



**SYM**

FOREWORD

HOW TO USE THIS MANUAL

CONTENTS

SERIAL NUMBER

*GTS 250i / RV 250i*

*GTS 300i / JOYMAX 300i*

**SERVICE MANUAL**



This service manual contains the technical data of each component inspection and repair for the SANYANG LM25W5 / LM30W 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, LM25W5 / LM30W 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 INDUSTRY CO., LTD.**

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## How To Use This Manual



This service manual describes the basic information of different system parts and system inspection & service for SANYANG LM25W5 / LM30W 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.

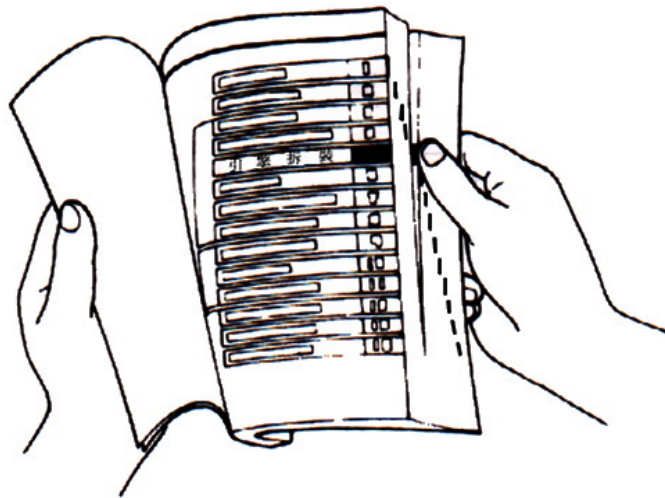
The 13th to the 16th chapter contain the relative parts of the body frame assembly.

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.



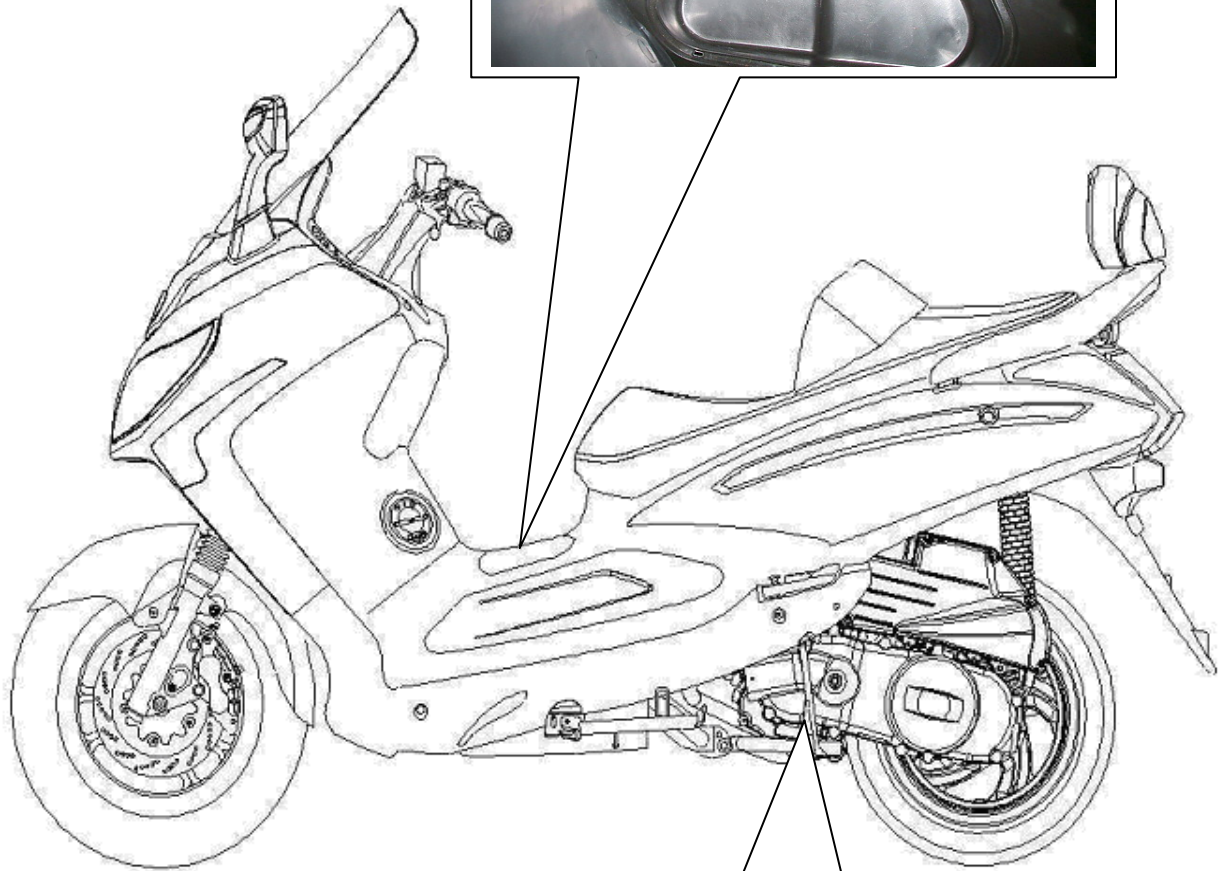
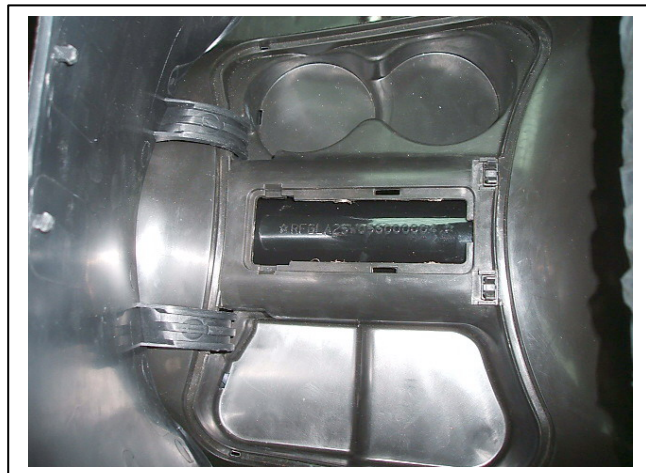
There are 4 buttons, “[Foreword](#)”, “[Contents](#)”, “[How to use this manual](#)” and “[Mechanism Illustrations](#)” on the PDF version, and can be access to these items by click the mouse.

If user wants to look for the content of each chapter, selecting the words of each chapter on the contents can reach to each chapter. There are two buttons, “Homepage and contents, onto the top line of first page of the each chapter. Thus, if the user needs to check other chapters, he can click the top buttons to back the homepage or contents. The content of each chapter can be selected too.

Therefore, when needs to checking the content inside of the chapter, click the content words of the chapter so that can back to the initial section of the content. In addition, there is a “[To this chapter contents](#)” button at the second page of each contents so that clicking the button can back to the contents of this chapter.

Page	Content	Index
1-1 ~ 1-18	<a href="#">General Information</a>	1
2-1 ~ 2-18	<a href="#">Maintenance Information</a>	2
3-1 ~ 3-8	<a href="#">Lubrication System</a>	3
4-1 ~ 4-60	<a href="#">Fuel Injection System</a>	4
5-1 ~ 5-12	<a href="#">Engine Removal</a>	5
6-1 ~ 6-16	<a href="#">Cylinder Head / Valve</a>	6
7-1 ~ 7-8	<a href="#">Cylinder / Piston</a>	7
8-1 ~ 8-14	<a href="#">V-Belt Drive System</a>	8
9-1 ~ 9-8	<a href="#">Final Drive Mechanism</a>	9
10-1 ~ 10-10	<a href="#">AC Generator / Start Clutch</a>	10
11-1 ~ 11-8	<a href="#">Crankshaft / Crankcase</a>	11
12-1 ~ 12-14	<a href="#">Cooling System</a>	12
13-1 ~ 13-14	<a href="#">Body Cover</a>	13
14-1 ~ 14-12	<a href="#">Brake System</a>	14
15-1 ~ 15-10	<a href="#">Steering / Front Wheel / Front Cushion</a>	15
16-1 ~ 16-6	<a href="#">Rear Wheel / Rear Fork / Rear Cushion</a>	16
17-1 ~ 17-22	<a href="#">Electrical Equipment</a>	17
18-1 ~ 18-10	<a href="#">Emission Control System</a>	18
19-1 ~ 19-2	<a href="#">Electrical Diagram</a>	19





<b>Symbols and Marks</b> .....1-1	<b>Torque Values</b> ..... 1-12
<b>General Safety</b> .....1-2	<b>Trouble Diagnosis</b> ..... 1-14
<b>Before Servicing</b> .....1-3	<b>Lubrication Points</b> ..... 1-18
<b>Specifications</b> .....1-9	

## 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-30 API SG class oil. Warranty will not cover the damage that caused by not apply with the limited engine oil. (Recommended oil: KING MATE G-3 oil)
	Grease	King Mate G-3 is recommended.
	Gear oil	King Mate gear oil serials are recommended. (Bramax HYPOID GEAR OIL # 140)
	Locking sealant	Apply sealant; medium strength sealant should be used unless otherwise specified.
	Oil seal	Apply with lubricant. °
	Renew	Replace with a new part before installation.
	Brake fluid	Use recommended brake fluid DOT3 or WELLRUN brake fluid.
	Special tools	Special tools
	Correct	Meaning correct installation.
	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).

# 1. General Information

## 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.

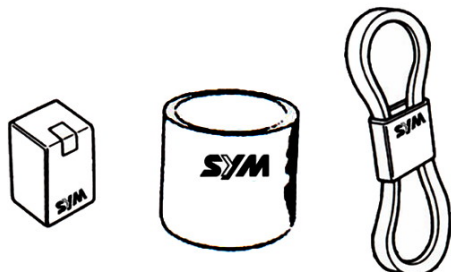
### Brake Fluid

#### Caution

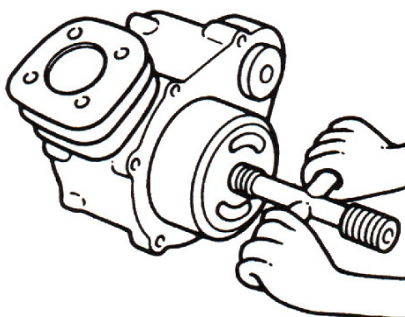
Brake fluid spilled on painted, plastic, or rubber parts may cause damage to the parts. Place a clean towel on the top of the parts for protection when servicing the brake system. Keep the brake fluid beyond reach of the children.

## Before Servicing

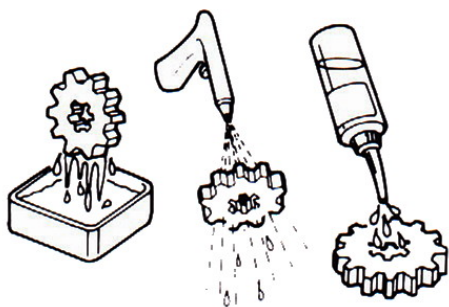
- Always use SANYANG genuine parts and recommended oil. Using improper parts may cause damage to or destruction of the vehicle.



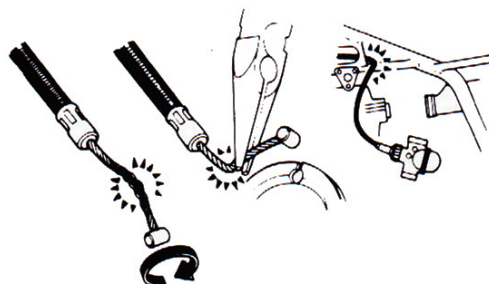
- Special tools are designed for removal and installation of component parts without damaging them. Using wrong tools may result in parts damage.



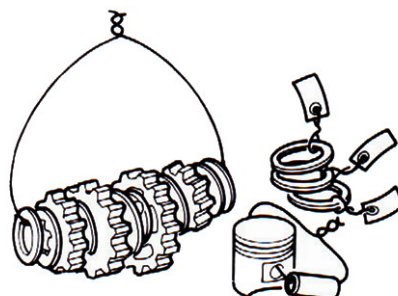
- When servicing this vehicle, use only metric tools. Metric bolts, nuts, and screws are not interchangeable with the Britain system, using wrong tools and fasteners may damage this vehicle.
- Clean the outside of the parts or the cover before removing it from the vehicle. Otherwise, dirt and deposit 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.



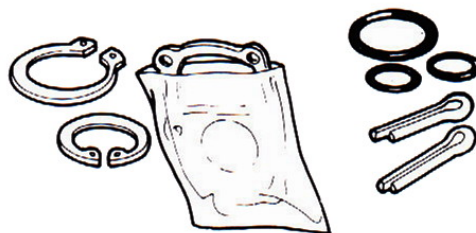
- Never bend or twist control cables to avoid unsmooth control and premature worn out.



- 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.



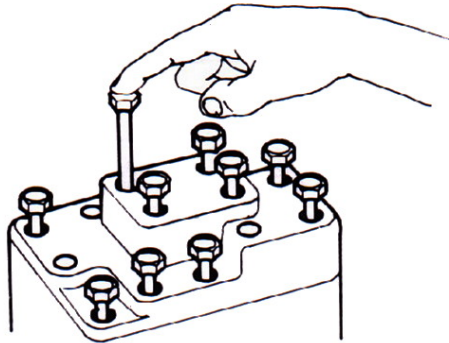
- Note the reassemble position of the important components before disassembling them to ensure they will be reassembled in correct dimensions (depth, distance or position).
- Components not to be reused should be replaced when disassembled including gaskets metal seal rings, O-rings, oil seals, snap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



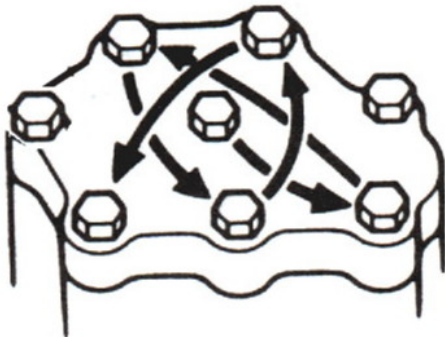


# 1. General Information

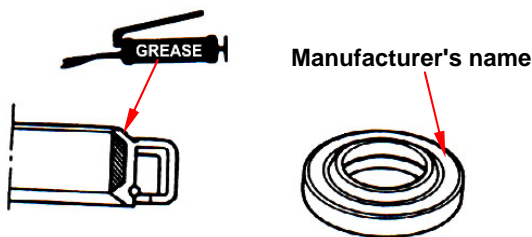
- The length of bolts and screws for assemblies, cover plates or boxes is different from one another, be sure they are correctly installed. In case of confusion, Insert the bolt into the hole to compare its length with other bolts, if its length out side the hole is the same with other bolts, it is a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



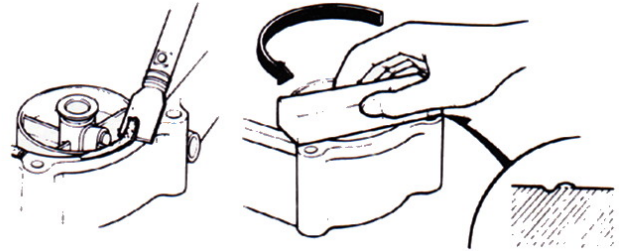
- Tighten assemblies with different dimension fasteners as follows: Tighten all the fasteners with fingers, then tighten the big ones with special tool first diagonally from inside toward outside, important components should be tightened 2 to 3 times with appropriate increments to avoid warp unless otherwise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



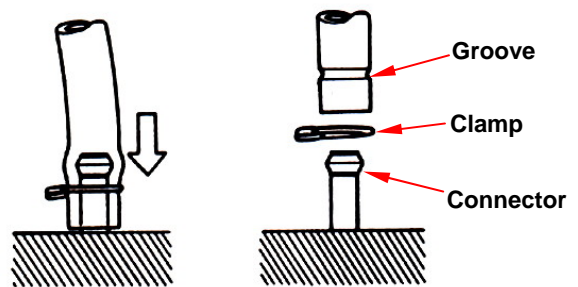
- When oil seal is installed, fill the groove with grease, install the oil seal with the name of the manufacturer facing outside, and check the shaft on which the oil seal is to be installed for smoothness and for burrs that may damage the oil seal.



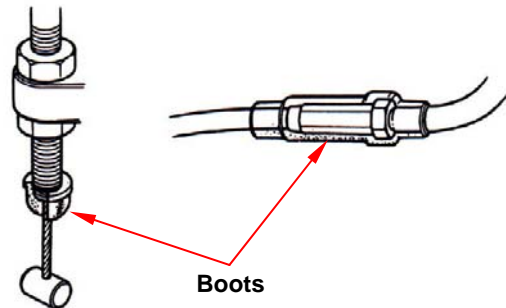
- Remove residues of the old gasket or sealant before reinstallation, grind with a grindstone if the contact surface has any damage.



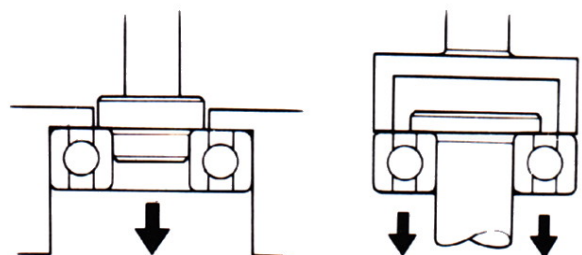
- The ends of rubber hoses (for fuel, vacuum, or coolant) should be pushed as far as they can go to their connections so that there is enough room below the enlarged ends for tightening the clamps.



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

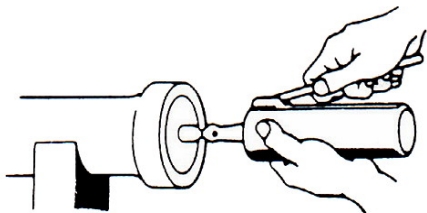


- The tool should be pressed against two (inner and outer) bearing races when removing a ball bearing. Damage may result if the tool is pressed against only one race (either inner race or outer race). In this case, the bearing should be replaced. To avoid damaging the bearing, use equal force on both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



Both of these examples can result in bearing damage.

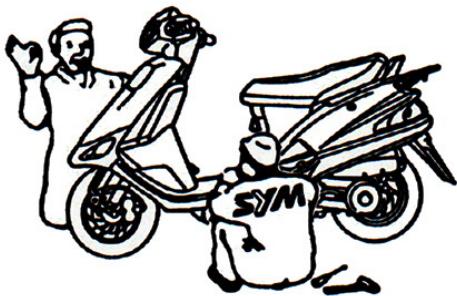
- Lubricate the rotation face with specified lubricant on the lubrication points before assembling.



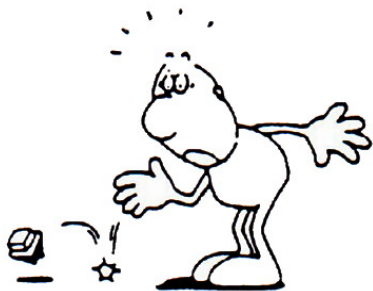
- Check if positions and operation for installed parts is in correct and properly.



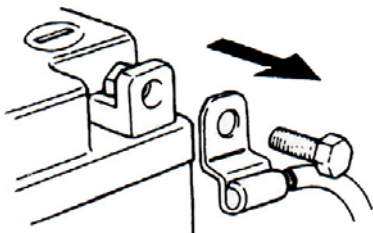
- Make sure service safety each other when conducting by two persons.



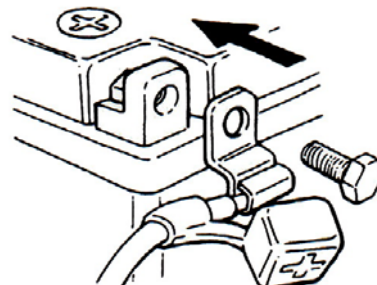
- Note that do not let parts fall down.



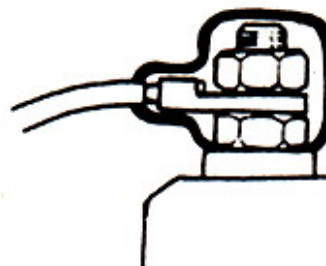
- Before battery removal operation, it has to remove the battery negative (-) cable firstly. Notre tools like open-end wrench do not contact with body to prevent from circuit short and create spark.



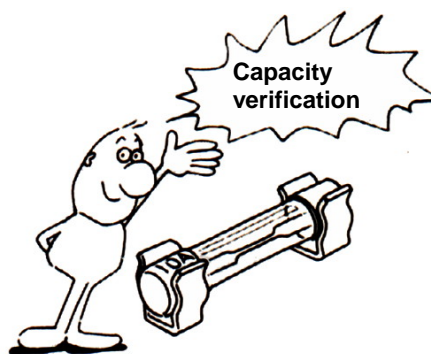
- After service completed, make sure all connection points is secured. Battery positive (+) cable should be connected firstly.
- And the two posts of battery have to be greased after connected the cables.



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

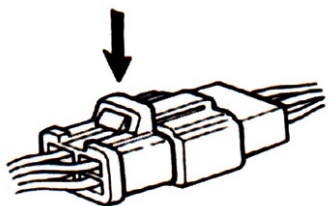


- If fuse burned, it has to find out the cause and solved it. And then replace with specified capacity fuse.



# 1. General Information

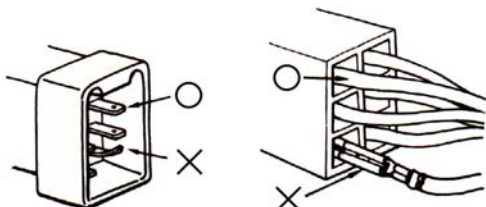
- When separating a connector, it locker has to be unlocked firstly. Then, conduct the service operation.



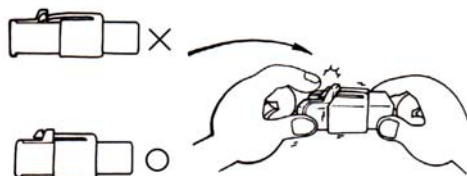
- Do not pull the wires as removing a connector or wires. Hold the connector body.



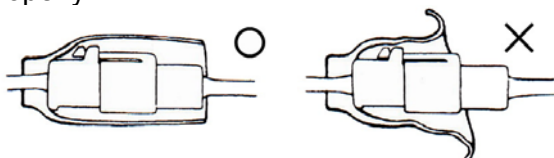
- Make sure if the connector pins are bent, extruded or loosen.



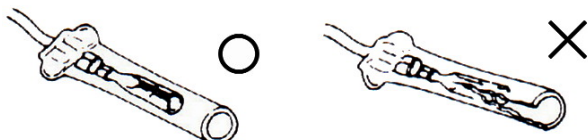
- Insert the connector completely. If there are two lockers on two connector sides, make sure the lockers are locked in properly. Check if any wire loose.



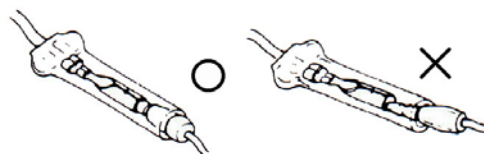
- Check if the connector is covered by the twin connector boot completely and secured properly.



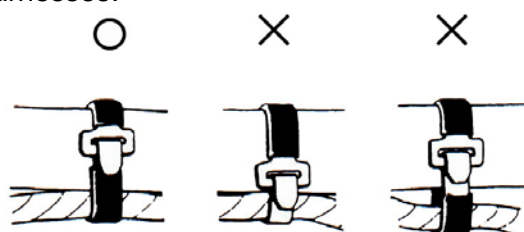
- Before terminal connection, check if the boot is crack or the terminal is loose.



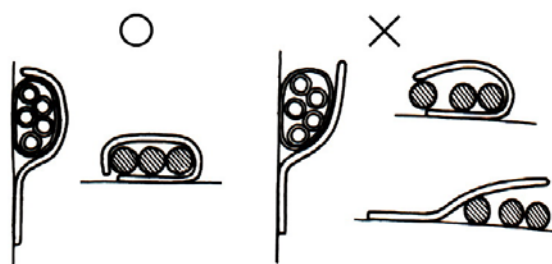
- Insert the terminal completely. Check if the terminal is covered by the boot. Do not let boot open facing up.



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



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

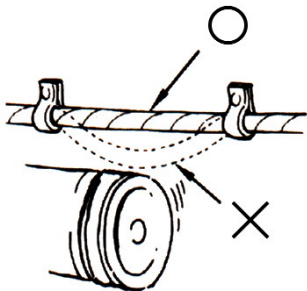


- Do not squeeze wires against the weld or its clamp.

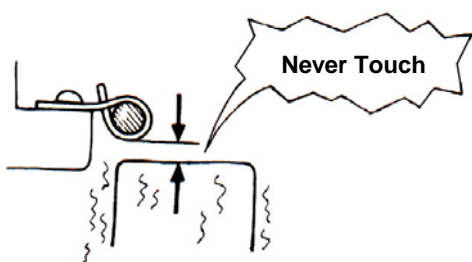




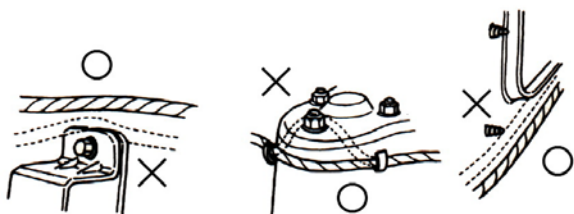
- Do not let the wire harness contact with rotating, moving or vibrating components as routing the harness.



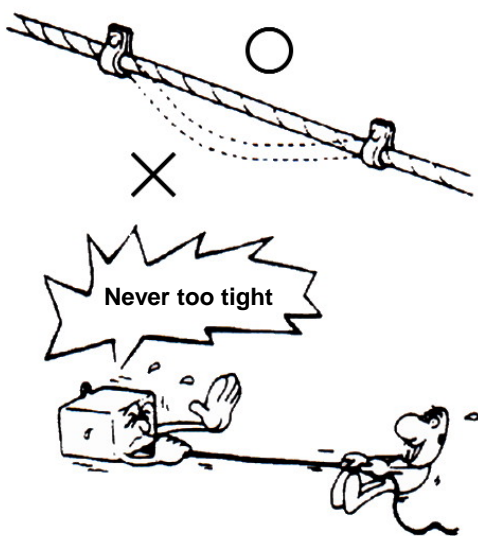
- Keep wire harnesses far away from the hot parts.



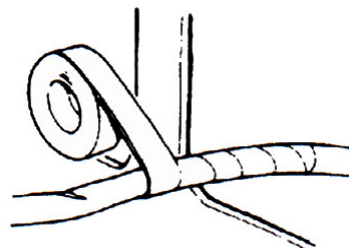
- Route wire harnesses to avoid sharp edges or corners and also avoid the projected ends of bolts and screws.



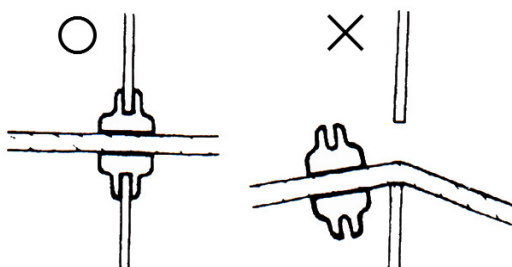
- Route harnesses so that they neither pull too tight nor have excessive slack.



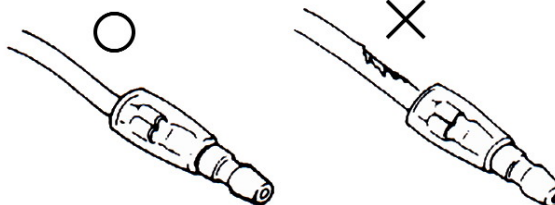
- Protect wires or wire harnesses with electrical tape or tube if they contact a sharp edge or corner. Thoroughly clean the surface where tape is to be applied.



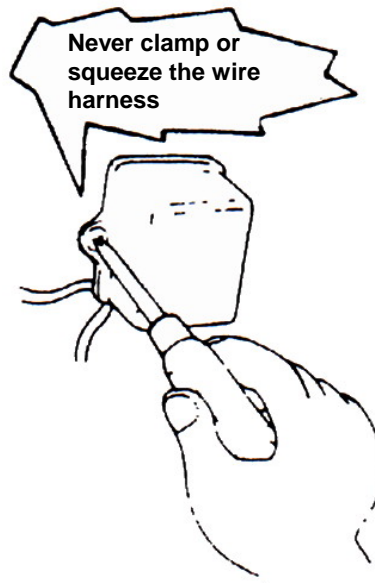
- Secure the rubber boot firmly as applying it on wire harness.



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



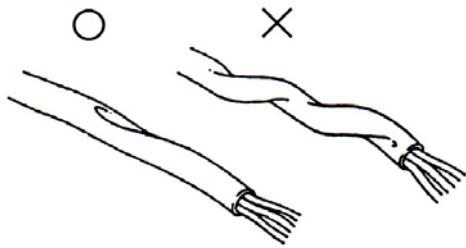
- Never clamp or squeeze the wire harness as installing other components.



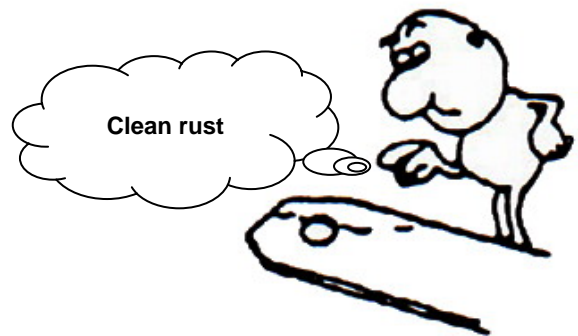


# 1. General Information

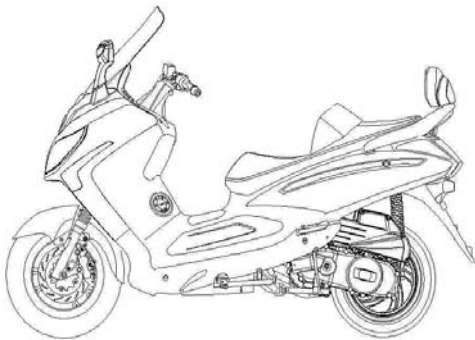
- Do not let the wire harness been twisted as installation.



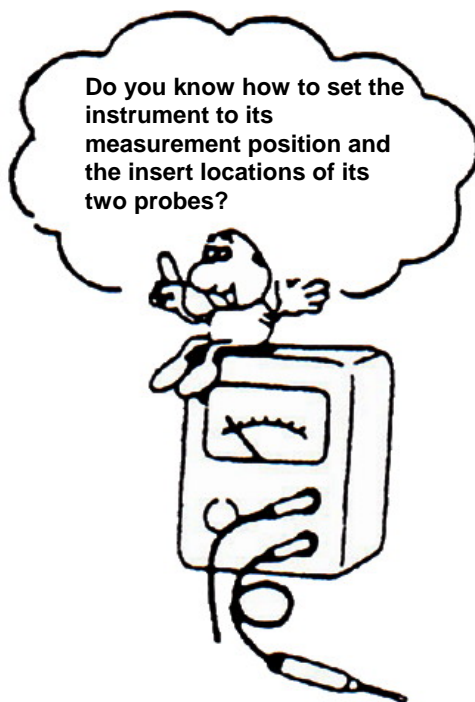
- With sand paper to clean rust on connector pins/terminals if found. And then conduct connection operation later.



- 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.



Specifications

MAKER		SANYANG		MODEL		LM25W5-6/7		
Dimension	Overall Length	2165 mm		Suspension System	Front	TELESCOPIC FORK		
	Overall Width	870 mm			Rear	UNIT SWING		
	Overall Height	1395 mm		Tire Specifications	Front	110 / 90-13 56P		
	Wheel Base	1495 mm			Rear	130 / 70-13 57P		
Weight	Curb Weight	Front	79 kg		Brake System	Front	DISK (ø 240 mm)	
		Rear	111 kg			Rear	DISK (ø 220 mm)	
		Total	190 kg					
	Passengers/Weight		Two / 150 kg		Performance	Max. Speed	128 km/hr	
	Total Weight	Front	134 kg			Climb Ability	<27°	
		Rear	206 kg		Reduction	Primary Reduction	Belt	
Total		340 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 unleaded		Speedometer		0 ~ 160 km/hr		
Cycle/ Cooling		4-stroke/ Liquid-cooled		Horn		<110 dB/A		
Engine	Cylinder	Bore	71 mm		Muffler		Expansion & Pulse Type	
		Stroke	63.3 mm		Exhaust Pipe Position and Direction		Right side, and Backward	
		Number/Arrangement	SINGLE CYLINDER		Lubrication System		Forced circulation & splashing	
Displacement		250.6 cc		Exhaust Concentration	CO	<2.0 g/km		
Compression Ratio		10.5 : 1			HC	<0.3 g/km		
Max. HP		23.4 ps / 8000 rpm			NOx	<0.15 g/km		
Max. Torque		2.3 kg-m / 5500 rpm		E.E.C.		-		
Ignition		Full transistor ignition		P.C.V.		√		
Starting System		Electrical starter		Catalytic reaction control system		√		

# 1. General Information

## Specifications

MAKER		SANYANG		MODEL		LM25W5-P LM25W7-7	
Dimension	Overall Length		2165 mm		Suspension System	Front	TELESCOPIC FORK
	Overall Width		870 mm			Rear	UNIT SWING
	Overall Height		1395 mm		Tire Specifications	Front	110 / 90-13 56P
	Wheel Base		1495 mm			Rear	130 / 70-13 57P
Weight	Curb Weight	Front	79 kg		Brake System	Front	DISK (ø 240 mm)
		Rear	111 kg				
		Total	190 kg			Rear	DISK (ø 220 mm)
	Passengers/Weight		Two / 150 kg		Performance	Max. Speed	128 km/hr
	Total Weight	Front	134 kg			Climb Ability	<27°
		Rear	206 kg		Reduction	Primary Reduction	Belt
		Total	340 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 unleaded		Speedometer		0 ~ 160 km/hr	
Cycle/ Cooling		4-stroke/ Liquid-cooled		Horn		93~112 dB/A	
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	CO	<2.0 g/km	
Compression Ratio		10.5 : 1			HC	<0.3 g/km	
Max. HP		23.4 ps / 8000 rpm			NOx	<0.15 g/km	
Max. Torque		2.3 kg-m / 5500 rpm		E.E.C.		-	
Ignition		Full transistor ignition		P.C.V.		√	
Starting System		Electrical starter		Catalytic reaction control system		√	



# 1. General Information

## Specifications

MAKER		SANYANG		MODEL		LM30W-6/T	
Dimension	Overall Length		2165 mm		Suspension System	Front	TELESCOPIC FORK
	Overall Width		870 mm			Rear	UNIT SWING
	Overall Height		1395 mm		Tire Specifications	Front	110 / 90-13 56P
	Wheel Base		1495 mm			Rear	130 / 70-13 57P
Weight	Curb Weight	Front	79 kg		Brake System	Front	DISK (ø 240 mm)
		Rear	111 kg			Rear	DISK (ø 220 mm)
		Total	190 kg				
	Passengers/Weight		Two / 150 kg		Performance	Max. Speed	128 km/hr
	Total Weight	Front	134 kg			Climb Ability	<27°
		Rear	206 kg		Reduction	Primary Reduction	Belt
		Total	340 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 unleaded		Speedometer		0 ~ 160 km/hr	
Cycle/ Cooling		4-stroke/ Liquid-cooled		Horn		93~112 dB/A	
Engine	Cylinder	Bore	73 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		263.7 cc		Exhaust Concentration	CO	<2.0 g/km	
Compression Ratio		10.1 : 1			HC	<0.3 g/km	
Max. HP		23.3 ps / 7500 rpm			NOx	<0.15 g/km	
Max. Torque		2.5 kg-m / 5500 rpm		E.E.C.		-	
Ignition		Full transistor ignition		P.C.V.		√	
Starting System		Electrical starter		Catalytic reaction control system		√	

# 1. General Information

## Torque Values

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

### Standard Torque Values for Reference

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

### Engine Torque Values

Item	Q'ty	Thread Dia. (mm)	Torque Value(kgf-m)	Remarks
Cylinder stud bolt	4	10	1.0~1.4	Apply oil to thread
Cylinder head nut	4	8	3.6~4.0	
Cylinder head right bolt	2	8	2.0~2.4	
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	
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	28	5.0~6.0	
Clutch outer nut	1	14	5.0~6.0	
Drive face nut	1	14	8.5~10.5	
ACG. Flywheel nut	1	14	5.0~6.0	
Crankcase bolt	7	6	0.8~1.2	
Mission case bolt	7	8	2.6~3.0	
Muffler mounting bolt	3	10	3.2 ~3.8	
Muffler mounting nut	2	8	1.0 ~1.2	



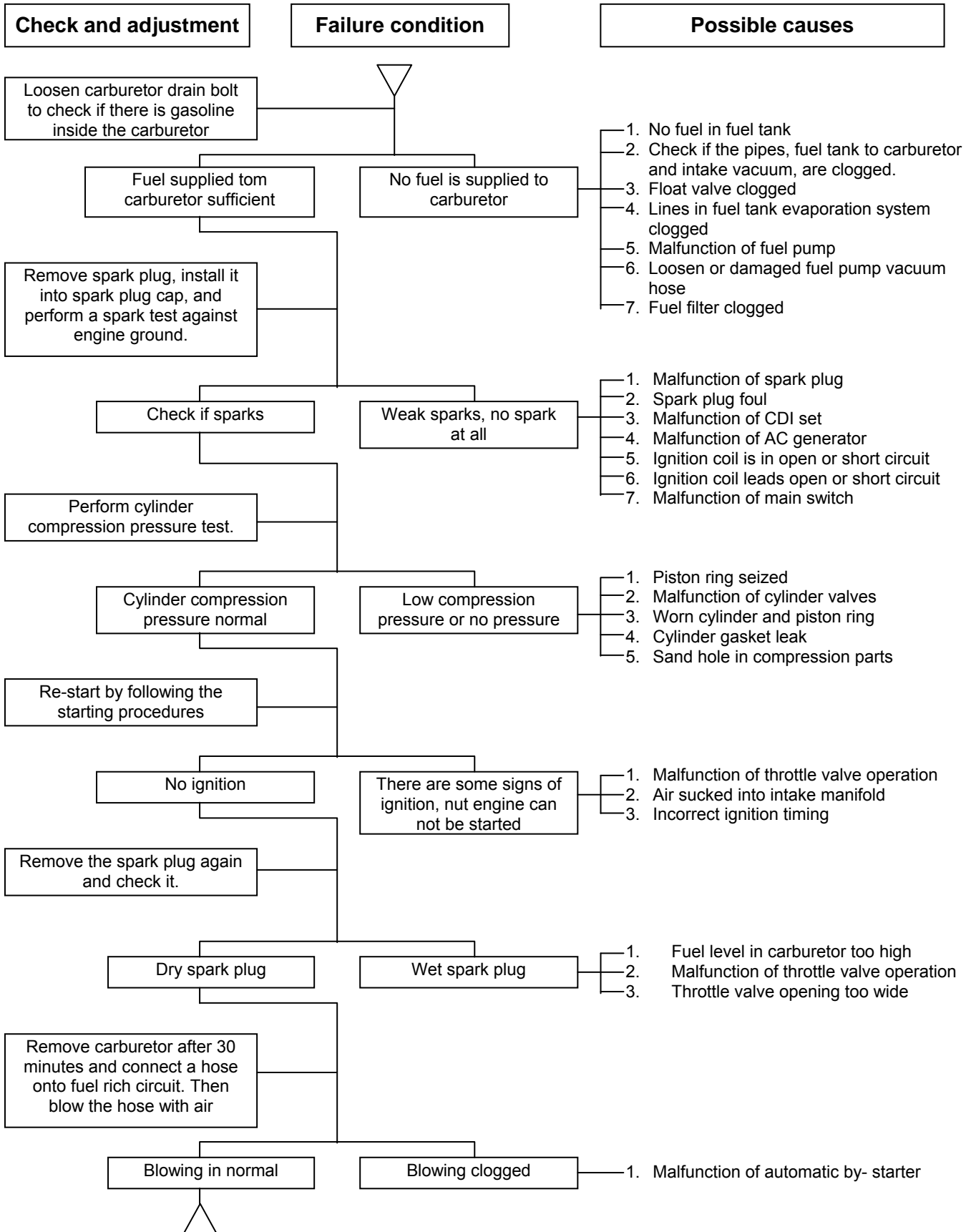
### Frame Torque Values

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	1.0~2.0	
Steering top cone race	1	BC1	2.0~3.0	
Front wheel axle nut	1	12	5.0~7.0	
Rear wheel axle nut	1	16	11.0~13.0	
Front cushion mounting bolt	4	10	3.5~4.5	
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	2	10	3.0~4.0	
Brake air-bleeding valve	1	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	2	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 standard nut	1	10	4.0~5.0	
Air cleaner bolts	2	6	1.0~1.4	

# 1. General Information

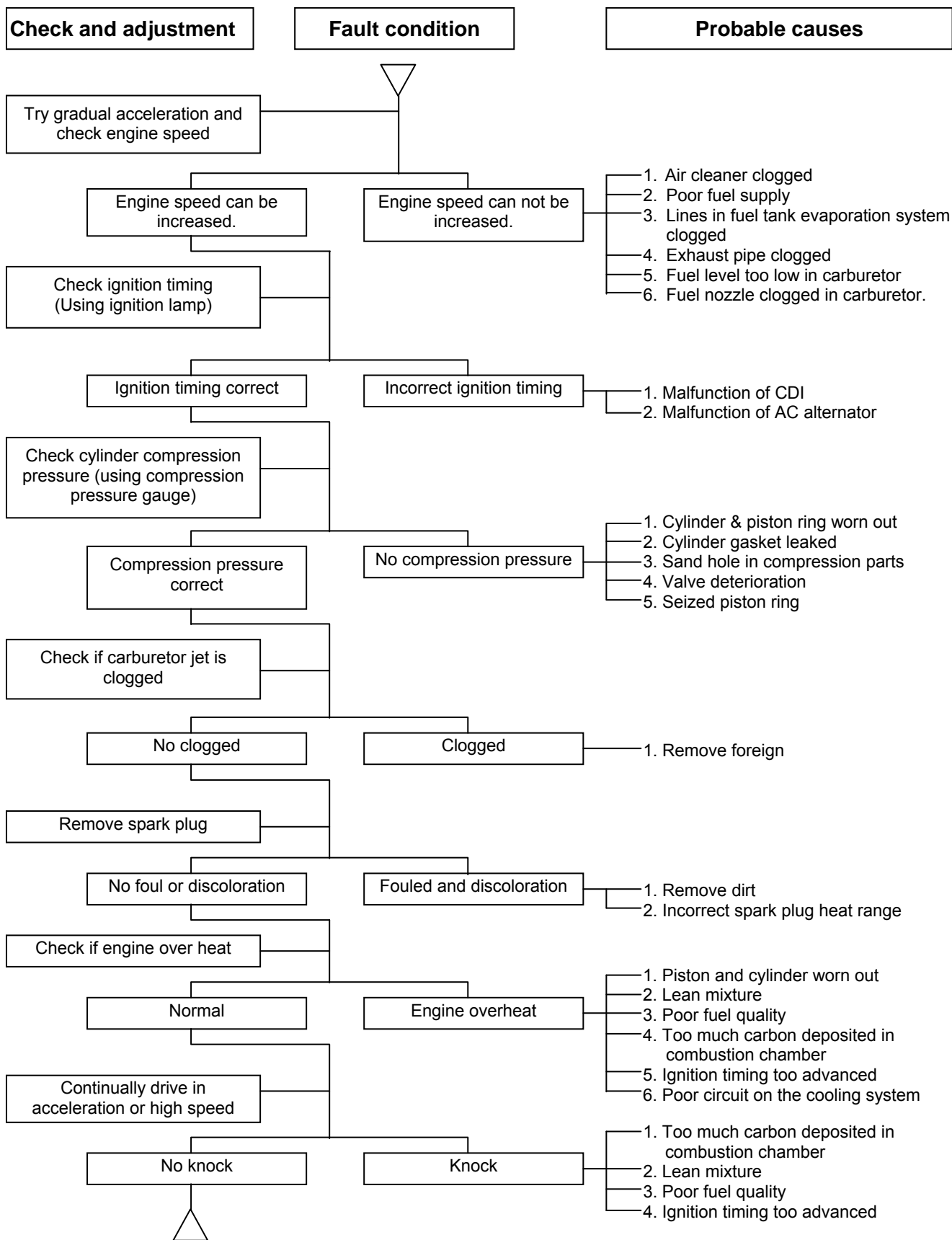
## Trouble Diagnosis

### A. Engine hard to start or can not be started





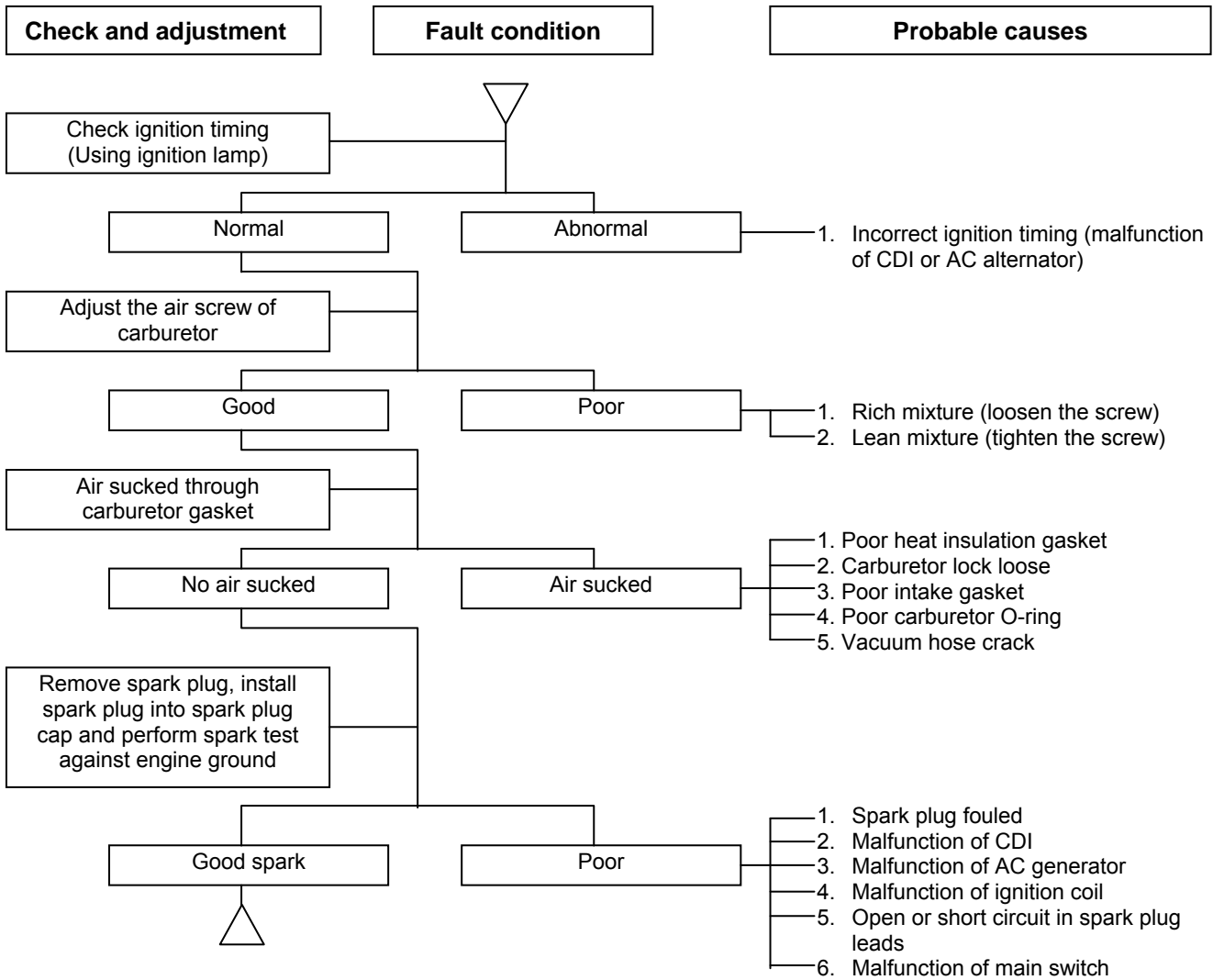
**B. Engine run sluggish (Speed does not pick up, lack of power)**



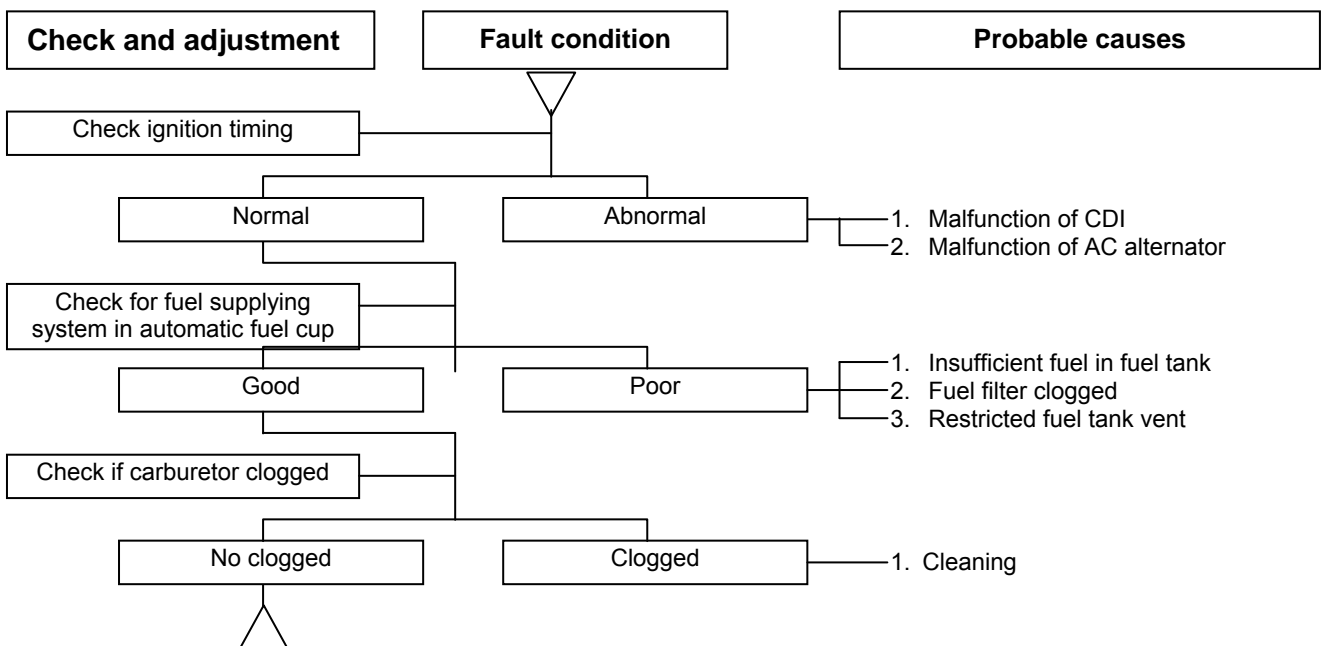


# 1. General Information

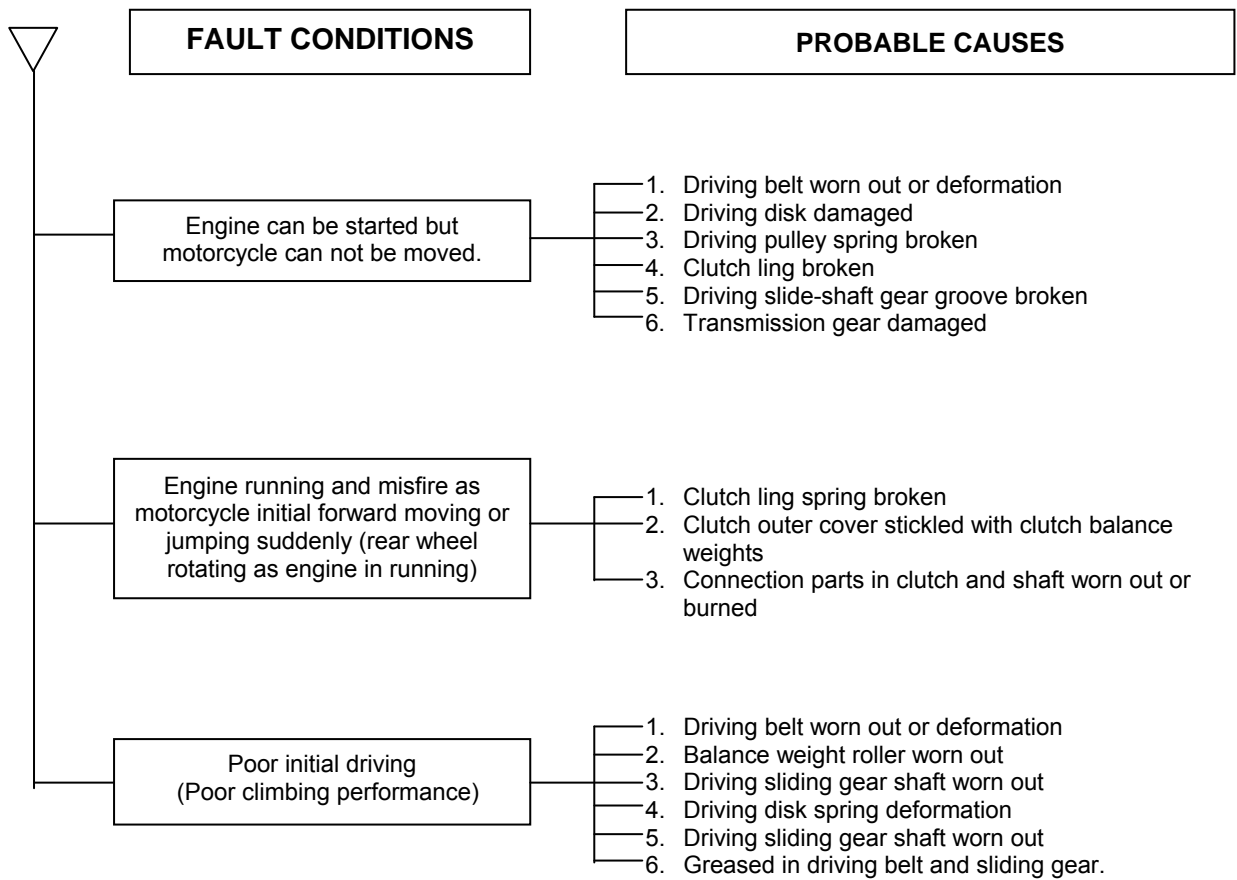
## C. Engine runs sluggish (especially in low speed and idling)



## D. Engine runs sluggish (High speed)



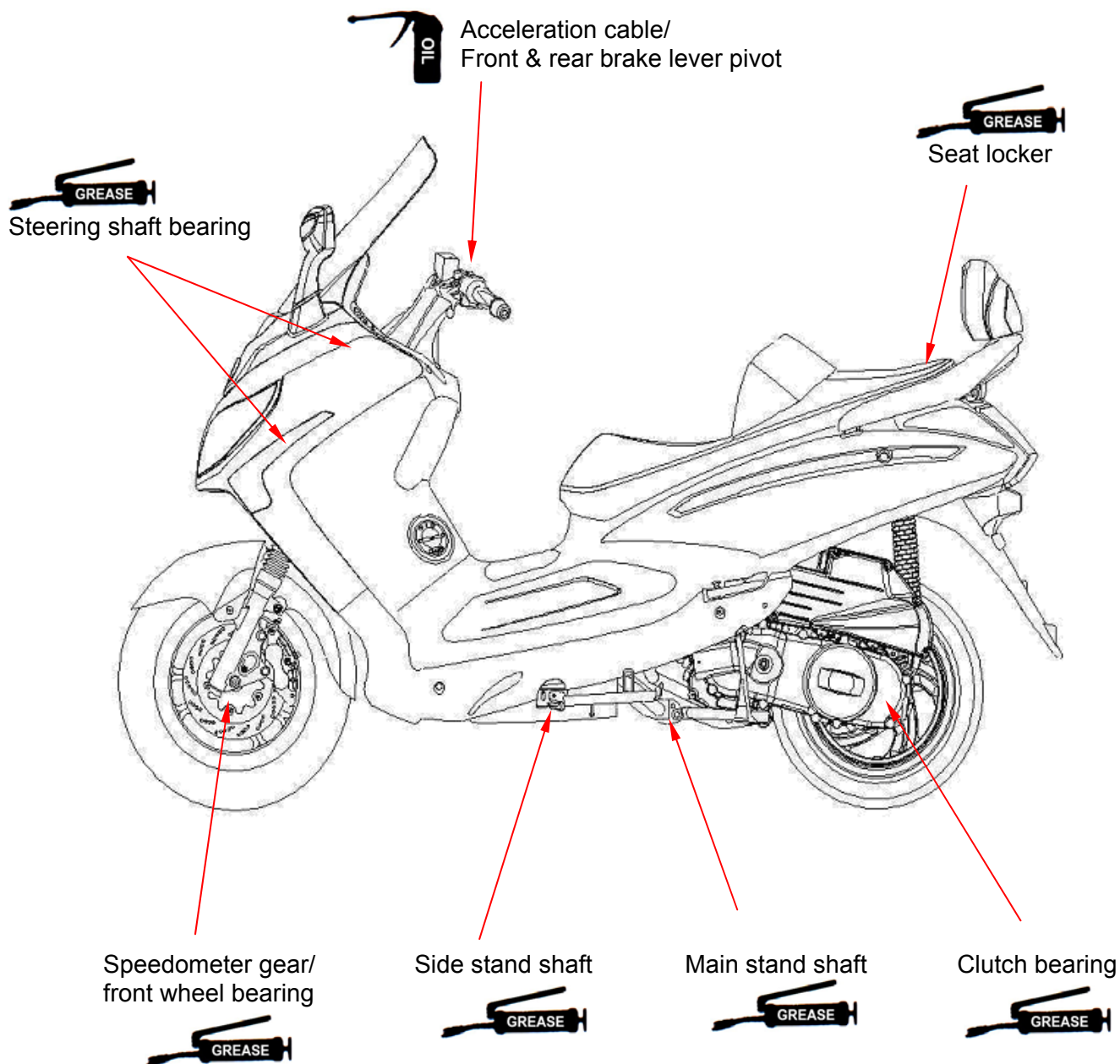
E. Clutch, Driving And Driving Pulley



# 1. General Information



## Lubrication Points





Precautions in Operation ..... 2-1	Drive Belt ..... 2-8
Periodical Maintenance Schedule ..... 2-2	Steering Handle Top Bearing ..... 2-9
Engine Oil ..... 2-3	Cushion ..... 2-9
Engine Oil Strainer Clean ..... 2-3	Disk Brake System ..... 2-10
Gear Oil ..... 2-4	Brake Light Switch / Start Switch ..... 2-12
Fuel Lines / Cable ..... 2-4	Headlight Distance Adjustment ..... 2-12
Air Cleaner ..... 2-5	Wheel / Tire ..... 2-12
P.C.V. System ..... 2-6	Battery ..... 2-13
Valve Clearance ..... 2-6	Nuts, Bolts Tightness ..... 2-13
Spark Plug ..... 2-7	Special Tools List ..... 2-14
Cylinder Compression Pressure ..... 2-8	

## Precautions in Operation

Model		LM25W5-6/7/P LM25W7-7	LM30W-6/T
Fuel Tank Capacity		12,000 c.c.	
Engine Oil	capacity	1,400 c.c.	
	change	1,200 c.c.	
Transmission Gear oil	capacity	180 c.c.	
	change	160 c.c.	
Capacity of coolant	Engine + radiator	850 c.c.	
	Reservoir upper	420 c.c.	
Clearance of throttle valve		2~6 mm	
Spark plug		CR8E (gap:0.6~0.7 mm)	
Timing advance idle speed		BTDC 10° / 1,650 rpm	
Full timing advanced		BTDC 30°	
Idling speed		1,650±100 rpm	
Cylinder compression pressure		12 ± 2 kgf/cm <sup>2</sup>	
Valve clearance	IN	0.10±0.02 mm	
	EX	0.15±0.02 mm	
Tire dimension	Front	110/90-13 56P	
Tire dimension	Rear	130/70-13 57P	
Tire pressure (cold)	single	Front: 1.75 kg/cm <sup>2</sup> Rear: 2.25 kg/cm <sup>2</sup>	
	Load 90 Kg (full load)	Front: 2.25 kg/cm <sup>2</sup> Rear: 2.5 kg/cm <sup>2</sup>	
Battery		12V10Ah (MF battery) / YTX12-BS	

## 2. Maintenance Information

### Periodical Maintenance Schedule

No	item	Every 300KM	1 Month every 1,000KM	3 month every 3,000KM	6 month every 6,000KM	1 year every 12,000KM
1	☆Air cleaner	I		C	C	R
2	☆2nd air jet leaner	I		C	C	R
3	☆Fuel filter	I			I	R
4	☆Oil filter	C			C	C
5	☆Engine oil change	R	Replacement for every 1,000 km			
6	Tire pressure	I	I	I	I	I
7	Battery inspection	I	I	I	I	I
8	Brake & free ply check	I	I	I	I	I
9	Steering handle check	I			I	I
10	Cushion operation check	I			I	I
11	Every screw tightening check	I	I	I	I	I
12	Gear oil check for leaking	I	I	I	I	I
13	☆Spark plug check or change	I		I	R	R
14	☆Gear oil change	R	Replacement for every 5,000 km			
15	Frame lubrication				L	L
16	Exhaust pipe	I	I	I	I	I
17	☆Ignition timing	I	I	I	I	I
18	☆emission check in Idling	A	I	I	I	I
19	☆Throttle operation	I		I	I	I
20	☆Engine bolt tightening	I		I	I	I
21	☆CVT driving device(belt )				I	R
22	☆CVT driving device(roller)				C	C
23	Lights/electrical equipment/multi-meters	I	I	I	I	I
24	Main/side stands & springs	I			I	I
25	Fuel lines	I		I	I	I
26	Shock absorbers			I	I	I
27	Cam chain	I		I	I	I
28	☆Valve clearance	I		A	A	A
29	☆Crankcase evaporative control system	I		C	C	C
30	☆Crankcase blow-by over-flow pipe		Replacement for every 2,000 km			
31	☆2nd air jet system	I		I	C	C
32	☆Evaporative control system			I	I	I
33	Lines & connections in cooling system	I	I	I	I	I
34	Coolant reservoir	I	I	I	I	I
35	Coolant	I	Replace			
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 use r manual instructions. They are prohibited to be adjusted or repaired by unauthorized people. Otherwise, SYM is no responsible for the charge.

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



## 2. Maintenance Information

### Engine Oil

Turn off engine, and park the motorcycle in flat surface with main stand.  
 Check oil level with oil dipstick  
 So not screw the dipstick into engine as checking.  
 If oil level is nearly low level, fill out recommended oil to upper level.

### Oil Change

#### ⚠ Caution

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

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**

Add oil to crankcase (oil viscosity SAE 10W-30)  
 Recommended using King serial oil.

**Engine oil capacity:**

**Disassembly 1400c.c.**  
**Replacement 1200c.c.**

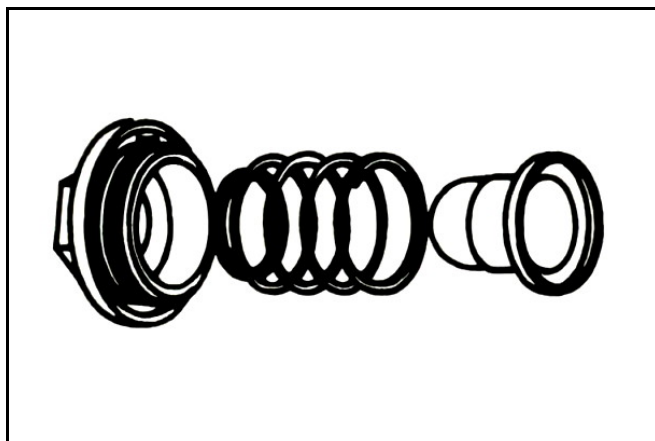
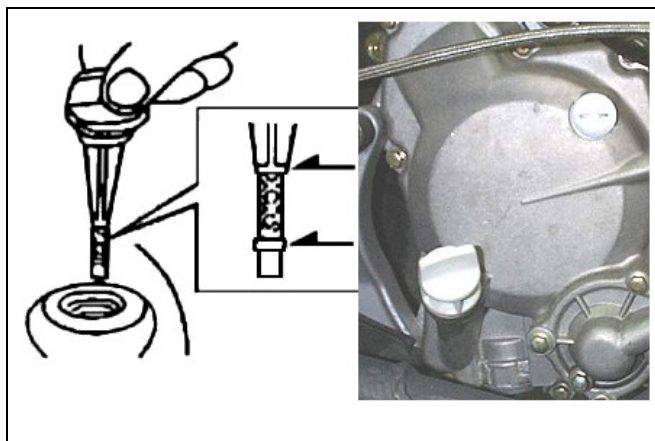
Install dipstick, start the engine for running several minutes.

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 : 1.3~1.7kgf-m**





## 2. Maintenance Information

### Gear Oil

Oil level inspection  
Park the motorcycle on flat surface with main stand.  
Turn off the engine.

### Gear Oil Change

Remove oil inspection bolt.  
Remove drain plug and drain oil out.  
Install the drain plug after drained.

**Torque value: 0.8~1.2kgf-m**

Add gear oil to specified quantity from the inspection hole.

Install the inspection bolt.

**Torque value: 1.0~1.4kgf-m**

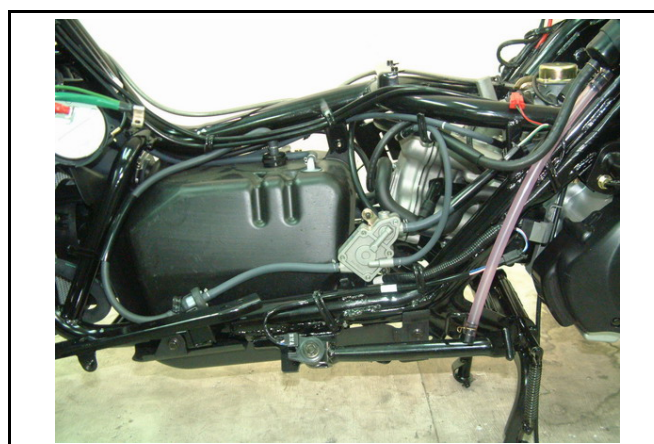
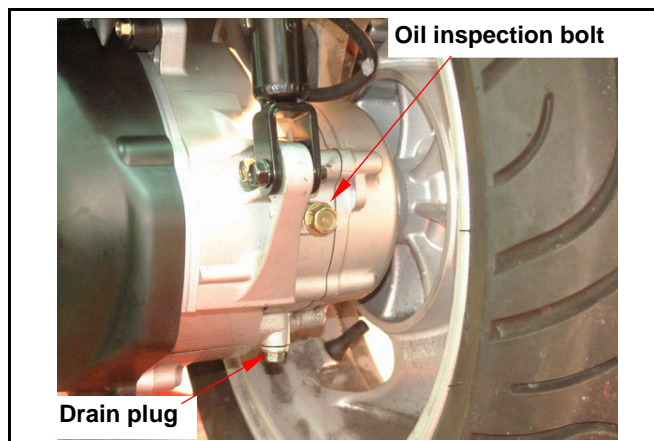
**Gear Oil Quantity: 170 c.c. when replacing**

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

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 oil leaking.

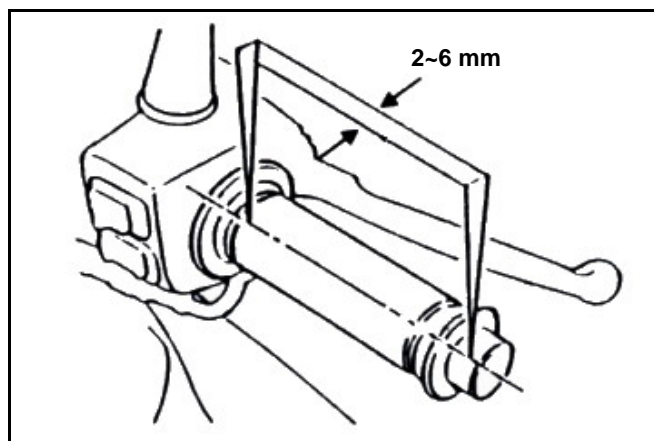


### Fuel Lines / Cable

Remove luggage box.  
Remove rear carrier.  
Remove body covers.  
Check all lines, and replace it when they are deterioration, damage 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.

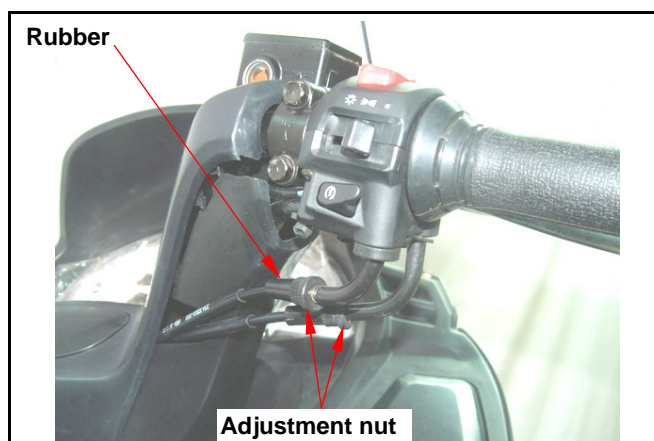
Check acceleration cable and replace it if deteriorated, twisted or damaged.

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.



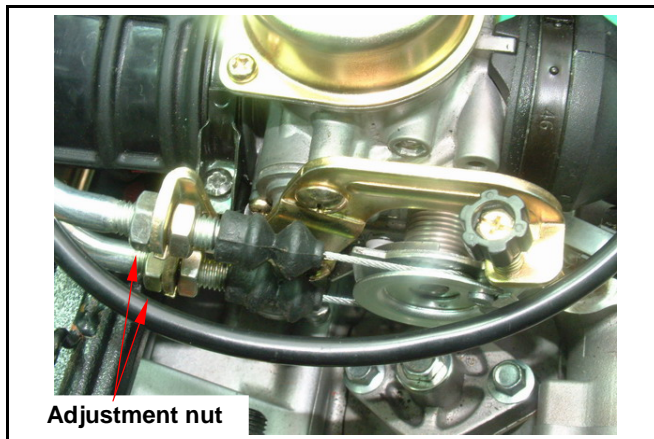


## 2. Maintenance Information

Primary adjustment is conducted from bottom side.

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

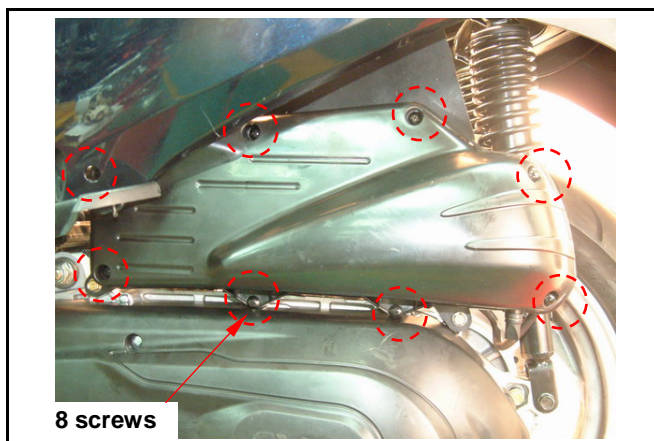
Tighten the fixing nut, and check acceleration operation condition.



### Air Cleaner

#### Air Cleaner Element

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



Remove the body cover.

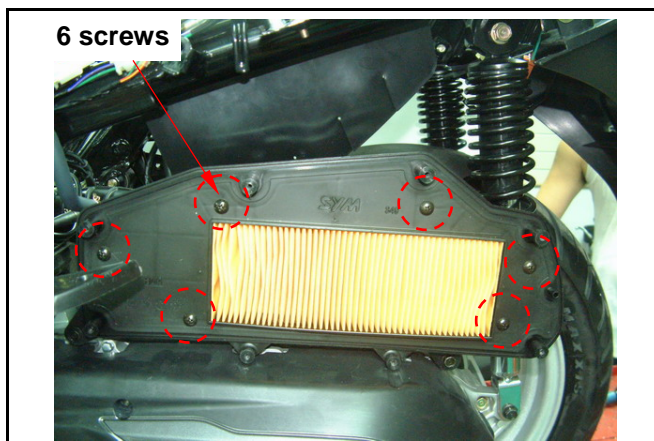
Loosen bolt from the air cleaner air hose.



Remove 6 screws, and then remove the air cleaner element.

#### ⚠ Caution

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





## 2. Maintenance Information

### P.C.V. system

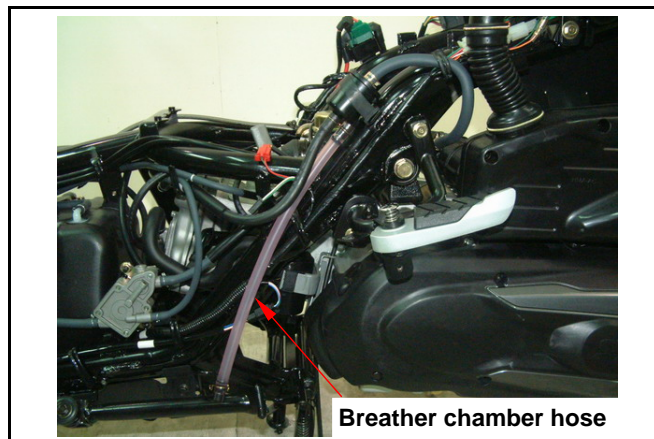
Remove the plug from lower of the breather chamber hose.

Release the dry internal deposit.

Every 2,000 kilometers release oil

#### ⚠ Caution

- A In releases the breather chamber hose in the transparent section as worthy of looking at as any deposit
- In the multi- rain or the accelerator in the situation rides, must reduce the maintenance traveling schedule
- In releases the breather chamber hose in the transparent section as worthy of looking at as any deposit



### Valve Clearance

#### ⚠ Caution

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

Remove luggage box.

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.

**Valve clearance (IN) : 0.10±0.02 mm.**

**Valve clearance (EX) : 0.15±0.02 mm.**

Loosen fixing nut and turn the adjustment nut for adjustment.

#### ⚠ Caution

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

**Special tool: Tappet adjuster**

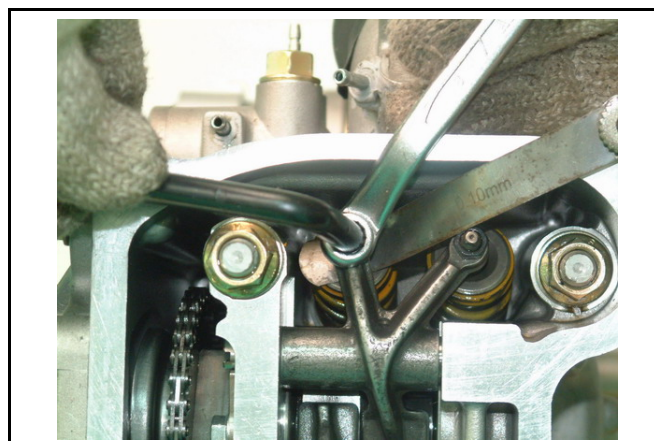
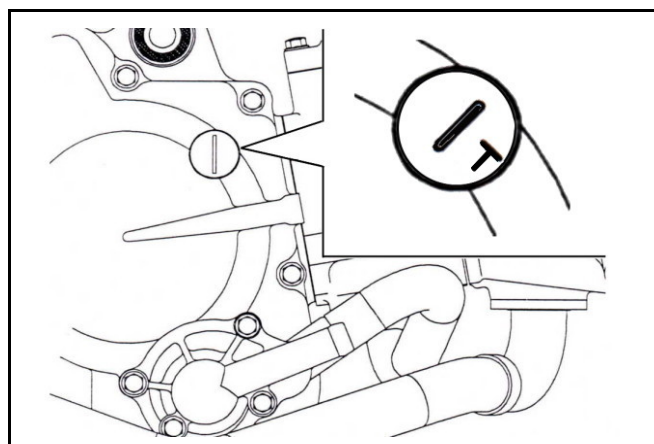
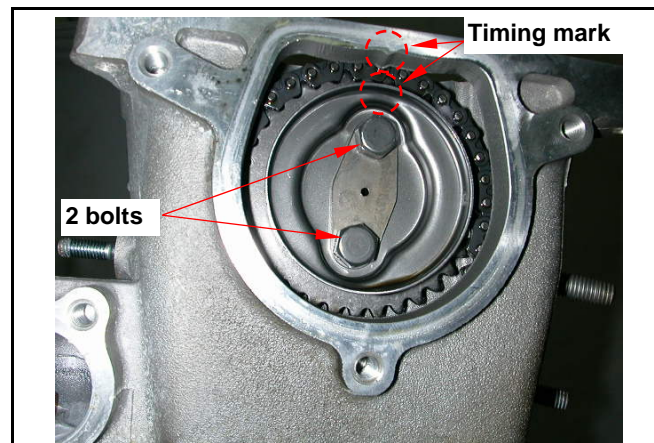
**SYM-9001200-08**

**SYM-9001200-09**

**SYM-9001200-10**

**Special tool: Tappet adjuster wrench**

**SYM-9001200**



### 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: 0.6~0.7 mm**

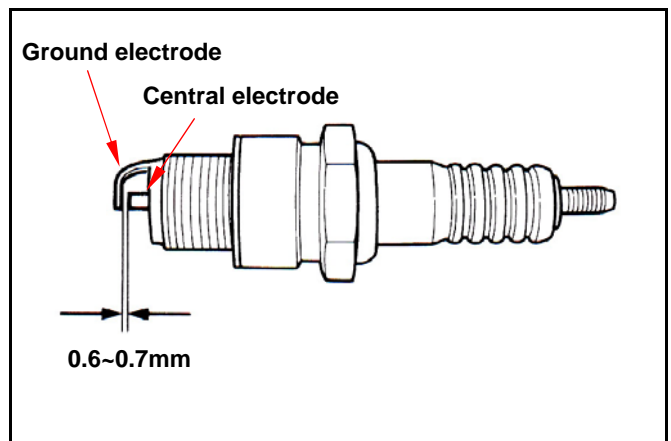
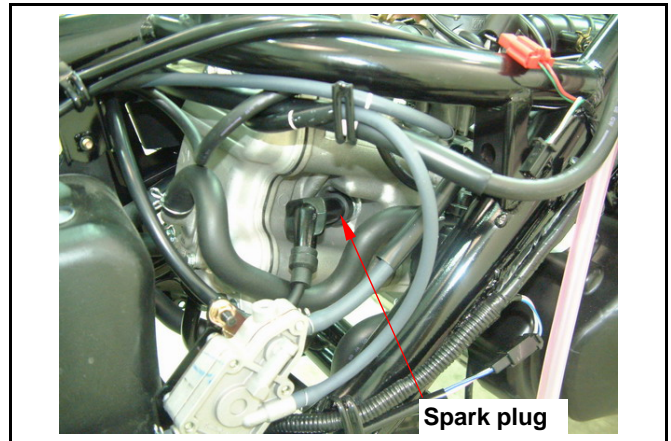
Carefully bend ground electrode of the plug to adjust the gap if necessary.

Hold spark plug washer and install the spark plug by screwing it.

Tighten the plug by turning 1/2 turn more with plug socket after installed.

**Tighten torque: 1.0~1.2kgf-m**

Connect spark plug cap



## 2. Maintenance Information

### 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

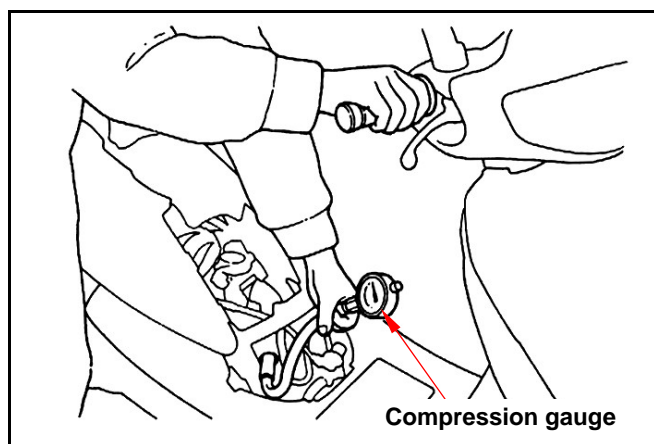
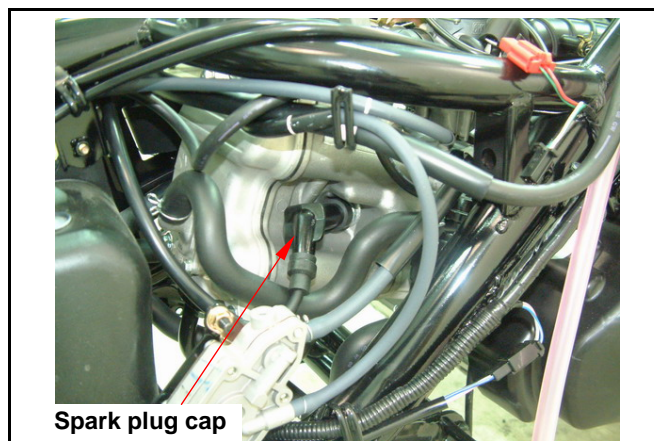
- Rotate the engine until the reading in the gauge no more increasing.
- Usually, the highest pressure reading will be obtained in 4~7 seconds.

#### Compression pressure : $12 \pm 2$ Kg/cm<sup>2</sup>

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

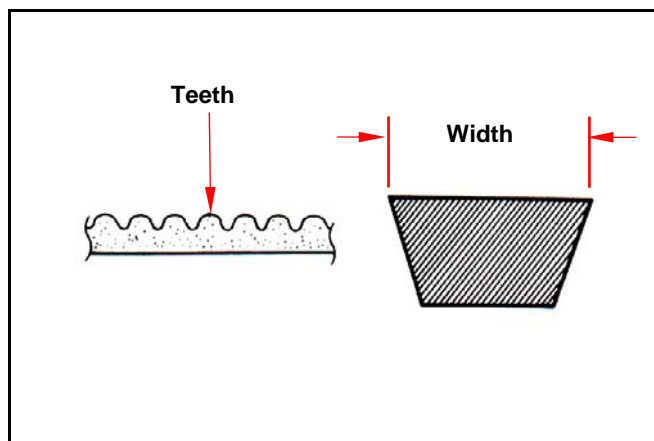
Remove mounting bolt located under air cleaner.

Remove the engine left side cover and the cover.

Check if the belt is crack or worn out.

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

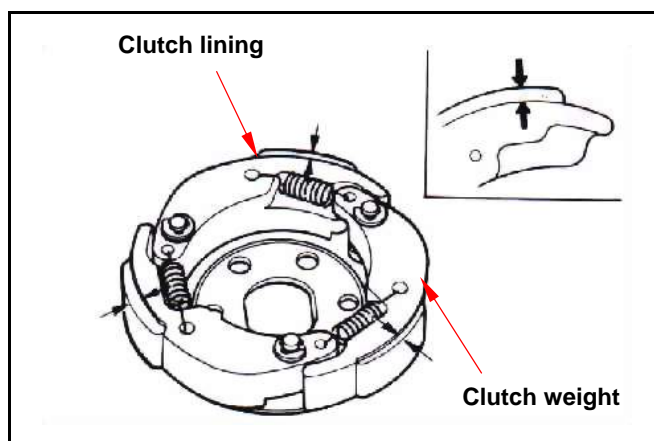
**Width limit: 22.5 mm or above**



### 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





## Steering Handle Top Bearing

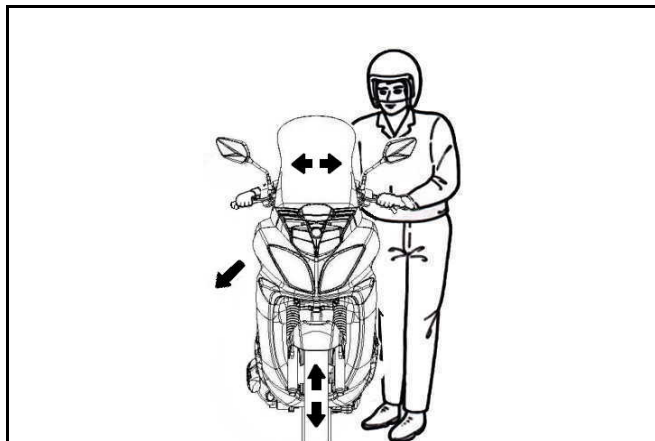
### ⚠ Caution

- 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.

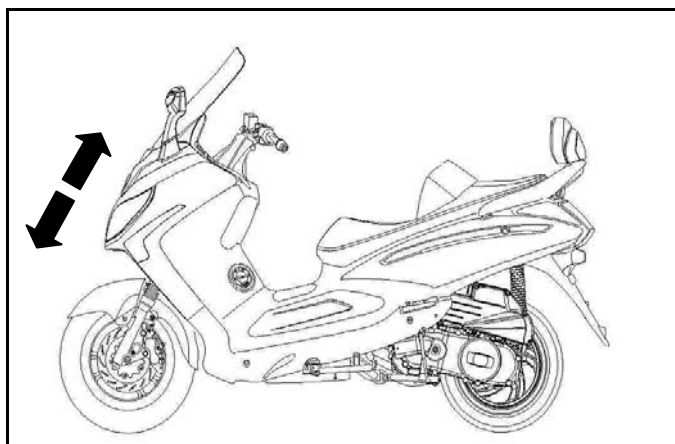
### Front cushion

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

Check if it is damaged.

Replace relative parts if damage is found.

Tighten all nuts and bolts.



### Rear Cushion

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

Check if it is damaged.

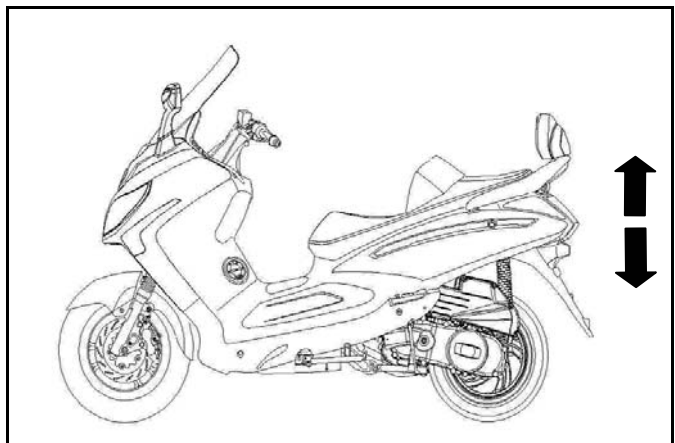
Replace relative parts if damage is found.

Park motorcycle with main stand.

Turn the rear wheel forcefully and check if engine bracket bushing is worn out.

Replace the bushing if looseness is found.

Tighten all nuts and bolts.

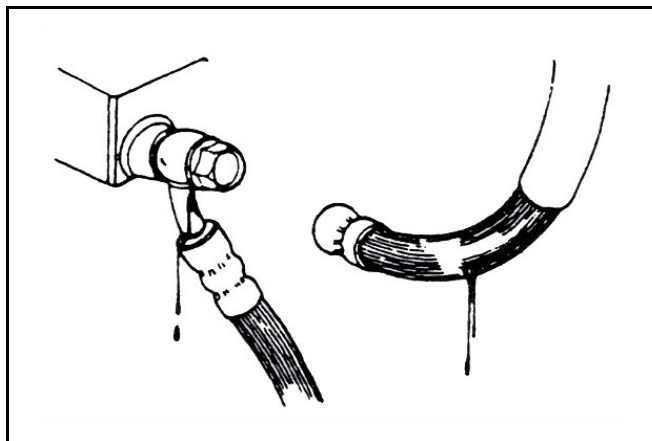


## 2. Maintenance Information

### Disk Brake System

#### Brake System Hose

Make sure the brake hoses for corrosion or leaking oil.

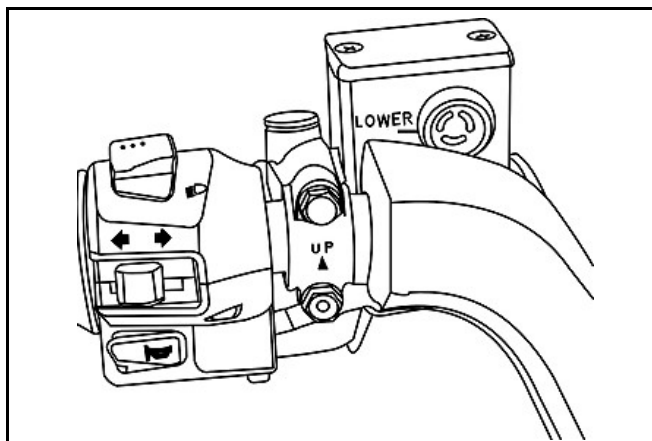


#### Brake Fluid

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

#### ⚠ Caution

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



#### Filling Out Brake Fluid

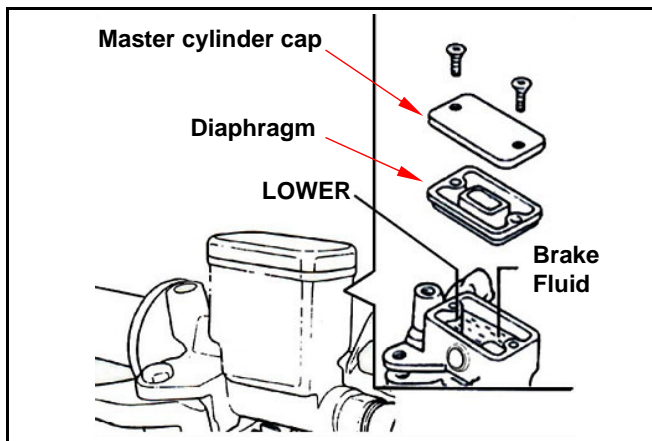
Tighten the drain valve, and add brake fluid. Operate the brake lever so that brake fluid contents inside the brake system hoses.

#### Added Brake Fluid

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

#### ⚠ Caution

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

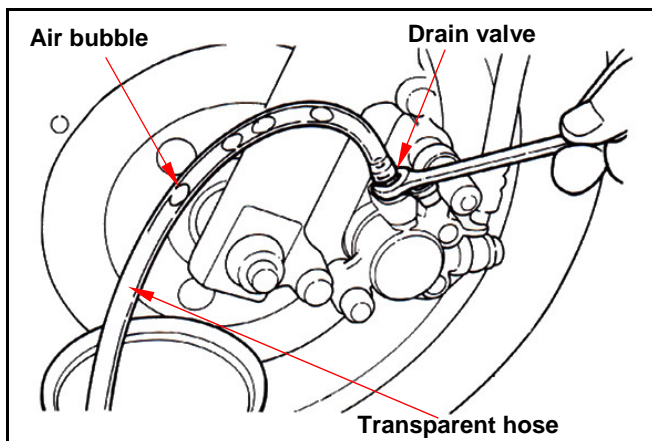


#### Air Bleed Operation

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

#### ⚠ Caution

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





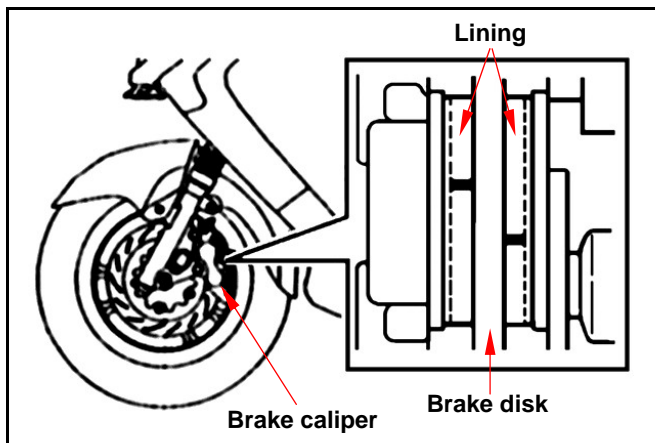
## 2. Maintenance Information

### Brake Lining Wear

The indent mark on brake lining is the wear limitation.  
 Replace the brake lining if the wear limit mark closed to the edge of brake disc.

**⚠ Caution**

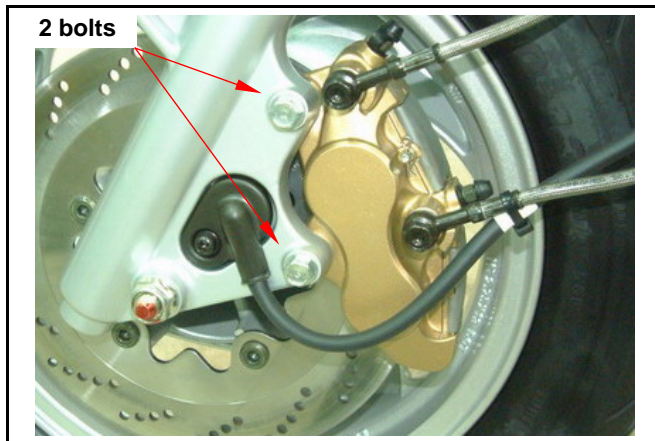
- It is not necessary to remove brake hose when replacing the brake lining.



Remove the brake clipper bolt, and take out the clipper.

**⚠ Caution**

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

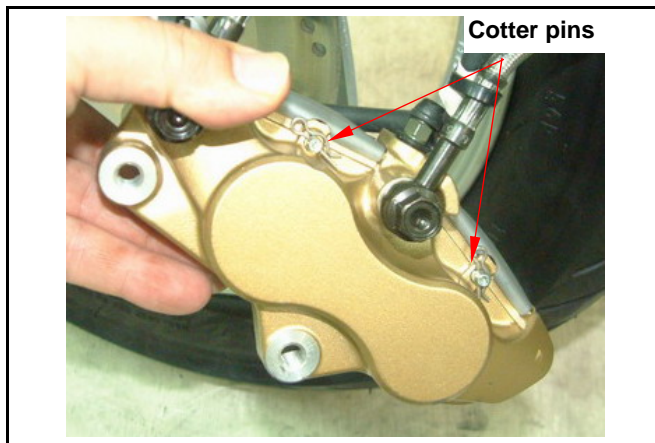


Pry out the brake lining with a flat driver if lining is clipped.

Remove 2 cotter pins

**⚠ Caution**

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



Remove the brake pad shafts and pads.



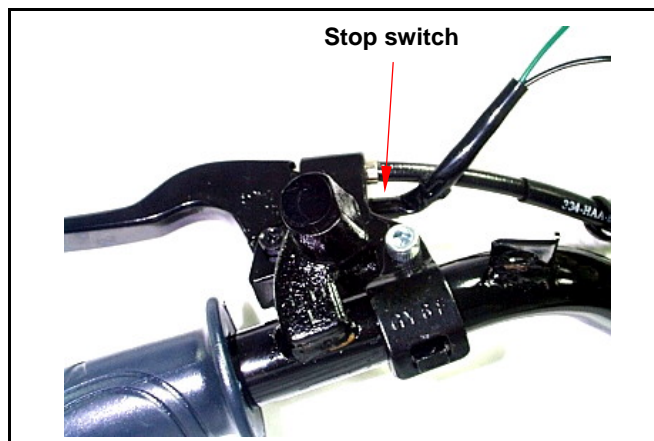


## 2. Maintenance Information

### 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.



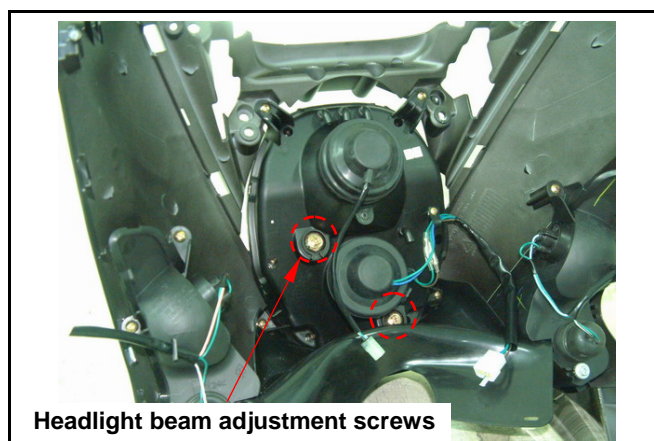
### Headlight Distance Adjustment

Turn on main switch

Headlight beam adjustment. Turn the headlight adjustment screw to adjust headlight beam high.

#### ⚠ Caution

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



### Wheel / Tire

#### ⚠ Caution

- Tire pressure check should be done as cold engine. °

#### Appointed tire pressure

Tire size		Front tire	Rear tire
Tire pressure as cold engine (Kg/cm <sup>2</sup> )	Load for under 90 Kg	1.75	2.25
	Full loaded	1.75	2.50

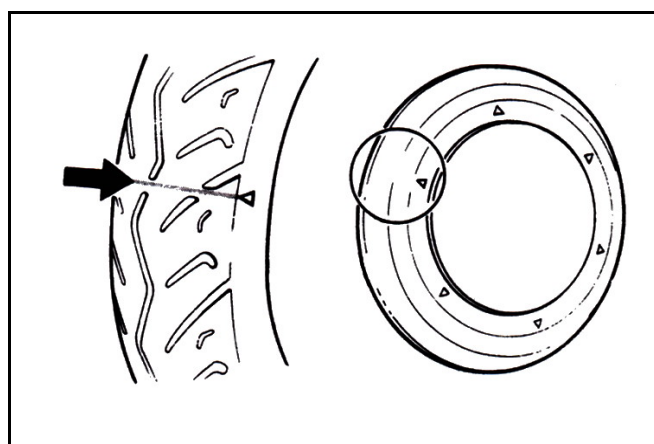
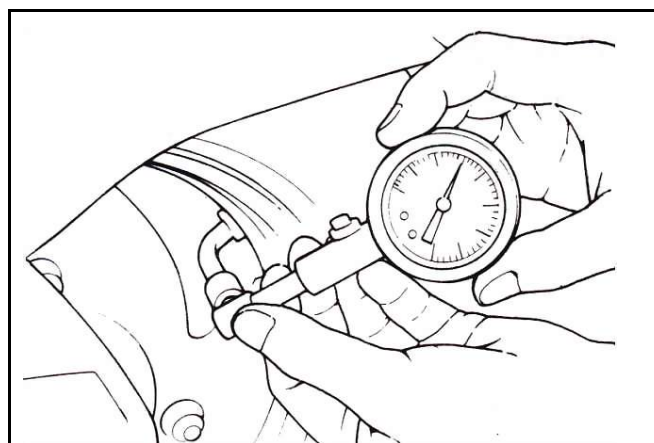
Check if tire surface is ticked with nails, stones or other materials.

Check if front and rear tires' pressure is in normal. Measure tire thread depth from tire central surface.

Replace the tire if the depth is not come with following specification

**Front tire : 1.5 mm**

**Rear tire : 2.0 mm**



## Battery

Open the inner box lid.  
Loosen screw & remove the battery cover

### Battery cable remove :

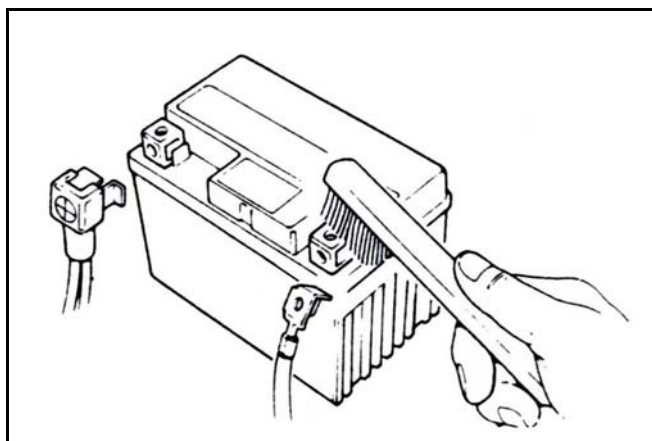
1. Disconnect the cable negative terminal (-),
2. then the cable positive terminal (+)
3. Remove the battery from the motorcycle. °

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

Install the battery in the reverse procedures of removal

### ⚠ Caution

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



## 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.



## 2. Maintenance Information



### Special Tools List





					
<b>NAME</b>	Left crank bearing puller	<b>NAME</b>	R/L. crank case disassemble tool	<b>NAME</b>	Valve cotter remove & assembly tool
<b>NO</b>	SYM-9100100	<b>NO</b>	SYM-1120000-HMA H9A	<b>NO</b>	SYM-1471110/20
					
<b>NAME</b>	L. Crank shaft puller	<b>NAME</b>	Tappet adjusting wrench	<b>NAME</b>	Tappet adjusting
<b>NO</b>	SYM-1130000-HMA H9A	<b>NO</b>	SYM-9001200	<b>NO</b>	SYM-9001200-08 09 10
					
<b>NAME</b>	R. crank case bearing 6201 assembles tool	<b>NAME</b>	Left crankshaft & oil seal assembly socket.	<b>NAME</b>	Rocker arm shaft disassemble
<b>NO</b>	SYM-9614000-HMA 6201	<b>NO</b>	SYM-2341110- HMA RB1	<b>NO</b>	SYM-1445100
					
<b>NAME</b>	Bearing driver 6204	<b>NAME</b>	Assembly directs puller	<b>NAME</b>	Drive shaft puller
<b>NO</b>	SYM-9110400	<b>NO</b>	SYM-2341110	<b>NO</b>	SYM-2341110- HMA RB1

					
<b>NAME</b>	Inner bearing puller	<b>NAME</b>	Outer bearing puller	<b>NAME</b>	Handle stand nut wrench
<b>NO</b>	SYM-6204022	<b>NO</b>	SYM-6204001	<b>NO</b>	SYM-5321100
					
<b>NAME</b>	Clutch nut wrench	<b>NAME</b>	Universal holder	<b>NAME</b>	AC.G. Flywheel puller
<b>NO</b>	SYM-9020200	<b>NO</b>	SYM-2210100	<b>NO</b>	SYM-3110000-HMA
					
<b>NAME</b>	Steering head top thread wrench	<b>NAME</b>	Bearing driver HK1516	<b>NAME</b>	Bearing puller 6205
<b>NO</b>	SYM-5320010	<b>NO</b>	SYM-9100200-HMA RB1 HK1516	<b>NO</b>	SYM-9100400 HMA RAI 6205
					
<b>NAME</b>	Air operated bearing puller	<b>NAME</b>	Oil seal driver 34*52*5	<b>NAME</b>	Right crankcase cover bearing 6201 puller.
<b>NO</b>	SYM-9100410-400 A6205	<b>NO</b>	SYM-9125500-HMA	<b>NO</b>	SYM-9614000-HMA RB1 6201

## 2. Maintenance Information



					
<b>NAME</b>	Bearing driver 6205	<b>NAME</b>	Drive shaft & oil seal (25*40*8) socket	<b>NAME</b>	Bearing puller 6303
<b>NO</b>	SYM-9615000-6205	<b>NO</b>	SYM-9120200-HMA	<b>NO</b>	SYM-6303000-HMA H9A 6303
		 (Ø30mm)		 (Ø22mm)	
<b>NAME</b>	Bearing driver 6201	<b>NAME</b>	Crankcase bush puller	<b>NAME</b>	Crankcase bush puller
<b>NO</b>	SYM-9614000-6201	<b>NO</b>	SYM-1120310	<b>NO</b>	SYM-1120320
					
<b>NAME</b>	Water pump mechanical seal driver	<b>NAME</b>	Water pump bearing driver 6901	<b>NAME</b>	Water pump oil seal driver (inner)
<b>NO</b>	SYM-1721700-H9A	<b>NO</b>	SYM-9100100	<b>NO</b>	SYM-9120500-H9A
					
<b>NAME</b>	Vacuum pressure gauge	<b>NAME</b>	Fuel pressure gauge	<b>NAME</b>	Multi-meter
<b>NO</b>	SYM-HT07011	<b>NO</b>	SYM-HT07010	<b>NO</b>	SYM-HE07007-01

					
<b>NAME</b>	Cylinder pressure gauge	<b>NAME</b>	Vehicle circuit test tool kit	<b>NAME</b>	Vehicle circuit test harness kit
<b>NO</b>	SYM-HT07008	<b>NO</b>	SYM-HE170008	<b>NO</b>	SYM-HE170008-01
					
<b>NAME</b>	Efi System Diagnostic tool				
<b>NO</b>					



## 2. Maintenance Information

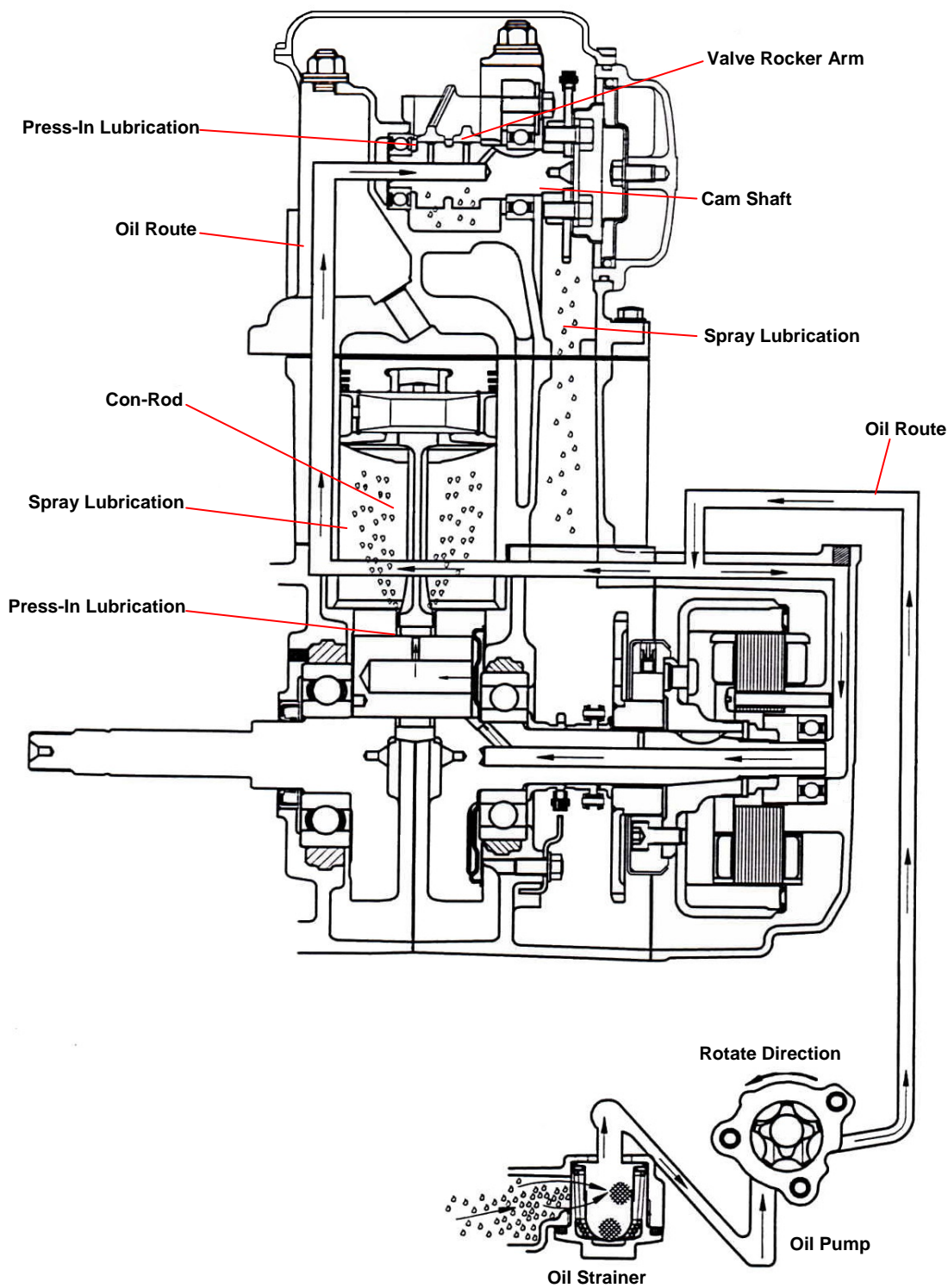
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**NOTE:**

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



### 3. Lubrication System

#### Precautions in Operation

##### General Information:

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

##### Specifications

Engine oil quantity Disassembly: 1400 c.c.

Change: 1200c.c.

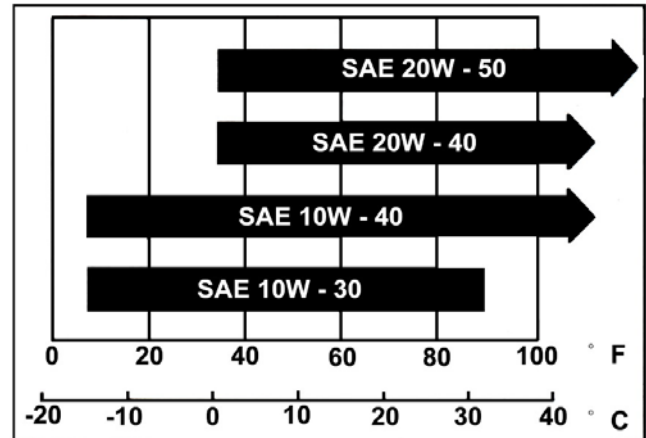
Oil viscosity SAE 10W-30 (Recommended King serial oils)

Gear oil Disassembly: 180c.c.

Change: 160c.c.

Gear oil viscosity SAE 140

(Recommended SYM Hypoid gear oils)



##### Unit:

mm

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

##### Torque value

Torque value oil strainer cap	1.3~1.7kgf-m
Engine oil drain bolt	3.5~4.5kgf-m
Gear oil drain bolt	1.1~1.5kgf-m
Gear oil join 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 in periodical
- Cylinder head gasket damage
- Piston ring worn out

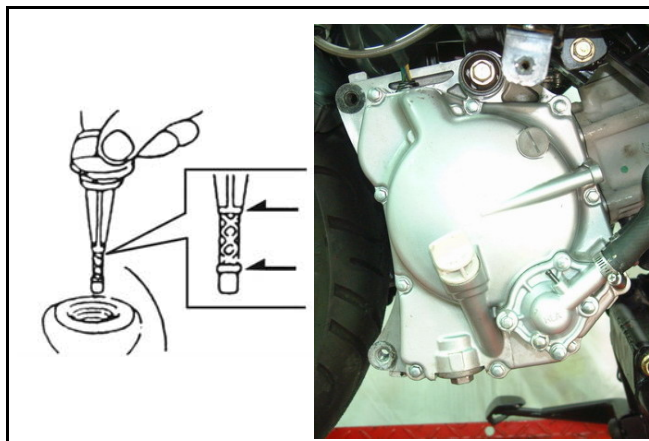
## Engine Oil

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

Check oil level with oil dipstick.

So not screw the dipstick into engine as checking.

If oil level is nearly low level, fill out recommended oil to upper level.



## Oil Change

### ⚠ Caution

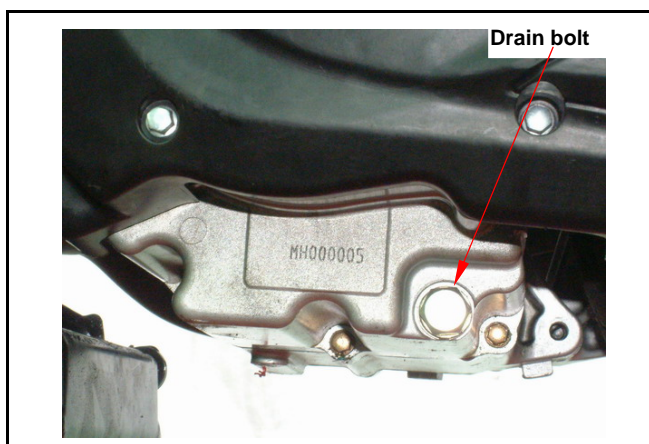
Drain oil as engine warmed up so that makes sure oil can be drained smoothly and completely.

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

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

Install oil drain bolt.

**Torque value : 3.5~4.5kgf-m**



## 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 : 1.3~1.7kgf-m**

Add oil to crankcase (oil viscosity SAE 10W-30)

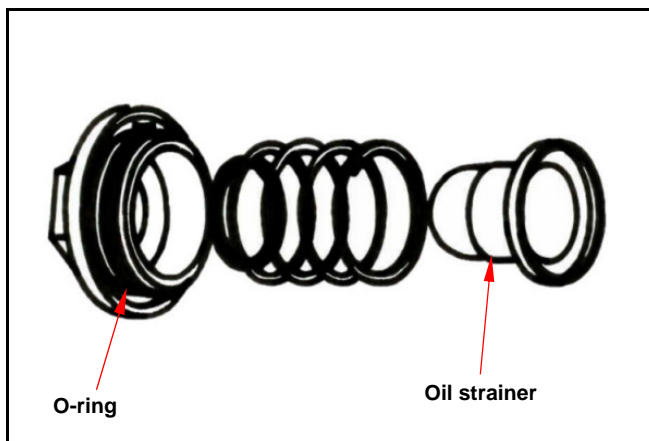
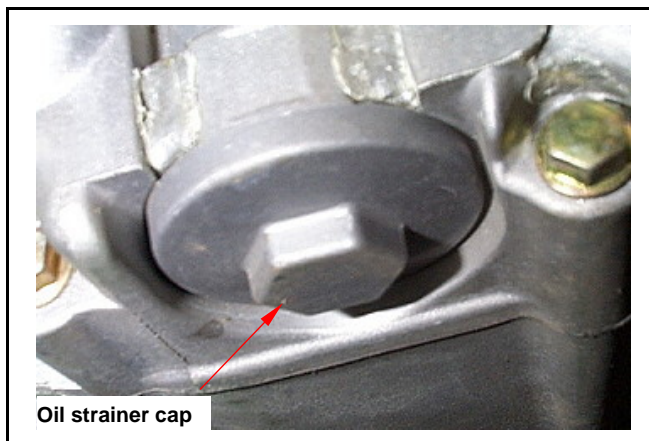
Recommended using King serial oil.

**Engine oil capacity: 1200c.c. when replacing**

Install dipstick, start the engine for running several minutes.

Turn off engine, and check oil level again.

Check if engine oil leaks.



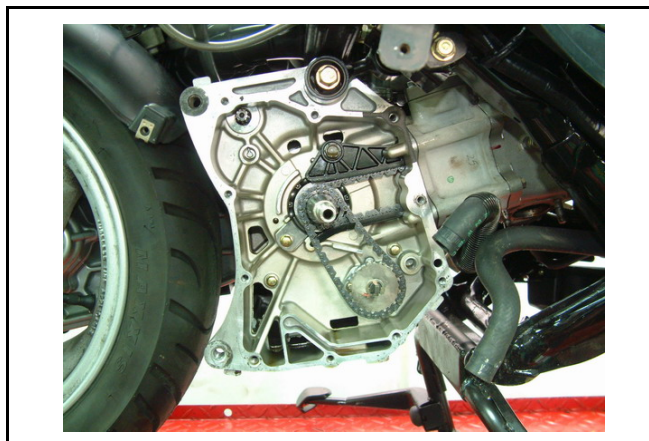


### 3. Lubrication System

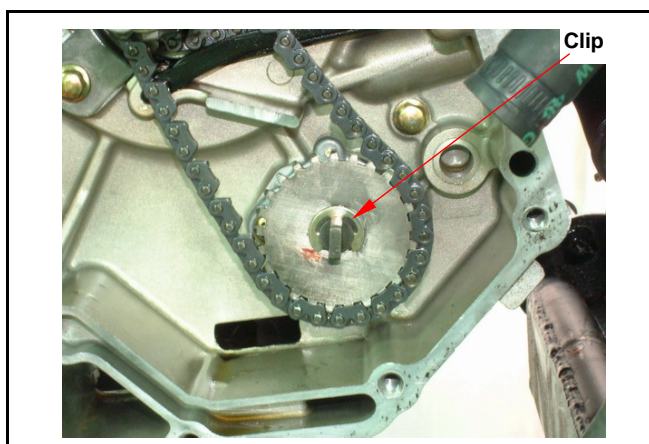
#### Oil Pump

##### Oil Pump Removal

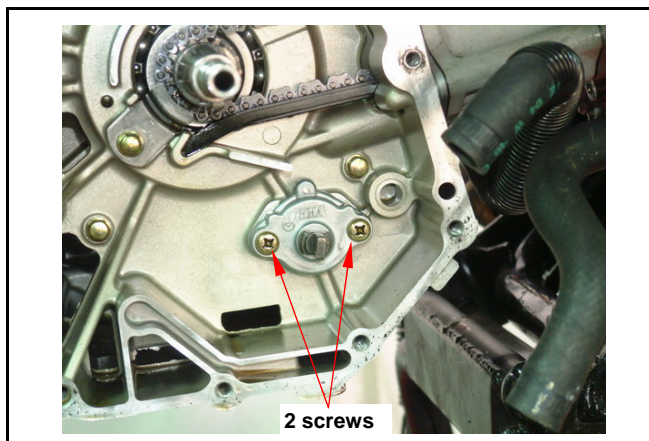
Remove generator and starting gear. (Refer to chapter 10) ◦



Remove cir clip and take out oil pump driving chain and sprocket.



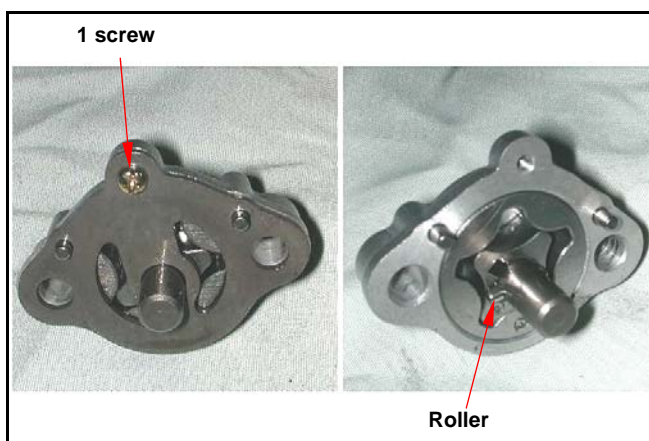
Make sure that pump shaft can be rotated freely. Remove 2 screws on the oil pump, and then remove oil pump.



##### Oil Pump Disassembly

Remove the screws on oil pump cover and remove the cover.

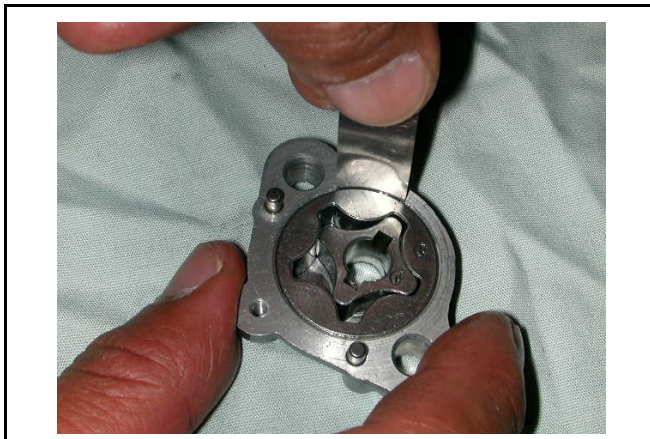
Remove oil pump shaft roller and shaft.



#### Oil Pump Inspection

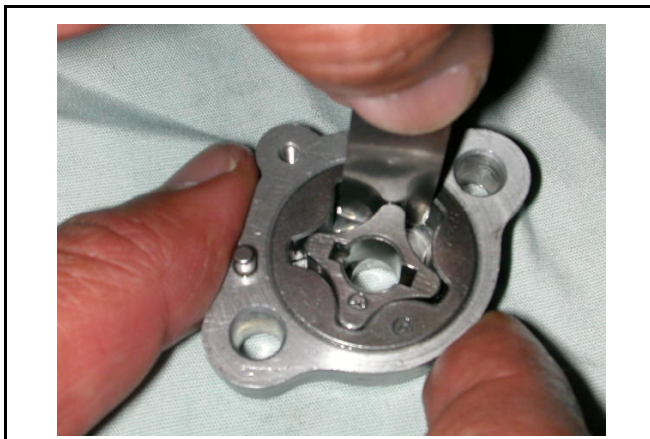
Check the clearance between oil pump body and outer rotor.

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

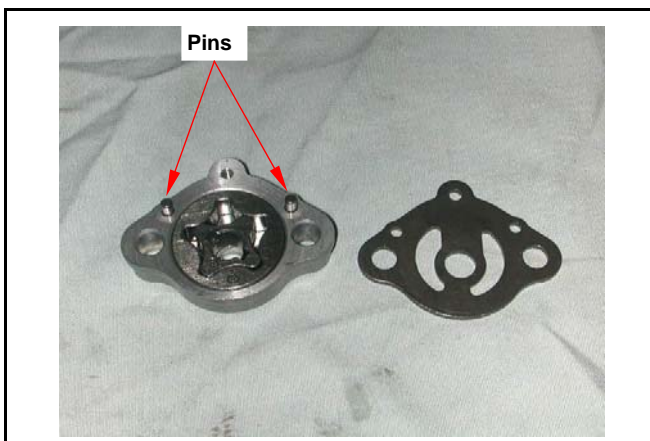


#### Oil Pump Re-assembly

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.

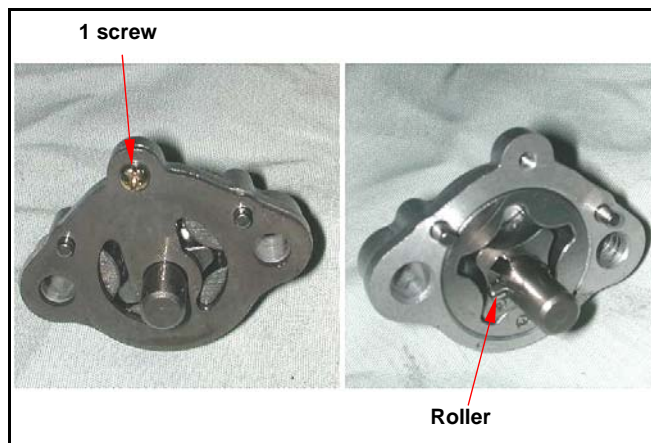




### 3. Lubrication System



Tighten the oil pump screw.

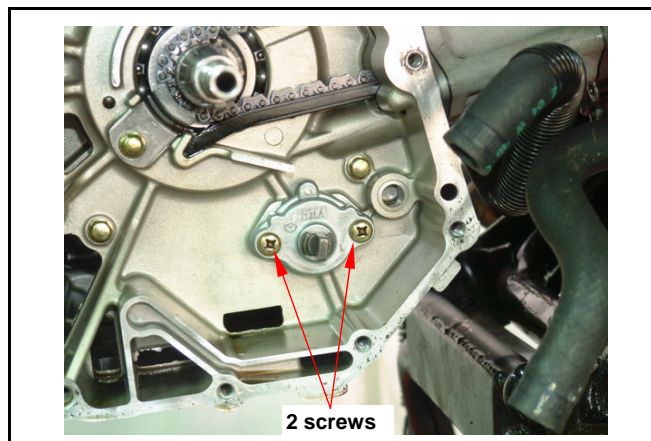


#### Oil Pump Installation

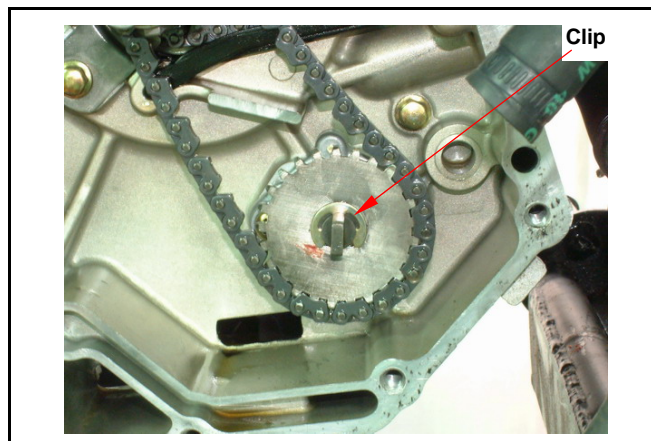
Install the oil pump, and then tighten screws.

**Torque value : 0.1~0.3kgf-m**

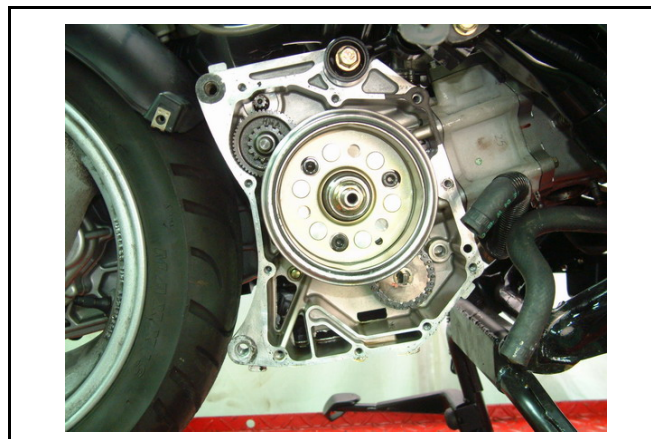
Make sure that oil pump shaft can be rotated freely.



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

Remove oil join bolt.

Remove drain bolt and drain gear oil out.

Install the drain bolt after drained.

**Torque value: 1.1~1.5kgf-m**

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

Add oil to specified quantity from the join hole.

**Gear Oil Quantity: 160c.c. when replacing**

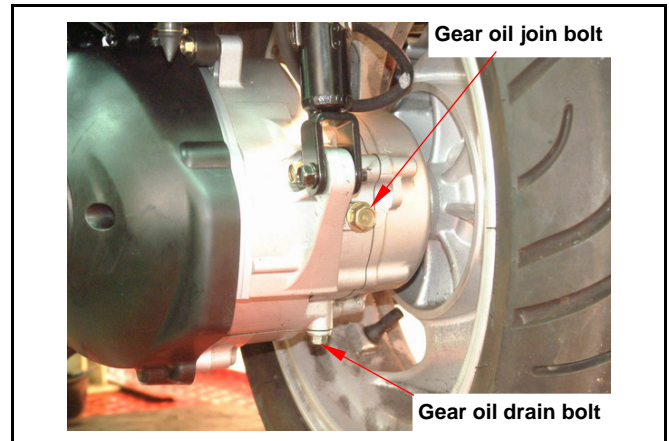
Make sure that the join bolt washer can be re-used, and install the bolt.

**Torque value: 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 oil leaking.





## 3. Lubrication System

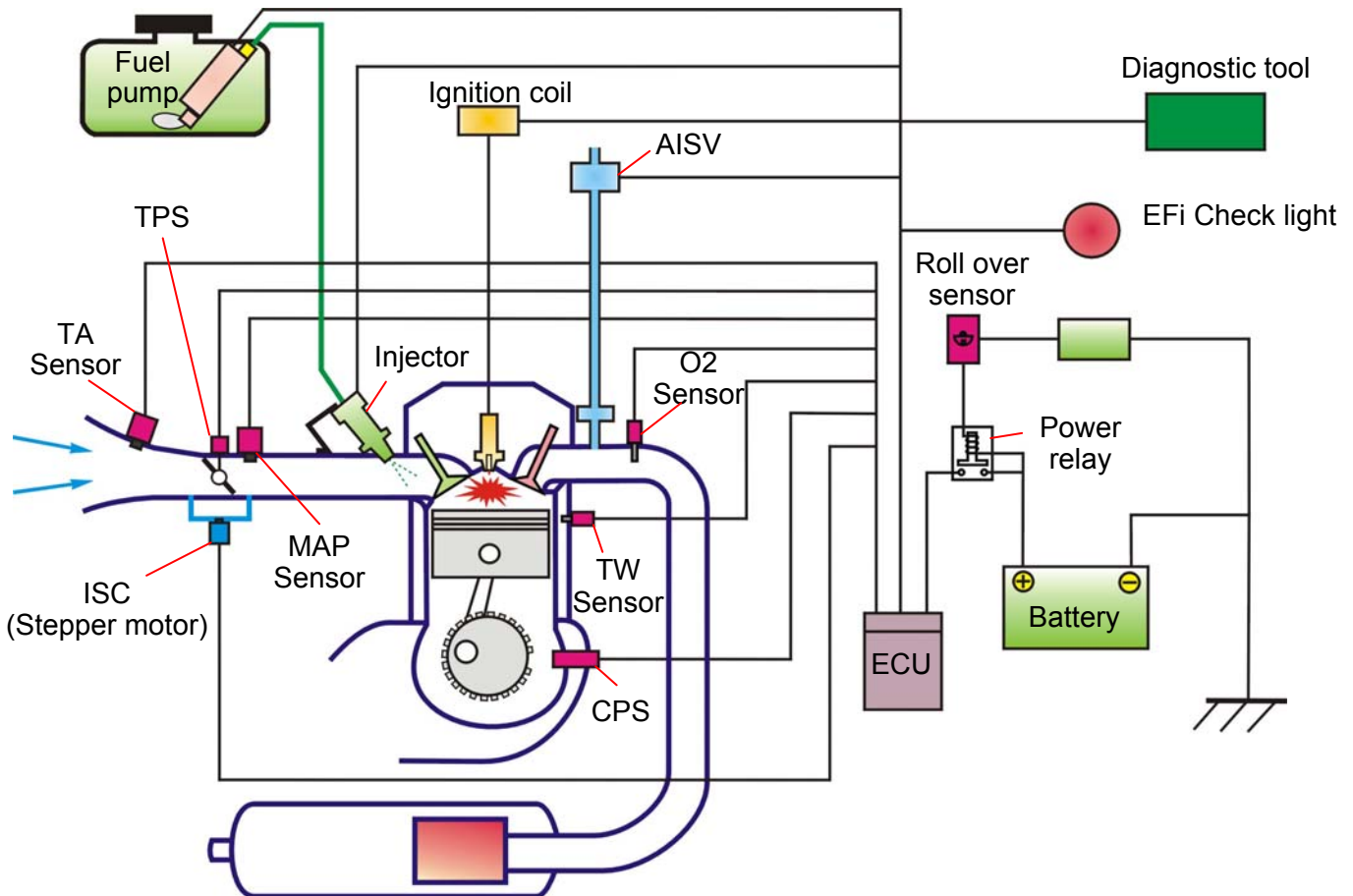
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Notes:

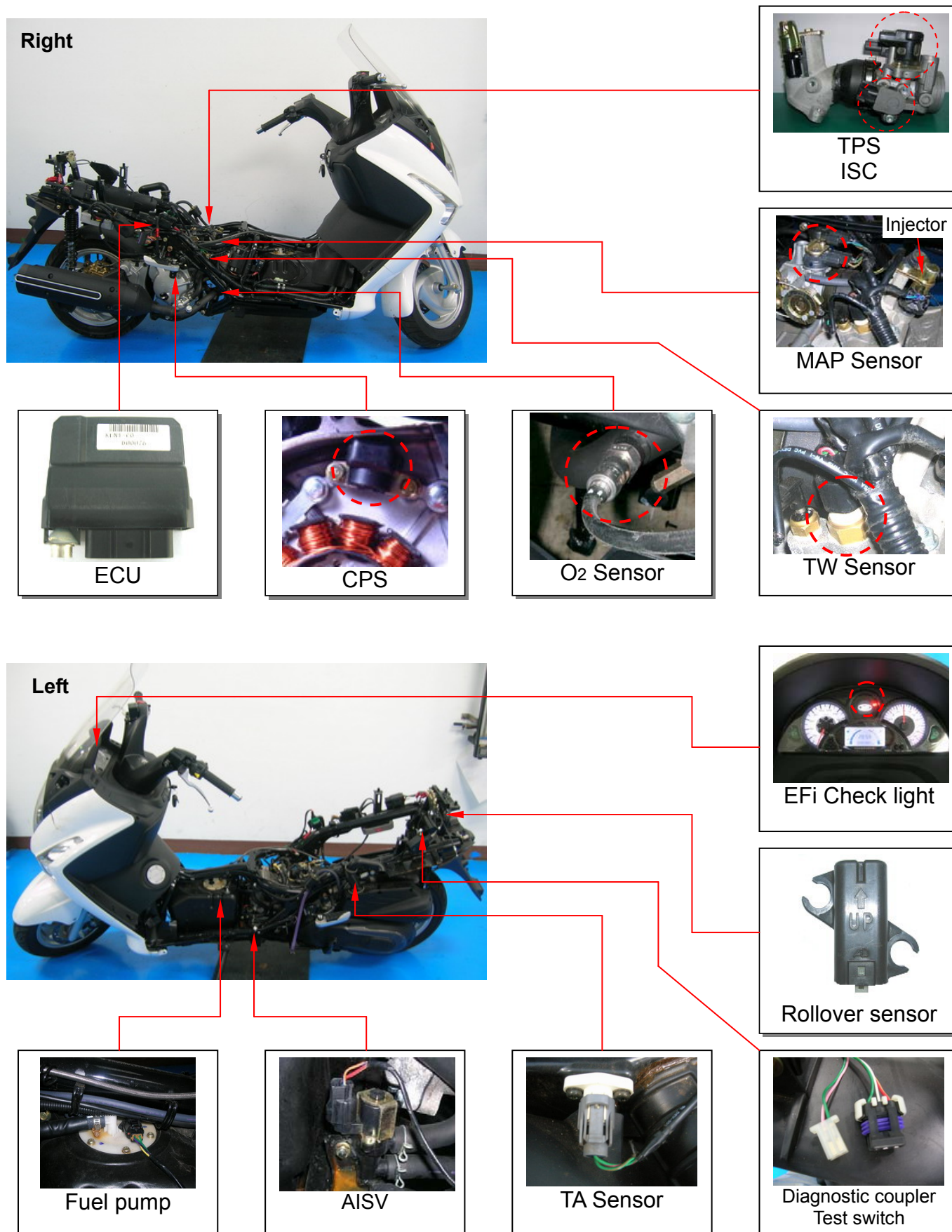
EFi System Components.....	4-1	Integrated Troubleshooting Procedure .....	4-37
EFi System Vehicle Configuration .....	4-2	Air Cleaner.....	4-40
EFi System Operation .....	4-3	EFi System Diagnosis Methods .....	4-41
EFi System Introduction.....	4-4	Check Light Fault Codes Differentiation .....	4-42
Fuel System.....	4-5	Fault Code And Sensors Table .....	4-43
Ignition System.....	4-6	Fault Code and Check Light Flashing Lighting Identification Table .....	4-44
Sensors / Drives.....	4-7	EFi System Diagnostic Tool - V70 .....	4-45
Precautions in Operation .....	4-14	Diagnosis Use Note .....	4-46
EFi System Components Description 4-15		Troubleshooting Table.....	4-58
EFi System Circuit.....	4-31	Comprehensive Maintenance List .....	4-59
ECU Pin Configuration .....	4-32		
Troubleshooting .....	4-33		

## EFi System Components



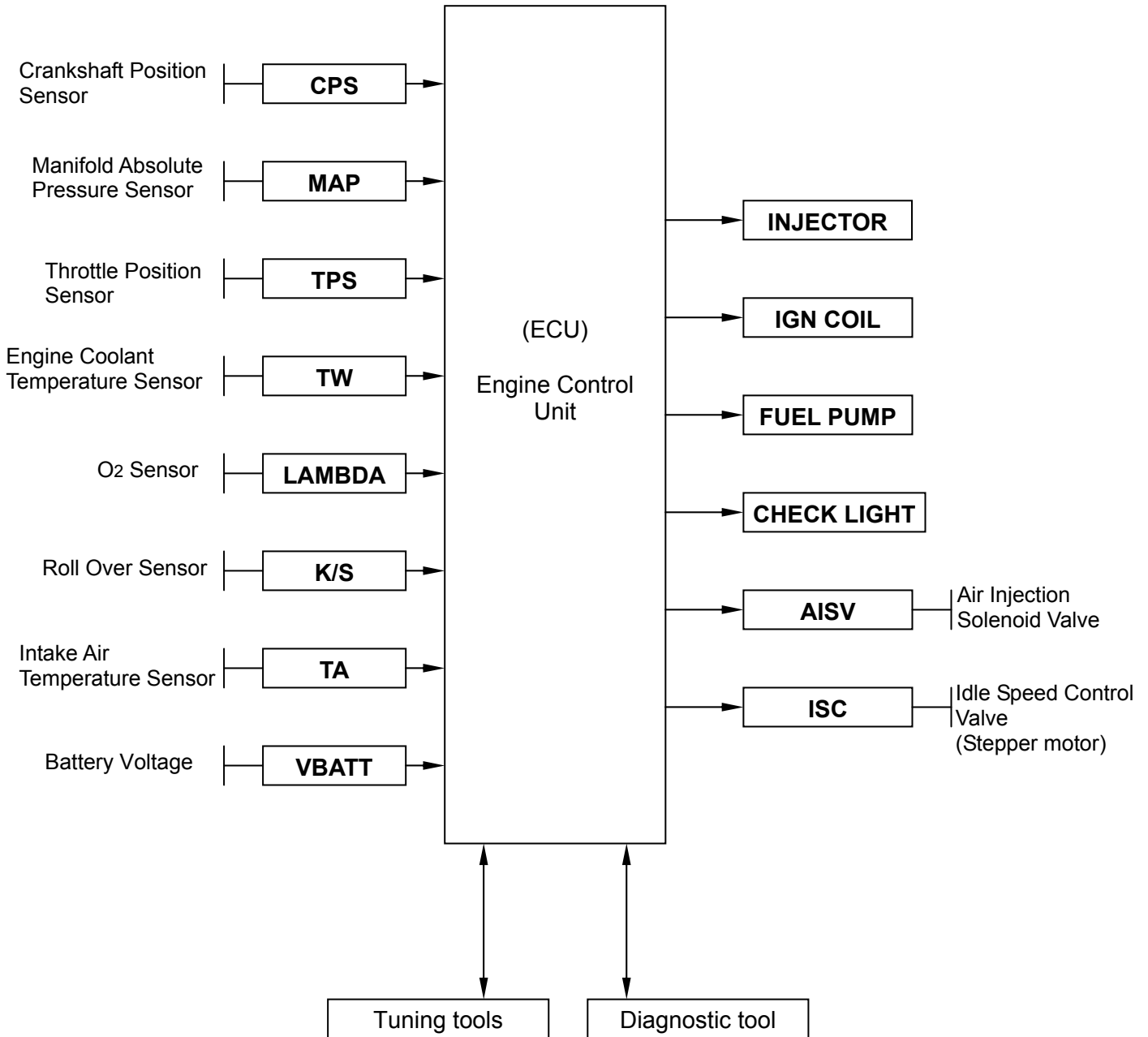
# 4. Fuel Injection System

## EFi System Vehicle Configuration





## EFi System Operation





## 4. Fuel Injection System

---

### EFi System Introduction

Based on 4-stroke SOHC engine, displacement 250 c.c. 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 O<sub>2</sub> 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.

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  $294 \pm 6$  kPa. 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.

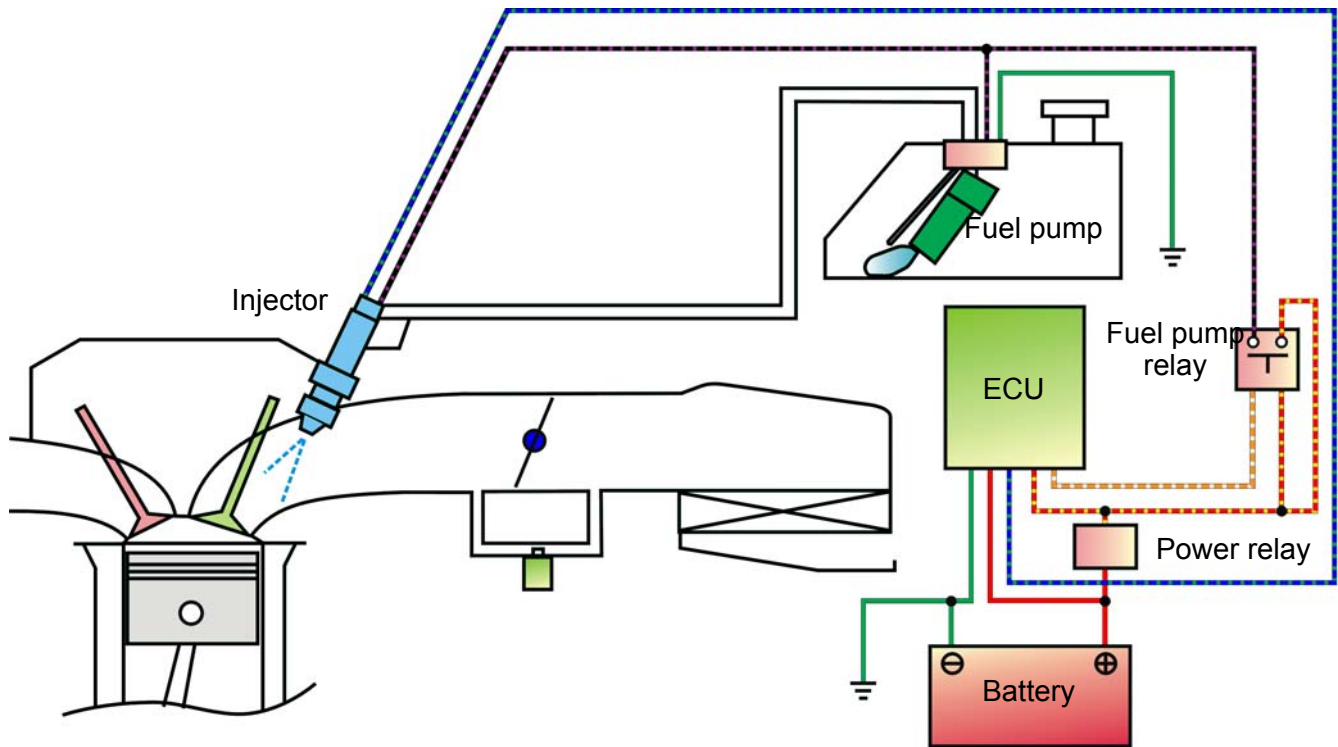
In the traditional gasoline engine, the carburetor supplies the fuel. The process is done by the engine vacuum and the negative pressure in the carburetor by mixing fuel and air. Under this condition, three major processes are done simultaneously in the carburetor: 1. Air quantity measurement. 2. Fuel 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  $294 \pm 6$  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. O<sub>2</sub> 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  $3 \text{ kg / cm}^2$ ). 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

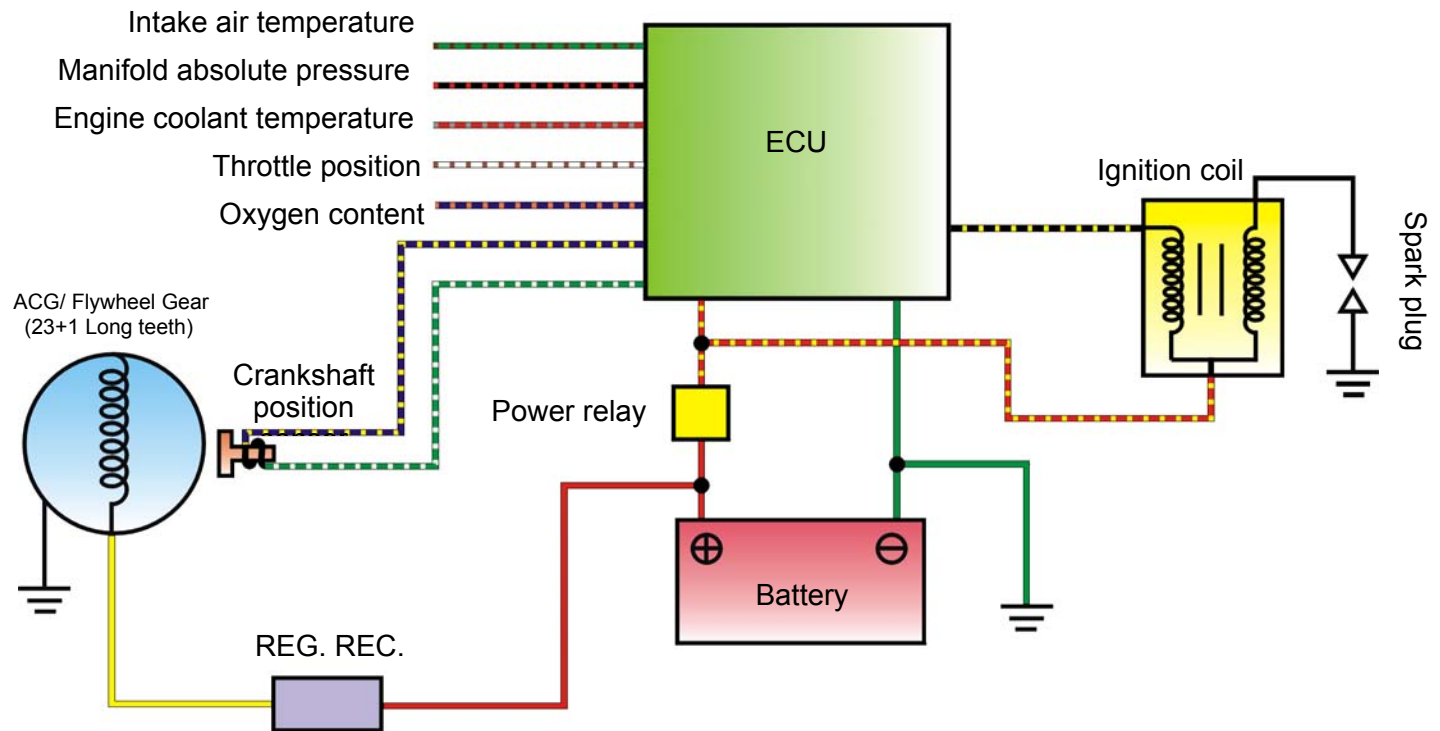
Double-hole type injector provides two intake valves fuel injection quantity, enhances the effect of fuel atomization, and reduces HC emissions. Short-type injector cap can easily fix the injector, receive the fuel from the fuel pump, and limit injector rotation sliding. The signals from ECU control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

## 4. Fuel Injection System

### Ignition System



### Principle

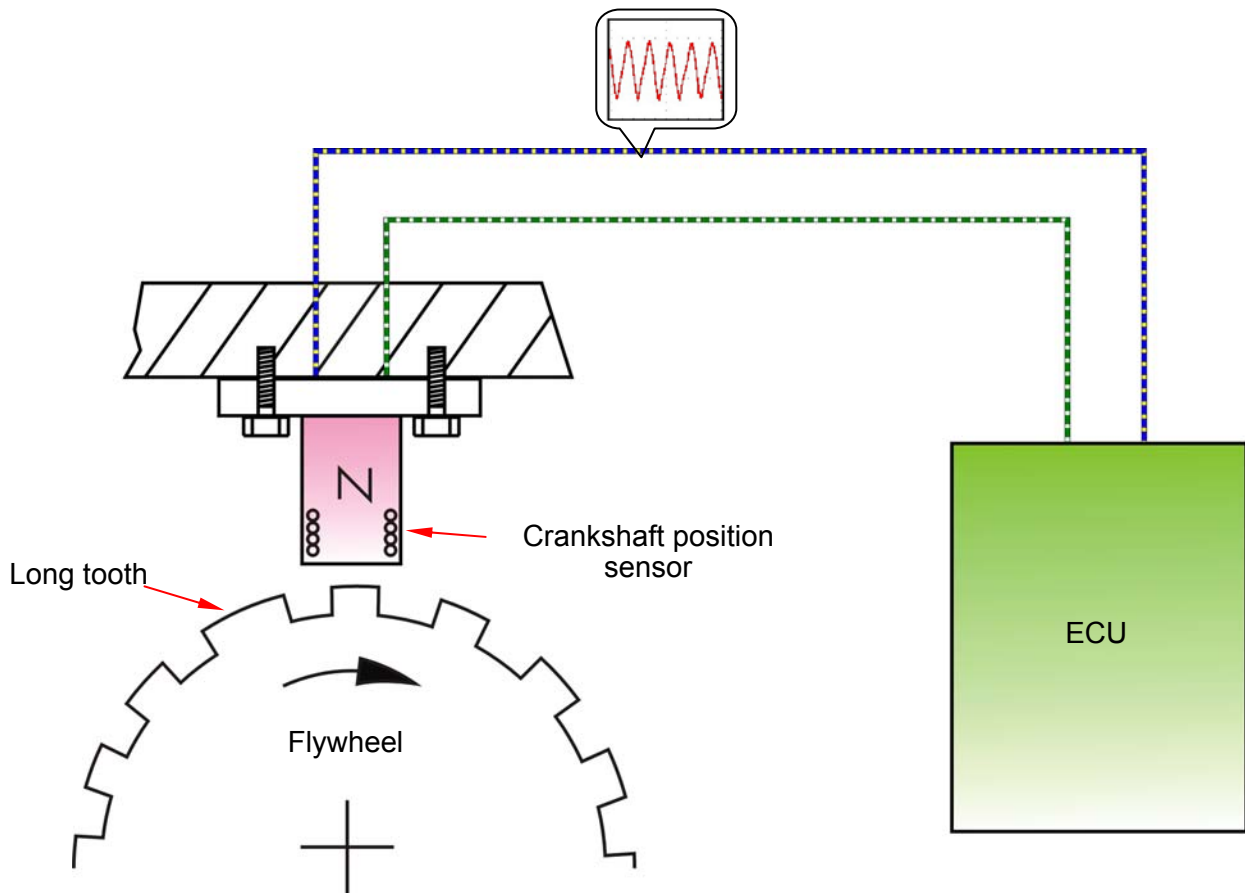
The computer programmed ignition system receives the signals from the Crankshaft position sensor, Throttle position sensor, O<sub>2</sub> Sensor, MAP sensor, Intake air temperature sensor, Engine coolant temperature sensor. Calculating the engine RPM, the 16-bit microcomputer determines the appropriate 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 ° / 1650RPM
2. Spark plug: NGK CR8E Clearance: 0.6 to 0.7 mm
3. ACG crankshaft position sensor coil resistance: 80 ~ 160 Ω (Green / White - Blue / Yellow)
4. Ignition coil primary circuit resistance: 2.8 Ω ± 15% (20 ° C) (Red / Yellow - Black / Yellow)
5. Battery Type / Capacity: YTX12A-BS or GTX12A-BS / 12V 12Ah

## Sensors / Drives

## Crankshaft Position Sensor (CPS)

**Description**

Right after the engine is started; the crankshaft position sensor identifies the TDC position by detecting the long 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.

**Function**

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



# 4. Fuel Injection System



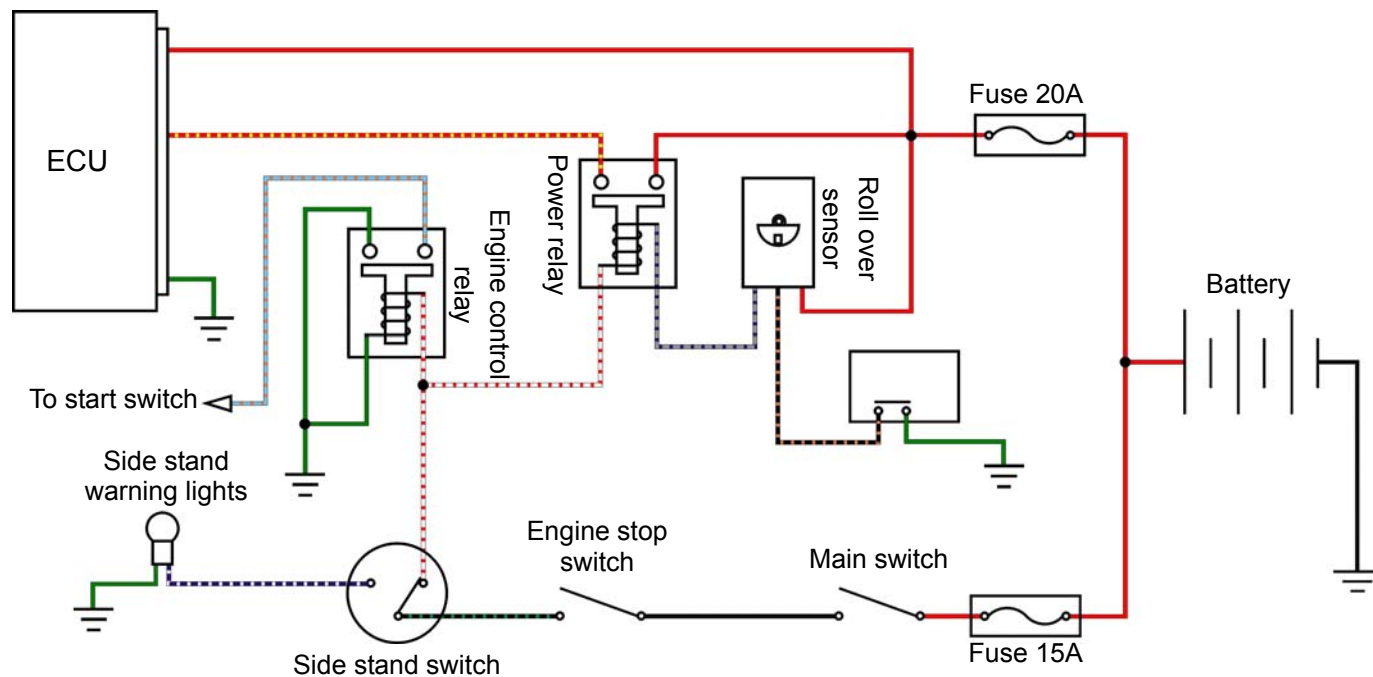
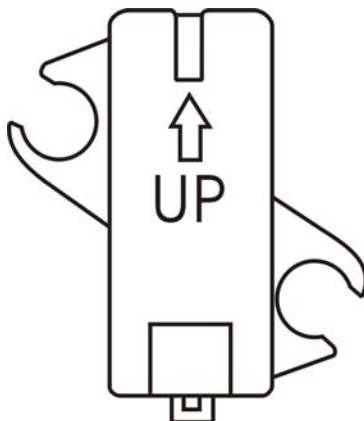
## Roll Over Sensor

### Function

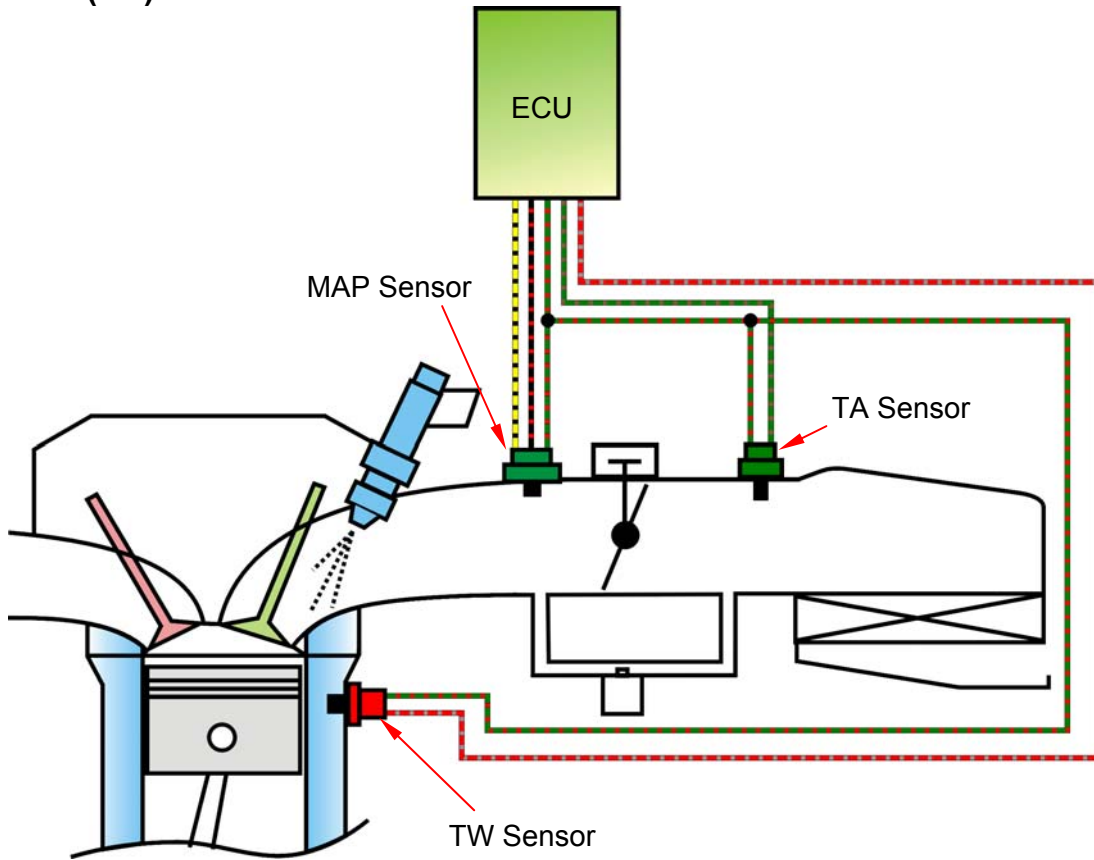
As a safety device, when the motorcycle tips over, it will cut off power supply of ECU and shut down the engine.

### 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.

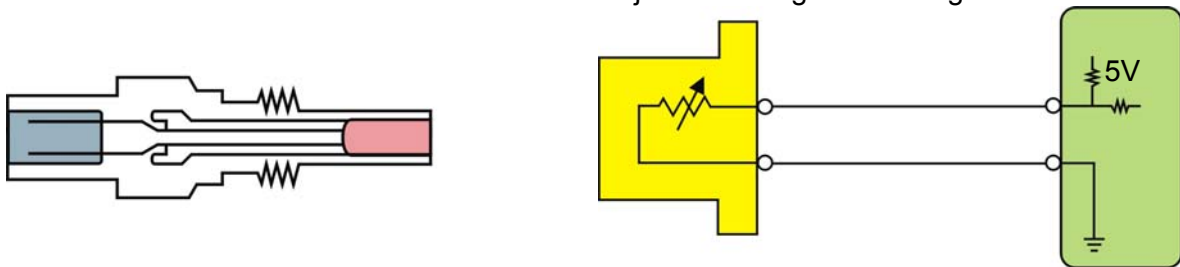


## Manifold Absolute Pressure (MAP) / Engine Water Temperature (TW) / Intake Air Temperature (TA) Sensors



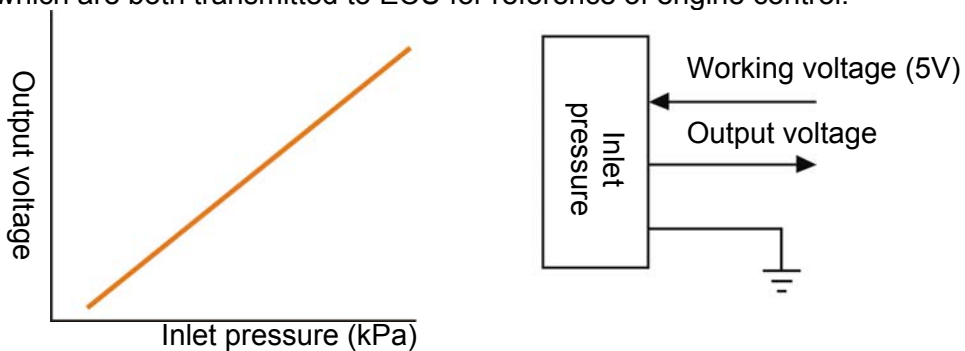
### Engine water temperature / Intake air temperature sensor:

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:

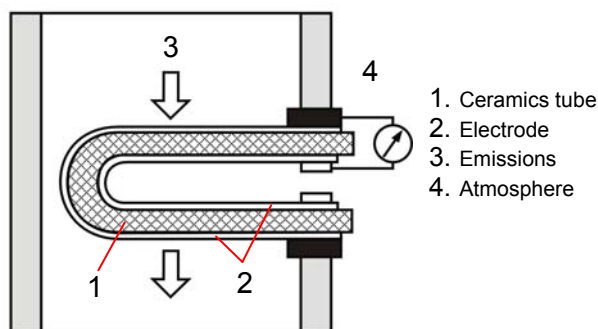
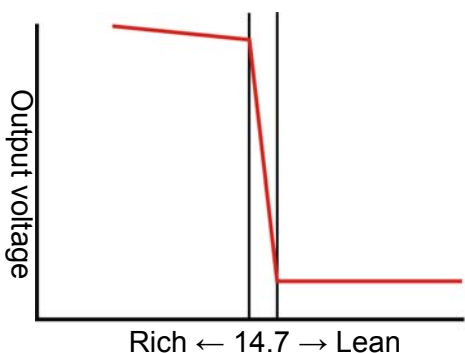
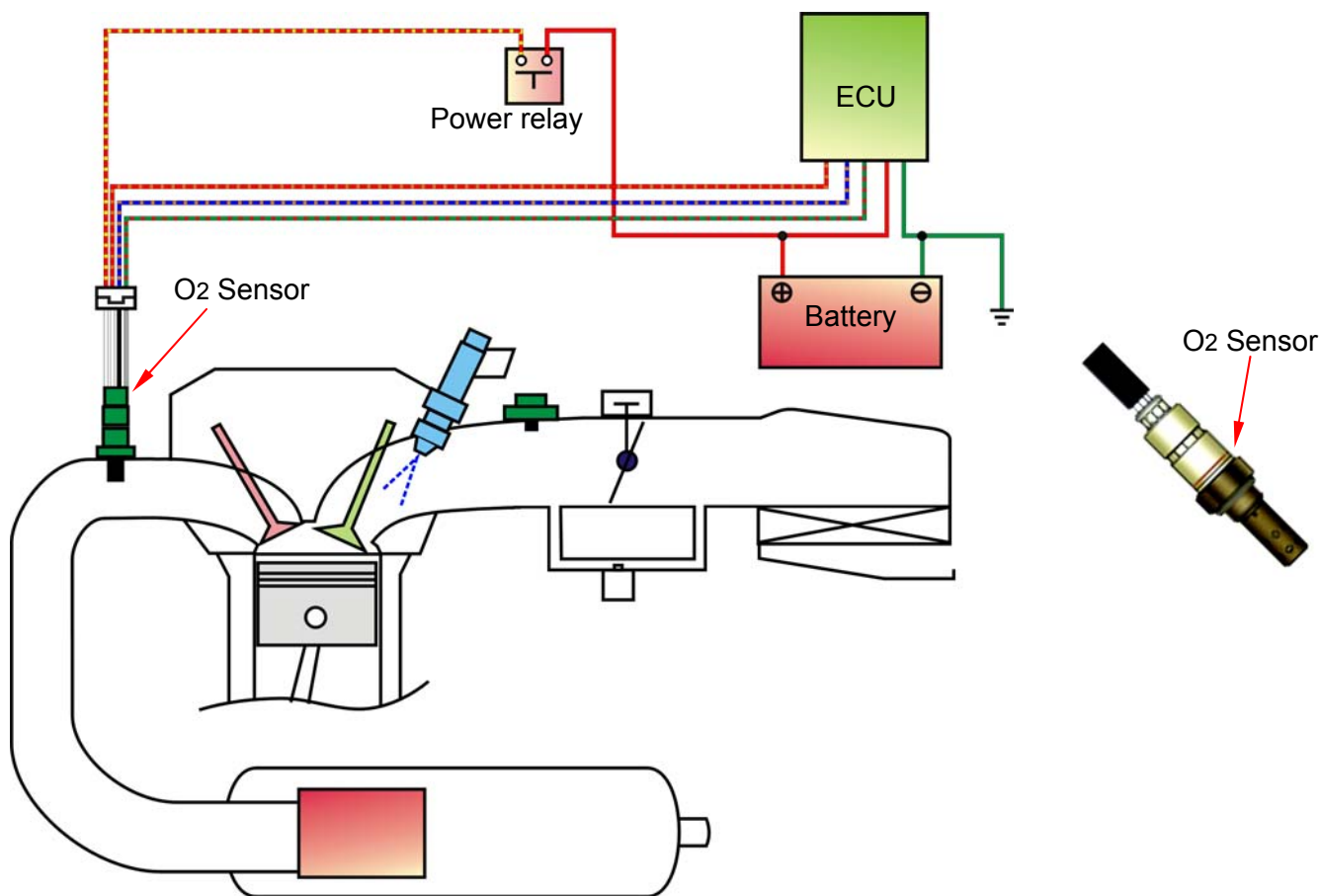
Manifold absolute pressure sensor (MAP Sensor) uses the piezoresistive resistor composed of silicon diaphragm, forming the Wheatstone bridge circuit to measure the atmospheric pressure and the intake manifold pressure, which are both transmitted to ECU for reference of engine control.



# 4. Fuel Injection System



## O<sub>2</sub> Sensor



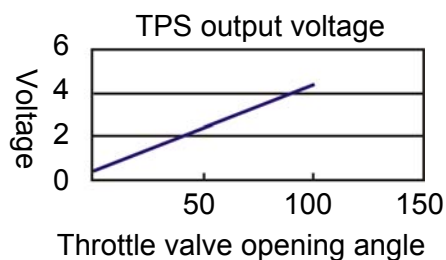
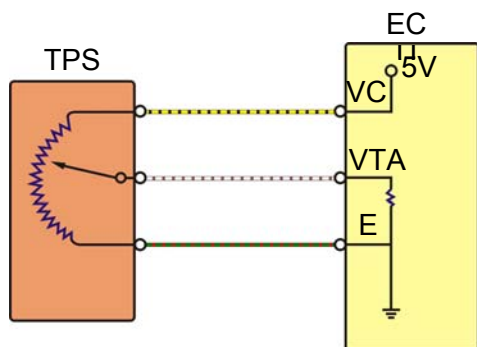
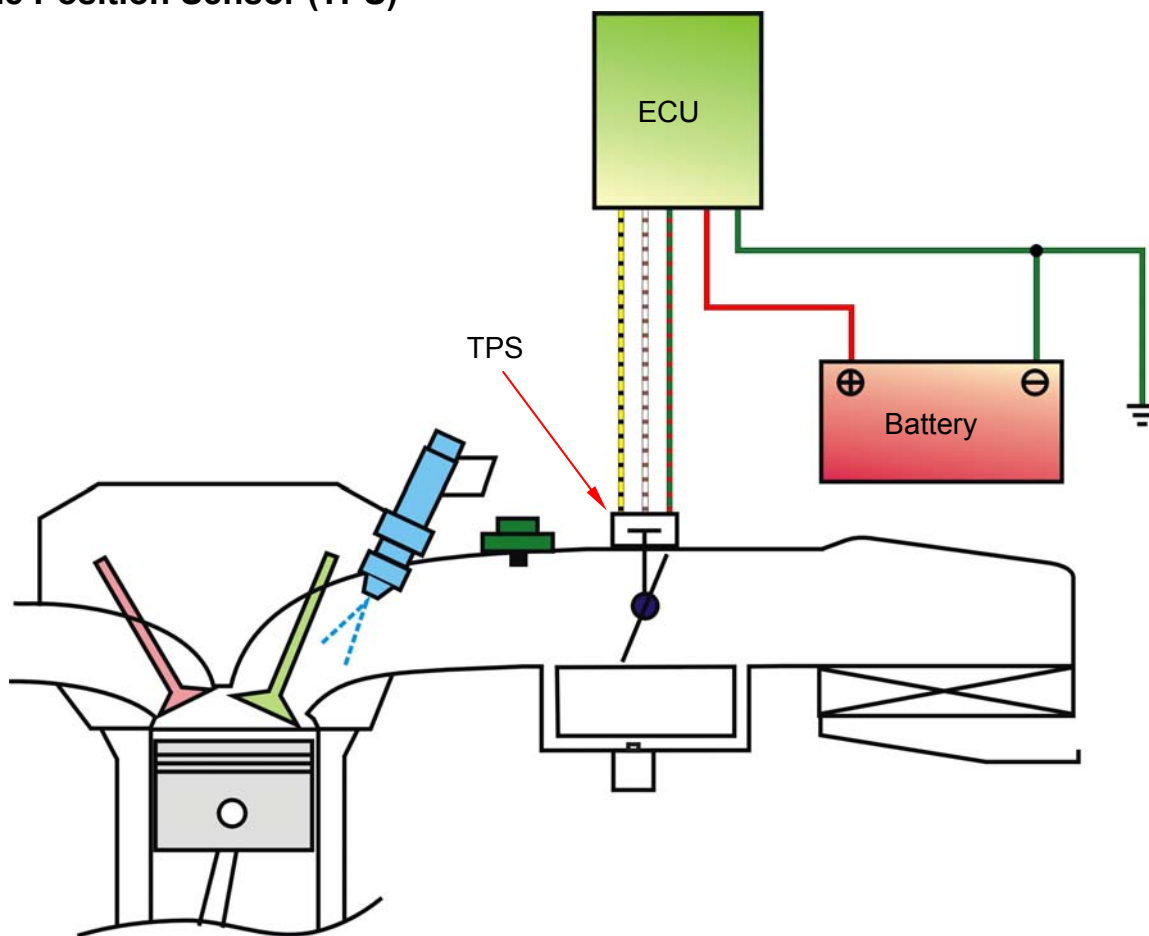
- 1. Ceramics tube
- 2. Electrode
- 3. Emissions
- 4. Atmosphere

### Function

O<sub>2</sub> 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<sub>x</sub> concentration.

1. O<sub>2</sub> Sensor outputs feedback signal to ECU which keeps the air-fuel mixture near the stoichiometric ratio approximately 14.6 and forms the closed loop control system.
2. When the air-fuel mixture is near the stoichiometric ratio, CO / HC / NO<sub>x</sub> are converted most efficiently.
3. O<sub>2</sub> Sensor heater resistance: 6.7 ~ 10.5 Ω
4. O<sub>2</sub> Sensor amendment in the voltage value: between 100 ~ 900 mV

## 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

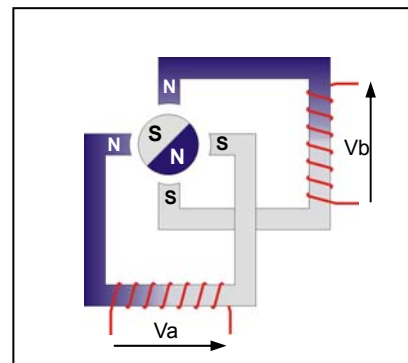
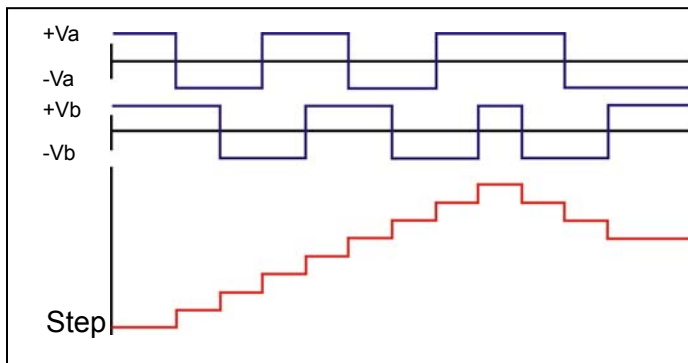
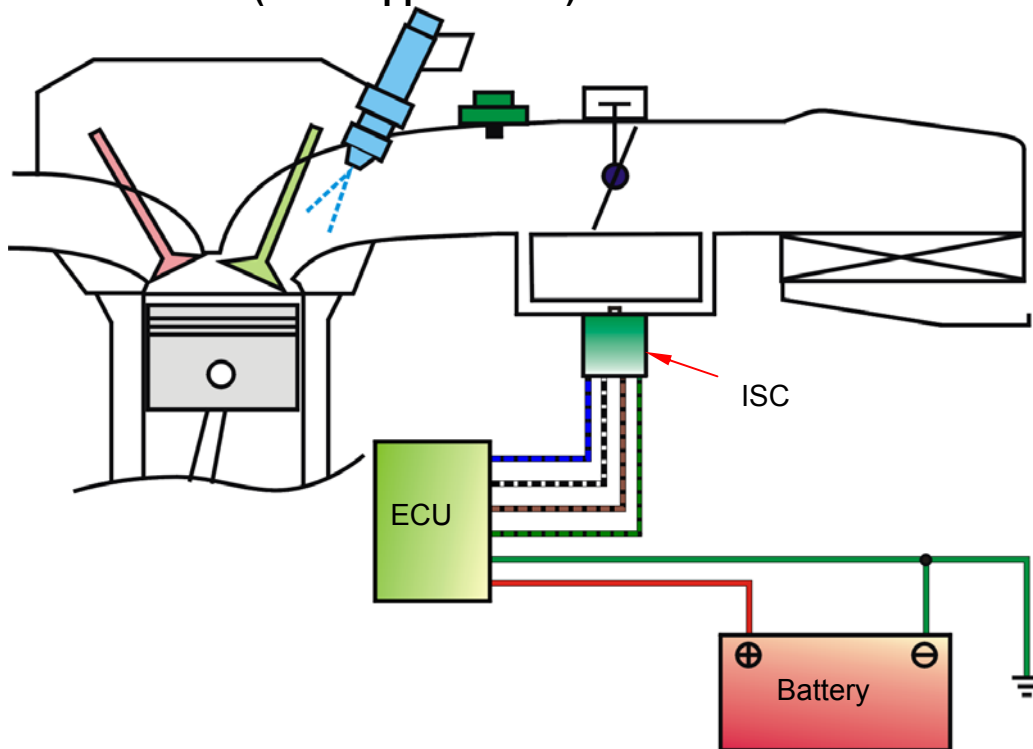
TPS determines the throttle valve position and sends signal to ECU as reference of engine control.



# 4. Fuel Injection System



## 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.

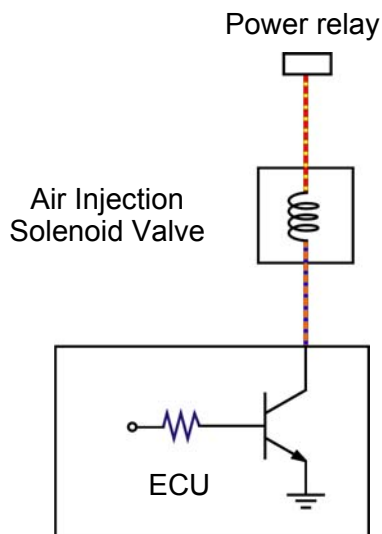
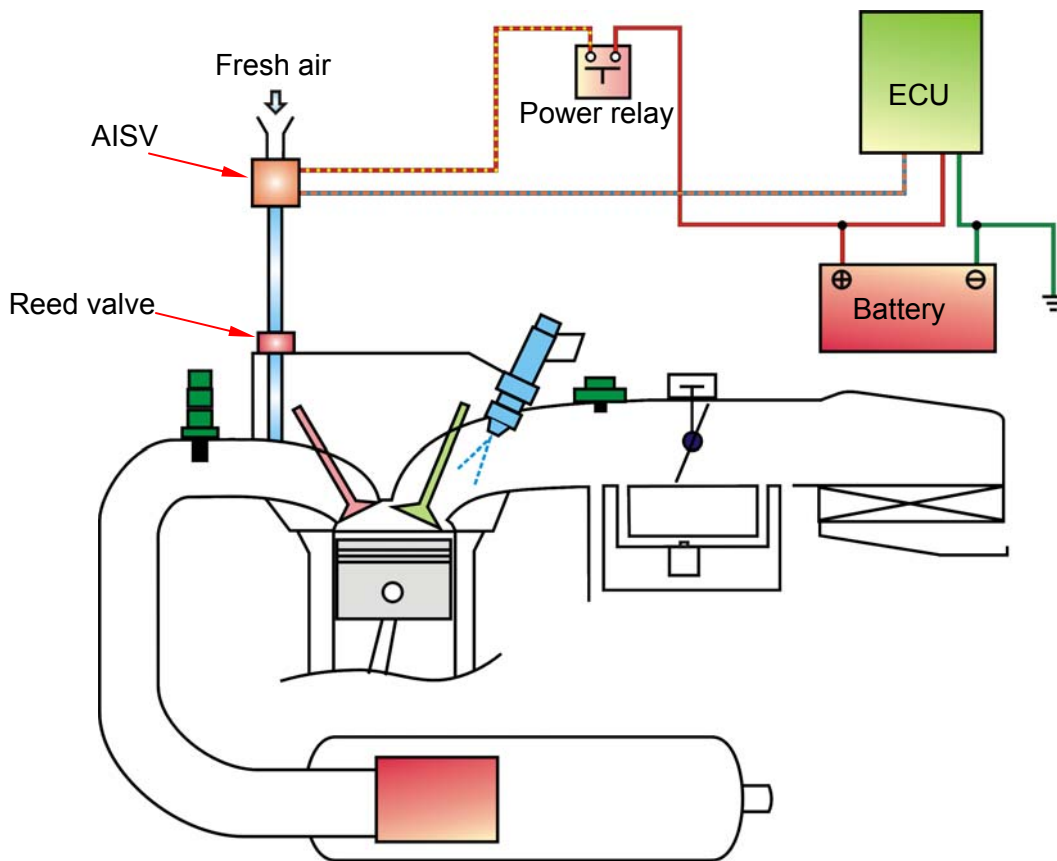
## Air Injection Solenoid Valve (AISV)

### 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.



## 4. Fuel Injection System

### 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.

### Specification

Item	Specifications
Idle RPM	1650±100 rpm
Throttle handle free play	2~6 mm
Fuel pressure	294±6kPa (about 3.0kg/cm <sup>2</sup> )

### Torque value

Engine Temperature sensor	0.74~0.88 kgf-m
O <sub>2</sub> Sensor	3.6~4.6 kgf-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 36-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.

```

==Version==
DIAG. ID:0002000000020
S/H VER :001
DIAG. VER: 03
MODEL: SYM GTS250
NAME: HML00203

<UP> up <DOWN> down
<Enter> Exit <LEFT> left <RIGHT> right

```

```

==Version==
H/W VER :
S/H VER : 001
CALI ID :
ECU NI : 001

DIAG. ID:0002000000020
S/H VER :001
DIAG. VER: 03
MODEL: SYM GTS250
NAME: HML00203

<UP> up <DOWN> down
<Enter> Exit <LEFT> left <RIGHT> right

```

#### Detection judge:

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

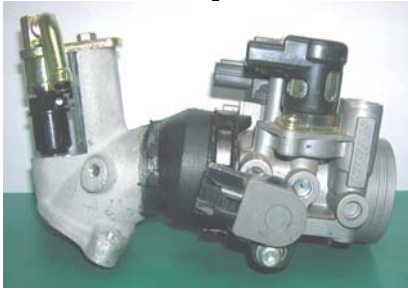
#### Treatment of abnormal phenomena:

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.



## 4. Fuel Injection System

### Throttle Body

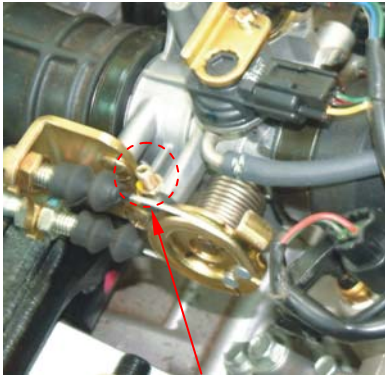


#### Functional Description:

- 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.

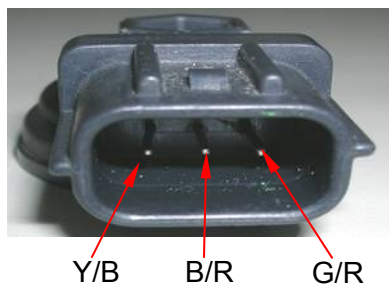
#### Treatment of abnormal phenomena:

- 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.



Throttle positioning screw

## 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)



### Cautions

- 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:  $5.0 \pm 0.1V$
- Plains output voltage values:  $2.87 \pm 0.03V$  (Conditions: In the plains 101.3 kPa Measurement)



### Cautions

- 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.

## 4. Fuel Injection System

### TA Sensor



Resistance value measurement

#### 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:

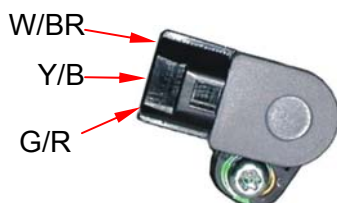
Resistance value and the temperature between relationships as follows

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

#### 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

### 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.

### ⚠ Cautions

- 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:  $5.0 \pm 0.1V$
- Full throttle voltage value:  $0.6 \pm 0.02V$
- Full throttle closed voltage value:  $3.78 \pm 0.26V$



## 4. Fuel Injection System

```
(01/03) Data stream ↔×
+Engine SPD--- 1650RPM (Idle:1550~1750)
FAULT NO----- 0 (Normal 1:0)
BATT. VOLT----- 14.1V (Above 12V)
FUEL PUMP----- ON (Idle:ON)
MAP----- 35Kpa (Idle:32~38Kpa)
TPS position----- 0% (Idle: < 1.5%)
TPS position--- 0.6V (Idle: 0.58~0.62)
O2 SENSOR----- 130mV (Idle: 50~200mV)
O2 HEATER----- OFF (> 3500rpm=ON)
ENGINE TEMP---- 90°C (Stable:85~95°C)
<UP> prev <DOWN> next <Ent> fixed <F4> waveform
<EXIT> exit <LEFT> PgUp <RIGHT> PgDn, <F1> Help
```

Throttle output signal  
measurement

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.

## TW Sensor



### 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:

- 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



Resistivity measurements

### 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.

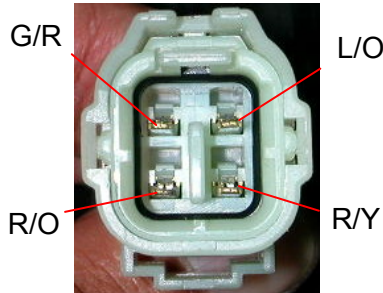
# 4. Fuel Injection System

## O<sub>2</sub> Sensor



### Functional Description:

- Use 8 ~ 16V DC power supply, has the 4-pin coupler, a power supply pins for heater; for a heater control pin; signal for a grounding pin; O<sub>2</sub> for a signal pin.
- O<sub>2</sub> Sensor output feedback signal to the ECU fuel ratio control in the vicinity of 14.5 ~ 14.7, a closed-loop fuel control.
- When the air-fuel ratio control in the near equivalent, CO / HC / Nox to have the highest conversion efficiency.



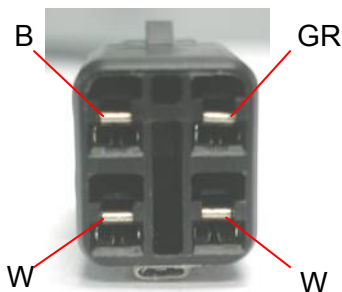
### Testing Procedures:

#### 1. Voltage confirmed:

- Removed O<sub>2</sub> Sensor and the wire harness between the coupler.
- Open the main switch, but not to start engine.
- Use "voltage meter" DC stalls (DCV) to check inlet pressure sensor voltage.
- Confirmed working voltage:  
 Volteg meter negative access to the wire harness sensor coupler 2nd pin (Red / Orange).  
 Voltage meter positive access to the wire harness sensor coupler first pin (Red / Yellow).



Confirmed working voltage



#### 2. Resistance Confirmation:

- Remove O<sub>2</sub> Sensor and the wire harness between the coupler.
- Use of the "meter" Ohm stalls, Measurement O<sub>2</sub> Sensor heater resistance.
- Measurement resistance value  
 Ohm meter negative access to the O<sub>2</sub> sensor coupler 2nd pin (White).  
 Ohm meter negative access to the O<sub>2</sub> sensor coupler first pin (White).



Resistance Confirmation



Numerical voltage changes that the situation.

#### 1. Used the diagnosis tool to confirm of O<sub>2</sub> sensor work situations:

- Connected the "diagnosis tool" to diagnosis coupler and open the main switch to start the engine.
- Engine to be completely warm-up (idling state operation "5 minutes" above).
- Screen will switch to the diagnosis tool of "DATA STREAM 01/01" screen, select " O<sub>2</sub> Sensor" project, and switches to a wave of images, turn the throttle engine speed to about 4500 rpm, Observation O<sub>2</sub> Sensor actuator circumstances.
- Observation O<sub>2</sub> Sensor voltage values that the situation changes.

#### Detection judge:

- Working voltage value: **above 10V**
- Resistance value: **6.7~10.5Ω**
- O<sub>2</sub> Sensor amendment in the voltage value of between 100 ~ 900 mV beating; representatives pollution closed-loop control system to normal, if contrary to maintain a fixed value for abnormalities.



#### Treatment of abnormal phenomena:

- O<sub>2</sub> sensor damage, heater damaged or couplers to poor contact.
- Check whether the abnormal wire harness lines.
- O<sub>2</sub> Sensor anomaly, the proposed replacement of the O<sub>2</sub> Sensor , and measurements again.

## 4. Fuel Injection System

### 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: **Supply voltage = Battery voltage**

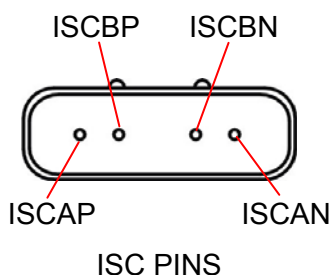
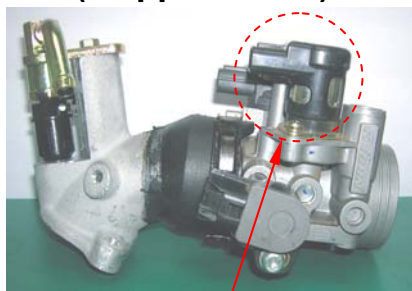
#### Treatment of abnormal phenomena:

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 ( $\Omega$ ), 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.

### ⚠ Cautions

- 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:  $15 \sim 25\text{ }^\circ\text{C}$ )
  - B phase:  $80 \pm 10\Omega$  (Environmental conditions:  $15 \sim 25\text{ }^\circ\text{C}$ )
2. Actuator inspection:
 

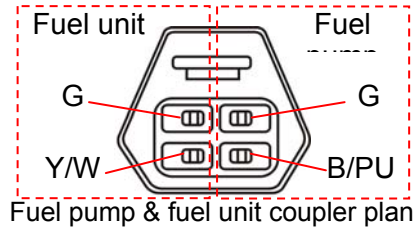
In the above steps Idle Air Control Valve (ISC) Idling motor actuator control of inspection, ISC will be slightly vibration or "... da... da..." continuous voice.

### Treatment of abnormal phenomena:

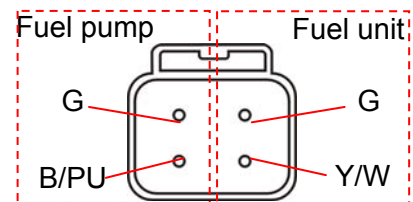
- Idle air control valve damage, or poor coupler contact.
- Check whether the abnormal wire harness lines.
- Idle Air Control Valve anomaly, the proposed replacement of the Idle Air Control Valve, further inspection of its actuator.

# 4. Fuel Injection System

## Fuel Pump



Confirmed working voltage



Resistance Confirmation

### 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  $3 \text{ kg / cm}^2$ ).
- 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).

### ⚠ Cautions

- 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  $3 \text{ kg/cm}^2$ )**

### 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:  **$4 \sim 107.5 \Omega$**



Fuel system pressure measurement

### Testing Procedures 3:

#### Fuel pressure measurement:

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

#### Cautions

- 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 demolition - injector

### Detection judge 3:

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

### 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 demolition - fuel pump

## 4. Fuel Injection System

### 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.



Injector resistance confirmation

#### Testing Procedures:

1. Resistance Confirmation:
  - Use of the "meter" Ohm stalls ( $\Omega$ ), measurement of the injector resistance value.
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:  $11.7 \pm 0.6 \Omega$
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.

#### Treatment of abnormal phenomena:

1. Injector 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.

#### 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.



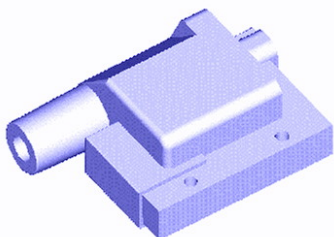
Injection-state atomizing good



Injection-state unusual



### 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 O<sub>2</sub> 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 ( $\Omega$ ), measurement of the ignition coil resistance value.

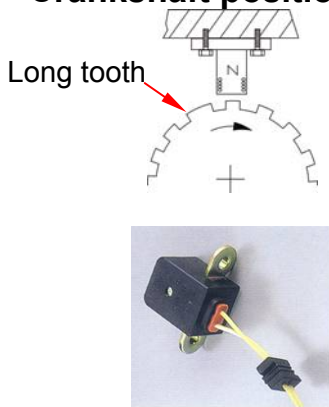
##### Detection judge:

- Ignition coil primary circuit:  $2.8\Omega \pm 15\%$  ( $20^\circ\text{C}$ )

##### 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.

### 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 (23 +1 long 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 ( $\Omega$ ), measurement of the crankshaft position sensor resistance value.

##### Detection judge:

- Resistance value:  $80\sim 160\Omega$  ( $20^\circ\text{C}$ )

##### 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



## 4. Fuel Injection System

### 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 ( $\Omega$ ), measurement of the secondary air injection solenoid valve resistance value.

##### Detection judge:

Resistance value =  $26 \pm 2.6\Omega$  (20°C)

##### Treatment of abnormal phenomena:

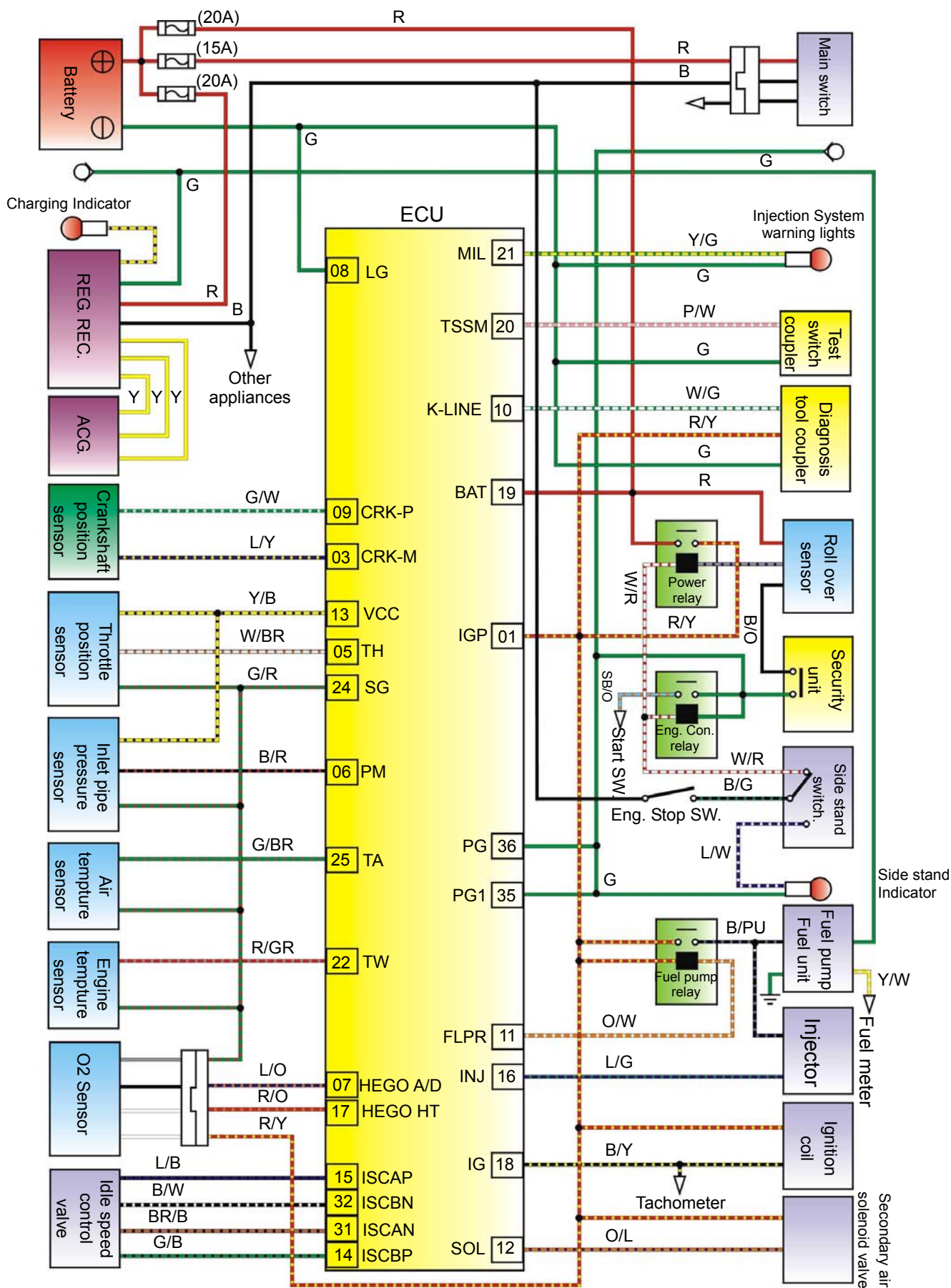
- Secondary air injection solenoid valve internal short circuit or open circuit, or coupler bad contact.
- Check whether the abnormal wire harness lines.
- Secondary air injection solenoid valve anomaly, the proposed replacement of the new one.





# 4. Fuel Injection System

## EFI System Circuit

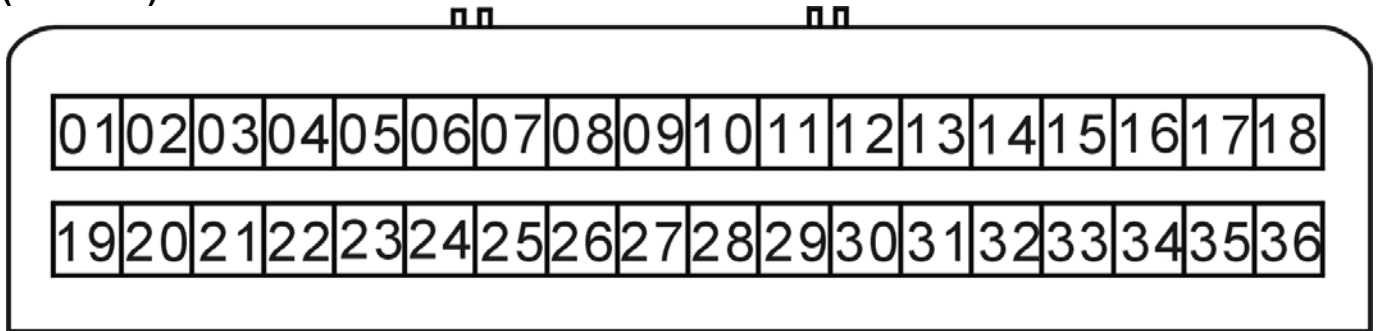


# 4. Fuel Injection System



## ECU Pin Configuration

(ON ECU)



### ECU Pin Note

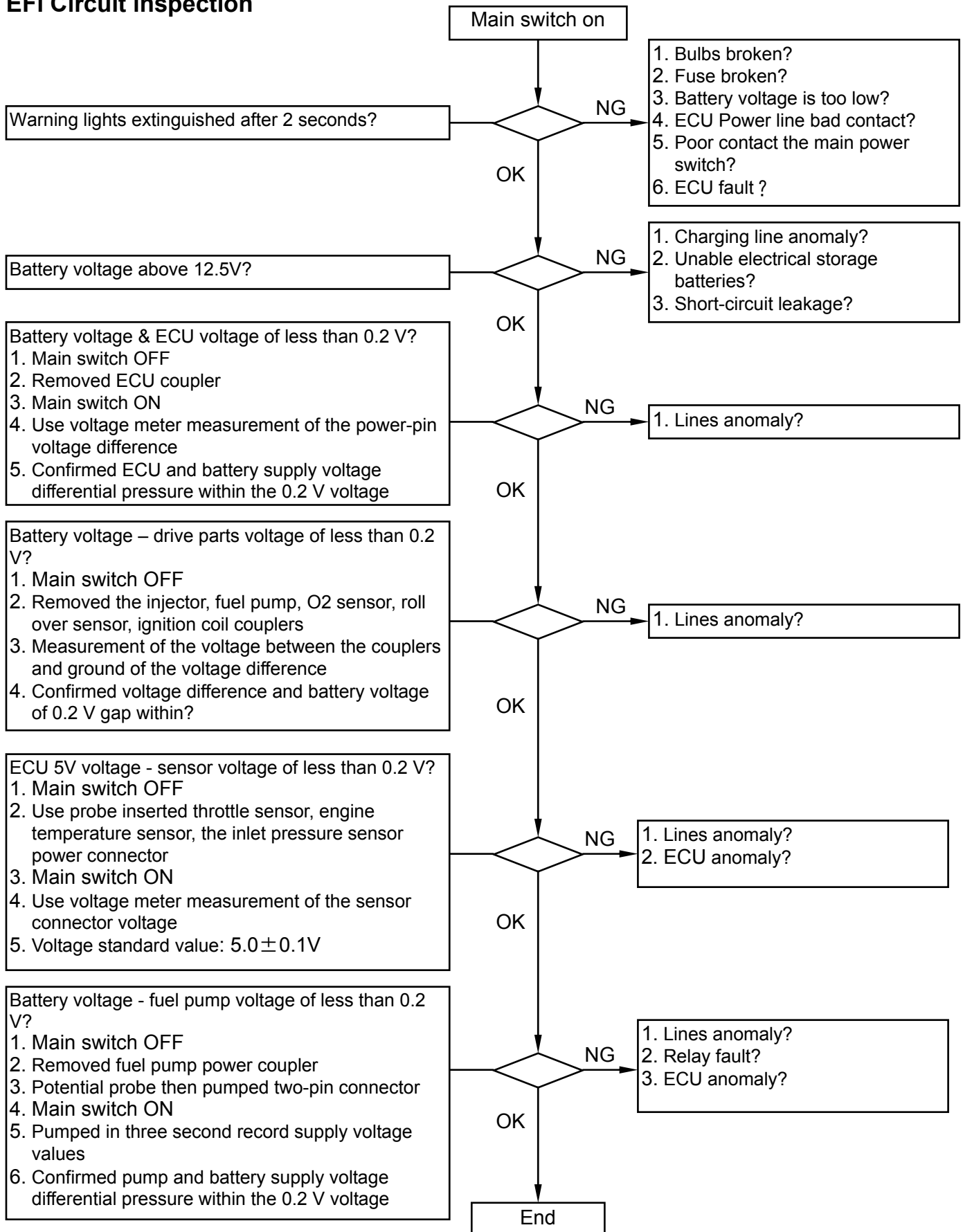
Pin NO.	Wire color	Pin code	Note	Pin NO.	Wire color	Pin code	Note
01	R/Y	IGP	Drive components Power +	19	R	BAT	ECU power +
02			No use	20	P/W	TSSM	Test switch signal (A/D)
03	L/Y	CRK-P	Crankshaft pos. Sensor+	21	Y/G	MIL	Warning Lights O/P
04			No use	22	R/GR	TW	Eng. Water Temp. Sensor (A/D)
05	W/BR	TH	Throttle position [A/D]	23			No use
06	B/R	PM	Manifold Press. SNSR I/P [A/D]	24	G/R	SG	Sensor ground
07	L/O	HEGO A/D	O <sub>2</sub> Sensor [A/D]	25	G/BR	TA	Intake air temperature sensor (A/D)
08	G	LG	ECU ground	26			No use
09	G/W	CRK-M	Crankshaft pos. Sensor-	27			No use
10	W/G	K-LINE	Sequence transmission signal output / input	28			No use
11	O/W	FLPR	Fue pump relay O/P	29			No use
12	O/L	SOL	AISV O/P	30			No use
13	Y/B	VCC	Sensor power + (DC 5V)	31	BR/B	ISCAN	Step motor A phase power -
14	G/B	ISCBP	Step motor A phase power +	32	B/W	ISCBN	Step motor B phase power -
15	L/B	ISCAP	Step motor B phase power +	33			No use
16	L/G	INJ	Fuel injector O/P	34			No use
17	R/O	HEGO HT	O <sub>2</sub> Sensor heater ground	35	G	PG1	Drive components ground
18	B/Y	IG	Ignition coil O/P	36	G	PG	Drive components ground



# 4. Fuel Injection System

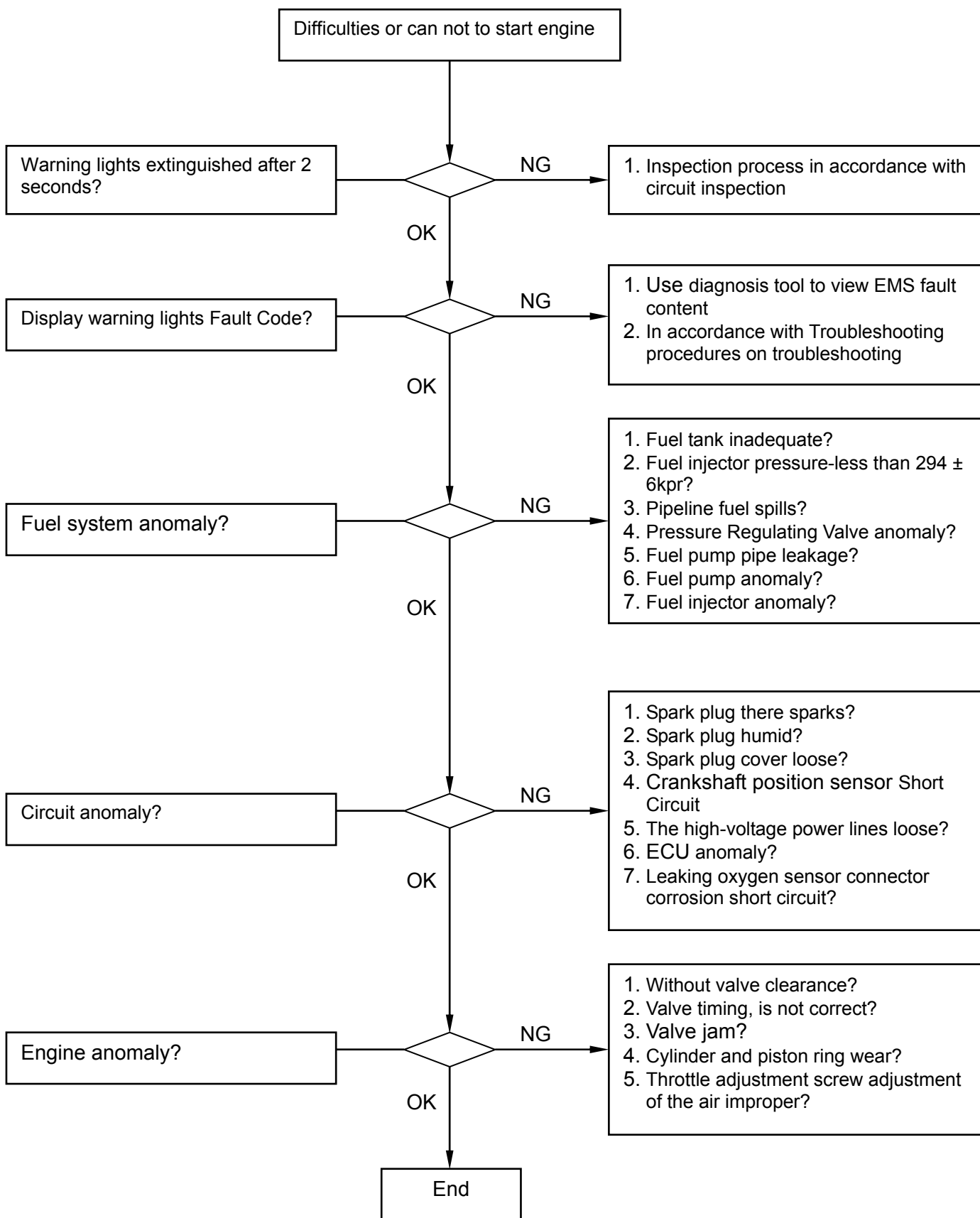
## Troubleshooting

### EFi Circuit inspection



# 4. Fuel Injection System

## Can not Start the engine or difficult to start inspection

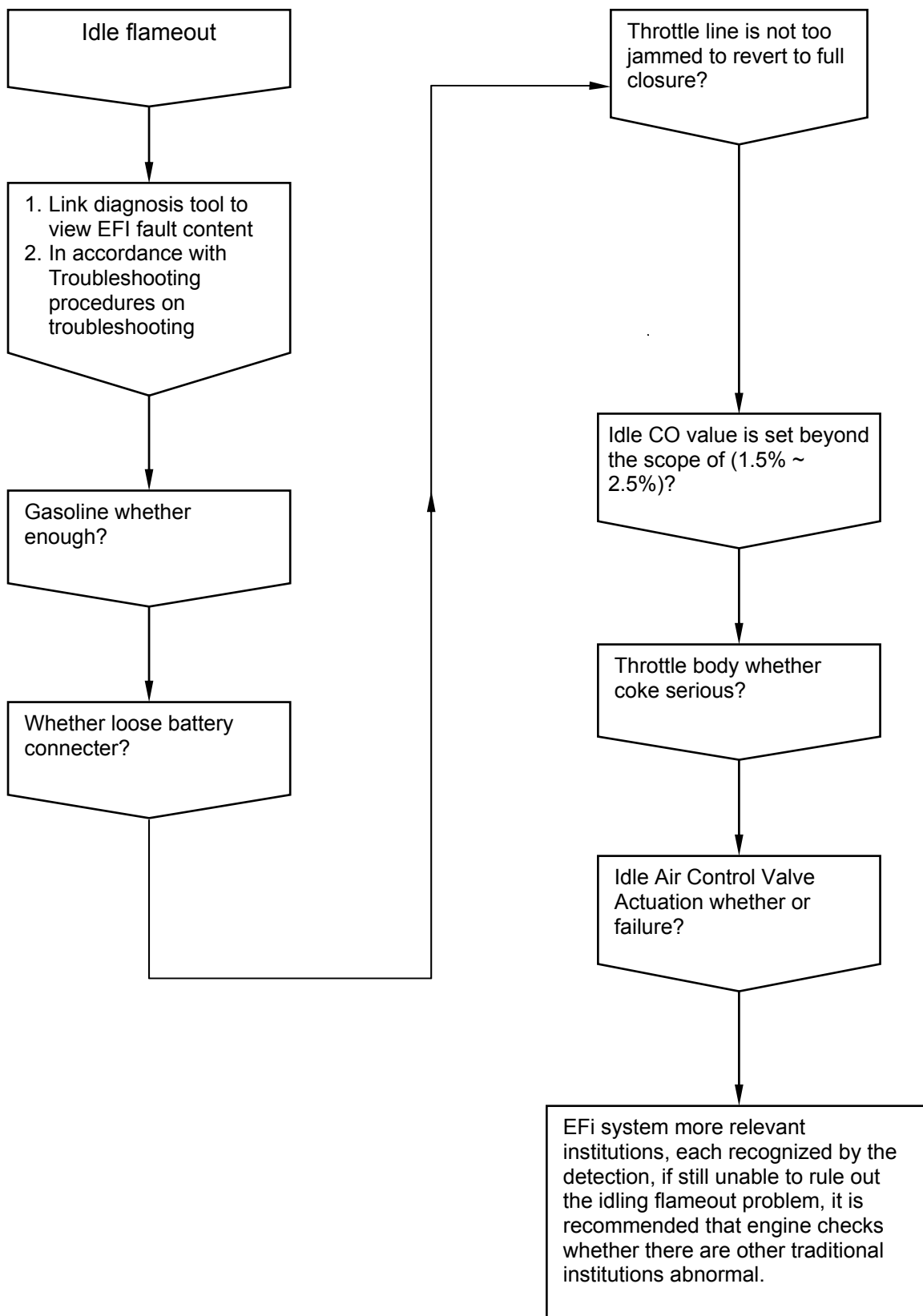






# 4. Fuel Injection System

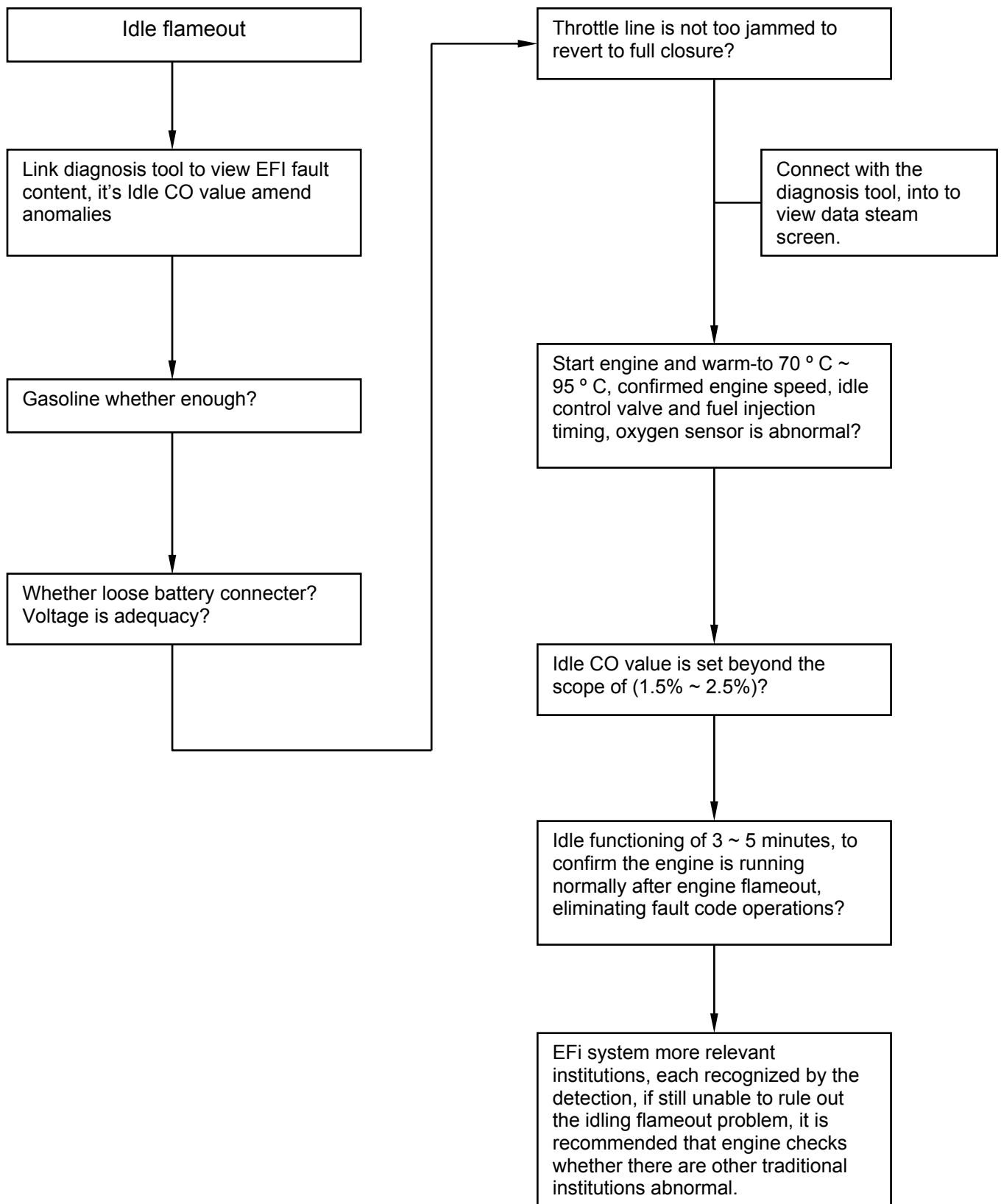
## Idle flameout diagnosis



## 4. Fuel Injection System

### CO value revised anomaly

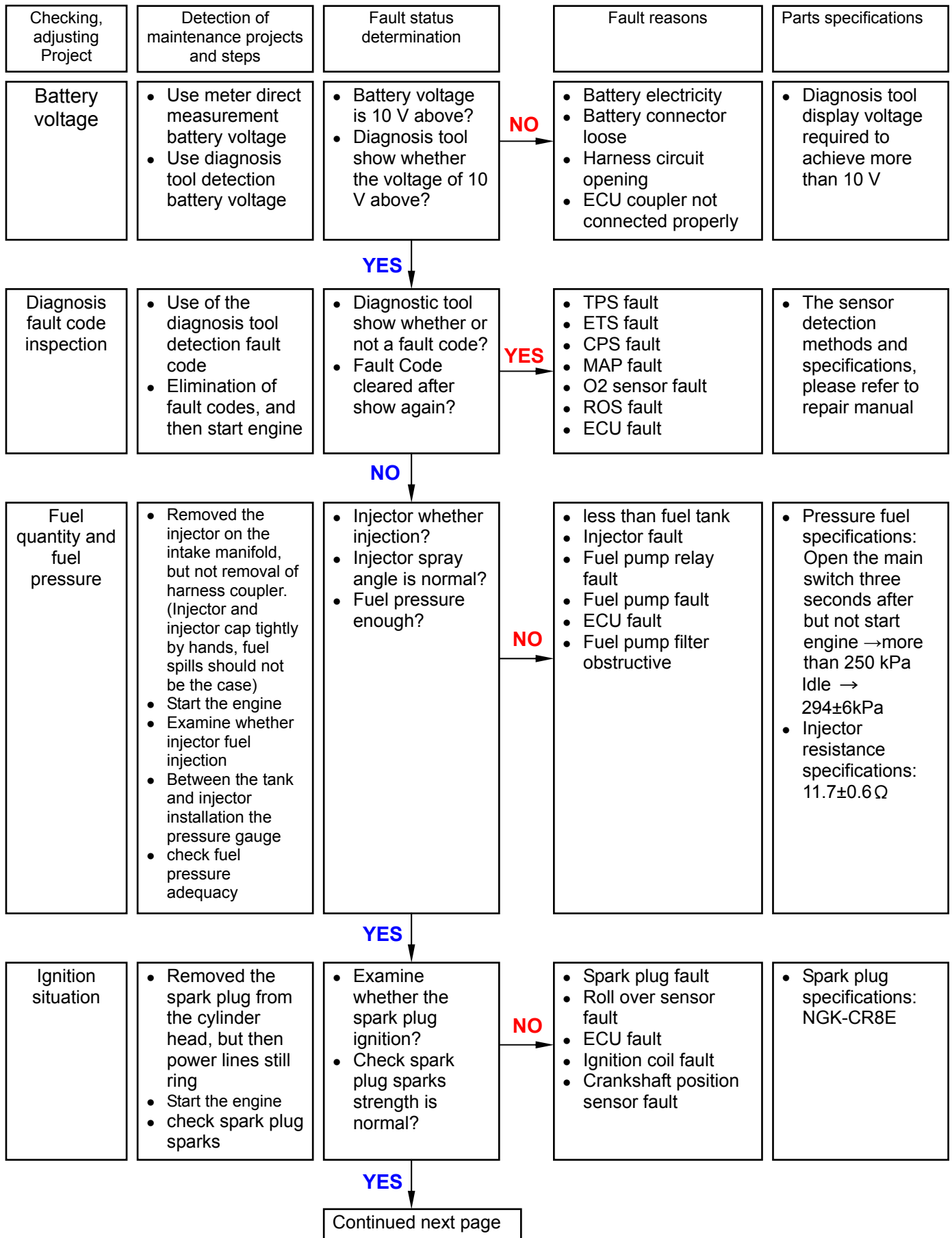
O<sub>2</sub> Sensor equipped with the system, in principle, not adjusted CO value, such as CO value deviated from the normal range, check O<sub>2</sub> Sensor and other agencies anomaly.



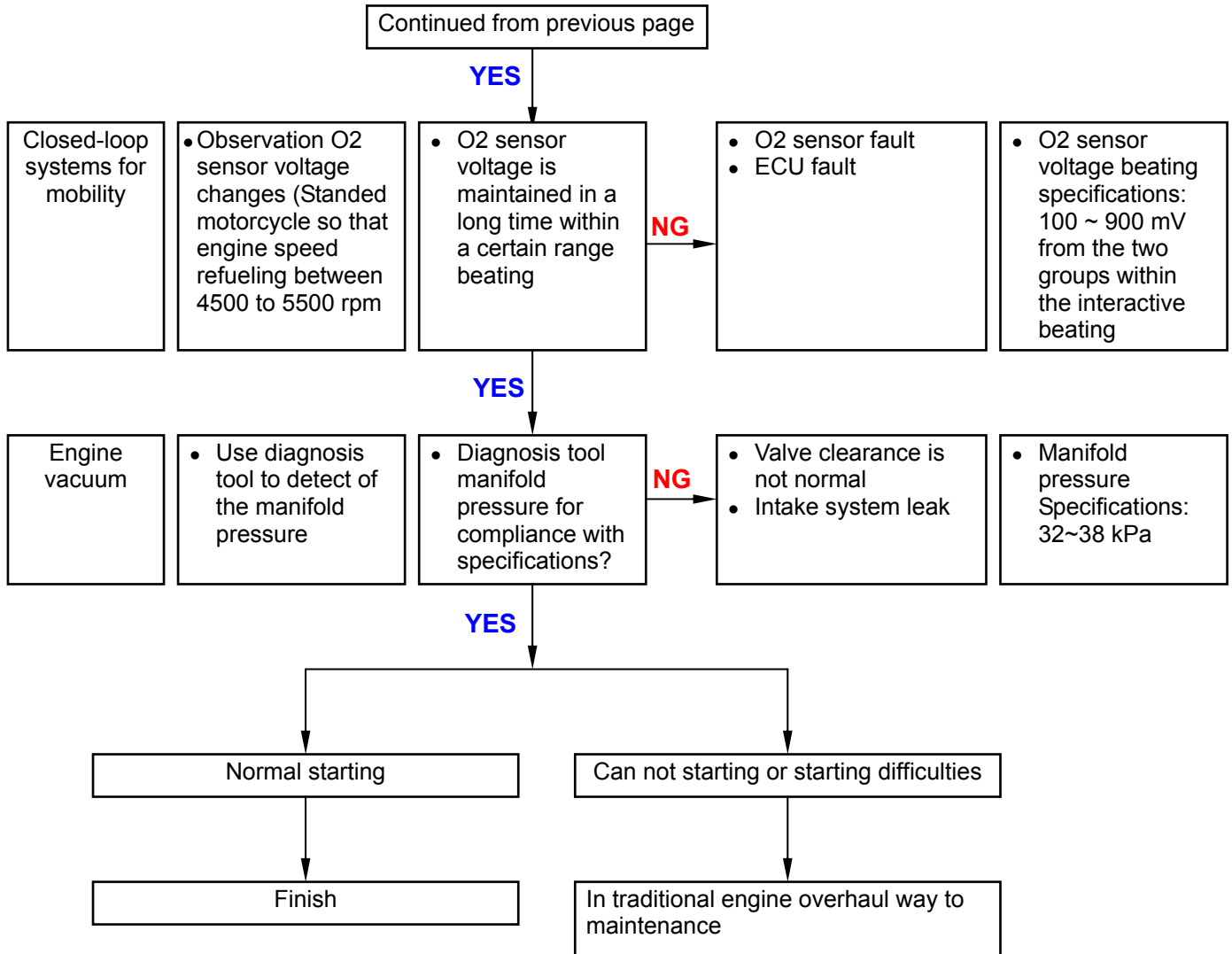


# 4. Fuel Injection System

## Integrated Troubleshooting Procedure



# 4. Fuel Injection System





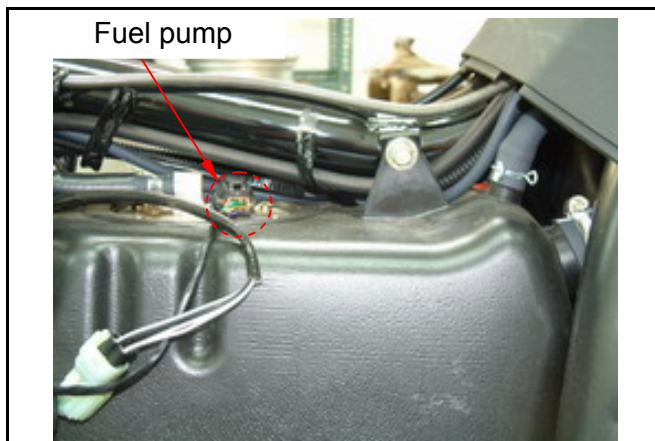
## 4. Fuel Injection System

### Remove fuel pump/fuel unit

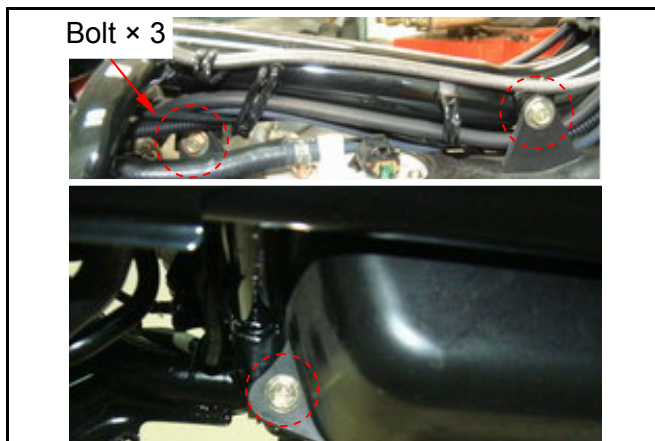
Remove side cover.  
Remove rear carrier  
Remove rear bodycover.  
Remove floor panel.  
Remove under cover.  
(refer to chapter 14)



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.

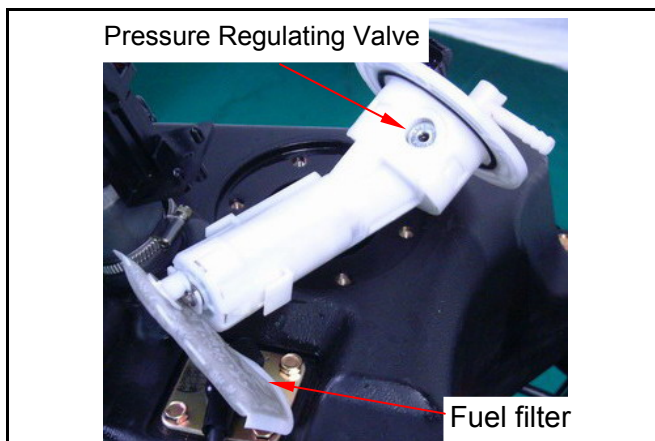


### Remove / Install fuel pump and fuel unit

Remove fuel pump fixed bolts (Bolt × 6), remove fuel pump.  
Install In the anti-demolition order.

#### Cautions

- 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/cm<sup>2</sup>).





## 4. Fuel Injection System

### Air Cleaner

#### Remove

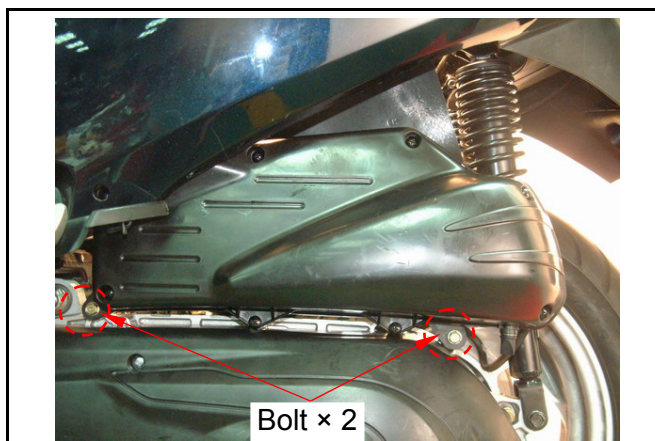
Remove left side body cover and luggage box.  
Remove rear carrier and body cover.  
Remove fuel gas recover tube.  
Remove waste gas purification system pipes.  
Remove intake temperature sensor coupler.



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

#### Install

Install In the anti-demolition order.

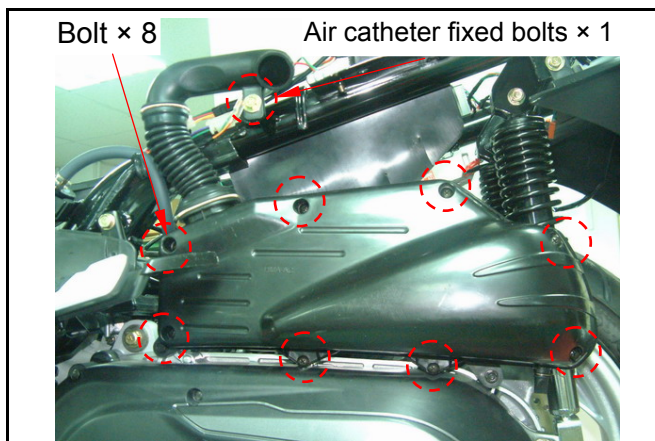


#### Clean air cleaner element

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

#### Cautions

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

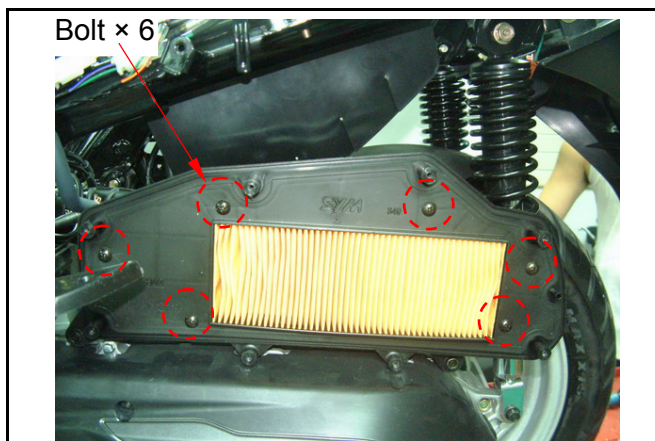


#### Install air cleaner element

Install In the anti-demolition order.

#### Cautions

- 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.



### 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).



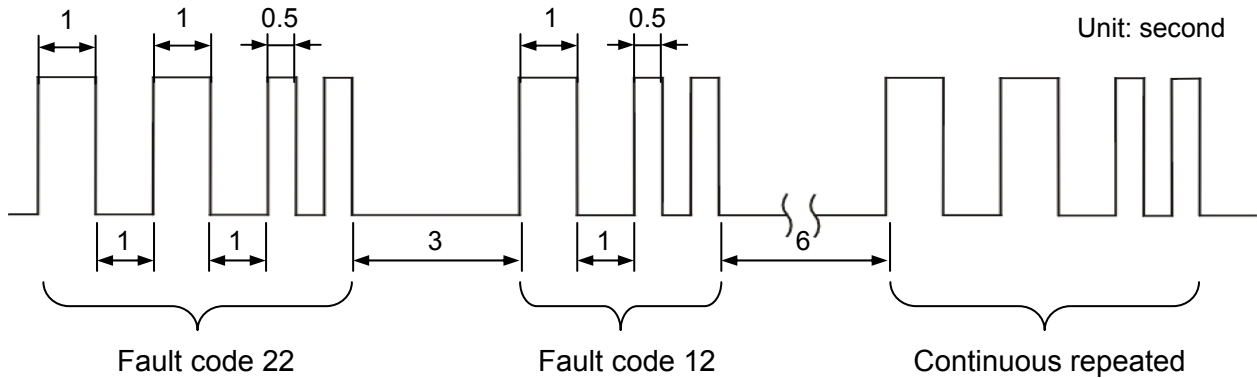
Diagnostic tool coupler and test switch coupler plant

## 4. Fuel Injection System

### Check Light Fault Codes Differentiation

#### Check light flashing mode

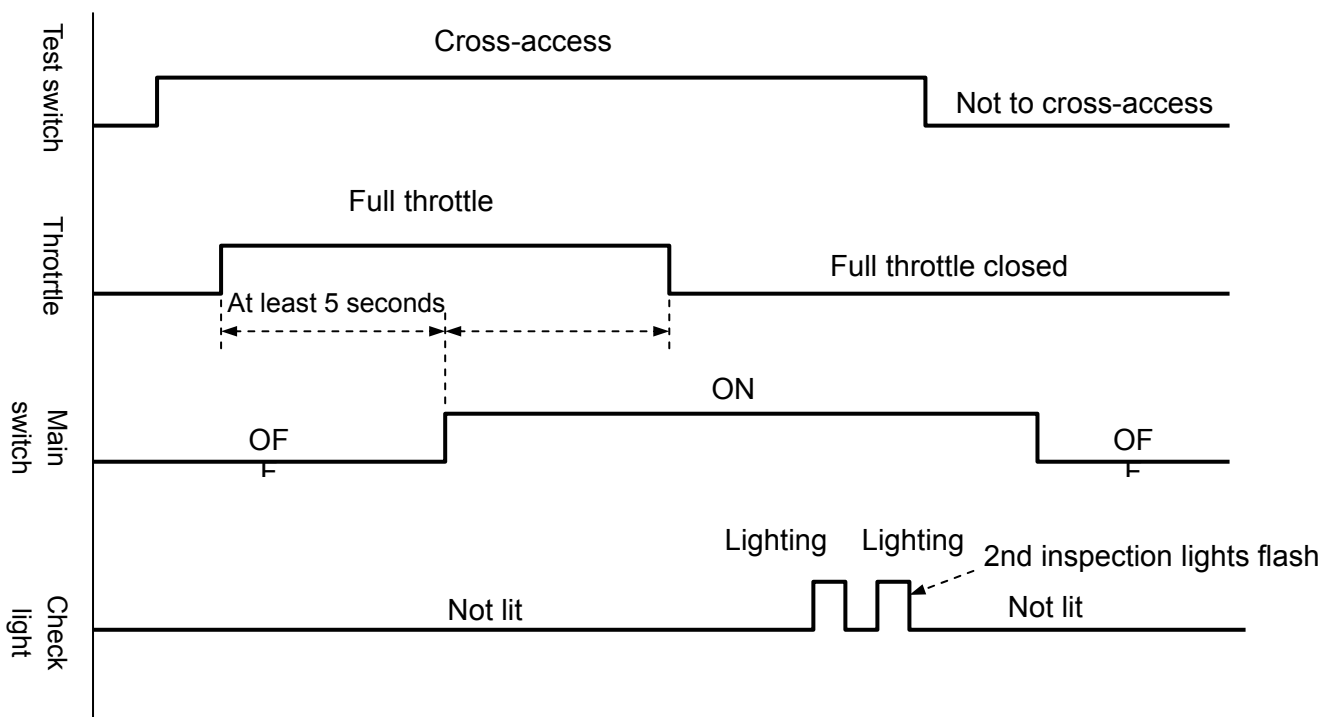
If problem without diagnosis tool to be detected, it can be cross-access the test switch coupler, the motorcycle from the CHK lights flashing signal interpretation, and then the basis for the diagnosis of dynamic information tables on the priorities of light, and prompts you to the motorcycle to the emergence of some warning, or FLASH CODE is to determine what kind of fault, and exclusion.



#### Fault Code manual removal procedure:

When there is without diagnosis tool, can be manually cleared Fault Code, the implementation of the following steps:

1. Main switch OFF
2. Cross-access the test switch for interconnection access, and without opening up (cross-access movement must indeed).
3. Full throttle and do not open up.
4. Main switch ON
5. Described above, the No. 3 with the No. 4 movements continued liberalization of 5 seconds later, about 5 seconds after inspections at carnivals "flash twice" to complete the removal of fault code.
6. Then remove the cross-wiring.



## Fault Code and Sensors Table

No.	Fault codes	Fault Description	Parts Inspection
1	0120	Throttle position sensor fault	TP Sensor and wire
2	0105	Manifold absolute pressure sensor fault	MAP sensor and wire
3	0115	Engine temperature sensor fault (water)	TW Sensor and wire
4	0195	Engine oil temperature sensor fault (oil)	Engine temperature sensor and wire
5	0110	Intake air temperature sensor fault	TA Sensor and wire
6	1630	Roll over sensor fault	Roll over sensor and wire
7	0130	O <sub>2</sub> sensor fault	O <sub>2</sub> Sensor and wire
8	0201	I N J #1 fault	Injector and wire
9	0351	IG #1 fault	Ignition coil and wire
10	0230	Fuel pump fault	Fuel pump and wire
11	0135	O <sub>2</sub> sensor heater fault	O <sub>2</sub> Sensor and wire
12	1505	ISC Idle_speed control motor fault	ISC stepper motor and wire
13	1410	Exhaust 2 <sup>nd</sup> air control solenoid valve fault	AISV and wire
14	0335	Crankshaft position sensor fault	Crankshaft position sensor and wire
15	1205	MAP wire fault	MAP sensor and wire
16	0603	EEPROM fault	EEPROM

## 4. Fuel Injection System

### Fault Code and Check Light Flashing Lighting Identification Table

No.	Fault codes	Fault Description	Check light	Check light flashing state	Parts Inspection
1	0120	Throttle position sensor fault	Lighting	long 0 , short 6	Throttle position sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" throttle position sensor (TPS) chapter			
2	0105	Manifold Absolute Pressure sensor fault	lighting	long 0 , short 9	MAP sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" manifold Absolute Pressure sensor (MAP) chapter			
3	0115	Engine temperature sensor fault (water)	lighting	long 1 , short 2	Engine temperature sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" engine temperature sensor (WPS) chapter.			
4	0195	Engine oil temperature sensor fault (oil)	lighting	long 1 , short 1	Engine temperature sensor and wire
		The current reservation			
5	0110	Intake temperature sensor fault	lighting	long 1 , short 3	Intake temperature sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" intake temperature sensor (TAS) chapter.			
6	1630	Roll over sensor fault	lighting	long 1 , short 5	Roll over sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" Roll over sensor chapter.			
7	0130	O <sub>2</sub> sensor fault	lighting	long 1 , short 7	O <sub>2</sub> Sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" O <sub>2</sub> sensor chapter.			
8	0201	I N J #1 fault	lighting	long 3 , short 3	Injector and wire
		Fault detection procedures Please refer to the "EFI System components description" fuel injector chapter.			
9	0351	IG #1 fault	lighting	long 3 , short 7	Ignition coil and wire
		Fault detection procedures to adhere to the traditional way			
10	0230	Fuel pump fault	lighting	long 4 , short 1	Fuel pump and wire
		Fault detection procedures Please refer to the "EFI System components description" fuel pump chapter.			
11	0135	O <sub>2</sub> sensor heater fault	lighting	long 4 , short 5	O <sub>2</sub> Sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" O <sub>2</sub> Sensor chapter.			
12	1505	ISC motor fault	lighting	long 4 , short 9	Step motor and wire
		Fault detection procedures Please refer to the "EFI System components description" idle speed control valve (ISC) chapter.			
13	1410	Exhaust 2 <sup>nd</sup> air solenoid valve fault	lighting	long 5 , short 4	2 <sup>nd</sup> air control valve and wire
		Fault detection procedures Please refer to the "EFI System components description" 2 <sup>nd</sup> air solenoid valve chapter.			
14	0335	Crankshaft position sensor fault	lighting	long 6 , short 6	Crankshaft position sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" Crankshaft position sensor chapter.			
15	1205	PM wire fault	lighting	long 6 , short 8	Manifold absolute pressure sensor and wire
		Fault detection procedures Please refer to the "EFI System components description" Manifold absolute pressure sensor (MAP) chapter.			
16	0603	EEPROM fault	Not lit	long – , short –	EEPROM
		This fault Please direct replacement ECU			



## EFi System Diagnostic Tool - V70



**Note:**

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

**Method of Use:**

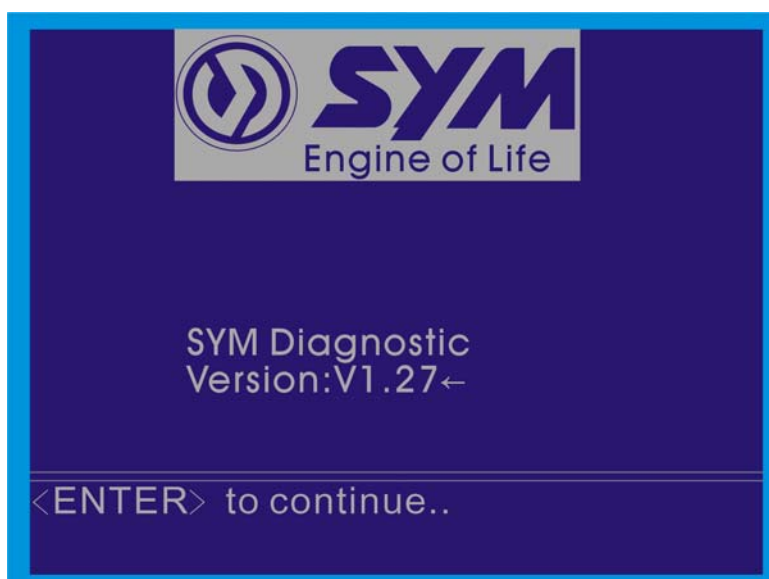
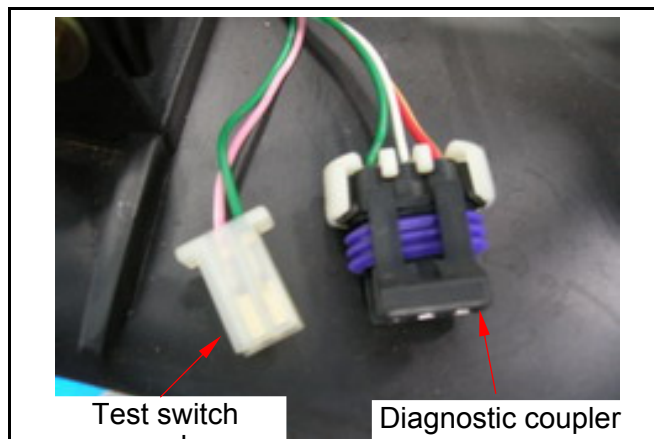
1. Maintain engine flameout state, do not open main switch.
2. Opened the luggage box lighting light cover (screw x2), connected to the diagnostic connector for diagnosis tool.
3. Then open the main switch and the diagnosis tool power switch after diagnosis display screen appeared the words connection.
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.

## 4. Fuel Injection System

### Diagnostic Tool Use Note

#### Diagnosis of connectivity

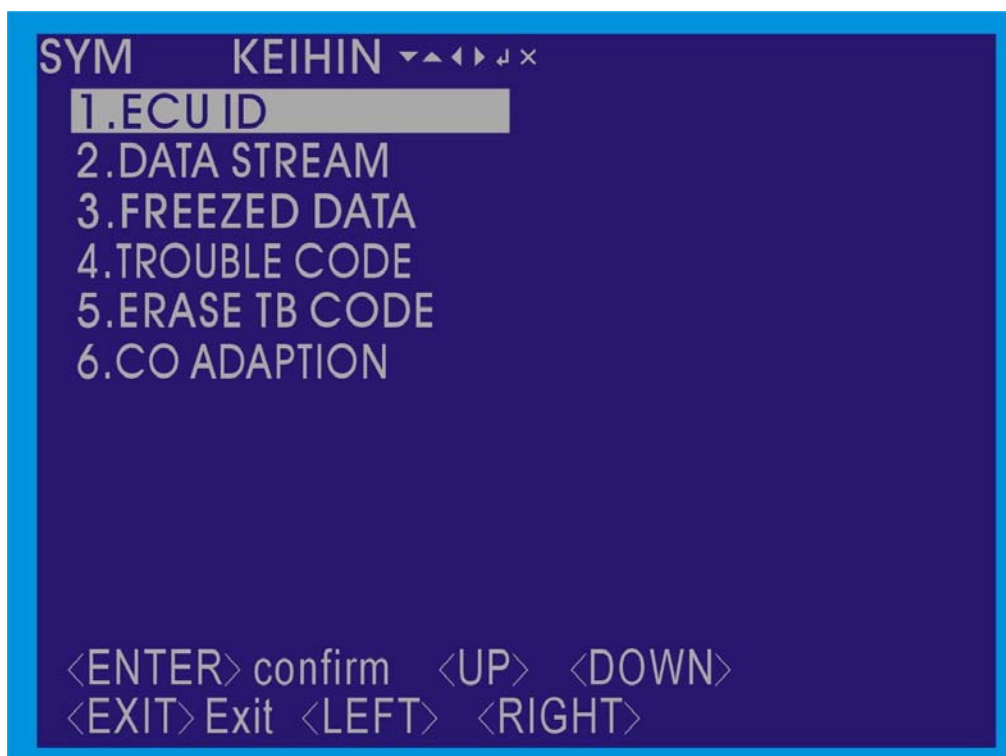
1. For the diagnostic tool coupler access to the motorcycle injection system diagnostic signal coupler.
2. main switch ON.
3. Open the diagnosis left power switch, which turn on the LCD screen, the screen brightness adjustment knob to the appropriate brightness.
4. SYM and cartridge content display on screen (such as icon), by the beginning of the implementation of any button.
5. Display diagnostic software release; press the "ENTER" button to the implementation.



**Options main functional areas:**

1. ECU ID
2. DATA STREAM
3. FREEZED DATA
4. TROUBLE CODE
5. ERASE TB CODE
6. CO ADAPTION

Use "▲" "▼" button, select mobile anti-white subtitles implementation of the project, and then press the "ENTER" key to the implementation.



## 4. Fuel Injection System

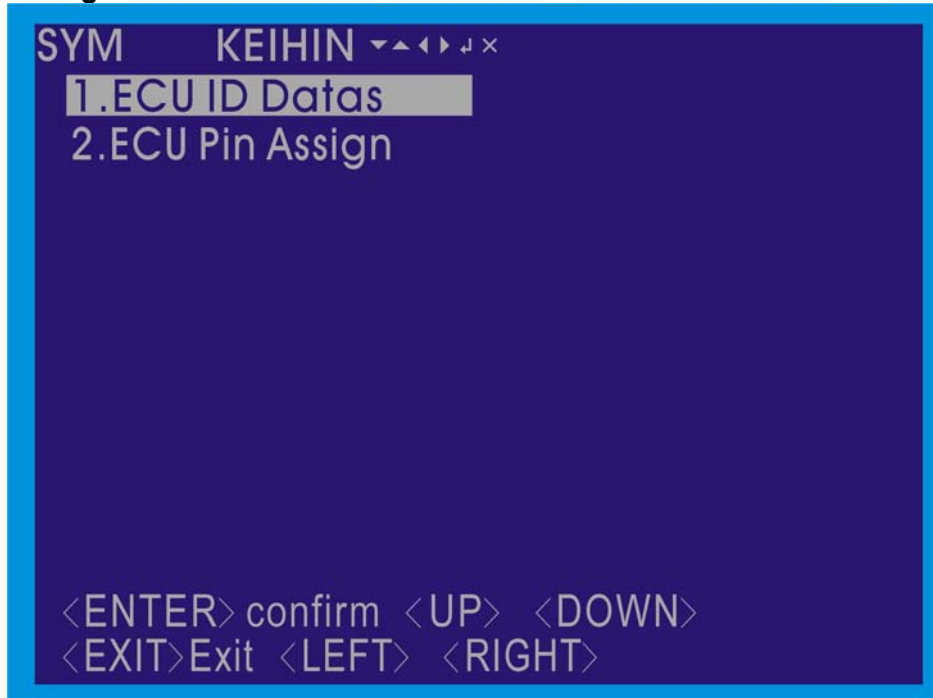
### 1. ECU ID

In the directory functions used "▲" "▼" button, select ECU ID project, press the "ENTER" button to the implementation of information systems function.

ECU ID containing two functions:

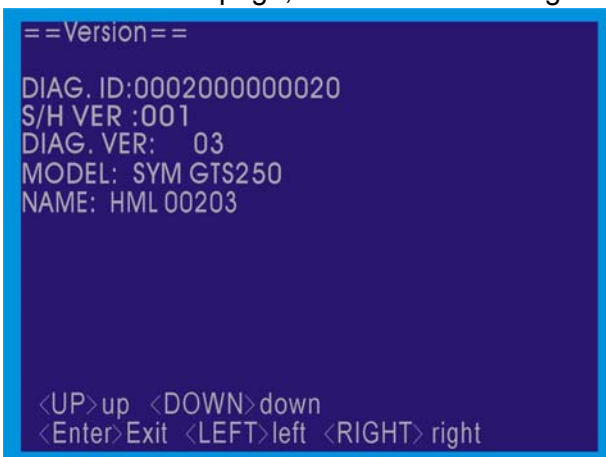
#### 1-1. ECU ID Datas

#### 1-2. ECU Pin Assign

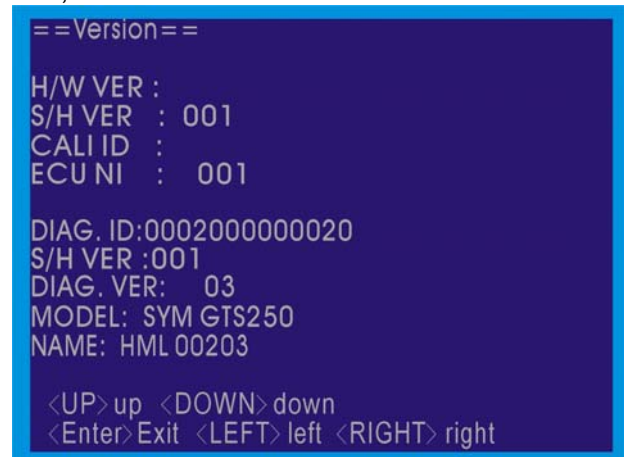


#### 1-1. ECU ID Datas

Use "▲" "▼" button, select ECU ID projects, press the "ENTER" button to the implementation. A total of 2 page, use "◀ left" and "right ▶" button, view ECU information.



DIAG. ID: 0002000000020 (Diagnosis tool ID)  
 S/H VER: 001 (Software Version)  
 DIAG. VER: 03 (Diagnosis Version)  
 MODEL: SYM GTS250  
 NAME: HML 00203

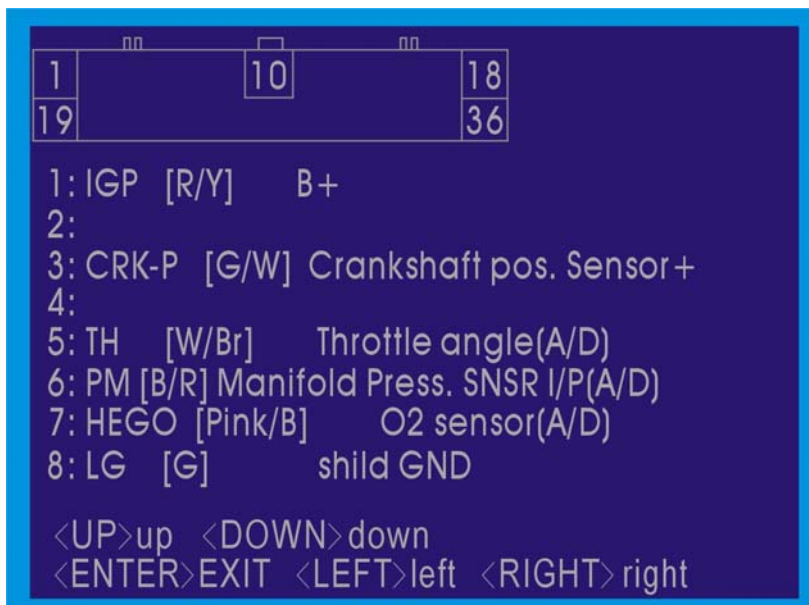


H/W VER: (Hardware version)  
 S/H VER: 001 (Software Version)  
 CALI ID: (Correction ID Code)  
 ECU NO: 001

## 1-2. ECU Pin Assign

Use "▲" "▼" button, select the ECU pin project, press the "ENTER" button to the implementation of the ECU pin functions.

ECU pin assign total of 5 pages that can be used "◀ left" and "right ▶" button, view the page note.

**Page 1:**

- 1: IGP [R/Y] B+
- 2:
- 3: CRK-P [G/W] Crankshaft pos. Sensor-
- 4:
- 5: TH [W/Br] Throttle angle [A/D]
- 6: PM [B/R] Manifold Press. SNSR I/P [A/D]
- 7: HEGO [Pink/B] O2 sensor [A/D]
- 8: LG [G] shield GND

**Page 2:**

- 9: CRK-M [L/Y] Crankshaft pos. Sensor+
- 10: K-LINE [W/G] K-Line
- 11: FLPR [O/W] Fuel pump relay O/P
- 12: SOL [O/L] 2<sup>nd</sup> air (RV250)
- 13: VCC [Y/B] Sensor V+ (DC 5V)
- 14: ISCBP [G/B] Step MTR B+ (RV250)
- 15: ISCAP [L/B] Step MTR A+ (RV250)
- 16: INJ [L/G] Injection O/P

**Page 3:**

- 17: HEGOHT [R/O] O2 Sensor heater
- 18: IG [B/Y] Ignition O/P
- 19: BAT [R] Battery B+ (RV250)
- 20: TRIG [Pink] Test sw
- 21: MIL [Y/G] MIL O/P
- 22: TE [R/Gr] Eng. Temp. Sensor (A/D)
- 23:
- 24: SG [G/R] Sensor (A/D) GND

**Page 4:**

- 25: TA [G/Br] IAT Sensor (RV250)
- 26:
- 27:
- 28:
- 29:
- 30:
- 31: ISCAN [Br/B] Step MTR A- (RV250)
- 32: ISCBN [B/W] Step MTR B- (RV250)

**Page 5:**

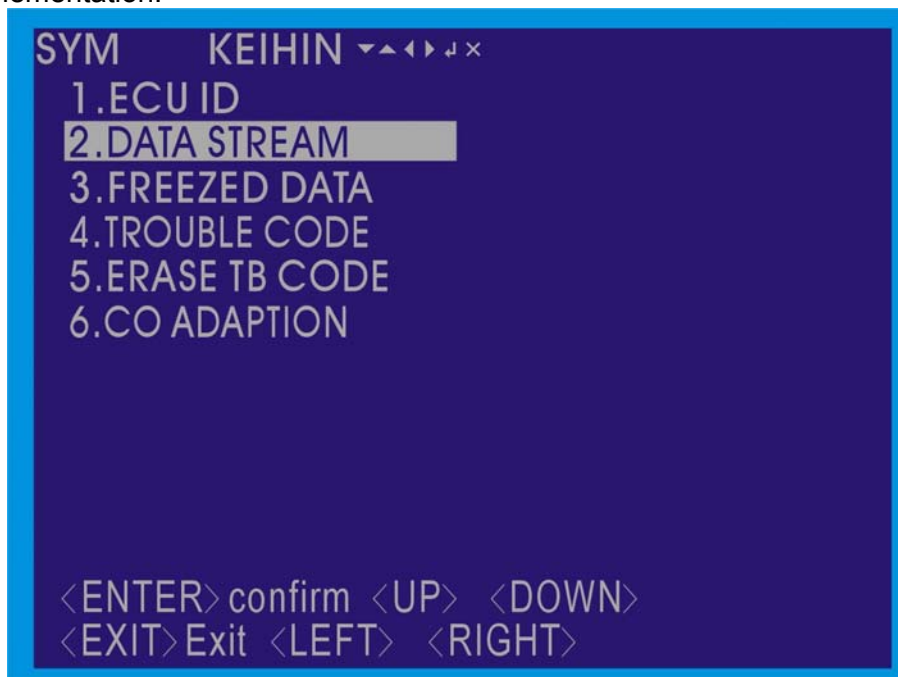
- 33:
- 34:
- 35: PG1 [G] System GND
- 36: PG [G] System GND



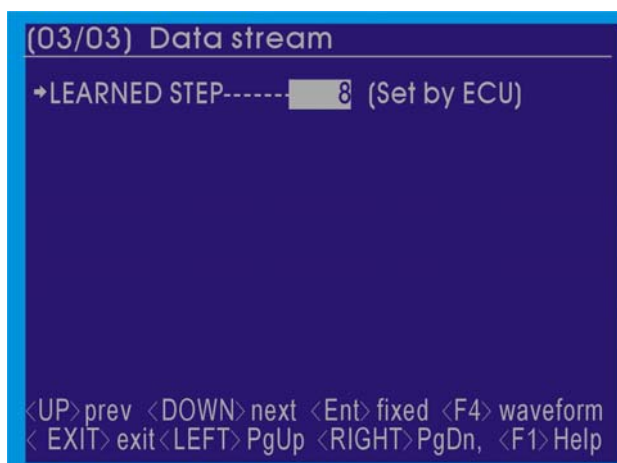
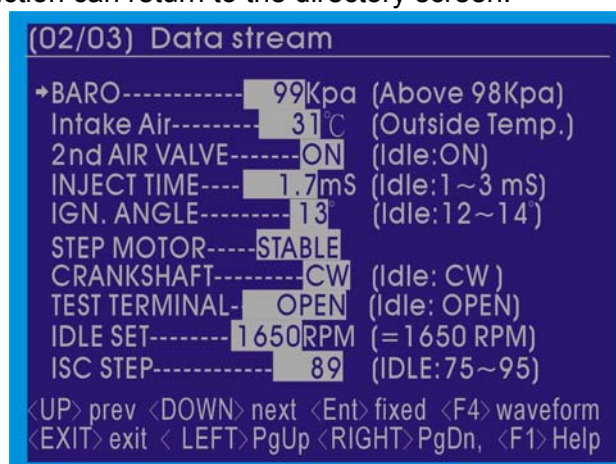
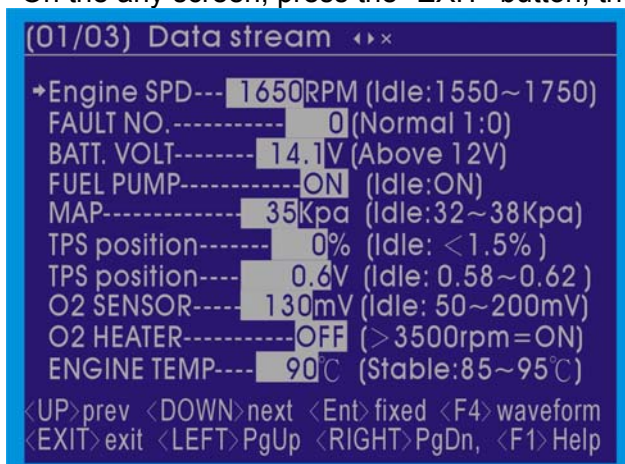
## 4. Fuel Injection System

### 2. DATA STREAM

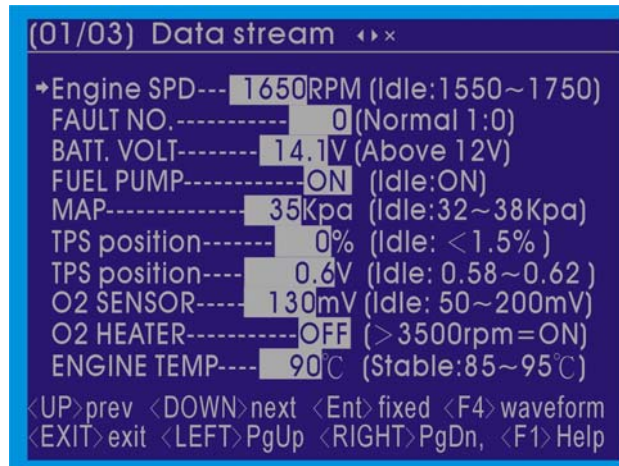
In the directory functions used "▲" "▼" button, select "DATA STREAM" project, press the "ENTER" key to the implementation.



A total of 3 pages, are able to use "◀ left" and "right ▶" button, view injection system information. On the any screen, press the "EXIT" button, the function can return to the directory screen.



## Data stream (1/3)



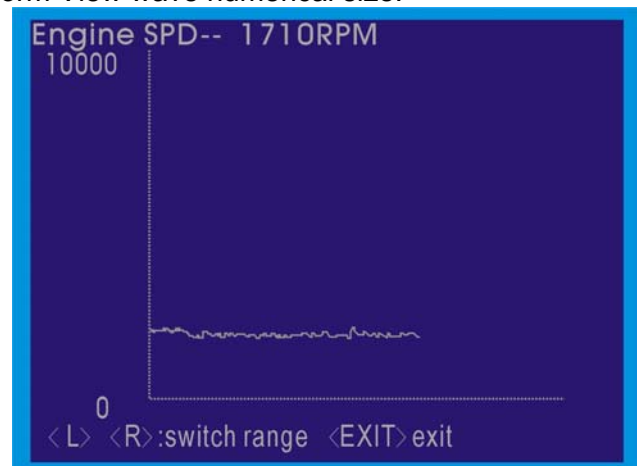
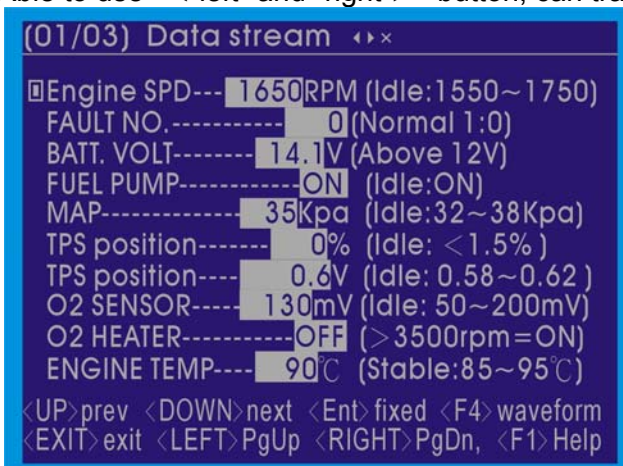
The screen showed the ECU captured by the engine of the state immediately.

The following data for the benchmark idling state:

- Engie SPD--- 1650 RPM (Idle:1550~1750) →Engine idle speed
- FAULT NO.----- 0 (Normal:0) →Fault code number
- BATT. VOLT----- 14.1 V (Above 12V) →Battery voltage
- FUEL PUMP-----ON (Idle:ON) →Fuel pump actuator state
- MAP----- 35 kPa (Idle:32~38kPa) →Manifold pressure
- TPS position----- 0 % (Idle:< 1.5%) →Throttle opening
- TPS position--- 0.6 V (Idle:0.58~0.62) →Throttle sensor voltage
- O<sub>2</sub> SENSOR----- 130 mV (Idle:50~200mV) →O<sub>2</sub> sensor voltage
- O<sub>2</sub> HEATER-----OFF (Idle:> 3500rpm=ON) →O<sub>2</sub> heater actuator state
- ENGINE TEMP-- 90 °C (Stable:85~95°C) →Engine temperature (cooling water temperature)

In the "DATA STREAM" of the screen use "▲" "▼" button to move the left side of the project "→" symbol selected items, press the "ENTER" button lock of the project, and press the "F4" button showed that the wave of projects.

Able to use "◀ left" and "right ▶" button, can transform View wave numerical size.

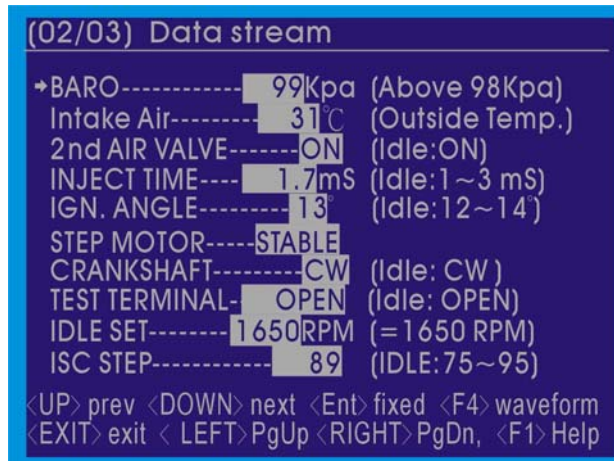


Numerical analysis of images (1 / 3), the waveform can be displayed as shown in the following items:

- Engie SPD
- BATT. VOLT
- MAP
- TPS position %
- TPS position Voltage
- O<sub>2</sub> SENSOR Voltage
- ENGINE TEMP

## 4. Fuel Injection System

### Data stream (2/3)



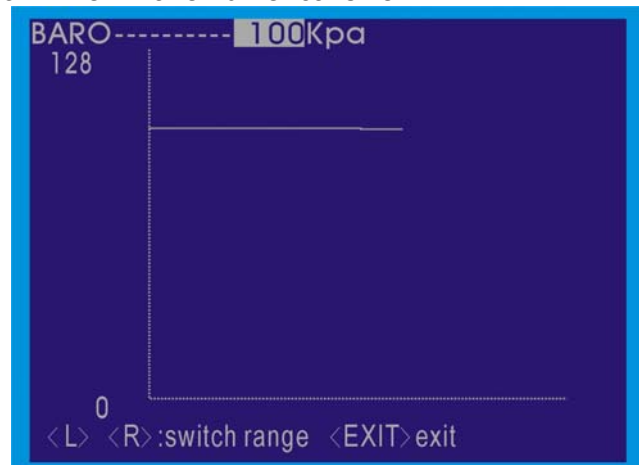
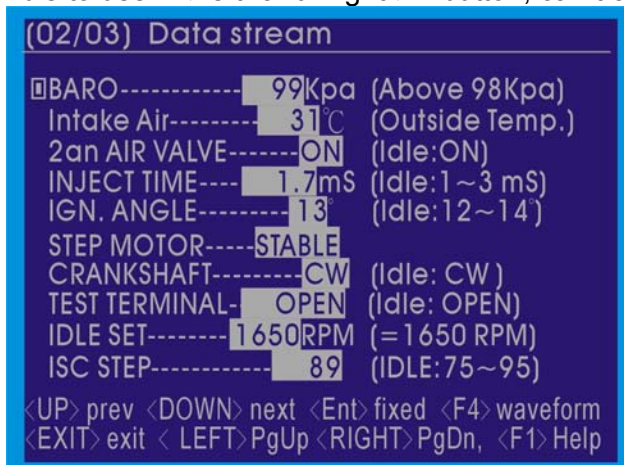
The screen showed the ECU captured by the engine of the state immediately.

The following data for the benchmark idling state:

- BARO----- kPa (Above 98kPa) →Atmospheric pressure
- Intake Air----- °C (Outside Temp.) →Intake air temperature
- 2nd AIR VALVE----- V (Idle:ON) →Secondary air solenoid valve actuator state
- INJECT TIME---- mS(Idle:1~3mS) →Injection time
- IGN. ANGLE----- (Idle:12~14) →Ignition timing
- STEP MOTOR ----- →Idle air control valve step motor actuator state
- CRANKSHAFT ----- (Idle:CW) →Crankshaft functioning direction
- TEST TERMINAL-- (Idle:OPEN) →Test terminal state
- IDLE SET----- RPM (=1650 RPM) →Idle speed goal set value
- ISC STEP----- (Idle:75~95) →Idle Air Control Valve stepper motor learning step

In the "DATA STREAM" of the screen use "▲" "▼" button to move the left side of the project "→" symbol selected items, press the "ENTER" button lock of the project, and press the "F4" button showed that the wave of projects.

Able to use "◀ left" and "right ▶" button, can transform View wave numerical size.

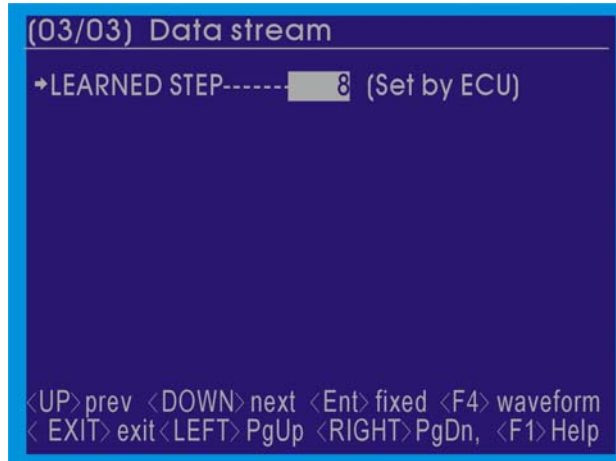


Numerical analysis of images (2 / 3), the waveform can be displayed as shown in the following items:

- BARO
- Intaje Air
- INJECT TIME
- IGN. ANGLE
- IDLE SET
- ISC STEP



## Data stream (3/3)



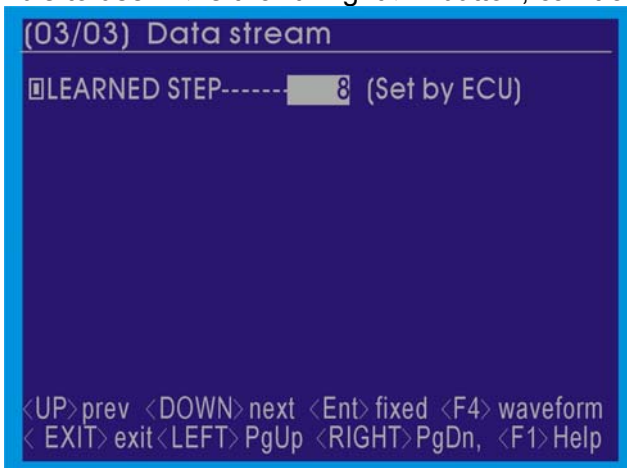
The screen showed the ECU captured by the engine of the state immediately.

The following data for the benchmark idling state:

- LEARNED STEP----- 8 (Set by ECU) →Idle Air Control Valve stepper motor learning step

In the "DATA STREAM" of the screen use "▲" "▼" button to move the left side of the project "→" symbol selected items, press the "ENTER" button lock of the project, and press the "F4" button showed that the wave of projects.

Able to use "◀ left" and "right ▶" button, can transform View wave numerical size.



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

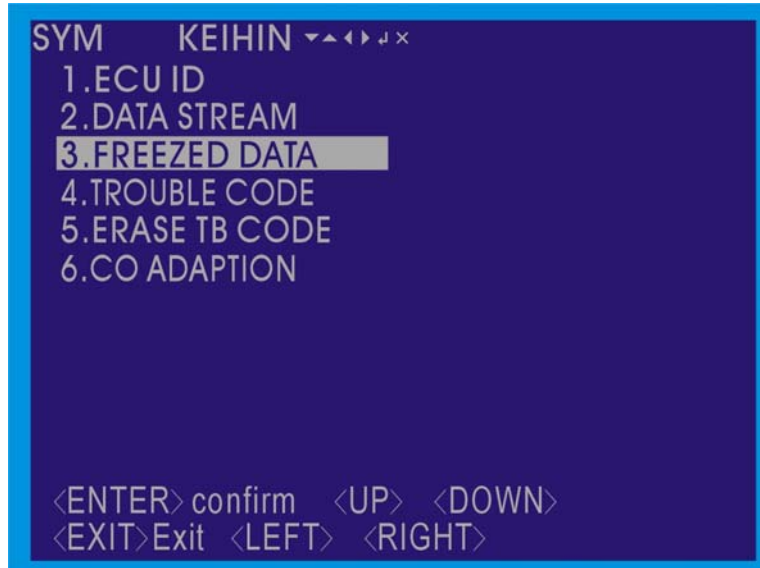
- LEARNED STEP NO.

## 4. Fuel Injection System

### 3. FREEZED DATA

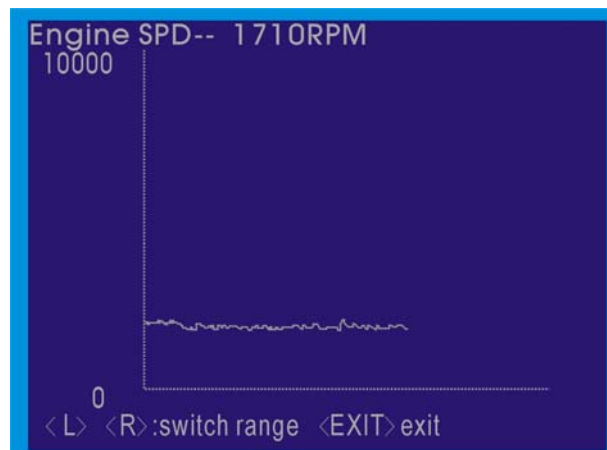
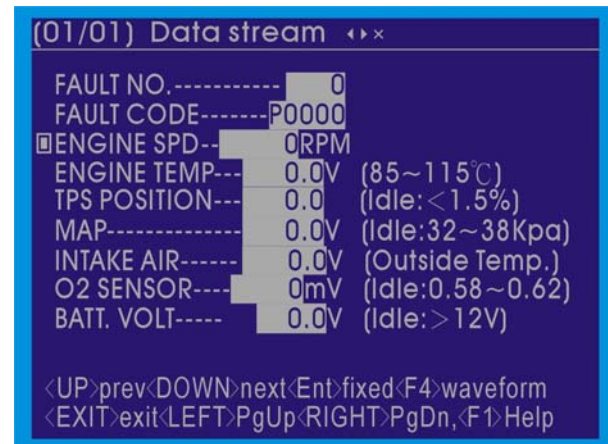
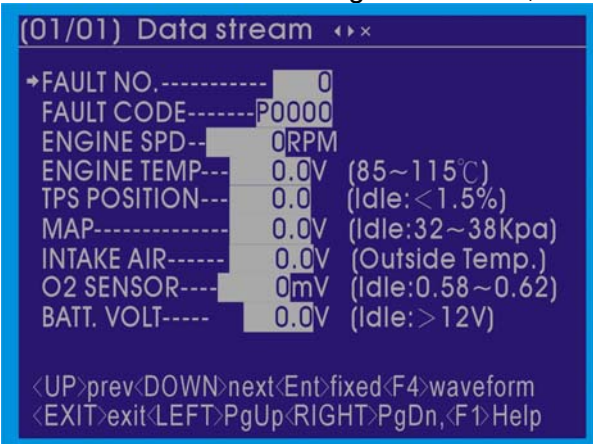
**Objective:** When a sensor fault, the EMS system will record all the parameters of fault signals, in order to facilitate fault diagnosis.

In the directory functions used "▲" "▼" button, select "FREEZED DATA" project, press the "ENTER" key to the implementation.



Only one page, at any screen, press the "EXIT" button, the function can return to the directory screen. In the "FREEZED DATA" of the screen use "▲" "▼" button to move the left side of the project "→" symbol selected items, press the "ENTER" button lock of the project, and press the "F4" button showed that the wave of projects.

Able to use "◀ left" and "right ▶" button, can transform View wave numerical size.







# 4. Fuel Injection System

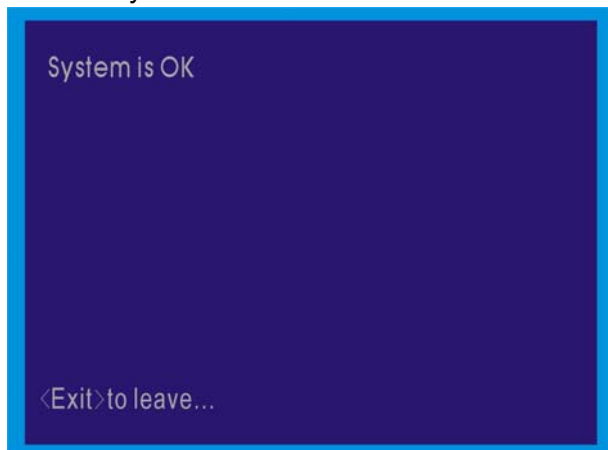
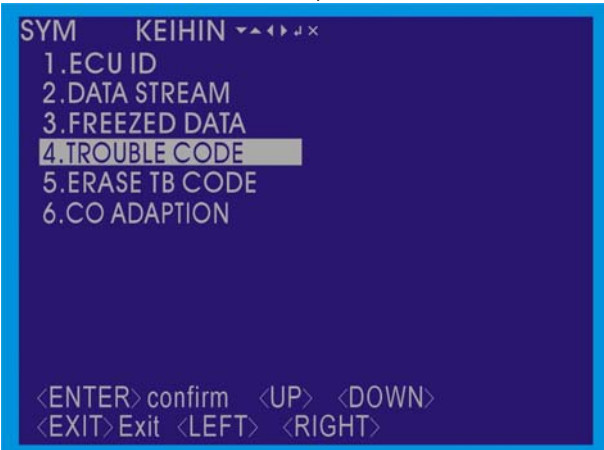
## 4. TROUBLE CODE

In the functional directory select "TROUBLE CODE" project, press the "ENTER" button implementation, the message began to read fault.

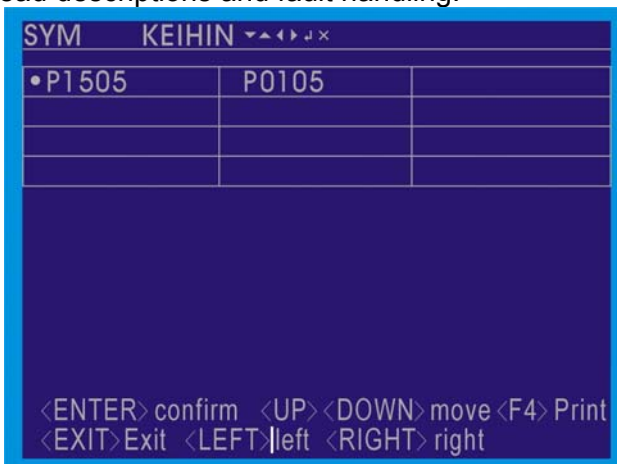
**Fault Code:** electronic injection system that had happened fault of the message (whether or not completion of repair).

Without any fault is that showing "System is OK".

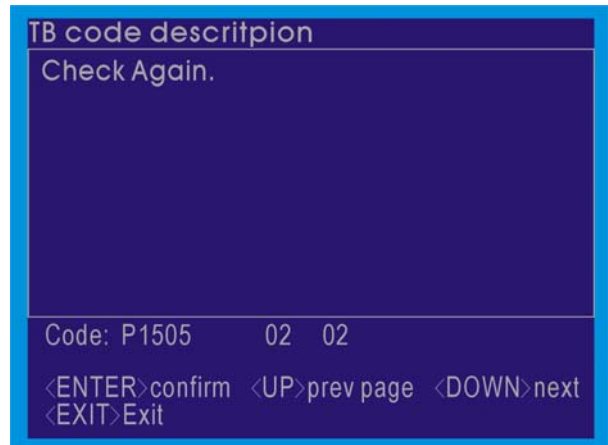
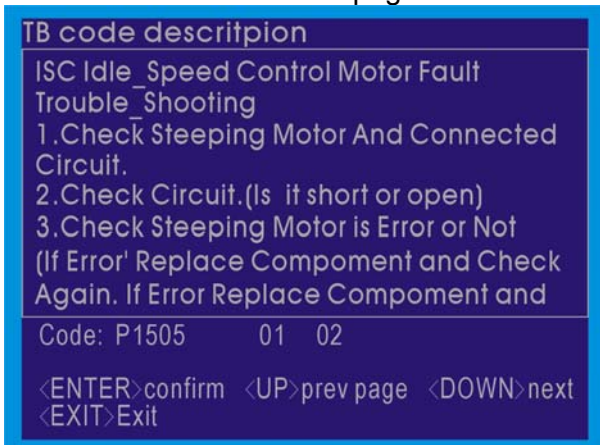
Press the "EXIT" button, the function can return to the directory screen.



If the system has faulty code, that is showing the fault code, that can be used "◀ left" and "right ▶" or "▲" "▼" button selected the fault code (selected before the code "•" tags) that, press the "ENTER" button, the code can be read descriptions and fault handling.



Fault code in the note and treatment of the pages, if the first one page did End, they can press the "▲" "▼" button to turn the pages to read all that.

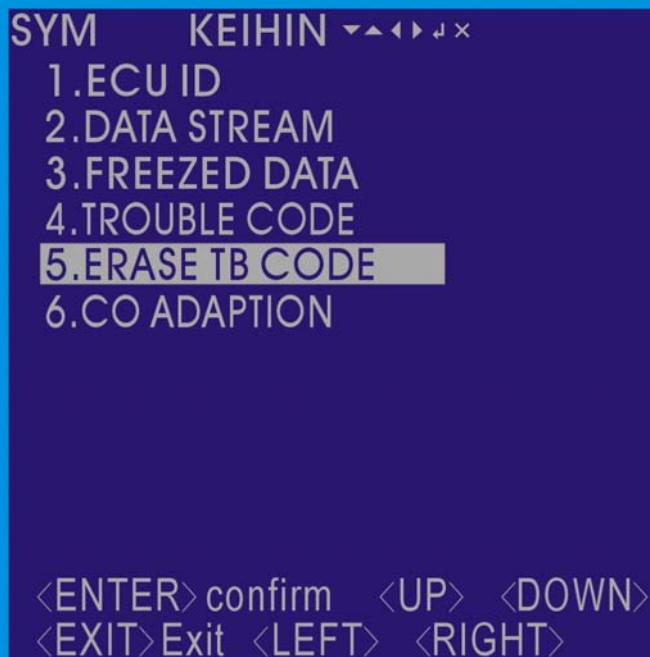


## 4. Fuel Injection System

### 5. ERASE TB CODE

In the directory functions used "▲" "▼" button, select "ERASE TB CODE" project, press the "ENTER" key to the implementation.

**Conditions:** The main switch "ON", or in the engine running state, the fault code can be removed.

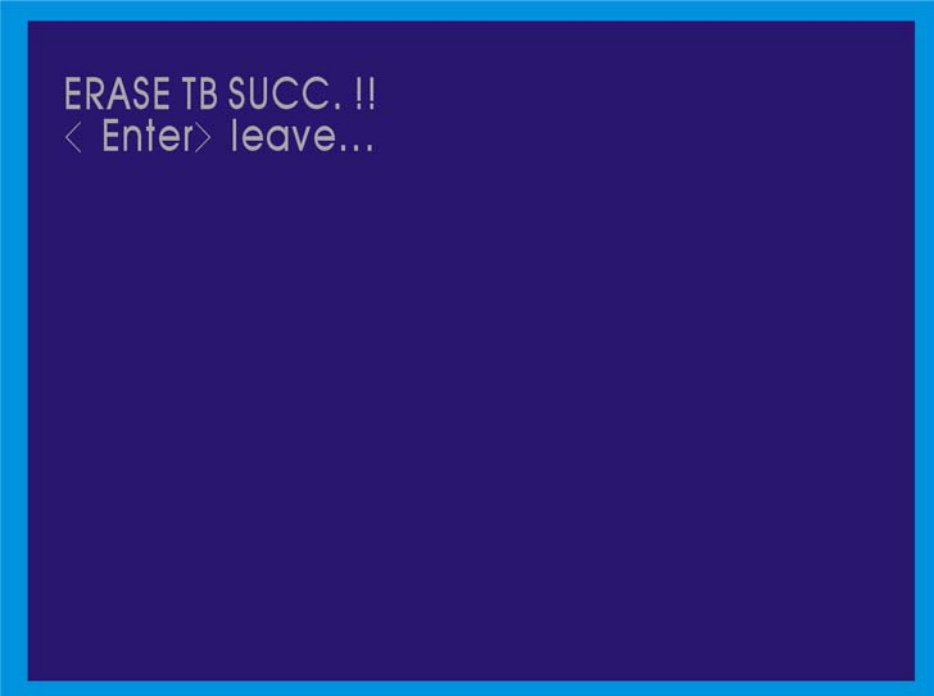


```
SYM    KEIHIN  ▾▲◀▶↓×
1.ECU ID
2.DATA STREAM
3.FREEZED DATA
4.TROUBLE CODE
5.ERASE TB CODE
6.CO ADAPTION

<ENTER>confirm  <UP>  <DOWN>
<EXIT>Exit  <LEFT>  <RIGHT>
```

Fault code removed, namely showing the "ERASE TB SUCC.!!".

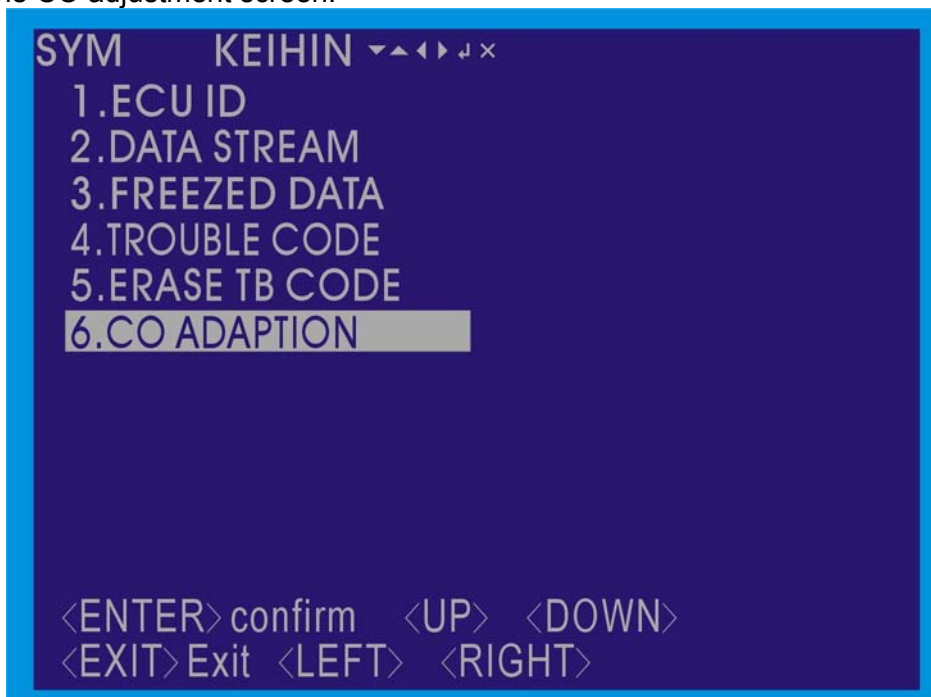
Press the "EXIT" button, the function can return to the directory screen.



```
ERASE TB SUCC. !!
< Enter> leave...
```

## 6. CO ADAPTION

In the directory functions used "▲" "▼" button, select "CO ADAPTION" project, press the "ENTER" button into the CO adjustment screen.

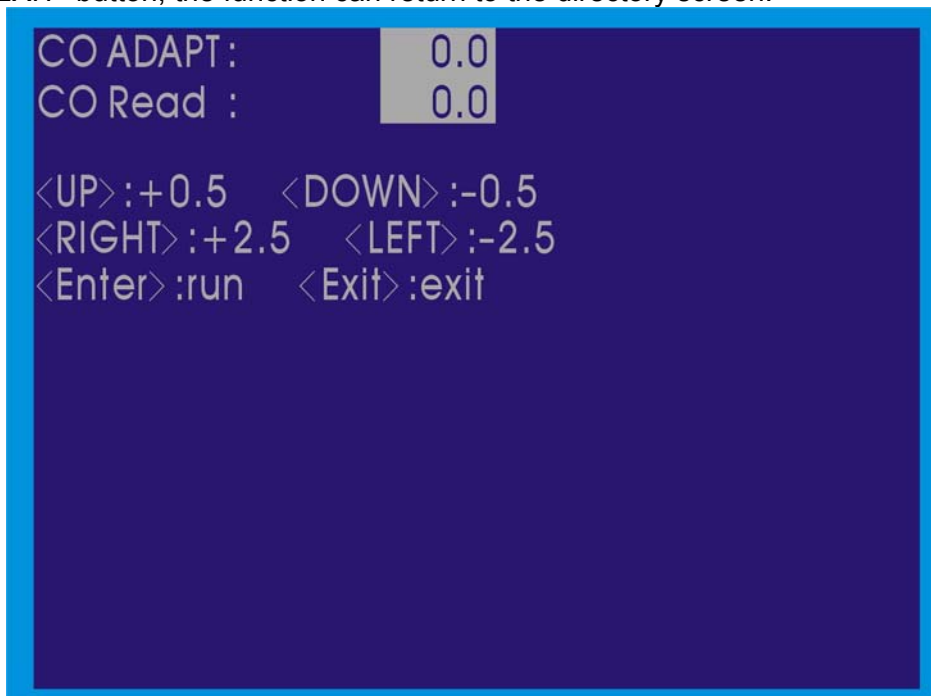


Use "◀ left" and "right ▶" or "▲" "▼" button, CO value can be adjusted.

CO ADAPT: CO adjusted value.

CO Read: CO read-back value.

Press the "EXIT" button, the function can return to the directory screen.



# 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				
		Security unit	Fuel pump relay		Inlet pressure sensor	Fuel pressure adjustment valve					
		Main switch	Fuel filter								
		Battery									

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

## Comprehensive Maintenance List

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

**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

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Note:

<a href="#">Precautions in Operation.....</a>	<a href="#">5-1</a>	<a href="#">Rear Fork .....</a>	<a href="#">5-9</a>
<a href="#">Engine Removal .....</a>	<a href="#">5-2</a>	<a href="#">Engine Bush Removal .....</a>	<a href="#">5-11</a>
<a href="#">Engine Hanger .....</a>	<a href="#">5-8</a>	<a href="#">Engine Installation .....</a>	<a href="#">5-12</a>

### 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. Carburetor.
  2. Driving disk, driving belt, clutch, and transporting disk.
  3. Final reduction gear mechanism.
  4. AC. Generator.

#### Specification

Item		LM25W5-6/7/P LM25W7-7 LM30W-6/T
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	850 c.c.
	Reservoir upper	420 c.c.

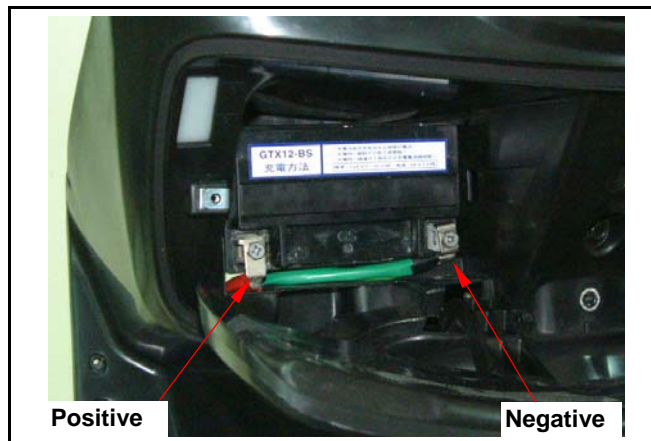
#### Torque Values

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

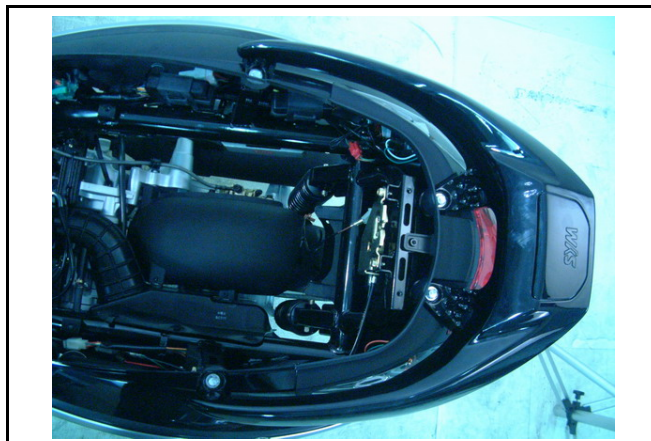
## 5. Removal & Installation of Engine

### 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 (6 bolts, 2 screws).  
 (Refer to chapter 14)

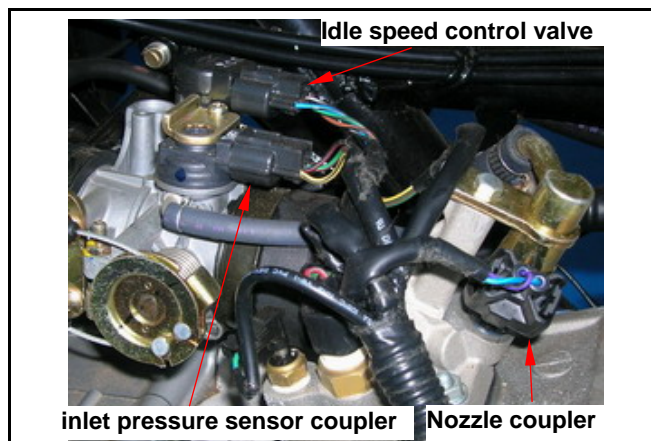


Remove right and left side covers (4 screws on each side.).  
 Remove rear carrier (4 bolts).  
 Remove body cover (4 screws & 1 coupler).  
 (Refer to chapter 14)



### Remove fuel injection system of electrical couplers and fuel hoses

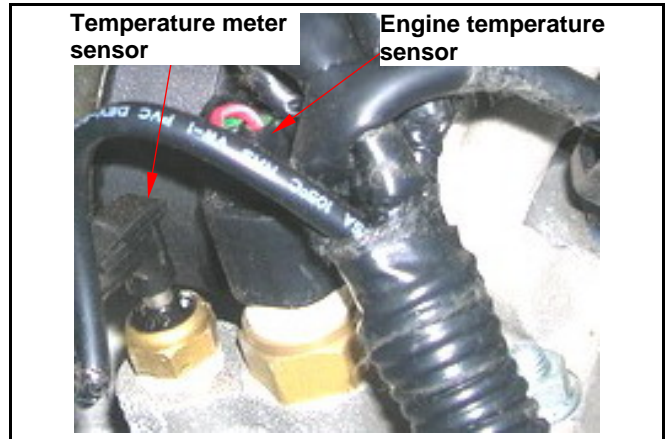
Remove idle speed control valve, inlet pressure sensor, nozzle of couplers.



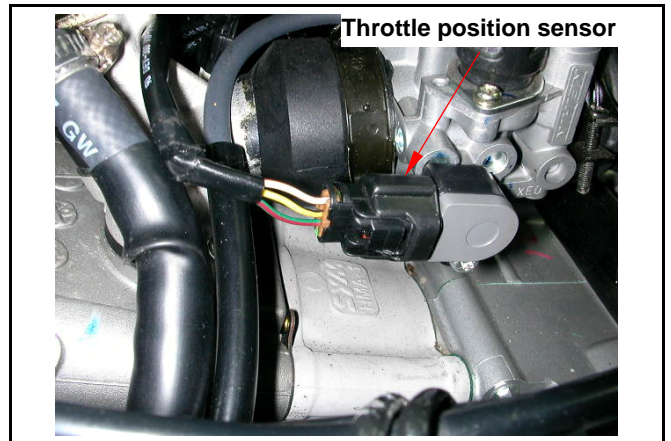


## 5. Removal & Installation of Engine

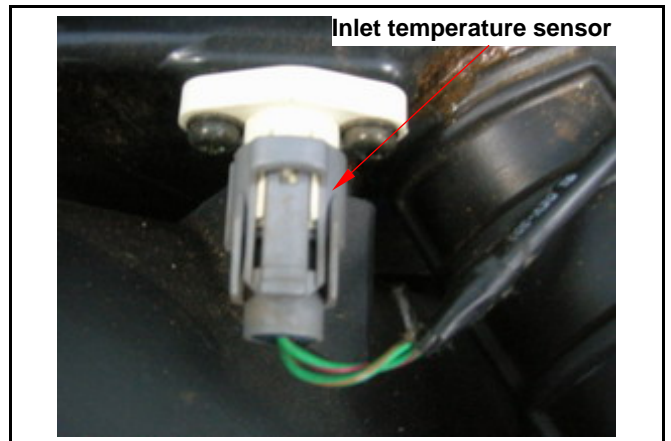
Remove the temperature meter sensor and engine temperature sensor wire couplers.



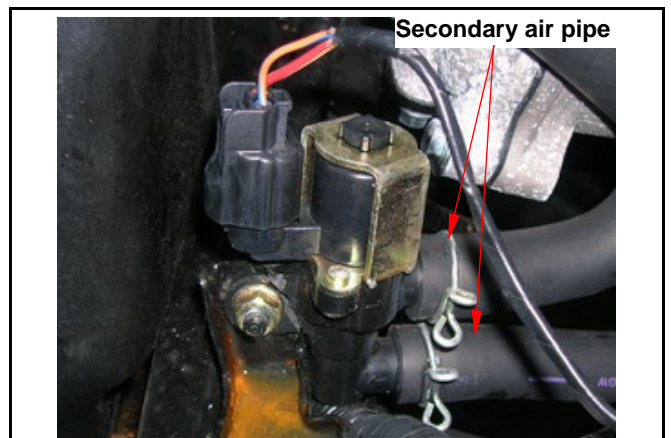
Remove throttle position sensor coupler.



Remove inlet temperature sensor coupler.



Remove secondary air electromagnetic valve pipe.

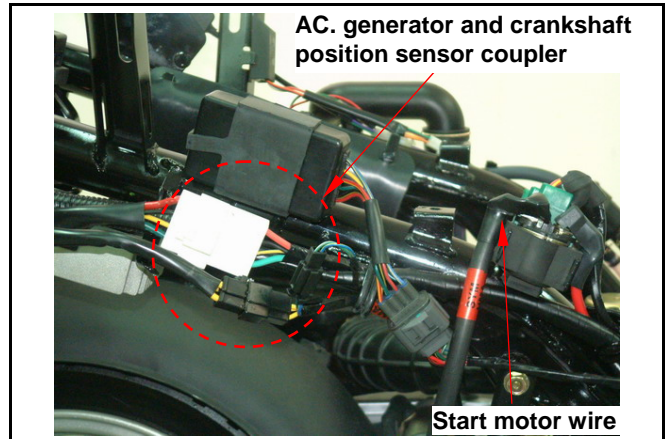




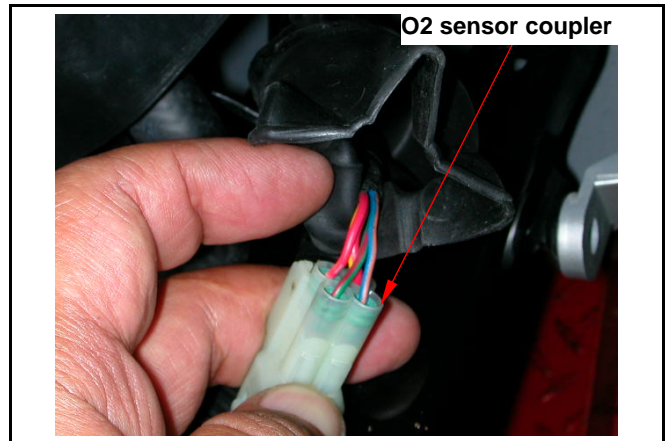
## 5. Removal & Installation of Engine



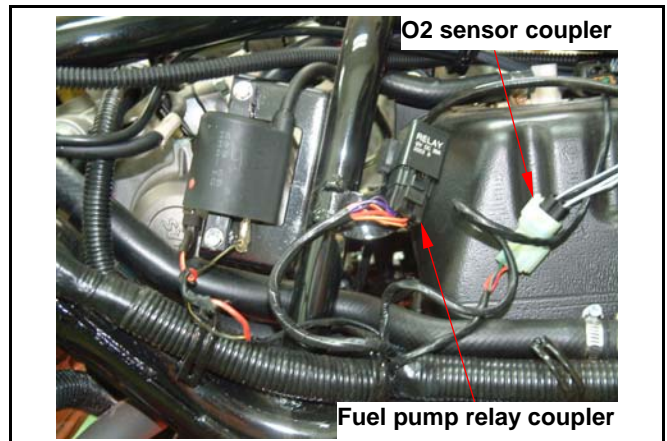
Remove AC. generator and crankshaft position sensor coupler.  
Remove start motor wire from the start relay.



Remove O2 sensor wire coupler.



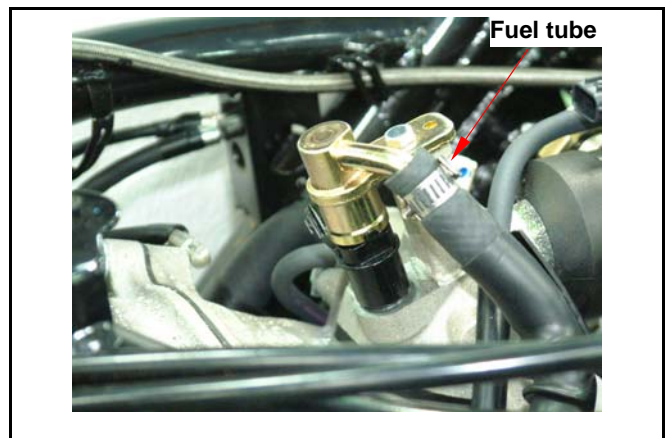
Remove fuel pump relay wire coupler.



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

**⚠ Caution**

- Demolition for the pipeline, will be required for residual pressure in the pipeline to divest, or use the folder surrounds the tubing to prevent petrol splash.

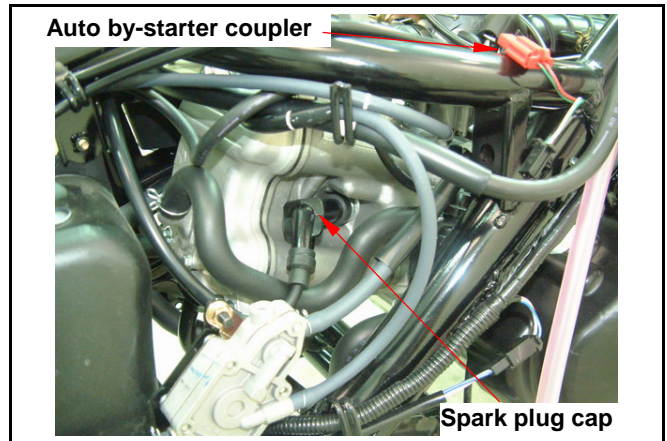




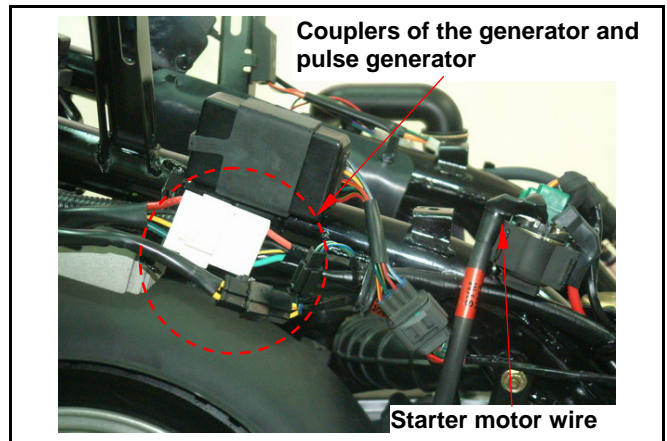
## 5. Removal & Installation of Engine

### Carburetor type and other common Mechanical

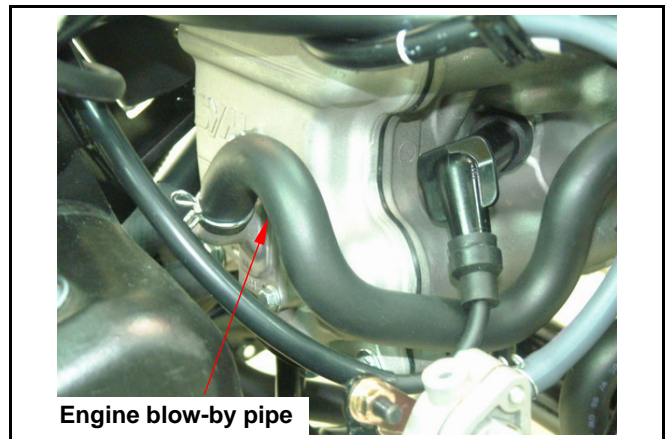
Remove the power coupler of auto by-starter.  
Remove the spark plug cap.



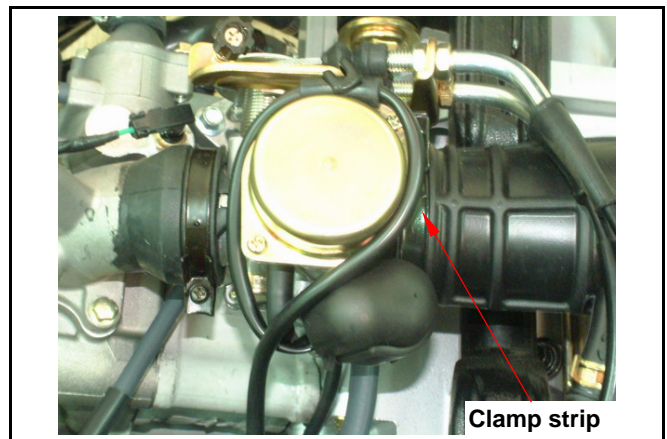
Remove the generator power wire and pulse generator connector.  
Remove the starter motor wire.



Remove engine blow-by pipe.

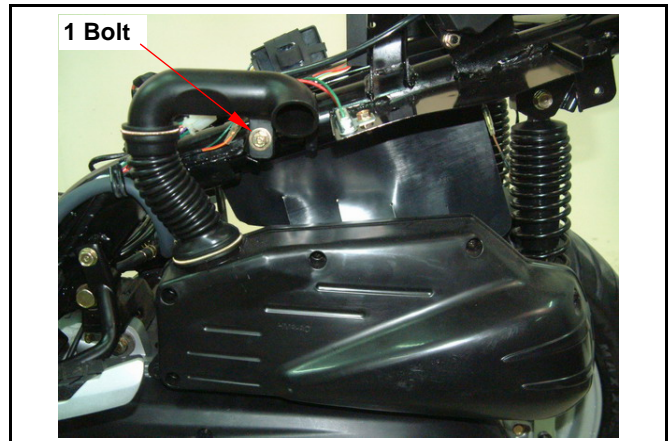


Remove the fuel line, vacuum hose, and throttle valve cable from the carburetor.  
Loosen the clamp strip of air cleaner and carburetor, and then remove the air cleaner hose.

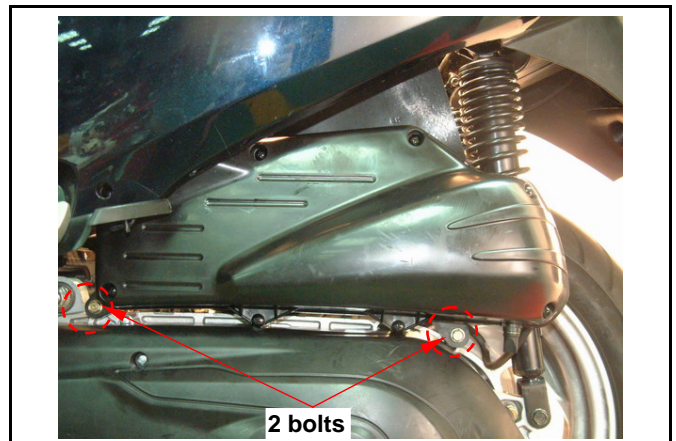


## 5. Removal & Installation of Engine

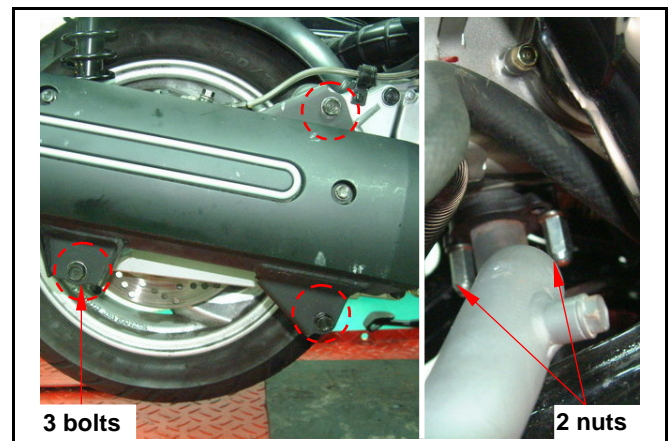
Remove the air cleaner inlet pipe connection bolt (1 bolt).



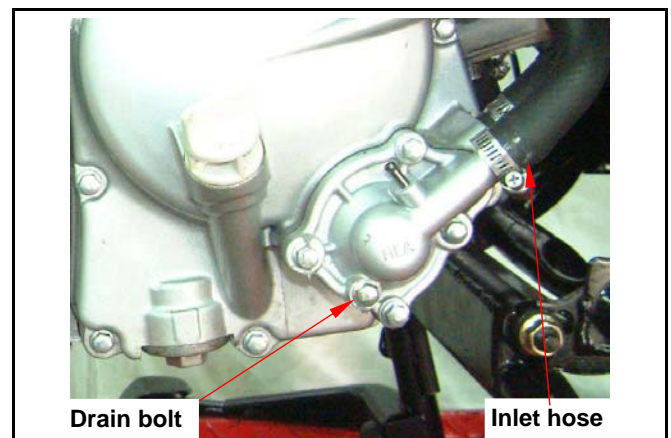
Remove the air cleaner connection bolts (2 bolts).  
Remove the air cleaner.



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



Drain out coolant, and remove coolant inlet hose.

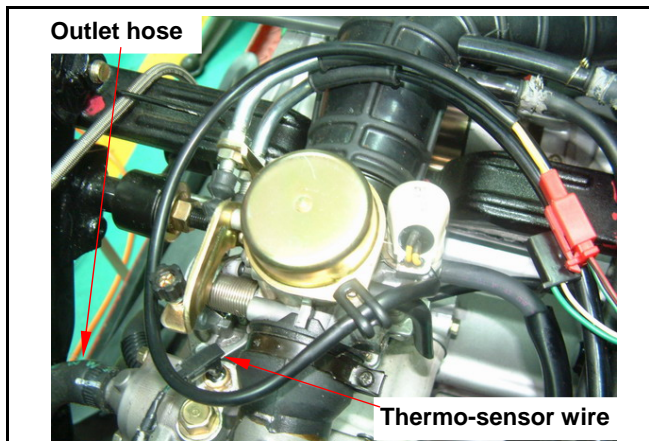




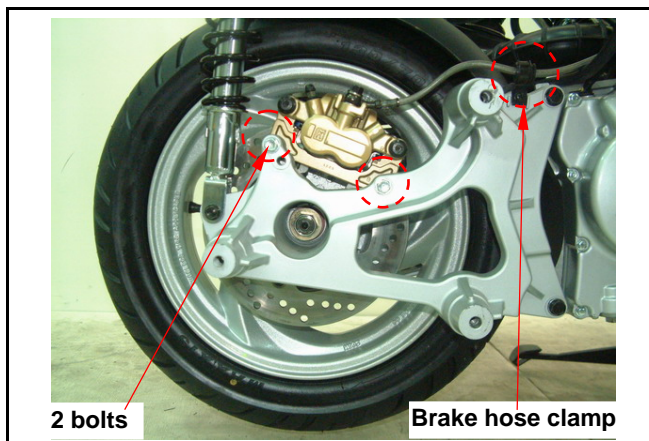


## 5. Removal & Installation of Engine

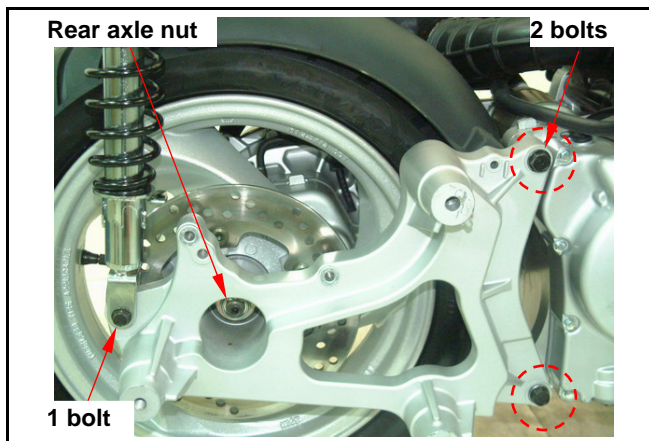
Remove the coolant outlet hose and thermo-sensor wire.



Remove rear brake hose clamp and rear brake caliper.



Remove the right rear cushion lower bolt (1 bolt).  
Remove the rear fork bolts (2 bolts).  
Remove the rear wheel axle nut (1 nut).

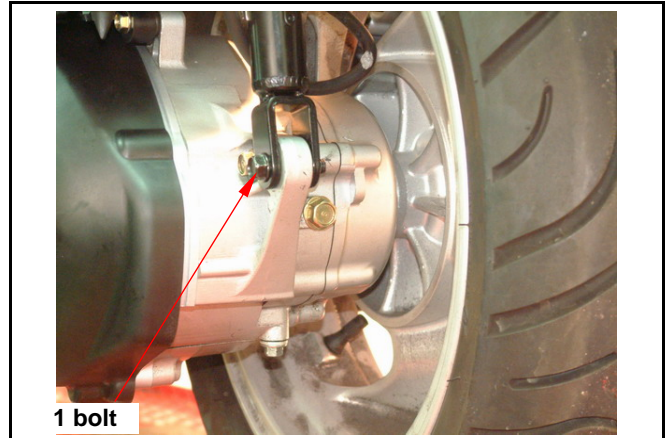


Remove the rear fork and rear axle collars.



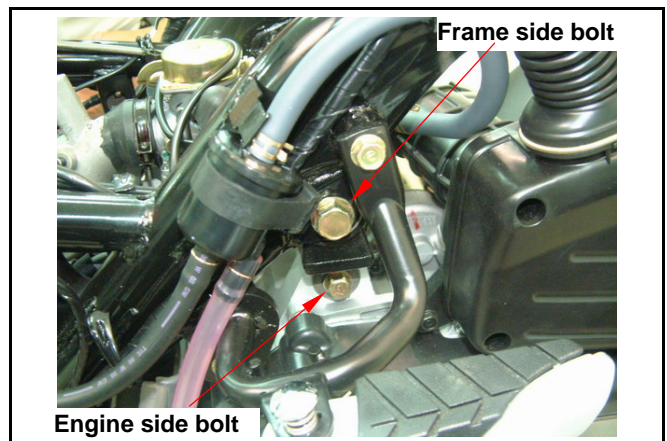
## 5. Removal & Installation of Engine

Remove left rear cushion lower bolt (1 bolt).



With a bracket to support the engine to prevent from it damage by falling down as removing the engine.

Remove frame side engine hanger bolts (each side 1 bolt), and then remove engine.



### Engine Hanger

#### Removal

Remove the engine side bolts of engine hanger. (1 bolt on each side)

Remove the engine hanger.

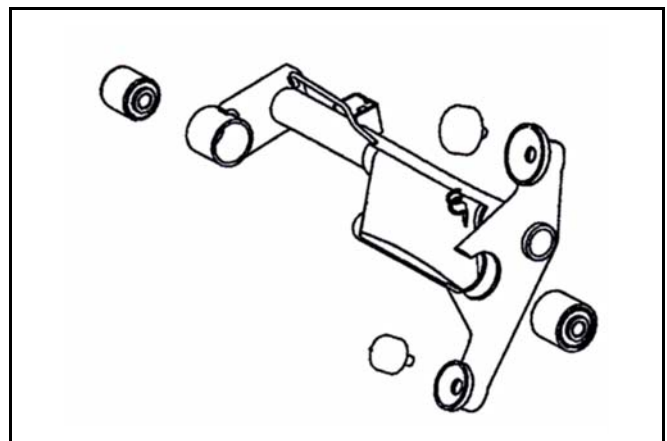
Check if the engine hanger bush and cushion rubber for damage. If so, replace with new ones.

#### Installation

Tighten the bolts and nuts of engine hanger.

**Engine hanger nut:**

**Torque Value: 7.5~9.5kgf-m**





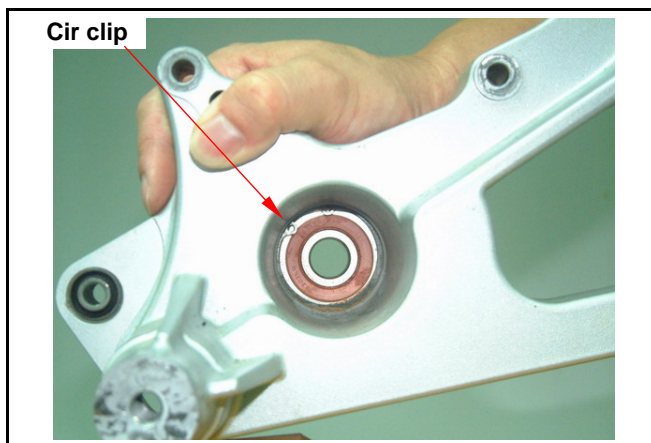


## 5. Removal & Installation of Engine

### Rear Fork

#### Bearing Inspection

Check bearings on rear fork.  
 Rotate bearing inner ring with fingers.  
 Check if bearing can be turned in smooth and silent, 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 cir clip.  
 Drive the bearing out of the rear fork.

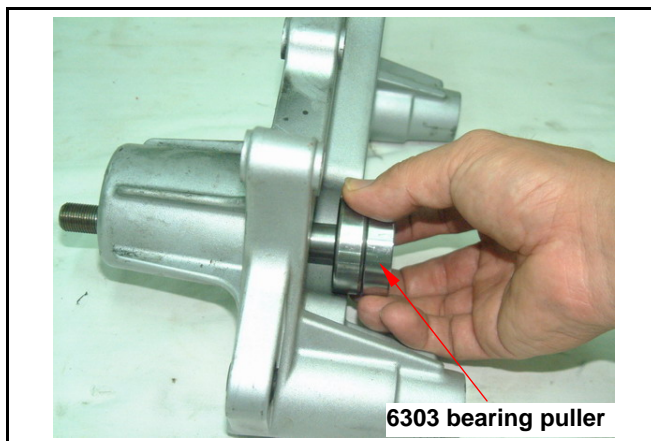


#### Bearing installation

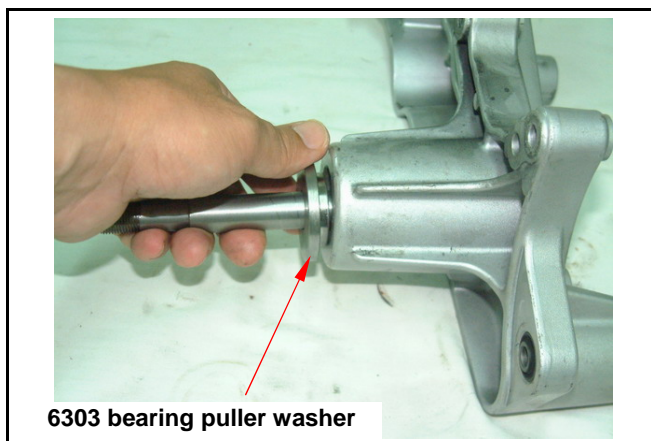
Install new rear axle bearing and bearing puller into rear fork.

#### Special Service Tools:

Rear fork bearing puller SYM-6303000-6303



Install the washer of the 6303 bearing puller.





## 5. Removal & Installation of Engine

Install assembly directs puller bearing puller.

**Special Service Tools:**

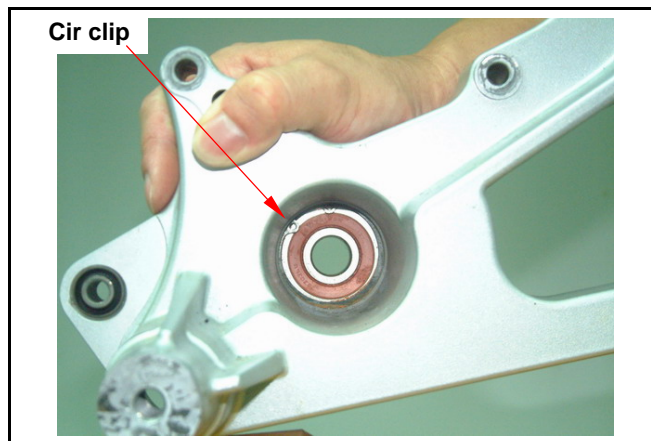
Assembly directs puller      SYM-2341110



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



Install bearing mounting cir clip.

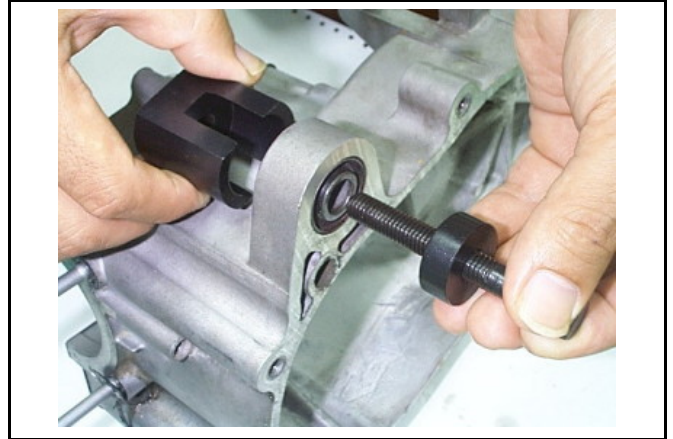


### Engine Bush Removal

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.

Engine hanger bush:  $\varnothing 28\text{mm}$

Rear cushion bush:  $\varnothing 20\text{mm}$



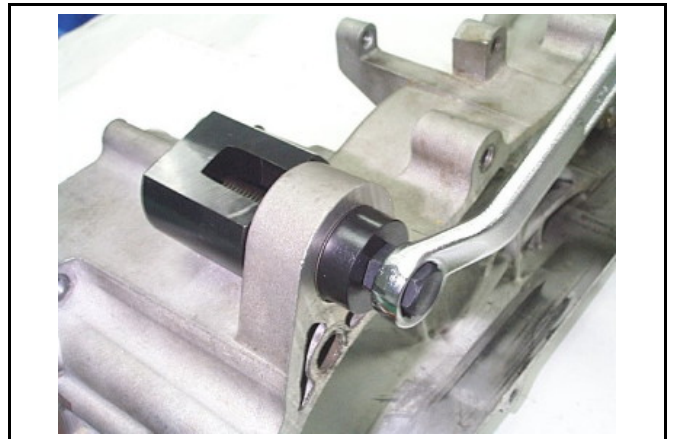
### Pressing out

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:

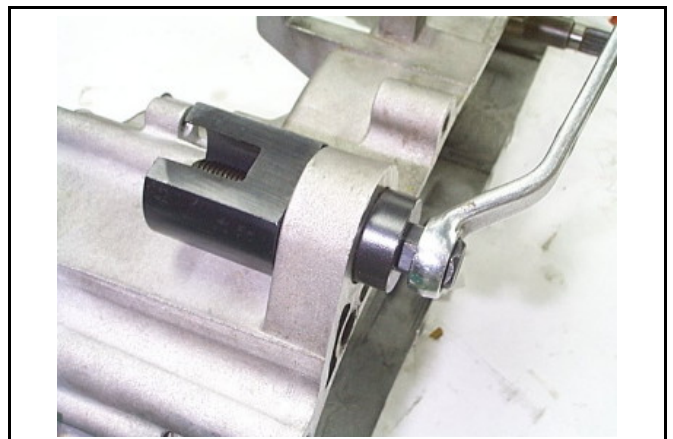
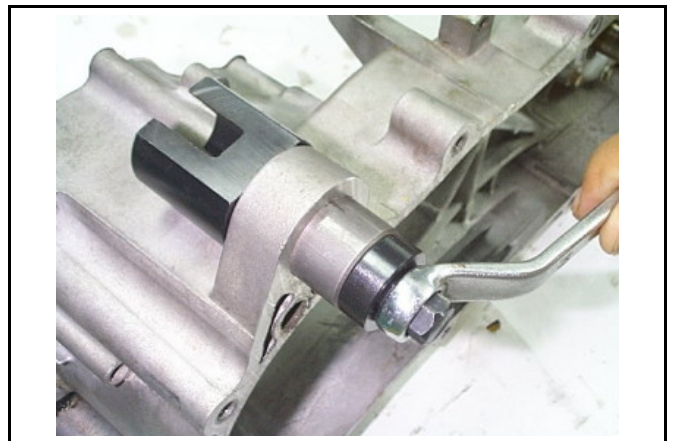
Crankcase bush remover/presser SYM-1120310

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.



## 5. Removal & Installation of Engine

### Engine Installation

Install the engine according to the reversing order of removal.

#### Caution

- Note both feet and hands safety for squeezing as engine installation.
- Do not bent or squeeze each wires or hose.
- Route all cables and wires in accordance with the routine layout.

**Engine hanger nut:**

**Torque Value: 7.5~9.5kgf-m**

**Rear cushion bolt:**

**Torque Value: upper: 3.5~4.5kgf-m**

**under: 2.4~3.0kgf-m**

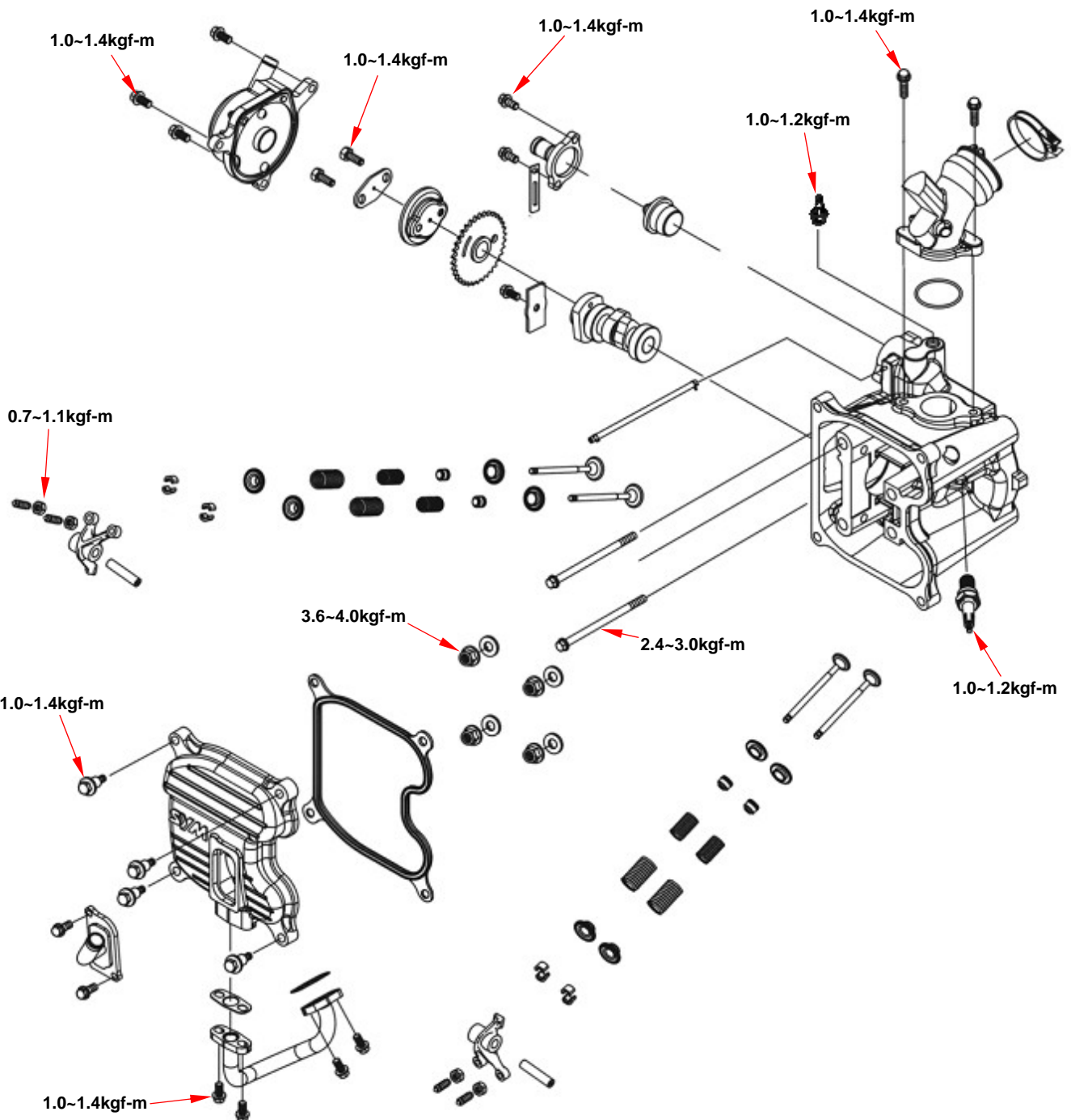
**Rear wheel axle nut:**

**Torque Value: 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





## 6. Cylinder Head / Valve

### Precautions in Operation

#### General Information

- This chapter is contained maintenance and service for cylinder head, valve, and camshaft as well as rocker arm.
- Cylinder head service can be carried out when engine is in frame.

#### Specification

Item		Standard	Limit
Compression pressure		12±2 kg/cm <sup>2</sup>	---
Camshaft	Height of cam lobe	Intake	34.880
		Exhaust	34.740
Rocker arm	ID of valve rocker arm		11.982~12.000
	OD of valve rocker arm shaft		11.966~11.984
Valve	OD of valve stem	Intake	4.975~4.990
		Exhaust	4.950~4.975
	ID of valve guide		5.000~5.012
	Clearance between valve stem and guide	Intake	0.010~0.037
		Exhaust	0.025~0.062
	Free length of valve spring	Inner	38.700
		outer	40.400
	Valve seat width		1.600
	Valve clearance	Intake	0.10±0.02mm
		Exhaust	0.15±0.02mm
Tilt angle of cylinder head		---	0.050

#### Torque Value

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

#### Tools

##### 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.

### Low compression pressure

#### 1. Valve

- Improper valve adjustment
- Burnt or bent valve
- Improper valve timing
- Valve spring damage
- Valve carbon deposit.

#### 2. Cylinder head

- Cylinder head gasket leaking or damage
- Tilt or crack 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 wear out or damage
- Chain wear out or looseness
- Auto-tensioner wear out or damage
- Camshaft sprocket
- Rocker arm or rocker arm shaft wear out

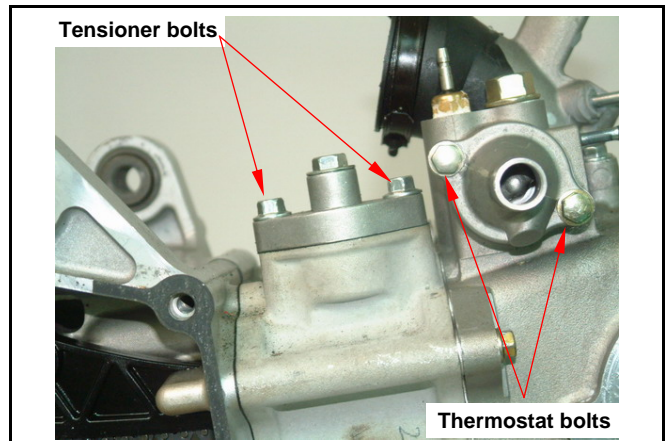
## 6. Cylinder Head / Valve

### Cylinder Head Removal

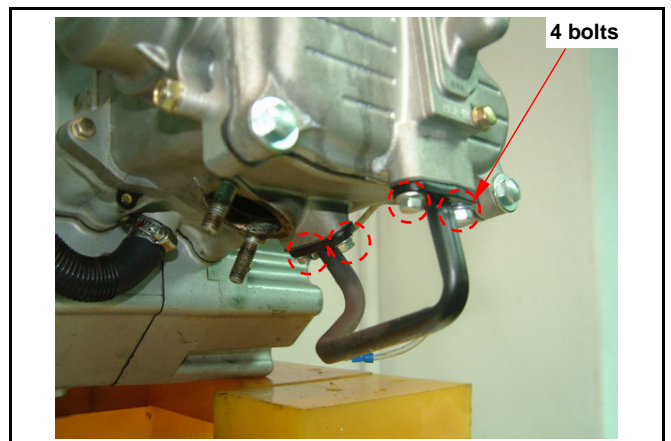
Remove engine. (Refer to chapter 5)



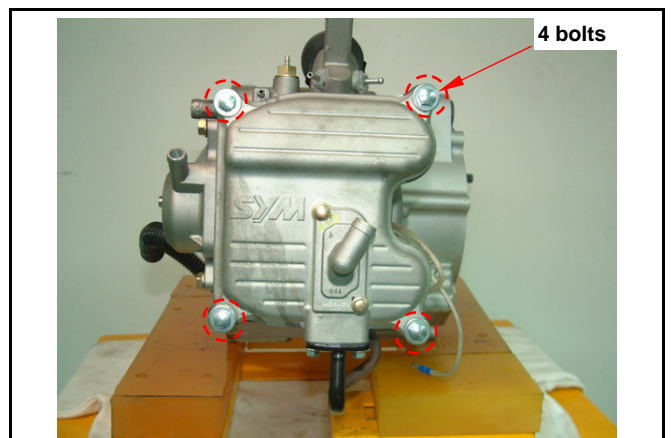
Remove 2 bolts of thermostat and then remove the thermostat.  
 Remove hole bolt and spring for the cam chain tensioner.  
 Loosen 2 bolts, and then remove tensioner.  
 Remove thermostat (2 bolts).



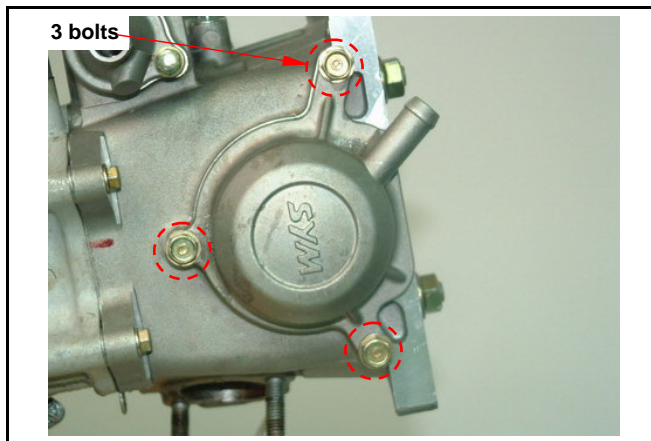
Remove Air Injection system (AI) pipe mounting bolts.  
 Remove spark plug.



Remove cylinder head cover (4 bolts).

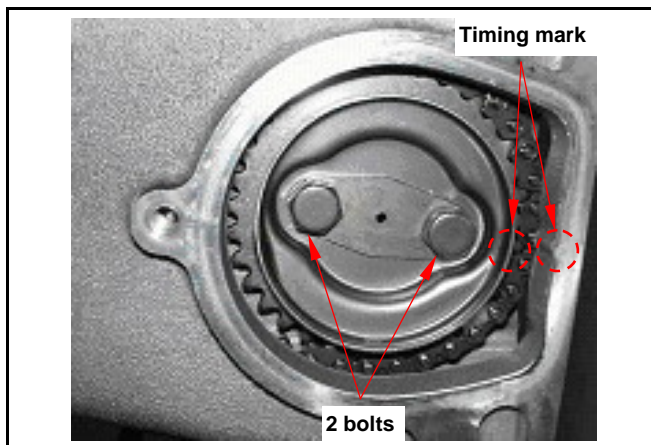


Remove the side cover mounting bolts of cylinder head, and then take out the side cover.

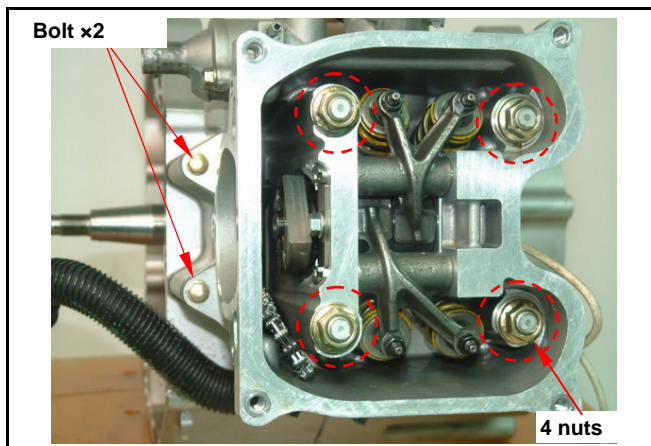


Remove left crankcase cover, and turn the drive face, and align the timing mark on the sprocket with that of cylinder head, piston is at TDC position.

Remove cam sprocket bolts and then remove the sprocket by prying chain out.



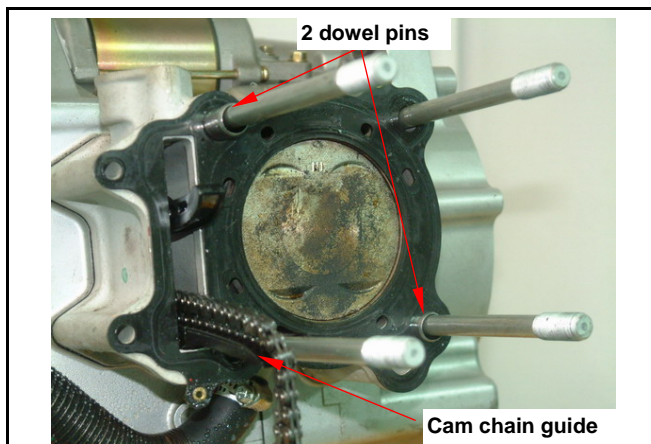
Remove the 2 cylinder head mounting bolts from cylinder head right side, and then remove 4 nuts and washers from cylinder head upper side. Remove the cylinder head.



Remove cylinder head gasket and 2 dowel pins. Remove chain guide. Clean up residues from the matching surfaces of cylinder and cylinder head.

**⚠ Caution**

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

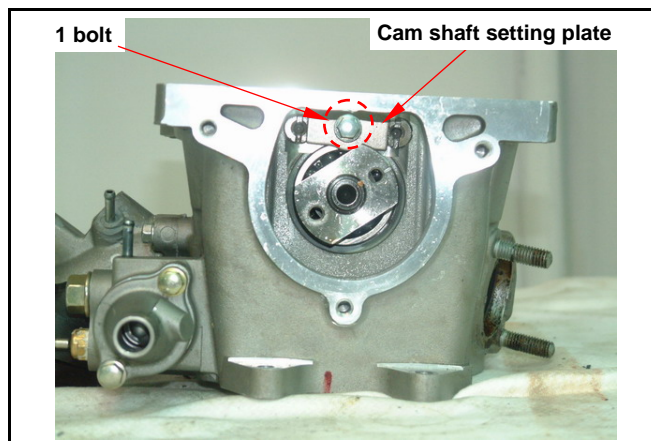




## 6. Cylinder Head / Valve

### Cylinder Head Disassembly

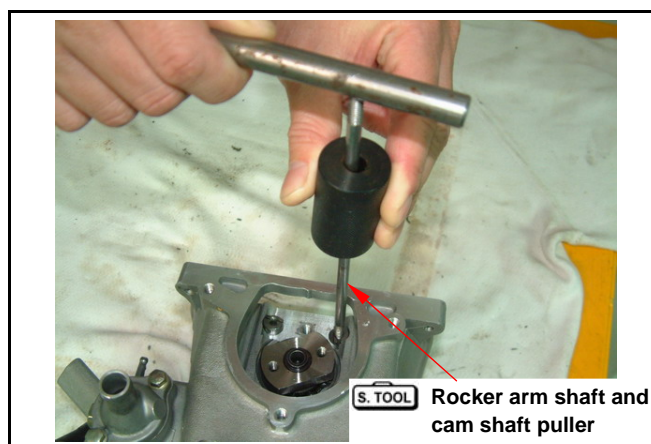
Remove cam shaft setting plate (1 bolt).



Remove rocker arm shafts and rocker arms.

**Special Service Tool:**

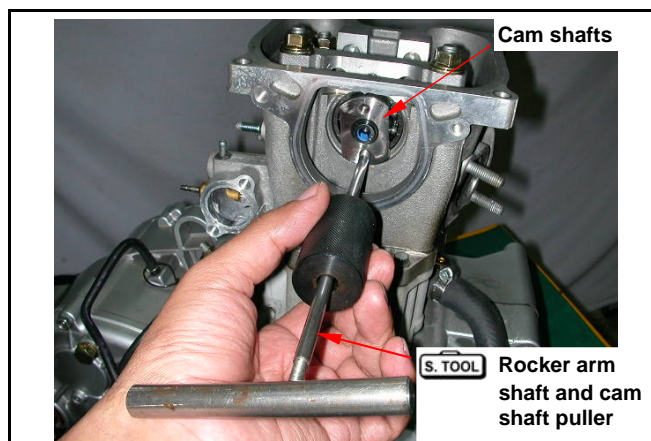
**Rocker arm and cam shaft puller SYM-1445100**



Remove cam shafts.

**Special Service Tool:**

**Rocker arm and cam shaft puller SYM-1445100**



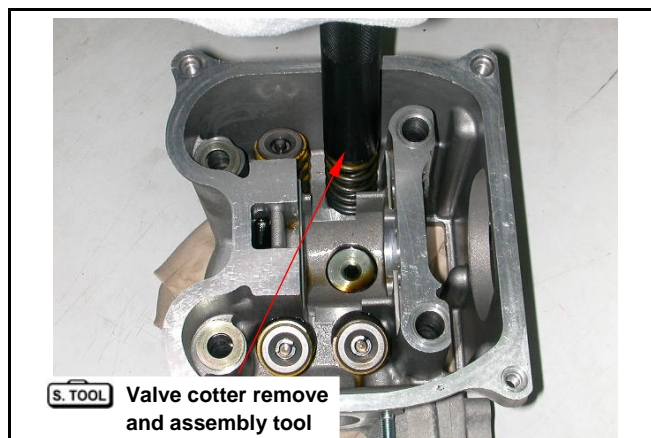
Use a valve cotter remove & assembly tool to press the valve spring, and then remove valves.

#### Caution

- In order to avoid losing spring elasticity, do not press the spring too much. Thus, press length is based on the valve cotter in which can be removed.

**Special Service Tool:**

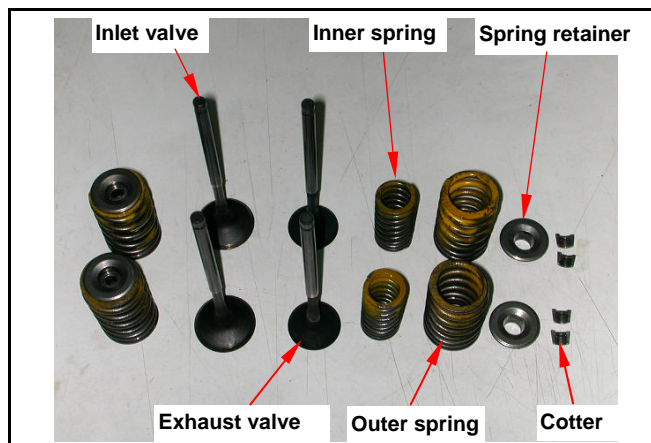
**Valve cotter remove & assembly tool SYM-1471110-SY125**



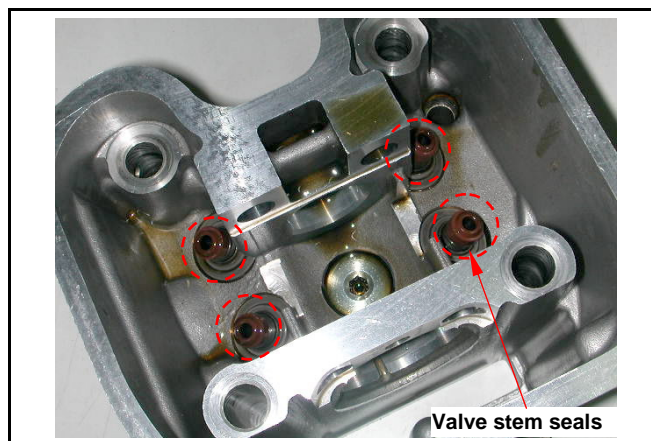


## 6. Cylinder Head / Valve

Remove valve cotters, spring retainers, springs and valves.



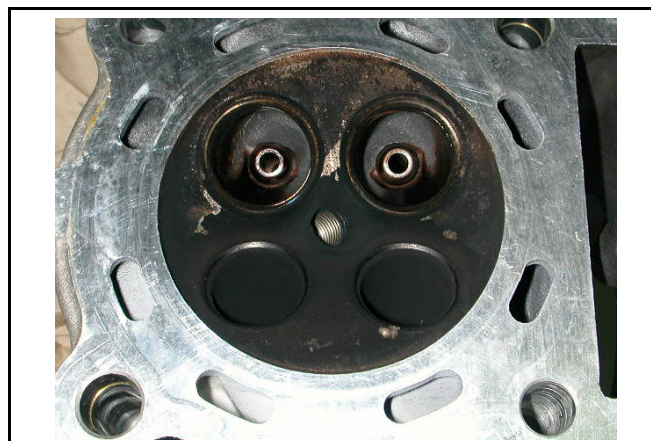
Remove valve stem seals.



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

**⚠ Caution**

- Do not damage the matching surface of cylinder head.



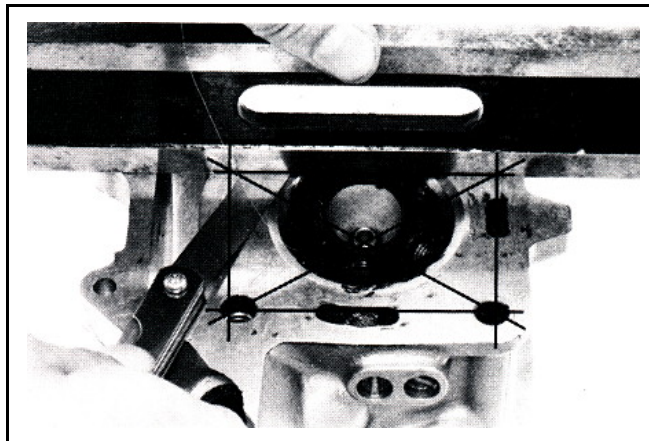


## 6. Cylinder Head / Valve

### Cylinder Head Inspection

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

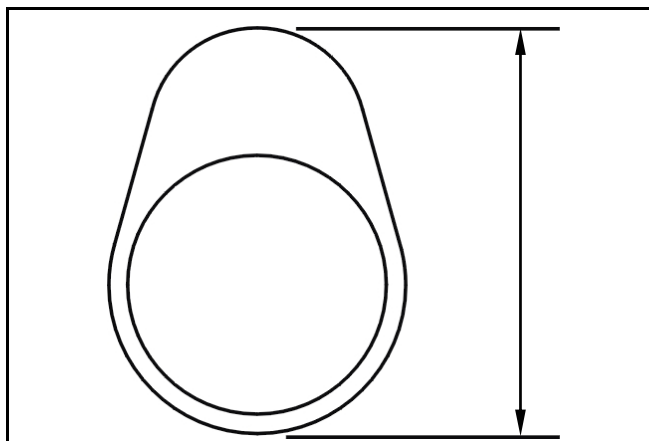
Inspect cam lobe height for damaged.

**Service Limit:**

**IN: Replacement when less than 34.860mm**

**EX: Replacement when less than 34.725mm**

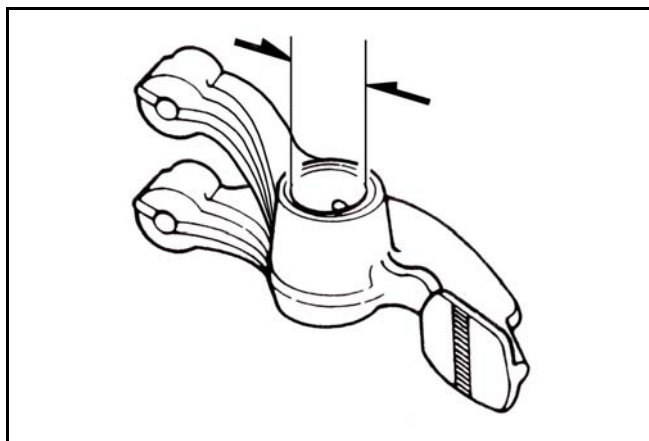
Inspect the camshaft bearing for looseness or wear out. If any damage, replace whole set of camshaft and bearing.



### Rocker Arm

Measure the cam rocker arm I.D., and wear or damage, oil hole clogged?

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



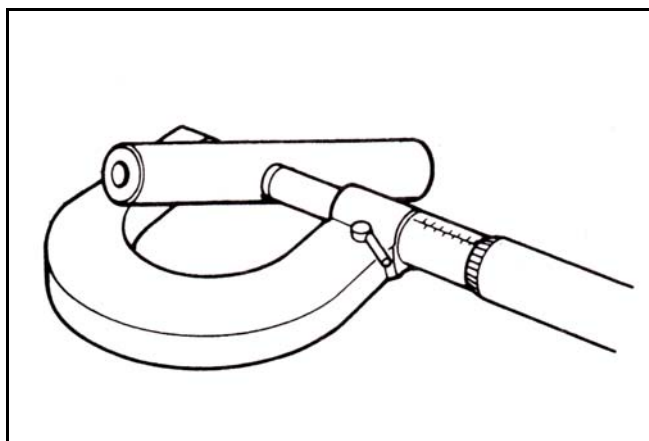
### Rocker Arm Shaft

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.**



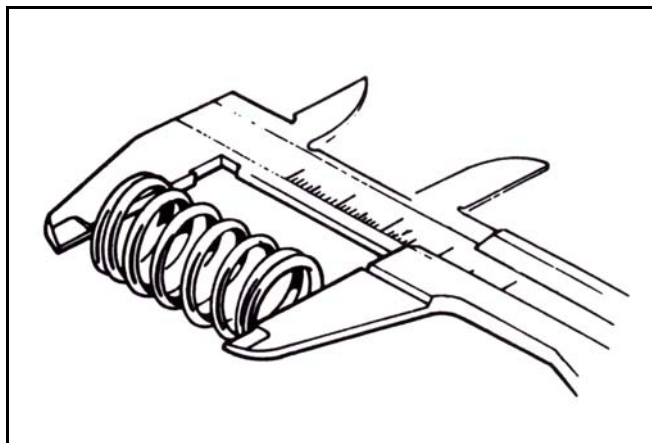
### Valve spring free length

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

**Service Limit: IN: 4.90 mm**

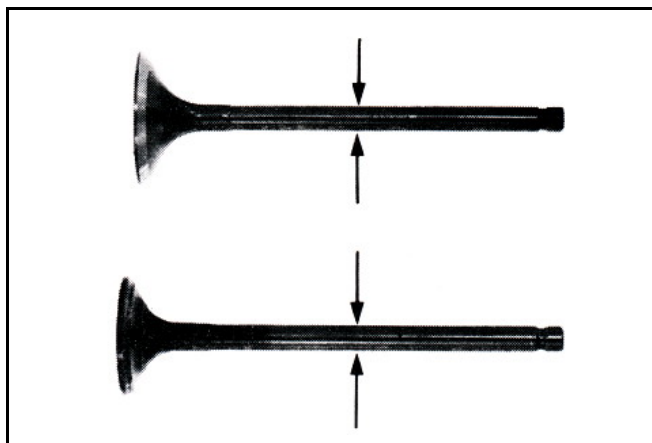
**EX: 4.90 mm**

### 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**

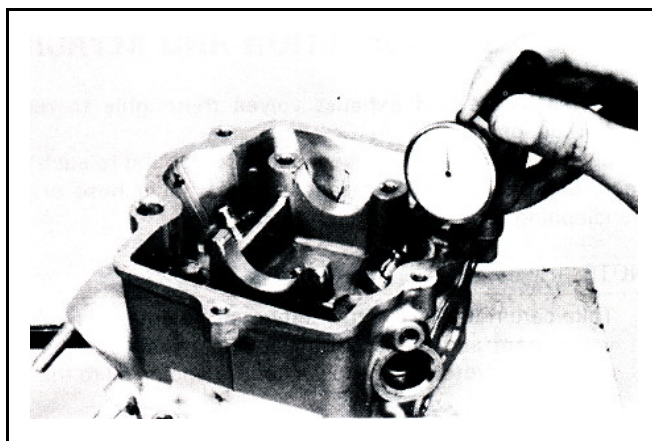
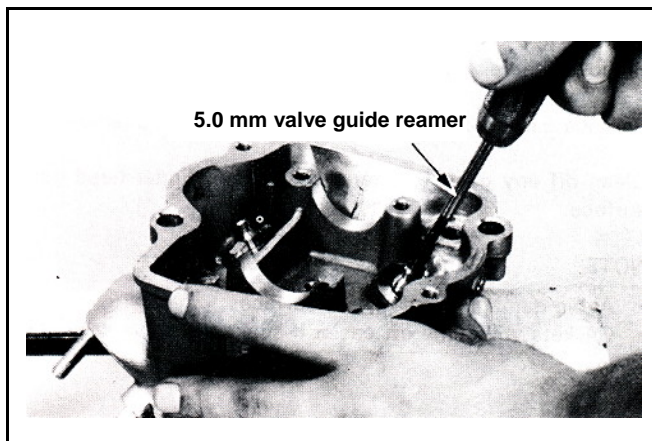
#### ⚠ Caution

- If clearance between valve stem and valve guide exceeded service limit, check whether the new clearance that only replaces new valve guide is within service limit or not. If so, replace valve guide.

Correct it with reamer after replacement. If clearance still exceeds service limit after replaced valve guide, replace valve stem too.

#### ⚠ Caution

- It has to correct valve seat when replacing valve guide.



## 6. Cylinder Head / Valve

### Valve Stem Replacement

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

#### Caution

- Do not let torch heat cylinder head directly. Otherwise, the cylinder head may be deformed as heating it.
- Wear on a pair of glove 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 deformation after pressed 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**

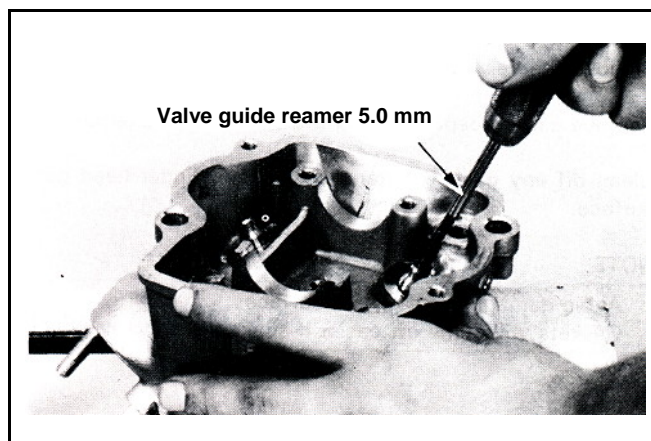
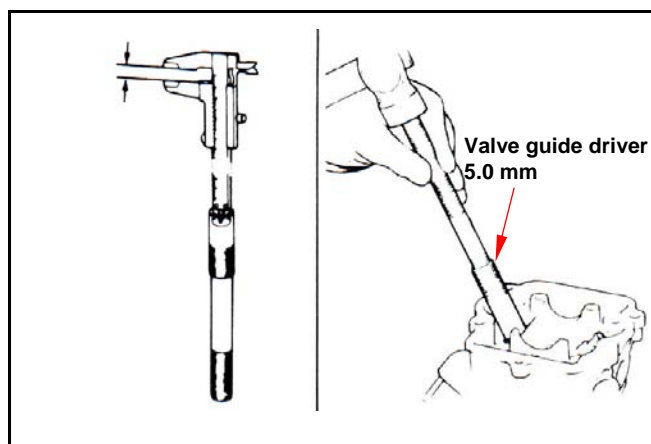
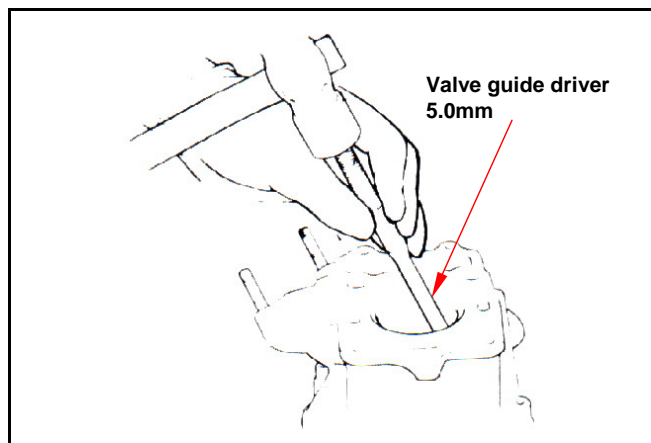
Wait for the cylinder head cooling down to room temperature, and then correct the new valve guide with reamer.

#### Caution

- Using cutting oil when correcting valve guide with a reamer.
- Turn the reamer in same direction when it be inserted or rotated.

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 onto 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 between valve stem and valve guide.
- Clean up the emery after corrected, 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 roughness, wear out, or incomplete contacted with valve seat.

### Valve seat inspection

If the valve seat is too width, narrow or rough, corrects 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.

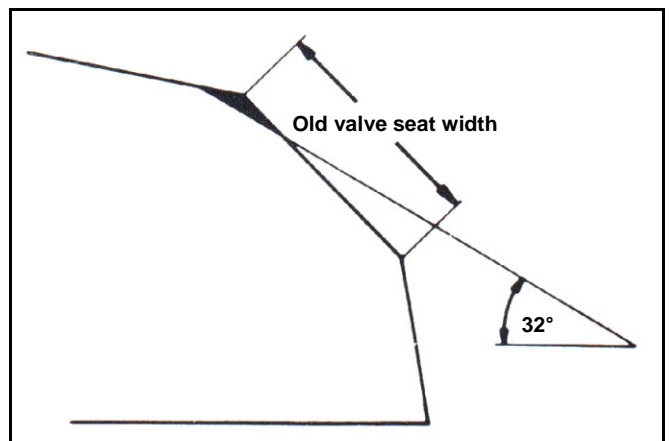
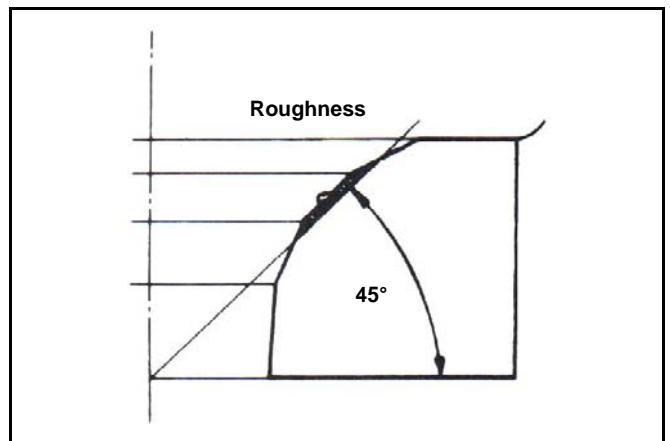
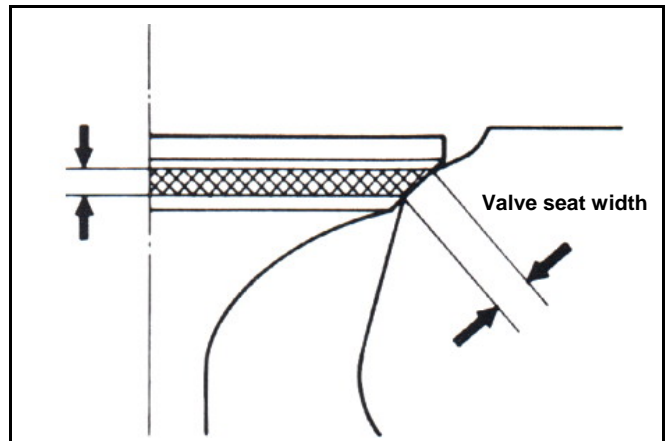
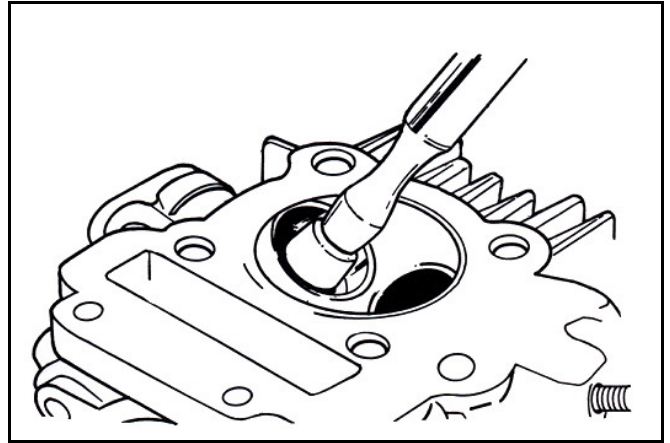
Refer to operation manual of the valve seat chamfer cutter.

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

### ⚠ Caution

- After valve guide had been replaced, it has to be ground with 45° valve seat chamfer cutter to correct its seat face.

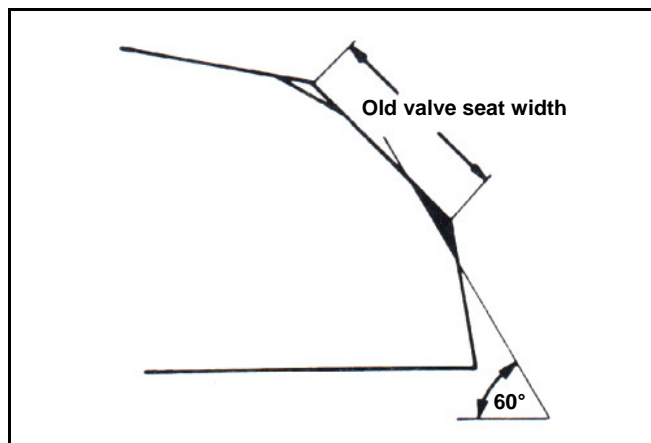
Use 32° cutter to cut a quarter upper parts out.





## 6. Cylinder Head / Valve

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

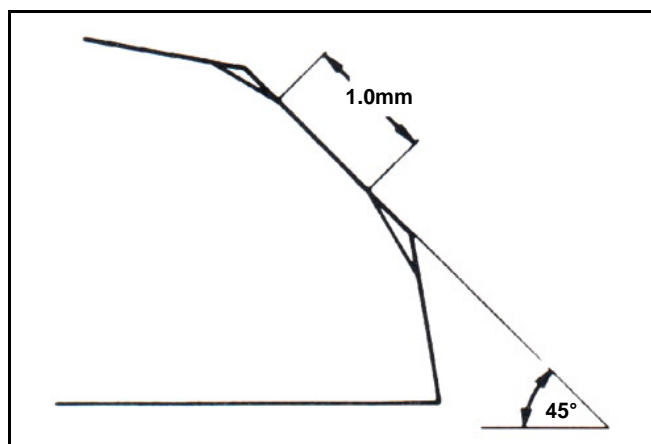


Use 45° cutter to grind the valve seat to specified width.

**⚠ Caution**

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

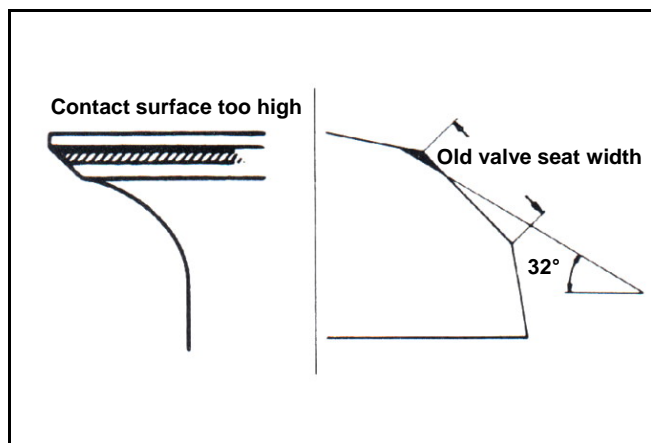
Grind valve seat again if necessary.



Coat the valve seat surface with red paint.  
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.

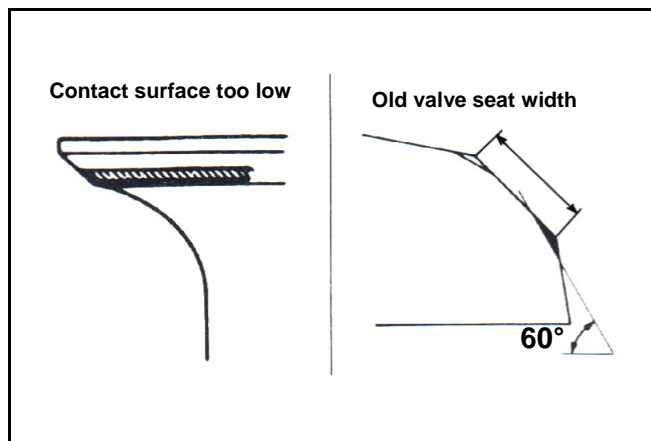
**⚠ Caution**

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

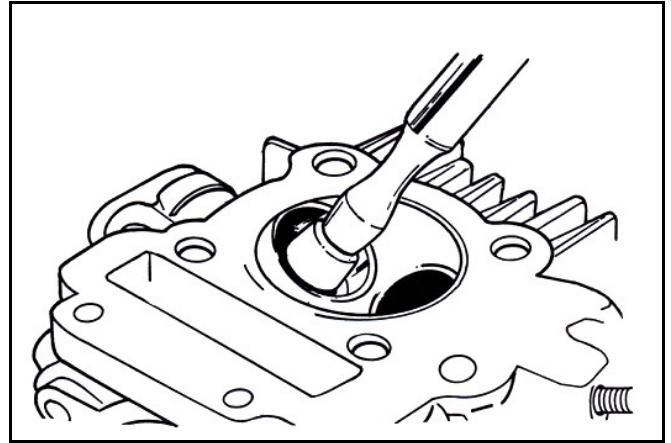


If the contact surface too high, grind the valve seat with 32° cutter.  
Then, grind the valve seat to specified width.

If the contact surface too low, grind the valve seat with 60° cutter.  
Then, grind the valve seat to specified width.



After the valve seat ground, coat valve seat surface with emery and then slightly press the ground surface.  
Clean up all emery coated onto cylinder and valve after ground.

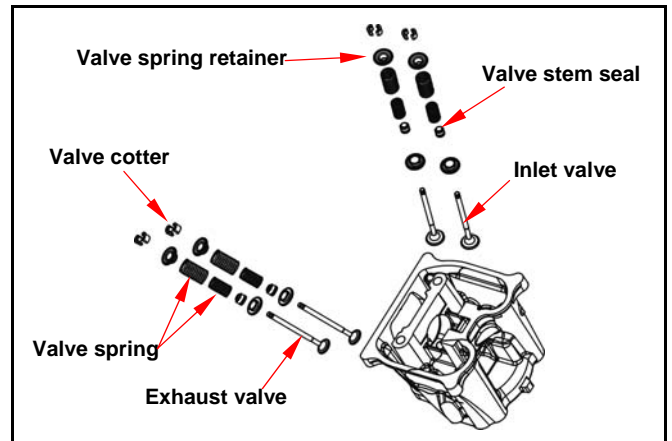


### Cylinder Head Reassembly

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.

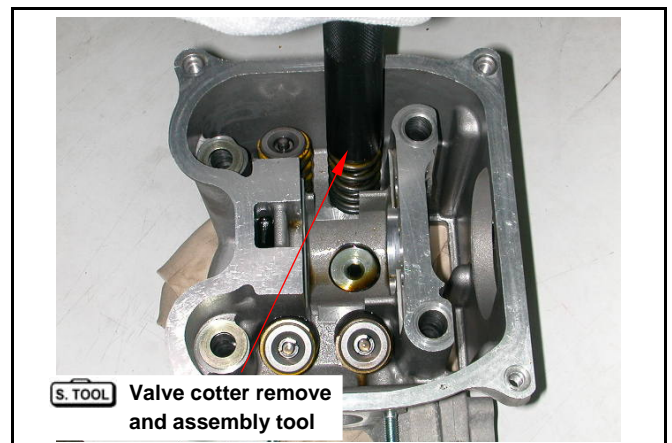


Put the valve cotters onto valve spring retainer.  
Use a valve cotter remove & assembly tool to press the valve springs, and then install valves.

#### ⚠ Caution

- In order to avoid damaging the valve stem and the cylinder head, in the combustion chamber place a rag between the valve spring remover/installer as compressing the valve spring directly.

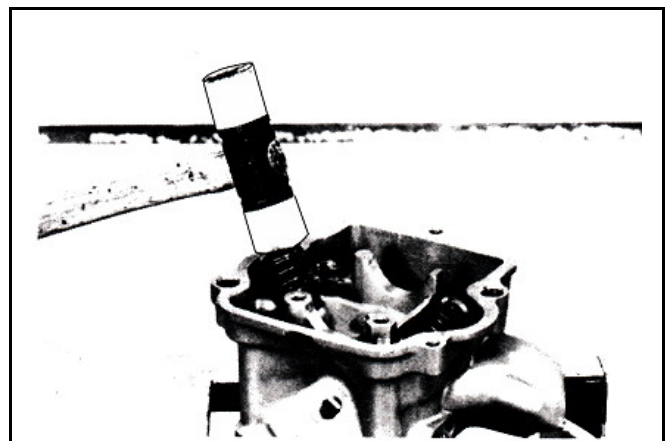
**Special Service Tool:**  
**Valve cotter remove & assembly tool**  
**SYM-1471110-SY125**



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

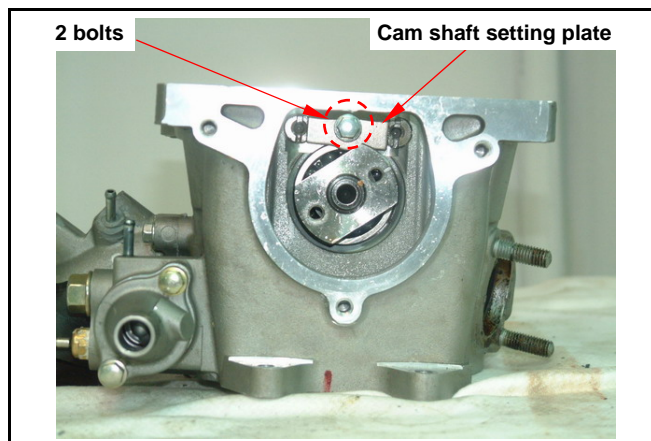
#### ⚠ Caution

- Place and hold cylinder head on to working table so that can prevent from valve damaged.



## 6. Cylinder Head / Valve

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

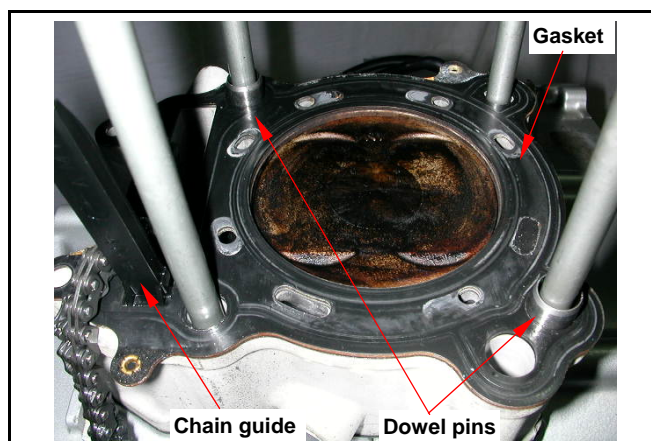


### Cylinder Head Installation

Clean up all residues and foreign materials onto 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 falling into crankcase as cleaning.

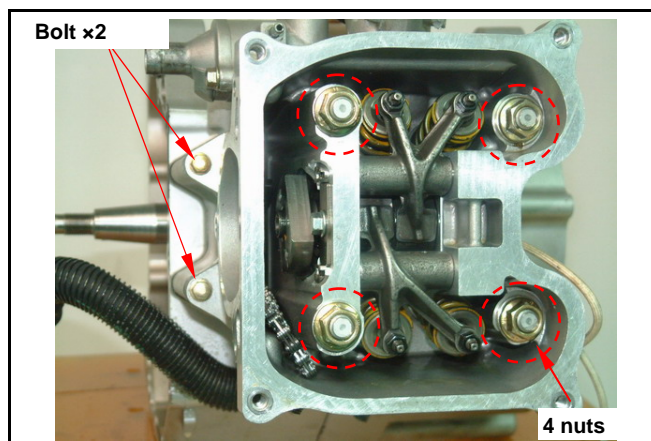


Install 4 washers and tighten 4 nuts on the cylinder head upper side, and then tighten 2 cylinder head mounting bolts of cylinder head right side.

#### Torque value:

**Nut** 3.6~4.0kgf-m

**Bolt** 1.0~1.4kgf-m

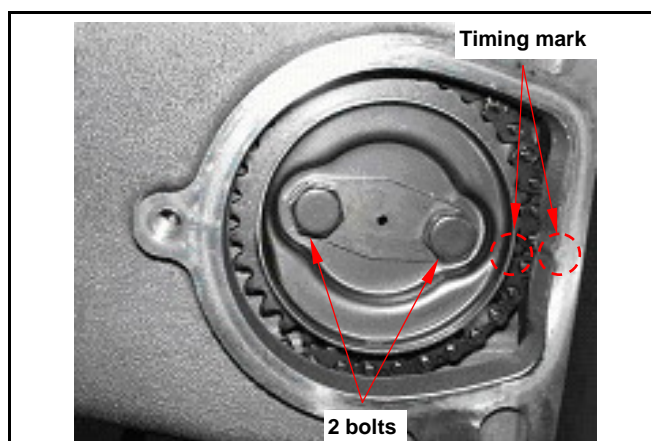


Install cam chain on to sprocket and align the timing mark on the sprocket with that of cylinder head.

Align sprocket bolt hole with camshaft bolt hole.  
Tighten the sprocket mounting bolts.

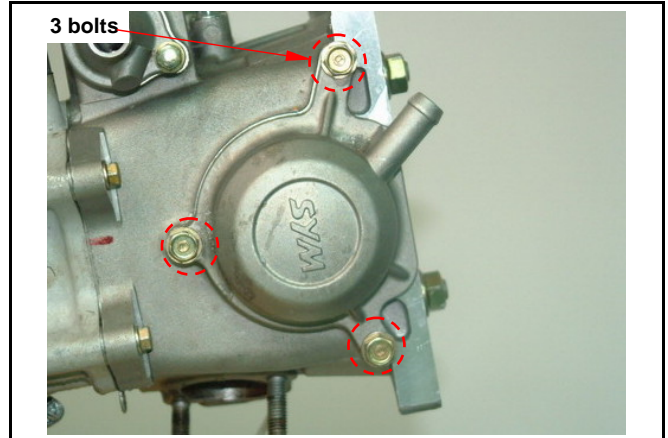
#### ⚠ Caution

- Make sure timing marks are matched.

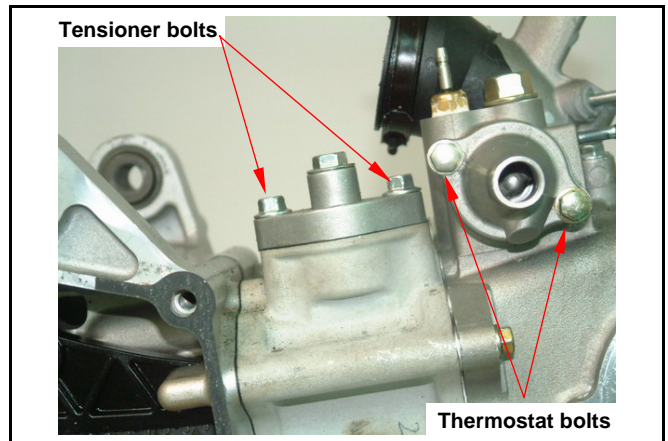




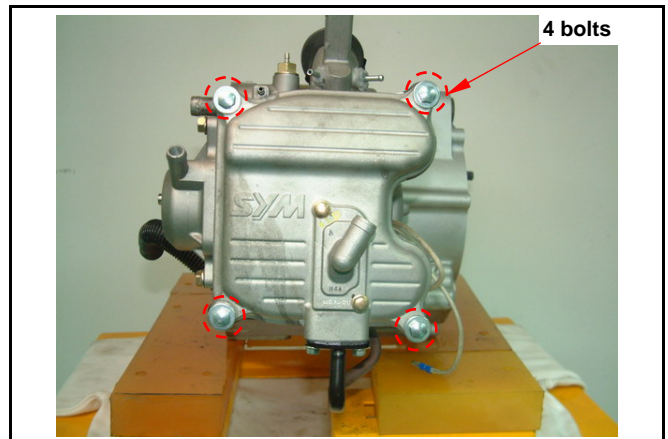
Install cylinder head side cover (3 bolts).



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



Install cylinder cover (4 bolts).



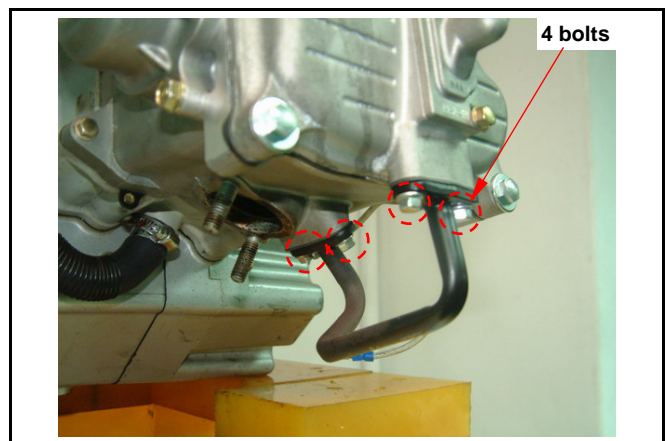
Install Air Injection system (AI) pipe. (4 bolts)  
Install inlet pipe onto cylinder head.  
Install and tighten spark plug.

**Torque value: 1.0~2.0kgf-m**

**⚠ Caution**

- This model is equipped with more precision 4-valve mechanism so its tighten torque can not be exceeded standard value in order to avoid causing cylinder head deformation, engine noise and leaking so that motorcycle's performance be effected.

Install the engine onto frame (refer chapter 5).

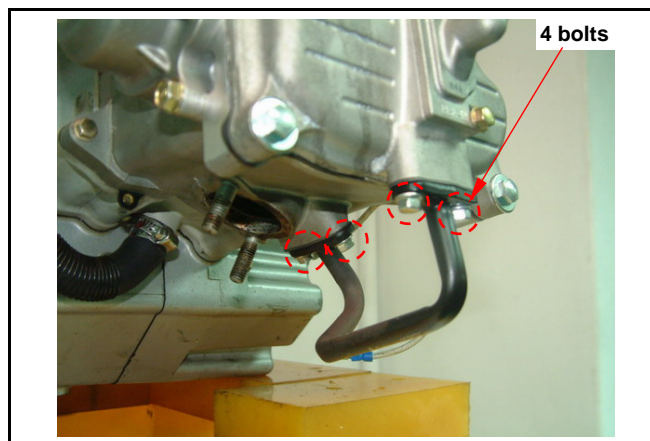




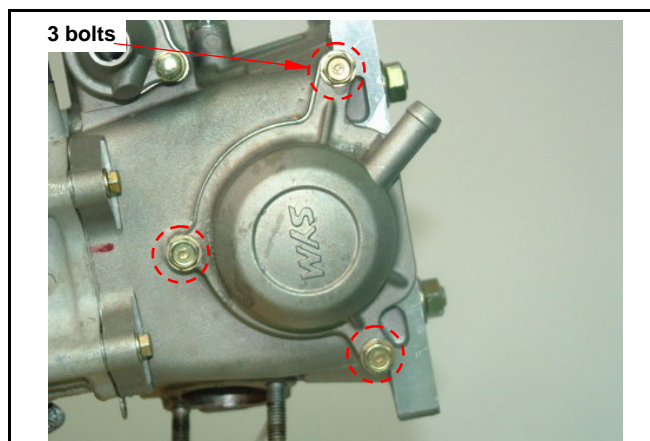
## 6. Cylinder Head / Valve

### Valve Clearance Adjustment

Loosen Air Injection system (AI) pipe upper side bolt (2 bolts).  
Remove cylinder head cover.



Remove the cylinder head side cover.



Remove left crankcase cover, and turn the drive face, and align the timing mark on the cam sprocket with that of cylinder head, piston is at TDC position.

Loosen valve clearance adjustment nuts and bolts located on valve rocker arm.  
Measure and adjust valve clearance with feeler gauge.

After valve clearance had been adjusted to standard value, hold adjustment bolt and then tighten the Adjustment nut.

**Standard Value:** IN  $0.10 \pm 0.02$  mm  
EX  $0.15 \pm 0.02$  mm

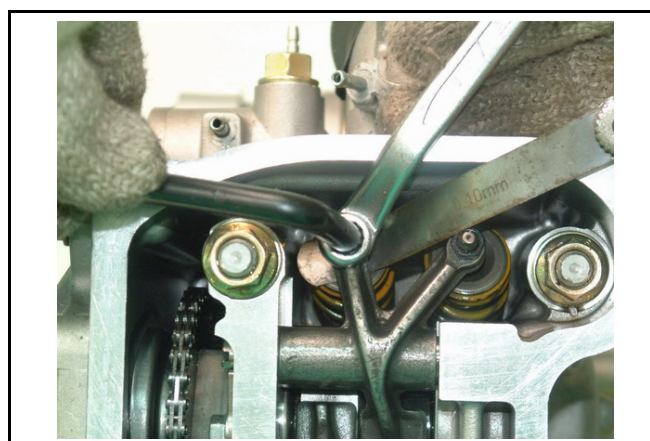
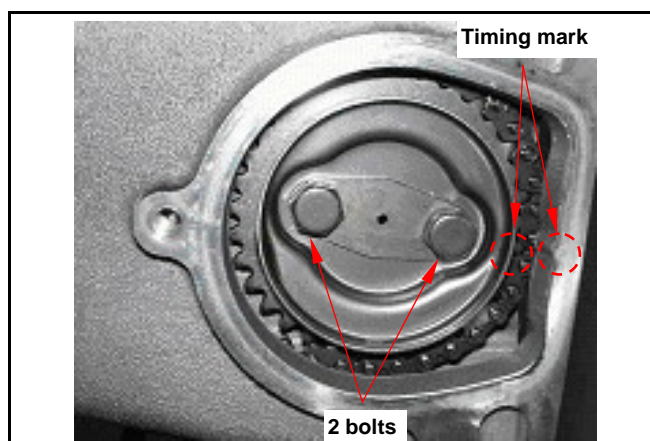
Install the cylinder head side cover.

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

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

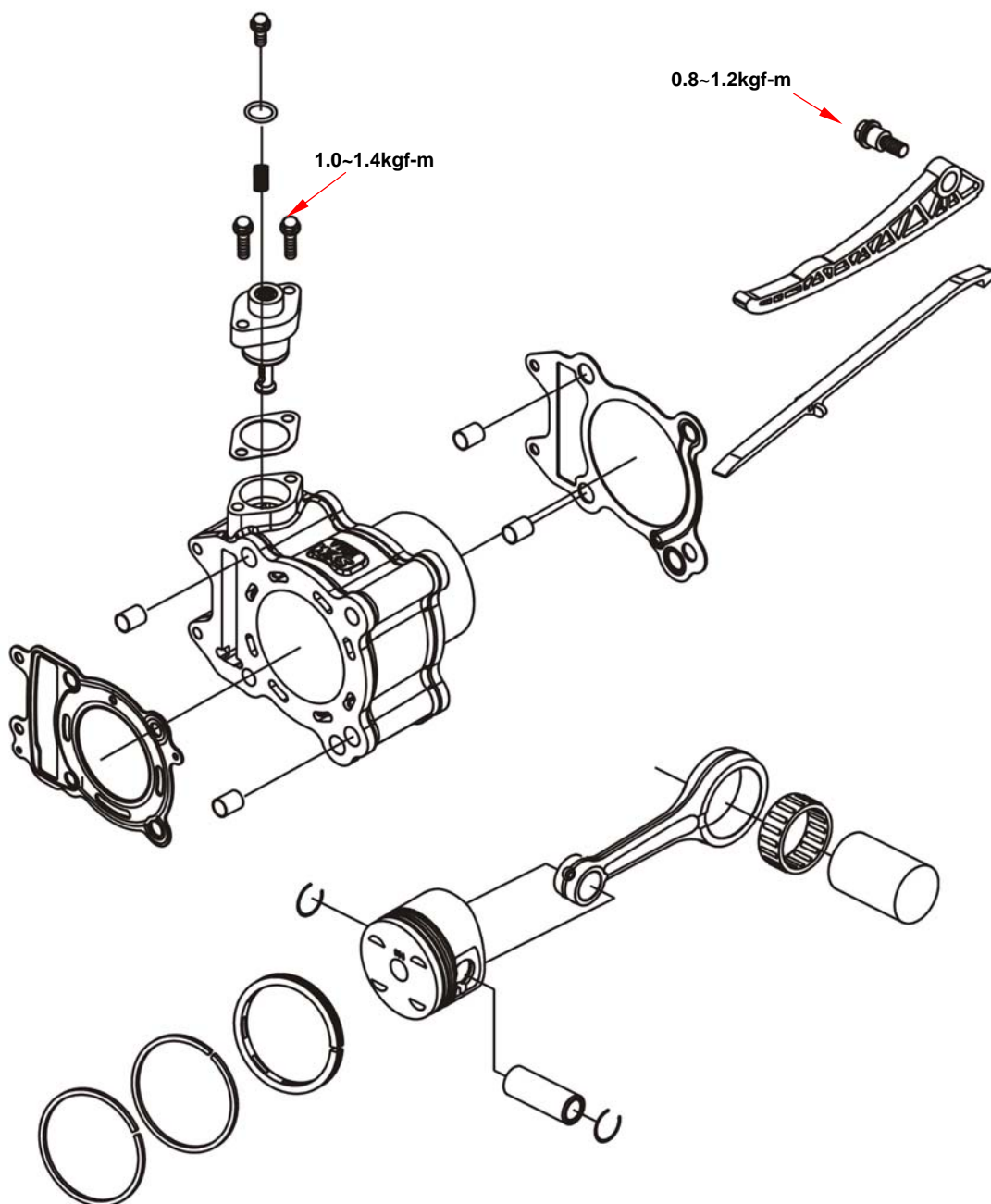
#### Caution

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



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

### 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		LM25W5		LM30W		
		Standard	Limit	Standard	Limit	
Cylinder	I.D.	70.995~71.015	71.100	72.995~73.015	73.100	
	Out of round	-	0.050	-	0.050	
	Taper	-	0.050	-	0.050	
	Warpage	-	0.050	-	0.050	
Piston/ Piston ring	Clearance between piston ring and ring groove	Top	0.015~0.050	0.090	0.015~0.050	0.090
		2 <sup>nd</sup>	0.015~0.050	0.090	0.015~0.050	0.090
	Piston ring end gap	Too	0.150~0.300	0.500	0.150~0.300	0.500
		2 <sup>nd</sup>	0.300~0.450	0.650	0.300~0.450	0.650
		Oil (side rail)	0.200~0.700	-	0.200~0.700	-
	Piston O.D. (2 <sup>nd</sup> )		70.430~70.480	70.380	72.430~72.480	72.380
	Clearance between piston and cylinder		0.010~0.040	0.100	0.010~0.040	0.100
	ID of piston pin boss		17.002~17.008	17.020	17.002~17.008	17.020
Piston pin O.D.		16.994~17.000	16.960	16.994~17.000	16.960	
Clearance between piston and piston pin		0.002~0.014	0.020	0.002~0.014	0.020	
Connecting rod small end I.D.		17.016~17.034	17.064	17.016~17.034	17.064	

### Troubleshooting

#### Low or Unstable Compression Pressure

- Cylinder or piston ring worn out

#### Smoking in Exhaust Pipe

- Piston or piston ring worn out
- Piston ring installation improperly
- Cylinder or piston damage

#### Knock or Noise

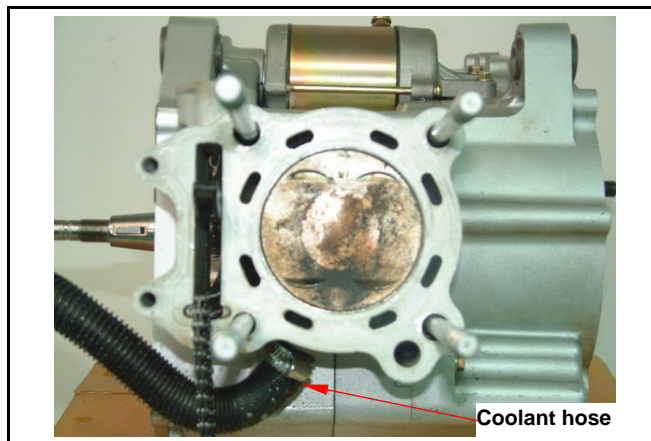
- Cylinder or piston ring worn out
- Carbon deposits on cylinder head top-side
- Piston pin hole and piston pin wear out

#### Engine Overheat

- Carbon deposits on cylinder head top side
- Cooling pipe clogged or not enough in coolant flow

### Cylinder / Piston Removal

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



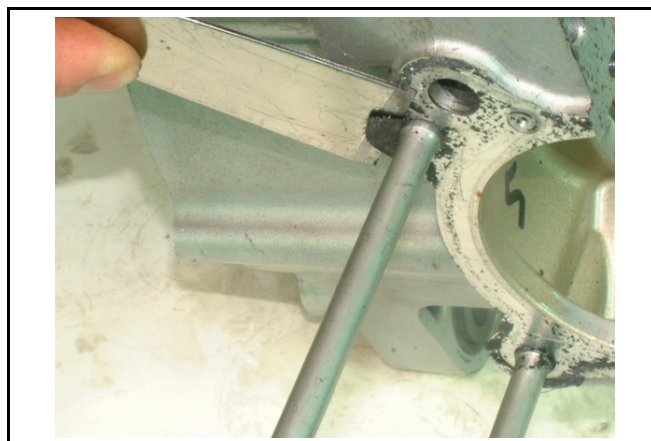
Cover the holes of crankcase and cam chain with a piece of cloth.  
 Remove piston pin clip, and then remove piston pin and piston.



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

#### Caution

- Soap the residues into solvent so that the residues can be removed more easily.



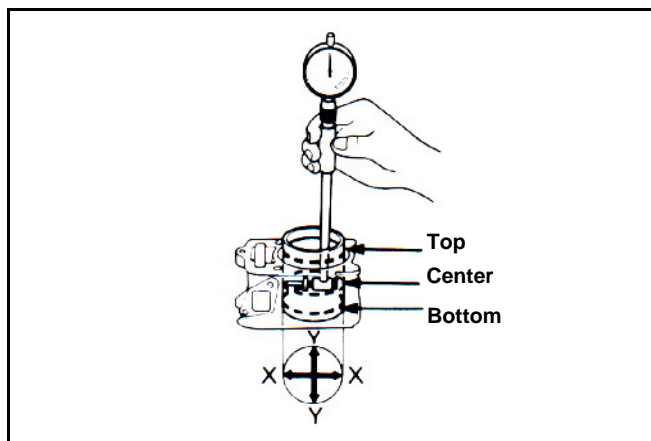
#### Inspection

Check if the inner diameter of cylinder is wear 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:

**LM25W5: 71.100 mm**

**LM30W: 73.100 mm**

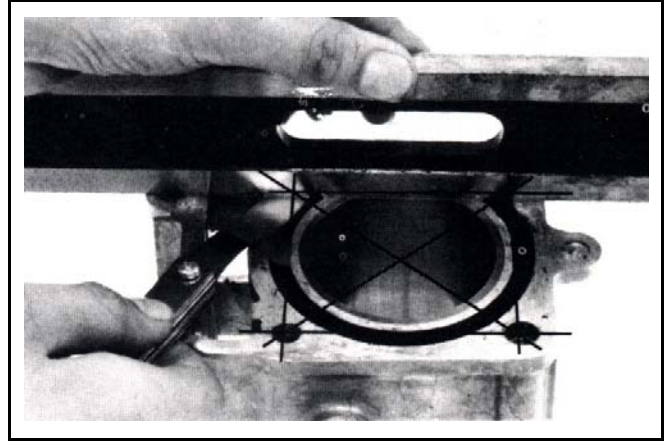




## 7. Cylinder / Piston

Measure the cylinder upper surface for warpage.

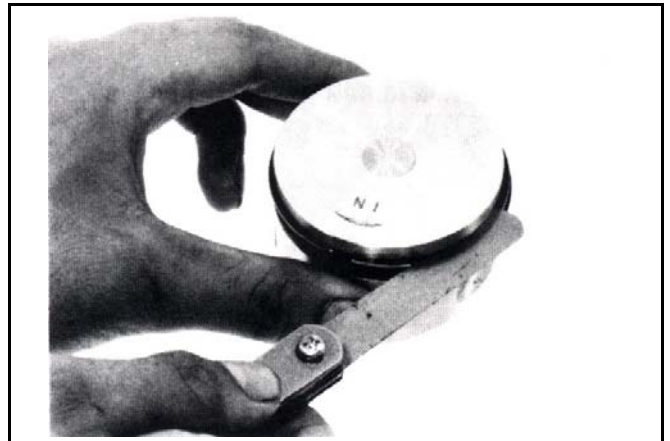
**Service limit: 0.05 mm**



Measure the clearance between piston rings and ring grooves.

**Service Limit: Top ring: 0.09 mm**

**2<sup>nd</sup> ring: 0.09 mm**

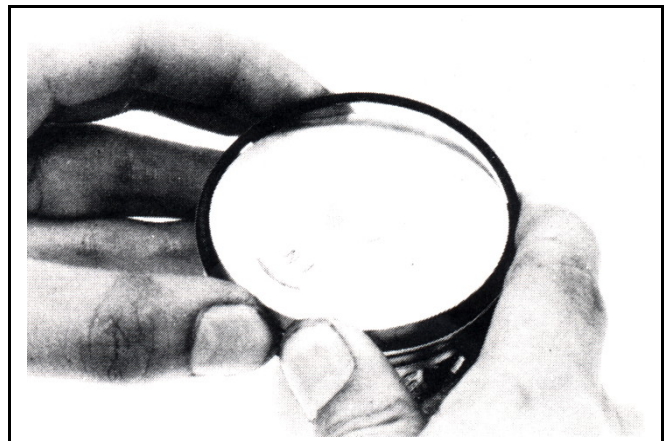


### Remove piston rings

Check if the piston rings are damaged or its grooves are worn.

#### Caution

- Pay attention to remove piston rings because they are fragile.

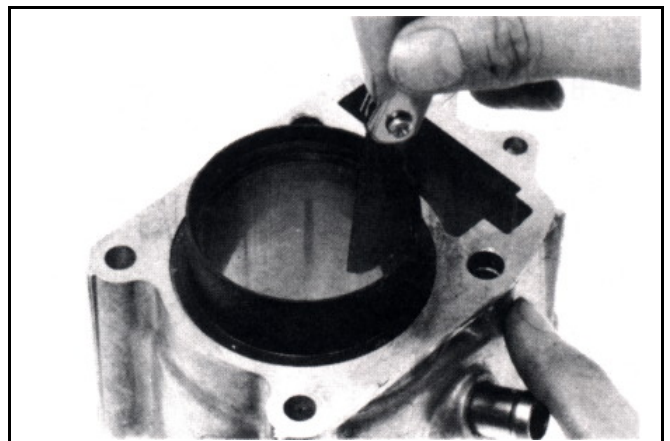


Place piston rings respective into cylinder below 20 mm of cylinder top. In order to keep the piston rings in horizontal level in cylinder, push the rings with piston.

Measure the piston ring end gap.

**Service Limit: Top ring: 0.50 mm**

**2<sup>nd</sup> ring: 0.65 mm**



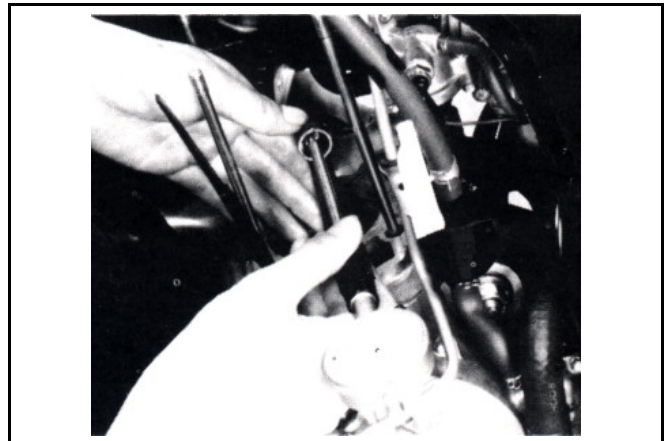
Measure the outer diameter of piston pin.

**Service Limit: 16.96 mm**



Measure the inner diameter of connecting rod small end.

**Service Limit: 17.064 mm**

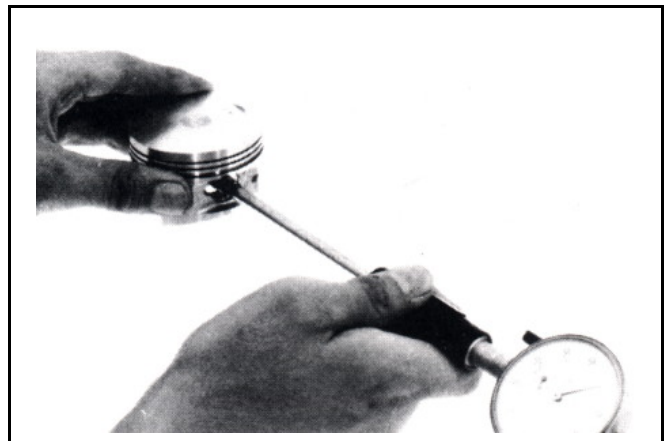


Measure the inner diameter of piston pin hole.

**Service Limit: 17.02 mm**

Calculate clearance between piston pin and its hole.

**Service Limit: 0.02 mm**



Measure the piston outer diameter.

**⚠ Caution**

- The measurement position is 10 mm distance from piston bottom side, and 90° to piston pin.

**Service limit :**

**LM25W5: 70.380 mm**

**LM30W: 72.380 mm**

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



## 7. Cylinder / Piston

### Piston Ring Installation

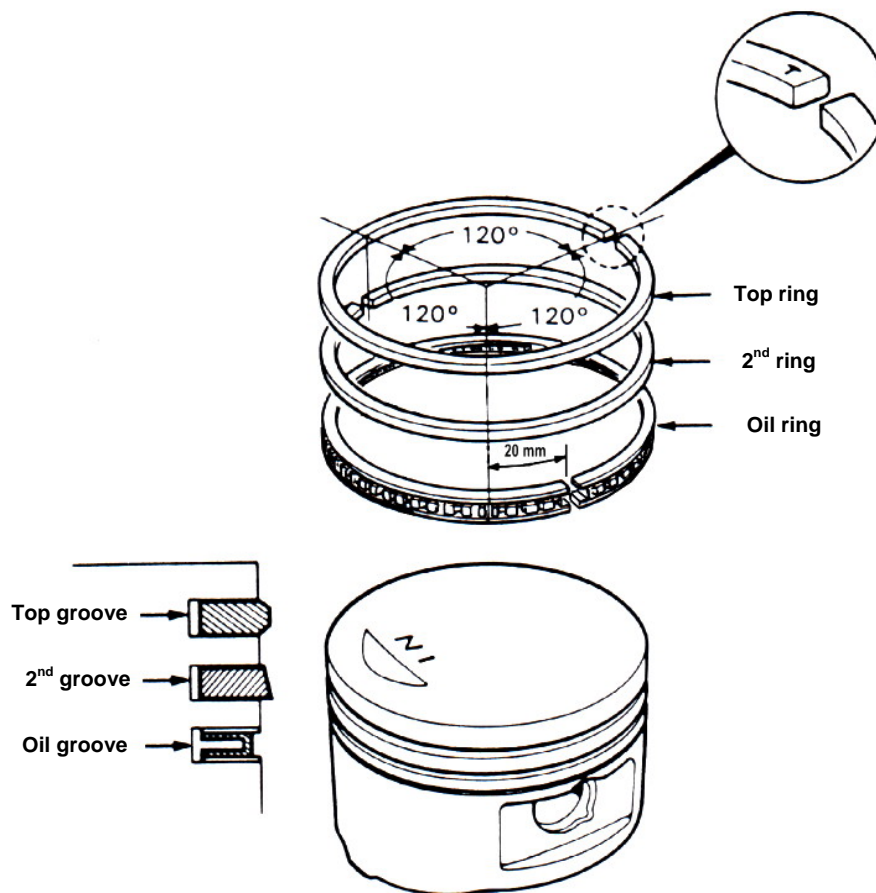
Clean up piston top, ring groove, and piston surface.

Install the piston ring onto piston carefully.

Place the openings of piston ring as diagram shown.

#### Caution

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



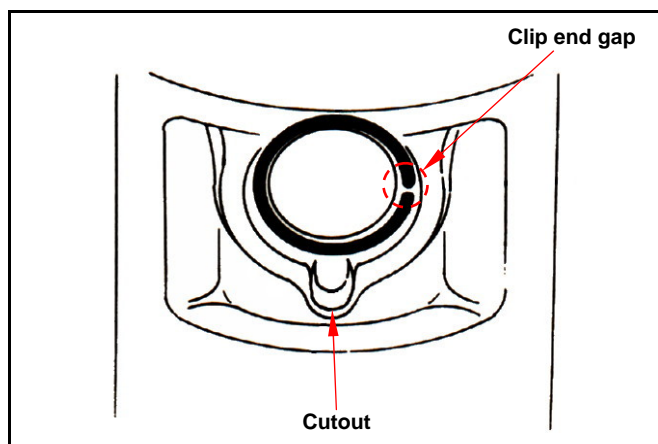
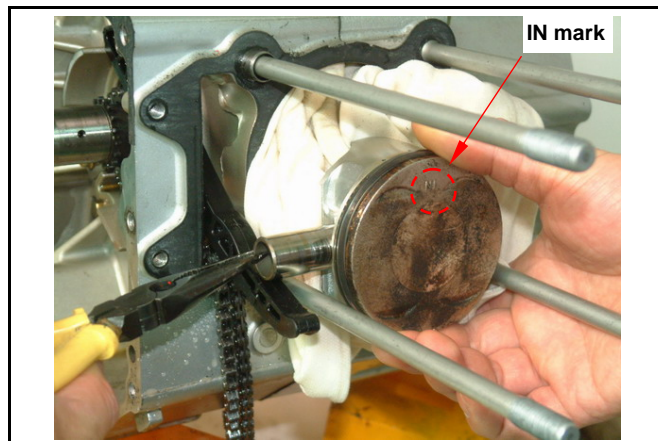
## Piston Installation

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 snap ring from falling into crankcase as operation.



## Cylinder Installation

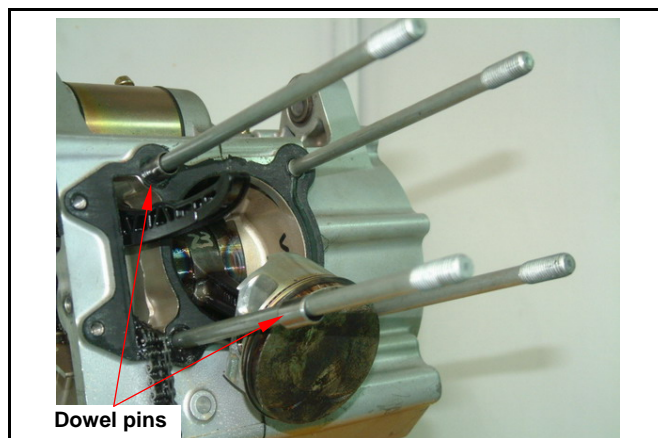
Clean up all residues and foreign materials on the matching surface of crankcase. Pay attention to not let these residues and foreign materials fall into crankcase.

### ⚠ Caution

- Soap the residues into solvent so that the residues can be removed more easily.



Install dowel pins and new cylinder gasket.





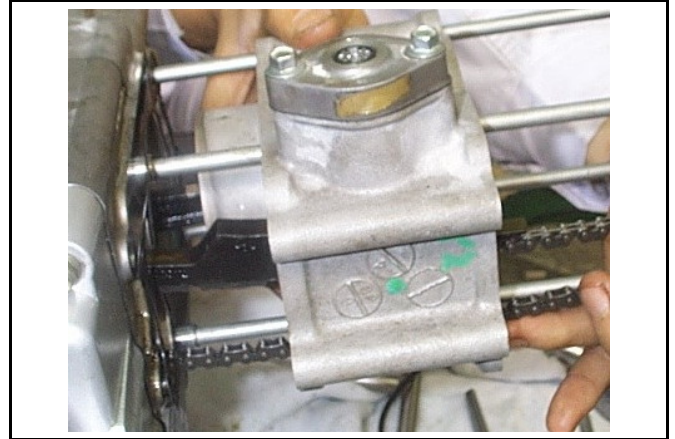
## 7. Cylinder / Piston

Coat some engine oil to inside of cylinder, piston and piston rings.

Care to be taken when installing piston into cylinder. Press piston rings in one by one as installation.

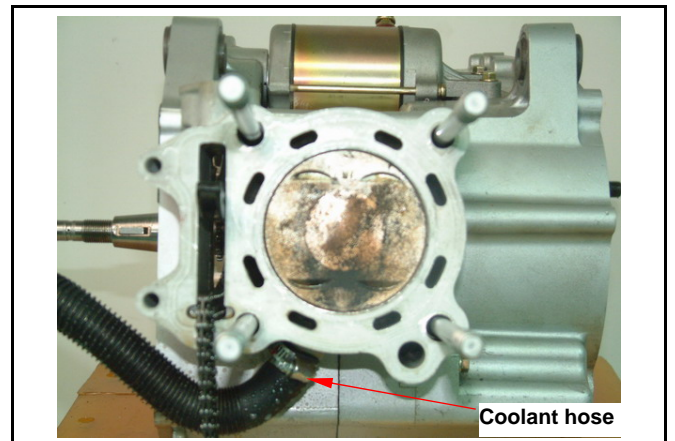
### Caution

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



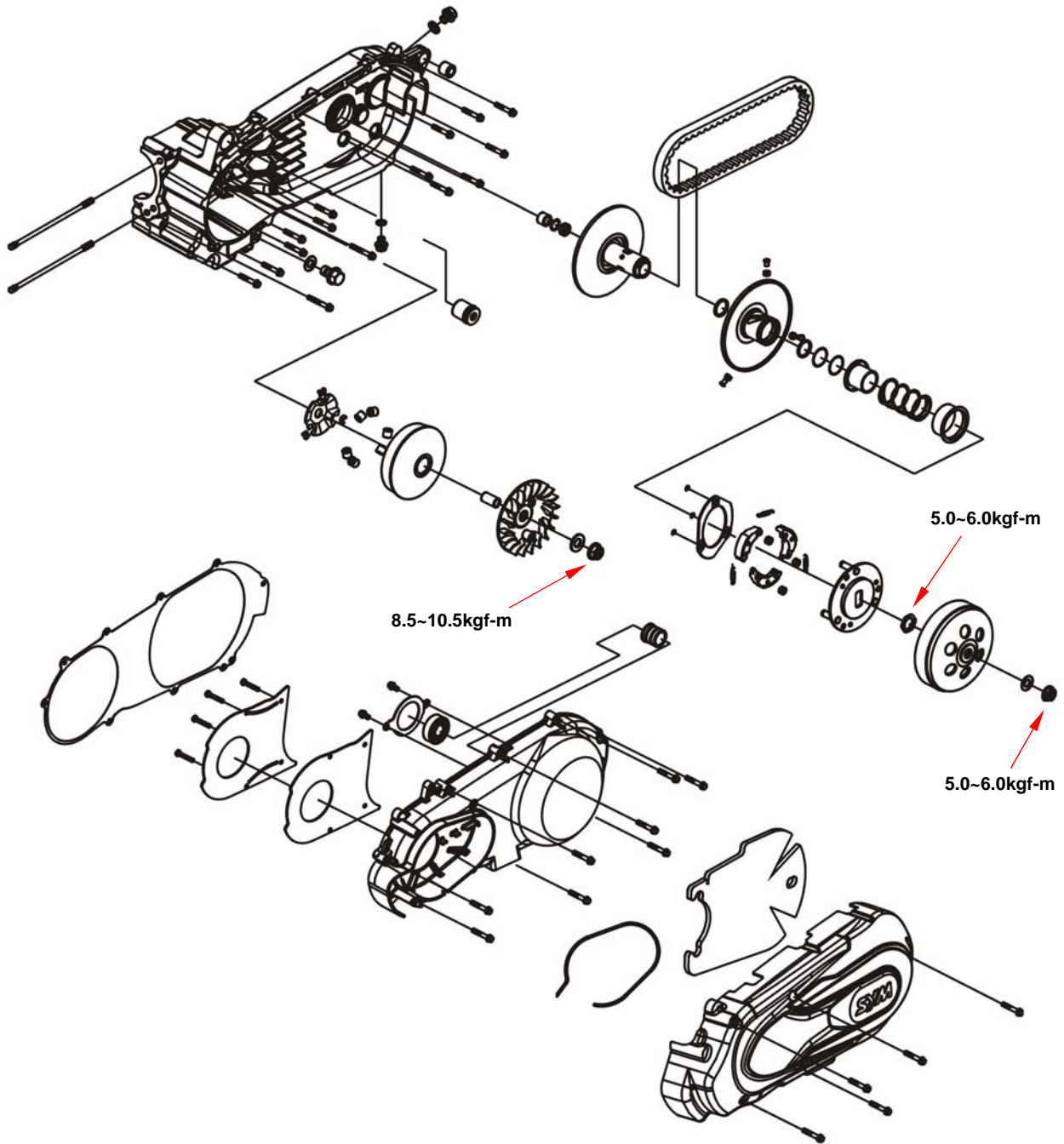
Install coolant hose onto cylinder.

Install cylinder head (refer to Chapter 6).



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 motorcycle.
- 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 mm	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: 5.0~6.0kgf-m
- Drive plate nut: 5.0~6.0kgf-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 motorcycle can not be moved

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

#### Insufficient horsepower or poor high speed performance

1. Worn drive belt
2. Insufficient spring force of driven pulley
3. Worn roller
4. Driven pulley operation un-smoothly

#### Shudder or misfire when driving

1. Broken clutch weight
2. Worn clutch weight



## 8. V-Belt Drive System

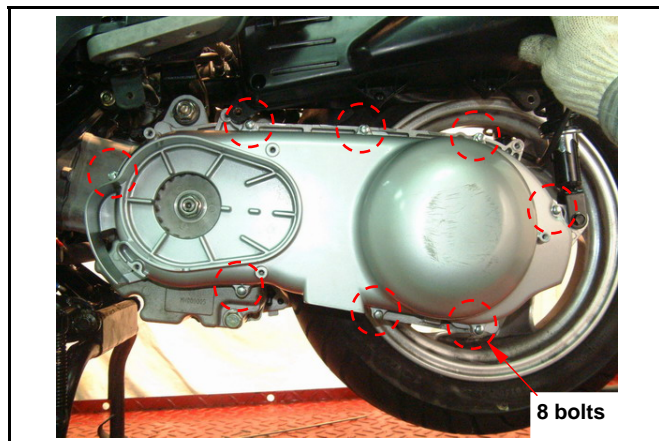
### Left Crankcase Cover

#### Left crankcase cover removal

Loosen 4 bolts from left side crank out cover & remove it.

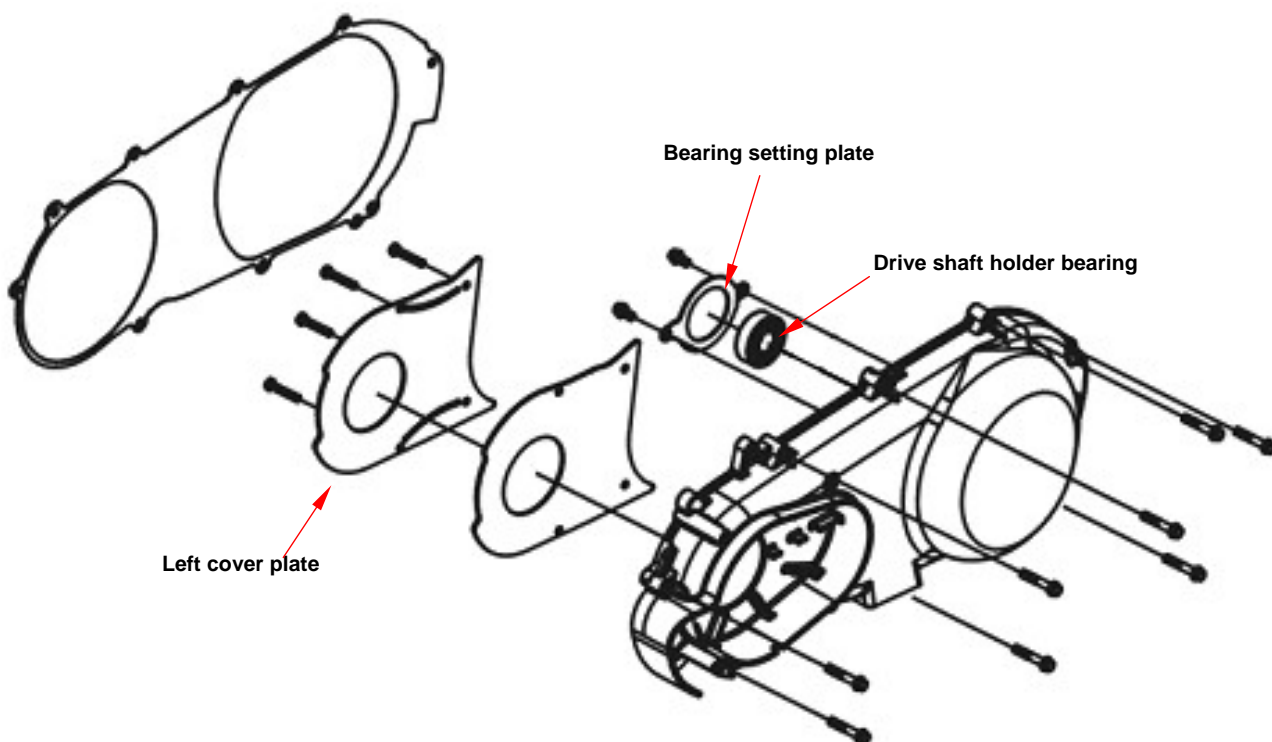
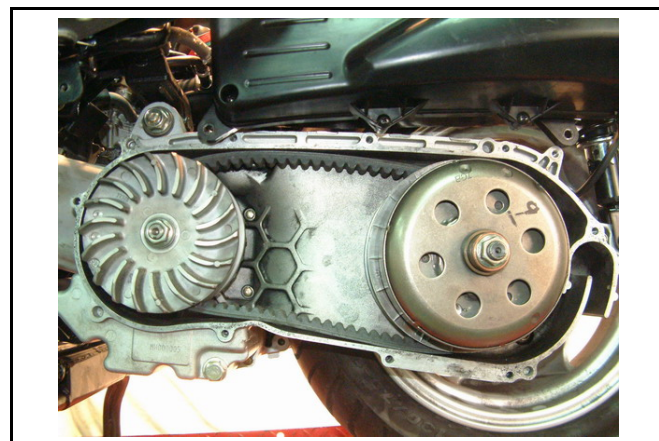
Remove left crankcase cover. (8 bolts)

Remove 2 dowel pin and gasket.



#### Left crankcase cover install

Install left crankcase cover in the reverse procedures of removal.

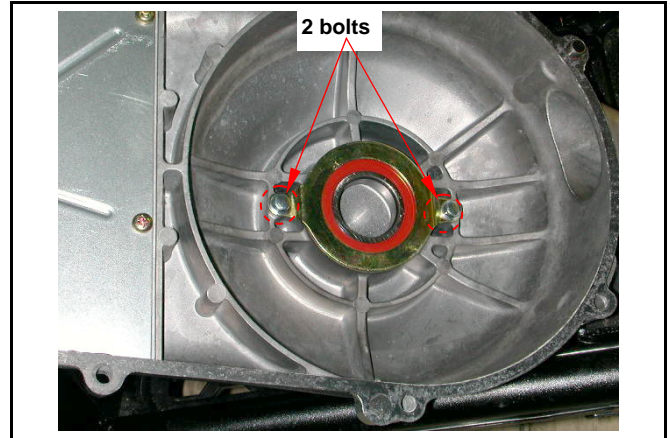




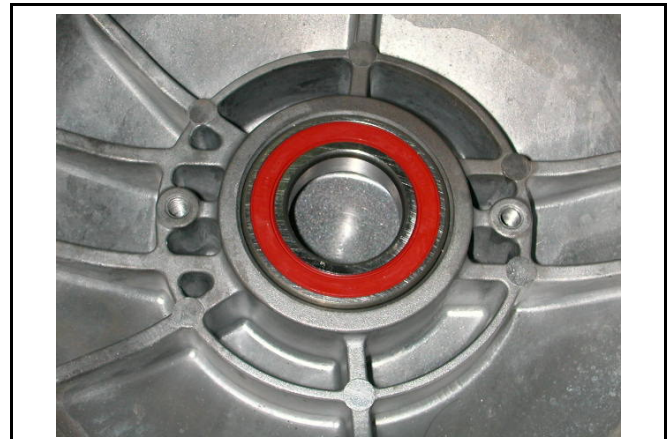
## 8. V-Belt Drive System

### Left crankcase cover inspection

Remove 2 bolts to remove left crankcase cover bearing setting plate.



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

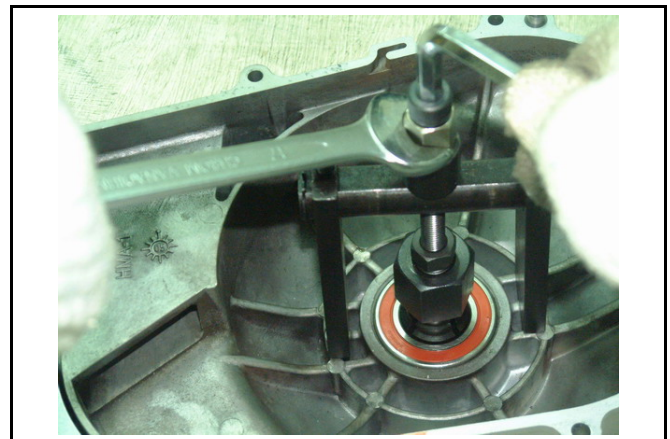


### Bearing replacement

Remove bearing with special service tools

**Special tools:**

**Inner bearing puller SYM-6204022**



Install bearing with special service tools.

**Special tools:**

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

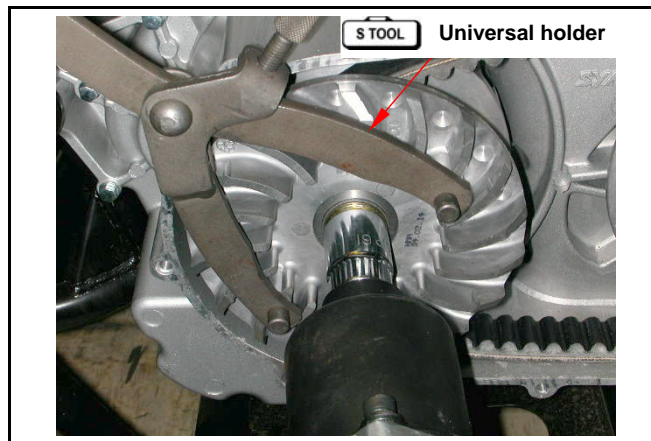


### Drive Belt

#### Removal

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

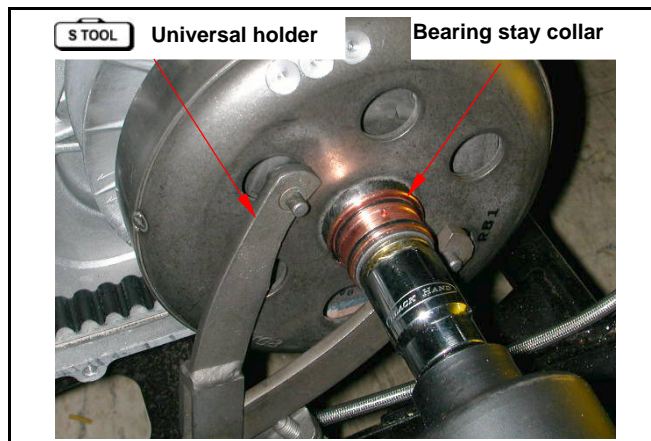
**Special Tool : Universal holder**



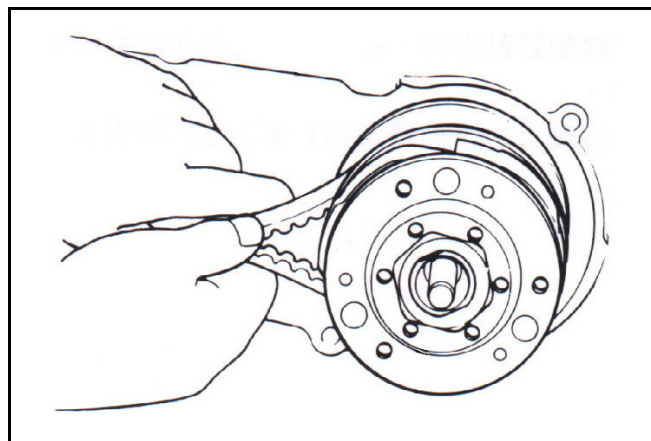
Hold clutch outer with universal holder, and remove nut, bearing stay collar and clutch outer.

#### ⚠ Caution

- Using special service tools for tightening or loosening the nut.
- Fixed rear wheel or rear brake will damage reduction gear system.



Push the drive belt into belt groove as diagram shown so that the belt can be loosened, and then remove the driven pulley.  
Remove driven pulley. Do not remove drive belt.  
Remove the drive belt from the groove of driven pulley.



#### Inspection

Check the drive belt for crack or wear. Replace it if necessary.

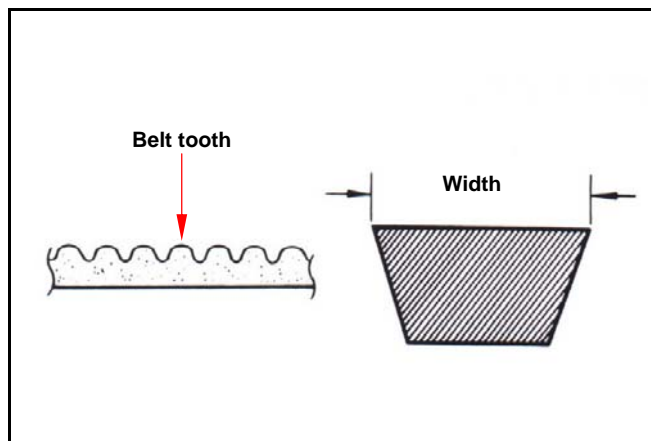
Measure the width of drive belt as diagram shown.

**Service Limit: 22.5 mm**

Replace the belt if exceeds the service limit.

#### ⚠ Caution

- Using 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.





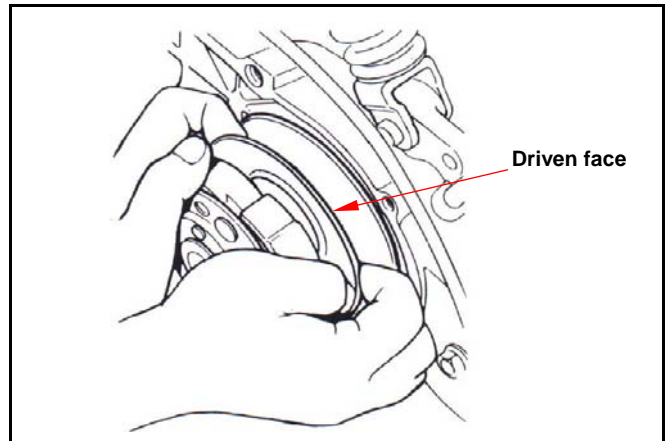
## 8. V-Belt Drive System

### Installation

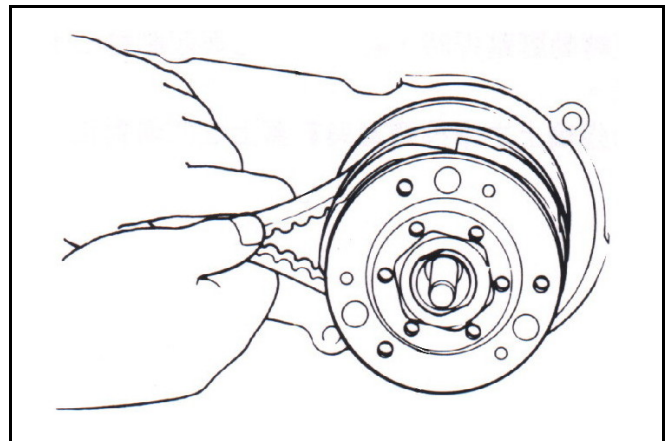
#### Caution

- Pull out driven face to avoid it closing.
- Cannot oppress friction plate comp in order to avoid creates the distortion or the damage.

Install drive belt onto driven pulley.

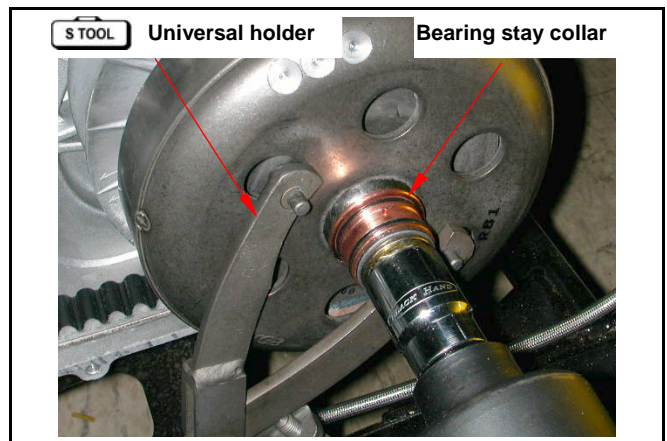


Install the driven pulley that has installed the belt onto drive shaft.  
On the drive belt another end to the movable drive face.



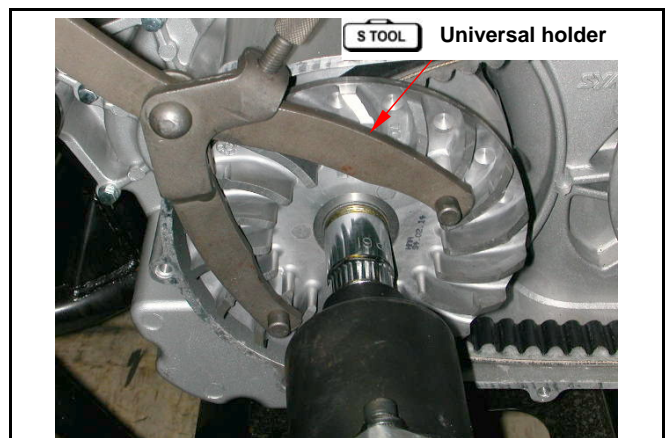
Install the clutch outer and bearing stay collar.  
Hold the clutch outer whit universal holder, and then tighten nut to specified torque value.

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



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

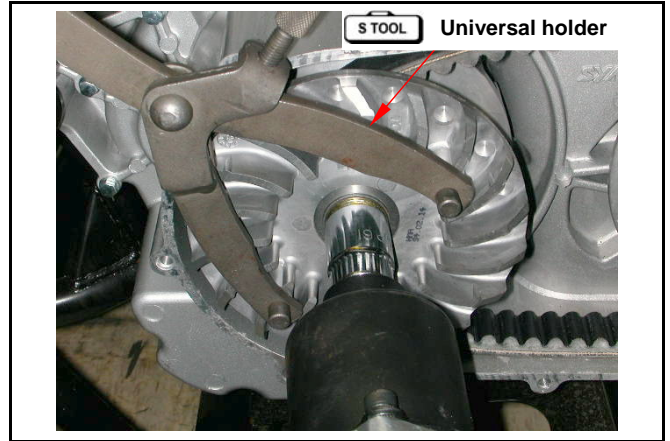
**Torque value: 8.5~10.5kgf-m**



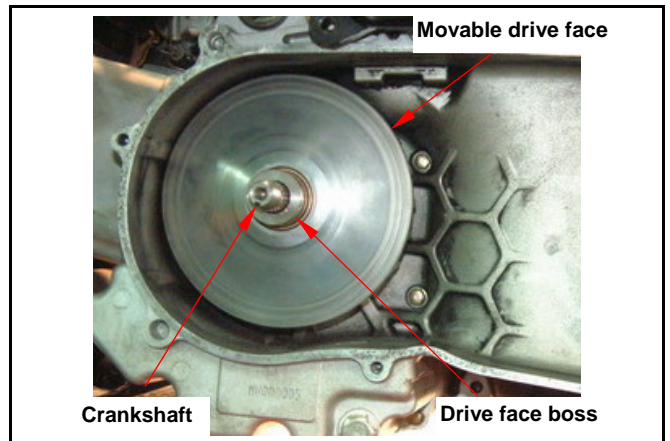
## Drive Face

### Removal

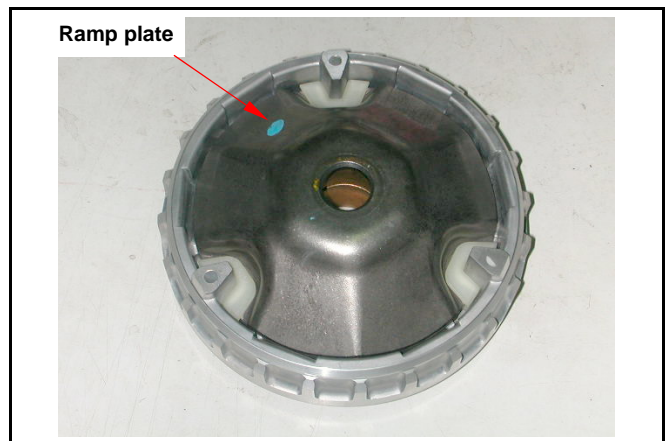
Remove left crankcase cover.  
Hold drive face with universal holder, and then remove drive face nut.  
Remove drive face and drive belt.



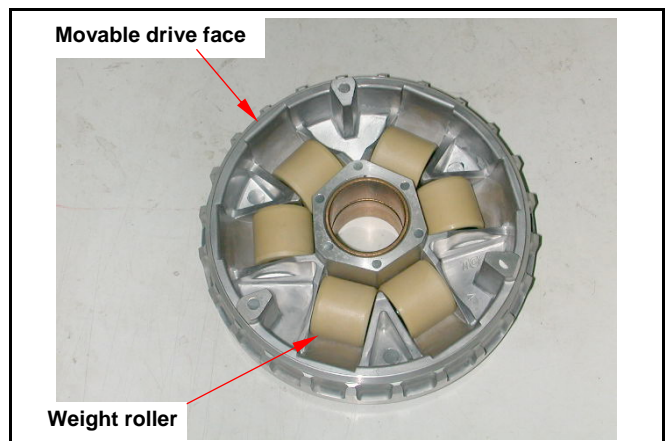
Remove movable drive face comp and drive face boss from crankshaft.



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.

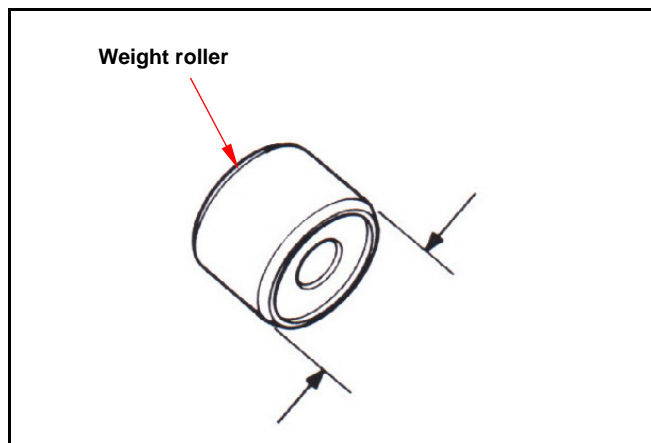
Thus, if weight rollers are worn out or damaged, the centrifuge force will be affected.

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: 19.0 mm**

**Weight: 17.2g**



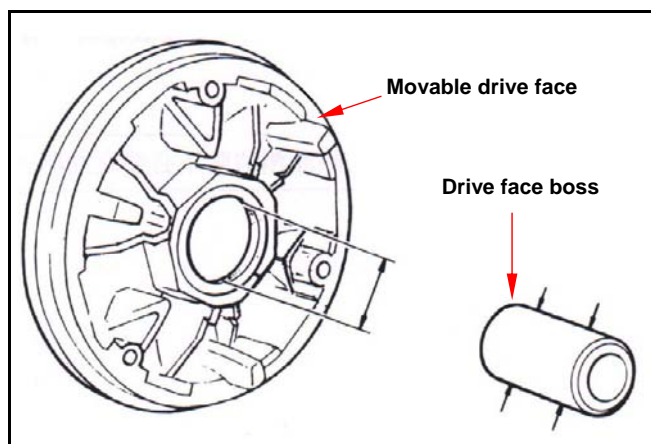
Check if drive face boss is worn or damaged and replace it if necessary.

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

**Service limit: 29.962 mm**

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

**Service limit: 30.060 mm**

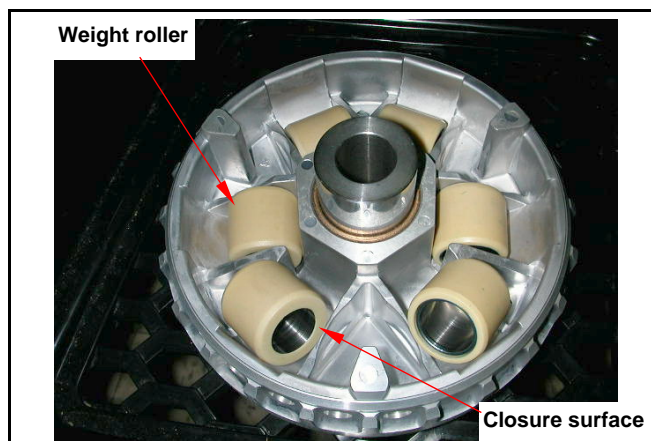


### Reassembly/installation

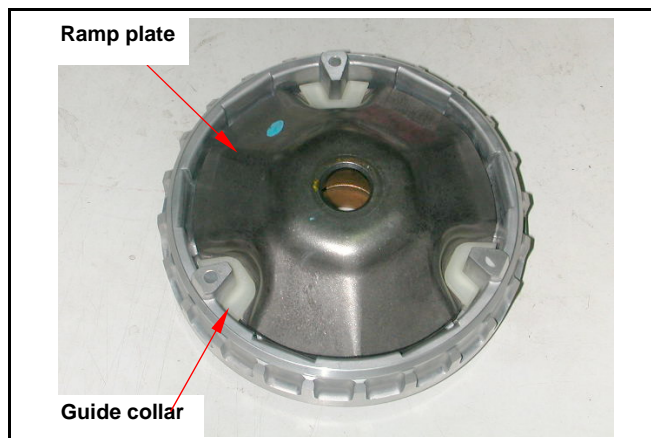
Install weight rollers.

#### Caution

- The weight roller two end surfaces are not certainly same. In order to lengthen the roller life and prevented exceptionally wears the occurrence, Please end surface of the closure surface counter clockwise assembles onto movable drive face.



Install ramp plate.



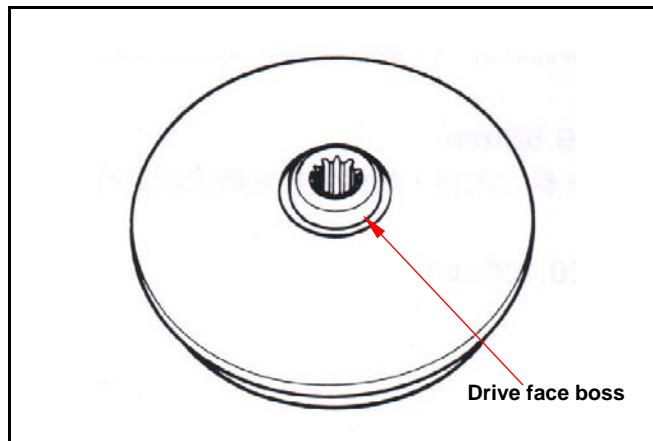


## 8. V-Belt Drive System

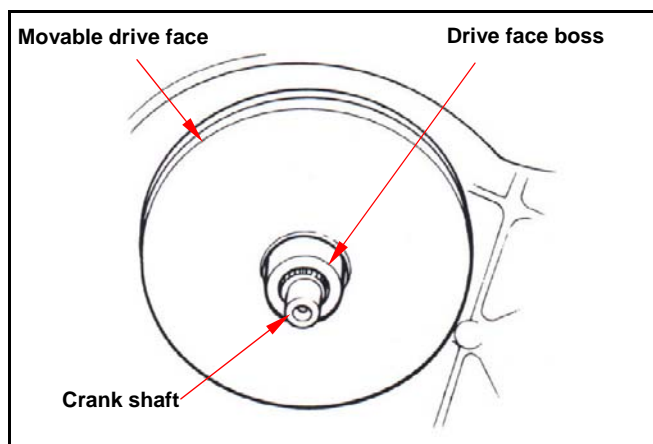
With 4~5g grease spreads wipes drives in the movable drive face axis hole.  
Install drive face boss.

### Caution

- The movable drive face surface has to be free of grease. Clean it with cleaning solvent.

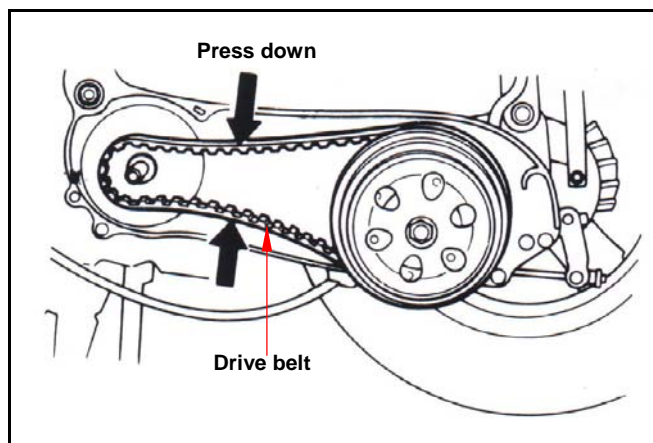


Install movable drive face comp. onto crankshaft.



### Driven pulley installation

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



Install drive face, washer and nut.

### Caution

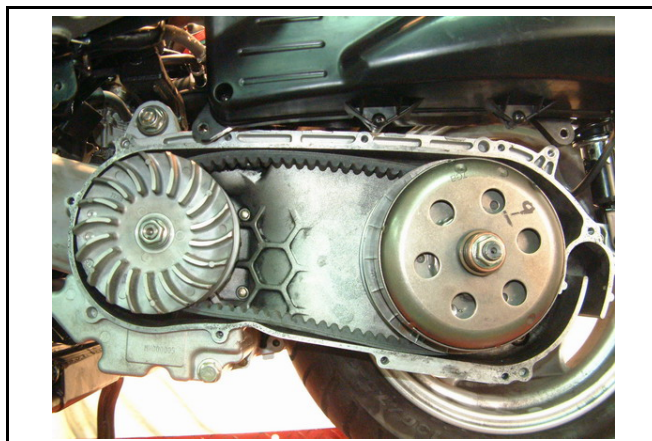
- Make sure that two sides of pulley surfaces have to be free of grease. Clean it with cleaning solvent.

Hold drives face with universal holder.

Tighten nut to specified torque.

**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.

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.

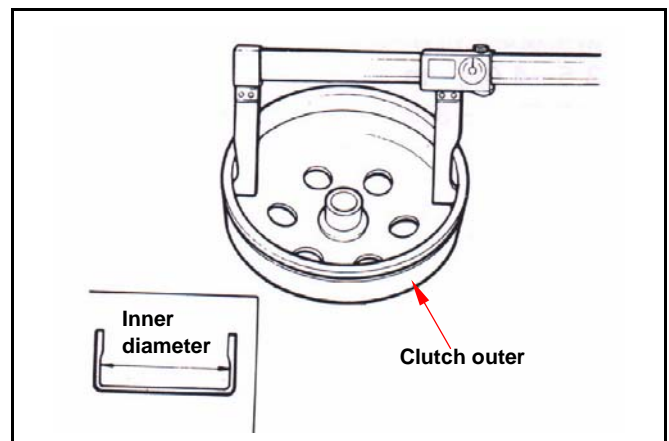
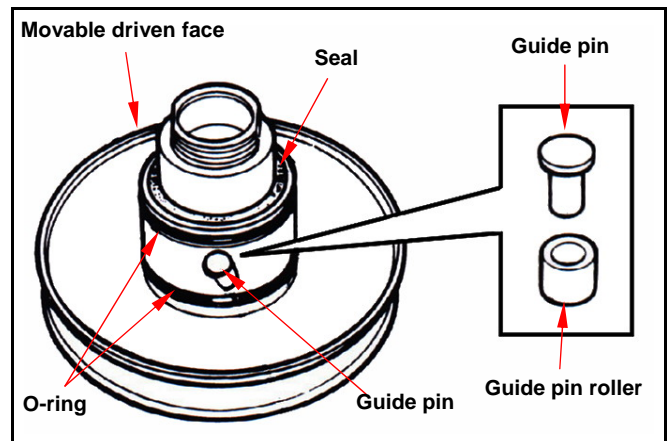
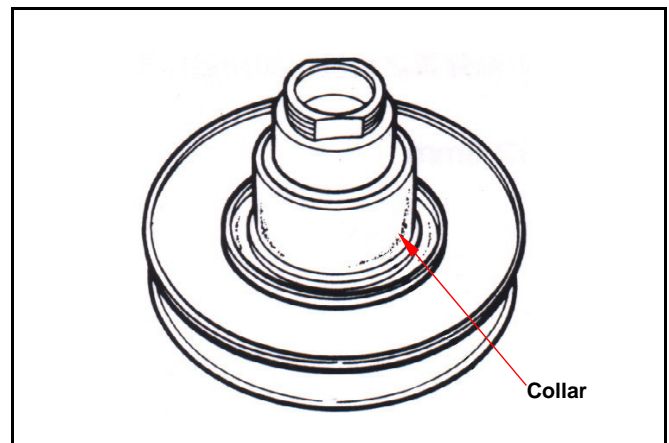
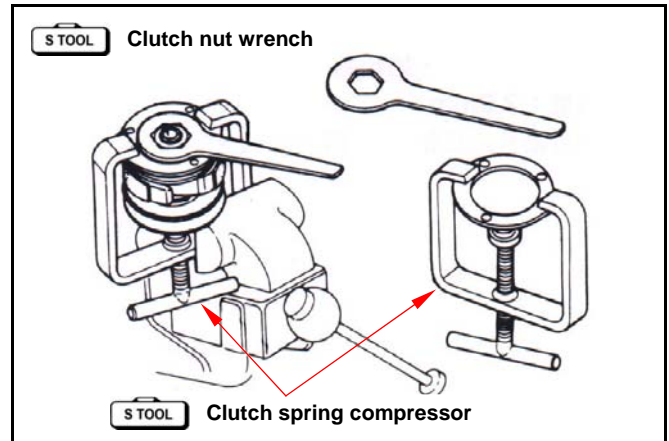
Remove guide pin, guide pin roller, and movable driven face, and then remove O-ring & oil seal seat from movable driven face.

#### Inspection

##### Clutch outer

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

**Service limit: 145.450 mm**

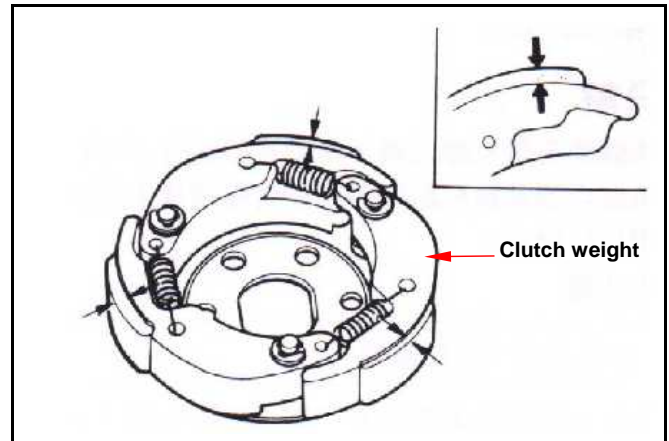




### Clutch weight

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

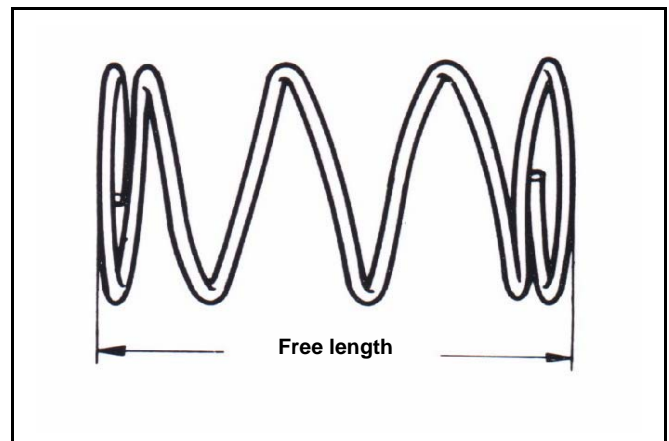
**Service limit: 3.0 mm**



### Driven pulley spring

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

**Service limit: 97.400 mm**



### Driven pulley

Check following items:

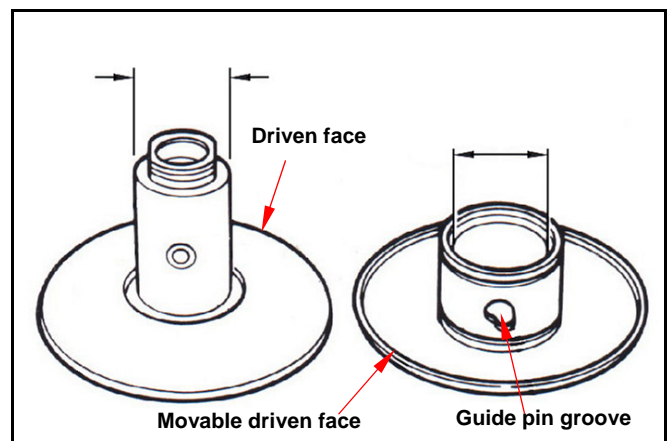
- If both surfaces are damaged or worn.
- If guide pin groove is damaged or worn.

Replace damaged or worn components.

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

**Service limit: Outer diameter 40.93 mm**

**Inner diameter 41.07 mm**



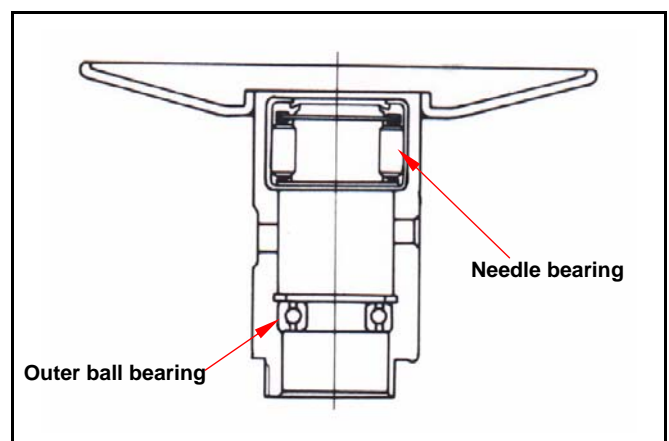
### Driven Pulley Bearing Inspection

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

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

Rotate the inside of inner bearing with fingers to check if the bearing rotation is in smooth and silent.

Check if the bearing outer parts are closed and fixed. Replace it if necessary.





## 8. V-Belt Drive System



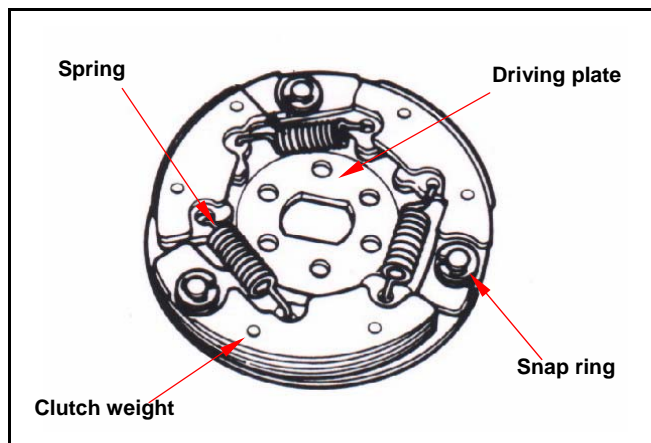
### Clutch weight Replacement

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

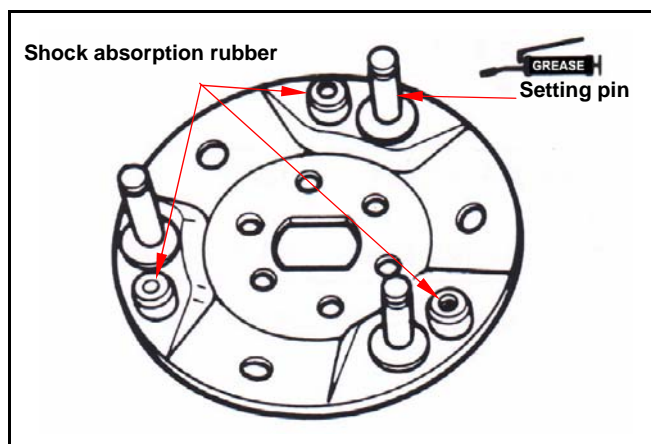
#### Caution

- Some of models are equipped with one mounting plate instead of 3 snap rings.

Check if spring is damage or insufficient elasticity.



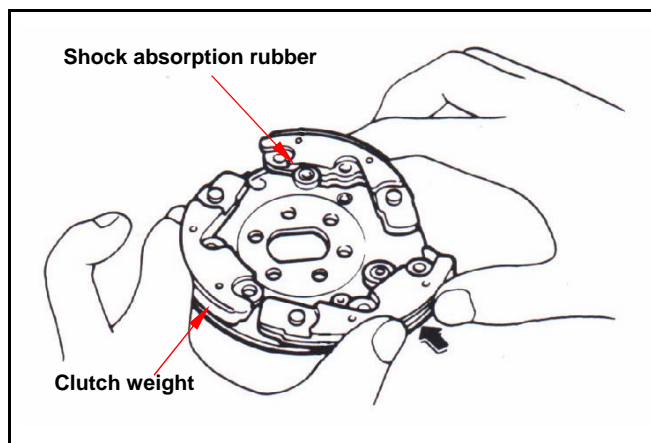
Check if shock absorption rubber is damage or deformation. Replace it if necessary. Apply with grease onto setting pins.



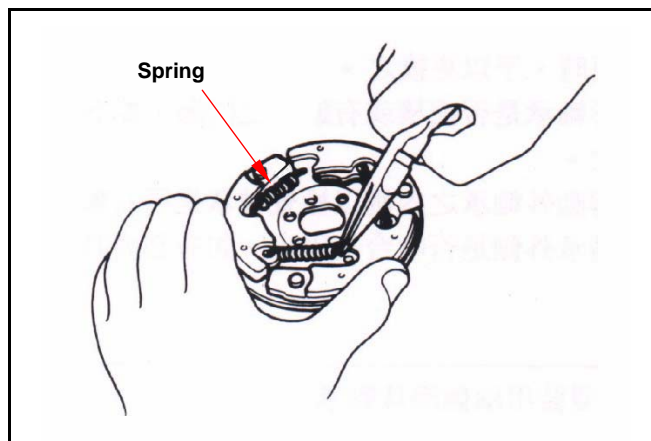
Install new clutch weight onto setting pin and then push to the specified location. Apply with grease onto setting pins. But, the clutch block should not be greased. If so, replace it.

#### Caution

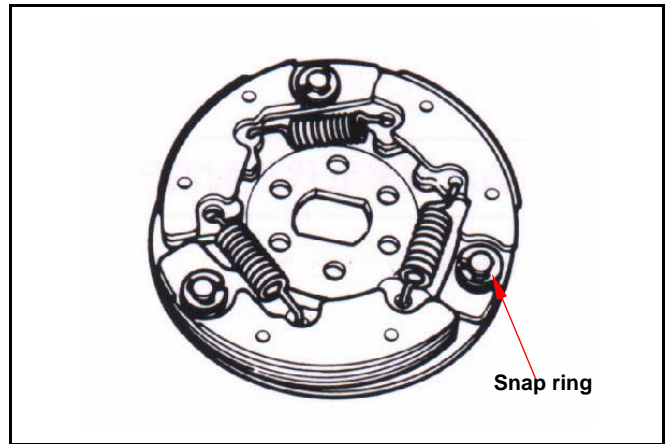
- Grease or lubricant will damage the clutch weight and affect the block's connection capacity.



Install the spring into groove with pliers.



Install snap ring and mounting plate onto setting pin.

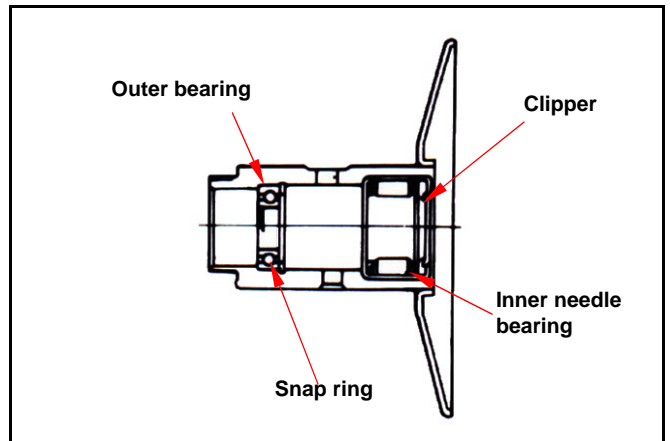


### Replacement of Driven Pulley Bearing

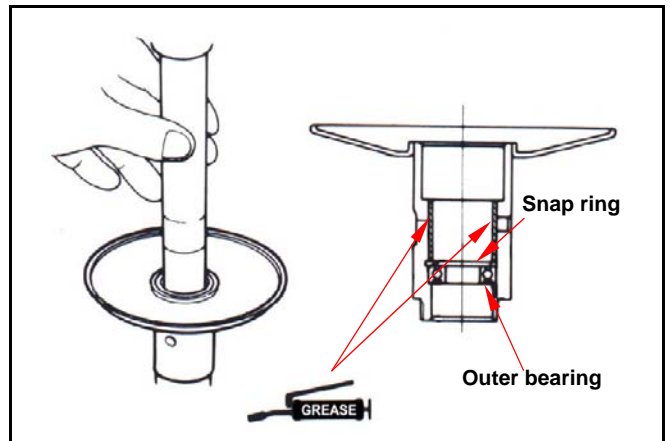
Remove inner bearing.

**⚠ Caution**

- If the inner bearing equipped with oil seal on side in the driven pulley, then remove the oil seal firstly.
- If the pulley equipped with ball bearing, it has to remove snap ring and then the bearing.



Remove snap ring and then push bearing forward to other side of inner bearing.  
Place new bearing onto proper position and its sealing end should be forwarded to outside.  
Apply with specified oil.

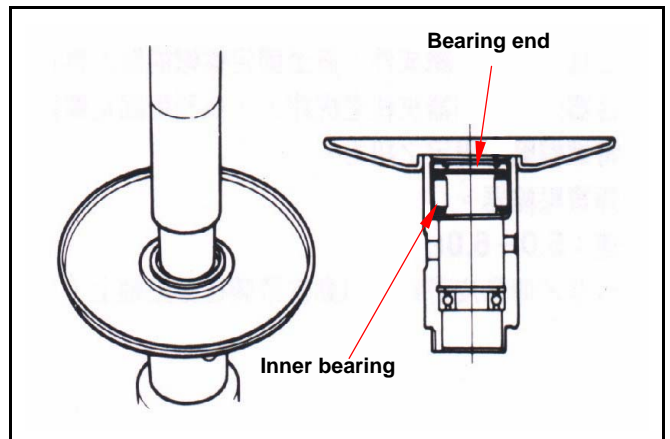


Install new inner bearing.

**⚠ Caution**

- Its sealing end should be forwarded to outside as bearing installation.
- Install needle bearing with hydraulic presser. Install ball bearing by means of hydraulic presser.

Install snap ring into the groove of drive face.  
Align oil seal lip with bearing, and then install the new oil seal (if necessary).

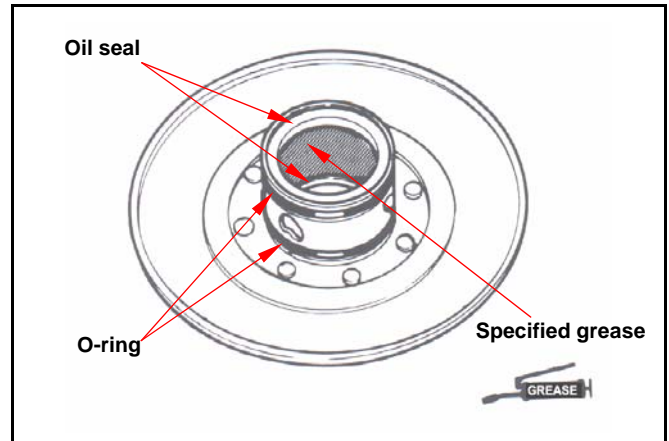


## 8. V-Belt Drive System

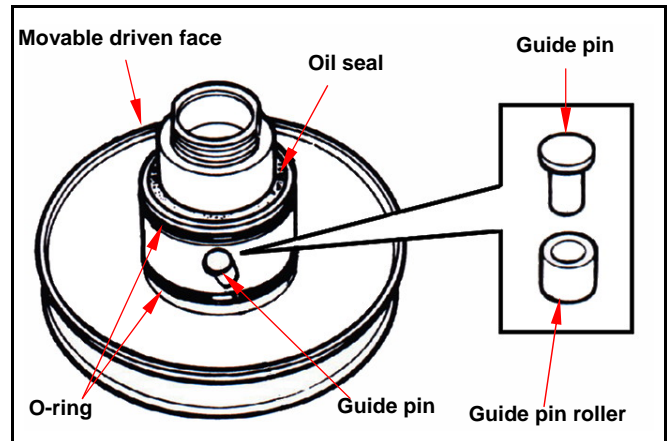
### Installation of Clutch Outer/Driven Pulley Assembly

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

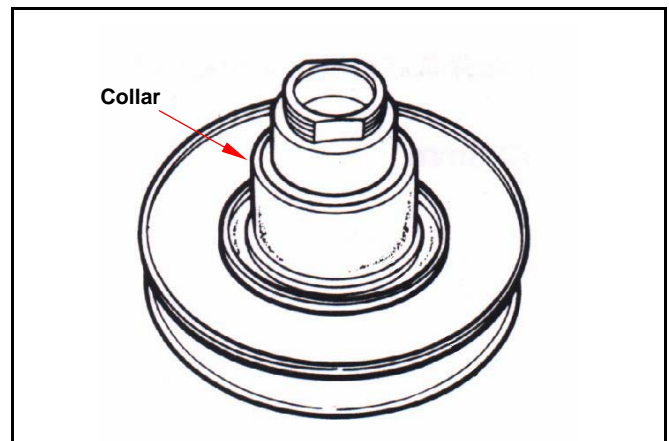
Apply with specified grease to lubricate the inside of movable driven face.



Install the movable driven face onto driven face.  
Install the guide pin and guide pin roller.



Install the collar.



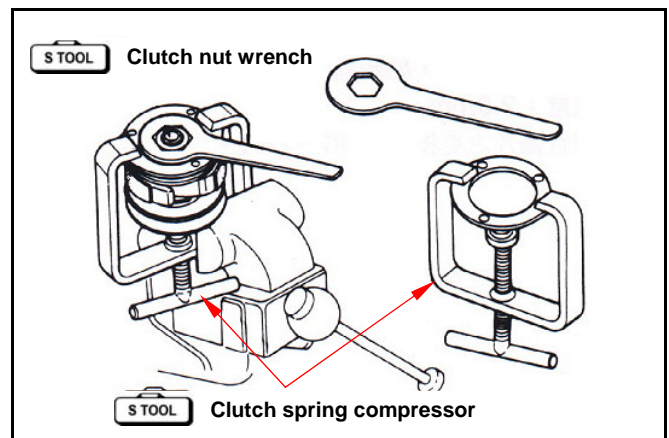
Install friction plate, spring and clutch weight into clutch spring compressor, and press down the assembly by turning manual lever until mounting nut that can be installed.

Hold the compressor by bench vise and tighten the mounting nut to specified torque with clutch nut wrench.

Remove the clutch spring compressor.

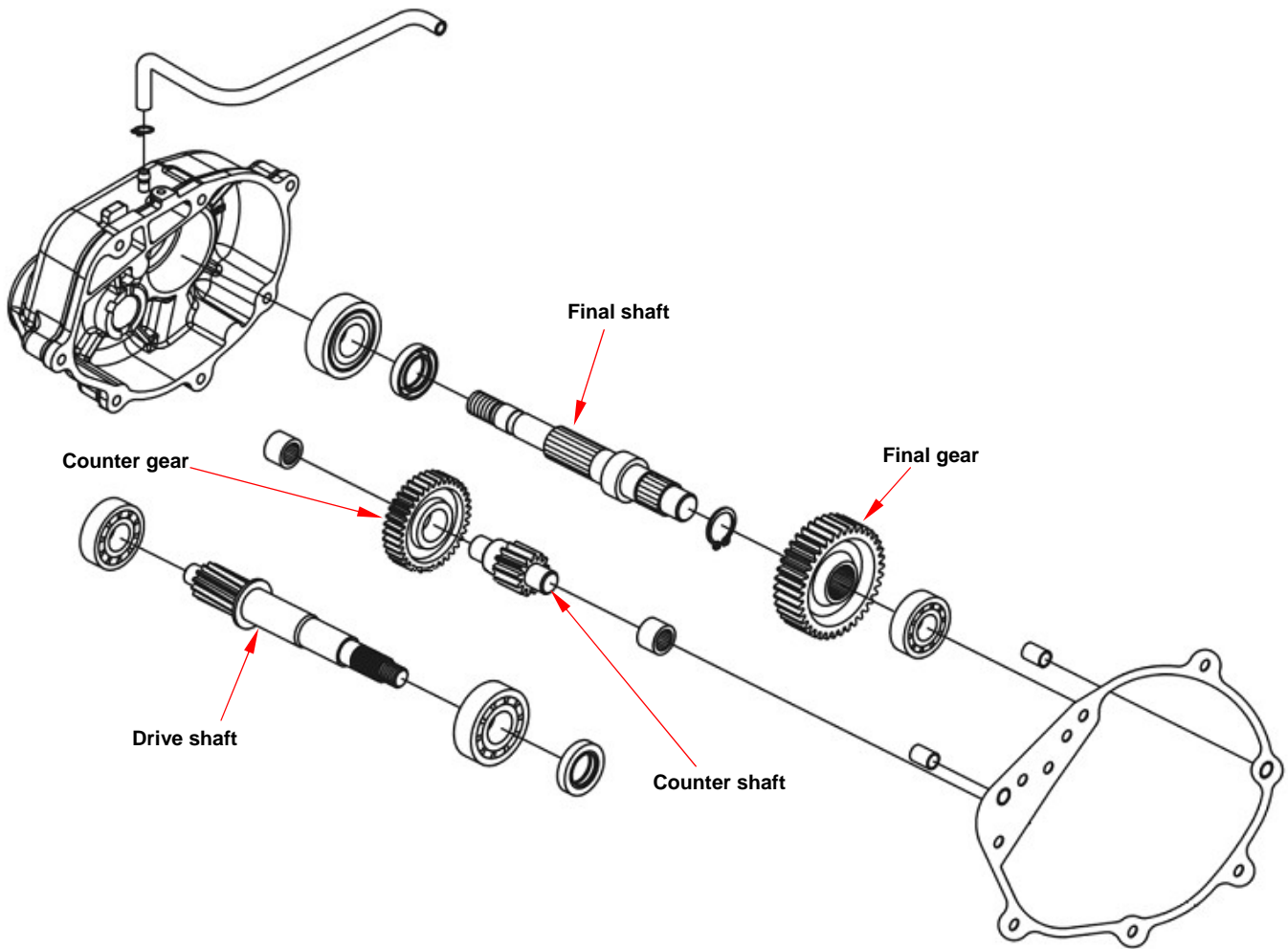
**Torque value: 5.0~6.0kgf-m**

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





## 9. Final Drive Mechanism

### Precautions in Operation

#### Specification

Application oil: scooter gear oil

Recommended oil: KING MATE serial gear oils

Oil quantity: 180 c.c. (160 c.c. when replace)

#### Torque value

Gear box cover 2.6~3.0kgf-m

#### Special tools

Bearing (6205) driver	SYM-9615000-6205
Bearing (6205) puller	SYM-9100400 HMA RA1 6205
Bearing (6203) driver	SYM-9620000
Drive shaft & oil seal (25*40*8) socket	SYM-9120200-HMA
Bearing (HK1516) driver	SYM-9100200-HMA HK1516
Bearing (6204) driver	SYM-9110400-6204
Oil seal drive 34*52*5	SYM-9125500-HMA
Inner bearing puller	SYM-6204021 or SYM-6204022
Outer bearing puller	SYM-6204001
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 can not be moved.

- Damaged driving gear
- Burnt out driving gear
- Damaged driving belt.

#### Noise

- Worn or burnt gear
- Worn gear

#### Gear oil leaks

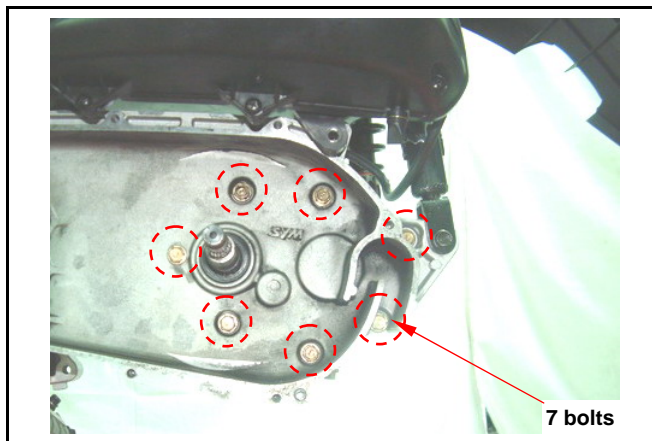
- Excessive gear oil.
- Worn or damage oil seal



## 9. Final Drive Mechanism

### Final Drive Mechanism Disassembly

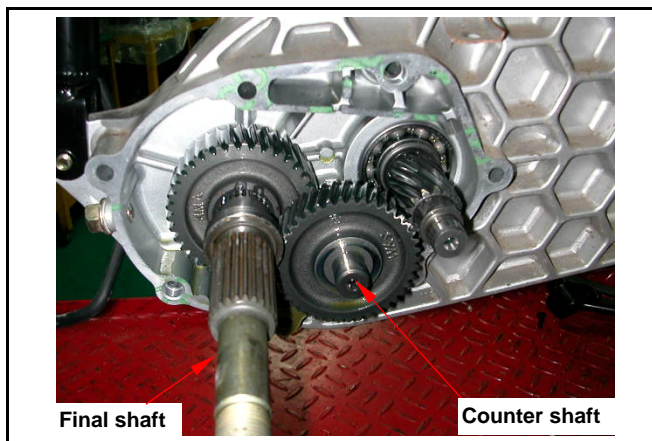
Remove the rear wheel.  
 Remove the clutch.  
 Drain out gear oil from gear box.  
 Loosen 7 bolts and remove gear box cover bolts.



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



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

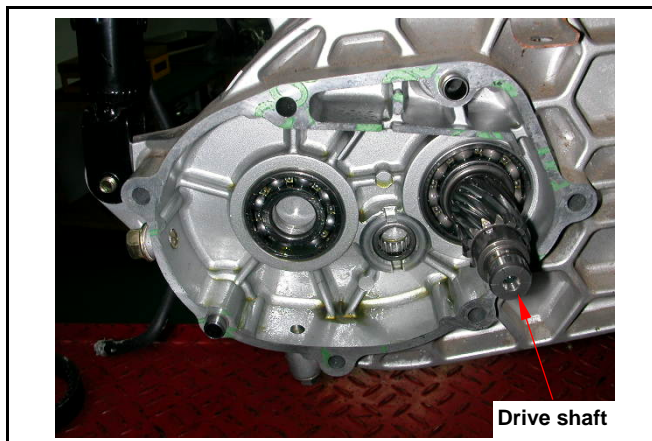


Remove the drive shaft.

**Special tool:**  
**Shaft protector**

**⚠ Caution**

- If non- essential do not remove the drive shaft from the cover upper side.
- If remove the drive shaft from the gear box cover, then its bearing has to be replaced.



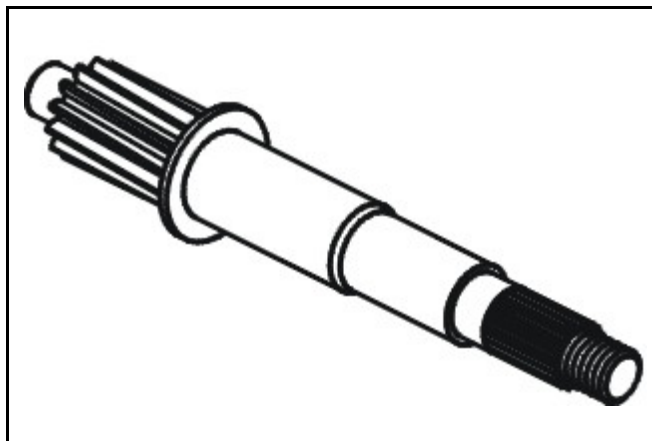
## 9. Final Drive Mechanism

### Final Drive Mechanism Inspection

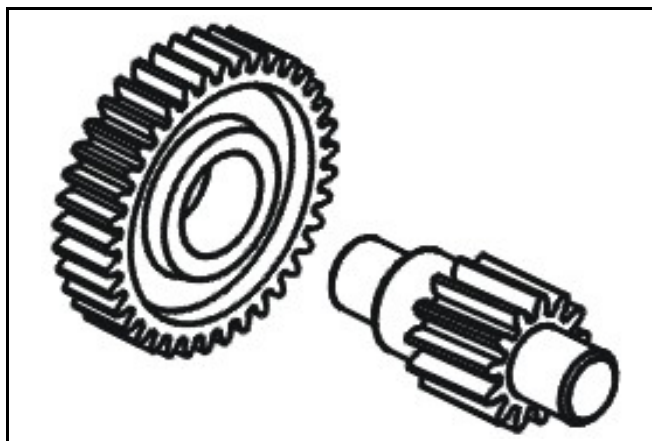
Check if the drive shaft is burned, worn or damaged and replace it if necessary.

#### Caution

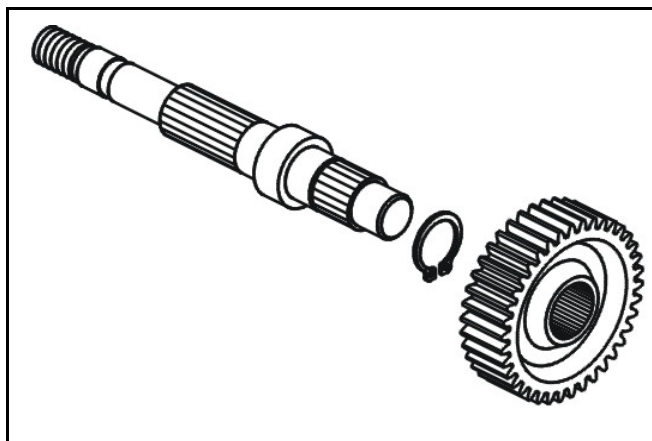
- If remove the drive shaft from the gear box upper side, then its bearing has to be replaced.



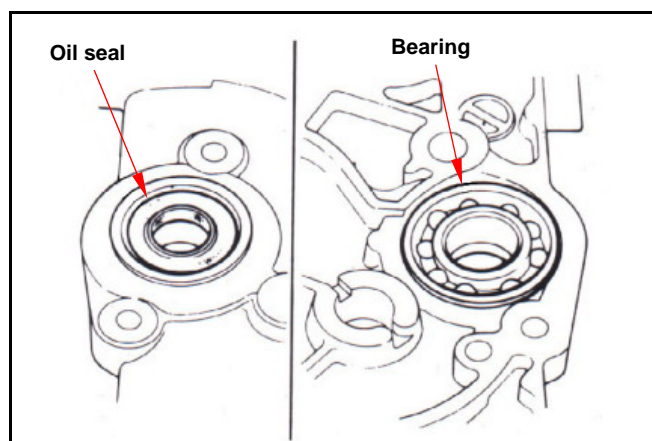
Check if the countershaft is wear or damage and replace it if necessary.



Check if the final shaft and gear are burn, wear or damage and replace it if necessary.



Check bearings on gear box cover.  
 Rotate each bearing's inner ring with fingers.  
 Check if bearings can be turned in smooth and silent, and also check if bearing outer ring is mounted on gear tightly.  
 If bearing rotation is uneven, noising, or loose bearing mounted, then replace it.  
 Check oil seal for wear or damage, and replace it if necessary.  
 Check gear box bearing as the same way above, and replace it if necessary.





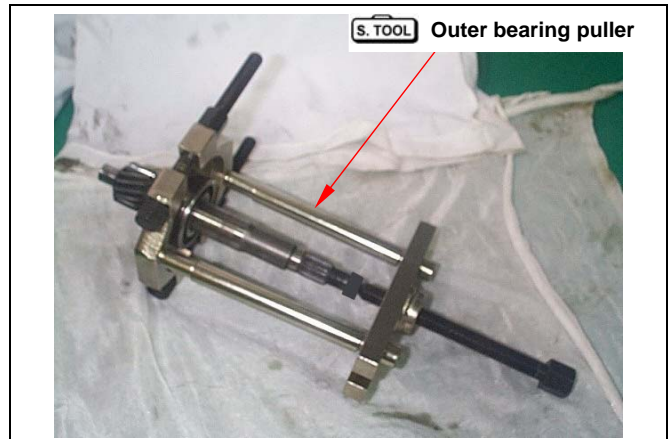
### Bearing Replacement

#### 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:**

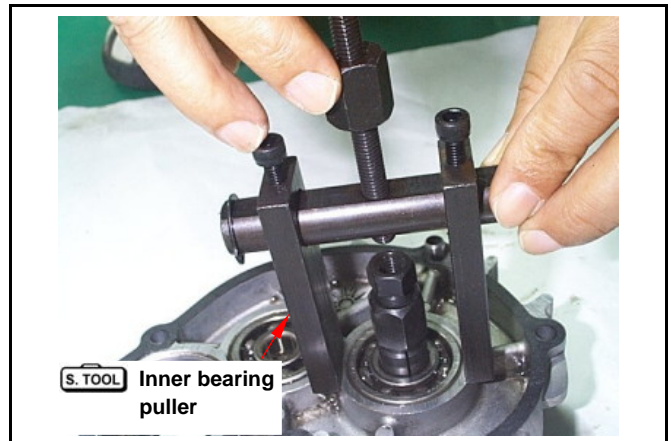
**Multi-functional bearing puller or Outer bearing puller** SYM-6204001  
**Shaft protector** SYM-6204010



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

**Special tool:**

**Inner bearing puller** SYM-6204020 or SYM-6204021



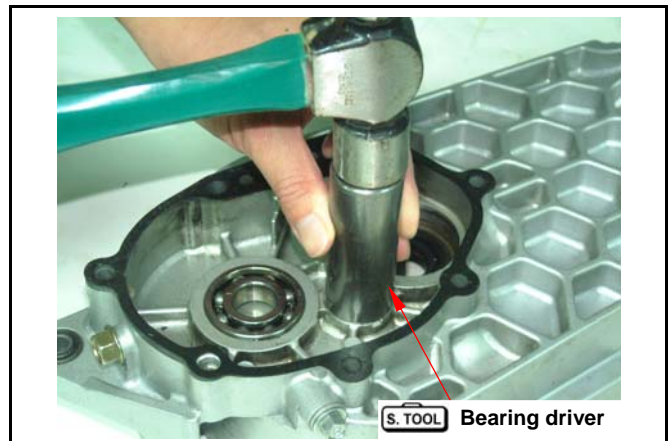
**⚠ Caution**

- Never install used bearings. Once bearing removed, it has to be replaced with new one.

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

**Special tool:**

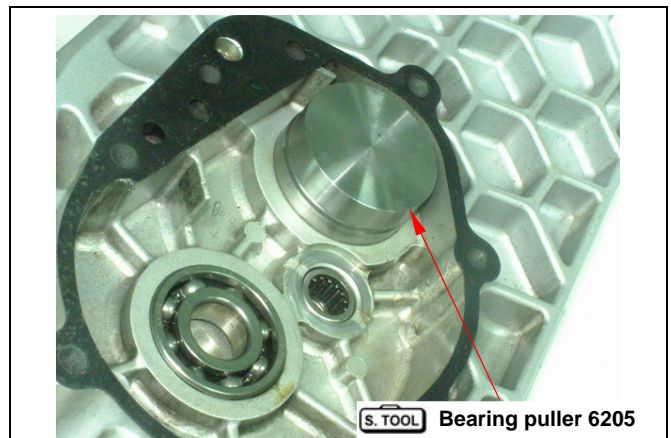
**Bearing driver 6205** SYM-9615000-6205  
**Bearing driver HK1516** SYM-9100200-HK1516



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

**Special tool:**

**Bearing puller 6205** SYM-9100400-6205





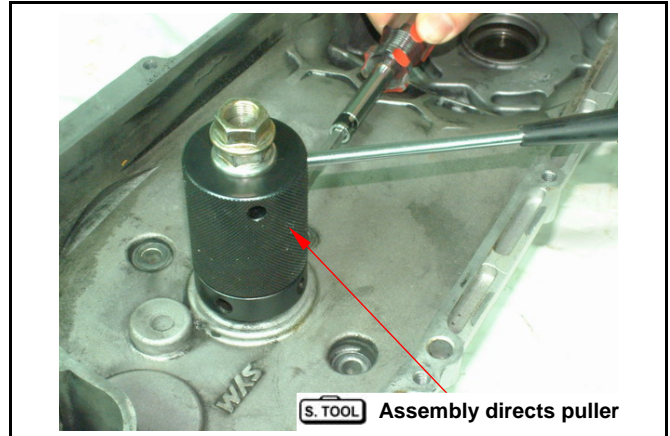
## 9. Final Drive Mechanism

Install assembly directs puller bearing puller.

**Special Service Tools:**

**Assembly directs puller** SYM-2341110

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

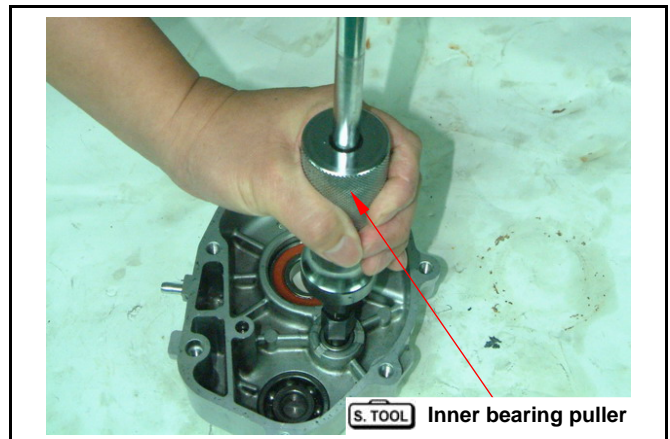


### Gear box cover side

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

**Special tool:**

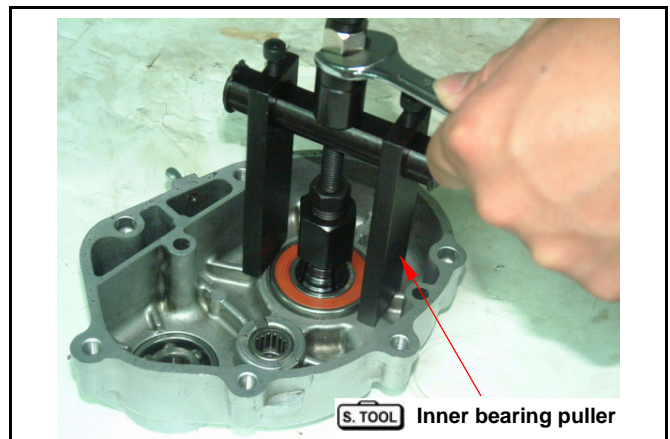
**Inner bearing puller** SYM-6204020 or SYM-6204021



Remove oil seal, and then remove final shaft bearing from gear box cover using following tools.

**Special tool:**

**Inner bearing puller** SYM-6204022



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





## 9. Final Drive Mechanism

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

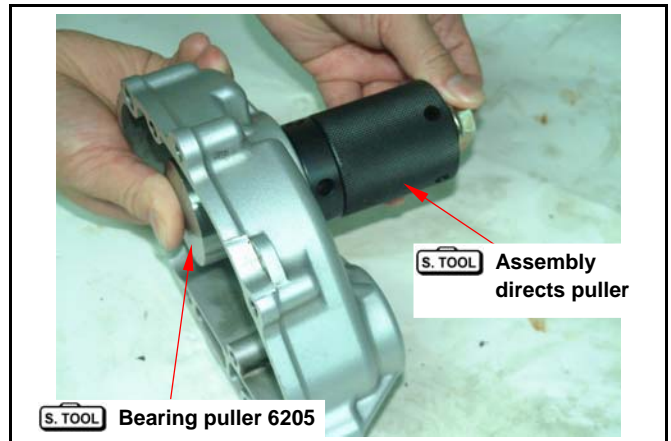
**Special tool:**

**Bearing puller 6205** SYM-9100400-6205

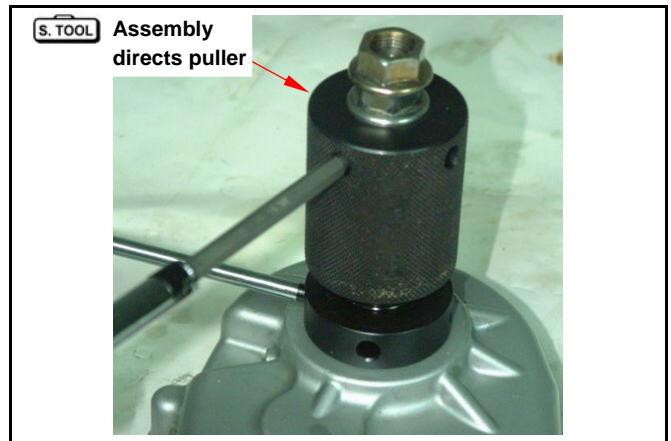
Install assembly directs puller bearing puller.

**Special Service Tools:**

**Assembly directs puller** SYM-2341110



Use screw driver holder bearing puller lower part, and turn the bearing puller upper part to install the final shaft bearing.



Apply with 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.

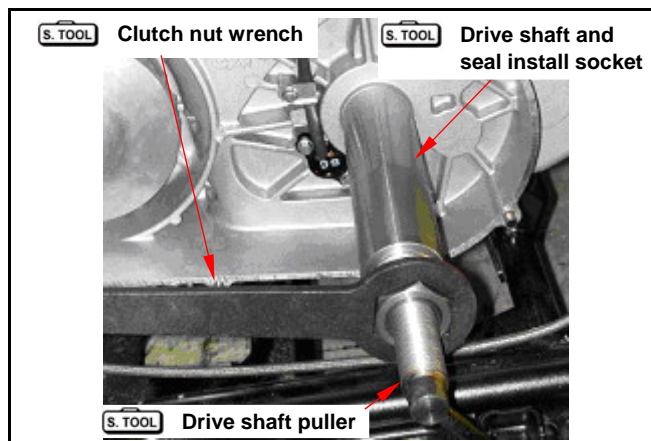
**Special tool:**

Drive shaft puller SYM-2341110- HMA RB1

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

SYM-9120200-HMA

Clutch nut wrench SYM-9020200



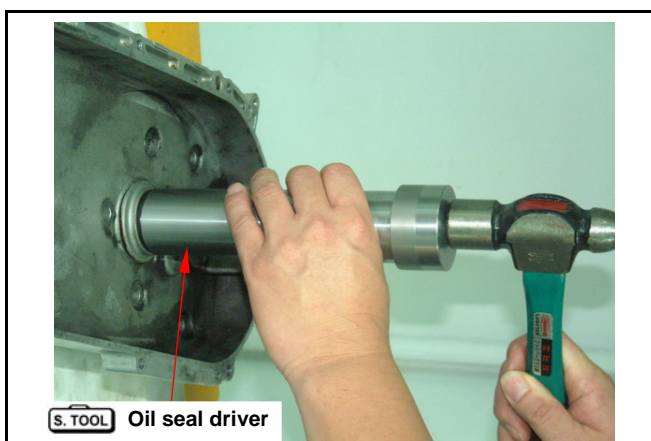
Apply with grease onto drive shaft oil seal.

Install the oil seal to left crankcase.

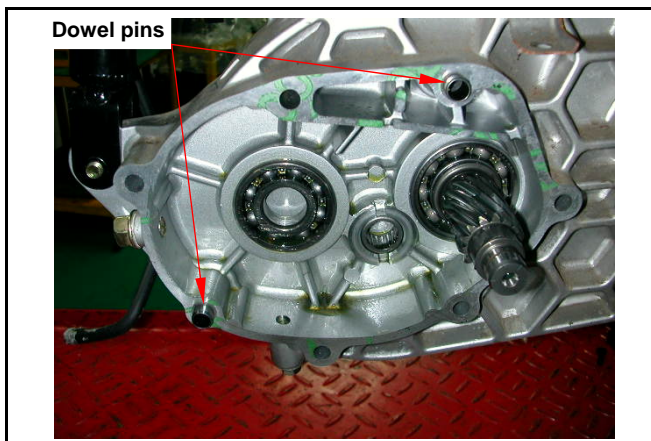
**Special tool:**

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

SYM-9120200-HMA



Install 2 dowel pins & new gasket.



Install counter shaft and final shaft into the gear box cover.

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

**Torque value: 2.6~3.0kgf-m**

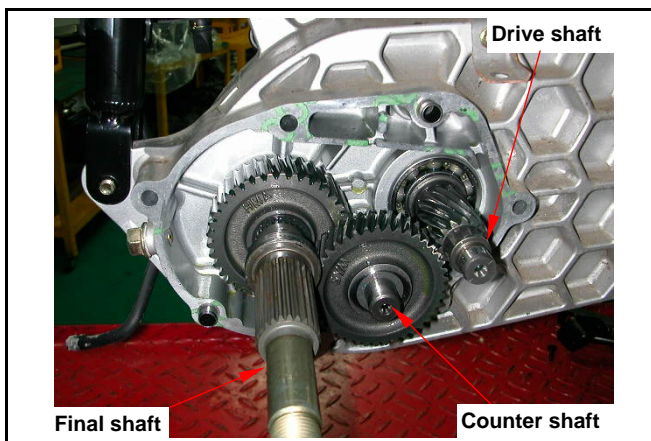
Install driven pulley / clutch outer / belt.

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

Install rear wheel.

Add gear oil.

**Gear oil quantity: 180c.c.**

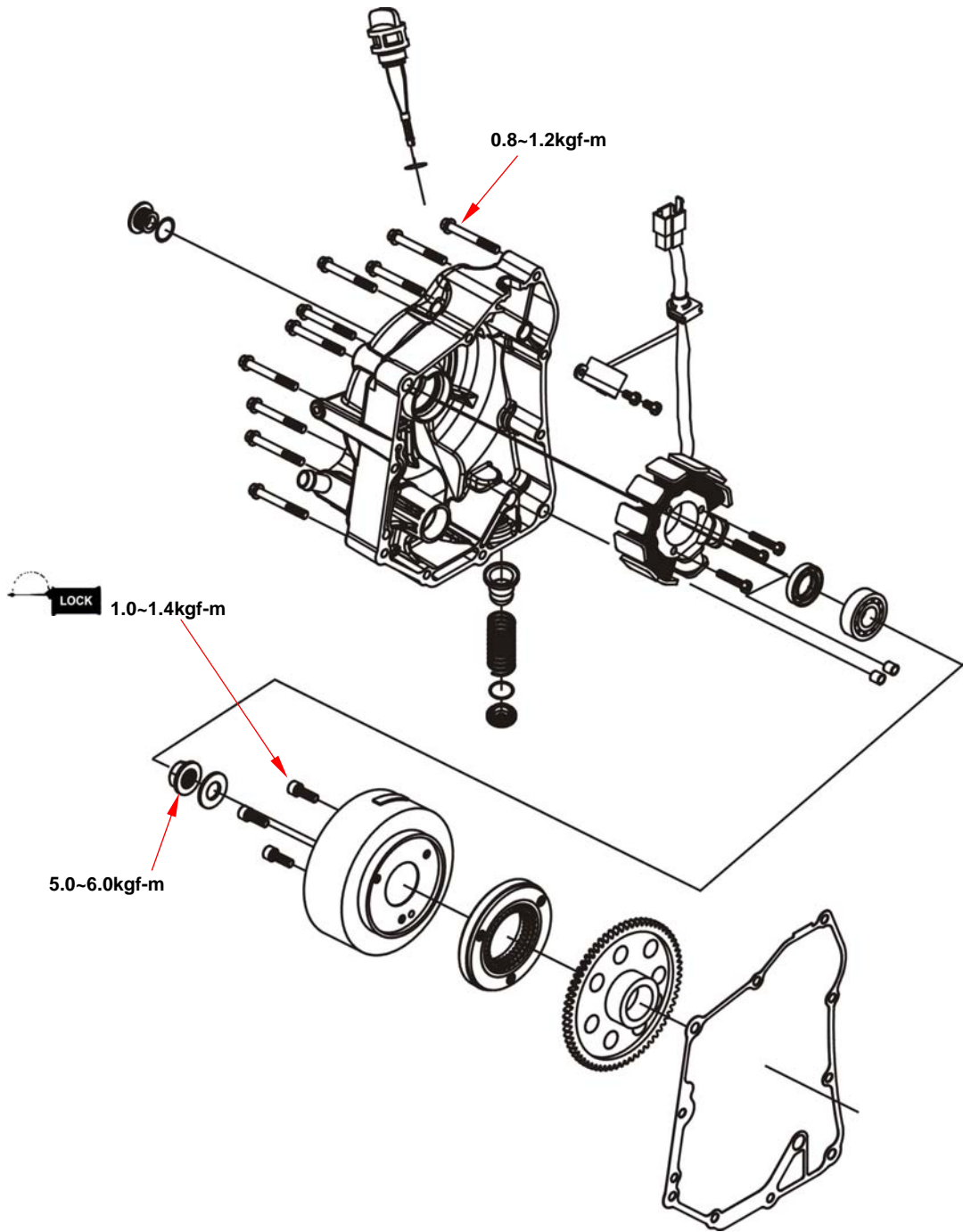






Mechanism Diagram.....10-1	Flywheel Removal ..... 10-5
Precautions in Operation .....10-2	Start Clutch ..... 10-6
Right Crankcase Cover Removal .....10-3	Flywheel Installation ..... 10-8
AC. Generator Removal.....10-4	AC.Generator Installation ..... 10-9
Right Crankcase Cover Bearing .....10-4	Right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

Mechanism Diagram





## 10. AC. Generator / Start Clutch

### 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

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

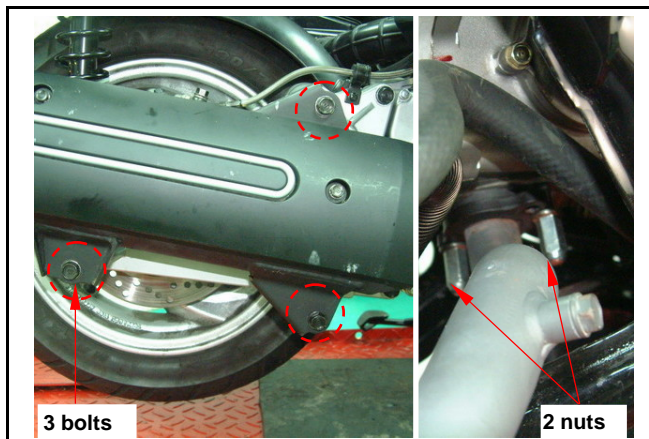
Flywheel nut	5.0~6.0kgf-m
Starting clutch hexagon bolt	1.0~1.4kgf-m with adhesive
8 mm bolts	0.8~1.2kgf-m
12 mm bolts	1.8~2.2kgf-m

#### Special tools

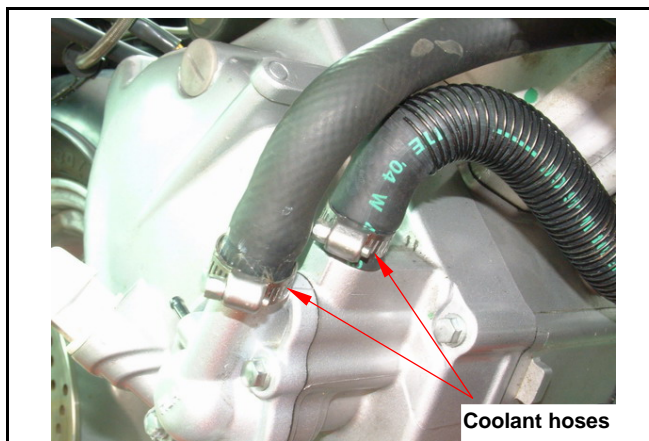
AC.G. flywheel puller	SYM-3110000-HMA
Left crank case cover 6201 bearing puller	SYM-9614000-HMA RB1 6201
Inner bearing puller	SYM-6204022
Universal holder	SYM-2210100

## Right Crankcase Cover Removal

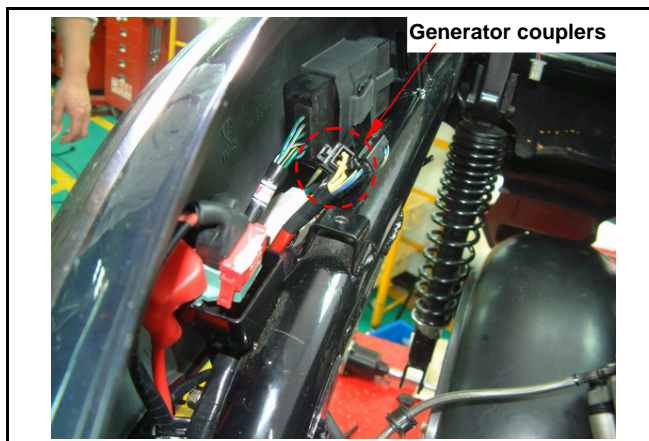
Remove left side cover.  
 Remove seat and luggage box.  
 (Refer chapter 13)  
 Remove the exhaust muffler (3 bolts, 2 nuts).



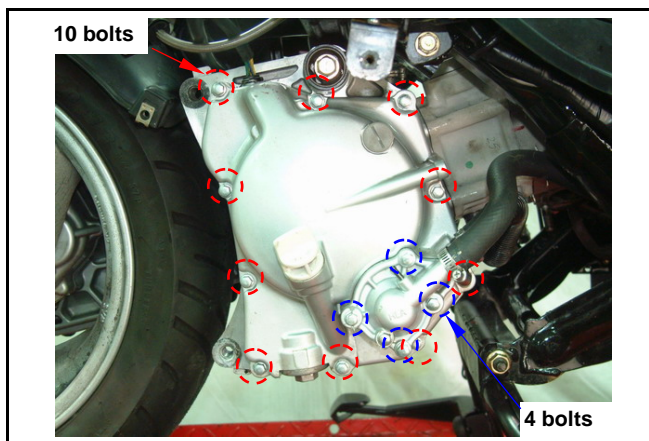
Drain out the engine oil and coolant (refer chapter 5).  
 Remove coolant hoses.



Disconnect the couplers of the power source output line.



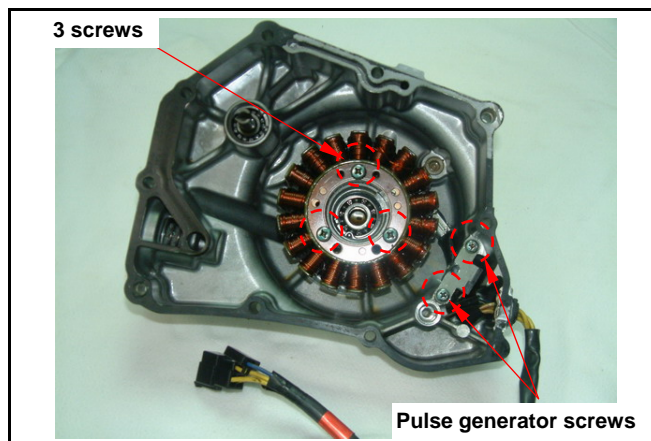
Remove water pump cover (4 bolts).  
 Remove 10 bolts from the right crankcase cover.  
 Remove the right crankcase cover.  
 Remove dowel pin and gasket.



## 10. AC. Generator / Start Clutch

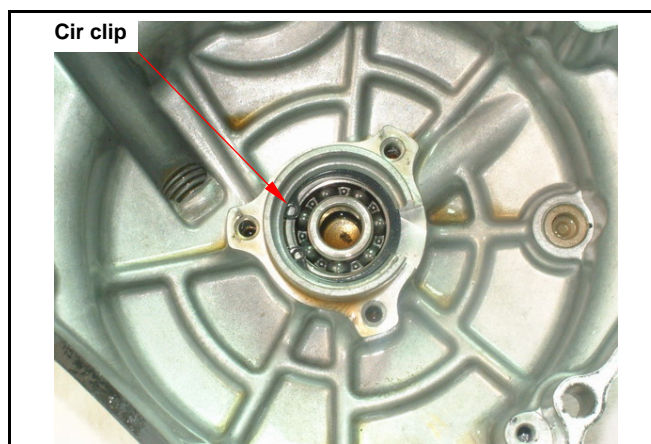
### AC. Generator Removal

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



### Right Crankcase Cover Bearing

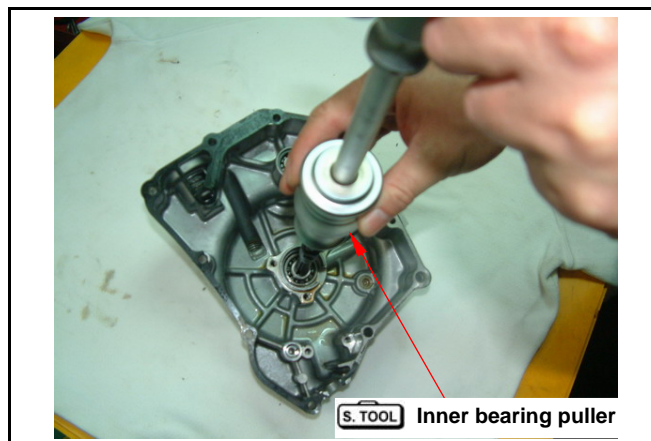
Rotate the bearing with finger to check if the bearing rotation is in smooth and silent. Check if the bearing outer parts are closed and fixed. Replace it if necessary.



Remove the bearing 6201 with inner bearing puller.

**Special tool:**

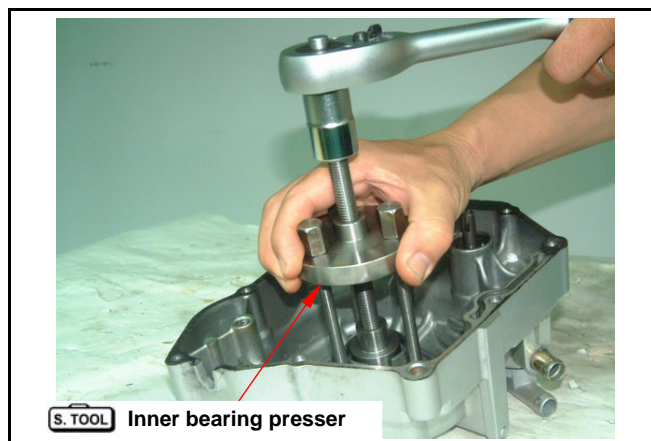
Inner bearing puller SYM-6204022



Install the bearing 6201 bearing with special tool.

**Special tool:**

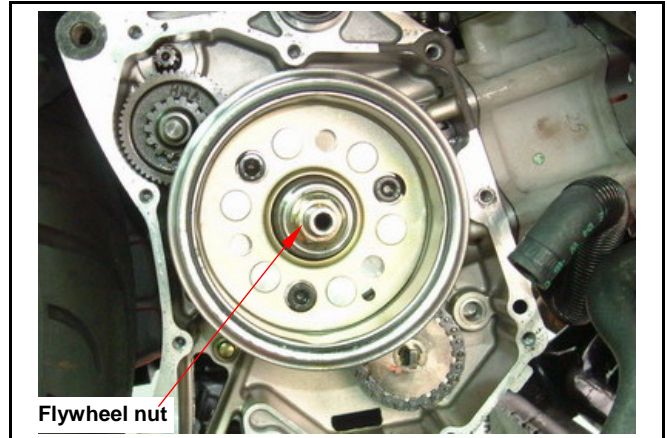
Right crankcase cover bearing 6201 presser  
SYM-9614000-HMA RB1 6201





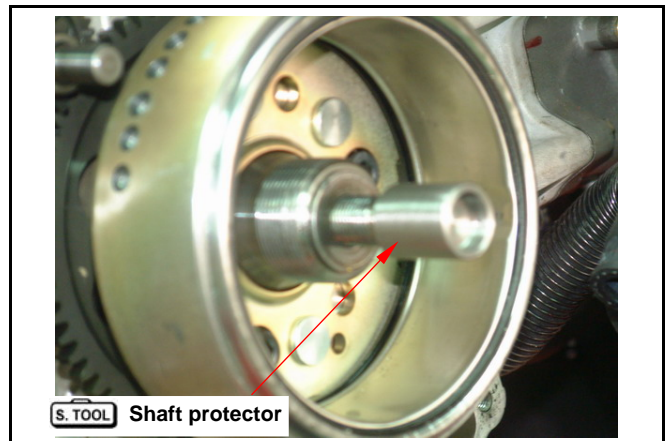
### Flywheel Removal

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



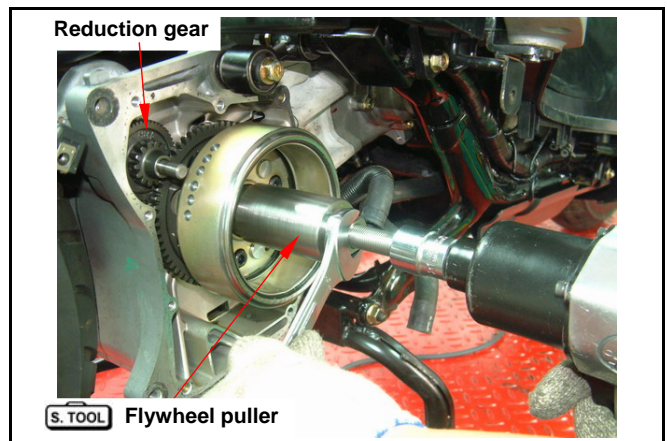
Installs shaft protector onto the crank shaft.

**Special tool:**  
**Shaft protector**

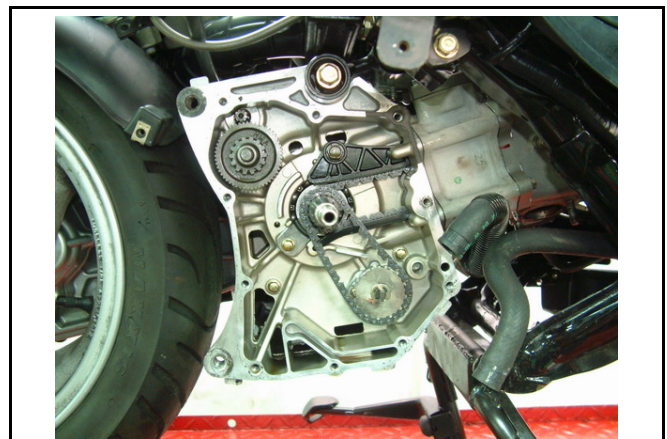


Remove starter reduction gear and shaft.  
Pull out flywheel with AC.G. flywheel puller.

**Special tool:**  
**AC.G. Flywheel puller SYM-3110000-HMA**



Remove flywheel and starting driven gear.





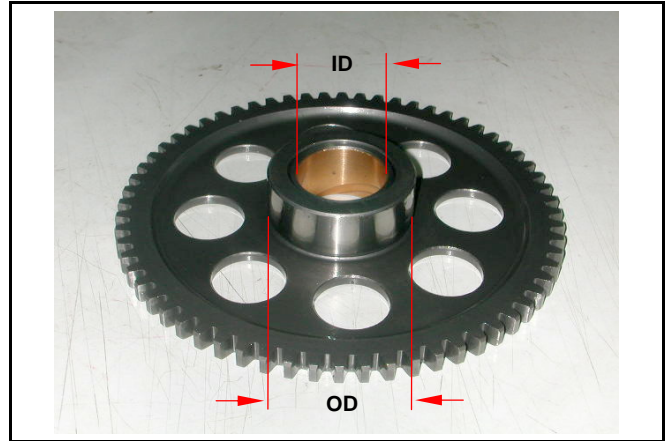
## 10. AC. Generator / Start Clutch

### Start Clutch

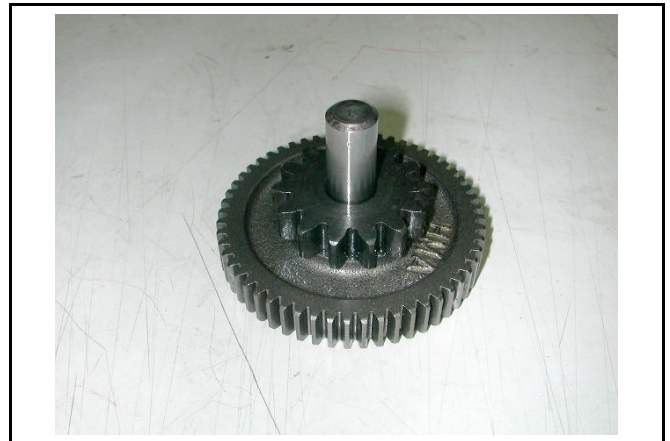
#### Start Clutch Inspection

Remove start clutch driven gear.  
Check the gear for wear or damage.  
Measure the ID and OD of the start clutch driven gear.

**Service Limit: ID: 25.050 mm**  
**OD: 42.100 mm**



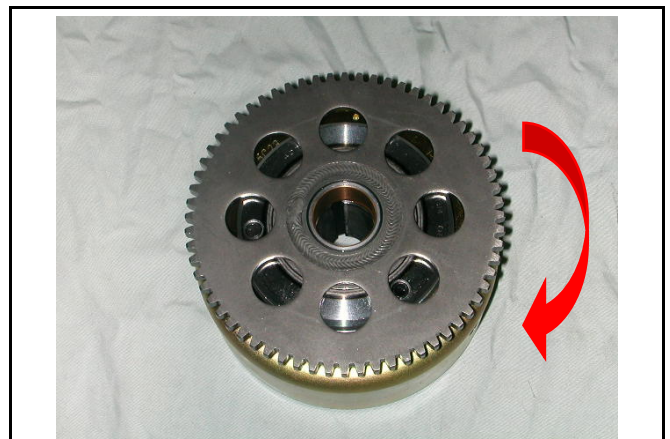
Check the starting reduction gear and shaft for wear or damage.



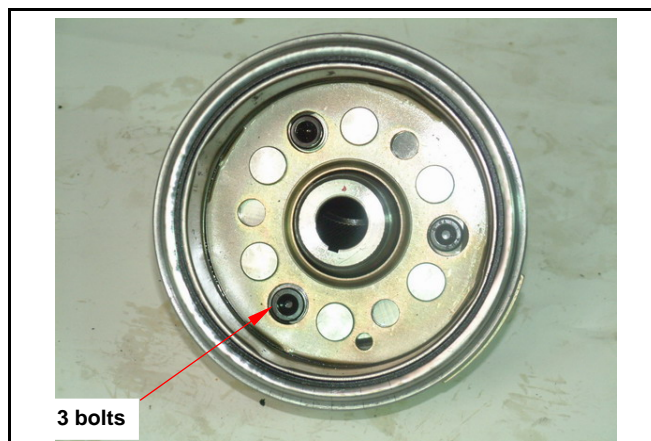
Check each roller for wear or damage.



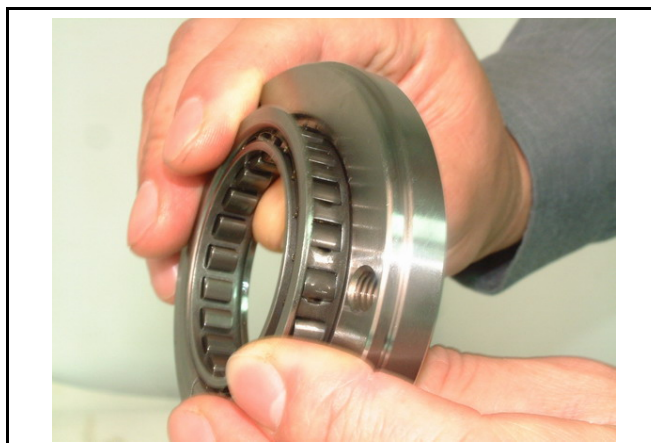
Install start clutch driven gear onto one way clutch.  
Hold flywheel and rotate start clutch gear.  
The start clutch gear should be rotated in C.C.W direction freely, but not C.W direction. (View as shown in this figure.)



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 each roller for wear or damage.



### One way clutch Installation

Install the components in the reverse procedures of removal.

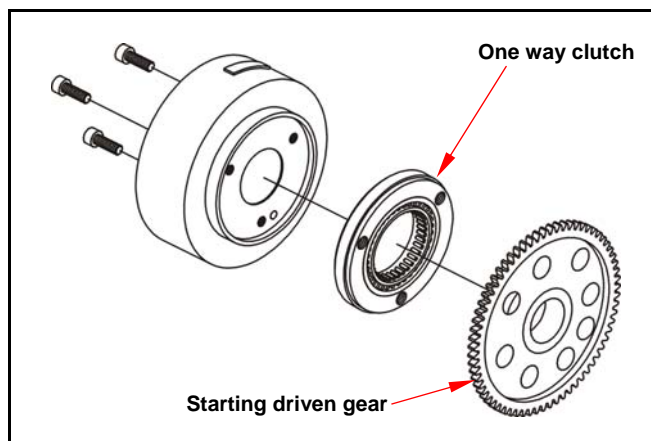
**Torque value: 1.0~1.4kgf-m**

#### Caution

- Cannot lock the thread of socket bolt.

#### Caution

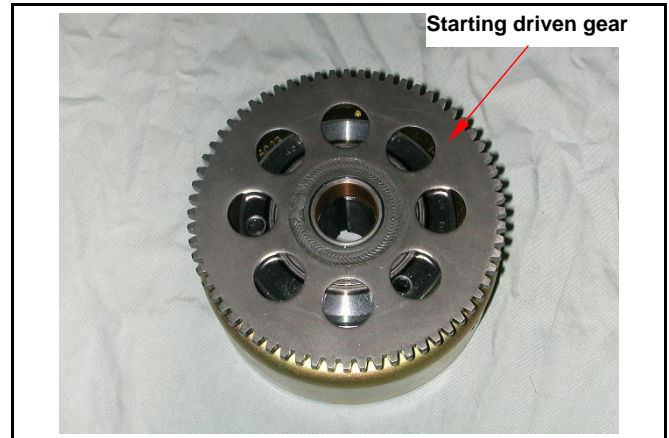
- The one way clutch must to with the generator flywheel and the starter gear, after one and loads the crank in, only then may lock the socket bolt, otherwise will create concentric the deviation, will cause the part to suffer injury.



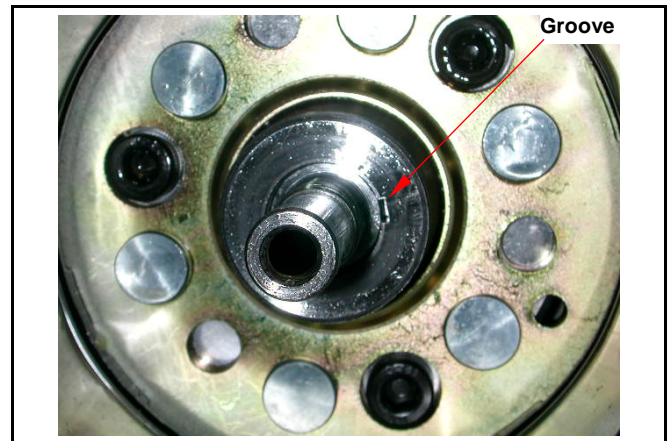
## 10. AC. Generator / Start Clutch

### Flywheel Installation

Install starting driven gear onto one way clutch.



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

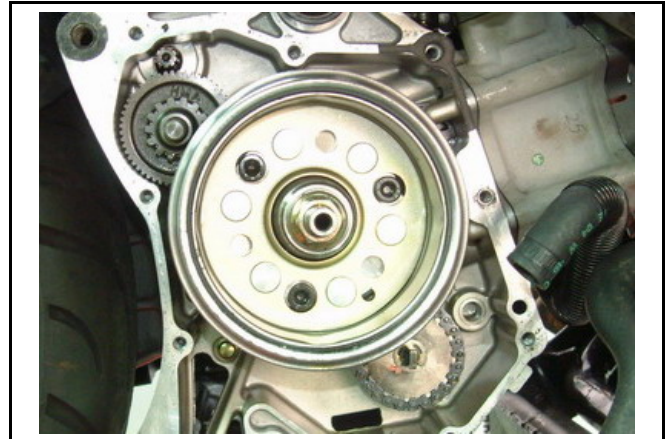


Hold the flywheel by drive face with universal holder, and tighten flywheel nut.

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

**Special tool:**

**Universal Holder SYM-2210100**





### AC. Generator Installation

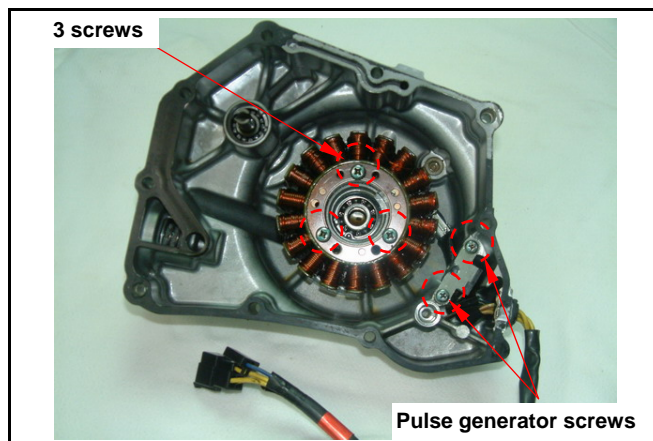
Install the AC.G. coil set onto right crankcase cover (3 screws).

Install pulse generator (2 screws).

Tie the wire harness securely onto the indent of crankcase.

#### Caution

- Make sure that the wire harness is placed under pulse generator.



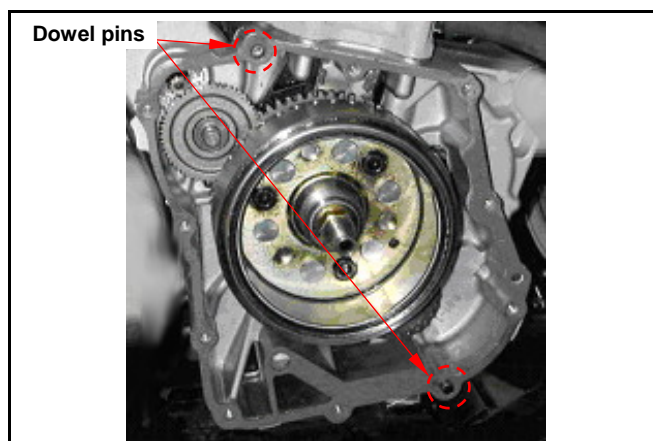
### Right Crankcase Cover Installation

Install dowel pins and new gasket.

Remove water pump cover.

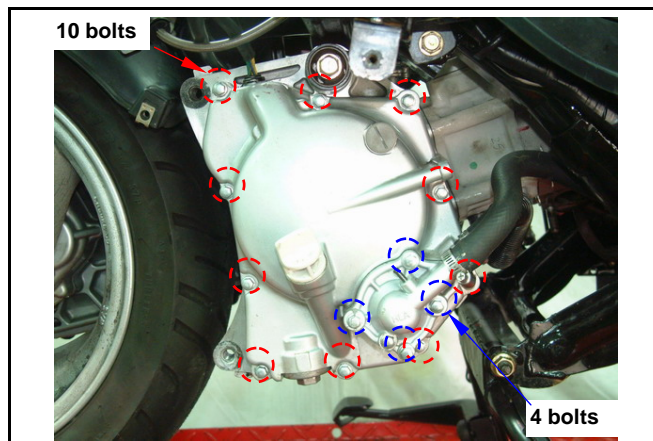
Install right crankcase cover onto the crankcase.

Note: 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.



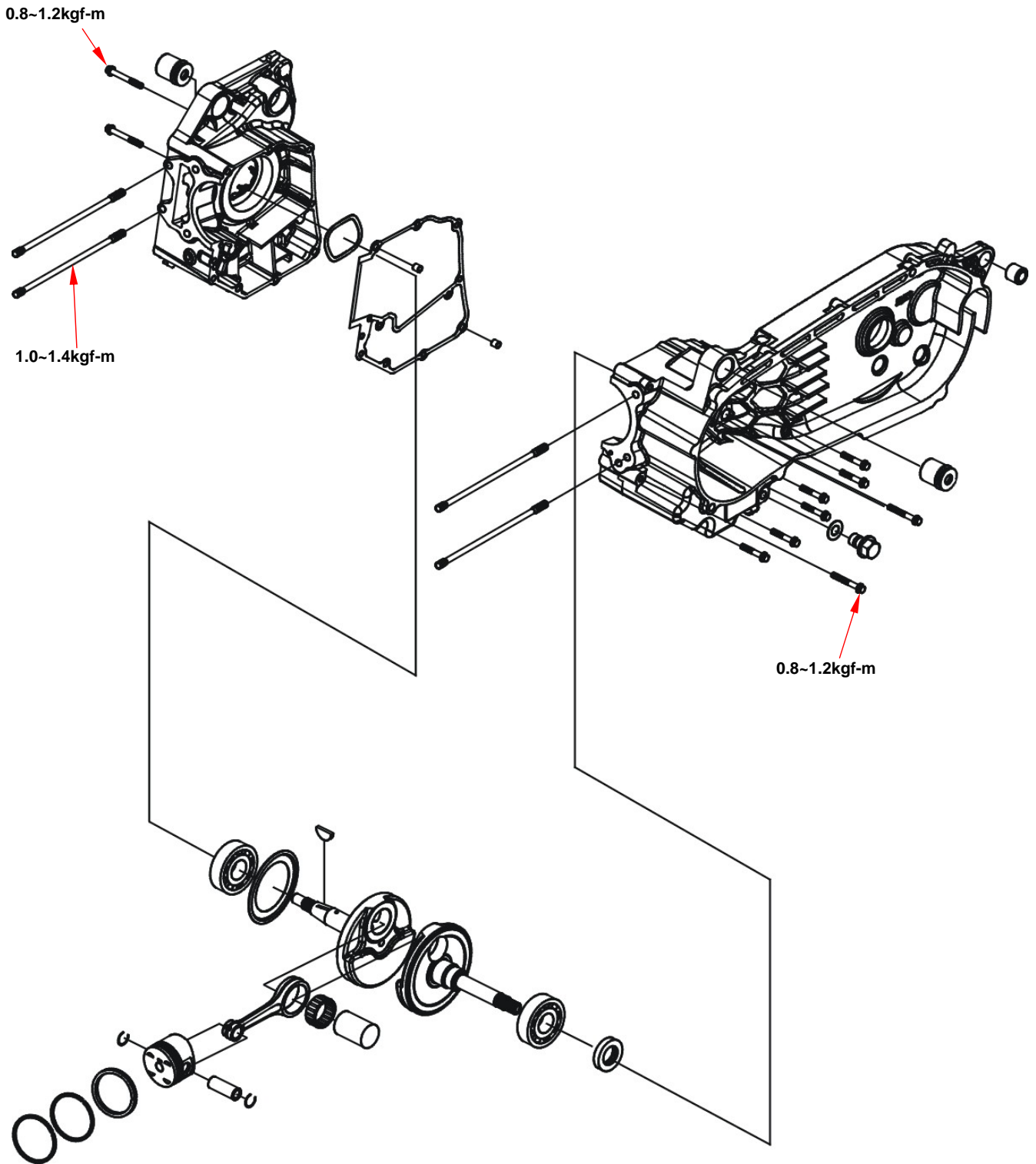


Notes:



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



## 11. Crankshaft / Crankcase

### Precautions in Operation

#### General Information

- This Section concerns disassembly of the crankcase for 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 it requires replacing the crankshaft bearing, the driving chain of engine oil pump or the timing chain, it is preferably to replace crankshaft as a unit.

#### Specification

Unit: 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	0.8~1.2kgf-m
Cylinder stud bolts	1.0~1.4kgf-m
Bolt for cam chain adjuster	1.2~1.6kgf-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

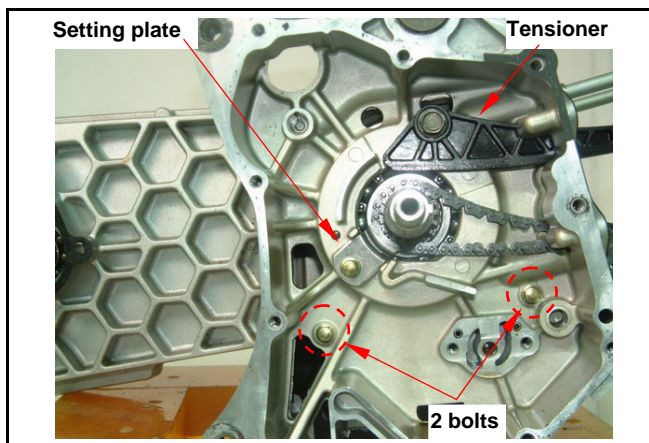
### Troubleshooting

#### Engine noise

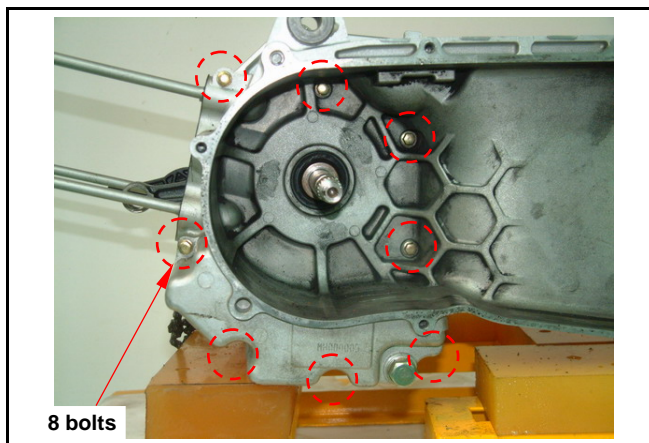
- Loose crankshaft bearing
- Loose crankshaft pin bearing
- Worn out piston pin and pin hole

## 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.



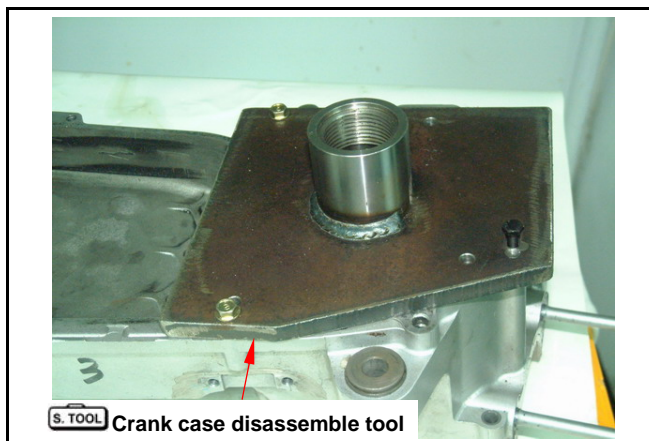
Loosen 8 bolts on the left crankcase.



Place right crankcase downward and left crankcase upward.  
 Install crank disassemble tool onto left crankcase.

### ⚠ Caution

- Care should be taken not to damage the contact surfaces.



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

### Special tool:

**Crank case disassemble**

SYM-1120000-HMA H9A

**L. Crank shaft puller**

SYM-1130000-HMA H9A

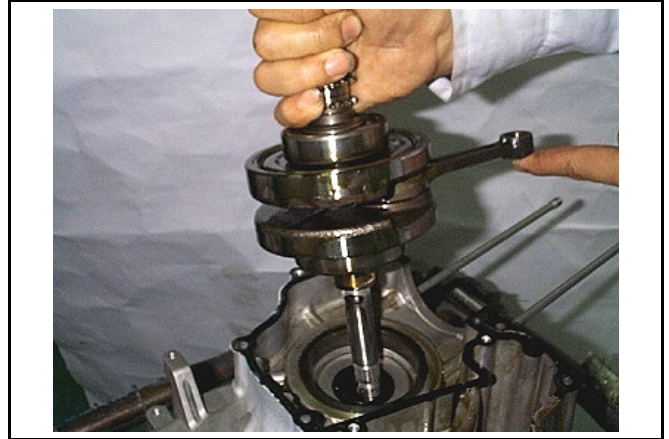
**Clutch nut wrench** SYM-9020200





## 11. Crankshaft / Crankcase

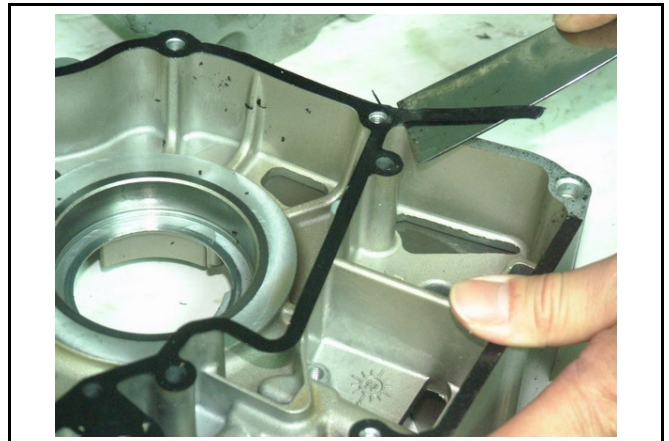
Remove crankshaft and wave washer from right crankcase.



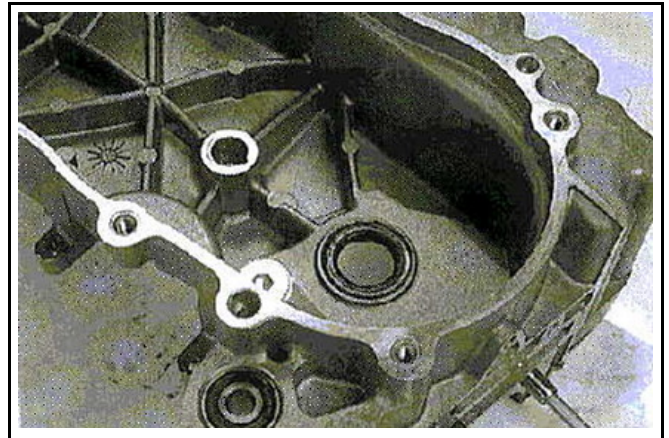
Remove gasket and dowel pins.  
Scrape gasket residues off the crankcase contact surface.

### Caution

- Do not damage contact surface of the gasket.
- It is better to moisten the gasket residue for easy scrapping.



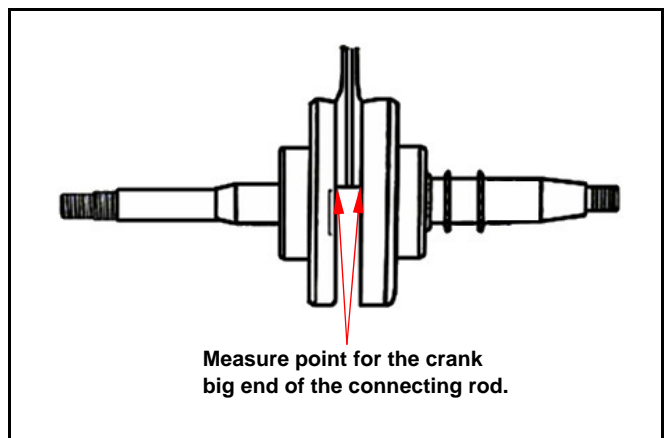
Drive out left crankcase oil seal.



### Crankshaft Inspection

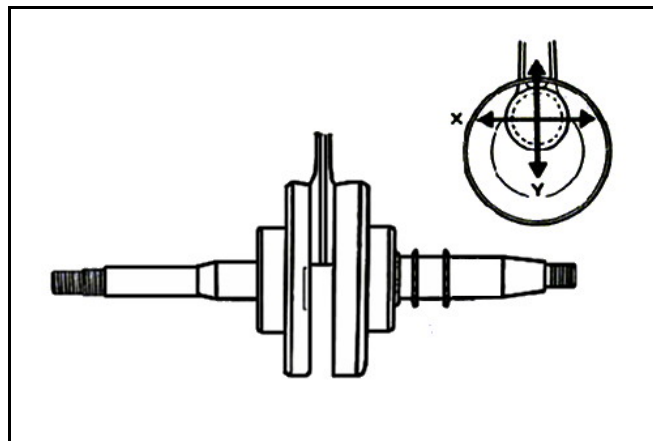
Use a thickness gauge to measure left and right clearance of connecting rod big end.

**Service limit: 0.6 mm**



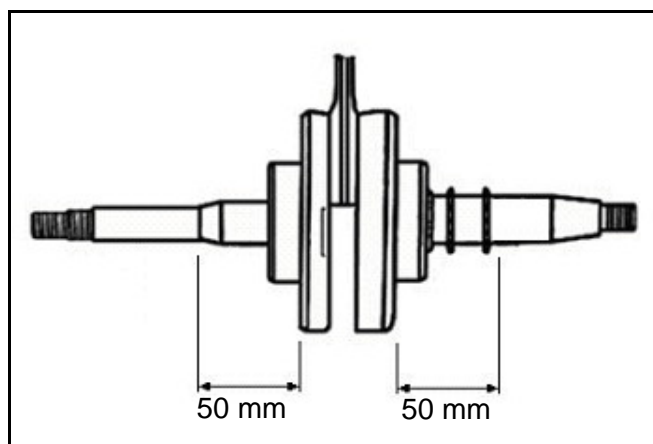
Measure the clearance of the big end at the vertical directions.

**Service limit: 0.05 mm**



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

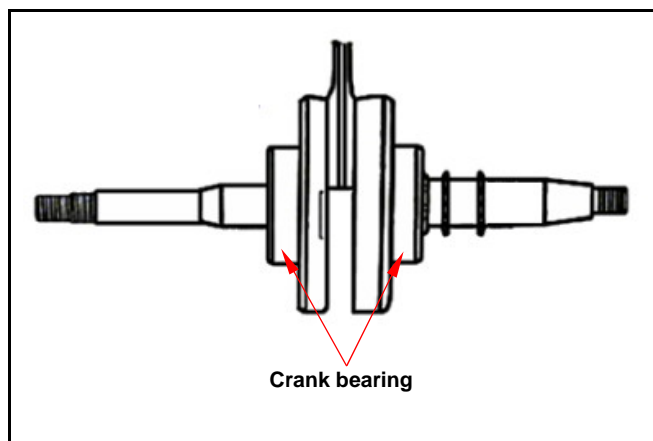
**Service limit: 0.10 mm**



### Check crankshaft bearing

Use hand to crank the bearing to see it moves freely, smoothly and noiseless.

Check the inner ring to see it links firmly on the bearing.



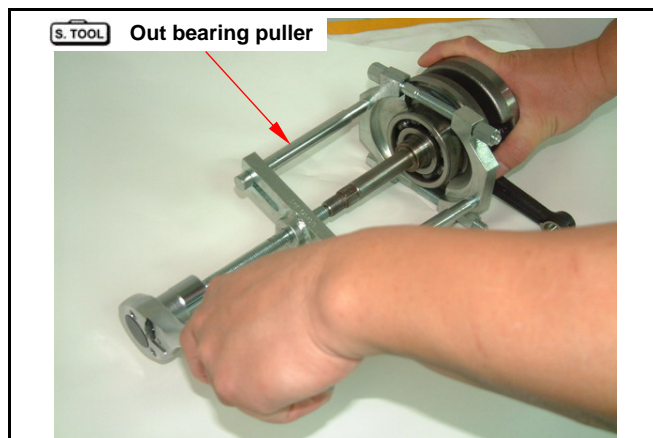
If any roughness, noise and loose linkage are detected, replace the bearing with new one.

### ⚠ Caution

- The bearing shall be replaced in pair.

### Special tool:

**Outer bearing puller SYM-6204001**



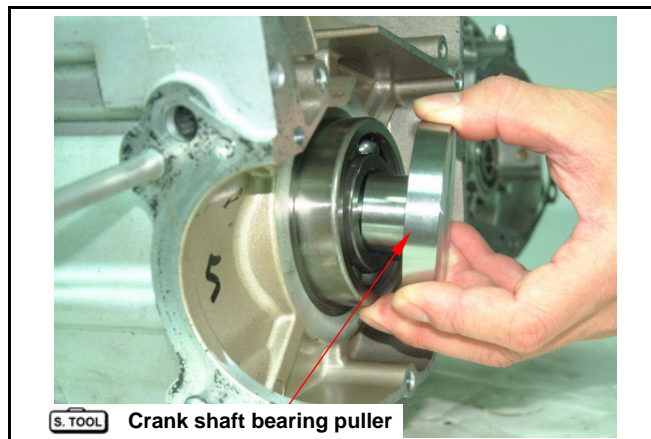
## 11. Crankshaft / Crankcase

### Crankcase Assembly

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

**Special tool:**

L. crank shaft bearing puller SYM-9100100



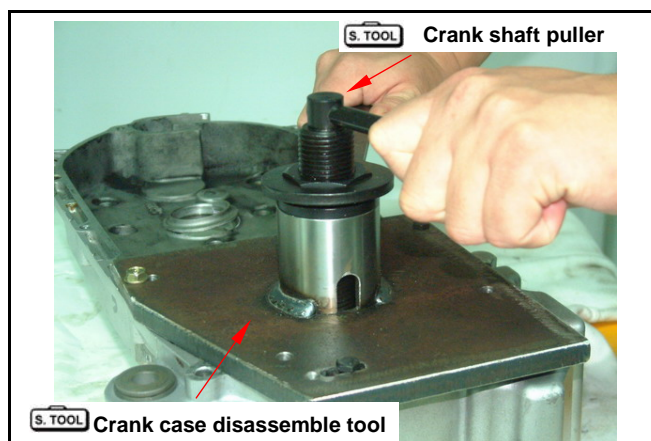
Install crank disassemble tool onto left crankcase. Install left crank shaft puller into crank case disassemble.

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

**Special tool:**

Crank case disassemble SYM-1120000-HMA H9A

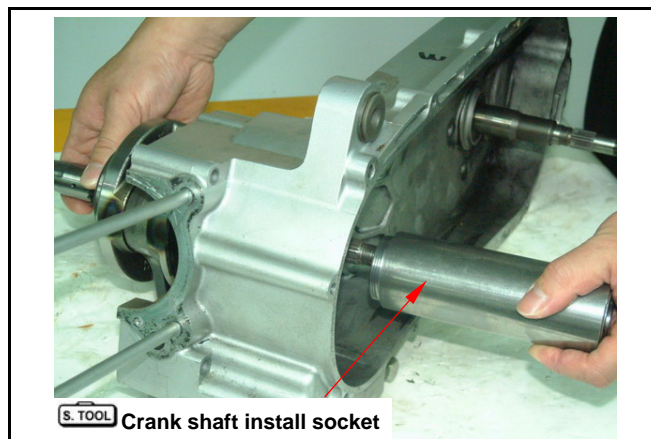
L. Crank shaft puller SYM-2341110-HMA  
Clutch nut wrench SYM-9020200



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

**Special tool:**

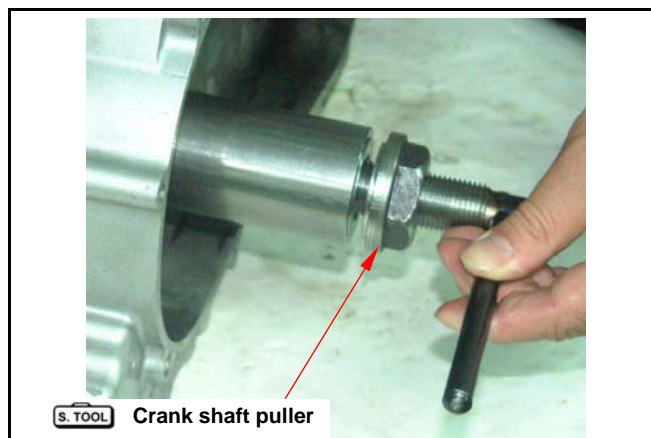
Crank shaft install socket & oil seal driver SYM-2341110- HMA RB1



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

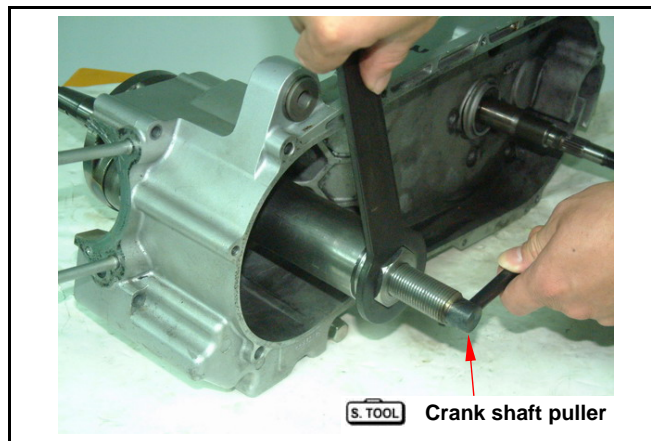
**Special tool:**

L. Crank shaft puller SYM-1130000-HMA H9A





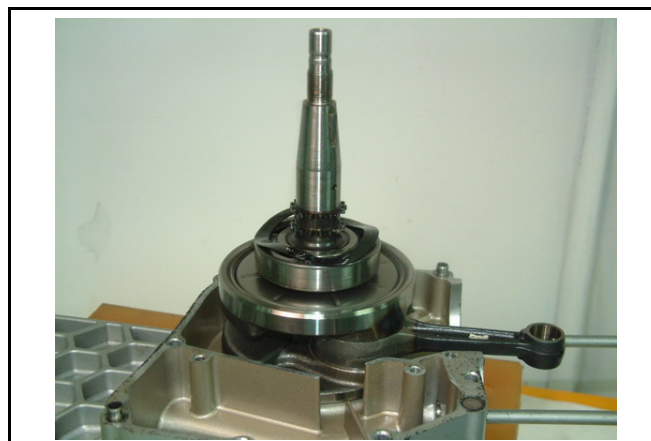
Hold left crank shaft puller, and turn the shaft puller nut by clutch nut wrench to pull in crank shaft into left crankcase.



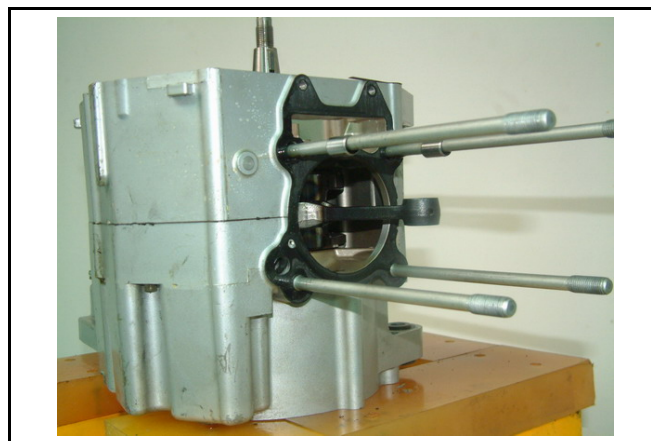
Put wave washer onto right crank bearing.

**⚠ Caution**

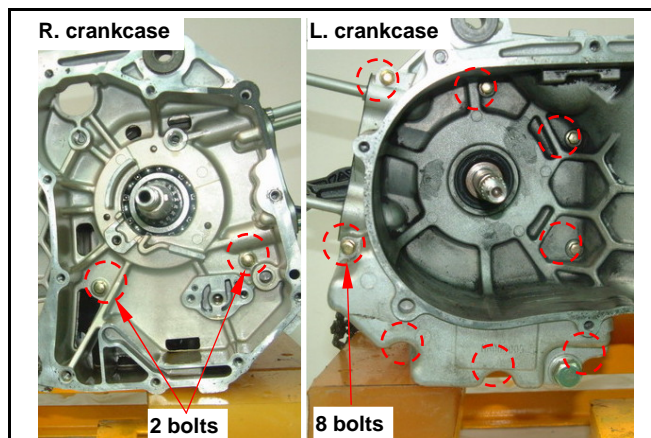
- Right flank the wave washer piece certainly must install. Cannot install the wrong position or leak the attire. Otherwise can cause the motorcycle to have the fierce vibration



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



Tighten 8 bolts on the left crankcase.  
Tighten 2 bolts on the left crankcase.  
**Torque value: 0.8~1.2kgf-m**





## 11. Crankshaft / Crankcase

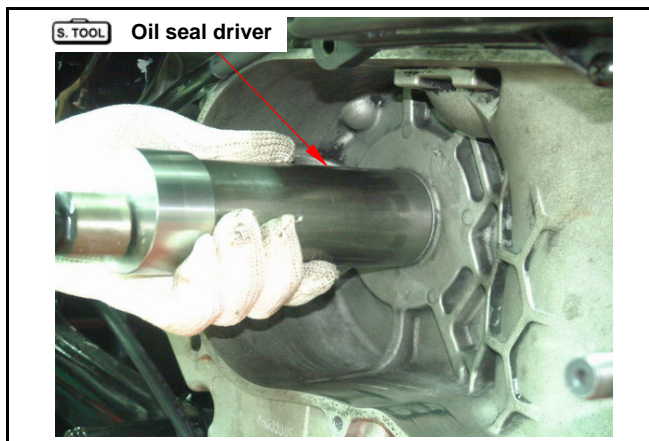
Apply a layer of grease on the lip of oil seal  
Clean the crankshaft with clean solvent.



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

**Special tool:**

**Crank shaft install socket & oil seal driver**  
**SYM-2341110- HMA RB1**

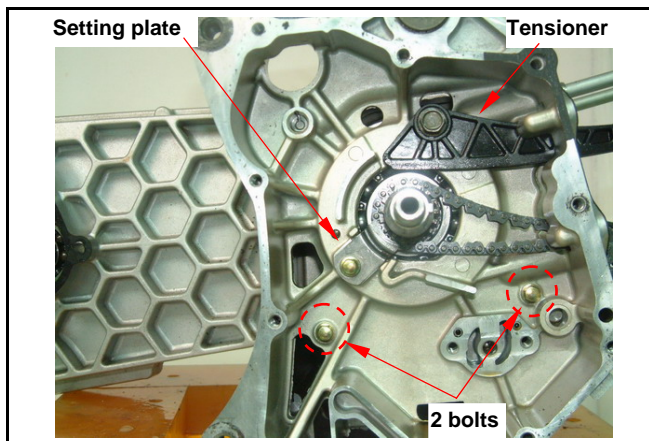


Install the cam chain tensioner & and tighten the bolts.

**Torque value: 1.2~1.6kgf-m**

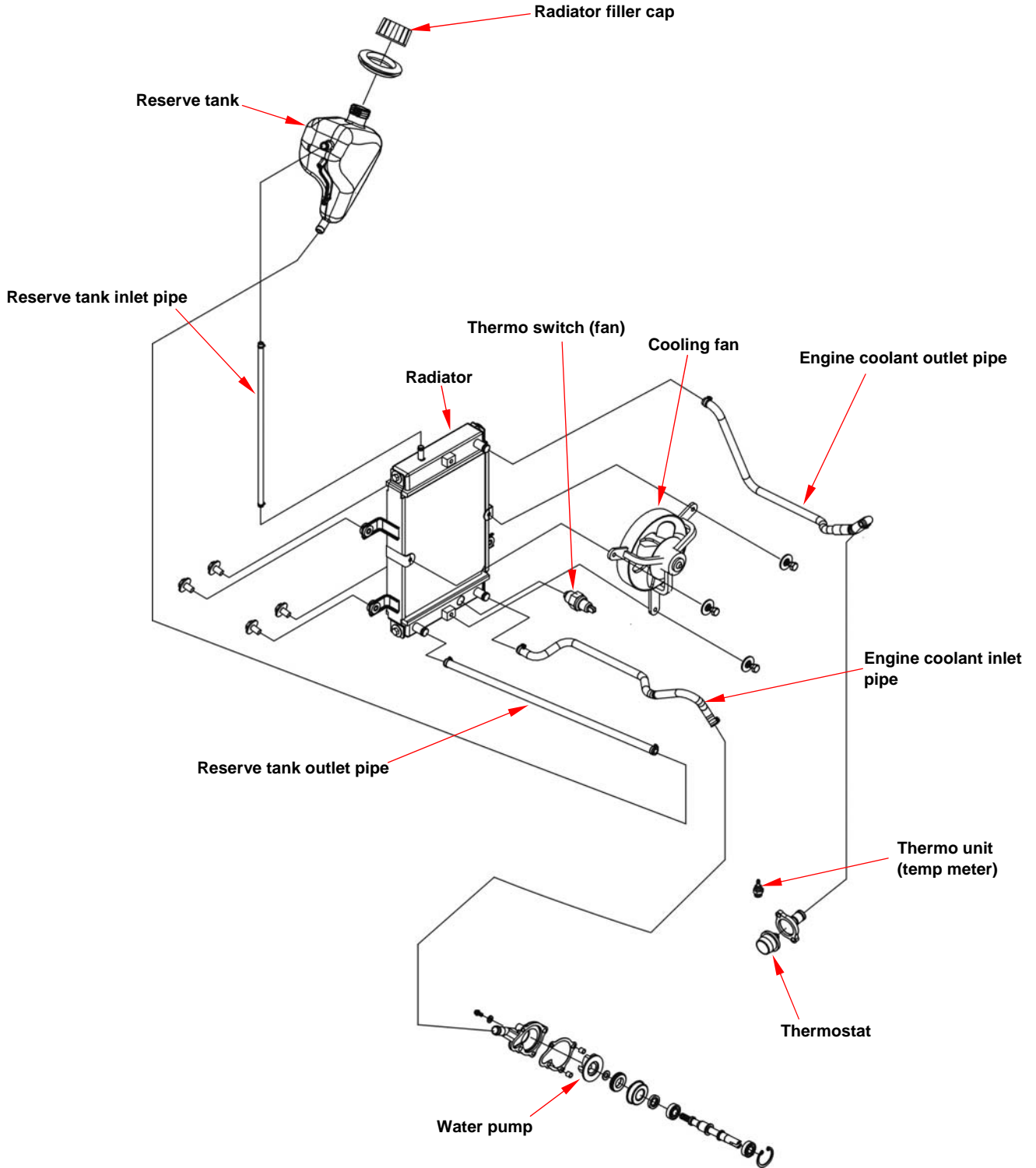
Install the cam chain.

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



## 12. Cooling System

### Precautions in Operation

#### General Information

#### Warning

- 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.
- Test the cooling system for any leakage 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 <sup>2</sup>
Capacity of coolant: Engine + radiator Reservoir upper	1400c.c. 420c.c.
Thermostat	Begins to activate at : 82~92°C Stroke : 0.05~3.0mm/80°C
Boiling point	Not-pressure : 107.7°C Pressurized: 125.6°C

#### Torque Value

For water pump rotor 1.0~1.4kgf-m

#### Tools Requirement

##### 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 stuck to closed.
- Insufficient coolant.
- The water hose and jacket are clogged.
- Fan motor malfunction.
- The filler cap of the radiator malfunction.

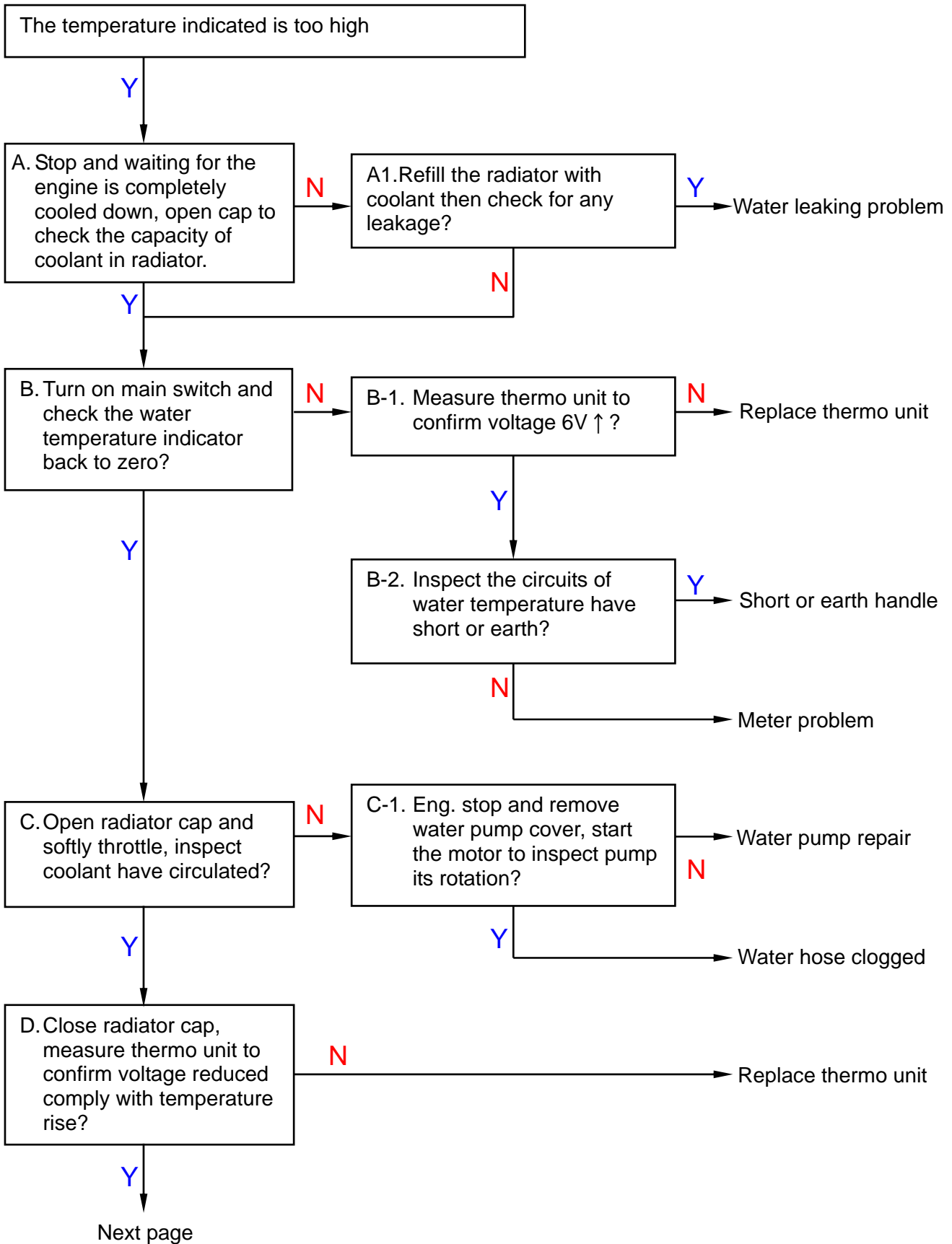
#### The engine temperature is too low

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

#### Coolant is leaking

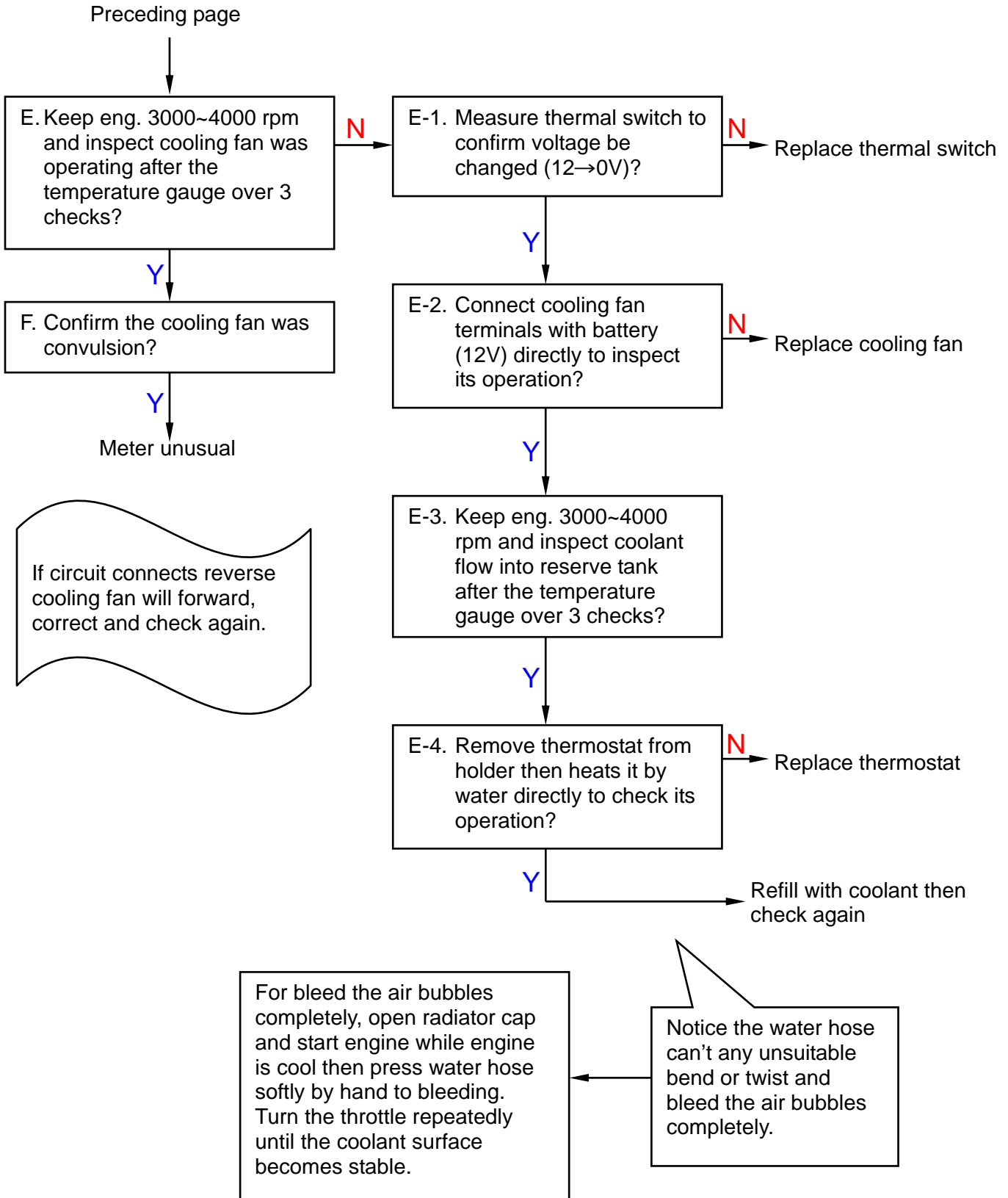
- The water pump mechanical seal does not function properly.
- The O ring is deteriorated.
- The water hose is broken or aged

Diagnosis for Cooling System





# 12. Cooling System

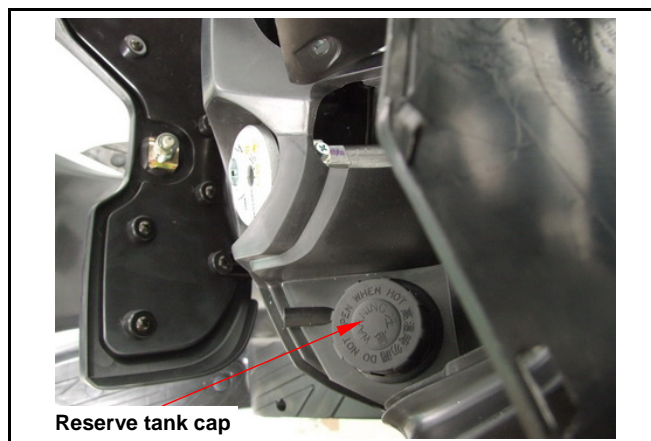


## Change of Coolant

### Warning

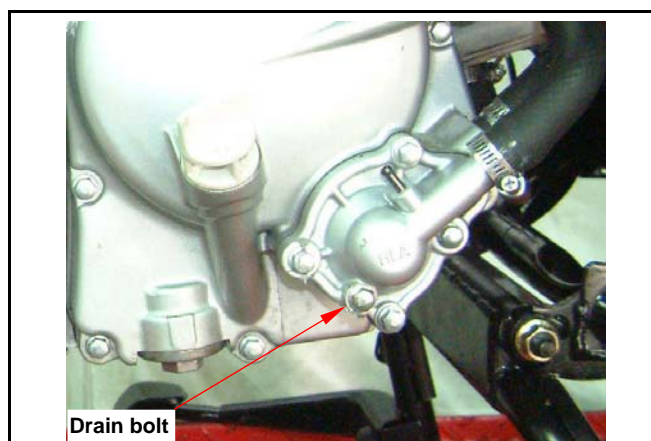
- Never attempt to carry out service work on the cooling system unless the engine is completely cooled down, otherwise, you may get scalded.

Remove the reserve 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.



Refilling system with coolant and bleeding the air bubbles.

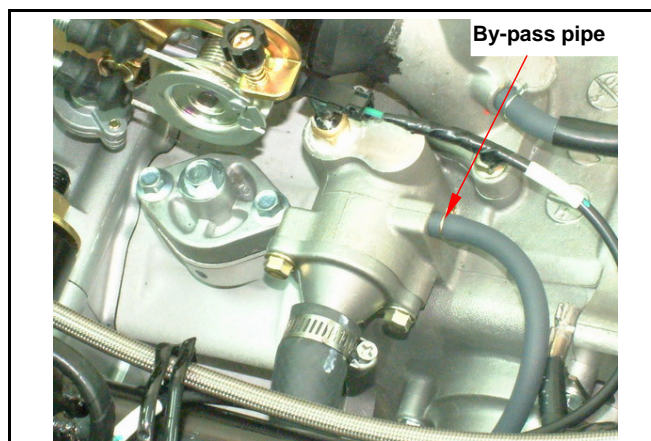
- Run the engine, and remove by-pass pipe.
- Check by-pass hole whether has the air bubble to emit.
- If emits without the air bubble, only has the coolant to flow out, then backflow pipe joint on, engine flameout.
- Remove radiator filler cap.
- Starts the engine, inspects does not have the air bubble in the radiator coolant, also the coolant liquid level is stable.
- Stop the engine. Add coolant to proper level if necessary.
- Screw and tighten up the radiator filler cap.

### Caution

- In order to avoid the water tank rusting, please do not use the unclear trade mark refrigerant.

Coolant recommended: SYM Bramax radiator agent.

Concentration: 50%



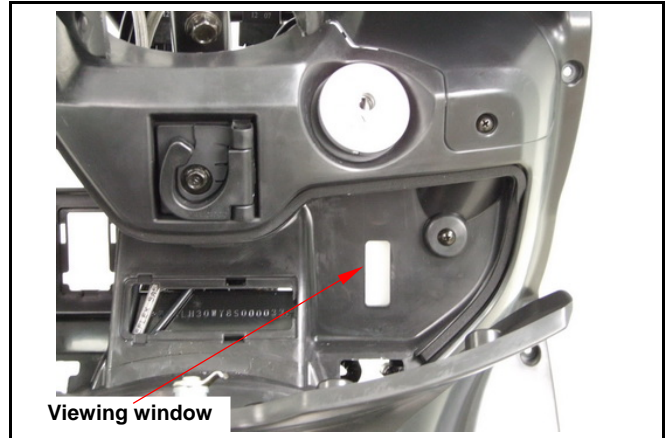
## 12. Cooling System

### Check reserve tank

- Open the inner box lid.
- Check the liquid level in the reservoir.
- Add coolant to proper level if too low.

### Caution

- The reserve tank liquid level too high, after avoids the water temperature elevating, in the cooling system the refrigerant backflow floods.



## Radiator

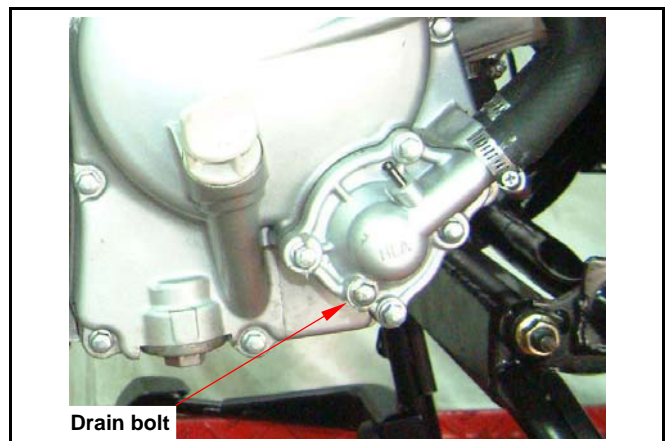
### Check

Check for any leakage from weld seam. Blow radiator clean using compressed air. If the radiator is blocked by dirt, use low pressure water jet to clean it. Care shall be taken when straightening the sink fan.



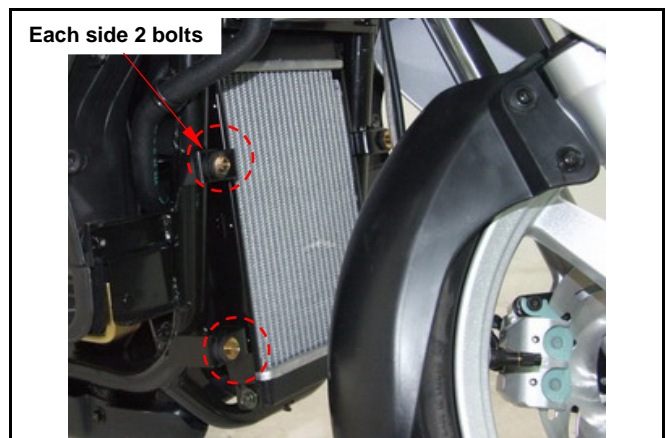
### Remove

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



Remove the front cover and under spoiler (refer chapter 12).

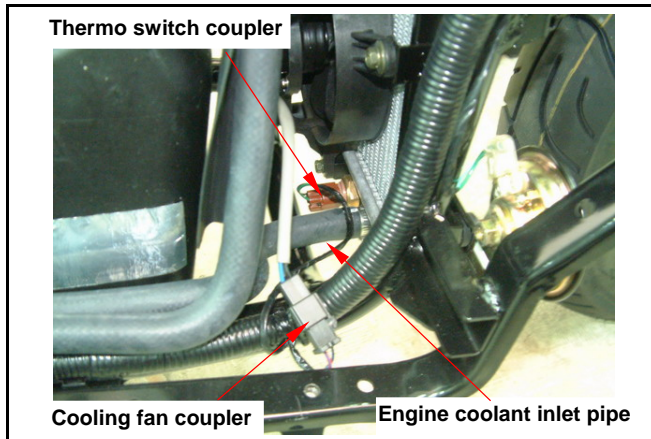
Loosen the radiator mounting bolts (4 bolts).



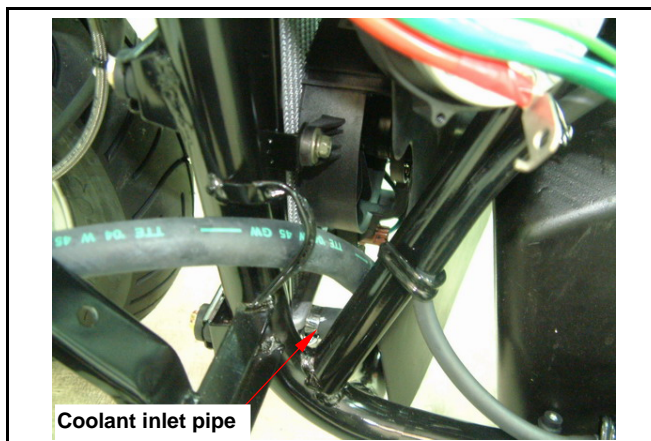


Disconnect the couplers for the thermo switch and fan motor.

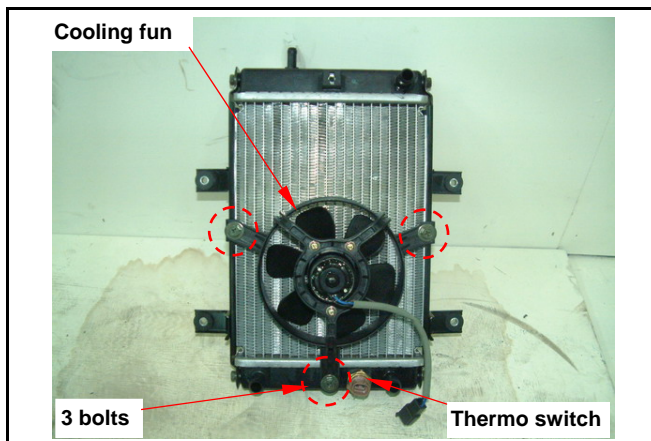
Remove engine coolant inlet pipe, reserve tank inlet pipe and radiator inlet pipe.



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



Loosen the cooling fan mounting bolts (3 bolts).  
Remove thermo switch.



### Installation

Install the removed parts in the reverse order of removal.

Install radiator in the reverse order of removal.

Upon completion, check for any leakage.

### Caution

- Liquid packing must be applied to the thermo switch before installing to avoid damaging the radiator.





## 12. Cooling System

### Water Pump

#### Check water pump seal / cooling system divulges inspection

- Disassembles the refrigerant drain bolt, overflows little buckles the N actually fluid, confirmed overflows the refrigerant whether has the greasy dirt.
- Turns on lathe the engine oil gauge rule, the inspection engine oil whether does have bleaches situation of the emulsified.

If has the above two kind of interior to divulge the phenomenon, possibly for the water pump inner two seal damages, the engine cooling system damages or the cylinder and the cylinder head gasket damages, please first dismantles the right crank case to say A confirms the replacement water pump seal, if does not have the question to take apart for overhaul cooling system of system again the cylinder head, the cylinder.

#### Removal of water pump

Loosen the drain bolt to drain out the coolant.  
Remove the water hose.

Loosen 4 bolts and remove the pump cover.  
Loosen 10 bolts and remove the engine right cover.

Take off the gasket and dowel pins.

Turn pump rotor clockwise and remove.

#### Caution

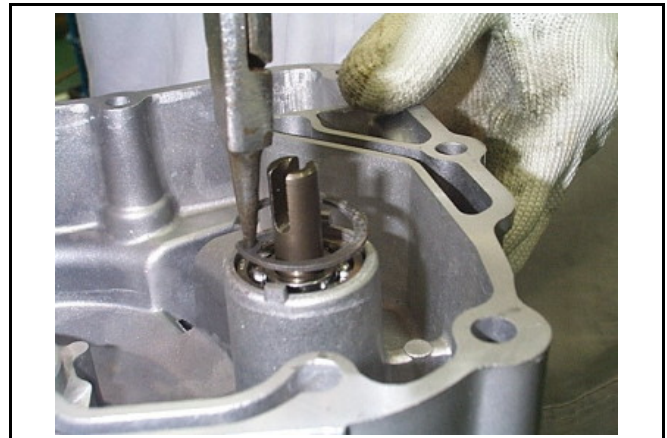
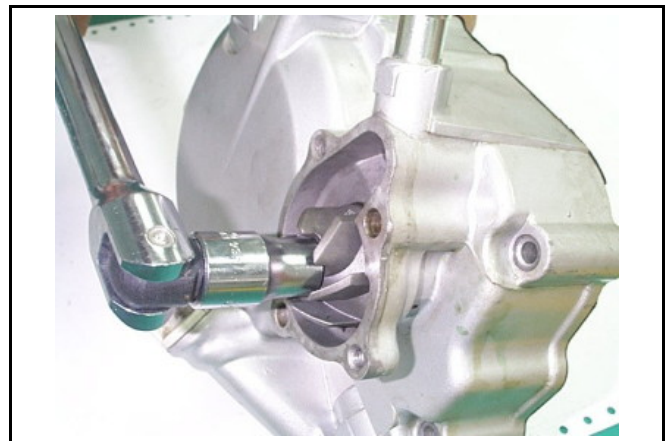
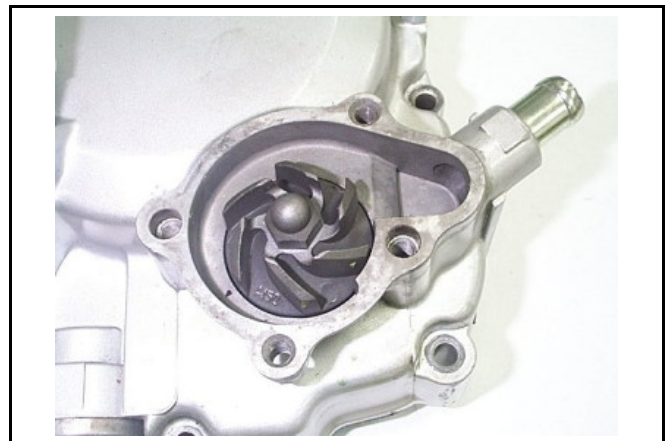
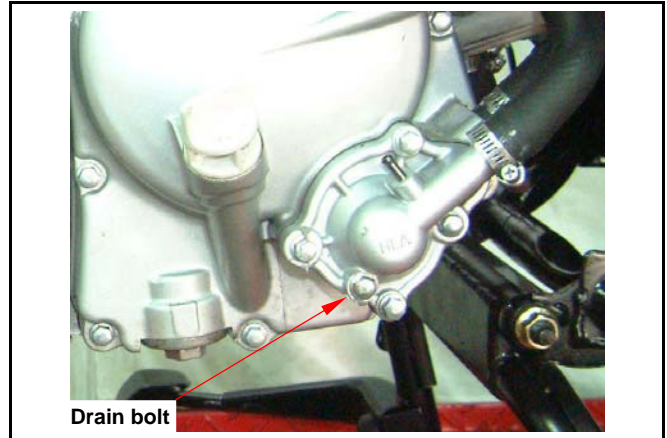
- The rotor is provided with left turn thread.

Remove the cir clip from the right crankcase cover.  
Remove the water pump shaft and the inner bearing.

Remove the outside bearing by inner bearing puller.

Rotate the inner ring of bearing, the bearing shall move smoothly and quietly.

If the bearing does not rotate smoothly or produces a noise, replace it with new one.



Check any wear and damage of the mechanical seal and inside seal.

**⚠ Caution**

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

**Replacement of Mechanical Seal**

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

**Special tools:**

**Inner bearing puller**

**Water pump bearing drive**

**⚠ Caution**

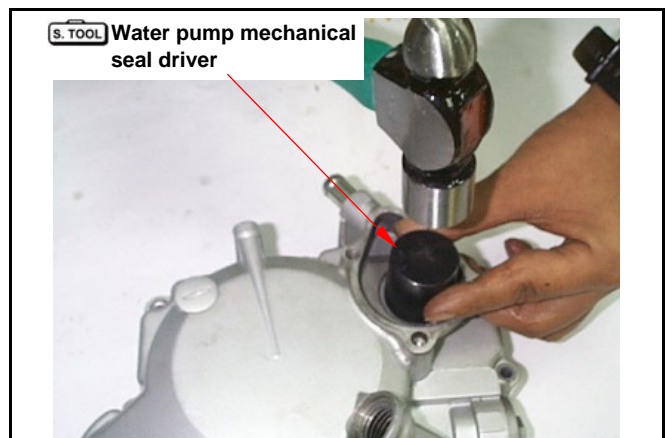
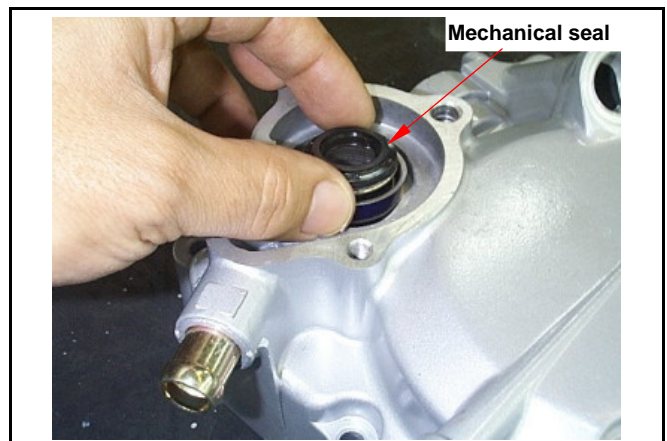
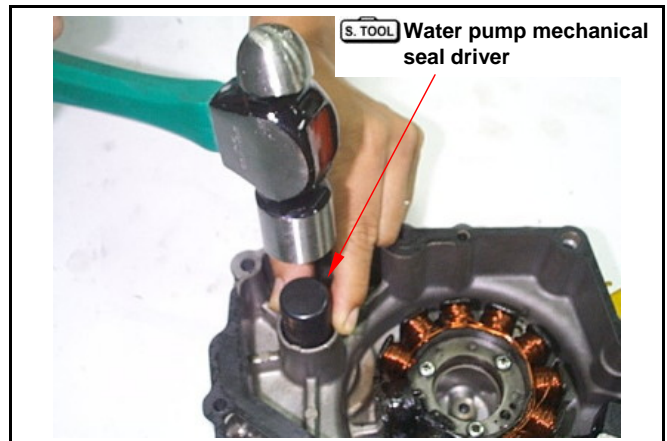
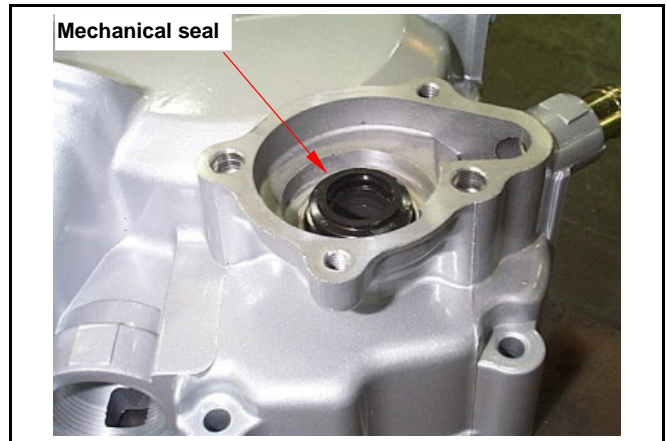
- Replace a new mechanical seal after removing it.

Apply a coat of sealant to the mating surfaces of the right crankcase before installing the new mechanical seal.

Install the mechanical seal onto the right crankcase.

**Special tools:**

**Water pump mechanical seal driver**





## 12. Cooling System

Install the new inner seal onto the right crankcase.

**Special tools:**

**Water pump oil seal driver (inner)**



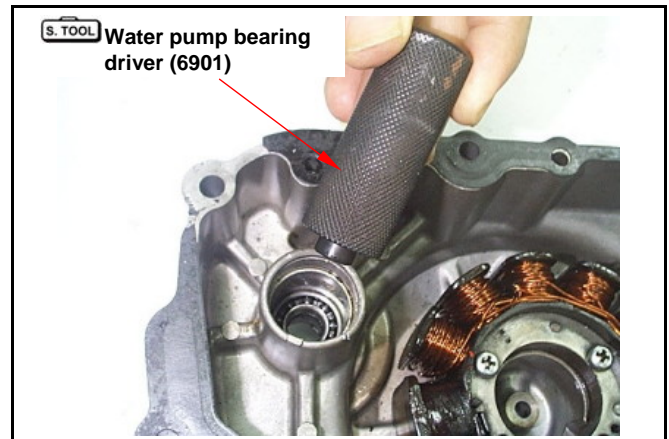
Install a new outside bearing to the right crankcase cover.

**Special tools:**

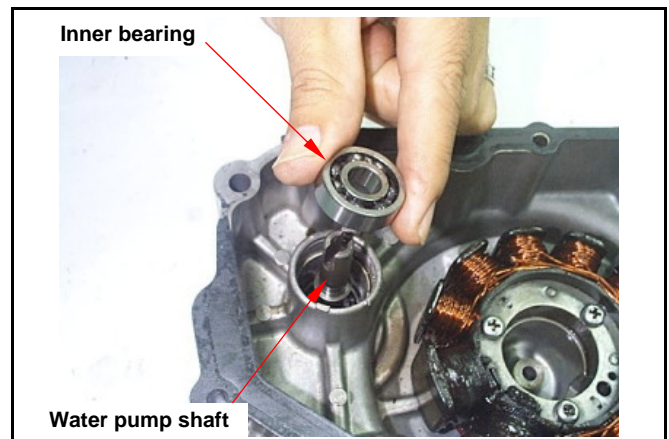
**Water pump bearing driver (6901)**

**⚠ Caution**

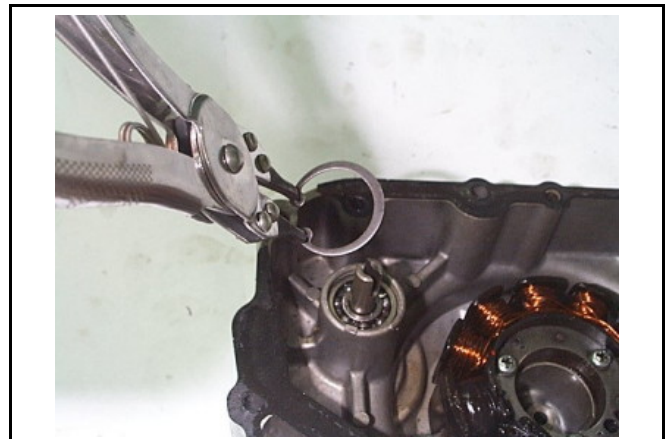
- Do not reuse old bearing. It must be replaced with a new one once it has been removed.



Mount the water pump shaft and the inner bearing to the right crankcase cover.



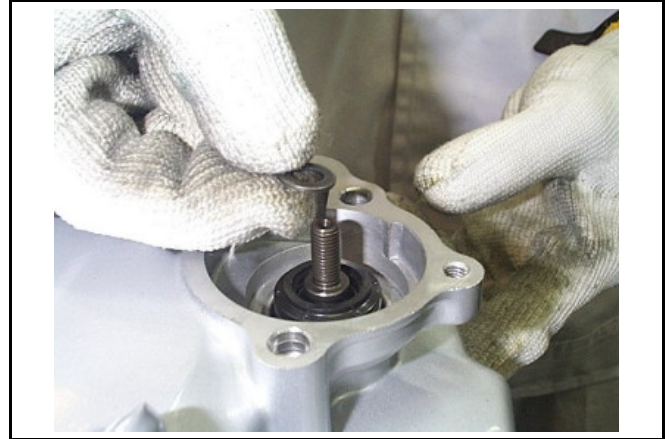
Install the cir clip to hold the inner bearing.



Install the seal washer into the rotor.

**⚠ Caution**

- Washer must be replaced together with the mechanical seal.

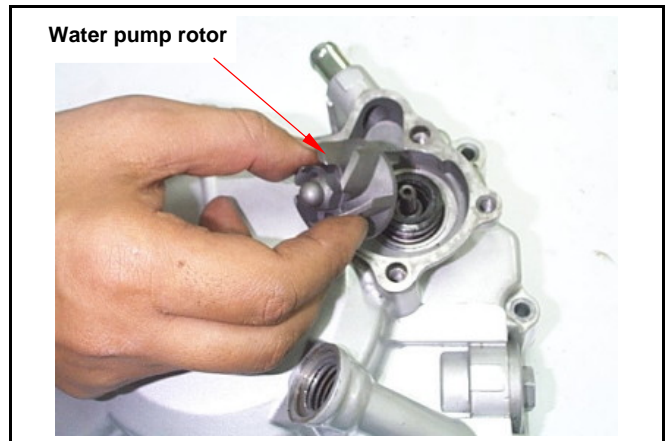


Install the rotor onto the water pump shaft and tighten.

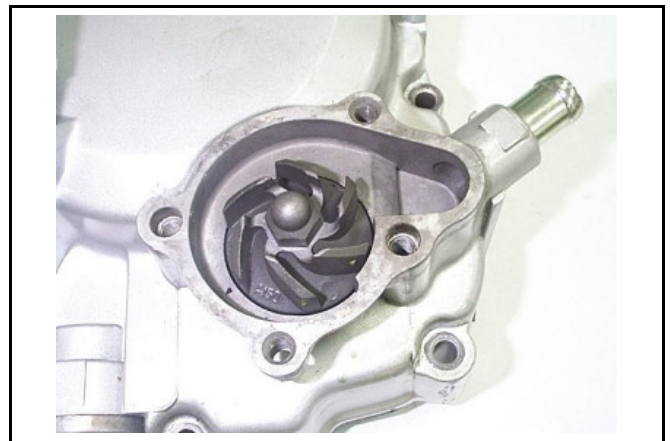
**Torque Value: 1.0~1.4kgf-m**

**⚠ Caution**

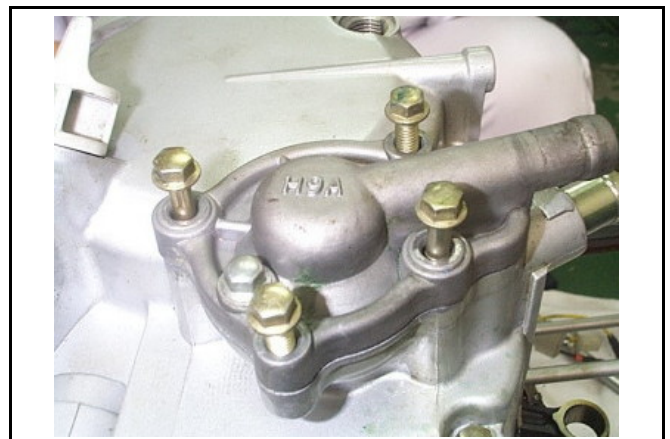
- The rotor is left thread.



Install the dowel pin and right cover gasket.  
The rotation water pump rotor, causes the water pump drive shaft scoop channel, aligns the oil pump drive shaft flange, install the right crank case. (10 bolts)



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





## 12. Cooling System

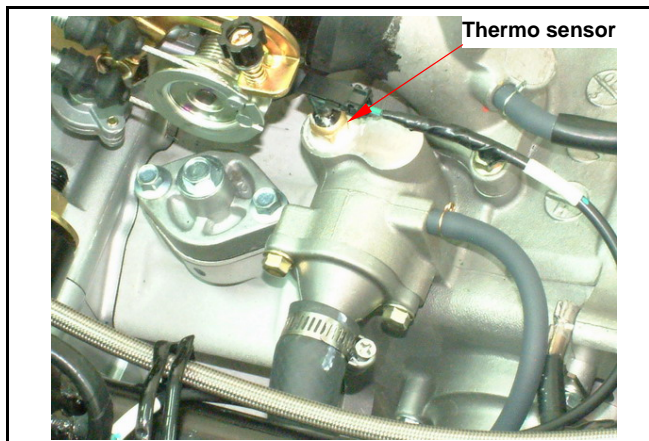


### Thermostat

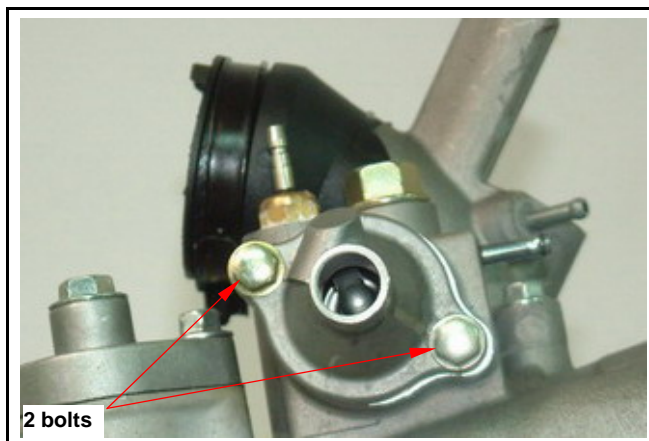
Please refer to chapter 17 for inspection of thermo unit.

### Removal

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



Remove the thermostat cover. (2 bolts)



Remove the thermostat.



### Inspection

Visually inspect thermostat for any damage.



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**

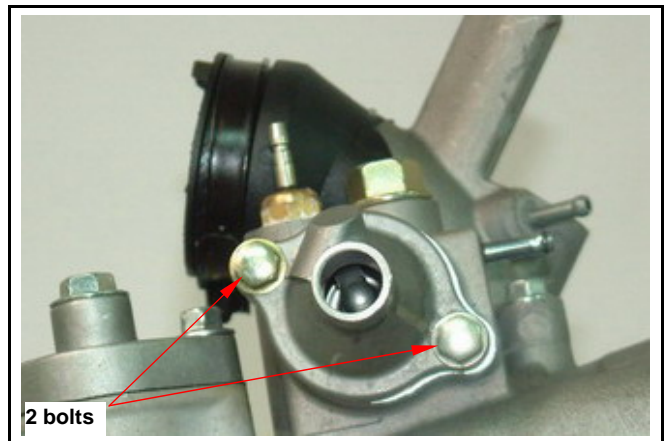
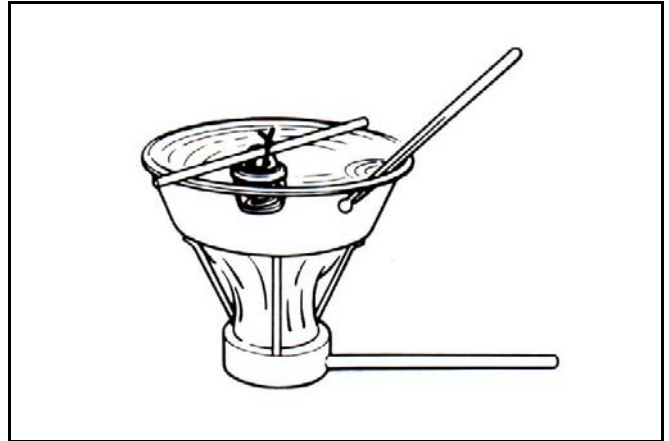
Valve begins to open	82~95°C
Valve stroke	0.05 ~ 3mm

**Installation**

Install the thermostat.

Install the thermostat cover. (2 bolts)

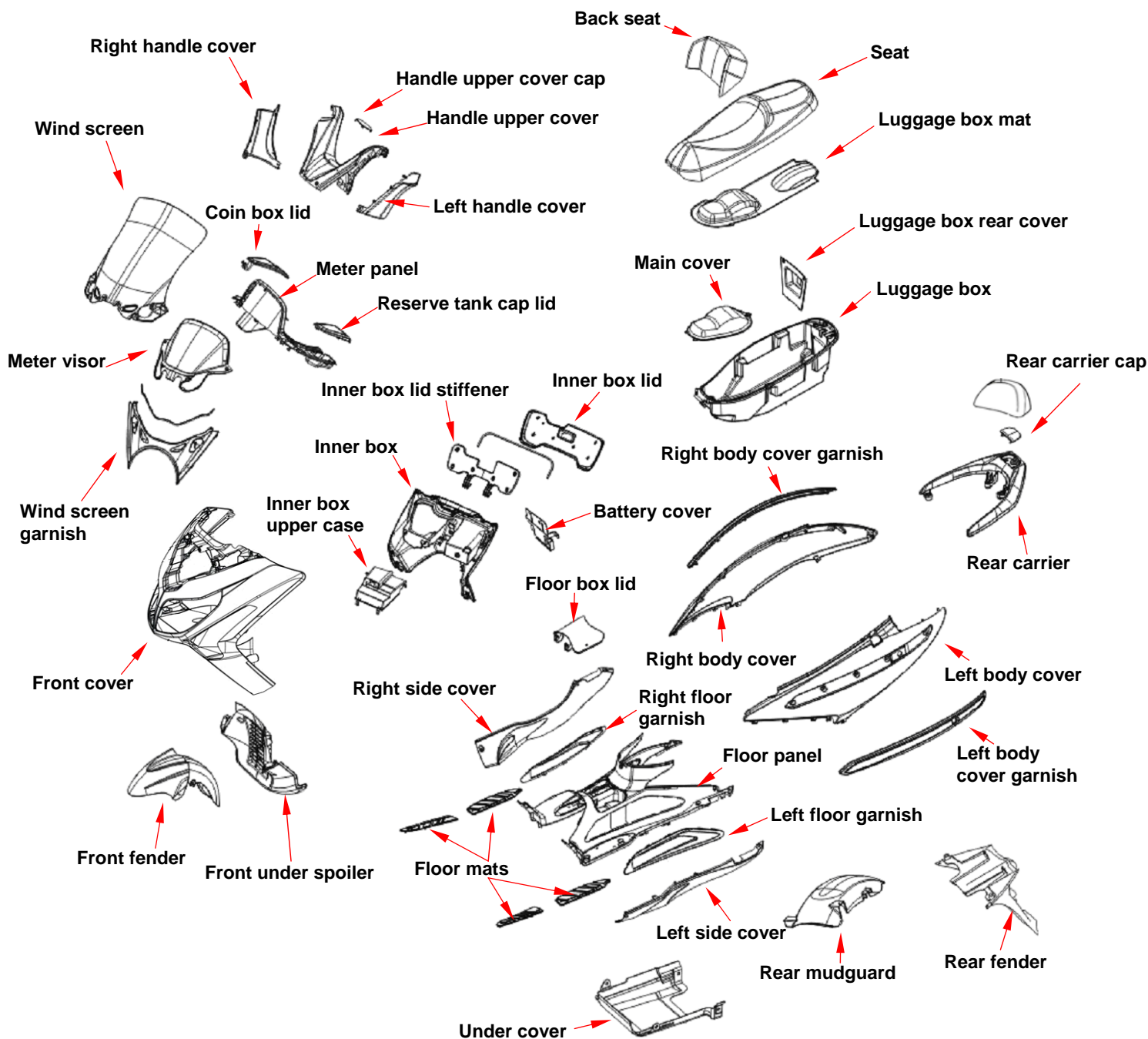
Refill the coolant and bleed out the air bubble (Page 12-5).



Notes:

Mechanism Diagram.....	13-1	Front Under Spoiler .....	13-10
Maintenance.....	13-2	Rear Carrier .....	13-10
Handle Cover.....	13-3	Luggage Box .....	13-11
Front Cover .....	13-4	Rear Body Cover .....	13-12
Meter Panel.....	13-6	Floor Panel .....	13-13
Inner Box .....	13-7	Front Fender.....	13-13
Side Cover .....	13-9	Rear Fender .....	13-14

Mechanism Diagram

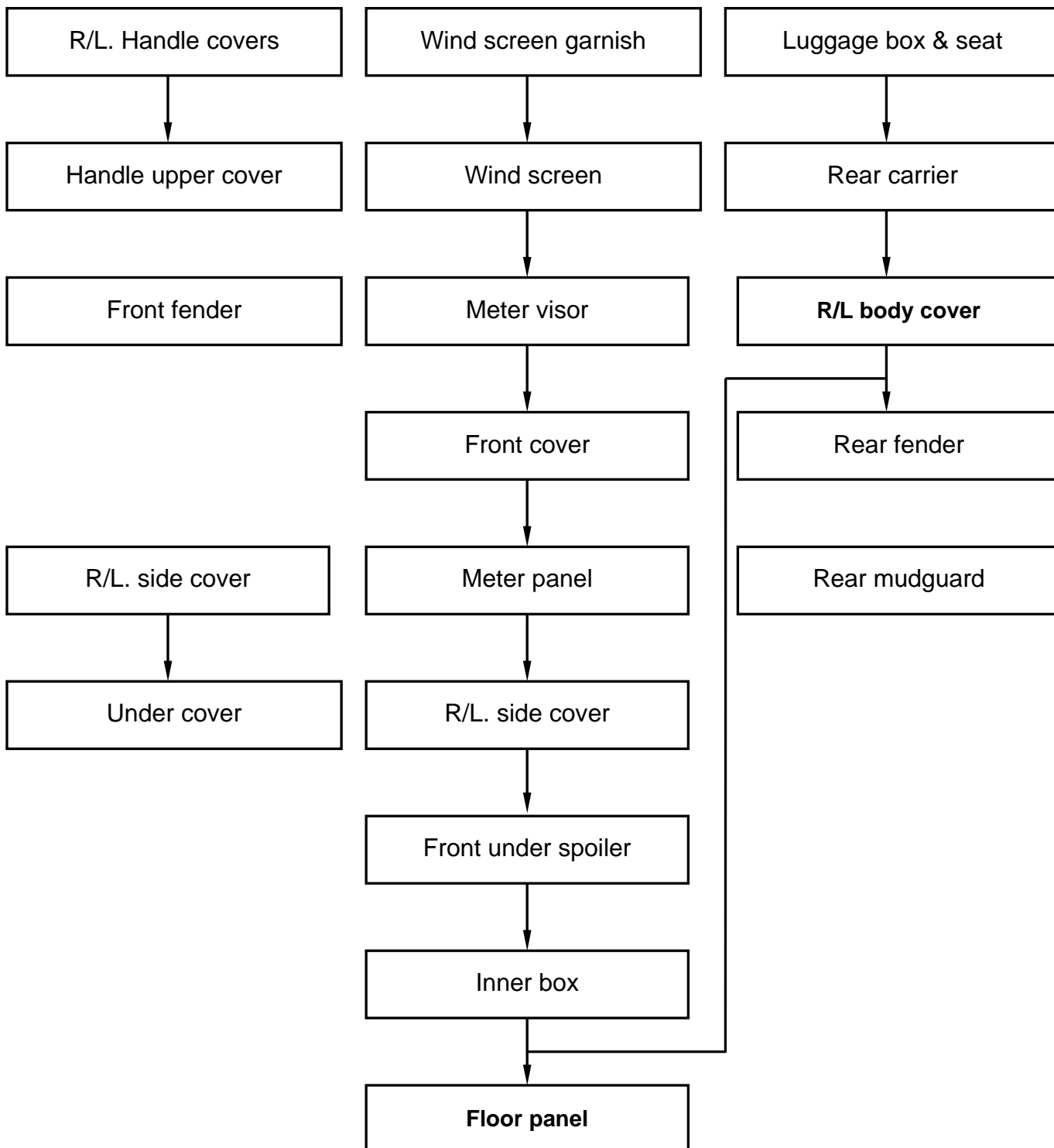




# 13. Body Cover

## Maintenance

Body covers disassemble sequence:

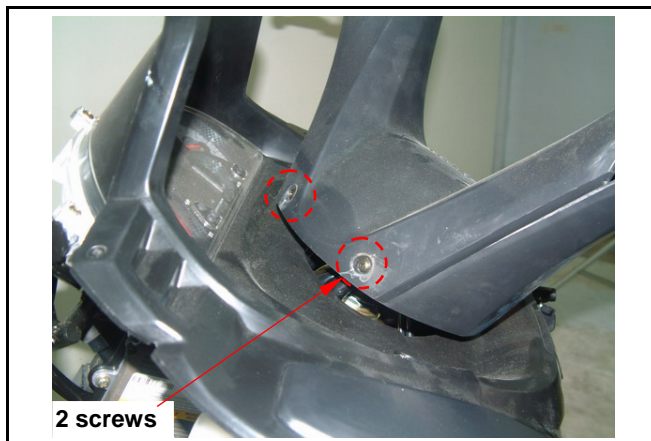


- Be careful not to damage various covers in assembly or disassembly operation.
- Never injure hooks molded on the body covers.
- Align the buckles on the guards with slot on the covers.
- Make sure that each hook is properly installed during the assembly.
- Never compact forcefully or hammer the guard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

### Handle Cover

#### Remove

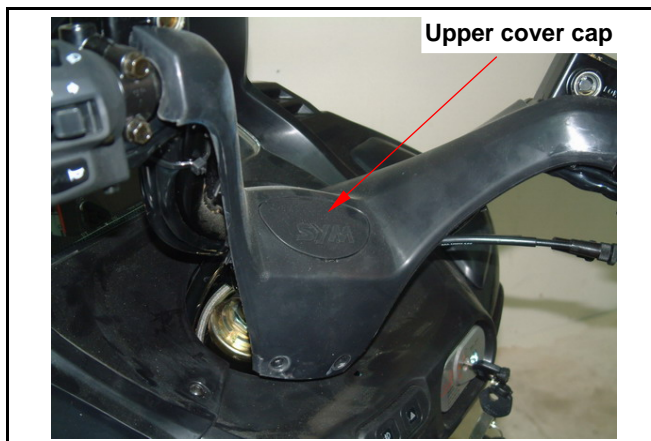
Loosen the 2 screws from handle upper cover front end.



Loosen the 2 screws from handle upper cover rear end.  
Remove right and left handle side cover.



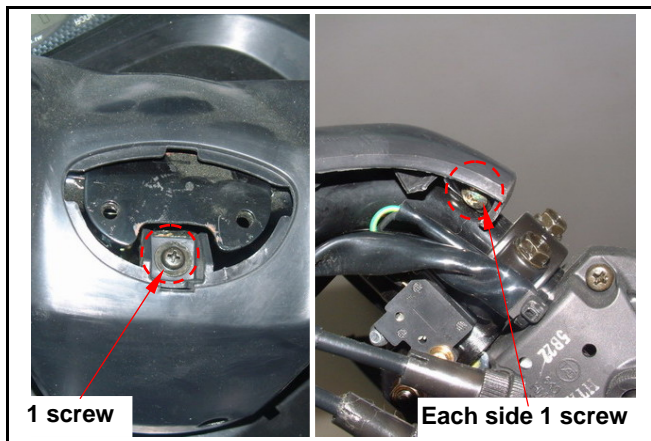
Remove the handle upper cover cap.



Loosen the 3 screws from the handle upper cover, and then remove handle upper cover.

#### Installation

Install in reverse order of removal procedures.

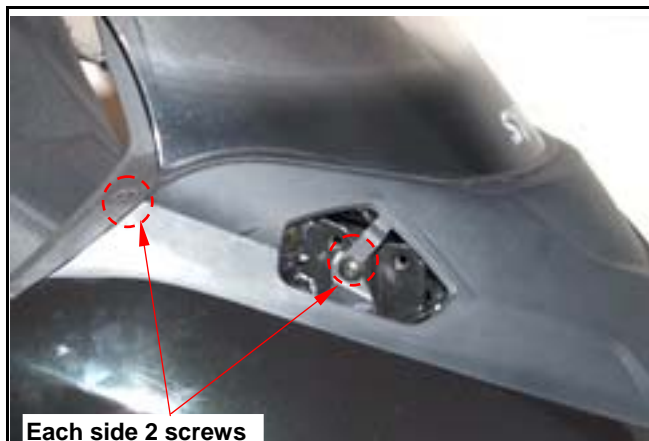


# 13. Body Cover

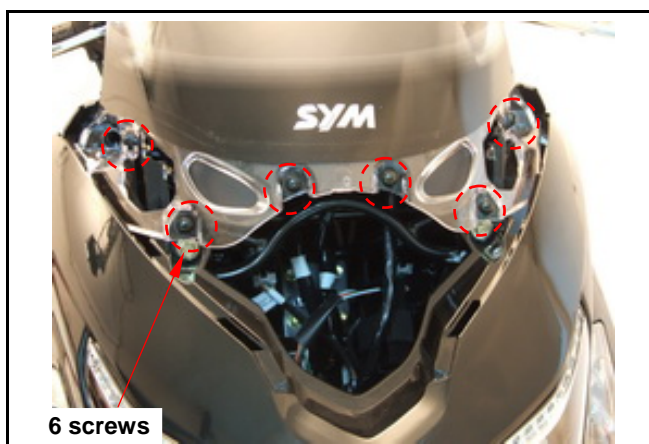
## Front Cover

### Remove

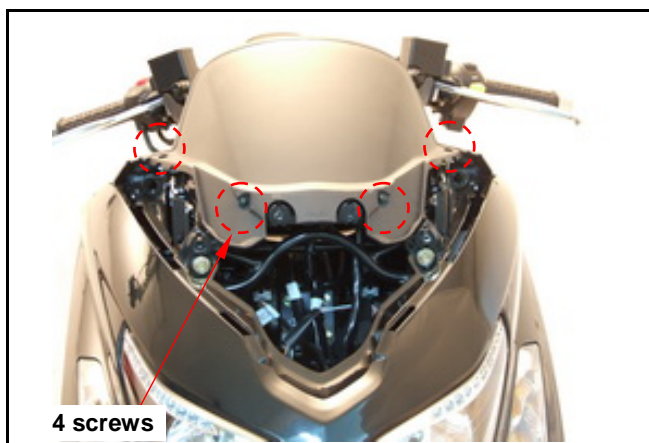
Loosen 4 screws from the wind screen garnish and remove the wind screen garnish.



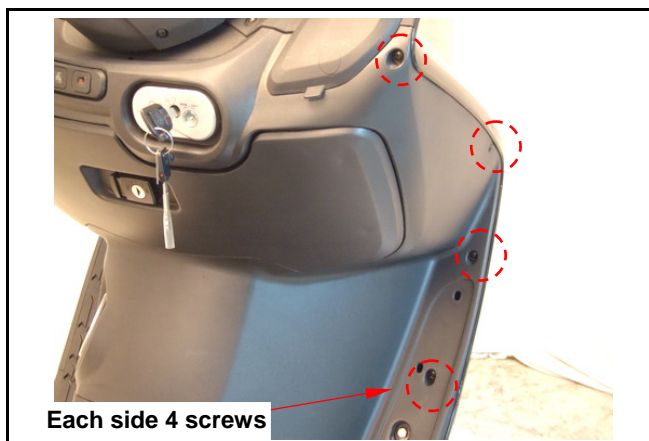
Loosen 6 screws from the wind screen and remove the wind screen.



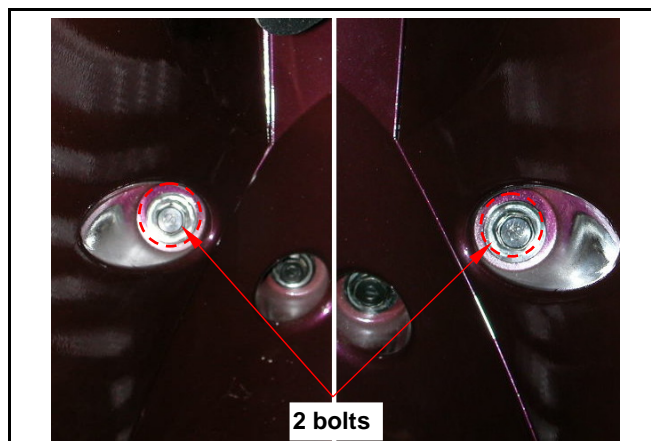
Loosen 4 screws from the meter visor and remove the meter visor.



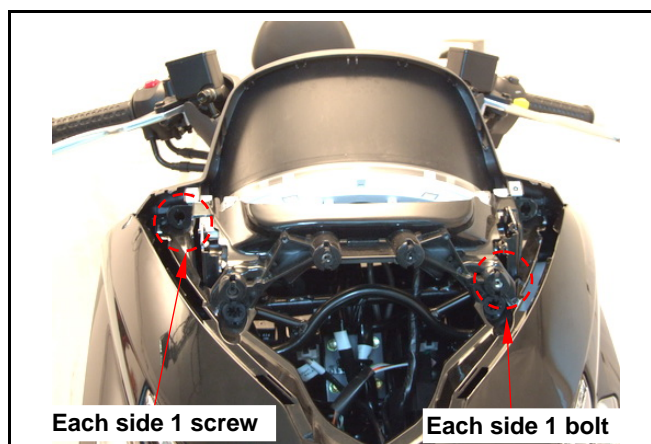
Loosen 8 screws from the inner box.



Loosen 2 bolts from the front cover under side.



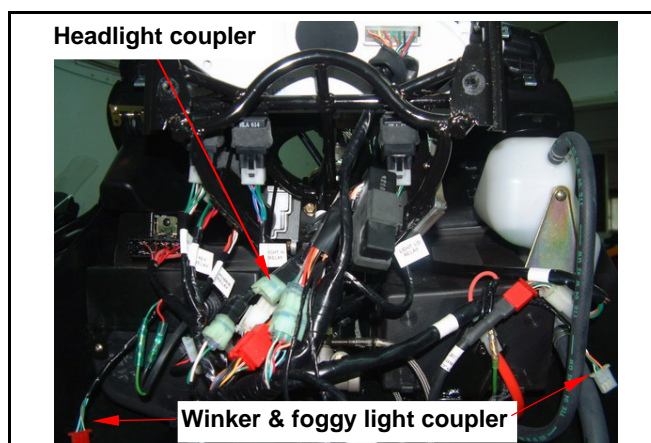
Loosen 2 screws and 2 bolts from the front cover upper side.



Disconnect the headlight, foggy light and winker light couplers.  
Remove the front cover.

### Installation

Install in reverse order of removal procedures.





# 13. Body Cover

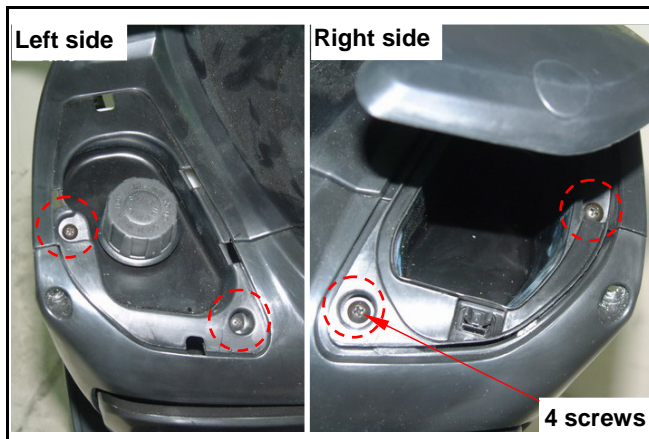
## Meter Panel

### Remove

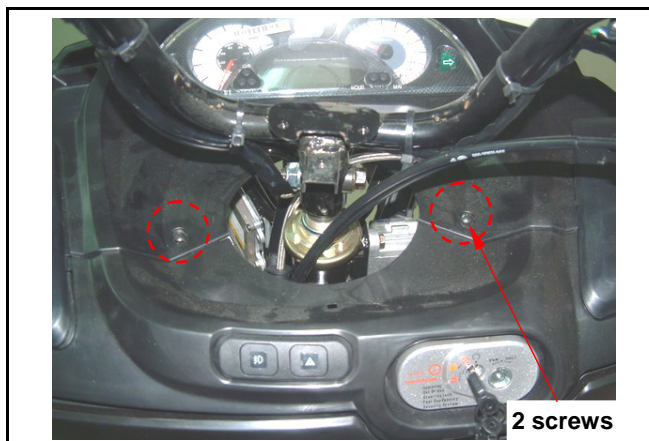
Remove wind screen garnish, wind screen, meter visor and front cover.

Remove reserve tank cap.

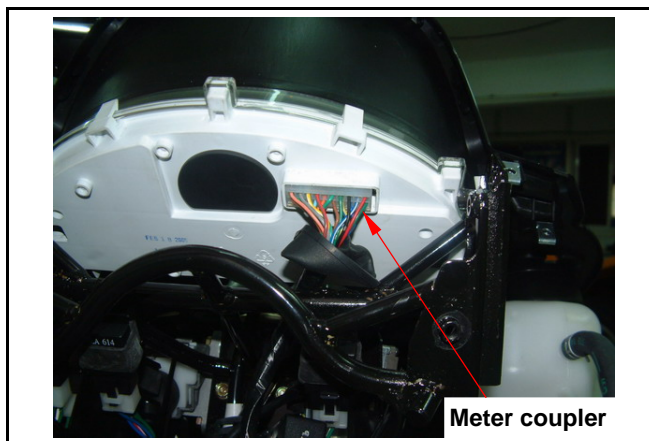
Loosen 4 screws from right & left side of the meter panel.



Loosen 2 screws from in side of meter panel.



Loosen the meter cord coupler.



Remove the meter panel.

### Installation

Install in reverse order of removal procedures.

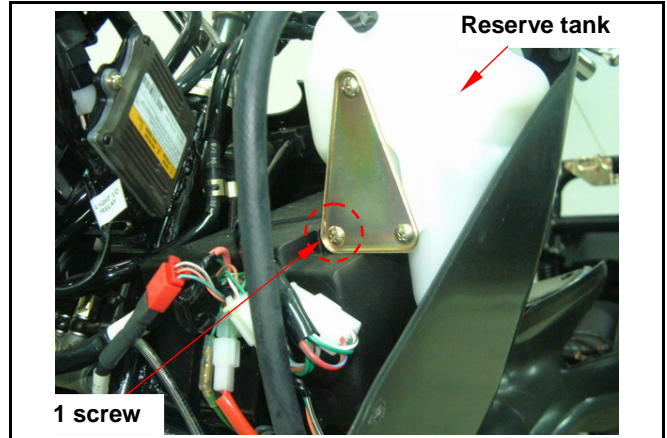


## Inner Box

### Remove

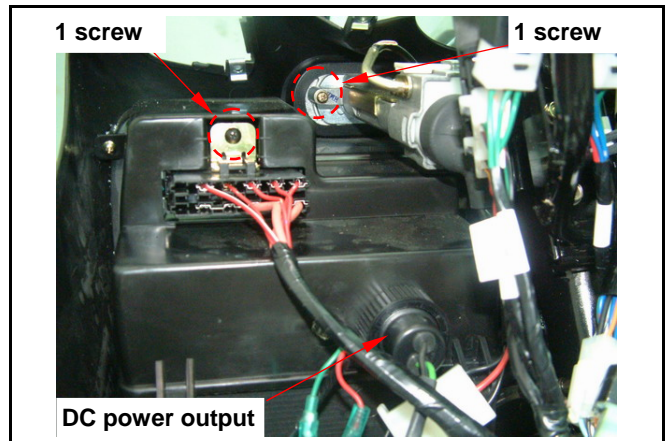
Remove wind screen garnish, wind screen, meter visor, front cover, meter panel, R/L side cover and front under spoiler.

Loosen 1 screw from reserve tank stay.



Loosen 1 screw from fuse box and remove it.  
Loosen 1 screw from main switch cap and remove the cap.

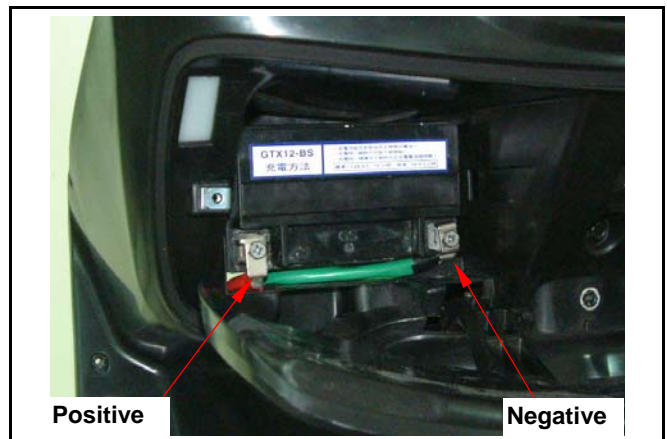
Loosen DC power output mounting nut, and remove DC power output.



Loosen 1 screw from battery cover and remove it.



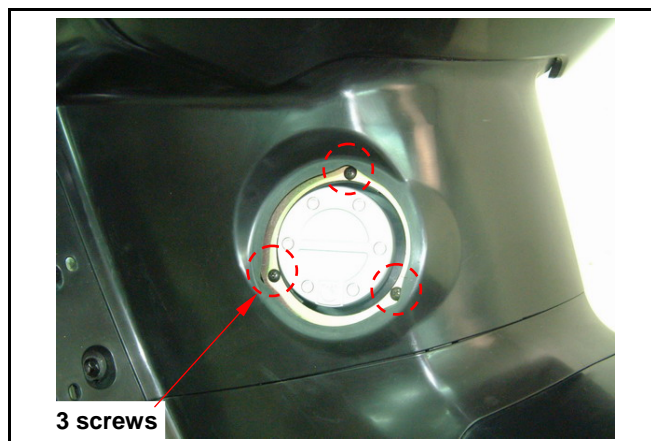
Remove the battery negative (-) cable.  
Remove the battery positive (+) cable.  
Remove the battery.



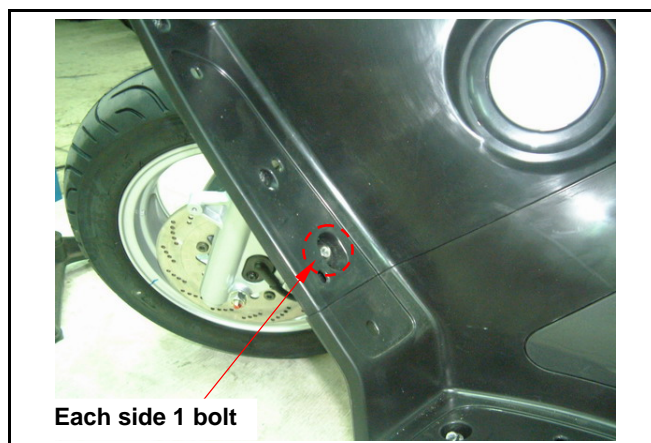


## 13. Body Cover

Remove the filler pipe cover.  
Loosen 3 screws of the filler pipe.



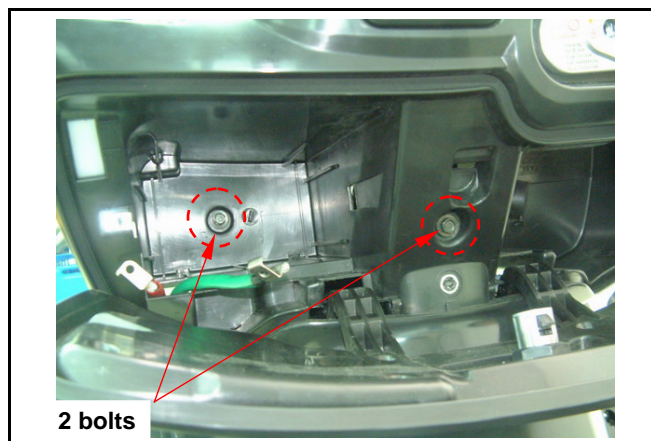
Loosen 2 bolts from inner box under side.



Loosen 2 bolts from inside of the inner box.  
Disconnect the hazard light and foggy light switch couplers.  
Remove inner box.

### Installation

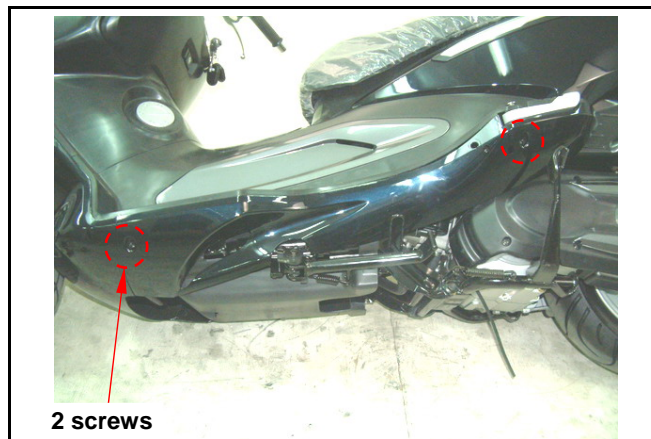
Install in reverse order of removal procedures.



## Side Cover

### Remove

Loosen 2 screws from the side cover side end.



Loosen 2 screws from the side cover upper end.



Remove the side cover.

### Installation

Install in reverse order of removal procedures.





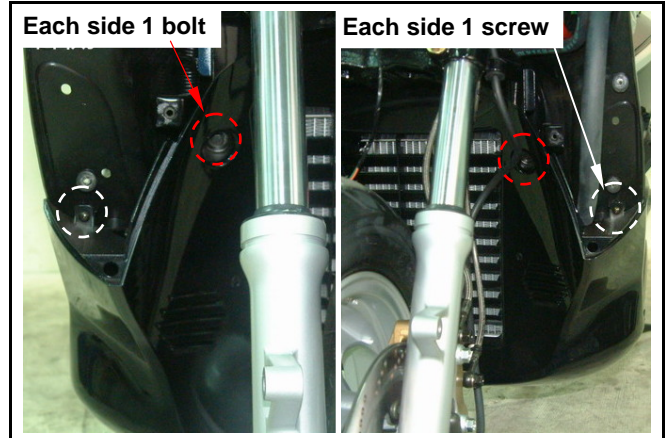
## 13. Body Cover

### Front Under Spoiler

#### Remove

Remove wind screen garnish, wind screen, meter visor, front cover and R/L side cover.

Loosen 2 screw and 2 bolts from the front under spoiler upper end.



Remove the front spoiler.

#### Installation

Install in reverse order of removal procedures.



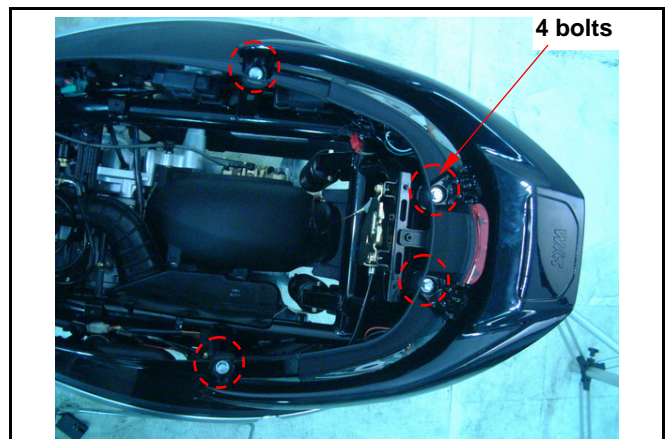
### Rear Carrier

#### Remove

Loosen 4 bolts from the rear carrier and remove it.

#### Installation

Install in reverse order of removal procedures.



## Luggage Box

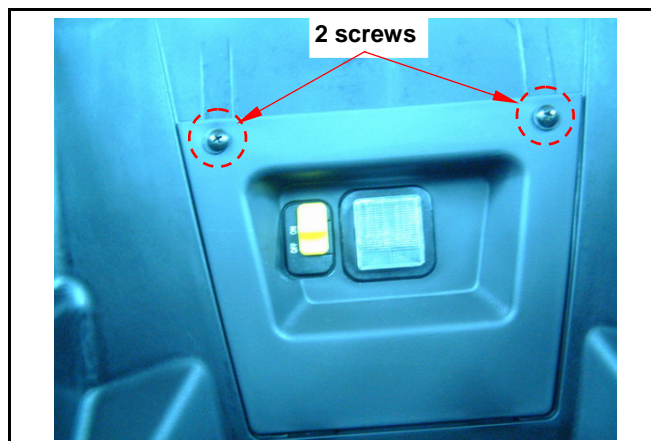
### Remove

Open the seat.

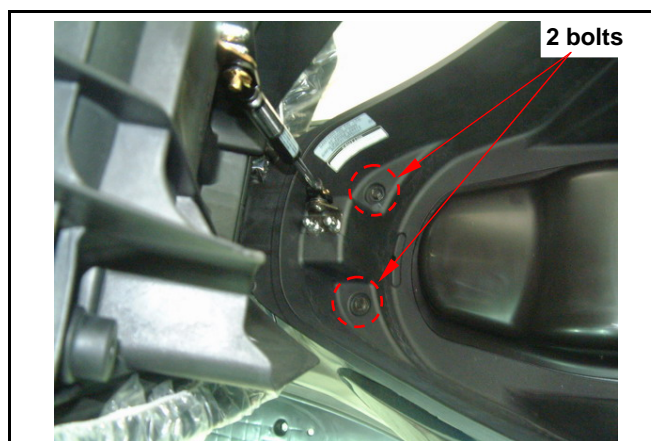
Loosen 2 screws from the luggage box rear cover.

Disconnect the luggage box light and switch coupler.

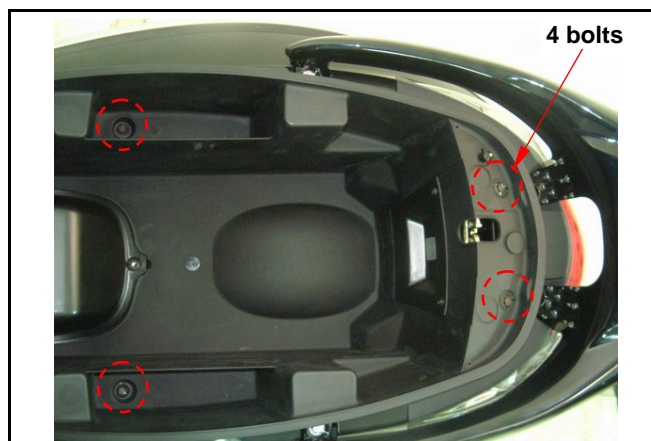
Remove the luggage box rear cover.



Loosen 2 bolts from luggage box front side



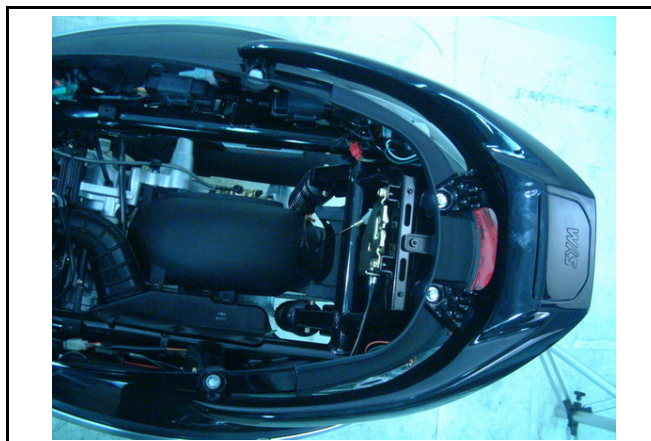
Loosen 4 bolts from luggage box rear side.



Remove the luggage box.

### Installation

Install in reverse order of removal procedures.





## 13. Body Cover

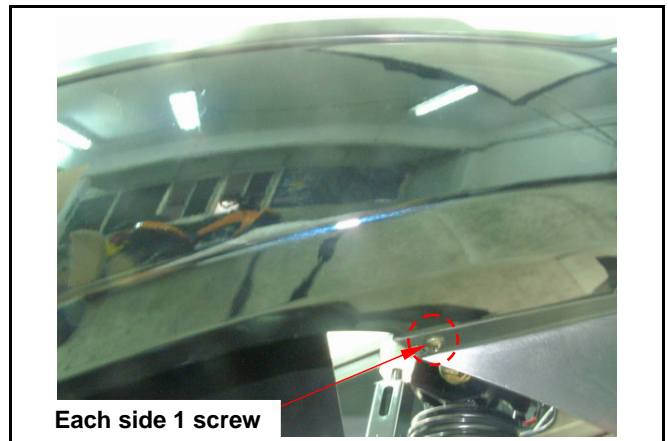
### Rear Body Cover

#### Remove

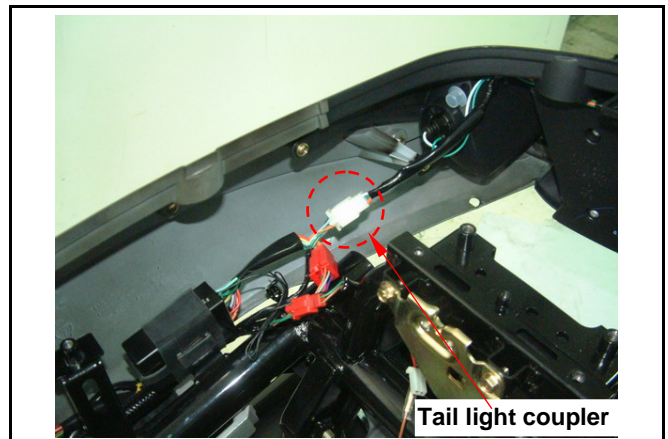
Loosen right and left side screws from rear end of floor panel.



Loosen right and left side screws from rear side of the body cover.



Disconnect the tail light coupler.



Remove the body cover.

#### Installation

Install in reverse order of removal procedures.

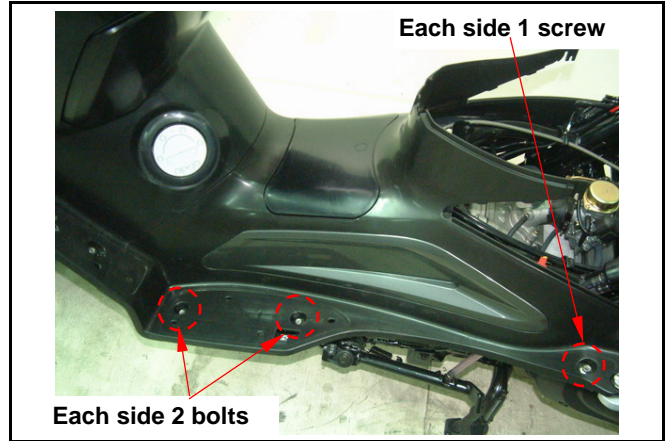




### Floor Panel

#### Remove

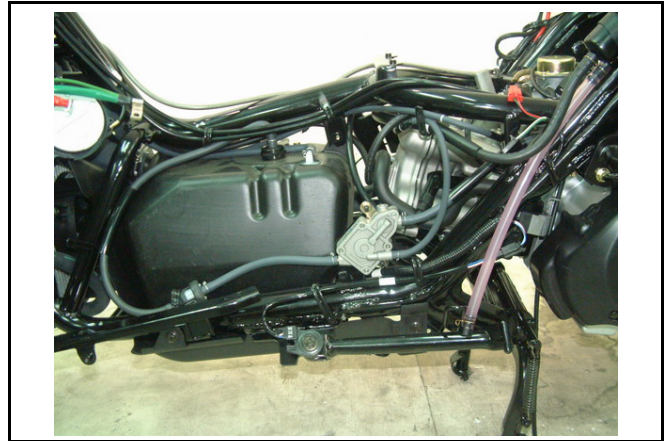
Remove wind screen garnish, wind screen, meter visor, front cover, R/L side cover, front under spoiler, inner box, luggage box and body cover. Loosen 4 bolts and 2 screws from floor panel.



Remove floor panel.

#### Installation

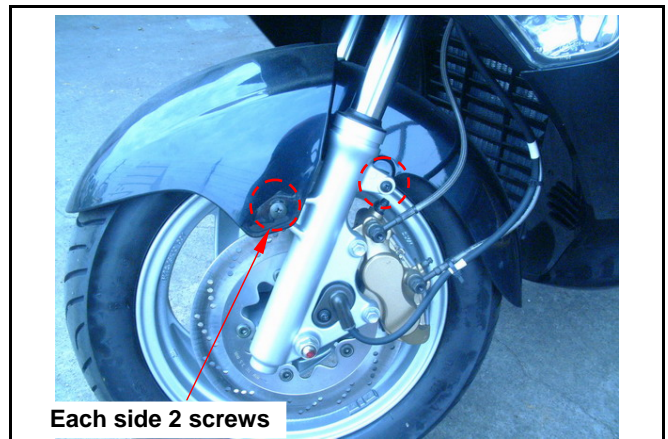
Install in reverse order of removal procedures.



### Front Fender

#### Remove

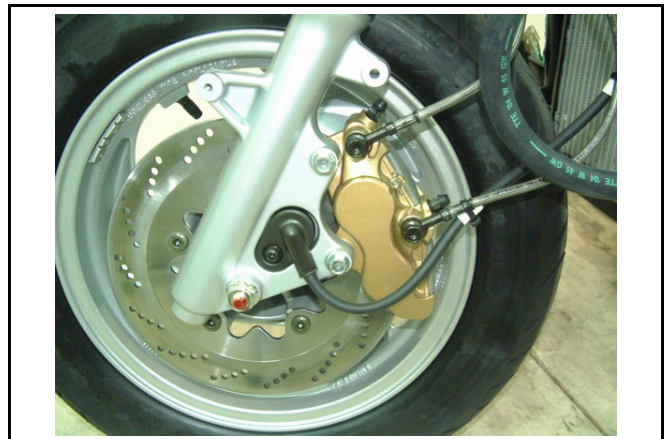
Loosen 4 screws from front cushion.



Remove the front fender.

#### Installation

Install in reverse order of removal procedures.

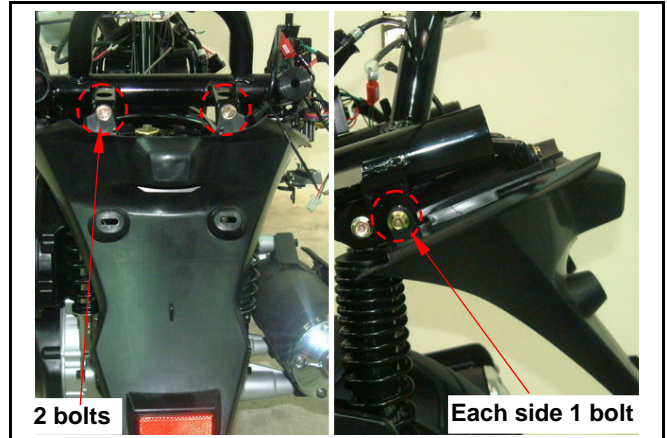




## 13. Body Cover

### Rear Fender

Loosen 4 bolts from rear fender.



Remove the rear fender.

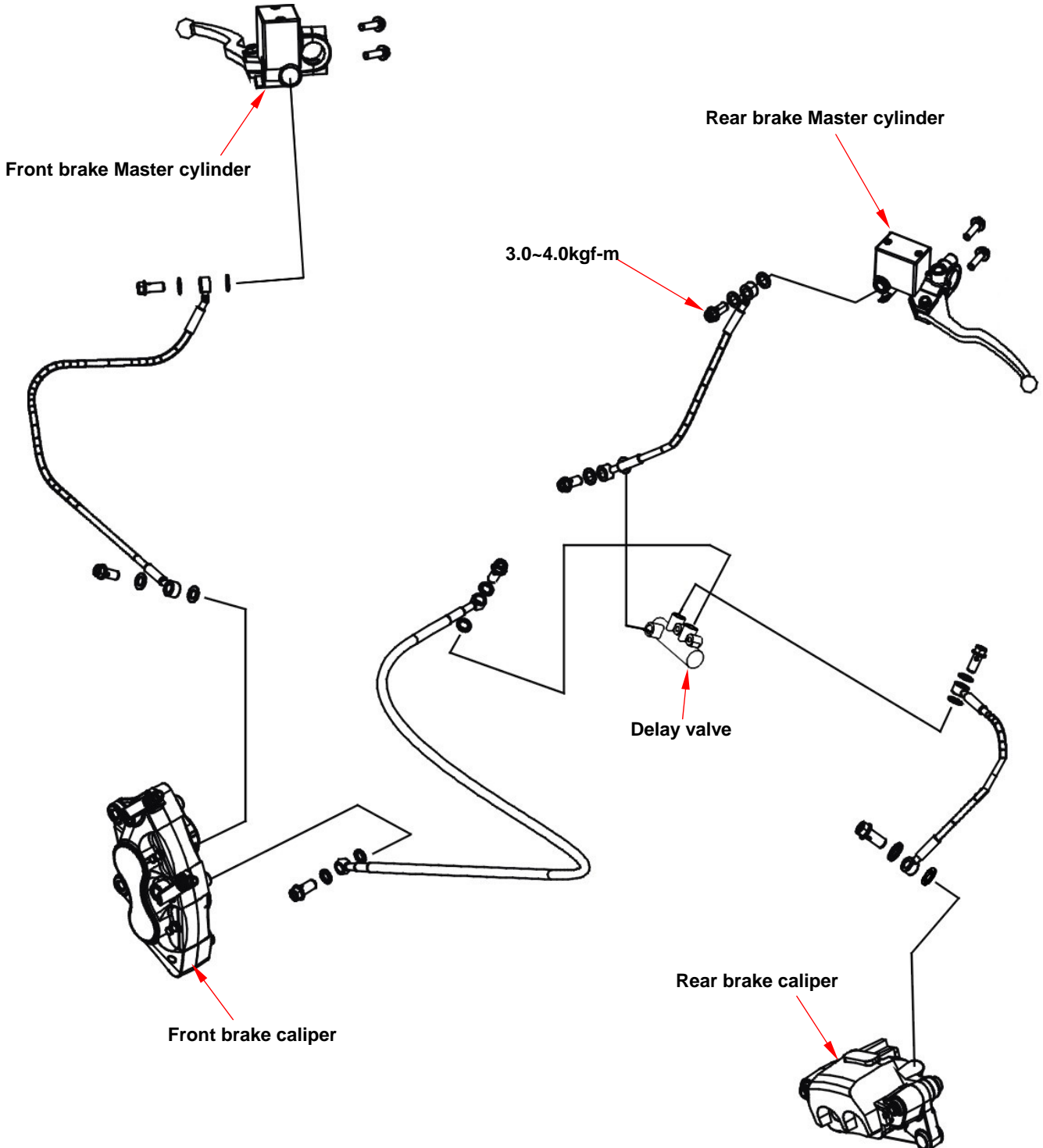
### Installation

Install in reverse order of removal procedures.



Mechanism Diagram.....	14-1	Brake Fluid Replacement / Air-bleed..	14-6
Precautions in Operation.....	14-2	Front Brake Caliper.....	14-7
Troubleshooting .....	14-3	Rear Brake Caliper.....	14-8
Disk Brake System Inspection.....	14-4	Brake Disk .....	14-9
Adding Brake Fluid.....	14-5	Master Cylinder .....	14-9

### Mechanism Diagram



## 14. Brake System

### Precautions in Operation

#### Caution

- Inhaling asbestos may cause disorders of respiration system or cancer, therefore, never use air hose 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 felt to be too soft, bleed the hydraulic system.
- While refilling brake fluid, care should be taken not to let the foreign material entering into the brake system.
- Do not spill brake fluid on the painted surfaces, plastic or rubber parts to avoid damage.
- Check the operation of the brake system before riding.

### Specifications

unit: mm

Item	Standard	Limit
The thickness of front brake disk	4.000	2.500
The thickness of rear brake disk	5.000	3.500
Front and rear brake disk eccentricity	< 0.100	0.300
Front brake master cylinder inner diameter	11.000~11.043	11.055
Front brake master cylinder piston outer diameter	10.957~10.984	10.945
Rear brake master cylinder inner diameter	14.000~14.043	14.055
Rear brake master cylinder piston outer diameter	13.957~13.984	13.945
Diameter of front disk	240.000	—
Diameter of rear disk	220.000	—
Thickness of front brake lining	5.000	2.000
Thickness of rear brake lining	6.000	2.000

### Torque values:

Brake hose bolts	3.0~4.0kgf-m
Bolt for front brake caliper	2.9~3.5kgf-m
Brake lever nut	0.8~1.0kgf-m
Air-bleed valve	0.8~1.0kgf-m

## Troubleshooting

### Soft brake lever

1. Air inside the hydraulic system
2. Hydraulic system leaking
3. Worn master piston
4. Worn brake pad
5. Poor brake caliper
6. Worn brake lining/disk
7. Low brake fluid
8. Blocked brake hose
9. Warp/bent brake disk
10. Bent brake lever

### Hard operation of brake lever

1. Blocked brake system
2. Poor brake caliper
3. Blocked brake pipe
4. Seized/worn master cylinder piston
5. Bent brake lever

### Uneven brake

1. Dirty brake lining/disk
2. Poor wheel alignment
3. Clogged brake hose
4. Deformed or warped brake disk
5. Restricted brake hose and fittings

### Tight brake

1. Dirty brake lining/disk
2. Poor wheel alignment
3. Deformed or warped brake disk

### Brake noise

1. Dirty lining
2. Deformed brake disk
3. Poor brake caliper installation
4. Imbalance brake disk or wheel

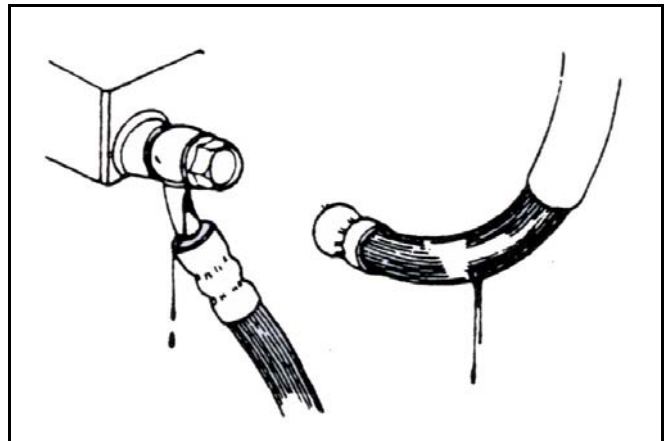


# 14. Brake System

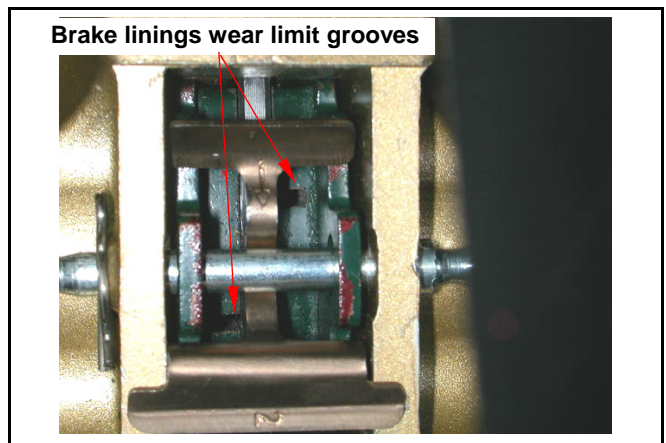
## Disk Brake System Inspection

### Inspection

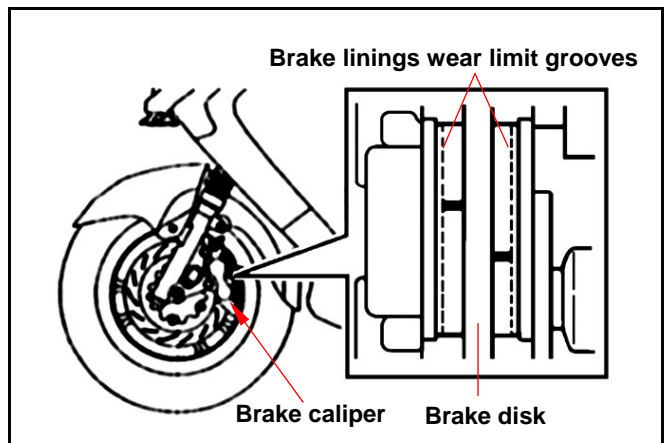
By visual examination whether divulges or the damage, with spanner inspection brake tube seam whether becomes less crowded, and the inspection handle bar turn right or turn left, or pressure the cushion, whether besides the pipeline protection department, whether there is interferes, contacts other parts of.



Remove the front brake pad cap.  
Check the brake from behind the brake caliper.



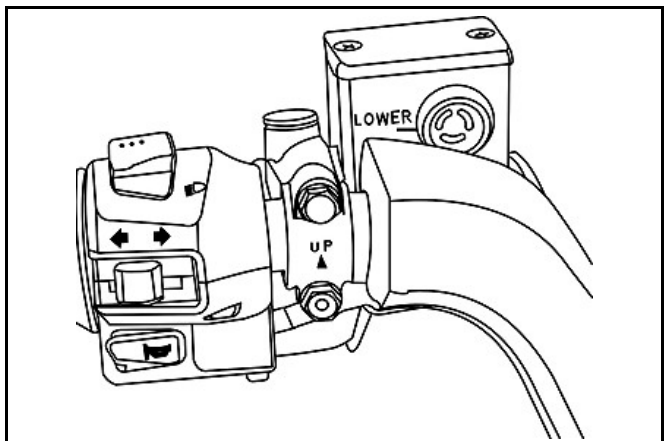
The brake pad must be replaced with new lining when the brake pad wear limit reaches the brake disk.



Park the motorcycle on a level ground, and check if fluid level is under the "LOWER" mark.  
Recommended Brake Fluid: WELL RUN BRAKE OIL (DOT 3).

### ⚠ Caution

- The vehicles inclined or just stop, the survey oil level could not be accurate, had to settle the 3~5 minute.
- In order to prevent has the chemical change, please do not use counterfeiting or other unclear trade marks brake fluid.
- Uses by all means must with the trade mark brake fluid, guarantees the ghost vehicle efficiency.



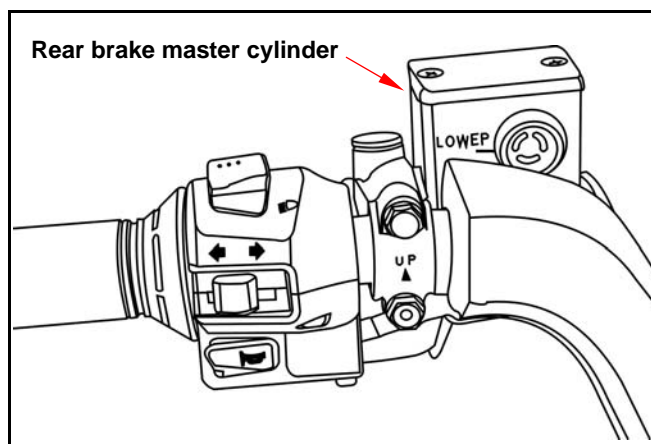
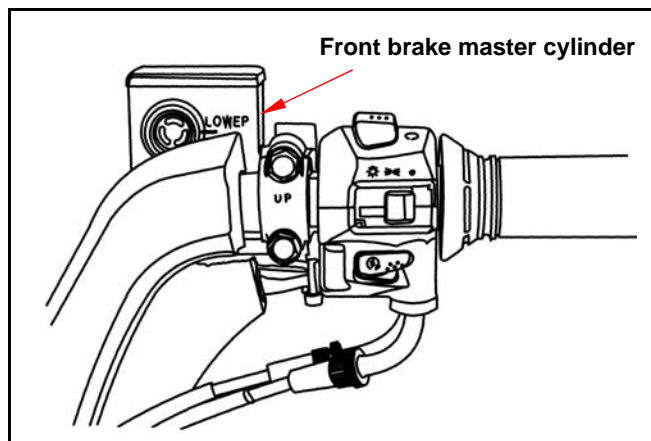
### Adding Brake Fluid

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

When maintenance brake system, will be supposed to paint the surface or the rubber parts catches up by the rags.

#### Caution

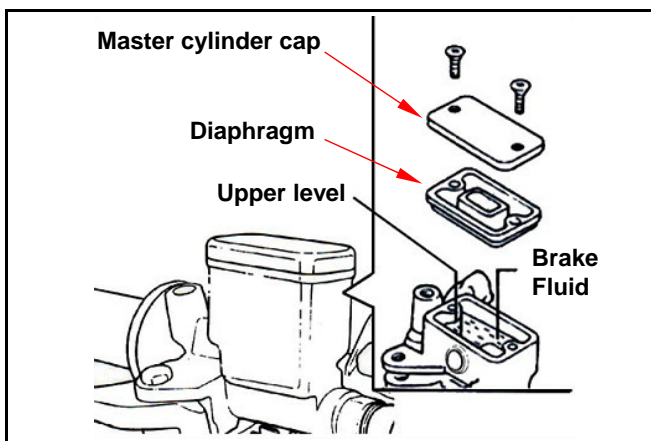
- Supplement brake fluid please do not surpass the upper limit, spilled brake fluid on painted surfaces, plastic or rubber components may result in their damages.



Remove the master cylinder cap and diaphragm. Increases the high quality brake fluid, uses by all means must with the trade mark brake fluid joins in the master cylinder. Clean the dirty brake disk.

#### Caution

- The dirty brake lining or disk will reduce the brake performance.
- To mixed non-compatible brake fluid will reduce brake performance.
- Foreign materials will block the system causing brake performance to be reduced or totally lost.



## 14. Brake System

### Brake Fluid Replacement / Air-bleed

Connect drain hose to air-bleed valve.

Open the drain valve on the calipers and delay valve the brake lever until the old brake fluid is entirely drained out.

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

#### Recommended brake fluid: WELLRUN DOT 3 brake fluid

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

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

Close the drain 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 described below:

1. Tightly hold the brake lever and open the drain valve around 1/4 turns, and then close the valve.

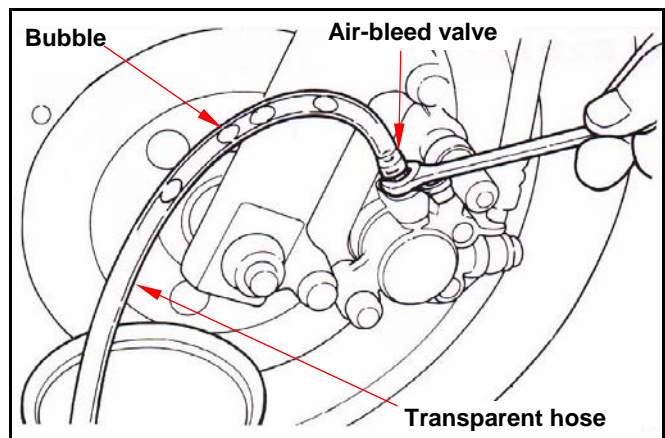
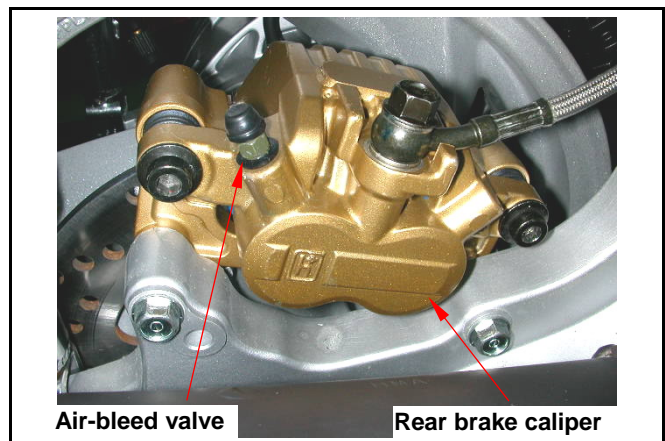
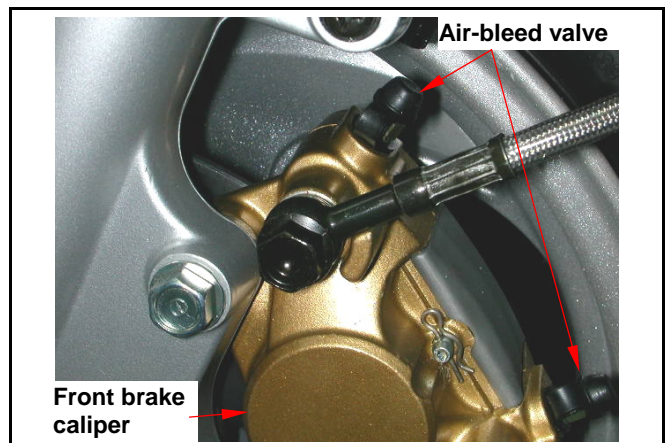
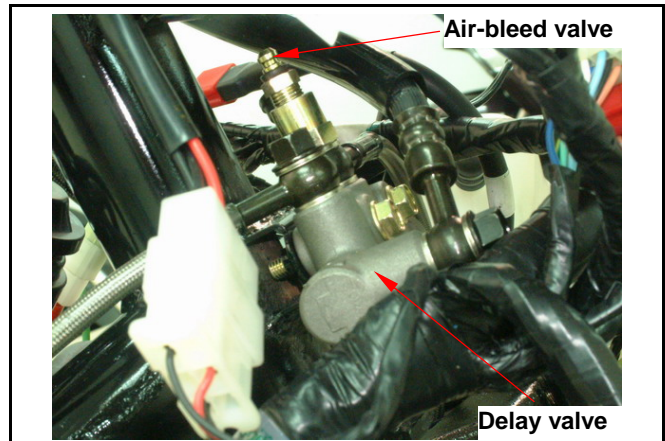
#### Caution

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

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

#### Caution

- Divulges the air to have to pump by the minute first divulges, then to caliper.
- May use fluid the replacement machine, the replacement fluid, the time is quicker, the air bubble also Compared with cannot remain





## Front Brake Caliper

### Removal

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

### ⚠ Caution

- Do not spill brake fluid on painted surfaces.

Remove two caliper mounting bolts and the caliper.

### Installation

Install the brake caliper and tighten the mounting bolts.

**Torque: 2.9~3.5kgf-m**

### ⚠ Caution

- Use M8 x 35 mm flange bolt only.
- Long bolt will impair 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 up the brake fluid to the reservoir and make necessary air bleeding.

### Brake pad replacement

Remove brake caliper.

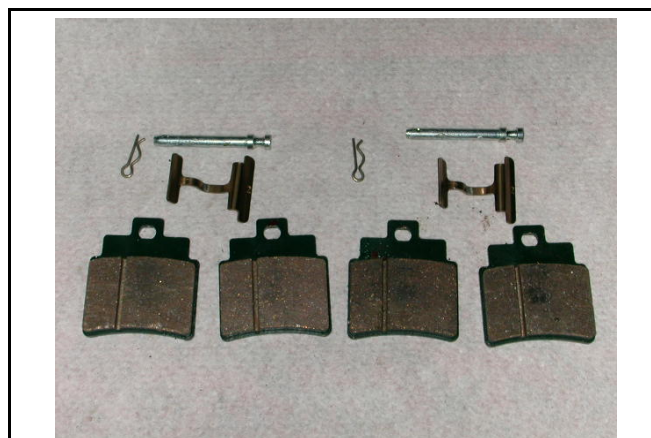
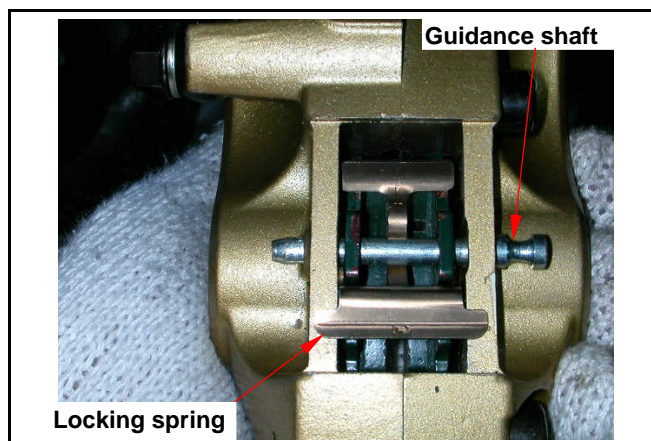
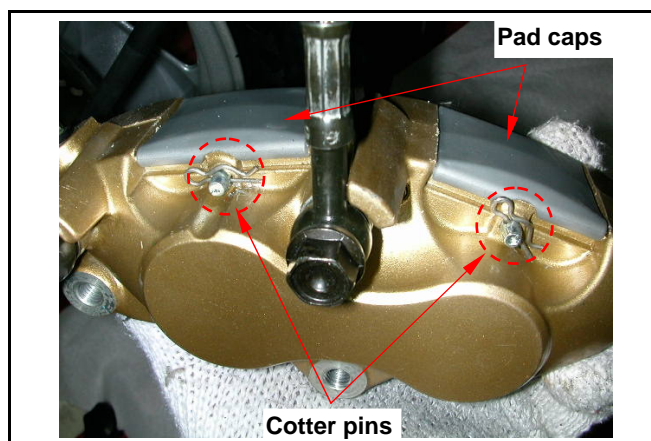
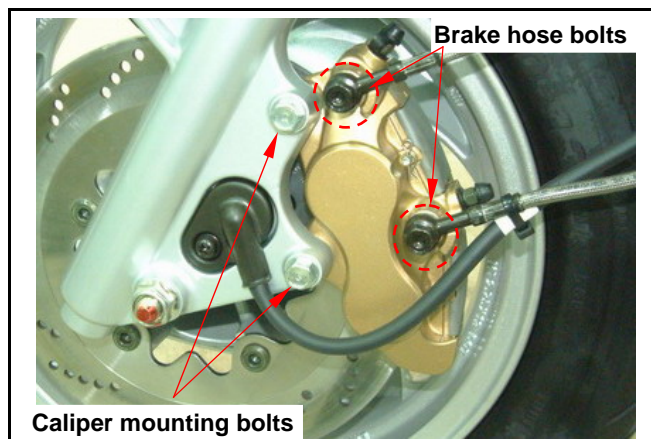
Remove brake pad caps.

Remove the brake pad guidance shafts cotter pins.

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

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

Install the brake pad guidance shafts cotter pins.  
Install the brake caliper and tighten the mounting bolts.





## 14. Brake System

### Rear Brake Caliper

#### Removal

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

#### ⚠ Caution

- Do not spill brake fluid on painted surfaces.

Remove two caliper mounting bolts and the caliper.

#### Installation

Install the brake caliper and tighten the mounting bolts.

**Torque: 2.9~3.5kgf-m**

#### ⚠ Caution

- Use M8 x 35 mm flange bolt only.
- Long bolt will impair 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 up the brake fluid to the reservoir and make necessary air bleeding.

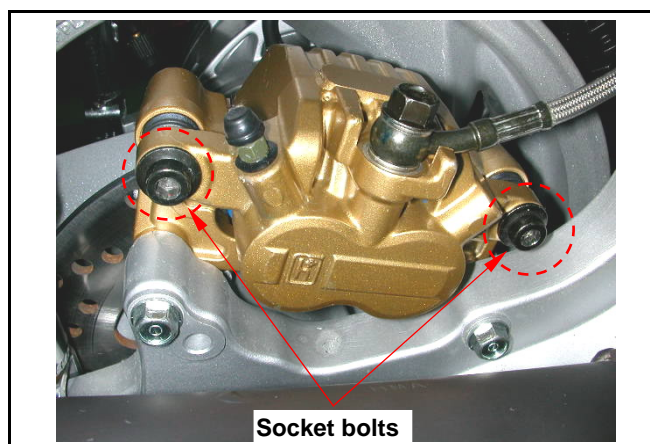
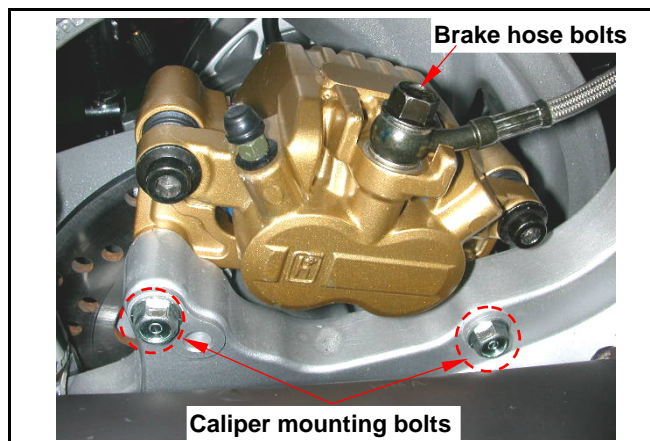
#### Brake pad replacement

Remove the brake caliper upper parts (2 socket bolts).

Take out the brake pads.

Install the new brake pads onto brake caliper bracket.

Install the brake caliper upper parts and tighten the socket bolts.



## Brake Disk

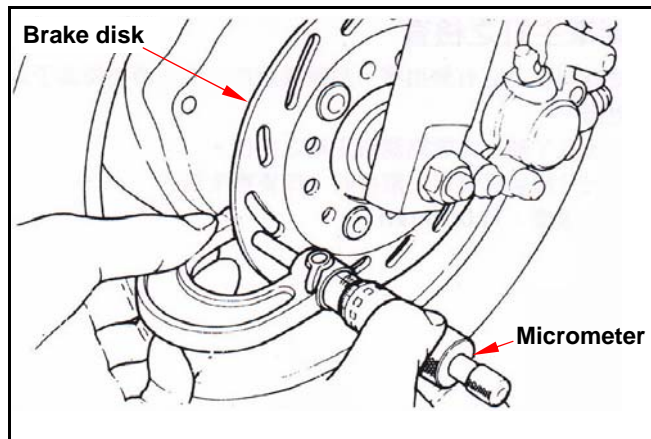
### Inspection

Visually check the brake disk for wear or break. Measure the thickness of the disk at several places. Replace the disk if it has exceeded the service limit.

#### Allowable limit:

Front brake disk 2.5 mm

Rear brake disk 3.5 mm

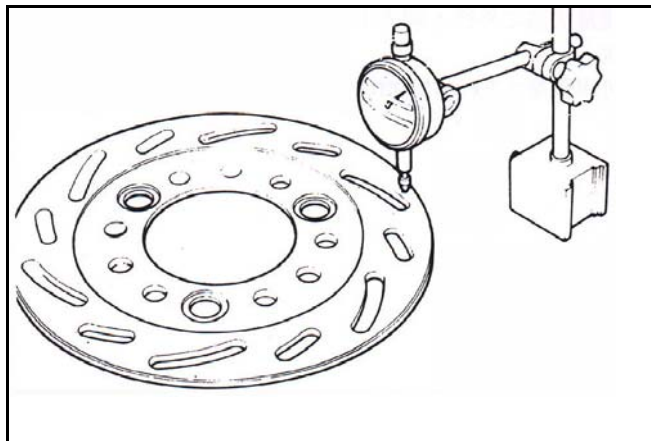


Remove the brake disk from wheel. Check the disk for deformation and bend.

#### Allowable limit: 0.30 mm

### ⚠ Caution

- The dirty brake lining or disk will reduce the brake performance.
- Brake lining includes the asbestos ingredient, cannot use the air-gun to be clean, the operator should dress the mouthpiece and the glove, use vacuum cleaner clean it.



## Master Cylinder

### Master Cylinder Removal

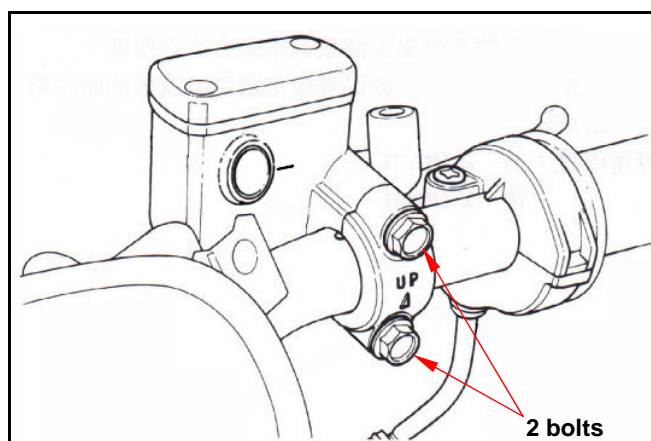
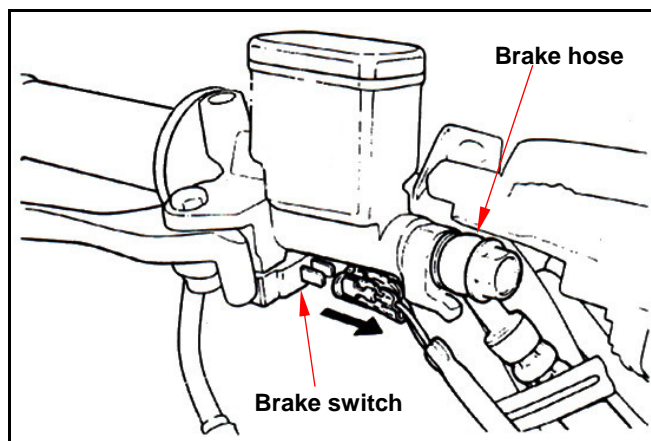
### ⚠ Caution

- Do not let foreign materials enter into the cylinder.

### ⚠ Caution

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

Remove the handlebar covers.  
Remove the leads of brake light switch.  
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.



# 14. Brake System

Remove the rubber pad.  
 Remove the cir clip.  
 Remove the piston and the spring.  
 Clean the master cylinder with recommended brake fluid.

## Master Cylinder Inspection

Check the master cylinder for damage or scratch.  
 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 exceed allowable limit.

**Allowable limit:**  
**Front brake: 11.055 mm**  
**Rear brake: 14.055 mm**

Measure the outer diameter of the piston.  
 Replace the piston if its measured value exceeds allowable limit.

**Allowable limit:**  
**Front brake: 10.945 mm**  
**Rear brake: 13.945 mm**

## Master Cylinder Assembly

### ⚠ Caution

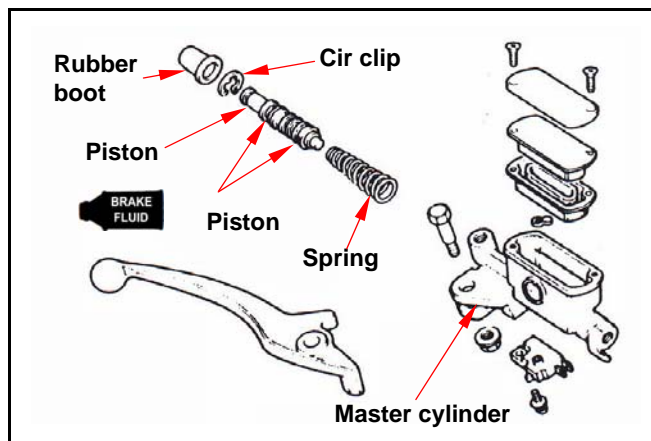
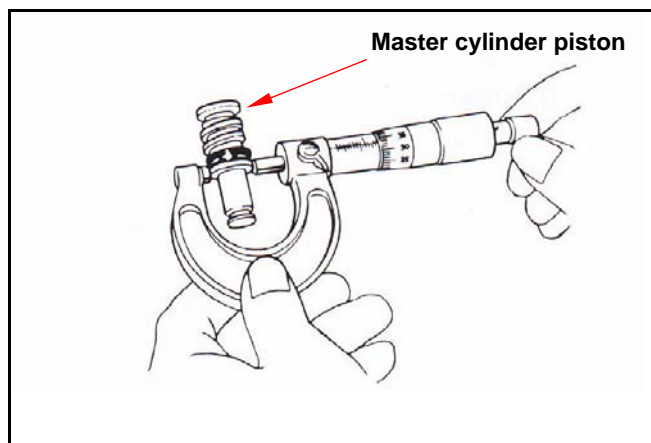
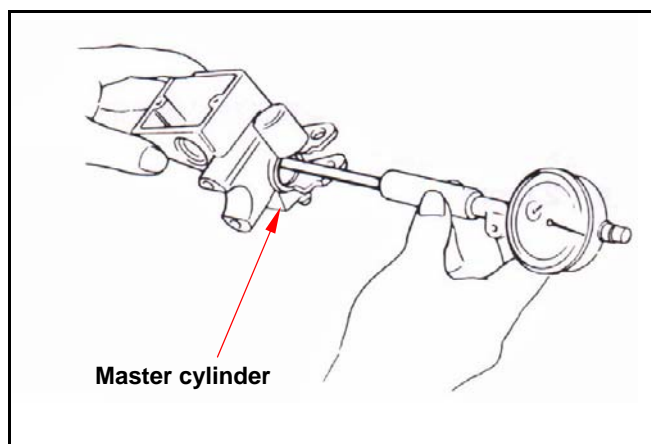
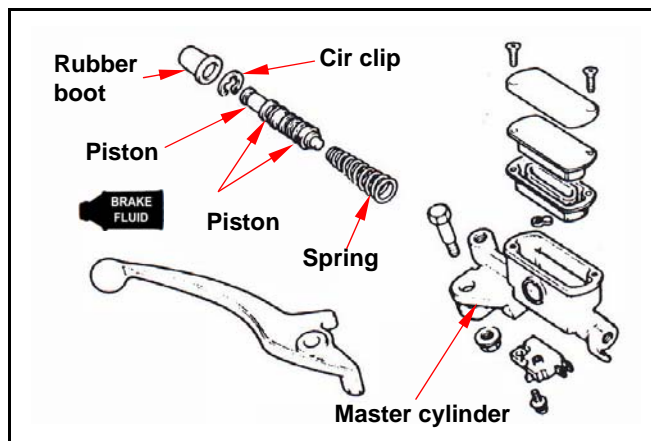
- It is necessary to replace the whole set comprising piston, spring, piston cup, and cir clip.
- Make sure there is no dust on all components before assembling.

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 master cup's cavity should be face inside of master cylinder when installing the master cup.  
 Install the cir clip.

### ⚠ Caution

- Never install cup lip in the opposite direction.
- Make sure the cir clip is seated securely in the groove.

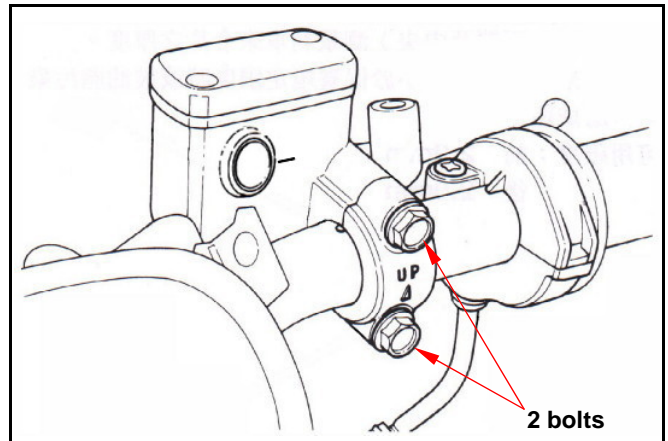
Install the rubber pad into groove properly.





### Master Cylinder Installation

Install the rubber pad into the groove correctly. Place the master cylinder onto handlebar, and install the bolts. Install the brake lever, and connect leads to brake light switch.



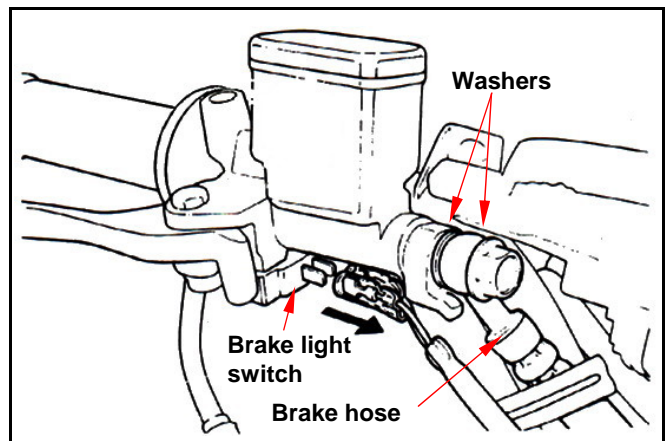
Connect brake hoses with 2 new washers. Tighten the brake hose bolt to the specified torque value. Make sure the hose is installed correctly. Install all wires, hoses, and components carefully so avoid to twisting them together.

#### ⚠ Caution

- Improper routing may damage leads, hoses or pipes.

#### ⚠ Caution

- Kink of brake leads, hose or pipe may reduce brake performance.



Add specified brake fluid and bleed the system.



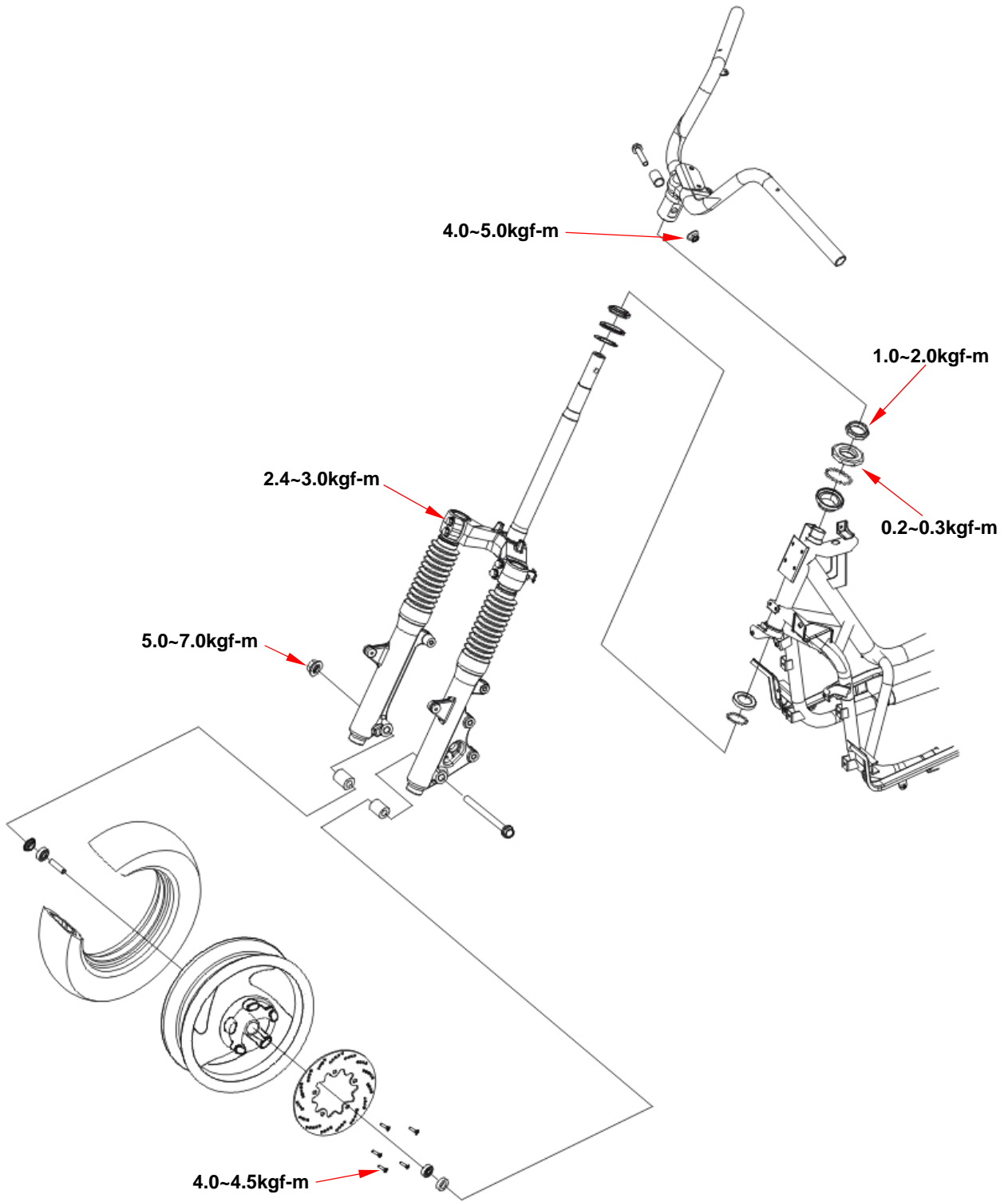
Note:



# 15. Steering / Front Wheel / Front Cushion

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



## 15. Steering / Front Wheel / Front Cushion

### 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

Nut for the front wheel axle	5.0 ~ 7.0kgf-m
Nut for the steering handle	4.0 ~ 5.0kgf-m
Lock nut for the steering handle stem	1.0 ~ 2.0kgf-m
Top crown for the steering handle stem	0.2 ~ 0.3kgf-m
Locating screw for the speedometer cable	0.15 ~0.3kgf-m
Front cushion upper lock bolt	2.4 ~ 3.0kgf-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-6204010
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

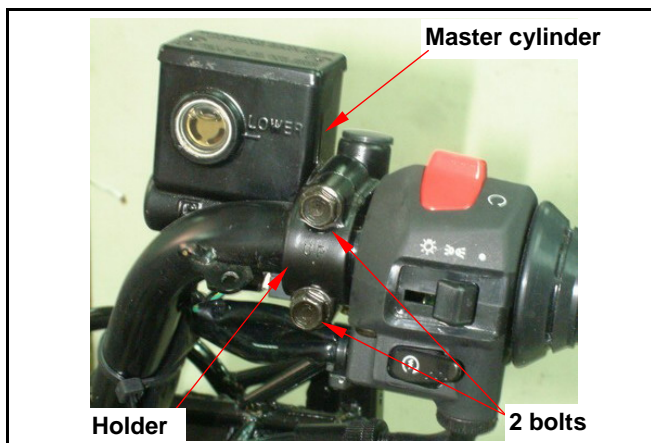
- Front cushion is warped.
- The joint of the front cushion gets loose.

## Steering Handle

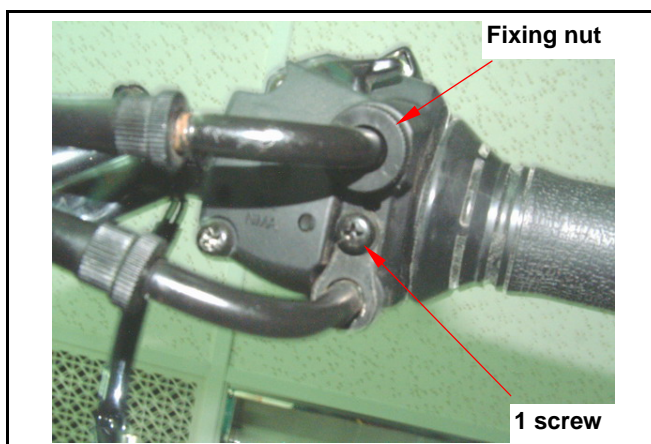
### Remove

Remove the right and left handle side cover, handle upper cover and front cover. (Refer to chapter 13)

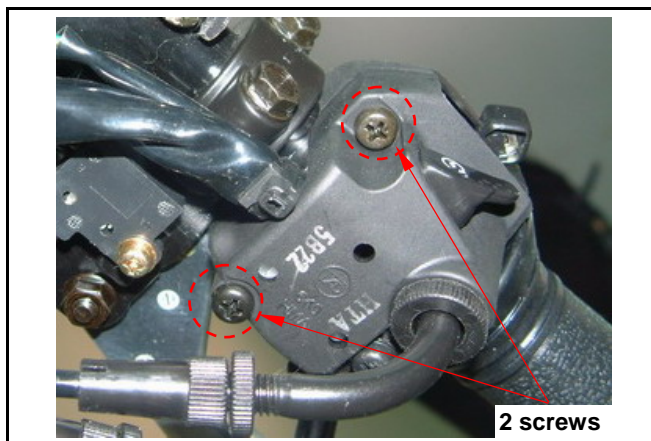
Loosen the lock bolts for the master cylinder of the front brake.



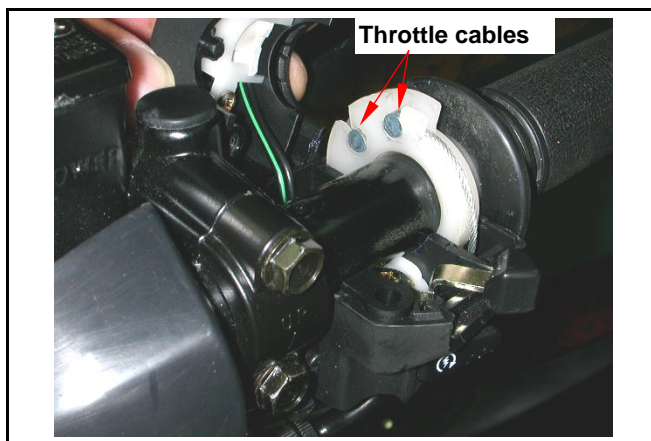
Loosen the deceleration throttle cable fixing nut. Loosen 1 screw from the acceleration throttle fixing plate.



Loosen 2 screws from the throttle holder.



Remove throttle holder, handle switch, cables and grip.

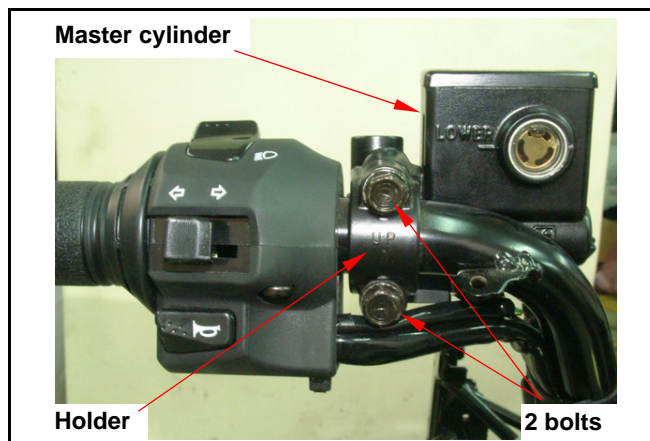




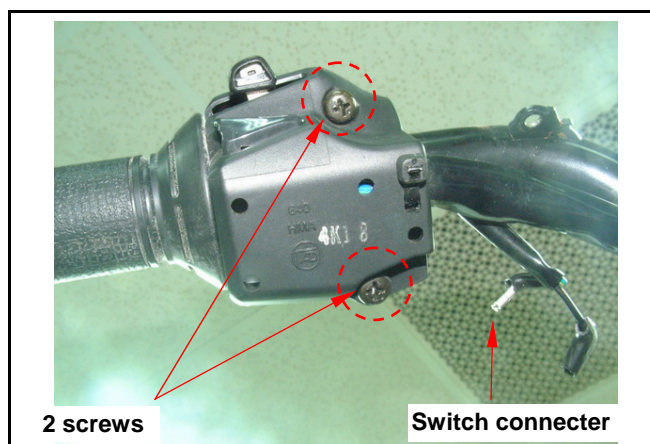
## 15. Steering / Front Wheel / Front Cushion



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 right handle switch.

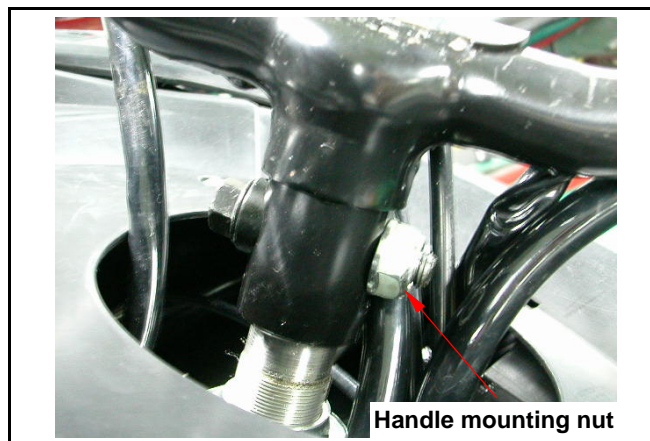


Loosen handle mounting nut.  
Remove handle mounting bolt, and then remove the handle.

### Installation

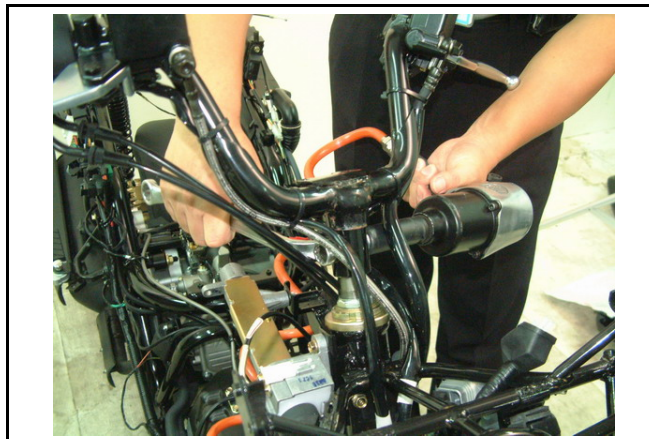
Install handle and align with bolt hole.  
Install bolt and nut and then tighten it.

**Torque value: 4.0~5.0kgf-m**



Apply with grease onto throttle cable and the sliding surface of handle.  
Align the lock pin with the hole on the handle.  
After the installment completes, carries on the following inspection and the adjustment:

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

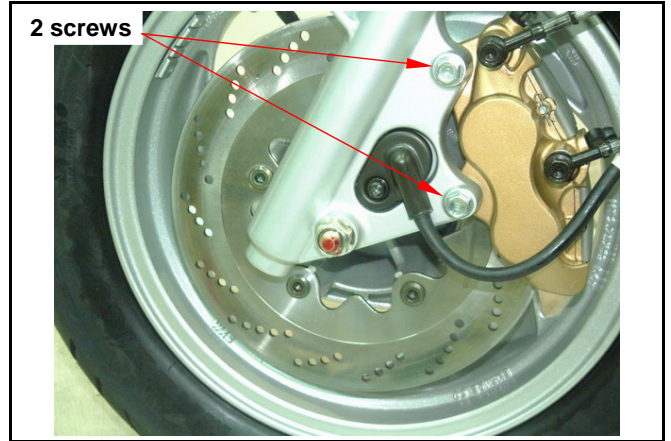


## Front Wheel

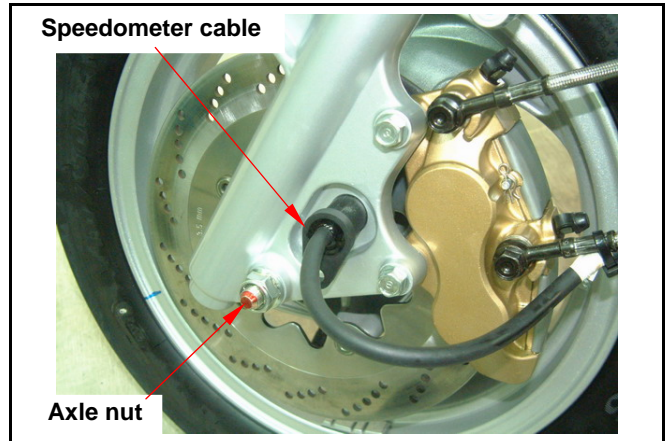
Loosen 2 bolts from the front brake caliper and remove it

### ⚠ Caution

- Care shall be taken not to push the brake lever to avoid the brake pad being squeezed out. In case that the brake pad is accidentally squeezed out, use a screwdriver to force it back to the place.



Loosen screw & remove speedometer cable.  
Turn loose the axle nut.



Pull out the front wheel axle.  
Remove the front wheel and both side collar.



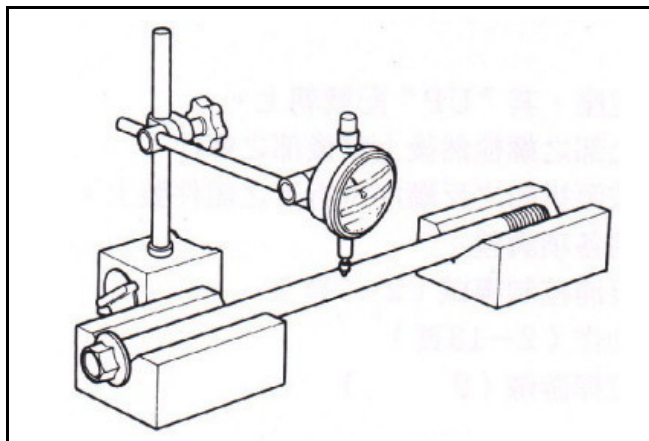
## 15. Steering / Front Wheel / Front Cushion

### Inspection

#### Wheel axle

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

**Service limit: 0.2 mm**

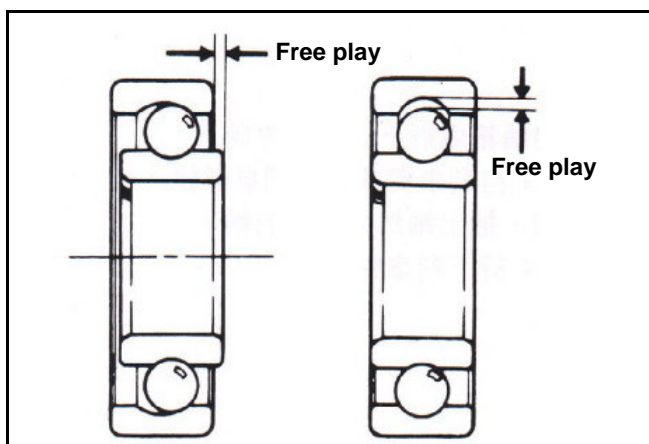


#### Bearing

Use finger to move the inner ring of each bearing, it shall move smoothly and quietly. Check the outer ring is securely attached on the wheel hub. If the motion of the inner ring of the bearing is not smooth, or noisy and loose when being moved, remove and discard it.

#### ⚠ Caution

- The bearing shall be replaced in pair.



#### Wheel

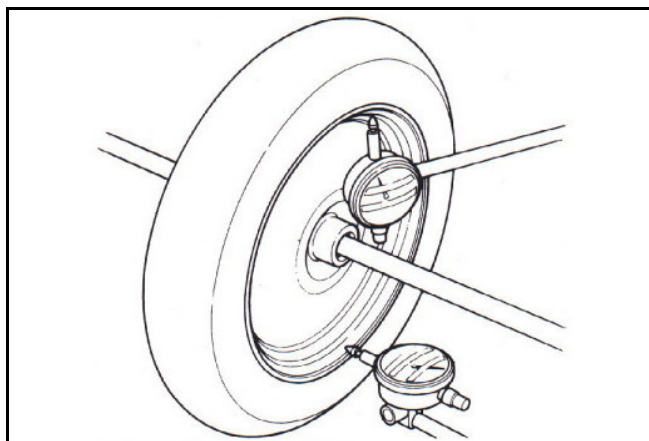
Place the wheel on to a rotation seat to check its rim wobbling.

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

**Service limit:**

**Radial: 2.0 mm (0.08 in)**

**Axial: 2.0 mm (0.08 in)**



### Disassembly

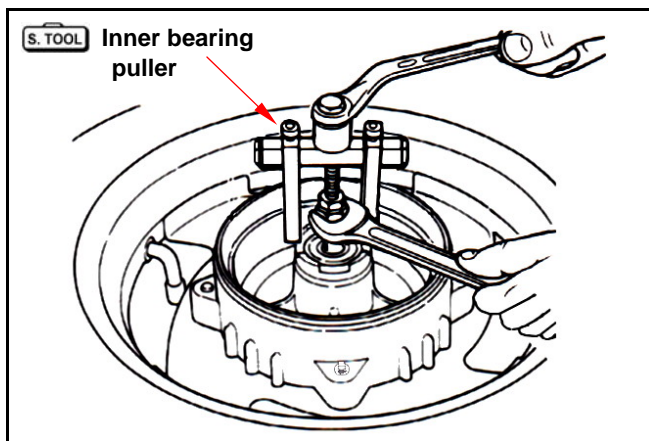
Remove brake disk (5 bolts).

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

Remove dust seal and bearing from right side.

**Special tools:**

**Inner bearing puller SYM-6204020**





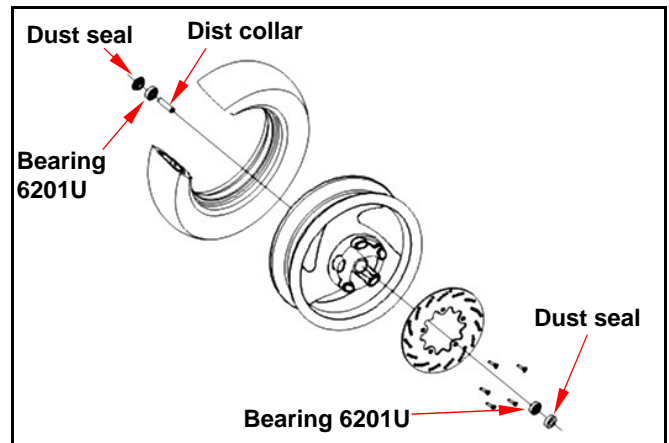
**Assembly**

Fill out the block of bearing by grease.  
Drive the left bearing, dust seal and install the dist. collar.

Install the right side bearing.

**⚠ Caution**

- Carefully install the bearing in correct and evenly.
- Bearing outer face should be faced up as bearing installation.



Install the brake disk and then tighten the bolts.

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





## 15. Steering / Front Wheel / Front Cushion



### Front Cushion

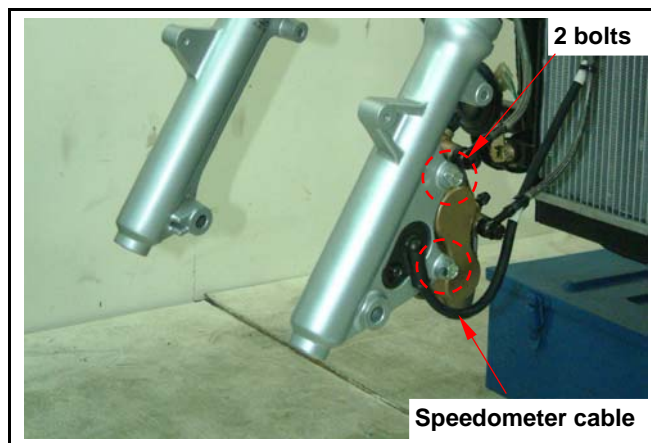
#### Remove

Remove front cover, front under spoiler and front fender.

Remove front wheel.

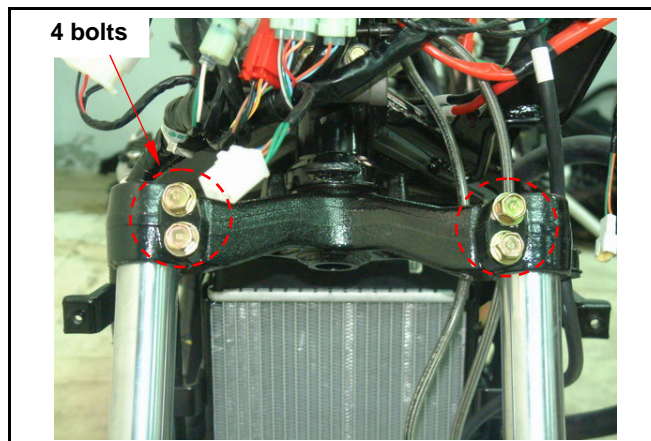
Remove front brake caliper.

Remove speedometer cable.



Loosen 4 bolts from steering stem.

Remove the front cushions.

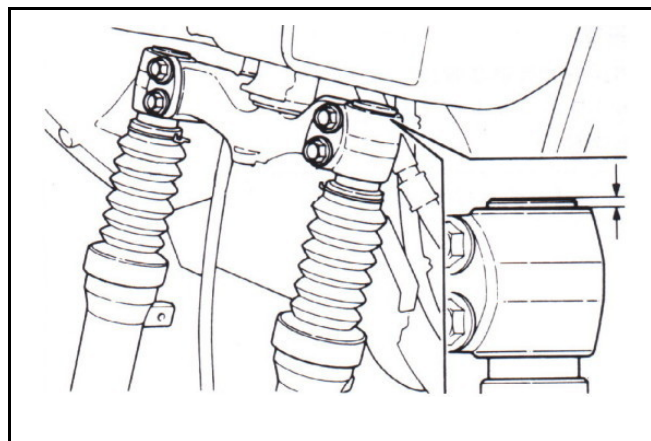


#### Installation

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

**Torque value: 2.4~3.0kgf-m**

Install the removed components in reverse order of removal procedures.



## Steering Stem

### Remove

Remove handle, front wheel and front cushion.  
Remove the steering stem mounting nut.

Remove top cone race and steering stem.

### ⚠ Caution

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

### Special tools:

**Steering stem top thread wrench SYM-5320010**

**Handle stand nut wrench SYM-5321100**

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.

### Installation

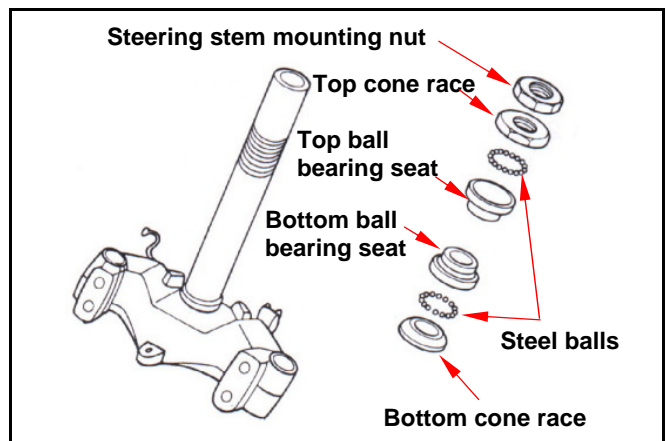
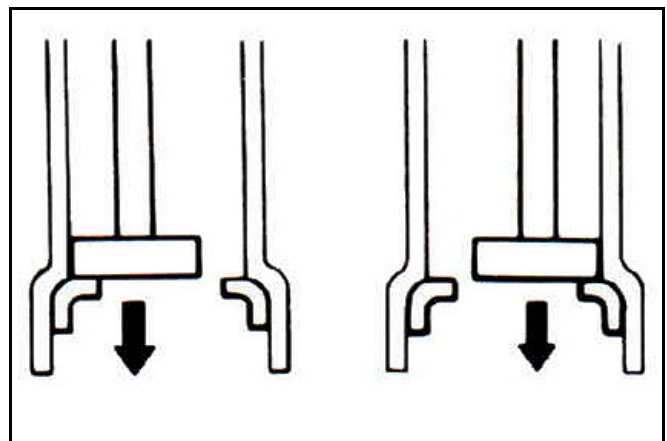
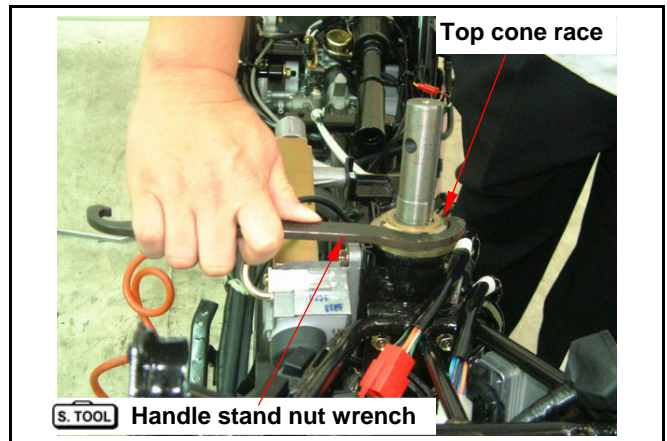
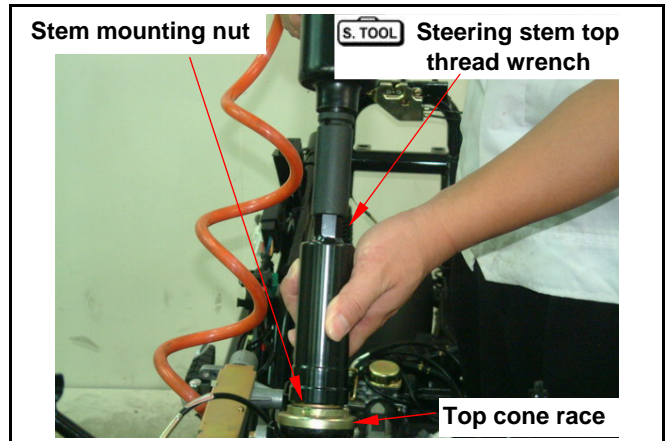
Install a new bottom cone race onto the steering stem.

Push the cone race until to mounted position.

### ⚠ Caution

- Do not tilt the ball bearing seats as installation.

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



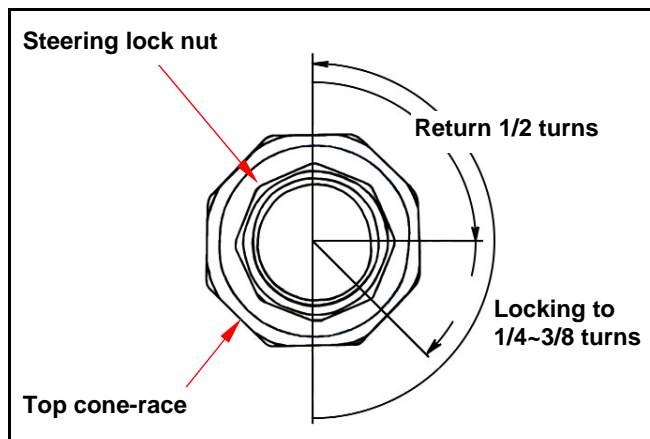
## 15. Steering / Front Wheel / Front Cushion

Lubricate the top cone race seat with grease. Screw the cone race in to top ball bearing seat till touching, and then screw out the cone race 1/4~3/8 turns.

**Torque value: 0.25kgf-m**

### ⚠ Caution

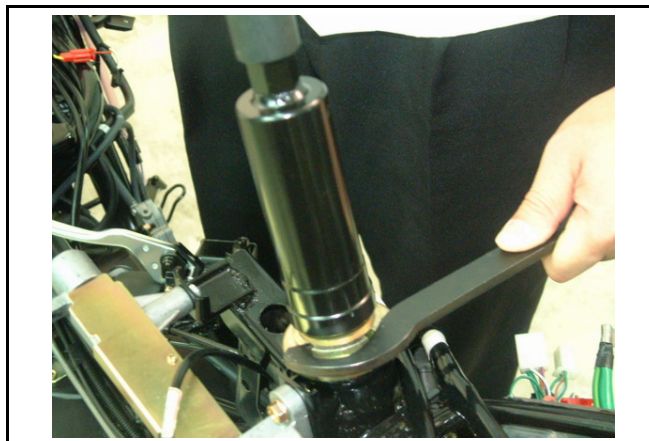
- Check the steering stem that should be rotated freely and no clearance in vertical direction.



Install the steering stem mounting nut and tighten the nut by means of holding the top cone race body.

**Torque value: 1.0~2.0kgf-m**

Install in reverse order of removal procedures.

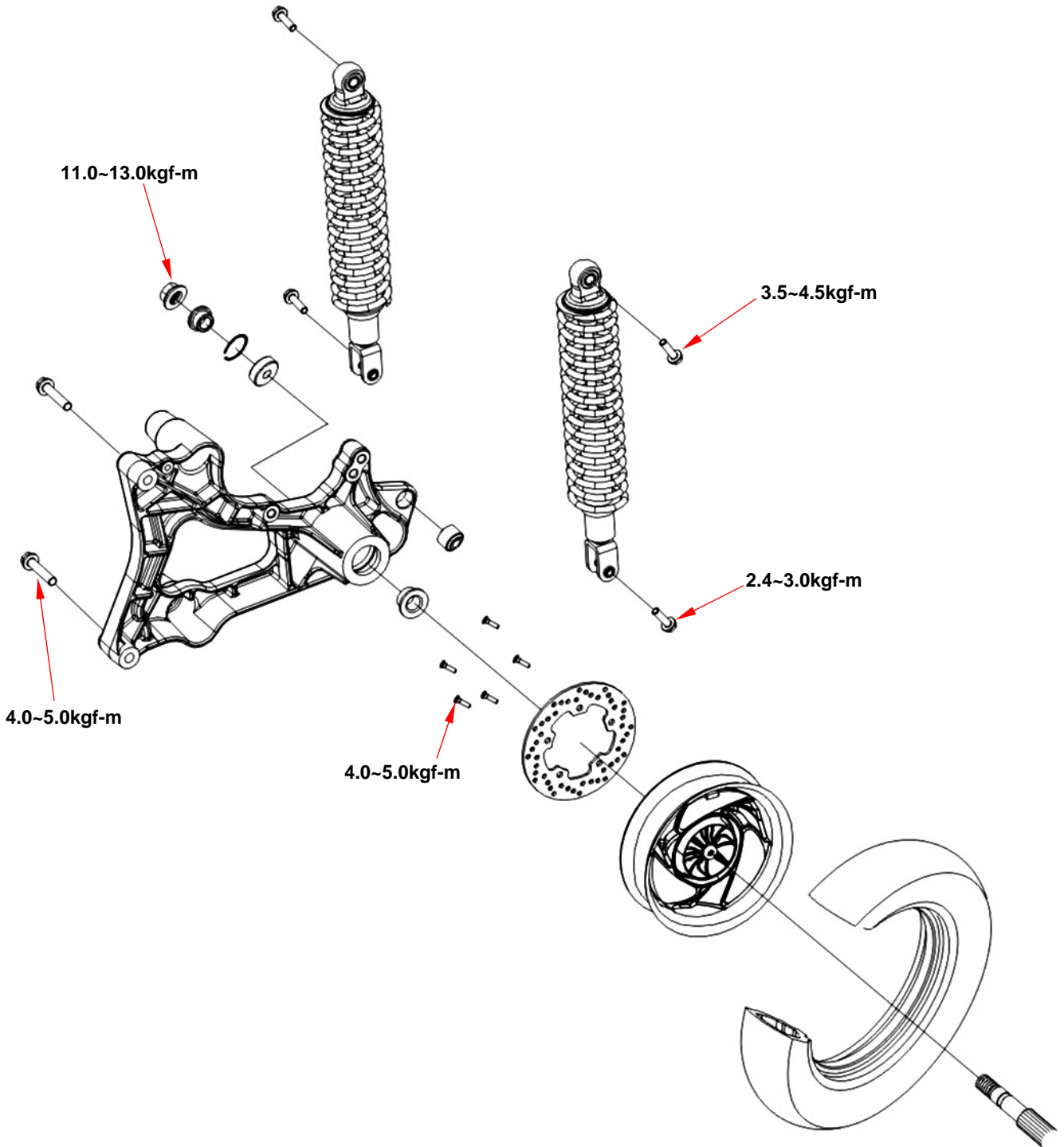




# 16. Rear Wheel / Rear Fork / Rear Cushion

Mechanism Diagram.....16-1	Rear Wheel ..... 16-3
Precautions in Operation.....16-2	Rear Fork..... 16-5
Troubleshooting .....16-2	Rear Cushion..... 16-6
Muffler.....16-3	

## Mechanism Diagram





## 16. Rear Wheel / Rear Fork / Rear Cushion

### 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

Unit: 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 bolts	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

- The spring is too weak.

#### Noisy Brake

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

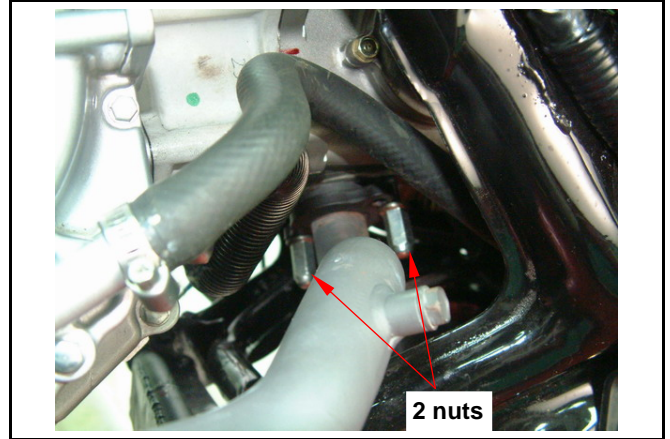
#### Poor Performance of Brake

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

## Muffler

### Removal

Loosen the 2 nuts from exhaust muffler front side.



Loosen the 3 mounting bolts by exhaust muffler right side.

Remove exhaust muffler.

### Installation

Install in reverse order of removal procedures.

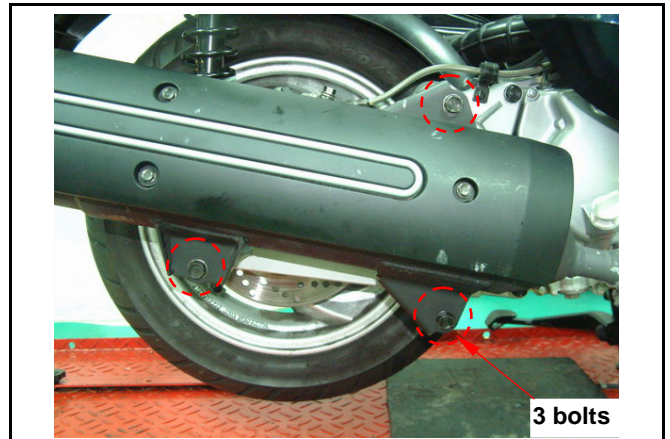
#### ⚠ Caution

- Replace the front side muffler pipe gasket if worn or deformed.

#### Torque Value:

Muffler mounting bolt 3.2 ~ 3.8kgf-m

Muffler mounting nut 1.0 ~ 1.2kgf-m



## Rear Wheel

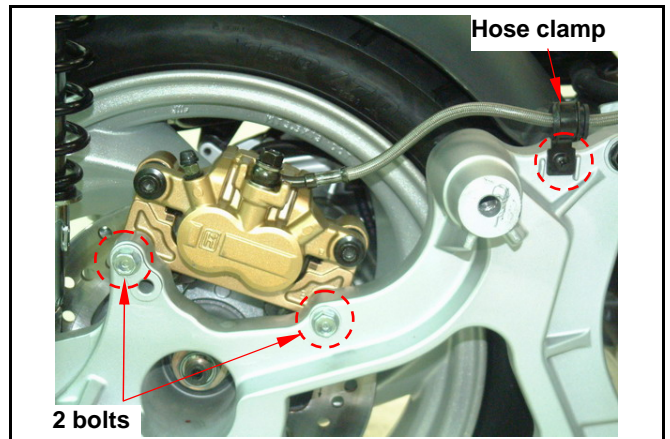
### Removal

Remove the exhaust muffler.

Remove the rear brake caliper (2 bolts) and brake hose clamp (1 bolt).

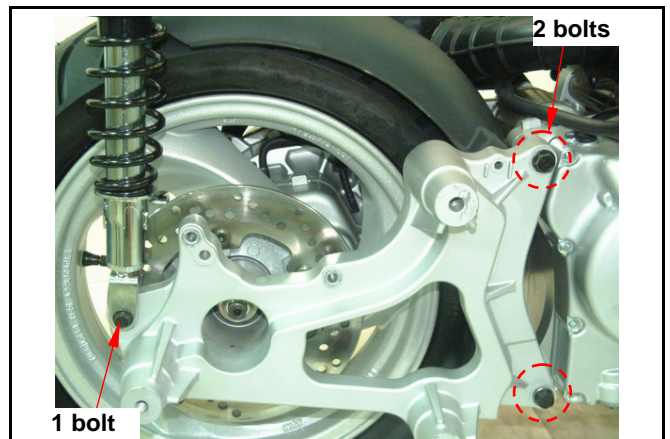
#### ⚠ Caution

- Care shall be taken not to push the brake lever to avoid the brake pad being squeezed out. In case that the brake pad is accidentally squeezed out, use a screwdriver to force it back to the place.



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.



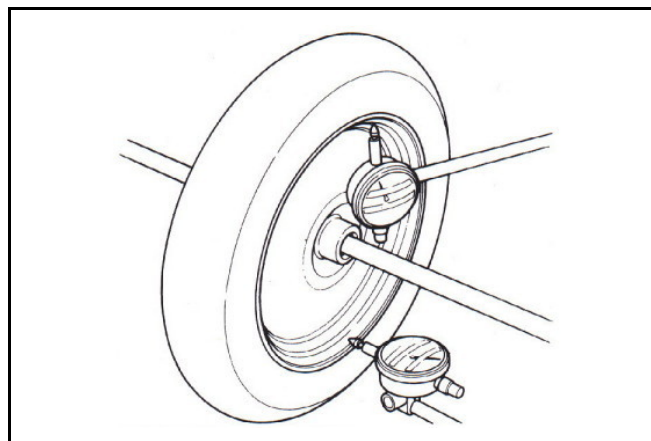
Remove rear fork and both side collars.  
Remove the rear wheel.



### Inspection 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:

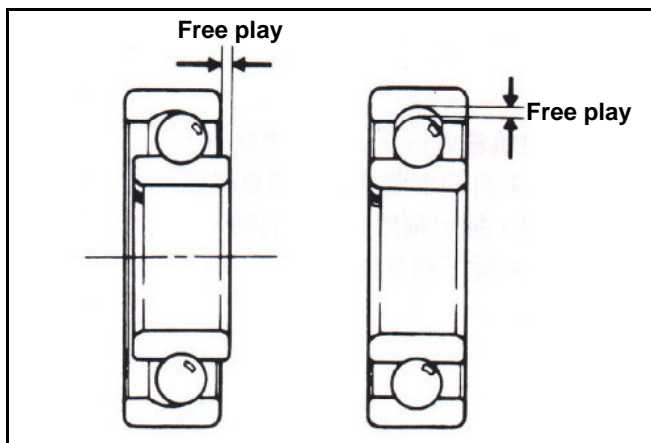
Rear wheel axle nut	11.0~13.0kgf-m
Rear cushion under bolt	2.4~3.0kgf-m
Rear fork mounting bolt	4.0~5.0kgf-m
Brake clipper mounting bolts	2.9~3.5kgf-m



## Rear Fork

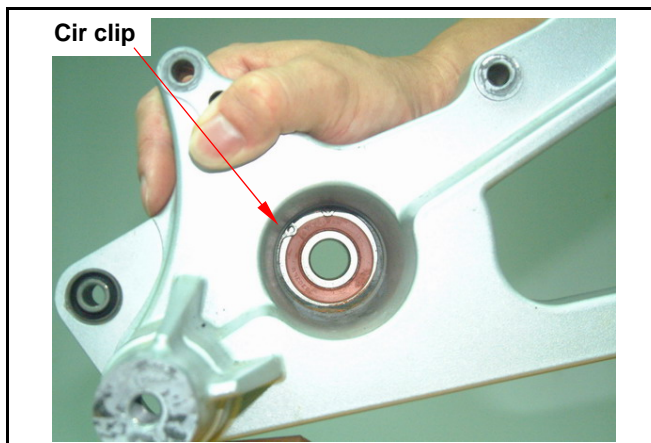
### Inspection rear fork bearing

Rotate the inner ring of the bearing with a finger. The bearing should move smoothly and quietly. Check the fit of the bearing and rim. Replace the bearing if its motion is not smooth or noisy.



### Replacement of rear fork bearing

Remove the bearing lock cir clip.



Uses the bearing driver; drive out the bearing.

**Special tool: Bearing driver**



Install new rear fork bearing and bearing puller (6303) onto rear fork.

Install assembly directs puller bearing puller.

**Special Service Tools:**

**Rear fork bearing 6303 bearing puller**

**SYM-6303000-HMA H9A 6303**

**Assembly directs puller SYM-2341110**

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

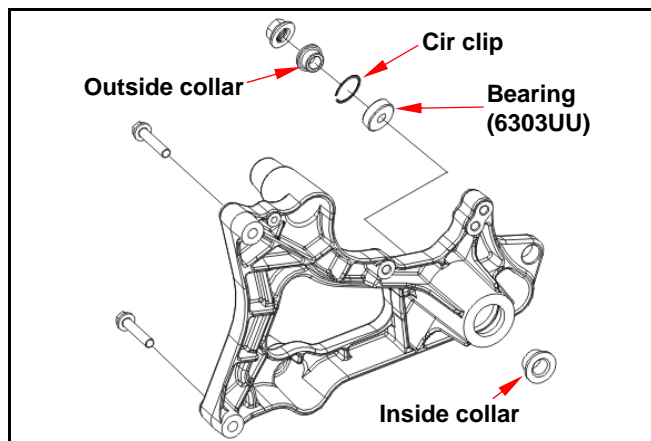




## 16. Rear Wheel / Rear Fork / Rear Cushion



Install the bearing lock cir clip.



### Rear Cushion

#### Removal

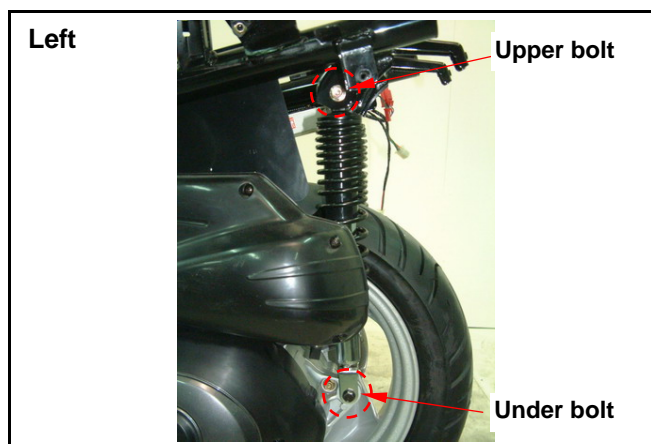
Remove the luggage box, rear carrier and body covers.

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

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

Remove the under bolts by left and right rear cushions.

Remove the upper bolts by left and right rear cushions, and then remove the cushion.



#### Installation

Install in reverse order of removal procedures.

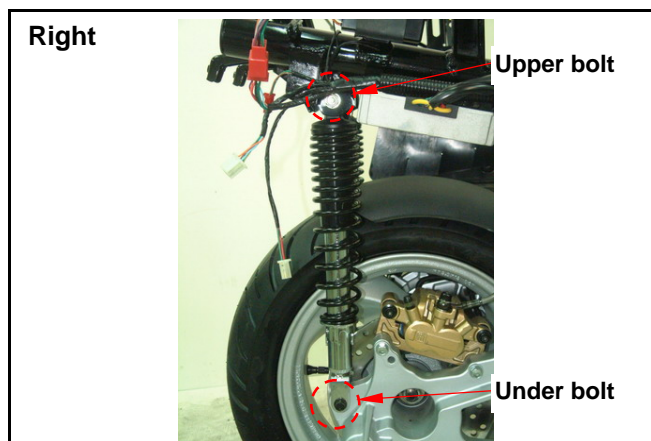
#### ⚠ Caution

- The rear cushion must be replaced as a unit. Never disassemble the rear cushion as that would damage the structure.

#### Torque Value

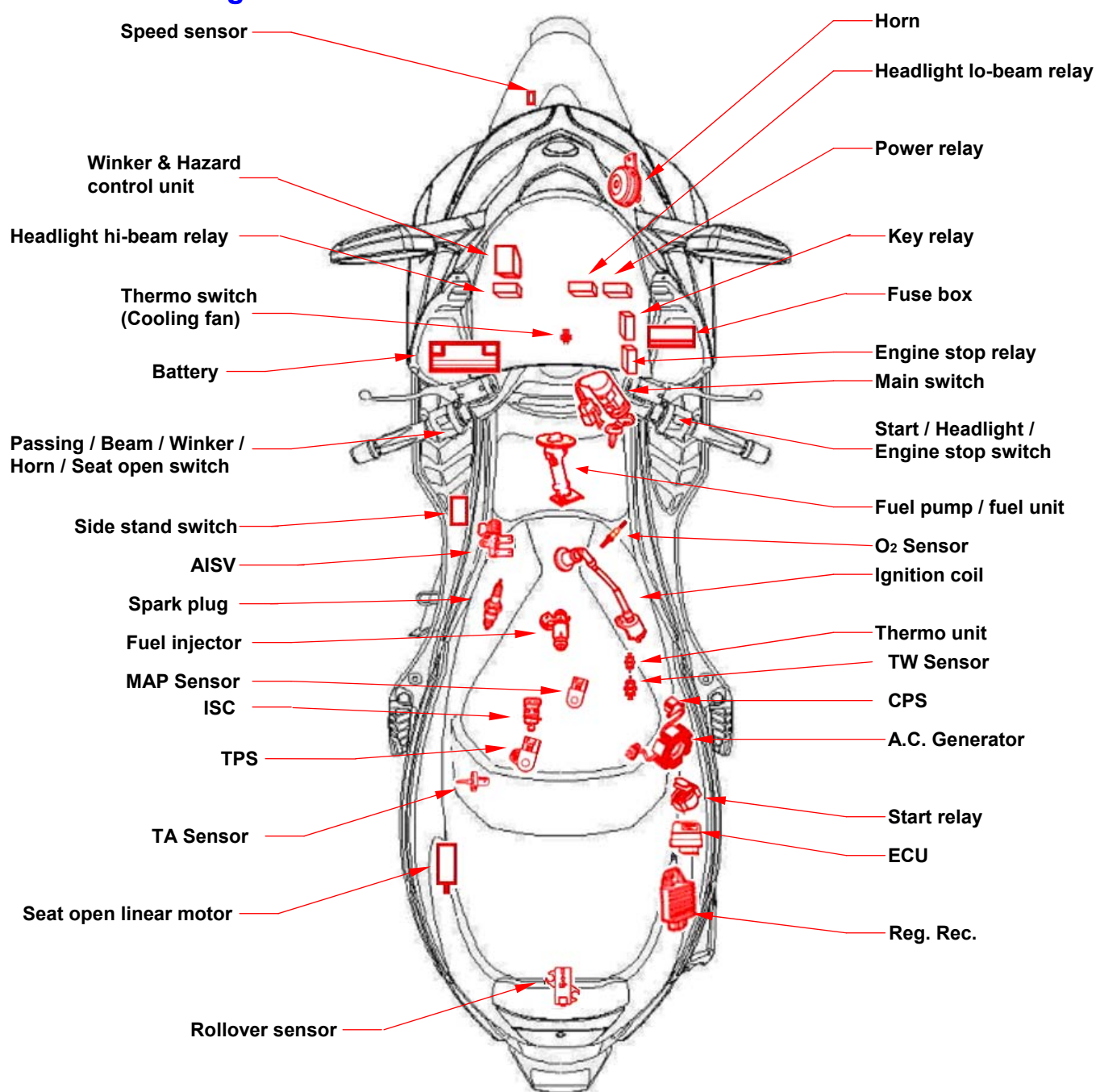
Rear cushion upper bolt: 3.5~4.5kgf-m

Rear cushion under bolt: 2.4~3.0kgf-m



Mechanism Diagram .....	17-1	Starting System .....	17-11
Precautions in Operation.....	17-2	Meter.....	17-13
Specification .....	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

**Mechanism Diagram**



## 17. Electrical System

### Precautions in Operation

- When removing the battery, the disconnection sequence of cable terminals shall be strictly observed. (First disconnect the negative cable terminal, next, 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 / 2,000 rpm

#### Ignition system

Description		Specification
Spark plug	Model	NGK CR8E (Recommended)
	Gap	0.6~0.7 mm
Ignition coil and resistance	Primary winding	2.8Ω±15%
	Secondary winding	Without cap:9 KΩ± 20%
With cap:14.1 KΩ± 20%		
Crankshaft position sensor resistance (20°C)		80~160 Ω
Ignition timing advance	At idle speed	BTDC 10° / 1650 rpm
	Full advanced	BTDC 30°

## Troubleshooting

### No voltage

- Battery discharged
- The cable disconnected
- The fuse is blown
- Improper operation of the main switch
- Low voltage
- The battery is not fully charged
- Poor contact
- Poor charging system
- Poor voltage regulator

### No spark produced by spark plug

- The spark plug is out of work
- The cable is poorly connected, open or short-circuited
- Poor connection between ECU and ignition coil
- Poor connection between ECU and the main switch
- Poor main switch
- Poor ECU.
- A.C.G. is out of work

### Starter motor does not work

- The fuse is blown
- The battery is not fully charged
- Poor main switch
- Poor starter switch
- The front and rear brake switches do not operate correctly
- Starter relay is out of work
- The ignition coil is poorly connected, open or short-circuited
- The starter motor is out of work

### Intermittent power supply

- The connector of the charging system becomes loose
- Poor connection of the battery cable
- 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

- Burnt fuse
- 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
- Incorrect ignition timing
  - Poor ACG
  - Improper installation of CPS
  - Poor ECU

### Weak starter motor

- Poor charging system
- The battery is not fully charged
- Poor connection in the windings
- The motor gear is 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

#### Removal

Loosen 1 screw and remove the battery cover. Disconnect the negative cable terminal first, then the positive cable terminal.

Remove the battery.

#### Voltage Check

Use the digital voltmeter to check the voltage of the battery.

#### Voltage:

**Fully charged:** 12.8V ↑ at 20°C

**Undercharged:** Below 12.0 V at 20°C

#### ⚠ Warning

- Keep flames away while recharging.
- Charging is completely controlled by the ON/OFF switch on the charger, not by battery cables.

#### 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	10 hr	1 hr

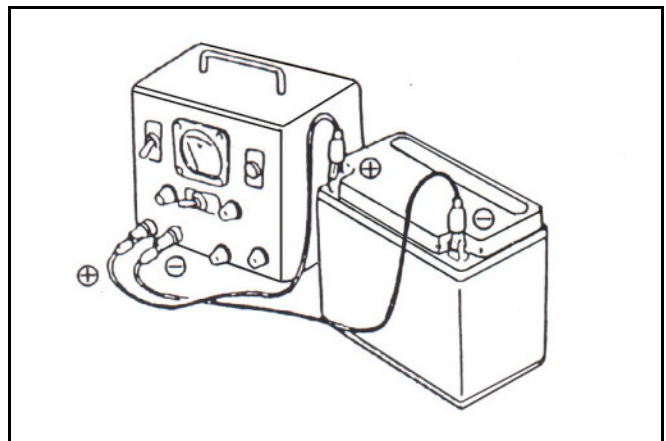
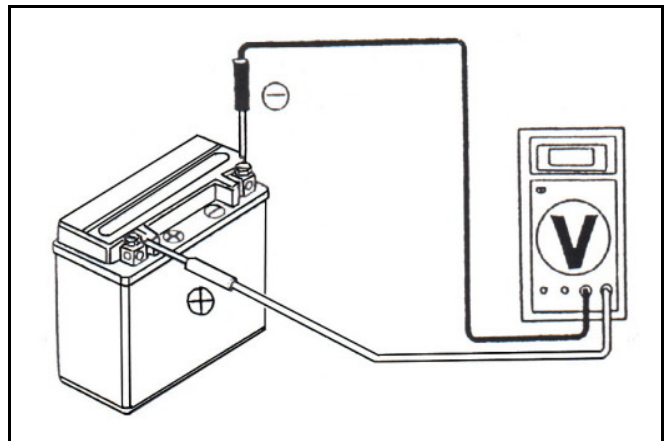
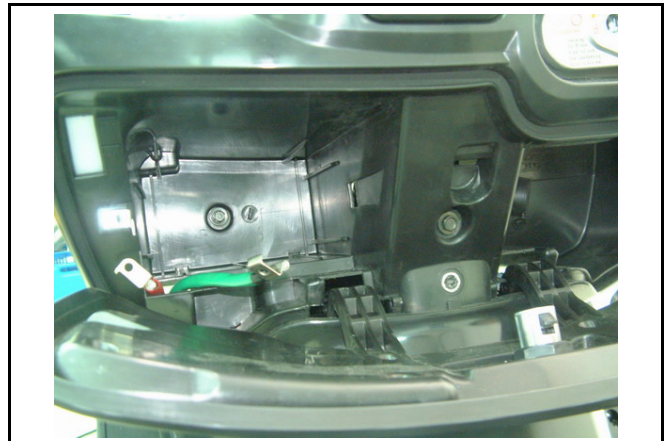
#### ⚠ Warning

- Keep flames away while recharging.
- Charging is completely 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 to charge will render damage to the battery.

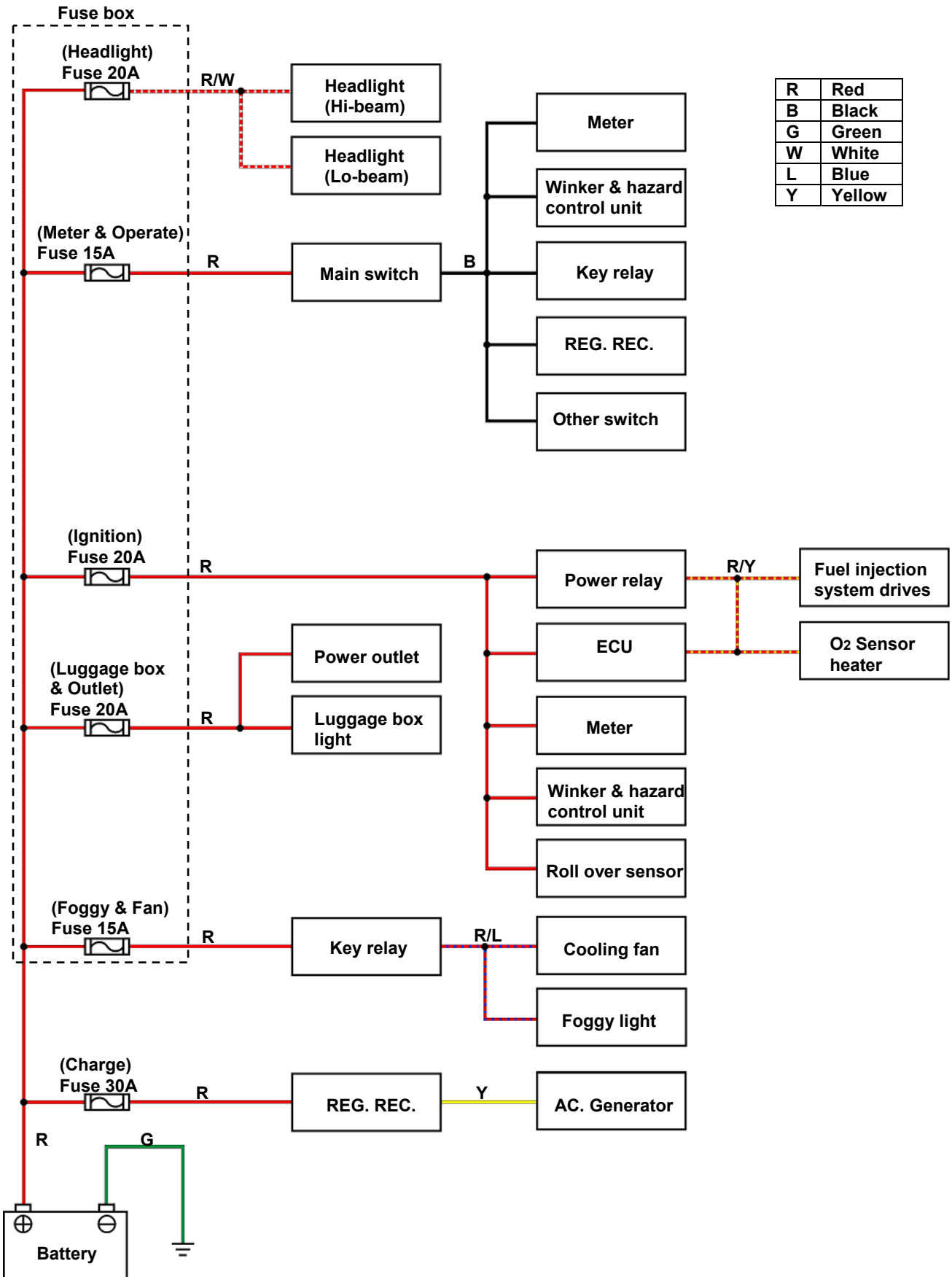
When installing the battery, coat the cable terminal with grease.





Fuse

Fuse circuit diagram

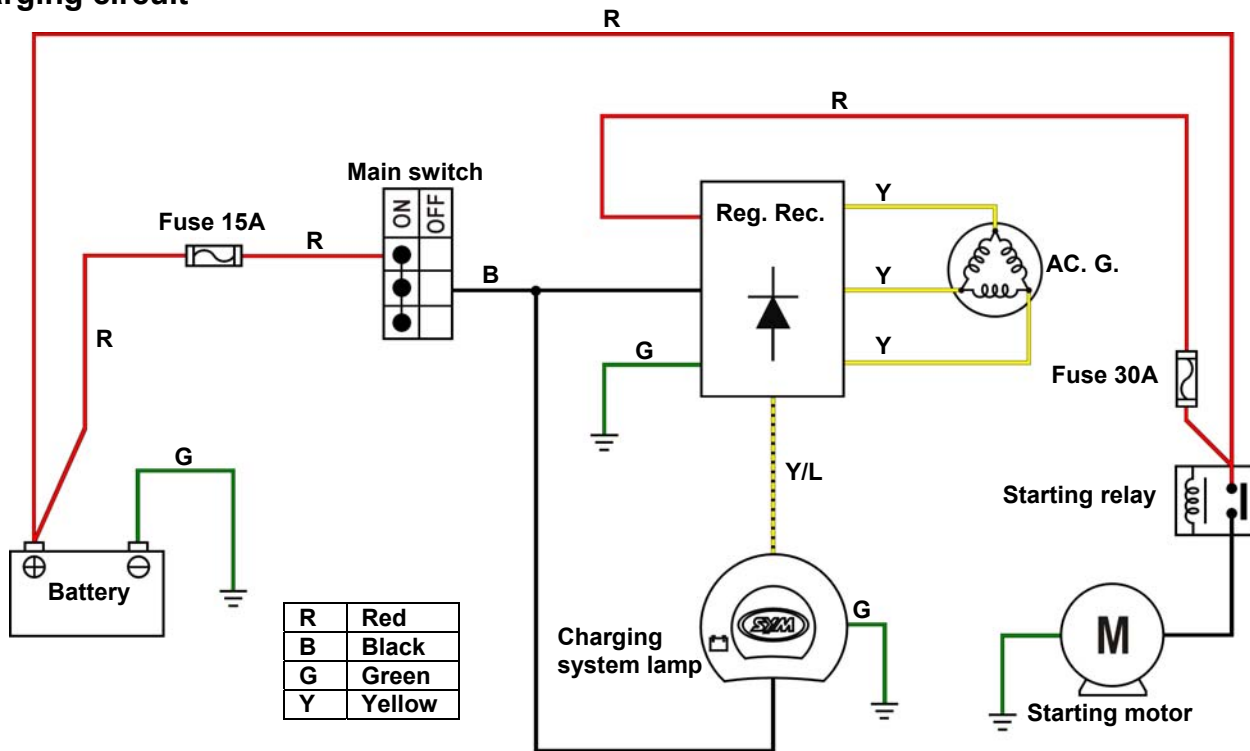


# 17. Electrical System



## Charging System

### Charging circuit



### Regulator rectifier Inspection

(KΩ)

- \ +	Y1	Y2	Y3	R	B	Y/L	G
Y1		∞	∞	∞	∞	∞	∞
Y2	∞		∞	∞	∞	∞	∞
Y3	∞	∞		∞	∞	∞	∞
R	∞	∞	∞		∞	∞	∞
B	5~30	5~30	5~30	∞		5~30	1~10
Y/L	∞	∞	∞	∞	∞		∞
G	2~20	2~20	2~20	∞	1~10	5~30	

#### Inspection on regulator rectifier wire

Remove the luggage box, rear carrier and body covers.

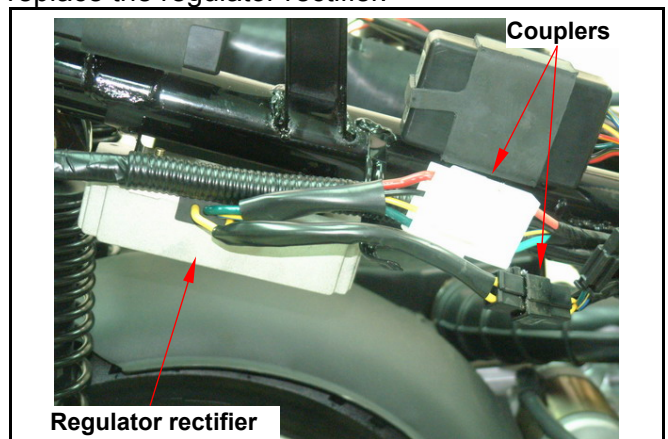
Disconnect two 3 pin couplers of the regulator rectifier.

Inspection the rectifier coupler to the wire harness passes the condition.

Item	Check Points	Standard Value
Main switch connection	R—B	Battery voltage (ON)
Battery connection	R—G	Battery voltage
Charging coil	Y—Y	0.2~0.4 Ω

If the readings measured are not normal, check parts in the circuit.

If the parts are normal, then trouble is in the wiring. If there is nothing wrong with parts and wiring, replace the regulator rectifier.



### Inspection on AC. Generator coil

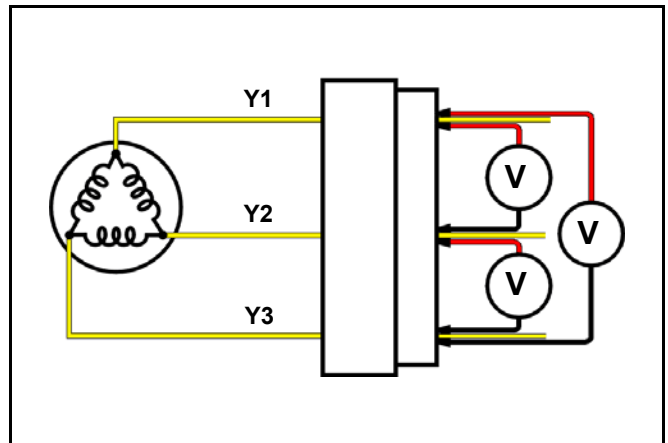
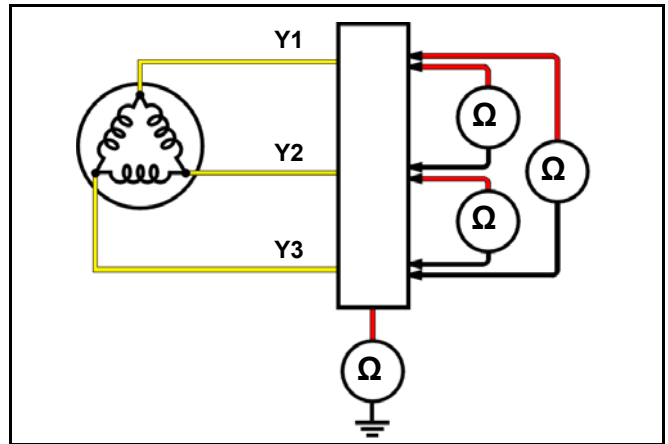
Remove the luggage box, rear carrier and body covers.

Disconnect 3 pin couplers of the generator coil. 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	$\Omega$
Y1	70~80	0.2~0.4
Y2	70~80	0.2~0.4
Y3	70~80	0.2~0.4

And you can check voltage by engine is running.



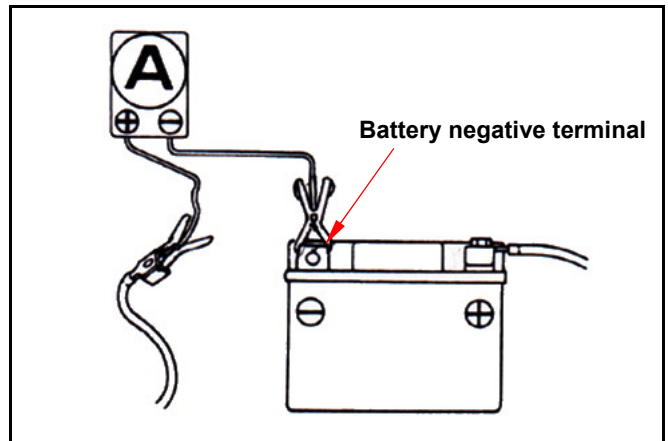
### Current Leakage Inspection

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. Disconnect each cable one by one and take measurement of the current of each cable to locate the short circuit.

**Allowable current leakage: Less than 10mA**

#### 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.

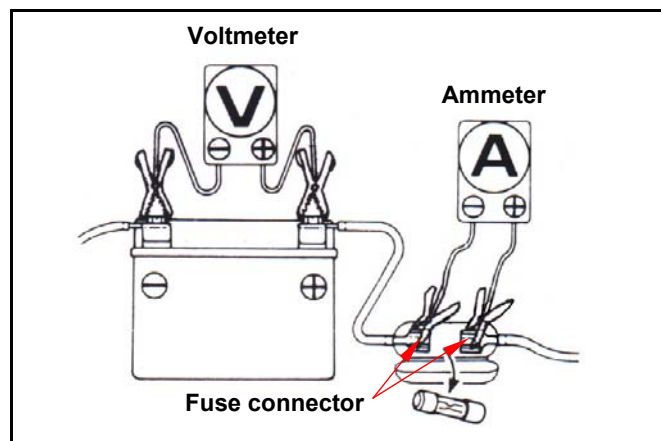


If the leaked current exceeds the specified value, it may indicate a short circuit.



## 17. Electrical System

### Inspection on Charging Voltage



#### ⚠ Caution

- Before conducting the inspection, be sure that the battery is fully charged. If undercharged, the current changes dramatically.
- Use a fully charged battery having a voltage larger than 13.0 V
- 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

- When the probe is reversibly connected, use a voltmeter having an indication that the current flows from the positive or the negative direction and the measurement should be at zero, ammeter at one direction only.

#### ⚠ Caution

- Do not use short-circuit cable.
- It is possible to measure the current by connecting an ammeter between the battery positive terminal and the cable position terminal, however, while the starter motor is activated, the surge current the motor draws from the battery may damage the ammeter. Use the kick starter to start the engine.
- 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.

Turn on the headlight to high beam and start the engine.

Accelerate the engine to the specified revolution per minute and measure the charging voltage.

**Specified Charging Current:**

**1.2 A / 6000 rpm**

**Control Charging Voltage:**

**14.5 V/1650 rpm**

#### ⚠ Caution

- To replace the old battery, use a new battery with the same current and voltage.

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.

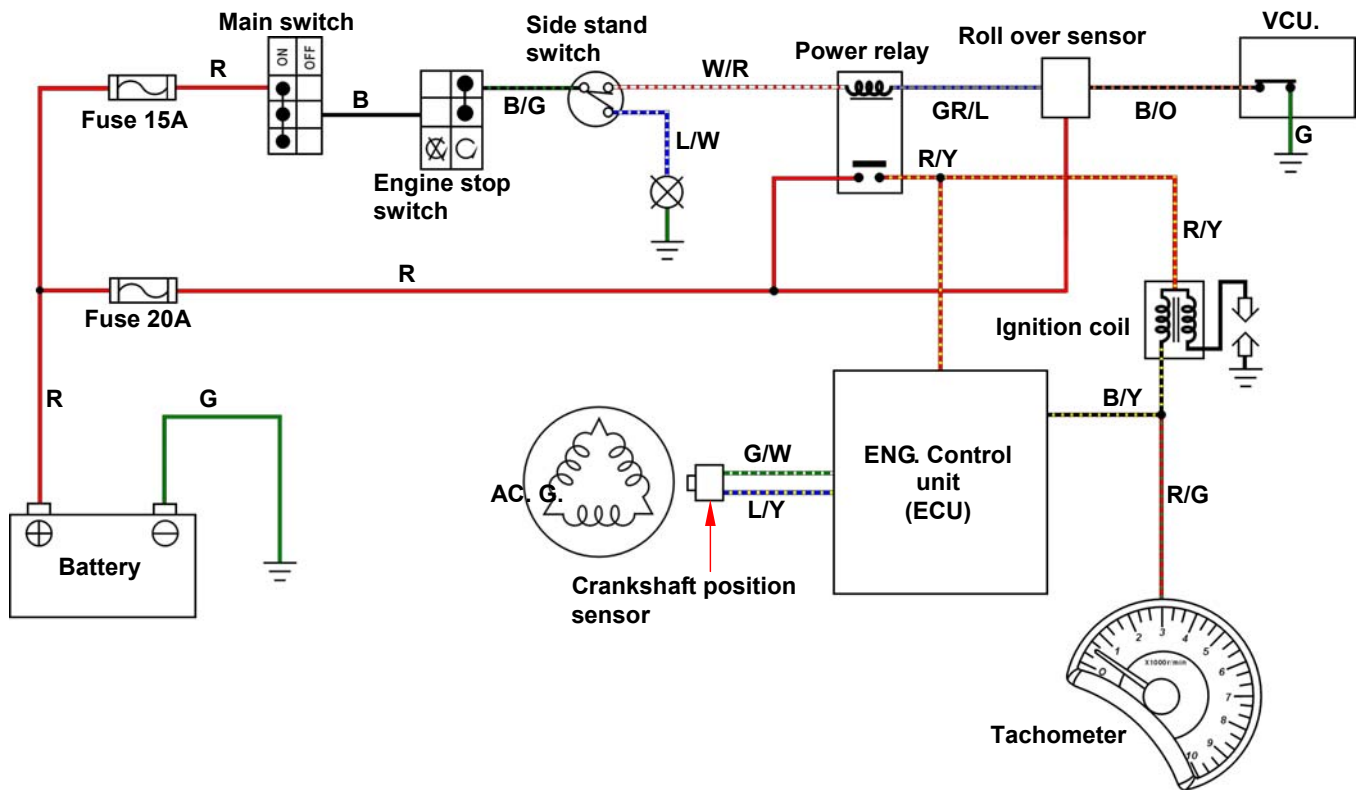
1. The charging voltage can not exceed the voltage between two battery terminals and the charging current is in the discharging direction.
2. The charging voltage and current are too much higher than the standard values.

The following problems are not related to the charging system; correct it if any by following steps indicate in the checking list.

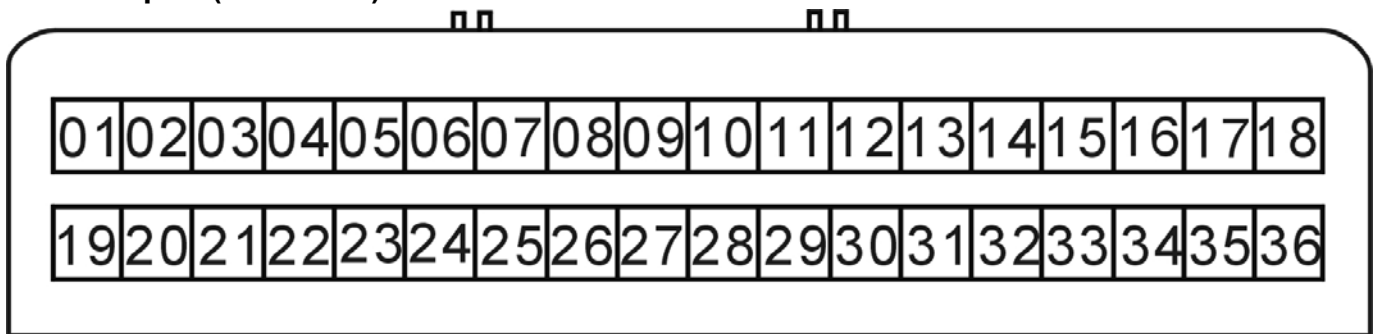
- (1) The standard charging voltage and current can only reach when the revolution of the engine exceeds the specified rpm.
  - Bulbs used exceed their rate and consume too much power.
  - The replacement battery is aged and does not have enough capacity.
- (2) The charging voltage is normal, but the current is not.
  - The replacement battery is aged and does not have enough capacity.
  - Battery used do 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

Ignition circuit diagram



ECU. coupler (ECU. side)



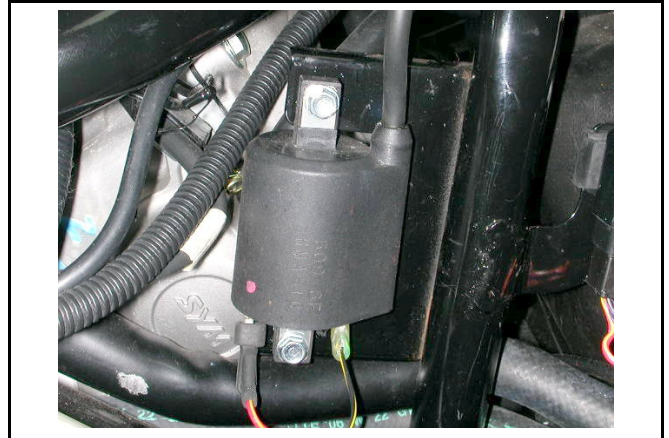
- 01 pin(R/Y) : Drive components Power.
- 03 pin(L/Y) : Crankshaft position sensor positive
- 09 pin(G/W) : Crankshaft position sensor negative
- 18 pin(B/Y) : Ignition coil

## 17. Electrical System

### Inspection on ignition coil

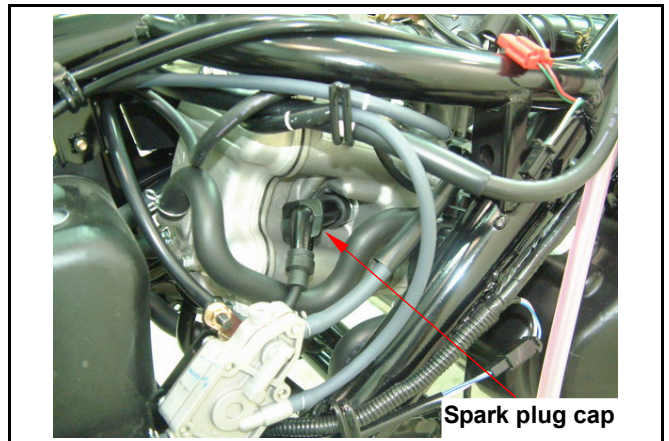
Remove the right floor garnish.  
Disengage the connector of the ignition coil.  
Measure the resistance between the terminals of the primary winding.

**Standard resistance:  $2.8\Omega \pm 15\%$  (20°C)**

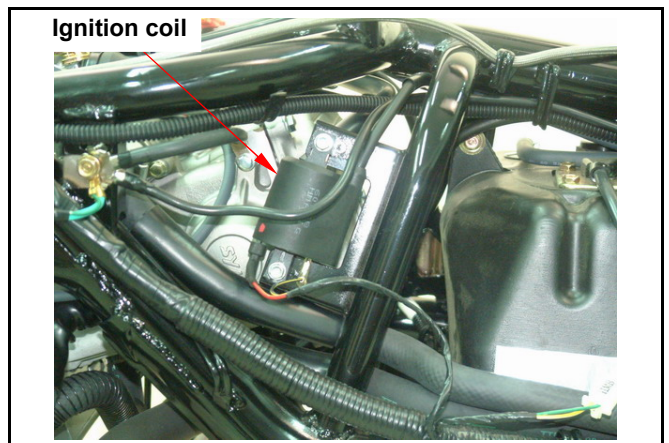


### Replacement on ignition coil

Remove the cap from the spark plug.



Loosen 2 bolts and replace the ignition coil if necessary.

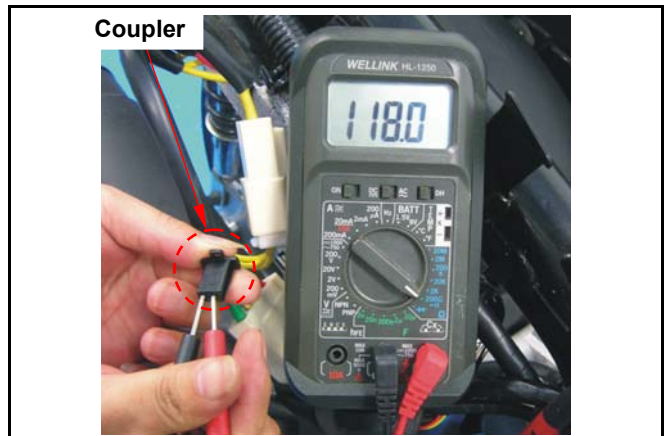


### Inspection of crank position sensor

Remove luggage box (bolt×6).  
Disconnect the coupler of the crank position sensor and measure the resistance between the terminals of green/white and blue/yellow.

**Standard resistance: 80~160Ω**

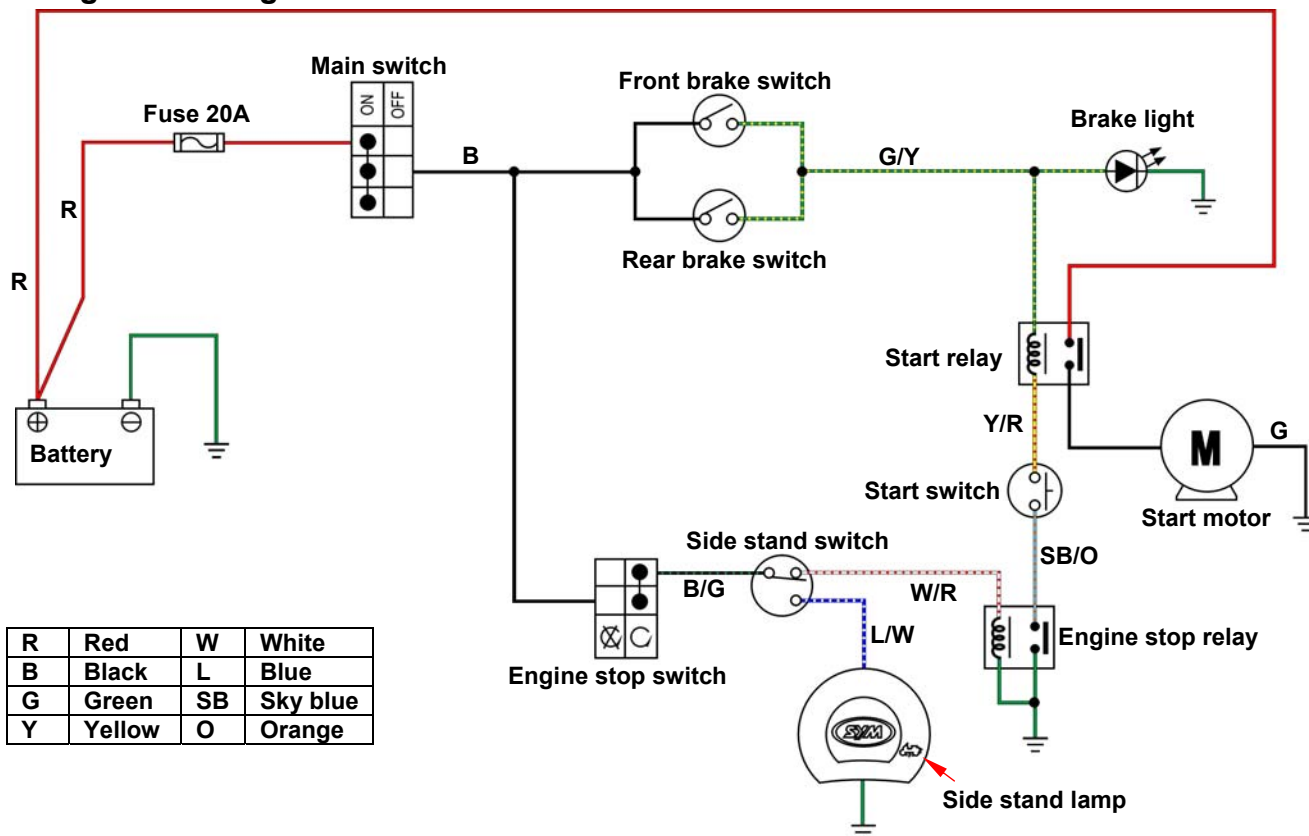
Please refer to the section 11 for disassembly of coil.





## Starting System

### Starting circuit diagram



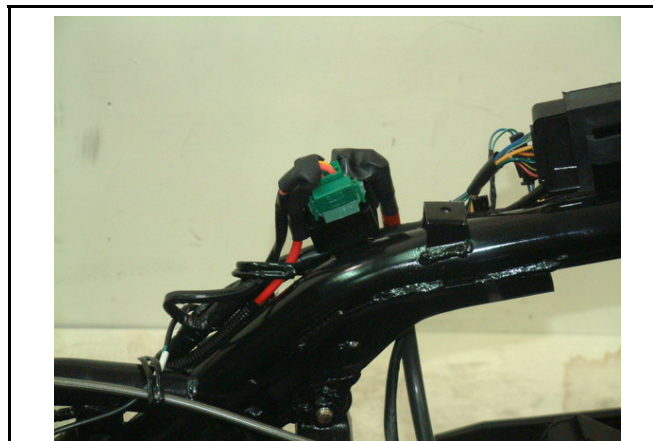
### Inspection on starter relay

Open the main switch.  
 Press the brake.  
 Push down the starter switch.  
 If a sound of “Looh Looh” is heard, it indicates the relay function normally.

Open the inner box lid, and remove battery cover.  
 Disconnect the negative cable terminal of the battery.



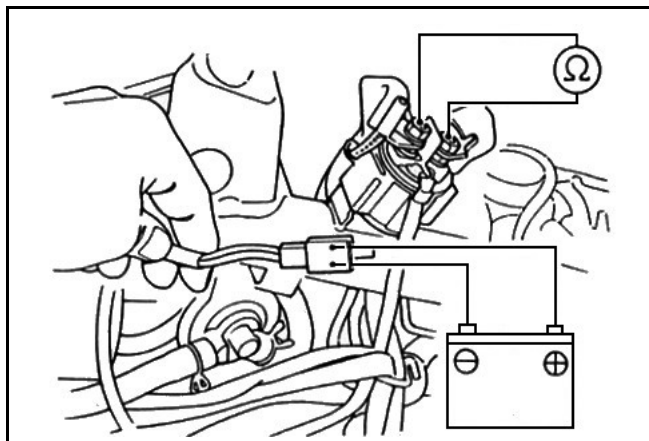
Remove the luggage box.  
 Disconnect the cable positive terminal from the start relay.





## 17. Electrical System

Disconnect the positive cable of the starter motor.  
 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.

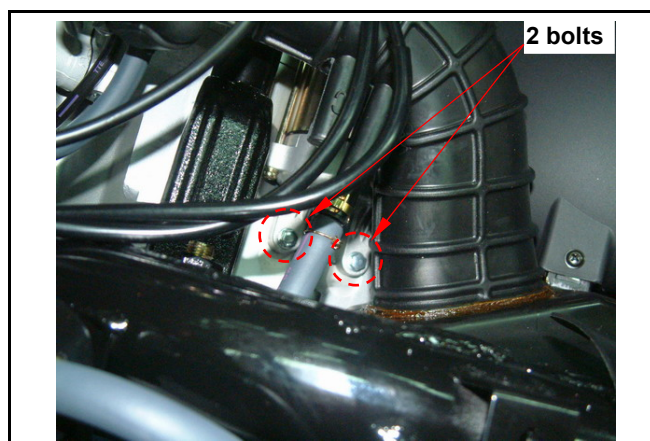


### Removal of Starter motor

Turns off the main switch  
 Remove the luggage box.  
 Disconnect the coupler of the start relay.  
 Disconnect the cable negative terminal of the battery.  
 Disconnect the starter motor power cable.  
 Loosen 2 bolts & remove starter motor.

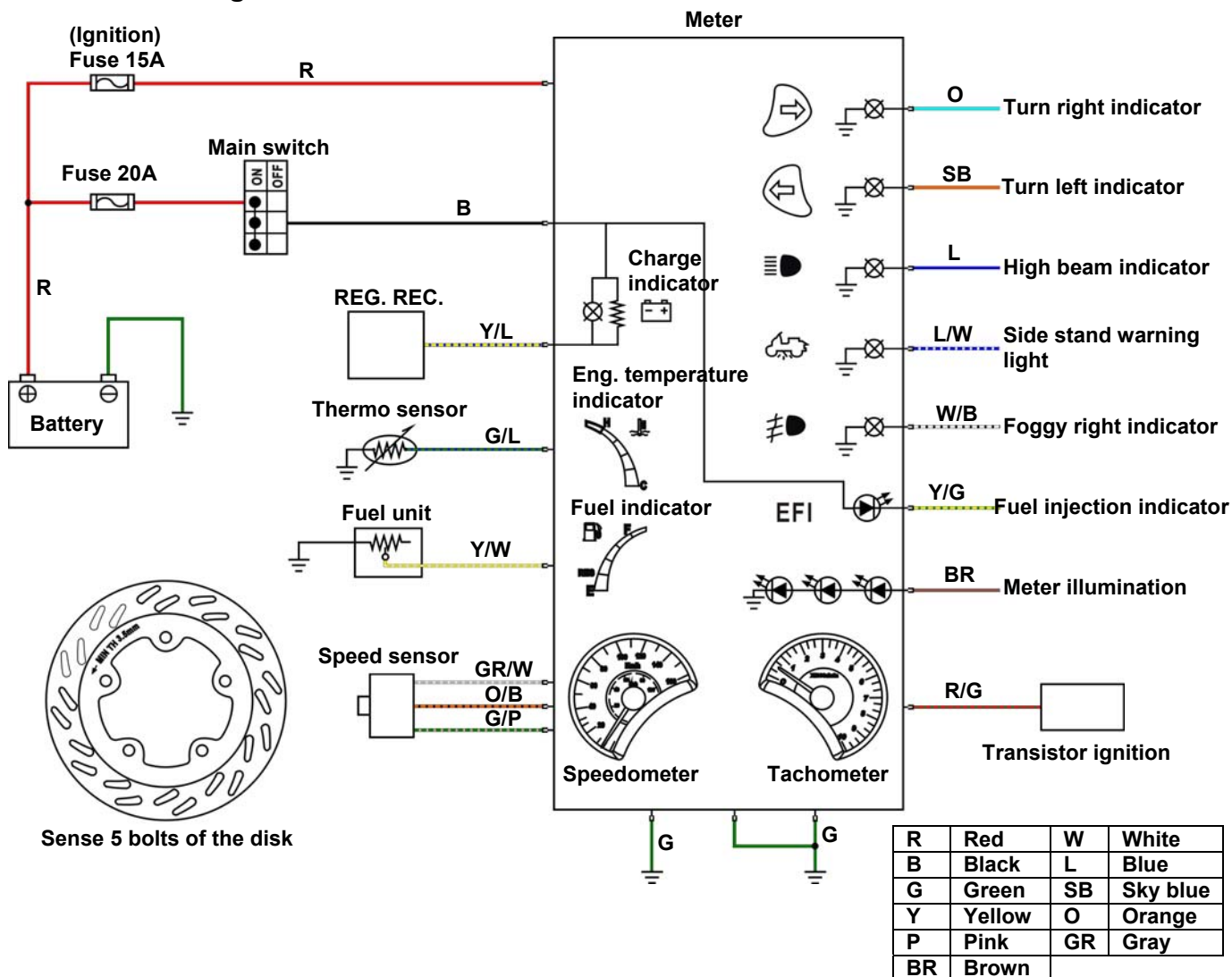
### Installation of starter motor

Install in reverse order of removal procedures.



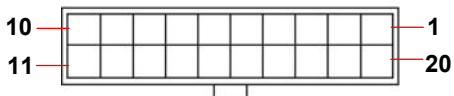
Meter

Meter circuit diagram

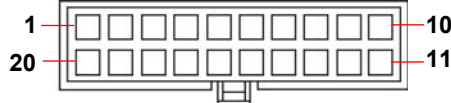


Sense 5 bolts of the disk

Meter coupler



Wire harness coupler



Wire harness coupler

Red	Yellow / Green	Black	Green	Green / Pink	Green	Red / Green	Yellow / White	Gray / White	Orange / black
BATT+	EFI	IGN+	BATT-	SP-	BATT-	RPM	Fuel+	SP+	SP
Green	Blue / White	Blue	Yellow / Blue	Brown	Sky Blue	Orange	White / Black	Green / Blue	
GND.	Side stand	Hi-beam	Charge	ILLUMI.	Turn-R	Turn-L	Foggy	TEMP.	

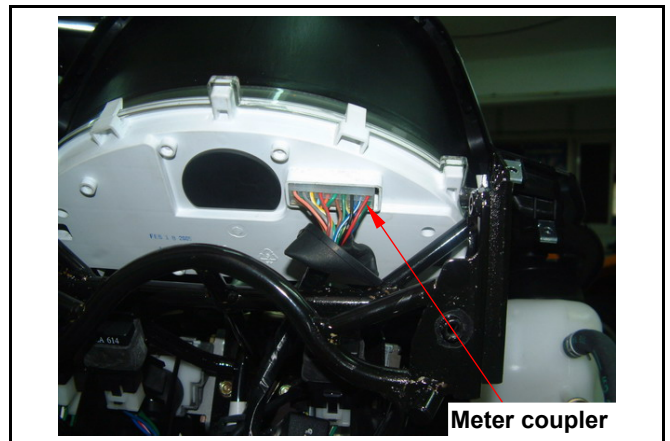
## 17. Electrical System

### Removal of meter

Remove wind screen garnish, wind screen, meter visor, front cover, meter visor.  
(Refer chapter 14)



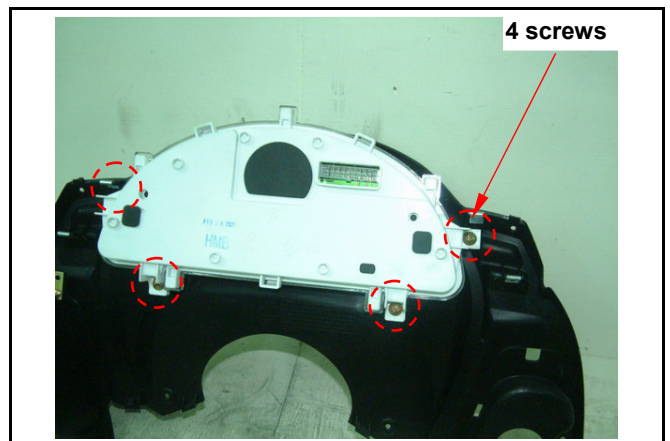
Disconnect the coupler of the speedometer, and take off the meter panel and meter.



Loosen 4 screws from meter panel.  
Remove the speedometer.

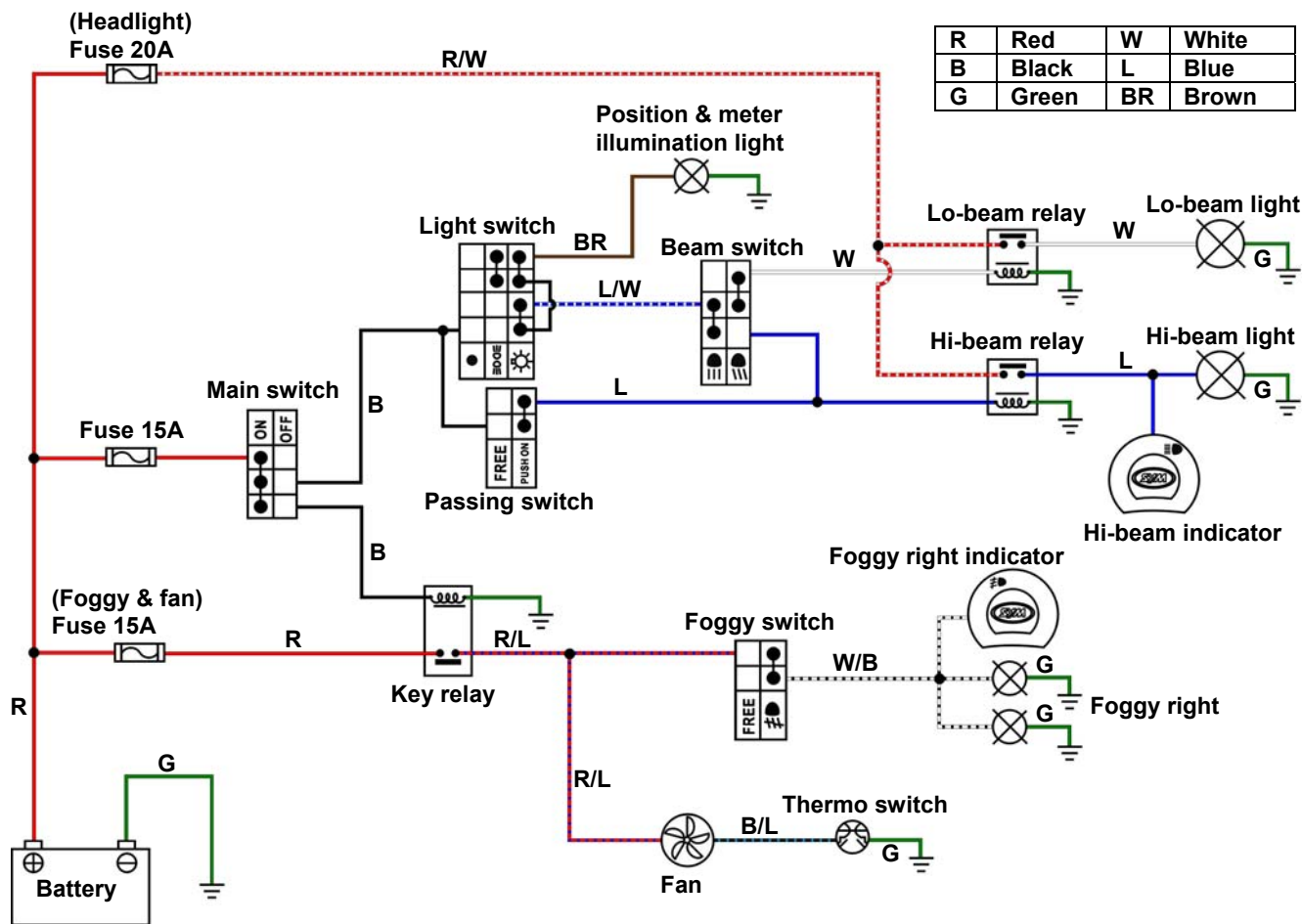
### Installation of meter

Install in reverse order of removal procedures

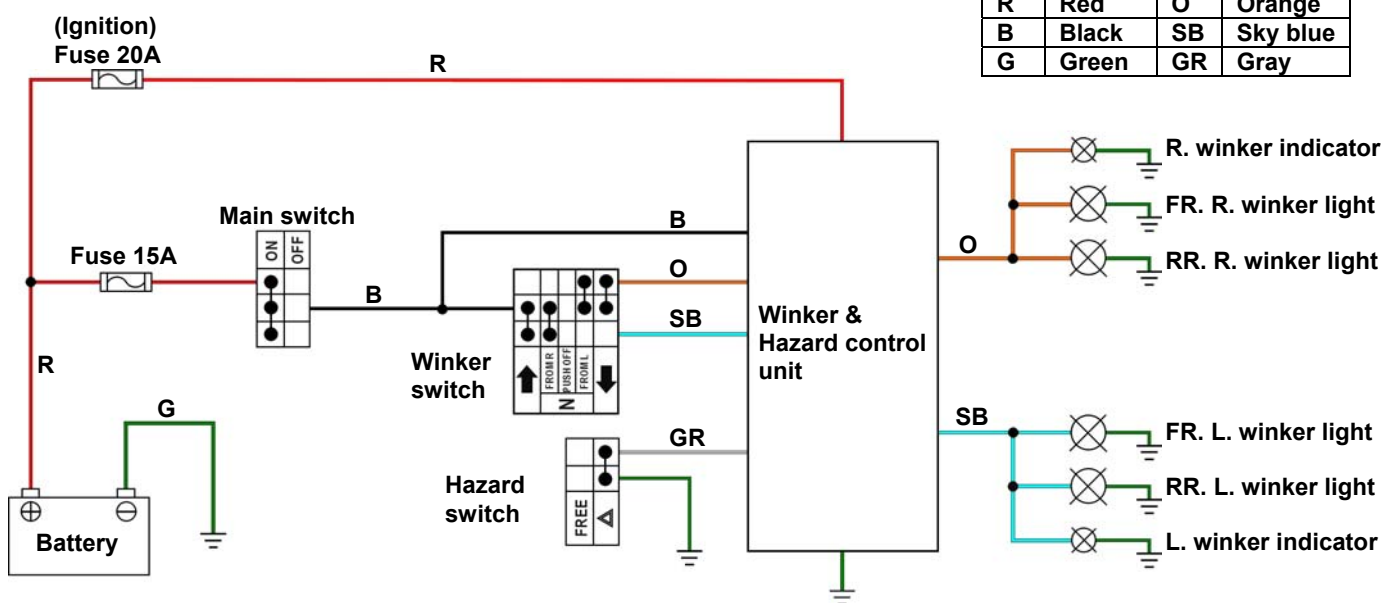


Light / Bulb

Headlight and foggy light circuit diagram



Winker light circuit diagram





## 17. Electrical System

### Headlight bulb replacement

Hold the headlight bulb socket.  
Rotate the headlight bulb and remove it.  
Replace with new bulb if necessary.

#### Specification:

Lo-beam bulb    **12V 55W (H11)**

Hi-beam bulb    **12V 55W (H11)**

#### Caution

- Headlight bulb can be replaced without removing the front cover.
- 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.

### Front winker bulb replacement

Hold the winker bulb socket.  
Rotate the winker bulb and remove it.  
Replace with new bulb if necessary.

#### Specification:

Winker light bulb    **12V 21W**



#### Installation

Install the bulb of the headlight in reverse order of removal.



**Foggy light bulb replacement**

Hold the foggy light bulb socket.  
 Rotate the foggy light bulb and remove it.  
 Replace with new bulb if necessary.

**Specification:**

**Foggy light bulb**      **12V 27W**



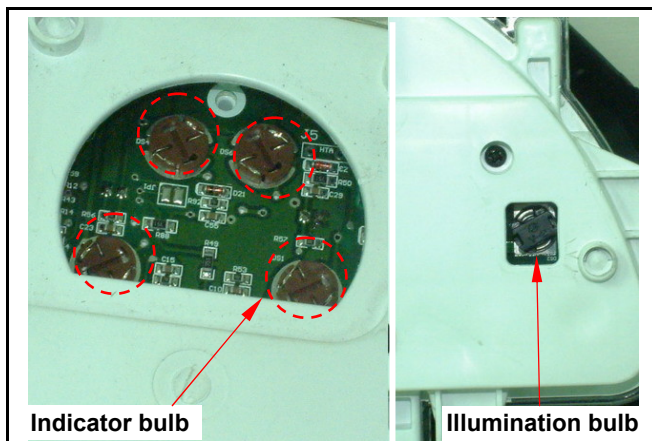
**Installation**

Install the bulb of the headlight in reverse order of removal.



**Meter illumination bulb replacement**

Remove the meter board waterproofing rubber.



Indicator bulb

Illumination bulb

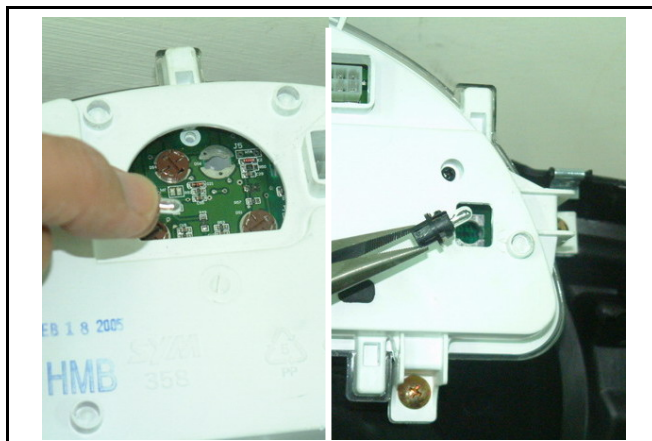
Uses the slotted screwdriver to turn the indicator bulb seat in C.C.W. direction, and remove the indicator bulb.

Uses the round nose pliers turn the illumination bulb seat in C.C.W. direction, and remove the illumination bulb.

**Specification:**

**Indicator bulb**      **12V 1.7W**

**Illumination bulb**      **12V 1.7W**





# 17. Electrical System



## Switch / Horn

### Main switch

#### Inspection

Remove the front cover.  
 Disconnect the main switch coupler.  
 Check the continuity between two points as indicated below

Position \ Pin	BAT	BAT1	BAT2
LOCK			
OFF			
ON	●	●	●
Wire Color	Red	Black	Blake

#### Replacement of main switch

Remove main switch cap.  
 Disconnect the coupler of the main switch and loosen the mounting bolts (3 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

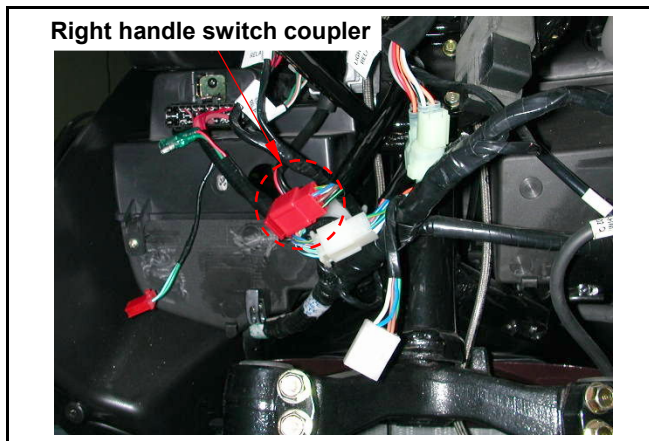
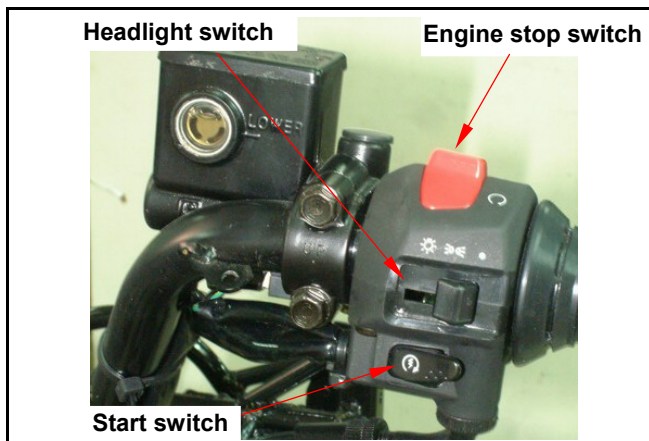
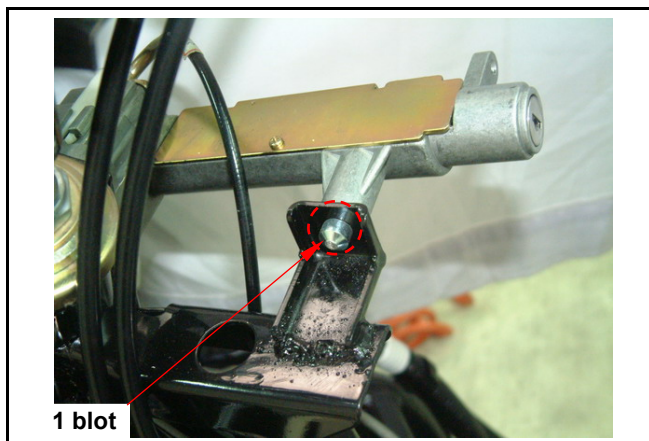
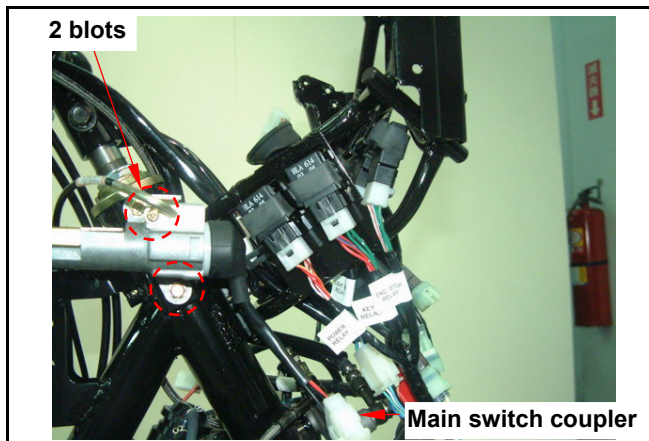
Remove the handle cover and front cover.  
 Disconnect the coupler of right handle switch.  
 Check the continuity between two points as indicated in the table below

#### Headlight switch

Position \ Pin	TL	CI	HL	CI
●				
	●	●		
	●	●	●	●
Wire Color	Brown	Black	Black	Blue /White

#### Start and engine stop switch

Position \ Pin	ST	E	ST	E
	●	●		
FREE				
			●	●
Wire Color	Black	Black /Green	Yellow / Red	Sky blue/ Orange



## Left handle switch

Remove the handle cover and front cover.  
Disconnect the coupler of left handle switch.  
Check the continuity between two points as indicated in the table below

### High and low beam switch

Position \ Pin	LO	HL	HI
		● — ●	●
	● — ●	●	
Wire color	White	Blue / White	Blue

### Winker switch

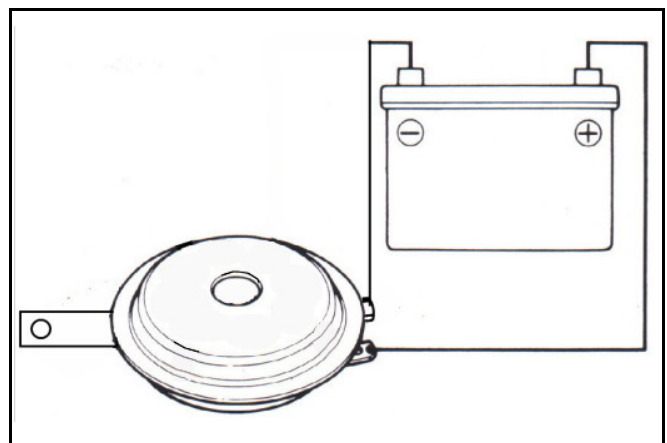
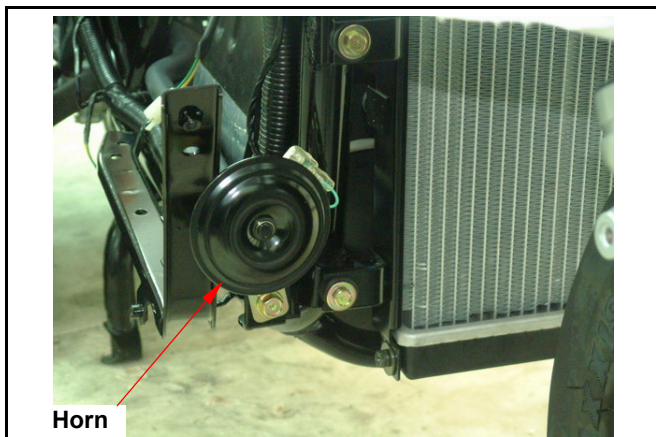
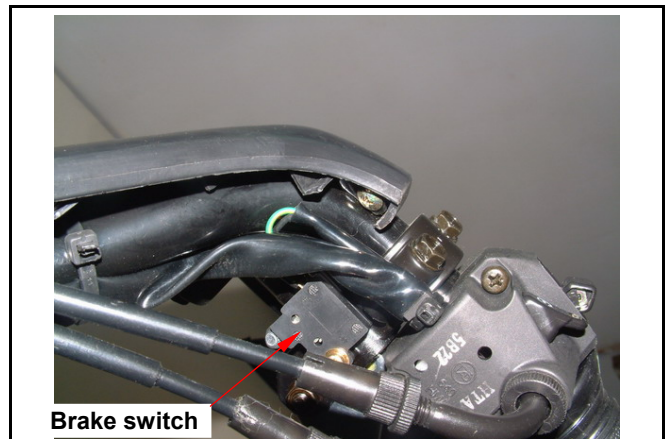
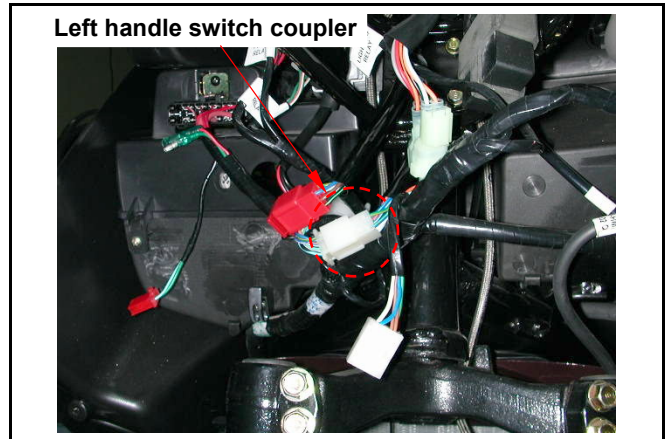
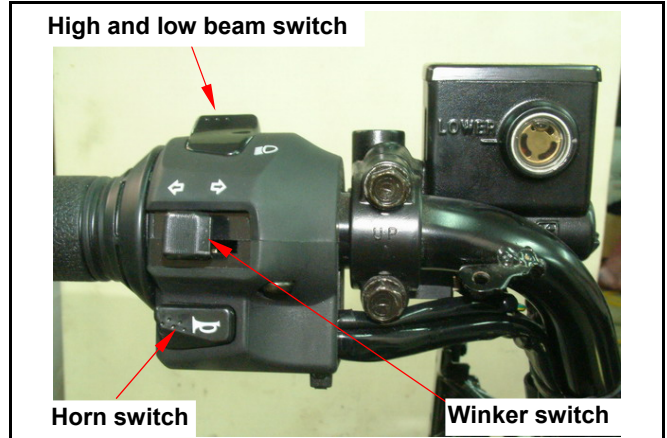
Position \ Pin	R	WR	L
	● — ●	●	
N	FROM R	● — ●	
	PUSH OFF		
FROM L		● — ●	●
		● — ●	
Wire color	Sky blue	Gray	Orange

## Brake Switch

While grasp the brake lever firmly, the terminals of white/green and green/yellow of the brake should have continuity.  
Replace the switch if damaged.

## 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.





# 17. Electrical System

## Fuel Unit

- Open the seat.
- Remove the luggage box.
- Remove the rear carrier.
- Remove right & left side cover.
- Remove the body cover
- Remove the floor panel.
- Disconnect the coupler of the fuel unit.
- Loosen 4 bolts from fuel unit and remove it.

**⚠ Caution**

- Great care shall be taken not to damage or bend the float arm of the gauge.

When the float arm shifts to the F position or the E position, the resistance measured shall be as follows:

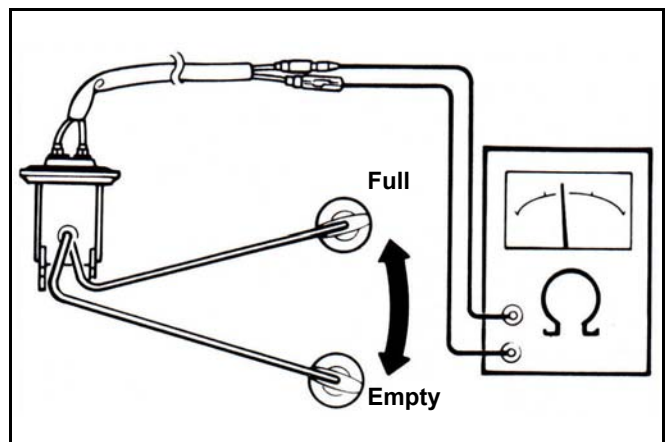
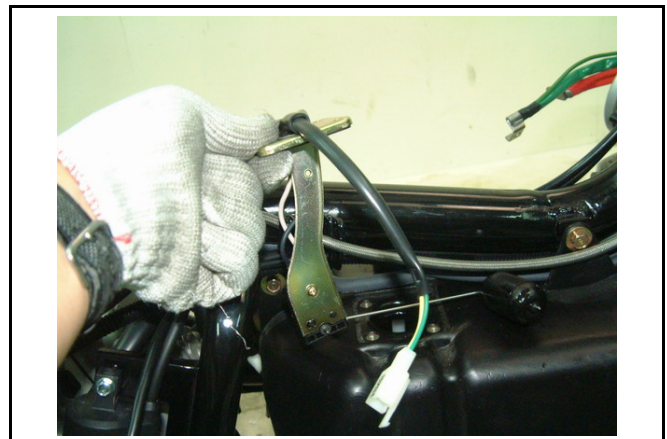
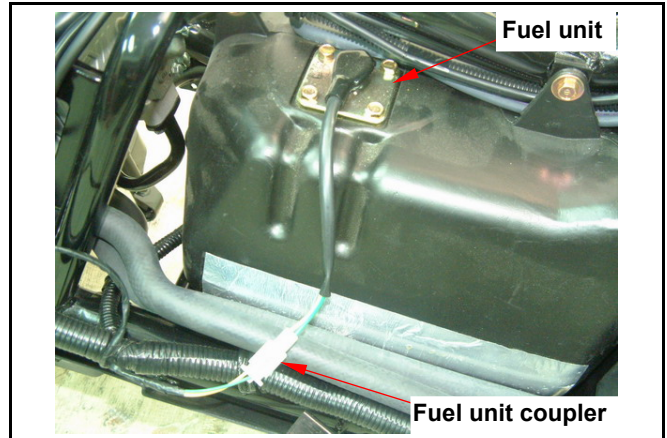
Position	Resistance
E (Empty)	97.5~107.5 Ω
F (Full)	4~10 Ω

- Connect the wiring to the fuel unit and the ohmmeter as shown.
- Connect the fuel unit coupler to the wire harness.
- Turn on the 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 mounted on the radiator controls the operation of the cooling fan motor. In case that the fan motor fails to work, disconnect the green and black/blue leads and connect jump wires to the terminals, then, turn on the main switch, the fan motor should operate.

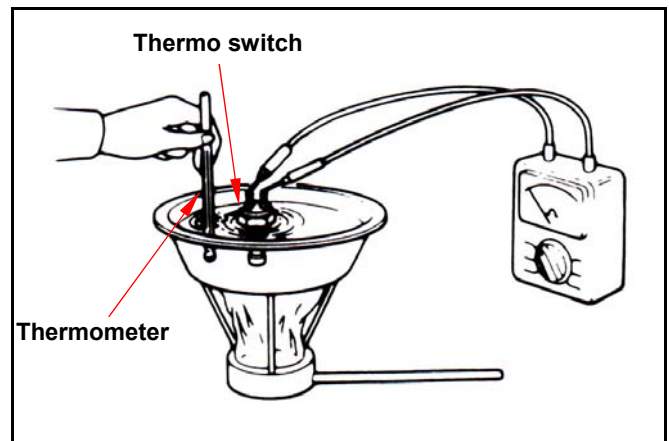
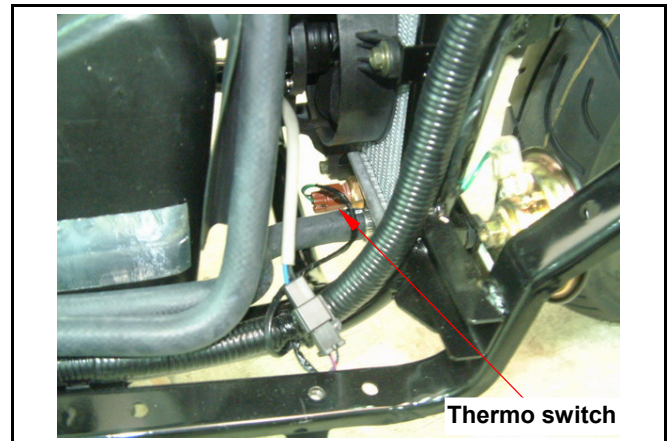
If the fan motor still fails to run, measure battery voltage between the green and black / blue leads. If there is no voltage, check for blown fuse, loose connection or short-circuit.

If the fan motor runs, check the thermo switch in the manner as described 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 increase the coolant temperature 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 teeth are completely submerged.



## 17. Electrical System

### Thermo Unit

Remove the thermo unit.

Hang the thermo unit in an oil heater, heat the oil and measure the resistance at each temperature.

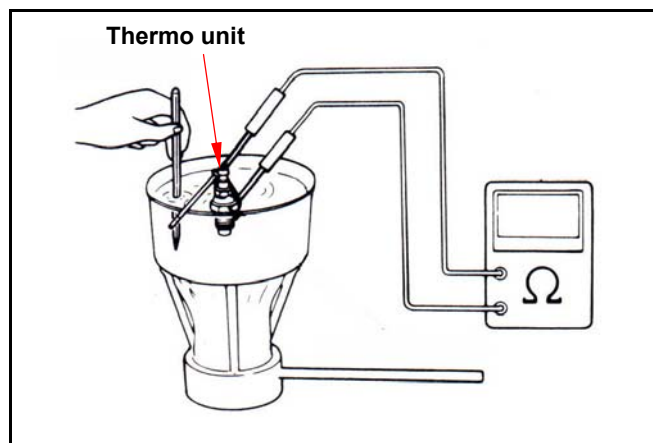
Temperature	50°C	80°C	100°C	120°C
Standard ( $\Omega$ )	134~149	47.5~57.0	26~29	14.8~17.2

#### Caution

- Wear gloves and goggles when performing this test.

#### Caution

- Engine oil should be used as a heating medium as the test temperature must be higher than 100°C.
- Contacting the container wall by the thermometer and the thermo unit may result in wrong readings.



### Water Temperature Meter

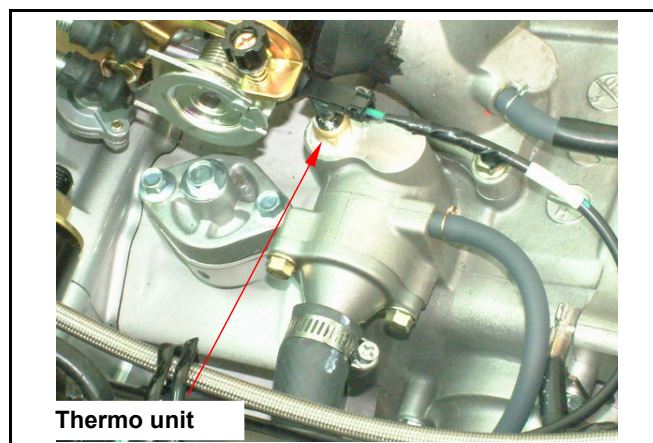
Disconnect the thermo sensor coupler and connect it to engine ground.

Turn on the main switch.

The needle of the water temperature meter should move to other end, H position.

#### Caution

- Do not ground the water temperature more than 5 seconds, or the meter will be damaged.



<b>Mechanisms in the Emission Control System</b> ..... 18-1	<b>Catalytic Converter (CATA)</b> ..... 18-4
<b>Functions of Mechanism in the Emission Control System</b> ..... 18-1	<b>Secondary Air Introduction System</b> ... 18-5
<b>Fuel Evaporative Emission Control System (E.E.C.)</b> ..... 18-2	<b>Positive Crankcase Ventilation System (P.C.V.)</b> ..... 18-8
	<b>Inspection Items</b> ..... 18-9

## Mechanisms in the Emission Control System

### Four-Stroke Engine Model

1. Catalytic Converter (CATA)
2. Evaporative Emission Control System (E.E.C.)
3. Air Injection System (A.I.)
4. Positive Crankcase Ventilation System (P.C.V.)

## 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 exhaust gas.
E.E.C. system	Evaporative emission control system	Activated carbon canister Purge control valve	A canister is used to absorb vapor from fuel tank and to introduce it into carburetor at an opportune timing.
A.I. 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.

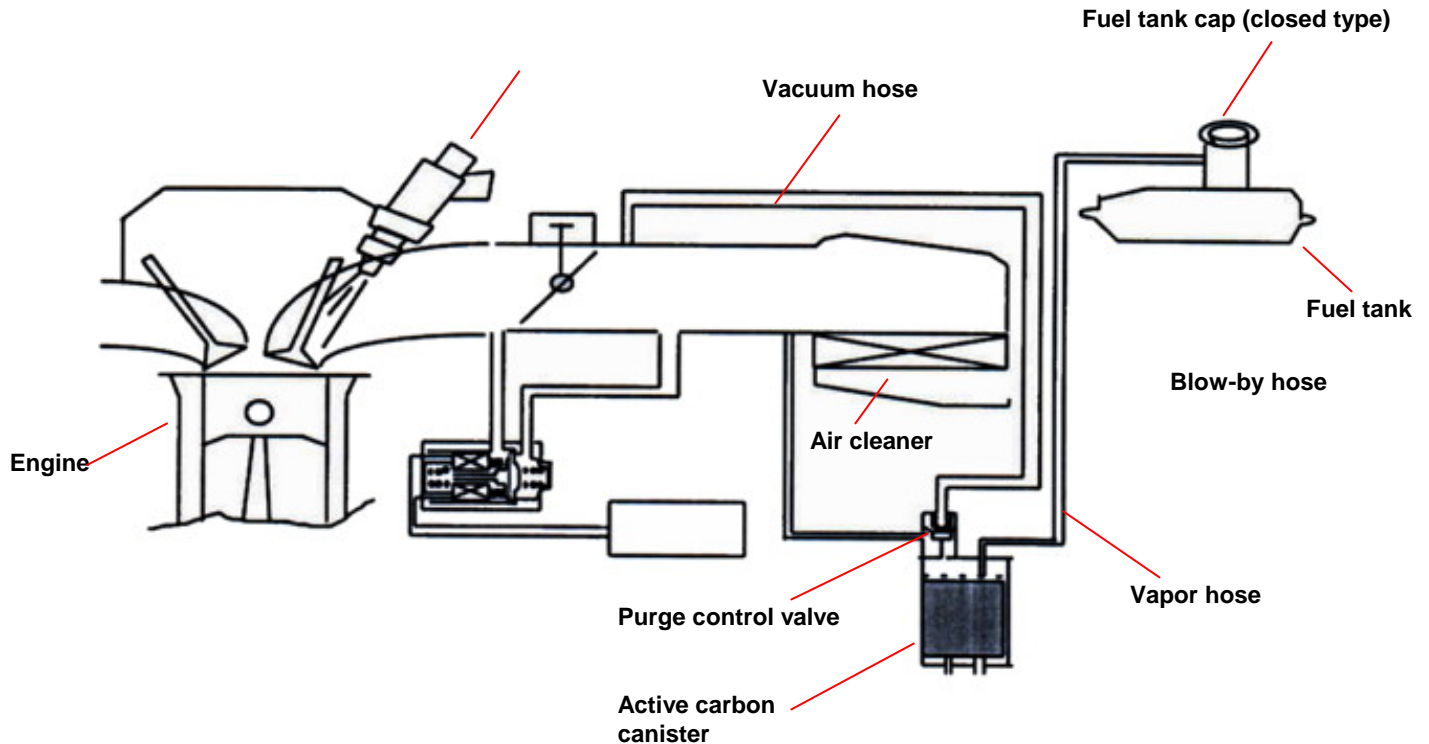


## 18. Emission Control System

### Fuel Evaporative Emission Control System (E.E.C.)

#### 1. Construction:

- Reduce HC to pollute air.
- To absorber fuel vapor and saving fuel consumption



#### 2. 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 active carbon.
- When the engine is running, the negative pressure of the intake manifold opens the purge line, release HC from the activated carbon and then sucks it 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.

#### 3. Troubleshooting:

Fuel can not flow to the fuel injector

- No fuel in the fuel tank
- Malfunction of the fuel pump/ fuel pressure regulator
- Clogged fuel system

#### 4. Cautions:

- Do not exceed the reed valve of the fuel filler when filling out fuel.
- Do not have rush acceleration or running in high speed when applying the spare fuel.

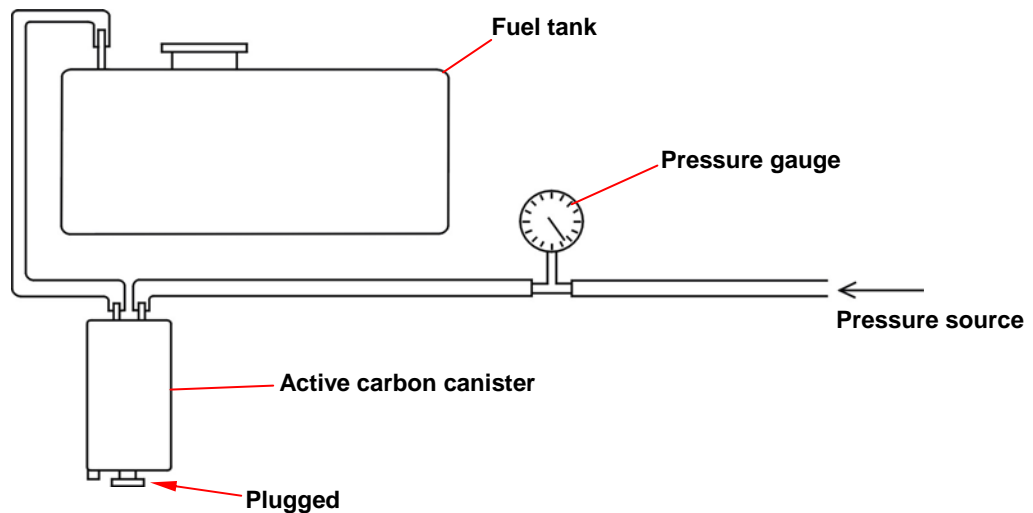
## Evaporative Emission Control System (EEC)

### 1. Visual check:

- 1) Check the outside of canister for damage.
- 2) Check all hoses for breakage.

### 2. Leak test:

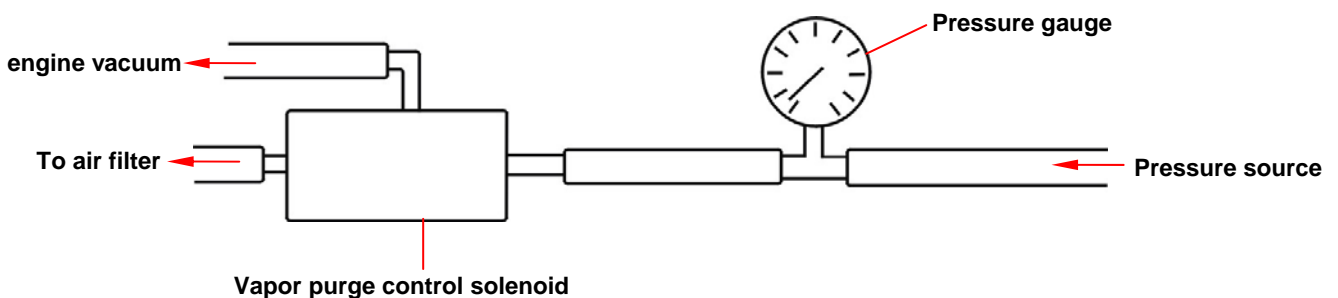
- 1) Disconnect the Vapor purge control solenoid hose, and connect a T-type hose connector to a pressure gauge and a pressure source as shown below:



- 2) Plug canister vent.
- 3) Apply 100mmAq into pressure source inlet then plug it. The pressure at the gauge should not drop to below 10mmAq within 10 seconds.

### 3. PCV Function Test

- 1) Disconnect the hose of connection to the active carbon canister, and then connect a T-type hose connector to pressure source as shown below:

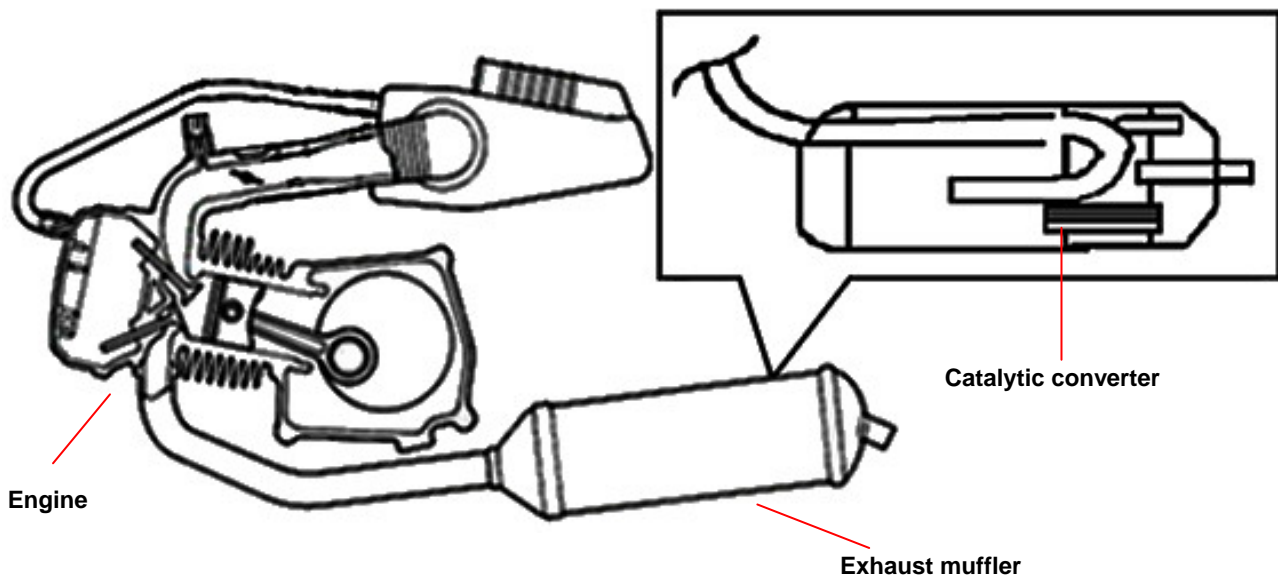


- 2) Apply 100mmAq into pressure source inlet as engine stopped then plug it. The pressure at the gauge should not drop to below 10mmAq within 10 seconds.

## 18. Emission Control System

### Catalytic Converter (CATA)

#### 1. Construction:

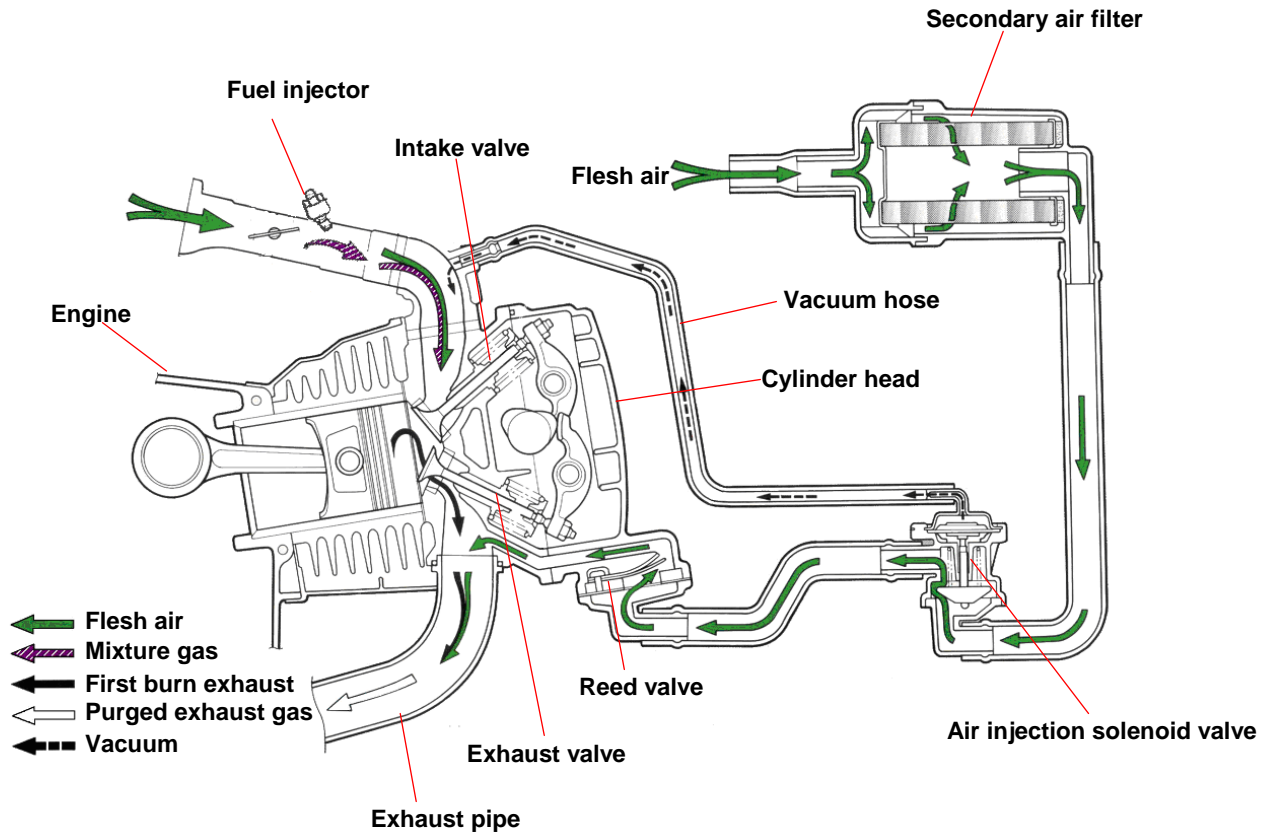


#### 2. Description:

- 1) The function of the catalytic converter is to transfer unburned CO, HC, and NO<sub>x</sub> harmless CO<sub>2</sub>, H<sub>2</sub>O, N<sub>2</sub> gases.
- 2) Pt, Pd, Rh...etc. precious metals are used into the catalytic converter so use only unleaded gasoline to prevent from cause the catalytic converter to fail.

## Secondary Air Introduction System

### 1. Construction



This system contained AISV (air Injection Solenoid Valve), Reed Valve and other intake components.

### 2. Principle of operation:

- Secondary air is introduced into exhaust manifold so that CO and HC in the exhaust will be burned again under a state of rich oxygen and appropriate temperature and be turned into harmless CO<sub>2</sub>, H<sub>2</sub>O.
- The opening and closing of the exhaust valve can generate a positive or a negative pressure pulse inside a motorcycle's exhaust system. Exhaust gas is controlled by a reed valve. When pressure inside the exhaust manifold is negative, reed valve will be sucked open by the negative pressure and outside air will enter to mix with CO, HC, thus generating a secondary burn reaction and turning them into harmless gases. When pressure inside the exhaust manifold is positive, reed valve will close to prevent exhaust back up and enter into the secondary air cleaner.
- Air cut-off valve (AICV) will cut off the secondary air supply during engine fuel returning cycle to reduce after-burning noises.



## 18. Emission Control System

### 3. Service Points/Trouble Diagnosis:

#### Diesel

- Malfunction of air inject solenoid valve (AISV).
- System hose leakage.
- Abnormal ignition timing.
- Lean mixture gas.
- Abnormal fuel supply.

#### Rich Exhaust Gas:

- plugged air-jet by dirty carburetor.
- poor adjustment of air adjustment screw.
- poor reed valve.
- System hose leakage or plugged.

#### Noise:

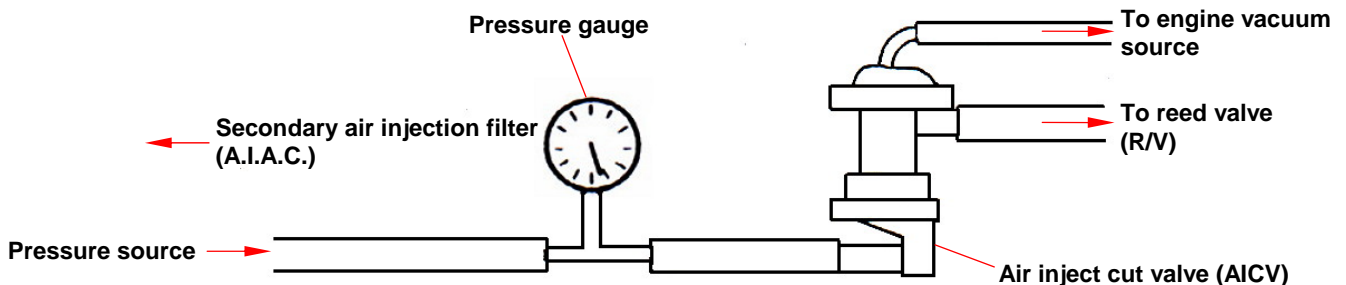
- System hose leakage.
- Loosen secondary air injection filter.
- Loosen secondary air injection filter hose.

### 4. AI System Service methods:

#### a. Visual check:

- Check reed valve, air cut-off valve, secondary air cleaner for outside damages.
- Check metal pipes and hoses for breakage and cracks.

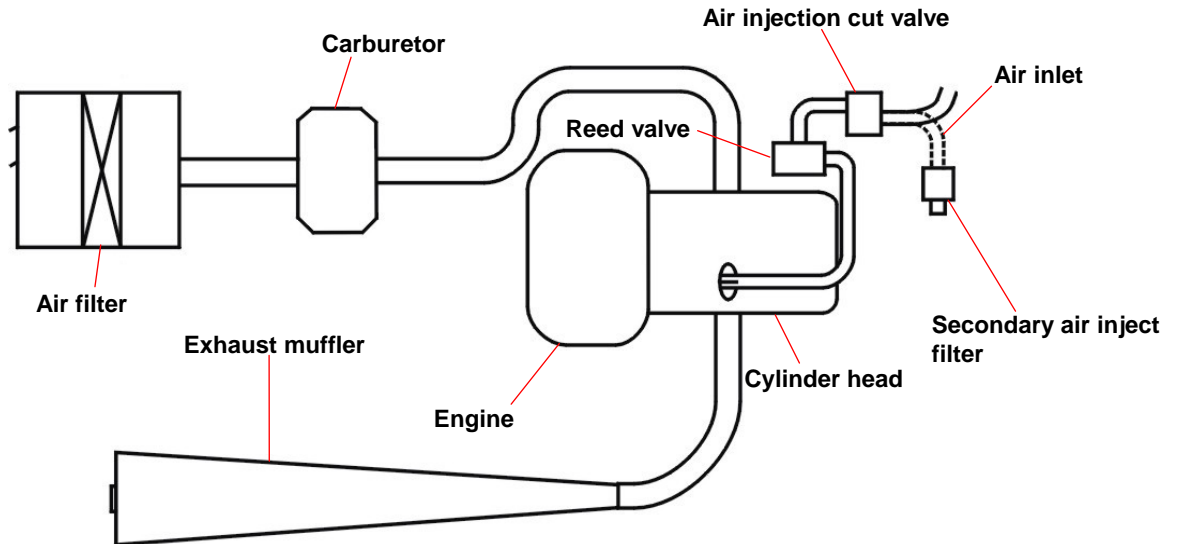
#### b. Leak test:



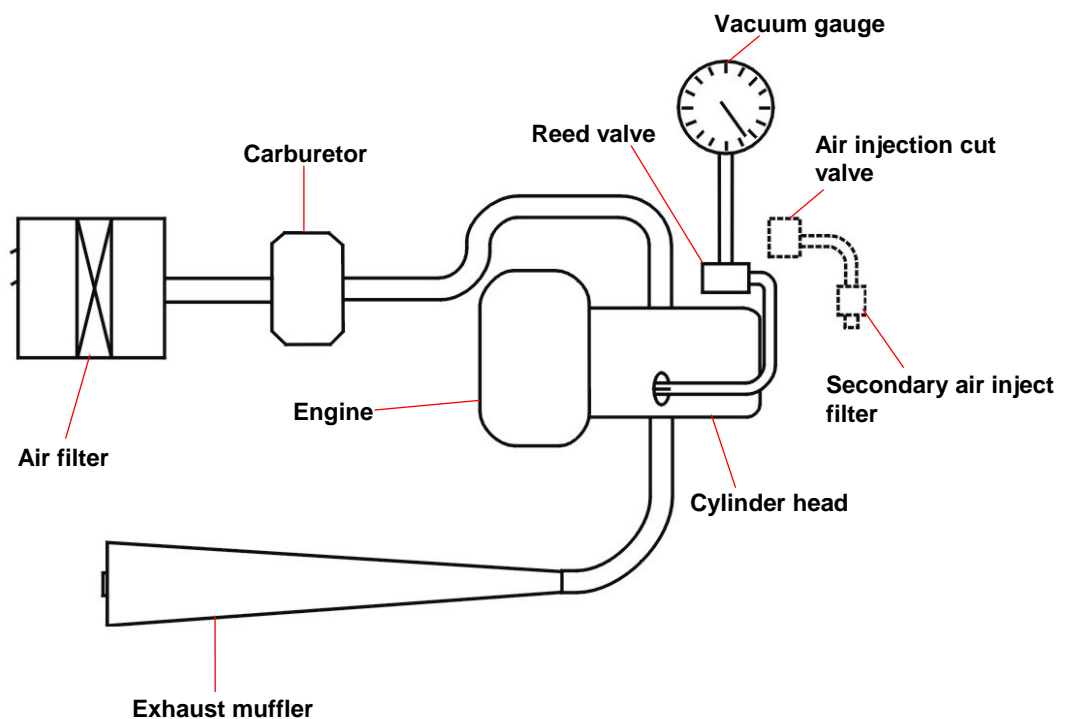
- Plug the hose leading to reed valve.
- Remove the hose of connection to air injection cut valve. Connect a T-type hose connector, pressure gauge and pressure source as shown above.
- With engine stopped, apply 1.0kg/cm<sup>2</sup> pressure to inlet and then plug it. There should be no leakage.

## 1. Warm-up test:

- Start engine.
- Remove the air injection filter.
- Check the air inlet if there is air-sucking sounds during idling (should hear Bo-Bo-Bo sound).



- If no sound is heard, remove air cut-off valve, and connect a vacuum meter to air pipe to check for leakage.

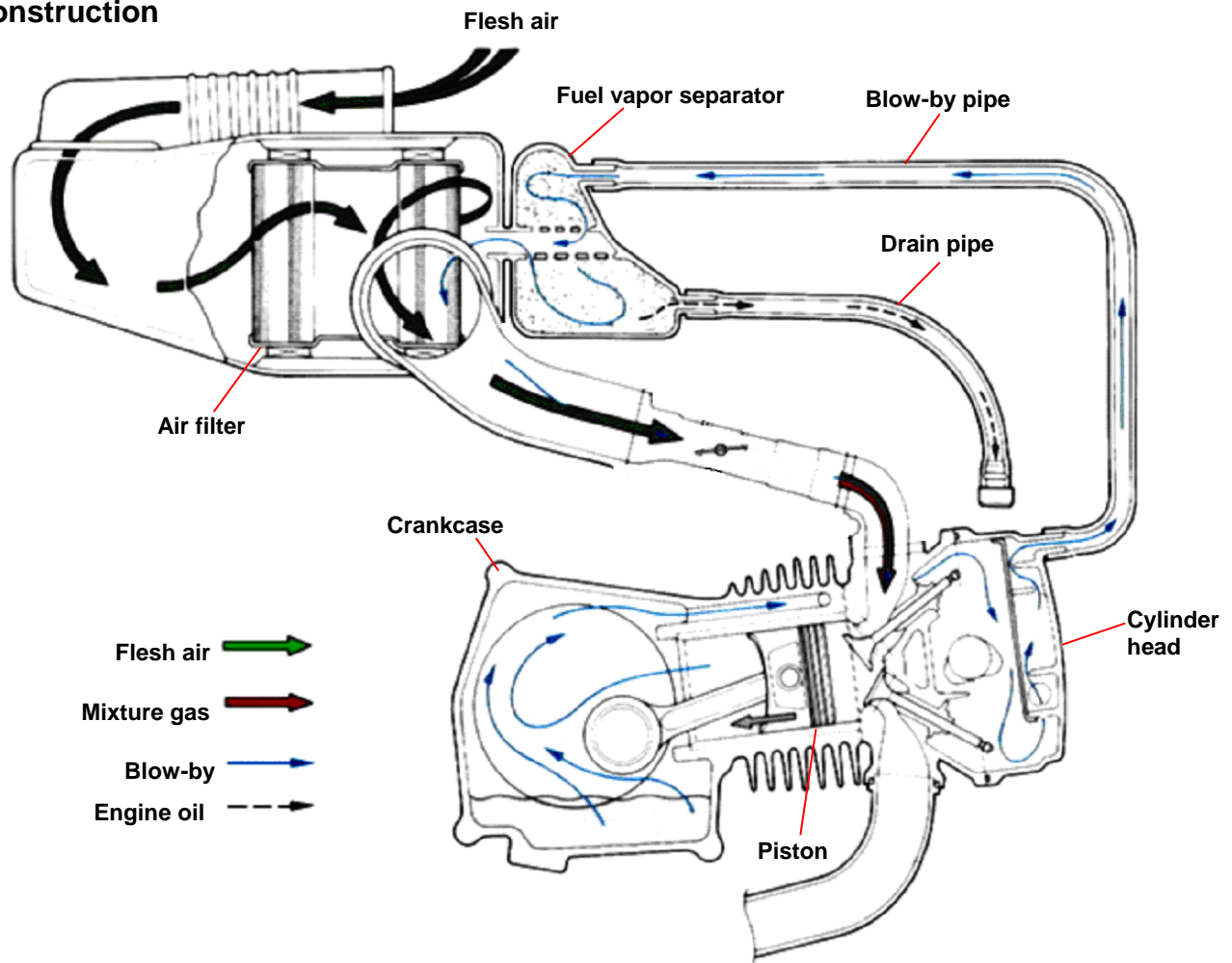


- If there is no vacuum, replace reed valve and test again.
- If there is no vacuum, check the air pipe for leakage, plugged or loose.

## 18. Emission Control System

### Positive Crankcase Ventilation System (P.C.V.)

#### 1. Construction



#### 2. 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.

#### 3. Service Methods

##### Visual check:

- Remove drain plug to drain the fuel when fuel level on the drain pipe reaches 80 % full.
- Check connecting hose for damage and looseness.

**Inspection Items****Secondary air injection system**

1. Visually inspect the reed valve, air injection solenoid valve, and secondary air filter as well as hoses for damage.
2. Leaking check.
3. Warm-up running check.

**Evaporative Emission Control System**

1. Visually inspect the activated carbon canister and hoses for damage.
2. Leaking check.
3. Function test of the purge control valve.

**Catalytic converter**

1. Check if exhaust gas content is within standard.
2. Remove the exhaust pipe and shake it gently for abnormal noise.

**Fuel Supply System**

1. Clean the air filter.
2. Check the air filter.
3. Clean the fuel injector and all circuit with air gun or specified solvent.
4. Check the fuel pump/ fuel pressure regulator for malfunction.
5. Adjust CO/HC values at idling. (engine rpm must be within specification)

**Ignition system**

1. Spark plug check and replacement.
2. Ignition coil check and replacement.



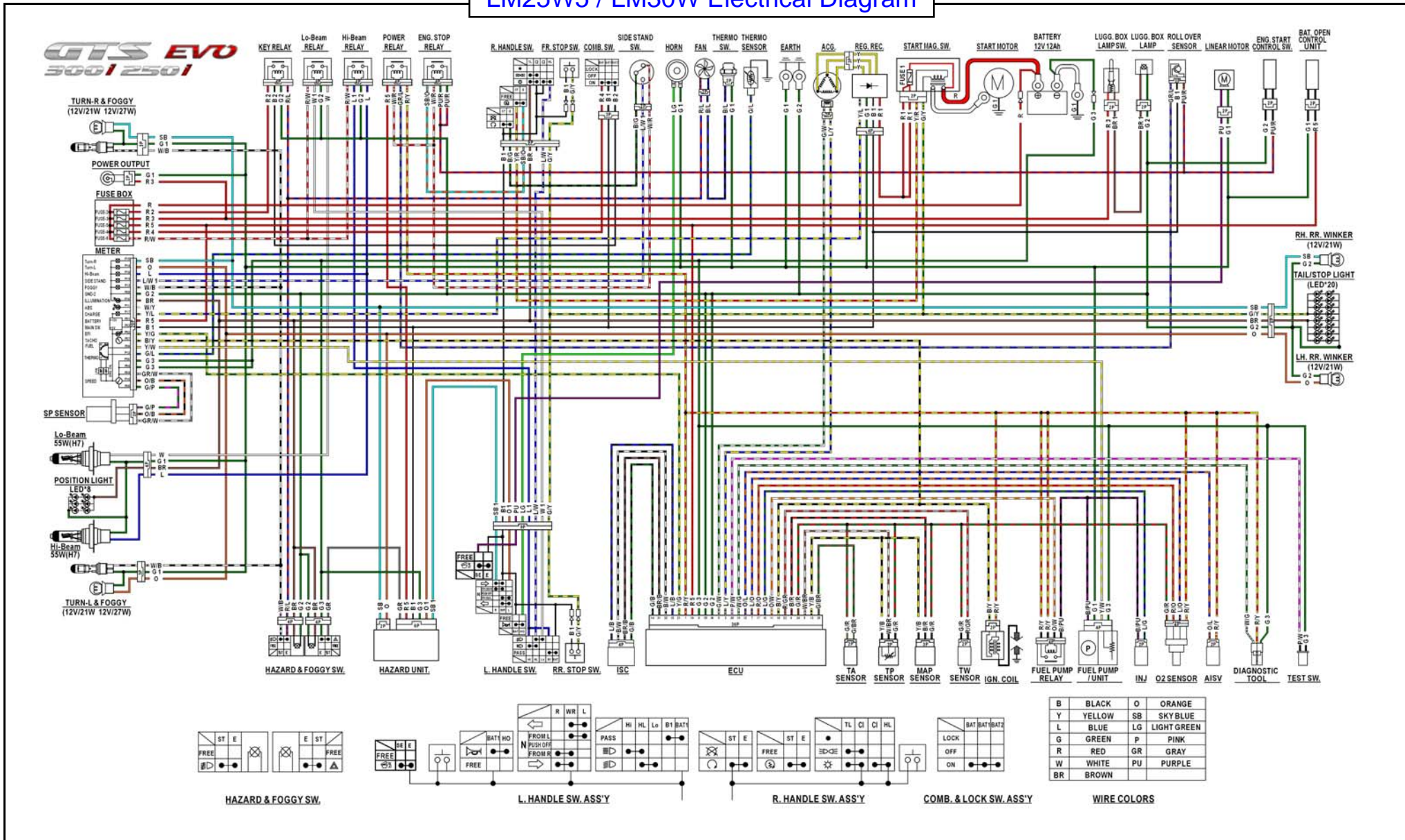
## 18. Emission Control System

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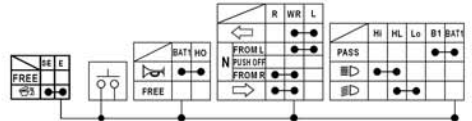


Note:

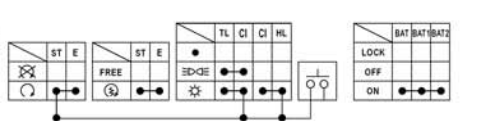
## LM25W5 / LM30W Electrical Diagram



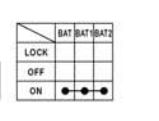
HAZARD & FOGGY SW.



L. HANDLE SW. ASS'Y



R. HANDLE SW. ASS'Y



COMB. & LOCK SW. ASS'Y

B	BLACK	O	ORANGE
Y	YELLOW	SB	SKY BLUE
L	BLUE	LG	LIGHT GREEN
G	GREEN	P	PINK
R	RED	GR	GRAY
W	WHITE	PU	PURPLE
BR	BROWN		

WIRE COLORS

## 19. Electrical Diagram

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**NOTE:**