

# **SERVICE MANUAL**

ATV-320 S/U

*2002/24*



JUNE 30, 2007

High Power Liquid Cooled Engine

**HER CHEE INDUSTRIAL CO., LTD.**

## Foreword

This service manual contains information on servicing ATV-320(S/U)

This manual is written for use as a guideline only. It is recommended that any mechanic, with or without sufficient experience, thoroughly read through the manual and only attempt to service those areas that are fully understood in accordance with the guidelines provided by this manual. For fully qualified mechanics, this manual supplies service data necessary for repairs and maintenance. It is highly recommended that a qualified mechanic, regardless of technical level, should study the service manual in full before attempting service on ATV-320

All the data and diagrams provided in this service manual are valid at the time of publication. Information may be updated without notice due to improvements or upgrades.

No quotation, reproduction, or reprint of the service manual, as a whole or in part, will be permitted without the express written consent from **ADLY** Motor sports.

# CONTENTS

General Information & Lubrication		
	General Information -----	F-4
	Information for Preparation -----	F-5
	Lubrication -----	F-7
Chapter 1	Engine, Transmission & Gear	
	Engine Removal & Installation -----	I-2
	Cylinder Head & Valve -----	I-5
	Cylinder & Piston -----	I-20
	Crankcase & Crankshaft -----	I-27
	Cooling System -----	I-33
	Transmission & Gear -----	I-38
Chapter 2	Fuel System & Carburetion	
	Carburetor -----	II-3
	Fuel Tank -----	II-7
	Air Cleaner -----	II-10
	Exhaust System -----	II-12
Chapter 3	Ignition and Starting System	
	Ignition System -----	III-1
	Starting System -----	III-4
	Recoil Backup Starting System -----	III-7
Chapter 4	Frame & Cover	
	Frame & Cover -----	IV-2
Chapter 5	Wheel, Tyres & Brakes -----	
	Handlebar & Steering -----	V-2
	Front & Rear Wheel -----	V-6
	Suspension System -----	V-9
	Hydraulic Brake -----	V-14
Chapter 6	Electrical Equipment	
	Alternator & Starter Gear-----	VI-2
	Electrical Equipment -----	VI-10
	Wire Diagram -----	VI-13

## General Information

### MODEL IDENTIFICATION



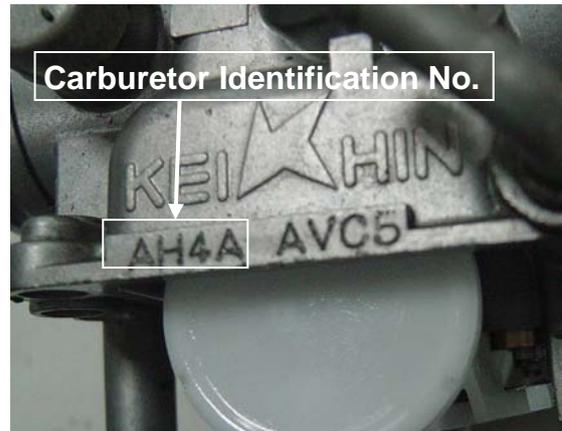
The frame serial number is stamped on the lower front right side of frame.



The engine serial number is stamped on the upper rear right crankcase.



The VIN (Vehicle Identification Number) is attached to the lower front right side of frame behind the frame number.

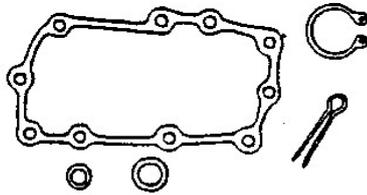


The carburetor identification number is stamped on the right side of the carburetor.

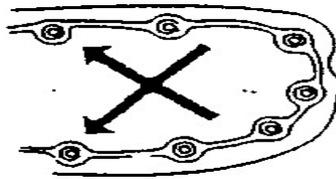
## Information for Preparation

### ATTENTION ON OPERATION

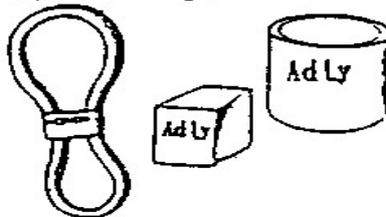
- All washers, oil rings, clamp rings, opening pins shall be duly replaced by a new item when dismantled.



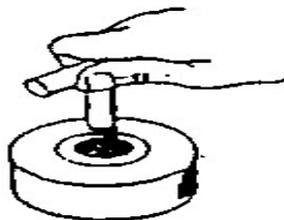
- Locking of all screws, nuts, cross screws shall be performed in the order of first the large screws and then the small ones and from inside to outside in opposite angles by tightening the torque locks.



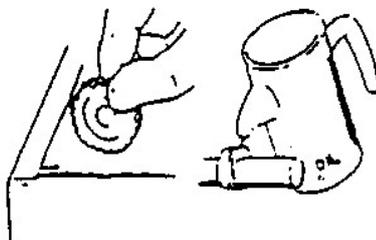
- All items must use original parts, pure oil and greases.



- All service shall use special tools and general tools to repair.



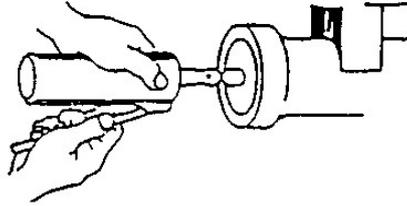
- All dismantled items requiring for checks shall be duly cleaned and for assembly, all items shall be duly lubricated.



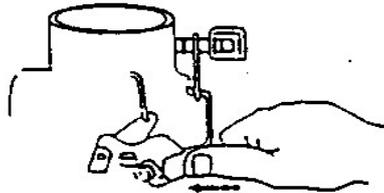
## Information for Preparation

### ATTENTION ON OPERATION

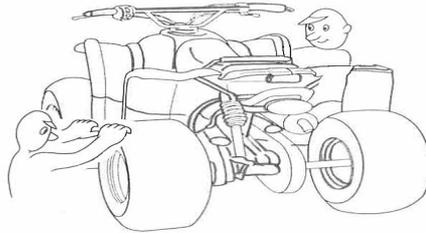
- Certified lubricants in cans shall be used on all the elements to be lubricated.



- After assembly, performance of all elements shall be duly checked and the locking shall be duly verified.



- In case of an operation is performed by over 2 people, the assignment shall be conducted in coordination and safety shall be the first priority.



- Definition of signs:  
The sign given in the Service Manual shall refer to the operation methods and observation.



**OIL:** Lubrication by designated lubricant.



**GREASE:** Lubrication by grease



**Special Tool:** Parts on which special tools shall be used



**General Tool:** General tools shall be used



**New:** Replace by new items after dismounting



**Attention**



**Dangerous and important operations**

## Lubrication

### GENERAL

The maintenance of the oil pump and engine oil can be done with the engine install in the frame.  
When removing and install the oil pump, use care not to allow dust or dirt to enter the engine and oil line.

### SPECIFICATION

ITEM		STANDARD mm (in)	SERVICE LIMT mm (in)
Oil pump	Rotor tip clearance	0.15 (0.006)	0.20 (0.008)
	Body clearance	0.15-0.20 (0.006-0.008)	0.25 (0.010)
	Rotor end clearance	0.04-0.09 (0.002-0.004)	0.12 (0.005)

### TORQUE VALUES

Oil drain plug	20-25 N.m (15-18 ft-lb)
Oil filter screen cap	18-22 N.m (13-16 ft-lb)
Transmission oil check bolt	10-15 N.m (7-11 ft-lb)
Transmission oil drain bolt	10-15 N.m (7-11 ft-lb)

## Troubleshooting

### Oil level too low

- External oil leaks
- Worn valve guide or seal
- Worn piston rings

### Oil contamination

- Oil not changed often enough
- Head gasket faulty
- worn piston rings

### Low oil pressure

- Oil level too low
- Clogged oil filter, oil passage, and or oil pipe
- Faulty oil pump

## Engine Oil

### OIL LEVEL

Warm up the engine.

Stop the engine and park the vehicle on level ground.

Check the oil level through the oil window.

If the level is near the lower of the window, fill to the middle level with the recommended engine oil.



### OIL CHANGE

#### NOTE

- Drain the oil from the crankcase while the engine is warm.

This ensures complete and rapid draining.

Place the oil pan under the engine.

Remove the oil filler cap and oil drain plug and drain the engine oil.

Remove the oil filter screen cap, spring and filter screen, and clean the filter screen.

After the oil has been completely drained, be sure the O-ring on the filter screen cap is in good condition and install the filter screen with the closed end facing out.

Install the spring and cap.

**Torque: 18-22 N.m (13-16ft-lb)**

Make sure that the sealing washer is in good condition, install the drain plug and tighten it.

**Torque: 20-25 N.m (15-18 ft-lb)**

Fill the engine with recommended engine oil through the oil filler hole.

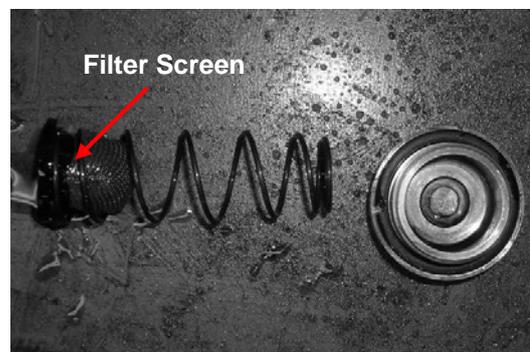
#### ENGINE OIL CAPACITY:

**0.8 Liter (0.85 US qt.) at change**

Reinstall the oil filler cap and start the engine and let it idle for a few minutes.

Recheck the oil level.

Check that there are no oil leaks.



## Oil Pump

### OIL PUMP REMOVAL

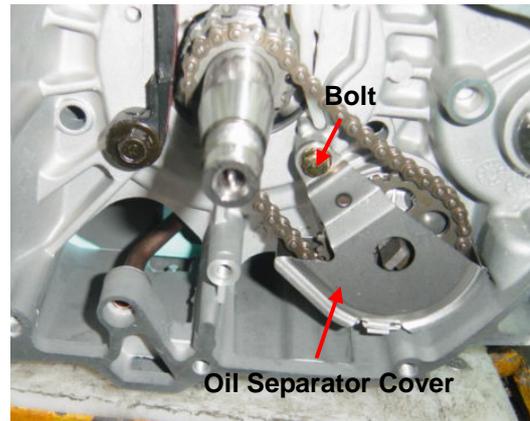
Remove the right crankcase cover.

Remove the flywheel and starter idle and driven gears.

Remove the attaching bolt and oil separator cover.

Remove the circlip, then remove the oil pump drive chain and driven sprocket.

Remove the two oil pump mounting bolts and remove the oil separator and oil pump.



### OIL PUMP DISASSEMBLY

Unscrew the pump cover attaching screw and disassemble the oil pump.

### OIL PUMP INSPECTION

Measure the pump body-to-outer rotor clearance.

**Service Limit: 0.25 mm (0.010 in)**

Measure the outer rotor-to inner rotor tip clearance.

**Service Limit: 0.20 mm (0.008 in)**

Check the rotor-to pump body clearance.

**Service Limit: 0.12 mm (0.005 in)**

### OIL PUMP ASSEMBLY

Install the outer and inner rotor into the pump body.

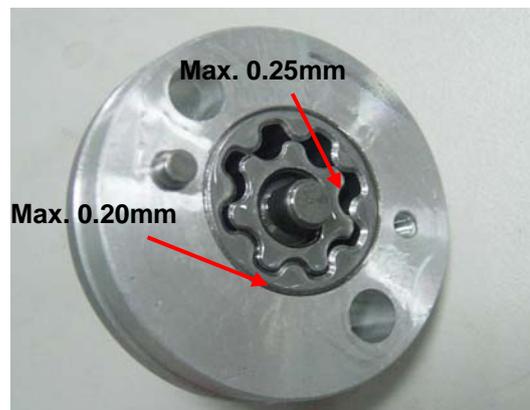
Insert the pump shaft by aligning the flats of the shaft and inner rotor.

Install the dowel pin.

Install the pump cover by aligning the hole of the cover with the dowel pin.

Tighten the screw.

Make sure that the pump shaft rotates freely without binding.



# **Chapter 1 Engine, Transmission & Gear**

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## **Contents**

---

Engine Removal & Installation

Cylinder Head & Valve

Cylinder & Piston

Crankcase & Crankshaft

Cooling System

Transmission & Gear

---

## **GENERAL SAFETY**

### **WARNING**

*If the engine must be running to do some work, make sure the area is well-ventilated. Never run the engine in a closed area. The exhaust contains carbon monoxide gas that may cause loss of consciousness and lead to death.*

### **WARNING**

*Gasoline is extremely flammable and is explosive under certain condition. Do not smoke or allow flames or sparks in your working area.*

### **WARNING**

*The battery electrolyte contains sulfuric acid. Protect your eyes, skin and clothing. In case of contact, flush thoroughly with water and call a doctor if electrolyte gets in your eyes.*

### **WARNING**

*The battery generates hydrogen gas which can be highly explosive. Do not smoke or allow flames or sparks near the battery, especially while charging it.*

## **SERVICE RULES**

1. Use genuine ADLY or ADLY-recommended parts and lubricants or the equivalents. Parts that do not meet ADLYs' design specifications may damage the vehicle.
2. Use the special tools designed for this product.
3. Use only metric tools when service the vehicle. Metric bolts, nuts and screws are not interchangeable with English fasteners. The use of incorrect tools and fasteners may damage the vehicle.
4. Install new gaskets, O-ring, cotter pin, lock plates, etc. when reassembling.
5. When tightening a series of bolts or nuts, begin with large-diameter or inner bolts first and tighten to the specified torque diagonally, unless a particular sequence is specified.
6. Clean parts in clean solvent upon disassembly. Lubricate any sliding surfaces before reassembly.
7. After reassembly, check all parts for proper installation and operation.

# **Chapter 1 Engine, Transmission & Gear**

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## **Engine Removal/Installation**

### **GENERAL**

A floor jack or other adjustable support is required to support and maneuver the engine.

### **SPECIFICATION**

Engine dry weight		32 kg (72 lb)
Oil capacity	Engine	1.0 liter (1.06 US qt.) at disassembly
		0.8 liter (0.85 US qt.) at change
	Transmission	0.6 liter (0.74 US qt.) at disassembly
		0.5 liter (0.63 US qt.) at change
Coolant capacity	Engine and radiator	1.1 liter (1.16 US qt.)
	Reserve tank	0.3 liter (0.31 US qt.)
	Total	1.4 liter (1.47 US qt.)

### **TORQUE VALUES**

Engine upper hanger plate	18 – 24 N.m (13 – 16 ft.lb)
Engine mounting nut	40 – 55 N.m (29 – 40 ft.lb)
Step bar rear bolt	40 – 55 N.m (29 – 40 ft.lb)
Step bar front bolt	18 – 24 N.m (13 – 16 ft.lb)
Chain cover bolt	10 – 14 N.m (7 – 10 ft.lb)

# Chapter 1 Engine, Transmission & Gear

## Engine Removal & Installation

### ENGINE REMOVAL

Park the vehicle on the level ground and pull parking lever to park the vehicle.  
Disconnect the battery ground (-) cable.  
Remove left and right floor panel and step bar.  
Remove foot brake pedal.



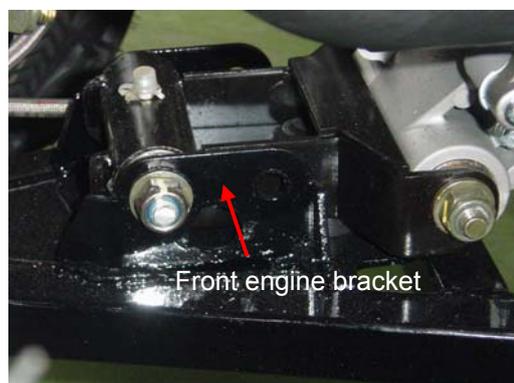
Remove front chain cover then disconnect drive chain.  
Disconnect gear selection rod then remove muffler ass'y.  
Disconnect coolant hose.  
Disconnect spark plug and generator wire connector and coupler



Disconnect blow-by tube at cylinder head cover and crankcase.  
Disconnect carburetor on intake manifold and vacuum tube.  
The engine is held in the frame by three point, two at bottom and one at rear upper.



Loosen the all nuts on fixing studs and move all studs.  
Remove the front engine bracket.  
Slightly raise the engine and pull it toward front frame then pull out the engine thru right side.



# Chapter 1 Engine, Transmission & Gear

## ENGINE INSTALLATION

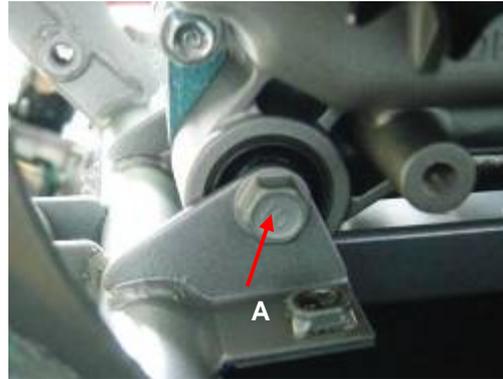
Move the engine into the frame

Insert the front engine bracket to correct position then insert the bolts.

Insert all other engine mounting bolts and tighten the nuts by following steps.

A. Rear lower engine mount

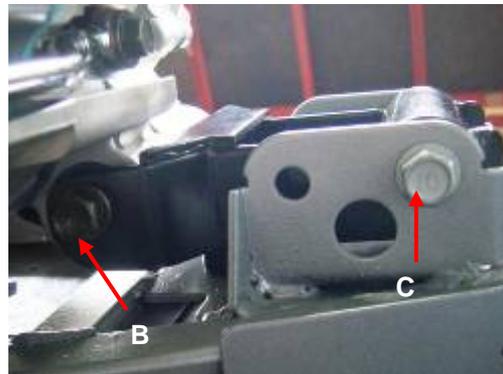
**Torque value: 40 – 55 N.m (29 – 40 ft.lb)**



B. Front engine mount

C. Front engine bracket

**Torque value: 40 – 55 N.m (29 – 40 ft.lb)**

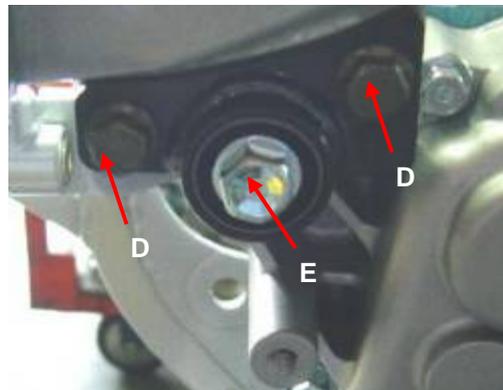


D. Rear upper hanger plate

**Torque value: 18 – 24 N.m (13 – 16 ft.lb)**

E. Rear engine mount.

**Torque value: 40 – 55 N.m (29 – 40 ft.lb)**



Install the removed parts in the reverse order of removal.

Refill coolant to specified volume and connect battery terminals.

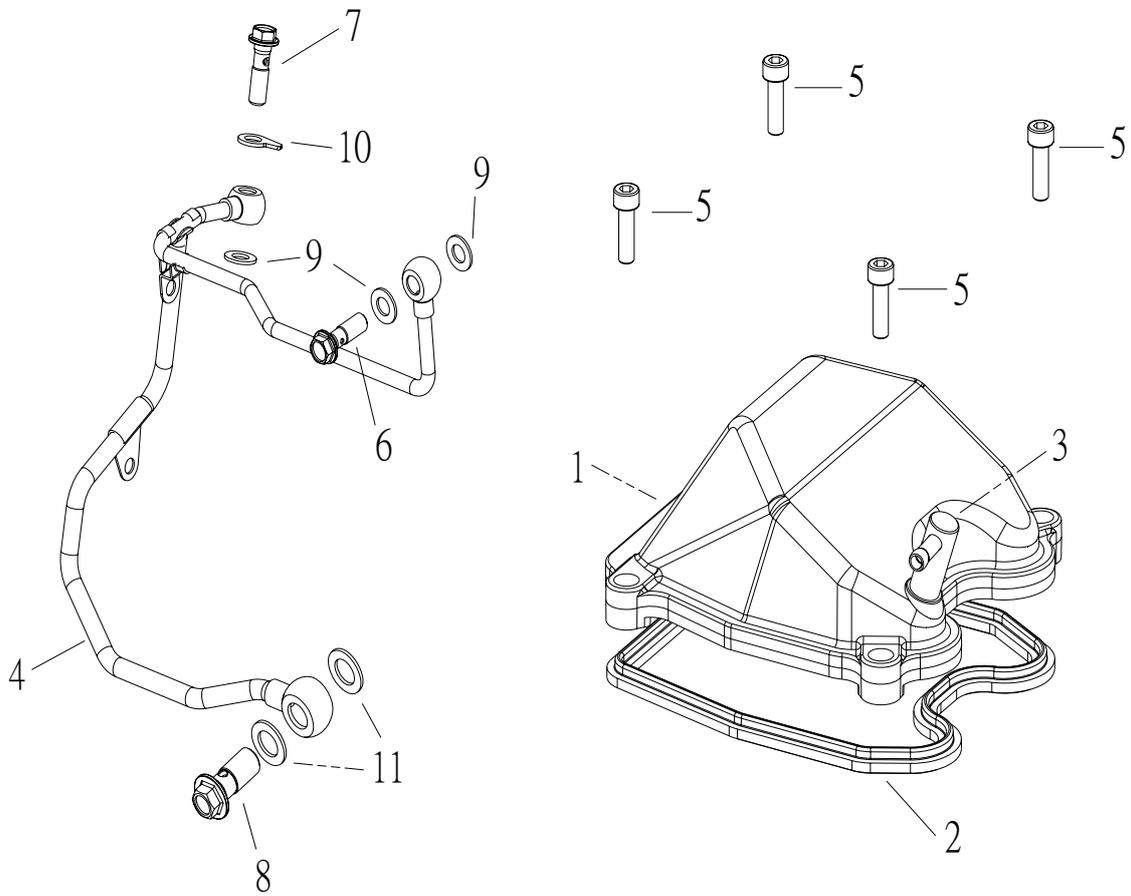
### **NOTE**

- Checked all connect points and oil level before restart the engine.



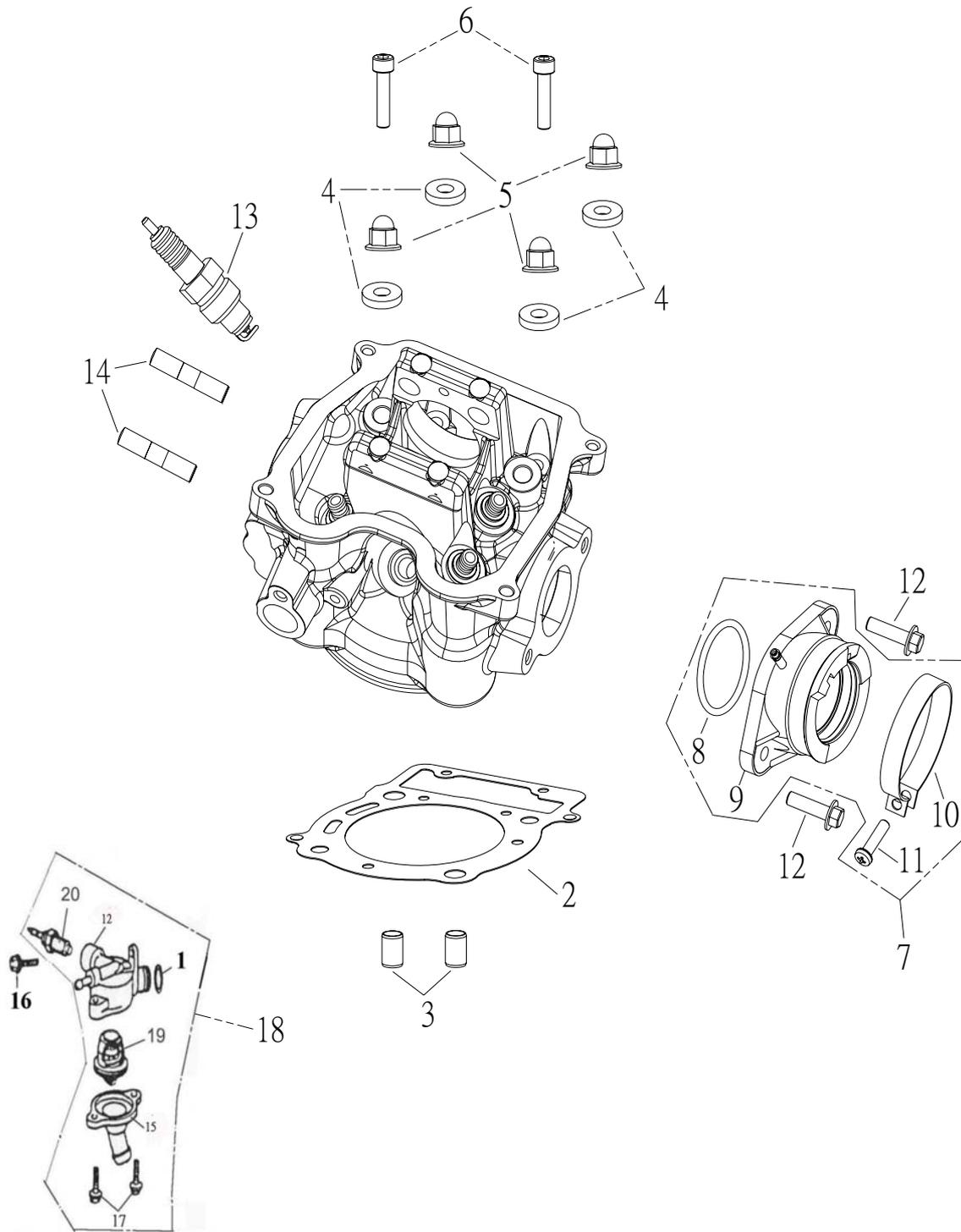
# Chapter 1 Engine, Transmission & Gear

## Cylinder Head Cover



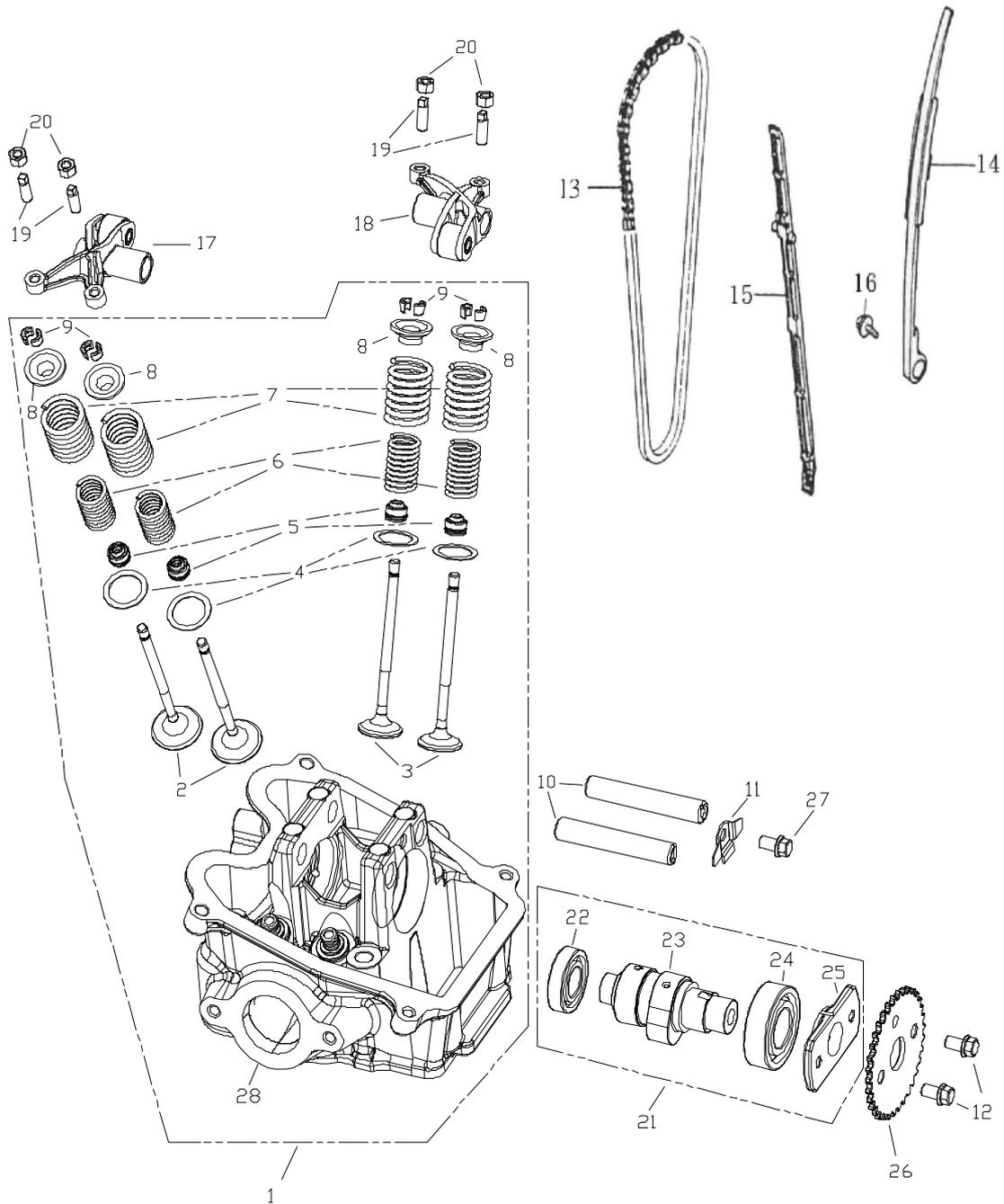
# Chapter 1 Engine, Transmission & Gear

## Cylinder Head



# Chapter 1 Engine, Transmission & Gear

## Camshaft / Valve / Cam



# Chapter 1 Engine, Transmission & Gear

## Cylinder Head/Valves Service Information

### GENERAL

This section covers maintenance of the cylinder head, valves, camshaft and rocker arms.

### SPECIFICATION

Item			Standard mm (in)	Service Limit mm (in)
Camshaft	Cam height	IN	34.590-34.34.700 (1.3618-1.3661)	34.54 (1.3598)
		EX	34.460-34.680 (1.3567-1.3654)	34.41(1.3547)
Rocker arm	Rocker arm I.D.		11.000-11.018 (0.4330-0.4337)	11.10 (0.4370)
	Shaft O.D.		10.966-10.984 (0.4318-0.4324)	10.91 (0.4295)
	Roller O.D.		17.00 (0.6693)	16.95 (0.6673)
Valve	Valve stem	IN	4.975-4.970 (0.1959-0.1965)	4.90 (0.193)
		EX	4.955-4.970 (0.1951-0.1957)	4.90 (0.193)
	Valve guide I.D.		5.00-5.012 (0.1969-0.1973)	5.03 (0.198)
	Stem-to-guide clearance	IN	0.010-0.037 (0.0004-0.0015)	0.08 (0.003)
		EX	0.030-0.057 (0.0012-0.0022)	0.10 (0.004)
	Valve spring free length	Inner	28.7 (1.13)	27.5 (1.08)
		Outer	32.0 (1.26)	30.4 (1.20)
Valve seat width		1.1 (0.04)	1.8 (0.07)	
Cylinder head warpage			-	0.05 (0.002)

### TORQUE VALUES

Cylinder head cover screw	3.5-5.0 N.m (2.5-3.6ft.lb)	Apply a locking agent
Cylinder cover bolt	8-12 N.m (6-9 ft.lb)	
Cylinder head cap nut	22-28 N.m (16-19 ft.lb)	
Camshaft holder bolt	8-12 N.m (6-9 ft.lb)	
Cam chain tensioner sealing bolt	8-12 N.m (6-9 ft.lb)	
Oil pipe bolt: 8 mm	8-12 N.m (6-9 ft.lb)	
Exhaust pipe stud bolt	7-11 N.m (5-8 ft.lb)	
Spark plug	15-20 N.m (11-15 ft.lb)	

# **Chapter 1 Engine, Transmission & Gear**

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## **Troubleshooting**

Engine top problems usually affect engine performance. These can be diagnosed by a compression test, or by tracing noises with a sounding rod or stethoscope.

### **Low Compression**

- Valves
  - Incorrect valve adjustment
  - Burned or bent valves
  - Incorrect valve timing
  - Broken valve spring
- Cylinder head
  - Leaking or damaged head gasket
  - Warped or cracked cylinder head
- Cylinder and piston

### **Compression Too High**

- Excessive carbon build-up on piston or combustion chamber

### **Excessive Noise**

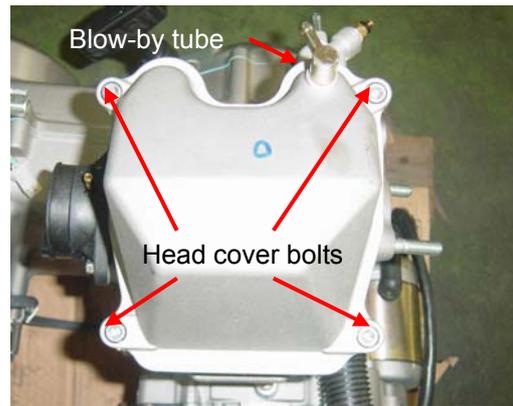
- Incorrect valve adjustment
- Sticking valve or broken valve spring
- Damaged or worn camshaft
- Loose or worn cam chain
- Worn or damaged cam chain tensioner
- Worn cam sprocket teeth
- Worn rocker arm and/or shaft

# Chapter 1 Engine, Transmission & Gear

## Cylinder Head Cover

### CYLINDER HEAD COVER REMOVAL

Remove blow-by hose on cylinder head cover.  
Remove four cylinder head cover bolts.



## Camshaft

### CAMSHAFT REMOVAL

Remove the cam chain adjuster sealing bolt and spring.  
Remove the two cam sprocket holder bolts.

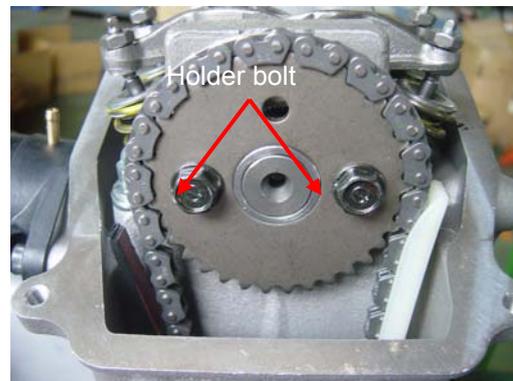
#### NOTE

- Be careful not to drop the bolts into the crankcase

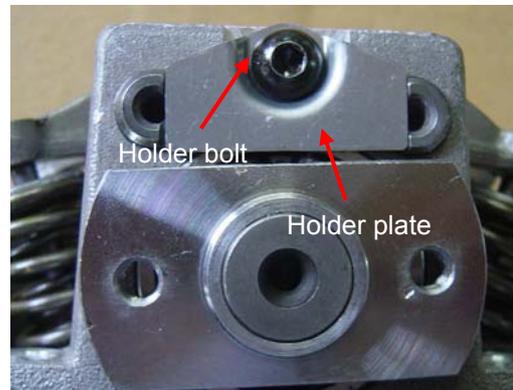
Derail the cam chain from the cam sprocket teeth and remove the cam sprocket.

#### NOTE

- Suspend the cam chain with a piece of wire to keep it from falling to the crankcase.



Remove rocker arm/cam shaft bearing holder plate mounting bolt and holder plate.  
Remove rocker arm shaft by using a M6 bolt screw in shaft then pull out the shaft.  
Remove rocker arm.  
Remove the cam shaft from cylinder head.



### CAMSHAFT INSPECTION

Check each cam lobe for wear or damage.  
Measure the intake and exhaust cam lobe height.

#### Service Limit: 34.54 mm (1.3598 in)

Turn the outer race of each camshaft bearing with your finger.  
The bearing should turn smoothly and quietly.  
Replace the camshaft assembly if the races do not turn smoothly or quietly.



# Chapter 1 Engine, Transmission & Gear

## Rocker Arm

### ROCKER ARM REMOVAL

Remove rocker arm/cam shaft bearing holder plate mounting bolt and holder plate.

Remove rocker arm shaft by using a M6 bolt screw in shaft then pull out the shaft.

Remove rocker arm.



### ROCKER ARM INSPECTION

Measure the rocker arm shaft O.D.

**Service Limit: 16.96 mm (0.6677 in)**



Measure the rocker arm bore I.D.

**Service Limit: 17.04 mm (0.6709 in)**



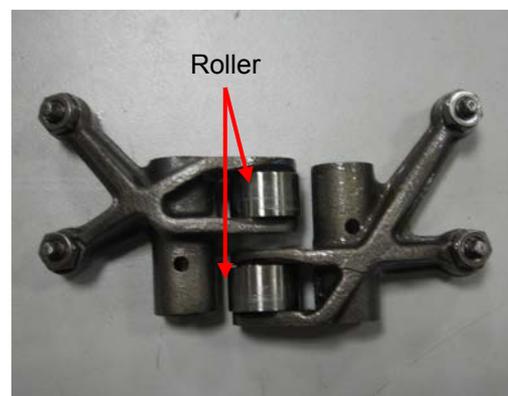
Turn the outer race of each rocker arm roller with your finger.

The roller should turn smoothly and quietly.

Replace the rocker arm assembly if the races do not turn smoothly or quietly.

Measure the rocker arm roller O.D.

**Service Limit: 16.95 mm (0.6673 in)**



# Chapter 1 Engine, Transmission & Gear

## Cylinder Head

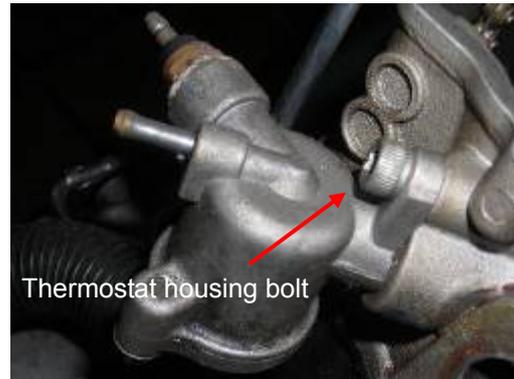
### CYLINDER HEAD REMOVAL

Remove the thermostat housing bolt and thermostat housing from the cylinder head.

Remove the cam chain adjuster sealing bolt and spring.

Remove the two cam sprocket holder bolts.

Derail the cam chain from the cam sprocket teeth and remove the cam sprocket.



Remove the cylinder head base bolt.



Remove the four cylinder head cap nuts and four copper washer.

Remove the cylinder head.



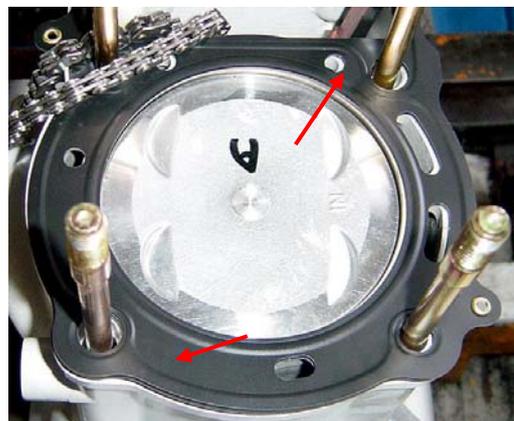
Remove the cylinder head gasket and dowel pins.

Remove the two bolts and carburetor insulator.

Remove all gasket material from the cylinder head mating surface.

### NOTE

- Careful not to drop the gasket material into cylinder.



# Chapter 1 Engine, Transmission & Gear

## CYLINDER HEAD DISASSEMBLY

Compress the valve spring and remove the valve cotters, retainers, springs, spring seat and valves.

### CAUTION

- To prevent loss of tension, do not compress the valve springs more than necessary to remove the cotters.

### NOTE

- Mark all disassembled parts to ensure correct reassembly.

Remove the valve stem seals.

Remove carbon deposits from the combustion chamber.

Clean off any gasket material from the cylinder head gasket surface.

### NOTE

- Avoid damaging the gasket surface.
- Gasket will come off easier if soaked in solvent

## INSPECTION

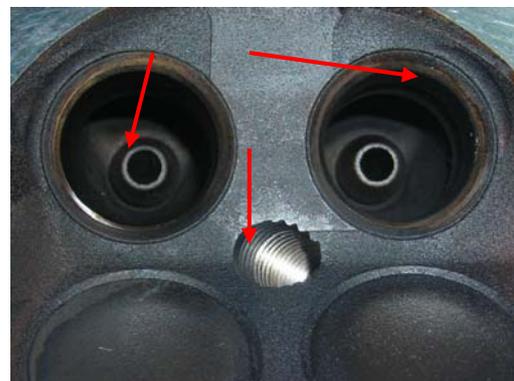
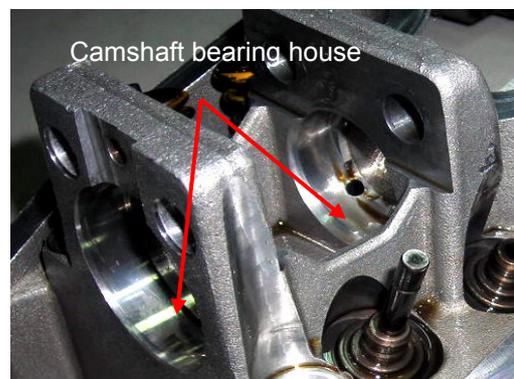
### CYLINDER HEAD

Check the camshaft bearing house for wear or damage.

Check the spark hole and valve areas for cracks.

Check the cylinder head for warpage with a straight edge and feeler gauge.

**Service Limit: 0.05mm (0.002in)**



# Chapter 1 Engine, Transmission & Gear

## VALVE SPRING FREE LENGTH

Measure the free length of the inner and outer valve springs.

### Service Limit:

Inner (IN, EX): 27.5 mm (1.08 in)

Outer (IN, EX): 30.4 mm ( 1.20 in)



## VALVE STEM

Inspect each valve for bending, burning, or abnormal stem wear.

Check valve movement in the guide and measure and record each valve stem O.D.

### Service Limit:

IN: 4.9 mm (0.193 in)

EX: 4.9 mm (0.193 in)



## VALVE GUIDE

### NOTE

- Remove the guides to remove any carbon build-up before checking clearance.

Measure and record each valve guide I.D. using a ball gauge or inside micrometer.

**Service Limit: 5.03 mm (0.198 in)**



Subtract each valve stem O.D. from the corresponding guide I.D. to obtain the stem-to-guide clearance.

### Service Limit:

IN: 0.08 mm (0.003 in)

EX: 0.10 mm (0.004 in)



# Chapter 1 Engine, Transmission & Gear

## NOTE

- If the stem-to guide clearance exceeds the service limits, determine if a new guide with standard dimensions would bring the clearance within tolerance. If so, replace any guide as necessary and to fit.

If the stem-to-guide clearance exceeds the service limits with new guide, replace the valve also.

## NOTE

- Reface the valve seats whenever the valve guide are replace.

## CYLINDER HEAD ASSEMBLY

Lubricate each valve stem with oil then insert the valves into the valve guides.

Install new valve stem seals.

Install the valve spring seat, springs and retainers.

The springs' tightly wound coils should face in toward the combustion chamber.

## NOTE

- There has paint marked on springs loosely wound coils both inner and outer springs.

Compress the valve springs using the valve spring compressor, then install the valve cotters.



# Chapter 1 Engine, Transmission & Gear

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## **CAUTION**

- To prevent loss of tension, do not compress the valve spring more than necessary.

Tap the valve stems gently with a plastic hammer to firmly seat the cotters.

## **CAUTION**

- Support the cylinder head above the working bench surface to prevent possible valve damage.



Install the carburetor insulator with two bolts and tighten the bolts.



## **CYLINDER HEAD INSTALLATION**

Install the dowel pins and a new gasket onto the cylinder

Install the cylinder head onto the cylinder.

Install four copper washers and cap nuts, and tighten the cap nuts.

**Torque: 22 – 26 N.m (16-19 ft.lb)**



## **NOTE**

- Tighten the cap nuts in a crisscross pattern in 2-3 steps.

Install the cylinder base bolt.

Install a new O-ring onto the thermostat housing.

Install the thermostat housing to the cylinder head and tighten the bolt.

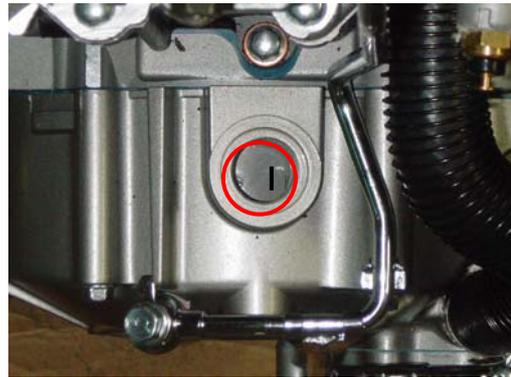


# Chapter 1 Engine, Transmission & Gear

## CAMSHAFT INSTALLATION

Remove the timing hole (oil filling) cap from the right crankcase cover.

Turn the drive pulley counterclockwise and align the "T" mark on the flywheel with the index mark on the right crankcase cover.



Insert the camshaft into camshaft holding house and turn down the intake and exhaust lobe.



Install intake and exhaust rocker arm to cylinder head.

Tighten the rocker arm/camshaft bearing holder plate mounting bolt.



Push the cam chain adjuster push rod back into the adjuster body by pressing the tab down.  
Rail the cam chain to the cam sprocket teeth and install the cam sprocket to camshaft as shown.  
Tighten the two cam sprocket holder bolts.  
Install the cam chain adjuster spring and sealing bolt, and tighten the sealing bolt.

**Torque: 8 – 12 N.m (6 – 9 ft.lb)**

Install the timing hole cap to the right rear cover.



# Chapter 1 Engine, Transmission & Gear

## VALVE CLEARANCE

### NOTE

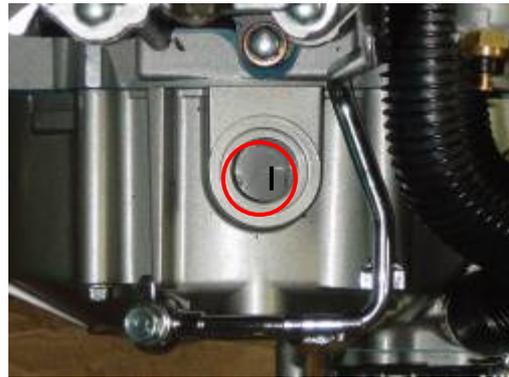
- Inspect and adjust valve clearance while the engine is cold (below 35 °C/95°F).

Remove the cylinder head cover.

Remove the left crankcase recoil cover.

Remove the timing hole plug (oil filling plug) from the right crankcase cover.

Remove the spark plug, this will make it easier to turn the crankshaft.



Rotate the recoil drive pulley counterclockwise and align the punch mark on the flywheel with the index mark on the right crankcase cover to bring the position to TDC (Top Dead Center) on the compression stroke.

With the engine in this position, all four valves can be checked.



Loosen the valve adjuster locknut and insert a feeler gauge of the thickness as specified between the valve stem and valve adjuster. Turn the adjusting screw until the clearance is correct then tighten the locknut

### NOTE

- Start with the intake valves

**Valve Clearance: IN 0.15 mm (0.006 in)  
EX 0.15 mm (0.006 in)**



When the clearances are correct for all four valves, install the cylinder head cover.

The remainder of installation is the reverse of removal.

## **Chapter 1 Engine, Transmission & Gear**

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### **CYLINDER HEAD COVER INSTALLATION**

Check the cylinder head cover seal for any buckle or broken.

Replace a new one if necessary.

Coating engine oil on seal face before install.

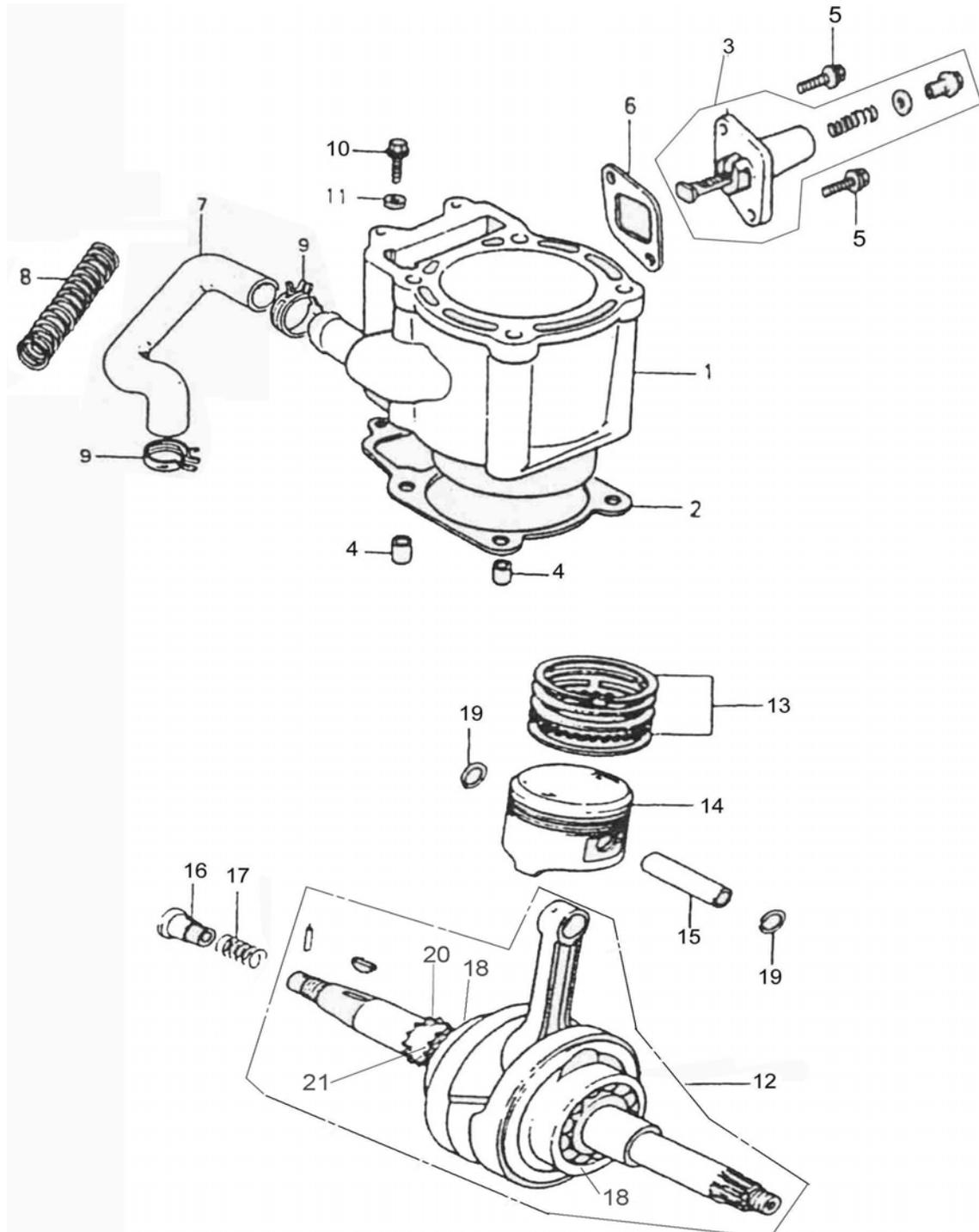
Install the cylinder head cover to cylinder and tighten four 6mm head cover bolts crisscross pattern in two or more steps.

**Torque: 8 – 12 N.m (6 – 9 ft.lb)**



# Chapter 1 Engine, Transmission & Gear

## Cylinder/Piston/Crankshaft



# Chapter 1 Engine, Transmission & Gear

## Cylinder/Piston/Crankshaft Service Information

### GENERAL

- It is recommended to remove the engine from frame body for cylinder and piston service.
- If the crankshaft bearing, oil pump drive sprocket or timing sprocket need to replacement, the crankshaft assembly must be replaced.

### SPECIFICAIONS

ITEM		STANDARD mm (in)	SERVICE LIMIT mm (in)	
Cylinder	I.D.	76.000-76.010 (2.9921-2.9925)	76.10 (2.9960)	
	Warpage	---	0.05 (0.002)	
	Taper	---	0.05 (0.002)	
	Out-of-round	---	0.05 (0.002)	
Piston, Piston ring	Ring-to-groove clearance	Top	0.015-0.050 (0.0006-0.0020)	
		Second	0.015-0.050 (0.0006-0.0020)	
	Ring end gap	Top	0.15-0.35 (0.006-0.014)	
		Second	0.15-0.35 (0.006-0.014)	
		Oil (Side rail)	0.2-0.7 (0.01-0.03)	
	Piston O.D.		75.985-76.000 (2.9915-2.9921)	75.90 (2.9882)
	Piston-to-cylinder clearance		0.010-0.040 (0.0004-0.0016)	0.10 (0.004)
Piston pin bore		17.002-17.008 (0.6694-0.6696)	17.04 (0.671)	
Piston pin O.D.		16.994-17.000 (0.6691-0.6693)	16.96 (0.668)	
Piston-to-piston ring clearance		0.002-0.014 (0.0001-0.0006)	0.02 (0.001)	
Connecting rod small end I.D.		17.016-17.034 (0.6699-0.6706)	17.06 (0.672)	
Connecting rod big end side clearance		0.05-0.4 (0.002-0.016)	0.6 (0.02)	
Connecting rod big end radial clearance		0-0.008 (0-0.0004)	0.05 (0.002)	
Crankshaft runout		---	0.10 (0.004)	

### TORQUE VALUES

Cam chain adjuster base bolt	8 – 12 N.m (6 – 9 ft.lb)
Cylinder stud bolt	7 – 11 N.m (5 – 8 ft.lb)

## Troubleshooting

### Low compression or uneven compression

- Worn cylinder or piston rings

### Excessive smoke

- Worn cylinder, piston or piston rings
- Improperly installed piston rings
- Damaged piston or cylinder

### Overheating

- Excessive carbon build-up on piston
- Blocked or restricted flow of coolant
- Sticking thermostat

### Knocking or abnormal noise

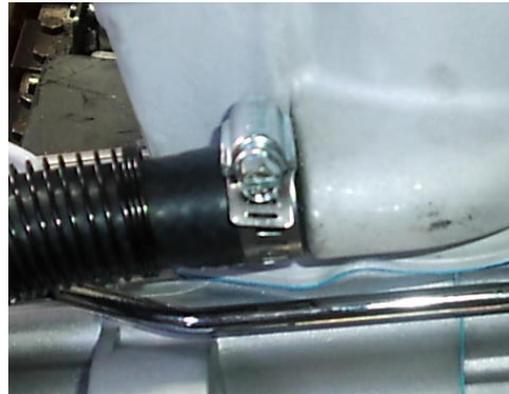
- Worn piston and cylinder
- Excessive carbon build-up on piston head

# Chapter 1 Engine, Transmission & Gear

## Cylinder

### CYLINDER REMOVE

- Remove the cylinder head.
- Disconnect the water hose from the cylinder.
- Remove the cam chain guide.
- Remove the cylinder base bolt and cylinder.



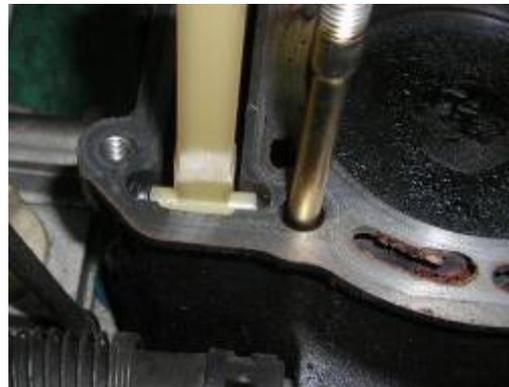
Remove the cylinder gasket and dowel pins.



- Place rags in the crankcase openings.
- Clean off any gasket material from the cylinder surface of the crankcase.

### NOTE

- Gasket material will come off easier if it is soaked in solvent.

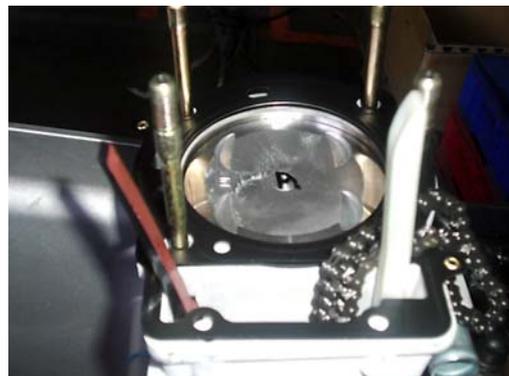


Remove the cam chain adjuster base and gasket from the cylinder.

Clean any material from the cylinder surface.

### NOTE

- Gasket material will come off easier if it is soaked in solvent.



# Chapter 1 Engine, Transmission & Gear

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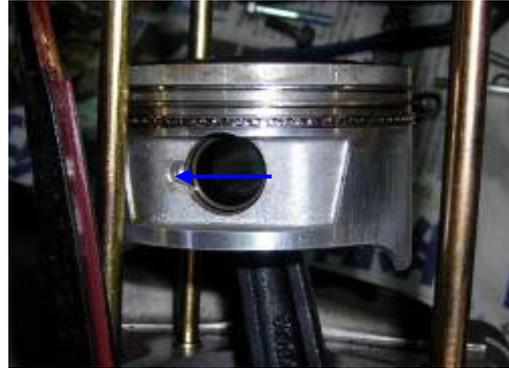
## Piston

### PISTON REMOVE

Place clean shop towels in the crankcase opening to keep the piston pin clips or other parts from falling into the crankcase.

Remove the piston pin clips with pliers.

Pull the piston pin out of the piston and remove the piston.



### PISTON, PISTON PIN AND PISTON RING INSPECTION

Measure the piston pin bore I.D.

**Service Limit: 17.04 mm (0.6709 in)**

Measure the piston pin O.D.

**Service Limit: 16.96 mm (0.6677 in)**

Calculate the piston pin-to-piston clearance

**Service Limit: 0.02 mm (0.001 in)**

Measure the piston ring-to-groove clearance

**Service Limits: TOP 0.09 mm (0.004 in)**

**2nd 0.09 mm (0.004 in)**

Measure the connecting rod small end I.D.

**Service Limit: 17.06 mm (0.6716 in)**

Remove the piston rings.

Inspect the piston for damage and ring grooves for wear.



# Chapter 1 Engine, Transmission & Gear

## CAUTION

- Piston rings are easily broken; take care not to damage them during removal.

Insert each piston ring into the cylinder 20 mm (0.75 in) in from the bottom. To ensure that it's square in the bore, use a piston to push it in.

Measure the ring end gap.

**Service Limits: TOP 0.50 mm (0.020 in)  
2nd 0.50 mm (0.020 in)**



Measure and record the piston O.D. at a point 10 mm (0.4 in) from the bottom and 90° to the piston pin bore.

**Service Limit: 75.90 mm (2.9882 in)**

Compare this measurement against the service limit and calculate piston-cylinder clearance.



## CYLINDER INSPECTION

Inspect the cylinder walls for scratches and wear. Measure and record the cylinder I.D. at three levels in both X, Y axis. Take the maximum reading to determine the cylinder wear.

**Service Limit: 76.10 mm (2.996 in)**

Calculate the piston-to-cylinder clearance. Take the maximum reading to determine the clearance

**Service Limit: 0.10 mm (0.004 in)**



# Chapter 1 Engine, Transmission & Gear

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## PISTON RING INSTALLATION

Clean the piston head, ring lands and skirts.

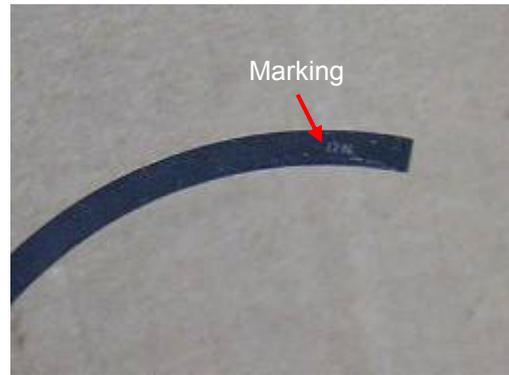
Carefully install the piston rings onto the piston.

Stagger the ring end gaps as shown.

### NOTE

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- Be careful not to damage the piston rings during assembly.
  - All rings should be installed with the markings facing up.
  - After installing the rings they should rotate freely without sticking.
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## PISTON INSTALLATION

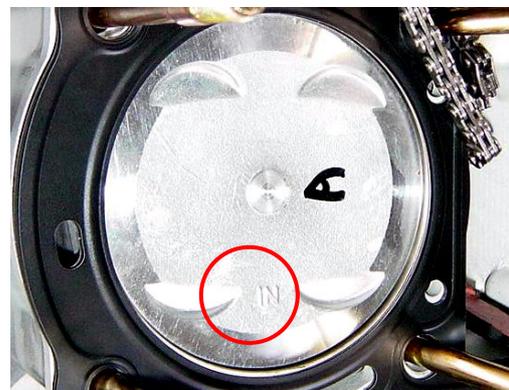
Install the piston and piston pin. Position the piston "IN" mark on the intake valve side.

Install a new piston pin clips.

### NOTE

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- Do not align the piston pin clip end gap with the piston cut-out.
  - Place a shop towel around the piston skirt and in the crankcase to prevent the piston pin clips from falling into the crankcase.
- 



# Chapter 1 Engine, Transmission & Gear

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## CYLINDER INSTALLATION

Install the cam chain adjuster base onto the cylinder with a new gasket.

Tighten the two adjuster base bolts.

**Torque: 8 – 12 N.m (6 – 9 ft.lb)**

Coat the cylinder bore, piston and piston rings with fresh engine oil.

Carefully lower the cylinder over the piston by compressing the piston rings, one at a time.

### **CAUTION**

- Do not force the cylinder over a ring; you may damage the piston and piston rings.

Loosely install the cylinder base bolt and seal washer.

Install the water hose to the cylinder.

Install the cam chain guide.

### **NOTE**

- Push the guide in until it bottoms in the crankcase guide hole.

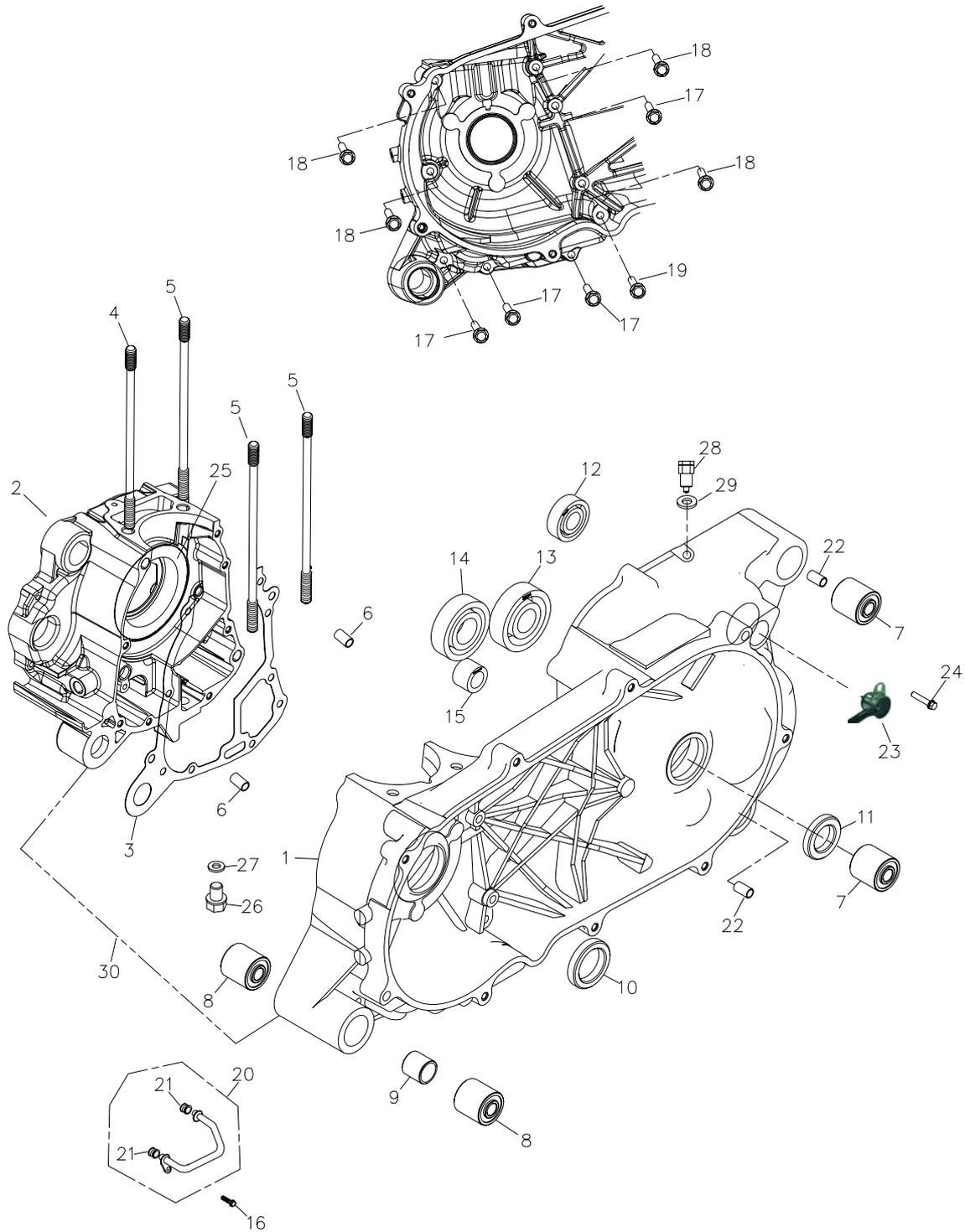
Install the cylinder head.

Tighten the cylinder base bolt.



# Chapter 1 Engine, Transmission & Gear

## Crankcase



# Chapter 1 Engine, Transmission & Gear

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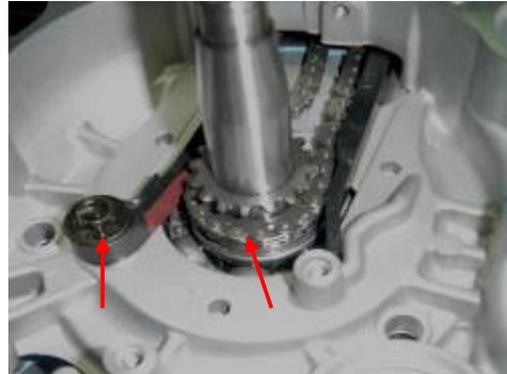
## Crankcase

### CRANKCASE SEPARATION

Remove the cam chain adjuster by removing the bolt.

Remove the cam chain.

Remove the nine crankcase attaching bolts.



Remove the crankcase with the left side crankcase down and remove the right crankcase.

### **CAUTION**

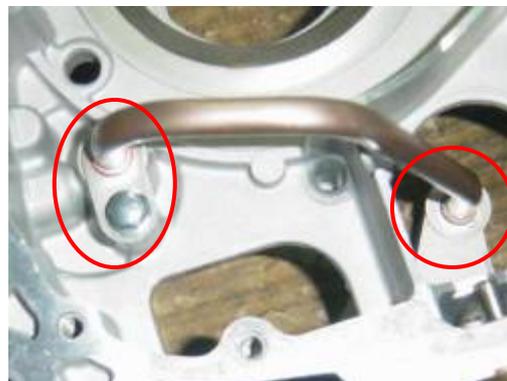
◦ Never pry the crankcase mating surfaces apart.  
Remove the gasket and dowel pins.



Remove the crankshaft from the left crankcase.

Remove the oil pipe from the right crankcase by removing the bolt.

Check the oil seal for wear or damage.  
Replace the oil seal if necessary.



# Chapter 1 Engine, Transmission & Gear

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## CRANKSHAFT INSPECTION

Measure the connecting rod big end side clearance with a feeler gauge.

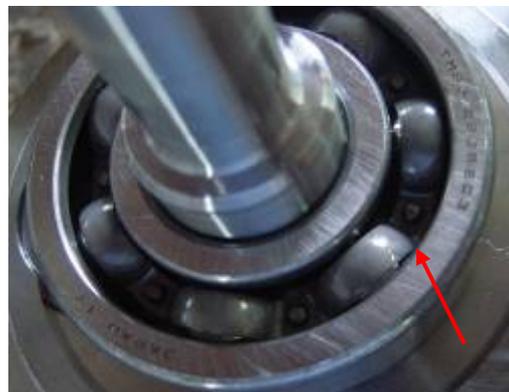
**Service Limit: 0.05 mm (0.002 in)**

Set the crankshaft on a stand or in V blocks and using a dial indicator to read run out at the points shown.

**Service Limit: 0.10 mm (0.004 in)**

Turn the outer race of each bearing with your finger. The bearings should turn smoothly and quietly. Also check that the bearing inner race fits tightly in the crankshaft.

Replace the crankshaft assembly if the races do not turn smoothly, quietly or if they fit loosely in the crankshaft.



## CRANKSHAFT ASSEMBLY

Remove all gasket materials from crankcase being careful not to damage the mating surfaces.

Apply grease to the lip of a new oil seal and install it into the left crankcase.

Wash the oil pipe in clean solvent and install new oil seals on both ends of the pipe.



# Chapter 1 Engine, Transmission & Gear

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Install the oil pipe into the right crankcase and secure it with the bolt.



Install the crankshaft into the left crankcase being careful not to damage the oil seal.



Install the dowel pins and a new gasket. Place the crankcase over the crankshaft and onto the left crankcase.

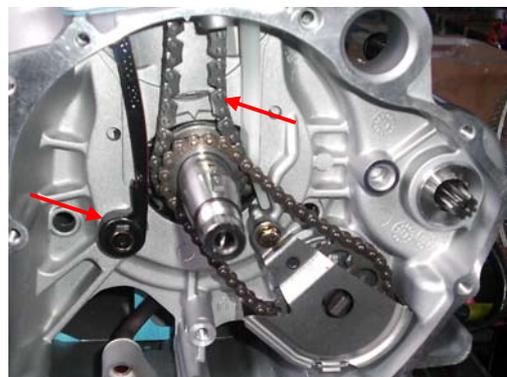
Install the nine crankcase attaching bolts.

**Torque: 8 – 12 N.m (6 – 9 ft.lb)**



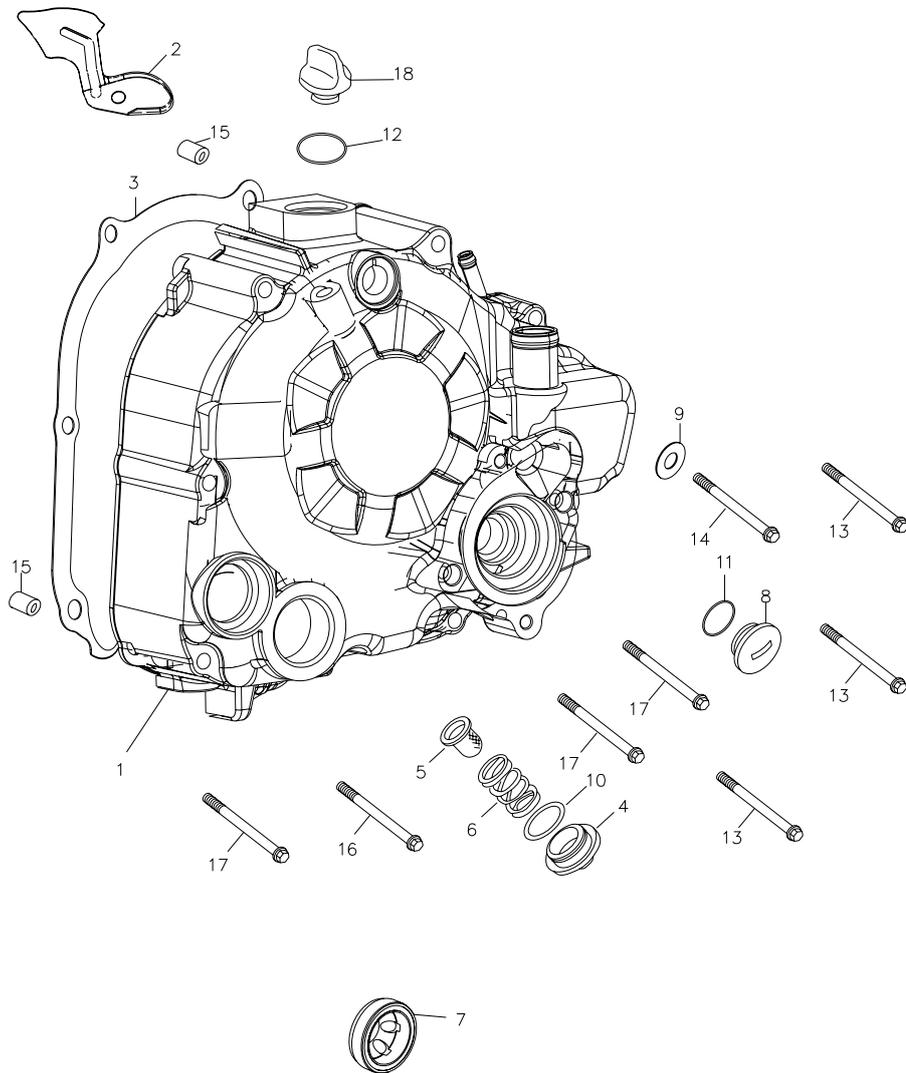
Install the cam chain, cam chain adjuster slipper and secure it with the bolt.

**Torque: 8 – 12 N.m (6 – 9 ft.lb)**



# Chapter 1 Engine, Transmission & Gear

## Right Crankcase Cover

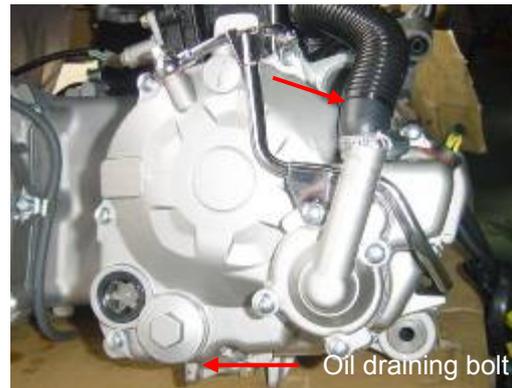


# Chapter 1 Engine, Transmission & Gear

## Right Crankcase

### REMOVAL

- Drain the coolant by disconnected coolant tube.
- Remove oil tube.
- Drain the engine oil thru oil filter cover or oil draining bolt.
- Remove right case mounting bolts.
- Remove right crankcase.
- Remove the crankcase gasket and dowel pins.

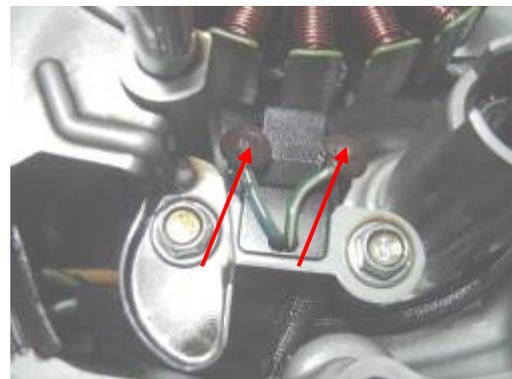


### INSPECTION

- Remove water pump cover and inspect the pump impeller for deficient or damage.
- Inspect the mechanical seal for wear or damage.
- Turn the water pump shaft to check the bearing, it should turn smoothly and quietly.



- Inspect ignition pulse generator soldering and check the sealing rubber for any deficient.



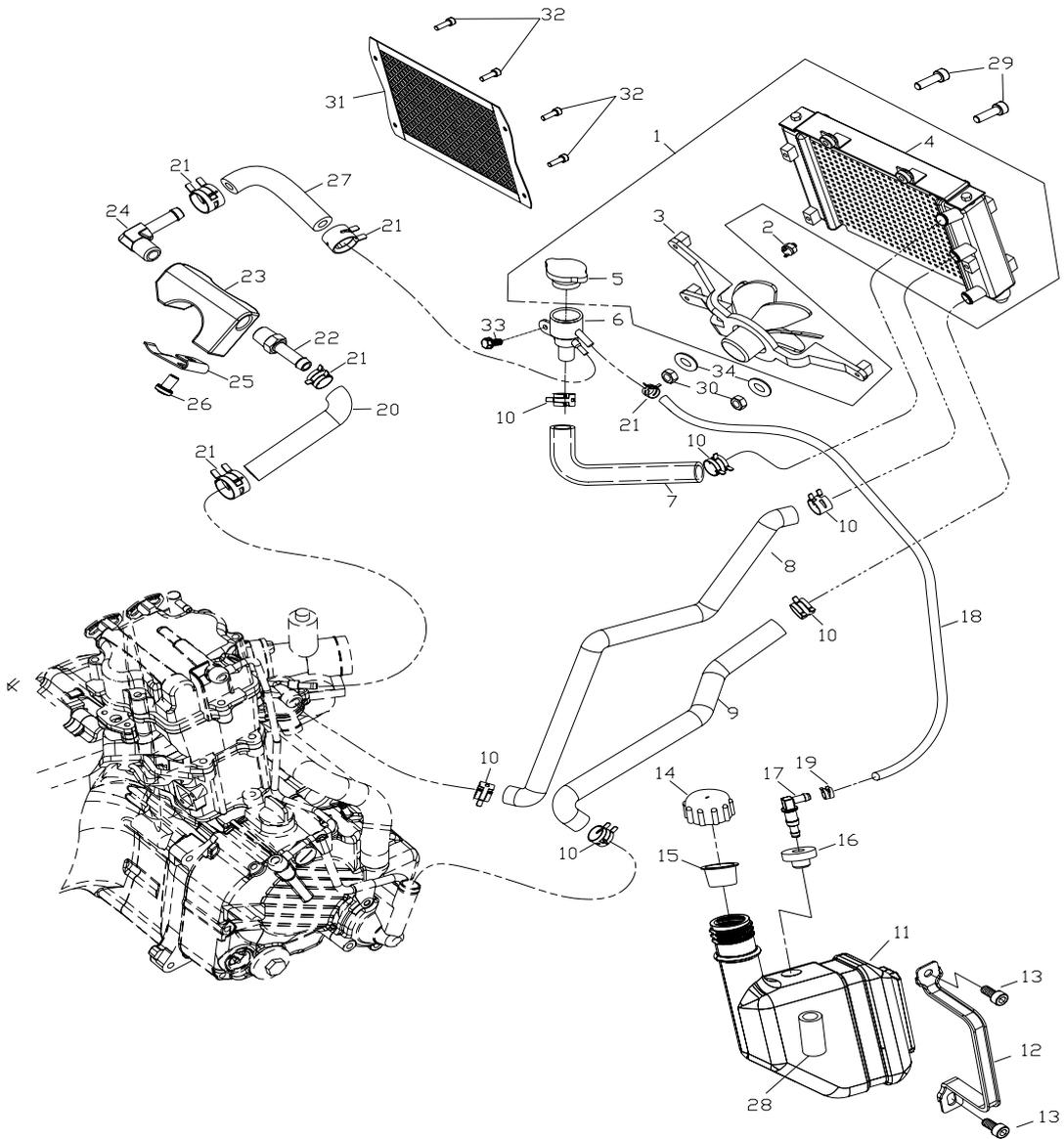
### INSTALLATION

- Use solvent to clean right crankcase.
- Install the dowel pins and a new gasket.
- Apply silicon sealing on ignition pulse generator sealing rubber.
- Align water pump shaft gap toward oil pump shaft then install the right crankcase and tighten the mounting bolts.
- Turn the water pump impeller to ensure shaft alignment then install water pump cover.



# Chapter 1 Engine, Transmission & Gear

## Cooling system



# Chapter 1 Engine, Transmission & Gear

## Cooling System Service Information

### GENERAL

#### **WARNING**

- *Do not remove the radiator cap when the engine is hot. The coolant is under pressure and severe scalding could result. The engine must be cool before servicing the cooling system.*
- ⊙ Use only distilled water and ethylene glycol in the cooling system. A 50/50 mixture is recommended for maximum corrosion. Do not use alcohol-based antifreeze.
- ⊙ Add coolant at the reserve tank. Do not remove the radiator cap except to refill or drain the system.
- ⊙ The cooling system service can be done with the engine on frame.
- ⊙ Avoid spilling coolant on painted surface.
- ⊙ After servicing the system, check for leaks with a cooling system taster.

#### **SPECIFICATION**

Radiator cap relief pressure	75-105 kPa (0.75-1.05 kg/cm <sup>2</sup> )
Freezing point (Hydrometer test)	55% distilled water + 45% ethylene glycol:-32°C (-26°F) 50% distilled water + 50% ethylene glycol:-37°C (-35°F) 45% distilled water + 55% ethylene glycol:-44.5°C (-48°F)
Coolant capacity: Radiator and engine	1.10 liter (1.16 US qt.)
Reserve tank	0.30 liter (0.31 US qt.)
Total system	1.40 liter (1.47 US qt.)
Thermostat	Begin to open:60°C to 65°C (140°F to 149°F) Valve lift:3.5-4.5mm (0.14-0.18in) at 80°C (176°F)
Boiling point (with 50-50 mixture)	Un-pressurized: 107.7°C (226°F) Cap on, pressurized: 125.6°C (258°F)

#### **TORQUE VALUES**

Water pump impeller (left hand threads)	10-14N.m (7-10 ft-lb)
Oil pipe bolt 8 mm	8-12 N.m (6-9 ft-lb)
12 mm	18-22 N.m (13-169 ft-lb)

### Troubleshooting

#### **Engine temperature too high**

- Faulty temperature gauge or gauge sensor
- Faulty radiator cap
- Thermostat stuck closed
- Insufficient coolant
- Passages blocked in radiator, hoses or water jacket
- Faulty water pump
- Faulty fan motor

#### **Engine temperature too low**

- Faulty temperature gauge or gauge sensor
- Thermostat stuck open

#### **Coolant leaks**

- Faulty pump mechanical seal
- Deteriorated O-ring.
- Damaged or deteriorated hoses

# Chapter 1 Engine, Transmission & Gear

## System Testing

### COOLING SYSTEM LEAK TEST

Remove the front luggage rack.

Remove the radiator cap.

Install special plug (radiator cap) and hose pincher on overflow hose.

Pressurize all system through coolant reservoir to 103 kPa (15 PSI).

Repair or replace components if system will not hold the specified pressure for at least six seconds.



## Coolant Replacement

### **WARNING**

◦ *The engine must cool before removing the radiator cap or severe scalding may result.*

Remove the front light fender (280AS) or front fender assy. (280AU).

Remove the radiator cap.

Place a drain pan under the water pump and drain the coolant from the system by removing the coolant tube.

Reinstall the coolant tube.

Fill the system with a 50-50 mixture of distilled water and ethylene glycol.

**Capacity: 1.1 L (1.16 US qt.)**

Bleed air from the system.

Start the engine and run until there are no air bubbles in the coolant and the level stabilizes

Stop the engine and add coolant up to the proper level if necessary.



# Chapter 1 Engine, Transmission & Gear

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Check the level of coolant in the reserve tank and fill to the correct level if the level is low.

Install the front light fender (280AS) or front fender assy. (280AU).

## Radiator

### INSPECTION

Inspect the radiator soldered joints and seams for leaks.

Blow dirt out from between core fins with low pressure air.

If insects etc., are clogging the radiator, wash them off with low pressure water.

### REMOVEAL

Remove the front light fender (280AS) or front fender assy. (280AU).

Drain the coolant.

Remove the radiator grill.

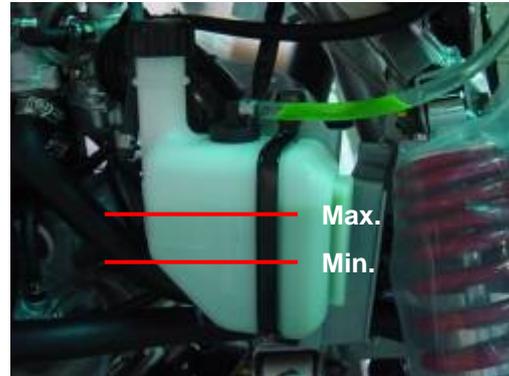
Disconnect the radiator upper and lower hoses from the radiator.

Disconnect the fan switch wire.

Remove two mounting screws and radiator.

### INSTALLATION

Install the radiator in the reverse order of removal. Fill and bleed the coolant system.



# Chapter 1 Engine, Transmission & Gear

## Thermostat

### REMOVAL

Disconnect the thermo sensor wire connector from the housing.

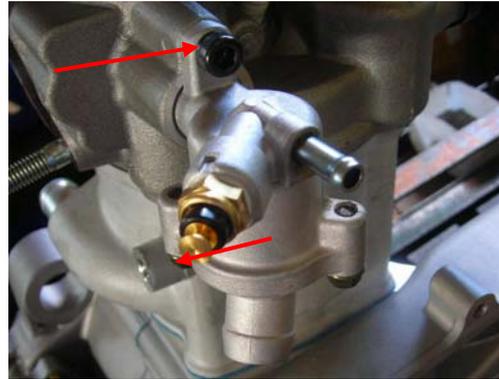
Drain the coolant

Remove the thermostat housing from the cylinder head by removing the mounting bolt.

Remove the cover attaching bolts and separate the thermostat housing.

Remove the O-ring from the thermostat housing.

Remove the thermostat from the housing.



### INSPECTION

Inspect the thermostat visually for damage.

Suspend the thermostat in heated water to check its operation.

### NOTE

◦ If the thermostat or thermometer touches the pan, you'll get a false reading.

Replace the thermostat if the valve stays open at room temperature, or if it responds at temperature other than those specified.

### Technical Data

Start to open	60°C to 65°C (140°F to 149°F)
Fully open	3.5-4.5mm (0.14-0.18in) when heated to 90°C (176°F) for 5 minutes



### INSTALLATION

Install in the reverse order of removal.

### NOTE

◦ Replace the O-ring with a new one and apply grease to it.

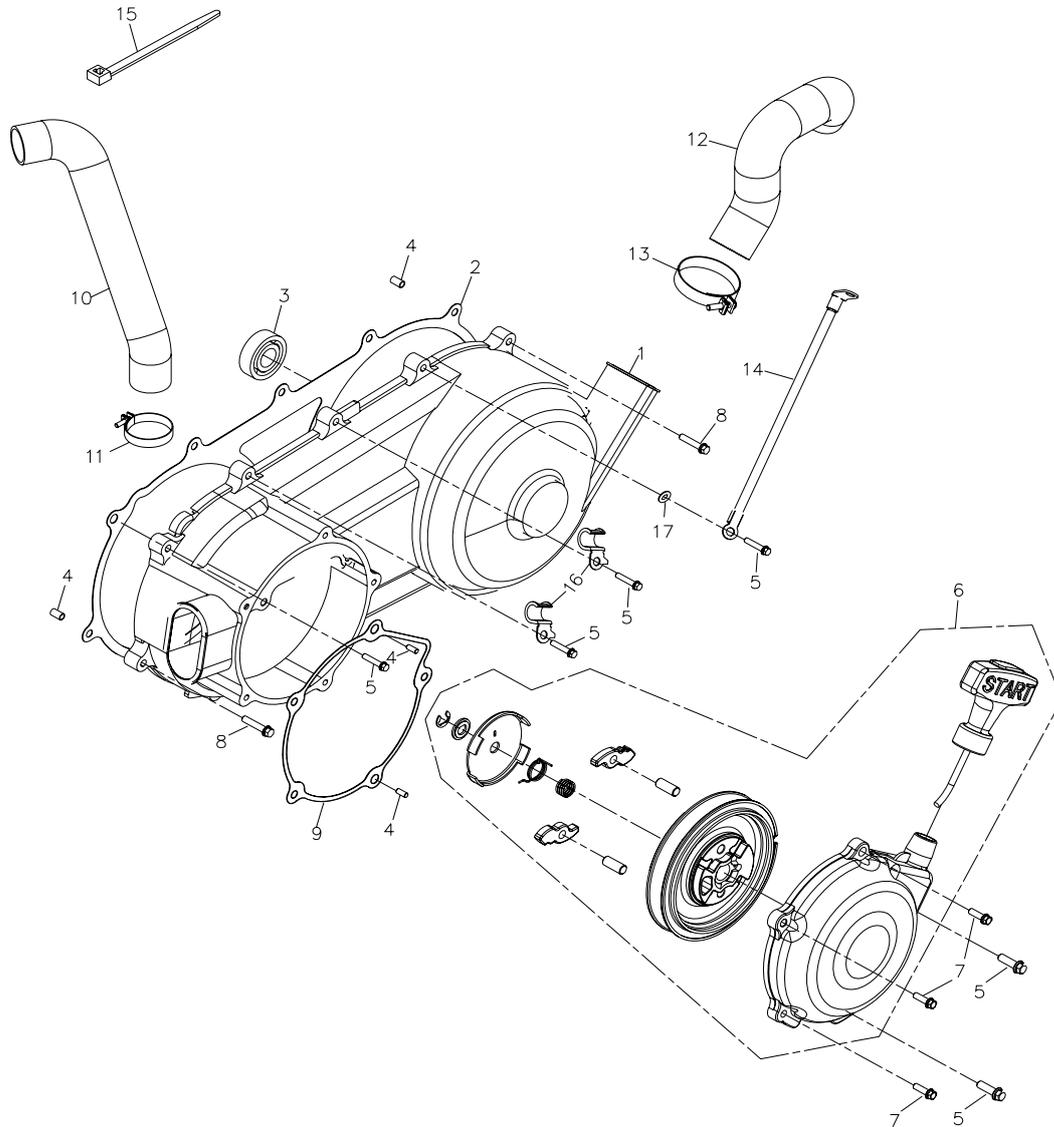
Tighten the thermostat housing mounting bolt.

Fill the coolant system with the specified coolant.



# Chapter 1 Engine, Transmission & Gear

## Left Crankcase Cover



# Chapter 1 Engine, Transmission & Gear

## Drive Pulley/Clutch/Driven Pulley Service Information

### GENERAL

- The drive pulley, clutch and driven pulley can be service with the engine installed.
- Avoid getting grease and oil on the drive belt and pulley faces.

### SPECIFICATION

ITEM	STANDARD mm (in)	SERVICE LIMIT mm (in)
Moveable drive face bushing I.D.	27.000-27.021 (1.0630-1.0638)	27.06 (1.065)
Drive face boss O.D.	26.970-26.990 (1.0618-1.0628-6)	26.94 (1.061)
Drive belt width	23.8-24.3 (0.937-0.957)	23.0 (0.9055 )
Clutch lining thickness	---	0.5 (0.02)
Clutch outer I.D.	153.0-153.3 (6.023-6.035)	153.5 (6.043)
Driven face spring free length	114.8 (4.520)	110.0 (4.33)
Driven face O.D.	40.96-40.98 (1.612-1.613)	40.92 (1.611)
Moveable driven face I.D.	41.00-41.04 (1.614-1.616)	41.06 (1.617)
Weight roller O.D.	23.0-23.2 (0.906-0.913)	22.4 (0.8819)
Drive/Driven face depth	---	0.40 (0.016)

### Torque Values

Left crankcase cover bolt	8-12 N.m (6-9 ft.lb)
Drive face nut	90-100 N.m (65-72 ft.lb)
Clutch outer nut	50-60 N.m (36-43 ft.lb)
Moveable driven face nut	70-90 N.m (51-65 ft.lb)

### Troubleshooting

#### Engine starts but vehicle won't move

- Worn or damaged drive belt
- Damaged ramp plate
- Worn or damaged clutch lining

#### Engine stalls or vehicle creeps

- Broken clutch weight spring

#### Poor performance at high speed or lack of power

- Worn drive belt
- Weak driven face spring
- Faulty driven face

# Chapter 1 Engine, Transmission & Gear

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## Left Crankcase Cover

### REMOVAL/INSTALLATION

Remove left foot bar.

Remove front and rear air tube on left crankcase.

Remove the crankcase cover attaching bolts and remove the crankcase cover, dowel pins and gasket.



Inspect the gasket for crankcase cover and replace it if necessary.

Install the left crankcase cover in the reverse order of removal.

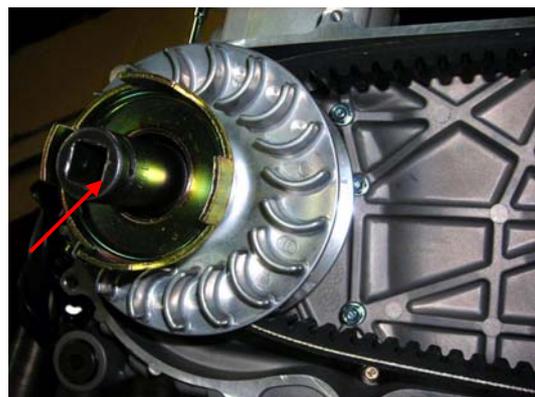
**Torque: 8 – 12 N.m (6 – 9 ft.lb)**

## Drive Belt

### REMOVAL

Remove the left crankcase cover.

Hold the drive pulley with the drive pulley holder and remove the drive pulley nut, washer and drive face.



Remove the drive belt.

# Chapter 1 Engine, Transmission & Gear

## INSPECTION

Check the drive belt for cracks, separation or abnormal or excessive wear.

Measure the drive belt width.

**Service Limit: 23.0 mm (0.9055 in)**



## INSTALLATION

Lay the drive belt on the driven pulley.

Squeeze the driven pulley to widen its faces then set the drive belt on the drive pulley face collar.

Reinstall the drive pulley face and recoil dish, hold the drive pulley and tighten the nut.

**Torque: 80 – 100 N.m (58 – 72 ft.lb)**



Reinstall the left crankcase cover.

## Drive Pulley

### REMOVAL

Remove the left crankcase cover.

Remove the drive belt.

Remove the moveable drive face assembly.

### NOTE

- If the spline fitting is tight, use a commercially available bearing puller.

### DISASSEMBLY

Remove the ramp plate.

Remove the weight rollers.



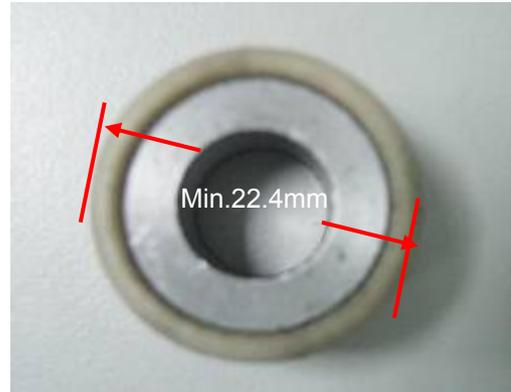
# Chapter 1 Engine, Transmission & Gear

## INSPECTION

Check the face seal for wear or damage.  
Replace the face seal with a new one if necessary.

Check each roller for wear or damage.  
Measure the weight roller O.D.

**Service Limit: 22.4 mm (0.8819 in)**



Measure the moveable drive face bushing I.D.

**Service Limit: 27.06 mm (1.065 in)**



Check the drive face collar for wear or damage.  
Measure the O.D. at the drive face sliding surface.

**Service Limit: 26.94 mm (1.061 in)**



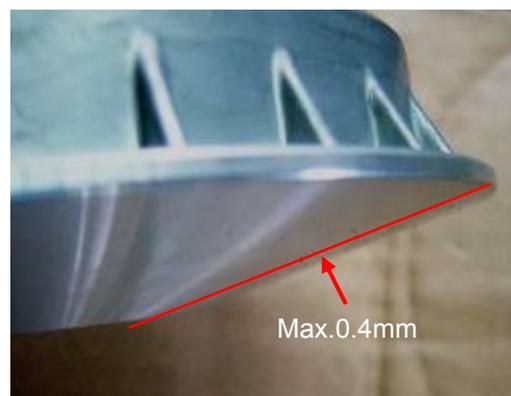
Check the driver face for wear or damage.  
Measure the drive face depth with the straight edge and feeler gauge.

**Service Limit: 0.4 mm (0.0016 in)**

Check the moveable drive face for wear or damage.

Measure the drive face depth with the straight edge and feeler gauge.

**Service Limit: 0.4 mm (0.0016 in)**



# Chapter 1 Engine, Transmission & Gear

---

## ASSEMBLY

Lubricate the inside of the moveable drive face with grease then install the weight rollers.

## NOTE

- Use 25-30g of grease and apply to the inside of the moveable drive face evenly.

Specified grease: Lithium based grease

Install the ramp plate.



Apply grease to the drive pulley collar.

Install the drive pulley face collar with the spline side facing out.

Clean off any grease or oil from the drive pulley faces.



## INSTALLATION

Install the moveable drive face onto the crankshaft.

Install the drive belt.

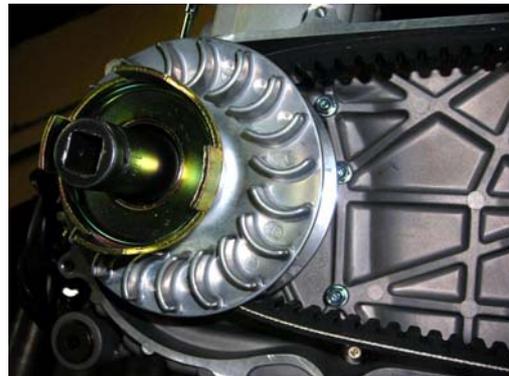
Clean the drive pulley face and install it.

Set the recoil dish onto the crankshaft and loosely install the drive pulley nut.

Apply engine oil to the threads of the drive pulley nut.

Hold the drive pulley and tighten the drive pulley nut.

**Torque: 90-100 N.m (65-72 ft.lb)**



## CAUTION

- Do not allow oil or grease on the drive belt or pulley face

Reinstall the removed parts in the reverse order of removal.

# Chapter 1 Engine, Transmission & Gear

---

## Clutch/Driven Pulley

### REMOVAL

Remove the left crankcase cover, drive pulley face and drive belt.

Hold the clutch outer with drive pulley holder and remove the drive pulley nut and clutch outer.

Remove the driven pulley/clutch assembly.



### INSPECTION

Check the clutch outer for wear or damage.

Measure the clutch outer I.D.

**Service Limit: 154.0 mm (6.063 in)**



Check the clutch shoes for wear or damage.

Measure the clutch lining thickness.

**Service Limit: 0.5 mm (0.02 in)**



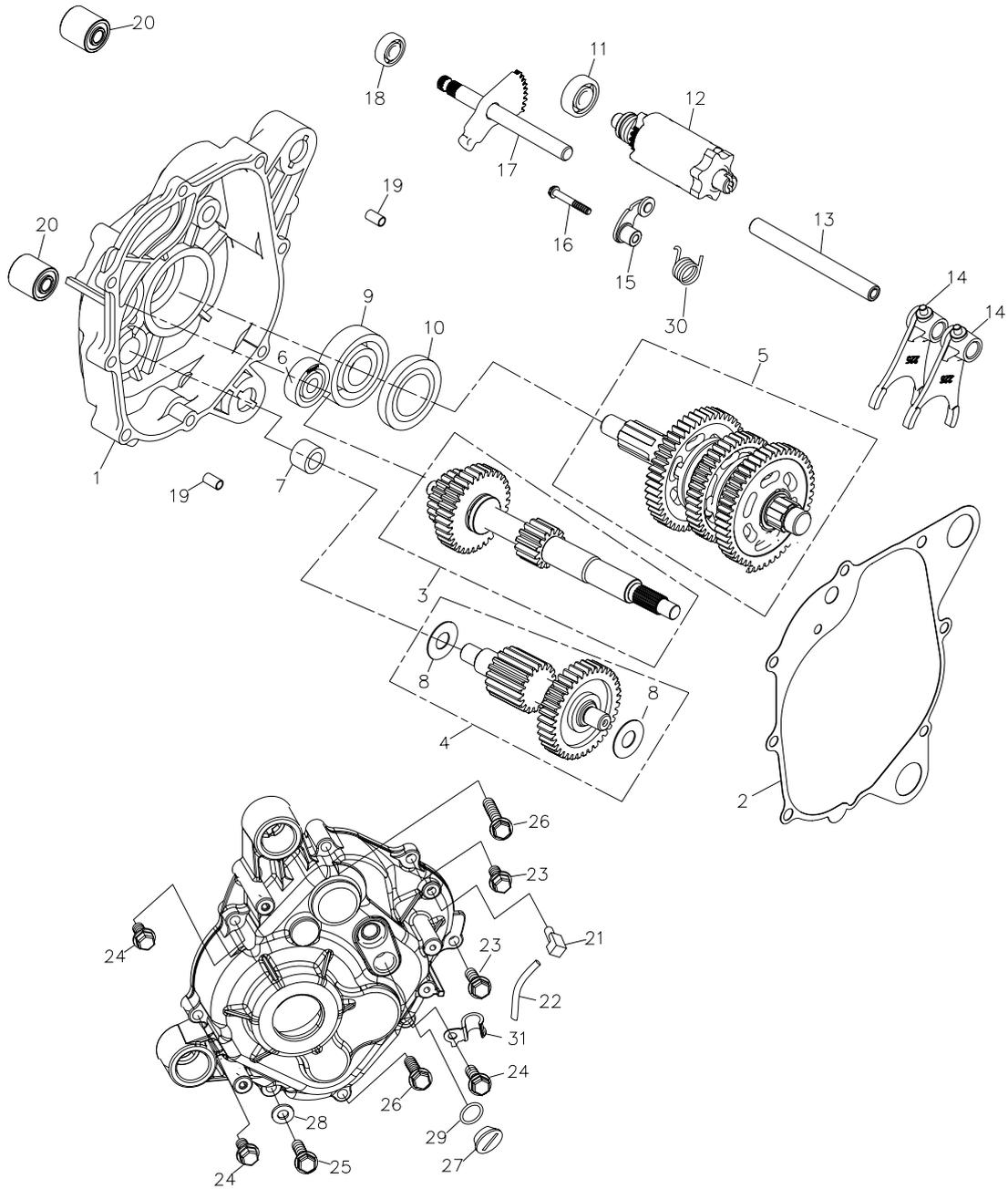
### NOTE

- Replace the clutch as a set.



# Chapter 1 Engine, Transmission & Gear

## Transmission



# **Chapter 1 Engine, Transmission & Gear**

---

## **Transmission Service Information**

### **SPECIFICATION**

Specified gear oil: SAE 85W/90 or equivalent

Oil capacity: 0.5 liter (0.52 US qt.) at change

0.6 liter (0.63 US qt.) at disassembly

### **TORQUE VALUES**

Transmission case cover	6 mm	8-12 N.m (6-9 ft.lb)
	8 mm	20-24 N.m (14-18 ft.lb)
	10 mm	10-15 N.m (7-11 ft.lb)

## **Troubleshooting**

### **Engine starts but vehicle won't move**

- Damaged or seized transmission

### **Abnormal noise**

- Worn, seized or chipped gear
- Worn bearing

### **Oil leak**

- Oil level too high
- Worn or damaged oil seal

# Chapter 1 Engine, Transmission & Gear

---

## Gearbox

### DISASSEMBLY

Drain the gear oil by loosen drain bolt.



Remove drive sprocket.



Remove shaft lever.

Loosen eight gearbox attaching bolts.

Remove right side gearbox cover, dowel pins and gasket.



Remove gear shaft arm.

Remove shift rod guide rod.

Remove shaft drum.

Remove gear set.

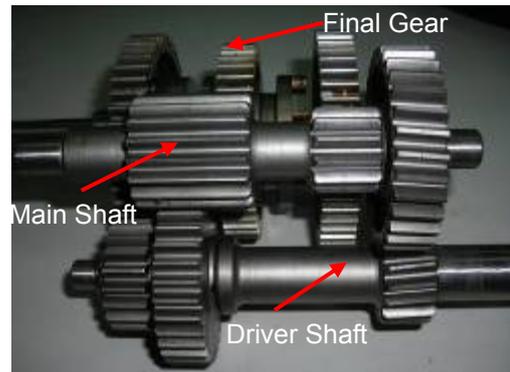


# Chapter 1 Engine, Transmission & Gear

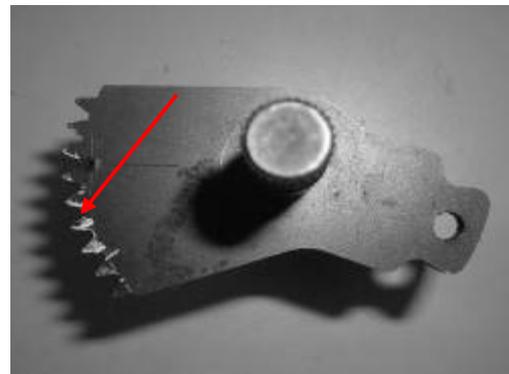
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## INSPECTION

Inspect drive shaft, main shaft and final gear set for abnormal wear or broken teeth.



Inspect gear shaft arm for abnormal wear or broken teeth.



Check oil seal for broken or damage, replace it if necessary.

Turn the inner race of each bearing with your finger. The bearing should turn smoothly and quietly.

Check engine mounting rubber bush.



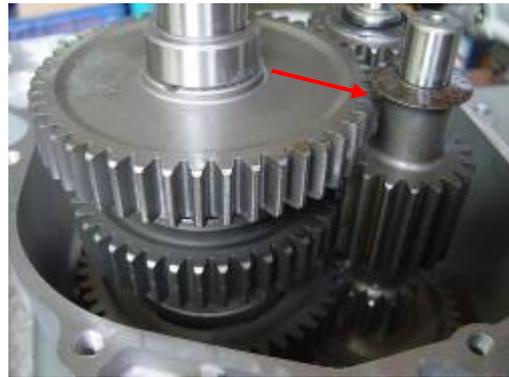
# Chapter 1 Engine, Transmission & Gear

## INSTALLATION

Install gear set to gear case.

### NOTE

◦ Do not forget install main shaft washer.



Install shaft drum.

Install gear shaft fork.



Install gear shift arm.

### NOTE

◦ Aligned shift forks to shift drum groove, gear shift arm to shift drum and shift drum retainer in correct position.



Install the dowel pins and a new gasket, add specified gear oil to gear box.

Install right side gear box cover and tighten the mounting bolts.

### Toque Value:

6 mm	8-12 N.m (6-9 ft.lb)
8 mm	10-15 N.m (7-11 ft.lb)



# Chapter 2 Fuel System & Carburetion

---

## Contents

---

Carburetor

Fuel Tank

Air Cleaner

Exhaust System

---

## Service Information

### GENERAL

The fuel system comprises a petrol tank from which petrol is fed by gravity to the float chamber of the Mikuni carburetor. A vacuum control tap with build-in gauze filter is located beneath the rear end of the fuel tank. An electrical fuel level sensor which provision single to speed meter and shows fuel level on it.

### WARNING

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- Gasoline is extremely flammable and is explosive under certain condition. Work in a well ventilated area. Do not smoke or allow flames or sparks in the work area.
- When disassembling the fuel system parts, note the location of the O-ring and gasket. Replace them with new ones if necessary on reassembly.
- Before disassembling the carburetor, drain the fuel in the float chamber by turning the drain screw.

#### US version only:

- Refer to the sticker on vehicle for the hose connections of the evaporative emission control system.

### CAUTION

---

- Do not bend or twist control cable. Damaged control cable may stick or bind.
- 

### SPECIFICATIONS

ITEM	STANDARD
Carburetor Type	Keihin CVK32
Identification Number	AH4A
Venturi diameter	32 mm
Float level	17.0-18.0 mm
Needle Jet	N8TT
Main Jet	138
Idle Jet	38
Choke Jet	60
Idle speed	1600 +/- 100 rpm
Throttle lever free play	2-6mm (1/8-1/4 in)

# **Chapter 2 Fuel System & Carburetion**

---

## **Troubleshooting**

### **Engine cranks but won't start**

- No fuel in tank
- No fuel to carburetor
- Engine flooded with fuel
- No spark at plug (faulty ignition system)
- Clogged air cleaner
- Intake air leak
- Improper choke operation
- Improper throttle operation
- Faulty fuel valve

### **Hard starting or stalling after starting**

- Improper choke operation
- Ignition malfunction
- Faulty carburetor
- Contaminated fuel
- Intake air leak
- Incorrect idle speed
- Faulty fuel valve

### **Rough idle**

- Faulty ignition system
- Incorrect idle speed
- Faulty carburetor
- Contaminated fuel

### **Misfiring during acceleration**

- Faulty ignition system

### **Backfiring**

- Faulty ignition system
- Faulty carburetor

### **Poor performance and fuel economy**

- Clogged fuel system
- Faulty ignition system
- Faulty fuel valve
- Faulty components in the evaporative emission control system (US version only)

### **Lean mixture**

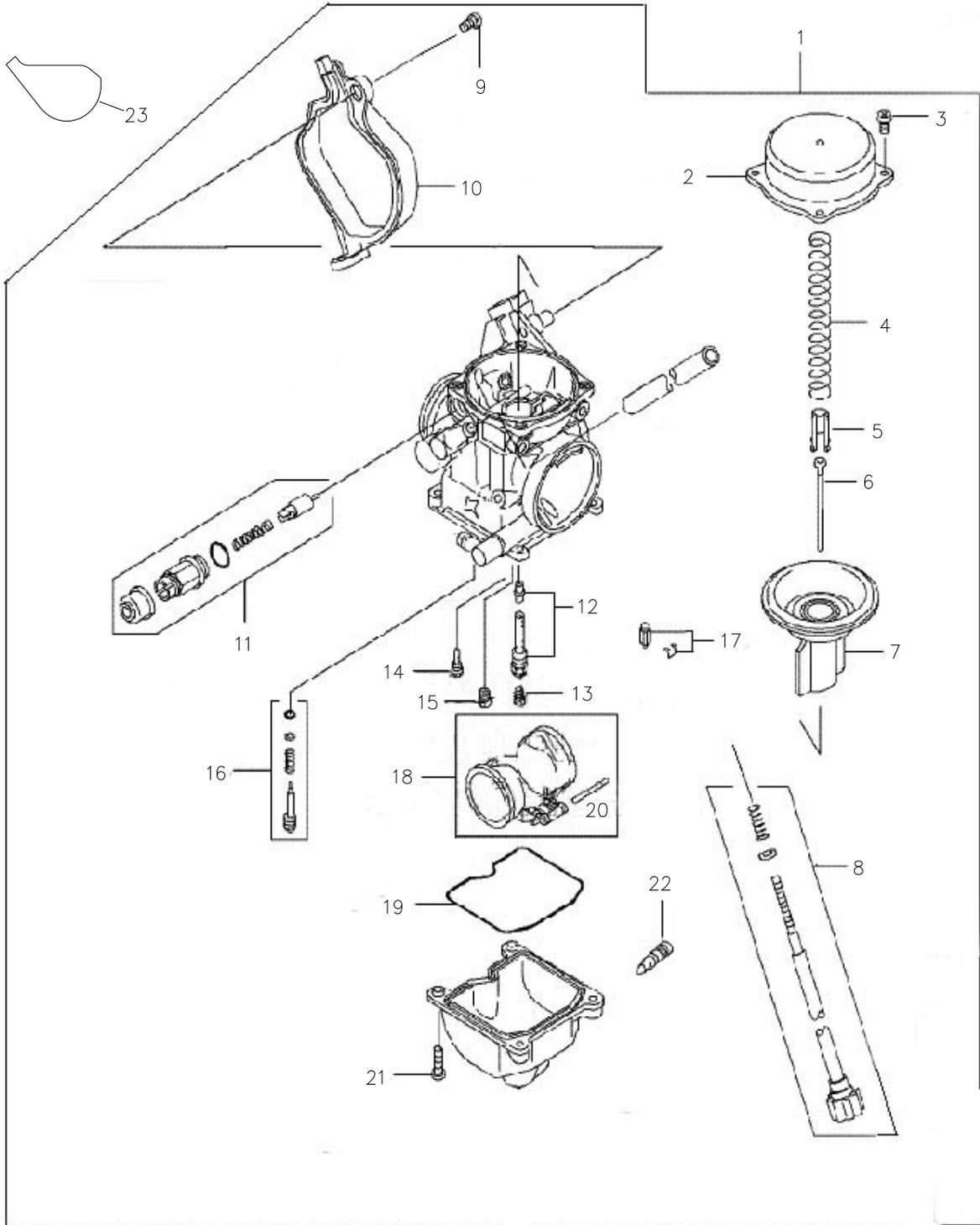
- Clogged fuel jet
- Stuck vacuum piston
- Faulty float valve
- Low float level
- Blocked fuel cap vent
- clogged fuel line
- Restricted fuel line
- Clogged air vent tube
- Intake air leak
- Faulty fuel valve

### **Rich mixture**

- Clogged air jets
- Faulty float valve
- Float level too high
- Improper choke operation
- Dirty air cleaner

# Chapter 2 Fuel System & Carburetion

## CARBURETOR



## Chapter 2 Fuel System & Carburetion

---

### Carburetor

#### CARBURETOR REMOVAL

Loosen the air filter tube and intake manifold bands.

Disconnect the throttle cable on carburetor side.

Remove the choke cable with choke piston.

Leave the throttle cable and choke cable on vehicle.

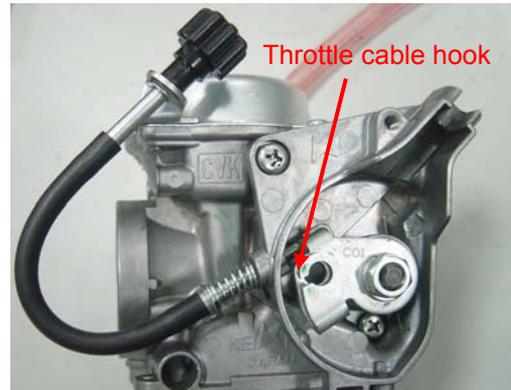
#### NOTE

◦ Do not damage jet needle on the throttle piston

Disconnect the heater component on carburetor.

Disconnect the fuel tube from the carburetor.

Remove the carburetor.

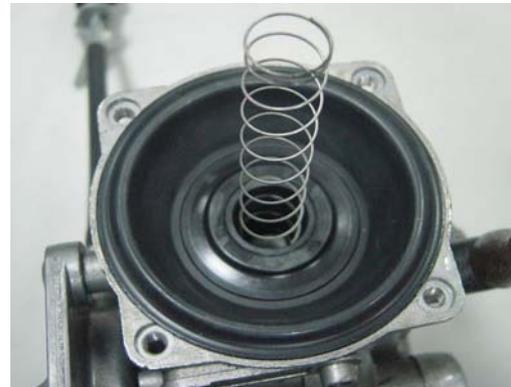


### Vacuum Chamber

#### DISASSEMBLY

Loosen the drain screw and drain the fuel from the float chamber.

Remove the four vacuum chamber cover screws and cover.



Remove the compression spring and the vacuum piston.

Turn the vacuum piston upside down then remove the needle holder and jet needle.



## Chapter 2 Fuel System & Carburetion

---

### Float/Float valve/Jets

#### DISASSEMBLY

Remove the four chamber screws and the float chamber.

Remove the main jet, needle jet holder, idle jet and choke jet.

Remove the float pin, float and float valve.

#### FLOAT VALVE INSPECTION

Inspect the float valve for grooves and nicks.

Inspect the operation of the float valve.

Blow open all passages with compressed air before assembling.

#### ASSEMBLY

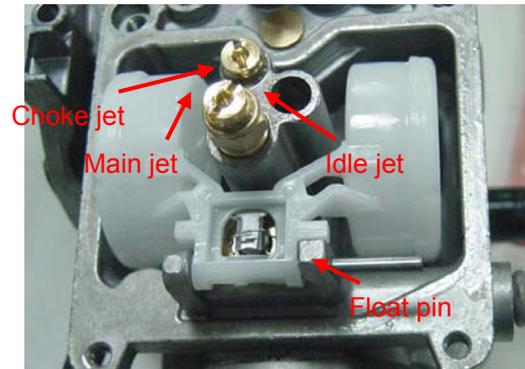
Clean main jet, needle jet holder, needle jet and idle jet in cleaning solvent and blow them open with compressed air.

Install the needle jet and needle jet holder.

Install the main jet and idle jet.

Install the float valve, float and float pin.

Reinstall the float chamber.



## **Chapter 2 Fuel System & Carburetion**

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### **CARBURETOR INSTALLATION**

Tighten the drain screw.

Connect the drain tube to the carburetor.

Install the throttle cable.

Install the choke cable with choke piston.

Install the carburetor aligning the tab on the carburetor with the groove in the intake manifold and tighten the band screw.

Install the air filter tube and tighten the connecting bands.

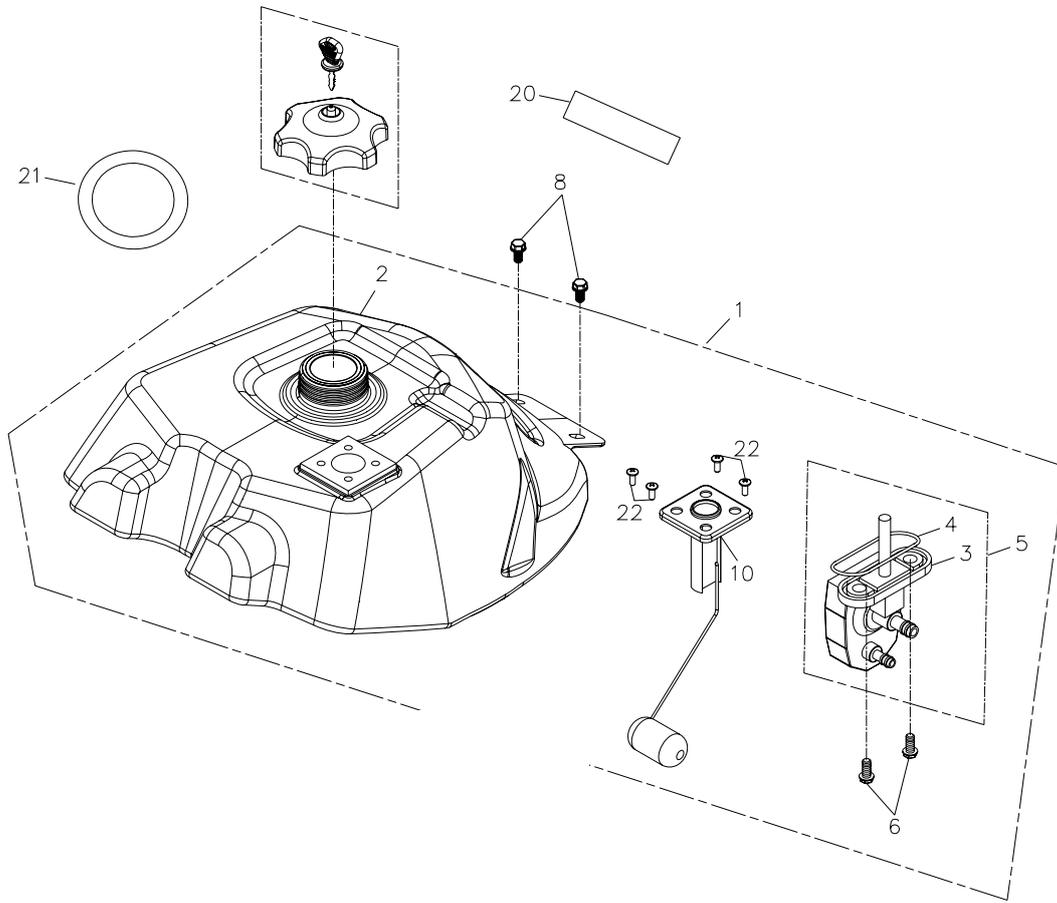
Adjust the following:

- throttle lever free play
- idle speed



# Chapter 2 Fuel System & Carburetion

## FUEL TANK



## Chapter 2 Fuel System & Carburetion

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### Fuel Tank

#### REMOVAL

#### **WARNING**

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- *Do not smoke or allow flames or spark in the work area.*
- 

Remove the seat.

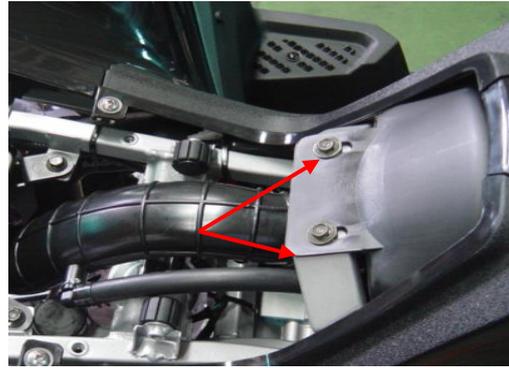
Remove the front fender.

Remove fuel tank to frame mounting bolts.

Disconnect the fuel tube and vacuum tube on fuel valve.

Disconnect the petrol gauge connector.

Remove the fuel tank from frame body.

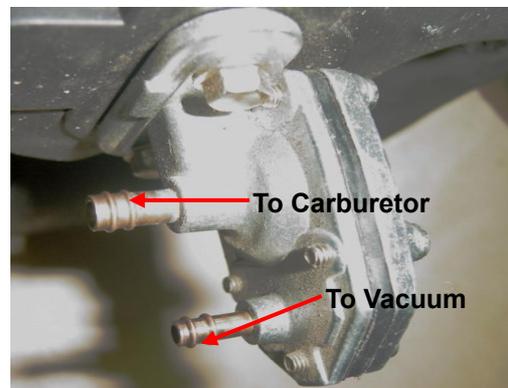


#### **FUEL VALVE INSPECTION**

Disconnect vacuum tube from fuel valve and fuel tube from carburetor.

Connect a commercially brake bleeder to vacuum tube then pump the brake bleeder.

Check the fuel flow thru fuel tube, if it's block or intermittently, replace the fuel valve.



#### **INSTALLATION**

Install the fuel tank in the reverse order of removal.

### Petrol Gauge Sensor

#### REMOVAL

Remove fuel tank.

Loosen four petrol gauge mounting bolts.

Remove petrol gauge from the fuel tank.

#### **NOTE**

---

- Do not damage or bend the float and float arm.



## **Chapter 2 Fuel System & Carburetion**

---

### **INSPECTION**

Check the petrol gauge seal for damage or deterioration and replace if necessary.

Use a ohmmeter connect to gauge terminal to check the ohm reading from upper to lower float level of petrol gauge.

**Ohm reading:  $10 \Omega \sim 90 \Omega$**

Replace petrol gauge if the ohm reading is discontinuousness or the reading is  $\infty$ .



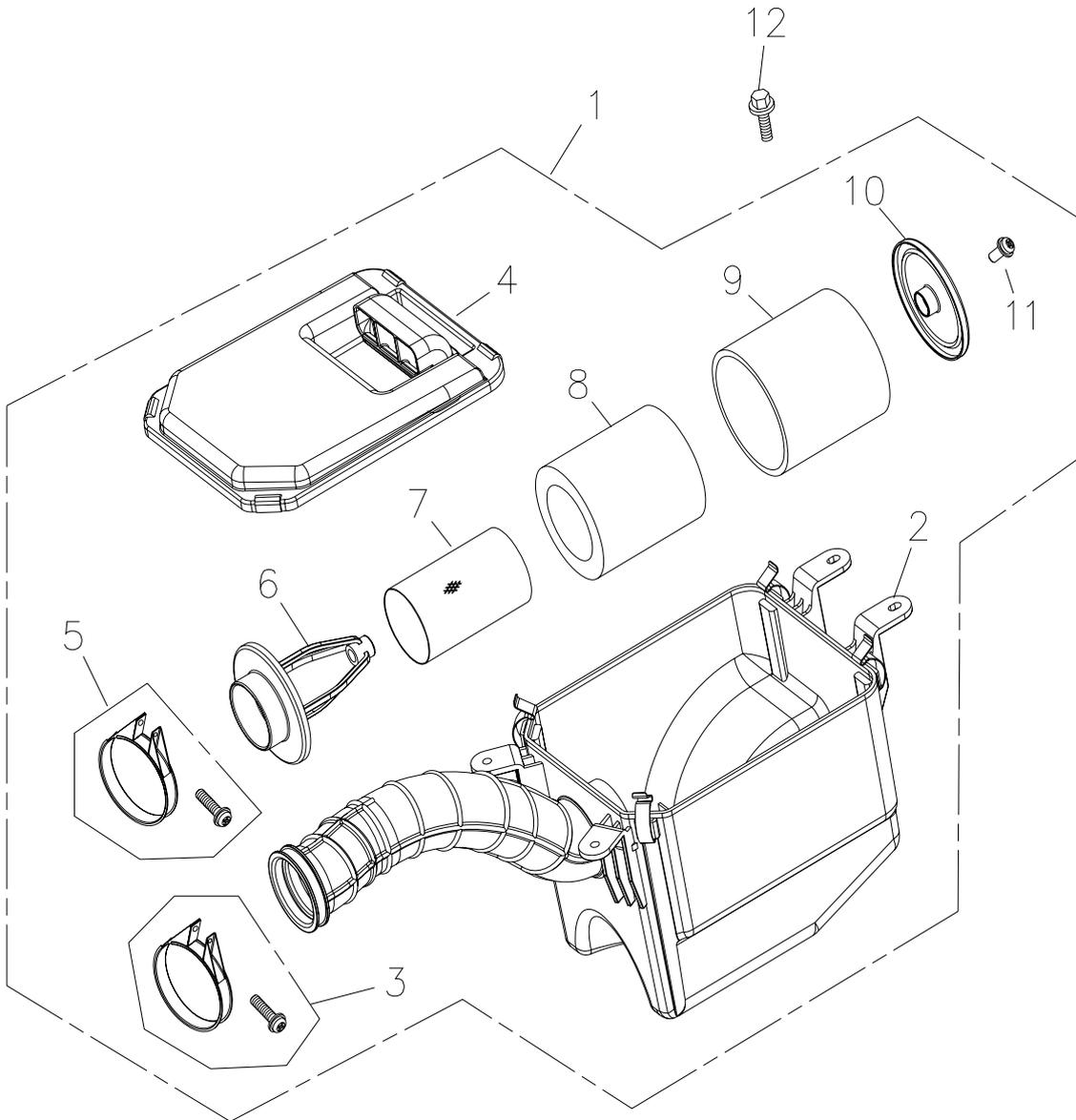
### **INSTALLATION**

Install the petrol gauge onto the fuel tank.

Install the mounting bolts.

# Chapter 2 Fuel System & Carburetion

## AIR CLEANER ASSEMBLY



## **Chapter 2 Fuel System & Carburetion**

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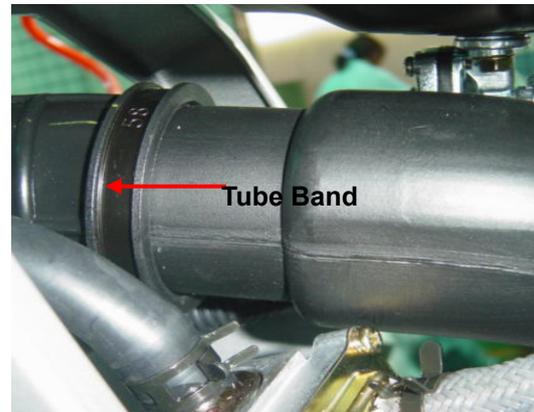
### **Air Cleaner Assembly**

#### **REMOVAL**

Remove the seat.

Loosen the air cleaner case to air camber connecting tube band.

Remove the four air cleaner case mounting bolts and remove the air cleaner case.



#### **INSPECTION AND CLEAN OUT**

Disconnect the air filter assembly mounting clamp.

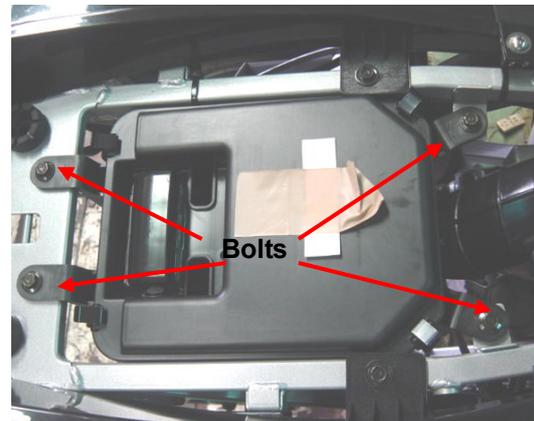
Remove the air filter element cover.

Drain the accumulated water or dust.

Clean the air cleaner case and filter element with compress air.

Inspect the filter element A and B, replace it if necessary.

Install the filter assembly to air cleaner case.



#### **NOTE**

- Tighten the mounting clamp screw securely.

#### **INSTALLATION**

Install the air cleaner case in the reverse order of removal.

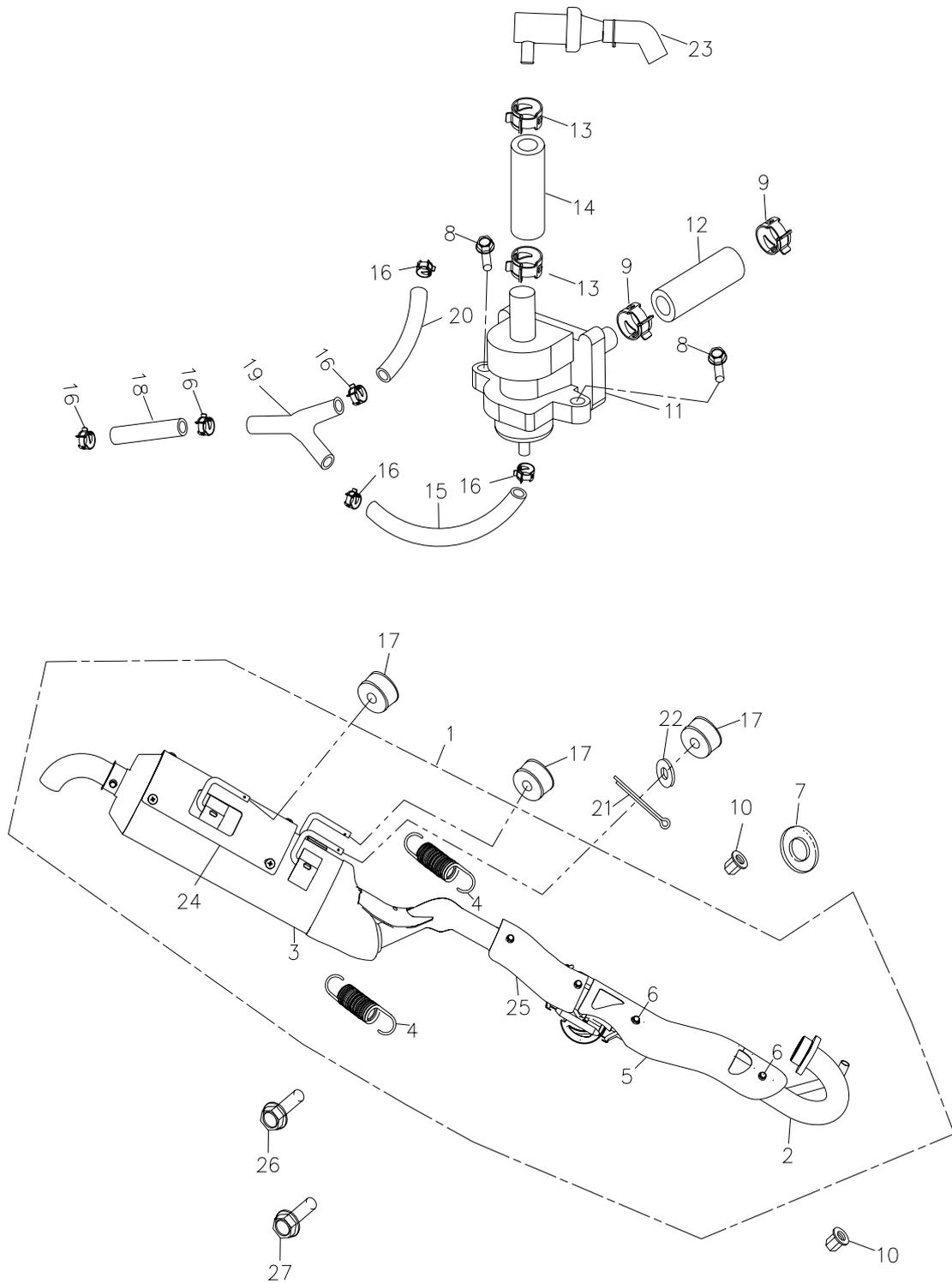
#### **NOTE**

- Tighten the connecting tube band screw securely.



# Chapter 2 Fuel System & Carburetion

## EXHAUST SYSTEM



## Chapter 2 Fuel System & Carburetion

---

### Exhaust System

#### REMOVAL

Disconnect the shaft selecting rod nut.

Loosen exhaust pipe front section to cylinder head mounting nuts.

Loosen muffler silencer hanger mounting bolts.

Pull back the muffler assembly for removal.

Bend the exhaust pipe front section to release pipe springs.



#### INSPECTION

Check the exhaust pipe gasket, replace it if necessary.



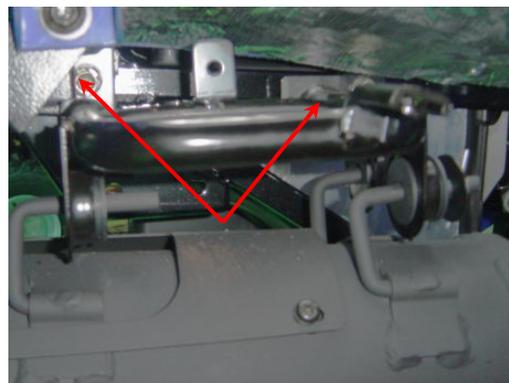
#### INSTALLATION

Install the muffler assembly in the reverse order of removal.

#### NOTE

- Tighten the exhaust pipe front section to cylinder head mounting nuts properly.

Start the engine to check any leak thru gasket.



# Chapter 3 Ignition and Starting System

## Ignition System Service Information

### GENERAL

- Ignition timing cannot be adjusted since the ignition control module is factory present.
- A continuity check can usually be made without removing the parts from the vehicle. Simply disconnect the wires and use a continuity tester or ohmmeter at the terminals.
- Inspect should be made sequence referring for troubleshooting of the system.

### SPECIFICATION

ITEM		STANDARD	
Ignition coil	Primary	0.1 – 0.3 $\Omega$	
	Secondary	With plug cap	3.7 – 4.6 k $\Omega$
		Without plug cap	7.4 – 11 k $\Omega$
Ignition pulse generator at 20 °C (68 °F)		50 – 170 $\Omega$	

### TROUBLESHOOTING

#### No spark at plug

- Poorly connected, broken or shorted wire.
  - Between ignition pulse generator and ignition control module (CDI)
  - Between CDI and ignition coil
  - Between CDI and ignition switch
  - Between ignition coil and spark plug
- Faulty:
  - Ignition switch
  - Ignition control module (CDI)
  - Ignition pulse generator
  - Spark plug

#### Engine starts but runs poorly

- Ignition primary circuit
  - Faulty ignition coil
  - Loose or bare wire
  - Poor connection at ignition switch
- Ignition secondary circuit
  - Faulty ignition coil
  - Faulty spark plug
  - Faulty spark plug wire
  - Poorly insulated plug cap
- Improper ignition timing
  - Faulty ignition pulse generator
  - Stator not installed properly
  - Faulty ignition control module (CDI)

## Chapter 3 Ignition and Starting System

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### Ignition Coil

#### INSPECTION

Disconnect the ignition coil primary wires and measure the resistance between the terminals.

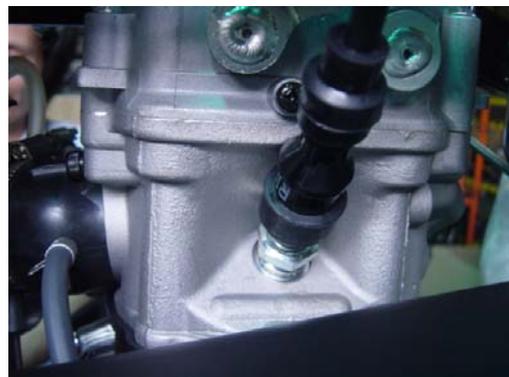
**Resistance: 0.1 – 0.3  $\Omega$**

Remove the spark plug cap from the spark plug and measure the resistance between the ignition coil primary terminal and spark plug cap.

**Resistance: 7.4 - 11 k $\Omega$**

If the resistance is out of the specification, remove the spark plug cap from spark plug wire and measure the resistance of the secondary coil.

**Resistance: 3.7 – 4.5 k $\Omega$**



#### REMOVAL/INSTALLATION

Disconnect the ignition coil primary wires connectors and remove the spark plug cap from the spark plug.

Remove the ignition coil mounting bolt and remove the ignition coil.

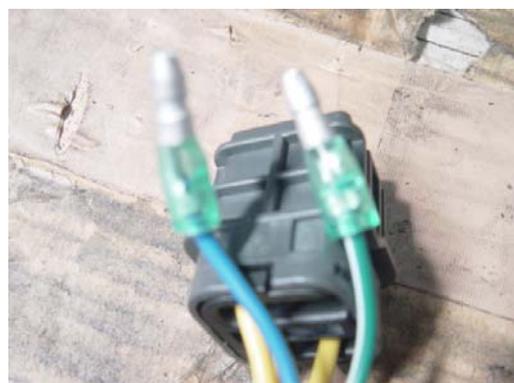
Install the ignition coil in the reverse order of removal.



### Ignition Pulse Generator

Disconnect the ignition pulse generator wire connectors and measure the resistance between the terminals.

**Resistance: 50 - 170  $\Omega$**



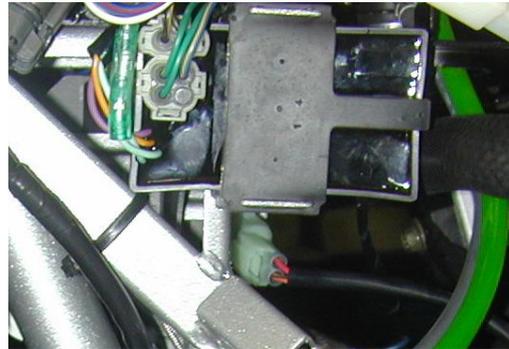
## Chapter 3 Ignition and Starting System

### Capacitive Discharge Ignition - C.D.I.

#### GENERAL

The CDI unit was located on front right of frame, about the right front shock absorber.

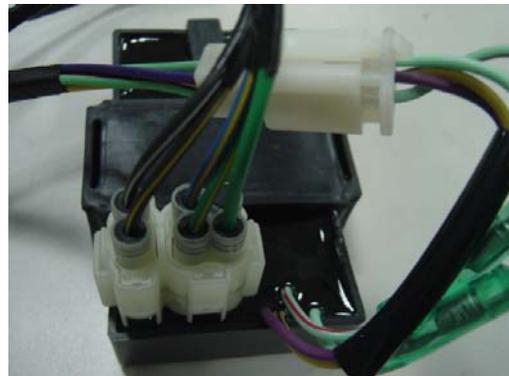
There are three electrical connectors for the CDI: the two-pin connector and a four-pin connector on CDI body and a four-pin gear position coupler.



#### INSPECTION

Disconnect the CDI coupler and connectors and check each circuit according to the table below:

CIRCUIT	COLOR	CORRECT
Ignition Puler	Bu/Y-G	50-170 $\Omega$
Ignition coil	BI/Y-G	0.1-0.3 $\Omega$
	BI/Y-Plug cap	w/cap 7.4-11k $\Omega$ w/o cap 3.7-4.5k $\Omega$
Ignition switch	BI/W-G	No continuity when switch ON



If the harness and all other components are all okay, the CDI is probably defective. But before replace a new one. It's a good idea to substitute a known good CDI.

# **Chapter 3 Ignition and Starting System**

---

## **Starting System Service Information**

### **SPECIFICATION**

ITEM	STANDARD	SERVICE LIMIT
Starter motor brush length	12.0-12.5 mm (0.47-0.49in)	6.5 mm (0.26 in)
Starter motor brush spring tension	680-920 g (1.49-2.03 lb)	680 g (1.49 lb)

### **TROUBLESHOOTING**

#### **Starter won't turn**

- Burned out fuse
- Weak battery
- Poorly connected, broken or shorted wire
- Faulty:
  - Ignition switch
  - starter switch
  - Rear brake light switch
  - Starter motor

#### **Lack of power**

- Weak battery
- Loose or bare wire
- Faulty starter gear

#### **Starter turns, but engine does not start**

- Faulty starter clutch
- Faulty starter pinion

## Chapter 3 Ignition and Starting System

### Starter Relay

#### GENERAL

The relay coil is normal if you hear a click when starter button is depressed with the ignition switch ON and brake lever pressed.



#### REMOVAL/INSPECTION

Remove the seat.

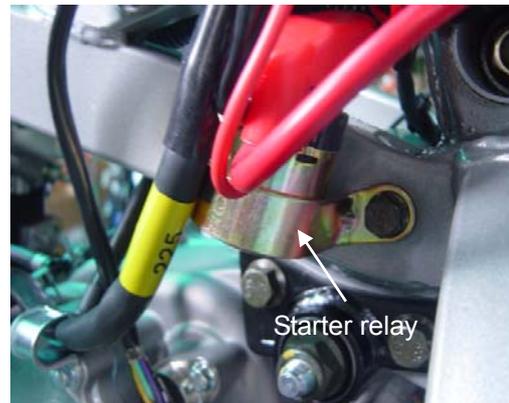
Disconnect the negative battery cable from the battery.

Disconnect the positive cable and starter motor cable from the starter relay.

Disconnect starter relay terminal and remove the starter relay.

Connect an ohmmeter between the positive and starter motor terminal.

Connect the yellow/red wire terminal to the positive battery terminal and green wire to the negative battery terminal by using a jumper wire.



Check for continuity between the starter relay terminal.

Replace the starter relay with a new one if there is no continuity.

#### INSTALLATION

Install the ignition coil in the reverse order of removal.



## **Chapter 3 Ignition and Starting System**

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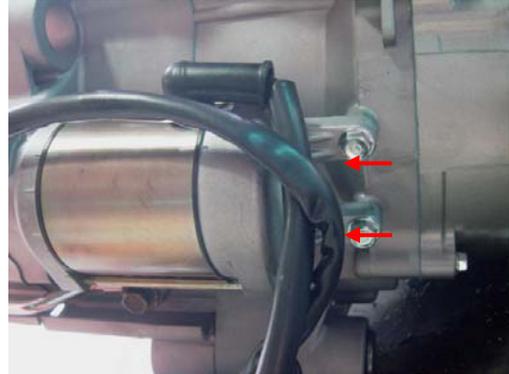
### **Starter Motor**

#### **REMOVAL**

Remove the negative battery cable from the battery.

Disconnect the starter cable from the starter motor.

Remove the two mounting bolts then remove the starter motor.



#### **INSTALLATION**

##### **NOTE**

---

- Before installing the starter motor, check the operation by connecting the starter motor wire to the starter relay.
- 

Install the starter motor in the reverse order of removal.

Tighten the starter motor cable attaching nut.

**Torque: 10-14 N.m (7-10 ft.lb)**

Install and tighten the starter motor mounting bolts.

**Torque: 10-14 N.m (7-10 ft.lb)**

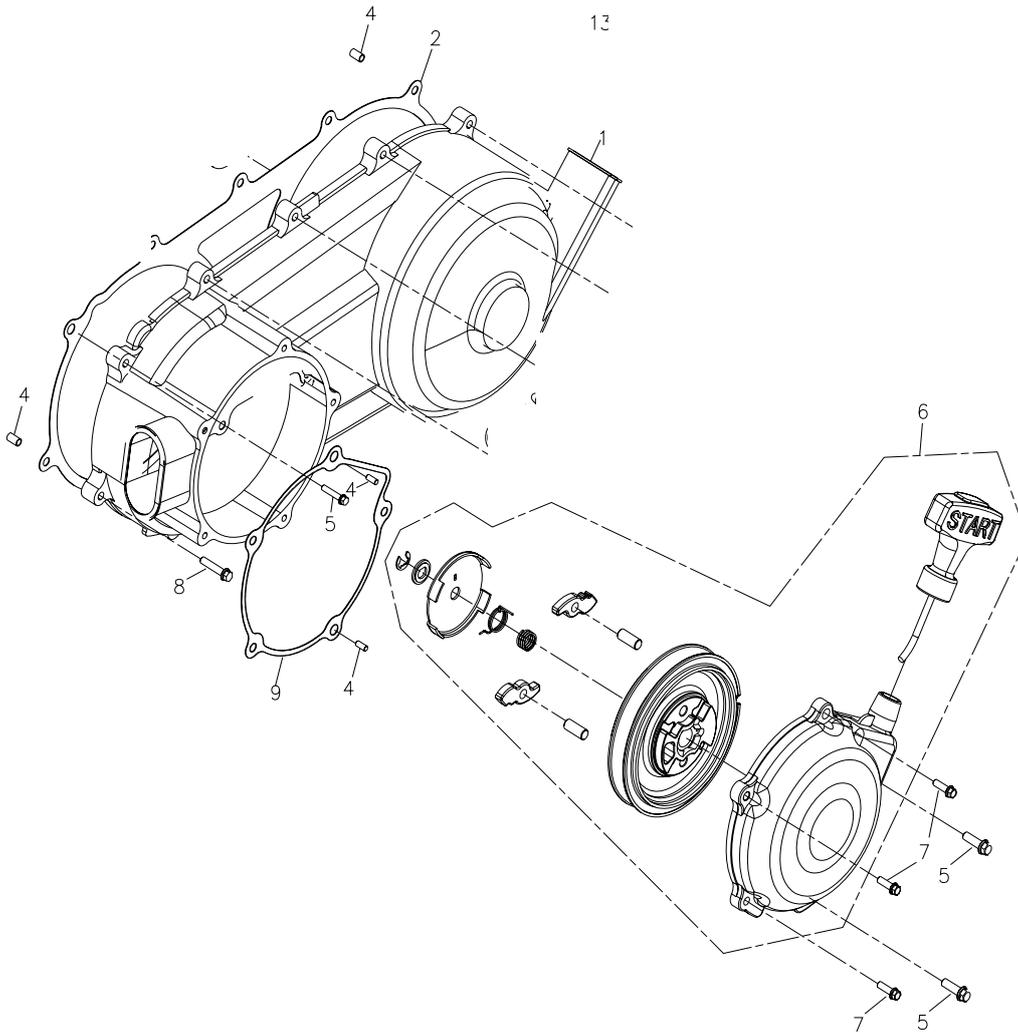
##### **NOTE**

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- Place the starter motor cable cover securely.
-

# Chapter 3 Ignition and Starting System

## Recoil Backup Starting System



## **Chapter 3 Ignition and Starting System**

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### **Recoil Backup Starting System**

#### **CHECK**

#### **NOTE**

- Pull the recoil haft rapidly to have enough kinetic energy for engine starting.

Park the vehicle on a level ground.

Put the gear shaft to "Neutral".

Turn the ignition switch "ON".

Pressed the brake lever then pull the recoil haft.

Repeat about-mentioned process till the engine starting.

After engine start, release the recoil haft, the wire should return into the recoil body and the haft stay to it's original position.

#### **NOTE**

- If the recoil haft can't back to original position, slightly pull out the recoil wire till it can retract.

If the recoil haft still can't return to it's original position, replace the recoil set.

#### **REMOVAL/INSTALLATION**

Remove foot pad.

Loosen five mounting bolts on recoil cover.

Remove recoil set.

Check starting dish edge for wear or damage.

Install the starter motor in the reserve order of removal.



## Chapter 4 Frame & Cover

---

### GENERAL INFORMATION

This Chapter covers the procedures necessary to remove and install the body panels and other body parts. Since many service and repair operations on this vehicle require remove of the panels and/or other parts, the procedure are grouped here and referred to from other Chapter.

In the case of damage to the panels or other parts, it is usually necessary to remove the broken component and replace it with a new (or used) one. The material that the plastic body parts are composed of doesn't lend itself to conventional repair techniques. There are, however, some shops that specialize in "plastic welding", so it would be advantageous to check around first before throwing the damaged parts away.

### NOTE

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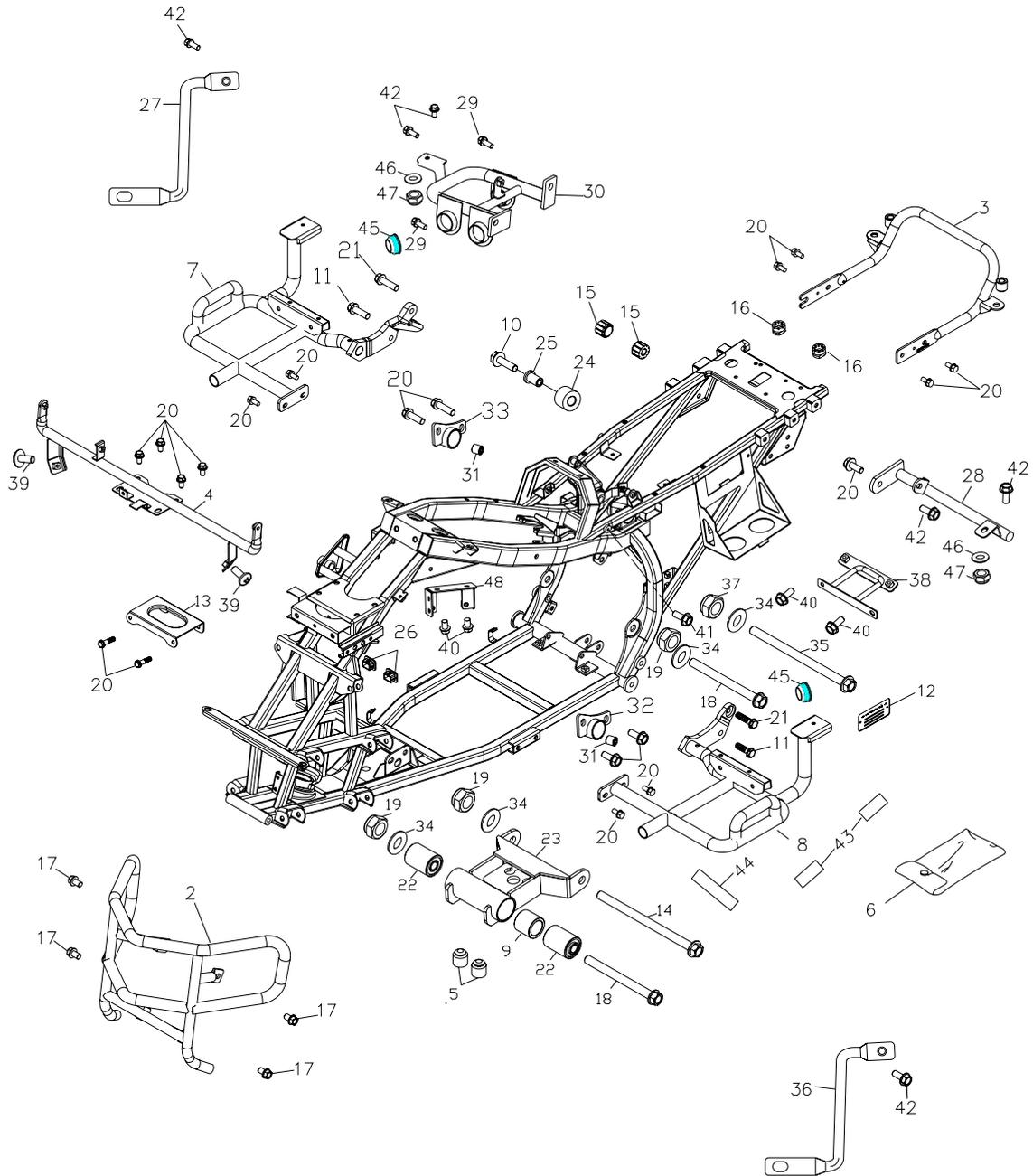
- When attempting to remove any body panel, first study the panel closely, noting any fasteners and associated fittings, to be sure of returning everything to its correct place on installation.
  - In some cases, the aid of an assistant will be required when removing panels, to help avoid damaging the surface.
  - Once the visible fasteners have been removed, try to lift off the panel as described but **DO NOT FORCE** the panel – if it will not release, check that all fasteners have been removed and try again. Where a panel engages another by means of tabs and slots, be careful not to break the tabs or to damage the bodywork.
  - Remember that a few moments of patience at this stage will save you a lot of money in replacing broken panels.
- 

### FRAME

- All models use a double-cradle frame made of steel tubing.
- The frame shouldn't require attention unless accident damage has occurred. In most cases, frame replacement is the only satisfactory remedy for such damage. A few frame specialists have the jigs and other equipment necessary for straightening the frame to the required standard of accuracy, but even then there is no simple way of assessing to what extent the frame may have been over-stressed.
- After the machine has accumulated a lot of miles, the frame should be examined closely for signs of cranking or splitting at the welded joints. Corrosion can also cause weakness at these joint.

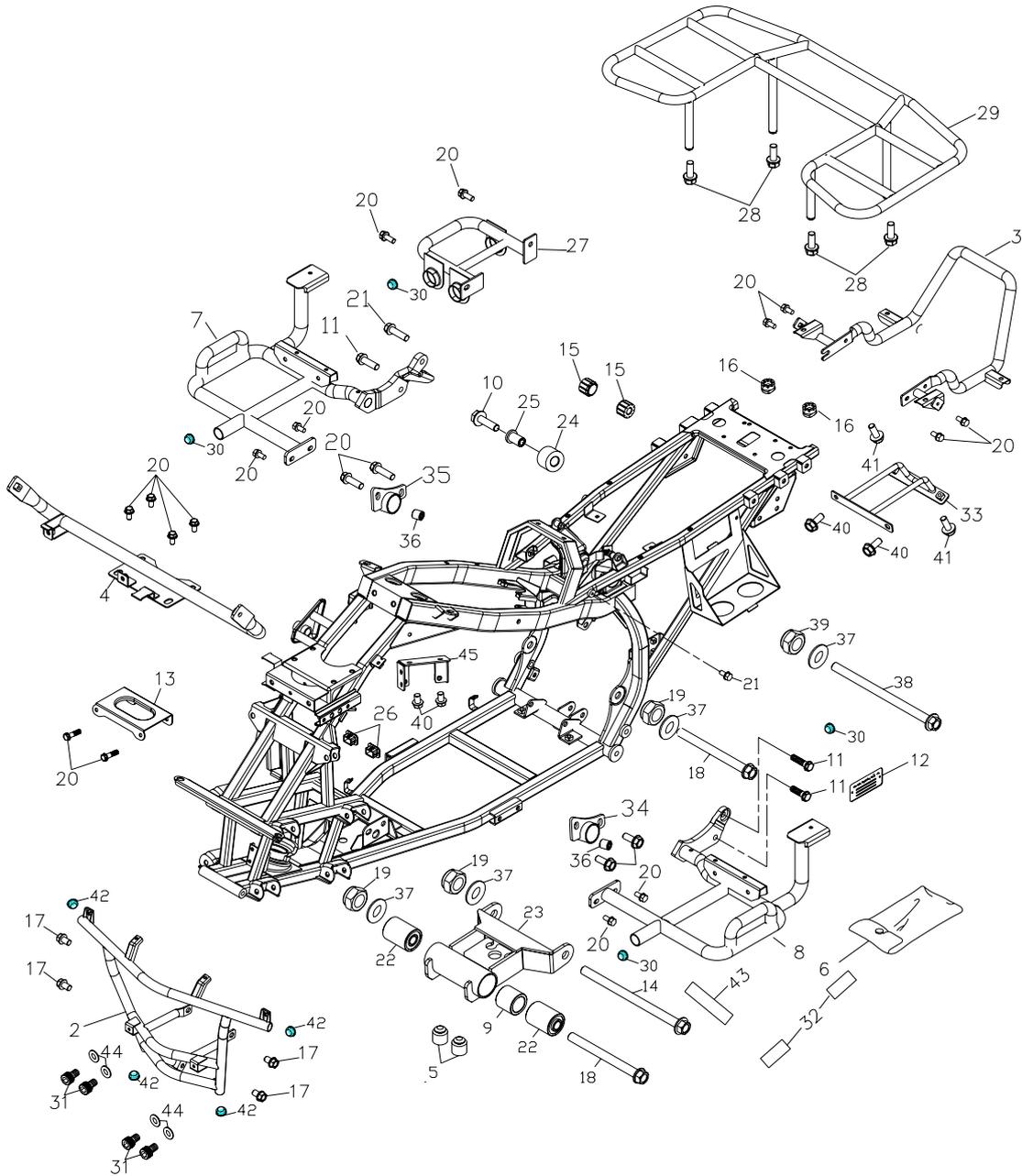
# Chapter 4 Frame & Cover

## FRAME BODY-320S



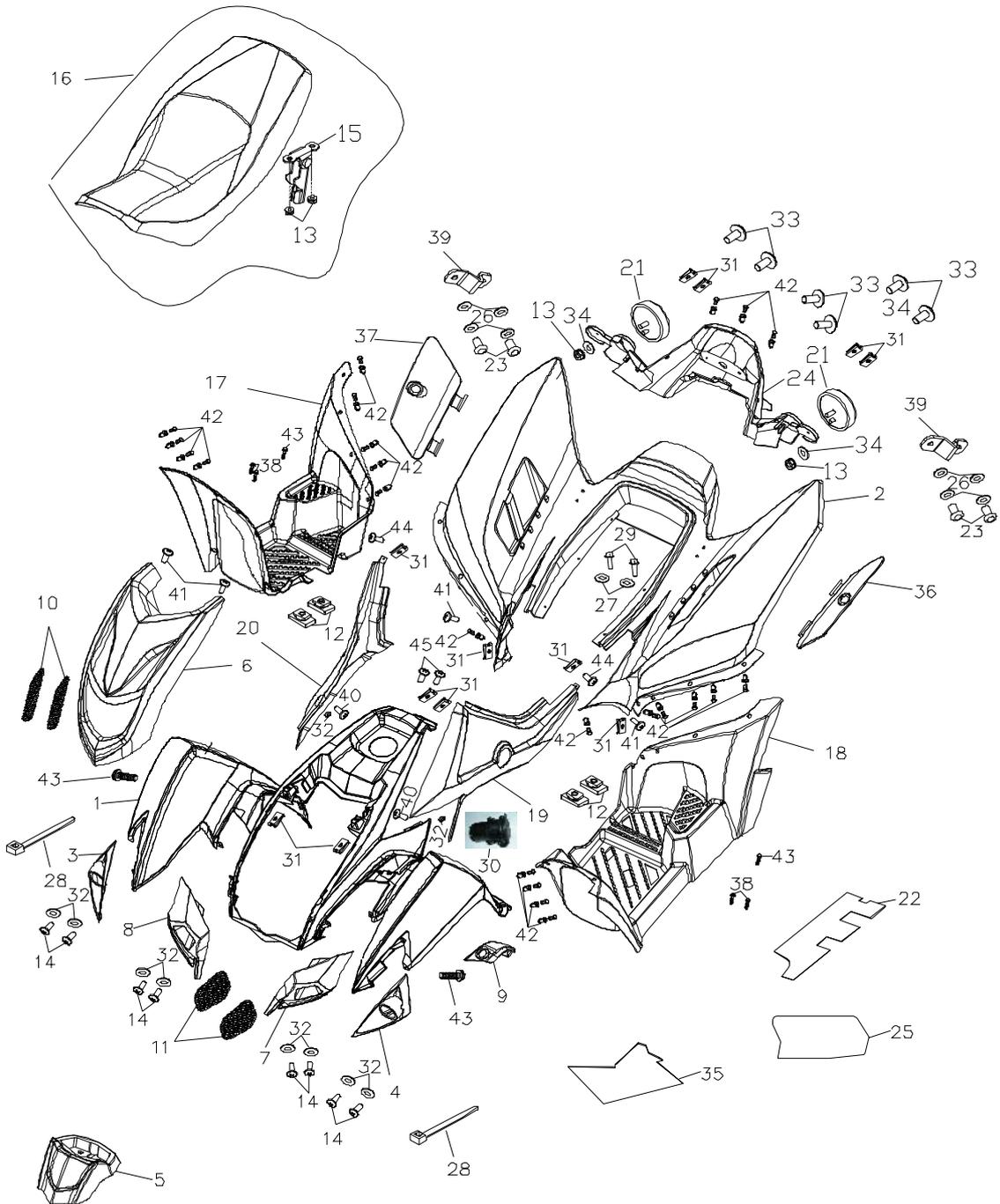
# Chapter 4 Frame & Cover

## FRAME BODY-320U



# Chapter 4 Frame & Cover

## BODY COVER& SEAT-320S





## Chapter 4 Frame & Cover

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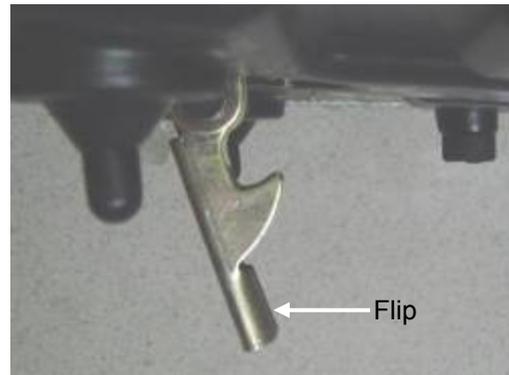
### REAR FENDERS

#### REMOVAL

Remove the seat by flip back the latch level and lift the back end of seat.

Remove left and right floor panels.

Remove rear carrier.



Disconnect tail light and L/R indicator light connector.



Remove upper fender to frame mounting bolts and front to rear fender joint bolts.

Remove two lower mount bolts.

Remove tail light fender. (320S)

Open the rear luggage box and remove the mounting bolt. (320S)



Raise up the fender and pull to back to remove the rear fender.

#### INSTALLATION

Install the rear fender in the reverse order of removal.

#### NOTE

- Be sure to insert floor panel tabs to front and rear fenders corresponding slots.



## Chapter 4 Frame & Cover

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### FRONT FENDER

#### REMOVAL

320S

#### NOTE

◦ The aid of an assistant will be required when removing front panel.

Remove L/R floor panel.

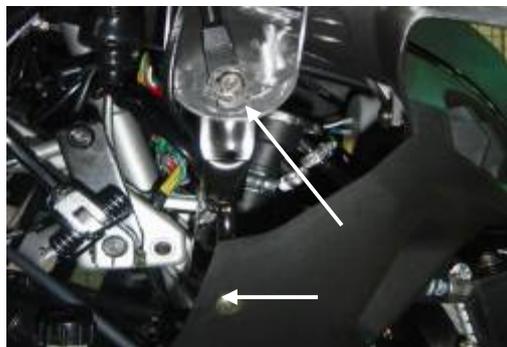
Remove front fascia and disconnect headlight wire.



Disconnect indicator light and main switch wire.

Remove L/R side cover and front to rear joint bolts.

Remove speedometer cover and handle bar supporter then make handle bar freely for moving.



Remove fender to frame mounting bolts

Remove shaft nob and shaft rod plate fixing bolts.

Remove fuel cap



With an assistant to help to raise the front fender and let it passed the handle bar and remove it from frame.

## Chapter 4 Frame & Cover

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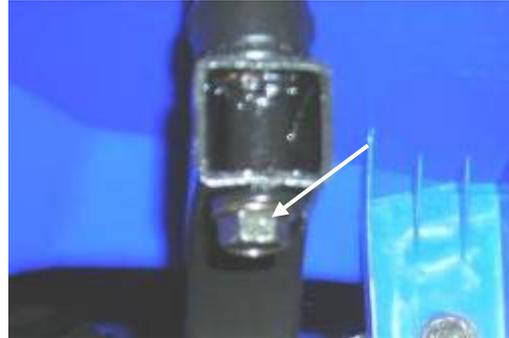
### 320U

Remove L/R floor panel.

Remove front carrier (optional accessory).

Disconnect headlight, indicator light and main switch connector.

Remove shaft nob and shaft rod plate fixing bolts.



Remove two fender to frame mounting bolts

Remove four bumper cover to bumper and headlight to bumper mounting bolts.

Remove fuel cap then remove fuel tank dash board.



### **NOTE**

---

- Lock the fuel cap to fuel tank as soon as removed fuel tank dash board.
- 

With an assistant to help to raise the front fender and pull forward to passed the handle bar and remove it from frame.



### **INSTALLATION**

Install the rear fender in the reverse order of removal.

### **NOTE**

---

- Be sure to insert floor panel tabs to front and rear fenders corresponding slots.
- 



## Chapter 4 Frame & Cover

---

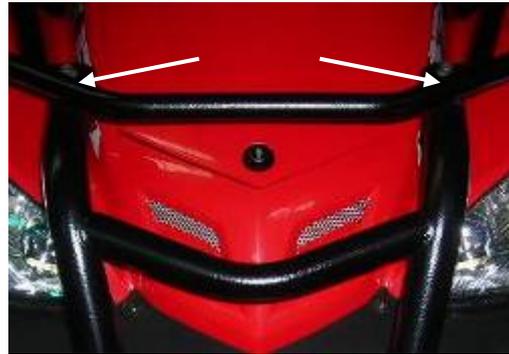
### FRONT/REAR CARRIER (320U ONLY)

#### FRONT CARRIER REMOVAL

Loosen two carrier to bumper mounting bolts.

Loosen two carrier to cover fixed pole bolts.

Remove the front carrier.

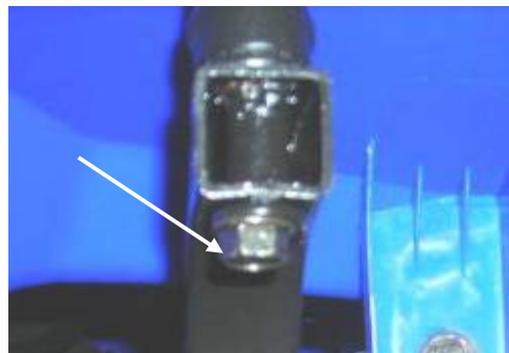


#### INSTALLATION

Install the front carrier in the reverse order of removal.

#### NOTE

◦ Attached all four bolts first and after aligned the carrier, tighten the bolts.



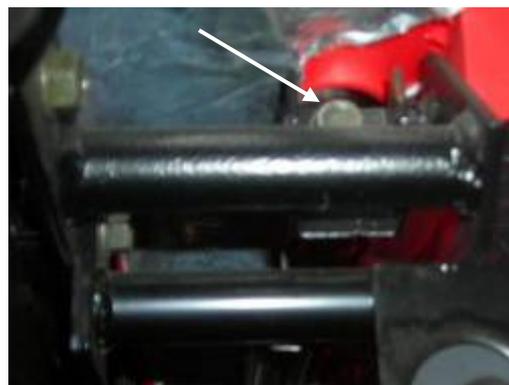
#### INSTALLATION

Install the front carrier in the reverse order of removal.

#### REAR CARRIER REMOVAL

Remove two carrier to plate bracket bolts and two carrier to rear bumper bolts.

Remove the rear carrier.



#### INSTALLATION

Install the front carrier in the reverse order of removal.

## Chapter 4 Frame & Cover

---

### FRONT BUMPER REMOVAL

Remove the front carrier.

Remove four bumper mounting bolts.

Remove the front bumper.

#### **NOTE**

◦ Attached all four bolts first, and after aligned the bumper, then tighten the bolts.



### INSTALLATION

Install the front bumper in the reverse order of removal.

### REAR BUMPER REMOVAL

Remove the rear carrier.

Remove four bumper mounting bolts.

#### **NOTE**

◦ The right side front bolt also tightens the muffler bracket. For easily removing the rear bumper, loosen another bracket mounting bolt, too,

Remove the rear bumper.



### INSTALLATION

Install the rear bumper in the reverse order of removal.



# Chapter 5 Wheels, Tires & Brakes

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## Contents

---

Handlebar & Steering

Front & Rear Wheel

Suspension System

Hydraulic Brake

---

## Service Information

### Specification

ITEM		STANDARD mm (in)	SERVICE LIMIT mm (in)
Axle round out		---	0.2 (0.008)
Rim round out	Radial	---	2.0 (0.08)
	Axial	---	2.0 (0.08)

### Torque Values

Steering shaft nut	80-120 N.m (58-87 ft.lb)
Steering shaft holder bolt	50-60 N.m (36-43 ft.lb)
Handle bar holder clamp nut	30-40 N.m (22-29 ft.lb)
Handle bar holder clamp bolt	24-30 N.m (17-22 ft.lb)
Tie rod end	45 N.m (33 ft.lb)
Ball joint Upper	55 N.m (40 ft.lb)
Lower	55 N.m (40 ft.lb)
Front wheel hub nut	59-79 N.m (43-58 ft.lb)
Rear wheel hub nut	140-160 N.m (101-116 ft.lb)
Wheel nut	64 N.m (17-22 ft.lb)
Brake disk bolt	30 N.m (22 ft.lb)
Shock absorber	
Front	45 N.m (33 ft.lb)
Rear Upper	108 N.m (80 ft.lb)
Lower	59 N.m (43 ft.lb)

### Troubleshooting

#### Hard steering

- Steering shaft nut too tight
- Steering shaft bearing damage
- Steering shaft holder too tight
- Insufficient tire pressure

#### Soft suspension

- Damper oil leaks
- Weak shock absorber spring

#### Steers to one side or do not tract straight

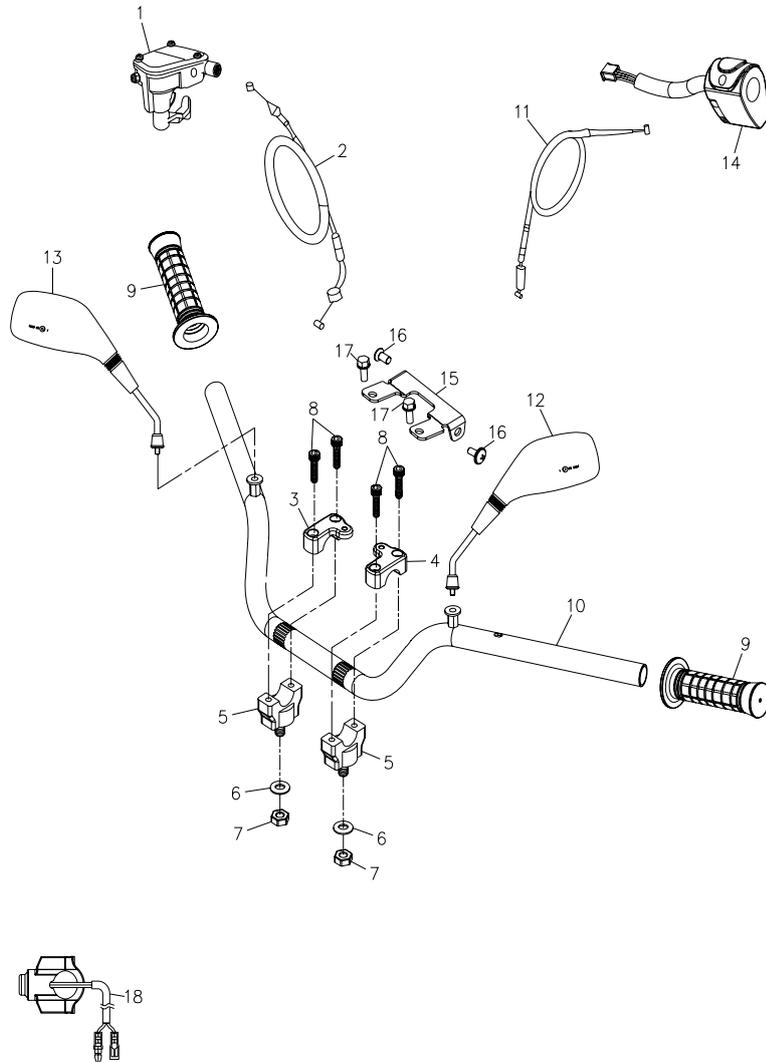
- Insufficient toe in setting
- Bend A-arm
- Insufficient tire pressure

#### Front wheel wobbling

- Bent rim
- Faulty or unevenly worn tire
- Excessive wheel bearing play

# Chapter 5 Wheels, Tires & Brakes

## HANDLE BAR





# Chapter 5 Wheels, Tires & Brakes

## Handlebar

### REMOVAL

Remove the speedometer assembly mounting screws.

Loosen L/R hand brake master cylinder holder mounting bolts and remove brake cylinder from handlebar.

Loosen L handle switch mounting bolts and remove switch from handlebar.

Disconnect brake switch wire, overdrive switch wire, throttle and choke cable.

Loosen four handle clamp hex socket bolts and remove handlebar.

### NOTE

- Do not remove the brake hose bolt from the brake cylinder.

### INSTALLATION

Install handlebar onto lower holders and aligning the punch mark on the handlebar with the upper surfaces surface of the lower holders.

Install the handlebar upper holders and tighten four hex socket bolts.

#### **Torque: 24-30 N.m (17-22 ft.lb)**

Install the L/R hand master cylinder holder with the UP mark facing up and aligning the end of the holder with the punch mark on the handlebar.

Tighten the upper bolt first, then tighten the lower bolt.

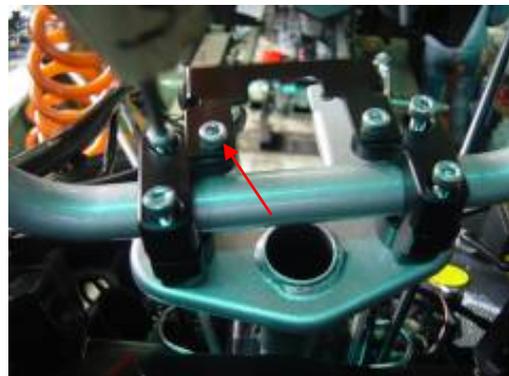
#### **Torque: 24-30 N.m (17-22 ft.lb)**

Install the L handle switch housing aligning the locating pin on the housing with the hole in the handlebar.

Connect the throttle and choke cable.

Connect the brake switch and overdrive wire.

Insert speedometer assembly to the handlebar and tighten the mounting screw.



## Chapter 5 Wheels, Tires & Brakes

---

### Steering

#### STEERING SHAFT REMOVE

Remove the front fender.

#### NOTE

- Raise the front frame and secure with stable stand for easily working.

Remove the handlebar.

Remove tie rod end nuts on steering shaft side.

Remove the steering shaft nut.

Remove the steering shaft holder bolts

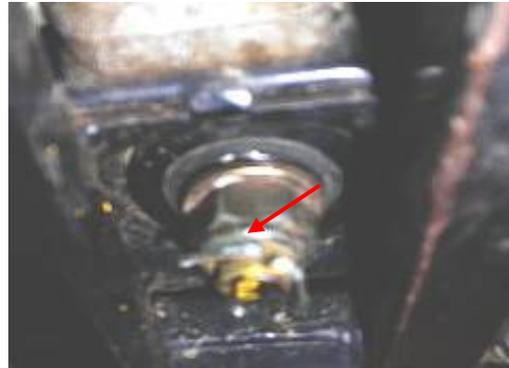
Remove the steering shaft holder basket and pull out the steering from frame.



#### INSPECTION

Inspect tie rod end mounting plate for wear or damage and replace if necessary.

Inspect steering shaft bush and holder bush for wear and damage. Replace if necessary.



#### NOTE

- Apply grease to steering shaft bush and holder bush when replace and reassembling.

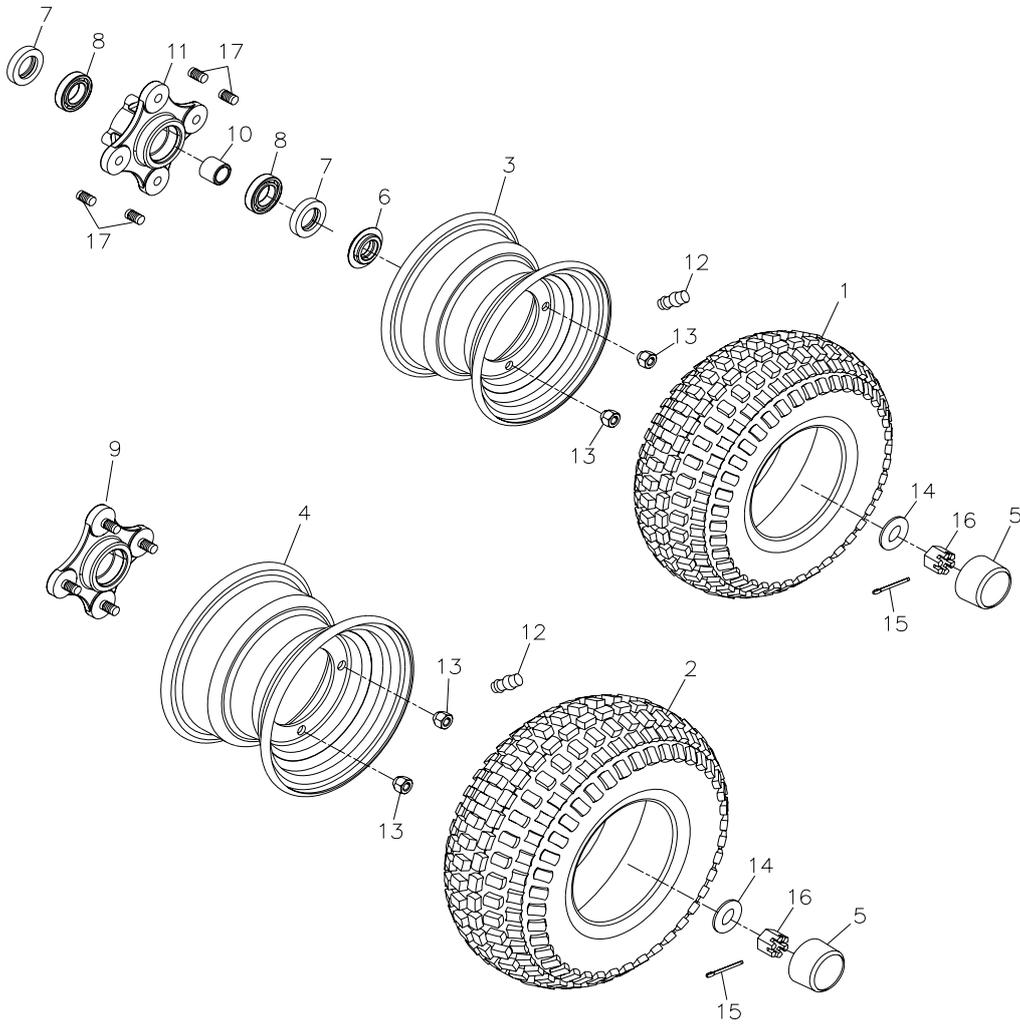
#### INSTALLATION

Install the steering shaft in the reverse order of removal.



# Chapter 5 Wheels, Tires & Brakes

## FRONT & REAR WHEEL



# Chapter 5 Wheels, Tires & Brakes

## Front & Rear Wheel

### WHEEL REMOVAL

#### NOTE

◦ Use a hydraulic jack for easily serving.

Use parking brake to locked rear wheel.

Slightly loosen wheel nuts.

Raise the frame to let wheel leave ground.

Loosen and remove wheel nuts then remove wheel.



### INSPECTION

Check the tires for cuts or embedded object

Check the front and rear wheels rim for trueness.

#### Service Limits:

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

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

Replace if the reading exceeds the service limit.

Measure the tread depth at the center of tires.

Replace the tires if the tread depth reaches the following limits:

#### Minimum tread depth:

**Front: 1.5 mm (0.06in)**

**Rear: 2.5 mm (0.08in)**

### INSTALLATION

Align wheel to hub studs and install wheel nuts.

Down the vehicle to ground and tighten wheel nuts to specified torque.

**Torque: 64 N.m (47 ft.lb)**

## Chapter 5 Wheels, Tires & Brakes

---

### HUB REMOVAL

Remove the wheel.

Remove the hub to axle mounting nut cotter pin.

Loosen the hub to axle mounting nut and remove nut and plane washer.

Remove the hub from axle.



### INSPECTION

#### Front hub

Check oil seal for broken or damage, replace it if necessary.

Turn the inner race of each bearing with your finger. The bearing should turn smoothly and quietly.

Check the outer race fits tightly in the hub.

Remove and discard the bearing if the races do not turn smoothly, quietly or if they are fit loosely in the hub.



#### NOTE

---

◦ Replace the hub bearing in pairs.

### INSTALLATION

Install front and rear hub in the reverse order of removal.

#### Torque:

**Front: 59-79 N.m (43-58 ft.lb)**

**Rear: 140-160 N.m (101-116 ft.lb)**

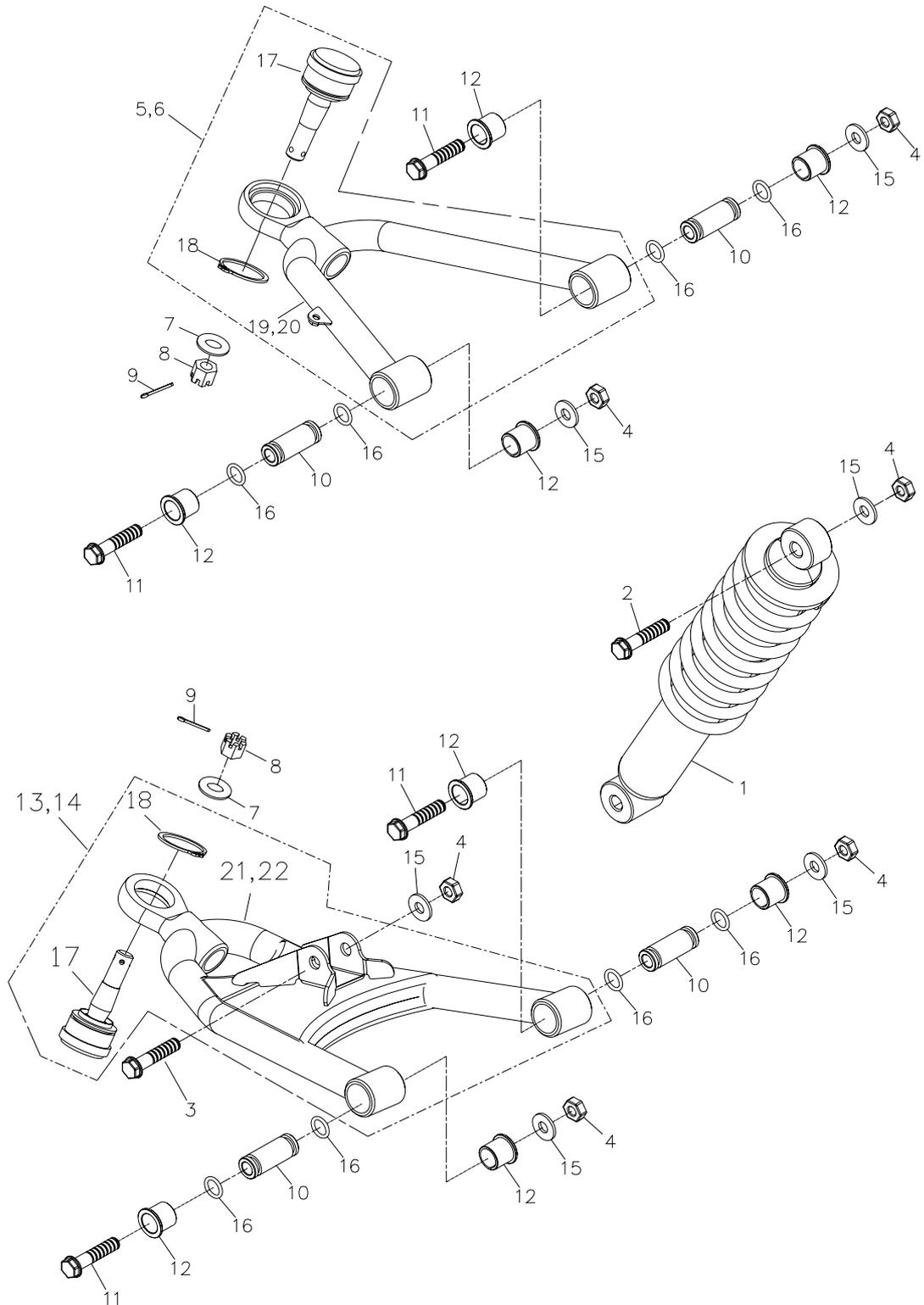
#### NOTE

---

◦ Use a new axle mounting nut cotter pin.

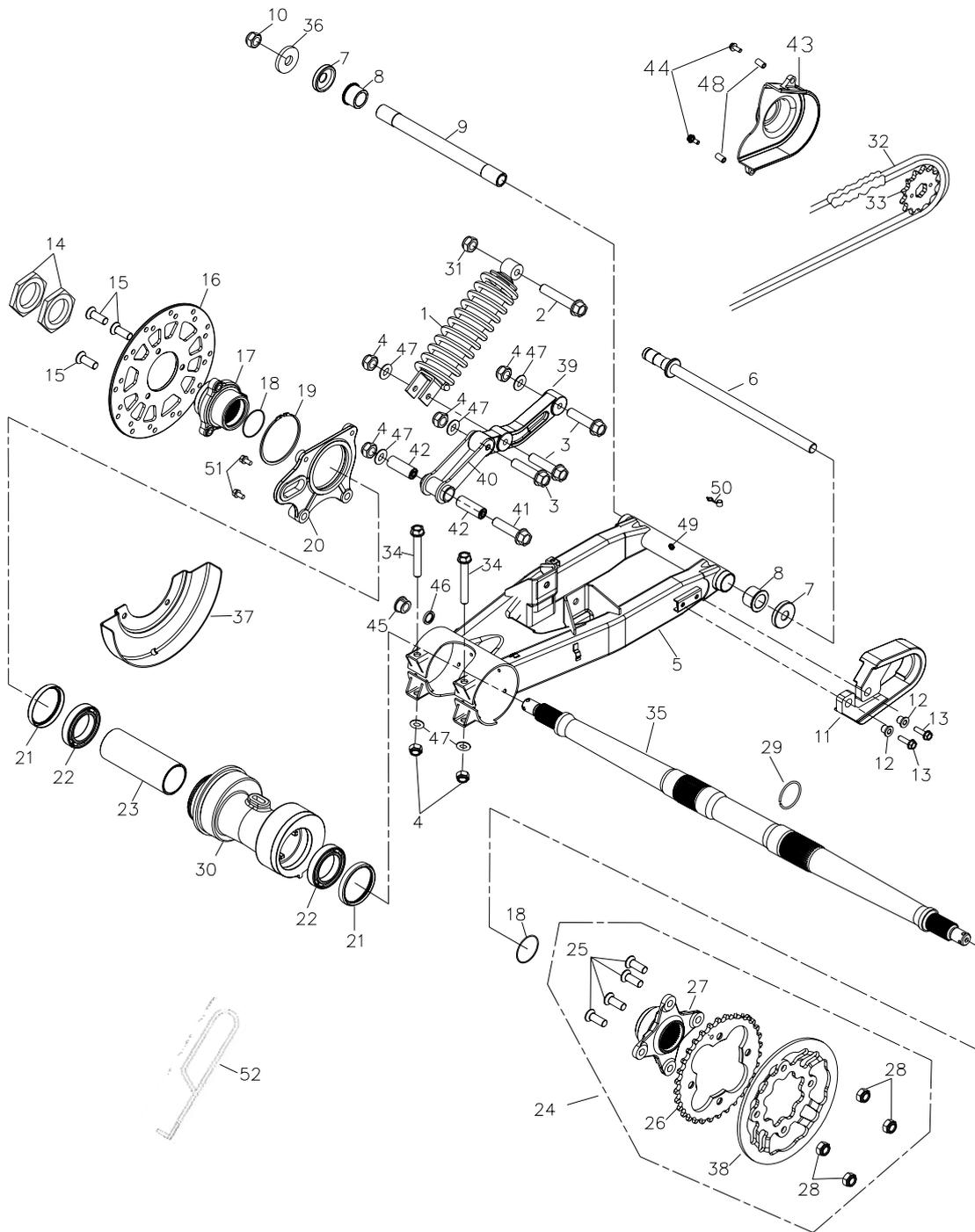
# Chapter 5 Wheels, Tires & Brakes

## FRONT SUSPENSION



# Chapter 5 Wheels, Tires & Brakes

## REAR SUSPENSION & SWING ARM SUB ASS'Y



# Chapter 5 Wheels, Tires & Brakes

## Front Suspension

### A-arm REMOVAL

#### CAUTION

- Support the vehicle frame steady when servicing or inspecting.

Remove front tire.

Remove tie rod end on knuckle.

Remove upper and lower ball joint on knuckle and apart the knuckle with brake clipper from ball joint.

Remove lower shock absorber mounting bolt.

Remove upper and lower a-arm mounting bolts and remove a-arm from vehicle frame.

#### INSPECTION

Inspect ball joint rubber and joint for wear or damage.

Replace ball joint upper and lower at same time.

Inspect a-arm bushing, replace it if necessary.

Inspect a-arm for any crushed or bended.

#### INSTALLATION

Install upper and lower a-arm in the reverse order of removal.

#### Torque:

**Ball joint**                    55 N.m (40 ft.lb)

**Mounting bolts**            30 N.m (22 ft.lb)

**Tie rod end nuts**           45 N.m (33 ft.lb)

#### NOTE

- Apply greases on both of axle holder oil seal before installation.



# Chapter 5 Wheels, Tires & Brakes

## Rear Suspension

### SWING ARM REMOVAL

#### CAUTION

- Support the vehicle frame steady when servicing or inspecting.

Remove L and R foot pad and rear tires.

Disconnect drive chain and remove the chain

Remove rear shock absorber mounting bolts both upper and lower then remove shock from axle.

Remove rear caliper and pull back caliper set with brake line and parking brake cable aside the swing arm assemble.

Remove rocker arm to chassis mounting bolt.

Remove foot brake pedal.

Loosen the swing arm bolt and remove it.

Pull back the swing arm assembly with axle and remove it from chassis.



#### INSPECTION

Check swing arm bushing and oil seal for broken or damage, replace it if necessary.

Check rocker arm bushing and roller bearing.

The bearing must turn smoothly and quietly.

Check shoe slider for unusually wear, replace it if necessary.

#### INSTALLATION

Install rear wheel axle in the reverse order of removal.

## Chapter 5 Wheels, Tires & Brakes

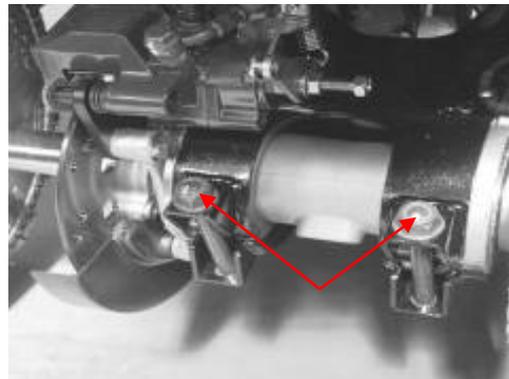
### REAR WHEEL AXLE RMOVAL

Loosen brake disk flange tighten nuts and remove the nuts.

Remove brake disk flange assembly.

Push wheel axle to right side and remove axle with rear sprocket assembly from axle holder.

Remove rear sprocket assembly from axle.



### SPROCKET INSPECTION

Check sprocket teeth, replace if show as illustration.

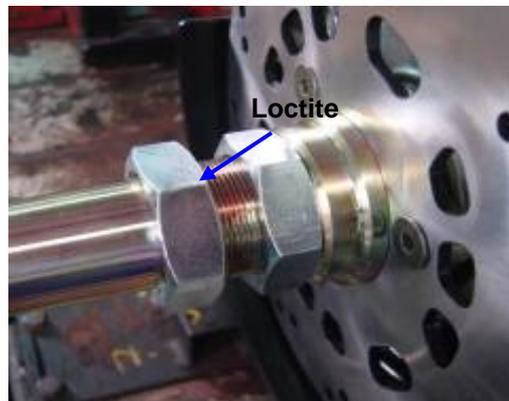
### REAR AXLE HOLDER INSPECTION

Check oil seal for broken or damage, replace it if necessary.

Turn the inner race of each bearing with your finger. The bearing should turn smoothly and quietly.

Check the outer race fits tightly in the holder.

Remove and discard the bearing if the races do not turn smoothly, quietly or if they are fit loosely in the holder.



### NOTE

- Replace holder bearing in pairs.

### INSTALLATION

Install rear wheel axle in the reverse order of removal.

### NOTE

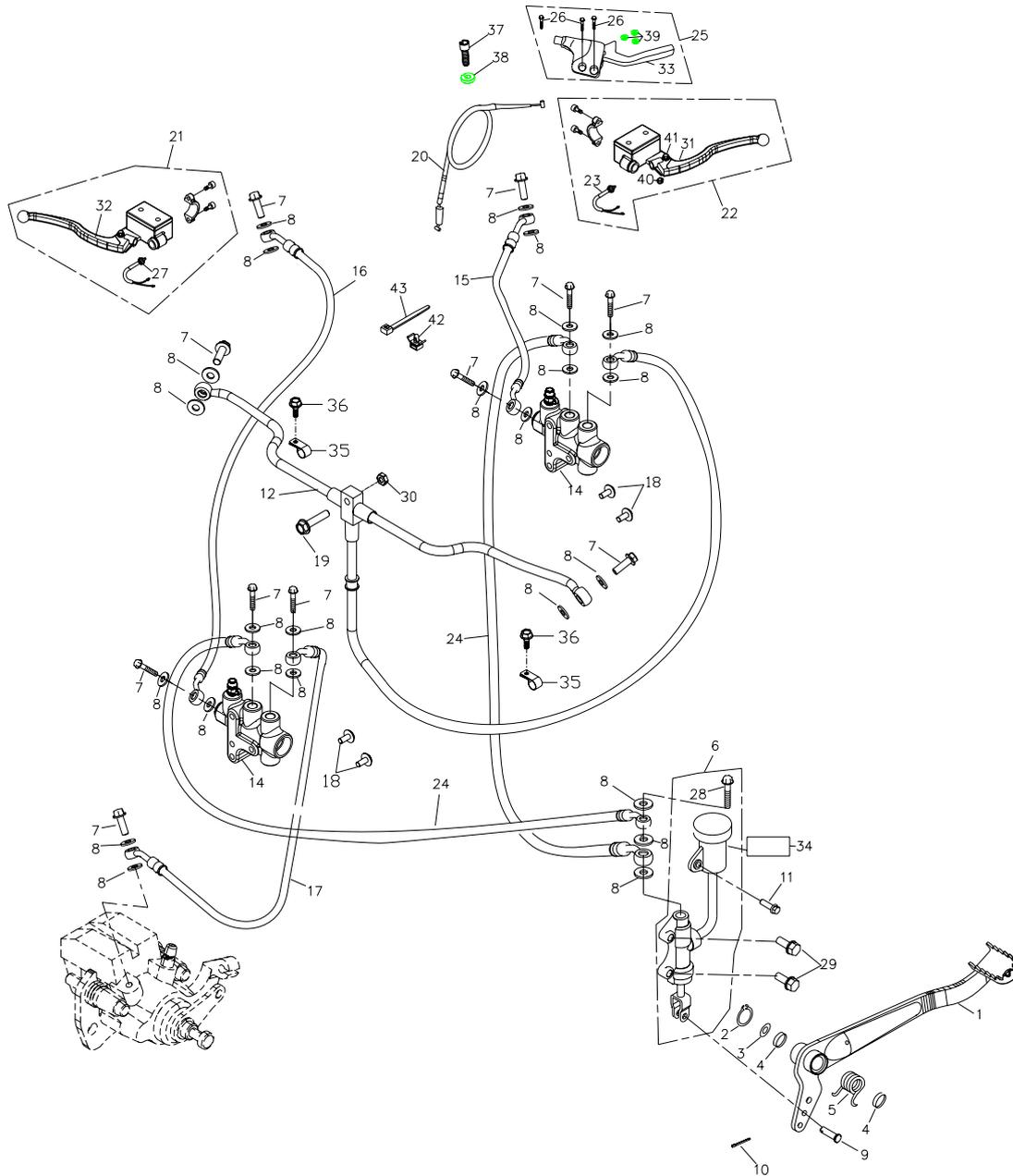
- Apply greases on bushing before installation.

### NOTE

- Apply **Loctite** on brake disk flange tighten nuts when installation.

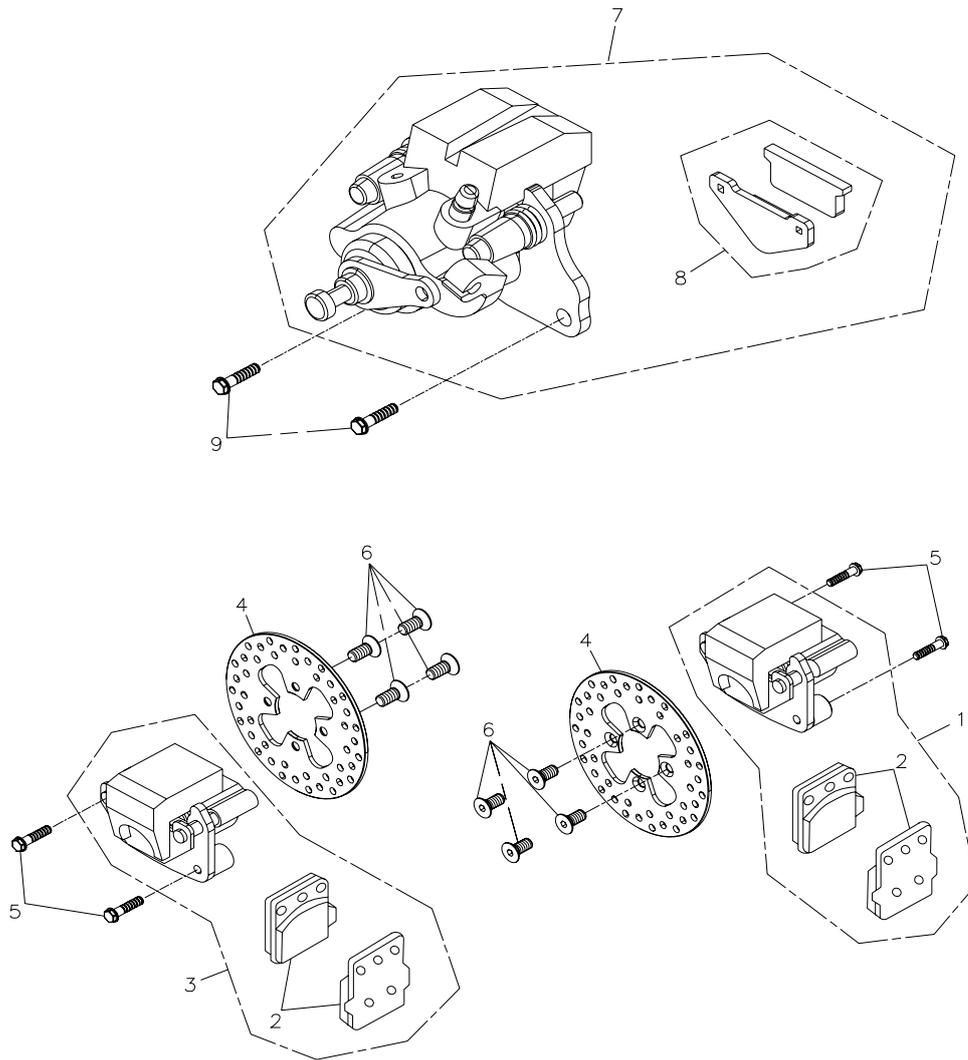
# Chapter 5 Wheels, Tires & Brakes

## HYDRAULIC BRAKE SYSTEM



# Chapter 5 Wheels, Tires & Brakes

## BRAKE CALIPER



# Chapter 5 Wheels, Tires & Brakes

## Service Information

### GENERAL

- The brake calipers can be removed without disconnecting the hydraulic system.
- Bleed the hydraulic system if it has been disassembled or if the brake feels spongy.
- Do not allow foreign material to enter the system when filling the reservoir.
- Brake fluid will damage painted, plastic and rubber parts. Whenever handling brake fluid, protect the painted, plastic and rubber parts by covering them with a rag. If fluid does get on the parts, wipe it off with a clean cloth.
- Always check brake operation before riding the motorcycle.

### SPECIFICATION

ITEM		STANDARD mm (in)	SERVICE LIMIT mm (in)
Disc thickness	Front	4.0 (0.16)	3.0 (0.14)
	Rear	4.0 (0.16)	3.5 (0.14)
Disc runout		---	0.3 (0.012)
Brake pad thickness			1.0 (0.04)

### TORQUE VALUES

Bleed valve	4-7 N.m (3-5 ft.lb)
Caliper mounting bolt	30 N.m (22 ft.lb)
Brake fluid line bolt	34 N.m (25 ft.lb)
Master cylinder holder bolt	10-14 N.m (7-10 ft.lb)

### Troubleshooting

#### Brake lever soft or spongy

- Air bubbles in hydraulic system
- Low fluid level
- Hydraulic system leaking

#### Brake lever too hard

- Sticking piston(s)
- Clogged hydraulic system
- Pads glazed or excessively worn

#### Brake drag

- Hydraulic system sticking
- Sticking piston(s)

#### Brakes grab or pull to one side

- Pads contaminated
- Disc or wheel misaligned

#### Brake chatter or squeal

- Pads contaminated
- Excessive disc runout
- Caliper installed incorrectly
- Disc or wheel misaligned

# Chapter 5 Wheels, Tires & Brakes

## Brake Fluid Replacement/Bleeding

### BRAKE FLUID DRAINING

#### WARNING

- *A contaminated brake disc or pads reduces stopping power. Discard contaminated pads and clean a contaminated disc with a high quality brake degreasing agent.*

#### CAUTION

- Do not allow foreign material to enter the system when filling the reservoir.
- Avoid spilling fluid on painted, plastic or rubber parts. Place a rag over these parts whenever the system is serviced.

With the fluid reservoir parallel to the ground, remove the reservoir cap and diaphragm plate.

Connect a hose to the bleed valve.

Loosen the caliper bleed valve and pump the brake lever until no more fluid flows out of the bleed valve.

Close the bleed valve.



## Chapter 5 Wheels, Tires & Brakes

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### BRAKE FLUID FILLING/BLEEDING

Fill the reservoir with DOT-3 or DOT-4 brake fluid from a sealed container.

### CAUTION

---

- Do not mix different types of fluid. They are not compatible.
- 

Connect a commercially available brake bleeder to the bleed valve.

Pump the brake bleeder and loosen the bleed valve.

Bleeding front wheel first by bleeding front brake shunt then left and right brake caliper. After completed bleeding front wheels calipers, then bleeding the rear brake shunt and caliper.

Add fluid when the fluid level in the master cylinder reservoir is low.

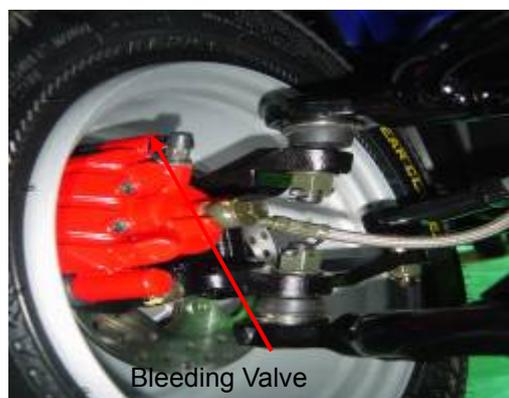
### NOTE

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- Check the fluid level often while bleeding the brakes to prevent air from being pumped into the system.
  - When using a brake bleeding tool, follow the manufacture's operating instruction.
  - If air is entering the bleeder from around the bleed valve threads, seal the threads with Teflon tape.
- 

Repeat the above procedures until air bubbles do not appear in the plastic hose.

Close the bleed valve and operate the brake lever. If it feels spongy, bleed the system by performing BLEEDING procedure.



## Chapter 5 Wheels, Tires & Brakes

### **BRAKE FLUID FILLING/BLEEDING**

If a brake bleeder is not available, perform the following procedure:

Pump up the system pressure with the lever until there are no air bubbles in the fluid flowing out of the reservoir small hole and lever resistance is felt.

1. Squeeze the brake lever and hold it down, then open the bleed valve half turn and then close the valve.

#### **NOTE**

- Do not release the brake lever until the bleed valve has been closed.

2. Release the brake lever slowly and wait several seconds after it reaches the end of its travel.

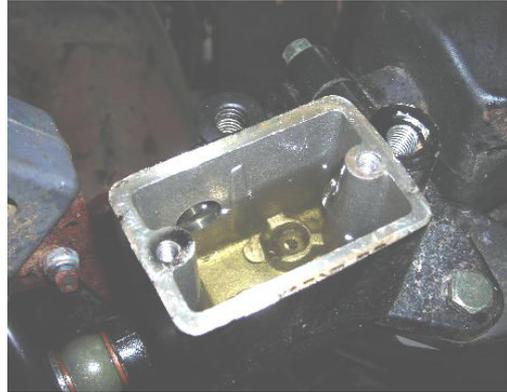
Repeat steps 1 and 2 until bubbles cease to appear in the fluid.

Tighten the bleed valve.

**Torque: 4-7 N.m (3-5 ft.lb)**

Fill the fluid reservoir to the upper level mark.

Reinstall the diaphragm, diaphragm plate and reservoir cap.



## Chapter 5 Wheels, Tires & Brakes

### BRAKE PAD REPLACEMENT

#### WARNING

- *Never blow out brake dust with compressed air and don't inhale it.*

#### NOTE

- Always replace the brake pads in pair to assure even disc pressure.

### FRONT BRAKE PADS

Remove the front wheel.

Remove the caliper mounting bolts and remove caliper from knuckle.

#### NOTE

- It's unnecessary to remove the brake line for brake pads replacement.

Loosen two brake pad fixation bolts and pull out the bolts.

Push brake pads against caliper piston to let it back into the caliper bore then remove inner brake pad from caliper house.

Press caliper mounting plate toward bore side then push outer brake pad out of the caliper.

#### NOTE

- For easily remove the outer pad, pull the pad apart with align pin one side first then the other

### INSTALLATION

Installation is the reverse of removal. Using a C-clamp, depress the piston back into the caliper bore to provide enough room for the new pads to clear the disc.

Insert brake pads fixation bolts and tighten the bolts.

Tighten the caliper mounting bolts.

**Torque: 30 N.m (25 ft.lb)**



## Chapter 5 Wheels, Tires & Brakes

---

### REAR BRAKE PADS

Remove the caliper mounting bolts and remove caliper from rear swing arm.

Push caliper piston back into the caliper bore to provide enough room for remove pads.

Remove the inner pad first then outer pad.

### NOTE

- For easily remove the outer pad, pull the pad apart with align pin one side first then the other



Installation is the reverse of removal. Using a C-clamp, depress the piston back into the caliper bore to provide enough room for the new pads to clear the disc.

Tighten the caliper mounting bolts.

**Torque: 30 N.m (25 ft.lb)**

### BRAKE DISC INSPECTION, REMOVAL AND INSTALLATION

#### INSPECTION

Visually inspect the surface of the disc for score mark and other damage.

Light scratches are normal after use and won't affect brake operation, but deep grooves and heavy score marks will reduce braking efficiency and accelerate pad wear.

If the disc is badly grooved it must be machined or replaced.

Check the thickness of the disc with a micrometer. If the disc is thinner than service limit, replace it.

The minimum thickness is also stamped into disc.

**Service limit: Front 3.5 mm**

**Rear 3.5 mm**



## Chapter 5 Wheels, Tires & Brakes

### REMOVAL AND INSTALLATION

#### Front disc removal/installation

Remove the wheel hub.

Remove the disc retaining bolts on hub.

Installation is the reverse of removal.

Tighten the disc retaining bolts.

**Torque: 43 N.m (31 ft.lb)**

#### **NOTE**

◦ Used pre-coating anti-loosen bolts.



#### Rear disc removal/installation

Remove the left rear wheel hub.

Remove the rear caliper.

Remove the disc retaining bolts and remove the disc.

Installation is the reverse of removal.

Tighten the disc retaining bolts.

**Torque: 43 N.m (31 ft.lb)**



#### **NOTE**

◦ Used pre-coating anti-loosen bolts.



## Chapter 5 Wheels, Tires & Brakes

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### Parking Brake

#### ADJUSTMENT

Park the vehicle on a level ground.

Pull the parking lever to left side.

Loosen the parking brake adjust bolt fixing nut and then turn in the adjust bolt until you can feel it touch the piston wall.

Turn out the adjust bolt half turn and hold the adjust bolt then tight the fixing nut.



#### NOTE

- Pull the parking lever to right side and push the vehicle to check it's movable or not. If it could easily moving, the adjustment is not in position. Re-adjust and check to confirm.



# **Chapter 6 Alternator/Electrical Equipment**

---

## Contents

---

Alternator & Starting Motor

Battery

Lights & Horn

Wire Diagram

---

## **Alternator/Starter Clutch**

### **Service Information**

#### **GENERAL**

- The alternator and starter clutch can be serviced with the engine installed in the frame.

#### **SPECIFICATION**

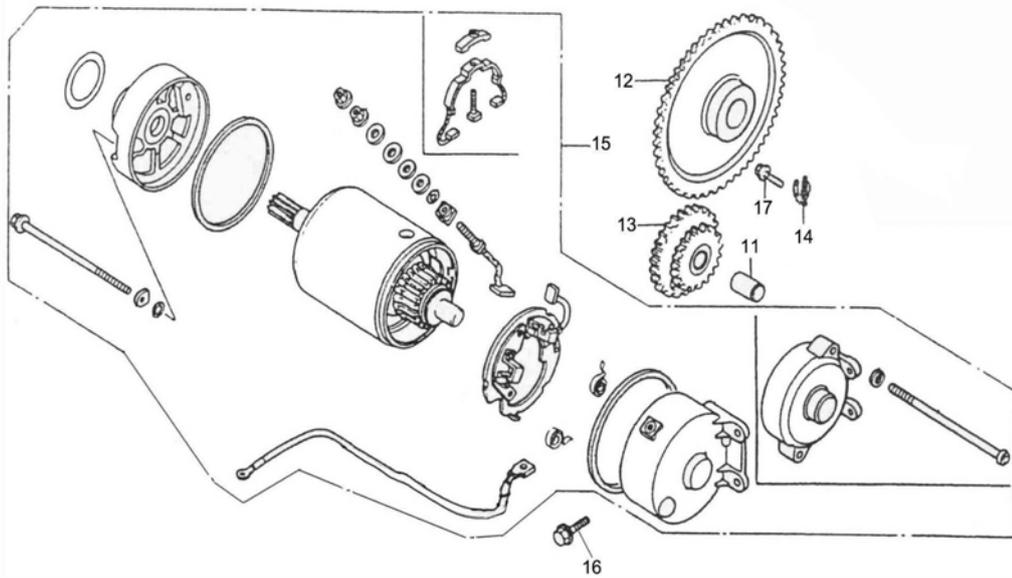
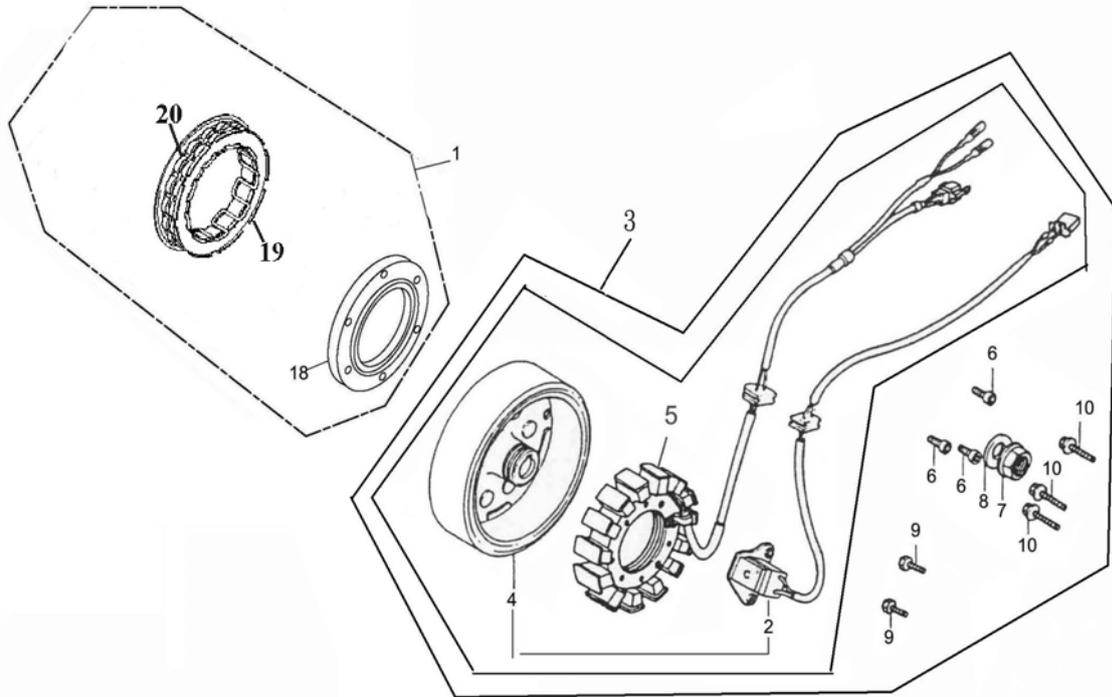
ITEM	STANDARD mm (in)	SERVICE LIMIT mm (in)
Starter driven gear I.D.	22.026-22.045 (0.8672-0.8679)	22.10 (0.870)
Starter Driven gear O.D.	42.195-42.208 (1.6612-1.6617)	42.15 (1.659)
One way clutch outer I.D.	58.897-58.927 (2.3187-2.3200)	58.98 (2.322)

#### **TROQUE VALUES**

Flywheel nut		105-115 N.m (76-83 ft.lb)
Oil pipe bolt	8 mm	8-12 N.m (6-9 ft.lb)
	12 mm	18-22 N.m (13-16 ft.lb)
One way clutch bolt		28-32 N.m (21-24 ft.lb)

# Chapter 6 Alternator/Electrical Equipment

## Alternator & Starter Gear



## **Chapter 6 Alternator/Electrical Equipment**

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### **Right Crankcase Cover**

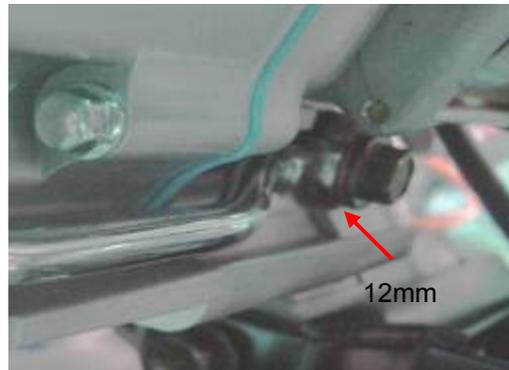
#### **REMOVAL**

Remove right foot pad.

Drain the coolant by disconnecting the water hoses of the water pump.



Remove the two pipe bolts, two 8 mm oil pipe bolts, 12 mm oil pipe bolt and washer, then remove the pipe.



Disconnect the pulse generator and alternator wire connectors.



Disconnect the crankcase breather tube from the right crankcase cover.

Remove the right crankcase cover attaching bolts and right crankcase cover.

Remove the dowel pins and gasket.



## **Chapter 6 Alternator/Electrical Equipment**

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### **STATOR REMOVAL**

Remove the wire grommet from the groove in the cover.

Remove the breather plate and ignition pulse generator.

Remove the three stator attaching bolts and stator.



### **FLYWHEEL REMOVAL**

Remove the oil orifice from the end of the crankshaft.

Hold the flywheel with a flywheel holder and remove the flywheel nut and washer.



### **NOTE**

◦ Be careful not to drop the drive pin into the crankcase.

Remove the flywheel with a flywheel puller.

Remove the woodruff key from the crankshaft.

## **Chapter 6 Alternator/Electrical Equipment**

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### **Starter Gear**

#### **STARTER IDLE/DRIVEN GEAR REMOVAL**

Remove the starter idle gear.

Remove the set plate.

Remove the starter driven gear and idle gear shaft.



#### **STARTER GEAR INSPECTION**

Inspect the starter driven gear for wear or damage.

Measure the starter driven gear I.D. and O.D.

**Service Limit: I.D. 22.10 mm (0.870in)**

**O.D. 42.15 mm (1.659in)**

Inspect the starter idle gear and shaft for wear or damage.



Install the starter driven gear onto the one way clutch and check for proper operation by turning the starter driven gear.

The starter driven gear should only turn in one direction.

## **Chapter 6 Alternator/Electrical Equipment**

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### **Starter Clutch**

#### **DISASSEMBLY**

Remove the hex socket bolts using an impact driver and 6 mm socket bit.

Measure the one way clutch outer I.D.

**Service Limit: 58.98 mm (2.322in)**



#### **ASSEMBLY**

Install the one way clutch into the one way clutch outer.

Install the one way clutch assembly to the flywheel and tighten with 6 mm socket bolts.

**Torque: 28-32 N.m (21-24 ft.lb)**



#### **NOTE**

◦ Apply a locking agent to the socket bolt threads.

#### **INSTALLATION**

Install the starter driven gear onto the crankshaft.  
Install the set plate and set plate bolt.

Check that the starter driven gear rotates freely.  
Install the starter idle gear shaft.

Install the starter idle gear on the shaft.



## **Chapter 6 Alternator/Electrical Equipment**

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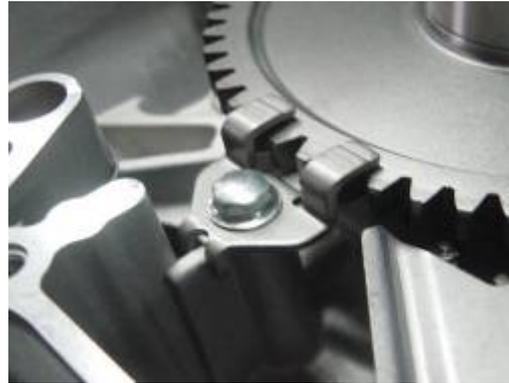
### **FLYWHEEL INSTALLATION**

Install starter gear to crankshaft, apply some grease onto crankshaft for easily insert.

Install starter gear holding plate by slight raise the starter gear and insert the holding plate.

Fasten the holding plate tighten blot.

Wipe off oil and grease from the tapered section of the crankshaft and flywheel.

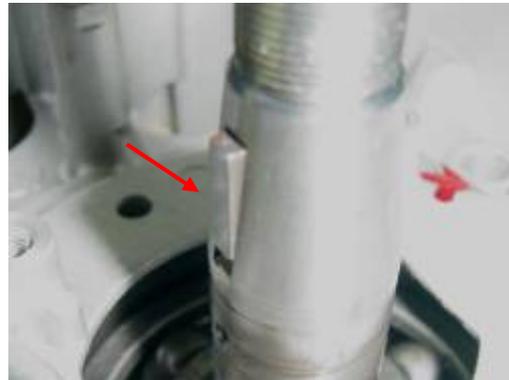


Install the oil orifice drive pin in the crankshaft.

Install the woodruff key into the crankshaft slot.

Install the flywheel onto the crankshaft, aligning the key on the crankshaft with the groove in the flywheel.

Apply oil to the washer and install onto the crankshaft.



Apply molybdenum disulfide grease to the flywheel nut and crankshaft threads then install and tighten the flywheel nut while holding the flywheel.

**Torque: 105-115 N.m (76-83 ft.lb)**

Install the spring and oil orifice onto the crankshaft aligning the slot in the orifice with the drive pin in the crankshaft.



## **Chapter 6 Alternator/Electrical Equipment**

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### **STATOR INSTALLATION**

Install the stator on the right crankcase cover with the three bolts.

Install the ignition pulse generator and breather plate with two bolts.

Install the wire grommet in its groove in the cover securely.

### **NOTE**

- Be sure to route the stator wire under the pulse generator.
  - Make sure that the breather plate is in position securely.
- 



### **RIGHT CRANKCASE COVER INSTALLATION**

Install the dowel pins and a new gasket.

Install the right crankcase cover over the crankcase, aligning the water pump shaft groove with the oil pump shaft.

Install the right crankcase cover attaching bolts and tighten them.

Connect the crankcase breather tube to the right crankcase cover

Connect the ignition pulse generator and alternator wire couplers and connector.

Connect the water hoses to the water pump.

Make sure that the oil pipe is not clogged.

Install the oil pipe with oil bolts and sealing washers.



## Chapter 6 Alternator/Electrical Equipment

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### CAUTION

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- The 8 mm oil pipe bolt for the cylinder head cover side is black because its oil hole differs from the oil pipe bolt for the right crankcase cover side.
  - Install the oil pipe bolts in the correct position.
  - If the 8 mm oil pipe bolts are interchanged, engine damage may result.
- 



### NOTE

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- Make sure that the sealing washer tab at the right crankcase cover faces the right crankcase side.
- 

Install the oil pipe stay bolts on the right crankcase cover and water pump.

Tighten the 8 mm and 12 mm oil pipe bolts.

**Torque: 8 mm: 8-12 N.m (6-9 ft.lb)**  
**12 mm: 18-22 N.m (13-16 ft.lb)**



Tighten the oil pipe stay bolts.

# **Chapter 6 Alternator/Electrical Equipment**

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## **Electrical Equipment Service Information**

### **GENERAL INFORMATION**

- The machines covered by this manual are equipped with a 12 volt electrical system. The components include a three-phase permanent magnet alternator and a regulator/rectifier unit. The regulator/rectifier unit maintains the charging system output within the specified range to prevent overcharging and converts the AC (alternating current) output of the alternator to DC (direct current) to power the lights and other components and to charge the battery.
- Electrical problems often stem from simple causes, such as loose or corroded connections or a blown fuse. Prior to any electrical troubleshooting, always visually check the condition of the fuse, wires and connections in the problem circuit.
- If testing instruments are going to be utilized, use the diagrams to plan where you will make the necessary connections in order to accurately pinpoint the trouble spot.
- One method of finding short circuits is to remove the fuse and connect a test light or voltmeter in its place to the fuse terminal. There should be no load in the circuit. Move the wiring harness from side-to-side while watching the test light. If the bulb lights, there is a short to ground somewhere in that area, probably where insulation has rubbed off a wire. The same test can be performed on other components in the circuit, including the switch.
- A ground check should be done to see if a component is grounded properly. Disconnect the battery and connect one lead of a self-powered test light (such as a continuity tester) to a known good ground. Connect the other lead to the wire or ground connection being tested. If the bulb lights, the ground is good. If the bulb does not light, the ground is not good.
- A continuity check is performed to see if a circuit, section of circuit or individual component is capable of passing electricity through it. Disconnect the battery and connect one lead of a self-powered test light (such as a continuity tester) to one end of the circuit being tested and the other lead to the other end of the circuit. If the bulb lights, there is continuity, which means the circuit is passing electricity through it properly. Switched can be checked in the same way.
- Remember that all electrical circuits are designed to conduct electricity from the battery, through the wires, switches, relays, etc. to the electrical component (light bulb, motor, etc.). From there it is directed to the frame (ground) where it is passed back to the battery. Electrical problems are basically an interruption in the flow of electricity from the battery or back to it.

## Chapter 6 Alternator/Electrical Equipment

### Headlight

#### BULB REPLACEMENT

Remove headlight panel. (280AS only)

Disconnect the headlight coupler.

Remove headlight bulb rubber dust seal.

Remove the bulb socket.

Remove the clip and replace the headlight bulb.

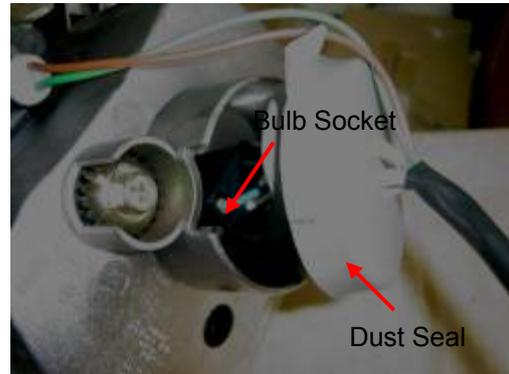
#### CAUTION

- Do not put finger prints on the headlight bulb, they may create hot spots on the bulb.
- If you touch the bulb with your hands, clean it with a cloth moistened with alcohol to prevent its early failure.
- Do not try to replace the bulb with light ON.

Position the headlight bulb rubber dust seal.

#### NOTE

- Install the dust seal securely.



### Speedometer

#### REMOVAL/INSTALLATION

Loosen two mounting bolts of speedometer cover.

Disconnect speedometer connectors and pull out the speedometer cover with speedometer.

Loosen three speedometer mounting screws and remove the speedometer.

Install the speedometer in the reverse order of removal.



## Chapter 6 Alternator/Electrical Equipment

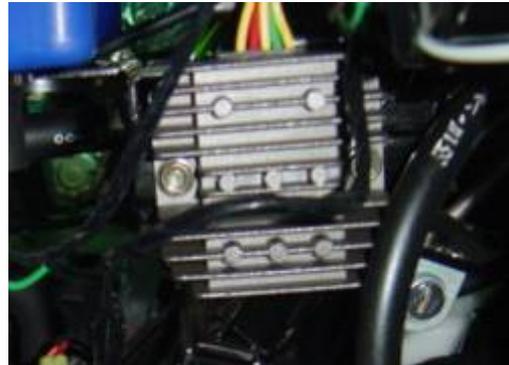
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### Regulator/Rectifier

#### GENERAL

Regulator/rectifier was located on left front side of front fender.

The regulator/rectifier unit maintains the charging system output within the specified range to prevent overcharging and converts the AC (alternating current) output of the alternator to DC (direct current) to power the lights and other components and to charge the battery.



#### INSPECTION

During the regulator normally function, the alloy body of regulator will become heated.

Started the engine, use your hand to touch the alloy body to check if it's functional.

When engine is running, turn off the light and other electrical accessory and use a voltmeter to check the volts of battery.

**Battery volts: 13.6 – 14.3 V**

Replace the regulator if it's not heated or charging volts not in range when engine is running.



#### REMOVAL/INSTALLATION

Disconnect alternator wire couplers and connector on right side then loosen two mounting bolts and remove regulator.

Install the regulator in the reverse order of removal.



