Symbols

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

 Oil	Use recommended engine/transmission oil, unless otherwise specified.
 Grease	Use lithium based multi-purpose grease, unless otherwise specified.
 Locking agent	Apply locking agent, medium strength sealant should be used unless otherwise specified.
 Apply sealant	Apply sealant.
 Renew	Replace with a new part before installation.
 Brake fluid	Use recommended brake fluid DOT 3 or DOT 4.
 Fork oil	Use recommended fork or suspension fluid.
 Special tool	Use special tools to disassemble/assemble specific parts.

Abbreviation List

The following abbreviations are used to identify the respective parts or systems.

ABS	Anti-lock Brake System.
AISV	Air Injection Solenoid Valve
CPS	Crankshaft Position Sensor
ECU	Electronic Control Unit
EFi	Electronic Fuel Injection system
ISC	Idle Speed Controller
MAP sensor	Manifold Air Pressure sensor
TW sensor	Engine temperature sensor / coolant temperature sensor
TA sensor	Intake Air Temperature sensor
TPS	Throttle Position sensor
OBD	Onboard Diagnosis
O_2 sensor	Oxygen sensor / lambda sensor
ID	Inside Diameter
OD	Outside Diameter
ATDC	After Top Dead Center
ABDC	After Bottom Dead Center
BBDC	Before Bottom Dead Center
BTDC	Before Top Dead Center

General Safety

Carbon monoxide

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

⚠ Caution

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

Gasoline

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

⚠ Caution

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

Used engine oil

⚠ Caution

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

Hot components

⚠ Caution

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

Battery

⚠ Caution

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

Brake pad

Do not use compressed air or a cleaning brush to clean the brake system; use a vacuum cleaner to prevent the asbestos fiber from drifting in the air.

⚠ Caution

- Inhaling asbestos fiber may result in lung disease or cancer.

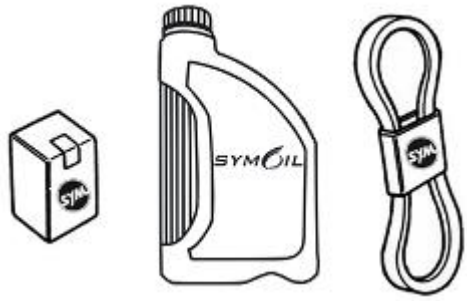
Brake fluid

⚠ Caution

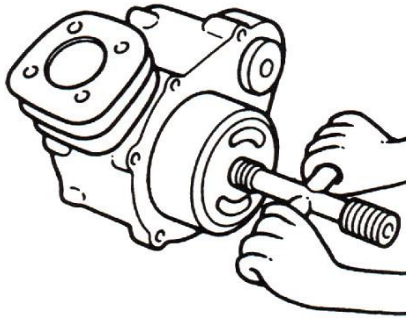
- Brake fluid may cause damage to the surface of the painted parts, or even the structure of the plastic or rubber parts. Place a clean cloth for protection when servicing the brake system. Keep the brake fluid beyond reach of children.

Service Precautions

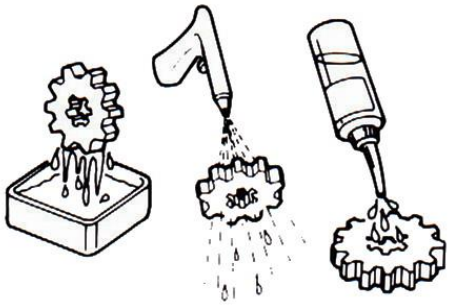
Always use with SANYANG genuine parts and recommended oils. Using non-designated parts for SANYANG motorcycle may damage the motorcycle.



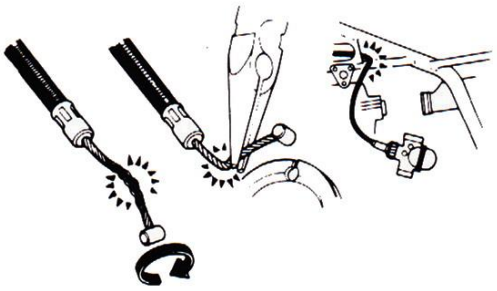
Special tools are designed for remove and install of components without damaging the parts being worked on. Using wrong tools may result in parts damaged.



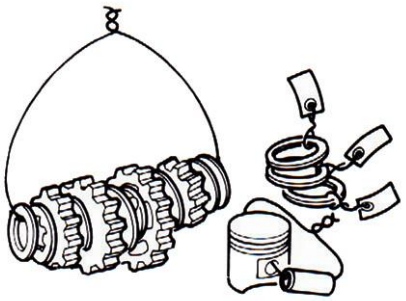
- When servicing this motorcycle, use only metric tools. Metric bolts, nuts, and screws are not interchangeable with the English system, using wrong tools and fasteners may damage this vehicle.
- Clean the outside of the parts or the cover before removing it from the motorcycle. Otherwise, dirt and deposit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



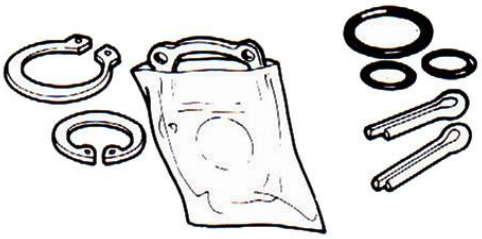
- Never bend or twist a control cable to prevent unsmooth control and premature worn out.



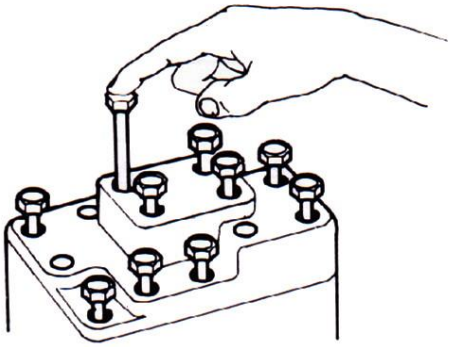
- Rubber parts may become deteriorated when old, and prone to be damaged by solvent and oil. Check these parts before installation to make sure that they are in good condition, replace if necessary.
- When loosening a component which has different sized fasteners, operate with a diagonal pattern and work from inside out. Loosen the small fasteners first. If the bigger ones are loosen first, small fasteners may receive too much stress.
- Store complex components such as transmission parts in the proper assemble order and tie them together with a wire for ease of installation later.



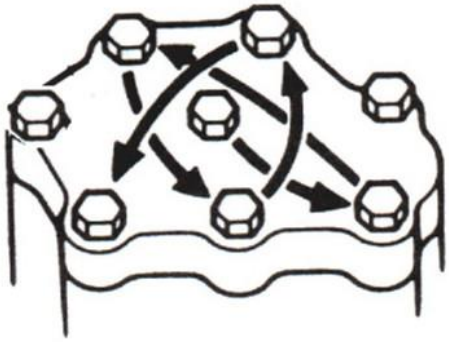
- Note the reassemble position of the important components before disassembling them to ensure they wil l be reassembled in correct dimensions (depth, distance or position).
- Components not to be reused should be replaced when disassembled including gaskets metal seal rings, O-rings, oil seals, snap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



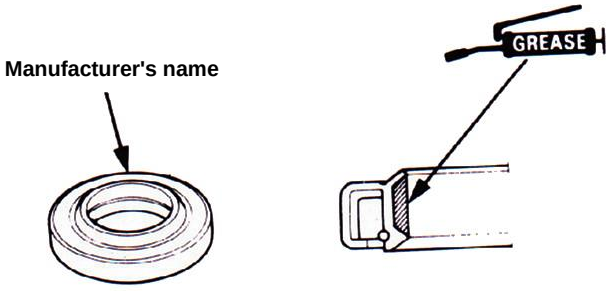
- The length of bolts and screws for assemblies, cover plates or boxes is different from one another, be sure they are correctly installed. In case of confusion, Insert the bolt into the hole to compare its length with other bolts, if its length out side the hole is the same with other bolts, it is a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



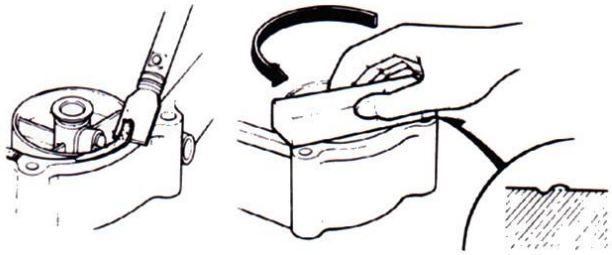
- Tighten assemblies with different dimension fasteners as follows: Tighten all the fasteners with fingers, then tighten the big ones with special tool first diagonally from inside toward outside, important components should be tightened 2 to 3 times with appropriate increments to avoid warp unles s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



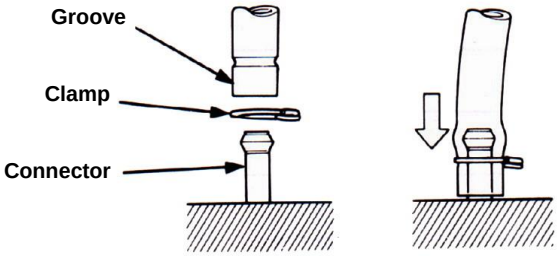
- When oil seal is installed, fill the groove with grease, install the oil seal with the name of the manufacturer facing outside, check the shaft on which the oil seal is to be installed for smoothness and for burrs that may damage the oil seal.



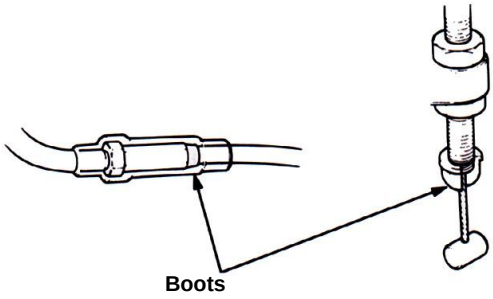
- Remove residues of the old gasket or sealant before reinstallation, grind with a grindstone if the contact surface has any damage.



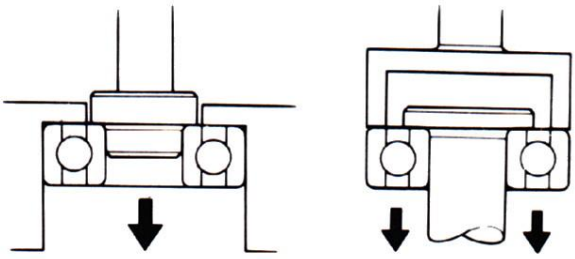
- The ends of rubber hoses (for fuel, vacuum, or coolant) should be pushed as far as they can go to their connections so that there is enough room below the enlarged ends for tightening the clamps.



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

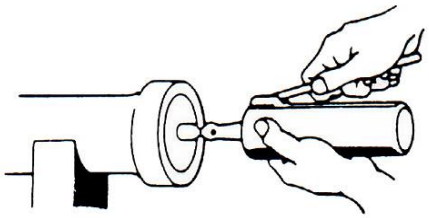


- The tool should be pressed against two (inner and outer) bearing races when removing a ball bearing. Damage may result if the tool is pressed against only one race (either inner race or outer race). In this case, the bearing should be replaced. To avoid damaging the bearing, use equal force on both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

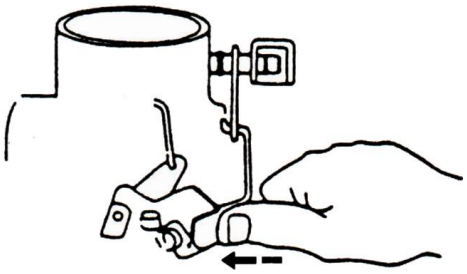


Both of these examples can result in bearing damage.

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



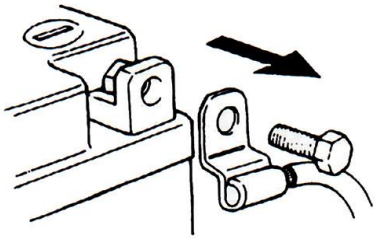
- Check if positions and operation for installed parts is in correct and properly.



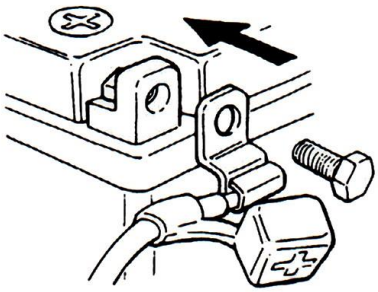
- Make sure service safety each other when conducting by two persons.

- Note that do not let parts fall down.

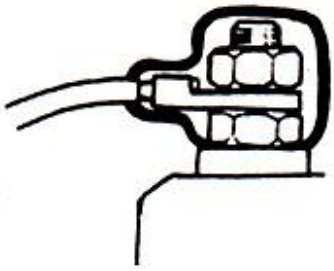
- Before battery removal operation, it has to remove the battery negative (-) cable firstly. Notre tools like open-end wrench do not contact with body to prevent from circuit short and create spark.



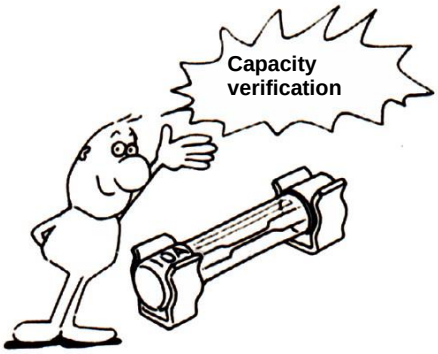
- After service completed, make sure all connection points is secured. Battery positive (+) cable should be connected firstly. And the two posts of battery have to be greased after connected the cables.



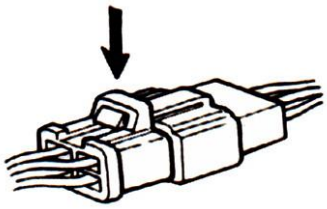
- Make sure that the battery post caps are located in properly after the battery posts had been serviced.



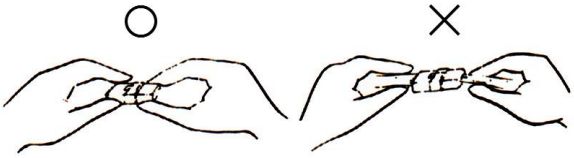
- If fuse burned, it has to find out the cause and solved it. And then replace with specified capacity fuse.



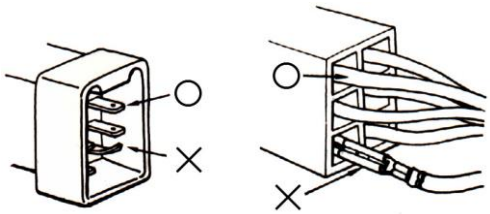
- When separating a connector, it locker has to be unlocked firstly. Then conduct the service operation.



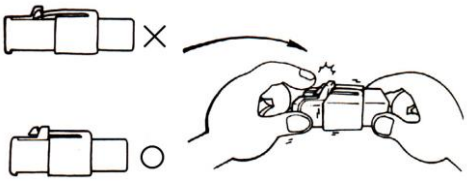
- Do not pull the wires as removing a connector or wires. Hold the connector body.



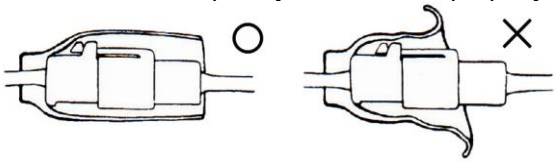
- Make sure if the connector pins are bent, extruded or loosen.



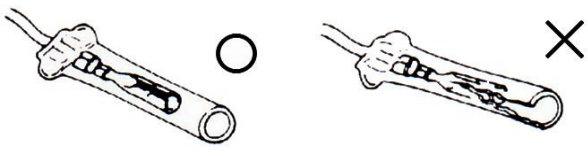
- Insert the connector completely. If there are two lockers on two connector sides, make sure the lockers are locked in properly.
  Check if any wire loose.



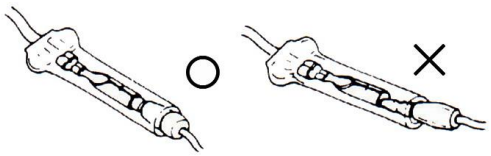
- Check if the connector is covered by the twin connector boot completely and secured properly.



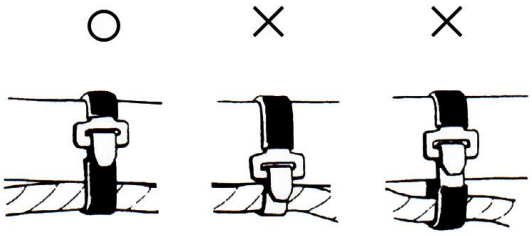
- Before terminal connection, check if the boot is crack or the terminal is loose.



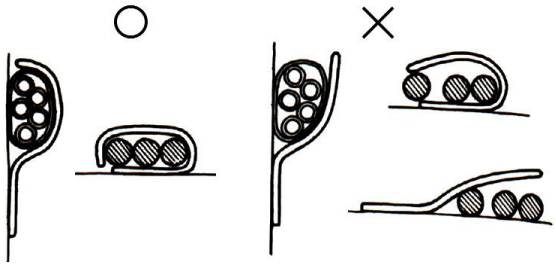
- Insert the terminal completely.
  Check if the terminal is covered by the boot.
  Do not let boot open facing up.



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

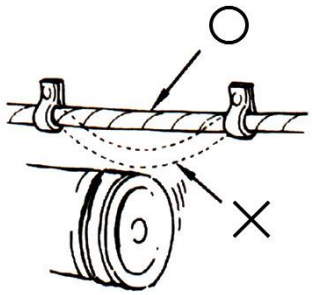


- Wire band and wire harness have to be clamped secured properly.

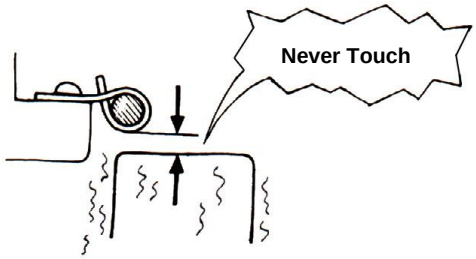


- Do not squeeze wires against the weld or its clamp.

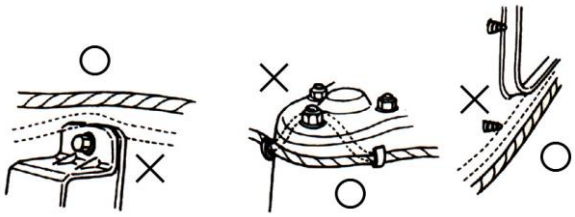
- Do not let the wire harness contact with rotating, moving or vibrating components as routing the harness.



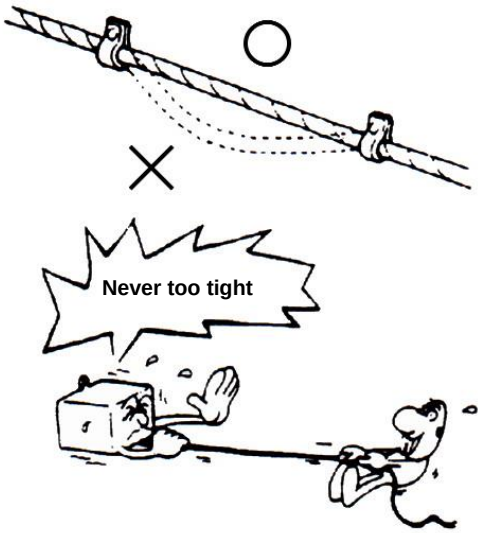
- Keep wire harnesses far away from the hot parts.



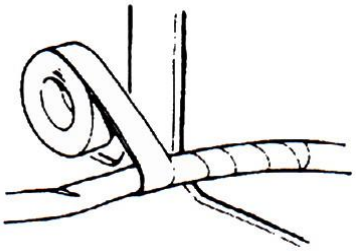
- Route wire harnesses to avoid sharp edges or corners and also avoid the projected ends of bolts and screws.



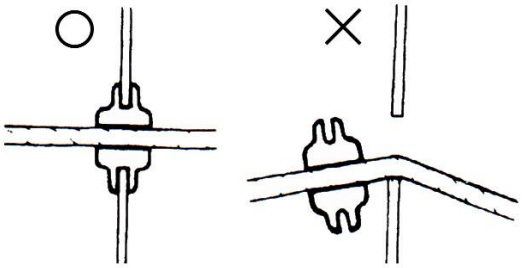
- Route harnesses so that they neither pull too tight nor have excessive slack.



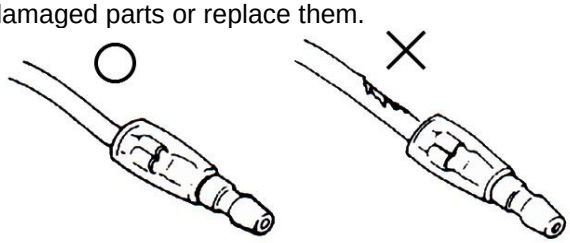
- Protect wires or wire harnesses with electrical tape or tube if they contact a sharp edge or corner. Thoroughly clean the surface where tape is to be applied.



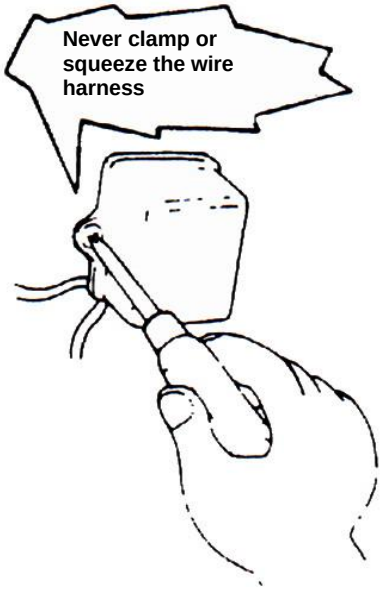
- Secure the rubber boot firmly as applying it on wire harness.



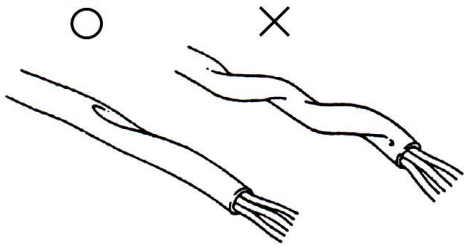
- Never use wires or harnesses which insulation has been broken. Wrap electrical tape around the damaged parts or replace them.



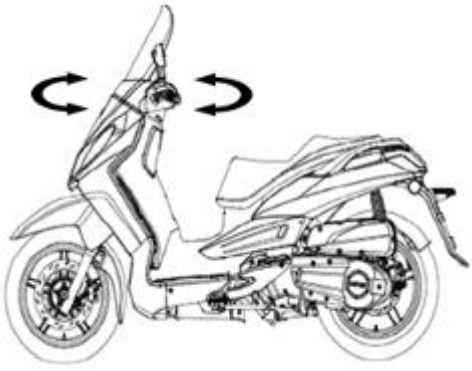
- Never clamp or squeeze the wire harness as installing other components.



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

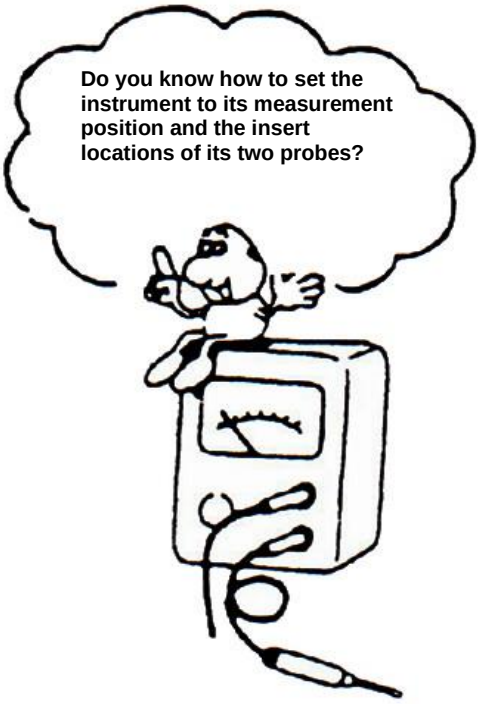


- Wire harnesses routed along the handlebar should not be pulled too tight or have excessive slack, be rubbed against or interfere with adjacent or surrounding parts in all steering positions.



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

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

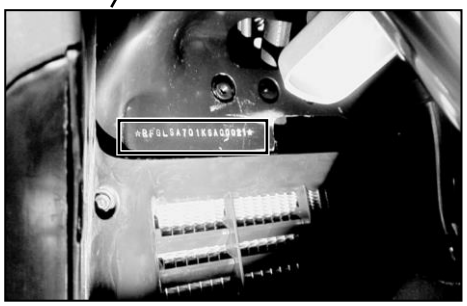


Model Identification

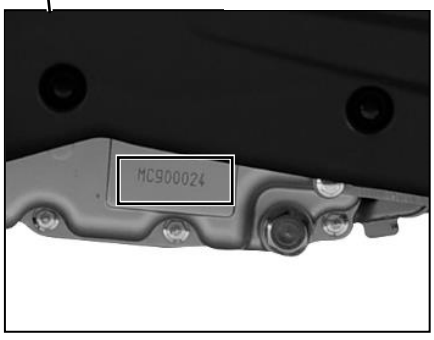
LS30W1-EU. Right side view

LS30W1-EU, Left side view

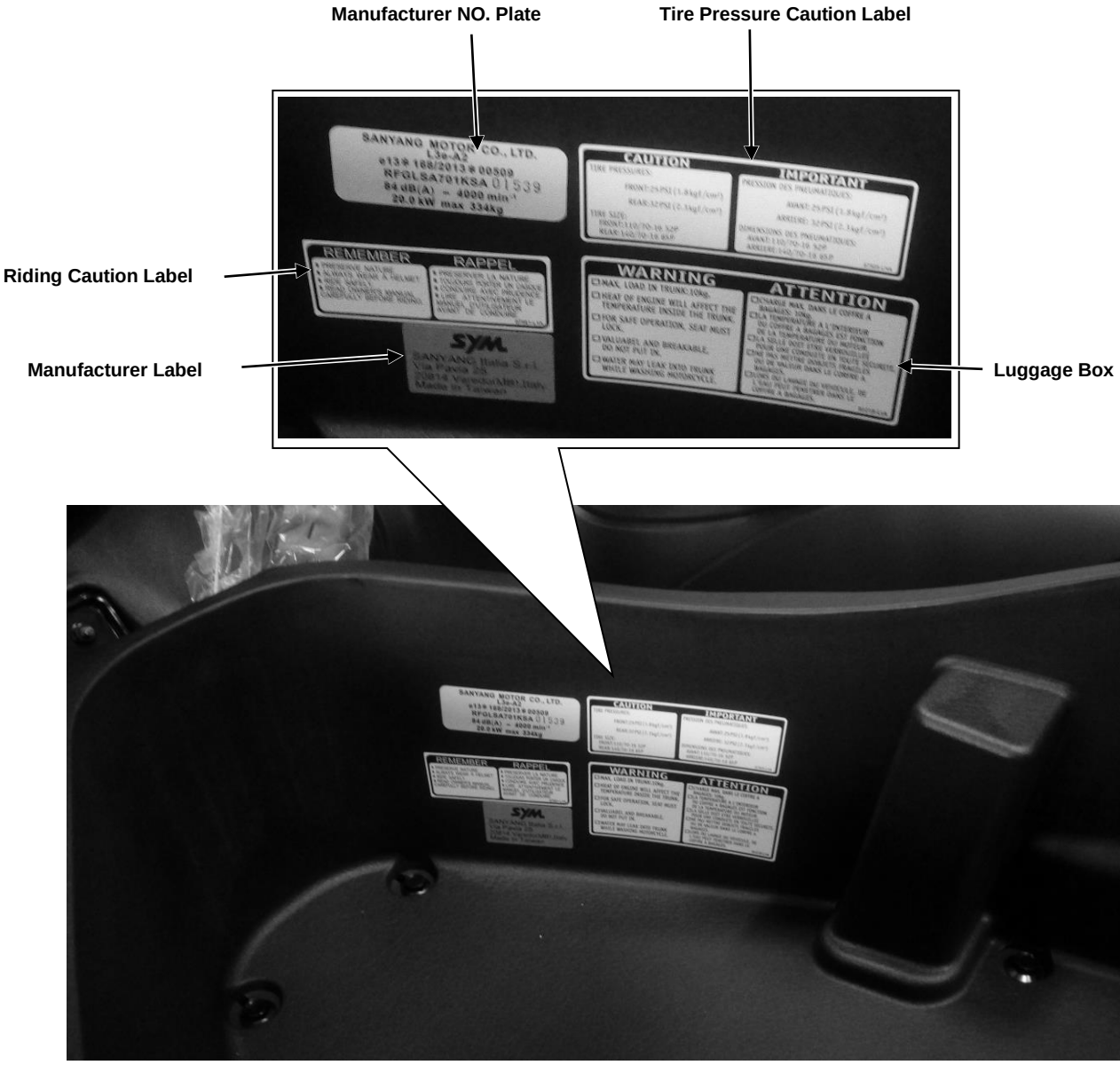
Frame number (VIN)

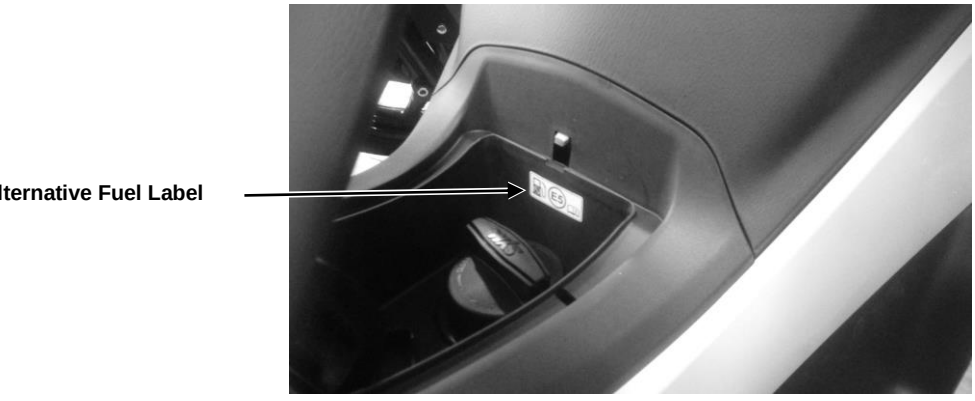


Engine number



Label Location





General Specifications

Item	LS30W1-EU
Dimensions	
Overall length	2,220 mm
Overall width	770 mm
Overall height	1,230 mm
Wheelbase	1,500 mm
Ground clearance	145 mm
Seat height	800 mm
Dry weight	
Curb weight	174 kg
Fuel tank capacity	10 L
Minimum turning radius	2.5 m
Engine	
Type	4T, SOHC, 4V, 1 cylinder
Cooling system	Liquid cooled
Bore × stroke	75 mm × 63 mm
Displacement	278.3 cm^3
Compression ratio	10.4:1
Maximum horse power	27 PS @ 8,000 rpm
Maximum torque	2.6 kgf-m @ 6,000 rpm
Idle speed	1,550 ± 100 rpm
Fuel system:	EFi (Electronic fuel injection), Keihin
Throttle bore	32.5 mm
Min. octane rating	Unleaded 92 RON or gasohol up to 5%
Starting system	Electric starter
Ignition system	Battery and coil
Timing advance	Electronically advanced
Valve timing:	
Intake:	
Open	5 ± 3° BTDC
Close	45 ± 3° BBDC
Lift	7.8 mm
Exhaust:	
Open	45 ± 3° BBDC
Close	5 ± 3° ATDC
Lift	7.6 mm
Valve clearance:	
Intake	0.10 ± 0.02 mm
Exhaust	0.15 ± 0.02 mm

Lubrication system:	Forced, wet sump
Oil pump	Trochoid
Engine oil:	Metallic mesh
Grade	API SG or greater
Viscosity	SAE 10W30 or 10W40
Capacity	1.4 L (total), 1.2 L (change)
Air cleaner	Paper type
Transmission	
Driving system	CVT (Continuously variable transmission)
Primary reduction ratio	2.31 ~ 0.78
Final reduction ratio	8.35
Clutch	Centrifugal
Transmission oil:	
Grade	API SG or greater
Viscosity	SAE 10W30 or SAE 85W-140 (85W-90≦0℃)
Capacity	180 cc (total), 160 cc (change)
Air cleaner	Sponge type
Frame	
Type	Underbone steel tube
Caster	27.5°
Trail	156.5 mm
Front tire:	
Standard	Maxxis M6135, 1.8 kgf/cm^2 (25 psi)
Size	110/70-16 52P
Rear tire	
Standard	Maxxis M6135, 2.3 kgf/cm^2 (32 psi)
Size	140/70-16 65P
Rim	
Front	16 × MT 3.0
Rear	16 × MT 3.5
Front suspension:	
Type	Telescopic fork
Travel	88 mm
Rear suspension:	
Type	Dual shock absorber
Travel	75 mm
Brake system:	
Front	Single disk 287 mm, single sided 2 piston caliper
Rear	Single disk 260 mm, single sided 2 piston caliper

Item	LS30W1-EU
Electrical Equipment	
Battery	MF, YTX12-BS, 12V 10Ah
Headlight:	
Type	LED
Beam	High / low
Tail/brake light	LED
License plate light	12V 5W
Turn indicator	12V 10W × 4
Alternator:	
Type	Three phase, AC
Max. output (batt:14V)	10.4A ↑ @1,500rpm
	12V, 20A ↓ @10,000rpm
USB charger	5V, 2A maximum

Ignition System Specifications

Item	LS30W1-EU
Spark plug	NGK CR8E
Spark plug gap	0.7 ~ 0.8 mm
Ignition coil:	
Type	ECU controlled digital transistor
Ignition timing	8° BTDC @1,550rpm ~ 28° BTDC @8,000rpm
Resistance, primary	2.8 ± 0.4 Ω
CPS resistance @ 20℃	120 ± 24 Ω

Starting Clutch Gear Specifications

Item	Standard (mm)	Service Limit (mm)
Starting clutch gear I.D.	25.026 ~ 25.045	25.010
Starting clutch gear O.D.	42.192 ~ 42.208	42.100

Battery, Charging System Specifications

Item	LS30W1-EU
Battery	
Type	MF, YTX12-BS
Capacity	12V, 10Ah
Current leakage	1 mA maximum
Fully charged	13 ~ 13.2 V
Needs charging	< 12.3 V
Alternator	
Output	< 280 W @10,000 rpm
Coil resistance @ 20℃	
Y to Y(wire to wire)	0.60 ± 0.12 Ω

Fuse Specifications

Item	LS30W1-EU
Battery	20A
Meter/EFi	10A
Cooling fan	5A
Lights	10A
Horn/winker	5A
Brake/start	5A
ABS-HU	20A
ABS-HU	30A
Option (USB power output)	10A

EFi Specifications

Item	LS30W1-EU
TA sensor resistance	
40℃	1.136 ± 0.095 kΩ
100℃	0.155 ± 0.007 kΩ
TW sensor resistance	
40℃	1.136 ± 0.095 kΩ
100℃	0.155 ± 0.007 kΩ
Fuel injector resistance	10.50 ± 0.53 Ω

Cooling System Specifications

Item	LS30W1-EU
Coolant	
Capacity	
Total	1.4L
Reserve tank	200 cc (FULL mark)
Antifreeze	High quality ethylene glycol with corrosion inhibitor
Standard concentration	50 : 50 (mixture with pure water)
Radiator cap relief pressure	0.90 ± 0.15 kgf/cm^2
Thermostat	
Begin to open	82 ± 1.5℃
Fully open	95℃
Max. valve lift	Above 3 mm
Cooling fan	
Temp. to activate	98 ± 3℃ (controlled by thermoswitch)
Thermoswitch function	Conduct or not

Cooling System Specifications

Item	LS30W1-EU
Fuel pressure (ignition on)	294 kPa, 3.0 kgf/cm^2
Fuel pump flow at 13.5V	35 l/hr

Miscellaneous Component Specifications

Item	LS30W1-EU
Thermounit resistance	(for coolant temperature gauge display)
50℃	133.9 ~ 178.9 Ω
100℃	26.2 ~ 29.3 Ω
Fuel unit resistance	(fuel level sensor)
Full	1150 ± 20 Ω
Empty	100 ± 5 Ω

Lubrication System Specifications

Item	Standard (mm)	Service Limit (mm)
Oil pump rotor		
Outer rotor ~ inner rotor clearance	0.15	0.20
Outer rotor ~ body clearance	0.15 ~ 0.20	0.25
Rotor side clearance	0.04 ~ 0.09	0.12

Transmission System Specifications

Item	Standard	Service Limit
V-belt width	23.200 mm	22.500 mm
Movable drive face boss OD	29.946 ~ 29.980 mm	29.926 mm
Movable drive face ID	30.000 ~ 30.040 mm	30.060 mm
Weight roller OD	24.92 ~ 25.08 mm	19.00 mm
Clutch outer ID	144.9 ~ 145.1 mm	-
Clutch weight thickness	3.0 mm	2.0 mm
Driven pulley spring free length	102.4 mm	97.4 mm
Driven pulley boss OD	40.950 ~ 40.990 mm	40.930 mm
Driven face ID	41.000 ~ 41.050 mm	41.070 mm
Weight roller weight	17.7~18.3 g	17.2 g

Cylinder Head/Valve Specifications

Item	Standard	Service Limit (mm)
Compression pressure	14 ± 2 kgf/cm^2	–
Valve clearance		
IN	0.10 ± 0.02 mm	–
EX	0.15 ± 0.02 mm	–
Valve rocker arm ID	12.000 ~ 12.018 mm	–
Valve rocker arm shaft OD	11.966 ~ 11.984 mm	11.936
Camshaft / Cam lobe height		
IN	34.885 mm	34.860
EX	34.747 mm	34.725
Valve		
Valve stem OD		
IN	4.975 ~ 4.990 mm	4.900

EX	4.950 ~ 4.975 mm	4.900
Valve guide ID		
IN / EX	5.000 ~ 5.012 mm	–
Valve stem ~ guide clearance		
IN	0.010 ~ 0.037 mm	–
EX	0.025 ~ 0.062 mm	–
Valve spring free length		
Inner	38.7 mm	35.2
Outer	40.4 mm	36.9
Valve seat width		
IN	1.0 mm	–
EX	1.0 mm	–
Cylinder head warpage	–	0.05

Crankshaft/Piston/Cylinder Specifications

Item	Standard (mm)	Service Limit (mm)
Crankshaft		
Connecting rod side clearance	0.10 ~ 0.40	–
Runout R/L	–	0.10
Main journal bearing oil clearance	0 ~ 0.008	–
Cylinder		
ID	74.995 ~ 75.015	73.100
Warpage	–	0.05
Piston / piston rings		
Piston ring-to-ring groove clearance		
Top	0.015 ~ 0.050	–
Second	0.015 ~ 0.050	–
Piston ring end gap		
Top	0.15 ~ 0.30	–
Second	0.30 ~ 0.45	–
Oil ring side rail	0.20 ~ 0.70	–
Piston OD at second ring	74.236 ~ 74.286	72.380
Piston pin bore ID	17.002 ~ 17.008	–
Piston pin OD	16.994 ~ 17.000	16.960
Piston to piston pin clearance	0.002 ~ 0.014	–
Cylinder to piston clearance	0.010 ~ 0.040	–
Connecting rod small end ID	17.016 ~ 17.034	–

Brake System Specifications

Item	Standard	Service Limit (mm)
Brake fluid, front & rear	DOT 3 or DOT 4	
Brake disk thickness		
Front	4.4 ~ 4.7 mm	4.0
Rear	5.3 ~ 5.7 mm	4.5
Brake disk warpage		
Front	–	0.25
Rear	–	0.25
Brake pad thickness		
Front	4.8 mm	1.0
Rear	6.0 mm	1.0
Wheel speed sensor ~ detection wheel clearance	1.1 ~ 1.6 mm	–

Suspension Specifications

Item	Standard	Service Limit (mm)
Fork oil		
Type	10W~15W	–
Total capacity	126 ± 1cc (per side)	–

＊ Specifications or equipment are subject to change without notice.

Torque Values

Standard Tightening Torque Values

Type	Torque		Type	Torque	
	kgf-m	N-m		kgf-m	N-m
5 mm bolt & nut	0.5	5.3	5 mm screw	0.4	4.3
6 mm bolt & nut	1.0	10	6 mm screw & SH flange bolt	0.9	9
8 mm bolt & nut	2.2	22	6 mm bolt、nut	1.2	12
10 mm bolt & nut	3.5	35	8 mm bolt、nut	2.7	27
12 mm bolt & nut	5.5	55	10 mm bolt、nut	4.0	40

Engine Torque Values

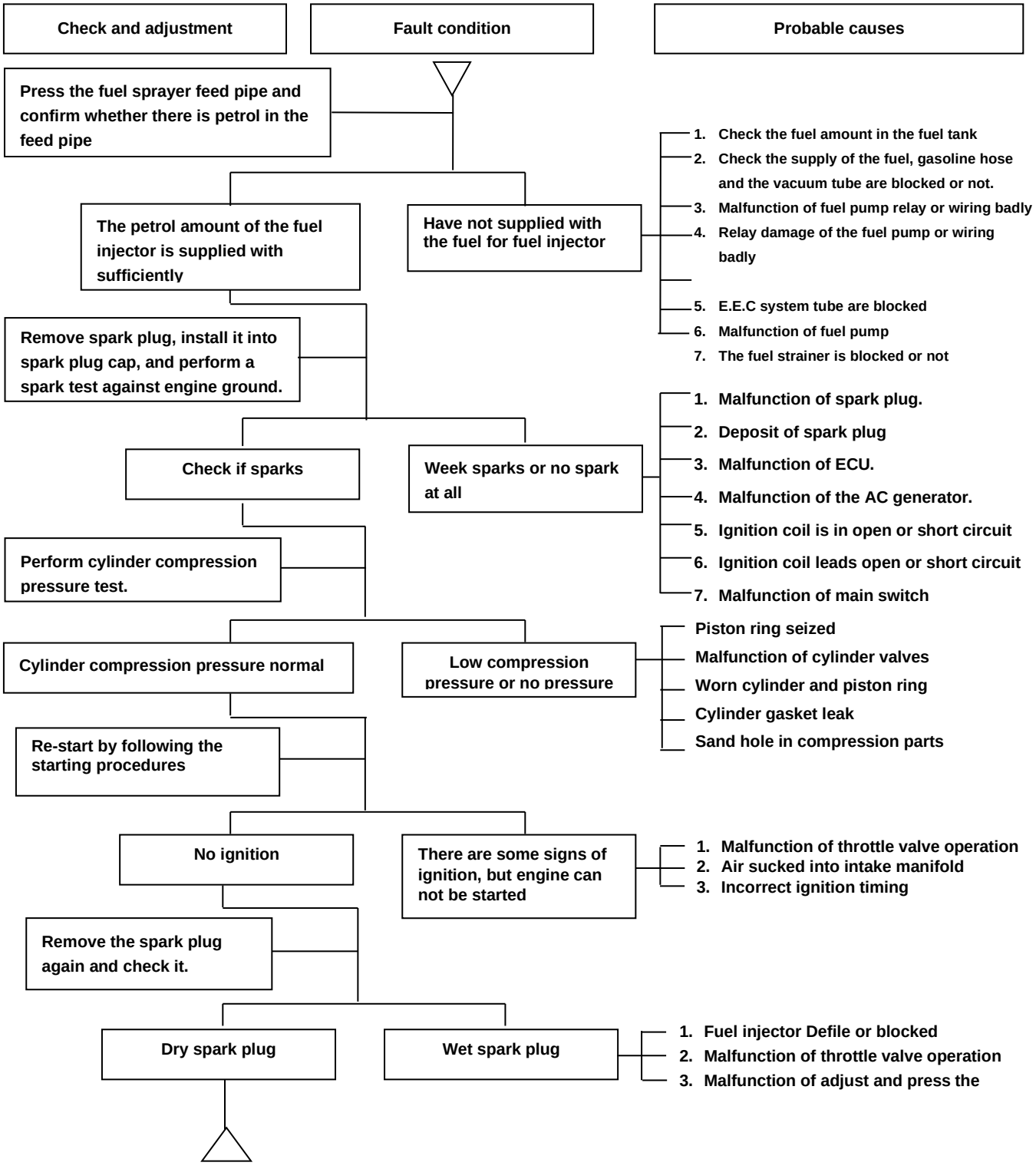
Item	Q'ty	Thread Dia. (mm)	Torque		Remarks
			kgf-m	N-m	
Cylinder stud bolt	4	10	1.2	11.8	Stud side
Tappet adjusting cap	1	30	1.5	14.7	
Engine oil drain bolt	1	12	3.9	39.2	
Cylinder head					
Stud bolt	2	8	2.7	26.5	Exhaust pipe side
Nut	4	10	3.2	32.3	
Camshaft	1	6	1.2	11.8	Camshaft setting plate
Reed valve, pan screw	2	3	0.1	0.8	
Cylinder head side cover	3	6	1.2	11.8	SH flange bolt
Cylinder head cover bolt	4	6	1.0	9.8	
Tappet adj. screw nut	4	5	0.9	8.9	Apply oil
Cam chain tensioner pivot	1	8	1.0	9.8	Special bolt
Cam chain tensioner lifter	2	6	1.2	11.8	SH flange bolt
Oil pump, pan screw	1	3	0.2	2.0	
Water pump impeller	1	7	1.2	11.8	
Transmission oil filler bolt	1	10	1.2	11.8	
Transmission oil drain bolt	1	8	1.0	9.8	
Drive face bolt, flange	1	14	9.3	93	Apply oil
Clutch outer bolt, flange	1	14	6.4	63.7	
Drive plate bolt	1	36	8.8	88.3	
One way clutch bolt, socket	3	8	2.9	29.4	Apply locking agent
Alternator fly wheel nut, flange	1	14	7.4	73.5	
Spark plug	1	10	1.1	10.8	
Thermounit	1	PT 1/8	1.1	10.8	

Frame Torque Values

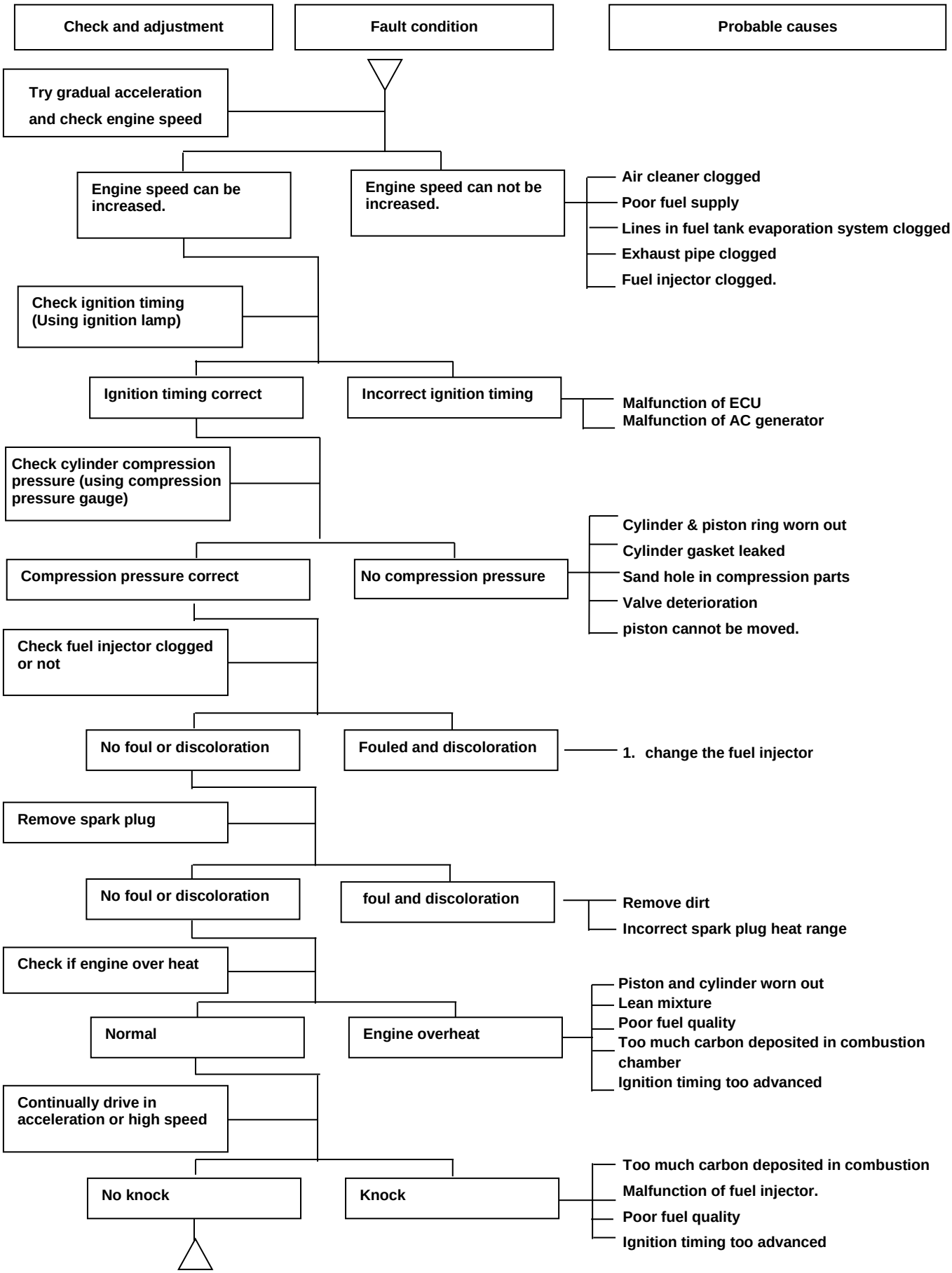
Item	Q'ty	Thread Dia. (mm)	Torque		Remarks
			kgf-m	N-m	
Engine hanger					
Frame side, bolt	2	12	8.5	85	Flange bolt
Engine side, nut	1	12	8.5	85	Lock nut
Tension rod nut	2	12	6.0	60	
Steering					
Steering handle post	1	10	4.5	45	
Steering stem lock nut	1	BC1	7.0	70	
Steering top cone race	1	BC1	2.5	25	
Wheel					
Front axle	1	14	5.5	55	
Rear axle nut	1	16	12	120	Lock nut
Suspension					
Front fork bolt	4	10	4.0	40	
Rear shock upper side	2	10	4.0	40	
lower side	2	8	2.7	27	
Brake					
Brake caliper bolt, front	2	8	3.2	32	
Brake caliper bolt, rear	2	8	3.2	32	
Oil bolt, brake hose	8	10	3.5	35	
Master cylinder bolt, front/rear	4	6	1.2	12	SH type
Brake disk bolt, front/rear	10	8	4.5	45	
Rear fork (swing arm) bolt	3	10	4.5	45	
Main stand	1	10	4.5	45	U nut
Windscreen (optional)					
Grommet side bolt, upper	4	5	>0.1	>1	
Frame side bolt	4	5	>0.3	>3	

Trouble Diagnosis (Electronic Fuel Injection System)

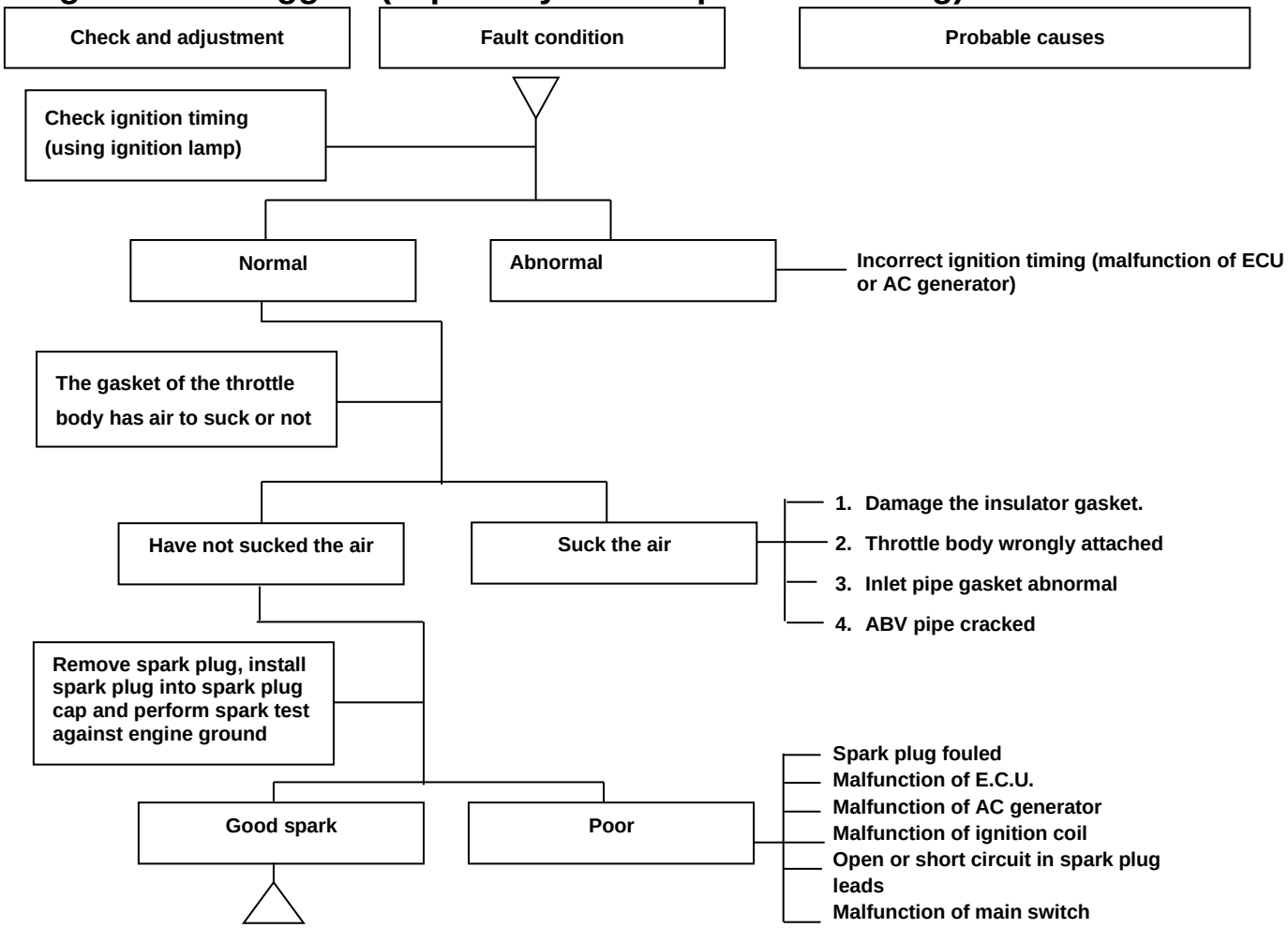
A. Engine cannot be started or difficult to be started



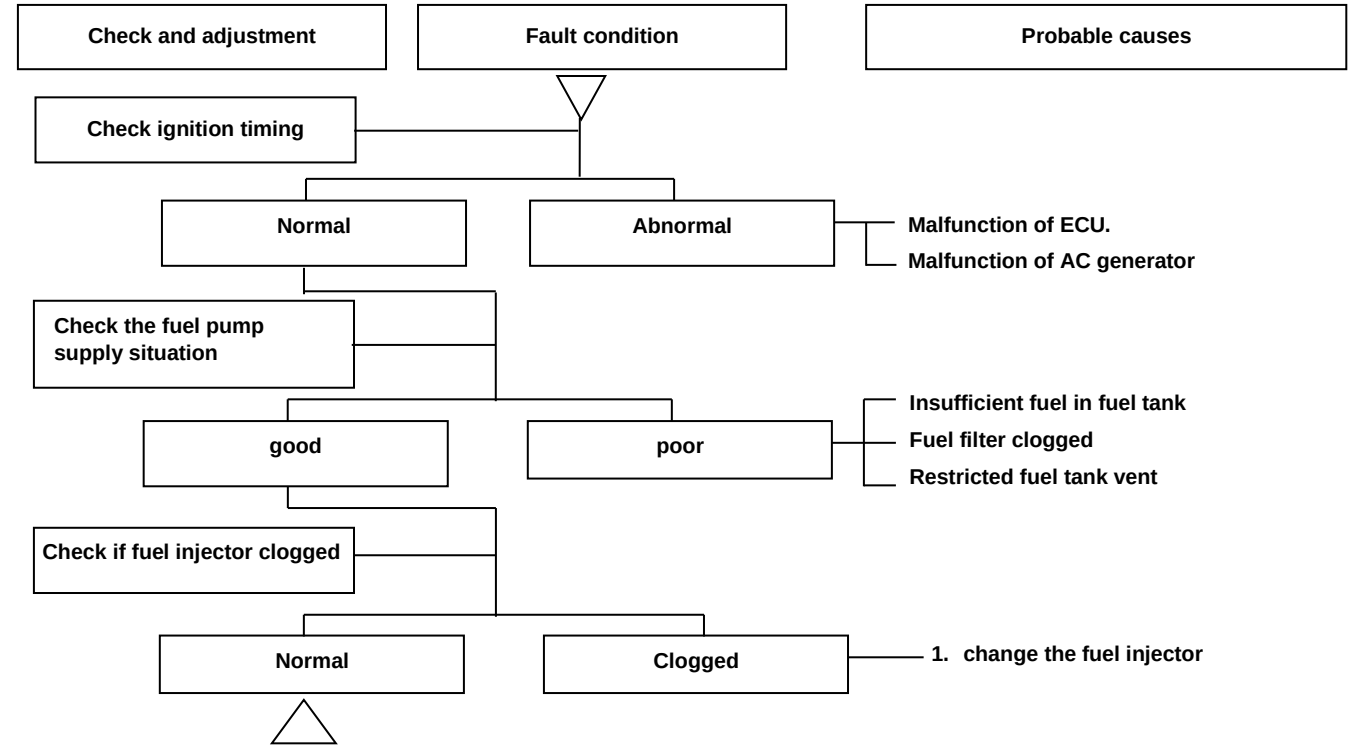
B. Engine run sluggish (Speed does not pick up, lack of power)



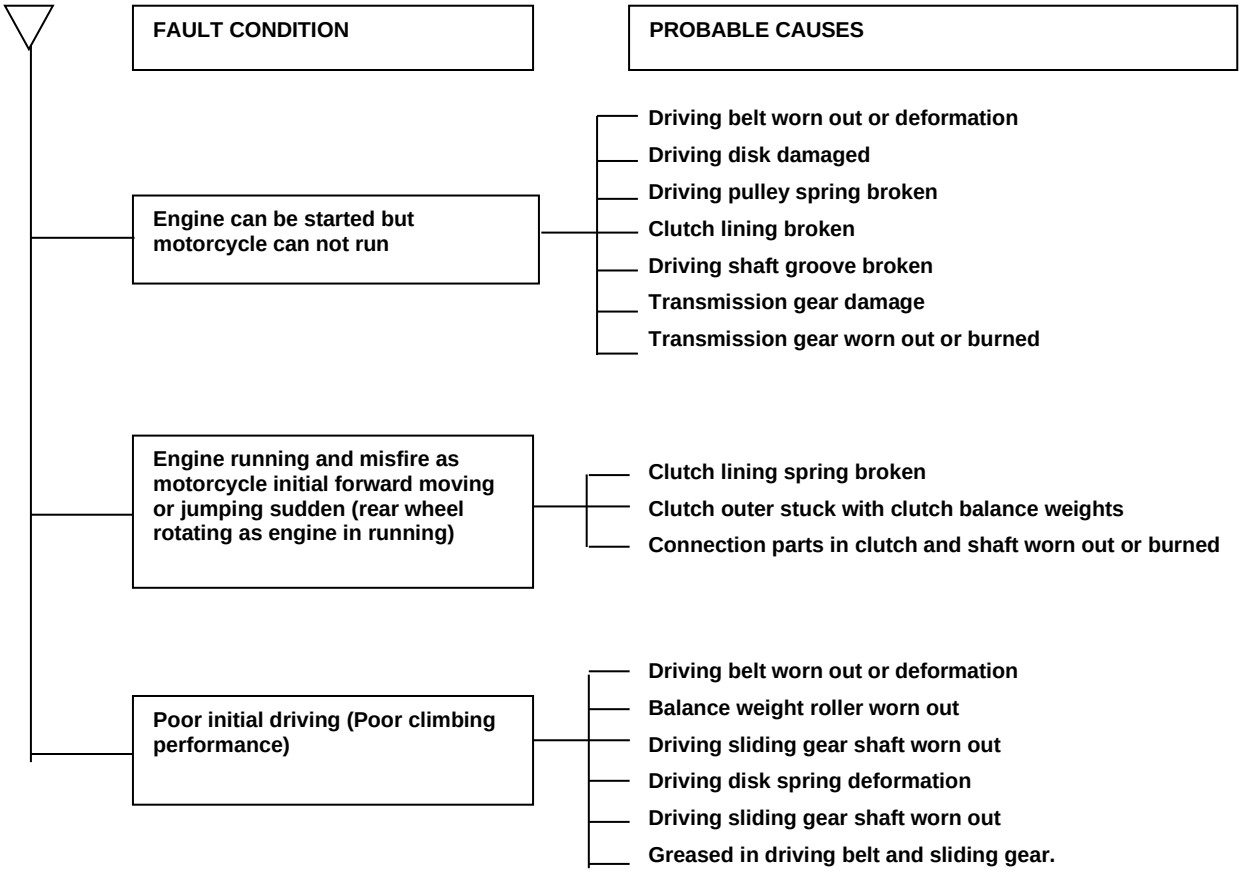
C. Engine runs sluggish (especially in low speed and idling)



D. Engine runs sluggish (High speed)

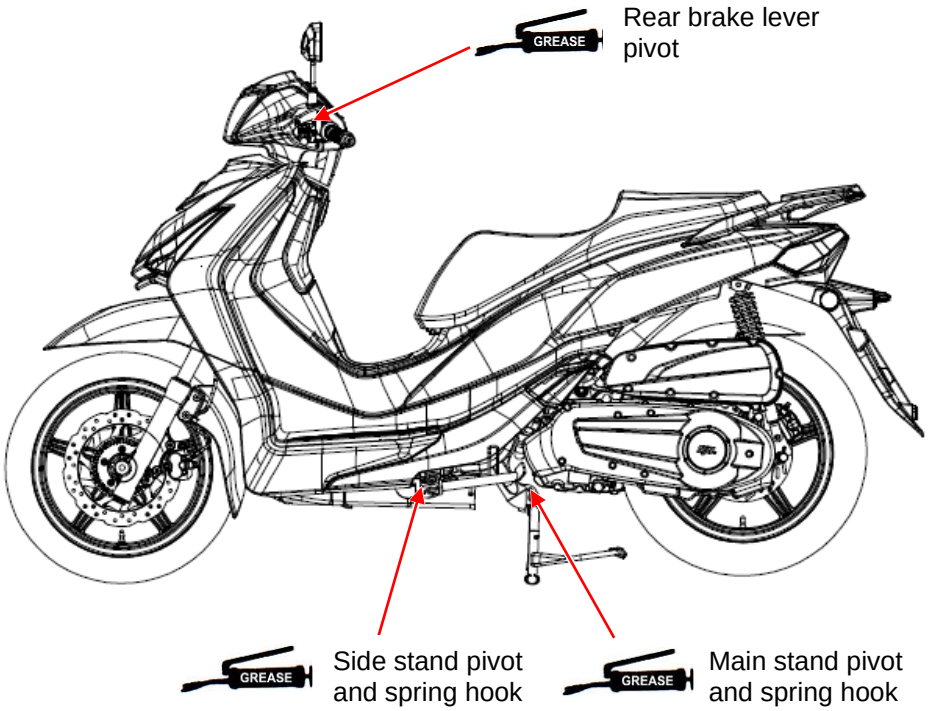


E. CLUTCH AND DRIVING PULLEY



Lubrication Points

Proper lubrication is very important for smooth operation and long life of each working part.



Notice:

- Lubricate the above parts especially when the vehicle has been operated under wet or rainy conditions.
- Clean off rusty spots and wipe off any oil or grease.

Torque Values

Engine Torque Values

Item	Q'ty	Thread Dia. (mm)	Torque		Remarks
			kgf-m	N-m	
Cylinder stud bolt	4	10	1.2	11.8	Stud side
Tappet adjusting cap	1	30	1.5	14.7	
Engine oil drain bolt	1	12	3.9	39.2	
Cylinder head					
Stud bolt	2	8	2.7	26.5	Exhaust pipe side
Nut	4	10	3.2	32.3	
Camshaft	1	6	1.2	11.8	Camshaft setting plate
Reed valve, pan screw	2	3	0.1	0.8	
Cylinder head side cover	3	6	1.2	11.8	SH flange bolt
Cylinder head cover bolt	4	6	1.0	9.8	
Tappet adj. screw nut	4	5	0.9	8.9	Apply oil
Cam chain tensioner pivot	1	8	1.0	9.8	Special bolt
Cam chain tensioner lifter	2	6	1.2	11.8	SH flange bolt
Oil pump, pan screw	1	3	0.2	2.0	
Water pump impeller	1	7	1.2	11.8	
Transmission oil filler bolt	1	10	1.2	11.8	
Transmission oil drain bolt	1	8	1.0	9.8	
Drive face bolt, flange	1	14	9.3	93	Apply oil
Clutch outer bolt, flange	1	14	6.4	63.7	
Drive plate bolt	1	36	8.8	88.3	
One way clutch bolt, socket	3	8	2.9	29.4	Apply locking agent
Alternator fly wheel nut, flange	1	14	7.4	73.5	
Spark plug	1	10	1.1	10.8	
Thermounit	1	PT 1/8	1.1	10.8	

Frame Torque Values

Item	Q'ty	Thread Dia. (mm)	Torque		Remarks
			kgf-m	N-m	
Engine hanger					
Frame side, bolt	2	12	8.5	85	Flange bolt
Engine side, nut	1	12	8.5	85	Lock nut
Tension rod nut	2	12	6.0	60	
Steering					
Steering handle post	1	10	4.5	45	
Steering stem lock nut	1	BC1	7.0	70	
Steering top cone race	1	BC1	2.5	25	
Wheel					
Front axle	1	14	5.5	55	
Rear axle nut	1	16	12	120	Lock nut
Suspension					
Front fork bolt	4	10	4.0	40	
Rear shock upper side	2	10	4.0	40	
lower side	2	8	2.7	27	
Brake					
Brake caliper bolt, front	2	8	3.2	32	
Brake caliper bolt, rear	2	8	3.2	32	
Oil bolt, brake hose	8	10	3.5	35	
Master cylinder bolt, front/rear	4	6	1.2	12	SH type
Brake disk bolt, front/rear	10	8	4.3	43	
Rear fork (swing arm) bolt	3	10	4.5	45	
Main stand	1	10	4.5	45	U nut
Windscreen (optional)					
Grommet side bolt, upper	4	6	1.0	10	
Handle pipe side bolt	4	5	2.7	27	

Standard Tightening Torque Values

Type	Torque		Type	Torque	
	kgf-m	N-m		kgf-m	N-m
5 mm bolt & nut	0.5	5.3	5 mm screw	0.4	4.3
6 mm bolt & nut	1.0	10	6 mm screw & SH flange bolt	0.9	9
8 mm bolt & nut	2.2	22	6 mm bolt、nut	1.2	12
10 mm bolt & nut	3.5	35	8 mm bolt、nut	2.7	27
12 mm bolt & nut	5.5	55	10 mm bolt、nut	4.0	40

Specifications

Item	LS30W1-EU	Service Limit
Fuel System		
Throttle grip free play	5° ~ 10°	
Idle speed	1,550 ± 100 rpm	
Air cleaner element	Paper type	
Cooling System		
Coolant		
Antifreeze	High quality ethylene glycol with corrosion inhibitor	
Standard concentration	50 : 50 (mixture with pure water)	
Total capacity	1.4L	
Cylinder Head		
Valve clearance		
Intake	0.10 ± 0.02 mm	
Exhaust	0.15 ± 0.02 mm	
Engine oil		
Grade	API SG or greater	
Viscosity	SAE 10W30 or 10W40	
Transmission oil		
Grade	API SG or greater	
Viscosity	SAE 10W30/10W40 or 85W-90	
Capacity	180 cc (total), 160 cc (change)	
CVT		
V-belt width	24.0 mm	22.5 mm
Transmission air cleaner	Sponge type	
Brake System		
Brake fluid, front & rear	DOT 3 or DOT 4	
Brake disk thickness		
Front	4.4 ~ 4.7 mm	4.0 mm
Rear	5.3 ~ 5.7 mm	4.5 mm
Brake disk warpage		
Front	–	0.25 mm
Rear	–	0.25 mm
Brake pad thickness		
Front	4.8 mm	1.0
Rear	6.0 mm	1.0
Wheel speed sensor ~ detection wheel clearance	1.1 ~ 1.6 mm	–
Ignition System		
Spark plug	NGK CR8E	
Spark plug gap	0.7 ~ 0.8 mm	

Periodical Maintenance Schedule

	Items \ Mileage / Month	First 1,000KM	Every 1,000KM	Every 5,000KM	Every 10,000KM	Every 15,000KM
		First month	1 Month	3 Months	6 Months	1 Year
1	Air cleaner element		C			
2	Oil filter screen	C		C		
3	Engine oil level		I			
4	Engine oil	R		R		
5	Brake fluid			I	Replace every 20,000km	
6	Wheels/ tires	I	I			
7	Electrical system			I		
8	Spark plug			I	R	
9	Steering stem bearings	I		I		
10	Brake light switch			I		
11	V-belt			I		R
12	Fuel hose	I		I		
13	Throttle control system	I		I		
14	Engine idle speed	I		I		
15	Clutch weight wear				I	
16	Valve clearance				I	
17	V-belt air cleaner				I	
18	Suspension system				I	
19	Fuel lines	I		I		
20	Chassis parts			L		
21	Crankcase breather	C		C		
22	Coolant	I	I			R
23	Cooling fan, cooling system hoses	I	I			
24	Brake pad wear		I			
25	Bolts/ nuts and fasteners	I		I		

I: Inspect and clean, adjust, lubricate or replace if necessary
R: Replace
C: Clean (replace if necessary)
L: Lubricate

Have your vehicle checked, adjusted, and recorded maintenance data periodically by your SYM authorized dealer to maintain the vehicle in 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. Clean or replace the air cleaner element more often when the motorcycle is operated on dusty roads or in the heavily- polluted environment.

2. Maintenance should be performed more often if the vehicle is frequently operated in high speed and after the vehicle has accumulated a higher mileage.

3. Preventive maintenance

   a. Ignition system－Perform maintenance and check when continuous abnormal ignition, misfire, after-burn, overheating occur.

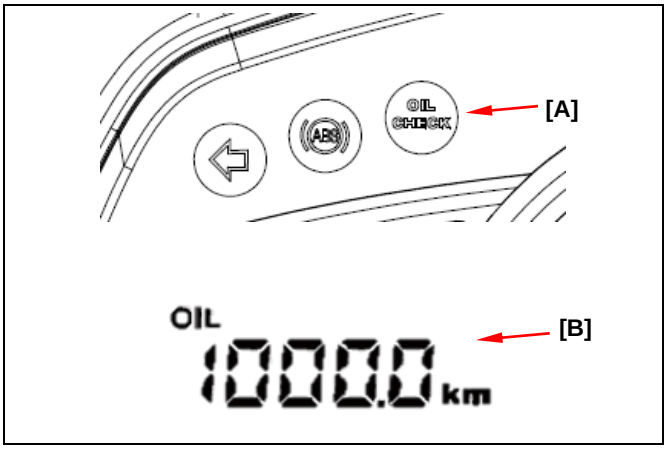
   b. Carbon deposit removal－Remove carbon deposits in cylinder head, piston heads, exhaust system when power is obvious lower.

   c. Replace worn out pistons, cylinder head.

Engine Oil

Oil level inspection

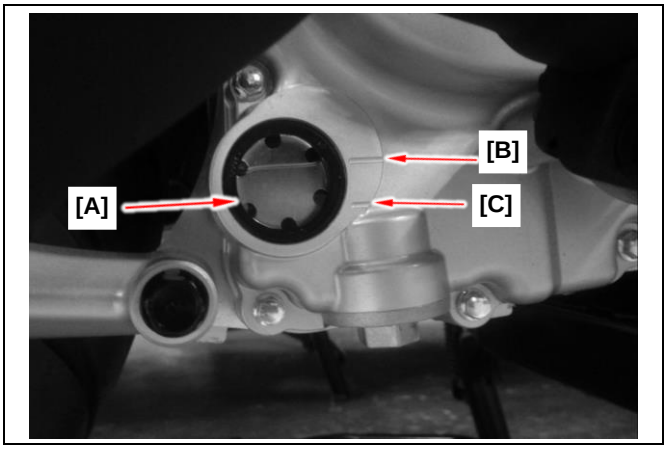
Check engine oil level when the oil check light [A] goes on. It goes on every 1,000 km in accordance with the oil distance meter [B].



Turn off the engine, and park the vehicle upright in a flat surface with the center stand.

Start the engine and idle it for 3 ~ 5 minutes.
Stop the engine and wait for 2 ~ 3 minutes.

Check oil level in the oil inspection window [A].
If the oil level is nearly lower level [C], fill out recommended oil to the upper level [B].



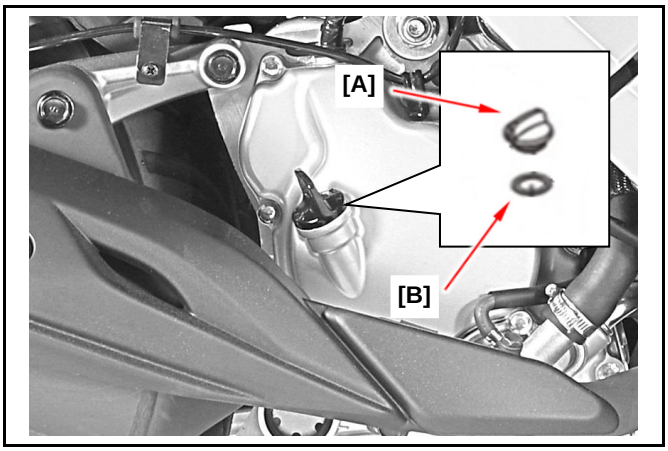
After checking oil level, quickly push the S button on the dashboard to reset the oil check light and oil distance meter.

Oil change

Notice:

- Drain oil when the engine is warm to make sure oil can be drained smoothly and completely.

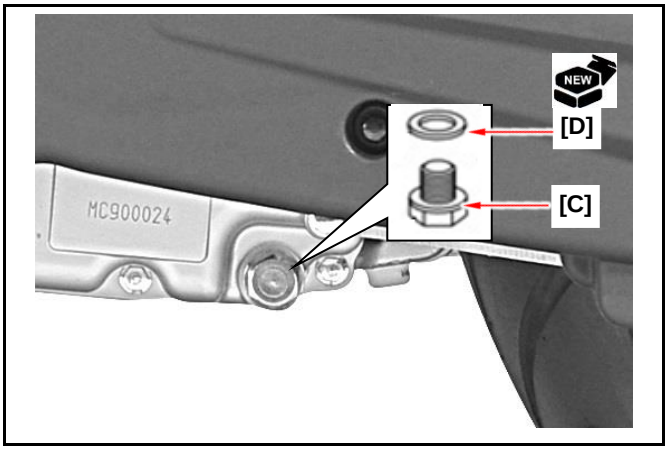
Place an oil pan under the engine, and remove the oil filler cap [A] and its O- ring [B].



Check that the O- ring is not damaged, replace it if necessary.

Remove the oil drain bolt [C] and the washer [D] to drain oil.

After draining, install the oil drain bolt with a new drain bolt washer.
Torque value: 3.5~4.5 kgf-m



Add oil to the crankcase

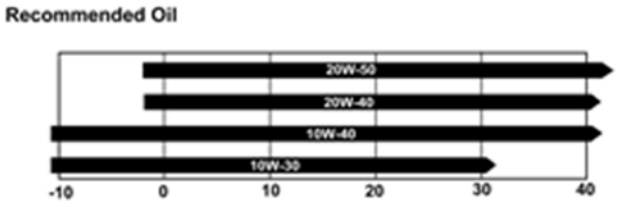
Install the oil filler cap and the O-ring, start the engine and run several minutes.

Turn off the engine, and check oil level again.

Check if engine oil leaks.

RECOMMENDED ENGINE OIL:
Genuine SYM 4-stroke oil or an equivalent API classification SG or greater.
Viscosity: 10W30 or 10W40

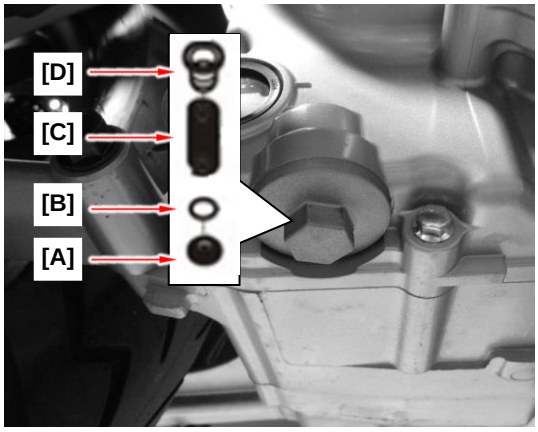
Capacity :
Disassembly – 1,400c.c.
Replacement – 1,200c.c.



Cleaning of Oil Filter Screen

Drain the engine oil out (page 2-5).

Remove the followings:
- Oil filter screen cap [A]
- O- ring [B]
- Spring [C]
- Oil filter screen [D]



Clean the oil filter screen with an air gun.

Reverse the steps of removal to install.

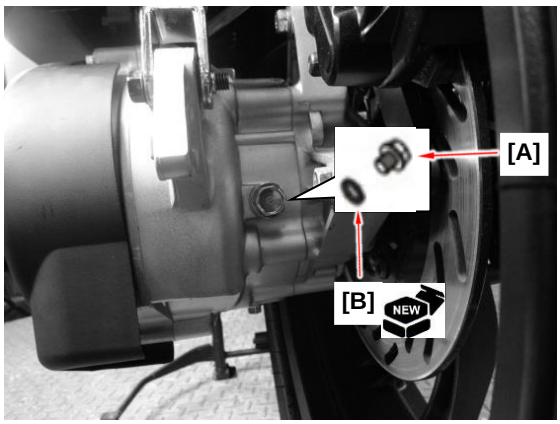
Change a new O- ring and apply engine oil to the O-ring when installing.
Torque value：1.0~2.0 kgf-m

Transmission Oil

Transmission oil change

Run the scooter for several minutes to warm up the oil. Stop the scooter and turn off the engine.

Place an oil pan under the final drive case and remove the filler bolt [A]. Replace a new washer [B] is recommended.

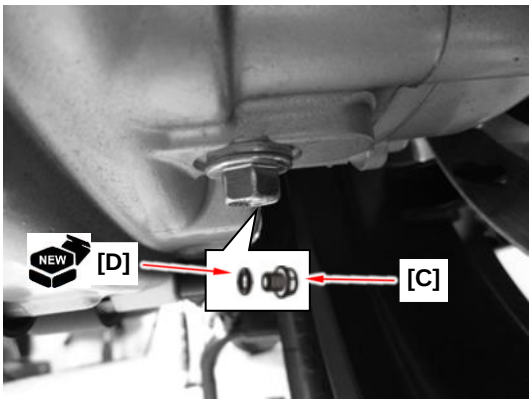


Remove the drain bolt [C] to drain the oil. Replace the washer [D] with a new one.

After draining the oil, install the drain bolt and the new washer.
Torque value：1.0~1.4 kgf-m

Fill in recommended transmission oil to the final drive case.

RECOMMENDED TRANSMISSION OIL:
Genuine SYM transmission oil or an equivalent API classification SG or greater.
Viscosity: 10W30/10W40 or 85W-90

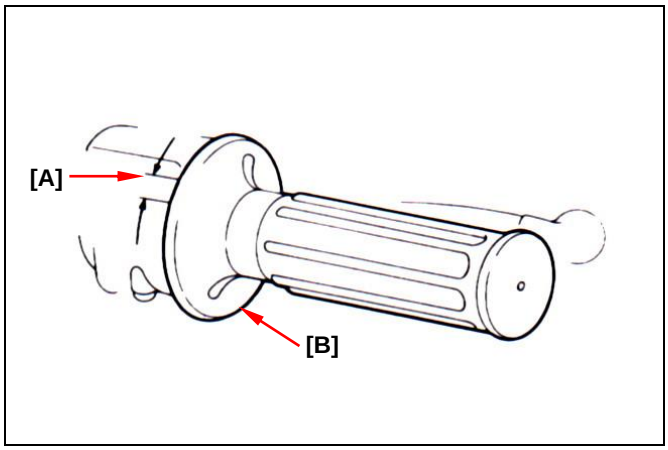


Capacity :
Disassembly – 180c.c.
Replacement – 160c.c.

Throttle Control System Inspection

Throttle operation

Check the throttle grip free play [A] for smooth operation.
Adjust the throttle cables if the free play is incorrect.
Measure the handle bar free play at its flange part [B].
Free play: 5˚ ~10˚ .



Check that the throttle grip works smoothly from full open to full close, and the throttle closes quickly and completely in all steering positions.

If the throttle grip does not return properly, replace the throttle cable with a new one. Replace the throttle cable when it is deteriorated, twisted or damaged.

With the engine idling, turn the handlebar all the way to the right and left to ensure the idle speed does not change.
If the idle speed increases, check the throttle cable free play and its routing.

⚠ Warning

- Make sure there is sufficient ventilation when running the engine.

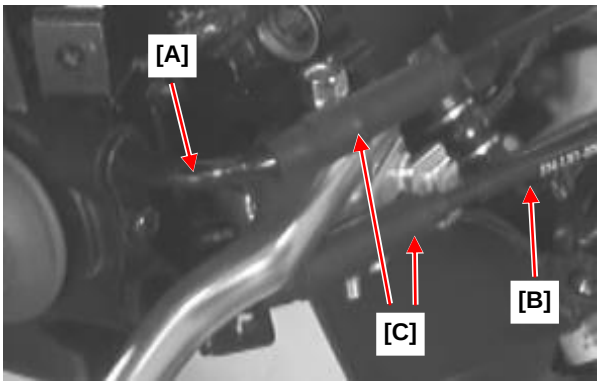
Throttle free play adjustment

Remove the handlebar front cover (page 13-10).
Turn the handlebar to the straight ahead position.

Minor adjustment is made with the upper adjuster of the throttle cable [A] or [B].

Release the dust cover [C].

Loosen the lock nut, and then adjust it by turning the adjuster.
Free play: 5˚ ~10˚ .

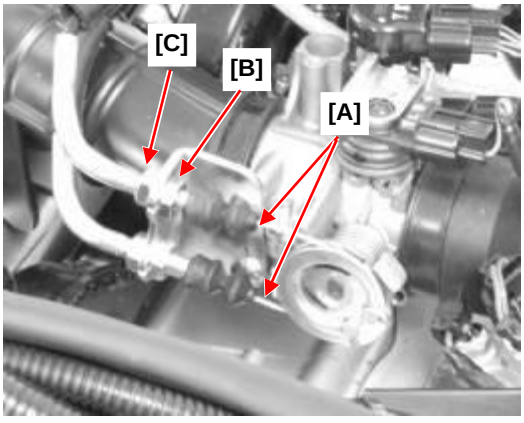


Tighten the lock nut, slide on the dust seal, and check the throttle operation.

Primary adjustment should be carried out from bottom end of the throttle cables [A].

Loosen the locknut [B], and adjust by turning the adjuster [C].

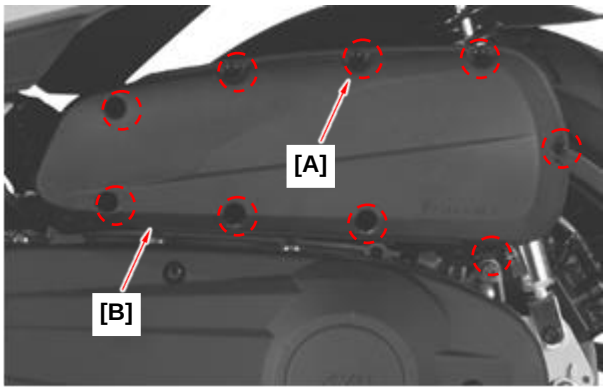
Tighten the locknut, and check throttle operation.



Air Cleaner

Air cleaner element replacement

Remove the air cleaner cover screws [A] to remove the air cleaner cover [B].

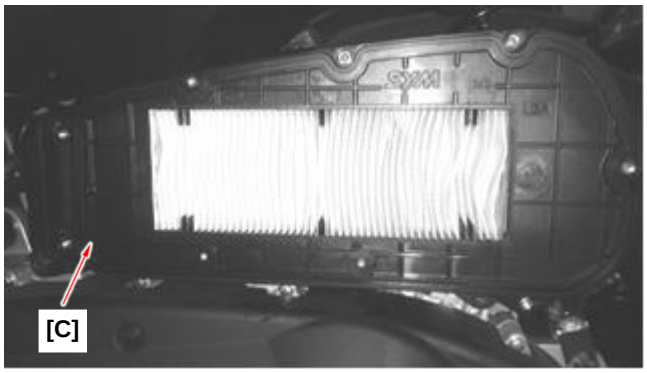


Remove the air cleaner element [C] and install a new one.

Install the air cleaner cover.

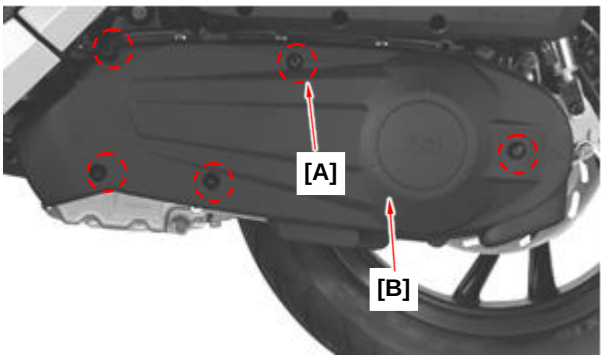
Notice:

- Use only SYM genuine air cleaner element to ensure engine performance.

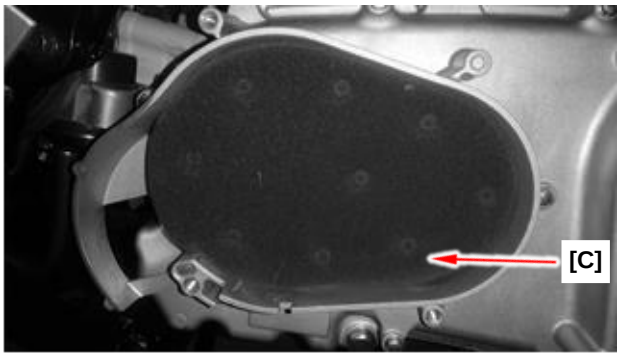


V-belt air cleaner element replacement

Remove the screws [A] to remove the left crankcase outer cover [B].



Replace the v-belt air cleaner [C] with a new one.



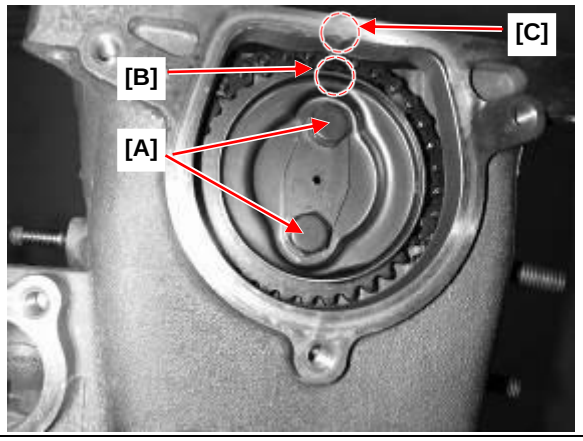
Valve Clearance

Valve clearance inspection and adjustment

Notice:

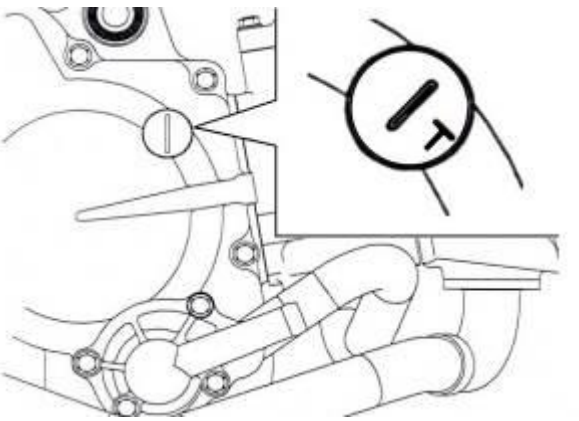
- Inspection and adjustment should be carried out when the engine temperature is under 35℃.

Remove the luggage box (page 13-16).
Remove the cylinder head cover & the side cover.
Remove ignition timing inspection cap located on the right cover of the engine.
Turn the camshaft bolt [A] clockwise and let the "-" mark [B] on the camshaft sprocket align with the cylinder head mark [C] so that piston is placed at TDC in compression stroke.



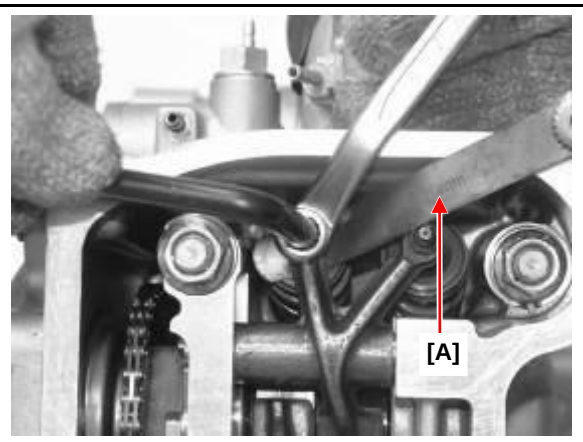
Notice:

- Do not turn the bolt counterclockwise to prevent the camshaft bolt from loosening.



Check valve clearance with feeler gauge [A].

Valve clearance
Intake: 0.10 ± 0.02 mm
Exhaust: 0.15 ± 0.02 mm



Loosen fixing nut and turn the adjustment nut for adjustment.

Special tool: Tappet adjuster
SYM-9001200-08
SYM-9001200-09
SYM-9001200-10
Tappet adjuster wrench
SYM-9001200

Fuel Line

Remove the floor panel (page 13-20).

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

⚠ Warning

- Gasoline has low flash point, so any spark or fire is strictly prohibited when dealing it.

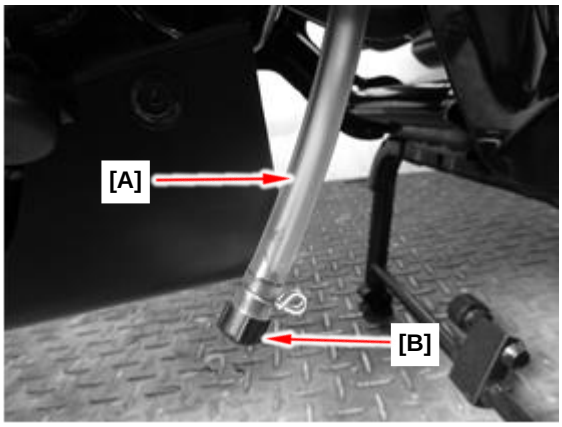
Crankcase Breather

Check if there's oil in the breather hose [A]. Drain the oil if necessary.

Remove the plug [B] to drain the oil.

Notice:

- Inspect the breather hose when changing engine oil.
- Service more frequently when ridden in rain, overturned or after the vehicle is washed.



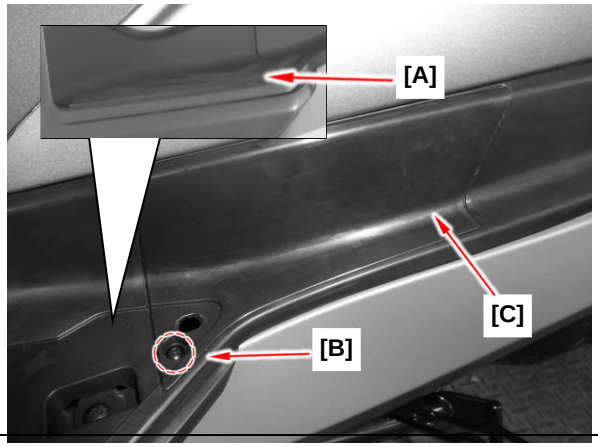
Spark Plug

Spark plug inspection

Remove the left floor mat [A].

Remove the screw [B].

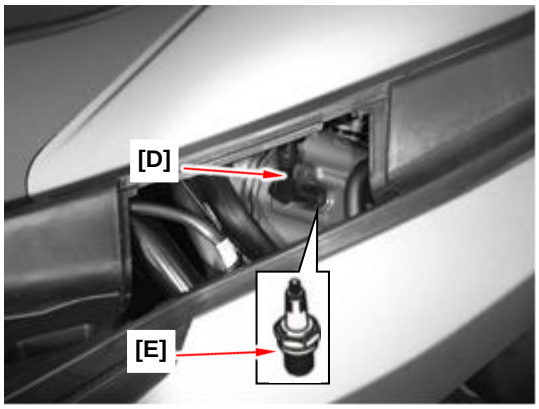
Remove the spark plug maintenance lid [C] by inserting a flat head screwdriver covered with a protective cloth.



Remove spark plug cap [D].

Remove the spark plug [E] with a spark plug wrench.

Clean around the spark plug hole and make sure no debris is allowed to enter the combustion chamber.



If the electrodes are contaminated with heavy deposits or the insulator is damaged, replace with a new one.

RECOMMENDED SPARK PLUG:
NGK CR8E

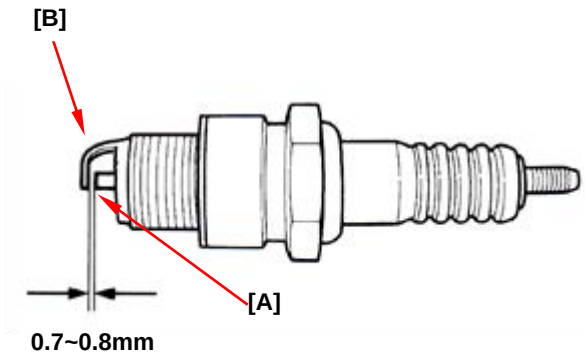
Measure the spark plug gap [A] with a wire type feeler gauge.
Spark plug gap: 0.7~0.8 mm

Carefully bend ground electrode [B] 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.
Tightening torque: 1.0~1.2 kgf-m

Install the spark plug cap.

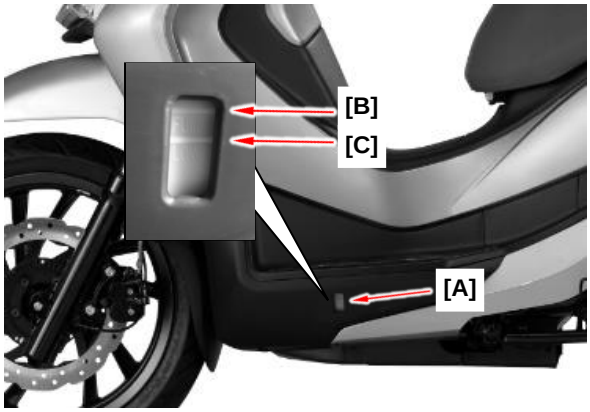


Coolant Level Inspection

Position the motorcycle on level ground and in an upright position.

Inspect coolant level in the coolant inspection window [A].

The coolant level must be between the FULL [B] and LOW [B] marks.



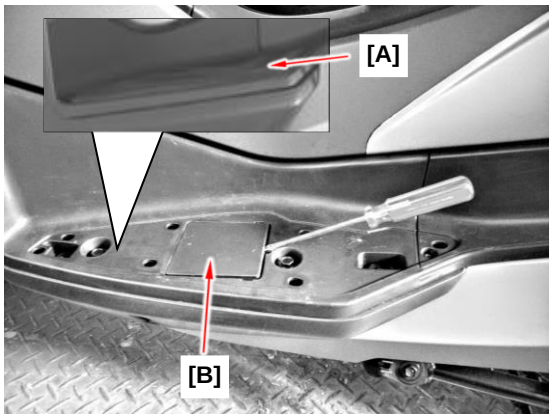
Top up the coolant when the level is at the LOW mark.

RECOMMENDED COOLANT:

Genuine SYM long life coolant or an equivalent 50% solution of ethylene glycol based antifreeze.

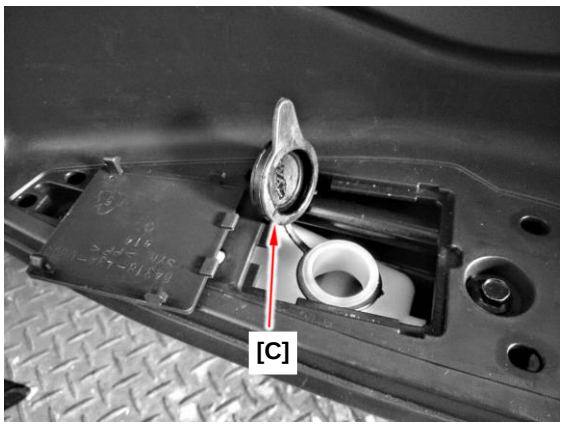
Remove the left floor panel mat [A].

Remove the maintenance cap [B] with a flathead screw driver.



Open the reserve tank cap [C] to fill in coolant.

Reverse the steps of removal to install.



Notice:

- Inspect coolant level when the engine is cold.

Steering Play Inspection

Lift the front wheel off the ground.

Turn handlebar from right to left [A] and check if it turns smoothly. Make sure the control cables do not interfere with the handlebar rotation.

If the handle bar turns unevenly or has vertical movement, inspect the steering stem.
Move the fork legs back and forth [B], if looseness is found, inspect the steering stem.

Special tool: No tripod holder- SYM- 3299610

Suspension

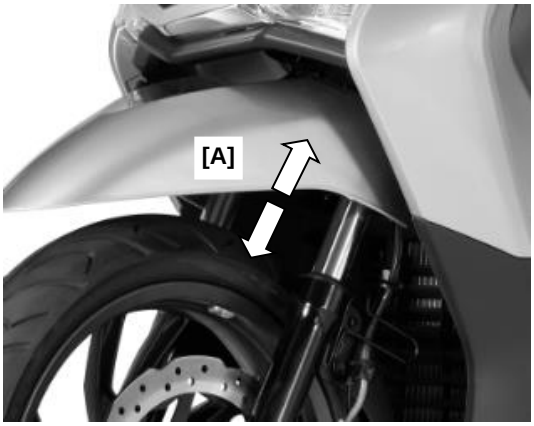
Front/rear suspension inspection

Compress the front forks for several times to check operation.

Check if it is damaged, loose fasteners or has oil leaking.

Replace damaged parts.

Tighten all nuts and bolts.

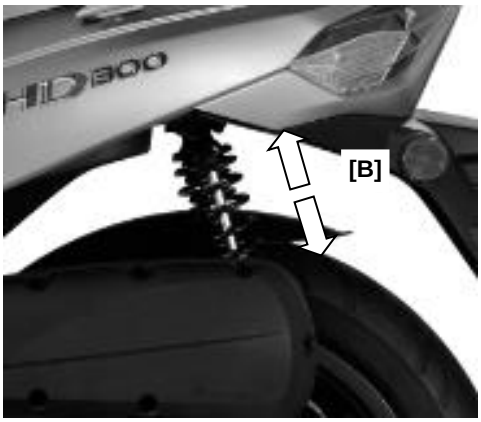


Compress the rear shock absorbers for several times to check operation.

Check if it is damaged, loose fasteners or has oil leaking.

Replace damaged parts.

Tighten all nuts and bolts.



⚠ Warning

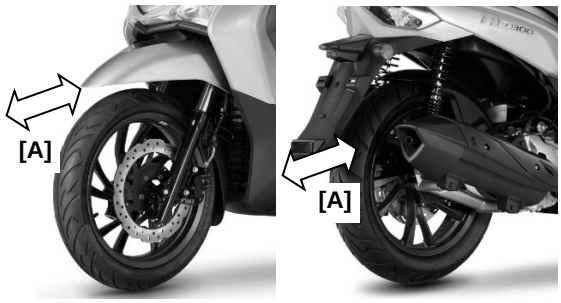
- Do not ride the motorcycle with poor suspension.
- Looseness, wear or damage cushion will make poor maneuverability.

Wheels/tires

Support the motorcycle upright safely; to check the front wheel bearings, raise the front wheel off the ground; to check the rear wheel bearings, raise the rear wheel off the ground.

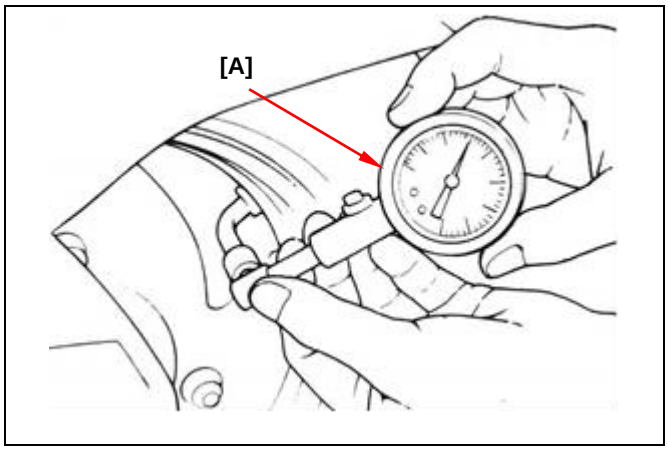
Hold the fork leg or rear swing arm, push and pull [A] the front or rear wheel to check if the wheel bearings are worn.

Replace the front or rear wheel bearings if necessary



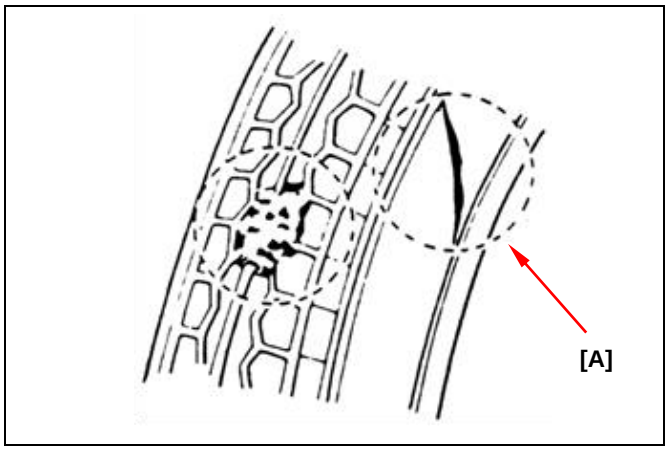
Check the tire pressure with a tire pressure gauge [A] when the tires are cold.

Recommended tire pressure
Front: 1.8 kgf/cm² (25 psi)
Rear: 2.3 kgf/cm² (32 psi)



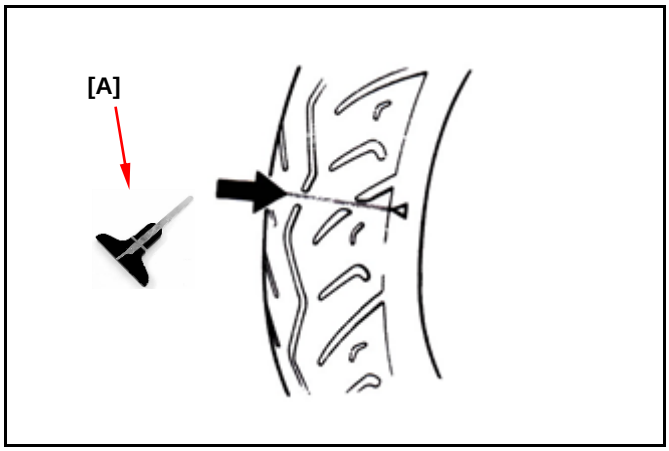
Check the tires for damage, if cuts are founded on tire wall [A], replace the damaged tire immediately.

Recommended tire size
Front tire: 110/70-16 52P
Rear tire: 140/70-16 65P



Measure the tread depth with a depth gauge [A] at the center of the tires.

Replace the tire when the tread depth reaches the limits instituted by your government.

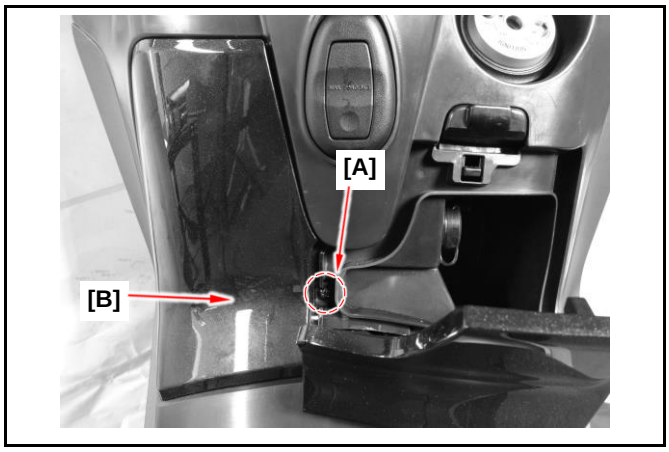


Battery

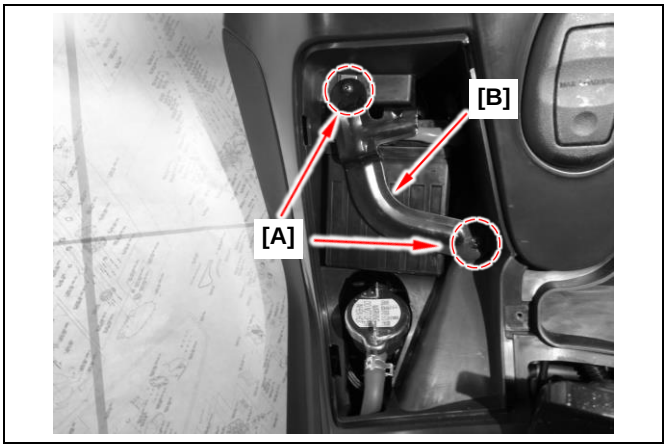
Battery removal

Open the glove box cover and remove the screw [A].

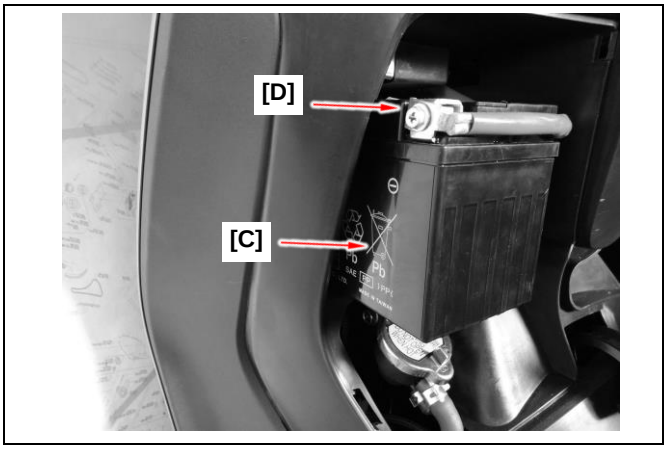
Remove the battery room cover [B].



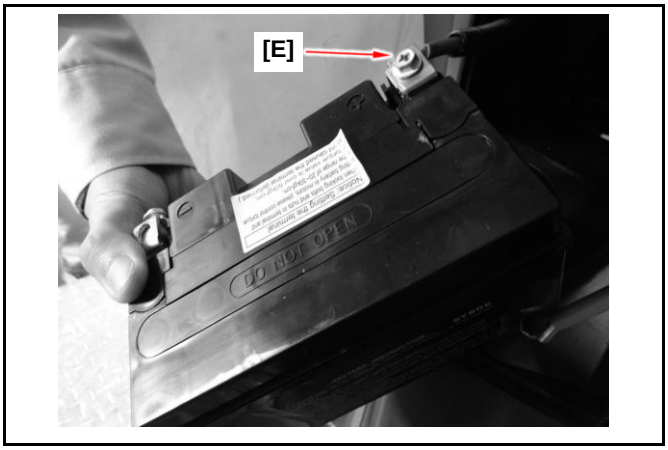
Remove the 2 screws [A] to remove the battery holder [B].



Pull out the battery [C] and disconnect the (-) terminal.

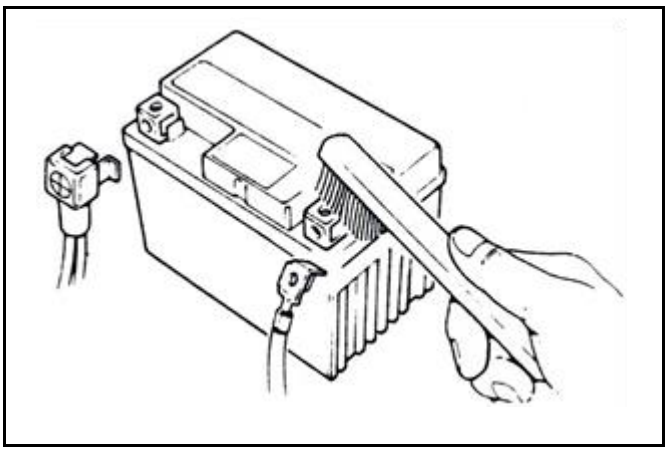


Carefully hold the battery and disconnect the (+) terminal [E].



If there is some rust on battery terminals, apply hot water to the terminal and clean it with copper brush.

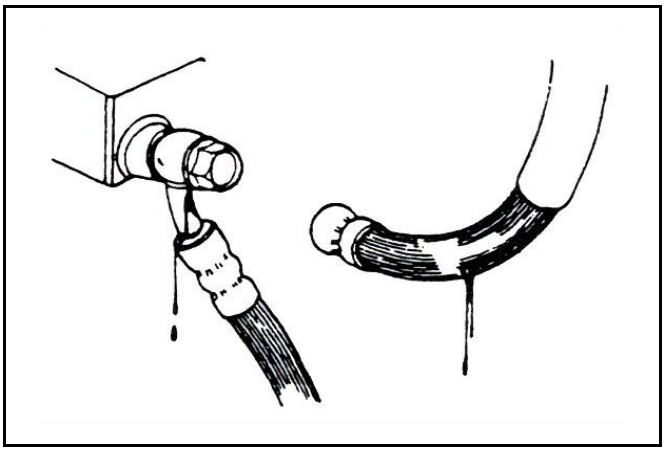
Install the battery in the reverse procedures of removal.



Brake System

Brake hose inspection

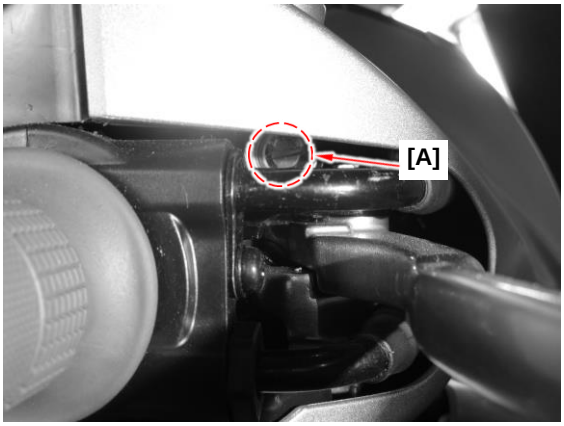
Inspect the brake hose joints and surfaces for leaking and damage. Replace a new one if necessary.



Brake fluid level

Set the motorcycle upright.

Check brake fluid level in the front and rear brake fluid reservoir. If the level is lower than the “MIN” level line [A] in the front/rear reservoir, add recommended brake fluid. Also check brake system for leaking if low brake fluid level is found.

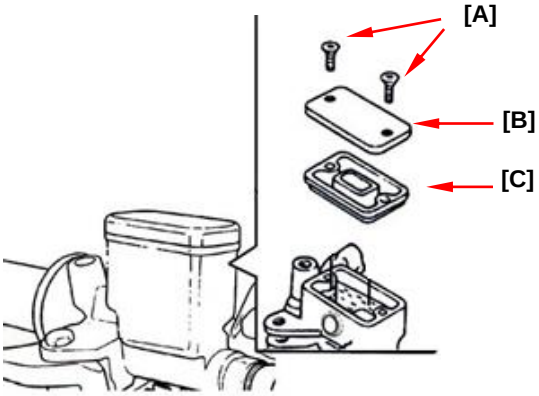


Adding brake fluid

Set the scooter upright and steady.

Remove the below components:

- Front handlebar cover (page 13-10).
- Screws [A] (For front reservoir)
- Reservoir cap [B]
- Diaphragm [C]



Fill the reservoir with DOT3 or DOT4 brake fluid to adequate level.

Install the diaphragm, the reservoir cap and the screws.

RECOMMENDED BRAKE FLUID: “SYMOIL” DOT4 Brake Fluid.

Notice:

- In order to keep brake fluid in horizontal position, do not remove the cap until the motorcycle is steady.
- Do not operate the brake levers after the caps are removed. Otherwise, the brake fluid will spill out.
- Do not mix different brake fluid together.

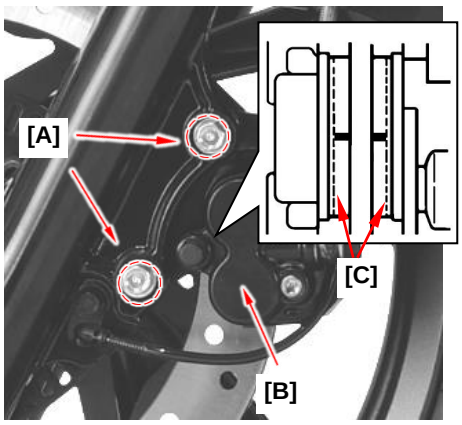
Front brake pad wear inspection

Set the scooter upright and steady.

Remove the bolts [A] to remove the front caliper [B].

Replace the brake pads when each pad is worn to the wear limit grooves [C].

Torque value：3.2 kgf-m



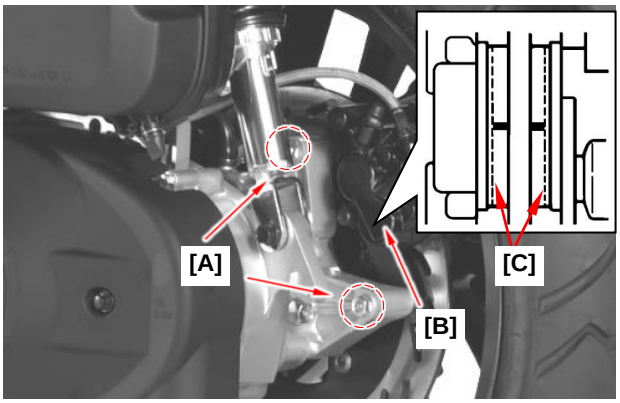
Rear brake pad wear inspection

Set the scooter upright and steady.

Remove the bolts [A] to remove the front caliper [B].

Replace the brake pads when each pad is worn to the wear limit grooves [C].

Torque value：3.2 kgf-m



Notice:

- Always replace the brake pads in pair to ensure brake performance.

Brake disks inspection

Inspect the front and rear brake disks for damage, warp or cracks. Change new disks if necessary. If oil is found on the disks, clean with brake system cleaner.

Measure the disks with a vernier caliper. Change new disks when the thickness is below the service limits.

Service limit

Front: 4.0 mm

Rear: 4.5 mm

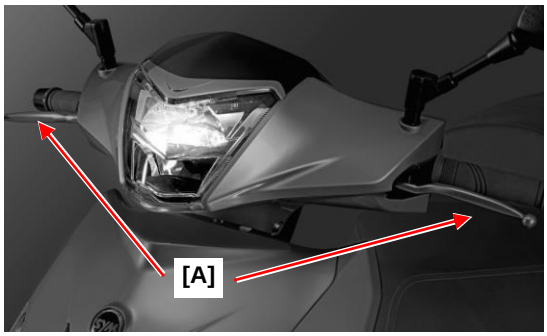
Brake Operation

Set the motorcycle upright.

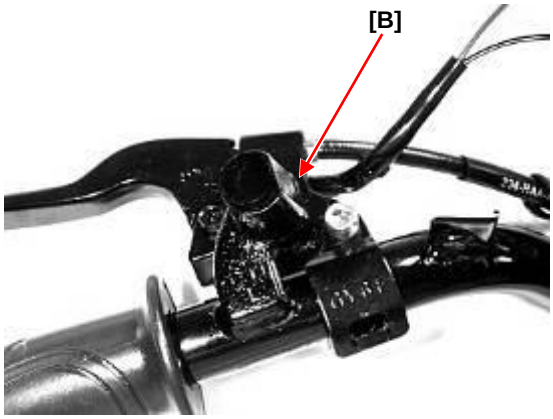
To check the front brake, raise the front wheel off the ground. To check the rear brake, raise the rear wheel off the ground.

Apply the brake levers [A], make sure the front or rear wheel does not rotate.

If the lever feels “spongy”, bleed the air in the brake system (page 2-17).



Make sure the brake light comes on when each brake lever is applied. If the brake light does not come on, change the brake light switches [B] if necessary.

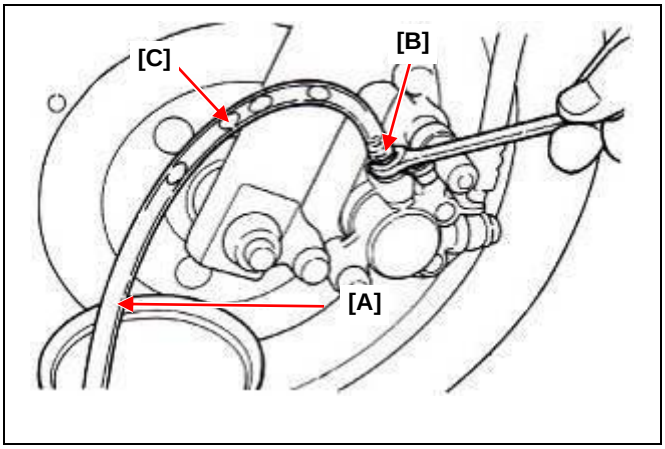


Air Bleeding

Connect a transparent hose [A] to the draining hole [B]. Hold the brake lever and open air draining hole. Perform this operation alternative until there is no air inside the brake system hoses.

Notice:

- Do not release the brake lever before closing the draining hole.

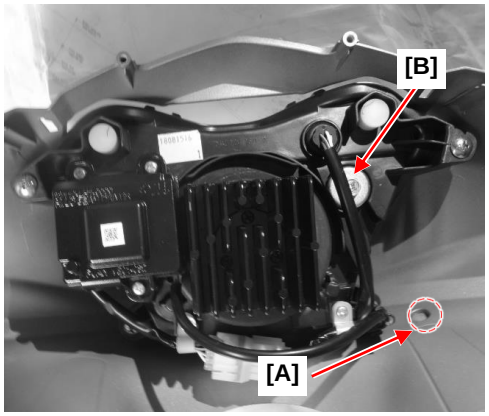


Headlight Aim

Turn ignition switch on.
Insert a screw driver from the adjusting hole [A] without disassembling handle bar covers.
Turn the screw driver to adjust the adjusting screw [B].

Notice:

- Follow local regulations to adjust headlight aim.
- Improper adjustment can dazzles other drivers or makes insufficient lighting.



Cylinder Compression Pressure

Warm up the engine then turn off the engine.

Remove the spark plug (page 2-10).

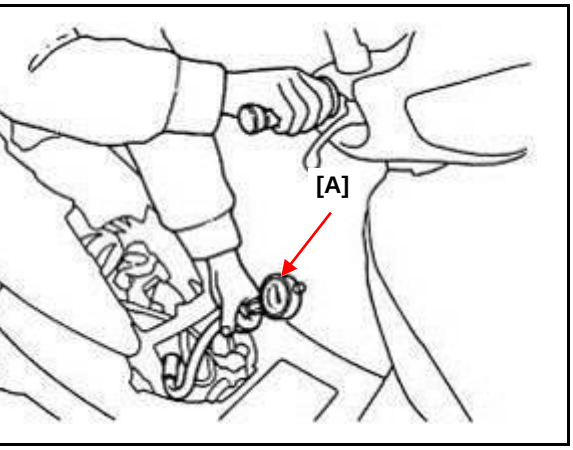
Install the cylinder pressure gauge [A].

Turn ignition switch on, fully open the throttle and push the start button to crank the engine until the reading stabilizes.
Standard compression pressure: 14 ± 2 kg/cm²

If the pressure is below maximum specification:
- Check valve clearance.
- Check valve leaking.
- Check cylinder head leaking, piston, piston ring and cylinder wear out.

If the pressure is above minimum specification, check the cylinder head, piston crown and valve surface for carbon deposits. Eliminate the carbon deposits on the above mentioned parts.

Install the spark plug (page 2-10).



CVT System

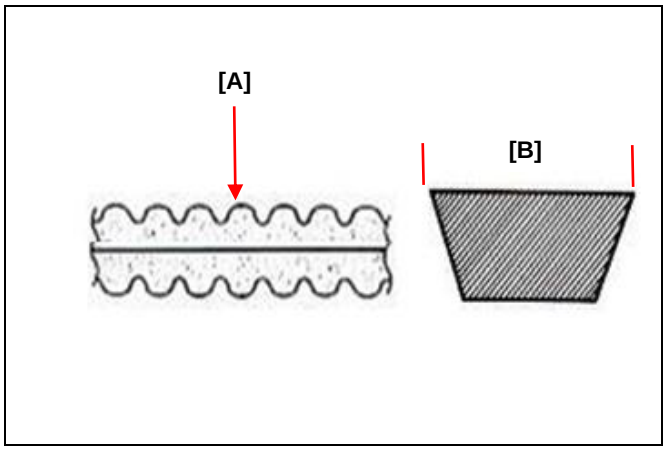
Drive V-Belt

Remove the left crankcase outer cover.
Remove the left crankcase cover.

Inspect the V-belt [A] for damage or crack. Change a new one if necessary.

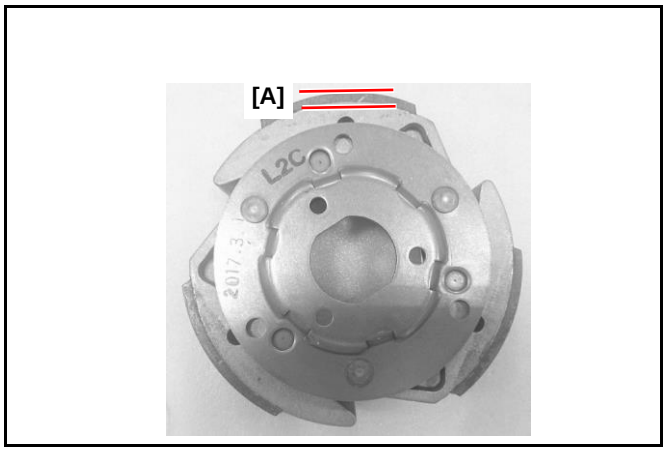
Measure the width [B], if the width is below service limit, change a new one.

Service limit: 22.5 mm



Clutch Weight

Run the motorcycle and increase throttle valve gradually to check the clutch operation.
If the motorcycle vibrates during moving forward, inspect the wear condition [A] of the clutch weight.
Replace it if necessary.

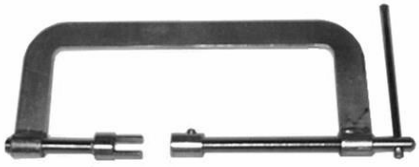


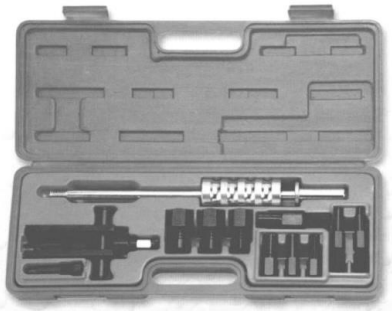
Nuts, Bolts Tightness

Apply periodical maintenance in accordance with the Periodical Maintenance Schedule (page 2-4).

Check if all the bolts and nuts on the frame are tightened within standard torque.
Check all fixing pins, snap rings, hose (pipe) clamps, and wire holders for security.

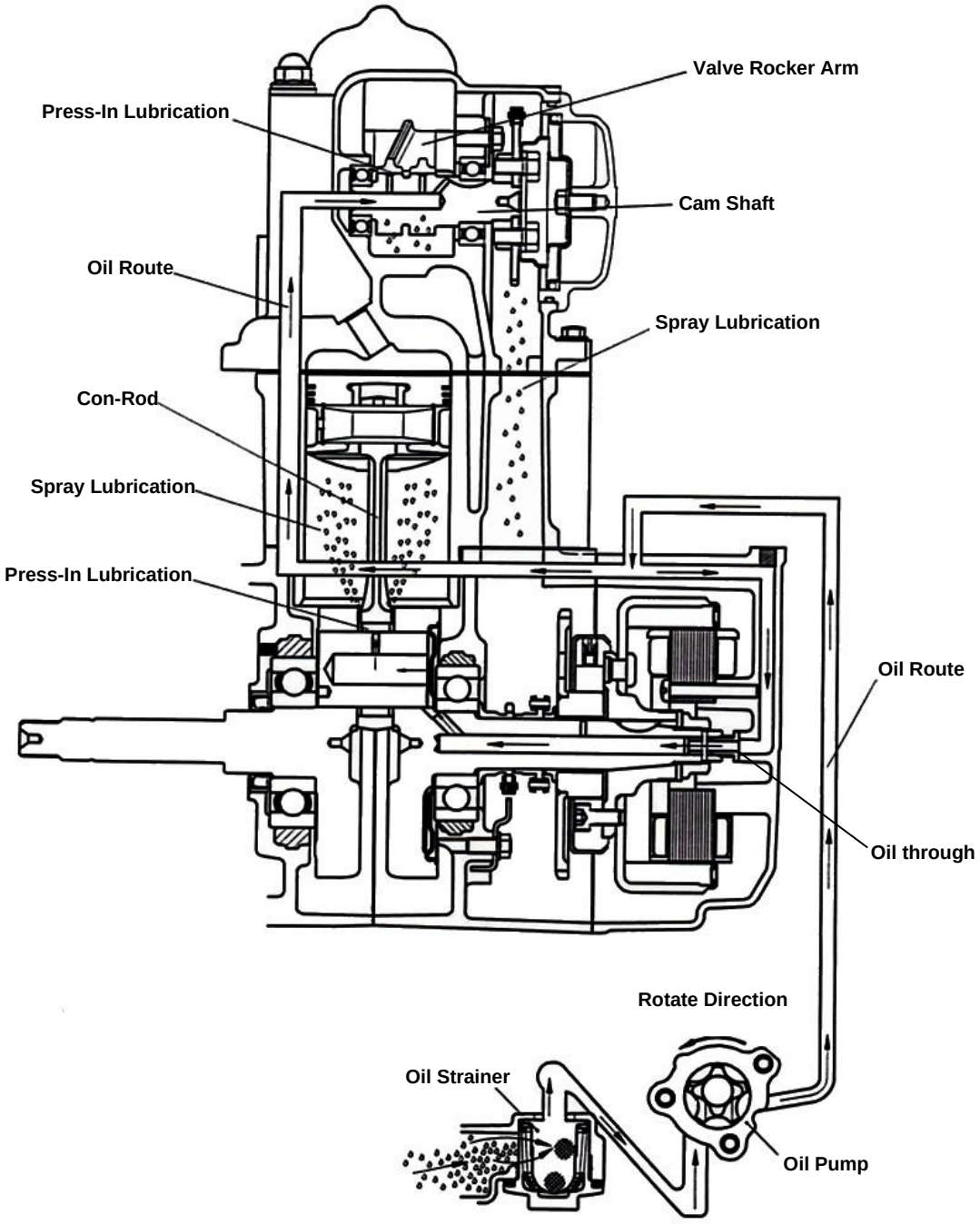
Special tools

		
Name: Rocker arm shaft disassemble tool SY No.: SYM-1445100	Name: Flywheel puller SY No.: SYM-3110000-HMA	Name: Valve remove and assemble tool SY No.: SYM-1471110/20
		
Name: Valve spring compressor SY No.: SYM-1471100	Name: Tappet adjusting wrench SY No.: SYM-9001200	Name: Tappet adjusting tool SY No.: SYM-9001210
	 (6203/6004UZ)	 (20*34*7)
Name: Steering Nut Wrench SY No.: SYM-5320000	Name: 6203/6004UZ bearing Driver SY No.: SYM-9620000	Name: 20*32*6 oil seal driver SY No.: SYM-9120200
 (6204)	 (6301)	
Name: 6204 Bearing Driver SY No.: SYM-9110400	Name: 6301 Bearing Driver SY No.: SYM-9610000	Name: Digital clamp meter SY No.: SYM-HE07007-05

					
Name	Inner bearing puller set	Name	Outer bearing puller	Name	Bearing driver
SY No.	SYM-6204020	SY No.	SYM-6204001	SY No.	SYM-6204024
					
Name	Crankcase bush puller	Name	Cylinder pressure gauge	Name	Vacuum pressure gauge
SY No.	SYM-1120310	SY No.	SYM-HT07008	SY No.	SYM-HT07011
					
Name	EFi System Diagnostic tool	Name	Fuel pressure gauge	Name	Multi-meter
SY No.		SY No.	SYM-HT07010	SY No.	SYM-HE07007-01
					
Name	Vehicle circuit test tool kit	Name	Vehicle circuit test harness	Name	Fuel hose clamp
SY No.	SYM-HE170008	SY No.	SYM-HE170008-01	SY No.	SYM-1950500

					
Name	EFI fuel hose pliers	Name	EFI fuel hose removal pliers	Name	Water pump mechanical seal driver
SY No.	SYM-1768100	SY No.	SYM-1768110	SY No.	SYM-1721700-H9A
					
Name	Water pump bearing driver	Name	Water pump oil seal driver		
SY No.	SYM-9100100	SY No.	SYM-9120500-H9A		

NOTE:



Precautions in Operation

General Information:

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

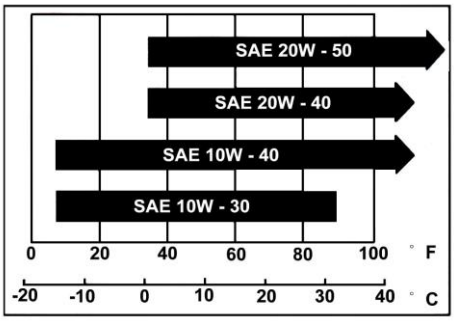
Specifications

Engine oil quantity Disassembly: 1400 c.c.
Change: 1200 c.c.

Oil viscosity SAE 10W30/10W-40
(Recommended "**SYMOIL**" serial oils)

Gear oil Disassembly: 180 c.c.
Change: 160 c.c.

Gear oil viscosity SAE 10W30 or SAE 85W90
(Recommended "**SYMOIL**" gear oils)



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	1.0~2.0kgf-m
Gear oil drain plug	0.8~1.2kgf-m
Gear oil inspection bolt	1.0~1.4kgf-m
Oil pump connection bolt	0.8~1.2kgf-m

Troubleshooting

Low engine oil level

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

Low oil pressure

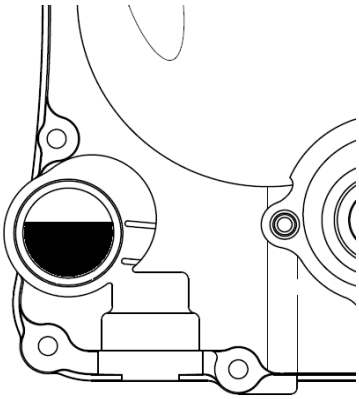
- Low engine oil level
- Clogged in oil strainer, circuits or pipes
- Oil pump damage

Dirty oil

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

Engine Oil

Turn off engine, and park the motorcycle in flat surface with main stand.
Check oil level in the inspection window.
If oil level is nearly low level, fill out recommended oil to upper level.



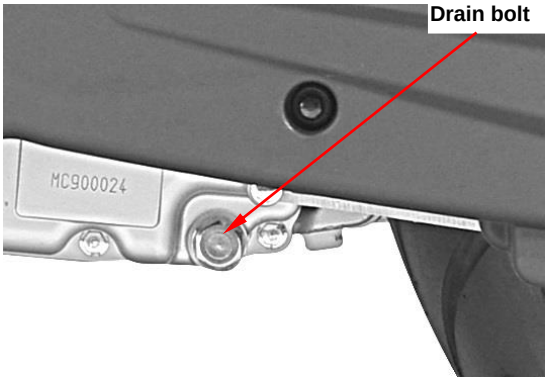
Oil Change

⚠ Caution

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

Place a oil pan under the motorcycle, and remove oil drain bolt.
After drained, make sure washer can be re-used.
Install oil drain bolt.

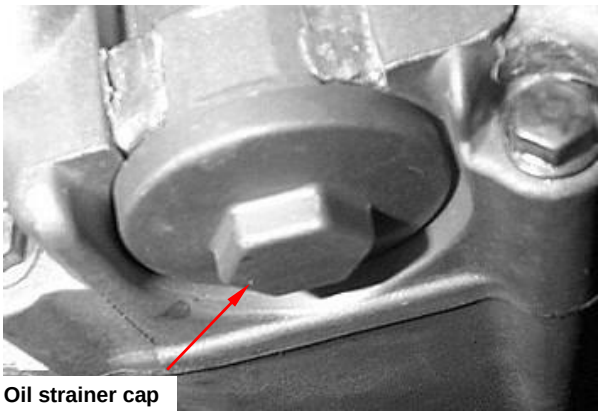
Torque value：3.5~4.5kgf-m



Engine Oil Strainer Clean

Drain engine oil out.
Remove oil strainer and spring.
Clean oil strainer.
Check if O-ring can be re-used.
Install oil strainer and spring.
Install oil strainer cap.

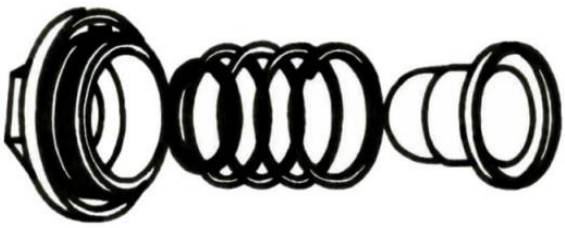
Torque value：1.0~1.2kgf-m



Add oil to crankcase (oil viscosity SAE 10W-30/10W40)
Recommended using SYMOIL serial oil.

Engine oil capacity: 1.2 L when replacing

Install filler cap, start the engine for running several minutes.
Turn off engine, and check oil level again.
Check if engine oil leaks.

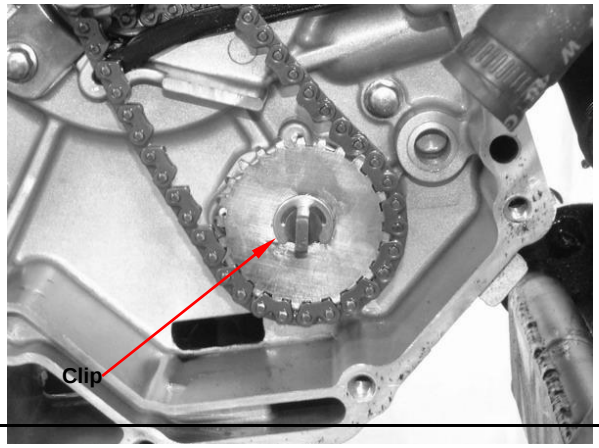


Oil Pump

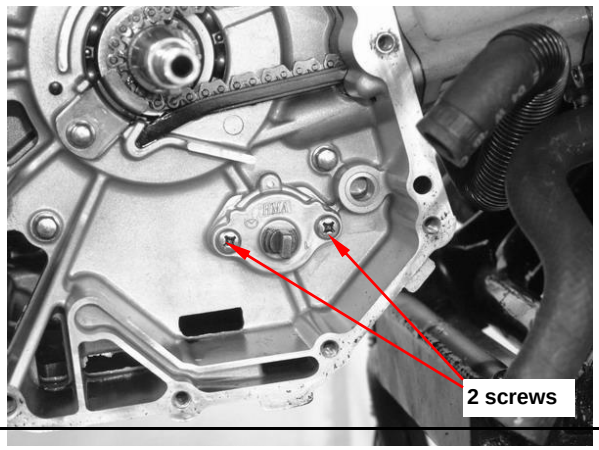
Oil Pump Removal

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

Remove snap ring and take out oil pump driving chain and sprocket.

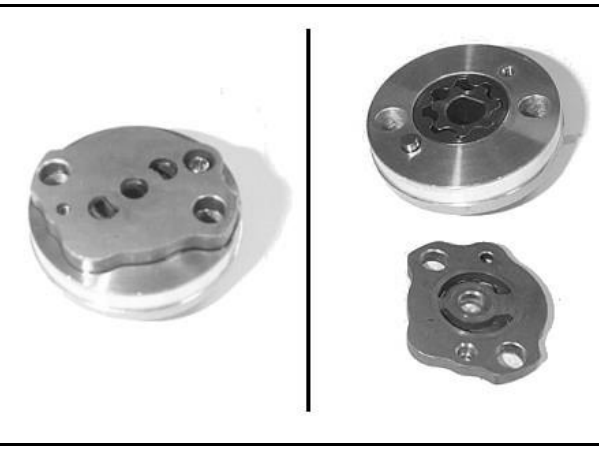


Make sure that pump shaft can be rotated freely. Remove 2 bolts on the oil pump, and then remove oil pump.



Oil Pump Disassembly

Remove the screws on oil pump cover and disassemble the pump as illustration shown.



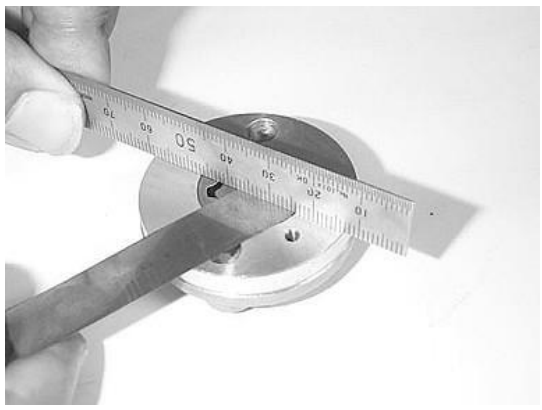
Oil Pump Inspection

Check the clearance between oil pump body and outer rotor.

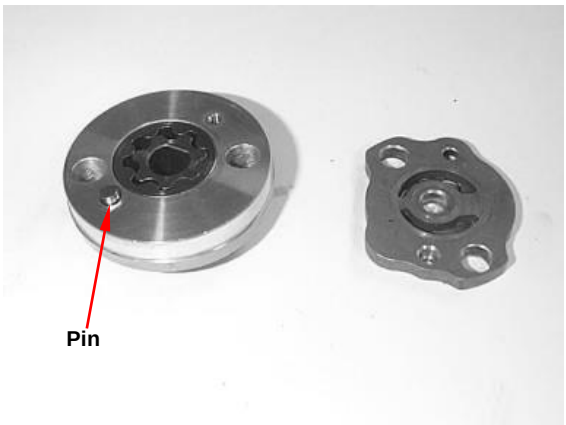
Limit: 0.25 mm

Check clearance between inner and outer rotors.
Limit: 0.20 mm

Check clearance between rotor side face and pump body
Limit: 0.12 mm



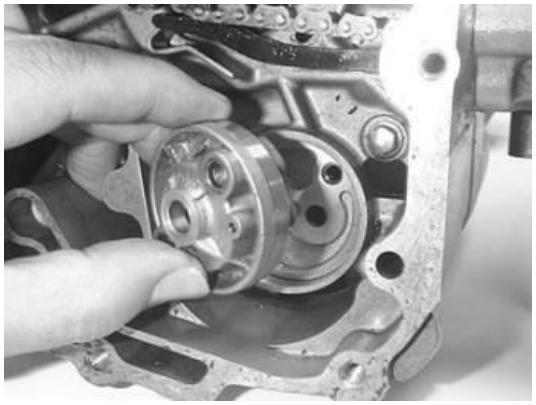
Oil Pump Re-assembly
Install inner and outer rotors into the pump body
Align the indent on driving shaft with that of inner rotor. Install the driving shaft
Install fixing pin



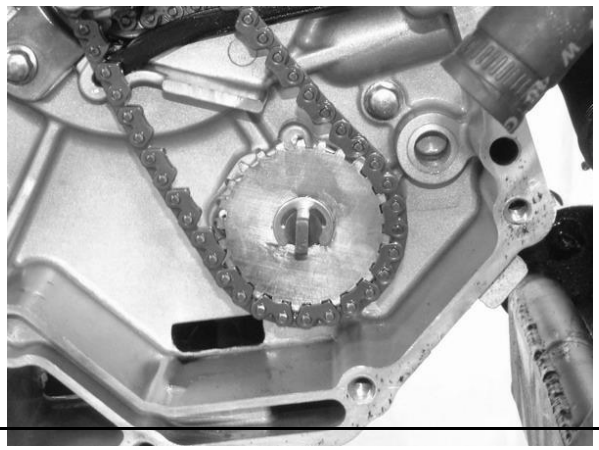
Install the oil pump cover and fixing pin properly

Oil Pump Installation
Install the oil pump, and then tighten bolts.

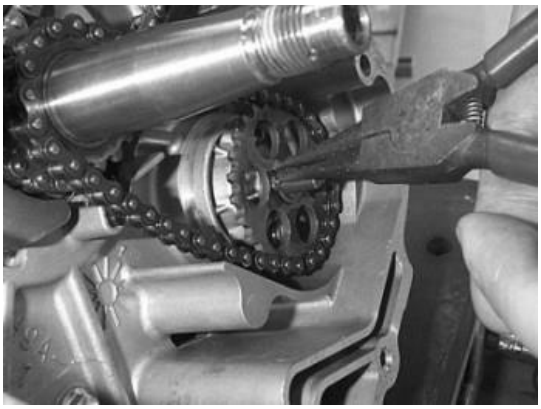
Torque value：0.8~1.2kgf-m



Make sure that oil pump shaft can be rotated freely.



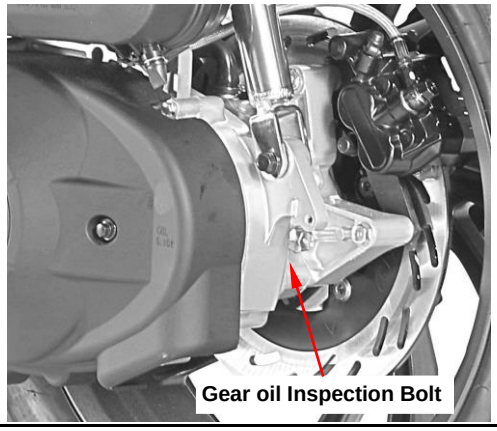
Install oil pump driving chain and sprocket, and then install snap ring onto oil pump shaft.



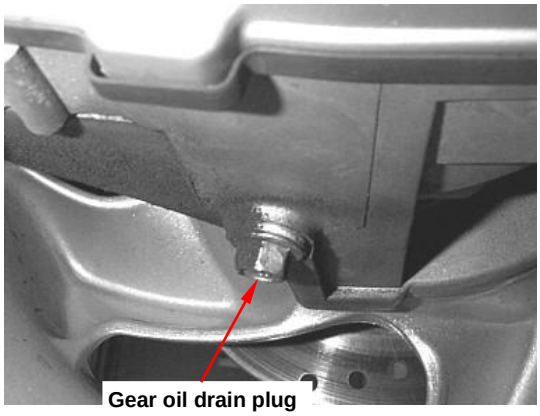
Install starting gear and generator.
(Refer to chapter 10)

Gear Oil

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



Gear lubrication oil quantity has to be measured with measure device.
If oil level is too low, add gear oil. Recommended using SYMOIL series oils.
Install oil inspection bolt.

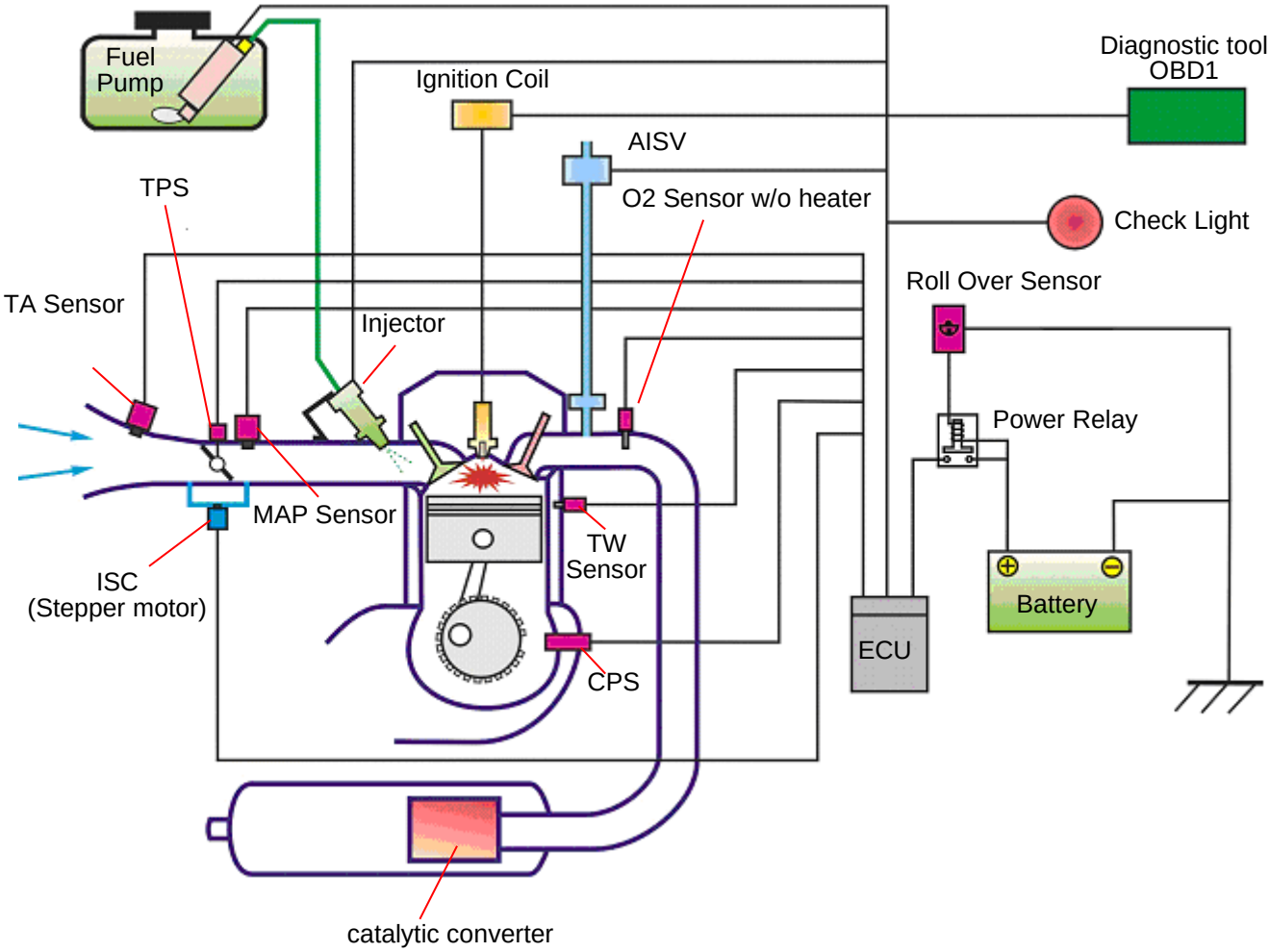


Gear Oil Change

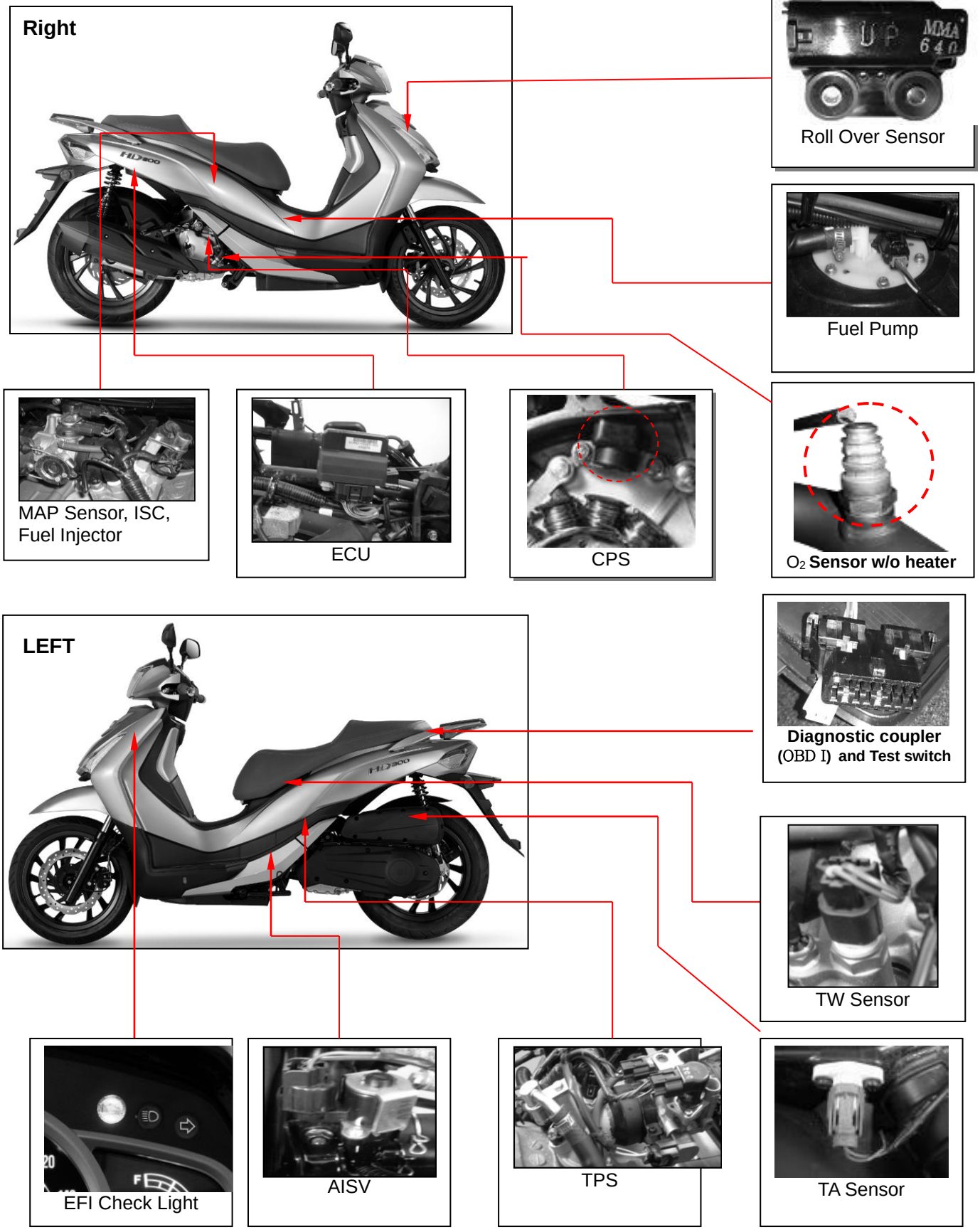
Remove oil level inspection bolt.
Remove drain plug and drain oil out.
Install the drain plug after drained.
Torque value: 0.8~1.2kgf-m
Make sure that the drain plug washer can be re-used.
Add oil to specified quantity from the inspection hole.
Gear Oil Quantity: 160 c.c. when replacing
Make sure that 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.

Notes:

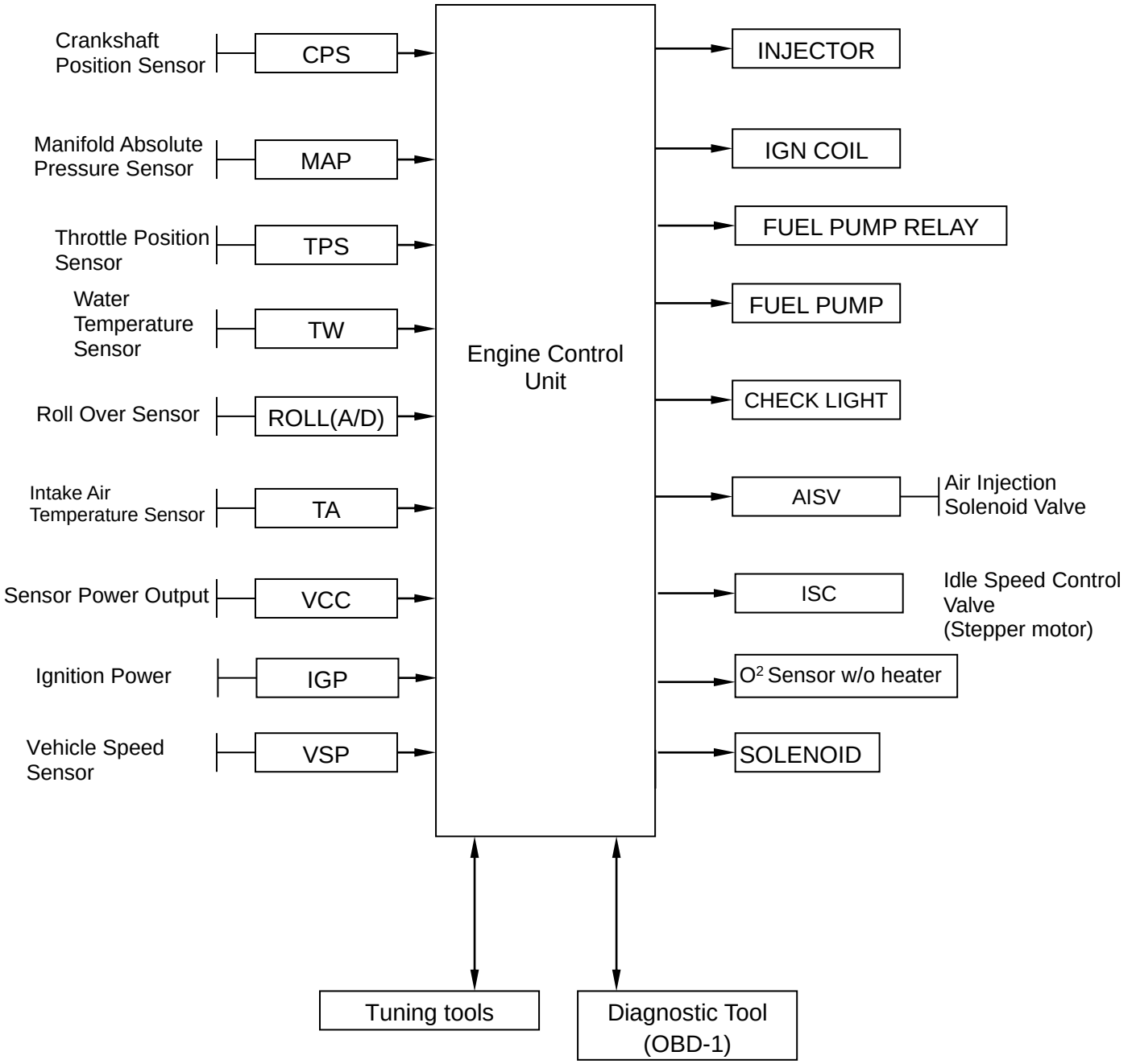
Fuel Injection System Components



Fuel Injection System Configuration



Operation of Fuel Injection System



Fuel Injection System Introduction

Based on 4-stroke SOHC engine, displacement 278 c.c. electronically controlled fuel injection system, evaporative fuel absorbed by the activated carbon canister. The engine burns off the blow-by fuel-gas from the crankcase through the fuel-air separating device. The O_2 Sensor enhances the efficiency of the catalytic converter, by dynamically controlling the Air/Fuel ratio.

Electronic Fuel Injection Devices

Fuel supplying devices: fuel tank, fuel pump, fuel filter, and fuel pressure regulator.
Fuel controlling devices: fuel injector, and ECU.
The fuel is pumped by the electrical fuel pump inside the fuel tank to the injector fixed on the intake manifold. The fuel pressure regulator keeps the fuel pressure around 294±6kpr. The signals from ECU enable the injector to spray fuel into the combustion chamber once each two crankshaft-revolutions. The excessive fuel flows back to the fuel tank through the pressure regulator. Fuel pump is placed inside the fuel tank to reduce the working noise. Electrically controlled ignition and injection system effectively reduce fuel consumption rate and air pollution.

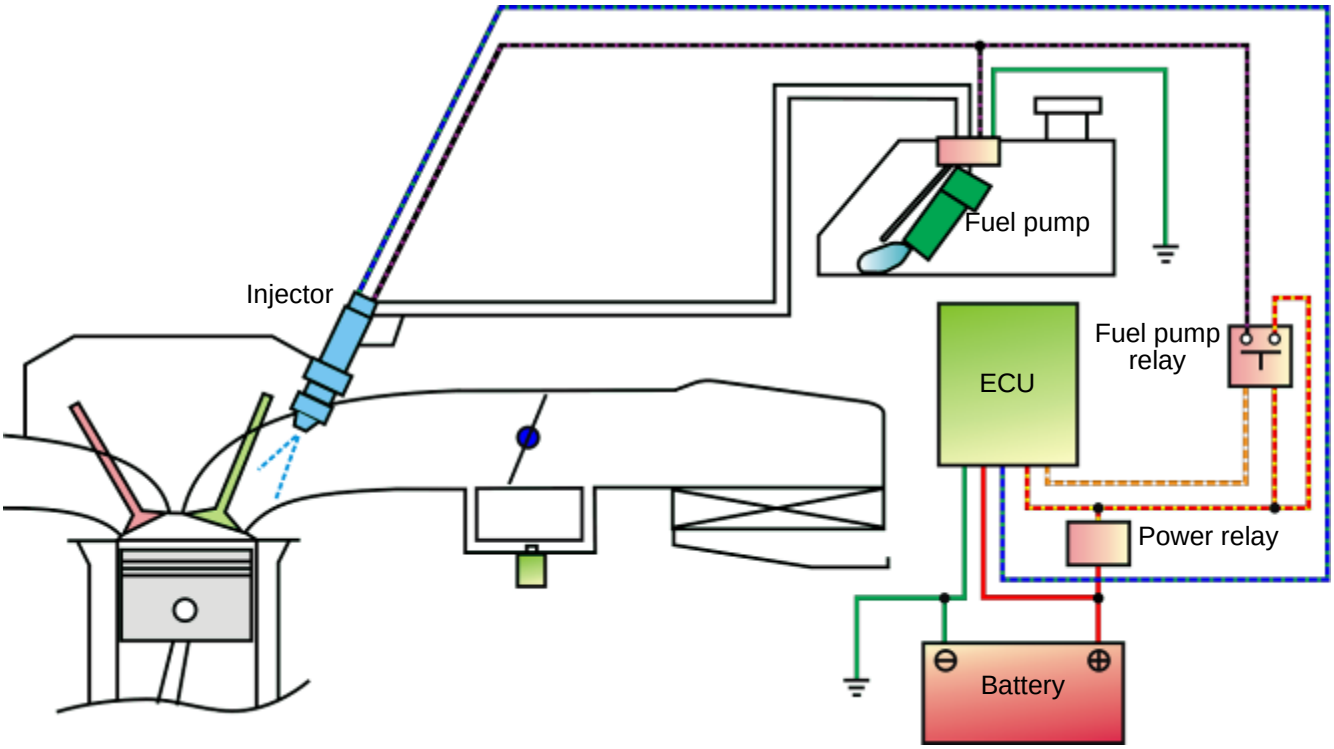
In traditional gasoline engine, carburetor supplies the fuel. The process is done by engine vacuum, and the negative pressure in the carburetor mixes fuel with air. Under this condition, three major processes are done simultaneously in the carburetor: 1. Air quantity measurement. 2. The determination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

Electronic Fuel Injection System separates the three major processes into three different devices: 1. MAP Sensor and TA Sensor gauge the air quantity and temperature and send the signal to ECU as a reference. 2. ECU decides the amount of fuel to be injected, according to the default Air/Fuel ratio. 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 to the condition of the engine. The engine RPM, and the throttle position determine 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±6kpr pressure difference between intake manifold and fuel pipe, raising the accuracy of fuel injection.
4. By measuring the air pressure of intake manifold, this system gives the vehicle better accommodation to the environment.
5. Idle speed control system supplies fuel and air to stabilize the idle running, and cold starting.
6. O_2 Sensor feeds back the signal to minimize the exhaust pollution.

Fuel System Outline



System Description

1. After Key-on, the sensors send signals to the ECU. ECU controls the fuel pump relay, making the fuel pump operate. If the engine is not started, the fuel pump will be shut down in 2 or 3 seconds in order to save electricity. The fuel pressure regulator maintains fuel pressure at 294 ± 6kpa (about 3 kg / cm ²). According to the operating conditions and the environmental compensation coefficients, fuel injector injects appropriate fuel quantity. Key-off or engine stopped operating, the fuel pump stops running.
2. Impurities are filtrated by the fuel filter, which should be regularly replaced.
3. When the engine can not be started, do not start motor for continuous movement which could led to lack of battery electricity (less than 10 V), the electric fuel pump will not be able to move.

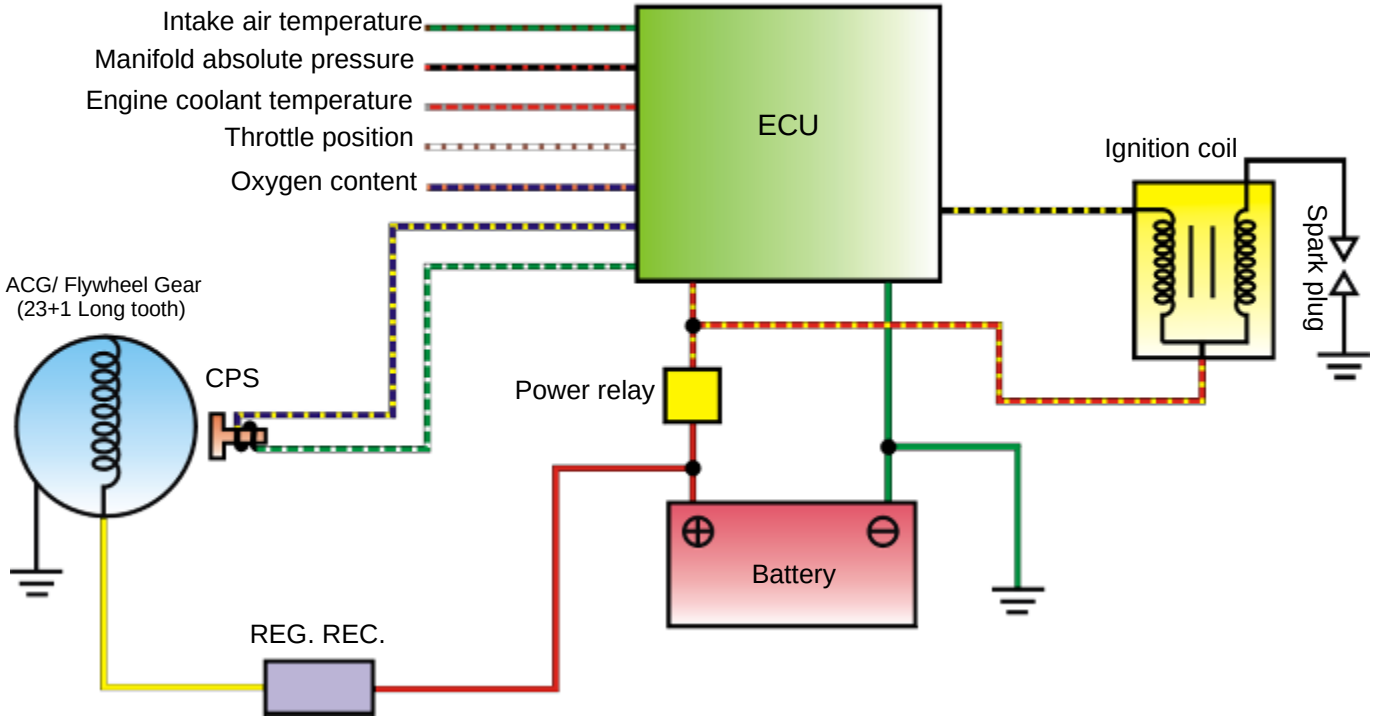
Injector

Two-hole injector provides intake valves with two fuel injection, increasing fuel atomization effect, and reducing HC emission. The short-type injector cap can easily fix the injector and receives fuel from the fuel pump, preventing the injector from rotating and sliding. ECU supplies control signals to the fuel pressure regulator which uses the diaphragm and spring to maintain the fuel pressure at 294 ± 6kpa (about 3 kg / cm ²), and controls the injection quantity by determining the injection time width.

Fuel pump

Electrical fuel pump is mounted inside the fuel tank, powered by the battery and controlled by ECU. Fuel pressure at idle speed: 294 ± 6kpa (about 3 kg / cm ²).

Ignition System Outline



Principle

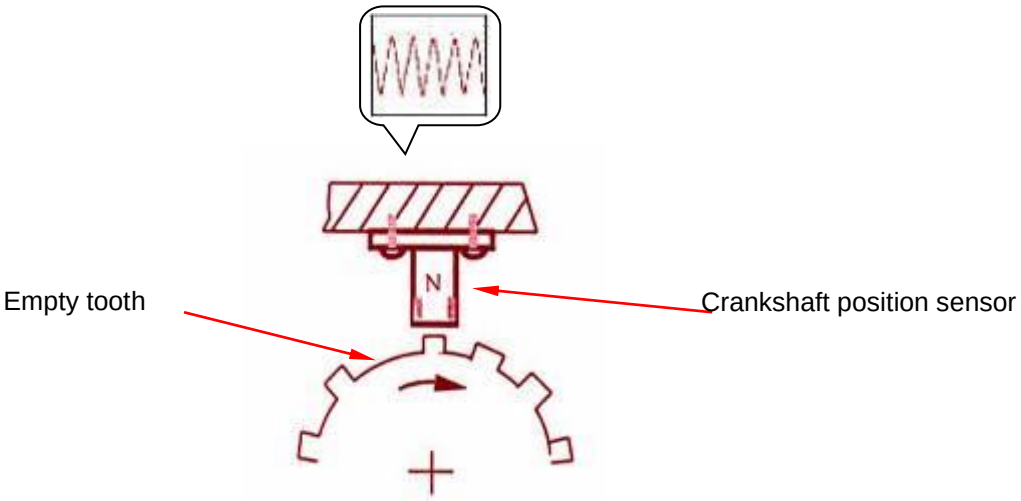
ECU determines the appropriate ignition timing by receiving the signals from the CPS, TPS, O_2 Sensor, MAP Sensor, TA Sensor and TW Sensor in accordance with the engine RPM. The ignition coil produces 25000~30000 volts to fire the spark plug, maximizing the engine output, and improving the fuel comsumption efficiency.

Specifications

1. Ignition timing: 8 ° BTDC / 1550RPM
2. Spark plug: NGK CR8E Clearance: 0.7 to 0.8 mm
3. ACG crankshaft position sensor coil resistance: **120Ω±20% (20°C)** (Green / White - Blue / Yellow)
4. Ignition coil primary circuit: 2.8 Ω ± 15% (20 º C) (Red / Yellow - Black / Yellow)
5. Battery Type: GT12A-BS 12V 10Ah

Sensors and Drives Outline

Crankshaft Position Sensor (CPS)



Description

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

Function

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

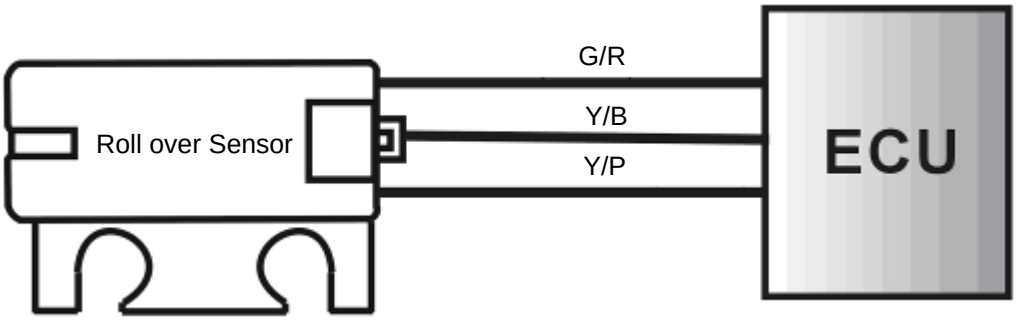
Roll Over Sensor

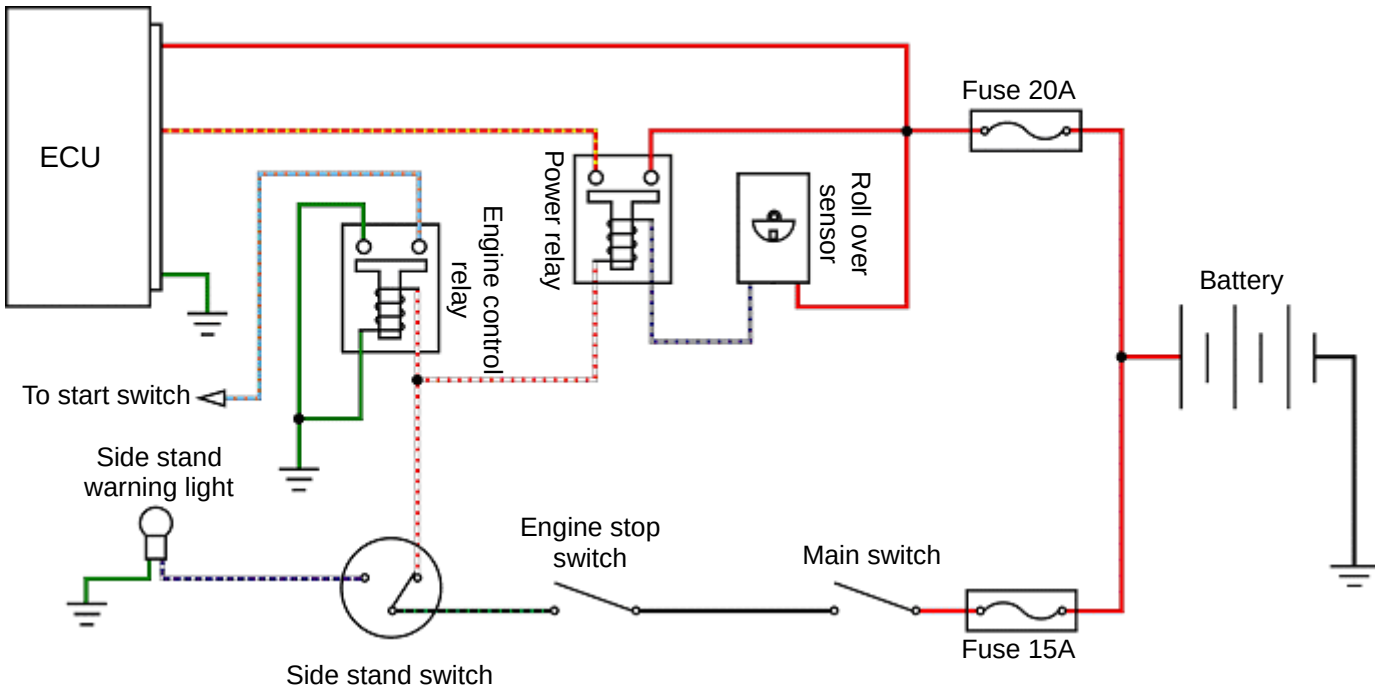
Function

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

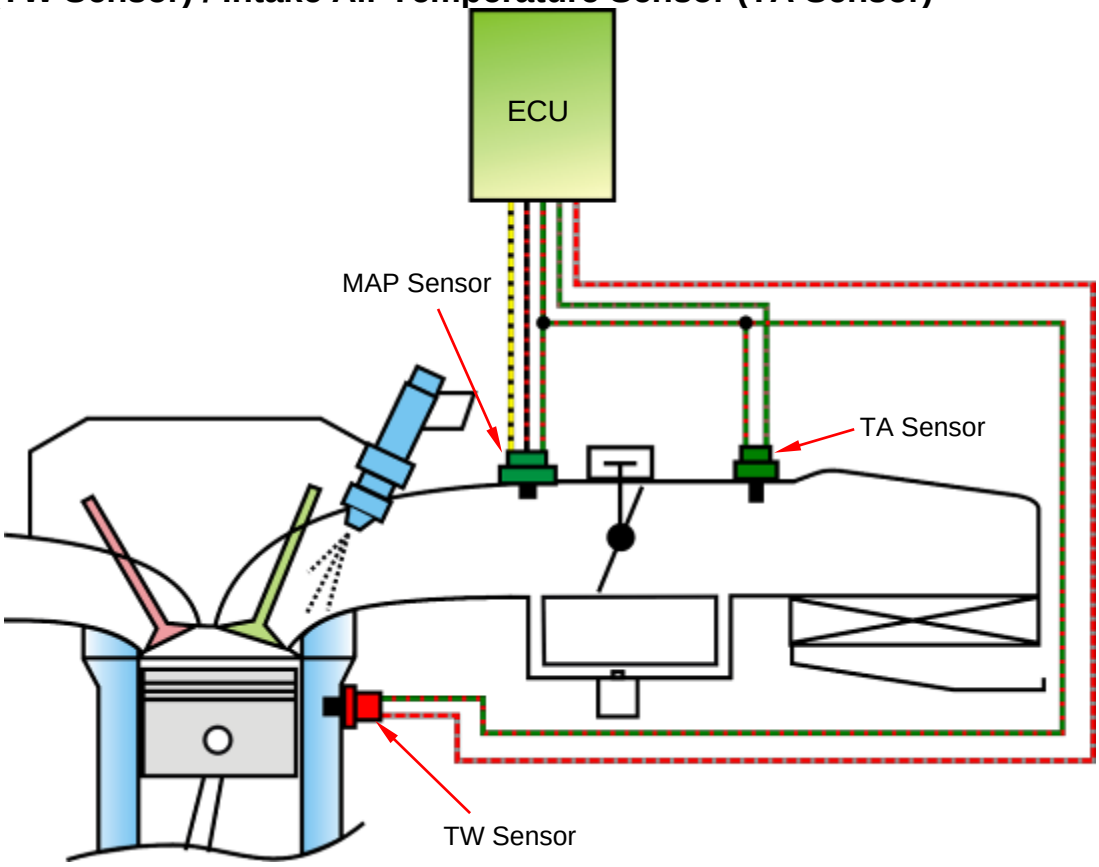
Note

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.



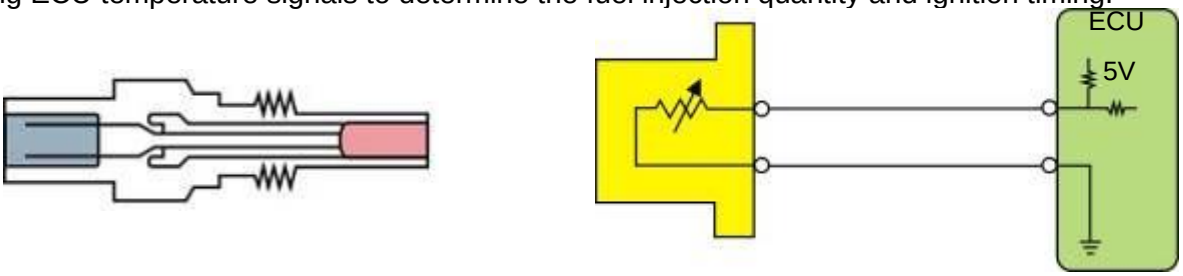


Manifold Absolute Pressure Sensor (MAP Sensor) / Engine Coolant Temperature Sensor (TW Sensor) / Intake Air Temperature Sensor (TA Sensor)



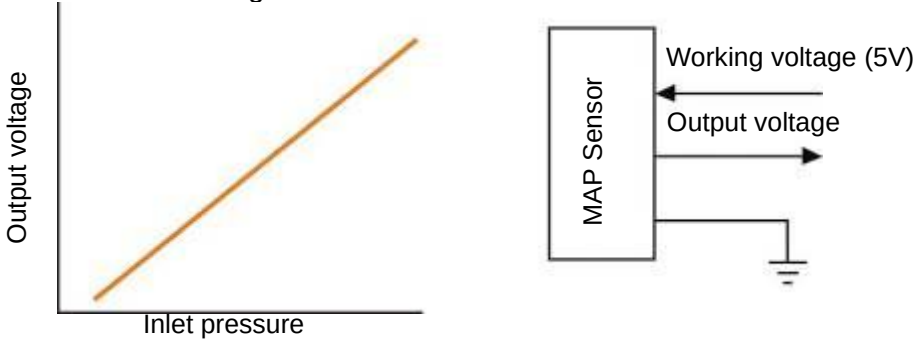
TW Sensor / TA Sensor:

Using negative temperature coefficient thermistor, TW Sensor and TA Sensor measure outside temperature. As heat goes up, resistance goes down; resistance goes up as temperature goes down, providing ECU temperature signals to determine the fuel injection quantity and ignition timing.

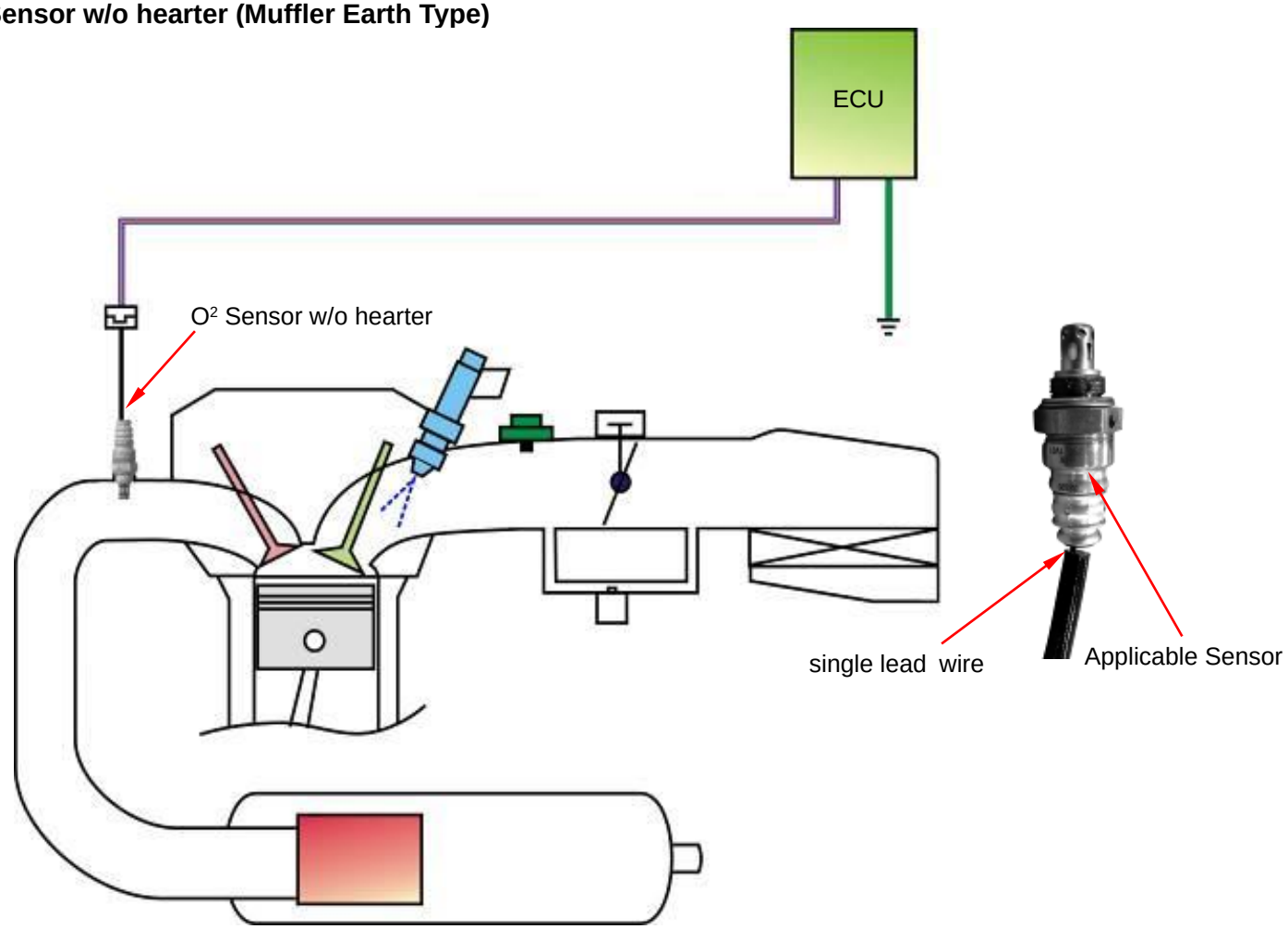


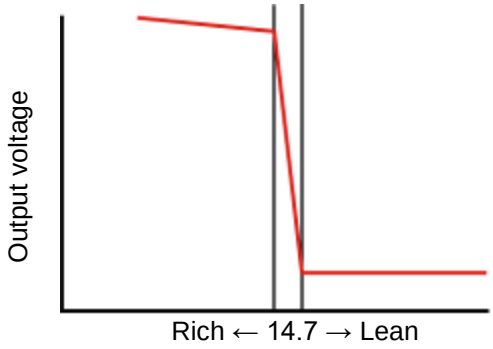
MAP Sensor:

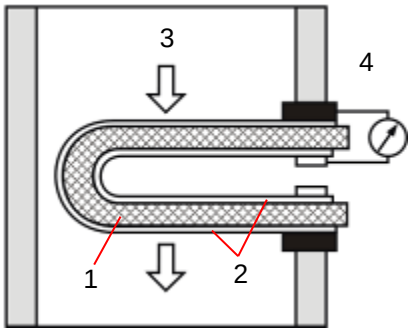
MAP Sensor uses the piezoresistive resistor composed of silicon diaphragm, forming the Wheatstone bridge circuit to measure the atmospheric pressure and the intake manifold pressure, which are both transmitted to ECU for reference of engine control.



O^2 Sensor w/o hearter (Muffler Earth Type)







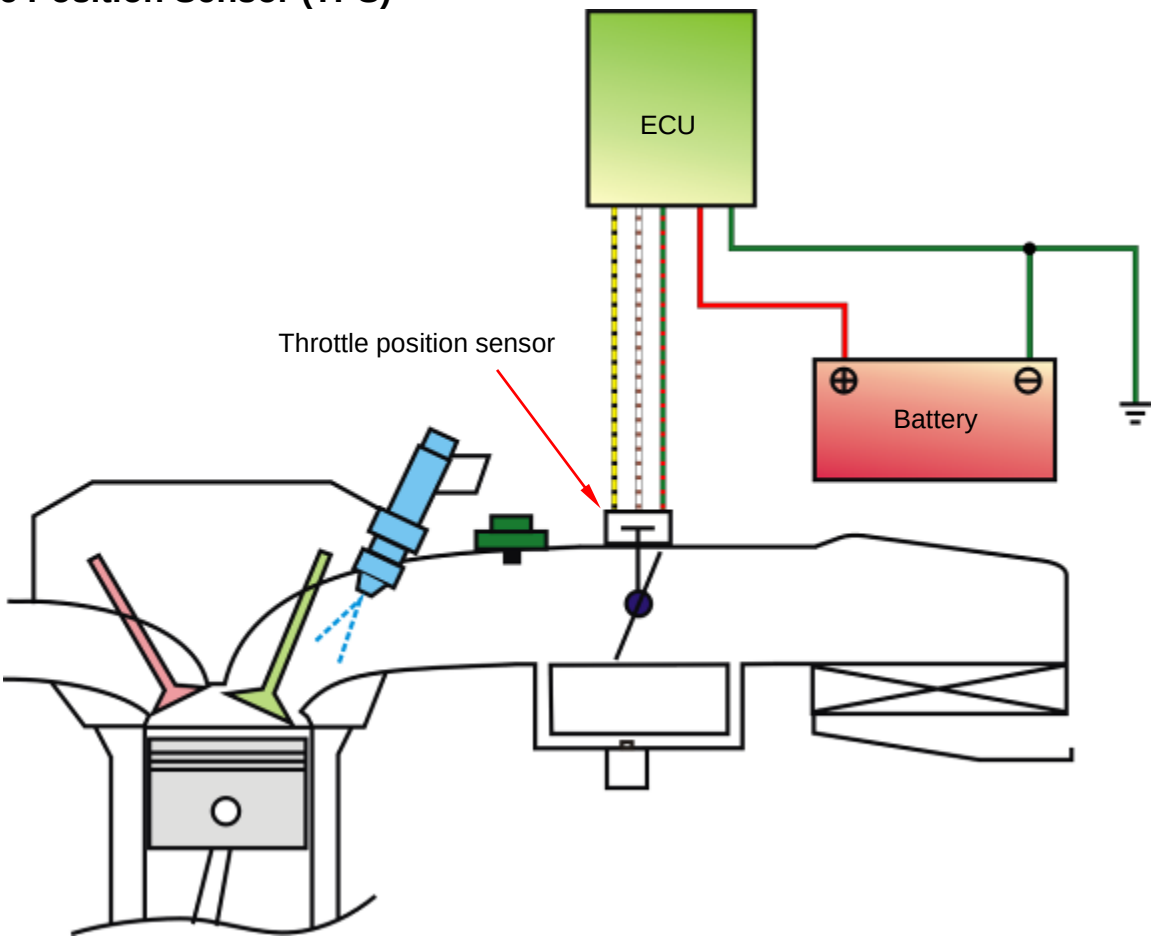
1. Ceramic tube
2. Electrode
3. Exhaust gas
4. Atmosphere

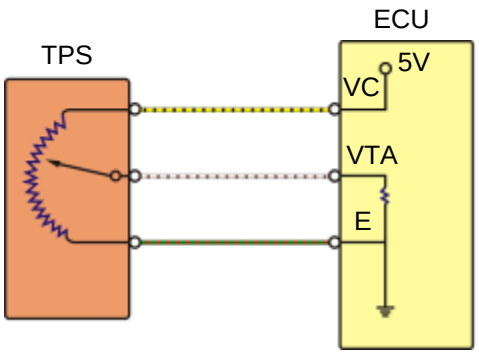
Function:

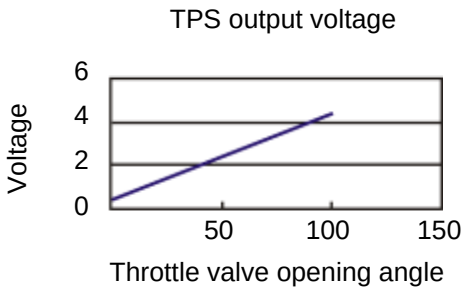
O_2 Sensor measures the proportion of oxygen in the exhaust gas, sending signals to ECU which adjusts the air-fuel ratio by changing the fuel injection time. If the proportion of oxygen is too low, it means the rich air-fuel mixture with higher HC & CO concentration in the exhaust gas. If the proportion of oxygen is too high, it means the lean air-fuel mixture with higher temperature and higher NOx concentration.

1. O_2 Sensor outputs feedback signal to ECU which keeps the air-fuel mixture near the stoichometric ratio approximately 14.7 and forms the closed loop control system.
2. When the air-fuel mixture is near the stoichometic ratio, CO / HC / NOx are converted most efficiently.
3. O_2 Sensor produces a rapidly fluctuating output voltage between approxiamately :100 ~ 900 mV

Throttle Position Sensor (TPS)



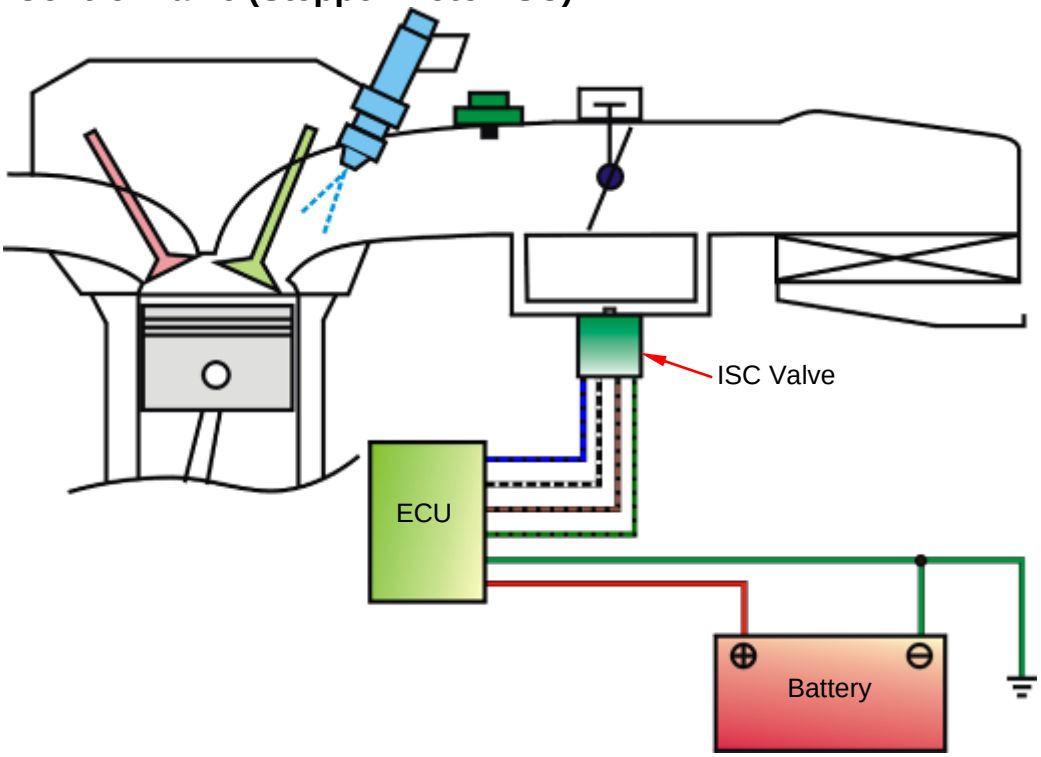


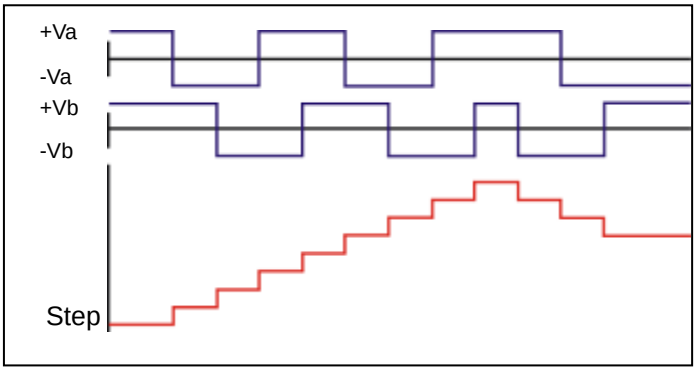


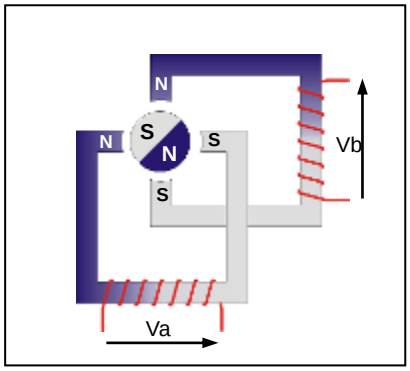
Basic Principle:
TPS is a rotary variable electric resistor. When it is rotated, both electric resistance and voltage value change, determining the throttle position.

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

Idle Speed Control Valve (Stepper Motor ISC)







Function:

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

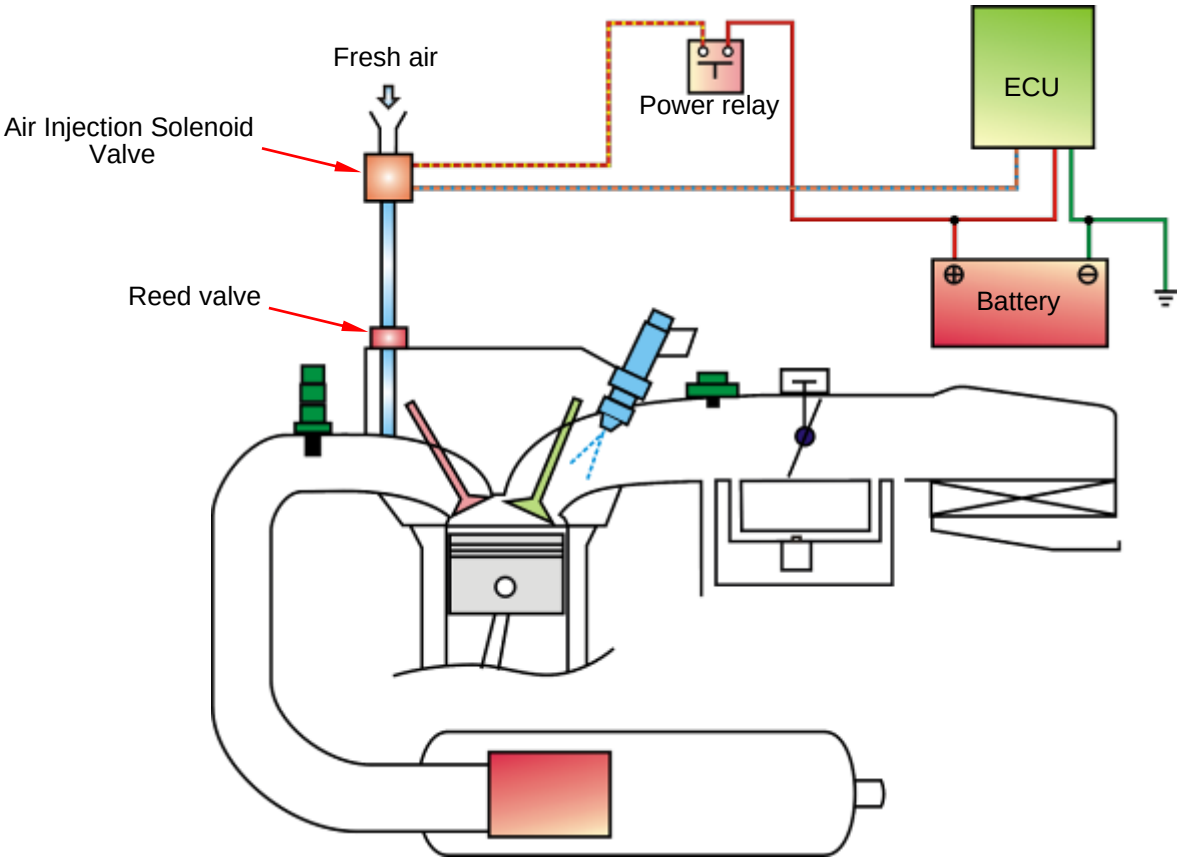
Air Injection Solenoid Valve (AISV)

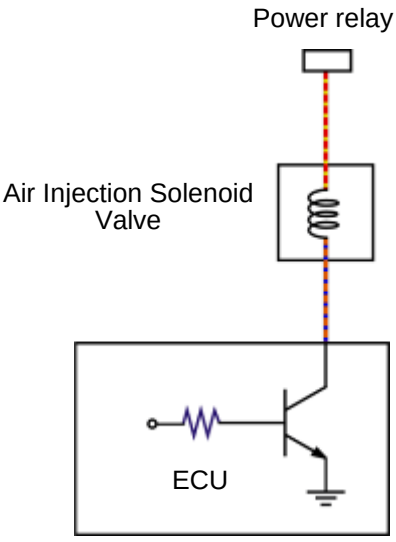
Function:

AISV introduces appropriate air quantity to reduce pollutant emission.

Basic Principle:

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





Precautions in Operation

General Information

⚠ Warning

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

⚠ Cautions

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

Specification

Item	Specifications
Idle Speed	1550±100 rpm
Throttle free play	5~10°
Fuel pressure	294±6kpa (about 3.0kg/cm²)

Torque value

TW Sensor: 1.0~1.4 kgf-m
O_2 Sensor: 2.0~3.0 kgf-m

Special Tools

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

Fuel Injection System Components Description

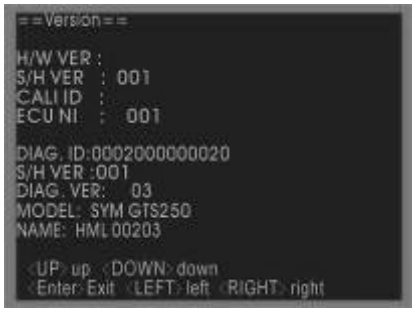
ECU (Engine Control Unit)

Function Description:

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

Testing Procedures:

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



Detection Judgement:

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

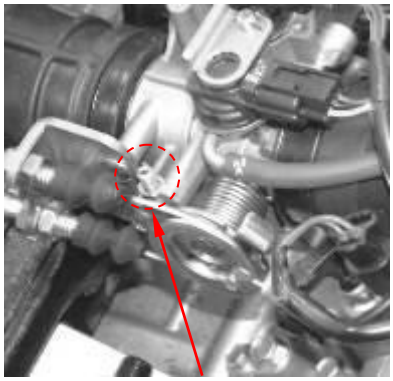
Treatment of abnormal phenomena:

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

Throttle Body

Functional Description:

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

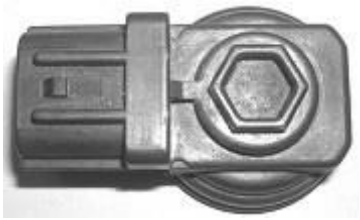


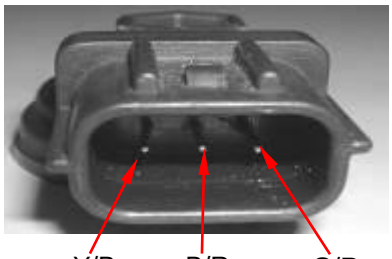
Throttle valve positioning screw

Treatment of abnormal phenomena:

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

MAP Sensor





Working voltage measurement

Output voltage measurement plains

Functional Description:

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

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

Testing Procedures:

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

⚠ 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±0.1V
- Plains output voltage values: 2.87±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.

TA Sensor

Functional Description:

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

Testing Procedures:

Resistance Value Measurement:

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

Resistance value measurement

Detection judge:

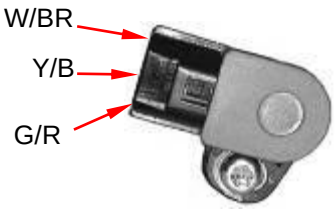
Resistance value and the temperature between relationships as follows

Temperature (℃)	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



Working voltage measurement

Throttle output signal measurement - full closed

Throttle output signal measurement - full

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

Testing Procedures:

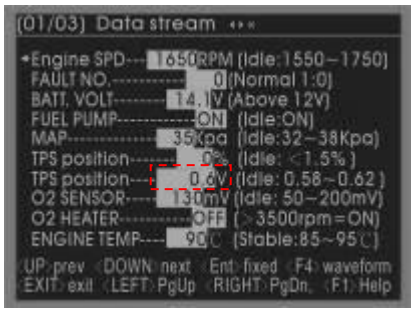
1. Sensor connector to properly (using the probe tool), or can be removed connector to voltage measurements (direct measurement).
2. Opened the main switch, but not to start engine.
3. Use "volteg meter" DC stalls (DCV) to check sensor voltage.
4. Confirmed working voltage:
   - Volteg meter negative 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±0.1V
- Full throttle voltage value: 0.6±0.02V
- Full throttle closed voltage value: 3.77±0.1V



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 (Engine Coolant Temperature 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.

Resistivity measurements

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

Treatment of abnormal phenomena:

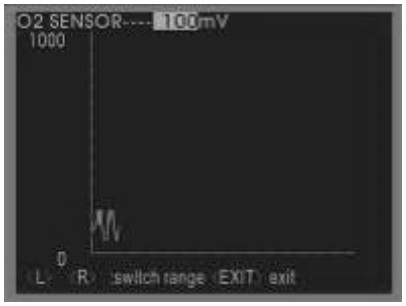
- Temperature sensor damage or couplers to poor contact.
- Check whether the abnormal wire harness lines.
- Temperature sensor anomaly, the proposed replacement of the temperature sensor.

O_2 Sensor w/o heater

Applicable Oxygen Sensor

Functional Description:

- This body-groud type sensor is tightened on the muffler mounting boss at the specified torque 25±5N· m, with single lead wire carries the sensor signal 0.1~0.9 volts to the ECU while ground return is achieved through the vehicle body.
- O2 sensor produces feedback signal to the ECU which keeps the air/fuel mixture ratio control in the vicinity of 14.5 ~ 14.7 to minimize emissions, which is referred to as fuel "closed loop" control. When the air/fuel mixture ratio control in the near equivalent, CO / HC / NOx to have the highest conversion efficiency.
- The sensor parts of element must be hot above 350 degree C or higher in this feedback area before it will start to generate a voltage signal.

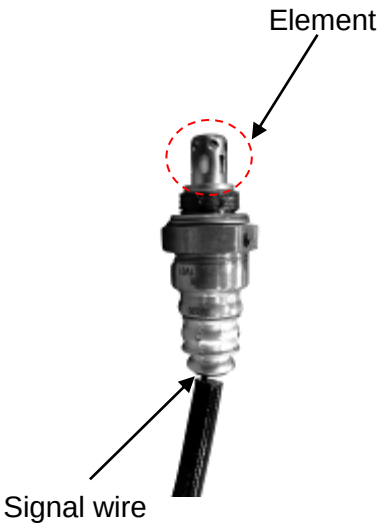


Voltage Output Wavy Line Display

Testing Procedures:

Sensor diagnosis:

- Use the "diagnosis tool" to read the oxygen sensor's voltage output .
- Connect the "diagnosis tool" to OBDl diagnosis coupler and open the main switch to start the engine.
- The sensor must be hot in order to meet the temperature requirements (idling "5 minutes" at least).
- Screen will switch to the "diagnosis tool" of "DATA STREAM 01/01" screen, select " O2 Sensor" project, next switches to a wave of images.
- Speed up the engine up to 4500 rpm, and watch the " O2 Sensor" voltage output waveform constant flip-flopping back and forth with different speeds.



Detection judge:

- A good O2 sensor should produce an oscillating waveform at idle that makes voltage transitions from near 100 mV to near 900 mV, it means the sensor is doing its job on closed-loop control system.
- If it sees little or no change in level readings, it may set a trouble code and illuminate the EFi Check lamp.

Trouble Codes and Description

Component Inspection	Description	Trouble Code
O2 sensor	Too low input voltage	P0131
	Too high input voltage or open	P0130

Treatment of sensor abnormality:

- When no signal is received from the O2 sensor, check if circuit opens, shorts or goes out of range.
- Any O2 sensor that is defective obviously needs to be replaced. And then again use the "diagnosis tool" to extinguish the EFi Check lamp and erase the trouble code.

Roll over sensor

Functional Description:

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

Testing Procedures:

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

Detection judge:

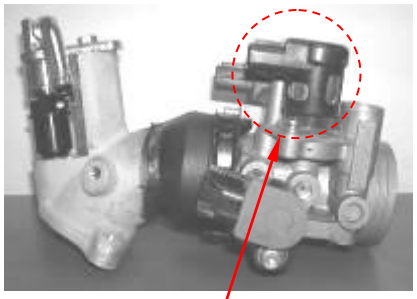
Voltage: Normal : 0.4~1.4V
Rollover : 3.7~4.4V

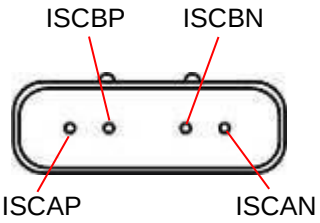
Treatment of abnormal phenomena:

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

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

ISC Valve (stepper motor)：





ISC PINS

A phase measurement of the resistance value

B phase measurement of the resistance value

Functional Description:

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

Testing Procedures 1:

Resistance Confirmation:

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

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

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

⚠ Cautions

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

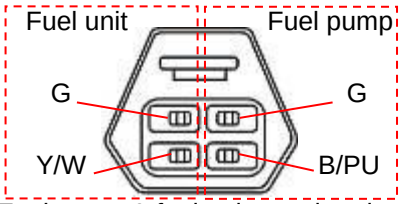
Detection judge:

1. Resistance value:
   A phase: 80 ± 10Ω (Environmental conditions: 15 ~ 25 ℃)
   B phase: 80 ± 10Ω (Environmental conditions: 15 ~ 25 ℃)
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.

Fuel Pump



Fuel pump & fuel unit coupler plan

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±6kpa (about 3 kg / cm^2).
- The fuel pump is located inside of the fuel tank, and installed a filter in front of its inlet so that can prevent from foreign materials sucking into the fuel pump to damage it and the fuel injector.

Testing Procedures 1:

Fuel pump working voltage confirmed:

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

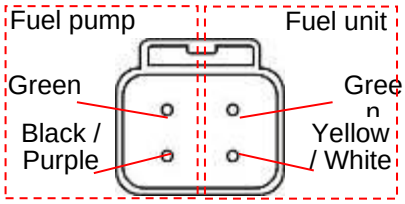
Confirmed working voltage

⚠ 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±0.5Ω
3. Fuel pressure: 294±6kPa (about 3kg/cm^2)



Harness-face coupler plan

Testing Procedures 2:

Resistance Confirmation:

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

Resistance Confirmation

Detection judge 2:

- Fuel unit resistance value: 95~117Ω

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±6kPa (about 3kg/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

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 (Ω), 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±0.6Ω
2. injection state:
   - Fuel atomizing good, with a clear scattering angle → judged as normal.
   - Injection-state such as water, no obvious scattering angle → found abnormal.

Injection-state atomizing good

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→the proposed replacement of the new one injector.
   - Fuel pressure shortage → confirmed hydraulic pressure, the proposed replacement fuel pump to confirm.

Injection-state unusual

⚠ Warning

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

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_2 Sensor, issued by the signal, with the engine Speed through the ECU to determine the appropriate ignition is, by the current of a crystal intermittent control, a 25000-30000 volts of secondary hypertension, flashover triggered spark plug, this approach will not only enable the engine to achieve maximum output function, also help to improve the efficiency of fuel consumption and pollution improvements.

Testing Procedures:

Resistance Confirmation:

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

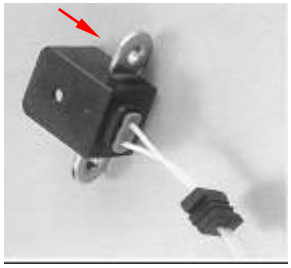
Detection judge:

- Ignition coil primary circuit: 2.8±15% Ω(20ºC)

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



Measurement resistance value

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 (Ω), measurement of the crankshaft position sensor resistance value.

Detection judge:

- Resistance value: 100~140Ω(20ºC)

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.

AISV

Functional Description:

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

Testing Procedures:

Resistance Confirmation:

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

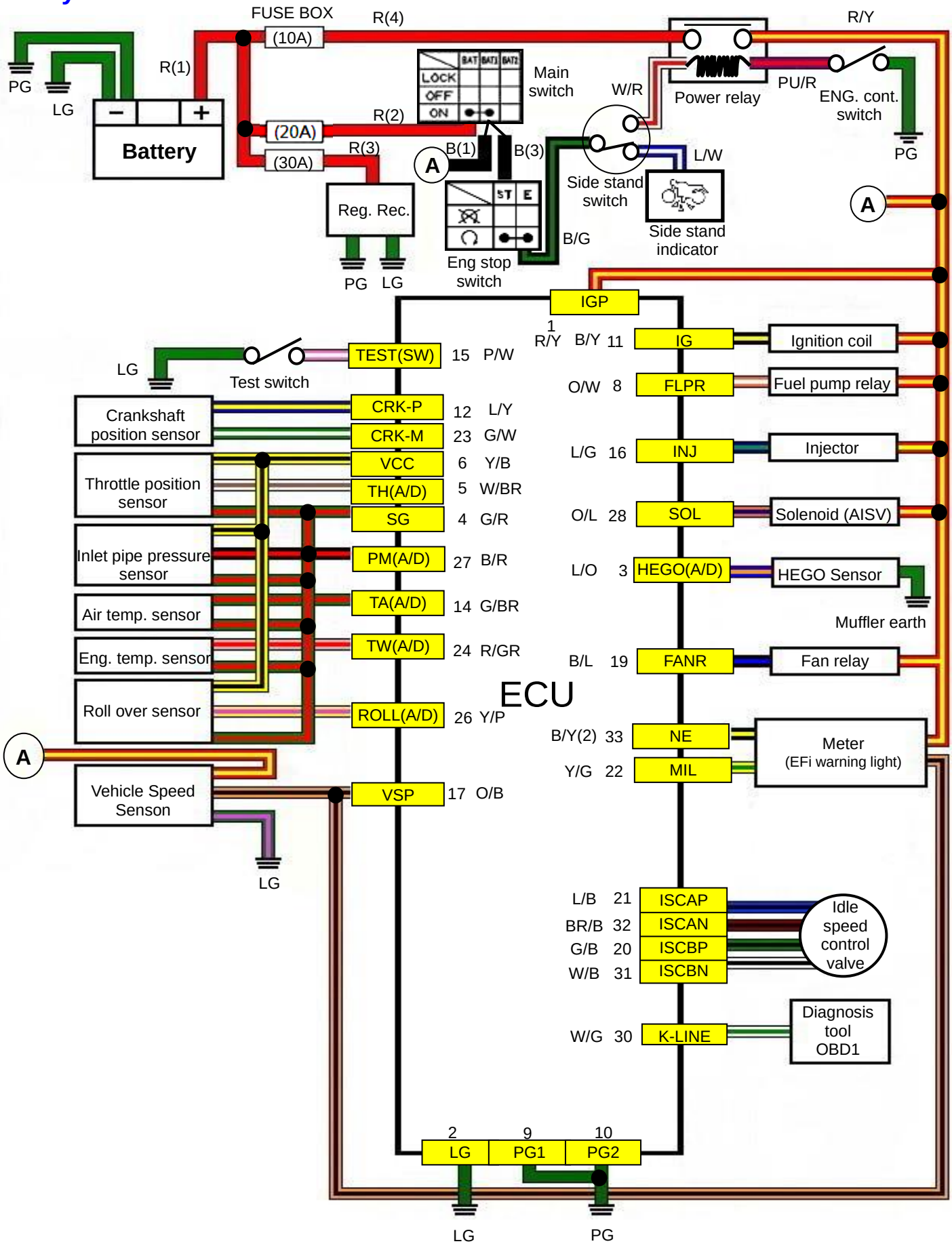
Detection judge:

Resistance value = 22Ω ± 2Ω(20~30℃)

Treatment of abnormal phenomena:

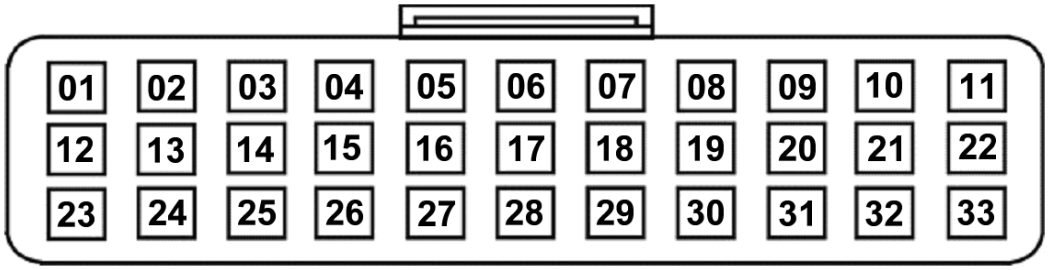
- Secondary air injection solenoid valve internal short circuit or open circuit, or coupler bad contact.
- Check whether the abnormal wire harness lines.
- Secondary air injection solenoid valve anomaly, the proposed replacement of the new one.

EFi System Circuit



ECU Pin Configuration

(ON ECU)

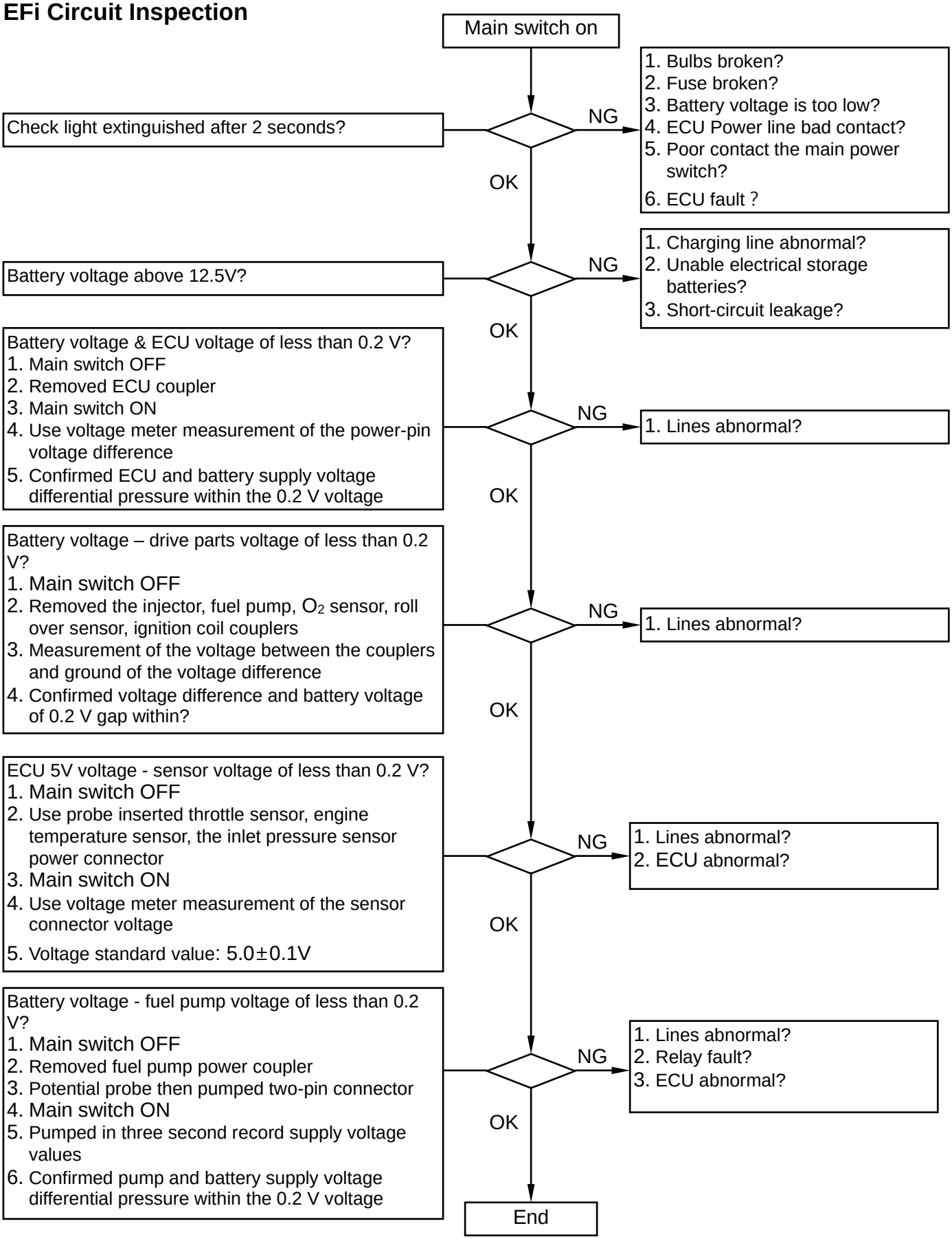


ECU Pin Note

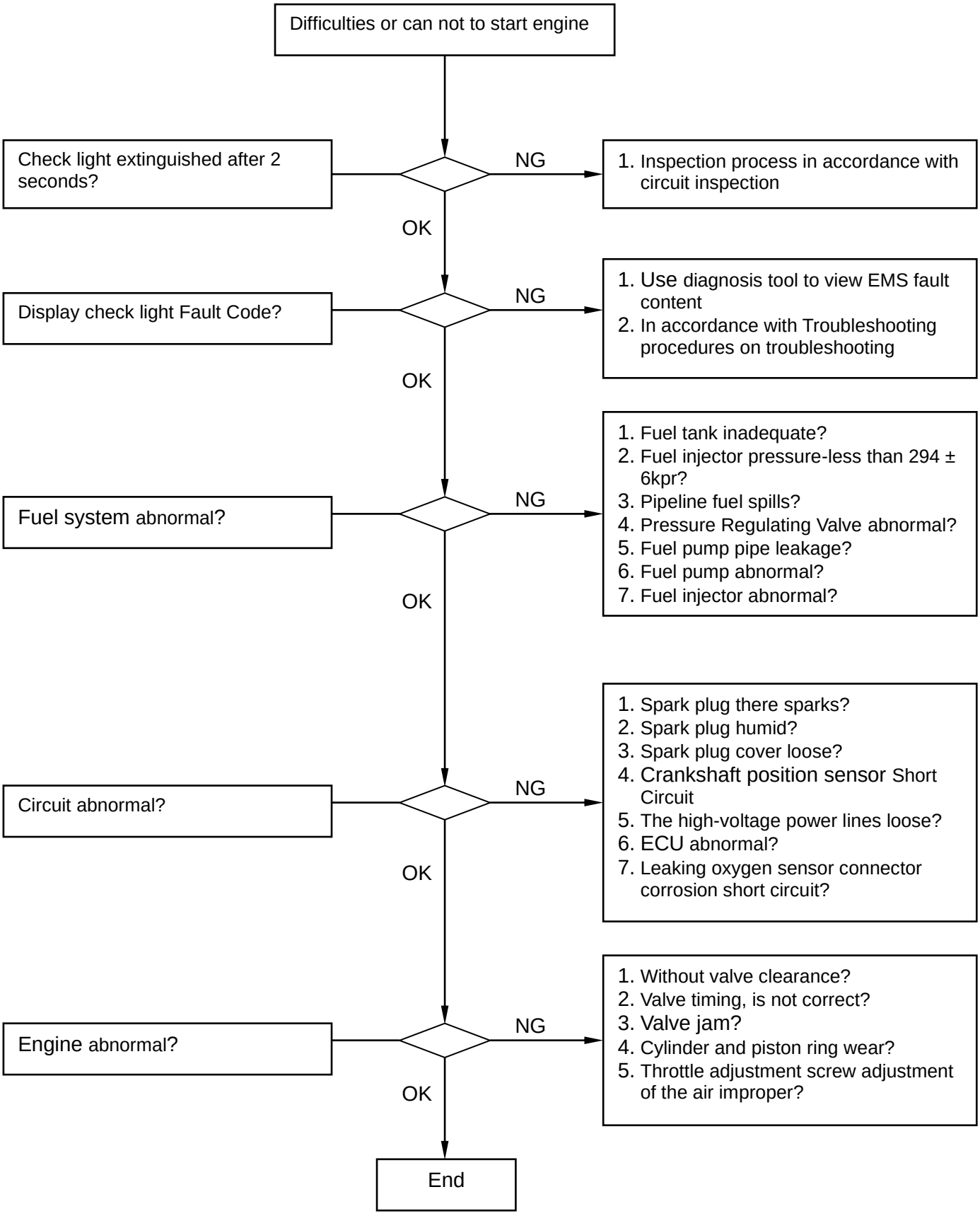
Pin NO.	Pin code	Wire color	Note
1	IGP	R/Y	Ignition Power
2	LG	G(4)	Logic Ground
3	HEGO	L/O	Hego Sensor
4	SG	G/R	Sensor ground
5	TH	W/BR	TPS signal
6	VCC	Y/B	Sensor Power Output (+5V)
7	N/A	N/A	N/A
8	FLR	O/W	Fuel Pump Relay
9	PG1	G(4)	Power Ground 1
10	PG2	G(4)	Power Ground 2
11	IG	B/Y(1)	Ignition Coil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

Fault Diagnosis

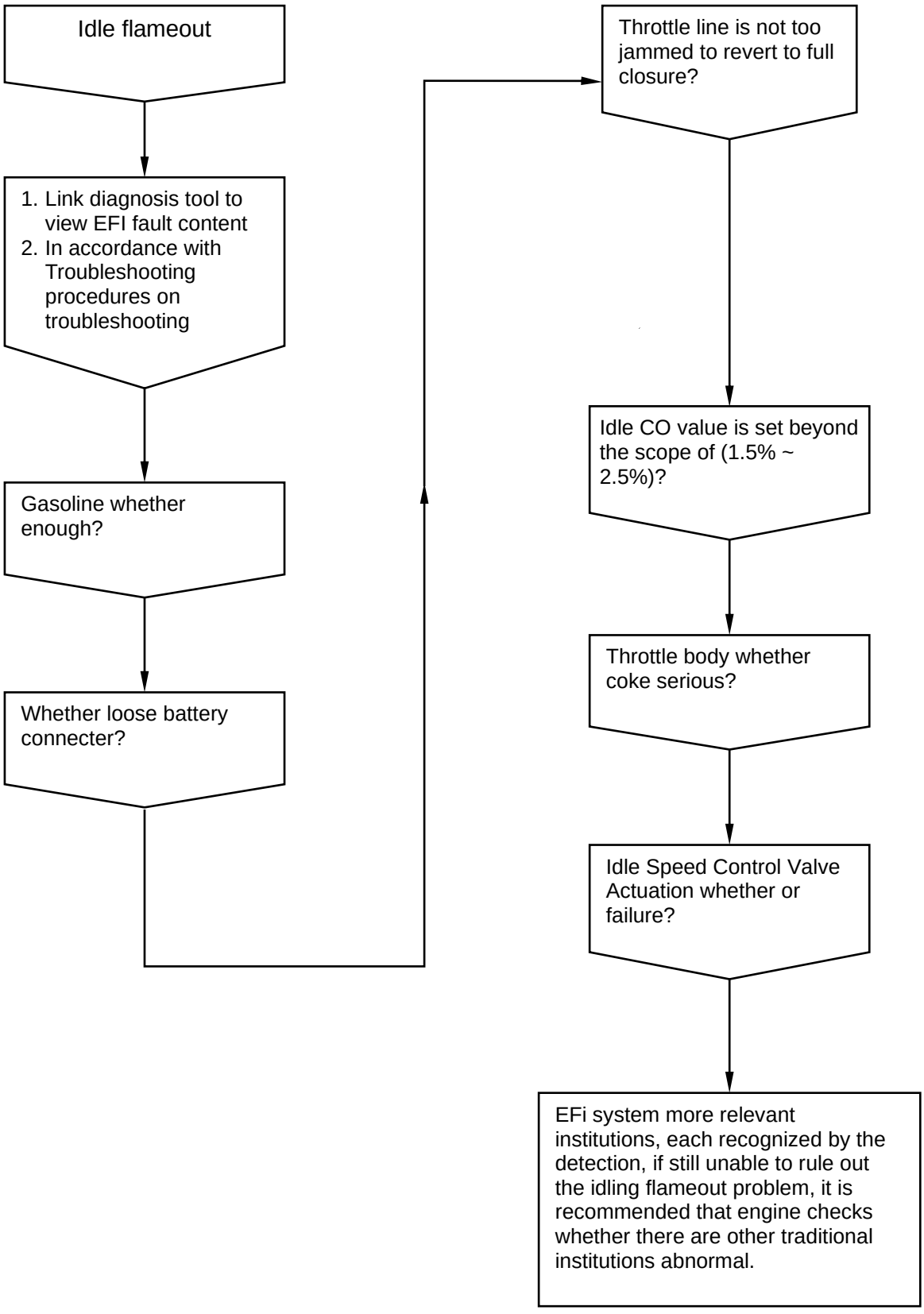
EFi Circuit Inspection



Can not Start the engine or difficult to start inspection

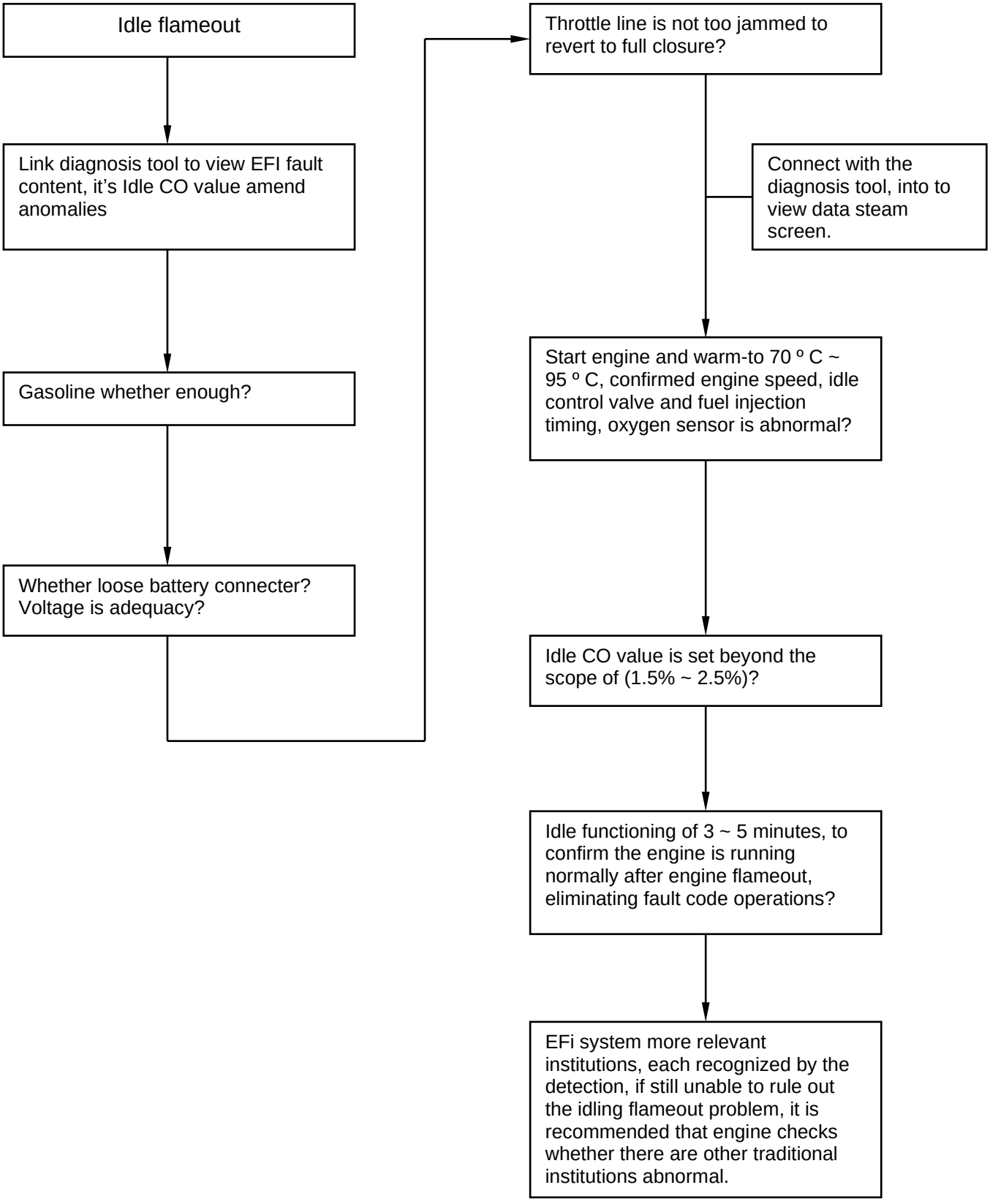


Idle flameout diagnosis



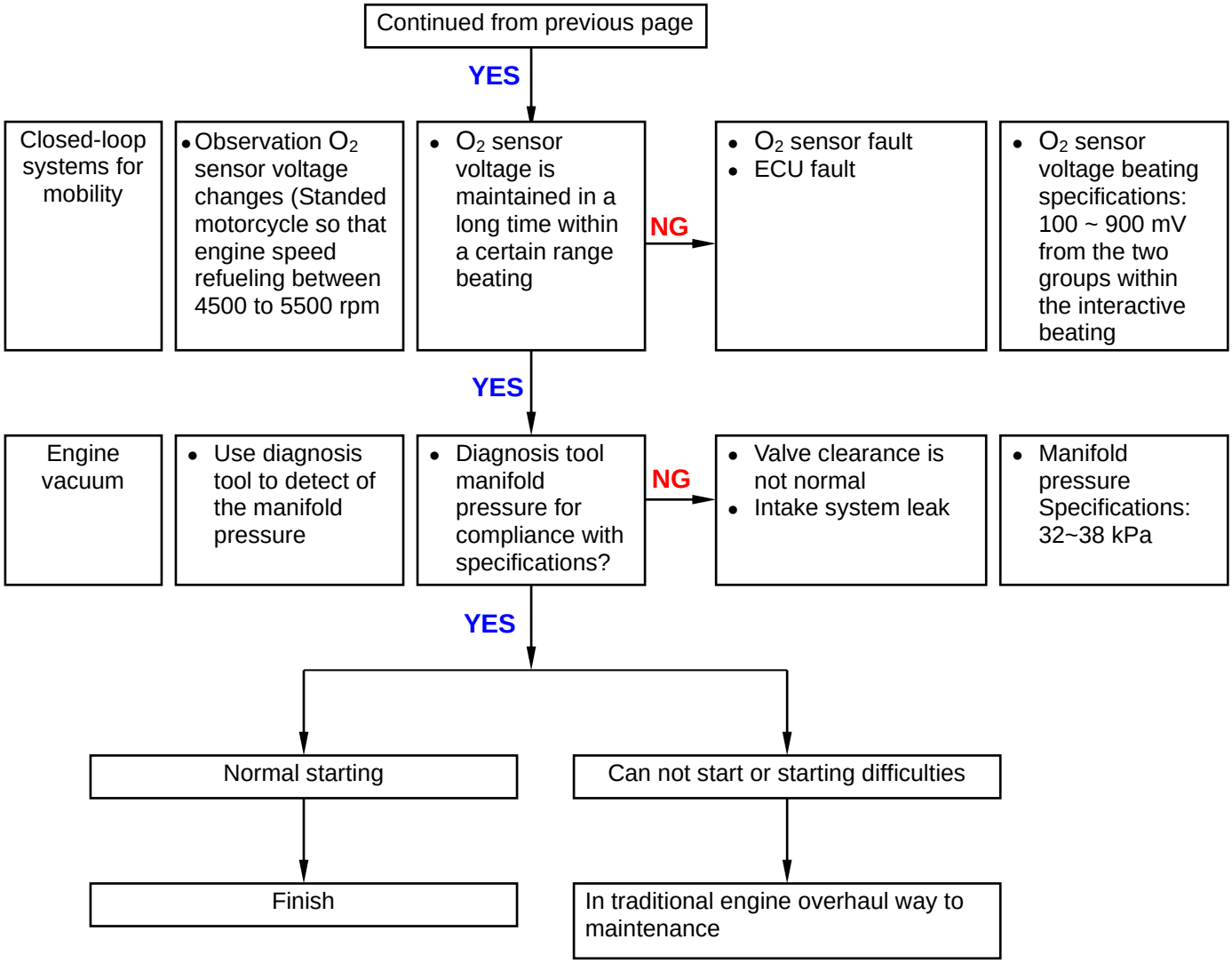
CO value abnormal

O_2 Sensor equipped with the system, in principle, not adjusted CO value, such as CO value deviated from the normal range, check O_2 Sensor and other agencies.



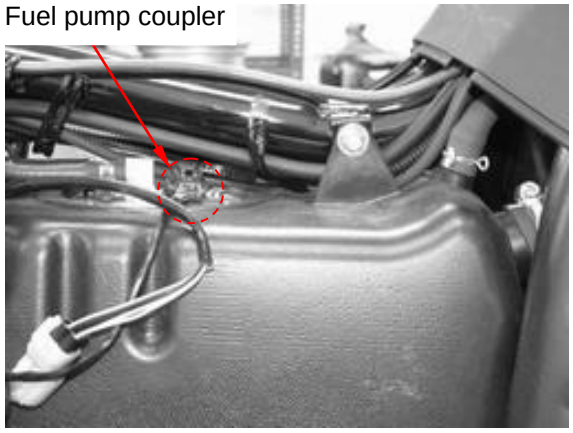
Integrated Failure Diagnosis Program

Checking, adjusting Project	Detection of maintenance projects and steps	Fault status determination		Fault reasons	Parts specifications
Battery voltage	• Use meter direct measurement battery voltage • Use diagnosis tool detection battery voltage	• Battery voltage is 10 V above? • Diagnosis tool show whether the voltage of 10 V above?	NO	• Battery electricity • Battery connector loose • Harness circuit opening • ECU coupler not connected properly	• Diagnosis tool display voltage required to achieve more than 10 V
		YES			
Diagnosis fault code inspection	• Use of the diagnosis tool detection fault code • Elimination of fault codes, and then start engine	• Diagnostic tool show whether or not a fault code? • Fault Code cleared after show again?	YES	• TPS fault • ETS fault • CPS fault • MAP fault • O_2 sensor fault • ROS fault • ECU fault	• The sensor detection methods and specifications, please refer to repair manual
		NO			
Fuel quantity and fuel pressure	• Removed the injector on the intake manifold, but not removal of harness coupler. (Injector and injector cap tightly by hands, fuel spills should not be the case) • Start the engine • Examine whether injector fuel injection • Between the tank and injector installation the pressure gauge • check fuel pressure adequacy	• Injector whether injection? • Injector spray angle is normal? • Fuel pressure enough?	NO	• less than fuel tank • Injector fault • Fuel pump relay fault • Fuel pump fault • ECU fault • Fuel pump filter obstructive	• Pressure fuel specifications: Open the main switch three seconds after but not start engine →more than 250 kPa Idle → 294±6kPa • Injector resistance specifications: 11.7±0.6Ω
		YES			
Ignition situation	• Removed the spark plug from the cylinder head, but then power lines still ring • Start the engine • check spark plug sparks	• Examine whether the spark plug ignition? • Check spark plug sparks strength is normal?	NO	• Spark plug fault • Roll over sensor fault • ECU fault • Ignition coil fault • Crankshaft position sensor fault	• Spark plug specifications: NGK-CR8E
		YES			
		Continued next page			

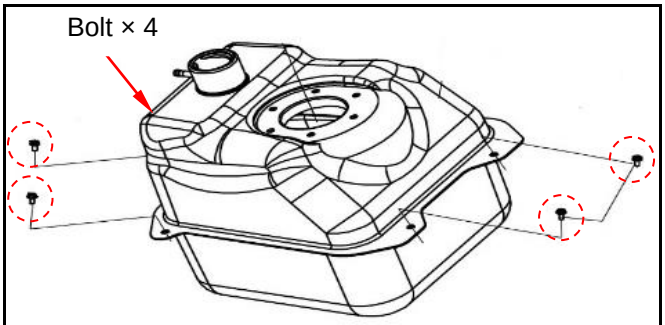

Continued from previous page
YES
Closed-loop systems for mobility
• Observation O_2 sensor voltage changes (Standed motorcycle so that engine speed refueling between 4500 to 5500 rpm
• O_2 sensor voltage is maintained in a long time within a certain range beating
NG
• O_2 sensor fault
• ECU fault
• O_2 sensor voltage beating specifications: 100 ~ 900 mV from the two groups within the interactive beating
YES
Engine vacuum
• Use diagnosis tool to detect of the manifold pressure
• Diagnosis tool manifold pressure for compliance with specifications?
NG
• Valve clearance is not normal
• Intake system leak
• Manifold pressure Specifications: 32~38 kPa
YES
Normal starting
Can not start or starting difficulties
Finish
In traditional engine overhaul way to maintenance

Remove side cover.
Remove rear carrier
Remove rear bodycover.
Remove floor panel.
Remove under cover.
Remove fuel pump/fuel unit
(refer to chapter 12)

Remove fuel pump lines coupler.
Release the fuel tube folder, removed the fuel tube.



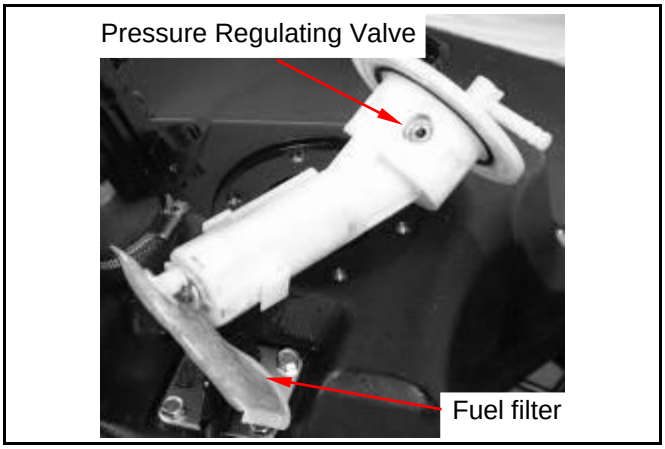
Remove the fuel tank fixed bolts (Bolt × 4), remove the fuel tank.



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/cm2).

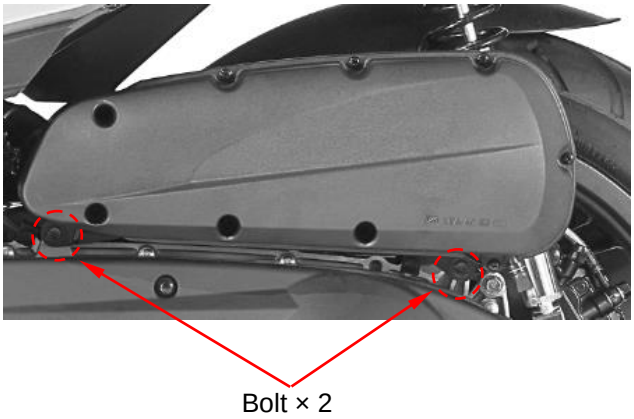


Air Cleaner

Remove

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

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

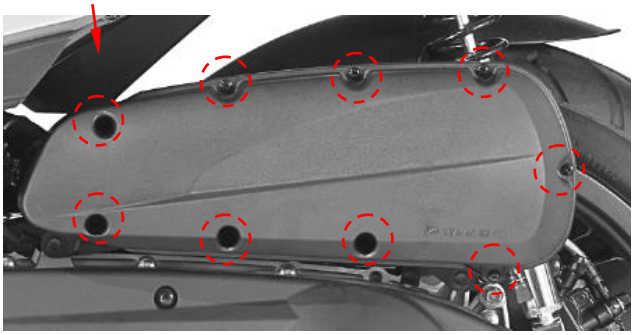


Install

Install In the anti-demolition order.

Clean air cleaner

Remove air cleaner cover (bolt×9).
Remove air cleaner filter.
Use compressed air to remove the adhesion of dirt, if not too much dirt cleared, please new replacement.



⚠ Cautions

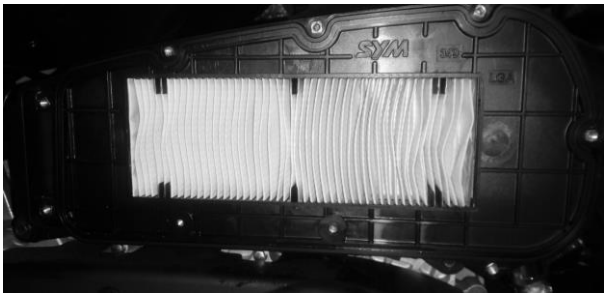
- Air cleaner filter for paper products, must not soak or cleaning by water.

Install air cleaner

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.



Fault Diagnosis Note

When the motorcycle injection system show the failure code, 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.

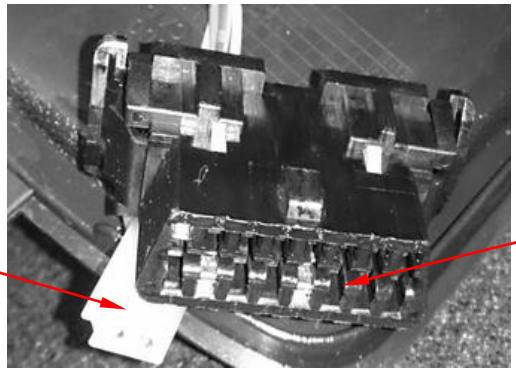
Inspection by Diagnostic Scanner

Connect the diagnostic scanner to the motorcycle, proceed the inspection 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



Trouble Code(s) and Sensor(s) Table

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

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

EFI Diagnostic Scanner - 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.

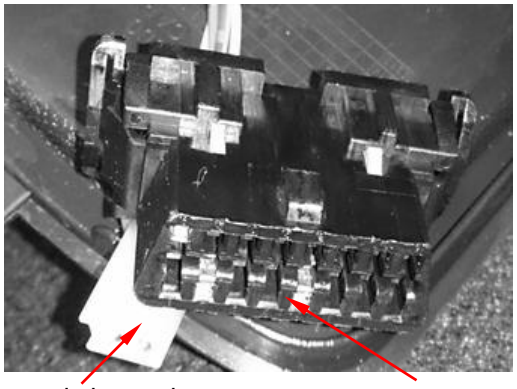
Method of Use:

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" buttom to leave of the various functions.
7. Must to close the main switch or power switch of the diagnosis tool after, and then can removal of diagnosis tool coupler.

Diagnostic Scanner Use Note

Diagnosis of connectivity

1. For the diagnosis 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" buttom to the implementation.

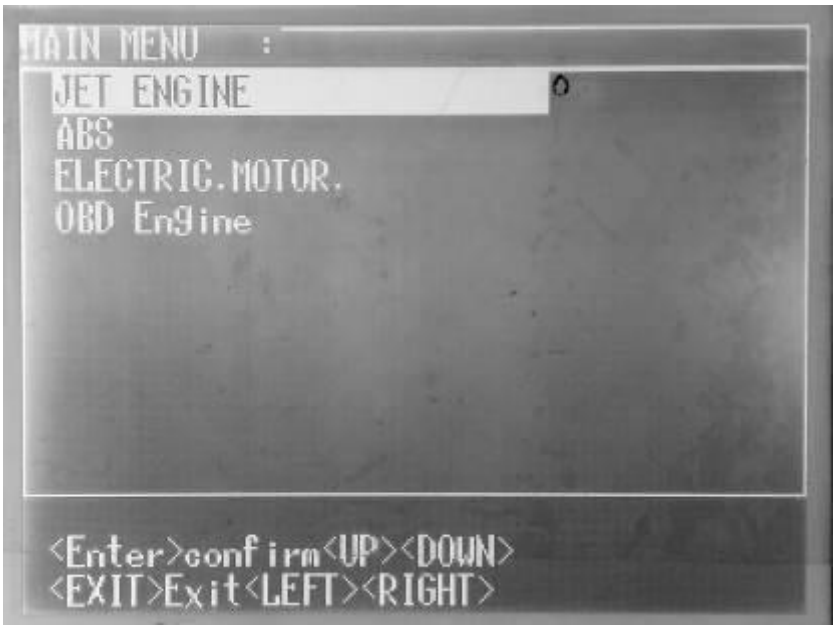


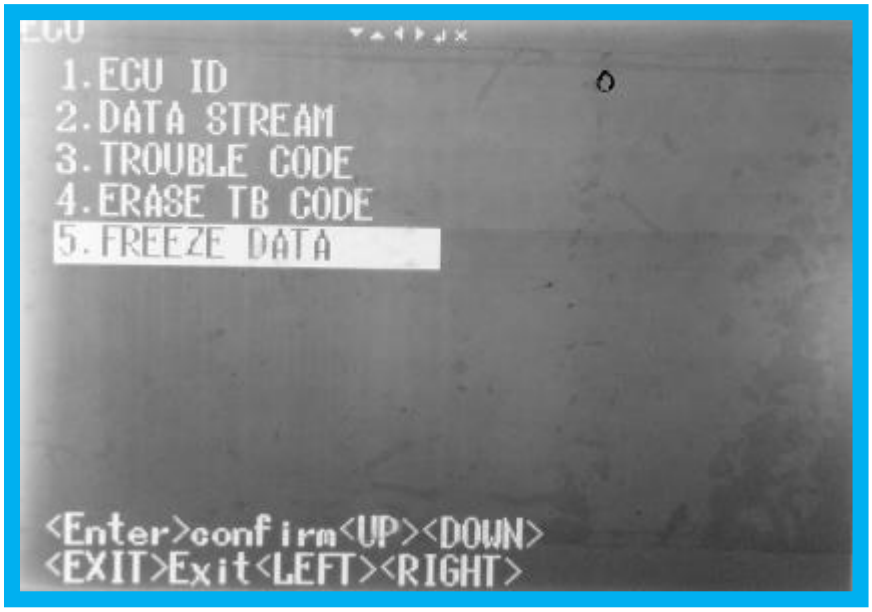
Test switch coupler　　Diagnostic coupler (OBD I)

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.





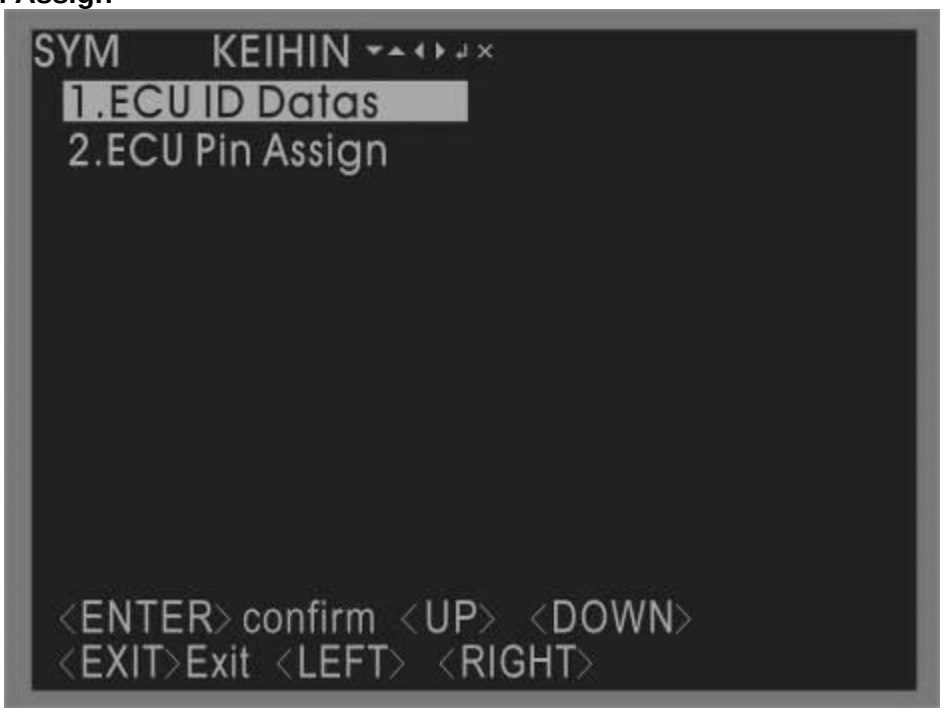
1. ECU ID

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

ECU ID containing two functions:

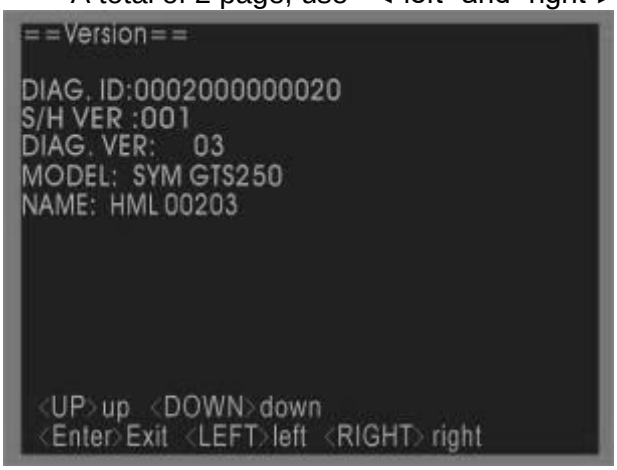
1-1. ECU ID Datas

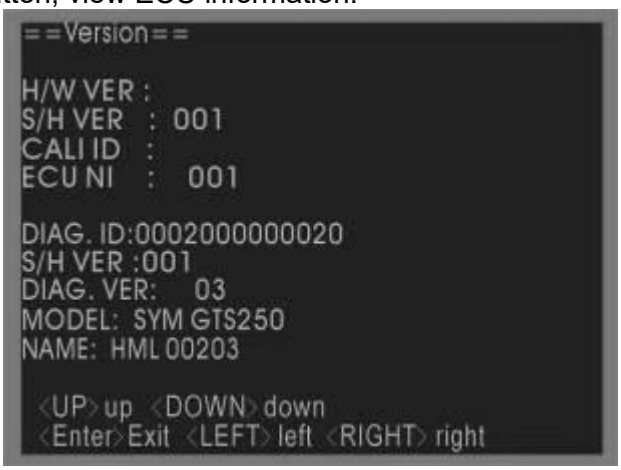
1-2. ECU Pin Assign



1-1. ECU ID Datas

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





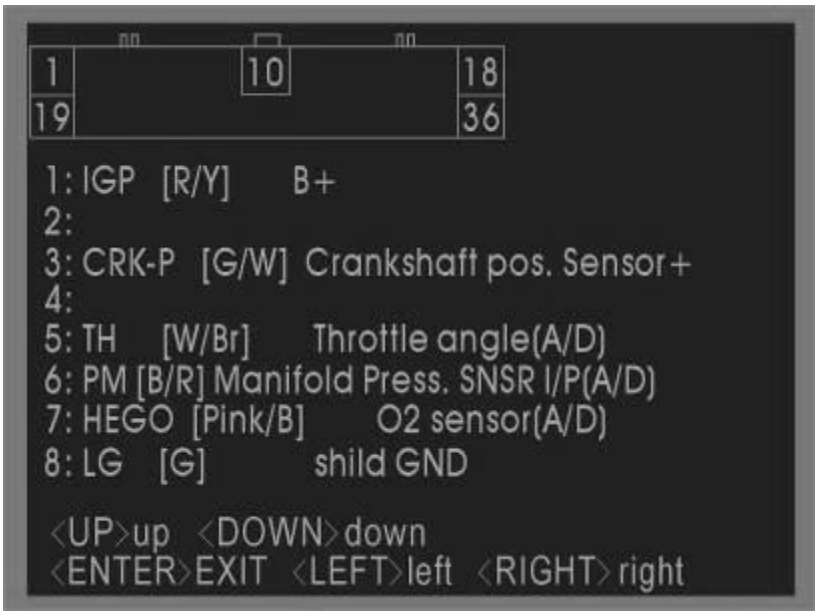
DIAG. ID: 0002000000020 (Diagnosis tool ID)
S/H VER: 001 (Software Version)
DIAG. VER: 03 (Diagnosis Version)
MODEL: SYM GTS250
NAME: HML 00203

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" buttom 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] shild 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] 2nd 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

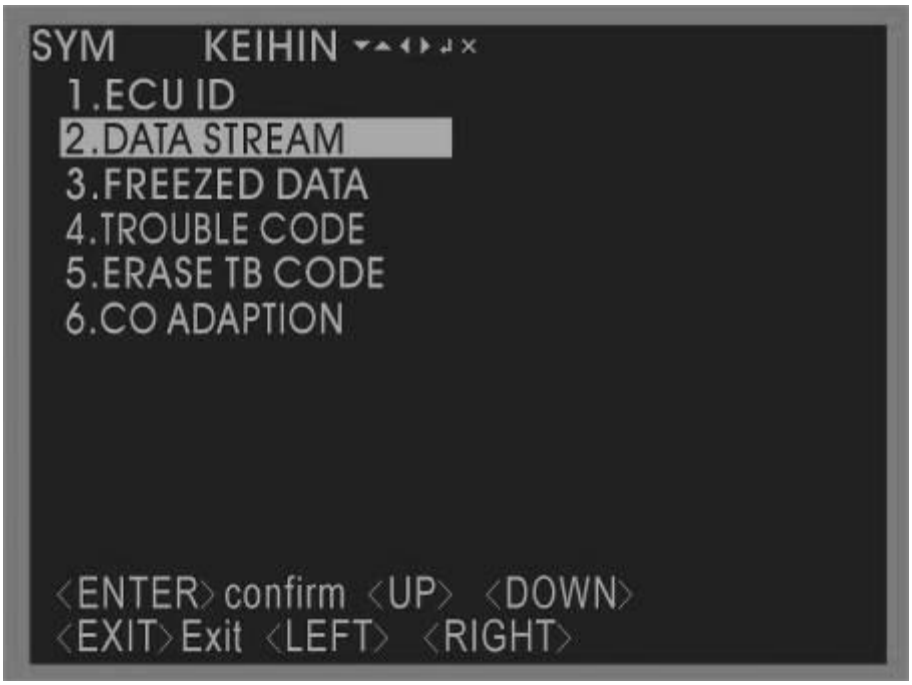
Page 3:
17: HEGOHT [R/O] O2 Sensor heater
18: IG [B/Y] Ignition O/P
19: BAT [R] Battery B+ (RV250)
20: TRIG [Pink] Test sw
21: MIL [Y/G] MIL O/P
22: TE [R/Gr] Eng. Temp. Sensor (A/D)
23:
24: SG [G/R] Sensor (A/D) GND

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)

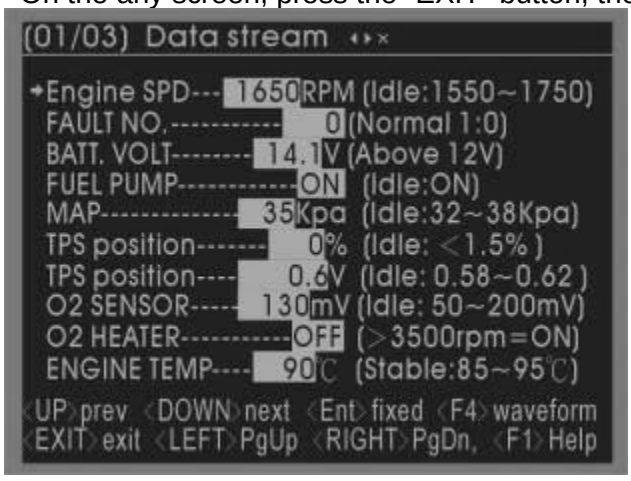
Page 5:
33:
34:
35: PG1 [G] System GND
36: PG [G] System GND

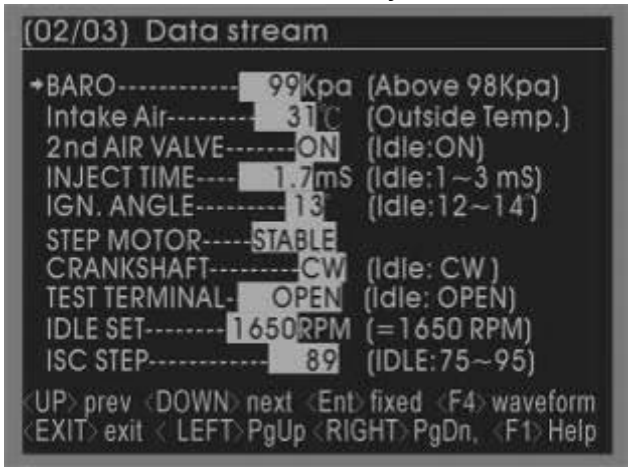
2. DATA STREAM

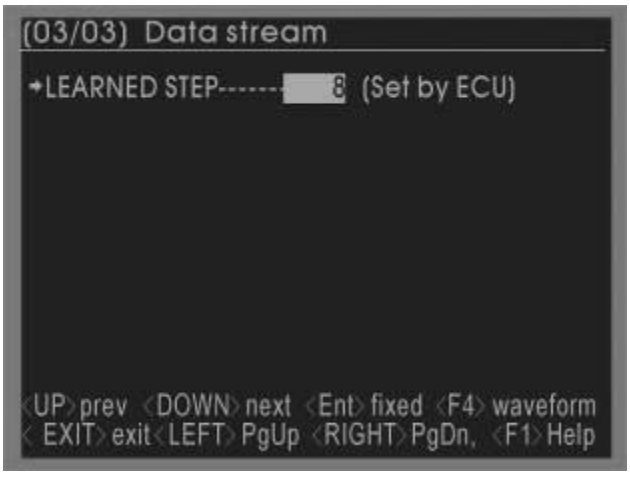
In the directory functions used "▲" "▼" button, select "DATA STREAM" project, press the "ENTER" key to the implementation.



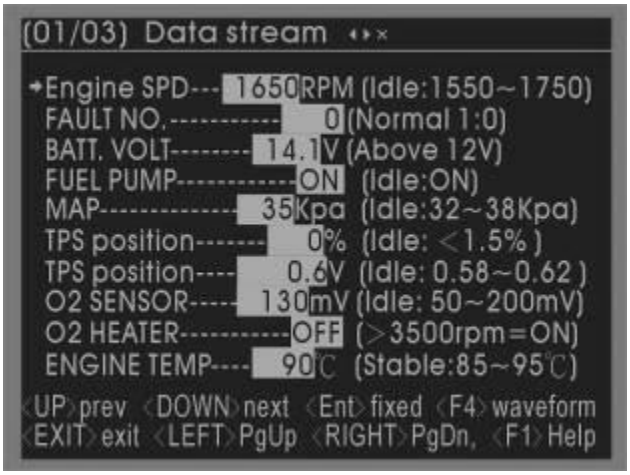
A total of 3 pages, are able to use "◄ left" and "right ►" button, view injection system information. On the any screen, press the "EXIT" button, the function can return to the directory screen.







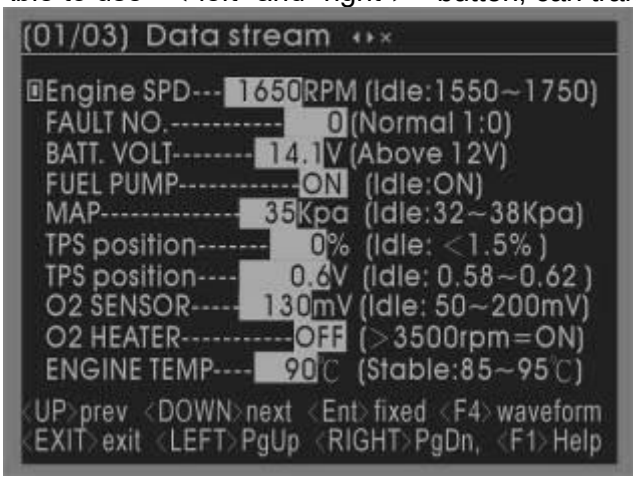
Data stream (1/3)

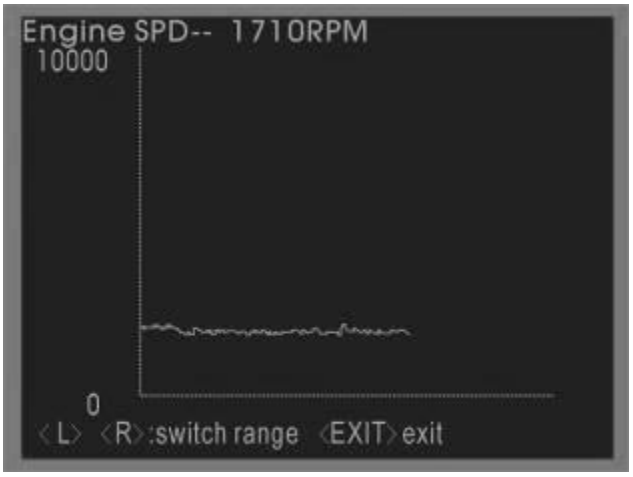


The screen showed the ECU captured by the engine of the state immediately.
The following data for the benchmark idling state:

- Engie SPD--- RPM (Idle:1550~1750) →Engine idle speed
- FAULT NO.-------- (Normal:0) →Fault code number
- BATT. VOLT---- V (Above 12V) →Battery voltage
- FUEL PUMP--------- (Idle:ON) →Fuel pump actuator state
- MAP---------- kPa (Idle:32~38kPa) →Manifold pressure
- TPS position------ % (Idle: ‹ 1.5%) →Throttle opening
- TPS position---- V (Idle:0.58~0.62) →Throttle sensor voltage
- O_2 SENSOR---- mV (Idle:50~200mV) →O_2 sensor voltage
- O_2 HEATER--------- (Idle: › 3500rpm=ON) →O_2 heater actuator state
- ENGINE TEMP-- ºC (Stable:85~95ºC) →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" buttom 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.

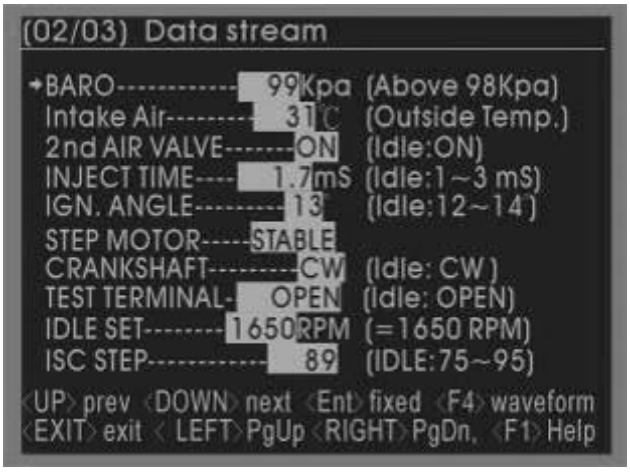




Numerical analysis of images (1 / 3), the waveform can be displayed as shown in the following items:

- Engie SPD
- BATT. VOLT
- MAP
- TPS position %
- TPS position Voltage
- O_2 SENSOR Voltage
- ENGINE TEMP

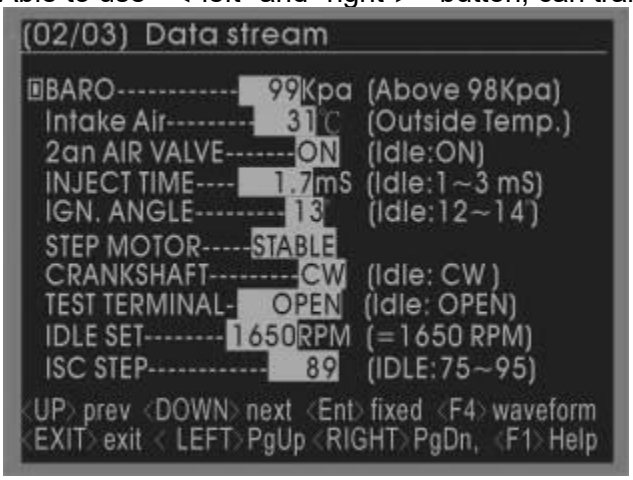
Data stream (2/3)



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---------- ºC (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

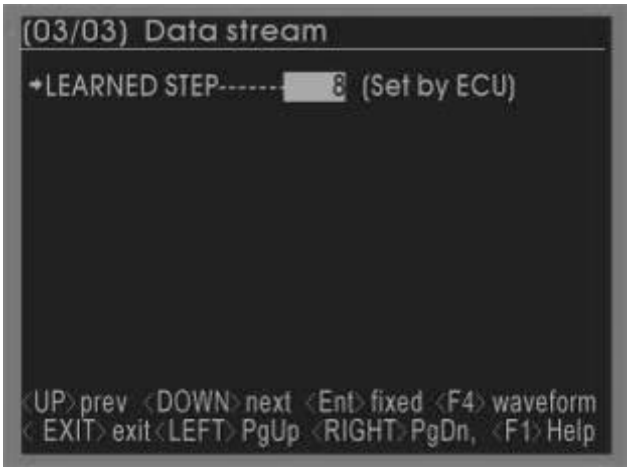
In the "DATA STREAM" of the screen use "▲" "▼" button to move the left side of the project "→" symbol selected items, press the "ENTER" buttom lock of the project, and press the "F4" button showed that the wave of projects.
Able to use "◄ left" and "right ►" button, can transform View wave numerical 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

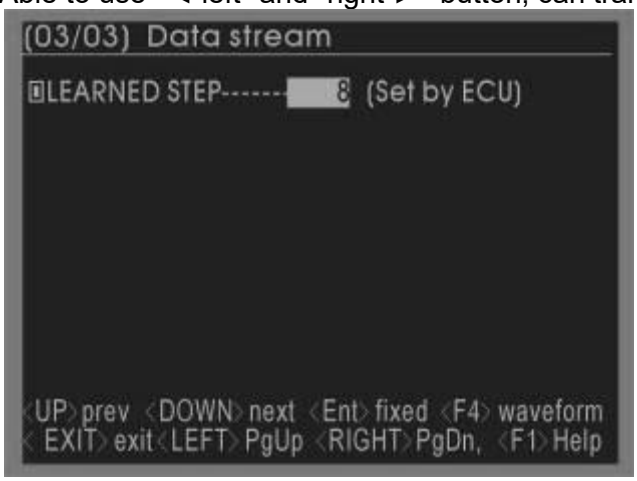
Data stream (3/3)



The screen showed the ECU captured by the engine of the state immediately.
The following data for the benchmark idling state:

- LEARNED STEP---------- (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" buttom 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.

3. FREEZED DATA

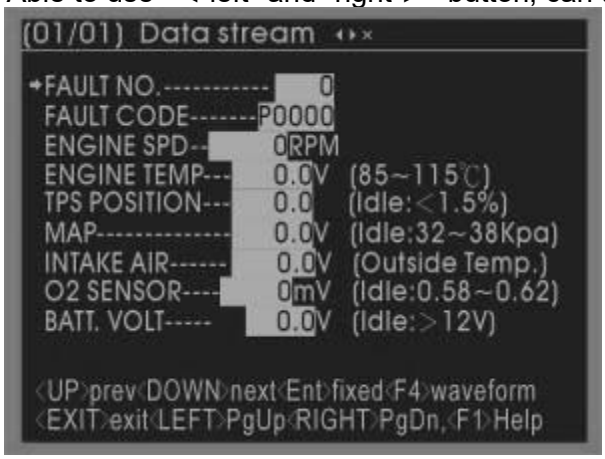
Objective: When a sensor fault, the EMS system will record all the parameters of fault signals, in order to facilitate fault diagnosis.

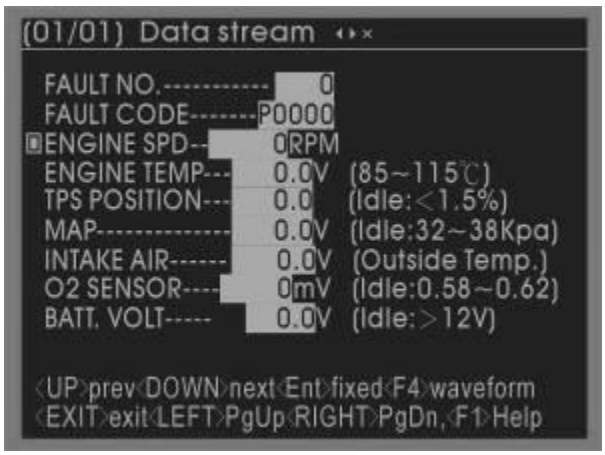
In the directory functions used "▲" "▼" button, select "FREEZED DATA" project, press the "ENTER" key to the implementation.

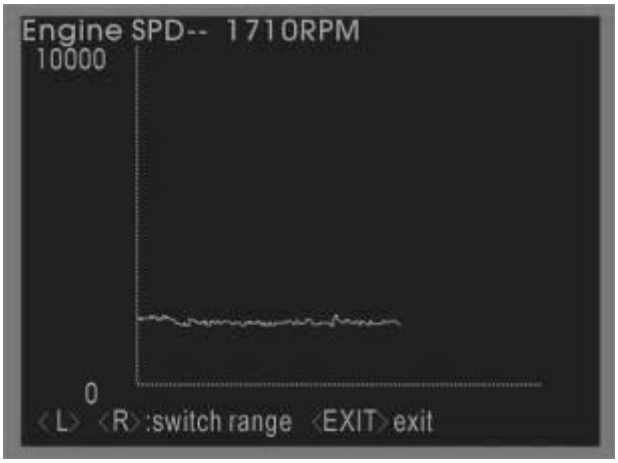
Only one page, at any screen, press the "EXIT" button, the function can return to the directory screen.

In the "FREEZED DATA" of the screen use "▲" "▼" button to move the left side of the project "→" symbol selected items, press the "ENTER" buttom 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.







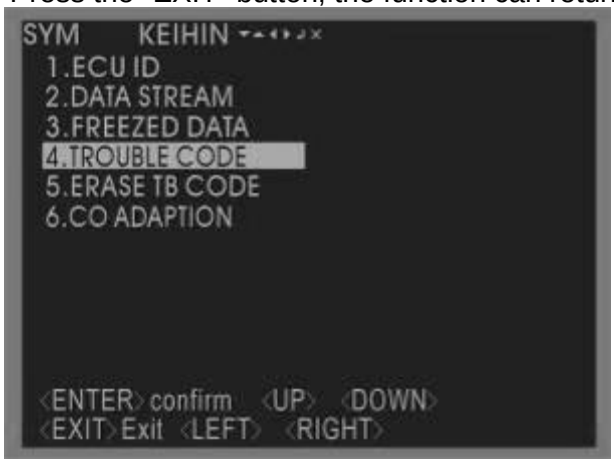
4. TROUBLE CODE

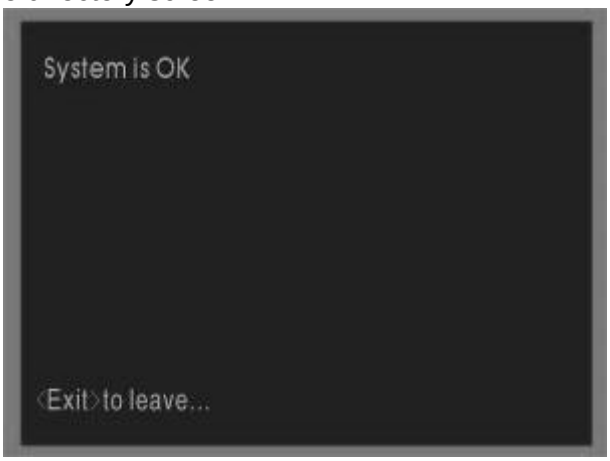
In the functional directory select "TROUBLE CODE" project, press the "ENTER" button implementation, the message began to read fault.

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

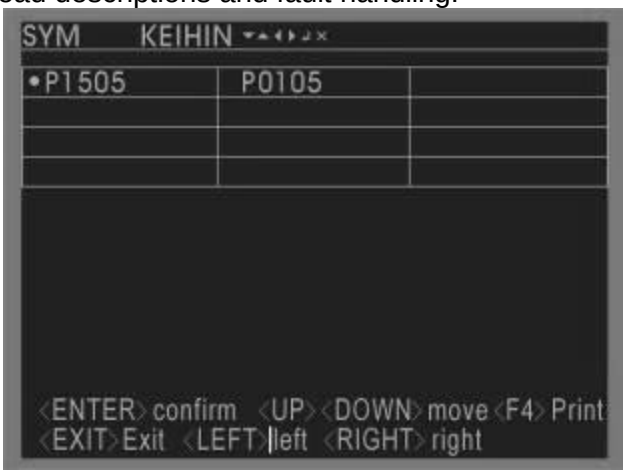
Without any fault is that showing "System is OK".

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

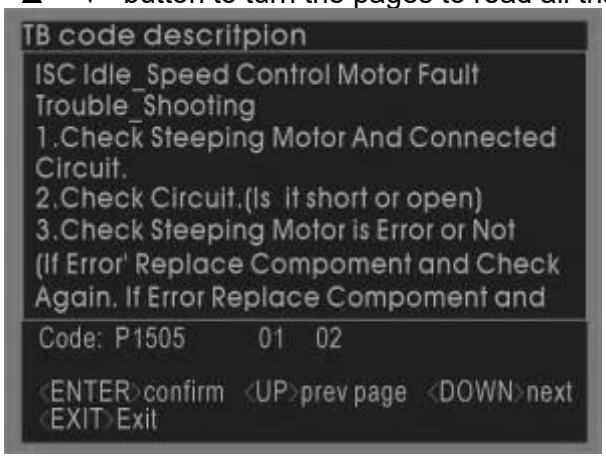


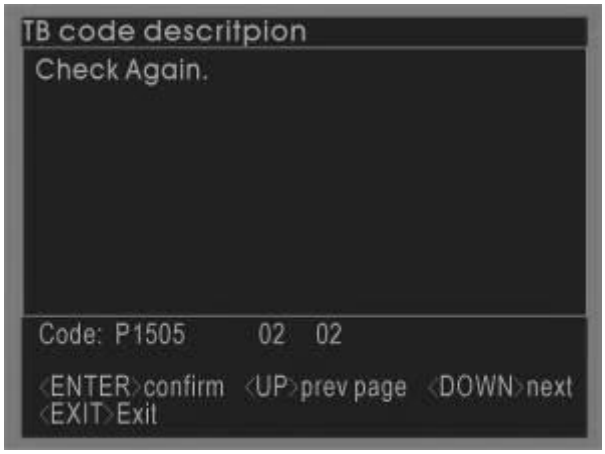


If the system has faulty code, that is showing the fault code, that can be used "◄ left" and "right ►" or "▲" "▼" button selected the fault code (selected before the code "•" tags) that, press the "ENTER" button, the code can be read descriptions and fault handling.



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.

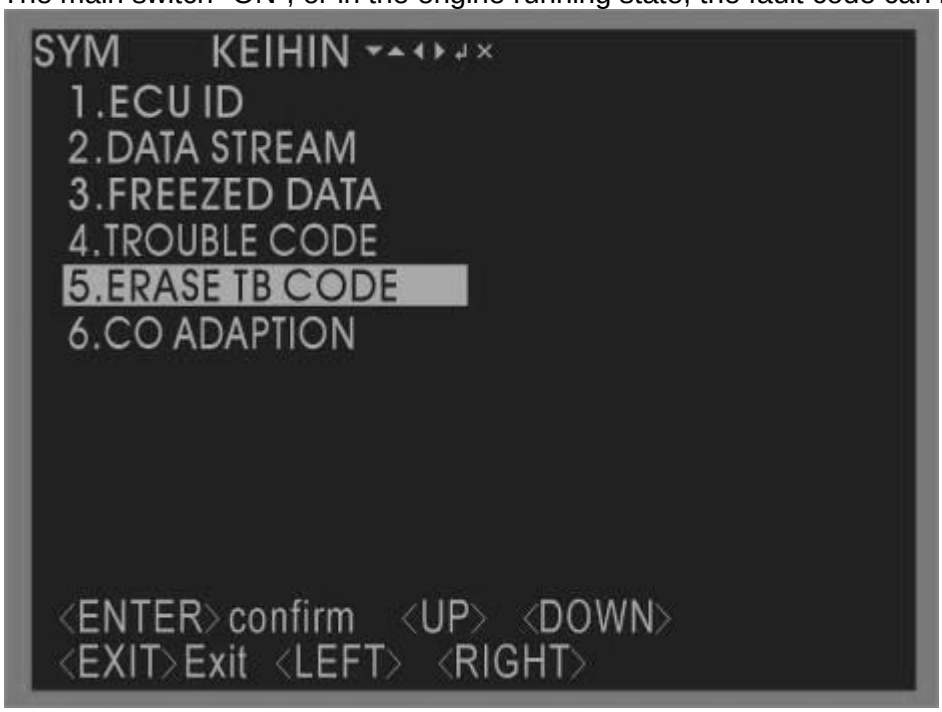




5. ERASE TB CODE

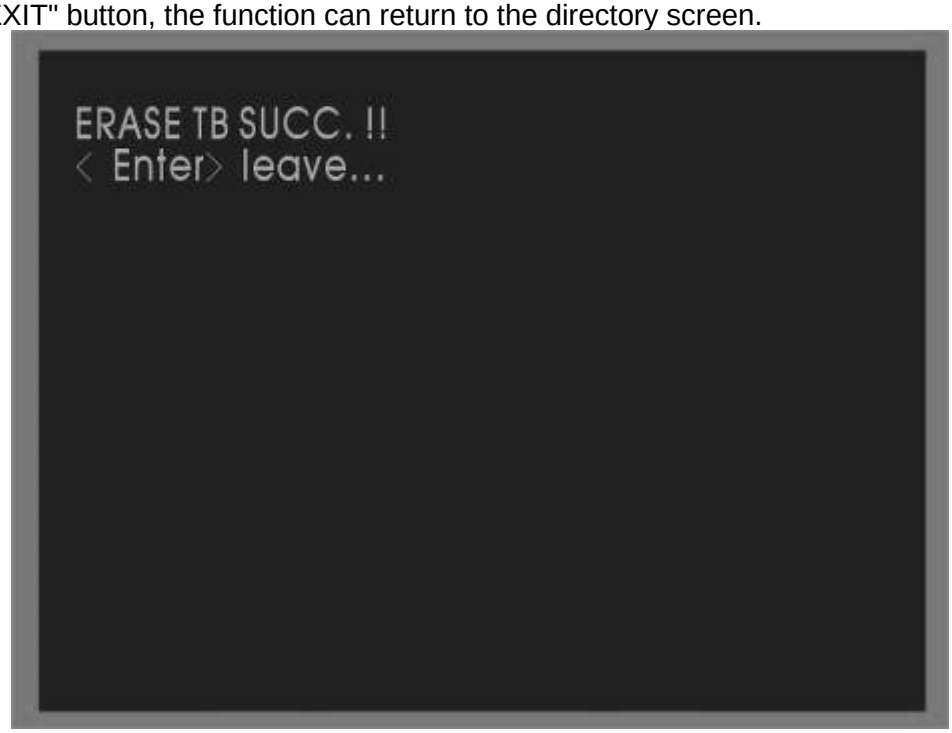
In the directory functions used "▲" "▼" button, select "ERASE TB CODE" project, press the "ENTER" key to the implementation.

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



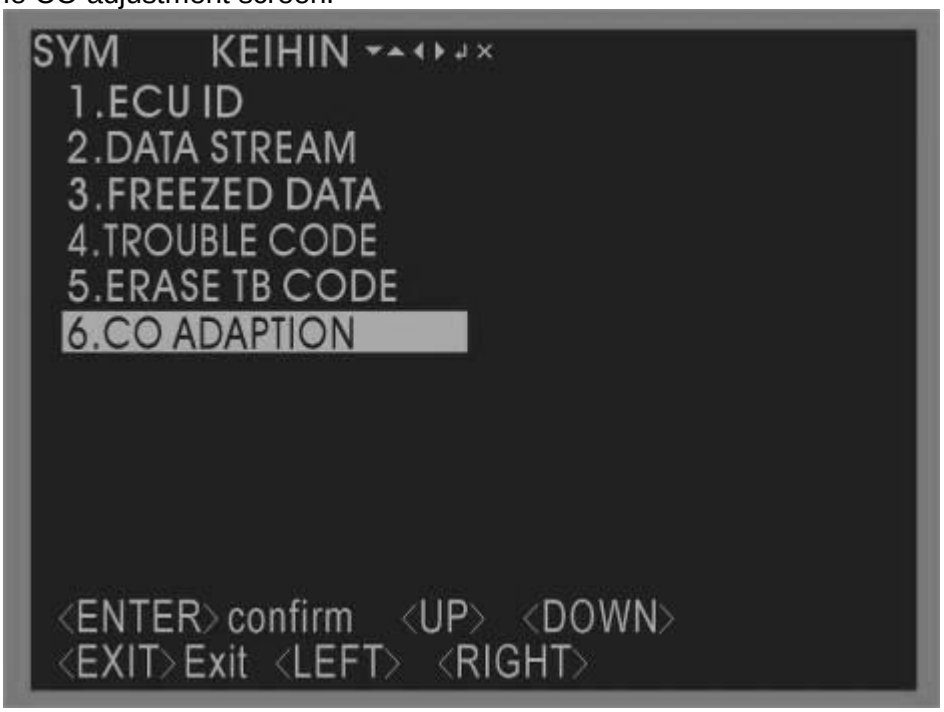
Fault code removed, namely showing the "ERASE TB SUCC.!".

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

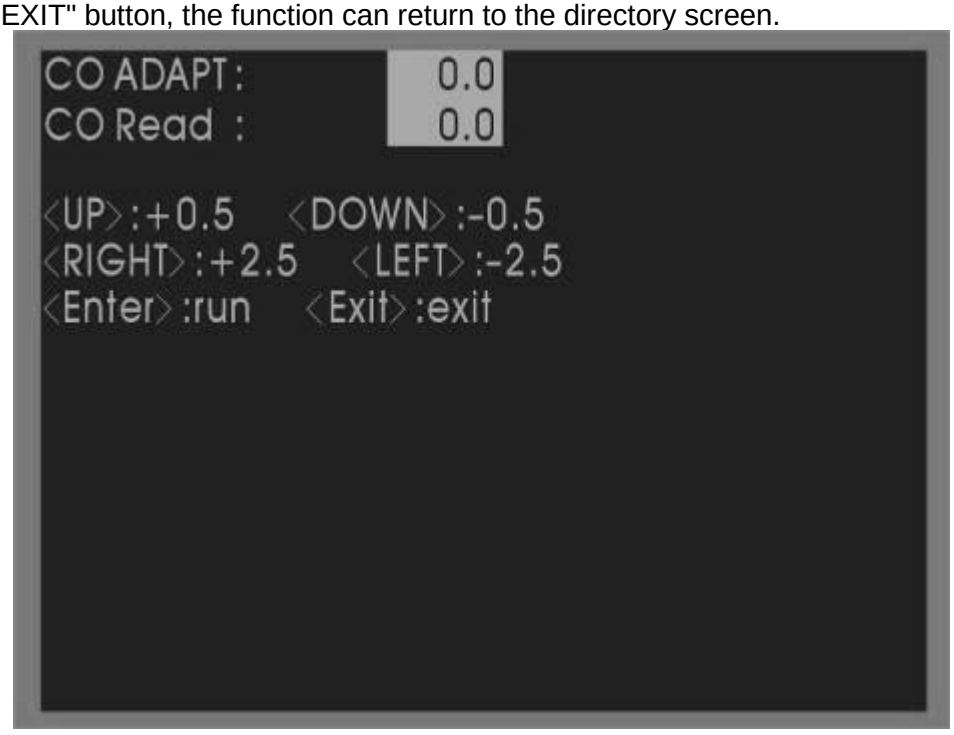


6. CO ADAPTION

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



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	O	O	O	O	O		O	O		
	Difficult to start	O	O		O			O		O	O
Idle state	Without idle			O	O	O		O		O	O
	Idle not smooth					O	O	O	O	O˘	
	RPM NG							O	O		
	CO NG		O			O	O	O	O		
Acceler-ation	Not smooth		O	O	O	O		O	O	O	O
	Inability and slow		O	O	O	O		O	O	O	O
Flameo-ut	Idle flameout				O			O			
	Acceleration flameout							O	O		
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	**Power and voltage**	● Use meter direct measurement battery voltage ● Use diagnosis tool detection of battery voltage	● Battery voltage	● Battery voltage = 10V Above	● Battery electricity ● Battery connector loose ● Harness circuit opening ● ECU coupler not connected properly
2	**Fuel pressure**	● Use fuel pressure gauge, connected in series between the injector and the Pressure Regulating Valve ● Main switch ON, but not start engine ● Check fuel pressure ● Start engine (idle) ● Check change of the fuel pressure ● throttle several rotation ● check to the change of fuel pressure again	● Open the main switch, but not to start the engine of pressure ● Pressure in idle ● Rotating throttle, situation of pressure changes	● Open main switch, but not srart: pressure = 250kPa (Stable value) ● Idle state: pressure = 294±6kPa (Beating situation from top to bottom) ● rotation throttle moment: pressure = 294±6kPa (Slightly beating)	● Fuel not enough ● Security switch not disarm ● Ruel pump relay fault ● Ruel pump fault ● Injector fault ● ECU fault
3	**Ignition state**	● The spark plug removed from the cylinder head, but the power lines still ring ● Start engines or use for the diagnosis tool of output View spark plug ignition conditions	● Spark plug specifications ● Whether the spark plug ignition ● Spark plug sparks whether it is normal strength	● Specifications: NGK-CR8H ● Ignition conditions: With traditional engines found ways	● Spark plug fault ● Roll over sensor fault ● ECU No. 5 pin fault ● Ignition coil fault ● Crankshaft position sensor fault
4	**Engine vacuum**	● Diagnosis tool to detect the use of	● Manifold pressure of diagnosis tool	● Manifold pressure =32~38kPa	● Valve clearance abnormal ● Intake system leak
5	**Injection state**	● The injector removed from the throttle body, but not dismantle pipeline ● Main switch ON, but not start engine ● Investigation the injector it's leaking fuel? ● Once again start engines or use for the diagnosis tool of output function ● Check injector fuel injection and the injection situation	● Open the main switch, but did not start engine the injection situation ● Injector state when start	● Not started, injector not leaking fuel ● In started, the injection state must show fan shape	● Security unit is configured not disarm ● Fuel pump relay fault ● Fuel pump fault ● Injector fault ● ECU fault
6	**Closed - loop control system**	● Use of diagnostic tool observation O2 Sensor voltage changes	● Stable condition, sensor voltage variation (Idle continued 5 minutes later to measurement)	● Idle stable condition: O2 Sensor voltage = 50 ~ 200mV (Show from top to bottom beating phenomenon)	● O2 Sensor fault ● ECU fault
7	**Fault Code Detection**	● Use of the diagnosis tool existing fault-detection code or historical Fault Code ● Elimination of the implementation of fault codes, check can be eliminated ● Once again start engine ● Check fault is it happen again	● Diagnosis tool of the fault code is it can be eliminated ● Start again, the fault is it will happen again	● Without any residual Fault Code ● If residual Fault Code, according to the "Fault Code Maintenance Form" implementation of troubleshooting	● throttle position sensor fault ● Engine temperature sensor fault ● Intake temperature sensor fault ● Manifold pressure sensor fault ● O2 Sensor fault ● Crankshaft position sensor fault ● ECU fault ● Roll over sensor fault

Notes: 1.Fuel pressure gauge connected between the fuel tank and injector, open the main switch to repeatedly shut down, fuel system makes pressure stability.
2.Injector and injector cap tightly by hands, fuel spills should not be the case.

Note:

Operational Precautions

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		LS30W1-EU
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	1400 c.c.
	Reservoir upper	1200 c.c.

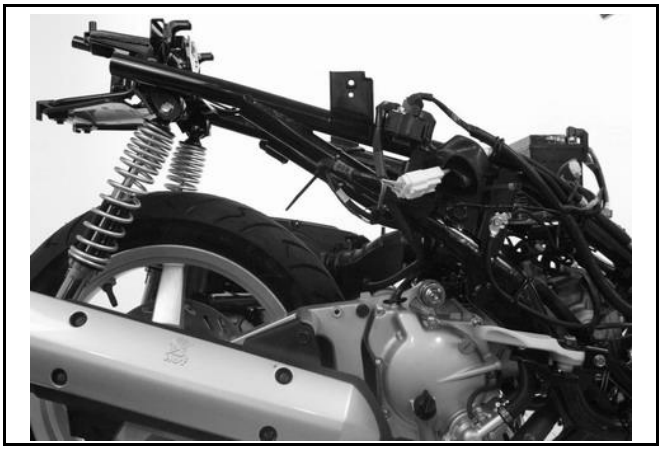
Torque Values

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

Engine Removal

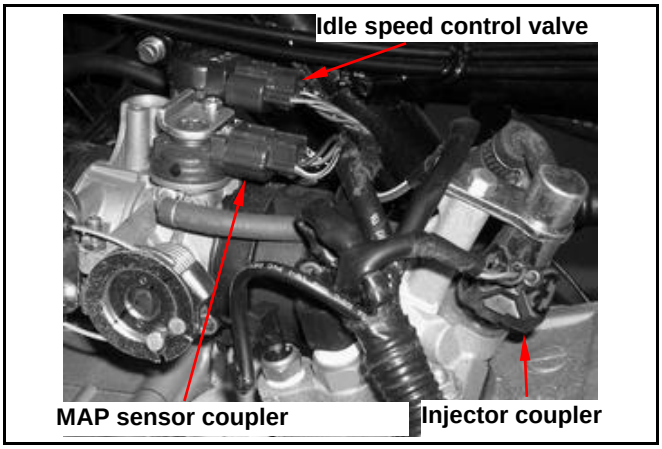
Remove the luggage box (6 bolts).
(Refer to chapter 13)

Remove right and left side covers.
Remove rear center cover.
Remove rear carrier.
Remove right and left side garnish.
Remove body cover.
Remove floor panel.
(Refer to chapter 13)

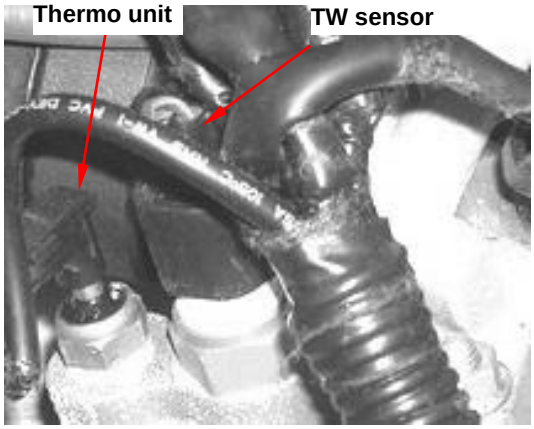


Remove fuel injection system of electrical couplers and fuel hoes

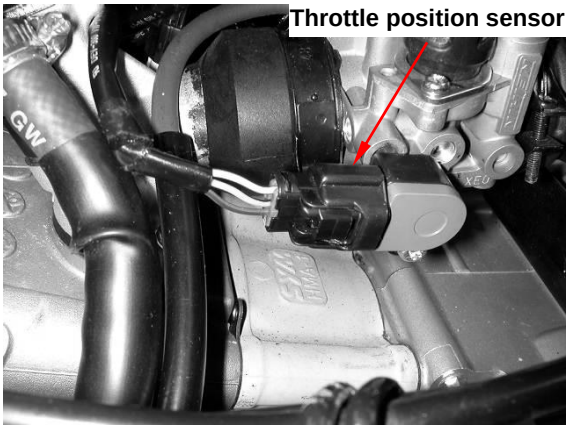
Remove idle speed control valve, MAP sensor, injector couplers.



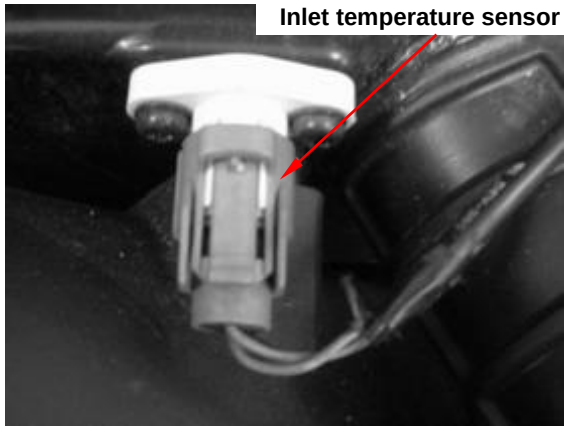
Remove the thermo unit and TW sensor wire couplers.



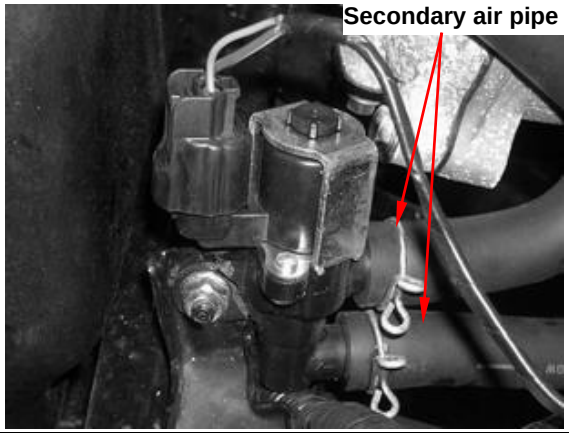
Remove the throttle position sensor coupler.



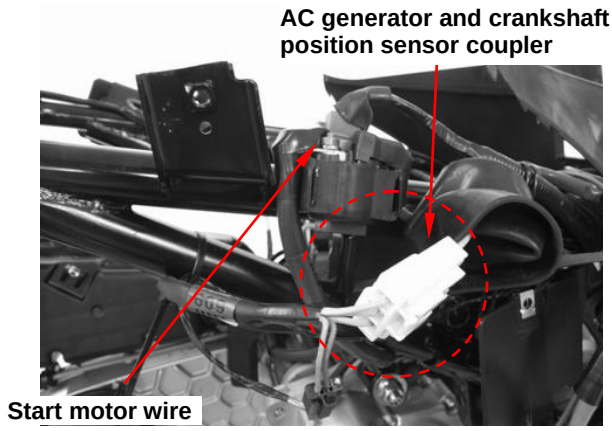
Remove the TA sensor coupler.



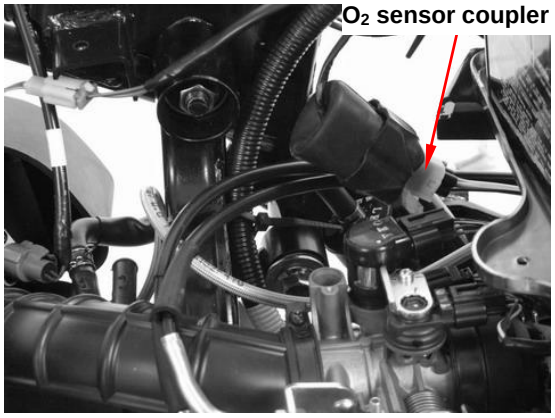
Remove the AISV pipe.



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



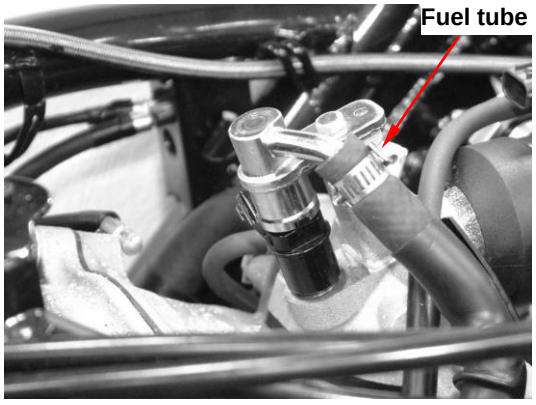
Remove O_2 sensor wire coupler.



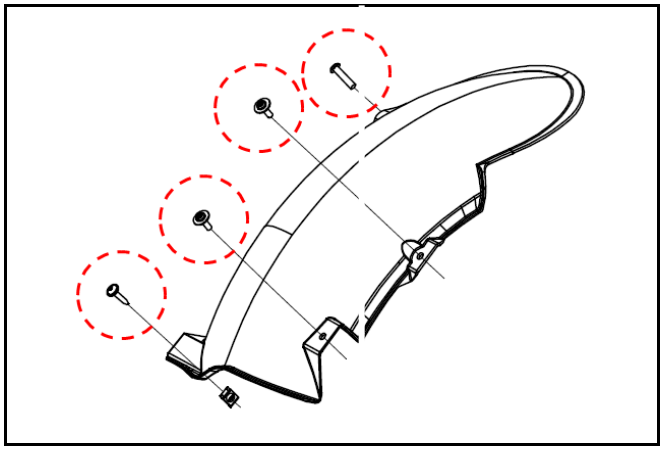
Start engine for the pipeline to be exhausted within the residual pressure, the engine flameout, relaxing fuel tube folder, open for fuel tube.

Caution

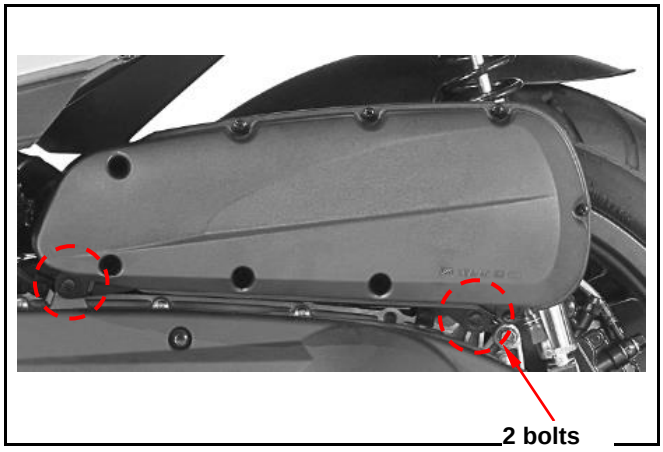
- Demolition for the pipeline will be required for residual pressure in the pipeline to divest, or use the folder surrounds the tubing to prevent petrol splash.



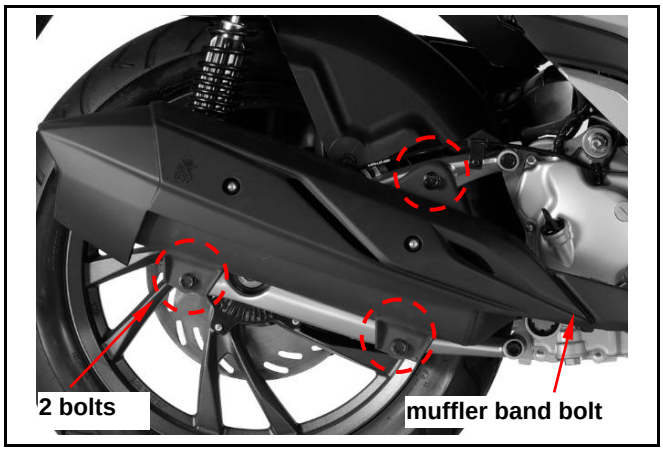
Loosen 4 screws from rear mudguard.



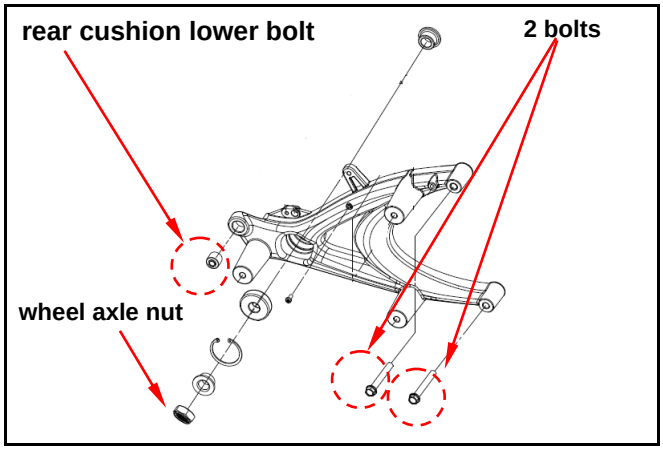
Remove the air cleaner connection bolts (2 bolts).
Remove the air cleaner.



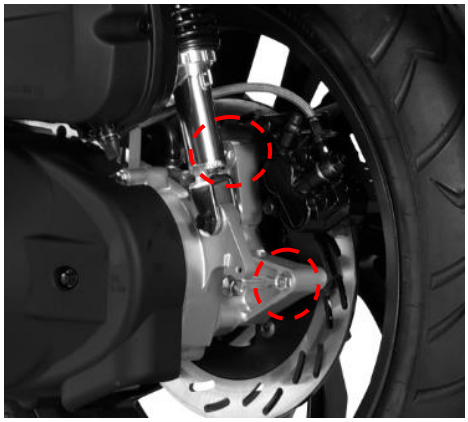
Loosen the 3 bolts from muffler.
Loosen the muffler band bolt (1 bolt).
Remove the muffler.



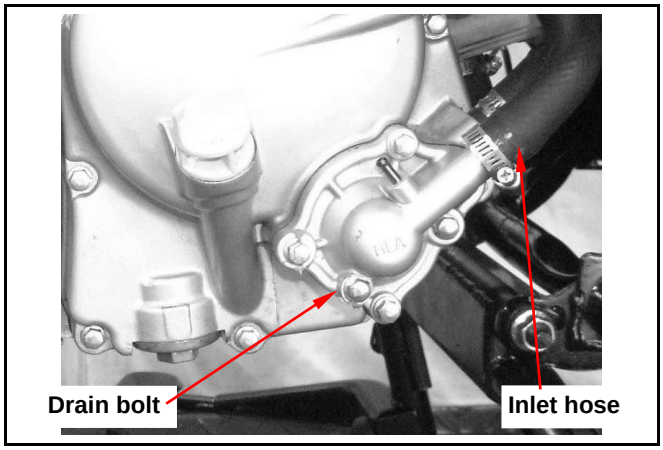
Remove the right rear cushion lower bolt (1 bolt).
Remove the rear fork bolts (2 bolts).
Remove the rear wheel axle nut (1 nut).



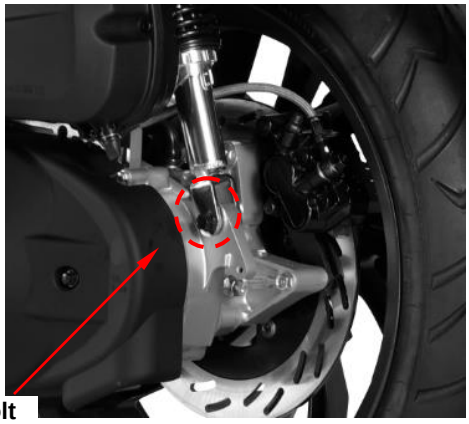
Remove rear brake hose clamp and rear brake caliper.(2 bolts)



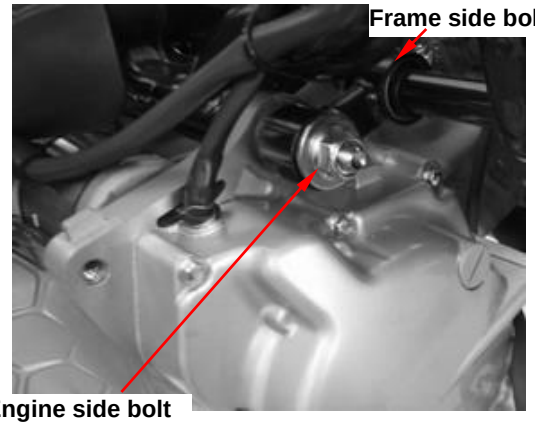
Drain out coolant, and remove coolant inlet hose.



Remove left rear cushion lower bolt (1 bolt).



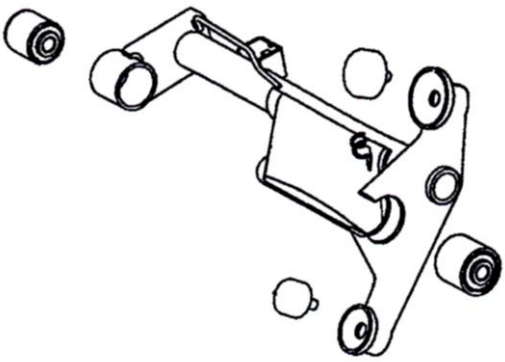
Remove frame side engine hanger bolts (each side 1 bolt), and then remove engine.



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.



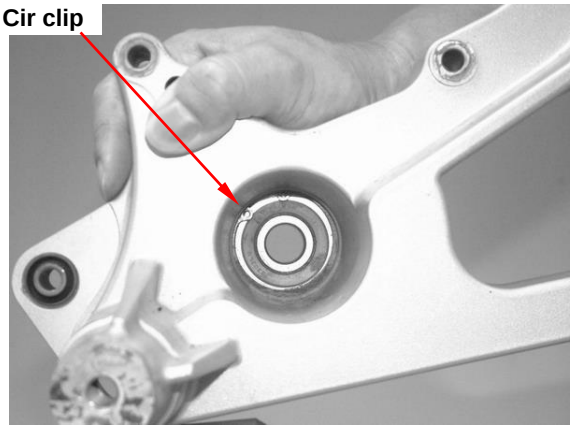
Installation

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

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.

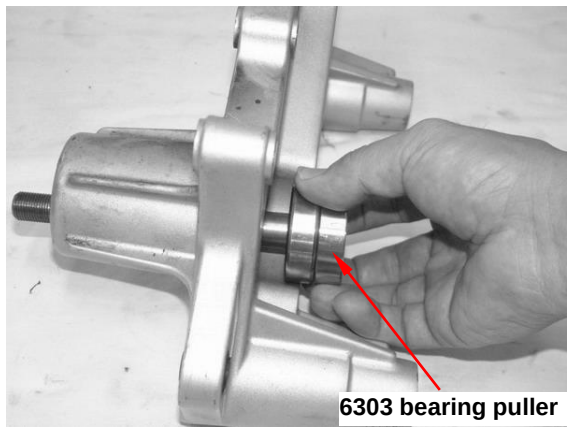


Bearing removal

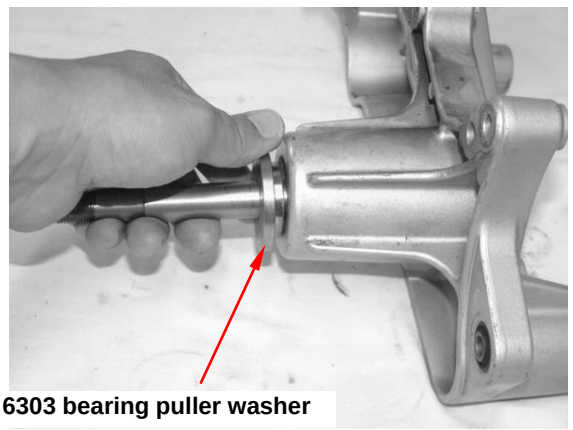
Remove bearing mounting cir clip.
Drive the bearing out of the rear fork.

Bearing installation

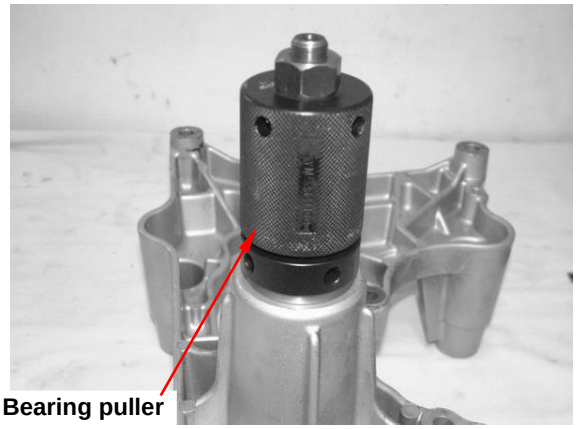
Install new rear axle bearing and baring puller into rear fork.
Special Service Tools:
Rear fork bearing puller SYM-6303000-6303



Install the washer of the 6303 bearing puller.

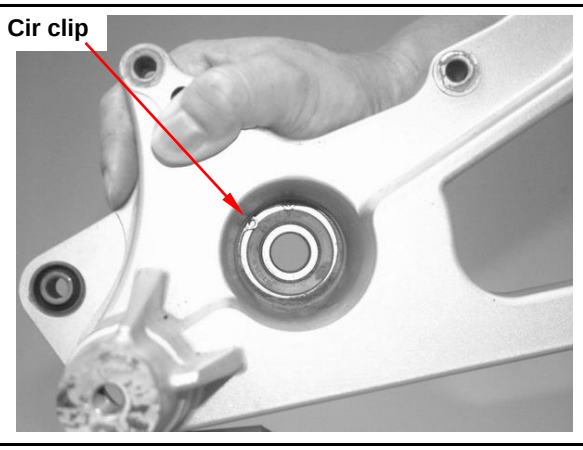


Install assembly directs puller bearing puller.
Special Service Tools:
Assembly directs puller SYM-2341110



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.



Removal of Engine Mount Bushing

If engine hanger frame and the cushion rubber of rear cushion bushing are damaged. Then use the bushing remover / presser, ø28mm & ø20mm, to press the bushing out and replace it with new one.

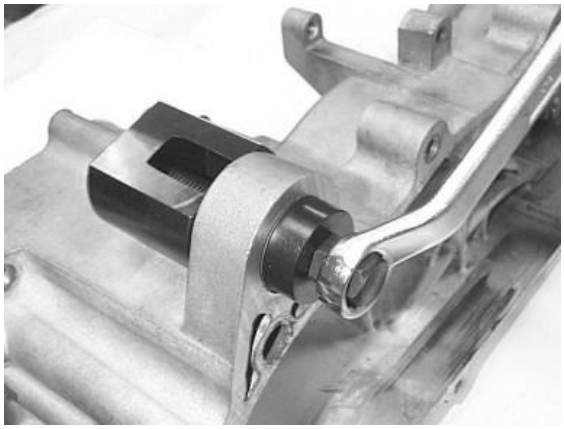
Engine hanger bushing: ø **28mm**
Rear cushion bushing: ø **20mm**

Pressing out

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

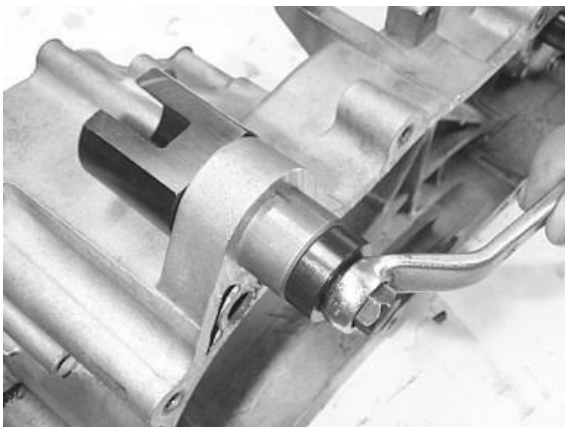
Special Service Tools:

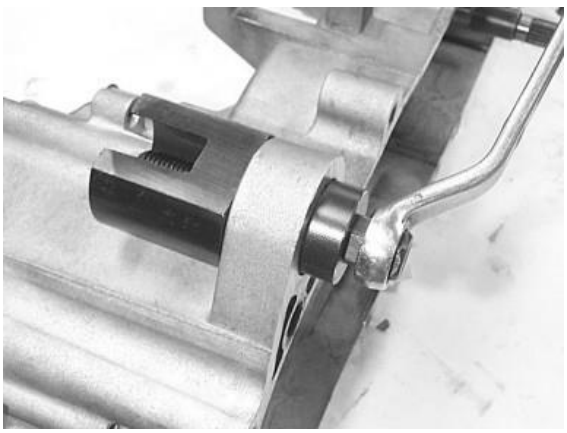
Crankcase bushing remover SYM-1120310
Crankcase bushing remover SYM-1120320



Pressing In

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



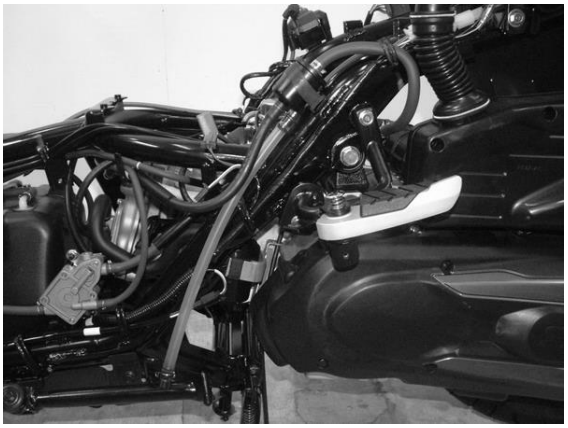


Installation of Engine

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.

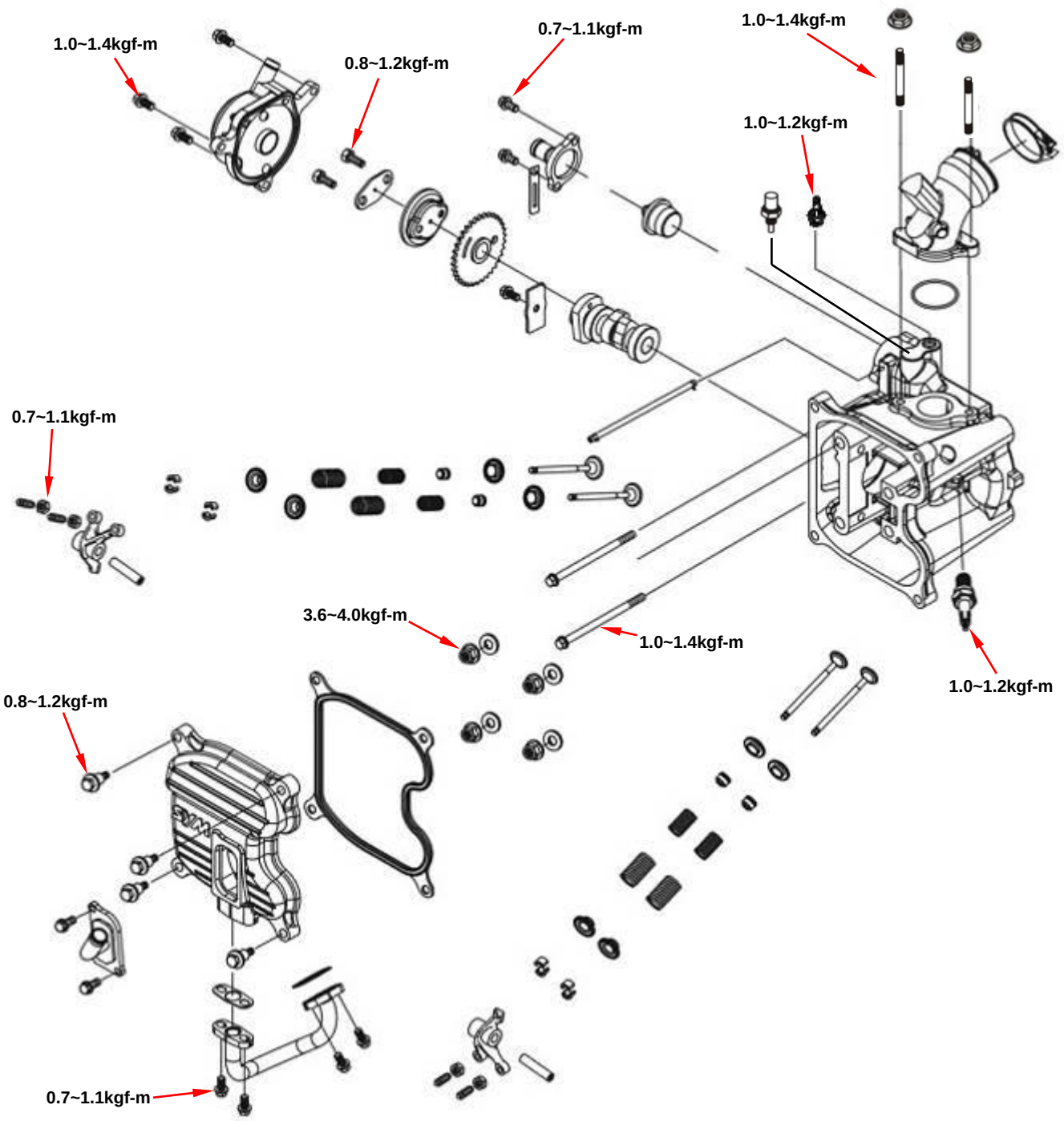


Engine hanger flange bolt/lock nut:
Torque Value: 7.5~9.5kgf-m

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



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			14±2 kg/cm^2	---
Camshaft	Height of cam lobe	Intake	34.885	34.860
		Exhaust	34.747	34.725
Rocker arm	ID of valve rocker arm		12.000~12.018	---
	OD of valve rocker arm shaft		11.966~11.984	11.936
Valve	OD of valve stem	Intake	4.975~4.990	4.900
		Exhaust	4.950~4.975	4.900
	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	35.200
		outer	40.400	36.900
	Valve seat width		1.000	---
	Valve clearance	Intake	0.10±0.02mm	---
		Exhaust	0.15±0.02mm	---
Tilt angle of cylinder head			---	0.050

Torque Value

Cylinder head cover bolt	0.8~1.2kgf-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	1.0~1.4kgf-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

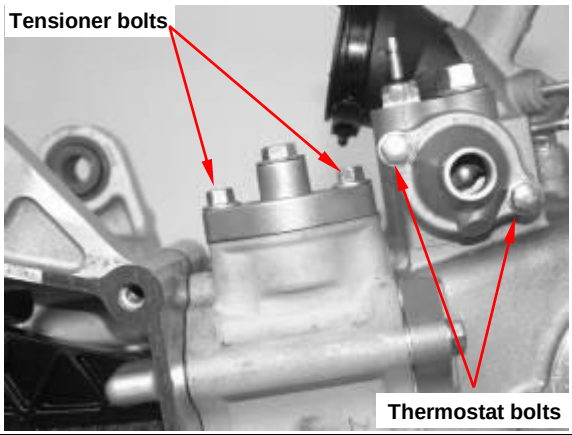
Noise

- 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

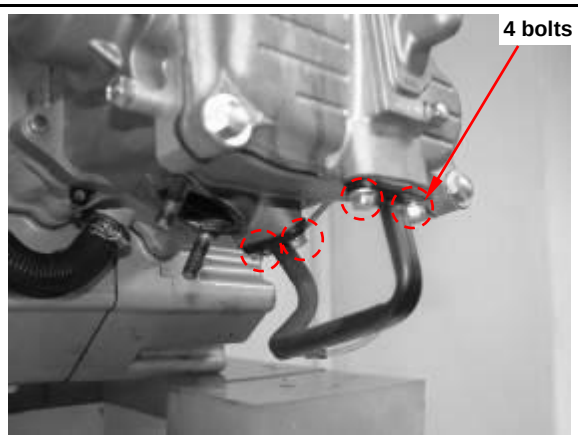
Cylinder Head Removal

Remove engine. (Refer to chapter 5)

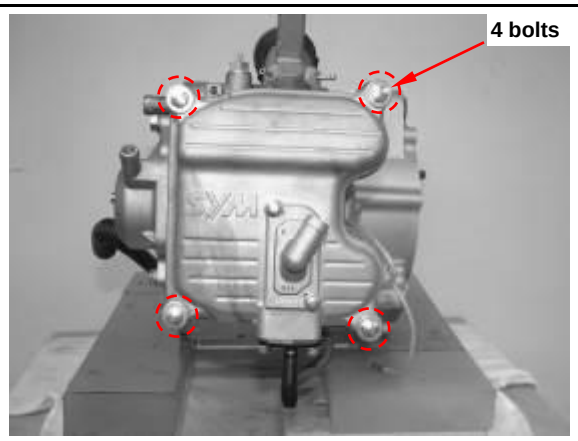
Remove 2 bolts of thermostat and then remove the thermostat.
Remove 2 bolts and spring for the cam chain tensioner.
Loosen 2 bolts, and then remove tensioner.
Remove thermostat (2 bolts).



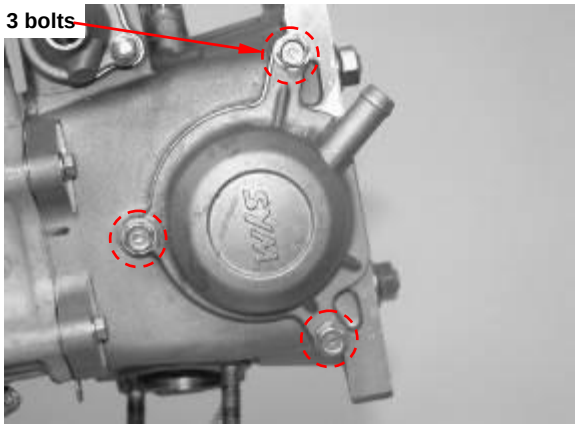
Remove Air Injection system (AI) pipe mounting bolts.
Remove spark plug.



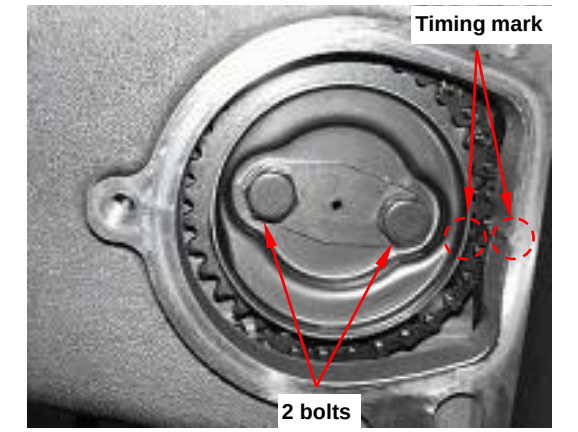
Remove cylinder head cover (4 bolts).



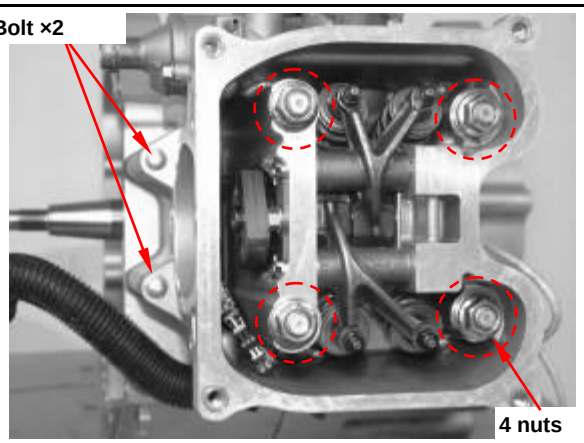
Remove the side cover mounting blots of cylinder head, and then take out the side cover.



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.



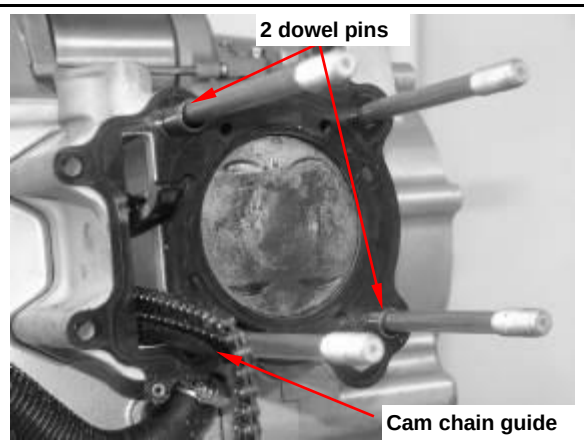
Remove the 2 cylinder head mounting bolts from cylinder head right side, and then remove 4 nuts and washers from cylinder head upper side.
Remove the cylinder head.



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

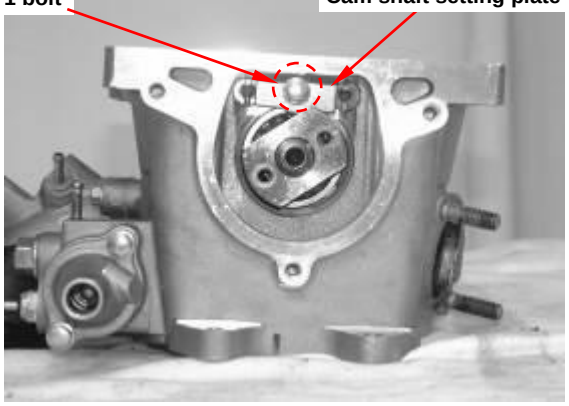
Caution

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

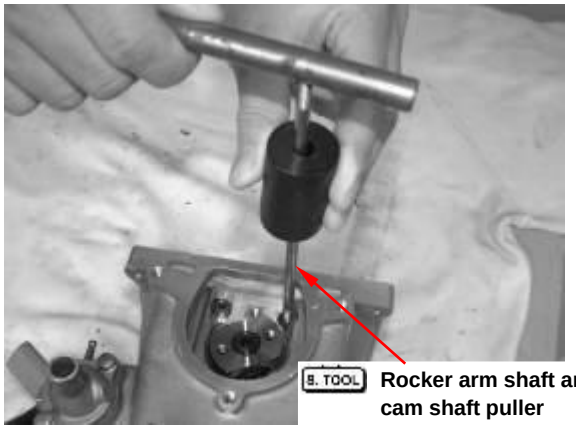


Cylinder Head Disassembly

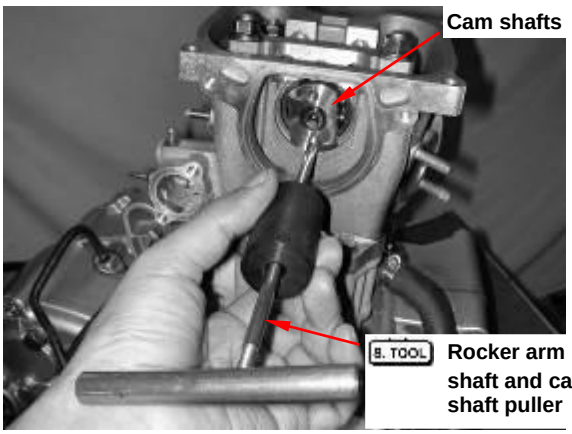
Remove cam shaft setting plate (1 bolt).



Remove rocker arm shaft 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

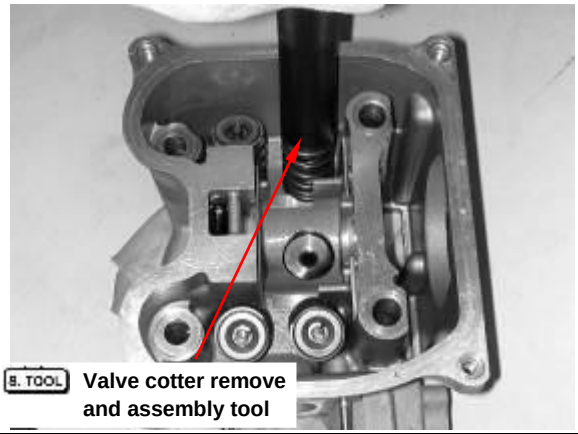


Use a valve cotter remove & assembly tool to press the valve spring, and then remove valves.

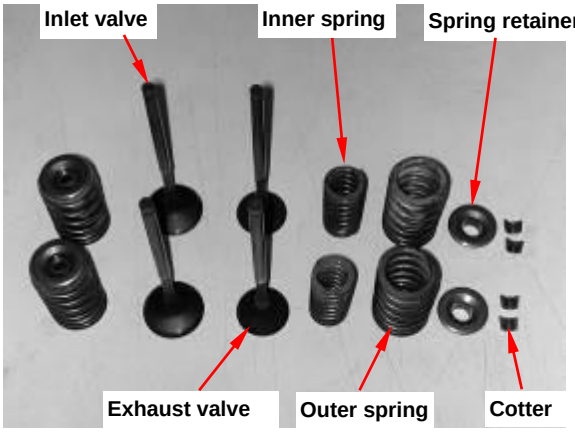
Caution

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

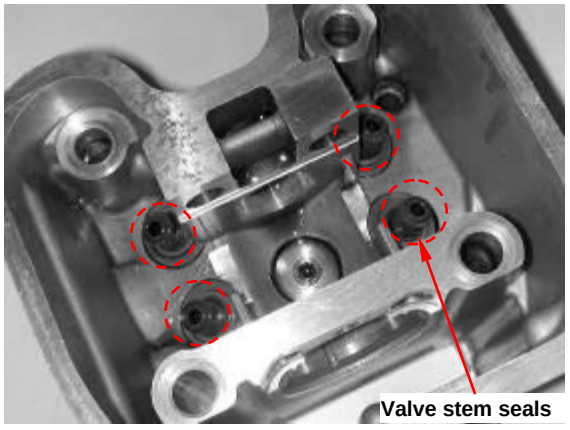
Special Service Tool:
Valve cotter remove & assembly tool SYM-1471110-SY125



Remove valve cotters, spring retainers, springs and valves.



Remove valve stem seals.



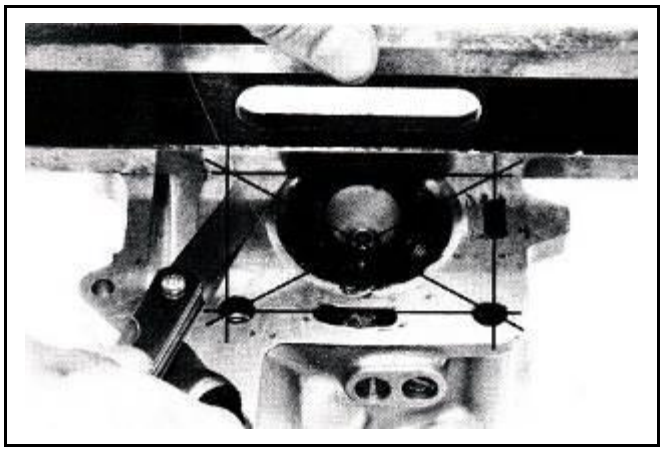
Clean carbon deposits in combustion chamber. Clean residues and foreign materials on cylinder head matching surface.

Caution

- Do not damage the matching surface of cylinder head.

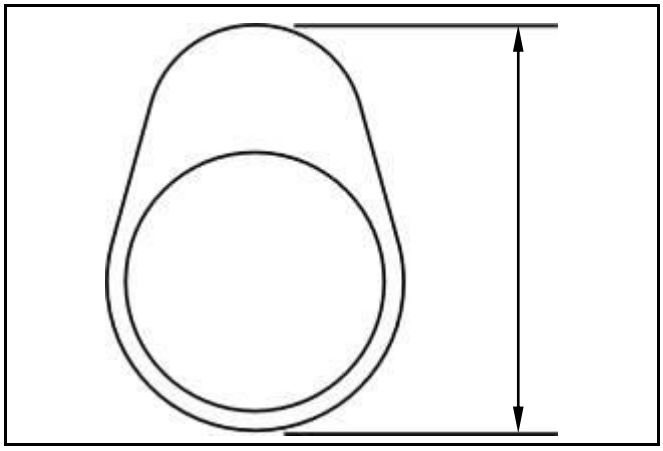
Cylinder Head Inspection

Check if spark plug and valve holes are cracked.
Measure cylinder head warp with a straightedge and thickness gauge.
Service limit: 0.05 mm



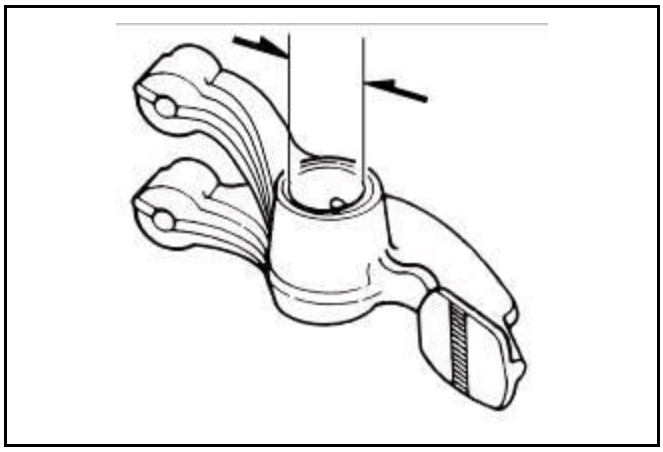
Camshaft

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

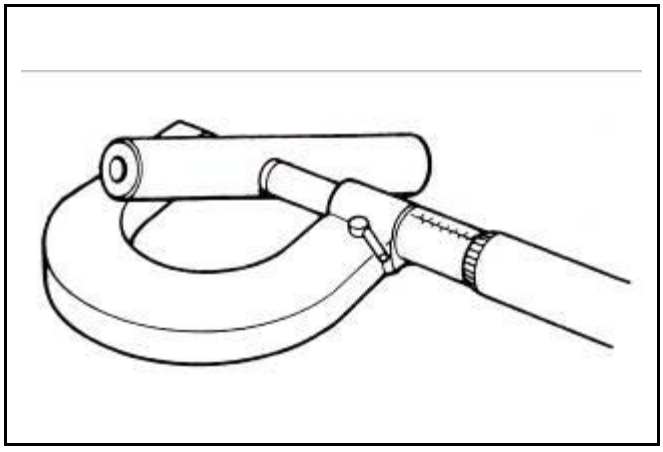
Measure the cam rocker arm I.D., and wear or damage, oil hole clogged?



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.



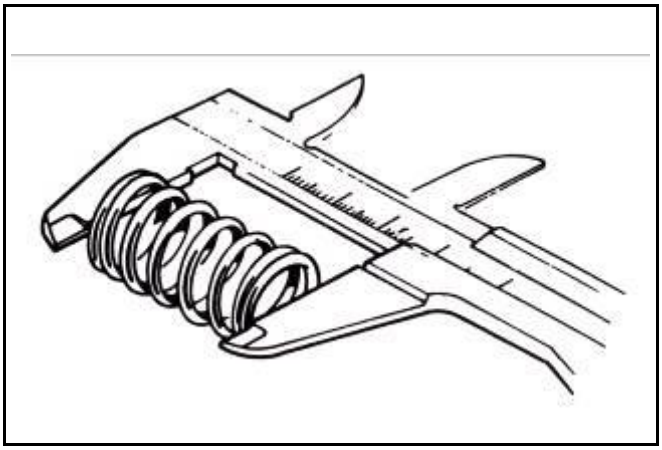
Valve spring free length

Measure the free length of intake and exhaust valve springs.

Service limit:

Inner spring 38.7 mm

Outer spring 40.4 mm

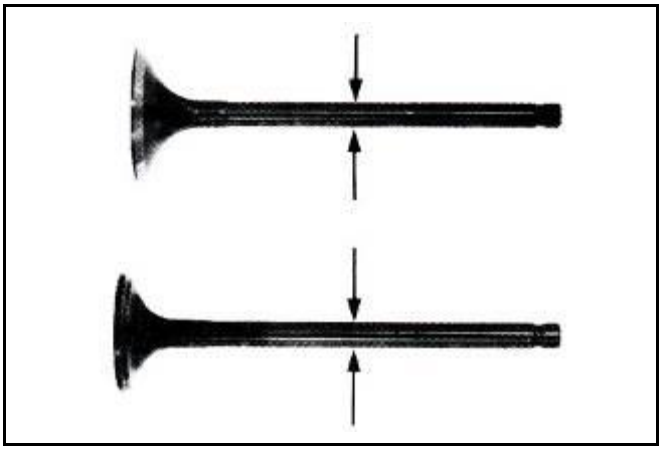


Valve stem

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

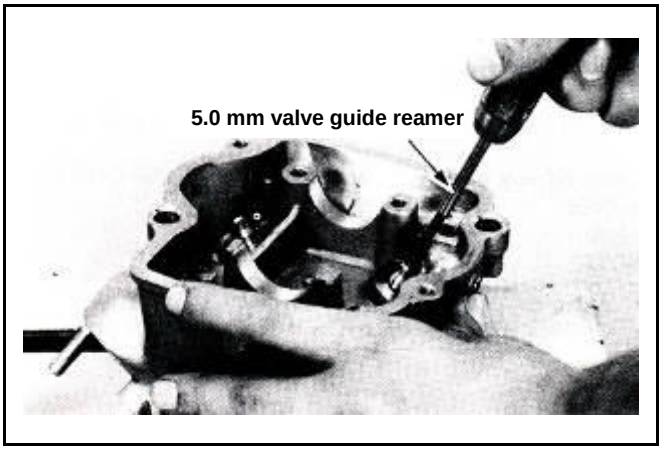
Caution

- 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.

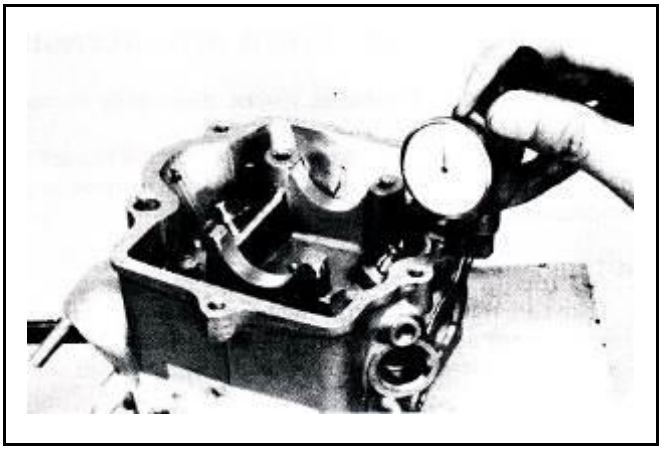
The difference that the inner diameter of valve guide deducts the outer diameter of valve stem is the clearance between the valve stem and valve guide.



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.

Valve Stem Replacement

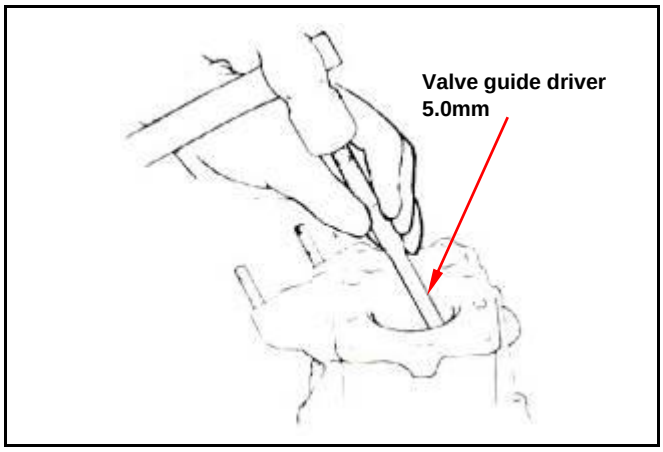
Heat up cylinder head to 100~150 ℃ with heated plate or toaster.

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



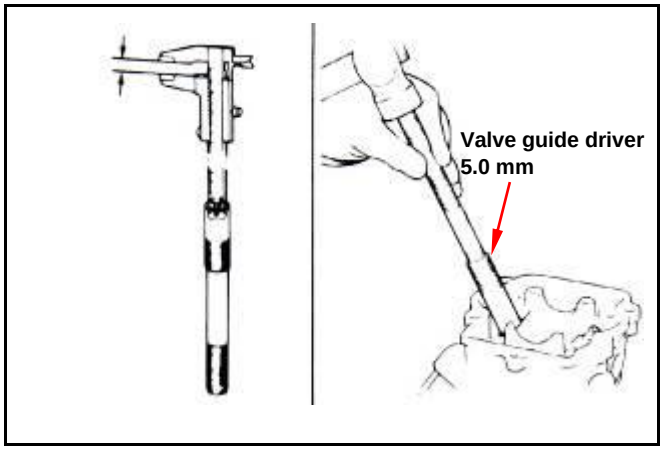
Caution

- 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℃.

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



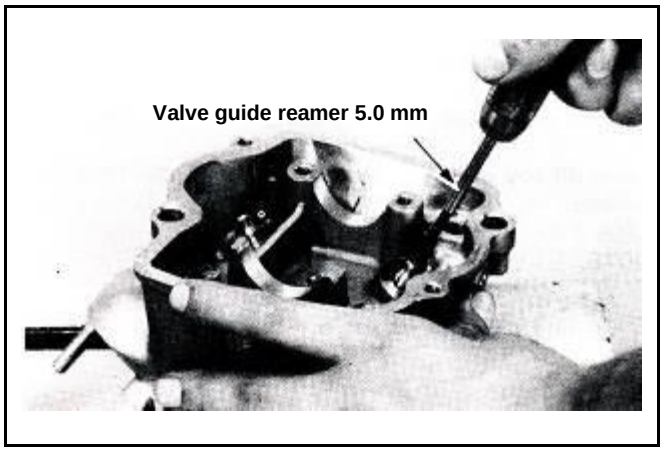
Wait for the cylinder head cooling down to room temperature, and then correct the new valve guide with reamer.

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

Check the contact condition of valve seat.

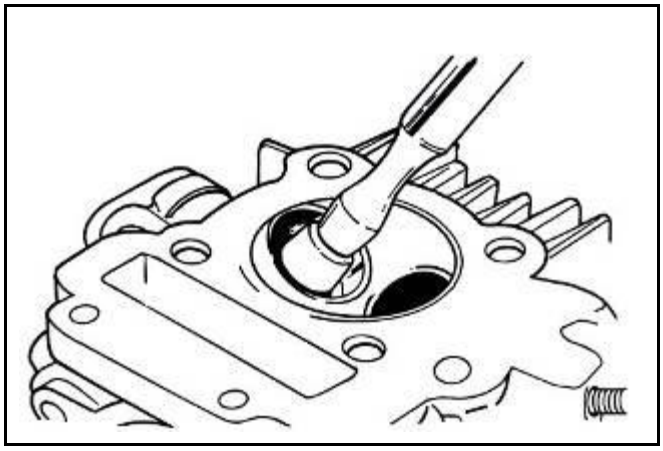
Valve seat grinding

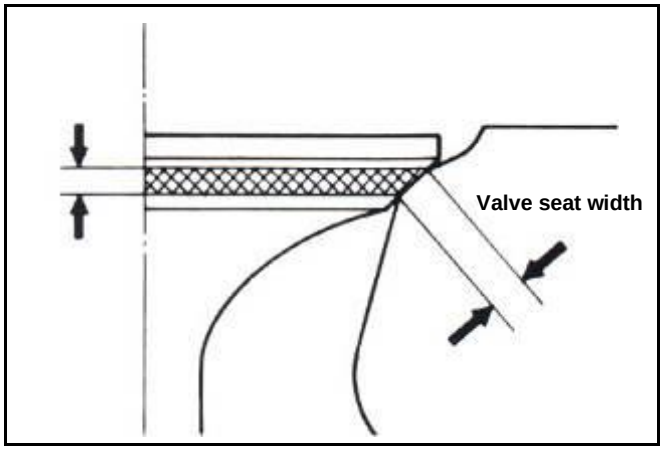
The worn valve seat has to be ground with valve seat chamfer cutter.
Refer to operation manual of the valve seat chamfer cutter.
Use 45° valve seat chamfer cutter to cut any rough or uneven surface from valve seat.

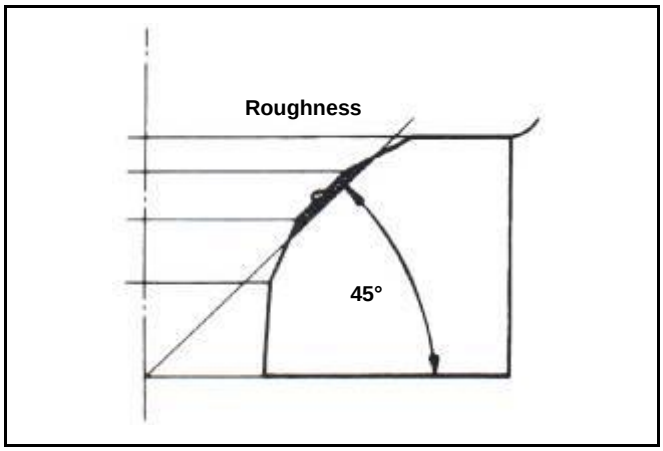
Caution

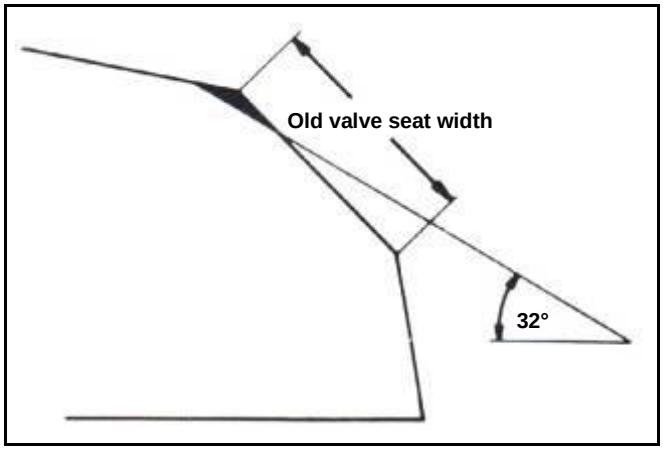
- After valve guide had been replaced, it has to be ground with 45° valve seal chamfer cutter to correct its seat face.

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

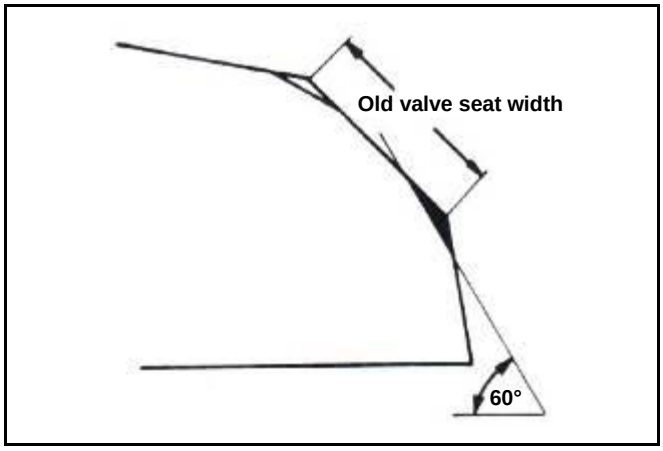








Use 60° cutter to cut a quarter lower parts out.
Remove the cutter and check new valve seat.

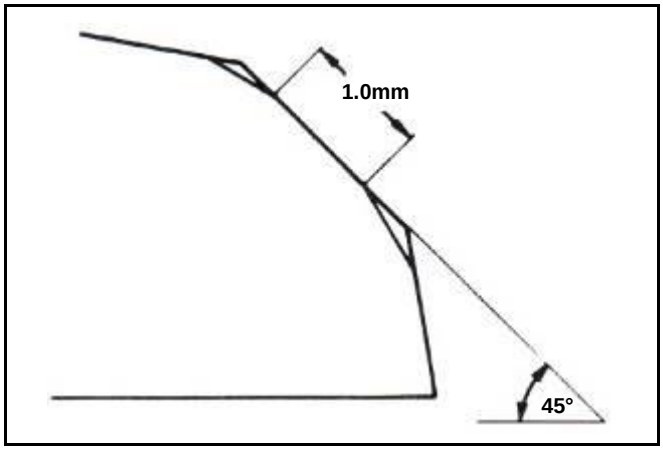


Use 45° cutter to grind the valve seat to specified width.

Caution

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

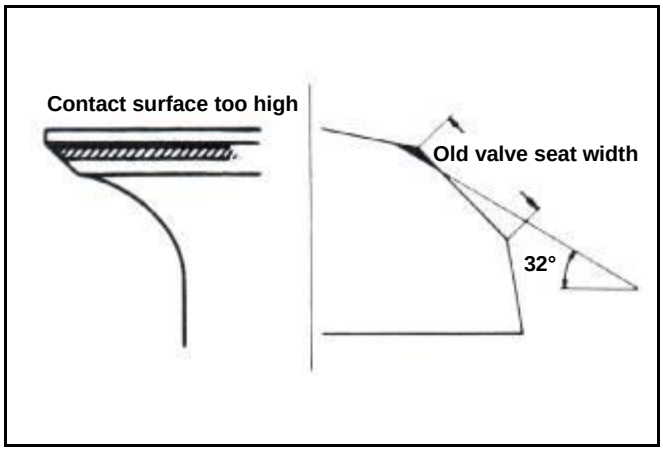
Grind valve seat again if necessary.



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.

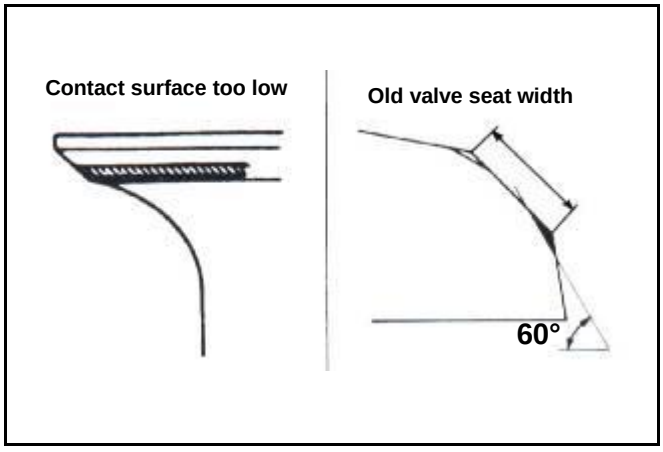
Caution

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

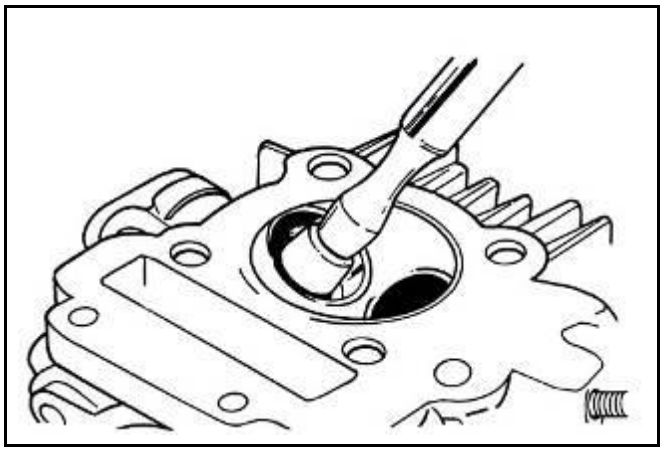


If the contact surface is too high, grind the valve seat with 32° cutter.
Then, grind the valve seat to specified width.

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.

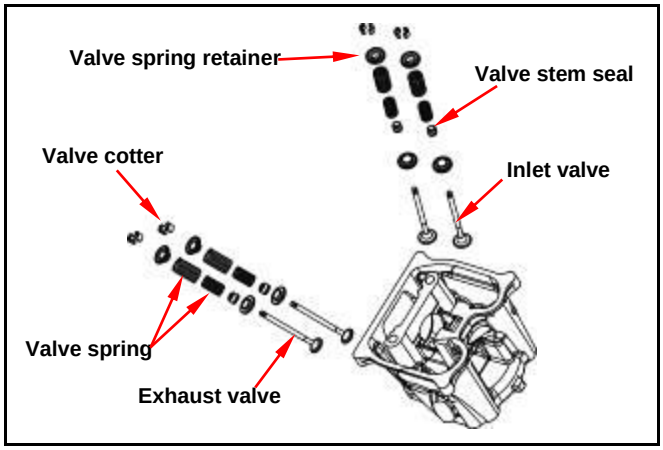


Cylinder Head Reassembly

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.

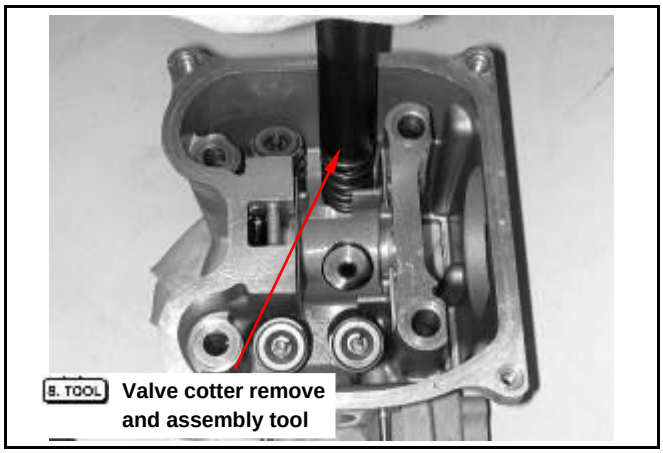


Put the valve cotters onto valve spring retainer.
Use a valve cotter remove & assembly tool to press the valve springs, and then install valves.

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.

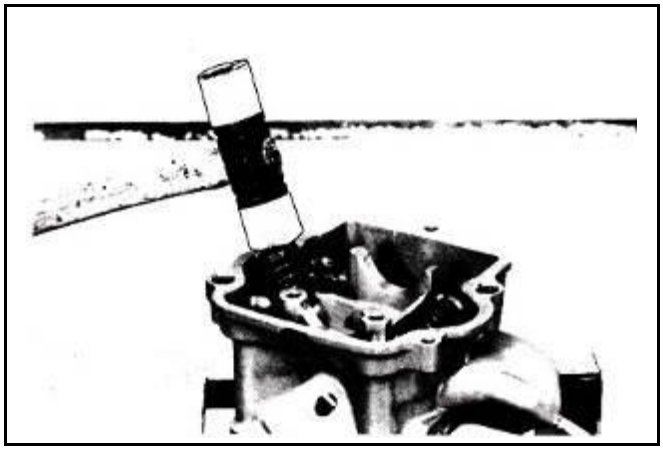
Special Service Tool:
Valve cotter remove & assembly tool
SYM-1471110-SY125



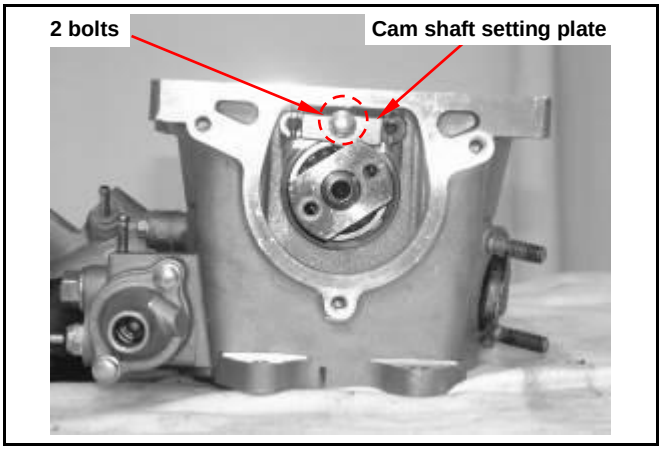
Tap the valve stems gently with a plastic hammer to make sure valve retainer and valve cotter is settled.

Caution

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



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

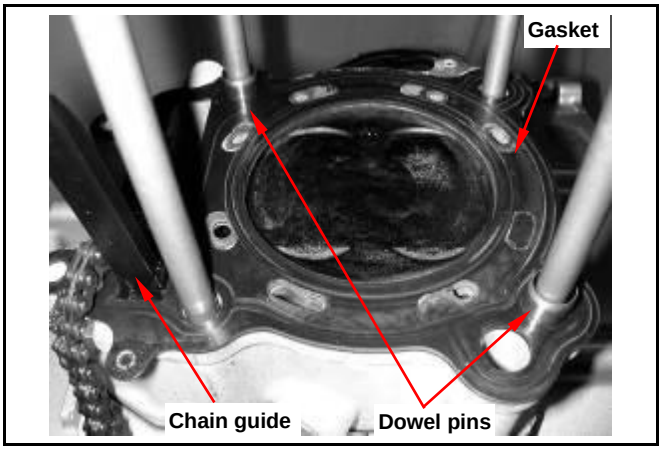


Cylinder Head Installation

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.

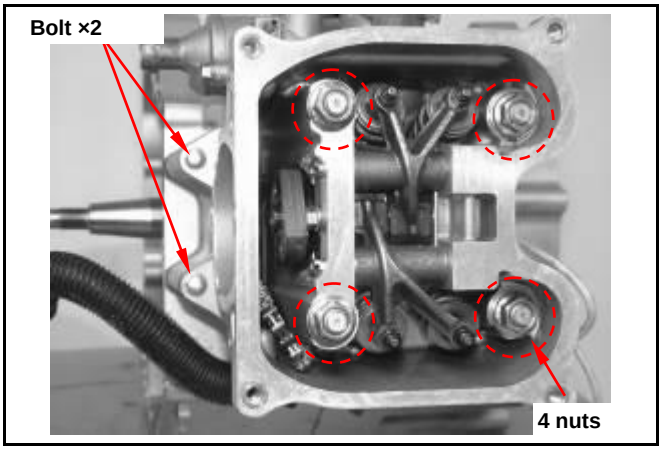
⚠ Caution

- 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.

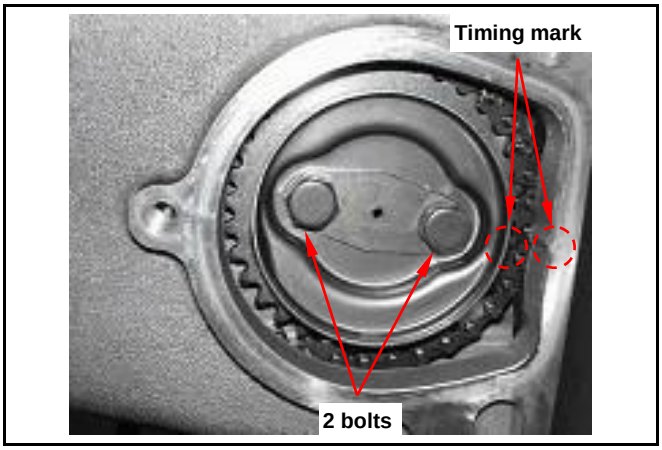
Torque value:
Nut 3.6~4.0kgf-m
Bolt 1.0~1.4kgf-m



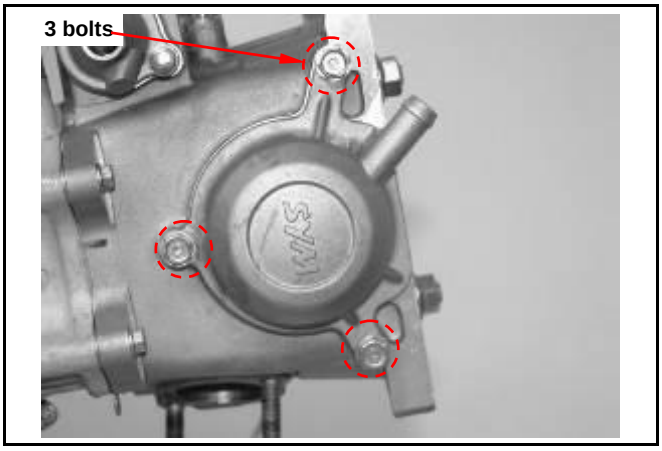
Install cam chain on to sprocket and align the timing mark on the sprocket with that of cylinder head.
Align sprocket bolt hole with camshaft bolt hole.
Tighten the sprocket mounting bolts.

⚠ Caution

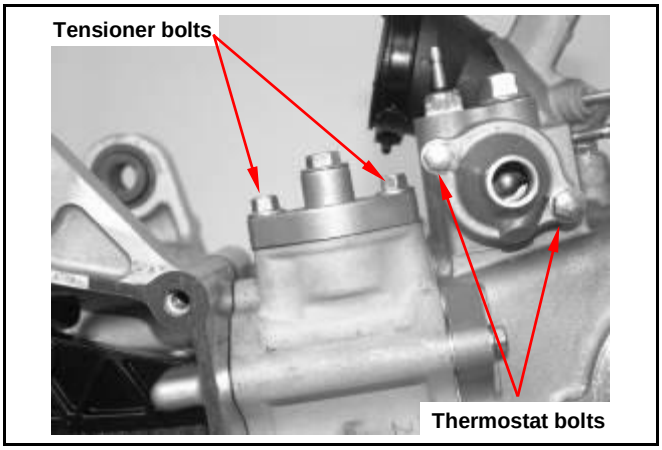
- Make sure timing marks are matched.



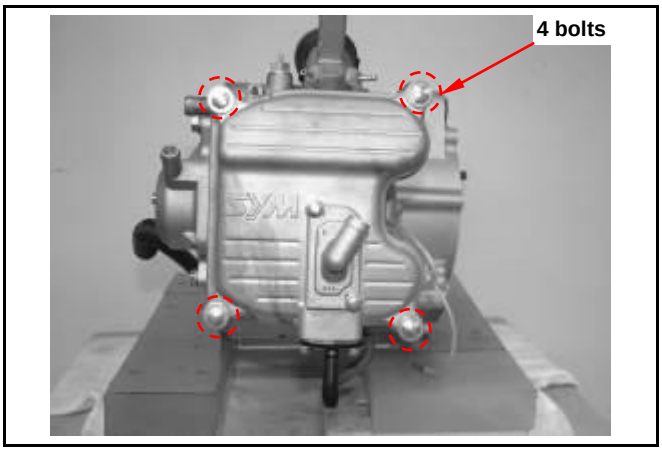
Install cylinder head side cover (3 bolts).



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).

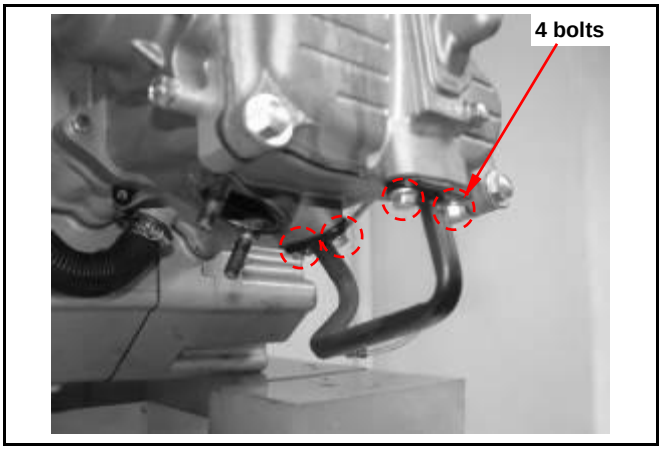


Install Air Injection system (AI) pipe. (4 bolts)
Install inlet pipe onto cylinder head.
Install and tighten spark plug.
Torque value: 0.7~1.1kgf-m

Caution

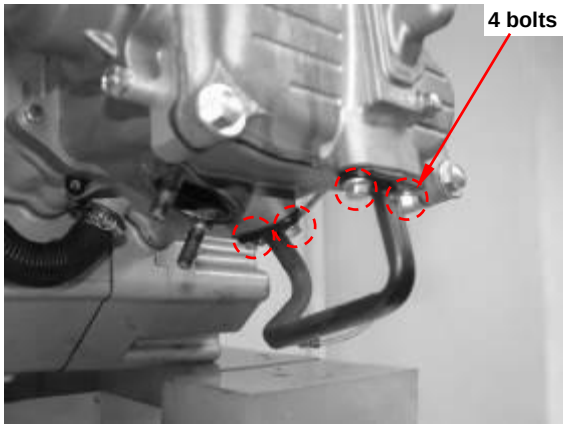
- This model is equipped with more precision 4-valve mechanism so its tighten torque can not be exceeded standard value in order to avoid causing cylinder head deformation, engine noise and leaking so that motorcycle's performance be effected.

Install the engine onto frame (refer chapter 5).

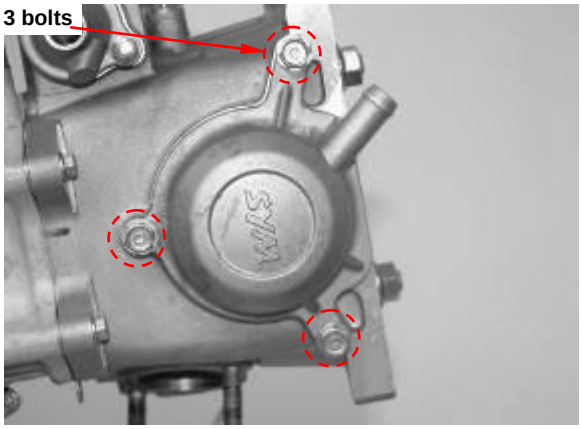


Valve Clearance Adjustment

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

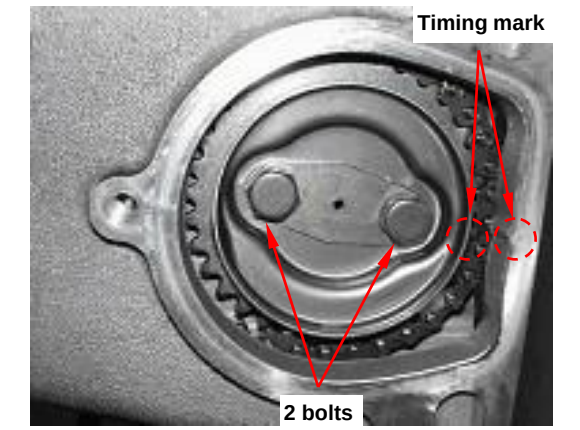


Remove the cylinder head side cover.



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 ± 0.02 mm
EX 0.15 ± 0.02 mm



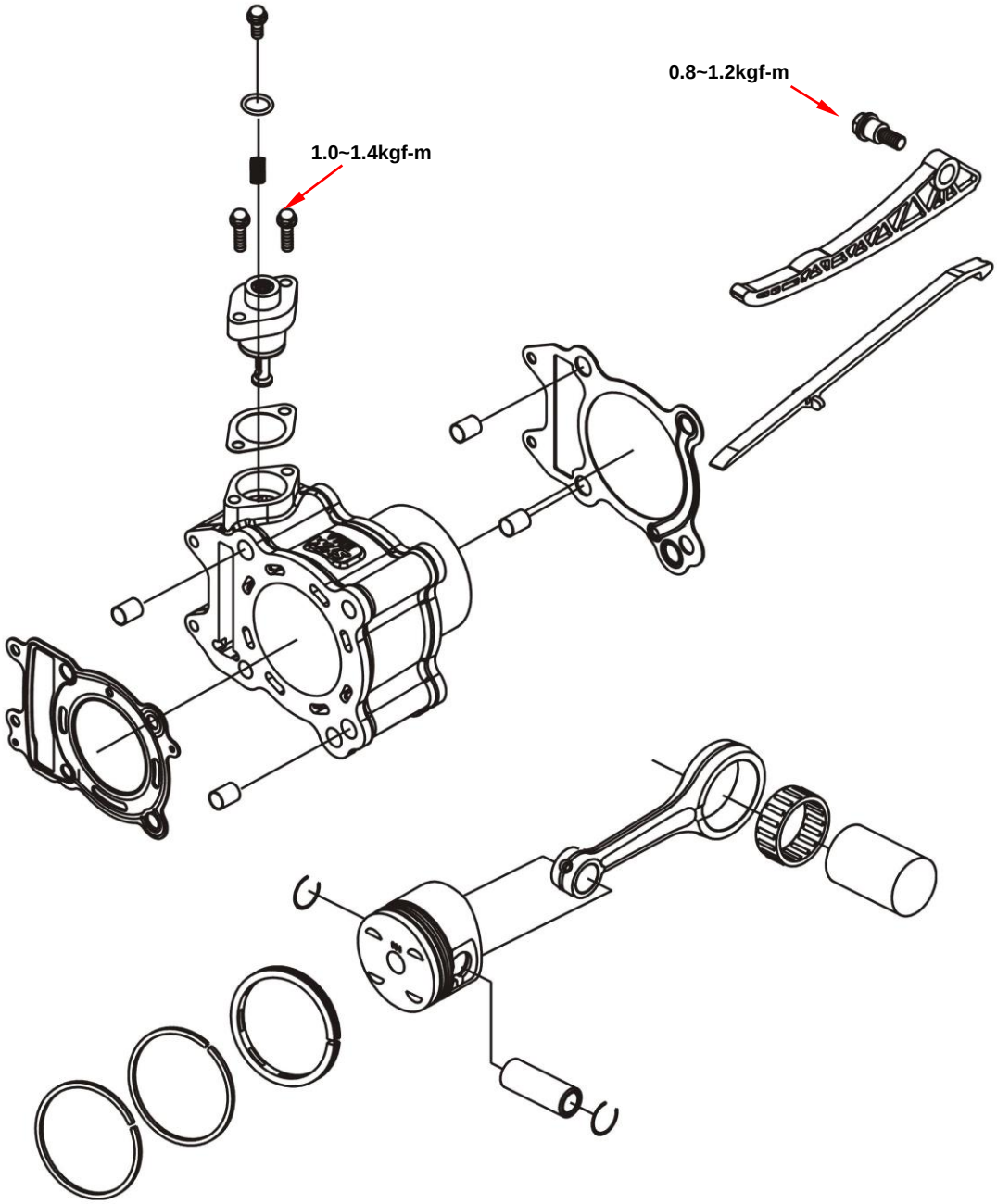
Install the cylinder head side cover.
Start the engine and make sure that engine oil flows onto the cylinder head.
Stop the engine after confirmed, and then install the cylinder head cover and AI pipe.

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.

NOTE:

Mechanism Diagram



Precautions in Operation

General Information

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

Specification

Unit：mm

Item			Standard	Limit
Cylinder	ID		74.995~75.015	73.100
	Bend		-	0.050
Piston/ Piston ring	Clearance between piston rings	Top ring	0.015~0.050	-
		2nd ring	0.015~0.050	-
	Ring-end gap	Top ring	0.150~0.300	-
		2nd ring	0.300~0.450	-
		Oil ring side rail	0.200~0.700	-
	OD of piston (2nd)		74.236~74.286	72.380
	Clearance between piston and cylinder		0.010~0.040	-
	ID of piston pin boss		17.002~17.008	-
OD of piston pin			16.994~17.000	16.960
Clearance between piston and piston pin			0.002~0.014	-
ID of connecting rod small-end			17.016~17.034	-

Trouble Diagnosis

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

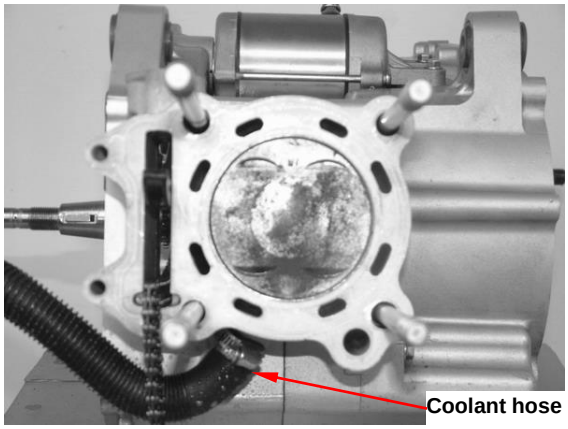
- Cylinder or piston ring worn out
- Carbon deposits on cylinder head top-side
- Piston pin hole and piston pin wear out

Engine Overheat

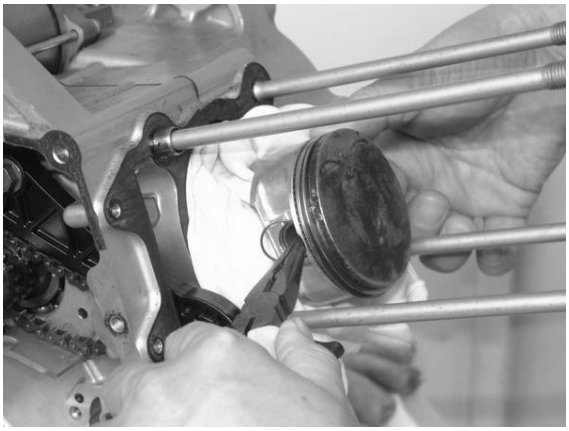
- Carbon deposits on cylinder head top side
- Cooling pipe clogged or not enough in coolant flow

Cylinder and 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.



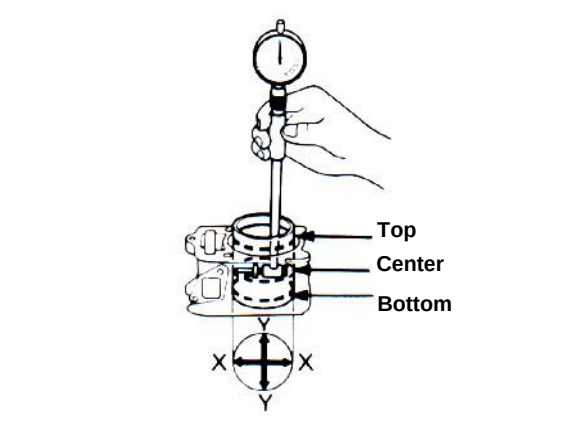
Remove cylinder gasket and dowel pin.
Clean up all residues or foreign materials from the two matching surfaces of cylinder and crankcase.

⚠ Caution

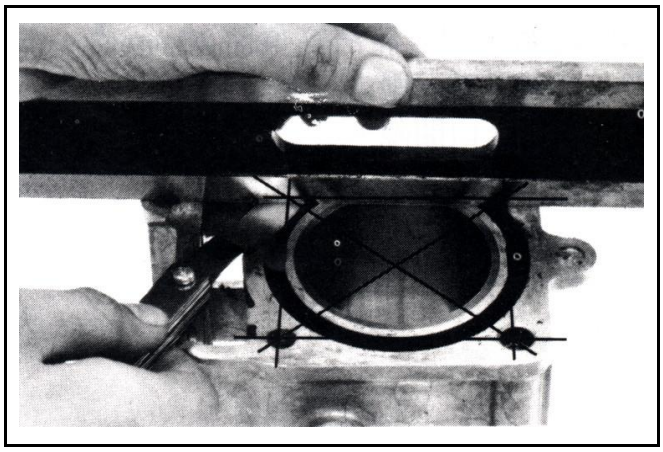
- Soap the residues into solvent so that the residues can be removed more easily.

Inspection

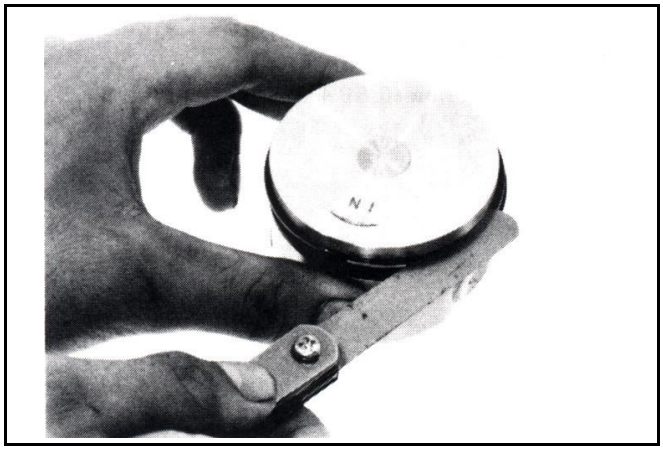
Check if the inner diameter of cylinder is wear out or damaged.
In the 3 positions, top, center and bottom, of cylinder, measure the X and Y values respective in the cylinder.



Check cylinder if warp.
Service limit: 0.05 mm



Measure clearance between piston rings and grooves.

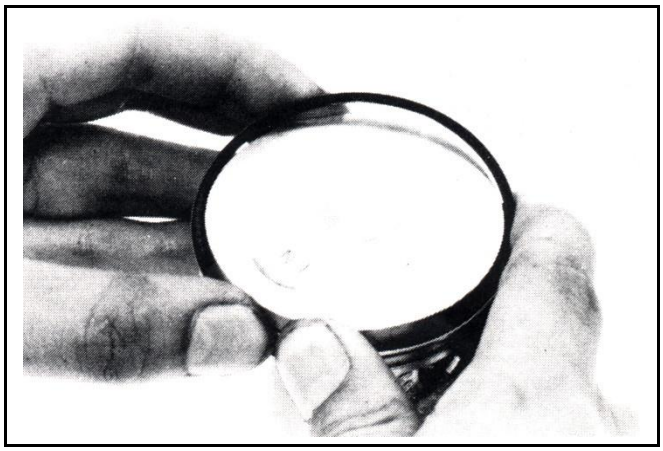


Remove piston rings

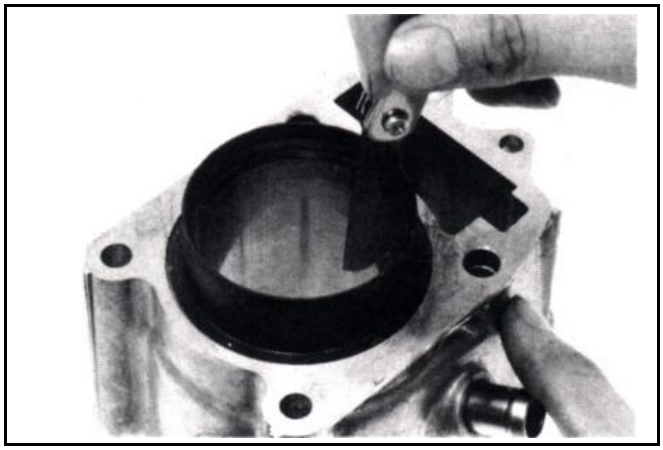
Check if the piston rings are damaged or its grooves are worn.

⚠ Caution

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

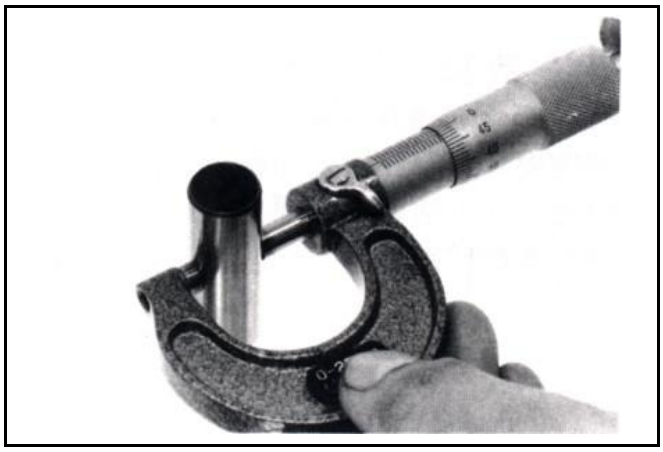


Place piston rings respective into cylinder below 20 mm of cylinder top. In order to keep the piston rings in horizontal level in cylinder, push the rings with piston.



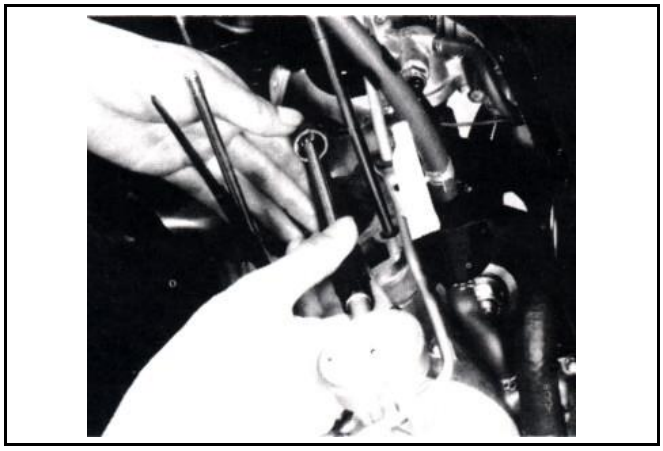
Measure the outer diameter of piston pin.

Service Limit: 16.96 mm

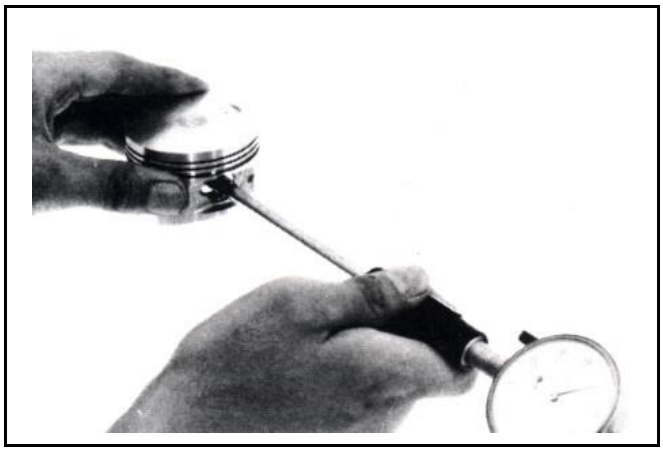


Measure the inner diameter of connecting rod small end.

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.



Measure piston outer diameter.

⚠ Caution

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

Service limit：72.380 mm

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

Piston Ring Installation

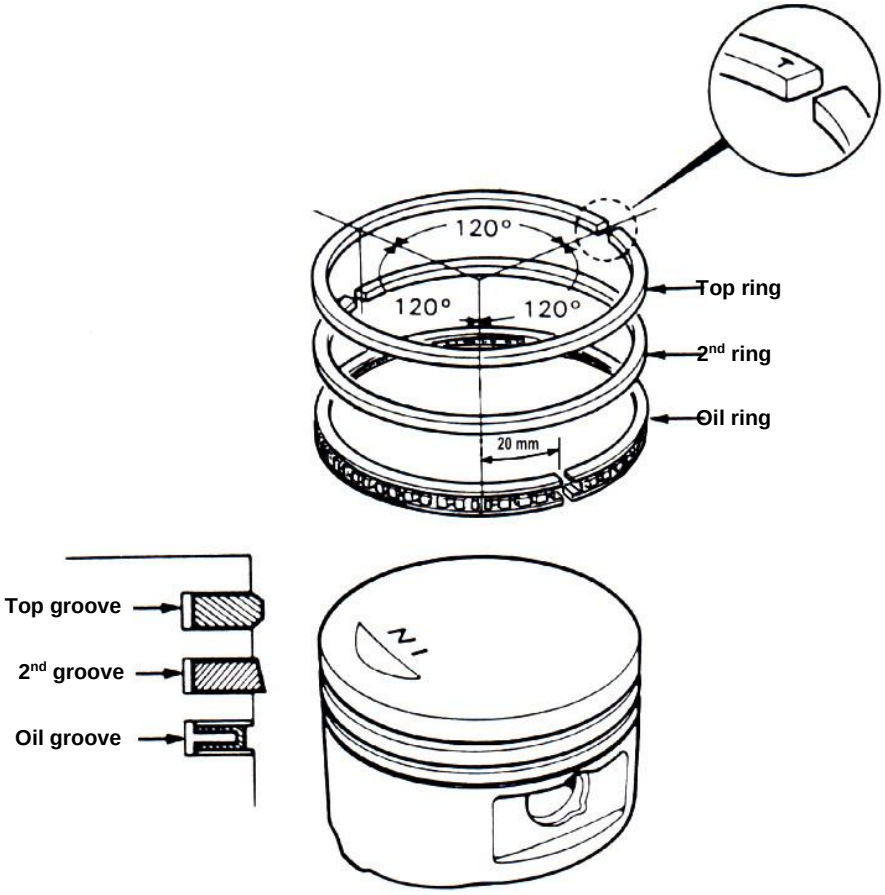
Clean up piston top, ring groove, and piston surface.

Install the piston ring onto piston carefully.

Place the openings of piston ring as diagram shown.

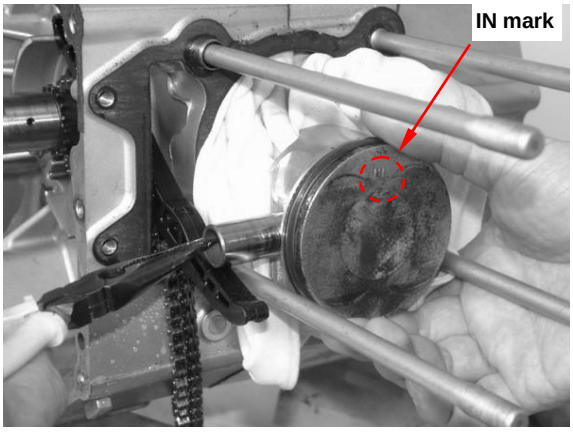
⚠ Caution

- 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

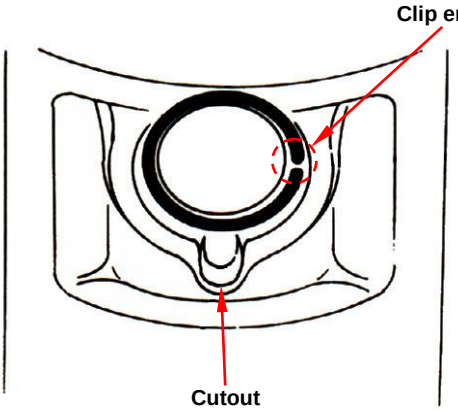
Install piston and piston pin, and place the IN marks on the piston top side forward to inlet valve.



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.



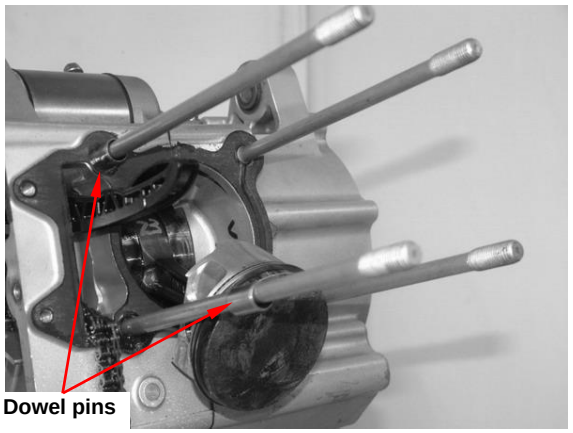
Cylinder Installation

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.

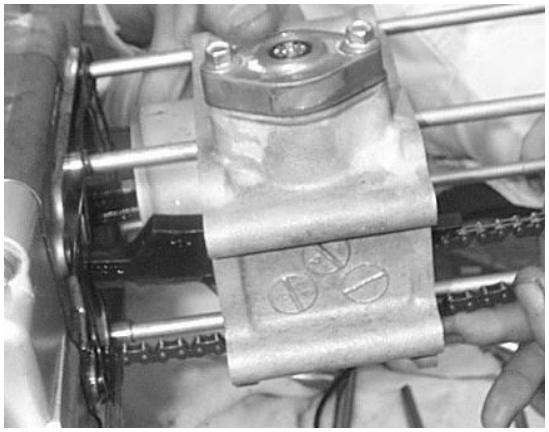
Install dowel pins and new cylinder gasket.



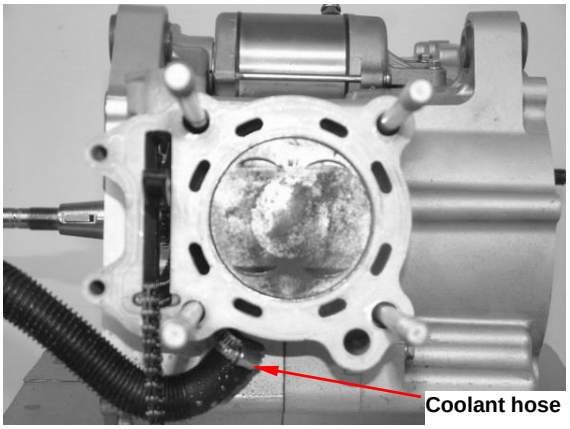
Coat some engine oil to inside of cylinder, piston and piston rings.
Care to be taken when installing piston into cylinder. Press piston rings in one by one as installation.

⚠ Caution

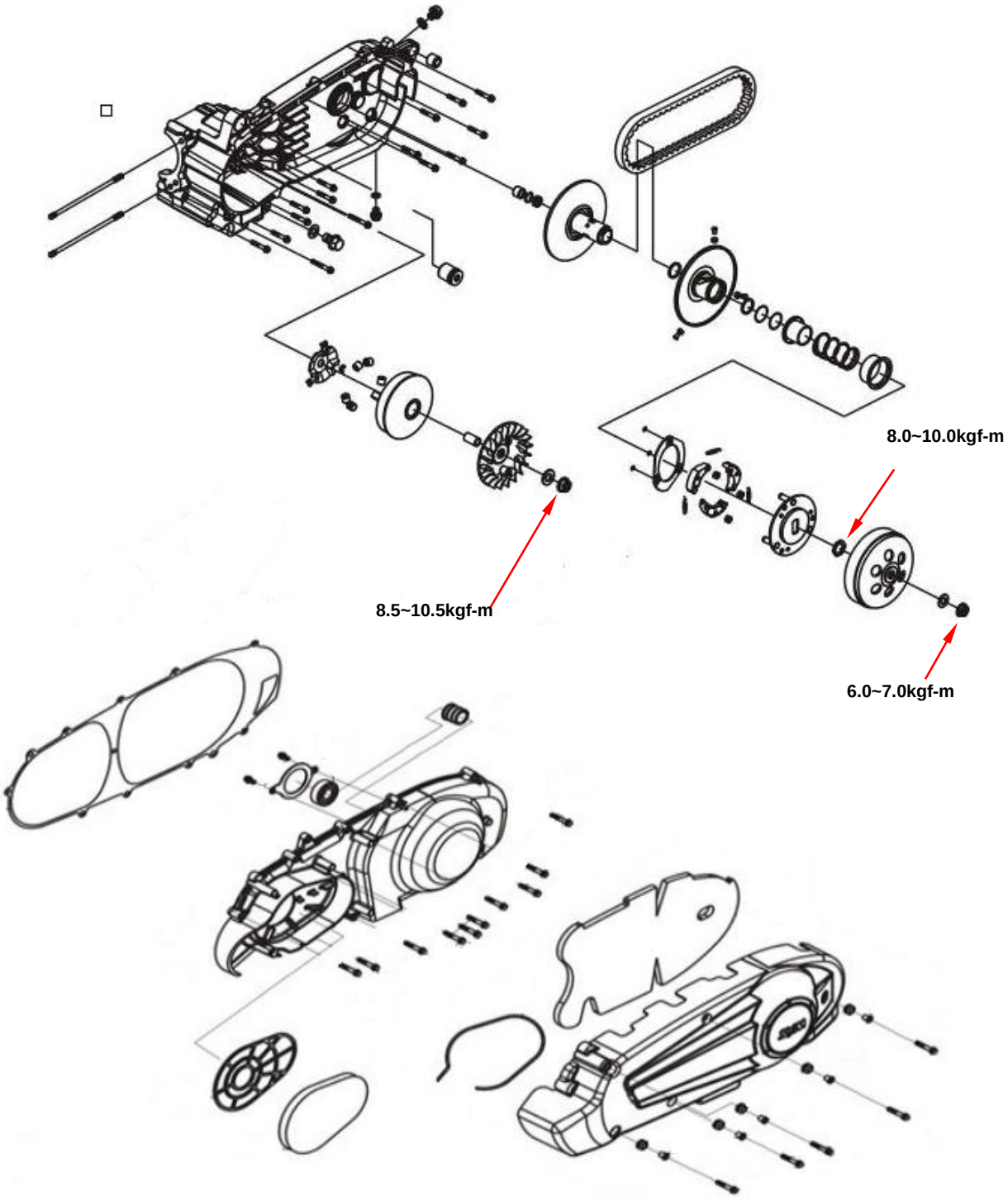
- Do not push piston into cylinder forcefully because piston and piston rings will be damaged.



Install coolant hose onto cylinder.
Install cylinder head (refer to Chapter 6).



Mechanism Diagram



Maintenance Precaution

Precautions in Operation

- 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
Driving belt width	23.200 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	24.920~25.080 mm	19.000 mm
ID of clutch outer	144.9~145.1 mm	-
Thickness of clutch weight	3.000 mm	2.000 mm
Free length of driven pulley spring	102.400 mm	97.400 mm
OD of driven pulley boss	40.950~40.990 mm	40.930 mm
ID of driven face	41.000~41.050 mm	41.070 mm
Weight of weight roller	17.700~18.300 g	17.200 g

Torque value

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

Special Service Tools

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

Trouble Diagnosis

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

Shudder or misfire when driving

1. Broken clutch weight
2. Worn clutch weight

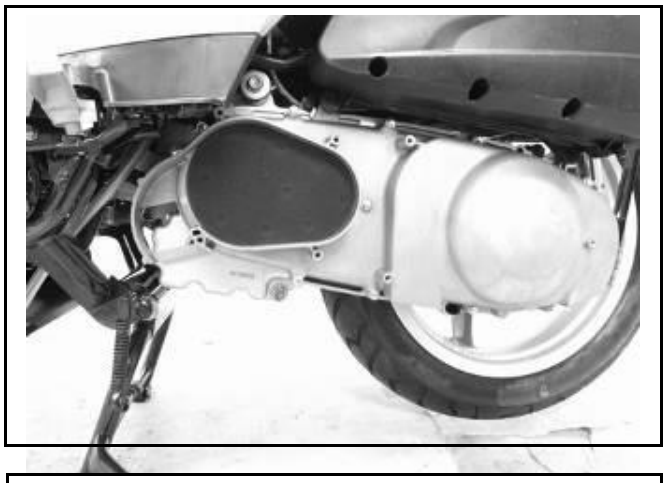
Insufficient horsepower or poor high speed performance

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

Left Crankcase Cover

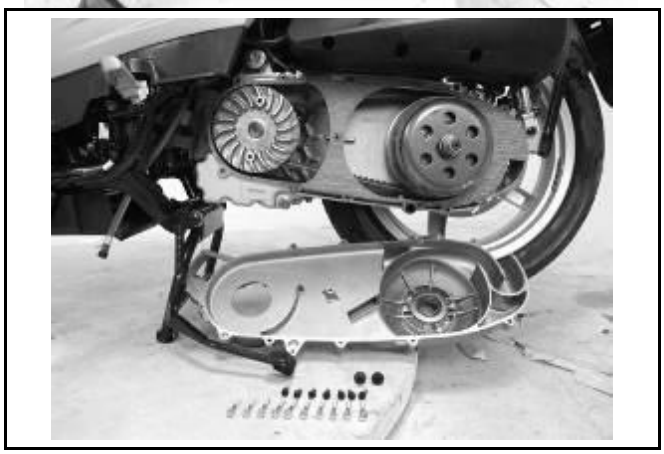
Left crankcase cover removal

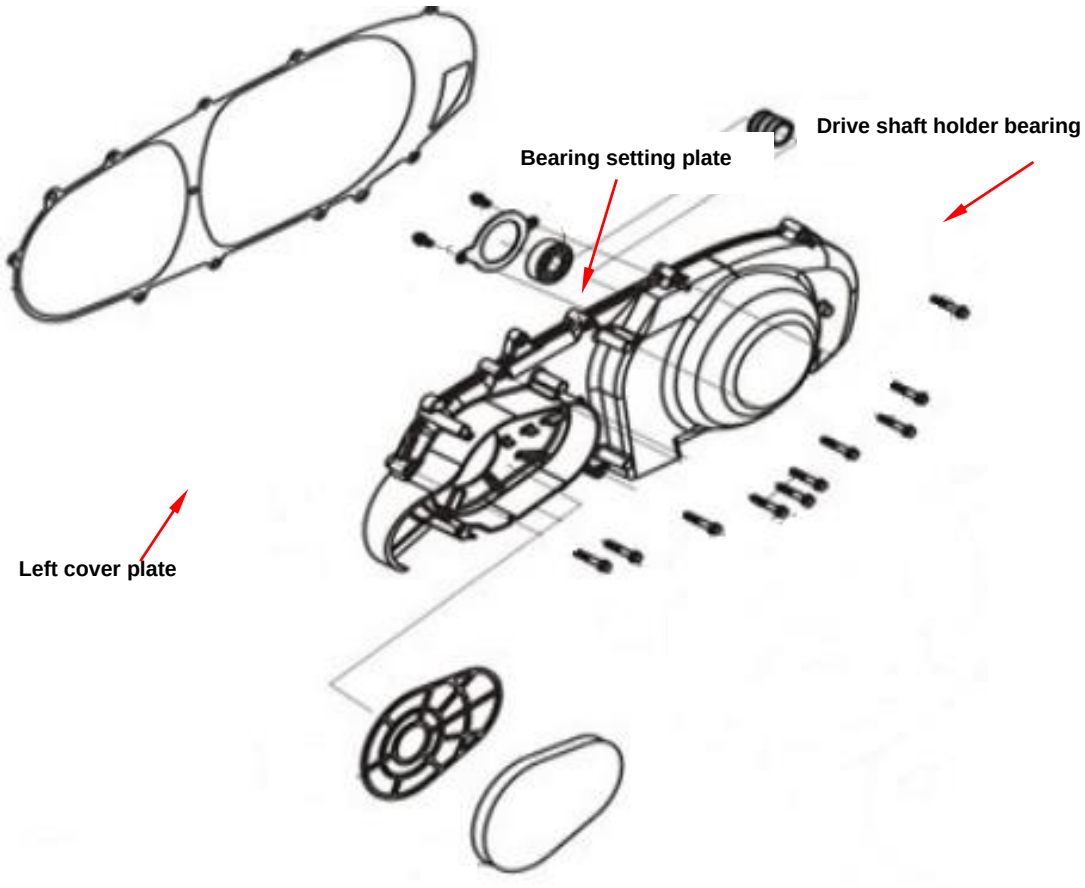
Loosen 4 bolts from left side crank out cover & remove it.
Remove left crankcase cover. (10 bolts)
Remove 2 dowel pin and gasket.



Left crankcase cover install

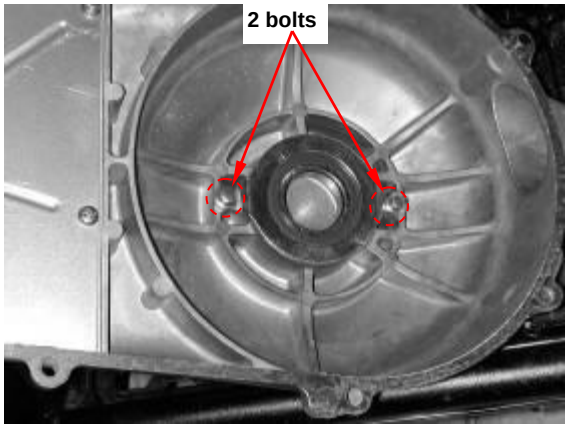
Install left crankcase cover in the reverse procedures of removal.





Left crankcase cover inspection

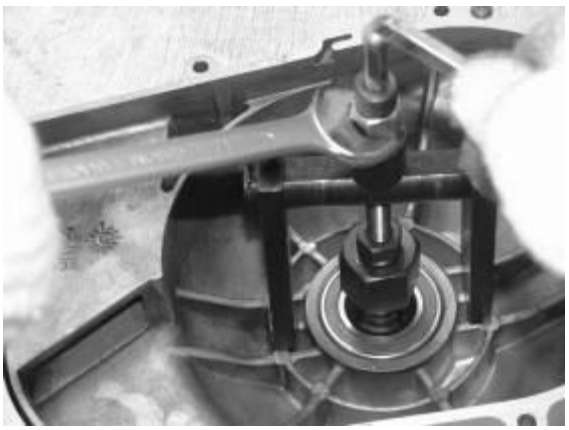
Remove 2 bolts to remove left crankcase cover bearing setting plate.



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

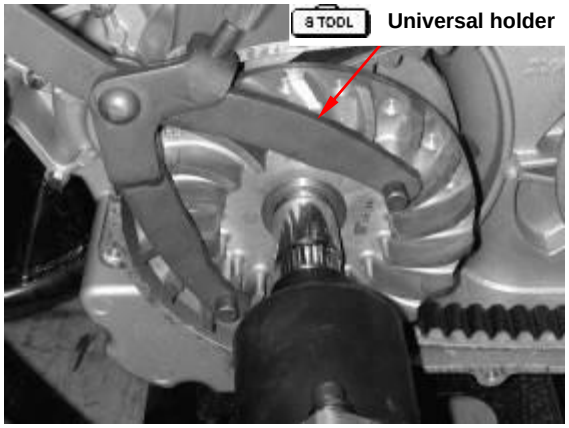


Install bearing with special service tools.
Special tools:
Right crank case bearing 6201 assembles tool
SYM-9614000-HMA 6201

Drive Belt

Removal

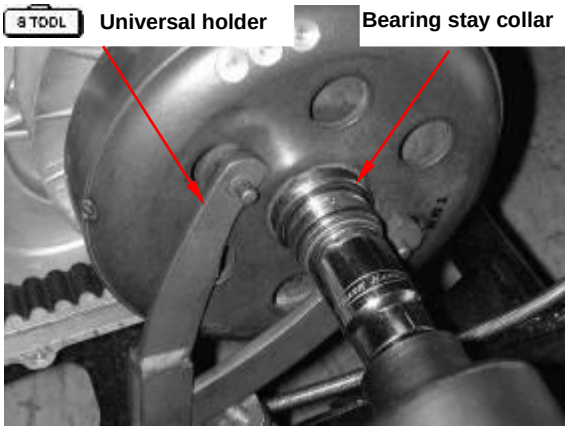
Remove left crankcase cover.
Hold drive face with universal holder, and remove nut and drive face.
Special Tool：Universal holder



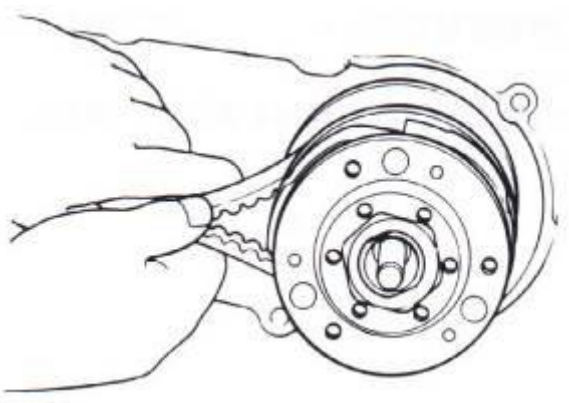
Hold clutch outer with universal holder, and remove nut, bearing stay collar and clutch outer.

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.

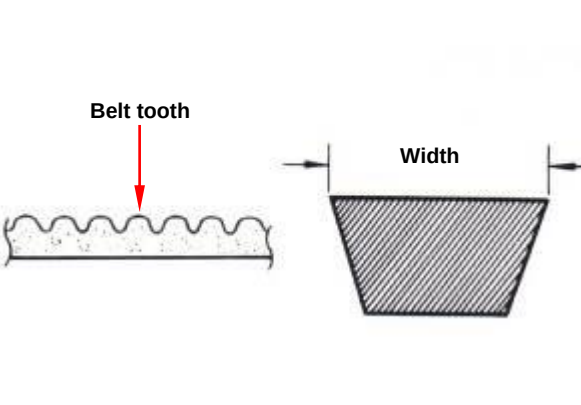


Inspection

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.

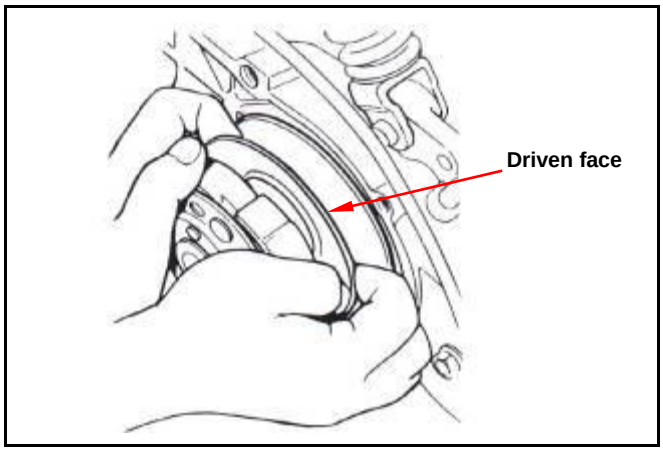


Installation

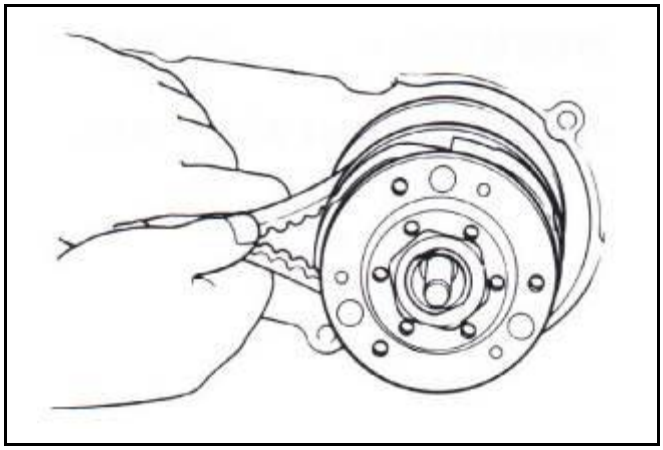
Caution

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

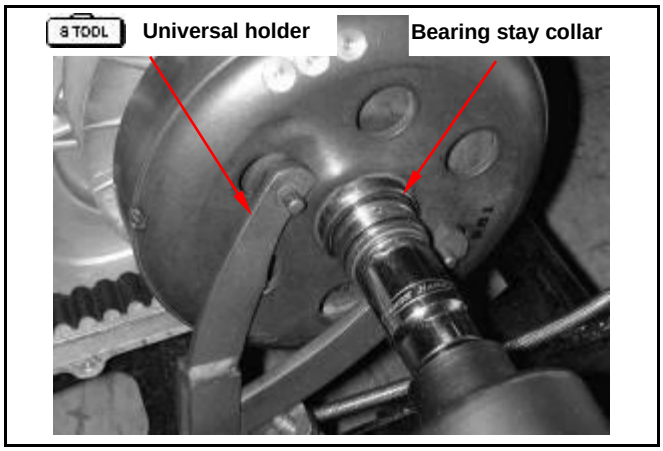
Install drive belt onto driven pulley.



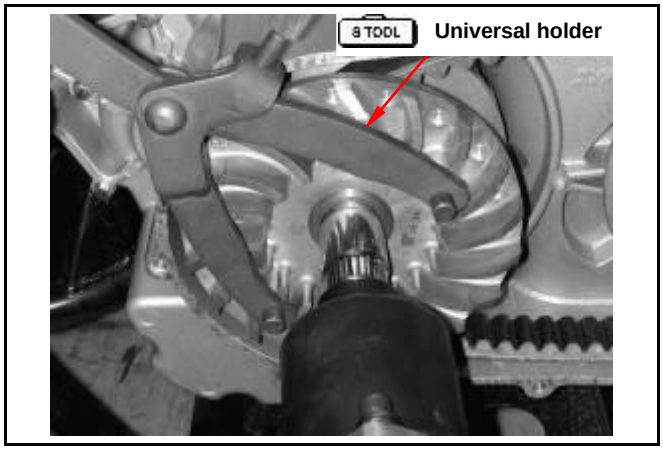
Install the driven pulley that has installed the belt onto drive shaft.
On the drive belt another end to the movable drive face.



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: 6.0~7.0kgf-m



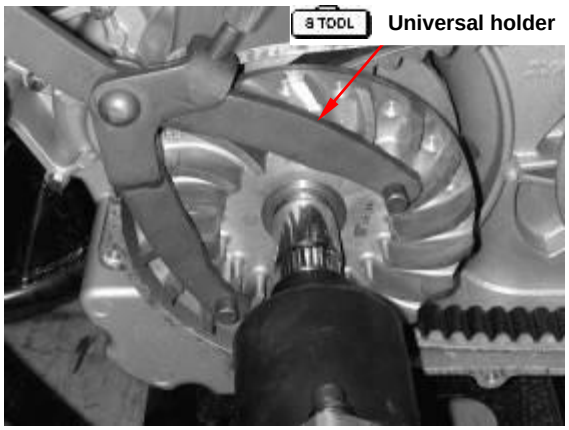
Install the drive face, washer and drive face nut.
Hold drive face with universal holder, and then tighten nut to specified torque value.
Torque value: 8.5~10.5kgf-m



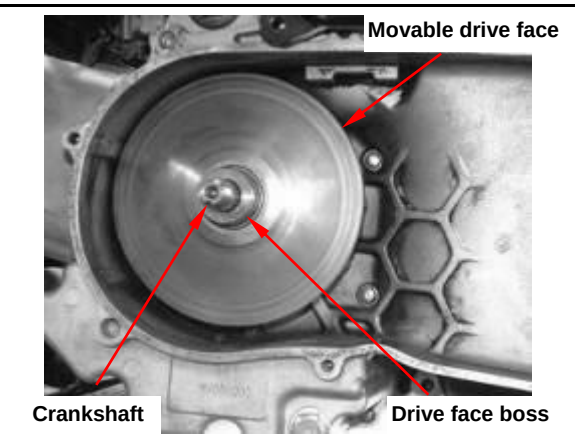
Drive Face

Removal

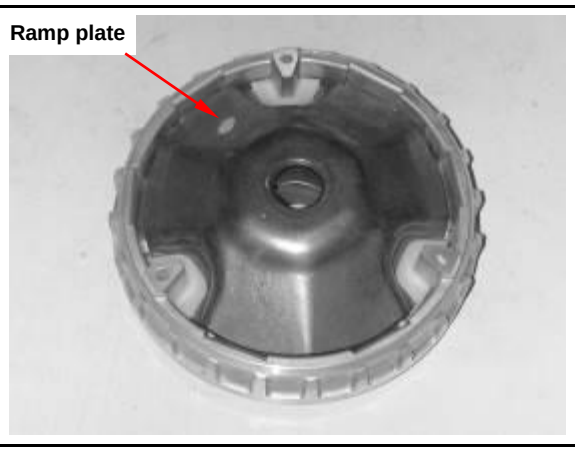
Remove left crankcase cover.
Hold drive face with universal holder, and then remove drive face nut.
Remove drive face and drive belt.



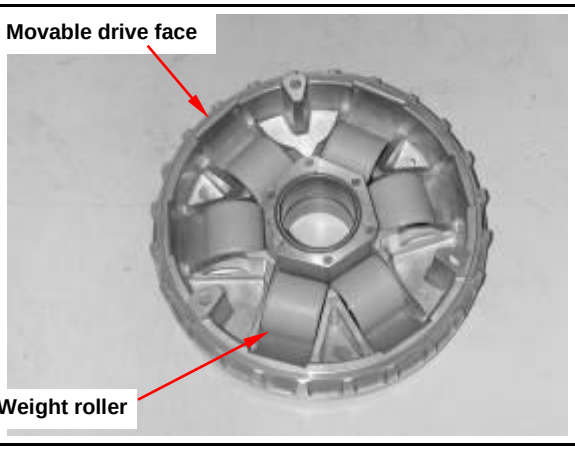
Remove movable drive face comp and drive face boss from crankshaft.



Remove ramp plate.

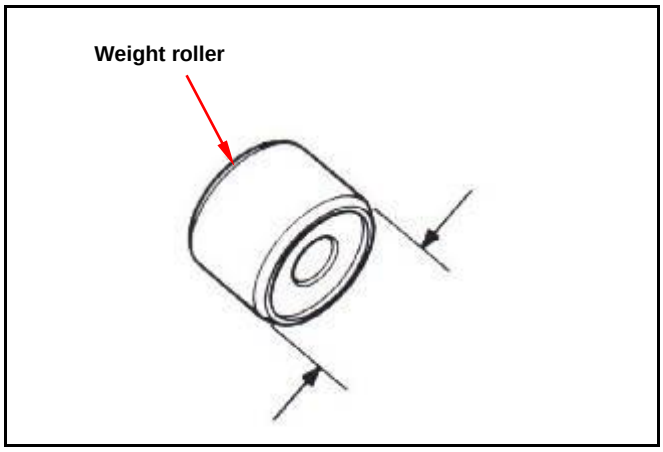


Remove weight rollers from movable drive face.



Inspection

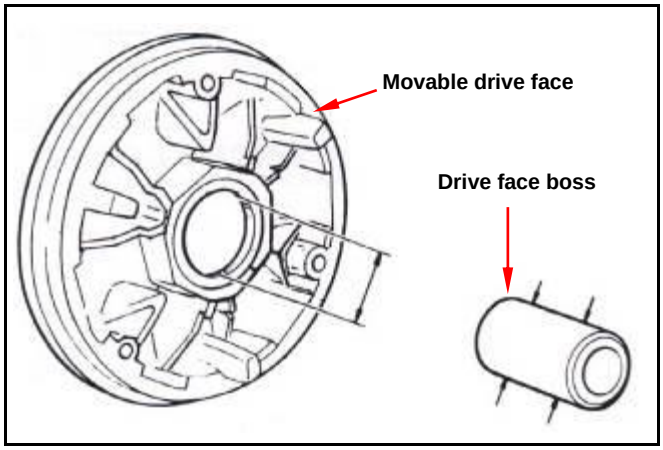
The weight rollers are to press movable drive face by means of centrifuge force.
Thus, if weight rollers are worn out or damaged, the centrifuge force will be affected.
Check if rollers are worn or damaged. Replace it if necessary.
Measure each roller's outer diameter. Replace it if exceed the service 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: 29.926 mm

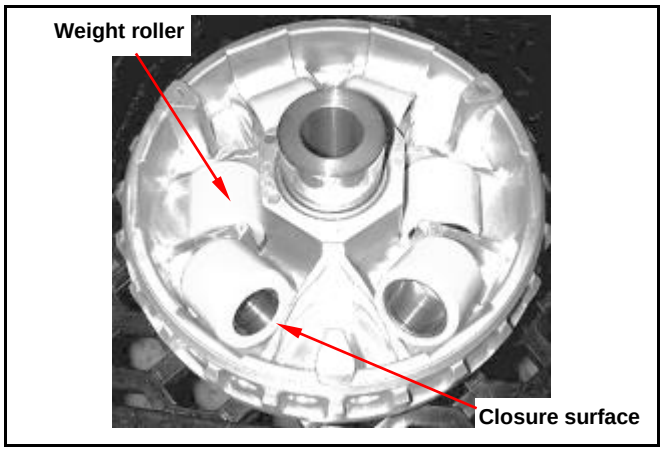
Measure the inner diameter of movable drive face, and replace it if it exceed service limit.
Service limit: 30.060 mm



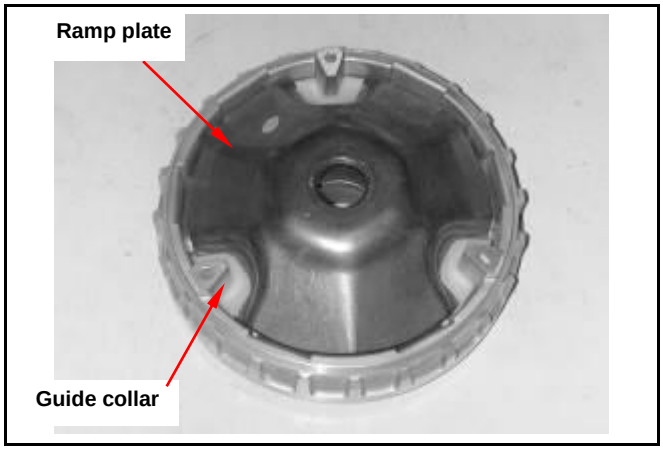
Reassembly/installation
Install weight rollers.

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.



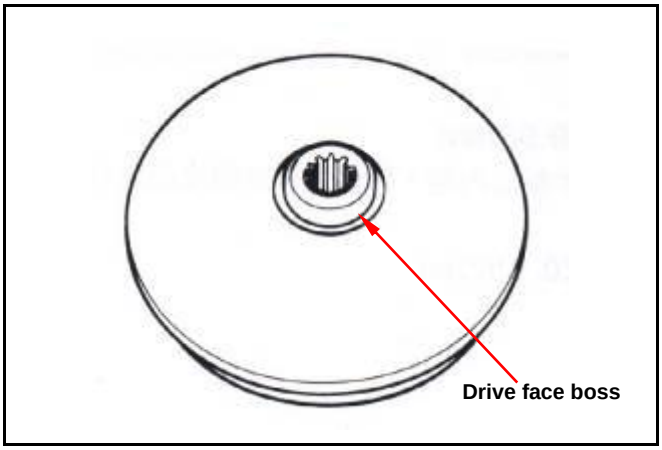
Install ramp plate.



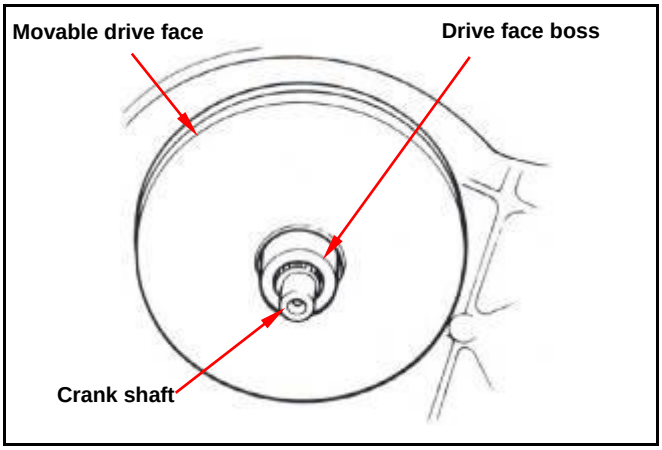
With 4~5g grease spreads wipes drives in the movable drive face axis hole.
Install drive face boss.

Caution

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

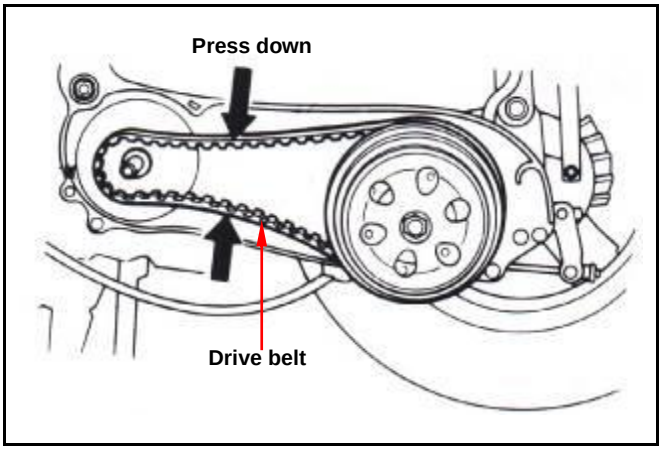


Install movable drive face comp. onto crankshaft.



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.

Clutch Outer/Driven Pulley

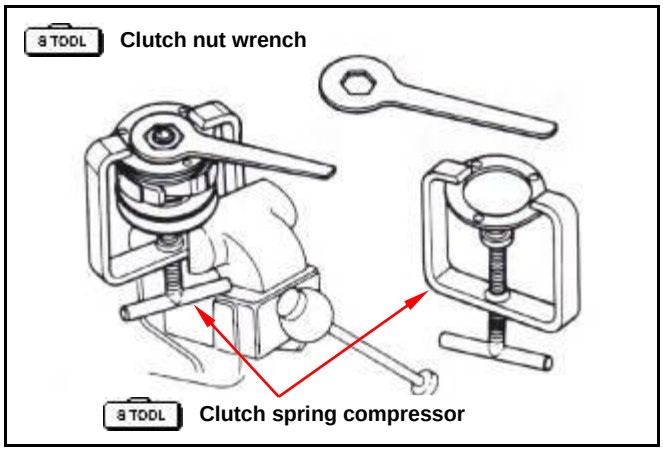
Disassembly

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.

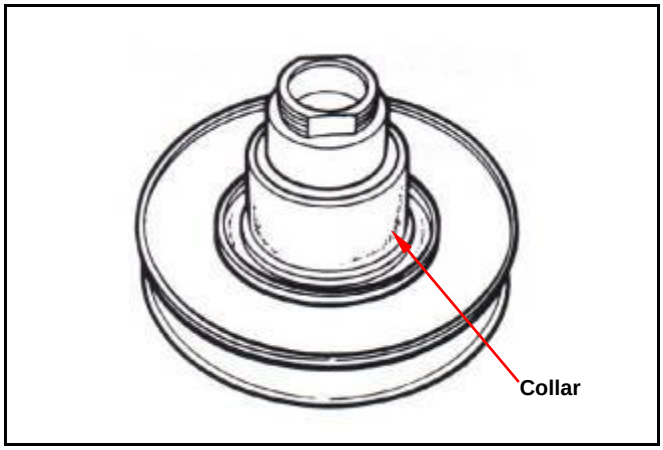
Caution

- Do not press the compressor too much.

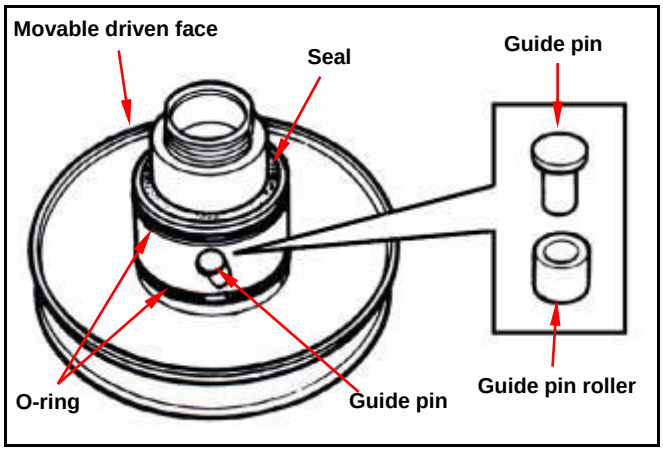
Hold the clutch spring compressor onto bench vise, and then remove mounting nut with special service tool.
Release the clutch spring compressor and remove friction plate, clutch weight and spring from driven pulley.



Remove seal collar from driven pulley.



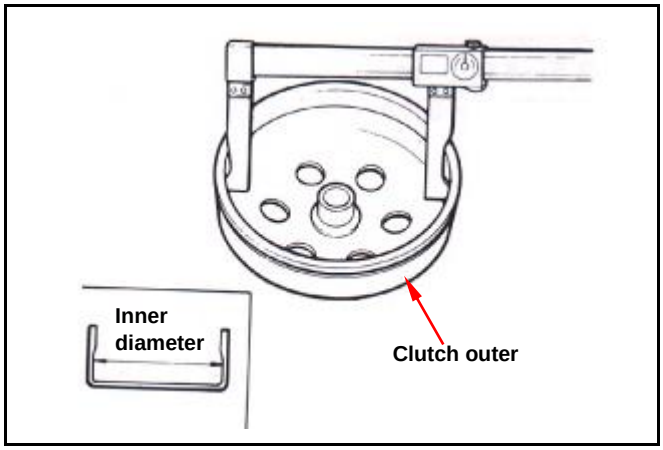
Remove guide pin, guide pin roller, and movable driven face, and then remove O-ring & oil seal seat from movable driven face.



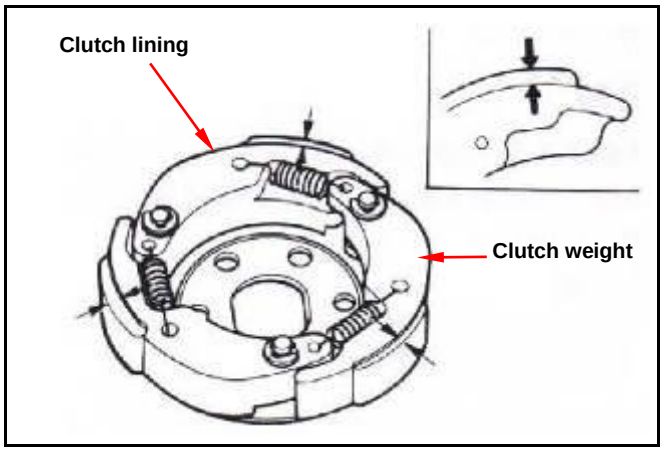
Inspection

Clutch outer

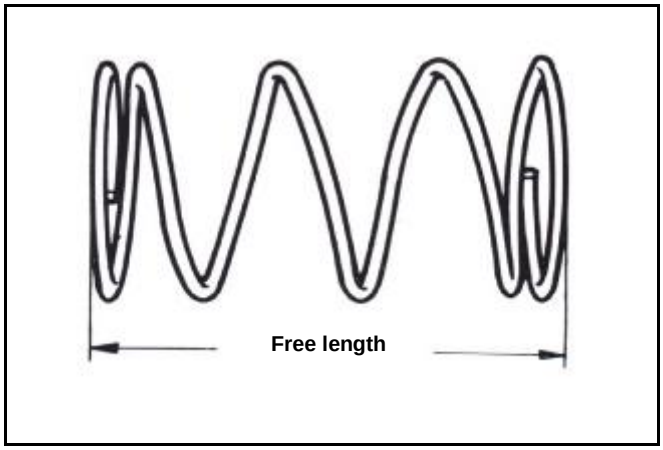
Measure the inner diameter of clutch outer.
Replace the clutch outer if exceed service limit.
Service limit: 145.450 mm



Clutch lining
Measure each clutch weight thickness. Replace it if exceeds service limit.
Service limit: 2.0 mm

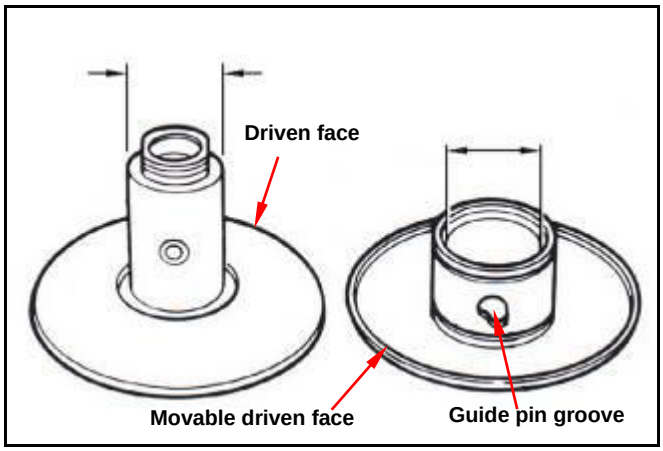


Driven pulley spring
Measure the length of driven pulley spring. Replace it if exceeds service limit.
Service limit: 97.400 mm

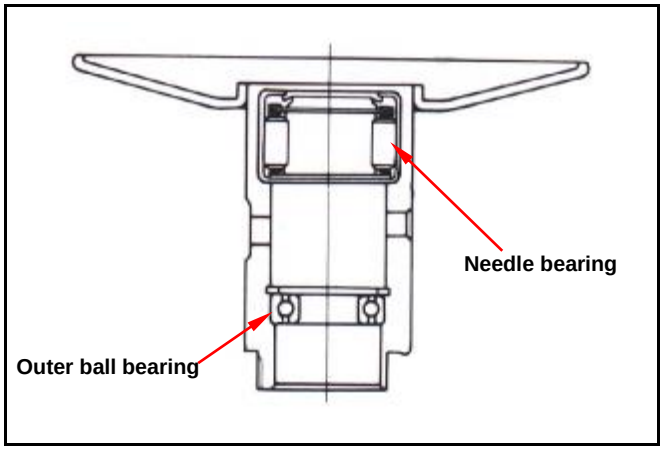


Driven pulley
Check following items:
- If both surfaces are damaged or worn.
- If guide pin groove is damaged or worn.

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.



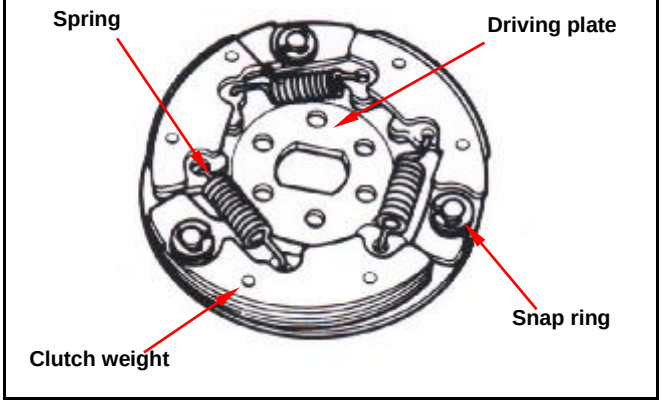
Clutch weight Replacement

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

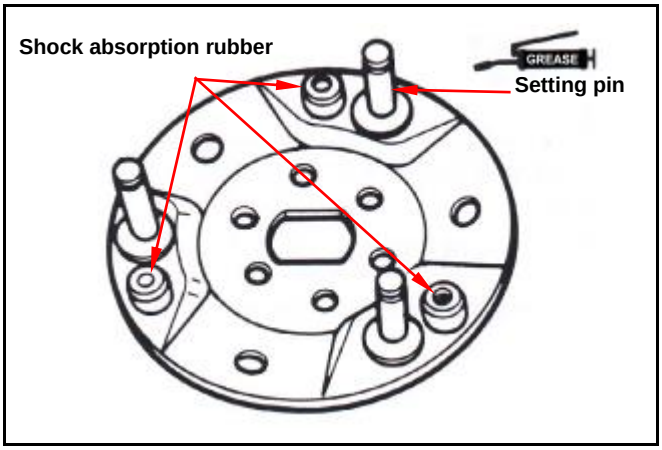
Caution

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

Check if spring is damage or insufficient elasticity.



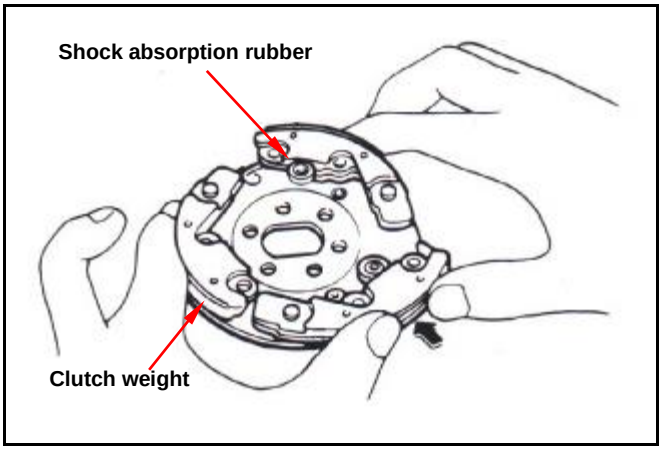
Check if shock absorption rubber is damage or deformation. Replace it if necessary.
Apply with grease onto setting pins.



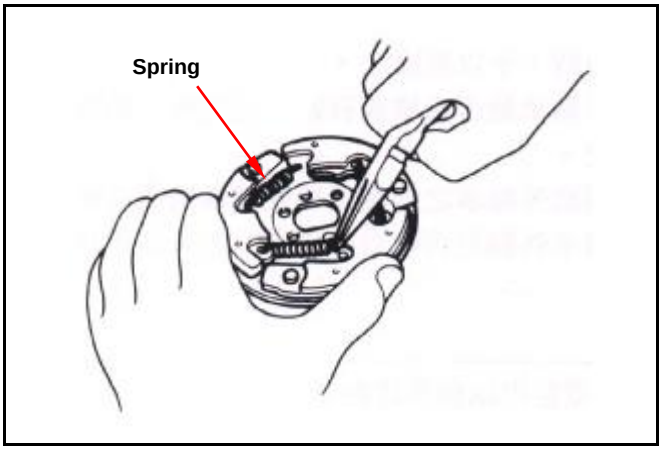
Install new clutch weight onto setting pin and then push to the specified location.
Apply with grease onto setting pins.
But, the clutch block should not be greased. If so, replace it.

Caution

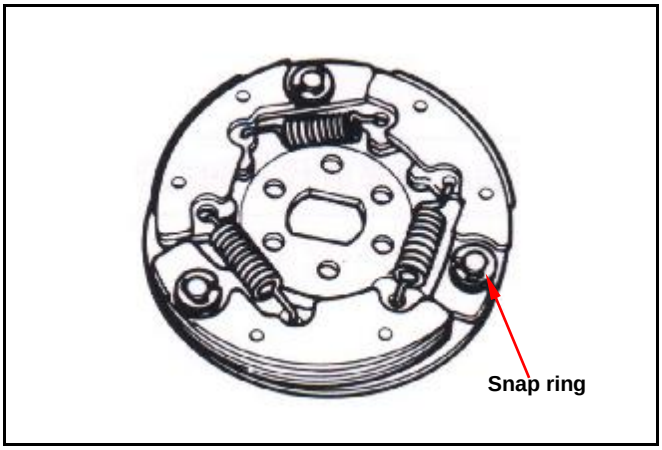
- Grease or lubricant will damage the clutch weight and affect the block's connection capacity.



Install the spring into groove with pliers.



Install snap ring and mounting plate onto setting pin.

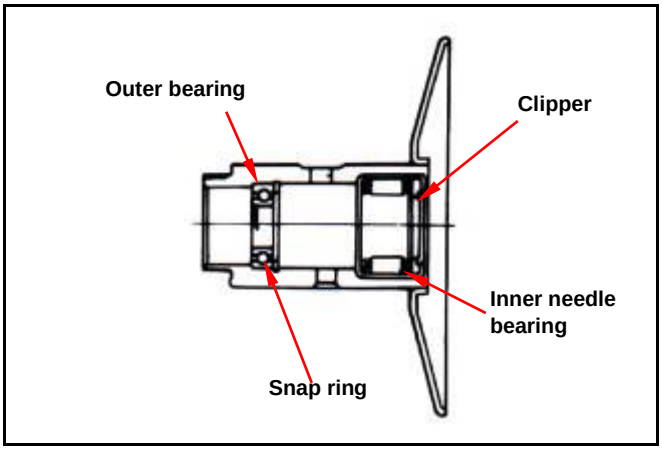


Replacement of Driven Pulley Bearing

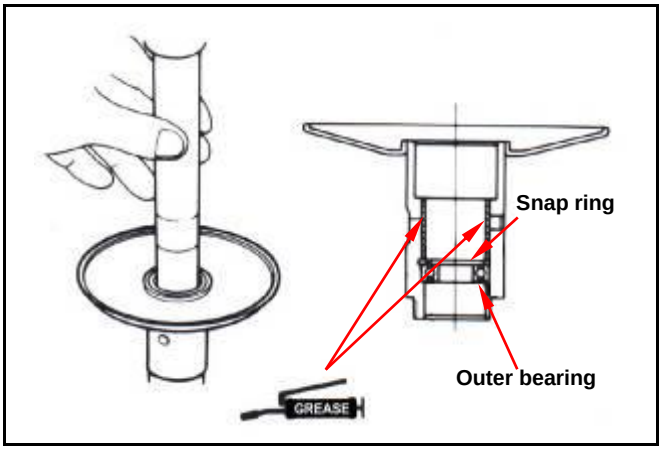
Remove inner bearing.

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.

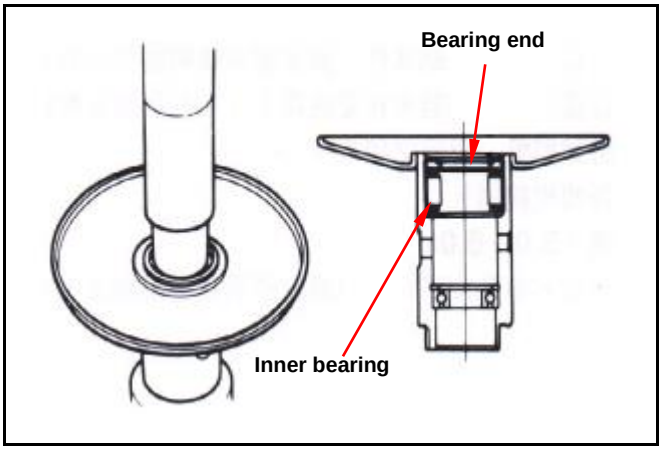


Install new inner bearing.

Caution

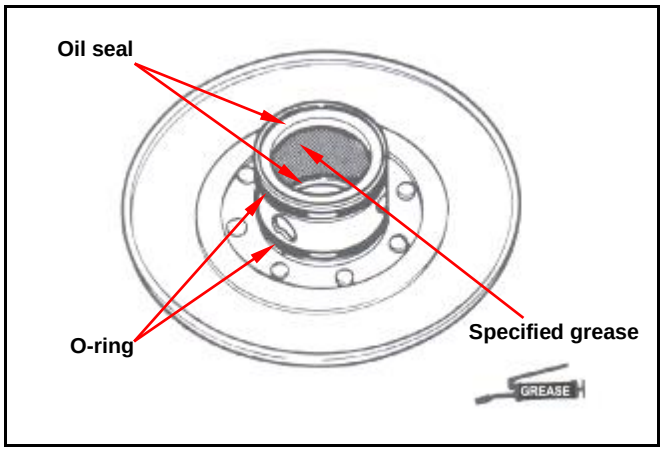
- Its sealing end should be forwarded to outside as bearing installation.
- Install needle bearing with hydraulic presser. Install ball bearing by means of hydraulic presser.

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

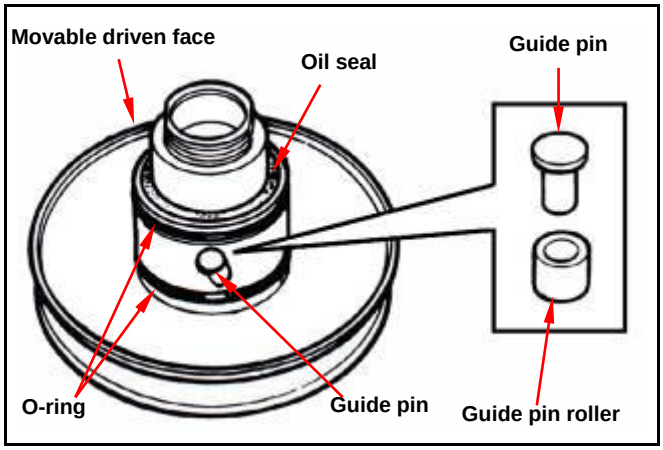


Installation of Clutch Outer/Driven Pulley Assembly

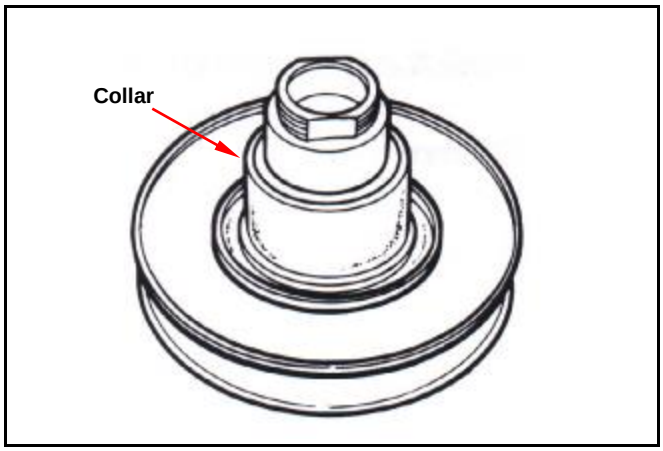
Install new oil seal and O-ring onto movable driven face.
Apply with specified grease to lubricate the inside of movable driven face.



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

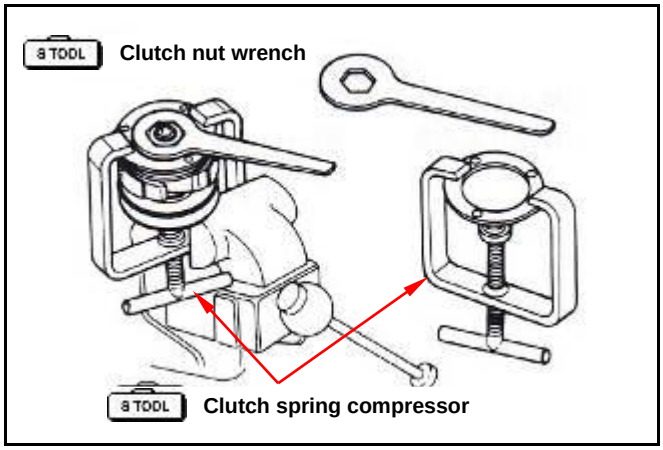


Install the collar.



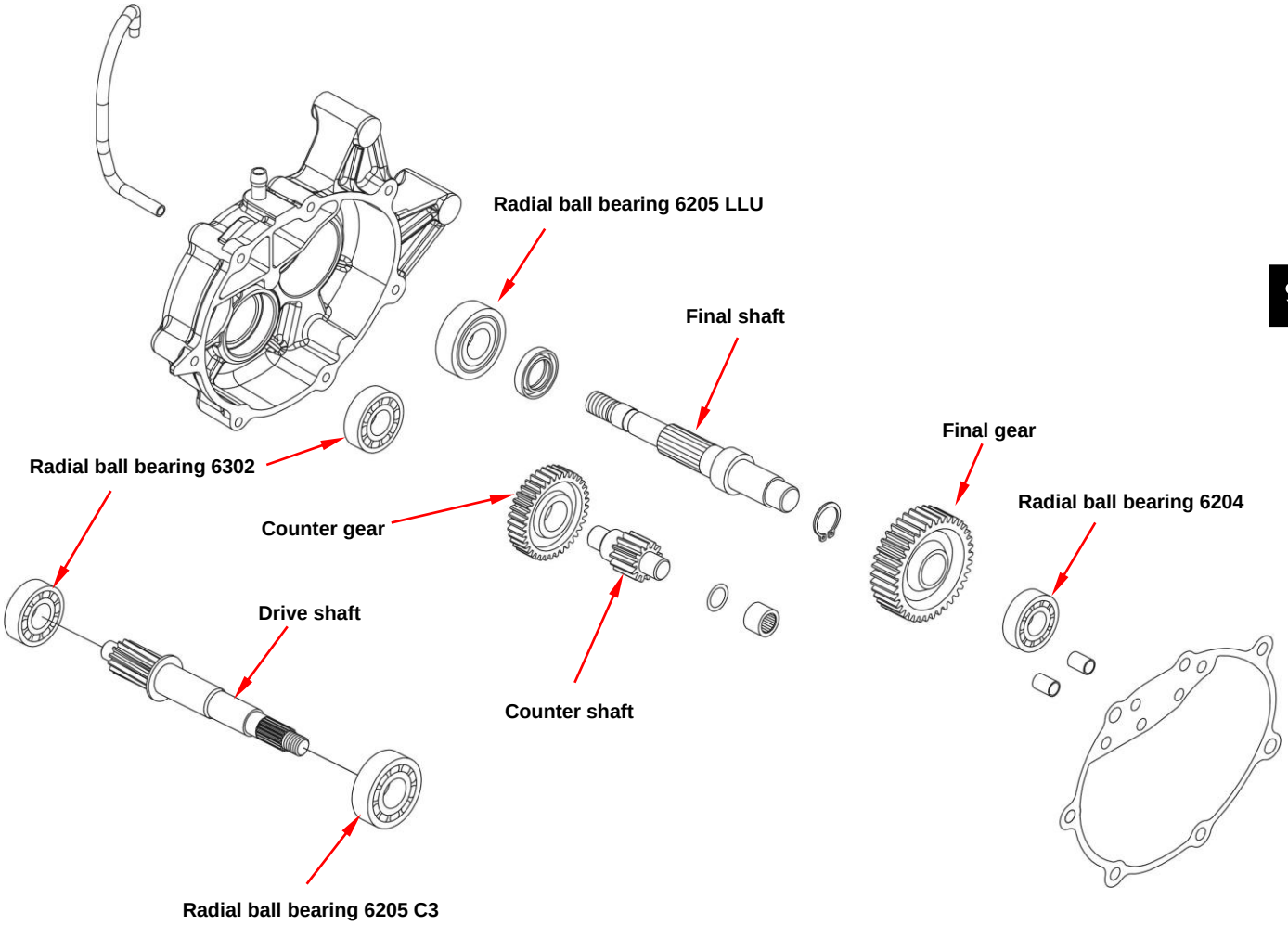
Install friction plate, spring and clutch weight into clutch spring compressor, and press down the assembly by turning manual lever until mounting nut that can be installed.
Hold the compressor by bench vise and tighten the mounting nut to specified torque with clutch nut wrench.
Remove the clutch spring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

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



NOTE:

Mechanism Diagram



Precautions in Operation

Specification

Application oil: scooter gear oil
Recommended oil: "**SYMOIL**" serial gear oils
Oil quantity: 180 c.c. (160 c.c. when replacing)

Torque value

Gear box cover	2.4~3.0kgf-m

Special tools

Bearing driver	SYM-6204024
Bearing (6205) puller	SYM-9100400 HMA RA1 6205
Drive shaft & oil seal (25*40*7) socket	SYM-9120200-HMA
Bearing (HK1516) driver	SYM-9100200-HMA HK1516
Oil seal drive 32*52*7	SYM-9125500-HMA
Inner bearing puller	SYM-6204022
Outer bearing puller	SYM-6204010
Drive shaft install puller	SYM-2341110- HMA RB1
Bearing install puller	SYM-2341100
Clutch nut wrench	SYM-9020200

Trouble Diagnosis

Engine can be started but motorcycle can not be moved.

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

Noise

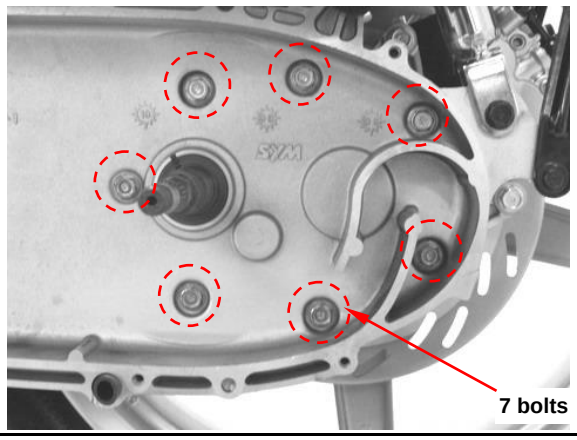
- Worn or burnt gear
- Worn gear

Gear oil leaks

- Excessive gear oil.
- Worn or damage oil seal

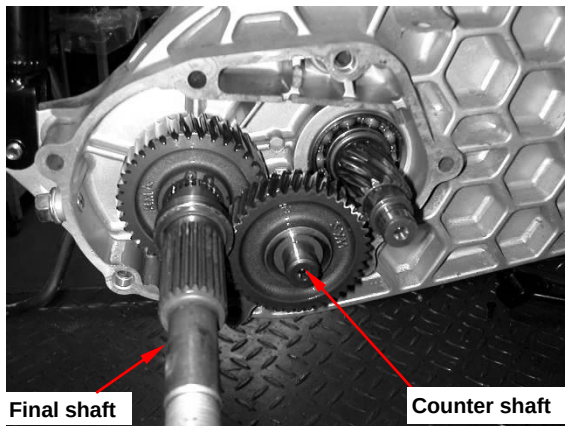
Disassembly of Final Drive Mechanism

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.

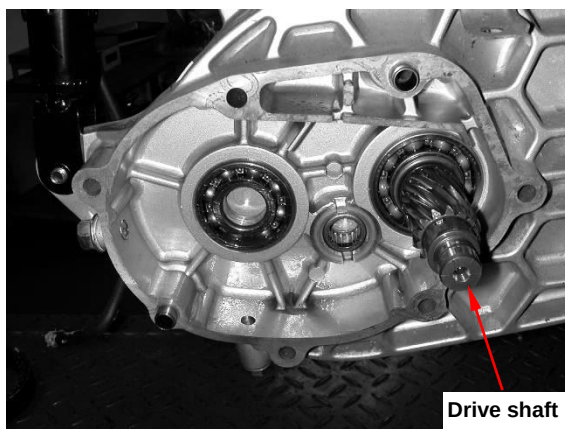
Remove final gear.
Remove counter shaft, gear and 2 washers.
Remove final shaft.



Remove the drive shaft.
Special tool:
Shaft protector

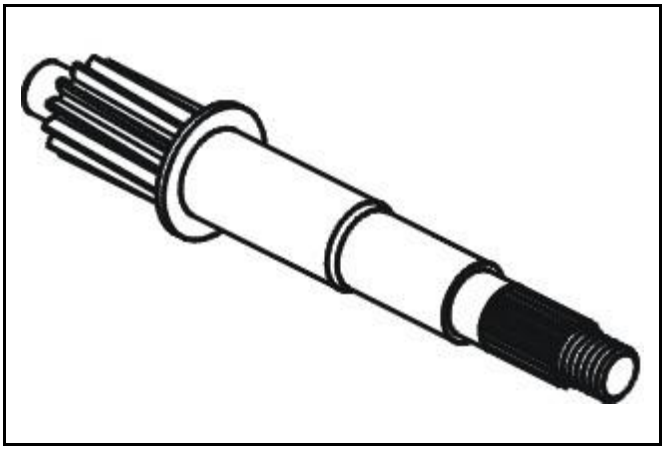
⚠ Caution

- 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.



Inspection of Final Drive Mechanism

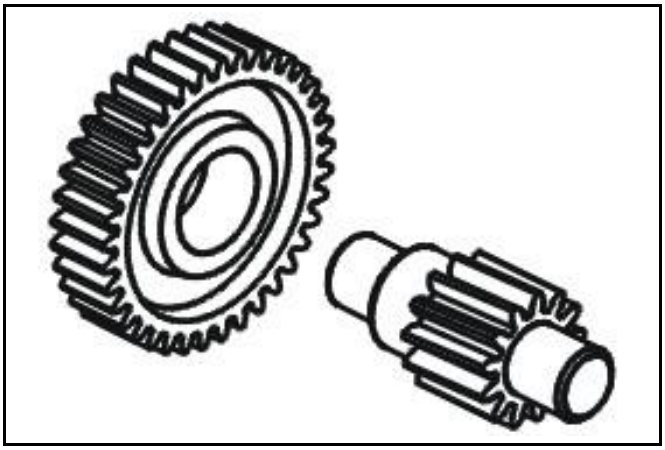
Check if the drive shaft is worn or damaged and replace it if necessary.



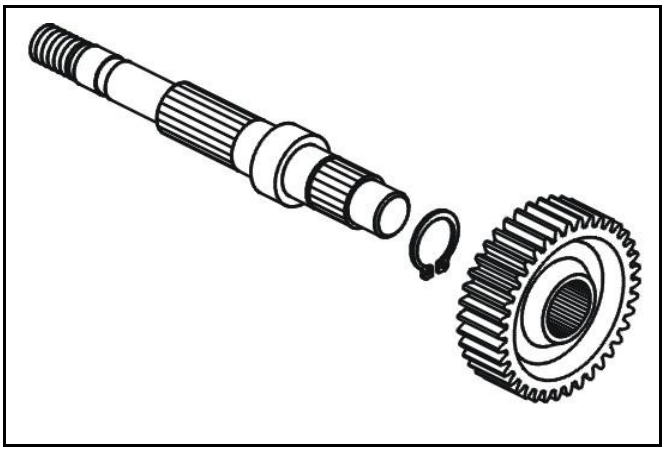
Caution

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

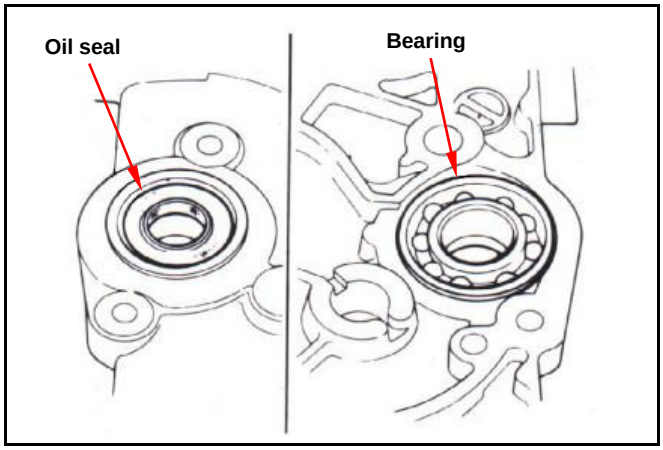
Check if the countershaft is worn or damaged, replace it if necessary.



Check if the final shaft and gear are worn or damaged, replace it if necessary.



Check bearings on gear box cover.
Rotate each bearing's inner ring with fingers.
Check if bearings can be rotated smoothly and silently, 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

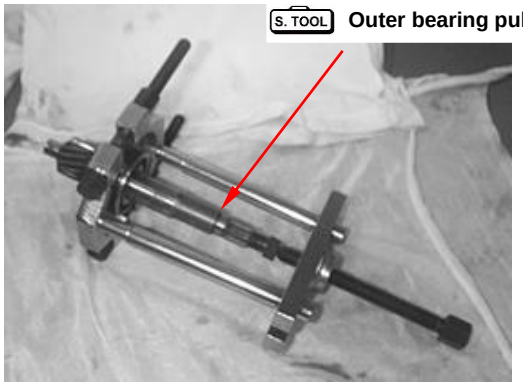
Left crankcase side

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**

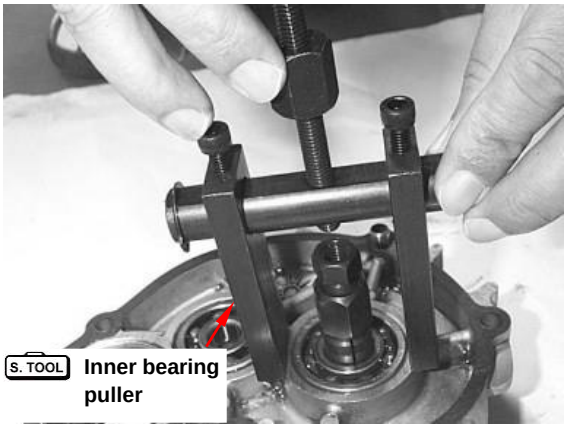
Shaft protector **SYM-6204010**



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

Special tool:

Inner bearing puller SYM-620422



Caution

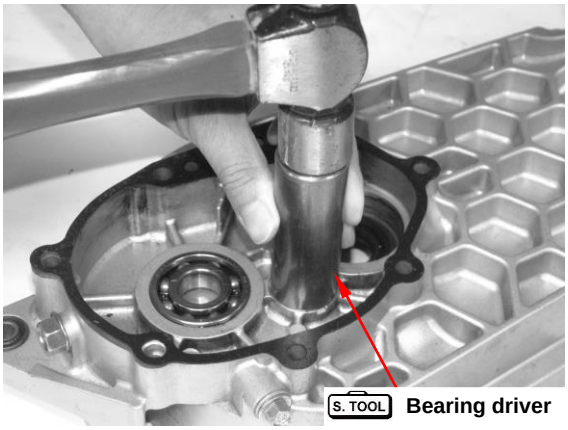
- Never install used bearings. Once bearing removed, it has to be replaced with new one.

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

Special tool:

Bearing driver **SYM-6204024**

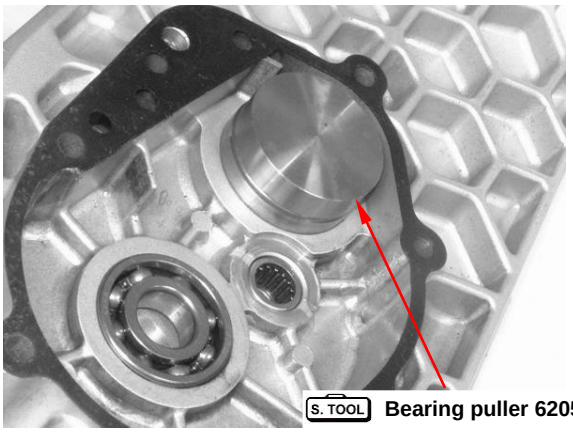
Bearing driver HK1516 **SYM-9100200-HK1516**



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

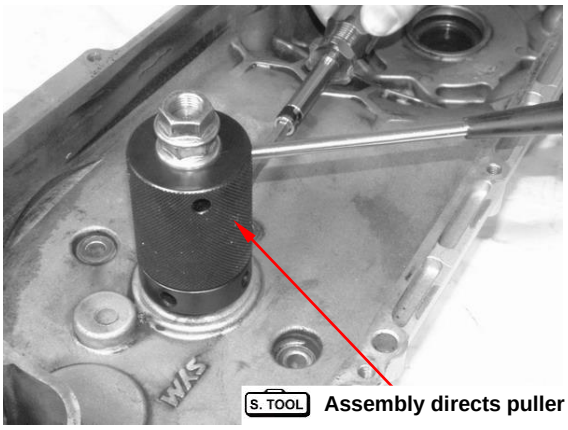
Special tool:

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



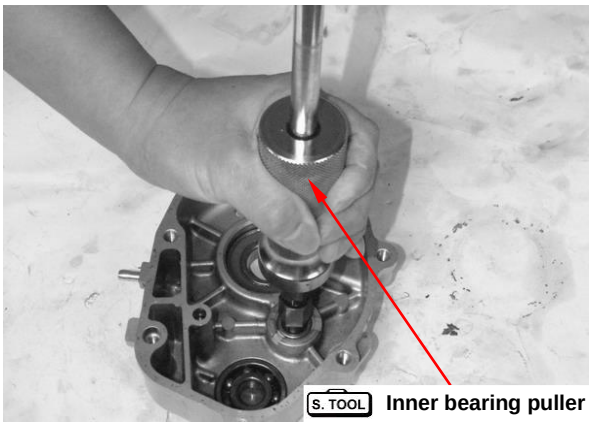
Install assembly directs puller bearing puller.
Special Service Tools:
Assembly directs puller SYM-2341110

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

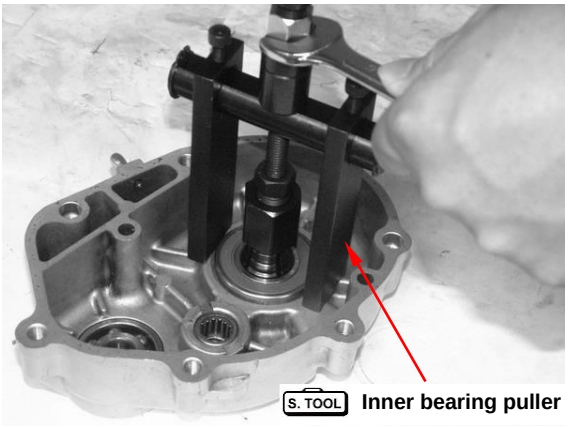


Gear box cover side

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



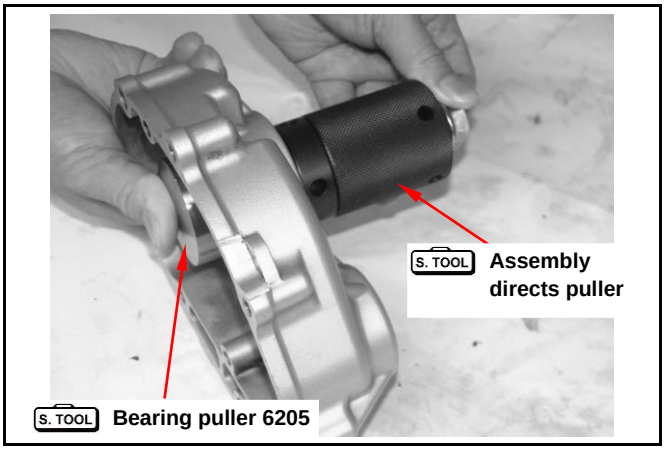
Remove oil seal, and then remove final shaft bearing from gear box cover using following tools.
Special tool:
Inner bearing puller SYM-6204022



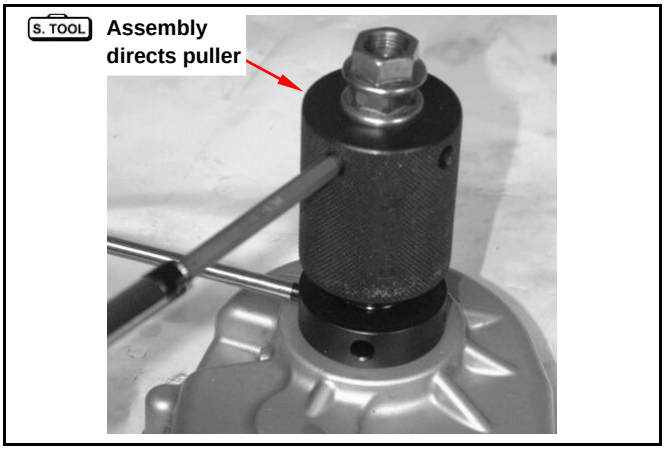
Install a new drive shaft bearing and counter shaft bearing into gear box cover.

Install new final shaft bearing and bearing puller onto left crankcase.
Special tool:
Bearing puller 6205 SYM-9100400-6205

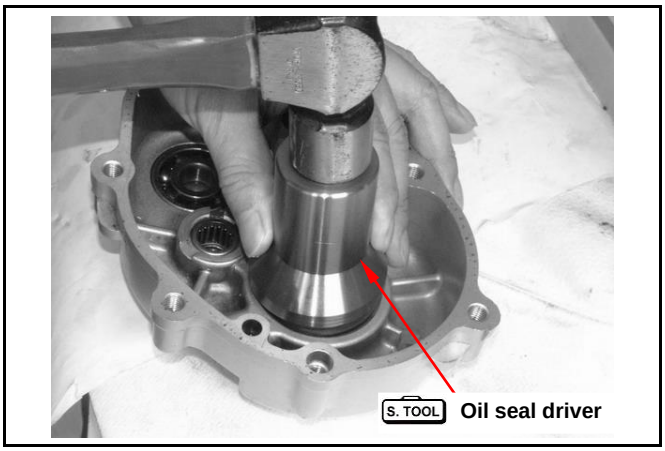
Install assembly directs puller bearing puller.
Special Service Tools:
Assembly directs puller SYM-2341110



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

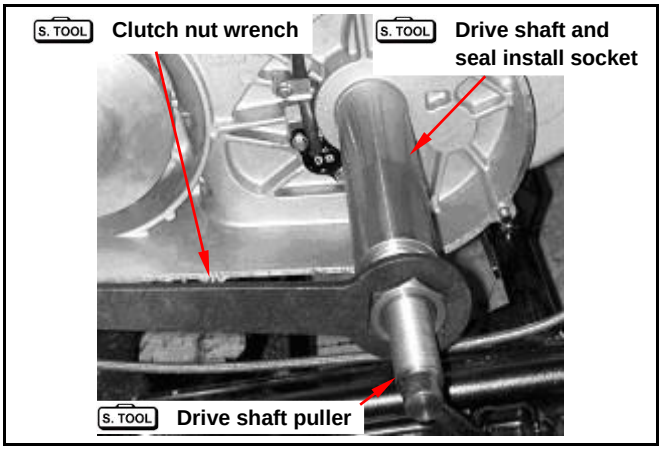


Apply with grease onto final shaft oil seal.
Install the oil seal into gear box cover.
Special tool:
Oil seal driver 32*52*7 SYM-9125500-HMA

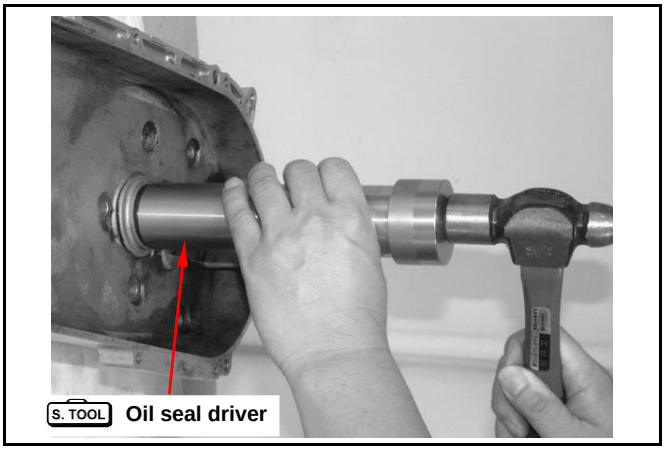


Re-Assembly of Final Drive Mechanism

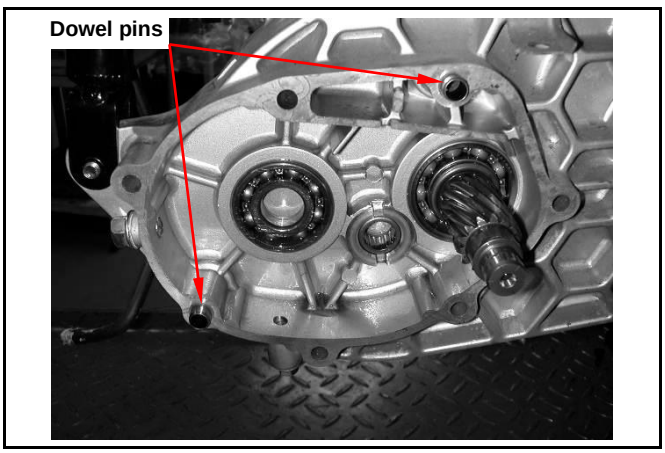
Install drive shaft.
Special tool:
Drive shaft puller SYM-2341110- HMA RB1
Drive shaft socket & oil seal driver (25*40*7) SYM-9120200-HMA
Clutch nut wrench SYM-9020200



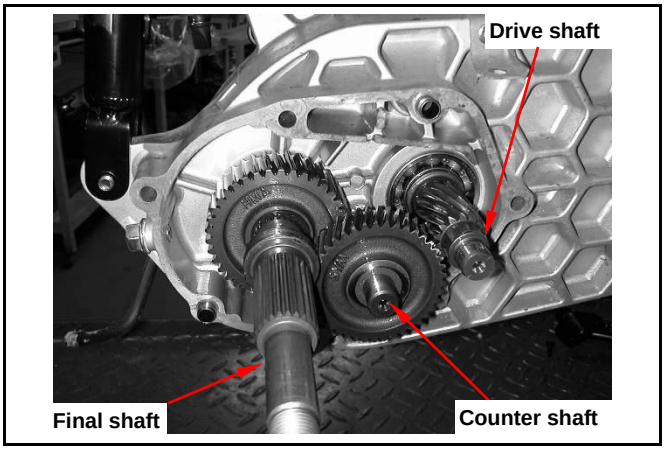
Apply with grease onto drive shaft oil seal.
Install the oil seal to left crankcase.
Special tool:
Drive shaft socket & oil seal driver (25*40*7) SYM-9120200-HMA



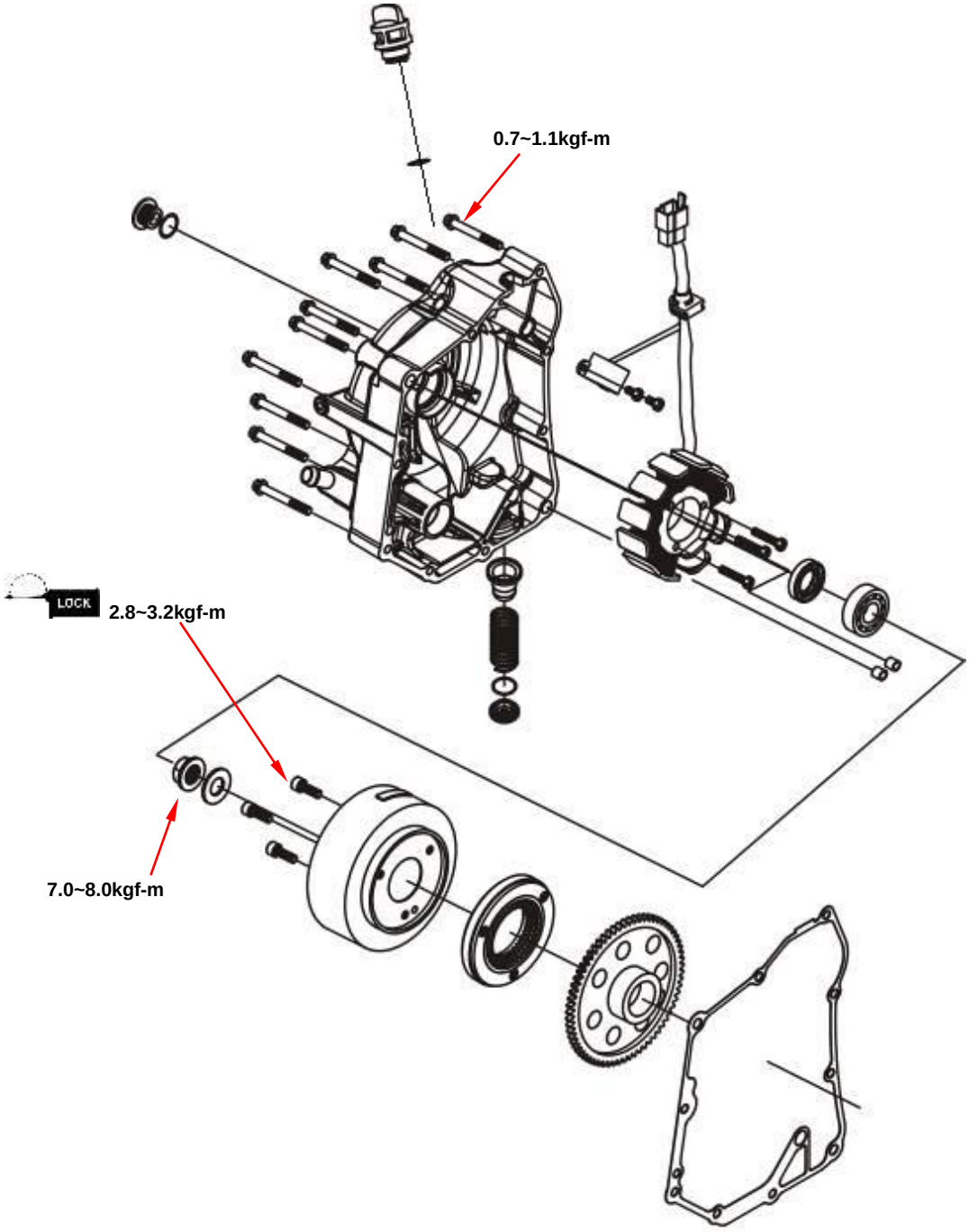
Install 2 dowel pins & new gasket.



Install counter shaft and final shaft into the gear box cover.
Install the gear box and tighten the bolts (7 bolts).
Torque value: 2.4~3.0kgf-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



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	25.010
OD of starting clutch gear	42.192~42.208	42.100

Torque value

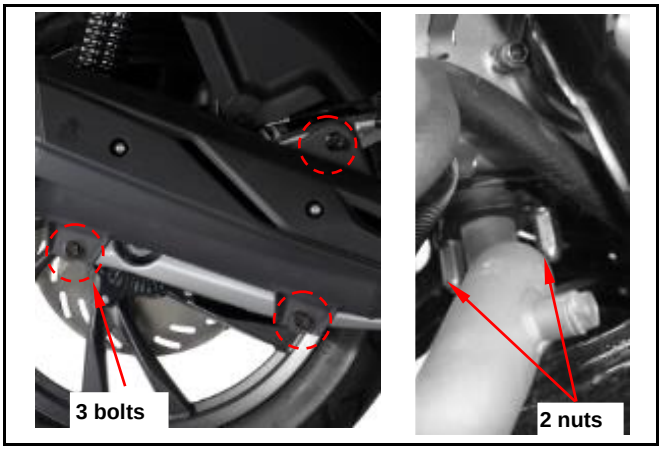
Flywheel nut	7.0~8.0kgf-m
Starting clutch hexagon bolt	2.8~3.2kgf-m with adhesive

Special tools

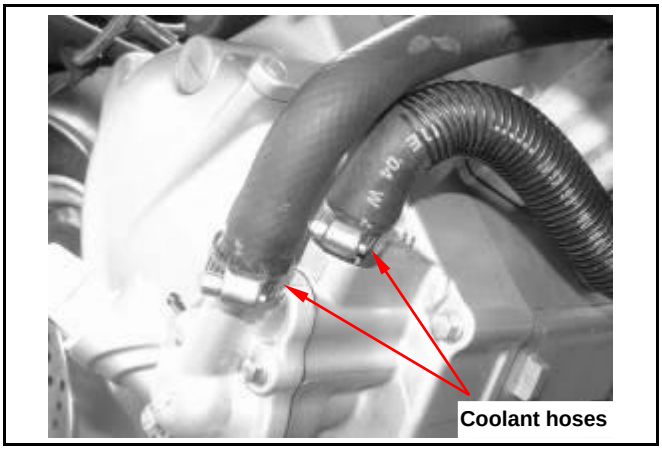
AC.G. flywheel puller	SYM-3110000-HMA
Left crank case cover 6201 bearing puller	SYM-9614000-HMA RB1 6201
Inner bearing puller	SYM-6204025
Universal holder	SYM-2210100

Right Crankcase Cover Removal

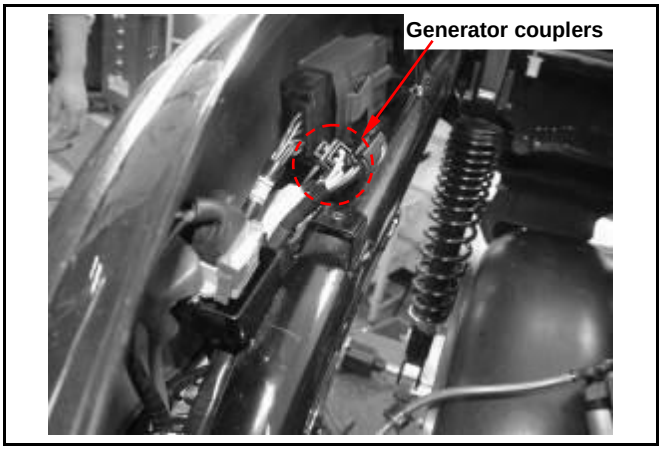
Remove right side cover.
Remove seat and luggage box.
(Refer chapter 13)
Remove the exhaust muffler (3 bolts, 2 nuts).



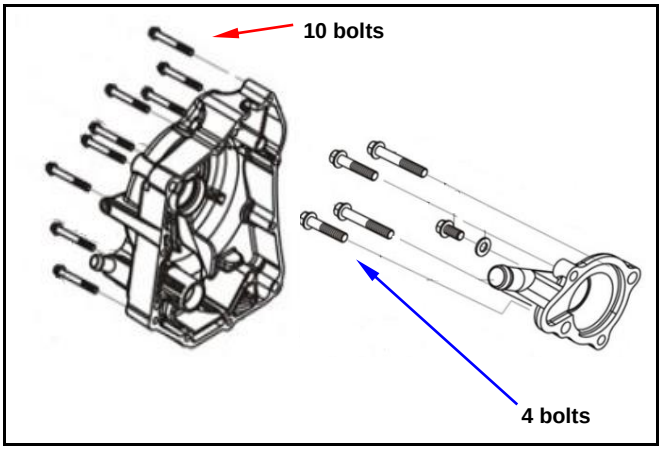
Drain out the engine oil and coolant (refer chapter 5).
Remove coolant hoses.



Disconnect the couplers of the power source output line.

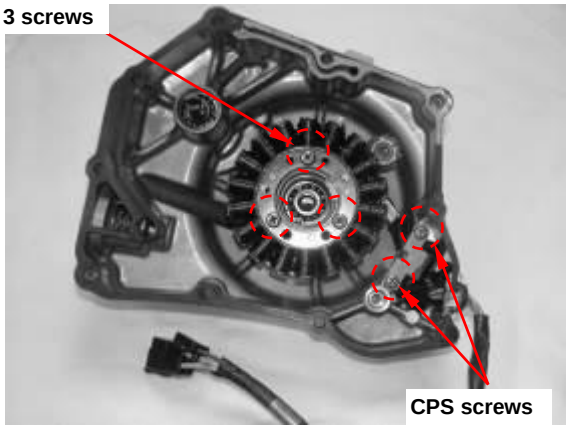


Remove water pump cover (4 bolts).
Remove 10 bolts from the right crankcase cover.
Remove the right crankcase cover.
Remove dowel pin and gasket.



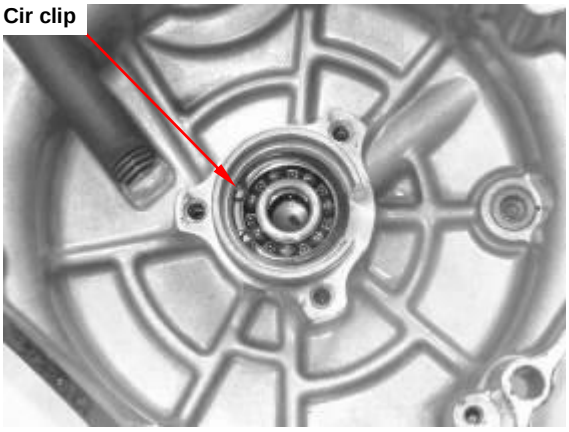
AC Generator Removal

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

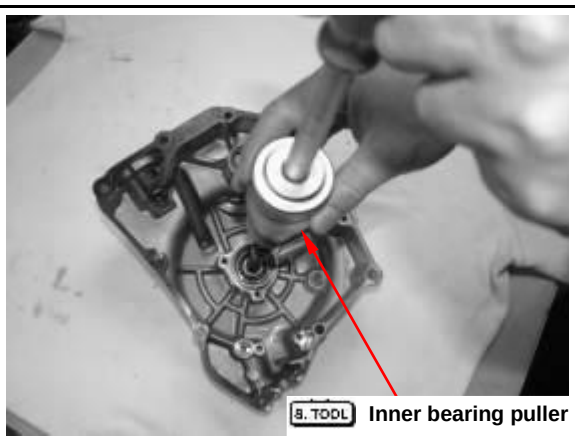


Right Cover Bearing

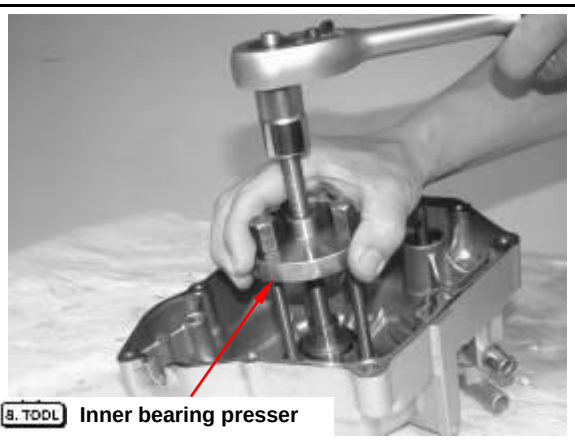
Rotate the bearing by fingers to check if the bearing rotation is smooth and silent.
Check if the bearing outer parts are closed and fixed, replace it if necessary.



Remove the bearing 6201 with inner bearing puller.
Special tool:
Inner bearing puller SYM-6204025

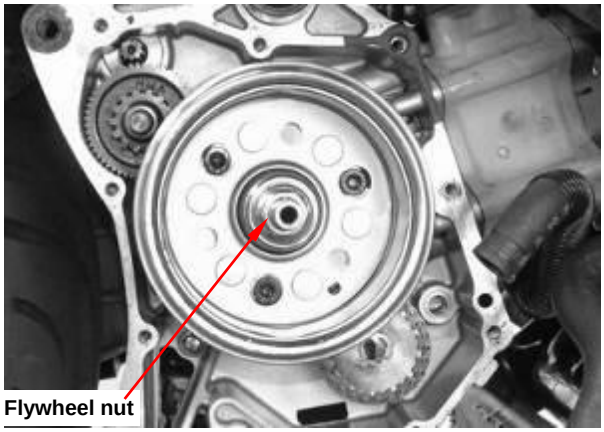


Install the bearing 6201 bearing with special tool.
Special tool:
Right crankcase cover bearing 6201 presser
SYM-9614000-HMA RB1 6201

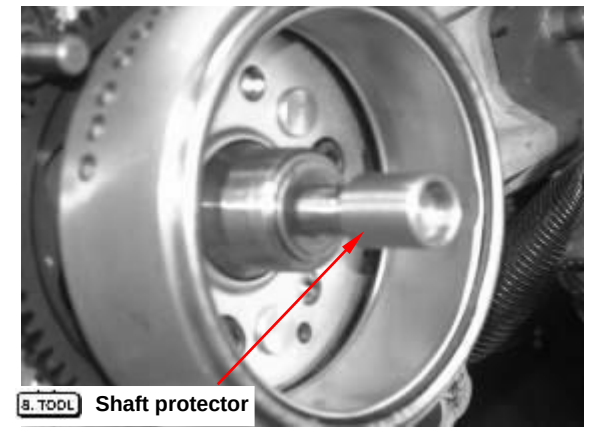


Flywheel Removal

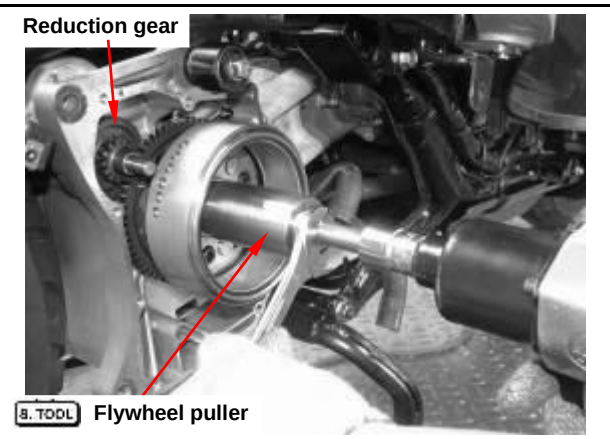
Remove right crankcase cover and generator coil.
Remove flywheel nut.



Install shaft protector onto the crank shaft.
Special tool:
Shaft protector



Remove starter reduction gear and shaft.
Pull out flywheel with AC generator flywheel puller.
Special tool:
Flywheel puller SYM-3110000-HMA

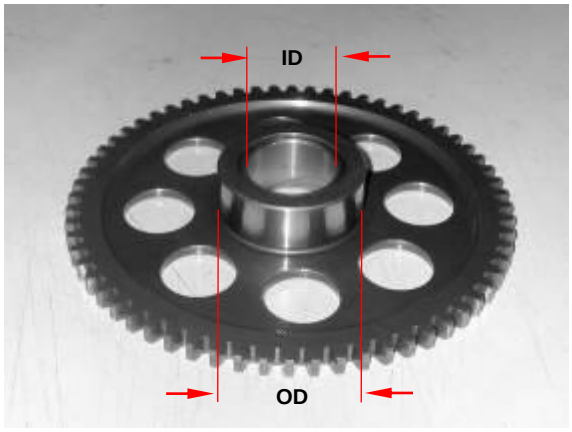


Remove flywheel and starting driven gear.

Starting Clutch

Starting Clutch Inspection

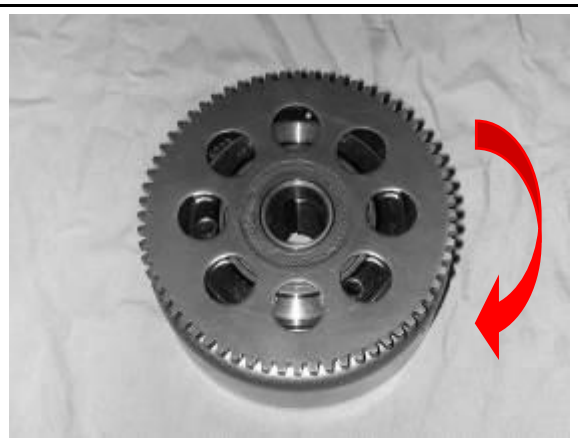
Remove starting clutch driven gear.
Check the gear for wear or damage.
Measure the ID and OD of the starting clutch driven gear.
Service Limit: ID: 25.050 mm
OD: 42.100 mm



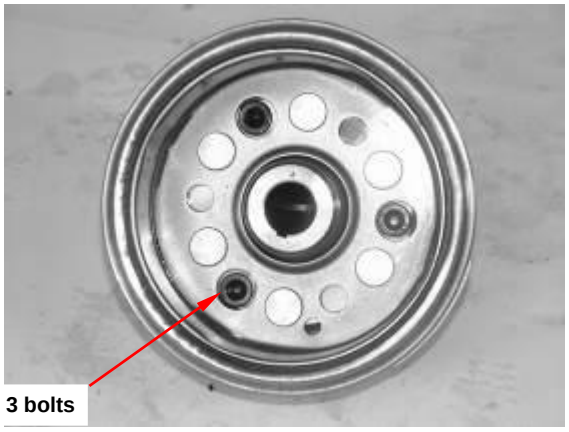
Check the starting reduction gear and shaft for wear or damage.

Check each roller for wear or damage.

Install starting clutch driven gear onto one way clutch.
Hold flywheel and rotate starting clutch gear.
The starting clutch gear should be rotated in counterclockwise direction freely, but not clockwise direction.



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

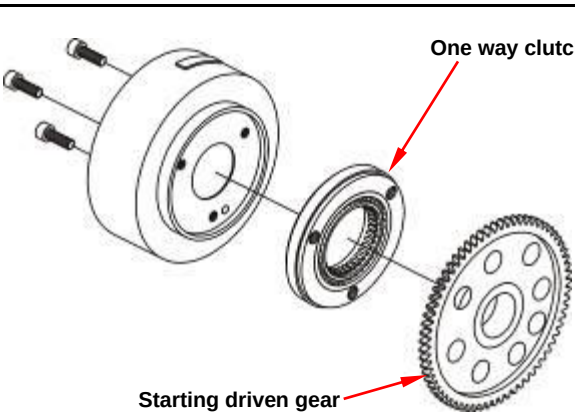
Install the components in the reverse procedures of removal.
Torque value: 2.8~3.2kgf-m

Caution

- Cannot lock the thread of socket bolt.

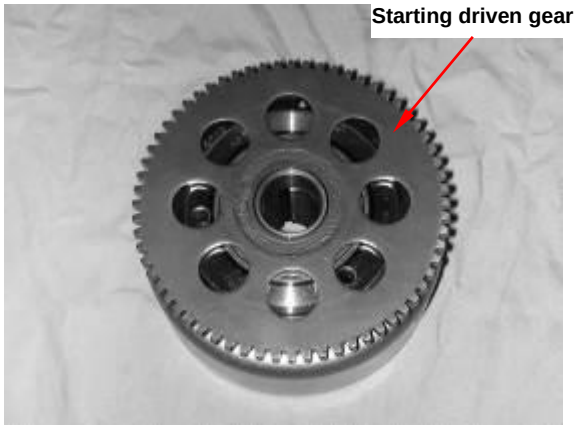
Caution

- 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.

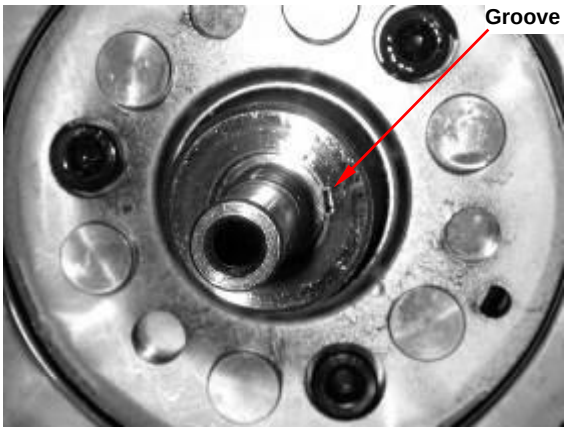


Flywheel Installation

Install starting driven gear onto one way clutch.



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



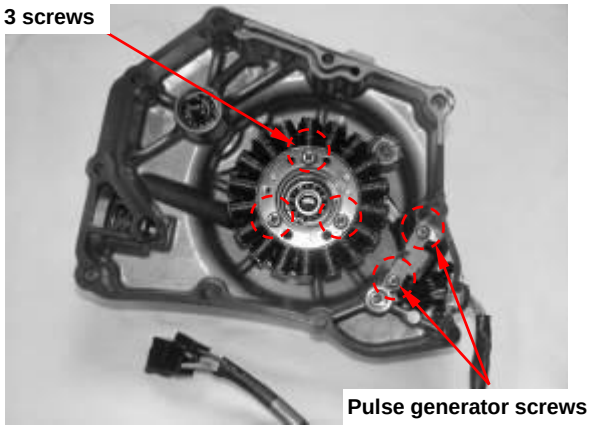
Hold the flywheel by drive face with universal holder, and tighten flywheel nut.
Torque value: 7.0~8.0kgf-m
Special tool:
Universal Holder SYM-2210100

AC Generator Installation

Install the AC Generator coil onto right crankcase cover (3 screws).
Install the CPS (2 screws).
Tie the wire harness securely onto the indent of crankcase.

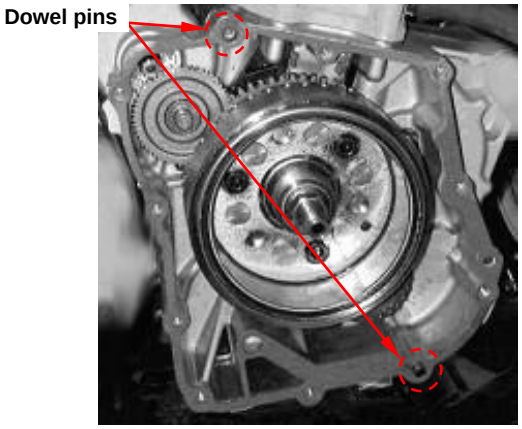
Caution

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

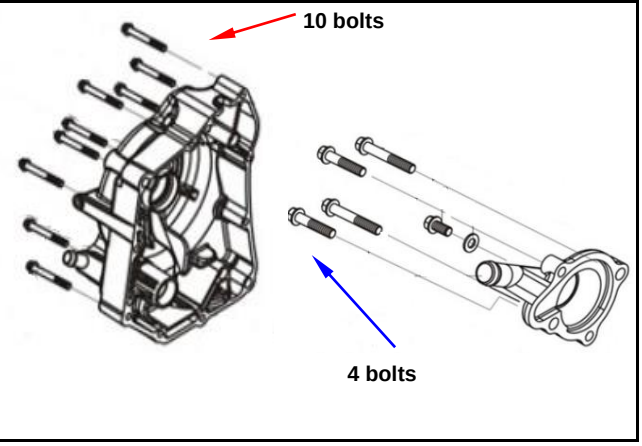


Right Crankcase Cover Installation

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.



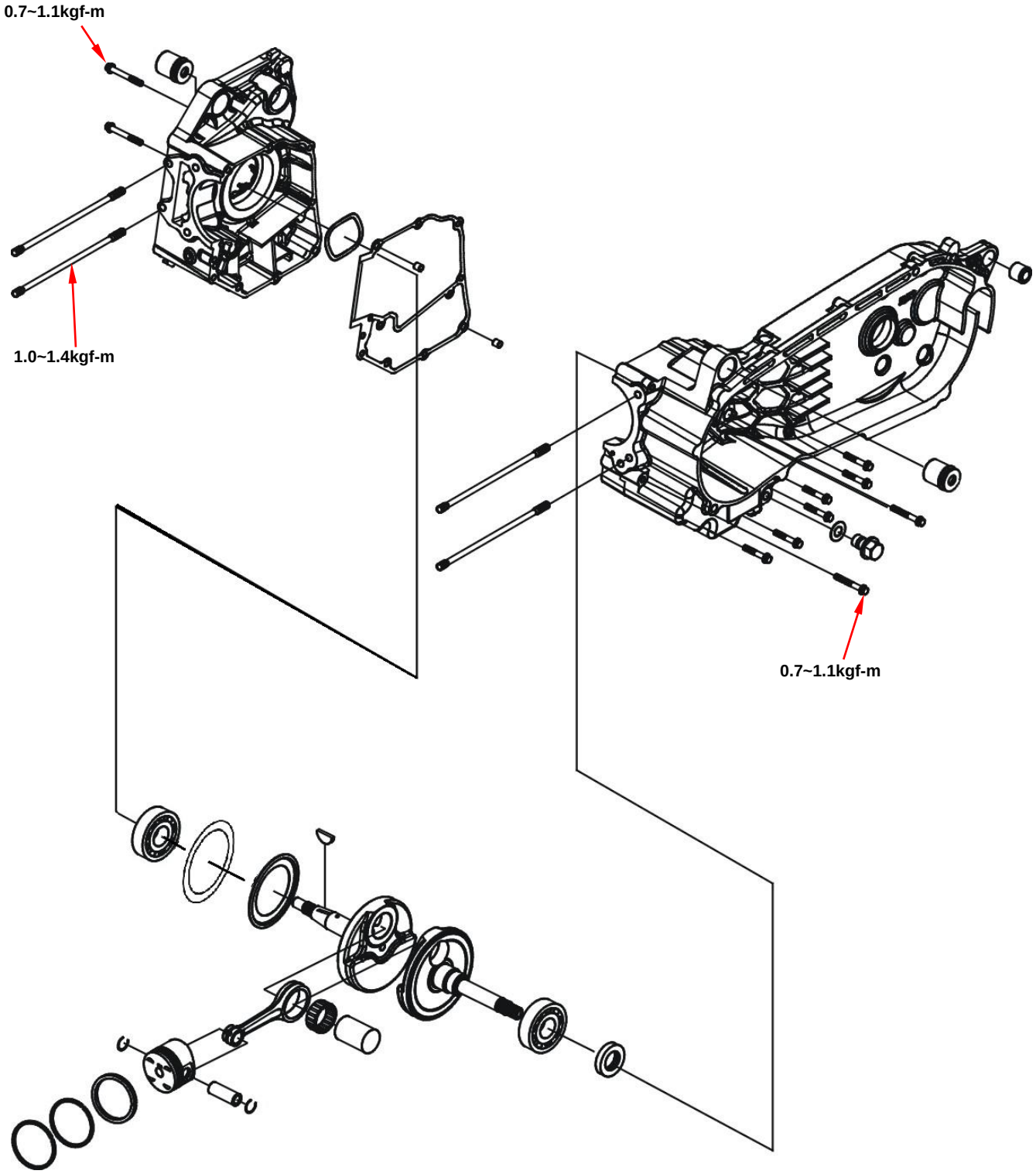
Install right crankcase cover (10 screws).
Install the dowel pin, new gasket and water pump cover onto crankcase cover.



Connect coolant hoses onto the right crankcase cover.
Add engine oil and coolant.

Notes:

Mechanism Diagram



General Information

Operational precautions

- 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	-
Vertical clearance of the big end of the connecting rod	0~0.008	-
Run-out	-	0.100

Torque value

Bolts for crankcase	0.7~1.1kgf-m
Cylinder stud bolts	1.0~1.4kgf-m
Bolt for cam chain tensioner	0.8~1.2kgf-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-6204010
Inner bearing puller	SYM-6204025
Clutch nut wrench	SYM-9020200

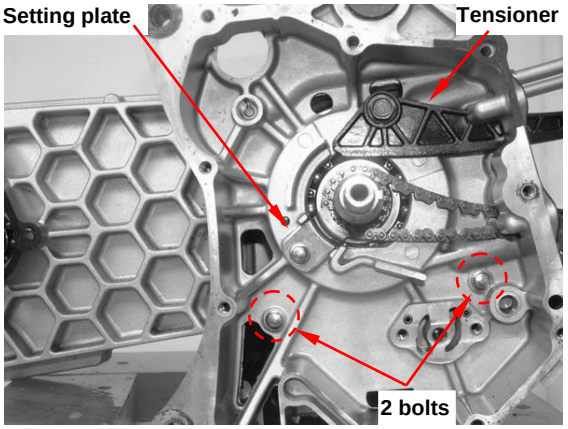
Trouble Diagnosis

Engine noise

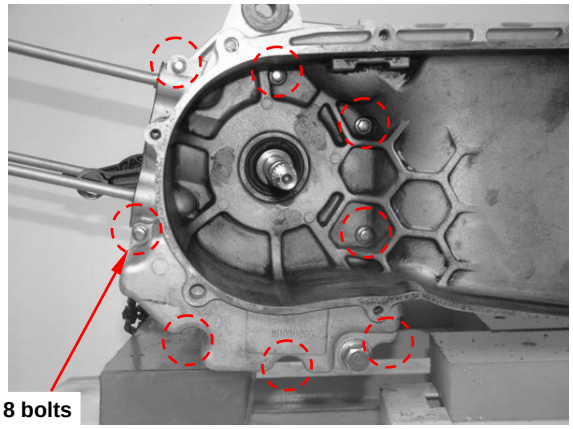
- Loose crankshaft bearing
- Loose crankshaft pin bearing
- Worn out piston pin and pin hole

Crankcase Disassembly

Remove the cam chain setting plate, and then remove cam chain.
Loosen the pivot bolt and remove the cam chain tensioner.
Loosen 2 bolts on the right crankcase.



Loosen 8 bolts on the left crankcase.



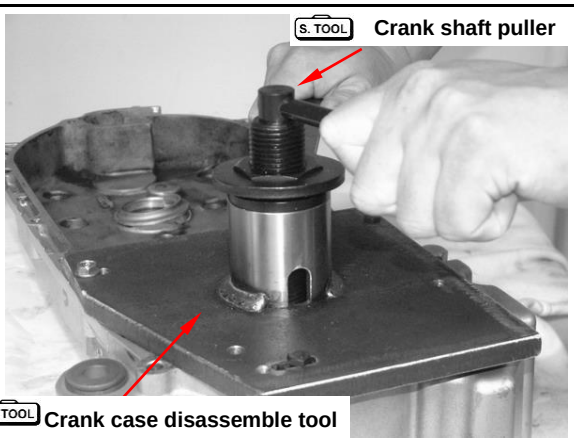
Place right crankcase downward and left crankcase upward.
Install crankshaft disassemble tool onto left crankcase.

Caution

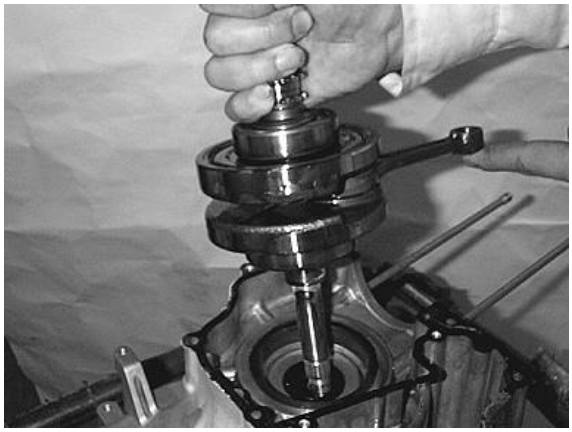
- Care should be taken not to damage the contact surfaces.

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



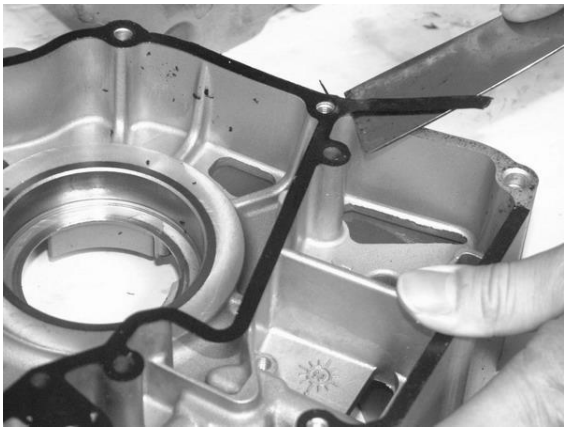
Remove crankshaft and wave washer from right crankcase.



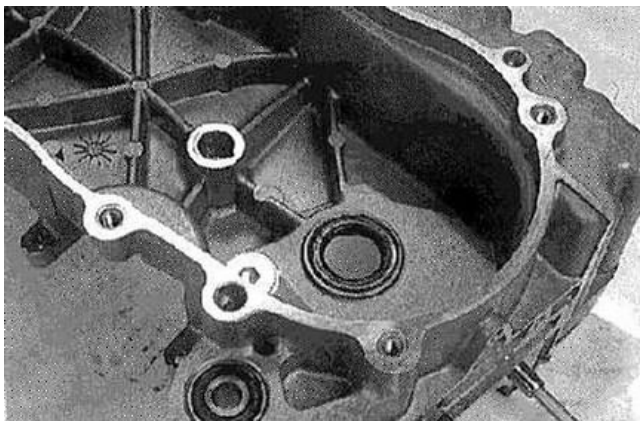
Remove gasket and dowel pins.
Scrape gasket residues off the crankcase contact surface.

Caution

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

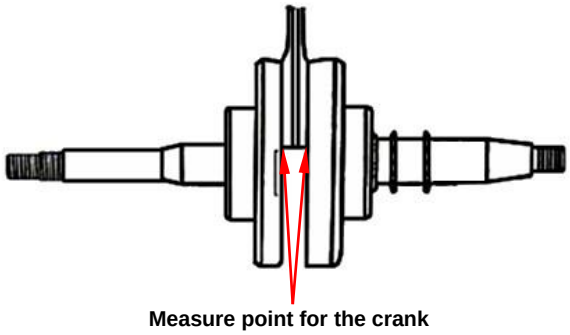


Drive out left crankcase oil seal.



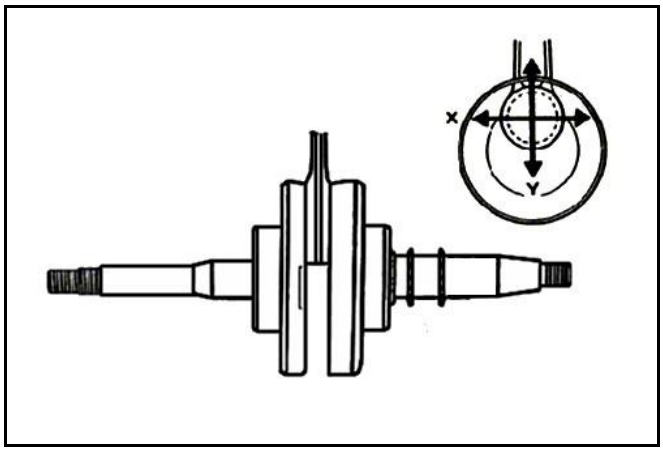
Crankshaft Inspection

Use a thickness gauge to measure left and right clearance of connecting rod big end.
Service limit: 0.6 mm

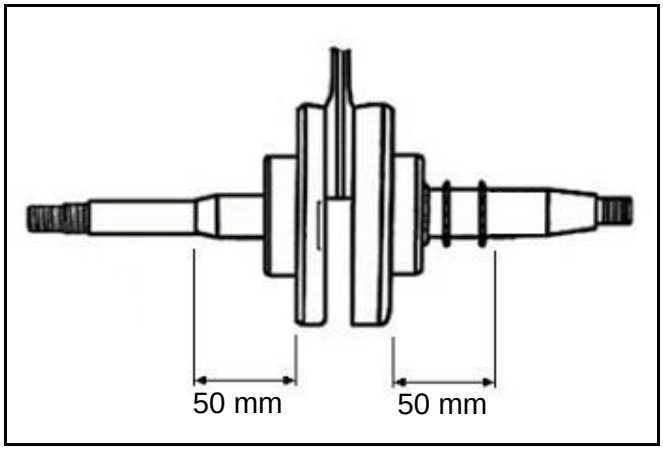


Measure point for the crank big end of the connecting rod.

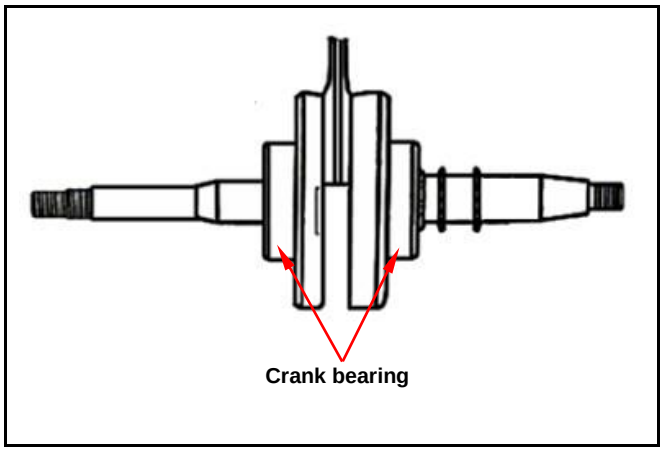
Measure the clearance of the big end at the vertical directions.
Service limit: 0.05 mm



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.

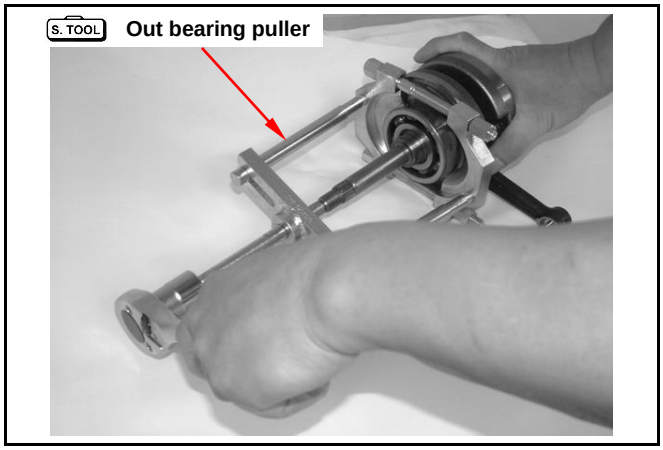


If any roughness, noise and loose linkage are detected, replace the bearing with new one.

Caution

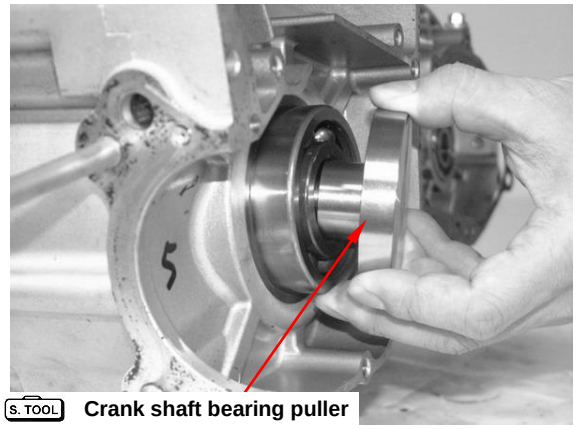
- The bearing shall be replaced in pair.

Special tool:
Outer bearing puller SYM-6204010

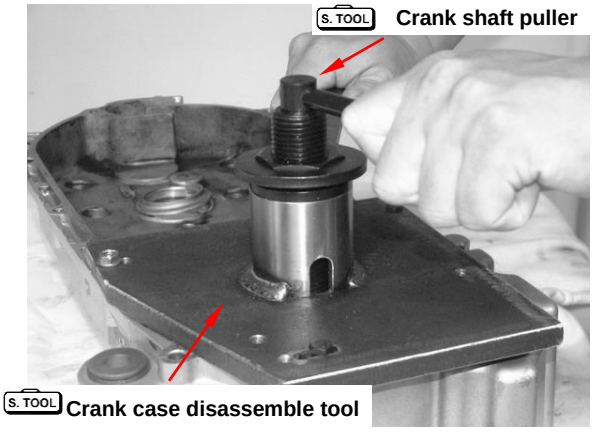


Crankcase Reassembly

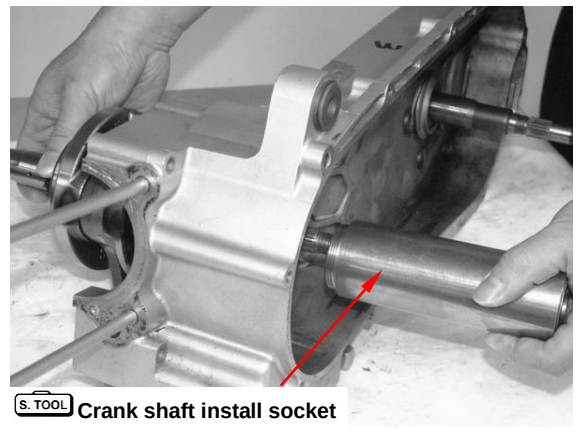
Install new bearing and bearing puller onto left crankcase bearing hole.
Special tool:
L. crank shaft bearing puller SYM-9100100



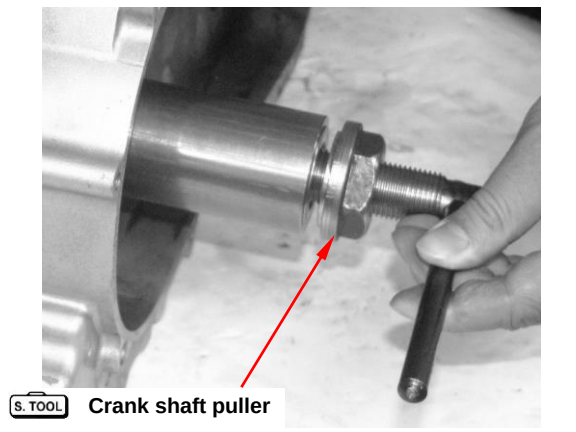
Install crank disassemble tool onto left crankcase.
Install left crank shaft puller into crank case disassemble.
Hold left crank shaft puller, and turn the shaft puller nut by clutch nut wrench to pull in crank shaft bearing into left crankcase.
Special tool:
Crank case disassemble SYM-1120000-HMA H9A
L. Crank shaft puller SYM-2341110-HMA
Clutch nut wrench SYM-9020200



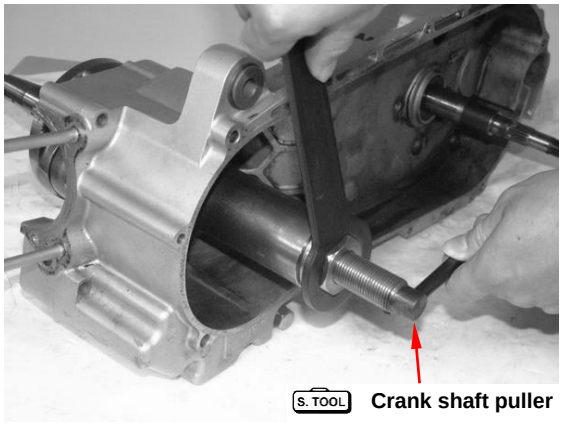
Install crank shaft onto the left crankcase and install crank shaft install socket.
Special tool:
Crank shaft install socket & oil seal driver SYM-2341110- HMA RB1



Turn in the crank shaft puller spiral tooth to the left crank shaft.
Special tool:
L. Crank shaft puller SYM-1130000-HMA H9A



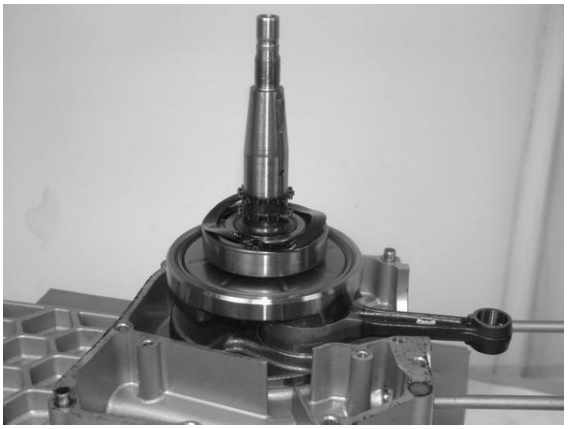
Hold left crank shaft puller, and turn the shaft puller nut by clutch nut wrench to pull in crank shaft into left crankcase.



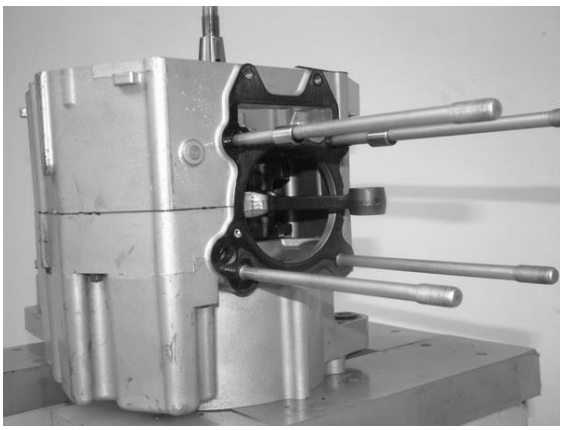
Put wave washer onto right crank bearing.

Caution

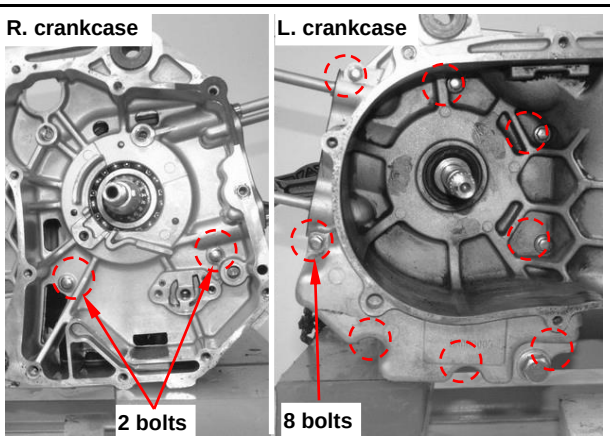
- Right flank the wave washer piece certainly must install. Cannot install the wrong position or leak the attire. Otherwise can cause the motorcycle to have the fierce vibration



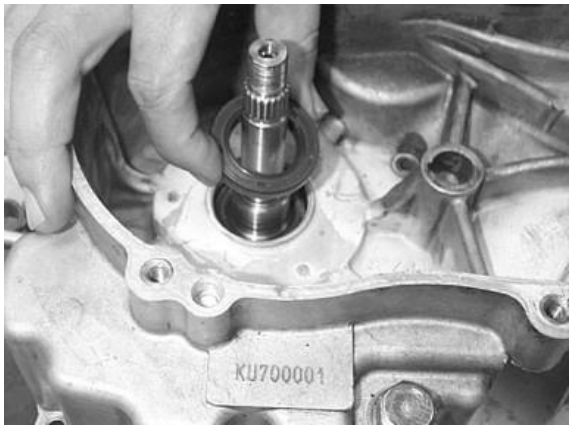
Install 2 dowel pins and new gasket.
Install the right crankcase onto the left crankcase



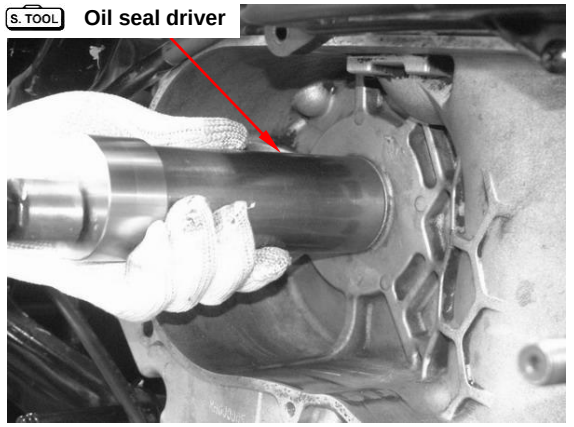
Tighten 8 bolts on the left crankcase.
Tighten 2 bolts on the left crankcase.
Torque value: 0.8~1.2kgf-m



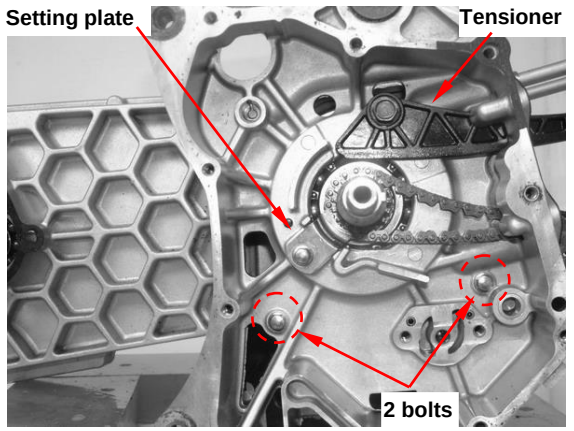
Apply a layer of grease on the lip of oil seal
Clean the crankshaft with clean solvent.



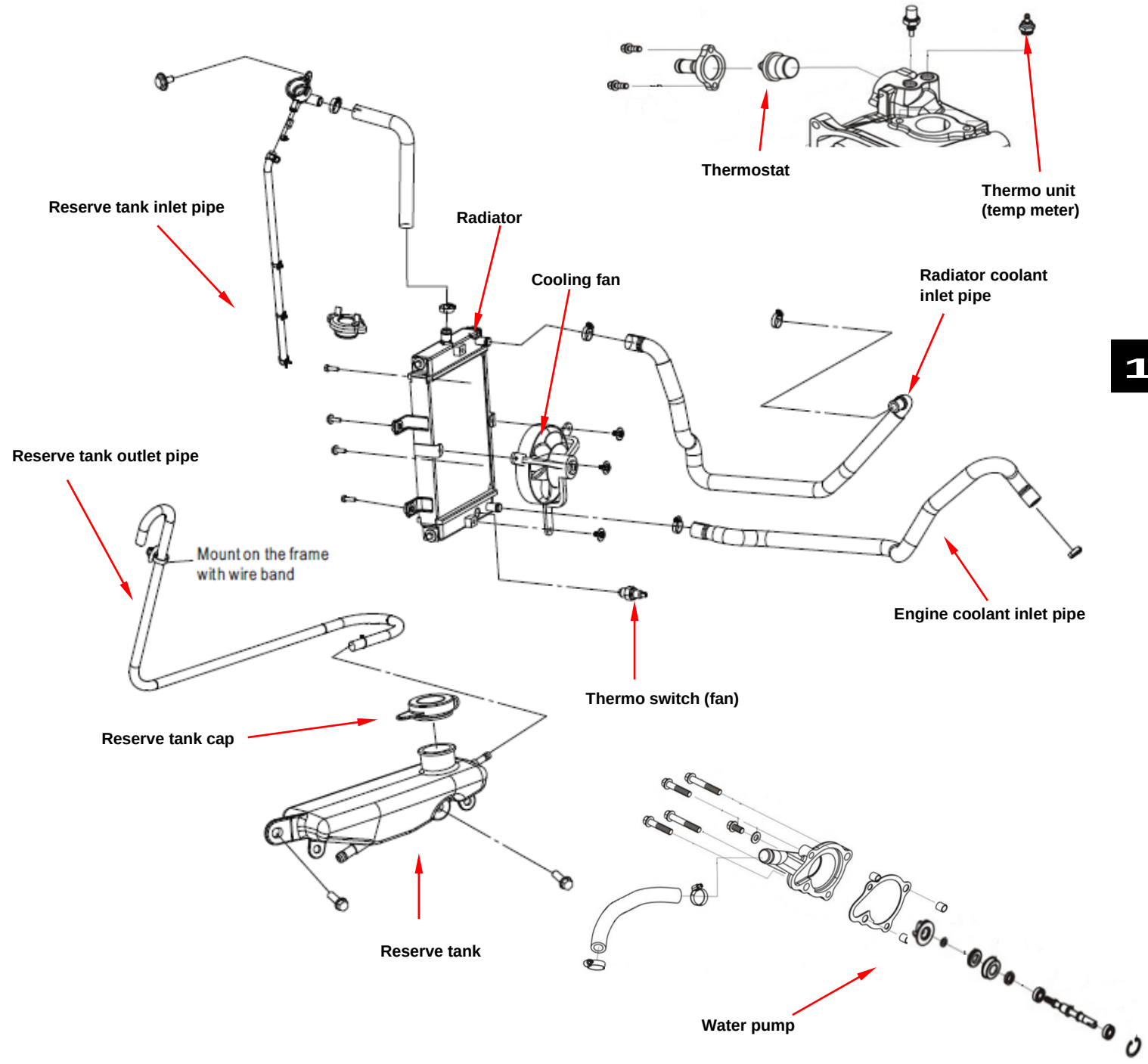
Install the oil seal in the left crankcase with special tool.
Special tool:
Crank shaft install socket & oil seal driver
SYM-2341110- HMA RB1



Install the cam chain tensioner & and tighten the bolts.
Torque value: 0.8~1.2kgf-m
Install the cam chain.
Install the cam chain setting plate.



Mechanism Diagram



General Information

General

⚠ 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 reserve tank.
- 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 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/cm²
Capacity of coolant: Engine + radiator Reserve tank	1400c.c. 200c.c.
Thermostat	Begins to activate at : 82 ± 1.5 ºC Max. valve lift : Above 3 mm
Boiling point	Not-pressure : 107.7ºC Pressurized: 125.6ºC

Torque Value

For water pump impeller 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

Trouble Diagnosis

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.

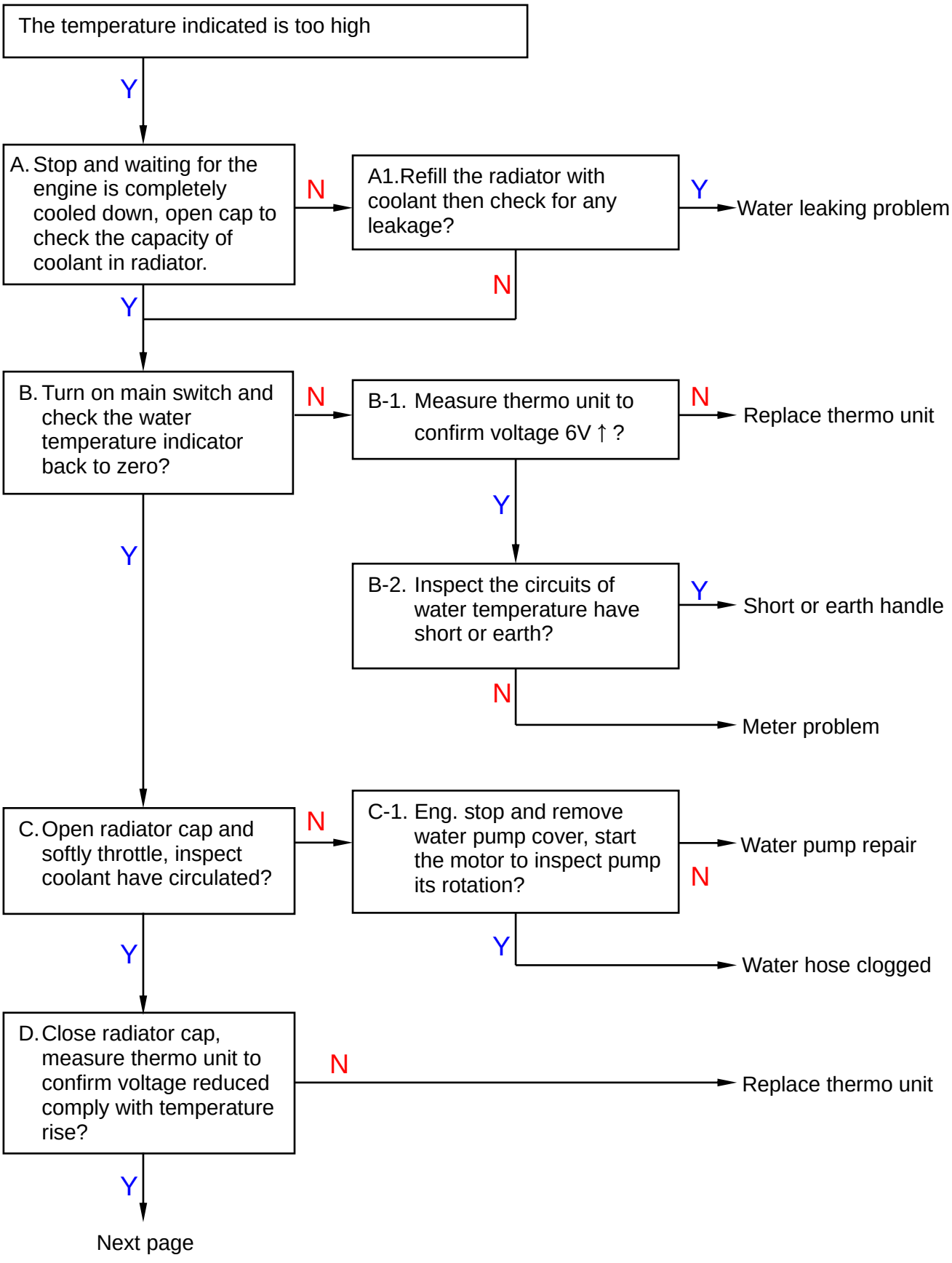
The engine temperature is too low

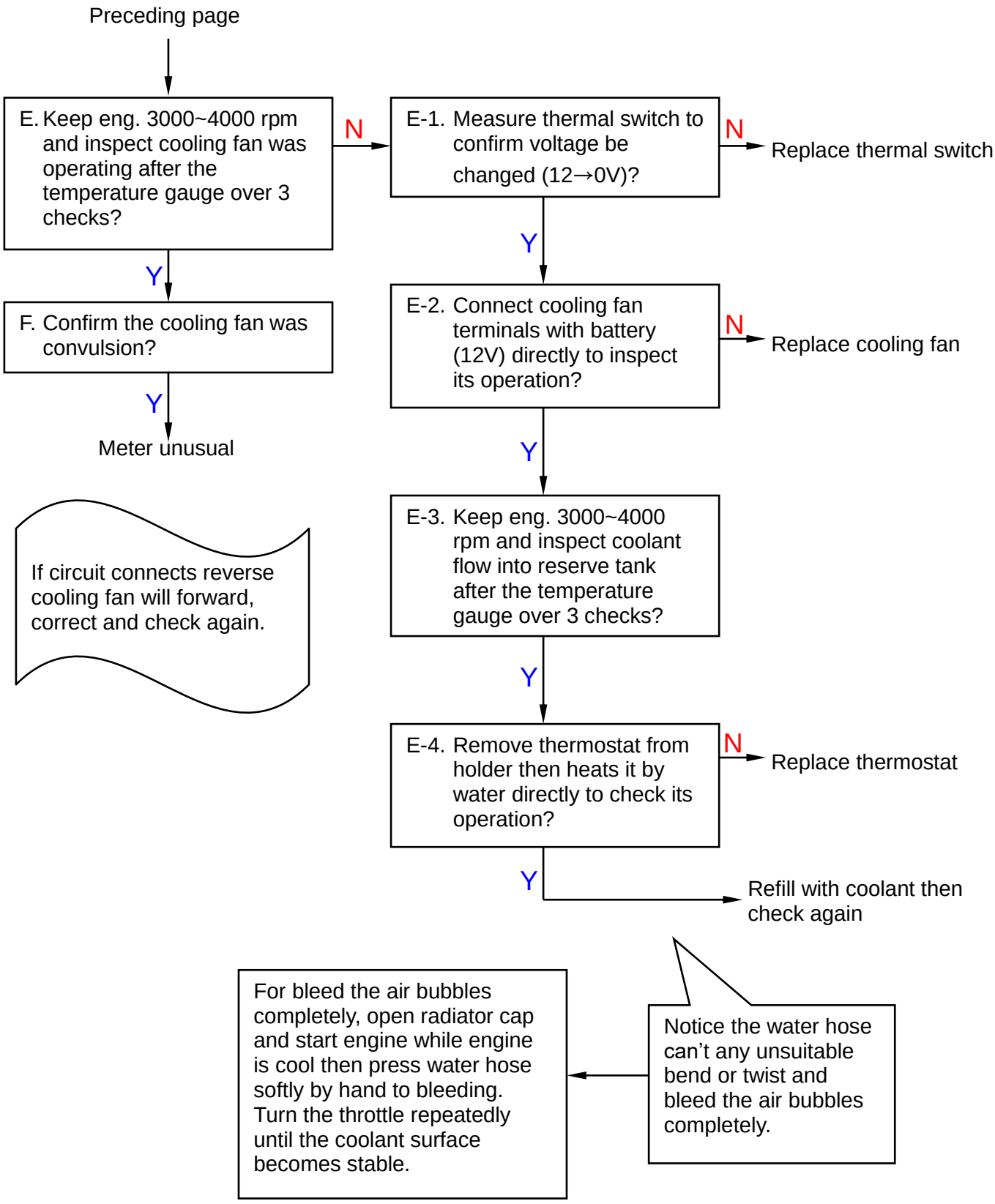
- The water thermometer and the temperature sensor malfunction.
- The thermostat is stuck to open.

Coolant is leaking

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

Cooling System Fault Elimination



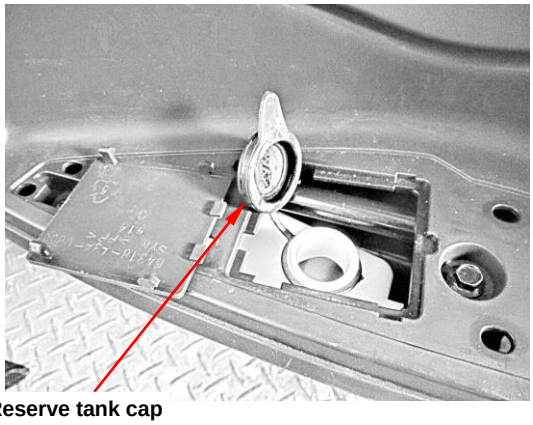

Preceding page
E. Keep eng. 3000~4000 rpm and inspect cooling fan was operating after the temperature gauge over 3 checks?
N
E-1. Measure thermal switch to confirm voltage be changed (12→0V)?
N
Replace thermal switch
Y
Y
E-2. Connect cooling fan terminals with battery (12V) directly to inspect its operation?
N
Replace cooling fan
F. Confirm the cooling fan was convulsion?
Y
Y
Meter unusual
If circuit connects reverse cooling fan will forward, correct and check again.
E-3. Keep eng. 3000~4000 rpm and inspect coolant flow into reserve tank after the temperature gauge over 3 checks?
Y
E-4. Remove thermostat from holder then heats it by water directly to check its operation?
N
Replace thermostat
Y
Refill with coolant then check again
For bleed the air bubbles completely, open radiator cap and start engine while engine is cool then press water hose softly by hand to bleeding. Turn the throttle repeatedly until the coolant surface becomes stable.
Notice the water hose can't any unsuitable bend or twist and bleed the air bubbles completely.

Coolant Replacement

Warning

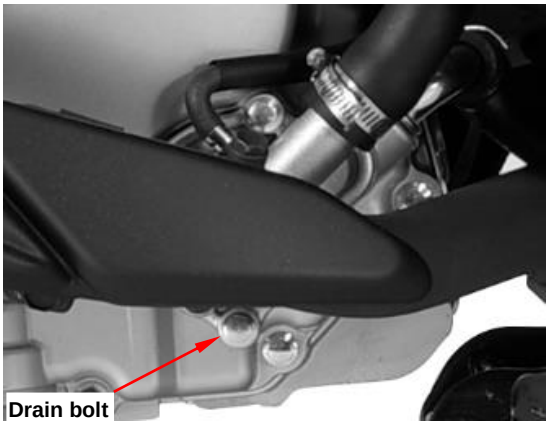
- Never attempt to carry out service work on the cooling system unless the engine is completely cooled down, otherwise, you may get scalded.

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


Reserve tank cap

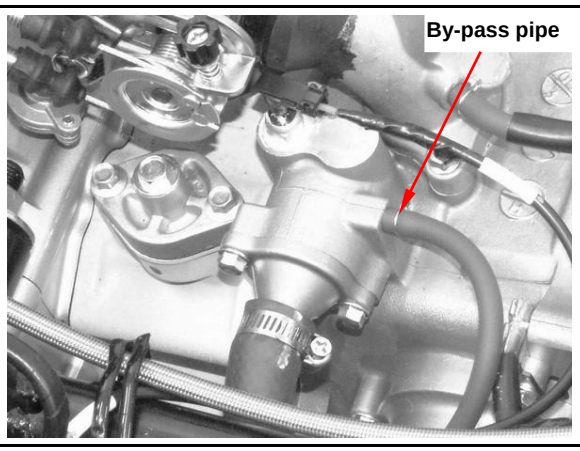
Place a water pan under the water pump; loosen the drain bolt to drain out the coolant.

Reinstall the drain bolt.


Drain bolt

Refill system with the coolant and bleed out the air bubbles.

- Run the engine, and remove by-pass pipe.
- Check the by-pass hole and see if the air bubble emit or not.
- If there is no air bubble emit with only the coolant flow out, then reinstall the pipe and shut down the engine.
- Remove the radiator filler cap.
- Start the engine; make sure the coolant level is stable without any air bubble emitting.
- Shut down the engine; add the coolant to the proper level if necessary.
- Reinstall the radiator filler cap.


By-pass pipe

Caution

- To avoid the water tank rusting, do not use the uncertified coolant.

Coolant recommended: SYM Long Life Coolant.
Concentration: 50%

Check reserve tank

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

⚠ Caution

- Do not make the coolant level in the reserve tank too high.

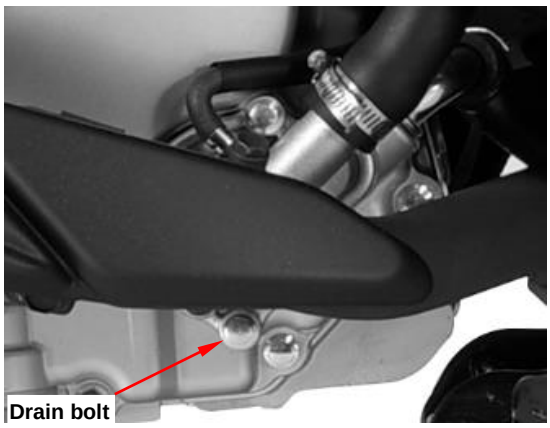
Radiator

Check

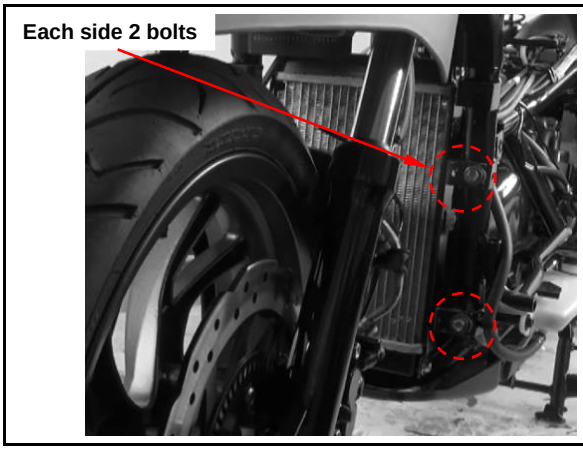
Check for any leakage from weld seam.
Blow radiator clean using compressed air. If the radiator is blocked by dirt, use low pressure water jet to clean it.
Care shall be taken when straightening the sink fan.

Remove

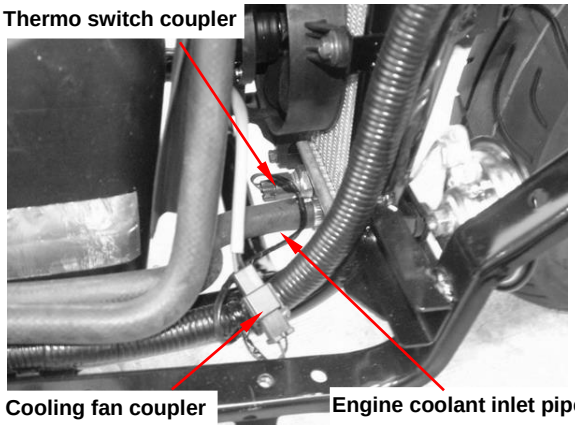
Place a water pan under the water pump; loosen the drain bolt to drain out the coolant.



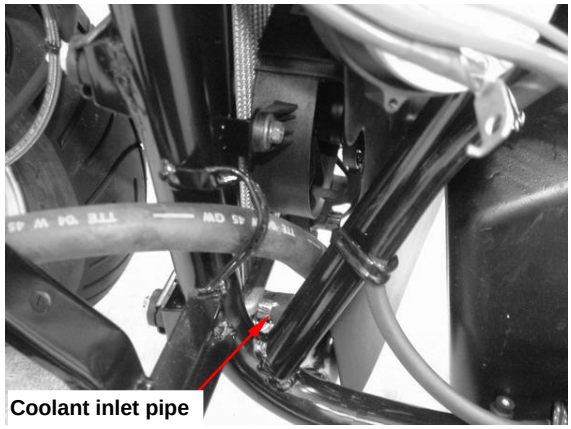
Remove the front cover and under spoiler (refer chapter 13).
Loosen the radiator mounting bolts (4 bolts).



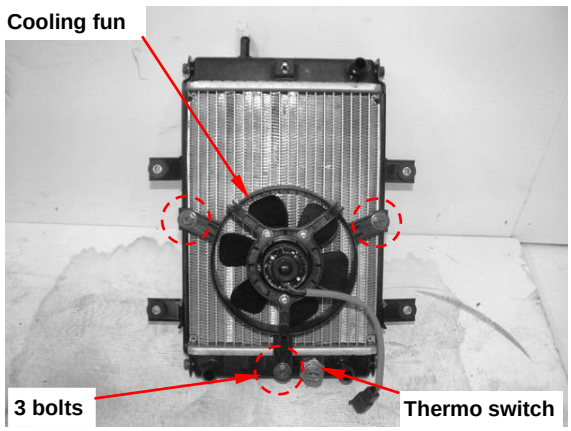
Disconnect the couplers for the thermo switch and fan motor.
Remove engine coolant inlet pipe, reserve tank inlet pipe and radiator inlet pipe.



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



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

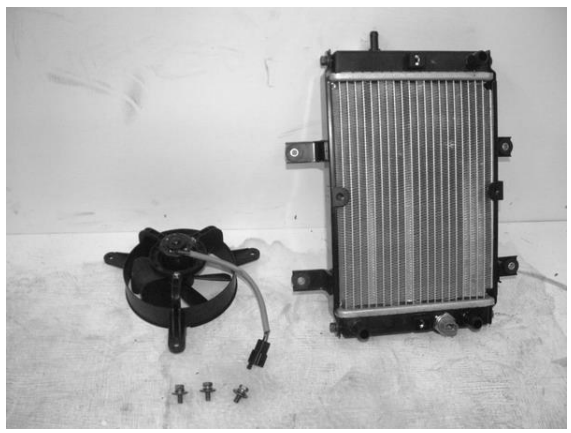


Installation

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.

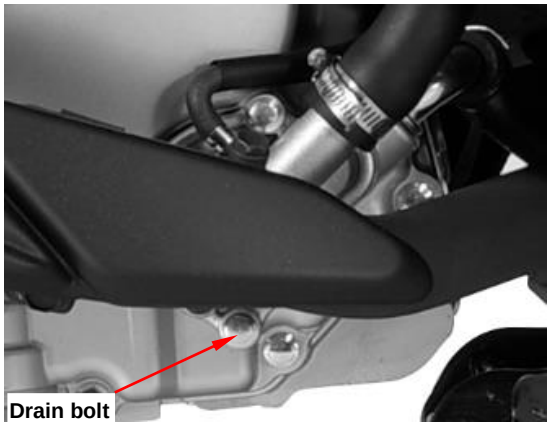


Water Pump

Check water pump seal / cooling system divulges inspection

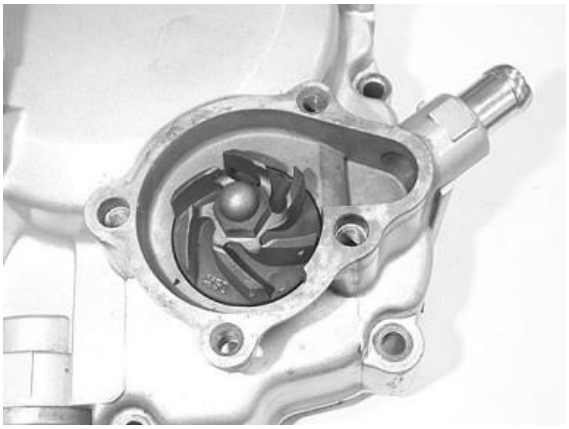
- Disassembles the refrigerant drain bolt, overflows little buckles the N actually fluid, confirmed overflows the refrigerant whether has the greasy dirt.
- Turns on lathe the engine oil gauge rule, the inspection engine oil whether does have bleaches situation of the emulsified.

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

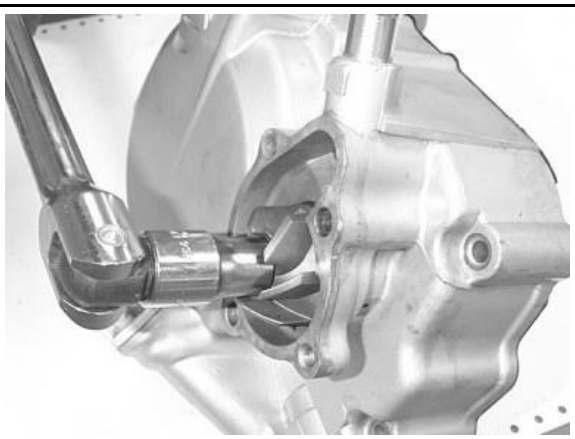
Loosen the drain bolt to drain out the coolant.
Remove the water hose.
Loosen 4 bolts and remove the pump cover.
Loosen 10 bolts and remove the engine right cover.
Take off the gasket and dowel pins.



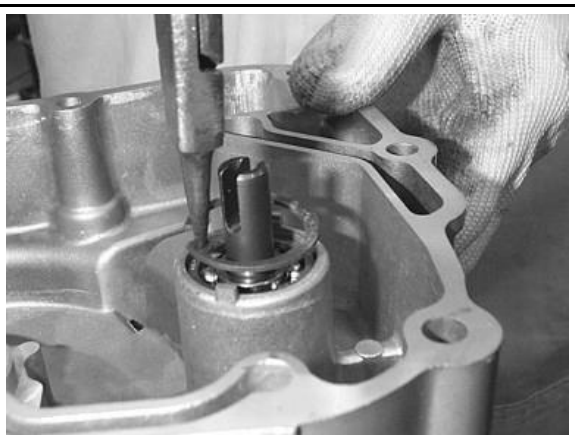
Turn pump rotor clockwise and remove.

Caution

- The rotor is provided with left turn thread.



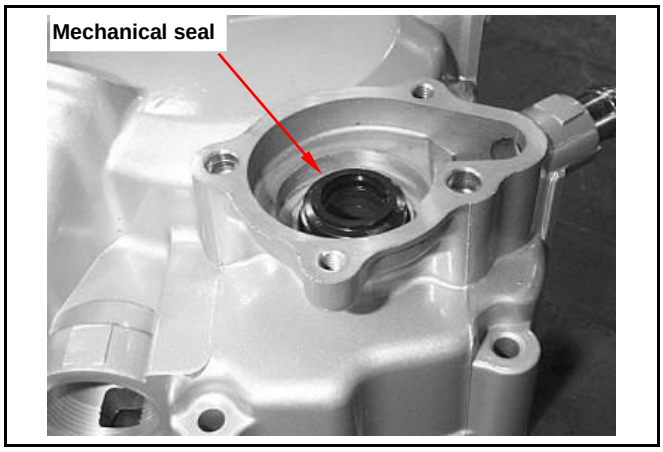
Remove the cir clip from the right crankcase cover.
Remove the water pump shaft and the inner bearing.
Remove the outside bearing by inner bearing puller.
Rotate the inner ring of bearing, the bearing shall move smoothly and quietly.
If the bearing does not rotate smoothly or produces a noise, replace it with new one.



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

Caution

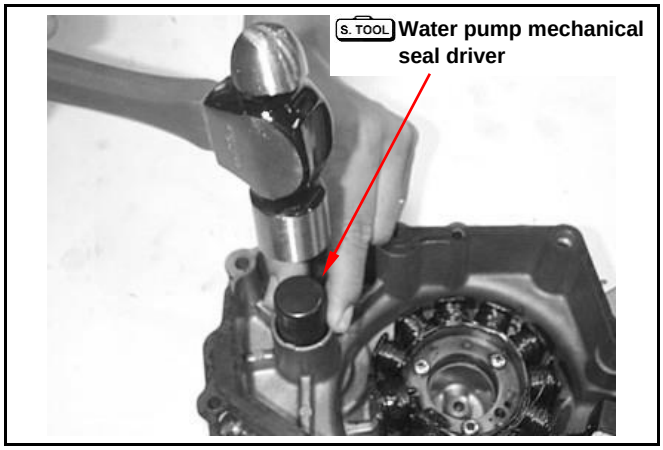
- The mechanical seal and inside seal must be replaced as a unit.



Replacement of Mechanical Seal

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

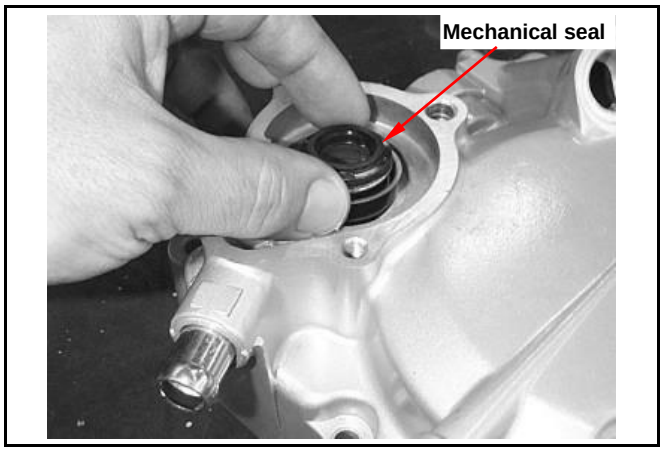
Special tools:
Inner bearing puller
Water pump bearing drive
SYM-9100100



Caution

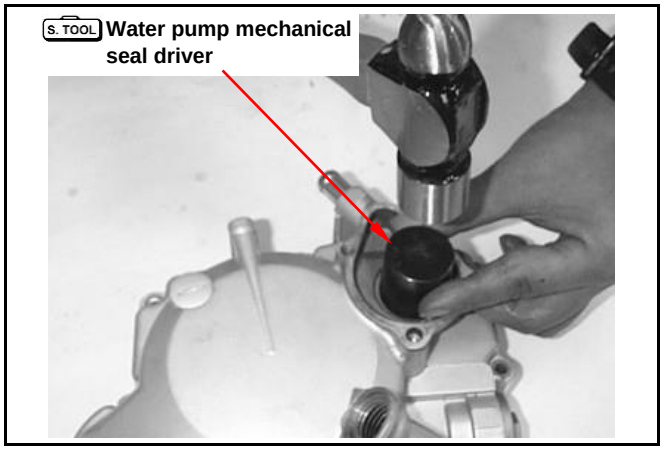
- Replace a new mechanical seal after removing it.

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

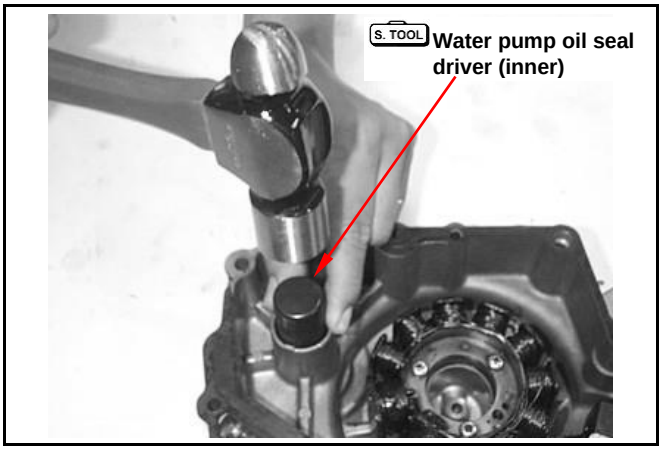


Install the mechanical seal onto the right crankcase.

Special tools:
Water pump mechanical seal driver
SYM-1721700-H9A



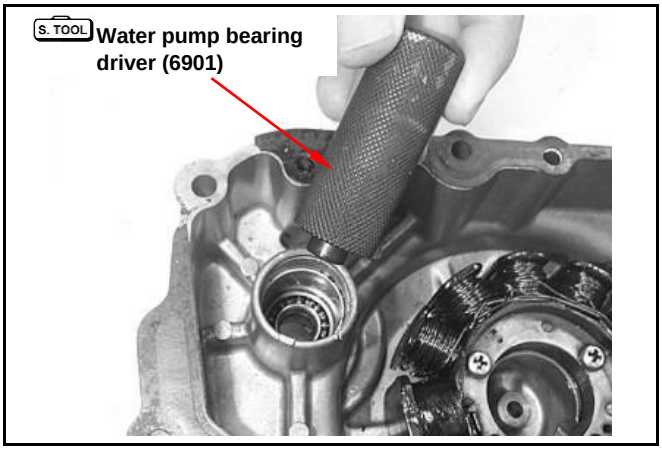
Install the new inner seal onto the right crankcase.
Special tools:
Water pump oil seal driver (inner)
SYM-9120500-H9A



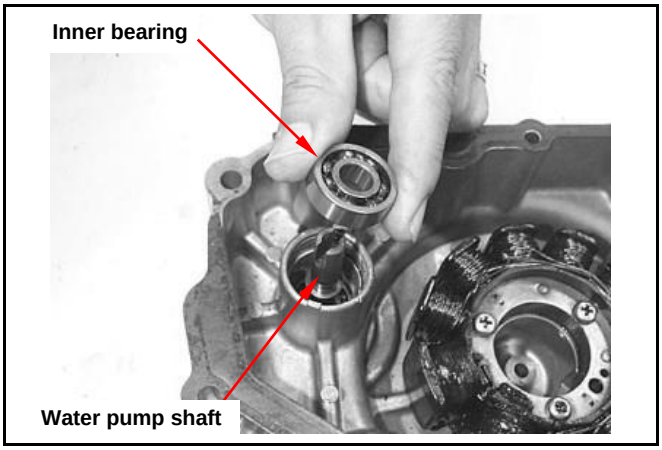
Install a new outside bearing to the right crankcase cover.
Special tools:
Water pump bearing driver (6901)
SYM-9100100

⚠ Caution

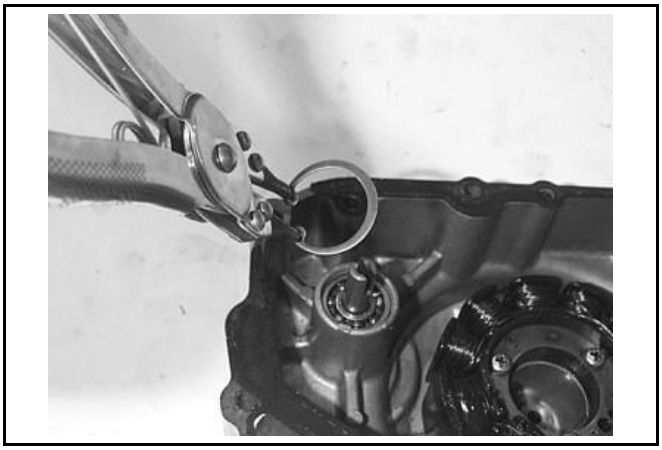
- Do not reuse old bearing. It must be replaced with a new one once it has been removed.



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.

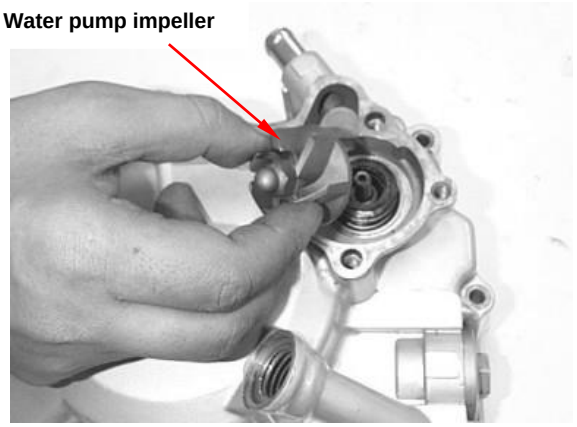
Caution

- Washer must be replaced together with the mechanical seal.

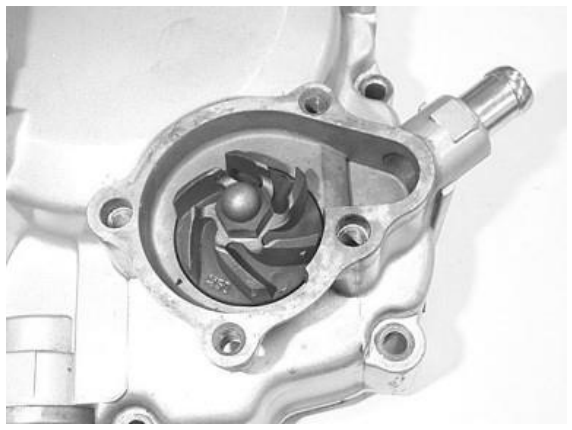
Install the impeller onto the water pump shaft and tighten.
Torque Value: 1.0~1.4kgf-m

Caution

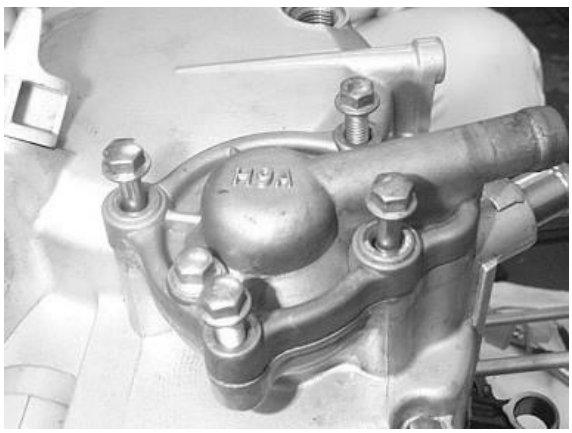
- The impeller is left thread.



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.

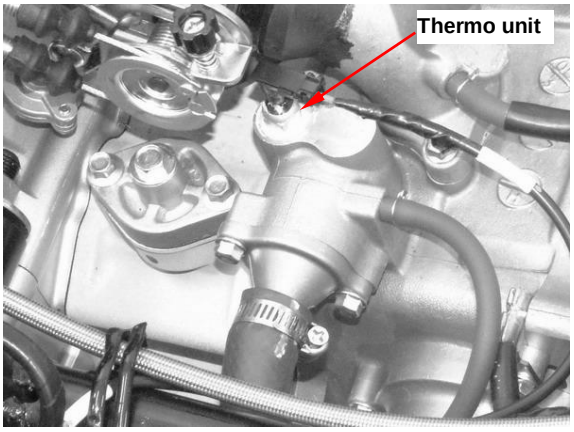


Thermostat

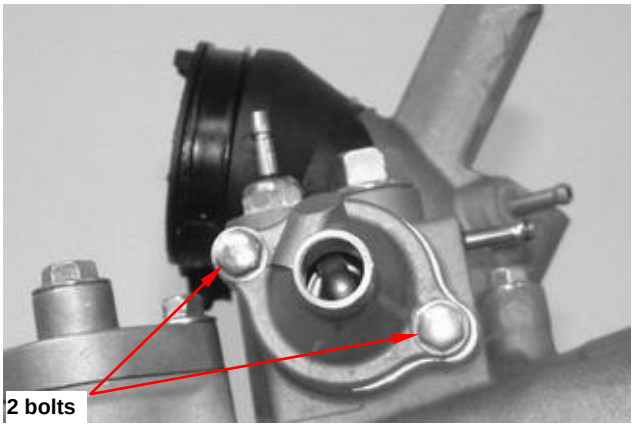
Please refer to chapter 17 for inspection of thermo unit.

Removal

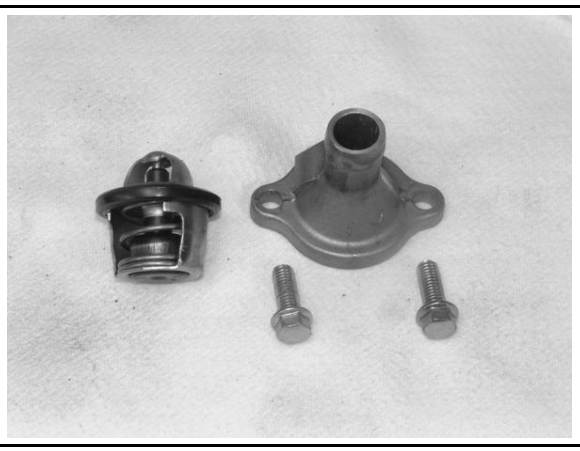
Remove the luggage box and body cover.
Drain out the coolant.



Remove the thermostat cover. (2 bolts)



Remove the thermostat.



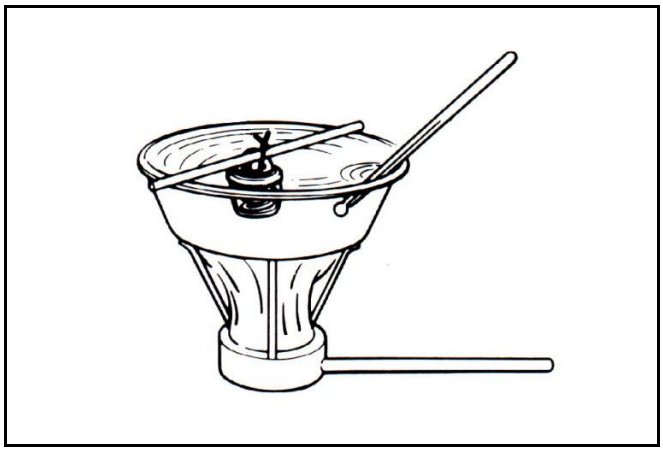
Inspection

Visually inspect thermostat for any damage.

Place the thermostat into heated water to check its operation.

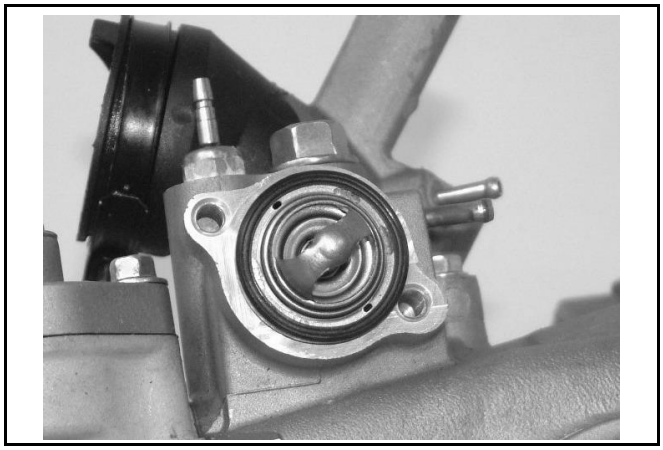
Caution

- 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.



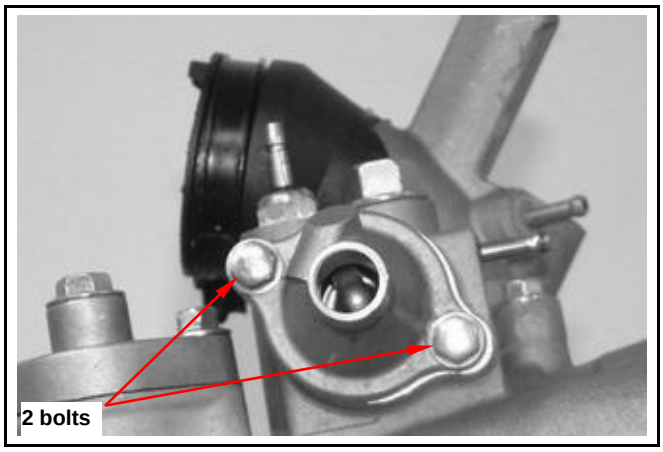
Technical Data

Valve begins to open	82 ± 1.5℃
Valve stroke	0.05 ~ 3mm



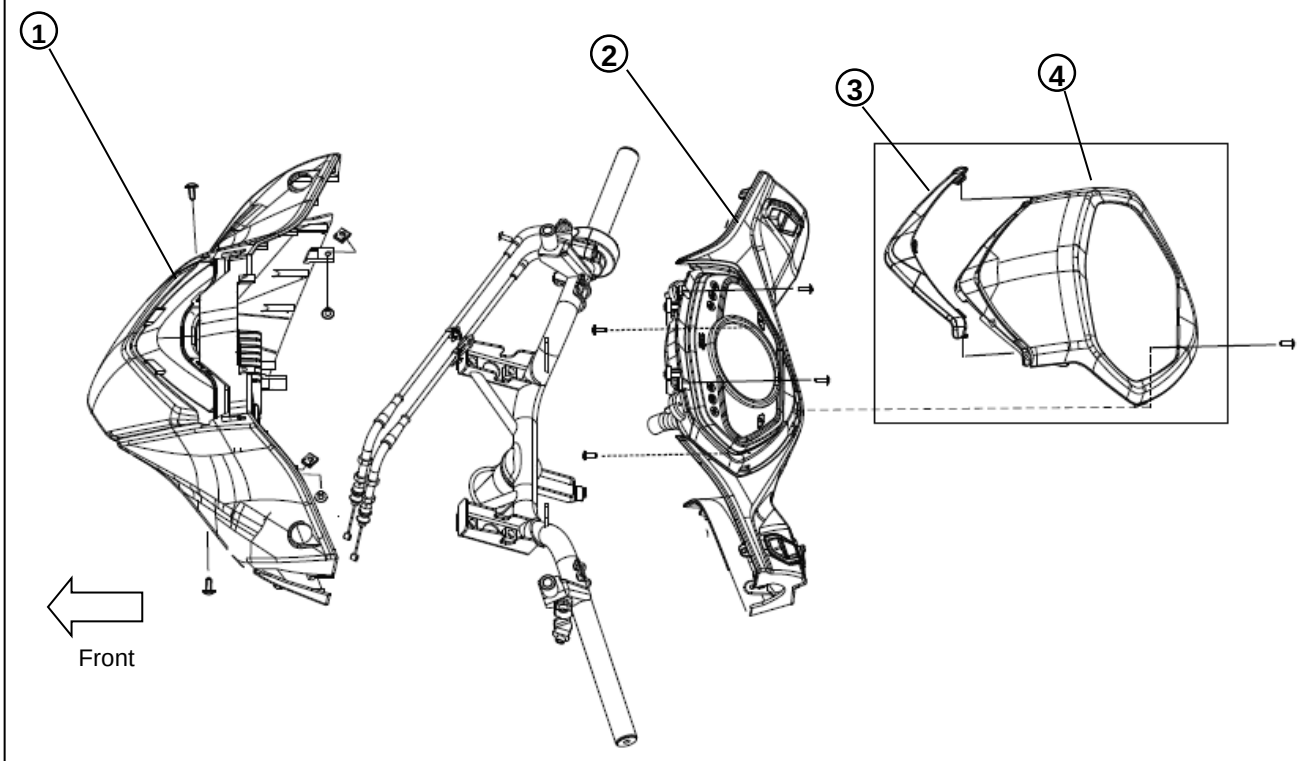
Installation

Install the thermostat.
Install the thermostat cover. (2 bolts)
Refill the coolant and bleed out the air bubble (Page 12-5).

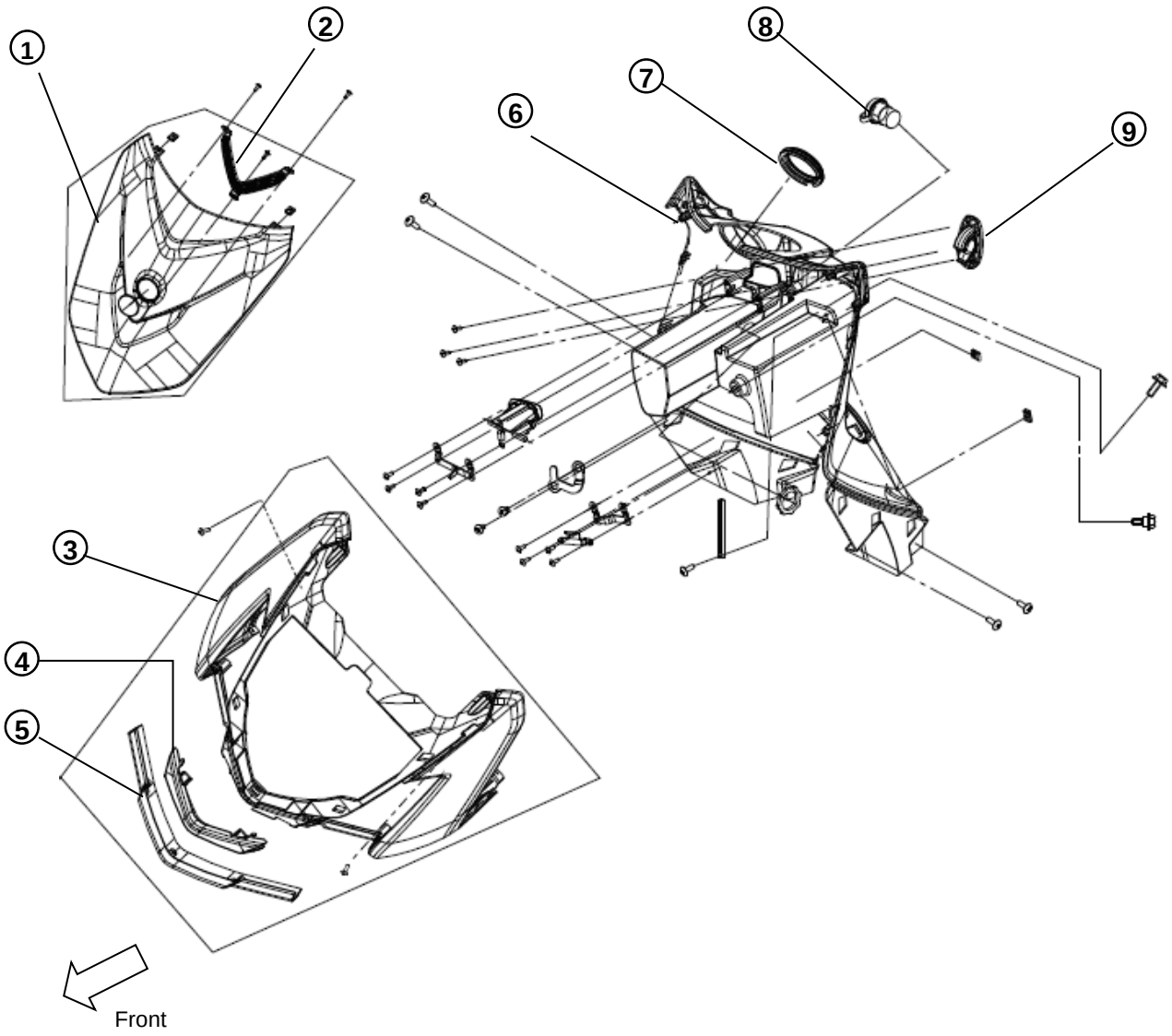


Notes:

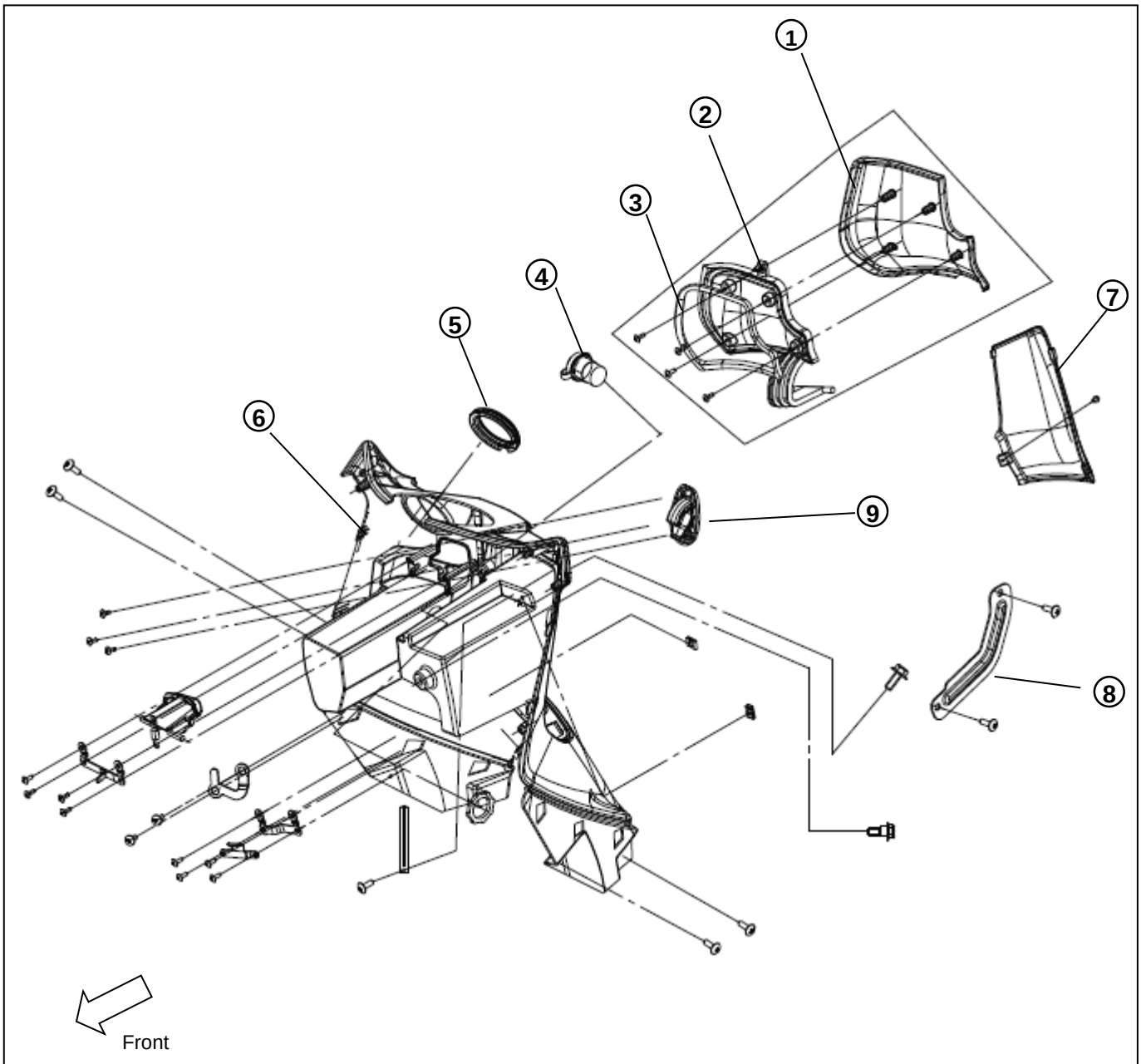
Explode Chart



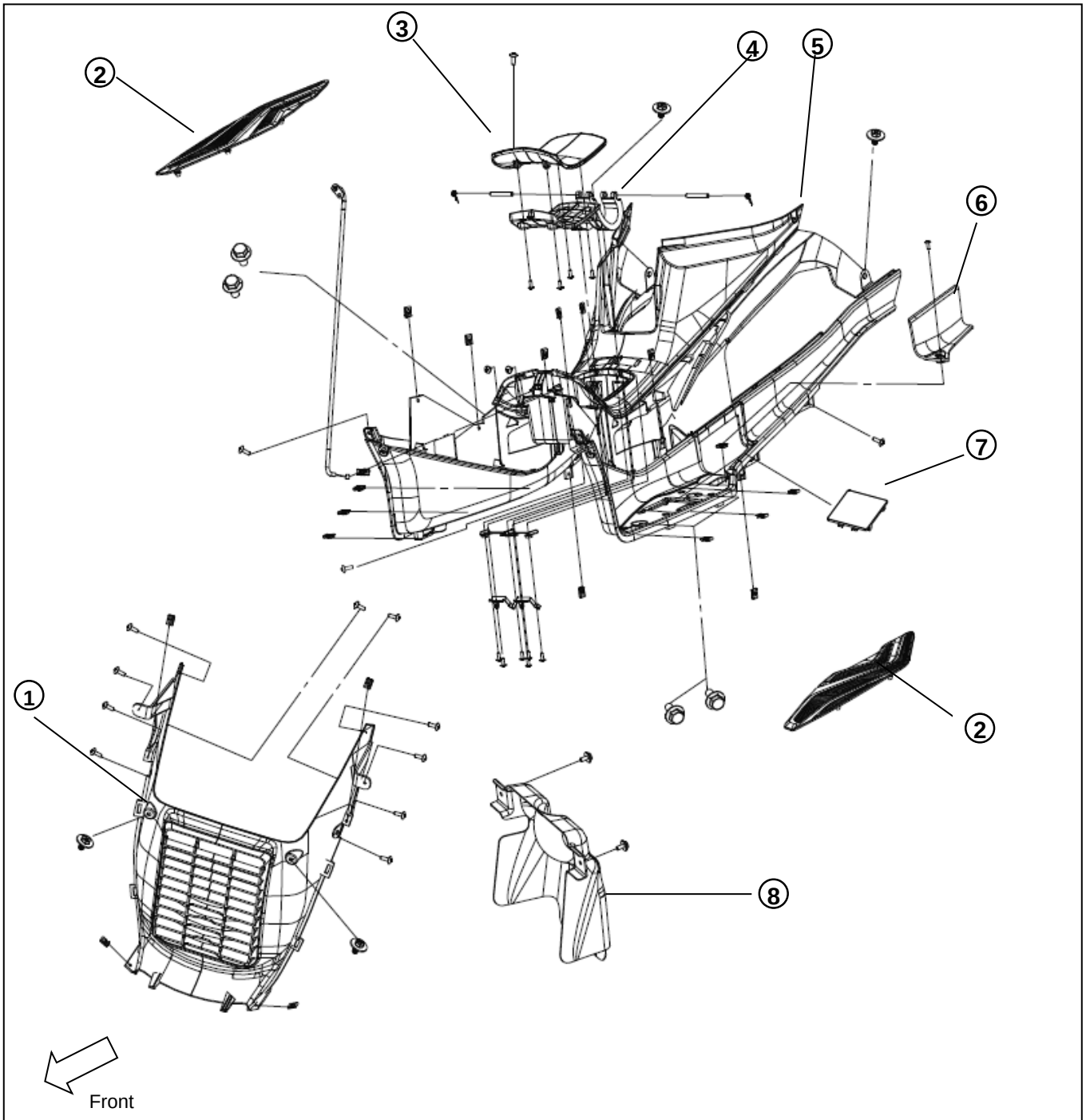
① Handle cover, front (w/ headlight)
② Handle cover, rear (w/ meter instrument)
③ Headlight garnish
④ Meter instrument cover



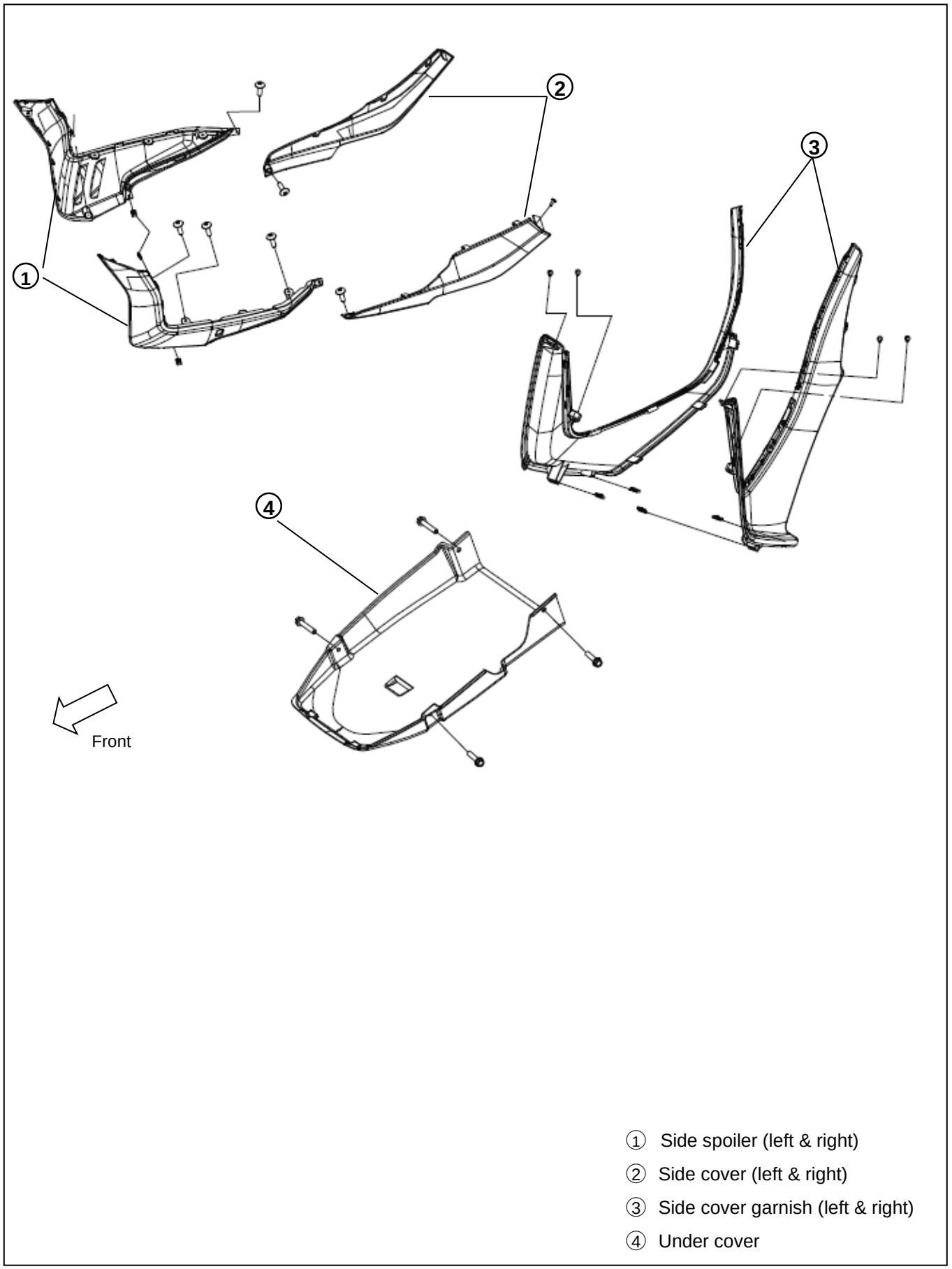
① Front top cover
② Front top cover grill
③ Front cover
④ Front cover garnish- A
⑤ Front cover garnish- B
⑥ Innerbox
⑦ Key set packing
⑧ USB charger
⑨ Luggage hook



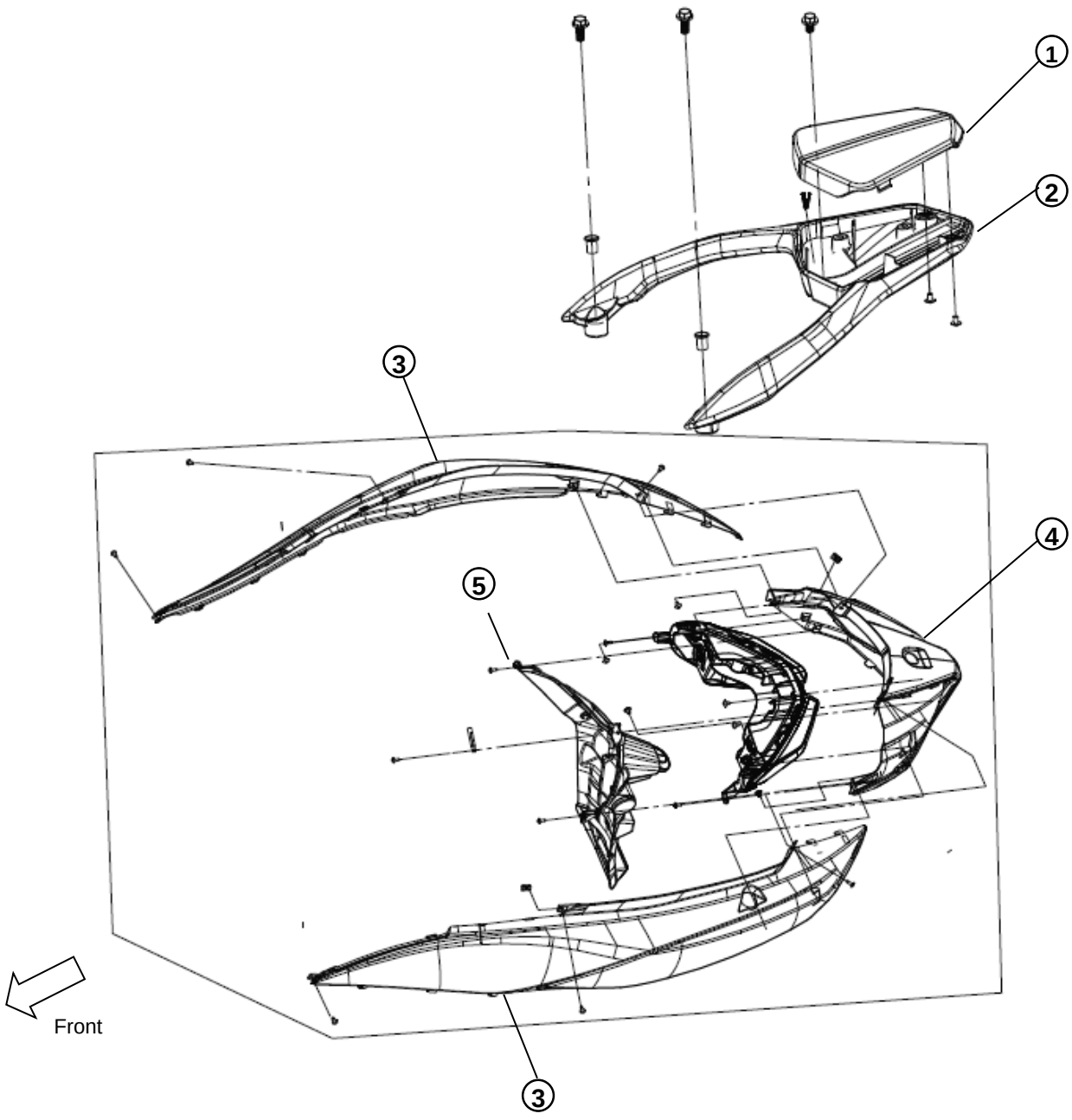
① Glove box cover
② Glove box cover stiffener
③ Glove box seal
④ USB charger
⑤ Key set packing
⑥ Inner box
⑦ Battery room cover
⑧ Batttery band
⑨ Luggage hook



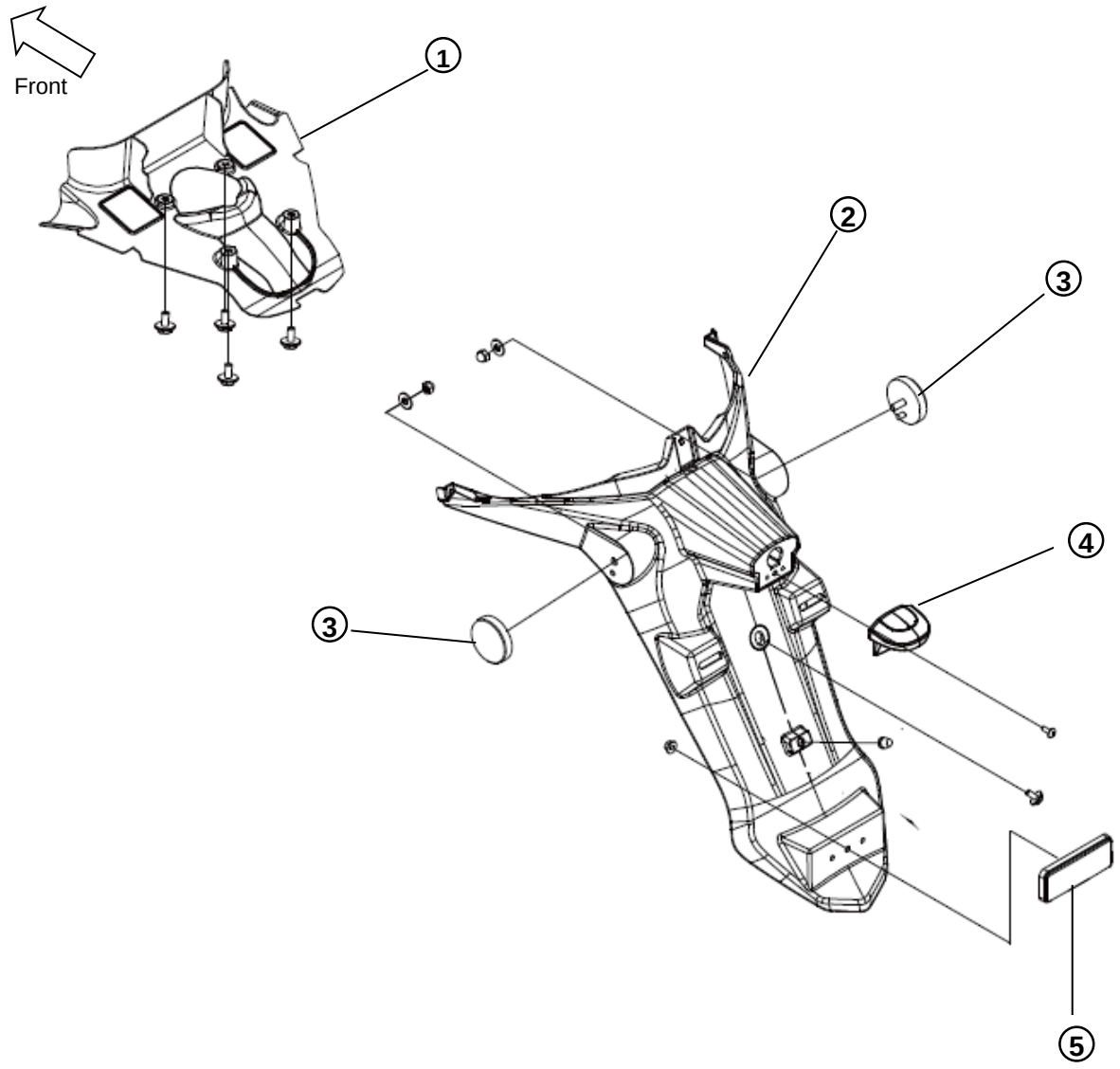
① Front under spoiler
② Floor mat (left & right)
③ Fuel lid
④ Fuel lid stiffener
⑤ Floor panel
⑥ Spark plug maintenance lid
⑦ Coolant maintenance cap
⑧ Fuel tank heat guard



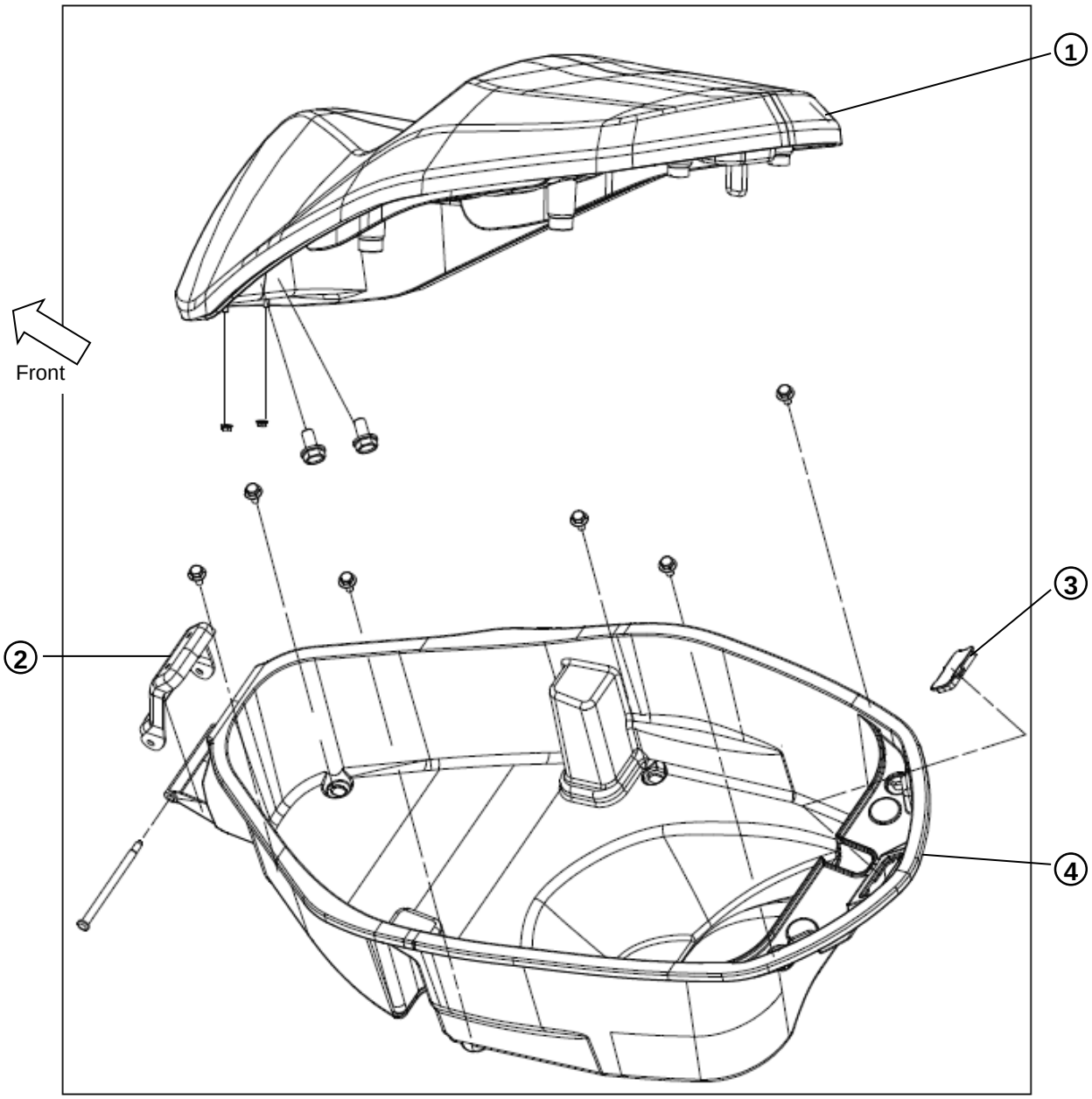
① Side spoiler (left & right)
② Side cover (left & right)
③ Side cover garnish (left & right)
④ Under cover



① Top box seat cover
② Rear carrier/top box seat
③ Body cover (left & right)
④ Rear center cover
⑤ Rear fender

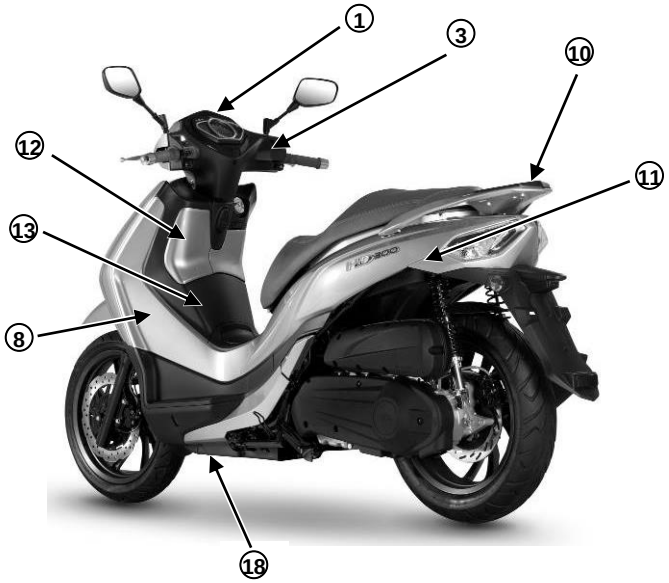


① Rear inner fender
② Rear fender
③ Side reflector (left & right)
④ License plate light
⑤ Rear reflector, red



① Seat
② Seat hinge
③ Diagnostic plug lid
④ Luggage box

Removal Sequence



① Meter instrument frame

② Handle cover, front

③ Handle cover, rear

④ Front top cover

⑤ Side cover (left & right)

⑥ Side spoiler (left & right)

⑦ Front cover

⑧ Side cover garnish (Left & right)

⑨ Luggage box (w/ seat)

⑩ Rear carrier/top box seat

⑪ Body cover w/ rear fender (left & right)

⑫ Battery room cover

⑬ Inner box

⑭ Floor panel

⑮ Front under spoiler

⑯ Front fender

⑰ Front mud guard

⑱ Under cover

① → (page 13-10)
② → (page 13-10)
③ → (page 13-11)
④ → (page 13-12)
⑤ → (page 13-12)
⑥ → (page 13-13)
⑦ → (page 13-14)
⑧ → (page 13-16)
⑨ → (page 13-16)
⑩ → (page 13-17)
⑪ → (page 13-17)
⑫ → (page 13-18)
⑬ → (page 13-18)
⑭ → (page 13-20)
⑮ → (page 13-21)
⑯ → (page 13-21)
⑰ → (page 13-22)
⑱ → (page 13-22)

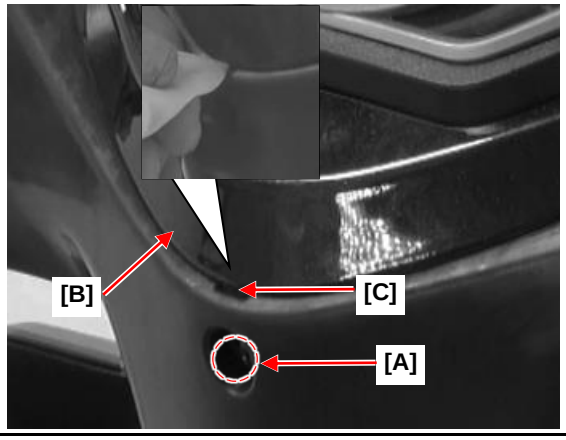
Meter Instrument Cover (w/ headlight garnish)

Place the scooter upright and steady.

Remove the cover screw [A].

Remove the cover [B] by inserting a flat head screw driver covered with a protective cloth to the slit [C].

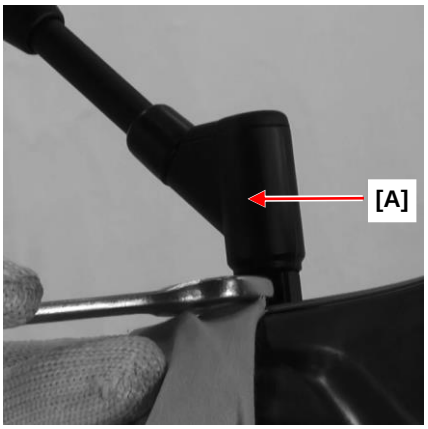
Reverse the above steps to install.



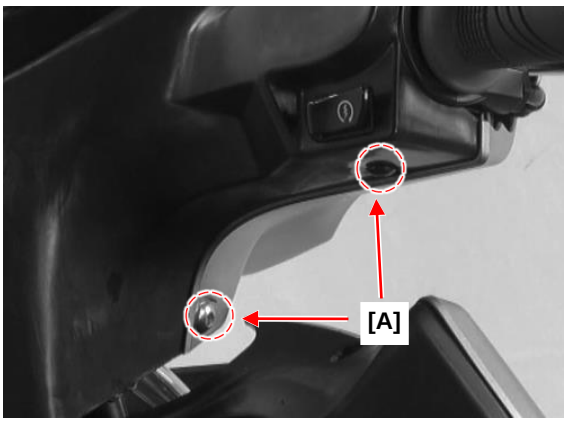
Handle Cover, Front

Remove the meter instrument cover (page 13-10).

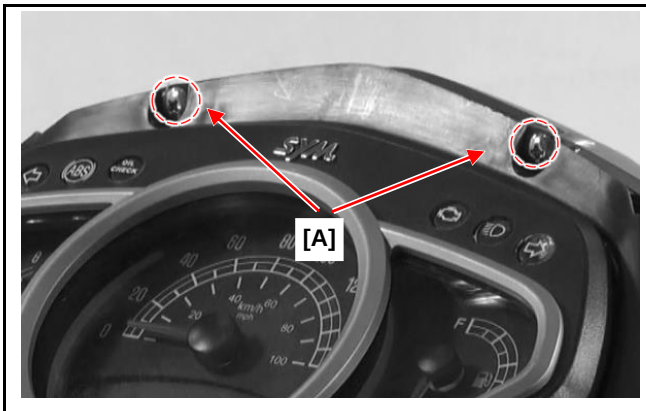
Cover the handle covers with a protective cloth and unscrew the 2 back mirrors [A] (left & right).



Remove the lower 4 screws [A] (left & right).



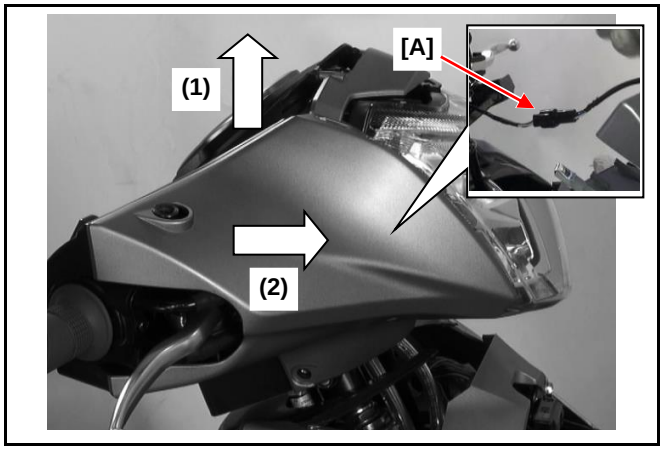
Remove the 2 upper screws [A].



Pull the front cover upward [A] and forward [B] to remove the front handle cover (with headlight).

Disconnect the headlight coupler [A].

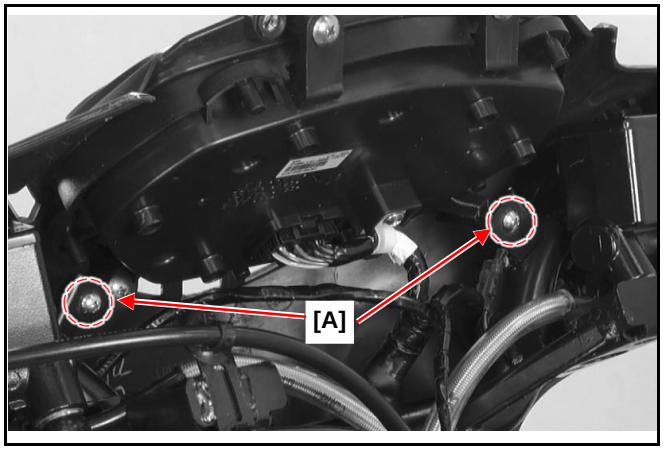
Reverse the above steps to install.



Handle Cover, Rear (w/ meter instrument)

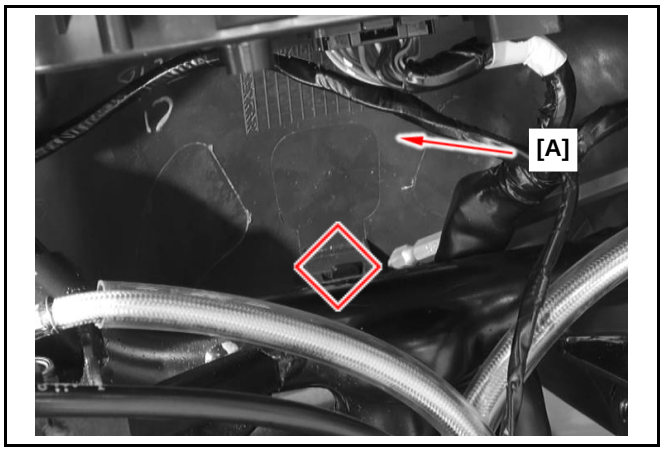
Remove the meter instrument cover (page 13-10).
Remove the front handle cover (page 13-10).

Remove the 2 rear cover screws [A].

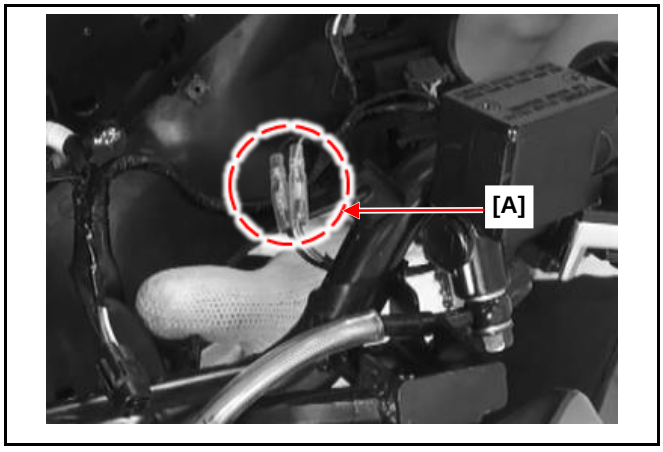


Pull up the rear handle cover to remove the rear handle cover [A].

◇: Tenon/hooked part

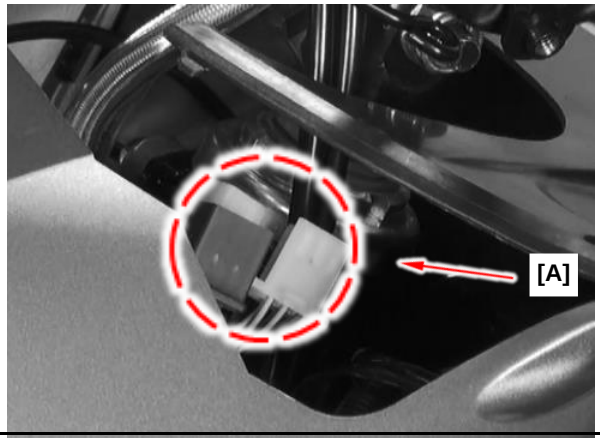


Disconnect the 4 brake light wires [A] (left & right).



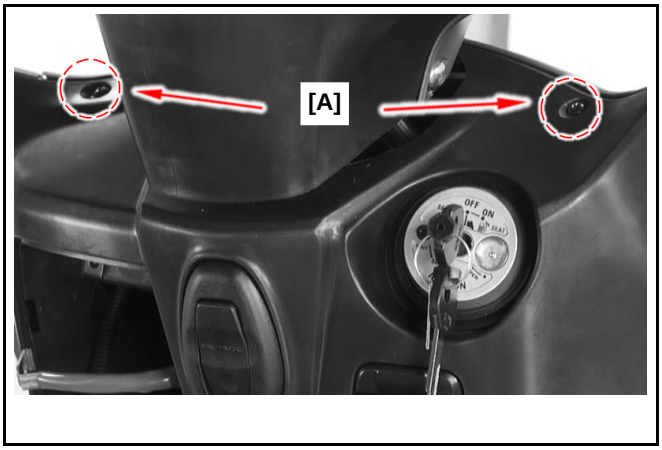
Disconnect the 3 meter instrument couplers [A].

Reverse the above steps to install.



Front Top Cover

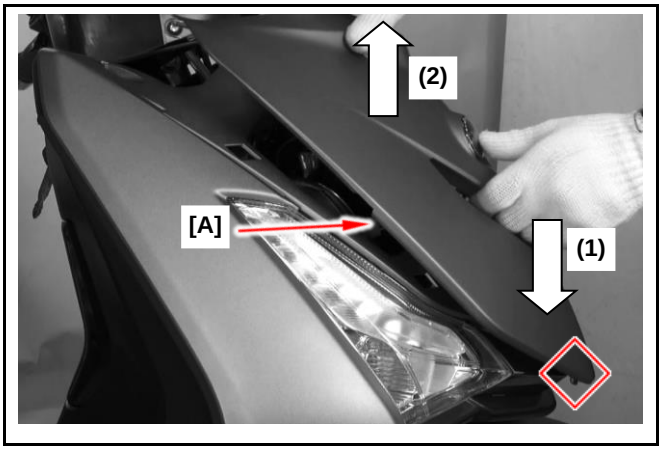
Remove the 2 front top cover screws [A].



Push down then pull up to detach the front top cover [A].

◇: Tenon/hooked part

Reverse the above steps to install.



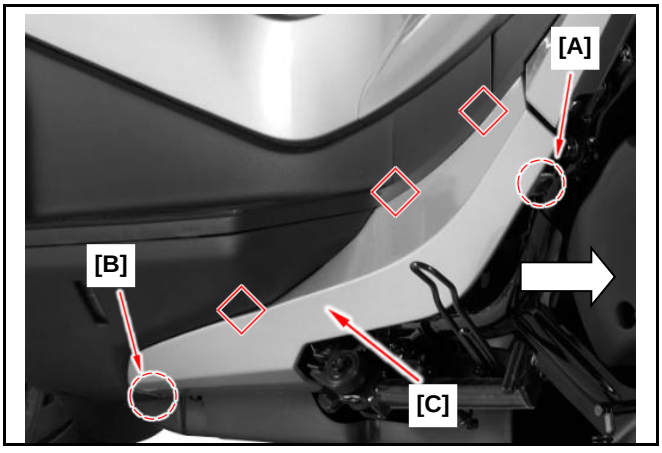
Lower Fairing

Remove the 2 plastic nuts [A] (left & right).
Remove the 2 screws [B] (left & right).

Pull backward to detach the 2 lower fairings [C] (left & right).

◇: Tenon/hooked part

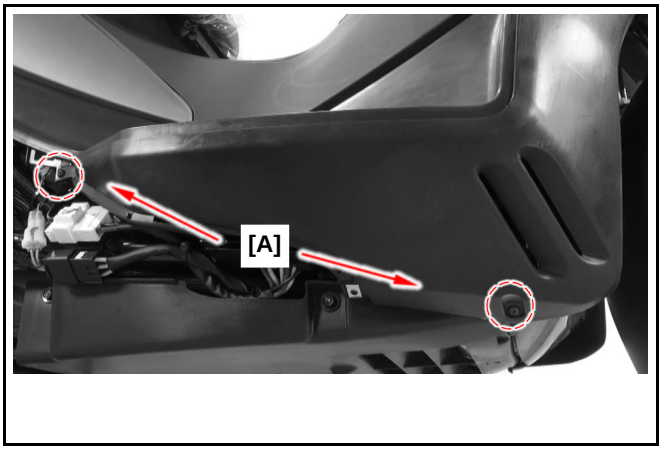
Reverse the above steps to install.



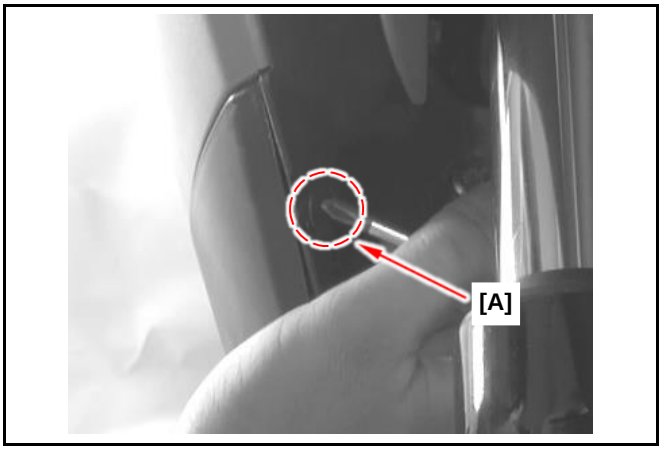
Side Spoiler

Remove the lower fairings (page 13-12).

Remove the 4 lower screws [A] (left & right).

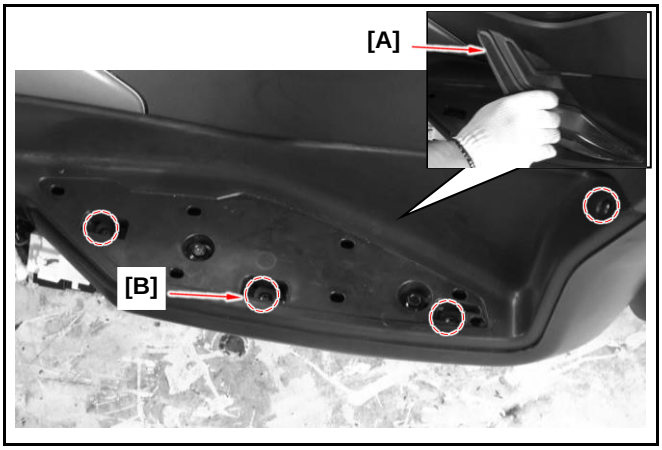


Remove the 2 plastic nuts [A] (left & right).



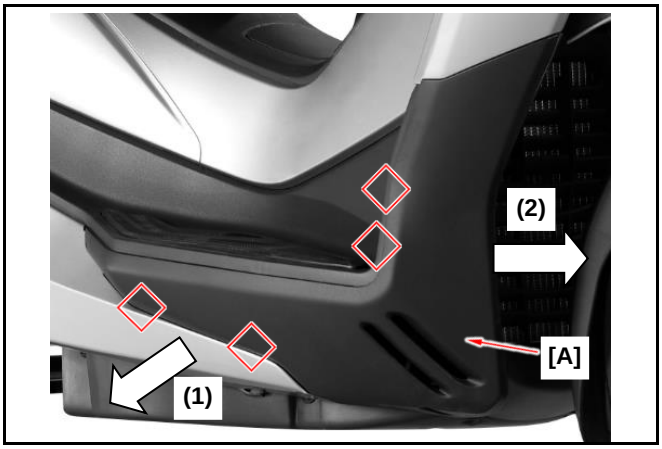
Remove the 2 mats [A] (left & right).

Remove the 4 upper screws [B] (right).

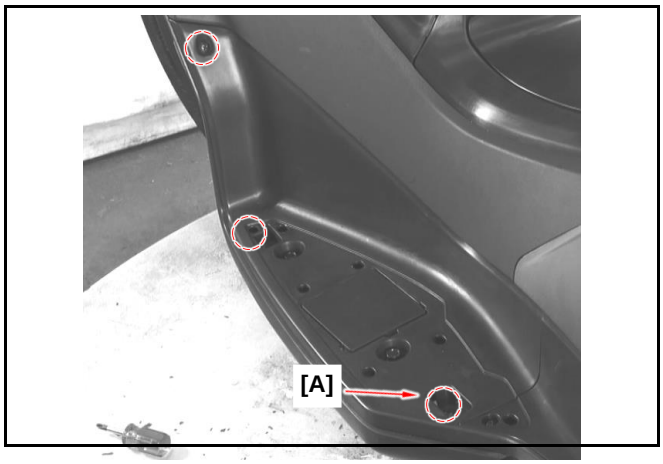


Pull and push forward to detach the right side spoiler [A].

◇: Tenon/hooked part

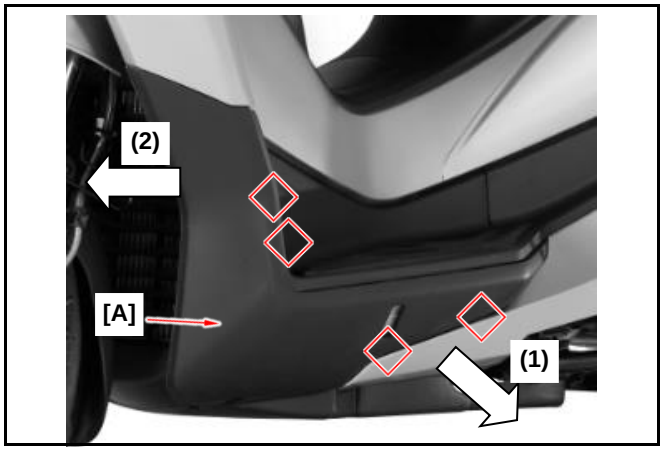


Remove the 3 upper screws [A] (left).



Pull and push forward to detach the left side spoiler [A].

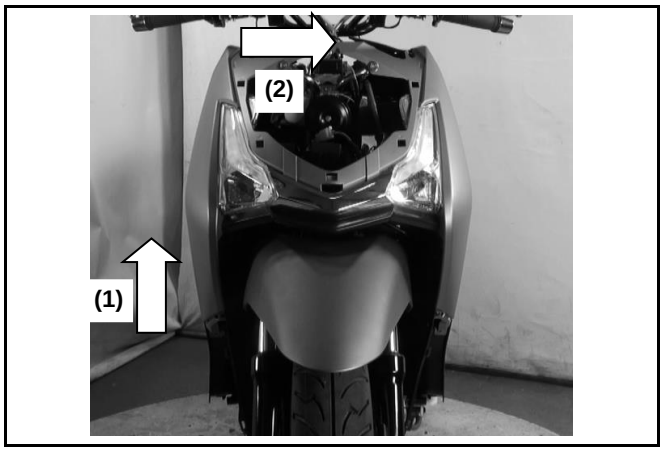
◇: Tenon/hooked part



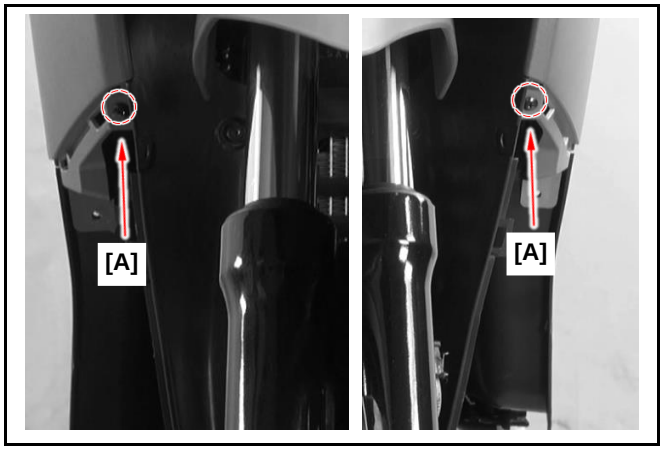
Front cover

Remove the front top cover (page 13-10).
Remove the side spoiler (page 13-13).

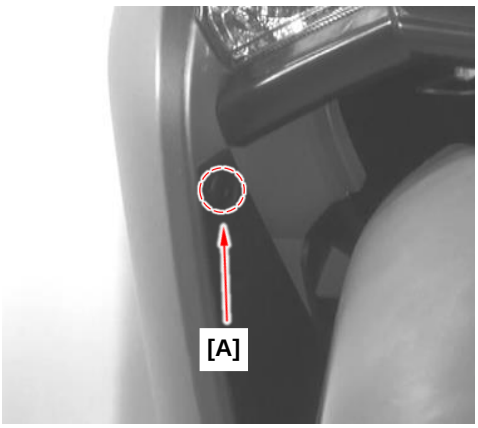
Remove the screws/plastic nuts from lower to upper side (1), from outer to inner side (2).



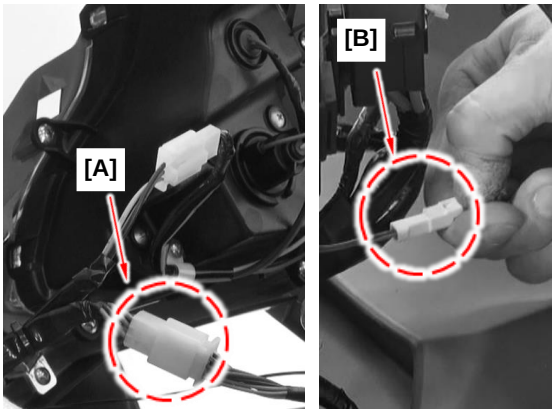
Remove the 2 lower screws [A].



Remove the 2 plastic nuts [A] (left & right).

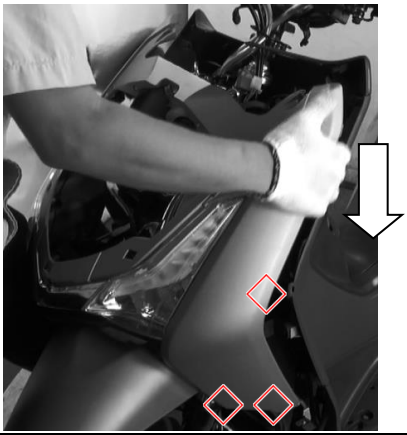


Disconnect the headlight coupler [A] and the position light coupler [B].



Hold the front cover [A] and push it down to detach.

◇: Tenon/hooked part



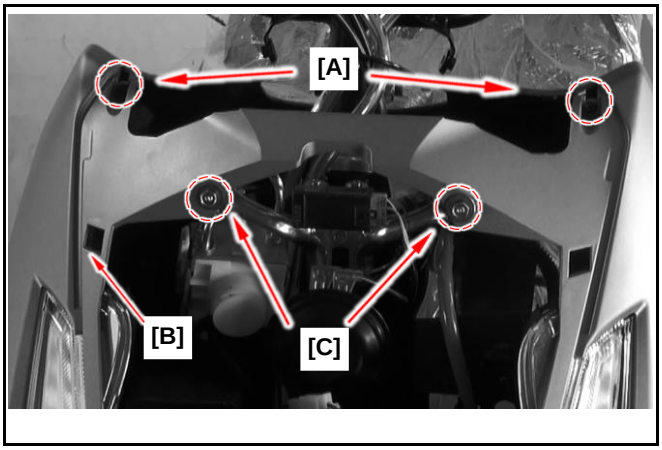
Remove the 2 screws [A].

Carefully hold the front cover [B] and remove the 2 bolts [C].

Reverse the above steps to install.

Notice:

- Do not damage the wires.

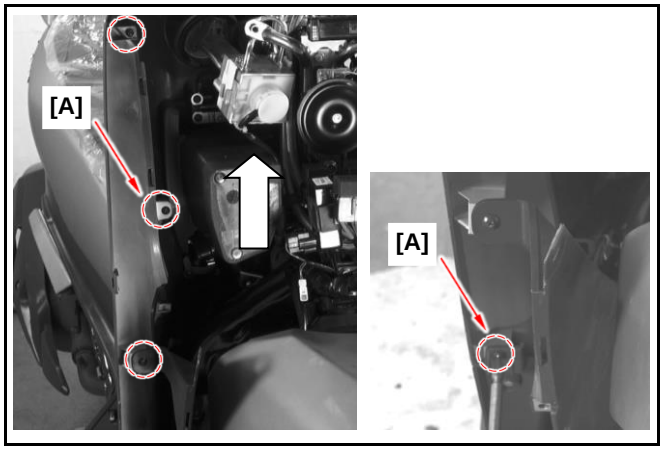


Side Cover Garnish

Remove the front top cover (page 13-10).
Remove the side spoiler (page 13-13).
Remove the front cover (page 13-14).

Remove the 8 screws [A] (left & right).

Remove the screws/plastic nuts from lower to upper side.



Push forward to remove the 2 side cover garnishes.

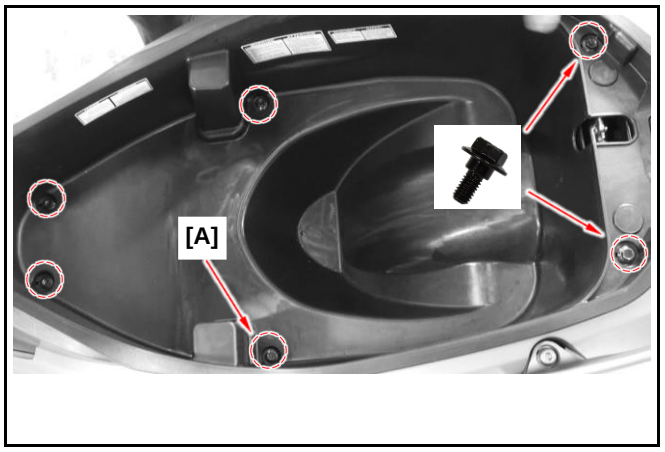
◇: Tenon/hooked part

Reverse the above steps to install.

Luggage Box

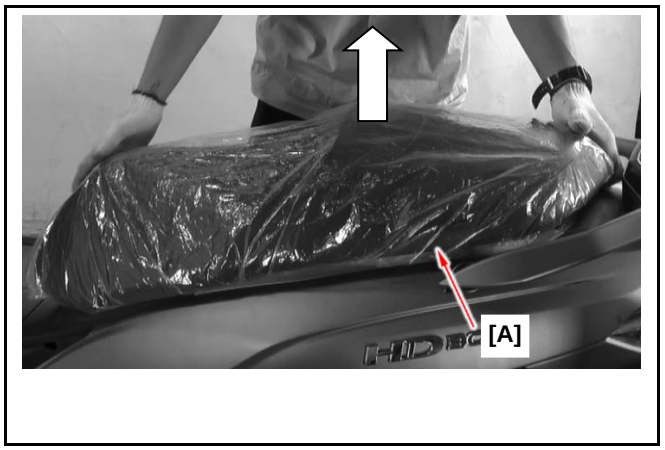
Turn ignition switch to seat open position to open the seat.

Remove the 6 seat bolts [A].



Pull up the luggage box (with seat) [A] to remove.

Reverse the above steps to install.



Rear Carrier/Top Box Seat

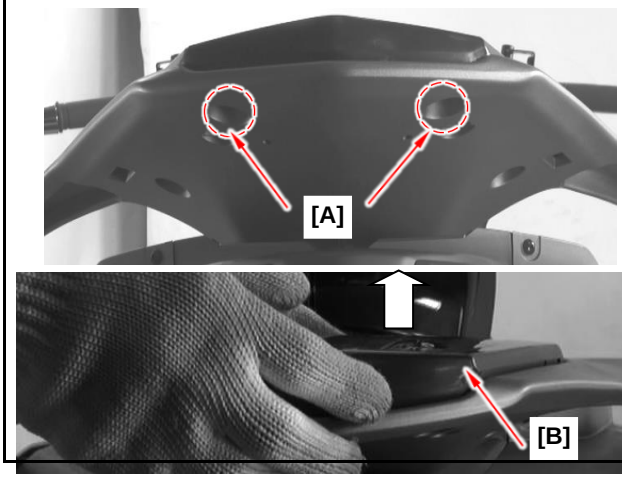
Remove the 2 screws [A].

Carefully pull up the tail of the top box seat cover [B].

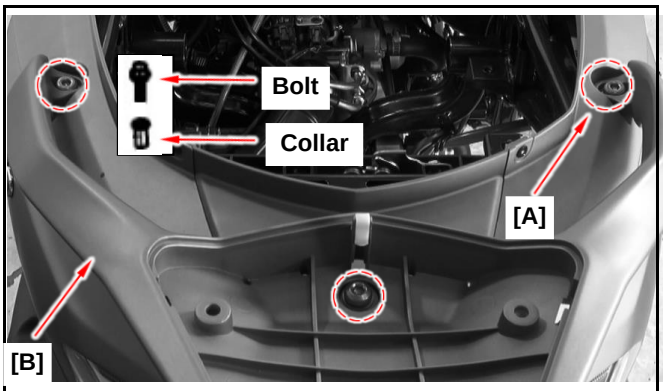
Notice:

- To install a top box, the top box seat cover must be removed.

Reverse the above steps to install.



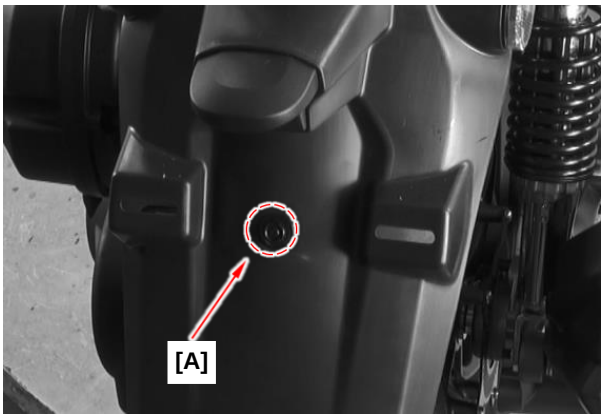
Remove the 3 bolts [A] to remove the rear carrier [B].



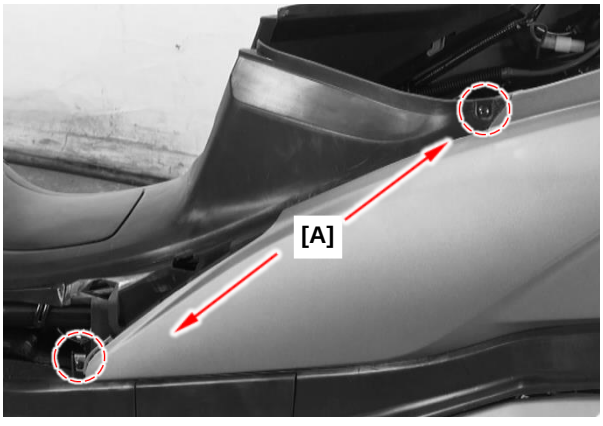
Body Cover

Remove the rear carrier (page 13-17).

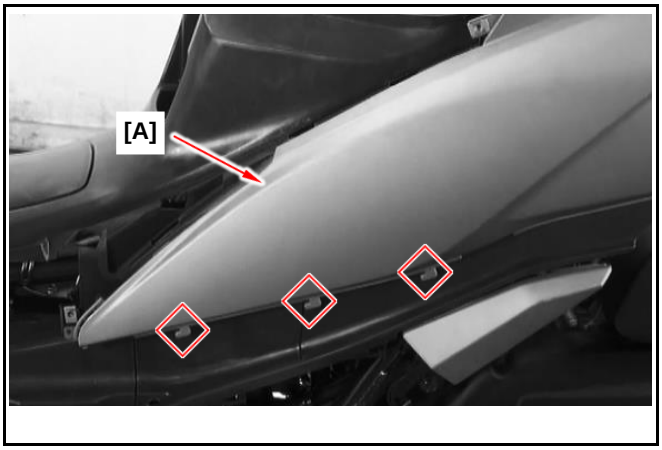
Remove the rear fender bolt [A].



Remove the 4 frame cover screws [A] (left & right).



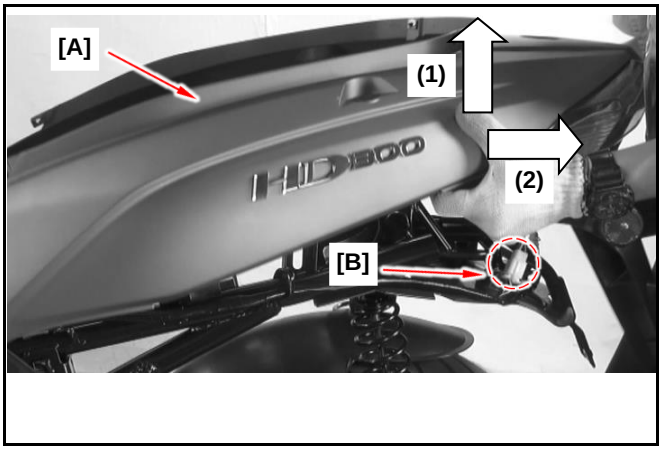
Detach the front part of the body cover [A] (left & right).



Hold the body cover [A], pull up then pull backward to remove the body cover.

Disconnect the rear light set coupler [B].

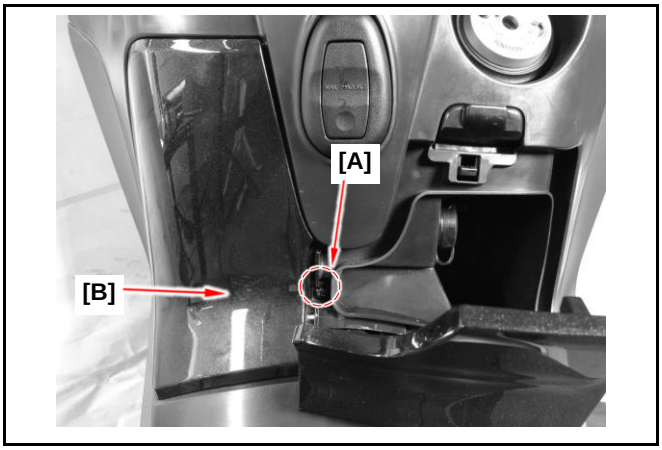
Reverse the above steps to install.



Battery Room Cover

Open the glove box cover and remove the screw [A].

Remove the battery room cover [B].



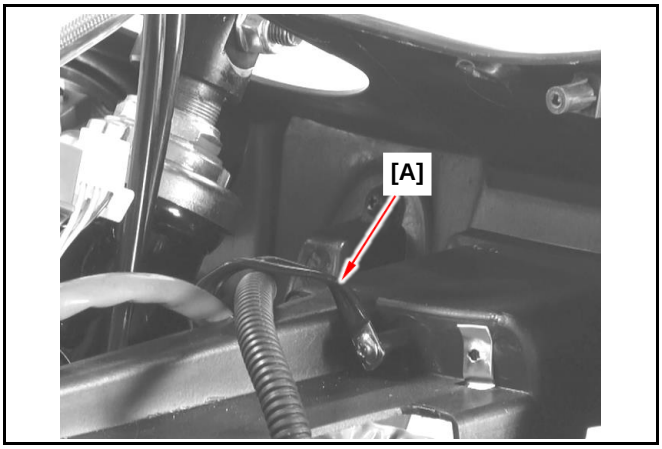
Inner Box

Notice:

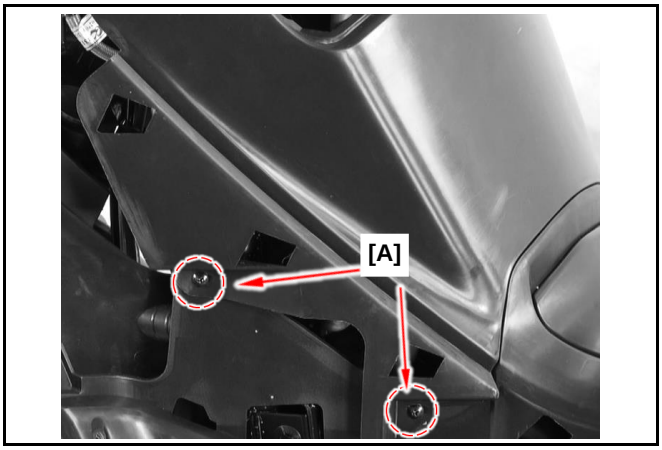
- Remove the battery before removing the inner box (page 2-10).

Remove the battery room cover (page 13-18).
Remove the front top cover (page 13-10).
Remove the side spoiler (page 13-13).
Remove the front cover (page 13-14).
Remove the side cover garnish (page 13-16).

Release the metallic wire band [A].

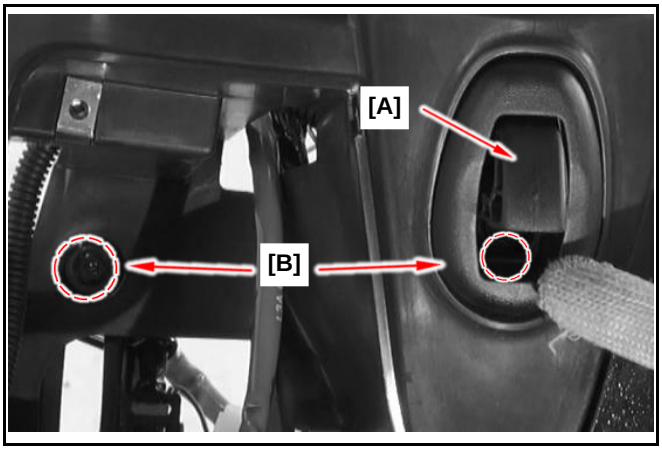


Remove the 4 inner box screws [A] (left & right).

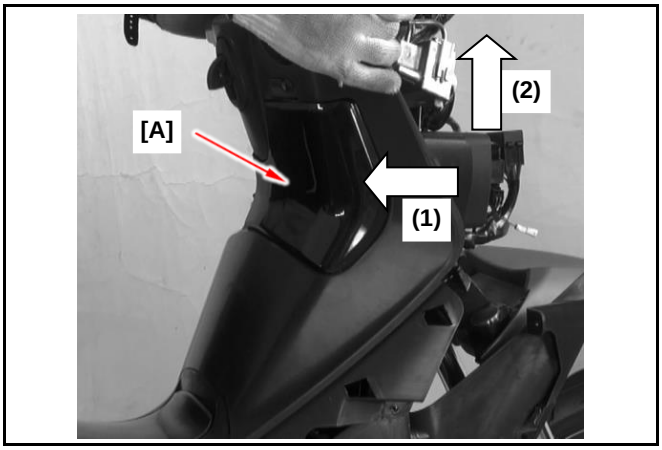


Flip up the luggage hook [A].

Remove the 2 bolts [B].

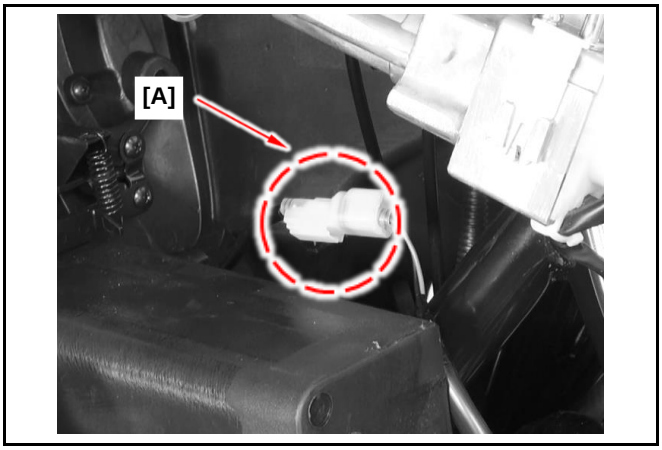


Pull backward then pull up to remove the inner box [A].



Disconnect the USB charger coupler [A].

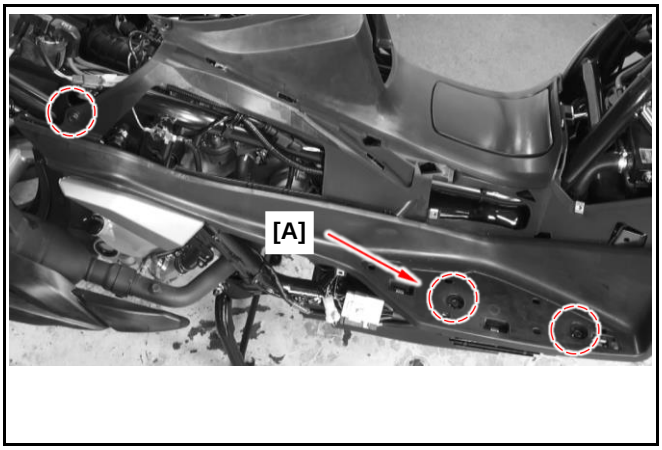
Reverse the above steps to install.



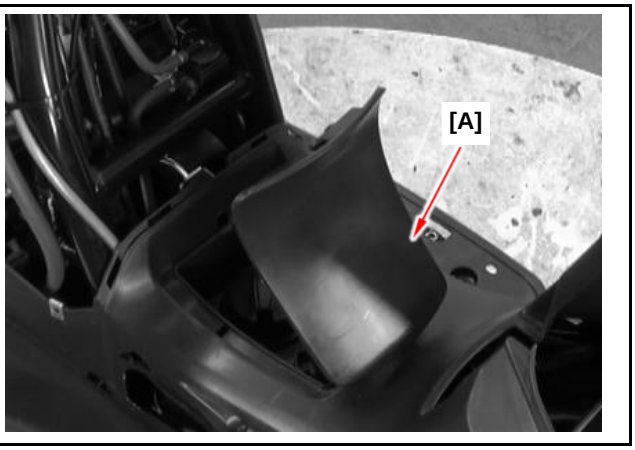
Floor Panel

Remove the battery room cover (page 13-18).
Remove the front top cover (page 13-10).
Remove the side spoiler (page 13-13).
Remove the front cover (page 13-14).
Remove the side cover garnish (page 13-16)
Remove the inner box (page 13-18).

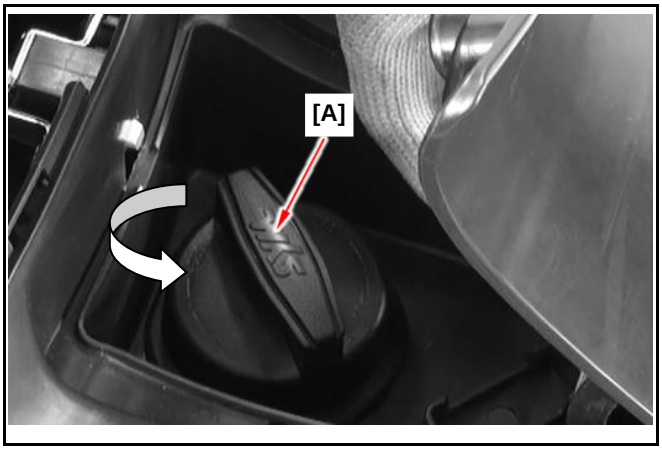
Remove the 6 bolts [A] (left & right).



Turn ignition switch to fuel lid position to release the fuel lid [A].



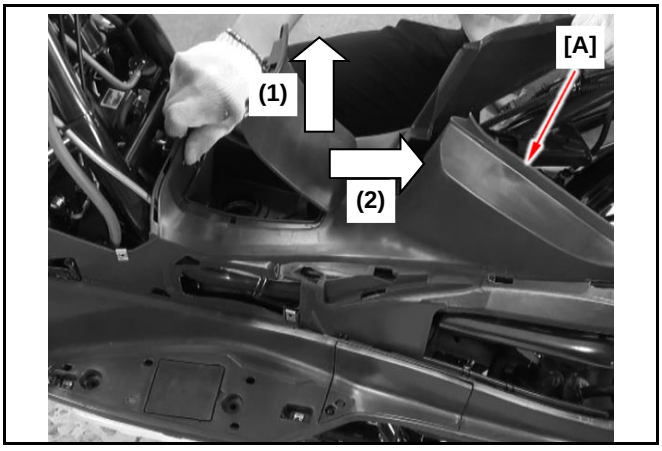
Remove the fuel tank cap [A].



Pull up then push backward to remove the floor panel [A], do not try to totally remove the floor panel.

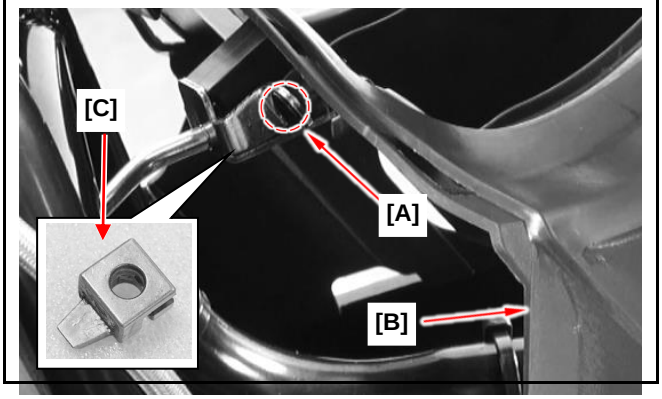
Notice:

- Carefully pull/push the floor panel to keep fuel lid lock from damage.



Remove the 2 fuel lid lock screws [A].

Remove the Floor panel [B].

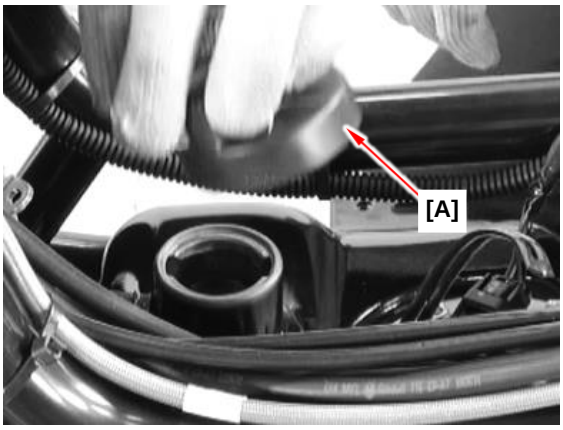


Notice:

- Chose a proper tool to remove the 2 fuel lid lock screws.
- Check the fuel lid lock catch [C] function before installing.

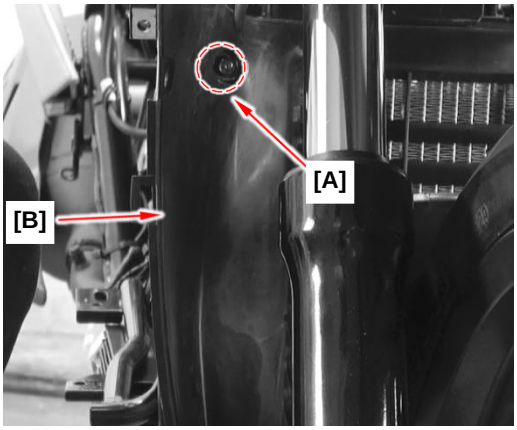
Screw on the fuel tank cap [A].

Reverse the above steps to install.



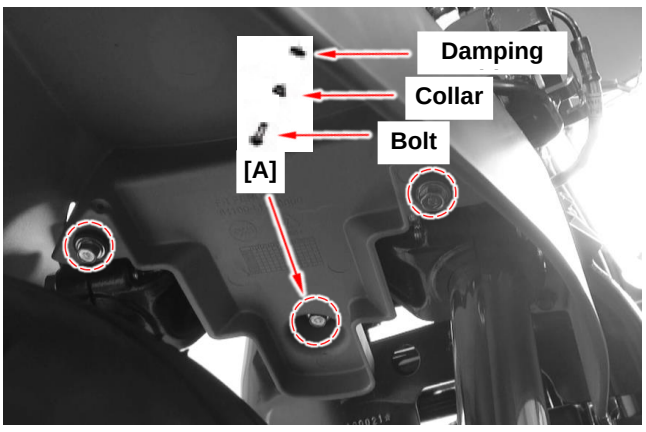
Front Under Spoiler

Remove the 2 spoiler bolts [A] (left & right).
Remove the spoiler [B].



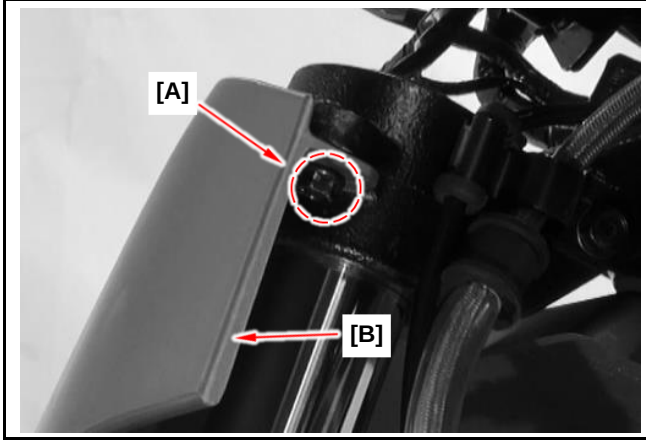
Front Fender

Remove the 3 front bolts [A].



Remove the 2 rear bolts [A] (left & right).

Remove the front fender [B].

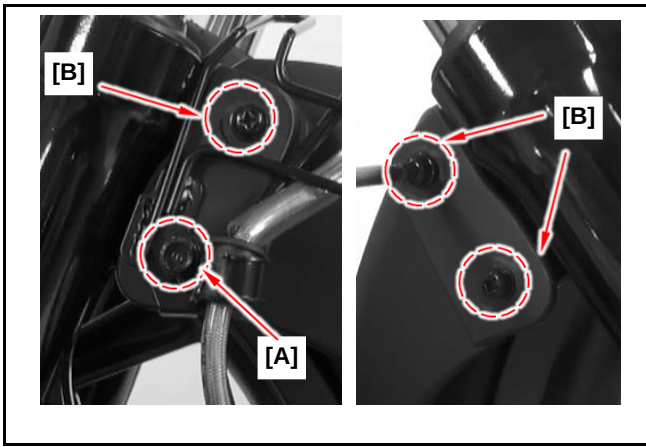


Front Mudguard

Remove the bolt [A].

Remove the 3 washer bolts [B].

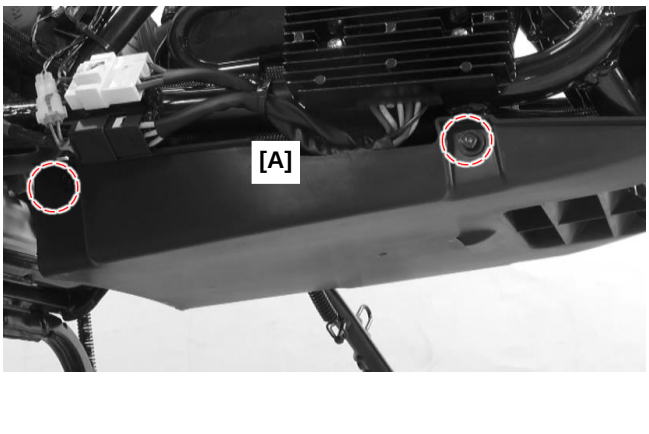
Remove the front mudguard.



Under Cover

Remove the lower fairing (page 13-12).
Remove the side spoiler (page 13-13).

Remove the 2 bolts [A].

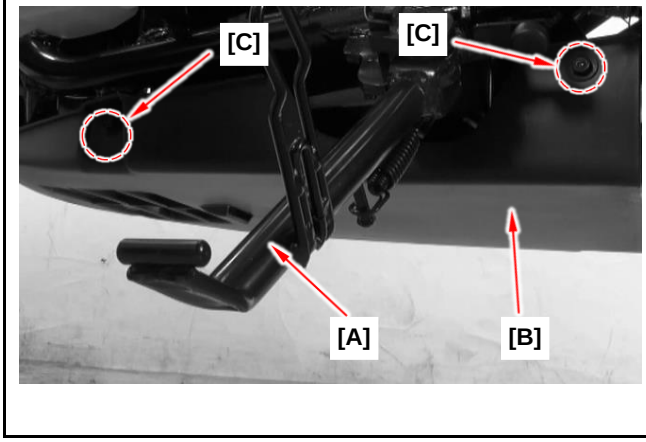


Lower the side stand [A].

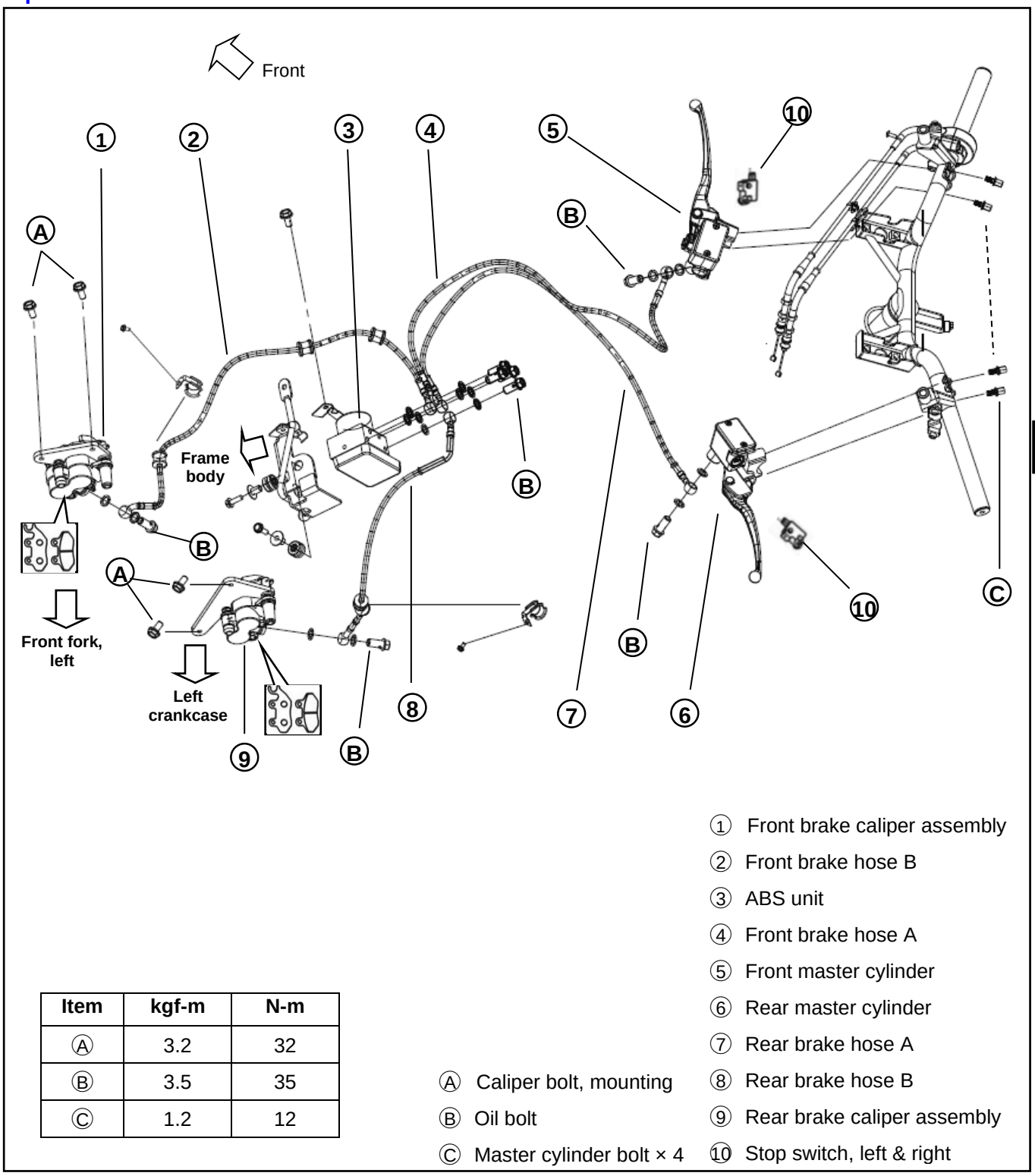
Carefully hold the fairing [B], remove the 2 bolts [C].

Remove the under cover.

Reverse the above steps to install.



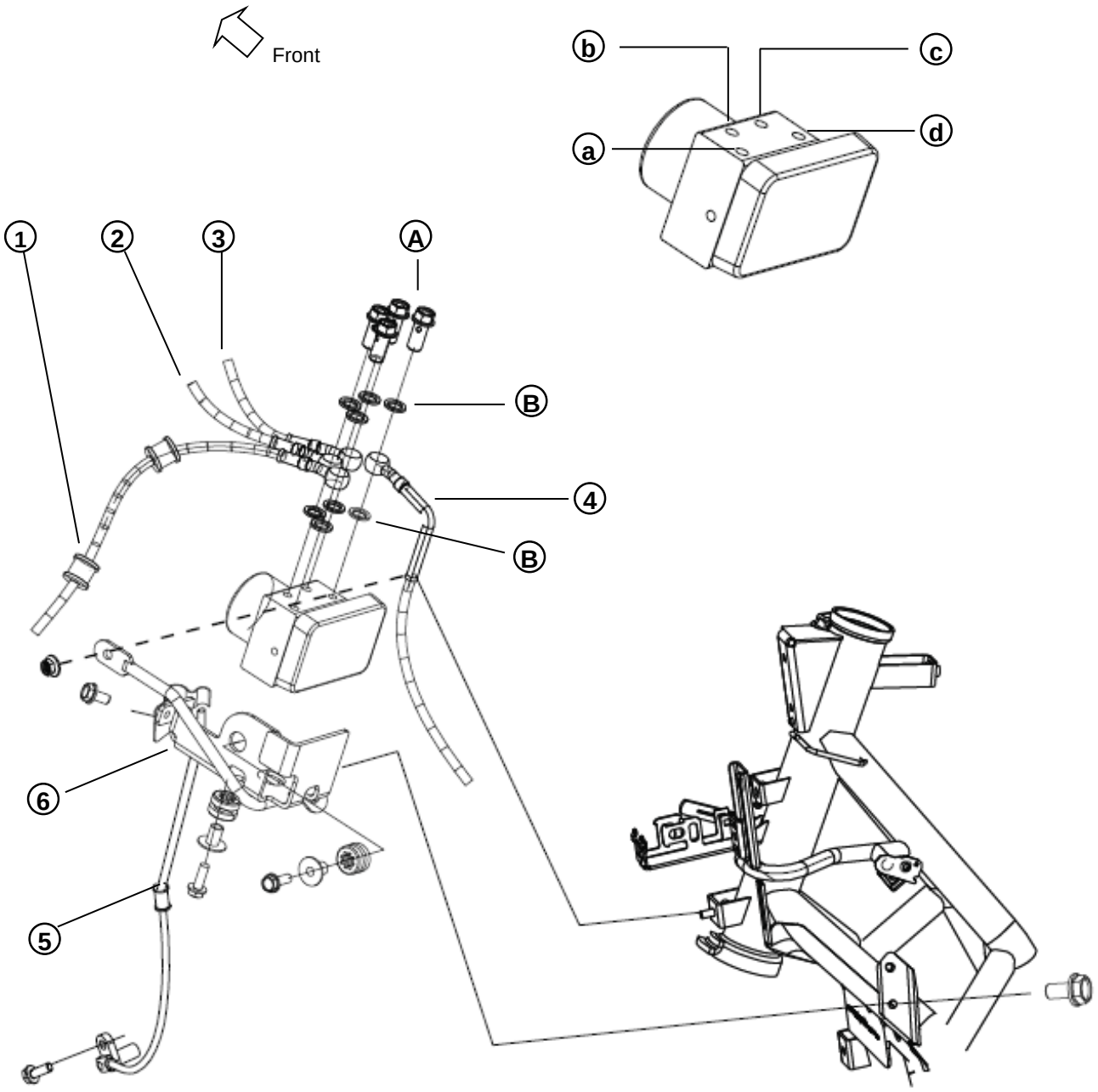
Explode Chart



Item	kgf-m	N-m
Ⓐ	3.2	32
Ⓑ	3.5	35
Ⓒ	1.2	12

Ⓐ Caliper bolt, mounting
Ⓑ Oil bolt
Ⓒ Master cylinder bolt × 4

① Front brake caliper assembly
② Front brake hose B
③ ABS unit
④ Front brake hose A
⑤ Front master cylinder
⑥ Rear master cylinder
⑦ Rear brake hose A
⑧ Rear brake hose B
⑨ Rear brake caliper assembly
⑩ Stop switch, left & right



① Front brake hose B
② Front brake hose A
③ Rear brake hose B
④ Rear brake hose A
⑤ Front wheel speed sensor
⑥ ABS unit bracket

Ⓐ Oil bolt × 4
Ⓑ Oil bolt washer × 8

ⓐ To front caliper
ⓑ To front master cylinder
ⓒ To rear master cylinder
ⓓ To rear brake caliper

Operational Precautions

Warning

- This brake system is originally filled with DOT 4 brake fluid; do not mix with different types of fluid.
- Do not let any foreign object enter the brake system when refilling brake fluid.
- Brake fluids are moisture-wicking, do not use any brake fluid taken from old, used or unsealed containers. Do not use leftover brake fluid from last servicing or stored for long period.
- Seal the container completely when storing brake fluid.
- Shorten brake fluid service interval if the scooter is frequently ridden in wet environment.
- Oil or fluid contaminated brake disk/brake pad can easily reduce brake performance, replace contaminated brake pads and clean brake disk with brake system cleaner.
- If oil leakage is found on front fork, inspect the front brake instantly.
- Do not spill brake fluid on the painted surfaces, plastic or rubber parts to avoid damage.
- Check brake system operation before riding.

Specifications

Item	Standard	Service Limit (mm)
Brake fluid, front & rear	DOT 3 or DOT 4	
Brake disk thickness		
Front	4.4 ~ 4.7 mm	4.0
Rear	5.3 ~ 5.7 mm	4.5
Brake disk warpage		
Front	–	0.25
Rear	–	0.25
Brake pad thickness		
Front	4.8 mm	1.0
Rear	6.0 mm	1.0
Wheel speed sensor ~ detection wheel clearance	1.1 ~ 1.6 mm	–

Torque Values

Item	Q'ty	Thread Dia. (mm)	Torque		Remarks
			kgf-m	N-m	
Brake					
Brake caliper bolt, front	2	8	3.2	32	
Brake caliper bolt, rear	2	8	3.2	32	
Oil bolt, brake hose	8	10	3.5	35	
Master cylinder bolt, front/rear	4	6	1.2	12	SH type
Brake disk bolt, front/rear	10	8	4.5	45	

Trouble Shooting

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

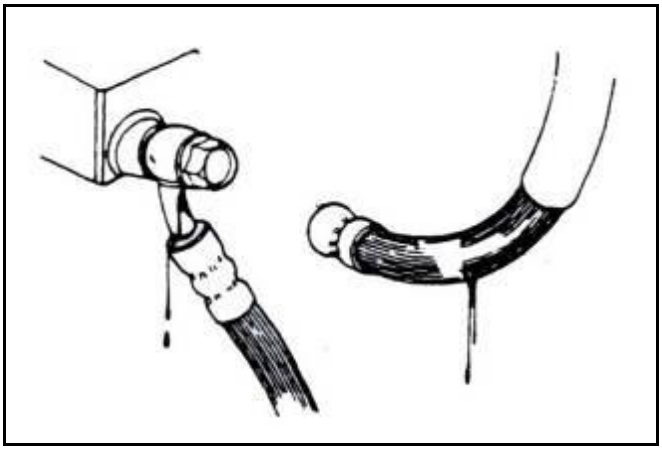
Brake noise

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

Brake System Inspection

Brake hose inspection

Inspect the brake hose joints and surfaces for leaking and damage. Replace a new one if necessary.



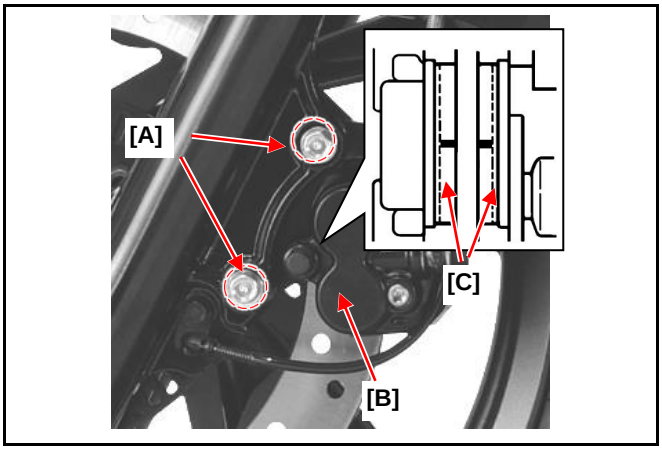
Front brake pad wear inspection

Set the scooter upright and steady.

Remove the bolts [A] to remove the front caliper [B].

Replace the brake pads when each pad is worn to the wear limit grooves [C].

Torque value：3.2 kgf-m

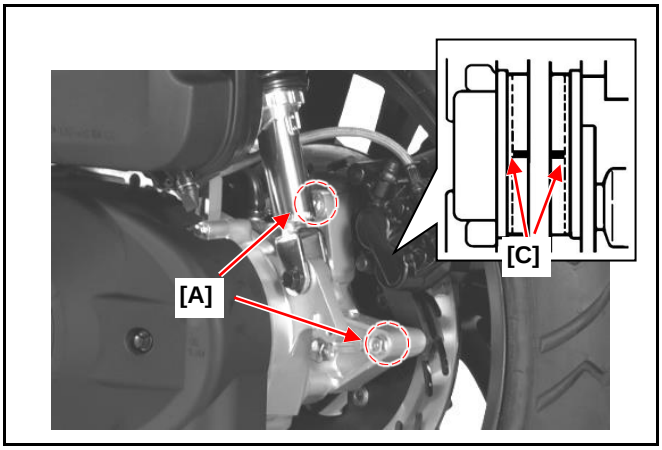


Rear brake pad wear inspection

Set the scooter upright and steady.

Remove the bolts [A] to remove the front caliper [B].

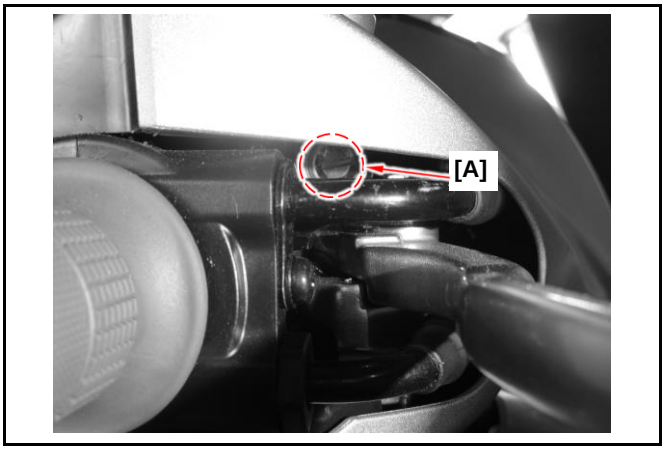
Replace the brake pads when each pad is worn to the wear limit grooves [C].



Brake fluid level

Set the motorcycle upright.

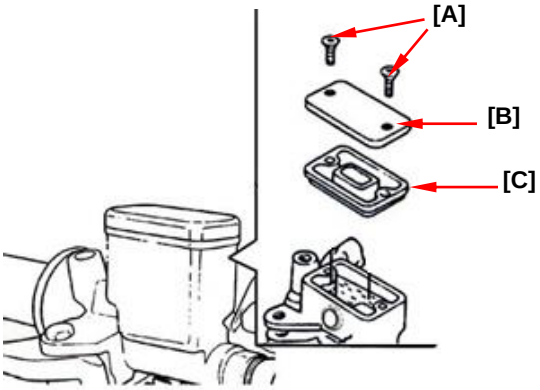
Check brake fluid level in the front and rear brake fluid reservoir. If the level is lower than the “MIN” level line [A] in the front/rear reservoir, add recommended brake fluid. Also check brake system for leaking if low brake fluid level is found.



Adding brake fluid

Set the scooter upright and steady.

Remove the below components:
- Front handlebar cover (page 13-10).
- Screws [A] (For front reservoir)
- Reservoir cap [B]
- Diaphragm [C]



Fill the reservoir with DOT3 or DOT4 brake fluid to adequate level.

Install the diaphragm, the reservoir cap and the screws.

RECOMMENDED BRAKE FLUID: "SYMOIL" DOT4 Brake Fluid.

Notice:

- In order to keep brake fluid in horizontal position, do not remove the cap until the motorcycle is steady.
- Do not operate the brake levers after the caps are removed. Otherwise, the brake fluid will spill out.
- Do not mix different brake fluid together.

Brake Fluid Replacement

Connect drain hose to brake bleeder valve.

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

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

Recommended brake fluid: "SYMOIL" DOT4 Brake Fluid

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

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

Close the valve when finishing the brake system refilling fluid procedure, and operate the brake lever to check whether air bubble is in brake system or not.

If brake is still soft, please bleed the system as described below:

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

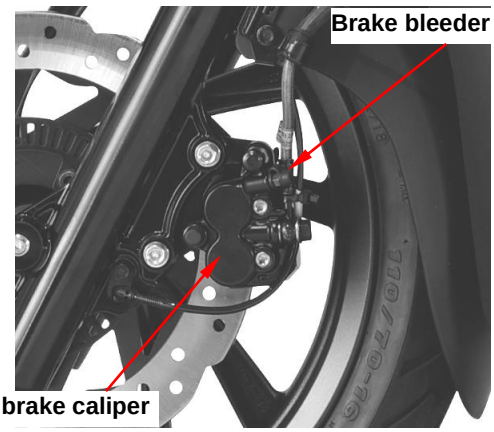
Caution

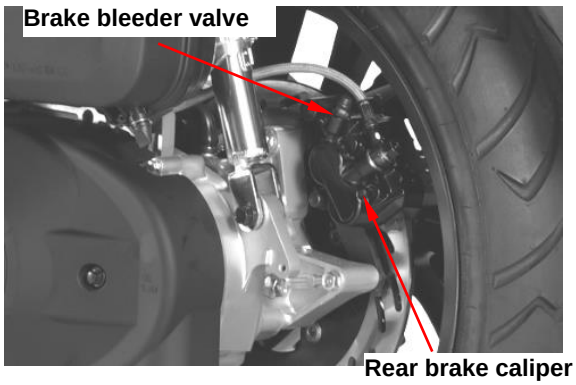
- Do not release the brake lever before the drain valve is closed.
- Always check the brake fluid level when carrying out the air bleeding procedure to avoid air enter into the system.

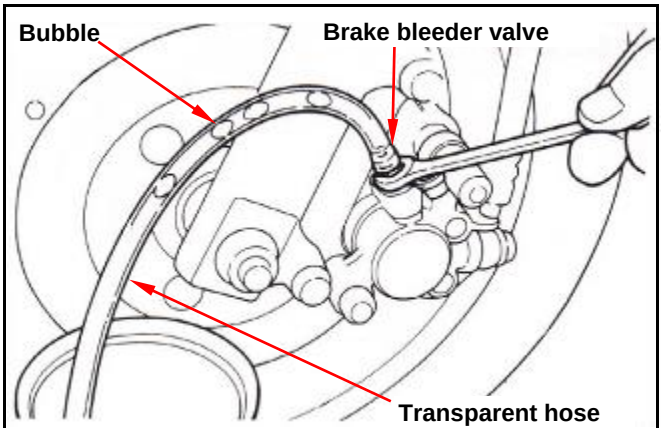
2. Slowly release the brake lever, and wait for a few seconds until it reaches its top position.
3. Repeat the steps 1 and 2 until there is no air bubble at the end of the hose.
4. Tightly close the drain valve.
5. Make sure the brake fluid is in the UPPER level of the master cylinder, and refill the 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 oil bolt 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: 3.2 kgf-m

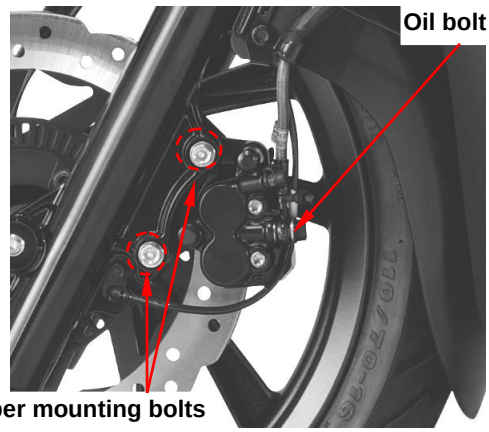
Caution

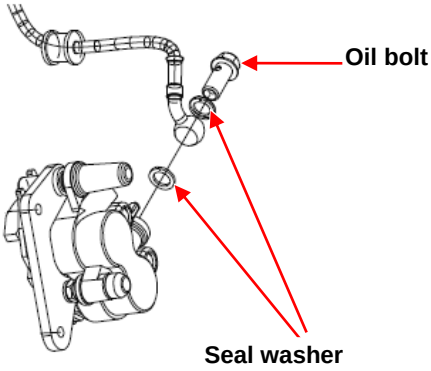
- Use M8 x 35 mm flange bolt only.
- Long bolt will impair the operation of brake disk.

Use two seal washers and oil bolt to lock the hoses and brake caliper in place.

Torque: 3.5 kgf-m

Refill up the brake fluid to the reservoir and make necessary air bleeding.





Brake pad replacement

Remove brake caliper.

Remove the brake pad guidance shafts cotter pins.

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

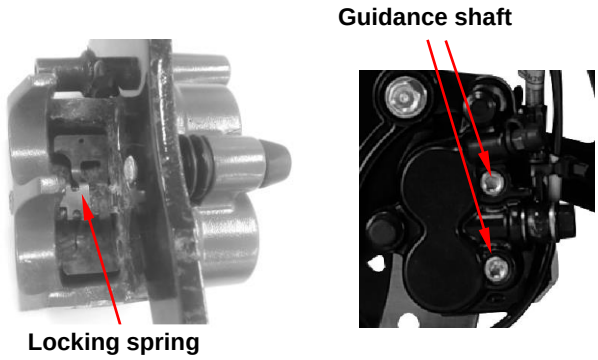
Install the new brake pads onto brake caliper.

Install the brake pad guidance shafts and locking springs.

Torque: 15 kgf-m

Install the brake pad guidance shafts cotter pins.

Install the brake caliper and tighten the mounting bolts.



Rear Brake Caliper

Removal

Place a container under the brake caliper, and loosen the oil 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: 3.2 kgf-m

Caution

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

Use two seal washers and oil bolt to lock the hoses and brake caliper in place.

Torque: 3.5 kgf-m

Refill up the brake fluid to the reservoir and make necessary air bleeding.

Brake pad replacement

Remove brake caliper.

Remove the brake pad guidance shafts cotter pins.

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

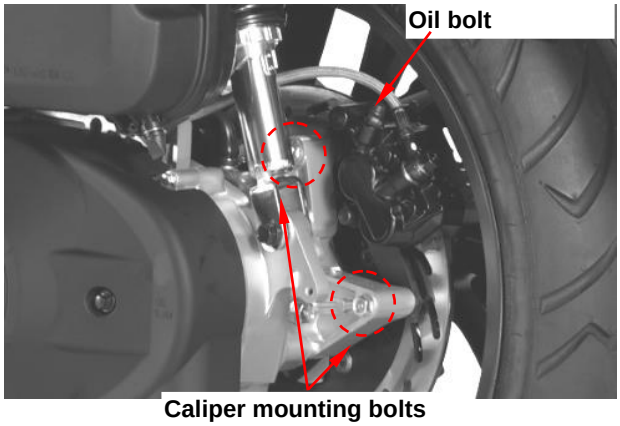
Install the new brake pads onto brake caliper.

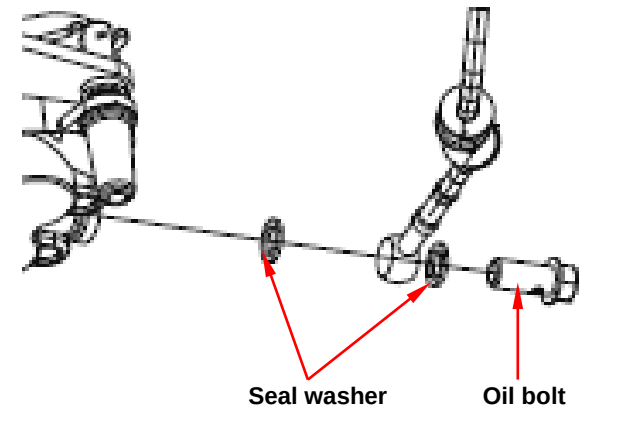
Install the brake pad guidance shafts and locking springs.

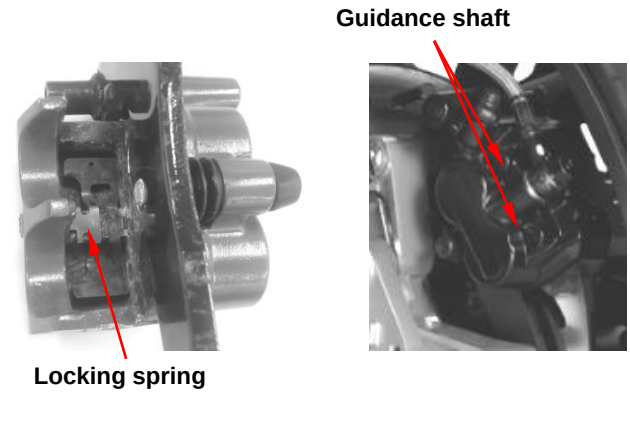
Torque: 15 kgf-m

Install the brake pad guidance shafts cotter pins.

Install the brake caliper and tighten the mounting bolts.







Brake Disk

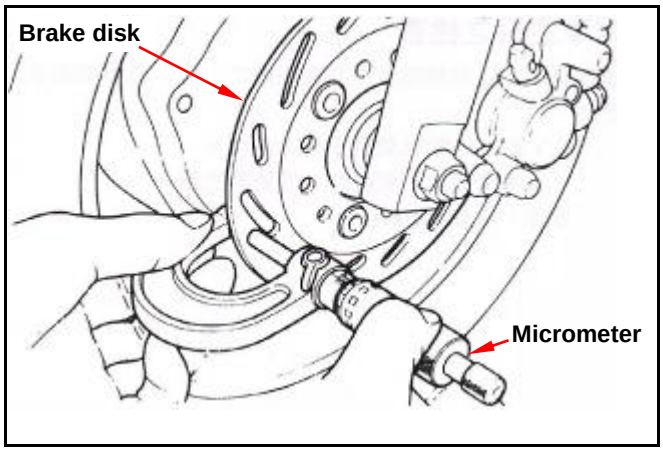
Inspection

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:

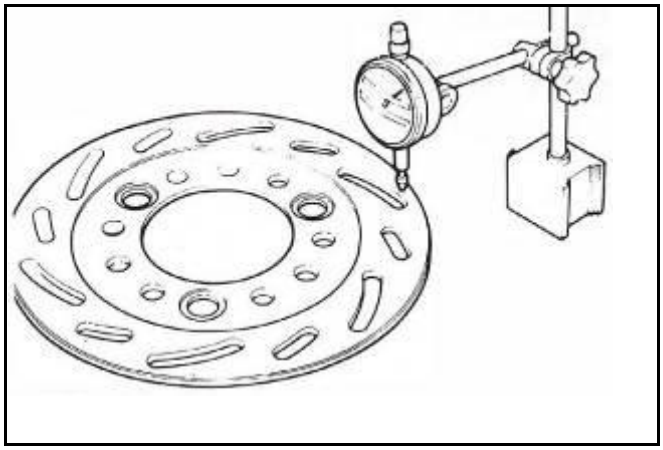
Front brake disk ***4.0 mm***

Rear brake disk ***4.5 mm***



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

Allowable limit: 0.25 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

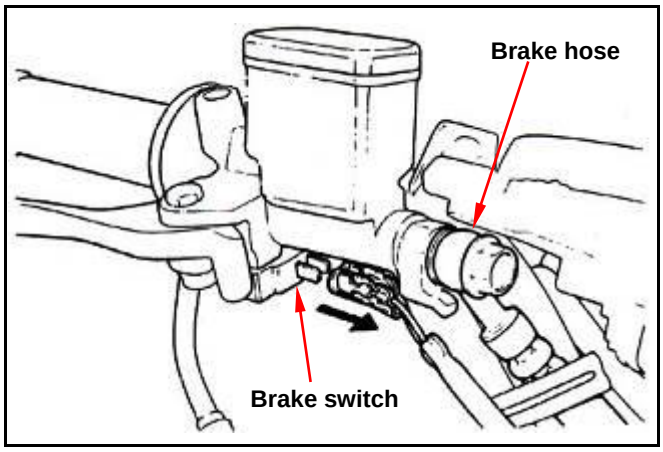
Caution

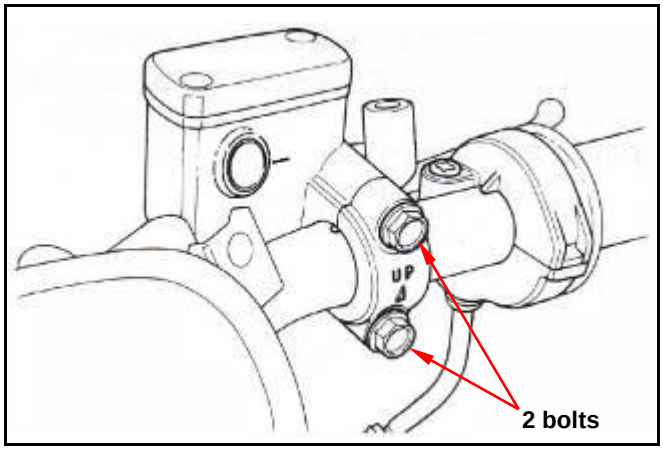
- Do not let foreign materials enter into the cylinder.

Caution

- The whole set of master cylinder should be replaced as a set.

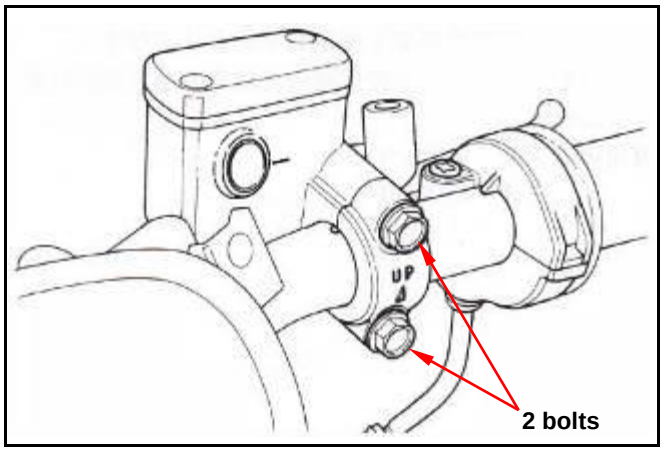
Remove the handlebar covers.
Remove the leads of brake light switch.
Drain out the brake fluid.
Remove the brake lever from the brake master cylinder.
Remove the brake hose.
Remove the master cylinder bolts and the master cylinder.



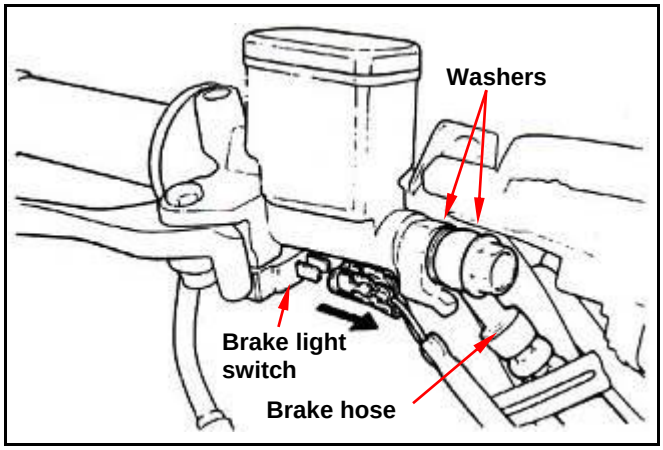


Master Cylinder Install

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.

ABS (Anti-lock Brake System)

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

Use of non-recommended tires may cause malfunctioning of ABS and can lead to extended braking distance. The rider could have an accident as a result. Always use recommended standard tires for this scooter.
When the ABS is functioning, rider may feel successive pulses in the brake lever. This is normal.

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

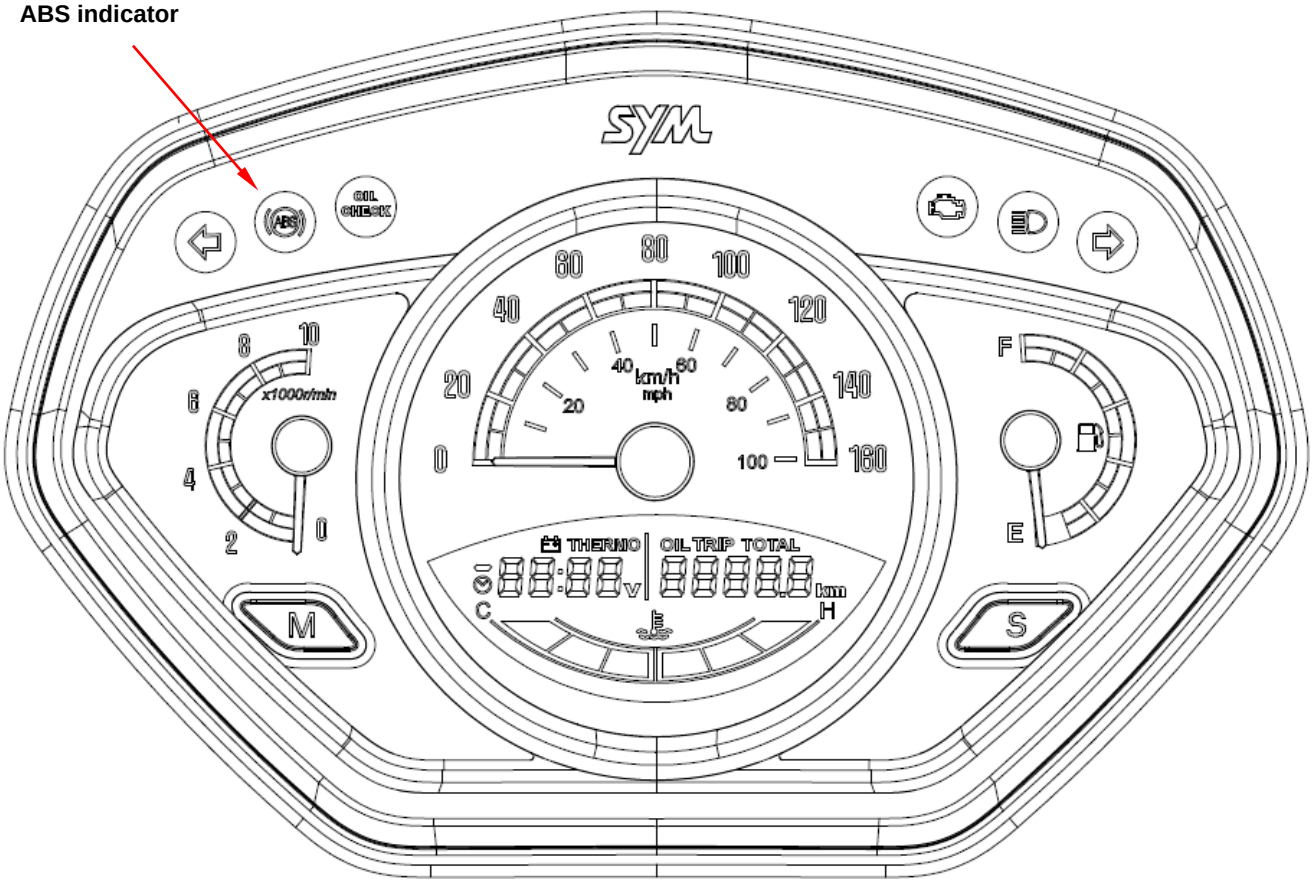
ABS does not function if the battery is discharged.

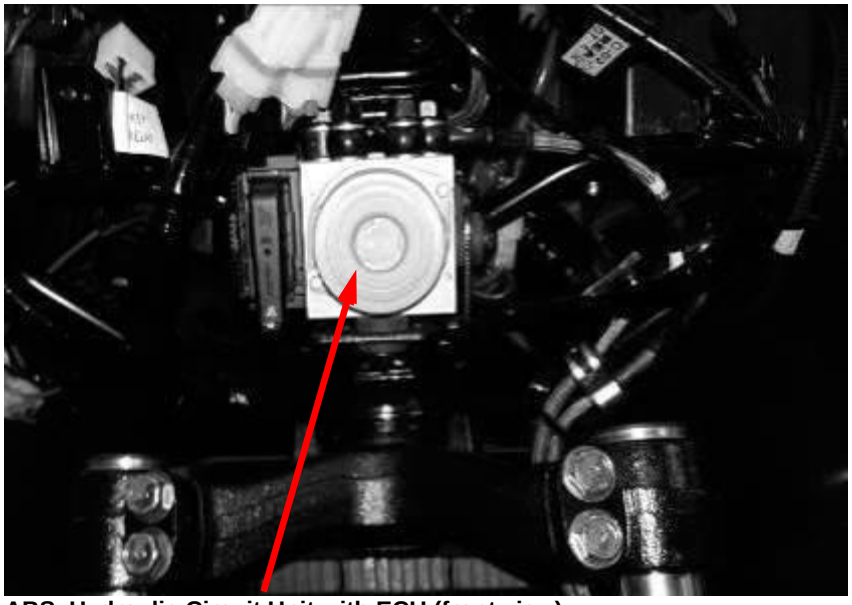
ABS indicator light:

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

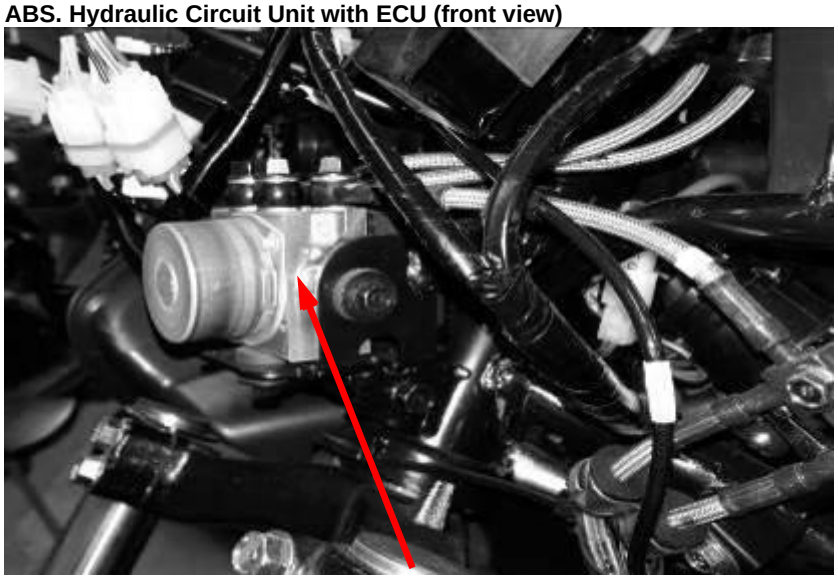
If the indicator light is on, ABS may be out of function. However, the brake system can still work properly. You should have the ABS checked.

ABS indicator

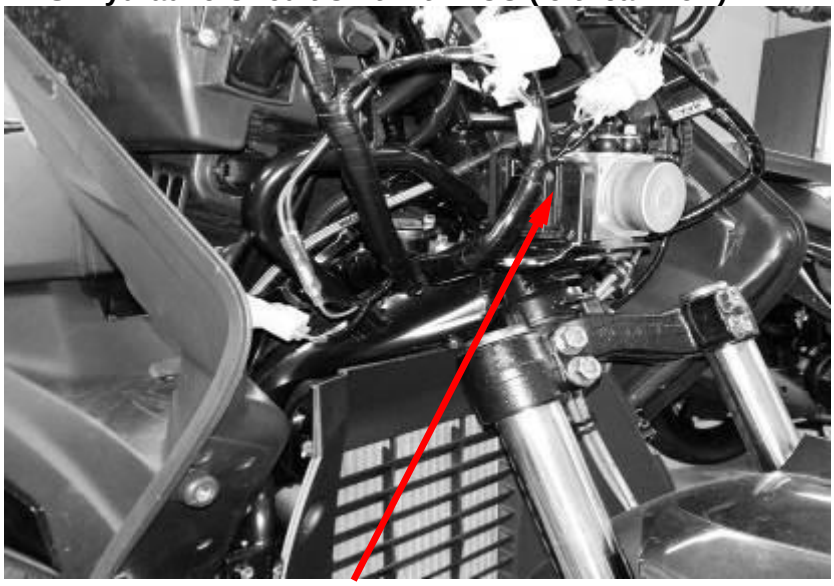




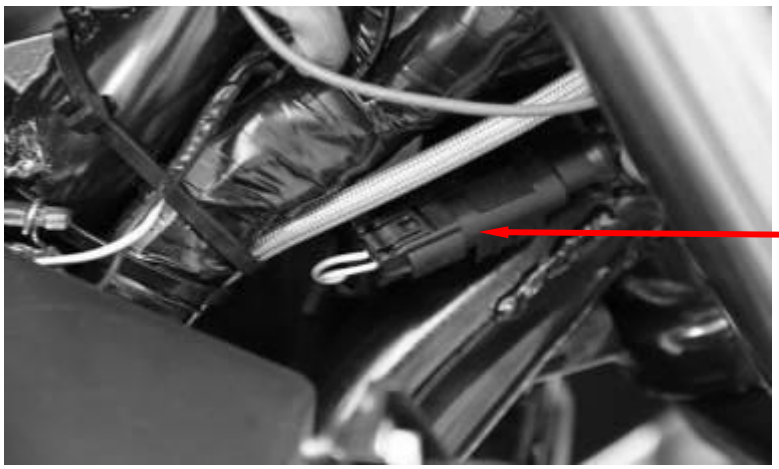
ABS. Hydraulic Circuit Unit with ECU (front view)



ABS. Hydraulic Circuit Unit with ECU (left rear view)

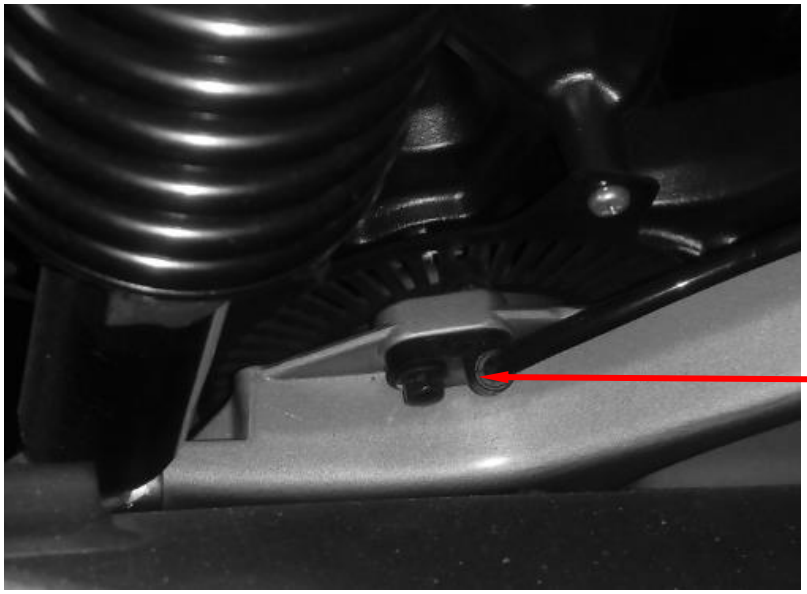


ABS. Hydraulic Circuit Unit with ECU (right rear view)



⚠Caution

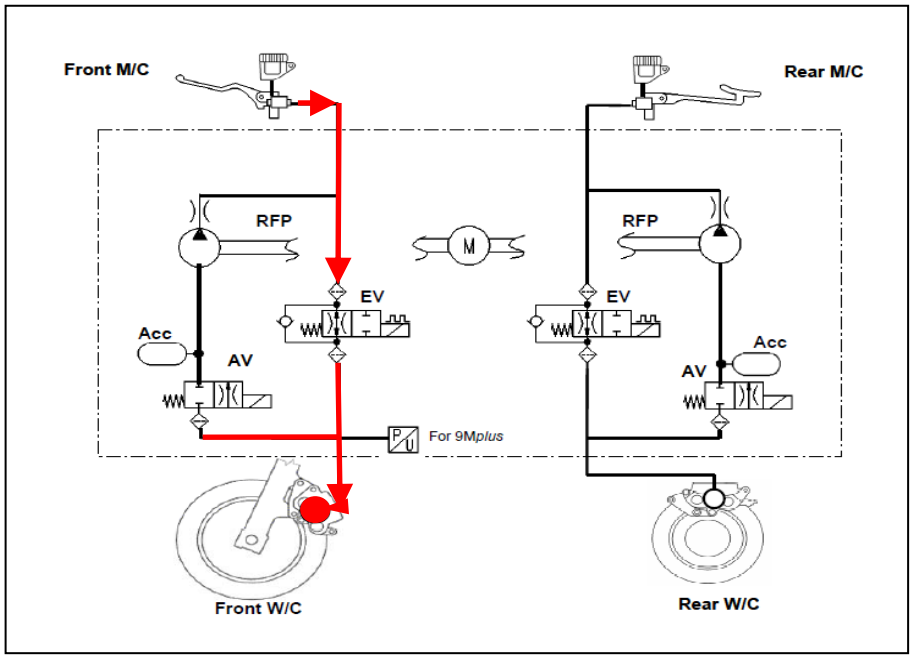
Do not remove the ABS control unit coupler when the main switch is ON, or the ABS control unit will be damaged.



ABS components location

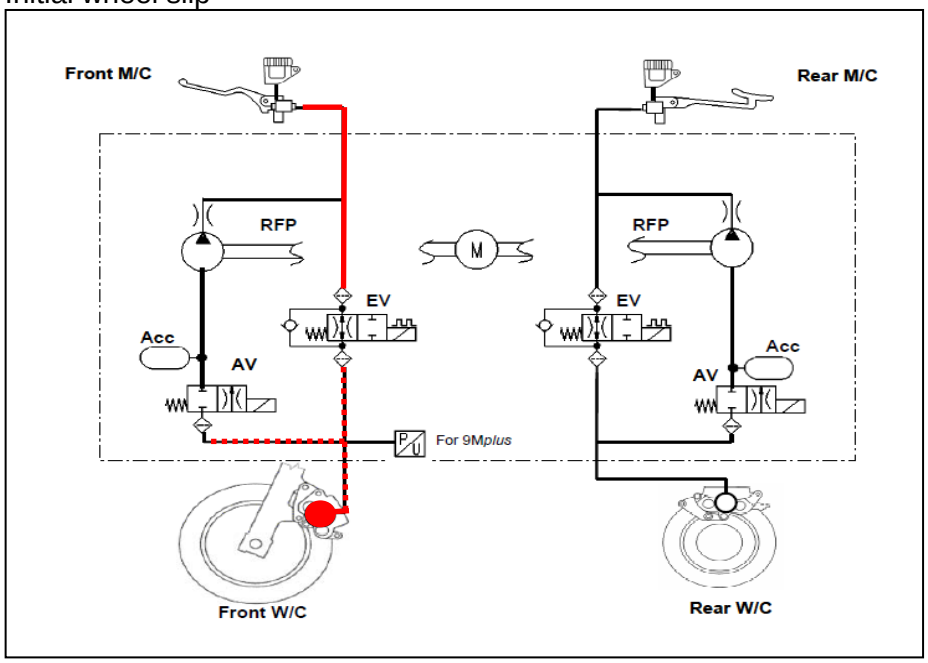
ABS description

Normal brake



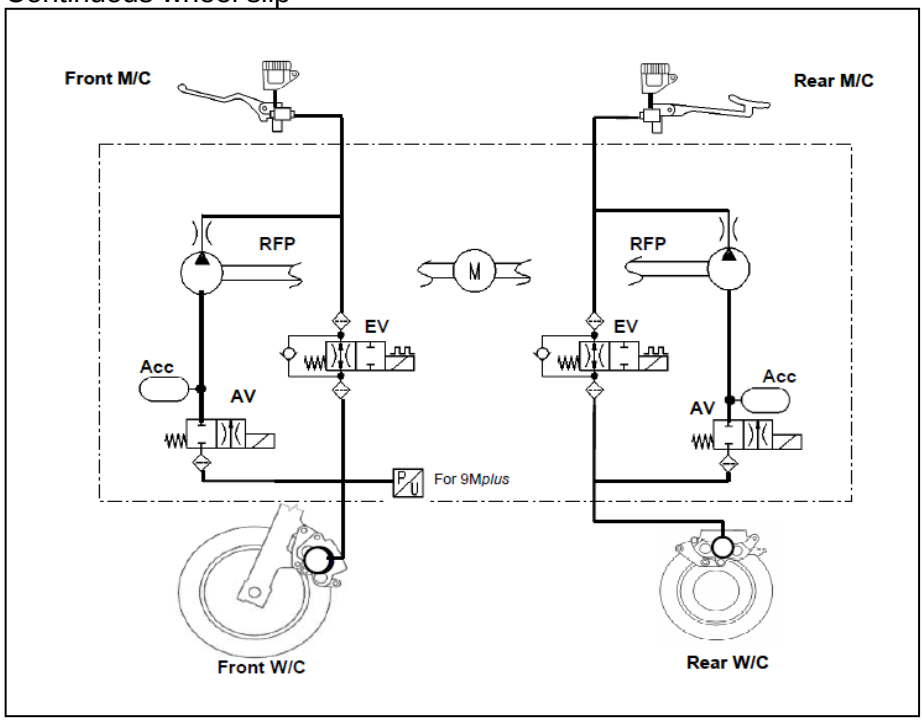
When the brake is applied, speed sensors detect the front and rear wheel speed. When there is no wheel slip, EV (inlet valve for maintaining pressure) keeps open and AV (outlet valve for pressure reduction) is closed. Brake calipers receive pressure for master cylinders and brake normally.

Initial wheel slip



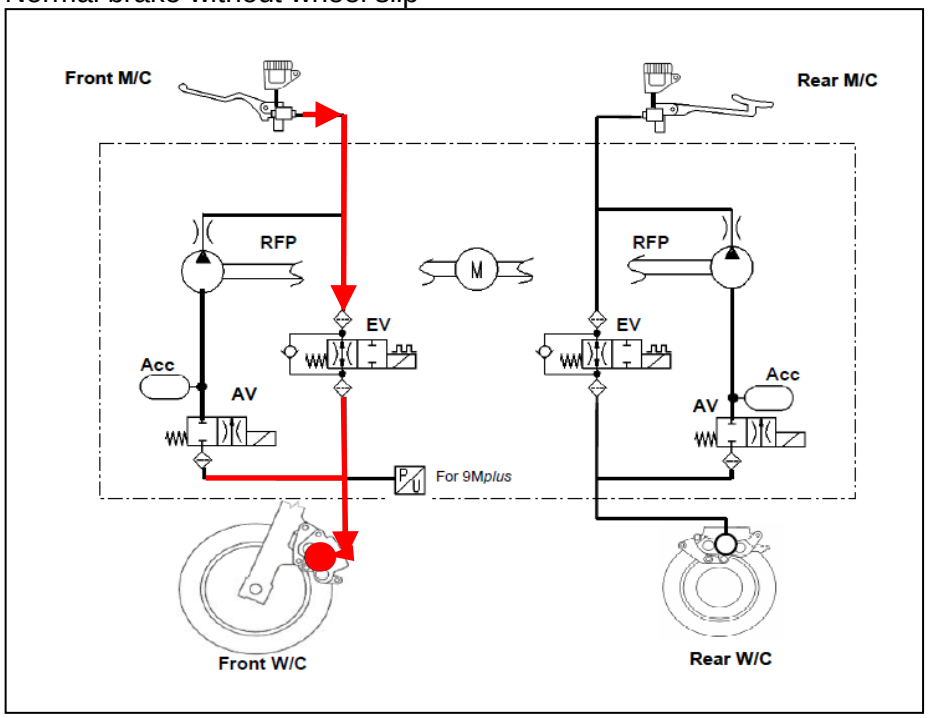
When the initial wheel slip is detected by the wheel speed sensors, EV and AV are both closed. Brake caliper keeps the pressure and brake continues.

Continuous wheel slip



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

Normal brake without wheel slip



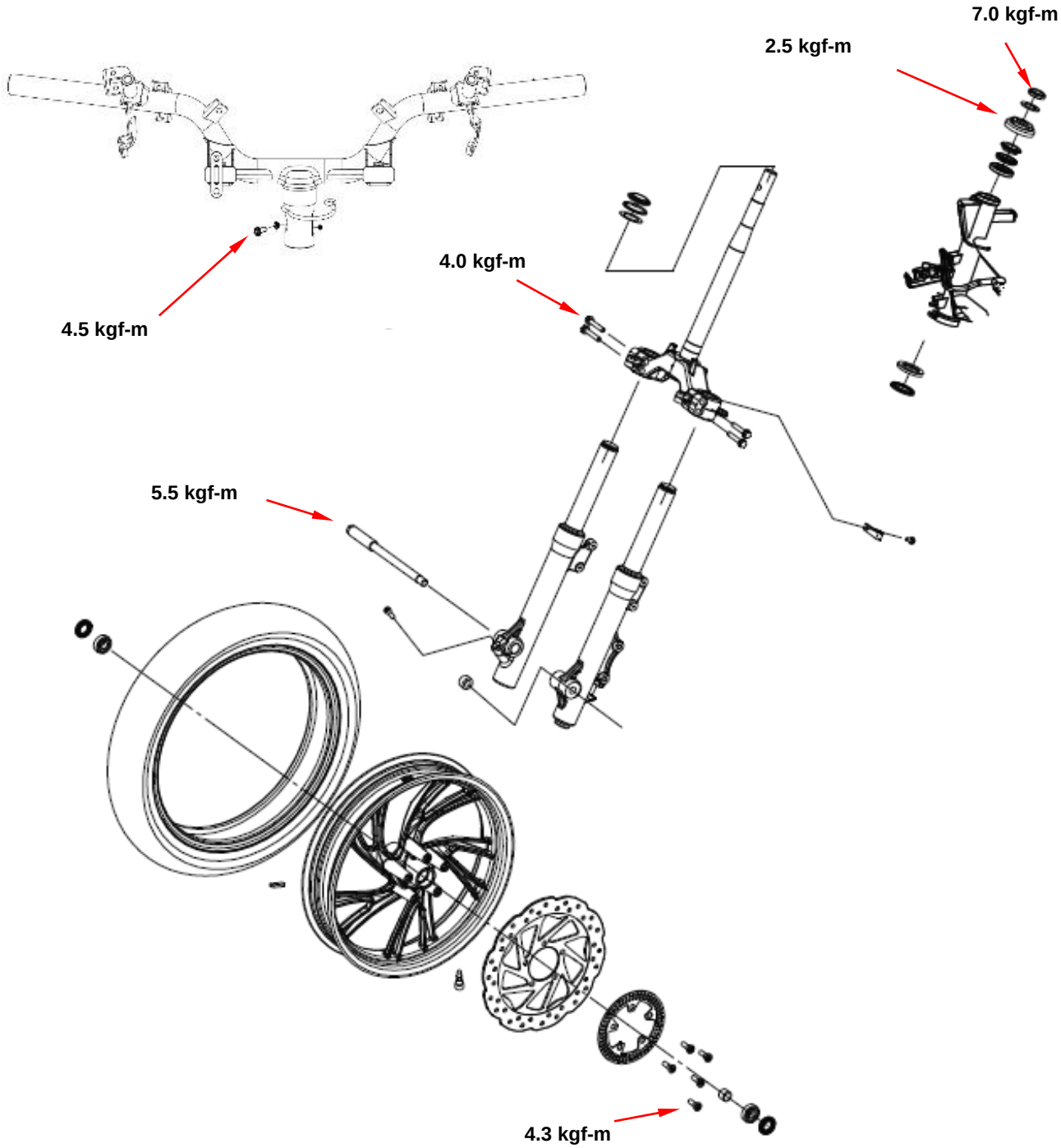
When the pressure reduction continues, the wheel speed sensors detect no wheel slip. EV keeps open and AV is closed. Brake caliper receives pressure from master cylinder and normal brake is applied.

Diagnostic Trouble Codes

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

NOTE:

Explode Chart



Operational Precautions

General

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

Torque Values

Steering handle post	4.5 kgf-m
Steering stem lock nut	7.0 kgf-m
Steering top cone race	2.5 kgf-m
Front axle	5.5 kgf-m
Rear axle nut	12 kgf-m
Front fork bolt	4.0 kgf-m
Front brake disk	4.3 kgf-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	

Trouble Diagnosis

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.

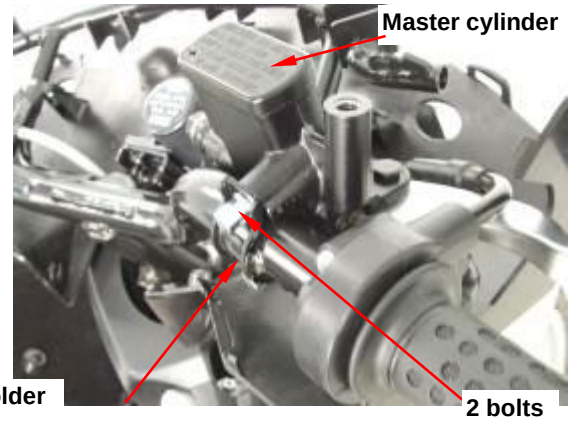
Noise in front cushion

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

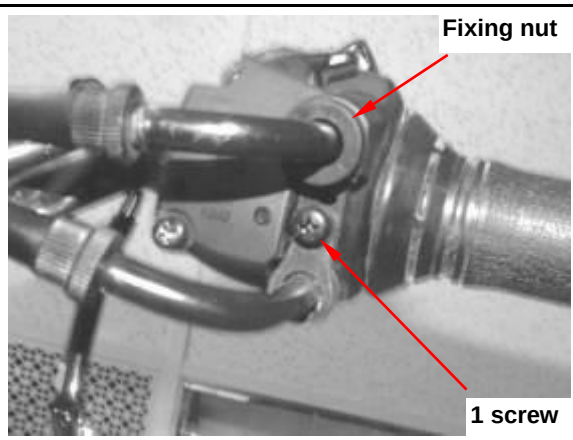
Steering Handle

Remove

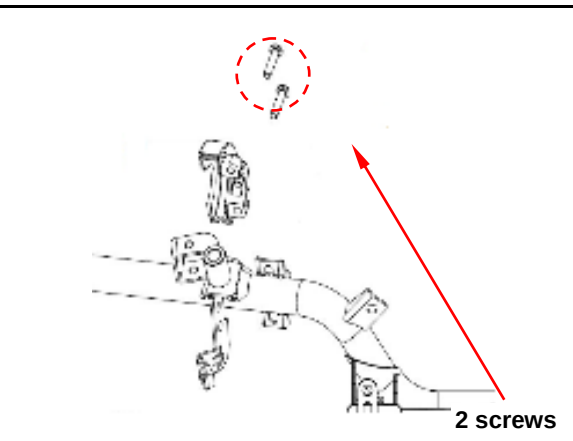
Remove the right and left handle side cover, handle upper cover and front cover. (Refer to chapter 13)
Loosen the lock bolts for the master cylinder of the front brake.



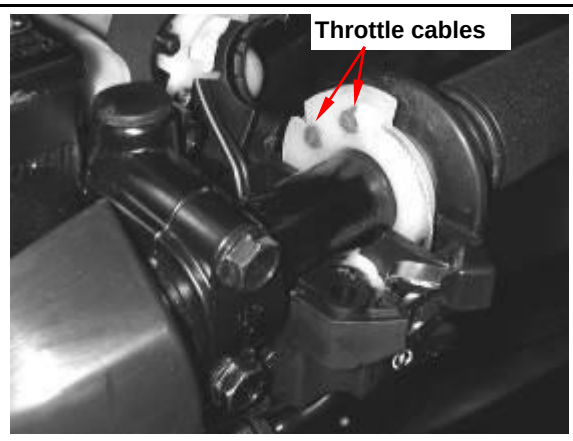
Loosen the deceleration throttle cable fixing nut.
Loosen 1 screw from the acceleration throttle fixing plate.



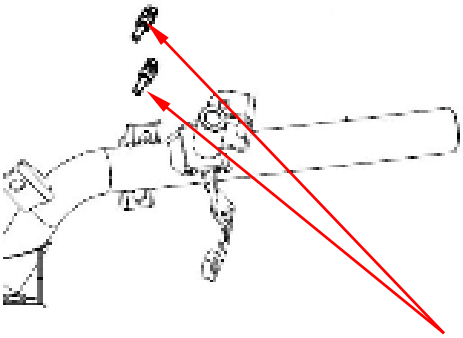
Loosen 2 screws from the throttle holder.



Remove throttle holder, cables and grip.



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



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

Installation

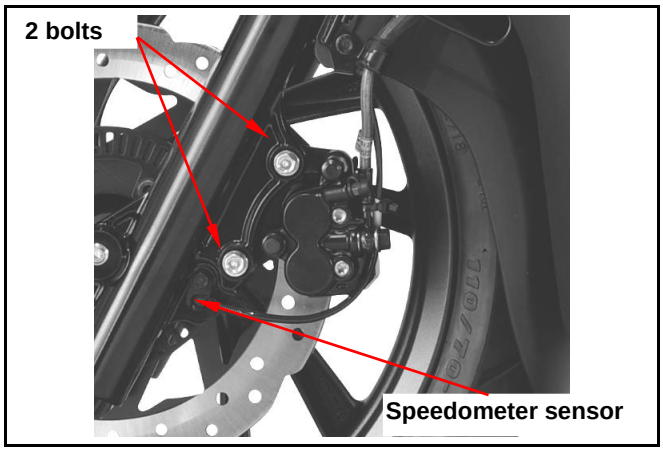
Install handle and align with bolt hole.
Install bolt and nut and then tighten it.
Torque value: 4.5 kgf-m

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

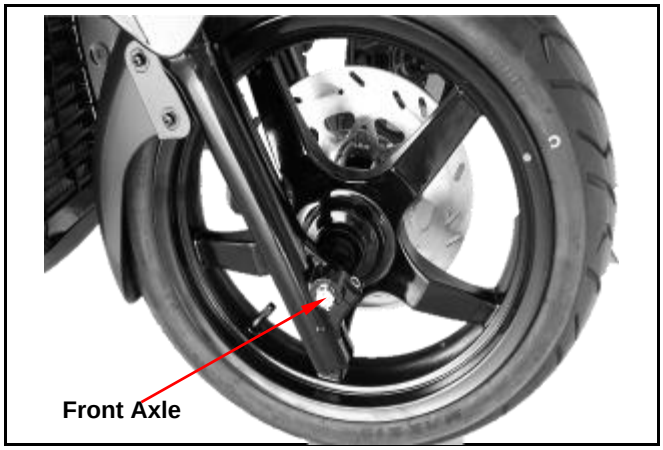


⚠ Caution

- 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.

Loosen the socket bolt and front axle from light side front cushion.



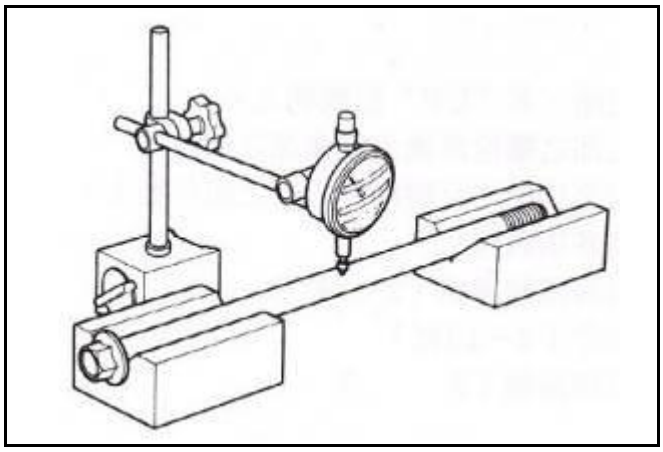
Pull out the front wheel axle.
Remove the front wheel and both side collar.

Inspection

Wheel axle

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

Service limit: 0.2 mm

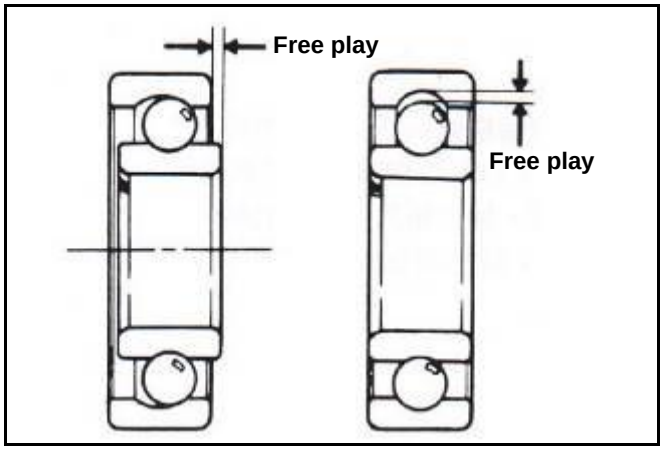


Bearing

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.



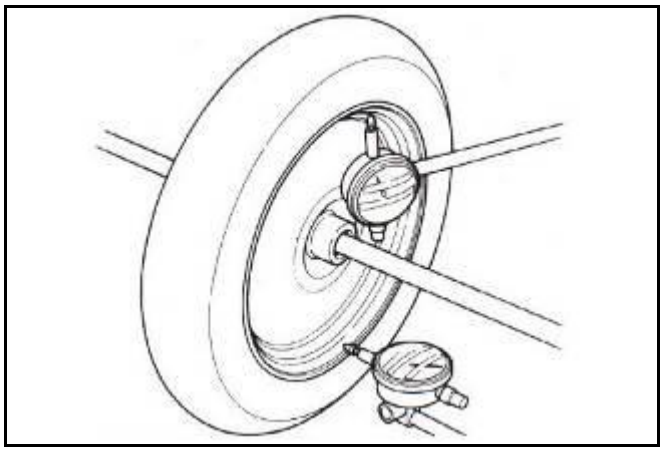
Wheel

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: 1.0 mm

Axial: 1.0 mm

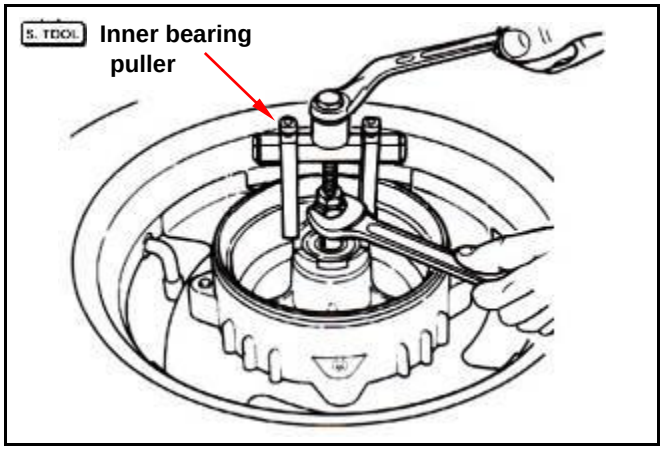


Disassembly

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

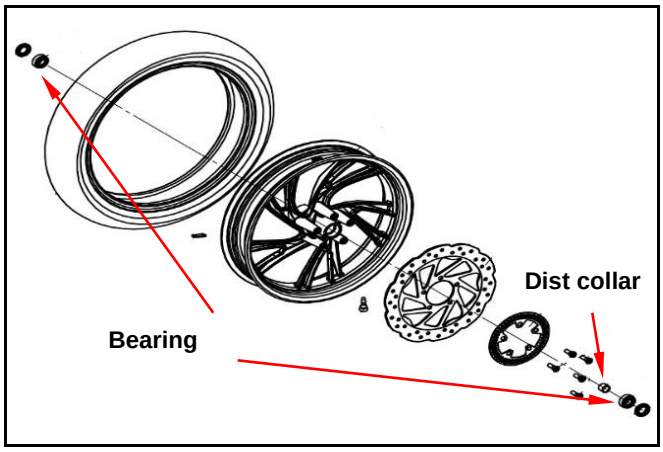


Assembly

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.



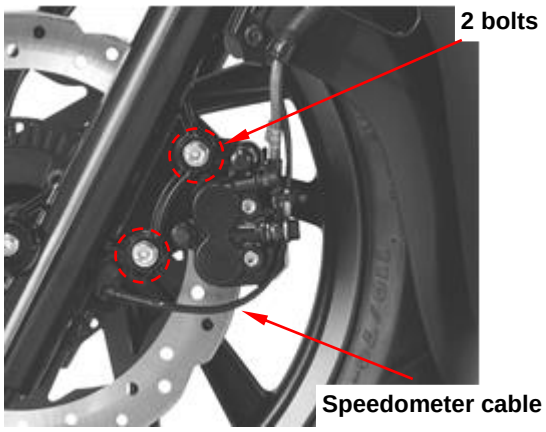
Install the brake disk and then tighten the bolts.

Torque value: 4.3 kgf-m

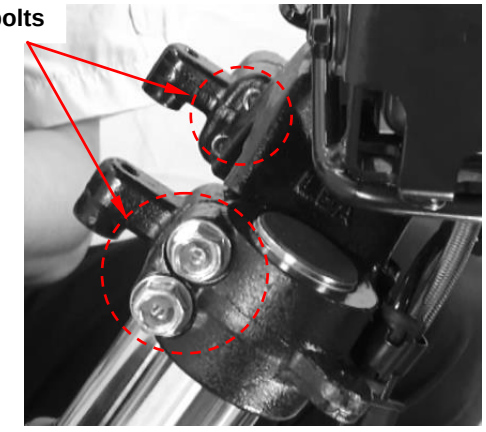
Front Cushion

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.

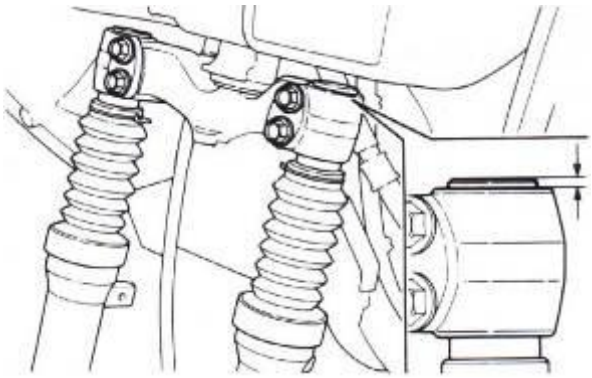


Installation

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

Torque value: 4.0 kgf-m

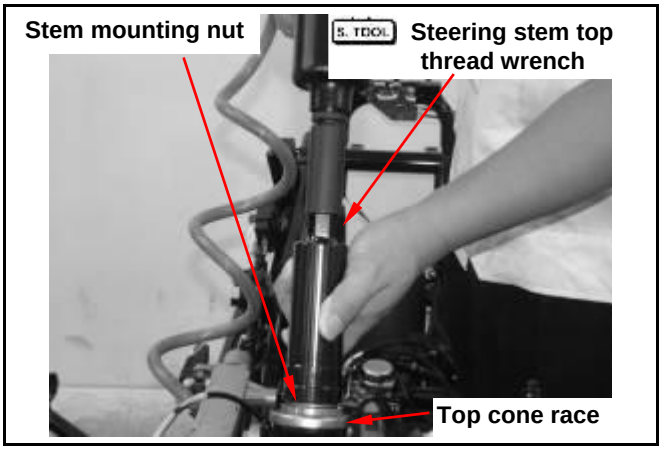
Install the removed components in reverse order of removal procedures.



Steering Stem

Remove

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

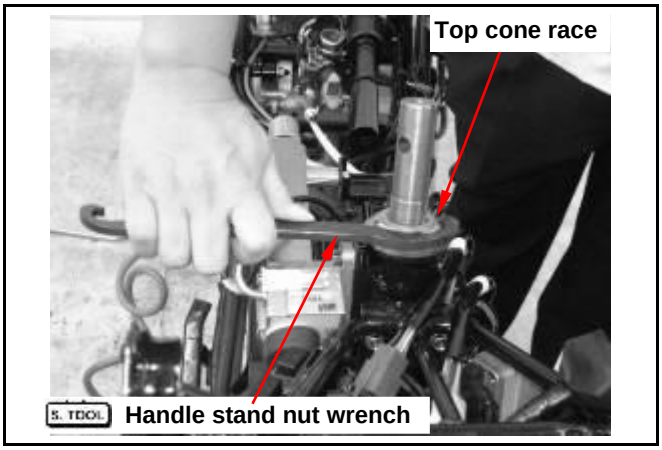


Remove top cone race and steering stem.

⚠ Caution

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

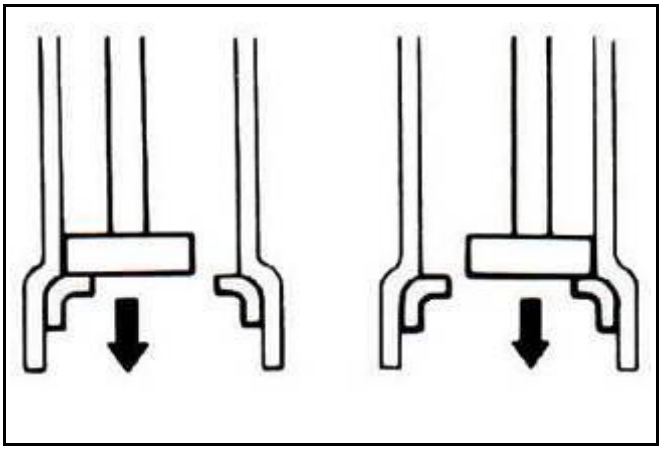
Special tools:
Steering stem top thread wrench SYM-5320010
Handle stand nut wrench SYM-5321100



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.



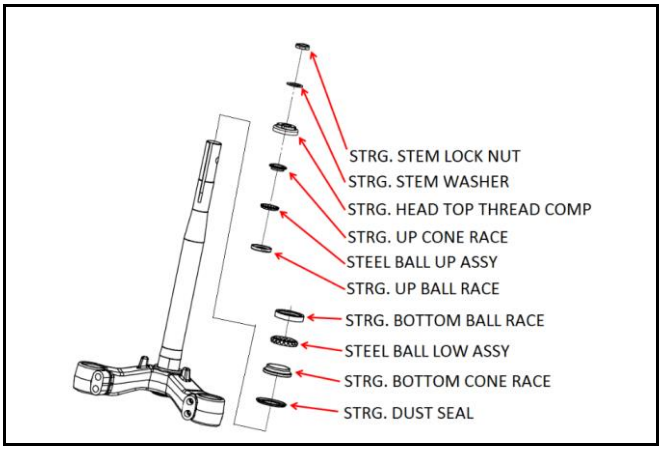
Installation

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)

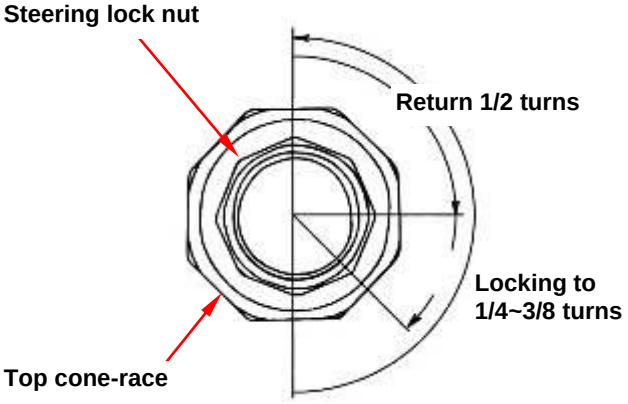


Lubricate the top cone race seat with grease. Screw the cone race in to top ball bearing seat till touching, and then screw out the cone race 1/4~3/8 turns.

Torque value: 2.5 kgf-m

⚠ Caution

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



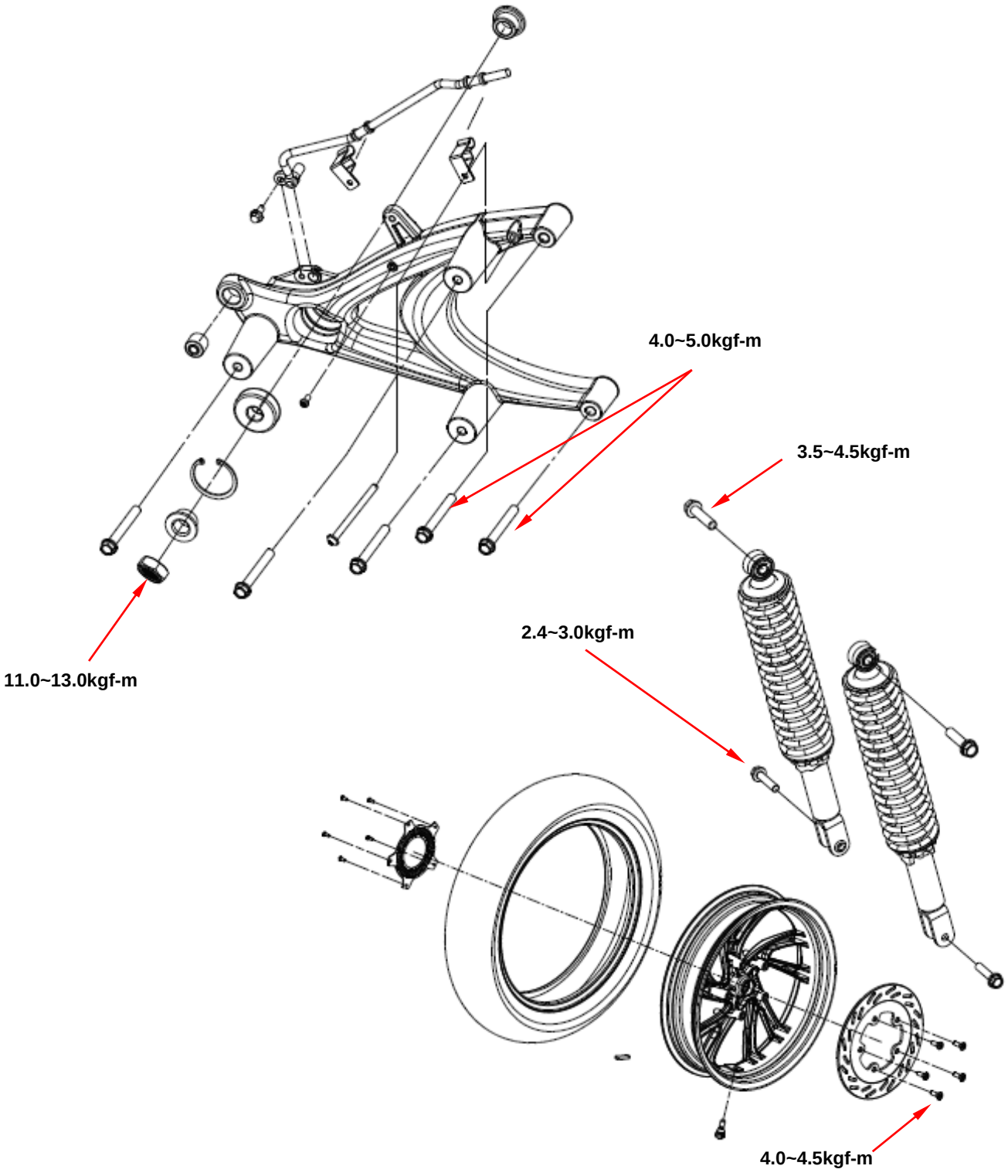
Install the steering stem mounting nut and tighten the nut by means of holding the top cone race body.

Torque value: 7.0 kgf-m

Install in reverse order of removal procedures.

NOTE:

Mechanism Diagram



Operational Precaution

General

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

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 bolt (engine side)	2.4~3.0kgf-m
Brake clipper mounting bolts	2.9~3.5kgf-m
Brake disc mounting bolt	4.0~4.5kgf-m

Trouble Diagnosis

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.

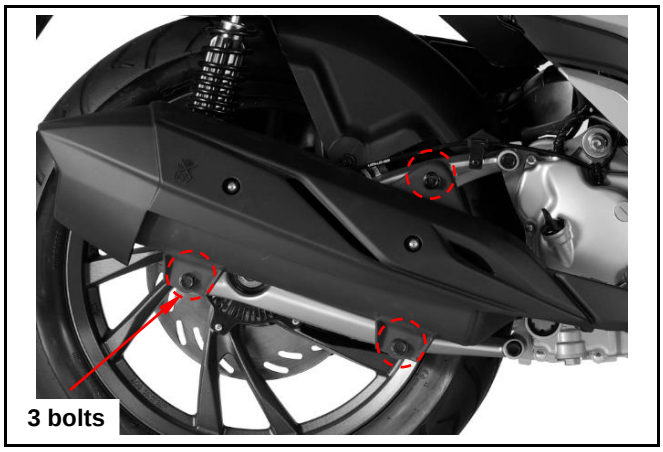
Poor Performance of Brake

- 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 1 mounting bolt by 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

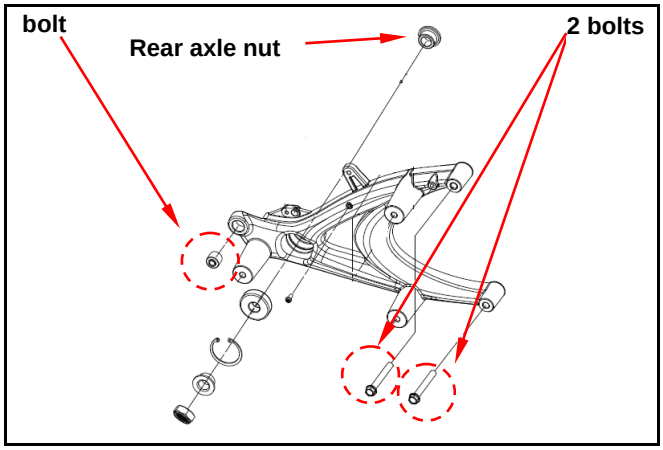
- Replace the front side muffler pipe gasket if worn or deformed.

Torque Value:
Muffler mounting bolt (engine side) 2.4 ~ 3.0kgf-m

Rear Wheel

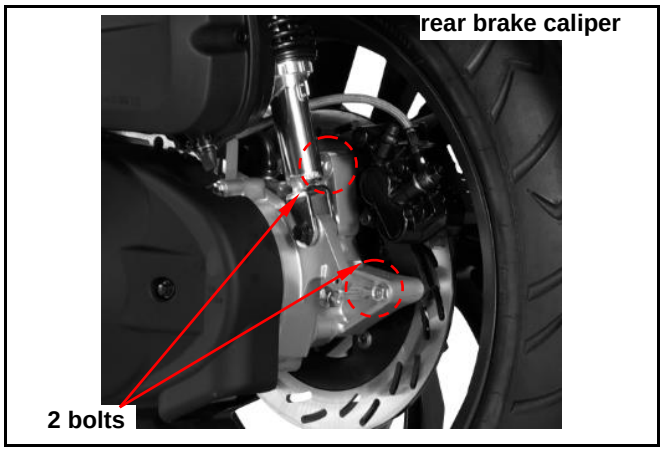
Removal

Remove the exhaust muffler.
Remove the lower bolt of the right side rear cushion.
Remove 2 bolts and rear axle nut of the rear fork.
Remove the rear brake caliper (2 bolts) and brake hose clamp (1 bolt).



Caution

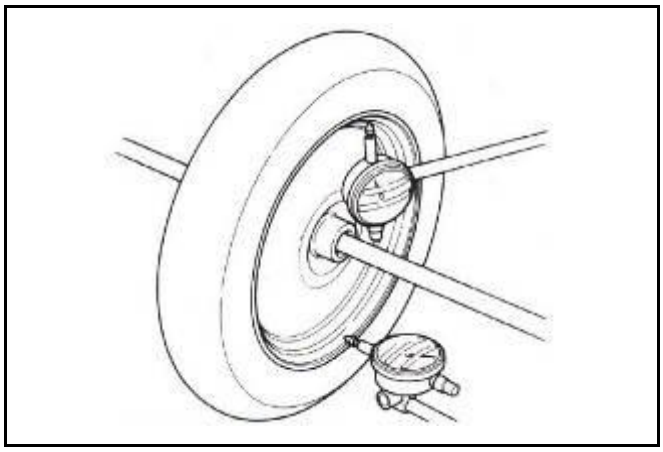
- Care shall be taken not to push the brake lever to avoid the brake pad being squeezed out. In case that the brake pad is accidentally squeezed out, use a screwdriver to force it back to the place.



Remove the 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.



Installation

Install in reverse order of removal procedures.

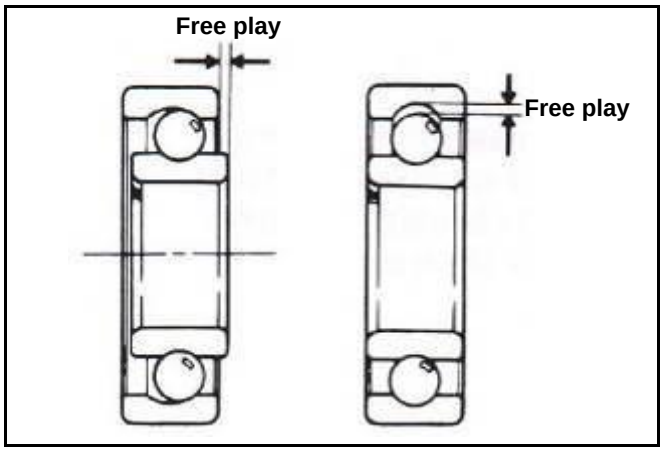
Torque Value:

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

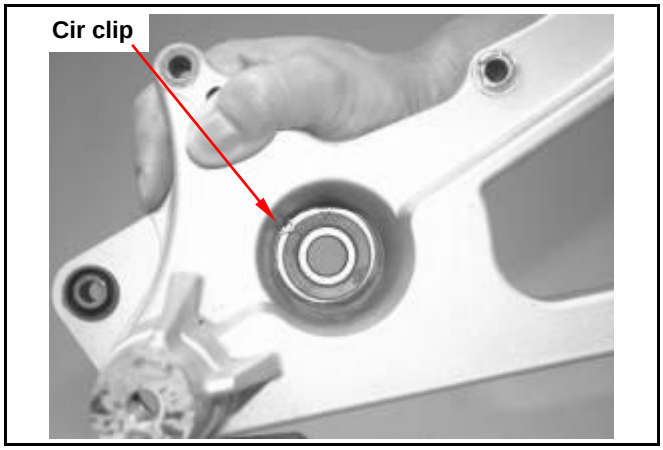
Inspection rear fork bearing

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.

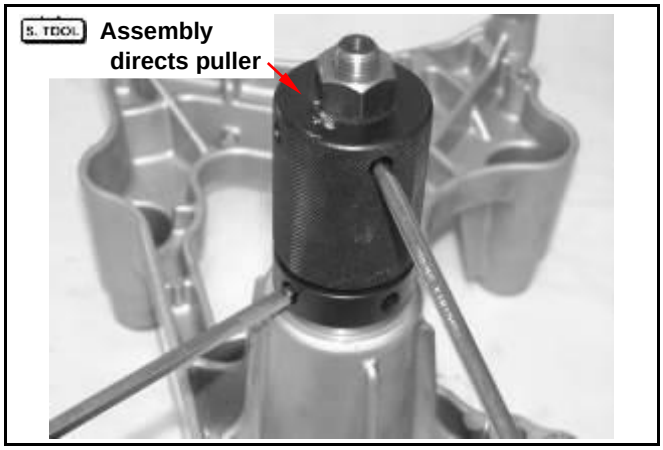


Uses the bearing driver; drive out the bearing.

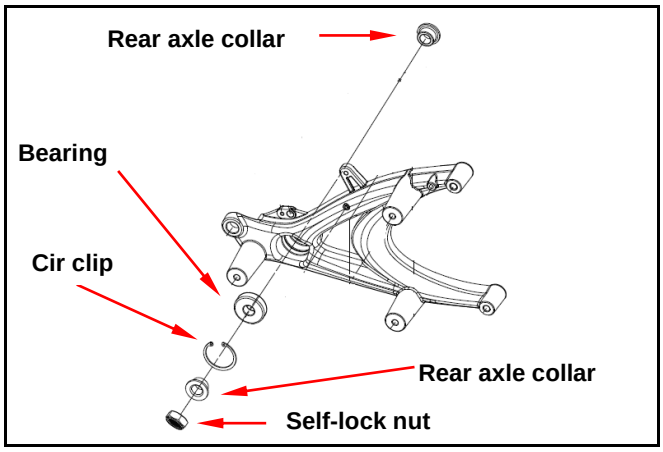
Special tool: Bearing driver

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.



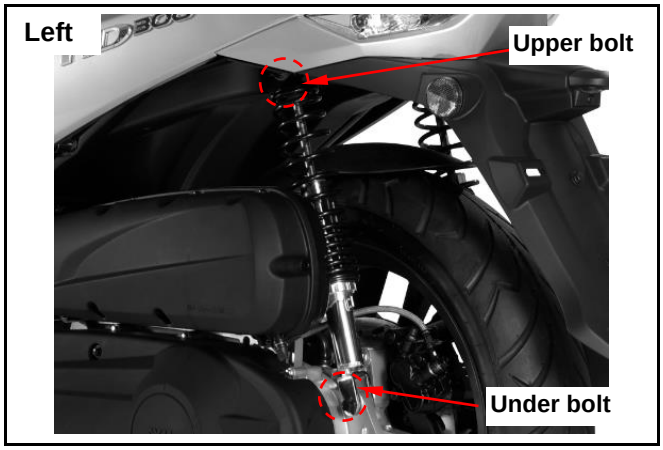
Install the bearing lock circlip.



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.

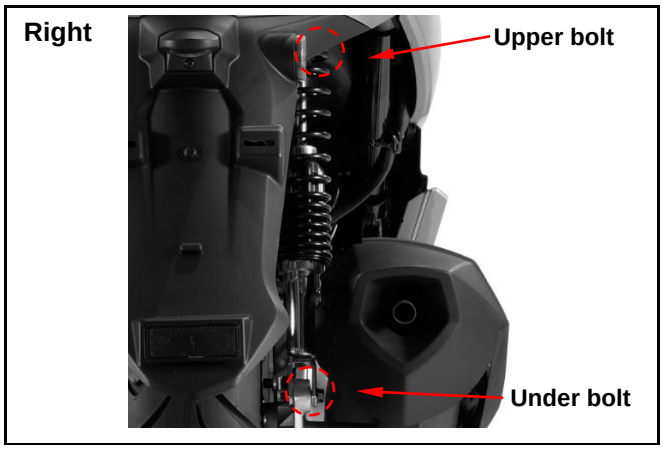


Installation

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

NOTE:

Emission Control System Classification

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

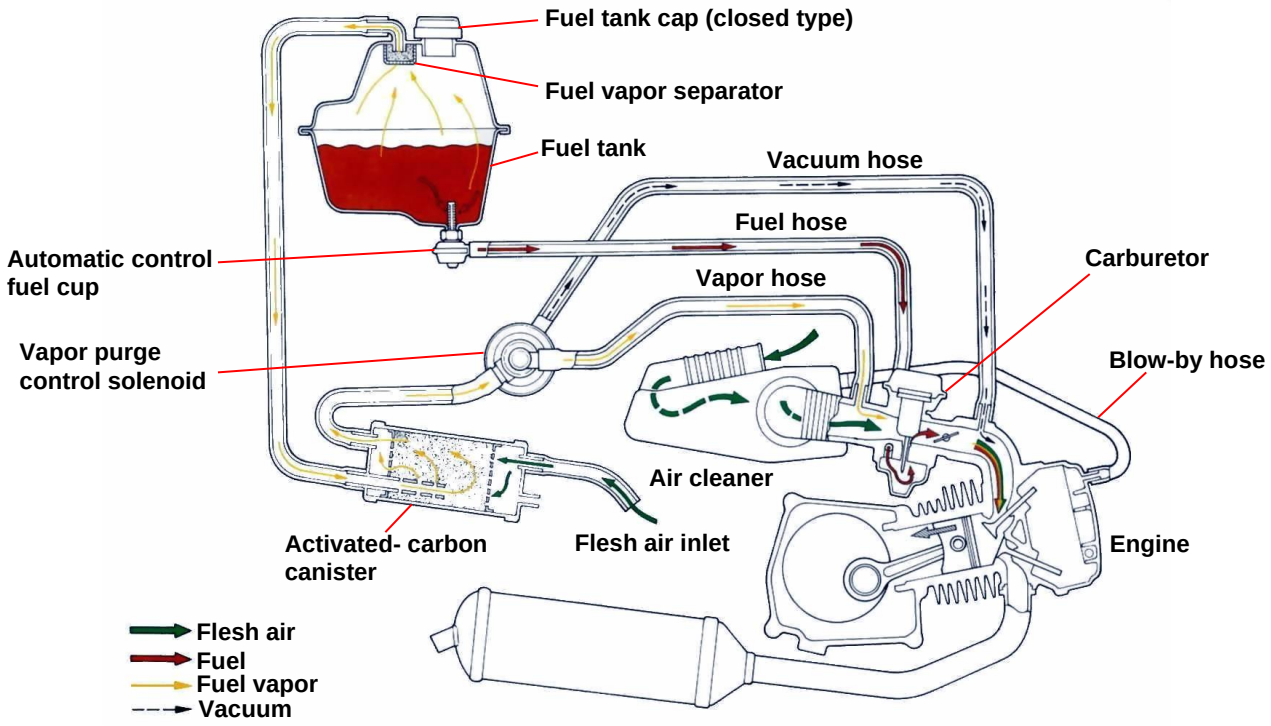
Emission Control System Description

System	Device	Components	Purpose & function
Combustion chamber	Combustion chamber	4-valve combustion chamber	The semi-circular combustion chamber is designed to balancing 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 the intake manifold at an opportune timing.
P.C.V. system	Crankcase blow-by gas introducing device	Vapor separator	To introduce blow-by gas into combustion chamber via a vapor separator for burning.

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

1. Construction:

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



2. Principle of operation

- Vapor generated in fuel tank and fuel system through evaporation is collected in the confined system to prevent it from escaping into the atmosphere, at the same time, the vapor will be introduced into a charcoal canister where the hydrocarbon in the vapor will be absorbed by activated carbon.
- When the engine is running, the negative pressure of intake manifold opens the purge control valve, forces HC off from activated carbon and then sucks it into engine together with air from bottom of the canister.
- The canister can be used repeatedly without reducing its performance because of the system's purge function.

3. Trouble Diagnosis:

- No fuel in the fuel tank
- Loosen vacuum hose of the fuel pump
- Jammed hose in the system

4. Cautions:

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

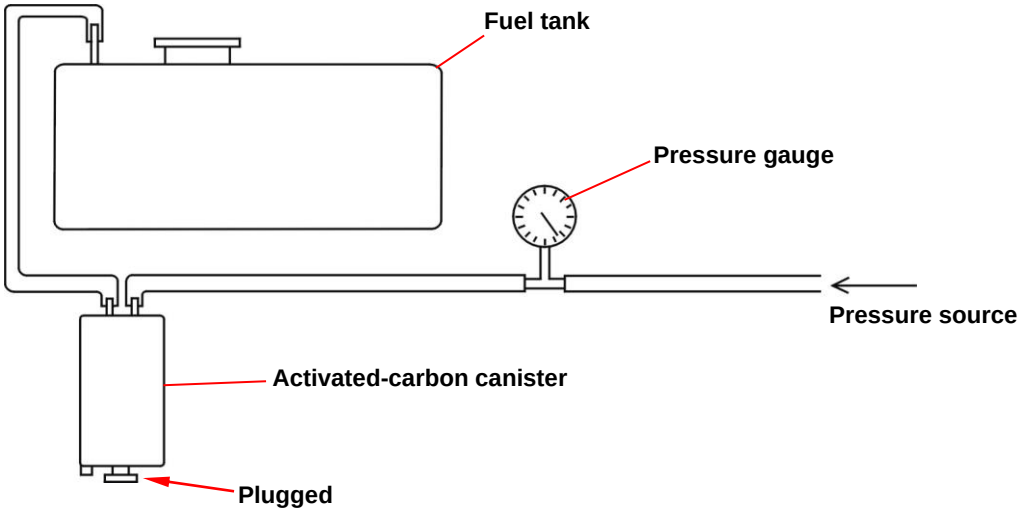
Evaporative Emission Control System (E.E.C.) Inspection

1. Visual check:

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

2. Leakage test:

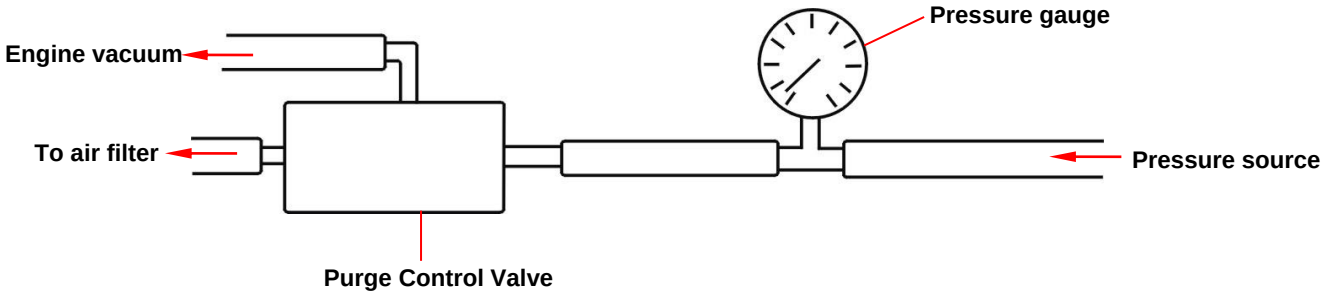
1) Disconnect the Purge Control Valve hose, and connect a T-type hose connector to a pressure gauge and a pressure source as shown below:



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

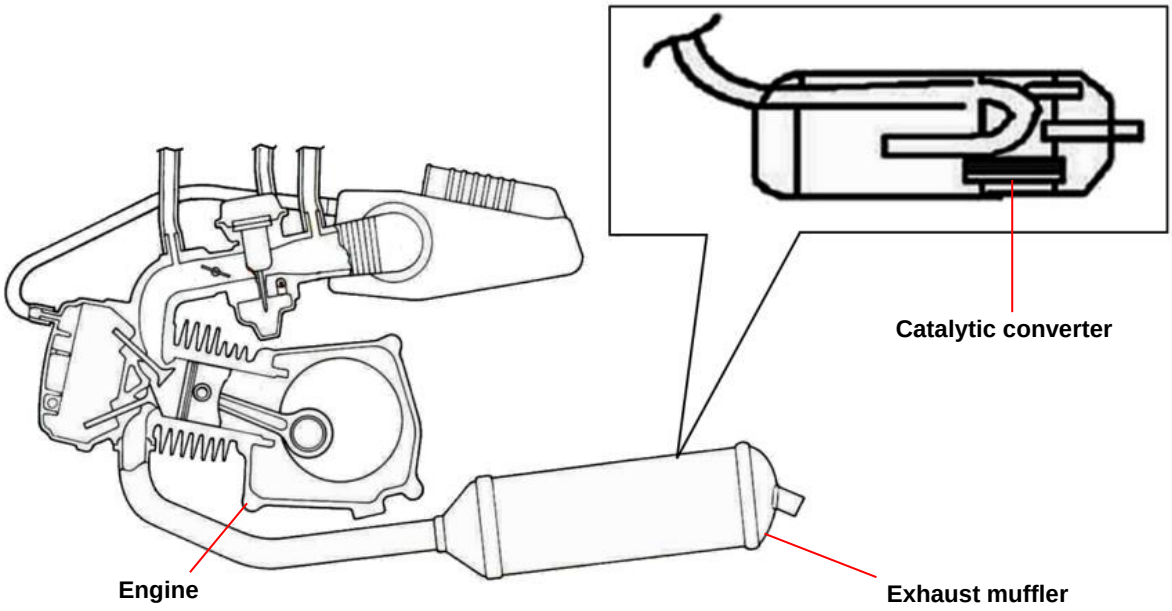
1) Disconnect the hose of connection to the activated-carbon canister, and then connect a T-type hose connector to pressure source as shown below:



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.

Catalytic Converter (CATA)

1. Construction:

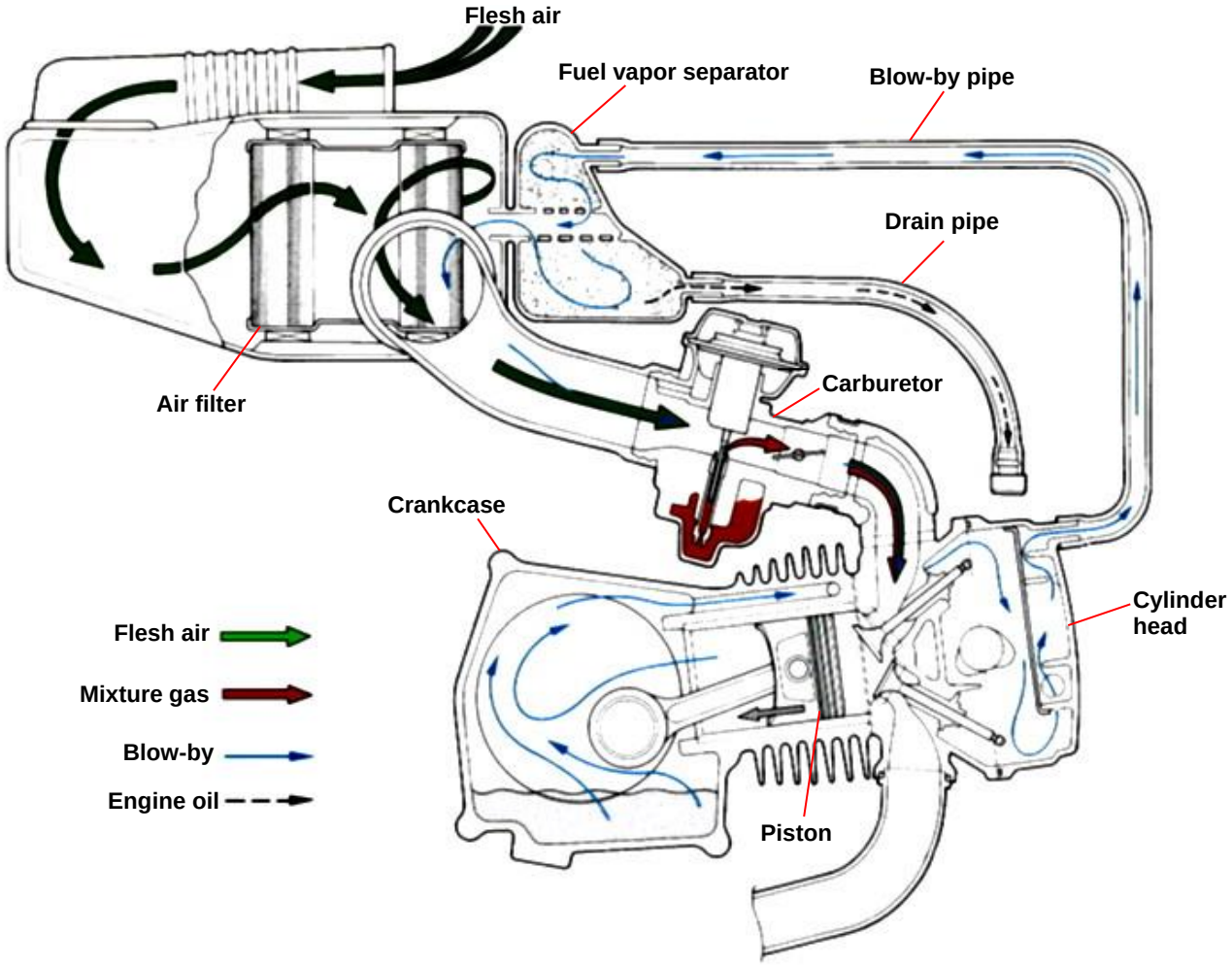


2. Description:

1) The function of the catalytic converter is to transfer unburned CO, HC, and NOx to harmless CO_2, H_2O, N_2 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.

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

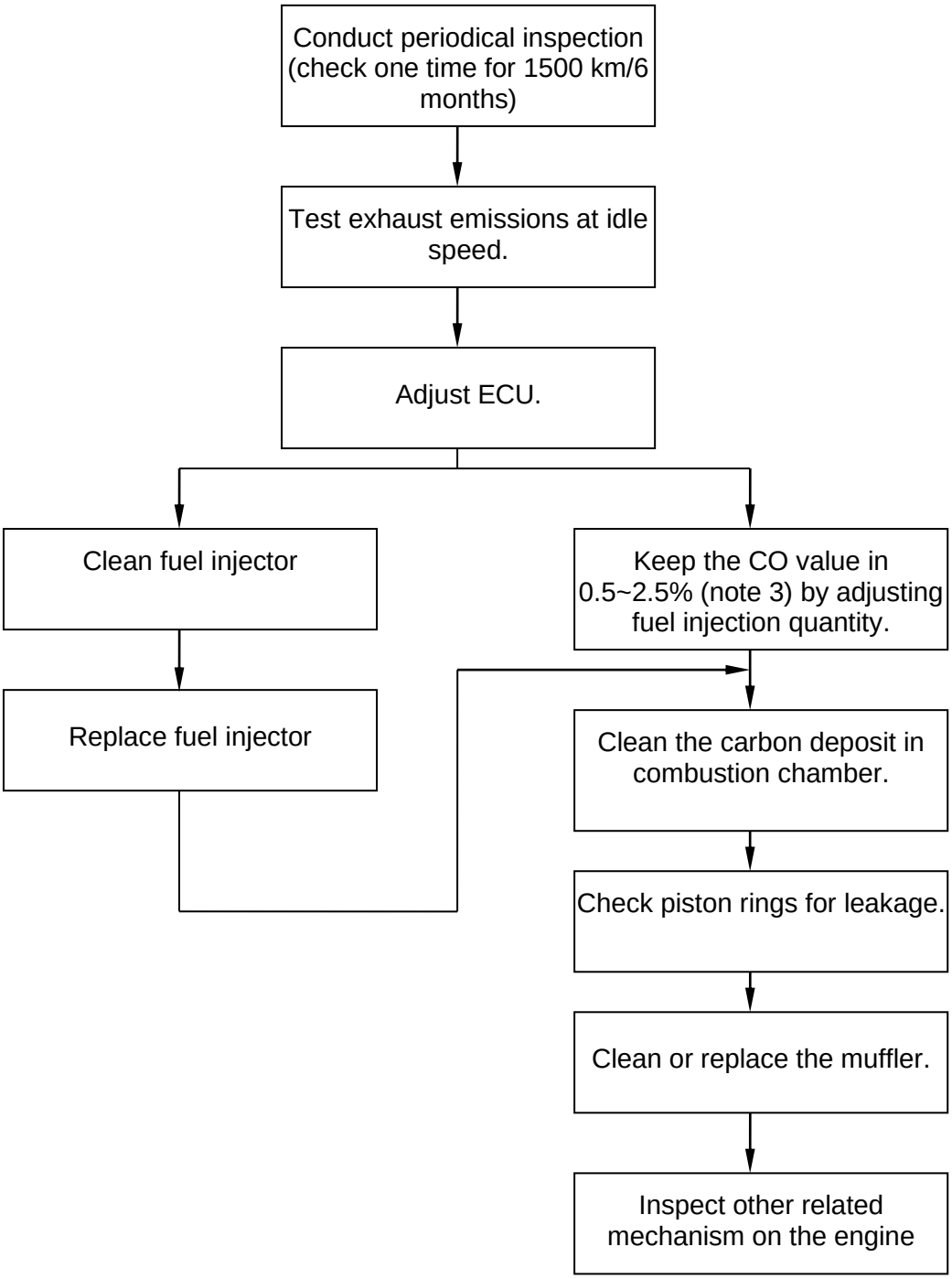
Fuel Evaporation Control System
1. Visual inspect the carbon canister and hoses for damage.
2. Leaking check.
3. Function test of the purge control solenoid.

Catalytic converter
1. Check if exhaust gas content is within standard.
2. Remove the exhaust pipe and shake it gently for noise.

Fuel Supply System
1. Clean the air filter.
2. Check the air filter.
3. Clean the carburetor fuel jet, air jet and all circuit with air gun or specified solvent.
4. Check the float level of carburetor.
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.

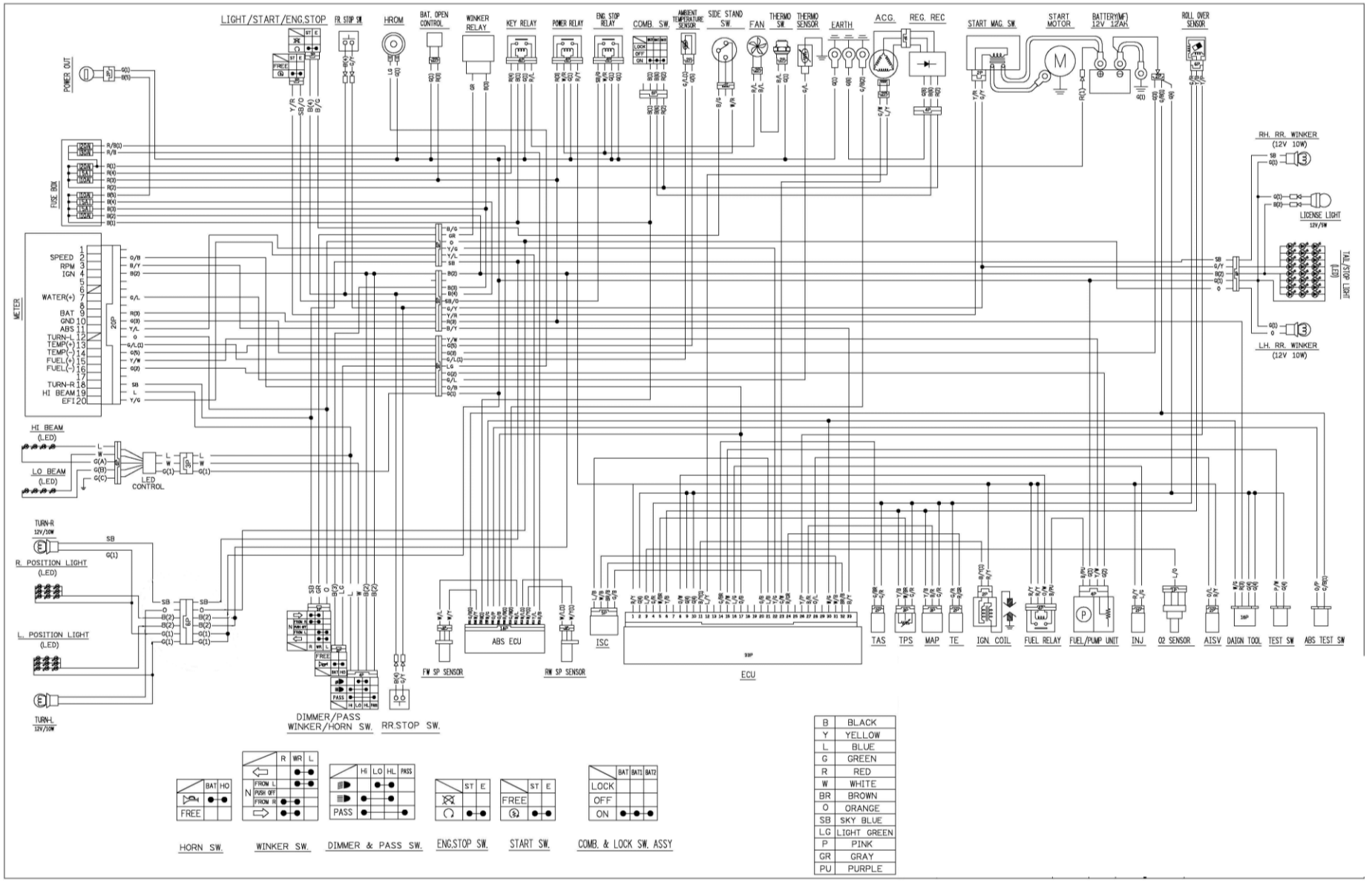
Countermeasure for Abnormal Emission Pollutants



Note: If CO value can not be adjusted to the default value by adjusting ECU, follow the procedures to check or replace components.

NOTE:

LS30W1-EU Electrical Diagram



B	BLACK
Y	YELLOW
L	BLUE
G	GREEN
R	RED
W	WHITE
BR	BROWN
O	ORANGE
SB	SKY BLUE
LG	LIGHT GREEN
P	PINK
GR	GRAY
PU	PURPLE

NOTE: