# **CHAPTER 1 GENERAL INFORMATION**

## A WARNING

The parts of different types/ variants/ versions maybe un-interchangeable, even some parts have almost same appearance. Always refer to Parts Manual of each UTV model for spare parts information and service.

1.1 IMPORTANT INFORMATION

1.2 V.I.N AND ENGINE SERIAL NUMBER

**1.3 VEHICLE DIMENSIONS** 

## **1.1 IMPORTANT INFORMATION**

#### PREPARATION FOR REMOVAL PROCEDURES

- 1. Remove all dirt, mud, dust and foreign material before removal and disassembly.
- 2. Use proper tools and cleaning equipment.
- 3. When disassembling the machine, always keep mated parts together. This includes gears, cylinders, pistons and other parts that have been "mated "through normal wear. Mated part must always be reused or replaced as an assembly.
- 4. During machine disassembly, clean all parts and place them in trays in the order of disassembly. This will speed up assembly and allow for the correct installation of all parts.
- 5. Keep all parts away from any source of fire.

#### **REPLACEMENT PARTS**

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

#### GASKETS, OIL SEALS AND O-RINGS

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

#### LOCK WASHERS/PLATES AND COTTER PINS

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



#### **BEARINGS AND OIL SEALS**

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



#### CAUTION:

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

① Bearing



#### T-Boss570 SERVICE MANUAL 21.0

## **CHAPTER 1 GENERALINFORMATION**

#### CIRCLIPS

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

④Shaft

### **CHECKING OF CONNECTIONS**

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

- 1. Disconnect:
- Connector
- 2. Dry each terminal with an air blower.
- 3. Connect and disconnect the connector two or three.
- 4. Pull the lead to check that it will not come off.
- 5. If the terminal comes off, bend up the pin ①and reinset the terminal into the connector.
- 6. Connect:
  - Connector

#### NOTE:

The two connectors " click " together.

7. Check for continuity with a tester. **NOTE:** 

- If there is no continuity, clean the terminals.
- Be sure to perform the steps 1 to 7 listed above when checking the wire harness.
- Use the tester on the connector as shown.









## A WARNING

Never run an engine in an enclosed area. Carbon monoxide exhaust gas is poisonous and can cause severe injury or death. Always start engines outdoors.

Gasoline is extremely flammable and explosive under certain conditions. Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Always keep alert and wear protection.

Exhaust system components are very hot during and after use of UTV. Never service when the engine is warm or hot. Escaping steam from cooling system or hot oil from the machine can cause severe burns. The engine must be cool before service.

Crate of the UTV and parts in the UTV maybe have sharp edge, always pay attention and wear protection.

#### **CONVERSION TABLE**

#### How to use the CONVERSION TABLE

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

METRIC		MULIPLIER		IMP
**mm	х	0. 3937	=	**in
**cm	х	0.03937	=	**in

#### **CONVERSION TABLE**

METRIC TO IMP				
	Known	Multiplier	Result	
Torque	m ∙ kg	7.233	ft • lb	
	m ∙ kg	86.794	In • Ib	
	cm • kg	0.0723	ft • lb	
	cm • kg	0.8679	In • lb	
Weight	kg	2.205	lb	
	g	0.03527	OZ	
Distance	km/h	0.6214	mph	
	km	0.6214	mi	
	m	3.281	ft	
	m	1.094	yd	
	cm	0.3927	in	
	mm	0.03927	in	
Volume/	cc(cm <sup>3</sup> )	0.03527	oz(IMP liq.)	
Capacity	cc(cm <sup>3</sup> )	0.06102	cu • in	
	lit(liter)	0.8799	qt (IMP liq.)	
	lit(liter)	0.2199	gal(IMP liq.)	
Miscellaneous	kg/mm	55.997	lb/in	
	kg/cm <sup>2</sup>	14.2234	psi(lb/in <sup>2</sup> )	
	Centigrade	9/5(°C)+32	Fahrenheit(°F)	

#### 1.2 V.I.N AND ENGINE SERIAL NUMBER

The vehicle identification number ① is

stamped

into the rear right of the frame tube.



The engine serial number 2 is stamped into left side of engine crankcase.



## 1.3 VEHICLE DIMENSIONS







## **NOTES**


## 

The parts of different types/ variants/ versions maybe un-interchangeable, even some parts have almost same appearance. Always refer to Parts Manual of each UTV model for spare parts information and service.

- 2.1 PERIODIC MAINTENANCE
- 2.2 THROTTLE PEDAL INSPECTION
- 2.3 CHOKE ADJUSTMETN
- 2.4 FUEL SYSTEM
- 2.5 TOE ALIGNMENT
- 2.6 BRAKING SYSTEM INSPECTION
- 2.7 SUSPENSION SPRING RPELOAD ADJUSTMENT
- 2.8 WHEELS
- 2.9 TIRE PRESSURE
- 3.0 FRAME, NUTS, BOLTS, FASTENERS

### 2.1 PERIODIC MAINTENANCE

#### GENARAL CAUTION

#### Mark on the following chart

Due to the nature of the adjustments marked with a  $\mathbf{D}$  on the following chart, it is recommended that service be performed by an authorized dealer.

• More often under severe use, such as dirty or wet conditions to purge water or dirt contamination from grease fittings and other critical components.

#### PERIODIC MAINTENANCE SCHEDULE

Careful periodic maintenance will help keep your vehicle in the safest, most reliable condition. Inspection, adjustment and lubrication intervals of important components are explained in the following chart on the following pages.

Maintenance intervals are based upon average riding conditions and an average vehicle speed of approximately 16km/h (10 miles per hour). Vehicles subjected to severe use, such as operation in wet or dusty areas, should be inspected and serviced more frequently.

Inspect, clean, lubricate, adjust or replace parts as necessary.

**NOTE:** Inspection may reveal the need for replacement parts. Always use genuine parts available from your dealer.

Service and adjustments are critical. If you are not familiar with safe service and adjustment procedures, have a qualified dealer perform these operations.

- A = Adjust I = Inspect
- C = Clean L = Lubricate
- D = Drain R = Replace
- T =Tighten to Correct Torque

	Item	Hours	When	Remarks
•	Brake System	Pre-ride	Pre-ride	Pre-ride inspection item
	Accelerator pedal	Pre-ride	Pre-ride	Inspect –adjust, lubricate, replace if necessary; pre-ride inspection item
	Fuel System	Pre-ride	Pre-ride	Check for leaks at tank cap, lines, fuel valve, filter, and carburetor.
•	Tires	Pre-ride	Pre-ride	Inspect daily, pre-ride inspection item
•	Front and Rear Wheels/ Hubs	Pre-ride	Pre-ride	Pre-ride inspection item
•	Steering	Pre-ride	Pre-ride	Inspect daily, lubricate
D	Wheels bearings	10 hrs	Monthly	Check for looseness/ damage. Replace if damaged.
	Frame nuts, bolts fasteners	Pre-ride	Pre-ride	Pre-ride inspection item
•	Air Filter-Pre-Cleaner	Daily	Daily	Inspect-Clean
	Coolant/Level Inspection	Daily	Daily	Replace engine coolant every one year
•	Air Box Sediment Tube	Daily	Daily	Drain deposits whenever visible
	Headlamp Inspection	Daily	Daily	Check operation daily; apply dielectric grease to connector when replaced
	Tail/ indicator lamp inspection	Daily	Daily	Check operation daily; apply dielectric grease to socket when replaced
•	Air Filter-Main Element	Weekly	Weekly	Inspect –Replace if necessary
	Battery	20 hrs	Monthly	Check/clean Terminals; check fluid level
D	Brake pad wear	10 hrs	Monthly	Inspect periodically
•	Rear Gear case Oil	100 hrs	Monthly	Check monthly and change annually
•	Front Gear case Oil	100 hrs	Monthly	Check monthly and change annually
	Engine Cylinder Head and Cylinder Base Fasteners	25 hrs	3 months	Inspect (re-torque required at first service only)
•	General Lubrication	50 hrs	3 months	Lubricate all fittings, pivots, cables, etc.
•	Engine Oil-Level/Change	30 hrs	3 months	Check Level Daily; Break in Service at 1 month. Change oil more often in cold weather use.

	Item	Hours	When	Remarks
•	Oil Filter	50 hrs	6 months	Inspect-clean
	Engine breather hose	100 hrs	6 months	Inspect
D	Throttle Cable/ Accelerator pedal	20 hrs	monthly	Inspect –adjust, lubricate, replace if necessary; pre-ride inspection item
	Coolant strength	100 hrs	6 months	Inspect strength seasonally
	Shift linkage	50 hrs	6 months	Inspect, adjust
D	Drive belt	50 hrs	6 months	Inspect, replace if necessary
D	Steering system	50 hrs	6 months	Check operation and for looseness, worn, damage, binding feeling / Adjust, repair, Replace if necessary. Check toe alignment /Adjust if necessary.
D	Toe adjustment	As required	As required	Periodic inspection, adjust when parts are replaced
D	Front Axle (CV Joints)	10 hrs	Monthly	Check for/ Axle boots/ looseness/ damage.
D	Rear Axle (CV Joints)	10 hrs	Monthly	Check for/ Axle boots/ looseness/ damage.
•	Front Prop Shaft & Shaft Yoke	50 hrs	6 months	Check for looseness/ damage.
•	RearPropShaft,Shaft Yoke & Boots	50 hrs	6 months	Check for/ boots/ looseness/ damage.
•	Front Suspension	50 hrs	6 months	Inspect-lubricate, tighten fasteners
•	Rear Suspension	50 hrs	6 months	Inspect, tighten fasteners
	Spark Plug	100 hrs	12 months	Inspect-replace if necessary
D	Ignition Timing	100 hrs	12 months	Inspect and adjust as needed
D	Fuel System	50 hrs	6 months	Check for leaks at tank cap, lines, fuel valve, filter, and carburetor. Replace lines every one year
D	Fuel Filter	100 hrs	12 months	Replace annually
	Radiator	100 hrs	12 months	Inspect/clean external surface

Item	Hours	When	Remarks
Cooling System	50 hrs	6 months	Inspect/replace if
hoses			necessary
Spark arrestor	10 hrs	monthly	Clean out-replace if
			necessary
Clutches (drive and	25 hrs	3 months	Inspect, clean
driven)			
Engine mounts	25 hrs	3 months	Inspect
Valve clearance	100 hrs	12	Inspect/adjust
		months	
Brake fluid	200 hrs	24	Change every two years
		months	
Idle Speed	As	As	Adjust
	required	required	
Headlight Aim	As	As	Adjust if necessary
	required	required	

#### LUBRICATION RECOMMENDATIONS

	ltem	Lube Rec	Method	Frequency
	1. Engine	SAE10W-5	Add to proper	Check level daily
•	Oil	0/SN	level on dipstick	
	2.Brake Fluid	DOT 3	Maintain level	As require;
		Only	Between fill lines. See	change
			"16. MAINTENANC/	every two years
			Brakes"	or 200 hours
	3.Rear Gear case oil	SAE	See "16.MAI-	Change annually
		GL-4	NTENANCE/ Rear	or
		85W/90	Gear Case Lubrication"	at 100 hours
	4.Front Gear case	SAE	See "16.MAI-	Change annually
	oil (only for 4WD	GL-4	NTENANCE/ Front	or
	Model)	85W/90	Gear Case Lubrication"	at 100 hours







	ltem	Lube Rec	Method	Frequency
•	5.Steering system	Grease	Lubricate the pivoting and sliding parts	Every 3 months or 50 hours
•	6.Tie rods	Grease	Grease	Semi-annually
•	7.Shift Linkages	Grease	Locate fittings and Grease	Semi-annually
•	8.Front Wheel bearings	Inspect	Inspect and replace bearings if necessary	Semi-annually
•	9.Ball joints	Grease	Inspect, Locate fittings and Grease, or replace it if necessary	Semi-annually
•	10.Prop Shaft & Shaft Yoke, Spline Joint	Grease	Locate fitting and Grease	Semi-annually
•	11. Front/Rear A-arm pivot Shaft	Grease	Locate fitting on pivot shaft and grease with grease gun	Every 3 months or 50 hours
•	12.Throttle Cable	Grease M	Grease, inspect and replace it if necessary	Monthly or 20 hours
•	13. Accelerator pedal and brake pedal	Grease	Grease, inspect	Monthly or 20 hours
•	14.Rear Wheel Bearing	Inspect	Inspect and replace bearings if necessary	Semi-annually

### NOTE:

- 1. More often under severe use, such as wet or dusty conditions.
- 2.Grease: Light weight lithium-soap grease.

3. Grease M: Molybdenum disulfide (MoS<sub>2</sub>) grease (water resistant).

4. When suspension action becomes stiff or after washing.

5. Hours are based on 10 mph(16Km/h) average.

#### 2.2 THROTTLE PEDAL INSPECTION THROTTLE FREEPLAY

If the throttle pedal has excessive play due to cable stretch or cable misadjustment, it will cause a delay in throttle speed. Also, the throttle may not open fully. If the throttle pedal has no play, the throttle may be hard to control, and the idle speed may be erratic. Check the throttle pedal play periodically in accordance with the Periodic Maintenance Chart and adjust the play if necessary.

#### THROTTLE FREEPLAY INSPECTION

- 1. Apply the parking brake.
- 2. Put the gear shift lever in the N(Neutral) position.
- 3. Start the engine, and warm it up thoroughly.
- 4. Measure the distance the throttle pedal moves before the engine begins to pick up speed. Free play should be 1.5 3 mm.

#### Adjustment

- 1. Slide the boot off inline cable adjuster sleeve. Loosen adjuster locknut.
- 2. Turn adjuster until 1.5 to 3 mm, freeplay is achieved pedal. NOTE: While adjusting freeplay, it is important you flip the throttle lever back and forth.
- 3. Tighten locknut.





## 2.3 CHOKE ADJUSTMETN

If the choke knob does not stay out when pulled, adjust the choke tension by tightening (clockwise) the chock cable boot until the choke slider freely but stays out when pulled.

If smooth choke operation is not obtainable, inspect choke cable for kinks or sharp bends in routing



## 2.4 FUEL SYSTEM

#### EFI

## 

- Always stop the engine and refuel outdoors or in a well venltilated area.
- Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.
- Do not overfill the tank. Do not fill the tank neck.



- $\Lambda$  If you get fuel in your eyes or if you swallow gasoline, see your doctor immediately.
- If you spill fuel on your skin or clothing, immediately wash it off with soap and water and change clothing.
- Never start the engine or let it run in an enclosed area. Fuel powered engine exhaust fumes are poisonous and can cause loss of consciousness and death in a short time.
- /! Never drain the float bowl when the engine is hot. Severe burns may result.

#### **FUEL LINES**

- Check fuel lines for signsof wear, deterioration, damage or leakage. Replace if necessary.
- 2. Be sure fuel lines are routed properly and secured with cable ties.

#### CAUTION:

Make sure lines are not kinked orpinched.

Replace all fuel lines every two years.

#### VENT LINES AND ROLL OVER VALVE

- 1. Check fuel tank, oil tank, battery and transmission vent lines for signs of wear, deterioration, damage of leakage. Replace every two years.
- 2. Be sure vent lines are routed properly and secured with cable ties.



**CAUTION:** Make sure lines are not kinked or pinched.

**NOTE:** Make sure the † mark on the roll over valve is upwards.

## 2.5 TOE ALIGNMENT

METHOD: STRAIGHTEDGE OR STRING Be sure the steering wheel in a straight ahead position. **NOTE:** String should just touch side surface of rear tire on each side of the UTV. Measure from string to rim at front and rear of rim. Rear rim measurement (A) should be 1/8" to 1/4" (3 to 6



## 

Always pay attention to tie rods assembly, Both ends <sup>–</sup> must screw in same and enough threads length.

mm) more than front rim measurement (B).

## **2.6 BRAKING SYSTEM INSPECTION**

The following checks are recommended to keep the braking system in good operating condition. Service life of braking system components depends on operating conditions. Inspect brakes in accordance with the maintenance schedule and before each ride

•Keep fluid level in the master cylinder reservoir to the indicated level on reservoir.

•Use DOT 3 brake fluid.

**NOTE:** Use new brake fluid or brake fluid from a sealed container to avoid contamination to system.



Parallel

Parallel

- •Check brake system for fluid leaks.
- •Check brake for excessive travel or spongy feel.
- •Check friction pads for wear, damage and looseness.
- •Check surface condition of the disc.

#### **BRAKE PAD INSPECTION**

Pads should be changed when friction material is worn to 3/64" (1mm).

#### **HOSE/FITTING INSPECTION**

Check braking system hoses and fittings for cracks, deterioration, abrasion, and leaks. Tighten any loose fittings and replace any worn or damaged parts.

#### ADJUSTING THE BRAKE PEDAL

Check the brake pedal free play. Free play should be

- 8 12mm. Out of specification  $\rightarrow$  Adjust.
- 1. Loosen the locknut
- Turn brake rod in or out until the correct free play is obtained. Turning in: Free play is increased.

Turning out: Free play is decreased.

3. Tighten the locknut

#### ADJUSTING THE PARKING BRAKE

Although the parking brake has been adjusted at the factory, the brake should be checked for proper operation. The mechanical brake must be maintained to be full functional.

- 1. With the engine off, apply the parking brake lever and attempt to move the UTV.
- 2. If the rear wheels are locked, it is adjusted properly.
- 3. If the wheels are not locked, it must be adjusted.

# To adjust (set up) the mechanical parking brake, use the following procedure

**Note:** The adjusting on the caliper is for the wear out of the pads.

- 1. With the engine off, loosen the adjustor on the lever.
- 2. Loosen the jam nut of the adjuster on the caliper.
- 3. Turn the adjuster bolt CW (clockwise) by hand till





the pad touch the brake disc, turn the adjuster bolt CCW (counterclockwise) by 1/4 to one turn for 10 to 20mm free play at the end of the parking lever.

- 4. Tighten the jam nuts securely against the adjusters.
- 5. Make sure the rear wheels turns freely without dragging.
- 6. Turn the adjustor (the one on the lever) and apply the lever. While adjusting, it is important you apply the lever back and forth for operation, free play and the locking of the parking position.
- 7. Make sure the rear wheels turns freely without dragging and parking brake works properly.
- 8. Field test for parking. It must be capable of holding the laden UTV stationary on an 20% up and down gradient.

A temporary adjusting can also be done to the brake cable on the parking lever side by turn the adjuster (nut) directly. But the adjust range is limited. Always do the **procedure 1 to 8** when necessary.

## 2.7 SUSPENSION SPRING RPELOAD ADJUSTMENT

Operator weight and vehicle loading affect suspension spring preload requirements. Adjust if necessary.

#### FRONT SUSPENSION

Compress and release front suspension. Damping should be smooth throughout the range of travel. Check all front suspension components for wear or damage.

Inspect shock for leakage

Shock spring preload can be adjusted using the shock spanner wrench.

#### **REAR SUSPENSION**

Compress and release rear suspension. Damping should be smooth throughout the range of travel. Check all rear suspension components for wear or damage.

Inspect shock for leakage





Shock spring preload can be adjusted using the shock spanner wrench.

## A WARNING

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

Turn the adjuster ① to increase or decrease the spring preload. Standard position: 3 Minimum (Soft) position: 1 Maximum (Hard) position: 5

#### 2.8 WHEELS

Inspect all wheels for runout of damage. Check wheel nuts and ensure they are tight. Do not over tighten the wheel nuts.

#### WHEEL REMOVAL

- 1. Stop the engine, place the transmission in gear and lock the parking brake.
- 2. Loosen the wheel nuts slightly.
- 3. Elevate the side of the vehicle by placing a suitable stand under the footrest frame.
- 4. Remove the wheel nuts and remove the wheel.

#### WHEEL INSTALLATION

- 1. With the transmission in gear and the parking Brake locked, place the wheel in the correct Position on the wheel hub. Be sure the valve stem is toward the outside and rotation arrows on the tire point toward rotation.
- 2. Attach the wheel nuts and finger tighten them. Install as shown at left for front or rear wheels.
- 3. Lower the vehicle to the ground.
- 4. Securely tighten the wheel nuts to the proper Torque listed in the table. On wheel nuts, Make sure tapered end of nut goes into taper on wheel.

#### Wheel Nut Torque Specifications



Front and rear

Bolt Size	Specification	
Front M10X1.25	55Lbs.Ft	75Nm
Rear M10X1.25	55Lbs.Ft	75Nm

**CAUTION:** If wheels are improperly installed it could affect Vehicle handling and tire wear.

#### 2.9 TIRE PRESSURE

# TIRE INSPECTION CAUTION:

- Maintain proper tire pressure. Refer to the warning tire pressure decal applied to the vehicle.
- Improper tire inflation may affect UTV maneuverability.
- When replacing a tire always use original equipment size and type and replace in pairs, especially in 4X4 model.
- The use of non- standard size or type tires may affect UTV handling and cause machine damage, especially in 4X4 model.

#### TIRE TREAD DEPTH

Always replace tires when tread depth is worn to 1/8" (3mm ) or less.

## 

Operating an UTV with worn tires will increase the possibility of the vehicle skidding easily with possible loss of control.

Worn tires can cause an accident.

Always replace tires when the tread depth measures 1/8" (3mm ) or less.

## 3.0 FRAME , NUTS, BOLTS, FASTENERS

Periodically inspect the tightness of all fasteners in accordance with the maintenance schedule. Check that all cotter pins are in place. Refer to specific fastener torques listed in each chapter.

Tire Pressure Inspection			
Front Rear			
see detail on the mark of sidewall	see detail on the mark of sidewall		



## **CHAPTER 3 ENGINE**

# **CHAPTER 3 ENGINE**

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## **3.1 Service information**

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Item	Conversion
Pressure	1kgf/cm²=98.0665kPa1kPa=1000Pa
	1mmHg=133.322Pa=0.133322kPa
Torque	1kgf • m=9.80665N • m
Volume	1mL=1cm <sup>3</sup> =1cc
	1L=1000cm <sup>3</sup>
Force	1kgf=9.80665N

## Unit conversion table

## DANGER/WARNING/CAUTION

Please read the following notification carefully which emphasize the special meaning of DANGER, WARNING and CAUTION. Always pay attention to these notifications when servicing the engine.

## DANGER: indicates a high risk which should be alert to. WARNING: indicates a moderate risk which should be alert to. CAUTION: indicates a minor risk which should be paid attention to.

However, DANGER, WARNING and CAUTION notification included in this service manual don't cover all the potential risk in the engine operation and repair. Therefore, mechanics should be equipped with knowledge of basic mechanical safety beside the notification of DANGER and WARNING. If you are not confident to complete the whole repair, please refer to the senior mechanic for support.

## 3.1.1 General precautions

 $\cdot When two or more persons working together, pay attention to the safety of each other.$ 

·When it is necessary to run the engine indoors, make sure that exhaust gas is forced out doors.

When working with toxic or flammable materials, make sure that the area you work in is well ventilated and that you follow all of the manufacturer's instruction. Never use gasoline as a cleaning solvent.

•To avoid getting burned, do not touch the engine, engine oil, radiator, and exhaust system until they have cooled.

•After servicing the fuel, oil, engine coolant, exhaust or brake system, check all of the lines, and fittings related to the system for leaks.

In order to protect the environment, do not unlawfully dispose of motor oil, engine coolant or parts no longer used.

# 3.1.2 FUEL, OIL AND ENGINE COOLANTRECOMMENDATION

**FUEL:** Use unleaded gasoline that is Graded 92 octane or higher. **ENGINE OIL:** Use 4-stroke motor oil, the oil need to meet API service Classification SG or higher. If engine oil with a SAE 15W-40 is not available, choose from the right chart according to the environmental temperature.



**ENGINE COOLANT:** Since antifreeze also has corrosion and rustinhibiting properties, engine coolant contains antifreeze, and the freezing point should below the atmospheric temperature like  $5^{\circ}$ C.

# Recommended coolant type: -35°C anti-frozen, antisepsis, high-boil coolant.

#### 3.1.3 Engine running-in

As the engine has a lot of relative motions parts, such as pistons, piston rings, cylinder blocks and inter-meshing gears, thus, good operation at the beginning is necessary. It helps a good adaptation to each part, adjust working gap, and make a smooth friction surface to bear heavy load. Recommended running-in time: 20 hours, see detailed specification below:

#### 0~10 hours

Avoid continuous operation above half-throttle or vary the speed of the vehicle from time to time. Do not operate it at one set throttle position. Allow a cooling-off period of 5 to 10 minutes after every hour of operation. Avoid acceleration heavily. The accelerator should be changed smoothly, avoid changing heavily from small to bigger

#### 10~20 hours

Avoid prolonged operation above three-quarter throttle. Allow using freely but not full throttle.

## 3.1.4 ENGINE SHAPE & LOCATION OFENGINE IDENTIFICATION NUMBER(EIN)



Engine Right side

## 3.1.5 ENGINE GENERAL INFORMATION

NO.		ITEM		TYPE/SPECIFICATION	
1	Туре			Single-cylinder, liquid-cooled, 4-stroke, SOHC	
2		Bore × St	roke	91mm×76.8mm	
3		Displacer	nent	499.5mL	
4	C	ompressic	on ratio	10.3:1	
5	Low	idling spe	ed(Idling)	1500r/min±100r/min	
6		Startin	g	Electric	
		igni	ition type/	ECU / BTDC10°1500r/min	
	Electric	igni	tion timing		
7	al	Sparkp	lug/Electrode	DCPR8EA-9NGK/0.8mm~0.9mm	
· ·	ai svetem		gap		
	System	Magneto	type/Power	Permanent Magnet AC Type	
	Combus	Combu	stion chamber	Triangular combustion chamber	
8	tion	Thrott	le body type	D46	
0	evetom				
	System	Ai r	filter type	Sponge, Paper filter	
		G	Sasoline	RQ-92	
9	Valves system	Va	lves type	SOHC/ Timing chain drive	
	Lubricatio	Lubrication type		Pressure and splash	
10	n Syctom	Oil p	oump type	Rotor drive	
	n System	Oil	filter type	Paper type, replaceable	
		Engi	ine oil type	SAE10W/50/SN	
11	Cooling	Co	oling type	Liquid-cooled/close-loop cooling	
	system	Coolant type		—35℃anti-corrosion and anti-freezing	
		Trans	mission type	CVT+ Gearshift	
		Rec	lucer gear	Two forward gear, one reverse gear, one	
				park	
		Gearsh	nift methods/	Manual operation/L-H-N-R-P	
10	Drive	(	orders		
12	train	CVT	ratio range	3.106~0.677	
	system	Gearshift	Final ratio	1.333(24/18,bevel gear)	
		Tallo	Secondary	1.952(41/21),	
			ratio		
			Variable	L:2.53(38/15);	
			gear	H: 1.35(27/20); R:2.07(29/14)	
			Total ratio	L:6.595; H: 3.514; R:5.392	
13		Overall s	size	$L(mm) \times W(mm) \times H(mm)$ : 621×515×506	
14		Dry weig	ght	62kg	
15		Output ty	ре	Front/Rear shaft drive	
16	Rotation of engine output		ne output	When forward, clockwise(rear view)	

Valves &Cylinder Head			(	( mm )
Item	Standard value		Service limit	Remarks
Dia. Of valve neck	Intake valve	Φ <b>33</b>		
	Exhaust valve	Φ <b>29</b>		
Thickness of valve neck	Intake/Exhaust	1	0.5	
Valve clearance(cold	Intake	$0.06{\sim}~0.~08$		
engine)	Exhaust	0.08~ 0.10		
Inner dia. Of valve guide	Intake/Exhaust	5.000~5.012	5.045	
Outer dia. of valve stem	Intake	4.96~ 4.975	4.93	
	Exhaust	4.95~ 4.965	4.93	
Gap between valve	Intake	0.020~0.047		
guide and stem	Exhaust	0.030~0.057		
Valve stem roundness (diameter difference)		0.006	0.06	
Valve end run-out	Intake/Exhaust	0.03	0.05	
Valve length	Intake	90		
	Exhaust	89		
valve plate cone run-out	Intake/Exhaust	0.03	0.05	
Width of valve seat seal	Intake	1.5±0.15	1.7	
	Exhaust	1.7±0.15	1.8	
Valve spring free length	Intake/Exhaust	40	38.2	
Elasticity of valve spring	Intake/Exhaust	33:200N~235N		
		$23:530N\!\sim\!587N$		
Cam length	Intake	32.971~33.011	32.871	
	Exhaust	32.985~33.025	32.865	
Camshaft shaft neck	Φ35	34.959~34.975	34.95	
	Φ <b>22</b>	21.959~21_980	21.95	
Gap between outer dia.	Φ35	34.993~35.025	35.04	
of camshaft and holes	Φ22	22.012~22.025	22.04	
Gap between outer dia.	Φ35	0.018~0.066	0.09	
of camshaft and holes	Φ22	0.032~0.066	0.09	
Axial clearance of	0.12~0.28			
Camshaft run-out			0.10	
Bore diameter of rocker	Intake/Exhaust	12.000~12.025	12.03	
Dia. of rockshaft	Intake/Exhaust	11.973~11.984	11.96	
Fit gap between	Intake/Exhaust	0.016~0.045	0.07	
Axial gap between	Intake/Exhaust	0.06~0.34		
Flatness of cylinder head bottom surface	0.03		0.05	
Flatness of cylinder head cover combination	0.08		0.10	

Cylinder, Piston, Piston Ring & Crankshaft					
Item	S	Stand	dards	Service limit	Remarks
Cylinder compression	1000kPa				
Piston/Cylinder clearance	0.0	)30~	~0.050	0.10	
Dia. of Piston	90.95m down al	nm $\sim$ ong	90.979 mm to the piston	90.85	
Inner diameter of cylinder	90	$\sim$ 91	.015		
Flatness of cylinder top and bottom surface		0.0	03	0.05	
Free ener of nisten ring	1 <sup>st</sup> ring	R	round 11.7	8.9	
Free open of piston ring	2 <sup>nd</sup> ring	R	round12	9.5	
	1 <sup>st</sup> ring		0.25~0.40	0.15	
Gap of piston ring	2 <sup>nd</sup> ring	)	0.30~0.45	0.15	
	Oil ring	g	0.2~0.7	0.15	
	1 <sup>st</sup> ring		0.02~0.06		
Height of piston ring	2 <sup>nd</sup> ring		0.02~0.06		
	Oil ring		0.03~0.15		
	1 <sup>st</sup> ring		1.17 ~ 1.19		
Height of piston ring	2 <sup>nd</sup> ring		1.47~1.49		
	Oil ring		2.37~2.47		
	1 <sup>st</sup> ring		1.21 ~ 1.23		
Width of piston ring	2 <sup>nd</sup> ring	)	1.51~1.53		
	Oil ring		2.50~2.52		
Inner diameter of piston pin hole	22.0	004~	~22.010		
Diameter of piston pin	21.9	991~	~22.000	21.980	
Inner diameter of small end of connecting rod	22	.01~	~22.02	22.06	
Gap of piston/piston pin	0.0	004~	~0.015	0.08	
Small end hole of connecting rod / gap of piston pin	0.004~0.015		~0.025	0.08	
Side gap of big end of connecting rod	0.1~0.45		0.7		
Thickness of big end of connecting rod	22.95~23.00				

Item	Standards	Service limit	Remarks
Thickness of big end of connecting rod	22.95~23.00		
Crankshaft beat	0~0.025	0.055	
Connecting rod bearing journal	36.992~36.996	36.068	
Connecting rod bearing bore	37.006~37.028	37.06	
Gap of connecting rod bearing	0.01~0.032	0.065	
Main journal	41.955~41.970	41.935	
Case main bearing bore	41.980~42.000	42.10	
Gap of main bearing	0.045~0.01	0.08	
Gap of crankshaft axial direction	0.05~0.45	0.6	

## **3.1.6 MAINTENANCESPECIFICATIONS**

Lubrication System

Item		Standards	Service
			Limit
Engine ()	Oil Change	2600mL (without oil filter replacement)	_
Capacity	, Oil Change	2700mL(with oil filter replacement)	
	Oil Capacity	3000mL	—
Recommended engine oil (see original) Grade/TEMP		Special for four stroke motorcycle SAE-15W/40 if it's not available, select alternative according to the	
MULTIGRADE		following specifications. ·API classifications: SG or higher ·SA E classifications: according to the left chart.	
	Clearance Between Inner and Outer Rotor	0.1mm $\sim~$ 0.15mm	0.2mm
Oil	Clearance Between Outer Rotor and Case	0.08mm $\sim$ 0.15mm	0.2mm
Pump	Oil Pump Rotor End Clearance	0.1mm~0.15 mm	0.2mm
Rotor	Engine oil pressure	1500r/min, 90 °C, 200 kPa $\sim$ 400kPa, general 240 kPa 6000r/min, 90 °C, 600 kPa $\sim$ 700kPa, general 600 kPa	

## **COOLING SYSTEM**

I	tem	Star	Service Limit	
	Opening temperature	<b>65℃±2℃</b>		
Thermostat	Fully opening	8	<b>5</b> ℃	
	Travel when fully opening	When 85	5℃,≥5mm	
Radiator pre	cap opening	110 kPa±15k	Pa(1.1kgf/cm <sup>2</sup> )	
	Water	Resistant of	Resistant of	
Relations	temperature	В	A,C	
between	(°C)	terminal( $\Omega$ )	Terminal(k $\Omega$ )	
water temp	-20		13.71~16.94	
and resistan	t 25		1.825~2.155	
of water	50	176~280		
temp. senso	r 80	63.4~81.4	0.303~0.326	
	110	24.6~30.6	0.138~0.145	
Working	OFF-ON	Arour	nd 89℃	
temp. of				
thermo	ON-OFF	Around 82°C		
switch				
		-35℃anti-freez		
Coolant type		-corrosive and		
		point		

#### Clutch +Transmission mechanism

(mm)

Item		Standards	Service limit	Remarks
Belt width		35.2	33.5	
Free length of driven pulley spring		238.5	214	
Hole dia. of driven pulley collar	3	8.10~38.14	38.30	
Clearance between gearshift fork and engagement groove		0.10~0.35	0.45	
Thickness of gearshift fork		5.8~5.9	5.7	
Groove width of high/low sliding	6.05~6.15		6.25	
Output gear groove width of driven shaft		6.05~6.15	6.25	
Groove width of gearshift drum	8.05~8.10			
Dia. of gearshift pawl pin		7.90~7.95	7.83	
Hole dia. of gear box		25~25.021	25.025	
Hole dia. of Reverse gear transition		25~25.021	25.025	
Dia of main shaft	Φ <b>30</b>	28.980~29.993	29. 970	
	Φ17	16.983~16.994	16.978	
	Φ15	14.983~14.994	14.978	
Dia. of secondary shaft	Φ <b>17</b>	16.983~16.994	16.978	
	Φ <b>20</b>	19.980~19.993	19.974	
Dia. of drive bevel gear	Φ17	16.983~16.994	16.978	
shaft	Φ <b>25</b>	24.980~24.993	24.974	
Dia. of reverse intermediate gear	Φ <b>20</b>	19.980~19.993		

#### Air Intake System

Item	Standards	
Throttle Body Part NO.	1BK-13520-00	
Fuel Injector Part NO.	1BK-13510-00	
Idle Speed	1500 r/min±100r/min	

## Electric system

Item		Standards	Remarks
	Туре	DPR8EA-9 (NGK)	
Sparkplug	Gap of sparkplug	0.8mm $\sim$ 0.9mm	
Chara	cteristic	>8mm,under0.1MPa	
Desistance of	Primary	0.74Ω~0.78Ω	
ignition coil	Secondly	10.1Ω~11.1kΩ	
Resistance of	magneto coil	0.5Ω~1.5Ω	
Resistance of speed sensor (trigger)		900Ω~1000Ω	
Voltage without load (cold		>	
engine)		50V(AC), 5000r/min	
Max. output power of magneto		320W, 5000r/min 460W/5000r/min	
Stable	voltage	13.5V~15V	
Secondly voltage of ignition coil		≥25kV	
Peak voltage of Trigger coil		Peakvoltage≥3V, 200r/min	
Resistance of starter relay coil		<b>3</b> Ω ~5Ω	
Resistance of co	auxiliary relay pil	$90\Omega{\sim}100\Omega$	

## 3.1.7 Engine tightening Torque list

Item	Qty	Dia. Of thread(mm)	Torque (N·m)	Remarks
Oil drain boltM12×1.5	1	M12×1.5	28~32	
OIL PASSAGE BOLT M14×1.5(left case)	2	M14×1.5	32~36	
Plug screw, oil passage pressing plate (left case)	4	M6×12	8~12	Thread locker glue
Primary screen cover bolt	3	M6×20	8~12	Thread locker glue
Oil pressure switch	1	M10×1	12~15	Thread locker glue
ScrewR21/8(CVT oil passage)	1	R21/8	18~22	Apply seal gum
Bolt, CVT air intake plate	4	M6×12	8~12	Thread locker glue
CVT cover screw Plug screw(left crankcase cover)	8	M6	6~8	
Relief valve(left crankcase cover)	1	M20×1.5	28~32	
Bolt of wiring clamper (left crankcase cover)	1	M6×10	8~12	Thread locker glue
Screw of oil seal plate(left crankcase cover)	3	M6×8	8~12	
Adjust nut, valve clearance	8	M6	8~12	
Bolt, timing sprocket	2	M6×10	8~12	
Bolt, decompressor, starter	1	M8×32	28~32	
Bolt, cylinder	4	M10	40~45	
Bolt, cylinder installation	2	M6×132	8~12	
Plug, spark	1	M12×1.25	18~20	
Sensor, water TEMP	1	M12×1.5	16~20	
StudboltM8×42 (exhaust port)	2	M8×42	20~25	Thread locker glue
Nut, thrustM8 (exhaustport)	2	M8	13	
Item	Qty	Dia. Of thread(mm)	Torque (N·m)	Remarks
--	-----	-----------------------	-----------------	-----------------------
Plug,ScrewM12×1.5	1	M12×1.5	28~32	
BoltM6×45(thermostat cap)	2	M6×45	6~10	
Injector seat installation bolt	2	M8×25	20~25	
Bolt COMP. Cylinder head cover	4	M6	6~8	
Thread tension plate pin	1	M8	22~28	Thread locker glue
Bolt, magneto stator	3	M6×30	8~12	Thread locker glue
Bolt, overriding clutch COMP	6	M8×20	28~32	Thread locker glue
Bolt, drive pulley(CVT drive pulley)	1	M12×1.5- LH	55~60	
Screw, CVT driven pulley	1	M20×1.5	110~120	Thread locker glue
Lock nut, drive bevel gear	1	M22×1	140~150	
Bolt(bearing seat, drive bevel gear)	4	M8×28	38~42	
Screw (bearing holder, drive bevel gear)	4	M8×25	15~20	
Stopper nut (driven bevel gear)	1	M65×1.5	100~120	Thread locker glue
Bolt(bearing seat, driven bevel gear)	4	M8×28	38~42	
Nut, Driven Bevel Gear	1	M16×1.5	140~160	
Nut, Front output shaft	1	M14×1.5	95~100	
Bolt, gear orientation	1	M14×1.5	38~42	Thread locker glue
Bolt, oil pump cover	3	M5×16	6~8	Thread locker glue
Bolt, oil guard	2	M6×12	8~12	Thread locker glue
Magnetor Rotor nut	1	M16×1.5	160~170	Thread locker glue

## 3.1.8 Engine Service Tools

#### **Measurement Tools**

Meas	urement Tools		
No.	Description	Specification	Purpose
1	Vernier Caliper	0-150mm	For measuring the length and thickness
2	Micrometer	0-25mm	For measuring outer diameters of rocker arm, valve stem
			and camshaft
3	Micrometer	25-50mm	For measuring the max. lift of camshaft
4	Micrometer	75-100mm	For measuring piston skirt
5	Cylinder Gauge		For measuring cylinder bore diameter
6	Small Bore Gauge	10-34mm	For measuring inner gauge of rocker arm, piston pin bore,
			connecting rod small end bore
7	Dial Indicator	1/100	For measuring the play
8	Straightedge Gauge		Plane measuring
9	Feeler Gauge		Plane and valve clearance measuring
10	Fuel Level Gauge		For measuring the carburetor fuel level
11	Thickness Gauge		For measuring the clearance
12	Spring Balance		For measuring the spring tension
13	Tachometer		For measuring engine speed
14	Oil Pressure Gauge		For measuring oil pressure
15	Compression Gauge &		For measuring cylinder compression
	Adapter		
16	Radiator Cap Tester		For measuring radiator cap opening pressure
17	Ohmmeter		For measuring resistance and voltage
18	Ammeter		For measuring current/switches
19	Thermometer		For measuring liquid temperature
20	Timing Light		For checking the ignition timing
21	Torque Wrench		For measuring the tightening torque
Gene	ral-purpose and Auxiliary To	ols	
22	Alcohol Burner		Heating up
23	Magnetic Stand		For micrometer
24	Slab		Auxiliary tool for measuring
25	V-block		For measuring the play
26	Tweezer		For installation of valve cotter
27	Circlip Pliers		For removal and installation of circlips
28	Long Nose Pliers		For removal and installation of retainers
29	Impact Driver		For removal of cross-headed bolts

#### Special Tools

No.	Description	Specifications	Purpose
1	Rotor assy puller	1BE-85610-00	Remove magneto rotor
2	Bearing retainer, nut wrench	LH188MR FZ/24	Removal of Front output shaft Bearing retainer
3	Bearing limit nut, nut wrench	LH188MR FZ/25	For removing Bearing limit nut
4	Drive pulley puller	1BX-17653-00	Removal of drive pulley
5	Driven pulley expander	1BX-17654-00	Removal/installation of drive belt
6	Driven pulley spring compressor	1BA-17730-00 FZ/1	Disassemble driven pulley
7	The tool for one way clutch of drive pulley	1BA-17628-00 FZ/1	Assemble one way clutch of drive pulley

#### Materials for Operation and Fixing

Materials for engine operation engine oil, grease and coolant. Fixing materials include sealant, thread locker, etc.

Description	Туре	Application Area	Remark
Lubricating Oil/Engine Oil	4-stroke motor oil SAE15W-40 Or SAE10W-40 API : SG or higher	Cylinder rotating parts, sliding parts Inner crankcase rotating parts, sliding parts Cylinder head rotating parts, sliding parts Refer to Engine Lubrication System (→5-99)	capacity 2600ml (for changing oil) 2700ml (for replacing filter) 3000ml (for engine repairing)
Molybdenum lubrication oil		piston pin、 valve stem、 valve oil seal、 camshaft	
Grease	#3 MoS2 Lithium Base Grease	Oil seal, O-ring and other rubber seals. Sealed bearing	
Coolant	-35℃ antifreeze, corrosion-resistant, high boiling point coolant	Cooling system、Water- seal	Capacity according to radiator and water hose
Joint Face Sealant		Crankcase splitting surfaces, contact surface between crankcase and cylinder,	
Thread Locker		Thread Parts	See 3.1.7

## **3.2 INSPECTION ANDADJUSTMENT**

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## 3.2.1 Period maintenance table

Engine maintenance is a periodic job, careful periodic maintenance is very important, will assure your vehicle having a good performance, reliability, economy and durability. Details are explained in below 191MR engine periodic maintenance chart.

ATTENTION : Maintenance intervals in the following chart are based upon average riding conditions. Vehicles subjected to severe use must be inspected and serviced more frequently

A: Adjus	st	10 hours or 300km						
C:Clean		20 hours or 750km						
I:Inspect					Every 50 hours or 1500km			
L:Lubrica	te				Eve	ry 10	0 hours or 3000km or 1 year	
к:керіас	ê					Eve	ry 200 hours or 6000km or	
						2yea	ars	
							Remark	
	Facilitating							
	Conditions &	Ι		Ι	I			
Engine	abnormal sound							
	Exhaust condition		1				No black smoke or blue	
			'	'	'		smoke	
	Valve setting		I,		Ι,		In: 0.06mm $\sim$ 0.08mm	
	Valve Setting		А		А		Out: 0.08mm~0.10mm	
	Idle speed	Ι		I			1500 r/min±100r/min	
							No carbon deposition,	
	Spark Plug		Ι		I	R	electrode gap:	
							0.8mm~0.9mm	
	Air Filter		С	R				
CVT	CVT Belt				R		Replace every 2000km	
system	Primary Pulley,				Ι,			
	Driven pulley				С			
En	gine oil, filter		R		R			
Т	hrottle Body	Ι			I, L			
	Water volume	Ι		Ι				
Coolina	Water pipe	Ι			Ι			
System	Radiator valve	I		I			$0.75 \text{ kg/cm} \sim 1.05 \text{kg/cm}$	
2	opening pressure			I				
Replace coolant			Replace every 2 years					

1

#### 3.2.2 Procedure of Maintenance &

#### Adjustment

This section describes the maintenance procedures for each item mentioned in the periodic maintenance chart.

3.2.3 Valve clearance

Excessive valve clearance results in valve noise and insufficient valve clearance results in valve damage and reduced power.

Check the valve clearance at the period indicated above and adjust the valve clearance to specification, if necessary.

• Remove CVT case cover (1);

• Remove RPM sensor(2) of left crankcase cover:

• Remove cylinder head cover (3);

• Turn the crankshaft until the line(4) of T.

D.C. on rotor is aligned with mark (5) of inspection hole on left crankcase..

• Insert feeler gauge to check the clearance between the valve stem end and the adjust bolt on the rocker arm.



• If the clearance is incorrect, bring it into the specified range using the special tool.

Loosen valve adjust bolt and nut, insert a feeler gauge between the valve stem end and valve adjusting bolt (0.06mm thickness for intake valve, 0.08mm thickness for exhaust valve), tighten valve adjust bolt, make sure it slightly contacts the feeler gauge, tighten bolt and nut.

Locknut: 12N·m Tools: Valve adjuster

Feeler gauge Material: Thread Locker

#### Caution:

## Securely tighten the locknut after completing adjustment 3.2.4 ENGINE IDLESPEED

• Install cylinder head, speed sensor Start the engine and warm it up for several minutes, measure engine speed with a tachometer.

Engine idle speed: 1500r/min  $\pm$  100r/ min

Tool: Tachometer

## 3.2.5 SPARKPLUG

•Remove the spark plug (1) with a special tool;

#### Specification: DPR8EA-9(NGK)

• Spark plug inspection : If the electrode is extremely worn or burnt, or spark plug has a broken insulator, damaged thread, etc, replace the spark



plug with a new one

In case of carbon deposit, clean with a proper tool.

SPARK PLUG GAP: Measure the spark plug gap with a feeler gauge. Out of specification: Adjust Spark plug gap: 0.8mm $\sim 0.9$ mm



Spark plug installation

Tightening Torque: 18~20N.m Tool: Spark Plug Wrench Feeler Gauge **3.2.6 AIRFILTER** 

If the air cleaner is clogged with dust, intake resistance will be increased, with a resultant decrease in power output and an increase in fuel consumption. Check and clean the air filter as following:

Remove 2 nuts ① and 2 bolts ② fixing

clamp .

#### Note:

Be careful not to drop the o-ring into the air filter box that is attached to the air filter top cover.

Loosen ② clamps ③ , remove top cover ④



and separate filter element (5).

Use high-pressure air to clean the filter element and replace it if necessary.

#### Warning:

Never use with gasoline or low flash point solvents to clean the filter element.

Inspect the filter element for tears. Torn element must be replaced.

• Inspect the filter element for tears, torn element must be replaced.

**Note:**Makesurethattheairfilterelement is in good condition at all times. The surest waytoaccelerateenginewearistooperate the engine without the element or with torn element. If driving under dustyconditions, clean the air filter element more frequently





## 3.2.7 Drive belt, CVT

Removal

#### • Remove CVT cover.

●Loosen primary bolt(1) and gasket(2), take drive disk.

• Loosen / driven pulley nut (3).

• Remove / driven pulley together with drive belt.

• Remove drive belt (4) from / driven wheel.



CHAPTER 3 ENGINE

#### Inspection

• Inspect CVT friction disk for wear and damage. If any cracks or damages are found, replace CVT with a new one.

 Inspect drive belt for wear and damage.
 If any cracks or damages are found, replace drive belt with a new one.

●Inspect drive belt for width, if width is out Of service limit, replace drive belt with a new one.

Service Limit: 33.5mm Tool: Vernier Caliper

#### Installation

Reverse the removal procedure for installation. Pay attention to the following:

• Insert drive belt with a special tool , as low as possible, between secondary sliding sheave and primary fixed sheave:

• Hold / driven wheel with a special tool and tighten the nut to the specified torque.

Nut, / driven pulley: 110~120N. m

• Install driving pulley and bolt. Hold the driving pulley with a special tool and tighten the bolt to the specified torque.

Bolt, drive pulley: 55~60N. m



• Screw off Driven pulley Expander, turn driving pulley, until the drive belt is properly



1

MAX

seated.

Install CVT cover

# 3.2.8 Inspection of Lubrication System

Check Engine Oil Level

Keep the engine in a plan position

Remove oil dip rod(1)

● Clean oil dip rod, insert oil dip rod but do not tighten it.

• Take out oil dip rod and check if oil is between upper and lower limit.

• If the engine oil is insufficient, fill more oil until the sufficient oil is obtained.

Engine oil: SAE15W/40 SG or higher



1

oil dip

rod

DrainBolt: 28~32N. m● Fill engine oil (about2700mL)

• Install oil dip rod, start the engine and allow it to run for several minutes at idling speed.

Turn off the engine and wait for about3minutes,and then check the oil level on the dipstick.

#### Caution :

The engine oil should be changed whentheengineiswarm.lftheoilfilter should be replaced,replace engineoil at the same time.

**Replacing Oil Filter** 

 Remove relative parts (see Replacing Engine Oil)

• Remove oil filter cover bolt (1) and filter cover(2)

Remove O ring (3), then oil filter(4)





Oil Filter Element Inspection Check and clean the engine oil filter

2

inlet 1 and outlet area 2 for dirt and other contaminations.

Oil Filter Element Installation Install a **NEW** o-ring on oil filter cover, Apply engine oil on o-ring and the end of filter;

Install the element into oil filter bore; Install the element into oil filter bore, bolt. Torque screws to:8~12N. m

#### 3.2.9 Inspection of Cooling System

Check initially at 50 hours or 1500km, replace coolant every 2 years Check radiator, reservoir tank and water hoses.

Leakage or Damage——Replace Inspection of engine coolant

Check coolant level by observing the upper and the lower limit on the reservoir tank. If the level is below lower limit, fill coolant until the level reaches the upper limit.

**Replacing Coolant** 

• Remove radiator cap (1)and reservoir tank cap (2)

 Place a pan below water pump, and drain cool- ant by removing drain plug (3) and water hose (4)

• Drain coolant from reservoir tank.



1







Clean radiator with fresh water, if necessary.

• Connect water hose (4), and tighten clamp (3) securely

• Fill the fresh specified coolant into the radiator

• Loosen bleed bolt (5), on water pump, when coolant flow from bleed bolt, tighten the bolt. Install radiator cap (1) securely after filling coolant.

• Start the engine and keep it running for several minutes. After warm up and cooling down the engine, open radiator cap and check coolant. Fill the specified coolant until the level is between the upper and lower lines on the reservoir tank.

#### Caution :

Repeat the above procedures several times and make sure the radiator is filled with coolant and air isdischarged.

Fill coolant into the reservoir tank till between upper and lower limit. Install reservoir tank cap.

Norning · Nover mix with otherbrand

Inspection of Radiator Hose

Check radiator hose and clamp, leakage or damage----- Replace.

## 3.2.10 Inspection of cylinder

#### pressure

Cylinder pressure can reflect the inner cylinder working status. Check cylinder pressure is necessary.

Cylinder pressure: 1000kPa

A lower cylinder pressure may be caused by:

1

2

- Excessive wear of cylinder
- •Wear of piston or piston ring
  - Piston ring jam in groove
  - Poor closure of valve seat
  - Damaged cylinder gasket or other defects

**Testing Cylinder Pressure** 

#### Note:

Before testing of cylinder pressure, make surethatcylinderheadboltsaretightened tothespecifiedtorqueandvalveclearance has been properlyadjusted.

- •Warm up the engine before testing
- Make sure battery is fully charged
- Remove spark plug 1

Installcylinderpressuregauge2inspark plug hole

Keep throttle full open

• Press start button crank the engine a few seconds. Record the maximum reading of cylinder pressure.

Tools: Cylinder Pressure Gauge

## 3.3 Engine Removal, Inspection & Installation

3.3.1 Removal/Installation Orders and the Page Numbers table	3-29
3.3.2 Engine Removal	3-31
3.3.3 Engine Inspection	3-41
3.3.4 Engine Installation	3-78

## 3.3 Engine Removal, Inspection & Installation

## 3.3.1 Engine Removal/Installation Orders and the Relative Page Numbers

Item	Description	Disassemb ly	Inspection/M aintenance	Assem bly	Remark s
	Spark Plug	3-31	3-20	3-88	
	Cylinder Head Cover	3-31	3-41	3-88	
	Timing Chain Tensioner	3-31	3-41	3-87	
Engine	Start decompression COMP	3-31	3-41	3-87	
Front Sid	de Timing driven sprocket	3-32	3-41	3-87	
	Camshaft	3-32	3-42	3-86	
	Cylinder Head	3-32	/	3-86	
	Rocker arm	3-32	3-43	3-86	
	Rocker arm shaft	/	3-43	3-86	
	Valve Spring	3-44	3-45	3-51	
	Valve	3-45	3-46	3-50	
	Valve Guide	3-47	3-47		
	Guide chain plate	3-32	3-52	3-84	
	Cylinder	3-32	3-52	3-84	
	Piston	3-33	3-53	3-84	
Ļ	CVT Cover	3-33	3-55	3-88	
Engine Right Sid	Primary Sheave/Secondary de Sheave/Drive Belt	3-33	3-56	3-83	
	CVT case	3-34	3-62	3-83	
	Chain holder, Tension plate	3-34	3-62	3-83	
	Timing Chain	3-34	3-62	3-83	
	Starting Motor	3-34	/	3-83	
	Sector Gear	3-35	3-62	3-80	
	Water Pump	3-35	3-63	3-82	
<b>♦</b> Engine	Сар	3-36	/	3-82	
Left Side	Oil filter	3-36	3-63	3-82	
	Left Crankcase Cover/ Magneto Stator	3-36	3-63	3-81	
	Magneto Rotor	3-36	3-63	3-81	
	Starting Driven Gear	3-37	3-64	3-80	
	Starting Dual Gear	3-37	3-65	3-80	
	Oil pump drive gear/Oil pump dual gear	3-37	3-65	3-80	

## To be continue

ltem	Description	Disassemb ly	Inspection/M aintenance	Assem bly	Remark s
	Gear Position Bolt	3-37	/	3-80	
	Right Crankcase /Crankcase inspection	3-38	3-66	3-79	
Ļ	Front Output Shaft Components/ Driven Bevel Gear Components	3-38	3-70	3-79	
Engine Center	Bevel Gear Components	3-39	3-71	3-79	
	Transmission Main Shaft	3-39	3-72	3-78	
	Shift Drum / Shift Fork COMP	3-39	3-73	3-78	
	Drive countershaft	3-39	3-73	3-78	
	Crankshaft	3-40	3-76	3-79	
	Balance Shaft	3-40	3-77	3-79	
	Oil Pump	3-40	3-77	3-80	
	Filter Net	3-40	/	3-80	
	Left Crankcase	/	3-66	/	

Notes: Arrowhead direction is for engine removal orders. Reverse the direction for assembly and installation.

## 3.3.2Engine Removal

Preparation before engine removal
Prepare a proper tray used for load of components

Prepare necessary removal and assembly tools
Drain up engine oil
Drain up coolant

Engine Front SideSpark Plug● Remove spark plug with special wrench

#### **Cylinder Head Cover**

• Remove 4 bolts of cylinder head cover. Remove cylinder head cover (1)



#### **Timing Chain Tensioner**

• Remove screw plug ①, insert a flat screwdriver into slot of timing chain tensioner adjuster, turn it clockwise tolock tensioner spring;

• Remove tensioner fix bolt

Remove tensioner and gasket



**CHAPTER 3 ENGINE** 

## Start decompression COMP

• Remove bolt (1), Remove Start decompression COMP(2)

## Timing driven sprocket

- Loosen two bolts (1)of timing driven sprocket
- Remove timing driven sprocket

## Camshaft, rocker arm

- Loosen bolt(1)
- Remove camshaft holder

Nate: T. um some baff to Free

- Remove rocker arm shaft, Remove rocker arm
- Remove camshaft

## Cylinder Head, Guide Chain Plate

- Remove 2 bolts (1) of cylinder head
- Remove 4 cylinder head bolts 2 diagonally
- Remove cylinder head
- Remove guide chain plate
- Remove dowel pin and cylinder head gasket









#### Cylinder

• Remove cylinder

#### Piston

Put a clean rag under piston so as not to drop piston pin circlip into crankcase.

• Remove piston pin circlip (1) and discard it.

Remove piston pin circlip (1) from piston pin hole (connecting rod hole) Remove piston (2) from connecting rod

## **Engine Right Side**

#### **CVT** Cover

• Remove CVT cover (see5.2.7)

Driving pulley / driven pulley /Drive Belt

 Remove drive bolt (1) clockwise and driven screw (2) anticlockwise

#### Drive pulley / driven pulley /Drive Belt

Remove drive pulley with special tools
Remove drive pulley / driven pulley /drive belt

Tool: Drive pulley puller (3) (1BX-17653-00)









#### **CVT** Case

Remove bolt of air intake plate
 Remove air intake plate

- Remove bolt of CVT case
- Remove CVT case
- Remove dowel pin
   Remove paper gasket and discard it.

#### Chain holder, Tension plate

- Remove bolt 1 of tension plate Remove tension plate2
- Remove bolt 4 of chain holder Remove chain holder3

#### **Timing Chain**

• Remove timing chain from crankshaft sprocket

#### **Starting Motor**

- Remove 2 bolts of starting motor
- Remove starting motor



#### **Sector Gear**

• Remove 4 bolts of sector gear housing cover

Remove sector gear housing cover1

- Remove dowel pin and gasket
- Remove drive sector gear

• Loosen bolt 3, remove driven sector gear



- Screw out bolt of water pump
- Remove water pump









#### Side Cover

•Remove 4 bolts, remove Side Cover

#### Cap

Remove 3 bolts, remove cap

#### **Oil Filter**

- Screw out 3 bolts of filter cover
- Remove filter cover, O ring
- Remove oil filter

#### Left Crankcase Cover/Magneto Stator

- Remove bolts of left
- Remove left crankcase cover
- Remove dowel pin and gasket





#### **Magneto Rotor**

- Remove nut of Magneto Rotor
- Install special tool to rotor thread Remove rotor and woodruff key
- Tool: Rotor assy puller (1BE-85610-00)



#### Starting Driven Gear/Starting Dual Gear

• Remove starting driven gear 1 and needle bearing

• Remove starting dual gear 2 and shaft

#### Oil pump drive gear/Oil pump dual gear

- Remove oil guard bolt
- Remove oil guard(1)

Remove two Circlip (2) by circlip plier
Remove oil pump drive gear (3), oil pump dual gear (4) and gasket

- Remove needle bearing(5)
- Remove pin shaft (6),gasket



#### Gear position bolt

- Remove gear position bolt(1)
- Remove spring and steel ball







#### **Right Crankcase**

Remove left crankcase bolts

• Remove right crankcase bolts

• Separate crankcase carefully with rubber hammer knocking the case

## Front Output Shaft, Driven Bevel Gear

- Remove nut of Real output coupler(1)
- Remove bevel gear cover bolt
- Remove driven bevel gear(2)

#### Caution:

Do not damage the seal surface of right/left crankcase when separating Crankshaft should remain in the left crankcase half.







 Remove nut 1, gasket 2, front output coupler3,oilseal4,frontoutputshaftbearing ring5(LH)

• Remove Front Output Shaft6







#### **Drive Bevel Gear**

• Screw out driven bevel gear bearing seat bolt

• Remove driven bevel gear from left crankcase

#### **Transmission Main Shaft**

• Remove transmission main shaft7

## Shift Drum, Shift Fork, Drive countershaft

• Remove shift drum 8, shift fork 9, and drive countershaft10



#### Crankshaft

Remove crankshaft from left crankcase

Balance ShaftRemove balancer shaft from left crankcase







#### Oil bump

• Screw out oil pump bolt

Remove oil bump(1)

### **Filter Net**

- Screw out the bolt
- Remove filter cap(2)
- Remove filter net

## 3.3.3Engine Inspection

#### **Cylinder Head Cover**

Check if any scratch is on the cap. Check is any crack, crush or hardening on the sealer ring. If so, change accordingly.

- 1. Cylinder Head Cover
- 2. Cylinder Head Cover Seal Ring





#### **Timing Chain Tensioner**

Check tensioner for any damage or poor
 Function. Damage, poor function: Replace

Performance stability inspection methods

■ Insert screw driver 3 into the slotted end of adjusting screw, turn it clockwise to loosen the tension and release the screwdriver

■ Move the screw driver and let go of the arm slowly, ensuring the arm snaps back smoothly. If not, replace the chain tensioner with a new one.

#### Start decompression COMP

• Check if any crack is on the reducer. If any, change a new one.

• Move pressure reducing arm4. Check if pressure-reducing rocker arm and camshaft can move flexibly and return automatically.

Timing Driven sprocket
Check any scratch or damage on cam-



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shaft timing chain wheel. If the gear is scratched or damaged, change a new one completely(including camshaft timing chain wheel and timing chain).

#### **Camshaft Inspection**

• Check any scratch, abrasion, crack or other damage on each camshaft and journal.

• Check journal dia. And height of camshaft by micrometer

Camshaft			
Cam(intake)			
New part	$32.985$ mm $\sim$ $33.025$ mm		
Maintenance limit	32.865 mm		
Cam(exhaust)			
New part	32.971mm~33.011mm		
Maintenance limit	32.871 mm		

Camshaft journal(timing chain side)				
New part	$34.959$ mm $\sim$ $34.975$ mm			
Maintenance limit	34.950 mm			
Camshaft bearing shaft ( ignition plug side				
New part	21.959mm~21.980 mm			
Maintenance limit	21.950 mm			

• Test tolerant clearance of camshaft sides and cylinder cap

Camshaft bearing hole(timing chain side)				
New part	$35.007$ mm $\sim$ $35.025$ mm			
Maintenance limit	35.040 mm			
Camshaft bearing hole(spark plug side)				
New part	$22.012 \text{mm}{\sim} 22.025 \text{ mm}$			
Maintenance limit	22.040 mm			

If parameters are beyond standards, change the parts.

## Cylinder head cover Remove rocker arm

- Remove rocker arm shaft(1)
- Remove rocker arm(intake and exhaust) Including adjusting screw and nut.
- 1. Rocker shaft
- 2.Exhaust rocker arm



- A. Cam(exhaust valve)
- B. Cam(intake valve)
- C. Camshaft journal(timing chain side)
- D. Camshaft journal(ignition plug side)



- A. Camshaft bearing hole(timing chain side)
- B. Camshaft bearing hole(spark plug side)



3.Intake rocker arm

4.Adjusting screw

5.Nut

Remove washer(1).



1. Washers

2. Rocker Arm, Exhaust

3. Cylinder Head Spark Plug Side 4.Big Taper to Spark Plug Side



Rocker Arm, Exhaust
 Roller
 Bore for Rocker Arm



1. Free Movement of Adjustment



#### **Rocker Arm Inspection**

• Inspect each rocker arm for cracks and scored friction surfaces. If any, replace rocker arm assembly.

• Check the rocker arm rollers for free movement, wear and excessive radial play. Replace rocker arm assembly if necessary.

• Check rocker arm bore diameter. If Diameter is out of specification, change rocker arm assembly.

Rocker Arm Bore Diameter		
New	12.000mm~12.018mm (0.4724in~0.4731in)	
Service Limit	12.030mm (0.4736in)	

• Check adjustment screws for free movement, cracks and/or excessive play.

## **Rocker Arm Shaft**

• Check for scored friction surfaces; if any, replace parts.

• Measure rocker arm shaft diameter.

Rocker Arm Shaft Diameter		
New	11.973mm~11.984mm	

Service Limit	11.960mm
---------------	----------

Any area worn excessively will require parts replacement.

A. Measure rocker arm shaft diameter here

#### Valve Spring Removal

• Use valve spring compressor clamp to compress valve spring

#### WARNING

Always wear safety glasses when disassembling valve springs.Be careful when unlockingvalves.Components could fly away because of the strong spring preload



Valve Spring Compressor Clamp



#### Valve Spring Compressor Cup



Align valve spring compressor clamp with the center of Valve

Remove valve lock clips.

• Withdraw valve spring compressor, valve spring retainer and valve spring.



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- 1. Valve Spring Compressor Clamp
- 2. Valve Spring Compressor Cup
- 3. Valve lock clip

## Valve Spring Inspection

• Check valve spring for visible damages, If any, replace valve spring.

• Check valve spring for free length and straightness.

Valve Spring Free Length		
Normal New	40 mm	
Service Limit	38.2 mm	

Replace valves springs if not within specifications.



A. Valve Spring Length

#### Valve Removal

• Push valve stem, then pull valves(intake and exhaust)out of valve guide.



1. Intake Valve33mm 2. Exhaust Valve29mm

• Remove valve stem seal with Snap-on plier and discard it.



Plier
 Valve Stem Seal
#### **Valve Inspection**

#### Valve Stem Seal

Always install new seals whenever valves

are removed

#### Valve

• Inspect valve surface, check for abnormal stem wear and bending. If out of specification, replace by a new one.

Valve Out of Round		
(Intake and Exhaust Valves)		
New	0.005 mm	
Service limit	0.06 mm	

#### Valve Stem and Valve Guide Clearance

• Measure valve stem and valve guide in three places using a micrometer and a small bore gauge.

**NOTE:** Clean valve guide to remove

Change valve if valve stem is out of specification or has other damages such as wear or friction surface.

Valve Stem Diameter		
Exhaust Valve		
New	$4.95$ mm $\sim$ $4.965$ mm	
Service limit	4.930 mm	
Intake Valve		
New	$4.96$ mm $\sim$ $4.975$ mm	
Service limit	4.930 mm	

Replace valve guide if valve guide is out of Specification or has other damages, such as wear or friction surface

Valve Guide Diameter	
(Intake and Exhaust Valves)	
New	$5.000$ mm $\sim$ $5.012$ mm
Service limit	5.045 mm



A. Valve Stem Diameter



1. Valve Seat

2. Exhaust Valve Contaminated Area

3.Valve Face(Contact Surface to Valve Seat)

#### Valve Face and Seat

• Check valve face and seat for burning or pitting and replace valve or cylinder head if there are signs of damage.

• Ensure to seat valves properly. Apply some lapping compound to valve face and work valve on its seat with a lapping tool (see Valve Guide Procedure below).

Measure valve face contact width.

**NOTE:** The location of contact area should be in center of valve seat.

• Measure valve seat width using a caliper.

Valve Seat Contact Width	
Exhaust Valve	
NEW	1.20mm $\sim$ 1.40mm
Service limit	1.80 mm
Intake Valve	
New	1.10mm $\sim$ 1.30mm
Service limit	1.70 mm

If valve seat contact width is too wide or has dark spots, replace the cylinder head.

#### Valve Guide Removal

• Use valve guide remover and a hammer, drive the valve guide out of cylinder head.



A. Valve Contact Surface Width B. Valve Seat Contact Width



#### Valve Guide Remover



1. Valve Guide Remover 2. Valve Guide Apter 3 Engine

#### Valve Guide Inspection

Always replace valve stem seals whenever valve guides are removed. Clean the valve guide bore before rein-

stalling the valve guide into cylinder head.

#### **Injector Seat**

• Unscrew the set bolt and remove the injector seat(1)

# **Injector Seat Inspection**

• Inspect Injector Seat for cracks or other damage.

Check the seal for wear or excessive using. Replace it if necessary.

# Water Temperature Sensor and Thermostat

●Unscrew the Thermostat bolt, remove the Thermostat Cover, Thermostat, Thermostat Seat and Water Temperature Sensor.

• Water Temperature Sensor Inspection (Check 5. 4. 6)

• Thermostat Inspection (Check 3.4.7)





### **Cylinder Head Installation**

#### Valve Guide Installation

For installation, reverse the removal procedure. Pay attention to the following details.

• Use valve guide installer to install valve guide.



#### Valve Guide Installer



- 1. Valve Guide Installer
- 2. Valve Guide



- 1. Thrust Surface of Cylinder Head
- 2.Valve Guide
- A. Measurement from Thrust Surface
- to Valve Guide Top

• Push valve guide in the cold cylinder head as per following illustration.

Valve Guide	
(Measurement "A")	
NEW	14.70mm $\sim$ 15.30 mm

• Valve guide to be adjusted in diameter by using a reamer.

Valve Guide Diameter	
(Intake and Exhaust Valves)	
New	$5.000$ mm ${\sim}5.012$ mm

**NOTE:** Ensure to turn reamer in the right direction. Use cutting oil and make brakes to clean reamer/valve guide from metal shavings.

• Apply some lapping compound to valve face and work valve on its seat with a lapping tool.

**NOTE:** Ensure to seat valves properly. Apply marking paste to ease checking contact pattern.

• Repeat procedure until valve seat/valve face fits together.

Note: Clear up the abradant

# Valve Installation

For installation, reverse the removal procedure(Check 5-45).Pay attention to the following details.

●Install a **NEW** valve stem seal. Make sure thrust washer is installed before installing seal.

• Apply engine oil on valve stem and install it.



- 1. Valve Guide
- A. Valve Guide Diameter



1. Valve Seat

2. Valve Face(contact surface to valve seat)

3. Turn valve while pushing against cylinder head A. Valve Seat Angle45



1. Valve Spring Lower Seat 2.Sealing Lips of Valve Stem Seal

#### Valve Spring Installation

For installation, reverse the removal procedure(Check 5-45). Pay attention to the following details.

• Colored area of the valve spring must be placed on top.

• To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

**NOTE:** Valve cotter must be properly engaged in valve stem grooves.

• After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

CAUTION: An improper locked valve spring will cause engine damage. Rocker Arm Installation

**NOTE:** Use the same procedure for exhaust and intake rocker arm.

Apply engine oil on rocker arm shaft.

Installtherockerarmshaftwiththechamfere dedgefirstandusefollowingprocedure.

1、Insert a rocker arm pin through rocker arm pin bere.

2 . Install a thrust washer then proper rocker arm(exhaust side)or (intake side).

3、Push in rocker arm shaft until its chamfer reaches the end of rocker arm bore.

• Place the other thrust washer and push rocker arm shaft to end position.

#### Thermostat Installation

● Install the Thermostat seat(1), Thermostat(2),Thermostat cover (3) and two bolts (4)



Position of the ValveSpring
 Valve Cotter



1. Rocker Arm 2. Thrust Washer(Timing Chain Side) 3. Thrust Washer(Spark Plug Side)



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#### **Injector Seat Installation**

• For installation, reverse the removal procedure (Check 3-48).



1 .Injector Seat

#### **Upper Guide Chain Inspection**

• Inspect Upper guide chain, check for abnormal wear, cracks and rubber fall off. If out of specification, replace by a new one.

#### **Cylinder Body Inspection**

#### Cylinder Body Distortion

• Check the flatness of gasket surface, total 7 point to inspect with a straight edge and thickness gauge. Take clearance readings from several places. If any clearance reading is out of the service limit, replace with a new cylinder body. Cylinder Body Distortion Service Limit:

#### 0.05mm

Tool: Thickness Gauge, straight edge

# Cylinder Body Inner Diameter Inspection

• Check the scoring or other damages in the inner wall of Cylinder Body, Replace it if necessary.

• Measure the diameter of bore by Inner diameter gauge from upper, middle and lower places of cylinder inner diameter to check with two mutual vertical directions.

Standard Cylinder Bore: 91.0-91.015mm



Tool: Inner diameter gauge

#### Piston Piston Diameter

 Inspect piston for cracks or other damage. Replace piston and piston ring if necessary.

●Vertical measure the piston on the 8mm direction between piston pin by micrometer

Replace piston if out of service limit.

Piston Parameter	
New	90.950mm $\sim$ 90.970 mm
Service Limit	90.85 mm



#### **Piston Ring Groove Clearance**

• Measure the one-sided clearance of piston 1 and 2 by Straight edge, if out of service limit, replace piston and piston ring.

Service limit (Clearance) piston ring1: 0.15mm piston ring 2: 0.15mm

Service limit (Width)

piston ring 1: 1.21mm~1.23mm

piston ring 2: 1.51mm~1.53mm

Oil ring: 2.50mm~2.52mm

Service limit (Thickness) piston ring 1: 1.17mm~1.19mm piston ring 2: 1.47mm~1.49mm

Tool: Straight edge Micrometer(0~25mm)





# piston ring free gap and piston ring end gap

• Using a feeler gauge measure each ring free gap, place the ring in the cylinder To measure the ring end gap, If the clearance is too large, the piston and piston rings should be replaced.

piston ring free gap (service limit)

piston ring 1: 8.9mm piston ring 2:9.5mm piston ring end gap (service limit)

piston ring 1: 1.5mm

piston ring 2: 1.5mm

Tool: Vernier caliper. Feeler gauge

### **Piston Pin and Pin Bore**

• To measure the inner diameter of piston pin bore by Bore dial indicator.

To measure the outer diameter of piston pin by micrometer

If out of service limit, replace piston and piston pin

piston Pin Bore(service limit): 22.02mm

● To measure the outer diameter of piston Pin in three difference positions by micrometer.

piston Pin outer diameter(service limit): 21.980mm

Tool: Inner diameter gauge(18mm~35mm) Micrometer(0~25mm)





#### **CVT** Cover

• Inspect CVT Cover for cracks. Replace a new CVT Case if necessary

• Inspect seal ring of CVT Cover for ageing, damage. Replace a new one if necessary





- 1 、 Drive Pulley Fixed Sheave
- $2 \ \mathrm{V}$  Drive Belt
- 3、Ajusting Washer
- 4、Spring,Drive Pulley
- 5、Drive Pulley Sliding Sheave
- 6、Centrifugal weight
- 7、Cam
- 8、Nut
- 9、Washer

- 10 、 Driven Pulley Fixed Sheave
- 11 、 Driven Pulley Sliding Sheave
- $12_{\times}$  Spring holder
- 13 、Locating pin
- 14 、Circlip
- 15 、Spring
- 16 、Washer

#### **Drive Pulley**

Loosen Drive Pulley Nut, remove,
 CVT, Drive pulley fixed And Sliding
 Sheave

• Remove the Cam (1) and Centrifugal Weight (2)



#### **Centrifugal Weight Inspection**

 Inspect Centrifugal Weight and Sliding surface for wear or damage, Replace a set of centrifugal weight if abnormal



# Drive Pulley Fixed and Sliding Sheave Inspection

 Inspect the abnormal conditions of drive surface for multistep wear or other damage. Replace it if abnormal

Inspect one-way clutch if equipped.
 Replace it if abnormal

#### **Drive Pulley Installation**

To install it as contrary process of removal



**Driven Pulley** 

Disassembly



1. Cam and slider marks 2. Spring Installation Holes Marks



 As the illustration shows, place driven pulley on the special tool base.

 Turn special tool handle to compress the cam and spring. Using a circlip

**Note:** Use special tool to remove circlip in order to avoid any wounding if spring

remover(a plier), remove circlip.

Special tool: Driven pulley spring

compressor

seat flying up.

(1BA-17730-00 FZ/1)

1. Driven Pulley Spring Compressor 2. Driven Pulley



- 1. Driven Pulley Spring Compressor
- 2. Circlip
- 3. Circlip Remover

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 Slowly loosen tool handle to release the spring tension and remove the special tool;

Remove cam;

Remove guide pin;

Remove spring and sliding sheave of driven pulley.





- 1.Cam
- 2.Guide Pin
- 3.Spring
- 4. Sliding Sheave of Driven Pulley

#### **Driven Pulley Inspection**

#### **Driven Pulley Fixed Sheave Inspection**

• Check driven pulley faces for any abnormal conditions, such as heavy wear or visible damage. Replace if necessary.

**NOTE:**Driven pulley assembly is precisely matched.If only fixed sheave or sliding sheave is replaced,the vibration may increase.It' s recommended to replace both when necessary.



1. Drive Face of Fixed Sheave

#### **Driven Pulley Sliding Sheave Inspection**

• Inspect the drive face of sliding sheave for heavy wear and damage. Replace it if necessary.

**NOTE:**Driven pulley assembly is precisely matched. If only fixed sheave or sliding sheave is replaced, the vibration may increase. It's recommended to replace both when necessary.

• Inspect the 3 sliders on driven pulley for wear and other damages. If the worn thickness is over the measurement illustrated in the following figure, replace all 4 sliders at the same time.



1. Drive Face of Sliding Sheave



- 1. Slider
- 2. Sliding Sleeve



 $A \ge 1.5 mm$ 

### **Cam Inspection**

 Check spring cam sliding face for wear and other damages. Replace if necessary.





# **Driven Pulley Spring Inspection**

• Check spring free length. If it is shorter than limit length, replace it.

Spring free limit length A: 214.0mm.

#### **Driven Pulley Assembly** Reverse the disassembly procedure for driven pulley assembly.



1.Spring

#### **Drive Belt**

• To inspect Belt for greasy dirt

• To inspect Belt for cracks and damage

• To measure width of belt by vernier caliper Replace a new one if any damage or out of Service limit

Drive Belt service limit: 33.5mm

**Tools: Vernier Caliper** 





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#### **CVT Case Inspection**

Inspect Bearing Sleeve (1) and Oil seal(2).Replace it If necessary

#### Lower Timing Chain Guide Inspection

• To inspect the lower timing chain guide for damage or ageing Replace it if necessary

#### **Tensioner Plate Inspection**

• To inspect tensioner plate for damage or ageing. Replace it if necessary.

#### **Timing Chain Inspection**

• To inspect the radial clearance of timing Chain.

 To inspect timing chain for excessive wear Replace timing chain and timing chain sprocket if excessive wear or damage

#### **Gearshift Sector Gear Inspection**

#### **Gearshift, Drive Sector Gear**

• To inspect drive sector gear for cracks or other defects. Replace it if necessary.

• To measure Gear shaft diameter (A) for cracks or other defects. Replace it if out of service limit.

Service limit: 14.976mm~14.994mm



#### Gearshift driven sector gear inspection

• To inspect driven sector gear for damage or abnormal Replace it if necessary.

#### **Oil filter**

• To replace a new oil filter

• Periodic replacement oil filter base on requirements of Maintenance period.



#### Crankcase (LH)Cover

• To inspect magneto coil(2) for damage or Short circuit, Replace it if abnormal.

•Smear Thread-locking Adhesives on bolts and fasten base on standard torque while assembling.

Torque:10N. m



#### Magneto rotor

• Remove the set bolt of overrun clutch by wrench



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• To inspect the overrun clutch roller and Cam for wear or damage. Replace it if defected.

• To install the overrun clutch as right direction.

■ Smear lubricating oil on the overrun clutch

■ Tighten the bolt after smear threadlocking adhesives by Wrench as standard torque.

Bolt Torque: 30N • m

Accessory: Thread-locking adhesives

• Install driven gear

 Driven gear will be locked if turn it as the direction of arrow by "B" indicated. Otherwise, it is smooth running.

Turning the driven gear bearing.
 Replace it if not well running.

• Remove driven gear bearing by special tools

Install the driven gear bearing by special tools

Tool: Bearing installation & removal tool







#### **Dual Gear**

• To inspect the dual gear surface for scratch or bump against. Replace it if abnormal.



• To inspect the gear surface for scratch, bump against or plastic ageing. Replace it if abnormal





#### **Oil Pump Dual Gear**

• To inspect the gear surface for scratch, bump against or plastic ageing. Replace it if abnormal





- 7. Bearing
- 8.Copper spacer
- 9. Bolt
- 16. Oil strainer cover 17.Copper spacer
- 18.DrainBolt
- 24.Gearshift sensor
- 25.Spacer
- 26.Oil pressure sensor

# **Crankcase inspection**

• Check crankcase halves for cracks or other damage. Replace if necessary.

• Measure plain bearing inside diameter and compare to magneto and CVT side journal diameter of crankshaft (refer to CRANKSHAFT).Replace if the measurements are out of specification.



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Plain bearing inside diameter	
Service limit	42.100mm

# Plain Bearing Replacement Plain Bearing Removal

Caution: Always support crankcase halves properly when ball bearings or plain bearings are removed .Damages to crankcase halves may occur if this procedure is not performed correctly.

**NOTE:** Always use a press for removal of plain bearing. Remove plain bearing with the proper plain bearing remove/installer.

• Carefully push the plain bearings out from the crankcase half inside towards the outside.

1、 Plain bearing bore diameter



2.Plain bearing remover/installer

#### **Plain Bearing Installation**

Crankcase	Plain Bearing
A	Red
В	Blue

Install plain bearings with the proper plain bearing remover/installer in a cool crankcase. Do not lubricate plain bearing and /or crankcase for



installation.

- 1. Oil bore T-Boss570 SERVICE MANUAL 21.0
- 2. The partition of the plain bearing
- 3. Crankcase mark

 Carefully press-in the plain bearings in the same direction as during installation, from then crankcase inside towards the outside.

During installation, make sure not to damage the 3 sealing surface of the crankcase.

CAUTION: Mark position of oil bore on crankcase and on plain bearing remover/installer .Align mark on plain bearing remover/installer with mark on crankcase.Wrong oil bore will stop supply to plain bearing and will cause engine damaged.

#### Ball Bearing and oil sealing Inspection

• To inspect the ball bearing for oil clearance, sound or turning stationarity after Cleaned and lubricated the ball bearing. Replace it if abnormal by special tools.

• To inspect all oil sealing for wear, cracks. Replace it if abnormal by special tool

• To remove and inspect the gearshift





sensor (24) for break over performance by multimeter. Replace it if abnormal
To remove and clean the drain bolt(18) and Oil strainer(14)

• To install bearing, oil seal by special tools. Bearing with lubricating oil, Oil seal lips with lubricating grease

 Install new "O" ring "O" ring with lubricating grease

• Install gearshift sensor(24)and speed sensor(12).

 Install spacer(17) and drain bolt(18), tighten it as standard torque.
 Torque(Drain Bolt):30N • m
 Tool: Bearing remover and installer Multimeter

#### **Drive Bevel Gear**

• To protect the drive bevel gear shaft by one clean duster cloth and clamp by vise

• Loosen the Drive Bevel Gear Nut (3),remove Drive Bevel Gear(4) and Adjusting spacer(5).



• To inspect Drive Bevel Gear(4)and Output Driven Gear (2) for rust, cracks, wear. Replace it if necessary.

●To inspect Bearing(8)for turning. Replace it if abnormal.

• To adjust Adjusting Spacer(5) if replace any one of Crankcase(Right),Drive Bevel



Gear (4),Drive Bevel Gear cover(1). Detail to check Bevel Gear adjusting method

• To tighten tight Nut(3)by standard torque and with lubricating oil on bearing (8) before install.

Service Limit(Drive Bevel Gear Tight Nut): 140~150N.m

- 1- Drive Bevel Gear Cover
- 2- Output Driven Gear Bear
- 3- Drive Bevel Gear Nut
- 4- Drive Bevel Gear
- 5- Adjusting spacer
- 6- Drive Bevel Gear Shaft
- 7- Bearing Plate
- 8- Bearing

# Front Output Shaft

• To inspect Bearing (7) for wear or well running. To inspect Oil seal (5) for damage. Replace if abnormal.

• To inspect Bearing(7) for lubrication oil and Oil seal (5)lips for grease before install output shaft

● To tighten Bearing Stop Nut(6) with thread glue as standard torque Bearing Stop Nut Torque:78~82N·m Front Output Shaft Nut Torque:95~100N·m

# **Driven Bevel Gear**

To remove Nut(4),Gasket (19),Coupler
 (16) and Oil seal(17)

• To proper protect the thread of Driven Bevel gear by protector, fixed bevel gear cover(15),Push out the Driven bevel gear.

• Put one clean duster cloth ①, under the bevel gear cover, to remove the Bearing stop nut(11) and Bearing By special wrench ②

• To inspect Driven Bevel Gear(9)for crack, wear. Replace it if necessary.

• To inspect bearing(10)and (12) for well running. Replace it If not

To install by use new oil seal(17)and



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# "O" ring seal(13)

● To adjust Adjusting Spacer(14) if replace any one of Crankcase(Right),Driven Bevel Gear (9),Driven Bevel Gear cover(15). Detail to check Bevel Gear adjusting method

 To tighten stop Nut(11) with thread glue by standard torque and with lubricating oil on Bearing (10) ,Bearing (12),Oil seal(17) and "O" ring seal before install. BearingStopNutTorque: 100~120N.m Driven Bevel Gear Nut Torque: 140~160N. m Bevel Gear Spacer Adjusting Method

• To adjust spacer ① and ② if replace any one of Crankcase, Bevel gear or Bevel Gear Cover.



#### **Bevel Gear Adjustment**

# Measure Bevel Gear Backlash

• To install Drive and Driven Bevel Gear on the Crankcase.

To tighten the Drive Bevel Gear by straight Screwdriver ③with duster cloth ② into the Speed sensor hole①

To install special tool<sup>3</sup> and dial indicator
4

Tool: Bevel Gear backlash measuring tool Dial indicator

#### a=46mm

• To measure backlash by running the Driven Bevel Gear shaft.

• To adjust spacer thickness if out of service limit. Remeasure the backlash of Bevel Gear till to accord with service limit.





Bevel Gear backlash service limit: 0.1mm~0.2mm

### Adjustment Method:

Measured	Washer Thickness
Backlash	Adjustment
<0.1mm	Reduce washer thickness
0.1~0.2m	Correct
>0.2mm	Increase washer thickness

### **Gear Surface Contact Inspection**

To inspect Gear surface contact after backlash adjusted. Detail as follows:

• Remove Drive and Driven Bevel Gear Shaft from Crankcase.

• Clean splodge and grease for each gears of Drive and Driven Bevel Gear.

• With dyestuff for each gears surface of Driven Bevel gear

• To install Drive and Driven Bevel Gear

• Running the Driven Bevel Gear from front and back direction.

• To inspect dyestuff of Bevel Gears after removed Drive and Driven Bevel Gear.

1







• If it is proper gear contact surface ②, move to next Step.

● If it is improper gear contact surface ① and ③, adjust spacer thickness of Bevel



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Gear and recheck till to accord with standard requirement.

#### **Drive Shaft Inspection**

• To inspect gear surface for hard spot, damage, excessive wear. Replace it if necessary.

#### **Drive layshaft Combination**

• To remove the layshaft as picture

• To inspect gear surface for hard spot, damage, excessive wear.

To inspect bearing and bush for damage or wear. Replace it if necessary.

#### Shift Drum, Shifting Fork

●To inspect shifting fork clearance as picture indication: Check fit clearance by feeler gauge. Replace shifting fork ,or gears, or together replacement if clearance out of service limit



Shifting fork standard gap: 0.10mm~0.35mm Service limit:0.45mm

● To measure the width of shifting fork slot by vernier caliper Standard values: 6.05mm~6.15mm

● To measure the thickness of shifting fork by vernier caliper Standard values: 5.80mm~5.90mm

• To inspect shifting fork ① and ② for damage, curve. Replace it if with defects.

• Install shift fork on the shift fork rod to





move it by left and right. If not smooth. Replace it.

• To roll the shift fork rod on the slab. Replace it if curve

• To inspect the shift fork spring for broken, damage. Replace it if any defects.

• To inspect Shift Drum Cam for crack, wear. Replace it if any defects.

#### Installation

Reverse process for installation and removal. Attention as follows:









### Caution:

Retainer ring couldn't reuse if removed it from shaft Install a new one.

Don't too wide open when install retainer ring.

To confirm the retainer ring has been

fully installed after assembled.

• Don't reverse install the shift fork and spring when assemble the shift fork.

2. Parking Arm;

4.shift fork

- 1. Shift fork, shaft.
- 3. Retainer ring
- 5. Thin shift fork spring
- 6 Thick shift fork spring
- 7.Springseat

#### **Crankshaft Inspection**

**NOTE:**Checkeachbearingjournalofcranksh aft for scoring,scuffing,cracks and other signs of wear.

**NOTE:**Replace the crankshaft if the gears are worn or otherwise damaged.

CAUTION: Components with less than the service limit always have to be replaced. Otherwise severe damage may be caused to the engine.



Connecting Rod Small End Inner Diameter

• To measure connecting rod small end inner Diameter by bore dial indicator. Replace it if out of service limit Service limit: 22.060mm

Tool: Bore dial indicator(18mm~35mm)

#### **Crankshaft Axial Play**





• Use dial gauge to measure crankshaft axial play at MAG side.

Crankshaft Axial Play	
New	0.050mm~0.450mm
Service Limit	0.6mm

If play is out of specification, replace crankcase and/ or crankshaft.

**Connecting Rod Big End Axial Play** 

• Using a feeler gauge, measure the distance between butting face of connecting rods and crankshaft counterweight.

Connecting Rod Big End Axial Play	
New	0.130mm~0.350mm
Service Limit	0.7mm



1.Crank shaft 2.Connecting Rod 3.Gauge

# **Balance Shaft**

• To inspect balance shaft and balance shaft gear Replace it if damage.

• To inspect balance shaft gears for crack, scratch or others. Replace it if damage

# **Oil Pump Inspection**

• To inspect all parts of Oil Pump. Replace it if any defects.

 To measure bottom clearance (a) (clearance between inner and outer rotor) and backlash(b) (clearance between outer rotor and crankcase), Replace oil pump if out of service limit



Bottom Clearance standard value: 0.1mm ~ 0.15mm Limit value: 0.2mm Backlash Standard value: 0.08mm~0.15m Limit value: 0.2mm

# 3.3.4Engine Installation

The installation essentially the reverse of the removal procedure, special attention as follows:

**Note:**Clean all parts before install. Without any cracks for all parts before install. All motion parts should with lubrication oil before install Oil seal lips and O ring seal with lubrication grease

Caution: Without any grease in belt, drive and driven pulley

# Middle parts of Engine Installation

Crankcase (right),Front output shaft, Driven Bevel Gear

• To install Crankcase(right), Front output shaft, Driven Bevel Gear and fasten bolt as tandard torque, Detail as



torque:40N. m

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## Shifting Drum, Shifting fork, Drive layshaft

● Insert the shifting fork into the sliding sleeve, then install the drive layshaft, shifting fork, shifting drum into crankcase(left)

#### Main Shaft

• Install the Mail Shaft

5.Adjusting Spacer
6.Driven Bevel Gear
7.Coupler
8.Bolt
10.Nut

11. Washer



## **Drive Bevel Gear**

• Install Drive Bevel (2) and tighten 4 bolts (1)

Erection Bolt torque (M8X 28):40N. m

## Balance Shaft, Crankshaft, Connection rod Install balance shaft

• Turn the balance shaft into proper position(as picture indication), install into crankshaft

•Keep a strip of straight line for marks on crankshaft, oil bore of balance shaft neck

Running the crankshaft and balance shaft to inspect whether match for balance shaft bore and gap of crankshaft. If not, reinstall

1. Balance shaft bore 2. Crankshaftgap

## Crankcase (right)

• Wipe Sealant on the crankcase(left) junction surface

 Install three locating pin and "O" ring seal as picture indicated

• Mould assembling, light touch to well done by rubber hammer

Tighten the bolt as standard torque
 Torque:M6:10N • m

M8:25N • m

**Note:** opposite angles cross and grading to tighten the bolt.



## **Gears Set Bolt**

Put in steel ball, install the set bolt(1), tighten It as standard torque
 Standard torque: 40N • m

## **Primary Strainer**

- Install primary strainer and cover(2)
- Tighten bolt as standard torque

Standardtorque:8N • m



## Shift Sector Gear

- Install shift sector gear, tighten bolt
- Install locating pin and gasket
- Close the shift cover. Tighten bolt

• To inspect gears for smooth changing or others. If not, recheck all parts and install again.



- 1 .Bolt
- 2 .Shifting Drive Sector Gear
- 3 .Shifting Driven Sector Fear

## Engine (left parts)Installation Oil Pump

Install oil pump as right picture indication

Tighten bolt

 Inspect oil pump for smooth running that hold by pliers. Replace and reinstall it if not
 Standard Torque : 7N • m



Outer rotor, Oil pump 4.Oil Pump
 Roller pin 5.Oil pump shaft
 Inner rotor, Oil pump6.Bolt

## Oil Pump driving gear, Oil pump dual gear

- Install dual gear and driving gear.
- Install circlip by circlip plier

**Note:** Don't open when install,and the new circlip have to be used.

Install oil baffle plate, tighten bolt as standard torque.

Torque: 8N • m

## Dual gear

Install dual gear(1) and dual gear shaft(2)

## Driven gear

Install driven gear(3)

## **Magnetor Rotor Combination**

 Install woodruff key into crankshaft key groove

Install Magnetor Rotor Combination
Install Nut (1)and Washer (2)
Standard Torque : 160~170N • m

Caution:Clean out grease on the surface of Magnetor Rotor and Crankshaft Conical surface by noncombustible materials and keep drying.

## Left Crankcase

• Install Locating Pin(1) and sealing gasket(2)

Nata: Llas now cooling gookat









Install left crankcase

• Install left crankcase fastening bolt



## Shaft Sleeve, Blanking Cap

Install shaft sleeve
Install blanking cap and tighten bolt.
Installation keeps the Reverse procedure with removal

## **Oil filter**

• Install new oil filter and O ring seal, tighten bolt.

Water Pump●Install water pump and tighten bolt.



## Starting motor

• Install starting motor, tighten fixed bolt

## Engine right side

## Upper guide chain

• Install upper guide chain

## Lower timing chain guide

Install Lower timing chain guide

## **Tensioner plate**

• Install tensioner plate, tighten bolt

## **CVT** case

Install dowel pin 6, gasket 3 and gasket9,install CVT case to the right crankcase.

Install bolt 2, bolt 7and bolt10

• Install guide 13 and screw4

## Drive pulley, driven pulley, drive belt

• Use special tool to open fixed plate and sliding plate

• Install drive belt on drive pulley and driven pulley

## WARNING:

Drive belt contact surface should be free from any grease or oil.

Tool: Driven pulley expander (1BX-17654-00)



- 1. Upper Guide Chain
- 2. Lower Timing Chain Guide
- 3. Tensioner plate





- 1. driven pulley expander
- 2. driven pulley
- 3. Drive belt

 Install CVT assy and tighten bolt and nut to the specified torque

**NOTE:** Install bolt of drive pulley anticlockwise.Install nut of driven pulley clockwise

Drive pulley bolt tightening torque: 55~60N. m

Driven pulley nut tightening torque: 110~120N. m

## Engine top side

## Piston

●Install the piston rings in the order of oil ring, ②ring, ①ring.

● the first member to go to the oil ring groove is spacer①, after placing the spacer fit the two side rails②.

WARNING: When installing thespacer

Install the second ring A and the first ringB.

## NOTE:

Ring A and ring Bdiffer in shape. Ring A marks "D" and ring B marks"DY".The marks should be face up when installing

• After installing, inspect the smoothness of piston ring moving.

The gaps of three rings should tagger
 120° . and the gaps should not face the axial direction of piston pin or the main push surface of piston.

1. Do not face to the main push surface of piston.

2. Do not face to the axial direction of piston pin.



1. CVT assy 2. Bolt

3. Nut









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• Apply a light coat of moly oil to the piston pin.

• Install piston pin into holes of piston and connecting rod small end



• place a clean rag beneath piston and install piston pin circlip ①;

• Install the dowel pins and the new cylinder gasket.

## Cylinder

• Apply engine oil to piston skirt and cylinder wall.

• Hold each piston ring with proper position, insert piston into the cylinder.

## Chain Guide

• Install chain guide 2

 Install dowel pin 1 and new cylinder gasket 3

• Rotating crankshaft, and rotate the piston to upper dead center of crankshaft

1. Dowel pin

3. Cylinder gasket



## Cylinder head

• Install cylinder head, tighten bolts diagonally to the specified torque.

Cylinder head cover bolt tightening torque:

Initial: 20N. m Final: 40~45N. m

Camshaft, Rocker Arm

Install camshaft
Install rocker arm
Install rocker shaft

Install boltM6



- 1. Cylinder head cover bolt M10
- 2. Nut M6



- 1. Rocker arm 4. Adjusting screw
- 2. Exhaust rocker 5.Nut

3. Intake rocker 6. Camshaft



- Install camshaft holder into the groove of camshaft.
- Tighten bolt
- 1. The position of camshaft holder
- 2. The locating groove of camshaft
- 3. The moving direction

## **Timing Driven Sprocket**

Remove speed sensor and align the carved line of magneto and mark of left cover. If not alignment, rotate camshaft and make them be aligned.



• Hitch timing chain

• Tighten the fastening bolt to the specified torque

#### Specified torque: 15N. m

**NOTE:** make sure to apply screw locker

#### **Decompressor Starter**

- Install decompressor starter
- Tighten the bolt to the specified torque

Decompressor starter bolt specified torque: 30N. m



1 .carved line of magneto



chain sprocket fastening bolt
 carved of timing chain sprocket
 the contact surface of cylinder head cove



#### **Timing Chain Tensioner**

 Insert flat head screw driver into the end of tensioner groove, rotate clockwise and lock tensioner spring

• Install timing chain tensioner and new seal gasket (1)

• Install fixed bolt (2)and fasten it to the specified torque

Chain tensioner bolt specified torque: 10N. m

• after installing tensioner, use flat head screw driver to rotate it anticlockwise and make the spring press the tensioner adjuster to compress timing chain.

Install new gasket 3

• Install tensioner screw to the specified torque;

Tensioner screw specified torque:

8N. m

## **Cylinder Head Cover**

- Put rubber ring on cylinder head cover
- install cylinder head cover
- tighten bolt
- Spark plug
- install and tighten spark plug(3)

## **CVT** cover











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## 3.4 Cooling and lubrication system

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## 3.4.1Engine cooling system chart



## 3.4.2 Engine Coolant





The cooling used in cooling system is mixture of 100% ethylene glycol antifreeze. The coolant will protect the cooling system from freezing at temperature above -  $30^{\circ}$ C.

#### WARNING:

Use high quality ethylene glycol base antifreeze and mixed with distilled water. Never mix alcohol base antifreeze and different brands of antifreeze The ratio of antifreeze should not be more than 60% or less than 50% Do not use anti-leak additive

## 3.4.3 Inspection of cooling circuit

Remove radiator ①and connect tester②

• Give a pressure of 105kPa, and check if the cap hold the pressure for at least 10 seconds

• If the pressure drops during 10 seconds, it indicates that there is leakage with the cooling system. In this case, check the complete system and replace the leaking parts or components.

## 3.4.4 Inspection and cooling of Radiator and Water Hoses Radiator Cap

• Remover radiator cap(1)

• Install radiator cap to cap tester ②

● slowly increase pressure to 108kPa and if the cap hold the pressure for at least 10 seconds

• If the cap cannot meet the pressure requirement, replace it.

Radiator Cap Valve Opening Pressure Standard: 108kPa Tool: Radiator Cap Tester

## **Radiator Inspection and Cleaning**

Remove dirt or trash from radiator with compressed air

• Correct the radiator fins with a small screwdriver



#### **Radiator Hose Inspection**

• Check radiator hoses leakage or damage. If the hoses are leakage and damaged, replace them

• Check tightening of clamps. Replace the clamps if necessary

 After inspection and cleaning of radiator and hoses, check coolant level. Fill coolant if necessary

## 3.4.5 Inspection of Fan Motor

Remove fan motor from radiator
Turn the vanes and check if they can turn smoothly

•Check fan motor. Make sure that the battery applies 12 volts to the motor and the motor will run at full speed while the ammeter will indicate the ampere not more than 5A. If the motor does not work or the ampere exceeds the limit, replace the motor

●Installation: Apply a little thread locker to the bolts and tighten to the specified torque.

Fan Motor Bolt Tightening Torque: 10N • m





- 1. Radiator;
- 3. Fan Motor;

5.

- in wotor,
- Radiator Cap;
   MountingNut;
   Thermo switch





#### Inspection of Thermo switch

Remove thermo switch

• Check the thermo switch for closing or opening by testing it at the bench as illustrated. Connect the thermo switch ¢Ù to the circuit tester, place it in a vessel with engine oil. Place the vessel above a stove.

• Heat the oil to raise the temperature slowly and take the reading thermostat 2, when the thermo switch closes and opens.

Tool: ammeter Thermo switch Operating Temperature:

Standard: (OFF-ON): Approx.88℃

(ON-OFF): Approx. 82℃

## WARNING:

Avoid sharp impact on thermoswitch. Avoid contact of thermoswitch with thermometer or vessel.

• Installation: Use a new O-ring ③ and tighten the thermo switch to the specified torque;

Thermo switch Tightening Torque: 17N • m

• Check coolant level after installation of thermo switch. Fill coolant if necessary

## 3.4.6 Inspection of Water tem-

## **Perature Sensor**

• Place a rag under water temperature sensor 1 and remove it from cylinder head

• Check the resistance of water temperature sensor as illustrated on the right. Connect the temperature sensor 2 to the circuit tester, place it in a vessel with engine oil. Place the vessel above a stove





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Tool: ohmmeter, thermometer

 Heat the oil raise the temperature slowly and take the reading from ohmmeter
 (4) and thermometer (3)

and

Water

Resistance	
Temperature	

Temperature (°C)	50	80	1 00	120
Resistance ( <u>0</u> )	154±16	52±4	27±3	16±2

• Installation: Apply a little thread locker and install it to the cylinder head by tightening to the specified torque

Water temperature Sensor Tightening Torque: 16N • m

## WARNING:

Avoid sharp impact on temperature sensor; Avoid contact of temperature sensor with thermometer or vessel

• After installation, check the coolant level. Fill coolant if necessary

## 3.4.7 Inspection of Thermostat

- Remove thermostat housing
- Remove thermostat
- Check thermostat pellet for cracks. If necessary, replace it.

• Test the thermostat according to the following steps:

 ${\rm \AA}{\rm Pass}$  a string between thermostat flange as illustrated on the right



☆Immerse the thermostat in a beaker with water. Make sure the thermostat is in the suspended position without contact to the vessel. Heat the water by placing the beaker above a stove and observe the temperature rise on a thermometer ☆Take the temperature reading from thermometer when the thermostat valve opens.

Thermostat Valve Opening Temperature:71  $^{\circ}C \pm 3 ^{\circ}C$ 

Tool: Thermometer

☆Keep heating the water to raise the water temperature. When the water temperature reaches the specified valve, the thermostat valve should have been lifted by 3. 5-4.5mm

 $\lesssim$ If thermostat valve opening temperature or thermostat valve lift does not reach the standards, replace it.

• Install thermostat: reserve the removal procedure for installation

 $rac{1}{\sim}$  Install thermostat housing. Tighten to the specified torque:

Tightening Torques: 10N • m

## 3.4.8 Water Pump

#### Water pump cover

Water pump is on engine left crank- shaft cover

#### **Removal and Disassembly**

#### WARNING:

When engine is hot, do not remove radiator cap or loose coolant discharge plug screw to prevent from injury.

#### Drain coolant

• Remove radiator water outlet from water pump cover

•Remove mounting bolt from water pump cover

Remove water pump



#### Illustration

- 1. coolant drain plugs crew
- 2. Seal gasket
- 3. bolt
- 4. water pump cover



#### Inspection of water pump cover

• Check water pump cover seal gasket, if necessary, replace it

#### Installation of water pump cover

 Install water pump cover reverse the removal procedure for installation
 Water Pump Cover Bolts Tightening Torque: 6N.m

• Tighten mounting bolts diagonalcross.

- Check impeller for smoothturning
- install the new O-ring

Use the new O-ring to prevent leakage; Apply grease to O-ring



 Install water pump and tighten the bolts and bleed bolt
 Water pump bolts tightening torque: 10N • m

- Connect water tubes
- Inject coolant









Add oil to the engine parts (piston, cylinder body, camshaft and so on) which run at high speed.

Engine lubrication should be special oil. Engine oil is not only used as lubrication, but also used to wash, rustproof, seal and cool.

## 3.4.10 Inspection of Lubrication system

(Refer to 5.2.8 inspection of lubrication system)

# 3.4.11 Inspection of engine oil pump

(Refer to 3-77)

## 3.5 FUEL INJECTION SYSTEM

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Below shows the layout of typical EMS for engine. The solid lines in the figure 1 below indicate the output signals from the Engine Controller and the dotted lines indicate the input signals to the controller from various sensors and switches.



## 3.5.1 **ECU**

## 3.5.1.1 Description & Working Principle

The ECU continuously monitors the operating conditions of the engine through the system sensors. It also provides the necessary computation, adaptability, and output control in order to minimize the tailpipe emissions and fuel consumption, while optimizing vehicle drivability for all operating conditions. The ECU also provides diagnosis when system malfunctions occur.

#### 3.5.1.2 Appearance

The MT05 ECU has a polyester header, with an aluminum base plate. below shows the top and bottom view of the MT05 ECU.



## 3.5.1.3Handling – DOs & DONTs

ACTION	REASON
<b>DO NOT</b> : Place the ECU close to the	High temperature might reduce the life of the ECU and also can damage the ECU
exhaust pipe of Engine when removed	

<b>DO NOT</b> : Place the ECU close to or pour water, oil or any other liquids.	ECU is susceptible to water and liquids
<b>DO NOT</b> : Allow mud or other debris to accumulate on the surface of the ECU	Having mud or debris accumulated on the ECU casing reduces its heat dissipation efficiency.
<b>DO NOT</b> : Apply any voltage relative to any point to the ECU	Drastically affects the performance of the ECU and may lead to ECU damage
<b>DO NOT</b> : Clean ECU with any solvent or any corrosive liquid	Can damage the housing of the ECU
<b>DO:</b> Take extreme care that water droplets or excess moisture should not fall on ECU connectors	ECU connectors can get short and may lead to ECU damage
<b>DO:</b> Clean the ECU with a moist cloth and keep it dry	Prevents ECU damage

## 3.5.1.4 Installation requirements

The ECU shall be mounted using M5 machined screws with a torque of 3.9Nm  $\pm 10\%$ . The mounting surface should also be flat to avoid subjecting the base plate to unnecessary force and warping the PCB.

## 3.5.1.5 **Power Requirements**

□ □ Power Supply: The controller's power supply module will power up the microprocessor if the battery voltage is greater than 6.3 Volts. The power on is controlled by the controller hardware only.

Operating Range: All planned functions are executed in this range. Battery and/or Ignition voltage: 9.0 to 16V DC

□ Power Off: The controller will turn its power off when the ignition voltage: < 6.2 VDC. The controller prepares for entry into Power Down mode. The preparation involves storing important information into EEPROM.

□Reset: During reset, all outputs shall be set to a predefined state. The controller shall monitor itself for proper operation and enter reset should any internal errors be detected. The controller shall then restart normal operations after the computer has properly reset □Over Voltage: the controller will survive no permanent damage if the ignition voltage does not exceed 26V for more than 1 minute

□ Reverse Voltage: The controller will survive with no permanent damage: Battery and/or Ignition voltage < -13V DC for 1 minute

## 3.5.1.6 Temperature Requirements

□ Storage: The controller shall suffer no damage as a result of being stored at temperatures of -40 □C or +105 □C continuously for 168 hours. If the storage temperature is not as extremely high as +105 □C or as extremely low as -40 □C, the ECU could be stored for longer time without damage.

□ Operating: The controller shall operate in the ambient temperature from -20  $\Box$ C to +85  $\Box$ C.

## 5.5.1.7 Maintenance service and Repair

ECU is a non-serviceable part. Once there are problems, it's important to first determine if the problem is caused by software/calibration. If it is caused by software/calibration, please refer to software/calibration reflashing procedure. In the event of ECU hardware failure or malfunction (during warranty period only) the ECU should be sent back to the vehicle manufacturer giving complete details of the ECU Part No, Serial number, Vehicle Model & Make, manufacturing Date, Total kms run on the vehicle, Location of use, Vehicle No, Date of return.

## 3.5.2 INJECTOR

#### 3.5.2.1 Appearance

The figure below shows the standard Multec 3 Fuel Injector appearance



## 3.5.2.2 Seal rings

Seal rings for injectors (refer to Figure 12) are made to withstand temperatures ranging from -40°C to 150°C (-40 to 302°F) without leakage or seeping. They must also be resistant to varying amounts of fuel additives to fuel (i.e., ethanol, etc.). The following are currently available seal rings designs. Please contact a Delphi representative if the specific sealing requirements are not met by these designs:

## Injector to fuel rail seal ring

- Dimensions:
- ID. : 6.35 mm
- OD. : 14.85 mm
- Cross-section: 4.25 mm
- Materials
- Viton GLT (blue color). For low temperature applications
- Viton A (black). All other applications.

## Injector to manifold

- Dimensions:
- ID: 9.61 mm
- OD: 14.49 mm
- Cross-section: 2.44 mm
- Materials:
- Viton A (black or brown other applications.)

## 3.5.2.3 Seal rings replacement

□ Lubricate the seal rings with an approved lubricant or equivalent. The lubricant application process must prevent lubricant from contacting the director plate, which could possibly restrict the injector flow.

It is preferred to not reuse the seal rings when re-installing an injector. If re-use is necessary, carefully inspect each seal ring for any signs of damage, as even minor defects can lead to fuel / vacuum leakage. Always install injectors and seal rings using the recommended service procedures to avoid the possibility of a safety hazard.
 When installing seal rings to the injector inlet, take extra care not to damage the seal on the injector top flange.

## 3.5.2.4 Lubricant Recommendation

Lubrication should be applied to the O-rings only for ease of injector installation. The table 4 is a list of lubricant oils that were tested and approved for O-ringlubrication. These lubricants have shown to have no effect on injector performance (plugging, sticking).

Lubrication Recommendation		Table: 6
Lubricant Name	Supplier	Viscosity (cSt) @ 40 °C
Spindura 10	Equilon	10
Spindura 22	Equilon	21
DTE-24	Mobil	32
DTE-25	Mobil	46
DTE-26	Mobil	68
Norpar 15	Exxon / Mobil	<1
Drawsol 60	DA Stewart	1-2
NocoLube AW 46	NOCO Energy	46
NocoLube AW 32	NOCO Energy	32
Advantage Spindle Oil	Advantage Lubrication Specialties	10

## 3.5.2.5 Over-Voltage

The Multec 3 injectors and the Multec 3.5 injectors can withstand a voltage of 26v for a maximum of one minute at a duty cycle of 100 ms pulse width and 200 ms period. The injector will be pressurized with calibration test fluid at normal operating pressure during the test. This will not result in any permanent physical damage to the injector or coil assembly, or any degradation in electrical performance.

## 3.5.2.6 Temperature Requirements:

Typical injector temperature environments are defined below. The Multec 3injectors and the Multec 3.5 injectors will not experience any loss of the ability to comply with the flow tolerance requirements after exposure to the following temperature environments. Also, they will not experience unacceptable external leakage, any type of physical degradation, or loss of service life during or after being exposed to these ambient conditions.

□ Normal Operating Temperature Range: - 30 to 125C

□ □ Extreme Operating Temperature Range (some performance degradation): - 40to 150C

□ Storage Temperature Range: -60 to 60C

#### 3.5.2.7 Fuel Contamination

The injector fuel inlet filter protects the fuel injector from initial build fuel contamination as well as from fuel system assembly contamination. Filtration is extremely important because particle contaminants can cause an injector to stick open, flow shift or tip leak.

The injector inlet filter is not a serviceable component and is designed only to trappotential built-in contamination between the chassis fuel filter and injector.

## 3.5.2.8Wire Routing

□ □ Electrical wiring to the injector should be routed so that conductors are protected from excessive heat, damage, and wear.

□ □ Avoid unnecessary handling(disconnecting and connecting) of the electrical connector.

#### 3.5.2.9 Handling - DOs & DONTs

ACTION	REASON
<b>DO NOT</b> : Re-use injector seal rings if at all possible. If no other choice exists, take extra care in inspecting the seal rings for damage.	Leakage.
<b>DO NOT</b> : Dip injector tips into lubricants.	Can plug injector spray orifices.
DO NOT: Cycle injector repeatedly without fuel	Damage to internal mechanical components.
pressure.	
<b>DO NOT</b> : Pulse (actuate) a suspected high leak	Can dislodge internal contamination if

rate injector (leak >50 sccm air)	
<b>DO NOT</b> : Allow water to enter fuel system from	Can damage injectors.
air lines, etc. during leak checks.	
<b>DO NOT</b> : Contact or apply load to the injector	Apply load to 45 deg angle on nylon over mold
tip for installation.	see
<b>DO NOT</b> : Pound injectors into manifold during	Can damage injectors or seal rings.
assembly to engine.	
DO NOT: Apply excessive side loads to	May cause loss of electrical continuity.
electrical connectors.	
<b>DO NOT</b> : Use any dropped unit.	Internal damage may have occurred.
DO NOT: Store injectors, rails, or	External contamination can damage the injector
subassemblies including engines on which the	electrically and/or mechanically.
injectors have been installed in an unprotected	
environment.	
<b>DO NOT</b> : Use the injector as a handle.	Do not use the injector to lift assemblies
<b>DO NOT</b> : Rack, stage, or handle parts in a	Damage will occur.
manner that allows contact between parts.	5
<b>DO NOT</b> : Remove packing in a way that allows	Damage could occur due to contact
contact between parts.	between parts
<b>DO NOT</b> : Tap on fuel injectors to correct any	Can damage injector.
malfunction.	
<b>DO NOT:</b> Replace the injector with other part	Will severely affect the performance of the
number not recommended for this	injector
application	
<b>DO:</b> Take extra care when installing new fuel	Prevent tearing seal ring during installation
seal ring over injector inlet flange.	
<b>DO</b> : Use proper lubricants on seal ring surfaces	Avoid damage to seal ring during installation.
to install injector in engine. Minimize time	Avoid contamination at seal.
between applying lubricant and inserting	
injector /rail.	
<b>DO</b> : Pulse (actuate) stuck closed or tip-leak	To verify the injector failure
suspected injector (Actuate consists of one	
pulse<5 sec duration at 9 to 15V).	
<b>DO</b> : Pulse (actuate) injectors prior to a dry fuel	Injector valves may not reseat without fuel
system leak test at engine/vehicle assembly to	after shipping and handling resulting in false
reseat injector valves.	leakage.
<b>DO</b> : Avoid any liquid contamination in the	Coil could short circuit.
injector area.	
<b>DO</b> : Use care during connection of harness to	Avoid terminal damage.
injector.	
DO: Use recommended terminal lubricant on	Minimize potential for terminal fretting corrosion.
mating connector.	_
<b>DO</b> : Return any dropped, damaged, or suspect	Ensure fast and correct diagnosis of root cause.
material with a tag that describes the problem	-

## 3.5.2.10 Installation guide lines

Follow these guidelines to prevent damage to the injector and it's electrical interface during the replacement or re-installation process.

□ Lubrication: Apply a light coating of lubricant to the lower injector seal ring. ISO 10 light mineral oil or equivalent is recommended.

□ □ The preferred technique is to apply the lubricant to the sockets the injectors are being installed into, rather than directly to the seal ring itself. This will help minimize the possibility of injector contamination.

□ Avoid applying lubricant over the director plate holes – this may restrict injector flow. Do not dip the injector tip in lubricant.

□ All Multec 3 and Multec 3.5 injectors come from the factory with the seal rings attached. The re-use of seal rings is not preferred when replacing an injector. If an injector is to be re-used, and no new seal rings are available, take care to inspect each seal ring for signs of damage. Even minor defects in the seal ring can lead to leakage. Take extra care in installing seal ring over flange of injector inlet.

□ □ Carefully installing the harness connector will prevent terminal damage. Listen for a positive audible click from the connector retention device — this ensures that it is fully engaged.

□ □ Avoid unnecessarily disconnecting/reconnecting the harness connector.

□ □Wires routed in a manner that can allow them to become pinched between components can result in a short circuit and a stuck open injector.

□□For injectors that require orientation for spray pattern, do not rotate the injector in the fuel rail assembly to install the injector electrical connector. This may dislodge the retaining clip, and result in improper spray orientation

## 3.5.2.11 Replacement Techniques

The following procedure outlines standard Multec 3 and Multec 3.5 Fuel Injectors removal and replacement.

## Warning: The injector and all associated hardware may be extremely hot.

□ Shut off ignition.

Disconnect negative battery cable to avoid possible fuel discharge if an accidental attempt is made to start the engine.

□ □ Disconnect the electrical connector from the injector wiring harness.

□ □ Relieve fuel pressure

□ ■ Remove the retaining clip from the fuel injector.

□ Remove the fuel line connection from the injector

□ □ Carefully clean debris from the interface surfaces. Do not damage seal mating surfaces.

□ □ Remove the injector from the manifold

□ Apply a light coating of a lubricant to both the upper and lower injector seal ring of the replacement injector.

□ Install the new injector into the manifold. Check that the injector is installed in the original orientation to maintain proper spray targeting, and that the retaining clip is properly seated on the injector and the fuel line

□ Install the retaining clip after connecting the fuel line

□ □ Tighten the injector mounting to the desired torque as mentioned in the manufacturer manual

 $\Box$   $\Box$  Tighten the fuel line

□ ■ Re-install the injector electrical connector

□ Check for fuel leaks with the key "on" and the engine "off"

□ Start engine and verify proper operation

## 3.5.2.12Interchange ability

The injector should be replaced in service only with an equivalent injector of the same part number. On occasion, a new part number may supersede part numbers. Consult the appropriate vehicle service manual and part number guide for the latest replacement injector part number information.

## 5.5.2.13Plugging

Fuel deposits cause plugging resulting in flow shifts over the life of the injector.

Fuel varnish or gumming, a type of injector deposit, is created when certain types of fuel are heated by high injector tip temperatures at soak (no fuel flow). Deposit build up in the director holes causes the flow shifts

□ □ Plugging can cause flow restrictions, frictional changes and the collection of other particles attracted by the tacky surface. The flow restrictions can degrade emissions and drivability.

□ Other fuel and environmental conditions may cause crystal or corrosion growth in the injector and cause a flow shift.

□ □ Oxidation stability of the gasoline affects the potential for deposit formation and must be controlled by the fuel supplier.

□□Increased levels of detergent additives reduce the rate of injector plugging.

□ □ Incase of plugging of injector follow the injector cleaning procedure mentioned in the section below

## 3.5.2.14 Cleaning Procedure

 $\Box$   $\Box$  Electrically disable the fuel pump by removing the fuel pump connection.

□ Relieve the fuel pressure in the system and disconnect the fuel connection at the injector. Plug the fuel feed line.

□ □ Injector cleaner with the specific ratio of the cleaner and gasoline to be mixed in the Injector cleaning tank.

□ □ Connect the injector-cleaning tank to injector in the vehicle.

□ Pressurize the injector-cleaning tank to system pressure.

□ Start and idle the engine for 15- 20 minutes.

□ □ Disconnect the injector-cleaning tank from the system and install the fuel pump connections. Connect the fuel feed line to injector.

□ Start and idle the vehicle for an additional 2 minutes to ensure the residual injector cleaner is flushed from system.

## 3.5.3 Throttle Body Assembly (with stepper motor)

## 3.5.3.1 Description and Working Principle

The Throttle Body Assembly is an interactive system comprised of the following subsystems: the main casting body, bearing system, shaft and valve system, return spring system, cable interface system, throttle position sensing system, and the bypass air control system. The subsystems interact and support each other to provide all the functional requirements, which are mentioned below -

□□Control intake air flow

 $\Box$   $\Box$  Control idle air flow

□ Sense throttle position - Provide position feedback to Engine Controller

□ Provide reactionary force to the throttle

3532Annearance

To: Idle stepper motor tion Sen Intake AirPresssure and Temperature Sensor



## 3.5.3.3 Technical Parameters

Throttle Position Sensor: □ Reference voltage: 5±0.1VDC □ Resistance between T1 and T2: 3k~12kΩ



#### Idle Air Control Valve:

□ □ Operating voltage: 7.5~14.2 VDC

 $\square$  Solenoid resistance: 53 $\Omega$ ±10%

□ □ Solenoid inductance: 33mH±20%

#### 3.5.3.4 Operating Conditions

Normal Operating Temperature: -30~120°C

#### 3.5.3.5 Throttle Body Removal

□ □ Disconnect negative terminal of the battery

□ □ Disconnect electric lead wire of throttle position sensor coupler, stepper motor coupler and MAP/MAT sensor coupler ( if this sensor is mounted on the throttle body)

□ □ Disconnect accelerator cable from throttle body

□ Remove air cleaner outlet hose and throttle body outlet hose

## 3.5.3.6 Cleaning Procedure

If there is cover on the bottom, it may be removed and cleaned using carburetor cleaner (3M make recommended). Once the throttle body cover is removed, spray the throttlebody cleaner inside the shipping air passage, and use the brushes to gently dislodge the dirt, gum and varnish that are present. Do not let the bye pass holes be blocked by dirt or foreign particles.

## 3.5.3.7 Throttle Body Installation

Reverse the procedure for installation noting the following:

□ □ Adjust accelerator cable play

□ Check to ensure that all removed parts are back in place.

□ Reinstall any necessary part which have not been reinstalled

#### 3.5.3.8 Precautions

□ □ Do not submerge TPS in any cleaning fluid.

 $\square$   $\square$  Always open the throttle valve using the throttle cable or lever.

□ □ Do not hold the valve at opening position by inserting tools or any sticks into the bore. The valve may be warped and the bore may be scratched. This type of damage may

keep the throttle from opening easily or fully closing.

## 3.5.3.9 Handling - DOs & DONTs

ACTION	REASON
DO: Use care during assembly of harness to	Avoid terminal damage.
throttle body.	
DO: Avoid any liquid contamination in the	Ensure proper operation.
throttle body area.	
DO: Unload and install units one at a time from	Damage may be done to critical components.
packing trays.	
DO: Return any dropped, damaged, or suspect	Ensure fast and correct diagnosis of root cause.
material with a tag that describes the problem.	
(Only warranty cases)	
DO: Remove and discard protective caps just	Protects system from contamination, which can
before assembling mating components.	prevent proper operation.
DO: clean the by pass passage after removing	To ensure good idle stability
bottom cover	
---	--
<b>DO NOT:</b> Use any dropped or impacted unit.	Internal damage may have occurred or
	emissions settings may have been upset.
<b>DO NOT:</b> Store units without protective caps in	Contamination may impair correct operation.
place.	
<b>DO NOT:</b> Ship or store near saltwater without	Corrosion buildup may impact proper
protection.	operation.
<b>DO NOT:</b> Exposed to environmental conditions	Corrosion buildup may impact proper
(Moisture)prior to complete vehicle installation.	operation.
<b>DO NOT:</b> Apply any voltage other than system	Damage could occur
voltage for testing.	
<b>DO NOT:</b> Apply excessive band clamp loading	Damage could occur.
<b>DO NOT:</b> Remove packing in a way that allows	Minimum air leakage could be affected and/or
contact between parts.	other damage could occur.
<b>DO NOT:</b> Release the throttle cam abruptly	Damage could occur.
from any position without the throttle linkage	
attached.	
<b>DO NOT:</b> Let the by pass holes be blocked by	This could effect idle stability
dirt or foreign particles.	
DO NOT: Rake, stage, or handle parts in a	Damage will occur.
manner that allows contact between parts.	

3.5.4 Engine Cool ant Temperature Sensor

## 3.5.4.1 Description and Working Principle

This sensor is used in water cooled engines. It provides a resistance that varies as a function of temperature within prescribed tolerance limits. The sensor has a negative temperature coefficient of resistance. This is a non-serviceable part.

## 3.5.4.2 Appearance



## 3.5.4.3Installation Requirements

□ Dynamic Torque Requirement: The sensor shall be hand into the application and then driven by a driver with a maximum no load speed of 400 rpm or installed to the desired torque by a hand torque wrench (5/8" hex). The recommended installation torque is: □ Minimum: 20 N·m

□ Maximum: 25 N•m

□ Static Torque Requirement: The torque required to remove the sensor from the mating hole shall be within 200% of the installation torque mentioned above.

## 3.5.4.4 Operating Environment

□ □ This device is intended for use in engine coolant and air cooled applications and shall withstand such an under hood environment.

 $\square$   $\square$ Normal Operating Temperature: -40°C ~ 135°C (continuously).

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 $\square$  Relative Humidity: 0 to 100% RH.

□ □ Typical Pressure: When installed at the minimum torque the sensor shall be capable of sealing engine coolant with a positive pressure of 206.8 kPa (30 psi)at 135°C applied to the probe tip end of the sensor.

Extreme Operating Environment: Maximum temperature excursion to 150°C for 1 hour.

#### 3.5.4.5 Storage Environment

□ Storage temperature: -40°C to 120°C for an indefinite duration

□ □ Transport at altitudes to: 13,700 m for an indefinite duration Electrical Environment

 $\Box$  Typical Voltage: The sensor circuit operates with a DC voltage reference of 5  $\pm$  0.1 VDC.

□ □ Maximum Excitation Current: The sensor calibration shall not be affected by a current source of less than 1 mA at all temperatures.

#### 3.5.4.6 Sample Cleaning

□ □When necessary the samples may be cleaned in isopropyl alcohol for one minute with mating connectors in place and then air-dried

# 3.5.5Intake Air Pressure and Temperature Sensor(MAP&MAT) 3.5.5.1**Description and Working Principle**

This sensor has two functions. The first is the intake manifold air temperature, it provides a resistance that varies as a function of temperature within prescribed tolerance limits. The second is the intake manifold air pressure; it provides a voltage varies as the intake air pressure.

#### 3.5.5.2 Appearance



The appearance of the MAP&MAT Sensor is shown as above.

#### 3.5.5.3 **Operating Environment**

□ This device is intended for use in inlet manifold for sensing air temperature and pressure which shall withstand such an under hood environment.

□ □ Pressure Range: 20~102kPa

□ □ Temperature Range: -40~105°C

□ Relative Humidity: 0 to 100% RH.

□ □ Extreme Operating Environment: Maximum temperature excursion to 125°C for 2 hours.

#### 3.5.5.4 Storage Environment

□ Storage temperature: -50°C to 150°C for an indefinite duration

#### 3.5.5.5 Electrical Environment

 $\Box$   $\Box$  Typical Voltage: The sensor circuit operates with a DC voltage reference of 5  $\pm$  0.1 VDC.

#### 3.5.5.6 Sample Cleaning

□ □When necessary the samples may be cleaned in isopropyl alcohol or gasoline for one minute with mating connectors in place and then air-dried

### 3.5.6Oxygen Sensor

#### 3.5.6.1 Description and Working Principle

This sensor is a device for monitoring the residual oxygen in the exhaust of an internal combustion engine. It consists of the wide range sensor and stoichiometric sensor. Usually we use stoichiometric sensor on the small engine. It is the feedback element for engine closed loop control.

#### 3.5.6.2 Appearance

The appearance of the Engine Oxygen Sensor is shown as below



#### 3.5.6.3 Technical Parameters

 $\square \square A/F$  ratio rich threshold: >750 mVDC

□ A/F ratio lean threshold:<120 mVDC

□ □ Heater power: 7.0W

(These parameters as above are measured basing on 450°C (engine dyno),typically on 70% duty at 10Hz and under 13.5V)

 $\Box$  Heater part resistance: 9.6±1.5 $\Omega$ 

(This parameter is measured basing on 21°C)

□ Operating temperature range: 260-850 °C

## 3.5.6.4 Fuel Quality Requirements

- □ □ P≤0.0002g/L
- □ □ S≤0.04% (weight proportion)x
- □ □ Si≤4ppm

#### 3.5.7 Ignition Coil

## 3.5.7.1 Description and Working Principle

This coil provides energy to the spark plug in the combustion chamber. The coil itself doesn't have a driver. The high voltage tower of the coil is connected to the spark plug using a high voltage cable assembly. This is a non-serviceable component.

## 3.5.7.2 Appearance

The appearance of the Ignition coil is shown as below.



#### 3.5.7.3 Technical Parameters

□ □ Input voltage: 9~14VDC

□ Output voltage: ~25~30KV

□ □ Operating temperature: -30 ~110 °C

□ Storage temperature: -40~155°C

□ ■ Mounting Torque: 8.8~11.8Nm

#### 3.5.7.4Installation requirements

□ □ The vehicle frame provides the mounting surface and mounting holes.

□ □ Mount coil close to the spark plug and keep the plug wire length very short (less than 6 ").

□ Mount coil away from any pick coil device. Especially, a VR type Crank / Cam sensor. Keep a Min distance of 150 mm (around 6") between coil and any VR sensor device.

 $\Box \Box \mathsf{Never}$  route the coil C- wire with the same bundle as the Crank sensor wires.

There is around 200 V peak potential between C- wire and engine ground. This voltage potential could cause a noise on sensor cables.

ACTION	REASON
<b>DO NOT</b> : Install the low voltage connectors with the power applied	This might cause an unwanted secondary firing, possibly leading to personal injury
<b>DO NOT</b> : Use a screw driver to asset in removing secondary boots from the secondary tower. Use tools designed for secondary removal.	It is possible to damage a secondary lead in such a manner that creates an electrical path to outside the system permitting improper system operation misfire, or even possible personal injury if arcing occurs.
<b>DO NOT</b> : Use parts that have been dropped or display physical damage	Damaged components can lead to premature failure.
<b>DO NOT</b> : Scratch or apply any non approved material to the surface of the high voltage tower which mates with the high voltage secondary leads.	This can jeopardize the seal integrity of the mating surfaces which in turn can create a secondary high voltage leak path.
<b>DO NOT</b> : Strike any part of the ignition system with a tool or other object.	This can lead to physical damage which can cause a system malfunction or failure.
<b>DO NOT</b> : Permit paint or other sprayed materials to be sprayed onto the electrical connectors.	Insulating type sprays can create a high resistance or open connection. And, a conductive type spray can create an electrical short condition.
<b>DO NOT</b> : Support the ignition system by the wiring harness or plug wire.	These leads are not designed to support the weight of the ignition system. It can create a poor electrical connection Or become disconnected allowing the system to fall and be subjected to physical damage
<b>DO NOT</b> : Pierce or probe the secondary leads.	This creates an electrical path to outside the system permitting improper system operation, misfire, or

## 3.5.7.5 DOs and DONTs

	even possible personal injury if arcing occurs.
<b>DO NOT</b> : Operate without the spark plug attached	If a technician or mechanic comes in contact with the high voltage generated during operation, personal injury may occur. Or if the optime is operated under
	this condition, unburned fuel may fill the converter area creating a potential hazard
<b>DO NOT</b> : Share ignition component wiring with	This prevents electrical cross talking between
other components, Dedicated wiring is required.	components which can lead to component malfunction
<b>DO NOT:</b> Apply voltage to the ignition system	This can cause reduced performance or an electrical
other than vehicle system voltage for testing purposes.	malfunction of the ignition system
<b>DO NOT</b> : Use high impact tools to apply the	Damage to the coil tower, secondary boot, or mating
sparkplug boot to the ignition secondary towers.	connection surfaces might occur.
hand is preferred.	
<b>DO</b> : Install the secondary leads before connecting	In the event the low voltage connection has been
the primary leads.	made and the power applied, unwanted secondary
	output might occur possibly resulting in injury,
	damage
<b>DO</b> . Take care when working around the ignition	The high voltage produced by the coil secondary
system.	circuit can cause personal injury and/or damage test equipment
<b>DO</b> : Proper handling and shipping methods need	Damaged components can lead to premature failure.
to be in place to reduce the rick of demoge due to	
impact, moisture, or contamination	
<b>DO</b> : Avoid unnecessary disconnecting and	The electrical connections are not designed for
connecting of the electrical components.	repeated connection and disconnection.
<b>DO</b> : Insure the low voltage connectors are entirely	This prevents intermittent electrical connections
Seated and the locking mechanism is engaged.	Connector and/or component damage may occur
testing the ignition system.	connector and/or component damage may occur.
<b>DO</b> : Insure the appropriate seals are included in	Liquid intrusion into the terminal connection area
the connector system.	might occur causing an electrical intermittent or short
	condition. In the event of severe terminal corrosion,
<b>DO</b> : Operate with gasoline based internal	Other fuels or combustion designs may require
combustion engines.	additional design considerations
DO: The power feed line should be fused.	This could protect the system in the event of an electrical short
<b>DO</b> : The module heat sink and back plate must not	The high level of voltage and current which the
the engine	performance degradation or failure
<b>DO</b> : Connection of the module back plate to	This greatly reduce potential ground loops and acts
vehicle ground is desirable whenever possible	as a heat transfer source from the module.
<b>DO</b> : The ignition system ground wire should be	This would greatly reduce the possible of unwanted
should be grounded at the same engine block	electrical ground loops.
position as the engine controller	
<b>DO</b> : The electrical wiring to the ignition system	Helps prevent electrical intermittent, open or shorted
should be routed so that the conductors are	operating conditions.
protected from excessive heat, damage, and wear.	Voltage spikes can be transmitted from the
with the ignition primary harness or any other	secondary cables into other leads which are in close
electrical harness.	This could
	create a component performance degradation or failure condition
DO: Spark plug wires(secondary leads) & primary	- Spark plug wires carry very high voltage (30,000
wiring: - must not contact sharp surface	voit). It the secondary lead loses its dielectric characteristics thru being nicked out, chaffed then
- must not be under tension between fixed points	an arc thru to a nearby ground could take place. This
- must be clear of moving parts (belts, fan, etc)	kind of condition could lead to misfire, no start, or
- must be protected from or kept at least 125 mm	premature failure of ignition system.
away from radiant heat source exceeding 400 F.	
- musi de protecteu nom environmental damage	

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(dirt, splash, oils, fluids, etc) - must be retained, secured or insulated to prevent pinching mis-routing rattles and squeaks	
<b>DO</b> : Not all fasteners are designed for repeat use. Beware of fastener specifications. All harnesses should be supported within 6" of a mating connection.	Adequate retention force might not be achieved if the fastener is not designed to be reused. Mating connections are not designed to support the weight of the harness assembly
<ul> <li>DO: For removing spark plugs follow the following steps:</li> <li>1- Grasp the spark plug boot and gently rotate</li> <li>90 ; and then pull the spark plug boot and cable away from the spark plug</li> <li>2- Before removing spark plug, brush or air blast dirt away from the well areas</li> <li>3- Use correct size deep socket wrench to loosen each spark plug one or two turns</li> </ul>	To remove spark plugs from Aluminum heads, allow the engine to cool. The heat of the engine, in combination with a spark plug that is still hot, may cause the spark plug threads to strip the cylinder head upon removal Use goggles to protect eyes from dirt when applying compressed air to spark plug wells
<ul> <li>DO: Cleaning a spark plug could be done as follow:</li> <li>1- wipe all spark plug surfaces cleanremove oil, water, dirt and moist residues.</li> <li>2- If the firing end of spark plug has oily or wet deposit, brush the spark plug in an approved, nonflammable and non-toxic solvent. Then dry the spark plug thoroughly with compressed air</li> <li>3- Use a propane torch to dry wet-fuel fouled plugs. Allow the torch flame to enter up the center electrode insulator. Allow plug to cool down</li> <li>4- If the spark plug threads have carbon &amp; scale deposits, clean with wire brush, taking care not to injure the electrode or the insulator tip</li> </ul>	<ul> <li>Cleaning a spark plug will reduce the voltage required for an electrical arc(spark) across the electrodes</li> <li>Cleaning &amp; re-gapping will not restore a used spark plug to a new condition. It may be more economical and efficient to replace used sparkplugs with new plugs instead of cleaning.</li> <li>Sooted plugs should be replaced</li> <li>Do not cool by using water or any liquid</li> <li>Clean threads permit easier installation and proper seating which will maximize transfer heat away from the plug</li> </ul>
<b>DO</b> : Regap spark plugs to the exact measurement specified by the engine manufacturer to keep the best fuel economy and proper engine performance - Use round wire-type gauge for an accurate measure of gap on all used spark plugs - when gapping a spark plug only the side electrode is moved. The center electrode must not be moved	<ul> <li>Too wide a gap could cause the plug to misfire(higher required ignition voltage).</li> <li>Too narrow of a gap could affect idle stability</li> <li>A flat gauge can't accurately measure the spark plug on used plugs</li> </ul>
<b>DO</b> : When replacing spark plugs with new ones, always use equivalent plugs with same heat range, thread, size, etc	<ul> <li>Higher heat range plug(hotter plug) could lead to pre-ignition &amp; possible piston damage</li> <li>Lower heat range (colder plug) could lead to cold fouling &amp; emission problem</li> </ul>
DO: For installing spark plugs follow the following steps: 1- make sure the cylinder head threads and sparkplug threads are clean. Make sure the sparkplug thread is free of dings and burrs. If necessary, use a thread chaser and seat cleaning tool. 2- Make sure the spark plug gasket seat is clean, then thread the gasket to fit flush against the gasket seat. Tapered seat plugs do not require gaskets 3- Screw the spark plugs finger-tight into the cylinder head. Then, use a torque wrench to tighten spark plugs following manufacturer's recommendation). Torque is different for various plug type & cylinder head material	<ul> <li>If the thread is damage, it prevents a good heat transform from the shell to the cylinder head</li> <li>Do not use any type of anti-seize compound on spark plug threads. Doing this will decrease the amount of friction between the threads. The result of the lowered friction is that when the spark plug is torqued to the proper specification, the sparkplug is turned too far into the cylinder head. This increases the likelihood of pulling or stripping the threads in the cylinder head</li> <li>Over-tightening of a spark plug can cause stretching of the spark plug shell and could allow blow by to pass thru the gasket seal between the shell and insulator. Over-tightening also results in extremely difficult removal</li> </ul>

## 3.5.8Diagnostic Tools 3.5.8.1Motor Scanner (for MT05 EMS) 3.5.8.2 Precautions

□ □ Motor-Scanner is a precision instrument and should be protected from vibration and impact.

 $\Box$  If the unit does not run correctly or the screen is unstable when first turned on, disconnect it from the main lead and try again.

□ □ Make sure the DLC is always firmly inserted into the diagnostic socket.

 $\Box$   $\Box$  Never test electrical signals that exceed the limit of specifications.

 $\Box \Box$  Test cannot be performed by the person who is driving the car.

 $\Box$   $\Box$  This unit should be used and stored in the following conditions:

Ambient temperature: 0~50°C

Relative humidity: <90%

#### 3.5.8.3 Configurations

Delphi Motor scanner consists of 2 main part: the main units (with diagnostic main cable) and diagnostic connector link (one end is 6PIN connector; the other is the interface for connecting diagnostic main cable). They are shown in figure 34 as below.



Outline of Main Unit



Main Unit

The 6PIN diagnostic connector link cable and USB type main unit's software update cable are in the delivered package.

1	Diagnostic Cable	To connect the unit and vehicle socket for diagnosis
2	reserved Key	The Key is reserved for future
3	[₩] Key	To return to the previous interface.
4	[ ] Key	To move the cursor to upper item in the menu
5	[•]Key	To move the cursor to down item in the menu
6	[ Key	To confirm and execute this operation.

Screen:

128×64 array high definition screen with back light for displaying all the information during testing.

Keyboard:

There are 5 keys (one is reserved) on the main unit for selecting and controlling test steps.

#### 3.5.9. Preparations Connection

□ Find the 6PIN diagnostic socket on the motor.

□ □Connect one end of the diagnostic main cable to the main unit, and the other end to diagnostic socket on the motor, tighten the screws.

Normal Power – on Display

When power is on normally, the unit will display:



Seconds later, the unit will display:



## 3.5.10. Functions

Delphi Motor-Scanner can be used to diagnose Delphi Engine Management

System with functions: Read DTC, Clear DTC, Data Stream, Status Stream, and Record Data.

Operations

When the unit is powered up, the screen will display the interface as below.



Here, we take diagnostic function for demonstration.

Select 1 and press [\*] key, it will display an interface for language selection, as shown below:

Sel. operation	
<ul> <li>&gt; 1. English</li> <li>2. Portuguese</li> <li>3. Chinese</li> </ul>	

Select 'English' and press [\*] key, it will display information about the diagnostic software version, press [\*] to continue, the interface will display as below:

<ul> <li>Diagnostic Function</li> <li>Send Data to PC</li> </ul>	Sel. operation	
	> Diagnostic Function Send Data to PC	

**Diagnostic Function** 

Here, we take 'diagnostic function' for demonstration.

Select 'diagnostic function' and press [\*], the screen will display an interface to indicate 'Delphi-3' diagnostic connector should be used.

Press [\*], the screen will display engine information as below:

Sel. operation	
> 1. Engine MT05	
1	

Press [\*] , with 'accessing system' fleeting on the screen, then, it will display as below:



Available functions are as follows:

- □ □ Read DTC
- □ □ Clear DTC
- □ □ Data Stream
- □ □ Status Stream
- □ □ Record Data
  - Press [\* ]or [\*] key to select function you needed.
- 1. Read DTC

Select 'Read DTC', and press [\*], it will display fault code as below:

Power Train System			
• P0118	P0113	P0122	
P0201	P0650	P0135	
P0351			

Press [\*] or [\*] key to move '.' icon, and select fault code, take 'P0118' for example, it's selected when there is '.' in front of it, press [\*], the screen will display detailed information of the code, as below:



2. Clear DTC

Select 'Clear DTC' and press, it will display as below:



3. Data Stream

Select 'Data Stream' and press [\*], it will display as below:

Data Stream
MAP
Command AFR.
afr.

Press [\*] or <sup>[\*]</sup> key for page up/down to view more. Press <sup>[\*]</sup> key to exit. 4. Status Stream

Select 'Status Stream' and press [\*], the interface will display as below:

Data Stream
Fuel Cutoff Enable
Clear Flood EnableNO
NO

Press [\*] or [\*] key for page up/down to view more. Press [\*] key to exit. 5. Record Data

Select 'Record Data' and press $\left[ oldsymbol{\mathscr{T}}  ight]$	<sup>]</sup> , it will dis	play:
---	----------------------------	-------

Plate Number Input	
Enter Code: [0-9,A-Z]	
000000	

Press [\*] or [\*] key to enter code, when the first number of the code was set, press [\*] to confirm and continue to input the sequent numbers, till all the 7numbers were input. When all the 7 numbers were set, press [\*], the screen will display a message for confirmation of the Plate Number input. Press [\*] to return to the previous interface to

input the code again or press [\*] to confirm the code.

Press [\*], another interface will be displayed for you to input date, as below:



It's the same way to enter month as vehicle code input. Month was input, then enter date, as below:

Date Input	
Enter Date: [1-31]	
<u>0</u> 0	

Then, 'Enter Year' continues, as below:

Date Input	
Enter Year: [00-99]	
<u>0</u> 0	

After that, 'Enter Week' follows, as below:

Date Input	
Enter Week: [0-6]	
۵	

Till now, the 'date input' was completed, and it starts to record data, press [\*\*] to stop recording.

□ □ Check malf code meaning by reading the below table.

Fault code	Description
P0107	MAP Circuit Low Voltage or Open
P0108	MAP Circuit High Voltage
P0112	IAT Circuit Low Voltage
P0113	IAT Circuit High Voltage or Open
P0117	Coolant/Oil Temperature Sensor Circuit Low Voltage

P0118	Coolant/Oil Temperature Sensor Circuit High Voltage or Open
P0122	TPS Circuit Low Voltage or Open
P0123	TPS Circuit High Voltage
P0131	O2S 1 Circuit Low Voltage
P0132	O2S 1 Circuit High Voltage
P0032	O2S Heater Circuit High Voltage
P0031	O2S Heater Circuit Low Voltage
P0201	Injector 1 Circuit Malfunction
P0202	Injector 2 Circuit Malfunction
P0230	FPR Coil Circuit Low Voltage or Open
P0232	FPR Coil Circuit High Voltage
P0336	CKP Sensor Noisy Signal
P0337	CKP Sensor No Signal
P0351	Cylinder 1 Ignition Coil Malfunction
P0352	Cylinder 2 Ignition Coil Malfunction
P0505	Idle Speed Control Error
P0562	System Voltage Low
P0563	System Voltage High
P0650	MIL Circuit Malfunction
P1693	Tachometer Circuit Low Voltage
P1694	Tachometer Circuit High Voltage
P0137	O2S 2 Circuit Low Voltage
P0138	O2S 2 Circuit High Voltage
P0038	O2S Heater 2 Circuit High Voltage
P0037	O2S Heater 2 Circuit Low Voltage
P0500	VSS No Signal
P0850	Park Neutral Switch Error
P0445	CCP short to high
P0444	CCP short to low/open
P0601	ECU EEPROM fault detection

# 3.6 Troubleshooting

Complaint	Symptom and Possible Causes	Remedy
	Compression is Too Low	
	1. Worn cylinder	Replace
	2. Worn piston ring	Replace
	3. Leakage with cylinder gasket	Replace
	4. Wear valve guide or improper	Replace or repair
Engine will not start	valve seating	
or is hard to start	5. Loose spark plug	Tighten
	6. Slow cranking of starting motor	Check electrical part
	7. Faulty valve timing	Adjust
	8. Improper valve clearance	Adjust
	No Sparking from Spark Plug	
	1. Fouled spark plug	Clean or Replace
	2. Wet sparkplug	Clean and dry or
		replace
	3. Defective ignition coil	Replace
	4. Open or short circuit with pickup	Replace
	coil	
	5. Faulty generator	Replace
	No Fuel Reach Into Carburetor	
	1. Clogged fuel tank vent tube	Clean or Replace
	2. Clogged or faulty fuel valve	Clean or Replace
	3. Faulty carburetor needle valve	Replace
	4. Clogged fuel hose	Replace
	5. Clogged fuel filter	Clean or Replace
	Transfer is not in Neutral position	Set to Neutral
		position
	1. Improper valve clearance	Adjust
	2. Improper valve seating	Replace or Correct
	3. Faulty valve guide	Replace
	4. Worn rocker arm or rocker	Replace
Engine stalls easily	arm shaft	
or has unstable	5. Fouled spark plug	Replace
idle speed	6. Improper spark plug gap	Replace or Adjust
	7. Faulty ignition coil	Replace
	8. Clogged idle-vale inlet & exhaust	Adjust Fuel level
	pipe	
	9. Faulty magneto	Replace

Complaint	Symptom and Possible Causes	Remedy
	1. Weak valve spring	Replace
	2. Worn camshaft	Replace
	3. Fouled spark plug	Clean or replace
	4. Insufficient spark plug gap	Adjust or replace
Poor engine	5. Improper valve timing	Adjust
running in high-	6. Faulty ignition coil	Replace
speed range	7. Weak high pressure oil pump,	Adjust or replace
	resulting in poor fuel supply	
	8. Dirty air filter	Clean or replace
	1. Excessive engine oil	Check oil level and drain
	2. Worn piston ring	Replace
Exhaust smoke is	3. Worn valve guide	Replace
dirty or thick	4. Scored or scuffed cylinder wall	Replace
	5. Worn valve stem	Replace
	6. Worn valve stem oil seal	Replace
	1. Improper valve clearance	Adjust
	2. Weak valve spring	Replace
	3. Improper valve timing	Adjust
	4. Worn cylinder	Replace
	5. Worn piston ring	Replace
	6. Improper valve seating	Replace or Correct
	7. Fouled spark plug	Clean or replace
Engine lacks power	8. Improper spark plug gap	Clean or replace
	9. Clogged carburetor jet	Clean or replace
	10. Improper fuel level in fuel	Adjust fuel level
	chamber	Clean or replace
	11. Dirty air filter	Replace
	12. Worn rocker arm or rocker	
	arm shaft	Tighten or replace
	13. Air leakage from air intake pipe	Check oil level and drain
	14. Excessive engine oil	
	1. Carbon deposit on piston top	Clean
	2. Insufficient or excessive engine oil	Check level, add or drain
Engine overheats	3. Faulty oil pump	Replace
	4. Clogged oil passage	Clean
	5. Air leakage from air intake pipe	Tighten or replace
	6. Incorrect engine oil	Change engine oil
	7. Faulty cooling system(see5.2.9)	

Complaint	Symptom and Possible Causes	Remedy
	Valve Chatter	
	1. Excessive valve clearance	Adjust
	2. Worn or broken valve spring	Replace
	3. Worn rocker arm or camshaft	Replace
	Noise from Piston	
	1. Worn piston	Replace
	2. Worn cylinder	Replace
	3. Carbon deposit in combustion	Clean
	4. Worn piston pin or pinhole	Replace
	5. Worn piston ring or piston ring	Replace
	groove	
	Noise from Liming chain	Danlaga shain 9 annaskat
		Replace chain & sprocket
		Replace chain & sprocket
Engine is noisv	3. Faulty chain tensioner	Repair or replace
	Noise from Clutch	
	1. Worn or damaged crankshaft	Replace
	2 Worn inner race soline	Replace
	Neise from Crenkshoft	
	Noise from Cranksnaπ	Poplago
		Replace
		Періасе
	Noise from CVT	
	1. Worn or slipping drive belt	Replace
	2. Worn rollers in primary sheave	Replace
	Noise from Transmission	
	1. Worn or damaged gear	Replace
	2. Worn or damaged input or output	Replace
	3. Worn bearing	Replace
	1. Worn or damaged clutch shoes	Replace
Slipping Clutch	2. Weakened clutch shoe spring	Replace
enpping erater	3. Worn clutch housing	Replace
	4. Worn or slipping drive belt	Replace

# **CHAPTER 4 CHASSIS**

#### WARNING

The parts of different types/ variants/ versions maybe un-interchangeable, even some parts have almost same appearance. Always refer to Parts Manual of each CUV model for spare parts information and service.

- 4.1 FRONT A-ARM REPLACEMENT
- 4.2 REAR A-ARM REPLACEMENT
- 4.3 REAR STABILIZER BAR REMOVAL/INSTALLATION
- 4.4 BOX REMOVAL/INSTALLATION
- 4.5 STEERING ASSEMBLY REMOVAL/INSTALLATION

## **4.1 FRONT A-ARM REPLACEMENT**



22. Arm Lwr Frt Lh Assy;

21. Arm Upper Frt Lh Assy

23. Carrier Bearing Wheel Lh Assy

1. Elevate and safely support vehicle with weight removed from front wheel(s).

2.Remove the wheel nuts and wheel.

**NOTE:** To ease the removal of the spindle bolt, remove the hub cap and loosen the spindle bolts before removing the wheel.

3.Remove the brake caliper. Suspend the brake caliper from the frame with a wire. **NOTE:** Do not let the brake caliper hand from the brake line or damage may occur.

## **CHAPTER 4 CHASSIS**

4.Remove the spindle nut, and washer. Remove the hub assy by sliding it off of the shaft.

5.Remove cotter pin from ball joint stud at wheel end of A- arm and loosen nut until it is flush with end of stud.

6.Using a soft face hammer, peen nut to loosen A- arm from bolt. Remove nut and A-arm from hub strut assembly.

7.Loosen and remove two bolts on A-arm, and remove A-arm.

8.Examine A-arm bushing. Replace if worn or tore. Discard hardware.

9.Install new A-arm assembly onto vehicle frame. Install new bolts and new nuts. **NOTE:** 

Tighten the nuts only finger-tighten at this time. They will be tightened to the final torque after the front wheels are installed and the vehicle is on the ground.

## 

DO NOT reuse old bolts. Serious injury or death could result if fasteners come loose during operation.

10.Attach A-arm to strut assembly. Tighten ball joint nut to 25 ft. lbs. (35 Nm). If cotter pin holes are not aligned, tighten nut slightly to align. Install a new cotter pin with open ends toward rear of machine. Bend both ends in opposite directions around nut.

11. Re-install the hub assy. Install washer, and the spindle nut to 103 ft.lbs (140Nm). Aim the gap of the shaft for use the chisel to hit the nut until it locked.

12.Install the brake caliper. Apply Loctite<sup>™</sup> 243 to screw threads of the bolts and torque bolts to 18ft. lbs. (25 Nm ).

13.Install the wheel and torque nuts to 55ft. lbs. (75 Nm).

14.lower the vehicle to the ground. Apply Loctite<sup>™</sup> 243 to screw threads of the A arm bolts and torque bolts to 37-44 ft. lbs. (50-60 Nm ).

## **WARNING**

Upon A-arm installation completion, test vehicle at low speeds before putting into regular service.

## **4.2 REAR A-ARM REPLACEMENT**



- 1. Carrier Bearing Wheel Rear Lh; 2. Grease Fitting M6;
- 4. Circlip 63;
- 7. Shaft Pivot ,Upper;
- 10. Bushing, Short;
- 13. Shaft, Rear Upper Arm;
- 16. Arm Lwr Rear Lh;
- 19. Cover, Arm Lwr Rear Lh:
- 22. Bolt M10X1.25X62.5;
- 25. Ball Pin, Lh;
- 28. Bushing Stabilizer;
- 31. Arm Lwr Rear Lh Assy;

- 5. Shaft Pivot .Lwr:
- 8. Bolt M10X1.25X90;
- 11. Arm Upper Rear Lh;
- 14. Scr Hxfl, Rear Upper Arm;
- 17. Plug;
- 20. Screw M5X10;
- 23. Bolt M10X1.25X57:
- 26. Ball Pin, Rh;
- 29. Bolt M8X20;
- 32. Arm Upper Rear Lh Assy;
- 33. Carrier Bearing Wheel Rear Lh Assy
- 1. Elevate and safely support vehicle with weight removed from the rear wheel(s).

2. Remove the wheel nuts and wheel. NOTE: To ease the removal of the spindle bolt,

remove the hub cap and loosen the spindle bolts before removing the wheel.

- 3. Bearing
  - 6. Scr Hxfl,Rear Arm,Lwr
  - 9.Nut M10
  - 12. Bushing, Long 15. Square Rubber Plug
- 18. Shaft, Rear Lwr Arm
- 21. Rear Shock Absorber Assy
- 24. Stabilizer Bar
- 27. Bracket Stabilizer
- 30. Nut M8

## **CHAPTER 4 CHASSIS**

- Remove the brake caliper. Suspend the brake caliper from the frame with a wire.
   NOTE: Do not let the brake caliper hand from the brake line or damage may occur.
- 4. Remove the spindle nut, and washer. Remove the hub assy by sliding it off of the shaft.

5. Loosen two bolts that secure the rear knuckle to the A-arm. Remove the rear knuckle assembly by sliding it off of the shaft.

- 6. Remove the bolt that secures the shock and coil to the lower A-arm.
- Loosen two bolts that secure the A-arm to frame by alternating each about 1/3 of the way until A-arm can be removed. Perform this procedure on the upper A-arm.



## **CHAPTER 4 CHASSIS**

- 8. Examine the A-arm bushing and A-arm shaft. Replace if worn. Discard hardware.
- 9. Remove the bottom stabilizer bar nut.
- 10. Loosen two bolts that secure the A –arm bushing to frame by alternating each about 1/3 of the way until the A-arm can be removed. The lower A-arm should now be free to remove.
- 11. Insert new A-arm bushings and new A-arm shaft into new A-arm.
- 12. Install new A-arm assembly onto vehicle frame. Apply Loctite<sup>™</sup> 242 to screw threads of the <u>A arm bolts and</u> torque bolts to 44 ft. lbs. (60 Nm ).

## **WARNING**

DO NOT reuse old bolts. Serious injury or death could result if fasteners come loose during operation.

- 13. Attach A-arm to rear knuckle. Tighten upper and lower bolts to 44 ft. lbs. (60 Nm ).
- 14. Install the shock and tighten shock bolt to 44 ft. lbs. (60 Nm ).
- 15. Install the stabilizer and tighten nut.
- 16. Re-install the hub assy. Install washer, and the spindle nut to 103 ft.lbs (140Nm). Aim the gap of the shaft for use the chisel to hit the nut until it locked.
- 17. Install the brake caliper. Apply Loctite<sup>™</sup> 243 to screw threads of the bolts and torque bolts to 18ft. lbs. (25 Nm ).
- 18. Install the wheel and torque nuts to 55ft. lbs. (75 Nm).
- 19. lower the vehicle to the ground. Apply Loctite<sup>™</sup> 243 to screw threads of the A arm bolts and torque bolts to 44 ft. lbs. (60 Nm ).

## A WARNING

Upon A-arm installation completion, test vehicle at low speeds before putting into regular service.



## **4.3 REAR STABILIZER BAR REMOVAL/INSTALLATION**



- 1. Elevate and safely support vehicle with weight removed from the rear wheel(s).
- 2. Remove the rear wheel to gain access to the stabilizer bar, each side.
- 3. Remove the stabilizer bar nut from the lower A-arm, each side.
- 4. Remove the two bolts that secure the stabilizer bar to the main frame, each side.
- 5. Remove the stabilizer from the frame.
- 6. Inspect the stabilizer bar. Inspect the bushings and replace if needed.
- 7. Inspect the stabilizer joint and replace if needed.
- 8. Reverse the procedure for installation. Torque the stabilizer bolts to 18.5 ft.lbs (25 Nm).





# 4.4 BOX REMOVAL/INSTALLATION

#### **Box Removal**

- 1. Disconnect taillight transition line at lower right of the Box from the wiring harness.
- 2. Lift the box into the dump position.
- 3. Remove the box shock pin from the frame.
- 4. Remove the shocks from the shock brackets. Let the shocks fully extend.

**CAUTION:** Safely support the box during the rest of the removal process. The box is not as stable with the shocks removed.

- 5. Remove the cotter pin from the hinge pin.
- 6. Remove the hinge pin.

**CAUTION:** Safely support the box during the rest of the removal process. The box is not as stable with the hinge pin removed.

7. With the hinge pins removed, remove the box from the frame. Two people maybe needed to remove the bed from the frame.

**CAUTION:** Use caution when removing the box. It is recommended to have two people to carefully remove the box from the frame.

#### **Box Installation**

- 1. Place the box onto the frame. Align the hinges of the box with the frame.
- 2. Install the box hinges.
- 3. Secure the box hinges with the bolts.
- 4. With the hinges installed, decompress the box shocks and place them into the shock brackets on the frame.
- 5. Secure the box shocks with the shock pin.
- 6. Lower the box and secure the latch.
- 7. Connect taillight transition line to the wiring harness.





## 4.5 STEERING ASSEMBLY REMOVAL/INSTALLATION



- 1. With the steering wheel cover bolts removed, remove the steering wheel cover and the steering wheel.
- 2. With the steering wheel holder nut removed, remove the steering wheel holder.
- 3. Remove the steering column bolts.
- 4. Remove the upper of the steering column.
- 5. Remove the cotter pins and the tie rod end bolts (both sides).
- 6. With the cover bolts removed, remove the steering assy and the lower of the steering column.
- 7. Reverse the procedure for installation.

# **NOTES**

#### WARNING

The parts of different types/ variants/ versions maybe un-interchangeable, even some parts have almost same appearance. Always refer to Parts Manual of each CUV model for spare parts information and service.

5.1 WHEEL, HUB, AND SPINDLE TORQUE TABLE 5.2 FRONT HUB EXPLODED VIEW 5.3 FRONT HUB REMOVAL/INSPECTION 5.4 FRONT HUB INSTALLATION 5.5 FRONT HUB BEARING REPLACEMENT 5.6 FRONT DRIVE AXLE REMOVAL/ INSPECTION 5.7 FRONT DRIVE AXLE INSTALLATION 5.8 FRONT DRIVE AXLE DISASSEMBLY/ INSPECTION 5.9 FRONT DRIVE AXLE ASSEMBLY 5.10 REAR HUB EXPLODED VIEW 5.11 REAR HUB AND KNUCKLE REMOVAL/INSPECTION 5.12 REAR HUB AND KNUCKLE INSTALLATION 5.13 REAR DRIVE SHAFT REMOVAL 5.14 REAR DRIVE SHAFT INSTALLATION 5.15 REAR GEARCASE EXPLODED VIEW 5.16 REAR GEARCASE DISASSEMBLY 5.17 REAR GEARCASE ASSEMBLY 5.18 FRONT GEARCASE EXPLODED VIEW 5.19 FRONT GEARCASE DISASSEMBLY 5.20 FRONT GEARCASE ASSEMBLY

# 5.1 WHEEL, HUB, AND SPINDLE TORQUE TABLE

Item	Specification
Front Wheel Nuts	55 Ft.Lbs 75 Nm
Rear Wheel Nuts	55 Ft.Lbs 75 Nm
Front Hub Nut on Spindle/ outer CV joint	103 Ft.Lbs 140 Nm
Rear Hub Retaining Nut	103Ft.Lbs 140 Nm

Refer to exploded views and text for torque values of other fasteners.

**CAUTION:** Locking nuts, and bolts with pre-applied locking agent should be replaced if removed. The self- locking properties of the nut or bolt are reduced or destroyed during removal.

## **5.2 FRONT HUB EXPLODED VIEW**



## **5.3 FRONT HUB REMOVAL/INSPECTION**

1. Elevate front end and safely support machine under footrest/frame area.

**CAUTION:** Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

2. Check bearings for side play by grasping the tire/Wheel firmly and checking for movement.



- 3. Grasp the top and bottom of the tire. The tire should rotate smoothly without binding or rough spots.
- 4. Remove wheel nuts and wheel.
- 5. Remove the two brake caliper mounting bolts.

**CAUTION:** Do not hang the caliper by the brake line. Use wire to hang the caliper to prevent possible damage to the brake line.

- 6. Remove front spindle nut, and washer.
- 7. Remove front hub assembly.
- Rotate each bearing by hand and check for smooth rotation. Visually inspect bearing for moisture, dirt, or corrosion, or roughness is evident.





## **5.4 FRONT HUB INSTALLATION**

- 1. Inspect the hub strut bearing surface for wear or damage.
- 2. Apply grease to drive axle spindle.
- 3. Install spindle through the backside of the hub strut. Install the hub onto the spindle.
- 4. Install spindle nut and tighten to 103 ft.lbs (140Nm).
- 5. Knock on the edge of the spindle nut, so that it can be clamped into the limit slot.
- Install brake caliper using new bolts. (Apply Loctite<sup>™</sup> 243 to threads) Tighten bolts to 18 ft.lbs (25Nm)

**CAUTION:** New bolts have a pre-applied locking agent which is destroyed bolts upon removal. Always use new brake caliper mounting bolts upon assembly.

7. Install wheel and wheel nuts and tighten evenly in a cross pattern to specified torque.





## **5.5 FRONT HUB BEARING REPLACEMENT**

1. Remove outer snap ring.

- 2. From the back side, tap on the outer bearing race with a drift punch in the reliefs as shown.
- Drive bearing out evenly by tapping on outer race only. Once bearing is at bottom of casting, support casting on outer edges so bearing can be removed.





4. Inspect bearing.

**NOTE:** Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement sideways between inner and outer race.

5. Inspect bearing housing for scratches, wear or damage. Replace new if damaged.

# 5.6 FRONT DRIVE AXLE REMOVAL/INSPECTION



**NOTE:** The outer CV joint cannot be disassembled or repaired, if damage or faulty the drive axle assembly must be replace.

- 1. Drive Axle/Outer CV Joint Assembly.
- 2. Boot Band "A".
- 3. Outer Board Boot.
- 4. Boot Band "B".
- 5. Stopper Ring
- 6. Plunging Joint
- 7. Circlip
- 8. Bearing
- 9. Stopper Ring
- 10. Inboard boot.

NOTE: Always order and replace 6 and 8 together.

#### REMOVAL

- 1. Place the vehicle on level ground and set the parking brake, Block the rear wheels so the vehicle will not roll in either direction.
- 2. Remove the front wheels, steering tie rods, disconnect the A arm on the ball joint end as described in this Chapter and Chapter 4.

**CAUTION:** To avoid damage to the front gearcase oil seal, hold the front drive shaft horizontal and straight out from the front differential during removal.

- 3. Hold the drive shaft straight out.
- 4. Place a tire lever between the inner CV joint and the differential housing, with a small piece of wood against the housing to help get "leverage" and protect the casting. "pop" the in inner CV joint out from the front gearcase.

#### INSPECTION

**NOTE:** The boots are subjected to a lot of abuse if the vehicle is ridden in rough terrain. If the boots are damage and left un-repaired, the driveshaft joints will fair prematurely by allowing the joint to be exposed to dirt, mud and moisture. This also allow the loss of critical lubrication.

 Check the rubber boots for wear, cuts or damage and replace if necessary as described under the Disassembly / Assembly procedure in this





chapter.

- Move each end of the drive shaft in a circular motion (and also a reciprocate for inner one) and check the drive shaft joints for excessive wear or play.
- This inner CV joint (inboard pivot joint) can be serviced if there is wear or play. The outer CV joint (outboard pivot joint) cannot be serviced if worn or damage and if necessary, the drive shaft assembly must be replaced.

## 5.7 FRONT DRIVE AXLE INSTALLATION

**CAUTION:** To avoid damage to the front gearcase oil seal and the strut oil seal, hold the front drive shaft horizontal and straight into the strut during installation.

- 1. Hold the drive shaft straight in from the front differential.
- 2. Push the drive shaft straight into the front differential and push it in all the way until it bottoms out. If necessary, carefully tap on the outer end of the drive shaft with a rubber mallet or soft-faced mallet.
- After the drive shaft is installed, pull the inner CV joint a little to make sure the drive shaft stopper ring has locked into the front differential side gear groove.
- 4. Carefully install the outer CV joint (spindle) into the strut, install the front hub and wheel.
- 5. Install the ball joint on the A arm, the steering tie rods, the hubs and the wheels as described in this Chapter and Chapter 4.



## **5.8 FRONT DRIVE AXLE DISASSEMBLY/ INSPECTION**

#### INNER CV JOINT DISASSEMBLY

**NOTE:** The outer CV joint cannot be disassembled or repaired, if damage or faulty the drive axle assembly must be replace.

 Open the clamps on both boot band "A" and "B" on the inner CV joint, then remove boot band "B".

Discard the boot band, it cannot be reused.

- 2. Carefully slide the boot (A) onto the drive axle and off the inboard joint.
- 3. Wipe out all of the molybdenum disulfide grease within the inboard joint cavity.
- 4. Remove the stopper ring from the inboard joint.
- 5. Remove the inner CV joint.
- 6. Remove the circlip and slide off the bearing assembly. Be careful not to drop any of the steel balls from the bearing cage.
- 7. Slide the inner CV off the drive axle and discard the boot band "A", it cannot be reused.
- 8. If the outboard boot requires replacement, perform the following:
  - a. Open the clamps on both boot bands "A" and "B" on the outer CV joint, then remove boot band "B". Discard the boot band, it cannot be reused.
  - b. Slide the outboard boot off the drive axle and discard the boot band "A", it cannot be reused.
- 9. Inspect the drive axle as described in this chapter.

#### **INNER CV JOINT INSPECTION**

- 1. Clean the bearing assembly in solvent and thoroughly dry.
- 2. Inspect the steel balls, bearing case and the bearing race for wear or damage.
- 3. Check for wear or damage to the inner splines of the bearing race.
- If necessary, disassembly the bearing assembly for further inspection. Carefully remove the steel balls from the bearing cage then remove the bearing race from the bearing cage.
- 5. If any of the components of the bearing assembly are damaged, replace the entire assembly as no replacement parts are available.
- Clean the inner CV joint in solvent and thoroughly dry.
- 7. Inspect the interior of the inboard joint where the steel balls ride. Check for wear or damage and replace the joint if necessary.
- 8. Inspect the snap ring groove on the inboard joint for wear or damage.





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- 9. Inspect the splines on the inner CV joint for wear or damage.
- Check the stopper ring in the end of the inboard joint. Make sure it seats in the groove correctly, if damage the ring must be replaced. See right picture.
- 11. Inspect the exterior of the inner CV joint for cracks or damage, replace if necessary. Check the movement of the joint for excessive play or noise by moving the drive axle in a circular and reciprocate direction.
- 12. Inspect the drive axle for bending, wear or damage.
- 13. Inspect the inner end splines, the outer end splines and the front hub cotter pin hole for wear or damage. If any of these areas are worn or damaged, replace the drive axle.



Check the movement of the joint





**NOTE:** Inner CV joint must be replaced with the bearing as an assembly.

## 5.9 FRONT DRIVE AXLE ASSEMBLY

- The rubber boots are not identical and must be installed on the correct joint. The boots are marked as follows:
  - a. Inner CV joint boot : "inner",
  - b. Outer CV joint boot: "outer".
- 2. If the outboard boot was removed, install a new boot onto the drive axle at this time.

**NOTE:** Position the new boot bands with their tabs facing toward the rear of the vehicle.

- 3. Install two new small boot bands onto the drive axle.
- 4. Install the inboard boot and move the small boot band onto the boot. Bend down the tab on the boot band and secure the tab with the locking



clips and tap them with a plastic hammer. Make sure they are locked in place.

- 5. If the bearing assembly was disassembled, assemble the bearing as follows:
  - a. Position the bearing race and install the race into the bearing case. Align the steel ball receptacles in both parts.
  - b. Install the steel balls into their receptacles in the bearing case.
  - c. Pack the bearing assembly with molybdenum disulfide grease. This will help hold the steel balls in place.
- 6. Position the bearing assembly with the small end of the bearing going on first and install the bearing onto the drive axle.
- 7. Push the bearing assembly on until it stops, then install the circlip, Make sure the circlip seats correctly in the drive axle groove.
- Apply a liberal amount of molybdenum disulfide grease to the bearing assembly. Work the grease in between the balls, the race and the case. Make sure all voids are filled with grease.
- 9. Apply a liberal amount of molybdenum disulfide grease to the inner surfaces of the inboard joint.
- 10. Install the inboard joint over the bearing assembly and install the stopper ring. Make sure it is seated correctly in the inboard joint groove.
- 11. After the stopper ring is in place, fill the inboard joint cavity behind the bearing assembly with additional molybdenum disulfide grease.
- 12. Pack each boot with the following amounts of molybdenum disulfide grease:
  - a. Inboard boot:35-55grams(1.2-1.9oz.).
  - b. Outboard boot:30-50grams(1.1-1.8oz.).
- 13. Move the inboard boot onto the inner CV joint.
- 14. Move the inboard joint on the drive axle.

**NOTE:** Position the new boot bands with their tabs facing toward the rear of the vehicle .

- 14. Move the small boot band onto the boot. Bend down the tab on the boot band and secure the tab with the locking clips and tap them with a plastic hammer. Make sure they are locked in place.
- 15. Install the large boot bands onto each boot.









**CAUTION:** It is critical to avoid undue stress on the rubber boots after the drive axle is installed and the vehicle is run. Don't twist the boot, and always set the both ends in designed position.

- 16. Secure all large boot bands. Bend down the tab on the boot band and secure the tab with the locking clip and tap them with a plastic hammer. Make sure they are locked in place.
- 17. If removed, install the stopper ring and make sure it is seated correctly in the drive axle groove.
- 18. Apply molybdenum disulfide grease to the end splines.

## 5.10 REAR HUB EXPLODED VIEW



# 5.11 REAR HUB AND KNUCKLE REMOVAL/INSPECTION

1. Elevate rear end and safely support machine under main frame area.

**CAUTION:** Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

- Check bearings for side play by grasping the tire/Wheel firmly and checking for movement. Grasp the top and bottom of the tire. The tire should rotate smoothly without binding or rough spots.
- 3. Remove wheel nuts and wheel.


4. Remove the two brake caliper attaching bolts.

**CAUTION:** Do not hang the caliper by the brake line. Use wire to hang the caliper to prevent possible damage to the brake line.

- 5. Remove rear spindle nut, and washer.
- 6. Remove the upper and lower control arm bolts.
- 7. Slide the rear hub and knuckle from the rear drive axle.
- 8. Inspect the rear hub and knuckle assembly by hand for smoothness and side to side movement, replace as needed.

# 5.12 REAR HUB AND KNUCKLE INSTALLATION

- 1. Start the rear hub and knuckle assembly onto the drive shaft.
- 2. Align the bottom of knuckle and lower control arm. Secure with the lower control arm bolt.
- 3. With the driveshaft placed in the knuckle, align the knuckle with the top control arm. Secure with the upper control arm bolt.
- 4. Torque the top and bottom A-arm bolts as shown in the photo.
- 5. Install the washer and the new spindle nut.
- 6. Lower the vehicle. Torque the spindle nut to 103 ft.lbs. (140 Nm).
- 7. Knock on the edge of the spindle nut, so that it can be clamped into the limit slot.
- Install brake caliper using new bolts. (Apply Loctite<sup>™</sup> 243 to threads) Tighten bolts to 18 ft.lbs (24 Nm).
- 9. Install the wheel and wheel nuts. Torque wheel nuts to 55 ft.lbs. (75 Nm).





# 5.13 REAR DRIVE SHAFT REMOVAL

- 1. Repeat of the steps in the "REAR HUB AND KNUCKLE REMOVAL" section.
- 2. Slide the rear drive axle out of the knuckle by pulling the hub and knuckle assembly outward and down.
- 3. Pull the rear drive axle straight out of the frame. Use short sharp jerks to free the circlip from the gearcase. The circlip holds the axle in the gearcase.
- 4. Inspect the axle splines and CV boots for any damage.





## 5.14 REAR DRIVE SHAFT INSTALLATION

 Install a new circlip onto the rear drive shaft. Apply Anti-Seize Compound onto the rear driveshaft splines (both ends).

2. Reinstall the rear driveshaft into the rear gearcase. Be sure the circlip is securely fit into the rear gearcase. Use a rubber mallet to tap on the outboard end of the driveshaft if necessary.



- 3. Slide the rear drive axle into the knuckle.
- Lift knuckle into place and install bolt to upper and lower control arm. Torque bolt to 45 ft.lbs (60 Nm).
- 5. Install the washer and the new spindle nut.
- 6. Lower the vehicle. Torque the spindle retaining nut to 103 ft.lbs. (140 Nm).
- 7. Knock on the edge of the spindle nut, so that it can be clamped into the limit slot.
- Install brake caliper using new bolts. (Apply Loctite<sup>™</sup> 243 to threads) Tighten bolts to 18 ft.lbs (24 Nm)
- 9. Install the wheel and wheel nuts. Torque wheel nuts to 55ft.lbs. (75 Nm).



# 5.15 REAR GEARCASE EXPLODED VIEW

## REAR GEARCASE EXPLODED VIEW



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1	Nut, Rear Output Shaft	1	25	Clutch Gear	1
2	Washer, Rear Output Shaft Nut	1	26	Bearing 6210	1
3	Coupler, Rear Axle	1	27	Bevel Gear -Driven	1
4	Bolt M8×50	4	28	Diff Case	1
5	Mount Bracket-Parking Braking	1	29	Hexagon Flange Bolt M10 $ imes$ 1.25 $ imes$ 16	8
6	Oil Seal $35 \times 61 \times 9$	1	30	Bearing 110	1
7	Bearing 30205	1	31	O-Ring 151 $\times$ 3	1
8	Bevel Gear Bearing Housing	1	32	Adjusting Shim	AR
9	O-Ring 69×3	1	33	Rear Axle Box Cover	1
10	Bearing Sleeve	AR	34	Bolt M8×25	8
11	Adjusting Shim, Bevel Gear - Driving	1	35	Wearing Ring	2
12	Bearing 30206	1	36	Planetary Gear	2
13	Bevel Gear -Driving	1	37	Gear Shaft	1
14	Diff Solenoid	1	38	Pin $4 \times 30$	1
15	O-Ring 17×3	1	39	Side Gear Thrust-Washer	2
16	Oil Seal $30 \times 50 \times 13.5$	2	40	Diff Side Gear	2
17	Vent Nozzle	1	41	Shift Return Spring	2
18	Clip	2	42	Shift Lever Spring	1
19	Vent Pipe	1	43	Shift Lever	1
20	Bolt M18×1.25	1	44	Shift Bar	1
21	Washer 18	1	45	Shift Yoke	1
22	Gear Case,Rear Axle	1	46	Shift Pin	1
23	Drain Plug	1	47	Rear gearcase	1
24	Washer	1	48	Breathing airbag	1

#### 5.16 REAR GEARCASE

#### DISASSEMBLY

**Important:** Before staring any operation On the gearbox, make sure that never clean the gearbox with a high pressure water jet.

The pinion gear assembly (A) is NOT intended to be disassembled from the case. as it requires special tooling in order to properly reassemble. If there is any damage to the pinion gear, bearings or case, the assembly must be replaced. Pinion and ring gear shimming information is NOT provided due to manufacturing requirement.

**1**.remove the breathing airbag(*NO.48*).  $\rightarrow$ Fig 0





oil drain from the gearbox.

assembled.  $\rightarrow$  Fig 1

**Important:** Clean the plug carefully.



Fig 1

**3**.Remove the differential solenoid (NO.14) from the gearcase cover if servicing the solenoid, shift lever, shift lever spring, or shift voke. If none of these items are being serviced. The solenoid can remain installed in the gearcase cover.  $\rightarrow$  Fig 1





2. Remove the oil drain plug (NO.23) and let the **4**.Remove the Bolts M8 $\times$ 50 (*NO.4*), Remove assembly (A).  $\rightarrow$  Fig 3 Replace the sealing washer (NO.24) before it's





Fig 5

**7**.Remove the shims from the differential assembly. Be sure to keep the shims together for reassembly.  $\rightarrow$  Fig 6

Fig 3 5.Remove Bolts M8 $\times$ 25 (*NO.34*) that secure the housing.  $\rightarrow$ Fig 4





**6**.Remove the differential assembly (**B**) from the housing..  $\rightarrow$  Fig 5



**8**.Inspect the bevel gear for chipped, worn, or

broken teeth. Important: Do not disassemble the differential

assebly (**B**). Replace as an assembly if damage or worn.  $\rightarrow$  Fig 7



proceed to "Rear Gearcase Assembly."  $\rightarrow$  Fig 9



**Fig 9 11**.Loosen the lock shift pin (*NO.46*).  $\rightarrow$  Fig 10

Fig 7

## NOTE: The PINION GEAR ASSY (A) AND THE DIFFERERNTIAL ASSEMBLY ( B) MUST BE REPLACED SIMULTANEOUSLY,NOT SEPARATELY.

**9**.Remove the clutch gear (*NO.25*) from the gearcase cover.  $\rightarrow$  Fig 8



Fig 8

**10**.Inspect the shift lever (NO.43), shift level spring (NO.42), shift return spring (NO.41), and shift yoke (NO.45) for excessive wear or damage. If disassembly is required proceed to the next step. If no disassembly is required



Fig 10 12.Remove the pin from the gearcase cover.  $\rightarrow$ Fig 11



**13.**Carefully remove the shift yoke assembly from the gearcase cover.  $\rightarrow$  Fig 12



**14.**Inspect the shift lever (*NO.43*), shift level

spring (*NO.42*), shift return spring (*NO.41*), shift yoke(*NO.45*), and lock shift bar (*NO.44*), Inspect the components for excessive wear or damage and replace as needed.  $\rightarrow$  Fig 13



# 5.17 REAR GEARCASE ASSEMBLY

**Important:** Before staring any operation on the gearbox, to ensure that the surface of all parts is clean.

**1.NOTE:** The pinion gear assembly is NOT

intend to be disassembled from the case, as it requires special tooling in order to properly reassemble. If there is any damage to the pinion gear, bearings or case, the assembly must be replace.  $\rightarrow$  Fig14



Do Not Disassemble Replace as an assembly if damaged or worn

**2**.Replace the Oil Seal  $30 \times 50 \times 13.5$ (*NO.16*) located in the main gearcase and gearcase cover



Fig 15

3.Replace all worn components.

**4.**If previously removed; assembly the shaft lever, shift lever spring, shift return springs, shift yoke, and lock pin bushing.  $\rightarrow$  Fig 13

**5**.Carefully install the shift yoke assembly into the gearcase cover.  $\rightarrow$  Fig 12

**6**.Install the lock shift (*NO.46*) pin and tighten. → Fig 11

**7.**Install the clutch gear (*NO.25*) and the original shims into the gearcase.  $\rightarrow$  Fig 16



**Fig 16 8.**Install the differential assembly into the carrier housing.  $\rightarrow$  Fig 17



Fig 17

**9.**Install the original shims(*NO.32*) and the new O-ring(*NO.31*) onto the Rear Axle Box Cover(*NO.33*), then assemble the Rear Axle Box Cover(*NO.33*) and install the bolts that secure the cover to the housing. Torque the bolts in a criss cross pattern to **25-30Nm.**  $\rightarrow$  Fig 18



Fig 18

**10**.Install the pinion gear assembly. Torque the bolts in a criss cross pattern to **25-30Nm**.  $\rightarrow$  Fig 19



Fig 19

**11**.If previously removed, install the Diff Solenoid (*NO*.14) into the carrier cover. Torque solenoid to **40-55Nm**.  $\rightarrow$  Fig 20



**12**.Mount the oil drain bolt (*NO.23*) and washer (*NO.24*). Add 250  $\pm$  25mL oil(85W/90GL-4). Fig 21



**13**.Assamble the breath airbag(*NO.48*). → Fig 22



Fig22

## 5.18 FRONT GEARCASE EXPLODED VIEW

#### FRONT GEARCASE EXPLODED VIEW



1	Nut, Front Output Shaft	1	26	Bearing 16007	1
2	Washer, Front Output Shaft Nut	1	27	O-Ring 141×2.4	1
3	O-Ring	1	28	Gear Case, Front Axle	1
4	Coupler, Front Axle	1	29	Bolt M8×25	6
5	Oil Seal 48 $ imes$ 65 $ imes$ 9	1	30	Screw M8×8	1
6	Bearing Retainer	1	31	Washer 8	1
7	Bearing 6007	2	32	Vent Nozzle	1
8	Bevel Gear -Driving	1	33	Clip	1
9	Needle Bearing	1	34	Vent Pipe	1
10	Oil Seal 24 $ imes$ 38 $ imes$ 8	2	35	O-Ring 81.2×1.9	1
11	Fill Plug	1	36	Gear Motor	1
12	O-Ring 30.5×3	1	37	Screw M8×20	4
13	Drain Bolt	1	38	Pin Shaft	1
14	Washer 10	1	39	Shift Fork	1
15	Front Axle Box Cover	1	40	Drive Gear	1
16	Adjusting Shim(61×48)	as needed	41	Pin 5×25	1
17	Bevel Gear -Driven	1	42	Wearing Ring	2
18	Top Bracket,Differential Gear	1	43	Gear(Center), Differential	2
19	Bracket,Differential	1	44	Washer	1
20	Bolt M10×1.25×20	6	45	Shim	1
21	Bearing 61912	1	46	Driven Gear	1
22	Adjusting Shim( $83 \times 71$ )	as needed	47	Gear Shaft	1
23	Drive Clutch	1	48	Front Axle	1
24	Drive Clutch Cover	1	49		
25	Circlip 62	1	50		

#### 5.19 FRONT GEARCASE DISASSEMBLY

**Important:** Before staring any operation On the gearbox make sure GEAR MOTOR (*NO.36*) is protected (if mounted). Never clean the gearbox with a high pressure water jet.  $\rightarrow$ Fig 0.





Remove the DRAIN BOLT (*NO.13*) and let the oil drain from the gearbox.
 Important: Clean the plug carefully and Replace WASHER 10 (*NO.14*) before Its assembled. →Fig 1.



Fig 1

**2.** Remove the NUT (NO.1) and the washer (NO.2).

 $\rightarrow$ Fig 2



Fig 2 3. Remove the O-RING (*NO.3*) .  $\rightarrow$  Fig 3.



Fig 3

**4.** Remove the COUPLER (*NO.4*).  $\rightarrow$  Fig 4.



Fig 4

# **5.** Remove the OIL SEAL (NO.5) and repalce with a new seal.

 $\rightarrow$ Fig 5.



Fig 5 6. Remove the four SCREW (*NO.37*).  $\rightarrow$ Fig 6.



Fig 6

**7.** Remove the GEAR MOTOR (*NO.36*).  $\rightarrow$  Fig 7.



Fig 7 8. Remove the six bolts M8 X L28 (NO.29) .  $\rightarrow$  Fig 8.





**9.** Remove the GEAR CASE ASSY, FRONT AXLE (NO.28) and CASE COVER ASSY, FRONT AXLE (NO.15) .  $\rightarrow$  Fig 9.



Fig 9

10. Remove the DIFFERENTIAL GEAR ASSYA from the housing.→Fig 10





**11.**Inspect the bevel gear for chipped, worn or broken teeth.

NOTE: The DIFFERENTIAL GEAR ASSY (A) is NOT intended to be disassembled, as it requires special tooling in order to properly reassemble. If there is any damage to the gear, bearings or others, the assembly must be repalced.

 $\rightarrow$ Fig 11





 Remove the shims from the differential assembly. Be sure to keep the shims together for reassembly.

 $\rightarrow$ Fig 12.



**12.** Remove the SCREW (*NO.30*) and the WASHER (*NO.31*).

 $\rightarrow$ Fig 13.





**13.** Remove the PIN SHAFT (*NO.38*), SHIFT FORK (*NO.39*).  $\rightarrow$  Fig 14





**14.** Remove the DRIVE CLUTCH (*NO.23*).  $\rightarrow$  Fig 15.



Fig 15

**15.** Inspect the bearing (NO.26). If the bearing **18.** Remove the OIL SEAL (*NO.5*). was damaged, remove the RETAINER (*NO.25*) → Fig 18. first, and then remove the bearing (*NO.26*).  $\rightarrow$  Fig 16.



Fig 16 16. Remove the DRIVE CLUTCH COVER (NO.24).  $\rightarrow$ Fig 17.







Fig 18

**19.** Remove the BEARING RETAINER (*NO.6*) with special tool.

 $\rightarrow$ Fig 19.



Fig 19

**20.** Remove the DRIVE PINION GEAR **B**.  $\rightarrow$  Fig 20.



Fig 20 NOTE: The DIFFERENTIAL GEAR ASSY (A) AND THE DRIVE PINION GEAR B MUST BE REPLACED SIMULTANEOUSLY,NOT SEPARAT

# 5.20 FRONT GEARCASE ASSEMBLY

Note:Grease all seals and O-rings with all season Grease upon assembly

**1.** Mount the drive clutch cover (*NO.24*).  $\rightarrow$  Fig 1



Fig 1

**2.** Mount the retainer 62 (NO.25) .  $\rightarrow$  Fig 2.





Fig 4 5.Install the screw (NO.30) and washer (NO.29), then mount the screw (NO.30) .  $\rightarrow$ Fig 5.



**3.** Mount the drive clutch (*NO.23*).  $\rightarrow$  Fig3.



Fig 3 4.Mount the pin shaft (*NO.38*) and the shift fork (*NO.39*).  $\rightarrow$ Fig 4.





**6.** Mount the adjust shim (*NO.22*). →Fig 6.



Fig 6

**7.**Install the DIFFERENTIAL GEAR ASSY **A** into the carrier housing.  $\rightarrow$ Fig 7



Fig 7 8.Install the DRIVE PINION GEAR B and install the BEARING RETAINER (*NO.6*) with special tool  $\rightarrow$ Fig 8.



**Fig 8** 9.Install a new OIL SEAL (*NO.5*) .→Fig 9



Fig 9 10.Mount the adjust shim (*NO.16*).  $\rightarrow$  Fig 10



#### Fig 10

**11.**Assemble the gearcase halves and install the bolts (*NO.29*) that secure the cover to the housing. Torque the bolts in a criss cross pattern to  $20\sim25$ Nm.  $\rightarrow$ Fig 11



Fig 11

**12.** Mount the gear motor **A**. **Important:** Before assemble the gear motor (*NO.36*), make sure that the shift fork (*NO.39*) is in their correct position as shown.  $\rightarrow$ Fig 12.





Fig 12 13. Mount the four screws (NO.37) .  $\rightarrow$  Fig 13.





**14.** Mount the coupler (*NO.4*) .  $\rightarrow$  Fig 14





Fig 16

17.Add 200-250mL oil(85W/90GL-4).

Fig 14

**15.** Mount the O-ring(NO.3).  $\rightarrow$  Fig 15



Fig 15

**16.** Apply some Loctite 263 thread locker on screw thread, mount the nut(*NO.3*), tighten it to a torque of 50~60Nm.

 $\rightarrow$ Fig 16.

# <u>NOTES</u>

#### WARNING

The parts of different types/ variants/ versions maybe un-interchangeable, even some parts have almost same appearance. Always refer to Parts Manual of eachUTV model for spare parts information and service.

**NOTE:** Also See Chapter 2 for Maintenance Information.

- 6.1 SPECIFICATIONS
- 6.2 TORQUE
- 6.3 BRAKE SYSTEM SERVICE NOTES
- 6.4 BURNISHING PROCEDURE
- 6.5 BRAKE BLEEDING-FLUID CHANGE
- 6.6 PARKING BRAKE AND BRAKE LINE INSPECTION
- 6.7 PARKING BRAKE ADJUSTMENT
- 6.8 PARKING BRAKE REAR CALIPER REMOVAL/INSTALL
- 6.9 FRONT PAD INSPECTION / REMOVAL / REPLACEMENT
- 6.10 FRONT DISC INSPECTION / REMOVAL / REPLACEMENT
- 6.11 FRONT CALIPER REMOVAL/ INSPECTION / INSTALLATION
- 6.12 REAR BRAKE PAD REMOVAL/ INSPECTION / INSTALLATION
- 6.13 REAR CALIPER REMOVAL/ INSPECTION/ INSTALLATION
- 6.14 REAR BRAKE DISC INSPECTION / REMOVAL / REPLACEMENT

# **6.1 SPECIFICATIONS**

Front Brake Caliper						
	ltem	Standard	Service Limit			
Brake Pad Friction material		0 157"/ 5 5mm	0.04"/ 1mm			
Thickness		0.137 / 5.51111				
Brake Di	sc Thickness	0.150- 0.164"/3.810- 4.166mm	0.140"/ 3.556mm			
Brake Disc Thickness Variance			0.002 "/ .051m m			
Between Measurements		-				
Brake Disc Runout		-	0.005 "/ .127mm			
Rear Brake Caliper						
	ltem	Standard	Service Limit			
Brake Pad	hydraulic	0.157"/ 5.5mm				
Friction	Hydraulic with	0.226"/ 6mm	0.04"/ 1mm			
material	mechanics park	0.2307011111				
Thickness	mechanics park	0.197"/ 5mm				
Brake Disc Thickness		0.177-0.187"/4.496-4.750m m	0.167"/4.242mm			
Brake Disc Thickness						
Variance		-	0.002 "/ 0.051mm			
Between Measurements						
Brake Disc Run out		-	0.005 "/ 0.127mm			

# 6.2 TORQUE

ltem	Torque (ft. lbs. except where noted*)	Torque (Nm)
Front Caliper Mounting Bolts	18.0	25
Rear Caliper Mounting Bolts	18.0	25
Front Brake Disc	18.0	25
Rear Brake Disc	18.0	25
Park Brake Mouting Bolts	33	45
Banjo Bolt	15.0	21

# **6.3 BRAKE SYSTEM SERVICE NOTES**

- It is strongly recommended always change the caliper and (or) the master cylinder as an assembly. The parts inside maybe not interchangeable due to different brake manufactures and (or) different brake type.
- Do not over fill the master cylinder fluid reservoir.
- Make sure the brake lever and pedal returns freely and completely.

- Check and adjust master cylinder reservoir fluid level after pad service.
- Make sure atmospheric vent on reservoir is unobstructed.
- Adjust foot brake after pad service.
- Test for brake drag after any brake system service and investigate cause if brake drag is evident.
- Make sure caliper moves freely on guide pins (where applicable).
- Inspect caliper piston seals for foreign material that could prevent caliper pistons from returning freely.
- Perform a brake burnishing procedure after install new pads to maximize service life.
- DO NOT lubricate or clean the brake components with aerosol or petroleum products. Use only approved brake cleaning products.

# **6.4 BURNISHING PROCEDURE**

Brake pads (both hydraulic and mechanical) must be burnished to achieve full braking effectiveness. Braking distance will be extended until brake pads are properly burnished. To properly burnish the brake pads, use the following procedure.

- 1. Choose an area large enough to safely accelerate the CUV to 50 km/h (30 mph ) and to brake to a stop.
- 2. Using hi gear, accelerate to 50 km/h (30 mph); then compress brake lever (pedal) to decelerate to 0-8km/h (5 mph).
- 3. Repeat procedure on each brake system 20 times until brake pads are burnished.
- 4. Adjust the mechanical parking brake (if necessary).)
- 5. Verify that the brake light illuminates when the hand lever is compressed or the brake pedal is depressed.

# 

Failure to properly burnish the brake pads could lead to premature brake pad wear or brake loss. Brake loss can result in severe injury.

## 6.5 BRAKE BLEEDING-FLUID CHANGE

**NOTE:** When bleeding the brakes or replacing the fluid always start with the caliper farthest from the master cylinder.

## CAUTION:

Always wear safety glasses.

## CAUTION:

Brake fluid is highly corrosive. Do not spill brake fluid on any surface of the CUV.

This procedure should be used to change fluid or bleed brakes during regular maintenance.

- 1. Clean reservoir cover thoroughly.
- 2. Remove cover from reservoir.



- 3. If changing fluid, remove old fluid from reservoir with a brake fluid pump or similar tool.
- 4. Add brake fluid up to the indicated MAX level on the reservoir.

#### **DOT 3 Brake Fluid**

- 5. Begin bleeding procedure with the caliper that is farthest from the master cylinder. Install a box end wrench on the caliper bleeder screw. Attach a clean, clear hose to the fitting and place the other end in a clean container. Be sure the hose fits tightly on the fitting.
- 6. Slowly pump foot pedal until pressure builds and holds.
- 7. Hold brake pedal on to maintain pedal pressure, and open bleeder screw. Close bleeder screw and release foot pedal.

**NOTE:** Do not release foot pedal before bleeder screw is tight or air may be drawn into master cylinder.

8. Repeat procedure until clean fluid appears in bleeder hose and al air has been purged. Add fluid as necessary to maintain level in reservoir.

# CAUTION:

Maintain at least 1/2 "(13mm) of brake fluid in the reservoir to prevent air from entering the master cylinder.

- 9. Tighten bleeder screw securely and remove bleeder hose.
- 10. Repeat procedure steps 5-9 for the remaining

calipers.

- 11. Add brake fluid to MAX level inside reservoir. Master Cylinder Fluid Level Between the MIN line and the MAX line of reservoir.
- 12. Install master cylinder reservoir cover.
- 13. Field test machine at low speed before putting into service. Check for proper braking action and pedal reserve. With pedal firmly applied, pedal reserve should be no less than 1/2 " (13mm ).
- 14. Check brake system for fluid leaks and inspect all hoses and lines for wear or abrasion. Replace hose if wear or abrasion is found.



# **6.6 PARKING BRAKE AND BRAKE LINE INSPECTION**

1. Inspect the spring on the parking brake lever assembly.



2. Inspect the parking brake cable at the parking brake lever assembly on the brake caliper.

3. Inspect the brake lines and brake line connections for possible leaks or loose lines.

# 6.7 PARKING BRAKE ADJUSTMENT

#### **Parking Brake Inspection**

- 1. Push the parking brake up with your hand.
- 2. After 2 to 4 clicks of lever travel, the vehicle should not roll while parked.
- 3. If the vehicle moves, adjustment is necessary.
- 4. Adjust the parking brake where the cable attaches to the lever assembly on the rear brake caliper.

#### Parking Brake Adjustment

- 1. Place the vehicle in neutral on a flat level surface.
- 2. Carefully lift the rear of the vehicle off the ground and stabilize on jack stands.
- 3. Loosen the jam nut (A) on the rear caliper adjustment bolt (B).
- 4. Tighten the adjustment bolt (B) until the rear tire will not roate.
- 5. Back the adjustment bolt (B) out 1/4 turn.
- 6. Tighten the jam nut (A) while holding the adjustment nut (B) in place.



Parking Brake Cable





# **6.8 PARKING BRAKE REAR CALIPER REMOVAL / INSTALL**

#### Park Brake Caliper Disassembly / Pad Inspection

**NOTE:** Do not get oil, grease, or fluid on the park brake pads. Damage to the pads may cause the pads to function improperly.

1. Loosen the two brake caliper bolts in equal increments. Remove the bolts from the bracket and lift park brake assembly out.



 Measure the thickness of the caliper parking brake pads. Replace pads if worn beyond the service limit. Service Limit 0.3/64"(1 mm)

#### Park Brake Caliper Installation

- Install the park brake assembly into place. Tighten the two bolts in increments for proper installation.
- 2. Torque the two bolts to 33ft.lbs. (45 N.m).
- 3. Test the park brake for proper function.



# 6.9 FRONT PAD REMOVAL / INSPECTION / INSTALLATION

**NOTE:** The brake pads should be replaced as a set. **REMOVAL** 

1. Elevate and support front of CUV safely.

## CAUTION:

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

2. Remove the front wheel.



- 4. Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed.
  NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper.
  Remove excess fluid from reservoir as required.
- 5. Push mounting bracket inward and slip outer brake pad past edge. Remove inner pad.





#### INSPECTION

Measure the thickness of the pad friction material. Replace pads if worn beyond the service limit. Service Limit 0.3/64"(1 mm)



#### INSTALLATION

- Lubricate mounting bracket pins with a light film of All Season Grease, and install rubber dust boots.
- 2. Compress mounting bracket and make sure dust boots are fully seated. Install pads with friction material facing each other. Be sure pads and disc are free of dirt or grease.
- 3. Install caliper on hub strut, and torque mounting bolts.

#### Front Caliper Mounting Bolts Torque 18 ft. lbs. (25 Nm )

- 4. Slowly pump the brake lever until pressure has been built up. Maintain at least 1/2 "(13 mm) of brake fluid in the reservoir to prevent air from entering the brake system.
- 5. Install the adjuster screw and turn clockwise until stationary pad contacts disc, then back off 1/2 turn (counter clockwise).
- Be sure fluid level in reservoir is up to MAX line inside reservoir and install reservoir cap.
   Master Cylinder Fluid Up to MAX line inside reservoir
- 7. Install wheels and torque wheel nuts.
- 8. It is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise. Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Repeat procedure 10 times.



# 6.10 FRONT DISC INSPECTION / REMOVAL / REPLACEMENT

#### INSPECTION

- 1. Visually inspect the brake disc for nicks, scratches, or damage.
- Measure the disc thickness at 8 different points around the pad contact surface using a 0-1" micrometer and a dial indicator. Replace disc if worn beyond service limit.
   Brake Disc Thickness

New 0.150-0.164" (3.810 - 4.166 mm) Service Limit 0.140" (3.556 mm)



#### Brake Disc Thickness Variance Service Limit 0.002 " (0.051 mm) difference between measurements

 Mount dial indicator as shown to measure disc runout on the dial indicator. Replace the disc if runout exceeds specifications.
 Brake Disc Runout Service Limit 0.005" (0.127 mm)

#### **REMOVAL/ REPLACEMENT**

- 1. Removal caliper and hub. Apply heat to the hub in the area of the brake disc mounting bolts to soften the bolt locking agent.
- 2. Remove bolts and disc.
- 3. Clean mating surface of disc and hub.
- 4. Install new disc on hub and tighten to specified.

### **CAUTION:**

Always use new brake disc mounting bolts. Front Brake Disc Mounting Bolt Torque :

18 ft. lbs. (25 Nm )



# 6.11 FRONT CALIPER REMOVAL/ INSPECTION / INSTALLATION

### CAUTION:

The caliper is a non-serviceable component; it must be replaced as an assembly.

**NOTE:** If any special service needed, contact the CUV manufacture via the agent for the parts and special instruction.

#### REMOVAL

- 1. Remove wheel, remove caliper from the strut.
- 2. Loosen and remove brake hose to caliper. Place a container under caliper to catch fluid draining.



#### INSPECTION

Inspect caliper body for nicks, scratches or worn. Replace caliper as an assembly if any problem exists.

#### INSTALLATION

- Install caliper on hub strut, Apply Loctite<sup>™</sup> 243 to screw threads and Install new bolts.
   Front Caliper Mounting Bolt Torque
   18 ft. lbs. (25 Nm )
- 2. Install brake hose and tighten to specified torque.

Banjo Bolt Torque: 15 ft. lbs. (21 Nm)

**NOTE:** If new brake pads are installed, it is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise. Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Repeat procedure 10 times.

### 6.12 REAR BRAKE PAD REMOVAL/ INSPECTION / INSTALLATION

**NOTE:** The brake pads should be replaced as a set. **REMOVAL** 

#### 1. Elevate and support rear of CUV safely.

#### CAUTION:

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

- 2. Remove the rear wheel.
- Remove the two caliper bolts and lift caliper off of disc.

**NOTE:** When removing caliper, be careful not to damage brake line. Support caliper so as not to kink or bend brake line.

4. Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed.

**NOTE:** Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper.



Remove excess fluid from reservoir as required.

- 5. Remove the brake pads.
- 6. Clean the caliper with brake cleaner or alcohol.

#### INSPECTION

Measure the thickness of the pad friction material. Replace pads if worn beyond the service limit. Service Limit 0.3/64"(1 mm)



#### INSTALLATION

- 1. Install new pads in caliper body.
- Install caliper and torque mounting bolts.
   Brake Caliper Torque: 18 ft. lbs. (25 Nm )
- 3. Turn adjuster screw back in finger tight using a hex wrench.
- 4. Slowly pump the brake lever until pressure has been built up. Maintain at least 1/2 "(13 mm) of brake fluid in the reservoir to prevent air from entering the brake system.
- 5. Install wheels, burnishing procedure should be performed.

# 6.13 REAR CALIPER REMOVAL/ INSPECTION/ INSTALLATION

## CAUTION:

The caliper is a non-serviceable Component; it must be replaced as an assembly.

**NOTE:** If any special service needed, contact the CUV manufacture via the agent for the parts and special instruction.

# CAUTION:

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

- 1. Safely support the rear of the machine.
- 2. Use a wrench to remove the brake line. Place a container to catch brake fluid draining from brake



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lines.

- 3. After the fluid has drained into the container, remove the caliper mounting bolts and remove caliper.
- 4. Remove brake pad as described above.
- 5. Inspect surface of caliper for nicks, scratches or damage and replace if necessary.
- 6. Install brake pads in caliper body with friction material facing each other, with the spacer between the pads. Install retaining pin through outer pad, pad spacer and inner pad.
- 7. Install caliper and torque mounting bolts to 18 ft.lbs. (25 Nm).
- 8. Install brake hose and tighten to specified torque.

#### Banjo Bolt Torque: 15 ft. lbs. (21 Nm)

- 9. Bleed.
- 10. Field test unit for proper braking action before putting into service. Inspect for fluid leaks and firm brakes. Make sure the brake is not dragging when lever is released. If the brake drags, recheck assembly and installation.
- 11. Install the rear wheel and wheel nuts. Carefully lower the vehicle.

**NOTE:** If new brake pads are installed, it is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise.

# 6.14 REAR BRAKE DISC INSPECTION / REMOVAL / REPLACEMENT

### INSPECTION

- 1. Visually inspect the brake disc for nicks, scratches, or damage.
- Measure the disc thickness at 8 different points around the pad contact surface using a 0-1" micrometer and a dial indicator. Replace disc if worn beyond service limit.

Brake Disc Thickness New 0.177-0.187" (4.496 - 4.750 mm) Service Limit 0.167" / 4.242 mm Brake Disc Thickness Variance Service Limit 0.002 " (0.051 mm)
## difference between measurements

 Mount dial indicator as shown to measure disc runout on the dial indicator. Replace the disc if runout exceeds specifications.
 Brake Disc Runout Service Limit 0.005" (0.127 mm)

## **REMOVAL/ REPLACEMENT**

- 1. Removal wheel/ hub and caliper.
- 2. Remove bolts and disc from the flange.
- 3. Clean mating surface of disc and hub.
- 4. Install new disc on flange. Tighten to specified.
  Rear Brake Disc Mounting Bolt Torque : 18 ft. lbs. (25 Nm )

## CAUTION:

Always use new brake disc mounting bolts.

## <u>NOTES</u>