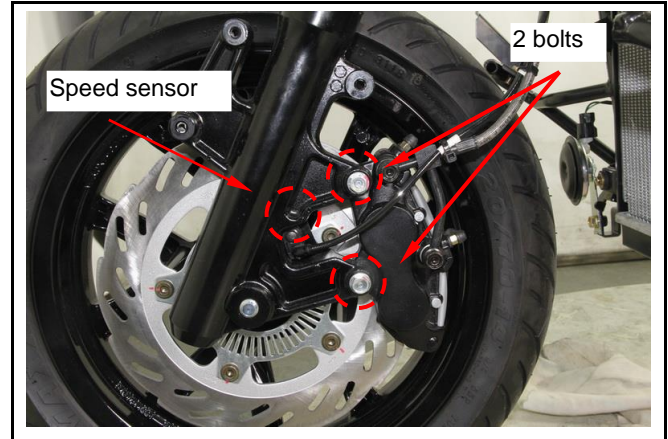
**Front Wheel
Removal**

Loosen 2 bolts from the front brake caliper and remove it

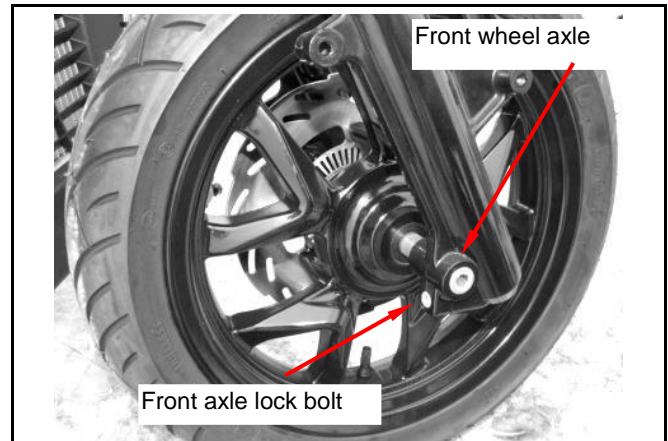
⚠ Caution

- After removing the caliper, do not pull brake lever. Or the brake pads will be pressed out.

Remove speed sensor. (1 screw)



Remove the front axle lock bolt.



Remove the front wheel axle.

Remove the front wheel and both side collar.



15. Steering / Front Wheel / Front Cushion

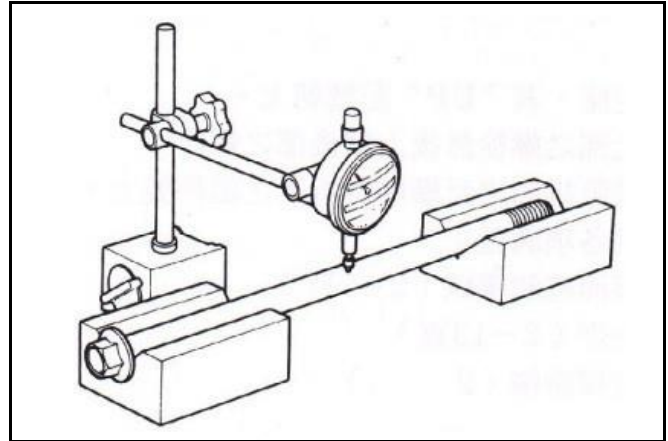


Inspection

Wheel axle

Place the wheel axle on a V block, measure its runout.

Service limit: 0.2 mm



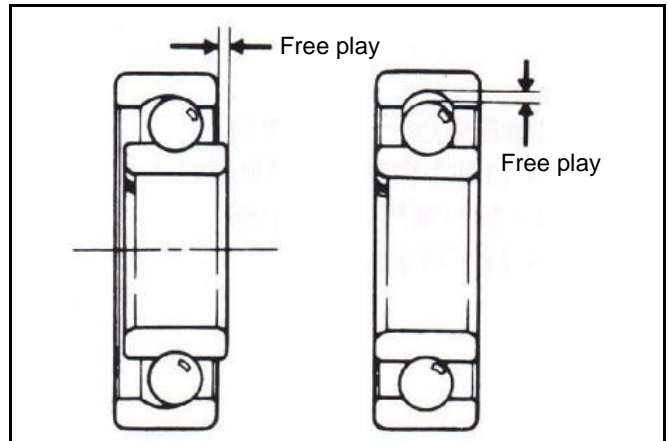
Bearing

Rotate each bearing's inner ring with fingers. Check if bearings can be turned smoothly and silently, and also check if bearing outer ring is mounted tightly on rim.

Replace the bearing, if the rotation is uneven, noisy, or loose bearing mounted.

Caution

- The bearing shall be replaced in pair.



Wheel

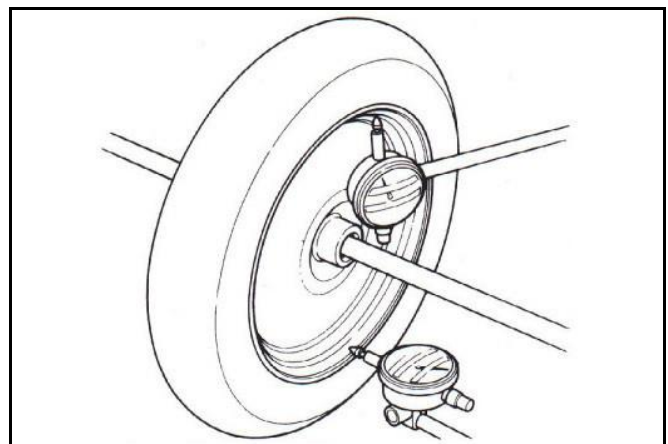
Place the wheel on to a rotation seat to check its rim runout.

Turn the wheel with hand and measure its rim runout value with a dial gauge.

Service limit:

Radial: 2.0 mm

Axial: 2.0 mm



Disassembly

Remove brake disk. (5 bolts)

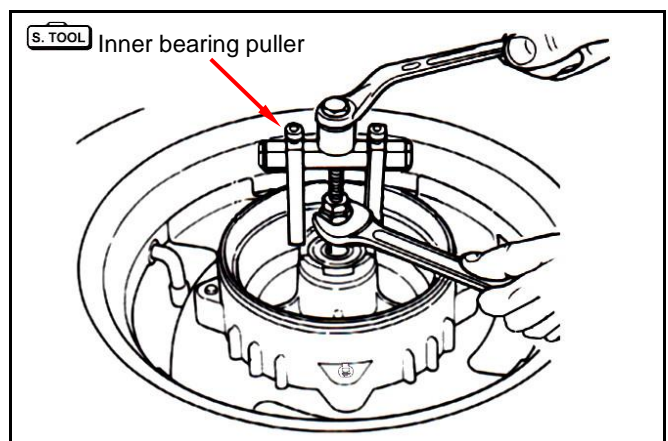
Remove dust seal, bearing and dist. collar from left side.

Remove distance collar.

Remove dust seal and bearing from right side.

Special tools:

Inner bearing puller **SYM-6204025**



Assembly

Apply grease on the inner bearing housing of rim.

Install the left bearing.

Install distance collar and the right bearing.

Install new dust seal on both sides.

⚠ Caution

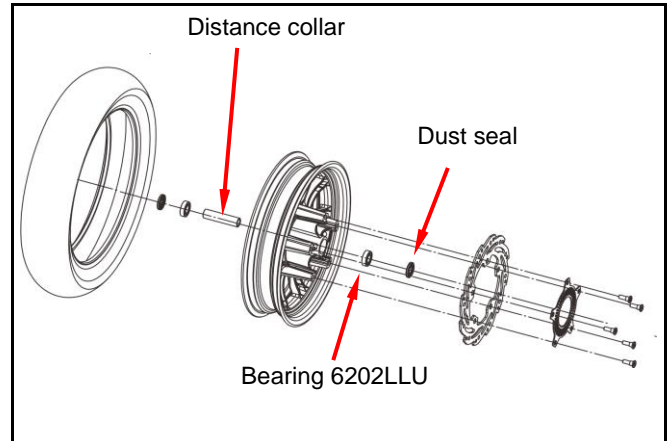
- Carefully install the bearing in correctly and evenly.
- Never install used bearings. Once the bearing is removed, replace with a new one.

Install the brake disk and then tighten the bolts.

Torque value: 4.0~4.5kgf-m

Front wheel installation

Install in the reverse order of disassembly.



15. Steering / Front Wheel / Front Cushion



Front Cushion

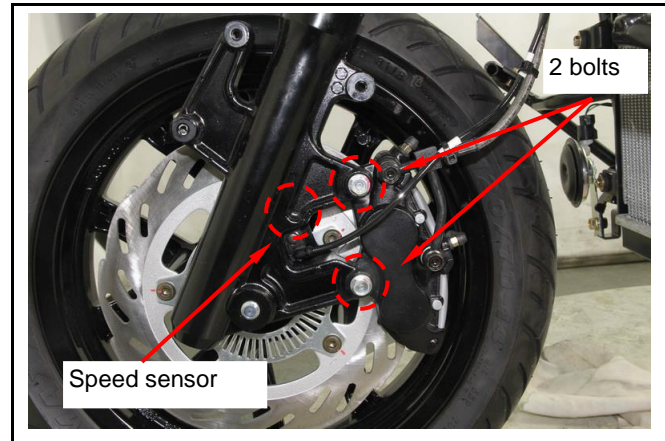
Removal

Remove front cover, front under spoiler and front fender.

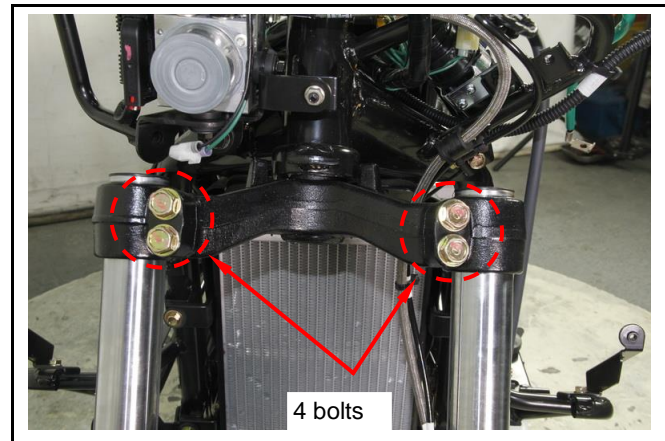
Remove front wheel.

Remove front brake caliper.

Remove speed sensor.



Loosen 4 bolts from steering stem.



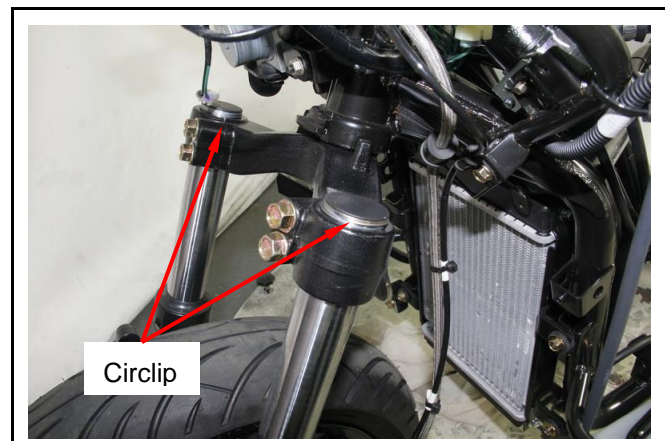
Remove circlip and remove front cushions.

Installation

Align the cover flange with upper level of the cushion clamp, and then tighten bolts.

Torque value: **4.0~4.5kgf-m**

Install the removed components in reverse order of removal procedures.



Steering Stem

Removal

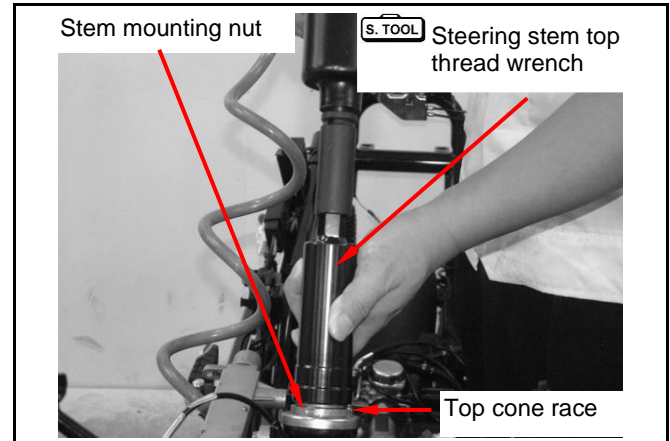
Remove handlebar, front wheel, front brake system, and front cushions.

Remove the steering stem mounting nut by steering stem top thread wrench.

Special tool:

Steering stem top thread wrench

SYM-5320010



Remove top cone race by handle stand nut wrench.

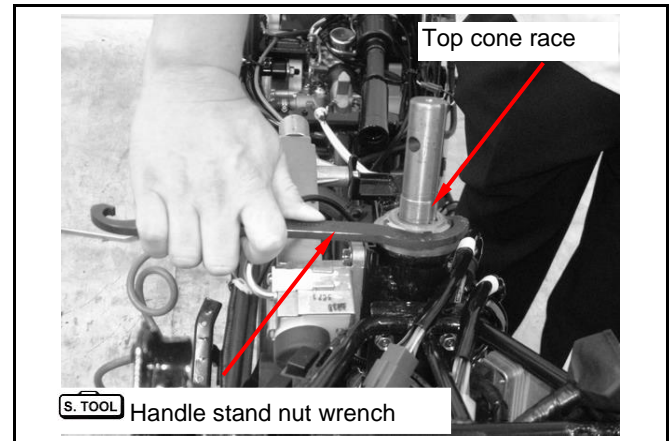
Remove steering stem.

Special tools:

Handle stand nut wrench SYM-5320000

⚠ Caution

- Place the steel ball onto a parts container to prevent from missing.

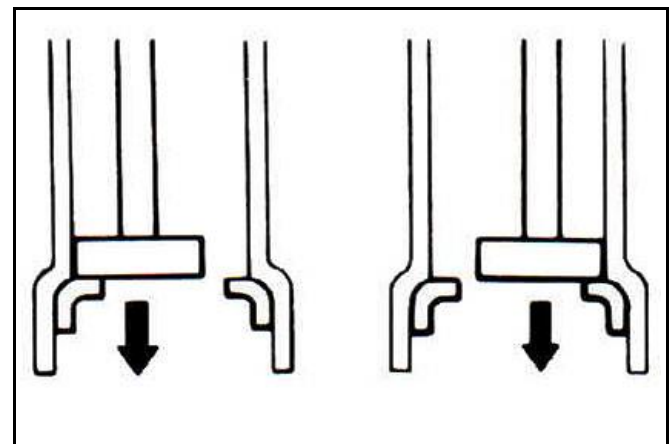


Slightly tap the top and bottom ball bearing seats with a plastic hammer to remove the seats.

Remove bottom cone race body with a punch.

⚠ Caution

- Do not damage the steering stem and frame.



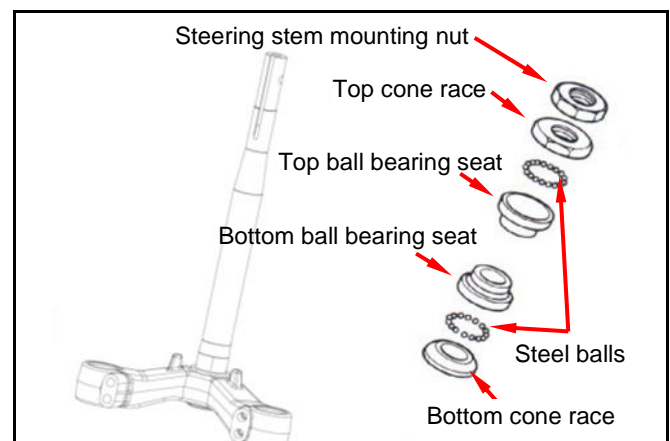
Installation

Install a new bottom cone race onto the steering stem and lubricate with grease.. Push the cone race until to mounted position.

⚠ Caution

- Do not tilt the ball bearing seats as installation.

Apply grease onto the ball bearing seats, and install steel balls onto the seats. (Top: 26 balls, bottom: 29 balls)



15. Steering / Front Wheel / Front Cushion

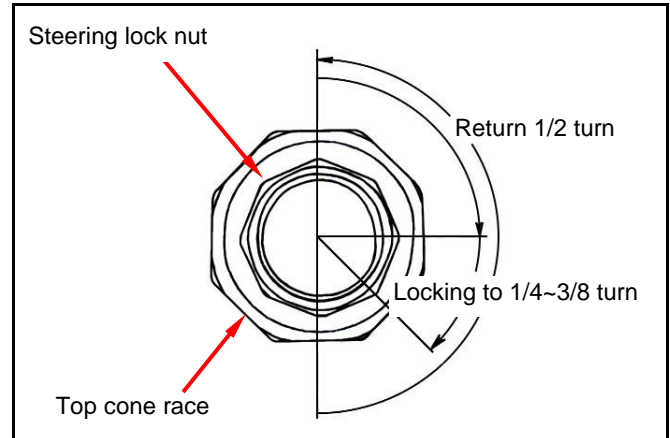


Install steering stem onto frame.
Lubricate the top cone race seat with grease.
Screw the cone race in to top ball bearing seat till touching, then screw out 1/2 turn, and then screw in 1/4~3/8 turn with specified torque value.

Torque value: 6.0~8.0kgf-m

Caution

- Do not over tighten the top cone race, or the bearing seats will be damaged.



Install steering stem mounting nut to hold top cone race, and then tighten the nut.

Torque value: 1.0~1.4kgf-m

Special tools:

Steering stem top thread wrench

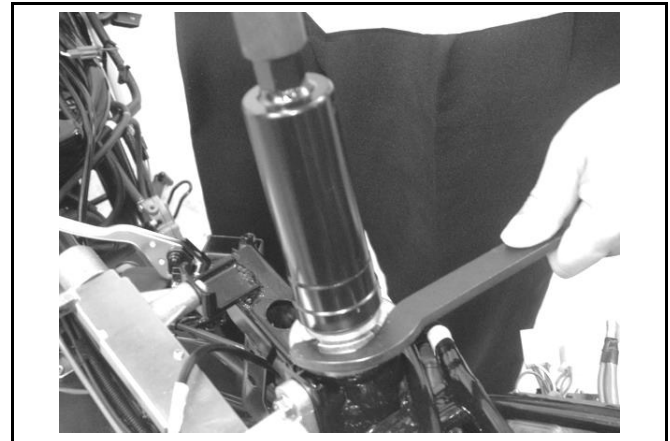
SYM-5320010

Handle stand nut wrench

SYM-5320000

Caution

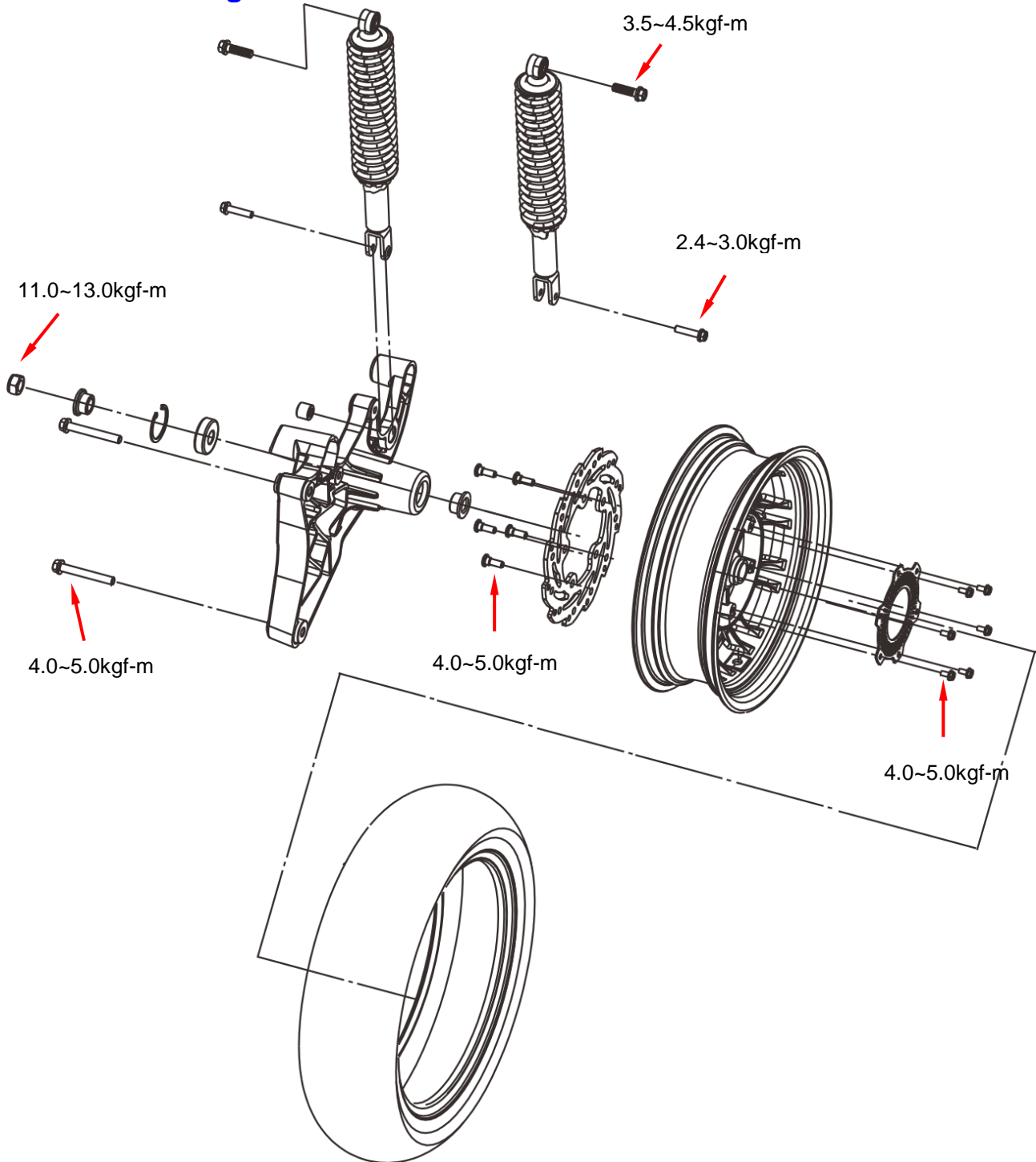
- Check the steering stem that should be rotated freely and no clearance in vertical direction.



Install other parts in reverse order of removal procedures.

Mechanism Diagram	16-1	Rear Wheel	16-3
Precautions in Operation	16-2	Rear Fork	16-5
Troubleshooting	16-2	Rear Cushion	16-9
Muffler	16-3		

Mechanism Diagram



Precautions in Operation

General Information

Please refer to the Maintenance Manual for tubeless tire in respect to the removal, repair and installation of the tires.

Service data

mm

Item		Standard	Allowable Limit
Run-out of rear rim	Radial	-	2.0
	Axial	-	2.0

Torque Value

Rear wheel axle nut	11.0~13.0kgf-m
Rear cushion upper bolt	3.5~4.5kgf-m
Rear cushion under bolt	2.4~3.0kgf-m
Rear fork mounting bolt	4.0~5.0kgf-m
Exhaust muffler mounting nut	1.0~1.2kgf-m
Exhaust muffler mounting bolt	3.2~3.8kgf-m
Brake clipper mounting bolt	2.9~3.5kgf-m
Brake disc mounting bolt	4.0~5.0kgf-m

Troubleshooting

Run-out of rear wheel

- Deformed or bent wheel hub
- Improper tires.
- Loose wheel shaft.

Soft Cushion

- Weak spring.

Noisy Brake

- Worn brake lining.
- Offset brake disc.
- Improper assembly of brake caliper.
- Brake disc or wheel imbalance.

Poor Performance of Brake

- Improperly adjusted brake.
- Contaminated brake lining.
- Worn brake lining.
- Air inside brake fluid pipe.
- Grease on brake disc.
- The brake fluid pipe is clogged.
- The brake fluid pipe is deformed or bent.
- Insufficient amount of brake fluid in the reservoir

Muffler

Removal

Loosen connecting bolt. (1 bolt)
 Loosen the mounting bolts on rear side. (3 bolts)
 Remove exhaust muffler.

Installation

Install in reverse order of removal procedures.

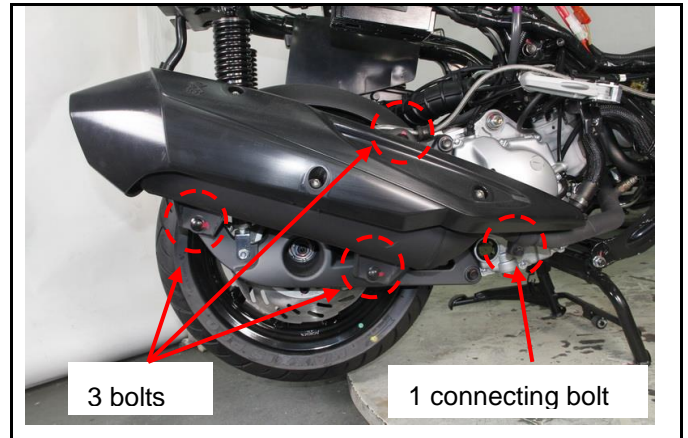
⚠ Caution

- Replace the front side muffler pipe gasket if worn or deformed.
- Remove O2 sensor coupler first before removing muffler.

Torque Value:

Muffler mounting bolt 3.2 ~ 3.8kgf-m

Muffler mounting nut 1.0 ~ 1.2kgf-m



Rear Wheel

Removal

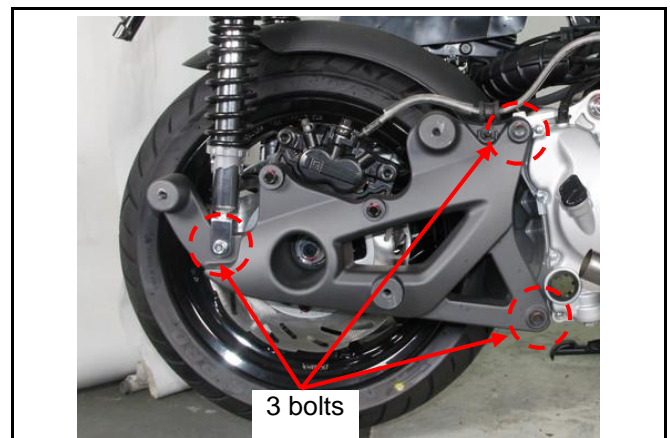
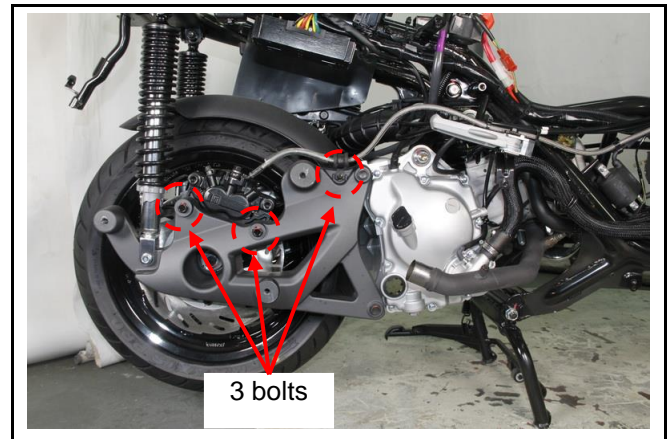
Remove 3 muffler mounting bolts and 1 connecting bolt.
 Remove brake caliper. (2 bolts)
 Remove brake hose clamp. (1 bolt)

⚠ Caution

- When caliper is removed, do not pull brake lever, or the brake pad will be pressed out.

Remove the lower bolt of the right side rear cushion.

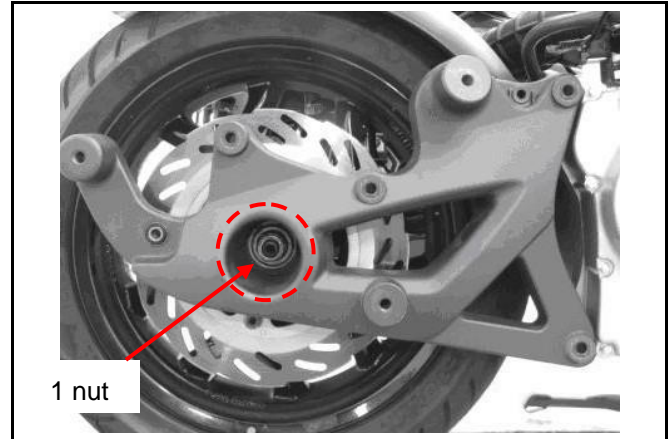
Remove 2 bolts of the rear fork.



16. Rear Wheel / Rear Fork / Rear Cushion



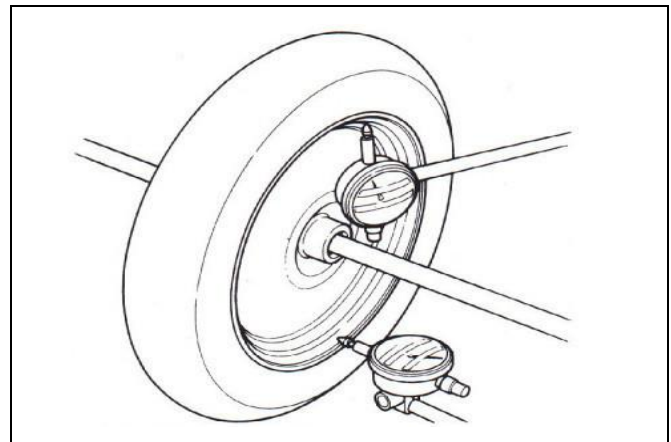
Remove rear wheel axle nut.



Remove rear fork and both side collars.
Remove the rear wheel.



Inspection of rear wheel rim
Place the wheel rim on a rotational support.
Rotate it by hand and measure the run-out with a dial indicator.
Run-out limit: 2.0 mm



Installation

Install in reverse order of removal procedures.

Torque Value:

Rear wheel axle nut 11.0~13.0kgf-m

Rear cushion upper bolt 3.5~4.5kgf-m

Rear cushion lower bolt 2.4~3.0kgf-m

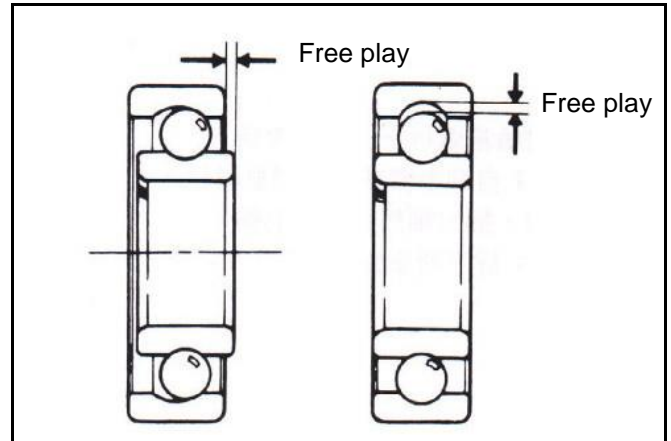
Brake clipper mounting bolt 2.9~3.5kgf-m

Rear Fork

Inspection of rear fork bearing

Rotate each bearing's inner ring with fingers. Check if bearings can be turned smoothly and silently, and also check if bearing outer ring is mounted tightly on rear fork.

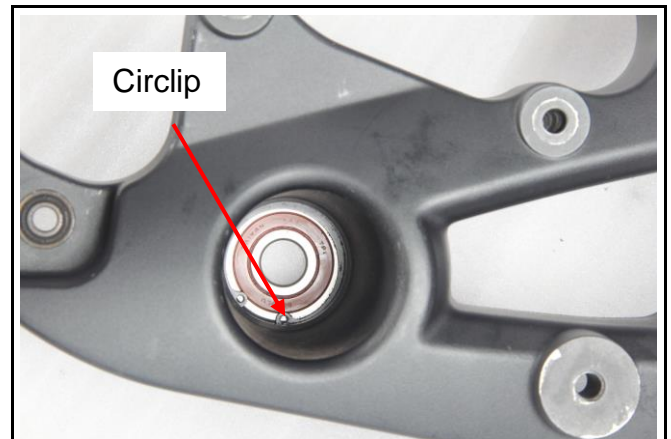
Replace the bearing, if the rotation is uneven, noisy, or loose bearing mounted.



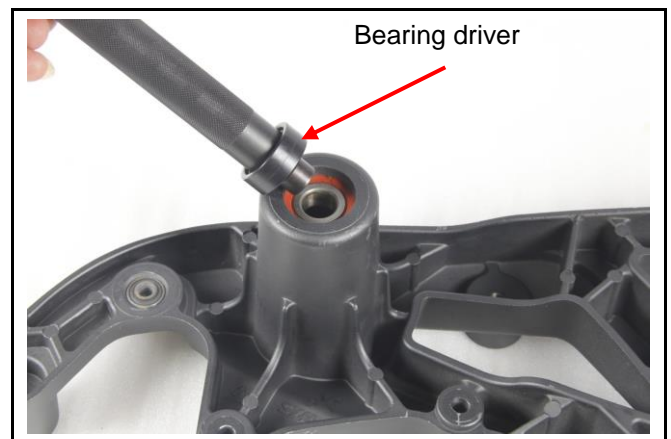
Tools for rear fork bearing replacement.



Use external pliers to remove the circlip.



Choose the correct bearing install puller.



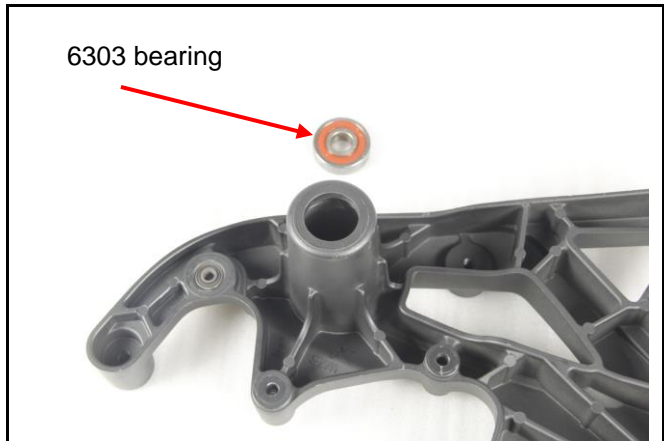
16. Rear Wheel / Rear Fork / Rear Cushion



Drive the bearing out by bearing install puller.



6303 bearing

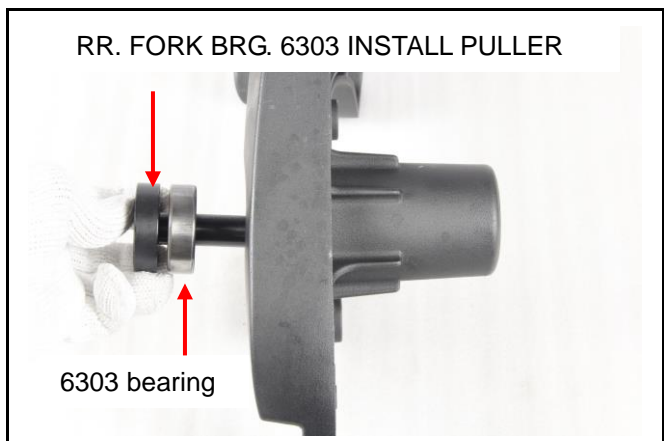


Special tools:
RR. FORK BRG. 6303 INSTALL PULLER
SYM-6303000-HMA H9A
BEARING INSTALL PULLER
SYM-2341100

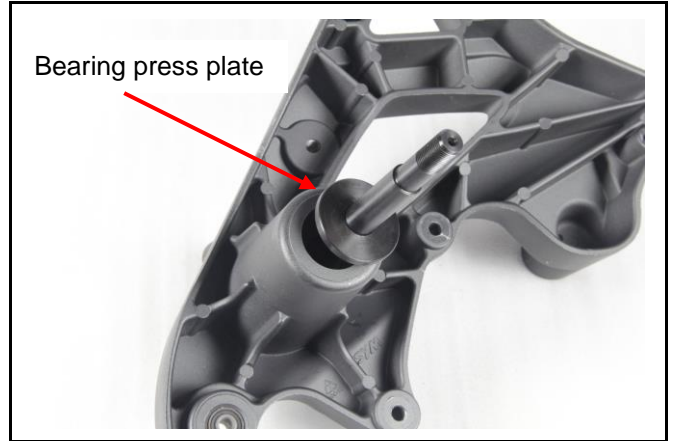


Install a new bearing and the RR. FORK BRG. 6303 INSTALL PULLER onto rear fork.

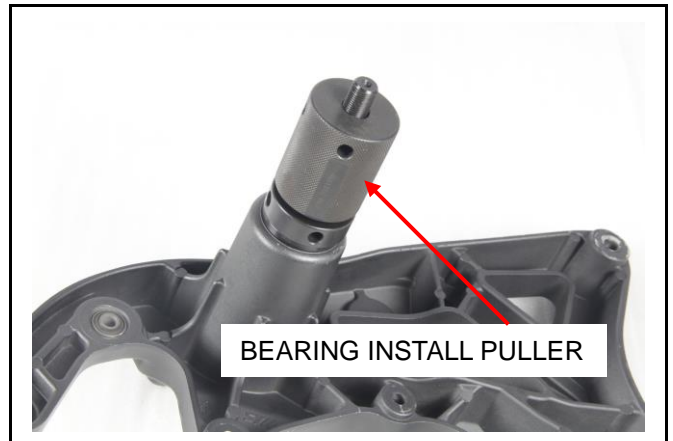
RR. FORK BRG. 6303 INSTALL PULLER



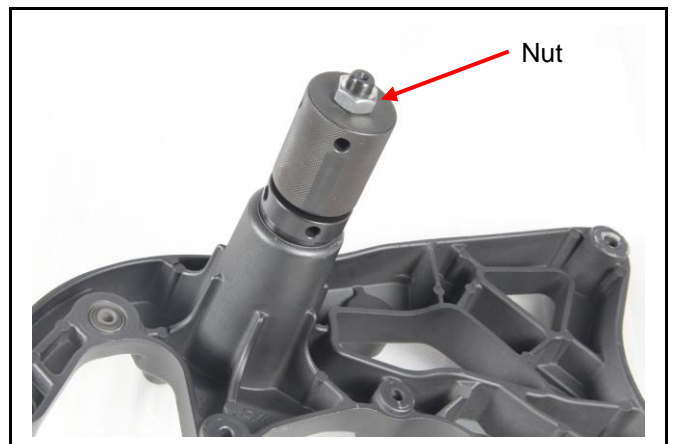
Install bearing press plate.



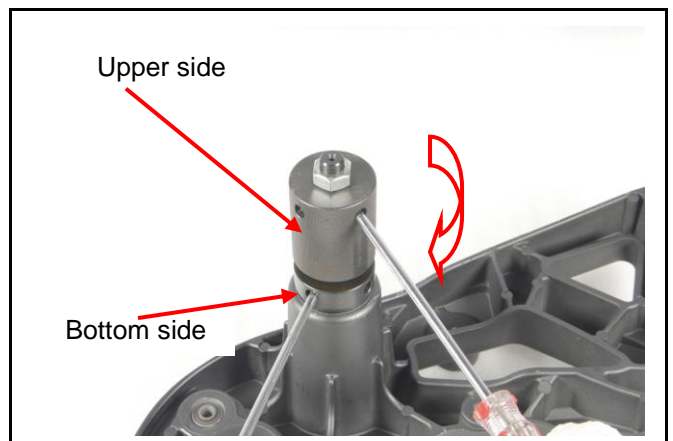
Install BEARING INSTALL PULLER with RR. FORK BRG. 6303 INSTALL PULLER. **BEARING INSTALL PULLER SYM-2341100**



Tighten the nut.



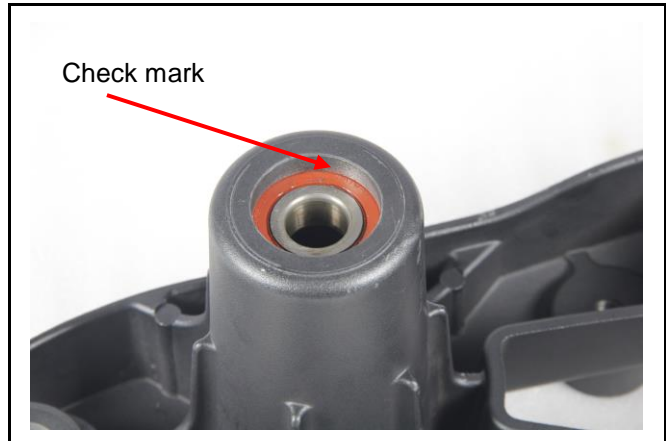
Hold bottom side of BEARING INSTALL PULLER with a screwdriver and rotate the upper side with another screwdriver clockwise.



16. Rear Wheel / Rear Fork / Rear Cushion



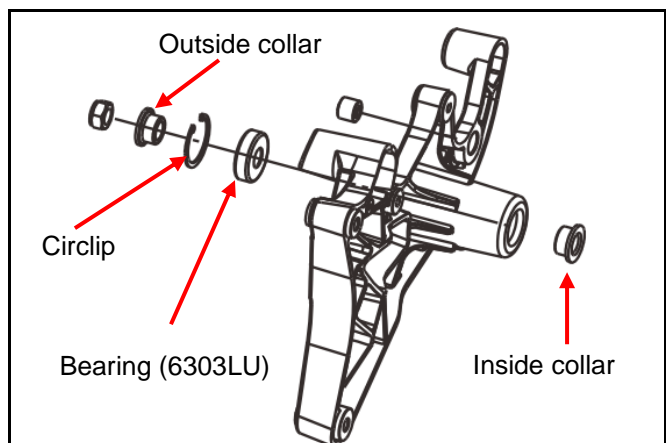
Press bearing into rear fork.
Check if bearing is on the correct position.



Install circlip.



Rear fork assembly diagram.



Rear Cushion**Removal**

Remove the luggage box, rear carrier and body covers.

Loosen the mounting bolts of the air cleaner. (2 bolts)

Remove the exhaust muffler. (3 bolts, 2 nuts)

Remove the under bolts of rear cushions. (1 bolt on each side)

Remove the upper bolts of rear cushions. (1 bolt on each side)

Remove rear cushions.

Installation

Install in reverse order of removal procedures.

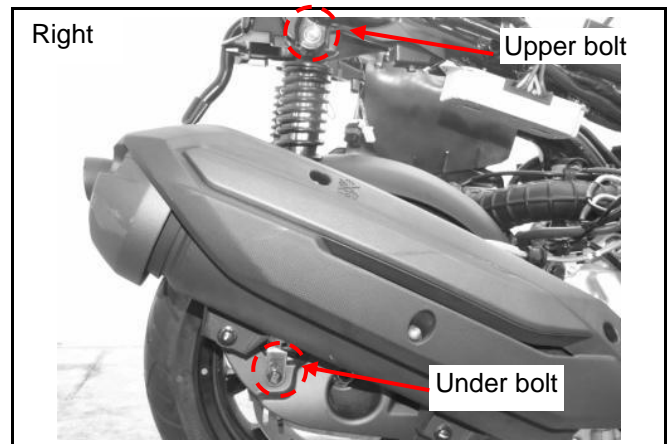
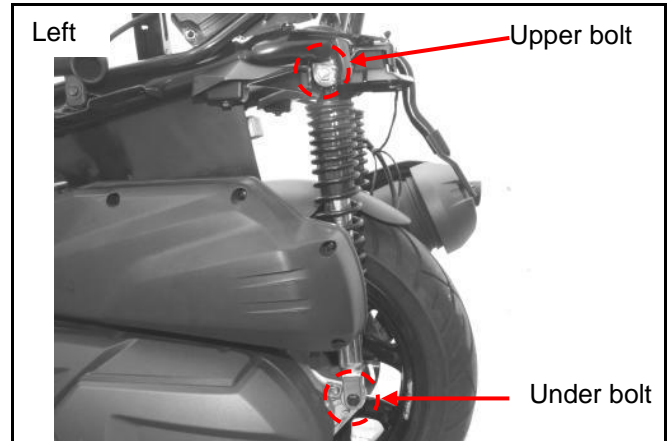
⚠ Caution

- The rear cushion must be replaced as a unit. Never disassemble the rear cushion, or structure and rubber boot will be damaged.

Torque Value

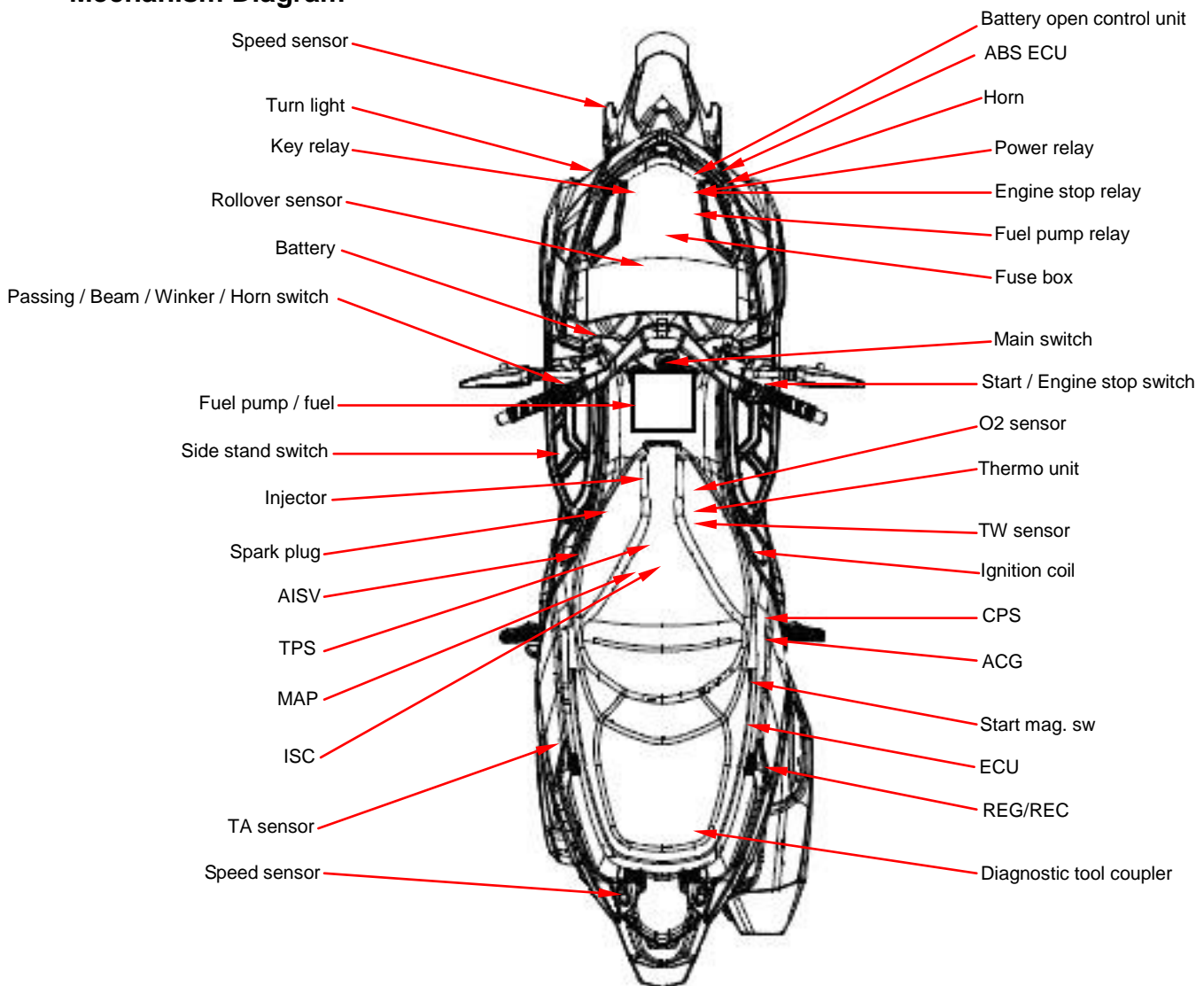
Rear cushion upper bolt: 3.5~4.5kgf-m

Rear cushion under bolt: 2.4~3.0kgf-m



Mechanism Diagram	17-1	Meter	17-13
Precautions in Operation	17-2	Light / Bulb	17-15
Troubleshooting	17-3	Switch / Horn	17-18
Battery	17-4	Fuel Unit	17-20
Fuse	17-5	Cooling Fan Thermo Switch	17-21
Charging System	17-6	Thermo Unit	17-22
Ignition System	17-9	Water Temperature Meter	17-22
Starting System	17-11		

Mechanism Diagram



Precautions in Operation

- When removing the battery, first disconnect the negative cable terminal, then the positive cable terminal.
- The model of the spark plug and the tightening torque.
- The ignition timing.
- Adjustment of headlight.
- Removal and installation of AC generator.
- The maintenance-free battery requires no inspection of electrolyte level and refilling of distilled water.
- To recharge the battery, remove the battery from rack without removing ventilation caps.
- Unless in emergency, never rapid-charge the battery.
- The voltage must be checked with the voltmeter while charging the battery.
- As ECU assembly does not require an ignition timing check. In case ignition timing is incorrect, check ECU and AC generator. Verify with an ignition timing light after replacement if necessary.

Specification

Charging system

Description		Specification
Battery	Capacity	12V10Ah
	Charging rate	1.2A / 5~10hr (standard) 5A / 1hr (fast charging)
Leak current		Below 10mA
Charging current		1.2A / 1500 rpm
Control voltage in charging		14.5±0.5 V / 2000 rpm

Ignition system

Description		LW30
Spark plug	Model	NGK CR8E
	Gap	0.6~0.7 mm
Ignition coil and resistance	Primary winding	2.8Ω±15%
	Secondary winding (without cap)	9.0 KΩ± 20%
	Secondary winding (with cap)	19.0 KΩ± 20%
Crankshaft position sensor resistance (20°C)		120Ω±20% (20°C)
Ignition timing advance	At idle speed	10° BTDC / 1550 rpm
	Full advanced	30° BTDC

Troubleshooting**No voltage****Battery discharged**

- Cable disconnected
- Fuse blown
- Improper operation of main switch

Low voltage

- The battery not fully charged
- Poor contact
- Poor charging system
- Poor voltage regulator

No spark

- Spark plug out of work
- Cable poorly connected, open or short-circuited between ACG and ECU / between ECU and ignition coil / between ECU and main switch
- Poor main switch
- Poor ECU
- ACG out of work

Starter motor does not work

- Fuse blown
- Battery not fully charged
- Poor main switch
- Poor starter switch
- Poor front or rear brake switches
- Starter relay out of work
- Cable poorly connected, open or short-circuited
- starter motor out of work

Intermittent power supply

- Loose charging system connector
- Battery cable poor connection
- Poor connection or short-circuit of the discharging system
- Poor connection or short-circuit of the power generation system

Charging system does not operate properly

- Fuse blown
- Poor contact, open or short circuit
- Poor regulator rectifier
- Poor ACG

Engine does not crank smoothly

- Primary winding circuit
 - ~ Poor ignition coil
 - ~ Poor connection of cable and connectors
 - ~ Poor main switch
- Secondary winding circuit
 - ~ Poor ignition coil
 - ~ Poor spark plug
 - ~ Poor ignition coil cable
 - ~ Current leakage in the spark plug cap
- Incorrect ignition timing
 - ~ Poor ACG
 - ~ Improper installation of CPS
 - ~ Poor ECU

Weak starter motor

- Poor charging system
- Battery not fully charged
- Poor connection in the windings
- Motor gear jammed by foreign material

Starter motor is working, but engine does not crank

- Poor starter motor pinion
- The starter motor runs in reverse direction
- Poor battery

17. Electrical System



Battery

Voltage Check

Use the digital voltmeter to check the voltage of the battery.

Fully charged: 12.8V ↑ at 20°C

Undercharged: 12.0 V ↓ at 20°C

⚠ Caution

- Keep flames away while recharging.
- Charging shall be controlled by the ON/OFF switch on the charger, not by battery cables.

Removal

Remove battery cover. (2 screws)
Disconnect the negative cable terminal first, then the positive cable terminal. Remove the battery.

Charging

Connect the positive terminal (+) of the charger to the battery positive terminal (+).
Connect the negative terminal (-) of the charger to the battery negative terminal (-).

	Standard	Maximum
Charging current	1.2A	5A
Charging time	5~10hr	1hr

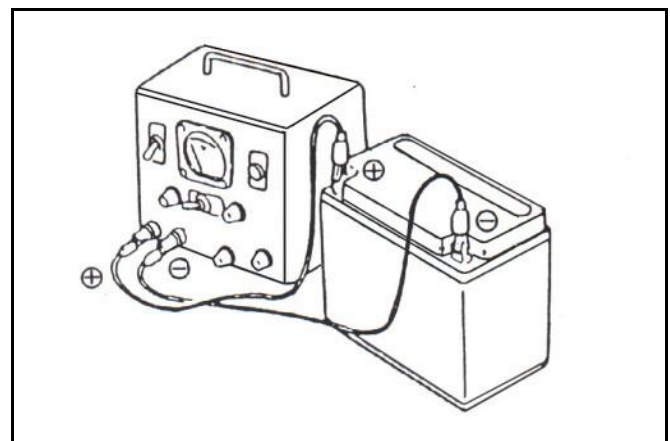
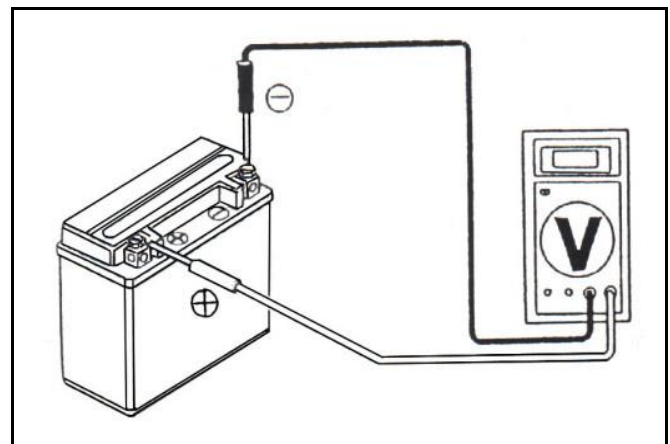
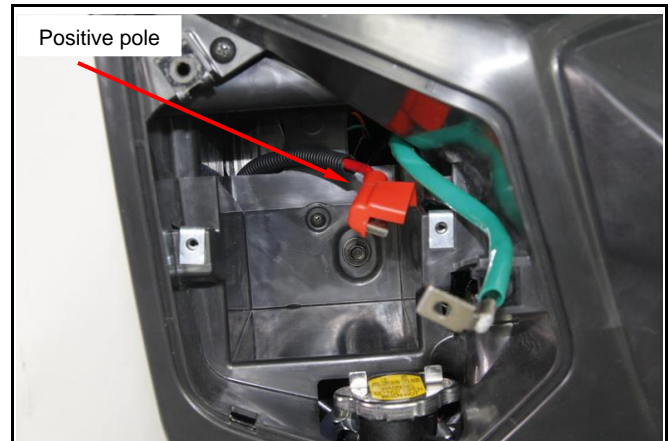
⚠ Caution

- Keep flames away while recharging.
- Charging shall be controlled by the ON/OFF switch on the charger, not by battery cables.

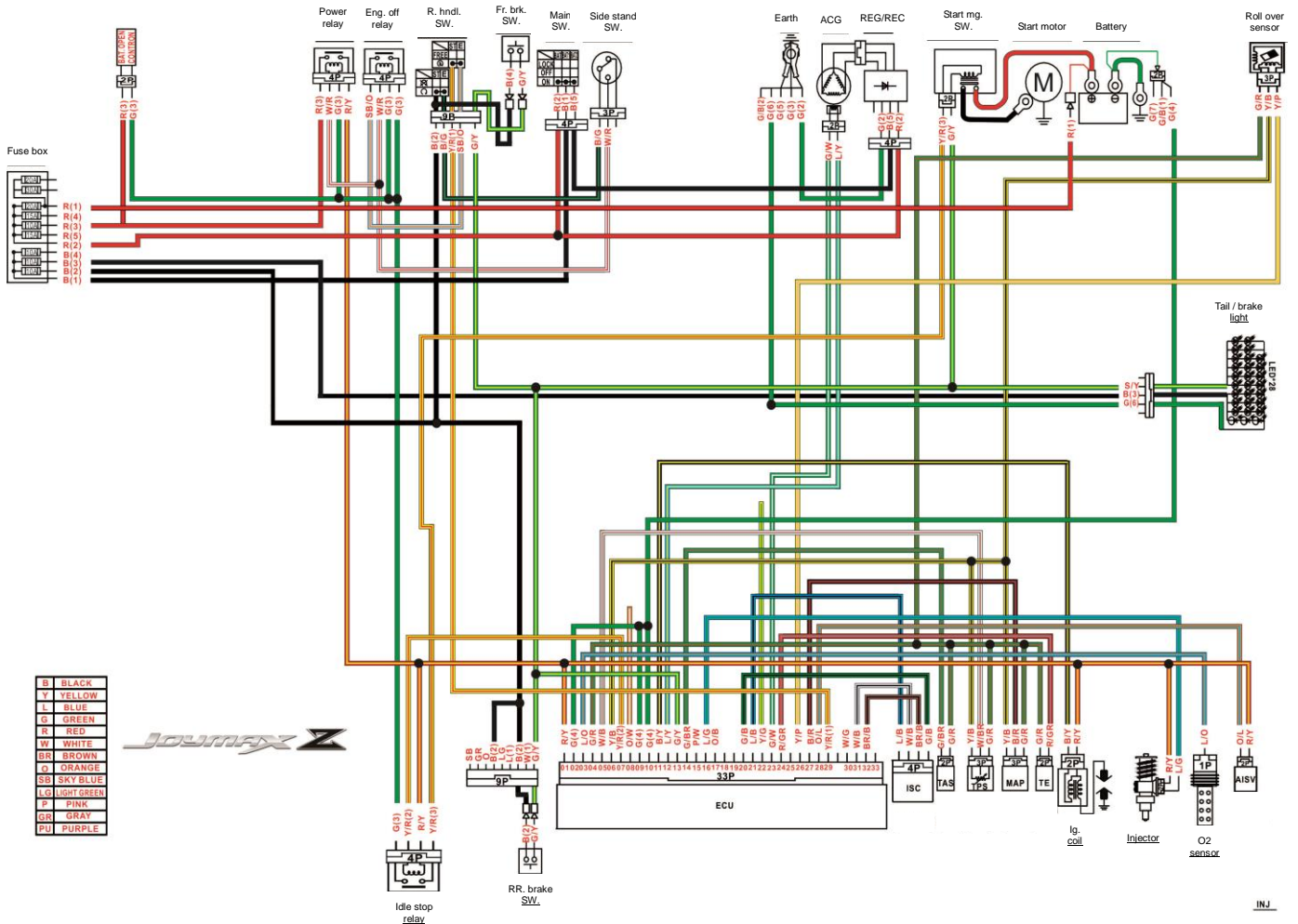
⚠ Caution

- Never rapid charge the battery unless in emergency.
- Verify the battery is recharged with current and duration prescribed above.
- Large current and fast time charging will damage battery.
- Check battery capacity after charging completed 3 hours later.

When installing the battery, coat the cable terminal with grease.



Starting / Charging / Ignition system



Charging System

Regulator rectifier electrical impedance Inspection (KΩ)

	+	Y1	Y2	Y3	R	B	G
Y1			∞	∞	∞	∞	∞
Y2		∞		∞	∞	∞	∞
Y3		∞	∞		∞	∞	∞
R		∞	∞	∞		∞	∞
B		5~30	5~30	5~30	∞		1~10
G		2~20	2~20	2~20	∞	1~10	

replace the regulator rectifier.

Inspection on regulator rectifier wire

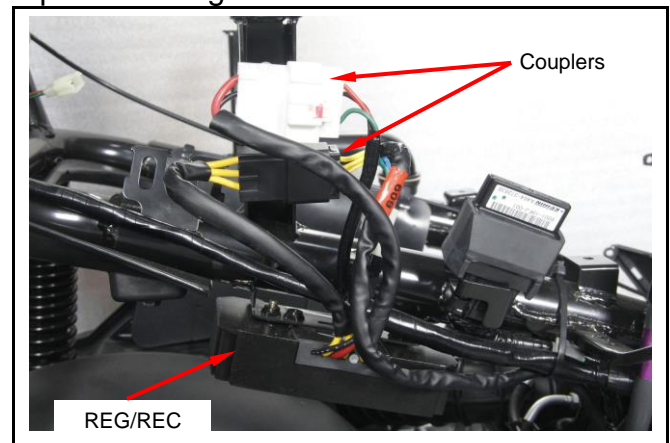
Remove the luggage box, rear carrier and body covers.

Inspect the rectifier coupler to the wire harness condition.

Item	Check Points	Standard Value
Main switch connection	R- B	Battery voltage (ON)
Battery connection	R- G	Battery voltage
Charging coil	Y- Y	0.2~0.4Ω

If the readings measured are not normal, check parts in the circuit.

If there is nothing wrong with parts and wiring,



Inspection on AC. Generator charging coil

Remove the luggage box, rear carrier and body covers.

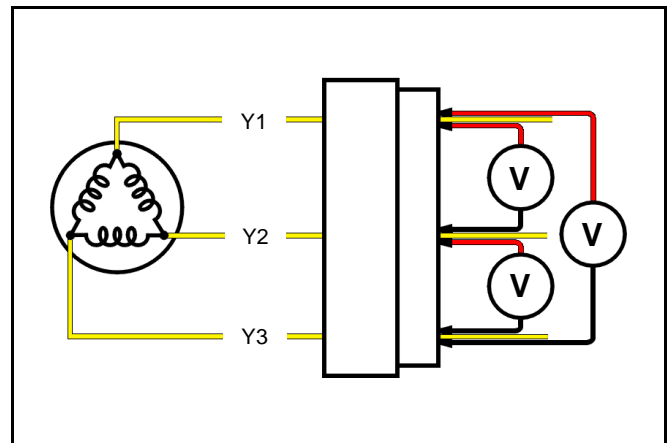
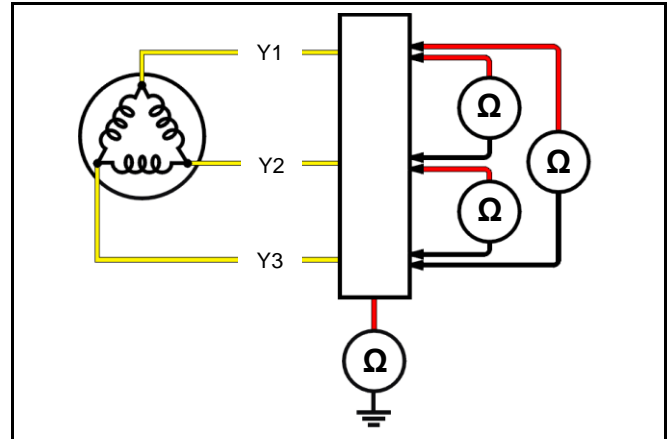
Connect an ohmmeter to the each terminal end.

Check the continuity of the each terminal end, and engine ground with short circuit?

If there is no continuity or short circuit, replace the AC. Generator.

	V	Ω
Y1	70~80	0.24±20%
Y2	70~80	0.24±20%
Y3	70~80	0.24±20%

And you can check voltage when engine is running.



Current Leakage Inspection

Turn the main switch to OFF position, and remove the negative cable terminal (-) from the battery.

Connect an ammeter between the negative cable terminal and the battery negative terminal.

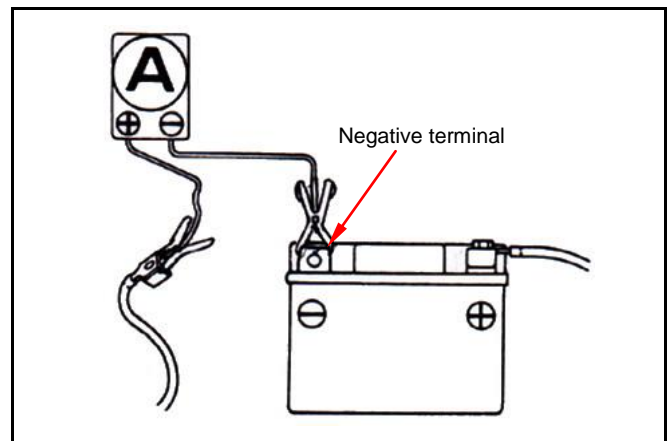
Caution

- In the current leakage test, set the current range at the largest scale, then gradually decrease to the lower scale as the test process goes to avoid possible damage to the ammeter and the fuse.
- Do not turn the main switch to ON position during test.

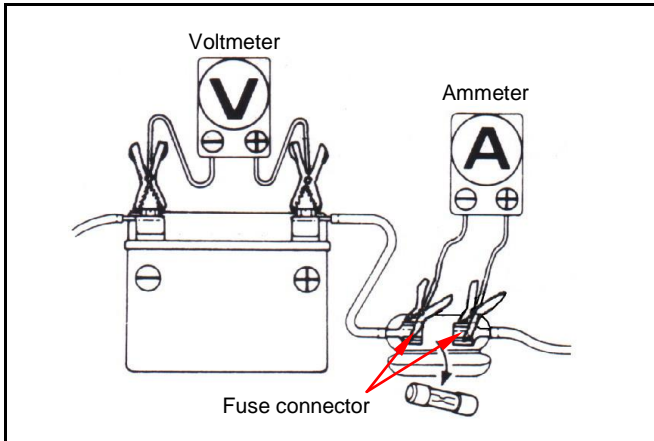
If the leaking current exceeds the specified value, it may indicate a short circuit.

Leaking current: under 10mA

Under testing condition, disconnect each point to find out the short.



Inspection on Charging Voltage



⚠ Caution

- Before conducting the inspection, be sure that the battery is fully charged.
- If undercharged, the current changes dramatically.
- While starting the engine, the starter motor draws large amount of current from the battery.

After the engine is warmed up, replace original battery with a fully charged battery. Connect a digital voltmeter to the battery terminals. Connect an ammeter between both ends of the main fuse.

⚠ Caution

- Please use an ammeter having an indication that the current flows from the positive or the negative direction. If using an ammeter with only one direction, the discharging current will be 0 A.

⚠ Caution

- Do not use a short-circuit cable.
- The main switch shall be turned to OFF position during the process of inspection. Never tamper with the ammeter and the cable while there is current flowing through. It may damage the ammeter.

Connect a tachometer.

Start the engine and turn on the headlight to high beam.

Accelerate the engine to the specified revolution per minute and measure the charging voltage.

Charging Current:

0.4A/2500 rpm (Headlight on)

1.0A/6000 rpm

Charging Voltage:

14.5V/1500 rpm

⚠ Caution

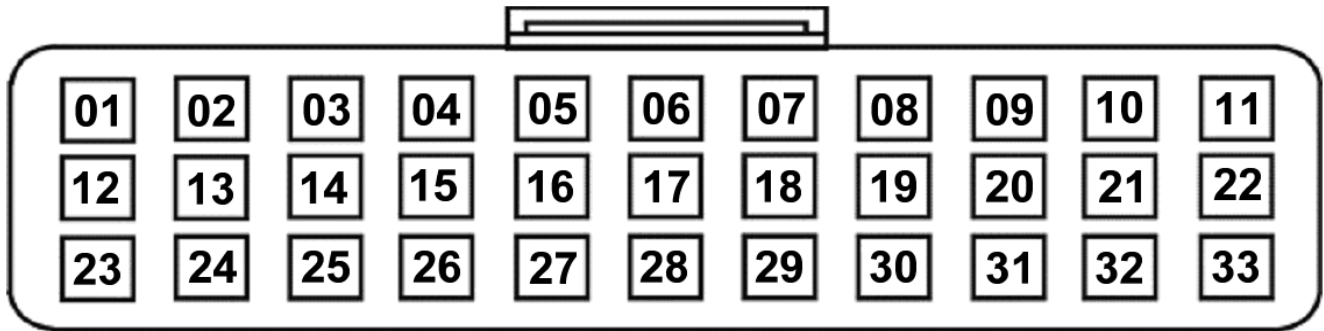
- When replacing a new battery, be sure the charging current and voltage is normal.

The following problems are related to the charging system, follow the instructions provided in the checking list to correct it if any one of the problems takes place.

- ①. The charging voltage cannot exceed the voltage between two battery terminals and the charging current is in the discharging direction.
- ②. The charging voltage and current are much higher than the standard values.

The following problems are not related to the charging system; correct it if any by following steps indicate in the checking list.

- ①. The standard charging voltage and current can only be reached when the revolution of the engine exceeds the specified rpm.
 - Bulbs used exceed their rate and consume too much power.
 - The replacement battery is aged and does not have enough capacity.
- ②. The charging voltage is normal, but the current is not.
 - The replacement battery is aged and does not have enough capacity.
 - Battery used does not have enough electricity or is over charged.
 - The fuse of the ammeter is blown.
 - The ammeter is improperly connected.
- ③. The charging current is normal, but the voltage is not.
 - The fuse of the voltmeter is blown.

Ignition System**ECU coupler (ECU. side)**

- 01 pin(R/Y): Drive components Power.
- 23 pin(G/W): Crankshaft position sensor negative
- 12 pin(L/Y): Crankshaft position sensor positive
- 11 pin(B/Y): Ignition coil

Inspection on ignition coil

Remove right floor cover.

Disconnect the connector of the ignition coil.

Measure the resistance between the terminals of the primary winding.

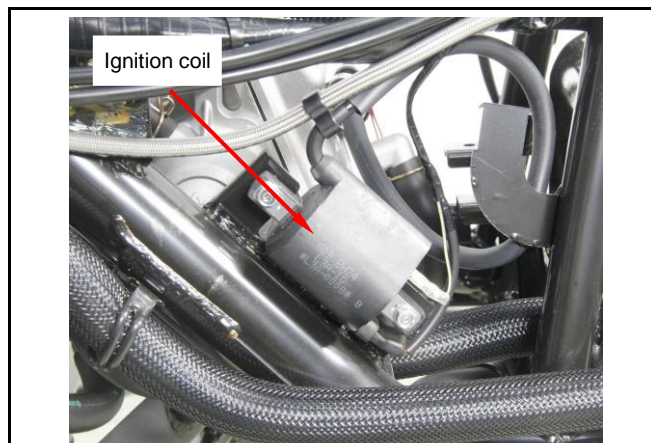
Standard resistance: $2.8\Omega \pm 15\%$ (20°C)

Measure the resistance between the terminals of the second winding.

Standard resistance:

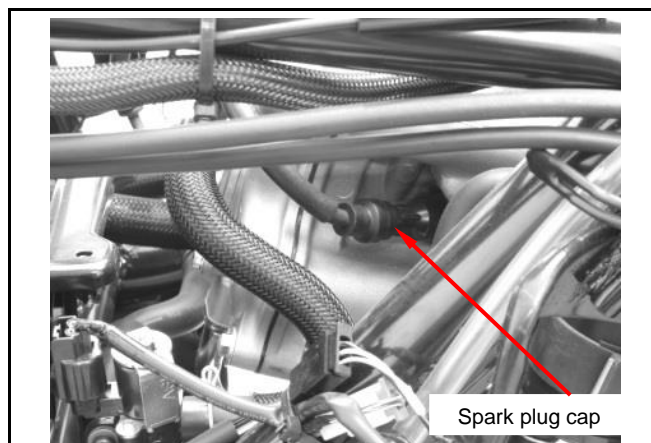
$9.0\text{ K}\Omega \pm 20\%$ (without cap)

$19.0\text{ K}\Omega \pm 20\%$ (with cap)



Replacement on ignition coil

Remove the cap from the spark plug.



Loosen 2 bolts and replace the ignition coil

Inspection of crank position sensor

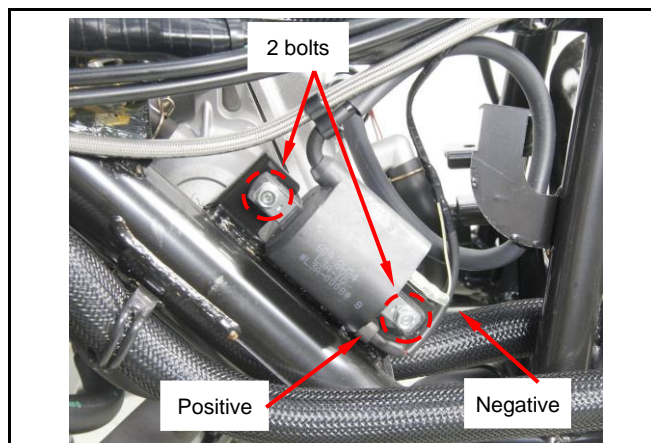
Remove luggage box. (6 bolts)

Disconnect the coupler of the crank position sensor and measure the resistance between the terminals of green/white and blue/yellow.

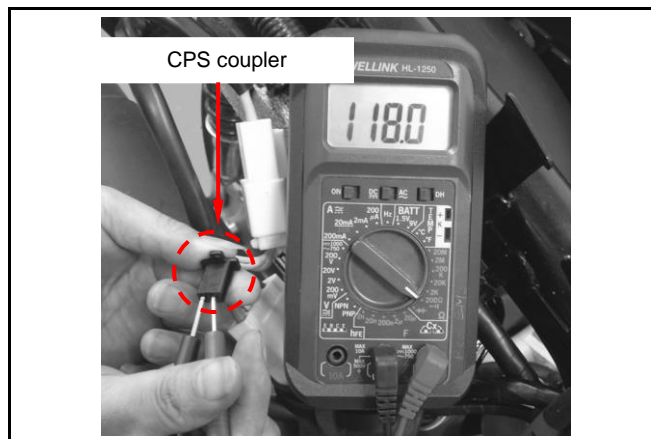
Standard resistance: $120\Omega \pm 20\%$ (20°C)

Caution

- When conducting the test, it is not necessary to remove the cables from engine.



Please refer to chapter 10, if it is necessary to replace the cables.



Starting System

Inspection on starter relay

Open the main switch.

Press the brake.

Push down the starter switch.

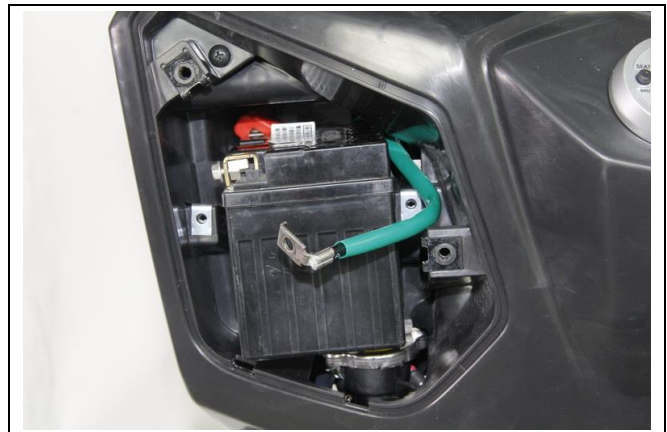
If a sound of “Looh Looh” is heard, it indicates the relay functions normally.

Open the inner box lid, and remove battery cover.

Disconnect the negative cable terminal of the battery.

Remove the luggage box.

Disconnect the cable positive terminal from the start relay.



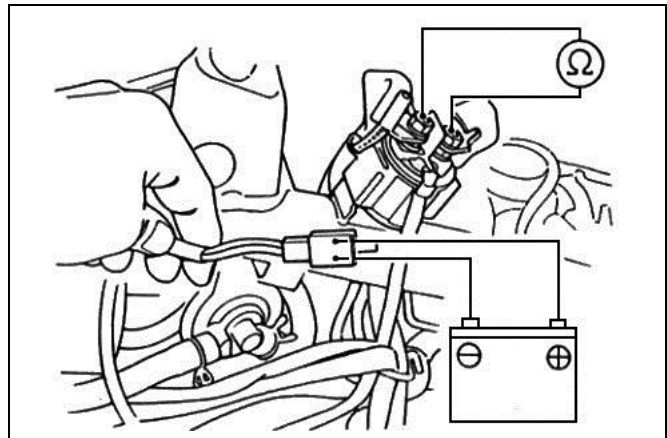
Disconnect the coupler of the relay.

Connect an ohmmeter to the large terminal end.

Connect the yellow/red cable to the battery positive terminal and the green/yellow cable to the battery negative terminal.

Check the continuity of the large terminal end.

If there is no continuity, replace the relay.



Removal of starter motor

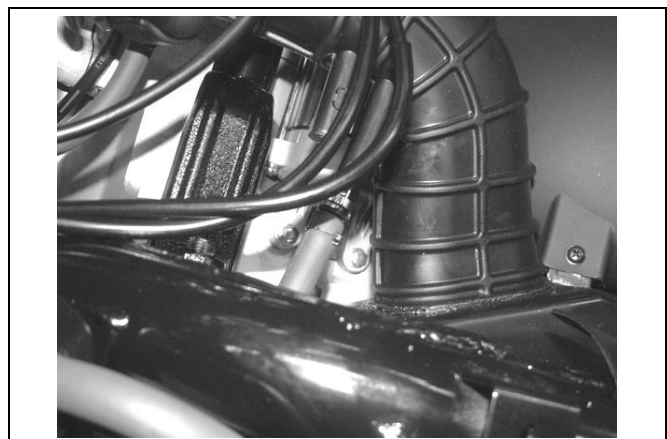
Turn off the main switch

Remove the luggage box.

Disconnect the negative terminal of the battery.

Disconnect the starter motor power cable.

Loosen 2 bolts and remove starter motor.



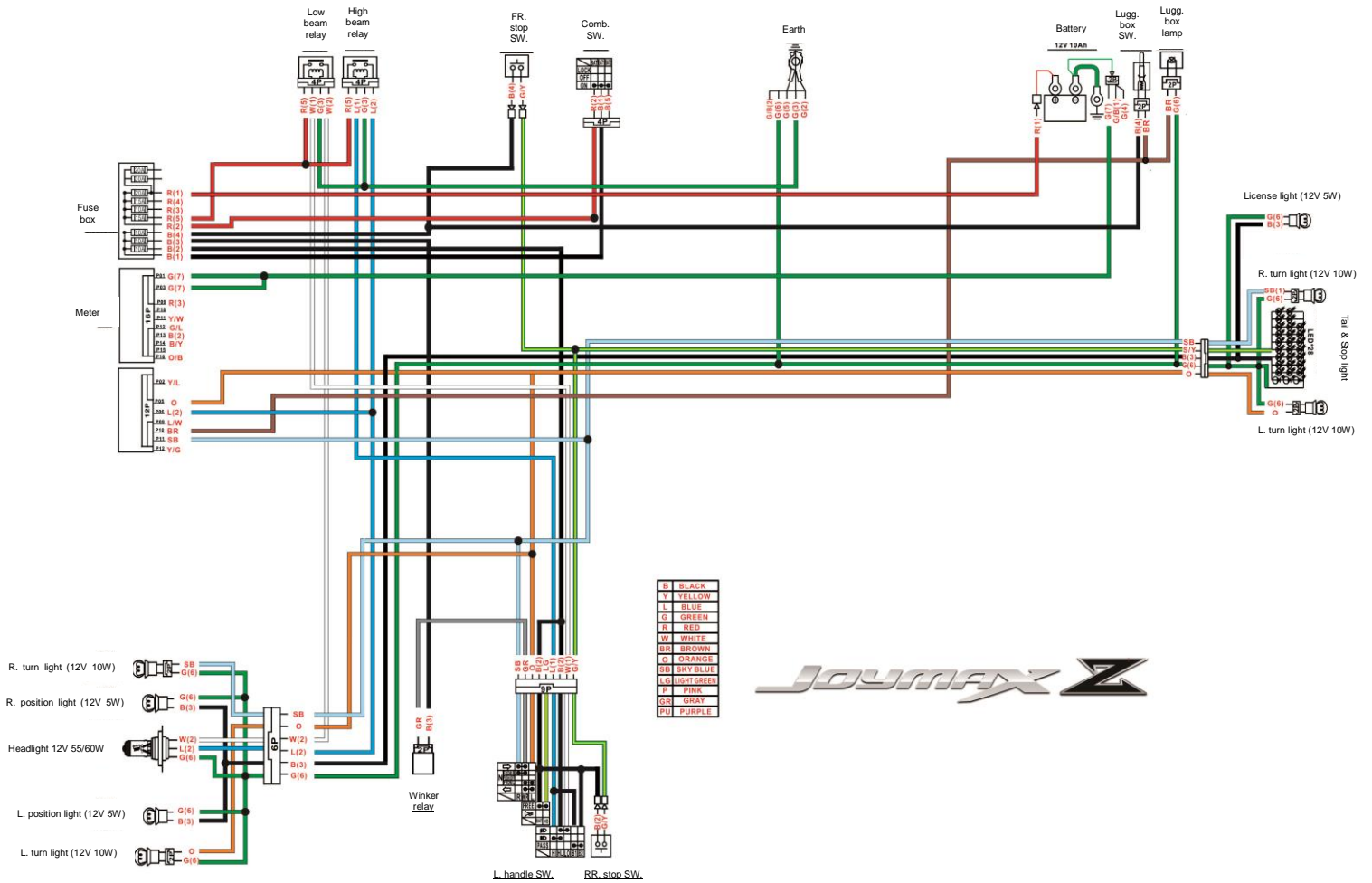
Installation of starter motor

Install in reverse order of removal procedures.

17. Electrical System



Meter and Light System Light circuit diagram



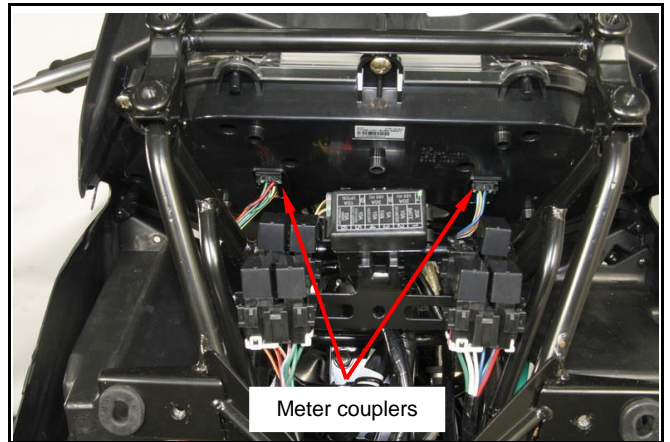
JOYMAX Z

Removal of meter

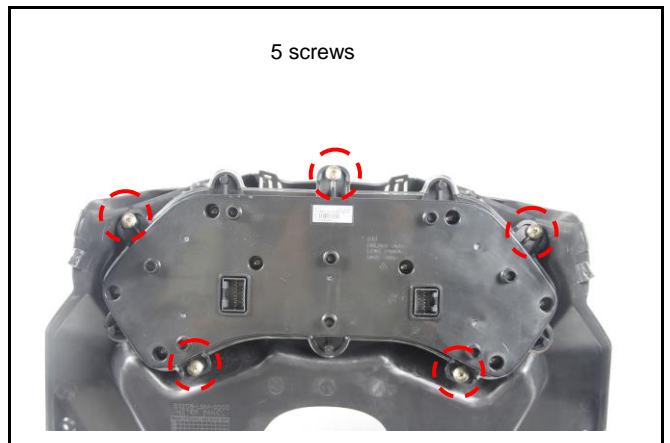
Remove wind screen garnish, wind screen, front top cover, and meter panel.
(refer to chapter 13)



Disconnect the couplers of the speedometer, and remove the meter panel and meter.



Loosen 5 screws from meter panel.
Remove the speedometer.



Installation of meter

Install in reverse order of removal procedures.

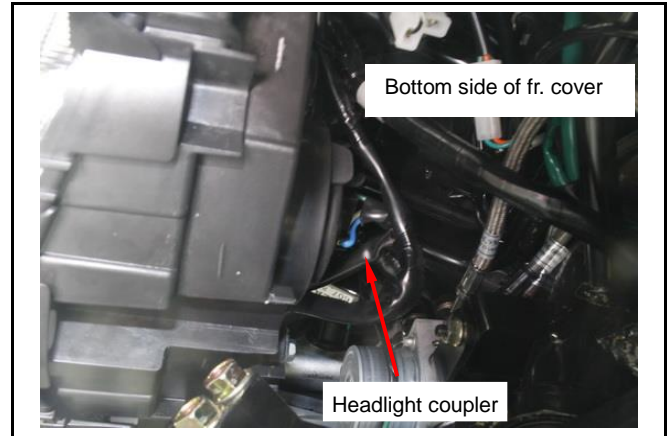
17. Electrical System



Light / Bulb

Headlight bulb replacement

Service from the bottom side of front cover.



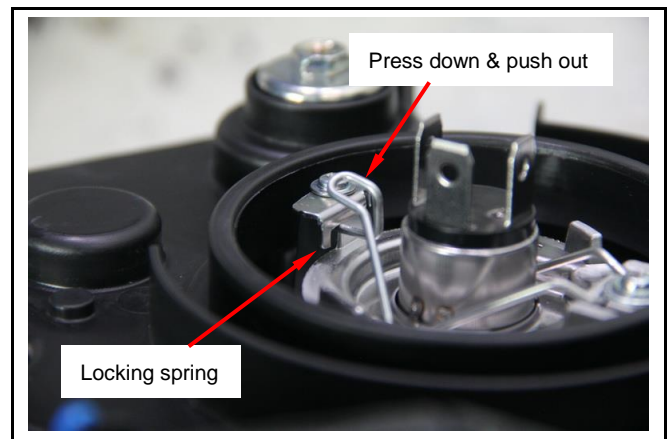
Disconnect the headlight coupler.



Remove the rubber protector.



Press down the locking spring and push out to detach from groove.



Remove the bulb.

Replace with new bulb if necessary.

Specification:

Lo-beam bulb 12V 55W (HS1)

Hi-beam bulb 12V 60W (HS1)

⚠ Caution

- Never touch the bulb with bare fingers, which may create a heat point and lead to premature bulb failure.
- Clean the fingerprint left on the bulb with alcohol.

Installation

Install the bulb of the headlight in reverse order of removal.

After installation, check if the headlight functions normally.



Check and adjust headlight beam.



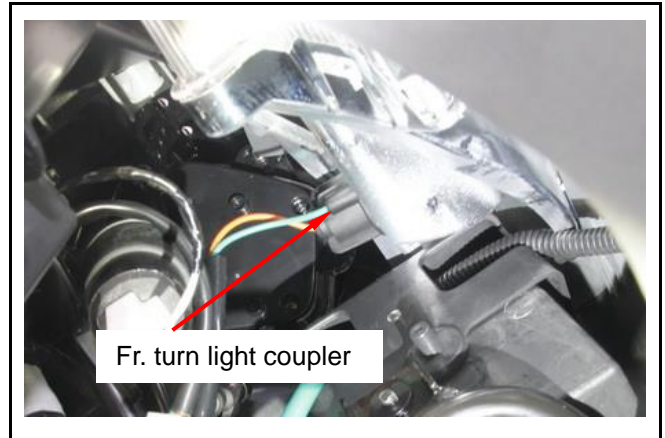
Use a screwdriver to adjust the beam.



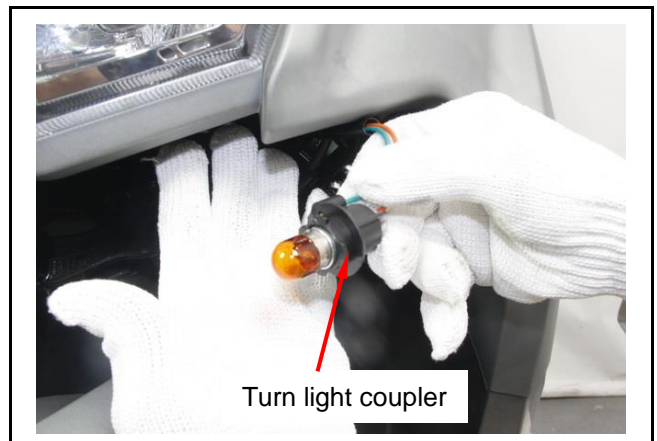
17. Electrical System

Front turn light bulb replacement

Service from the bottom side of front cover.



Turn the coupler counter-clock-wise to remove coupler and bulb.



Press bulb down and turn counter-clock-wise to remove the bulb.

Replace with new bulb if necessary.

Specification:

Turn light bulb: 12V 10W

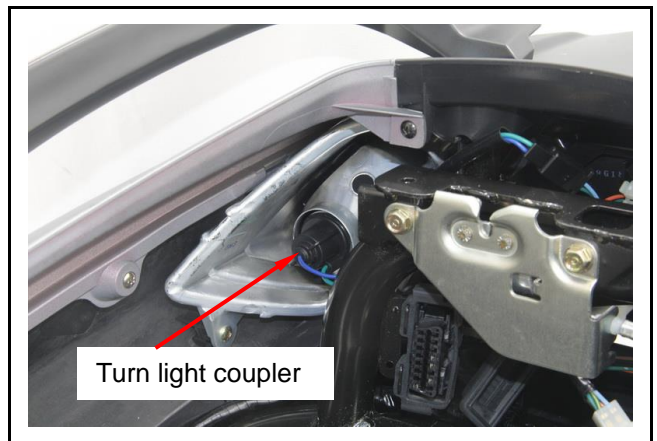


Front turn light bulb replacement

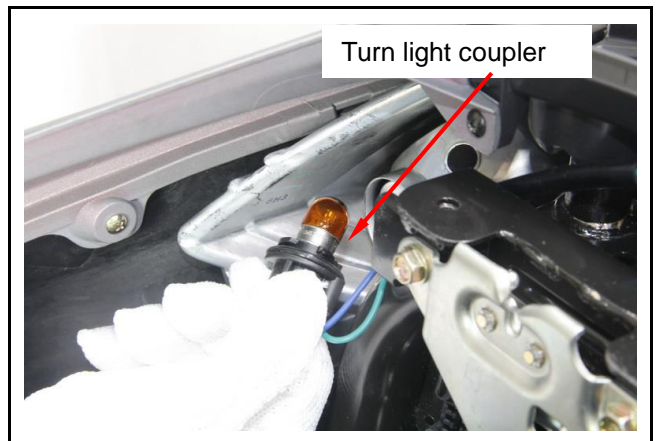
Remove luggage box.



Turn the coupler counter-clock-wise to remove coupler



Remove coupler and bulb.



Press bulb down and turn counter-clock-wise to remove the bulb.

Replace with new bulb if necessary.

Specification:

Turn light bulb: 12V 10W



17. Electrical System



Switch / Horn

Main switch

Inspection

Remove the front cover. (refer to chapter 13)

Disconnect the main switch coupler.

Check the continuity between two points as indicated below:

Position \ Pin	BAT	BAT1	BAT2
LOCK			
OFF			
ON	●	●	●
Wire color	R	B	B

Replacement of main switch

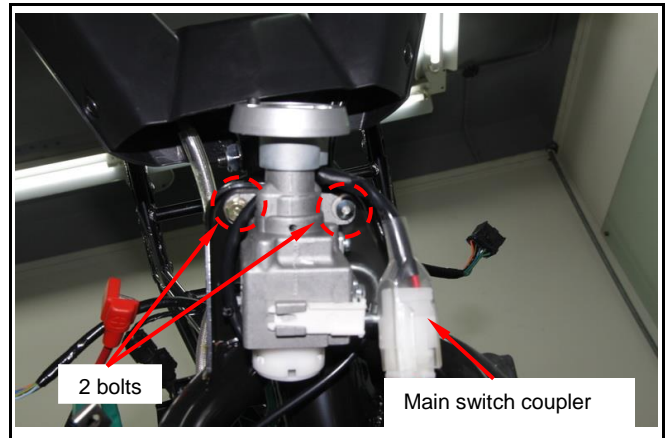
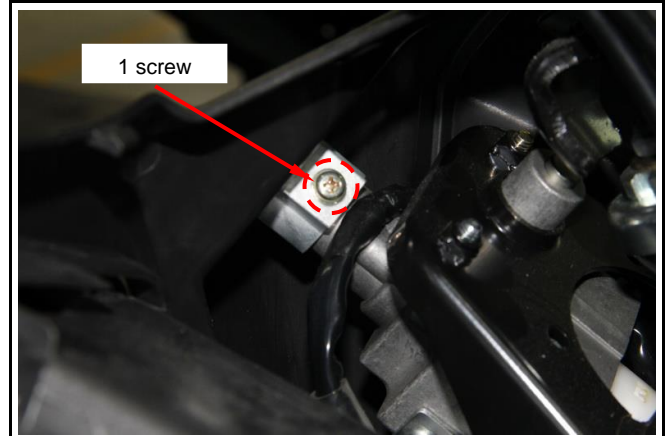
Remove main switch cap.

Disconnect the coupler of the main switch and loosen the mounting bolts. (2 bolts)

Remove the main switch.

Install the new main switch and tighten the mounting bolts.

Install the main switch coupler and cap.



Right handle switch

Remove the handlebar cover and front cover.

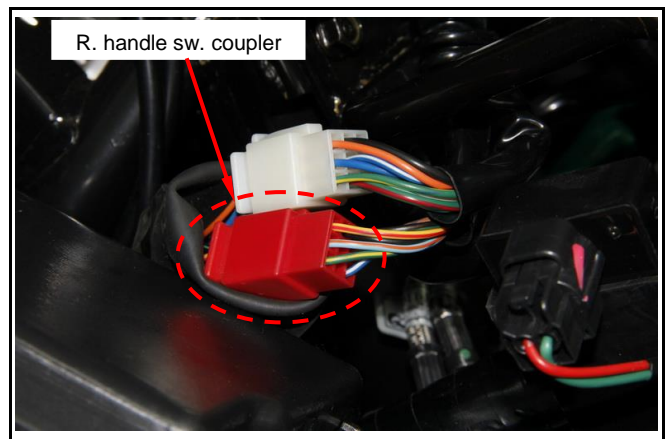
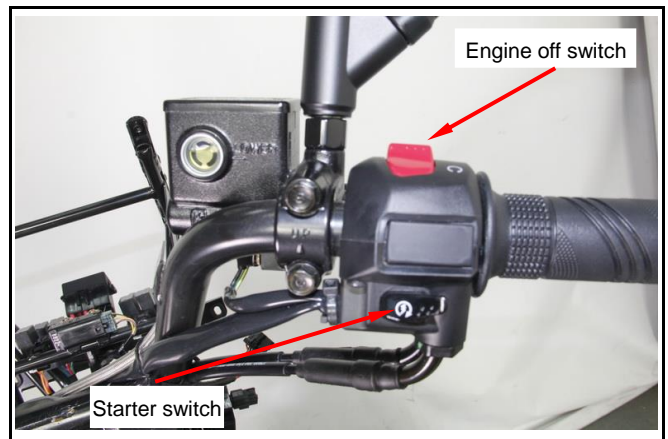
(refer to chapter 13)

Disconnect the right handle switch coupler.

Check the following switch circuit.

Starter / engine off switch

Position \ Pin	ST	E	ST	E
	●	●		
FREE				
			●	●
Wire color	B	B/G	Y/R	SB/O



Left handle switch

Remove the handlebar cover and front cover.
(refer to chapter 13)

Disconnect the left handle switch coupler.
Check the following switch circuit.

High /Low beam switch

	HI	HL	LO	B1	B2
		●—●	●—●		
	●—●	●—●			
PASS				●—●	●—●
Wire color	L	B	W	B	B

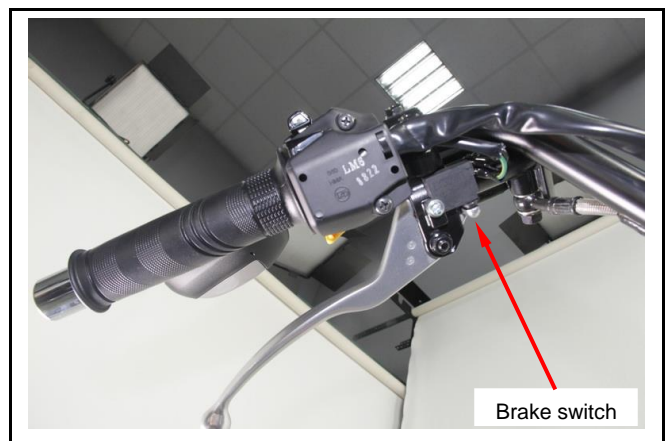
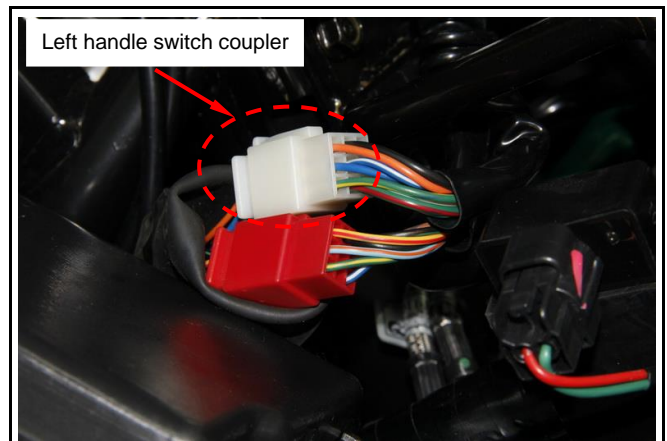
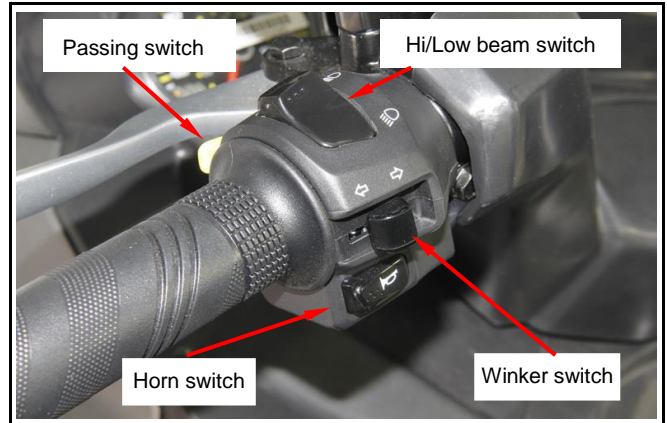
Winker switch

	Pin	R	WR	L
Position				
		●—●	●—●	
N	FROM R	●—●	●—●	
	PUSH OFF			
	FROM L		●—●	●—●
			●—●	●—●
Wire color		SB	B	O

Brake Switch

While pulling the brake lever, the terminals of white/green and green/yellow of the brake should have continuity.

Replace the switch if damaged.



17. Electrical System

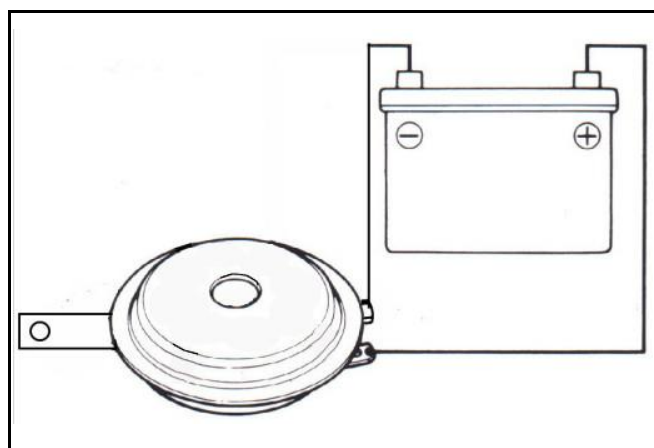


Horn

Remove the front cover and front under spoiler.

Apply 12 V power source to two terminals of the horn, the horn should sound.

Replace the horn if necessary.



Fuel unit

- Remove the luggage box and rear carrier.
- Remove right & left side cover.
- Remove the body cover.
- Remove the floor panel.
- Disconnect the coupler.
- Remove the fuel pump with fuel unit.

Caution

- Do not bend or damage the float arm when removing.

When the float arm shifts to the F position or the E position, the resistance measured shall be as follows:

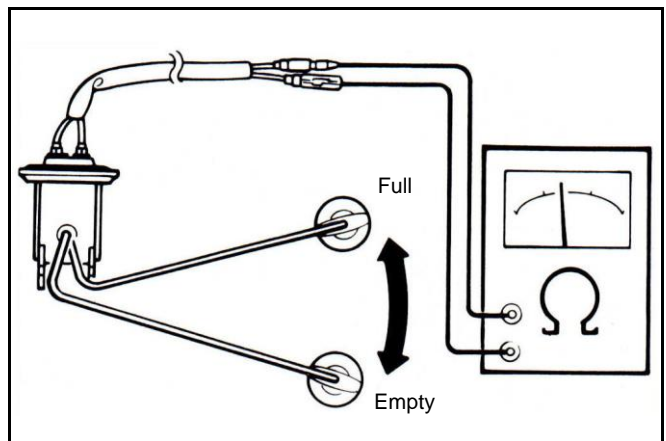
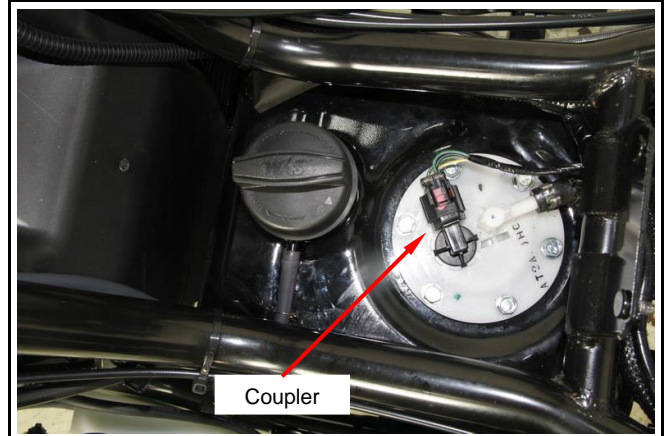
Arm Position	Resistance
E (Empty)	95~105 Ω
F (Full)	1130~1170 Ω

Connect the coupler to wire harness.
Turn on main switch.
Move the float arm to verify the proper position the fuel gauge needle indicates.

Arm Position	Needle Position
Up (Full)	F (Full)
Down (Empty)	E (Empty)

Caution

- While conducting the test, turn on the direction indication lamp to make sure that the battery is in serviceable condition.



Cooling fan thermo switch

The thermo switch is mounted on the radiator to control the operation of the cooling fan motor. In case the fan motor fails, disconnect the green and black/blue leads and connect jump wires to the terminals, turn on the main switch, the fan motor should operate.

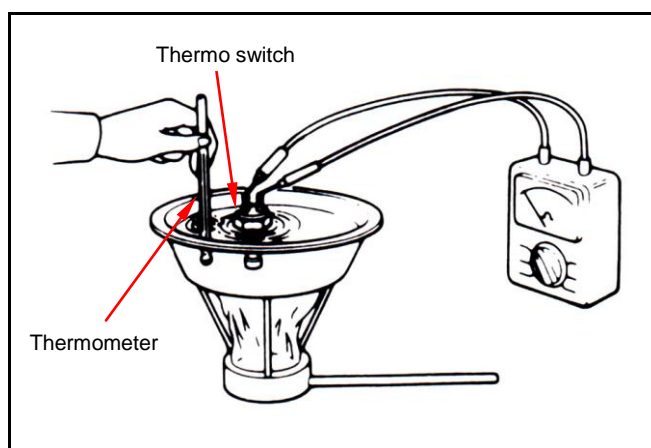
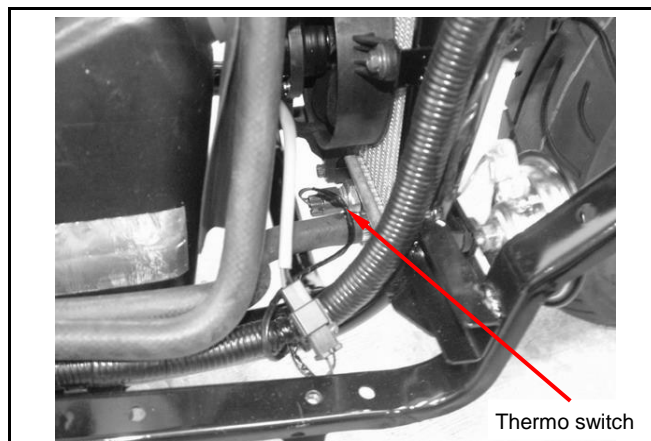
If the fan motor still fails, measure battery voltage between the green and black / blue leads.

If there is no voltage, check if fuse is blown, loose connection or short-circuit. If the fan motor runs, check the thermo switch in the manner as below:

Hang the thermo switch on the bowl filled with coolant to check the switch's opening and closing temperatures, confirm the switch is open circuited at room temperature, increase the coolant temperature gradually. The switch should have a continuity at 95-101°C.

Caution

- Keep the coolant at a constant temperature at least for three minutes. Sudden coolant temperature change will cause the thermometer and the tester to indicate wrong readings.
- Never let the thermometer and the thermo switch contact the wall of the bowl, which may result in wrong readings.
- The thermo switch shall be placed in the coolant until the thread is completely submerged.

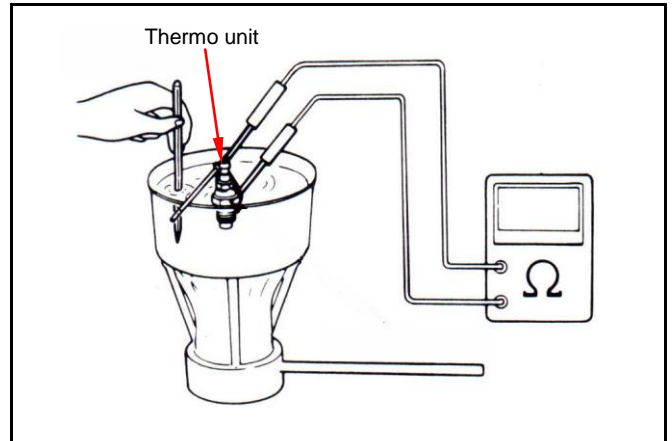


Thermo unit

Remove the thermo unit.

Hang the thermo unit in coolant, heat the coolant and measure the resistance at each temperature.

Temperature	50°C	80°C	100°C	120°C
Standard (Ω)	134~149	47.5~57.0	26~29	14.8~17.2

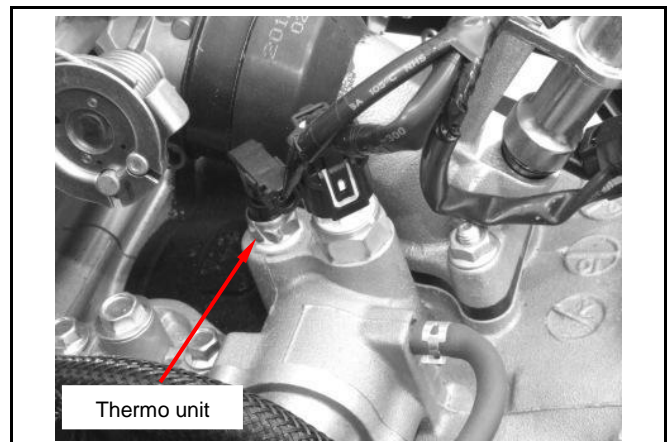


⚠ Caution

- Wear gloves and goggles when performing the test.

⚠ Caution

- Never let the thermo unit contact the wall of the bowl, which may result in wrong readings.



Water temperature meter

Disconnect the thermo sensor coupler and connect it to engine ground.

Turn on main switch.

The needle of the water temperature meter should move to H position.

⚠ Caution

- Do not ground the water temperature more than 5 seconds, or the meter will be damaged.

Note:

Mechanisms in the Emission Control System 18-1	Catalytic Converter (CATA) 18-3
Functions of Mechanism in the Emission Control System 18-1	Positive Crankcase Ventilation System (P.C.V.) 18-4
Fuel Evaporative Emission Control System (E.E.C.) 18-2	Air Injection Solenoid Valve (A.I.S.V.) 18-5
	Ignition System 18-6
	Inspection Items 18-7

Mechanisms in the Emission Control System

Four-Stroke Engine Model

1. C.A.T.A. → Catalyst Converter
2. E.E.C. → Evaporative Emission Control System
3. A.I. → Air Injection System
4. P.C.V. → Positive Crankcase Ventilation System

Functions of Mechanism in the Emission Control System

General

The emission control strategy of this model is formulated based on a four-stroke SOHC single-cylinder engine. It adopts secondary air introducing device to purify the exhaust, in addition, it adopts an activated carbon canister to absorb the fuel vapor generated from the fuel system.

Engine refinements

Four Valves designed combustion chamber, together with optimum compression ratio, ignition timing, intake and exhaust timing, have all contributed to maximize the intake/exhaust efficiency and combustion efficiency.

Secondary air introducing system

It is used to introduce secondary air into exhaust pipe so that unburned exhausts, CO & HC, may be burned again and to be harmless gases.

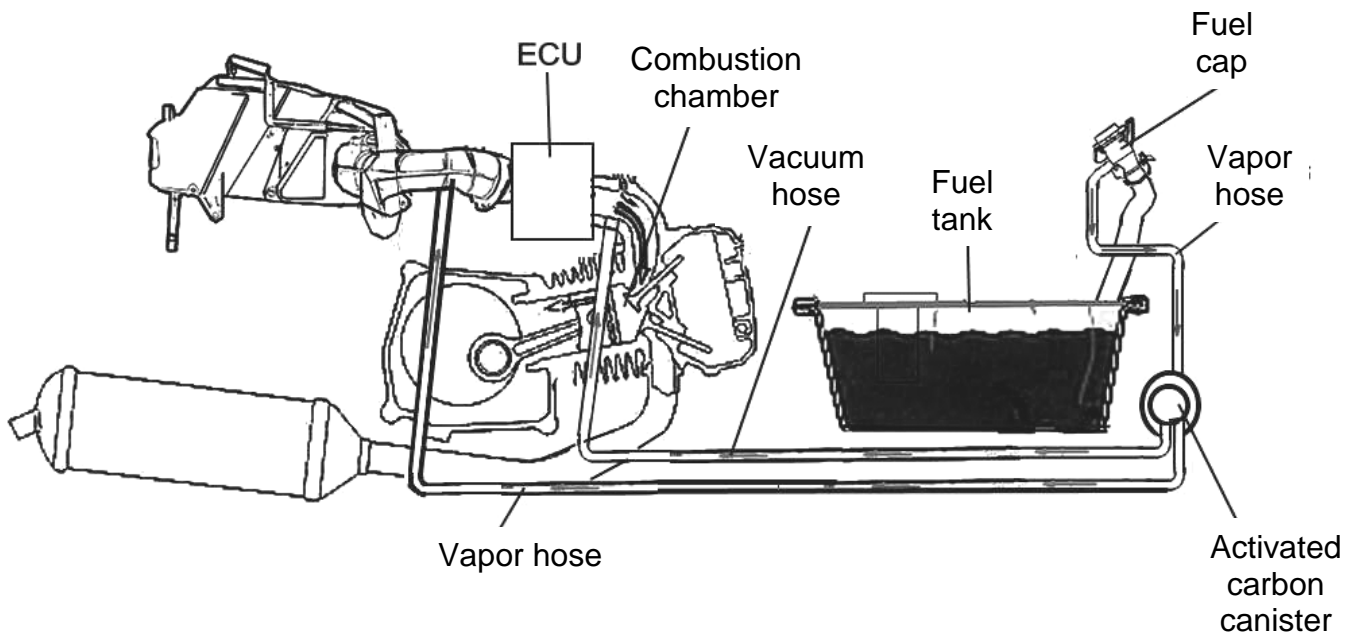
System	Device	Components	Purpose & Function
Combustion system	Combustion chamber	4-valve combustion chamber	The semi-circular combustion chamber is designed to balance the air stream to achieve the combustion stability.
Exhaust system	Post-treatment device	Catalytic converter	Installed a three-way catalytic converter in the middle of exhaust pipe to oxidize the CO, HC in the exhausted gas.
E.E.C. system	Evaporative emission control system	Activated carbon canister purge control valve	A carbon canister is used to absorb vapor from fuel tank and then transfer it into inlet pipe at right timed pulses.
A.I.S.V system	Secondary air-injection system	Air injection solenoid valve Secondary air filter	To introduce fresh air into exhaust manifold controlled by an air cut valve to burn the exhaust again.
P.C.V. system	Crankcase blow-by introducing device	Vapor separator Drain pipe	To introduce blow-by into combustion chamber via a vapor separator for burning then discharging.

18. Emission Control System

Fuel Evaporative Emission Control System (E.E.C.)

Construction:

- Reduce HC pollution.
- To absorb fuel vapor and reduce fuel consumption



Principle of operation

- Vapor generated from the fuel tank and fuel system through evaporation is contained in the confined system to prevent it from escaping into the atmosphere, at the same time, the vapor will be introduced into an activated carbon canister where the hydrocarbon in the vapor will be absorbed by activated carbon.
- When the engine is running, the negative pressure of the intake manifold opens the purge line, the released HC from the activated carbon is sucked into the engine together with air from the bottom of the canister.
- The canister can be used repeatedly without reducing its performance because of the system's purge function.

Troubleshooting

Fuel cannot flow to the fuel injector

- No fuel in the fuel tank
- Vacuum hose detached from manifold
- Clogged fuel system

Cautions

- Do not exceed the reed valve of the fuel filler when filling fuel.
- Do not rush acceleration or run in high speed when applying the spare fuel.

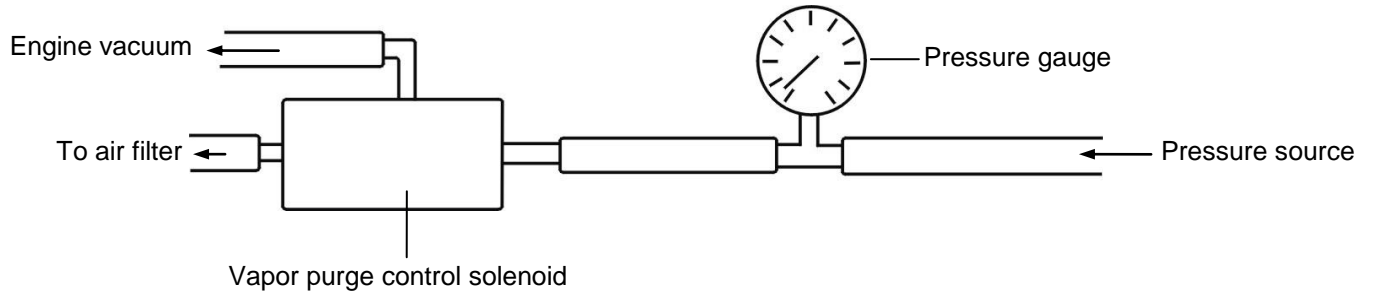
E.E.C. Inspection

Visual check:

- Check if hoses are damaged.

PCV Function Test:

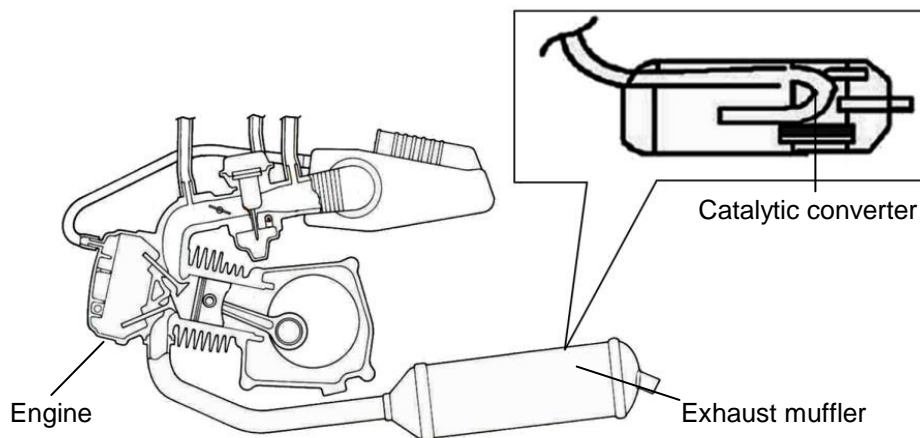
Disconnect the hose of connection to the active carbon canister, and then connect a T-type hose connector to pressure source as shown below:



Apply 100mmAq into pressure source inlet as engine stop, then plug it. The pressure at the gauge should not drop to below 10mmAq within 10 seconds.

Catalytic Converter (CATA)

Construction:

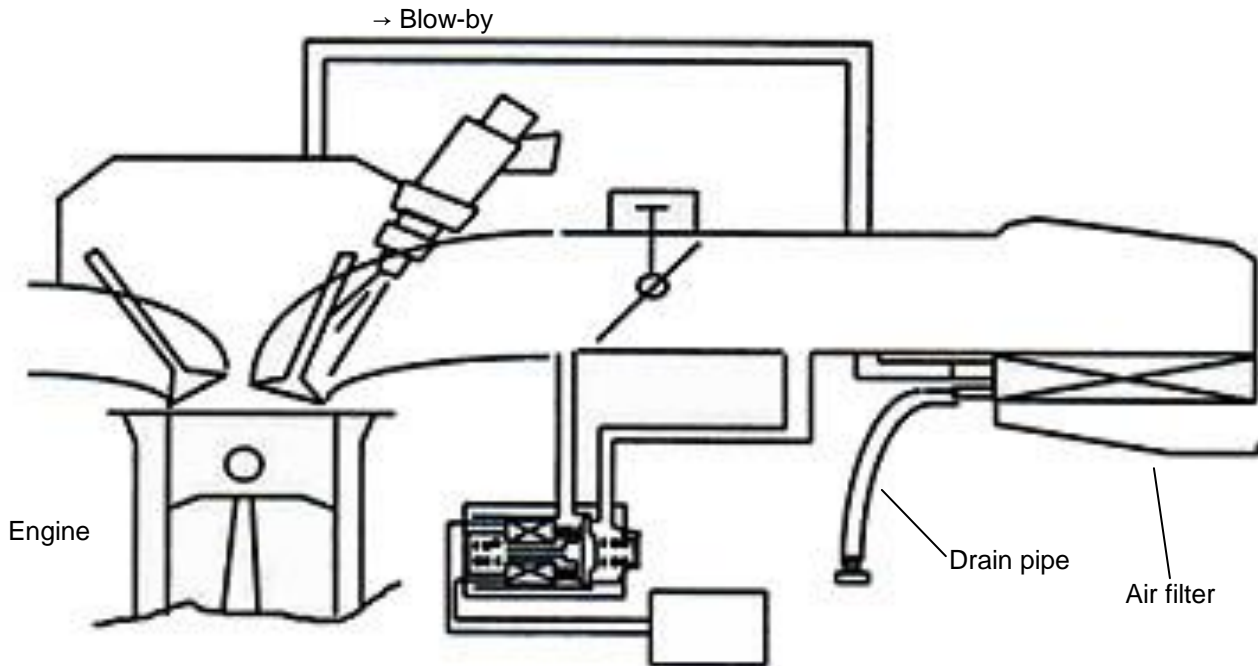


Description:

- The function of the catalytic converter is to transfer unburned CO, HC, and NOx to harmless CO₂, H₂O, N₂ gases.
- Pt, Pd, Rh...etc. precious metals are used into the catalytic converter so use only unleaded gasoline to prevent the catalytic converter from failure.

Positive Crankcase Ventilation System (P.C.V.)

Construction:



Principle of operation:

- Install a separated chamber on cylinder head, and suck the blow-by gas to the fuel vapor separator by engine vacuum.
- Drill a hole in the air cleaner and install a vapor separator, so that blow-by from crankcase will flow through a cylinder check valve and then separated by the separator.
- The separated vapor will be sucked into combustion chamber by engine negative pressure to be burned again instead of discharging into atmosphere. Drain liquidized fuel in the drain pipe periodically.

P.C.V. inspection

Visual check:

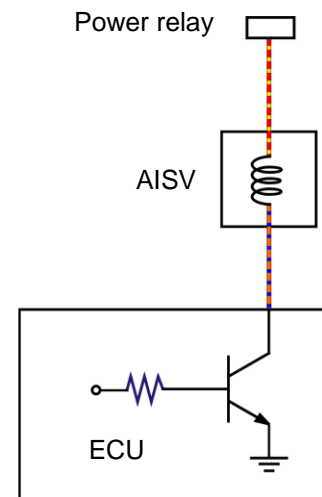
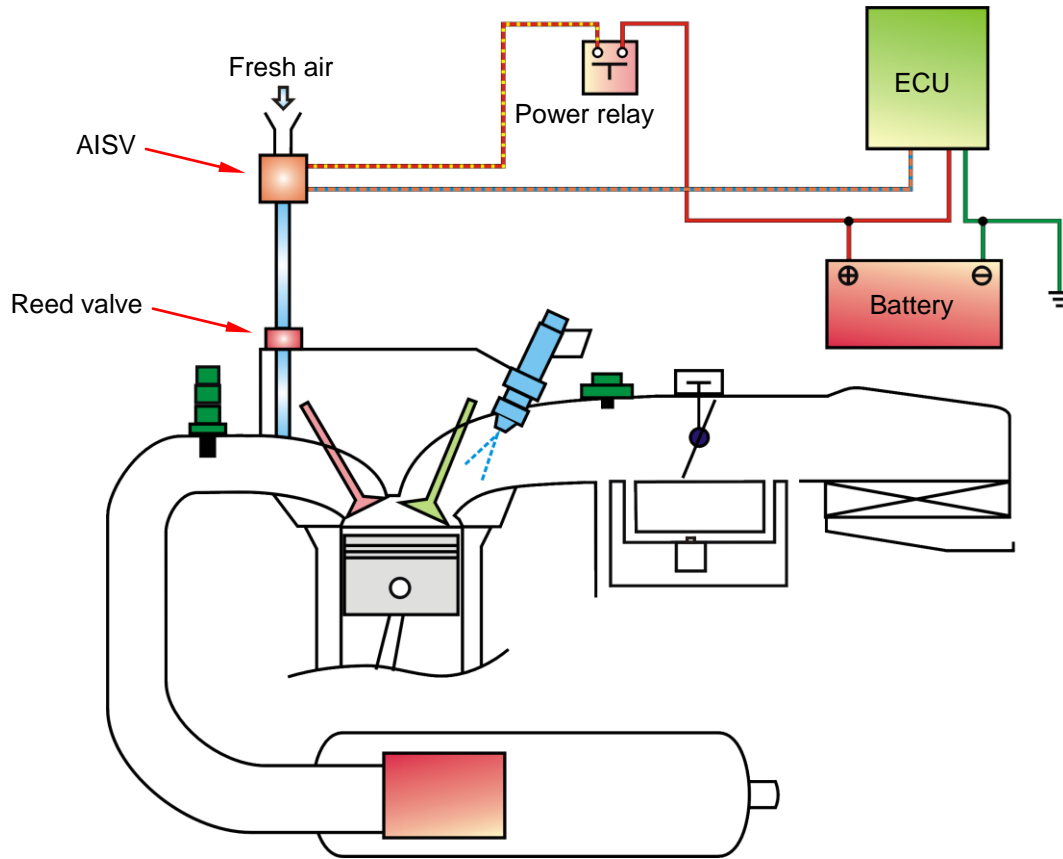
- Remove drain plug to drain the fuel when fuel level on the drain pipe reaches 80 % full.
- Check if hoses are damaged and loosened.

Air Injection Solenoid Valve (A.I.S.V.)

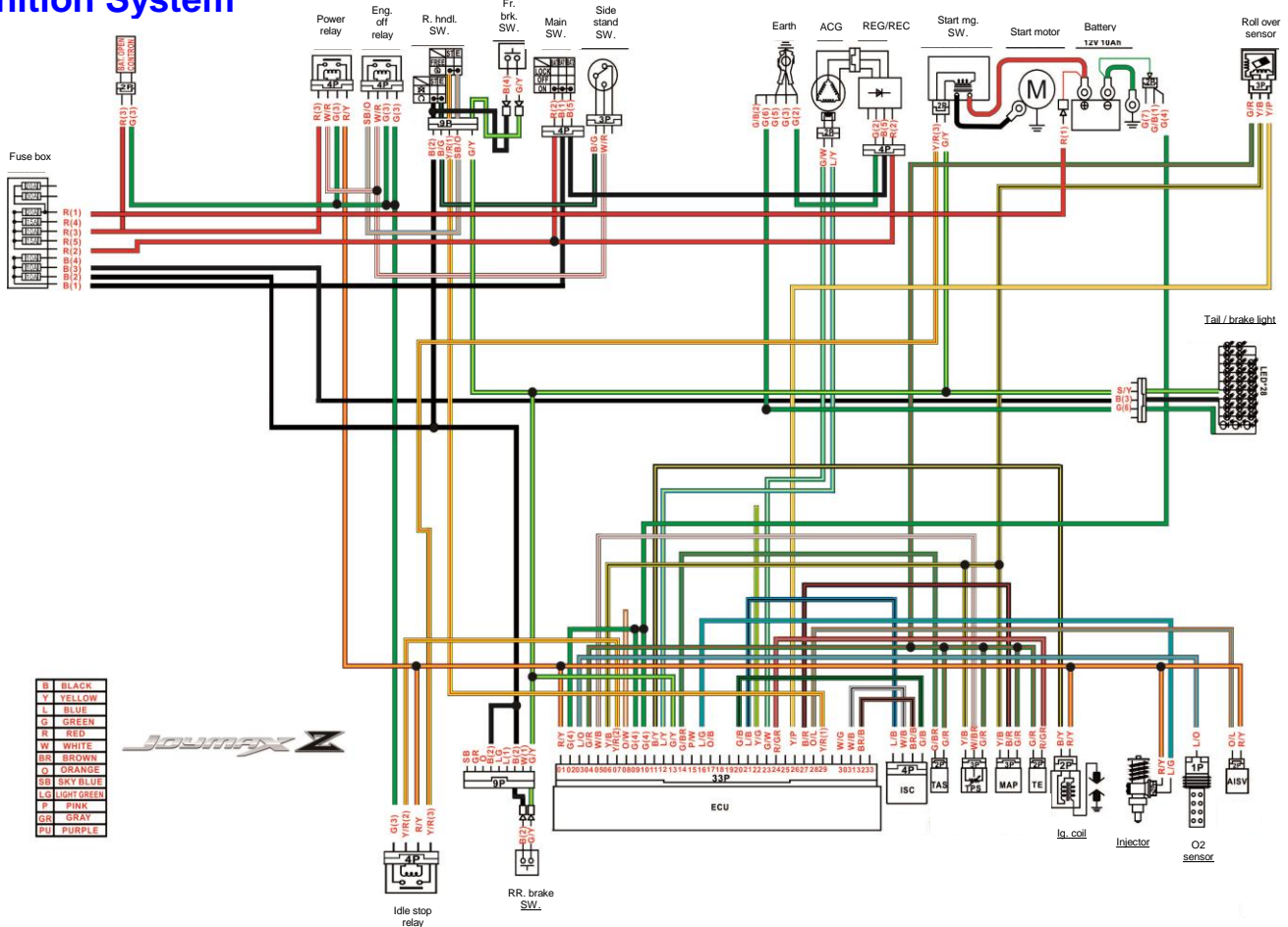
Function: Introduce adequate fresh air to reduce pollution.

Principle of operation:

When engine RPM and throttle opening is higher than setting value, ECU can control the open or close of AISV.



Ignition System



• Principle:

The computer programmed ignition system receives the signals from the Crankshaft position sensor, Throttle position sensor, O₂ Sensor, MAP sensor, Intake air temperature sensor, Engine coolant temperature sensor. Calculating the engine RPM, the 16-bit microcomputer determines the appropriate ignition timing, controls the ignition coil and triggers the spark plug. This way can not only make the engine achieve the maximum power output, but also help improve fuel consumption rate.

• Specifications:

- Ignition timing: BTDC 10°/1650 rpm
- Spark plug: NGK CR8E Clearance: 0.6 to 0.7 mm
- ACG crankshaft position sensor coil resistance: 120Ω±20% (20°C)
- Ignition coil primary circuit resistance: 2.8 Ω ± 15% (20 ° C)
- Battery Type / Capacity: YT12A-BS or GT12A-BS / 12V 10Ah

Inspection Items

Evaporative Emission Control System

- Visually inspect if the activated carbon canister and hoses are damaged.
- Leaking check.
- Function test of the purge control valve.

Catalytic converter

- Check if exhausted gas content is within standard.
- Remove the exhaust pipe and shake gently to check if there is abnormal noise.

Fuel Supply System

- Clean / replace the air filter.
- Inspect fuel filter.
- Clean the fuel injector and all circuit with air gun or specified solvent.
- Adjust CO/HC values at idling. (engine rpm must be within specification)

Ignition system

- Spark plug check and replacement.
- Ignition coil check and replacement.

Note:
