



ETON America

MATRIX 50

Service Manual

Covers:

Matrix 50 Scooter

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1. INFORMATION

1.1 SAFETY

Gasoline is extremely flammable and is explosive under certain conditions.

Do not smoke or allow sparks or flames in your work area.

Never run the engine in a closed area. The exhaust contains poisonous carbon monoxide gas that may cause loss of consciousness and lead to death.

The battery electrolyte contains sulfuric acid. Protect your eyes, skin and clothing. If you spill the electrolyte on your skin or in your eyes, flush thoroughly with water. Call a doctor if electrolyte gets in your eyes.

1.2 NOTES

All information, illustrations, directions and specifications included in this publication are based on the latest product information available at the time of approval for printing.

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1.3 Specifications

Engine		
Type		Two cycle air cooled oil injected
Displacement		49.3cc
Bore / Stroke		φ40.0 * 39.2mm
Compression - Ratio / Pressure		6.8 : 1 / 90-120psi
Torque / BHP		5.2N m @ 7000rpm / 1.5BHP
Estimated MPG		65mpg
Starting		Electrical with Kick starter back up
Transmission		
Type		Automatic (C.V.T. V-Belt)
Chassis		
Overall Length		1830mm / 72.0"
Overall Width		650mm / 25.6"
Overall High		1100mm / 43.3"
Wheel Base		1260mm / 49.6"
Dry Weight		91kg / 201 lbs.
Suspension		
Front		Telescopic Fork
Rear		Unit Swing Arm / Single Shock
Brakes		
Front		Hydraulic Disc
Rear		Hydraulic Disc
Tires		
Front		120/90-10
Rear		130/90-10
Tire Pressure	Front	Front 18psi / 1.25kg/cm2 (Cold)
	Rear	Rear 25psi / 1.75kg/cm2 (Cold)
Carburetor		
Make/Size		Mikuni 18mm (Manual Coke)
Main Jet		85mm
Pilot Jet		20mm
Air Mixture Adjustment		Back out ¾ - 1¼ turns
Idle Speed		Idle 1700 - 1900rpm
Battery		
Jell Acid (Maintenance Free)		12V-4AH/5AH - GTX5L-BS
Fluids		
Fuel	Type	Unleaded Gasoline 89 octane
	Volume	4.5liters / 1.2gal
2 Cycle Oil	Type	High grade synthetic 2 cycle injector oil
	Volume	1.1 liters / 1.2qts
Transmission	Type	SAE 80/90 weight
	Volume	100cc / 3.4oz

Spark Plug	
NGK (recommended)	BPR7HS
Nipendenso	W22FRP-U
Champion	QL82YC
Electrode Gap	0.6-0.7mm / 0.023"
GVWR	240kg. / 530lbs.
GAWR (Front)	76kg. / 167lbs.
GAWR (Rear)	165kg. / 164lbs.
Available Colors *Subject to availability	Red
	Blue

1.4 SERIAL NUMBER

The frame serial number is stamped on the front of the frame, at the front of the footrest plate.
The engine serial number is stamped on the left side of the engine crankcase.



1.5 Standard Torque Values

ENGINE

- | | |
|----------------------|------------------------------|
| ➤ Cylinder head nut | 28-30 N-m (20.7-22.1 lb./ft) |
| ➤ Spark plug | 12-19 N-m (8.9-14.0 lb./ft) |
| ➤ Cylinder head bolt | 20-30 N-m (14.8-22.1 lb./ft) |
| ➤ Alternator bolt | 8-12 N-m (5.9- 8.9 lb./ft) |

FRAME

- | | |
|-------------------------------------|------------------------------|
| ➤ Handlebar upper holder bolt | 24-30 N-m (17.7-22.1 lb./ft) |
| ➤ Steering shaft nut | 50-60 N-m (36.9-44.3 lb./ft) |
| ➤ Steering shaft bushing holder nut | 24-30 N-m (17.7-22.1 lb./ft) |
| ➤ Wheel rim bolt | 18-25 N-m (13.3-18.4 lb./ft) |
| ➤ Tie rod lock nut | 35-43 N-m (25.8-31.7 lb./ft) |
| ➤ King pin nut | 30-40 N-m (22.1-29.5 lb./ft) |
| ➤ Handlebar lower holder nut | 40-48 N-m (29.5-35.4 lb./ft) |
| ➤ Front wheel bolt | 24-30 N-m (17.7-22.1 lb./ft) |
| ➤ Front axle nut | 55-65 N-m (40.6-47.9 lb./ft) |
| ➤ Front brake arm nut | 4-7 N-m (3.0- 5.2 lb./ft) |
| ➤ Rear brake arm nut | 7-12 N-m (5.2- 8.9 lb./ft) |
| ➤ Rear axle nut | 60-80 N-m (44.3-59.0 lb./ft) |
| ➤ Rear wheel bolt | 24-30 N-m (17.7-22.1 lb./ft) |
| ➤ Exhaust muffler mounting bolt | 30-35 N-m (22.1-25.8 lb./ft) |
| ➤ Engine hanger bolt | 24-30 N-m (17.7-22.1 lb./ft) |

2. MAINTENANCE

- 2.1 MAINTENANCE DATA
- 2.2 MAINTENANCE SCHEDULE
- 2.3 FUEL TUBE
- 2.4 THROTTLE OPERATION
- 2.5 THROTTLE CABLE ADJUSTMENT
- 2.6 AIR CLEANER
- 2.7 SPARK PLUG
- 2.8 IDLE SPEED
- 2.9 BRAKE SYSTEM
- 2.10 WHEELS AND TIRES
- 2.11 STEERING SYSTEM
- 2.12 GEAR OIL

2.1 MAINTENANCE DATA

SPECIFICATION

SPARK PLUG:

SPARK PLUG GAP:	0.6-0.7 mm
RECOMMENDED SPARK PLUGS:	NGK BPR7HS
THROTTLE LEVER FREE PLAY:	5-10 mm
IDLE SPEED: 1600±100 rpm	
BRAKE LEVER FREE PLAY:	15-25 mm

TIRES:

FRONT TIRE SIZE	120/90-10
REAR TIRE SIZE	130-90-10
FRONT/REAR TIRE PRESSURE	2.5± 0.3 kgf/cm ²

TORQUE VALUES

SPARK PLUG	12-19 N-m
TIE-ROD LOCK NUT	35-43 N-m

LUBRICATION:

ENGINE OIL JASO FC Grade or same degree oil	
GEAR LUBRICATION OIL SAE 40	

2.2 MAINTENANCE SCHEDULE

The maintenance intervals in the follow table are based upon average riding conditions. Riding in unusually dusty areas may require more frequent servicing. E-TON recommends that all maintenance and inspections be performed ONLY by a qualified and fully trained technician.

	INITIAL SERVICE (First week)	REGULAR SERVICE (Every 30 operating days)	EVERY YEAR
Fuel Line			I
Throttle Operation	I	I	I
Air Filter system & Element	I	C	R
Spark Plug		I	R
Carburetor Idle Speed	I	I	I
Brake Shoe Wear	I	I	I
Brake System	I	I	I
Nut, Bolt, Fastener	I	I	I
Wheels & Wheel Nuts	I	I	I
Steering System		I	I
Suspension System		I	I
C.V.T. Air Filter		C	R
Air Induction Reed Valve		I	C/R
Transmission Gear Oil		I	R

Note –

I: Inspect and Clean, Adjust, Lubricate, or Replace (if necessary)

C: Clean

L: Lubricate

R: Replace

2.3 FUEL TUBE

Inspect the fuel lines for deterioration, damage, or leaks, and replace if necessary.

2.4 THROTTLE OPERATION

Inspect for smooth throttle lever full opening and automatic full closing in all steering positions.

Inspect for deterioration, damage, or kinking in the throttle cable. Replace if necessary.

Check the throttle lever. Free play is 5-10 mm at the tip of the throttle lever.

Disconnect the throttle cable at the upper end.

Lubricate the cable with commercially available lubricant to prevent premature wear.



2.5 THROTTLE CABLE ADJUSTMENT

Slide the rubber adjuster cap off the throttle housing, loosen the locking nut, and adjust the free play of the throttle lever by turning the adjuster on the throttle housing. Inspect the free play of the throttle lever.

This free play should be 5-10mm.



2.6 AIR CLEANER

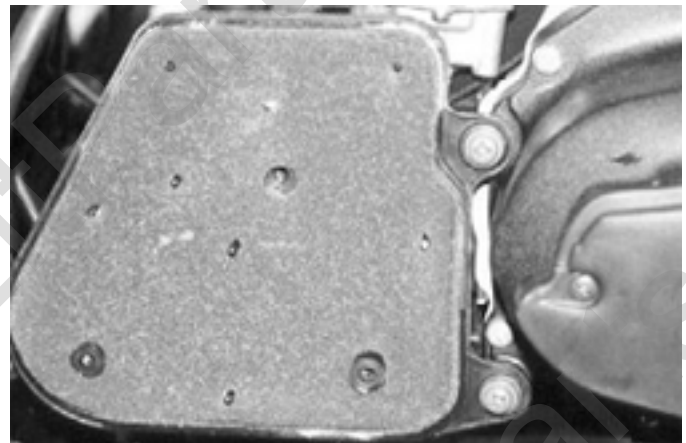
Unscrew the air cleaner cover screws.

Pull out the air filter element from the air cleaner case. Wash the element in non-flammable solvent.

Squeeze out the solvent thoroughly.

Let it dry. Soak the filter element in gear oil and then squeeze out the excess oil.

Install the element into the air cleaner carefully.



2.7 SPARK PLUG

The spark plug is located at the front of the engine. Disconnect the spark plug cap and remove the spark plug. Check the spark plug electrodes for wear. Change the spark plug if the electrodes and insulator tip appear unusually fouled or burned.

Discard the spark plug if there is apparent wear or if the insulator is cracked or chipped.

The spark plug gap should be set to 0.6-0.7mm.

With the sealing washer attached, thread the spark plug in by hand to prevent cross threading.

Torque the spark plug to 12-19 N-m.



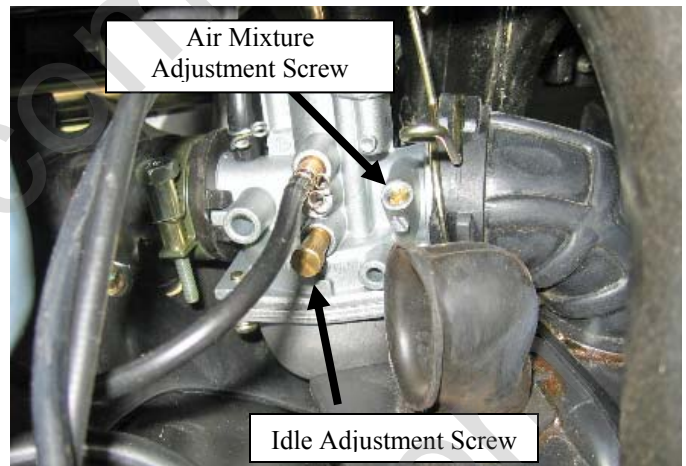
2.8 IDLE SPEED

Connect a tachometer.

Warm up the engine for at least 10 minutes.

Turn the idle-speed adjust screw on the carburetor to obtain the idle speed. "Turn in" (clockwise) to get higher speed. "Turn out" (counter clockwise) to get lower speed.

IDLE SPEED: 1600 ± 100 rpm



2.9 BRAKE SYSTEM

Inspect the front brake lever and cable for excessive play or other damage.

Replace or repair if necessary.

Measure the free play of the brake lever at the end of the brake lever.

The standard of free play is 15-25 mm.

Inspect the rear brake lever and cable for excessive play or other damage.

Replace or repair if necessary.

Measure the free play of the rear brake lever at the end of the lever. The standard is 15-25 mm.

Adjust the free play of the rear brake lever by turning the adjuster on the rear axle.



2.10 WHEELS AND TIRES

Inspect the tire surfaces for cuts, nails, or other sharp objects. Check the tire pressure at cold tire condition.

The standard tire pressure is 2.5 ± 0.3 kgf/cm²



2.11 GEAR OIL

Transmission gear oil needs to be changed every year or after every 3000 miles of service.

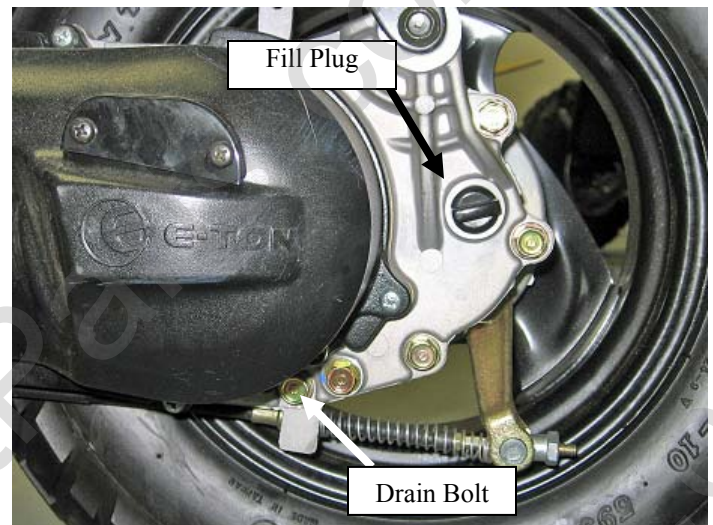
The drain bolt is located at the rear of engine.

Remove the drain bolt and loosen the fill bolt to drain the transmission gear box.

Inspect the drained oil for foreign materials. If the oil contains a high concentration of metal shavings or powder, disassemble the transmission for further inspection.

Reinstall the drain bolt and refill the gear box with 100cc / 3.4oz of SAE 80-90 Gear Oil

Note: for best results, drain the transmission while the engine is warm.



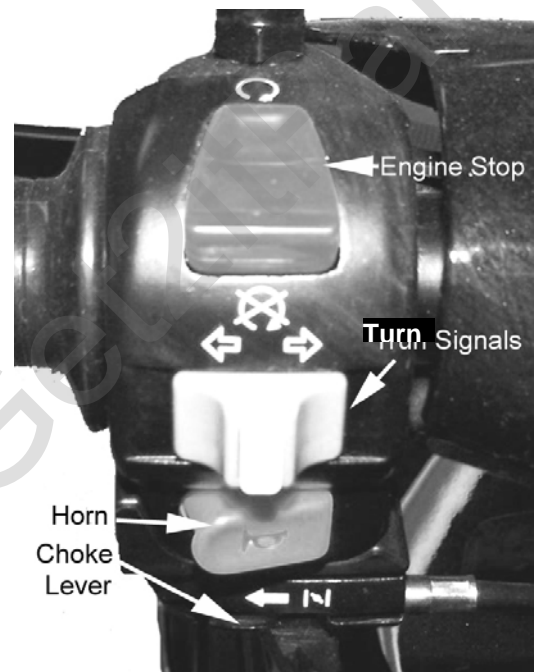
2.12 ENGINE STOP SWITCH

The engine stop switch is located beside the left handle bar.

In an emergency, pushing this switch will stop the engine.

The stop switch must be placed in the on position, the top of the switch pressed down, for the engine to start.

If your engine fails to start, check the switch.



2.13 HIGH-LOW BEAM CONTROLLER

This controller is located beside right handle bar and controls the headlight intensity setting. When the switch is placed in the full right position, the headlights are set to illuminate at 100% intensity. In the center position the headlight will illuminate at 60% intensity. Placed in the far left position, the headlights will be off.

NOTE: It is recommended that you have the headlight on at all times when operating the vehicle to improve your visibility to other traffic.



3. ENGINE REMOVAL AND INSTALLATION

3.1 ENGINE REMOVAL

Remove the seat, helmet box, and body cover.
(See chapter 10 for complete instructions)



Disconnect oil tube, fuel tube, and vacuum line tube.



Disconnect the wires of the A/C generator and the starter motor.



Disconnect the wires of the carburetor and the throttle cable.



Remove the cap from the spark plug.



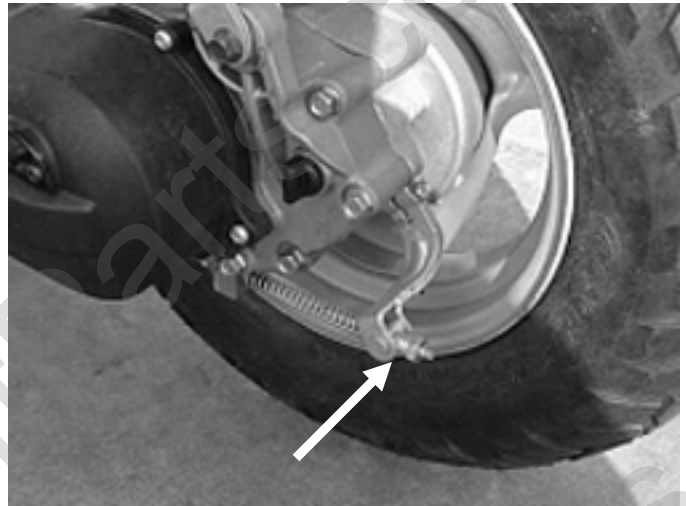
Remove the bolt at the low end of the rear shock.



Remove the engine hanger nut.



Remove the rear brake cable adjusting nut.



Pull the engine out from the frame.



3.2 ENGINE INSTALLATION

Install engine in reverse order of disassembly.

Torque value:

M8 nut 15 - 22 lbf-ft

M10 nut 22 - 29 lbf-ft

M12 nut 36 - 43 lbf-ft

After installing the engine, check the parts below:

- All connections (A/C generator, starter motor, etc)
- Carburetor throttle cable
- Rear brake cable
- Oil tubes and fuel tubes

4. ENGINE FUEL SYSTEM

4.1 TROUBLESHOOTING

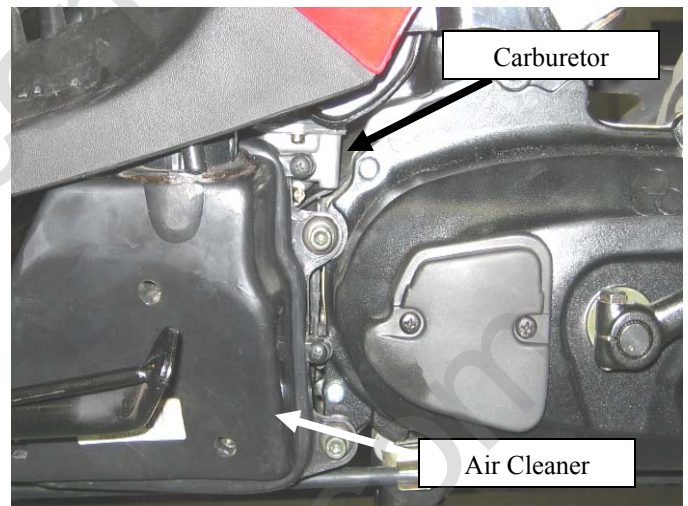
ENGINE WILL NOT START	<ul style="list-style-type: none">➤ NO FUEL IN TANK➤ NO FUEL IN CYLINDER➤ TOO MUCH FUEL INTO CYLINDER➤ NO SPARK AT PLUG➤ AIR CLEANER CLOGGED
ENGINE IDLES UNSTEADILY, STALLS, OR RUNS POORLY	<ul style="list-style-type: none">➤ IMPROPER ADJUSTMENT OF THE IDLE SPEED SCREW AT CARBURETOR➤ IGNITION MALFUNCTION➤ FUEL/AIR MIXTURE RATIO TOO LEAN OR TOO RICH➤ AIR CLEANER DIRTY➤ INSULATOR LEAKS➤ FUEL TANK CAP BREATHING HOLE CLOGGED
LEAN MIXTURE	<ul style="list-style-type: none">➤ CARBURETOR FUEL JET CLOGGED➤ FUEL TANK CAP BREATHING HOLE CLOGGED➤ FUEL FILTER CLOGGED➤ FUEL FLOWS IN THE TUBE IRREGULARLY➤ FLOAT LEVEL IN CARBURETOR TOO LOW
RICH MIXTURE	<ul style="list-style-type: none">➤ FLOAT NEEDLE VALVE IN CARBURETOR FAULTY➤ FLOAT LEVEL TOO HIGH➤ AIR DUCT IN CARBURETOR IS CLOGGED➤ AIR CLEANER DIRTY

4.2 CARBURETOR

REMOVAL

Remove the air cleaner.
Disconnect the fuel line and auto-choke electric wire.
Unscrew the intake pipe mounting bolts at the carburetor, and then remove the carburetor.

Note: Before removing carburetor, you must shut the fuel flow off.



Remove the carburetor cap.
Remove the throttle cable from the throttle valve while depressing the throttle valve spring.



Remove the needle clip retainer, the jet needle, and needle clip. Inspect the throttle valve and jet needle surface for wear, scratches, or dirt.



DISASSEMBLY

Unscrew the float chamber screws and remove the float chamber.



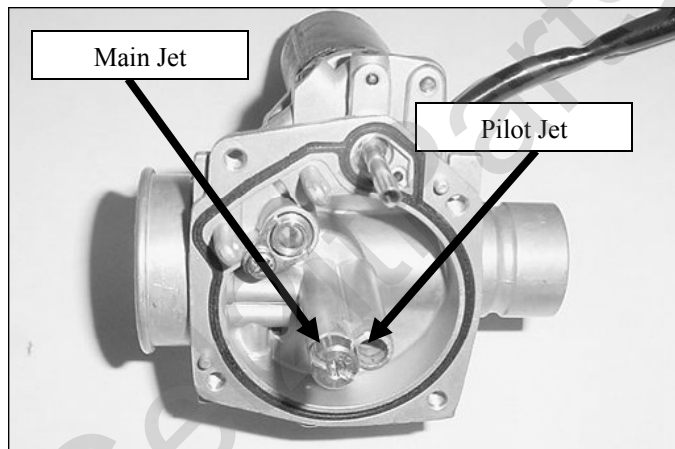
Disassemble the float arm pin, float and float needle valve.

Inspect the seat of the float needle valve for wear or damage.



Disassemble the idle jet, main jet, idle speed adjustment screw, and idle mixture adjustment screw.

Inspect all jets and screws for wear or damage.
Clean the passages and jets with compressed air.



ASSEMBLY

Clean all parts in solvent and blow it dry with compressed air. Assembly is the reverse order of disassembly.

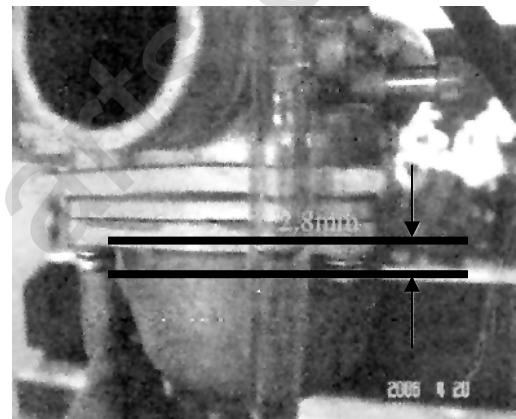
THROTTLE VALVE ASSEMBLY

Install the needle clip on the jet needle.
Install the jet needle into the throttle valve.
Assemble the throttle cable, spring, and throttle valve. Align the throttle valve groove with the idle speed adjust screw and install the carburetor cap to the carburetor.



Factory specification is 2.8~3.5mm for the float level.

Adjustment may be necessary if insufficient fuel
or excess fuel in carburetor.



5. ENGINE LUBRICATION AND COOLING SYSTEM

5.1 TROUBLESHOOTING

NOT ENOUGH OIL GIVEN TO ENGINE	<ul style="list-style-type: none">➤ THE OIL LEVEL IN THE OIL TANK IS TOO LOW.➤ OIL TUBES NOT FIXED PROPERLY.➤ OIL LEAKING FROM TUBE ENDS.➤ OIL TUBES BROKEN.➤ OIL TUBES CLOGGED.➤ OIL PUMP BROKEN.
INSUFFICIENT OIL LEVEL IN TANK	<ul style="list-style-type: none">➤ EXTERNAL OIL LEAKS➤ WORN CYLINDER HEAD GASKET➤ WORN PISTON RINGS
ENGINE OVERHEATS	<ul style="list-style-type: none">➤ PUMP NOT ADJUSTED PROPERLY➤ OIL QUALITY IS BAD

5.2 ENGINE LUBRICATION SYSTEM

The gears of the oil pump are driven by the engine crankshaft. Pump gears rotate the plunger shaft in the oil pump. This shaft sends the lubricating oil into the crankcase to mix with the mixture of air-fuel flow evenly. The oil enters and covers the cylinder inner wall, piston surface, and piston rings.

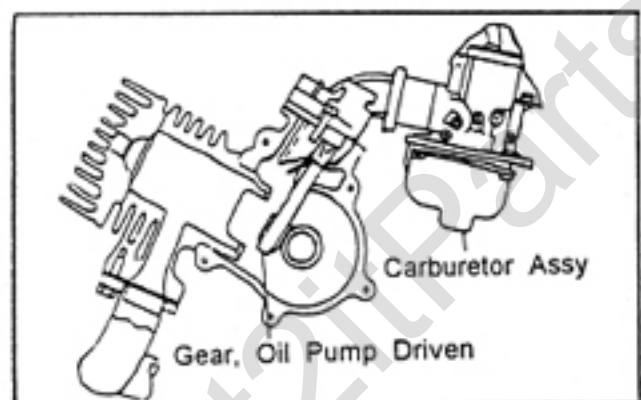
5.3 CAUTION: Fuel/Oil Ratio

Having enough oil in the engine is very important.

If the oil quantity is too low, the engine will be seriously scratched, likely seize, and possibly not work again.

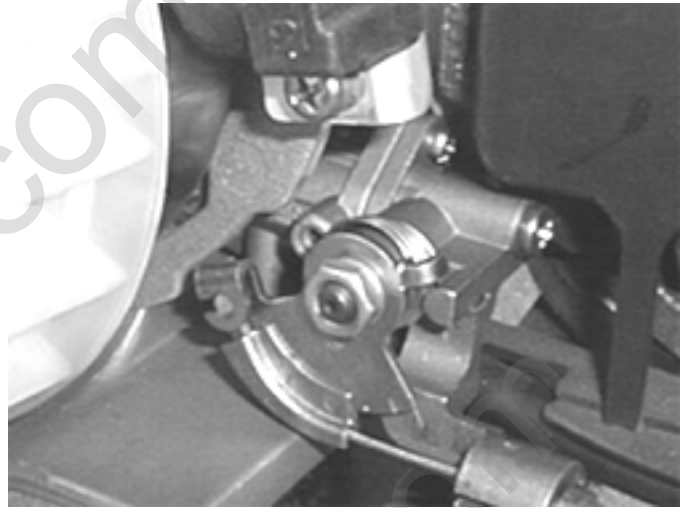
When the cylinder wall is scored or scratched, replace the piston, piston rings, and cylinder together.

Check the combustion system and lubrication system carefully.



5.4 OIL PUMP

The quantity of oil that is delivered from oil pump increases with the engine speed and carburetor throttle width opening. The oil pump is located under the right side of the engine and connected by a control cable from the throttle. The throttle cable assembly splits into two cables with one end controlling the carburetor throttle cylinder and the other end controlling the quantity of oil delivered by the oil pump.

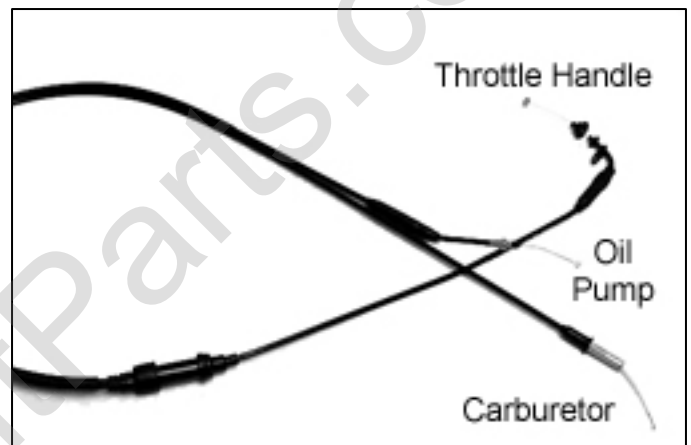


DISASSEMBLE OIL PUMP

Remove the helmet box.
Disconnect the input and output oil tube.
Unscrew the oil pump fixing bolts.
Remove the oil pump.

INSPECT OIL PUMP

Check the matching side in the crankcase.
Inspect the oil pump body.
Inspect the gear part for damage.
Inspect the O-ring for any leaks.



ASSEMBLE OIL PUMP

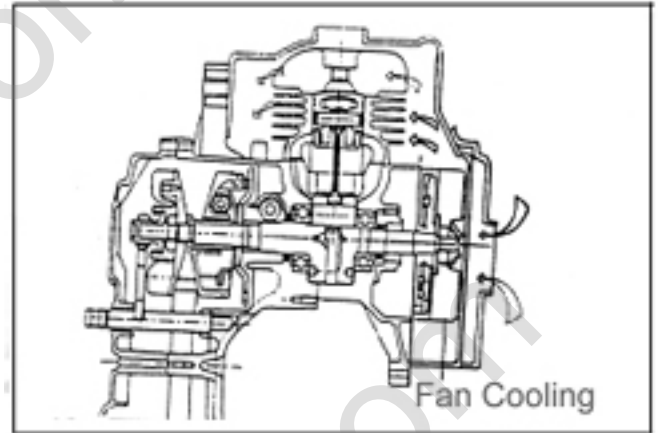
Apply grease on the O-ring and gear parts.
Insert the oil pump into the engine crankcase.
Fasten the fixing bolts.
Torque value is 6 – 9 lbf-ft.



5.5 COOLING SYSTEM

The engine-cooling fan forces the air over the engine. The cooling fan is on the right side of engine. The air is forced to flow through cylinder fin and cylinder head. This prevents the cylinder and piston from overheating.

Disassemble the engine fan cover and cylinder plastic cover. Inspect the fan and cylinder fin. If the blades of the fan are broken, replace with a new fan.



6. ENGINE COMBUSTION SYSTEM

6.1 TROUBLESHOOTING

LOW COMPRESSION	<ul style="list-style-type: none">➤ HEAD GASKET LEAKING OR DAMAGED➤ WARPED OR CRACKED CYLINDER HEAD➤ CYLINDER OR PISTON RINGS WORN OUT
HIGH COMPRESSION	<ul style="list-style-type: none">➤ EXCESSIVE CARBON BUILD-UP ON PISTON HEAD OR IN COMBUSTION CHAMBER
EXCESSIVE NOISE	<ul style="list-style-type: none">➤ PISTON AND CYLINDER WORN OUT➤ EXCESSIVE CARBON BUILD-UP
EXCESSIVE SMOKE	<ul style="list-style-type: none">➤ CYLINDER OR PISTON RINGS WORN OUT➤ IMPROPER INSTALLATION OF PISTON RINGS➤ PISTON OR CYLINDER WALL SCORED OR SCRATCHED
OVERHEATING	<ul style="list-style-type: none">➤ EXCESSIVE CARBON BUILD-UP ON THE PISTON OR COMBUSTION CHAMBER➤ ENGINE COOLING SYSTEM (FAN, CYLINDER COVER, ETC.) WORKING IMPROPERLY➤ OIL QUANTITY LOW➤ WRONG IGNITION TIMING

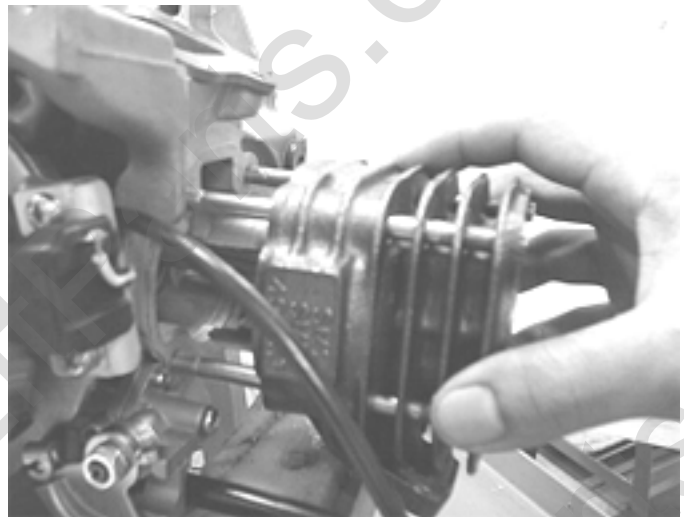
6.2 CYLINDER AND PISTON REMOVAL

Remove the engine. (See chapter 3)
Disassemble the air cleaner and carburetor.
Remove the intake pipe mounting bolts.
Remove the cylinder bolt nuts.



Remove the cylinder head.
Remove the cylinder carefully, so the whole piston is visible.
Remove one piston pin clip.
Remove the piston and piston pin.
Spread each piston ring and remove it.

Note: Don't let the clip drop into the engine crankcase.



6.3 CYLINDER AND PISTON INSPECTION

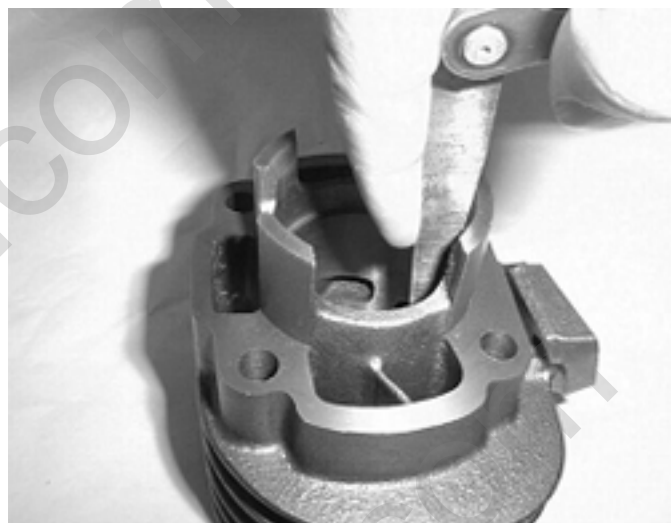
Inspect the cylinder bore for wear or damage.
Measure the cylinder inner diameter at three levels in the X- and Y-axis.

Taper limit: 0.10 mm
Out of round limit: 0.10 mm

Check the cylinder head surface for signs of warping with a straight edge and feeler gauge.
Service limit: 0.10 mm



Insert each piston ring into the cylinder, and measure the end gap.
Service limit: 0.5 mm



Measure the clearance between the ring and groove.
Service limit: 0.09 mm



Measure the pistons outer diameter at 10 mm above the bottom.
Service limit: 39.9 mm



Measure the piston pin bore, and the piston pin outer diameter.

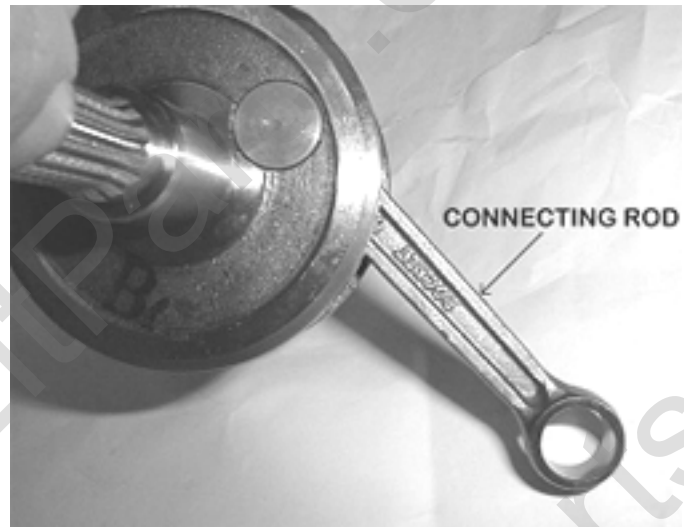
Pin outer diameter Service limit: 10.04 mm

Pin bore Service limit: 9.96 mm



Measure the connecting rod small end inner diameter with a small hole-gauge.

Service limit: 14.06 mm



6.4 INSTALLATION

Install the piston rings with the marks facing up. Do not damage the piston rings by spreading the ends too far.

Note: The piston ring gap must align with the ring pin in the ring groove of piston.

Clean the cylinder gasket surface, being careful not to drop any gasket material into the crankcase.

Apply some oil to the inside of the connecting rod small end.

Install the piston, piston pin, and clip.

Install the piston with the arrow mark facing the exhaust pipe.



Do not align the piston pin clip end gap with the piston cut-out.

Install a new cylinder gasket.

Apply a thin coat of engine oil to the piston rings and cylinder wall.

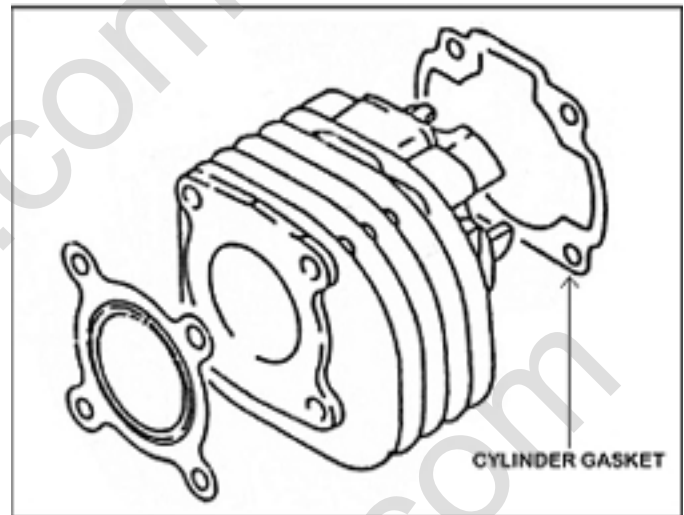
Install the cylinder, compressing the piston rings.

Replace the cylinder head gasket.

Install the cylinder head.

Tighten the cylinder-mounting bolt.

Torque: 20-30 N-m

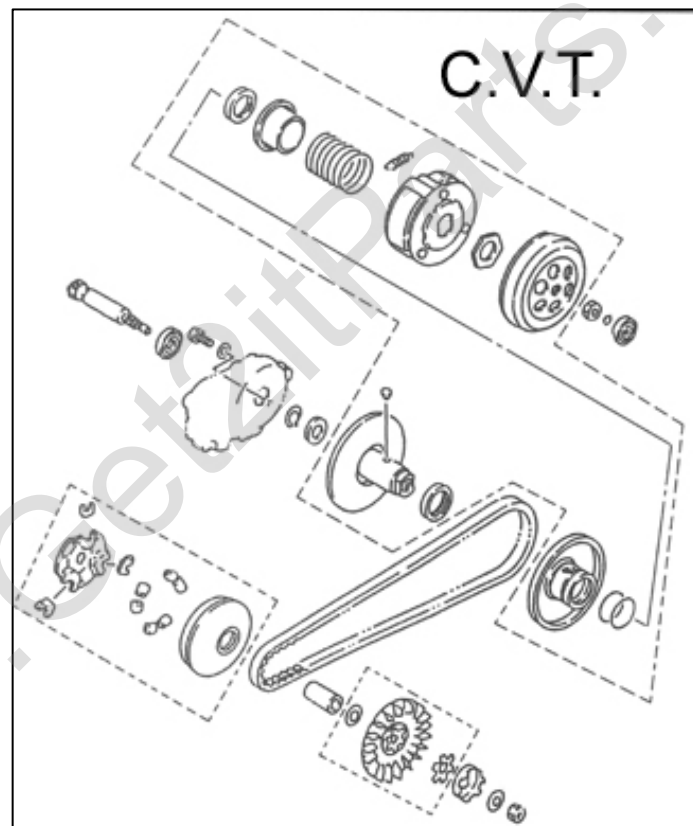


7. TRANSMISSION SYSTEM

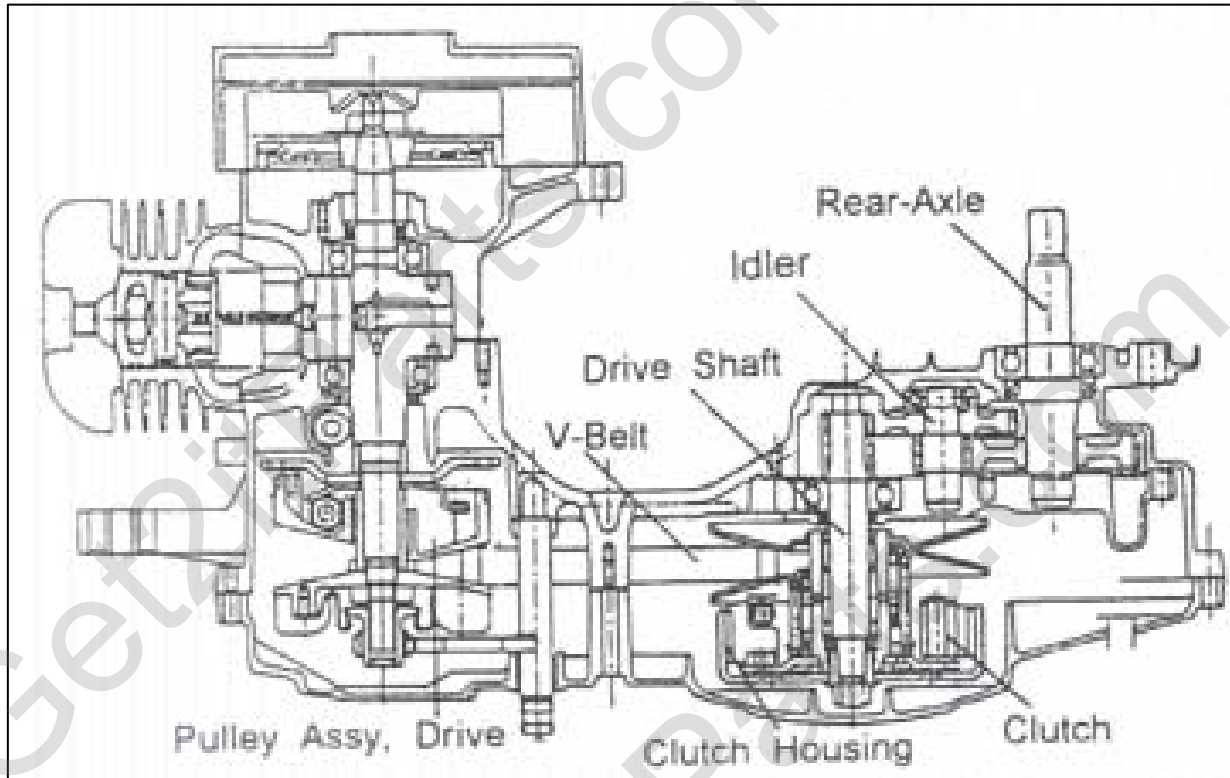
7.1 TROUBLESHOOTING

Vehicle will not move after engine is started →	<ul style="list-style-type: none">➤ BELT WORN➤ FRONT PULLEY WORN OR BROKEN➤ CLUTCH LINING WORN
Vehicle will not attain high speed →	<ul style="list-style-type: none">➤ BELT WORN➤ ROLLERS WORN➤ SPRING OF REAR PULLEY IS DISTORTED➤ ELECTRONIC SPEED LIMITER EXCEEDED

7.2 THE PARTS DRAWING OF TRANSMISSION SYSTEM



7.3 TRANSMISSION POWER PATH



- The crankshaft torque drives the front pulley.
- The torque (drive) pulley turns the belt.
- The belt drives the rear (driven) pulley.
- The force is transmitted through the clutch shoe, clutch housing, and drive shaft.
- The drive shaft turns the idle gear in gearbox.
- Turning speed is reduced by the final-gear and transmitted to the rear-axle shaft to move rear wheel.

7.4 AUTOMATIC CONTINUOUS VARIABLE TRANSMISSION

The transmission is a combination of an automatic centrifugal clutch and a V-belt continuous variable transmission, which can change the transmission ratio automatically.

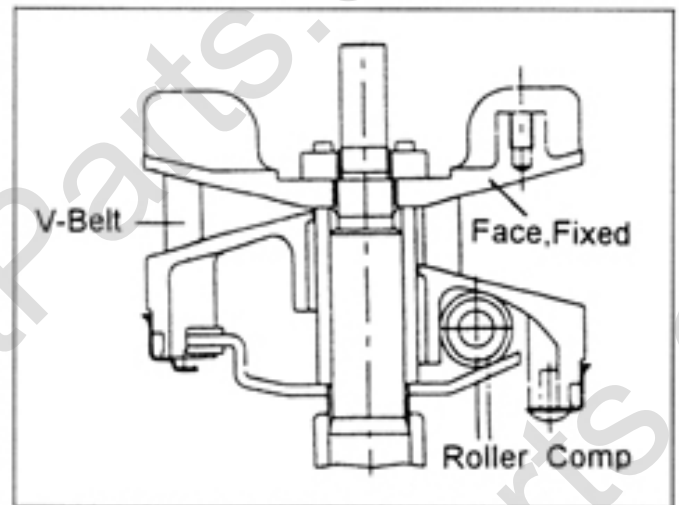
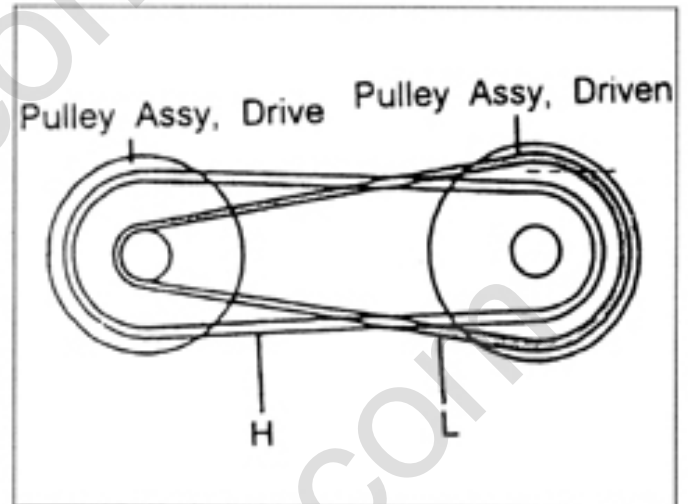
When the engine speed increases, the drive pulley will push the belt by centrifugal force from the six rollers.

Then, the pitch circle of belt in the drive pulley will be larger.

The belt at the drive pulley is forced to move to the center of the shaft, and then the radius of pitch circle is decreased.

The transmission ratio is therefore altered by the alteration of pitch circle's radius.

(In the drawing, "H" means high speed; "L" means low speed)



7.5 CONTINUOUS VARIABLE TRANSMISSION

V-Belt

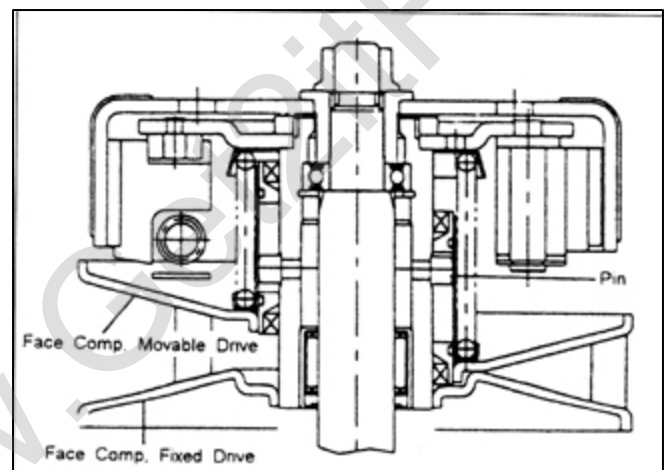
The belt is made of rubber fiber. It is resistant to heat, pressure, and abrasion. The inner side of the belt is toothed.

Drive Pulley

Due to increasing engine speed, the rollers push the movable drive face by centrifugal force. Then, the belt is pressed and enlarges its turning radius. The aluminum fan is installed on the exterior of the fixed drive face. It can reduce the belt temperature.

Driven Pulley

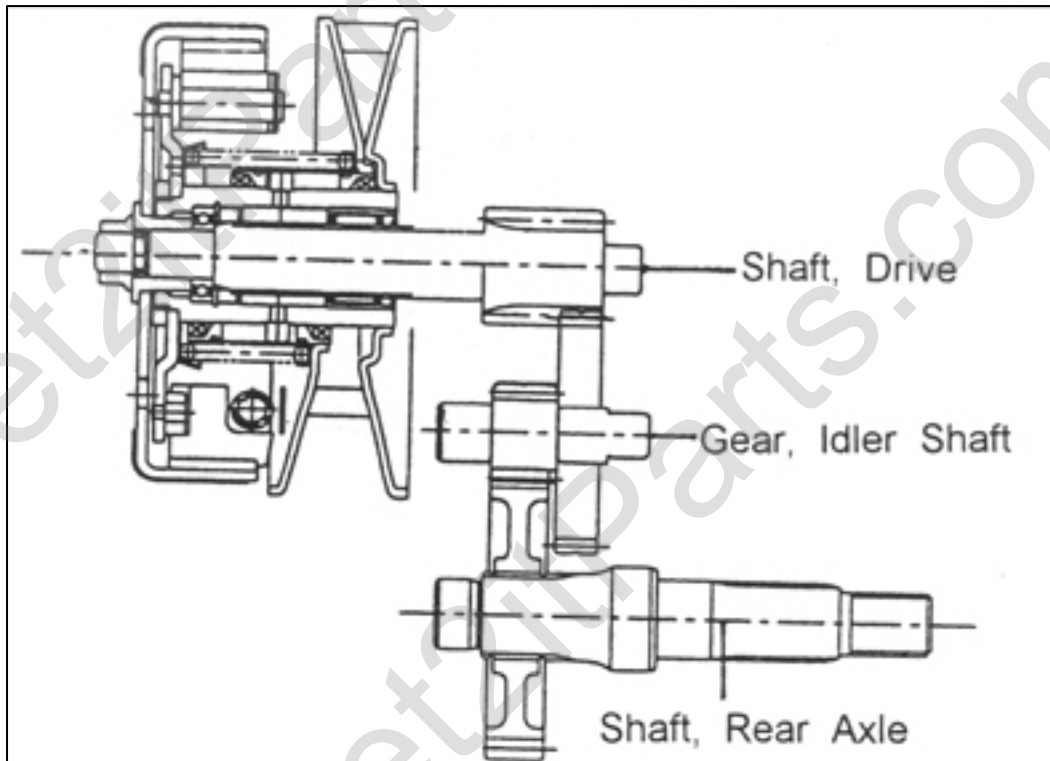
Because the revolving radius of the V-Belt at the drive end is enlarged, the Face Comp Movable Drive is squeezed out by the V-Belt at the driven end to shorten the revolving radius.



There is a Torque Cam on the Movable Drive Face.

The torque Cam is loaded from the outside. When the outside load is higher than the engine's output, the pulley of the fixed shaft and belt slip to make the Movable Drive Face move along the inner side of the cam and compensate to increase to high torque (toward low speed) and make the engine maintain smooth running with original revolution.

7.6 TRANSMISSION BOX



The torque received by the drive shaft will be transmitted by the speed reduction of two sets to the rear axle shaft.

The first gear ratio is 36/13.

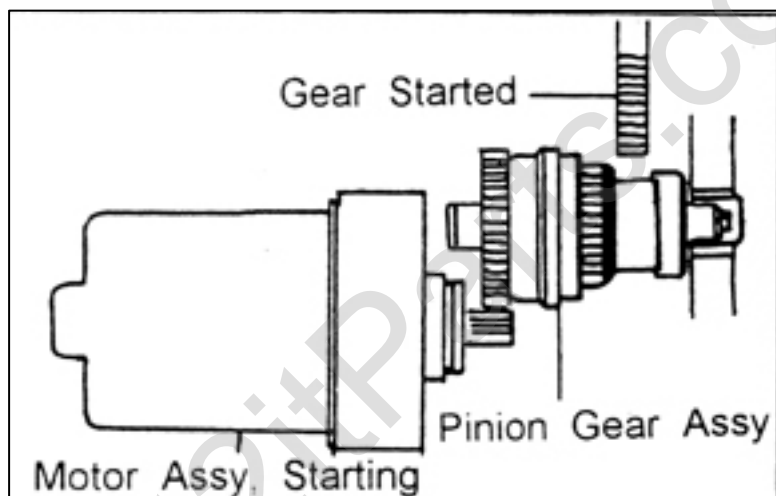
The second gear ratio is 48/12.

DISASSEMBLING THE TRANSMISSION BOX

1. Remove the exhaust pipe. Torque value: M6: 7 - 9 lbf-ft
M10: 25 - 29 lbf-ft
2. Unscrew rear axle nut and remove rear wheel.
3. Unscrew oil-drain bolt at the bottom of crankcase.
4. Let the oil flow out from transmission box.
5. Unscrew six bolts of transmission box cover.
6. Remove the transmission cover.
7. Remove the gears from transmission box.

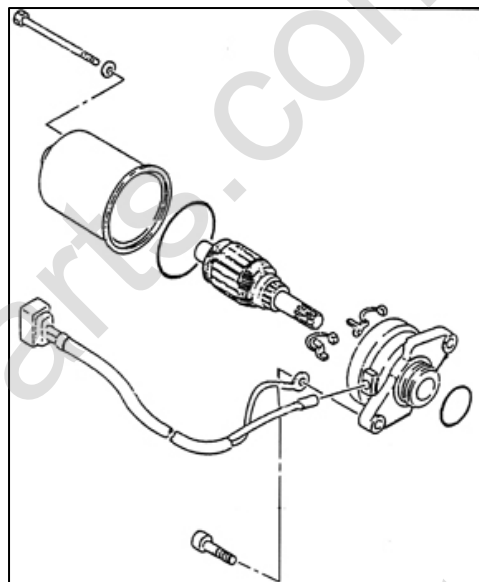
Lubricating oil is SAE 80/90, 100cc/3.4oz.

7.7 ELECTRIC STARTER MOTOR



The Starter Motor is installed on the upper side of engine.

The starter motor can only be activated when the left hand brake is applied and the engine stop switch is in the run position.

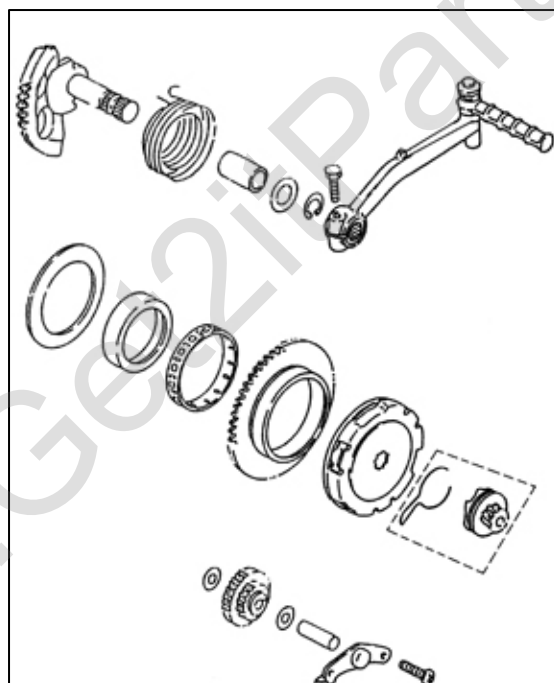


7.8 KICK STARTER

The kick-starter arm is on the left side of engine. When the kick-starter arm is kicked, the gear of the starter shaft will drive the kick-starter to turn the crankshaft to start the engine.

After the engine is started, the kick-starter will stop the transfer of power to the kick-starter driven gear.

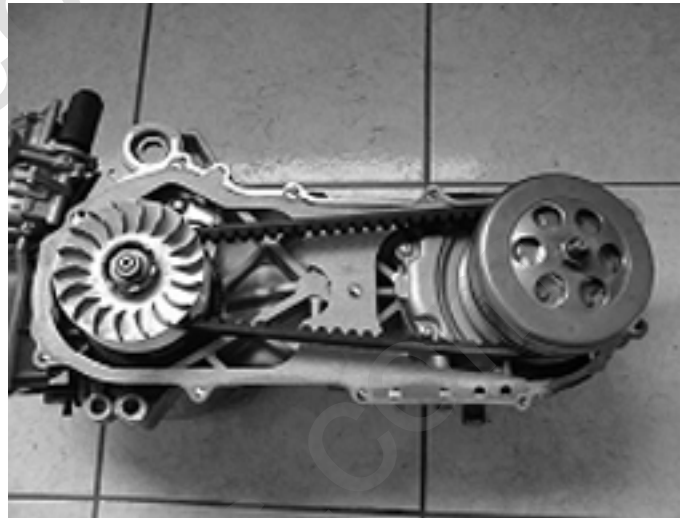
When the kick-starter lever is released, the kick-starter gear will go back to its original position.



7.9 DISASSEMBLY AND INSPECTION OF THE C.V.T. SYSTEM

Remove the engine clutch cover by unscrewing the fixed bolts. Check the belt for wear. If necessary, replace the belt. Disassemble the front drive pulley and check the six rollers for wear. If necessary, replace the rollers.

Remove the screws on the clutch cover at the left side of the engine. Take off the clutch cover and gasket. The belt, front pulley and rear pulley are now visible. Unscrew the front pulley fixing nut. Remove the front pulley carefully. Take out the six rollers from the front pulley. Inspect the surface of the rollers. If there is serious wear, replace with new rollers. Inspect the belt. If it is broken or loose, replace with a new one.



8. FRONT WHEEL, BRAKE AND STEERING SYSTEM

8.1 TROUBLESHOOTING

STEERING IS HEAVY	<ul style="list-style-type: none">➤ DAMAGED STEERING BEARINGS➤ DAMAGED STEERING BEARING RACES➤ STEERING SHAFT HOLDER TOO TIGHT➤ DAMAGED TIRE➤ LOW INSUFFICIENT TIRE PRESSURE
HANDLEBAR POSITIONED IMPROPERLY	<ul style="list-style-type: none">➤ BENT FRONT FORK➤ BENT FRONT AXLE➤ DAMAGED FRONT WHEEL➤ DAMAGED FRONT FORK SHOCK ABSORBERS➤ UNBALANCED FRONT SHOCK ABSORBERS
FRONT WHEEL IS WOBBLING	<ul style="list-style-type: none">➤ BENT RIM➤ IMPROPERLY INSTALLED WHEEL HUB➤ EXCESSIVE PLAY IN WHEEL BEARING➤ DAMAGED TIRE
POOR BRAKE PERFORMANCE	<ul style="list-style-type: none">➤ BRAKE SHOES WORN➤ WORN BRAKE DISK➤ BRAKE DISK OILY, GREASY, OR DIRTY➤ IMPROPER BRAKE ADJUSTMENT
FRONT SUSPENSION NOISE	<ul style="list-style-type: none">➤ LOOSE FRONT SUSPENSION FASTENERS➤ BINDING SUSPENSION LINK

8.2 MAINTANENCE DATA

Front brake disk thickness

Standard: 3.6 mm

Minimum limit: 3.1 mm

Rim warping limit: 2.0 mm

8.3 SPEEDOMETER CABLE REMOVAL

Remove the handlebar cover.
Unscrew speedometer cable nut.

Unscrew the speedometer cable fixing bolt at the front wheel. Pull out the worn speedometer cable.
Install a new speedometer cable.

NOTE: Before assembling the new speedometer cable, apply grease on the inner line of this cable.



8.4 HANDLEBAR REPLACEMENT

Remove the rear view mirrors.
Disassemble the upper cover of handlebar.
Disconnect the speedometer cable and connectors of switches.
Disassemble the rear brake cable and rear brake lamp connector near the left handlebar.

Remove the right grip assembly.
Disconnect the throttle cable.
Unscrew the brake master cylinder fixing bolt.
Remove the brake master cylinder assembly.



Remove the fixing nut and handlebar bolt on the front fork. Remove the handlebar.

Torque when installing a handlebar:

M6 nut: 7 - 9 lbf-ft

M10 nut: 22 - 29 lbf-ft

8.5 FRONT WHEEL

Remove the locking nut at the right side of the front wheel.

Pull out the front wheel axle. Take off the collar.
Remove the speedometer gear unit.
Remove the front wheel assembly.

Torque when replacing the front wheel:

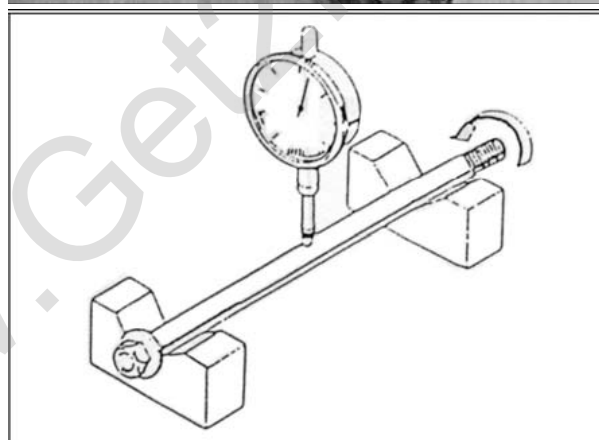
M10 nut: 22 - 29 lbf-ft

NOTE: Apply the grease on the speedometer gear unit before assembly.

INSPECT THE FRONT WHEELAXLE

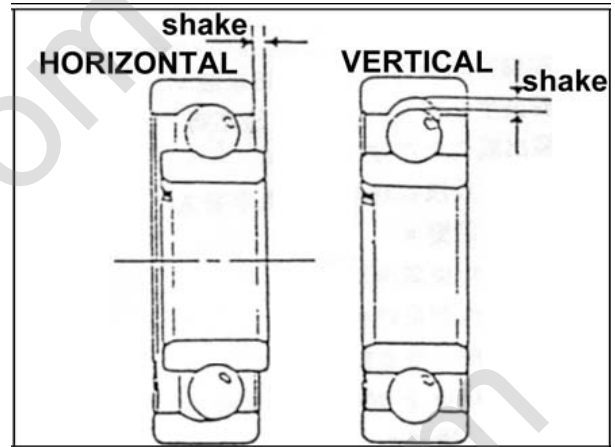
Check the wheel axle for bending.

Standard maximum: **0.2 mm**



FRONT WHEEL AXLE BEARING INSPECTION

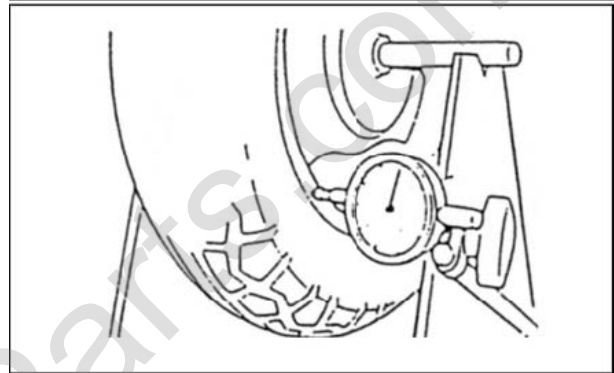
Spin the wheel. Replace with a new bearing if needed.



INSPECT THE FRONT RIM

Check the rim swing limit.

Limit: Replace if the swing is over 2.0mm



8.6 FRONT BRAKE

REPLACING THE FRONT DISK BRAKE CALIPER ASSEMBLY

Unscrew the two front disk brake caliper fixing bolts.
Take off the front disk brake caliper.

Torque value when replacing: M8 nut: 14 - 22 lbf-ft



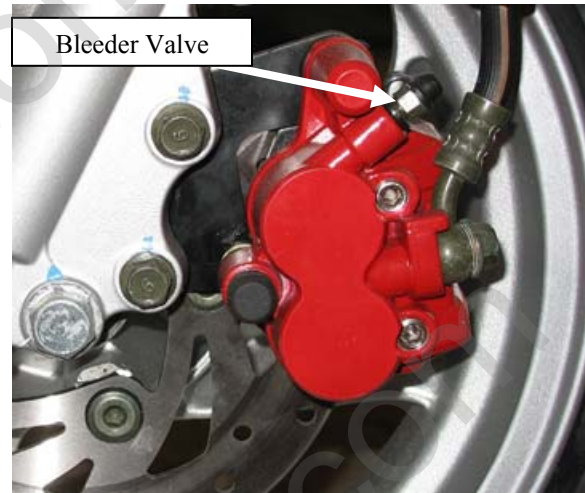
REMOVING THE AIR FROM THE FRONT DISK BRAKE CALIPER

Fill the brake reservoir with the recommended DOT3 brake fluid in the brake master cylinder at the right handlebar (see picture).

Be careful not to spill any brake fluid when refilling.
Release and lock the bleeder valve at the disk brake caliper.



Engage the front brake a few times by pulling the brake lever gently. Then, hold the front brake level all the way in; while holding in, release the bleeder valve on the front caliper to force the air out. Then, lock the valve. Repeat this action until no more air flows out.
Torque value: 4 lbf-ft

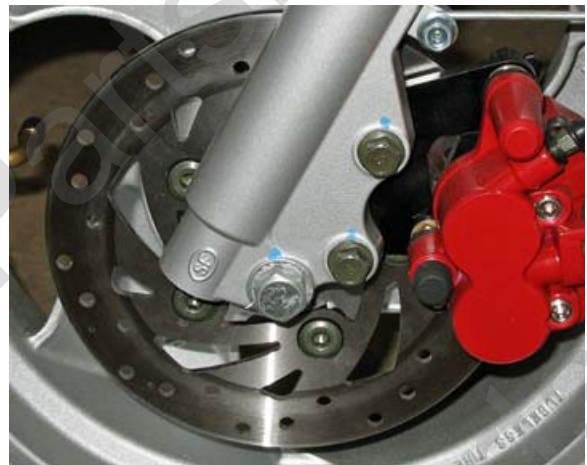


DISASSEMBLING THE FRONT BRAKE DISK

Disassemble the front wheel.
Unscrew the three brake disk fixing bolts.
Remove the brake disk.
Torque of these M8 nuts: 14 – 22 lbf-ft

INSPECT BRAKE DISK

Measure the thickness of the brake disk.
Standard thickness: **3.6 mm**
Limit: **3.1 mm**



BRAKE SHOES (LINING) INSPECTION

Measure the thickness of the brake lining.
Standard thickness: **4.0 mm**
Limit: 3.0 mm
NOTE: Do not get grease on the lining surface.



8.7 FRONT FORK

FRONT FORK INSPECTION

Replace if there is any bending or distortion.

FRONT SHOCK ABSORBER INSPECTION

Look for leaks, torn seals, scratched shafts, and loose connections.



9. REAR WHEELAND BRAKE SYSTEM

9.1 TROUBLESHOOTING

BAD BRAKE PERFORMANCE	<ul style="list-style-type: none">➤ WORN BRAKE SHOES➤ BRAKE ADJUSTED IMPROPERLY➤ BRAKE LININGS OILY, GREASY, OR DIRTY➤ WORN BRAKE DRUM➤ BRAKE ARM SETTING IMPROPERLY ENGAGED
VIBRATION OR WOBBLE	<ul style="list-style-type: none">➤ BENT RIM➤ DAMAGED TIRED➤ WHEEL AXLE IMPROPERLY TIGHTENED

9.2 MAINTENANCE DATA

Brake drum inner diameter

Standard: 110 mm

Limit: 110.5 mm

Lining thickness

Standard (minimum): 4.0 mm

Limit: 2.0 mm

9.3 REAR WHEEL REMOVAL

Remove the muffler.

Unscrew the rear wheel axle nut.

Remove the rear wheel.

Torque value for installation:

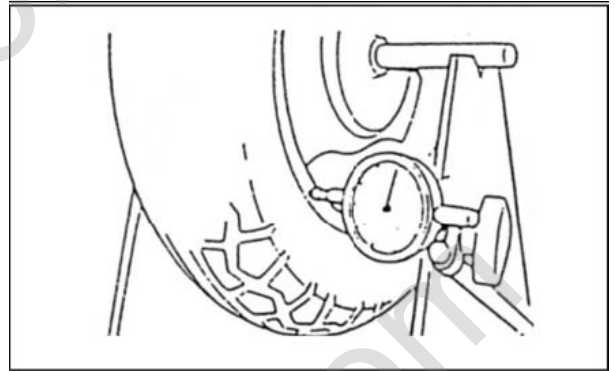
M6 nut: 5 – 8 lbf-ft

M14 nut: 40 lbf-ft



9.4 REAR WHEEL INSPECTION

Measure the rear wheel rim for distortion.
Replace rim if the distortion is over 2.0 mm in difference.



9.5 REAR BRAKE

REAR BRAKE DRUM INSPECTION

Measure the rear brake drum inner diameter.
Replace if the diameter is over 110.5mm.



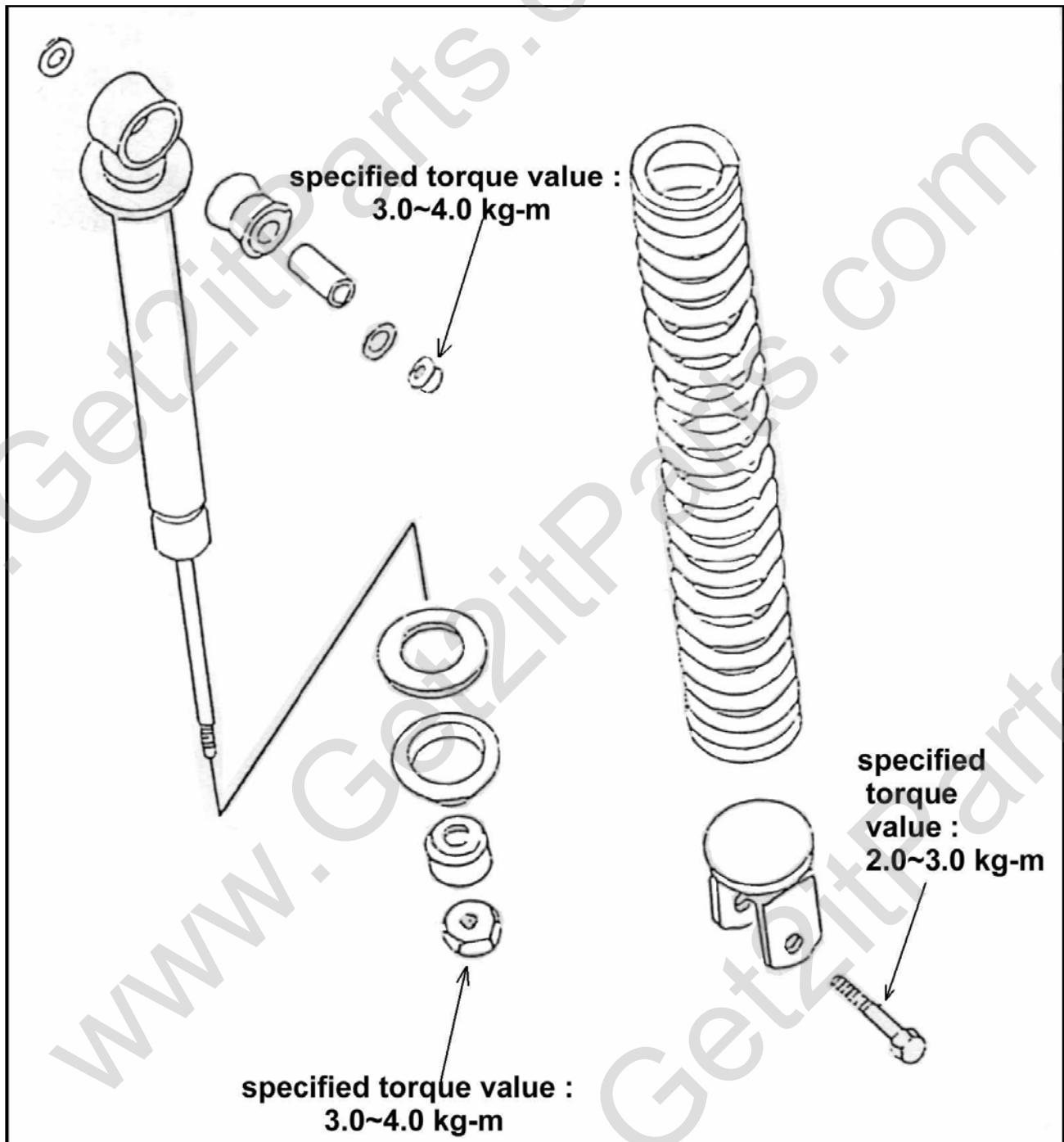
BRAKE LINING INSPECTION

Measure the brake lining thickness.
Replace if it is less than 3.0 mm.
Standard thickness: 4.0mm
Service limit: 3.0mm

Note: Do not allow grease to come into contact with the lining surface



9.6 REAR SHOCK ABSORBER PARTS DRAWING



10. PLASTIC BODY PARTS

10.1 FRONT FENDER

Unscrew the five fixing screws between the front fender and leg shield.
Remove the front fender.



10.2 BODY COVER

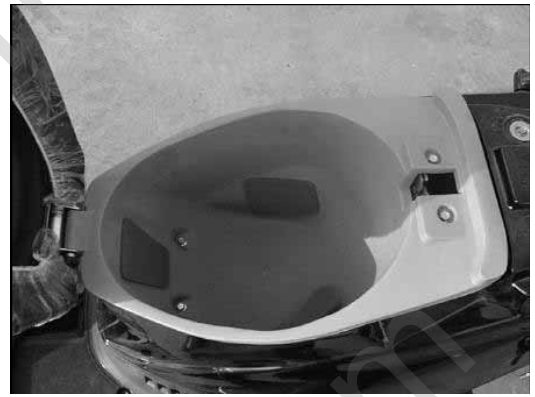
Unscrew the four fixing bolts on the rear handle bar.
Remove the rear handle bar.



Unscrew the two fixing screws of each side of the protective covers.



Open the seat.
Unscrew four fixing bolts of the helmet box.
Remove the helmet box.



Unscrew the fixing screws between the body cover and middle cover.
Remove the middle cover.



Unscrew the two fixing screws of the body cover under the middle cover.



Open and remove the fuel tank cap.
Unscrew the two fixing screws of the body cover near the fuel tank cap.



Unscrew two taper screws of the body cover near the footrest board. Remove the body cover.



Unscrew three fixing screws of the battery cover at footrest board. Remove the battery cover.



Disconnect the negative terminal of the battery, then disconnect the positive terminal. Remove battery. Unscrew the fixing screws of the lower cover. Remove the lower cover.



Unscrew three screws of the leg shield. Remove the leg shield.



Unscrew four fixing screws near the rear lamp cover.



Remove rear lamp cover.



Unscrew two fixing bolts of the footrest board.



Remove footrest board.

Torque value:
M6: 5 – 8 lbf-ft
M5: 3 – 4 lbf-ft



11. ELECTRICAL SYSTEM

11.1 TROUBLESHOOTING

ENGINE STARTS BUT STOPS

- IMPROPER IGNITION TIMING
- FAULTY SPARK PLUG

NO SPARK AT PLUG

- ENGINE STOP SWITCH AT “ OFF “
- FAULTY IGNITION COIL
- FAULTY GENERATOR
- FAULTY CDI UNIT
- POOLY CONNECTED:
 - Between CDI and ignition coil
 - Between alternator and CDI unit
 - Between CDI and engine stop switch
 - Between ignition coil and spark plug
 - Between generator and CDI unit

ENGINE STARTS BUT RUNS POORLY

- IGNITION PRIMARY CIRCUIT
 - Faulty generator
 - Faulty CDI unit
 - Faulty alternator exciter coil
 - Loosen contacted terminals
 - Faulty ignition coil
- IGNITION SECONDARY CIRCUIT
 - Faulty plug
 - Loosen contacted spark plug wire
- IMPROPER IGNITION TIMING
 - Faulty generator
 - Faulty CDI unit

CHARGING SYSTEM FAILURE

- LOOSE, BROKEN OR SHORTED WIRE
- FAULTY ALTERNATOR
- FAULTY IGNITION SWITCH
- LOOSE BATTERY CONNECTION

ENGINE INTERMITTENT POWER

- LOOSE CHARGING SYSTEM CONNECTION

STARTER MOTOR WILL NOT TURN

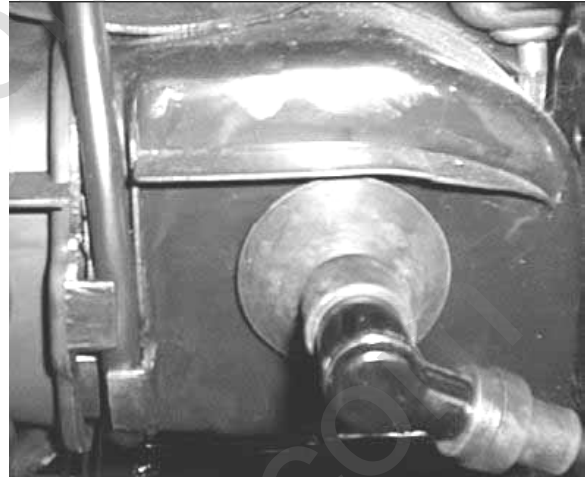
- DEAD BATTERY
- FAULTY IGNITION SWITCH
- LOOSE OR DISCONNECTED WIRE

STARTER MOTOR AND ENGINE TURN, BUT ENGINE DOES NOT START

- FAULTY IGNITION SYSTEM
- ENGINE PROBLEMS
- FAULTY ENGINE STOP SWITCH

11.2 IGNITION COIL

Remove the spark plug cap from the spark plug.
Disconnect the ignition coil primary wire.



Testing the ignition coil:

- Remove the coil wire cap from the spark plug
- Unplug the ignition coil primary leads
- Test the primary coil as shown in the picture. Primary coil resistance should range between 0.1-0.3 Ω .
- Test the secondary coil as shown in this picture. Secondary coil resistance should range between 7.4-12.0 k Ω .
- If the test results fall outside the stated ranges, replace the ignition coil assembly.



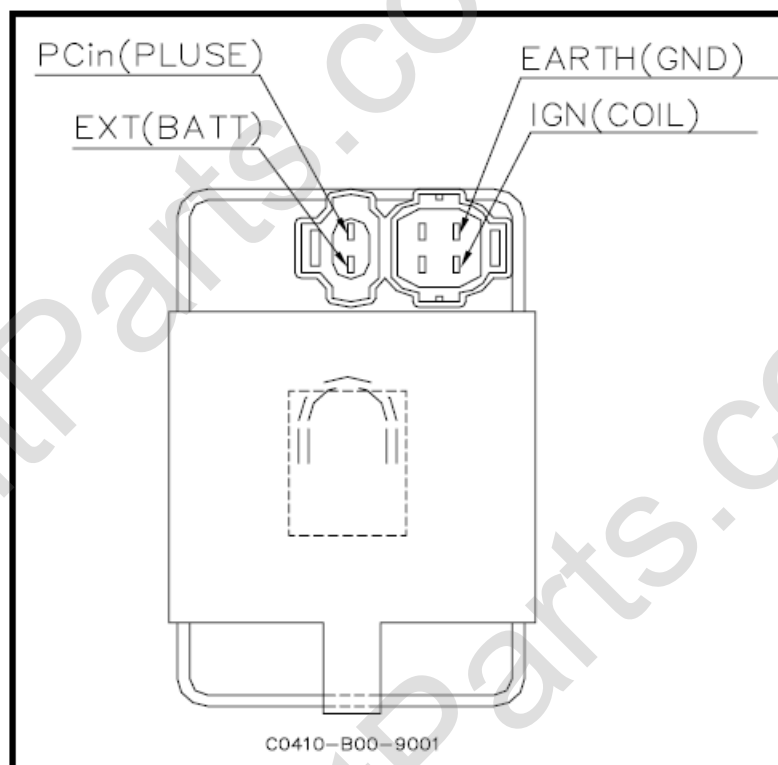
11.3 IGNITION TIMING, CDI SPECIFICATION, AND A/C GENERATOR TEST

The preprogrammed ignition advance is $15^{\circ} \pm 3^{\circ}/4000\text{rpm}$.

Ignition timing is controlled by the CDI (Capacitive Discharge Ignition) module and is set at the factory via a RCP (ROM Chip Program). The timing cannot be manually adjusted.



Matrix CDI Module Specifications



PN2B & PN2C -- C0410-B00-9001

Electric resistance(Ω) specification

-	EXT	IGN	Pcin	GND
EXT		10-12K	60-80K	∞
IGN	7-8K		28-32K	∞
Pcin	28-32K	10-12K		∞
GND	11-14K	1-3K	40-50K	

Specifications highlighted in yellow are the suggested critical testing points. Test points should be tested first.

We suggest using analogy type multi-meter to test the electric resistance. We have found using digital type meter produces to many inaccurate readings.

A/C Generator Test



<u>Wires</u>	<u>Measurement</u>
Blue & Yellow/Black	90~130 Ω
White & Red/White	0.830~1.130 Ω
White/Red & Yellow/Red	0.700~0.950 Ω

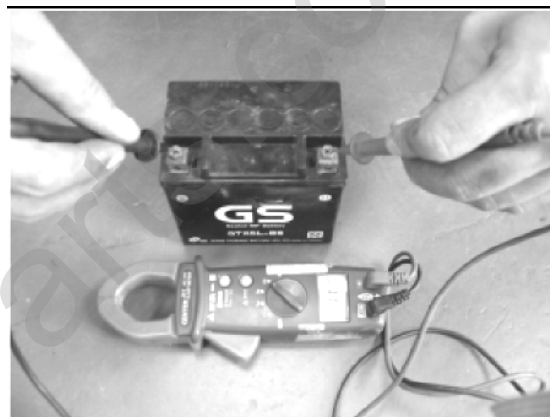
11.4 BATTERY INSPECTION AND MAINTENANCE

CAUTION: The battery emits flammable and explosive fumes during normal operation. Keep away from sparks, open flame, and other possible sources of ignition. Always provide adequate ventilation during charging and maintenance of the battery. The battery contains sulfuric acid (an electrolyte). Contact with skin or eyes may cause severe burns or blindness. Always wear protective clothing and eye protection when servicing the battery. The electrolyte is toxic. If swallowed, drink large quantities of water or milk and seek medical attention immediately, or contact a poison control center.

The battery is located under the seat in the battery compartment.

Battery removal:

- Remove the battery retainer strap
- Disconnect the negative (BLACK) battery lead first
- Disconnect the positive (RED) battery lead next
- Use caution when disconnecting lead so as not to cause a spark
- Remove the battery from the battery compartment



Testing the battery:

- Measure the battery voltage using a multi-meter set to Voltage
- A fully charged battery should read 13.0-13.5V. An under charged or faulty battery will be below 12.0V.
- If the battery is showing under charge condition, charge the battery using a trickle charger at 7 amps for 10 hours. When charging the battery, it should be removed from the unit. Connect the charger lead to the battery before turning on the charging unit. Turn the charging unit off before disconnecting the charging leads from the battery. Retest the battery voltage. If the battery voltage shows an under charge condition after charging, replace the battery.



New battery preparation:

- The new battery is shipped dry with the electrolyte in a separate container. Remove the battery cell caps and install the electrolyte in the battery cells. **CAUTION:** Electrolyte contains sulfuric acid that can cause severe burns if contact is made with the skin or eyes.
- Allow the battery to completely absorb the electrolyte (approximately one (1) hour). The battery should have a full charge. The battery is a gel acid battery and will not show any liquid electrolyte when fully absorbed.

DO NOT place the new battery on a charger as this can damage the cell plates and make the battery unusable.

Battery installation:

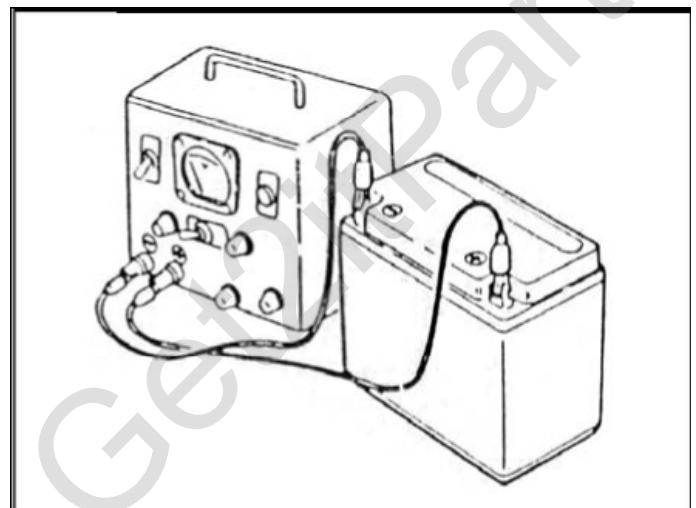
- Place the battery in the battery compartment.
- Clean the battery terminals and lead connectors of all dirt and corrosion.
- Attach the positive (RED) lead to the [+] positive terminal of the battery first.
- Attach the negative (BLACK) lead to the [-] negative terminal of the battery next.
- Check the lead routing to ensure they are clear of obstruction and do not fall between the battery and unit body where they could be abraded or otherwise damaged.
- Attach the battery retainer strap to secure the battery in place.



Battery charging:

- If the battery become discharged or shows low voltage you can recharge the battery using a 12 volt battery trickle charger.
- Connect the positive lead of the charger to the positive terminal of the battery.
- Connect the negative lead of the charger to the negative terminal of the battery.
- Turn on the charger and allow the battery to charge from 4 to 6 hours.
- Test the battery voltage after charging it should give a reading of between 12-and 13 volts.
- If after charging the battery is still indication a low voltage or the battery will not hold the charge for more than a day or two the battery should be replaced.

ETON recommends replacing the battery every two years for optimal performance.



Battery Storage:

If the vehicle will not be in use for an extended period of time, the battery should be removed and stored in a location that will ensure that battery will not freeze.

DO NOT store the battery on a concrete surface as it can draw the charge from the battery and damage the battery plates.

11.5 STARTER MOTOR

The starter motor is attached to the engine.

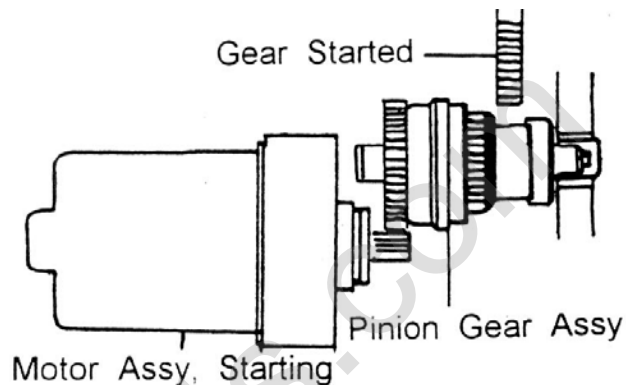
Unscrew the two starter motor fixing

Bolts and remove the starter motor.

Disconnect the motor wire.

Connect motor and battery to check the functionality of the motor.

(See chapter #7)



11.6 WIRING DIAGRAM

Matrix 50 Wire Diagram

