



MANUEL ATELIER

HYTRACK HY910IS

Standard Motor Corporation





Introduction

This service manual contains the technical data of each component inspection and repair for the SMC ML series 850 ATVs. The manual is shown with illustrations and focused on "Service Procedures", "Operation Key Points", and "Inspection Adjustment" so that provides technician with service guidelines. If the style and construction of the ATV are different from that of the photos, pictures shown in this manual, the actual vehicle shall prevail. Designs and specifications are subject to change without notice.

Service Department
Standard Motor Corporation

HOW TO USE THIS MANUAL

This service manual describes basic information of different system parts and system inspection & service for SMC ML series. In addition, please refer to the manual contents in detailed for the model you serviced in inspection and adjustment.

Chapter 1 includes general information and trouble diagnosis.

Chapter 2 includes service maintenance information.

Chapter 3~12 includes engine and transmission systems.

Chapter 13 includes cooling system.

Chapter 14~18 includes assembly frame body.

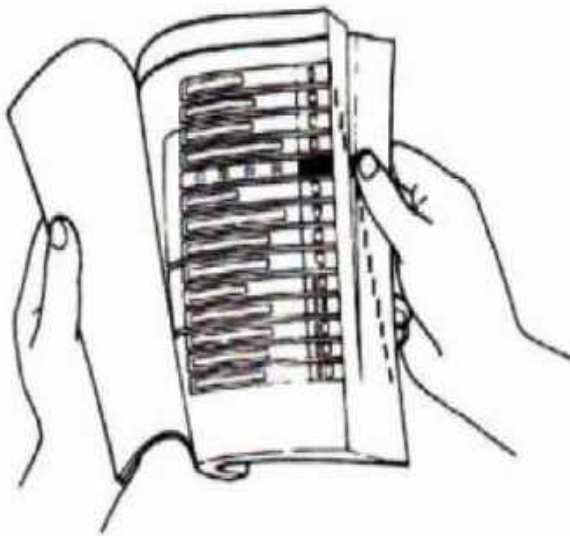
Chapter 19 includes electronic fuel injection system

Chapter 20 includes electric power steering

Chapter 21 includes electrical equipment.

Chapter 22 includes wiring diagram.

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



SERIAL NUMBER

Frame number (right side front)



Engine number (left side front)



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1. General Information

This chapter offer you the general information of SMC ML safety notice, caution and the tools torque setting, please read carefully and make sure you have well acknowledge and skills before start to do any repair/inspection jobs as mentioned at furthering chapters.

1-01. Symbols and Marks

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

Warning	Means that serious injury or even death may result if procedures are not followed.
Caution	Means that equipment damages may result if procedures are not followed.
Engine oil	Limits to use SAE 10W-40 API/SH class or above oil. Warranty will not cover the damage that caused by not apply with the limited engine oil.
Grease	Chassis grease is recommended.
Gear oil	Gear oil serials are recommended. (Gear oil SAE 80/90 is recommended)
Locking sealant	Apply sealant; medium strength sealant should be used unless otherwise specified.
Oil seal	Apply with lubricant.
Renew	Replace with a new part before installation.
Brake fluid	Use recommended brake fluid DOT4.
Special tools	Special tools
Correct	Meaning correct installation.
Wrong	Meaning wrong installation.
Indication	Indication of components.
Directions	Indicates position and operation directions

1-02 General information refer to your own safety

Below are some of the general informations to your own safety during the repair/service time.

Carbon monoxide

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

Caution

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

Gasoline

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

Caution

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

Used engine oil

Caution

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

Hot components

Caution

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

Battery

Caution

2. Battery emits explosive gases; Flame is strictly prohibited. Keeps the place well ventilated when charging the battery.
3. Battery contains sulfuric acid (electrolyte) which can cause serious burns so be careful do

not be spray on your eyes or skin. If you get battery acid on your skin, flush it off immediately with water. If you get battery acid in your eyes, flush it off immediately with water and then go to hospital to see an ophthalmologist.

4. If you swallow it by mistake, drink a lot of water or milk, and take some laxative such as vegetable oil and then immediately go to see a doctor.
5. Keep electrolyte beyond reach of children.

Brake pad

Do not use an air hose or a dry brush to clean components of the brake system; use a vacuum cleaner or the equivalent to avoid dust flying.

Caution

Inhaling brake shoe or pad ash may cause disorders and cancer of the breathing system.

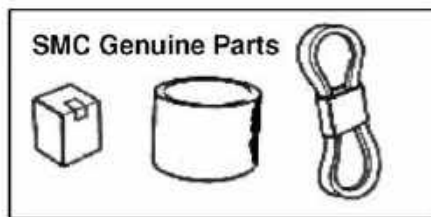
Brake fluid

Caution

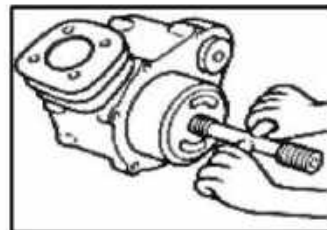
Spilling brake fluid on painted, plastic, or rubber parts may cause damage to the parts. Place a clean towel on the above-mentioned parts for protection when servicing the brake system. Keep the brake fluid beyond reach of children.

1-03. Service Precautions

1. Always use with SMC genuine parts and recommended oils.
→ Using non-genuine parts for SMC ATV may damage the ATV and out of SMC warranty service.



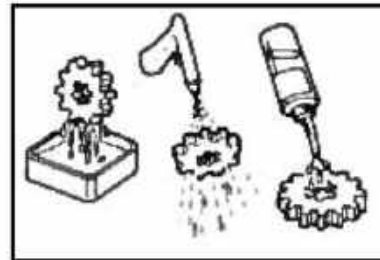
2. Special tools are designed for remove and install of components without damaging the parts being worked on. Using wrong tools may result in parts damaged. Lock up /release disposable clamps use special tool as well.



3. When servicing this ATV, use only metric tools. Metric bolts, nuts, and screws are not

interchangeable with the English system, using wrong tools and fasteners may damage this vehicle.

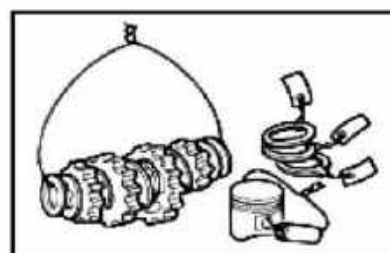
4. Clean the outside of the parts or the cover before removing it from the ATV. Otherwise, dirt and deposit accumulated on the part's surface may fall into the engine, chassis, or brake system to cause damage.
5. Wash and clean parts with high ignition point solvent, and blow dry with compressed air. Pay special attention to O-rings or oil seals because most cleaning agents have an adverse effect on them.



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



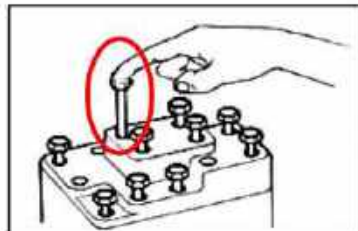
7. Rubber parts may become deteriorated when old, and prone to be damaged by solvent and oil. Check these parts before installation to make sure that they are in good condition, replace if necessary.
8. When loosening a component which has different sized fasteners, operate with a diagonal pattern and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



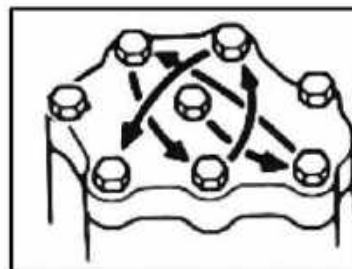
10. Note the reassemble position of the important components before disassembling them to ensure they will be reassembled in correct dimensions (depth, distance or position).
11. Components not to be reused should be replaced when disassembled including gaskets, metal seal rings, O-rings, oil seals, snap rings, clips, clamps, split pins, washers, disposable bolts, screws, nuts, clampsand so on.



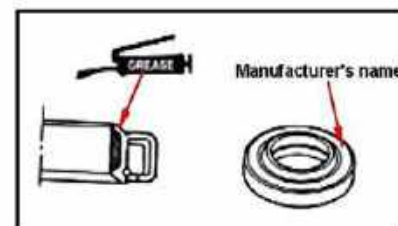
12. The length of bolts and screws for assemblies, cover plates or boxes is different from one another, be sure they are correctly installed. In case of confusion, Insert the bolt into the hole to compare its length with other bolts, if its length outside the hole is the same with other bolts, it is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



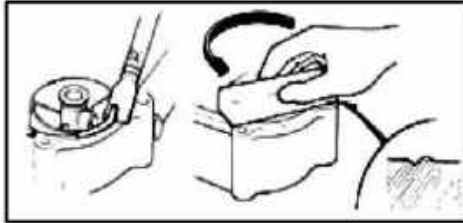
13. Tighten assemblies with different dimension fasteners as follows: Tighten all the fasteners with fingers, then tighten the big ones with special tool first diagonally from inside toward outside, important components should be tightened 2 to 3 times with appropriate increments to avoid warp unless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



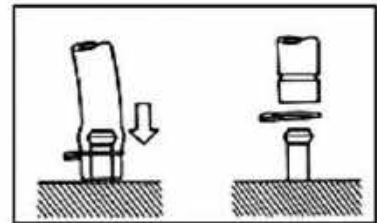
14. When oil seal is installed, fill the groove with grease, install the oil seal with the name of the manufacturer facing outside, and check the shaft on which the oil seal is to be installed for smoothness and for burrs that may damage the oil seal.



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

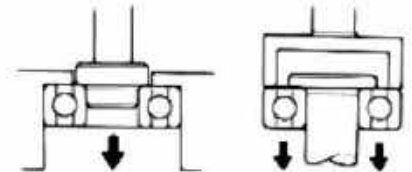


16. The ends of rubber hoses (for fuel, vacuum, or coolant) should be pushed as far as they can go to their connections so that there is enough room below the enlarged ends for tightening the clamps.

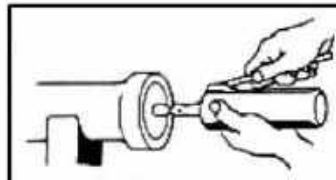


17. Rubber and plastic boots should be properly reinstalled to the original correct positions as designed.
18. The bearing tool should be pressed against two (inner and outer) bearing races when removing a ball bearing. Damage may result if the tool is pressed against only one race (either inner race or outer race). In this case, the bearing should be replaced. To avoid damaging the bearing, use equal force on both races.

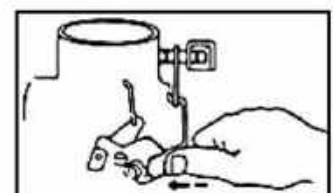
(Both of these examples can result in bearing damage)



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



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



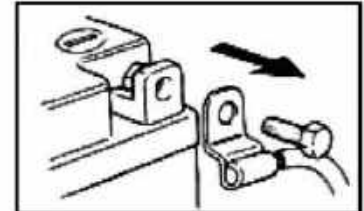
21. Make sure service safety for each other when conducting by two persons.

22. Do not let parts fall down.

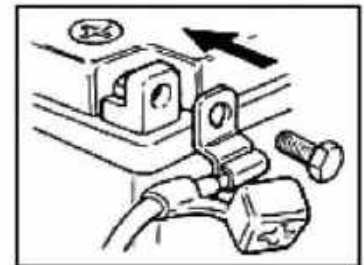


23. Battery removal/installation.

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

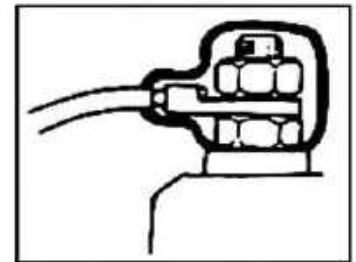


2. After service completed, make sure all connection points is secured. Battery positive (+) cable should be connected firstly when re-install the battery cord. .



3. And the two pole sides of battery have to be greased after connected the cables.

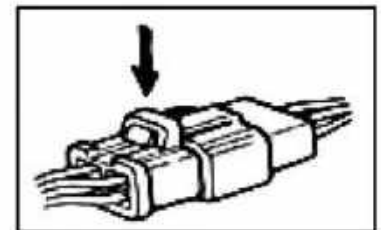
4. Make sure that the battery post caps are located in properly after the battery posts had been serviced.



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

25. Connector unlock/insert

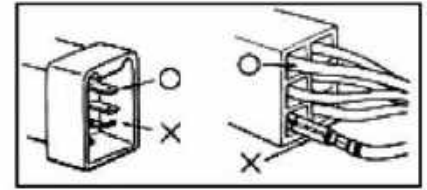
1. When separating a connector, it locker has to Insert the terminal completely, unlocked it first.



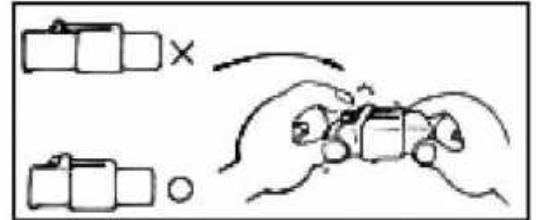
2. Do not pull the wires as removing a connector or wires. Hold the connector body.



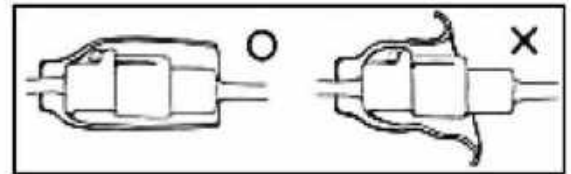
3. Make sure if the connector pins are bent, extruded or loosen.



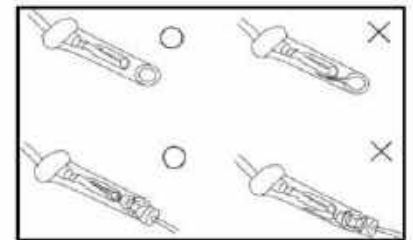
4. Insert the connector completely. If there are two lockers on two connector sides, make sure the lockers are locked in properly. Check if any wire loose.



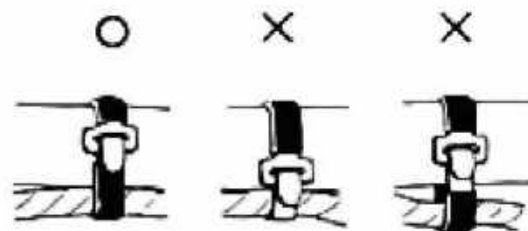
5. Check if the connector is covered by the twin connector boot completely and secured properly.



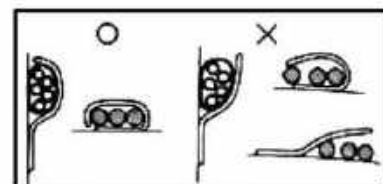
6. Before terminal connection, check if the boot is crack or the terminal is loose.



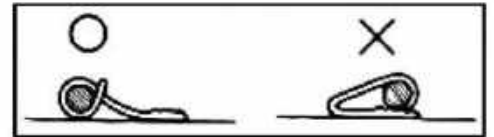
26. Secure wires and wire harnesses to the frame with respective wire bands at the designated locations. Tighten the bands so that only the insulated surfaces contact the wires or wire harnesses.



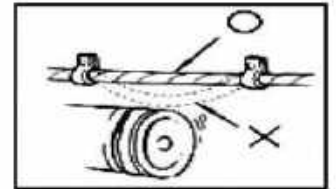
27. Wire band and wire harness have to be clamped secured properly.



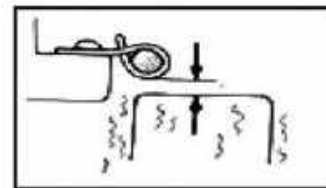
28. Do not squeeze wires against the weld or its clamp.



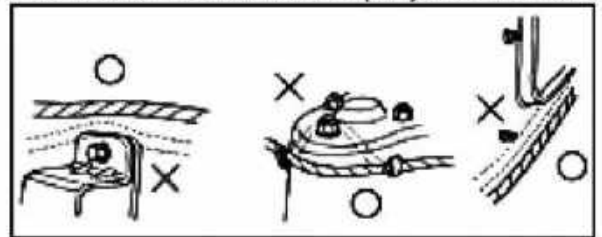
29. Do not let the wire harness contact with rotating, moving or vibrating components as routing the harness.



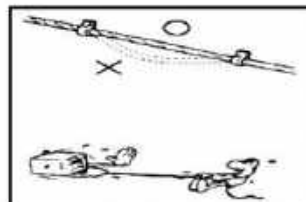
30. Keep wire harnesses far away from the hot parts.



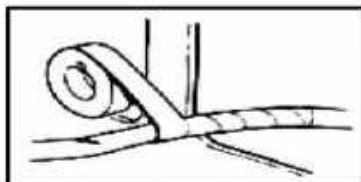
31. Route wire harnesses to avoid sharp edges or corners and also avoid the projected ends of bolts and screws.



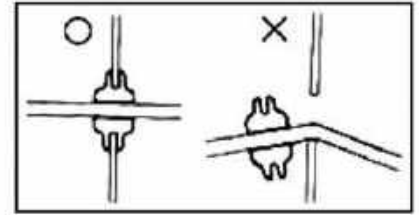
32. Route harnesses so that they neither pull too tight nor have excessive slack.



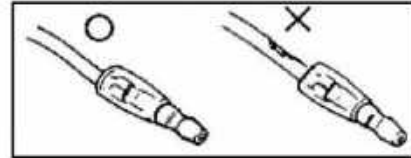
33. Protect wires or wire harnesses with electrical tape or tube if they contact a sharp edge or corner. Thoroughly clean the surface where tape is to be applied.



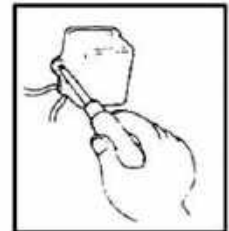
34. Secure the rubber boot firmly as applying it on wire harness.



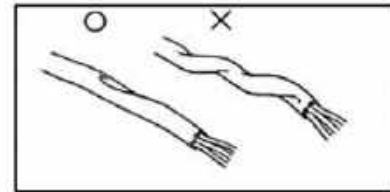
35. Never use wires or harnesses which insulation has been broken. Wrap electrical tape around the damaged parts or replace them.



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



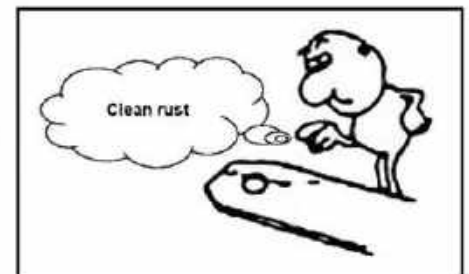
37. Do not let the wire harness been twisted as installation.



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

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

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



1-04 Specification

ML9

- Dimension : 2315mm/1260mm/1280mm (version 1,2)
Wheel base : 1482mm
Seat / G.Clearance : 904mm/ 300 mm
Weight : Un-laden Mass = 364kg; with running order Mass = 377Kg
Engine : SOHC 4 Stroke
Cylinder : 2 cylinder, vertical 1-2 (V-Twin)
Bore * Stroke : 92*61.5
Displacement : 818cc
Compression Ratio :10.3:1
Lubricant : Wet Sump
Fuel injection: Delphi (MT05)
Spark Plug : NGK DCPR7E x 2; 0.7-0.8mm
Starting : Electrical starter
Ignition : ECM
Generator : ACG Fly Wheel Magneto 350W@ 5000 rpm
Engine Oil : 4 Stroke Engine Oil 10W40 API/SL grade or above, synthetic base is recommended.
Engine Oil : At change (2.0L); at disassembly (2.2L)
Air-Filter : Wet type element
Transmission (F-R) : C.V.T Automatic with centrifugal clutch.
Transmission gear box oil: GL-3 80W90 at change (400cc) / at disassembly (450cc)
Gear Shifting : L-H-N-R-P
Final Drive : 3 ways (2WD, Limited slip 4WD, Differential lock 4WD) with shaft drive
Final gear box oil : SAE 90 API; at change (0,29L) at disassembly (0,30L)
Differential gear box : SAE 90 API; at change (0,29L) at disassembly (0,33L)
RPM limit : Forward limited 8000 +/- 100 and Reverse speed on 15KM/HR.
Radiator (liquid coolant): 2080 c.c. coolant (standard concentration 50%)
Reserve tank coolant : 300 c.c. +/- 20cc coolant (standard concentration 50%)
Fuel : Unleaded gasoline (#95 Octane or above is recommended)
Fuel tank : 23L
Chassis : Steel tube frame
Front Suspension : Independent, Double A-arm/153 mm travel, 5-Section adjustable pre-loaded
Rear Suspension : Independent, Double A-arm/ 209 mm travel, 5-Section adjustable pre-loaded
Brake (F/R) : Front dual hydraulic disc ϕ 220mm / Rear double hydraulic disc ϕ 200mm
F. Brake operation : Front RH side handle brake lever for front wheeler



R. Brake operation : Front LH side handle brake lever for rear wheel; R side footrest brake pedal for integrate front and rear wheel at the same time

Steering : Electric Power Steering (12V30A250W)

Tire : Tubeless

Front/Rear : (F) AT 25x8-12 (for 12" wheel rim), or AT 26x8-14 (for 14" model)
(R) AT 25x10-12 (for 12" wheel rim), or AT 26x10-14 (for 14" model)

Battery : MF type 12V/18A, i.e. YUASA® YTX 20L-BS or GS Battery® GTX20L-BS

Head Light (version1) : (F. Double light) 12V 35W* 2 (Hi-Beam); 12V/55W*2 (Low- beam)

Head Light (version2) : (F. Square light) 12V 35/35W* 2 (Hi/Lo Beam)

Position lamp : 12V 5W *2

Rear / Flasher Light : 12V 21/18W* 2 ; 12V 10W* 2

Fuse : Main (30A/40A) / Headlight (15A) / A.DC Jack(10A) / Four-wheel-drive(10A)

Signal system (10A) / Backup (30A(40A)/15A/10A)

ECM (15A)/Regulator (35A/40A)/EPS(40A)

PS: version 1 = double f. light; version 2 = square font light

1-05. Tool Torque value setting

The torque values listed in table are for more important tighten torque values. Please see standard values for not listed in the table. (more details should be taken by dealers/importers)

1. Engine Torque

Item	Q'ty	Thread Dia. (mm)	Tor Value (N-m)	LT glue
Cylinder bolt	3	6	10	
Cylinder head bolt	2	6	10	
Cylinder head bolt	4	12	60	
Crankcase R	7	6	10	
Drain bolt	1	12	25	
Crankcase L	5	6	10	
Crankcase L	1	8	18	
Oil pump screw	3	6	10	243
Spark plug	2	-	15	
Flange bolt for crankcase R & L	4	8	25	
Flange bolt for crankcase R & L	12	6	10	
Tensioner	2	6	10	243
Thermo cover bolt	4	6	10	243
F cylinder head	1	12	25	
Camshaft retainer	2	6	10	
Tension	4	6	10	243
Cylinder head	4	6	10	
Cylinder head	8	10	55	
Thermo switch	1	-	15	
Sprocket bolt	3	10	30	243
Flywheel bolt	3	8	30	638
Crankshaft bolt for flywheel	1	16	150	638
Stater	3	6	10	
Water pump impeller	1	-	20	
Crankcase cover R	11	6	10	
Crankcase cover L	14	6	10	
Starter motor	1	8	20	
Starter motor	1	6	10	
Head cover	8	6	10	
Oil pressure sensor	1	-	12	243
Rocker arm bolt	2	8	20	
Manifold bolt	5	6	10	
Manifold bolt	4	8	20	
Drive face	1	-	130	
Driven face	1	-	60	
CVT cover	18	6	10	243
Connecting bolts for transmission	3	8	20	243

2. Transmission Gear Box Torque

Item	Q'ty	Thread Dia. (mm)	Tor Value (N-m)	LT glue
Inner installing base	2	6	10	243
Speed sensor bolt	1	6	7	
Drain bolt	2	10	30	
Housing bolt	4	8	25	243
Retainer bolt	3	8	25	243
Output end cover	4	8	25	243
Bearing retainer for input shaft	4	8	25	243
Parking gear bolt	1	8	25	243

3. Frame Torque

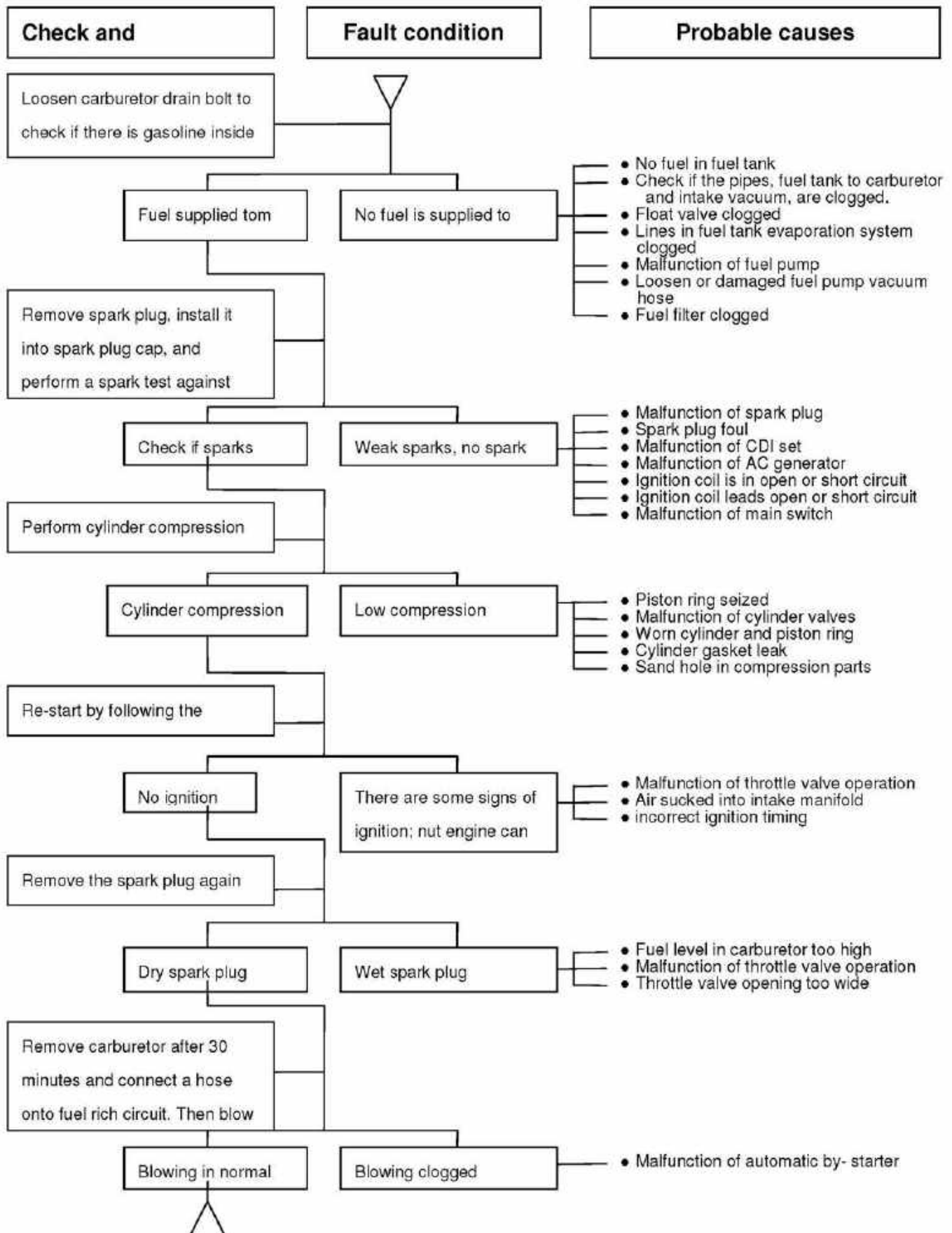
Item	Q'ty	Thread Dia. (mm)	Tor Value (N-m)	LT glue
Handlebar upper holder bolt	4	8	23	
Steering shaft nut(EPS)	1	14	180	638
Steering shaft lock bolt(EPS)	1	10	48	243
Steering tie-rod nut	4	10	25	
Knuckle rear nut	4	10	45	
Steering shaft holder bolt	2	8	25	
Front wheel nut	8	10	55	
Front axle castle nut	2	18	260	243
Rear axle castle nut	2	22	260	243
Rear wheel nut	8	10	55	
Engine hanger fixing bolt	2	10	48	243
Engine hanger nut	1	10	45	
Engine fixing nut	2	10	61	
Front gear box fixing nut	1	10	70	
Front gear box fixing bolt	2	10	55	243
Rear gear box fixing nut	2	10	70	
Front gear box connecting nut	1	14	150	638
Rear gear box connecting nut	1	12	150	638
Front/Rear suspension arm bolt	8	10	45	
Front / Rear suspension arm nut	8	10	45	
Anti roll bar jointer nut	4	10	48	
Anti roll bar holder bolt	4	8	30	
Brake lever bolt	2	5	10	
Brake hose bolt	10	10	30	
Brake caliper bolt(front)	4	8	30	
Brake caliper bolt(rear)	2	10	40	
Caliper holder	2	10	40	
Final drive hub bolt	4	8	33	
Air-bleed valve	2	5	5	
Brake disc bolt	13	8	28	243
Brake shunt bolt	2	10	30	
Master cylinder center	2	10	30	



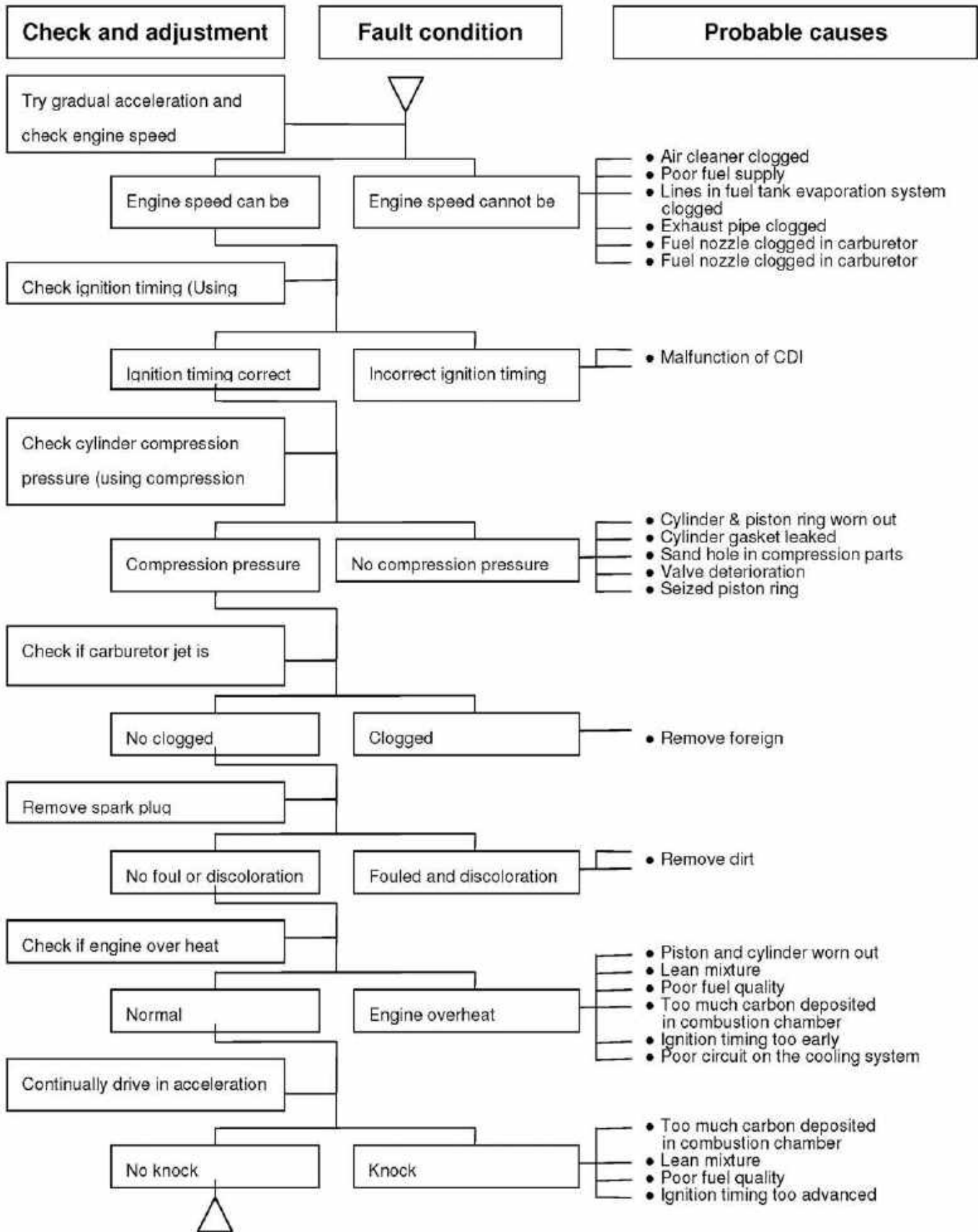
Master cylinder rear	2	6	23	
Exhaust muffler mounting bolt	2	8	30	243
Exhaust muffler connection nut	4	8	30	
Gear motor bolt	3	6	13	
Differential gear box bolt	6	10	50	243
Cover for front gear box bolt	6	8	33	243

1-06. Troubles Diagnosis

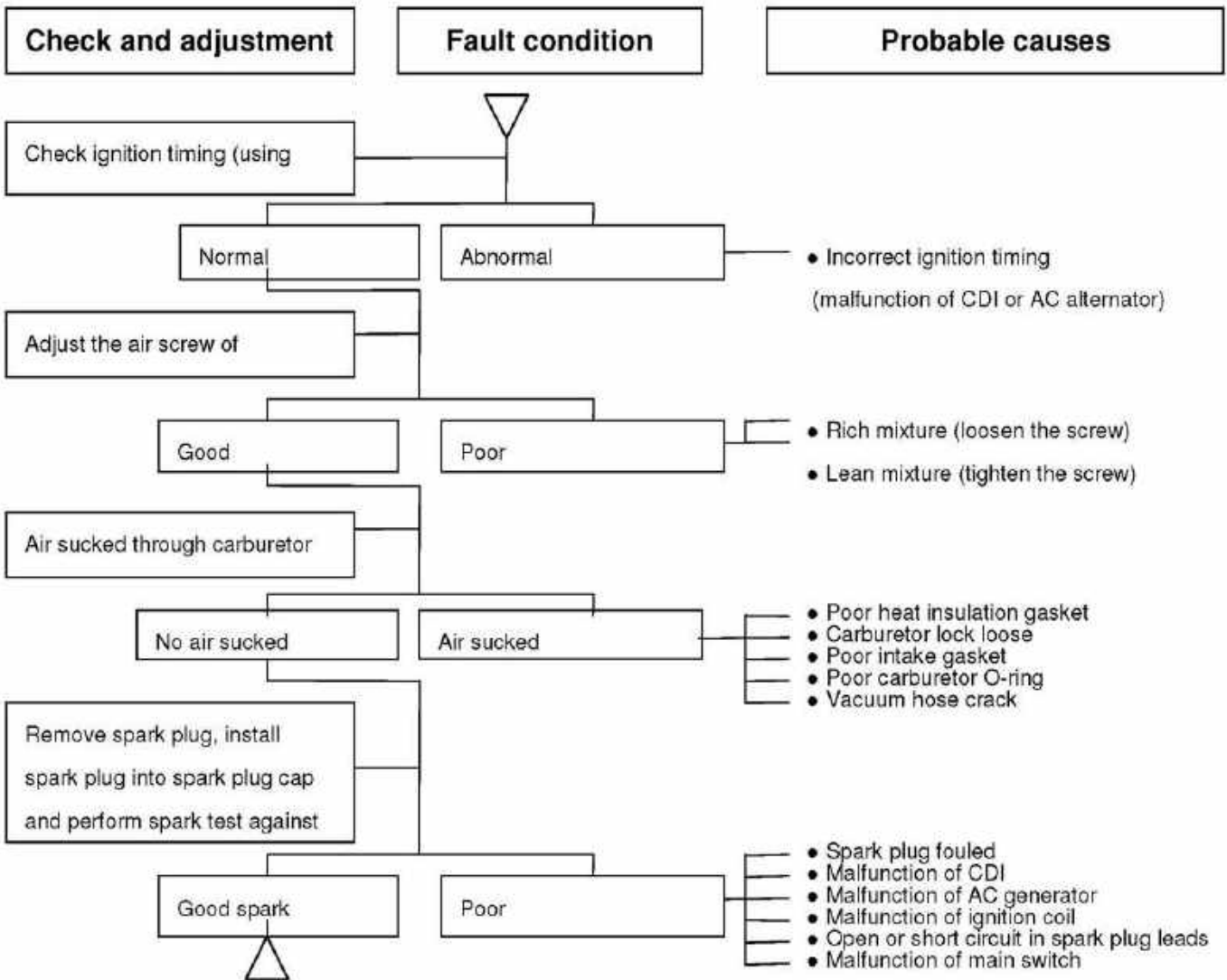
A. Engine hard to start or cannot be started



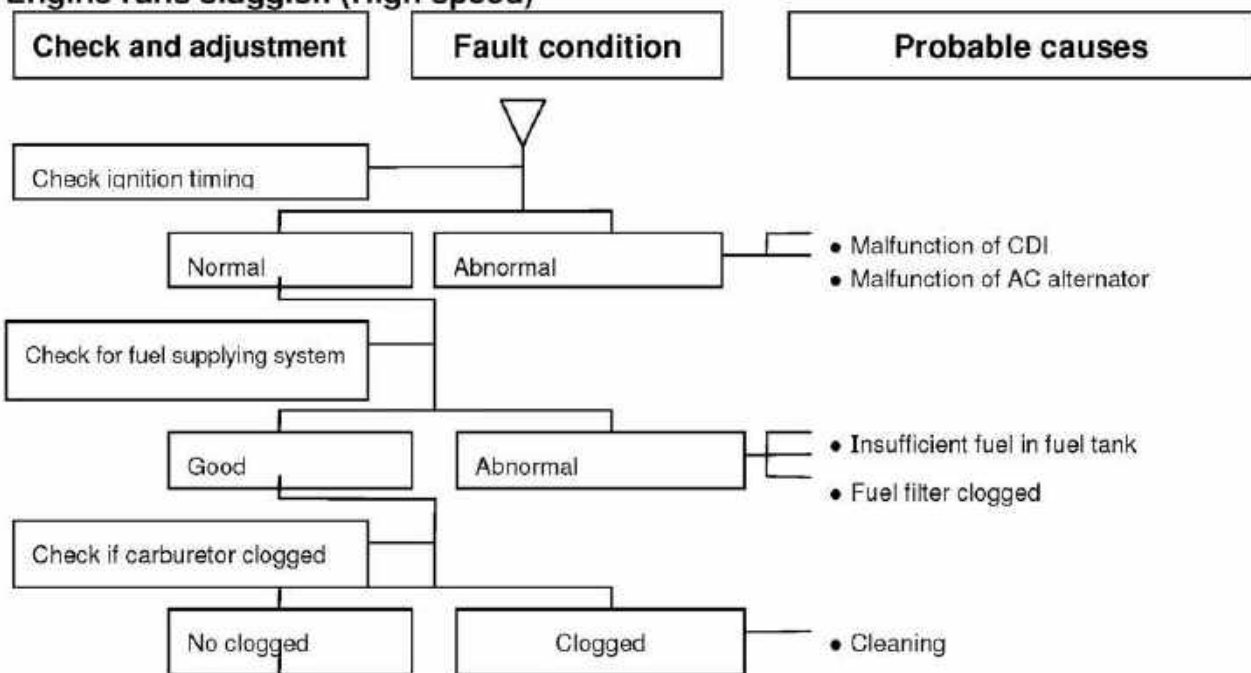
B. Engine run sluggish (speed does not pick up, lack of power)



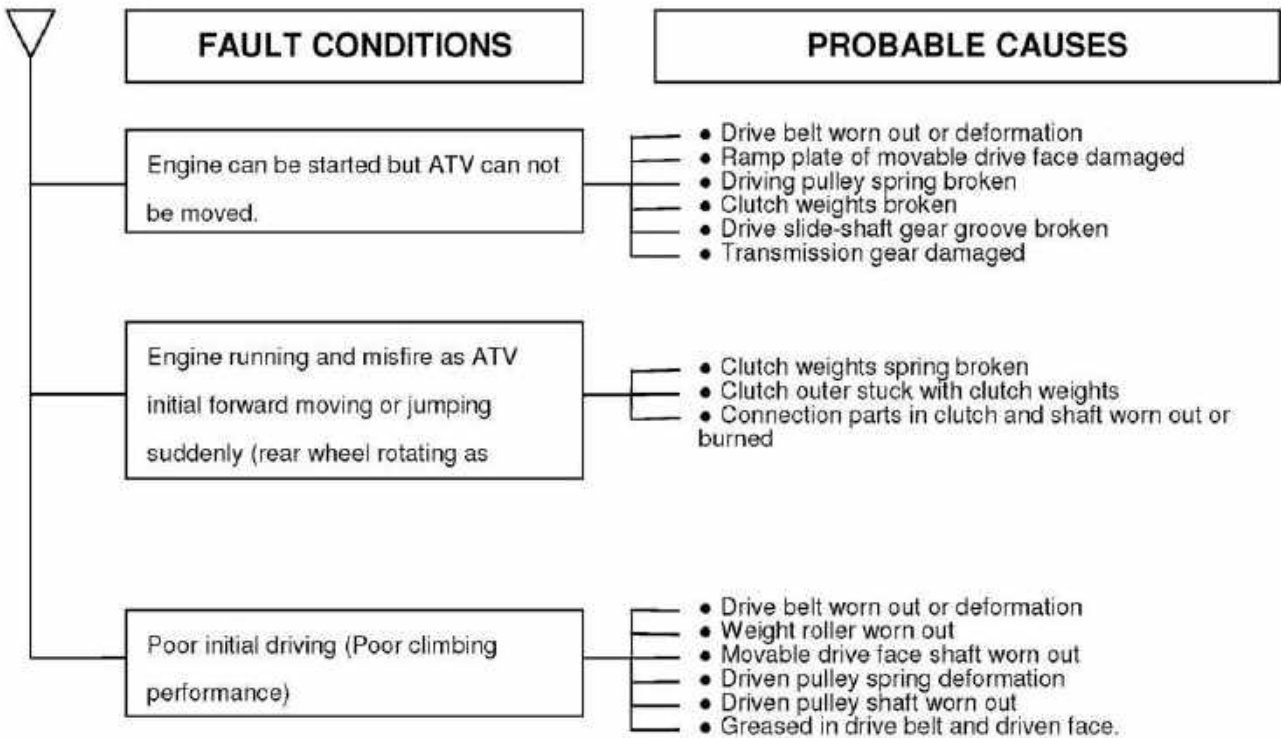
C. Engine runs sluggish (especially in low speed and idling)



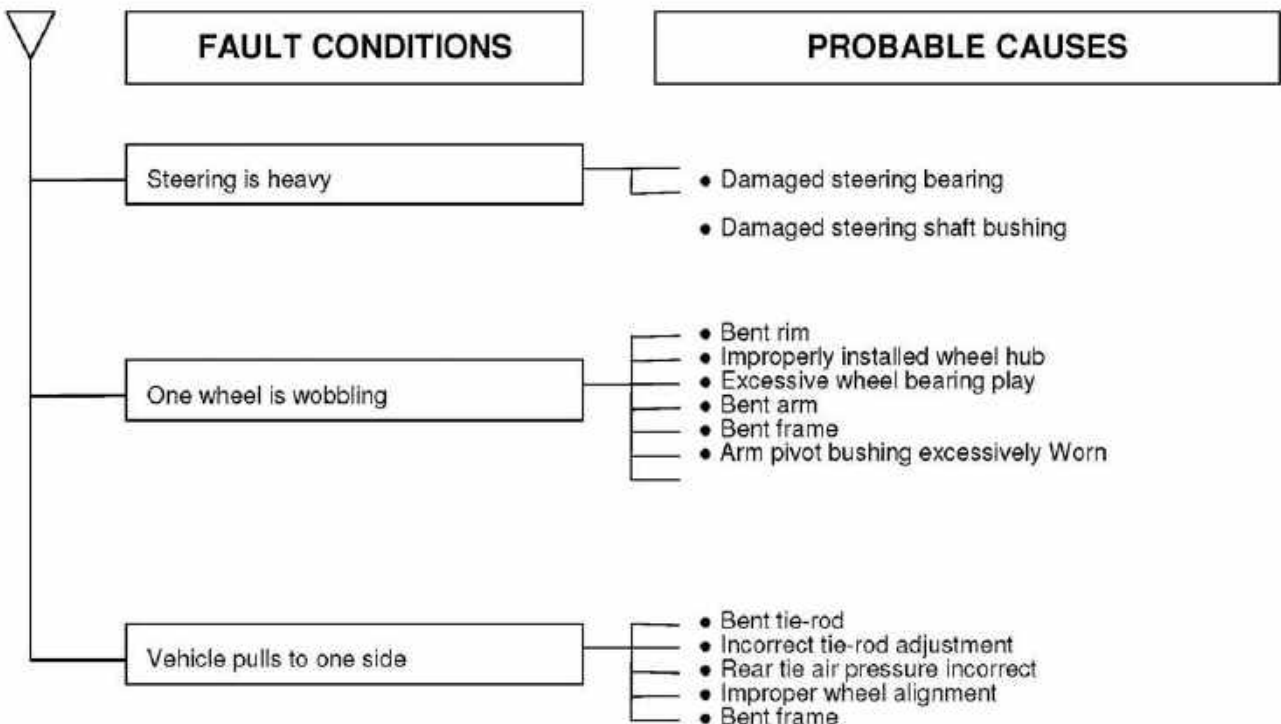
D. Engine runs sluggish (High speed)



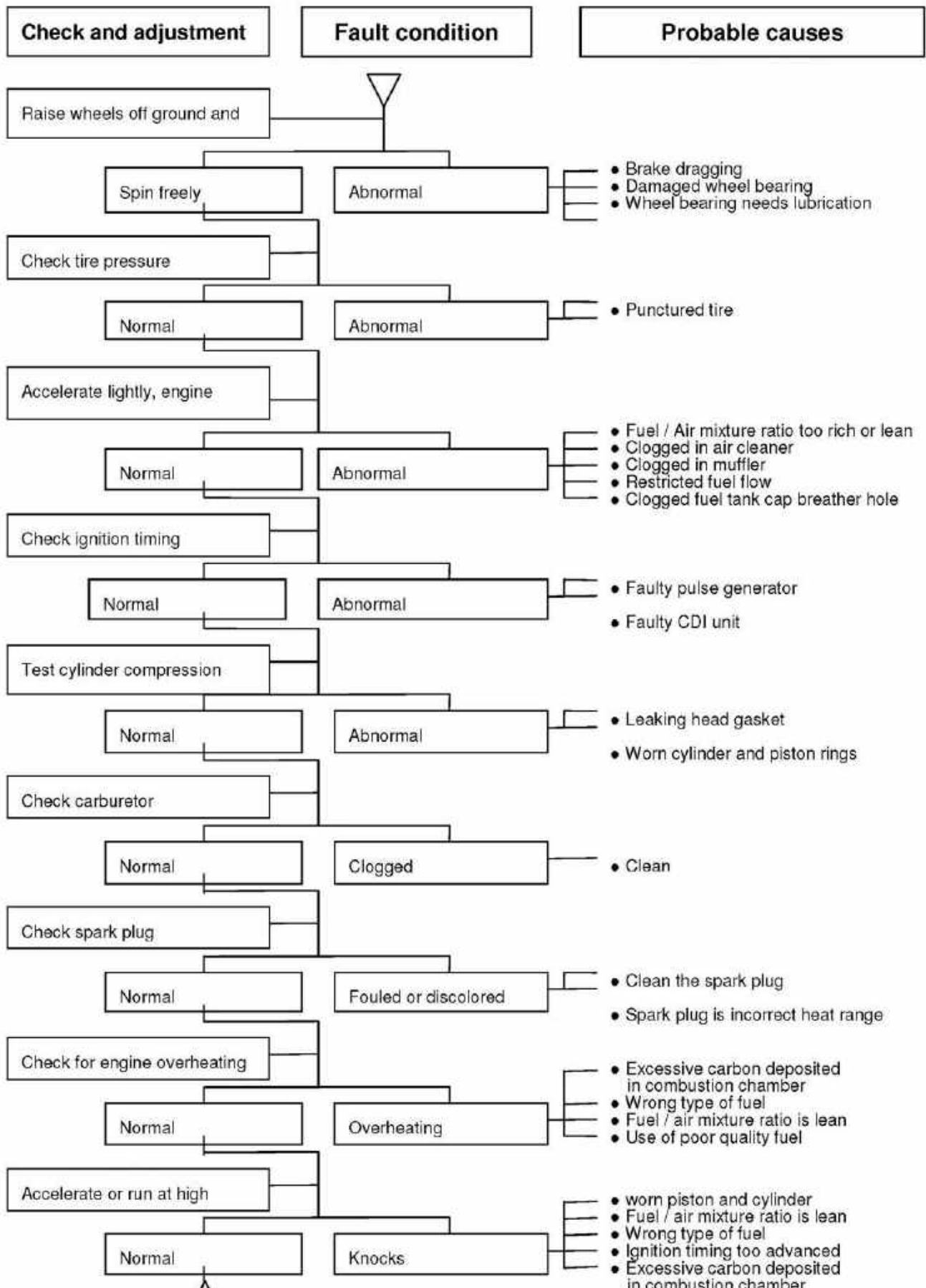
5. Clutch, driving and driving pulley



F. Poor handling



G.Loss power





Note:



- 2-01. Technical Data
- 2-02. Periodical Maintenance Schedule
- 2-03. Fuel Hoses
- 2-04. Throttle Cable
- 2-05. Air Cleaner
- 2-06. Spark Plug
- 2-07. Valve Clearance
- 2-08. Idle Speed Adjustment
- 2-09. Ignition System
- 2-10. Cylinder Compression Pressure
- 2-11. Drive Belt
- 2-12. Brake System (Disk Brake)
- 2-13. Brake Light Switch/Starting Inhibitor
- 2-14. Headlight Beam Distance
- 2-15. Clean Spark Arrester
- 2-16. Suspension
- 2-17. Steering Handle
- 2-18. Wheel/Tire
- 2-19. Check the Oil
- 2-20. Toe-in Adjustment
- 2-21. C.V. Joint Boot Check
- 2-22. Seat Opening & Installing
- 2-23. Nuts, Bolts Tightness
- 2-24. ECM
- 2-25. Fuel pump
- 2-26. Injector
- 2-27. EPS (electric power steering) system
- 2-28. Fuse and Relay
- 2-29. Applying lubricant/grease
- 2-30. Secure Loosen

2-01 Technical Data of Oil & Pressure Capacity

Fuel Tank Capacity		22000 c.c.±5%
Engine Oil	Capacity	2200 c.c.
	Change	2000 c.c.
Transmission Gear Box	Capacity	450 c.c.
	Change	400 c.c.
Front differential oil	Capacity	330c.c
	Change	290c.c
Rear gear box oil	Capacity	300 c.c.
	Change	290 c.c.
Capacity of coolant	Engine + radiator + hoses	2500 c.c.
	Reservoir upper	300 c.c.
Clearance of throttle valve		1~3 mm
Spark plug	Type	NGK DCPR7E
	Gap	0.7~0.8 mm
"F"Mark in idling speed		BTDC 12.5°/1250 rpm
Full timing advanced		BTDC 20°/ rpm
Idling speed		1250±100 rpm
Cylinder compression pressure		13±2 kgf/cm ²
Valve clearance		IN:0.10 ±0.02 mm EX:0.15 ±0.02 mm
Tire dimension	Front	AT25x8-12 / AT26x8-14 or other
	Rear	AT25x10-12 /AT26x10-14 or other
Tire pressure (cold)		8(7)±0.2 psi (On road) / 5(3.5) ±0.2 psi (Off road)
Battery		12V18Ah (type : MF battery)



2-02 Periodical Maintenance Schedule

Have your ATV checked, adjusted, and recorded maintenance data periodically by your SMC Authorized Dealer to maintain the ATV at the optimum condition. The above maintenance schedule is established by taking the hours or kilometers as a reference whichever comes first.

Item	Check Items	Maintenance Kilometer	300KM	1000KM	2500KM	Every 2500KM	Every 5000 KM	Remarks
		Maintenance Interval	20 hr	60 hr	150 hr	150 hr	300hr	
Engine maintenance								
1		Engine oil (Check oil level every 1000~1200KM or after 1500 KM travel)	R	R	R	R	R	
2		Engine Oil filter Cartridge	R	R	R	R	R	
3	*	Engine idle speed	I		I	I	I	
4	*	Valve clearance			I	I	I	
5	*	Ignition timing/Cam Chain			I	I	I	
6		Spark plug check or change			I	I	I	
Fuel and air system								
7		Air cleaner element (Remark)	Clean and replace if necessary for Every 20~40 hours (more often when in wet or dusty areas)					
8	*	Air Cleaner Breather tube	I		I	I	I	
9	*	Engine idle Speed		I	I	I	I	
10	*	Throttle operation /Speed limiter	I	I	I	I	I	
11	*	Fuel lines (check or cracks/damage)			I	I	I	
12	*	Fuel filter	I		I	I	I	
Frame/Steering/Suspension/Brake/ Wheel & Tires								
13	*	Upper and low A-Arm	I	I	I	I	I	
14	*	Steering Shaft (lubricant, Toe in check)			I/L	I/L	I/L	
15	*	Front and Rear shock absorber check			I	I	I	
16	*	Front /Rear brake free play check	I	I	I	I	I	
17	*	Front / Rear brake wear	Replace whenever worn to the limited					
18	*	Front and Rear Brake Fluid Level/Leakage Check	I	I	I	I	I	
19	*	Wheel rim check for damage	I		I	I	I	
20	*	Wheel Hub Bearing looseness/damage	I		I	I	I	
21	*	Tire (Wear/Pressure)	I		I	I	I	
22	*	Nuts, Bolt, Bush, fastener check and lubricant.	I	I	I	I	I	
23	*	Engine Mount check			I	I	I	



Chapter 2 Maintenance Information

24	*	Fr. & Rr. Steering Knuckle pivot	L	L	L	L	L		
25	*	Parking Brake/Throttle cable	I/L	I/L	I/L	I/L	I/L		
26		Stabilizer bushes			I	I	I		
Transmission									
27		Transmission gear oil / Differential gear oil	R			R	R		
28		Final gear oil	R			R	R		
29	*	Axle boots	I	I	I	I	I		
30	*	CVT driving belt/weight rollers	I			I	I		
31	*	CVT driving Clutch	I			I	I		
Liquid Cooling system									
32		Radiator (coolant level, flow, leakage)	I	I	I	I	I		
33		Coolant reservoir (level, leakage)	I	I	I	I	I		
34		Coolant	Change every 2 years						
35	*	Cooling Fan function/ Hose leakage	I	I	I	I	I		
Electrical System									
36		Multi-function LCD Display (dashboard/speedometer)	I	I	I	I	I		
37	*	Lights /electrical equipment	I	I	I	I	I		
38	*	Front and rear brake switch	I	I	I	I	I		
39		Battery Voltage	I	I	I	I	I		
EFI System/EPS									
40	*	Fuel pump ass'y	I	I	I	I	R		
41	*	Fuel delivery hose	I	I	I	R	R		
42	*	Throttle Body	I	I	I	C	C		
43		Lean (tilt) switch		I	I	I	I		
44		O ² sensor	I	I	I	I	R		
45	*	ECM/TPS/CTS/ETS	I	I	I	I	I		
46	*	EPS motor ass'y	I	I	I	I	I		
47		Steering column connections	I	I	I	I	I		
48		ECU eps	I	I	I	I	I		

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

Remarks:

- Air cleaner needs to be cleaned every 20-40 hrs drive and requires more frequently cleaning or replacement after riding on (1) dusty rain days (2) sand area (3) snow days.
- Maintenance should be performed more often if the ATV is frequently operated in high speed



Chapter 2 Maintenance Information

and after the ATV has accumulated a higher mileage.

3. Check battery (18A) before riding ATV. Re-charge battery or replace a new battery, if it necessary.
4. Always keeps the coolant level between Max. and Min. mark (coolant reservoir), replace or add coolant or distilled water, if it necessary. Replace all new coolant every 12-16 months! Only use the distilled water to mix coolant (standard concentration 50%)
5. Preventive maintenance
 - a. Ignition system: perform maintenance and check when continuous abnormal ignition, misfire, after-burn or overheating occurs.
 - b. Carbon deposit removal: remove carbon deposits in cylinder head, piston heads, exhaust system when power is obvious lower than ever.
6. Fuel pump ass'y need to be replaced the whole set within 3~4 year working period.
7. Do not reuse any clamps, clips, secure pin....and so on.
8. EFI system related periodical maintenance refer to Chapter 19.
9. EPS system related details refer to Chapter 20.

- CAUTION: The user must perform the period check & service and keep the service records all the time, or have SMC dealer for a periodic maintenance program. Failure to follow the periodic maintenance of your vehicle will lead to poor performance, broken of your vehicle and out of product warranty.

- CAUTION: At once, " check engine warning lamp " turn on, stop engine and find out the fault reason then exclude the problems shown up in OBD (on-board diagnosis), re-start engine, refer to 19-03/19-04/19-18.

-NOTE: The display of speedometer have been designed a " wrench" shown up in every 150 hours engine running. It reminds you to process necessary period check & service.

2-03 Fuel Hoses

Ensure all lines are all clamped & fixed well and replace it when they are deterioration, damage or leaking (refer to 19-09).

Warning

Gasoline is a low ignition material, any kind of fire is strictly prohibited as dealing it.
All locked up clamps can not be reused.

2-04 Throttle Cable

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

Check handle-bar operation if it's smooth.
Check acceleration cable and replace it if deteriorated, twisted or damaged.

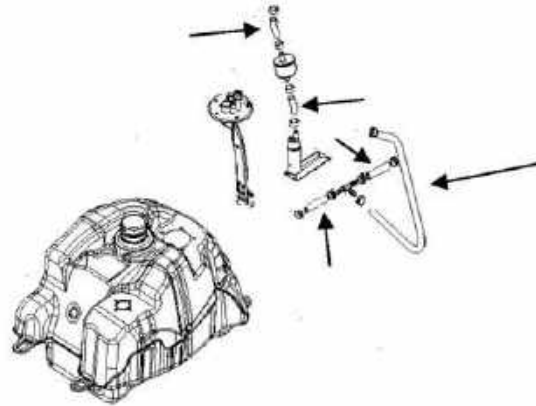
Lubricate the cable if operation is not smooth.
Measure the throttle lever free play in its flange part.

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

Tighten the fixing nut, and check acceleration operation condition.

Free play: 1~3 mm.

2-05. Air Cleaner



Remove seat, loosen 6 clamps from the air cleaner cover and then remove the cover. Separate the protective wire net and remove the air cleaner element.

Clean the element with non-flammable or high-flash point solvent and then squeeze it for dry.

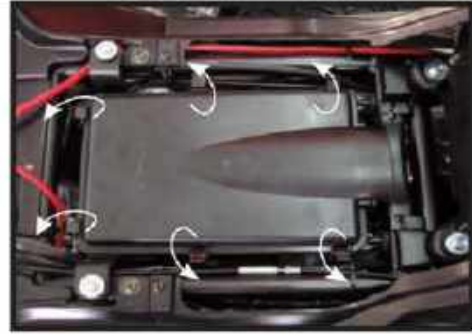
Install back the element, ensure yellow side up.

Caution

Never use gasoline or acid organized solvent to clean the element.

Soap the element into cleaning engine oil and then squeeze it out. Install the element onto the element seat and then install the air cleaner cover.

Refer to 4-07.



1. Protective wire

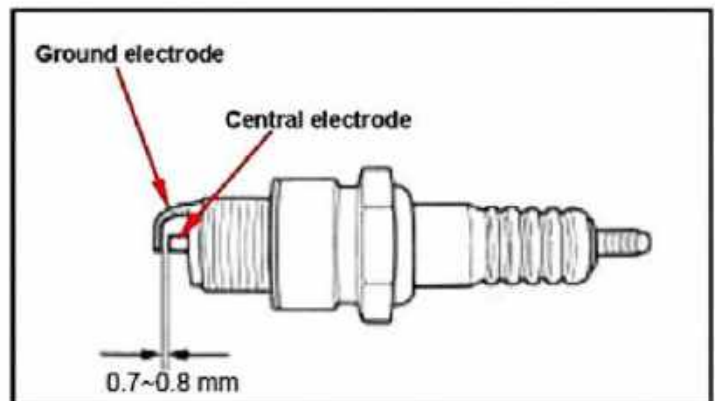
2-06. Spark Plug

Recommended spark plug : NGK- DCPR7E

- a. Remove spark plug cap.
- b. Clean dirt around the spark plug hole.
- c. Remove spark plug.
- d. central electrode color checking.

Torque value: 20±2 N.m

Refer to 6-06



2-07. Valve Clearance

Caution

Checks and adjustment must be performed

when the engine temperature is below 35°C.
Refer to 6-07 d.e.f.

Caution

- Do not turn the bolt in C.C.W. direction.
- When piston is at the TDC on the compression stroke, there should be clearance between valve stem tips and rocker arm adjusting screws. If no, rotate crankshaft one turn.

Valve clearance inspection and adjustment.
Check & adjust valve clearance with feeler gauge.

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

Caution

Re-check the valve clearance after tightened the fixing nut by rotating crankshaft two turns.

2-08. Idle Speed/ Adjustment

In cold starting, the engine have been started, the rpm will be raised to high about 3000~3500rpm then drop back to normal idle speed. Do not engage the gear during the raising rpm period. It controlled by throttle body, mainly on TPS (CTS).

Idle speed: 1250±100rpm

Caution

EFI system idle speed have been fixed in factory and not allow to be adjusted. It

normally controlled by TPS(CTS) on throttle body. Please refer to 19-07/19-03 to get back idle speed, if problem.

2-09. Ignition System

The battery supplies the primary side of ignition coil through a relay while the ECM completes the circuit for each cylinder by switching it to the ground at the right moment. The ECM can detect open and short circuit in the winding.

The ECM controls the ignition system. Connect the OBD to ECM to check both cylinders ignitions. For more information , refer to 19-11 Start engine.

Ensuring ignition timing is incorrect by OBD and check the camshaft/sprocket camshaft installation, pulser coil of generator, ignition coil..... or ECM settings. Refer to 19-

Warning

Never check for the engine ignition spark from an open coil and /or spark plug as spark may cause potential fuel vapor to ignite.

2-10. Cylinder Compression Pressure

- a. Warm up engine.
- b. Turn off the engine.
- c. Remove spark plug cap and spark plug
- d. Install compression gauge.
- e. Crank the engine with the electric starter with throttle wide-open until the compression reading on the gauge stabilizes.
- f. Check the same way on the other one.



Caution

Usually, the highest pressure reading will be obtained in 4~7 seconds.

Compression pressure: $13 \pm 2 \text{ Kg/cm}^2$

Check following items if the pressure is too low:

- a. Incorrect valve clearance.
- b. Valve leaking.
- c. Cylinder head leaking
- d. Piston, piston ring and cylinder worn out.

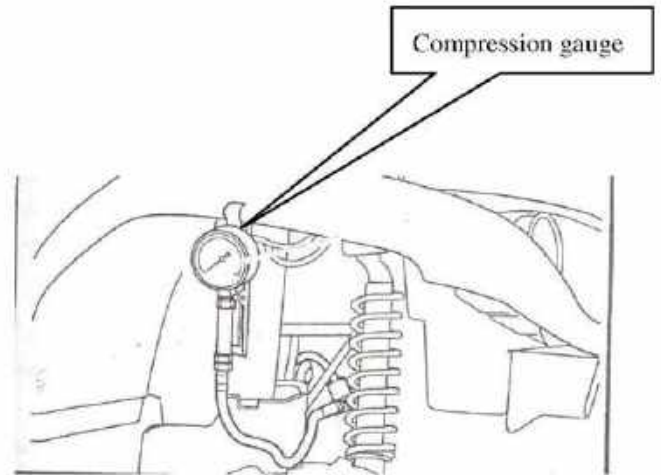
If the pressure is too high, check carbon deposits in combustion chamber or piston head.

2-11. Drive Belt

- a. Release all necessary clamps, ducts & parts.
- b. Remove left crankcase cover.
- c. Install the expander which enclosed in toolbox into the fixed sheave of driven pulley and tighten the bolt fully, causing the gap to loosen the belt then remove the belt.

Inspection

Check the drive belt for crack or wear. Replace it if necessary. Measure the width of drive belt as diagram shown.



Service Limit: 30mm(width)

Replace the belt if it's out of specification.

Caution

- Using the SMC genuine parts for replacement.
- The surfaces of drive belt or pulley must be free of grease.
- Clean up all grease or dirt before installation.
- Install back the belt with mark side-up then release the expander.
- Turn the belt forward for checking movement after finish installing.

Refer to 8-05.

2-12. Brake System (Disk Brake)

Brake System Hose

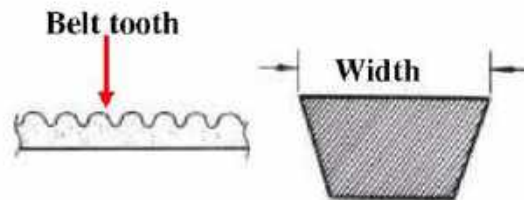
Make sure the brake hoses contain no corrosion or leaking oil.

Brake Fluid

Make sure the brake fluid reservoir top is horizontal. Then check brake fluid level in the brake fluid reservoir. If the level is lower than the LOWER limit, add brake fluid to UPPER limit. Also check brake system for leaking if low brake level found.

Caution

- Brake fluid may damage plastic parts. Always clean up spilled brake fluid right away.
- Do not operate the brake lever after the cap had been removed. Otherwise, the brake fluid will spread out if operate the lever. Do not mix non-compatible brake



fluid together.

Air Bleed / Brake fluid Change Operation

- a. Open the rubber cap of draining valve on the caliper.
- b. Connect a transparent hose to draining valve.
- c. Loosen the drain valve.
- d. Repeat pressing the brake lever and check the fluid that out of caliper, inspect if there still any air bubble being bleed out. Be careful to add the fresh brake fluid on the master cylinder side at same time to avoid extra air into the brake system. Perform this operation until there is no air inside the brake system hoses. A vacuum machine applied will be very helpful.
- e. Closed the drain valve

Added Brake Fluid

Add brake fluid to UPPER limit level.

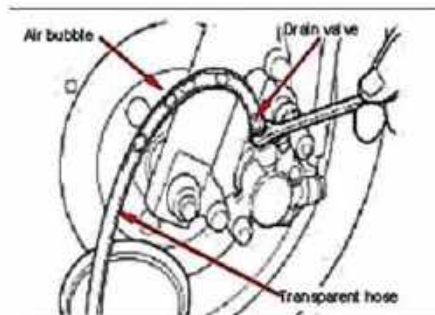
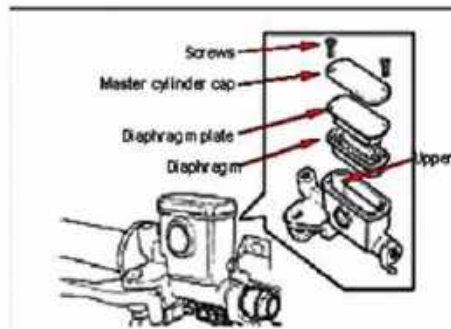
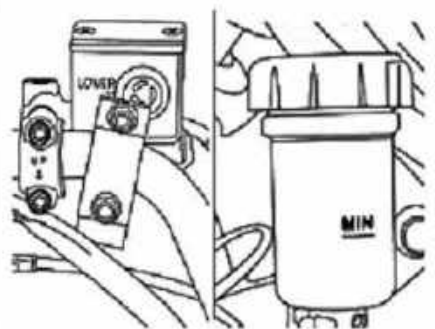
Recommended brake fluid: DOT4

Caution

- Use only the designed quality brake fluid: other brake fluids may deteriorate the rubber seals, causing leakage and poor brake performance.
- Refill with the same type of brake fluid: mixing brake fluids may result in a harmful chemical reaction and lead to poor brake performance.
- Be careful that water does not enter the brake master cylinder when refilling.

Brake Lining Wear

The indicator mark on brake lining is the wear



limitation (1mm).

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

Caution

To check front brake lining must be remove front wheel first.

Note:

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

Brake Pads Replacement (refer to Chapter 14)

Make sure the brake lining condition. Replace the lining pads if the brake lining wear limitation groove close to the brake disc.

Caution

Do not operate the brake lever after the caliper being removed to avoid pushing out piston. Be sure the brake pads must be replaced by one set.

2-13. Brake Light Switch/Starting

Inhibitor Switch

The foot brake light switch is operated by movement of brake pedal. A proper adjusting is necessary when the brake light comes on just before the braking effect starts.

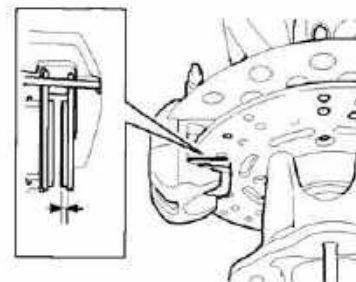
The hand brake light switch is operated by lever movement.



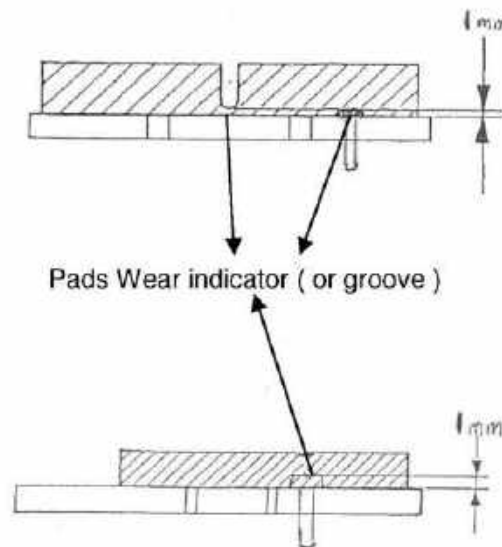
Front Brake



Rear Brake



Check brake lining



Pads Wear indicator (or groove)



adjustable nut

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

2-14. Headlight Beam Distance

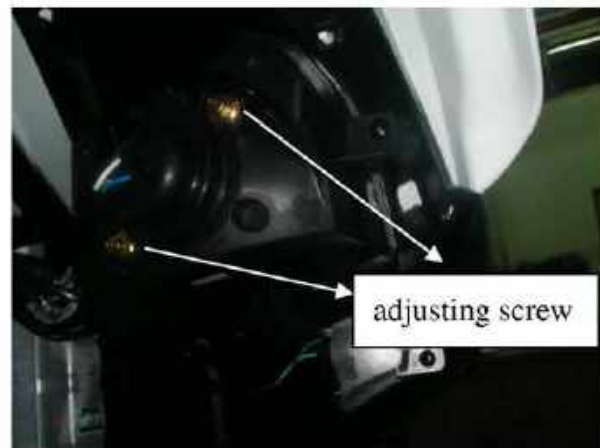
Turn on main switch

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

Caution

To adjust the headlight beam follows related regulations.

Improper headlight beam adjustment will make in coming driver dazzled or insufficient lighting.



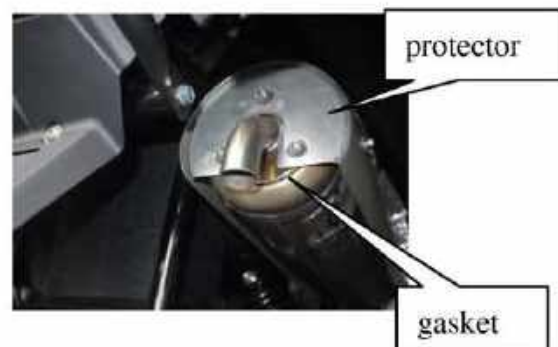
2-15. Cleaning Spark Arrester

Warning

- Always let the exhaust system cool before performing this operation.
- Do not start the engine when removing the tailpipe.

Cleaning step

- a) Remove the bolts and protector.
- b) Remove the gasket and tailpipe out of muffler.
- c) Use a wire brush to remove any carbon deposits from spark arrester portion of tailpipe and the inner contact surfaces of the muffler.



- d) Replace a new gasket
- e) Insert back the tailpipe to muffler and align the bolt hole
- f) Tighten the bolts and protector.

Note:

The arrester may have different type according requests.

2-16. Suspension / Adjustment

Warning

- Do not ride the ATV with poor suspension.

Looseness, wear or damage suspension will make poor stability and drive-ability.

- Always adjust both shock absorbers spring preload to the same setting. Uneven adjustment can cause poor handling and loss of stability.

Adjustment:

Normal shock:

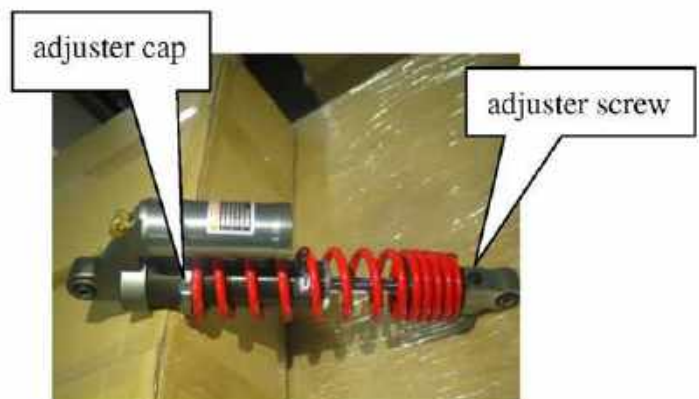
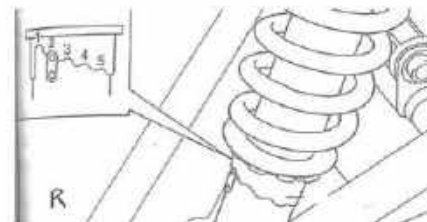
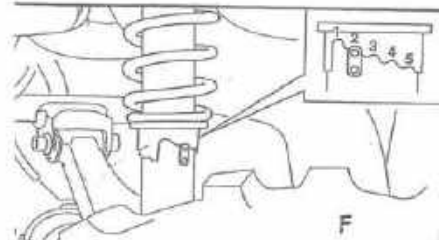
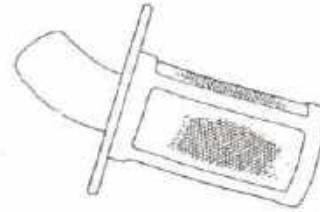
Use a wrench to turn the adjuster to increase or decrease the spring preload.

- Standard position: 2
- Min(soft) position: 1
- Max(hard) position: 5

Nitrogen shock (as option):

- 1) loading adjusting: use a wrench to turn the adjuster to increase or decrease spring preload.
- 2) damping adjusting: adjust "press side" by turning the upper adjuster cap (s=> soft, h=>hard). To adjust "pull side" by turning lower adjuster screw.

Check & Replacement :



Suspension

- Press down the front/rear suspension for several times to check its operation.
- Check if it is damaged (oil leaking / bad bound & rebound/bend)

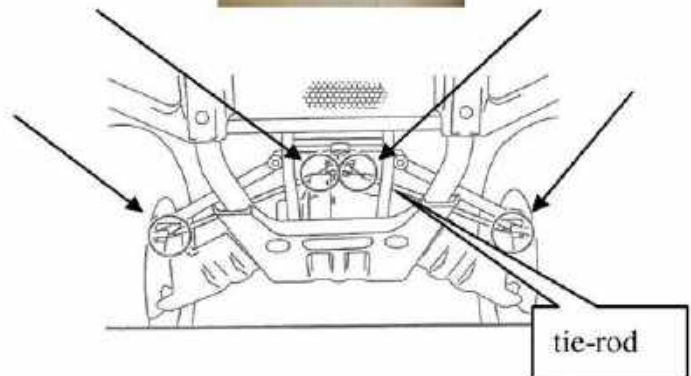
Replace relative parts if damage found.

2-17. Steering Handle

1. Place the machine on a level surface.
 - Check steering assembly bushings
 - ⇒ Move the handlebar up and down, and /or back and forth.
 - Excessive free play → Re-screw the bushings or Replace the steering bushings.
 - Check the tie-rod ends
 - ⇒ Move tie rod vertically
 - Excessive free play → replace the tie rod ends.(the arrow shown)

2. Lift the front wheel out of ground.
 - Check all wires and cables if they are interfered with the rotation of steering handle bar.
 - ⇒ Turn handle from right to left alternative and check if turning is smoothly.
 - Check the ball joints and/or wheel bearings.
 - ⇒ Move the wheels laterally back and froth.

Excessive free play → replace the front arms



and/or wheel bearings

2-18. Wheel/Tire

Caution

- The vehicle is equipped with low pressure tires. It's important that they be inflated correctly and maintained at the proper pressures.
- Tire pressure check should be done before riding.
- Follow the size and characteristics as recommended when the tires need to be replaced

Checking the tires

1. Check if tire surface is ticked with nails, stones or other materials.
2. Check the tire pressures by tire gauge. Out of specification → set the proper pressures when tires are cold. Tires pressures should be equal in both tires in front and in rear.

Tire pressure: As recommend in warning labels on the model.

3. Measure tire groove depth from tire central surface. Replace the tire if the depth decrease to 3mm due to wear.

Front & rear tire groove depth limit: 3mm

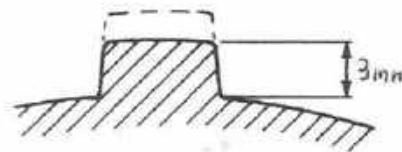
Checking the wheels

Caution

Never attempt repairs to the wheel.

Check the wheels if damage/bends →

tire gauge



replace

2-19. Check the oil

Always place the machine on a level surface,

then check the oil..

- Engine oil
refer to 3-04.
- Final gear oil
 - Checking
 - 1) Loosen oil check bolt

Note: Do not remove the bolt, otherwise the gear oil may come out.

- 2) Check that gear oil seeps out or not. If no oil seeps out, change the final gear oil.

- Changing
 1. Remove oil filler bolt & drain plug and drain out final gear oil (place a container under the final gear case).
 2. Install back the plug and fill oil to final gear case

Periodic oil change: 290cc

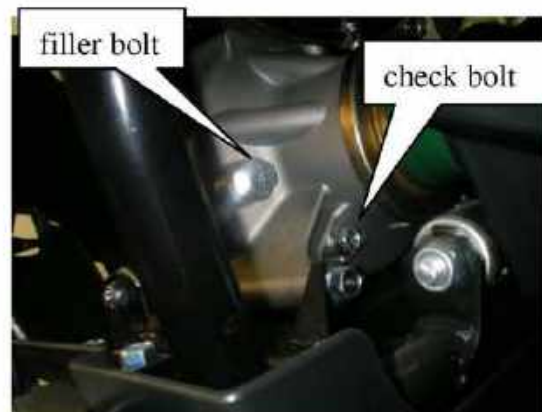
Oil change after disassembling: 330cc

Recommended oil: SAE 90 API “GL-4”

Hypoid gear oil.

- 3) Replace a new gasket and install back the bolt.

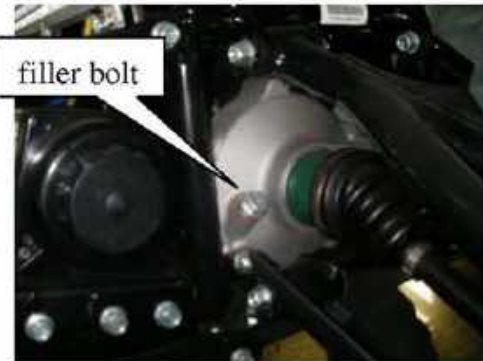
- Differential gear oil
 - Checking



- 1) Remove the oil filler bolt
- 2) Check oil level which should be up to the brim of hole. If oil level low, add oil to proper level.

■ Changing

- 1) Remove the oil filler bolt & drain plug and drain out the oil (place a container under the final gear case).
- 2) Install back oil filler bolt and fill oil to differential gear case.



Periodic oil change: 290cc

Oil change after disassembling: 330cc

Recommended oil: SAE 90 API "GL-4"

Hypoid gear oil.

- 3) Replace a new gasket and install back the filler bolt.

● Transmission gear oil

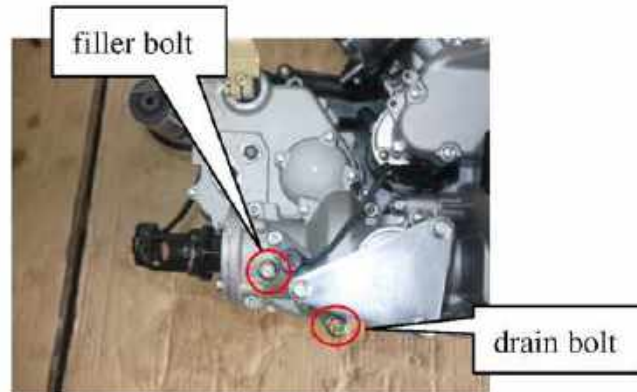
■ Checking

- 1) Remove the oil filler bolt
- 2) Check oil level which should be up to the brim of hole. If oil level low, add oil to proper level.

- 3) attention on oil seal damage

■ Changing

- 1) Remove the oil filler bolt & drain plug and drain out the oil (place a container under the final gear case).
- 2) Install back drain bolt and fill certain oil to transmission gear box and screw up filler bolt with new washer.



Periodic oil change: 400cc

Oil change after disassembling: 450cc

**Recommended oil: SAE 90 API "GL-4"
Hypoid gear oil.**

2-20. Toe-In adjustment

Place the machine on a level surface.

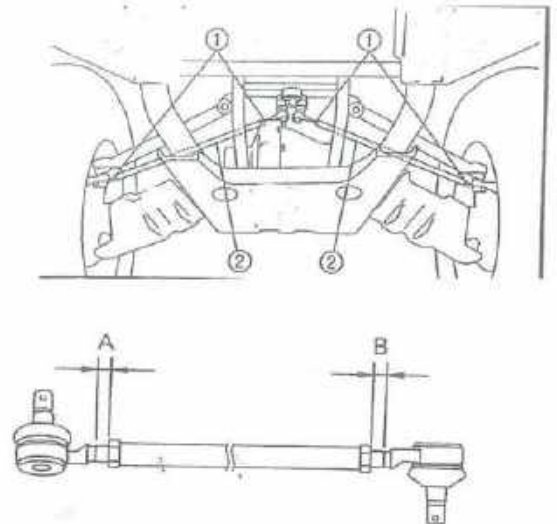
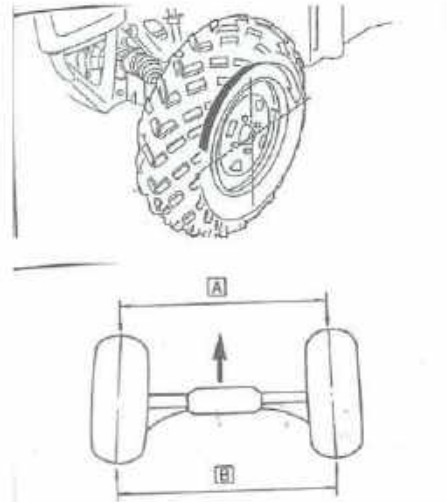
Measurement:

- 1) Ensure both front tire tread centers.
- 2) Let handlebar straight ahead
- 3) Measure the width A between the marks
- 4) Rotate the front tires 180° until the marks are exactly opposite one another.
- 5) Measure the width B between the marks.
- 6) Calculate the toe-in by

$$\text{Toe-in} = B - A$$

Toe-in : 0 ~ 10mm (with tire touching the ground)

- 7) If toe-in incorrect, adjust it
 - Mark both tie-rods ends.
 - Loosen the locknuts(tie-rod end) ① of both tie-rods.
 - The same number of turns should be given to both the right and left tie-rods ② until the specified toe-in is obtained. This is to keep the length toe-in of the rods the same.
 - Tighten the rod end locknuts of both tie rods, check the $A = B$ roughly.



2-21. C.V. Joint Boot Check

Often to check the C.V joint boot (front and rear),

Damage → Replace (refer to Chapter 17)

2-22. Seat Opening & Installing

- Opening – Stop the engine and turn the key to the left to engage cable and release seat catch.
 - cable should be adjusted to be proper
- Installing – Put seat forward down to the two catches of chassis and hook the catch and insert to the dampers.
 - ensure a damper in the middle, missing → replace.

2-23. Nuts, Bolts Tightness

Perform periodical maintenance in accord with the Periodical Maintenance Schedule. Check if all bolts and nuts on the frame are tightened securely.

Check all fixing pins, snap rings, hose clamp, and wire holders for security

2-24. ECM

Please keep clean and order in lines on the ECM position.

The ECM is equipped with a self-diagnostic function. If this function detects a malfunction in the system, a fault code is stored in the



memory of the ECM. The fault code can be read only by OBD (On –Board Diagnosis) provided by SMC.

Refer to 19-04/19-05.

2-25. Fuel pump

It have been installed with fuel tank. Please check the fuel pump function every maintenance. Refer to 19-08.

2-26. Injector

They are very accurate parts installed in both sides of manifold by injector caps.

- Avoid dropping. Dropping => replaced
- Leaking => replaced
- shortage => replaced
- blocked => clean by supersonic machine in a specified solvent
- less to pull/insert the connector as possible as you can

- install the injector to manifold
 - 1) apply fuel on the oil ring
 - 2) insert injector slowly and carefully by turning pushing
 - 3) ensure the injector fully match to the manifold
 - 4) fix the injector cap

- refer to 5-06/19-06.



2-27. EPS (electric power steering)

system

The ATV is optional for EPS by a self-diagnostic function. EPS warning light have shown on the display.

The EPS warning light comes on when the main switch is set to "ON", and then goes off once the engine is started. If the warning light remains on or comes on after the engine is started, the EPS system may be defective.

EPS system is controlled by ECU which with self-diagnostic which reserved in design.

Do not try to modify the ECU by computer or design.

(more detail refer to 15-11 & Chapter 20)

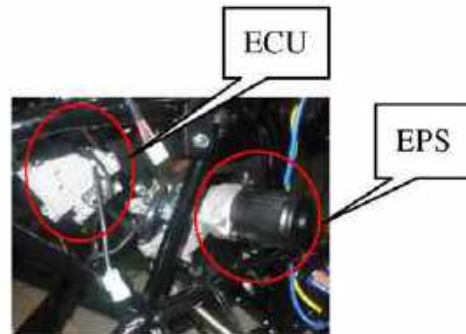
2-28. Fuse and Relay

ATV fitted with fuses and relay to have more security & protection on operation.

A breakdown for the fuses and functions:

Main switch	=> 30A(40A)
Headlight	=> 15A
A.DC Jack	=> 10A
4WD	=> 10A
Signal system	=> 10A
Back up	=> 30A(40A)/15A/10A
EFI system	=> 15A
Charging	=> 35A(40A)
EPS	=> 40A

A breakdown for relays and fuctions:



fuse for charging

fuse for EPS

12V DC 30A => EFI system
 12V DC 30A => Fuel pump
 12V DC 30A => Fan motor
 (refer to 19-15)



2-29. Applying lubricant/grease

A common sense on the installation for the vehicle is to lubricate where the parts you want to install is for rotating, reciprocating, contacting surface, smooth requiring and so on.

- oil – normally for inside engine installation → oil seal, o-ring, bearings, shaft, piston, cylinder
- grease (different kind specified on functions)– normally for outside engine/chassis parts installation → oil seal, o-ring, bearings, shaft, steering, axle, jointer, cable
- fuel – special for fuel system → installation for carburetor, throttle body, injector, fuel pump, intake



2-30. Secure loosen

There are many kinds way to secure your parts for loosening/lacking..... on this ATV, please always replace the new one or applying should-be glue again at once re-installing.

- 1) locker
- 2) cotter pin

3) secure nut, bolt or retainer



4) bolt with solid-state glue



5) applying loctite glue



6) disposable clamp

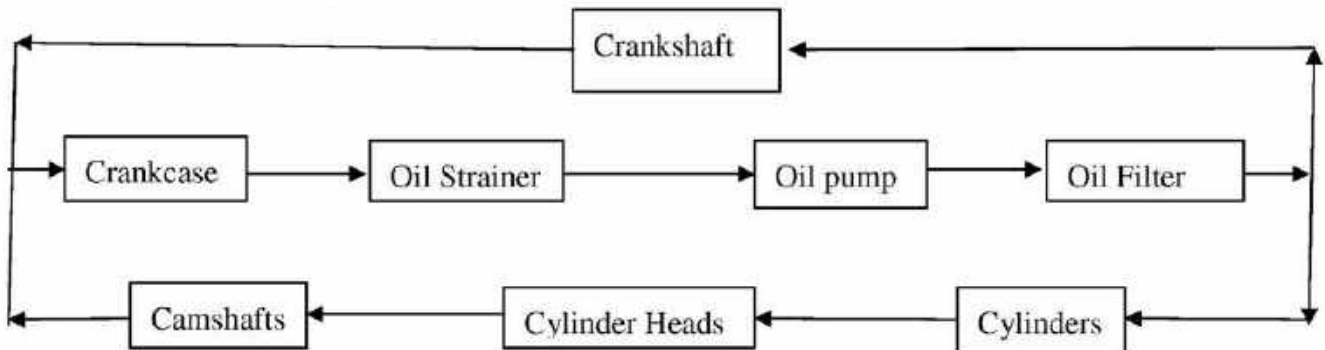




NOTE:

- 3-01. Mechanism Diagram
- 3-02. Precautions in Operation
- 3-03. Troubleshooting
- 3-04. Engine Oil
- 3-05. Oil Filter Unit
- 3-06. Engine Oil Pressure Checking
- 3-07. Cover, Left crankcase
- 3-08. Oil Pump
- 3-09. Oil Pressure Regulator
- 3-10. Oil Strainer
- 3-11. Reed Valve

3-01.Mechanism Diagram



3-02. Precautions in Operation

General Information

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

Specifications

Engine oil capacity Disassembly: 2200 c.c.

Replacement: 2000 c.c.

Oil viscosity SAE 10W-40

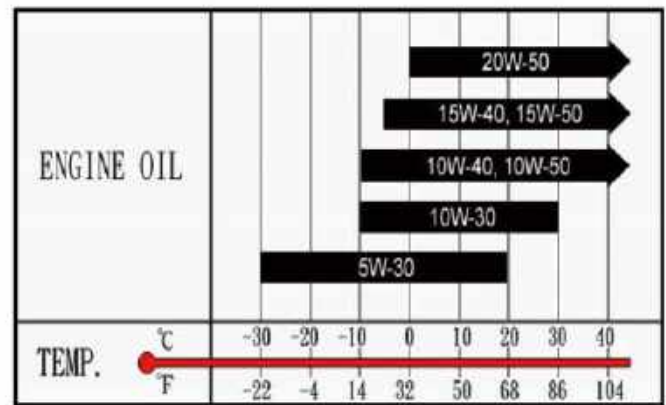
(Recommended: Synthetic base)

Rear gear box oil replacement: 290c.c.

Front differential gear oil replacement: 290c.c.

Transmission gear oil replacement: 400c.c.

Gear oil viscosity SAE 90W



3-03. Troubleshooting

Low engine oil level

- Oil leaking
- Valve guide or seat worn out
- Piston ring worn out
- Abnormal blow-by

Low oil pressure

- Low engine oil level
- Clogged in filter, strainer, circuits or pipes
- Oil pump damage
- Damaged reed valve
- Damaged oil pressure switch

High oil pressure

- Damaged reed valve
- Damaged oil pressure switch
- Clogged the oil passages

Dirty oil

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

3-04.Engine Oil

Oil Check

Park the ATV in flat surface and turn off engine, wait for a few minutes.

Check oil level with oil dipstick.

1. Screw out the dipstick, wipe out the oil on the dipstick
2. Plug the dipstick into engine, slightly screw dipstick fully, and take out for oil level checking.

If oil level is nearly(or below) to min level, fill recommended oil to be in the between maximum and minimum level. Never overfill.

Oil Change

⚠ Caution

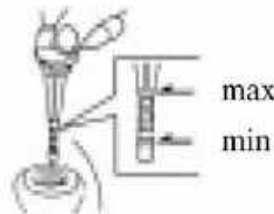
Drain oil as engine warmed up so that makes sure oil can be drained smoothly and completely.

- 1) Place the machine in flat level.
- 2) Start the engine and let it warm up for several minutes.
- 3) Stop the engine and place an oil pan under the ATV, and remove dipstick and oil drain bolt.
- 4) Drain out the engine oil from crankcase.
- 5) Clean the magnetic drain plug and replace a new washer then install back oil drain bolt.
- 6) Fill sufficient oil to reach the specified level and screw back dipstick.
- 7) Warm-up the engine for a few minutes, then stop the engine .
- 8) Check again the oil level in the range of levels or not.

Torque value : 20 N.m

Recommended oil: refer to 3-02.

3-05. Oil Filter Unit



Oil and oil filter must be replaced at the same time.

- 1) Same steps to drain out the engine oil as 3-04.
- 2) Remove the oil filter cover and take out the o-ring & oil filter unit
- 3) Clean the inlet and outlet bore by air blow
- 4) Install a new o-ring to oil filter cover and install a new filter to cover. Apply few engine oil to o-ring and end of the filter (with rubber side). Install the cover set back to the engine. Make sure that the o-ring is properly seated on cover.
- 5) Tighten the bolts evenly to torque 10 N.M.
- 6) Same steps to fill engine oil as 3-04.

Torque value : 10 N.M

Caution:

- Genuine parts should be replaced only. Please use SMC genuine oil filter unit.
- Check the correct oil filter installing direction and protection of o-ring with applying oil.
- To get the best protection to the engine, strongly suggest to replace the oil filter unit all the time when engine oil replacement.

Oil Quantity:

Periodic oil change : 2.0L

3-06. Engine Oil Pressure Checking

Always check the engine pressure after replacing the engine oil.

- Disconnect the oil pressure switch
- Connect the oil pressure gauge to the oil pressure switch
- Start the engine and check the followings:



Oil pressure	1250 rpm	6000 rpm	
minimal	70 kpa	350 kpa	
nominal	180 kpa	420 kpa	
maximal	300 kpa	550 kpa	

Out of specification → check oil pump, oil passage, oil filter..... under this chapter.

- After solving the findings, start the engine again and check it again.
- Connect back the wire harness.



Special tool: oil pressure gauge

Ask for the part-no. to dealer, if necessary.

3-07. Cover, Left Crankcase

A. Cover, Left Crankcase Removal

a. Unscrew all bolts on the cover, left crankcase.

- by crisscross

b. Use soft hammer to lightly beat the cover and slowly and carefully move the cover out.

- gasket have to be replace all the time.



B. Inspection

- check the cover cracks/damage → replace
- check the plain bearing worn/damage/big clearance → replace. (refer to 12-05)
- check the oil bore on the plain bearing blocked/deterioration → clean/replaced. (refer to 12-05)
- check the oil seal on the cover damage → replace
- keep the contact surface away from sharp

devices.

C. Installation

Reverse the removal procedure.

- apply the engine oil on the plain bearing and oil seal to install the cover into crankshaft (refer to 12-05)
- ensure all components have been fixed well then install the cover.

Torque value: 10 N-m

3-08.Oil Pump

A. Oil Pump Removal

- a. Remove the AC Generator.(Refer to Chapter 9).
- b. Remove the cir-clip/thrust washer/pump gear/needle pin.
- c. Remove three screws on oil pump.
- d. Remove the oil pump.
- e. Make sure that pump shaft can be rotated freely.



3-09. Oil pressure regulator

It works when oil pressure exceeds 450 Kpa to release the extra pressure.

A. Removal

- 1) remove plug screw and pull out the parts inside.
- 2) there are pressure regulator housing, spring and regulator valve.

B. Inspect

- 1) any shavings, blocking, contamination → clean
- 2) any worn/damage on components → replace
- 3) check free length of spring
 - service limit : 37mm, less → replace
 - torture → replace

C. Install

Reverse the removal procedure.

- ensure the sequence and direction of the components

Torque value:

Plug screw 20 N.M

3-10. Oil Strainer

A. Removal

1. unscrew two bolts.
2. remove the retaining plate and take out the oil strainer.

B. Inspect

1. clean the strainer by air gun
2. check the strainer for the cracks/ torture or damage → replace

C. Install

Reverse the removal procedure.



- apply the glue243 to the bolts and torque the bolts.

Torque value:

Retaining plate bolt 5N.m

3-11. Reed Valve

Reed valve release extra oil in the crankcase to prevent over oil accumulation which may raise high pressure.

A. Removal

1. unscrew three bolts.
2. remove the stopper and take out the reed valve.

B. Inspect

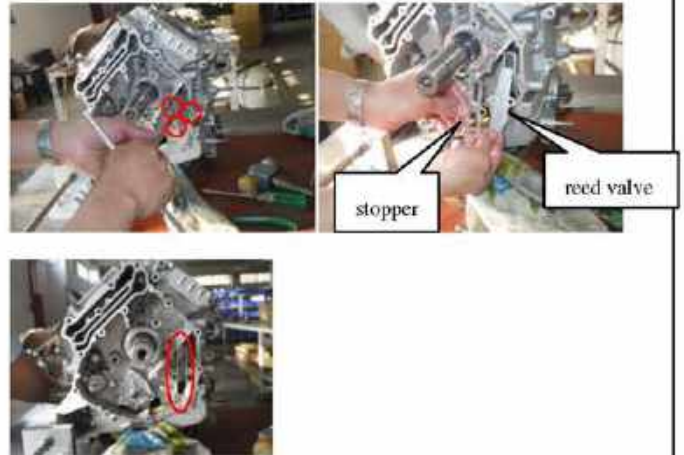
1. clean the stopper and reed valve
2. check the reed valve for the cracks/ torture or damage → replace

C. Install

Reverse the removal procedure.

Torque value:

Retaining stopper bolt 10N.m

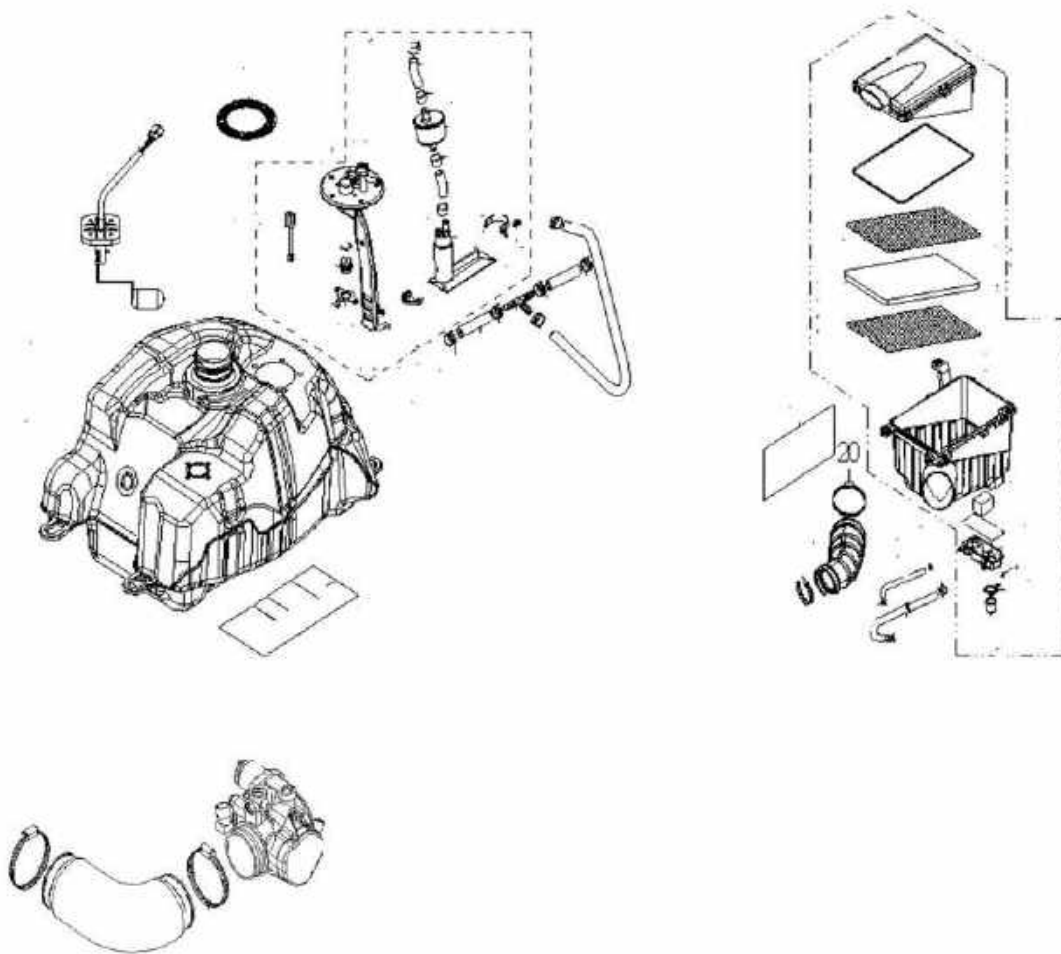




Notes:

- 4-01. Mechanism Diagram.....
- 4-02. Precautions in Operation.....
- 4-03. Trouble Shooting.....
- 4-04. Remove / Install Throttle Body.....
- 4-05. Disassembly/Assembly Throttle Body.....
- 4-06. Fuel Tank / Sender Unit
- 4-07. Air Cleaner
- 4-08. Fuel Pump ass'y
- 4-09. Fuel hose

4-01. Mechanism Diagram



4-02. Precautions in Operation

A. General Information

Warning

Gasoline is a low ignition point and explosive materials, so always work in a well-ventilated place and strictly prohibit flame when working with gasoline. Always disconnect battery prior to working on the fuel system. Beware to disconnect battery exactly in the specified order, BLACK(-) cable first.

Cautions

- Do not bend off throttle cable. Damaged throttle cable will make unstable drivability.
- When disassembling fuel system parts, pay attention to O-ring position, replace with new one after re-assembly
- Fuel injection system holds much pressure on all fuel lines and components, ensure the power disconnecting, away from any fire spark or heating source, well ventilated place and so on firstly. All fuel lines which remain under pressure all the time connected with disposal clamps, that's a one-time use only, beware to replace a new one and correctly be installed. Wear safety glasses and slowly disconnect the fuel hoses to minimize spilling.
- Replace any damaged or deteriorated fuel lines

Specification

Throttle Body

Item	D46
diameter	Ø54mm
I.D number	D46
IACV	Delphi 24086058 7.5V~14.2V
TPS	Delphi 24086056 5V
Idle speed	1250 ± 100rpm
Throttle handle clearance	1~3mm

4-03. Trouble Shooting

Poor engine start

- No fuel in fuel tank
- Clogged fuel tube
- Too much fuel in cylinder
- No spark from spark plug(malfunction of ignition system)
- Clogged air cleaner
- Malfunction of throttle operation
- Malfunction of throttle body/ECM

Stall after started

- Incorrect ignition timing
- Dirty engine oil
- Air existing in intake system
- Incorrect idle speed
- Malfunction of throttle body/ECM

Rough idling

- Malfunction of ignition system
- Incorrect idle speed
- Dirty fuel
- Malfunction of throttle body/ECM
- Injector clogged
- Injector tilt or unsealed

Intermittently misfire as acceleration

- Malfunction of ignition system
- Malfunction of throttle body/ECM
- Open or dropping in connecting harness

Late ignition timing

- Malfunction of ignition system
- Malfunction of throttle body/ECM

Power insufficiency and fuel consuming

- Fuel system clogged
- Malfunction of ignition system
- Malfunction of throttle body/ECM
- Clogged injector

Mixture too lean

- Clogged fuel injector
- Clogged fuel tank cap vent
- Clogged fuel filter
- Obstructed fuel pipe
- Clogged air vent hose
- Air existing in intake system
- Malfunction of throttle body/ECM

Mixture too rich

- Clogged air injector
- Dirty air cleaner
- Malfunction of throttle body/ECM

4-04. Remove / Install

4-04-01 Throttle Body (TB)

A. Removal

- a. Remove the R/L side cover and fuel tank
- b. Disconnect throttle cable from TB
 1. Remove the screw from throttle cap on TB and take out the cap.
 2. Loosen the cable and take out the plug then unscrew the nut of cable and pull out the cable.
 3. Disconnect all harnesses of TB
 4. Loosen the clamp of between TB and joint, air cleaner and slightly separate them
 5. Loosen the clamp of between TB and joint of intake.
 6. Take out TB slightly



B. Installation

- 1) Install in reverse order of removal procedures.
 - 2) Ensure to grease the cable and plug.
 - 3) Ensure the concave of cap match to convex of TB.
- 2) Ensure all clamps fixed firmly and correctly and all harnesses have been connected back.



4-05. Disassembly/Assembly Throttle

Body

Caution:

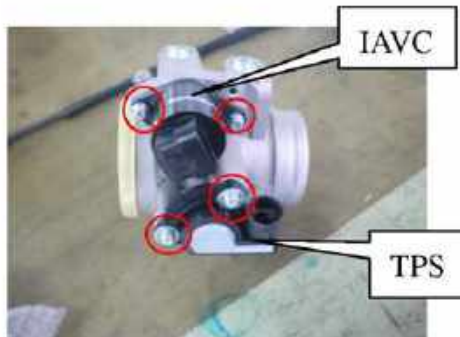
Throttle Body have been adjusted properly at once delivery. We strongly suggest not to disassemble it without professional training. Refer to 19-07.

4-05-01. Disassembly

1. Mark the position of TPS both screws with body by paint pen.
2. Remove all screws
3. Take out all electric parts and store them safely.
 - IAVC
 - TPS
3. TB have to keep it clean and safely stored.

Caution:

- Any damage in electric parts => replaced
- Deteriorated, clogged, clashed TB => clean or replaced



4-05-02. Assembly

1. Assemble IAVC, TPS back to positions by screws. The screws for TPS are with washers and match to the painted markings.

Toque: 20±5kg-cm

2. Assemble the cap

Toque: 15±5kg-cm

Caution:

- TPS re-installation have to be adjusted by OBD. Get more information from authorized dealers and Chapter 19.

4-06. Sender Unit /Fuel Tank

Before the fuel tank remove, please remove the side cover, top cover (as mentioned at chapter 5)

4-06-01. Sender unit

a. Removal.

1. Disconnect the sender unit coupler from wire harness.
2. Remove the 4 screws and then take out the sender unit

Caution

- Do not bend the float arm of sender unit
- Do not fill too much fuel to fuel tank.
- Sender unit inspection (Refer to electrical equipment chapter 20).

b. Sender unit installation

Install the gauge in the reverse order of removal.



4-06-02. Fuel tank

Before removal the fuel tank, please process the fuel drain out and fuel hose disconnect as mentioned.

a. Removal

1. Disconnect the fuel hose from fuel pump. Fuel hoses remain under pressure at all times. Always proceed with care. (refer to).
2. Remove 2 flange bolt at front fuel tank side and 2 flange bolts at rear side, then remove fuel tank.

b. Inspection

Check the fuel tank if crack, damage or even fuel leaking. Replace with new if broken.

c. Installation

Install the tank in the reverse order of removal, and connect necessary wires.

Torque: Fuel tank flange bolt :

1.0kgf-m

Caution

- Do not forget to install the gasket of sender unit.
 - Ensure to switch off all switches and disconnect battery. (refer to 4-2)
 - Do not reuse clamp. Replace a new one.
 - Always hold the inlet of fuel pump to connect or disconnect hose pipe.
-
- Ensure the insulation paper to be attached.
 - Do not overfill the fuel tank. Be careful not



to spill fuel, especially on the engine or exhaust pipe. Wipe up any spilled fuel immediately. Be sure the fuel tank cap is closed securely.

- Do not refuel right away after the engine has been running and is still very hot.

Note: Accompany fuel cap closed to fuel tank. Twist fuel cap (with a key cover) right to the thread on the opening of tank until torque loosen and lock it by key.



4-07. Air Cleaner

a. Removal

1. Loosen the clamp on air cleaner air duct in connecting with throttle body.
2. Release the hose clamps on the breathe hoses from engine and from transmission gear box in connecting to air cleaner, then disconnect the breathe hoses from air cleaner.
3. Remove the 4 flange bolts and pull backward the air cleaner to remove it from frame.



b. Installation

Install the air cleaner in the reverse order of removal.

- Ensure the joint, air cleaner latch and fix

correctly on both two ends to air cleaner and throttle body by clamps.

- Ensure the installation in two breath hoses from engine and transmission gear box.

**Torque: Air cleaner flange bolt (M6*28):
1.0kgf-m**

c. Cleaning air cleaner element

Separate the wire net protector clamp strip of air cleaner element.

1. Remove the air filter cover by release the fixing clip x 6.
2. Remove the air filter element.
3. Wash the element gently but thoroughly in solvent.
4. Squeeze the excess solvent out of the filter and let it dry. Do not twist the filter element when squeezing it.
5. Inspect the element. If damaged, replace it.
6. Apply some motor oil to the element which element should be wet but not dropping.
7. Reinstall the element to the element guide.
8. Reinstall the element assembly and parts removed for access.

Caution

- Never use gasoline or acid organized solvent to clean the element.
- Element should be yellow part side up.
- Loosen the drain bolt to release the mixtures at the periodic maintenance.



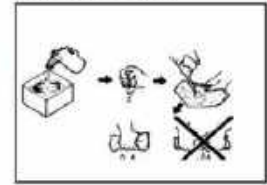
1. Air cleaner cover, 6 x fixing clip



1. Air cleaner element



1. Protective wire



d. Cleaning oil catch

Oil catch system have fitted to the bottom of air cleaner which breath the air from engine and transmission. It will accumulate the vapor from engine and gear box.

- To drain out the mixture water is necessary for every riding.
=> release the clip and drain out the cap drain → clean the cap drain
Damage → replace
- Ensure to clean oil catch system in every air cleaner maintenance.
 - 1) remove the cover of oil catch.
 - 2) clean the element as air cleaner
Damage → replace
 - 3) clean the oil catch system and ventilate by air gun.
 - 4) install back the element and cover and fix the 3 screws. Pay more attention on the seal on the system.

5) connect the breath hoses from engine and gear box.

4-08. Fuel pump ass'y

Caution:

Do not dismantle the fuel pump ass'y without professional trainings. We strongly suggest to replace the whole fuel pump ass'y.

Refer to 19-08.

a. Removal

1. Release the disposal clamp by tool and disconnect fuel hose. Be aware to hold the inlet



of pipe to slightly pull fuel hose out.

Warning:

Fuel hoses remaining pressure, always slowly and carefully to disconnect the hoses. Fuel drop must be wiped and cleaned right away(refer to 4-2).

2. Unscrew 5 screws on the fuel pump

3. Take it out slowly by turning 90 degree.

4. Keep it in a dry and clean condition.

b. Inspection

1. Check fuel pump bracket, cracked/rusty=> replaced

2. Check the fuel filter, clogged/deteriorated => replaced.

3. Check the hoses, crash/leak => replaced



4. Clamps => always replace new one
5. Check VSR (regulate valve)
 - a) contaminated / dropped => replaced
 - b) warning by OBD => replaced
 - c) certain period maintenance => replaced
 - d) suggest to replace VSR at once
 disassembling
6. Check fuel pump comp.
 - a) crash => replaced
 - b) cloth clogged => replaced
 - c) not enough fuel pressure => replaced
 - d) circuit shortage warning by OBD => replaced
 - e) certain periodic maintenance => replaced

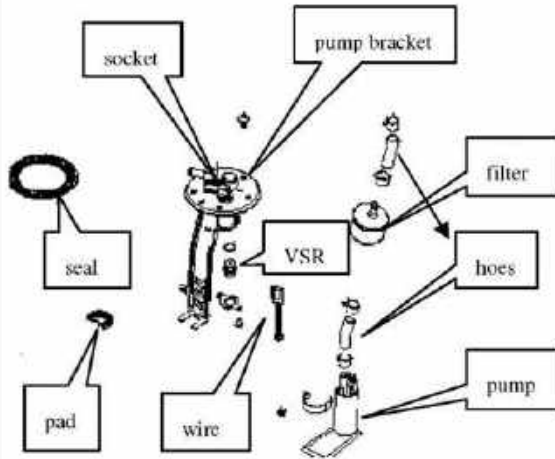
Caution: Suggest not to disassemble the fuel pump ass'y.

c. Installation

Check all combinations of fuel pump ass'y have been assembled correctly.

1. Install fuel pump ass'y in the reverse order of removal, and connect necessary wires and fuel hoses.
2. Always replace a new seal, fuel pump bracket and clamp
3. The inlet of fuel pump set to backward 45° as picture.
4. Fix back the 5 screws in a crisscross by specified torque.

Toque: 20kgf/cm



4-09. Fuel hose

There are three fuel hoses which deliver fuel from fuel pump to injectors. A 3-way connector have been set to divide fuel to both injectors on manifold.

Warning:

As previous description, they always remain the pressure (refer to 4-2). No matter to install /disassemble or checking the fuel hoses, please follow all attentions on this chapter.

a) remove

- 1) hold the inlet of fuel pump or injector to remove the hose
- 2) use special tool to release the disposal clamp
- 3) dispose the clamps

b) inspection

any crash/ contamination/ deterioration/ ageing/ torture/ damage → replace

c) install

- 1) a new clamp have to be installed
- 2) use special tool to install the clamps
- 3) always hold the inlet of fuel pump or injector to insert the hose to proper position.





Notes:



5-01. Precautions in Operation
5-02. Removal of Engine
5-03. Engine Installation
5-04. Exhausted-pipe
5-05. Manifold

5-01. Precautions in Operation

General Information

- Ensure to let engine and exhaust system cool down before remove engine.
- Ensure to disconnect the battery cable/ electrical connection/ fuel lines.....etc. firstly.

Specification

- Lubrication type : Pressure + Splash

Item		Capacity
Engine oil capacity	Replacement	2000c.c.
	Disassembly	2200c.c.
Rear axle gear oil capacity	Replacement	290 c.c.
Front differential gear oil capacity	Replacement	290 c.c.
Transmission gear oil capacity	Replacement	400 c.c.
	Disassembly	450 c.c.
Coolant capacity	Engine& radiator + hoses	2500 c.c.
	Reservoir	300+/- 20 c.c.
	Total	2800 c.c.

- In general: petrol / four stroke/ 4 valves/ V twin cylinder/ EFI/ water cooled / EPS
- Generator: Permanent magnet AC type
- Magnet generated power: > 350W
- Engine management system: Delphi EFI system
- Oil filter type: Primary filtration + refined filtration
- Gasoline grade: better above 92#
- Fuel pressure: 3.0~3.5 Kpa
- Starting method: Electric start
- CVT type: Rubber v-belt CVT
- Speed adjusting range: 2.7 ~ 0.75
- Downhill auxiliary braking: yes



- Transmission gear box type: Gear drive
- Output type: Front & rear shafts output four wheel / 2x4 & 4x4
- Differential gear box: Front
- Differential gear lock: optional
- Gear delivery type : L/H/N/R/P
- Shifting delivery way: Electric

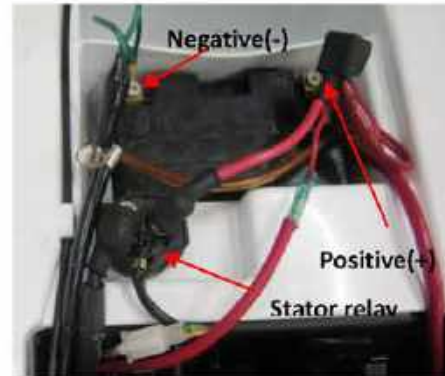
5-02. Engine Removal

a. Remove the seat.

- Switch the ignition switch from "off" to "seat open" to release the seat.
- Remove out the seat.

b. Remove the battery

- Remove the battery cord.
Firstly remove negative terminal (-) and then remove the battery positive (+) terminal.
- Remove the battery.



c. Remove the R & L side cover above the footrest cover.

- Screw out the 7 tapping screws at side covers
- Remove out the R and L side cover.



d. Remove R & L footrest cover

- Screw out 8 pan head screws in connecting to R/L footrest bar and front/rear cover.
- Remove the R and L footrest cover

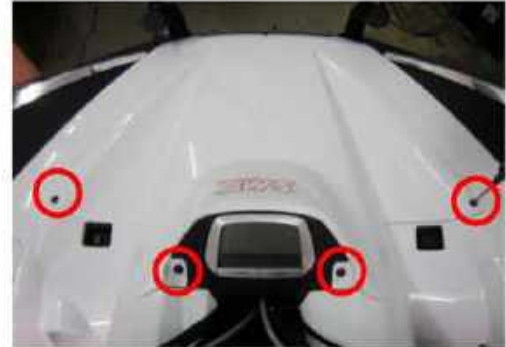


e. Remove the front carrier

- Remove out 4 flange bolts from front carrier.
- Remove out the front carrier


f. Remove out the front top cover.

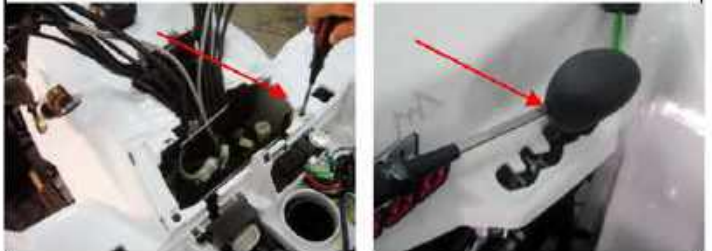
- Screw out 4 tapping screws as photo show.
- Remove out the front too cover.


g. Remove the Multi-functional display

- Screw out 1 fixing bolt
- Disconnect the meter wire coupler from wire harness.
- Remove the multi-functional display.


h. Remove the top cover (fuel tank cover)

- Remove the fuel tank cap
- Remove out two tapping screws at the front of top cover (fuel tank cover) in connecting with front cover.
- Remove the screw on the gear shifter ball grip, and then remove the gear shifter ball grip
- Turn and remove the ignition switch cap
- Remove the 2 flange bolts at rear side above the fuel tank (co-tighten structure with fuel tank & top cover to the frame)



- Remove the top cover (fuel tank cover).

i. Remove the fuel tank.

- Disconnect the sander unit wire connector
- Disconnect the fuel hoses
- Remove the fuel tank.

(for detail message, please refer to 4-06)

j. Remove the front cover.

- Disconnect all couplers of electric components.
- Remove 7 tapping screws on the front cover in connecting with front shield cover.
- Remove out the front cover.

k. remove out the rear carrier

- Remove the 4 flange bolts in connecting between rear carrier and frame behind the rear cover
- Remove out the rear carrier.

l. remove the rear fender.

- Remove tapping screws inside the rear storage box
- Remove the pan head screw M6x15 * 3 and tapping screw *10 on the rear cover side in connecting with frame and rear baggage cover.
- Remove the 2 flange bolts, then remove the seat catch stay, disconnect the seat lock cable.
- Disconnect the electrical connectors for tail light, wipers.



SEAT LOCK CABLE

- Remove the rear fender.



m. Remove the muffler

- Loose the clamp at connecting side between rear exhaust pipe and muffler.
- Remove the two flange bolts on the muffler side to engine.
- Remove the muffler from front exhaust pipe.



n. Remove the exhaust pipe

- Disconnect two oxygen sensor couplers firstly.
- Loose the clamp at connecting side between rear pipe and front pipe and remove 2 flange nuts on the rear cylinder head and pull out the rear pipe.
- remove 2 flange nuts on the front cylinder head and take the front pipe out.



Caution: Oxygen sensor unit can't be dropped and tortured. Keep the harness in nature.



o. Disconnect the CVT cooling inlet & outlet duct.

- Remove the clamps on CVT inlet duct joint between CVT inlet duct and LH crankcase, then remove air inlet duct and air inlet joint.

- Remove the clamp on CVT outlet duct at rear side of L. Crankcase, and disconnect the air duct.



p. Remove the fuel tank, air cleaner & throttle body

- refer to 4-06 to remove fuel tank
- refer to 4-04 to remove throttle body
- refer to 4-07 to remove air cleaner.

q. Remove electrical wire couplers from engine and cables connecting to engine

- Remove the spark plug cap
- Remove the A.C. Generator wire couplers and release out from frame clamps.
- Disconnect the gear position sensor ends (covered by silicon glue).
- Disconnect the velocity sensor coupler.
- Disconnect the Thermo sensor plug coupler.
- Disconnect the start motor coupler & Ground wires for winch
- Disconnect TPS, injector, IACV,MAPMAT....sensors coupler
- Disconnect regulator coupler
-and so on



r. remove the gear shifter

- Screw out the flange bolt behind shift lever and remove out gear shifting rod.


s. Remove out the liquid cooling hoses from engine

- Disconnect hose clamp on inlet side of water pump
- Drain out all coolant at the time disconnecting In hose, water pump
- Disconnect the coolant hose clamp from front cylinder head.


Caution:

- Use container to reverse the coolant. Better to wait for some mintues for dropping.
- Always drain out the coolant from the side of water pump (the lower point).
- Check the hose crash => replaced

t. remove the manifold and engine hanger

- unscrew the four bolts on the manifold,



attention to the different length bolts.

- take out the manifold with injector and fuel hoses (release the fuel hoses refer to 4-04/ 4-06 & 2-03) (refer to 2-26 for injector)

- The engine hanger fixed in the left top side of engine. Unscrew the two bolts on the engine and unscrew the nut and bolt on the frame and remove out the engine hanger.



u. remove the front and rear drive shaft connector from front gear box and rear gear box.

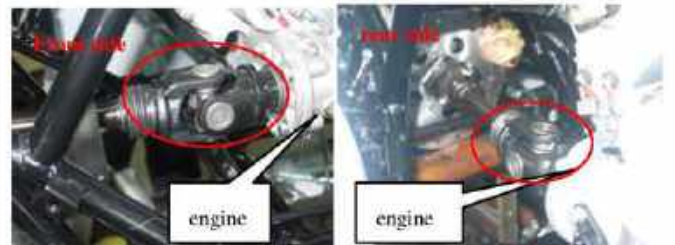
- **Two way to select for remove the shaft connectors**

1) remove the circlips in the universal jointers to release the jointers in the front and rear.

→ always replace a new circlips

→ secure the installation to recheck the fixings.

2) remove the front and rear gear boxes fixing bolts and move back the front and rear boxes to release the shaft connector.



- **Suggestion the way (2) for removing the engine.**

v. engine remove out

- unscrew the fixed bolts and nuts in the front and rear engine mountings of engine.

Front engine mounting : in the left bottom side of engine

Rear engine mounting : in the left upper side of the transmission gear box.



- tilt the engine to be 60° to left and move it to left and remove the engine out from left side of frame body.



5-03. Engine Installation

Check the engine mounting rubber dampers in the front and rear for any damage.

Install the engine in the reverse procedures of removal.

Caution

- Be careful when removing and installing the engine.
- Clean the engine if necessary before installing.
- Do not crash the body covers when removal and installing.
- Follow the recommended torque values for all installing engine and covers. (refer to 1-05).
- Follow the recommended loctite glue applying when installing. (refer to 1-05)
- Replace all necessary consuming parts.
- Check the engine hanger inside bushing => damage → replace
- Install the engine hanger: 1) to fix the two bolts firstly with 243 glue to the engine by recommended torque 2) then fix the bolt and nut to the frame, recheck the bushing function.
- Do not bend or twist the wires and tubes.
- Cables wires have to be routed in accordance with normal layout.
- Recheck the security in connecting jointers in the front and rear gear box. Grease the spindle of connecting jointers to rear and front gear box.
- Ensure refill recommended lubricant and sufficient quantity. (refer to 2-01/3-04/5-01)
- Coolant hoses installed and refill the sufficient quantity. (refer to 2-01/5-01)



- To avoid foreign dropping to CVT cover, to cover the opening of CVT inley and outlet ducts when you assemble parts.

5-04. Exhausted-pipe

a. Removal

refer to 5-02. m/n

b. Inspection

- Identify the exhausted-pipe version if with homologated plate on it or not.
- Check front pipe and rear muffler crack → replaced
- Check the gaskets/clamp => crack/damage → replaced
- Check protection cover and insulated fiber crack/damage → replaced
- Check spark arrester/tail-pipe crack/blocked → replaced / clean (refer to 2-15)

c. Installation

refer to 5-02.m/n

1) install front pipe

- gasket to be inserted into front cylinder head
- screw in two nuts by hand fully

2) install rear pipe

- gasket to be inserted into rear cylinder head
- screw in two nuts by hand fully



- put the two clamps to the front and rear pipe connection pipe



3) install the muffler

- insert the front end of muffler into the rear pipe and match two muffler fixing points and screw in the two bolts with rubber but not tighten them. Apply 243 glue to the two bolts.



- 4) tighten the four flange nuts to the rear and front cylinders to lock the rear and front pipe in balance by recommended torque. (refer to 1-05)

Torque: 30 N-m



- 5) tighten the two bolts in muffler to frame by recommended torque. (refer to 1-05)

Torque: 30 N-m



- 6) fix the clamps in the rear connection and front connection.

Torque: 30 N-m

7) recheck all pipe and fixing points not touching to frame and engine => touch → adjust

8) install the O² sensor on the front pipe and rear pipe by recommended torque and connect the coupler to wire harness.

Torque: 70 N-m

Caution:

- Always replace new gasket at once disassembling exhaust-pipe.
- Install the gasket
 - 1) push gasket to the rear pipe inside and to be flat on the inlet opening.
 - 2) push gasket into front end of muffler inside to be flat on the inlet opening.



5-05. Manifold

Caution: Fuel hoses maybe under pressure. Cover the fuel hose connection with an absorbent rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage.

Release fuel pressure by running engine until it runs out of gas.

(refer to 2-03/2-26)

a. Removal

refer to 5-02 t

b. Inspection

- check to the fuel hoses crash/deterioration → replace => unplug fuel hoses from injector

- check to the injector (refer to 2-26) and MAPTS
=>unplug both injectors from the injector holders => o-ring damage → replace
=>unplug MAPTS => o-ring damage → replace

Clean the injector by fuel → check the four jets condition

- check to the manifold
 - 1) for cracks, warping at flanges or any damage → replace
 - 2) clean the inlet and outlet of manifold by air gun.
 - 3) check to the oil rings → replace a new one

c. Installation

Follow the reverse of the removal procedure.

- ensure install injector into holder properly as picture.

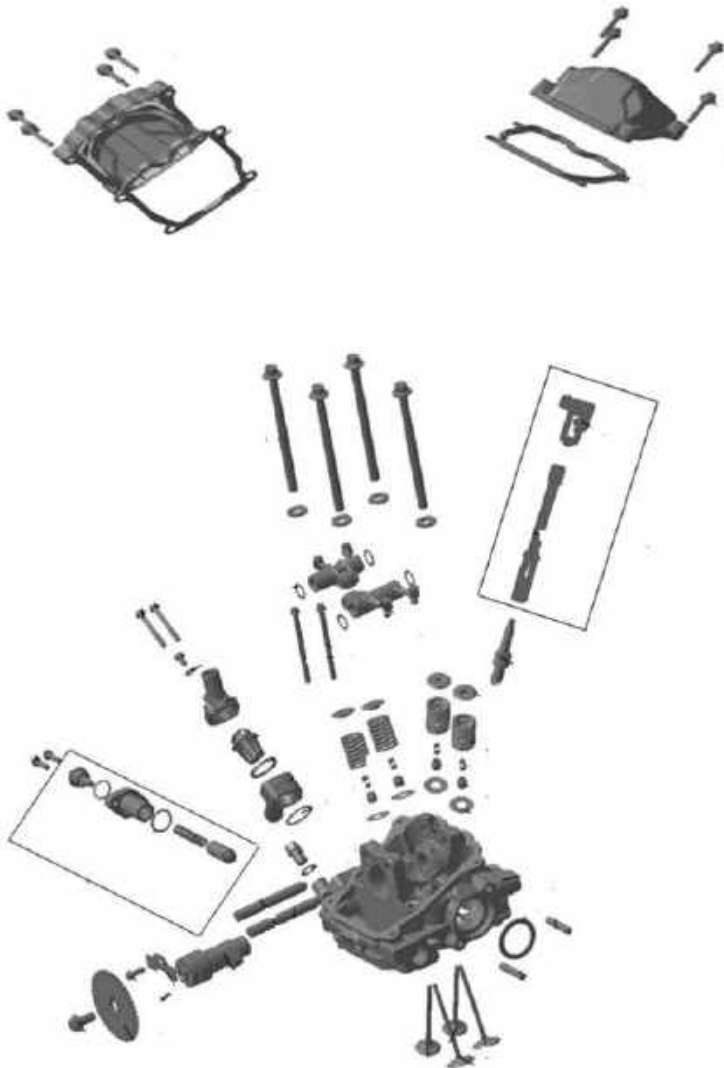




NOTE:

- 6-01. Mechanism Diagram.....
- 6-02. Precautions in Operation.....
- 6-03. Troubleshooting.....
- 6-04. Cylinder Head Removal.....
- 6-05. Cylinder Head Inspection.....
- 6-06. Valve Seat Inspection and Service.....
- 6-07. Cylinder Head Reassembly.....

6-01. Mechanism Diagram





6-02. Precautions in Operation

General Information

- This chapter is contained maintenance and service for cylinder head, valve, and camshaft as well as rocker arm.
- Prevent burning yourself on hot engine parts.
- Fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off an fuel spillage.
- Cylinder head service can be carried out when engine is in frame.
- Torque wrench tightening specifications must strictly be adhered to.

6-03. Troubleshooting

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

Low compression pressure

1. Valve

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

2. Cylinder head

- Cylinder head gasket leaking or damage
- Tilt or crack cylinder

3. Piston

- Piston ring worn out.

High compression pressure

- Too much carbon deposit on combustion chamber or piston head

Noise

- Improper valve clearance adjustment
- Burnt valve or damaged valve spring
- Camshaft wear out or damage
- Chain wear out or looseness
- Auto-tensioner wear out or damage
- Camshaft sprocket
- Rocker arm or rocker arm shaft wear out

6-04. Cylinder Head Removal

a. Remove the engine from the frame.
(Refer to chapter 5)

b. Remove connecting pipe and manifold

- Release 2 clamps to remove connecting pipe.
- Unscrew the four bolts and remove the manifold with injectors.
 - 1) with M8*25 and M8*40 different bolts

c. Remove the head covers

- Remove the 4 flange bolts each and take out the head covers
- check the rubber gasket, any damage/crash → replace

d. Remove the thermostat cover and take out the thermostat (refer to 13-08)

- unscrew two bolts each and take the cover out.
- the thermostat only stay in front cylinder head
- the rear cylinder head only set the cover to deliver the coolant

e. Remove the spark plugs.



f. Remove the coil, pulse



g. Piston TDC position align

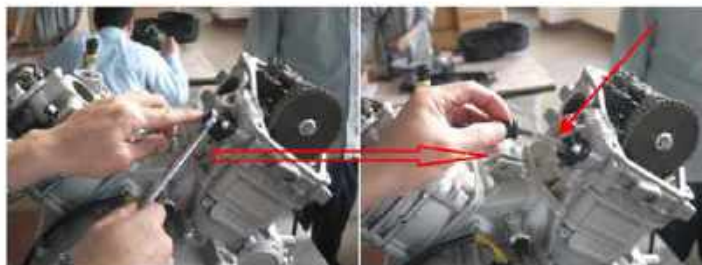
1) Remove the cap on right crankcase cover, and turn the crankshaft clockwise.



2) Align the timing mark on the cam sprocket with that of cylinder head to make the piston at TDC position.

h. Remove the chain tensioner

1) unscrew the cap of chain tensioner and take out the cap with o-ring and spring.



2) unscrew the two bolts on the tensioner and remove the body.

- Timing chain tensioner is spring loaded. Never perform this operation immediately after the engine has been run because the exhaust system can be very hot. Wait until exhaust system is warm or cold.



i. Remove the Cam Sprocket

1) Unscrew the bolt of cam sprocket
2) move the sprocket out and aside the chain



3) take the pin of camshaft out

- Check to the timing chain => with sprocket for excessive radial play => worn or damaged → replace

NOTE: Replace timing chain only with sprocket as a set.

j. Remove the cylinder head comp.

1) unscrew two bolts inside the cylinder head



2) unscrew the four bolts of cylinder head crosscrise and take out them

a) two bolts inside the cylinder head



3) remove out the cylinder head comp.

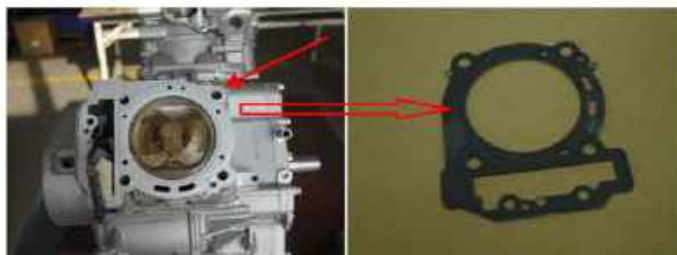


k. Remove cylinder head gasket

- Always replace a new gasket

Caution

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



- Clean up residues from the matching surfaces of cylinder and cylinder head.

Note:

Do the same procedures as above to remove the another cylinder head.

I. Remove the rocker arm

- 1) unscrew the bolt and take out the stopper



- 2) remove both rocker arm shafts and take out both rocker arms.



- rocker arm is with roller and a pair for cam shaft.
- a protector washer inside the rocker arm to the wall of cylinder head
- keep the rocker arms in a good condition



m. Remove the camshaft

- 1) slightly turning and remove out the camshaft

- the cylinder head have been machined a cam shaft for the cam shaft removing and installing.



- Beware the different camshaft on the front cylinder head and rear cylinder head. You may find out additional machined circle on the front one (for front cylinder).



n. Remove the valve, cotter, valve spring and seal

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

Caution

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

- Clean carbon deposits in combustion chamber.

1) slightly scrape the carbon or
2) spray the cleaner to clean the carbon then wait for few minutes then clean it.

- Clean residues and foreign materials on cylinder head matching surface.

Caution

Do not damage the matching surface of cylinder head.

2) if you need to remove the valve stem seal (don't need to remove the seal in general), use the seal puller to remove the valve stem seals.



6-05. Parts inspection

a. Cylinder Head Inspection

- Check if spark plug and valve holes are cracked.
- Eliminate carbon deposits by a rounded scraper then clean it in solvent.
 - avoid damaging valve seats/guide plug threads and matching surface
- Eliminate mineral deposits/rust on water jacket.
- Measure the cam shaft bearing

Service Limit:

IN(A): Replacement when less than 22.040mm

EX(B): Replacement when less than 35.040mm

- Measure cylinder head warp with a straightedge and thickness gauge on cross surfaces..

Service limit: 0.05 mm

b. Camshaft

- Inspect cam two lobes height for crash or out of specification → replace.

Service Limit:

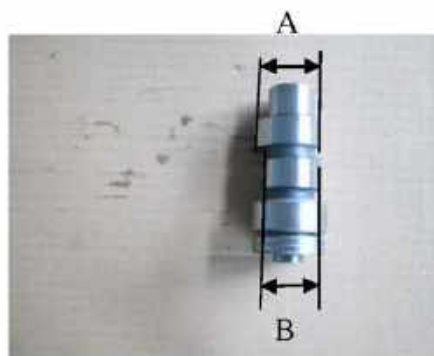
IN(A): Replacement when less than 32.090mm

EX(B): Replacement when less than 31.920mm

- Inspect the camshaft bearing journal for wear out. → replace the whole set.

Service Limit:

IN(A): Replacement when less than



21.95mm

EX(B): Replacement when less than 34.95mm

c. Rocker Arm

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

Service Limit: Replace when it is more than 12.060 mm

- roller => not smooth, discoloration or scratches → replace

d. Rocker Arm Shaft

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

Service Limit: Replace when it is less than 11.990 mm.

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

Service Limit: Replace when it is less than 0.07mm.

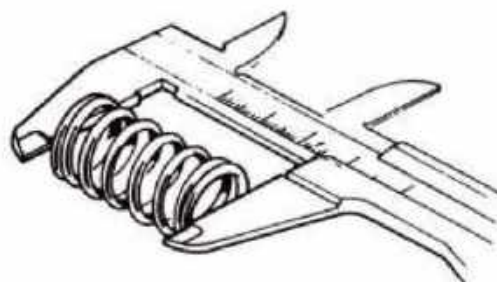
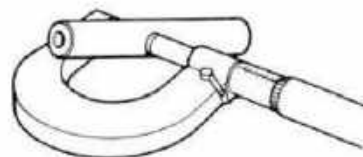
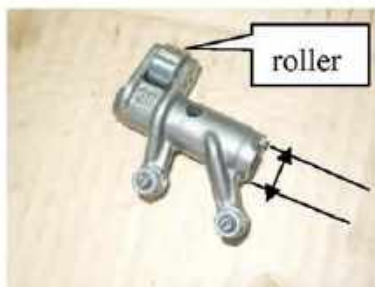
e. Valve spring free length

Measure the free length of springs.

Service limit: 39mm

f. Valve stem

- Check if valve stems are bend, crack or burn.
- Check the operation condition of valve stem in valve guide, and measure &



record the valve stem outer diameter.

- Round measurement if out of specification → replace.

Service Limit:

IN: 4.93 mm

EX: 4.93 mm

Round limit: 0.06mm

g. Valve guide

Caution

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

Tool: 5.0 mm valve guide reamer

Measure and record each valve guide inner diameters.

Service limit: 5.05 mm

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

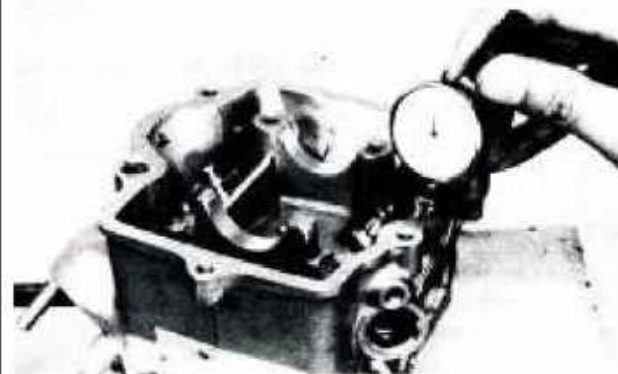
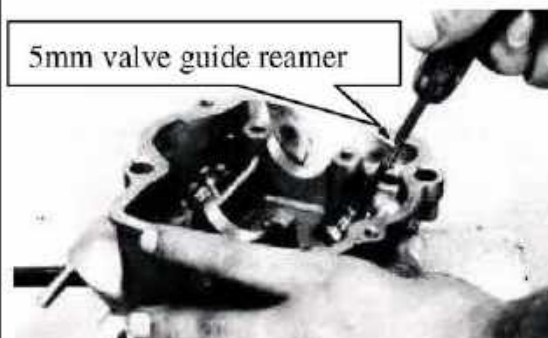
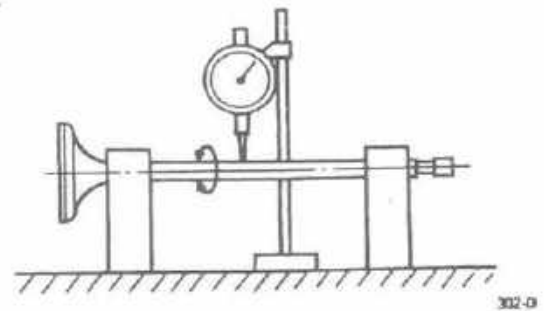
Service Limit: IN < 0.08 mm

EX < 0.10 mm

Note:

- When installing a new valve always replace the guide.
- If the valve is removed or replaced always replace the valve oil seal

6-06. Valve Seat/Valve Inspection



and Service

Clean up all carbon deposits on inlet and exhaust valves. Apply with emery slightly onto valve contact face. Grind valve seat with a rubber hose or other manual grinding tool.

Caution

Do not let emery enter into between valve stem and valve guide.

Clean up the emery after corrected, and apply with engine oil onto contact faces of valve and valve seat. Remove the valve and check its contact face.

Caution

Replace the valve with a new one if valve is roughness, wear out, or incomplete contacted with valve seat.

Valve seat inspection

If the valve seat is too wide/ rough/ with dark spot/ burning → replace cylinder head

Valve seat wide

EX valve seat service limit: 2.00mm

IN valve seat service limit: 1.80mm

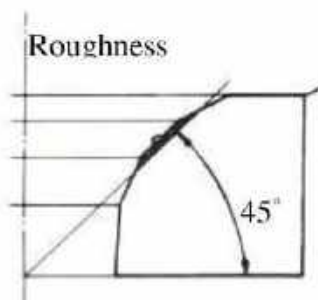
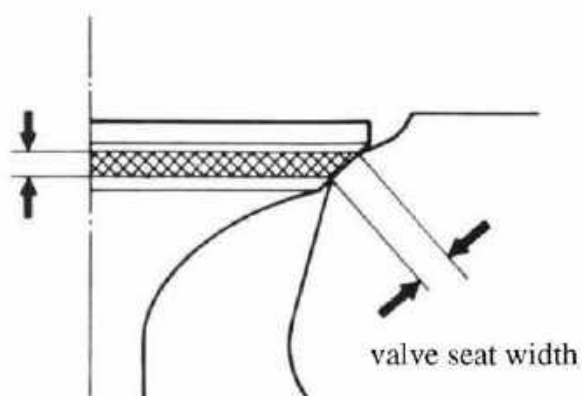
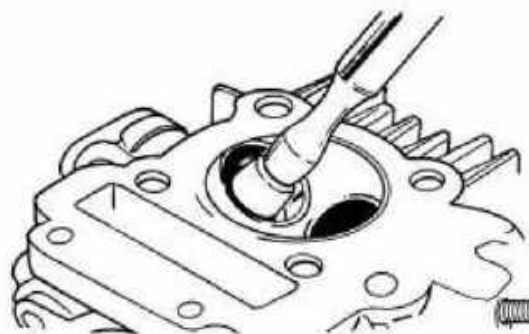
Check the contact condition of valve seat.

Valve seat grinding

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

Refer to operation manual of the valve seat chamfer cutter.

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



Caution

- After valve guide had been replaced, it has to be ground with 45° valve seal chamfer cutter to correct its seat face.
- Use 32° cutter to cut a quarter upper parts out.
- Use 60° cutter to cut a quarter lower parts out.

Remove the cutter and check new valve seat.

Use 45° cutter to grind the valve seat to specified width (1.0mm).

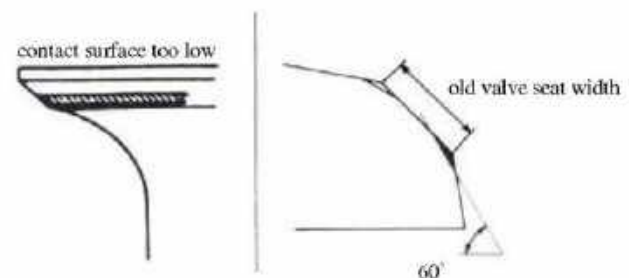
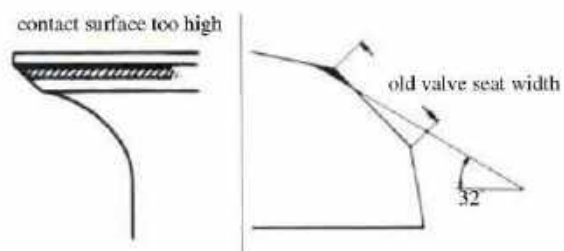
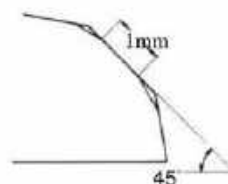
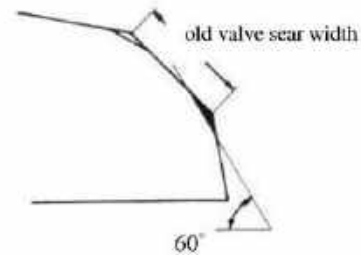
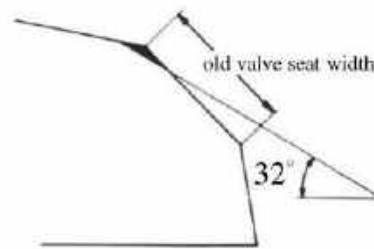
Caution

- Make sure that all roughness and uneven faces had been grounded.
- Grind valve seat again if necessary.
- Coat the valve seat surface with red paint.
- Install the valve through valve guide until the valve contacting with valve seat, slightly press down the valve but do not rotate it so that a seal track will be created on contact surface. Then check the contact surface.

Caution

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

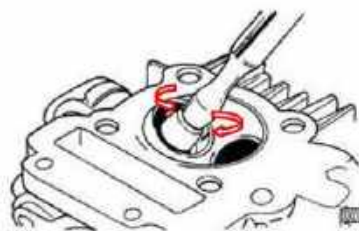
- If the contact surface too high, grind the valve seat with 32° cutter. Then, grind the valve seat to specified width.
- If the contact surface too low, grind the valve seat with 60° cutter. Then, grind the valve seat to specified width.
- After the valve seat ground, coat valve seat surface with emery and then



slightly press the ground surface.

- Clean up all emery coated onto cylinder and valve after ground.

Install back all components properly & spark plug and test any leaking by filling little fuel to combustion space.



6-07. Cylinder Head Reassembly

a. install the valve

- Lubricate valve stem with engine oil, and then
- Insert the valve into valve guide.
- Install new valve stem oil seal by special tool
Special tool: valve seal remover and installer
Ask for dealer for special tool No. if necessary.
- Install valve springs and retainers by special tool
Special tool: valve cotter remove & assembly tool
Ask for dealer for special tool No. if necessary.

Caution

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

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



Caution

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

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

Caution

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

b. Install the camshaft and rocker arm

- Apply engine oil to the bearing of camshaft and contact hole on cylinder head.
- put four washers on the cylinder head inside both walls as picture
- Insert the camshaft to the cylinder head. Be careful to push slightly to avoid the damage.
 - different camshaft to the front and rear cylinder head, refer to 6-04 m.
 - hole for camshaft is oval for installing, refer to 6-04 m.
- Install the pair rocker arms and insert the rocker arm, shaft. and recheck the operation of rocker arm by moving camshaft.
 - apply enough engine oil on the rocker arm and rocker arm, shaft
 - ensure the rocker arm, shaft installing position to the end.
 - rocker arm is a pair



- Insert the plate, stopper to the camshaft and torque the bolt.
Torque value: 10 N-m



- Insert the pin to the camshaft



c. install the cylinder head onto the cylinder.

- Clean up all residues and foreign materials from the matching surfaces of both cylinder and cylinder head.
- Install chain guide, dowel pins and a new cylinder head gasket onto the cylinder.



Caution

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



- Install 4 washers and bolts to cylinder head. Tighten the bolts to the specified torque in three steps (30=>40=>50N-m) in the proper tightening in crisscross. Then tighten cylinder head mounting bolt of cylinder head.



Torque value:

Cylinder head bolt : 50 N-m

Cylinder mounting bolt : 10N-m



d. Install the Cam chain sprocket, chain tensioner and timing align.

- Stretch out the cam, chain and install the cam, sprocket to the cam
 - try to align the two “—” mark parallel to the edge of the cylinder head.
 - the concave of sprocket have to install to the pin of camshaft.

Refer to 6-04 i

- Install the chain tensioner
 - install the tensioner body to the cylinder head

- install the spring, o ring to the cap then push it into the cylinder head

- fix the cap



- Turn the crankshaft to right and align the 1-I (front cylinder and mark "I") to the concave and check the rocker arms are loosen (on the TDC).
 - recheck the two "—" mark have to be parallel to the edge of the cylinder head.
 - **if not parallel → re-install and adjust the sprocket until to be parallel**



- Apply 243glue and torque the mounting bolt of sprocket

Torque value: 10 N-m



e. Valve Clearance Adjustment

- Complete the correct installation as d., go to adjust valve clearance.
- Loosen valve clearance adjustment nuts and bolts located on valve rocker arm.
- Measure and adjust valve clearance with feeler gauge.
- After valve clearance had been adjusted to standard value, hold adjustment bolt and then tighten the Adjustment nut (refer to 2-07).

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

- Check the adjusting bolt contact surface any damage or blue discoloration → replace
 Smell sufficient oil to all combinations in the cylinder head.



Refer to 2-07.

- Turn the crankshaft clockwise 280°

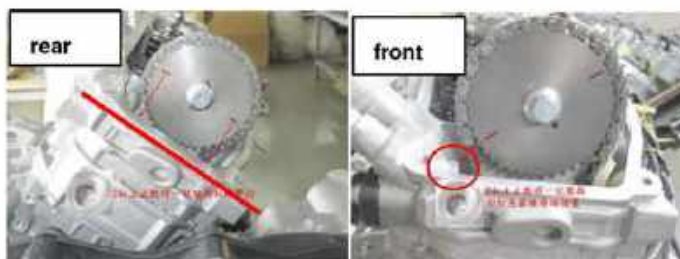


- Do the same procedures as above for rear cylinder.
 - Ensure to align 2-l (rear cylinder and mark "l")



f. Re-check the timing align

- front sprocket mark parallel to cylinder head edge → rear sprocket mark arrow to the angle as picture.
- rear sprocket mark parallel to cylinder head edge → front sprocket mark arrow to the angle as picture



g. Install the thermostat in the front cylinder head and install the CTS in the rear cylinder head then install the covers.

- refer to 6-04 d. and 13-08



h. Install the cylinder head cover

- check any damage on rubber gasket
- insert gasket to the groove of head cover properly and install back bolts.
- ensure the matching perfectly after installing.



i. Install back the cap and coil,pulse.



j. Install and tighten both spark plugs
(NGK – DCPR7E)

- refer to 2-06

Torque value: 15N-m



NOTE:

7-01. Mechanism Diagram.....
7-02. Precautions in Operation.....
7-03. Trouble Shooting.....
7-04. Cylinder and Piston Removal.....
7-05. Inspection on Cylinder /Piston/Piston Ring.....
7-06. Piston Ring Installation.....
7-07. Piston Installation.....
7-08. Cylinder Installation.....

7-01. Mechanism Diagram



7-02. Precautions in Operation

General Information

Both cylinders and pistons service cannot be carried out when engine mounted on frame.

Specification

Unit : mm

Item		limit	
Cylinder	ID	92	
	Bend	0.05	
Piston / Piston ring	Clearance between piston rings	Top ring	0.15
		2 nd ring	0.15
	Ring-end gap	Top ring	1.50
		2 nd ring	1.50
		Oil scrape ring	1.50
	Clearance between piston and cylinder		0.21
	ID of piston pin boss		19.980
OD of piston pin		20.045	
Clearance between piston and pin		0.065	

7-03. Trouble Shooting

Low or Unstable Compression Pressure

- Cylinder or piston ring worn out

Smoking in Exhaust Pipe

- Piston or piston ring worn out
- Piston ring installation improperly
- Cylinder or piston damage
- Abnormal blow-by

Knock or Noise

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

Engine Overheat

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

7-04. Cylinder and Piston Removal

a. Remove the cylinder head (refer to chapter 6).

b. Remove two dowel pins

c. Remove the chain guide

d. Remove the cylinder

1) may slightly knock the cylinder wall by plastic hammer if cylinder is very tight inside.

2) pull out the cylinder slowly and carefully by both hands when bottom of the cylinder liner close to piston/ piston ring.

3) discard cylinder gasket → replace a new one

Caution:

Cover the hole of crankcase and cam chain with a piece of cloth or plate stopper to prevent foreign material falling into the crankcase.

e. remove the piston/pin/clip from crankshaft

- Remove the piston pin clips.

- Remove the piston pin and piston from connecting rod.



f. Do the same ways as above for another cylinder.

7-05. Inspection on Cylinder /Piston

/Ring

a. Cylinder wall check

1) Check if the inner diameter of cylinder is worn out / scoring or damaged → replace a new one

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

Service limit: 92.08

b. Check cylinder if warp.

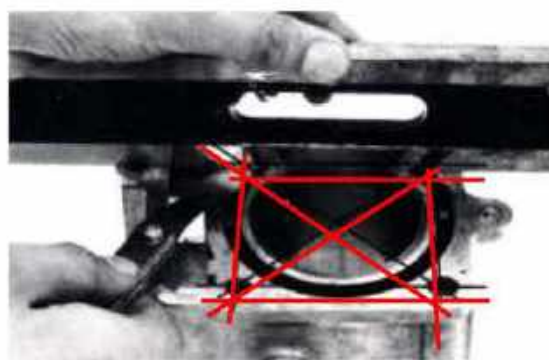
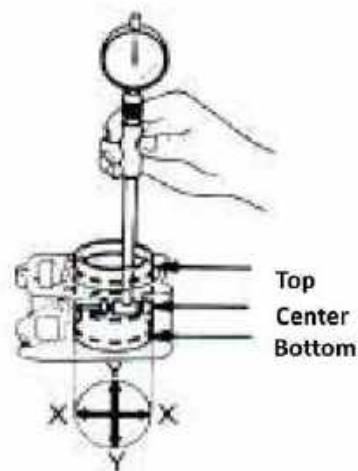
Service limit: 0.05 mm

c. Measure clearance between piston rings and grooves.

Service Limit: Top ring: 0.15 mm

2nd ring: 0.15 mm

Oil scraper ring: 0.25mm



d. Piston ring check

- Remove piston rings carefully.
- There are 3 rings (top ring(upper compression ring)/second ring (lower compression ring)/ oil scraper ring x 1 set (3 pcs))
- Check if the piston rings are damaged or its grooves are worn.

Caution

Pay attention to remove piston rings because they are fragile.

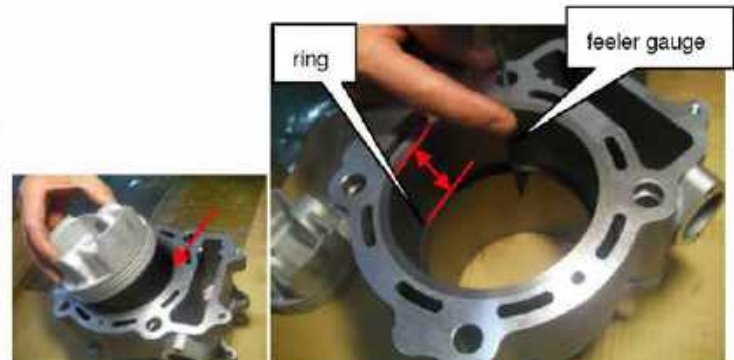
Identify the top and second ring carefully.

Ring end gap check:

- Place piston rings respective into cylinder below about 8~16 mm from cylinder top (push the ring with piston crown to be at a right angle on the cylinder bore) then measure ring end gap by feeler gauge.
- Top ring is brighter than 2nd ring.

Service Limit: Top ring: 1.50 mm
 2nd ring: 1.50 mm
 Oil scraper ring: 1.50mm

Note: You can't measure the end gap on the spring ring. If oil scraper ring rails show excessive gap → replace all rings.



e. Measure the outer diameter of piston pin.

Service Limit: 19.980 mm

f. Measure the inner diameter of piston pin hole.

Service Limit: 20.045 mm

g. Calculate clearance between piston pin and its hole.

Service Limit: 0.065 mm

h. Measure piston skirt diameter.

Measure piston out-skirt "D". The measurement position is **8.0 mm** from piston bottom edge by micrometer.

Standard skirt diameter:

91.950 ~ 91.966mm

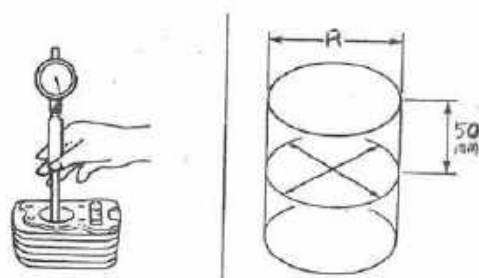
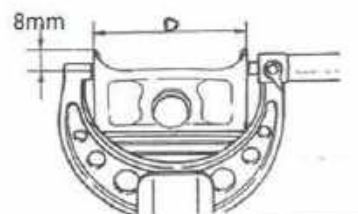
Service limit: 91.850mm

Out of specification → replace

i. Measure cylinder bore diameter

Measure the average value "R" at 50mm from the top of cylinder by cylinder bore gauge.

$$R = (X+Y)/2$$



Standard cylinder bore diameter:

92.005 ~ 92.045mm

Service limit : 92.06mm

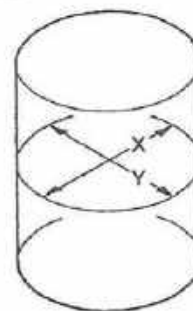
Out of specification → rebore or replace

j. Calculate clearance between piston and cylinder

- refer to step i & j.
- value $R - D =$ piston-to-cylinder clearance

Service limit : 0.21mm

Out of specification → rebore or replace cylinder , and replace the piston and piston rings as a set.



7-06. Piston Ring Installation

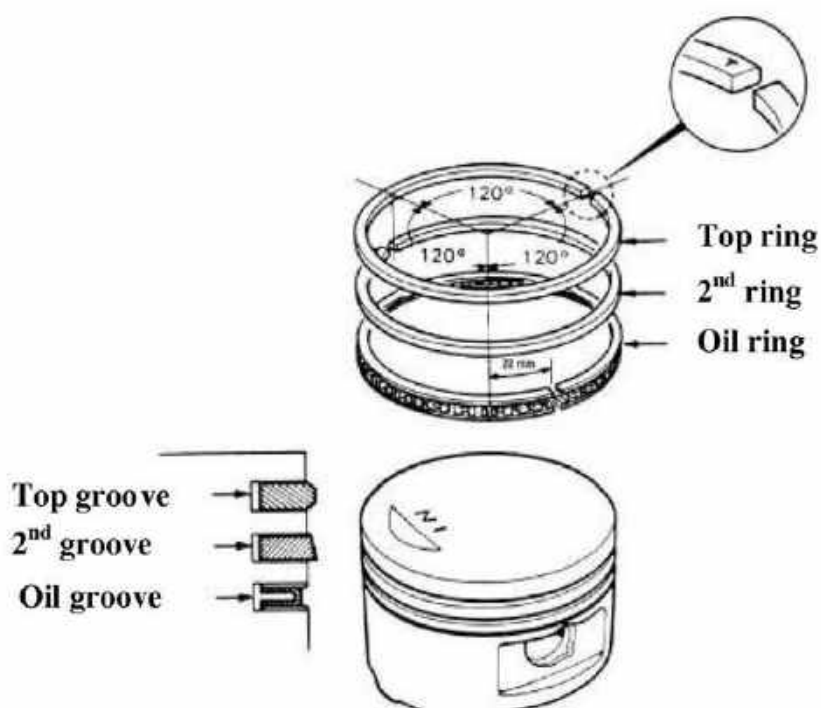
Clean up piston top, ring groove, and piston surface.

Install the piston ring onto piston carefully.

Place the openings of piston ring as diagram shown.

Caution

- Do not damage piston and piston rings in installation.
- All marks (R) on the piston rings must be forwarded to up side.
- Top ring with chrome coating is different to 2nd ring.
- Make sure that all piston rings can be rotated freely after installed.



7-07. Piston set Installation

- Before installation of Piston set onto connecting rod, clean up all residues and foreign materials on the contact surface of crankcase. Pay attention not to let these residues and foreign materials fall into crankcase.

Caution

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

- Apply engine oil on the piston pin and insert piston pin into piston and connecting rod by placing the \triangle mark on the piston to the following position:

Front cylinder: Mark \triangle on top of piston must show to intake side.

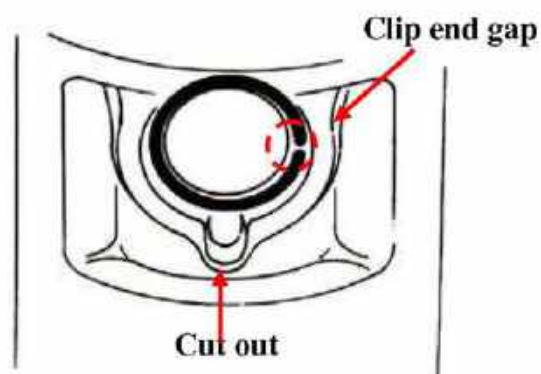
Rear cylinder: Mark \triangle on top of piston must show to exhaust side.

Caution

- Must follow \triangle to the front and rear cylinder in different position.



- Install 2 new piston pin clips, avoid the clip end gap too near to cut out groove of piston.



Caution

1. Do not let the opening of piston pin clip align with the piston cut out.
2. Place a piece of cloth or stopper tool between piston and crankcase in order to prevent snap clip from falling into crankcase as during servicing.
3. Match the same grade (if necessary) with piston and cylinder in a new installation.

7-08. Cylinder Installation

- Install dowel pins and new cylinder gasket.
- Apply some engine oil to inside of cylinder, piston and piston rings.
- Use piston clamped to hold the piston ring and install the cylinder parallel and gentle to avoid damage the cylinder inner wall. When the piston rings are all installed inside cylinder, remove the clamp and push gently to install cylinder to crankcase.

Caution

- Do not push piston into cylinder forcefully

because piston and piston rings will be damaged.

- Be careful not to damage the timing chain damper during installation.
- Pass the timing chain through the timing chain cavity and hold the chain until installing cylinder head.

- Tighten the cylinder to crankcase by 3 flange bolt

Torque: Cylinder Flange Bolt (M6x25):

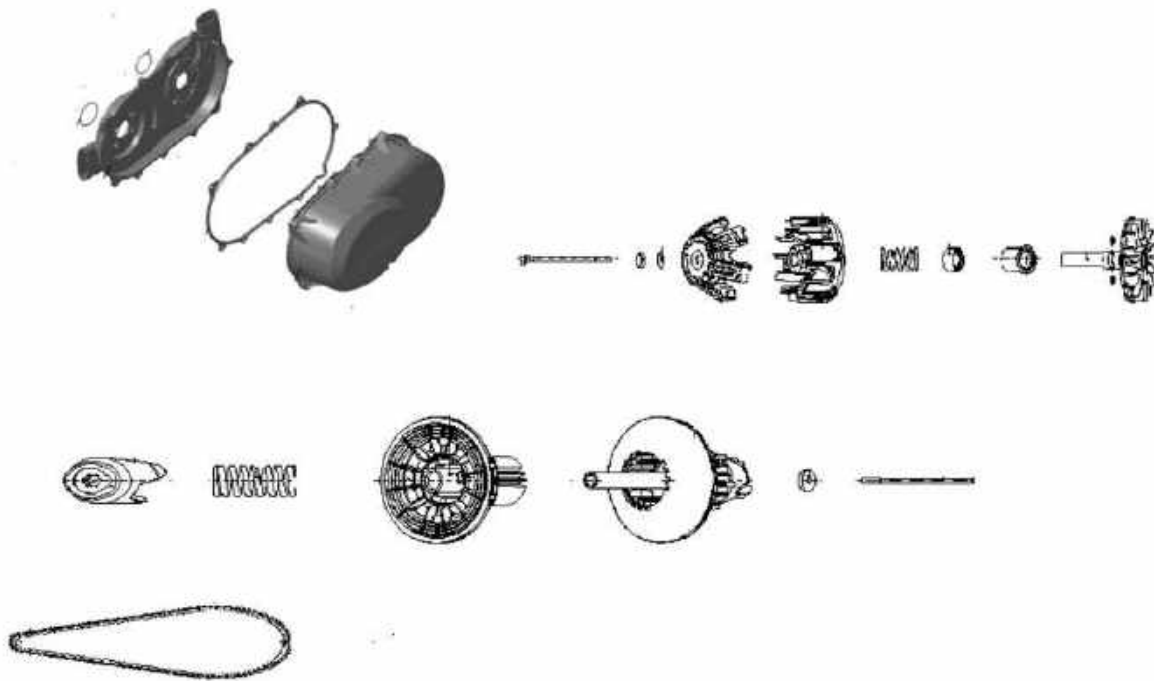
1.0kg-m /10Nm

- Install coolant hose with hose clamp onto cylinder and water pump side.
- Install cylinder head (refer to Chapter 6).

NOTE:

8-01. Mechanism	.....
8-02. Maintenance Description	.....
8-03. Trouble Diagnosis	.....
8-04. Left Crankcase Cover	.....
8-05. Drive belt	.....
8-06. Drive Pulley, Spring, Spring Retainer, One Way Clutch & Fixed Sheave	.....
8-07. Driven Pulley, Spring & Cam	.....
8-08. Ventilated CVT Cover	.....

8-01. Mechanism Diagram



8-02. Maintenance Description

Precautions in Operation

General Information

- Drive pulley, belt and driven pulley can be serviced on the vehicle.
- Drive pulley, belt and driven pulley must be free of any grease. Never lubricate any components except one way clutch and friction washer.
- Never touch CVVT while engine is running, never drive vehicle when CVT cover is removed.
- The clutch assembly is a precisely balanced unit. Never replace parts with used parts from another clutch assembly.

8-03. Trouble Diagnosis

Engine can be started but ATV can not be moved

1. Worn drive Belt / Slipping belt
2. Worn drive sheave
3. Worn or damaged clutch weight
4. Broken driven pulley
5. Damage clutch spring
6. Damage transmission gear

Shudder or misfire when driving

1. Broken/blocked drive/driven pulley
2. Broken/blocked belt

Insufficient horsepower or poor high speed performance

1. Worn drive belt / Oil or grease on V-belt
2. Insufficient spring force of driven pulley
3. Worn roller/slider shoe/centrifugal lever/ pivot bolt/ sliding sleeve
4. Driven pulley operation un-smoothly
5. Pulley not fixed firmly
6. Worn torque gear/cam
7. Faulty operation

Clutch slips

1. Damaged, loose or worn clutch spring
2. Damaged or worn slider shoe/roller/pivot bolt
3. Seized drive pulley sliding sheave

8-04. Left Crankcase Cover

Caution:

- Never touch CVT while engine is running.
- Never drive vehicle without CVT cover.

Release the front CVT inlet duct and rear CVT outlet duct firstly for more easier working.

a. Left crankcase cover removal

1. Remove left crankcase cover flange bolts x 9
2. Remove CVT cover from L. Crankcase.
 - CVT cover with rubber gasket => check the gasket crack/damage → replace
3. In the rear bottom of CVT cover, a drain cap have been set.
 - Remove out the drain cap by hand at once the CVT get the water in and drain out the water.
 - remind to insert back the drain cap after drain out the water.



Caution:

Try not to let the CVT get the water in, it will slip the driving belt....and so on. At once, CVT get water in, drain out the water and restart the engine for some time for drying.

b. Inspection

- Check the cover any damage → replace
- Clean the cover inside.

c. CVT cover installation

match the gasket then tighten the 9 flange bolt crisscross.



Torque: 10N-m

8-05. Drive Belt

8-05-01 Removal

1. Prepare the special tool (special bolt)

2. Screw in the bolt into Driven pulley set fully to expand the driven pulley set.

3. Take out the v-belt from bottom turning to upper.



8-05-02. Inspection

- check the belt any crash/damage/deterioration → replace
- refer to 2-11.

8-06. Drive Pulley, Spring, Spring

Retainer, One Way Clutch & Fixed

Sheave

8-06-01. Removal

1. Mark the drive pulley and fixed sheave before the removal to align the matching in the assembly.

2. Unscrew the bolt and remove the whole drive pulley slowly and pivot bolt with two washers.
 - attention to the spring reaction, hold the whole pulley and unscrew the pivot bolt slowly and step by step.
 - attention on the sequence of spring washer(thicker) and thrust washer



3. Remove the spring retainer and one way clutch

- spring retainer with a friction washer in the ditch of retainer.
=> friction washer have to be replaced if moving forward in neutral
- the one way clutch which inside with one way rail (bearings)
- do not suggest to remove the one way clutch unless inspection/measuring.



4. Prepare the drive pulley puller (special tool) for removing the fixed sheave.

- ask parts-no. for dealer if necessary for the special tool



5. Screw in the puller by hand then slowly screw in by wrench step by step to remove out the fixed sheave slowly and carefully.



8-06-02. Inspection/cleaning

Mark the Drive Pulley if you need to disassemble it for reinstalling back matching.

a. Drive Pulley

1. Check to the slider shoe worn/ crack/damage → replace

- remove the slider shoe by flat screw driver → always replace new ones (at once disassembling)



2. Check to the bearing sleeve worn/ crack /damage → replace

- remove the bearing sleeve by soft hammer → always replace new ones (at once disassembling)



3. Check to the roller worn/crack/damage → replace

- Measure the OD & ID, if necessary

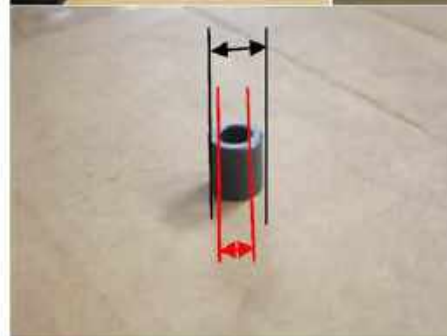
Service limit: OD: 13.2mm

ID: 9.0mm



4. Check to the centrifugal lever => worn/ crack/ damage → replace

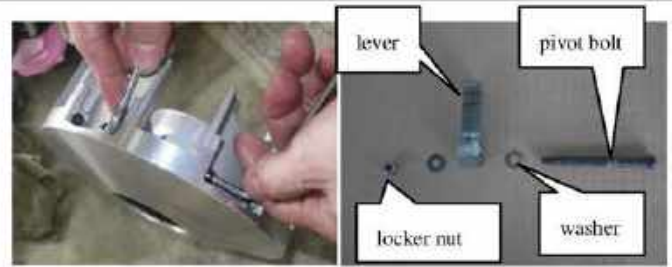
- remove the centrifugal lever
- check lever, thrust washers, pivot bolts and lock nuts if the contact surfaces show heavy visible wear/rusty.



- check the pivot bolt OD => out of

specification → replace

Service limit: 6.0mm



5. Check to the sliding sheave

- Sliding contact surface => crack / worn → replace
- centrifugal lever pivot bore diameter => out of specification → replace

Service limit: 6.0mm



- bushing measurement
Big end => out of specification → replace

Service limit: 55.2mm

Small end => out of specification → replace

Service limit: 33.2mm



6. Assembly

- Using the genuine parts for replacement.
- Clean up all grease or dirt before installation.
- attention direction of assembling for bearing sleeve.
- rollers must move easily after installation.
- centrifugal lever must move easily after installation
- rollers/centrifugal lever/slider shoe have to be replace only a set.



b. Spring

- measure free length => out of specification → replace

Service limit: 85mm



c. One way clutch

- check bearings for excessive play and smooth operation => replace if necessary

- clutch spring free length measurement => out of specification → replace

Service limit: 4mm

- installation
 - 1) insert the two (cup + spring) and hold them then push one way clutch into the shaft of fixed sheave. Turning the clutch and ensure the cup + spring get into the rail of clutch inside.

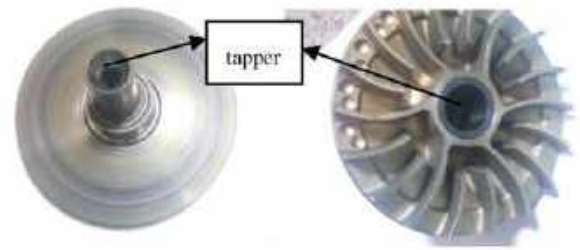


- 2) one way check => turning clutch to get the one way direction



d. Fixed sheave

- contact surface=> scratches/damage → replace
- check the both end of tapper



Caution: Do not apply any lubricant on the tapper.

8-07. Driven Pulley, Spring & Cam

8-07-01. Removal

1. Unscrew the driven pulley bolt by wrench
 - hold the whole set and use air wrench
 - slowly unscrew and step by step, Compression spring bounding is dangerous.
2. Remove the compression spring
3. Remove the cam



8-07-02. Inspection

a. Driven pulley

- remove the circlip and take out the torque gear.
- clean the dust deposit on all surfaces
- check the torque gear
 - 1) any damage/crack/worn → replace
 - 2) check the inside an outside guide diameter

Service limit:

outside & inside guide: 7.5mm

- separate sliding sheave and fixed sheave
 - 1) sliding sheave checking
 - => Cracks/scratch/worn → replace
 - => bushings diameter worn → replace

Service limit: 30.2mm



2) fixed sheave checking

- Dispatch the shaft by press machine.
(Place a hollow base under the fixed sheave).
=> Cracks/scratch/worn → replace
=> bushing diameter worn → replace

Service limit: 30.2mm

- bearing checking
=> not smooth/loosen → replace

b. Spring

- Torture → replace
- Check to the free length=> out of specification → replace

Service limit: 125mm

c. Cam

- visible damage/crash → replace

8-07-03. Installation

Reverse the removal procedure.

- secure the circlip on the torque gear
- match the spline of cam into the countershaft
- Push the driven pulley by your hand on the shaft to compress the spring then install the driven pulley screw and washer.
- Always follow the recommend torque (refer to 1-05)



8-08 Ventilated CVT Cover

a. Removal

Unscrew all bolts on the cover and take out the cover.

b. Inspection

- any crash/deterioration/damage → replace
- check to the oil ring on the back of cover => damage/aged → replace



NOTE:

9-01. Mechanism Diagram	.....
9-02. Precautions in Operation	.....
9-03 Starter Motor	.....
9-04. Right Crankcase Cover & A.C. Generator	.....
9-05. A.C.G Fly Wheel & One-Way Clutch	.....
9-06. Starter Clutch Gear & Starter Reduction Gear	.....
9-07. Water pump	.....

9-01. Mechanism Diagram



9-02. Precautions in Operation

General information

- Refer to chapter 18: The troubleshooting and inspection of alternator
- Refer to chapter 18: The service procedures and precaution items of starter motor
- Always perform the electric tests before removing or installing whatever component.
- Torque wrench tightening specifications must strictly be adhered to.
- Locking devices (ex. locking tabs, elastic stop nuts, self-locking fasteners, cotter pins...etc) must be installed or replaced with new ones where specified.

9-03. Starter Motor

a. Removal

1. Unscrew the two bolts on the starter motor.



2. Use soft hammer to slightly beat the bottom of starter motor and pull it out slowly.

- take care on the o-ring



b. Inspection

- check to the spindle of gear => worn/ damage → replace
- check to the o-ring => cracks/damage → replace

c. Installation

Do the reverse procedure of removal.

- apply enough engine oil on the o-ring and insert starter motor by turning and pushing.
- check to the engagement with reduction gear (refer to 9-06)
- two bolts fixing

Torque Value: 10 N-m for M6

20 N-m for M8

9-04. Right Crankcase Cover & A.C.

Generator

a. Removal

1. Drain the engine oil
2. Unscrew all mounted flange bolts from the right crankcase cover.

Note: Always working in a crisscross pattern, loosen each bolt 1/4 of a turn. Remove them



after all of them are loosened.

3. Use soft hammer lightly beat the cover and pull the cover with A.C. Generator.



b. Inspection

- Check the Generator and Pulse coil if working normal (refer to chapter Electrical Equipment)
- Check the cover for cracks or damage → replace

Note:

Clean all metal components in a nonferrous metal cleaner.

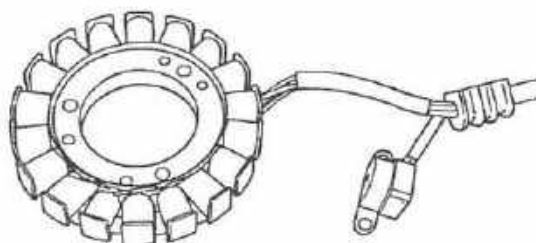
c. Installation

1. Install the A.C. Generator (Magneto Ass'y) to the right crankcase cover.
2. Install the dowel pins and R. Crankcase cover gasket to the R. Crankcase.
3. Put on the R. Crankcase cover (with Magneto) and tighten all flange bolts in crisscross pattern.

Torque: Flange Bolt 10N-m

9-05. A.C.G. Flywheel & One-Way

Clutch



a. Removal

1. Remove the flange bolt and washer from A.C. Generator flywheel.

2. Use flywheel puller to remove flywheel.
 - Screw in the flywheel flange bolt some threads by hand,
 - Screw in flywheel puller clockwise to the crankshaft.
 - Use wench to hold the A.C.G. flywheel puller and clockwise screw in the push shaft of A.C.G. flywheel puller,
 - To pull out the A.C.G. Fly wheel ass'y with one way clutch.

Special tool: flywheel puller, please ask for dealer for part-no.

Note: CPS (crank position sensor) positioned in right crankcase cover and sensor the flywheel to get rpm message to ECM. (refer to 6-04)

b. Disassemble of One-way Clutch.

1. Remove 3 socket bolts from the inner side of A.C. G. flywheel.



2. Remove the clutch outer race and one way clutch from A.C.G. flywheel.



c. Outer Race & One-Way Clutch Inspection

1. Check outer race cracks/damage → replace
2. Check roller inside one-way clutch wear/damage → replace

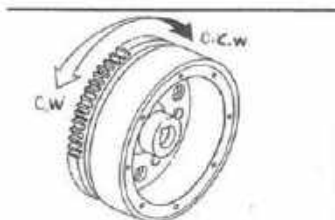


3. One-Way Clutch Function test.

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

d. Installation

- Remind the direction mark "↑" of needle bearing forward to outside.
1. Put the one way clutch into clutch outer race and then install to A.C.G. Flywheel. Replace new 3 socket bolts and tighten them crosswise.



Torque value: 25N-m

Note: Always replace new socket bolt at

once disassembling or apply glue #638 on bolt roundly.

2. Align the flywheel groove with woodruff key, and then install the flywheel Ass'y (including one-way clutch) onto the R. Crankshaft.

3. Insert the plate washer and screw in the flange bolt with glue638. Tighten the flywheel flange bolt by specific torque value.

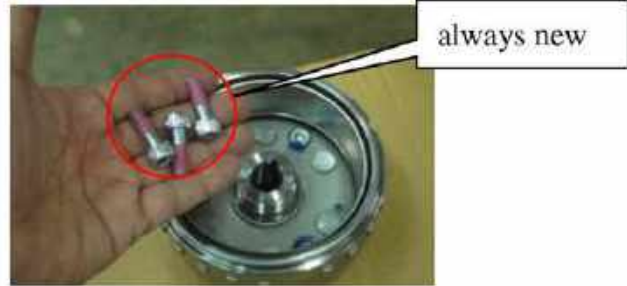
Torque: 145 N-m

9-06. Starter Clutch Gear & Start Reduction Gear

Starter Motor engage the starter reduction gears and drive the starter clutch gear to rotor the crankshaft.

a. Removal

1. Remove out the Starter clutch gear



2. Remove the starting reduction gears and two reduction gear shafts.



b. Inspection

1. Starter clutch gear

- check needle bearing => damage/burnt → replace if necessary
- check the collar and teeth for wear/damage → replace



2. Reduction gears & shafts

- check the teeth for wear/damage → replace
- check the shafts for wear/damage → replace

c. Installation

The installation is the reverse of the removal procedure.

Use installing jig to install the needle bearing to a proper distance for starter clutch gear.

- apply engine oil to the bearing/collar/shafts and teeth.
- apply engine oil to the shaft holes on crankcase
- check the rotation in smooth

9-07. Water Pump (refer to 13-07)

Water pump have been driven by water pump gear which driven by crankshaft through a intermediate gear. (refer to 10-04).

Water pump gear drive the water pump idle shaft with idle gear and engage another idle gear on water pump shaft to make reduction of impeller of water pump.

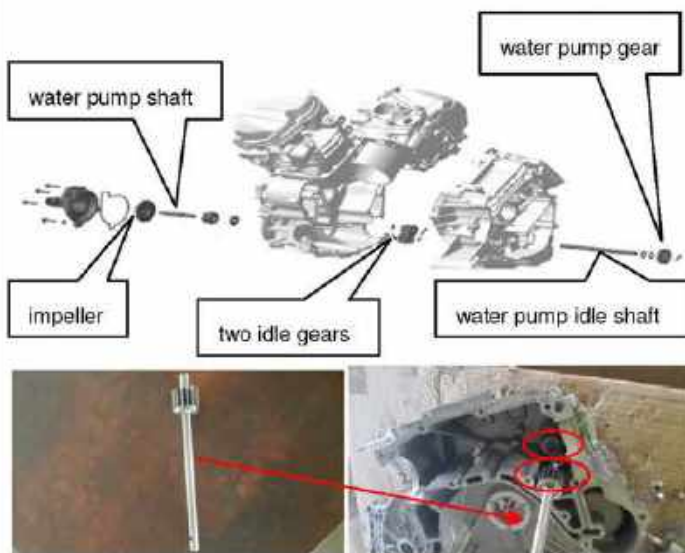
Drain out the coolant before removal.

a. Removal

1. Unscrew four bolts on the water pump housing.

- one bolt with copper washer is the drain bolt for drain the coolant.

Note: Always replace a new washer at once removing.



2. Remove the water pump housing.



3. Impeller removal

Impeller and water pump shaft are with right-hand threads.

- Remove by turning clockwise.



4. idle gear removal

a) Release the cir-clip

- Always a new cir-clip to be replaced.
- b) take out the idle gear/ pin /water pump shaft and thrust washer.



c) take out the water seals by – screw driver and find the oil seal inside.

- water seal is always a pair (one side with spring and another side with Teflon cover in the impeller.
- always replace water seal in a pair.



b. Inspection (refer to 13-07)

1. check to the o-ring on housing => damage → replace
2. check the housing => crash/damage → replace.



3. impeller checking => damage → replace
4. idle gear checking => damage → replace
5. check to water pump shaft => threads damage → replace
6. oil seal checking => damage → replace
7. water seal checking => damage → replace

c. Installation

Do the reverse procedures as removal.

- install oil seal and water seal by jig
- apply enough engine oil on oil seal and water seal and water pump shaft when installing.
- a new cir-clip to be installed
- install the thrust washer in position
- turn the counter-clockwise to screw up the impeller.

Torque: 2.5 N-m

- fix the four bolts on the housing by recommend torque.

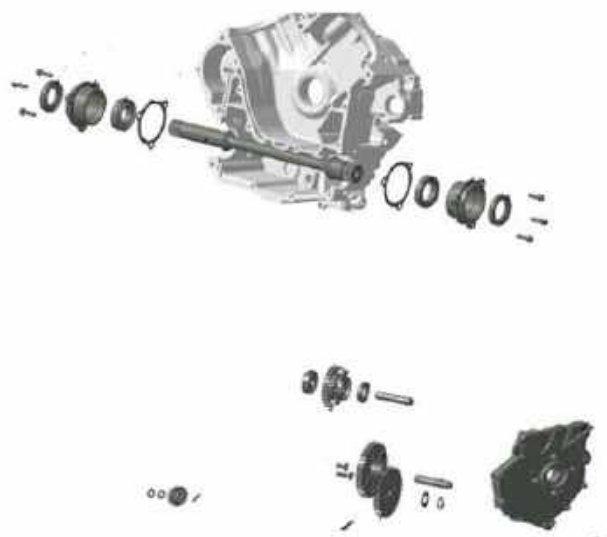
Torque: 10 N-m



NOTE:

10-01. Mechanism.....
10-02. Trouble Diagnosis.....
10-03. Engine Drive Shaft.....
10-04. Cover, Left Crankcase.....
10-05. Drive gears system.....

10-01. Mechanism Diagram



10-02. Trouble Diagnosis

Engine can be started but vehicle cannot move.

- Damaged gear shift system
- Damaged engine drive shaft
- Wrong installation
- Worn V-belt

Noise

- Worn or burnt gear
- Worn gear
- Wrong installation

Extra oil in the air cleaner

- Too much oil to be added
- Excessive blow-by in the engine
- Broken breather gear
- Damage in the cover, left crankcase

10-03. Removal Engine Drive Shaft

Engine power deliver to CVT system and transfer to transmission gear box to get the kinds of powers to be delivered by Drive shaft from rear to front. The engine power transfer to wheel driving power by front and rear gear box.

You may do this chapter before disassembling crankshaft.

1) Removal

a. Loose and remove 3 flange bolts and take out the bearing cover with oil seal & bearing from engine rear side.

- take care on the oil seal when pulling
- gasket have to replace at once disassembling.
- bearing checking smooth

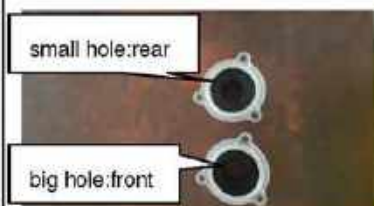


b. Loose and remove 3 flange bolts and take out the bearing cover with oil seal & bearing from engine front side.

- take care on the oil seal when pulling
- gasket have to replace at once disassembling.
- bearing checking smooth



Note: the front and rear bearing covers are different, pay attention on installations.



c. Remove out the engine drive shaft from front end.



2) Inspection

- a. Check the spindle on the shaft worn/damage → replace
- b. Check the bearing covers => worn/damage/cracks → replace
- c. Check the bearings=> excess play/damage/noise running → replace
- d. Check the oil seals => oil leaking/cracks/deterioration → replace



3) Installation

Do the reverse procedure as removal.

- apply engine oil on the spindle before install
- apply the engine oil on the oil seal and bearing
- attention on the installation direction on the shaft.
- attention on bearing cover different on the front and rear ones.



10-04. Cover, Left Crankcase

1) Removal

- a) Unscrew all bolts on the cover by crisscross.



b) Use soft hammer to beat the cover slightly and remove the cover.

- a new gasket have to replace for sure.



2) Inspection

- Check the cover => cracks/damage → replace
- Check the contact surface => crash /damage → replace
- Check to the oil seal => damage → replace



Note: There are two holes for shafts, one for breather gear shaft and another one for intermediate gear (refer to 10-05)



- Check to the plain bearings => damage / out of specification → replace
①: plain bearing ②: oil bore

Service limit: inside diameter A
34.120 mm

Note: 1)Always use special remover/installer to replace plain bearing.

2) Press the special tool to remove/install plain bearing only. Never use hammer to install bearings. Only install bearings in cool crankcase.

3) Do not lubricate plain bearings and crankcase for installation.

4) Carefully match the oil bore while installation.



10-05. Drive Gears System

There are four drive gears on the left crankcase.

- 1) Breather gear spray and fling oil to prevents engine oil coming out through the breathing system into the air cleaner(refer to 3-07).
- 2) Intermediate gear drive two gears (water pump gear and oil pump gear) by reduction.
- 3) Water pump gear drive water pump.
- 4) Oil pump gear drive oil pump.



a. Breather gear (refer to 10-04)

1) Removal

Take the shaft with gear which embed a bearing.

2) Inspection

- gear wear/damage → replace whole set
- bearing work smooth => not smooth → replace whole set
- bearing with excessive play → replace whole set
- oil seal damage → replace whole set
=>attention to the oil seal install in a upside down direction.
- shaft wear/damage → replace whole set

3) Installation

- Reverse the removal procedure.
- Match the tooth to the tooth of crankshaft.
- Check the rotation for smooth with crankshaft.
- Apply enough engine oil when installing



b. Intermediate gear

1) Take out the shaft with gear.

2) Inspection

- gear wear/damage → replace
- shaft wear/damage → replace

3) Installation

- Reverse the removal procedure.
- Match the gear tooth to the tooth of crankshaft, oil pump gear, water pump gear.
- Check the rotation for smooth with crankshaft, oil pump gear and water pump gear.
- Apply enough engine oil when installing



c. Oil pump gear

refer to 3-08.

d. Water pump gear (refer to 9-07)

1) Removal

Remove the pin on the water pump shaft and take out the water pump gear.

- Attention to the two washers in the bottom



2) Inspection

- gear wear/damage → replace
- attention to the water pump idle gear shaft => torture/damage → replace

3) Installation

- Reverse the removal procedure.
- Match the tooth to the tooth of

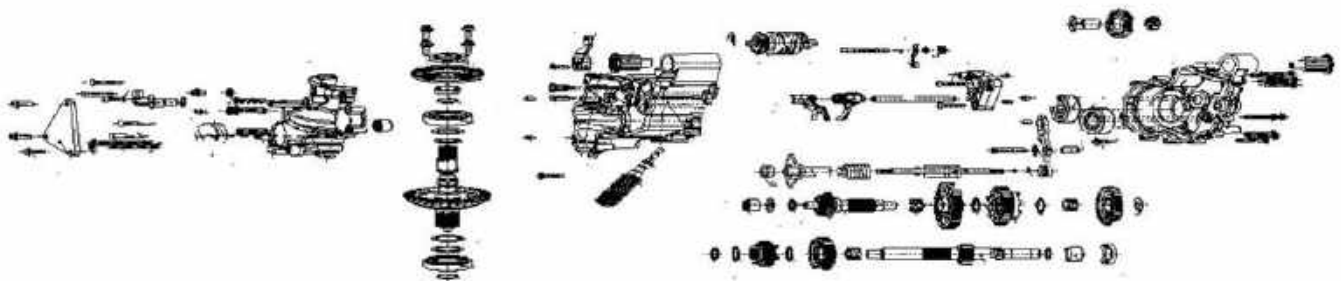
intermediate gear

- Check the rotation for smooth
- Apply enough engine oil when installing

NOTE:

11-01. Mechanism
11-02. Precautions in operation
11-03. Trouble Diagnosis
11-04. Separation from Engine
11-05. Disassembling Transmission Gear box
11-06. Transmission Inspection
11-07. Transmission Reassembly

11-01. Mechanism Diagram



11-02. Precautions in Operation

- This Section concerns separation of the engine and transmission gear box.

Remove following components before disassembling crankcase.

- Engine remove Chapter 5
- CVT system Chapter 6

- Drain out gear oil before working on it.
- Torque wrench tightening specifications must strictly be adhered to. Locking devices (ex. locking tabs, elastic stop nuts, self-locking fasteners, cotter pins...etc) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

11-03. Trouble Diagnosis

Engine can be started but vehicle cannot move.

- Damaged drive gear
- Burnt out drive gear
- Damaged gear shift system
- Worn V-belt
- Sized transmission gear
- Foreign object between transmission gears

Noise

- Worn or burnt gear
- Worn gear

Gear oil leaks

- Excessive gear oil.
- Worn or damage oil seal

Engine oil leaks

- Worn or damage oil seal/O-ring
- Damage/cracks crankcase
- Crack on mating surfaces of crankcase
- Crack on contact surfaces of delivery pipes.

Jumps out of gear

- Worn shift fork
- Incorrect axial ply on shift drum
- Worn shift drum groove
- Worn gear dog
- Incorrect shift gear in running mode

11-04. Separation from Engine

Note:

Before disassembly of the transmission, please refer below chapter to remove necessary parts.

Chapter 5 Engine removal

Chapter 8 CVT driving system

Lie down the disassembled engine right side up as above picture.

Better to set a working base to fix the engine.

- a. Remove the three nuts
- b. Remove gear box backward and separate the gear box from engine.
- c. Take out the join collar
- d. Take out the rubber gasket
- e. Take out the o-ring

Note:

1) O-ring set in the guide and rubber gasket set in the bottom.

2) a new o-ring and rubber gasket replace always.





11-05. Disassembling Transmission Gear

Box

Avoid scoring housings, bearing cover, shift shaft, distance sleeve of counter shaft or output shaft during disassembling.

Avoid damage the machinery surface on the covers, cases of gear box.

a. Unscrew the three bolts and remove the stopper plate



b. Unscrew the bolt and remove the speed sensor.



c. Remove 4 bolts on output shaft cover



d. Remove 2 bolts on the rear cover gear box.



e. Remove 4 bolts on the small cover.

- f. Remove out the rear cover gear box.
- use soft hammer slightly beat the cover upward for easily moving.



- g. Remove the output shaft cover.
- check to the oil seal crack, damage → replace



- h. Remove the output shaft.



- i. Remove one bolt on output shaft cover and turn the gear box upside down.



- j. Remove the distance collar of countershaft.
(refer to 8-08)

- check the collar cracks/damage → replace
- attention on the o-ring inside=> damage → replace



- k. Unscrew all bolts on the case of gear box.
- unscrew the bolts by crisscross.

- l. Press the countershaft and use soft hammer slightly beat the case upward to remove the case of gear box.





m. Remove the insulating plate and take out the shifting shaft comp.

- attention on the thrust washer under the shifting shaft comp.
- check the thrust washer damage → replace



n. Remove the shifting fork shaft and take out the shift fork from shift drum.



o. Turn index lever outward then remove the shift drum out.



p. Remove low range gear with bevel gear.

- attention the shim on the upper of bevel gear.

q. Remove the sliding gear and another shift fork.



r. Remove the reverse gear with needle bearing and thrust washer.

- attention on the needle bearing and thrust washer.



s. Push the countershaft upward and remove the countershaft.



t. Unscrew the bolt on index lever and remove out index lever with spring/ring/washer and bolt.

- remind the sequence in the following => twist spring/ ring / index lever / washer



u. Unscrew the bolt and remove the parking lock lever with washer.

- attention on the washer



v. Unscrew 3 bolts and remove the installing base.

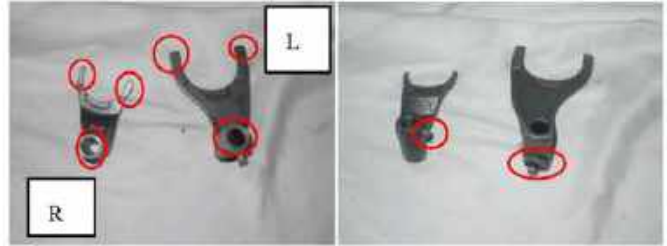


11-06. Transmission Inspection

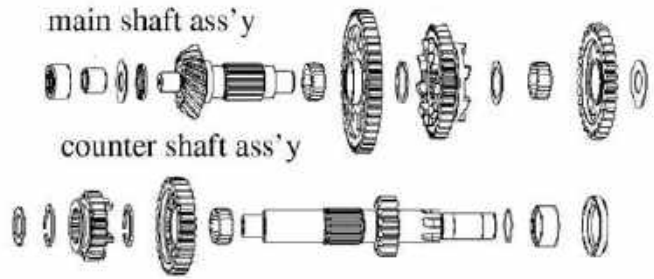
- a. Shift drum -- groove scratches/wear/damage → replace
 - gear wear/damage



- b. Shift forks (L & R)/ guide bar
 - Shift forks (L & R)
 - groove follower wear/damage → replace
 - fork pawl scoring/bend/wear/damage → replace
 - Guide bar – bends → replace
 - check the movement with fork forward and backward



- c. Main shaft and Counter shaft Ass'y
 - Remind to take note on the sequence/direction of all components and install them back by notes.



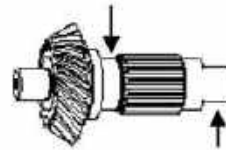
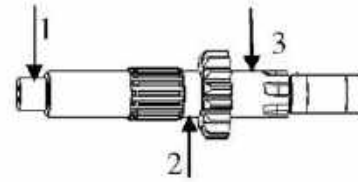
- Gear teeth – blue discoloration/wear → replace



- Mated dogs – round edges/cracks/missing portions → replace



- Shafts
 - run-out checking by dial gauge – out of specification → replace
run-out limit: 0.03mm
 - countershaft wear checking
Service limit:
 1. 17.990mm
 2. 24.970mm
 3. 24.970mm
 - main shaft wear checking
Service limit: 24.984mm
 - oil passages checking – clogged → blow out with compressed are or clean.



- Shim replacing - Always replace the shim by a new one with the same thickness.
- Washer/bushing checking – blue discoloration/cracks/wear → replace
- Bearings checking – loosen, damaged → replaced
- Check the movement of shafts ass'y after reassembling as a whole set.



- d. Check the output shaft ass'y
- Remind to take note on the sequence/direction of all components and install them back by notes.
 - shaft – bend/damage → replace
 - gear – cracks/pitting/damage → replace
 - ball bearings – turn free and smoothly => loose/damage → replace
 - shims replacing -- Always replace the shim by a new one with the same thickness.



- thrust washer -- blue discoloration/cracks/wear → replace
 - spindle – damage/wear → replace
- e. Check the parking lock lever and index lever
- parking lock lever – the gear tooth wear/damage → replace
 - index lever – work not free and smoothly → replace
- f. Check bearings on the gear box case. Clean and lubricate, then rotate each bearing's inner race by fingers.
- Check if the bearings can be rotated smoothly and silently and also check if the bearing outer ring is mounted on gear tightly.
 - If the bearing rotation is uneven, noising, roughness, loose bearing mounted, then replace it.
- g. Check oil seal for wear or damage, and replace it if necessary.

Caution

- The bearings/seal should be replaced with new one after they are removed from the crankcase by the bearing puller.
- h. Check the cases
- Thoroughly wash the case halves in a mild solvent.
 - Clean all the gasket mating surfaces and crankcase mating surfaces thoroughly.
 - Check all oil delivery passages – clogged



11-06. Transmission Re-assembly

Do the reverse steps as 11-05 Disassembling Transmission.

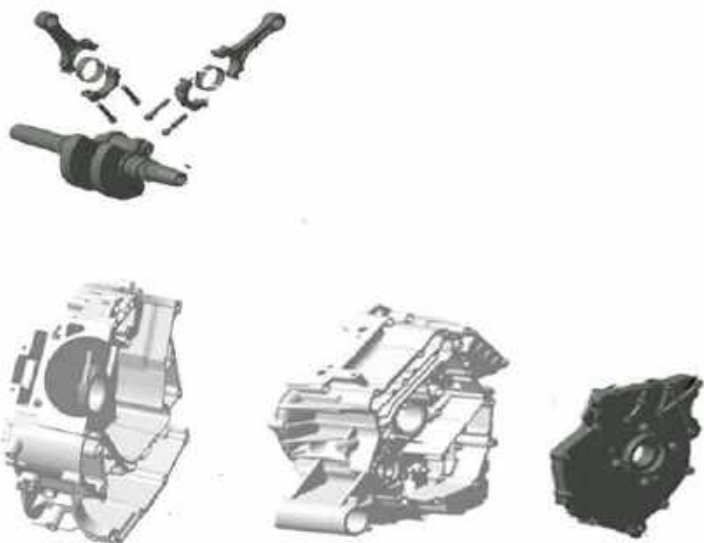
- Avoid scoring housings, bearing cover, shift shaft, output shaft.....
- Backlash checking -- Temporarily install the right housing with four M8 screws beside bearing seats. Verify output shaft backlash. If backlash is within specifications , fixed all covers.
- Connecting gear position harness (refer to 19-13)
 - Follow the 1,2,3 harness to screw in to the position as picture.
 - After connecting, glue the contacts by silicon glue for proofing water.



NOTE:

12-01. Mechanism Diagram	.....
12-02. General Information	.....
12-03. Trouble Diagnosis	.....
12-04. Removal of Crankshaft	.....
12-05. Inspection	.....
12-06. Re-assembly	.....
12-07. Crankcases Checking	.....

12-01. Mechanism Diagram



12-02. General Information

Operational precautions

This Section concerns disassembly of the crankcase for repair purpose.

Remove following components before disassembling crankcase.

– Engine remove	Chapter 5
– Cylinder head	Chapter 6
– Cylinder and piston	Chapter 7
– Drive face and driven pulley	Chapter 8
– AC generator/Start one way clutch	Chapter 9
– Drive shaft	Chapter 10
– Transmission	Chapter 11

12-03. Trouble Diagnosis

Engine noise or vibrations

- Loose crankshaft bearing
- Loose crankshaft pin bearing
- Worn out piston pin and pin hole
- Plain bearings worn
- Magneto rotor got loose.
- Loose connecting rods.
- Engine mounting bushes damage or loose.

12-04. Removal of Crankshaft

Before do the followings, please do the chapter 5,6,7,8,9,10 and 11.

a. Separating crankcase

1. Place left crankcase downward and right crankcase up.
2. Loosen bolts on the outside of right crankcase.
3. Loosen bolts in the inside of right crankcase.
4. Attention to loosen the bolts in the coolant delivery ditches.
5. Remove all loosening bolts.

Caution

Do not make damage to the contact faces.
Loosen all bolts by crisscross.

6. Apart the right crankcase from left crankcase slowly and carefully. Use soft hammer to slightly beatings on the crankcases to help separating.

b. Remove crankshaft from crankcase L.

1. carefully take crankshaft out



2. store it in a safe condition

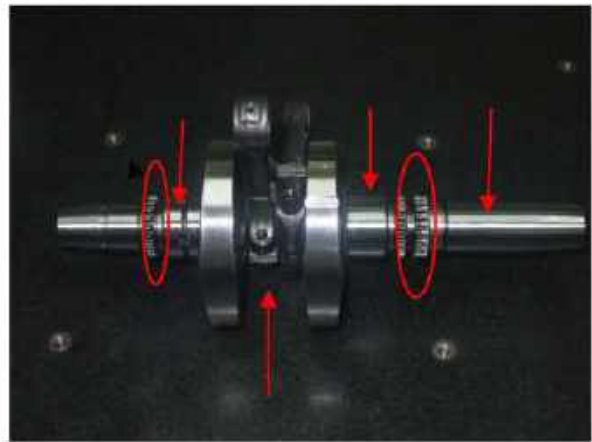
c. Remove the water pump drive shaft with gear

- Remove the shaft on crankcase R.
- Refer to 10-05



12-05. Inspection

- Check
 - check all bearing journal of crankshaft => scoring, scuffing, cracks, worn → replace
 - check gears teeth for chain or gear => worn, damage → replace
 - connecting rod => scuffing, cracks, roughness, worn → replace
 - threads => damage → replace
 - heat burn → replace



- Measure
 - crankshaft axial play
=>use dial indicator to check the axial play => out of specification → replace

Service limit: 0.6mm

- connecting rod big end axial play
=>use feeler gauge to measure distance between butting face of connecting rods and crankshaft counterweight => exceed specified tolerance → replace

Service limit: 0.6mm



- connecting rod small end clearance
=> use 3 point micrometer to measure => out of specification → replace

Service limit: 20.060mm

- crankshaft bearing journal clearance
A,B,C – out of specification → replace crankshaft

Service limit:

A : 42.0mm (MAG side)

B: 42.0mm (PTO side)

C: 34.01mm

● **Disassemble**

Do not suggest to disassemble the crankshaft unless instructed.

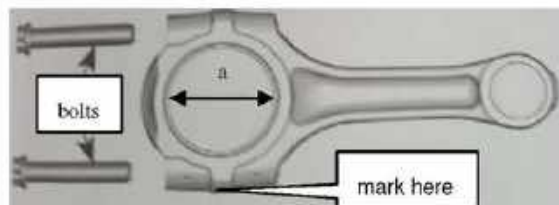
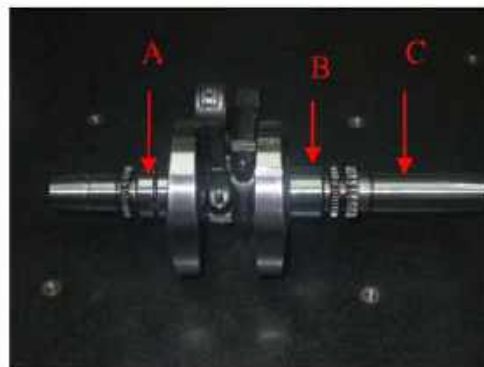
- use paint pen to mark the connecting rod before removing bolts
- remove the bolts for the connecting rods.
- remove the connecting rods

Note: always replace connecting rod bolts if removing the connecting rod.

- suggest to replace new plain bearings at once disassembling rods.

Note: Plain bearings replaced instructed. Do not replace it by your own.

- measure the dimension of crankpin
service limit:40.1mm
=> check to the oil passage => blocked → clean



- check to the big end dimension "a"

service limit: 40.1mm

radial clearance: 0.09mm

12-06. Re-assembly

- Install crankshaft as reverse procedures as removal.
- Attention on tighten torque as recommended. refer to 1-05.

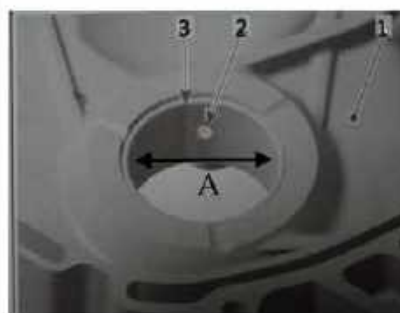
12-07. Crankcases Checking

- Crankcases L checking
 - 1) check all threads of bolts => damage
→ repair / replace
 - 2) check all water passages or oil passages => blocked → clean / repair / replace
 - 3) check all contact surfaces => damage
→ repair / replace
 - 4) check engine mounting bush => deterioration, damage → replace
 - 5) check inside & outlook => damage → repair / replaced
 - 6) check the plain bearing => worn, heat burn, damage/out of specification → replace

①: crankcase ②:oil bore ③: plain bearing

**Service limit: inner diameter A
42.10mm**

Note: Do not replace plain bearing without instructing. Refer to 10-4.



- Crankcases R checking
 - 1) check all threads of bolts => damage
→ repair / replace
 - 2) check all water passages or oil passages => blocked, damage → clean / repair / replace
 - 3) check all contact surfaces => damage
→ repair / replace
 - 4) check inside & outlook => damage → repair / replaced
 - 5) check the plain bearing => worn, heat burn, damage/out of specification → replace

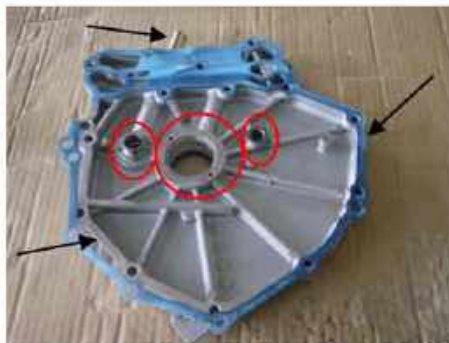
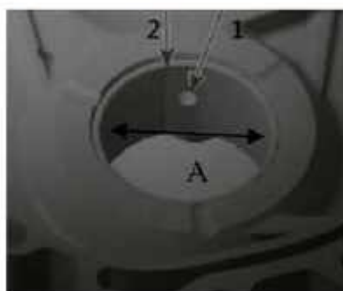
①: oil bore ②: plain bearing

Service limit: inner diameter A
42.10mm

Note: Do not replace plain bearing without instructing. refer to 10-4.

- Crankcases cover L checking
 - 1) check all threads of bolts => damage
→ repair / replace
 - 2) check all water passages, oil passages or ventilated passages => blocked, damage → clean / repair / replace
 - 3) check all contact surfaces => damage
→ repair / replace
 - 4) check inside & outlook => damage → repair / replaced
 - 5) check oil seal => damage → replace
 - 6) check the plain bearing => worn, heat burn, damage → replace

Note: Do not replace plain bearing without instructing.



Note: Always replace the whole set crankcase with plain bearings.

NOTE:

13-01 General Information

13-02 Technical Specification

13-03 Trouble Diagnosis

13-04 Coolant Check/Replacement

13-05. Radiator Cap/ Reservoir Tank

13-06. Radiator / Cooling Fan

13-07. Checking Water Pump

13-08. Thermostat/Thermostat Sensor

13-01. General Information

WARNING:

Removing the radiator cap while the engine is hot can allow the coolant to spray out, seriously scalding you. Always let the engine and radiator cool down before removing the radiator cap. Never start engine without coolant. Some engine parts such as the rotary seal on water pump shaft can be damaged.

Never drain or refill cooling system when engine is hot.

CAUTION:

Radiator coolant is toxic. Keep it away from eyes, mouth, skin and clothes.

Test the cooling system for any leakage after the repair.

- If any coolant get in your eyes, rinse them with water and consult a physician immediately.
- If any coolant in swallowed, induce vomiting, gargle and consult a physician immediately.
- If any coolant gets in your skin or clothes, rinse thoroughly with plenty of water.

NOTE:

Use coolant with silicate inhibitors may cause premature wear of water pump seals or blockage of radiator passages. Using tap water may cause engine damage.

To prevent rust formation or freezing condition, always replenish the system with 50% antifreeze and 50% water. Do not use tap water, straight antifreeze or straight water in the system. During cold weather, straight antifreeze thickens and does not have the same efficiency. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

13-02. Technical Specification

Item	Specification
Pressure to open filler cap	1.1±0.15 kgf/cm ²
Capacity of coolant: Engine + radiator + hoses	2,500 ± 50 c.c.
Reservoir Tank	300cc ± 20 c.c.
Thermostat	Begins to activate at 71±1.5°C
Thermos switch (Fan Switch)	Begins to activate at 85±3°C
Boiling point	Not-pressure: 107.7°C Pressurized: 125.6°C

13-03. Trouble Diagnosis

a. The engine temperature is too high

- The water thermometer, Thermo Switch (Fan Switch) sensor do not work properly.
- The thermostat is stuck to close.
- Insufficient coolant.
- The water hose and jacket are clogged.
- Fan motor malfunction.
- The radiator filler cap of the radiator malfunction.
- EFI malfunction checked by OBD.

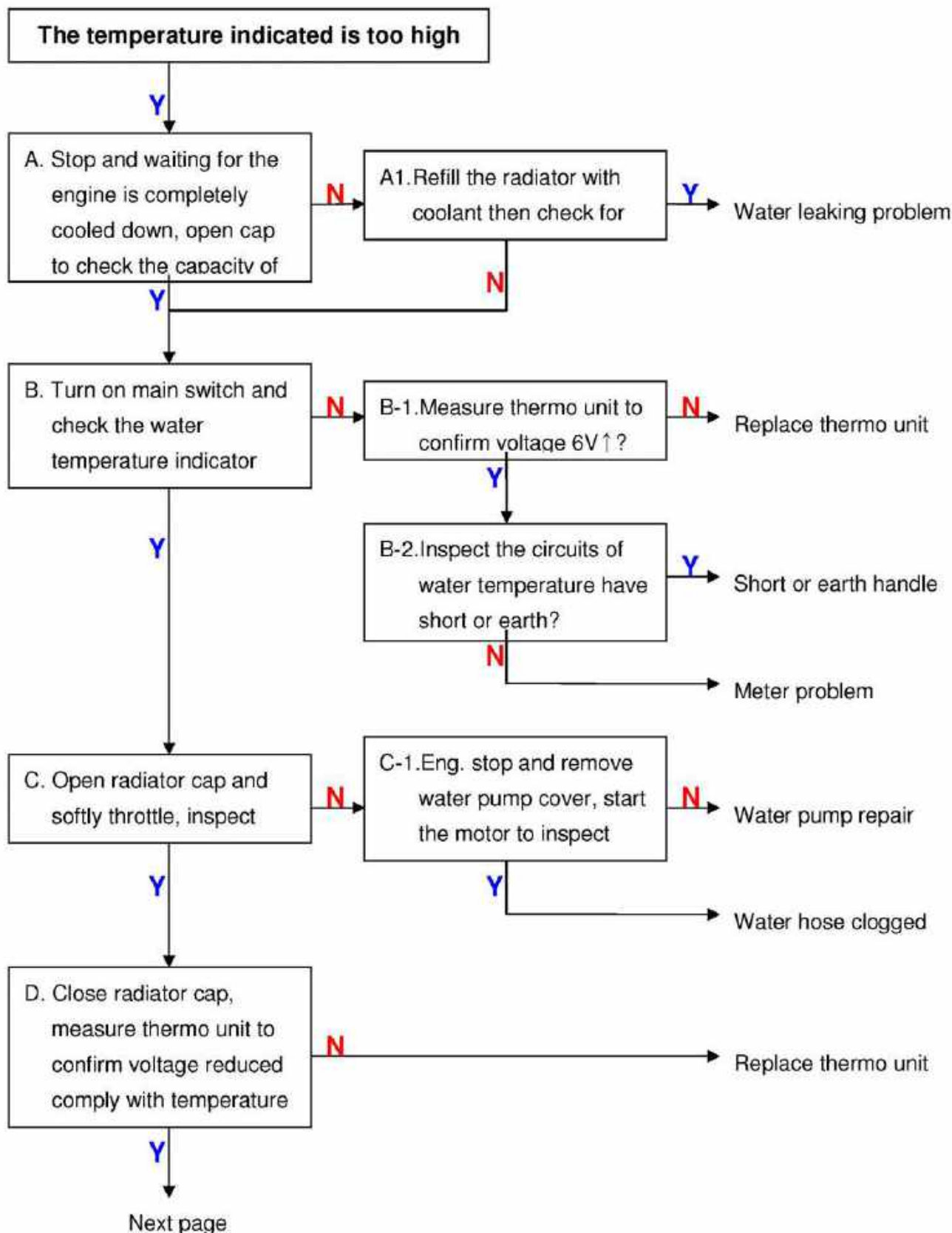
b. The engine temperature is too low

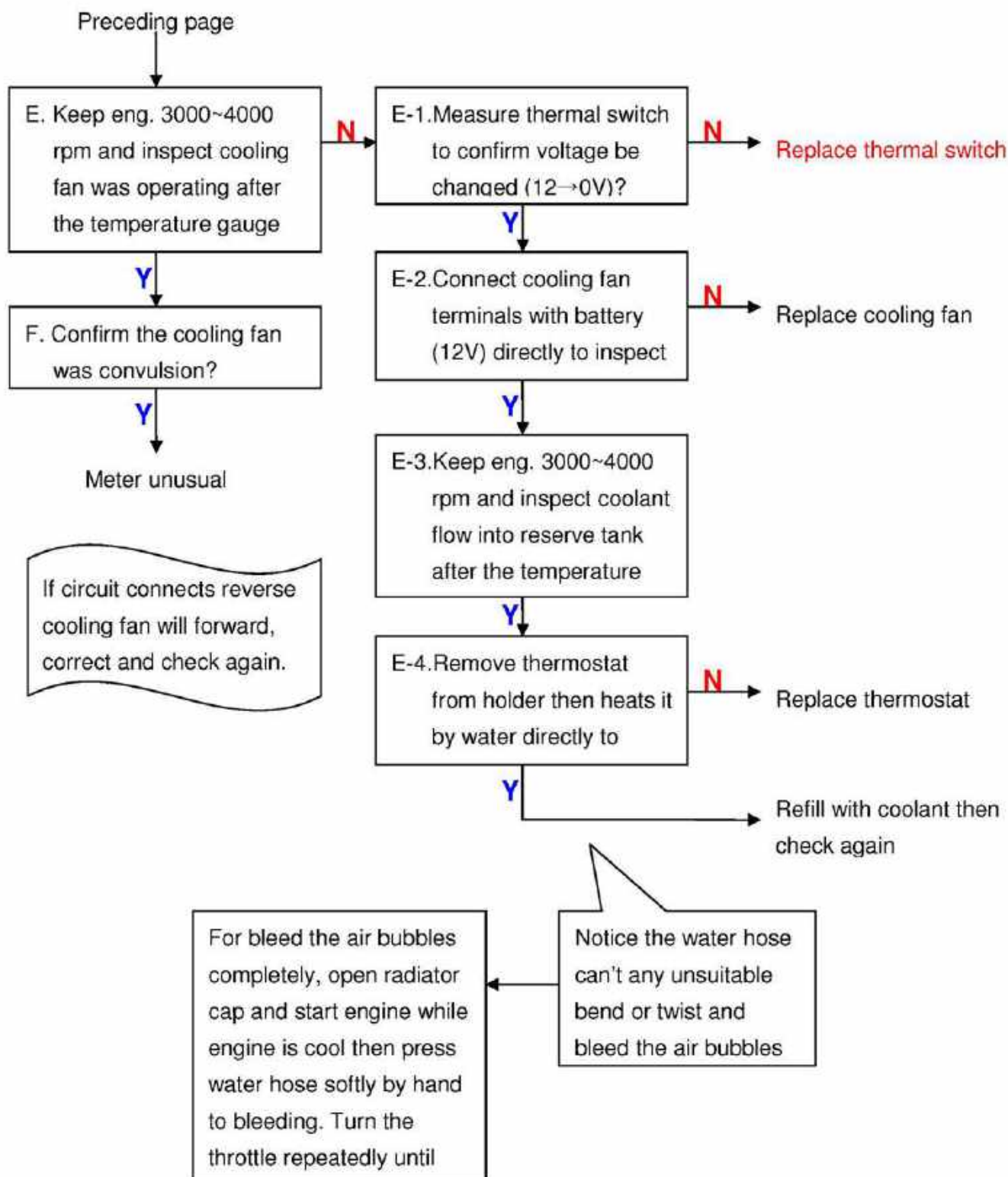
- The water thermometer and the temperature sensor malfunction.
- The thermostat is stuck to open.
- EFI malfunction checked by OBD.

c. Coolant is leaking

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

d. Trouble Diagnosis for Cooling System





13-04. Coolant Check / Replacement

Warning

Never attempt to work on the cooling system unless the engine is completely cooled down.

a. Coolant check

1. Check the coolant liquid level inside the reservoir tank. Add coolant to the proper level between Min. to Max. if necessary.
2. Remove the front center cover, and then remove reservoir tank filler cap.
3. Add recommended coolant to the Max. level if the coolant is not enough.
4. Greased dirt coolant => replaced
5. Reinstall the reserve tank filler cap and the front center cover.

Caution

Do not over fill the coolant to the reserve tank, to avoid split out of liquid coolant while liquid

Caution: Coolant leaking check.

Check the coolant circular system on radiator / cylinder-cylinder head / water pump and hoses-clamp side if any leaking.





b. Coolant replacement

1. Place a water pan under the water pump to reverse the coolant.
2. Remove the filler cap of radiator.
3. Remove the clamp in In hose pipe and drain out the coolant
4. Unscrew the bolt with washer to drain out the coolant in water pump.
 - Always a new washer replaced.
5. Reverse the above removal procedures and check the fixings.
6. Refilling system with recommended coolant through the filler opening up to the filler neck.
Bleed the air from the system as follow:
 - a. Start the engine and let it idle for 2~3 minutes.
 - b. Snap the throttle three to four times to bleed air from the system.
 - c. Stop the engine and add coolant to the proper level if necessary.
Reinstall the radiator cap.
 - d. Check the level of coolant in the



reserve tank and fill to the upper level if it is low.

Caution:

- Use recommended coolant only(Long Life Coolant, LLC 50% density).
- Do not start engine in a frozen coolant.
- Drain out coolant if vehicle stay in outside for frozen weather for a long time and remark “ No coolant inside”.
- Periodic replacing new coolant helps engine running.
- Check out coolant level in a long-term un-riding.

13-05. Radiator Cap /Reservoir

Tank

13-05-01 Radiator Cap

a. Removal

1. Open the Front center cover
2. Push down and turn the radiator filler cap by counter-clockwise direction to remove the radiator cap.



b. Inspection

Use pressure tester to test the radiator filler cap. Hermetically seal the filler cap, apply water and pressure to the filler cap. Replace it with new one if tester fail to maintain the specified pressure within a given time limit, or the opening pressure is too high or too low. The specified pressure shall be maintained at least for 6 seconds in the test

Relief pressure for the filler cap:

1.1 kgf/cm²

Apply pressure to the radiator, engine and water hose to check for any leakage

Caution

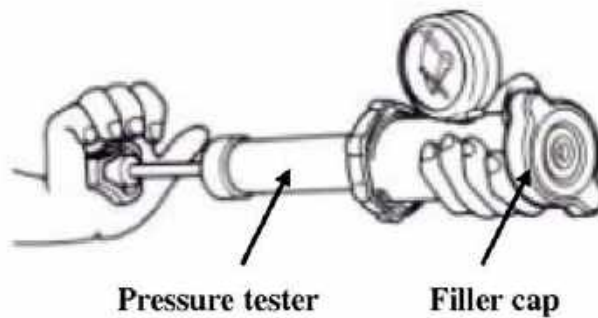
High pressure may damage the radiator. Never use pressure which exceeds

1.1 kg/cm².

If the system fails to maintain the specified pressure for at least 6 seconds, repair or replace parts.

13-05-02 Reservoir tank.
a. Removal

1. Remove the front covers (refer to Chapter 5, body covers)
2. Use the water pan under the reservoir tank.
3. Disconnect the hose clamp on the radiator filler tube, carefully



disconnect the reservoir tank hose from radiator filler tube to drain out the coolant inside the reservoir tank.



Remove the two (2) hex bolt with washer and then remove the reservoir tank from EPS and chassis.



Caution:

- Replace the hose clamps if necessary.
- Wipe and dry coolant anytime.

b. Inspection

1. Check the reservoir tank if any cracks, deteriorates or broken, replace with new if necessary.
2. Check the reservoir tank water hose (to radiator filler tube) if any cracks, leaking. Replace with new if necessary.
3. Check the hose and hose clamps if it is being well seated and tightened.
4. Check the cap of reservoir tank, crash => replaced



b. Installation

1. Install the reservoir tank in the reverse way of dis-assembly. Make sure the hose and hose clamps are well seated and installed.
2. Add the coolant into the reservoir tank to the max. level but not over the limit (please ref. 13-04 for detail)

13-06. Radiator / Cooling Fan

13-06-01 Radiator removal.

Note:

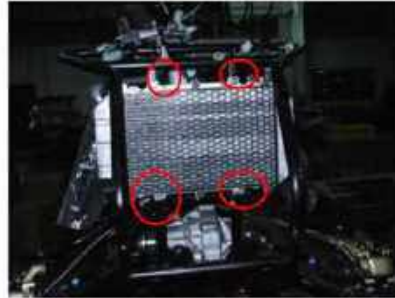
Before the removal of radiator and related parts, please process the coolant drain out process as mentioned on 13-04.

a. Radiator assembly removal

1. Remove the water hose clamps on the right upper /lower side of the radiator (Water pump in hose and radiator in hose) and remove the hoses from radiator.



2. Disconnect the water hose of reservoir tank water from radiator filler tube.
3. Remove the Hex. bolt with washer (M6*16) on the radiator cap set and disconnect the radiator cap set from chassis.
4. Disconnect the couplers for the thermo switch and fan motor from wire harness.
5. Loosen the radiator 4 Hex. bolts with washer (M6*22) and then remove radiator Assy (with cooling fan).



b. Radiator filler tube removal

Remove the hose clamp on the radiator side and then disconnect the radiator cap hose.

Screw out the hex. bolt with washer (M6x16) and remove the radiator filler tube with hose.



c. Disassembly of cooling fan

1. Loosen the 4 Hex. bolts with washer (M6x22) from the rear side of radiator, and then remove the cooling fan.

d. Fan Motor Switch removal

Use wrench, turn counter-clockwise to remove the fan motor switch at left middle side of radiator.

Caution

Handle the fan motor switch carefully as it is vulnerable to impact.



13-06-02 Inspection
a. Radiator

1. Use air gun to blow the dust-mud on the radiator and gently clean it by water.
2. Check the radiator if leaking, clogged or damage. Straighten any flattened fins with a thin flat-head screwdriver. Replace with new if necessary.

b. Fan Motor Switch

1. Check the fan motor switch if working correctly.
 - Connect an ohm pocket tester (for continuity test) with the thermo switch.
 - Fill the water in a container, and heat it.
 - Read the temperature by the thermometer gauge while temperature increases by heat.
 - Check the continuity on the pocket tester.

The switch continuity at $85^{\circ}\text{C} \pm 3^{\circ}\text{C}$

c. Cooling Fan

Connect the Fan coupler with battery wire and check the Fan if function properly.

d. Water Hose

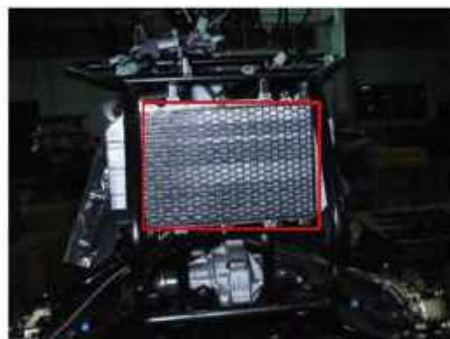
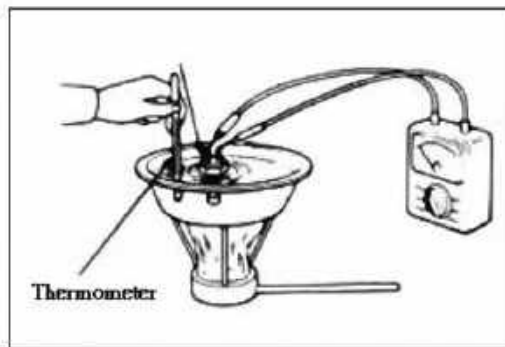
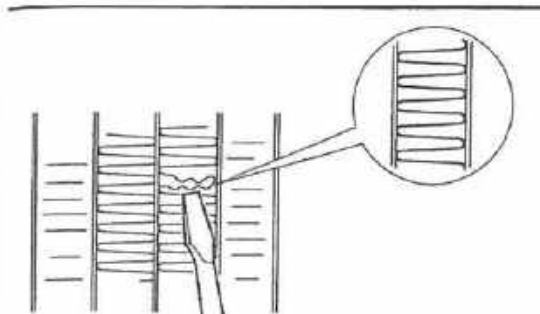
Check the water hoses if cracks, leaking or damage. Replace with new if necessary.

e. Radiator defend

- clogged/contaminated=>clean
- crash/torture=>replaced

f. Grommet

- aged/crash => replaced



13-06-03 Installation of Radiator Assy.

- Install the removed parts in the reverse order of removal.
- Install radiator in the reverse order of removal.
- Upon completion, re-fill the coolant as mentioned at 13-04.

Installation Torque:

- a. Hex. Bolt with Washer (M6*22) for Radiator: 0.7 kgf-m
- b. Hex. bolts with washer (M6x16) for radiator cap: 0.7 kgf-m
- c. Fan Motor Switch (M6*18): 2.8 kgf-m

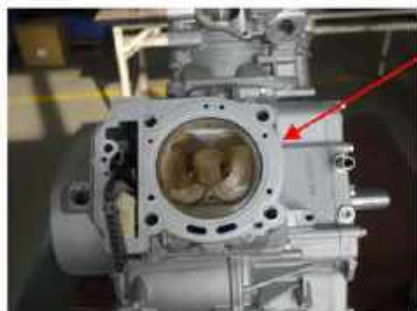
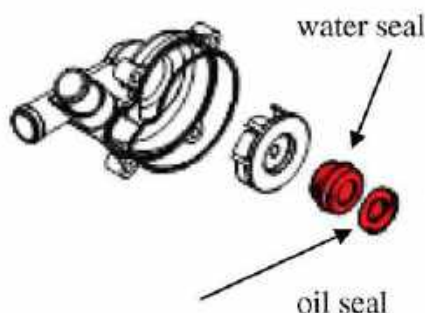
13-07. Checking Water Pump

Check water seal / cooling system divulges inspection

Unscrew a bolt, overflows little buckles the actually fluid, confirmed overflows the refrigerant whether has the greasy dirt.

Screw out the engine oil drain bolt and let the inside oil comes a little bit, check the engine oil whether does have bleaches situation of the emulsified.

1. If has the above two kind of interior to divulge the phenomenon, possibly for the water pump inner two seal damages or the cylinder head gasket damages, please: First disassemble the water pump housing, to confirm the replacement of water seal.



2. If after check the seal is confirm ok, then keep to have advance service check on the cylinder head gaskets of sealing between the cylinder / cylinder head side.

a. Removal of water pump

Refer to 9-07.

b. Inspection

Refer to 9-07.

Caution

- The impeller is provided with right hand thread bolt.
- Always replace new o-rings
- Always replace a pair of water seal set
- Keep a very clean on water seal set

c. Installation

- Install the removed parts in the reverse order of removal.
- Smell lubricant roundly to insert the water pump set turning slightly back to engine case.
- Crisscross fixing the water pump cover.
- Ensure correct direction of all seals.

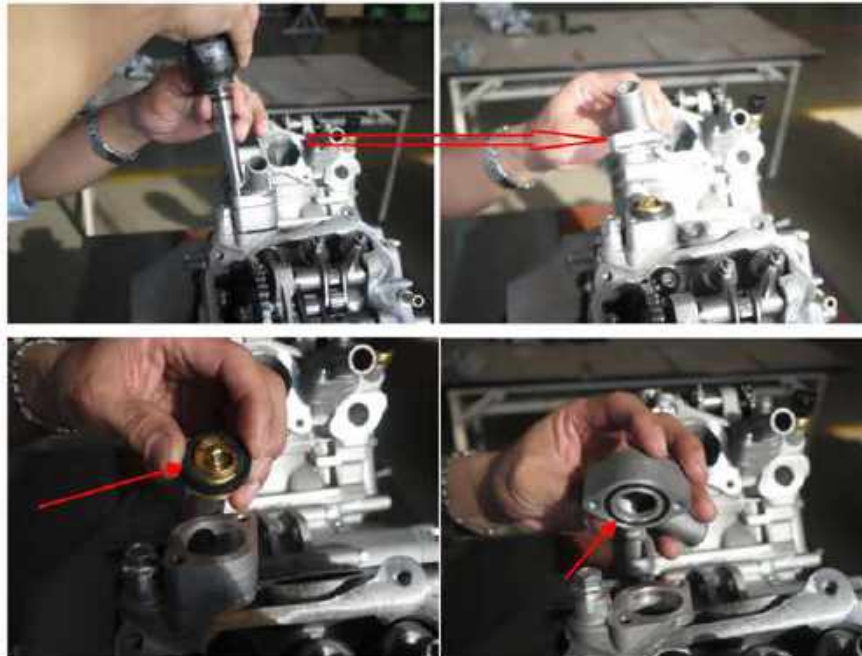


13-08. Thermostat/Thermo Sensor

Refer to 6-04.

a. Removal of thermostat(only in the front cylinder head)

1. Drain out the coolant.
2. Remove the thermostat cover (2 bolts) on the front cylinder head.
3. Remove the thermostat.
4. Attention o-ring on the cover => brittle, hard, damage → replace



Note: Only one thermostat in the engine. There is no thermostat in the rear cylinder.

b. Removal of thermo sensor.

1. Use wrench to remove the thermo sensor from rear cylinder head side.



Note: Attention the sensor is only in rear cylinder head.



c. Inspection (Thermostat)

1. Visually inspect thermostat for any damage.
2. Place the thermostat into water and slowly heat the water, check its temperature indicated.

Technical Data

Valve begins to open	<u>$65 \pm 1.5^{\circ}\text{C}$</u>
Valve stroke	<u>0.5 ~ 8mm</u>

NOTE:

If the accuracy of the thermostat is in doubt, replace it. A faulty thermostat could cause serious overheating or overcooling.

3. Installation

- do reverse procedures as removal.
- Install the thermostat cover. (2 bolts)

Torque: Flange Bolt: 6 N-m

- Wrench up the thermostat sensor by torque

Torque: Flange Bolt: 16 N-m

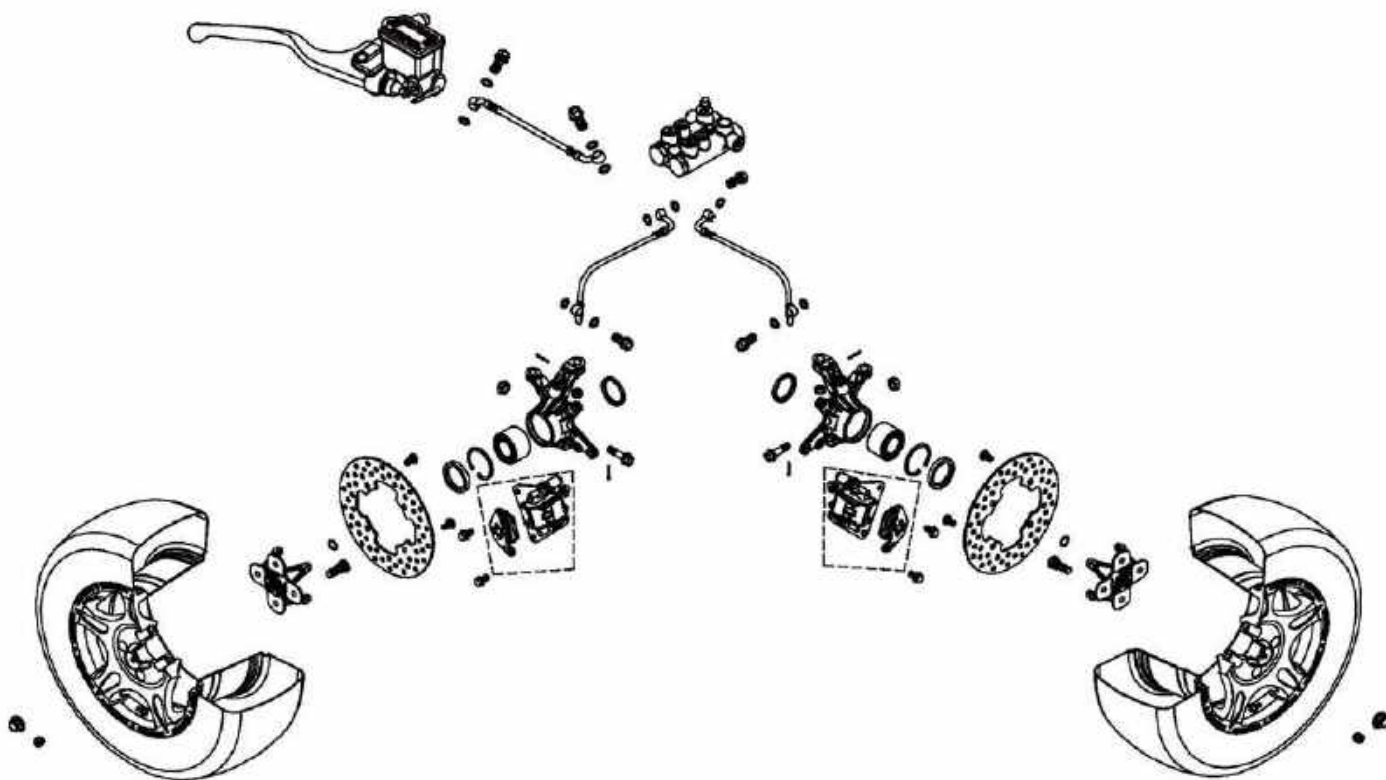
- Refill the coolant and bleed out the air bubble



NOTE:|

- 14-01. Mechanism Diagram
- 14-02. Maintenance Description
- 14-03. Trouble Diagnosis
- 14-04. Front Wheel/ Tire
- 14-05. Front Wheel Hub
- 14-06. Disk Brake System Inspection
- 14-07. Adding Brake Fluid
- 14-08. Front Brake fluid replacement / Air-bleed
- 14-09. Front Brake Caliper
- 14-10. Front Brake Disk
- 14-11. Front Brake Master Cylinder

14-01 Mechanism Diagram



14-02. Maintenance Description

a. Operational precautions

Caution

- During servicing, keep oil or grease off the brake pads and disk.
- Drain the brake fluid from the hydraulic brake system before disassembly.
- Clean the contaminated brake disk with high-performance brake degreaser and replace the brake pads.
- The brake caliper can be removed without removing the hydraulic system.
- After the hydraulic system is removed, or the brake system is soft, bleed the air out of hydraulic system.
- While refilling brake fluid, care should be taken not to let the foreign material entering into the brake system.
- Do not spill brake fluid on the painted surfaces, plastic or rubber parts to avoid damage.
- Check the operation of the brake system before riding.
- Make sure to use recommended brake fluid.
- Please refer to the service manual of tubeless tire in respect to the removal, repair and installation of the tire.

b. Specifications

Item	Standard (mm)	Limit (mm)
The thickness of front brake disk	3.50	3.0
The thickness rear brake disk	5.0	4.5
Front and rear brake disk eccentricity	< 0.1	0.3
Master cylinder inner diameter	14.000~14.043	14.055
Master cylinder piston outer diameter	13.957~13.984	13.945
Diameter of front disk	220mm	-
Diameter of rear disk	200mm	-
Thickness of brake lining	4.5	1.5

Tire pressure as cold: 8(7) psi (on road tire)
 5(3.5) psi (off road tire)

14-03. Trouble Diagnosis

Soft brake lever

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

Uneven brake

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

Brake noise

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

Steers to one side

1. Bent tie rods
2. Wheel installed incorrectly
3. Unequal tire pressure
4. Incorrect wheel alignment

Hard operation of brake lever

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

Tight brake

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

Hard steering

1. Faulty tire
2. Insufficient tire pressure

Front wheel wobbling

1. Faulty tire
2. Worn front brake drum bearing
3. Bent rim
4. Axle nut not tightened properly

14-04. Front Wheel/Tire

a. Removal

Raise the front wheels with tires off the ground by placing a jack or other support under the frame.

Remove the front wheel nuts, and then remove front wheels.

b. Inspection (refer to 2-08)

1. Check the wheel rim if any cracks, distorts or damaged. Replace with new if necessary.
2. Check the tire
 - Surface – wear/damage → replace

Tire wear limit front/rear : 3.0mm

- Measure cold tire pressure refer to standard tire pressure.
Out of specification → adjust

c. Installation

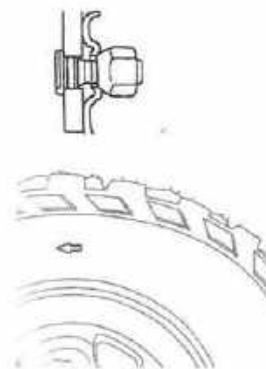
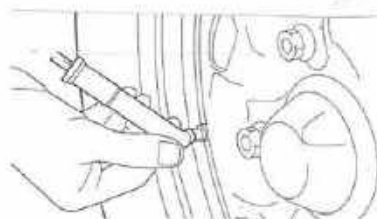
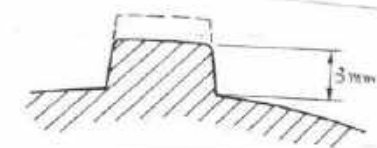
1. Install the front wheel/tire and tighten the nuts.
 - Install each nut with its tapered side towards the wheel.
 - The arrow mark on the tire must point in the direction of wheel rotation.

Torque: 5.5kg-m / 55 N-m

Note: Always balance the wheel when tire or wheel has been changed or replaced.

Warning:

- Never attempt even small repairs to the wheel.
- Ride conservatively after installing a tires to allow it to seat itself properly on the rim.
- It's dangerous to ride with a worn-out

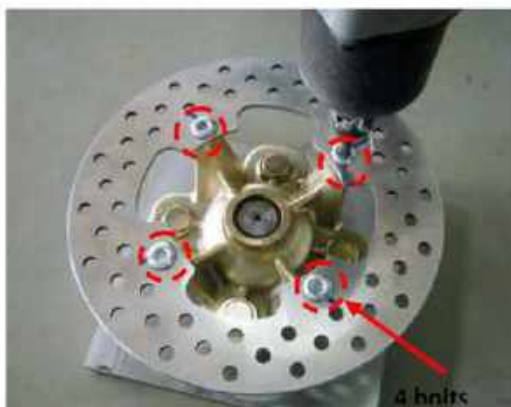
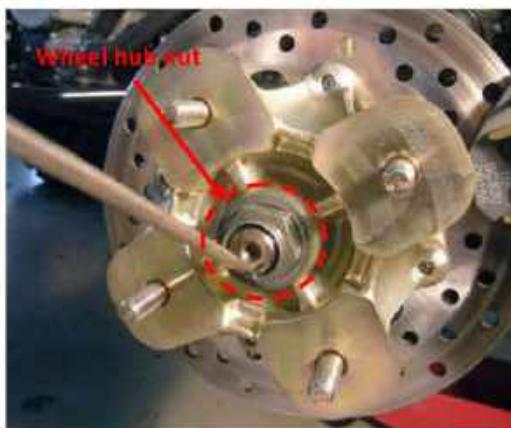
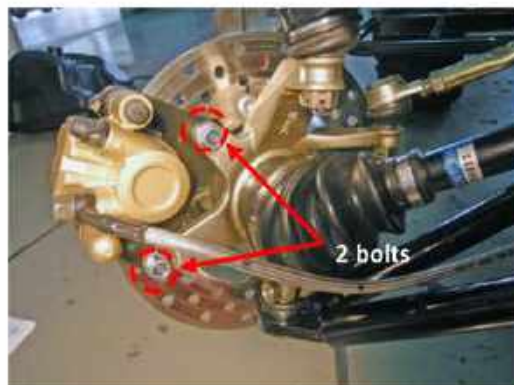


tire when tire wear is out of specification, replace the tire immediately.

14-05. Front Wheel Hub

a. Removal

- Remove the 2 flange bolts (M8*16) between caliper bracket and knuckle, and then remove front brake caliper.
- Use screw driver and hammer, to knock back the locked wall of wheel flange bolt.
- Remove the front LH/RH wheel hub nut and washer and remove wheel hub with brake disk.
- Remove 4 button bolts (M8*17), and then remove the brake disk from wheel hub.



c. Installation

1. Install the brake disc to the front wheel hub.
Be aware the recessed portion of the bolt hole faces away from the hub.

**Torque: Brake disk button bolts (M8*17)
3.5kgf-m**

2. Clean and grease the front LH/RH drive axle (outside of Knuckle)
3. Put the O-ring onto the front LH/RH drive axle
4. Install wheel hub into the front LH/RH drive axle.
5. Apply the glue to the wheel hub locknut

6. Tighten the wheel hub nut with specific torque. Stake the collar wall of the nut into the notch of the shaft.

- Always replace a new nut.

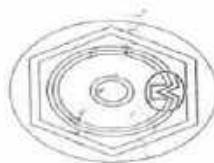
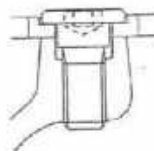
Note: Install wheel hub nut (M20).

Torque: 26kgf-m / 260 N-m

7. Install the caliper (with bracket) to the knuckle by tighten the flange bolt (M8*16)

Note: Install front brake caliper.

**Torque: Bolt, brake caliper bracket (M8*16)
2.5kgf-m/25 N-m**



14-06.Disk Brake System Inspection

a. Inspection

1. By visual examination whether fluid leaking or the damage on the brake hose side, the connecting bolts washer side, and caliper body side.
2. Turn the handle left and right, pressure to the front shock, to check if there any interfere, abnormal pull & push on the hose side.
3. Check the brake from inside the brake caliper. The brake pad must be replaced with new lining when the brake pad wears to the service limit.

Note:

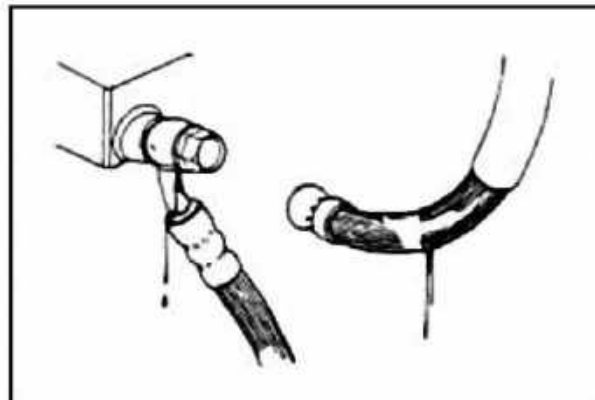
Remove the front wheel rim before the front brake lining check.

- Park the ATV on a plane ground, and check the master cylinder screen if fluid level is under the "LOWER" mark. If yes, check the brake system if any leaking, and add the sufficient brake oil into the master cylinder.

Recommended Brake Fluid:
BRAKE FLUID (DOT 4).

Caution

- a. If the vehicles being parked inclined or just stopped, the survey of brake oil level could not be accurate, it is better to settle the vehicle 3~5 minute before checking.
- b. In order to prevent chemical deteriorate and cause bad performance on braking power or even lead to a accident, please always use recommended brake fluid.



- c. Do not mix different specs. of the brake fluid.
- d. Replace brake fluid at once it's dirty.
- e. Always check brake fluid level before riding.

14-07. Adding Brake Fluid

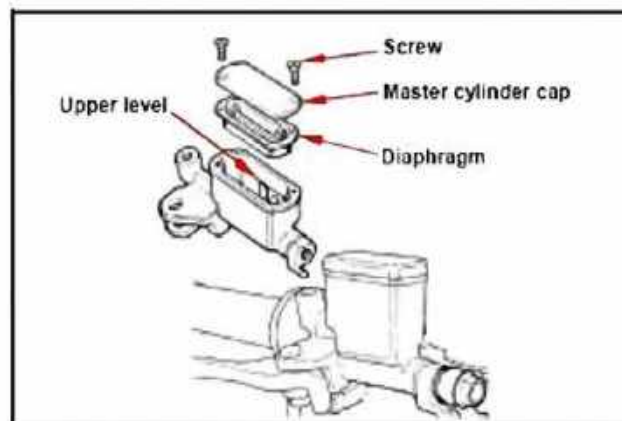
Note:

Before the brake fluid reservoir cap is removed, turn the handle to keep the fluid inside the master cylinder at horizontal.

- a. Screw out 2 screw on the master cylinder cap and remove the master cylinder cap and diaphragm.
- b. Add high quality brake fluid, uses only trade mark brake fluid joins in master cylinder.
- c. Put back the diaphragm and master cylinder cap, and press the brake lever slightly, to check if brake force is firm and solid. If there is soft still while apply the brake lever, check and do the air bleeding procedure to get rid out of air inside the brake system.
- d. Check again the oil level between the upper and lower limit, and tighten the bolts to close the master cylinder

Caution

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



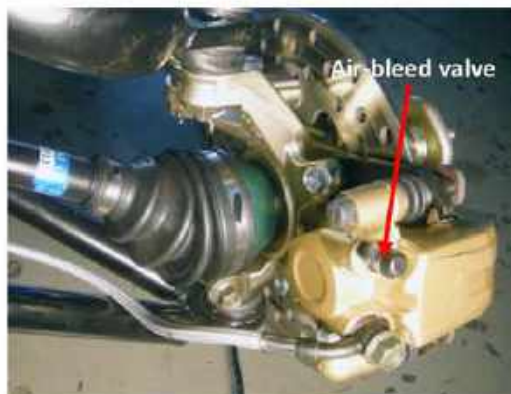
Caution

- The dirty brake lining or disk will reduce the brake performance.
- To mixed non-compatible brake fluid will reduce brake performance.
- Foreign materials will block the system causing brake performance to be reduced or totally lost.
- Be careful that water doesn't enter the brake master cylinder when refill. Water will significantly lower the boiling point of the brake fluid and may result in vapor lock.

14-08. Front Brake fluid replacement / Air-bleed

Do the air bleeding / brake fluid replacement process below when there is soft while apply the front brake lever or replace the new brake fluid.

- a. Connect a transparent drain hose to air-bleed valve on the one side of the front caliper and place an oil container to collect the exhaust brake fluid.
- b. Open the master cylinder cap and diaphragm at right side of handle bar,, check and add the brake fluid while doing the below air bleeding process.
- c. Open the drain valve around 1/4 turns on the caliper and keep applying the front brake lever.
- d. Checks the drain hose for the air bubble flow while apply the brake lever. Close the air bleeding bolt until there is no air bubble comes out/ brake fluid become clear (new)
- e. Do the same procedures on another front caliper to drain out the air bubble / replace the brake fluid.
- f. Apply the brake lever to check if the brake feeling is firm and solid.



- g. Add front master cylinder the brake fluid to the level between upper and lower limit and closed the master cylinder.

Note:

- You can use the vacuum machine to drain out the air bubble /replace the brake fluid, instead of applying the brake lever.
- Use shop towels to cover plastic parts and coated surfaces to avoid damage caused by splash of brake fluid.

Recommended brake fluid:
DOT 4 brake fluid

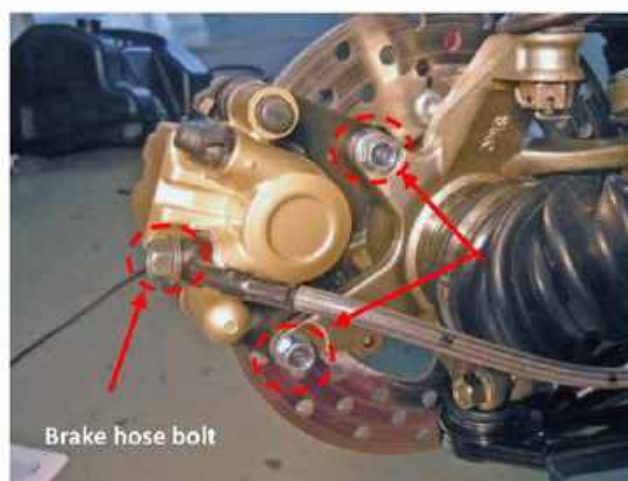
14-09. Front Brake Caliper

a. Front Caliper Removal

- Remove the 4 flange nuts (M10) and remove the front wheel.
- Remove the 2 flange bolt (M8*16) on the knuckle and remove caliper (with bracket) from knuckle firstly.
- Place a container under the brake caliper, and loosen the brake hose bolt, to drain out the brake fluid and finally remove the brake hose. *(No need to do this while inspection/replace of the brake pad, unless you have to replace defect caliper/brake hose)*

b. Brake pad removal(if brake pad lining reach to the service limit)

1. Push the bracket and take out the brake pad set.



2. Push the brake piston back to the inner of caliper, if there no symptom of brake fluid leaking.

c. Inspection

1. Check the oil hose if any cracks, oil leaking at connecting or hose itself side. Replace with new if leaking found.
2. Check the caliper inner piston/ oil seal if any oil leaking. Replace with new caliper ass'y when oil leaking found.
3. Check the brake pad lining thickness:

Standard: 4.5mm (a)

Service limit: 1.5mm (b)

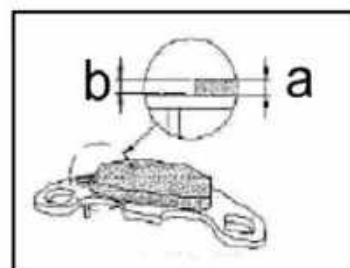
d. Installation of brake pad and caliper to the knuckle.

1. Install the brake pad set into brake caliper.
2. Use two copper washers and hose union bolts (M10*22) to lock the brake hose and install the brake house to the caliper. (If the brake hose is being removed from caliper.)

**Torque: Union bolt (M10*22) for brake hose
3.0kgf-m / 30 N-m**

3. Install the brake caliper and tighten the bolts securely.

**Torque: Caliper bracket bolt (M8x16mm)
3.0kgf-m/30 Nm**



Caution

1. Use M8 x 16 mm flange bolt only.
2. Longer bolts will interfere the operation of brake disk.
3. Process the air bleeding/brake fluid replacement procedures that mentioned at 14-08 & 2-12.

14-10. Front Brake Disk

a. Inspection

1. Visually check the brake disk for wear/break or distorted.
2. Measure the thickness of the disk by dial gauge at several places. Replace the disk if it has exceeded the service limit.

Standard Value: 3.5mm

Service limit: 3.0 mm

3. Remove the brake disk from wheel hub.
4. Check the disk for deformation.

Standard: 0.20 mm or below

Service limit: 0.30 mm

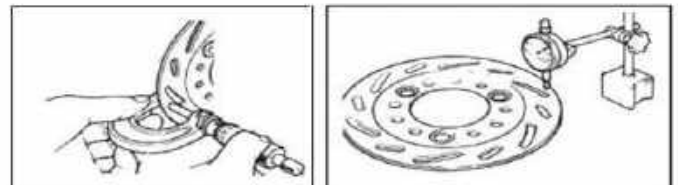
Caution

The dirty brake lining or disk will reduce the brake performance.

14-11. Front Brake Master Cylinder

a. Front Master Cylinder Removal

1. Disconnect the front brake switch wire coupler from wire harness.
2. Remove the two socket bolts on the master cylinder holder, and then remove the front master cylinder set.
3. Put the oil pan at ground, remove the union bolt (M10*22) and two copper washer, and disconnect the front upper brake hose with Fr. Master cylinder. Be careful not to split out the brake fluid onto any plastic / paint items. (only for service need if necessary)



Caution

1. Do not let foreign materials enter into the master cylinder oil reservoir tank.
2. For your own safety and reliability of braking power, factory do not suggest customer to repair a defect master cylinder / caliper. If possible, always replace with master cylinder assy (master cylinder, piston, spring, diaphragm and cir-clip) when parts being diagnose as defect.

b. Master Cylinder Install

1. Align the installation punch mark on the handle bar, place the master cylinder onto handlebar, and install the socket bolts.
2. Connect brake hoses with union bolt (M10*22) and 2 new copper washers. Tighten the brake hose union bolt to the specified torque value.

Torque: 3.0 kg-m / 30 N-m

3. Install brake switch to the master cylinder .

Caution

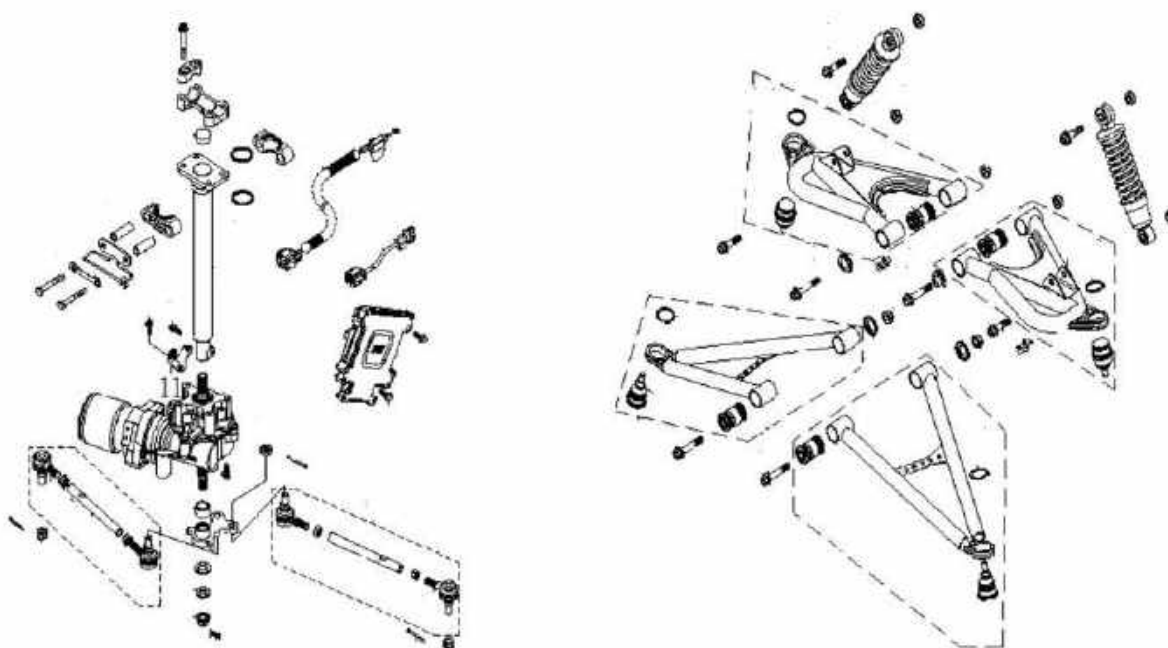
1. Improper hose routing may damage leads, hoses or pipes.
2. Wrong brake leads, hose or pipe may reduce brake performance.
3. Add specified brake fluid and bleed the system.



Notes:

15-01. Mechanism Diagram	.....
15-02. Operation Precautions	.....
15-03. Trouble Diagnosis	.....
15-04. Steering Handle	.....
15-05. Steering Column	.....
15-06. Steering Tie-Rod	.....
15-07. Front Steering Knuckle	.....
15-08. Front Suspension	.....
15-09. Suspension A- arm	.....
15-10. Toe-In	.....
15-11. EPS	.....

15-01. Mechanism Diagram



15-02. Operational Precautions

Torque

Handlebar upper holder bolt(M8*50)	2.3kg-m/23 Nm
Steering column (stem) holder bolt(M8*60)	2.3kg-m/23 Nm
Steering column (stem) lower lock nut(M14)	18 kg-m/180 Nm
Steering tie-rod castle nut (M10)	3.0 kg-m/30 Nm
Knuckle nut (M10)	4.8 kg-m/48 Nm
Suspension arm nut (M10)	4.5 kg-m/45 Nm
Front shock absorber mounting nut(M10)	4.5 kg-m/45 Nm

15-03. Trouble Diagnosis

Hard to steer

- Faulty tire.
- Steering shaft holder too tight.
- Insufficient tire pressure.
- Faulty steering shaft bushing.
- Damaged steering shaft bushing.
- Bent or damaged frame

Front wheel wobbling

- Faulty tire.
- Worn front knuckle bearing.
- Deformed wheel
- Incorrect wheel balance
- Axle nut not tightened properly.
- Damaged wheel bearings
- Excessive wheel runout
- Bent or loose wheel axle

Steers to one side

- Bent tie rods.
- Wheel installed incorrectly.
- Uneven tire pressure.
- Uneven tire wear
- Bent frame.
- Worn swing arm pivot bushings.
- Incorrect wheel alignment.

Front suspension noise

- Loose front suspension fasteners.
- Binding suspension link.
- Leaking oil
- Bent or damaged damper rod
- Fatigued or damaged shock absorber spring

Hard suspension

- Faulty front swing arm bushings.
- Improperly installed front swing arms.
- Bent front shock absorber swing rod.

Soft suspension

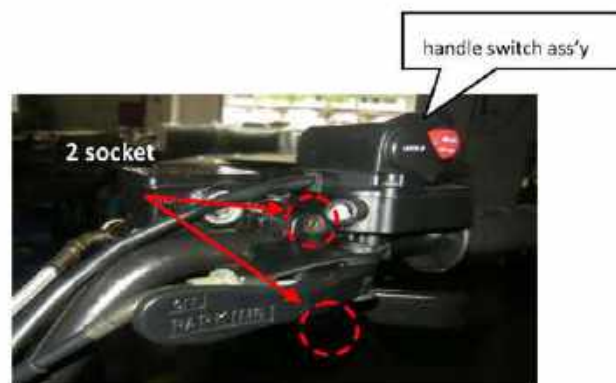
- Weak front shock absorber springs.
- Worn or damage front swing arm bushings.
- Leaking oil

15-04. Steering Handle

- **Removal**
- Remove the handlebar upper cover.

- Loosen the two socket bolts at right handle side, and then remove the front brake master cylinder and parking brake lever set.
- Remove 2 socket bolts, and then remove RH Handle switch ass'y from right handle side.
- Remove the 2 socket bolts on the winch control switch bracket, and remove the winch switch.

- Loosen the 2 socket bolts for the rear brake master cylinder & parking brake, and remove rear brake master cylinder.



- Remove the 2 pan head screws (M5*30 & M5*40) on the left handle switch assy, and remove the left handle switch assy.



- Remove handle mounting flange bolt (M8*50), and then remove the handle upper holder and handle bar.

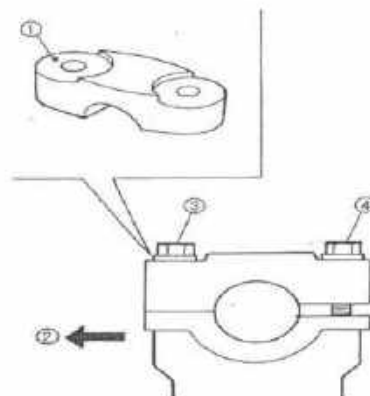


- **Inspection**

Handlebar – Bends/Cranks/Damaged → Replace

- **Installation**

1. Install in reverse order of removal procedures.
2. When install the handle bar in the middle side of the handle bar, be sure to aim the align point in the front horizontal connecting surface
3. The upper handlebar holder should be installed with the punched mark ① forward ②.
4. First tighten the bolts ③ on the front side of the handlebar holder, and then tighten the bolts ④ on the rear side.
5. When install the RH handle switch, be sure to align the punch point mark



6. Torque value

- Handle mounting flange bolt (M8*50)
2.3kgf-m/23Nm

- Pan head screw (M5*30&M5*40) for LH Handle switch.
0.45~0.60 kg-m /4.5~6 Nm
- RH Handle Switch socket bolt(M6x22mm):
1.0 kgf-m/ 10 Nm
- Master Cylinder (RH/LH) socket bolt (M10):
3.0kgf-m/30Nm
- Pan head screw (M6) for choke cable.
0.8~1.0 kgf-m /8~10 Nm

15-05. Steering Column

Only describe the steering column with EPS.
Without EPS, please refer to Workshop Manual in JMAX 700/750.

Also refer to 2-27 and 15-11 about EPS.

a. Remove-

1. Unscrew the bolt on bottom of the steering column.
2. Loosen 2 Hex. bolts (M8*60) , and then remove steering column (stem) cable guide plate, lock washer, collars, column stem bushings and oil seals.
3. Remove out the column upward.



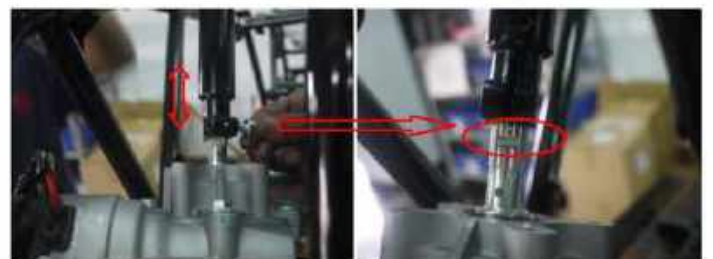
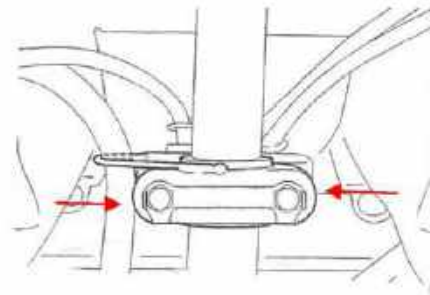
b. Inspection

- Check column – wear/ damage/ bend/ spindle damage → replace
- Check steering stem bushings -- wear/damage → replace
- Check the two collars=> wear → replace
- Check oil seals => damage → replace
Covered by two oil seals to be away from water and dust.
- refer to 2-17.

c. Installation

- Install in reverse order of removal procedures.
- follow all torques fixings on 1-05 and replace a new locker washer and secure it.

- Install the steering column:
 - 1) Apply with grease onto steering column spindles.
 - 2) Insert the column into input shaft of EPS.
 - Input shaft machine a • mark and =₁ concave.
 - • mark match to the notch of column
 - 3) Apply 243 glue on the bolt roundly and screw into the = concave on input shaft by hand.
 - Input shaft also machined a =₁ concave in order to tighten the column to input shaft.
 - to match the =and bolt, you may move the column up and down a little bit to find the most proper concave.



- 4) Screw in the bolt by torque
Torque: 48 N-m



15-06. Steering Tie-Rod

a. Remove

1. Remove the LH/RH front wheel & Hub (refer to Chapter 14)
2. Remove cotter pin and tie-rod nut from output shaft of EPS.
3. Take out the nut, spring washer and washer.
 - take care on the sequence.
4. Remove the pitman with steering tie-rod.
 - Not necessary to disassemble the tie-rods from pitman unless replace the tie-rods.
5. Remove the distance collar inside.



6. If you want to remove the tie-rod;
- Remove the LH/RH front wheel & Hub (refer to Chapter 14)
 - Remove cotter pin and tie-rod nut from lower steering column side and disconnect the LH/RH tie rod from pitman arm.
 - Remove cotter pin and tie-rod nut from LH/RH steering knuckle side, and then remove the tie-rod.

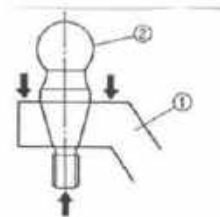
Note: Use a general puller to separate the ball joint ② and steering knuckle ①.

b. Inspection

- Inspect the tie-rod for damage or bending → replace
- Inspect on tie-rod ends if damage, wear or deterioration → replace
- Turn roughly or loosely → replace the tie-rod ends.
- Inspect the pitman => wear/ damage/ spindle damage → replace
- Inspect the distance collar => wear/ damage → replace
- Always replace a new spring washer.

c. Installation

- Install by the reverse way of removal.
- Distance collar and pitman installing
 - distance collar is with radius machinery, install it by this side up into the output shaft of EPS.



b) pitman machine a concave to matching engage the mark "I" on the output shaft.

c) install in the washer/spring washer and apply 638glue inside castle nut and fix by torque and secure it by cotter pin.

Torque: 180N-m

- always replace a new spring washer and install it in a right direction.

3. Wrench the castle nut on tie-rod nuts and secure them by cotter pin.

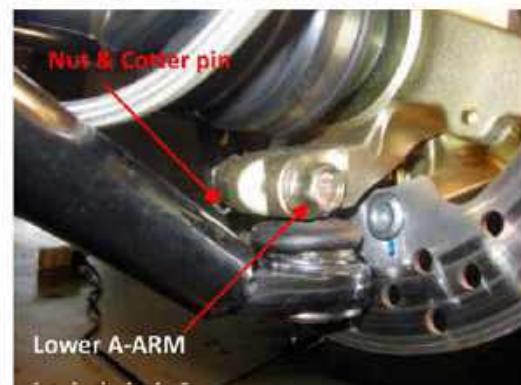
Torque: 25N-m

4. Adjust the adjusting nuts on both sides to process toe-in adjustment (refer to 2-20).

15-07. Front Steering Knuckle

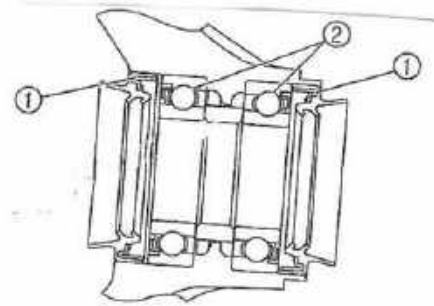
a. Remove

1. Remove front wheel, front brake caliper, front wheel hub and brake disk as mentioned on chapter 14.
2. Remove cotter pin and tie-rod castle nut, then remove tie rod on the Fr. LH/RH knuckle side as mentioned on 15-06.
3. Remove cotter pin, universal joint castle nut, and then disconnect the knuckle with upper A-arm.
4. Remove cotter pin, universal joint keyhole bolt & nut at lower A-arm side, and then remove the knuckle from Front LH / RH drive axle.



b. Inspection

1. Inspect on universal joint at rubbers if damage, wear or deterioration.
2. Turn the universal joint with fingers. The ball joints should turn smoothly and soild.
3. Check the two bearings ② inside the Fr. LH/RH knuckle. Replace it with bearing puller if bearing is wear/ damage or turn roughly.
4. Check the two side of oil seal ① inside the Fr. LH/RH knuckle if damage. Replace it with new if necessary.


c. Installation

1. Install in reverse order of removal procedures.
2. If replace the bearings:
Steps as followings:
 - Clean the outside of steering knuckle
 - Remove the oil seals ①
 - Drive out the bearing ②
 - Apply lithium base grease to the bearings and oil seals.
 - Replace a new cir-clip to the steering knuckle and correctly installing.

Torque: Upper & Lower A-ARM universal joint nut (M10): 4.8 kg-m / 48Nm

After tightened the nuts, install the cotter pins.

15-08. Front Suspension

a. Remove

1. Remove front shock absorber under nut and flange bolt on the upper A-arm.
2. Remove front shock absorber upper nut & flange bolt , and then remove the front shock absorber.

b. Inspection

- Shock absorber rod
Bends/damage → replace
- Shock absorber ass'y
Oil leaks → replace
- Spring
Fatigue → Replace
Move the spring up and down.

Warning:

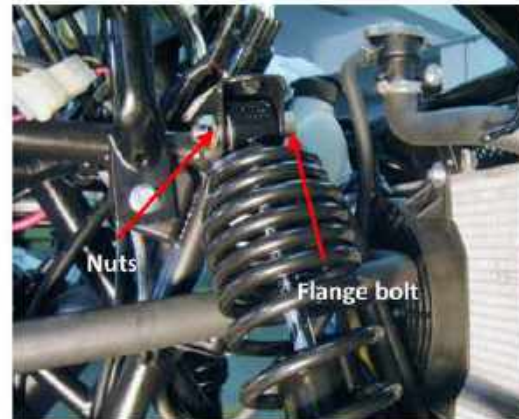
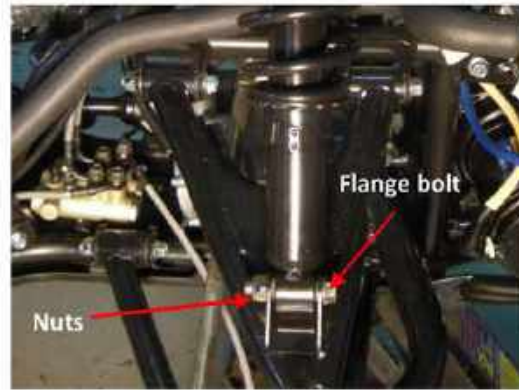
Unbalance setting on the RH & LH front shock absorber may lead to steering difficult, lean or even roll, end in result with accident (refer to 2-16).

3. Installation

- Install in reverse order of removal procedures.
- Refer to 15-08

Torque:

Fr. shock absorber upper and lower nylon nut: **4.5 kgf-m (45 N-m)**



15-09. Suspension A-Arm

a. Remove

- Remove front wheel, wheel hub, and brake caliper, brake disk, tie-rod, knuckle and front shock absorber as mentioned at previous section. .
- Loosen upper suspension arm nuts (M10), remove A arm flange bolts (M10*70), and then remove the upper suspension arm. (Upper A-arm).
- Loosen under suspension arm nuts, remove swing arm bolts and then remove under suspension arm (lower A-arm).

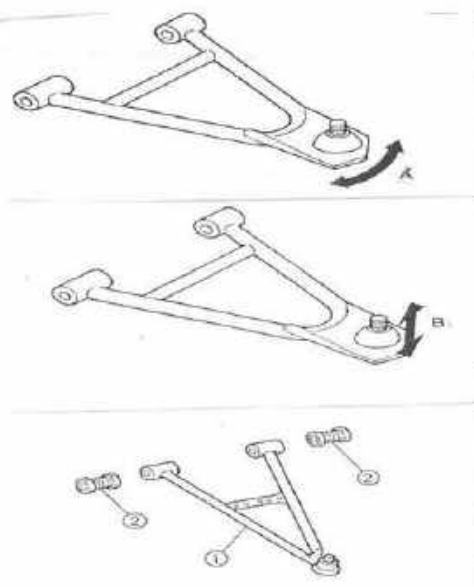
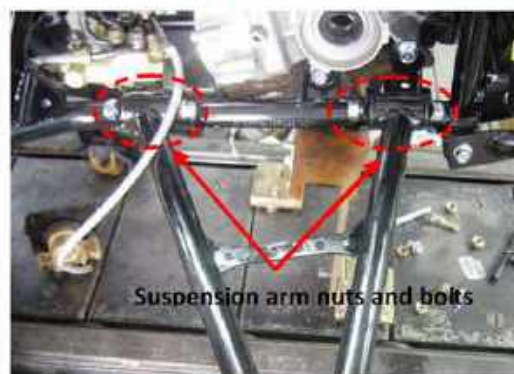
b. Inspection

Checking steps:

- Check the front arm side play A by moving it from side to side. If side play is noticeable, check the bushings.
- Check the front arm vertical movement B by moving it up and down. If the vertical movement is light or rough, or if there is binding, checking the bushings.

Checking the front arm:

- Front arms ① – Bends/damage → replace
- Bushings ② – wear/damage → replace



c. Installation

- Install in reverse order of removal procedures.
- Install front arms and shock absorbers

Steps:

- Install the front arm (upper) ① and front arm (lower) ②.

Note:

- Lubricate the bolts ③ with grease.
- Be sure to position the bolts ③ so that the bolt head faces outward.
- Temporarily tighten the nuts ④.
- Install the front shock absorber ⑤.
- Install the ball joints.
- Install the new cotter pins.
- tighten the nuts ④.

Torque value:

- Nut ④ : 4.5 kgf-m
- Nut ⑥ : 4.5 kgf-m
- Nut ⑦ : 2.5 kgf-m
- Nut ⑧ : 4.8 kgf-m

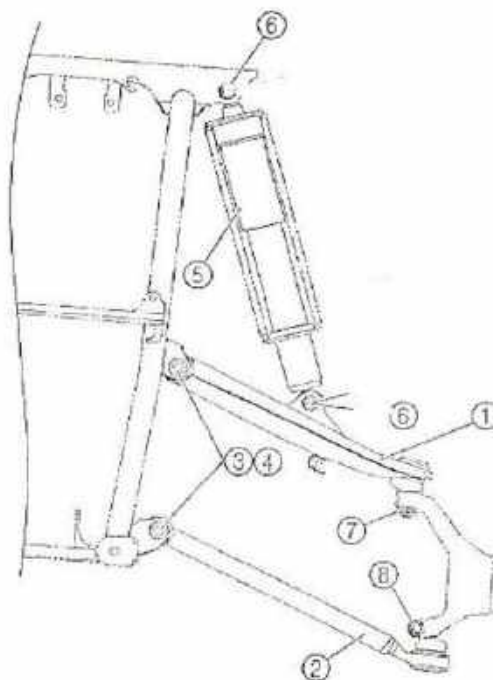
15-10. Toe-In

When repair or disassemble steering system parts, must to adjustment the toe-in.

- refer to 2-20.
- Tighten the locknut (rod end): 1.5kgf-m. and mark them.
- After setting the toe-in to specification, run the machine slowly for some distance with both hands lightly holding the handlebar and check that the handlebar responds correctly. If not, turn either the right or left tie-rod within the toe-in specification.

Toe-in:

0~10mm (with tire touching ground)



15-11. EPS

The vehicle is optional for EPS (electric power steering). EPS system helps the user in the steering more efficiency and easier no matter on riding or tracking. Although this system owns lots of protections in the abuse ridings, however, a understanding on EPS operation is necessary.

Refer to 2-27, Chapter 20.

a) Removal

- follow the procedures to remove the covers, steering column, tie-rod, knuckles, a-arms, suspension, tires..... as this chapters.

1) Disconnect three harnesses on the transfer controller.

2) Unscrew four bolts by crisscross to dispatch from chassis.

3) Remove out the EPS assembly.

4) Unscrew two bolts on the transfer controller and remove it out.



b) Inspection

- clean the EPS assembly and controller by air gun
- check the assembly cracks/damage
→ replace
- refer to 20- to check the motor
- refer to 19- to check the controller

c) Installation

Follow the steps to install back the EPS is very important.

- 1) prepare all EPS set and steering column
- 2) Install the EPS motor into the chassis

3) Apply the 243glue on the four fixing bolts and screw in the EPS motor through bracket on chassis.

Caution: Do not fix the four bolts before the steering column installation.

4) Follow the 15-05 to insert the steering column to EPS input shaft and fixed it.

5) Follow the 15-04 to well install the steering column bushings and fix and secure it.



6) Screw in the four screws into the EPS motor by crisscross by recommend torque.

Torque:30N-m

7) Screw in the two bolts to transfer controller and plug in the harnesses.





NOTE:

- 16-01. Mechanism Diagram
- 16-02. Maintenance Description
- 16-03. Trouble Diagnosis
- 16-04. Rear Wheel/Tire
- 16-05. Rear Wheel Rim, Knuckle and Drive axle
- 16-06. Rear Brake System Inspection
- 16-07. Adding Brake Fluid
- 16-08. Brake Fluid Replacement / Air-Bleed
- 16-09. Rear Brake Caliper
- 16-10. Rear Brake Disc
- 16-11. Rear Suspension ARM
- 16-12. Rear Brake Master Cylinder
- 16-13. Parking Brake

16-02. Maintenance Description

a. Operational precautions

Caution/Notice

1. Use vacuum cleaner or other authorized tool instead to clean the dust on brake disc and caliper.
2. The brake caliper can be removed without removing the hydraulic system.
3. After the hydraulic system is removed, or the brake system is felt to be too soft or sponge feel, bleed the hydraulic system.
4. While refilling brake fluid, care should be taken not to let the foreign material entering into the brake system.
5. Do not spill brake fluid on the painted surfaces, plastic or rubber parts to avoid damage. Check the operation of the brake system before each riding.
6. Please refer to the Maintenance Manual of tubeless tire in respect to the removal, repair and installation of the tire.

b. Specifications

Item	Standard (mm)	Limit (mm)
The thickness of front brake disk	3.5	3.0
The thickness rear brake disk	5.0	4.5
Front and rear brake disk eccentricity	< 0.1	0.3
Master cylinder inner diameter	14.000~14.043	14.055
Master cylinder piston outer diameter	13.957~13.984	13.945
Diameter of front disk	220	-
Diameter of rear disk	200	-
Thickness of brake lining	4.5	1.5

Tire pressure as cold : **8(7)psi (On-road)**
5(3.5)psi (Off-road)

16-03. Trouble Diagnosis

a. Soft/sponge feel when apply the brake lever / brake paddle

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

b. Hard operation of brake lever

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

c. Uneven brake

- Dirty brake lining/disk
- Poor wheel alignment
- Clogged brake hose
- Deformed or warped brake disk
- Restricted brake hose and fittings

d. Tight brake

- Dirty brake lining/disk
- Poor wheel alignment
- Deformed or warped brake disk

e. Brake noise

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

16-04. Rear Wheel/Tire

a. Removal

- Raise the rear wheels off ground by placing a jack or other support under the frame.
- Remove the four rear wheel lock nuts, and the remove rear wheel.

b. Inspection

- Check the wheel rim cracks, bends, damage → Replace a new
- Check the tire (refer to 14-04)

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

c. Installation

- Install the rear wheel and tighten the lock nuts.
- Refer to 14-04

Torque for wheel lock nut M10: 5.5 kgf-m



16-05. Rear Hub, Knuckle and Drive Axle

a. Remove

1. Remove the rear hub.

- Remove the flange nut (M20) from rear wheel hub by wrench, then pull out the LH/RH rear hubs.
- Always a new nut to be replaced.

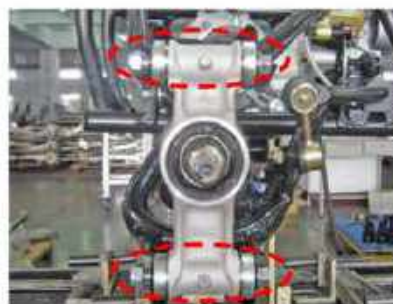
2. Remove the rear wheel knuckle

- Remove the o-ring from LH/RH rear drive axle.
- Use wrench to hold the flange bolt (M10*95) head side, then loosen and remove the upper and lower fixing 2 flange bolts / nuts on the rear wheel knuckle (R/L).
- Remove the thrust covers on the rear knuckles
- Remove the rear knuckle.

- #### 3. Pull out the rear LH/RH drive axle from rear transmission gear box. Hold the two ends as picture, and pull out the inside end in a sudden.

b. Inspection

1. Rear Hub – damage/cracks/ worn spindles → replace
2. Rear Knuckle
 - Oil seal – cracks/damage → replace
 - Bearing – roughness → replace (refer to 15-06)
 - Inner collar/bush/cir-clip/grease nipple/ thrust washers => damage → replace
3. Constant Velocity Joint
Excessive play → Replace the joint ass'y.



Refer to Chapter 17.

Recommended repairing boot:

42533-MAX-00 (Boot set)

42838-MAX-00 (Boot set)

c. Installation

1. Install the LH / RH drive axles assy to the rear gear box. Hold two ends and insert the inside end in a sudden.

- recheck the fixing by pull the axles forward and backward.

2. Install rear wheel knuckle and tighten the flange nuts & bolts at upper and lower knuckle side.

Torque:5.5 kgf-m

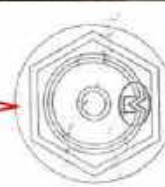
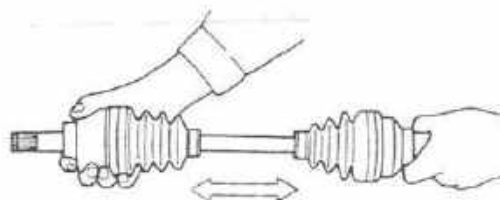
- Ensure the thrust washers have been correctly installed.

3. Insert new o-rings to the rear drive axle, then Install rear wheel hub.

- Apply enough grease on the oil seals and drive axles before installing.
- Add 243glue to the rear drive axle and flange nut , then stake collar of the nut into the notch of the shaft.
- Always replace a new nut

Torque:26kgf-m

16-06. Rear Brake System Inspection



The vehicle have been designed with a CBS (consolidated brake system). A brake shunt have been installed to integrate both hand brakes and footbrake. It brakes four wheels in balance by footbrake and right hand brake in front & left hand brake in rear.

a. Inspection

- Refer to 2-12/2-13/14-06
- By visual examination whether fluid leaking or the damage on the brake hose side, the connecting bolts washer side, and caliper body side.
- Turn the handle left and right, pressure to the rear shock, to check if there any interfere, abnormal pull & push on the hose side.
- Check the brake from inside the brake caliper. The brake pad must be replaced with new lining when the brake pad wears to the service limit.
- Park the ATV on a plane ground, and check the master cylinder screen if fluid level is under the "LOWER" mark. If yes, check the brake system if any leaking, and add the sufficient brake oil into the master cylinder.

Recommended Brake Fluid:

Brake Fluid (DOT 4).

- Apply the brake lever on left hand side (rear brake) and on the right foot pedal side, check the free play, brake power, if perform normal. Adjust the parking brake cables or do the air bleeding on the hydraulic brake system.
- Refer to 14-06/ 16-13

b. Removal

Attention the followings;



- unscrew two bolts behind rear caliper to release it.
- use vacuum machine to draw out the brake fluid before disassemble caliper, brake shunt, brake hoses and master cylinder
- always replace new copper washers if you unscrew the union bolts.
- always clean the union bolts at once disassembling by air gun.



c. Installation

Attention the followings;

- refill enough brake fluid but never be over the Max level.
- enough torque value on the union bolt fixings with cooper washers.

Torque value: 30 N-m

- never grease or lubricant on the brake pads or disc.
- installing brake pedal
 - 1) insert the pin to connect pedal and master cylinder and secure cotter pin.
 - 2) grease the pedal and pedal running shaft.
 - 3) install torsion spring, pedal ,washer and secure the E clip.
 - 4) check the parallel to the master cylinder operation. If not, adjust the nut of master cylinder to get.
 - 5) fix the two bolts on the master cylinder
 - 6) install brake switch spring and adjust to be properly.



16-07. Adding Brake Fluid

- Refer to 14-07.
- Before the brake fluid reservoir is removed, turn the handle so that the brake fluid reservoir becomes horizontal.
- Check the rear brake fluid reservoir tank on the front left master cylinder and right footrest side, if the brake fluid level is above the lower limit.
- If the brake fluid level is lower to the limit, remove the brake fluid cap and diaphragm and add the recommended brake fluid.

Clean the dirty brake disk



16-08. Brake Fluid Replacement / Air-bleed

- Refer to 14-08/2-12

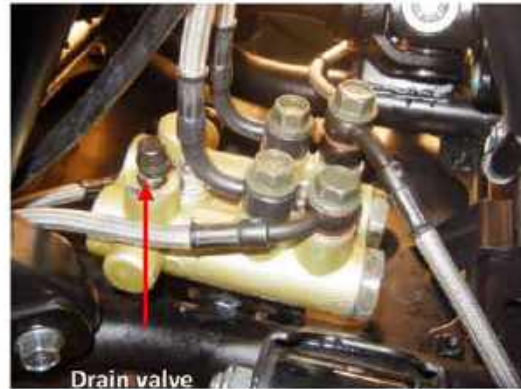
Before Air bleeding on the hydraulic brake system, please apply the brake pedal, front and rear brake lever, to distinguish where the air bubble is located.

Do the air bleeding / brake fluid replacement process below when there is a sponge feel while apply the rear pedal or replace the new brake fluid.

a. Air bleeding on the brake shunt Assy side.

- Connect a transparent drain hose to air-bleed valve on the brake shunt, and place an oil container under the brake shunt to collect the exhaust brake fluid.
- Open the brake fluid reservoir cap at right footrest side, check and add the brake fluid while doing the below air bleeding process.
- Open the drain valve around 1/4 turns on the brake shunt and keep applying the brake pedal.
- Checks the drain hose for the air bubble flow while apply the brake pedal. Close the air bleeding bolt until there is no air bubble comes out/ brake fluid become clear (new)
- Apply the brake pedal to check if the brake feeling is firm and solid.
- Add brake fluid on rear brake fluid reservoir the level between upper and lower limit and closed the reservoir cap.

**Recommended brake fluid:
DOT 4 brake fluid**



b. Air bleeding on the rear brake caliper side.

- Refer to 14-08

Caution:

Before doing the rear caliper air bleeding, please make sure there is no air bubble between rear master cylinder to brake shunt side.

- Connect a transparent drain hose to air-bleed valve on the rear brake caliper, and place an oil container under the rear brake caliper to collect the exhaust brake fluid.
- Open the rear brake master cylinder cap at left handle bar side, check and add the brake fluid while doing the below air bleeding process.
- Open the drain valve around 1/4 turns on the rear brake caliper and keep applying the brake pedal.
- Check the drain hose for the air bubble flow while apply the brake lever. Close the air bleeding bolt until there is no air bubble comes out/ brake fluid become clear.
- Apply the brake lever to check if the brake feeling is firm and solid.
- Add brake fluid on rear brake master cylinder at the level between upper and lower limit and closed the reservoir cap.

Recommended brake fluid:
DOT 4 brake fluid

16-09. Rear Brake Caliper

- Refer to 14-09

Note:

It is unnecessary to remove the brake hose on the normal service work only if the rear caliper is defect.



a. Removal

1. Place a container under the rear caliper,
 2. Loosen the fluid hose bolt on the caliper.
 3. After brake fluid out completely, remove the brake hose union bolt, two copper washers and then finally remove the brake hose.
- better to use vacuum machine to draw out the fluid.

Caution

Do not spill brake fluid on plastic surfaces.

4. Remove two caliper bracket bolts on the rear gear box side and remove the rear caliper(with bracket).

b. Inspection

Make sure the brake linings condition. Replace the linings if the brake linings wear limitation groove close to the brake disk.

c. Installation

- Install the brake caliper and tighten the attaching bolts securely.

Torque: 4.5 kg-m/45 Nm

Caution

1. Use **M10 x 50 mm** flange bolt only.
 2. Long bolt will impair the operation of brake disk.
- Use two seal copper washers and hose union bolts to lock the hose and brake caliper in place.

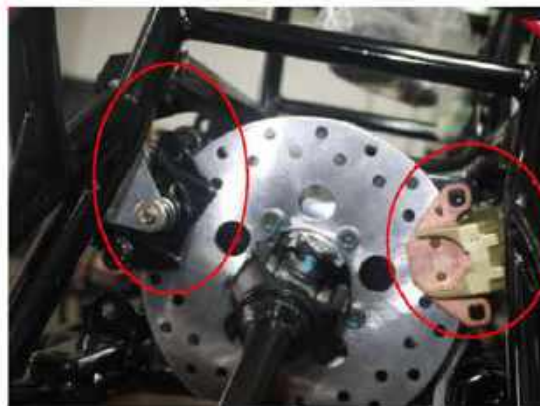
Torque: 4.5kg-m / 45Nm

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



16-10. Rear Brake Disc

Two brake system have been set to the rear brake disc. One is rear brake caliper. The other one is parking brake.



a. Removal

1. Stand the frame off the ground; remove the right and left side of rear wheel rim and footrest cover.
2. Remove the ANTI-ROLL BAR
 - Remove the right and left side of the fixing bolt of ball joint at the lower of suspension arm.
 - Remove the fixing bolt of the anti-roll bar holder and then remove the anti-roll bar.
3. Remove 2 bolts on rear gear box and remove the rear caliper with bracket.
4. Remove parking brake caliper
 1. Release the fixing nuts on the cable and remove the parking brake cable from brake arm.
 2. Remove the 2 flange bolts on the parking brake caliper side and remove the parking brake caliper.
5. Disconnect the drive shaft from rear gear



box and pull out the rear drive shaft (refer to 5-02)

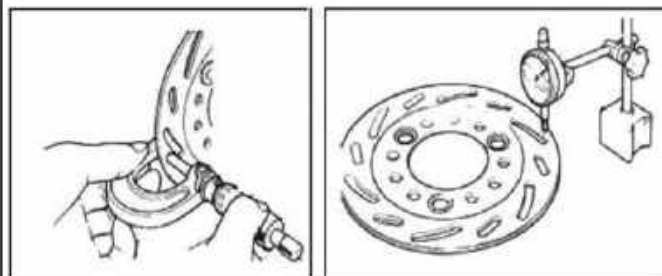
6. Use G-clamp to hold two side of needle bearing cap at rear brake disc side, add the pressure, remove the cir-clip on the cross joint side, then remove the universal joint (with cross joint on it)



7. Remove the 4 socket bolt on the rear brake disc and remove the brake disc.

8. Inspection

- refer to 2-12/14-10
- Visually check the brake disk for wear or break.
- Measure the thickness of the disk at several places. Replace the disk if it has exceeded the service limit.



Allowable limit: 4.5 mm

- Check the disk for deformation and bend.

Allowable limit: 0.30 mm

Caution

1. The dirty brake lining or disk will reduce the brake performance.
2. Please do not use the air-gun to be clean, the operator should use vacuum cleaner to clean it.

- Check the universal joint at anti-roll bar, if any deform, rubber seal damage, oil leaking, un-smooth bearing operation. Replace with new if necessary.



- Check the anti-roller bar, holder and bush

side, if any deform, damage, replace with new if necessary.

9. Installation

Do the reverse way of removal. Grease the bearing, oil seal on the rear propeller shaft before install.

Torque setting:

1. Install the rear brake disk and tighten the socket bolts (M8*17) refer to 14-05.

Torque: 3.5kg-m

2. Install the anti-roll bar and tighten the holder bolts (M8*12).

Torque: 3 kgf-m

3. Install the anti-roll bar universal joint to the rear lower suspension arm and tighten the flange nuts.

Torque: 4.8 kgf-m

4. Installation of parking brake caliper socket bolt(M8*45)

Torque: 3kgf-m

5. Installation of rear brake caliper bracket flange bolt (M10*50):

Torque:4.0kgf-m

6. Installation of the rear drive shaft the socket bolts (M8*17) with loctite glue.

Torque:4.0 kg-m

16-11. Rear Suspension ARM

a. Removal

1. Removal of rear shock absorber

- Shift the vehicle to let the vehicle off ground.
- Remove the rear wheel R/L
- Remove the lower and then upper fixing bolts and removes the rear shock absorber.



2. Remove the upper and lower rear suspension arm

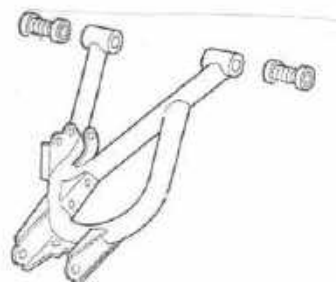
- Remove the anti-roll bar, wheel hub, knuckle, rear axle, rear shock absorber as mentioned at previous section of Chapters.
- Remove 2 flange bolts (M10*70) and nuts (M10) on the upper suspension arm, then remove the upper suspension arm.
- Remove 2 flange bolts (M10*70) and flange nuts (M10) on the lower suspension arm, and then remove the lower suspension arm.
- Remove the thrust cover at rear side of upper & lower A-arm



b. Inspection

1. Rear shock absorber

- Check the absorber if any oil leaking, damage.
- Check the bushings on the two side of absorber, if any break, deform. Replace with new if necessary.



2. Upper and lower rear suspension arm

- Check the bushings at the frame installation side, if any break, damage,

replace with new if necessary.

- Check the suspension arm body, if any deforms, crack, wear, and replace with new if necessary.

c. Installation

- Put a thrust cover at rear side of A-arm, install the rear arm lower and tighten the flange bolt (M10*70) and flange nut (M10).

Torque: 4.5 kg-m /45 Nm

- Put a thrust cover at rear side of A-arm, install the rear arm upper and tighten the flange bolt (M10*70) and flange nut (M10).

Torque: 4.5 kg-m /45 Nm

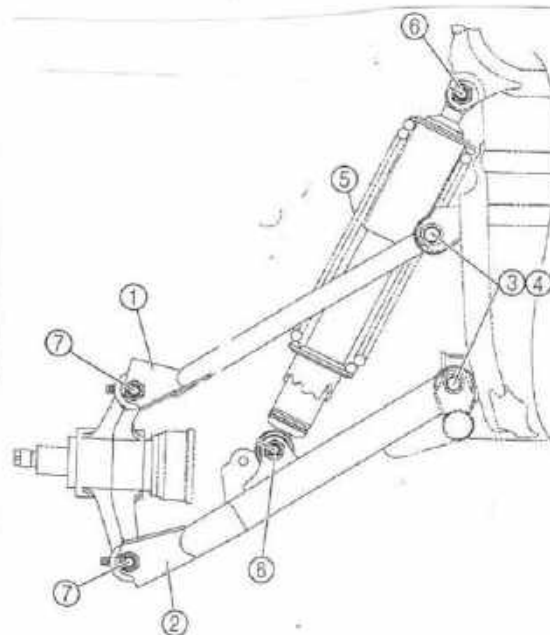
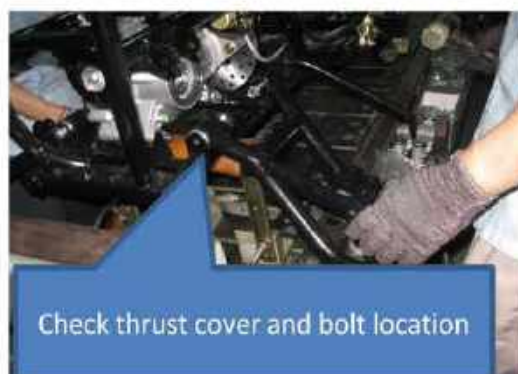
- Installation steps:

1. Install the rear arm (upper) ① and rear arm (lower) ②.
2. Lubricate the bolts ③ with grease.
3. Be sure to position the bolts ③ so that the bolt head faces outward.
4. Temporarily tighten the nuts ④.
5. Install the rear shock absorber ⑤ from top to lower.
6. Install the rear knuckle.
7. Tighten the nuts ④.

Torque value:

Nut ④: 4.5kgf-m

Nut ⑥ 4.5kgf-m



Nut ⑦ 4.5kgf-m

- Install the anti-roll bar, wheel hub and wheel rim as mentioned at previous section of this Chapter.



16-12. Rear Brake Master Cylinder

a. Master Cylinder Removal

Caution

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

1. Handle left side – rear brake master cylinder

- Remove brake light switch coupler.
- Loosen the brake fluid hose bolt on the left master cylinder side, drain out the brake fluid.
- Remove the brake hose.
- Remove the brake lever pivot bolt, and remove the brake lever from the brake master cylinder.
- Remove the master cylinder socket bolts and the master cylinder.



2. Right footrest side – rear brake master cylinder

- Place a container under the brake master cylinder, remove fluid hose clamp, and drain out the brake fluid.
 - better to use vacuum machine to draw out the fluid.
- Loosen the brake hose bolt and finally remove the brake hose.
- Remove the cotter pin from clevis pin in connecting with brake pedal and rear master cylinder, then remove the clevis pin.
- Remove the master cylinder 2 flange bolts and then remove the rear master cylinder.

b. Master Cylinder Inspection

- Check the master cylinder for damage or scratch. Replace it if necessary.
- Do not suggest to disassemble the brake related components (ex. master cylinder/caliper/shunt).

c. Master Cylinder Install

Caution

Improper routing may damage leads, hoses or pipes.

Caution



Wrong brake leads, hose or pipe may reduce brake performance.

1. Handle left side – rear brake master cylinder
 - Install the master cylinder onto handlebar, and install the bolts.
 - Install the brake lever, and connect the brake light switch.
 - Connect brake hoses with 2 new washers; tighten the brake hose bolt to the specified torque value.

Torque: 3.0 kg-m / 30 Nm

- Make sure the hose is installed correctly.
- Add specified brake fluid and bleed the system.

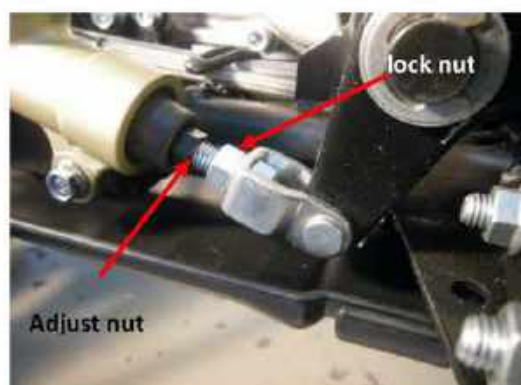
2. Right footrest side – rear brake master cylinder

Refer to 16-06 c.

- Install the master cylinder bolts and the master cylinder.
- Install brake push rod to the brake pedal, and install cotter pin onto clevis pin.
- Connect brake hoses with 2 new washers. Tighten the brake hose bolt to the specified torque.

Torque: 3.0 kg-m/ 30 N-m

- Install the fluid reservoir hose to rear master cylinder, and tighten with hose clamp. Make sure the hose is installed correctly.
- Add specified brake fluid and bleed the system.
- Adjust the brake pedal with correct play setting. Loosen lock nut, and turn adjustment nut and apply brake pedal to



adjust brake play. (refer to 16-06 c)

Suggest Free play: 2~4mm

16-12. Parking brake

a. Removal of caliper ass'y

1. Release the cable on the handle-bar and the two nuts of cable and remove the cable from caliper holder.
2. Turn the disk to find the hole for inside bolts.



3. Unscrew the two bolts M8*28



4. Remove the whole set of caliper ass'y from rear disk and rear gear box.



b. Inspection

Do not disassemble the caliper ass'y without special training. Suggest to replace the whole caliper.

1. Check crash/damage => replaced
2. Wear of pads => always replace a pair of pad
3. Boot crash => replaced



c. Installation

Do the reverse way of removal.

- M8*28 bolt fix
Torque: 3.3 kg-m / 33 Nm
- Grease the cable and adjust cable properly and test the parking brake.



NOTE:

- 17-01. Mechanism Diagram.....
- 17-02. Trouble Diagnosis.....
- 17-03. Wheel Drive Shaft Removal.....
- 17-04. Wheel Drive Shaft Disassembly.....
- 17-05. Wheel Drive Shaft Inspection.....
- 17-06. Repair Pack.....
- 17-07. Wheel Drive Shaft Assembly.....
- 17-08. Front and Rear Propeller Shaft.....

17-01. Mechanism Diagram



17-02. Trouble Diagnosis

a. Engine can be started but vehicle cannot move.

- Damaged wheel drive shaft
- Damaged propeller shaft
- Damaged front differential or rear gear box

b. Noise

- Worn or burnt drive shaft
- Worn or burnt steel ball
- Worn or burnt gear

c. Gear oil leaks

- Excessive gear oil
- Worn or damaged rubber boot
- Worn or damage oil seal

17-03. Wheel Drive Shaft Removal

a. Front wheel drive shaft removal

- Remove the front right / rear wheel.
- Remove the front right / rear brake caliper ,disk and wheel hub..(refer to 14-04/14-05/14-06/14-09/14-10/14-11 & 16-04/16-05/16-09/16-10/16-12/16-13)
- Remove the cotter pin, castle nuts, and then remove the tie-rod and steering knuckle.
- Remove the front right / left wheel drive axle



b. Rear wheel drive axle removal

- Remove the rear right / left wheel.
- Remove the rear right / left wheel hub.
- Remove the right / left wheel knuckle
- Remove the rear right / left wheel drive shaft.



17-04. Wheel Drive Axle Disassembly

a. Universal joint disassembly

- Open the boot band clip with scrapper.

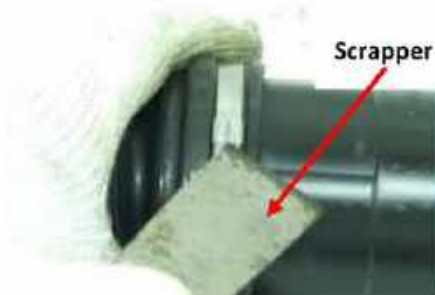
- Remove the rubber boot bands.

- Remove the UJ rubber boot.

- Disassemble the wheel drive shaft UJ assembly with rubber hammer & special tool.

Caution

Do not disassemble UJ assembly by using the steel hammer.



- Remove 6 steel balls from UJ assembly outer race.

- Remove the inner race and cage from the outer race.

- Clean the inner race, outer race, steel balls and cage.



b. Double Offset Joint Disassembly

- Open DOJ band clip with scrapper.
- Remove the wheel drive shaft boot band.
- Remove the DOJ rubber boot.

- Remove the inner cir-clip with screw drive.



- Disassemble DOJ assembly.



- Clean the DOJ assembly.
- Remove the cir-clip from the drive shaft.



- Remove the steel balls from cage.



17-05. Wheel Drive Axle Inspection

- a. Clean all spare parts. Check the surface of these parts for wear or scratch. Replace DOJ or UJ assembly if any stepped scratch is found.

- b. Check the inside surface of UJ outer race. Replace UJ assembly if it is damaged.

- c. Check the inside surface of DOJ assembly outer race. Replace double offset joint assembly if it is damaged.



17-06. Repair Pack

a. Check if DOJ & UJ boot is damaged. Replace DOJ or UJ assembly if it is damaged.



b. Remove the DOJ & UJ boot band.



c. Remove the DOJ & UJ cage.



d. Remove the DOJ & UJ boot.



e. Disassemble and clean all spare parts. Check if there is any corrosion on the surface of these parts. Replace DOJ or UJ assembly if any damaged part is found.

f. Clean the DOJ & UJ cage.

g. Unpack DOJ Repair Pack.

- Front: 42538-MAX-00
- Rear: 42838-MAX-00

h. Unpack UJ Repair Pack.

- Front: 42533-MAX-00
- Rear: 42533-MAX-00



17-07. Wheel Drive axle Assembly

a. DOJ assembly

- Assemble the DOJ boot.

- Assemble 6 steel balls, inner race and cage then drive shaft into the assembly.

- Assemble exit cir-clip onto drive shaft.

- Grease into the DOJ outer race.

Caution

Please use the grease of the repair pack. Using other oil may cause the part to be damaged.



- Install the wheel drive shaft and cir-clip into DOJ outer race.

- Install DOJ boot outside band.

- Install DOJ boot.
 Pull and open DOJ boot Pressure balancing that make it inside and external.

- Deduct DOJ band closely with rubber hammer.



b. assembly

- Assemble universal joint and UJ boot and Pour into the grease.

- Pour grease into the UJ boot inside.

Caution

Please use the grease of the repair pack. Using other oil may cause the part to be damaged.

- Assemble cir-clip with the tool.
- Strike the wheel drive shaft by rubber hammer.



- Install UJ boot.
- Pull and open DOJ boot to balance the inside and outside pressure.
- Install band with rubber hammer.



17-08. Front and Rear Drive Shaft

a. Rear Drive Shaft Remove

Refer to 5-02 u.

1) Take out the rear gear box with drive shaft.



2) Use the — screw driver to push the cir-clips out of ditch then use pliers to remove the 4 cir-clips



3) Remove the cross joint (refer to c.)

- attention to keep the caps with all needles and arrange in lines.



4) Take out universal joint and drive shaft.

b. Remove of front propeller shaft assy.

Refer to 5-02 u.

- 1) Take out the front gear box with drive shaft.

- 2) Use the — screw driver to push the cir-clips out of ditch then use pliers to remove the 4 cir-clips
- 3) Remove the cross joint (refer to c.)
 - attention to keep the caps with all needles and arrange in lines.

- 4) Take out universal joint and drive shaft.


c. Disassembly of the Front/Rear propeller shaft assy (universal joint and cross joint)

- Use the G-clamp to push two side of the cross joint cap and remove the fixing cir-clip.

- Remove the Cap of the cross joint.
(apply to all the universal joint dis-assembly of front and rear propeller shafts)



d. Inspection of the front and rear propeller shafts, cross joints

- Clean all the parts.
 - Check all couplings for wear or scratch, damage → Replace with new if necessary.
 - Check spindles/ threads of couplings for wear/scratch/damage → Replace
 - Cross joint => roughness/ loosing needle → replace
-
- Turn the cross joint cap, check if smoothly (check the condition of inside needle bearing if normal)
-
- Check needle bearing , fixing cir-clips on the cross joint. Replace with new one if wear/damage
 - Always replace the cross joint, needle bearings, (joint cap), cir-clips as a set.
 - Never re-use cir-clips at once disassembling.



e. Assembly of the universal joint/cross joint

- Grease the needle bearing inside the cap.
 - Lithium soap base grease.

- Install one side of cap to the cross joint through the universal joint hole, and close it by fixing cir-clip.
 - Always replace a new cir-clip.

- Put another side of the cap onto cross joint through opposite side the universal joint.

- Put the G-clamp to push the two edges of the cross joint cap, and install the fixing cir-clip.



- Turn the cross joint, and check if bearing, oil seal function well.



- Follow above, to install another universal joint on the same cross joint.

f. Install the front / rear drive/driven shafts.

Refer to 5-02 u.

1) As reverse procedure of removal to install the front / rear propeller shaft to the couplings of front gear box and rear gear box by cross joints.



2) Grease the spindles of shafts before install the propeller shaft to engine both sides.



- Move the whole front gear box with shaft installed backward to the engine front side coupling.
- Move the whole rear gear box with shaft installed forward to the engine rear side coupling.



3) Cover the spindles by rubber covers.

- use band to fix rubber cover to the shaft

Note:

1) Two couplings have to be fixed on the both side of engine. The same procedures as above to install the cross joints to the couplings.



2) Attention the fixings on engine both sides, apply 638 glue and torque value.

Front side → a) install the coupling b) apply the 638 glue to bolt and install washer and bolt c) torque the bolt.

Torque value : 30 N-m



Rear side → a) install the washer b) install the coupling c) apply 638 glue to bolt d) torque the washer and bolt

Torque value: 42 Nm

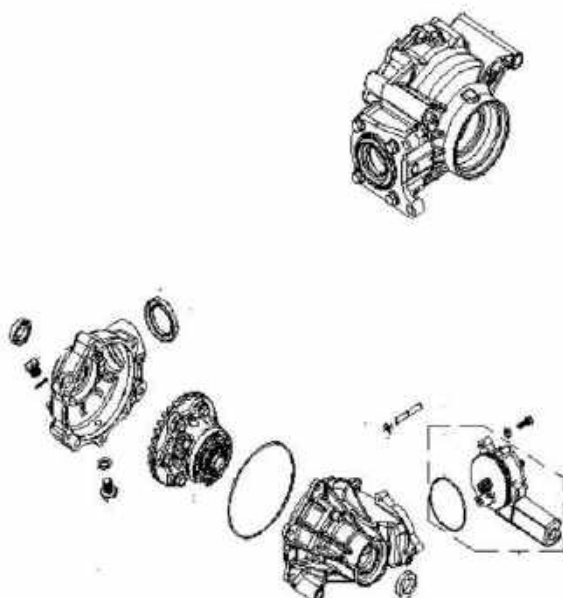




NOTE:

18-01. Mechanism Diagram.....
18-02. Trouble Diagnosis.....
18-03. Rear Gear Box
18-04. Front Differential Gear Box.....
18-05. Gear Motor Checking

18-01. Mechanism Diagram



18-02. Trouble Diagnosis

a. Engine can be started but vehicle cannot move.

- Disconnect couplings
- Damaged propeller shaft
- Damaged front differential or rear gear box

b. Noise

- Worn or burnt driving/drive pinion gear
- Bearing damage
- Gear tooth damage
- Shims adjusting
- Not correct engagement on gears
- Less gear oil/ not correct gear oil/ no oil replacement
- Improper gear backlash

c. Gear oil leaks

- Excessive gear oil
- Worn or damage oil seal/o-ring
- Damage on the gear box.

18-03. Rear Gear Box

a. Rear gear box removal

Refer to 17-08 to disconnect/install the couplings with engine.
Clean gear box before removing.

Clean gear box before removing.

- Drain out the gear oil by loosening drain bolt under the gear box.
- Unscrew two bolts to remove rear caliper.
- Unscrew two bolts and remove bolts/washers/nuts.
 - Loosen all bolts in stages, then remove.
- Release the breath pipe/park cable and remove the rear gear box out.
 - suggest to remove gear box as a whole set with disc and park caliper (as 17-08, also with driven shaft).



b. Inspect

- Lash adjustment have been done inside the gear box. Do not suggest to open the gear box without experience.
- Check the oil seals/o-ring damaged → replace
- Check bearings damaged → replace
- Check bevel gears damaged → replace
- Check the breath hose pipe broken/crack/damaged → replace
- At once change any gears, housing, cover → check the engagement lash, adjusting shims are necessary.

c. Gear box installation

- Assemble gear box sets as reverse steps.

- Ensure to follow specific torque

Torque value:

M10 Nut for Gear box: 8kgf-m

M10*50 bolt for caliper: 4kgf-m

- Ensure breath hose pipe fixing to the upper chassis pipe.

- Install back the drain bolt (& drive rear axles) then refill gear box oil then fix filler bolt.

- replace a new washer
- apply enough grease on oil seals/drive shaft/axles.
- gear oil (refer to 2-19)
- screw in the refill bolt

Periodic oil change: 290cc

Oil change after disassembling: 330cc

Recommended oil: SAE 90 API "GL-4" Hypoid gear oil.

- **Torque value:**
M12 drain bolt: 2.6kgf-m
M16 filler bolt: 2.6kgf-m



18-04. Front Differential Gear Box

a. Front differential gear box removal

Refer to 17-08 to disconnect/install the couplings with engine.
Clean gear box before removing.

Clean gear box before removing.

- Drain out the gear oil by loosening drain bolt under the gear box.
- Unscrew three bolts and remove nuts/washers/differential gear box.
 - Loosen the all bolts in stage, then remove them.
- Release the breath pipe/ wire harness and remove the front differential gear box out.
 - Be careful to disconnect the coupling.
 - Remove differential gear box with gear motor and driven shaft as a set.



b. Inspection

- Never dismantle gear motor ass'y, replace it as whole component, if necessary.
- Lash adjustment have been done inside the

differential gear box. Do not suggest to open the differential gear box without experience.

- Check bearings damaged → replace
- Check bevel gears damaged → replace
- Check the breath hose pipe broken/crack/damaged → replace
- At once change any gears, housing, cover → check the engagement lash, adjusting shims are necessary.

c. Differential Gear Box Installation

- Assemble front differential gear box sets as reverse steps.
 - tighten the bolts in stages, and torque the bolts as:

Toque value:

M10 Nut : 5.5kgf-m

M10*30 bolt: 5.5kgf-m

- apply loctite glue to M10*30 bolt
 - Put the gear box from left side of chassis and be careful to the gear motor and connect the drive shaft to the engine.
- Install back the drain bolt (& drive rear axles) then refill gear box oil then fix filler bolt.
 - replace a new washer
 - apply enough grease on oil seals/drive shaft/axles.
 - gear oil (refer to 2-19)

Periodic oil change: 290cc

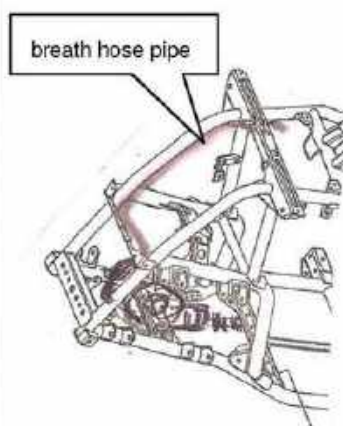
Oil change after disassembling: 330cc

Recommended oil: SAE 90 API "GL-4" Hypoid gear oil.

- **Torque value:**
M12 drain bolt: 2.6kgf-m
M16 filler bolt: 2.6kgf-m

- Ensure breath hose pipe to follow the chassis pipe

- Connect wire harness of gear motor.
 - Do not dismantle gear motor, replace a whole set.



18-05. Gear Motor Checking

Max700 built a front differential gear box with 2WD-4WD-diff.lock functions by electrical motor. To read owner manual carefully is advised before you handle your ATV. Unfamiliar operating may properly damage some components.

I would like to enclose following steps to show how to check and install the electrical gear motor.

Set the switch to the 2WD function then disconnect the harness of gear motor (26650-MAX-00) from gear position switch (62350-MAX-00) and disassemble the gear motor from diff. gear box.

Firstly, do not open the gear motor

(26650-MAX-00).

Secondly, check the gear motor whole set (26650-MAX-00) working correctly or not.

a) Check the point of gear matching to the mark of cover or not (of course, they are in 2WD function).

⇒ If not, please replace a new gear motor and go to

b) Connect the gear motor harness and re-test 2WD-4WD-Lock again and again

c) At the same time of b), also check to the LCD 2WD-4WD-LOCK showing correctly.

d) Finally, switch to 2WD, and check to the LCD.

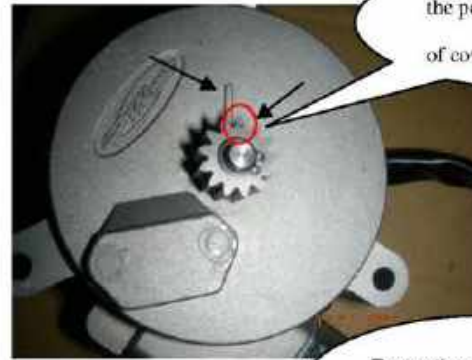
If show 2WD still → install gear motor back

If show 2WD flashing → replace a new gear motor

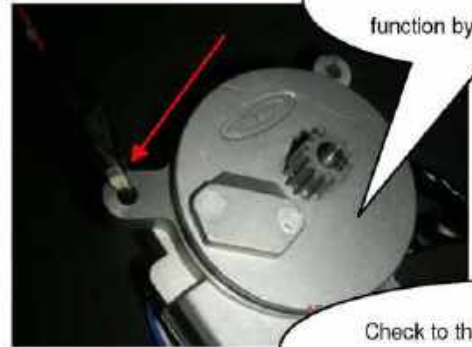
→ install the new gear motor to diff gear box

Thirdly, install gear motor back to diff gear box

1) Ensure to move the sliding gear (26661-MAX-00) to the right end as possible as you can as picture.



the point match to the mark of cover at 2WD condition



Re-try the 2-4-lock function by plug-in back



Check to the LCD matching to the 2-4-lock function.



Move the sliding gear to the right end

2) Ensure the gear motor to be 2WD and smoothly install it back to the diff gear box.

- Smell some lubricant to the oil ring of gear box and push gear box evenly to diff gear box. At the same time, ensure the sliding gear not moving backward for the engagement of gear motor.
- Before screwing the three screws, check the sliding gear again. If moving backward, not correctly engaging (the small gear and sliding gear) and try it again.
- Screw the three screws evenly
- Plug-in harness back to gear position switch (62350-MAX-00)

Re-check the function

Switch 2WD-4WD-Lock function and check to the LCD and test a ride

⇒ If not function still, redo the above process

Evenly engage the gear motor (the small gear) to the sliding gear and ensure sliding gear not moving backward.



To switch 2-4-lock function and check to LCD.



NOTE:

19-01. Mechanism Diagram
19-02. Introduction
19-03. Chart
19-04. OBD
19-05. ECM
19-06. Injector / Injector cap
19-07. Throttle Body
19-08. Fuel Pump ass'y / Fuel tank
19-09. Fuel delivery hose
19-10. Oxygen sensor / Exhaust-pipe
19-11. Ignition Coil
19-12. Engine Temperature sensor
19-13. Gear position switch
19-14. Crank Position sensor/ Generator ass'y
19-15. Relays control
19-16. Speedometer
19-17. Lean switch
19-18. Fault code

19-01 Mechanism Diagram





19-02. Introduction

How Electronic Fuel Injection Works

Electronic Fuel injection works on the some very basic principles. The following discussion broadly outlines how a basic **Electronic Fuel Injection (EFI)** system operates.

The Electronic Fuel Injection system can be divided into three basic sub-systems. These are the fuel delivery system, air induction system, and the electronic control system.

The Fuel Delivery System

- the fuel delivery system consists of the fuel tank, fuel pump, fuel filter, fuel delivery pipe, fuel injector and VSR.
- Fuel is delivered from the tank to the injector by means of an electric fuel pump. The pump is located in the top of fuel tank. Contaminants are filtered out by a high capacity in line fuel filter.
- Fuel is maintained at a constant pressure by means of a VSR in fuel pump assembly. Any fuel which is not delivered to the intake manifold by the injector is returned to the tank through a fuel return function.

The Air Induction System

- The air induction system consists of the air cleaner, throttle body and intake manifold.
- When the throttle valve is opened, air flows through the air cleaner, past the throttle valve to intake manifold.
- Air delivered to the engine is a function of rider demand. As the throttle valve is opened further, more air is allowed to enter the engine cylinder.
- The EFI system measures air flow indirectly by monitoring the pressure in the intake manifold.

Electronic Control System

- The electronic control system consists of various engine sensors, Electronic Control Module (ECM), fuel injector assemblies, and related wiring.
- The ECM determines precisely how much fuel needs to be delivered by the injector by monitoring the engine sensors.
- The ECM turns the injector on for a precise amount of time, referred to as injection pulse width or injection duration, to deliver the proper air/fuel ratio to the engine.

Basic System Operation

- Air enters the engine through the air induction system where it is measured by ECM. As the air follows into the cylinder, fuel is mixed into the air by the fuel injector.
- Fuel injectors are arranged in the intake manifold. The injectors are electrical solenoids which are operated by the ECM.
- The ECM pulses the injector by switching the injector ground circuit on and off.
- When the injector is turned on, it opens, spraying atomized fuel.
- As fuel is sprayed into the intake airstream, it mixes with the incoming air and vaporizes due to the low pressures in the intake manifold. The ECM signals the injector to deliver just enough fuel to achieve an ideal air/fuel ratio, often referred to as stoichiometry.
- The precise amount of fuel delivered to the engine in a function of ECM control.
- The ECM determines the basic injection quantity based upon measured intake air volume and engine rpm.
- Depending on engine operating conditions, injection quantity will vary. The ECM monitors variables such as coolant temperature, engine speed, throttle angle, and exhaust oxygen content and makes injection corrections which determine final injection quantity.

Advantages of EFI

Uniform Air/Fuel Mixtures Distribution

Cylinder has its own injector which delivers fuel directly to the intake. This eliminates the need for fuel to travel through the intake manifold, improving cylinder to cylinder distribution.

Highly Accurate Air/Fuel Ratio Control Throughout All Engine Operating Conditions

EFI supplies a continuously accurate air/fuel ratio to the engine no matter what operating conditions are encountered. This provides better drive ability, fuel economy, and emissions control.

Superior Throttle Response and Power

By delivering fuel directly at the back of intake, the intake manifold design can be optimized to improve air velocity at the intake. This improves torque and throttle response.

Excellent fuel Economy With Improved Emissions Control

Cold engine and wide open throttle enrichment can be reduced with an EFI engine because fuel puddling in the intake manifold is not a problem. This results in better overall fuel economy and improved emissions control.

Improved Cold Engine Start-ability and Operation

The combination of better fuel atomization and injection directly at the intake improves ability to

start and run a cold engine.

Simpler Mechanics, Reduced Adjustment Sensitivity

The EFI system does not rely on any major adjustments for cold enrichment or fuel metering. Because the system is mechanically simple, maintenance requirements are reduced.

Self Diagnosis System

A self diagnosis system is incorporated into all ECM in order to ensure that fuel injection system is operating normally. If this function detects a malfunction in the system, it immediately operates the engine under substitute characteristics and illuminates the engine trouble warning light to alert the rider that a malfunction has occurred in the system. Once a malfunction has been detected, a fault code is stored in the memory of the ECM.

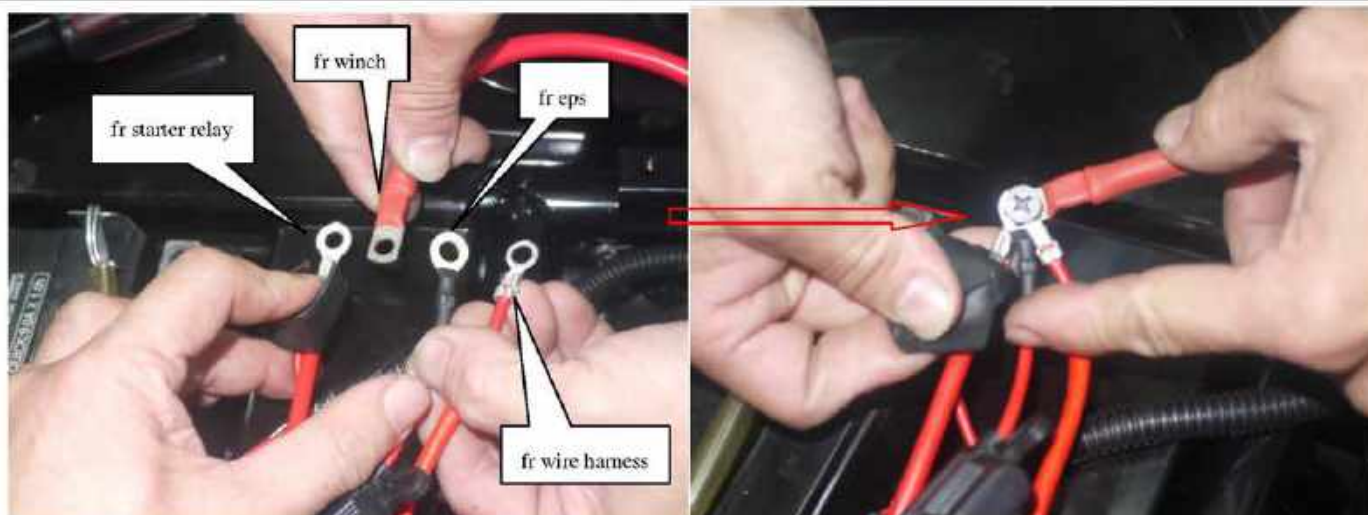
19-03. Chart

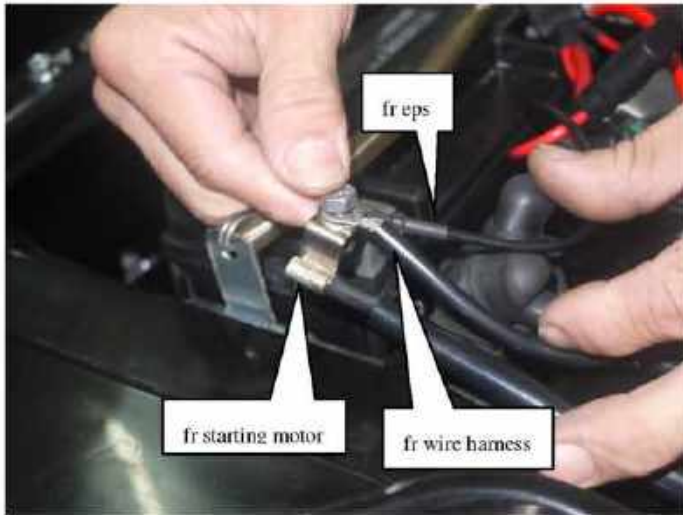
- Pre-delivery Inspection flow chart

Checking engine no. & frame no.



Refuel Gasoline & install battery (+/-) as picture





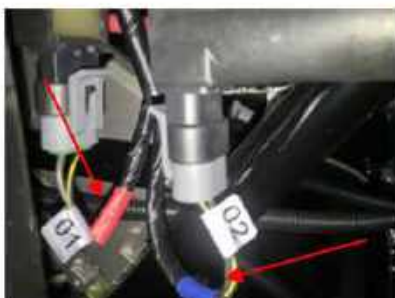
Inspect injectors, coils & O² sensors correctly installed and connected

Awareness: Red labels calls for first cylinder (front part); blue labels calls for second cylinder (rear part).

- a. if injectors lean → correct it
- b. if injectors installation with clearance → correct it
- c. injectors shall be engaged by injector caps (refer to 2-26 / 5-05)
- d. if injectors misplaced harness, it will be without idle after warm-up → correct it



- e. if coils misplaced harness, it will not start engine → correct it



f. if O₂ sensors misplaced harness, BLM value incorrect → correct it



↓ correct installations and connections

Turn on main switch → MIL brighten → check fuel pump function

=> turn on main switch => doesn't get any response from fuel pump => check related circuit (ex. connection loose, relay function, fuseetc) => to get fuel pump working

=> fuel pump working => to hear the pumping sound from fuel pump lasting for more than 2~3 seconds

=> if sounds less 2 seconds → replace ECM => retry it to get correct pump sound

=> if no sounds → check to related connections => correct it to get correct pump sound

↓ correct fuel pumping working

Start engine at MIL bright

=> can't start engine => connect OBD to inspect the troublesome issues (Note 1) => correct it and retry it

↓ engine starting

Check speedometer the MIL extinguish

=> MIL still bright => connect OBD to inspect the troublesome issue (Note 1) => correct it and retry it.

↓ MIL extinguish

Finish

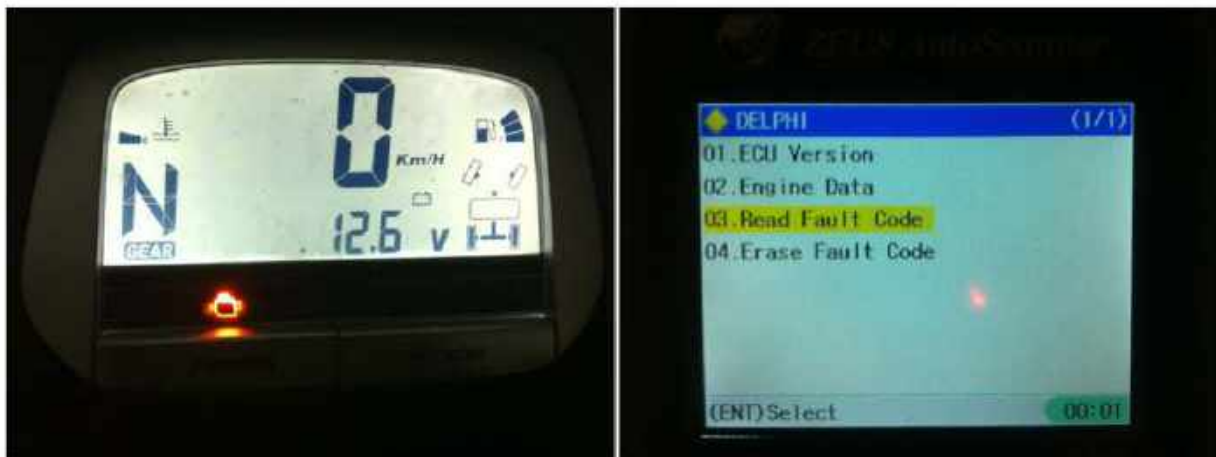
Note 1:

Exclude troublesome issue

MIL still bright

↓

Connect OBD to read fault codes



Inspect TPS AD on 5000~8500

=> if not in the range => adjust it (Remark 3) to be in the range



Inspect TPS position $\leq 0.3\%$

=> if not => check the throttle cable or throttle body function => adjust it to be correct



Start engine and run for 5 seconds



Turn off main switch for 15 seconds at least then re-start engine

=> 15 seconds is for ECM self-diagnosed



engine starting and running

The engine running in with choke function (rpm raise to 2000~2200 in cold starting and 1700~1900 in hot starting) and go down to be idle (1200±100) quickly

=> without choke function => check TPS AD => not in the range (8500~13000) => adjust TPS AD (Remark 3) to be in the range



↓ with chock function

Check Idle speed in a stable rpm (1200±100)

=> unstable => re-check and re-adjust a) TPS in the correct range b) Desired Motor Step (Remark 2) to be proper range



↓ stable idle

Turn lens switch over 65° to check it's function => engine cut off in 3 seconds

=> NG => replace lens switch



↓

Switch off main switch and re-start engine

↓ engine running

coolant temperature reaches 80° => inspect air induction effectiveness →

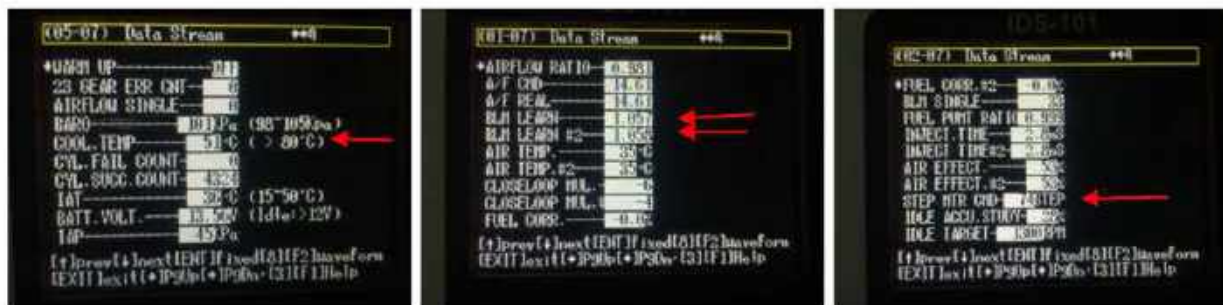
a) BLM multiplier b) MAP multiplier => allowance in 0.8~1.2

=> inspect desired motor step

↓

=> if BLM(block learning memory) & MAP multiplier allowance not in 0.8~1.2 → it might be in air leaking condition, check air induction system(air cleaner, TB, intakes, injectors...)

=> correct it



↓

Execute other final inspection steps

=>adjust or correct it

↓

Finish

Remark 1

At once repalcing or adjsuting EFI parts, please always do the following to ECM self-diagnosis, it can imporve the effectiveness of engine running.

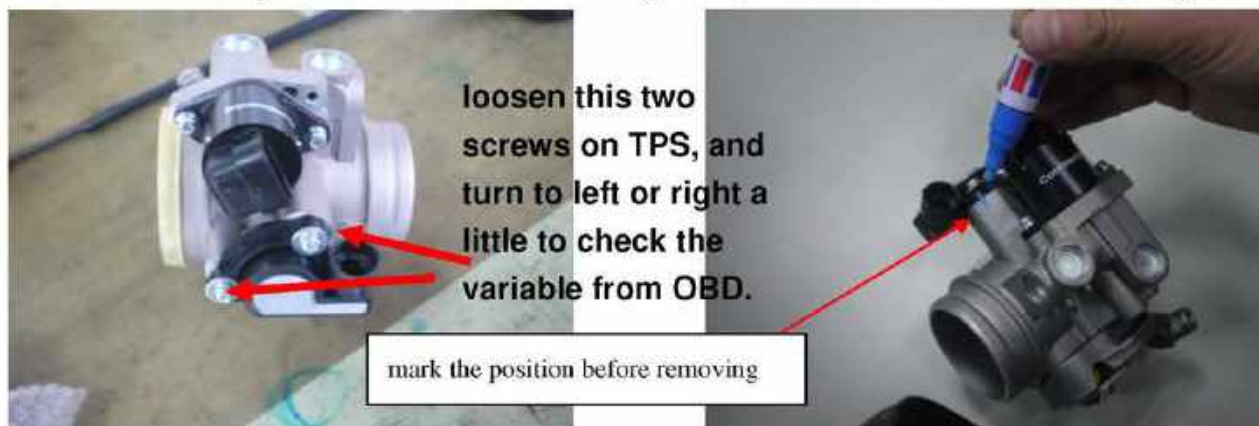
=> restart enigne and swtich off engine running for more than 15 seconds and restart engine

Remark 2

Desired motor step built-in 30~40 steps at coolant temperature 80°, but it's not absolute. In normal, it also runs well during 20~60 steps. If the steps lower than 10 or higher than 80, the idle speed maybe in unstable condition → adjust TPS position on TB to get the proper steps as built-in and recheck the TPS AD or to replace whole throttle body (TB).

Remark 3

TPS AD value adjustment => switch off engine for 15 seconds and restart engine


Remark 4
Fault code table

Fault code	Messages on fault code	message
P0031	O ² A heater circuit low voltage	first O ² heater shortage
P0032	O ² A heater circuit high voltage	first O ² heater high frequency shortage
P0037	O ² B heater circuit low voltage	second O ² earth shortage
P0038	O ² B heater circuit high voltage	second O ² high frequency shortage
P0107	MAP circuit low voltage or open	MAP earth shortage or open
P0108	MAP circuit high voltage	MAP high frequency shortage
P0112	ITA circuit Low voltage	ITA earth shortage or open
P0113	ITA circuit High Voltage	ITA high frequency shortage or open
P0117	Coolant/oil temperature sensor circuit low voltage	CTS earth shortage
P0118	Coolant/oil temperature sensor circuit high voltage	CTS high frequency shortage or open
P0122	TPS circuit low voltage or open	TPS earth shortage or open
P0123	TPS circuit high voltage	TPS high frequency shortage
P0131	O ² A circuit low voltage	first O ² circuit earth shortage
P0132	O ² A circuit high voltage	first O ² circuit high frequency shortage

P0137	O ² B circuit low voltage	second O ² circuit earth shortage
P0138	O ² B circuit high voltage	second O ² circuit high frequency shortage
P0201	Injector 1 circuit malfunction	first injector circuit shortage
P0202	Injector 2 circuit malfunction	second injector circuit shortage
P0230	FPR coil circuit low voltage or open	fuel pump circuit earth shortage or open
P0232	FPR coil circuit low voltage or open	fuel pump circuit high frequency shortage
P0336	CKP sensor noisy signal	crank position sensor circuit interference
P0337	CKP sensor no signal	crank position sensor got no message
P0351	Cylinder 1 ignition coil malfunction	first cylinder ignition circuit shortage
P0352	Cylinder 2 ignition coil malfunction	second cylinder ignition circuit shortage
P0444	CCP low voltage or open	charcoal canister valve earth shortage/open
P0445	CCP high voltage	charcoal canister valve high frequency shortage
P0500	Vehicle speed sensor no signal	speed sensor got no message
P0505	Idle speed control error	idle control shortage
P0562	System voltage low	system voltage low error
P0563	System voltage high	system voltage high error
P0650	MIL circuit malfunction	malfunction indicator lamp error
P0850	Park Neutral Switch Error	input error on neutral message
P1693	Tachometer circuit low voltage	rpm output circuit earth shortage
P1694	Tachometer circuit low voltage	rpm output circuit high frequency shortage

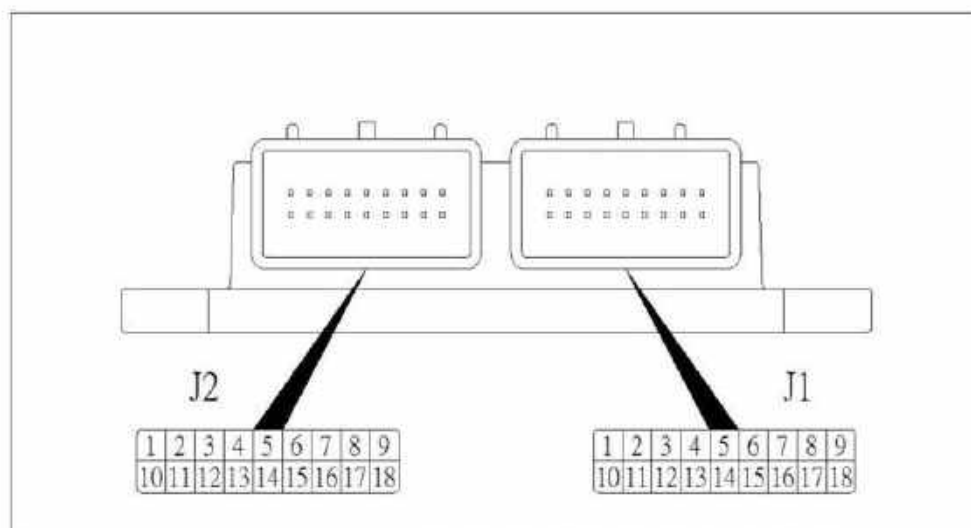
a. Exclude the troublesome and MIL is still "ON" → it may erase fault code in ECM by manual

(b.) → restart engine and check engine

b. Erase fault code by manual

- 1) to switch off engine by key for 15 seconds
- 2) to switch on/switch off 5 times within 5 seconds
- 3) to switch on again to be "RESET"

- **Terminal Alignment of ECM coupler**



Terminal Names

J1	J2
1.Idle air Control Valve(IACV) A High	1.Ignition Coil Signal A (1 cylinder)
2.Canister solenoid valve	2. Power ground (system)
3.Fault light	3.KW2000 (vehicle on-road diagnosis sys
4. 2 cylinder heating oxygen sensor	4.Crankshaft Sensor signal high (23tooth)
5. 2 cylinder oxygen sensor signal	5.Injector Signal A
6.Tachometer signal	6. Injector Signal B
7.CAN signal low line	7.O2 Sensor Heating 1 cylinder
8.CAN signal high line	8.Inlet Air Temperature signal
9.Power grounding (system)	9.Fuel Pump Relay Signal
10. 2 cylinder ignition coil driver	10. 5V Reference Voltage Ground
11.Idle Air Control Valve(IACV) A Low	11.Inlet Air Pressure Sensor Signal
12. Idle Air Control Valve(IACV) B High	12.Throttle Position Signal
13. Idle Air Control Valve(IACV) B Low	13.Crankshaft sensor signal low (23 tooth)
14. Dumping of sensor	14.Cylinder head Temperature Signal
15.Vehicle speed sensor	15.Ignition Power supply
16.2WD/4WD Shift Switch Signal 2WD/4WD	16. 5V Reference voltage
17. Unused	17. 1 cylinder O ² Sensor Signal
18.Reverse Switch Signal	18.Battery Power

Note 2 Example of standard OBD readings on ML850

(01-07) Data Stream **4

- *AIRFLOW RATIO— 0.999
- A/F CMD— 14.61
- A/F REAL— 14.61
- BLM LEARN— 1.057
- BLM LEARN #2— 1.058
- AIR TEMP.— 35°C
- AIR TEMP.#2— 35°C
- CLOSELOOP MUL.— -8
- CLOSELOOP MUL.#— -4
- FUEL CORR.— -0.0%

[↑]prev [↓]next [ENT]f ixed[8][F2]Waveform
[EXIT]exit [↵]PgUp [↵]PgDn [3][F1]Help

IDS-101

(02-07) Data Stream **4

- *FUEL CORR.#2— 0.0%
- BLM SINGLE— 33
- FUEL PUMP RATIO 0.999
- INJECT.TIME— 2.8ms
- INJECT.TIME#2— 2.8ms
- AIR EFFECT.— 53%
- AIR EFFECT.#2— 53%
- STEP MTR CMD— 74STEP
- IDLE ACCU.STUDY— 22%
- IDLE TARGET— 1300RPM

[↑]prev [↓]next [ENT]f ixed[8][F2]Waveform
[EXIT]exit [↵]PgUp [↵]PgDn [3][F1]Help

(03-07) Data Stream **4

- *IDLE OFFSET— 27RPM
- CURRENT DTC— P0000
- HISTORY DTC— P0131
- RUNNING TIME— 168sec
- IGN. ANGLE CMD— 8°CA
- IGN. ANGLE— 8°CA
- DYNA. IGN. ANGLE— 0°CA
- IGN. CHARGE— 1.2ms
- FUEL CUTOFF— OFF
- OVERSPD CUTOFF— OFF

[↑]prev [↓]next [ENT]f ixed[8][F2]Waveform
[EXIT]exit [↵]PgUp [↵]PgDn [3][F1]Help

(04-07) Data Stream **4

- *TILTED SWITCH— OFF (OFF)
- FUEL PUMP RUNNING— ON
- O2S HEATER— ON
- IGN. SWITCH— ON
- IDLE SPEED STATE— ON
- P/N SWITCH— ON
- DIAG. SWITCH— OFF
- MIL— OFF (OFF)
- SEQUENCE IGN. MODE— ON
- ENGINE RUNNING— ON

[↑]prev [↓]next [ENT]f ixed[8][F2]Waveform
[EXIT]exit [↵]PgUp [↵]PgDn [3][F1]Help

(05-07) Data Stream **4

- *WARM UP— OFF
- 23 GEAR ERR CNT— 0
- AIRFLOW SINGLE— 0
- BARO— 101kPa (98~105kPa)
- COOL. TEMP.— 51°C (> 80°C)
- CYL. FAIL. COUNT— 0
- CYL. SUCC. COUNT— 4324
- IAT— 38°C (15~50°C)
- BATT. VOLT.— 13.56V (Idle:>12V)
- IAP— 45kPa

[↑]prev [↓]next [ENT]f ixed[8][F2]Waveform
[EXIT]exit [↵]PgUp [↵]PgDn [3][F1]Help

(06-07) Data Stream **4

- *IAP COMP.— 43kPa
- IAP CMD— 45kPa
- IAP ANGLE— 182.9°CA
- O2S SENSOR VALID— ON
- O2S SENSOR VALID #— ON
- O2S VOLT.— 302.2mV (0~1000)
- O2S VOLT#2— 465.0mV
- ENGINE RPM— 1218RPM (Idle: 800~2000)
- TPS— 0% (Idle < 3.0%)
- TPS COMP.— 0%

[↑]prev [↓]next [ENT]f ixed[8][F2]Waveform
[EXIT]exit [↵]PgUp [↵]PgDn [3][F1]Help



19-04. OBD (On-Board Diagnostic)

a. OBD provided

SMC provides a special OBD to diagnosis the any troublesome in EFI system.

- Remove the front panel and find the coupler of diagnostic.
- Remove the protection cap
- Connect the OBD to diagnosis functions.
- Turn on switch to run OBD.
- Store OBD in box always and keep it dry.



19-05. ECM

In briefly, ECM is a unit collecting all working messages from engine and vehicle running. ECM works under pre-setup standardized elements by injector, IACV, fuel pump, ignition ...to mission activities in a optimum condition.

The ECM is equipped with a self-diagnostic function in order to ensure that fuel injection system is operating normally. If this function detects a malfunction in the system, it



immediately operates the engine under substitute characteristics and illuminated the engine trouble warning light in speedometer to alert the rider that a malfunction has occurred in the system. Once a malfunction has been detected, a fault code is stored in the memory of the ECM.

- Terminal Alignment of ECM coupler (refer to 19-03)
- Plug-in and out ECM
 - Only plug in and out in switch off
 - Always hold the unit to plug-in or out the couplers
 - To less to plug in and out as possible as you can
 - Correctly install two couplers
- Working and Storing
 - ECM works in temperatures range -20°C ~ 80°C
 - Keep it in a clean, dry and ventilation
 - Keep it away from electromagnetic part
 - Fix ECM firmly
 - Additional relay to protect ECM, check relay firstly at once showing ECM issue.



19-06. Injector / Injector cap

Injector is a electromagnetic coil ass'y which receiving messages from ECM to turn "ON" or "OFF" on sphere vale to control injecting timing.

- Working
 - with multi-point injector
 - fuel pressure at 350 kPa constantly
 - temperature -30°C ~ 120°C
- Installation
 - to compose injector and cap
=> smell gasoline on the o-ring of injector and manifold matching hole



=> slightly turn and downward push injector to manifold matching hole

=> latch the cap to injector and match to the fixing bolt holes.

=> fix screw to the injector

=> do the same procedures for another injector.

- Install manifold comp. (with injectors) to engine
 - => refer to 5-05
 - => beware the color of harness to injectors for front and rear cylinders (do not mistake the connections).

- Inspection
 - clogged => clean by supersonic machine or add cleaning solvent
 - leakage => replaced
 - shortage checked by circuit tester => replaced
 - ensure connection => less to plug in and out
- Intake manifold
 - Refer to 5-05



19-07. Throttle Body

Throttle body control the clean air into engine by valve. Air get into cylinder through intake and mix with fuel from injector. To control the air properly by sensors on it and ECM.

- Refer to 4-04 & 4-05
Suggest not to dismantle throttle body without professional trainings
- Inspection & cleaning
 - Prior to disassembly, mark the CTS original position with paint for accurate reinstallation
 - Make sure the valve open and close smoothly. If CTS adjustment is necessary, refer to 19-03.
 - Clean passageways with a spray-type cleaner and blow dry with compressed air. Do not use wire to clean passageways. If the components can't be cleaned it may be necessary to use a dip-type cleaning solution and allow them to soak. Follow the instructions carefully. Do not apply cleaning chemicals to the rubber and plastic materials.

Warnings:

- 1) Some cleaning chemicals, especially dip-type soaking solutions, are very corrosive and must be handled carefully.



2) Normally, the removed O-ring must be replaced with a new one. Replaced the component if o-ring not provided as spare.

19-08. Fuel pump assembly / Fuel tank

The fuel in the fuel tank is pumped up by the fuel pump and pressurizes fuel flows into the injector installed in the intake manifold by fuel delivery pipe. Fuel pressure is regulated by VSR in the pump ass'y. As the fuel pressure applied to the fuel injector is always kept at absolute fuel pressured of 350 kPa, the fuel is injected in conic dispersion when the injector opens according to the injection signal from the ECM. ECM get message from CSS (crankshaft sensor) at once turning on main switch, it will not work when crankshaft doesn't work.

There is no fuel return hose.

Attention: Do not dismantle fuel pump without professional trainings. To keep a good condition for riding, a period replacing whole set fuel pump is necessary in every 3~ 4 years running.

- Refer to 4-06 & 4-08.
Suggest not to dismantle fuel pump ass'y without professional trainings.
- Working
 - constant fuel pressure at 350kPa
 - under fuel temperature 60°C
- Assembling / Installation
 - VSR assembling

1) smell gasoline on o-ring and white edge



- 2) install VSR to pump bracket
- 3) cover the VSR fixing plate (cutting edge forward to inside)
- 4) fix the two screws by certain torque.

Fixing Torque: 1~1.5 kg/m

- fuel filter / pump assembling
 - 1) notice the flow direction

- 2) ensure two hoses installed with firmly clamps.

- 3) fuel pump fixed with a damper installing to bracket and connect to hose

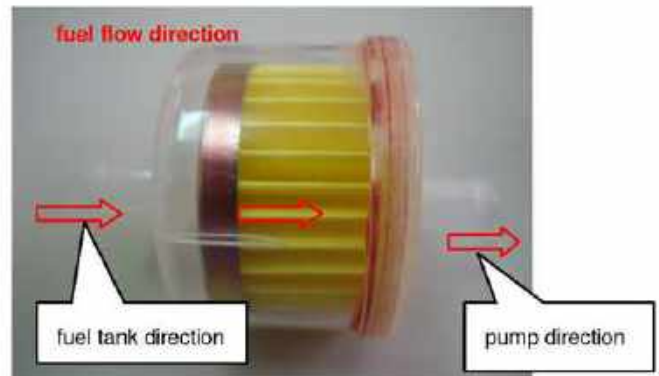
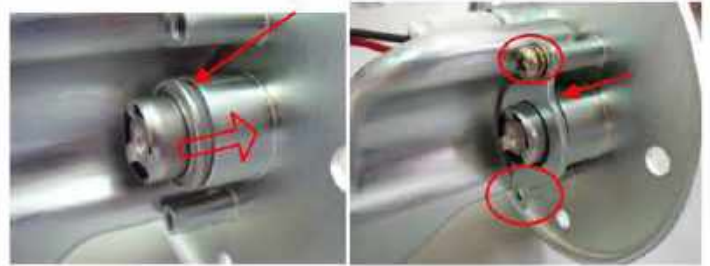
- 4) Connect harness and ensure coupler firmly connection

- 5) fix the clamp for pump by screw

Fixing torque: 1~1.5 kg/m

=> the damper have to be matched to the plate

=>can not crash the pump



- Inspection and attentions:
 - leakage checking
 - a) enough fuel in the fuel tank
 - b) switch on for 3 seconds and switch off for 15 seconds for 3~4 times
 - c) check the fuel pump assembly leakage
 - Check fuel pressure
 - => use gauge to check fuel pressure. Connect to fuel delivery hose.

Fuel pressure: 350kPa

- => replace a new delivery hose
 - a) All components can't be touched each other.
 - b) Replace hose pipes at least in every 3 years running
 - => crash/aged/uneven=> replaced
 - c) Always replace a new clamps
 - d) Do not pump the fuel pump without fuel
 - e) Do not pick up fuel pump by pulling harness
 - f) Ensure correct clamps, screws and hoses.
 - g) Do not exhaust fuel in the fuel tank
 - h) Do not torture filter element in fuel tank
 - i) Filter have to be checked in every 500~1000 km running.
 - Deteriorated/clogged=> replaced
 - Damaged => replaced
 - j) Fasten well on harness averting from sharp edge or steel parts

- Removal
 - Release fuel from fuel pump
 - 1) shift the gear to be neutral



- 2) disconnect wire harness from fuel pump
- 3) start engine to run till stop running
- 4) switch on/off for 3 seconds for 3 times

Attention:

Release all fuel before removal.

Work in well ventilated area.

Keep away from fire or spark.

Do not reuse clamp.

19-09. Fuel delivery hose

Fuel delivery hose delivery the fuel from fuel tank to injector at absolute fuel pressure of 350kPa. It's with high destiny rubber and secured by firm clamps. Disposable clamp also used on the both ends.

- Removing or reinstalling fuel delivery hose, always hold the opposite component (fuel pump ass'y or injector ass'y and manifold)
- Inspect fuel delivery hose within every 3 months or 700~1000 km.
- Replace fuel delivery hose within every 3 years.
- Any damage/leakage/aged/uneven => replace
- Replace new clamps in every removing
- Disposable clamp have to be locked up/released only by special tool. Always dispose released one.



19-10. Oxygen sensor / exhaust pipe

O² sensor is a element with multilayer ceramic. Zirconia is the most one. O² sensor is equivalent to a kind of battery which differ to the oxygen ions on both + - (in/out) electrodes to identify the air/fuel ratio (A/F) and send message to ECM.

- Working
 - Ideal working temperature 650°C~800°C
 - Works 1000°C in long run will reduced the life time.
 - Avoid to hit by objects when riding
 - Avert the frozen ice accumulated near sensor.
- Assemble
 - use wrench to fix the two O² sensors to exhaust-pipe

Torque: 4~6 kg/m (40~60Nm)

- connect wire harness
=> avoid to torture the ex-harness
- Inspection
 - damage/removal/aged=> replaced
 - shortage => replaced
- Removal
 - Always remove exhaust-pipe unit with O² sensor when maintenance
 - Refrain to remove O² sensor itself, the unit coated with anti-sintering agent to decrease burnt. To coat anti-sintering agent before reinstalling back the unit,



otherwise, replace a new one.

- Exhaust-pipe
Refer to 5-04

19-11. Ignition coil

Primary coil start to charge under ECM message and high voltage generated to spark plug ignite. ECM take control on ignition, pause and sparkling.

- Installation
 - ground wire have to be connect to coil ass'y
 - a bolt to fix to frame
Torque: 1 kg/m (10 Nm)
 - Connect wire harness to both ignition coils.
 - ➔ red line to front ignition and blue line to rear ignition.
 - ➔ the front ignition cap (with red line) install to front cylinder and rear ignition cap install to rear cylinder

Warnings:

Beware the front and rear cylinder to match the related color harness, RED for front cylinder and BLUE for rear cylinder.

- Turn both spark plug caps to both spark plugs
 - => firmly into proper positions (red => front and blue => rear)
 - => move forward and backward to check



- Inspection

No high voltage output

- primary peak voltage checking
=> connect multi-circuit tester
 - 1) Shift the gear to the neutral, turn the ignition switch "ON"
 - 2) Press the starter button and allow the engine to crank for a few seconds, and then measure the ignition coil primary peak voltage.

**Ignition Coil primary peak voltage
80V or more**

=> replace it if not in the range

- Ignition coil resistance checking
=> connect multi-circuit tester
=> measure ignition coil resistance in both the primary and secondary coils.

Ignition coil resistance:

Primary: $0.58 \pm 0.058 \Omega$

((+) terminal – (-)Ground)

Secondary: $7.1 \pm 0.71 k\Omega$

(spark plug cap – (-) terminal)

19-12. Engine temperature sensor

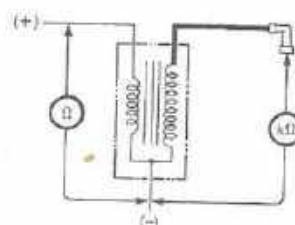
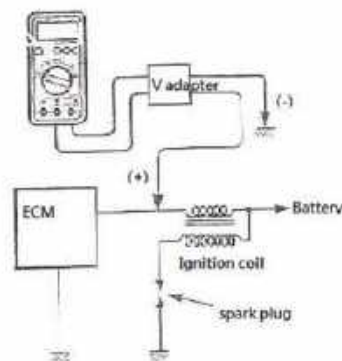
ETS sends message to EMS, EMS determine the engine working condition. In Delphi, it execute to sensor coolant and engine temperature and send two messages to ECM.

- Installation

- Use wrench to screw up to rear cylinder head

Torque: 1.5kg/m ($15 \pm 2 Nm$)

- Connect coupler correctly and lightly



($\leq 60\text{N}$)

- Inspection
 - Shortage/damage=> replaced

19-13. Gear Position Switch

It need to send related messages (2*4/4*4/speed control...) to speedometer.

- Identify the harness #1,#2 & #3 and install them to should-be positions as picture.
=> by clockwise #1,#2 and #3.
- Shortage => replaced
- after fixing the contacts, remind to glue the silicon for proof water.
- refer to 11-07



19-14. Crank Position Sensor / Generator

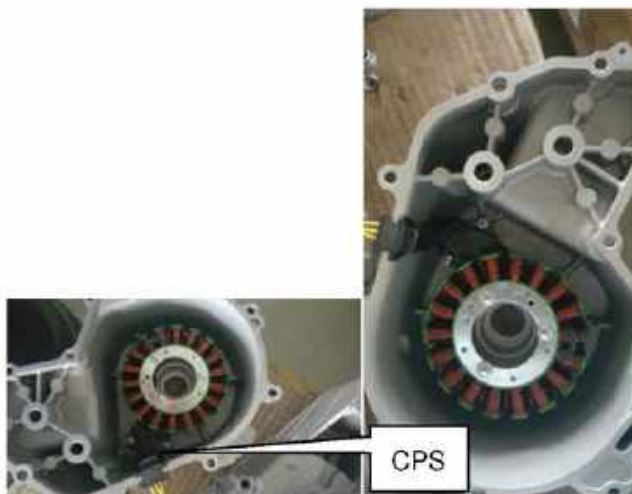
assembly

- Refer to 9-04
- Install generator to right cover of crankcase and fix CPS by two bolts correctly
- Ensure CPS output voltage $\geq 3.0\text{V}@300\text{rpm}$
- Ensure correct clearance between CPS and flywheel at 1.1mm

CPS clearance : 1.1mm

- Flywheel fixing in a certain torque.

Torque: 12 kg/m (120Nm)



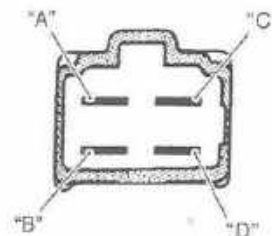
- Correctly connect coupler to harness

19-15. Relays control

For security for ECM/Fuel pump/Fan motor, SMC install three more relays to secure these three working systems.

-

Parts no.	Parts	Function	Coupler color
62550-SK2-00	relay	EFI system	black
62550-SK2-00	relay	Fuel pump	green
62550-SK2-00	relay	Fan motor	white



- Check Relay

First, check for insulation with the multi-circuit tester between terminals "A" & "B". Next, check for continuity between "A" and "B" with 12V voltage applied, positive (+) to terminal "C" and negative (-) to terminal "D". If continuity does not exist, replace relay with a new one.

19-16. Speedometer

The display is very important for rider and workshop. It contains many information on the operations and warning messages. To know well on the display is the very important for users. More and more electronic parts to be used on the vehicles and will be more and more display on the

speedometer.

- Identify the "ML9-00" on the back
- "check engine warning lamp" refer to 19-03.
- "eps" refer to 15-11 & Chapter 20.
- Refer to Instruction for speedometer.



EPS



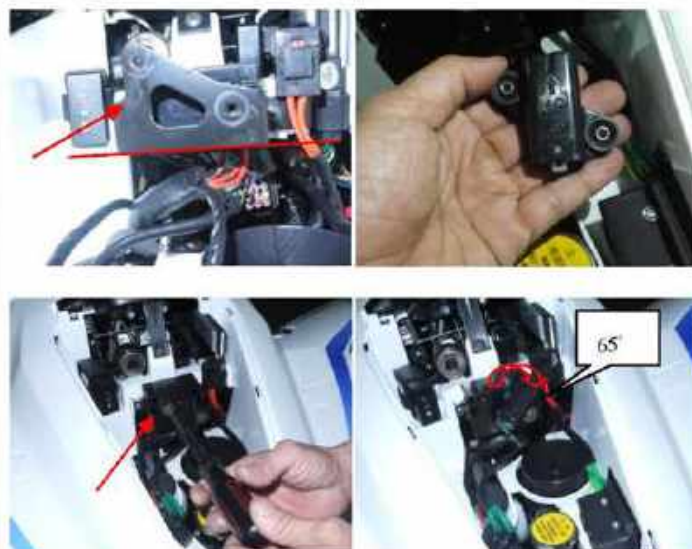
19-16. Lean switch (tilt sensor)

- Refer to 19-03.
- Installation
 - install it on the flat level
 - fix it as direction ↑ up to the bracket by two bolts

Fixing torque: 1.5~2.5Nm



- Inspection
 - check function
 - => start engine
 - => loosen a bolt
 - => tilt to more than 65° → engine stop
 - Tilt angle: 65°±10°
 - measure output voltage by circuit-tester
 - => set main switch to "ON"
 - => tilt the sensor angle to 65°
 - => measure output voltage
 - do not touch the contact of switch



19-17. Fault code

Refer to 19-03.

- **Fault code: P0107/P0108**
→MAP Circuit Low Voltage or Open / MAP Circuit High Voltage

Note: Delphi combine MAP/MAT in one unit, normally means IAP and IAT sensors separately.

- clogged vacuum passage throttle body and MAP
- Air being drawn from vacuum passage between throttle body and MAP
- MAP circuit open or shorted to the ground
- MAP sensor malfunction
- ECM malfunction
- Sensor voltage not within the range
 - $3.26V \leq \text{sensor voltage} \leq 6.6V$
 - =>sensor voltage is higher than specified value
 - sensor circuit is open or shorted to power sensors or ground circuit open
 - =>sensor voltage is lower than specified

value

→ sensor is shorted to the ground or power sensors open

Note: Atmospheric pressure varies depending on weather conditions as well as altitude. Take into consideration when inspecting voltage.

● **Fault code: P0112/P0113**

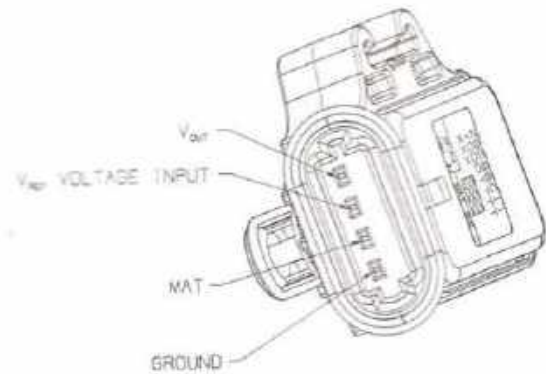
→ **IAT Circuit Low Voltage / IAT Circuit High Voltage or Open**

- MAT sensor circuit open or short
- MAT sensor malfunction
- ECM malfunction
- sensor voltage not within the range
 - $3.26V \leq \text{sensor voltage} \leq 6.6V$
 - => sensor voltage is higher than specified value
 - sensor circuit is open or ground circuit open
 - => sensor voltage is lower than specified value
 - sensor is shorted to the ground

● **Fault code: P0117/P0118**

→ **Coolant/Oil Temperature Sensor Circuit Low Voltage / Coolant/Oil Temperature Sensor Circuit High Voltage or Open**

- Installation condition checking => loosen or pinching
- Connections checking
 - => check the coupler of any pins that may pulled out.
 - => check the locking condition of the coupler
- Open or short circuit in wire harness
 - => repair or replace if there is an open or short circuit between CTS and ECM.
- Defective CTS => Use circuit tester check



the followings Ω

Defective => replaced

$^{\circ}\text{C}$	Ω
60	164.5 ± 16
80	82.6 ± 8
100	44.6 ± 4
115	28.7 ± 3
125	22.5 ± 2

● **Fault code: P0122/P0123**

➔ **TPS Circuit Low Voltage or Open / CTS**

(TPS) Circuit High Voltage

- CTS(TPS) maladjusted => refer to 19-03
 - CTS(TPS) circuit open or short
 - => check for looseness or pinching
 - => check the coupler for any pins that may have pulled out.
 - => check the locking condition of the coupler.
 - => any open or short circuit between CTS and ECU harness coupler
 - => Defective CTS
- 1) use circuit tester to check Ω
 - => $3\Omega \leq A \text{ \& \ } B \text{ ends} \leq 12\Omega$
 - 2) measure "C & A" and "C & B" Ω
 - => the value are smooth (not floating)
- ➔ not as 1) & 2) => replaced TPS

● **Fault code: P0131/P0132**

Fault code: P0031/P0032

Fault code: P0137/P0138

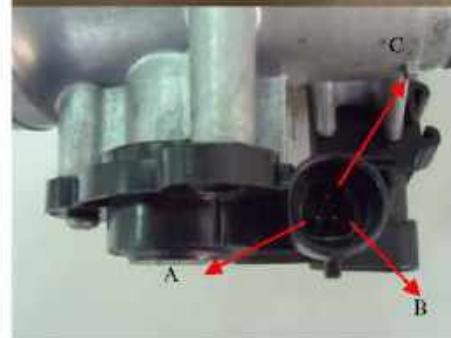
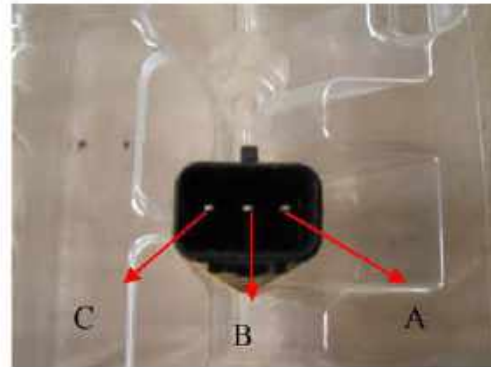
Fault code: P0037/P0038

➔ **O²S 1 Circuit Low Voltage/ O²S 1 Circuit High Voltage**

➔ **O²S Heater Circuit High Voltage/ O²S Heater Circuit**

Low Voltage

- Installation checking
 - => check for looseness or pinching
 - => check the coupler for any pins that may



have pulled out

=> fixing torque too much

=> malfunction on ECM

=> engine overheating

=> defective sensor

1) use circuit tester to check heater end Ω

$8\Omega \leq \text{heater end} \leq 11.2\Omega$

2) out of specification => replaced

● **Fault code: P0201/P0202**

➔ **Injector 1 Circuit Malfunction/ Injector 2**

Circuit Malfunction

- Connection checking
 - => check the couplers for any pins pulled out.
 - => installed in vertical
 - => fuel system pressure at 350kpa
 - => any open or short circuit between fuel injector coupler and ECU coupler
 - => defective injector
 - 1) clogged => clean
 - 2) use circuit tester check the Ω
- Specific $\Omega = 12 \pm 0.6\Omega$**
- 3) out of specification => replaced

● **Fault code: P0230/P0232**

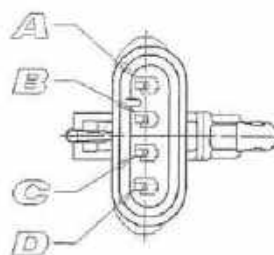
➔ **FPR Coil Circuit Low Voltage or Open / FPR**

Coil Circuit High Voltage

- Fuel pump relay circuit open or short
- Fuel pump relay malfunction
- ECM malfunction
- Fuel pump relay switch circuit shorted to power source.
- Faulty fuel pump relay
- Fuel pump relay coil circuit open or short
- refer to 19-15

● **Fault code: P0336/P0337**

➔ **CKP (crankshaft position)Sensor Noisy**



A: gray= sensor (ground)

B:black= sensor (output)

C:white= heater (-)

D:purple= heater (+)



Signal / CKP Sensor No Signal

=>The signal doesn't reach ECM for 3 sec. or more after receiving the starter signal.

- Connection checking: wire and couplers
- Metal particles or foreign material being stuck on the CKP sensor and rotor tip.
- CKP sensor circuit open or short
=> connect circuit tester (+) B (-) G
=> $400\Omega \leq \text{CKP} \leq 590\Omega$
=> out of specification → replaced CKP / stator
- CKP sensor malfunction
- ECM malfunction

● Fault code: P0351/P0352

→ Cylinder Ignition Coil Malfunction

- Connection checking:
wire/couplers/locking
- Open or short circuit
- Test the primary and secondary coil by circuit tester => refer to 19-11

● Fault code: P0505

→ Idle Speed Control Error

- TPS loosen => fix => refer to 19-03
- TPS not in the range => adjust => refer to 19-03
- Engine speed is high when idling
=> open circuit in harness
=> malfunction in the throttle body
=> malfunction in throttle cables
=> malfunction in ECM
=> relay defective
=> fuse blown
- refer to 19-03



● **Fault code: P0562/P0563**

→ **System Voltage Low/High**

- Battery output volt
 $10V \leq \text{battery output} \leq 16V$
- Connection checking
- Malfunction in charging system => refer to Chapter 21.
- Open or short circuit in harness
- Malfunction in ECM.

● **Fault code: P0650**

→ **MIL (malfunction indicator lamp) Circuit Malfunction**

- Connection checking: coupler, terminals, harness
- Relay and fuse checking
- Malfunction in ECM
- Malfunction in speedometer
- ECM self-diagnostic function checking and memory function checking
- refer to 19-03

● **Fault code: P1693/P1694**

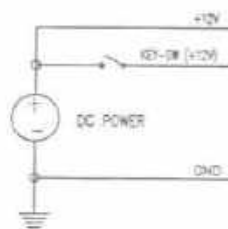
→ **Tachometer Circuit Low Voltage/ Tachometer Circuit High Voltage**

- Connection checking: coupler, terminals, harness
- open or short in harness
- relay and fuse checking
- ECM malfunction
- Speedometer defected
=> check the circuit
=> LED indicator function checking

● **Fault code: P0500**

→ **VSS No Signal**

Vehicle Speed Sensor located to the right side of engine. Sensor message send to speedometer



generating speed signal to ECM.

- Connection checking for coupler, terminals and harness.
- Open or short in harness
- Malfunction on ECM / speedometer
- Working temperature
-20°C ~150°C
- Defective VSS → replaced
=> deteriorated
=> overheated lubricant
=> damaged
=> degaussed

● **Fault code: P0850**

→ **Park Neutral Switch Error**

- Connection checking for coupler, terminals and harness.
- Open or short in harness
- Malfunction on ECM / speedometer
- Defective gear selector switch=> replaced
=> deteriorated
=> shortage
=> clogged
=> worn

● **Fault code: P0445/P0444**

→ **CCP short to high/ CCP short to low/open**

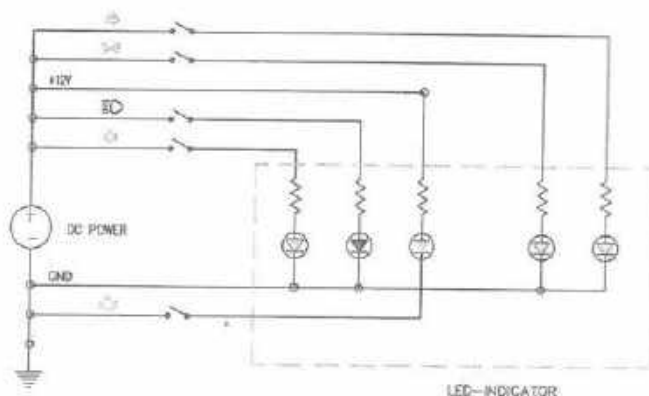
A canister solenoid valve to be used in vehicle.

- Check the connection
- Open or short in wire harness
- Malfunction on ECM

● **Fault code: P0171/P0172/P0174**

→ **BLM Max Adapt/ BLM Min Adapt/ PE system Lean**

- refer to 19-03



NOTE:

20-01. Mechanism Diagram
20-02. Introduction
20-03. Specifications
20-04. Operations
20-05. ECU Fault Code
20-06. Problem Shooting
20-07. OBD
20-08. ECU
20-09. Motor
20-10. Harness
20-11. Circuit

20-01 Mechanism Diagram



20-02. Introduction

Electric Power Steering (EPS) is a system which highly precision, sensitive and energy-saving, environmental protection and high-performance. EPS is equipped a control unit with a self-diagnostic function. If this function detects a malfunction in the EPS system, it lights the EPS warning light to alert the rider that a malfunction has occurred in the system.

- The EPS warning light comes on when the main switch is set to "ON", and then goes off once the engine is started. If the warning light remains on or comes on after the engine is started, the EPS system may be defective.
- The electrical circuit of the warning light can be checked by setting the main switch to "ON". If the warning light does not come on, the electrical circuit may be defective.

How Electric Power Steering Works

The internal torque sensor automatically measures the force and direction applied by the driver while steering , and relays the information to the ECU. The vehicle speed is also sent to the ECU and combined with the force and direction signal. A calculation is made and this is sent to the electric motor to create a controlled response movement. This is all done through intelligent ECU.

Advantages of EPS

EPS system helps the user in the steering more efficiency and easier no matter on riding or tracking. Although this system owns lots of protections in the abuse ridings, however, a understanding on EPS operation is necessary.

Self Diagnosis System

A self diagnosis system is incorporated into all ECU in order to ensure that EPS is operating normally. If this function detects a malfunction in the system, it immediately operates the motor under substitute characteristics and illuminates the warning light to alter the rider that a malfunction has occurred in the system. Once a malfunction has been detected, a fault code is stored in the memory of the ECU.

20-03. Specifications

EPS Assembly

Weight: 5.95 kg

Ratio: 21:1

Sensor: Non- contact

Waterproof Rating: IP7

Input Torque: 0.21 N-m

Output Torque: 0~80N-m

ECU

Weight: 0.85 kg

Supply Voltage: 12V

Max. Current: 30A

Average Power: 250W

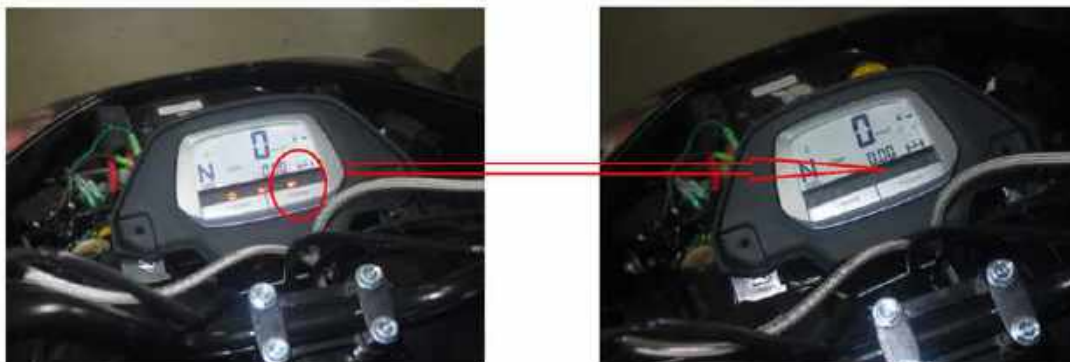
EMC Rating: ECE R10.05

Working Temperature: -40~85°C

20-04. Operations

Electric Power Steering (EPS) is a system which highly precision, sensitive and energy-saving, environmental protection and high-performance. In order to ensure the performance of the steering system, and improve the life of the steering system, we must insist on strict compliance with the following rules:

- The EPS warning light comes on when the main switch is set to "ON", and then goes off once the engine is started. If the warning light remains on or comes on after the engine is started, the EPS system may be defective.
- The electrical circuit of the warning light can be checked by setting the main switch to "ON". If the warning light does not come on, the electrical circuit may be defective.



- Do not dismantle the control box because you may change the parameters of the sensors and create an imbalance between the power to the right and left steering.
- Do not dismantle the housing/ motor, it may occur the power arrangement missing.
- Maintain a good battery, loss of battery power will result in heavy steering.
- Pack all electric connections with dielectric grease where possible to help against corrosion especially in damp humid conditions.
- Do not tap into the EPS electrical harness for any other aftermarket components this will affect the power supply to the system and create problems.
- Connector of the system must be in a good contact: avoid laying connectors in

damp, high temperature environment to ensure its good conductive.

- ECU must avoid high humid and high temperature conditions.
- Handling steering to the right end and left end, the motor positions in the end and assisting power reaches max. limit, the motor and ECU bring the heat. To control the steering handle is important to avoid the heating creations.
- When motor is working , you must not inset or extract the connector of controller, motor and sensor to protect them form its shocks of the current.
- The system will automatically switch to mechanical steering mode and won't affect the normal steering and driving. The fault light will flash regularly.

20-05. ECU Fault Code

Fault code table

Fault code	Messages on fault code	Suggestion
21	Main torque sensor disconnection	Check sensor wire harness
22	Main torque sensor output error (voltage is too high or low)	Check sensor wire harness
23	Vice torque sensor disconnected	Check sensor wire harness
24	Vice torque sensor output error (voltage is too high or low)	Check sensor wire harness
25	Main and vice torque difference is too large	Check sensor wire harness
26	Main torque sensor inner fault	Replace ECU
35	Current sensor zero offset is too large	Replace ECU
32	Motor disconnected	Re-insert wire of the motor
33	Current of ECU is over the limit	Replace ECU
34	One side of motor has no assistance	Replace ECU
36	Motor voltage abnormal	Check motor wire or plug

Fault code show at EPS indicator flashing message. Just check to the EPS indicator flashing condition to judge the possible fault. For example, fault code 21 → flashing (L)(O)(L)(O)(S) / fault code 32 → (L)(O)(L)(O)(L)(O)(S)(O)(S)

L: light up for 2 seconds S: light up for 1 second O: light off for 1 second; every interval 3 seconds.



20-06. Problem Shooting

1) no EPS light "ON" when key switch on

step	operations	yes	no	exclude
1	Inspect fuses(on power cord or main fuses box)	Go to 2	Fuse broken	Replace fuse
2	a) check to the main switch connections b) check to signal cord voltage = main switch voltage	Go to 3	Signal cord open / shortage	Re-connect
3	Check power cord voltage	Go to 4	Power code open or shortage	Re-connect
4	a) switch off main switch b) open signal cord and earth it c) re-connect and switch on to checking EPS light "ON"	Go to 5	EPS light burnt or signal cord open	Replace signal cord or EPS light
5	Connections on ECU	a) signal cord with bad earth b) ECU with bad earth c) replace a new ECU and recheck above	Bad earth	Replace coupler

2) EPS light still "ON"

step	operations	yes	no	exclude
1	Display a normal rpm	Go to 2	Speedometer connections checking	Re-connect
2	EPS light still "ON"	Replace a ECU		Replace a ECU

3) OBD show 21/22/23/24/25 fault code (means torque sensor defective)

step	operations	yes	no	exclude
1	a) switch off & take out ECU b) align handlebar then switch on, check to torque sensor cord voltage around 3.30V	Go to 2	Torque sensor cord open / ECU broken	Replace coupler / replace ECU
2	a) check to both voltage of torque sensor around 1.65V b) check to voltage one is 1.65V one is 3.3V	Circuit shortage ECU broken	Sensor broken ECU checking	

	c) check to both voltage and over 0.2V	Sensor broken	Re-plug in	
--	--	---------------	------------	--

4) OBD show 32/36 fault code (no power output)

step	operations	yes	no	exclude
1	Check to motor cord connection	Go to 2	Bad connection	Re-connect
2	a) Switch off then un-plug motor cord b) check to motor both cord ends conducting => consecutive?	Go to 3	Motor broken	Replaced
3	Check to the conducting between motor cord two ends and housing	Shortage of harness(replace motor)	ECU broken	Replace ECU

Summary of problem shootings

No.	condition	analysis	exclude
1	No power steering	a) bad contact in couplers b) fuse broken c) ECU, motor, sensor broken	a) check to the connections b) replace fuse c) replace ECU, motor,sensor
2	Operation noise	a) handling frictions b) motor noise c) worn spindles of input shaft, output shaft or steering column d) loosen or unfixed housing	a) correct handle b) replace motor c) replace EPS set or steering column d) refix
3	Steering slanting	a) sensor leaning b) front tires pressure not balance c) not correct toe-in d) ECU damage	a) refix b) proper pressure/ balance pressure c) recheck toe-in d) replace ECU
4	Steering power sometimes not wroking	a) signal cord coupler open b) rpm message not match to ECU	a) re-connection b) replace ECU
5	Heavy steering	a) poor battery b) motor damage (less power) c) less tires pressure	a) re-charge /replace battery b) replace motor c) fill up tire pressure

6	Shaking Steering LH/RH	a) opposite power output b) ECU damage c) worn ball-jointers in a-arms	a) exchange positive/negative electrode of motor b) replace ECU c) replace ball jointers in a-arm
7	Partial tight when steering LH/RH	a) output shaft of motor touch b) worn, rusty, deteriorated on input/output shafts c) motor installation incorrectly	a) adjust the installation b) replace motor c) adjusting or re-installation

20-07. OBD (On-Board Diagnostic)

a. OBD provided

SMC provides a special OBD to diagnosis the any troublesome in EFS system.

- Remove the harness
- Connect the OBD to ECU.
- Turn on switch to run OBD.
- Store OBD in box always and keep it dry.

NOTE: EPS indicator on display shows the fault code at once problem happened. Refer to 20-05.

20-08. ECU

In briefly, ECM is a unit collecting all working messages from steering motor running.

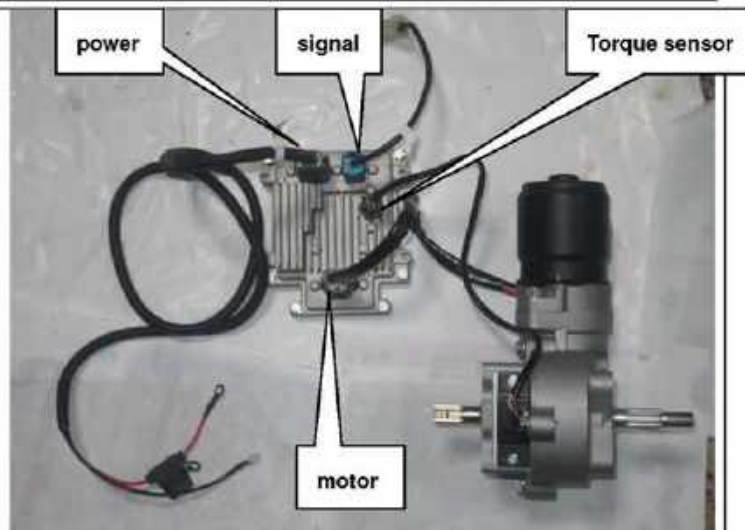
The ECU is equipped with a self-diagnostic function in order to ensure operating normal. If this function detects a malfunction in the system, it immediately operates the motor under substitute characteristics and illuminated trouble warning light in speedometer to alert the rider that a malfunction has occurred in the system. Once a malfunction has been detected , a fault code is stored in the memory of the ECU. Refer to 2-27/15-11.

Specially designed for ATV for highly water-proof grade. However, to avoid immersing the motor is necessary for rider. To clean surface of motor and check the glue on the motor for sealing is necessary after every riding.

Note: Do not open the ECU, it will affect the parameters.



- Plug-in and out ECU
 - Four connection plugs are for power/ signal/ torque sensor and motor.
 - Only plug in and out in switch off
 - Always hold the unit to plug-in or out the couplers
 - To less to plug in and out as possible as you can
 - Correctly install four couplers
- Working and Storing
 - ECU works in temperatures range -40°C ~ 85°C
 - Keep it in a clean, dry and ventilation
 - Keep it away from electromagnetic part
 - Fix ECU firmly
 - ECU is protected by 40A fuse, check it when problem happened.



20-09. Motor

Specially designed for ATV for highly water-proof grade. However, to avoid immersing the motor is necessary for rider. To clean surface of motor and check the glue on the motor for sealing is necessary after every riding.

Note: Do not open the motor.

- Working
 - Rotate slower
 - output higher torque
 - less power consumption
 - power reach 380W
- Removal
 - Refer to 15-11/2-27
- Installation
 - Refer to 15-11/2-27

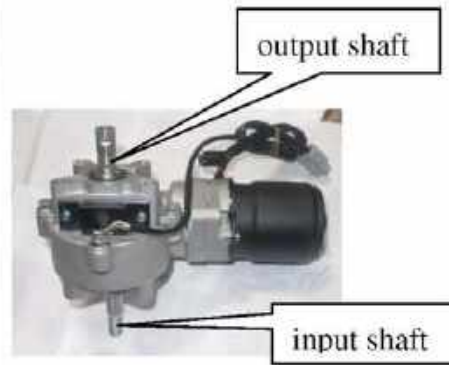


- Inspection
 - Check to the harness => cracks, deterioration → replace
 - Check the glue on the motor => damage/aged → re-glue
 - Check to the output shaft => worn → replace
 - Check to the input shaft => worn → replace
 - Check to the oil seals => damage → replace

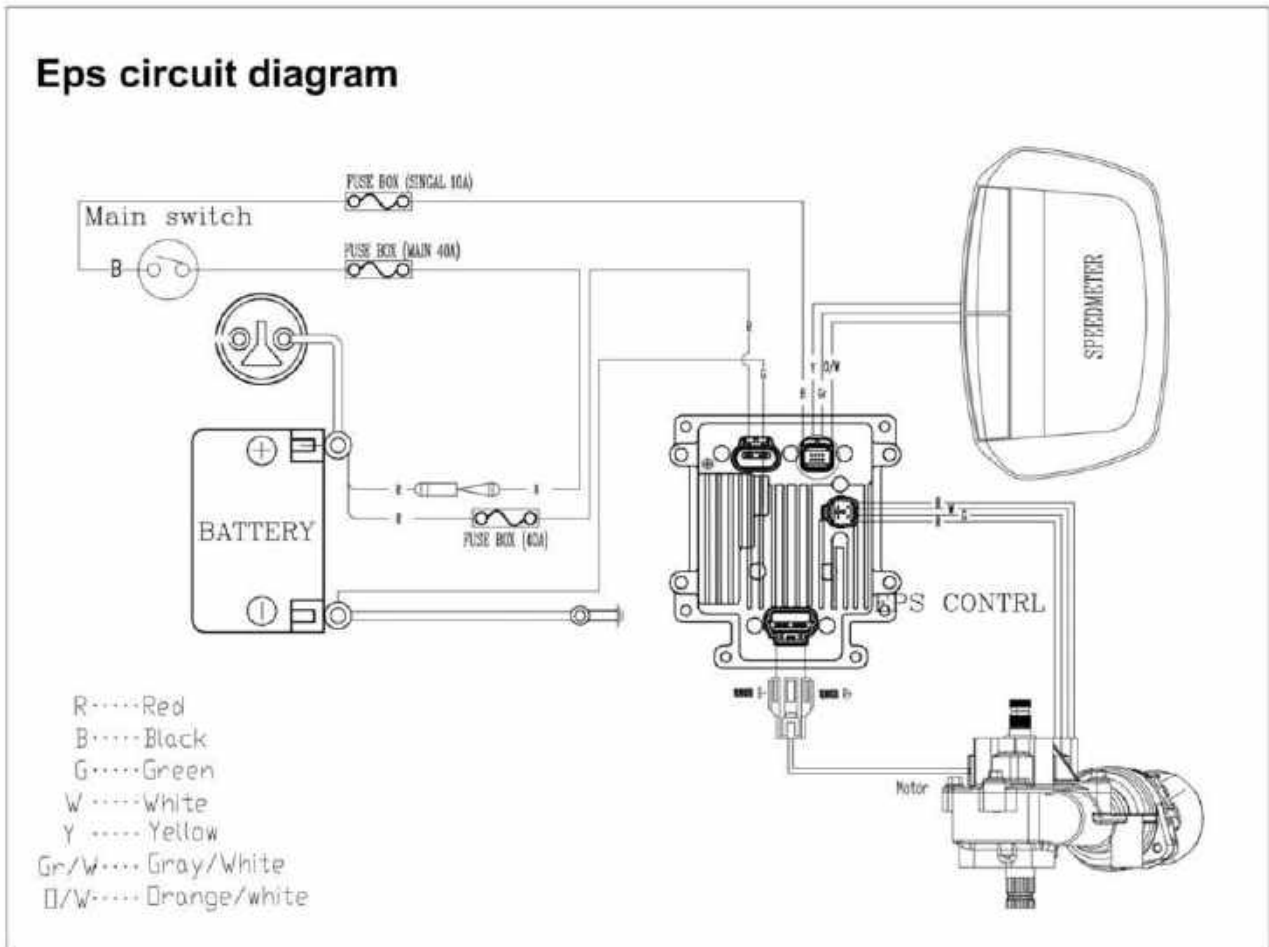
20-10. Harness

Two harness to be provided.

- Signal cord ⇔ main wire harness ⇔ speedometer → rpm/speed/warning light
 - Power cord ⇔ battery
- Refer to 20-8



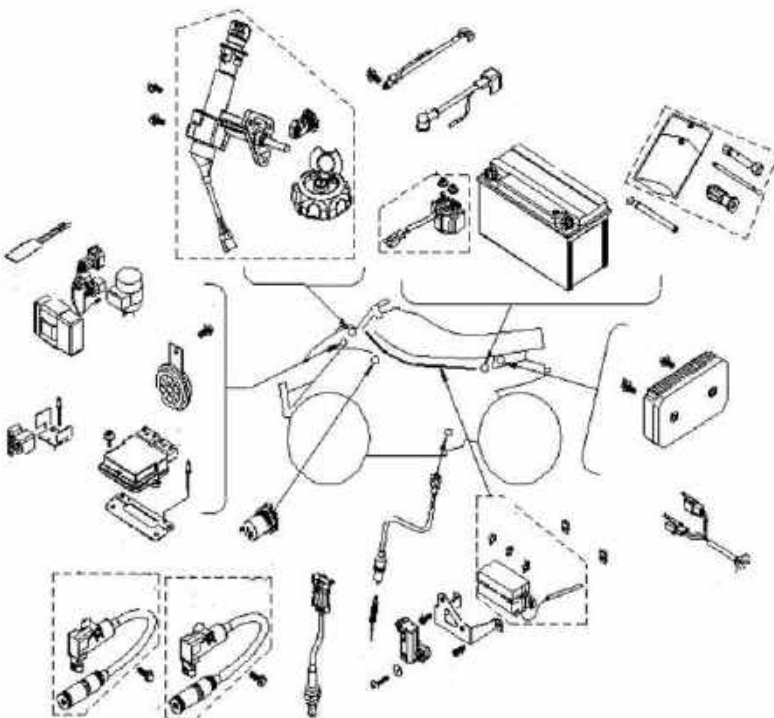
20-11. Circuit



NOTE:

21-01. Mechanism Diagram	.....
21-02. Maintenance Data	.....
21-03. Technical Specification	.....
21-04. Trouble Diagnosis	.....
21-05. Battery	.....
21-06. Charging System	.....
21-07. Ignition System	.....
21-08. Starting System	.....
21-09. Meters	.....
21-10. Light / Bulb	.....
21-11. Switch / Horn	.....
21-12. Sender Unit	.....
21-13. Cooling Fan Thermo Switch	.....
21-14. ETS unit	.....
21-15. DRL (daytime running lamp)	.....

21-01. Mechanism Diagram





21-02. Maintenance Data

Operational precaution

- When remove the battery, the disconnection sequence of cable terminals shall be strictly observed. (First disconnect the negative cable terminal, next, the positive cable terminal.)
- The model of the spark plug and the tightening torque.
- The ignition timing.
- Adjustment of headlight.
- Removal and installation of AC generator.
- The maintenance free battery requires no inspection of electrolyte level and refilling of distilled water.
- To recharge the battery, remove the battery without removing ventilation caps.
- Unless in emergency, never rapid charge the battery.
- The voltage must be checked with the voltmeter while charging the battery.
- The ECM is equipped with a self-diagnostic function in order to ensure that the fuel system is operating normally. Once a malfunction has been detected , a fault code is stored in the memory of ECM.
- Fault code can be read by OBD.
- Do not disconnect coupler from ECM, the battery cable from the battery, ECM ground wire harness from engine or main fuse before confirming OBD stored in memory.
- Stop and check when "Check engine warning lamp" turning on.
- EPS is equipped with a self-diagnostic function by ECU. Refer to Chapter 20.

21-03. Technical Specification

a. Charging system

Description		Specification
Battery	Type	MF type, factory default: GS or YUASA Brand
	Capacity	12V18Ah (GTX20L-BS or YTX20L-BS)
	Charging rate	1.4A / 5 ~ 10 hours (standard) hour 9A / 0.5(fast charging)
Leak current		< 1mA
Charging current		1.2 A / 1500rpm
Control voltage in charging		14.5 + 0.5 V / 1500rpm

b. Ignition system

Description		Specification
Spark plug	Model	NGK DCPR7E
	Gap	0.7~0.8mm
Ignition coil and resistance	Primary winding	0.58±10%Ω
	Secondary winding	Without cap:7.1±10%Ω
With cap: 15 ±10%KΩ		
Ignition timing "F" mark		15°TDC/1700rpm
		46°TDC/4200rpm

21-04. Trouble Diagnosis

a. No voltage

- Battery discharged
- The cable disconnected
- The fuse is blown / incorrect fuse
- Improper operation of the main switch
- Malfunction on ECM

b. Low voltage

- The battery is not fully charged
- Poor contact
- Poor charging system
- Poor voltage regulator
- Malfunction on ECM

c. No spark produced by spark plug

- The spark plug is out of work
- Broken or shorted ignition coil
- Poor main switch
- Relay shorted
- Incorrect spark plug gap / heat range
- Fouled spark plug
- Faulty spark plug cap
- AC.G. is out of work
- Poor grounded
- Malfunction on ECM

d. Starter motor does not work

- The fuse is blown/ incorrect fuse
- The battery is not fully charge
- Poor main switch
- Poor starter switch
- The front and rear brake switches do not operate correctly

f. Charging system does not operate properly

- Burnt fuse/incorrect fuse
- Poor contact, open or short circuit
- Poor regulator
- Poor ACG
- Poor grounded
- Relays shorted

g. Engine does not crank smoothly

1. Primary winding circuit
 - Poor ignition coil
 - Poor connection of cable and connectors
 - Poor main switch
2. Secondary winding circuit
 - Poor ignition coil
 - Poor spark plug
 - Poor ignition coil cable
 - Current leakage in the spark plug
3. Incorrect ignition timing
 - Poor AC.G.
 - Improper installation of the pulse sensor
4. Broken ACG rotor woodruff key
5. Faulty crankshaft position sensor
6. Malfunction on ECM

h. Weak starter motor

- Poor charging system
- The battery is not fully charged
- Poor connection in the windings
- The motor gear is jammed by foreign material
- Worn or damaged starting clutch
- Poor grounded

- Loose connections/ shorted wire
- Faulty starting clutch
- Faulty crankshaft position sensor
- Starter relay is out of work
- The ignition coil is poorly connected, open or short-circuited
- Poor grounded
- The starter motor is out of work
- Malfunction of ECM

e. Intermittent power supply

- The connector of the charging system becomes loose
- Defect regulator
- Poor connection of the battery cable
- Poor connection or short-circuit of the discharging system
- Poor connection or short-circuit of the power generation system
- Incorrect ignition timing
- Incorrect valve clearance
- Humility wire connections
- Clogged air filter
- Poor fuel pump function
- Malfunction of ECM

i. Starter motor is working, but engine does not crank

- Poor starter motor pinion
- The starter motor run in reverse direction
- Faulty crankshaft position sensor
- Broken ACG rotor woodruff key
- Clogged air filter
- Incorrect valve clearance
- Malfunction on ECM

21-05. Battery

a. Removal

- Remove the seat, and then you can see the battery.
- Disconnect the negative cable terminal (green) first, then the positive cable terminal (red).
- Remove the battery.

b. Voltage Check

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

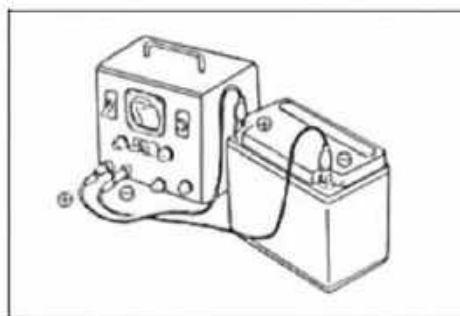
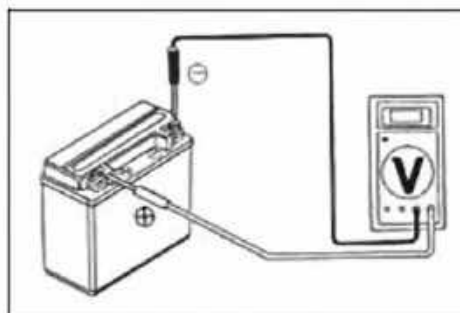
Voltage:

Fully charged: 13.0~13.2 V at 20°C

Undercharged: Below 12.3 V at 20°C

c. Charging

- Connect the positive terminal (+) of the charger to the battery positive terminal (+).
- Connect the negative terminal (-) of the charger to the battery negative terminal (-).



	Standard	Maximum
Charging current	1.4A	9.0A
Charging time	5~10H	1H

Warning

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

Caution

1. Never rapid charge the battery unless in emergency.

2. Verify the battery is recharged with current and duration prescribed above.
3. Large current and fast time charging could cause damage to the battery.
4. When installing the battery, coat the cable terminal with grease

d. Installation

1) take all positive cable terminals as picture

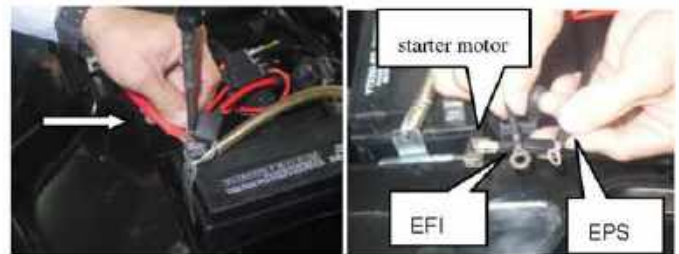
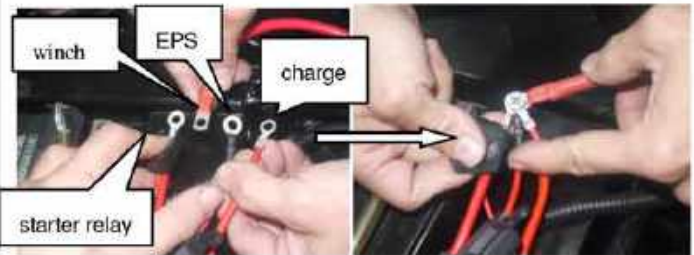
2) fix the positive cables as pictures:
charge => EPS => winch => starter relay (down)

3) cover the insulation cap properly

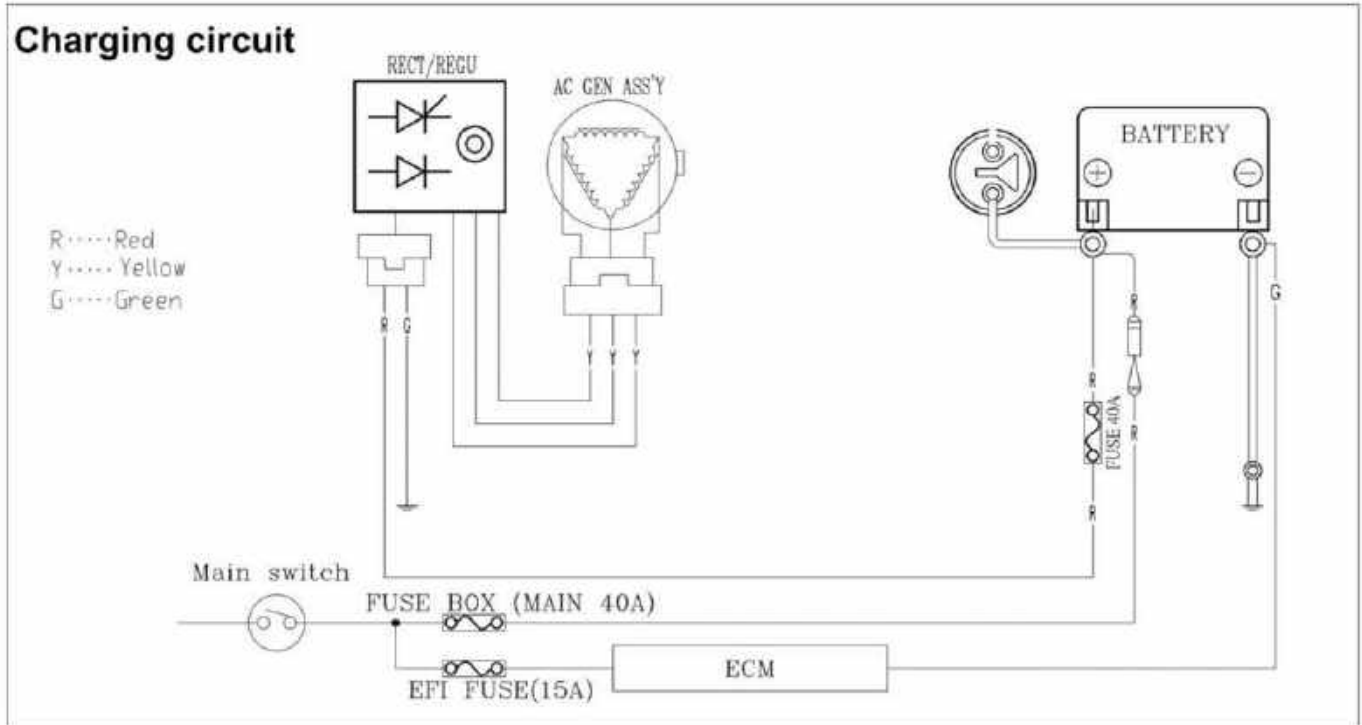
4) fix the negative cable terminals as picture:

EPS=>EFI=>starter motor (down)

5) arrange all cables and fuses in order as picture.



21-06. Charging System



a. Current Leakage Inspection

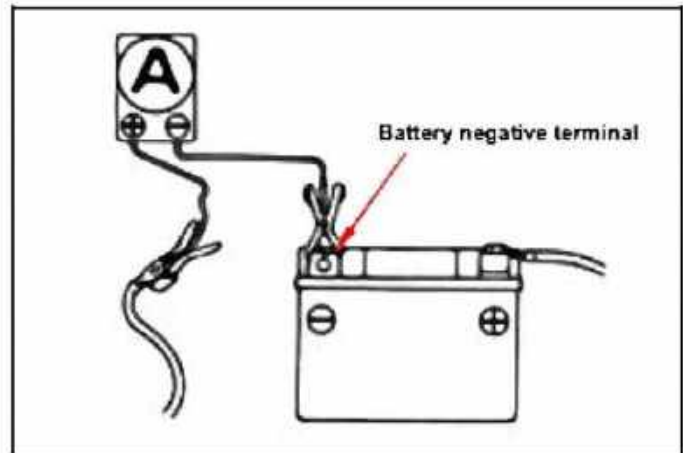
- Turn the main switch to OFF position, and remove the negative cable terminal (-) from the battery.
- Connect an ammeter between the negative cable terminal and the battery negative terminal.

Caution

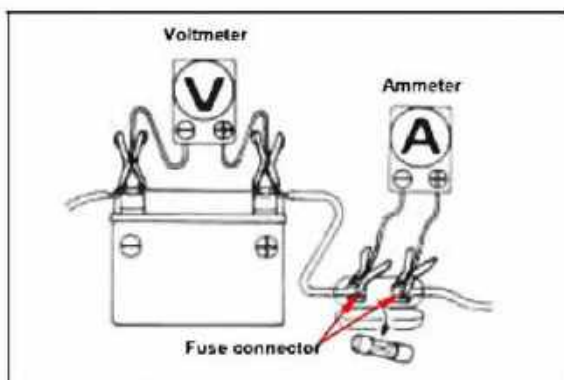
1. In the current leakage test, set the current range at the largest scale, then gradually decrease to the lower scale as the test process goes to avoid possible damage to the ammeter and the fuse.
 2. Do not turn the main switch to ON position during test.
- If the leaked current exceeds the specified value, it may indicate a short circuit.

Allowable current leakage: Less than 1mA

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



b. Inspection on Charging Voltage



Caution

1. Before conducting the inspection, make sure that the battery is fully charged. If undercharged, the current changes dramatically.
 2. Use a fully charged battery having a voltage larger than 13.0 V
 3. While starting the engine, the starter motor draws large amount of current from the battery.
 4. After the engine is warmed up, replace original battery with a fully charged battery.
- Connect a digital voltmeter to the battery terminals.
 - Connect an ammeter between both ends of the main fuse.

Caution

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

Caution

It is possible to measure the current by connecting an ammeter between the battery positive terminal and the cable position terminal,

- Connect a tachometer.
- Turn on the headlight to high beam and start the engine.
- Accelerate the engine to the specified revolution per minute and measure the charging voltage.

Specified Charging Current:

1.2 A / 6000 rpm

Control Charging Voltage:

14.5 + 0.5 V / 2000 rpm

Caution

1. To replace the old battery, use a new battery with the same current and voltage.
2. The following problems are related to the charging system; follow the instructions provided in the checking list to correct it if any one of the problems takes place.
 - (1) The charging voltage can not exceed the voltage between two battery terminals and the charging current is in the discharging direction.
 - (2) The charging voltage and current are too much higher than the standard values.

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

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

however, while the starter motor is activated, the surge current the motor draws from the battery may damage the ammeter.

- Use the kick starter to start the engine.
- The main switch shall be turned to OFF position during the process of inspection.
- Never tamper with the ammeter and the cable while there is current flowing through. It may damage the ammeter.

current is not.

- The replacement battery is aged and does not have enough capacity.
 - Battery used does not have enough electricity or is over charged.
 - The fuse of the ammeter is blown.
 - The ammeter is improperly connected.
- (3) The charging current is normal, but the voltage is not.
- The fuse of the voltmeter is blown.

Inspection on regulator rectifier

- Remove the seat, RH side cover
- Disconnect two couplers of the regulator

Rectifier.

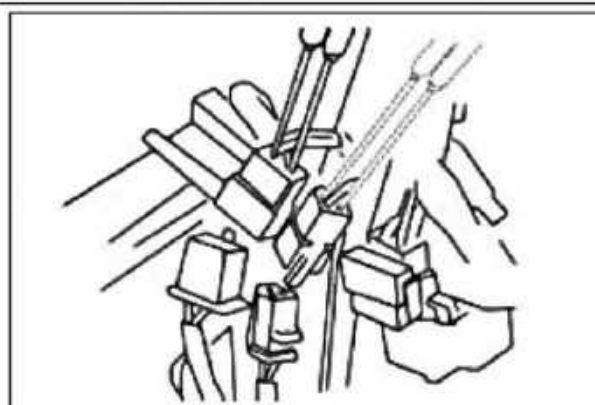
Inspection the rectifier coupler to the wire harness passes the condition.

Item	Check Points	Standard Value
Main switch		
Connection	R – B	Battery voltage (ON)
Battery connection	R---G	Battery voltage
Charging coil	Y---Y	$0.235 \pm 20\% \Omega$

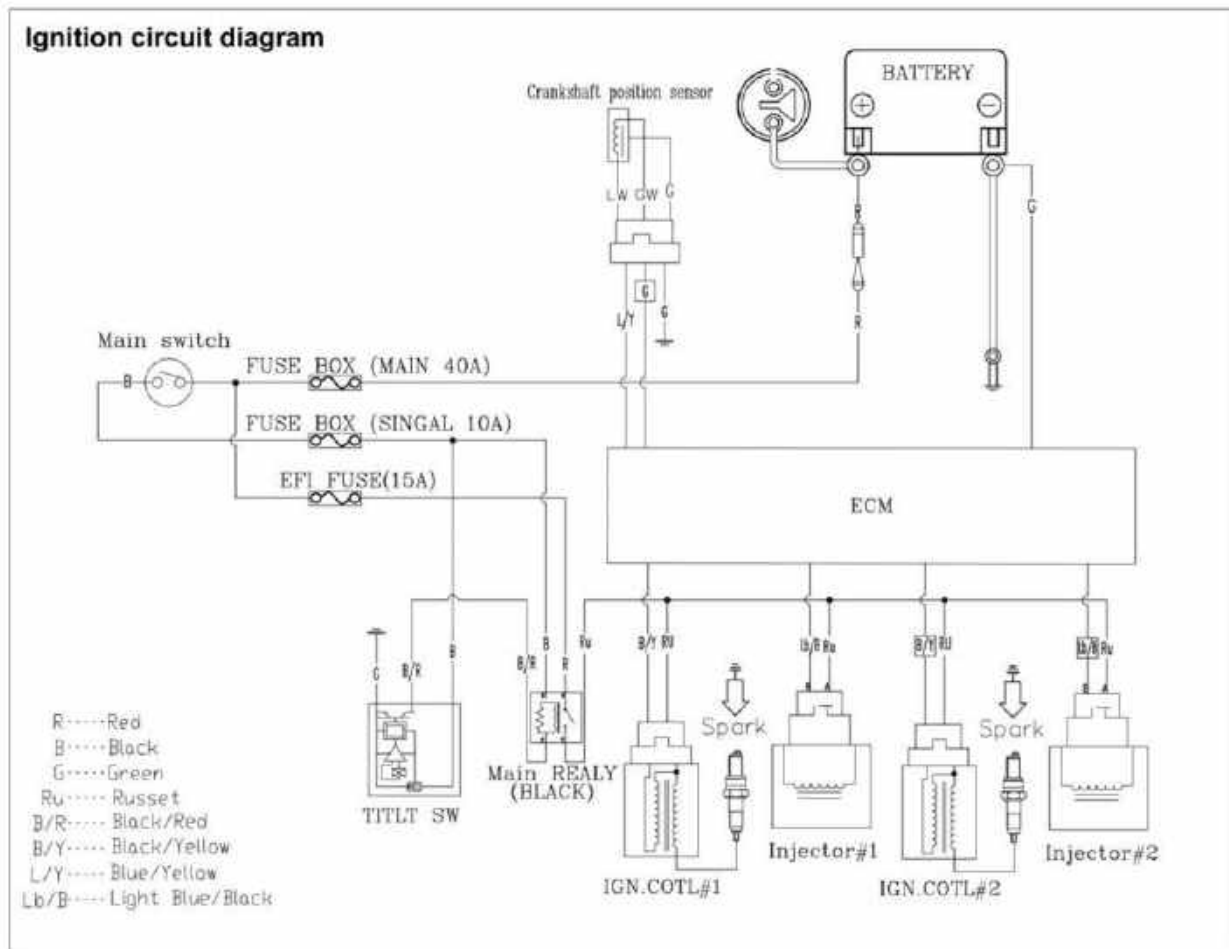
If the readings measured are not normal, check parts in the circuit.

If the parts are normal, then trouble is in the wiring.

If there is nothing wrong with parts and wiring, replace the regulator rectifier.



21-07. Ignition System



Item	Points to check	Result	
Main switch turn to "ON" position	B ~ W/B	Battery voltage	
Pulse generator	B ~ G	495±20%Ω	
Ignition coil	Primary circuit	B/Y ~ GND	2.9±10%Ω
	Secondary circuit	B/Y ~ with no cap	2.9±10%Ω
		B/Y ~ with cap	15.0±10%KΩ

Inspection on Ignition Coil

- Disengage the connector of the ignition coil and the spark plug cap.
- Measure the resistance between the terminals of the primary winding.
- Standard resistance: **$2.9\Omega \pm 10\%$**
- Remove the cap from the spark plug and measure the resistance between the spark plug and the primary winding.
- Two ignition coils, red line for front cylinder and blue line for rear cylinder. It can't make mistake.

Standard resistance:

With no cap: **$2.9 \pm 10\% \Omega$**

With cap: **$15.0 \pm 10\% K\Omega$**

Ignition Coil Replacement

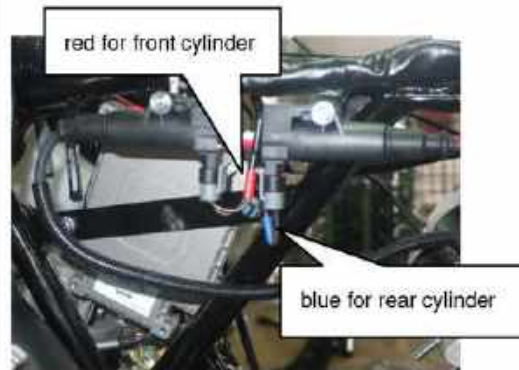
Loosen the lock bolt and replace the ignition coil if necessary.

Connect wire harness in a right color and make sure to earth green one to frame on front ignition coil.

Inspection of Pulse Generator

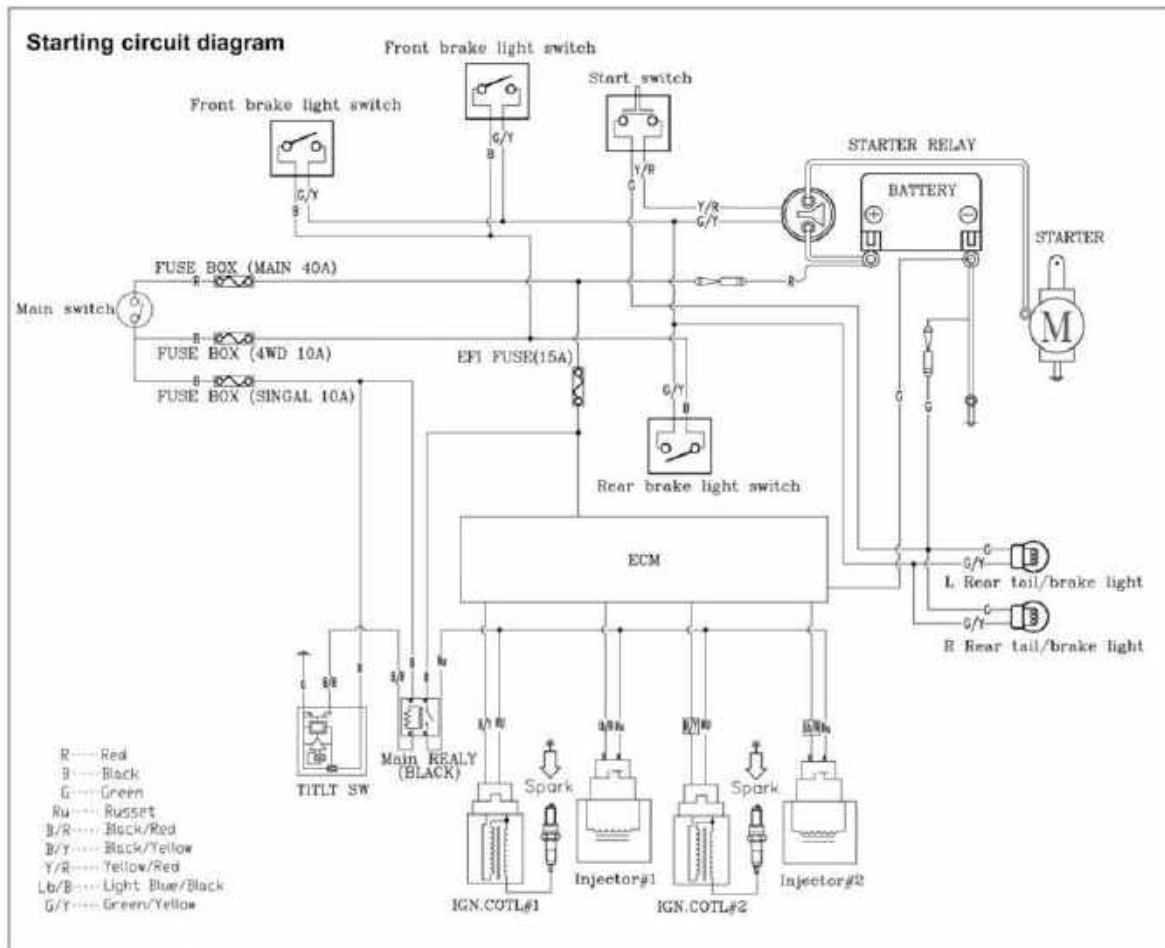
Disconnect the coupler of the pulse generator and measure the resistance between the terminals of blue and green.

Standard resistance: **$495\Omega \pm 20\%$**



21-08. Starting System

Starting circuit diagram



Inspection on starter relay

Open the main switch.

Press the brake.

Push down the starter switch.

If a sound of ."Looh Looh". is heard, it indicates the relay function normally.



Remove the seat.

Disconnect the negative cable terminal of the battery.

Disconnect the cable positive terminal from the relay.

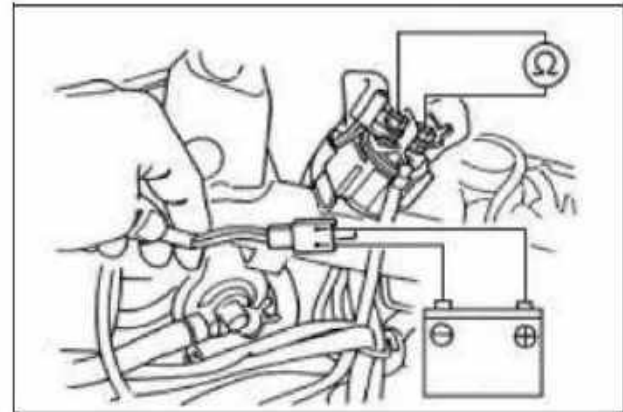
Disconnect the positive cable of the starter motor.

Disconnect the coupler of the relay.

Connect an ohmmeter to the large terminal end.

Connect the yellow/red cable to the battery positive terminal and the yellow/black cable to the battery negative terminal.

Check the continuity of the large terminal end. If there is no continuity, replace the relay.



Removal of Starter motor

Remove the seat.

Disconnect the cable negative terminal (-), then the cable positive terminal (+).



Loosen the two bolts and remove the shelter of starter motor.



Remove starter motor cable.



Loosen the lock bolts and remove the starter motor.



Installation of Starter motor

Install in reverse order of removal procedures.

21-09.Meters

- Refer to Instruction of Speedometer.
- EFI refer to 19-16



21-10. Light / Bulb

Replacing Bulb for Headlight

Remove waterproof cover for the headlight.

Remove bulb setting hook.

Take out the bulb connector and the bulb.
Replace with new bulb if necessary.

(High light H1 12V 35W)

(Low light H7 12V 35W)

Caution

Never touch the bulb with finger, which will create a heat point.

Clean the fingerprint left on the bulb with alcohol.

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

Upon completion of replacement, turn on the main switch to ensure the headlight works well.

Adjust the beam and distance of the headlight if necessary.



Replacing the Front winker light Bulb

Pull out the front winker light bulb seat.



Replace with new front winker light bulb.
(12V 10W)



Replacing Bulb of Position Light

Pull out the position light bulb seat.

Replace with new position light bulb.
(12V 5W)



Replacing Bulb of Taillight and Rear Winker Light

Take out the rubber caps.

Turn the taillight and rear winker light bulb connectors by CCW.



Replace with new rear winker light bulb.
(12V 10W)



Replace with new taillight bulb.
(12V 21/5W)



Be sure to cover back the rubber caps.

Replacing Bulb of License Light

Pull the license light bulb connector out.
Replace with new license light bulb.



Replace with new license light bulb.
(12V 5W/)



21-11. Switch / Horn

Main Switch

Inspection

Remove the front center cover.

Disconnect the main switch coupler.

Check the continuity between three points as indicated below:

MAIN SWITCH			
	B	R	Br
OFF			
1	○—○		
2	○—○—○		

Replacement of main switch

Disconnect the coupler of the main switch.

Push out the main switch.

Align the main switch stopper with the meter cover groove, and install main switch.

Install the main switch coupler.

Handle switches

Disconnect the coupler of handle from front fender left side.

Check the continuity between two points as indicated in the table below.

Start Switch

START		
	G	Y/R
FREE		
PUSH	○—○	

2WD/4WD/Diff Lock switch



LOCK SWITCH				
	G	W/L	Y/B	L/B
2WD	○	○		
4WD	○		○	
LOCK	○			○

Headlight Switch

LIGHT SWITCH			
	L	B	W
	○	○	
		○	○

Winker switch

DIRECTION LIGHT			
	Lb	Gr	O
	○	○	
N			
		○	○

Horn switch

HORN	
	G Lg
FREE	
PUSH	○ ○

Warning Light (Hazard)

WARNING LIGHT			
	Lb	Gr	O
	○	○	○
○			



Front Brake Switch

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



Rear Brake Switch

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



Horn

Remove the horn under front fender.

Apply **12 V** power source to two terminals of the horn, the horn should sound.
Replace the horn if necessary.



21-12. Sender Unit

Remove the seat.

Remove the fuel tank cap.

Remove the upper center cover and front fender (refer chapter 13).

Disconnect the coupler of the fuel unit.

Remove the fuel unit (4 bolts).

Caution

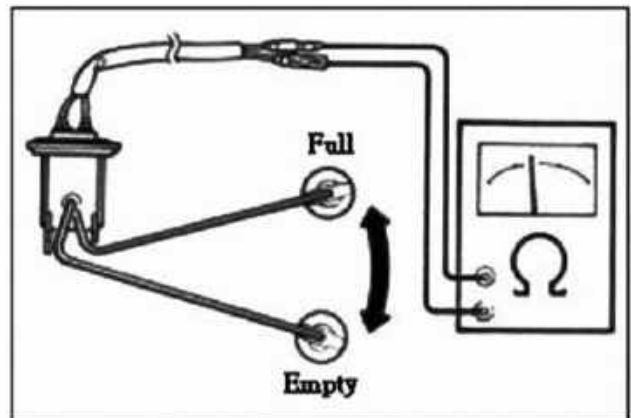
Great care shall be taken not to damage or bend the float arm of the gauge.



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

Position	Resistance
E (Empty)	90~100 Ω
F (Full)	4-10 Ω

Connect the wiring to the fuel unit and the ohmmeter as shown.

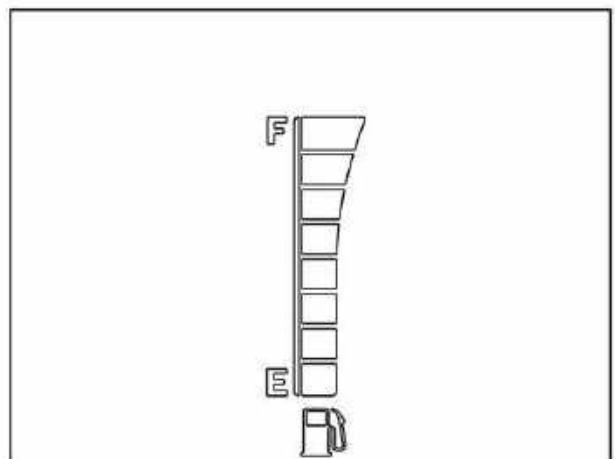


Connect the fuel unit coupler to the wire harness.

Turn on the main switch.

Move the float arm to verify the proper position the fuel gauge needle indicates.

Arm Position	Needle Position
Up (Full)	F (Full)
Down (Empty)	E (Empty)



Caution

While conducting the test, turn on the direction indication lamp to make sure that the battery is in serviceable condition.

21-13. Cooling Fan Thermo

Switch

The thermo switch mounted on the radiator controls the operation of the cooling fan motor. In case that the fan motor fails to work, disconnect the green and black/blue leads and connect jump wires to the terminals, then, turn on the main switch, the fan motor should operate.

If the fan motor still fails to run, measure battery voltage between the green and black/blue leads.

If there is no voltage, check for blown fuse, loose connection or short-circuit.

If the fan motor runs, check the thermo switch in the manner as described below:

Hang the thermo switch on the bowl filled with coolant to check the switch's opening and closing temperatures, confirm the switch is open circuited at room temperature, and increase the coolant temperature gradually.

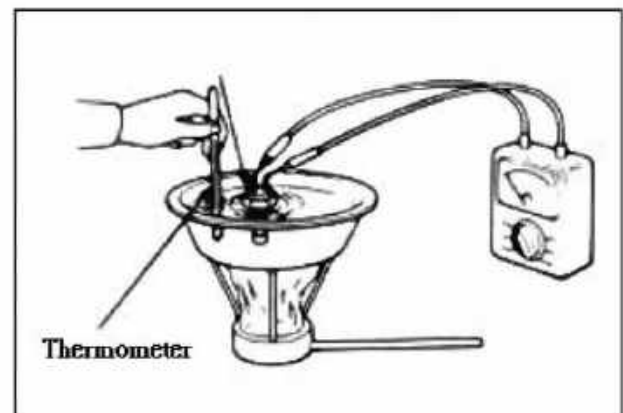
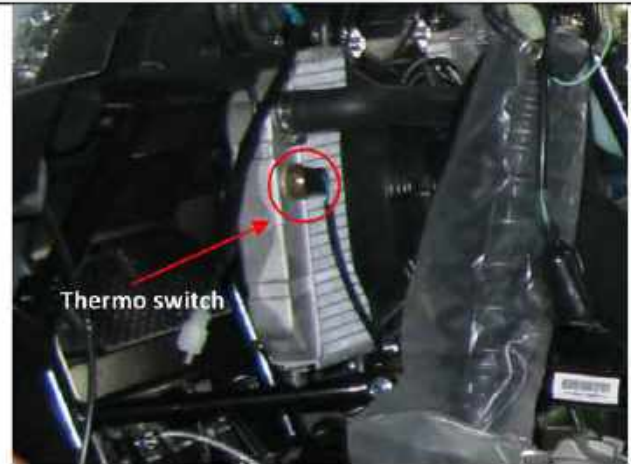
The switch should have continuity at $85\pm 3^{\circ}\text{C}$.

Caution

Keep the coolant at a constant temperature at least for three minutes. Sudden increase the coolant temperature will cause the thermometer and the tester to indicate wrong readings.

Never let the thermometer and the thermo switch contact the wall of the bowl, which may result in wrong readings.

The thermo switch shall be placed in the coolant until the teeth are completely submerged.



21-14. ETS unit

Remove the ETS unit on rear cylinder head.

Check the water temp indicator on the display.

- refer to 19-12



21-15. DRL (Daytime Running Lamp)

EEC models install DRL since 2016.1.1 according EEC regulations.

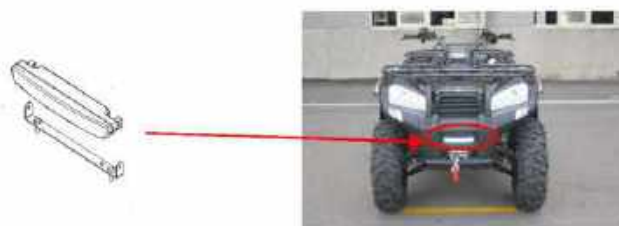
DRL is LED lamp.

a) The function:

1) turn on the key (engine not running) => the DRL turning on.

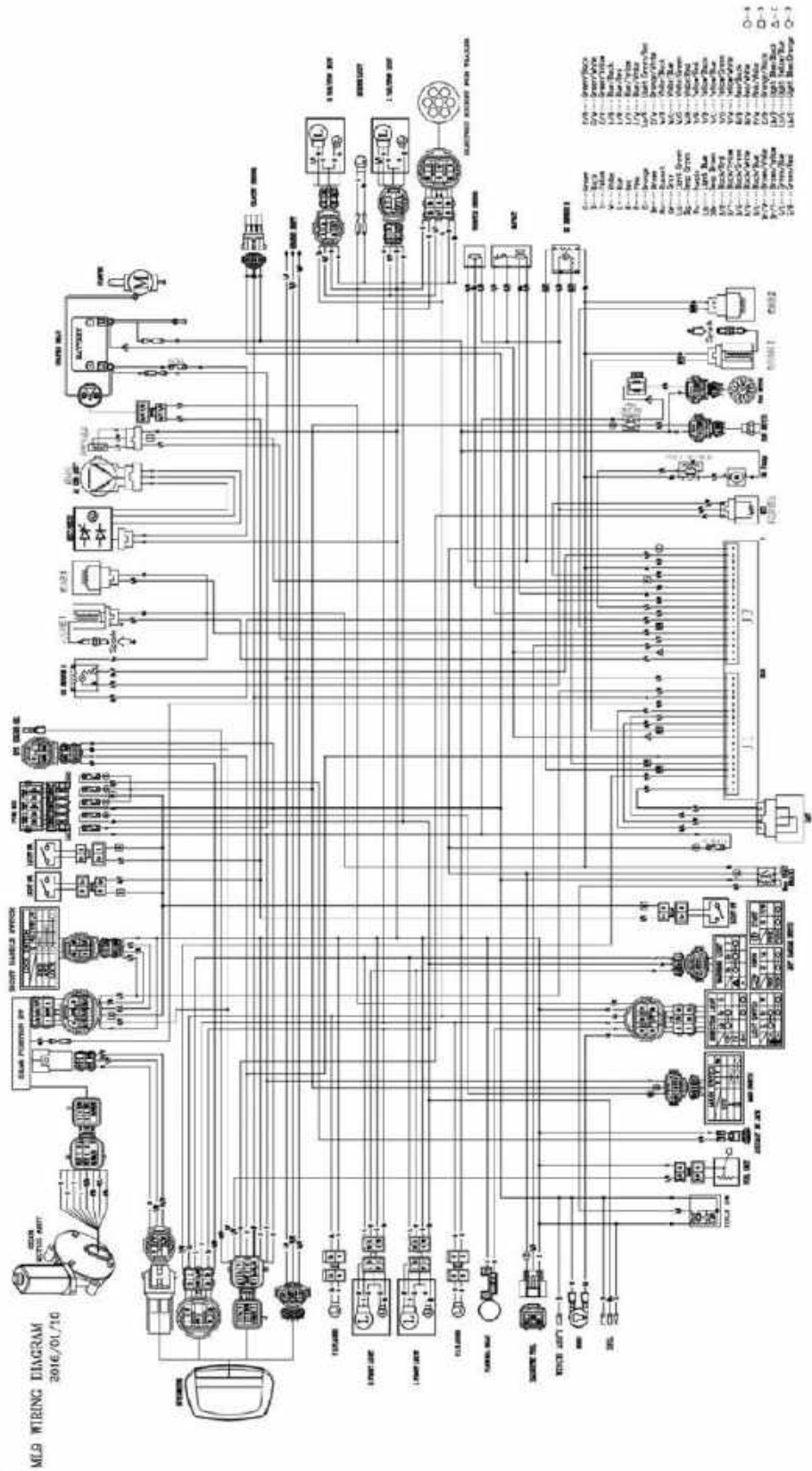
2) turn on the low beam light => the DRL turning off.

b) Check the DRL - crash / damage/ LED lamp not bright => replace whole set.



Notes:

22-01. Electrical Diagram
ML9



Notes: