

ZAFFERANO 250 Service Manual



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NOTICE

This manual was produced by the Benelli Motor Company primarily for use by Benelli dealers and their qualified mechanics. It is not possible to include all the knowledge of a mechanic in one manual, so it is assumed that anyone who uses this book to perform maintenance and repairs on a Benelli scooter has a basic understanding of the mechanical ideas and the procedures of scooter repair. Repairs attempted by anyone without this knowledge are likely to render the scooter unsafe and unfit for use.

Benelli Motorcycles USA is continually striving to improve all its models. Modifications and significant changes in specifications or procedures will be forwarded to all authorized Benelli dealers and will appear in future editions of this manual where applicable.

NOTE:

Designs and specifications are subject to change without notice.

IMPORTANT INFORMATION

Particularly important information is distinguished in this manual by the following notations.



The Safety Alert Symbol means ATTENTION! BE ALERT! YOUR SAFETY IS INVOLVED!



Failure to follow WARNING instructions could result in severe injury or death to the scooter operator, a bystander or a person inspecting or repairing the scooter.

CAUTION:

CAUTION: indicates special precautions that must be taken to avoid damage to the scooter.

NOTE:

NOTE: provides key information to make procedures easier or clearer.

Preparing documents

General safety Maintenance

rules Specification table Failure

diagnosis General Safety

Carbon monoxide

Engine must be started up in a well-ventilated place, not in a closed area.

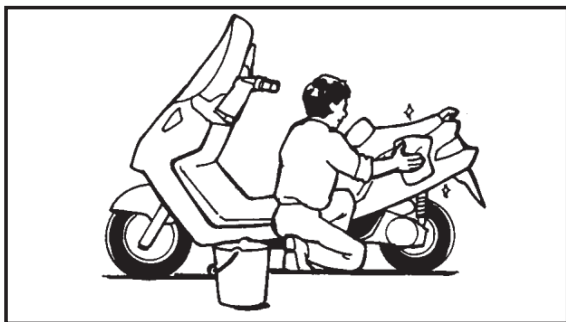
Note

Exhaust gas contains poisonous carbon monoxide, which may cause unconsciousness or even death of human.

Start the engine in an open place. An exhaust removal system shall be adopted if engine is started up in a closed area.

Petrol

Ventilation is required for working places. Fire is strictly forbidden in any working place or where petroleum is stored.



IMPORTANT INFORMATION

PREPARATION FOR REMOVAL PROCEDURES

1. Remove all dirt, mud, dust and foreign material before removal and disassembly.
2. Use proper tools and cleaning equipment.
3. Refer to the "SPECIAL TOOLS" section.

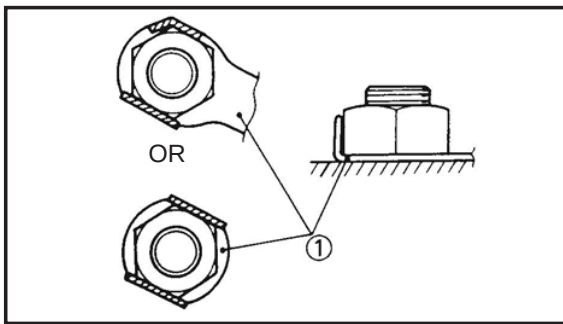
4. When disassembling the machine, always keep mated parts together. This includes gears, cylinders, pistons and other parts that have been "mated" through normal wear. Mated parts must always be reused or replaced as an assembly.
5. During machine disassembly, clean all parts and place them in trays in the order of disassembly. This will speed up assembly and allow for the correct installation of all parts.
6. Keep all parts away from any source of fire.

REPLACEMENT PARTS

1. Use only genuine Benelli parts for all replacements. Use oil and grease recommended by Benelli for all lubrication jobs. Other brands may be similar in function and appearance, but inferior in quality.

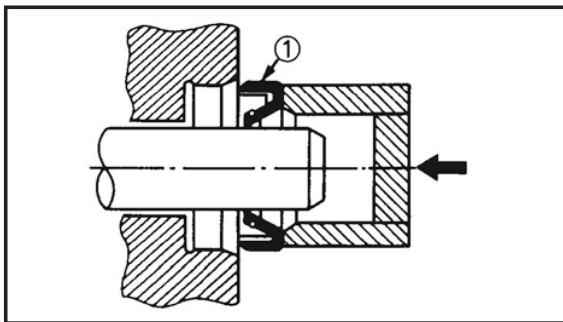
GASKETS, OIL SEALS AND O-RINGS

1. Replace all gaskets, seals and O-rings when overhauling the engine. All gasket surfaces, oil seal lips and O-rings must be cleaned.
2. Properly oil all mating parts and bearings during reassembly. Apply grease to the oil seal lips.



LOCK WASHERS/PLATES AND COTTER PINS

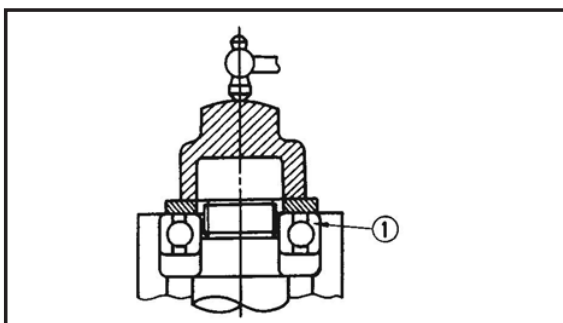
1. Replace all lock washers/plates and cotter pins after removal. Bend lock tabs along the bolt or nut flats after the bolt or nut has been tightened to specification.



BEARINGS AND OIL SEALS

Install bearings and oil seals so that the manufacturer's marks or numbers are visible. When installing oil seals, apply a light coating of lightweight lithium base grease to the seal lips. Oil bearings liberally when installing, if appropriate.

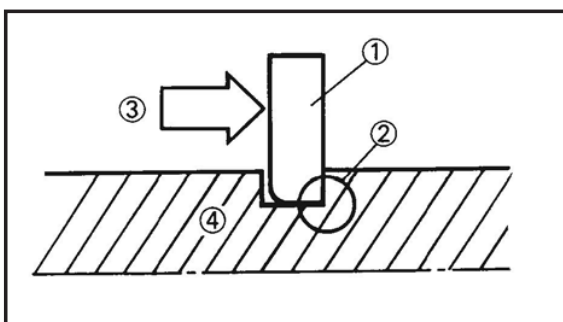
- ① Oil seal



CAUTION:

Do not use compressed air to spin the bearings dry. This will damage the bearing surfaces.

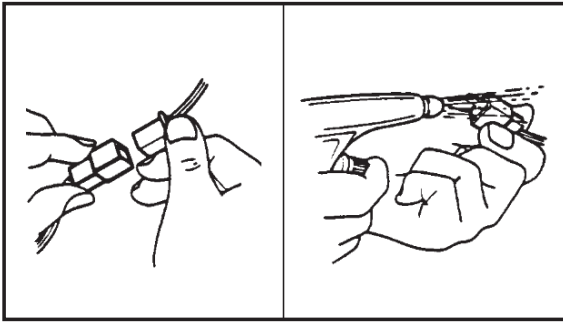
- ① Bearing



CIRCLIPS

1. Check all circlips carefully before reassembly. Always replace piston pin clips after one use. Replace distorted circlips. When installing a circlip ①, make sure that the sharp-edged corner ② is positioned opposite the thrust ③ it receives. See sectional view.

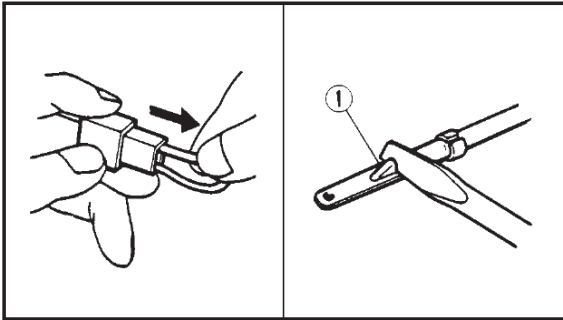
- ④ Shaft



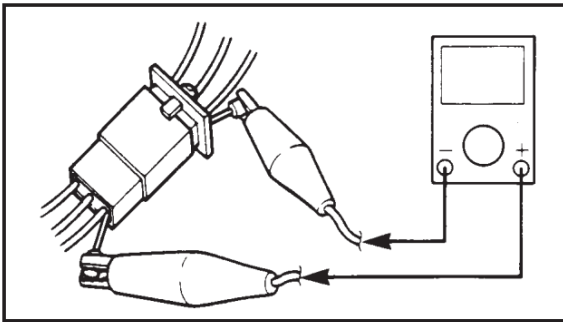
CHECKING OF CONNECTIONS

Dealing with stains, rust, moisture, etc. on the connector.

1. Disconnect
2. Connect
3. Dry each terminal with an air blower.



4. Connect and disconnect the connector two or three times.
5. Pull the leads to check that it will not come off.
6. If the terminal comes off, bend up the pin ① and reinsert the terminal into the connector.



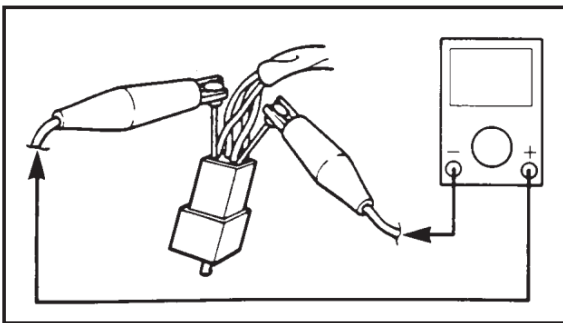
7. Connect: Connector

NOTE: _____
The two connectors "click" together.

8. Check for continuity with a tester.

NOTE: _____
If there is no continuity, clean the terminals.

- Be sure to perform the steps 1 to 7 listed above when checking the wire harness.
- For a field remedy, use a contact revitalizer available on the market.
- Use the tester on the connectors as shown.



HOW TO USE THE CONVERSION TABLE

All specification data in this manual are listed in SI and METRIC UNITS.

Use this table to convert METRIC unit data to IMPERIAL unit data.

Ex.

METRIC		MULTIPLIER		IMP
**mm	×	0.03937	=	** in
2 mm	×	0.03937	=	0.08 in

CONVERSION TABLE

METRIC TO IMP			
	Known	Multiplier	Result
Torque	mkg	7.233	ft•lb
		86.794	•
	cm.kg	0.0723	ft lb
		0.8679	•
Weight	kg	2.205	lb
	g	0.03527	oz
Distance	km/hr	0.6214	mph
	km	0.6214	mi
	m	3.281	ft
	m	1.094	yd
	cm	0.3937	in
	mm	0.03937	in
Volume/ Capacity	cc (cm ³)	0.03527	oz (IMP liq.)
	cc (cm ³)	0.06102	•
	lit (liter)	0.8799	qt (IMP liq.)
	lit (liter)	0.2199	gal (IMP liq.)
Miscella- neous	kg/mm	55.997	lb/in
	kg/cm ²	14.2234	psi (lb/in ²)
	Centigrade	°	Fahrenheit (°F)

SPECIAL TOOLS

The following special tools are necessary for complete and accurate tune-up and assembly.

Use only the appropriate special tools; this will help prevent damage caused by the use of inappropriate tools or improvised techniques.

When placing an order, refer to the list provided below to avoid any mistakes.

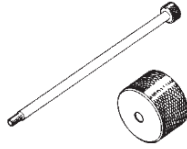
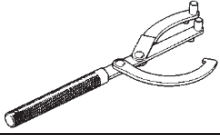
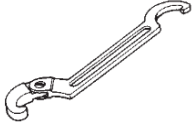
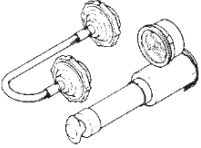
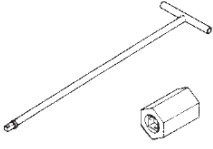
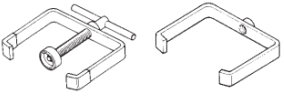
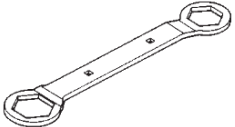
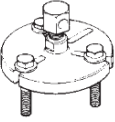
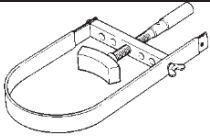
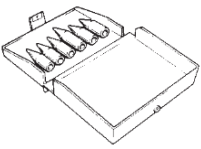
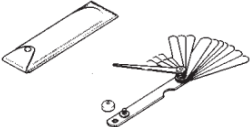
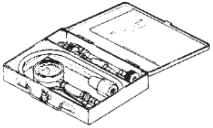
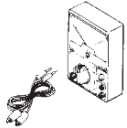
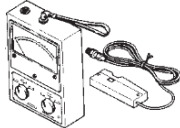
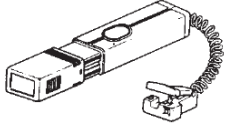
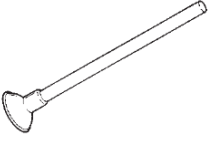
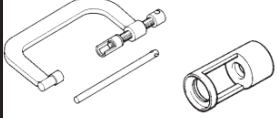
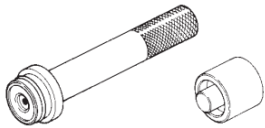
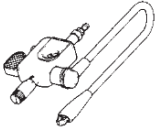
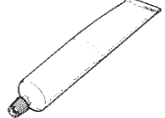
Illustration	Tool name	Tool Usage
	Weight Rocker arm shaft puller bolt	These tools are used when removing or installing the rocker arm shafts.
	Rotor holding tool	This tool is used to remove the flywheel magneto.
	Ringnut wrench	This tool is used to loosen and tighten the exhaust and steering ringnut.
	Valve adjusting tool	This tool is necessary for adjusting valve clearance.
	Fuel level gauge	This gauge is used to measure the fuel level in the float chamber.
	Radiator cap tester Adaptor	These tools are used for checking the cooling system.
	T-handle Damper rod holder	These tool are used for holding the damper rod holder when removing or installing the damper rod holder.
	Clutch spring compressor Clutch spring holder arm	These tools are used for removing the nut with holding the compression spring
	Locknut wrench	This tool is used when removing or installing the secondary sheave nut.

Illustration	Tool name	Tool Usage
	Flywheel puller	This tool is used for removing the rotor.
	Fork seal driver weight Fork seal driver attachment (ø33)	This tool is used when installing the fork seal.
	Oil seal guide	This tool is used for protecting the oil seal lip when installing the secondary sliding sheave.
	Ring nut wrench	This tool is used to loosen and tighten the steering ring nut.
	Sheave holder	This tool is used for holding the secondary sheave.
	Cylinder cup installer set	This tool is used for installing the cylinder cup to the master cylinder piston.
	Thickness gauge	This tool is used to measure the valve clearance.
	Compression gauge	These tools are used to measure the engine compression.
	Pocket tester	These instruments are invaluable for checking the electrical system.
	Engine tachometer	This tool is needed for detecting engine rpm.

Tool name	Tool Usage	Illustration
	Timing light	This tool is needed for detecting ignition timing.
	Valve lapper	This tool is used for removing and installing the lifter and for lapping the valve.
	Valve spring compressor Attachment	These tools are used when removing or installing the valve and the valve spring.
	Middle shaft bearing driver Mechanical seal installer	These tools are used for installing mechanical seal.
	Ignition checker	This instrument is necessary for checking the ignition system components.
	Sealant	This sealant (bond) is used for crankcase mating surface, etc.

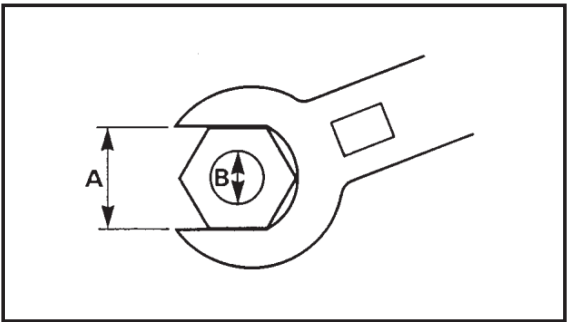
Specification (EFI Motorcycle ZAFFERANO)

Model		ZAFFERANO		Engine	Engine type	BJ169MM-5A	
Length inches		84.25			Fuel type	91# unleaded petrol or above	
Width inches		31.5			No. of cylinder	1	
Height inches		56.45			ID × stroke	69×66.8	
Wheelbase inches		58.75			Total displacement	249.7ml	
Weight lbs. (Curb weight)		Forward shaft	165		Startup	Electric	
		Backshaft	265		Cooling	Water cooling	
		Total	430		Lubrication	Force-feed and splash	
Tire Size		Front wheel			Air filter	Sponge	
		120/70-14			Capacity of gasoline tank	2.95 gallons	
		Rear wheel		Max. speed	75 mph		
		140/60-14		Grade ability	≥20 degree		
Transmission Device	Clutch	centrifugal		Performance	Idle speed -rpm	1400±100rpm/min	
	Transmission	CVT			Max. torque	17.3ft.lb /5000rpm	
	Drive	Belt drive			Max. Hp	20.8hp /6500 rpm	
Electric Device	Battery capacity/type	12V-6Ah/ dry-charged			Compression ratio	10.5 : 1	
	Magneto type	QJ（153-2）12V 200W/8500 rpm			Cylinder pressure	1.25MPa/1500rpm	
	Spark plug	NGK CR8E			Braking	Diameter of front brake disc	φ250mm
	Spark plug gap	0.6-0.7mm					

	Ignition	spark ignition DC capacitance	system	Diameter of rear brake disc (mm)	φ250mm
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GENERAL TORQUE SPECIFICATIONS

This chart specifies torque for standard fasteners with standard I.S.O. pitch threads. Torque specifications for special components or assemblies are included in the applicable sections of this book. To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion, in progressive stages, until full torque is reached. Unless otherwise specified, torque specifications call for clean, dry threads. Components should be at room temperature.



A: Distance across flats
B: Outside thread diameter

A (Nut)	B (Bolt)	General torque specifications	
		Nm	m kg
10 mm	6 mm	6	0.6
12 mm	8 mm	15	1.5
14 mm	10 mm	30	3.0
17 mm	12 mm	55	5.5
19 mm	14 mm	85	8.5
22 mm	16 mm	130	13.0

LUBRICATION POINT AND GRADE OF LUBRICANT

ENGINE

Lubrication Point	Symbol
Oil seal lips	
O-ring (Except V-belt drive unit)	
Cylinder head tightening nut mounting surface	
Crankshaft pin outside	
Connecting rod big end thrust surface	
Rotary filter inner surface	
Drive gear inner surface	
Cam chain outside sprocket inner surface	
Piston pin	
Piston outside and ring groove	
Camshaft cam profile	
Valve stem (IN, EX)	
Valve stem end (IN, EX)	
Rocker shaft	
Valve rocker arm inner surface	
Shaft	
Shaft (Oil pump assembly)	
Gasket (Oil pump assembly)	
Holder	
Idle gear 1 thrust surfaces	
Shaft 1	
Idle gear 2 thrust surfaces	
Idle gear 2 inner surface	
Main axle thrust surfaces	
Crankcase mating surfaces	Sealant
Crankcase breather plug	
Stator grommet	Sealant
Suction pipe	

LUBRICATION POINT AND GRADE OF LUBRICANT

SPEC



CHASSIS

Lubrication Point	Symbol
Front wheel oil seal lips (left/right)	
Swingarm oil seal lips (left/right)	
Steering head pipe bearing (upper/lower)	
Steering head pipe dust seal lips (upper/lower)	
Tube guide (throttle grip) inner surface	
Brake cable (brake lever)	
Brake lever and lever holder bolt sliding surface	
Sidestand sliding surface	
Centerstand sliding surface and mounting bolt	
Centerstand stopper pivot shaft	
Brake cam pivot shaft and cam surface	

Periodic Maintenance & Inspection Table

	Service cycle and time Inspection item	Per 600 MI	600 MI	2000 MI	4000 MI	6000 MI	8000 MI	Tools
		New	One mont	Three month	Six months	Nine months	Twelve months	
*	Air filter	I		C	C	R	C	Ordinary tools
*	Petrol filter	I			I	R		Ordinary tools
*	Fuel filter	C			C	C		Ordinary tools
	Replacement of engine oil	R	Replacement every 2000 MI					Ordinary tools
	Tire pressure	I	I	I	I	I	I	Tire pressure gauge, inflator
	Battery inspection	I	I	I	I	I	I	Densimete r,
	Actuation gap	I	I	I	I	I	I	Ordinary tools
	Inspection of steering handle fastening	I			I	I		Ordinary tools
	Absorber working inspection	I			I	I		Ordinary tools
	Screw fastening inspection	I	I	I	I	I	I	Torque spanner
	Oil leakage inspection for gearbox	I	I	I	I	I	I	Ordinary tools
*	Inspection or replacement of	I		I	R	R	I	Ordinary tools
*	Replacement of gearbox oil	I	Replacement every 3000 MI					Ordinary tools
	Lubrication of each part				L	L		Lubricator
	Exhaust pipe	I	I	I	I	I	I	Ordinary tools
*	Ignition timing	I	I	I	I	I	I	Timing lamp
*	Exhaust gas inspection at idle speed	A	I	A	A	A	A	Tachometer, CO HC analyzer
*	Throttle inspection	I		I	I	I	I	Ordinary tools
	Fuel pipeline inspection	I		I	I	I	I	Ordinary tools
	Lighting/metering/electric devices	I	I	I	I	I	I	Visual multimeter
	Main stand bracket	I			I	I		Ordinary tools
	Absorber			I	I	I	I	Ordinary tools
*	Torque force of engine bolts	I		I	I	I	I	Torque spanner

Anticipated Inspection

1	Ignition system—obviously continuous ignition abnormality, engine fire or overheating, which requires inspection and maintenance.
2	Carbon fouling elimination—obviously insufficient horsepower, which requires carbon fouling removal from cylinder head, piston head and exhaust system.
3	Piston & cylinder—excessive abrasion; replace cylinder if it is blocked.

Please have your motorcycle inspected and adjusted periodically at an authorized Benelli dealership to keep your vehicle in the best possible condition.

The above table is established under the presupposition of 600 mi/month.

I—Inspection A—Adjustment R—Replacement C—Cleaning L—Lubrication

Note: 1. “*” Regulations on exhaust emission made by the State Environmental Protection Agency shall be complied with. Maintenance must be carried out in accordance with the instruction manual supplied by the company. We are not responsible for any loss rising from private adjustment or maintenance.

2. Increase frequency of washing air filter if your motorcycle runs on sandy/gravel roads or under heavily polluted environments so as to extend its service life.

3. Motorcycles which often run at high speed or with high mileage shall be maintained more frequently.

Inspection / Adjustment

Preparing information

Periodic Maintenance & Inspection

Table Engine oil/ Oil filter

Fixing steering stem bearing &
handlebar Inspection & adjustment of
throttle cable

Air filter

Spark plug

Battery

Ignition timing

Rim/tires

Tire specifications

Cylinder

pressure Gear
oil

Replacement of gear oil

Drive belt

Free play of the front/rear
brake

Inspection of brake fluid level

Headlamp

Clutch

Front/rear suspension system

Bolt/nut/fasteners

Preparing Principles

General

Warning!

- Make sure that it is well ventilated before starting the engine. It is forbidden to start it in a closed area. Exhaust gas, which contains monoxide, may cause unconsciousness or even death.
- Petrol is liable to volatile or explode under certain conditions. Ventilation is required and no fire in any working places. Fire is strictly forbidden in working areas or where oil is stored.

Specification

Engine

Idle speed	1400±100rpm/mi
Spark plug gap	0.6-0.7mm
Spec. of spark plug	NGK CR8E
Cylinder compression pressure	1.25Mpa/1500rpm
Ignition time	BTDC12 degree ±1 degree 1500±100rpm

Frame

Free play of front brake lever		10-20mm		
Free play of rear brake lever		10-20mm		
Pressure unit: psi		Specification		Tire pressure
		EFI Motorcycle ZAFFERAN	Front wheel	120/70-14
			Rear wheel	140/60-14
Torque value	Locking nut for front wheel spindle	75-88N·m		
	Fixing nut for rear wheel	100-123N·m		

THROTTLE CABLE ADJUSTMENT

NOTE:

Prior to adjusting the throttle cable free play, the engine idling speed should be adjusted.

1. Check:

- Throttle cable free play ①
Out of specification → Adjust.



Free play (throttle cable):
3 to 5 mm at throttle grip flange

2. Adjust:

- Throttle cable free play

Adjustment steps:

NOTE:

Never accelerate the throttle when stopping the engine.

•

- Loosen the locknut ① on the throttle cable.
- Turn the adjuster ② in or out until specified free play is obtained.

Turning in → Free play is increased.

Turning out → Free play is decreased.

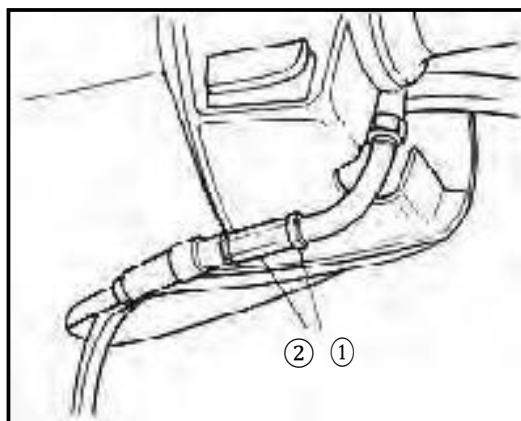
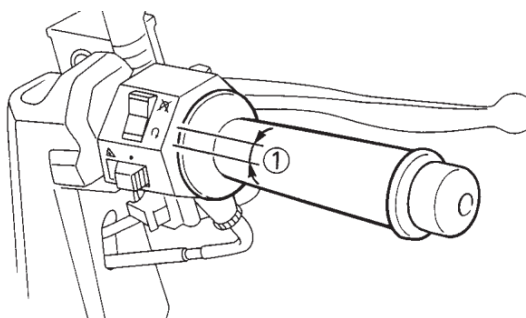
•

Tighten the locknut.



WARNING

After adjusting, turn the handlebar to the right and to the left to ensure that this does not cause the engine idling speed to change.



ENGINE OIL LEVEL INSPECTION

1. Stand the scooter on a level surface.

NOTE:

Make sure the scooter is upright when inspecting the oil level.

2. Start the engine and let it warm up for a few minutes.
3. Turn off the engine.
4. Inspect:

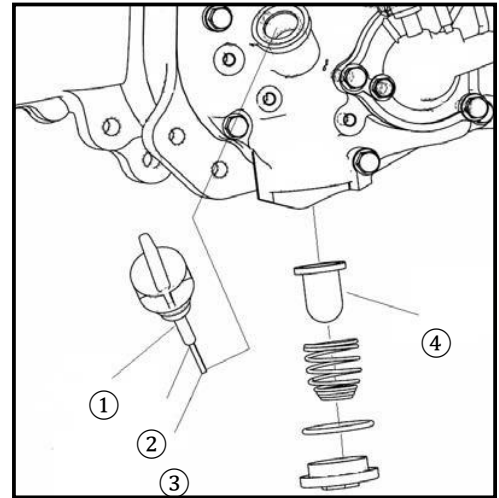
- Engine oil level
Oil level should be between maximum ② and minimum ③ marks.
Oil level is below the minimum mark
→ Add oil up to the proper level.

- ①: dipstick
- ②: maximum mark
- ③: minimum mark
- ④: filter

5. Start the engine and let it warm up for a few minutes.
6. Turn off the engine.

NOTE:

Wait a few minutes until the oil settles before inspecting the oil level.



ENGINE OIL REPLACEMENT

1. Start the engine and let it warm up for several minutes.
2. Turn off the engine and place an oil pan under the engine.

3. Remove:

- Oil filler plug
- Drain plug ①
- Compression spring ②
- Oil strainer ③
- O-ring

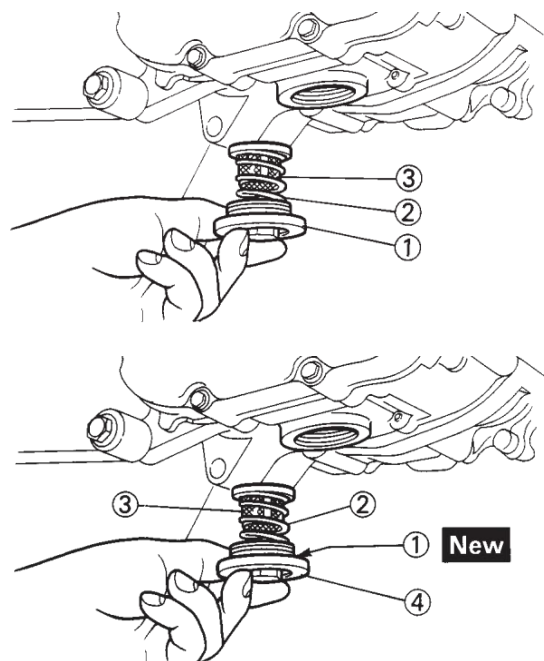
Drain the crankcase of its oil.

4. Install:

- O-ring ① **New**
- Compression spring ②
- Oil strainer ③
- Drain plug ④
- Oil filler plug

NOTE:

Check the O-ring (drain plug). If damaged, replace it with a new one.



5. Fill: Crankcase

	Oil quantity: 1.4L
---	-------------------------------------

6. Check: Engine oil level

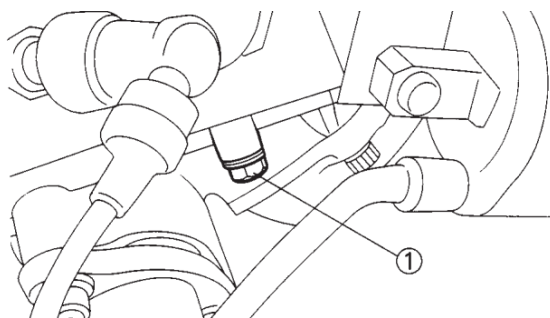
ENGINE OIL PRESSURE INSPECTION

1. Remove: Side Panels

2. Inspect: Oil Pressure

Inspection steps:

- Slightly loosen the oil check bolt ①.
- Start the engine and keep it idling until the oil begins to seep from the oil check bolt.
If no oil comes out after one minute, turn the engine off so it will not seize.
Check oil passages and oil pump for damage or leakage.
Start the engine after solving the problem(s), and recheck the oil pressure.
Tighten the oil check bolt to specification.



CAUTION:

- Start the engine and check the oil pressure with the oil check bolt loosened.
- Do not apply at high speeds more than specified when checking the pressure.

NOTE:

Wipe any spilled oil off of the engine.

TRANSMISSION OIL REPLACEMENT

NOTE:

Make sure the scooter is upright when replacing the oil.

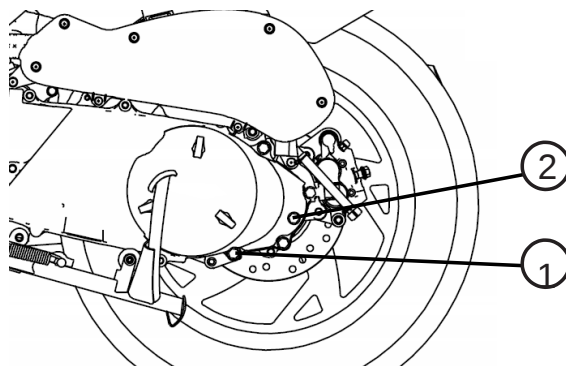
1. Stand the scooter on a level surface.
2. Start the engine for several minutes to warm it up and then stop.
3. Place an oil pan under the crankcase.
4. Remove:
 - Oil filler cap ②
 - Drain bolt ①Drain the oil.
5. Tighten:
 - Drain bolt
6. Fill:
 - Crankcase



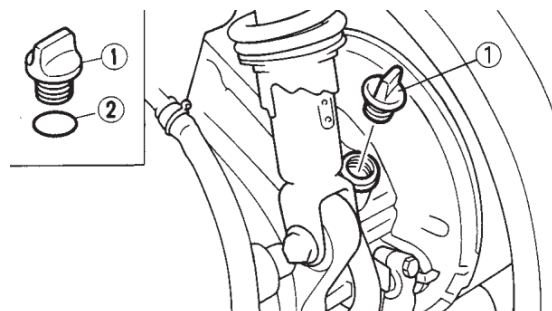
Recommended oil:
SAE 10W30 motor oil
Oil quantity:
0.25 L

CAUTION:

Wipe any spilled oil off the tire or the wheel.



7. Install:
 - Oil filler cap ①
 - O-ring ②
8. Start the engine for several minutes to warm it up and check for the oil leakage.



SPARK PLUG INSPECTION

1. Remove:

- Spark plug cap
- Spark plug

CAUTION:

Before removing the spark plug, use compressed air to blow away any dirt accumulated in the spark plug wells to prevent it from falling into the cylinder.

1. Check:

- Spark plug type
Incorrect → Replace.



Standard spark plug:
CR8E (NGK)

2. Inspect:

- Electrode ①
Wear/damage → Replace.
- Insulator ②
Abnormal color → Replace.
Normal color is a medium-to-light tan color.

2. Clean:

- Spark plug
(with spark plug cleaner or wire brush)

3. Measure:

- Spark plug gap ③
(with a plug gauge)
Out of specification → Adjust gap.



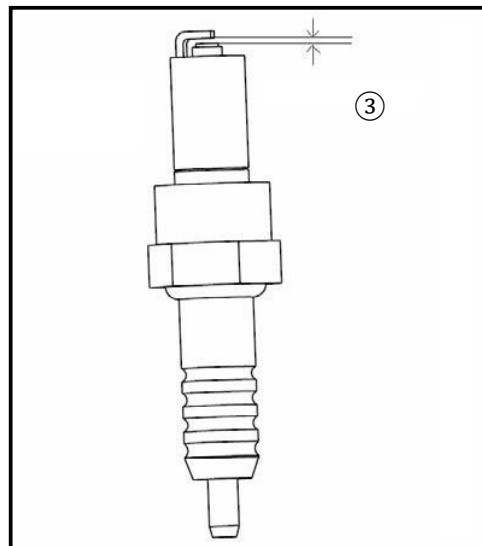
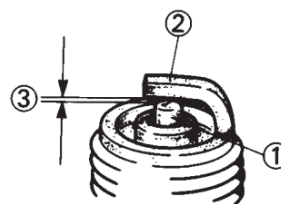
Spark plug gap:
0.6 1.7 mm

6. Install:

- Spark plug

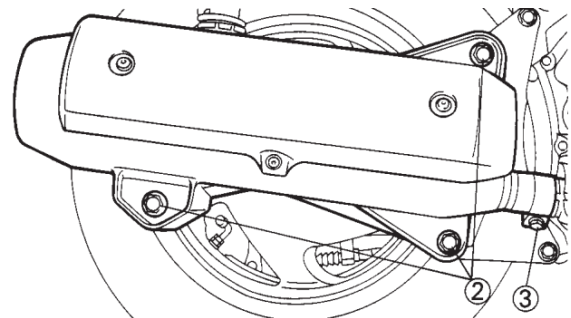
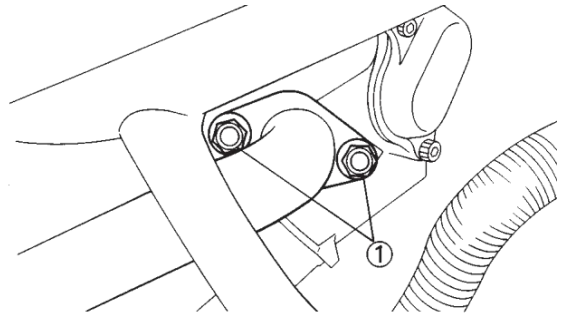
NOTE:

Before installing a spark plug, clean the gasket surface and plug surface.



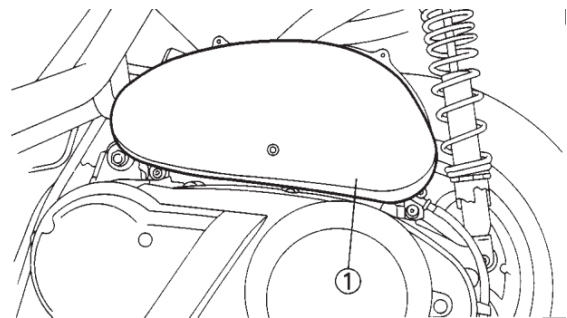
EXHAUST SYSTEM INSPECTION

1. Remove:
 - Side panels
2. Inspect:
 - Nut ① (exhaust pipe)
Loose/Damage → Tighten/replace.
 - Gasket (exhaust pipe)
Exhaust gas leaks → Tighten/replace.
3. Inspect:
 - Bolt ② (muffler)
 - Connecting bolt ③ (muffler)
Loose/Damage → Tighten/replace.



AIR FILTER CLEANING

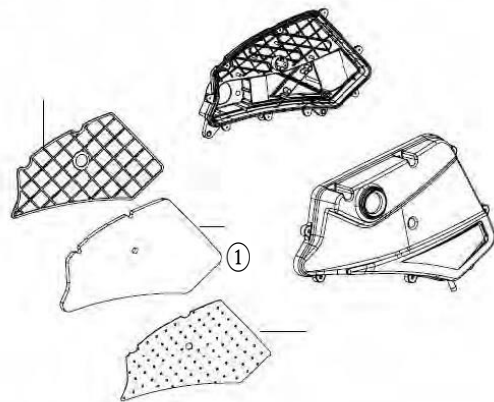
1. Remove:
 - Side panels
 - fixing screws of air filter
 - Air filter case cover
2. Remove:
 - Air filter element ①



CAUTION:

Never operate the engine without the air filter element installed. Unfiltered air will cause rapid wear of engine parts and may damage the engine. Operating the engine without the filter element will also affect the EFI tuning, leading to poor engine performance and possible overheating.

3. Inspect:
 - Air filter element
Damaged → Replace.
4. Clean:
 - Air filter element ①
Use foam filter cleaner to clean the element



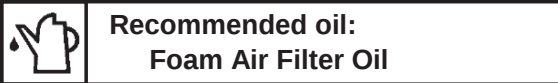
NOTE:

After cleaning, remove the remaining cleaner by squeezing the element.

CAUTION:

Do not twist the element when squeezing the element.

5. Apply the recommended oil to the entire surface of the filter and squeeze out the excess oil. The element should be wet but not dripping.



⚠ WARNING

Never use low flash point solvents such as gasoline to clean the air filter element. Such solvents may cause a fire or an explosion.

6. Install:
 - Air filter element
 - Air filter case cover
 - Side panels

CRANKCASE FILTER CLEANING

1. Remove:
 - Crankcase filter cover ①
 - Crankcase filter cover seal
 - Crankcase filter element ②

NOTE:

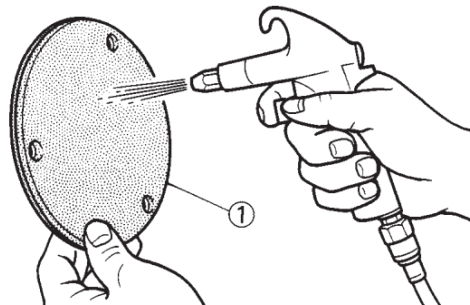
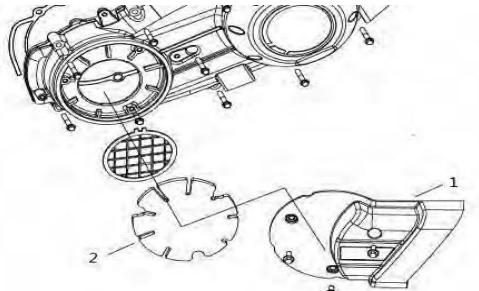
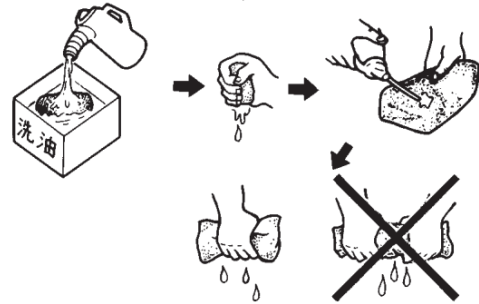
When installing the element in its case, be sure its sealing surface matches the sealing surface of the case so there are no air leaks.

2. Inspect:
 - Crankcase filter elementDamaged → Replace.

CAUTION:

This element is a dry type.
Be careful not to stain with grease or water.

3. Clean:
 - Crankcase filter element ①Blow out the dust in the element from the outer surface using compressed air.



4. Install:
 - Crankcase filter element
 - Crankcase filter cover seal
 - Crankcase filter cover

COMPRESSION PRESSURE MEASUREMENT

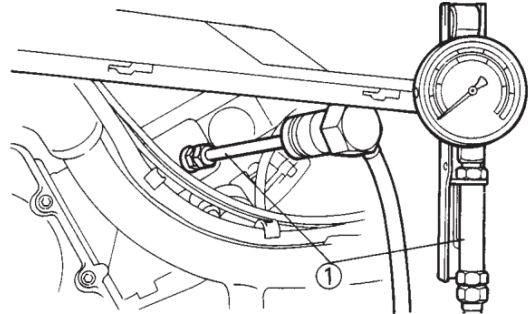
NOTE:

Insufficient compression pressure will result in performance loss.

1. Remove:
 - Side panels
2. Check:
 - Valve clearance
Out of specification → Adjust.
3. Start the engine and let it warm up for several minutes.
4. Turn off the engine.
5. Remove:
 - Spark plug

CAUTION:

Before removing the spark plug, use compressed air to blow away any dirt accumulated in the spark plug well to prevent it from falling into the cylinder.



6. Attach:
 - Compression gauge ①
7. Measure:
 - Compression pressure
If it exceeds the maximum pressure allowed → Inspect the cylinder head, valve surfaces and piston crown for carbon deposits.
If it is below the minimum pressure → Squirt a few drops of oil into the affected cylinder and measure again.
Follow the table below.

Compression (With oil applied into cylinder)	
Reading	Diagnosis
Higher than without oil	Worn or damaged pistons
Same as without oil	Possible defective ring(s), valves, Cylinder, head gasket or piston → Repair.

	Compression pressure (at sea level): Standard: 1.25Mpa/1500rpm
---	---

Measurement steps:

- Crank the engine with the throttle wide open until the reading on the compression gauge stabilizes.

WARNING

Before cranking the engine, ground all spark plug leads to prevent sparking.

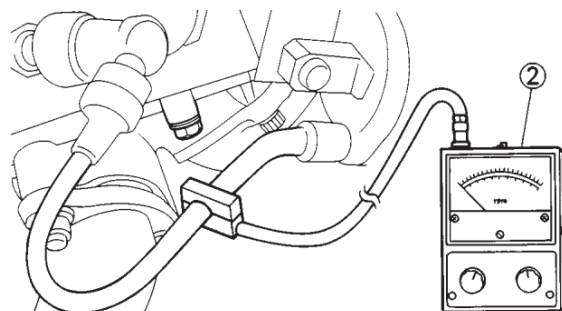
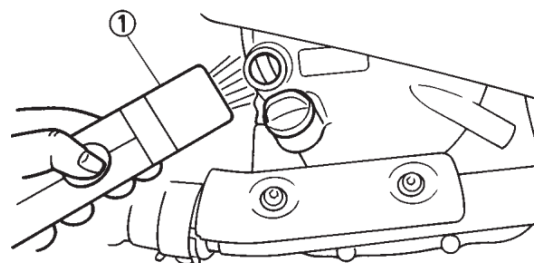
8. Install:
 - Spark plug
9. Install:
 - Side panels

IGNITION TIMING CHECK

NOTE:

Prior to checking the ignition timing, check all electrical connections related to the ignition system. Make sure all connections are tight and free of corrosion and that all ground connections are tight.

1. Remove:
 - Timing check plug
2. Attach:
 - Timing light ①
 - Engine tachometer ② (to the spark plug lead)



3. Check:

- Ignition timing

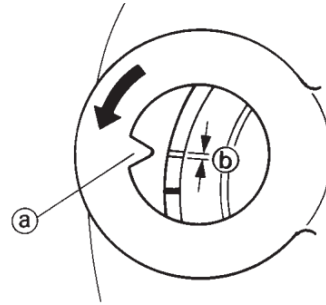
Checking steps:

- Start the engine and let it warm up for several minutes. Let the engine run at the specified speed.

	Engine idling speed: 1,450 ~ 1,550 r/min
---	---

Visually check the stationary pointer (a) to verify it is within the required firing range (b) indicated on the flywheel.

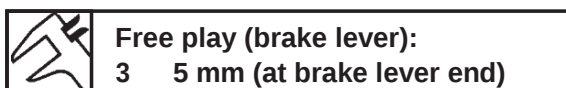
Incorrect firing range → Check the ignition system.



FRONT/ REAR BRAKE ADJUSTMENT

1. Check:

- Brake lever free play ①
Out of specification → Adjust.



2. Adjust:

- Brake lever free play

Adjustment steps:

- Loosen the locknut ②.
- Turn the adjuster ③ in or out until the specified free play is obtained.

Turning in → Free play is decreased.

Turning out → Free play is increased.
--

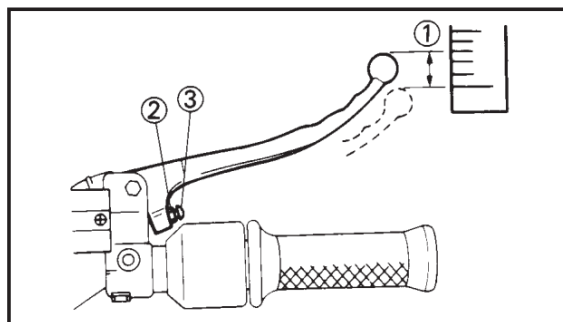
Tighten the locknut.

CAUTION:

Make sure that there is no brake drag after adjusting the front brake lever free play.

⚠ WARNING

A soft or spongy feeling in the brake lever can indicate the presence of air in the brake system. This air must be removed by bleeding the brake system before the motorcycle is operated. Air in the brake system will considerably reduce braking performance and could result in loss of control and possibly an accident. Inspect and bleed the brake system if necessary.



BRAKE FLUID LEVEL INSPECTION

1. Stand the scooter on a level surface.

NOTE:

Make sure the scooter is upright when inspecting the brake fluid level.

2. Stand the scooter on its centerstand.
3. Inspect:

- Brake fluid level
Brake fluid level is below the "LOWER" level line ① → Fill to proper level.



NOTE:

For a correct reading of the brake fluid level, make sure the top of the handlebar brake fluid reservoir is horizontal.

- If DOT#4 is not available, DOT#3 can be used.

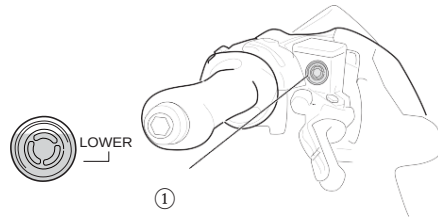
CAUTION:

Brake fluid may corrode painted surfaces or plastic parts. Always clean up any split fluid immediately.

⚠ WARNING

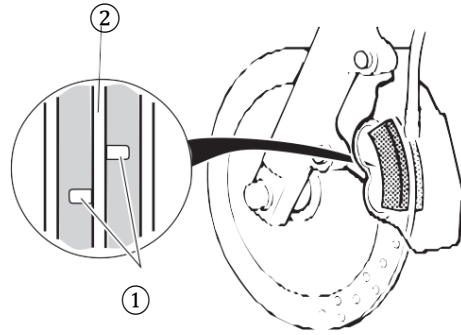
Use only the designated brake fluid. Other fluids may deteriorate the rubber seals, causing leakage and poor brake performance.

- Refill with the same type of fluid. Mixing fluids may result in a harmful chemical reaction leading to poor brake performance.
- Be careful that water does not enter the brake fluid reservoir during refilling. Water will significantly lower the boiling point of the fluid and may cause vapor lock.



BRAKE PAD INSPECTION

1. Operate the brake lever.
2. Inspect:
 - Brake pad (front)
Wear indicators ① almost touch the brake disc → Replace the brake pads as a set.
Refer to "FRONT AND REAR BRAKE" in CHAPTER 7.



AIR BLEEDING (HYDRAULIC BRAKE SYSTEM)

WARNING

Bleed the brake system whenever:

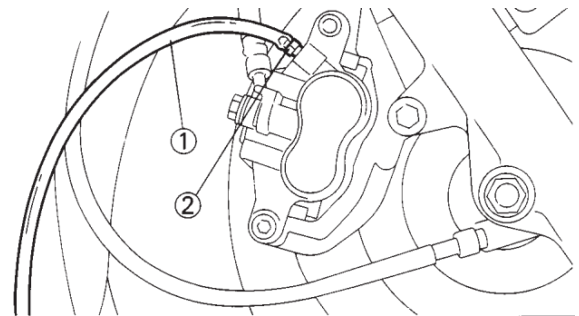
- The system is disassembled
- A brake hose is loosened or removed
- The brake fluid level is very low
- Brake operation is faulty

Loss of braking performance may occur if the brake system is not properly bled.

1. Bleed:
 - Brake system

Air bleeding steps:

- a. Fill the reservoir with the proper brake fluid.
- b. Install the diaphragm. Be careful not to spill any fluid or allow the reservoir to overflow.
- c. Connect a clear plastic hose ① tightly to the caliper bleed screw ②.
- d. Place the other end of the hose into a container.
- e. Slowly apply the brake lever several times.
- f. Pull the lever in. Hold the lever in position.
- g. Loosen the bleed screw and allow the lever to travel towards its limit.
- h. Tighten the bleed screw when the lever limit has been reached, then release the lever.
- i. Repeat steps (e) to (h) until all air bubbles have disappeared from the brake fluid.



NOTE: _____

When bleeding the brake system, make sure that there is always enough brake fluid in the brake fluid reservoir before applying the brake lever. Ignoring this precaution could allow air to enter the brake system, considerably lengthening the bleeding procedure.

- j. Tighten the bleed screw.

-

Bleed screw

NOTE: _____

If bleeding is difficult, it may be necessary to let the brake fluid settle for a few hours. Repeat the bleeding procedure when the tiny bubbles in the brake system have disappeared.

- k. Fill the brake fluid reservoir to the proper level.

 WARNING _____

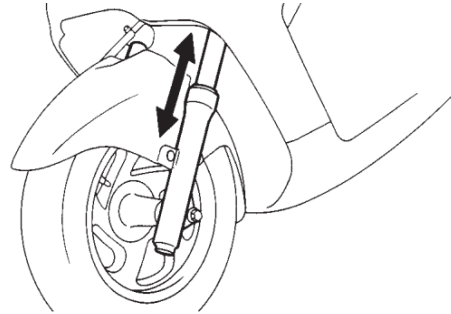
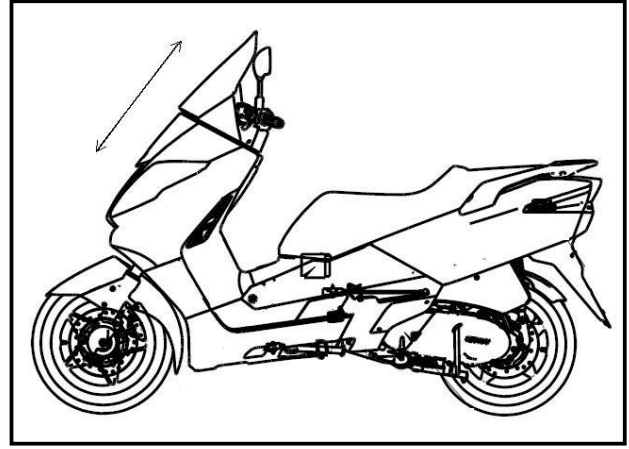
Check brake operation after bleeding the brake system.

FRONT FORK INSPECTION

⚠ WARNING

Securely support the scooter so that there is no danger of it falling over.

1. Stand the scooter on a level surface.
2. Check:
 - Inner tube
Scratches/damage → Replace.
 - Oil seal
Excessive oil leakage → Replace.
Hold the scooter upright and apply the front brake.
3. Check:
 - Operation
Push down hard on the handlebars several times.
Unsmooth operation → Repair.



REAR SHOCK ABSORBER INSPECTION

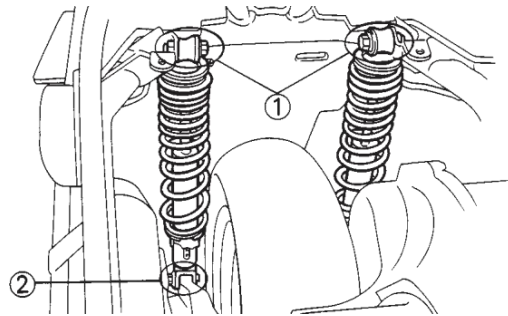
1. Remove:

- Side panel
- Box

Check:

-

Rear shock absorber mount
Looseness → Tighten.
Bolt (upper) ①
Bolt (lower) ②



REAR SHOCK ABSORBER ADJUSTMENT

⚠ WARNING

Always adjust each rear shock absorber preload to the same setting. Uneven adjustment can cause poor handling and loss of stability.

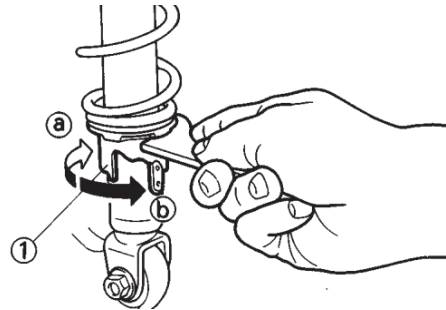
- Securely support the scooter so there is no danger of it falling over.

1. Adjust:

- Spring preload
Turn the adjuster ring ① to direction ① or ②.

NOTE:

Use the special wrench included in the owner's tool kit to adjust the spring preload.



Adjustment steps:

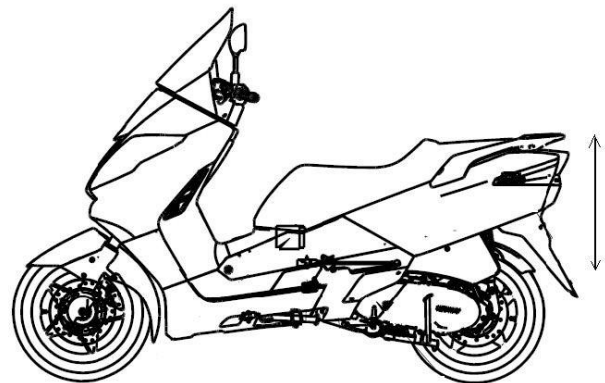
- Turn the adjuster ring in or out.

Turning toward ① →	Spring preload is increased.
Turning toward ② →	Spring preload is decreased.

	Hard		Standard	Soft	
Adjusting position:	5	4	3	2	1

CAUTION:

- Never turn the adjuster beyond the maximum or minimum setting.
- Always adjust each shock absorber to the same setting.



TIRE INSPECTION

1. Measure:

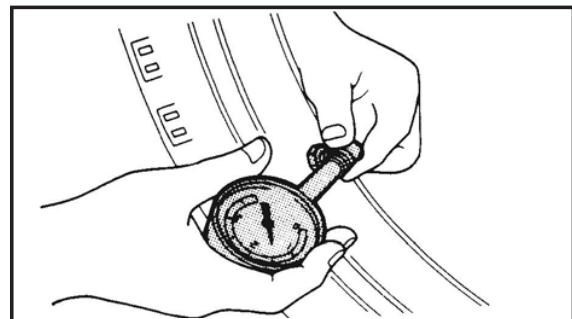
- Tire inflation pressure
Out of specification → Adjust.

WARNING

Tire inflation pressure should only be checked and adjusted when the tire temperature equals the ambient air temperature. Tire inflation pressure and suspension must be adjusted according to the total weight of the cargo, rider, passenger and accessories (fairing, saddlebags, etc. if approved for this model), and according to whether the scooter will be operated at high speed or not.

NEVER OVERLOAD THE SCOOTER.

- Operation of an overloaded scooter could cause tire damage, accident or injury.



* Load is the total weight of the cargo, rider, passenger and accessories.

2. Inspect:

- Tire surfaces
Wear/damage → Replace.



**Minimum tire tread depth
(front and rear):**
1.6 mm

- ① Tread depth
- ② Side wall
- ③ Wear indicator

⚠ WARNING

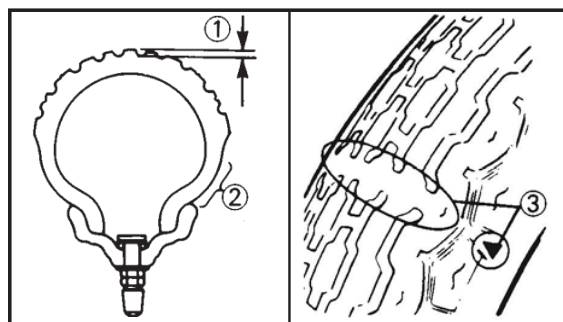
It is dangerous to ride with a worn-out tire. When the tire tread begins to show signs of wear, replace the tire immediately.

- Do not use tubeless tires on a wheel designed for tube type tires only. Tire failure and personal injury may result from sudden deflation.

Tube type wheel → Tube type tire only
Tubeless type wheel → Tube type or tubeless tire.

Be sure to install the correct tube when using tube type tires.

- After extensive tests, the tires listed below have been approved by Benelli Motor Co., Ltd. for this model. No guarantee concerning handling characteristics can be given if a tire combination other than one approved by Benelli is used on this scooter. The front and rear tires should always be by the same manufacturer and of the same design.



Required pressure

Unit: psi

ZAFFERANO	Specification	Tire pressures
FRONT wheel	120/70-14	36
REAR wheel	140/60-14	36

⚠ WARNING

After mounting a tire, ride conservatively for a while to give the tire time to seat itself properly in the rim. Failure to do so could lead to an accident with possible injury to the rider or damage to the scooter.

2. After a tire repair or replacement, be sure to tighten the valve stem locknut ① to specification.

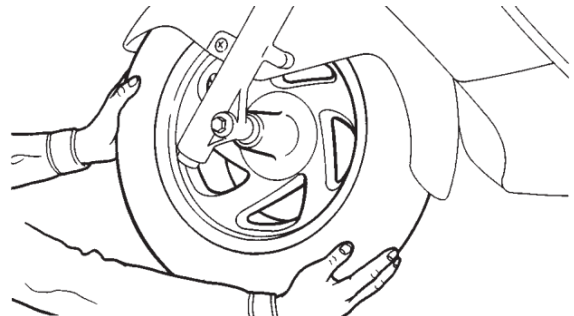
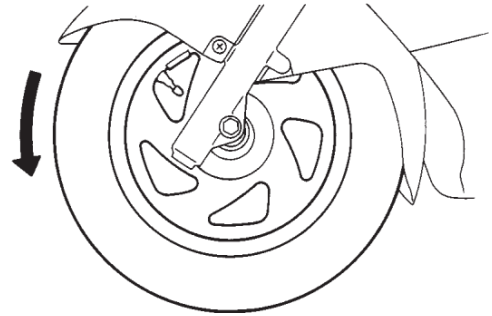
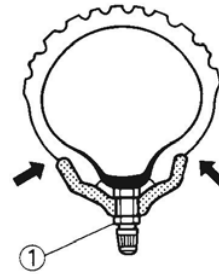
WHEEL INSPECTION

1. Inspect:
 - WheelsDamage/Bends → Replace.

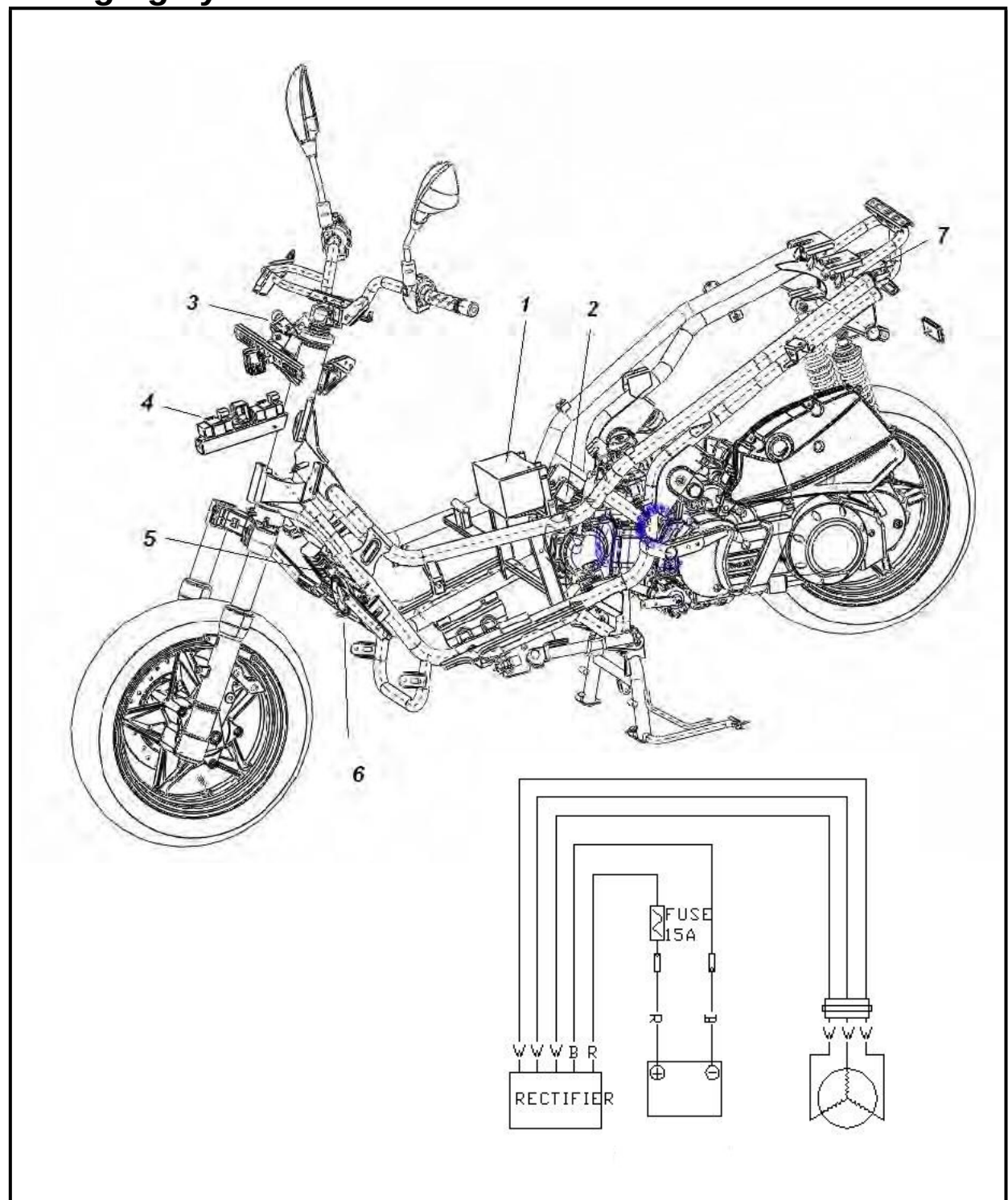
NOTE: _____
Always balance the wheel when a tire or wheel has been changed or replaced.

⚠ WARNING

Never attempt to make any repairs to the wheel.



Inspection and Maintenance of Electrical System Charging system



- 1.) Battery
 3.) Power lock assembly 4.) Flash apparatus 5.) Rectifier 6.) Horn

- 2.) Start Relay
 7.) ECU

1. Battery/Charging System

2. Preparing documents -----	1.1 Failure diagnosis-----	1.2
3. Battery -----	1.3 Charging system -----	1.4
4. Voltage/current regulator -----	1.5 Charging coil of magneto -	1.6
5. Disassembly of magneto ----		1.7

1.1 Preparing documents

Note of work:

*Note

1. Battery can be charged and discharged repeatedly. If it is charged after discharge, its service life will be shortened and performance is undermined. Normally, the battery performance will be degraded after two or three years. For battery with performance degradation (reduced capacity), voltage will recover temporarily after charging but decrease sharply when loading.
2. Battery overcharge: normally, overcharge can be judged upon the battery. In the case of short circuit inside the battery, its terminal is unable to detect voltage or the detected voltage is very low. Regulator failure: overvoltage inside the battery will shorten its service life.
3. The battery will be discharged if being stored for a long time, which reduces its capacity. It shall be charged about every three months when storing.
Check the charging system following the sequence listed on the failure diagnosis table.
4. Do not remove the connector when there is current through electrical parts, otherwise it will cause over voltage and damage to electrical parts inside the voltage regulator. Please operate it after the main switch is turned off.
5. It is unnecessary to check the maintenance-free (dry-charged) battery and add electrolyte and distilled water.
6. Check all the electric load.
7. Emergency charging can only be used under emergency situation.
8. Remove the battery from the motorcycle for emergency charging.
9. Do not use electrolyte-added batteries when interchanging batteries.
10. Use a voltmeter to check charging condition of the battery.

Preparing principles

Item			Specifications
Battery	Capacity/Type		12V-6AH/ dry-charged
	Voltage (68F)	Fully charged	13.1V
		Necessary	12.3V (not working for 1h)
	Charging current		Standard: 0.6A, quick: 6A
	Charging time		Standard: 10-15 hours, quick: 30 mins
Alternator	Capacit		200W/8500rp
	Coil impedance (68F)		Between white-black 3.3-3.5Ω
Voltage regulator	Type		Three-phase full-wave
	Charging voltage		14.5±0.5V/5.000rpm

Tightening torque force

Rectifier bolt	5.0 N·m
High-voltage coil fixing bolt	9.0 N·m
Flywheel fixing nut	5.0 N·m
Body guard bolt	9.0 N·m

Tools

Universal fixing spanner
 Flywheel remover
 Test instrument
 Multimeter

1.2 Failure diagnosis

Power supply dead

Battery over Emission
 Unconnected battery wiring
 Fuse blow
 system Poor switch

Low voltage

Poor battery charging
 Poor contact
 Poor charging system
 magneto Poor voltage/current regulator

Interrupted current

Poor contact of the charging wire
 Poor contact of the charging system
 Poor contact or short circuit of the lighting

Poor charging system

Poor contact, short circuit or open circuit of wire terminals
 Poor voltage/current regulator
 Poor

1.3 Battery

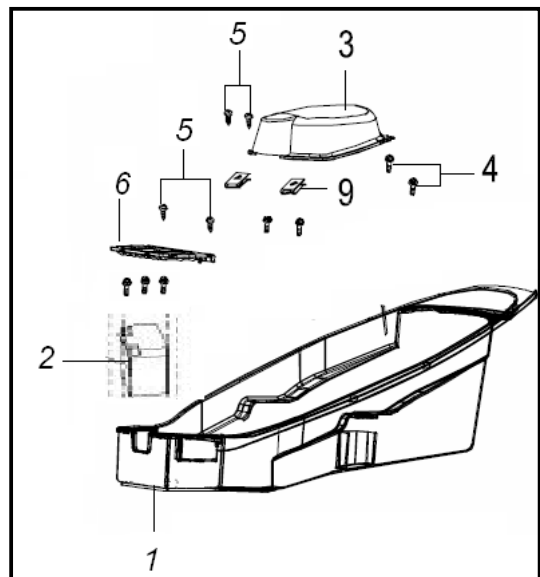
1.3.1 Battery

disassembly Remove the battery cover. Remove the clamp assembly.

Remove the negative lead and then the positive lead. Take out the battery.

Warning!

During the removal of the positive terminal, the tool should not be contacted with the frame. It is dangerous that spark caused by short circuit will ignite petrol and destroy the battery.



Install the battery in reversal order.

*** Note**

First positive terminal and then negative terminal to prevent short circuit.

Check the charging situation (open circuit voltage).
Open the battery cover and remove the fixing plate assembly of the battery.
Remove the lead of the battery connector.

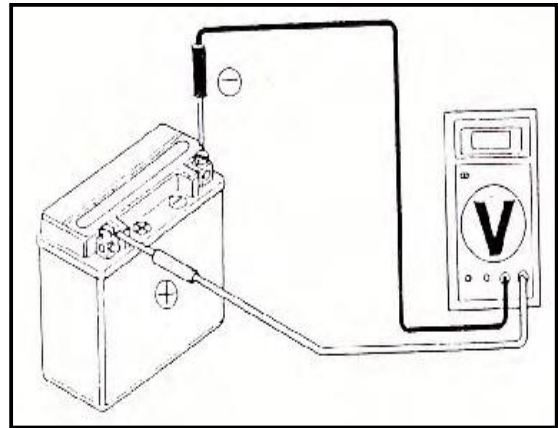
Measure voltage between terminals.

Fully charged: 13.1V

Insufficiently charged: 12.3V (not working for 1h)

*** Note**

Use a voltmeter to check the charging situation.



1.3.2 Charging

Connection method: connect the positive terminal of the charger with the positive terminal of the battery; connect the negative terminal of the charger with the negative terminal of the battery.

Warning!

- The battery should be far away from a fire source.
- Turn off the charger before or after charging to avoid explosive danger caused by spark which may exist in any connection.
- Comply with the current and time requirements for charging as stated on the battery.

*** Note**

- Except emergencies, you should not use emergency charging.
- Measure voltage 30 minutes after the battery is charged.

**Charging current: standard: 0.6A
quick: 6.0A**

**Charging time: standard: 10-15
hours**

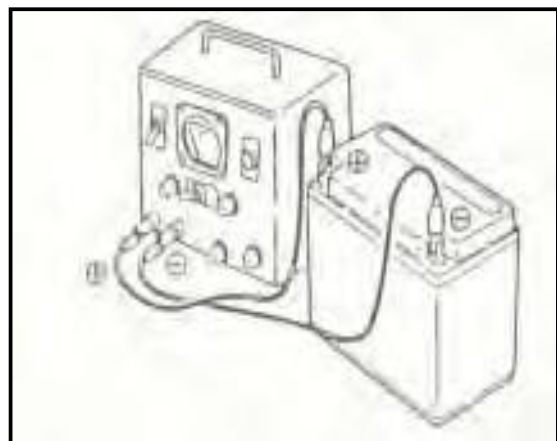
quick: 30 minutes

**Charging completed: open circuit voltage:
above 12.8V**

1.4 Charging system

1.4.1 Short-circuit test

Remove the earth lead from the battery.
Install a voltmeter between the negative terminal and the earth lead. Turn off the switch. Check short-circuit.



*** Note**

Connect the positive terminal of the multimeter with the negative terminal of the battery.

Check whether there is a short-circuit in the main switch or in the main wire in the case of any abnormality.

1.4.2 Charging check

Use a multimeter to check the charging status of the battery when it is being fully charged.

Install the fully charged battery after the engine warms up. Connect a voltmeter between terminals. Remove the main fuse and connect an ammeter between the terminals.

Start the engine and increase its speed gradually to measure the limiting voltage and current.

Limiting voltage/speed: 14-15V @ 5,000 rpm

Check the voltage regulator if the limiting voltage is not within its required range. Check the limiting voltage of the lighting system.

*** Note**

Set the multimeter to the AC voltage position.

Limiting voltage: 13.1±0.5V @ 5,000 rpm

Check the voltage/current regulator if the limiting voltage is not within its required range.

1.5 Voltage/current regulator

1.5.1 Main wiring check

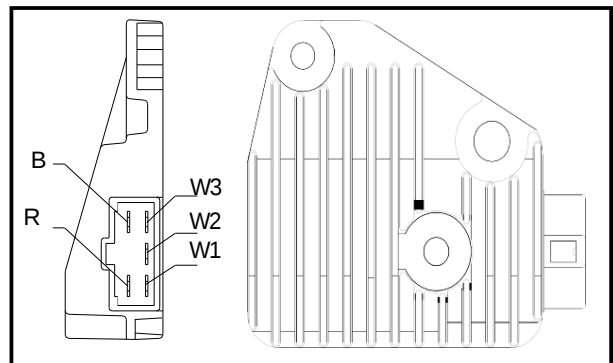
Remove 4p plug of the voltage/current regulator. Check conductivity between main wiring terminals.

Item (wire color)	Judgment
Between Battery(red) and GND of	With battery voltage
Between GND wire (black) and GND of the	With lead
Between charging coil (white) and the GND of the	Resistance in the coil of the magnetor.

(B: Black R: Red W: White)

1.5.2 Voltage-current regulator check

1. Select "diode" in the multimeter;
2. The black probe connects the red terminal of the stabilizer, and the red probe respectively connects white terminals of the stabilizer (white1, white2 and white3). Pointers indicate values. If not, the stabilizer is damaged and needs replacement.



3. The red probe connects the black terminal of the stabilizer and the black probe connects white terminals of the stabilizer (white1, white2, white3). Pointers indicate values. If not, the stabilizer is damaged and needs replacement.

*** Note**

- Do not touch any metal part of the test rod of the multimeter with your finger for check.
- Check with multimeter. Different multimeters show different impedance and different results.

Replace the voltage-current regulator when the impedance between terminals is abnormal.

1.6 Magneto charging coil

*** Note**

Check the magneto charging coil on the engine.

Check

Remove the 6p connector of the magneto.

Measure impedance between the white coil of the magneto and the body with multimeter.

Standard: 0.6-1Ω (68F)

Replace the magneto coil when the measured value exceeds the standard value.

1.7 Magneto disassembly

1.7.1 Disassembly

Remove the body guard.

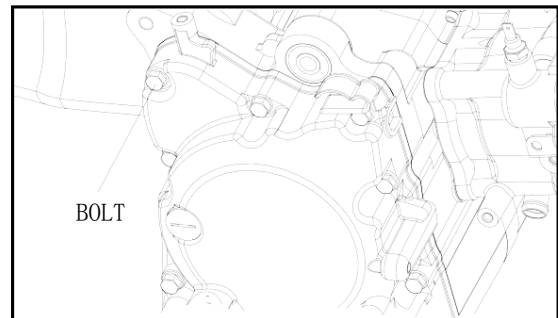
Fix the flywheel using the universal spanner. Remove fixing bolts of the flywheel.

Remove the flywheel using the puller tool.

Remove the solid key.

Remove the conductor joint.

Remove the stator.



1.7.2 Installation

Install the stator on the body of the engine. Connect the magneto joint.

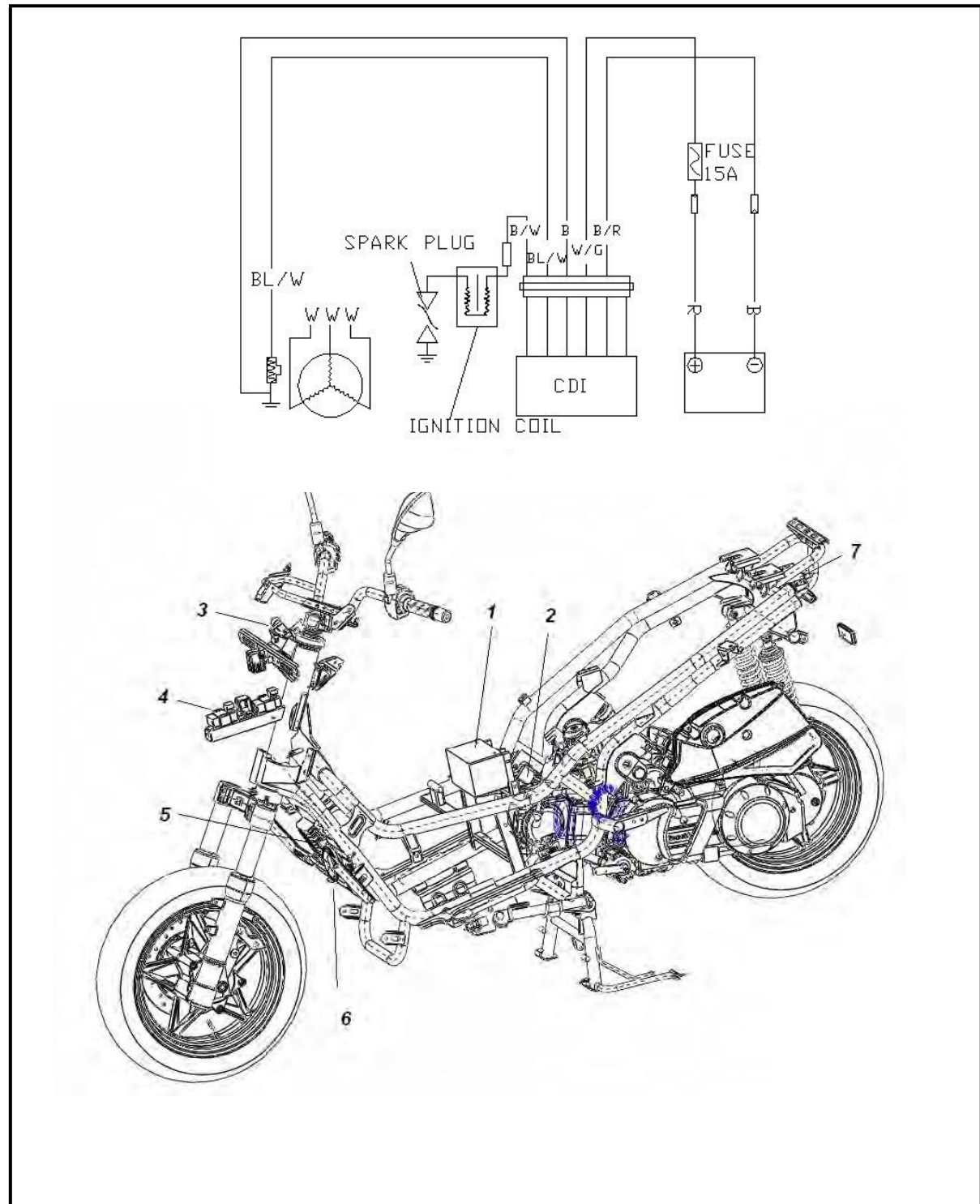
Clean up the crankshaft and the taper part of the flywheel. Install the solid key into the groove above the upper crankshaft key and confirm it.

Aim the groove in the flywheel at the solid key on the shaft.

*** Torque force:9.0 N·m**

Install the left body guard.

Ignition system



1.) Battery 2.) Starter Relay 3.) Power lock assembly 4.) Flash apparatus 5.) Rectifier 6.) Horn 7.) ECU

2. Ignition System

Preparing documents-----	2.1	RELATED PARTS Group
-----	2.4	
Failure diagnosis -----	2.2	Ignition coil -----
Ignition system check-----	2.3	Trigger-----
		2.5
		2.6

2.1 Preparing documents

Note of Work:

1. Check the ignition system following the sequence listed in the table of failure diagnosis.
2. This ignition system is an electronically and automatically angling device. It is solidified in the RELATED PARTS group and you don't have to adjust the ignition time.
3. Check the ignition system following the sequence listed in the table of failure diagnosis.
4. Do not make RELATED PARTS of the ignition system fall down or hang down or hammer it with strong force (primary causes for failure). Pay special attention during disassembly.
5. Failure of the ignition system is mostly caused by poor contact of the socket. Check whether each connector is in good condition.
6. Check whether the heat value used for the spark plug is proper. If not, the engine may work abnormally or the spark plug may be burnt.
7. Check in this chapter is based on the maximum voltage. It also refers to check on the impedance of the ignition coil.
8. Check the main switch according to the conduction table.
9. Remove the magneto and the stator according to instructions.

Preparing principles

Item		Standard value
Spark plug recommend	Standard	CR8E (NGK)
Spark plug		0.6-0.7mm
Ignition coil impedance (68F)	Primary coil	
	Secondary coil	0.4Ω±10%
		With plug cap 8-11KΩ
		Without plug cap 4.5-5.5KΩ
Impedance of trigger (68F)		100-200Ω
Measure the maximum primary voltage of the ignition coil		95-400V
Trigger Voltage		Over 1.7V

Tools

Attachments to the Maximum Voltage Table
Multimeter

2.2 Failure Diagnosis

No Spark

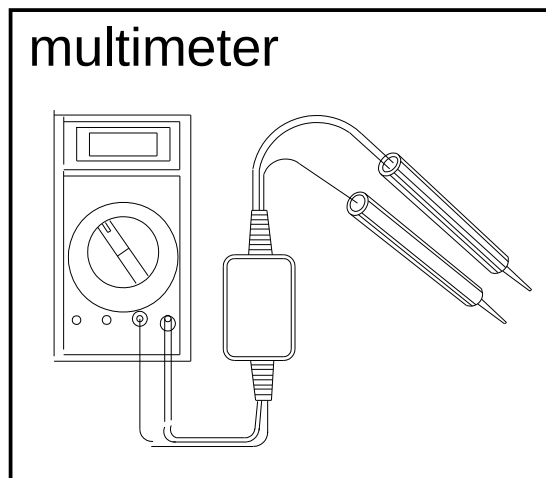
	Abnormality	Cause (confirm it sequentially as follows)
Ignition coil	Too low high-voltage	①The inner resistance is too small and it should be tested by required tester. ②Low speed of the crankshaft. ③Interfered tester (It is normal that voltage is always beyond the required value upon several measurements.) ④Poor wiring contact of the ignition system. ⑤Poor ignition coil. ⑥Poor charging coil (measured at the maximum voltage).
Side voltage	No or interrupted high voltage	①Incorrect connection of the tester. ②Poor main switch. ③Poor contact of RELATED PARTS terminal. ④Short circuit or poor contact of the GND of RELATED PARTS. ⑤Poor contact of charging coil (measured at the maximum voltage). ⑥Poor trigger (measured at the maximum voltage). ⑦Poor terminal of high-voltage wires. ⑧Poor RELATED PARTS group (when item is checked to be abnormal or there is no spark for spark plug.)
	Normal high voltage, but no spark	①Poor spark plug or secondary leakage of the ignition coil. ②Poor ignition coil.
Charging coil	No high voltage	①The inner resistance is too small and it should be tested by required tester. ②Low speed of the crankshaft. ③Interfered tester (It is normal that voltage is always beyond the required value upon several measurements.) ④Poor charging coil (Item ①-③ is checked to be normal.)
	No or interrupted high voltage	①Poor ignition coil. ②Poor charging coil.
Trigger	Too low high-voltage	①The inner resistance is too small and it should be tested by required tester. ②Low speed of the crankshaft. ③Interfered tester (It is normal that voltage is always beyond the required value upon several measurements.) ④Poor trigger (Item ① - ③ is checked to be normal.)
	No or interrupted high voltage	①Poor ignition coil. ②Poor trigger.

2.3 Ignition system check

* Note

- When there is no spark, check whether there is loose wiring or poor contact, and make sure all voltage values are normal.
- There are kinds of multimeters with different impedances and different test values.

Connect a high-pressure shunt or an ammeter with an input impedance above 10MΩ10CV to the multimeter.

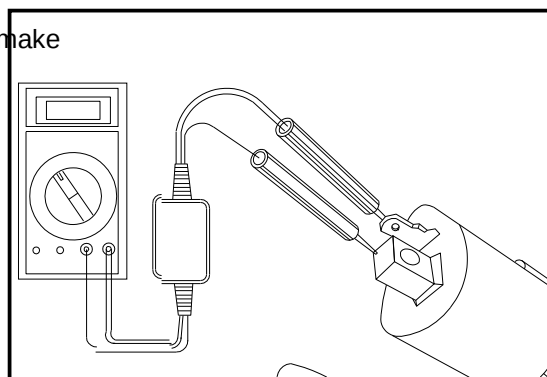


2.3.1 Primary voltage of the ignition coil

If you replace the original spark plug with a better one, make ground connection with the engine.

* Note

Make sure all wiring is correct before test. Cylinder compression pressure normally refers to the test value when the spark plug is installed on the cylinder head.



Connect the lead of the ignition coil and also the shunt between the primary coil terminal (black/white) and the GND.

Press the startup motor or step the actuating lever to measure the maximum primary voltage of the ignition coil. **Minimum voltage: above 95V.**

* Note

Never touch any metal part of the test rod with your finger to avoid electric shock.

2.3.2 Charging coil

* Note

Install the spark plug on the cylinder head and carry out measurement when the compression pressure is normal.

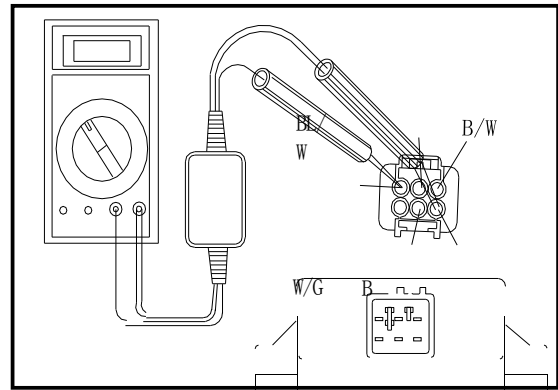
Remove 4P connector and 2P connector from RELATED PARTS group. Install a high-pressure shunt between the charging coil with 2P connector (red/white terminal) and 4P connector (black terminal). Press the startup motor or step the actuating lever to measure the maximum voltage of the charging coil. Connection: positive pole to red/white; negative pole to black. **Minimum voltage: above 95V.**

* Note

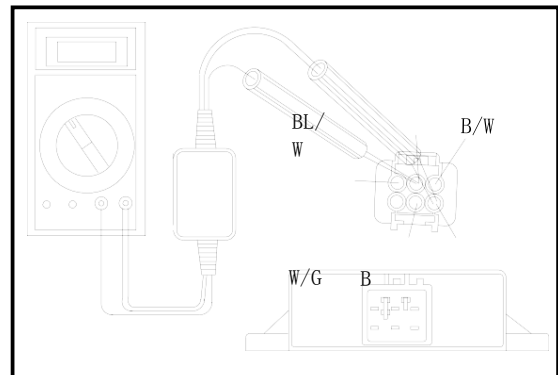
Never touch any metal part of the test rod with your finger to avoid electric

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B/L



B/R



When the maximum voltage measured at the terminal of RELATED PARTS Group is abnormal, dismantle the body guard and the magneto terminal.

Connect the charging coil (black/red) to the shunt. If the voltage of RELATED PARTS is measured to be abnormal while the voltage at the magneto terminal is normal, it is caused by poor contact or disconnected wiring.

If the voltage at both RELATED PARTS and magneto terminal appears to be abnormal, it is caused by poor charging coil. Please refer to charging coil check.

(B: black R: red W: white G: green BL: blue)

2.3.3 Trigger

* Note

Install the spark plug on the cylinder head and carry out measurement when the compression pressure is normal.

Remove 6P connector of RELATED PARTS group. Connect the peak-voltage shunt between the trigger with 6P connector (blue/white terminal) and 6P connector (black terminal).

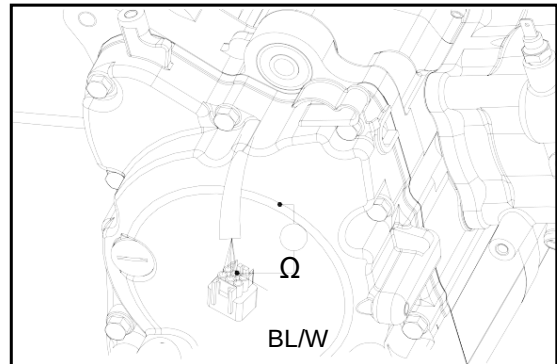
Press the startup motor or step the actuating lever to measure the maximum voltage of the trigger.

Connection: positive pole to blue/white; negative pole to black

Minimum voltage: above 1.7V.

* Note

Never touch any metal part of the test rod with your finger to avoid electric shock.



When the maximum voltage measured at the terminal of RELATED PARTS Group is abnormal, dismantle the right body guard and the magneto connector. Connect the trigger (blue/white) to the shunt.

- If the voltage of RELATED PARTS is measured to be abnormal while the voltage at the magneto terminal is normal, it is caused by poor contact or disconnected wiring.
- If the voltage at both RELATED PARTS and magneto terminal appears to be abnormal, it is caused by poor trigger. Please refer to the table of failure diagnosis.

2.4 RELATED PARTS GROUP

2.4.1 System check

Check the system.

Remove the RELATED PARTS Group, and check components of the ignition system at the terminal.

2.4.2 Check

Remove RELATED PARTS Group and check whether the terminal is loose.

Item	Test terminal	Standard (68F)
Main switch	Red--red/white	Conduction when the main switch is "OFF"
Trigger	Blue/white – white/green	100-200Ω
Primary coil of the ignition coil	Black/white--black	0.4Ω±10%
Secondary coil of the ignition coil	Black--spark plug cap excluding	4.5-5.5KΩ±10%

2.5 Ignition coil

2.5.1 Disassembly

Remove the body guard.

Remove the spark plug cap.

Remove the primary lead of the ignition coil.

Remove the fixing bolts and then the ignition coil. Install the ignition coil in reverse order.

* Note

Install the primary coil with black/white terminal.

(①: ignition coil)

2.5.2 Check the primary coil

Measure impedance between terminals of the primary coil.

Standard: 0.4Ω±10% (20°C)

It shows good if the impedance is within the range of standard values.

Replace the primary coil if the impedance shows ∞ which indicates that the coil is broken.

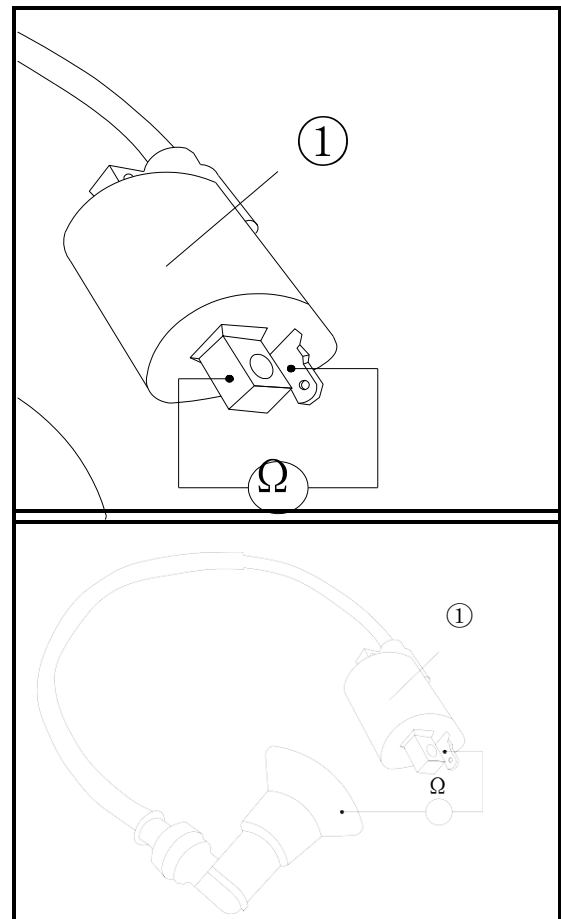
(①: ignition coil)

2.5.3 Secondary coil

Attached with spark plug. Measure the impedance between the wiring side of the spark plug cap and the terminals. **Standard: 8-11KΩ (68F)**

It shows good if the impedance is within the range of standard values.

The impedance ∞ indicates that the coil is broken.



Remove the spark plug cap. Measure the impedance between the primary side wire of the ignition coil and the negative terminal.

Standard: $4.5\text{--}5.5\text{K}\Omega \pm 10\%$ (68F)

2.6 Trigger

* Note

Check the trigger on the engine.

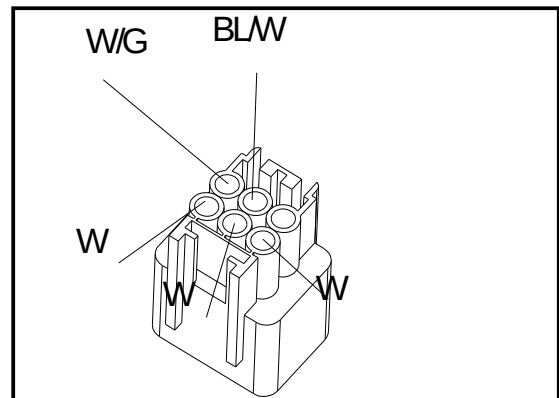
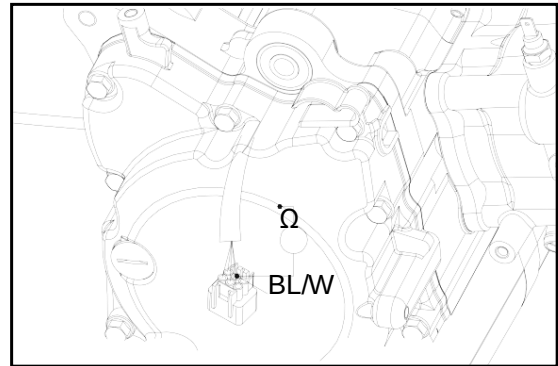
Check:

Remove the body guard.

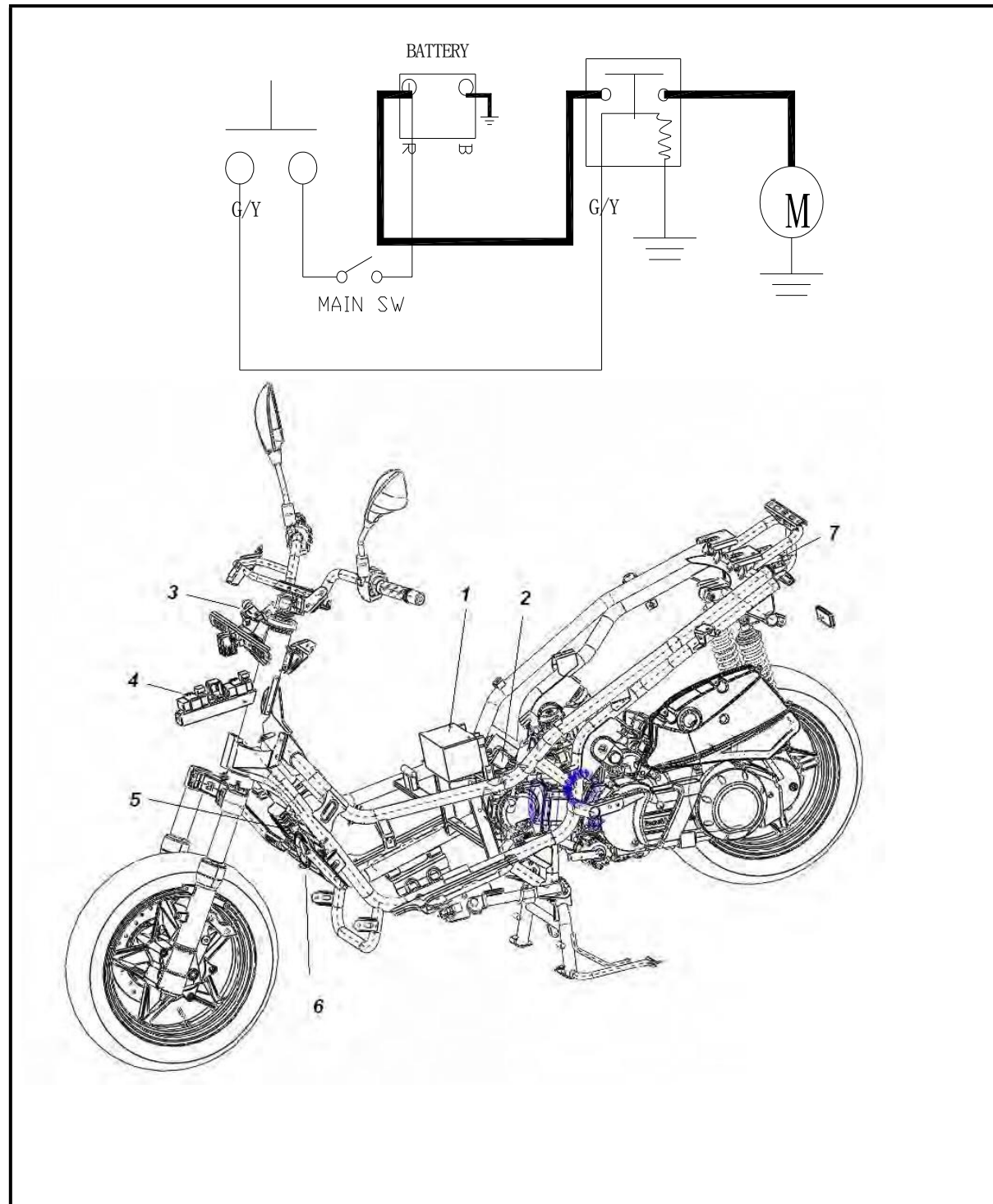
Remove the trigger terminal.

Measure the impedance between the blue/ white terminal of the side wire of the engine and the body GND.

Standard: $100\text{--}200\Omega$ (68F)



Starter System



- 1.) Battery 2.) Starter Relay 3.) Power lock assembly
4.) Flash apparatus 5.) Rectifier 6.) Horn 7.) ECU

3. Starter System

Preparing documents -----	3.1
Failure diagnosis -----	3.2
Starter motor -----	3.3
Starter relay -----	3.4

3.1 Preparing documents

Note of Work

Disassemble the starter motor on the engine.

For the disassembly of the starter clutch, please comply with regulations.

Preparing principles

Item	Standard	Limit for use
Length of the brush of the startup motor	12.5mm	8.5mm
Bushing of the startup idler shaft		8.3mm
Outer diameter of the startup idler shaft		7.94mm

Tightening torque force

Bolts for the clutch cover of the startup motor 12 N·m

Fixing bolts for the clutch of the startup motor 95 N·m

Tools:

Spanner for fixing nuts

Universal fixing spanner

3.2 Failure diagnosis

Startup failure

- Fuse blown
- Low battery
- Poor main switch
- Poor starter clutch
- Poor brake switch
- Poor starter relay
- Poor wiring contact
- Poor starter motor

Weak rotation of the starter motor

- Low battery
- Poor wiring contact
- Gear seized

No rotation of RE rotary engine of the starter motor

- Poor startup clutch
- Reversal rotation of the startup motor
- Low battery

3.3 Starter motor

3.3.1 Disassembly

* Note

Before the starter motor is disassembled, turn off the main switch, remove the GND wire of the battery, and then power on to check whether the starter motor works to ensure your safety.

Remove the wire connector for the starter motor. Remove the fixing bolts, separate the front and rear end caps, and dismantle the starter motor. Roll the waterproof rubber case and dismantle the terminal of the starter motor.

3.3.2 Breakdown

Remove screws in the shell, front cover, motor housing and other parts.

Check other components:

Replace any part with abraded, damaged or burnt surfaces. Clean the commutator surface if there is metal powder attached to it. Check conduction between the surface of the other components. Ensure non-conduction between armature shafts of the commutator. Check the conduction of the shell of the starter motor.

Ensure non-conduction between the conduction terminal and the startup motor shell.

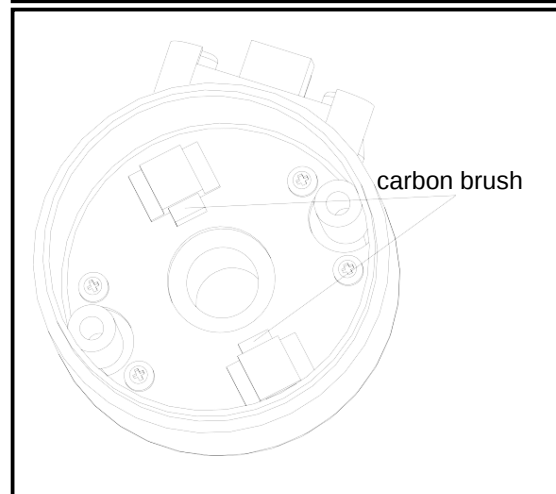
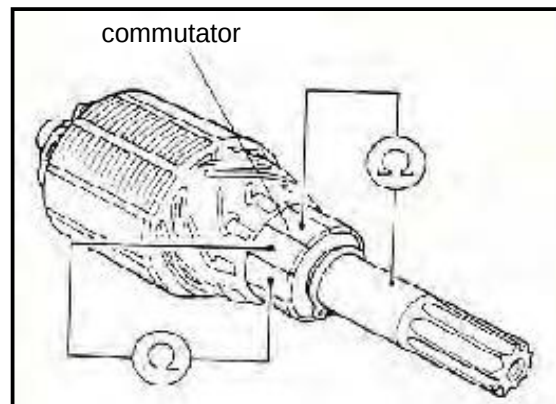
Check conduction between the conduction terminal and the brush.

Replace any abnormal part/s.

Check conduction of the brush bracket. Replace it when there is conduction. Measure the length of the brush.

Limit for use: replace it if lower than 8.5mm

Check smooth rotation of the needle bearing inside the front cover and whether it is loose when pressing. Replace it if there is any abnormality. Check whether the oil seal is abraded or damaged.



3.3.4 Assembly

Lubricate the oil seal inside the front cover with grease.

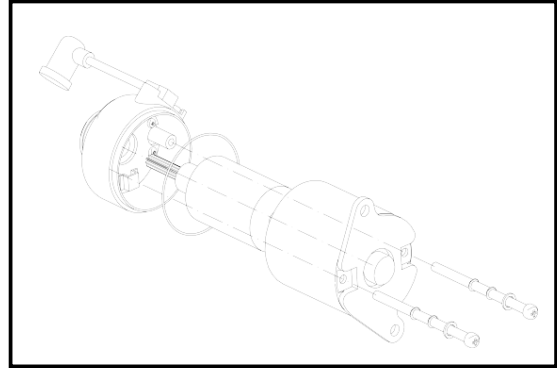
Install the brush on the bracket.

Lubricate moving parts at two ends of the brush shaft with grease.

Press each brush into the bracket.

*** Note**

- Pay special attention that the surface of the brush and the armature shall not be damaged.
- Pay attention that the armature shaft shall not damage lips of the oil seal.



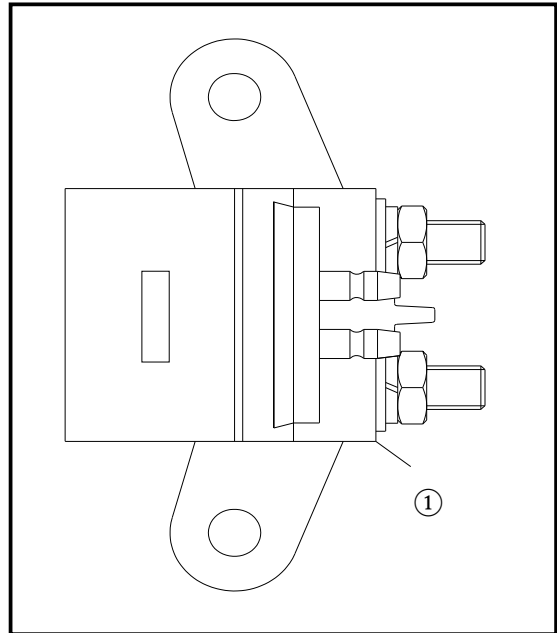
Install the rear cover of the motor.

Aim the screw hole of the motor shell at the screw hole of the front cover for installation.

Lock screws in the shell.

*** Note**

When the shell and the front cover are assembled, it is easy to pull the front cover with a magnet to attract the armature. Press it gently for assembly.



3.3.5 Installation

Install the lead of the starter motor and the dustproof boot. Then install the startup motor.

Install the wire clip for rear brake.

3.4 Starter relay

3.4.1 Check

Remove the body guard.

When the main switch is "on", check there is "click" sound at the time of pressing the starter motor.

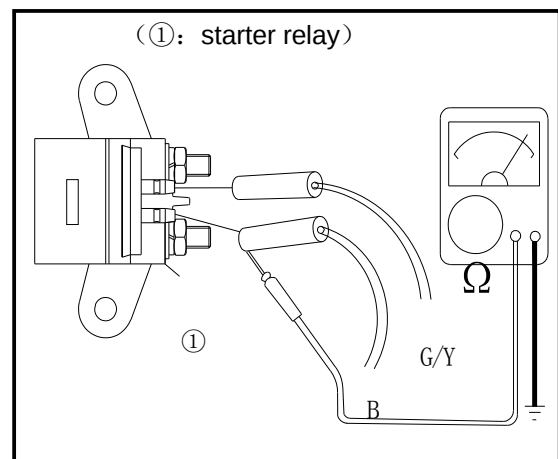
With click sound, it is normal.

- check the GND loop of the starter relay;
- check the movement of the starter relay.

3.4.2 Check voltage of the starter relay

Set up the main stand, and measure voltage between the negative pole of the green/yellow wire of the starter relay terminal and the body ground connection. When the main switch is "on", hold the brake lever. The battery voltage shall comply with regulations.

When there is no voltage at the starter relay terminal, check the conduction of the brake switch and leads.

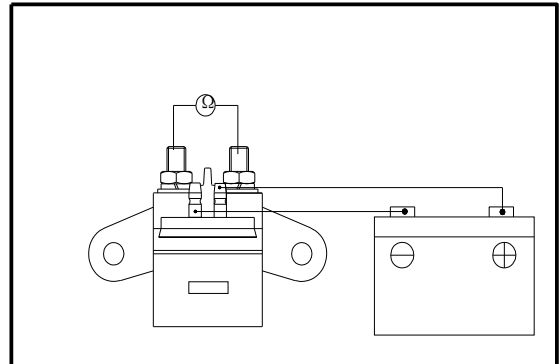


3.4.3 Check GND Loop of the Starter Relay

Remove the starter relay connector
Check conduction between the black wire of the lead terminal and the body ground connection.
When the starter button is pressed, it shall show good conduction between the black wire of the terminal and the body ground connection.
Check conduction of the starter button and leads when it is not conducted.

3.4.4 Check

Connect the starter relay to the battery, and the terminal of the starter motor to the multimeter.
Connect fully charged battery between the black wire and the green/yellow wire of the relay. The relay shall sound "click" and the multimeter shall indicate resistance of "zero".



4. Bulbs/Switches/Meters

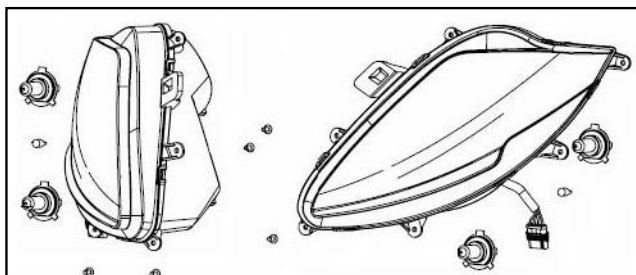
Preparing documents -----	4.1	Meters-----	4.6
Failure diagnosis-----	4.2	Main switch -----	4.7
Replacement of headlamp bulbs -----	4.3	Horn -----	4.8
Replacement of front steering lamp bulbs---	4.4	Handlebar switch -----	4.9
Replacement of tail lamp bulbs-----	4.5		

4.1 Preparing documents

Note of Work

Remove the switch from the vehicle to measure its conduction.

4.2 Failure diagnosis



When the main switch “ON” is not light, it is due to

- Poor bulbs.
- Poor switch.
- Bad contact or broken wires.

4.3 Replacement of the Headlamp Bulbs

4.3.1 Disassembly

Remove the front shield.
Remove the fixing screws for dismantling the headlamp.
Disconnect the headlamp connector.
Remove the headlamp.
Remove the glass of the headlamp.
Fix the headlamp and rotate the socket clockwise to remove the bulb.

4.3.2 Installation

Install the bulb in reverse order.

4.4 Replacement of Front Steering Lamp Bulbs

4.4.1 Disassembly

Remove the handlebar cowl.

Loosen fixing screws of steering lamps.
Remove the bulb socket from the lamps.

4.4.2 Installation

Install the bulb in reverse order.

①: front right steering lamp ②: front left steering lamp

4.5 Replacement of tail lamp bulbs

4.5.1 Disassembly

Remove the cushion assembly and body guard. Remove the rear armrest. Remove the fixing screws to dismantle the tail lamp shield. Disconnect the tail lamp connector. Remove the tail lamp and the rear steering lamp.

The tail lamp and the rear steering lamps are integrated.

4.5.2 Installation

Install the tail lamp in reverse order.

4.5.3 Replacement of tail lamp bulbs

4.5.3.1 Disassembly

Remove the fixing screws to dismantle the tail lamp bulbs.

Remove the bulbs from the socket

4.5.3.2 Installation

Install the tail lamp bulbs in reverse order.

4.6 Meter

Remove the rearview mirror.

Remove the handlebar cowling and waterproof connector. Remove the screws.

Remove the odometer assembly to dismantle the odometer.

Install the odometer in reverse order.

(①: odometer)

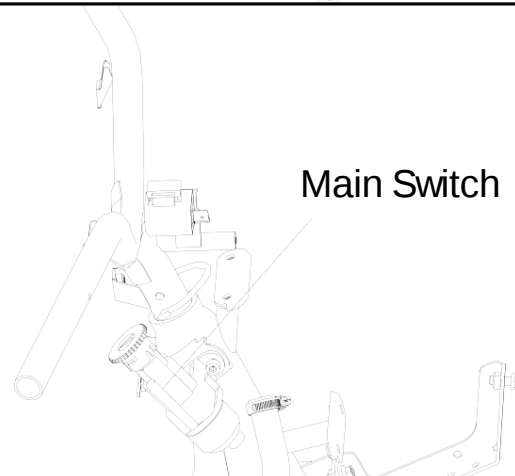
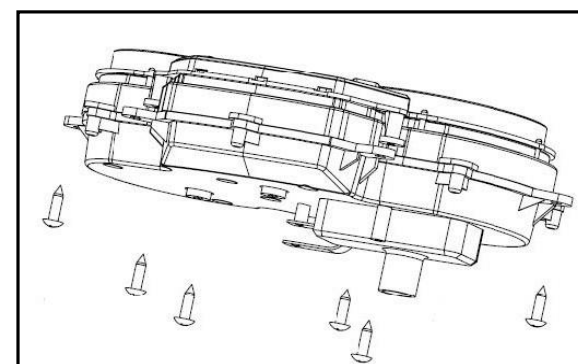
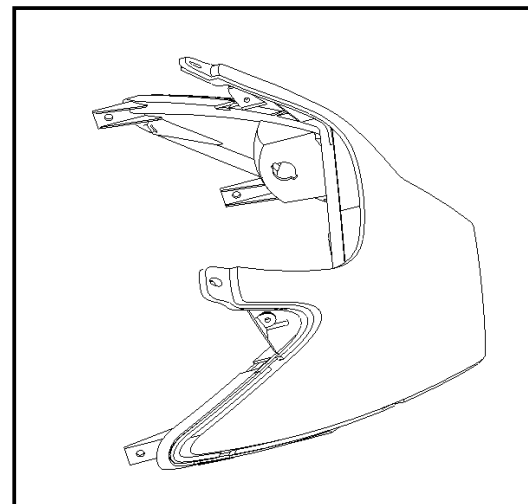
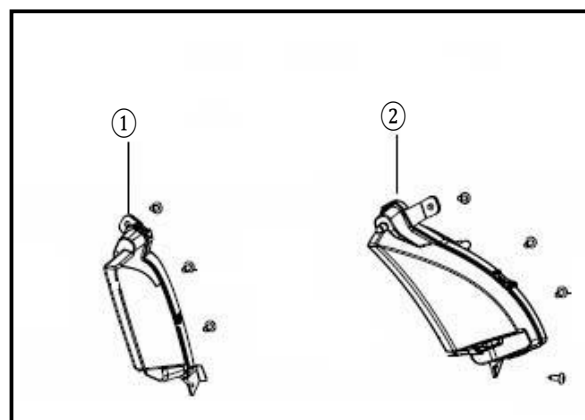
4.7 Main switch

4.7.1 Check

Remove the front guard.

Remove the main switch lead terminal.

Check conduction of the terminal.



Main Switch

	R	R/W	Y	O/BL
				
				
				
				

(R: red R/W: red/white Y: yellow O/BL: orange/blue)

4.7.2 Replacement of the Main Switch

Remove the front guard.

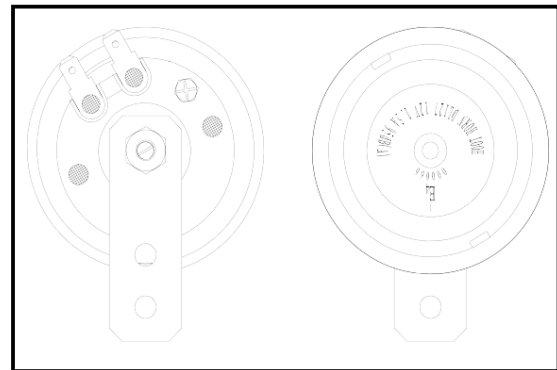
Remove the fixing bolts and the fixing seat for the main switch. Remove fixing bolts and replace the main switch.

4.8 Horn

Check

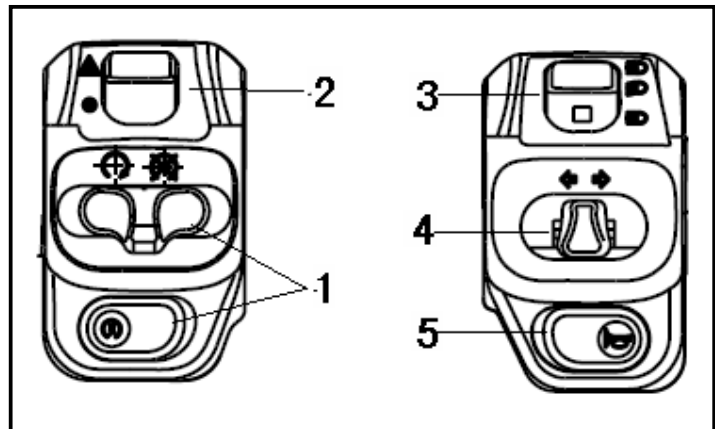
Remove horn wires.

Connect the horn to a battery, if it sounds, the horn is in good condition.



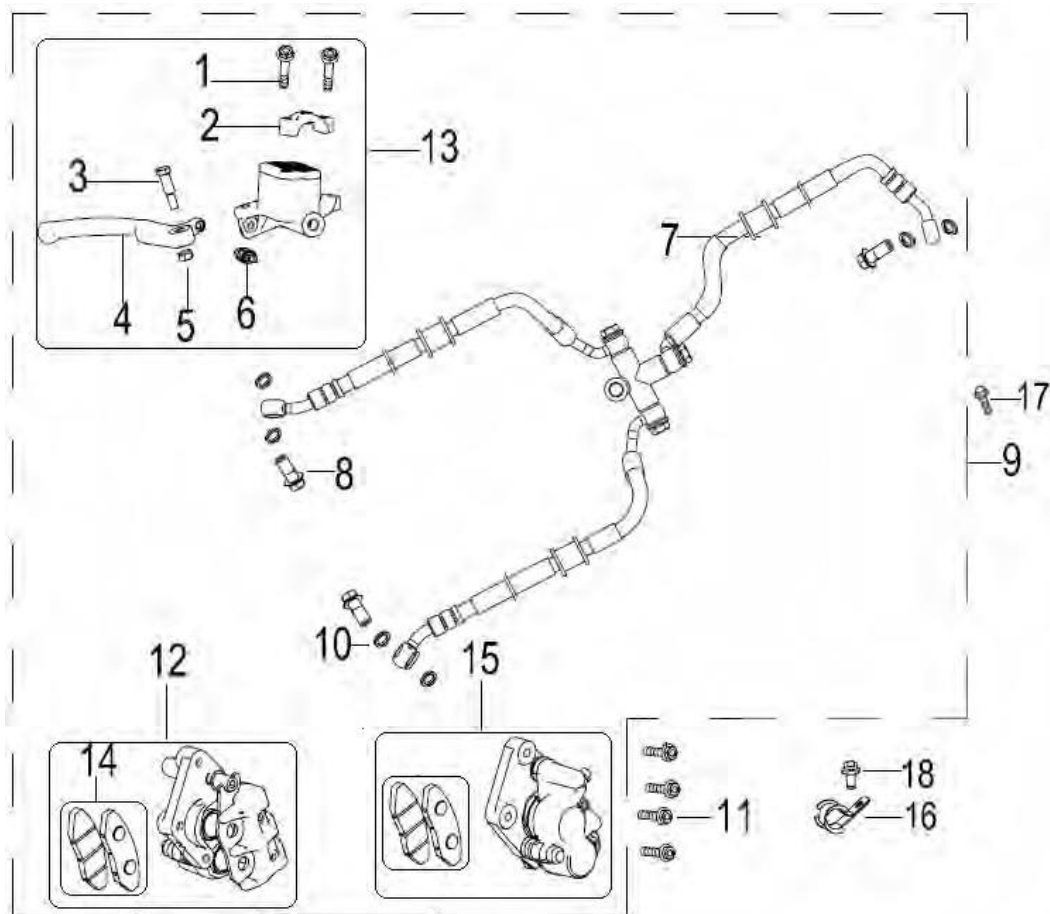
4.9 Handlebar Switch

- 1.) Electric Start Switch
- 2.) Hazard Light Switch
- 3.) Headlamp Beam. Passing Lamp Switch
- 4.) Turn Signal Switch
- 5.) Horn Switch



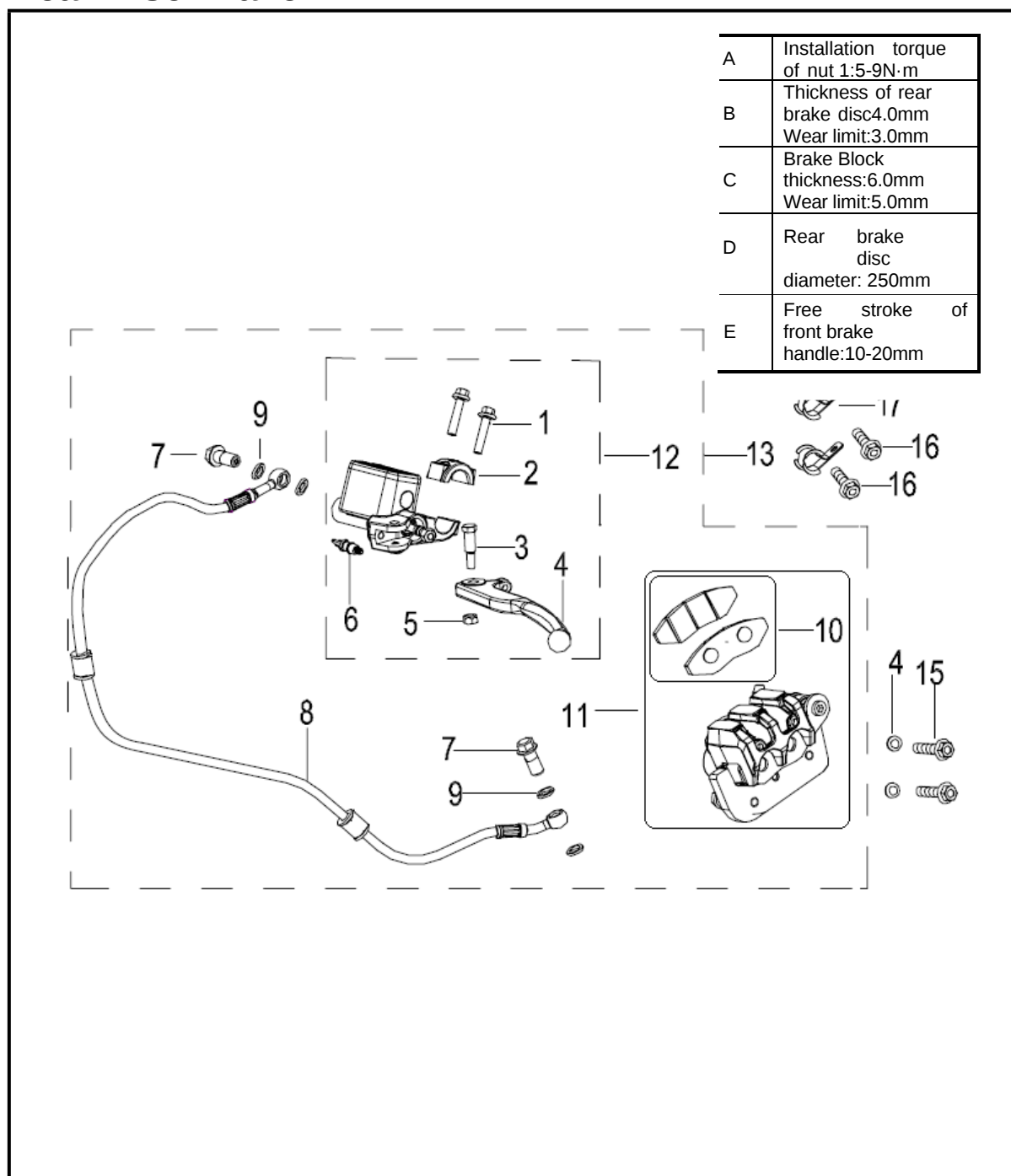
Inspection and Maintenance of Vehicle Front Disc Brake

A	Diameter of front brake disc:
B	Thickness of front brake disc: 4.0mm Wear limit: 3.0
C	Brake block thickness:6.0mm Wear limit: 5.0mm
D	Installation torque of nut 1 :5-9N·m
E	Free stroke of front brake handle:10-20mm



- 1.) Bolt 2.) Master Cyl. Strap 3.) Handle bolt 4.) Brake Lever 5.) Nut M6 6.) Front Brake Light Switch
7.) Front Brake Line 8.) Banjo Bolt 9.) Front Brake Assembly 10.) Washer 11.) Bolt M8×35 12.) Front
Right Brake Caliper Assembly 13.) Front fluid brake upper pump assembly 14.) Front Brake Pads
15.) Front Left Brake Caliper Assembly 16.) Pipe Clamp 17.) Bolt M6×35 18.) Bolt M6×12

Rear Disc Brake



- 1.) Bolt M6×35 2.) Master Cyl. Strap 3.) Handle Bolt 4.) Rear Brake Lever 5.) Nut M6 6.) Rear Brake Light Switch 7.) Banjo Bolt 8.) Rear Brake Hose 9.) Washer 10.) Rear Brake Pads 11.) Rear Brake Caliper Assembly 12.) Rear Brake Master Cylinder Assembly 13.) Rear Brake Assembly 14.) Washer $\phi 8$ 15.) Bolt M8×35 16.) Bolt M6×12 17.) Pipe Clamp

5. Brake

Maintenance instruction	5.1
Failure diagnosis	5.2
Front disc brake	5.3
Rear disc brake.....	5.4

5.1 Maintenance instruction

Note of Work

* Note

- Do not stain the brake assembly with oil spots during installation or disassembly.
- Clean it with required cleaning agent to maintain the brake performance.

* Check brake before riding.*

5.1.1 Specification

Item	Standard (mm)	Limit for use (mm)
Thickness of front brake disc	4.0	3.0
Thickness of front brake pad	6.0	3.0
Thickness of rear brake disc	4.0	3.0
Thickness of rear brake pad	6.0	3.0

EFI Motorcycle ZAFFERANO
brake: $\phi 250\text{mm}$

Diameter of front disc brake: $\phi 250\text{mm}$ Diameter of rear disc

5.1.2 Torque force

Fixing bolts for front/rear brake disc	22-29 N·m
Mounting bolts for front brake cylinder assembly	22-29 N·m
Mounting bolts for rear brake cylinder assembly	22-29 N·m

5.2 Failure diagnosis

Brake

Poor brake performance

1. Improper adjustment of the brake
2. Abraded brake pad
3. Improper installation of the brake pad
4. Stained brake pad or brake rotor

Abnormal noise

1. Abraded brake pad
2. Stained brake pad or brake disc

Slow reaction or tight lever

1. Improper adjustment of the brake
2. Abraded brake pad
3. Improper installation of the brake pad

5.3 Front Brake Assy.

5.3.1 Disassembly

* Note

- Replace the brake pad assembly.
- If the brake pads will be used again, mark it before disassembly so as to reinstall it in the original place.

Remove the following assemblies from the front absorber.

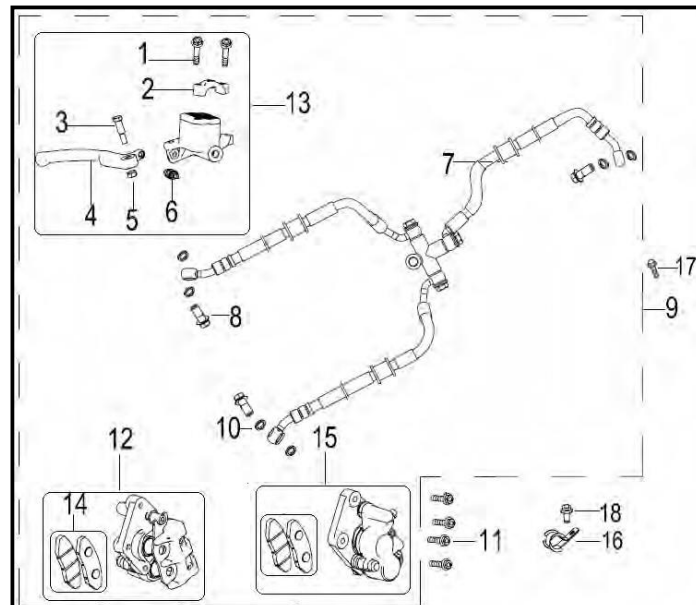
Front brake:

1. brake cylinder assembly
2. front brake hose assembly
3. brake pad assembly
4. connecting bracket of the front brake

* Note

- Do not stain the brake assembly with oil spots during installation or disassembly.
- Clean it with required cleaning agent to maintain the brake performance.

Loosen fixing bolts for the brake cylinder assembly.
Remove the brake cylinder assembly from the front absorber. Remove the front wheel spindle.
Remove the front wheel.
Remove the brake disc from the front wheel.



5.3.2 Check

Check whether brake pads are abraded. Replace it if necessary. Measure the brake pad and the brake rotor. Record maximum values.

Specification

Diameter of the front brake rotor

φ250mm

Thickness of the front brake rotor

5.0mm

* Note

- Measurement with a micrometer.

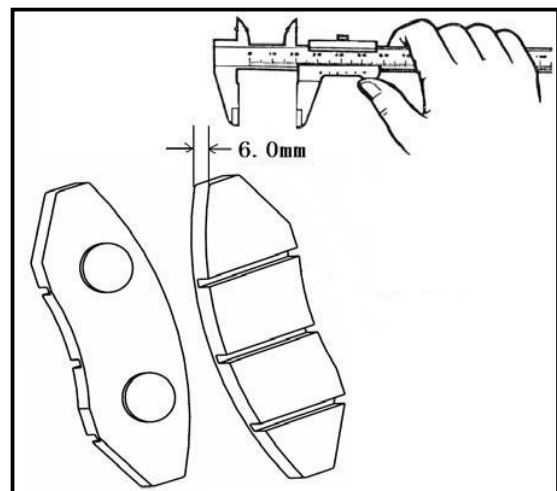
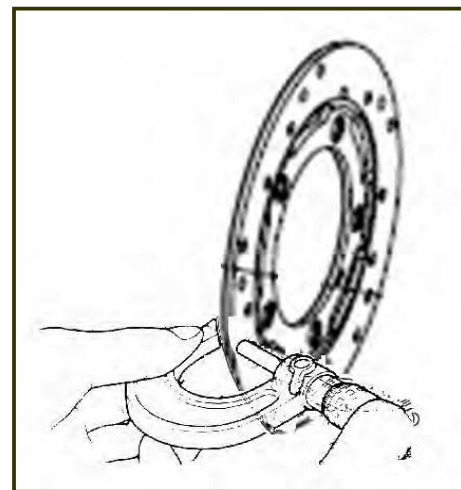
If the thickness of the brake rotor or the brake pads are below the required value for maintenance or it is stained with grease, please replace it.

Limit for use:

brake pads 3.0mm

brake rotor 3.0mm

Note: replace brake pads in pairs.



5.3.3 Installation

Install the brake rotor and the front wheel.

Install the front brake hose assembly and the brake cylinder assembly. Do not stain the brake pads and the brake rotor with grease.

* Note

Any grease on brake pads will reduce the brake performance and even lead to failure.

Tighten the bolts and nuts to the required torque force.

Torque force:

Fixing bolts for the brake rotor 22-29 N·m

Mounting bolts for the front brake pads assembly
22-29 N·m

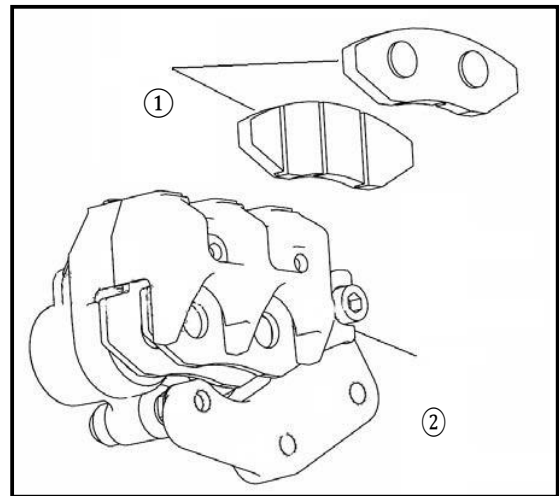
Do not stain brake pads with oil spots.

Use brake cleaning agent to clean brake pads with oil spots.

①: brake pad ②: brake cylinder

* Note

Any oil spots on brake pads will reduce brake performance.



5.4 Rear Brake Rotor

5.4.1 Disassembly

Remove the body guard.

Remove the rear brake cylinder assembly.

Remove the rear wheel.

Remove the brake rotor from the rim of the rear wheel.

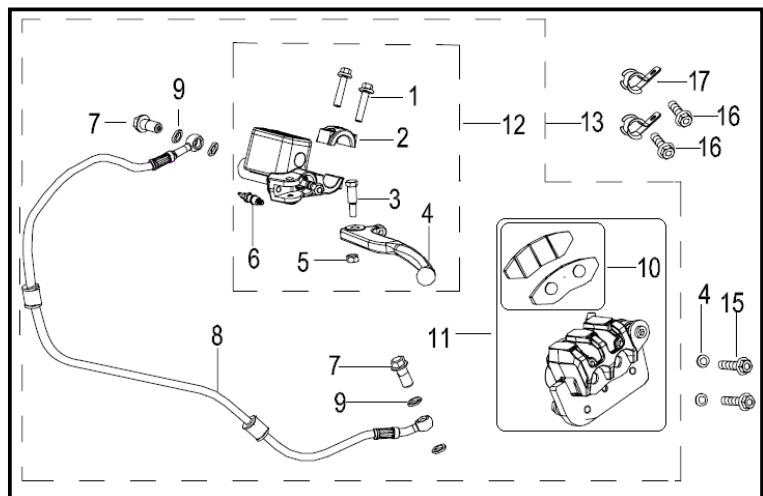
* Note

- Replace the brake pad assembly.
- If the brake pads will be used again, mark it before disassembly so as to reinstall it at the original place.

Remove following assemblies from the rear wheel.

Rear brake:

- 1.Brake block assembly
- 2.Rear brake tube
- 3.Brake cylinder
- 4.Rear fluid brake plate
5. Rear fluid tube clamp



5.4.2 Check

Check whether the brake rotor and the brake shoes are abraded. Replace them if necessary.
Measure the brake pads and the brake rotor. Record maximum values.

* Note

- Scrub the rusty brake rotor with sandpaper #120.
- Measurement with micrometer.

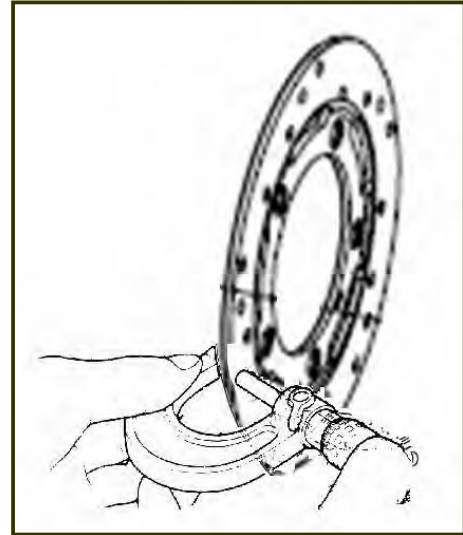
Measure the thickness of the brake rotor and the brake pads. If the thickness of the brake rotor or the brake pads is below the required value for maintenance or it is stained with grease, please replace it.

Note: replace brake pads in pairs.

Diameter of the rear brake rotor $\varnothing 240\text{mm}$

Thickness of the rear brake rotor 4.0mm

**Limit for use: brake pads 3.0 mm
brake rotor 4.0mm**



5.4.3 Installation

Install the rear brake rotor.

Install the rear wheel.

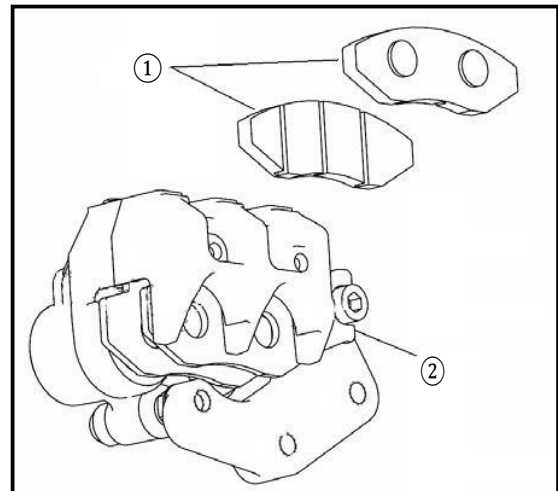
Install the rear brake cylinder assembly.

* Note

Any grease on brake pads will reduce the brake performance and even lead to failure.

Tighten bolts and nuts to the required torque force.

①: brake pad ②: brake cylinder



Torque force:

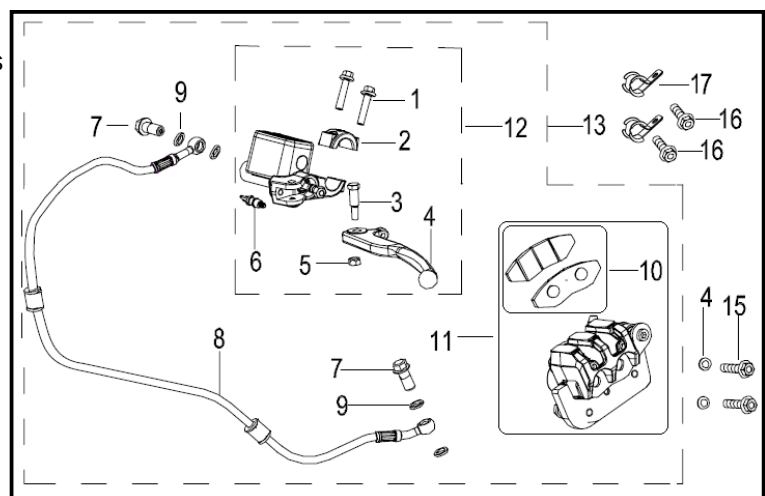
Fixing bolts for rear brake pad assembly: 22-29 N·m

Do not stain brake pads and brake rotors with oil spots.

Use brake cleaner to clean brake pads and brake rotor with oil spots.

* Note

Any oil spots on brake shoes will reduce the brake performance.



6. Body

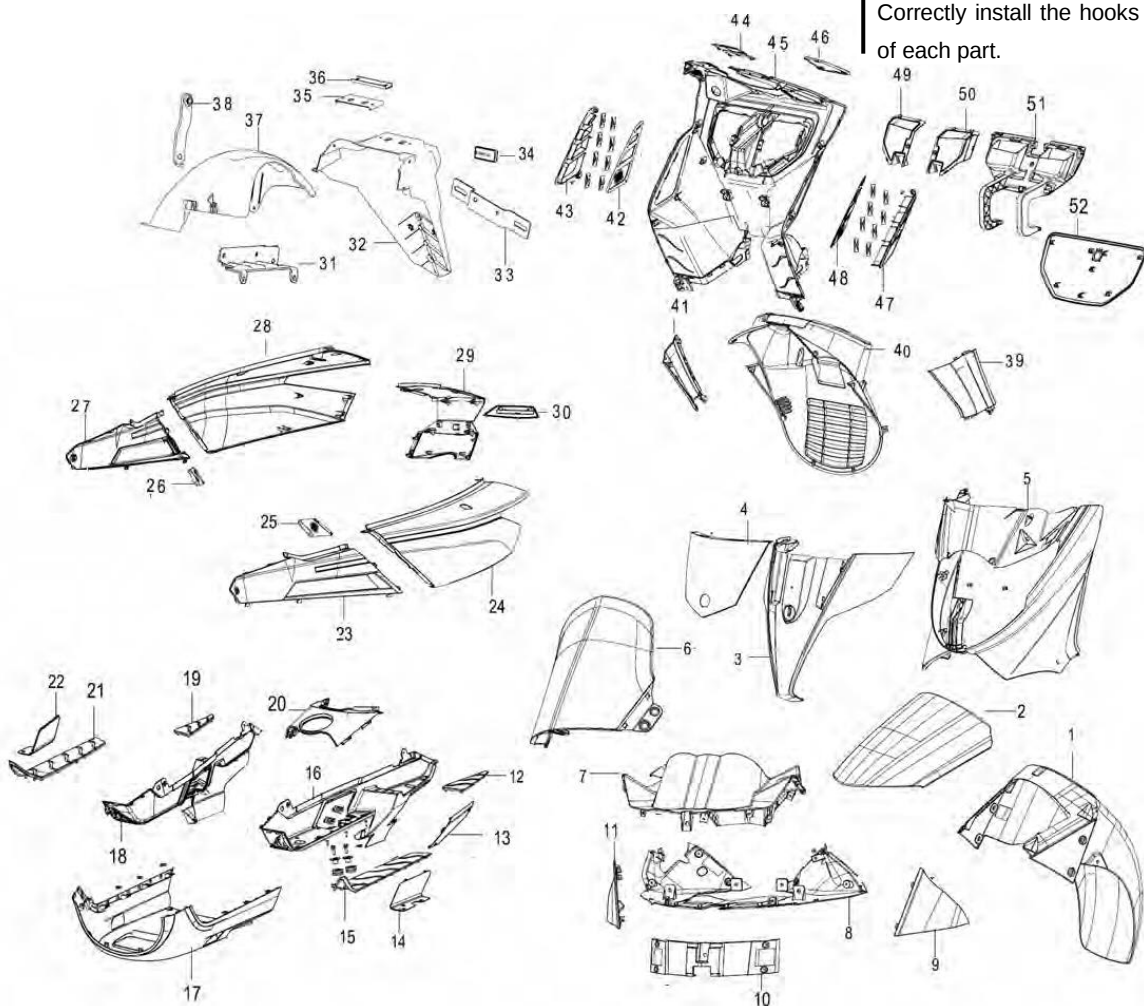
*Note

Do not damage the body when removing it.

Do not damage the hook of the body.

Do match the grooves for the panels.

Correctly install the hooks of each part.



1.) front fender 2.) front fender 3.) front shield panel 4.) decorating plate of the front shield 5.) front shield baseplate 6.) windshield 7.) handlebar front shield 8.) handlebar rear shield 9.) left baffle plate 10.) decorating cover of the handlebar front shield 11.) right baffle plate 12.) left rubber foot 13.) pedal cover plate 14.) inspection cover 15.) left rubber foot 16.) Left pedal 17.) Lower connecting plate 18.) Right pedal 19.) right rubber foot 20.) fuel tank guard 21.) right rubber foot 22.) spark plug cover 23.) rear fender installation assembly 24.) Right guard 25.) protecting net 26.) protecting net 27.) Front left guard 28.) Left guard 29.) rear connecting bracket of the left/right guard 30.) decorating cover plate of the guard 31.) rear fender installation assembly 32.) rear fender 33.) rear license plate bracket 34.) rear reflector assembly 35.) rear fender bracket 36.) rear fender installation assembly 37.) rear small fender 38.) rear fender bracket 39.) left connecting bracket 40.) inner guard of the baseplate 41.) right connecting bracket 42.) protecting vent 43.) right lattice of the foot guard 44.) front shield cover plate 45.) foot guard 46.) water filler 47.) left lattice of the foot guard 48.) protecting vent 49.) right inspection cover 50.) left inspection cover 51.) front storage box 52.) back panel of the front storage box

Dismantle the body in following order:

Handlebar front shield → windshield → handlebar rear shield → meter → front shield → front inner fender → foot guard →



Battery box cover → left/right pedal cover → left/right pedal rubber → left/right pedal guard → rear handrail → seat →



Helmet box → left/right rear guard → left/right front guard → rear fender
→ rear inner fender → rear inner fender rubber



→ rear lower fender → pedal → front fender

***Note**

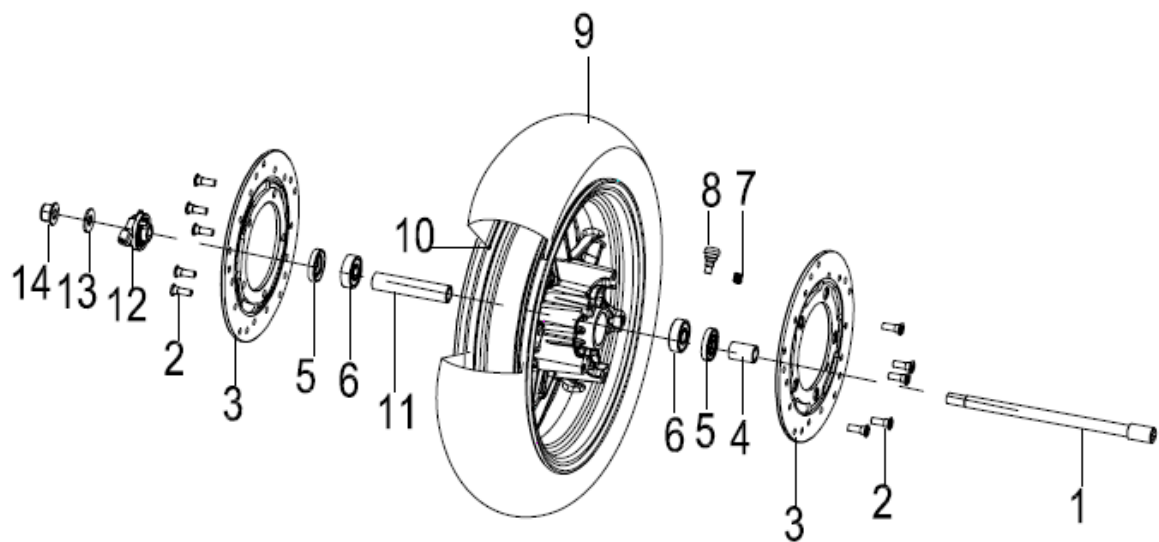
Do not damage any body parts during disassembly.

Do not damage any hook or claw in the body during disassembly. Align panels for the body at each corresponding groove.

Ensure correct installation of each hook or claw part during assembly. Do no damage any parts during assembly.

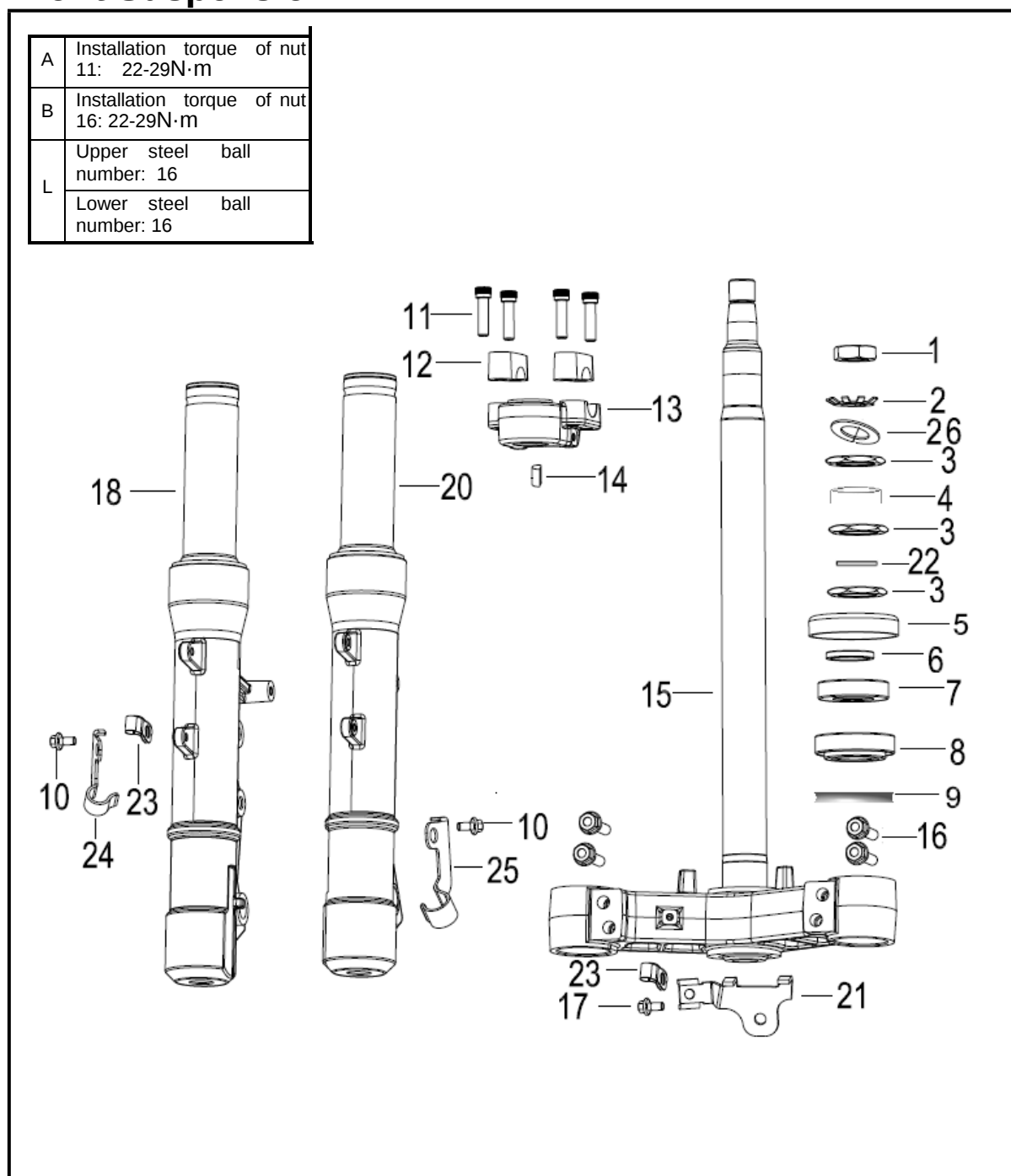
Front Wheel

A	Front wheel spec: tire120/70-14
B	Installation torque of nut 14: 75-88N·m
C	Rim run-out limit: Vertical: 2.0mm Horizontal: 2.0mm
D	Front wheel camber limit: 0.2mm
E	Front wheel certificate number:



1.) Front wheel axle 2.) Brake rotor bolt 3.) Brake rotor 4.) Left front wheel spacer 5.) Oil seal 6.) Bearing 7.) Valve stem cap 8.) Valve stem 9.) Tire 120/70-14 10.) Front wheel 11.) Bearing spacer sleeve 12.) Speedometer drive unit 13.) Washer 14.) Nut

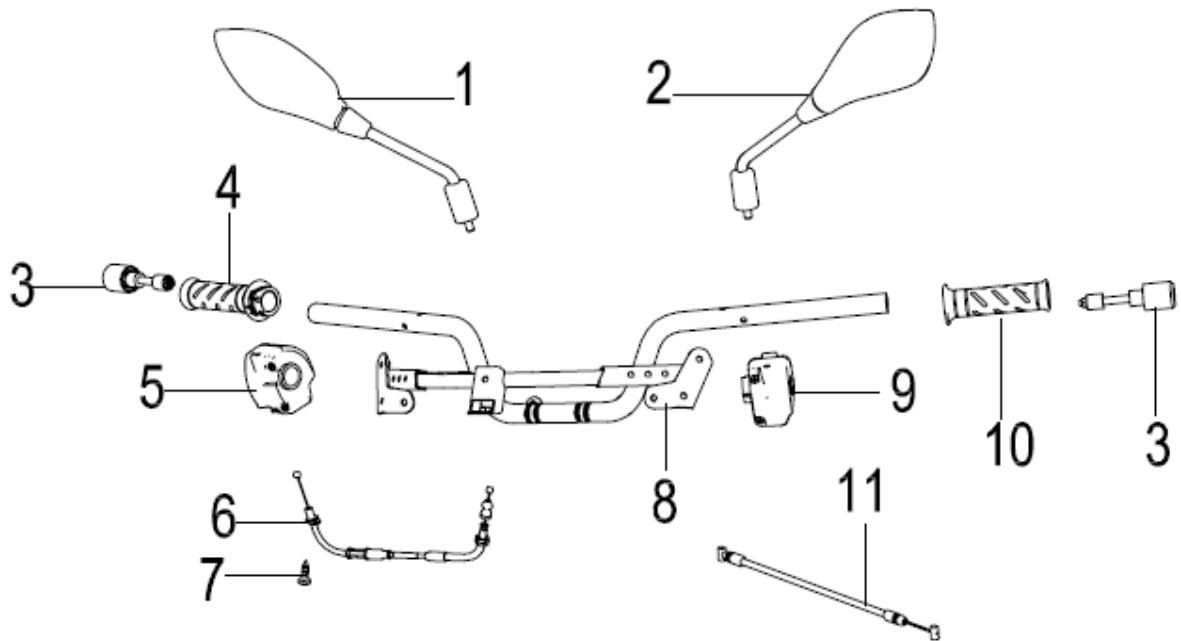
Front Suspension



1.) Nut 2.) Lock washer 3.) Nut 4.) Lock washer 5.) Dust seal 6.) Bushing 7.) Bearing 8.) Tapered roller bearing 9.) Dust seal 10.) Bolt M6×12 11.) Socket head cap screw M8×30 12.) Upper handlebar clamp 13.) Lower handlebar clamp 14.) Key 15.) Steering stem 16.) Bolt M8×35 17.) Bolt M5×10 18.) Front right fork assy. 19.) Socket head cap screw M6×25 20.) Front left fork assy. 21.) Three-way front brake hose clamp 22.) Rubber gasket 23.) Clamp 24.) Right brake hose clamp 25.) Left brake hose clamp 26.) Washer

Handlebars

A	Installation torque of nut 13: 55-62N·m
B	Free stroke of front brakehandle:10-20mm
C	Free stroke of rear brake handle: 10-20mm
D	Free stroke of throttle controlling handle: 5-10mm
E	Installation torque of nut 16: 5-9N·m



1.) Right rearview mirror assembly 2.) Left rearview mirror assembly 3.) Handlebar weight assembly 4.) Right handlebar grip w/ tube 5.) Right combination switch 6.) Throttle cable 7.) Bolt M5×10 8.) Handlebar assembly 9.) Left combination switch 10.) Left handlebar grip 11.) Seat latch cable

7. Front Wheel/Front Suspension

8. Preparing documents-----	7.1
9. Failure diagnosis-----	7.2
10. Front wheel-----	7.3
11. Steering handle-----	7.4
12. Front fork -----	7.5

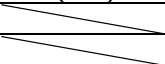
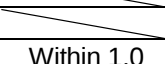
7.1 Preparing documents

Note of Work

Before removing the front wheel, you should use jack to support the body bottom and suspend the front wheel which shall not be reversely rotated.

Pay attention that brake pads and brake rotors shall not be stained with grease during operation.

Motorcycle Standards

Measurement points	Item		Standard (mm)	Limit for use (mm)
Front wheel spindle	Bend			0.2
Front wheel	Rim shimm	Vertically		2.0
		Horizontally	Within 1.0	2.0

Torque force

Fixing bolts for the steering handle
Locking nut for the front wheel spindle

22-29 N·m
75-88 N·m

Tools
Bearing puller
Locking nut
spanner

7.2 Failure diagnosis

7.2.1 Difficulty in steering

Failure of the steering handle bearing. Damaged steering handle bearing.
Low tire pressure.
Flat tire.

7.2.2 Unsteady steering

Damaged steering handle bearing.
Low tire pressure.
Bending of the front fork or the front wheel spindle.
Deformed or unbalanced front tire.

7.2.3 Front tire shimmy

Deformed rim.
Loose front wheel bearing.
Poor tire.

7.2.4 Difficulty in wheel rolling

Failure of wheel bearing or gear housing.

7.2.5 Abnormal noise from the front absorber

Fricative sound of the absorber guard.
Loose bolts in the absorber

7.3 Front wheel

7.3.1 Disassembly

Support the body bottom to suspend the front wheel
Remove the cotter pin and locking nuts for the front wheel spindle.

Remove the front wheel spindle, gear housing assembly and front wheel.

Remove screws, front fender and odometer cable.

①: wheel axle

Remove the front brake hose.

Remove the oil seal and the bearings respectively with oil seal remover and bearing puller.

7.3.2 Check

7.3.2.1 Check the bending of the wheel axle

Place the wheel spindle on the V-base and measure the eccentricity ratio with a dial indicator.

Limit for use: replacement when beyond 0.2mm

7.3.2.2 Check for rim shimmy

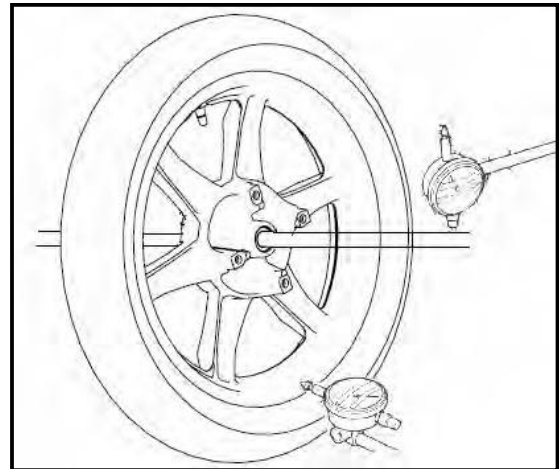
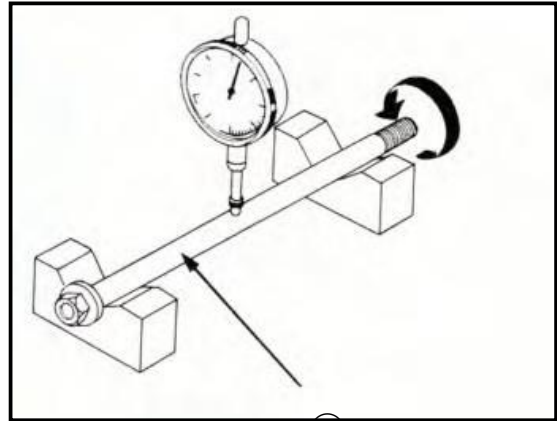
Place the rim on a precision bracket and check the rim shimmy.

Rotate the wheel by hand and read indication.

Limit for use:

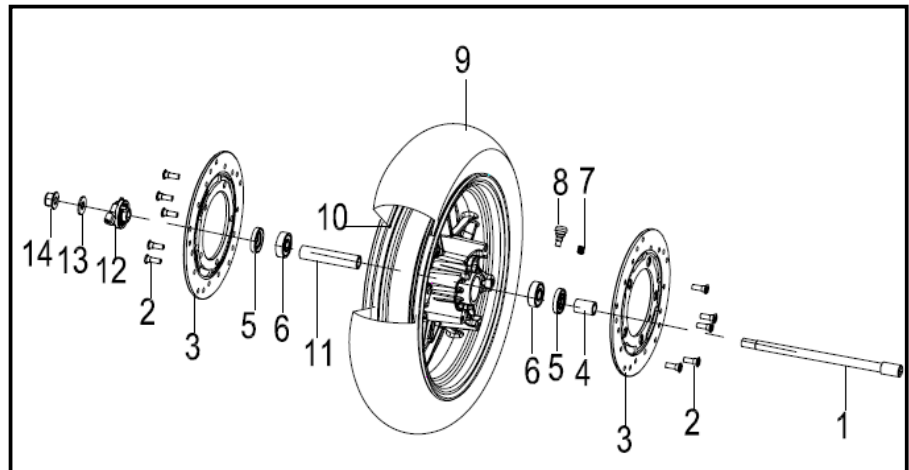
Vertically: replacement when beyond 2.0mm

Horizontally: replacement when beyond 2.0mm.



7.3.2.3 Check the front wheel bearing

Remove the left bushing and the oil seal of the front wheel.

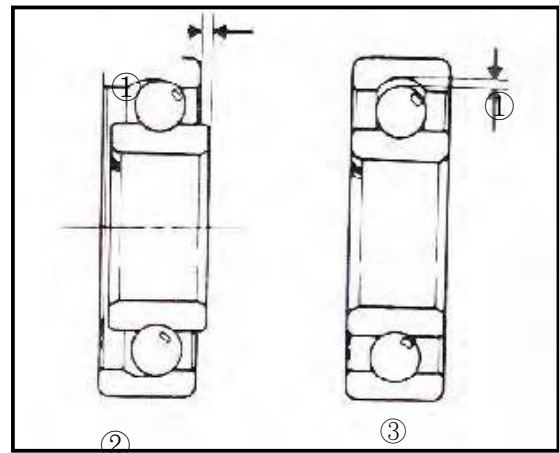


Check rolling of the bearings.

The bearings will not roll if abraded or loosened.

Replace it.

① clearance ② axially ③ radially



7.3.3 Bearing replacement

Remove the front wheel axle, front wheel, middle bearing sleeve and left axle spacer; then remove the oil seal and the bearing respectively with oil seal remover and bearing puller.

Note: replace dismantled bearings with new ones.

Lubricate the bearings with grease during installation. Then press the bearings in with bearing installation tools.

* Note

- Bearings must be pressed in horizontally.
- The oil seal side of the bearings shall be pressed in from the outside.

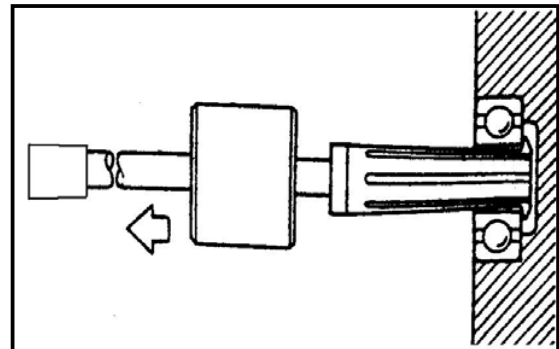
7.3.4 Installation

Lubricate the oil seal of the front wheel with grease. Lubricate gear engagement parts and moving parts with grease.

Install the middle bearing sleeve, bearings and oil seal. Align the gear housing assembly and then install the front wheel.

Note

- If the gear housing assembly of the odometer is not aligned and locked with the front wheel spindle, the gear housing assembly will be deformed.
- After the rim is installed, rotate the rim to ensure that the drive shaft of the odometer works normally.



Install and tighten the front wheel axle.

*** Note:** for disassembly and assembly of the front suspension of EFI Motorcycle ZAFFERANO, please see page 77.

Torque force

Locking nut for the front wheel axle

55-62 N·m

7.4 Handlebars

7.4.1 Disassembly

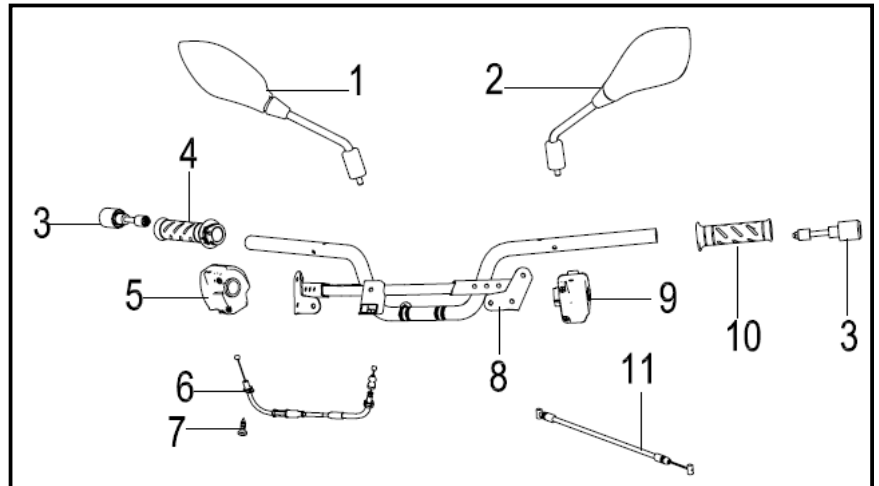
Remove the front and rear shield and the rearview mirror assembly.
Remove the front brake handle and the rear brake handle.

Remove the decorating cover of the grip, the throttle cable assembly and the right grip assembly.

Remove the left handlebar sleeve.

Remove fixing bolts for the handlebars.

Remove the handlebars.



7.4.2 Installation

Install it in reverse order.

Fixing bolts

Torque force: 40-60 N·m

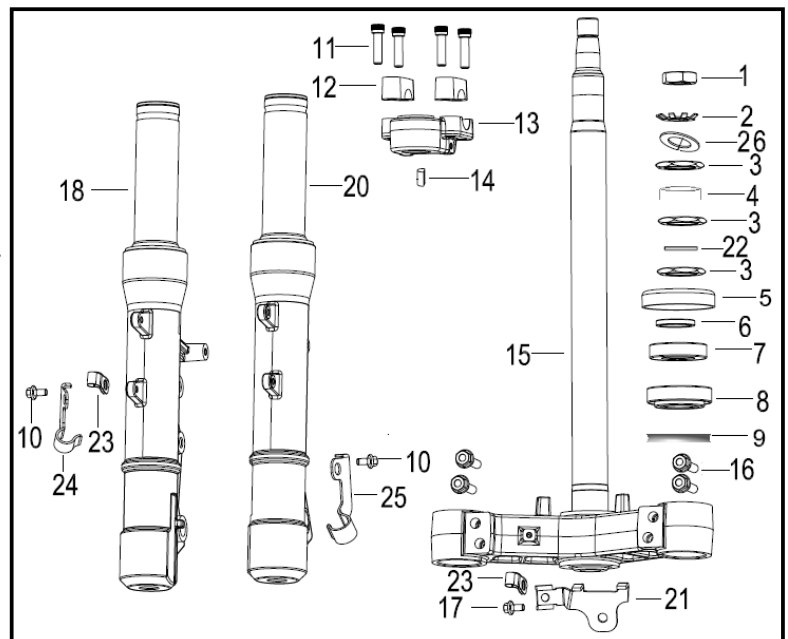
7.5 Front fork

7.5.1 Disassembly

Remove the front wheel.
Remove the front shield, front inner fender and front fender.
Remove the brake hose and the odometer cable.
Loosen the gland nut and the lock washer.
Remove the upper and the lower bearing cups. Remove the front forks.
Tools:
Fixing bolt spanner for the steering handle. Fixing nut spanner.
Special disassembly tool for bearing cups.

*** Note:**

•The opening of the body guard shall be cleaned with cloth.



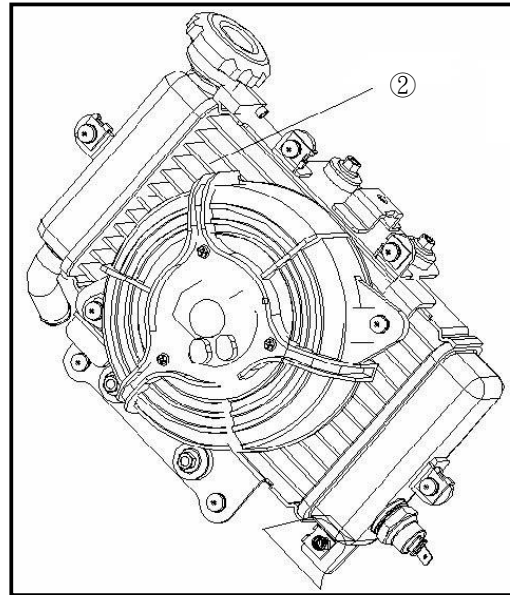
7.5.3 Installation

Tools:
Fixing nut spanner.
Ensure the front fork is not loose by left and right movement. Steps:
Install the steering handle.
Install the front absorber.
Install the front wheel.

7.6 Radiator/Reserve Bottle Assembly

7.6.1 Disassembly

Remove the body guard.
Remove the headlamp.
Loosen four fixing bolts for the radiator assembly.
Loosen the hose clamps for the inlet/outlet hoses of the radiator.
Remove the power cord of the cooling fan.
Remove the radiator assembly and the reserve bottle assembly.

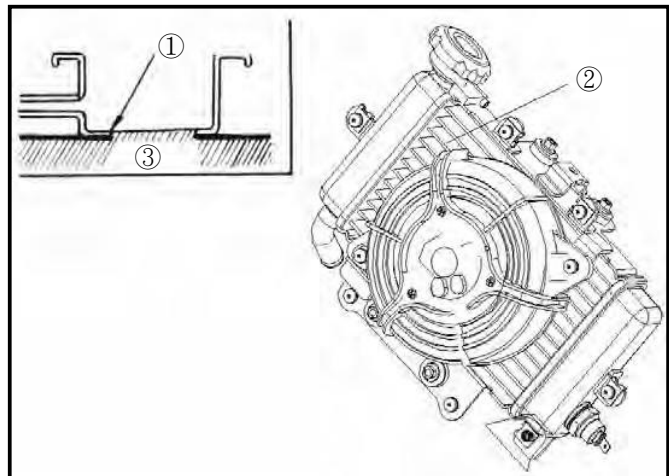


7.6.2 Check

Open the reserve bottle cover and check the coolant level inside.
Add coolant when it approaches the lower limit.
Broken or twisted heat sinks will reduce the cooling capability of the radiator.
Repair the radiator with a small screwdriver when over 1/3 of heat sinks are damaged or twisted.

Replacement

Check the liquid level of the radiator.
Remove the radiator cover after the liquid has fully cooled;
Completely remove the coolant;
Add the prepared coolant slowly through the filling hole (thru radiator cap) until it reaches the edge of the hole;
Install the radiator cap.

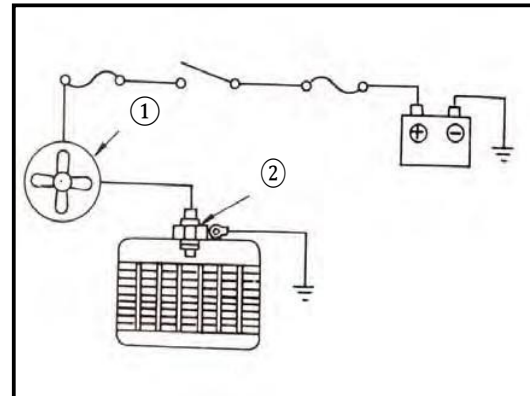


①: edge ②: heat sink ③: coolant

Note: please use 50/50 ethylene glycol antifreeze and water;
The minimum temperature for using coolant is -31F

Check the fan switch.
Replace it when the switch doesn't work normally.

①: cooling fan ②: fan switch



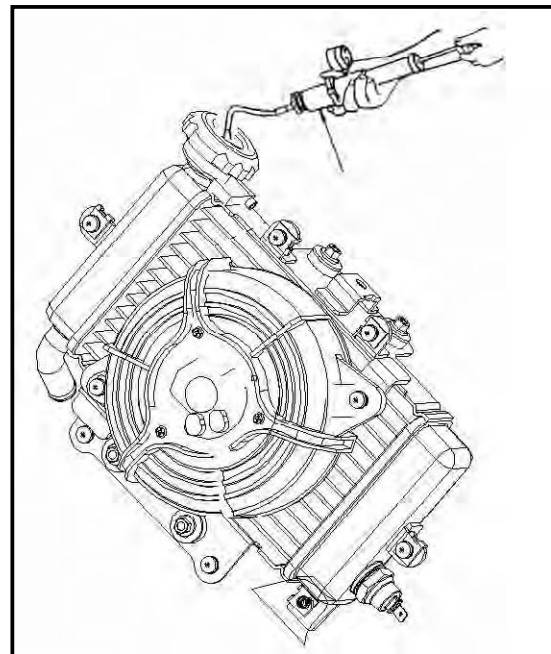
Pressure test the radiator.

Remove the radiator cover after the coolant has fully cooled. Apply the required pressure to the cooling system with the radiator pressure tester (lower than pressure for opening the valve of the cap) and ensure that it can keep for at least 6s under the required pressure; In the case of pressure leakage, check the hoses, all connections, pump position and inspection hole.

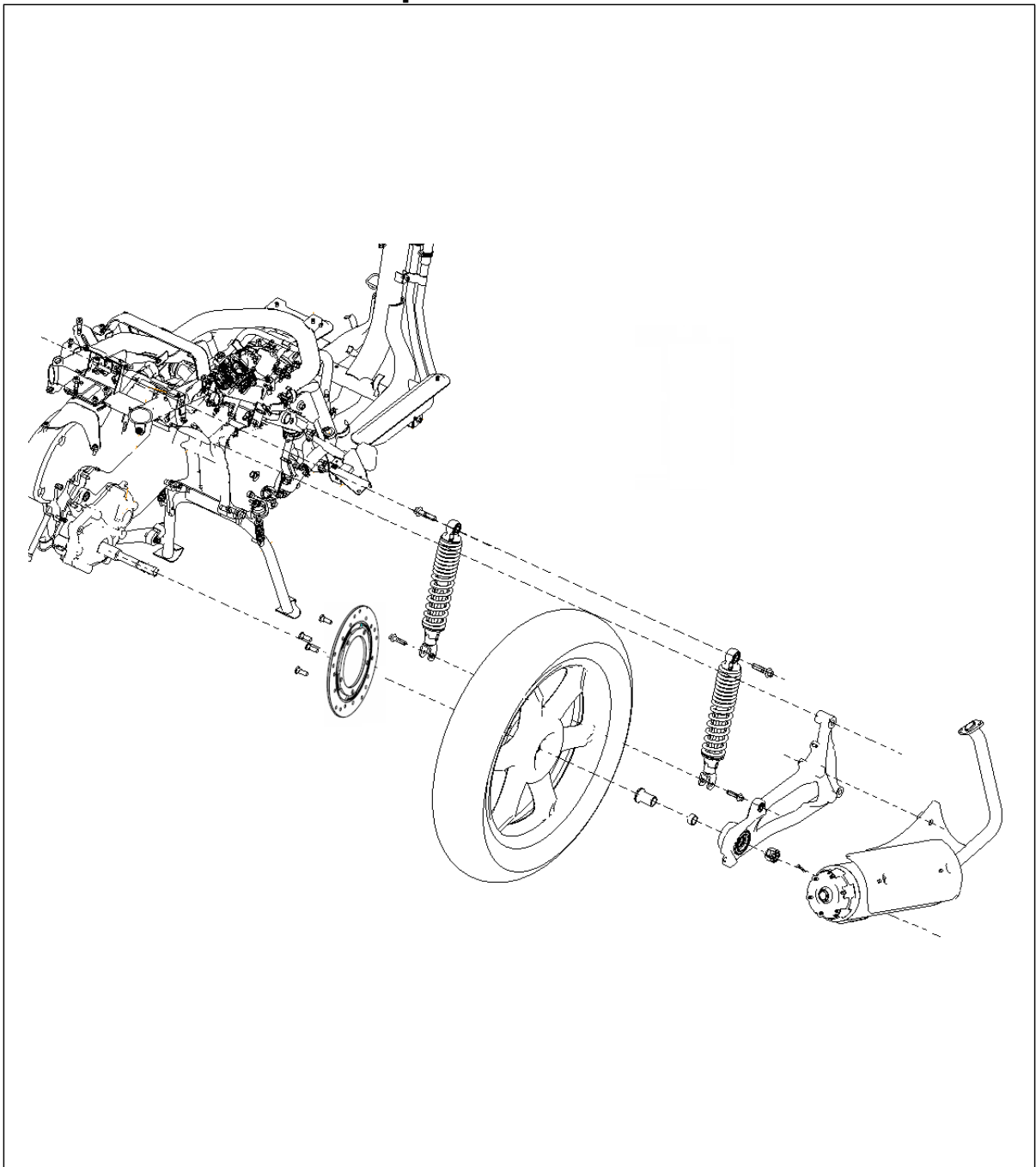
7.6.3 Installation

Install it in reverse order.

①: radiator pressure tester



Rear Wheel/Rear Suspension



8. Rear Wheel/Rear Suspension

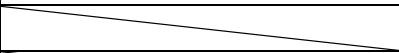
Preparing documents -----	8.1
Failure diagnosis -----	8.2
Rear wheel -----	8.3
Rear absorber/rear swing arm---	8.4

8.1 Preparing documents

Note of Work

The surface of the brake rotors and brake pads shall not be stained with oil spots.

Preparing Principles

Item		Standard (mm)	Limit for use (mm)
Rear wheel shimmy	Vertically		2.0
	Horizontally		2.0

Locking torque force

Fixing nut for the rear wheel	100-123 N·m
Top nuts for the rear absorber	37 - 44 N·m
Bottom nuts for the rear absorber	22 - 29 N·m

8.2 Failure diagnosis

8.2.1 Rear wheel shimmy

Deformed rim.
Tire failure
Rear wheel not fixed.
Low tire pressure.

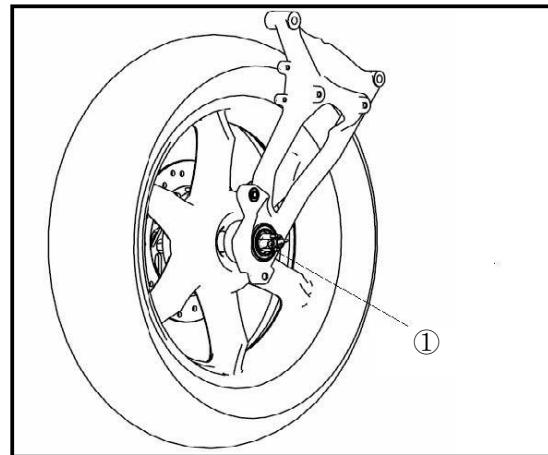
8.2.2 Too soft absorber

Elastic fatigue of spring

8.3 Rear wheel

8.3.1 Disassembly

Remove the body guard and the muffler. Remove the rear brake cylinder assembly.
Remove the nuts of the rear wheel spindle and the fixing bolts of the rear right absorber. Remove the rear absorber bracket assembly.
Remove the rear wheel.



(①: rear wheel spindle nut)

8.3.2 Check

8.3.2.1 Check rim shimmy

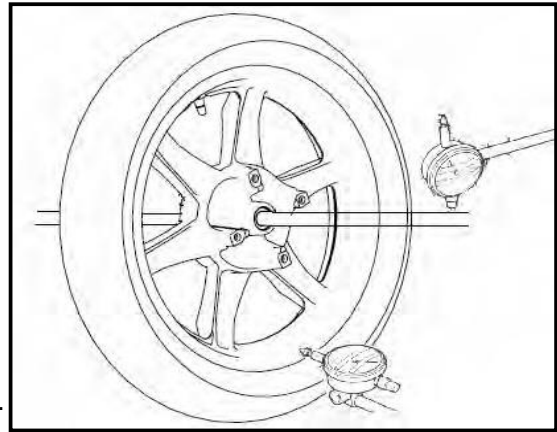
Rotate the wheel by hand and measure the eccentricity ratio with a dial indicator.

Limit for use:

Vertically: replacement when beyond 2.0mm.

Horizontally: replacement when beyond 2.0mm.

When the rear wheel shimmy exceeds the limit, the rear wheel bearing is loose, which causes a shimmy. Check and replace the rear wheel bearings.



8.3.3 Installation

Install the rear wheel in reverse order and lock nuts.

Fixing nuts for the rear wheel

Torque force: 100-113 N·m

8.4 Rear absorber/Rear Swing Arm

8.4.1 Disassembly of the rear absorber

Remove the seat and the left/right rear guard.
Remove the rear handrail and the rear fender.
Remove the muffler.
Remove the air cleaner assembly.
Remove the fixing bolts for the rear absorber.
Remove the rear absorber.

8.4.2 Installation

Install the rear shock absorber.

Torque force:

Upper fixing nut:

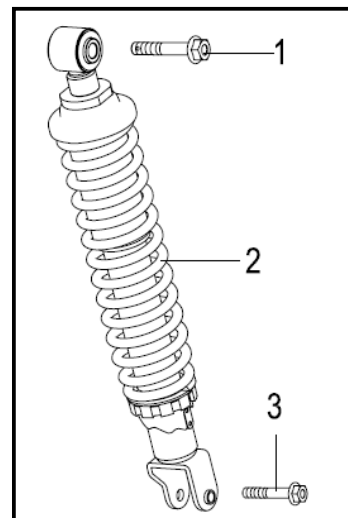
37-44 N·m

Lower fixing nut:

22-29 N·m

Install the rear absorber.
Install the air cleaner.
Install the muffler.
Install the rear handrail and the rear fender. Install the seat and the rear left/right guard.

①: bolt ②: rear absorber assembly ③: bolt

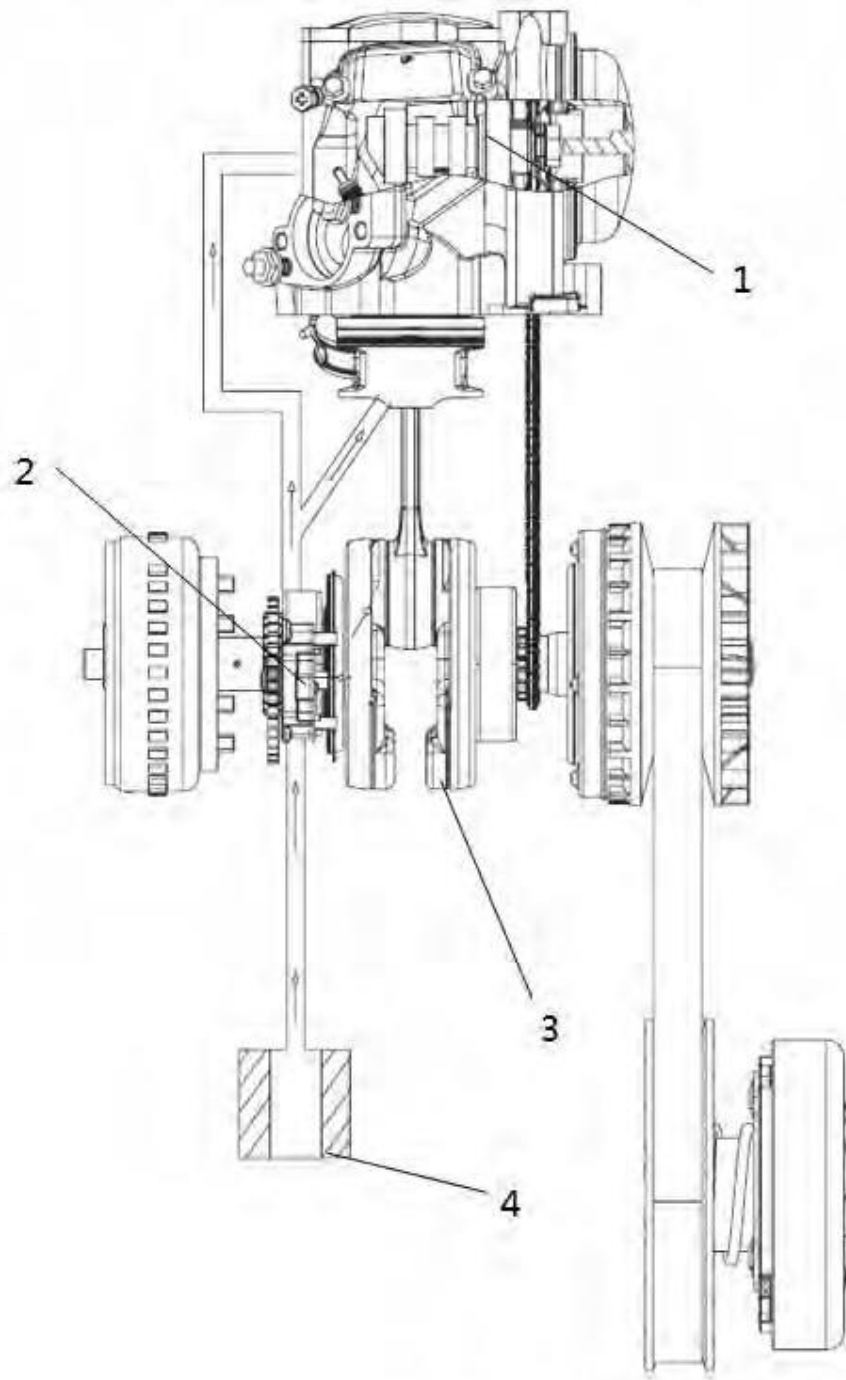


Check and Maintenance of the Engine

Table of Torque Force of Engine Fasteners

Name of fastening parts and fasteners	Tightening torque (N·m)
Cylinder cover bolts	27~30
Double end studs	32~35
Drain bolts of the gearbox	9~12
Drain bolts of the crankcase	20~25
Spark plug	17~25
Closing bolts	9~12
Blots for the transmission chamber	9~12
cover Fixing bolts for the motor	9~12
Fixing bolts for the oil pump	9~12
Locking nuts for the flywheel	190~210
Right cover bolt	9~12
Fixing screws of the impeller	9~12
Fixing screws of chain guide	9~12
Connecting bolts of the sprocket	50~60
Locking nuts of the clutch	107~123
Fixing screws of the coil	4~7

Lubricating system diagram



1 camshaft 2 oil pump 3 crank 4 fuel filter

9. Lubricating System

Preparing documents-----9.1

Failure diagnosis-----9.2

Oil pump-----9.3

9.1 Preparing Documents

Note of Work

After the oil pump is disassembled, carefully clean each part and its surface with high flash point contact cleaner. When the oil pump is disassembled, do not allow any impurities to fall into the crankcase.

Function of the lubricating system: the lubricating system of the engine is to provide lubricating oil to the frictional surface of each part, which transforms dry friction into liquid friction between lubricating oil particles and also reduces abrasion of the parts. It also cools components with high thermal load, absorbs shock from bearings and other parts, reduces noise, increases sealing between the piston rings and the cylinder wall, and cleans and removes particles in the surface.

Basic item standard and use limit

Item		Standard	Limit for use
Fuel capacity	when replacing fuel	1.4L	/
	when disassembly	1.5L	/
Oil pump rotor	radial clearance between inner and	0.04—0.11	0.17
	clearance between outer rotor and pump	0.11-0.176	0.23
	clearance between rotor surface	0.02-0.07	0.11
Gear oil capacity in the gearbox	when replacing fuel	0.4L	/
	when disassembly	0.4L	/

9.2 Failure diagnosis

Decreasing fuel

Natural consumption of fuel

Fuel leakage

Abrasive or incorrectly installed piston ring

Burnt engine

No fuel or low fuel pressure

Blocked fuel pipes

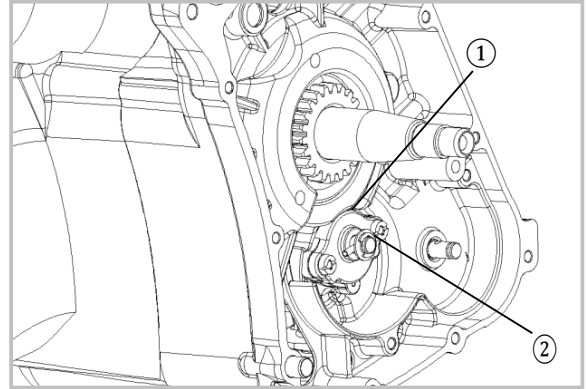
No fuel used

9.3 Oil pump

Disassembly

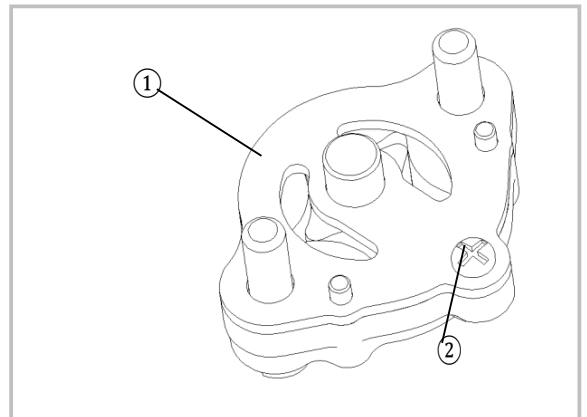
Remove the right cover, flywheel assembly and start gearwheel. Loosen the fixing bolt and remove the cover plate. Loosen the screw and remove the oil pump

- ①: oil pump
- ②: bolt



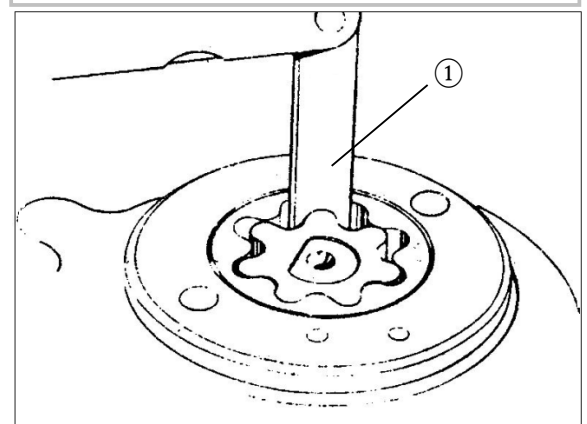
Remove the screw and the oil pump assembly.
Remove the screw and the oil pump cover.

- ①: oil pump cover
- ②: screw

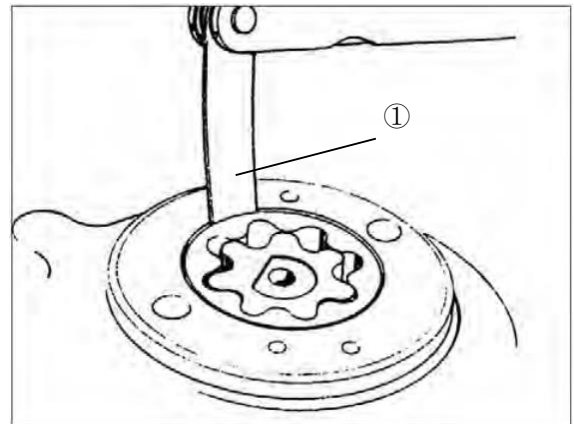


Check the radial clearance between the inner and outer rotors.
Limit for use: 0.17mm.

- ①: gauge



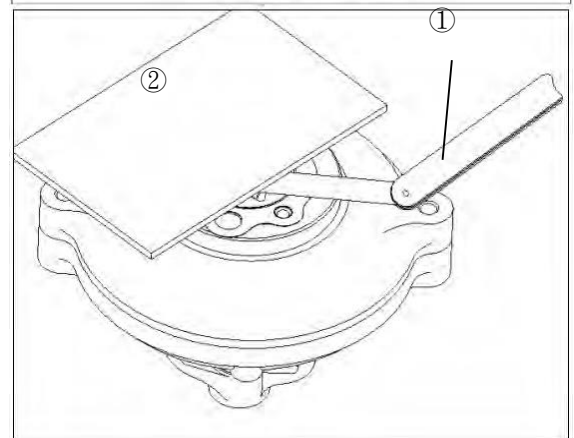
Check the clearance between the outer rotor and the oil pump housing.
Limit for use: 0.23mm.



Check clearance between rotor surface.
Limit for use: 0.11mm.

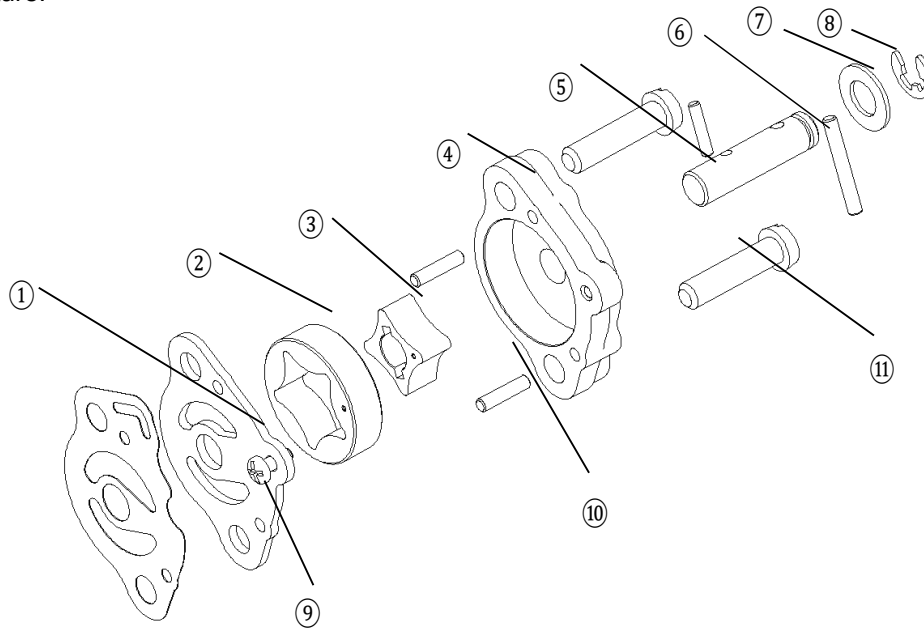
① : gauge

②: flat plate



Breakdown

Break down the oil pump according to the following picture.



- ① screw ② outer rotor ③ inner rotor ④ oil pump ⑤ oil pump shaft
⑥ pin ⑦ spacer ⑧ split washer ⑨ oil pump cover ⑩ cotter pin ⑪ oil pump screw

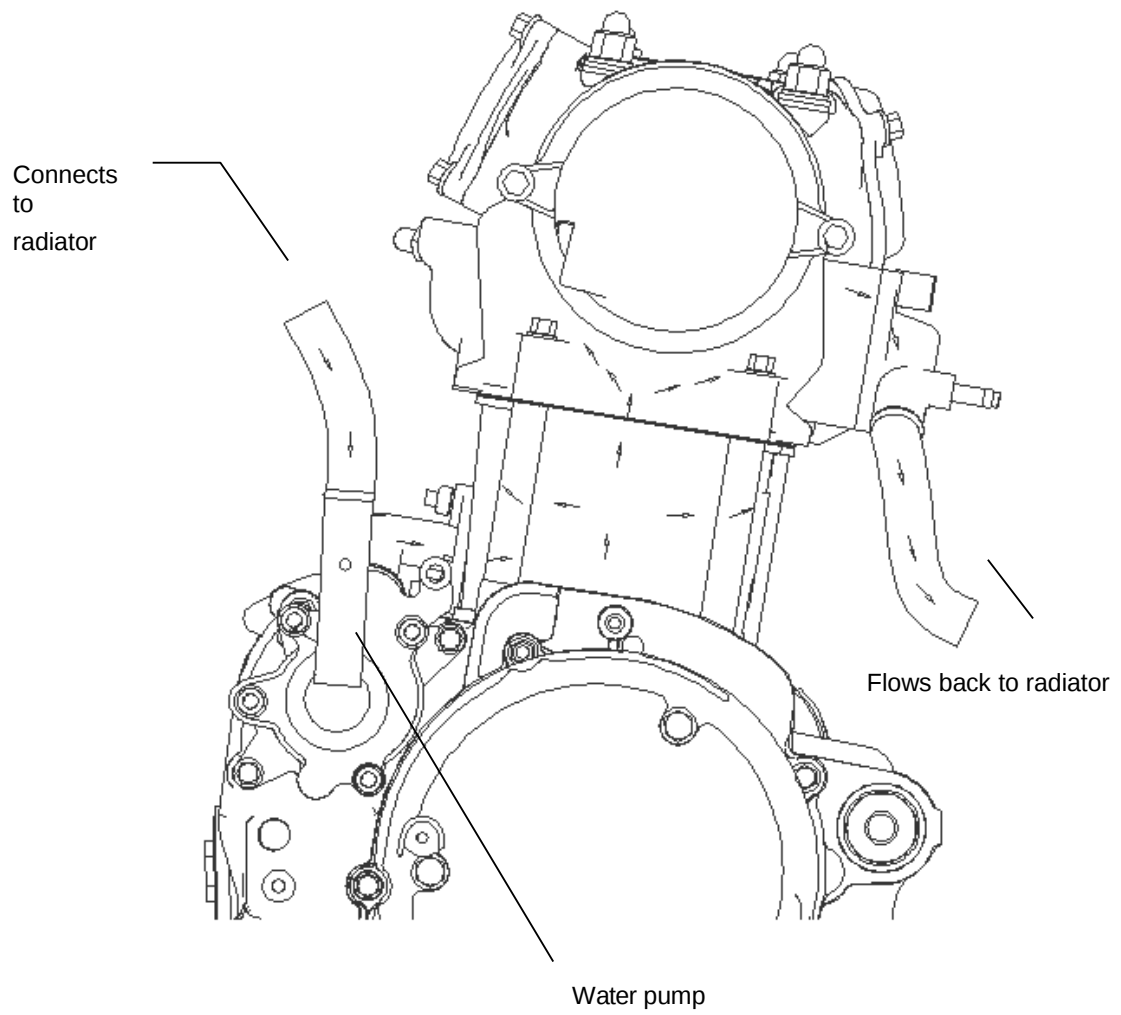
Note:

After assembly, the inner and outer rotors shall rotate flexibly without being seized.

9.3.3 Installation

Install it in reverse order.

Cooling System



10. Cooling System

Preparing Documents-----	10.1
Failure Diagnosis-----	10.2
Water Pump -----	10.3

10.1 Preparing Documents

Function of the cooling system:

The cooling method of the engine is water cooling. Water cooling, in which the water is used as the heat conductor, is a method of cooling high-temperature components and then transferring heat to the outside air, thus keeping the engine working under the optimum temperature.

Specific cooling circuit:

The cooling water entering from the crankcase goes to the cylinder water jacket through the water channel of the crankcase, then goes upward through the cylinder cover, finally enters into the radiator through the pipe to dissipate heat, and transfers heat to the outside air with the help of the radiator's fins.

10.2 Failure Diagnosis

Water leakage

Damaged seals

Broken pump assembly

Broken water hose

Over high temperature in cylinder block

Damaged blade of the water pump

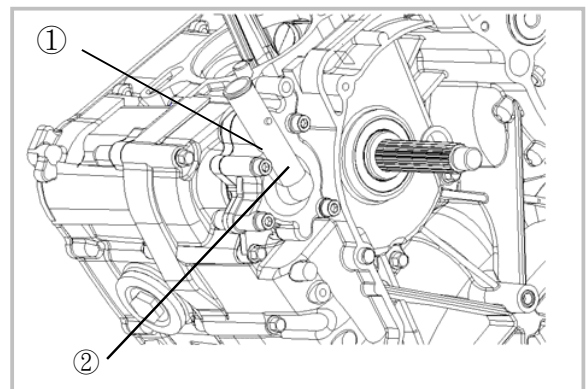
10.3 Water Pump

Disassembly

Loosen the bolt, and remove the water pump sub assembly.

①: bolt

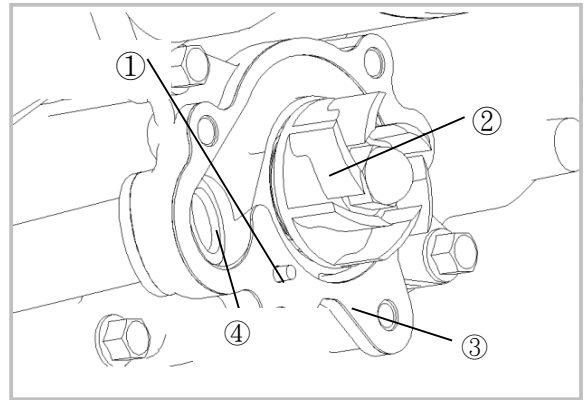
② : water pump cover



Loosen the bolt, and remove the water pump cover.
Remove the blade.

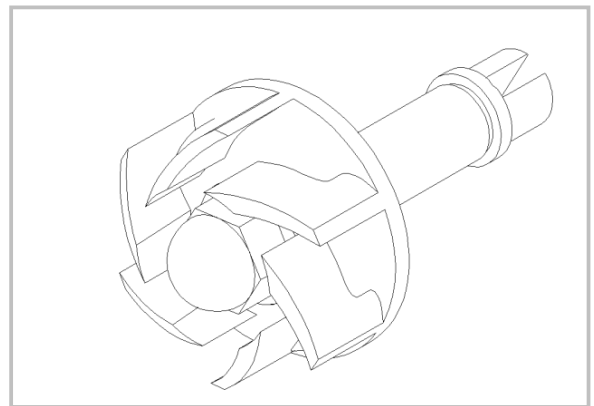
Note: Don't damage the spacer and the joint surface of the housing during disassembly.

- ①: dowel pin
- ②: impeller assembly
- ③: gasket
- ④: water inlet



Check

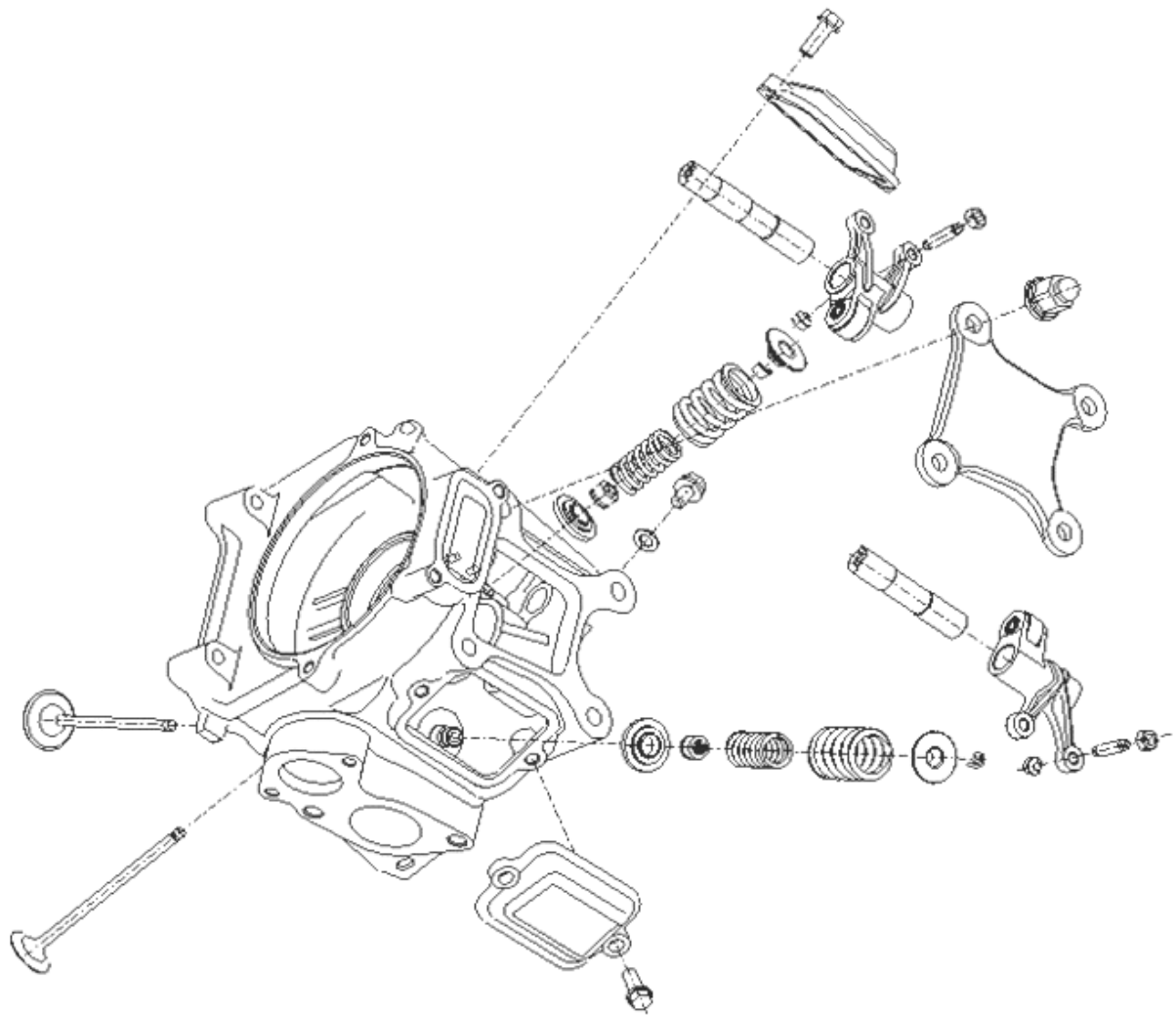
Check the abrasion of the blade assembly. If it is serious, replace it.



Installation

Install it in reverse order.

Cylinder Head/Valves



11. Cylinder Head/Valve

Preparation documents -----11.1

Failure diagnosis-----11.2

Cylinder head-----11.3

11.1 Preparation documents

Function of the cylinder head: The cylinder head is used to seal the cylinder and forms a combustion chamber with piston to bear the high temperature and high pressure combustible gas, and to intake and exhaust gas through the valve actuating mechanism.

Notes:

In order to assure a seal between the cylinder head and cylinder body, the cylinder head bears a strong bolt pretightening force. Pretightening force: 28 Nm.

All parts shall be cleaned and blown by high pressure air before inspection.

Preparation standard

Unit: mm

Item			Standard value	Usage limit
Cylinder pressure			1.2Mpa	—
Flatness of cylinder cover			0.03	0.05
Valve guide	Valve clearance	Inlet	0.08-0.1	0.09
		Exhaust	0.1-0.15	0.10
	ID of valve guide pipe	Inlet/Exhaust	4.5-4.512	4.532
	Clearance between valve lever and valve	Inlet	0.015-0.037	0.07
		Exhaust	0.03-0.052	0.08
	Width of valve seat	Inlet/Exhaust	0.8	1.4
Valve spring	Free length	Inner	31.92	29.92
		Outer	36.6	34.4
Rocker	Diameter of rocker hole	Inlet/Exhaust	12.01-12.028	12.07
	Diameter of rocker shaft	Inlet/Exhaust	11.983-11.994	11.94
	Clearance between rocker hole and	Inlet/Exhaust	0.016-0.045	0.10
Camshaft	Cam height	Inlet	33.27	33.14
		Exhaust	33.1	33

11.2 Failure Diagnosis

Low compression pressure

valve clearance is not adjusted properly
valve is burnt or bent
air tightness of valve seat is not good
cylinder head is gas-leaking
the spark plug is installed improperly

High compression pressure

Excessive carbon deposit in combustion chamber

Noise in the cylinder head

valve clearance is not adjusted properly
valve spring is damaged
camshaft worn or damaged gasket
camshaft and valve rocker is worn

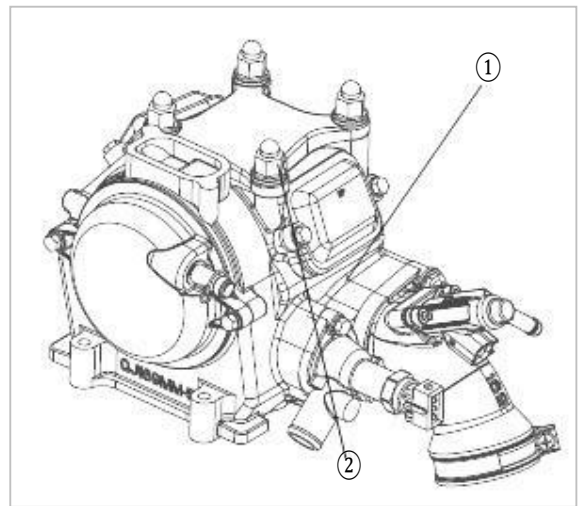
11.3 Cylinder Head

Removal

Remove the nut.

①: cylinder cover

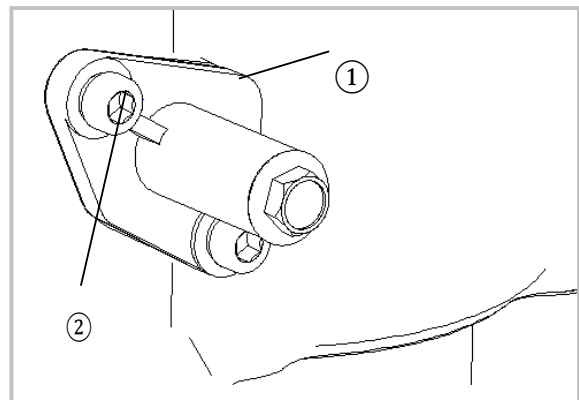
②: nut



Remove the bolt, and take off the chain tensioner and gasket.

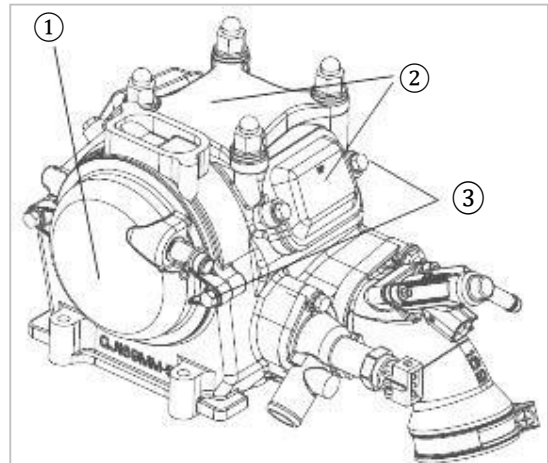
①: chain tensioner

②: bolt



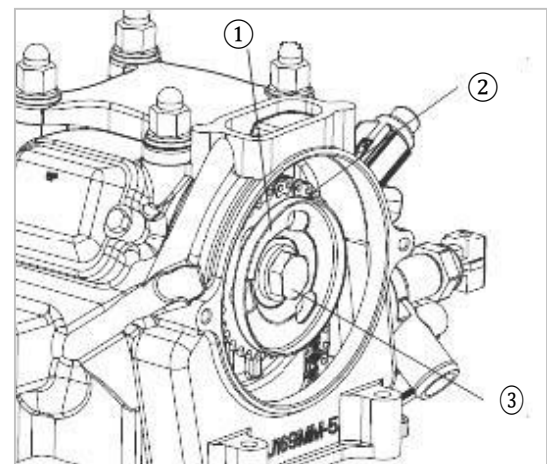
Remove the bolt, and take off the adjusting cover
And the cap sprocket cover cap.

- ①: cam sprocket cover cap
- ②: adjusting cover
- ③: bolt



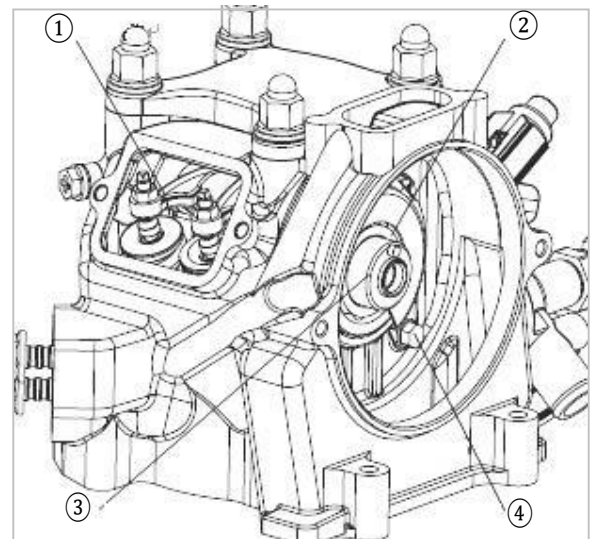
Remove the bolt and cam sprocket cover, and take off the chain. Remove the cylinder cover.
Notice: The chain should be hung by a metal wire in case it falls into the crankcase.

- ①: cam sprocket
- ②: chain
- ③: bolt



Remove the bolt and take down pressure plate.
Remove rocker and camshaft assembly.

- ①: rocker assembly
- ②: pressure plate
- ③: camshaft assembly
- ④: bolt



Inspection of the Cylinder Head

Check the outer ring of bearing, if the bearing doesn't rotate stably and easily, please replace the outer ring.

Check the inner ring of the bearing, if the inner ring doesn't fasten onto the camshaft, please replace it.

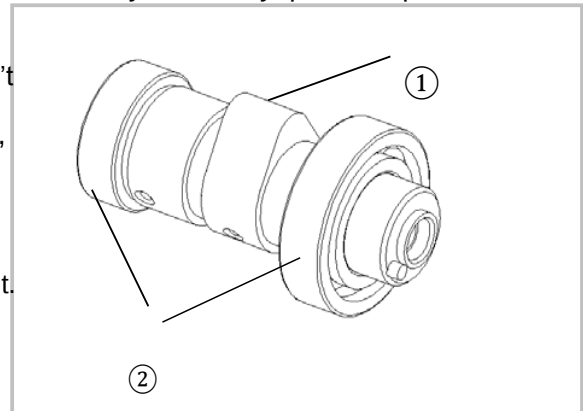
Check the nose of camshaft, if there is dot-like corrosion, scratches or bluing, please replace it.

Measure the height of the cam, at the same time check whether it is worn or damaged.

If not conforming to the specified value, please replace it.

Usage limit: height of cam: inlet: 33.14mm
exhaust: 33 mm

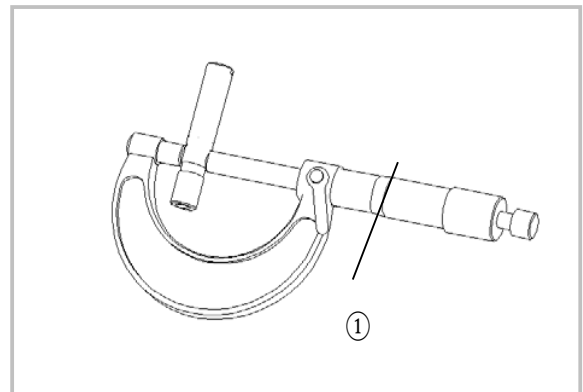
①: cam ②: bearing



Measure the OD of rocker shaft.

Usage limit: 11.94mm

①: micrometer



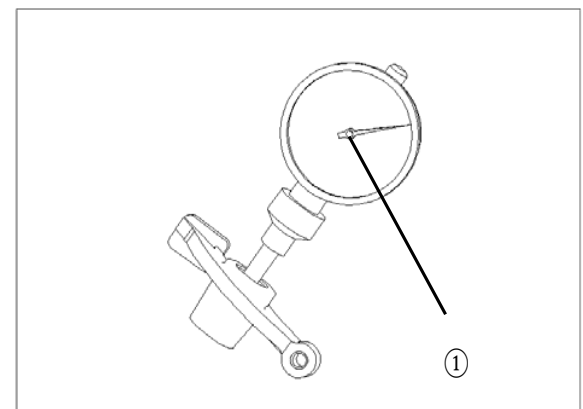
Measure the ID of rocker hole

Usage limit: 12.07mm

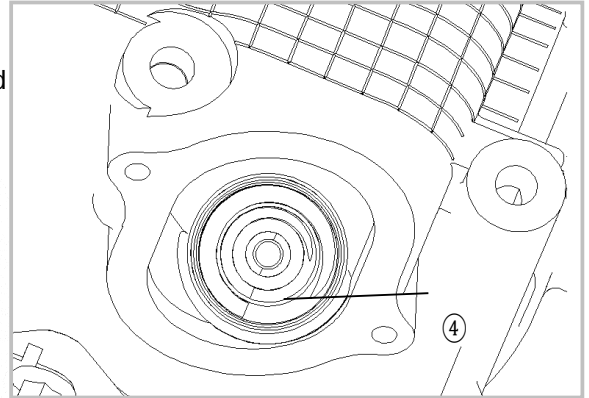
Clearance between the rocker hole and rocker shaft.

Usage limit: 0.10mm

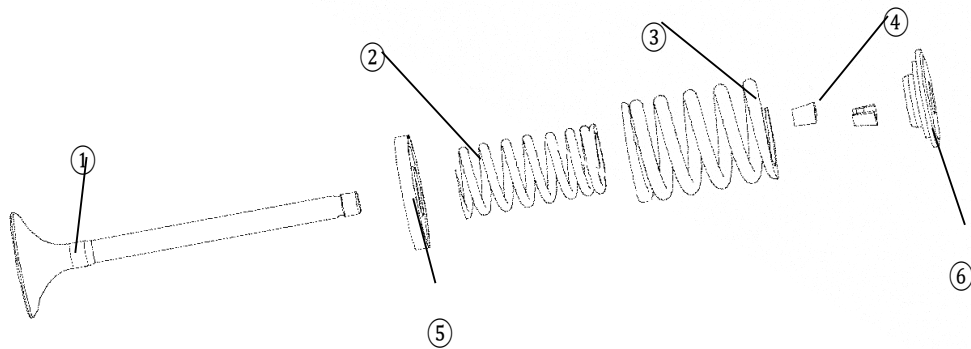
①: tester



Use the valve spring compressor to compress the valve spring, remove the valve collets. Then take down the spring seat, outer valve spring and inner valve spring and valves.



Valve Disassembly



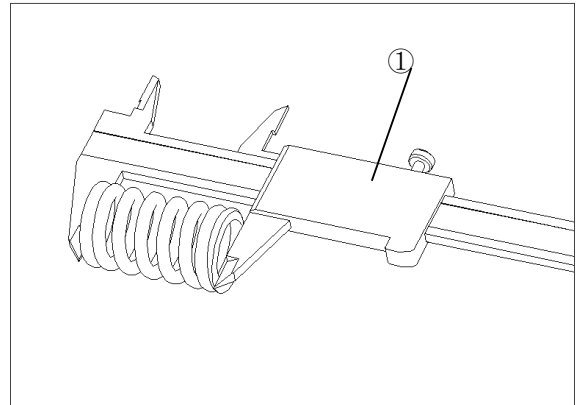
- ①: valve ②: inner spring ③: outer spring
④: valve collet ⑤: spring lower seat ⑥: spring upper seat

Valve Inspection

Measure the free length of valve spring.

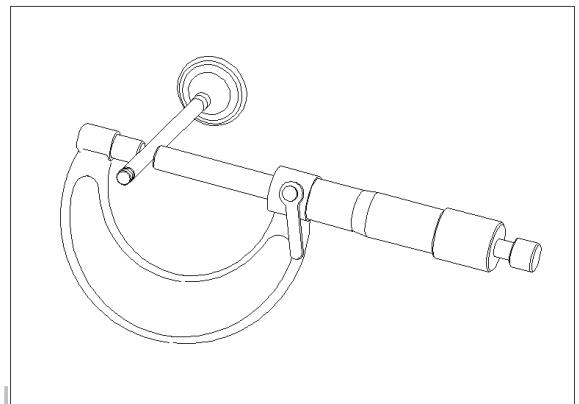
Usage limit: spring: inner 29.92mm
outer 34.4mm

①: vernier calliper



Measure the OD of valve lever.

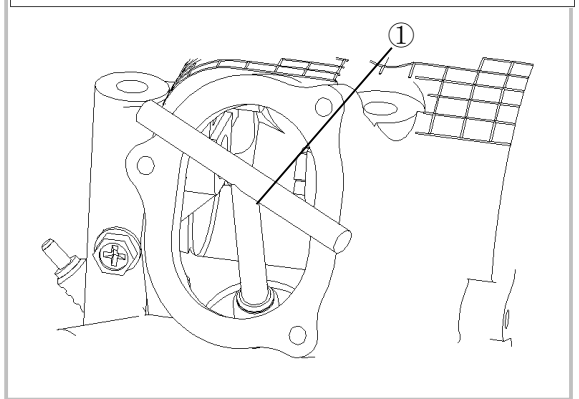
Usage limit: 4.43mm



Inspect the valve guide, please use a reamer before inspection.
Clear out the carbon deposits in the valve guide pipe.

Notice: please turn the reamer clockwise. Do not turn the reamer counter-clockwise.

①: valve reamer



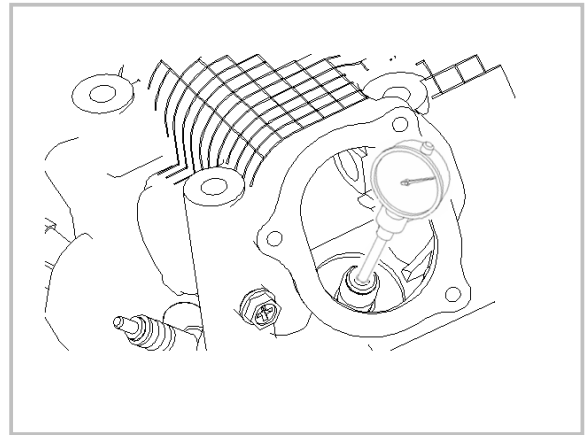
Measure the ID of every valve guide.

Usage limit: inlet/exhaust: 4.532mm

Usage limit of clearance between valve and valve guide pipe:

Inlet valve: 0.07mm

Exhaust valve: 0.08mm

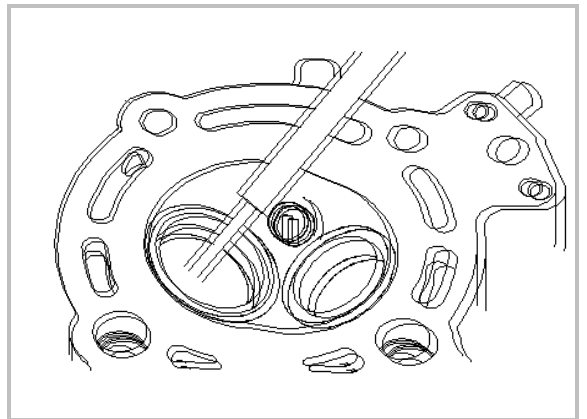


Replacement of Valve Guide

Note: When the clearance between the valve and valve guide pipe exceeds the usage limit, please replace the valve guide. After the replacement of valve guide, the surface of valve seat ring has to be refinished.

Put the valve guide into a freezer to cool for one hour. Heat the cylinder head to 212-302F with electric furnace or hot oven.

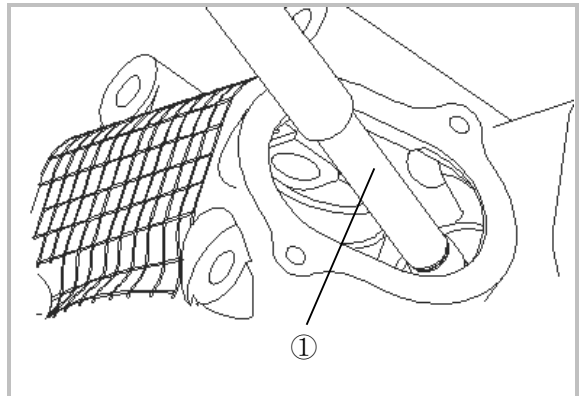
Fix the cylinder head, use the valve guide removing tools to remove the valve guide from the upper side of the cylinder head.



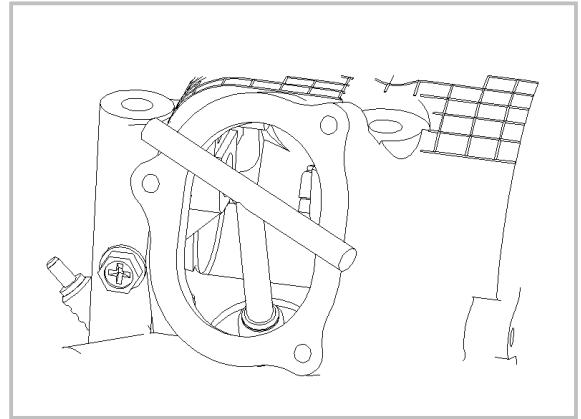
Place a new O-ring on the new valve guide. Install the valve guide from the top end of the cylinder head.

Note: Do not damage the cylinder head when installing the valve guides.

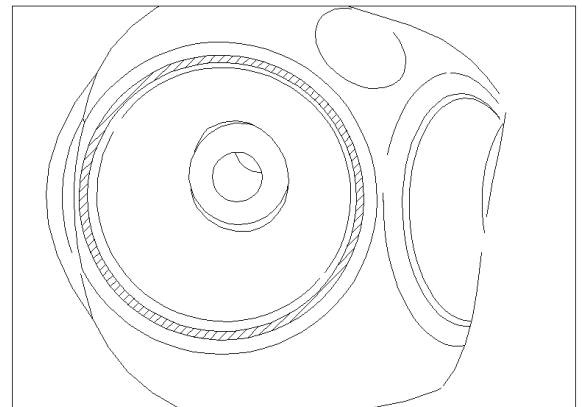
①: valve guide screwdriver



After inserting the valve guides, use the valve guide reamer to refinish the guide hole.
Note: when using the reamer to cut, please add the proper amount of cutting lubricant. The rotation direction of the reamer is clockwise.



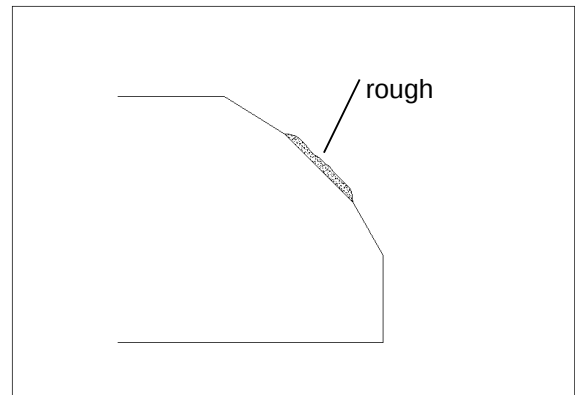
Clear out the carbon deposits in the combustion chamber and valve tracts, and clean the inlet valve and exhaust valve thoroughly. Inspect the contacting surface width of the valve seat (width of valve seat ring).



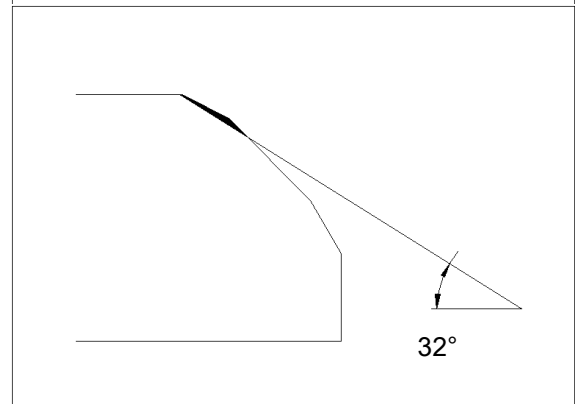
Refinishing of the Valve Seat

Use a 45° milling cutter to clear out the rough or uneven parts on the surface of the valve seat.

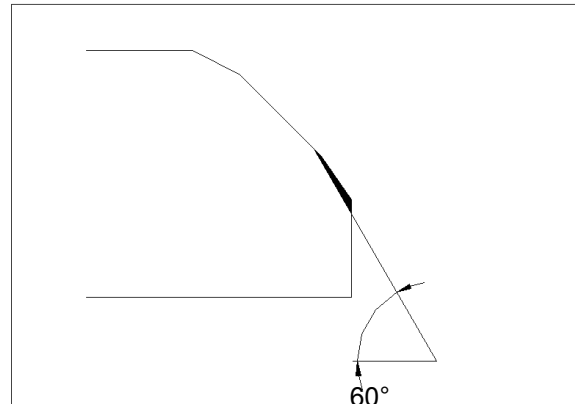
Note: Coat the valve seat ring with a transparent or Prussian blue coating to see more clearly.



Use a 32° milling cutter to clear out the 1/4 of the outer end of valve seat.



Use a 60° milling cutter to clear out the 1/4 of the bottom of valve seat. Take down the milling cutter and inspect the treated parts.



Use a 45° milling cutter to cut the valve seat to its appropriate width.

All the indentation and uneven parts have to be eliminated.

Standard width of valve seat ring: Inlet: 0.8mm

Exhaust: 0.8mm

If the contacting part is the place where the valve is too high, please use a 32° flat milling cutter to lower the valve seat.

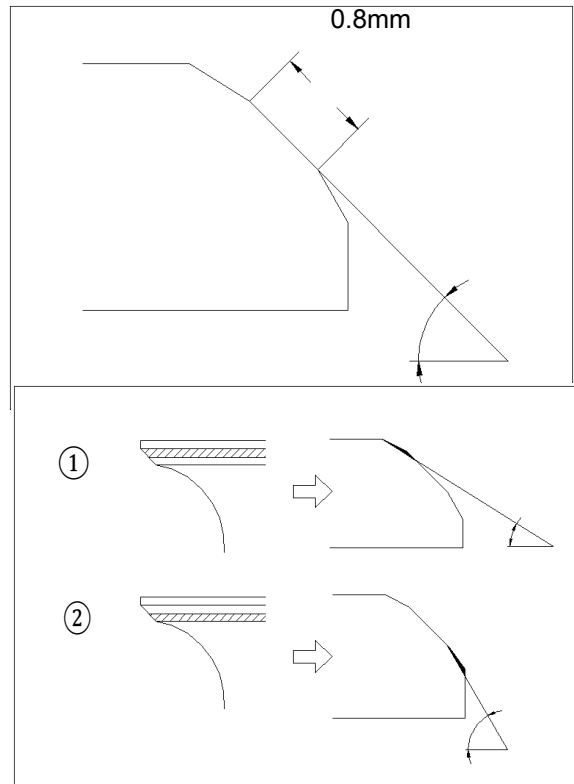
If the contacting part is the place where the valve is too low, please use a 60° inner milling cutter to elevate the valve seat.

Use a 45° finishing milling cutter to cut the valve seat to its appropriate specification.

After the cutting of the valve seat, please coat polishing agent onto the surface of valve and polish the valve slightly.

①: high contacting surface

②: low contacting surface



Installation

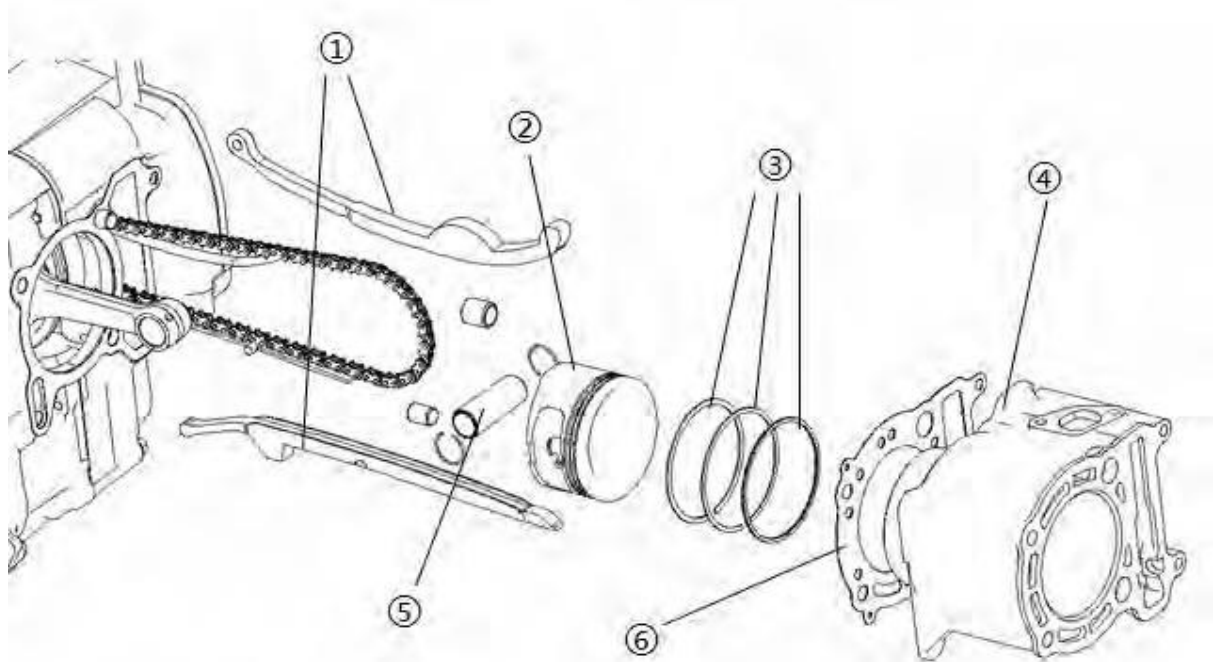
The installation sequence shall be in reversed sequence of removal.

Note:

When installing the valve spring, put the spring pitch span of smaller end towards the combustion chamber. When installing the valve collet, please use valve spring compression tools.

When installing the valves, please grease the surface of valve lever with machine oil first, then put it into the valve guide.

Cylinder Body and Piston



①: cam chain sliders ②: piston

④: cylinder body

⑤: piston pin

③: piston ring assembly

⑥: base gasket

12. Cylinder Body and Piston

Preparation documents-----	12.1
Failure diagnosis-----	12.2
Cylinder body-----	12.3
Piston-----	12.4

12.1 Preparation Documents

Function of the cylinder body: cylinder body provides space for gas compression, combustion and expansion.

It also transfers part of its heat energy to the cooling medium inside the cylinder.

Function of piston:

1. Piston bears pressure arising from mixture gas combustion cycle inside the cylinder and transfers the pressure to the connecting rod to make the crankshaft rotate.
2. It forms the combustion cylinder along with the cylinder cap.

Notes

All parts shall be cleaned and blown by high pressure air before testing.

Preparation Standard

Item		Standard value	Usage limit
Cylinder	Inside Diameter	69-69.01	69.5
	Cylindricity	0.005	0.05
	Circular degree		0.05
	Flatness	0.02	0.05
Piston Piston ring Piston pin	Piston mark direction		"IN" against the inlet valve /
	Measuring point of piston outer diameter		68.96-68.97 (at the bottom of piston skirt) 68.91
	Piston pin housing bore Inside		17.002- 17.04
	Outer diameter of piston pin		16.992-17 16.96
	Clearance between cylinder and		0.035-0.045 0.10
	Clearance between piston ring and piston ring	first ring	0.015-0.05 0.08
		second ring	0.015-0.05 0.08
	Clearance of the closed mouth of piston ring	first ring	0.35-0.55 0.70
		second ring	0.35-0.55 0.70
		Oil ring	0.2-0.7 /
	Clearance between piston and piston		0.002-0.016 0.02
	ID of wrist-pin end of connecting rod		17.010- 17.06
	Clearance between connecting rod and piston pin unit: mm		0.010-0.026 0.06

12.2 Failure diagnosis

Low compression pressure

wear, burning or snap in the piston

wear or damage in the cylinder or the piston

cylinder damaged gasket, gas leak between the crankcase and the gas

white smoke from the exhaust pipe

wear and damage in the piston ring

wear or damage in the piston or the

the crankcase and the gas

Higher compression pressure

Excessive carbon deposit in the

piston or combustion chamber

abnormal sound from the piston

damage in the cylinder, the

the piston ring

wear in the piston pinhole and piston pin

12.3 Cylinder Body

Removal of the cylinder body

Remove the cylinder head, then take off the cylinder cap gasket and locating pin.

Remove the main link plate.

Remove the cylinder.

①: cylinder ②: locating pin

③: gasket ④: main link plate

Check

Check abrasion of inner wall of the cylinder.

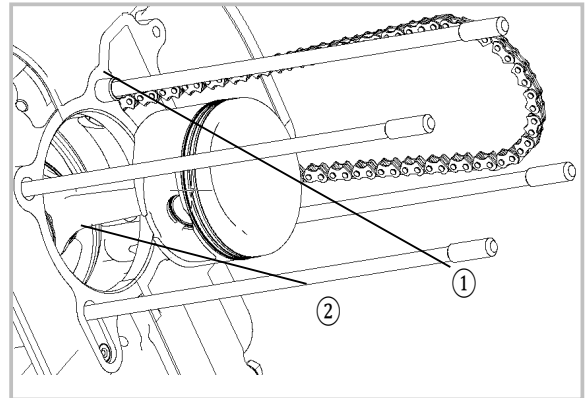
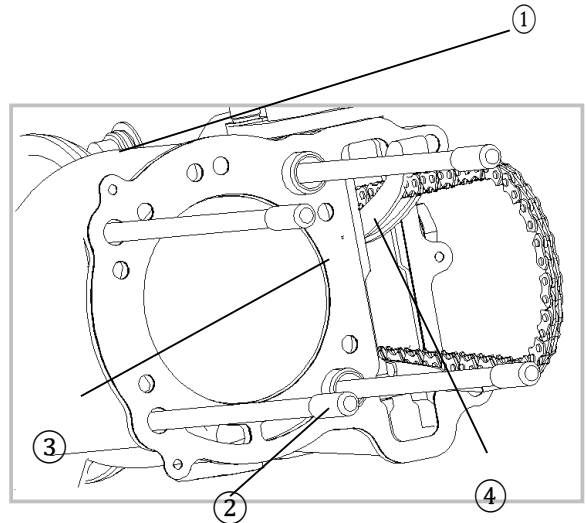
Change it if abrasion is severe.

Take off the gasket and locating pin.

Clean the gasket attached on the cylinder.

①: locating pin

②: gasket



12.4 Piston

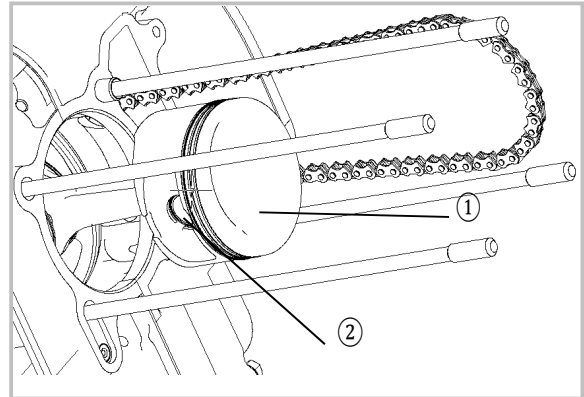
Removal

Remove the retaining clip of the piston pin.

Note: Don't allow the retaining ring fall into the crankcase during removal. Remove the piston pin and unload the piston.

①: piston

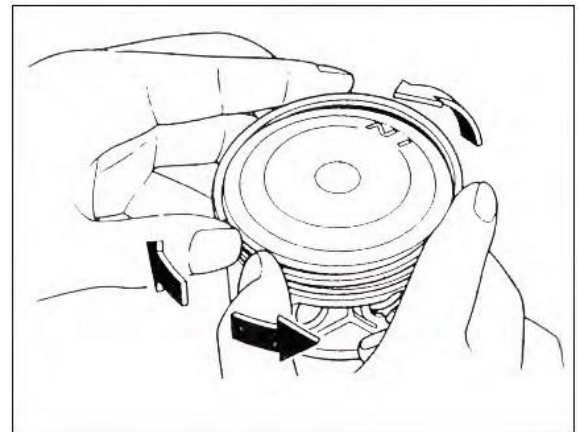
②: bead flange and piston pin



Examine the piston, the piston pin and the piston rings. Remove the piston rings.

Note:

Don't break or damage the piston rings.
Clear the carbon deposits from the piston ring grooves.



Load the piston ring.

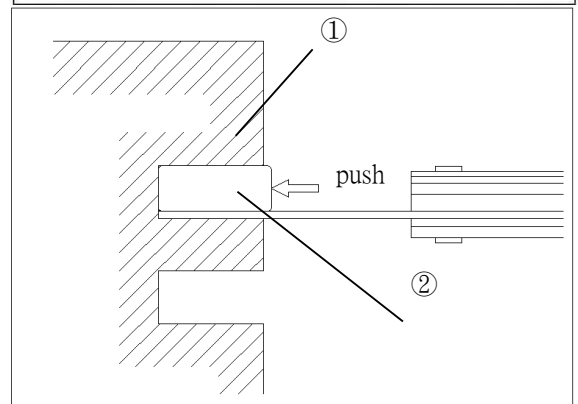
Measure the clearance between the piston ring and the piston ring groove.

Usage limit: first ring: 0.08mm.

second ring: 0.08mm.

①: piston

②: piston ring

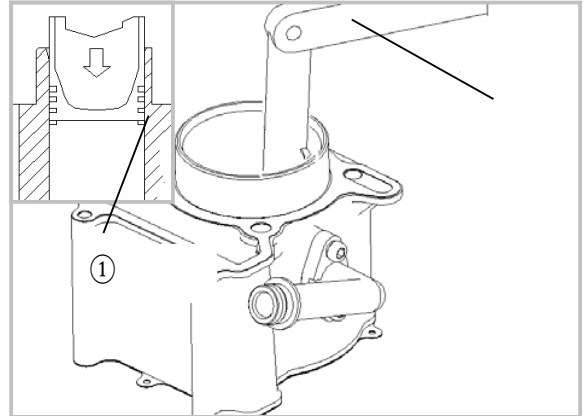


Remove the piston rings and install the piston rings at the bottom of the cylinder.

Note: press piston rings into the cylinder with the piston head. Measure clearance of piston ring gap.

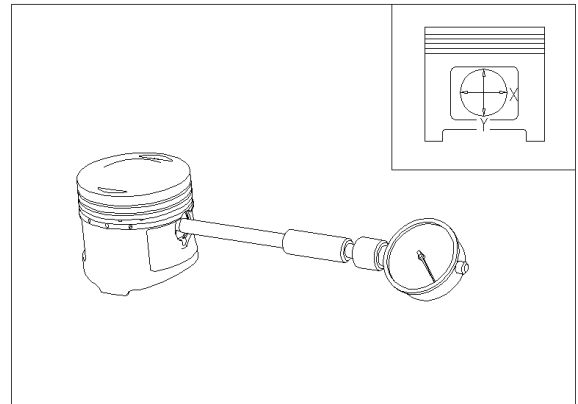
Usage limit: 0.70mm.

①: piston ring



Measure ID of piston pin hole.

Usage limit: 17.04mm.

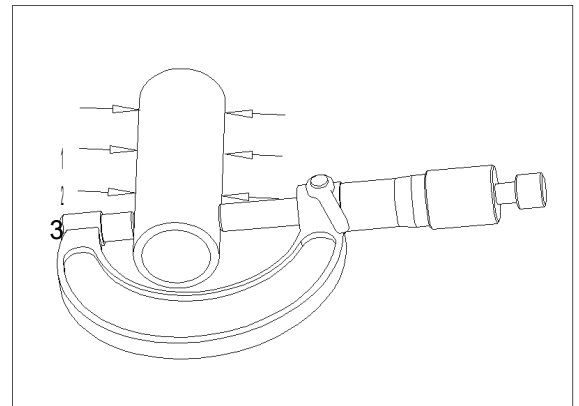


Measure OD of piston pin.

Usage limit: 16.96mm

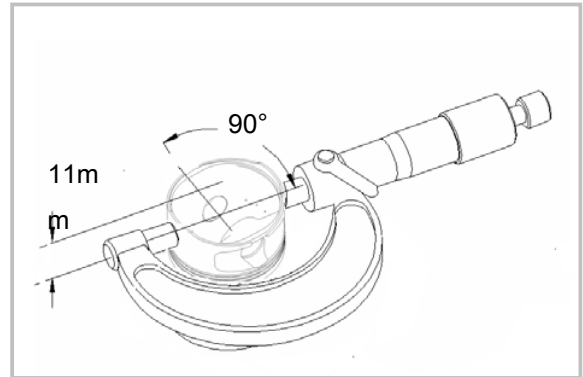
Clearance between piston pin hole and piston pin.

Usage limit: 0.02mm.



Measure OD of piston

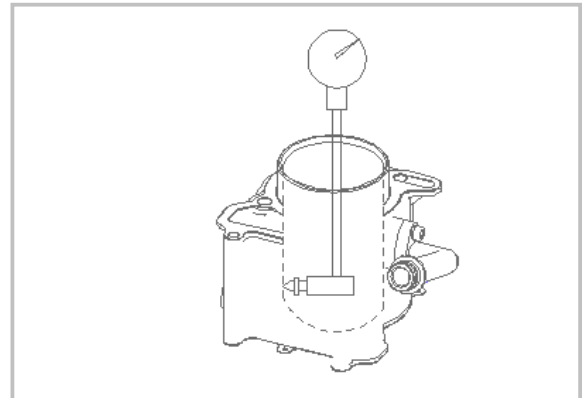
Note: measured place shall be perpendicular to the piston pin, at about 11mm below piston skirt.
Usage limit: 68.91mm.



Check scratch and abrasion of inner wall of the cylinder. Note: It shall be perpendicular to the piston pin, and the cylinder ID shall be measured at the upper, middle and lower locations

Usage limit: 69.5mm.
Measure the clearance between cylinder and piston. Take the maximum value.

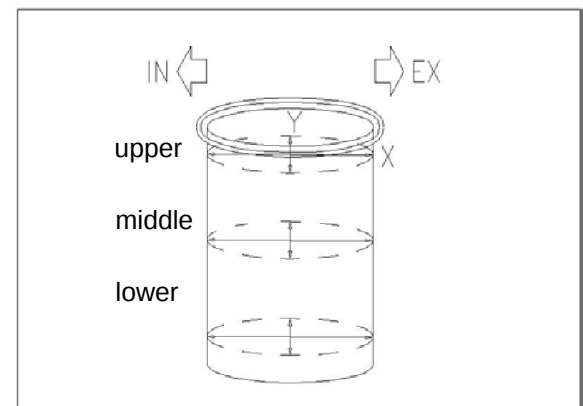
Usage limit: 0.1mm.



Measure circular degree of inner wall of cylinder
(difference in ID between X orientation and Y orientation)

Usage limit: 0.05mm.
Measure cylindricity of inner wall of cylinder (difference in ID along the upper, middle and lower locations between X orientation and Y orientation).

Usage limit: 0.05mm.



Check the flatness of cylinder surface.

Usage limit: 0.05mm

①: feeler gauge ②: tester

Measure the wrist-pin end of the connecting rod.

Usage limit: 17.06mm.

①: wrist-pin end of the connecting rod

Installation of the Piston

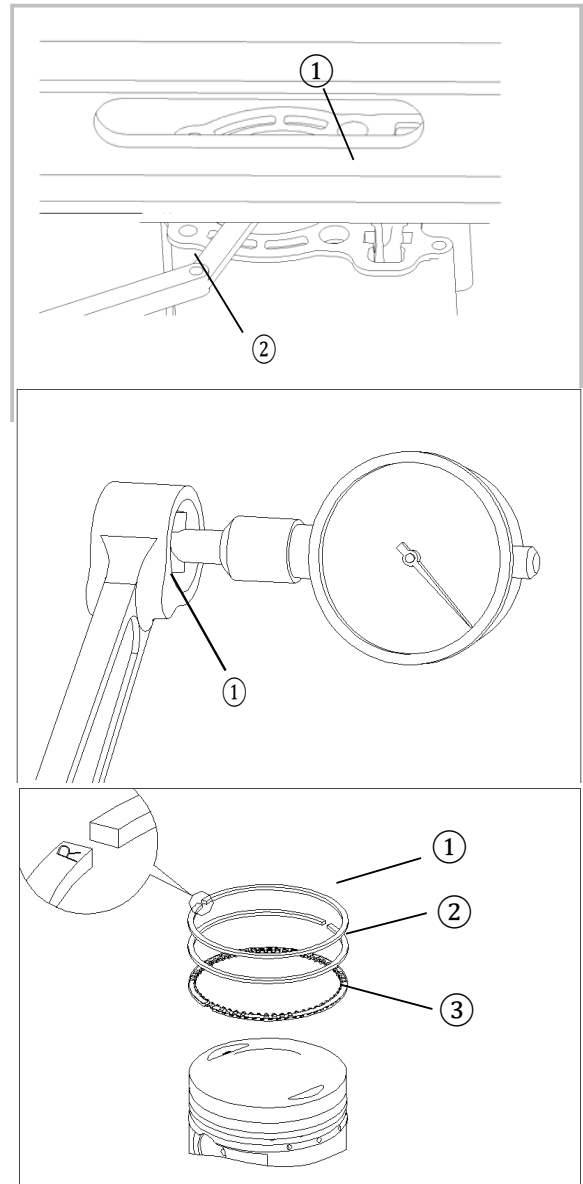
Install piston pin.

Lubricate piston ring and piston with machine oil and install with the piston ring marking facing upwards.

Note: Piston shall not be scratched and piston rings shall not be broken.

After installation of piston rings, it shall move easily inside the piston ring groove.

①: top ring ②: second ring ③: oil ring



Open the right cap, take off the actuation level assembly.
Clean gasket on crankcase.

Note: There should be no foreign material falling into the crankcase. Install piston, piston pin, and piston pin clips.

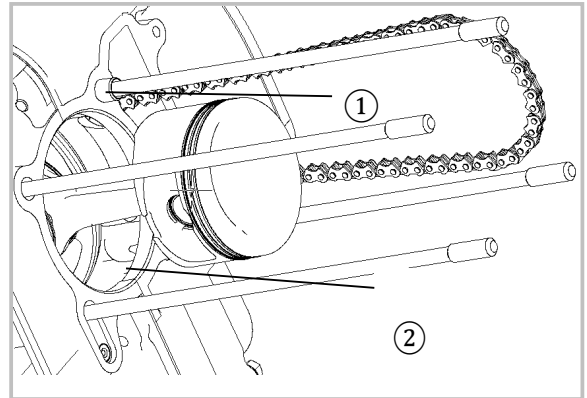
Installation of cylinder

Install gasket and locating pin onto the crankcase.
Lubricate machine oil on inner wall of cylinder, piston and piston rings. Be careful when installing piston rings into the cylinder.

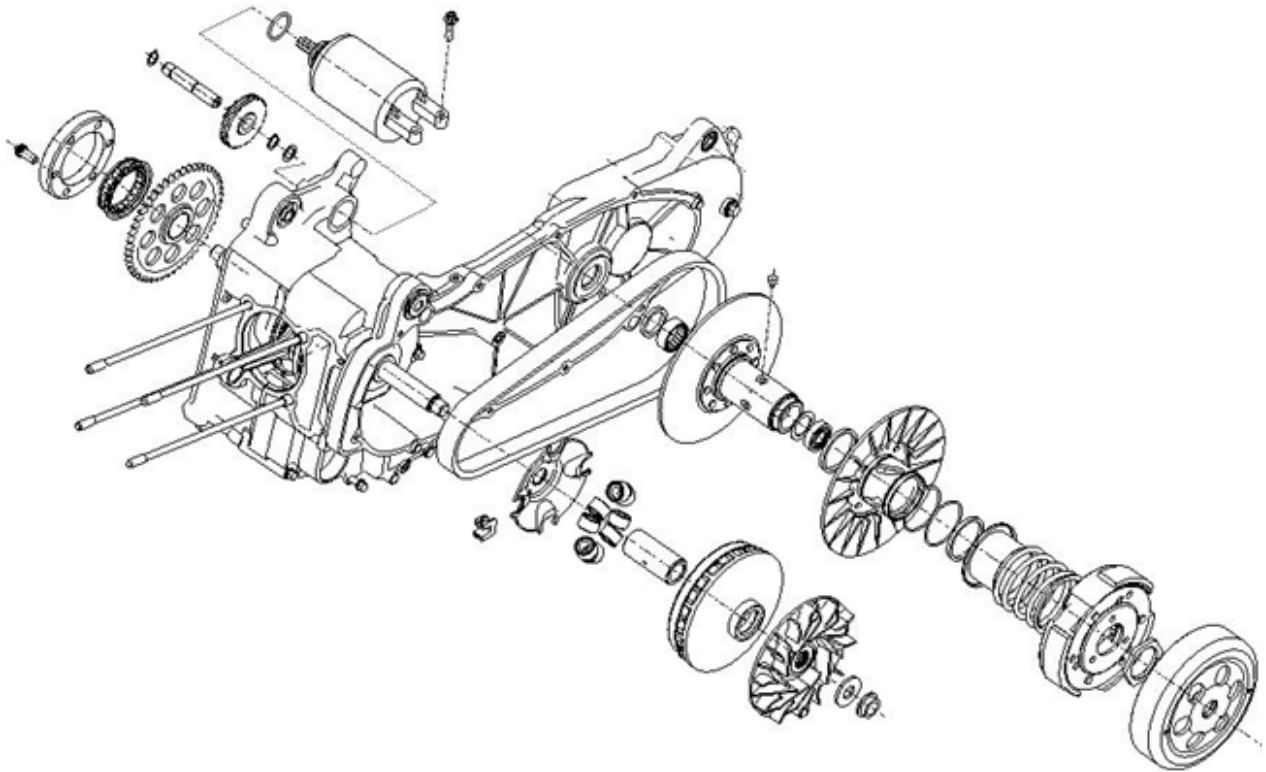
Note:

Do not damage piston rings.

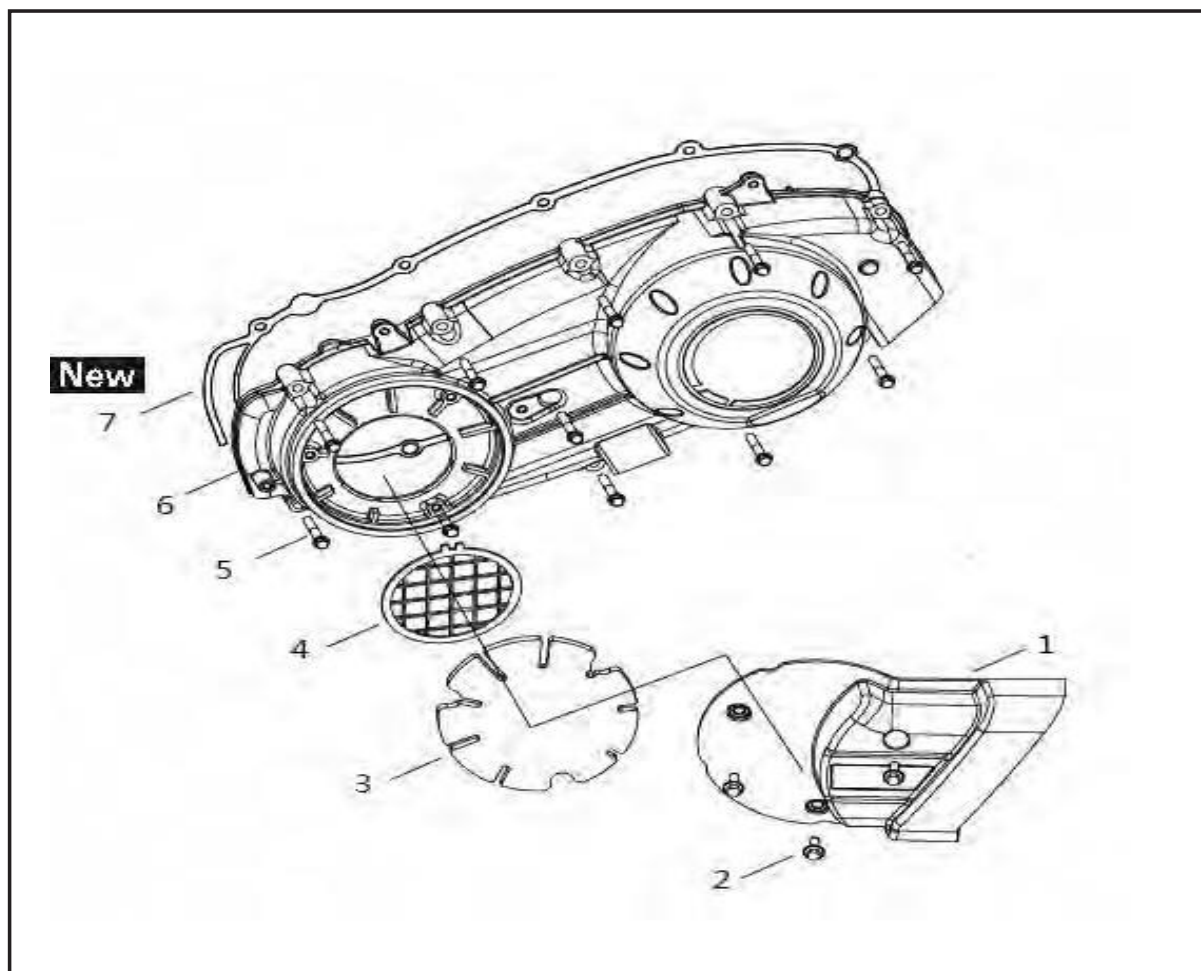
①: locating pin ②: gasket



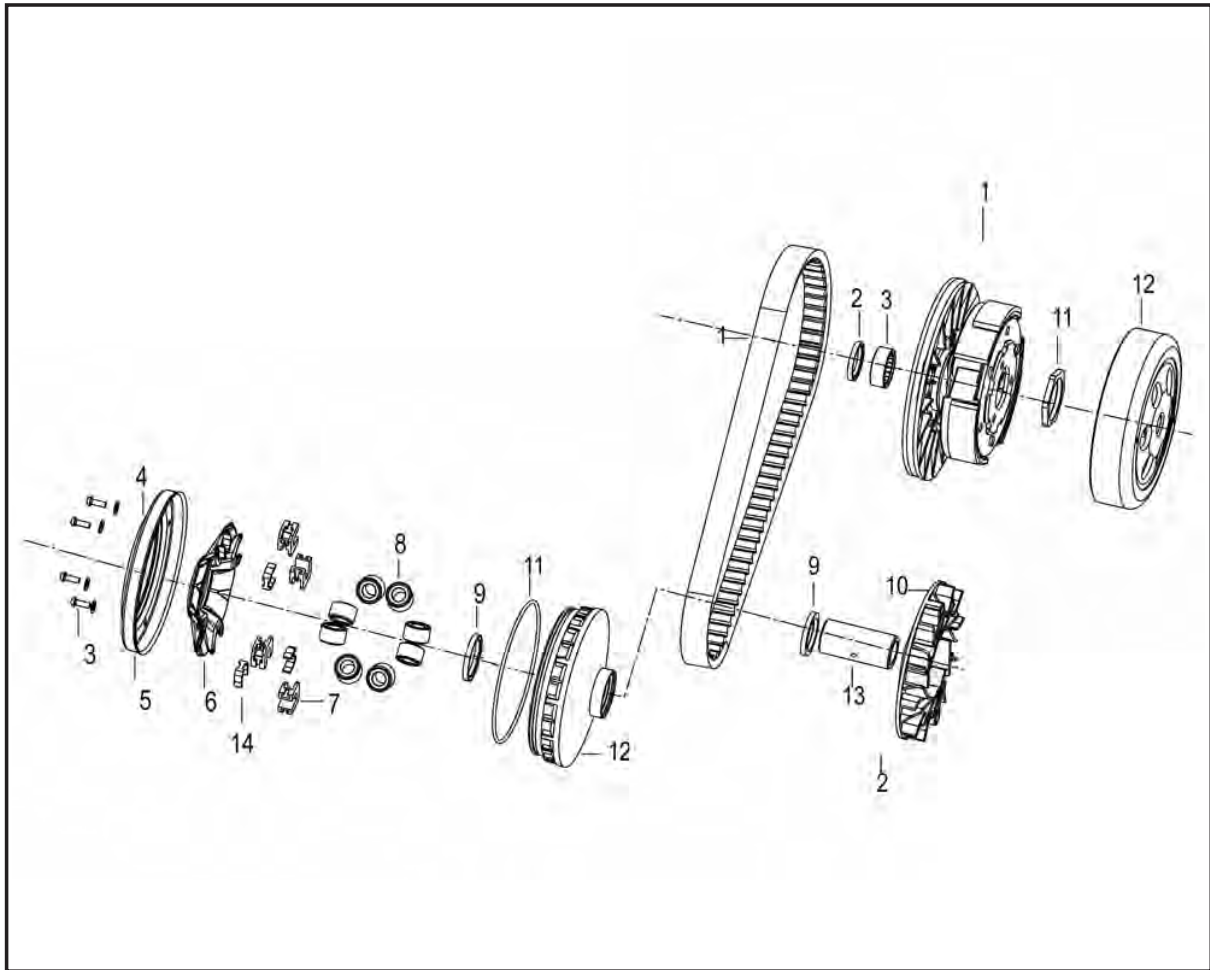
Driving Disc / Clutch / Driven Wheel



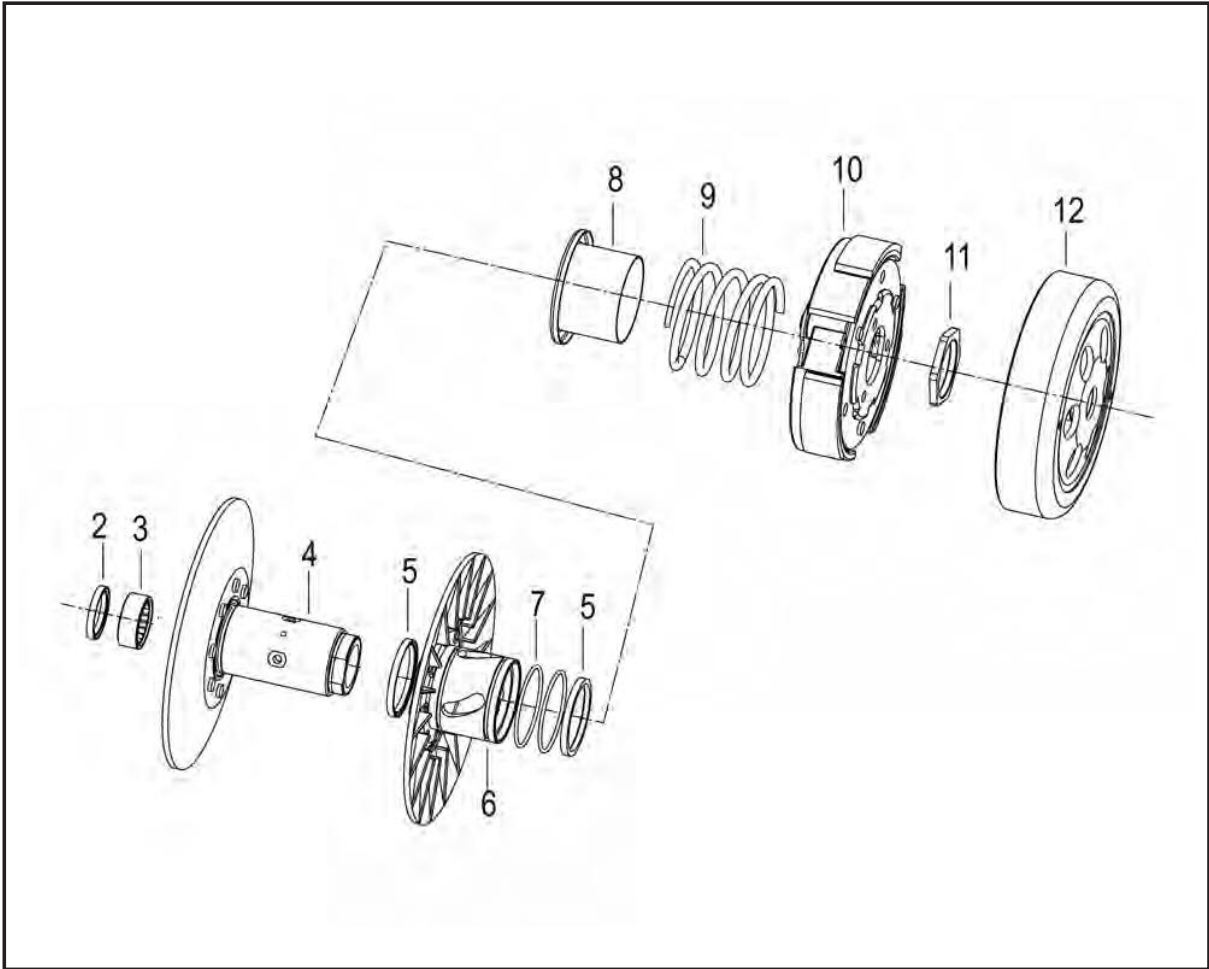
V-BELT, CLUTCH AND SECONDARY/PRIMARY SHEAVE CRANKCASE FILTER COVER AND CRANKCASE COVER (LEFT)



V-BELT, CLUTCH AND SECONDARY/PRIMARY SHEAVE



SECONDARY SHEAVE



13. Driving Disc / Clutch / Driven Wheel

Preparation documents-----	13.1
Failure diagnosis-----	13.2
Clutch/driven wheel-----	13.3

13.1 Preparation documents

Function: driving disc/clutch/driven wheel form step less speed variator. Driving disc and driven wheel transfer torsion through a triangular belt.

Notes

In operation, keep the drive belt free of oil or grease to minimize possibility of sliding between triangular belt and the wheel.

Preparation standard

Item	Standard value	unit: mm
		Usage limit
OD of right semi-driving wheel shaft sleeve	27.959-27.98	27.93
ID of right semi-driving wheel bushing	28-28.021	28.04
Width of triangular belt	22-23	21
Thickness of clutch abrasion piece	4	1.5
ID of clutch outer bushing	134.875-135.125	135.5
Free length of clutch compression spring	107±2	104
OD of driven wheel right semi-shaft	40.959-40.975	40.90
ID of driven wheel left semi slid bushing	41-41.025	41.06
OD of boll bearing	20-20.1	19.5

13.2 Failure diagnosis

Motor fails not make cycle run	low horsepower	shaking driving
Worn triangular belt	Worn triangular belt	broken clutch abrasion piece spring
Broken driven wheel	deformed clutch compression spring	
Broken or damaged clutch abrasion piece		worn ball bearing
Broken clutch compression spring		dirty driving belt wheel surface

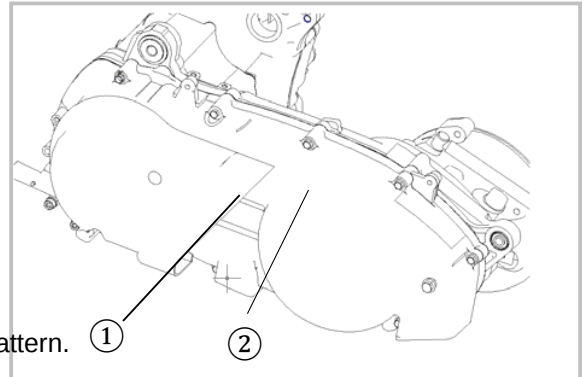
13.3 Left crankcase cover

Removal

Remove cover standing bolt and remove gasket as well as standing pin.

Note: Remove standing bolt and loosen in a crisscross pattern.

①: left cover ②: standing bolt



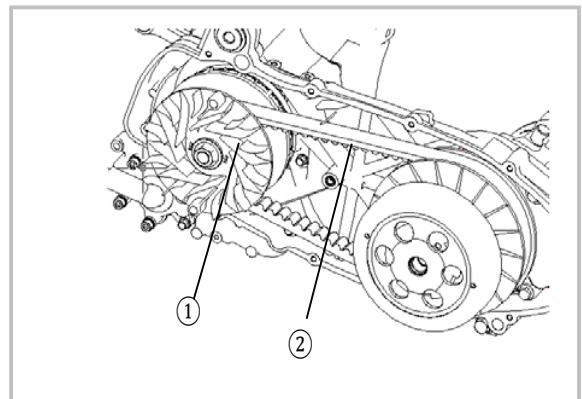
13.4 Driving disc

Removal

Remove the driving disc standing nut and remove the left semi part of driving disc. Remove triangular belt from driving disc.

①: left semi part of driving disc

②: triangular belt

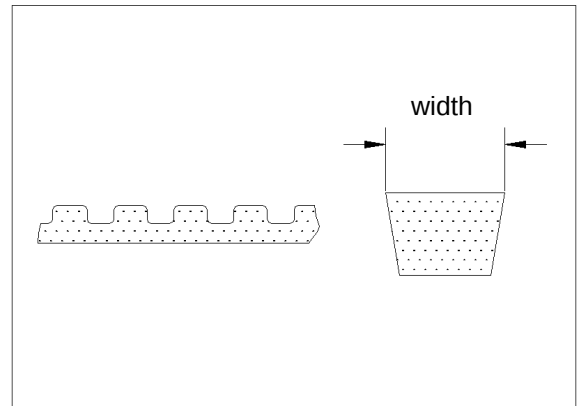


Check whether the triangular belt has cracks, or whether the rubber or cotton yarn has failed or is worn.

Measure width of triangular belt.

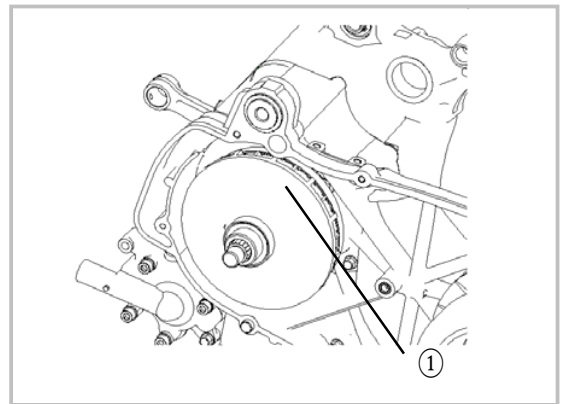
Usage limit: 21mm

Note: Please choose original factory parts when changing.

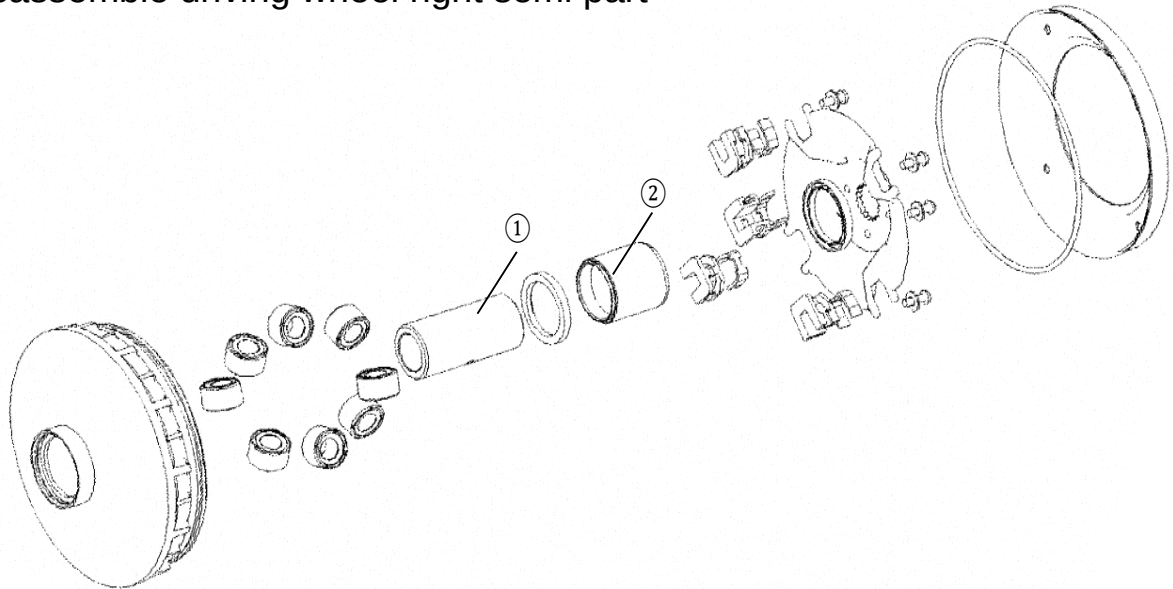


Remove driving wheel right semi part.

①: right semi part of driving disc



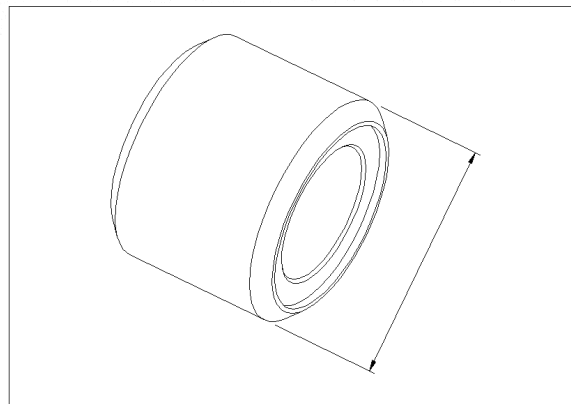
Disassemble driving wheel right semi part



①: shaft sleeve ②: bushing

Check abrasion of the ball bearing.
Measure OD of the ball bearing.

Usage limit: 19.5mm



Measure the right semi ID of driving wheel shaft
Sleeve.

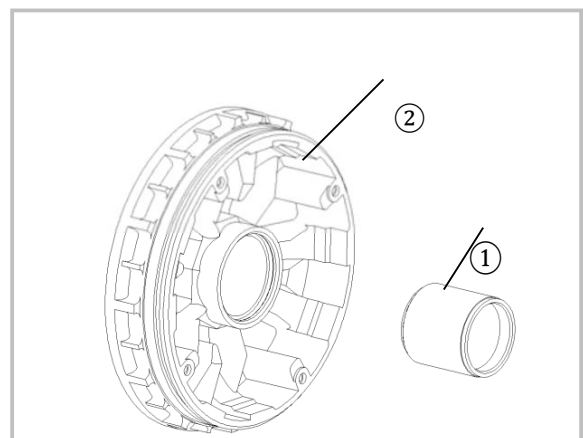
Usage limit: 28.04mm.

Measure the OD of the slide bushing.

Usage limit: 27.93mm.

①: slide bushing

②: right semi of driving wheel

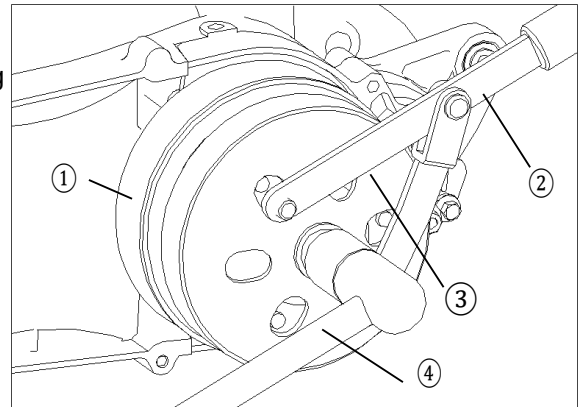


13.5 Clutch/Driven Wheel

Removal

Use retainer to fix the clutch bushing and remove standing nut. Remove clutch bushing and clutch/driven wheel.

- ①: driven wheel ②: retainer
③: clutch bushing ④: sleeve spanner

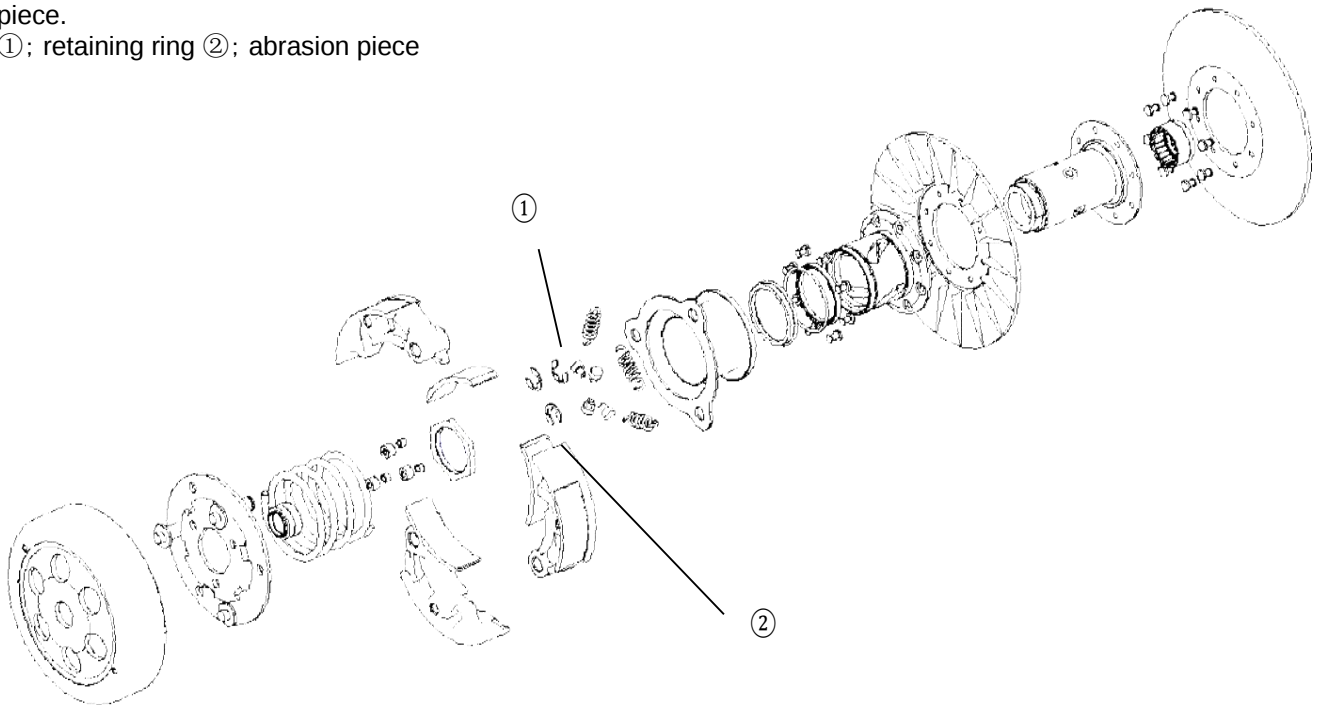


Disassemble Clutch

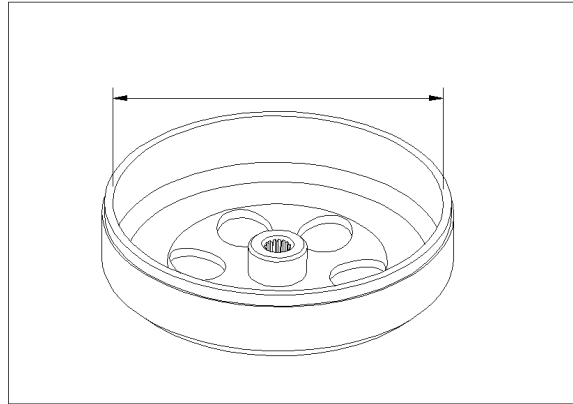
Remove retaining ring and disassemble clutch.

Note: While disassembling, no oil shall stick to clutch abrasion piece.

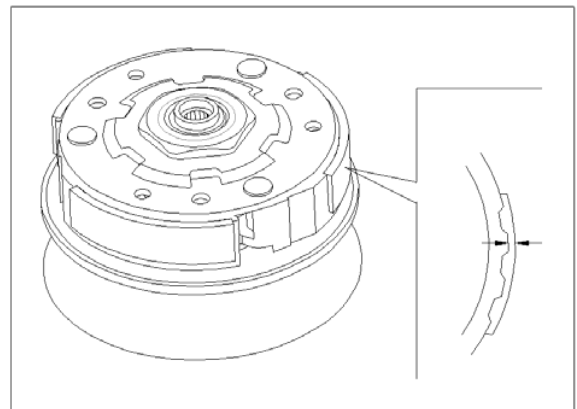
- ①: retaining ring ②: abrasion piece



Check the abrasion of clutch bushing.
Measure ID of clutch bushing.
Usage limit: 135.145mm



Check the abrasion of clutch abrasion piece. Measure the thickness of abrasion piece **Usage limit:** 1.5mm

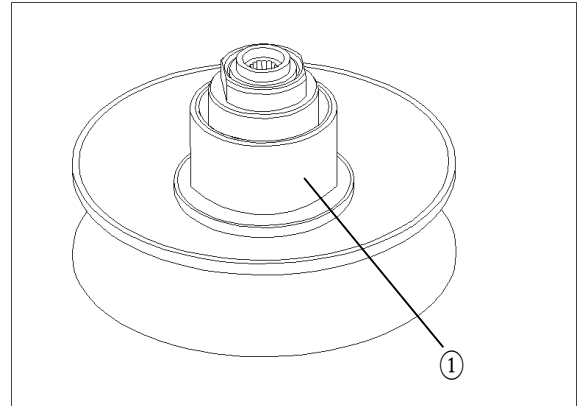


Disassemble clutch and driven wheel

Note: Use spring compressor in removal in case spring is damaged.
Fix spring compressor, and remove clutch standing nut
Loose compressor, and detach clutch and driven wheel.

Remove spring bushing.

①: spring bushing



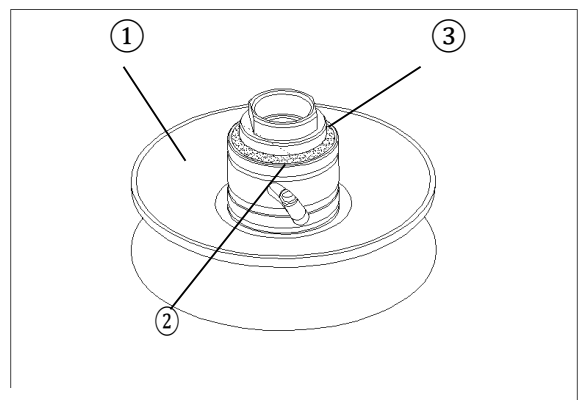
Remove directing pin.

Remove left semi weld of driven wheel.
Remove the oil seal on the left semi part of driven wheel.

①: left semi weld of driven wheel

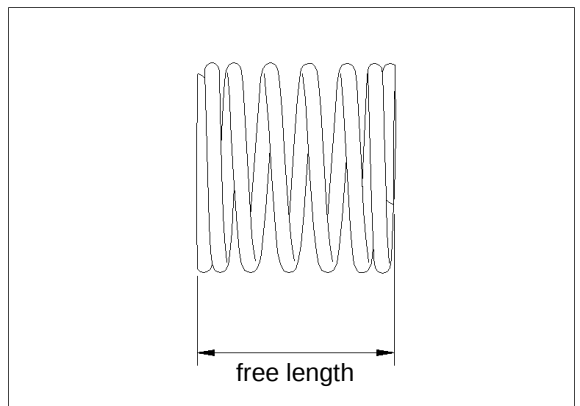
②: directing pin

③: oil seal

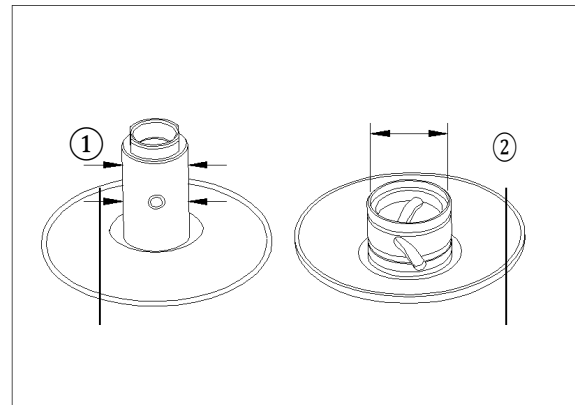


Check the free length of clutch spring

Usage limit: 104mm



Check abrasion of driven wheel.
 Measure right semi shaft sleeve OD of driven wheel. **Usage limit:** 40.90mm
 Measure left semi slide bushing ID of driven wheel. **Usage limit:** 41.06mm
 ① right semi part of driven wheel
 ② left semi part of driven wheel

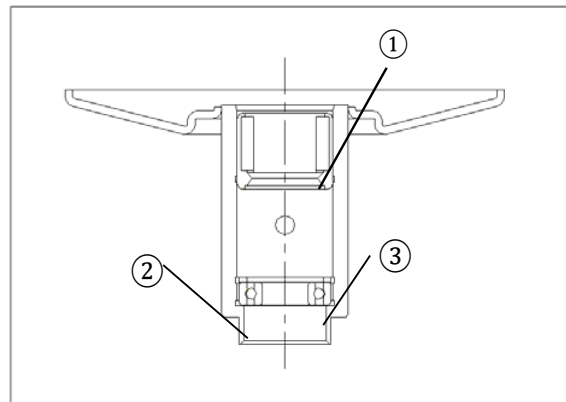


Replacement of right semi bearing of the driven wheel

Remove needle bearing from right semi driven wheel. Remove elastic retaining ring and outer roller bearing.

Note: The removed bearing is non-reusable.

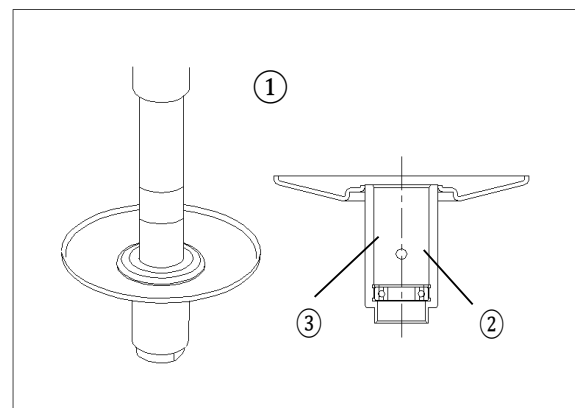
- ① needle bearing
- ② roller bearing
- ③ elastic retaining ring



Grease the outer rolling bearing evenly and put it into the bushing

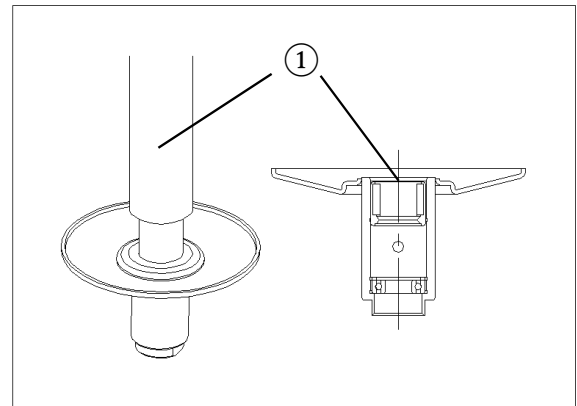
Note: Press the outer roller bearing into the bushing, face the marked side outward, and then fill the shaft cavity with 8-9g grease. Install elastic retaining ring

- ①: bearing screwdriver
- ②: rolling bearing
- ③: elastic retaining ring



Install needle bearing.
Press needle bearing with the tool in the figure.

①: bearing screwdriver



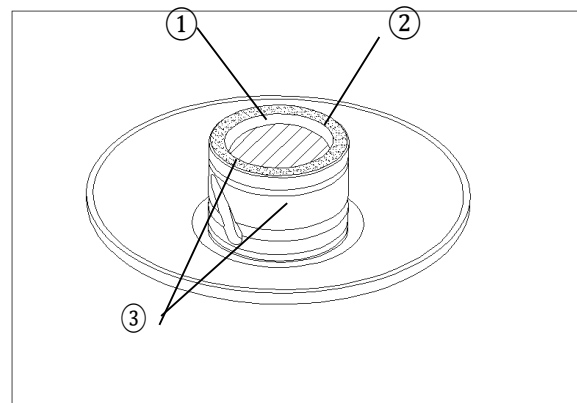
Assemble clutch/driven wheel

Clean grease on the driven wheel surface.
Install oil seal of driven left semi slide bushing.
Install greased O-ring onto the slider bushing of the driven wheel's left semi part.

①: Lubricating grease

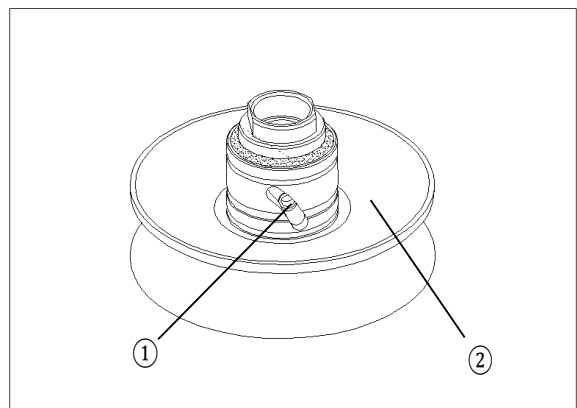
②: Oil seal

③: O-ring



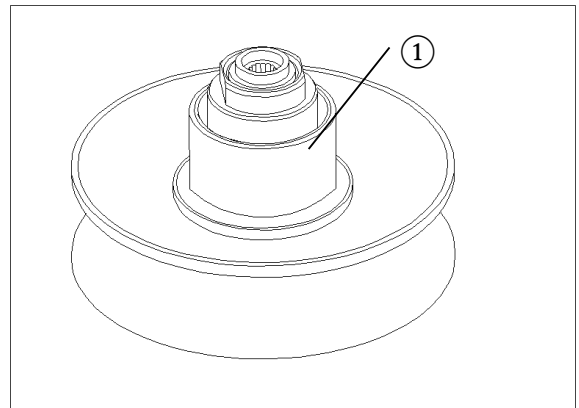
Assemble the left and right parts of the driven wheel together. Install greased directing pin into directing groove.

①: directing pin ②: directing groove



Install spring bushing.
Clean leaked grease.

①: spring bushing



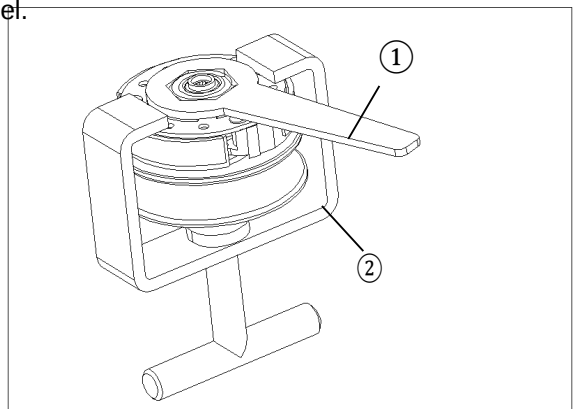
Install clutch compression spring and clutch on driven wheel.

Use clutch spring compression assembly, after compression install the locking nut

Note: Compress the spring moderately. Do not damage it

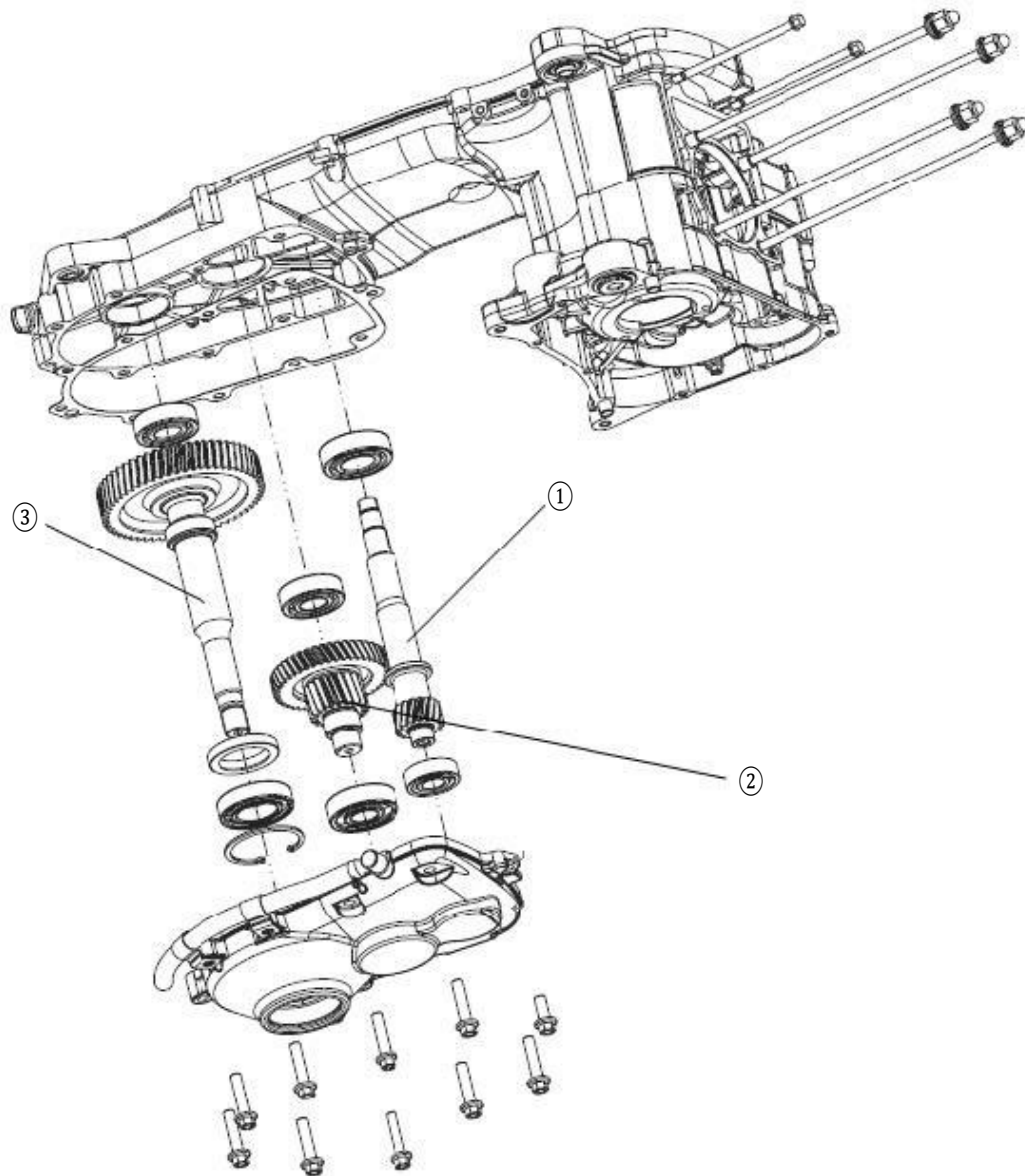
①: spanner (locking nut)

②: clutch spring compressor



Installation

Install driving disc/clutch/driven wheel in reversed sequence of removal.



- ①: input shaft
- ②: middle shaft
- ③: output shaft

14. Transmission

Preparation documents-----	14.1
Failure diagnosis-----	14.2
Gear box-----	14.3

14.1 Preparation documents

Function: transfer torsion and decide final output torsion and rotation speed.

14.2 Failure diagnosis

Motor fails to make motorcycle run

Broken driving gear

Burnt driving gear

Leaked gear oil

Too much gear oil

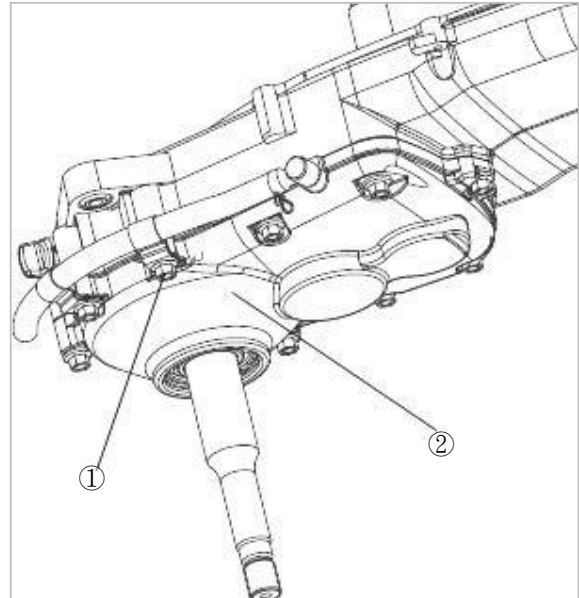
Damaged oil seal

14.3 Gear box

Removal

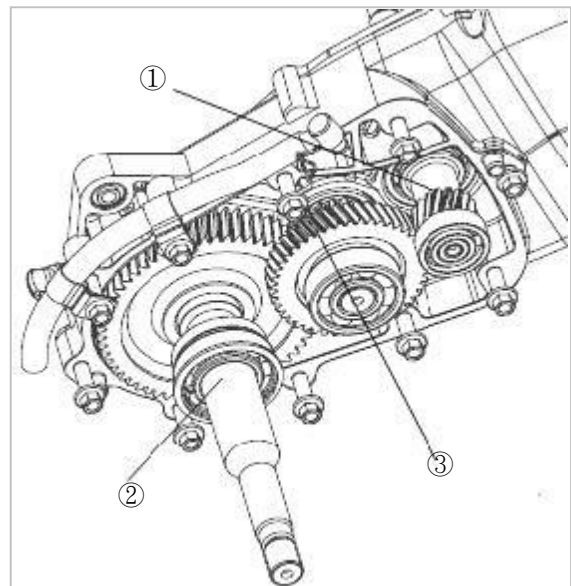
Loosen bolts and remove gear box cover.
Remove gasket and locating pin.

- ①: bolt
- ②: gear room cover



Remove output shaft assembly.
Remove middle shaft assembly.
Remove input shaft.
Check abrasion of input shaft, output shaft and each gear. Replace if the abrasion is serious.

- ①: input shaft
- ②: output shaft assembly
- ③: middle shaft assembly



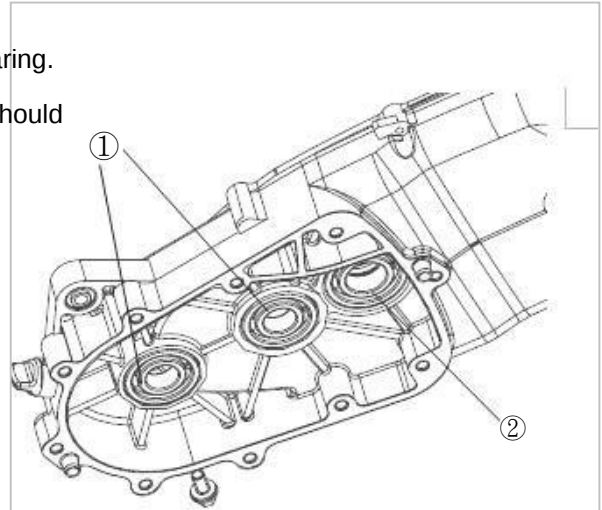
Remove oil seal on the gear box cover and remove bearing.

Note:

Bearing knocked out shall not be used any more, and should be replaced with a new one

Use special tools to disassemble bearing and oil seal

①: bearing ②: bearing oil seal



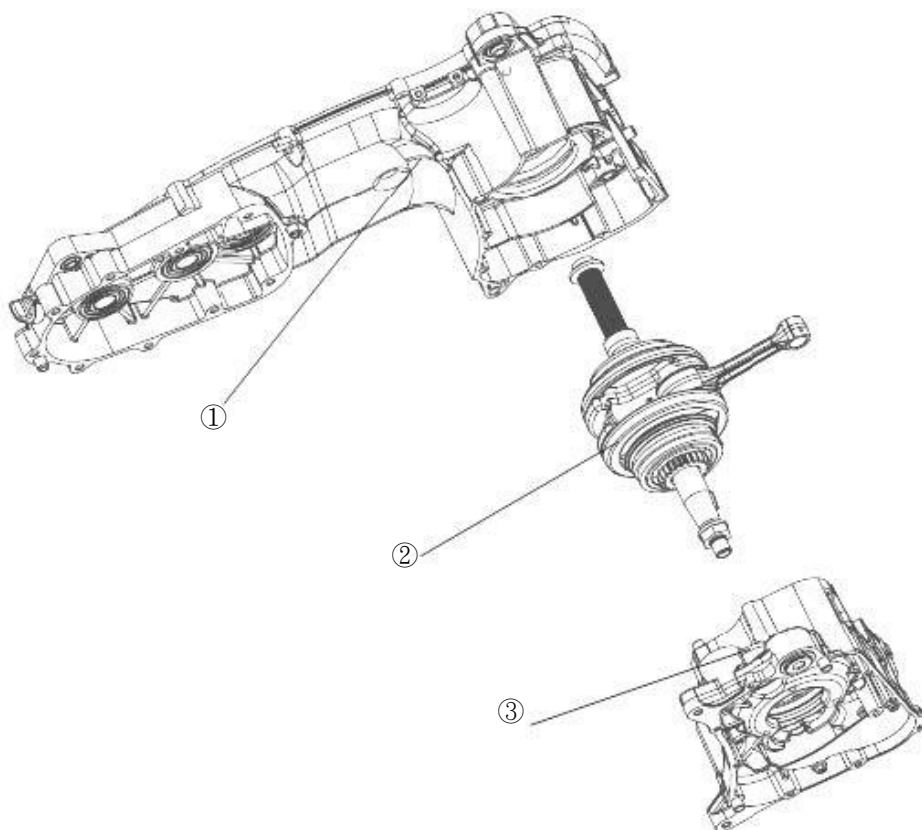
Installation

The installation sequence shall be in reverse sequence of removal.

Add 0.35L gear lubricant after installation.

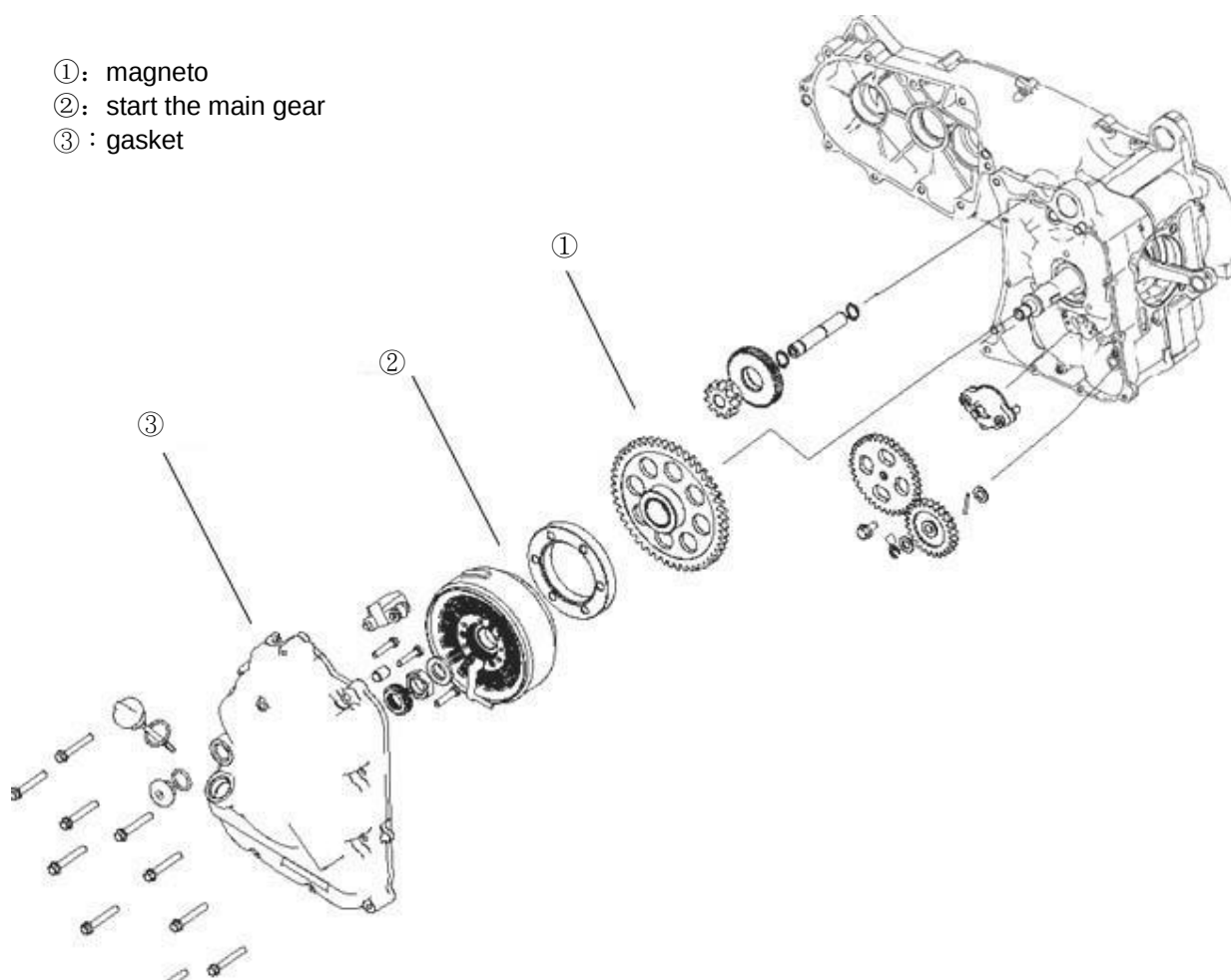
Note:

Use special tools to install bearings and oil seals in case they are damaged



- ①: left crankcase
- ②: crankshaft
- ③: right crankcase

- ①: magneto
- ②: start the main gear
- ③ : gasket



15. Crankcase

Preparation documents-----	15.1
Failure diagnosis-----	15.2
Crankcase-----	15.3

15.1 Preparation Documents

Function of the crankcase: The crankcase is the force-bearing part of the engine. Its main function is bearing crankshaft, clutch, transmission case, cylinder body and cylinder head, bearing the inertia force from combustion shock and the movement of crankshaft connecting rod system, and forming a closed space (oil sealing, gas sealing).

There are suspension holes in the crankcase, connecting the engine to other parts of the body through the connection with suspension holes in the car circuit

Notes

The crankcase is thin-section casting thus has to avoid shock on operation in case of deformation and fracture. All components must be cleaned and dried with high-pressure air before testing.

The lubricant in the crankcase should be drained before operation.

Preparation standard

unit: mm

Item		Standard value	Usage limit
Crankshaft	Left-right clearance of rod big end	0.5-0.75	0.9
	Radial clearance of rod big end	0.008-0.018	0.05
	Shimmy	0.03	0.09

15.2 Failure diagnosis

Noise in crankcase

Loose or broken parts inside crankcase

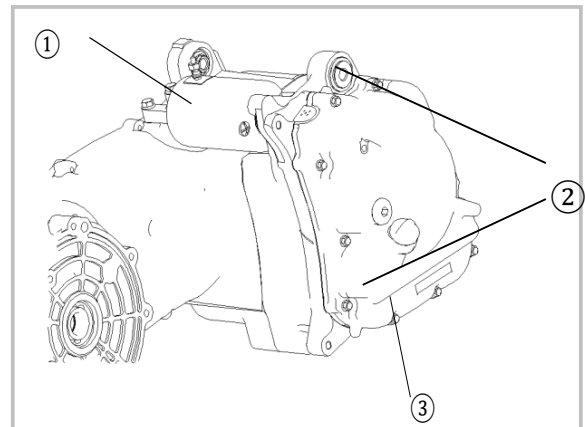
Loose crankshaft pin bearing

15.3 Crankcase

Removal of crankcase

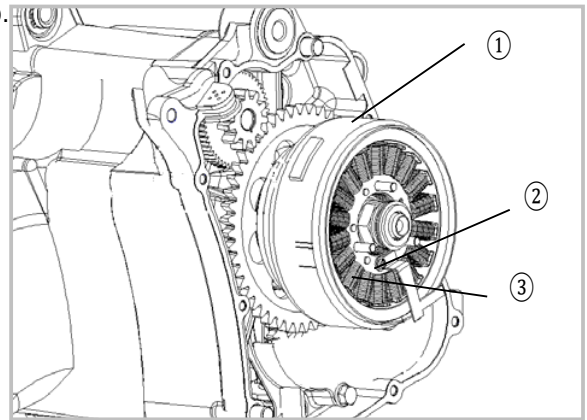
Loosen the fan casing standing bolt, remove the fan casing and take off the starter motor.

①: starter motor ②: bolt ③: fan casing



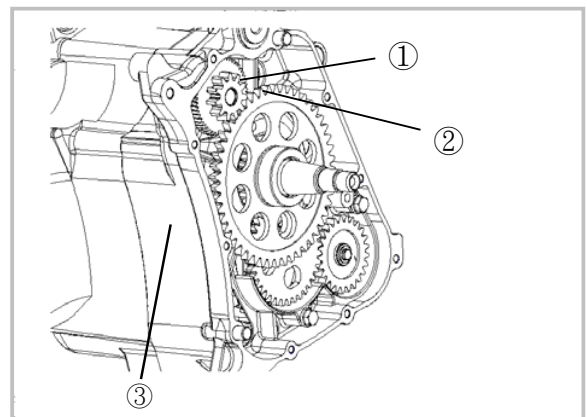
Remove the bolt, remove the cover and remove magneto.

①: magneto ②: cover ③: bolt



Loose the bolt and remove the right crankcase cover.
Take off the gasket.
Use special tool to loosen locking nut and remove the one-way clutch assembly.
Take off the starting idle gear and shaft.
Take off the starting motor.

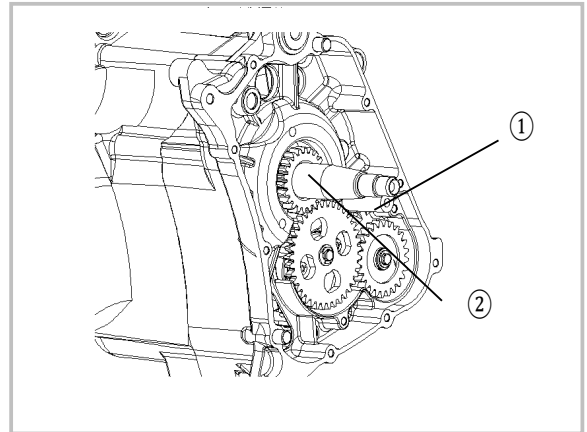
①: starting idle gear ②: one-way clutch assembly
③: right crankcase cover



Take off the oil pump gear and water pump gear.

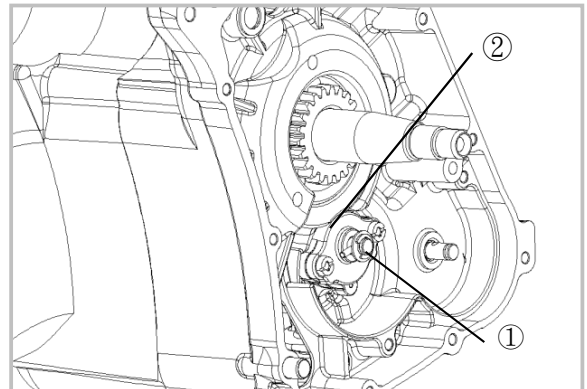
①: water pump gear

②: oil pump gear



Remove the bolt ①.

Remove the oil pump ②.

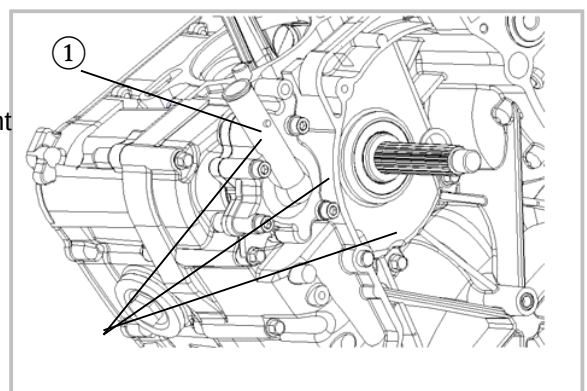


Remove the water pump bolt and closing bolt.

Remove the water pump.

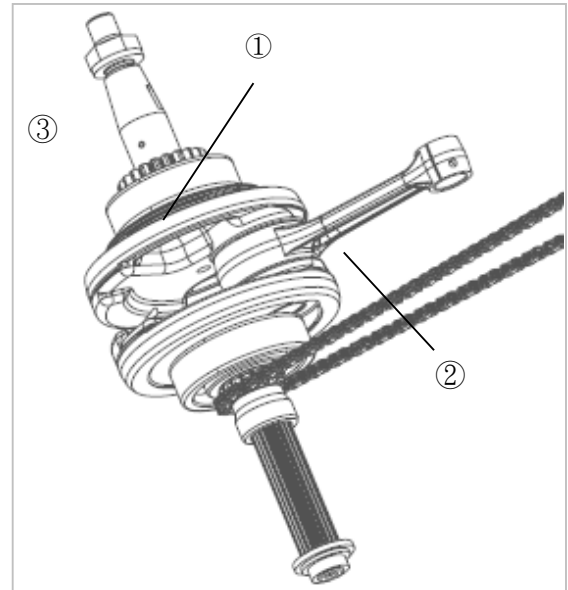
Put the left crankcase under the water and remove the right crankcase.

①: water pump



Remove the crankshaft connecting rod assembly.
Take off the timing chain.

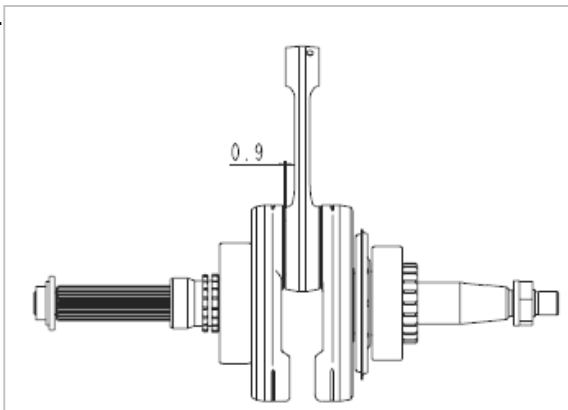
- ①: crankshaft assembly
- ② : timing chain
- ③: bolt



Inspection

Measure the right-left clearance of connecting rod big end.

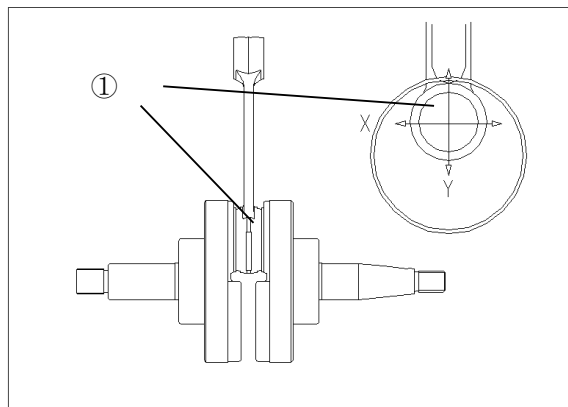
Usage limit: 0.9mm



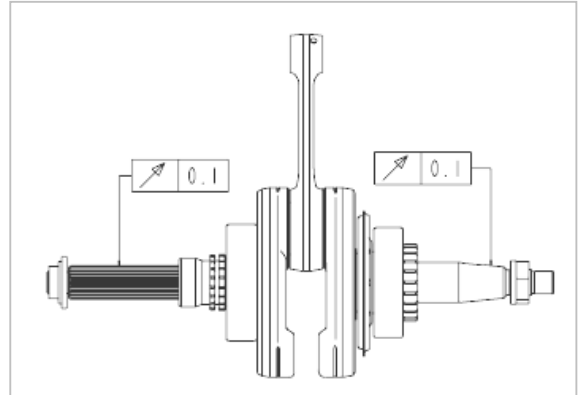
Measure clearance between X-Y orientation
of connecting rod big end

Usage limit: 0.05mm

- ①: connecting rod

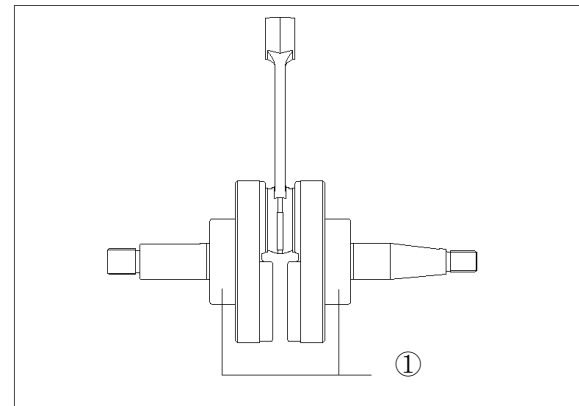


Shimmy measurement
Usage limit: 0.1mm



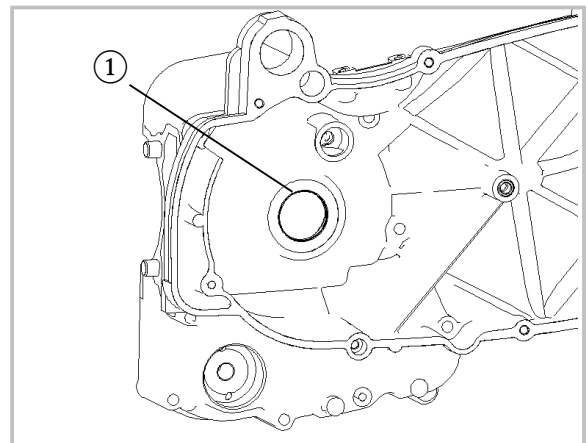
Check whether the crankshaft bearing revolution has noise or loose condition.
If there is noise or loose condition, replace the crankshaft assembly.

①: crankshaft bearing



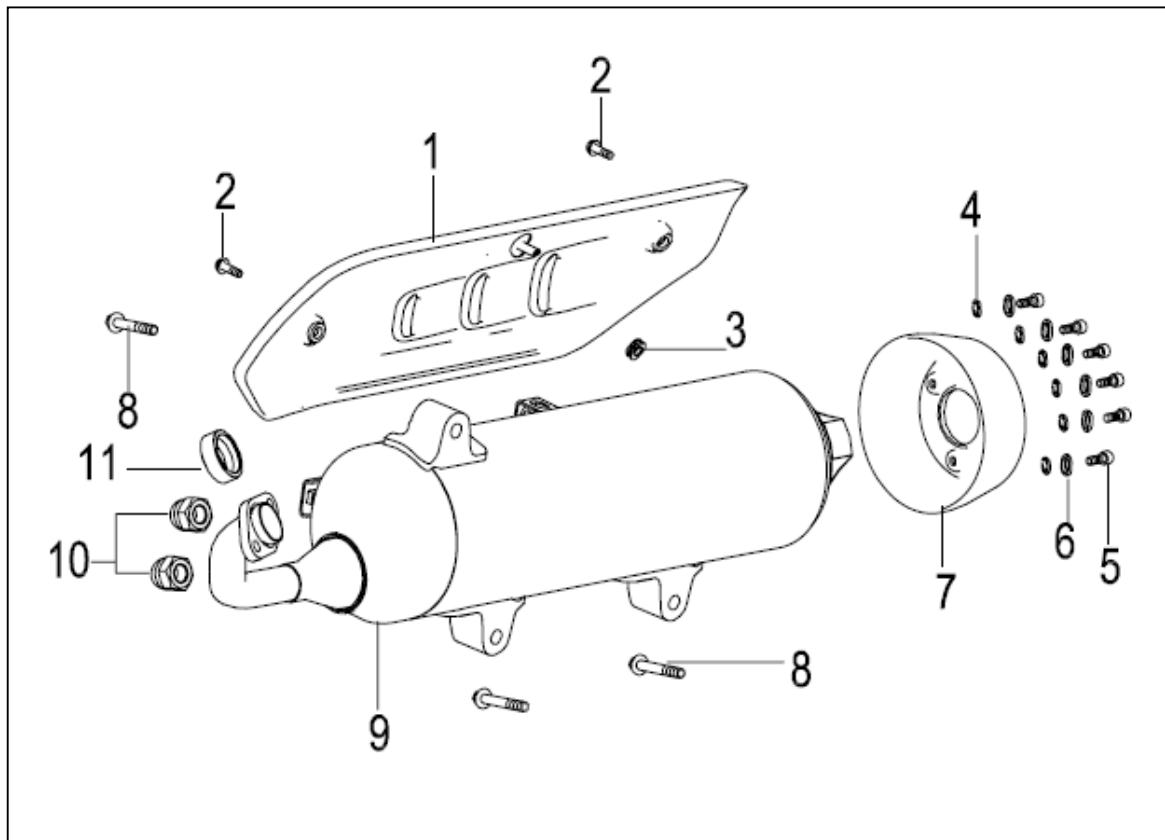
Remove the oil seal of left crankcase.
Note: The removed oil seal is non-reusable.
Use special tools to remove oil seal.

①: oil seal



Installation
Assemble crankcase according to reversed sequence of removal.
Note:
Install oil seal with special tools, in case the oil seal is damaged.

Inspection and Maintenance of Emission Control System Muffler



- 1.) Heat shield 2.) Bolt M6×16 3.) Rubber damper 4.) Lock washer $\phi 6$ 5.) Screw M6×12 6.) Washer $\phi 6$ 7.) Muffler end cap 8.) Bolt M10×95 9.) Muffler assembly 10.) Nut M8 11.) Muffler gasket

16. Emission control system

Emission control system recognizance-----	16.1
Regular maintenance notes/guarantee of Emission standards----	16.2
Mechanical function of exhaust gas control system-----	16.3
Catalytic transfer system-----	16.4
Measures for idle Emission value over defined value-----	16.5

16.1 Emission Control System Recognizance

1. The Emission system of this motorcycle is in conformity with the revision of EC/97/24/5/I and 2002/81/EC B stage by EU. We can assure you the quality under absolute normal use and proper maintenance according to the provision within effective service life.

2. Scope of warranty

1) Function warranty of Emission control system

We guarantee within the usage range (15,000 kilometers), all items conform to the periodic or irregular exhaust gas inspection implemented by the government institutions.

3. The following conditions are not covered by this warranty clause. If there is need of maintenance and repairing, the distributor or service center at each province and municipality of our Company will provide the best service to customers with reasonable prices.

1) Those without periodic maintenance within the time or kilometer specified by our Company.

2) Those without the periodic inspection, adjustment or maintenance by the distributor or service center of our company, or those who cannot submit the maintenance records.

3) Overload or misuse.

4) Change the motorcycle casually, remove the original parts or fill other equipment.

5) Used for racing or usually ride on the road suitable for non-motorized vehicle.

6) Damage because of weather disasters such as typhoon and water calamity etc. or damage and failure resulting from the neglect in use, motorcycle accident and foreign object striking.

7) Long term out-of-use without periodical maintenance.

8) The odometer is damaged without timely repairing or human-caused falsification, out-of-use and replacement.

9) Take the motorcycle to the inspection station to inspect the exhaust gas periodically every three months.

New motorcycle of our company has been inspected for noise with a result in conformity with EC 97/24/9 by EU.

16.2 Regular Maintenance Notes

- The state gives provisions for motor vehicles to conform gas pollutant emission standards to all manufacturers to ensure that the environmental pollution doesn't get worse. Apart from keeping with the gas pollutant emission standard in our production, our company makes great effort in gas purification and gas pollutant reduction.
- This motorcycle undergoes strict examination before leaving the factory with all qualities in conformity with gas pollutant emission standards. We formulate the regular check list concerning gas emission as follows in consideration of different use condition by customers. The use is requested to carry out regular checks, adjustments or maintenance according to the scheduled time to ensure normal emission.
- If other problems occur, please contact Benelli distributors or a Benelli service center for help.
- Relevant Emission provisions are shown as follows:

Emission provision	CO	HC	NO _x
Emission standard	≤2.0g/km	≤0.3g/km	0.5 g/km

※ If any changes about Emission provision, the latest national provision shall prevail.

- The company is not responsible for the ban of motorcycles that do not receive regular maintenance according to Benelli distributors or Benelli service center. Please do the necessary check frequently so as to keep a good motorcycle condition.

Note: ① Increase frequency of washing air filter if your motorcycle runs on sandy/gravel roads or under heavily polluted environments so as to extend its service life.

② Motorcycles which often run at high speed or with high mileage shall be maintained frequently.

Please pay attention to the following to make Emission meet standard:

- 1) Use of fuel: please use lead-free gasoline.
- 2) Please use defined machine oil.
- 3) Maintain the vehicle according to the regular maintenance table.
- 4) As to the exhaust gas emission control system, arbitrary adjustment or replacement is forbidden (including adjustment on the use of spark plug, idle speed, ignition timing, etc).
- 5) Cautions:
 - Since the disorder of ignition system, the charging system, and the fuel system has great influence on the catalytic system, please come to designated distributors or service center of our company for examination, adjustment or maintenance if any disorder of the above ones occurs.
- 6) The exhaust gas emission control system of the vehicle is in line with relevant provision of our country, make sure to use the quality components of our factory if needed, and receive service from designated distributors and service centers.

16.3 Mechanical Function of the Emission Control System

In general

Solution for exhaust gas is based on two-stroke single-cylinder motor and carburetor, which adopts gas-intake device to maintain qualified exhaust gas standard, meanwhile the fuel evaporative exhaust gas adopts active carbon canister.

* Engine improvement

Improve the engine elements such as spark plug, combustor, compression ratio, ignition time, Emission system, etc. in order to meet high intake and Emission efficiency and try for enhance combustion efficiency.

* Gas-intake device

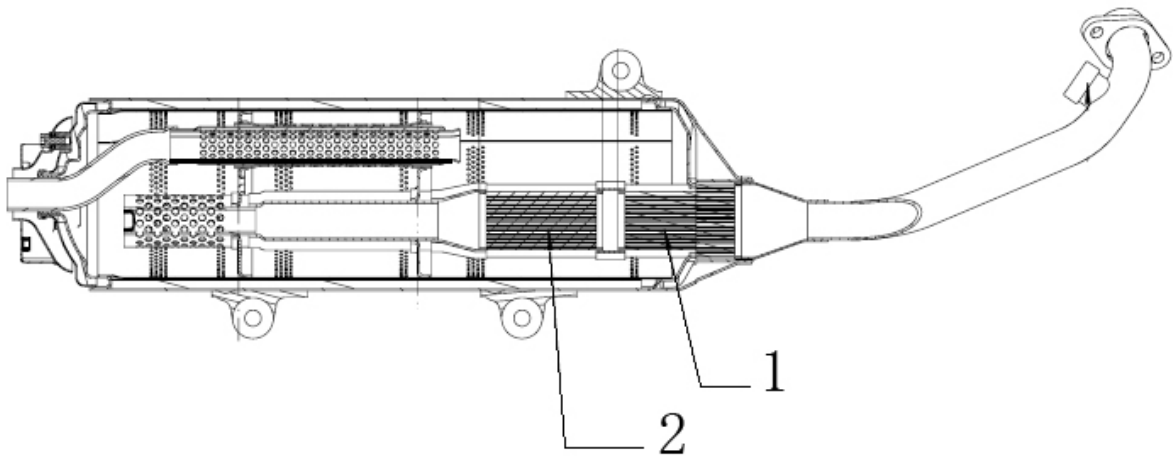
Intake gas into gas Emission tube, make incompletely burnt CO and HC react to form harmless gas.

Division	Device	Component	Purpose
Exhaust system	Catalytic device	Catalytic transfer	Canister oxidation catalyst in the center of gas Emission tube actualizes oxidation of CO, HC and

- Adjustable parameter and advised set value
 - Adjustment of idle speed – engine speed
1500±100rpm/min dense of CO 0.5-1.2%

16.4 Catalytic transfer system

16.4.1 Structure:



1: Primary Catalyst Location

2: Secondary Catalyst Location

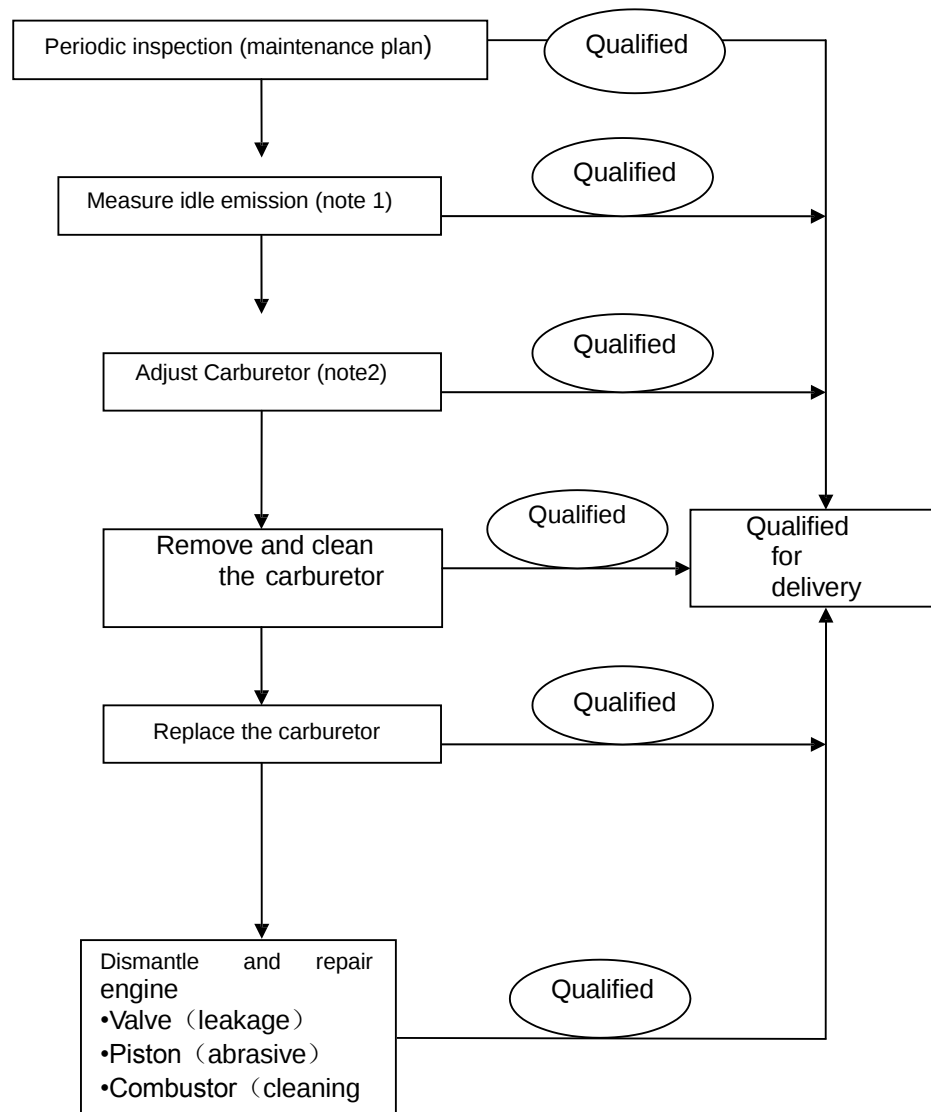
16.4.2 Instruction:

1. Function of transfer catalyst is to transfer completely burnt HC, CO and NO_x to harmless gas such as H₂O, CO₂, and N₂ for Emission.
2. Transfer catalyst includes rare metal such as platinum and rhodium. Only lead-free gasoline can be used.
* Note that lead gasoline may invalidate catalyst.

• **Notes in maintaining motorcycles (gas Emission tube) with catalytic transfer:**

- 1) For motorcycles with transfer catalyst, when the motor is running or just shut down, it shall not be touched because of high temperature.
- 2) Motorcycle with transfer catalyst shall not be near flammable material.
- 3) There is CO inside gas Emissions, which is harmful to health. So do not run the motor in a closed space.
- 4) Motorcycle with transfer catalyst shall not use lead gasoline. (prevention for catalytic poison) .
- 5) Do not push motorcycle to run motor. If it is necessary, you must stop for temperature of motor and catalyst to lower down.
- 6) Do not shut off the motor with gear up when running downward.
- 7) Do not drive motorcycle with bad ignition.
- 8) Do not remove spark plug and run motor to see whether there is spark in maintain motor ignition system. If necessary, the time shall be short.

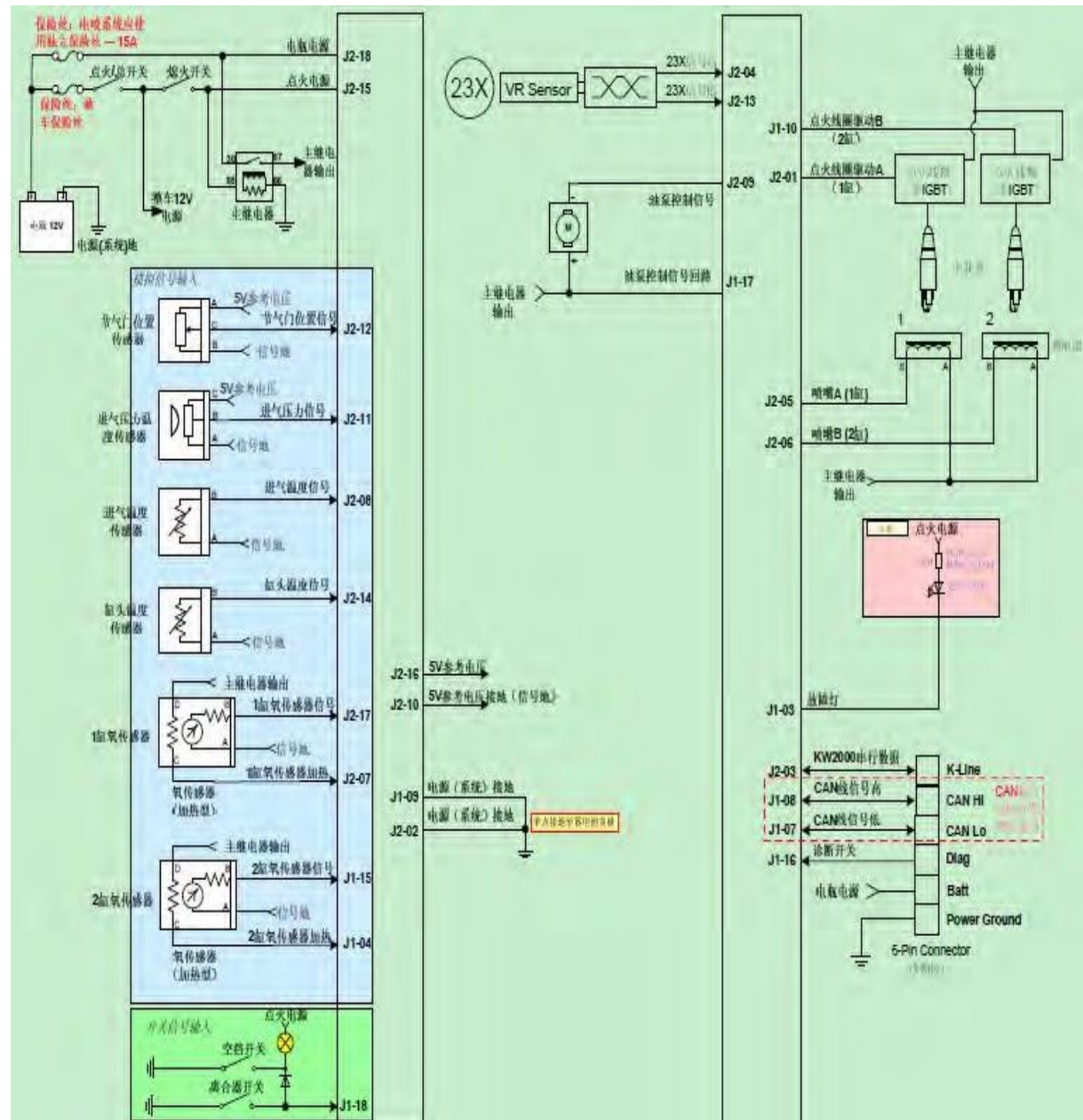
Measures When the Idle Speed Emission Value Exceeds the Standard



Note:

1. Measure it with the idle speed measurement program.
2. Adjust the engine speed with stop screws to live up to requirements and measure CO/HC at the idle speed.

Inspection and Maintenance of Electronic Fuel Injection (EFI) System



17. Electronic Fuel Injection System

Electronic Fuel Injection System-----	17.1
Components of Electronic Fuel Injection System-----	17.2
Failure Diagnosis-----	17.3
Common Troubleshooting-----	17.4

17.1 Introduction of Electronic Fuel Injection System

ZAFFERANO adopts the small-scale engine electronic fuel injection system manufactured by Delphi Company, which is controlled with oxygen sensors within a closed loop. The three-way catalytic converter would go through treatment with the gas after combustion in the engine, turn it into harmless gas and release it into the air. This system adopts the closed-loop independent function that can efficiently eliminate the manufacturing differences within the system and the other corresponding components, highly improving the integrity of the motorcycle, which can also reduce the deviations of the motorcycle after some time of actual use.

Notice:

Please power off and stop the fuel pump before disconnecting the high pressure fuel hose, and make sure the oil channel is closed. When disconnecting the fuel hose, be careful not to pollute the electronic component due to fuel spills.

Gasoline is a flammable and combustible liquid, so the operation shall be carried out in such a place with good ventilation

Cut off the power switch before removing the sensor plug.

The operation shall be carried out in a place with good ventilation, so that the electronic component may not be corroded by water.

After the removal of throttle, certain measures shall be taken to prevent the entrance of foreign objects. Use proper force to remove the socket of electronic component, or the electronic component may be broken.

Failure Diagnostic

Abnormal start, start failure, flameout, unstable idling

Fuel pump failure Blocked fuel pipe Fuel pump failure

Blocked gasoline filter; ECU data problem; improper gas mixture

Blocked gasoline pipe Gas leakage in the conjunction of air inlet

cracked pipe of air sensor Clogged fuel injector Poor position of idling bolt

ECU data problem sensor

failure sensor failure

Too much fuel in engine rarefied gas mixture

Fuel injector leakage blocked fuel injector

Over high pressure in oil pipe over low

pressure in fuel pipe Secondary air inlet in fuel system

ECU data problem Bad fuel sensor failure

ECU data problem air inlet system leakage

Ignition system failure

Blocked air filter

Gas mixture to thick
 Fuel injector leakage
 rarefied air mixture
 Fuel pressure problem
 ECU data problem sensor failure
 Blocked airway

17.2 Components of Electronic Fuel Injection System

17.2.1 Engine Controller (MT05 ECU)

The engine controller can test the operation conditions of the engine with various sensors at any time and guarantee the emission and economy of fuel by proper computing and self-study control output mechanism with the driving performance optimized. Once failures are found within the engine, the control would go through automatic diagnosis. The normal working of the system requires two ECU.

17.2.1.1 ECU Appearance



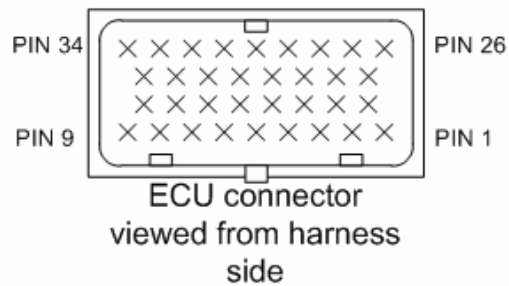
Above is the label of the ECU controller, which contains the type, component number, client number, hardware number, production number, software edition and bar code of the ECU. Such information shall not be erased or stained, or it will impact the guarantee of the product.

17.2.1.2 ECU Definition of ECU Connector Pin

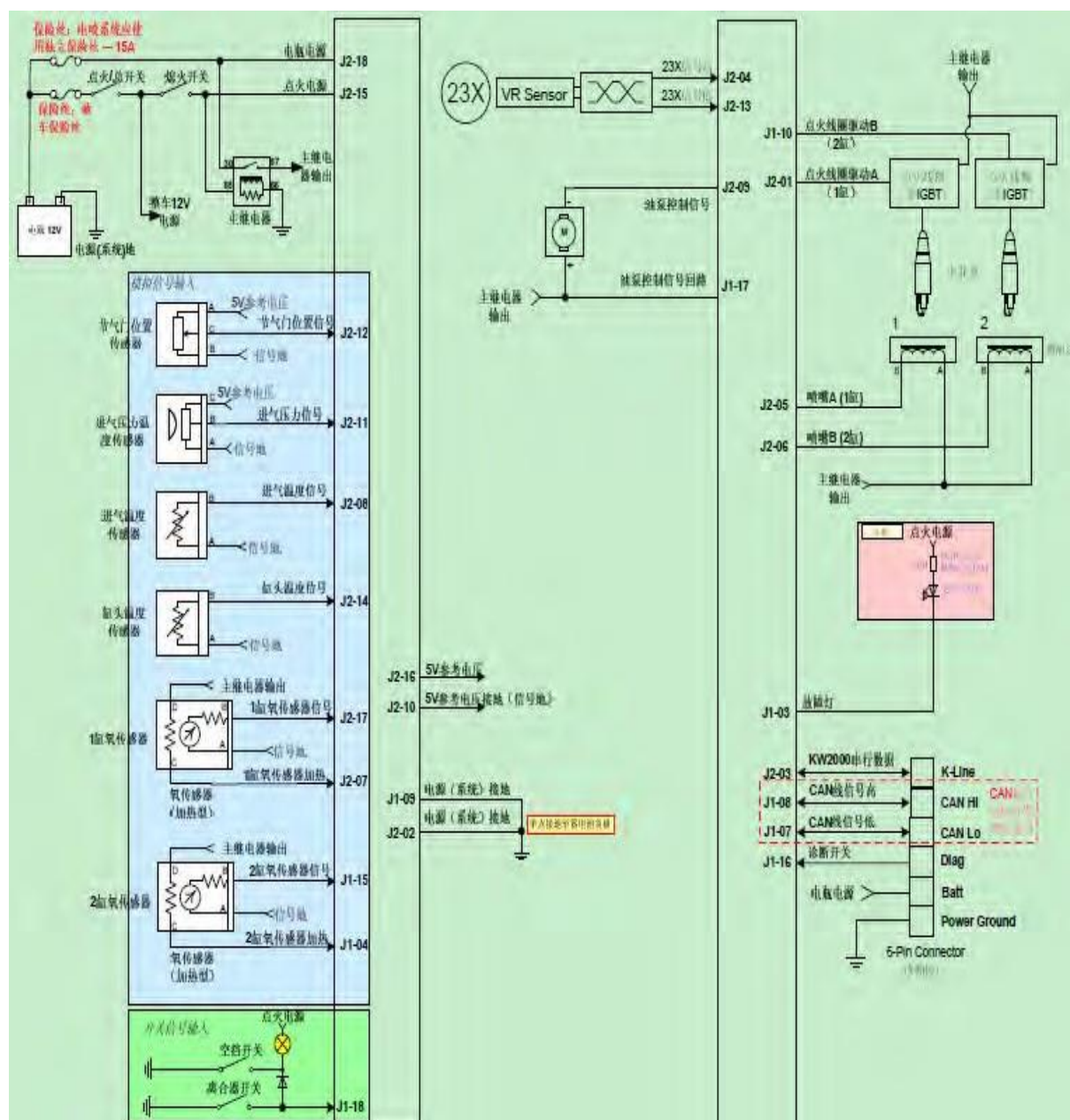
1) ECU 12:

J1-1		J2-1	Pin for activating 1-cylinder ignition coil
J1-2	Headlight control pin	J2-2	Pin for system grounding
J1-3	Pin for trouble light	J2-3	Pin for K line communication
J1-4	Pin for heating 2-cylinder oxygen	J2-4	Pin for crank signal high potential

	sensor		
J1-5	Pin for signal 2-cylinder oxygen	J2-5	Pin for activating 1-cylinder fuel injector
J1-6	Connector pin for tachometer	J2-6	Pin for activating 2-cylinder fuel injector
J1-7	CAN line low signal 1 pin	J2-7	Pin for heating 1-cylinder oxygen sensor
J1-8	CAN line high signal 1 pin	J2-8	Pin for intake temperature sensor signal
J1-9	Pin for system grounding	J2-9	
J1-10	Pin for activating 2-cylinder ignition coil	J2-10	Pin for 5V system reference voltage grounding
J1-11		J2-11	Pin for intake pressure sensor signal
J1-12		J2-12	Pin for throttle position sensor signal
J1-13		J2-13	Pin for crank signal low potential
J1-14	Dump switch (efficient at low)	J2-14	Signal pin for water temperature sensor
J1-15		J2-15	Ignition power (12V positive voltage after key)
J1-16		J2-16	
J1-17		J2-17	Pin for signal 1-cylinder oxygen sensor
J1-18	Pin for clutch system gear switch	J2-18	Battery power supply (battery 12V positive voltage)
Remarks:			
J1 indicates grey connectors on ECU, and J2 indicates black connectors on ECU. J1-1 means No. 1 pin on ECU grey connector.			



17.2.1.3 Circuit Diagram of Electronic Injection System

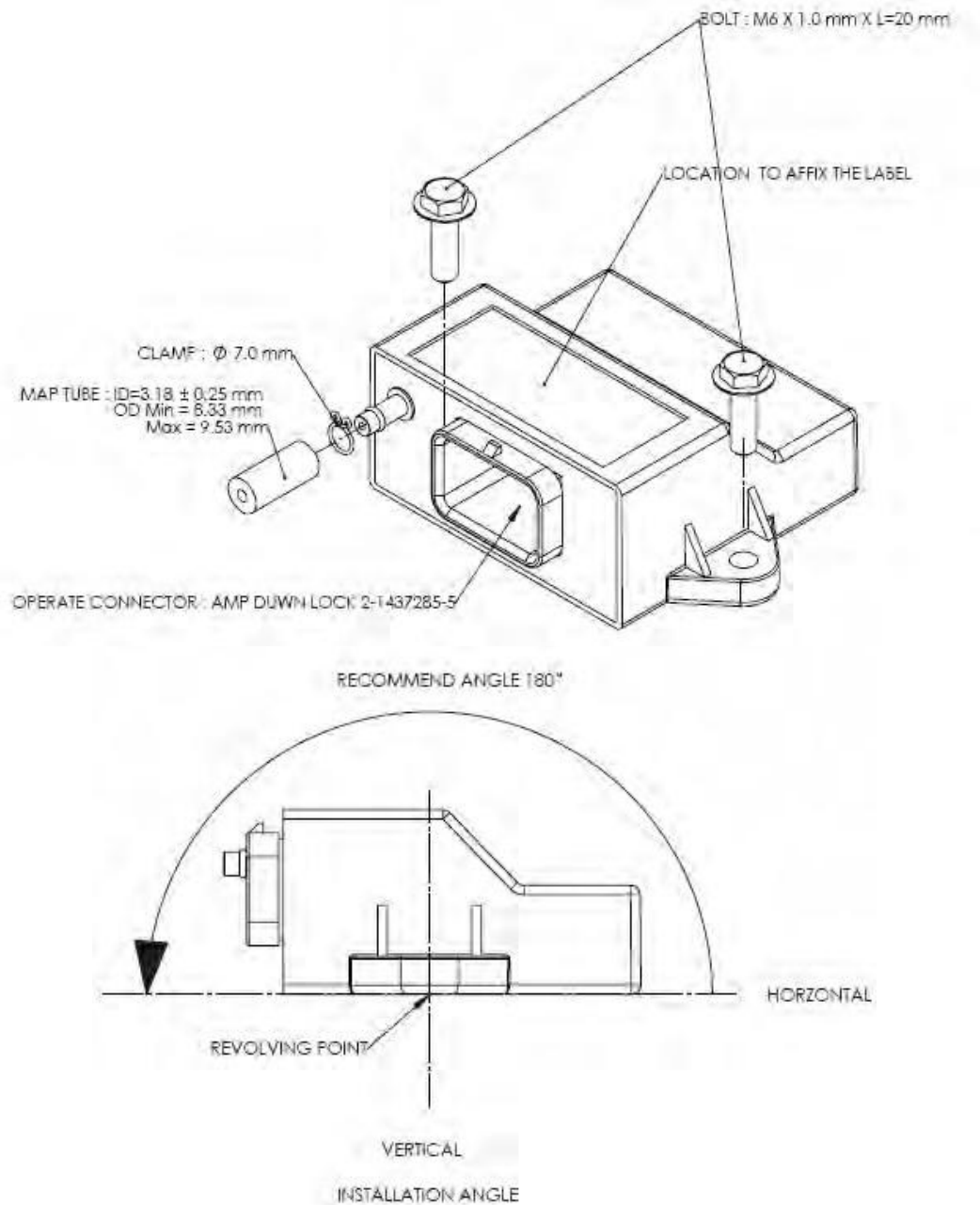


Notes:

- Keep ECU away from places of high temperature, like muffler or engine;
- Keep ECU away from water, engine oil or any places of liquid;
- Keep ECU away from mud or other dirt that would affect the heat dissipation function of ECU;
- Connect with M8 bolts and make sure the tightening torque is around 3.9Nm, keep the surface neat to prevent outside force to ECU in case of circuit board bending;
- The DC power supply voltage of ECU of normal working is between 9V and 16V. When it's working under a voltage not over 26V for one minute, permanent damage would not happen to ECU, neither when the backward voltage is not over 13V.

17.2.1.4 Installation requirements

The installation requirements for ECU controller are shown in the figure below (the tightening torque force for fixing bolts (M6) is 5 Nm).



17.2.1.5 Maintenance Instructions

Instructions on ECU controller	
Instruction	Cause
DON'T: Place ECU beside the engine or the exhaust pipe during transfer.	The service life of ECU is affected by high temperature which also easily damages the plastic shell of the ECU.
DON'T: Place ECU in water, oil or liquid environment.	ECU is sensitive to liquid.
DON'T: ECU is covered with mud or water.	Unfavorable for heat dissipation of ECU surface.
DON'T: Power connection to ECU randomly.	It seriously affects ECU function and definitely damages ECU.
DON'T: Water or too much vapor on the connector.	Short-circuit of ECU connector or a damaged ECU.
DON'T: Clean ECU with agent or corrosive liquid.	Damage ECU shell.
DO: Clean ECU with a wet cloth and keep it dry.	Prevent ECU from damage.
DO: When the ECU is reinstalled, check whether the air intake pipe is blocked. If yes, clean it.	Maintain vehicle performance.
DO: When the ECU is reinstalled, fix the air intake pressure pipe and ensure no leakage. Clamps and air intake pressure hoses shall match with the vehicle	Maintain vehicle performance.
DO: Keep the air intake hose always connect ECU and intake manifold.	Prevent dust from entering into the engine to ensure safety.
DO: When the air intake hose is pulled out from ECU, loosen the clamp at the joint and then pull the hose carefully from the ECU.	Prevent joints inside ECU from being loose and coating from being damaged.

17.2.1.6. Power Supply Requirements

- Power on:
Under normal conditions, the input voltage from battery keeps stable. When the ignition switch closes and the battery voltage exceeds 6.5V, ECU starts to work normally.
- Operation:
When the EFI system works, the battery voltage shall keep it between 9-16V to ensure normal operation of the system.
- Power down:
When the ignition switch is turned off, the ignition voltage is below 6.2V, the ECU enters into power down condition. ECU records values in EEPROM, such as fault codes, frozen fault codes, closed-loop values, revised air flow values and throttle values. Based on these values, it enables precision calculation of each parameter for the next startup.

- Reset mode:

When the ECU receives a reset command or faces a serious problem, the system enters into the reset mode. All I/O interface is reset to the predefined state and enters into normal working conditions after the reset is finished.

- Overvoltage/counter-voltage:

ECU, which works under overvoltage of 24V for no more than 1 minute, will not be damaged. ECU, which works under counter-voltage of 14V for no more than 1 minute, will not be damaged.

17.2.1.7 Working temperature

- Normal working temperature range: -22°F to 158°F
- Maximum working temperature: 176°F (continuous work for no more than 30 minutes)
- Storage temperature range: -40°F to 185°F

17.2.1.8 Maintenance and repair

The controller cannot be maintained after sale. When there are any problems, make sure whether it is caused by calibration or software first. If it is caused by calibration or software, update the calibration software. If any controller hardware fails or is damaged during the warranty period, the controller must be sent back to the factory, attached with detailed controller component number, serial number, vehicle type, date of production, accumulated miles, where used, and date of return.

17.2.2 Fuel injectors

17.2.2.1 General working principle:

The fuel injector is designed with an electromagnetic coil around an iron core inside. Two electrodes from the electromagnetic coil are the input control interface of the fuel injector. When the coil is connected to power, the electromagnetic attraction suppresses spring force and fuel pressure of the ball valve, and raises the valve. Thus, high-pressure fuel in the fuel pipe (250~400kPa) runs through the valve seat hole and the orifice plate, forms a cone-shaped fog and injects it to the intake valve. After the injector is disconnected, the magnetic force of the electromagnetic coil vanishes automatically, and the ball valve of the fuel injector closes automatically under the action of the return spring, which stops fuel injection.

17.2.2.2 Appearance of the fuel injector:



Check

Check whether the fuel injector is blocked; clean it with special equipment (such as ultrasonic) or special detergent;

Check whether there is fuel leakage from the fuel injector; if yes, replace it with a new fuel injector of the same part number;

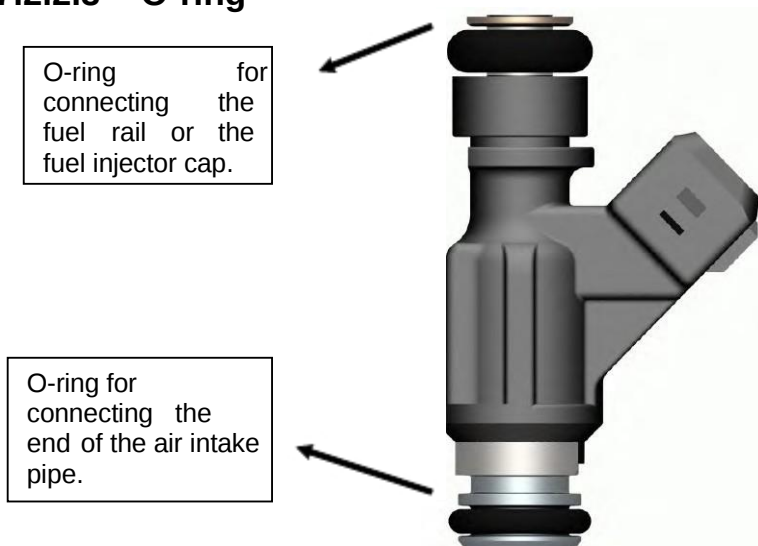
Check whether the electromagnetic coil of the fuel injector is damaged: measure resistance of the electromagnetic coil with a voltmeter; if it displays about 12ohm, the electromagnetic coil works normally; if it displays infinite, there is open circuit and the fuel injector has to be replaced.

Check whether the o-rings of the fuel injector is damaged or hardened; if yes, replace the o-rings.

Instructions:

- The fuel injector is designed with a filter inside which is irreparable. It is only used for filtering accumulated impurities in the fuel pipe between the fuel filter and the fuel injector. Impurities will cause failure such as bonding, flow deviation and leakage. Therefore, the fuel filter is very important.
- Replace it only with a new fuel injector of the same part number.

17.2.2.3 O-ring



O-ring shown in the 12 is able to ensure that there is no leakage in the fuel injector when working at between -40°F and 302°F. It also resists corrosion from all kinds of fuel additives (such as ethanol). The current o-ring design is shown below. If any DELPHI fuel injector is not consistent with following data, please contact DELPHI.

O-ring for connecting the fuel rail or the fuel injector cap

- Dimension:
- Inner diameter: 6.35mm
- Outer diameter: 14.85mm
- Section thickness: 4.25mm

O-ring for connecting the end of the air intake pipe

- Dimension:
- Inner diameter: 9.61mm

- Outer diameter: 14.49mm
- Section thickness: 2.44mm

17.2.2.4 O-ring replacement

- Use the suggested lubricating oil to lubricate the o-ring. Do not contact the orifice plate with lubricating oil, otherwise it affects fuel injection.
- We suggest that an o-ring can be used only once. If replacement is impossible, please check whether it is damaged before repeated use. Any minor damage will cause fuel leakage. To avoid any danger, please strictly comply with requirements to install the fuel injector.
- When an o-ring is installed onto the fuel injector, please be careful and do not damage the o-ring.

17.2.2.5 Suggested lubricant

For the convenience of fuel injector installation, lubricant shall be applied to the o-ring. The table below lists applicable and proved lubricant. According to tests, the following lubricant will not affect the performance of fuel injector.

Suggested Lubricant		
Name of lubricant	Manufacture	Viscosity (cSt) @40
Spindura1	Equilon	10
Spindura2	Equilon	21
DTE-24	Mobil	32
DTE-25	Mobil	46
DTE-26	Mobil	68
Norpar15	Exxon/Mobil	<1
Drawsol60	DAS Stewart	1-2
NocoLubeAW46	NOCO Energ	46
NocoLubeAW32	NOCO Energ	32
Advantage Spindle Oil	Advantage Lubrication Specialties	10

17.2.2.6 Over-voltage effect

The fuel injector can work under the voltage of 26V and pulse width of 100ms (200ms for a cycle) for 1 minute (with fuel). It does not affect flow or cause permanent damage to the electromagnetic coil or reduce the electromagnetic performance.

17.2.2.7 Temperature range

The standard temperature range of fuel injector is as follows. Under normal temperature range and normal flow tolerance, M3 and M3.5 fuel injector cannot be invalidated. Meanwhile, under normal work environment, fuel injectors can not cause any leakage, aging or shortened service life.

Work temperature range: -22~257°F

Work limits (leading to some performance degradation): -40~302°F

Storage temperature: -76~140°F

17.2.2.8 Fuel contaminants

The fuel injector is designed with a filter inside which is irreparable. It's only used for filtering

accumulated impurities in the fuel pipe between the fuel filter and the fuel injector. Impurities will cause failure such as bonding, flow deviation and leakage. Therefore, the fuel filter is very important.

17.2.2.9 Cable arrangement

- Cables of the fuel injector shall be deployed far away from heat source and protected from any external abrasion or damage.
- Do not insert/pull the fuel injector connector if it is not necessary.

17.2.2.10 Instructions

Instructions on the fuel injector	
Instruction	Cause
DON'T: use o-ring repeatedly. If it has to be used repeatedly, please check whether it is damaged before use.	Avoid leakage.
DON'T: immerse the injector mouth in lubricant.	Block the injection hole.
Forbidden: dry run under no fuel pressure.	Damage inner mechanical parts.
DON'T: operate the fuel injector whose leakage rate may exceed standards (leakage rate >50sccm air).	Eliminate contaminants and analyze causes for injector interference.
DON'T: allow water to enter into the fuel pipe during leakage rate inspection.	Cause damage to the fuel injector.
DON'T: Impose force on the fuel injector head during installation.	During installation on the nylon intake pipe, it is allowed to impose force at the angle of 45 degree.
DON'T: strike the fuel injector when it is installed on the intake pipe.	Damage the fuel injector and o-ring.
DON'T: impose tensile force on the connector.	Cause interrupted power supply.
DON'T: use a fuel injector which has been thrown.	Possible damage.
DON'T: store fuel injector, fuel rail or engine with fuel injector installed under non-protective environment.	Possible damage to electronic and mechanical components of the fuel injector by the external environment.
DON'T: pick up the fuel injector when lifting the assembly.	Damage the fuel injector.
DON'T: allow components to contact each other during storage.	Damage the fuel injector.
DON'T: allow components to contact each other during transportation.	Possible impact, which may cause damage to the fuel injector.
DON'T: hammer the fuel injector for troubleshooting in the case of an error.	Damage the fuel injector.
DON'T: use non-suggested fuel injectors instead of original fuel injectors.	Significantly affects the performance of the fuel injector.
DO: note that the o-ring shall not be cut	Protect the o-ring.

By the installation seat during the installation of the fuel injector.	
DO: install it into the hole after being applied with correct lubricant.	Protect the o-ring and reduce pollution.
DO: test the fuel injector adhered to the needle valve or whose needle valve fails in seating. (pulse to the fuel injector with the voltage between 9-15V for less than 5 seconds)	Confirm the invalidation of the fuel injector.
DO: before the fuel injector is assembled, carry out fuel leakage test to confirm seating of the needle valve.	The needle valve of the fuel injector may fail in seating during transportation or transfer, which causes fuel leakage.
DO: avoid liquid pollution to the fuel injector.	Cause short-circuit of the electromagnetic coil.
DO: carefully install/remove the cables.	Cause damage to terminals.
Should: use suggested lubricant during the installation of the connector.	Cause corrosion to terminals.
DO: do not use dropped, damaged or unqualified components, and label them to indicate problems.	Find causes to problems as soon as possible.

17.2.2.11 Installation Requirements

Please strictly comply with following instructions for installation and disassembly to avoid damage to fuel injectors and electronic components.

- Lubrication: apply a little lubricant to the lower part of the o-ring. Do not use ISO 10 light mineral oil or equivalent product.
- If it is possible, it is better to apply lubricant to the fuel injector seat other than the o-ring. Thus, it can minimize pollution to the fuel injector.
- Do not make the orifice plate contact with lubricant, which affects the volume of fuel injection. Do not pick up lubricant with the top of the fuel injector.
- All fuel injector o-rings are assembled before delivery. In principle, o-rings are not allowed to be used repeatedly. Please check whether there is any damage to the o-rings. Any minor damage will cause leakage. Install the o-ring into the holder carefully.
- Do not damage the connector when it is installed. The fuel injector connector is properly installed when there is a click sound.
- Do not install or disassemble unnecessary connectors.
- Do not tighten cables too much, otherwise it may lead to short circuit.
- Do not rotate the fuel injector during the installation of the connector, which leads to deviation from the fuel injection targets.

17.2.2.12 Replacement

The disassembly and replacement of the fuel injector are as follows.

Note:**High temperature in the fuel injector and its surrounding parts.**

- The motorcycle flames out.
- Disconnect the negative pole of the battery to avoid any accidental startup of the engine.
- Remove the fuel injector connector.
- Release fuel pressure.
- Remove the fuel rail from the fuel injector.
- Remove the fuel injector from the air intake pipe.
- Remove the fuel injector retention clamp and the fuel injector from the seat carefully.
- Carefully clean impurities on the contact surface of the fuel injector. Do not damage the contact surface.
- Apply lubricant to o-rings on both ends of the new fuel injector.
- Install the new fuel injector into the air intake pipe carefully and make sure it is facing the same direction as the original one is.
- Install the fuel injector seating and the retention clip.
- Tighten mounting bolts with required torque according to the installation manual.
- Install the fuel rail.
- Insert the fuel injector connector.
- Insert the key for power on. Check for fuel leakage from the fuel injector before engine startup.
- Start up the engine to check its operation.

17.2.2.13 Replaceability

Replace the fuel injector with one of the same part number. Part number may change. Please check the vehicle maintenance manual and the list of spare parts to select a correct fuel injector.

17.2.2.14 Fuel Injector Blocked

Accumulated impurities in the fuel can cause flow deviation and reduction of service life. When the engine stops working, deposits may be generated in fuel as heat from the engine runs through the fuel injector head. Deposits accumulated around the fuel injection holes lead to flow deviation.

- If the fuel injector is blocked, it may cause reduced flow, increased friction and accumulated impurities, which finally affects emissions and durability.
- Fuel and environmental factors cause fuel crystallization or corrosion to the fuel injector, which also leads to flow deviation.
- Unsteady fuel oxidation causes the generation of deposits. Please use high-quality gasoline.
- Add a certain amount of fuel injection cleaner to avoid deposits.
- When the fuel injector is blocked, please clean the fuel injector by the following method.

17.2.2.15 Cleaning

- Disconnect the fuel pump first.
- Release fuel pressure and then remove the fuel rail. After the fuel rail is removed, stuff it up with some material to avoid fuel drainage.
- Add fuel injection cleaner and gasoline proportionally to the fuel injector cleaner tank.
- Connect the fuel injector cleaner tank to the fuel injector.
- Adjust the cleaner fuel pressure to the vehicle system pressure of 2.5bar.
- Start up the engine, and keep it at the idle speed for 15-20 minutes.
- Remove the cleaner tank, and re-install the fuel rail to the fuel injector.
- Start up the engine and keep it at idle for 2 minutes. Ensure cleaner is completely removed.

17.2.3 Throttle Valve

17.2.3.1 General Working Principles:

The throttle valve mainly consists of the main cast valve body, return spring, throttle cable, throttle position sensor and idle adjustment screw.

The throttle position sensor provides the movement of the throttle to ECU; the idle adjustment screw is able to control the idle speed and its stability. It reduces the bypass flow clockwise and lowers the idle speed, while increasing the bypass flow counterclockwise will raise the idle speed. Normally, it should be fastened by two turns. All above subsystems work together to achieve the following functions:

- Control the air intake flow
- Control the air flow at idle speed
- Check the throttle position—provide throttle feedback signals to the engine control system
- Provides the throttle with return force

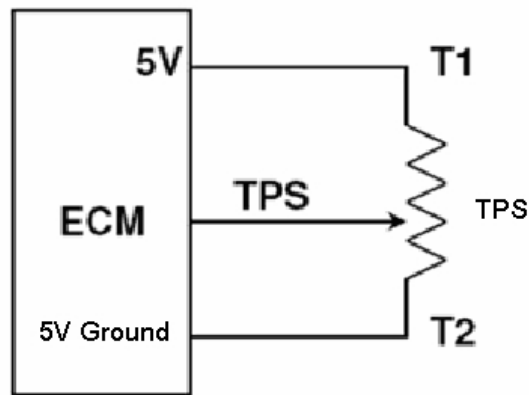
17.2.3.2 Appearance



17.2.3.3 Technical Parameters

Throttle valve (inner diameter: 26mm):

- Maximum flow: $19.29 \pm 1.0 \text{ g/s} @ 0.75 \text{ kPa}$ vacuum degree
 - Torque for opening the throttle valve:
 - At idle speed: $0.19 \pm 0.05 \text{ Nm}$
 - When fully open:
 $0.37 \pm 0.10 \text{ Nm}$
- Throttle position sensor:
- Reference voltage: $5 \pm 0.1 \text{ VDC}$
 - Resistance between T1 and T2: $3 \text{ k} \sim 12 \text{ k}\Omega$



17.2.3.4 Working Environment

Normal working environment: $-40 \sim 257^{\circ}\text{F}$

17.2.3.5 Disassembly of the Throttle Valve

- Power off
- Remove the negative cable of the battery
- Turn off the switch of the fuel pipe
- Loosen the clamp fixing the air cleaner
- Remove the throttle cable from the throttle cable wheel
- Loosen the clamp fixing the throttle valve body with the air intake pipe
- Remove the air cleaner and then remove the throttle valve assembly
- Loosen the clamp fixing the fuel injection rail with the fuel injector cap, and then remove the fuel injection rail.

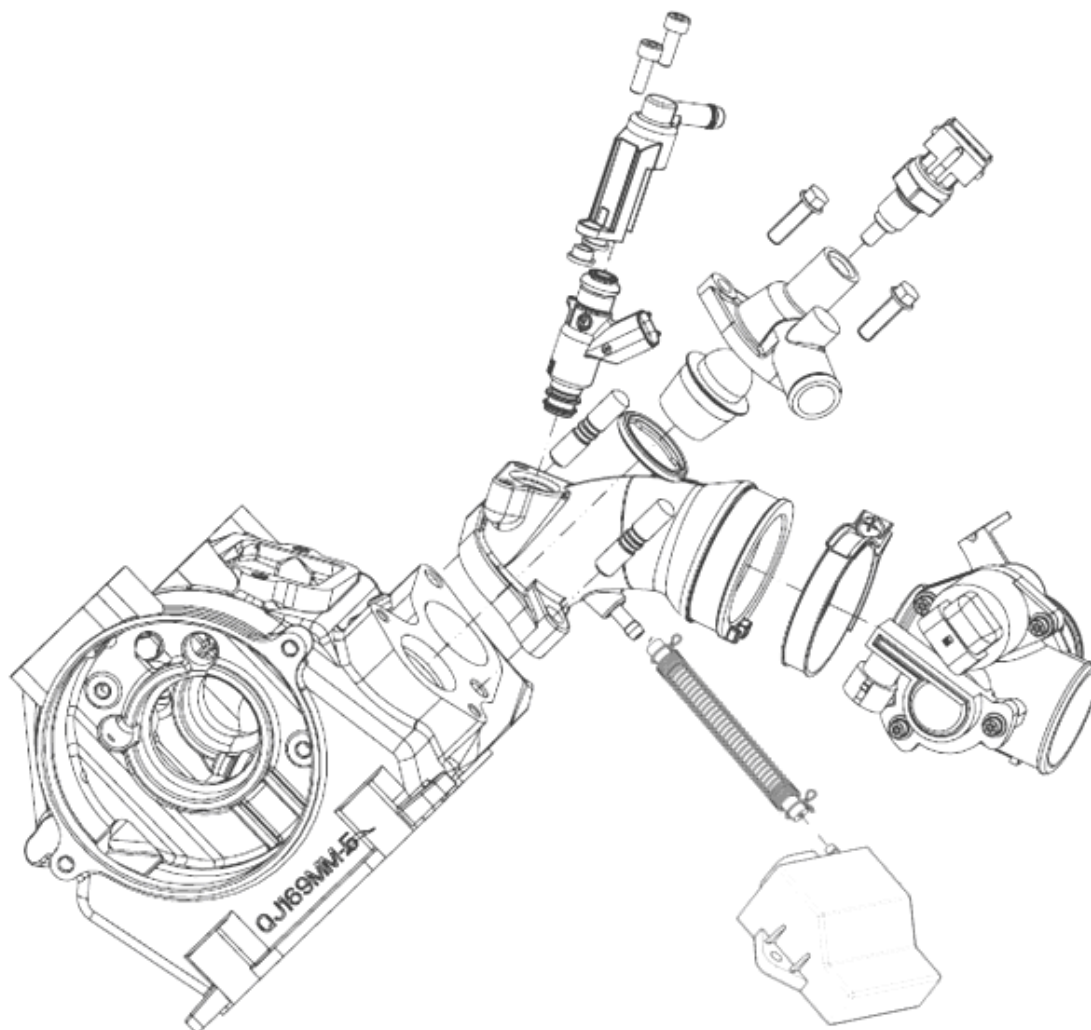
Note:

Residual fuel cannot drop onto electronic components;

Loosen the screw fixing the fuel injector cap
Remove the fuel injector cap and the fuel injector
Remove the fuel injector clamp
Separate the fuel injector cap and the fuel injector

Note:

Do not disassemble the throttle position sensor if unnecessary. A special adjustment and test device shall be used during the assembly of the throttle position sensor to determine whether its assembly position satisfies technical condition requirements.



Check

- Check whether the throttle cable wheel turns flexibly and returns normally; adjust the return spring to be within a reasonable range.
- Check whether the idle adjustment hole is blocked; clean it with detergent periodically.
- Check whether the valve channel is filthy or blocked by fouling; clean it with detergent periodically.
- Check whether the slide rheostat of the throttle position sensor is damaged; if yes, replace the throttle position sensor. (A special diagnosis device is required for check. A special adjustment and test device shall be used for replacement of the throttle position sensor to determine whether its assembly position satisfies technical condition requirements. Do not disassembly it if unnecessary.)

Note:

When cleaning the surface of the throttle valve assembly, please use non-metallic tools and non-strong corrosive agent to clean the internal and external surface.

17.2.3.6 Cleaning

Remove the cover at the bottom of the throttle valve and clean the body with carburetor cleaner (3M product suggested). Spray cleaner on the inner wall of the throttle valve and remove dust and carbon deposit lightly with a brush. Do not block the bypass with impurities.

Note:

Do not block the bypass with impurities.

If idle screws are removed and cleaned, assemble idle screws in following order:

- Install o-ring 1 on the idle bypass screw
- Install spring, washer, o-ring 2 on the idle bypass screw
- Install the above idle bypass screw on the throttle valve

After the idle screw is cleaned and assembled, use the diagnosis tool and adjust the idle speed.

Note:

Note: a new o-ring shall be used every time of installation.

17.2.3.7 Installation of the Throttle Valve

Install the throttle valve in reverse order and pay attention to the following:

- Adjust the throttle cable.
- Ensure all removed components are installed in place.
- Re-install all necessary parts.

17.2.3.8 Precautions

- Do not spray any cleaner into the TPS throttle position sensor.
- Use the throttle cable to open the throttle valve block.
- Do not insert any tool or stick into the throttle valve hole to keep the valve block open. It causes deformation of the valve block and damage to the inner wall of the throttle valve.
- Remove carbon deposits around the valve block to maintain air flow required by idle speed setting.
- Do not adjust the position of idle screws.
- Replace o-rings once disassembled.

17.2.3.9 Instructions

Instructions on the throttle valve assembly	
Instruction	Cause
DO: be careful when the throttle valve connector is used.	Avoid damage to the connector.
DO: avoid any liquid pollution to the throttle valve.	Ensure normal work.
DO: take and install only one piece of throttle valve from the component tray.	Possible damage to components.
DO: use a label to describe any problem related to any fallen, damaged or unqualified throttle valve (within warranty	Accurately analyze causes as soon as possible.
DO: remove and discard protective cap	Protect the system from pollution and keep it working normally.

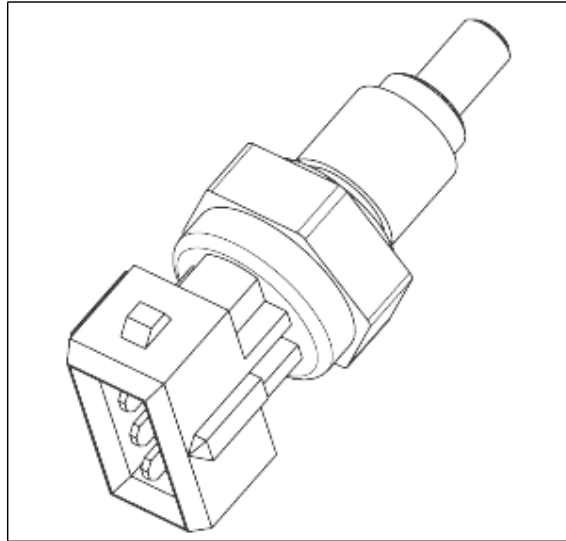
DO: clean bypass when the seat is removed.	Ensure stable idle speed.
DO: if idle screws are removed, replace the o-ring.	Ensure no air leakage from the o-ring.
DON'T: use any fallen or defective component.	Possible inner damage.
Forbidden: no protective cap for storage parts.	Possible impact on normal work due to pollution.
DON'T: no protection during transportation or transfer around salt spray.	Possible impact on normal work due to corrosion.
DON'T: completely exposed to the environment (humidity)	Possible impact on normal work due to corrosion.
DON'T: tested voltage exceeds the system voltage.	Possible damage.
DON'T: use excessively tightening torque.	Possible damage.
DON'T: hammer the fuel injector for troubleshooting when there is an error.	Damage to the fuel injector.
DON'T: components bump into each other when being unpacked.	Possible impact on the minimum air leakage or other damage.
DON'T: completely release the throttle at any position.	Possible damage.
DON'T: block the bypass hole with dirt or sand.	Possible impact on the stability of idle speed.
DON'T: take, store or hold components in a way of possibly touching other parts.	Possible damage.

17.2.4 Water Temperature Sensor

17.2.4.1 General Working Principle

This water temperature sensor for the engine cylinder head is used for water-cooled engines to measure the temperature of the cylinder head. Within the temperature range of this sensor, its resistance varies upon the engine temperature. Its character refers to negative temperature coefficient resistance. It is not maintainable.

17.2.4.2 Appearance



17.2.4.3 Installation Requirements

Dynamic torque requirement: start the threads by hand and torque it to the required torque with a dynamoelectric spanner of a speed over 400r/m. You can also screw it down to the required torque with a spanner by hand. The recommended torques are as follows:

20N·m~25N·m

Static torque requirement:

The torque required for disassembling the sensor from the engine shall not be over 200% of the assembling torque.

17.2.4.4 Working Conditions

- This sensor is primarily used on water cooled engines;
- Normal working temperature: -40~266°F (continuous working)
- Relative humidity of working: 0~100%
- Typical working pressure: under the minimum installation torque, the sensor can seal the engine coolant when the actual pressure is 206.8kPa (30psi) and the temperature is 275°F
- Limit working environment: 1 hour at the highest temperature of 302°F.

17.2.4.5 Storage Environment

- Storage temperature: -40°F to 248°F
- Indefinite transportation under altitude of 13700m

17.2.4.6 Electrical Environment

- Typical working voltage: reference voltage is 5±0.1VDC
- Maximum exciting current: when the feature test of the sensor is regulated under any temperature, its performance shall not be effected by any current lower than 1mA.

17.2.4.7. Sample cleaning

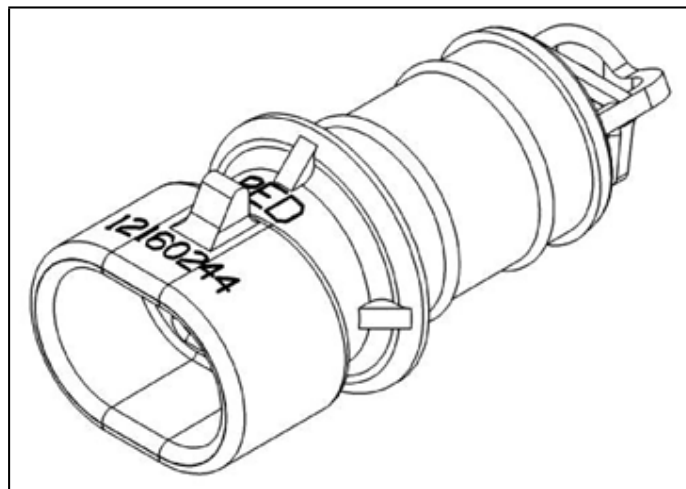
If necessary, the sensor can be cleaned with isopropanol first for not over 1 minute and then air dried. It is required to install a sealed joint in cleaning in case the fluid penetrates into inside of the sensor.

17.2.5 Intake Air Temperature Sensor

17.2.5.1 Working Principle

It is used for measuring the temperature of the intake air. Within the temperature scope of the sensor, the electric resistance would vary with different temperatures of the engine, which is a negative temperature coefficient resistor. The intake air temperature sensor is not a repairable part.

17.2.5.2 Appearance of Intake Air Temperature Sensor



17.2.5.3 Technical parameters

- Working voltage: 5DVC
- Response time: <15S
- Working temperature: -40~302°F
- Relative humidity: 0 to 100% RH

17.2.5.4 Installation requirements

- Suggested mounting hole diameter 12mm
- Suggested mounting hole depth: 12mm to 16mm
- Installation angle to the level >50°

17.2.5.5 Sample Cleaning

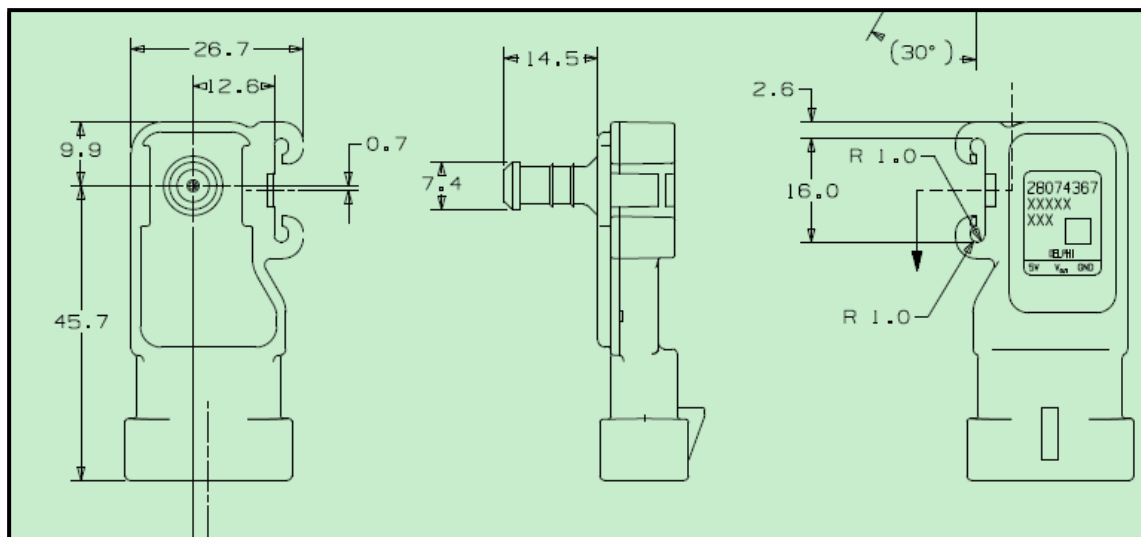
If necessary, the sensor can be cleaned with isopropanol first for not over 1 minute and then air dried. It is required to install a sealed joint in cleaning in case the fluid penetrates into inside of the sensor.

17.2.6 Intake Pressure Sensor

17.2.6.1 Working Principle

This sensor is mainly used for measuring the absolute pressure of the intake bend tube, which, in compliance with the change between the resistance value and the intake pressure, can measure the air input of the engine's combustion chamber indirectly.

17.2.6.1 Appearance



17.2.7 Oxygen Sensor

17.2.7.1 Working Principles

Oxygen sensor is mainly used for measuring the oxygen content within the exhaust pipe of combustion engine and for the fuel closed loop controlling in the engines, which can make sure the combustion of the engine is maintained at a reasonable air-gasoline ratio (14.7).

17.2.7.2 Appearance of the oxygen sensor



17.2.7.3 Technical Parameters

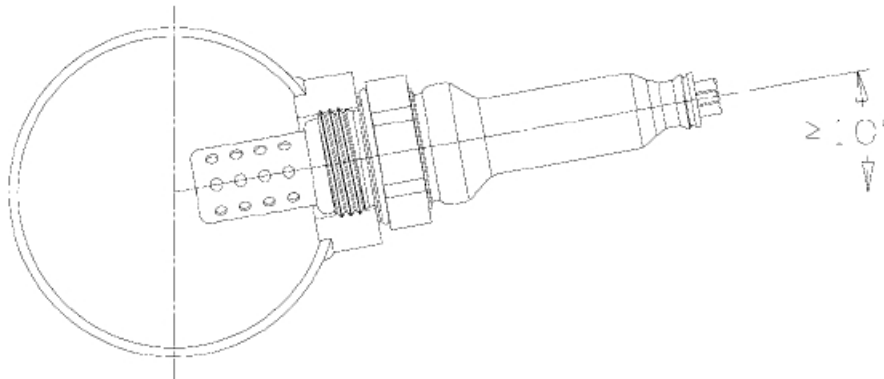
- Air-fuel ratio strong threshold value: $>750\text{VDC}$
- Air-fuel ratio rare threshold value: $<120\text{Mvdc}$
- Heater power of sensor: 7.0W

(the above parameters are received from the measuring stand; working condition: exhaust temperature: 842°F ; air-fuel ratio: 70%; voltage: 10Hz, 13.5V.)

- Resistance of heater: $9.6\pm 1.5\Omega$ (measured lower than 70°F)
- Working temperature scope $500\text{-}1562^{\circ}\text{F}$

17.2.7.4 Installation Requirements

- Installation angle (to the level): $\geq 10^{\circ}$



- Tightening torque: $40\text{-}60\text{Nm}$

17.2.7.5 Fuel requirement

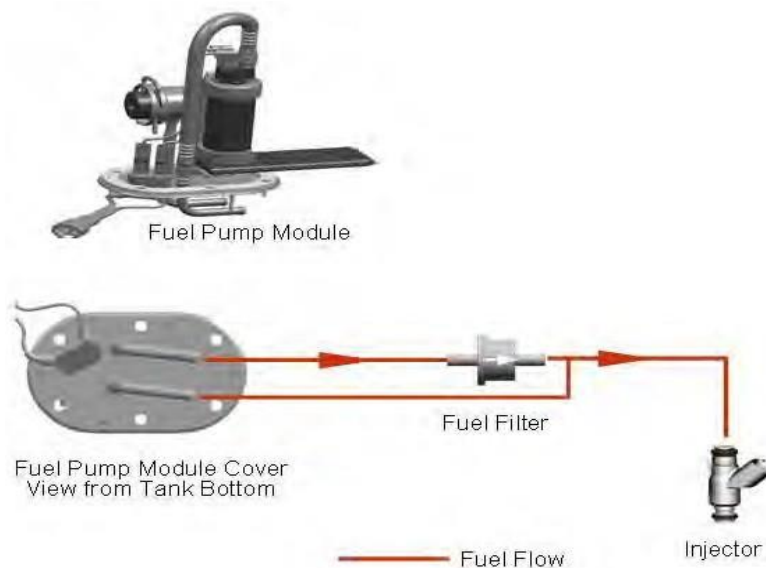
- $\text{Pb} \leq 0.005\text{g/L}$
- $\text{P} \leq 0.0002\text{g/L}$
- $\text{S} \leq 0.04\%$
- $\text{Si} \leq 4\text{ppm}$

17.2.8 Ignition Coil

17.2.8.1 Working Principles

The ignition coil can provide energy to the spark plug. The high voltage wire is used to connect the ignition coil and the spark plug.

17.2.8.1 Appearance



17.2.9 Fuel Pump Assembly

17.2.9.1 Working Principles

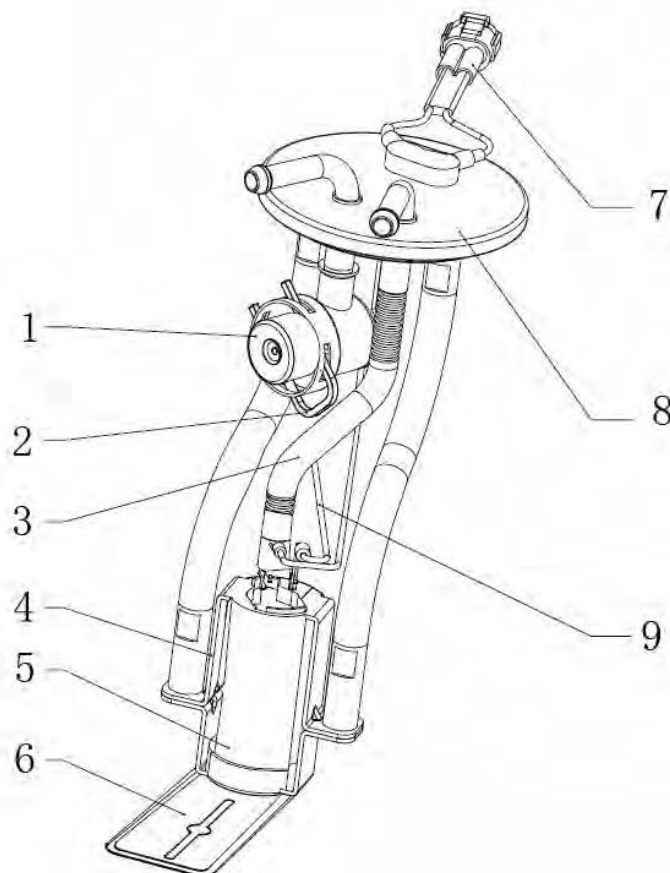
The electric pump works together with the pressure regulator to provide 250Kpa fuel pressure for the engine. It is installed under the gasoline tank.

Fuel pump assembly: provide pressure for the engine and fuel for the system required. It is installed on the bottom and provides fuel via the connection pipe.

Fuel Pump: electrical. It gets the pressure and fuel from the fuel tank by the driving impeller of the engine.

Pressure adjuster: mechanical film type, which can adjust the pressure of the fuel pump fuel to receive what is required.

17.2.9.2 Fuel Pump Assembly Appearance



- 1: pressure regulator 2: Pressure regulator clamp 3: high pressure fuel hose 4: pump installation bracket 5: fuel pump 6: filter screen 7: Fuel Pump harness 8: Fuel Pump bracket 9 : Fuel Pump harness

17.2.9.3

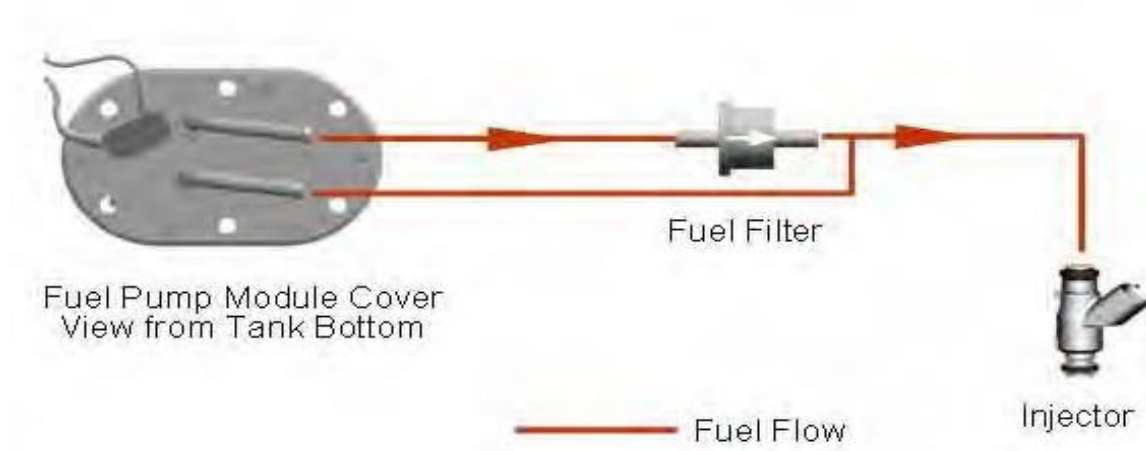
Label and Identification

Fuel pump assembly:

- Fuel pump assembly, fuel pump set and the pressure regulator are all equipped with production batches and dates.
- Fuel pump assembly: identified with a label on the installation plate. Fuel pump:
 - engraved on the pump. Oil pressure adjuster
 - engraved on the housing

17.2.9.4 Working environment

- Fuel pump assembly shall be installed on the bottom of the fuel tank in compliance with installation requirements.
- The overall design of the fuel tank is usually applicable for petrol. If there is ethanol contained in the fuel, please contact the fuel pump manufacturer to find out whether it can be used.
- Make sure there is enough fuel within the fuel tank for the first time running of the fuel pump. Do not run it when out of fuel.
- Connection method of the fuel hose can be referred to Fig. 28. Fuel flow layout of the motorcycle:



17.2.9.5 Maintenance Procedures

Safety Protection:

Guarantee personal safety in maintenance procedures of the fuel system:

- Disconnect positive terminal of the battery;
- Do not smoke and set up a "No Smoking" symbol nearby the operation area;
- Make sure the fire extinguishing apparatus are equipped;
- Guarantee good ventilation and keep it away from open fires;
- Wear safety glasses;
- To release the fuel vapor in the fuel tank, open the cap and then reset it;
- Once the engine stops, high pressure still exists within the fuel lines and there might be fuel spray if trying to disassemble or release the fuel line. Please refer to the chapter of "Fuel Pressure Release" to proceed.
- There might be a few amount of fuel spray after disassembling the fuel line. To prevent any dangers, use proper cleaning objects to block the fuel line.
- Make sure the fuel line and clamp are installed in compliance with the manual instruction after maintenance.
- Inspect the system for leakage in compliance with the chapter of "Fuel Leakage Inspection"

Procedures" after maintenance.

- Check and make sure there is enough fuel within the fuel tank when the pump is running after maintenance.

17.2.9.6 Failure Diagnosis of Fuel Pump Assembly

Step	Procedure	Yes	No
1	Start the ignition key and run the fuel pump	If the fuel pump starts to run, refer to step 4.	If the fuel pump fails to run, refer to step 2.
2	Disconnect the connector of the pump and check whether the power supply voltage is among the scope of 10V and 14V.	Refer to step 3.	Check the power circuit of fuel pump.
3	Supply 12V DC to the fuel pump; Make sure there is enough fuel within the tank in case of dry running; Fuel pump runs or not?	1. check the loop from fuel pump to ECU; 2. check the ECU.	1. check fuel pump harness; 2. check the fuel pump.
4	Check whether the front supply pressure of the nozzle is within the scope of 220kPa and 270kPa when the engine is at idle.	The fuel pump assembly runs normally.	Refer to step 5.
5	Check whether the pressure is lower than 220kPa	1. check if there is leakage on the fuel pipe; 2. check the fuel pump set; 3. check the pressure adjuster;	1. fuel filter is blocked; 2. the fuel pipe is kinked; 3. check the pressure regulator.

17.2.9.7 Removing the Fuel Pump Assembly

- refer to the chapter "Fuel Pressure Release Procedures" and release the fuel pressure;
- disconnect the negative terminal of the battery;
- cut off the connector of the fuel pump assembly harness;
- remove the residual fuel within the tank and store it in an appropriate container for security and pollution protection;
- remove the connection fuel hose from the pump to the assembly with standard tools;
- remove the fuel tank from the motorcycle;
- set the fuel tank reverse in case of scratch or damage;
- be careful not to break the strainer.

17.2.9.8 Installation of the Fuel Pump Assembly

- change the seal of the fuel pump assembly (a used seal could cause fuel leakage).
- fold the strainer and put the installation screws of the assembly asymmetrically, which can only be installed in compliance with regulated directions. The pressure adjuster face shall be pointed to the back of the fuel tank to make sure installation face is clean and neat.
- install the screws on the cover plate of the fuel pump and screw them down in compliance with Fig.

33. installation torque of screws: 3~4Nm. The fuel assembly shall be fixed with specific bolts and installed according to the specific orders and torques required. The wrong torques and orders would cause deformation and leakage at the washers.

- install the fuel tank onto the motorcycle;
- connect the fuel hoses and tighten with appropriate clamps;
- connect the fuel pump harness connector;
- check for leakage in compliance with the chapter of "Fuel Leakage Inspection Procedures" before running the engine.

17.2.9.9 Replacing the Pressure Regulator

- remove the fitting seat of the pressure regulator;
- remove the installation clamp of the pressure regulator with tools and prevent any damages in the procedures;
- take off the pressure regulator;
- to avoid damaging the exterior of the adjuster;
- put on lubricant around the O-ring of the new pressure regulator for the convenience of installation;
- make sure that both O-rings are installed on the pressure regulator (one with larger diameter and the other smaller);
- install the pressure regulator onto the seat of the fuel pump assembly bracket;
- it is strictly prohibited to strike the pressure regulator (which would damage the device);
- install the fuel pressure regulator clamp;
- replace with a new fuel pump assembly seal.

17.2.9.10 Fuel Leakage Inspection Procedures

Notice: do not go through this procedure on a hot engine.

Make sure the engine is cold and go through the following procedures:

- the transmission is in neutral,
- disconnect the connector between the fuel pump assembly harness and motorcycle harness;
- start the engine until it fires off automatically. Switch on and off the ignition key for 2 to 3 times continuously with an interval of 3 seconds.
- with the above procedures finished, connect the connector of the fuel pump assembly harness.

17.2.9.11 Fuel Leakage Inspection Procedures:

Finish maintenance of fuel system and make sure to go through the following fuel leakage inspection

- fill the fuel tank with enough fuel;
- turn on the ignition key for 3 seconds and turn it off for 15 seconds, and repeat this action for 3 to 4 times to build up the required fuel pressure within the fuel lines;
- check whether there is leakage on any parts of the fuel system (fuel tank, connection fuel pipe and pipe joints, etc.)

17.2.9.12 Cautions for Fuel Pump Assembly Usage

Cautions for Fuel Pump Assembly Usage	
Matters	Reasons
Do not: break the fuel pump	may lead to internal breakdown of the fuel pump
Do not: fuel pump "Dry Running" (No fuel in the	may lead to internal breakdown of the fuel pump

inlet and filter screen of the fuel pump) Make sure sufficient fuel in the fuel tank	
Do not: damage the filter screen during maintenance	foreign matters would come into the fuel pump through the damaged filter to destroy the fuel pump
Do not: disassemble the internal parts of the pump and the pressure regulator Do not: regulate the fuel pump and the pressure regulator	no guarantee
Do not: lift the fuel pump assembly with its wiring harness Do not: lift the fuel pump wiring harness in the vertical direction of the cover sheet	damage wiring harness/ power supply disconnection of the fuel pump
Do not: use damaged fuel pipe clamp	pressure leakage/fuel leakage
Do not: use fuel pump assembly with its badly damaged or clipped filter screen	foreign matters would come into the fuel pump through the damaged filter to destroy the fuel pump
Do not: remove fuel from the fuel tank with the fuel pump	not designed towards this end
Do not: fix other components with mounting screws to the fuel pump assembly	influence on installation of the fuel pump assembly
Do not: damage fuel pump wiring harness during maintenance of the fuel pump	damaged terminal may lead to poor contact/power supply disconnection
Do not: make the manual pump to touch the fuel pump assembly during defueling from the fuel tank	prevent the fuel pump assembly being damaged
Do: make sure no damage will be caused to the fuel pipes during maintenance	avoid fuel leakage
Do: use "original" sealing washer of fuel pump assembly only	imitated parts may lead to fuel leakage
Do: use specified fuel pipe clamp	make sure no fuel leakage or percolation in the fuel pipe joint
Do: fix the fuel pump wiring harness on the vehicles	reduce vibration
Do: use standard fuel	poor fuel may lead to early failure of the fuel pump
Do: replace the fuel filter within a schedule time	blocked filter may cause the reduction of the supply
Do: use qualified fuel filter	unqualified filter may damage nozzle, fuel pressure

	regulator and fuel pump
Do: make sure correct fuel pipe layout, without any interference with other components	improper layout may damage the fuel pipe
Do: make sure sufficient fuel in the fuel tank (close over the filter screen of the fuel pump)	avoid the fuel pump being "dry running"
Do: replace two O-rings during the maintenance of the pressure regulator	ensure correct pressure adjustment curve of the pressure regulator
Do: careful splicing for the connector assembly of fuel pump assembly wire harness	prevent the connector terminals from being damaged
Do: return all the crashed, damaged and suspicious parts and make description of the	make sure to find the root of the problem quickly and correctly

17.2.9.13 Common Problems

- a) The reverse connection of the connector of the fuel pump assembly causes the fuel pump run backwards, thus leading to inadequate fuel pressure for the engine. As a result, the engine cannot work normally.
- b) The fuel pump is damaged and cannot run.

Note:

1. Since a new motorcycle has no gasoline in its fuel tank at the very beginning, much air remains in the fuel line after the tank is fueled up. Therefore, it is necessary to turn the motor over for several times to dissipate all the air in the fuel line so that the engine can operate normally. This is a normal process, which will avoid the engine from taking a long time to start but still in failure in the later startup.
2. The gasoline can cool down the fuel pump, so do not run the pump with little or no fuel, or the fuel pump will be overheated and damaged.

17.3 Methods for Fault Diagnosis and Maintenance

The trouble light is on the instrument panel, with a sign of FI. In a normal circumstance, when turning on the key, the trouble light will turn on to indicate the electronic control injection system is powered-on and is ready to work. If the trouble light is off, it indicates that there is no power supply in the electronic control injection circuit and thus it cannot work. In this case, check the fuse and the connection of both positive and negative electrodes on the battery. After the engine has been started, if the trouble light turns off, it indicates that there is no fault; otherwise, if the trouble light is still on, it indicates that the electronic control injection system is abnormal and it is necessary to remove the faults.

There are three methods for fault detection:

17.3.1 Direct Diagnosis through the Flickering Trouble Light (FI) on the Instrument Panel

When any fault is confirmed, by switching the key for three times, i.e., turning the key on-off-on-off-on,

the trouble light will flash in corresponding fault code. Then check the fault code list for the breakdown in correspondence.

In case of reading faults with the trouble light, the rules of flash codes are illustrated as below. Take the open circuit of intake pressure sensor or short circuit of signal end pin to the negative electrode of the battery as an example, after the key has been switched for three times, the trouble light will flash 10 times standing for 0, flash once after 1.2 seconds standing for 1, flash 10 times after another 1.2 seconds standing for 0 and flash 7 times after another 1.2 seconds standing for 7, that is P0107. It shows that, except the number 0 is represented by flashing for 10 times, other numbers from 1 to 9 will flash as the number itself shows. If there are other fault codes, such as fault P0201, a fault in the fuel injector of front cylinder, the light of fault code P0201 will flash in 3.2 seconds after the flashing of P0107. The trouble lights of P0107 and P0201 will flash circularly in case of no other fault. Then faults can be checked according to the fault code list.

Decimal number will be adopted to show the fault code in PCHUD software. The decimal number in the fault code list is corresponded to the previous hexadecimal, thus faults can be found out in correspondence. If MULFCURR (current fault) =263, the corresponding fault code in the fault code list is P0107, i.e., a fault of intake pressure sensor.

MT05 Fault Code List

Fault code	Description	Corresponding decimal number
P0107	open circuit of intake pressure sensor or short circuit of signal end pin to the negative electrode of the battery	263
P0108	short circuit of signal end pin of the intake pressure sensor to the positive electrode of the battery	264
P0112	short circuit of signal end pin of the intake temperature sensor to the negative electrode of the battery	274
P0113	open circuit of intake temperature sensor or short circuit of signal end pin to the positive electrode of the battery	275
P0117	short circuit of signal end pin of the cylinder end temperature sensor to the negative electrode of the battery	279
P0118	open circuit of cylinder end temperature sensor or short circuit of signal end pin to the positive electrode of the	280
P0122	open circuit of throttle position sensor or short circuit of signal end pin to the negative electrode of the battery	290
P0123	short circuit of signal end pin of the throttle position sensor to the positive electrode of the battery	291
P0131	short circuit of signal end pin of the front cylinder oxygen sensor to the negative electrode of the battery	305
P0132	short circuit of signal end pin of the front cylinder oxygen sensor to the positive electrode of the battery	306
P0031	short circuit of heating end pin of the front cylinder oxygen sensor to the negative electrode of the battery	50
P0032	short circuit of heating end pin of the front cylinder oxygen sensor to the positive electrode of the battery	49
P0201	fault of for fuel injector front cylinder	513
P0202	fault of for fuel injector rear cylinder (plug-in device of the fuel injector is not plugged)	514
P0230	open circuit of oil pump or short circuit to the negative electrode of the battery	560
P0232	short circuit of oil pump to the positive electrode of the battery	562
P0336	signal interference of crank shaft position sensor	822
P0337	no signal of crank shaft position sensor	823
P0351	fault of ignition coil for front cylinder	849
P0352	fault of ignition coil for rear cylinder	850
P0562	voltage below level of electronic control injection system	137

P0563	over tension of electronic control injection system	137
P0560	fault of trouble light (damage of filament or plug-in device)	161
P1693	short circuit of tachometer line to the negative electrode of the battery	577
P1694	short circuit of tachometer line to the positive electrode of the battery	578
P0137	short circuit of signal end pin of the rear cylinder oxygen sensor to the negative electrode of the battery	311
P0138	short circuit of signal end pin of the rear cylinder oxygen sensor to the positive electrode of the battery	312
P0038	short circuit of heating end pin of the rear cylinder oxygen sensor to the positive electrode of the battery	56
P0037	short circuit of heating end pin of the rear cylinder oxygen sensor to the negative electrode of the battery	55

17.3.2 Fault Diagnosis by Diagnostic Apparatus



Operation Steps:

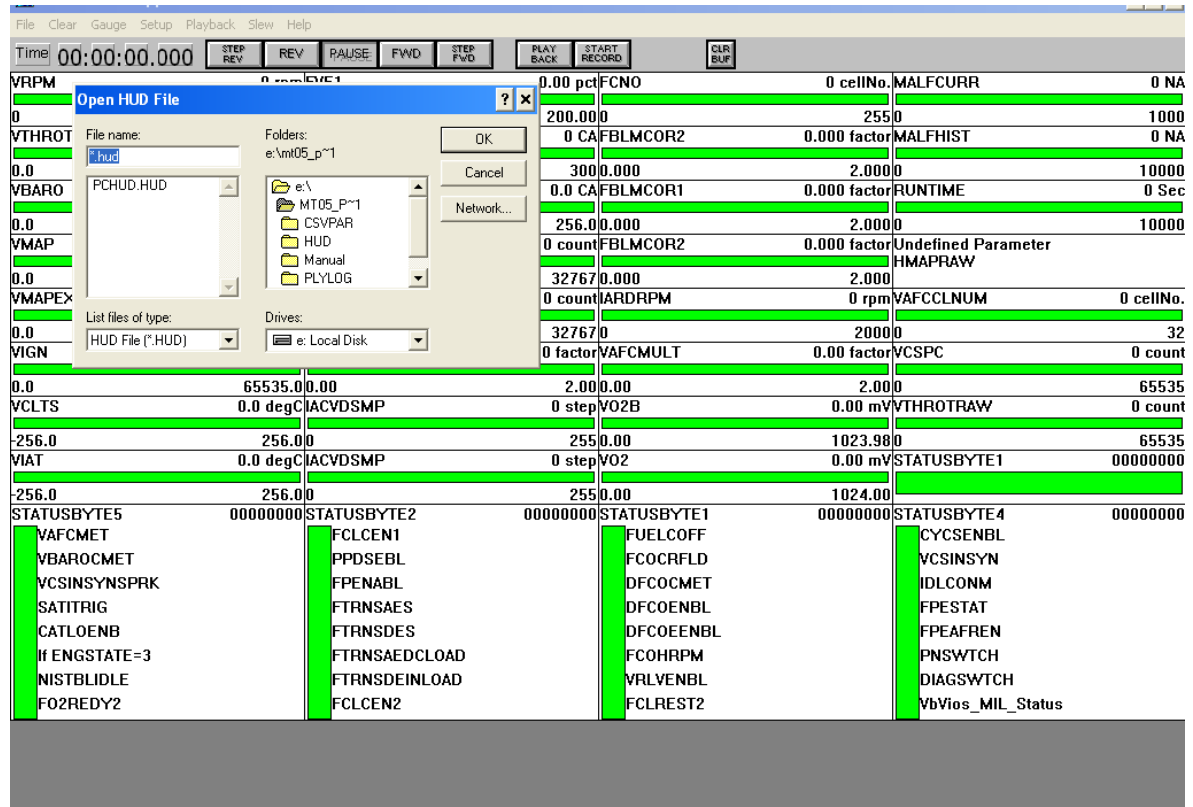
- Find the 6-hole diagnostic port on the motorcycle.
- Connect the harness line to the port on the diagnostic apparatus.
- Turn on the key to diagnose the faults.

17.3.3 Fault Diagnosis with the Diagnostic Software PCHUD

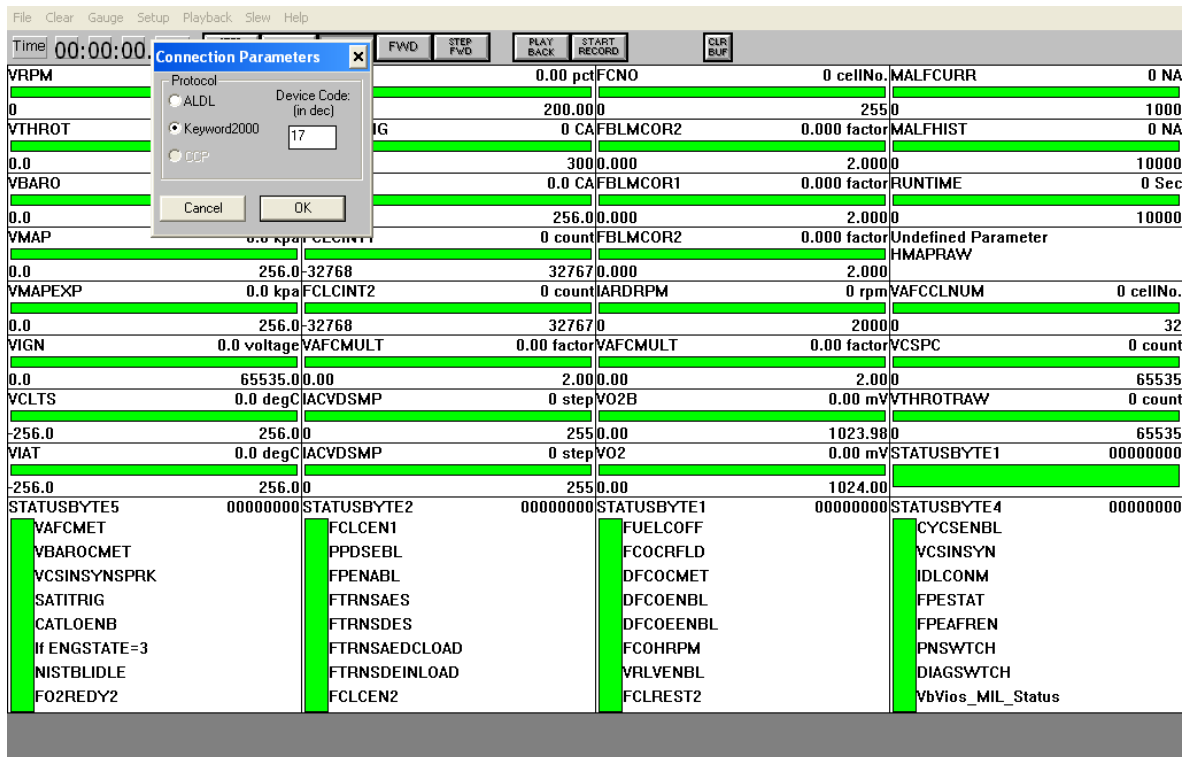
PCHUD software is used to inspect and record the operating data of the engine. Before using the software, connect a notebook computer to the 6-hole diagnostic port of the motorcycle with the K line. The notebook computer needs to install the K line driver software before using.

Instructions of PCHUD Software:

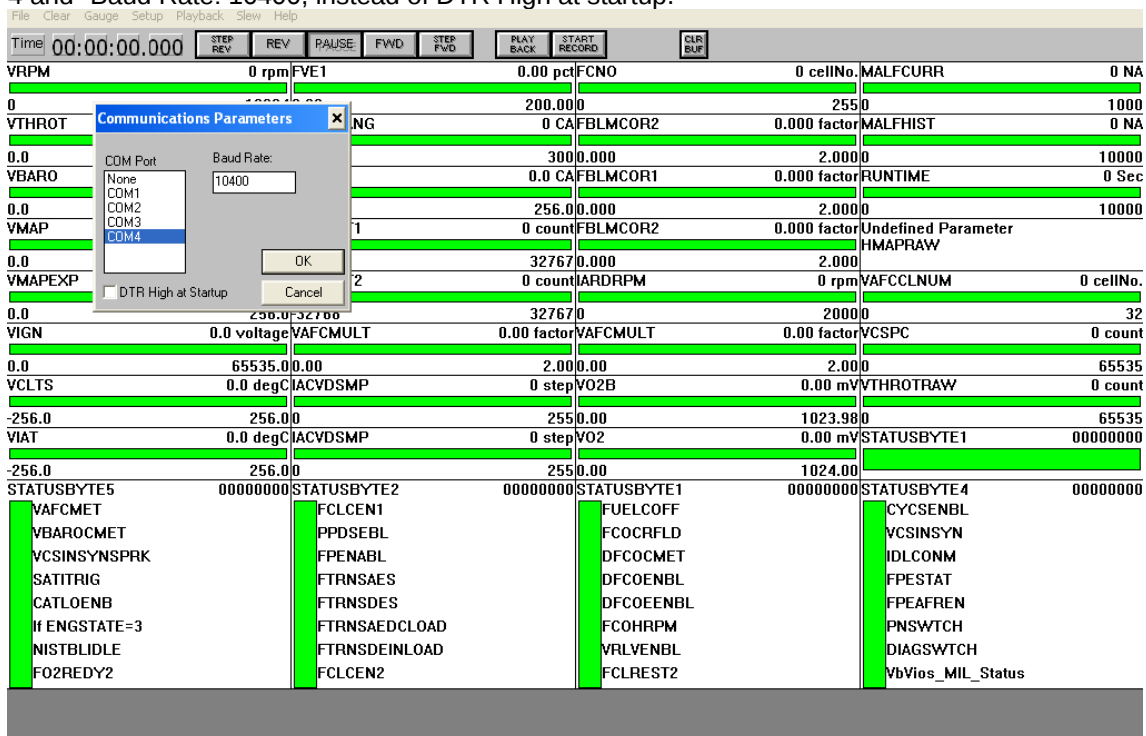
- (1) Connect a notebook computer to the 6-hole diagnostic port of the motorcycle with the K line and turn on the key.
- (2) Click the icon "HUD.EXE" to start PCHUD software
- (3) Select "File" on the software interface, click "Open", choose "PCHUD.HAD" and select OK.



- (4) Select "Parameter File" within "Setup", click the file MT05COMMON.par, choose "Comm protocol" within "Setup", then select "Keywork2000" and click OK, meanwhile, choose 17 in Device Code.



(5) If the real-time communication data fail to display on the soft ware interface when the power is on, check whether the connection setting of COM port in "Setup". Under the normal circumstance, set COM Port: 4 and Baud Rate: 10400, instead of DTR High at startup.



Normal communication is ready to make then. Current fault code is displayed in the position of MALFCURR and historical fault code displayed on MALFHIST.

MALFCURR	0 NA
0	1000
MALFHIST	0 NA
0	10000

Then check the corresponding fault according to the fault code list

PCHUD:

VRPM	engine speed
VTHROT	throttle position
VBARO	BARO
VMAP	manifold air pressure
VMAPEXP	expect manifold air pressure
VIGN	ignition key voltage
VCLTS	cylinder temperature or coolant temperature
VIAT	intake air temperature
STATUSBYTE5	STATUSBYTE5
VAFCMET	airflow correction met
VBAROCMET	Baro update met
VCSINSYNPRK	sequential spark enable
SATITRIG	tip-in Spark Advance retard trigger
CATLOENB	catlyst light-off logic enable
IF ENGSTATE=3	engine work in run state
NISTBLIDLE	stable warm idle
FO2REDY2	O2 ready
FCNO	block learn memory cell
FBLMCOR1	cylinder 1 block learn memory
FCLCINT1	intergral of close loop correction
FCLCMUL1	close loop correction
IARDRPM	desired idle rpm
IARPMERR	idle rpm error
FPWVC1	base pulse width of cylinder 1
VO2	Oxygen sensor signal
STATUSBYTE3	STATUSBYTE3
FO2STAT1	cylinder 1 oxygen sensor signal rich lean state
FCLREST1	cylinder 1 close loop correction reset
FOSHTREN	Oxygen sensor heater enable
FO2REDY1	cylinder 1 Oxygen sensor ready
IF IACV MODE=0	idle airflow control valve close loop correction enable
IAMTRLOST	IACV lost
IACMVIHB	IACV move disable
VIGNS	ignition state
FVE1	cylinder 1 Volumetric efficiency
VMAPRANG	MAP read angle
AFFNLAFR	target air fuel ratio

SAESTA	cylinder 1 Spark Advance
SAIDLDYN	idle dynamic Spark Advance
SPDWELL	dwel time
IAINTEGOFST	airflow integral of idle air control valve
IACVDSMP	desired position of idld air control valve
STATUSBYTE2	STATUSBYTE2
FCLCEN1	cylinder 1 close loop correction enable
PPDSEBL	prime pulse disable
FPENABL	fuel pump enable
FTRNSAES	acceleration enrich enter
FTRNSDES	deceleration enlean enter
FTRNSAEDCLOAD	acceleration enrich exit
FTRNSDEINLOAD	deceleration enlean exit
FCLCEN2	cylinder 2 close loop correction enable

17.4 Common Troubleshooting

17.4.1 Repair Tools

- a) Disassembling the parts of the electronic control system- common disassembly tools for auto machinery parts
- b) Circuit of the electronic control system and its electrical signal- digital multimeter (with beep)
- c) Diagnosing the faults in the electronic control system and checking the engine's operation
 - Fault diagnostic apparatus for electronic control system (recommended)
 - Fault diagnosis software(PCHUD) and port wire (if available)
- d) Fault code list of the electronic control system(for emergency)
- e) Fuel pressure gauge, range: 0 ~ 300kPa



17.4.2 Operation Data Flow of the Engine Shown on the Diagnostic Apparatus

Analyze and check the faults in engine through the operation data flow of the engine shown on the diagnostic apparatus

17.4.2.1 Step One

- a) Engine wire harness and vacuum line- may influence the system in controlling air flow and oil supply.
- b) Assembly of Oxygen sensor- may influence the system in judging the air-fuel ratio.

- c) Engine trouble light- influences the system in fault warning.
- d) Storage battery voltage- judges whether the battery power is adequate.
- e) According to the experience, judge whether the readings of coolant temperature sensor, air intake temperature sensor, manifold absolute pressure sensor and oxygen sensor are normal.
- f) Working range of throttle position sensor- Failure in completely turning on or off the sensor may influence the power performance of the engine and part of system function.

17.4.2.2 Step Two

Check whether the power supply of ECU is cut off- the communication between the diagnostic apparatus and the system halts after turning off the key switch.

17.4.2.3 Step Three

- a) Coolant temperature and its cycling- indicate whether the thermostat operates normally.
- b) Storage battery voltage- shows whether the generator works normally. Too high: maybe a fault in the generator regulator.
Too low: maybe the inappropriate connection of generator wires or a fault in the generator
- c) Manifold air pressure- may indicate whether there is an intake air leak or an air valve clearance
The air valve clearance is too small: the over high figure may influence the power performance of the engine. Meanwhile, because the exhaust valve opens too early, the increased temperature of the exhausted air will significantly reduce the service lives of oxygen sensor and ternary catalytic converter.
The air valve clearance is too large: may cause the manifold air pressure become low, thus influencing the system in judging the engine's operation and leading to abnormal idling in the engine's warming-up.
Besides, the clogged exhaust system, e.g., foreign materials in the exhaust passage, or the blocked ternary catalytic converter caused by the over-consumption of the engine oil, or damaged pieces inside of the ternary catalytic converter, will lead to an over high figure.
- d) Cycle number of the oxygen sensor reading- a small cycle number indicates the failure of the oxygen sensor.

17.4.3 Concise Fault Removal Techniques

Please take the following steps to repair the electronic control injection system. If the fault is removed in a certain step, the following steps can be suspended. Then check and remove the fault code by diagnostic apparatus in compliance with the term 14.4.2.

When using the diagnostic apparatus, the storage battery voltage cannot be lower than 8.5V.

17.4.3.1 Daily Use and Maintenance

- Unleaded gasoline #91 or higher is strongly recommended.
- Though ECU is damp-proof, it is forbidden to wash its cover with a high-pressure water gun.
- The fuel filter should be replaced every 7,000-10,000km
- In common circumstances, the throttle valve should be washed every 10,000km or every 1 year.

17.4.3.2 Fault Description- Startup Failure

a) Turn the ignition lock to "ON" to check whether the trouble light turns on.

If no:	◆ Check the fuse and the ground wire. ◆ Check whether ECU's plug is tightly connected. ◆ Check whether the light and circuit are normal through the inspection function of the diagnostic apparatus's actuator. ◆ Check and repair the light and its circuit. ◆ Make the judgment with another ECU.
If yes:	◆ Connect the diagnostic apparatus to the system's diagnostic port.

b) Whether the diagnostic apparatus can be connected to the system for communication

If no:	◆ Check the fuse and the ground wire ◆ Check whether ECU's plug is tightly connected ◆ Check whether the diagnostic apparatus works normally on another normal ◆ Make the judgment with another ECU.
If yes:	◆ Remove the fault shown by the diagnostic apparatus.

c) Check the faults in the ignition system- whether the spark plug can ignite normally

If no:	◆ Check whether the high-tension cable and spark plug are connected tightly or are damaged. Make the judgment with another ignition coil assembly ◆ Make the judgment with another ECU.
If yes:	◆ Check whether the high-tension cable is connected with the ignition coil and spark plug in a

d) Check the faults in the oil supply system

Whether the fuel pump is working- the working noise of the fuel pump can be heard in its nearby when starting the engine.

If no:	◆ Check whether the fuel pump relay works normally. ◆ Check whether the connection of crankshaft position sensor and its operation are normal. ◆ Make the judgment with another ECU.	
If yes:	1) Whether the supplied oil pressure is above 220Kpa	
	2) Inadequate pressure:	◆ Check whether there is enough gasoline in the fuel tank ◆ Check whether it is necessary to replace the fuel filter (note: the fuel filter for the electronic control injector should be replaced 7,000-10,000km) ◆ Whether the oil supply line and oil return line are damaged
	3) Normal pressure:	◆ Check whether the nozzle control line is abnormal ◆ Whether it is necessary to clean the oil nozzle

e) Check whether the cylinder is flooded with oil

If yes:	◆ Press the accelerator pedal to the limit and turn on the starter. After several seconds, there will be a sign showing the engine running.
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- f) Whether the clearance of crankshaft position sensor is too large

17.4.3.3 Fault Description- Startup Failure Accompanied with Backfire

- a) Check whether the high-tension cable of ignition coil is loose
b) Whether the timing gear is loose.

17.4.3.4 Fault Description- Unstable Idle Speed

Idle speed control system:	Check whether the idle speed by-pass bolt is too loose or tight. Usually it is necessary to screw 2 turns.
Oil supply system	Whether there is an oil pipeline leak

17.4.3.5 Fault Description- Too High/Low Idle Speed (Apparent Non-conformity to Target Idle Speed)

Idle speed is too high:	◆ When the water temperature is lower than 68°C, the system will increase the idle accelerate the warming up. Besides this normal process, check according to the steps. ◆ Check whether the idle air bypass hole is too large. ◆ Check whether the air valve clearance, especially the exhaust valve clearance, is large.
Idle speed is too low:	◆ Check the oil amount in the fuel tank, the fuel filter, the oil line pressure and the oil nozzle. ◆ Check whether the idle air bypass hole is too tiny. ◆ Check whether the air valve clearance is too small.

17.4.3.6 Fault Description- Unstable Idle Speed Slowing Down with Flameout

- a) Check the valve clearance
b) Check whether the idle air bypass hole and throttle body are too dirty

17.4.3.7 Fault Description-Poor Acceleration

- a) Whether the parameters at idle speed and high idle speed are normal
b) Check the oil amount in the fuel tank, and fuel filter.
c) Check whether the exhaust system is blocked, e.g., whether the ternary catalytic converter is clogged because of burning engine oil or damages.
d) Check the oil line pressure and the oil nozzle.
e) Check whether the trouble light turns on and whether it is because only one cylinder can work normally to ignite.

17.4.3.8 Fault Description- Little Misfire

Check whether the spark plug gap meets the standard between 0.7-1mm.

17.4.3.9 Fault Description- Non-conformity between Fault Code and Fault When Trouble Light is On

The ground wire of the system may be not connected well. Reconnect the ground wire, turn off the storage battery power line for 3 minutes and turn it on, then start the engine.

17.4.3.10 Fault Description- Abnormally High Oil Consumption

- a) Check the assembly of the oxygen sensor of two cylinders. If it is in a loose state, the oxygen sensor will make a wrong judgment of the slight lean burn in the cylinders, and thus add more fuel, leading to abnormally high oil consumption.
- b) When the engine's mechanical parts and the oxygen sensor are confirmed to be normal, start the engine to check the reading of the oxygen sensor. If the reading is always above 500 mV in a normal water temperature, check whether there is a leakage in the oil nozzle.

Note

- Most parts of electronic control injection system are non-repairable. Once a part is damaged, usually it needs to be replaced.
- When starting the engine, do not run any other organs of the engine (including the throttle, do not push the throttle in the startup).
- If the engine trouble light turns on when the engine is operating, it is necessary to check the reason and remove the fault as early as possible.
- Do not use leaded gasoline for lead will do harm to the oxygen sensor and ternary catalytic converter.
- When there is an abnormal consumption of the engine oil, the fault should be removed as soon as possible, or some substances in the engine oil will also do harm to the oxygen sensor and ternary catalytic converter.
- The air valve clearance should not be too small. If the air valve does not tightly shut off in the exhaust process, the exhaust temperature will be too high so that the service life of ternary catalytic converter will be reduced.
- When the temperature is lower than 10°C, if the motorcycle and the engine run at a low speed for a long time, the exhaust pipe may have carbon deposits and appear to be black. This is a normal phenomenon. It will disappear after the engine operates at a high speed for some time or by adopting appropriate methods to keep the engine coolant temperature in a specified range

